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1 About this guide

The procedures in this guide are intended to give you the ability to perform basic tasks with the Series C I/O such as configuring hardware devices, continuous control strategies. Respective forms are displayed to illustrate a procedure/concept only.

Revision History

| Revision | Date | Description |
|----------|---------------|---|
| A | November 2016 | Initial release of the document. |
| В | May 2017 | Updated the document regarding CC-TAID11 and CC-TAID01 IOTA pin numbers |
| С | July 2017 | Updated PAR # 1-30IYE85 and PAR # 1-45069MG details in the document |
| D | August 2017 | Updated Table 5: Topology rules regarding Series C IO module spec from 64 to 80 per C300 and Updated PAR # 1-TNZGOM details in the document |
| Е | August 2017 | Updated chapter 13 Series C I/O Link Fiber Optic Extenders (FOE) as per the received feedback. |
| F | December 2017 | Updated PAR # 1-3NDHL6P details in the document. |
| G | February 2018 | Updated PAR # 1-8Y24ZUX information in the document. |

1.1 Intended audience

This guide is intended for the following users:

- Persons responsible for system planning, initial hardware installation, and control strategy configuration
- Operators who help to maintain control system operations on a day-by-day basis
- Service persons responsible for routine maintenance of control hardware, and who diagnose and repair faults.

1.2 Prerequisite Skills

It is assumed that you should have some knowledge of Experion control systems and experience of working in a Microsoft Windows environment.

1.3 References

Listed here are the documents that contain general information for planning and implementing control hardware and network communications in your Experion system:

- Control Hardware Planning Guide Provides general information to assist you in planning and design of
 control hardware in an Experion system. Control hardware includes C200 Controllers, Series A Chassis I/O
 and FIMs, also, all I/O families, (except Series C I/O). It includes some supervisory network considerations
 for general reference.
- C300 Controller Guide This guide provides information that will assist you in planning and designing
 activities, as well as the installation, operation, and troubleshooting of Series C300 Controllers in an
 Experion system.
- Series C Fieldbus Interface Module (FIM) User Guide Provides planning and implementation guide for the Series C Fieldbus Interface Module.
- Fault Tolerant Ethernet Overview and Implementation Guide Provides basic installation instructions and configuration requirements for a Fault Tolerant Ethernet (FTE) network and its components.
- Fault Tolerant Ethernet Installation and Service Guide Contains instructions for installing and configuring a Fault Tolerant Ethernet (FTE) node. The guide includes troubleshooting and service information for an FTE node.
- Fault Tolerant Ethernet Bridge Implementation Guide Provides information for implementing a Fault Tolerant Ethernet supervisory network through the FTE Bridge module. It includes module installation, configuration, operation and service data.
- Process Manager I/O Troubleshooting and Maintenance Guide Guide features notification messages (soft fail codes and hard fail codes), service procedures and parts lists for PM I/O control hardware.

1.4 Terms and acronyms

The following table summarizes the terms and type representation conventions used in this guide.

Table 1: Terms and conventions

| Term/conventions | Meaning | Example |
|-----------------------|---|---|
| Click | Click left mouse button once. (Assumes cursor is positioned on object or selection.) | Click the Browse button. |
| Double-click | Click left mouse button twice in quick succession. (Assumes cursor is positioned on object or selection.) | Double click the Station icon. |
| Drag | Press and hold left mouse button while dragging cursor to new screen location and then release the button. (Assumes cursor is positioned on object or selection to be moved.) | Drag the PID function block onto the Control Drawing. |
| Right-click | Click right mouse button once. (Assumes cursor is positioned on object or selection.) | Right-click the AND function block. |
| <f1></f1> | Keys to be pressed are displayed in angle brackets. | Press <f1> to view the online Help.</f1> |
| <ctrl>+<c></c></ctrl> | Keys to be pressed together are displayed with a plus sign. | Press <ctrl>+<c> to close the window.</c></ctrl> |
| File->New | Shows menu selection as menu name followed by menu selection | Click File->New to start new drawing. |
| >D:\setup.exe< | Data to be keyed in at prompt or in an entry field. | Key in this path location >D: \setup.exe<. |

1 ABOUT THIS GUIDE

2 Series C I/O Purpose

Series C I/O Modules, along with I/O Termination Assemblies (IOTAs), perform module diagnostics input and output scanning and processing on all field I/O data and events. To allow a more efficient use of Controller resources, I/O processing is performed separately from control processing functions so that:

- I/O sample rates are completely independent of I/O quantity, controller loading, processing, and alarming
- allows more efficient use of advanced Control Processor capability, and
- provides for future I/O expansion.

Related topics

- "Comparing Process Manager I/O and Series C I/O" on page 24
- "What is Series C I/O?" on page 25
- "Series C Pulse Input Module (SCPIM)" on page 26
- "What is Universal Input/Output (UIO) Module?" on page 28
- "What is Low Level Analog Input (LLAI) Module" on page 30
- "Overview of the Universal Horizontal Input/Output (UHIO)" on page 31

2.1 Comparing Process Manager I/O and Series C I/O

The following list compares previous features of the Process Manager I/O and the Series C I/O:

- Non-Volatile Memory:
 - In the PM, memory was maintained over a power cycle within the I/O card itself.
 - With the Series C I/O, the configuration memory information is restored from the C300 controller at power-up of the I/O Module.
- IOL The Series C I/O link runs at twice the speed of the PMIO I/O Link. Each C300 I/O Link can be configured to provide Series-C or PMIO link speeds.
- Series C I/O fully supports HART I/O. This includes the use of Secondary HART Variables as control
 parameters.
- Separation of Primary from Secondary modules:
 - In the PM, the Primary and Secondary I/O Electronics modules could be separated, placed in different cabinets, and/or powered by different power systems.
 - Series C I/O does not have this capability.
- Series C permits Zone 2 mounting of the Controller and I/O
- In PMIO, the configuration memory is maintained only if a battery backup is installed.

2.2 What is Series C I/O?

The Experion Series C I/O modules are an expanding family of traditional and special function input/output signal interface devices. They supports local software configuration. These I/O modules share the same form factor as the C300 Controller and reside on the same type of common mounting system as other Series C components.

What is Series C I/O Mark II?

Series C Mark II is an enhancement to the existing Series C platform in terms of IO modules, related IOTAs, IO link, power supply, power distribution, and cabinet infrastructure, making it a more cost-effective solution than the earlier version. The design style continues to be the same.

Supported Series C Mark II I/O modules



Attention

Series C Mark II cannot support any PM I/Os.

C300 IOLINK block parameter IOLINKTYPE is used to determine if the IOLINK supports Series C Mark II I/O.

Table 2: Supported Series C Mark II I/O modules

| IOM model names | IOM block name | Description | No. of channels supported |
|-----------------|----------------|---|---------------------------|
| CC-PAIH01 | AI-HART | High Level Analog Input with HART (4) IOM | 16 |
| CC-PAOH01 | AO-HART | Analog Output with HART (4) IOM | 16 |
| DC-PDIL51 | DI-24 | Digital Input 24V IOM w/o OWD | 32 |
| DC-PDIS51 | DI-SOE | Digital Input SOE IOM | 32 |
| DC-PDOD51 | DO-24B | Digital Output 24V Bussed Out IOM w/o RB | 32 |
| DC-PDIS51 | DI-SOE | Digital Input SOE IOM | 32 |
| CC-PAIM51 | AI-LLAI | Low Level Analog Input Mux | 16 |
| CC-PAIH51 | AI-HART | AI HART IOM , R2 | 16 |
| CC-PAIN01 | AI-NON-HRAT | AI IOM NON-HART | 16 |
| CC-PAOH51 | AO HART | AO HART IOM, R2 | 16 |
| CC-PAON01 | AO-NON-HART | AO NON-HART IOM | 16 |

2.3 Series C Pulse Input Module (SCPIM)

The Experion Series C PIM is an interface between C300 Controller that enables high-accuracy pulse counting of pulse streams from rotating machinery such as turbines, flow meters, and densitometers. High-accuracy and repeatable measurement capability make the PIM well suited for metering and custody transfer applications.

The PIM has eight input channels. Out of the eight channels, some may be single consuming one channel or dual consuming 2 adjacent channels. The last 2 channels (channel 7 and channel 8) can also be configured as distinct Fast Cutoff using the two output channels on the module.

Each input channel has a 32-bit counter to perform pulse counting and frequency calculation. In addition, when these channels are configured as single input channels, these eight channels also have a second 32-bit timer for pulse period and pulse width measurement.

2.3.1 Features of PIM

The following are some of key the features of PIM.

- Supports IOM redundancy.
- Supports redundant module communications with the controller via IO link.
- Supports simulation with SIM-C300 The input value can be substituted by a program and/or UniSim using the SIMVALUE parameter.
- Supports high accuracy frequency, period, and pulse width measurement.
- Provides hardware support for Meter Suite applications.
- Provides connections to power field devices or pulse pre-amplifiers.
- Supports pulse multiplexing that enables good pulses from a dual pulse input pair to be copied to the Prover output interface.
- Supports Dual Pulse Integrity in accordance with ISO6551:1996 Level A, which is required to support interfacing of custody transfer meters with pulse outputs.
- Provides the flexibility of configuring the eight input channels as single input, dual input, or a combination
 of both single and dual input channels. For example you can configure the channels as;
 - 2 single input channels, 3 dual input channels or
 - 6 single input channels, 1 dual input channels.

For information on PIM specifications, refer to the Specifications document available on the Honeywell Online Support site.

2.3.2 Comparison between Series A and Series C PIM

The following table lists some of the differences between the Series A and Series C pulse input modules.

| Series C PIM | Series A PIM |
|--|--|
| Shares the same form factor as the Series C I/O family. | Requires two form factors to use with C300 controller; series A for the Pulse Input and the series C form factor for the controller and other I/O modules. |
| Supports IOM redundancy. | Does not support IOM redundancy. |
| Supports Dual Pulse Integrity to support interfacing of custody transfer meters with pulse outputs. | Does not support Dual Pulse Integrity. |
| Supports pulse multiplexing that enables good pulses from a dual pulse input pair to be copied to the Prover output interface. | Does not support pulse multiplexing. |

| Series C PIM | Series A PIM |
|---|--|
| Supports pulse length measurement in all channels. | Does not support pulse length measurement in the last two channels. |
| Supports configuration of all eight channels through use of PICHANNEL block. | Needs two blocks for configuring channels: Pulse Input Channel block for configuring the first six channels. Pulse Input Channel with Fast Cutoff block for configuring the last two channels. |
| The last two channels can be configured as Pulse Input channel types or Pulse Input with Fast Cutoff channel types. | The last two channels can be configured only as Pulse Input with Fast Cutoff channel types. |

2.4 What is Universal Input/Output (UIO) Module?

With R410, an Universal Input/Output (UIO) module is introduced that enables you to configure the input/output channels within a single IOM. The UIO module supports 32 channels. Each channel can independently be configured as one of the following types.

- Analog Input channel (0-20mA or 4-20mA)
- Analog Output channel (4-20mA)
- Digital Input channel (with or without broke-wire detection)
- Digital Output channel (with or without broke-wire detection)

The UIO channels and device blocks are compatible with existing Series C AI, AO, DI, and DO channels and blocks. In addition, each analog channel in the UIO module can be configured to support HART input/output functionality.

2.4.1 Features of UIO

The following list illustrates the key features of the UIO module.

- Supports optional IOM redundancy.
- Supports simulation with SIM-C300.
- Supports HART functionality for AI and AO channel types.
- Supports multiple channel type configurations.
- Operates in an extended temperature range (-40 degree Celsius to +70 degree Celsius).
- Supports the ability to monitor the current, minimum, and maximum temperatures.
- Supports remote control when it is located within 10 kilometers from the controller.
- · Supports open wire detection.
- Supports DO channel ganging from R430 onwards.
- Supports pulse counting functionality from R430 onwards.

Note: To use an AI HART channel in conjunction with the analog mode, it must be used on channels 13 through 20 only. If HART is used on any of the voltage inputs, it can cause an unstable analog PV value. The HART digital value will be unaffected.

Note:For information about UIO specification, refer to the latest Specification and Technical document available on the Honeywell Online Support site.

2.4.2 UIO features

Support for DO channel ganging

The UIO-DO channel is now enhanced to support ganging for enabling the delivery of more current output to the field (maximum current output of up to 2.0 Amperes). This is accomplished using the existing UIO hardware. DO channel ganging simply requires software configuration of up to four adjacent DO channels of the UIO module and appropriate channel wiring accordingly.

Attention

- Up to four DO channels can be ganged at a time.
- UIO-channel 32 cannot be ganged with channel 1.

Support for pulse counting functionality

The UIO module DI channel is capable of providing pulse counting functionality. However, only four DI channels (channels 15, 16, 17 and 18) support pulse counting functionality.

The UIO-DI channel pulse counting supports counting up to 10 KHz of input pulse frequency.

The UIO DI channel configuration consists of simply setting the Digital Input Type parameter to "Accum" from the Configuration tab of the DI channel.



Attention

Though UIO supports redundancy, it does not support pulse count synchronization. Therefore, after a switchover the counters are reset and restart at 0. If pulse count synchronization is required, you must use the Series C Pulse Input Module.

2.4.3 Differences between UIO channels and existing Series C Al, AO, DI, and DO modules

The following table lists some of the differences between the UIO and the existing Series C AI, AO, DI, and DO modules.

| UIO module | Series C Al, AO, DI, and DO modules |
|---|---|
| Supports temperature range between -40 degree Celsius to +70 degree Celsius | Supports temperature range between 0 degree Celsius to +50 degree Celsius |
| Supports multiple channel type configuration | Supports unique channel type configuration |

2.5 What is Low Level Analog Input (LLAI) Module

Starting with R430, a new Series C compliant Low Level Analog Input (LLAI) Module is introduced and designed to operate with the low voltage devices such as Thermocouples and RTDs. The AI-LLAI module supports 16 channels and accepts temperature inputs in the range of millivolts (mV).

This AI-LLAI module is identical to the existing Series C AI-LLMUX module except that the number of channels supported by the AI-LLAI module is reduced to 16 channels. Unlike the AI-LLMUX module, the field inputs can be directly connected to the AI-LLAI IOTA since it has its own IOTA. In addition, the AI-LLAI module supports a new RTD input type, that is, CU50Rtd. A new library is introduced in the standard library as "AI-LLAI."

Features of Al-LLAI

The following are some of the key features of AI-LLAI.

- Supports up to 16 RTDs or Thermocouple inputs.
- Operates in an extended temperature range (-40 degree Celsius to +70 degree Celsius).
- Supports a new RTD input type, CU50Rtd.
- Supports configurable Open Thermocouple Detection (OTD).
- Supports 1 second PV scanning with OTD protection.
- Supports N type thermocouple.



Note

AI-LLAI module does not support the following features.

- Remote cold junction capability
- · User defined table

2.6 Overview of the Universal Horizontal Input/Output (UHIO)

The Universal Horizontal Input/Output (UHIO) enables the replacement of the TDC 2000 Basic Controllers (CB) and Extended Controllers (EC) with the Experion Series C controllers and Universal I/Os. To enable mounting in the existing cabinets, new IOTAs are designed for the C300 Controller, Control Firewall, and the Universal I/O module such that it can fit into the space of the CB and EC modules. However, the existing TCBxx terminal panel, and the field wiring to the TCBs are retained. Note that different IOTAs are required for the UIO and UIO-2 modules. Either IOTA will screw onto the back panel.

The introduction of the UHIO hardware allows customers to migrate their Hiway-based control system to the FTE-based Experion Series C control system.

The following figure is an example of CB/EC rack that is replaced with the Experion Series C controllers and Universal I/Os.

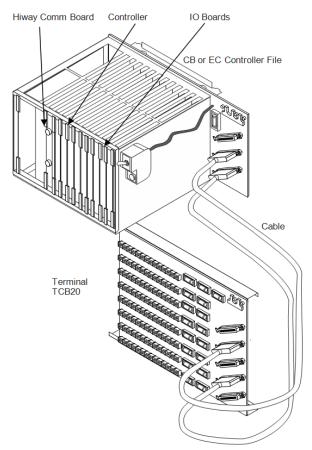


Figure 1: View of existing Basic Controller and Extended Controller

The following figures show the UHIO on the right side. The CC-HUIO11 uses UIO modules and the CC-HUIO12 uses UIO-2 modules.



Figure 2: Left: CC-HCN911 Right: CC-HUIO11



Figure 3: Left: CC-HCN911 Right: CC-HUIO12

In these figures, the following components are shown.

- Control Firewall
- C300 Controller
- Universal I/Os

2.6.1 Mapping the CB/EC racks with UHIO components

The following figure illustrates how to map the CB/EC with the UHIO components.

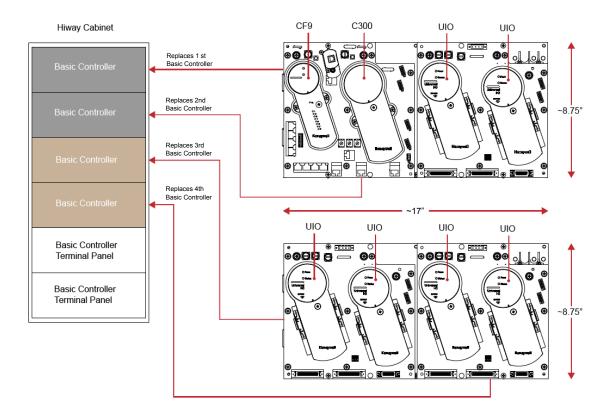


Figure 4: Mapping the CB/EC with the UHIO components



Attention

Note that you can increase the number of input/outputs by adding the Universal Input/Output (UIO) modules.

2.6.2 Features of UHIO

The key features of the UHIO are:

- Supports both redundant and non-redundant configuration for C300 Controller, UIO module, and CF9.
- Supports interchangeability of Series C components.
- Minimizes the effort for rewiring.

The UHIO also supports the following features.

- Provides mechanical connection to the TDC 2000 cabinet Backplane.
- Supports cabinet ground connections through the IOTA mounting screws.
- Provides electrical-mechanical connection to the IOM.
- Provides electrical-mechanical connection to the redundant IOL cable pair.
- Supports 24V fused electrical connections to the IOM(s) Series C 24V and COM power supply.
- Supports a signal common ground.
- Supports precision resistors for measuring analog inputs.
- Supports connection for up to 24 IO channels on the existing TCBs.
- Supports connection for up to 8 additional IO channels at a location.
- Supports manual reset input(s) for restarting a stopped UIO module.

- Supports voltage or current inputs.
- Supports hot-insertion of C300, CF9, and UIO modules.

2.6.3 UHIO hardware

The UHIO uses the following Series C IO components.

- Plug-in modules such as C300, CF9, and UIO.
- FTE network communications between the controller and Experion Station.
- I/O Link between the controller and all I/O modules.
- · Series C cabinet power supply.
- Experion Station and Control Builder as operator and engineering interfaces.



Attention

You cannot differentiate the appearance of the UHIO components from other Series C components in the Control Builder or the Station though the UHIO components are horizontally-oriented.

2.6.4 Differences between the Series C IOTA and the UHIO IOTA

The following table lists the differences between the Series C IOTA and the UHIO IOTA.

Table 3: Differences between the Series C IOTA and the UHIO IOTA

| Series C IOTA | UHIO IOTA |
|---|--|
| C300, CF9, and the UIO IOTA is mounted on the Series C cabinet. | New IOTA developed for C300/CF9 IOTA and UHIO cannot be mounted on the Series C CCA's. It can be mounted in a TDC 2000 basic cabinet (not a Series C cabinet) or in a PMIO cabinet using a special mounting bracket. |
| Series C UIO IOTA does not interface UIO module to Basic Controller Terminal Panels (TCBxx). Instead, Series C UIO IOTA is designed to directly interface with the field sensors/actuators. | UHIO IOTA is designed to interface the UIO module to the Basic Controller Terminal Panels (TCBxx). |
| Series C IOTA is vertically mounted on the cabinet. | UHIO IOTA is horizontally mounted on the cabinet. |



Attention

Series C Hazardous Certifications are not applicable to the UHIO components.

For more information about the C300/CF9/UHIO IOTA, see "Series C Universal Horizontal Input/Output (UHIO) components" on page 239.

2.6.5 About UHIO certification

General Purpose Certification

The UHIO's CSA General Purpose certification is applicable within Data Hiway (TDC 2000) cabinets with the Series C Power supply SPS5792-142935 (HPN 51454517-100). If any modifications have occurred since first installation, the UHIO's CSA General Purpose certification is voided and it is the responsibility of the end user to ensure they are still conforming to all applicable agency rules and regulations. The original TDC Basic Power Supplies do not support the UHIO CSA General Purpose Certification.

CE Mark certification

The UHIO's CE Mark is only applicable for installations within Data Hiway (TDC 2000) cabinets with the Series C Power supply SPS5792-142935 (HPN 51454517-100). It is assumed that the state of as shipped and as

first installed has been maintained for all applicable installations. For installations that do not satisfy the previously mentioned conditions, the end user is responsible to ensure that they conform to all applicable agency rules and regulations.

CC-HUIO12

The above constraints also apply to the CC-HUIO12 IOTA. Note that the CC-HUIO12 was tested with TCB cable 51192054 only. Using the original TCB cable 30731611 with adaptor cable 51202979 may not pass CE Mark tests. For the conducted immunity test between 150kHZ and 250kHz, the AI accuracy was 4.3% instead of its normal 0.1% at room temperature.

2 SERIES C I/O PURPOSE

3 Series C I/O Planning and Design

This guide is intended to provide general information to assist you in planning and designing the installation of your Experion Series C I/O.

Related topics

"General Planning References" on page 38

"Series C I/O and C300 topology" on page 42

"Supported Series C I/O modules" on page 44

"Supported Series C I/O options" on page 51

"I/O Link performance specifications" on page 57

"Universal Input/Output Module-2 (UIO-2)" on page 59

3.1 General Planning References

Refer to the following documents for planning and design details for the Experion system in general and the Fault Tolerant Ethernet supervisory network. For the sake of brevity, this Guide does not repeat the applicable general guidelines, considerations, and cautions that are covered in these other Guides.

- Control Hardware Planning Guide
- · Server and Client Planning Guide
- Fault Tolerant Ethernet Overview and Implementation Guide



Tip

For complete Series C Control System Hardware Configuration planning information, refer to the Control Hardware Planning Guide.

3.1.1 Series C I/O appearance

The layout of Series C components supports enhanced heat management and provides a 30% reduction in overall size (space required to mount the hardware) versus the equivalent Process Manger set.

3.1.2 Series C I/O features

The features of Series C I/O include:

- IO Module design tilted 18 degrees off center:
 - provides for better heat distribution
 - allows for efficient field wiring
- Combination of I/O Module and Field terminations in the same area. The I/O Module is mounted on the IOTA, which reduces cabinet space and eliminates items such as FTA connection cables.
- Redundancy is done directly on the IOTA by simply adding a second IOM to the IOTA (with the exception
 of the C300 controller).

For complete feature/functions for the following modules/IOTAs, refer to the Experion Series C I/O Specifications document.

Table 4: Series C features

| I/O module/IOTA | Feature/function |
|-----------------------|--|
| Analog Input w/HART | Extensive self-diagnostics |
| | Optional redundancy |
| | HART capable, multi-variable instruments |
| | • Fast (50ms) loop scan |
| | PV protection through a broken-wire detection diagnostic |
| | All channels configured for 4-20 mA inputs can detect broken field wires. A soft failure alerts the maintenance staff for corrective action. |
| | Non-incendive field power |
| | Non-incendive power for 4-20 mA loops is provided with no external marshalling. |
| Analog Input non-HART | Extensive self-diagnostics |
| | Optional redundancy |
| | • Fast (50ms) loop scan |
| | Non-incendive field power |

| I/O module/IOTA | Feature/function |
|----------------------------|---|
| Analog Output w/HART | Extensive self-diagnostics |
| | Optional redundancy |
| | HART capable, multivariable instruments |
| | Safe-state (FAILOPT) behaviors |
| | Each channel can be configured to HOLD, LAST, VALUE, or SHED to a SAFE VALUE. |
| | Output read back checking of current delivered to the field |
| | PV protection through a broken-wire detection diagnostic |
| | Each channel can detect broken field wire. A soft failure alerts the maintenance staff for corrective action. |
| | Non-incendive output |
| | No external marshalling required to support the 4-20ma loop, and still provides for channel power protection. |
| Analog Output non-HART | Extensive self-diagnostics |
| | Optional redundancy |
| | Safe-state (FAILOPT) behaviors |
| | Each channel can be configured to HOLD, LAST, VALUE, or SHED to a SAFE VALUE. |
| | Output read back checking of current delivered to the field |
| | Non-incendive output |
| Digital Input 24VDC | Extensive self-diagnostics |
| | IOM redundancy |
| | Input direct/reverse |
| | Internal or external field power selections |
| | Galvanic isolation |
| | PV protection through a broken-wire detection diagnostic |
| | Each channel can detect broken field wire. A soft failure alerts the maintenance staff for corrective action. |
| | Non-incendive output |
| | No external marshalling required to support the 4-20ma loop, and still provides for channel power protection. |
| Direct Input High Voltage | Extensive self-diagnostics |
| | Optional redundancy |
| | Input direct/reverse |
| | Galvanic isolation |
| Digital Input High Voltage | Extensive self-diagnostics |
| PROX | Input direct/reverse |
| | Galvanic isolation |

| I/O module/IOTA | Feature/function |
|-------------------------------|---|
| Direct Input - Sequence of | Extensive self-diagnostics |
| Events | Optional redundancy |
| DI-SOE | 1ms Sequence of Events for Discrete Inputs |
| | Low Latency / High Speed Scanning mode |
| | Broken wire detection |
| | Supplies non-incendive field power |
| | On board excitation power (no need for marshalling power) |
| | Direct / Reverse Input Indication |
| | Galvanic isolation |
| Direct Output bussed 24Vdc | Extensive self-diagnostics |
| | Functional redundancy |
| | Output direct/reverse |
| | Safe-state (FAILOPT) behaviors |
| | Each channel can be configured to HOLD, LAST, VALUE, or SHED to a SAFE VALUE. |
| | Fuse-less short circuit protection |
| | allows a short circuit to exist without blowing any fuses. When a particular channel is shorted, internal circuits detect this and remove power to the field connection. The channel remains de-energized until the short circuit is repaired |
| | Latched, pulsed or pulse-width modulated output |
| | Galvanic isolation |
| | Output read back checking to screw terminal |
| Digital Output - Relay IOTA | Galvanic isolation |
| | Counter EMF snubbing circuit |
| | Isolated dry contact (Form A or B) |
| | Output read back checking on system side of driver |
| Low Level Analog | TC and RTD operation |
| (temperature) Input - LLMUX | Remote cold junction capability |
| | 1 Second PV scanning with OTD protection |
| | Configurable OTD protection (See below) |
| | Temperature points can be added in 16 point increments |
| Low Level Analog | Thermocouple (TC) and RTD operation |
| (temperature) Input - LLAI | 1 Second PV scanning with Open Thermocouple Detection (OTD) protection |
| | Configurable OTD protection |
| Speed Protection Module - SP | Supports 2/3 voting logic for speed and acceleration. |
| | Supports multiple configurable trip limits for speed and acceleration. |
| Servo Valve Positioner Module | Supports PID execution and position calibration. |
| - SVPM | Computes valve position from LVDT/RVDT input signal and controls valve by signaling the Servo coil. |
| | Provides current modulation to avoid stiction in controlled device (servo valve). |
| Pulse Input Module - PIM | Highly accurate frequency/period calculations. |
| | Supports Dual Pulse Integrity in accordance with ISO6551:1996 Level A for custody transfer applications. |
| | Extensive self-diagnostics. |
| | Functional redundancy. |
| | Provides channel-to-channel and terminal block to backplane voltage isolation. |

| I/O module/IOTA | Feature/function |
|-------------------------------|---|
| Universal Input/Output Module | Extensive self-diagnostics |
| - UIOM | Optional redundancy |
| | Independently configurable I/O channels |
| | - controls DI, AI, DO, AO |
| | HART capable, multivariable instruments |
| | PV protection through a broken-wire detection diagnostic |
| | Safe-state (FAILOPT) behaviors |
| | Supports multiple channel configurations |
| | UIO-2 |
| | In addition to all features supported by UIO, the UIO-2 supports the following additional features: |
| | Provides one HART modem per I/O channel |
| | Supports pulse counting on up to four of any of the 32 channels configured as DI |
| | • Supports DO ganging within the following eight channel number groups: 1 - 4, 5 - 8, 9 - 12, 13 - 16, 17 - 20, 21 - 24, 25 - 28, and 29 - 32. However, ganging across these groups is NOT possible |
| | Beginning with Experion R500.1, the following new features are available: |
| | Supports SOE on any channel |
| | Supports NAMUR inputs. This function, however, will require external voltage translation for devices that do not support direct connection 24 VDC |

3.2 Series C I/O and C300 topology

•

Attention

Topology for the Series C I/O and C300 - 20mS CEE Controller is similar to the Series C I/O and C300 - 50ms Controller, with the exception that the C300 - 20mS CEE Controller does not support the PMI/Os.

Series C I/O is attached to an IOLINK that is being mastered by a C300 controller. It is important to note that:

- IOLINK Serves as data repository for IOM function blocks in Control Builder to provide communications interface with Series C I/O.
- Series C I/O cannot reside on an IOLINK mastered by an IOLIM or xPM.

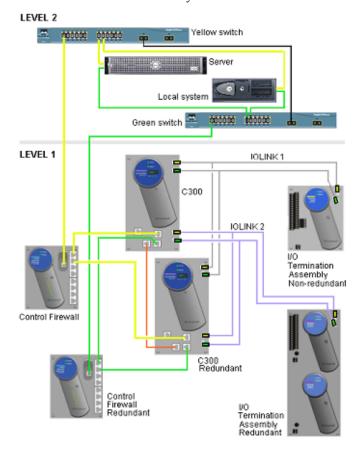


Figure 5: Series C I/O and C300 topology

3.2.1 Examining the topology rules

The following are the topology rules relating to the Series CI/O environment.

Refer to the following document for graphical representations of cabinet layouts depicting Series C, PMIO, FIM, and LLMUX hardware configurations. Control Hardware Planning Guide

Table 5: Topology rules

| Item | Impact | Description |
|------------|--------|---|
| Redundancy | None | Redundancy capacity and performance is displayed while redundancy is present. |

| Item | Impact | Description |
|-----------------------------------|------------------------------|--|
| Switchover | Same as PM I/O | Series C I/O hardware and/or software can switchover, recover, and resume full view in a timeframe no greater than PM I/O. |
| Initialization | All Series C I/O per C300 | Can be initialized in 60 seconds (+/- 25%) after cabinet-level loss power loss. |
| | 1 I/O module | Can be initialized in 10 seconds (+/- 25%) after IOM level loss power loss. |
| Multiple I/O Links | 2 | Design allows the use of multiple Series C I/O Links in the same cabinet. |
| I/O Link performance | None | I/O Link networks perform at the current distance and IOP count specifications. |
| I/O Link capacity | 40 max | Maximum of 40 redundant IOMs per link |
| | | (for either Series C I/O or PM I/O). |
| IOMs / C300 | 64 max | Maximum of 64 redundant IOMs per C300 (for PM I/O). |
| | 80 max | Maximum of 80 redundant IOMs per C300 (for Series C I/O). |
| Series C and PM I/O - combined | 64 | Design supports Series C and PM I/O FTAs in the same side of the cabinet. Current configuration prevents IOTA and FTAs in the same column. |

3.3 Supported Series C I/O modules

The list of I/O modules below can be used on a Series C IOLINK. The IOLINK contains a function that enables programming and reprogramming the executable image (rather than substitution of a removable hardware component). The preferred method of delivery of the image is over the IOLINK.



Tip

Series C IOLINK cannot contain any PM I/O IOPs.

C300 IOLINK block parameter IOLINKTYPE is used to determine if the IOLINK supports either Series C I/O or PMI/O.

Table 6: Available I/O modules

| IOM model names | IOM block name | Description | # of chnls | Similar to PMIO type | IOP model names |
|-----------------|-----------------------|--|------------|----------------------|-----------------|
| CU-PAIH01 | AI-HART | High Level Analog Input with HART | 16 | HLAIHART | |
| CC-PAIH01 | | (supports differential inputs on only channel 13 through channel 16) Refer to Attention | | | |
| CC-PAIH02 | AI-HART | High Level Analog Input with HART | 16 | HLAIHART | |
| | | ((supports differential inputs on all 16 channel) | | | |
| CC-PAIX02 | AI-HART | High Level Analog Input with Differential/Single-ended non- HART | 16 | HLAI | |
| | | (supports differential inputs on all 16 channels) | | | |
| CC-PAIX01 | AI-HL | High Level Analog Input with Differential non-HART | 16 | HLAI | |
| | | (supports differential inputs on only channel 13 through channel 16) | | | |
| | | Refer to Attention | | | |
| CU-PAIN01 | AI-HL | High Level Analog Input with | 16 | HLAI | |
| CC-PAIN01 | | non-HART | | | |
| CC-PAIH51 | AI-HART | 1 Modem, High Level Analog Input with HART | 16 | HLAIHART | |
| CU-PAON01 | AO | Analog Output with non-HART | 16 | AO16 | |
| CC-PAON01 | | | | | |
| CU-PAOX01 | AO | Analog Output with non-HART | 16 | AO16 | |
| CC-PAOX01 | | Refer to Attention | | | |
| CU-PAIM01 | AI-LLMUX ¹ | Low Level Analog Input Mux | 64 | LLMUX | |
| CC-PAIM01 | | | | | |
| CC-PAIM51 | AI-LLAI | Low Level Analog Input Mux | 16 | LLAI | |

| IOM model names | IOM block name | Description | # of chnls | Similar to PMIO type | IOP model names |
|---------------------|---------------------|---|------------|----------------------|-----------------|
| CU-PAOH01 | AO-HART | Analog Output with HART | 16 | AO16HART | |
| CC-PAOH01 | | | | | |
| СС-РАОН51 | AO-HART | 1 Modem, Analog Output with HART | 16 | AO16HART | |
| CU-PDIH01 | DI-HV | High Voltage Digital Input (IOM | 32 | DI | |
| CC-PDIH01 | | supports both 120 and 240 volts AC) | | | |
| CU-PDIL01 | DI-24 | Low Voltage Digital Input (24 | 32 | DI | |
| CC-PDIL01 | | volts DC) | | or | |
| | | | | DI24V | |
| CC-PDIL51 | DI-24 | Low Voltage, Digital Input (24 volts DC) | 32 | DI | |
| CU-PDIS01 | DI-SOE | Low Voltage Digital Input (24 | 32 | DISOE | Mx-PDIS12 |
| CC-PDIS01 | | volts DC) | | | |
| CU-PDOB01 | DO-24B ² | Bussed Low Voltage Digital | 32 | DO_32 | |
| CC-PDOB01 | | Output (24 volts DC) | | | |
| CC-PDOD51 | DO-24B | Bussed Low Voltage, Digital Output (24 volts DC) | 32 | DO32 | |
| CU-PSOE01 | DI-SOE | Low Voltage Digital Input SOE | 32 | DISOE | |
| CC-PSOE01 | | (24 volts DC) | | | |
| CC-PSP401 | SP | Speed Protection | 26 | | |
| CC-PSV201 | SVP | Servo Valve Positioner | 8 | | |
| CC-PPIX01 | PIM | Pulse Input Module | 8 | PI IOP | |
| CC-PUIO01 | UIO | Universal Input/Output Module | 32 | | |
| CC-PUIO31 | UIO | Universal Input/Output Module | 32 | | |
| Series C Mark II IO | M | | • | 1 | |
| CC-PAIH01 | AI-HART | High Level Analog Input with HART | 16 | | |
| CC-PAOH01 | AO-HART | Analog Output with HART | 16 | | |
| DC-PDIL51 | DI-24V | Digital Input (24 volt DC) without Open Wire Detection | 32 | | |
| DC-PDIS51 | DI-SOE | Low-Voltage Digital Input SOE- Low Resolution (24 volts DC) without Open Wire Detection | 32 | | |
| DC-PDOD51 | DO-24B | Bussed Low Voltage Digital Output (24 volts DC) without Open Wire Detection | 32 | | |
| CC-PAIH51 | AI-HART | 1 Modem, High Level Analog Input with HART | 16 | HLAIHART | |
| СС-РАОН51 | AO-HART | 1 Modem, Analog Output with HART | 16 | AO16HART | |
| CC-PAIN01 | AI-HL | High Level Analog Input with non-HART | 16 | HLAI | |
| CC-PAON01 | AO | Analog Output with non-HART | 16 | AO16 | |

Following Series C IO modules introduced in Experion PKS R410.

| HART Analog Input | CC -PAIH51 |
|-----------------------|------------|
| HART Analog Output | CC-PAOH51 |
| Digital Input 24V DC | CC-PDIL51 |
| Digital Output 24V DC | CC-PDOD51 |

These modules must be used only with Experion PKS R410 and later. These modules will not work as expected with earlier releases of Experion PKS. Using these with Experion releases prior to R410 by downgrading the firmware may render the module faulty and may not be possible to recover.

NOTES:

- 1. There are two models of High Level Analog Input such as, CU-PAIX01 and CU-PAIN01. The Module Hardware and the corresponding IOTAs are different and CU-PAIN01 is a new model. From the perspective of configuration and implementation, both High Level Analog Input models use the same IOM Block such as, AI-HL. It must be noted that the two models utilize the same configuration; online migration is not possible as mixed redundant pair is not possible. There are two models of Analog Output such as, CU-PAOX01 and CU-PAON01. Hence, similarly configuration, implementation, and interoperability constraints apply and CU-PAON01 is the new model.
- 2. Two new models of AI-HART (CC-PAIH02) and AI-HL (CC-PAIX02) modules are introduced to replace the older models of the AI-HART (CC-PAIH01) and AI-HL (CC-PAIX01) modules. The new models support both single-ended and differential inputs.
- 3. With R410, a new model of HART Analog Input CC-PAIH51 is introduced. The HART Analog Input CC-PAIH51 and Cx-PAIH01 use the same IOM block, that is, AI-HART. The configuration and implementation mentioned in note 1 applies to the HART Analog Input module.
- 4. With R410, a new model of HART Analog Output CC-PAOH51 is introduced. The HART Analog Output CC-PAOH51 and Cx-PAOH01 use the same IOM block, that is., AO-HART. The configuration and implementation mentioned in note 1 applies to the HART Analog Output module.
- 5. With R410, a new model of Digital Input 24V DC CC-PDIL51 is introduced. The Digital Input 24V DC CC-PDIL51 and Cx-PDIL01 use the same IOM block, that is, DI-24. The configuration and implementation mentioned in note 1 applies to the Digital Input 24V module.
- 6. With R410, a new model of Digital Output 24V DC CC-PDOD51 is introduced. The Digital Output 24V DC CC-PDOD51 and Cx-PDOB01 use the same IOM block, that is, DO-24B. The configuration and implementation mentioned in note 1 applies to the Digital Output 24V module.
- 7. Starting with R430, a new model of Low Level Analog Input Mux CC-PAIM51 is introduced.
- 8. The UIO (CC-PUIO01) has 32 configurable input or output channels. Each channel can be configured as one of the following:
 - Analog Input (0-20mA or 4-20mA active)
 - Analog Output (4-20mA active)
 - Digital Input (with or without line monitoring)
 - Digital Output (with or without line monitoring)
- 9. The UIO (CC-PUIO31) module is introduced with R432 and has 32 configurable input or output channels that are identical to the UIO (CC-PUIO01) module.

3.3.1 Compatibility matrix between Al modules and differential Al modules

You can choose the AI modules based on your functionality requirements. The following table lists the functionalities and the respective AI modules.

| If you want | Then you must select | | |
|----------------------------|----------------------|--|--|
| AI HART/GIIS functionality | CC-PAIH02 module | | |

| If you want | Then you must select |
|--|----------------------|
| Non-HART and Non-GIIS standard 2 wire transmitter (4-20mA input) | CC-PAIN01 module |
| Non-HART and Non-GIIS (1-5V input) | PAIX02 module |

The following table lists the compatibility matrix between AI modules and differential AI modules for redundant and non-redundant configuration.

| IOM | Redundant IOTA | Non- | Al | | HART | No. of differential | |
|-----------|----------------|----------------|--------|------|------|---------------------|------------------------------|
| | | Redundant IOTA | 4-20ma | 1-5V | 0-5V | | inputs |
| CC-PAIN01 | CC-TAIN11 | CC-TAIN01 | X | | | | None |
| CC-PAIH02 | CC-TAIX11 | CC-TAIX01 | X | X | X | X | Channels 13 through 16 |
| CC-PAIH02 | CC-TAID11 | CC-TAID01 | X | X | X | X | Channels 1 through 16 (1) |
| CC-PAIX02 | CC-TAIX11 | CC-TAIX01 | X | X | X | | Channels 13 through 16 |
| CC-PAIX02 | CC-TAID11 | CC-TAID01 | X | X | X | | Channels 1 through 16 |
| CC-PAIH51 | CC-TAIX61 | CC-TAIX51 | | X | | | None |

| IOM | Redundant IOTA | Non- | | No. of differential inputs |
|-----------|----------------|----------------|---|----------------------------|
| | | Redundant IOTA | | |
| CC-PAIH02 | CC-GAIX11 | CC-GAIX21 | X | Not applicable |
| CC-PAIX02 | CC-GAIX11 | CC-GAIX21 | X | Not applicable |

•

Attention

The following module types are superseded by a new version of the module.

- CC-PAIH01 superseded by CC-PAIH02
- CC-PAIX01 superseded by CC-PAIX02
- CC-PAOX01 superseded by CC-PAON01

3.3.2 Compatibility matrix between AO modules and differential AO modules

The following table lists the compatibility matrix between AO modules and differential AO modules for redundant and non-redundant configuration.

| IOM | Redundant IOTA | Non- | AO | HART | IS |
|-----------|----------------|----------------|--------|------|----|
| | | Redundant IOTA | 4-20mA | | |
| CC-PAOH01 | CC-TAOX11 | CC-TAOX01 | X | X | |
| CC-PAOH01 | CC-GAOX11 | CC-GAOX21 | X | X | X |
| CC-PAOX01 | CC-TAOX11 | CC-TAOX01 | X | | |
| CC-PAOX01 | CC-GAOX11 | CC-GAOX21 | X | | X |
| CC-PAON01 | CC-TAON11 | CC-TAON01 | X | | |

3.3.3 Difference between Al-HART modules Cx-PAIH01 and Cx-PAIH51

| AI-HART module Cx-PAIH01 | AI-HART module Cx-PAIH51 | |
|--|--|--|
| Supports Open Wire detection. | Does not support Open Wire detection. | |
| Supports 64-HART Communication units. | Supports 16- HART Communication units. | |
| Supports the following sensor types. | Supports only 1-5 V sensor type. | |
| • 1-5 V | | |
| • 0-5V | | |
| • 0.4-2V | | |
| Supports the following input types. | Supports only current (2-wire or self-powered transmitters) | |
| Voltage | input type. | |
| • Current (2-wire or self-powered transmitters) | | |
| Supports 16 input channels (single ended or differential). | Supports all single-ended input channels. | |
| Supports the following input range. | Supports only 4-20 mA (through 200 Ω) inputs. | |
| • 0 to 5V | | |
| • 1 to 5V | | |
| • 0.4 to 2V | | |
| • 4-20 mA (through 250 Ω) | | |
| Supports all HART scan rates. | Supports all HART scan rates except 1 Sec Dynamic, 1 Sec Device, 2 Sec Device and Dynamic. | |
| Supports differential voltage inputs. | Does not support differential voltage inputs. | |
| Supports field calibration | Field calibration is not required. | |

3.3.4 Difference between AO-HART modules Cx-PAOH01 and Cx-PAOH51

| AO-HART module Cx-PAOH01 | AO-HART module Cx-PAOH51 | |
|---------------------------------------|--|--|
| Supports 64-HART Communication units. | Supports 16- HART Communication units. | |
| Supports all HART scan rates. | Supports all HART scan rates except 1 Sec Dynamic, 1 Sec Device, 2 Sec Device and Dynamic. | |
| Supports field calibration. | Field calibration is not required. | |
| Supports OUTPUT READBACK. | Does not support OUTPUT READBACK. | |

3.3.5 Difference between bussed low voltage Digital Input modules Cx-PDIL01 and Cx-PDIL51

| Digital Input module Cx-PDIL01 | Digital Input module Cx-PDIL51 | |
|--------------------------------|---------------------------------------|--|
| Supports Open Wire detection. | Does not support Open Wire detection. | |

3.3.6 Difference between low voltage Digital Output modules Cx-PDOB01 and Cx-PDOD51

| Digital Output module Cx-PDOB01 | Digital Output module Cx-PDOD51 |
|--|---|
| Does not support Power fail diagnostics. | Supports Power fail diagnostics at module level to diagnose the output driver power failure (fuse/4 pin terminal block failure). When the failure is detected, OPFAIL soft fail is displayed on all the channels to take care of back initialization in upstream block. The following module level soft failure is displayed. 'Field Power Failure' Check the fuse or power supply status of the 4 pin terminal block when the error message is displayed. |
| Supports source output type. | Supports sink (open drain) output type. |
| Supports load current as 500mA. | Supports load current as 100mA. |

3.3.7 Difference between AI-LLMUX and CC-PAIL51 modules Cx-PAIM01 and Cx-PAIM51

| AI-LLMUX module Cx-PAIM01 | Al-LLAI module Cx-PAIM51 | |
|---|---|--|
| Supports 64 input channels. | Supports 16 input channels. | |
| Supports the following RTD types. | Supports a new RTD type, CU50Rtd, in addition to the RTD | |
| • Pt: 100 ohm DIN 4376 | types supported by the AI-LLMUX. | |
| • Pt: 100 ohm JIS C-1604 | | |
| • Ni: 120 ohm ED #7 | | |
| Cu: 10 ohm SEER | | |
| Supports field calibration | Field calibration is not required. | |
| Supports remote cold junction capability. | Does not support remote cold junction. | |
| Requires an external HPM FTA to connect the field inputs to IOTA. | Field inputs can be directly connected to the IOTA. | |
| Supports cold junction compensation range, -20 to +60 degree Celsius. | Supports cold junction compensation range, –40 to +70 degree Celsius. | |
| Supports the operating temperature between 0 to +60 degree Celsius. | Supports the operating temperature between –40 to +70 degree Celsius. | |

3.3.8 Identifying supported Series C I/O modules

The Series C I/O model designations follow a 'XX-YZZZNN' format.

Where:

- XX is CC or DC
- CC is for the Series C Product Line.

The model number for every Series C product begins with a C designation for Series C.

- DC is for the Series C Mark II.
- Y is either C, E, F, G, H, K, M, P, PW, S or T
 - C = Control Processor
 - E = Enclosure
 - F = FTE
 - G = GI/IS Termination Assembly

- H = Hazardous Interface
- K = Cabling
- M = Mechanical
- P = I/O Module
- PW = Power
- S = Custom Interface
- T = Termination Assembly
- ZZZ is a particular function or model.
- NN is a series of model and can be used as additional model information -

NN + 10 = Redundant complement to an IOTA.



Tip

Series C Mark II may not support all the above options.

3.3.9 Considerations for replacing or pairing Series C Analog I/O modules in a redundant configuration

In a redundant series C analog I/O module configuration, consider and complete the following before you replace or pair the modules.

| Release | Hardware revisions of old modules | Hardware revisions of new modules | Considerations and actions for replacing or pairing modules |
|---------------|--|--|--|
| R301 | <=K for AI_HART and AI_HL <=H for AO and AO HART | >=M for AI_HART and AI_HL >=J for AO and AO HART | You cannot pair an older hardware revision module with a latest hardware revision module. Replace your older module with a latest module. |
| R310 or later | <=K for AI_HART and AI_HL <=H for AO and AO_HART | >=M for AI_HART and AI_HL >=J for AO and AO_HART | You can pair an older hardware revision module with a latest hardware revision module. However, complete the following after you replace one of the older modules: 1. Migrate to the latest patch applicable for the release. 2. Migrate the applicable controllers 3. Update the firmware of the older hardware revision module. 4. Verify that the firmware versions of both the modules are indicated as "Green" in CTools. |

Model number references for the affected Series C Analog I/O modules

| Module model number | Module type | Hardware revisions of old modules | Hardware revisions of new modules |
|---------------------|-------------|-----------------------------------|-----------------------------------|
| CC- PAIH01/02 | AI_HART | <=K | >=M |
| CC- PAIX01/02 | AI_HL | <=K | >=M |
| CC- PAOH01 | AO_HART | <=H | >=J |
| CC- PAOX01 | AO | <=H | >=J |

3.4 Supported Series C I/O options

The following Series C I/O options are supported:

- I/O redundancy
- · Power supply redundancy
- HART communications
- Galvanically Isolated/Intrinsically Safe IOTAs
- Remote I/O (using Fiber Optic I/O Extender)
- Corrosion Protection
- · Harsh environment

3.4.1 Inspecting the I/O library

Series C module function blocks and I/O channel blocks are housed in the Series C I/O library of Control Builder.

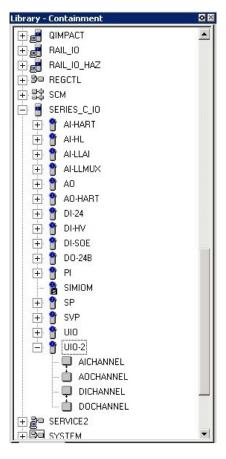


Figure 6: Series C I/O library

3.4.2 Inspecting IOM function blocks

All IOM function blocks are associated with (children of) an IOLINK function block.

The Series C I/O IOM function blocks are the following:

AI-HART

- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-24
- DI-HV
- DISOE
- DO-24B
- SP
- SVP
- PI
- UIO
- UIO-2

3.4.3 Inspecting channel function blocks

The Series C I/O Channel function blocks are the following:

Table 7: Series C I/O channel function blocks

| Channel block name | Associated with IOM blocks |
|--------------------|----------------------------|
| AICHANNEL | • AI-HART |
| | • AI-HL |
| | • AI-LLMUX ¹ |
| | • AI-LLAI |
| | • UIO |
| | • UIO-2 |
| AOCHANNEL | • AO |
| | AO-HART |
| | • UIO |
| | • UIO-2 |
| DICHANNEL | • DI-HV |
| | • DI-24 |
| | • DI-SOE |
| | • UIO |
| | • UIO-2 |
| DOCHANNEL | • DO-24B ² |
| | • UIO |
| | • UIO-2 |
| SP_AI | • SP |
| SP_AO | |
| SP_DI | |
| SP_DO | |
| SP_SPDVOTE | |
| SP_SPEED | |

| Channel block name | Associated with IOM blocks |
|--------------------|----------------------------|
| SVP_AI | • SVP |
| SVP_AO | |
| SVP_REGCTL | |
| SVP_DI | |
| PICHANNEL | • PI |

3.4.4 Defining module containment

An individual channel within a Series C I/O block is often abbreviated as an IOC block. While an IOC block must be 'contained in' a Control Module (CM) in Control Builder, the IOC block actually resides within the associated IOM device. This means you change the execution state (EXECSTATE) of a CM independent of the IOC's point execution state (PTEXECST).

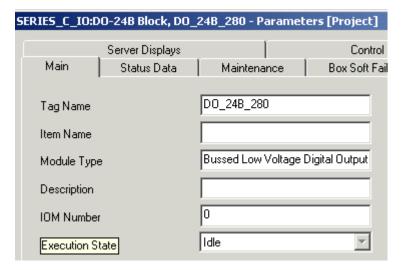


Figure 7: Execution State

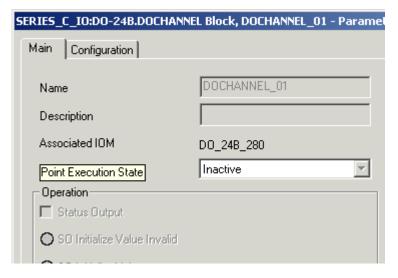


Figure 8: Point Execution State

3.4.5 Temperature Derating for UIO

The maximum outside module temperature must be limited depending on the internal dissipation.



Attention

- · Airflow through the module is assumed to be natural convection.
- Ensure that the UIO modules are installed in the correct position. A UIO module must be mounted in the upright
 position.

To determine the maximum acceptable outside module temperature for a typical configuration, perform the following steps.

- 1. Perform the Internal Dissipation Calculation for UIO.
 - a. Determine and record the actual configuration data.
 - b. Calculate the totals per dissipation contributor.
 - c. Add the totals of the previous step to determine the internal dissipation.
- 2. Using the **Temperature Derating Curves for UIO**, determine the maximum acceptable outside module temperature.

3.4.6 Internal dissipation calculation for UIO

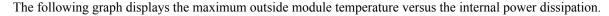
To calculate the maximum outside module temperature, you require the IO configuration. The maximum dissipation caused by the kernel logic of the UIO module is a fixed value. The other dissipation contributions depend on the channel configuration.

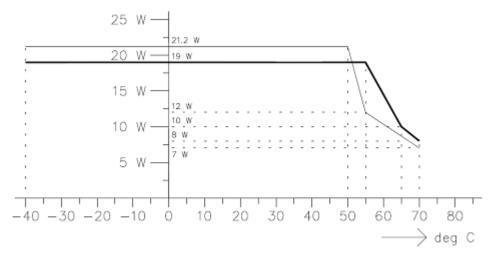
Table 8: Dissipation Calculation

| Dissipation contributor | Max. dissipation per channel (W) | Number of configured channels | Dissipation (W) | | |
|---|----------------------------------|-------------------------------|-----------------|--|--|
| Kernel logic | | | 5.5 | | |
| DI w/ OWD; field impedance $\geq 5 \text{ k}\Omega$ | 0.01 | | | | |
| DI; closed contact; 3.5mA | 0.085 | | | | |
| AI; I < 24mA; Current limited by field | 0.05 | | | | |
| AI; I > 24mA; Current limited by UIO * | 0.49 | | | | |
| DO; I < 0.3A | 0.115 | | | | |
| DO; I < 0.5A | 0.305 | | | | |
| AO; 500 Ω field impedance; I < 23mA | 0.225 | | | | |
| AO; 250 Ω field impedance; I < 23 mA | 0.335 | | | | |
| AO; field impedance < 250 Ω; I < 23 mA | 0.47 | | | | |
| AO; field impedance < 250 Ω; I < 20 mA | 0.42 | | | | |
| Total Power Dissipation (W) | | | | | |
| Max. outside module temperature °C | | | | | |

^{*} Analog input current above 24mA must be avoided. Field devices for the analog input must be configured to drive current below 24mA. For example, 3.5mA, for sensor fault conditions to minimize the UIO internal power dissipation. The thin-line derating curve needs to be taken when you are using current above 24mA.

3.4.7 Temperature Derating curves for UIO





Thick line: applicable for most applications having AO<=20mA and AI<=24mA

Thin line: applicable if one or more channels have AO>20mA or AI>24mA

3.4.8 Maximum Temperature Alarm for UIO-2

The alarm threshold safe operating temperature is determined based on the I/O channel configuration of the module and the anticipated module inlet air temperature.



Attention

- Airflow through the module is assumed to be natural convection.
- Ensure that the UIO modules are installed in the correct position. A UIO module must be mounted in the upright
 position.

To determine the maximum acceptable outside module temperature for a typical configuration, perform the following steps:

- 1. Perform the **High Temperature Limit Calculation for UIO-2**.
 - a. Determine and record the actual configuration data and the Estimated Ambient inlet air temperature.
 - b. Calculate the totals per dissipation contributor. For each channel type, multiply the total number of configured channels by the corresponding **Maximum Temperature Rise per channel** value.
 - c. Add the totals of the previous step to the **Estimated Ambient** temperature to determine the **High Temperature Limit Setting**. This limit value should not exceed 120 °C.
- 2. Enter the limit value into UIO-2 module configuration screen in Experion Control Builder.

3.4.9 High Temperature Limit Calculation for UIO-2

Table 9: Dissipation Calculation

| Estimated Ambient [°C] | 50 | | | |
|-------------------------------------|------------------|-----------------------------------|---|--|
| Dissipation Contributor | | Temperature Rise per channel [°C] | Number of channels (Total not to exceed 32) | Channel Contributio n to Temperature Rise [°C] |
| DI | Closed contact | 0.91 | 0 | 0.00 |
| DO | <500 mA | 1.06 | 0 | 0.00 |
| AI | <20 mA | 1.42 | 0 | 0.00 |
| AO | <22 mA, 220 ohms | 1.56 | 0 | 0.00 |
| Total Number of Configured Channels | 1 | I. | 0 | |
| High Temperature Limit Setting [°C] | | | 1 | 50 |

3.5 I/O Link performance specifications

The concept of a Link Unit (LU) was introduced with PM I/O where a LU was defined as being roughly equivalent to one parameter read (or write) per second.

With the introduction of Series C I/O, the transmission rate of data on an IOLINK configured with Series C I/O is now double that of PM I/O.



Attention

The Specification and Technical information is subject to change without notice and is superseded by information in applicable Experion product Specification and Technical data documents. Hence, for each Experion release, you are recommended to refer the applicable Specification and Technical data documents.

Table 10: Transmission rate of data on an I/O Link

| I/O type | Link rate per second | Link Units per second | |
|--------------|---------------------------|-----------------------|--|
| PM I/O | 1 parameter read or write | 1000 | |
| Series C I/O | 1 parameter read or write | 2000 | |

Note: Refer to Turbine Control User's Guide for I/O link performance specification of the SPM and SVPM.

3.5.1 Reviewing Link Unit utilization

The Link Unit utilization cycle rate varies depending on the type of block being used. The following table defines the specifications for the various blocks.

Link Units per cycle **Block names** Data processing Cycle time time **Event Collection** 1 Every primary IOM 500 ms Every secondary IOM **Event Collection** 1 500 ms 1.75 DI-xxx IOM blocks PV Scanning IOM block's SCANRATE 1.25 DO-xxx IOM blocks **BACKCALC Scanning** IOM block's SCANRATE AI-xxx IOM blocks 5 PV Scanning IOM block's SCANRATE AO-xxx IOM blocks **BACKCALC Scanning** 5 IOM block's SCANRATE **AOCHANNEL** 1 OP Store OP connector's CM Execution Rate status output for DOCHANNEL SO Store 1 SO connector's CM **Execution Rate** Pulse width modulation for IOM block's SCANRATE **BACKCALC Scanning** 1 DOCHANNEL Pulse width modulation for OP Store 1 OP connector's CM DOCHANNEL **Execution Rate**

Table 11: Link Unit utilization rates

3.5.2 Reducing I/O Link traffic

If I/O Link overruns persist, you reduce the I/O Link traffic by:

Increasing the value of the IOM's Scanning Rate parameter [SCANRATE]
 (i.e. increasing the time interval between IOM scans)

- Increase the Execution Period of Control Modules containing Output Channel blocks
- Reducing the number of IOMs configured
- Split the IOMs across multiple IOLINKS
- Check for presence of an address 'Chattering ' alarm events



Tip

Link IDs are only detected on their corresponding modules.

- Modules with Link ID 1 cannot detect Link ID 2.
- Modules with Link ID 2 cannot detect Link ID 1.

3.5.3 Event collection

Under normal conditions, every IOM configured on the I/O Link, whether primary or secondary, uses Link Units for event collection. This activity is periodic and can be accounted for, however; conditions in which numerous events and alarms are generated are unpredictable and may cause transient I/O Link overruns and delays in display updates. These transient overruns clear once the rush of events and alarms are collected.

3.5.4 PV and Back calculation scanning

The following I/O parameters are automatically scanned by the C300 as soon as the IOM block is loaded.

IOM block Scanned parameters

AI-xxx PV, PVSTS

AO-xxx OP, INITREQ

DI-xxx PVFL, BADPVFL

DO-xxx SO, INITREQ, OP

Table 12: I/O parameters scanned when the IOM is loaded

The number of AI and DI channel blocks contained within CMs or SCMs:

does not increase LU consumption.

The DO channel blocks contained in CMs and SCMs:

 does also not increase LU consumption for Back Calculation scanning, but LU consumption increases for each OP or SO store.

3.6 Universal Input/Output Module-2 (UIO-2)

Beginning with R432, a new Series C Universal Input/Output (UIO) module, the UIO-2, has been introduced. The UIO-2 not only supports all features and benefits offered by UIO, it also provides a few enhancements over the UIO. There are a few differences compared to the UIO too.

The UIO-2, driven by hardware miniaturization has resulted in a new design with reduced overall IOM and IOTA dimensions. Available in both redundant and non-redundant versions, the UIO-2 has a reduced footprint in the cabinet and increased density of IO point count per cabinet.

As the physical dimensions of the IOM and its IOTA are entirely different from the existing UIO, the UIO-2 is not a replacement for the UIO. The following sections provide a list of features of the UIO-2 and a list of significant differences between UIO-2 and UIO.

3.6.1 New and enhanced features of UIO-2

The UIO-2, in addition to providing all features provided by UIO, provides the following enhanced features beginning with R432:

- Is a single board module with physical dimension: 8.5 mm x 14.5 mm x 16 mm (5.5 mm dia) [4 x 4.5 dia x 14 width x 17 height]
- Dimensions of the redundant and non-redundant IOTAs are 12" and 9", respectively
- Provides one HART modem per I/O channel
- Supports pulse counting on up to four of any of the 32 channels that are configured as DI
- Supports DO ganging within the following eight channel number groups: 1 4, 5 8, 9 12, 13 16, 17 20, 21 24, 25 28, and 29 32. However, ganging across these groups is NOT possible.

Beginning with Experion R500.1, the following additional enhancements have been provided:

- Supports Sequence Of Events (SOE) functionality for digital input signals on all 32 channels
- Supports 24 V NAMUR type input signals with current (Amps) levels in accordance with IEC 60947-5-6:1999 specifications.

3.6.2 UIO-2 and UIO-1 compared

The following table describes the differences between UIO-2 and UIO-1.

Table 13: UIO-2 and UIO-1 comparison

| Feature | UIO-2 | UIO-1 |
|------------------|--|--|
| Board | Single board module | Three board module |
| IOTA dimensions | Redundant – 12" | Redundant – 18" |
| | Non-redundant – 9" | Non-redundant – 12" |
| HART modem count | One HART modem per channel | Only two HART modems: one modem dedicated to channels 1-16 and a second modem dedicated to channels 17-32. |
| Pulse counting | Supported on a maximum of 4 channels where each channel can be any of the 32 channels configured as DI. Input pulse frequency less than or equal to 15 KHz is supported. | Up to 4 channels, within channels 15 to 18 only, are supported for pulse counting. Input pulse frequency of 10 KHz is supported. |

| Feature | UIO-2 | UIO-1 |
|---------------------|--|--|
| DO ganging | Supported for 2, 3, or 4 channels within the following eight channel number groups: 1 - 4, 5 - 8, 9 - 12, 13 - 16, 17 - 20, 21 - 24, 25 - 28, and 29 - 32. However, ganging across these groups is NOT possible. | Supported for 2, 3,or 4 channels within any 4 channels. However, channels 32 and 1 cannot be ganged. |
| SOE | Supported on all 32 DI channels | Not supported. |
| NAMUR input signals | Supported on all DI channels receiving 24 V NAMUR type input signals with current (Amps) levels in accordance with IEC 60947-5-6:1999 specifications. | Not supported. |
| | The DI channel can be configured to detect and report Open Wire and Short Circuit conditions. | |
| | The following states are supported: | |
| | Open Wire | |
| | • ON | |
| | • OFF | |
| | Short Circuit | |
| | Note DI channels enabled for SOE cannot be configured to support NAMUR signal inputs. | |

4 Series C I/O Installation and Upgrades

The Experion release utilizes new hardware designs including those for the controllers, I/O modules, and switches. The information contained in this section defines how to establish the various hardware connections and Series C I/O firmware.

To review planning the entire Series C Control System, refer to the Control Hardware Planning Guide's Planning Your Series C Control System.

Related topics

- "Installation Declarations" on page 62
- "Installing the Series C IOTA on the carrier" on page 65
- "Mounting the I/O module on the IOTA" on page 67
- "Grounding and power considerations IOTA boards" on page 68
- "Connecting IOMs and field devices through I/O Termination Assemblies" on page 70
- "Powering the Series C system" on page 74
- "Fusing Series C IOTA boards" on page 75

4.1 Installation Declarations

•

Attention

This equipment shall be installed in accordance with the requirements of the National Electrical Code (NEC), ANSI/NFPA 70, or the Canadian Electrical Code (CEC), C22.1. It is supplied as 'open equipment' that is intended to be mounted on a sub-panel within an enclosure. The suitability of the enclosure and installed system shall be acceptable to the local 'authority having jurisdiction,' as defined in the NEC, or 'authorized person' as defined in the CEC.



Electrostatic discharge

Electrostatic discharge can damage integrated circuits or semiconductors if you touch connector pins or tracks on a printed wiring board.

- · Touch a grounded object to discharge static potential
- · Wear an approved wrist-strap grounding device
- · Do not touch the wire connector or connector pins
- Do not touch circuit components
- If available, use a static safe workstation
- When not in use, keep the component in its static shield box or bag



WARNING

Unless the location is known to be non-hazardous, do not:

- · Connect or disconnect cables
- Install or remove components
- · Install or remove isolators

While the control system is powered.

4.1.1 Introduction

The following figure represents the main cabling of the Series C300 controller, Control Firewall, and I/O IOTA boards.

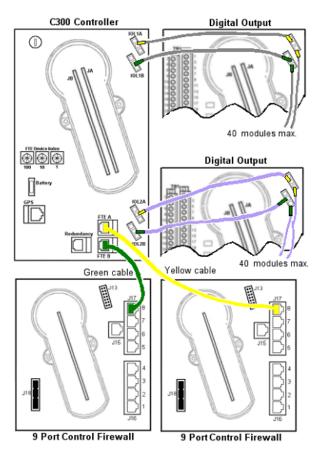


Figure 9: Series C board connections

4.1.2 I/O Link Address Jumpers

The I/O Link Address is configured using a push-on color-coded jumper with a printed number (1-40) that must be installed on each IOTA.



Attention

- IO modules configured using Gray address jumpers must be connected to I/O Link 1 on the C300.
- IO modules configured using Violet address jumpers must be connected to I/O Link 2 on the C300.
- IO modules connected to the wrong I/O Link do not communicate each other.
- The IOM Number parameter (IOMNUM) specifies the address of the module on the I/O Link and must match the I/O Link address jumper on the IOTA
- Only the Honeywell provided address jumper tiles must be used. When changing address jumpers, you must ensure that:
 - (1) The IOM is disconnected from the Link,
 - (2) Power cycled after the address change, then
 - (3) The IOM may be re-connected it back to the Link

4.1.3 Cabling

The following graphic is an example of possible configuration connections with regards to the Series C I/O cabinet. Your configuration may vary based on the module layout of your cabinet. The following table defines cable type and usage in the graphic below.

Table 14: Series C I/O cable types

| Cable | Color | Purpose |
|-----------------|---------------|--|
| FTE -A | Yellow | Connect controller to firewall (point-to-point) |
| FTE - B | Green | Connect controller to firewall (point-to-point) |
| FTE - Redundant | Orange | Private path between primary and secondary controller (point-to-point) |
| IOL1A | Grey/yellow | Connect controller to I/O |
| IOL1B | Grey/green | Connect controller to I/O |
| IOL2A | Violet/yellow | Connect primary controller to secondary controller and then to I/O |
| IOL2B | Violet/green | Connect primary controller to secondary controller and then to I/O |

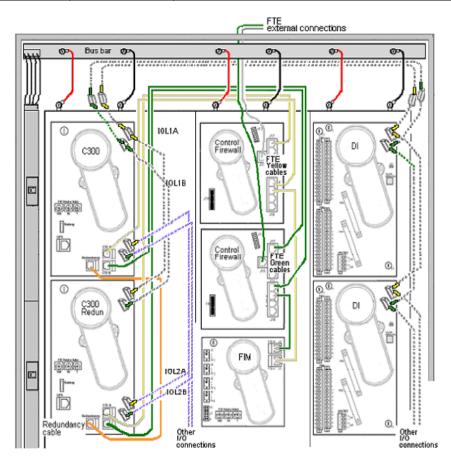


Figure 10: Series C cabling

4.2 Installing the Series C IOTA on the carrier

- You can use a redundant IOTA to support a non-redundant Series C IOM application. Just be sure to install the non-redundant Series C IOM in the primary location on the IOTA.
- Be sure the enclosure is connected to a protective earth ground using #8 AWG solid copper wire. There should be metal to metal contact between the grounding bus bar and the enclosure as well as the carrier.

Prerequisites

Carrier for mounting IOTA is installed in a cabinet or desired mounting location.

- Power supply is installed.
- Control firewall is installed.
- All wiring and pre-fabricated cables are available and labeled as applicable.
- Be sure all power is turned off at the installation location.
- You have the mounting hardware supplied with the components.

Mounting the IOTA

 Select desired mounting location on carrier and align mounting holes in IOTA with screw-hole locations on the carrier. Be sure component side of IOTA is facing up.

6 inch IOTA board 4 mounting screws

9 inch IOTA board 6 mounting screws 12 inch IOTA board



Attention

When mounting the either the 9 or 12 inch IOTA board, it is recommended to secure the three mounting screws on one side (either left or right) and then secure the other side.

Securing the four corner screws and the two middle screws may cause bowing of the board and impact the alignment of the IOTA board to the carrier holes and is not recommended.

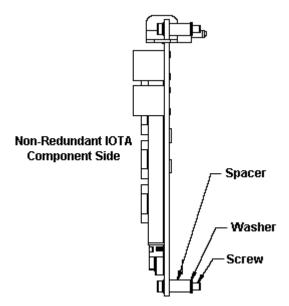


CAUTION

The IOTA power and ground screws can bind during installation or removal if the mounting screws are fully secured before the power/ground screws are installed.

Recommended sequence:

- Secure the IOTA to the carrier tightening the IOTA's mounting screws only half-way. Insert the spacers
 and washers between bottom of IOTA and top of carrier.
- Install the 24V (power) and ground (common) screws fully into the bus bars, torquing the screws to 5inch pounds.
- 3. Finish installing the IOTA by **tightening the IOTA's mounting screws only full-way**, torquing the screws to 3-inch pounds



4.3 Mounting the I/O module on the IOTA

Prerequisites

It is recommended to attach the IOTA board to the Backplane prior to mounting the module to the IOTA. Ensure the following:

- IOTA is mounted on the Backplane.
- Power supply is installed.
- Control firewall is installed.
- All wiring and pre-fabricated cables are available and labeled as applicable.
- All power is turned off at the installation location.
- You have the mounting hardware supplied with the components.

Mounting the module

- 1 Insert the module onto the IOTA board making sure that the circuit board mates properly with the IOTA board connector.
- **2** Secure the module to the:
 - IOTA board with two screws located on each side of the plastic cover.
 - Backplane with the long gray plastic screw located on the module's face.



CAUTION

Use only a #2 Phillips screw-driver to carefully loosen or tighten the long gray plastic screw. Do not use either a #1 Phillips screw-driver or a battery-powered screw-driver to remove or install the plastic screw as this can damage the screw head.

4.4 Grounding and power considerations - IOTA boards

The Series C cabinet allows mounted carriers that support the attachment of the IOTA boards. By making these connections, power, and chassis, grounding is provided to the IOTA board.

4.4.1 Testing for power



CAUTION

Extreme care must be taken when testing for power at the Series C bus bars. Improper testing can result in an electrical short circuit, which will impact all modules attached to the channel carrier assembly.

Never use a test probe at an unattached IOTA's 24V screw hole. The probe can potentially touch the back channel assembly causing a short circuit.

The following locations are recommended for testing power:

Preferred location if IOTAs are attached

• Center of the screw that attaches the IOTA to the 24V bus bar.

Preferred location if IOTAs are NOT attached.

Center of the screw of top connection terminal for power cable.

Testing for power at IOTA screw

- 1 Insert the test probe at the center of the screw that attaches the IOTA to the 24V power connection.
- 2 This concludes this procedure.

Testing for power at 24V bus bar top terminal

- 1 Carefully pull the red cap from the top of the terminal. It remains attached to the power cable.
 - Insert the test probe at the center of the screw to the 24V power terminal.
- 2 Carefully pull the black cap from the top of the terminal. It remains attached to the ground cable. Insert the test probe at the center of the screw to the COM ground terminal.
- 3 Replace the both caps.
- 4 This concludes this procedure.

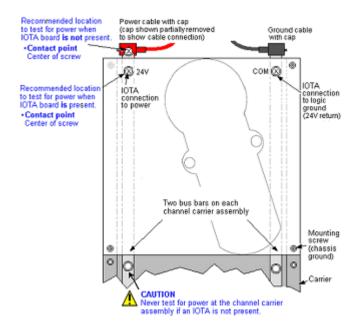


Figure 11: Grounding and power connections

4.5 Connecting IOMs and field devices through I/O Termination Assemblies

All connections between IOMs and field devices are through I/O Termination Assemblies (IOTAs). IOTAs are sometimes connected to ancillary hardware that pre-conditions the signal for use in Experion.

The following table defines the relationship between IOM type and the ancillary hardware.

Table 15: IOM types and ancillary hardware

| If IOM type is | Then the ancillary hardware | | |
|----------------|--|--|--|
| DO | takes the output signal and drives a set of relays | | |
| Digital Output | | | |
| AI LLMUX | can be one to four Field Termination Assemblies. | | |

These FTA's pre-condition and package the signals before they are received by the IOTA.

To simplify system hardware selection and to minimize spare parts requirements, IOMs can be used with various types of IOTAs. The following table provides a list of IOMs, their associated IOTAs, and ancillary hardware. All IOM models listed within the same cell can be installed on any of the IOTAs listed in the adjacent cell.



Attention

Connecting Series C IOM's into a Galvanically Isolated / Intrinsically Safe (GI/IS) environment requires specific GI/IS IOTAs.

Refer to the following for GI/IS IOTAs and the IOMs they support: "GI/IS IOTA models" on page 596

Table 16: IOMs, IOTAs, and ancillary cards

| IOM block type | IOM model number | IOTA model number | IOTA description ⁷ | IOTA supported FTAs or ancillary cards |
|-----------------------|---------------------|-------------------|---|--|
| AI-HART | Cx-PAIH01 | Cx-TAIX01 | AI, non-redundant | None |
| | Refer to Attention | Cx-TAIX11 | AI, redundant | None |
| | | Cx-GAIX11 | AI, GI-IS, non-redundant | MTL4541 |
| | | | | MTL4575 |
| | | Cx-GAIX21 | AI, GI-IS, redundant | MTL4544 |
| | | CC-TAID01 | Analog Input, Non-redundant, 16 ch. differential | |
| | Cx-PAIH51 | Cx-TAIX51 | AI, non-redundant | None |
| | | Cx-TAIX61 | AI, redundant | None |
| AI-HART Differential/ | CC-PAIH02 | Cx-TAIX01 | Analog Input, Non-redundant, 4 ch. differential | None |
| Single-ended | | Cx-TAIX11 | Analog Input, Redundant, 4 ch. differential | None |
| | | Cx-GAIX11 | Analog Input, GI-IS, Redundant, no differential, 4-20 mA only | MTL4544 |
| | | Cx-GAIX21 | Analog Input, GI-IS, Non-redundant, | MTL4541 |
| | | | no differential, 4-20 mA only | MTL4575 |
| | | CC-TAID11 | Analog Input, Redundant, 16 ch. differential | None |

| IOM block type | IOM model number | IOTA model number | IOTA description ⁷ | IOTA supported FTAs or ancillary cards |
|----------------|---|------------------------|--|--|
| AI-HL | Cx-PAIN01 | Cx-TAIN01 | AI, Non-redundant | None |
| | | Cx-TAIN11 | AI, Redundant | None |
| AI-HL | Cx-PAIX01 | Cx-TAIX01 | AI, Non-redundant | None |
| | Refer to Attention | Cx-TAIX11 | AI, Redundant | None |
| | | Cx-GAIX11 | AI, GI-IS non-redundant | MTL-4541 |
| | | | | MTL-4575 |
| | | Cx-GAIX21 | AI, GI-IS redundant | MTL-4544 |
| AI-HL | CC-PAIX02 | CC-TAIX01 | AI, non-redundant | None |
| Differential/ | | CC-TAIX11 | AI, redundant | None |
| Single-ended | | Cx-GAIX11 | AI, GI-IS, non-redundant | MTL4541 |
| | | | | MTL4575 |
| | | Cx-GAIX21 | AI, GI-IS, redundant | MTL4544 |
| | | CC-TAID01 | AI, non-redundant | None |
| | | CC-TAID11 | AI, redundant | None |
| AI | CC-PAIN01 | CC-TAIN01 | Analog Input, Non-redundant, no differential, 4-20 mA only | None |
| | | CC-TAIN11 | Analog Input, Redundant, no differential, 4-20 mA only | None |
| AI-LLMUX | Cx-PAIM01 | Cx-TAIM01 ⁴ | LLMUX, non-redundant, non-coated | Mx-TAMT04 |
| | | (note 1a) | | Mx-TAMR04 |
| | | | | Mx-TAMT14 |
| AI-LLAI | Cx-PAIM51 | Cx-TAIM51 | LLAI, non-redundant, non-coated | None |
| Cx-TAIM51 | LLAI, non- redundant, non- coated | | | None |
| AO-HART | Cx-PAOH01 | Cx-TAOX01 | AO, non-redundant | None |
| | | Cx-TAOX11 | AO, redundant | None |
| | | Cx-GAOX11 | AO,GI-IS non-redundant | MTL4546C |
| | | Cx-GAOX21 | AO, GI-IS redundant | MTL4549C |
| | Cx-PAOH51 | Cx-TAOX51 | AO, non-redundant | None |
| | | Cx-TAOX61 | AO, redundant | None |
| AO | Cx-PAOX01 | Cx-TAOX01 | AO, Non-redundant | None |
| | | Cx-TAOX11 | AO, Redundant | None |
| | | Cx-GAOX11 | AO, GI-IS, Non-redundant | MTL4546C |
| | | Cx-GAOX21 | AO, GI-IS, Redundant | MTL4549C |
| AO | Cx-PAON01 | Cx-TAON01 | AO, Non-redundant | None |
| | | Cx-TAON11 | AO, Redundant | None |
| DI-HV | Cx-PDIH01 | Cx-TDI110 | DI, 120VAC non-redundant | None |
| | | Cx-TDI120 | DI, 120VAC redundant | None |
| | | Cx-TDI220 | DI, 240VAC non-redundant | None |
| | | Cx-TDI230 | DI, 240VAC redundant | None |

| IOM block type | IOM model number | IOTA model number | IOTA description ⁷ | IOTA supported FTAs or ancillary cards |
|----------------|------------------|-------------------|---|--|
| DI-HV PROX | Cx-PDIH01 | CC-TDI151 | DI,120VAC non-redundant | None |
| DI-24 | Cx-PDIL01 | Cx-TDIL01 | DI-24V, non-redundant | None |
| | | Cx-TDIL11 | DI-24V, redundant | None |
| | | Cx-GDIL11 | DI-24VDC, GI-IS, redundant | MTL4516 |
| | | | | MTL4517 |
| | | Cx-GDIL21 | DI-24VDC, GI-IS, non-redundant | MTL4510 |
| | | Cx-GDIL01 | DI-24VDC, GI-IS, redundant (for expander) | MTL4511 |
| | | Cx-SDXX01 | GI-IS expander | MTL4511 |
| | Cx-PDIL51 | Cx-TDIL51 | DI-24V, non-redundant | None |
| | | Cx-TDIL61 | DI-24V, redundant | None |
| DI_SOE | Cx-PSOE01 | Cx-TDIL01 | DI-24V, non-redundant | None |
| | (note 4) | | | |
| DO-24B | Cx-PDOB01 | Cx-TDOB01 | DO-24V, bussed, non-redundant | None |
| | | Cx-TDOB11 | DO-24V, bussed, redundant | None |
| | | Cx-TDOR01 | DO- High Voltage Relay, non- | Cx-SD0R01 ² |
| | | | redundant | (note 2) |
| | | Cx-TDOR11 | DO- High Voltage Relay, redundant | Cx-SD0R01 ² |
| | | | | (note 2) |
| | | Cx-GDOL01 | DO-24VDC, GI-IS, redundant (for expander) | MTL4521 |
| | | Cx-SDXX01 | GI-IS expander | MTL4521 |
| | Cx-PDOD51 | Cx-TDOD51 | DO-24V, bussed, non-redundant | None |
| | | Cx-TDOD61 | DO-24V, bussed, redundant | None |
| SVPM | CC-PSV201 | CC-TSV211 | Servo Valve Positioner IOTA, Redundant, Coated | None |
| SPM | CC-PSP401 | CC-TSP411 | Speed Protection IOTA, Redundant, Coated | None |
| PI | CC-PPIX01 | CC-TPIX11 | Pulse Input w/ Fast Cutout, Redundant | None |
| UIO | CC-PUIO01 | CC-TUIO01 | UIO, Non-Redundant | None |
| | | CC-TUIO11 | UIO, Redundant | |
| UIO-2 | CC-PUIO31 | CC-TUIO31 | Universal IO-2, non-redundant, coated | None |
| | | CC-TUIO41 | Universal IO-2, redundant, coated | |
| DI-24 | DC-PDIL51 | DC-TDIL01 | DI 24V IOTA (Non-Redundant) | None |
| | | DC-TDIL11 | DI 24V IOTA (Redundant) | |
| DI-SOE | DC-PDIS51 | DC-TDIL01 | DI 24V IOTA (Non-Redundant) | None |
| | | DC-TDIL11 | DI 24V IOTA (Redundant) | |
| DO-24B | DC-PDOD51 | DC-TDOD51 | DO 24V Bussed without RB IOTA (Non-Redundant) | None |
| | | DC-TDOD61 | DO 24V Bussed without RB IOTA (Redundant) | |

NOTES

- 1. Cx-TAIM01 This does NOT require the MU-TLPA02 Power Adapter and supports in-cabinet configuration or in a suitable enclosure up to 1,000 feet remote from the LLMUX IOTA as displayed in Figure 15.
- 2. Cx-TAIM21 requires the MU-TLPA02 Power Adapter and can be mounted in-cabinet and remotely.
- 3. One CC-KREBxx uncoated cable is used to connect the IOTA to the relay extension board.
- 4. One CC-KREBxx coated cable is used to connect the IOTA to the relay extension board.
- 5. Bussed IOM (PDOB01) is used for both bussed outputs and relay outputs, however, only relay outputs require the additional card.
- 6. Redundantly configured IOMs must be installed on a redundant IOTA.
- 7. Non-redundant IOMs can be installed on non-redundant and redundant IOTAs. However, when installed on a redundant IOTA, non-redundant IOMs must be installed in the upper IOM slot of the redundant IOTA.
- 8. The IOTA type used for Series C IO DI-24V is used with the DI-SOE IOM also.
- 9. Non-redundant differential IOTA (CC-TAID01) length is 9', non-redundant IOTA (CC-TAIX01 and CC-TAIN01) length is 6', and differential redundant IOTAs (CC-TAID11, CC-TAIN11, and CC-TAIX11) length is 12'.
- 10. A third level of connector is available for all differential mode connections as an extension of channel 13 through 16 terminals for all 16 channels.
- 11. Differential configuration does not require any custom wiring as the IOTAs (CC-TAID01 and CC-TAID11) performs it internally.
- 12. Two new models of AI-HART (CC-PAIH02) and AI-HL (CC-PAIX02) modules are introduced to replace the older models of the AI-HART (CC-PAIH01) and AI-HL (CC-PAIX01) modules. The new models support both single-ended and differential inputs.
- 13. With R410, new models of AI-HART (Cx-PAIH51), AO-HART (Cx-PAOH51), DI-24V (Cx-PDIL51), and DO-24B2 (Cx-PDOD51) are introduced.

4.6 Powering the Series C system

Power systems for the Series C control hardware provides:

- optional redundant power supplies with separate mains power feeds
- · optional system battery backup is also available, and
- a memory RAM battery is provided to supply memory retention power for the C300 Controller

The capabilities and options available with the Series-C power system are very similar to those available with the Process Manager Power System.

Refer to the Series C Power Supply in the C300 Controller User Guide additional power system information.

4.7 Fusing - Series C IOTA boards

Series-C I/O modules are constructed to support normal field failures, wiring errors and conditions such as a shorted wire. All Series-C IOTAs contain at least one fuse that provides protection for catastrophic errors in the IOTA, IOM and other elements of the Series-C system. In normal operation as well as many abnormal operations, the fuse element should not blow.

The following attributes apply to all Series-C I/O modules:

- 24V DC power is protected by a fuse mounted on the IOTA.
- For redundant IOTAs, a fuse is provided for each IOM. If one fuse element were to blow, the partner IOM
 continues to operate.



Attention

In virtually all instances of normal field failure, the I/O module will recover without any maintenance action such as replacing a component or fuse.

To access the parts information for the fuses associated with each board and module, refer to "Series C recommended spares" on page 542 in the Recommended Spare Parts section.

4 SERIES C I/O INSTALLATION AND UPGRADES

5 Series C IOTA Pinouts

Related topics

- "Analog Input IOTA Models CC-TAIX01, CC-TAIX11" on page 78
- "Analog Input non-HART/HARTIOTA Models Cx-TAIX51, Cx-TAIX61" on page 89
- "Non-HART Analog Input IOTA (Models CC-TAIN01, CC-TAIN11)" on page 95
- "Differential Analog input IOTA (Models CC-TAID01 and CC-TAID11)" on page 102
- "Analog Output IOTA Models CC-TAOX01, CC-TAOX11, CC-TAON01 and CC-TAON11" on page 115
- "Analog Output HART IOTA Models Cx-TAOX51, Cx-TAOX61" on page 122
- "Low Level Analog Input Mux (LLMUX) IOTA Models CC-TAIM01" on page 126
- "Digital Input High Voltage IOTA Models CC-TDI110, CC-TDI120, CC-TDI220, CC-TDI230" on page 130
- "Digital Input High Voltage PROX IOTA Model Cx-TDI151" on page 135
- "Digital Input 24V IOTA Models CC-TDIL01, CC-TDIL11" on page 139
- "Digital Input 24V IOTA Models Cx TDIL51, Cx TDIL61" on page 147
- "Digital Output 24V IOTA Models CC-TDOB01, CC-TDOB11" on page 153
- "Digital Output 24V IOTA Models Cx-TDOD51, Cx-TDOD61" on page 158
- "Digital Output Relay Module IOTA Models CC-TDOR01, CC-TDOR11" on page 163
- "Digital Output Relay Extender board Models CC-SDOR01" on page 165
- "Speed Protection Module IOTA Model CC-TSP411" on page 169
- "Servo Valve Positioner Module IOTA Models CC-TSV211" on page 176
- "Universal Input/Output IOTA Models CC-TUIO01 and CC-TUIO11" on page 184
- "Universal Input/Output Phase 2 IOTA Models CC-TUIO31 and CC-TUIO41" on page 194
- "Low Level Analog Input (LLAI) Module IOTA model CC-TAIL51" on page 204
- "Pulse Input Module IOTA Model CC-TPIX11" on page 207
- "Upgrading Firmware in Series C I/O components" on page 209

5.1 Analog Input IOTA Models CC-TAIX01, CC-TAIX11

The Series C Analog Input IOTA board is represented by the following information and graphic.

To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Analog Input in the Recommended Spare Parts section. Series C Analog Input 6 inch, non-redundant IOTA is displayed.

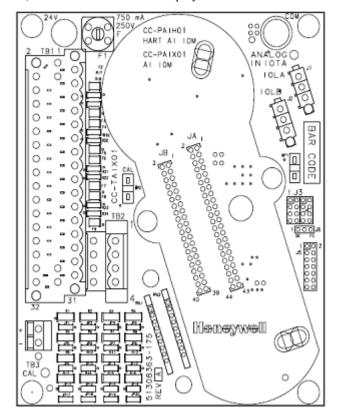


Figure 12: Series C Analog Input 6 inch, non-redundant IOTA

Note: All I/O field terminations accept up to 14 gauge stranded wire.

To properly wire, your module to the Series C Analog Input IOTA board with terminal block 1 (TB1) and terminal block 2 (TB2), use the following tables.

 Terminal block 1

 Channel
 Return screw
 Power screw

 Channel 1
 2
 1

 Channel 2
 4
 3

 Channel 3
 6
 5

Table 17: Al 6 inch, non-redundant - terminal block 1

| Terminal block 1 | | | |
|----------------------|----|-------------|--|
| Channel Return screw | | Power screw | |
| Channel 4 | 8 | 7 | |
| Channel 5 | 10 | 9 | |
| Channel 6 | 12 | 11 | |
| Channel 7 | 14 | 13 | |
| Channel 8 | 16 | 15 | |
| Channel 9 | 18 | 17 | |
| Channel 10 | 20 | 19 | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |
| Channel 14 | 28 | 27 | |
| Channel 15 | 30 | 29 | |
| Channel 16 | 32 | 31 | |

Table 18: Al 6 inch, non-redundant - terminal block 2

| Terminal block 2 - Low side of the differential inputs | | | |
|--|---------------------------|-----------------|--|
| If this TB2 | Then this channel is used | And this jumper | |
| Solew 13 useu | | is clipped | |
| 1 | 13 | JP17 | In the example below, cutting J20 would configure channel |
| 2 | 14 | JP18 | 16 for differential operation and pin 4 would be the low side (-) of the input signal. |
| 3 | 15 | JP19 | side () of the input signal. |
| 4 | 16 | JP20 | Refer to "Custom wiring - Analog Input module" on page 81 for additional power connection possibilities. |

Jumpers are utilized to support the following conditions:

Table 19: Jumpers to support Analog Input connections

| Channels | Signal screw | | |
|---------------|---|--|--|
| For channels | Each channel (1 through 12): | | |
| 1 through 12 | has a corresponding jumper. Therefore, channel 1's jumper would be JP1, and so forth. | | |
| | • the jumper must be cut if connected to voltage transmitters (1-5v. etc.) | | |
| | Channels 1 through 12 | | |
| | TB1 pin 1, 3, 5, 7, 9, 11, 13 15, 17, 19, 21, 23 145 ohms ←+24 | | |
| | TB1 pin 2, 4, 6, 8, 10, 12, 14 16, 18, 20, 22, 24 250 ohms cut for voltage transmitters (1-5v, etc). | | |
| For channels | Each channel 13 through 16: | | |
| 13 through 16 | • has a corresponding jumper. Therefore, channel 13's jumper would be JP13, and so forth. | | |
| | • the jumper must be cut if connected to voltage transmitters (1-5v. etc.) | | |
| | Jumpers J17 through J20 are used with Terminal Block 2 (TB2) and are used if the device is grounded in the field. | | |
| | Channels 13 through 16 | | |
| | TB1 | | |
| | TB1 pin 26, 28, 30, 32 250 ohms R13 through | | |
| | cut for voltage transmitters (1-5v, etc). TB2 | | |
| | pin 1, 2, 3, 4 cut for differential JP17 through input and if grounded in the field | | |
| | - | | |

5.1.1 Field wiring and module protection - Analog Input module

Individual field wiring is protected by an internal protection circuit permitting:

- Short circuit protection of input for field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Each signal can be shorted in the field with no damage to module or board. Other channels on the same IOM will not be affected

5.1.2 Two-wire transmitter wiring - Analog Input module

The AI IOM/IOTA is optimized for use with classic two-wire transmitters. All 16 channels can accept inputs from two-wire transmitters without any special wiring or jumper options.

The standard usage is to:

- · reserve the first 12 channels of the AI IOM/IOTA for classic two-wire transmitters, and
- use the last 4 channels of the IOM/IOTA to interface any of the supported input styles (including two-wire transmitters).

Depending on the input style applied to channels 13 through 16, you may need to cut jumpers on the IOTA and apply wiring to the TB2 terminal block on the IOTA. This is discussed in detail in the following sections.

5.1.3 Non two-wire transmitter wiring - Analog Input module

The IOTA is pre-engineered (without custom wiring) to accept sources that are not two-wire transmitters, but you must use channels 13 through 16.

When sources other than two-wire transmitters are to be interfaced and you have more than 4 per IOTAs, then:

- the first four must be interfaced to channels 13 through 16, and
- the remainder may be able to interface to channels 1 through 12 (depending on input style) but you must perform some degree of custom wiring.

NOTE: There are some input styles that simply cannot be applied to channels 1 through 12 - if that applies to you then you will likely need to purchase an additional IOM/IOTA.



CAUTION

The jumpers on the IOTA are non-repairable; once cut, they stay cut. Careful planning is a must.

5.1.4 Custom wiring - Analog Input module

Custom wiring means:

- using additional wires to TB2 (beyond their intended purpose for channels 13 through 16)
- and/or using wires to another termination area in the cabinet engineered on a project-basis.

Some of the styles (other than two-wire transmitter):

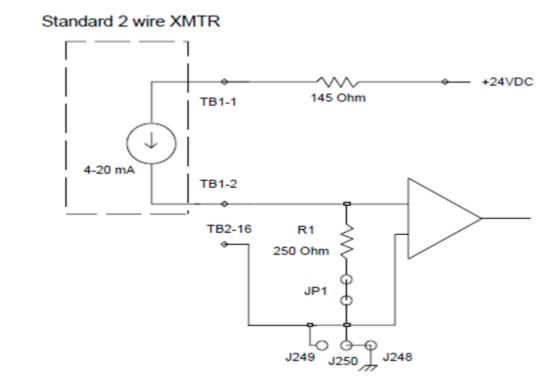
- can be applied to channels 1 through 12 with the use of custom wiring.
- Other cannot be applied to channels 1 through 12 at all.

Table 20: Custom wiring to support Analog Input

Standard and self-powered two-wire transmitter wiring

It is recommended to use channels 13 through 16, since these channels have a dedicated Series C ground screw (although it is possible to use channels 1 through 12).

Following figure illustrates an example jumper configuration for channel 1 of non-redundant 6 inch IOTA.



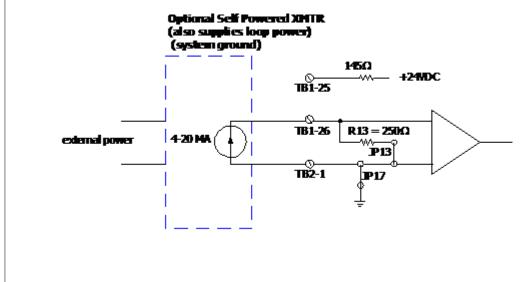
AZGND

Self-powered transmitter with EPKS system ground

It is recommended to use channels 13 through 16, since these channels have a dedicated Series C ground screw (although it is possible to use channels 1 through 12).

For the following example:

- · Channel 13 is used
- No jumpers need to be cut.
- The wire-pair is terminated to TB1-26 and TB2-1
- TB1-25 is not used.

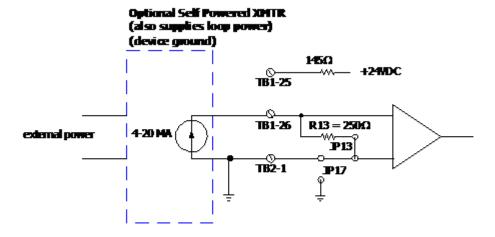


Self-powered transmitter with device grounded

This case can only be applied to channels 13 through 16 and the corresponding jumper must be cut.

For the following example:

- Cutting jumper JP-17 permits the transmitter's ground to be utilized
 - Series C ground is then not used. Device ground must remain within the specified common-mode limits of the AI IOM.
 - JP17 through JP20 are for channels 13 through 16, respectively.
- The wire-pair is terminated to TB1-26 and TB2-1.
- TB1-25 is not used.

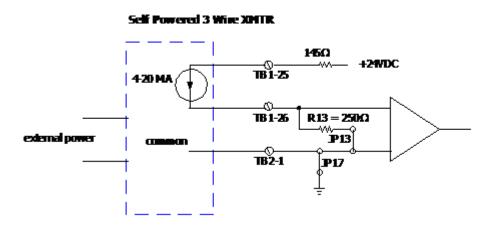


Self-powered 3-wire transmitter (system ground)

It is recommended to use channels 13 through 16, since these channels have 3 screws per channel (although it is possible to use channels 1 through 12).

For the following example:

- · Channel 13 is used
- No jumpers need to be cut
- The three wires are terminated to TB1-25, TB1-26 and TB2-1

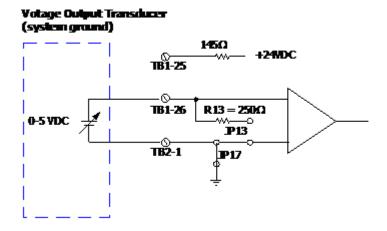


Voltage input (system ground)

It is recommended to use channels 13 through 16, since these channels have a dedicated Series C ground screw (although it is possible to use channels 1 through 12).

For the following example:

- Channel 13 is used.
- Jumper JP13 (for the 250 ohm spool) needs to be cut.
- The wire-pair is terminated to TB1-26 and TB2-1.
- TB1-25 is not used.



Slidewire

- Series C does not support Slidewire.

Range spool damage and wire shorting

Jumpers JP1 through JP16 are also used to overcome a damaged range spool (250 ohm dropping resistor).

A range spool can be damaged by being directly connected across a 24V for an extended period, such as, taking an even numbered terminal from TB1 to 24V. It can be removed from the circuit by clipping the corresponding jumper. You can continue to use the channel by providing a discrete (axial lead) 250 ohm resistor.

Example: using channel 5 and overcoming a damaged spool

- 1. One lead of the resistor connects to the even numbered screw on TB1 associated with that channel.
 - (i.e. screw N = 2 times channel M, so screw 10 is for channel 5).
- 2. The other lead of the resistor connects to Series C ground, which can probably be found on any of the TB2 screw positions (assuming the corresponding jumper JP17-20 is still installed).
 - If TB2 is already filled with wiring, 'doubling up' is permitted as long as the total wire dimension is less than the 14 AWG equivalent dimension.
- 3. Transmitter power is supplied in a non-incendive fashion through the odd-numbered terminals on TB1. This is done through a 145 ohm resistor inline with a Positive Temperature Coefficient (PTC) device that acts like a fuse (but never needs replacement).

Thus, these field terminals can be permanently shorted to ground without damage. This is an improvement over Process Manager due to the inclusion of the PTC device.

5.1.5 Analog Input wiring reference table

The following table summarizes the possible Analog Input wiring connections.

Table 21: Summary - Analog Input wiring connections

| Input style | Connection characteristics | |
|--|--|--|
| Standard 2-wire transmitter | Can use any of the 16 channels. | |
| | No custom wiring required. | |
| | No jumper cuts required. | |
| Standard self-powered transmitter | Can use any of the 16 channels. | |
| | No custom wiring required. | |
| | No jumper cuts required. | |
| Self-powered transmitter with loop power (system | Can use any of the 16 channels. | |
| ground) | • Custom wiring is required for channels 1-12: you must find a screw terminal at Series C ground for one leg of the transmitter. | |
| | No jumper cuts required | |
| Self-powered transmitter with loop power (device | Cannot use channels 1-12. | |
| ground) | • Only use channels 13-16. | |
| Self-powered 3-wire transmitter | Can use any of the 16 channels. | |
| (system ground) | • Custom wiring is required for channels 1-12: you must find a screw terminal at Series C ground for one leg of the transmitter. | |
| | No jumper cuts required | |
| Voltage Input (system ground) | Can use any of the 16 channels. | |
| | • Custom wiring is required for channels 1-12: you must find a screw terminal at Series C ground for one leg of the transducer. | |
| | You must cut the jumper associated with the range spool. | |
| Voltage Input (device ground) | Cannot use channels 1-12. | |
| | • Only use channels 13-16. | |
| 27 . 70 . 12 1 | I | |

Note: If multiple instruments need a ground reference the four positions of TB2 can serve as those ground points (assuming the JP17-JP20) jumpers are intact. If more than four grounding screws are needed then a custom wire from TB2 to a separate terminal block can allow for more grounding screw positions.

5.1.6 Allowable field wiring resistance - Analog Input module

The maximum allowable field wiring resistance between the transmitter and the IOTA connection terminal is dependent upon the voltage requirement of the transmitter. The formula for calculating the max wiring resistance for the Series C Analog Input is given by the following equation.

Rmax = [(13.0 - Vtx) / (0.022)]

where: Vtx = Voltage required at the transmitter terminal

5.1.7 IOTA board and connections - Analog Input module

Series C Analog Input 6 inch, non-redundant IOTA and field wiring connection is displayed below:

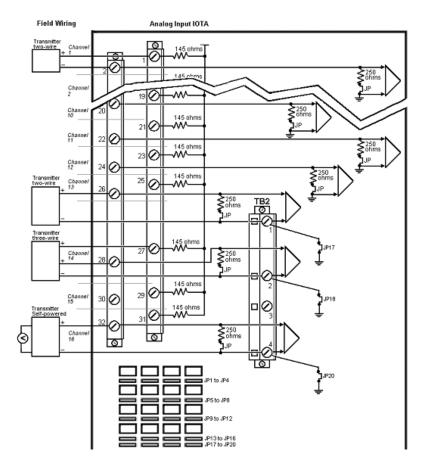


Figure 13: Series C Analog Input 6 inch, non-redundant IOTA and field wiring connections

Series C Analog Input 12 inch, redundant IOTA is displayed:

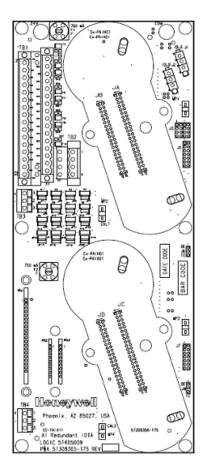


Figure 14: Series C Analog Input 12 inch, redundant IOTA

5.2 Analog Input non-HART/HARTIOTA Models Cx-TAIX51, Cx-TAIX61

This series C Analog Input IOTA board is represented by the following information and graphic. To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Analog Input in the Recommended Spare Parts section. Series C HART/non-HART Analog Input 6 inch, non-redundant IOTA is displayed in the following figure.

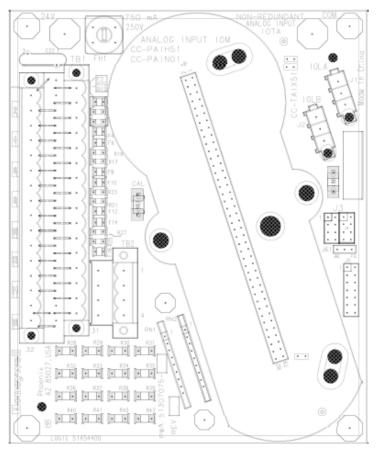


Figure 15: Series C HART/non-HART Analog Input 6 inch, non-redundant IOTA

Note: All I/O field terminations accept up to 14 gauge stranded wire.

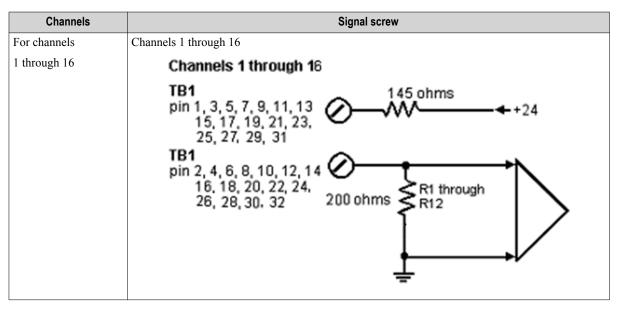
To properly wire your module to the HART/non-HART Analog Input IOTA with terminal block 1 (TB1) and terminal block 2 (TB2), use the following table.

Table 22: Al 6 inch HART Al, non-redundant - terminal block 1

| Terminal Block 1 (TB1) | | | | |
|---------------------------------------|---|---|--|--|
| Channel Return Screw Power Screw(24V) | | | | |
| Channel 1 | 2 | 1 | | |
| Channel 2 | 4 | 3 | | |

| Terminal Block 1 (TB1) | | | |
|------------------------|--------------|------------------|--|
| Channel | Return Screw | Power Screw(24V) | |
| Channel 3 | 6 | 5 | |
| Channel 4 | 8 | 7 | |
| Channel 5 | 10 | 9 | |
| Channel 6 | 12 | 11 | |
| Channel 7 | 14 | 13 | |
| Channel 8 | 16 | 15 | |
| Channel 9 | 18 | 17 | |
| Channel 10 | 20 | 19 | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |
| Channel 14 | 28 | 27 | |
| Channel 15 | 30 | 29 | |
| Channel 16 | 32 | 31 | |

Table 23: Al 6 inch, HART/non-HART Al, non-redundant terminal block 2



5.2.1 Field wiring and module protection - Analog Input HART module

Individual field wiring is protected by an internal protection circuit permitting.

- Short circuit protection of input for field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Each signal can be shorted in the field with no damage to module or board. Other channels on the same IOM will not be affected.

5.2.2 Two-wire transmitter wiring - Analog Input HART module

The AI IOM/IOTA is optimized for use with classic two-wire transmitters. All 16 channels can accept inputs from two-wire transmitters without any special wiring or jumper options.

5.2.3 Standard and self-powered two-wire transmitter wiring - Analog Input HART module

The HART/non-HART AI IOM/IOTA is optimized for use with classic two-wire transmitters. All 16 channels can accept inputs from two-wire transmitters. It is recommended to use channels 13 through 16, since these channels have a dedicated ground screw (although it is possible to use channels 1 through 12).

Following figure illustrates an example jumper configuration for channel 1 of non-redundant 9 inch IOTA.

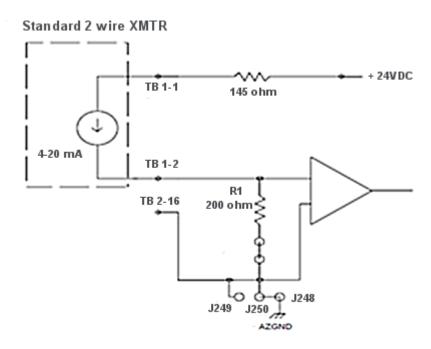


Figure 16: Non-redundant Analog Input 6 inch, standard 2-wire transmitter wiring

Standard self powered XMTR

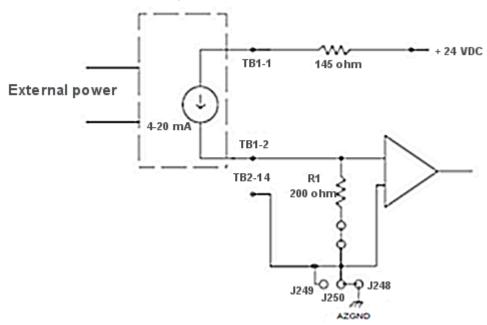


Figure 17: Non-redundant Analog Input 6 inch, self-powered 2-wire transmitter wiring

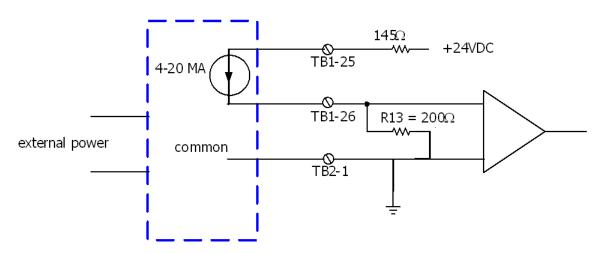
5.2.4 Self-powered 3-wire transmitter (system ground) - Analog Input HART module

It is recommended to use channels 13 through 16, since these channels have 3 screws per channel (although it is possible to use channels 1 through 12).

For the following example:

- · Channel 13 is used
- The three wires are terminated to TB1-25, TB1-26 and TB2-1

Self Powered 3 Wire XMTR



Note: TB1: This is done through a 145 ohm resistor inline with a Positive Temperature Coefficient (PTC) device that acts like a fuse (but never needs replacement). Thus, these field terminals can be permanently

shorted to ground without damage. This is an improvement over Process Manager due to the inclusion of the PTC device.

5.2.5 Analog Input HART module wiring reference table

The following table summarizes the possible Analog Input wiring connections.

Table 24: Summary - Analog Input wiring connections

| Input style | Connection characteristics | |
|---|---|--|
| Standard 2-wire transmitter | Can use any of the 16 channels. | |
| | No custom wiring required. | |
| Standard self-powered transmitter | Can use any of the 16 channels. | |
| | No custom wiring required. | |
| Self-powered transmitter with loop power(system | Can use any of the 16 channels. | |
| ground) | • Custom wiring is required for channels 1-12: you must find a screw terminal at ground for one leg of the transmitter. | |
| Self-powered 3-wire transmitter | Can use any of the 16 channels. | |
| (system ground) | • Custom wiring is required for channels 1-12: you must find a screw terminal at ground for one leg of the transmitter. | |

5.2.6 Allowable field wiring resistance - Analog Input HART module

The maximum allowable field wiring resistance between the transmitter and the IOTA connection terminal is dependent upon the voltage requirement of the transmitter. The formula for calculating the max wiring resistance for the Analog Input is given by the following equation.

Rmax = [(13.0 - Vtx) / (0.022)]

where: Vtx = Voltage required at the transmitter terminal

5.2.7 IOTA board and connections - Analog Input HART module

Series C Analog Input 6 inch, non-redundant IOTA and field wiring connection is displayed in the following image.

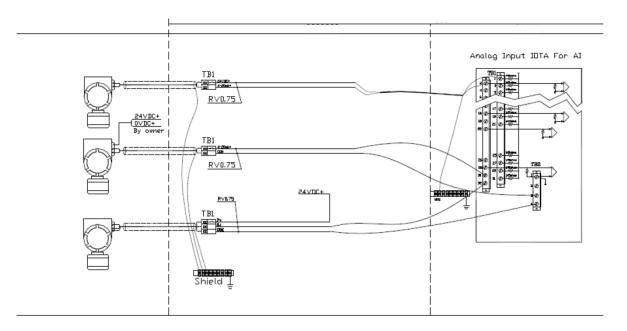


Figure 18: Series C Analog Input 6 inch, non-redundant IOTA and field wiring connection

The Series C Analog Input 12 inch, redundant IOTA is displayed in the following figure.

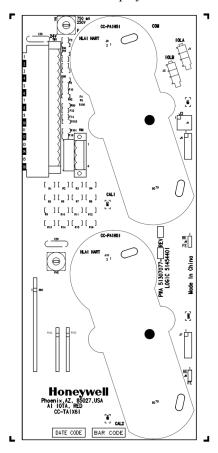


Figure 19: Series C HART/non-HART Analog Input 12 inch, redundant IOTA

5.3 Non-HART Analog Input IOTA (Models CC-TAIN01, CC-TAIN11)

This Series C Analog Input IOTA board is represented by the following information and graphic. To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Analog Input in the Recommended Spare Parts section. Series C non-HART Analog Input 6 inch, non-redundant IOTA is displayed in the following figure.

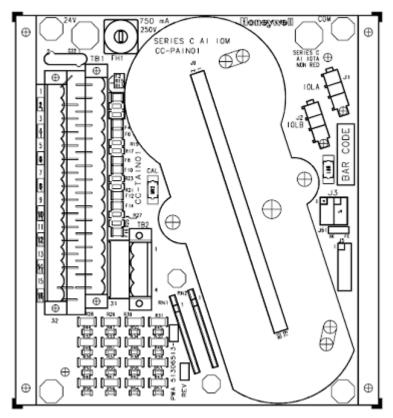


Figure 20: Series C non-HART Analog Input 6 inch, non-redundant IOTA

Note: All I/O field terminations accept up to 14 gauge stranded wire.

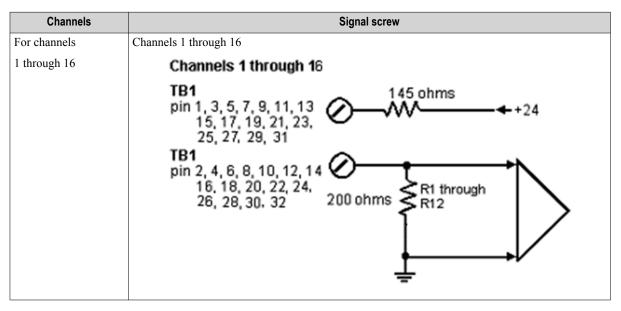
To properly wire your module to the Series C non-HART Analog Input IOTA with terminal block 1 (TB1) and terminal block 2 (TB2), use the following table.

Table 25: Al 6 inch, non-HART Al, non-redundant - terminal block 1

| Terminal Block 1 (TB1) | | | |
|------------------------|---|------------------|--|
| Channel Return Screw | | Power Screw(24V) | |
| Channel 1 | 2 | 1 | |
| Channel 2 | 4 | 3 | |
| Channel 3 | 6 | 5 | |

| Terminal Block 1 (TB1) | | | |
|------------------------|----|------------------|--|
| Channel Return Screw | | Power Screw(24V) | |
| Channel 4 | 8 | 7 | |
| Channel 5 | 10 | 9 | |
| Channel 6 | 12 | 11 | |
| Channel 7 | 14 | 13 | |
| Channel 8 | 16 | 15 | |
| Channel 9 | 18 | 17 | |
| Channel 10 | 20 | 19 | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |
| Channel 14 | 28 | 27 | |
| Channel 15 | 30 | 29 | |
| Channel 16 | 32 | 31 | |

Table 26: Al 6 inch, non-HART Al, non-redundant terminal block 2



5.3.1 Field wiring and module protection - non-HART Analog Input module

Individual field wiring is protected by an internal protection circuit permitting

- Short circuit protection of input for field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Each signal can be shorted in the field with no damage to module or board. Other channels on the same IOM will not be affected

5.3.2 Two-wire transmitter wiring - non-HART Analog Input module

The AI IOM/IOTA is optimized for use with classic two-wire transmitters. All 16 channels can accept inputs from two-wire transmitters without any special wiring or jumper options.

5.3.3 Standard and self-powered two-wire transmitter wiring - non-HART Analog Input module

The non-HART AI IOM/IOTA is optimized for use with classic two-wire transmitters. All 16 channels can accept inputs from two-wire transmitters. It is recommended to use channels 13 through 16, since these channels have a dedicated Series C ground screw (although it is possible to use channels 1 through 12).

Following figure illustrates an example jumper configuration for channel 1 of non-redundant 9 inch IOTA.

Standard 2 wire XMTR

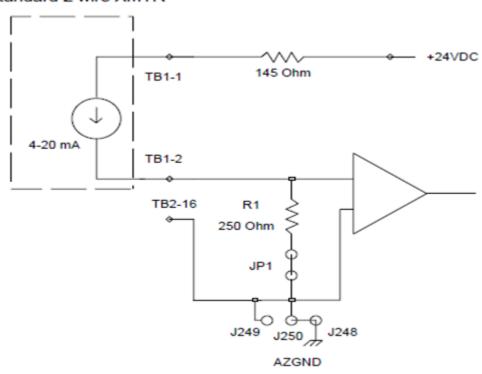


Figure 21: Non-redundant Analog Input 9 inch, standard 2-wire transmitter wiring

Standard self powered XMTR

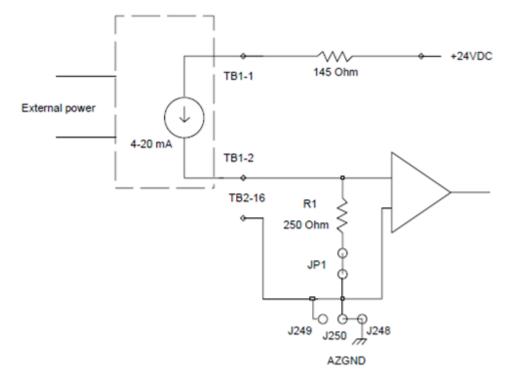


Figure 22: Non-redundant Analog Input 9 inch, self-powered 2-wire transmitter wiring

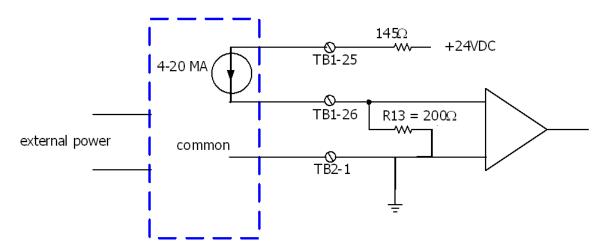
5.3.4 Self-powered 3-wire transmitter (system ground) - non-HART Analog Input module

It is recommended to use channels 13 through 16, since these channels have 3 screws per channel (although it is possible to use channels 1 through 12).

For the following example:

- Channel 13 is used
- The three wires are terminated to TB1-25, TB1-26 and TB2-1

Self Powered 3 Wire XMTR



Note: TB1: This is done through a 145 ohm resistor inline with a Positive Temperature Coefficient (PTC) device that acts like a fuse (but never needs replacement). Thus, these field terminals can be permanently shorted to ground without damage. This is an improvement over Process Manager due to the inclusion of the PTC device.

5.3.5 Non-HART Analog Input module wiring reference table

The following table summarizes the possible Analog Input wiring connections.

Table 27: Summary - Analog Input wiring connections

| Input style | Connection characteristics | |
|---|--|--|
| Standard 2-wire transmitter | Can use any of the 16 channels. | |
| | No custom wiring required. | |
| Standard self-powered transmitter | Can use any of the 16 channels. | |
| | No custom wiring required. | |
| Self-powered transmitter with loop power(system | Can use any of the 16 channels. | |
| ground) | • Custom wiring is required for channels 1-12: you must find a screw terminal at Series C ground for one leg of the transmitter. | |
| Self-powered 3-wire transmitter | Can use any of the 16 channels. | |
| (system ground) | • Custom wiring is required for channels 1-12: you must find a screw terminal at Series C ground for one leg of the transmitter. | |

5.3.6 Allowable field wiring resistance - non-HART Analog Input module

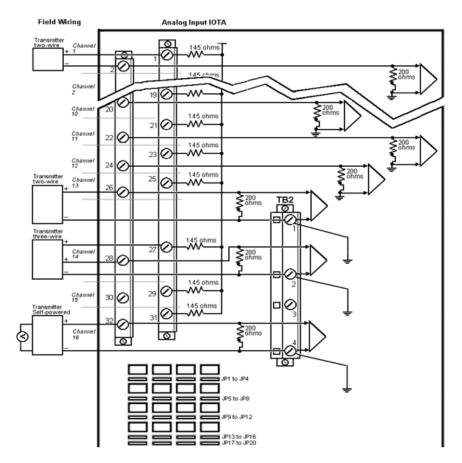
The maximum allowable field wiring resistance between the transmitter and the IOTA connection terminal is dependent upon the voltage requirement of the transmitter. The formula for calculating the max wiring resistance for the Series C Analog Input is given by the following equation.

Rmax = [(13.0 - Vtx) / (0.022)]

where: Vtx = Voltage required at the transmitter terminal

5.3.7 IOTA board and connections - non-HART Analog Input module

Series C Analog Input 6 inch, non-redundant IOTA and field wiring connection is displayed in the following image.



The Series C Analog Input 12 inch, redundant IOTA is displayed in the following figure.

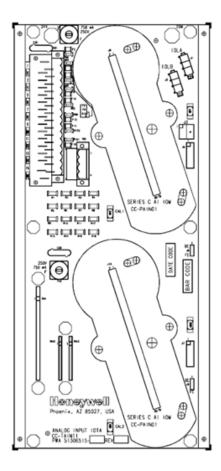


Figure 23: Series C non-HART Analog Input 12 inch, redundant IOTA

5.4 Differential Analog input IOTA (Models CC-TAID01 and CC-TAID11)

The Series C Analog Input 6 inch, 9 inch, and 12 inch modules supports all 16 channels for differential configuration. These channels can be configured to support different inputs such as 4-20mA, 1-5V, and 0-5V. All I/O field terminations of this IOTA is designed to accept up to 14 gauge stranded wire.

Note:

- These differential analog input modules are configured for differential configuration by default.
- The channels of these modules can be used for any configuration. that is, single-ended or differential configuration

5.4.1 Compatible IOTA models for differential analog input and output channels

| IOM model number | IOM Block Name | Description | Compatible IOTA model number |
|------------------|----------------|---|--|
| CC-PAIH02 | AI-HART | Differential/Single-ended Analog Input. It supports 16 channels and following inputs. • 4-20mA • 1-5V • 0-5V | CC-TAID01 - Non-redundant CC-TAID11 - Redundant CC-TAIX01 - Non-redundant CC-TAIX11 - Redundant CC-GAIX11 - GI-IS-Non- Redundant CC-GAIX21 - GI-IS-Redundant |
| CC-PAIX02 | AI | Differential/Single-ended Analog Input without HART functionality. It supports 16 channels and following inputs. • 4-20mA • 1-5V • 0-5V | CC-TAID01 - Non-redundant CC-TAID11 - Redundant CC-TAIX01 - Non-redundant CC-TAIX11 - Redundant CC-GAIX11 - GI-IS-Non- Redundant CC-GAIX21 - GI-IS-Redundant |
| CC-PAIN01 | AI-HL | Non-HART Analog Input module It supports 16 channels. | CC-TAIN01 (AI non-redundant; IOTA - 6') CC-TAIN11 (AI redundant; IOTA - 12') |
| CC-PAON01 | AO | Non-HART Analog Output module It supports 16 channels. | CC-TAON01 (AO, non-redundant; IOTA - 6') CC-TAON11 (AO, redundant; IOTA - 12') |

5.4.2 Standard and self-powered two-wire transmitter wiring - Differential Analog input module

The differential AI IOM/IOTA is optimized for use with classic two-wire transmitters. All 16 channels can accept inputs from two-wire transmitters. Note that, by default, the jumper settings must be changed to 'single-

ended configuration' as referred in the *Series C Differential Analog Input 9 inch – terminal block 2* table and the *Series C Differential Analog Input 12 inch – terminal block 2* table.

Following figure illustrates an example jumper configuration for channel 1 of non-redundant 9 inch IOTA.

Standard 2 wire XMTR

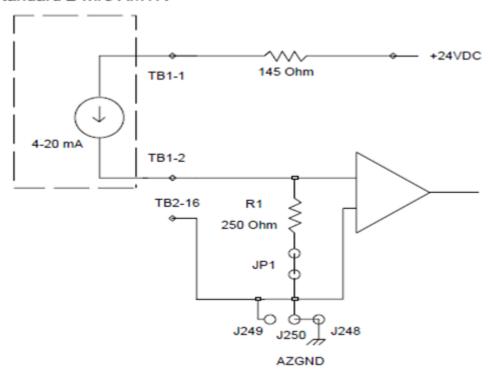


Figure 24: Non-redundant Analog Input 9 inch, standard 2-wire transmitter wiring

Standard self powered XMTR

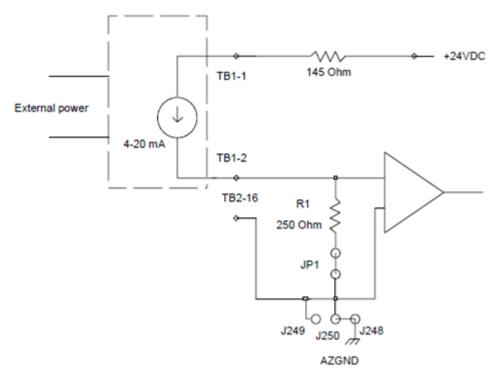


Figure 25: Non-redundant Analog Input 9 inch, self-powered 2-wire transmitter wiring

5.4.3 Custom wiring - Differential Analog input module



Attention

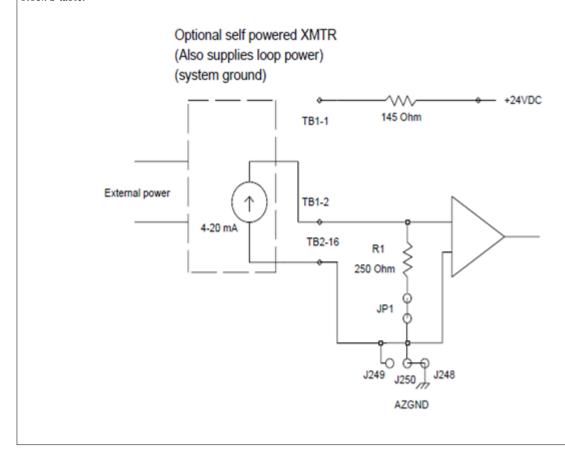
For differential HART transmitter, you can use only channel number 13 to 16. For non-HART differential transmitter, you can use all 16 channels in both differential mode and single-ended mode.

Custom wiring scenarios are explained in the following table.

Table 28: Custom wiring to support differential Analog Input

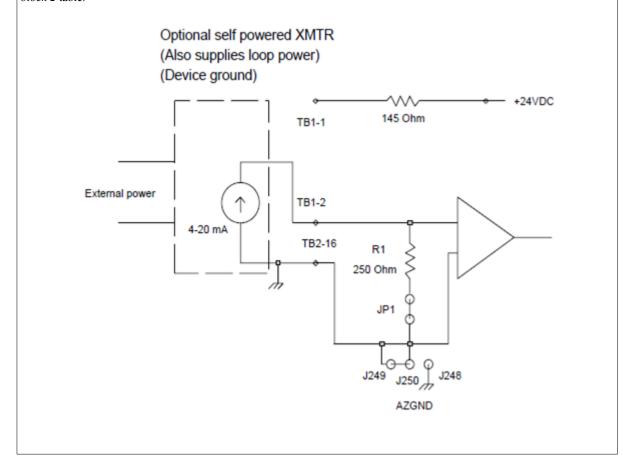
Self-powered transmitter with EPKS system ground

Self-powered transmitter is connected across the TB1 - 2 and TB2 - 16 for the channel 1 of the non-redundant 9' IOTA as illustrated in the following figure. Jumper settings must be configured as single-ended according to the *Series C Differential Analog Input 9 inch – terminal block 2* table and the *Series C Differential Analog Input 12 inch – terminal block 2* table.



Self-powered transmitter with device grounded

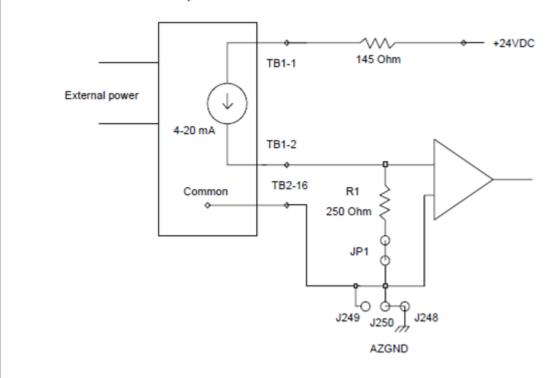
Self-powered transmitter is connected across the TB1 - 2 and TB2 - 16 for the channel 1 of the non-redundant 9' IOTA as illustrated in the following figure. Jumper settings must be configured for differential configuration according to the Series C Differential Analog Input 9 inch – terminal block 2 table and the Series C Differential Analog Input 12 inch – terminal block 2 table.



Self-powered 3-wire transmitter (system ground)

Self-powered transmitter is connected across the TB1 - 1 and TB2 - 2 when the common terminal is terminated at TB2 - 16. Jumper settings must be configured as single-ended according to the Series C Differential Analog Input 9 inch – terminal block 2 table and the Series C Differential Analog Input 12 inch – terminal block 2 table.

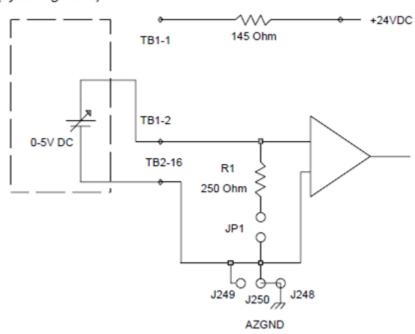
Standard self powered 3 wire XMTR



Voltage input (System ground)

Voltage output transducer is connected across TB1-2 and TB2-16 as illustrated in the following figure. To use voltage output transducer, 250? spool resistor must be disconnected by cutting the jumper (example, JP1). Jumper settings must be configured as single-ended according to the Series C Differential Analog Input 9 inch – terminal block 2 table and the Series C Differential Analog Input 12 inch – terminal block 2 table.

Voltage output Transducer (system ground)

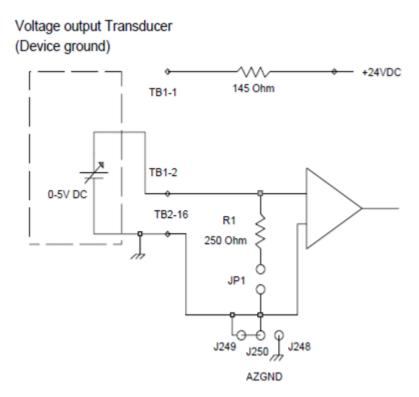


Note: You must plan cautiously when you cut the JP1 to JP16 jumpers as they are non-repairable. That is, once these jumpers are cut, you cannot short these jumpers.

Custom wiring scenarios

Voltage input (Device ground)

Voltage output transducer is connected across TB1-2 and TB2-16 as illustrated in the following figure. To use voltage output transducer, 250? spool resistor must be disconnected by cutting the jumper (example, JP1). Jumper settings must be configured for differential configuration according to the Series C Differential Analog Input 9 inch – terminal block 2 table and the Series C Differential Analog Input 12 inch – terminal block 2 table.



Note: You must plan cautiously when you cut the JP1 to JP16 jumpers as they are non-repairable. That is, once these jumpers are cut, you cannot short these jumpers.

Slide Wire: Series C does not support Slidewire.

5.4.4 Jumper configuration for differential configuration - Differential Analog input module

Jumper configuration for the non-redundant differential AI channel is illustrated in the following figure. Each channel is associated with 250? 'range spool' or 'dropping resistor' for sources that deliver 4-20mA. In addition, one jumper and three jumper pins are provided for each channel.

Example: channel 1 consists of JP1, J248, and J249.

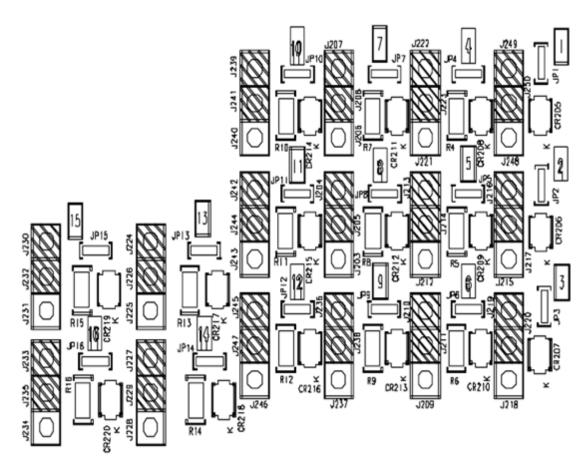


Figure 26: Series C differential non-redundant Analog Input 9 inch, jumper configuration

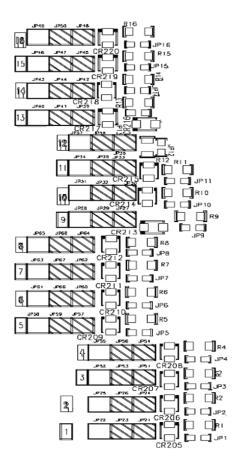


Figure 27: Series C differential redundant Analog Input 12 inch, jumper configuration



CAUTION

Jumper pins can bend or break while removing, replacing, or reinserting jumpers from/on the IOTA. Broken pins can result in loss of use of a channel on the module. Therefore, you must exercise caution while removing, replacing, or reinserting the jumpers so that the pins remain straight. Also, do not try to straighten the bent or deformed pins.

5.4.5 IOTA board and connections - Differential Analog input module

The Series C Analog Input 9 inch, non-redundant IOTA is displayed in the following figure.

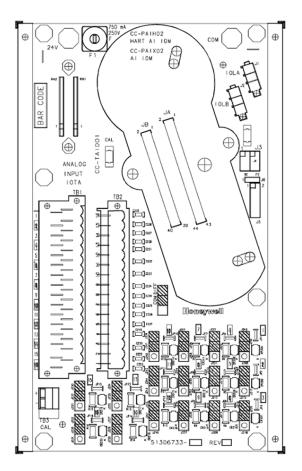


Figure 28: Series C Differential Analog Input 9 inch, non-redundant IOTA

To properly wire your module to the Series C Analog Input IOTA for differential configuration with terminal block 1 (TB1) and terminal block 2 (TB2), use the following table.

Table 29: Series C Differential Analog Input 9 and 12 inch - terminal block 1

| Terminal Block 1 | | | |
|------------------|--------------|-------------|--|
| Channel | Return screw | Power screw | |
| Channel 1 | 2 | 1 | |
| Channel 2 | 4 | 3 | |
| Channel 3 | 6 | 5 | |
| Channel 4 | 8 | 7 | |
| Channel 5 | 10 | 9 | |
| Channel 6 | 12 | 11 | |
| Channel 7 | 14 | 13 | |
| Channel 8 | 16 | 15 | |
| Channel 9 | 18 | 17 | |
| Channel 10 | 20 | 19 | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |

| Terminal Block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Attention

- Three pin jumper labels are different for 9' and 12' IOTAs.
- All channels available in these IOTAs are configured for differential mode by default. If a shorting jumper is not present, that channel is configured in differential mode. If you want to modify the configuration from differential mode to single ended mode, refer to these to short the pair of jumpers.

Table 30: Series C Differential Analog Input 9 inch - terminal block 2

| Terminal Block 2 | | | |
|------------------|----------------------|---|---|
| CC-TAID01 IOTA | | | |
| If TB2 screw is | Then, the channel is | And the pair of jumper to be short for differential configuration | And the pair of jumper to be short for single ended configuration |
| 16 | 16 | J233 - J235 | J234 - J235 |
| 15 | 15 | J230 - J232 | J231 - J232 |
| 14 | 14 | J227 - J229 | J228 - J229 |
| 13 | 13 | J224 - J226 | J225 - J226 |
| 12 | 12 | J245 - J247 | J246 - J247 |
| 11 | 11 | J242 - J244 | J243 - J244 |
| 10 | 10 | J239 - J241 | J240 - J241 |
| 9 | 9 | J236 - J238 | J237 - J238 |
| 8 | 8 | J204 - J205 | J203 - J205 |
| 7 | 7 | J207 - 208 | J206 - J208 |
| 6 | 6 | J210 - J211 | J209 - J211 |
| 5 | 5 | J213 - J214 | J212 - J214 |
| 4 | 4 | J222 - J223 | J221 - J223 |
| 3 | 3 | J219 - J220 | J218 - J220 |
| 2 | 2 | J216 - J217 | J215 - J217 |
| 1 | 1 | J249 - J250 | J248 - J250 |

Table 31: Series C Differential Analog Input 12 inch - terminal block 2

| Terminal Block 2 | | | | |
|--|-----|--------|-------------|-------------|
| CC-TAID11 IOTA | | | | |
| If TB2 screw is Then, the channel is And the pair of jumper to be short for differential configuration And the pair of jumper to be short for single ended configuration | | | | |
| TB2-16 | Cha | nnel 1 | JP21 - JP23 | JP22 - JP23 |
| TB2-15 | Cha | nnel 2 | JP24 - JP26 | JP25 - P26 |
| TB2-14 | Cha | nnel 3 | JP51 - JP53 | JP52 - JP53 |
| TB2-13 | Cha | nnel 4 | JP54 - JP56 | JP55 - JP56 |

| Terminal Block 2 | | | | |
|------------------|-----|----------------------|---|---|
| CC-TAID11 IOTA | | | | |
| If TB2 screw is | | Then, the channel is | And the pair of jumper to be short for differential configuration | And the pair of jumper to be short for single ended configuration |
| TB2-12 | Cha | nnel 5 | JP57 - JP59 | JP58 - JP59 |
| TB2-11 | Cha | nnel 6 | JP60, JP61 ,JP66 | JP61 - JP66 |
| TB2-10 | Cha | nnel 7 | JP62, JP63,JP67 | JP63 - JP67 |
| TB2-9 | Cha | nnel 8 | JP64, JP65, JP68 | JP65 - JP68 |
| TB2-8 | Cha | nnel 9 | JP27 - JP29 | JP28 - JP29 |
| TB2-7 | Cha | nnel 10 | JP30 - JP32 | JP31 - JP32 |
| TB2-6 | Cha | nnel 11 | JP33 - JP35 | JP34 - JP35 |
| TB2-5 | Cha | nnel 12 | JP36 - JP38 | JP37 - JP38 |
| TB2-4 | Cha | nnel 13 | JP39 - JP41 | JP40 - JP41 |
| TB2-3 | Cha | nnel 14 | JP42 - JP44 | JP43 - JP44 |
| TB2-2 | Cha | nnel 15 | JP45 - JP47 | JP46 - JP47 |
| TB2-1 | Cha | nnel 16 | JP48 - JP50 | JP49 - JP50 |

The Series C Analog Input 12 inch, non-redundant IOTA is displayed in the following figure.

Table 32: Series C Differential Analog Input 12 inch, redundant IOTA

5.5 Analog Output IOTA Models CC-TAOX01, CC-TAOX11, CC-TAON01 and CC-TAON11

This Series C Analog Output IOTA board is represented by the following information and graphics.

To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Analog Ouput in the Recommended Spare Parts section.

5.5.1 Field wiring and module protection - Analog Output module

The Analog Output module provides an output current range of 0ma, and 2.9 mA through 21.1 mA based on the requested Analog Output by the Series C controller. The output current including the HART modulated signal, does not exceed 22.5mA.

- Short circuit protection of field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Each field wiring pair can be shorted together without damage to the module or IOTA. Other channels in the same module(s) will not be affected.
- A +30 Vdc source can be continuously applied across the OUT+ to OUT- terminals of the IOTA without damage to either module(s) or IOTA (i.e. with the positive lead of the source connected to OUT+ and the negative lead connected to OUT-). To prevent damage to the IOTA surge protection diodes, the current must be limited to 500 mAdc if the source is applied in the reverse polarity (i.e. with the positive lead of the source attached to OUT-, negative lead attached to OUT+). This 500 mAdc restriction does not apply in the positive polarity case.

5.5.2 IOTA board and connections - Analog Output module

Series C Analog Output 6 inch, non-redundant IOTA is displayed.

Table 33: Series C Analog Output 6 inch, non-redundant IOTA

To properly wire your module to the Series C Analog Output IOTA board with terminal block 1 (TB1), use the following table.

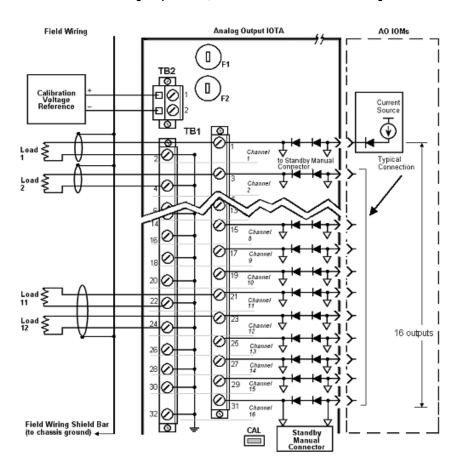
Table 34: AO 6 inch, non-redundant - terminal block 1

| Channel | Return screw | Signal screw |
|------------|--------------|--------------|
| | (OUT -) | (OUT +) |
| Channel 1 | 2 | 1 |
| Channel 2 | 4 | 3 |
| Channel 3 | 6 | 5 |
| Channel 4 | 8 | 7 |
| Channel 5 | 10 | 9 |
| Channel 6 | 12 | 11 |
| Channel 7 | 14 | 13 |
| Channel 8 | 16 | 15 |
| Channel 9 | 18 | 17 |
| Channel 10 | 20 | 19 |
| Channel 11 | 22 | 21 |
| Channel 12 | 24 | 23 |

| Channel | Return screw | Signal screw |
|------------|--------------|--------------|
| | (OUT -) | (OUT +) |
| Channel 13 | 26 | 25 |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Series C Analog Output 6 inch, non-redundant IOTA and field wiring connection

Table 35: Series C Analog Output 6 inch, non-redundant IOTA and field wiring connection



Series C Analog Output 12 inch, redundant IOTA is displayed:

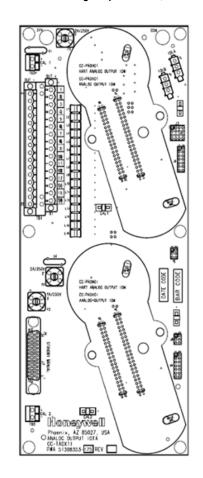


Table 36: Series C Analog Output 12 inch, redundant IOTA

5.5.3 Non-HART Analog Output IOTA (Models CC-TAON01, CC-TAON11)

The Series C non-HART Analog Output 6 inch, non-redundant modules supports all 16 channels for single-ended configuration. All I/O field terminations of this IOTA is designed to accept up to 14 gauge stranded wire.

5.5.4 IOTA board and connections - non-HART Analog Output module

The Series C Analog Output 6 inch, non-redundant IOTA is displayed in the following figure.

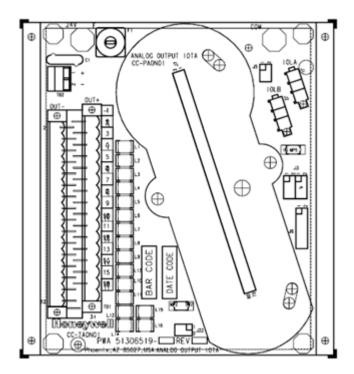


Figure 29: Series C non-HART Analog Output 6 inch, non-redundant IOTA

The Series C Analog Output 12 inch, redundant IOTA is displayed in the following figure.

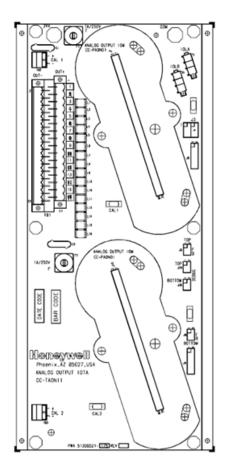


Figure 30: Series C non-HART Analog Input 12 inch, redundant IOTA

To properly wire your module to the Series C non-HART Analog Output IOTA with terminal block 1 (TB1) and terminal block 2 (TB2), use the following table.

Table 37: AO 6 inch, non-HART AO, non-redundant - terminal block 1

| Terminal Block 1 (TB1) | | | |
|---------------------------------|----|--------------------------------|--|
| Channel Return Screw (Negative) | | Analog Output Screw (Positive) | |
| Channel 1 | 2 | 1 | |
| Channel 2 | 4 | 3 | |
| Channel 3 | 6 | 5 | |
| Channel 4 | 8 | 7 | |
| Channel 5 | 10 | 9 | |
| Channel 6 | 12 | 11 | |
| Channel 7 | 14 | 13 | |
| Channel 8 | 16 | 15 | |
| Channel 9 | 18 | 17 | |
| Channel 10 | 20 | 19 | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |

| Terminal Block 1 (TB1) | | | |
|------------------------|-------------------------|--------------------------------|--|
| Channel | Return Screw (Negative) | Analog Output Screw (Positive) | |
| Channel 14 | 28 | 27 | |
| Channel 15 | 30 | 29 | |
| Channel 16 | 32 | 31 | |

Note:

TB1: 32 pin connector - screw block

- 16 channels positive output terminals must be connected through upper-side of 32 pin connector.
- 16 channels negative output terminals must be connected through lower-side of 32 pin connector.

The field wiring connection for Series C non-HART Analog Input 6 inch, non-redundant IOTA is identical to the Series C Analog Input 6 inch, non-redundant IOTA. For more information about the field wiring, refer to "IOTA board and connections - Analog Output module" on page 115.

5.6 Analog Output HART IOTA Models Cx-TAOX51, Cx-TAOX61

Note: Cx-TAOX51 and Cx-TAOX61 support only HART Modules.

The Analog Output IOTA board is represented by the following information and graphics.

To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Analog Ouput in the Recommended Spare Parts section.

5.6.1 Field wiring and module protection - Analog Output HART module

The Analog Output module provides an output current range of 0ma, and 2.9 mA through 21.1 mA based on the requested Analog Output by the Series C controller. The output current including the HART modulated signal, does not exceed 22.5mA.

- Short circuit protection of field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Each field wiring pair can be shorted together without damage to the module or IOTA. Other channels in the same module(s) will not be affected.
- A +30 Vdc source can be continuously applied across the OUT+ to OUT- terminals of the IOTA without
 damage to either module(s) or IOTA (i.e. with the positive lead of the source connected to OUT+ and the
 negative lead connected to OUT-). To prevent damage to the IOTA surge protection diodes, the current must
 be limited to 500 mAdc if the source is applied in the reverse polarity (i.e. with the positive lead of the
 source attached to OUT-, negative lead attached to OUT+). This 500 mAdc restriction does not apply in the
 positive polarity case.

5.6.2 IOTA board and connections - Analog Output HART module

Series C Analog Output 6 inch, non-redundant IOTA is displayed.

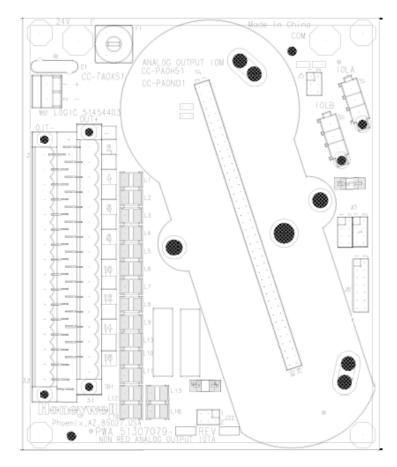


Figure 31: Series C Analog Output 6 inch, non-redundant IOTA

To wire your module to the Series C Analog Output IOTA board with terminal block 1 (TB1), use the following table.

Table 38: AO 6 inch, non-redundant - terminal block 1

| Channel | Return screw | Signal screw |
|------------|--------------|--------------|
| | (OUT -) | (OUT +) |
| Channel 1 | 2 | 1 |
| Channel 2 | 4 | 3 |
| Channel 3 | 6 | 5 |
| Channel 4 | 8 | 7 |
| Channel 5 | 10 | 9 |
| Channel 6 | 12 | 11 |
| Channel 7 | 14 | 13 |
| Channel 8 | 16 | 15 |
| Channel 9 | 18 | 17 |
| Channel 10 | 20 | 19 |
| Channel 11 | 22 | 21 |
| Channel 12 | 24 | 23 |
| Channel 13 | 26 | 25 |

| Channel | Return screw | Signal screw |
|------------|--------------|--------------|
| | (OUT -) | (OUT +) |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Series C Analog Output 6 inch, non-redundant IOTA and field wiring connection

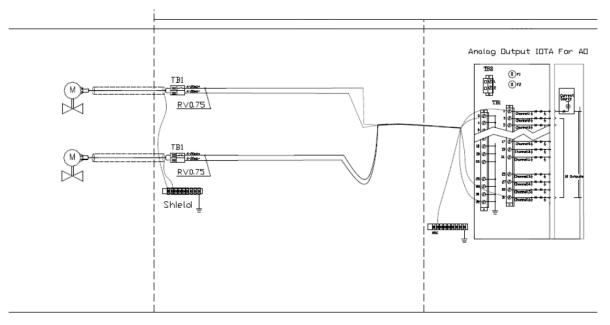


Figure 32: Series C Analog Output 6 inch, non-redundant IOTA and field wiring connection

Series C Analog Output 12 inch, redundant IOTA is displayed:

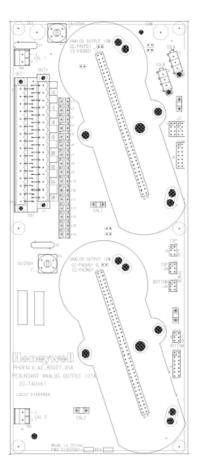


Figure 33: Series C Analog Output 12 inch, redundant IOTA

5.7 Low Level Analog Input Mux (LLMUX) IOTA Models CC-TAIM01

The Series C Low Level Mux IOTA board is represented by the following information and graphics.

To access the parts information for the:

- module
- IOTA
- · connector block assembly, and
- fuses

associated with this board and module, refer to Low Level Analog Input in the Recommended Spare Parts section.

5.7.1 Field wiring and module protection - Low Level Analog Input Mux (LLMUX) module

The LLMUX module provides power and communications to up to four Low Level Mux FTAs. Each FTA is protected by a specific fuse. Additionally, a main fuse protects the module's power path to all FTAs.

The following applies to fusing for LLMUX:

| Fuse | Functionality | Description |
|------|-----------------------------|-------------------|
| F1 | Power to module electronics | FUSE, 1 Amp |
| F2 | Switched power to all FTAs | Quick Blo, 5x20mm |
| F3 | Power to FTA 1 only | FUSE, 0.25 Amp, |
| F4 | Power to FTA 2 only | Quick Blo, 5x20mm |
| F5 | Power to FTA 3 only | |
| F6 | Power to FTA 4 only | |

Fuses 1 and 2

• The primary purpose of the main electronics fuse (F1) is to protect the module electronics. The primary role of the main FTA fuse (F2) is to isolate the power path from the module electronics and prevent a short circuit in the FTA power path from impacting the entire system.

Fuses 3 through 6

- A simultaneous failure of multiple FTAs can blow the common FTA fuse.
- A short circuit on a power cable to an FTA or a short in an FTA will blow the IOTA fuse for that FTA, but not affect any of the other FTAs or their fuses.

5.7.2 IOTA board and connections - Low Level Analog Input Mux (LLMUX) module

Series C Low Level 6 inch, non-redundant IOTA is displayed.

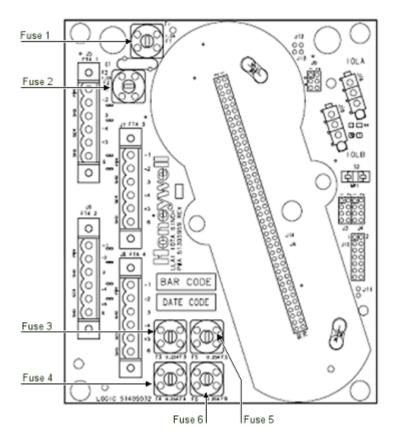


Figure 34: Series C Low Level 6 inch, non-redundant IOTA

To properly wire your module to the Series C Low Level Analog Input IOTA board with Field Termination Assembly 1 (FTA1) and 2 (FTA 2), use the following graphic and table.

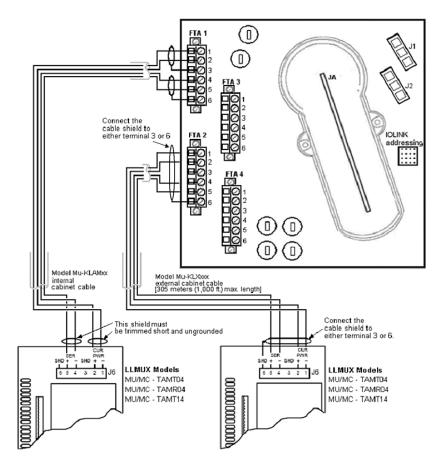


Figure 35: Series C Low Level Analog Input IOTA and field wiring connections

Table 39: LL MUX FTA connections

| Field Termination Assembly (for FTA's 1, 2, 3, and 4) | | |
|---|----------|--|
| Terminal Power screw | | |
| 1 power | negative | |
| 2 power | positive | |
| 3 shield | n/a | |
| 4 serial | negative | |
| 5 serial | positive | |
| 6 shield | n/a | |

Table 40: LL MUX FTA jumper unit positions

| Field Termination Assembly | | |
|----------------------------|---|--|
| - jumper unit position | | |
| FTA Unit position | | |
| FTA 1 | 0 | |
| FTA 2 1 | | |
| FTA 3 0 | | |

| Field Termination Assembly | | |
|----------------------------|--|--|
| - jumper unit position | | |
| FTA Unit position | | |
| FTA 4 1 | | |

5.8 Digital Input High Voltage IOTA Models CC-TDI110, CC-TDI120, CC-TDI220, CC-TDI230

The Series C Digital Input High Voltage IOTA board is represented by the following information and graphics. To access the parts information for the:

- · module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Digital Input - High Voltage in the Recommended Spare Parts section.

5.8.1 Field wiring and module protection - Digital Input High Voltage module

Field wiring power is provided externally, therefore, Series C protection is not required.

5.8.2 IOTA board and connections - Digital Input High Voltage module

Series C Digital Input High Voltage 9 inch, non-redundant IOTA is displayed.

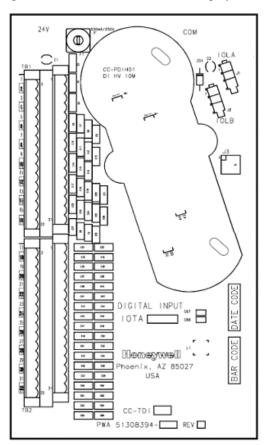


Figure 36: Series C Digital Input High Voltage 9 inch, non-redundant IOTA

Series C Digital Input High Voltage 12 inch, redundant IOTA is displayed.

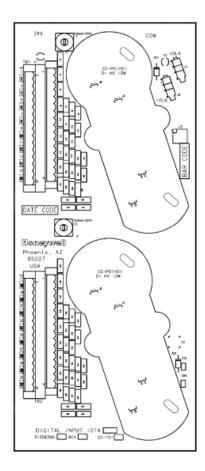


Figure 37: Series C Digital Input High Voltage 12 inch, redundant IOTA

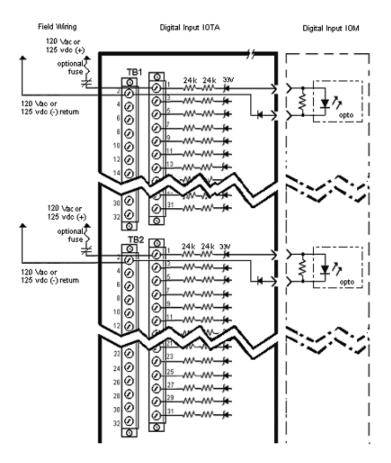


Figure 38: Series C Digital Input High Voltage 120 Vac and field wiring connections

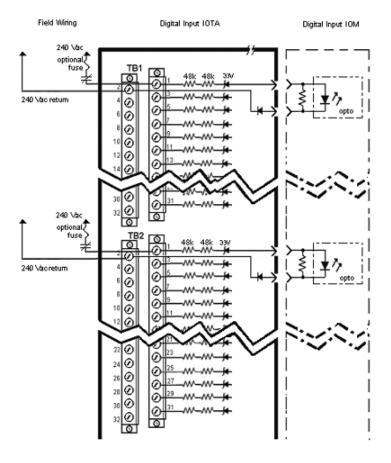


Figure 39: Series C Digital Input High Voltage 240 Vac and field wiring connections

To properly wire your module to the Series C Digital Input High Voltage IOTA board with terminal blocks 1 (TB1) and 2 (TB2) use the following table.

Table 41: DI HV 12 inch, redundant - terminal block 1

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 1 | 2 | 1 |
| Channel 2 | 4 | 3 |
| Channel 3 | 6 | 5 |
| Channel 4 | 8 | 7 |
| Channel 5 | 10 | 9 |
| Channel 6 | 12 | 11 |
| Channel 7 | 14 | 13 |
| Channel 8 | 16 | 15 |
| Channel 9 | 18 | 17 |
| Channel 10 | 20 | 19 |
| Channel 11 | 22 | 21 |
| Channel 12 | 24 | 23 |
| Channel 13 | 26 | 25 |

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Table 42: DI HV 12 inch, redundant - terminal block 2

| Terminal block 2 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 17 | 2 | 1 |
| Channel 18 | 4 | 3 |
| Channel 19 | 6 | 5 |
| Channel 20 | 8 | 7 |
| Channel 21 | 10 | 9 |
| Channel 22 | 12 | 11 |
| Channel 23 | 14 | 13 |
| Channel 24 | 16 | 15 |
| Channel 25 | 18 | 17 |
| Channel 26 | 20 | 19 |
| Channel 27 | 22 | 21 |
| Channel 28 | 24 | 23 |
| Channel 29 | 26 | 25 |
| Channel 30 | 28 | 27 |
| Channel 31 | 30 | 29 |
| Channel 32 | 32 | 31 |

5.9 Digital Input High Voltage PROX IOTA Model Cx-TDI151

The Series C Digital Input High Voltage PROX IOTA board is represented by the following information and graphics.

To access the parts information for the:

- · module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, see the "Recommended Spare Parts" table in the "IOM removal and installation under power" on page 542 section.

5.9.1 Difference between CC-TDI151 and CC-TDI110/CC-TDI120 IOTAs

The following table lists the differences between CC-TDI151 and CC-TDI110/CC-TDI120 IOTAs.

Table 43: Difference between CC-TDI151 and CC-TDI110/CC-TDI120 IOTAs

| CC-TDI151 | CC-TDI110/CC-TDI120 |
|---|--|
| Size of non-redundant IOTA is 12 inch. | Size of non-redundant IOTA is 9 inch. |
| Sensor current for ON condition is 7.5 mA at 90 voltage and 10 mA at 132 voltage. | Sensor current for ON condition is 1 mA at both 90 and 120 voltages. |
| Sensor current for OFF condition is 2 mA. | Sensor current for OFF condition is 0.32 mA. |

5.9.2 Field wiring and module protection - Digital Input High Voltage PROX IOTA (Cx - TDI151)

Field wiring power is provided externally, therefore, Series C protection is not required.

5.9.3 IOTA board and connections - Digital Input High Voltage module

Series C Digital Input High Voltage 12 inch, non-redundant PROX IOTA is displayed.

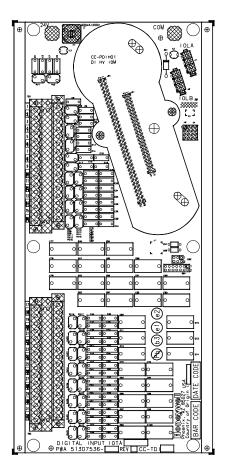


Figure 40: Series C Digital Input High Voltage 12 inch, non-redundant PROX IOTA

To properly wire your module to the Series C Digital Input High Voltage PROX IOTA board with terminal blocks 1 (TB1) and 2 (TB2) use the following table.

Table 44: DI HV 12 inch, non-redundant - terminal block 1

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 1 | 2 | 1 |
| Channel 2 | 4 | 3 |
| Channel 3 | 6 | 5 |
| Channel 4 | 8 | 7 |
| Channel 5 | 10 | 9 |
| Channel 6 | 12 | 11 |
| Channel 7 | 14 | 13 |
| Channel 8 | 16 | 15 |
| Channel 9 | 18 | 17 |
| Channel 10 | 20 | 19 |
| Channel 11 | 22 | 21 |
| Channel 12 | 24 | 23 |
| Channel 13 | 26 | 25 |

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Table 45: DI HV 12 inch, non-redundant - terminal block 1

| Terminal block 2 | | | |
|------------------|--------------|-------------|--|
| Channel | Return screw | Power screw | |
| Channel 17 | 2 | 1 | |
| Channel 18 | 4 | 3 | |
| Channel 19 | 6 | 5 | |
| Channel 20 | 8 | 7 | |
| Channel 21 | 10 | 9 | |
| Channel 22 | 12 | 11 | |
| Channel 23 | 14 | 13 | |
| Channel 24 | 16 | 15 | |
| Channel 25 | 18 | 17 | |
| Channel 26 | 20 | 19 | |
| Channel 27 | 22 | 21 | |
| Channel 28 | 24 | 23 | |
| Channel 29 | 26 | 25 | |
| Channel 30 | 28 | 27 | |
| Channel 31 | 30 | 29 | |
| Channel 32 | 32 | 31 | |

The field wiring connection of the Series C Digital Input High Voltage PROX IOTA is displayed in the following figure.

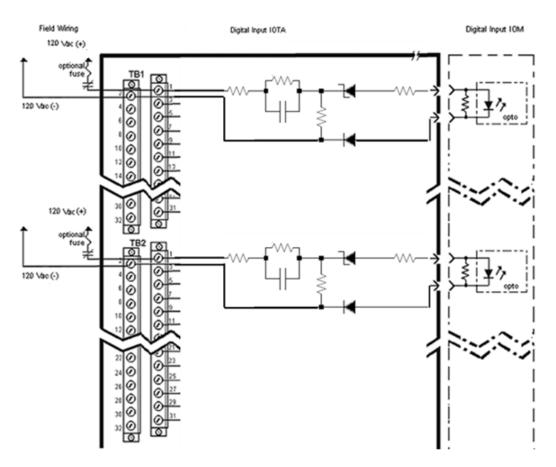


Figure 41: Field wiring connection of Series C Digital Input High Voltage PROX IOTA

5.10 Digital Input 24V IOTA Models CC-TDIL01, CC-TDIL11

The Series C Digital Input 24V IOTA board is represented by the following information and graphics. To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Digital Input 24V in the Recommended Spare Parts section.

5.10.1 Field wiring and module protection - Digital Input 24V module (CC-TDIL01, CC-TDIL11)

Field wiring is protected by an internal protection circuit which:

- Allows for internal or external DI sense power (field selectable using jumper block TB3)
- Permits short circuit protection of input for field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Allows each signal to be shorted in the field with no damage to module or board. Other channels on the same IOM are not affected.
- Field drive current is limited. Short circuit of input allowed.

Series C 24V Digital Input 9 inch, non-redundant IOTA is displayed.

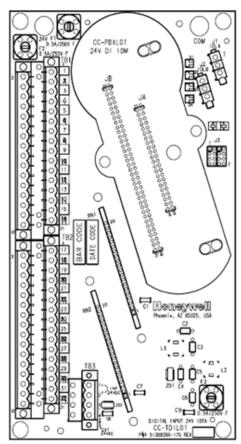


Figure 42: Series C 24V Digital Input 9 inch, non-redundant IOTA

To properly wire your module to the Series C Digital Input IOTA board with terminal blocks 1 (TB1), 2 (TB2), and 3 (TB3), use the following table.

Table 46: DI 9 inch, non-redundant - terminal block 1

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 1 | 2 | 1 |
| Channel 2 | 4 | 3 |
| Channel 3 | 6 | 5 |
| Channel 4 | 8 | 7 |
| Channel 5 | 10 | 9 |
| Channel 6 | 12 | 11 |
| Channel 7 | 14 | 13 |
| Channel 8 | 16 | 15 |
| Channel 9 | 18 | 17 |
| Channel 10 | 20 | 19 |
| Channel 11 | 22 | 21 |
| Channel 12 | 24 | 23 |
| Channel 13 | 26 | 25 |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Table 47: DI 9 inch, non-redundant - terminal block 2

| Terminal block 2 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 17 | 2 | 1 |
| Channel 18 | 4 | 3 |
| Channel 19 | 6 | 5 |
| Channel 20 | 8 | 7 |
| Channel 21 | 10 | 9 |
| Channel 22 | 12 | 11 |
| Channel 23 | 14 | 13 |
| Channel 24 | 16 | 15 |
| Channel 25 | 18 | 17 |
| Channel 26 | 20 | 19 |
| Channel 27 | 22 | 21 |
| Channel 28 | 24 | 23 |
| Channel 29 | 26 | 25 |
| Channel 30 | 28 | 27 |
| Channel 31 | 30 | 29 |
| Channel 32 | 32 | 31 |

Table 48: DI 9 inch, non-redundant - terminal block 3

| Terminal block 3 | | | |
|---------------------------|--|--|--|
| Internal | Used with Honeywell's 24v power supply | | |
| Screw 1 - internal 24V | [20] | | |
| Screw 2 - internal return | 1 + | | |
| Screw 3 - external 24V | | | |
| Screw 4 - external return | 3 + | | |
| External | Used with customer's 24v power supply | | |
| Screw 1 - internal 24V | _ | | |
| Screw 2 - internal return | | | |
| Screw 3 - external 24V | | | |
| Screw 4 - external return | 3 + 0 4 - | | |

Series C 24V Digital Input 9 inch, non-redundant IOTA and field wiring connection is displayed.



Tip

Optional open-wire detection can be instituted by attaching a 22k ohm resistor in the field wiring.

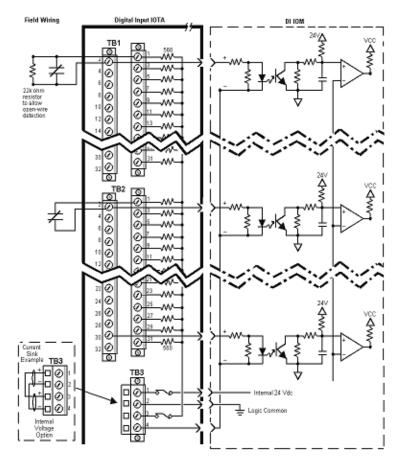


Figure 43: Series C 24V Digital Input 9 inch, non-redundant IOTA and field wiring connection

Series C 24V Digital Input 12 inch, redundant IOTA is displayed.

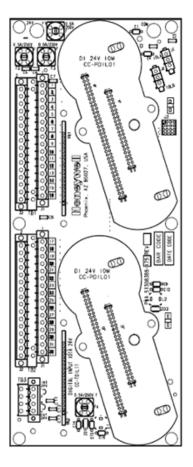


Figure 44: Series C 24V Digital Input 12 inch, redundant IOTA

5.10.2 Using DI 24V module (CC-TDIL01, CC-TDIL11) channels to report system alarms

You must include digital input channels in the control strategy to generate and report alarms based on their PVs. A typical strategy consists of a Control Module that contains the DI channel blocks where each PV (output) is connected to a PVFL input of a FLAGARRAY block configured for alarming.

The normal condition of the alarm input is ON.

Refer to the Control Building Guide for the following topics

- Creating and saving a control module
- Creating an instance of a basic function block
- Configuring alarms

Prerequisites

- You have installed and configured Series C 24V digital input I/O modules and associated IOTAs.
- You have alarm cables 51202343-001 (12-foot long) to connect power supply alarm contacts to 24V dc digital inputs on the IOM.

To connect the Power System alarm cable for RAM Charger Assembly 51199932-100

- 1 Plug the connection end of the alarm cable into the alarm connection on top of the power supply.
- 2 Connect the twisted pair wires to the terminal block 1 on the DI 24V IOTA in the following configuration. The associated alarm pins are also displayed.

| TERMINAL BLOCK 1 | | | PWR SUPPLY ALARM CONNECTOR | |
|------------------|---------|-------|----------------------------|---------|
| Wire color | Channel | Screw | Description | |
| White | 1 | 1 | Power supply 1 alarm + | (pin 8) |
| Black | 1 | 2 | Power supply 1 alarm - | (pin 3) |
| Blue | 2 | 3 | Power supply 2 alarm + | (pin 7) |
| Black | 2 | 4 | Power supply 2 alarm - | (pin 4) |
| Red | 3 | 5 | Battery alarm + | (pin 2) |
| Black | 3 | 6 | Battery alarm - | (pin 1) |
| Green | 4 | 7 | RAM charger cable alarm + | (pin 6) |
| Black | 4 | 8 | RAM charger cable alarm - | (pin 5) |

3 Ensure terminal block 3 connections are made in the following configuration Screw 1 + (internal 24V) to Screw 3 + (external 24V)

Screw 2 - (internal return) to Screw 4 - (external return)

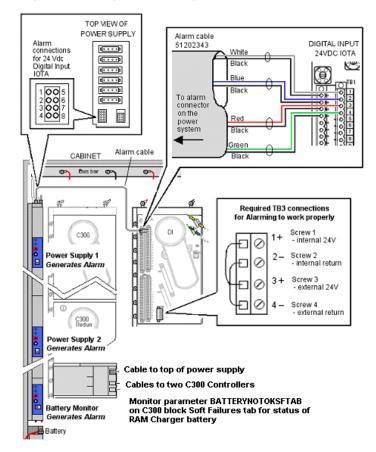


Figure 45: Alarm cable connection to the power supply and 24V DI IOTA for RAM Charger Assembly 51199932-100

5.10.3 Connecting the Power System alarm cable for RAM Charger Assembly 51199932-200

- 1 Plug the connection end of the alarm cable into the alarm connection on top of the power supply.
- 2 Connect the twisted pair wires to the terminal block 1 on the DI 24V IOTA in the following configuration. The associated alarm pins are also displayed.

| TERMINAL BLOCK 1 | | | PWR SU ALARM CONNECTOR (| |
|--------------------------|---|---------|-----------------------------|---------|
| Wire color Channel Screw | | Descrip | tion | |
| White | 1 | 1 | Power supply 1 alarm + | (pin 8) |
| Black | 1 | 2 | Power supply 1 alarm - | (pin 3) |
| Blue | 2 | 3 | Power supply 2 alarm + | (pin 7) |
| Black | 2 | 4 | Power supply 2 alarm - | (pin 4) |
| Red | 3 | 5 | Battery alarm + | (pin 2) |
| Black | 3 | 6 | Battery alarm - | (pin 1) |
| Green | 4 | 7 | Not Used (No Cable) | |
| Black | 4 | 8 | Not Used (No Cable) | |

3 Ensure terminal block 3 connections are made in the following configuration Screw 1 + (internal 24V) to Screw 3 + (external 24V)

Screw 2 - (internal return) to Screw 4 - (external return)

| TER | MINAL BLOCK 1 | | PWR | SUPPLY |
|--------------------------|---------------|------------------------------------|------------------------|-----------------------|
| | | ALARM CONNECTOR (40A power system) | | |
| Wire color Channel Screw | | Desc | cription | |
| White | 1 | 1 | Power supply 1 alarm + | (pin 8) |
| Black | 1 | 2 | Power supply 1 alarm - | (pin 3) |
| Blue | 2 | 3 | Power supply 2 alarm + | (pin 7) |
| Black | 2 | 4 | Power supply 2 alarm - | (pin 4) |
| Red | 3 | 5 | Power supply 3 alarm + | (pin 1) |
| TERMINAL BLOCK 1 | | PWR | SUPPLY | |
| | | | ALARM CONNECT | OR (40A power system) |
| Wire color | Channel | Screw | Description | |
| Black | 3 | 6 | Power supply 3 alarm - | (pin 2 |
| Green | 4 | 7 | Not Used (No Cable) | |
| Black | 4 | 8 | Not Used (No Cable) | |

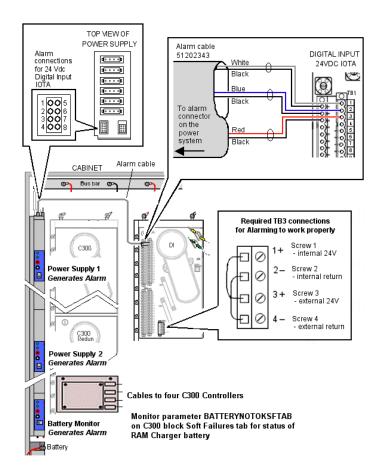


Figure 46: Alarm cable connection to the power supply and 24V DI IOTA for RAM Charger Assembly 51199932-200

5.11 Digital Input 24V IOTA Models Cx - TDIL51, Cx - TDIL61

The Series C Digital Input 24V IOTA board is represented by the following information and graphics. To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Digital Input 24V in the Recommended Spare Parts section.

5.11.1 Field wiring and module protection - Digital Input 24V module (Cx - TDIL51, Cx - TDIL61)

Field wiring is protected by an internal protection circuit, which:

- Allows for internal or external DI sense power (field selectable using jumper block TB3)
- Permits short circuit protection of input for field short circuits. Protection suitable for Division 2 non-incendive / Zone 2 non-arcing.
- Allows each signal to be shorted in the field with no damage to module or board. Other channels on the same IOM are not affected.
- Field drive current is limited. Short circuit of input allowed.

Series C 24V Digital Input 9 inch, non-redundant IOTA is displayed.

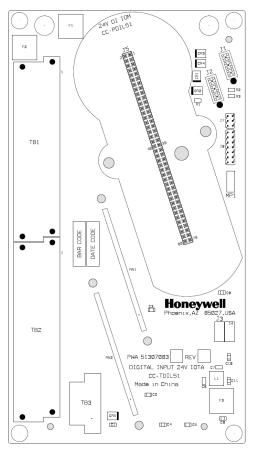


Figure 47: Series C 24V Digital Input 9 inch, non-redundant IOTA

To wire your module to the Series C Digital Input IOTA board with terminal blocks 1 (TB1), 2 (TB2), and 3 (TB3), use the following table.

Table 49: DI 9 inch, non-redundant - terminal block 1

| Terminal block 1 | | | |
|------------------|--------------|-------------|--|
| Channel | Return screw | Power screw | |
| Channel 1 | 2 | 1 | |
| Channel 2 | 4 | 3 | |
| Channel 3 | 6 | 5 | |
| Channel 4 | 8 | 7 | |
| Channel 5 | 10 | 9 | |
| Channel 6 | 12 | 11 | |
| Channel 7 | 14 | 13 | |
| Channel 8 | 16 | 15 | |
| Channel 9 | 18 | 17 | |
| Channel 10 | 20 | 19 | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |
| Channel 14 | 28 | 27 | |
| Channel 15 | 30 | 29 | |
| Channel 16 | 32 | 31 | |

Table 50: DI 9 inch, non-redundant - terminal block 2

| Terminal block 2 | | | | |
|------------------|--------------|-------------|--|--|
| Channel | Return screw | Power screw | | |
| Channel 17 | 2 | 1 | | |
| Channel 18 | 4 | 3 | | |
| Channel 19 | 6 | 5 | | |
| Channel 20 | 8 | 7 | | |
| Channel 21 | 10 | 9 | | |
| Channel 22 | 12 | 11 | | |
| Channel 23 | 14 | 13 | | |
| Channel 24 | 16 | 15 | | |
| Channel 25 | 18 | 17 | | |
| Channel 26 | 20 | 19 | | |
| Channel 27 | 22 | 21 | | |
| Channel 28 | 24 | 23 | | |
| Channel 29 | 26 | 25 | | |
| Channel 30 | 28 | 27 | | |
| Channel 31 | 30 | 29 | | |
| Channel 32 | 32 | 31 | | |

Table 51: DI 9 inch, non-redundant - terminal block 3

| Terminal block 3 | | | |
|---------------------------|--|--|--|
| Internal | Used with Honeywell's 24v power supply | | |
| Screw 1 - internal 24V | [6] | | |
| Screw 2 - internal return | ← □ □ □ □ □ | | |
| Screw 3 - external 24V | (→ □Ø 2 - | | |
| Screw 4 - external return | 3 + | | |
| External | Used with customer's 24v power supply | | |
| Screw 1 - internal 24V | _ | | |
| Screw 2 - internal return | | | |
| Screw 3 - external 24V | | | |
| Screw 4 - external return | 3 + | | |

Series C 24V Digital Input 9 inch, non-redundant IOTA and field wiring connection is displayed.

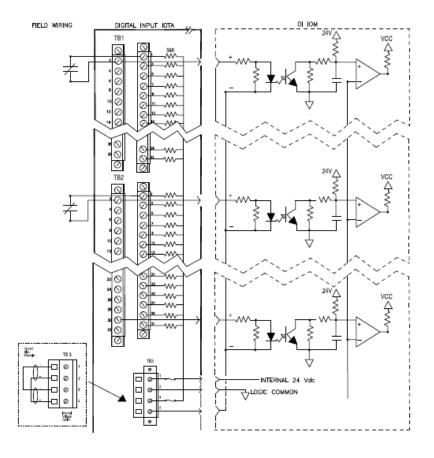


Figure 48: Series C 24V Digital Input 9 inch, non-redundant IOTA and field wiring connection

Series C 24V Digital Input 9 inch, redundant IOTA is displayed.

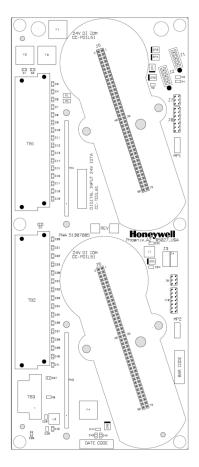


Figure 49: Series C 24V Digital Input 9 inch, redundant IOTA

5.11.2 Using DI 24V module (Cx - TDIL51, Cx - TDIL61) channels to report system alarms

You must include digital input channels in the control strategy to generate and report alarms based on their PVs. A typical strategy consists of a Control Module that contains the DI channel blocks where each PV (output) is connected to a PVFL input of a FLAGARRAY block configured for alarming.

The normal condition of the alarm input is ON.

Refer to the Control Building Guide for the following topics

- Creating and saving a control module
- Creating an instance of a basic function block
- Configuring alarms

Prerequisites

- You have installed and configured Series C 24V digital input I/O modules and associated IOTAs.
- You have alarm cables 51202343-001 (12-foot long) to connect power supply alarm contacts to 24V dc digital inputs on the IOM.

To connect the Power System alarm cable for RAM Charger Assembly 51199932-200

- 1 Plug the connection end of the alarm cable into the alarm connection on top of the power supply.
- 2 Connect the twisted pair wires to the terminal block 1 on the DI 24V IOTA in the following configuration. The associated alarm pins are also displayed.

| TERMINAL BLOCK 1 | | | PWR SUPPLY | |
|--------------------------|---|----------|-------------------------------|---------|
| | | | ALARM CONNECTOR (20A power sy | stem) |
| Wire color Channel Screw | | Descript | tion | |
| White | 1 | 1 | Power supply 1 alarm + | (pin 8) |
| Black | 1 | 2 | Power supply 1 alarm - | (pin 3) |
| Blue | 2 | 3 | Power supply 2 alarm + | (pin 7) |
| Black | 2 | 4 | Power supply 2 alarm - | (pin 4) |
| Red | 3 | 5 | Battery alarm + | (pin 2) |
| Black | 3 | 6 | Battery alarm - | (pin 1) |
| Green | 4 | 7 | Not Used (No Cable) | |
| Black | 4 | 8 | Not Used (No Cable) | |

3 Ensure terminal block 3 connections are made in the following configuration

Screw 1 + (internal 24V) to Screw 3 + (external 24V)

Screw 2 - (internal return) to Screw 4 - (external return)

| TERMINAL BLOCK 1 | | | PWR SUPPLY | | |
|------------------|---------|------------------------------------|------------------------|---------------|--|
| | | ALARM CONNECTOR (40A power system) | | | |
| Wire color | Channel | Screw | Description | | |
| White | 1 | 1 | Power supply 1 alarm + | (pin 8) | |
| Black | 1 | 2 | Power supply 1 alarm - | (pin 3) | |
| Blue | 2 | 3 | Power supply 2 alarm + | (pin 7) | |
| Black | 2 | 4 | Power supply 2 alarm - | (pin 4) | |
| Red | 3 | 5 | Power supply 3 alarm + | (pin 1) | |
| TERMINAL BL | OCK 1 | | PWR SUPPLY | | |
| | | | ALARM CONNECTOR (40A) | power system) | |
| Wire color | Channel | Screw | Desc | cription | |
| Black | 3 | 6 | Power supply 3 alarm - | (pin 2 | |
| Green | 4 | 7 | Not Used (No Cable) | | |
| Black | 4 | 8 | Not Used (No Cable) | | |

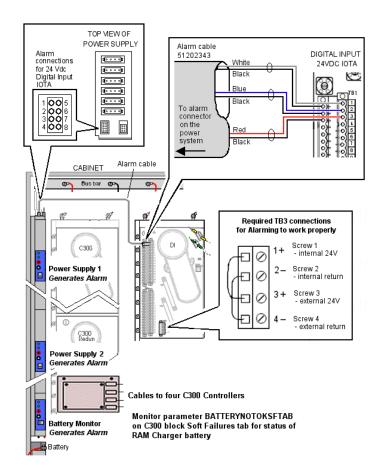


Figure 50: Alarm cable connection to the power supply and 24V DI IOTA for RAM Charger Assembly 51199932-200

5.12 Digital Output 24V IOTA Models CC-TDOB01, CC-TDOB11

CAUTION

When wiring the Digital Output 24V ensure that the external power is not reversed or the IOM will be damaged.

The Series C Digital Output 24V IOTA board is represented by the following information and graphics.

To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Digital Output 24V in the Recommended Spare Parts section.

5.12.1 Field wiring and module protection - Digital Output 24V module (CC-TDOB01, CC-TDOB11)

The Digital Output 24Volt Module provides a unique and highly functional output power protection method. When a short occurs in the field, the following occurs:

- the output circuits sense the over-current condition and shut down the output
- the shut down of the point places the mode of the point into Manual
- · an Over-current Soft Failure is generated

This failure is maintained until the short circuit condition is repaired and the point is again supplying the proper current.

Only one channel is affected at a time. If multiple channels are affected, they are individually shut down. Any channels that do not have a short circuit condition are unaffected.

• Thermal protection alarm if short in field of > 0.5A.

5.12.2 IOTA board and connections - Digital Output 24V module (CC-TDOB01, CC-TDOB11)

Series C 24V Digital Output 9 inch, non-redundant IOTA is displayed.

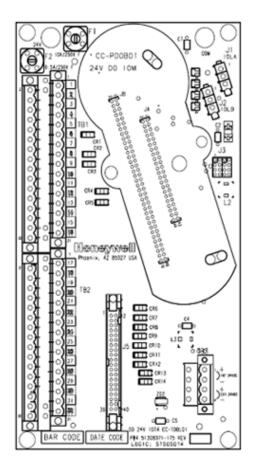


Figure 51: Series C 24V Digital Output 9 inch, non-redundant IOTA

To properly wire your module to the Series C 24V Digital Output IOTA board with terminal blocks 1 (TB1) and 2 (TB2), use the following table.

Table 52: 24V DO 9 inch, non-redundant - terminal block 1

| Terminal block 1 | | | | |
|------------------|--------------|-------------|--|--|
| Channel | Return screw | Power screw | | |
| Channel 1 | 2 | 1 | | |
| Channel 2 | 4 | 3 | | |
| Channel 3 | 6 | 5 | | |
| Channel 4 | 8 | 7 | | |
| Channel 5 | 10 | 9 | | |
| Channel 6 | 12 | 11 | | |
| Channel 7 | 14 | 13 | | |
| Channel 8 | 16 | 15 | | |
| Channel 9 | 18 | 17 | | |
| Channel 10 | 20 | 19 | | |
| Channel 11 | 22 | 21 | | |
| Channel 12 | 24 | 23 | | |
| Channel 13 | 26 | 25 | | |

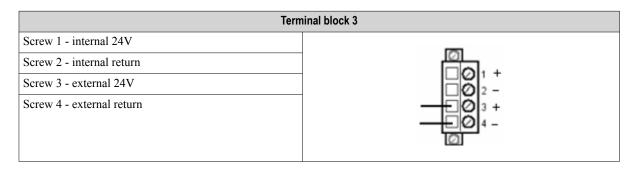
| Terminal block 1 | | | | |
|------------------|--------------|-------------|--|--|
| Channel | Return screw | Power screw | | |
| Channel 14 | 28 | 27 | | |
| Channel 15 | 30 | 29 | | |
| Channel 16 | 32 | 31 | | |

Table 53: 24V DO 9 inch, non-redundant - terminal block 2

| Terminal block 2 | | | | |
|------------------|--------------|-------------|--|--|
| Channel | Return screw | Power screw | | |
| Channel 17 | 2 | 1 | | |
| Channel 18 | 4 | 3 | | |
| Channel 19 | 6 | 5 | | |
| Channel 20 | 8 | 7 | | |
| Channel 21 | 10 | 9 | | |
| Channel 22 | 12 | 11 | | |
| Channel 23 | 14 | 13 | | |
| Channel 24 | 16 | 15 | | |
| Channel 25 | 18 | 17 | | |
| Channel 26 | 20 | 19 | | |
| Channel 27 | 22 | 21 | | |
| Channel 28 | 24 | 23 | | |
| Channel 29 | 26 | 25 | | |
| Channel 30 | 28 | 27 | | |
| Channel 31 | 29 | 28 | | |
| Channel 32 | 32 | 31 | | |

Table 54: 24V DO 9 inch, non-redundant - terminal block 3

| Terminal block 3 | | |
|---------------------------|---|--|
| Internal | Used with Honeywell's provided 24v power supply | |
| Screw 1 - internal 24V | | |
| Screw 2 - internal return | ← □ □ 1 + | |
| Screw 3 - external 24V | (🔠 🛛 - | |
| Screw 4 - external return | 3 + | |
| External | Used with customer's provided 24v power supply | |





CAUTION

When wiring the Digital Output 24V ensure that the

external power is not reversed or the IOM will be damaged.

Series C 24V Digital Output 9 inch, non-redundant IOTA and field wiring connection is displayed

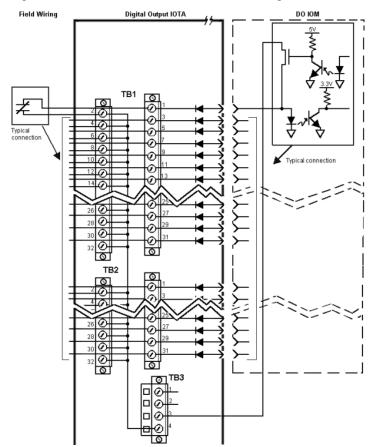


Figure 52: Series C 24V Digital Output 9 inch, non-redundant IOTA and field wiring connections

Series C 24V Digital Output 12 inch, redundant IOTA is displayed

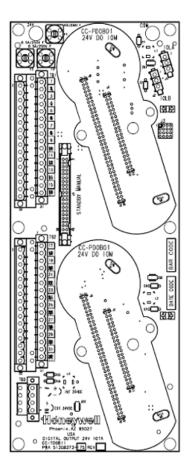


Figure 53: Series C 24V Digital Output 12 inch, redundant IOTA

5.13 Digital Output 24V IOTA Models Cx-TDOD51, Cx-TDOD61

A

CAUTION

When wiring the Digital Output 24V ensure that the external power is not reversed or the IOM will be damaged.

The Series C Digital Output 24V IOTA board is represented by the following information and graphics.

To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, refer to Digital Output 24V in the Recommended Spare Parts section.

5.13.1 Field wiring and module protection - Digital Output 24V (Cx-TDOD51, Cx-TDOD61)

The Digital Output 24Volt Module provides a unique and highly functional output power protection method. When a short occurs in the field, the following occurs.

- The output circuits sense the over-current condition and shut down the output.
- The shut down of the point places the mode of the point into Manual.
- An Over-current Soft Failure is generated.

This failure is maintained until the short circuit condition is repaired and the point is again supplying the proper current.

Only one channel is affected at a time. If multiple channels are affected, they are individually shut down. Any channels that do not have a short circuit condition are unaffected.

• Each channel in a DO module can handle a maximum load of 100mA.

5.13.2 IOTA board and connections - Digital Output 24V (Cx-TDOD51, Cx-TDOD61)

Series C 24V Digital Output 9 inch, non-redundant IOTA is displayed.

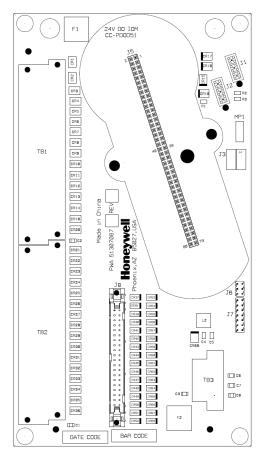


Figure 54: Series C 24V Digital Output 9 inch, non-redundant IOTA

To wire your module to the Series C 24V Digital Output IOTA board with terminal blocks 1 (TB1) and 2 (TB2), use the following table.

Table 55: 24V DO 9 inch, non-redundant - terminal block 1

| Terminal block 1 | | | | |
|------------------|--------------|-------------|--|--|
| >Channel | Return screw | Power screw | | |
| Channel 1 | 2 | 1 | | |
| Channel 2 | 4 | 3 | | |
| Channel 3 | 6 | 5 | | |
| Channel 4 | 8 | 7 | | |
| Channel 5 | 10 | 9 | | |
| Channel 6 | 12 | 11 | | |
| Channel 7 | 14 | 13 | | |
| Channel 8 | 16 | 15 | | |
| Channel 9 | 18 | 17 | | |
| Channel 10 | 20 | 19 | | |
| Channel 11 | 22 | 21 | | |
| Channel 12 | 24 | 23 | | |
| Channel 13 | 26 | 25 | | |

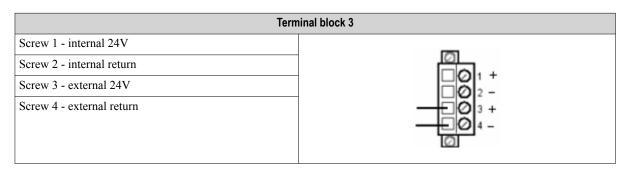
| Terminal block 1 | | |
|------------------|--------------|-------------|
| >Channel | Return screw | Power screw |
| Channel 14 | 28 | 27 |
| Channel 15 | 30 | 29 |
| Channel 16 | 32 | 31 |

Table 56: 24V DO 9 inch, non-redundant - terminal block 2

| Terminal block 2 | | | |
|------------------|--------------|-------------|--|
| Channel | Return screw | Power screw | |
| Channel 17 | 2 | 1 | |
| Channel 18 | 4 | 3 | |
| Channel 19 | 6 | 5 | |
| Channel 20 | 8 | 7 | |
| Channel 21 | 10 | 9 | |
| Channel 22 | 12 | 11 | |
| Channel 23 | 14 | 13 | |
| Channel 24 | 16 | 15 | |
| Channel 25 | 18 | 17 | |
| Channel 26 | 20 | 19 | |
| Channel 27 | 22 | 21 | |
| Channel 28 | 24 | 23 | |
| Channel 29 | 26 | 25 | |
| Channel 30 | 28 | 27 | |
| Channel 31 | 29 | 28 | |
| Channel 32 | 32 | 31 | |

Table 57: 24V DO 9 inch, non-redundant - terminal block 3

| Terminal block 3 | | |
|---------------------------|---|--|
| Internal | Used with Honeywell's provided 24v power supply | |
| Screw 1 - internal 24V | | |
| Screw 2 - internal return | ← □ 01 + | |
| Screw 3 - external 24V | (/ | |
| Screw 4 - external return | + | |
| External | Used with customer's provided 24v power supply | |





CAUTION

When wiring the Digital Output 24V ensure that the **external power is not reversed** or the IOM will be damaged.

Series C 24V Digital Output 9 inch, non-redundant IOTA and field wiring connection is displayed.

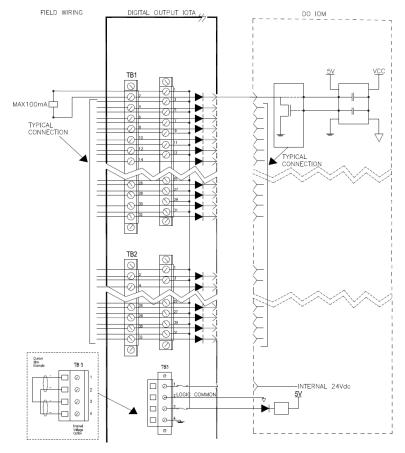


Figure 55: Series C 24V Digital Output 9 inch, non-redundant IOTA and field wiring connections

Series C 24V Digital Output 9 inch, redundant IOTA is displayed.

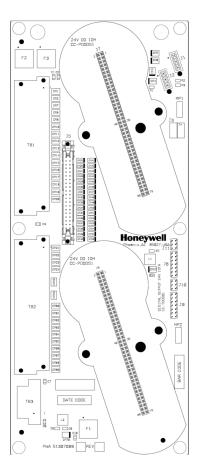


Figure 56: Series C 24V Digital Output 9 inch, redundant IOTA

5.14 Digital Output Relay Module IOTA Models CC-TDOR01, CC-TDOR11

The Series C Digital Output IOTA board is represented by the following information and graphics. To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, jumper link, slim power relay and
- fuses

associated with this board and module, refer to Digital Output Relay in the Recommended Spare Parts section. Series C Digital Output Relay non-redundant IOTA is displayed.

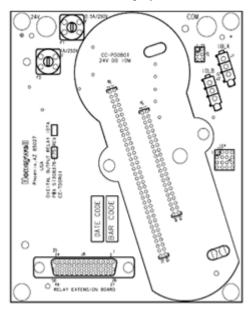


Figure 57: Series C Digital Output Relay, non-redundant IOTA

Series C Digital Output Relay redundant IOTA is displayed.

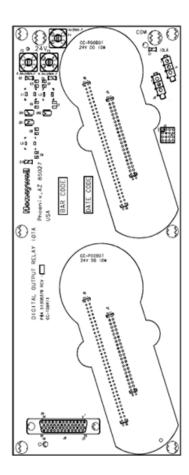


Figure 58: Series C Digital Output Relay, redundant IOTA

5.15 Digital Output Relay Extender board Models CC-SDOR01



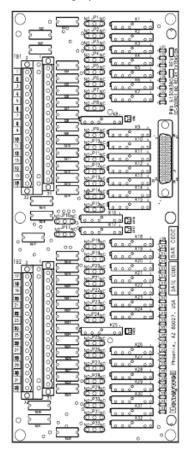


Figure 59: Series C Digital Output Relay Extender board

To properly wire your module to the Series C Digital Output Relay IOTA board with terminal blocks 1 (TB1) and 2 (TB2), use the following table.

Table 58: DO Relay Extender board- terminal block 1

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 1 | 2 | 1 |
| Channel 2 | 4 | 3 |
| Channel 3 | 6 | 5 |
| Channel 4 | 8 | 7 |
| Channel 5 | 10 | 9 |
| Channel 6 | 12 | 11 |
| Channel 7 | 14 | 13 |
| Channel 8 | 16 | 15 |
| Channel 9 | 18 | 17 |
| Channel 10 | 20 | 19 |

| Terminal block 1 | | | |
|----------------------------------|----|----|--|
| Channel Return screw Power screw | | | |
| Channel 11 | 22 | 21 | |
| Channel 12 | 24 | 23 | |
| Channel 13 | 26 | 25 | |
| Channel 14 | 28 | 27 | |
| Channel 15 | 30 | 29 | |
| Channel 16 | 32 | 31 | |

Table 59: DO Relay Extender board- terminal block 2

| Terminal block 2 | | |
|------------------|----------------------|----|
| Channel | Channel Return screw | |
| Channel 17 | 2 | 1 |
| Channel 18 | 4 | 3 |
| Channel 19 | 6 | 5 |
| Channel 20 | 8 | 7 |
| Channel 21 | 10 | 9 |
| Channel 22 | 12 | 11 |
| Channel 23 | 14 | 13 |
| Channel 24 | 16 | 15 |
| Channel 25 | 18 | 17 |
| Channel 26 | 20 | 19 |
| Channel 27 | 22 | 21 |
| Channel 28 | 24 | 23 |
| Channel 29 | 26 | 25 |
| Channel 30 | 28 | 27 |
| Channel 31 | 29 | 28 |
| Channel 32 | 32 | 31 |

Series C Digital Output Relay Extender board and field wiring connection is displayed.

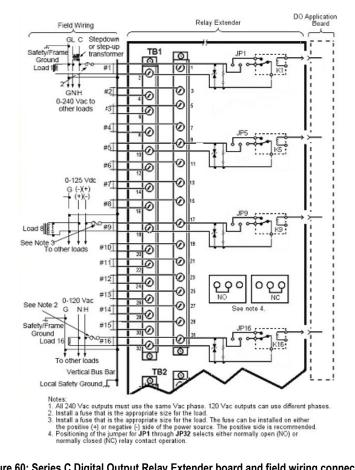


Figure 60: Series C Digital Output Relay Extender board and field wiring connections

5.15.1 DO Relay cover

The DO Relay Extender board being certified as high voltage (with socketed relays and jumpers) is protected by the DO Relay Cover. This complies with the hazardous location agency approvals. The cover has four captured screws; therefore, there are no loose parts.

5.15.2 To mount the DO Relay cover

- 1 Align the four captured screws on the cover to the corresponding holes on the DO Relay Extender board.
- 2 Tighten the four screws securing the cover.
- This completes this task.



Before changing any jumper settings, ensure the wires on the terminal block(s) have been removed.

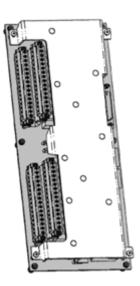


Figure 61: Series C Digital Output Relay Cover

5.16 Speed Protection Module IOTA Model CC-TSP411

The Series C Speed Protection Module (SPM) IOTA board is represented by the following information and graphic.

Series C SPM 18 inch, redundant IOTA is displayed.

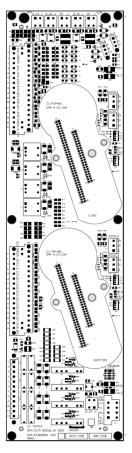


Figure 62: Series C Speed Protection Module 18 inch, redundant IOTA

To properly wire your module to the Series C Speed Protection Module (SPM) IOTA board with terminal block 1 (TB1), terminal block 2 (TB2), and terminal block 3 (TB3) use the following table.

Table 60: SPM 18 inch, redundant - terminal block 1

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|-------------------------------------|
| 1 | AI1+ | Analog Input Positive - Channel 1 |
| 2 | AI1- | Analog Input Negative - Channel 1 |
| 3 | AI1 24V | Analog Input 24V Supply - Channel 1 |
| 4 | AI2 24V | Analog Input 24V Supply - Channel 2 |
| 5 | AI2+ | Analog Input Positive - Channel 2 |
| 6 | AI2- | Analog Input Negative - Channel 2 |
| 7 | AI3+ | Analog Input Positive - Channel 3 |
| 8 | AI3- | Analog Input Negative - Channel 3 |
| 9 | AI3 24V | Analog Input 24V Supply - Channel 3 |

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|---|
| 10 | AI4 24V | Analog Input 24V Supply - Channel 4 |
| 11 | AI4+ | Analog Input Positive - Channel 4 |
| 12 | AI4- | Analog Input Negative - Channel 4 |
| 13 | AI5+ | Analog Input Positive - Channel 5 |
| 14 | AI5- | Analog Input Negative - Channel 5 |
| 15 | AI5 24V | Analog Input 24V Supply - Channel 5 |
| 16 | AI6 24V | Analog Input 24V Supply - Channel 6 |
| 17 | AI6+ | Analog Input Positive - Channel 6 |
| 18 | AI6- | Analog Input Negative - Channel 6 |
| 19 | AI7+ | Analog Input Positive - Channel 7 |
| 20 | AI7- | Analog Input Negative - Channel 7 |
| 21 | AI7 24V | Analog Input 24V Supply - Channel 7 |
| 22 | AI8 24V | Analog Input 24V Supply - Channel 8 |
| 23 | AI8+ | Analog Input Positive - Channel 8 |
| 24 | AI8- | Analog Input Negative - Channel 8 |
| 25 | PASS1+ | Passive Speed Sensor Input Positive - Channel 1 |
| 26 | PASS1- | Passive Speed Sensor Input Negative - Channel 1 |
| 27 | PASS2+ | Passive Speed Sensor Input Positive - Channel 2 |
| 28 | PASS2- | Passive Speed Sensor Input Negative - Channel 2 |
| 29 | PASS3+ | Passive Speed Sensor Input Positive - Channel 3 |
| 30 | PASS3- | Passive Speed Sensor Input Negative - Channel 3 |
| 31 | PASS4+ | Passive Speed Sensor Input Positive - Channel 4 |
| 32 | PASS4- | Passive Speed Sensor Input Negative - Channel 4 |

Table 61: SPM 18 inch, redundant - terminal block 2

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|--|
| 1 | ACT1+ | Active Speed Sensor 1 Positive - Channel 1 |
| 2 | ACT1- | Active Speed Sensor 1 Negative - Channel 1 |
| 3 | ACT1 24V | Active Speed Sensor 24V Supply - Channel 1 |
| 4 | ACT2 24V | Active Speed Sensor 24V Supply - Channel 2 |
| 5 | ACT2+ | Active Speed Sensor 2 Positive - Channel 2 |
| 6 | ACT2- | Active Speed Sensor 2 Negative - Channel 2 |
| 7 | ACT3+ | Active Speed Sensor 3 Positive - Channel 3 |
| 8 | ACT3- | Active Speed Sensor 3 Negative - Channel 3 |
| 9 | ACT3 24V | Active Speed Sensor 24V Supply - Channel 3 |
| 10 | ACT4 24V | Active Speed Sensor 24V Supply - Channel 4 |
| 11 | ACT4+ | Active Speed Sensor 4 Positive - Channel 4 |
| 12 | ACT4- | Active Speed Sensor 4 Negative - Channel 4 |
| 13 | DI1 24V | Digital Input 1, 24V Field Supply |
| 14 | DI1 | Digital Input 1 - Channel 1 |
| 15 | DI2 24V | Digital Input 2, 24V Field Supply |

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|-----------------------------------|
| 16 | DI2 | Digital Input 2 - Channel 2 |
| 17 | DI3 24V | Digital Input 3, 24V Field Supply |
| 18 | DI3 | Digital Input 3 - Channel 3 |
| 19 | DI4 24V | Digital Input 4, 24V Field Supply |
| 20 | DI4 | Digital Input 4 - Channel 4 |
| 21 | DI5 24V | Digital Input 5, 24V Field Supply |
| 22 | DI5 | Digital Input 5 - Channel 5 |
| 23 | DI6 24V | Digital Input 6, 24V Field Supply |
| 24 | DI6 | Digital Input 6 - Channel 6 |
| 25 | DI7 24V | Digital Input 7, 24V Field Supply |
| 26 | DI7 | Digital Input 7 - Channel 7 |
| 27 | DI8 24V | Digital Input 8, 24V Field Supply |
| 28 | DI8 | Digital Input 8 - Channel 8 |
| 29, 30 | | NC |
| 31 | AO1 | Analog Output 1 - Channel 1 |
| 32 | GND | Analog Output 1 Return |

Table 62: SPM 18 inch, redundant - terminal block 3

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|--|
| 1 | DO1_RTN | Digital Output 1 Return - Channel 1 |
| 2 | DO1_NC | Digital Output 1 Normally Closed Pin - Channel 1 |
| 3 | DO1_NO | Digital Output 1 Normally Open Pin - Channel 1 |
| 4 | DO2_RTN | Digital Output 2 Return - Channel 2 |
| 5 | DO2_NC | Digital Output 2 Normally Closed Pin - Channel 2 |
| 6 | DO2_NO | Digital Output 2 Normally Open Pin - Channel 2 |
| 7 | DO3_RTN | Digital Output 3 Return - Channel 3 |
| 8 | DO3_NC | Digital Output 3 Normally Closed Pin - Channel 3 |
| 9 | DO3_NO | Digital Output 3 Normally Open Pin - Channel 3 |
| 10 | DO4_RTN | Digital Output 4 Return - Channel 4 |
| 11 | DO4_NC | Digital Output 4 Normally Closed Pin - Channel 4 |
| 12 | DO4_NO | Digital Output 4 Normally Open - Channel 4 |

5.16.1 SPM Input wiring

Series C SPM 18 inch, redundant IOTA and field wiring connections for different channels are displayed.

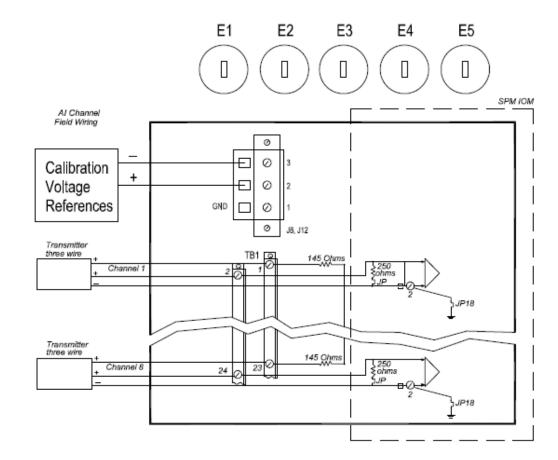


Figure 63: Series C SPM - AI Channel Field Wiring

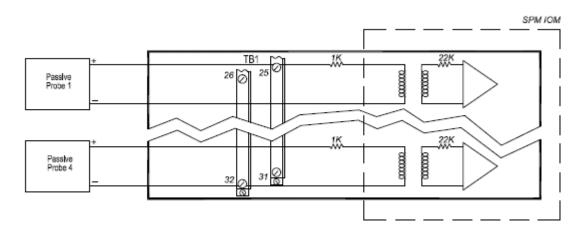


Figure 64: Series C SPM - Passive Probe Field Wiring

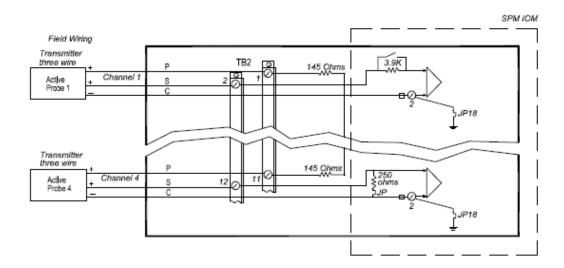
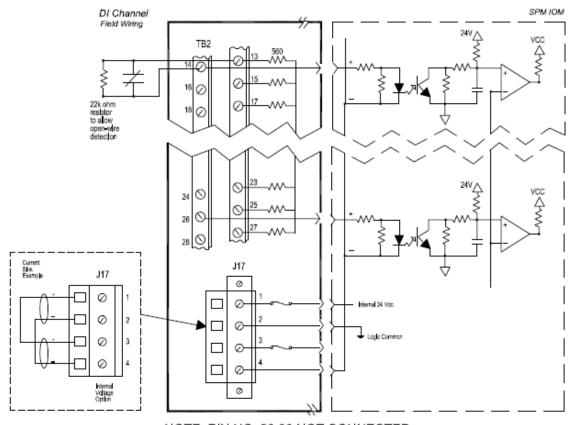


Figure 65: Series C SPM - Active Probe Field Wiring



NOTE: PIN NO. 29,30 NOT CONNECTED.

Figure 66: Series C SPM - DI Channel Field Wiring

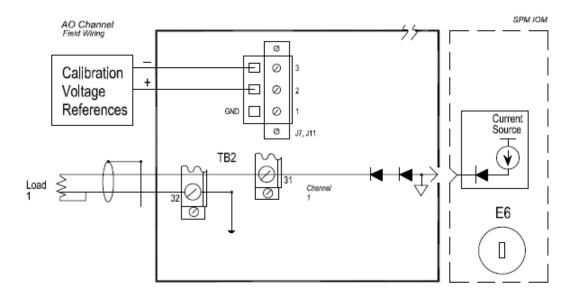


Figure 67: Series C SPM - AO Channel Field Wiring

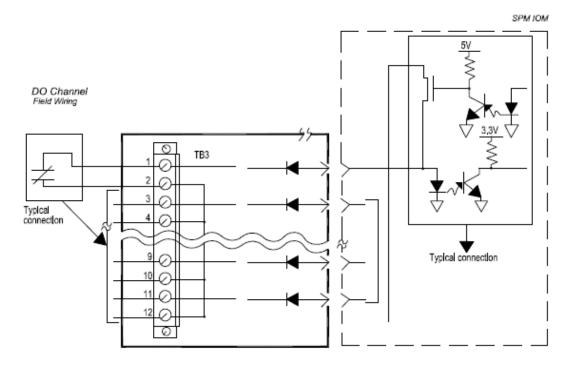


Figure 68: Series C SPM - DO Channel Field Wiring

SPM Fuses

Following table explains about fuses for the SPM.

| Fuses | Application Circuit |
|-------|---------------------|
| E1 | ACTIVE PROBE 24V |
| E2 | AI 24V |
| E3 | BOTTOM IOM 24V |

| Fuses | Application Circuit |
|-------|---------------------|
| E4 | INTERNAL 24V |
| E5 | TOP IOM 24V |
| E6 | EXTERNAL 24V |

For detailed information about the jumper settings of the SPM refer to *Turbine Control User's Guide*.

5.17 Servo Valve Positioner Module IOTA Models CC-TSV211

The Series C Servo Valve Positioner Module (SVPM) IOTA board is represented by the following information and graphic.

Series C SVPM 18 inch, redundant IOTA is displayed:

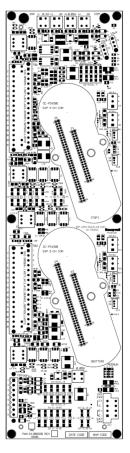


Figure 69: Series C Servo Valve Positioner Module 18 inch, redundant IOTA

To properly wire your module to the Series C Servo Valve Positioner Module (SVPM) IOTA board with terminal block 1 (TB1), terminal block 2 (TB2), and terminal block 3 (TB3) use the following tables.

Table 63: SVPM 18 inch, redundant - terminal block 1

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|---|
| 1 | L11A+ | LVDT Feedback A Positive (Field Device 1) - Channel 1 |
| 2 | L11A- | LVDT Feedback A Negative (Field Device 1) - Channel 1 |
| 3 | L11B+ | LVDT Feedback B Positive (Field Device 1) - Channel 1 |
| 4 | L11B- | LVDT Feedback B Negative (Field Device 1) - Channel 1 |
| 7 | L11X+ | LVDT Excitation Positive (Field Device 1) - Channel 1 |
| 8 | L11X- | LVDT Excitation Negative (Field Device 1) - Channel 1 |
| 11 | AI11+ | Analog Input Positive (Field Device 1) - Channel 1 |
| 12 | AI11- | Analog Input Negative (Field Device 1) - Channel 1 |
| 13 | AI11 24V | Analog Input 24V Supply (Field Device 1) - Channel 1 |

| Terminal Number | Signal Name | Signal Name and Description |
|-------------------------------------|-------------|---|
| 14 | AI12 24V | Analog Input 24V Supply (Field Device 2) - Channel 2 |
| 15 | AI12+ | Analog Input Positive (Field Device 2) - Channel 2 |
| 16 | AI12- | Analog Input Negative (Field Device 2) - Channel 2 |
| 19 | SO11+ | Servo Output Coil 1 (Field Device 1) Positive - Channel 1 |
| 20 | SO11- | Servo Output Coil 1 (Field Device 1) Negative - Channel 1 |
| 21 | SO12+ | Servo Output Coil 1 (Field Device 2) Positive - Channel 2 |
| 22 | SO12- | Servo Output Coil 1 (Field Device 2) Negative - Channel 2 |
| 25 | L12A+ | LVDT Feedback A Positive (Field Device 2) - Channel 2 |
| 26 | L12A- | LVDT Feedback A Negative (Field Device 2) - Channel 2 |
| 27 | L12B+ | LVDT Feedback B Positive (Field Device 2) - Channel 2 |
| 28 | L12B- | LVDT Feedback B Negative (Field Device 2) - Channel 2 |
| 31 | L12X+ | LVDT Excitation Positive (Field Device 2) - Channel 2 |
| 32 | L12X- | LVDT Excitation Negative (Field Device 2) - Channel 2 |
| 5, 6, 9, 10, 17, 18, 23, 24, 29, 30 | | NC |

Table 64: SVPM 18 inch, redundant - terminal block 2

| Terminal Number | Signal Name | Signal Name and Description |
|-----------------|-------------|---|
| 1 | L21A+ | LVDT Feedback A Positive (Field Device 1) - Channel 1 |
| 2 | L21A- | LVDT Feedback A Negative (Field Device 1) - Channel 1 |
| 3 | L21B+ | LVDT Feedback B Positive (Field Device 1) - Channel 1 |
| 4 | L21B- | LVDT Feedback B Negative (Field Device 1) - Channel 1 |
| 7 | L21X+ | LVDT Excitation Positive (Field Device 1) - Channel 1 |
| 8 | L21X- | LVDT Excitation Negative (Field Device 1) - Channel 1 |
| 11 | AI21+ | Analog Input Positive (Field Device 1) - Channel 1 |
| 12 | AI21- | Analog Input Negative (Field Device 1) - Channel 1 |
| 13 | AI21 24V | Analog Input 24V Supply (Field Device 1) - Channel 1 |
| 14 | AI22 24V | Analog Input 24V Supply (Field Device 2) - Channel 2 |
| 15 | AI22+ | Analog Input Positive (Field Device 2) - Channel 2 |
| 16 | AI22- | Analog Input Negative (Field Device 2) - Channel 2 |
| 19 | SO21+ | Servo Output Coil 2 (Field Device 1) Positive - Channel 1 |
| 20 | SO21- | Servo Output Coil 2 (Field Device 1) Negative - Channel 1 |
| 21 | SO22+ | Servo Output Coil 2 (Field Device 2) Positive - Channel 2 |
| 22 | SO22- | Servo Output Coil 2 (Field Device 2) Negative - Channel 2 |
| 25 | L22A+ | LVDT Feedback A Positive (Field Device 2) - Channel 2 |
| 26 | L22A- | LVDT Feedback A Negative (Field Device 2) - Channel 2 |
| 27 | L22B+ | LVDT Feedback B Positive (Field Device 2) - Channel 2 |
| 28 | L22B- | LVDT Feedback B Negative (Field Device 2) - Channel 2 |
| 31 | L22X+ | LVDT Excitation Positive (Field Device 2) - Channel 2 |
| 32 | L22X- | LVDT Excitation Negative (Field Device 2) - Channel 2 |

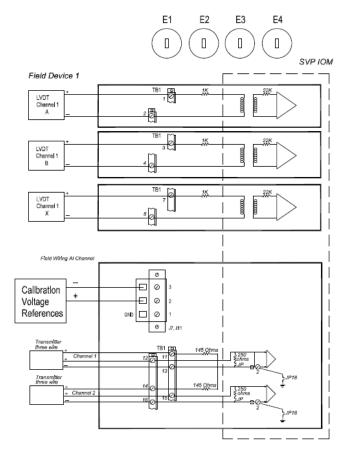
| Terminal Number | Signal Name | Signal Name and Description |
|-------------------------------------|-------------|-----------------------------|
| 5, 6, 9, 10, 17, 18, 23, 24, 29, 30 | | NC |

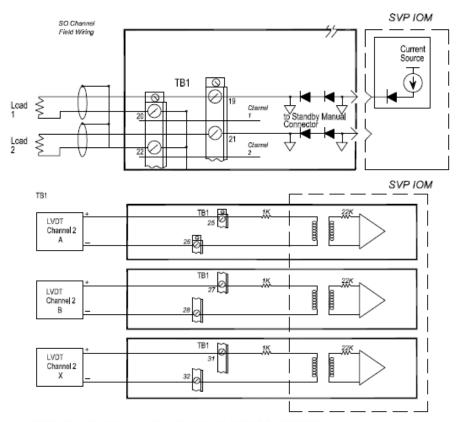
Table 65: SVPM 18 inch, redundant - terminal block 3

| Terminal Number | Signal Name | Signal Description |
|-----------------|-------------|----------------------------------|
| 1 | DI1 | Digital Input 1 - Channel 1 |
| 2 | DI1 24 V | Digital Input 1 24V Field Supply |
| 3 | DI2 | Digital Input 2 - Channel 2 |
| 4 | DI2 24V | Digital Input 2 24V Field Supply |
| 5 | AO1 | Analog Output 1 - Channel 1 |
| 6 | GND | Analog Output 1 Ground |
| 7 | AO2 | Analog Output 2 - Channel 2 |
| 8 | GND | Analog Output 2 Ground |

5.17.1 SVPM Input wiring

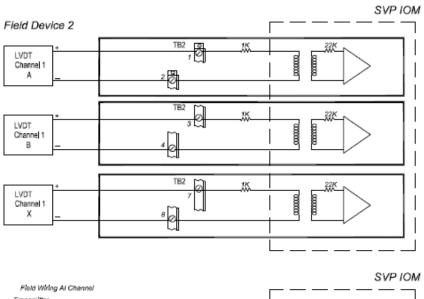
Series C SVPM 18 inch, redundant IOTA and field wiring connections for different channels are displayed.

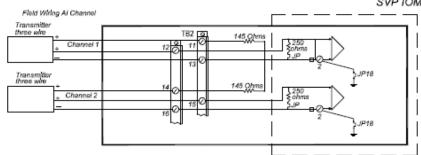


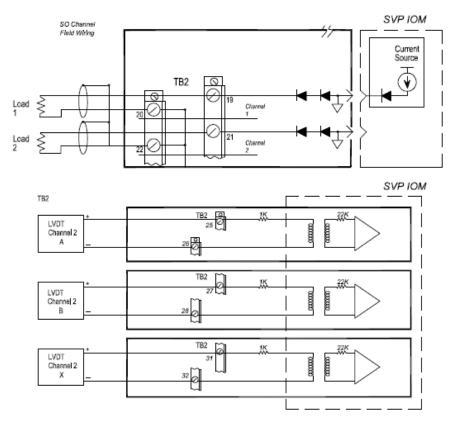


NOTE: PIN NO. 5,6,9,10,17,18,23,2429,30 NOT CONNECTED.

Figure 70: Series C SVP - Al channel Field Wiring for Field Device 1







NOTE: PIN NO. 5,6,9,10,17,18,23,2429,30 NOT CONNECTED.

Figure 71: Series C SVP - Al channel Field Wiring for Field Device 2

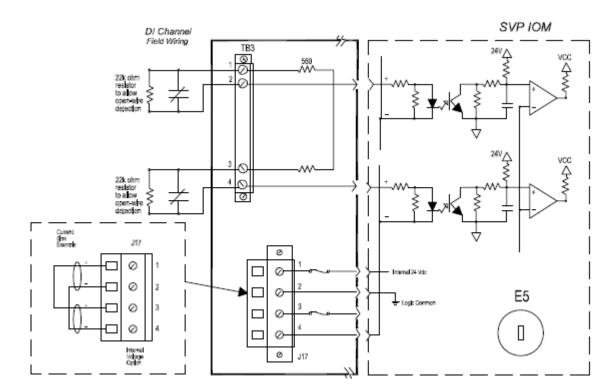


Figure 72: Series C SVP - DI channel Field Wiring

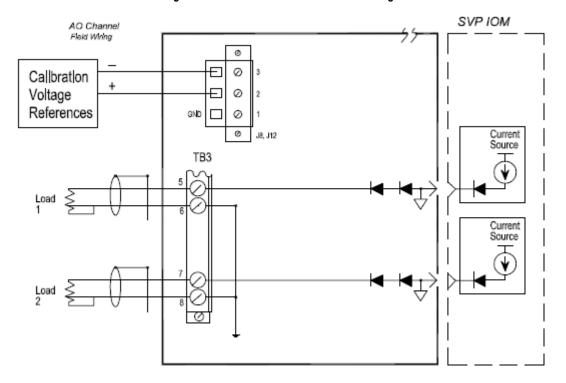


Figure 73: Series C SVP - AO channel Field Wiring

SVPM Fuses

Following table explains about fuses for the SVPM.

| Fuses | Application Circuit |
|-------|-----------------------------|
| E1 | AI Field Device Supply, 24V |
| E2 | BOTTOM IOM 24V |
| E3 | INTERNAL 24V - DI |
| E4 | TOP IOM 24V |
| E5 | EXTERNAL 24V - DI |

For detailed information about the jumper settings of the SVPM channels, refer to *Turbine Control User's Guide*.

5.18 Universal Input/Output IOTA Models CC-TUIO01 and CC-TUIO11

Series C UIO 12 inch, non-redundant IOTA is displayed.

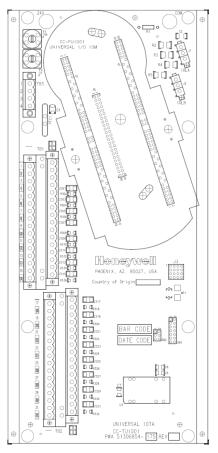


Figure 74: Universal Input/Output Module, 12 inch, non-redundant IOTA



Attention

The non-redundant UIO IOTA accommodates only one UIO module.

Series C UIO 18 inch, redundant IOTA is displayed.

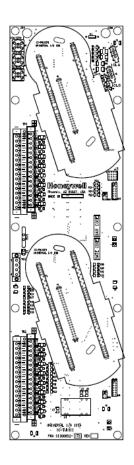


Figure 75: Universal Input/Output Module, 18 inch, redundant IOTA

To wire the module to the Series C UIO module IOTA board with terminal block 1 (TB1), terminal block 2 (TB2), and terminal block 3 (TB3), use the following tables.

Table 66: Terminal block 1

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 1 | -1 | +1 |
| Channel 2 | -2 | +2 |
| Channel 3 | -3 | +3 |
| Channel 4 | -4 | +4 |
| Channel 5 | -5 | +5 |
| Channel 6 | -6 | +6 |
| Channel 7 | -7 | +7 |
| Channel 8 | -8 | +8 |
| Channel 9 | -9 | +9 |
| Channel 10 | -10 | +10 |
| Channel 11 | -11 | +11 |
| Channel 12 | -12 | +12 |
| Channel 13 | -13 | +13 |

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 14 | -14 | +14 |
| Channel 15 | -15 | +15 |
| Channel 16 | -16 | +16 |

Table 67: Redundant - Terminal Block 2

| Terminal block 2 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 17 | -17 | +17 |
| Channel 18 | -18 | +18 |
| Channel 19 | -19 | +19 |
| Channel 20 | -20 | +20 |
| Channel 21 | -21 | +21 |
| Channel 22 | -22 | +22 |
| Channel 23 | -23 | +23 |
| Channel 24 | -24 | +24 |
| Channel 25 | -25 | +25 |
| Channel 26 | -26 | +26 |
| Channel 27 | -27 | +27 |
| Channel 28 | -28 | +28 |
| Channel 29 | -29 | +29 |
| Channel 30 | -30 | +30 |
| Channel 31 | -31 | +31 |
| Channel 32 | -32 | +32 |

Table 68: Redundant - Terminal Block 3

| Signal | Screw Number |
|--------|--------------|
| +24V | 1 |
| +24V | 2 |
| +24V | 3 |
| +24V | 4 |

5.18.1 UIO channel configured as Analog Input

The UIO IOM/IOTA is optimized for use with 2-wire, 3-wire or 4-wire transmitters. All 32 channels can accept inputs from most 2-wire, 3-wire or 4-wire transmitters without any special wiring.

The following are the items that UIO AI directly supports.

- 4-20mA / 0-20mA Current Inputs
- Devices that accept Honeywell 24V power to power a 0/4-20mA current source and (optionally) the device.
- Devices that return the current to the ground terminal of the Honeywell 24V power supply.
- External devices that can moderate non-compliant devices. For example: 'moderators' = current mirrors, isolators, GI/IS barriers, mv-to-I, and so on.

The following are the lists of items that are not directly supported by UIO AIs.

- Voltage inputs (1-5 or mv) e.g. a battery
- Thermocouples
- RTDs
- · NAMUR devices

Standard 2-wire transmitter with UIO

This can be applied to any of the channels 1 through 32.

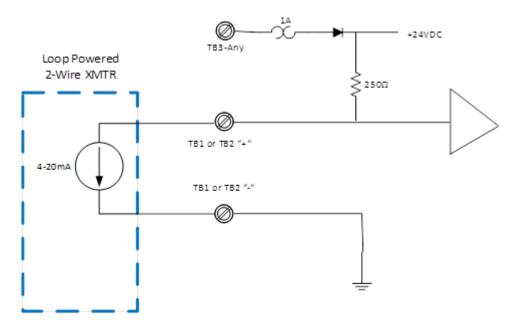


Figure 76: Standard 2-wire transmitter with UIO

Self-powered 3-wire transmitter with system ground

This can be applied to any channels from 1 through 32.

The simplest wiring is to have the 'common' wire and the 'current source' wire under the same terminal blocks screw. If the site wiring does not permit, then you must use a separate external terminal block.

The device must reference its 'DCS-side' common to EPKS common.

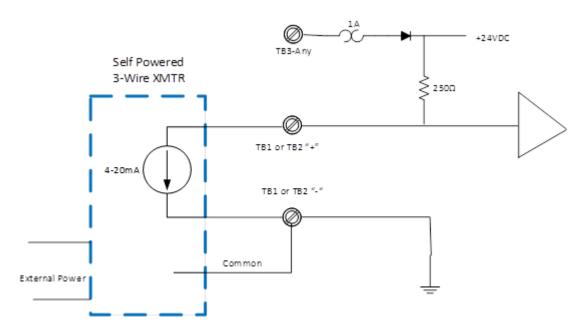


Figure 77: Self-powered 3-wire transmitter with system ground with UIO

Self-powered 4-wire transmitter

This can be applied to any of the channels from 1 through 32.

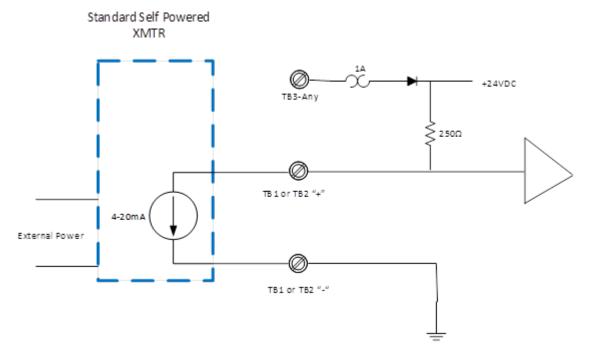


Figure 78: Self-powered 4-wire transmitter with UIO

Sourcing 4 Wire Device (e.g. Coriolis Meter) TB3-Any TB1 or TB2 "+" External Power

Figure 79: Self-powered Sourcing 4-wire Device

Series C UIO does not support the following input types:

- Voltage input: This is because Series C UIO supports only current measurements.
- Slidewire: This is because Series C UIO supports only current measurements.

5.18.2 Allowable field wiring resistance - UIO - Analog Input channel

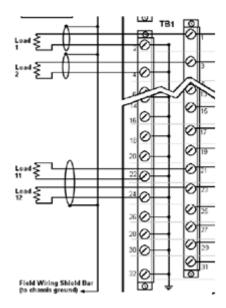
The maximum allowable field wiring resistance between the transmitter and the IOTA connection terminal is dependent upon the voltage requirement of the transmitter. The formula for calculating the maximum wiring resistance for the Series C UIO channel used as an analog input is given by the following equation.

Rmax = [(19.0-Vtx)/(0.022)]

Where, Vtx=Voltage required at the transmitter terminal.

5.18.3 UIO channel configured as Analog Output

The UIO can drive 0, 4-20mA. The field terminal block is wired similar to Series C Analog Output 6 inch, non-redundant IOTA.



As the OP% approaches -6.9%, the current output approaches 2.896mA (based on the linear equation that correlates 0-100% with 4-20mA). However, when the OP% is set to exactly -6.9%, the output is unpowered (0mA).

5.18.4 UIO channel configured as Digital Input

A UIO channel configured as a Digital Input consists of a 250-ohm resistor and a current limiter circuit. Refer to the following block diagram of the UIO channel configuration.

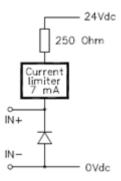


Figure 80: UIO_DI channel configuration

When the DI channel is configured with open wire detect (OWD), a resistor is required in the field near the switch contact as displayed in the following figure.

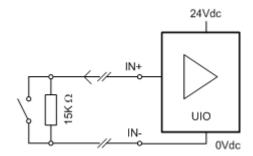


Figure 81: UIO-DI channel configured with open wire detection

A UIO channel configured as a digital input without open wire detect (OWD) consists of a 250-ohm resistance and a current limiter circuit. Refer to the following block diagram of this channel configuration, and a field-wiring example.

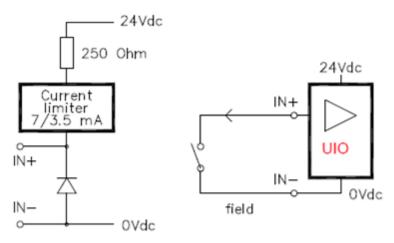


Figure 82: UIO-DI channel configured without open wire detection

Starting with R430, four UIO-DI channels are enhanced to support pulse counting when the DITYPE parameter is configured as "Accum." For more information about pulse counting configuration, refer to the "Configuring the DI channel for pulse counting" on page 337.

5.18.5 UIO channel configured as Digital Output

When you configure UIO as a Digital Output, the channel can supply up to 0.5A to the field.

0.5 Amp Digital Out

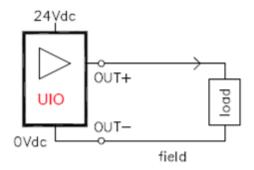


Figure 83: UIO as a Digital Output

Starting with R430, the UIO-DO channel is enhanced to support ganging. For more information about DO channel ganging configuration, refer to the "Configuring the DO channel for ganging" on page 339.

5.18.6 DO channel wiring configuration for ganging

You can configure a set of two, three, or four DO channels to deliver up to 1 Ampere, 1.5 Amperes, or 2 Amperes current to the field.

A two-pin branch with a pitch of 0.2 inches (5.08mm) can be used for interconnecting two DO channels. For example, Weidmuller part number can be used for interconnecting the DO channels. The following table lists the part number and the pins branch for interconnecting the DO channels.

| Pins | Part number | No.of DO channels Two pins |
|-------------------|---------------------|----------------------------|
| Two pins branch | Weidmuller LPA QB 2 | 2 |
| Three pins branch | Weidmuller LPA QB 3 | 3 |
| Four pins branch | Weidmuller LPA QB 4 | 4 |

The field wire must be connected with one of the OUT pins (together with the branch). One of the OUT pins can be used for connecting the return field wire. The following figure illustrates the different ways to join the DO channels.

- Two DO channels with a two pin branch
- Three DO channels with a three pin branch

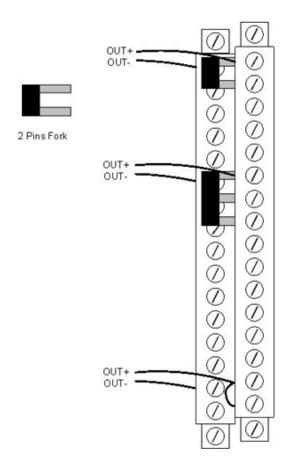


Figure 84: DO channel wiring for ganging

5.19 Universal Input/Output Phase 2 IOTA Models CC-TUIO31 and CC-TUIO41

Series C UIO-2 9 inch, non-redundant IOTA is displayed.

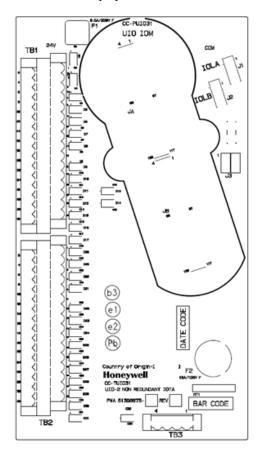


Figure 85: Universal Input/Output Module, 9 inch, non-redundant IOTA

•

Attention

The non-redundant UIO-2 IOTA accommodates only one UIO-2 module.

Series C UIO-2 12 inch, redundant IOTA is displayed.

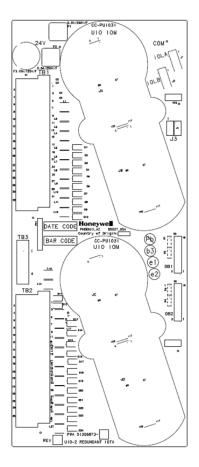


Figure 86: Universal Input/Output Module, 12 inch, redundant IOTA

To wire the module to the Series C UIO module IOTA board with terminal block 1 (TB1), terminal block 2 (TB2), and terminal block 3 (TB3), use the following tables.

Table 69: Terminal block 1

| Terminal block 1 | | |
|----------------------------------|-----|-------------|
| Channel Return screw Power screw | | Power screw |
| Channel 1 | -1 | +1 |
| Channel 2 | -2 | +2 |
| Channel 3 | -3 | +3 |
| Channel 4 | -4 | +4 |
| Channel 5 | -5 | +5 |
| Channel 6 | -6 | +6 |
| Channel 7 | -7 | +7 |
| Channel 8 | -8 | +8 |
| Channel 9 | -9 | +9 |
| Channel 10 | -10 | +10 |
| Channel 11 | -11 | +11 |
| Channel 12 | -12 | +12 |
| Channel 13 | -13 | +13 |

| Terminal block 1 | | |
|------------------|--------------|-------------|
| Channel | Return screw | Power screw |
| Channel 14 | -14 | +14 |
| Channel 15 | -15 | +15 |
| Channel 16 | -16 | +16 |

Table 70: Redundant - Terminal Block 2

| Terminal block 2 | | |
|------------------|--------------------------|-----|
| Channel | Channel Return screw Pow | |
| Channel 17 | -17 | +17 |
| Channel 18 | -18 | +18 |
| Channel 19 | -19 | +19 |
| Channel 20 | -20 | +20 |
| Channel 21 | -21 | +21 |
| Channel 22 | -22 | +22 |
| Channel 23 | -23 | +23 |
| Channel 24 | -24 | +24 |
| Channel 25 | -25 | +25 |
| Channel 26 | -26 | +26 |
| Channel 27 | -27 | +27 |
| Channel 28 | -28 | +28 |
| Channel 29 | -29 | +29 |
| Channel 30 | -30 | +30 |
| Channel 31 | -31 | +31 |
| Channel 32 | -32 | +32 |

Table 71: Redundant - Terminal Block 3

| Signal +24V | Screw Number |
|----------------|--------------|
| +24V | 1 |
| +24V | 2 |
| +24V | 3 |
| +24V | 4 |

5.19.1 UIO-2 channel configured as Analog Input

The UIO IOM/IOTA is optimized for use with 2-wire, 3-wire or 4-wire transmitters. All 32 channels can accept inputs from most 2-wire, 3-wire or 4-wire transmitters without any special wiring.

The following are the items that UIO AI directly supports.

- 4-20mA / 0-20mA Current Inputs
- Devices that accept Honeywell 24V power to power a 0/4-20mA current source and (optionally) the device.
- Devices that return the current to the ground terminal of the Honeywell 24V power supply.
- External devices that can moderate non-compliant devices. For example: 'moderators' = current mirrors, isolators, GI/IS barriers, mv-to-I, and so on.

The following are the lists of items that are not directly supported by UIO AIs.

- Voltage inputs (1-5 or mv) e.g. a battery
- Thermocouples
- RTDs
- · NAMUR devices

Standard 2-wire transmitter with UIO-2

This can be applied to any of the channels 1 through 32.

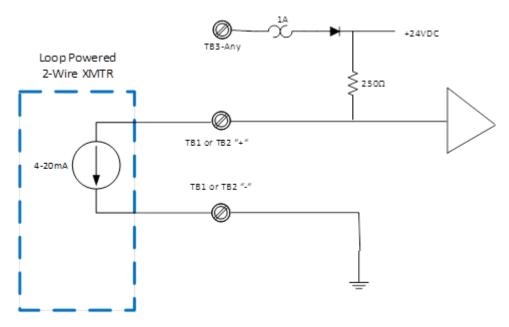


Figure 87: Standard 2-wire transmitter with UIO-2

Self-powered 3-wire transmitter with system ground

This can be applied to any channels from 1 through 32.

The simplest wiring is to have the 'common' wire and the 'current source' wire under the same terminal blocks screw. If the site wiring does not permit, then you must use a separate external terminal block.

The device must reference its 'DCS-side' common to EPKS common.

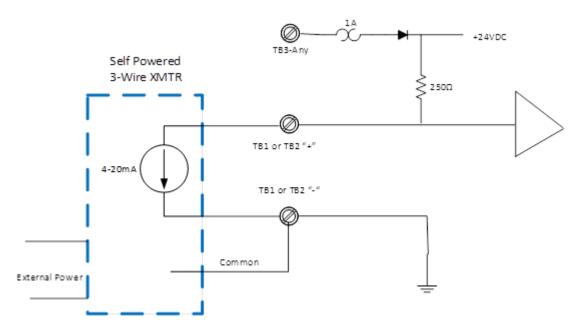


Figure 88: Self-powered 3-wire transmitter with system ground with UIO-2

Self-powered 4-wire transmitter

This can be applied to any of the channels from 1 through 32.

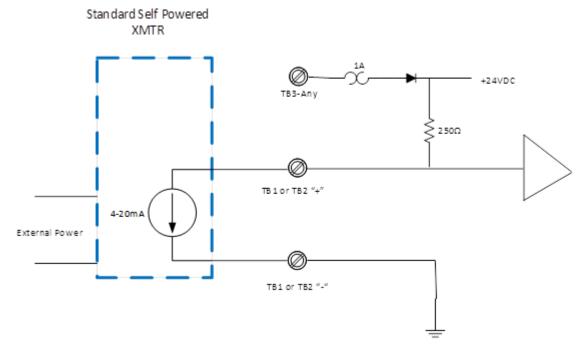


Figure 89: Self-powered 4-wire Transmitter with UIO-2

Sourcing 4 Wire Device (e.g. Coriolis Meter) 4-20mA TB1 or TB2 "+" External Power

Figure 90: Self-powered Sourcing 4-wire Device

Series C UIO-2 does not support the following input types:

- Voltage input: This is because Series C UIO-2 supports only current measurements.
- Slidewire: This is because Series C UIO-2 supports only current measurements.

5.19.2 Allowable field wiring resistance - UIO-2 - Analog Input channel

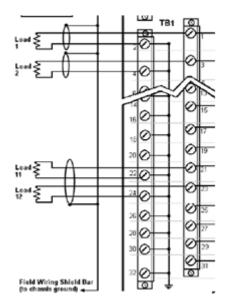
The maximum allowable field wiring resistance between the transmitter and the IOTA connection terminal is dependent upon the voltage requirement of the transmitter. The formula for calculating the maximum wiring resistance for the Series C UIO-2 channel used as an analog input is given by the following equation.

Rmax = [(19.0-Vtx)/(0.022)]

Where, Vtx=Voltage required at the transmitter terminal.

5.19.3 UIO-2 channel configured as Analog Output

The UIO-2 can drive 4-20 mA. The field terminal block is wired similar to Series C Analog Output 6 inch, non-redundant IOTA.



As the OP% approaches -6.9%, the current output approaches 2.896 mA (based on the linear equation that correlates 0-100% with 4-20 mA). However, when the OP% is set to exactly -6.9%, the output is unpowered (0 mA).

5.19.4 UIO-2 channel configured as Digital Input

A UIO-2 channel configured as a Digital Input consists of a 250-ohm resistor and a current limiter circuit. Refer to the following block diagram of the UIO-2 channel configuration.

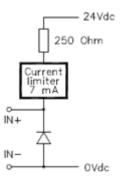


Figure 91: UIO_DI channel configuration

When the DI channel is configured with open wire detect (OWD), a resistor is required in the field near the switch contact as displayed in the following figure.

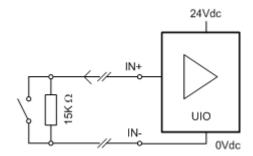


Figure 92: UIO-DI channel configured with open wire detection

A UIO-2 channel configured as a digital input without open wire detect (OWD) consists of a 250-ohm resistance and a current limiter circuit. Refer to the following block diagram of this channel configuration, and a field-wiring example.

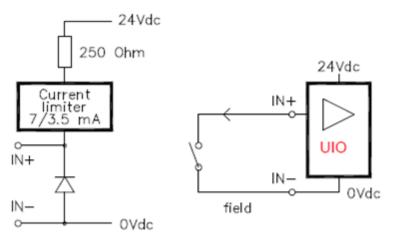


Figure 93: UIO-DI channel configured without open wire detection

Starting with R430, four UIO-DI channels are enhanced to support pulse counting when the DITYPE parameter is configured as "Accum." For more information about pulse counting configuration, refer to the "Configuring the DI channel for pulse counting" on page 337.

5.19.5 UIO-2 channel configured as Digital Output

When you configure UIO-2 as a Digital Output, the channel can supply up to 0.5A to the field.

0.5 Amp Digital Out

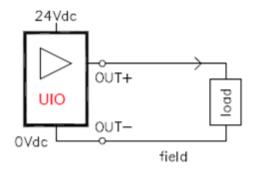


Figure 94: UIO-2 as a Digital Output

Starting with R430, the UIO-DO channel is enhanced to support ganging. For more information about DO channel ganging configuration, refer to the "Configuring the DO channel for ganging" on page 339.

5.19.6 DO channel wiring configuration for ganging

You can configure a set of two, three, or four DO channels to deliver up to 1 Ampere, 1.5 Amperes, or 2 Amperes current to the field.

A two-pin branch with a pitch of 0.2 inches (5.08mm) can be used for interconnecting two DO channels. For example, Weidmuller part number can be used for interconnecting the DO channels. The following table lists the part number and the pins branch for interconnecting the DO channels.

| Pins | Part number | No.of DO channels Two pins |
|-------------------|---------------------|----------------------------|
| Two pins branch | Weidmuller LPA QB 2 | 2 |
| Three pins branch | Weidmuller LPA QB 3 | 3 |
| Four pins branch | Weidmuller LPA QB 4 | 4 |

The field wire must be connected with one of the OUT pins (together with the branch). One of the OUT pins can be used for connecting the return field wire. The following figure illustrates the different ways to join the DO channels.

- Two DO channels with a two pin branch
- Three DO channels with a three pin branch

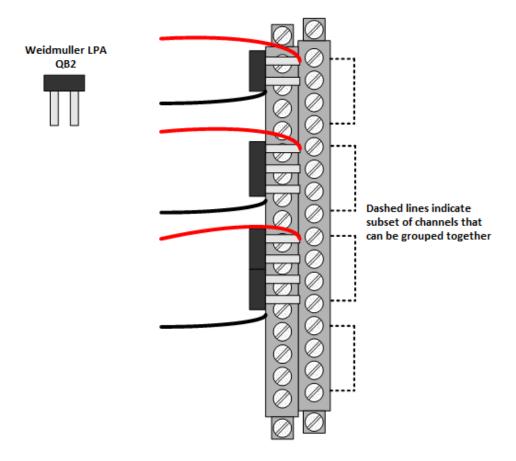


Figure 95: DO channel wiring for ganging

5.20 Low Level Analog Input (LLAI) Module IOTA model CC-TAIL51

This series C Low Level Analog Input (LLAI) IOTA board is represented by the following information and graphic.

To access the parts information for the:

- module
- IOTA
- · terminal plug-in assembly, and
- fuses

associated with this board and module, see Low Level Analog Input (LLAI) in the Recommended spare parts table.

Series C Low Level Analog Input (LLAI) 9 inch, non-redundant IOTA is displayed in the following figure.

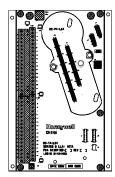


Figure 96: Series C Low Level Analog Input (LLAI) 9 inch, non-redundant IOTA

Note: All I/O field terminations accept up to 14 gauge stranded wire.

To properly wire your module to the LLAI IOTA with terminal block 1 (TB1) and terminal block 2 (TB2), use the following table.

| Channel | Terminal Block (TB1) | |
|------------|----------------------|---------------------|
| | Voltage + | Voltage - |
| Channel 1 | 1 | 3 |
| Channel 2 | 5 | 7 |
| Channel 3 | 9 | 11 |
| Channel 4 | 13 | 15 |
| Channel 5 | 17 | 19 |
| Channel 6 | 21 | 23 |
| Channel 7 | 25 | 27 |
| Channel 8 | 29 | 31 |
| | Те | erminal Block (TB2) |
| Channel | Voltage + | Voltage - |
| Channel 9 | 1 | 3 |
| Channel 10 | 5 | 7 |
| Channel 11 | 9 | 11 |

Table 72: Terminal block 1 and 2 for LLAI 0-100mV connections

| Channel | Terminal Block (TB1) | |
|------------|----------------------|-----------|
| | Voltage + | Voltage - |
| Channel 12 | 13 | 15 |
| Channel 13 | 17 | 19 |
| Channel 14 | 21 | 23 |
| Channel 15 | 25 | 27 |
| Channel 16 | 29 | 31 |

Table 73: Terminal block 1 and 2 for Thermocouple connections

| Channel | Terminal Block (TB1) | | |
|------------|----------------------|-------------------|--|
| | Thermocouple + | Thermocouple - | |
| Channel 1 | 1 | 3 | |
| Channel 2 | 5 | 7 | |
| Channel 3 | 9 | 11 | |
| Channel 4 | 13 | 15 | |
| Channel 5 | 17 | 19 | |
| Channel 6 | 21 | 23 | |
| Channel 7 | 25 | 27 | |
| Channel 8 | 29 | 31 | |
| | Tern | ninal Block (TB2) | |
| Channel | Thermocouple + | Thermocouple - | |
| Channel 9 | 1 | 3 | |
| Channel 10 | 5 | 7 | |
| Channel 11 | 9 | 11 | |
| Channel 12 | 13 | 15 | |
| Channel 13 | 17 | 19 | |
| Channel 14 | 21 | 23 | |
| Channel 15 | 25 | 27 | |
| Channel 16 | 29 | 31 | |

Table 74: Terminal block 1 and 2 for RTD connections

| Channel | Terminal Block (TB1) | |
|-----------|----------------------|------|
| | RTD1 | RTD2 |
| Channel 1 | 1 | 3 |
| Channel 2 | 5 | 7 |
| Channel 3 | 9 | 11 |
| Channel 4 | 13 | 15 |
| Channel 5 | 17 | 19 |
| Channel 6 | 21 | 23 |
| Channel 7 | 25 | 27 |
| Channel 8 | 29 | 31 |
| Channel | Terminal Block (TB2) | |

| Channel | Terminal Block (TB1) | | |
|------------|----------------------|------|--|
| | RTD1 | RTD2 | |
| | RTD1 | RTD2 | |
| Channel 9 | 1 | 3 | |
| Channel 10 | 5 | 7 | |
| Channel 11 | 9 | 11 | |
| Channel 12 | 13 | 15 | |
| Channel 13 | 17 | 19 | |
| Channel 14 | 21 | 23 | |

5.20.1 Field wiring for thermocouple/RTD

The LLAI module can be configured to support either thermocouple or RTD inputs. The following figure illustrates how to connect the pins in the terminal block for thermocouple/RTD inputs.

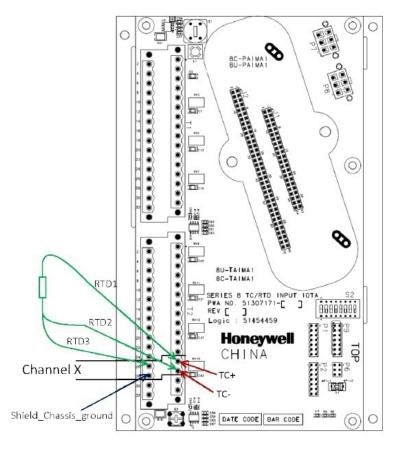


Figure 97: Terminal block wiring for thermocouple/RTD

5.21 Pulse Input Module IOTA Model CC-TPIX11

The Series C PIM redundant IOTA is represented by the following graphic.

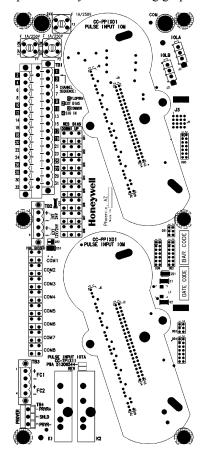


Figure 98: Pulse Input Module redundant IOTA

The following tables provide information on pin assignments of the terminal blocks of the Pulse Input Module IOTA.

Table 75: Pulse Input Module IOTA - Terminal block 1* pin assignments

| Terminal Block 1 | | | | |
|------------------|--------------------------------|-----------------|-----------------|-----------------|
| Channel | FLDPWR+ EXT BIAS COMMON SIG IN | | | SIG IN |
| | Upper connector | Lower connector | Upper connector | Lower connector |
| Channel 1 | 1 | 2 | 3 | 4 |
| Channel 2 | 5 | 6 | 7 | 8 |
| Channel 3 | 9 | 10 | 11 | 12 |
| Channel 4 | 13 | 14 | 15 | 16 |
| Channel 5 | 17 | 18 | 19 | 20 |
| Channel 6 | 21 | 22 | 23 | 24 |
| Channel 7 | 25 | 26 | 27 | 28 |
| Channel 8 | 29 | 30 | 31 | 32 |

* see text on IOTA for pin numbering.

Table 76: Pulse Input Module IOTA – Terminal block 2 * pin assignments

| Pin number | Description |
|------------|---------------|
| 1 | + INT 24V |
| 2 | – INT 24V |
| 3 | + EXT 12V/24V |
| 4 | – EXT 12V/24V |

^{*} see text on IOTA for pin numbering.

Table 77: Pulse Input Module IOTA – Terminal block 3 * pin assignments

| Pin number | Description |
|------------|-------------------|
| 1 | FC1 + (high side) |
| 2 | FC1 – (low side) |
| 3 | FC2 + (high side) |
| 4 | FC2 – (low side) |

^{*} see text on IOTA for pin numbering.

Table 78: Pulse Input Module IOTA – Terminal block 4 * pin assignments

| Pin number | Description |
|------------|-----------------|
| 1 | PRVR+ |
| 2 | Shield (screen) |
| 3 | PRVR- |

^{*} see text on IOTA for pin numbering.

Refer to the section "Series C PIM connectivity" on page 211 for information on connecting PIM.

5.22 Upgrading Firmware in Series C I/O components

Refer to the Upgrading firmware in Series C I/O components section in the *Control Hardware and I/O Module Firmware Guide*.

6 Series C PIM connectivity

This chapter contains information related to PIM channel terminal blocks and PIM connectivity details. This chapter contains information on connecting PIM to various components such as field sensor power, fast cutoff relays, Prover Pulse Bus, ST500 dual-pulse simulation.

Related topics

- "PIM connectivity block diagram" on page 212
- "Field device output stage types" on page 214
- "PIM resistor bias terminal blocks" on page 215
- "TB1 signal definitions" on page 217
- "TB1 pin assignments" on page 218
- "TB2 pin assignments for internal/external field sensor power" on page 219
- "TB3 pin assignment for fast cutoff relays" on page 224
- "About enabling pulse proving in PIM" on page 226
- "TB4 pin assignment for Prover Pulse Bus" on page 228
- "Using Prover Pulse Bus with optocoupler" on page 229
- "Connecting PIM with ST500 dual-pulse simulator (Swinton Technology)" on page 232
- "Connecting PIM with dual stream devices" on page 234
- "Connecting PIM with other sensor types" on page 235
- "Selecting PIM input threshold" on page 237
- "Recommended cable types" on page 238

6.1 PIM connectivity block diagram

The following figure displays a PIM connectivity block diagram.

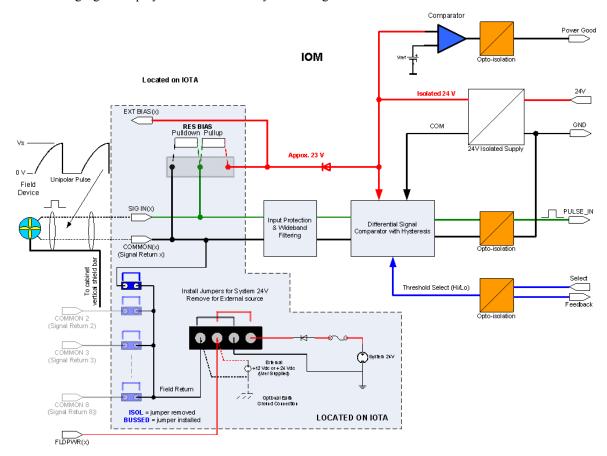


Figure 99: PIM connectivity block diagram

The following list summarizes the various components in the overall PIM connectivity block diagram.

- The field device connects to the IOTA screw terminals labeled SIG IN(x) and COMMON(x) where "x" denotes the channel numbers 1 through 8.
- The field sensor pulse output is conditioned by the input protection circuitry and filtered to reduce unwanted high-frequency noise. The filtered output is fed to the high-speed differential comparator which has a user-selectable threshold control. From Control Builder, you can select an appropriate low or high voltage threshold based on the sensor type and the value of the signal amplitude (V_s).
- Comparator hysteresis is also provided to further reduce false triggering especially for slow rise/fall time signals.
- Each of the eight PIM input channels are electrically isolated from one another and from system ground (cabinet ground).
- A comparator monitors the isolated +24 V channel power supply with respect to COMMON(x) and can detect a problem in the field wiring. If the output of the isolated supply falls below 22V or rises above 26V, a failure is indicated. Failures can be any of the following;
 - A short in the field wiring.
 - EXT BIAS(x) pin is shorted to COMMON(x).
 - Excessive current is being pulled from EXT BIAS(x) pin.
 - Power supply fails for some other reason.

If a failure occurs, the soft failure is reported in Control Builder and Station.



Attention

In redundant PIM modules, after a switchover, if the alarm for the reported channel still persists on the new primary, this most likely indicates a problem in the field wiring.

6.2 Field device output stage types

The output stage of most field sensors use an open collector bipolar transistor or an open drain MOSFET to produce a pulse for counting by a metering device. Open collector and open drain transistors require an externally supplied pull-up resistor and a source of dc power for transistor action to take place. Other types of sensor outputs may incorporate a push-pull, totem pole (for example TTL), or differential output stage which delivers fast rise/fall time pulses without the need of a pull-up resistor. Although not as common, some field sensors contain an open emitter or open source transistor for the output stage. This type requires an externally supplied pull-down resistor. PIM has been designed to operate with all of these types. This section provides information on the specific type and provide guidelines on the connectivity of each.

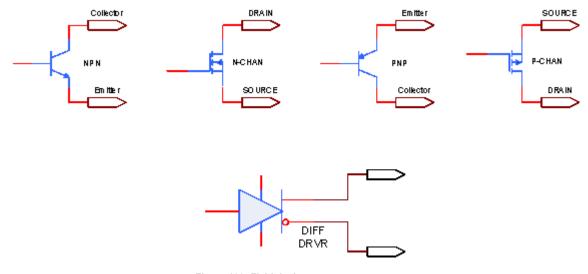


Figure 100: Field device output stage types

Attention

Millivolt signals are not counted by the PIM unless a suitable preamplifier is used to boost the signal to a level that can be detected by the PIM circuitry.

6.3 PIM resistor bias terminal blocks

The PIM IOTA provides eight terminal blocks (one for each channel) that enable the user to install the appropriate bias resistor for proper operation with the field device.

- Pull-up (open collector or open drain output stage)
- Pull-down (open emitter or open source output stage)
- No bias (Active drive differential, Transistor-Transistor Logic (TTL), and so on)

The following figure displays the channel 1 RES BIAS terminal block.

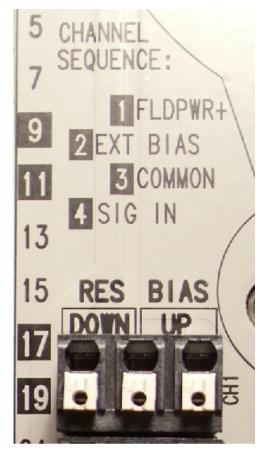


Figure 101: RES BIAS Terminal Block (channel 1 shown)

An externally supplied resistor can be inserted across two pins labeled UP (for pull-up) or DOWN (for pull-down).

For No bias option, terminal block(s) are left un-connected.



Note

- All IOTAs are shipped from the factory with all terminal blocks un-connected (No bias). The bias resistor
 values must be selected according to the field sensor's datasheet.
- A resistors installed in the RES BIAS UP position is the most commonly used option.

6.3.1 Inserting and removing resistors

It is recommended that resistor leads are bent and shrink tubing is applied as displayed in the following figure.

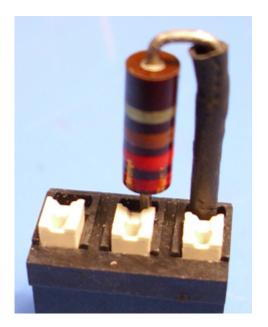


Figure 102: Recommended way of insulating resistor leads and bending them

For inserting the resistor, firmly press the resistor all the way into the holes. The locking mechanism inside the terminal block locks the resistor in place automatically.

For removing the resistor, gently press the white unlocking buttons.

6.4 TB1 signal definitions

Each of the eight channels is composed of a group of four signals. The following table provides information on the signal definitions.

Table 79: TB1 signal definitions

| Pin name | Input/ output | Description | |
|----------|------------------|---|--|
| SIG IN | Input | This pin is used to connect to field sensor's pulse output positive pin. | |
| COMMON | Input | This pin is used to connect to field sensor's pulse output negative pin. | |
| | | You can also use this pin for the negative return of the FIELD PWR or EXT BIAS. | |
| EXT BIAS | Output | This pin is used with pull-up resistor supplied by the user. The open circuit voltage of this pin is approximately 23 Vdc and can source up to 25 mA. This means that the pull-up resistor value must be no lower than 920 ohms. | |
| | | This pin can also be a source of isolated power not to exceed the above values. | |
| | | You can leave the EXT BIAS pin un-connected if not required. | |
| FLDPWR+ | Output | Positive source of power from connector TB2. | |
| | | This pin is used to power field sensor(s) with +24 Vdc from the Series C system, or optionally from an external power source. | |
| | | When the source of field power is the Series C +24V system supply, the negative terminal is tied to the Series C cabinet ground. Since the sensor signal common, COMMON(x), is used for the power return, the field sensor is no longer isolated. | |
| | | If more than one pulse input channel uses field power, the channels are no longer isolated from one another because of the shared return at pins $COMMON(x)$. | |
| | | FLDPWR+ 1 through 8 are electrically connected to each other on circuit board. This means they are bussed. | |

6.5 TB1 pin assignments

The following figure provides information on the pin assignments for TB1.

| | | TB1 | | |
|------|------|--------------------|---------------------|------|
| | | Low Tier Connector | High Tier Connector | |
| | | | | PIN# |
| CHAN | PIN# | | FLDPWR1+* | 1 |
| 4 | 2 | EXT BIAS1 | COMMON1 | 3 |
| ı | 4 | SIG IN1 | FLDPWR2+* | 5 |
| 2 | 6 | EXT BIAS 2 | COMMON2 | 7 |
| 2 | 8 | SIG IN 2 | FLDPWR3+* | 9 |
| 3 | 10 | EXT BIAS3 | COMMON3 | 11 |
| 3 | 12 | SIG IN3 | FLDPWR4+* | 13 |
| 4 | 14 | EXT BIAS4 | COMMON4 | 15 |
| 4 | 16 | SIG IN4 | FLDPWR5+* | 17 |
| 5 | 18 | EXT BIAS5 | COMMON5 | 19 |
| 3 | 20 | SIG IN5 | FLDPWR6+* | 21 |
| 6 | 22 | EXT BIAS6 | COMMON6 | 23 |
| U | 24 | SIG IN6 | FLDPWR7+* | 25 |
| 7 | 26 | EXT BIAS7 | COMMON7 | 27 |
| - 1 | 28 | SIG IN7 | FLDPWR8+* | 29 |
| 0 | 30 | EXT BIAS8 | COMMON8 | 31 |
| 8 | 32 | SIG IN8 | | |

Figure 103: PIM TB1 pin assignments

^{*} FLDPWR1+ through FLDPWR8+ are electrically connected (bussed) to each other on circuit board.

6.6 TB2 pin assignments for internal/external field sensor power

The following table provides information on the 4-pin connector TB2 pin assignments.

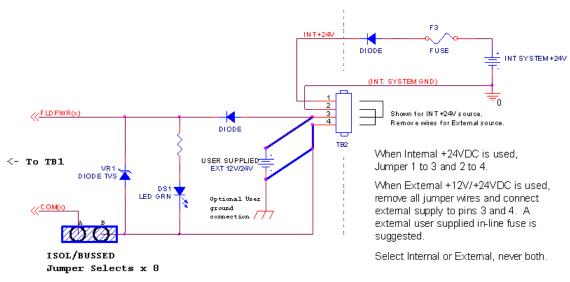
Table 80: PIM TB2 pin assignments

| Pin number | Description |
|------------|---------------|
| 1 | + INT 24V |
| 2 | - INT 24V |
| 3 | + EXT 12V/24V |
| 4 | - EXT 12V/24V |

The PIM IOTA allows field sensor powering from either the Series C System +24 V internal system supply or from an external user supplied power source.

6.6.1 Restrictions/limitations while using TB2

The following figure displays the internal/external sensor power circuit diagram.



Remove jumper wire from A to B to isolate channel (fully floating) Install jumper wire from A to B to connect channel COM to Int/Ext power source return

Figure 104: PIM TB2 - Internal/external sensor power circuit diagram

You must be aware of the following restrictions/limitations while using TB2.

- Only a dc source with polarity indicated in the above diagram can be used because of diode steering and reverse polarity protection.
- If an external source is used, the applied dc voltage must be +30 V or less. This is because there is a 33 V transient protection diode on the IOTA circuit board which could potentially be damaged if the supply exceeds 33V. (VR1 in the above diagram).
- F3 is a fast type fuse rated for 1A/250V. When the internal system supply is selected, the maximum current must be less than this value to avoid fuse rupture.
- You must provide fusing when an external supply is utilized (fusing from external supply is not shown in the above diagram).
- The diodes are rated at 1A, do not exceed this value.

- You can choose between the internal or external source. However, both cannot be used at the same time.
- If an application does not require field sensor power through TB2, completely disconnect all wiring from TB2 including jumper wires.

You can use the following connector in conjunction with TB2. The following figure displays the terminal block for channel 1. There are similar connectors for the remaining channels.

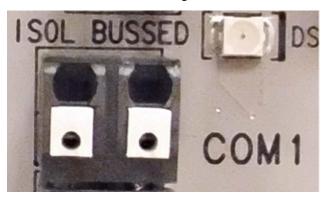


Figure 105: ISOL/BUSSED terminal blocks

In the default configuration (as shipped from factory), the COM(x) (signal returns) for all the eight channels are electrically isolated from each other and from system power return. Based on the topology required, you can choose to connect the signal return to the system power return (TB2 pin 4) by installing a jumper across the terminal block for the required channel.

6.6.2 Verifying the connection

The following figure displays the LED DS1 on the IOTA.

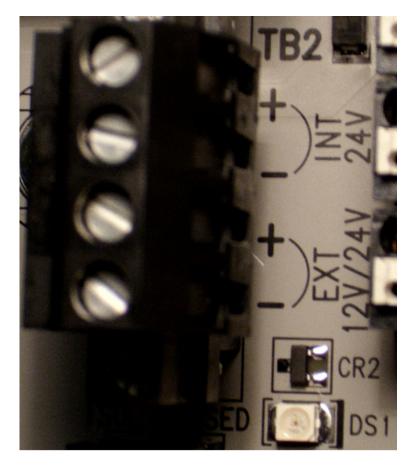


Figure 106: PIM TB2 - DS1 LED on IOTA

The green LED, DS1, on the IOTA adjacent to terminal block TB2 illuminates if either the Series C system 24V internal system supply or an external user supplied power source is properly connected to TB2. If this LED does not illuminate, check wiring to TB2, fuse F3, or the field wiring.

If TB2 is not used (no wires attached), then LED DS1 does not illuminate and this is normal.

6.6.3 Examples to illustrate sensor power connections through TB2

Example 1: Sensor powered from Series C System +24 V internal supply. Connections made through TB1, FLDPWR(x)+ and COMMON(x)

The following figure displays a sample diagram where the sensor is powered from Series C system +24 V internal supply and the power connections are made through TB1, FLDPWR(x)+ and COMMON(x).

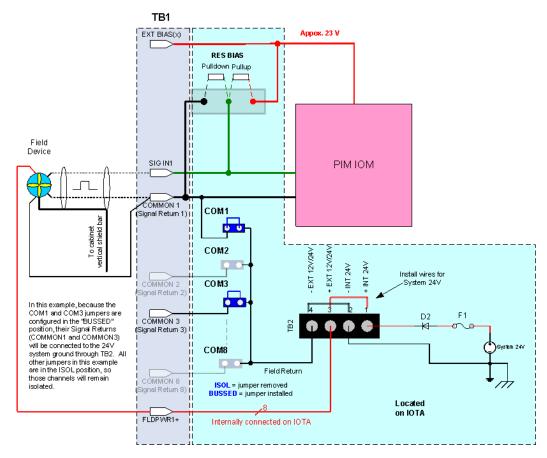


Figure 107: Sensor powered from Series C System +24 V internal supply. Connections made through TB1, FLDPWR(x), and COM(x)

For this type of connection, you need four wires. Two wires provide power to the sensor and the other two wires connect the pulse output from the sensor to the PIM. This example shows the field sensor connected to channel 1 but the procedure applies to the remaining channels.

The internal +24 Vdc supply, TB1, and TB2 are used to supply sensor power. This is accomplished by connecting the corresponding channel's FLDPWR1+ pin and COMMON1 pin to the positive and negative power leads of the field sensor respectively. To complete the circuit, place the jumper wire across the pins of the COM1 terminal block as illustrated in the above diagram so that so field return is tied to COMMON1.

Install wires at TB2 as illustrated in the above diagram to feed all eight of the FLDPWR(x) to TB1. There is no need to add individual wires from FLDPWR(x) to the $+EXT\ 12V/24V$ connector at TB2 as this is provided by internal copper tracks on the IOTA.

For clarity, the LED DS1 and other components are not shown in the above diagram. See also figure PIM TB1 pin assignments.

Example 2: Sensor powered from Series C System +24 V internal supply. Power connections directly made through TB2

The following figure displays a sample diagram where the sensor is powered from Series C system +24 V internal supply and the power connects are directly made through TB2.

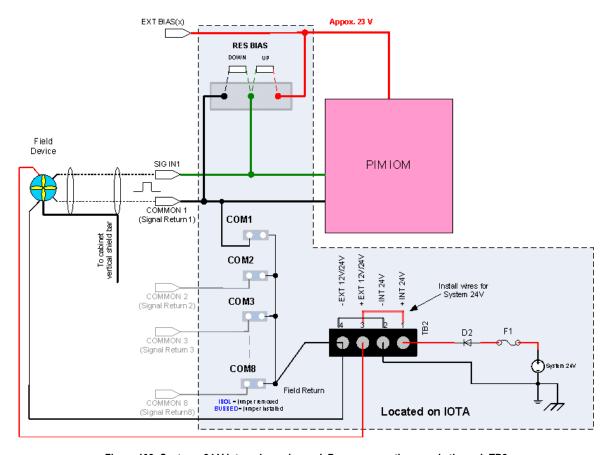


Figure 108: System +24 V internal supply used. Power connections made through TB2

In this example, the power connections are made through TB2 only.

All COM(x) jumpers in this example are removed (ISOL). If a jumper is installed (BUSSED), the respective signal common will be connected to the 24V system ground through TB2.

6.7 TB3 pin assignment for fast cutoff relays

Two optically isolated solid state relays, K1 and K2, are provided on the PIM IOTA for connection with DC loads. The solid state relays are fast responding type capable of turning ON or OFF in less than 1 millisecond. These relays can be controlled only when channels 7 and 8 are configured for fast cutoff in Control Builder.

The following tables provides information on the TB3 pin assignments.

Table 81: TB3 pin assignment

| Pin number | Description |
|------------|-------------------|
| 1 | FC1 + (high side) |
| 2 | FC1 - (low side) |
| 3 | FC2 + (high side) |
| 4 | FC2 - (low side) |

The following figure displays the TB3 connector on the IOTA.

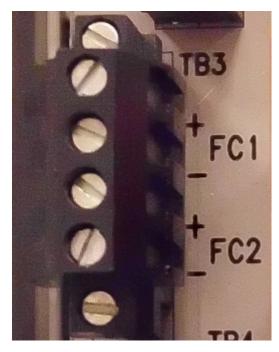


Figure 109: PIM TB3 connectors on IOTA

6.7.1 Key points on relays

The following list summarizes the key points on relays.

- Relay K1 (FC1) is associated with CH7 only.
- Relay K2 (FC2) is associated with CH8 only.
- User load can be connected in either leg (or both legs) of the relay path provided polarity is observed.
- Each relay contains a top mounted LED that illuminates green to indicate that the relay is in the ON state (conducting). The LED is extinguished to indicate the relay is in the OFF state (non-conducting).
- The IOTA relay connections are rated for 1.5 Adc, 60 Vdc maximum.
- The fuses in relays K1 and K2 are user replaceable (5 x 20 mm, 2.5A /250V, time lag).

- The relays K1 and K2 are electrically isolated from each other, from system power and ground and from chassis (cabinet) ground.
- Relays K1 and K2 are replaceable by ordering Honeywell part number 51190516-134.

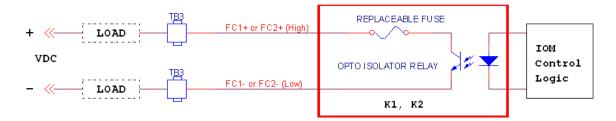


Figure 110: Fast Cutoff relay wiring diagram

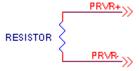
6.8 About enabling pulse proving in PIM

You must use Control Builder to select the stream to be proved (only one per PIM). This action connects the good pulses from the selected stream to the Prover Pulse Bus. For each good pulse from the selected stream, a 20 us wide positive going pulse is output on the PIM Prover Bus. The tri-state output of the Prover Pulse Bus allows for multiple Series C Prover Pulse outputs to be connected in parallel to a single ST102 (or other hardware) allowing for larger installations which have more meter streams for a single meter prover.

Only channel pairs configured in dual configuration can provide a source of good pulses for prover output.

Refer to the section "Enabling pulse proving in Pulse Input Module" on page 474 for more information.

For proper operation of the Prover Pulse Bus, a resistor must be connected to TB4 as shown in the following diagram.



If the prover pulse bus is used with more than one IOTA, only one resistor (Rext) is required. Refer to the following diagram.

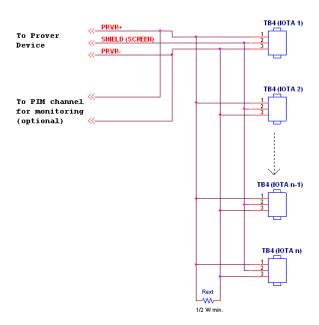


Figure 111: Multiple IOTAs connected in parallel on the Prover Bus

Attention

The value of the resistor is dependent upon the connected meter Prover device (user load). The Prover Pulse Bus is a high compliance source driver capable of producing 0 V to 24 V pulse outputs and currents up to 35 mA. You must exercise caution while selecting an appropriate resistor as excessive current could potentially damage the meter Prover device.

The following figure displays Prover Pulse voltage and current verses Rext.

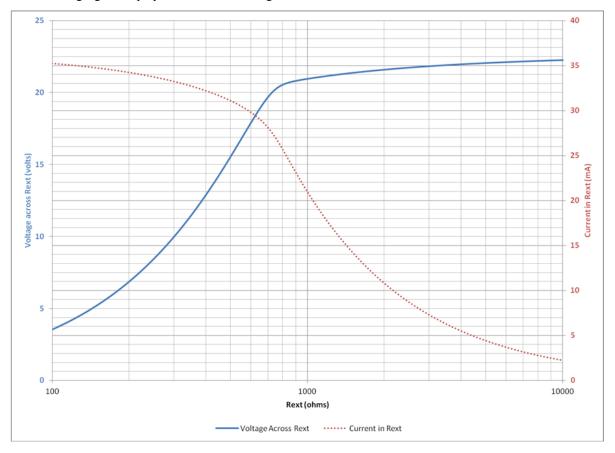


Figure 112: Graph of Prover Pulse voltage and current verses Rext

6.9 TB4 pin assignment for Prover Pulse Bus

The following table provides information on the 3-pin TB4 pin assignments for Prover Pulse Bus.

Table 82: TB4 pin assignments for Prover Pulse Bus

| Pin number | Description |
|------------|-----------------|
| 1 | PRVR+ |
| 2 | Shield (screen) |
| 3 | PRVR- |

The following figure displays the TB4 connector on the IOTA.

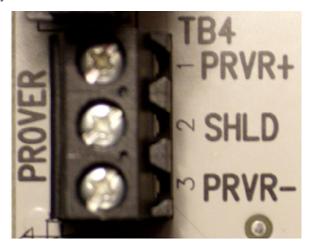


Figure 113: Prover Bus connector - TB4

Pin 2 of TB4 is connected on the IOTA to chassis ground. If shielded wire is used, tie the shield (screen) of the cable to this pin. If the cable leaves the Series C cabinet or cabinet complex, then it is recommended that twisted pair conductors with and overall shield be used for decreased noise and transient immunity.

If required, the PRVR+ and PRVR- lines can be optionally connected to a single stream input of the PIM for monitoring purposes (refer to figure *Multiple IOTAs connected in parallel on the Prover Bus*). The resistor, Rext, is mandatory for proper operation. For this option, do not install any external RES BIAS "UP" or "DOWN" for the single stream pulse channel because Rext also serves this purpose.

6.10 Using Prover Pulse Bus with optocoupler

You can connect the Prover Bus to an optocoupler (such as the input stage of a ST102) as displayed in the following diagram.

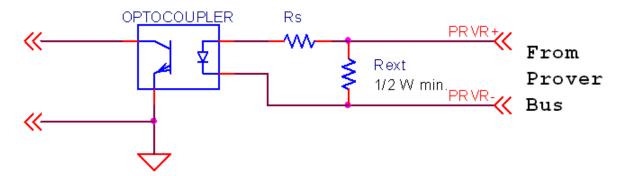


Figure 114: Illustration of using Prover Pulse Bus with Optocoupler

Since the Prover Pulse Bus is a high compliance driver and can source 35 mA, an additional series resistor "Rs" is required to limit the current into the photo diode to a safe value. The value of "Rs" can be selected so that the manufacturing ratings are not exceeded.

The following tables provide information on the approximate values of "Rs" for selected photodiode currents with "Rext" equal to 1 k ohms and 2.2 k ohms respectively. For all of the values listed in the tables, the power rating for "Rs" is ½ watt.

Conditions: Rext = 1k, photodiode V_{FWD}= 1.2 V

| Desired photodiode current (mA) | Rext (ohms) | Voltage difference at PRVR+ minus PRVR- | Standard 5% Value of Rs (ohms) |
|---------------------------------|-------------|---|--------------------------------|
| 5 | 1 K | 20.57 V | 3.9 k |
| 10 | 1 K | 18.95 V | 1.8 k |
| 15 | 1 K | 15.91 V | 1 k |
| 20 | 1 K | 12.36 V | 560 |

Conditions: Rext = 2.2 k, photodiode V_{FWD} = 1.2 V

| Desired photodiode current (mA) | Rext (ohms) | Voltage difference at PRVR+ minus PRVR- | Standard 5% Value of Rs (ohms) |
|---------------------------------|-------------|---|--------------------------------|
| 5 | 2.2 K | 21.35 V | 3.9 k |
| 10 | 2.2 K | 21.05 V | 2 k |
| 15 | 2.2 K | 20.71 V | 1.3 k |
| 20 | 2.2 K | 19.2 V | 910 |

Use the following graph to determine the "Rs" values for any given photodiode current.

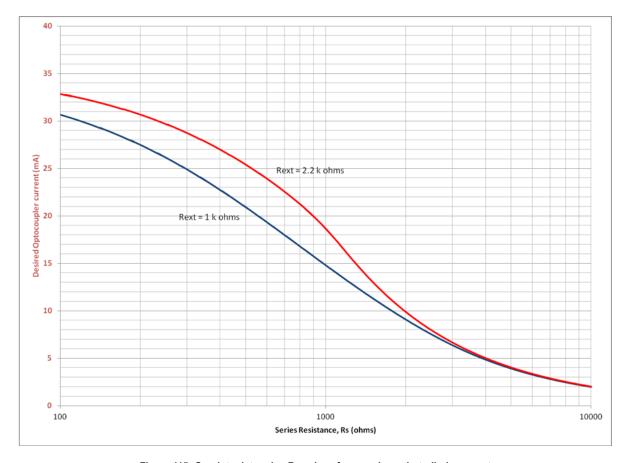


Figure 115: Graph to determine Rs values for any given photodiode current

Use the following graph to determine the a voltage values across "Rext" for any given "Rs".

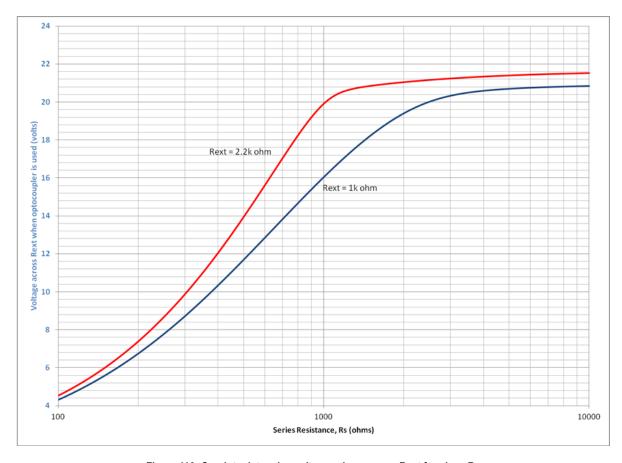


Figure 116: Graph to determine voltage values across Rext for given Rs

6.11 Connecting PIM with ST500 dual-pulse simulator (Swinton Technology)

You can connect PIM with ST500 dual-pulse simulator in a differential manner as well as a single-ended manner

6.11.1 Differential manner

The following diagram displays connecting a Swinton Technology, ST500 dual-pulse simulator, to the PIM IOTA in a differential manner.

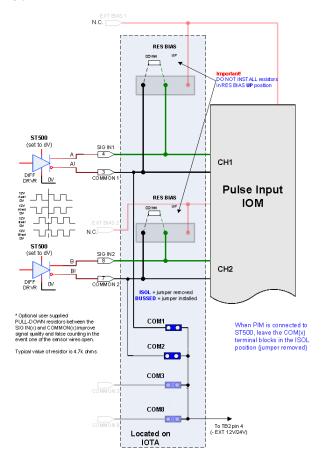


Figure 117: Connecting PIM with ST500 dual-pulse simulator – differential manner

In this example, channel 1 and channel 2 are displayed. The ST500 rear panel switches need to be set to the dV (differential voltage) position. The PIM channel blocks can be configured as single stream, or dual stream. When dual stream is chosen, the PIM utilizes dual pulse error detection per ISO 6551. It is important to ensure that RES BIAS UP option is not used for the channels connected to ST500 since ST500 uses a differential driver output stage and a pull-up will interfere with the signal quality and potentially damage the ST500. Also, ensure that COM(x) terminal blocks for the channels connected to ST500 are configured for ISOL position (jumpers removed) for fully isolated operation. Otherwise, the A! will be shorted to B! and cause signal corruption.

6.11.2 Single-ended manner

The following diagram displays connecting a Swinton Technology, ST500 dual-pulse simulator, to the PIM IOTA in a single-ended manner.

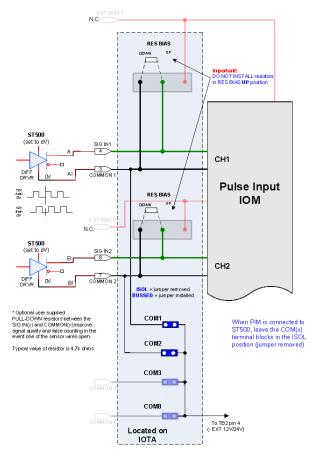


Figure 118: Connecting PIM with ST500 dual-pulse simulator - Single-ended manner

The difference between the differential and the single-ended connectivity is that the 0V pin of the ST500 driver connects to the COMMON(x) pins of the PIM IOTA. This arrangement forces the COMMON 1 and COMMON 2 to be electrically connected through the ST500. In this connection, A, A!, B, or B! can be connected to the SIG IN(x) pins of the IOTA. In the above diagram, SIG IN(x) is arbitrarily connected to A and B, which maintains the default phase 90-degree relationship.

6.12 Connecting PIM with dual stream devices

The following diagram provides information on connecting PIM with dual stream devices.

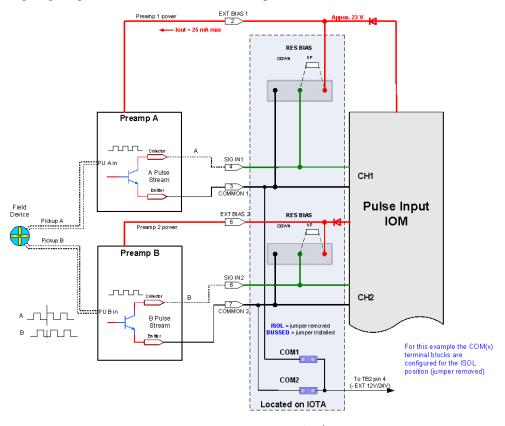


Figure 119: Connecting PIM with dual stream devices

The figure "Connecting PIM with dual stream devices" is an example of dual stream field device connected to PIM through magnetic pickup preamplifiers with open collector outputs. A 3-wire connection is used. In this example, the signal output of each preamplifier is connected to SIG IN1 and SIG IN2 inputs of the PIM. The preamplifier is powered from the PIM's EXT_BIAS1 and EXT_BIAS2 outputs. The preamplifier power return is internally connected to signal common. The maximum current that PIM can supply to the preamplifier is 25 mA. Select the preamplifier accordingly. Similar connectivity applies to the remaining dual channel pairs. Consult manufacturer's data sheet for details on the specific preamplifier.

6.13 Connecting PIM with other sensor types

The following diagram provides information on connecting PIM with other sensor types such as open collector, open drain, and high-side PNP (not very common).

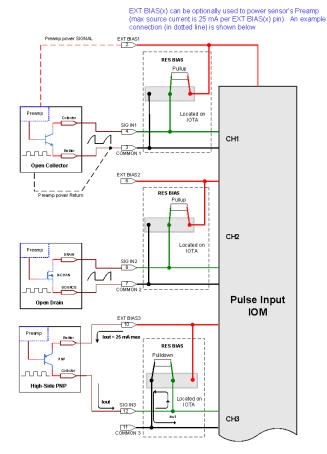


Figure 120: Connecting PIM with other sensor types

The first three PIM channels are used for illustration purposes. However, any channel can be configured for any of the sensor types.

The following diagram provides information on connecting PIM with a 4-20mA current source.

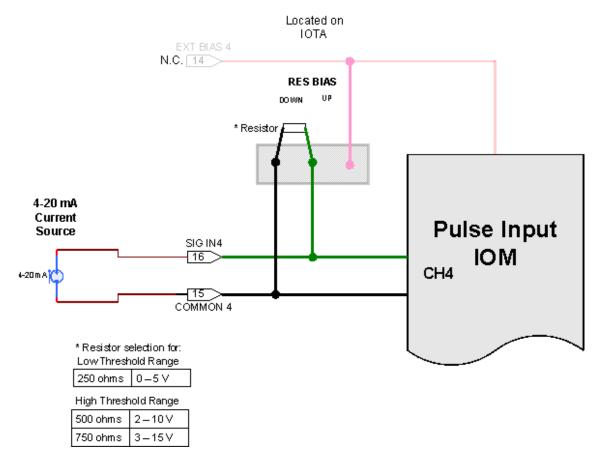


Figure 121: Connecting PIM with a 4-20mA current source

6.14 Selecting PIM input threshold

From Control Builder, you can select Low or High voltage thresholds depending upon the sensors used. Generally, if the sensor outputs a signal in the 0V to 5V range (for example, TTL), the Low threshold is the best choice. If the sensor's pulse output is an open collector or open drain type and the externally supplied Pull-up resistor is used on the IOTA, the High threshold is the best choice as the signal swings from 0V to about 23V. Other devices that are actively driven require knowledge of the output swing to determine the proper range. For example, the Swinton Technology ST500 Dual-Pulse Simulator outputs have a voltage swing of 0V to 12V with respect to the 0V terminal. Therefore, either the Low or the High threshold can be selected, but there will be slight difference in the measured Pulse Length (PL) parameter.



Attention

- Millivolt signals are not counted by the PIM unless a suitable preamplifier is used to boost the signal to a level that
 can be detected by the PIM circuitry.
- Current Pedestal signaling is not directly supported by PIM circuitry.

The following table lists the typical thresholds for the Low and High ranges.

Input Threshold Setting
Trip point for Rising Input
(Low to High transition)
Trip Point for Falling Input
(High to Low transition)
(typical)

2.75 V
2.04 V
0.71 V

High
8.41 V
7.7 V
0.71 V

Table 83: PIM input threshold – Typical low and high ranges

For dependable operation, the sensor signal needs to extend above and below the values mentioned in the above table to overcome noise and provide significant overdrive.

The following table lists recommended input values for dependable operation.

Table 84: PIM input threshold – Input values for dependable operation

The figure below provides a pictorial representation of the upper and lower trip points and hysteresis band. For illustration, the rising and falling edges are shown asymmetrically.

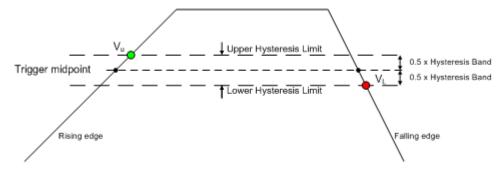


Figure 122: Illustration of upper and lower trip points and hysteresis band

6.15 Recommended cable types

This section provides recommendations on proper types of external cabling that should be used with the PIM. Honeywell does not provide PIM interface cables. You must select cables per your requirements.

The following Belden cable types can be used with PIM.

- Blue Hose Series 9463, 9463F, 3072F, 89463, 9463DB and so on)
- Brilliance Series (multi-conductor) 8774

However, you can use similar cables from other manufacturers.

6.15.1 Tips on cable usage

Multi-conductor Cables

Multi-conductor cables may be used to allow for a single run (for example, home run cable). However, only use cables with individually shielded twisted pairs to minimize crosstalk and false counting of pulses from one channel to another within the cable bundle. At a minimum, the selected cable should have individually shielded twisted pairs with 100% foil shield coverage. Preferably, a foil plus overall braid provides more shielding effectiveness. Wire selection is critical for pulse counting performance, therefore select appropriate cables.

For fast counting, low capacitance is also desirable so that the pulse fidelity (pulse distortion) at longer cable lengths is not be compromised.

A mix of multi-conductor and individual cable runs can be used with PIM.

EMI/RFI Considerations

For best EMI/RFI performance, use cables that have a braided shield (55% or greater coverage). Some cables are double shielded with a braid over foil. This provides the best performance if the environment is EMI harsh. Proper grounding of the shields is necessary to obtain best performance.

Shield (screen) termination

The shields (screen) of the cable carrying the pulse signals from the sensor to the PIM IOTA can be grounded at either end or both ends (double termination). If low frequency ground loops are a problem in the plant, tying the shield to ground at one end may be a better choice to minimize common mode noise and interference. If the ground system/grid of the plant does not have ground loops or the run from the PIM IOTA to the sensor is short, then double termination is often preferable.

7 Series C Universal Horizontal Input/Output (UHIO) components

The Series C UHIO is comprised of the following Series C components.

- 9-port Control Firewall CC-PCF901
- C300 Controller CC-PCNT02
- Universal Input/Output (UIO) Module CC-PUIO01 or CC PUIO31

In addition to the existing Series C components, the UHIO contains additional components as listed below in Table 85. All of these components are packaged together in various UHIO Configurations. These configurations are defined within the section titled "Components of UHIO" on page 252.

The following table lists the model number of UHIO components.

Table 85: UHIO component's model numbers

| Model Number/Part Number | Description |
|--------------------------|--|
| CC-HCAR01 | Horizontal Backplane PWA, coated |
| CC-HCN911 | Horizontal C300/CF9 IOTA PWA, coated |
| CC-HUIO11 | Horizontal UHIO IOTA PWA, coated |
| CC-HUIO12 | Horizontal UHIO IOTA PWA, coated |
| CC-HCMB02 | Battery Backup Mounting Panel |
| 51454517–100 | Series C Power Supply in Basic cabinet form factor |
| 51155572-100 | Half Panel Plastic Cover |
| CC-PCNT02 | C300 Module |
| CC-PCF901 | C9 Module |
| CC-PUIO01 | UIO Module |
| CC-PUIO31 | UIO-2 Module |

| Table Of Symbols | | |
|------------------|---|--|
| AI | Analog Input | |
| AO | Analog Output | |
| СВ | TDC 2000 Basic Controller | |
| CF9 | Control Firewall (9 refers to the number of ports, 1 uplink and 8 downlink) | |
| DI | Digital Input | |
| DO | Digital Output | |
| I/O | Input/Output | |

| Table Of Symbols | |
|------------------|-----------------------------------|
| IOTA | Input/Output Termination Assembly |
| UHIO | Universal Horizontal Input/Output |
| UIO | Universal I/O |
| PE | Protective Earth Ground |
| COTS | Commercial Off The Shelf |

| Replaceable Fuses | |
|-------------------|---------------------------------------|
| 51190582-150 | .5A, 250V, quick-acting, 5x20mm glass |
| 51190582-310 | 10A, 125V, quick-acting, 5x20mm glass |

Periodic Maintenance

· Non Required

| Replacement Parts | |
|-------------------|--------------|
| CC-PCNT02 | C300 Module |
| CC-PCF901 | C9 Module |
| CC-PUIO01 | UIO Module |
| CC-PUIO31 | UIO-2 module |
| 51190582-150 | .5A Fuse |
| 51190582-310 | 10A Fuse |

Related topics

[&]quot;About the Horizontal C300/CF9 IOTA" on page 241

[&]quot;About the Horizontal UHIO IOTA" on page 242

[&]quot;About the I/O connectors" on page 250

[&]quot;Components of UHIO" on page 252

[&]quot;Mounting the UHIO components" on page 273

[&]quot;General regulatory compliance" on page 274

[&]quot;COTS AC-DC Power supplies" on page 275

[&]quot;Protective Earth (Safety Ground)" on page 276

[&]quot;Environmental Characteristics" on page 278

7.1 About the Horizontal C300/CF9 IOTA

The C300 / CF9 IOTA is a combination board that joins a Series C C300 IOTA with a Series C CF9 IOTA. The dimensions of the C300/CF9 IOTA and the UHIO IOTA are the same, 8.66X8.37 inches.

The following figure displays the engineering drawing of the C300/CF9 IOTA.

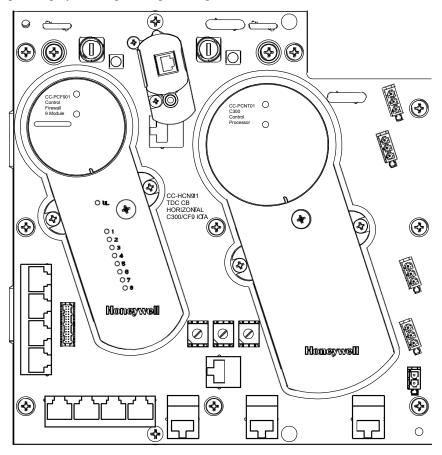


Figure 123: Horizontal C300/CF9 IOTA

7.2 About the Horizontal UHIO IOTA

The horizontal UHIO IOTA is designed for UIO and the dimension of the IOTA is same as that of horizontal C300/CF9 IOTA. This IOTA enables you to place the redundant UIO module side-by-side or horizontally. The placement of a UIO module differs from the placement of a Series C module, wherein you can only place the Series C modules vertically and hence it is named as "Universal Horizontal I/O." The horizontal UHIO IOTA is designed to interface the Series C UIO module with the CB/EC terminal panel – the TCBxx.

The following figures display the engineering drawings of the UHIO IOTA and the UHIO-2 IOTA.

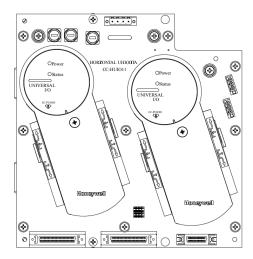


Figure 124: CC-HUIO11

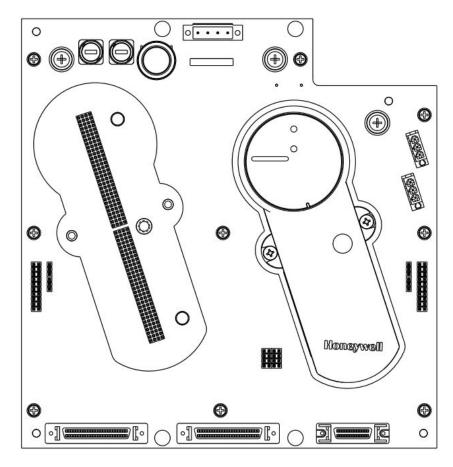


Figure 125: CC-HUIO12

7.2.1 Mapping the UIO channels to specific I/O types

Use of the UHIO IOTA with the UIO module pre-determines 24 of the 32 I/O channels to specific I/O types. The following table defines the mapping of UIO channels to TCBxx labeled channels.

The UHIO contains 32 UIO Channel Numbers as shown in the first column of the table below. Each of these channels can be configured as shown in the last column of the table.



Attention

The channel numbers listed are identical to what is displayed on the Experion Station and Control Builder.

Table 86: Mapping UIO channel to specific I/O types

| UIO Channel Number as displayed on Experion Station | TCBxx Channel Name | Spare Points I/O | UIO Channel Configuration Type |
|---|--------------------|------------------|--------------------------------|
| 1 | CO8 | - | AO |
| 2 | CO7 | - | AO |
| 3 | RV06 | - | VI |
| 4 | PV06 | - | VI |
| 5 | PV08 | - | VI |
| 6 | RV08 | - | VI |
| 7 | PV05 | - | VI |

| UIO Channel Number as displayed on Experion Station | TCBxx Channel Name | Spare Points I/O | UIO Channel Configuration Type | |
|---|--------------------|------------------|--------------------------------|--|
| 8 | RV05 | - | VI | |
| 9 | PV07 | - | VI | |
| 10 | RV07 | - | VI | |
| 11 | CO6 | - | AO | |
| 12 | CO5 | - | AO | |
| 13 | - | SP1 | AI, AO, DI, DO | |
| 14 | - | SP2 | AI, AO, DI, DO | |
| 15 | - | SP3 | AI, AO, DI, DO | |
| 16 | - | SP4 | AI, AO, DI, DO | |
| 17 | - | SP5 | AI, AO, DI, DO | |
| 18 | - | SP6 | AI, AO, DI, DO | |
| 19 | - | SP7 | AI, AO, DI, DO | |
| 20 | - | SP8 | AI, AO, DI, DO | |
| 21 | CO1 | - | AO | |
| 22 | CO2 | - | AO | |
| 23 | RV03 | - | VI | |
| 24 | PV03 | - | VI | |
| 25 | RV01 | - | VI | |
| 26 | PV01 | - | VI | |
| 27 | RV04 | - | VI | |
| 28 | PV04 | - | VI | |
| 29 | PV02 | - VI | | |
| 30 | RV02 | - VI | | |
| 31 | CO3 | - | AO | |
| 32 | CO4 | - | AO | |



Attention

All the AIs in the above table except for channels 13 thru 20 are 1 to 5V inputs

Examples of mapping UIO channels

The following are a few examples of mapping UIO channels to specific I/O types.

- Consider that you want to use PV08 on a TCB20. In this scenario, UIO channel 5 configured as an AI point type in Control Builder enables the monitoring of a device wired to PV08 on the terminal block.
- Consider that a valve is connected to a screw terminal CO5 on a TCB20. In this scenario to control this valve, configure channel 12 as an AO type on the appropriate UIO module in Control Builder.
- Consider that you want to monitor the state of a 24VDC switch (ON or OFF). In this scenario, configure one of the spare points (such as SP3) as a DI type to monitor the switch state. Note that the corresponding UIO channel in Control Builder for SP3 is channel 15.

7.2.2 Spare point I/O configuration

UIO channels 13 through 20 are available to be configured as spare I/O points. These channels can be configured as AI, AO, DI, or DO. In other words, the configuration and use of the UHIO spare points is the same as regular channels configured and used in Series C UIO.

For more information about the usage of the spare I/O points based on the configuration, see the following sections.

- UIO channel configured as analog input spare point "UIO channel configured as Analog Input" on page 186.
- UIO channel configured as analog output spare point "UIO channel configured as Analog Output" on page 189.
- UIO channel configured as digital input spare point "UIO channel configured as Digital Input" on page 190.
- UIO channel configured as digital output spare point-"UIO channel configured as Digital Output" on page 191.



Attention

There are no restrictions for configuring these eight spare I/O channels. Any combination of the four I/O types can be used for the eight spare I/O points.

Spare point panel

Honeywell recommends a solution for better configuration of the spare points. Phoenix Contact has designed a DIN rail mountable assembly for I/O of the spare points. The following figure illustrates the spare point panel.

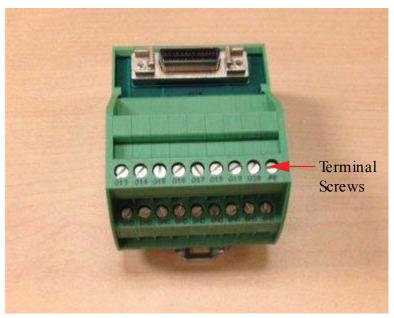


Figure 126: Spare point panel

This panel contains screw terminals for attaching field wiring for eight channels. The dimensions of the panel are 1.96 inches wide $\times 2.56$ inches high $\times 1.74$ inches depth and can be mounted anywhere in the cabinet.



Attention

For customers who want to use a spare I/O channel, one spare point panel is required per UHIO IOTA.

Phoenix Contact has assigned 2905715 as the part number to the spare point panel. Note that this part number is not assigned by Honeywell and hence, the spare points panel is not available through the Total Plant Configurator (TPC) tool.

Spare point cable

A special cable assembly is required for connecting the UHIO IOTA J7 connector with the Spare Points Panel. The cables are available in four different lengths. The spare points cables are not available through the TPC tool.

The following table lists the four cable part numbers and their lengths.

Table 87: Spare point cables

| Honeywell Part Number | Phoenix Contact Part Number | Description |
|-----------------------|-----------------------------|-------------------------------|
| 51202991-001 | | Spare Points Cable – 1 meter |
| 51202991-002 | 51202991 | Spare Points Cable – 2 meter |
| 51202991-005 | | Spare Points Cable – 5 meter |
| 51202991-010 | | Spare Points Cable – 10 meter |

Spare points connector

For customers who want to make a customized cable and panel assembly for the spare points I/O, use the following table to connect the spare point connector on the UHIO IOTA.

Table 88: Spare point connector assignment on the UHIO IOTA

| Spare Point Channel Number | J7 Pin Number | J7 Ground Pin Number |
|----------------------------|---------------|----------------------|
| 1 | 5 | 6 |
| 2 | 1 | 3 |
| 3 | 2 | 4 |
| 4 | 14 | 16 |
| 5 | 9 | 10 |
| 6 | 13 | 11 |
| 7 | 12 | 24 |
| 8 | 26 | 25 |

The following figure displays the pin numbers of the J7 connector on the UHIO IOTA.

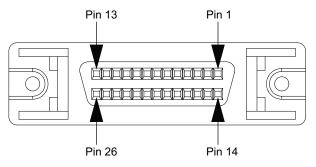


Figure 127: Spare points connector

The connector selected on the UHIO IOTA board assembly is TE Connectivity. One possible mating connector is TE Connectivity part number 1-5749111-0.

About ordering the spare points panel and cable

The spare points panel and cable can be ordered through Phoenix Contact's local distributors. You have to use the following Phoenix Contact web site for searching and locating a local distributor.

https://www.phoenixcontact.com

Configuring the UIO channels as spare channels

UIO channels 13 through 20 (as viewed in Control Builder) can be user configured as AI, AO, DI, or DO type. The following figure illustrates one of the possible configurations of channel 13 through 16 as DI types, and channels 17 through 20 as DO types.

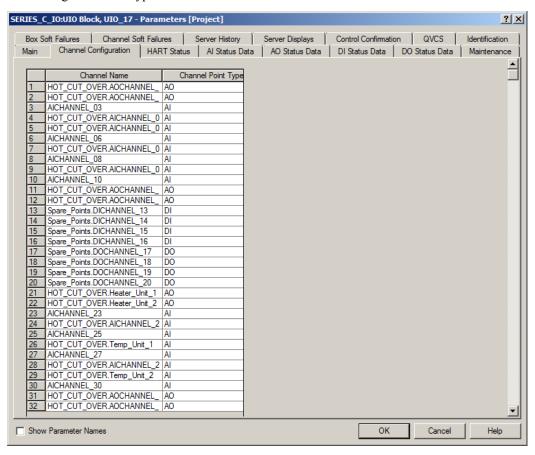


Figure 128: UIO channel configuration in the configuration form

The following figure illustrates the configured channels used in a Control Module as DI and DO types.

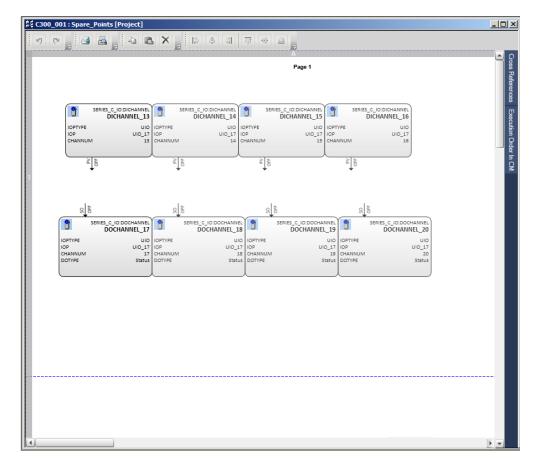


Figure 129: Spare point channels used in a Control Module

7.2.3 Guidelines for using the HART devices with the AO channel

To connect the HART devices to any of the eight AO channels on the TCBxx panels, modify the TCBxx board assembly such that the HART functionality functions as intended.

To make the HART functionality functions, you have to remove one capacitor per AO channel from the TCBxx panel. The following table lists which capacitor must be removed from the TCBxx panel; for the AO channel used with HART.

Table 89: Mapping of capacitors to AO channels on TCB00, TCB20, and TCB30

| TCBxx panel output | Capacitor to be removed per AO channel |
|--------------------|--|
| CO1 | C1 |
| CO2 | C2 |
| CO3 | C3 |
| CO4 | C4 |
| CO5 | C5 |
| CO6 | C6 |
| CO7 | C7 |
| CO8 | C8 |

7.2.4 UHIO Specifications

Specifications per I/O Type:

| I/O Type | Parameters | Channel Availability |
|----------|------------|-------------------------|
| VI | 1 – 5VDC | CH: 3-10, 23-30 |
| AI | 4 – 20mA | CH: 13-20 |
| AO | 4 – 20mA | CH: 1, 2, 11-22, 31, 32 |
| DI | 7mA Max | CH: 13-20 |
| DO | 1 – 500mA | CH: 13-20 |

Power Specification For 1 UHIO IOTA With Two UIO-2 Modules Fully Loaded

- 24 to 26VDC
- 5A

Backpanel Power Cable Specs

- 10 AWG
- 105C PVC Insulation
- 51202347-200

7.3 About the I/O connectors

The UHIO IOTA contains three I/O (J5, J6, and J7) connectors for connecting the UIO module to the field signals.

The following table provides information on the mapping of UIO channels to the I/O connectors.

Table 90: Mapping the UIO channels to the I/O connectors

| CB Channel Name | UIO Channel Number | TCB Phone Connector | UHIO IOTA Connector | TCB Field Connector | UIO Channel Type |
|-----------------|--------------------|------------------------|------------------------|------------------------|------------------|
| CO8 | 1 | Ј3 | J5 | TB8 | AO |
| CO7 | 2 | Ј3 | J5 | TB7 | AO |
| RV06 | 3 | Ј3 | J5 | TB6 | VI |
| PV06 | 4 | Ј3 | J5 | TB6 | VI |
| PV08 | 5 | Ј3 | J5 | TB8 | VI |
| RV08 | 6 | Ј3 | J5 | TB8 | VI |
| PV05 | 7 | Ј3 | J5 | TB5 | VI |
| RV05 | 8 | Ј3 | J5 | TB5 | VI |
| PV07 | 9 | Ј3 | J5 | TB7 | VI |
| RV07 | 10 | Ј3 | J5 | TB7 | VI |
| CO6 | 11 | Ј3 | J5 | TB6 | AO |
| CO5 | 12 | Ј3 | J5 | TB5 | AO |
| SP1 | 13 | none | Ј7 | none | AI, AO, DI, DO |
| SP2 | 14 | none | Ј7 | none | AI, AO, DI, DO |
| SP3 | 15 | none | Ј7 | none | AI, AO, DI, DO |
| SP4 | 16 | none | Ј7 | none | AI, AO, DI, DO |
| SP5 | 17 | none | Ј7 | none | AI, AO, DI, DO |
| SP6 | 18 | none | Ј7 | none | AI, AO, DI, DO |
| SP7 | 19 | none | J7 | none | AI, AO, DI, DO |
| SP8 | 20 | none | Ј7 | none | AI, AO, DI, DO |
| CO1 | 21 | J2 | Ј6 | TB1 | AO |
| CO2 | 22 | J2 | J6 | TB2 | AO |
| RV03 | 23 | J2 | Ј6 | TB3 | VI |
| PV03 | 24 | J2 | Ј6 | TB3 | VI |
| RV01 | 25 | J2 | Ј6 | TB1 | VI |
| PV01 | 26 | J2 | J6 | TB1 | VI |
| RV04 | 27 | J2 | J6 | TB4 | VI |
| PV04 | 28 | J2 | J6 | TB4 | VI |
| PV02 | 29 | J2 | J6 | TB2 | VI |
| RV02 | 30 | J2 | J6 | TB2 | VI |
| CO3 | 31 | J2 | J6 | TB3 | AO |
| CO4 | 32 | J2 | J6 | TB4 | AO |

In this table, three different I/O connectors have references as J5, J6, and J7. The UIO channels OUT1 through OUT12 are connected to the I/O connector J5. The UIO channels OUT21 through OUT32 are connected to the I/O connectors J6. The Basic Controller IO points are listed in the first column and the corresponding UIO channel names are listed in the second column.

•

Attention

- The spare channels are connected to the I/O connector J7.
- UIO channels mapped to the TCBxx terminal panel must be configured in Control Builder to the IO type as defined in the table "Mapping the UIO channels to the I/O connectors."
- The spare channels SP1 through SP8 can be configured in Control Builder as AI, AO, DI, or DO type.

7.4 Components of UHIO

The UHIO contains the following components.

- Horizontal Backplane
- · Battery mounting panel
- · RAM Battery Backup
- Power Supply
- · Half panel plastic cover
- Cables
- Upgrade configurations

Horizontal Backplane

Horizontal Backplane accommodates the Horizontal C300/CF9 IOTA and the Horizontal UHIO IOTA. For more information about the Horizontal Backplane, see "Horizontal Backplane" on page 252.

Battery mounting panel and RAM Battery Back up

The battery mounting panel is a new board that enables the existing Series C memory backup assembly to be mounted inside the Basic cabinet. For more information about the Battery mounting panel and RAM Battery Backup, see "Battery mounting panel and RAM Battery Backup" on page 253.

Power Supply

A new Series C modular power supply is introduced to replace the basic power supply. For more information about the power supply, see "UHIO Power Supply" on page 256.

Half panel plastic cover

A half panel plastic cover is available for protecting the empty position on the backplane. For more information about the half panel plastic cover, see "Half panel plastic cover" on page 257.

Cables

A new cable and an adaptor for the existing cable are introduced to interface between the CB/EC rack and the TCBxx. For more information about the cables, see "UHIO cables" on page 259.

Upgrade configurations

There are seven configurations introduced for UHIO. For more information about the configurations, see "UHIO Hardware Model Numbers" on page 261.

7.4.1 Horizontal Backplane

A new Horizontal Backplane is introduced to power up the new form factor CF9/C300 and UHIO IOTAs and to maintain the same form factor as the TDC 2000 CB/EC card file. The size and component placement of the Series C CF9/C300, and UHIO IOTAs is modified to fit on to the Horizontal Backplane and thereby the same form factor as the TDC 2000 CB/EC card file is maintained.

The Backplane is mounted on a mechanical frame that adds rigidity and support to the whole assembly. This frame is mounted in place of the TDC 2000 CB/EC card file.

This Backplane supports the following different configuration.

- Two C300/CF9 IOTA's mounted on the Backplane
- Two UHIO IOTA's mounted on the Backplane

One C300/CF9 IOTA and one UHIO IOTA mounted on the Backplane

The following table lists the model number and the part number of the Horizontal Backplane.

| Model Number | Part Number | Description |
|--------------|--------------|----------------------------------|
| CC-HCAR01 | 51454504-175 | Horizontal Backplane PWA, coated |

The following figure displays the front view of the Horizontal Backplane.



Figure 130: Horizontal Backplane

You have to fix the Horizontal Backplane on the cabinet using the four screws (as highlighted in the figure). You may also mount just one of either IOTA onto the Backplane.



Note

An IOTA can be mounted on the left or right side of the Backplane. In addition, a half panel plastic cover is available for covering up the empty position on the Backplane.

7.4.2 Battery mounting panel and RAM Battery Backup

RAM Battery Backup

A small Battery Backup assembly provides the battery power for the RAM associated with the C300 Controller. Since the existing Series C RAM needs to be mounted on the TDC Basic cabinet, a battery mounting panel is introduced for mounting the UHIO's RAM. Similar to Series C, the RAM battery backup for UHIO configurations can supply battery backup power from one to four C300s.

The following figure displays the RAM battery and the assembly.



Figure 131: RAM Battery Backup and Battery assembly

| Numbers | Description |
|---------------|------------------------------|
| 1 | Battery mounting panel |
| 2 RAM Battery | |
| 3 | Screw for mounting the panel |

Battery mounting panel

A new board is introduced for mounting the existing Series C memory backup assembly (RAM) inside the basic cabinet. The following table lists the contents of the Battery Backup assembly.

Table 91: Battery Backup Mounting Kit (51155581-100)

| Part Number | Description | Quantity |
|--------------|--|----------|
| 51307261-175 | Battery Backup mounting PWA | 1 |
| 51108385-630 | MACH SCR PAN HD CROSS REC | 4 |
| 51197521-006 | WASHER, LOCK | 4 |
| 99000228-007 | SM. M5 FL/WSHR,NICKL | 4 |
| 51155586-100 | Battery Backup mounting kit installation instruction sheet | 1 |

The following table lists the contents of the battery mounting kit.

Table 92: Battery Backup Mounting Kit (CC-HCMB02)

| Part Number | Description | Quantity |
|--------------|-----------------------------|----------|
| CC-SCMB02 | C300 Memory Backup Assembly | 1 |
| 51155581-100 | Battery Mounting Kit | 1 |

The following figure displays the battery mounting panel.

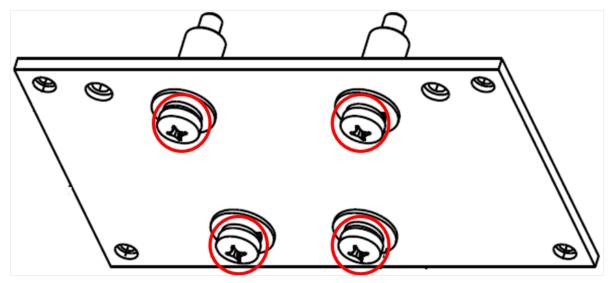


Figure 132: Battery mounting panel

In this figure, the highlighted screws are used to mount the panel.

Alternative RAM Charger Module

RAM Charger module (TDI model number: SPS5792-2-LF) is available for providing memory backup power for C300 controller module.

Part number of RAM charger module

The following table lists the part number of RAM charger module. This part number need to be procured separately.

Table 93: Part numbers for RAM charger module assembly

| Part Number | Description |
|--------------|--|
| SPS5792-2-LF | RAM charger module (HPN: 51454475-100) |

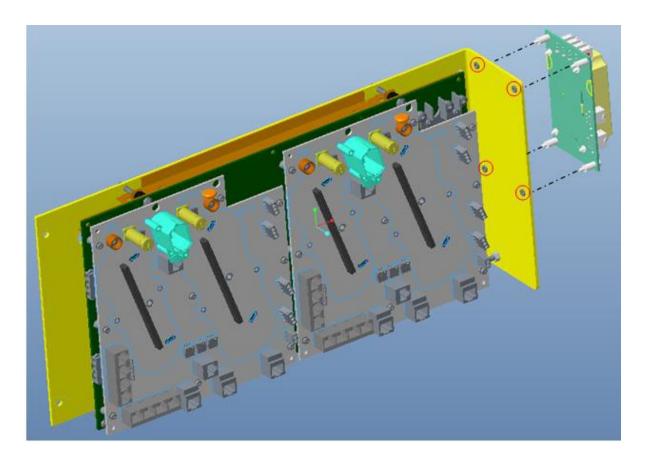
Mounting the RAM charger module

Prerequisites

The UHIO mounting plate is installed.

To install the RAM charger module on the UHIO mounting plate

- 1. Align the mounting holes in the RAM charger module with the screw hole locations on the right side of the UHIO mounting plate.
- 2. Secure the RAM charger module to the mounting plate with four screws and nuts (p/n# 30735043-302) from CCZHMT10 kit.
- 3. The Red circle denotes the nuts. The screws must be tightened to 3.9 Nm.



7.4.3 UHIO Power Supply

The Series C modular power supply is repackaged to fit in the same space as the Basic cabinet power supply.



Attention

The new power supply is not included in the seven UHIO configurations. The power supply must be ordered separately.

The following figure displays the new power supply.



Figure 133: UHIO Power supply

The following figure displays old and new power supplies.



Figure 134: Old and new power supply

7.4.4 Half panel plastic cover

A half panel plastic cover is available for covering up the empty position on the Backplane. The half panel plastic cover can be installed on either sides of the IOTA based on the empty position.

The following figure displays the half panel cover.

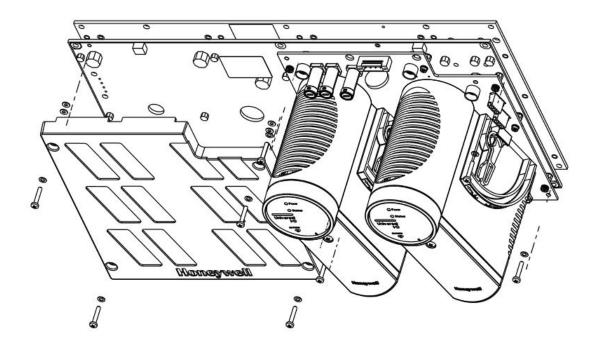


Figure 135: Half panel cover

In this figure, see 4 screws that are used to mount the plastic cover to the Backplane.

This panel covers half of the Backplane when only one IOTA is installed. The half panel cover can be installed on either side of the Backplane, as displayed in the following figure.

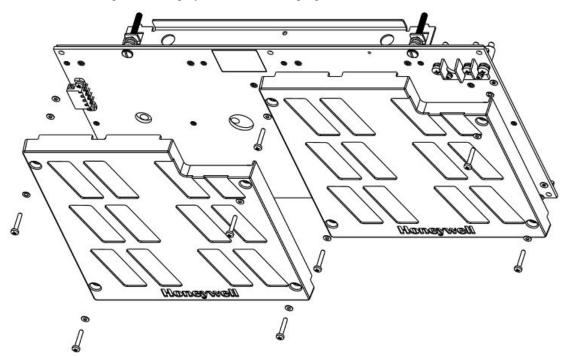


Figure 136: Half panel cover installed on the Backplane

7.4.5 UHIO cables

There are two options available to connect the UHIO IOTA to the TCBxx.

- Replace the existing cables with new compatible cables.
- Add a cable adapter to the existing cable to make the existing cable plug compatible with the UHIO IOTA.



Attention

Due to the availability of different lengths, cables are not included in the UHIO configurations. Therefore, the cables must be ordered separately.

Replacing the existing cables

The following table lists the new cables and the respective part numbers that are introduced with UHIO.

Table 94: TCB cable and its part numbers

| Part Number | Description |
|--------------|------------------------------|
| 51192054-101 | UHIO cable, 1 meter length |
| 51192054-102 | UHIO cable, 2 meter length |
| 51192054-103 | UHIO cable, 3 meter length |
| 51192054-104 | UHIO cable, 1.5 meter length |
| 51192054-110 | UHIO cable, 10 meter length |
| 51192054-115 | UHIO cable, 15 meter length |

The following image displays the new cables connected from the UHIO IOTA to the TCBs.



Figure 137: New cable connected from UHIO IOTA to TCBs

In this figure, 1 denotes the UHIO end and 2 denotes the TCB end.

Adding an adapter to the existing cables

A new cable adapter is introduced to use with the existing cable there by making the existing cable plug compatible with the UHIO IOTA. This cable adapter modifies the connector style from TCB style that is used on the CB/EC to UHIO style that is used on the UHIO IOTA. The cable adapter is available in two different lengths to order. The following table lists the part numbers and the adapter.

Table 95: UHIO cable adapter

| Part Number | Description |
|--------------|--------------------------------------|
| 51202979-005 | UHIO cable adapter, 0.5 meter length |
| 51202979-010 | UHIO cable adapter, 1 meter length |

The following figure displays the engineering drawing of the cable adapter.

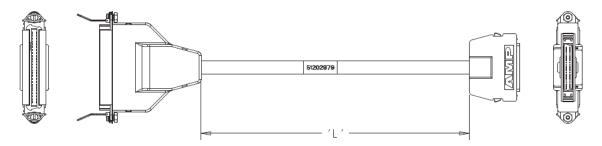


Figure 138: UHIO cable adapter

7.4.6 UHIO Hardware Model Numbers

There are seven hardware upgrade configurations introduced with the UHIO. These hardware configurations can be used for different configuration as mentioned in the following table.

Table 96: UHIO hardware model numbers

| Model Number | Description | |
|--------------|--|--|
| CC-ZHR010 | UHIO with C300/CF9 IOTA, redundant UIO | |
| CC-ZHN010 | UHIO with C300, CF9, non-redundant UIO | |
| CC-ZHR012 | UHIO with C300/CF9 IOTA, redundant UIO-2 | |
| CC-ZHN012 | UHIO with C300/CF9, non-redundant UIO-2 | |
| CC-ZHR020 | UHIO with 2 sets of redundant UIO | |
| CC-ZHN020 | UHIO with 2 sets of non-redundant UIO | |
| CC-ZHR021 | UHIO with 2 sets of redundant UIO-2 | |
| CC-ZHN021 | UHIO with 2 sets of non-redundant UIO-2 | |
| CC-ZHR030 | UHIO with 1 sets of redundant UIO | |
| CC-ZHN030 | UHIO with 1 sets of non-redundant UIO | |
| CC-ZHR031 | UHIO with 1 set of redundant UIO-2 | |
| CC-ZHN031 | UHIO with 1 set of non-redundant UIO-2 | |
| CC-ZHR040 | UHIO with redundant C300 and redundant CF9 | |
| CC-ZHR041 | UHIO with redundant C300 and redundant CF9 | |

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Attention

Due to variations allowed in cabinet layouts, the following components are not included in the configurations (described in this topic), but they are necessary for completing the installation of UHIO.

- I/O Link cables (51202329-xxx) Different lengths and connectors are available.
- Power supply
- FTE cables
- Terminal panel cables
- RAM Battery Backup assembly

For controller and communication redundancy, order an additional CC-ZHR010 configuration or CC-ZHN010 configuration.

CC-ZHR010

This UHIO hardware configuration contains:

- one C300 Controller
- one 9-port Control Firewall
- · redundant UIO modules

The following figure displays the layout of CC-ZHR010.

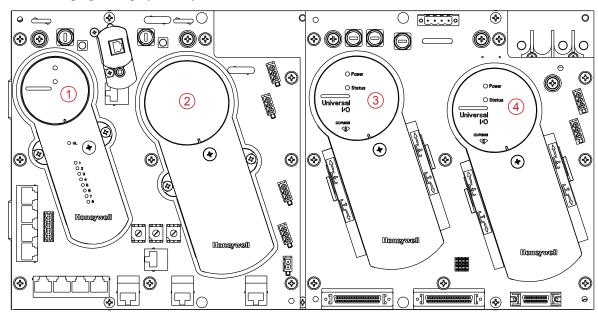


Figure 139: Layout of CC-ZHR010

| Number | Description |
|-------------------|--|
| 1 | Control Firewall |
| 2 C300 Controller | |
| 3 and 4 | Redundant Universal Input/Output (UIO) modules |

CC-ZHR012

This UHIO hardware configuration contains:

- one C300 Controller
- one 9-port Control Firewall
- redundant UIO-2 modules

The following figure displays the layout of CC-ZHR012.

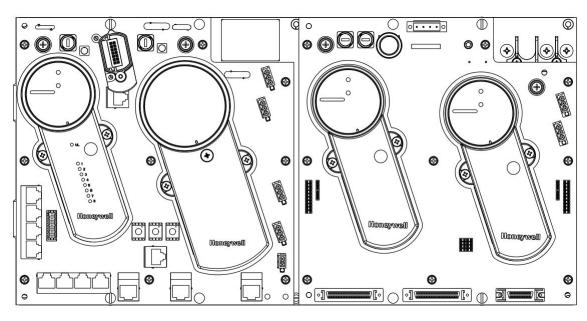


Figure 140: Layout of CC-ZHR012

CC-ZHN010

This UHIO hardware configuration contains:

- one C300 Controller
- one 9-port Control Firewall
- a non-redundant UIO module

The following figure displays the layout of the CC-ZHN010.

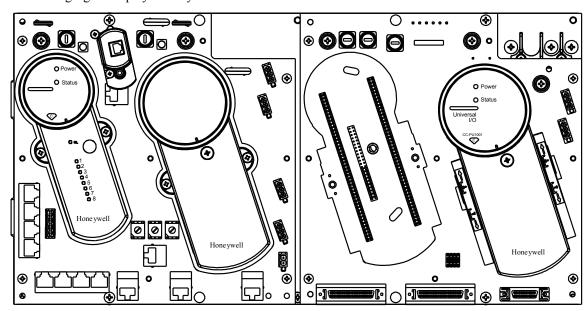


Figure 141: Layout of CC-ZHN010

The non-redundant UIO module must be installed on the right side of the UHIO IOTA.

CC-ZHN012

This UHIO hardware configuration contains:

- one C300 Controller
- one 9-port Control Firewall
- a non-redundant UIO-2 module

The following figure displays the layout of the CC-ZHN012.

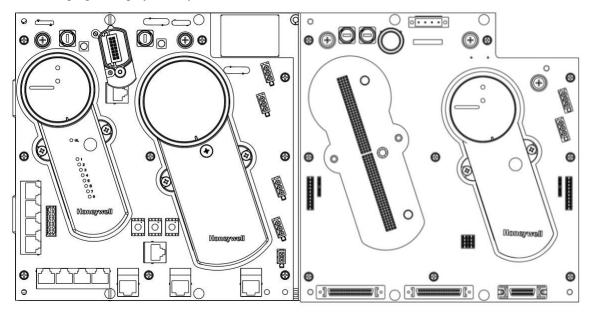


Figure 142: Layout of CC-ZHN012

The non-redundant UIO module must be installed on the right side of the UHIO—2 IOTA.

CC-ZHR020

This UHIO hardware configuration contains two sets of redundant UIO modules. The following figure displays the layout of the CC-ZHR020.

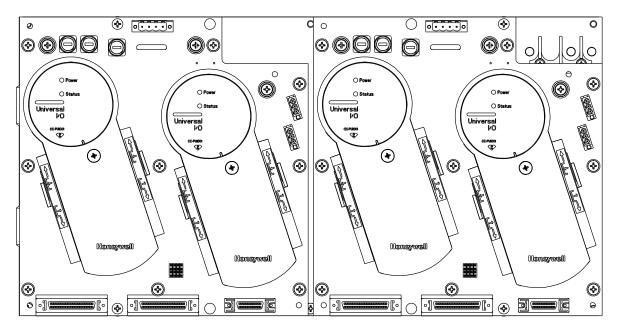


Figure 143: Layout of CC-ZHR020

In this figure, two set of redundant UIO modules are displayed.

CC-ZHR021

This UHIO hardware configuration contains two sets of redundant UIO-2 modules. The following figure displays the layout of the CC-ZHR021.

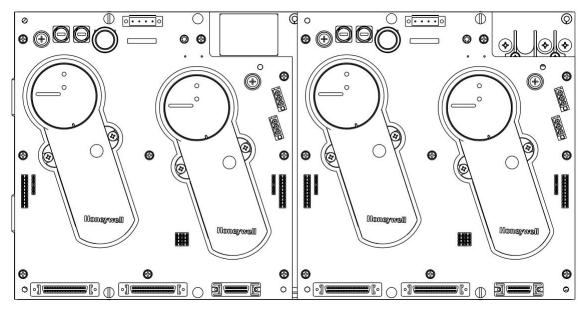


Figure 144: Layout of CC-ZHR021

In this figure, two set of redundant UIO-2 modules are displayed.

CC-ZHN020

This UHIO hardware configuration contains two sets of non-redundant UIO modules. The following figure displays the layout of the CC-ZHN020.

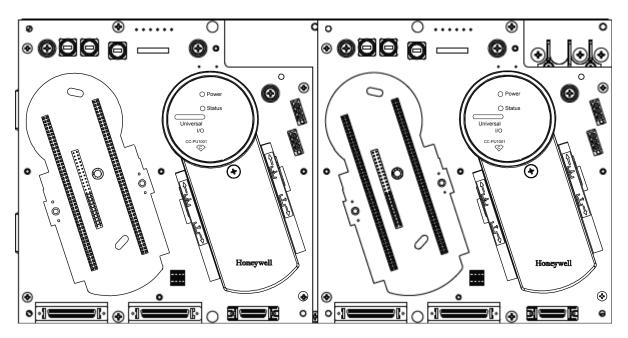


Figure 145: Layout of CC-ZHN020

The non-redundant UIO module must be installed on the right hand side of the UHIO IOTA.

CC-ZHN021

This UHIO hardware configuration contains two sets of non-redundant UIO-2 modules. The following figure displays the layout of the CC-ZHN021.

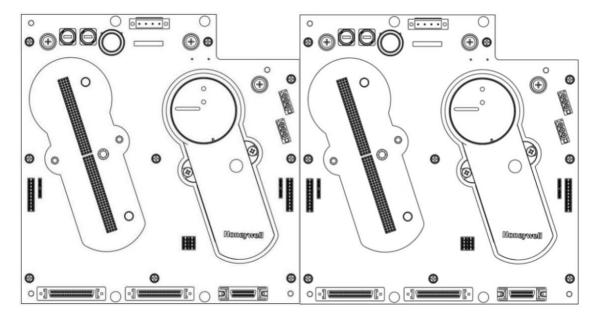


Figure 146: Layout of CC-ZHN021

The non-redundant UIO-2 module must be installed on the right hand side of the UHIO-2 IOTA.

CC-ZHR030

This UHIO hardware configuration contains a single redundant UIO module. The following figure displays the layout of the CC-ZHR030.

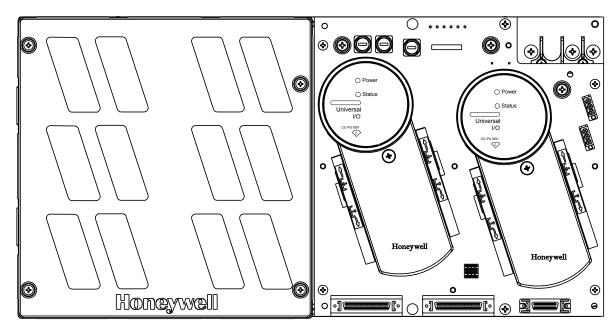


Figure 147: Layout of CC-ZHR030

CC-ZHR031

This UHIO hardware configuration contains a single redundant UIO-2 module. The following figure displays the layout of the CC-ZHR031.

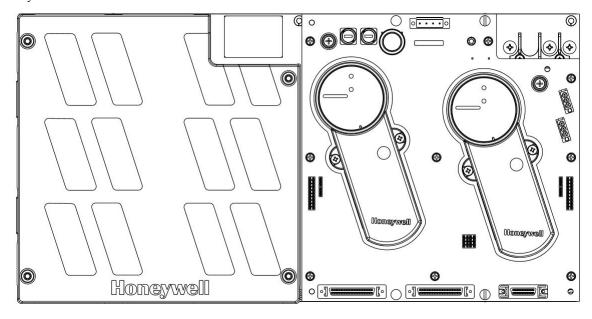


Figure 148: Layout of CC-ZHR031

CC-ZHN030

This UHIO hardware configuration contains a single non-redundant UIO module.

The non-redundant UIO module must be installed on the right hand side of the UHIO IOTA.

The following figure displays the layout of the CC-ZHN030.

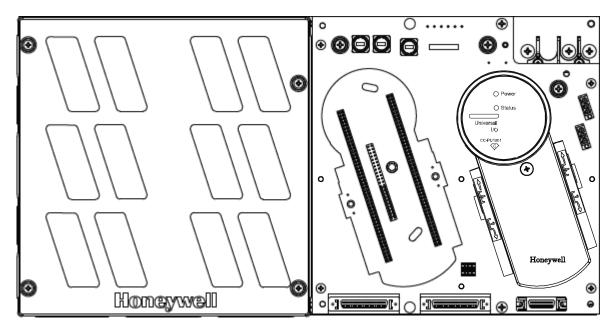


Figure 149: Layout of CC-ZHN030

CC-ZHN031

This UHIO hardware configuration contains a single non-redundant UIO-2 module.

The non-redundant UIO-2 module must be installed on the right hand side of the UHIO-2 IOTA.

The following figure displays the layout of the CC-ZHN031.

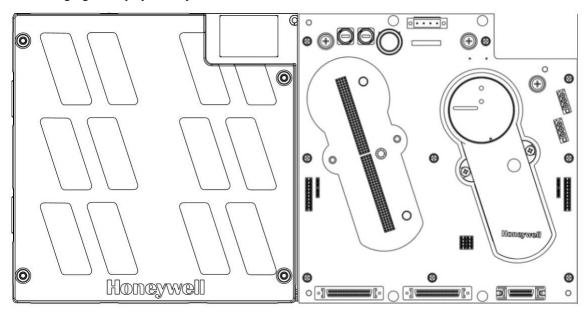


Figure 150: Layout of CC-ZHN031

CC-ZHR040

This UHIO hardware configuration contains two sets of C300 Controller and 9-port Control Firewall. The following figure displays the layout of the CC-ZHR040.

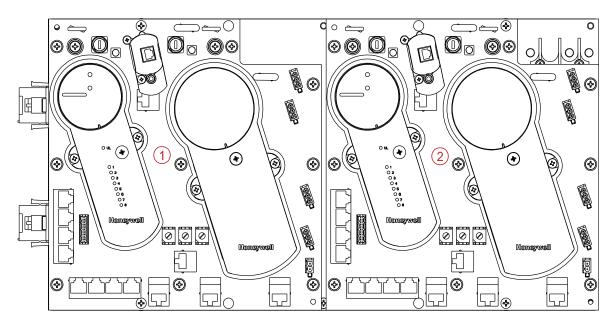


Figure 151: Layout of CC-ZHR040

In this figure, 1 and 2 denote the two sets of C300 Controller and 9-port Control Firewall.

CC-ZHR041

This UHIO hardware configuration contains two sets of C300 Controller and 9-port Control Firewall. The following figure displays the layout of the CC-ZHR041.

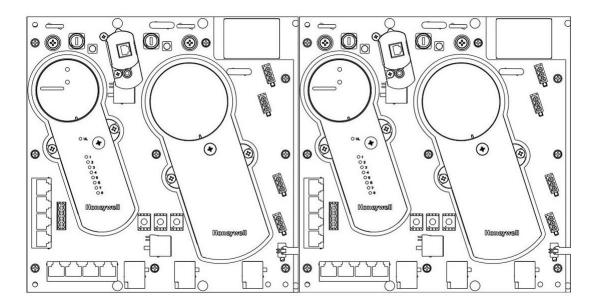


Figure 152: Layout of CC-ZHR041

In this figure, 1 and 2 denote the two sets of C300 Controller and 9-port Control Firewall. This enables you to migrate a Series C system with redundant C300 Controller and CF9.



Attention

The UHIO's CSA General Purpose Certification for the Hardware configuration CC-ZHR0404 is only applicable within Data Hiway (TDC 2000) cabinets with the Series C Power supply SPS5792-142935 (HPN 51454517-100).

7.4.7 Mounting Assembly CC-ZHMT10

Part numbers of CC-ZHMT10

The following table lists the part numbers of the CC-ZHMT10 configuration.

Table 97: Part numbers of CC-ZHMT10

| Part Number | Description | |
|--------------|---|--|
| 51306877-100 | Backplate, Mounting, UHIO | |
| 51202341-102 | I/O link – PM to Series C I/O link cable | |
| 51202984-100 | Cable for C300 Memory Backup Power | |
| 51202347-200 | 24V Power cable | |
| 51202948-300 | 24VDC Power Supply Cable | |
| 51202330-300 | CABLE, BATTERY RAM CHARGER 30IN | |
| 99000222-740 | Screw, Mach, Pan-Head, Slotted, M5x40L, ISO- | |
| 51195195-346 | 1T5ra8d0e -in instructions for upgrade configurations | |
| 51195168-616 | Screw, Thread Forming, BLACK, M5x16 | |
| 51108884-006 | LOCK WASHER, SPLIT, M5 | |
| 51108385-616 | Screw, Mach, Pan-Head, Cross Rec | |
| 51108393-006 | LOCK WASHER, EXT TOOTH | |
| 51108388-006 | HEX NUT | |
| 30735043-302 | NUT, Self Clinching, M3 | |
| 51305978-805 | CABLE ASSEMBLY, ETHERNET, ORANGE | |

Mounting the Universal Hiway Input/Output mounting plate

To mount the Universal Hiway Input/Output mounting plate (51306877-100), perform the following procedure:

- 1. Position the mounting plate to align the screws with the appropriate holes in the cabinet.
- 2. Following Figures show mounting hole alignment according to 7-slot, 10-slot and 13-slot rack locations.

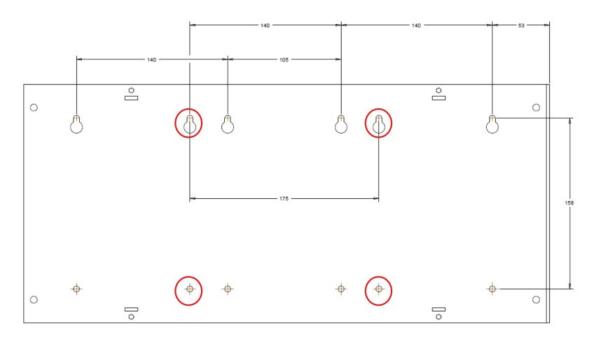


Figure 153: Mounting holes aligned to 7-slot rack

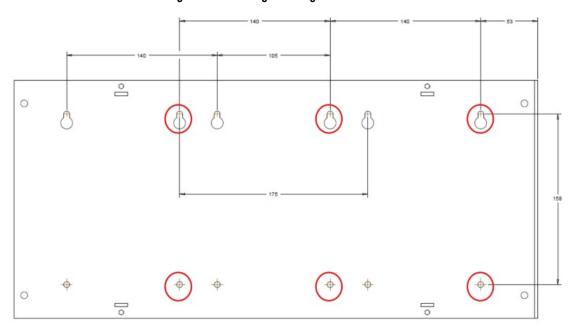


Figure 154: Mounting holes aligned to 10-slot rack

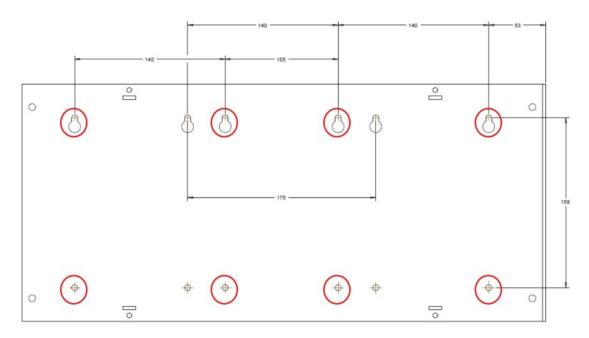


Figure 155: Mounting holes aligned to 13-slot rack

3. Tighten screws to 3.9 Newton-meters.

7.5 Mounting the UHIO components

You can mount the UHIO components in the following order.

- 1. UHIO IOTA on the Horizontal Backplane
- 2. C300/CF9 IOTA on the Horizontal Backplane
- 3. C300 Controller
- 4. Control Firewall
- 5. Universal Input/Output (UIO) module
- 6. UHIO Power supply
- 7. Battery mounting panel and RAM battery



Note

For ease of installation, it is permissible to mount the IOTA's onto the Backplane before mounting the Backplane and IOTA assembly into the cabinet (steps 1 and 2 above). Series C modules can be installed after mounting the Backplane assembly in the cabinet.

For more information about mounting these components, see TDC 2000 CB and EC to UHIO Module Upgrade Kit Installation Guide.

Any installations per this manual are subject to acceptance by the Authority Having Jurisdiction (AHJ).

7.6 General regulatory compliance

Regulatory and agency approvals, for the product described in this document, are only applicable to the product as delivered by Honeywell. Any deviation to the product and or installation instructions, as provided by Honeywell, must be evaluated with regard to all local regulatory requirements. It is the responsibility local Authority Having Jurisdiction (AHJ) to ensure the suitability of the installation of this product and to assess the impact to the installed base certification with regard to all regulatory requirements.

The product described in this document must be installed within an enclosure providing adequate protection for the intended environment and meeting all local regulatory requirements. Refer to all installation instructions provided with the product. It is the responsibility of the local Authority Having Jurisdiction (AHJ) to ensure the suitability of the enclosure and final installation with regard to all regulatory requirements.

The electromagnetic compatibility (EMC) of the product described in this document has been verified, for the intended environment, when installed in an enclosure.

The product described in this document must be installed according to Honeywell Process Solution system configuration rules and installation instructions and within an enclosure providing adequate electromagnetic interference (EMI) protection, for the intended environment. The enclosure should be made of electrically conductive material (metallic) and be enclosed on all sides, with minimal openings. The enclosure chassis must be electrically bonded to protective earth (PE) according to the installation instructions and local electrical code. Openings in the enclosure should not have a dimension larger than 5mm (maximum hole diameter or slot length). Openings in the enclosure with a dimension larger than 5mm, such as vent holes or fan grills, should be covered with wire mesh (metallic) screen and the wire mesh electrically bonded to the enclosure chassis in multiple locations around the perimeter of the opening. The wire mesh should not have openings with dimensions larger than 5mm. Refer to all installation instructions provide with the product. It is the responsibility of the system owner and the local Authority Having Jurisdiction (AHJ) to ensure the suitability of the enclosure and the EMI protection provided by the enclosure.

7.7 COTS AC-DC Power supplies

Only AC-DC power supplies are qualified for use with this product and the power supply must meet the following requirements:

- 1. Industrial EMC requirements according to IEC 61326-1, Table 2 (industrial locations).
- 2. End installation product safety ratings.
- 3. Manufacturer installation requirements
- 4. Power supply cannot be substituted for connection to a dc distribution network.
- 5. If Power Supply is installed external to the UHIO equipment cabinet the dc supply wires must be less than 3m in length.
- 6. Certified to an appropriate Industrial Safety standard.

7.8 Protective Earth (Safety Ground)

⚠ The Protective earth (PE) conductor must be connected to the identified protective conductor terminal (see the figure below) upon equipment installation. The Protective earth conductive terminal is sized to accommodate a maximum 10AWG (5.26mm^2).

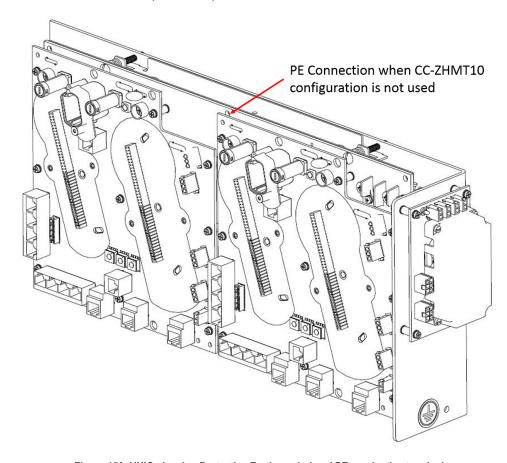


Figure 156: UHIO showing Protective Earth symbol and PE conductive terminal

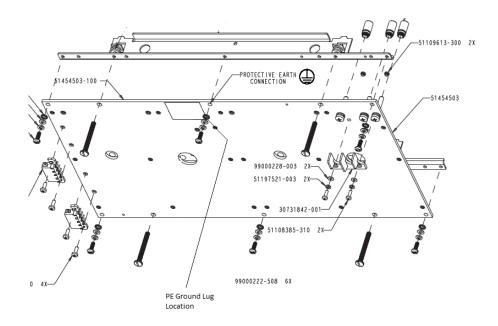


Figure 157: UHIO backplane showing Protective Earth connection

Use below parts from CC-ZHMT10 configuration to connect wire to the mounting plate

| Part Number | Description |
|--------------|----------------------------------|
| 51108385–616 | Screw, Mach, Pan-Head, Cross Rec |
| 51108393-006 | LOCK WASHER, EXT TOOTH |
| 51108388-006 | HEX NUT |

The screw must be tightened to 3.9 Nm.



Note

When the CC-ZHMT10 configuration is not present the PE ground connection is made to the top center screw on the backpanel as shown in the above diagram. To make this connection loosen the screw at this location and place the PE ground lug between the external tooth lock washer and the flat washer. Now retorque the screw to x Nm (x in lbs).

7.9 Environmental Characteristics

The following table lists the environmental characteristics and requirements for the Series C components.

| Environmental Specifications | Operating Limits | Transportation and Storage Limits | |
|-------------------------------------|---------------------------|-----------------------------------|--|
| Ambient Temperature Range | 0 to +60 °C | -40 to +85 °C | |
| Temp. Rate of Change | <= 1 °C/min | <= 5 °C/min | |
| Relative Humidity ^{2, 3} | 5 to 95% (non-condensing) | 5 to 95% (non-condensing) | |
| Barometric Pressure Altitude | -300 to +2000 m | Any | |
| Corrosives | G3 | G3 | |
| Vibration ^{4, 5} | | | |
| Frequency (Hz) | 0–60 | 0–60 | |
| Acceleration (g) | 0.2 | 0.2 | |
| Mechanical Shock | | | |
| Acceleration (g) | 5 | 25 | |
| Duration (ms) | 30 | 30 | |
| Pollution degree | 2 | | |
| Overvoltage category | II | | |



Note

- Operating limits define the range of operating conditions within which the system is designed to operate.
 Performance characteristics are defined when operating in this state. For more information about the operating limits, see ANSA/ISA D 51.1.
 - a. Transportation and storage limits define the range of conditions to which the system may be subjected without permanent damage to the equipment. Performance is not guaranteed in this state. For more information about the transportation and storage limits, see ANSA/ISA D 51.1.
- 2. This rating applies to the internal ambient temperature of the enclosure with the doors closed.
- 3. The maximum relative humidity specification applies up to 40 °C. Above 40 °C, the RH specification is derated to 55%, to maintain constant moisture content.
- 4. 10 Hz is approximate exact crossover frequency is determined by the intersection of the displacement and acceleration.
- 5. Composite Transportation Test Curve--encompassing maximum Random Vibration power spectral density values associated with ground, air, and sea transportation environments.

8 Rail-Mounted Universal Input/Output (UIO) Module

The Rail-Mounted Universal Input/Output module is designed to mount the Series C Universal Input/Output module vertically on a 35 mm TS-35 DIN (Deutsches Institut für Normung) rail. The entire mounting arrangement is used in non-standard Honeywell cabinets, and wall mount standalone scenarios.

Attention

- You should not mount the rail-mounted UIO module horizontally on a DIN rail.
- The mounting of Input/Output Termination Assembly (IOTA) and power supply for rail-mounted UIO module is identical to the mounting of IOTA and power supply for Series C I/O modules.

The rail-mounted UIO has the following categories.

- **Mechanical** This category is used for holding the IOTAs/IOMs that can be mounted outside the standard Honeywell cabinet with provision for routing the system cables.
- Electrical This category is used for providing an interface to connect ground and power from external power supply to the IOTA screw terminals in non-standard Honeywell cabinets where bus bars are not present. The interface has Printed Wiring Assembly (PWA), which also includes Reverse polarity, Electrostatic discharge (ESD) and Surge protections complying with CE standards.

Benefits

The following are the benefits of rail-mounted UIO module.

- Space consumption is less.
- Cost-effective since there is no investment required for cabinets to mount the module.
- Relocation of components is simple and easy.

Related topics

- "Physical description of rail-mounted UIO module assembly" on page 280
- "Input/output Link (IOL) management" on page 282
- "Single Mode FOE for rail-mounted UIO" on page 283
- "System wiring" on page 284
- "Power supply requirements" on page 286
- "Agency approvals" on page 288
- "Environmental Conditions" on page 289
- "Rail-mounted UIO module assembly" on page 290
- "Mounting base tray assembly on DIN rail" on page 294
- "Mounting UIO module on the IOTA" on page 297
- "Grounding and power connections" on page 299
- "Wiring connections" on page 301
- "Removing rail-mounted UIO module" on page 307
- "Replaceable spare parts" on page 308

8.1 Physical description of rail-mounted UIO module assembly

The following figure illustrates the physical description of rail-mounted UIO module assembly.

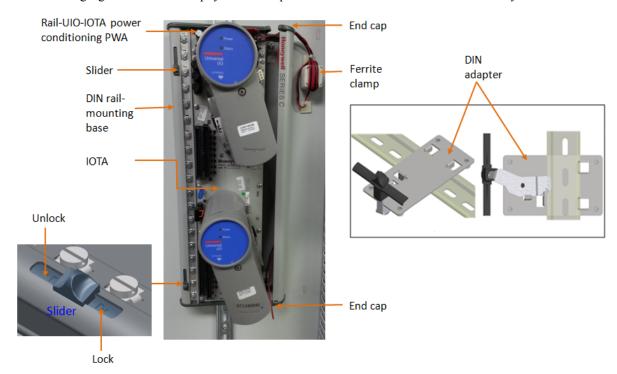


Figure 158: Rail-mounted UIO module assembly

| Component | Description |
|--------------------------------------|---|
| DIN rail-mounting base | It is designed to mount IOTA, UIO, rail-UIO-IOTA power conditioning PWA, end caps, and DIN adapter. |
| Rail-UIO-IOTA power conditioning PWA | It is designed to provide the interface between the external 24V DC power supply and the rail-UIO-IOTA. A conducting copper clamp is used for mounting the Printed Wiring Assembly (PWA) to the IOTA. |
| IOTA | It is mounted directly on the base. The power and ground connections to the IOTA are identical to the power and ground connections of the Series C IOTA and no special instructions are required for mounting. |
| End caps | These caps cover the open ends of the rail-mounted UIO module assembly. |
| Ferrite clamp | This is a device used for reducing the amount of RF (radio frequency) noise, or interference, in a wire that conducts electricity. Ferrite clamps are typically used for improving the performance of sound systems, including microphones. |
| Sliders | This is a plastic cap placed over the lever of the clamp, which can be used for locking or unlocking the module on the rail by moving slider towards the lock symbol and moving slider towards the unlock symbol respectively. |
| DIN adapter | This enables the rail-mounted UIO module assembly to be secured to a standard TS35 top hat (35mm width x 7.5 mm Height x 1.5 mm thick) DIN rail. |
| DIN rail stopper | This is used for preventing the rail-mounted UIO module assembly from sliding down during normal operational conditions. |

The following table provides the part numbers of the selected items that would be considered infrastructure for the rail-mounted UIO module assembly.

For redundant rail-mounted UIO module:

| Model Numbers | Description | Quantity | Size | Weight |
|----------------------|--|----------|----------------------------------|---------|
| CC-MDUR18 | Redundant rail-mounted UIO Module | | 510 x 209 x 53 mm (L x W x H) | 1.45 kg |
| CC_TUIO11 | UIO redundant IOTA | 1 | | |
| 51155561-100 | DIN RAIL POWER CONDITIONER WITH FERRITE CLAMP | 1 | | |
| 51454481-100 | ASSEMBLY, RAIL MOUNT SERIES C-18 inch with stopper | 1 | | |
| 51202980-100 | LABEL, RAIL MOUNT AGENCY APPROVAL 18" | 1 | | |

Non-redundant rail-mounted UIO Module:

| Model Numbers | Description | Quantity | Size | Weight |
|----------------------|--|----------|----------------------|---------|
| CC-MDUN12 | Non-redundant rail-mounted UIO Module | | 362 x 209 x 53 mm | 1.25 kg |
| CC_TUIO01 | UIO non-redundant IOTA | 1 | | |
| 51155561-100 | DIN RAIL POWER CONDITIONER WITH FERRITE CLAMP with stopper | 1 | | |
| 51454481-101 | ASSEMBLY, RAIL MOUNT SERIES C-12 inch (includes Stopper) | 1 | | |
| 51202980-101 | LABEL, RAIL MOUNT AGENCY APPROVAL 12" | 1 | | |



Attention

When the equipment is mounted outside, you must use a sun/rain shield protect the unit from direct sunlight.

8.2 Input/output Link (IOL) management

The IOL management includes the following:

- · Support for UIO IOTA versions in rail-mounted UIO assembly.
 - 18" UIO IOTA redundant
 - 12" UIO IOTA non-redundant
- DIN rail support for mounting the rail-mounted UIO assembly.

The rail-mounted UIOs can be mounted in the assembly options as in the following diagram. The following configuration is also applicable for non-redundant version.





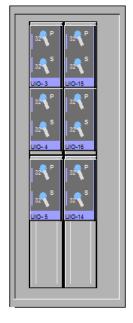




Figure 159: Rail-mounted UIO layout options

| Component | Description | |
|---------------|---|--|
| Drop cables | 51202329-102 – can connect up to 2 redundant UIO IOTA. (I/O link Cable Pair, 6 Drop, 6in pitch) 51202329-402 – can connect up to 3 non-redundant UIO IOTA's. (I/O link Cable Pair, 3 Drop, 12 pitch) | |
| Header cables | 51202329-606 – connecting to IOL1 - (3 drops, gray header cable pair, daisy-chained) 51202329-616 – connecting to IOL2 - (3 drops, Violet header cable pair, daisy-chained) | |
| | Attention Each I/O link can support 40 redundant or non-redundant IOMs. | |
| System tray | IOL needs to run in the system tray of the Rail-mounted UIO. | |

With the 3 drops header cable and 6 drops drop cable, the I/O link can cover 3X3 rail-mounted UIO modules as shown in this diagram.



Attention

For more information about the I/O Link management, refer to the Experion Control Hardware planning Guide.

8.3 Single Mode FOE for rail-mounted UIO

The Single Mode Fiber Optic I/O Link Extender (SMFOE) is used for the Rail-mounted UIO, as this has a DIN rail-mountable option.

Attention

FOE is mandatory for the installation and system wiring for Rail-mounted UIO.

FOE is placed inside the cabinet on the remote group side and also placed inside the cabinet on the control room side

- FOE Component Options: MOXA SMFOE option consists of the following parts.
 - ICF-1150-S-SC-T, MOXA FOE Module, quantity 2
 - 51155436-100- Install kit, IOL Extender on DIN Rail, quantity -1
- The MOXA FOEs clip to a DIN rail and they are laterally secured by end brackets. See *Figure: DC power line wiring through system tray* in the section "Wiring connections" on page 301 for illustration.
- Lower-left or right corner of the cabinet is ideal for mounting the FOE.
- One SMFOE is used for connecting to a matrix of 3X3 rail-mounted UIO network or lower. Refer to the figures in the section "System wiring" on page 284 for illustration.
- SMFOE can extend the I/O link up to 10 KM.
- Temperature specification of MOXA SMFOE is -40 to +85 degC.
- The "leap-frog" topology is supported for the SMFOE similar that of the Multi Mode. For more information about the topology, see "Defining the Fiber Optic topology" on page 511.

8.4 System wiring

The Rail-mounted UIO module end to end connections in 3X3 matrix are shown in the following diagrams. The following figure illustrates the end-to-end system wiring connections in a single cabinet.

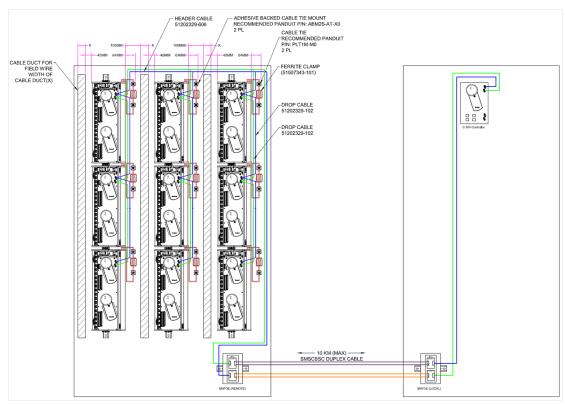


Figure 160: End-to-end system wiring - Rail-UIOs in single cabinet

The following figure illustrates the end-to-end system wiring connections for the adjacent cabinets.

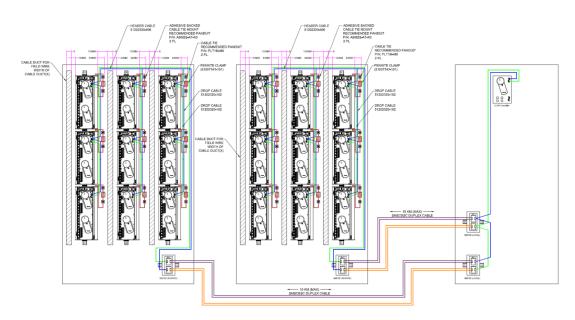


Figure 161: End-to-end system wiring - Rail-UIOs in adjacent cabinet

8.5 Power supply requirements

The rail-mounted UIO module is powered from a +24VDC remote industrial grade power supply. The DC power is supplied directly to each rail-mounted UIO assembly. Note that the customer will supply conditioned power that meets the Series C specifications. It operates reliably from a DC power source of 20VDC to 26VDC. The rail-mounted UIO module in redundant configuration consumes power at 10 Ampere from the power source.

A DC fused terminal block (TB) needs to be mounted inside the non-standard Honeywell cabinet to terminate the incoming DC power cord from the external remote DC power supply. From this terminal strip, a pair of wire with 18 AWG (0.82 mm2) terminates on the rail-mounted UIO TB. See **Figure: DC power line wiring through system tray** in the section "Wiring connections" on page 301 to view the connections of fused TB and FOE.

The below specifications are applicable for each rail-mounted UIO module.

| | Outp | out Specifications | |
|------------------------------------|---|---|---|
| | MUST be MET specifications for Series C system | | |
| | Reference | Operating Limits | Comments |
| | Conditions | Or | |
| | Full load @ 25° C (+/-2° C) is the base reference conditions. Additional conditions are noted below | Operating Feature | |
| DC Output | | 20V min | Must include |
| Voltage (VDC) | | 26V max | combined effects of temp, line/load regulation, aging effects. |
| DC OUTPUT | | Should be not more than | |
| VOLTAGE STABILITY | | +/- 0.1% for 8 hours, following a 6 hour warm-up period | |
| DC output Holdup Time | For all line voltage values within the normal operating band | The DC output should be maintained (with maximum load current) for at least 20 milliseconds after a (100%) dropout of the AC line input | |
| Low Freq - Ripple & Noise | From DC to 2x power line frequency and at the switch mode frequency | Less than 200 milli-volts peak-to-peak | For all input line and output load conditions. |
| Noise on the Negative Output | DC to 50MHz | Less than 3.0V peak-to-peak | Measurement to be made between System Common and Safety Ground |
| Output Current Limiting | Power supply should be capable of operating without damage continuously. | For power supply(ies) of 20A or less, the soft limit is 135%. For power supply(ies) between 20A to 40A, the soft limit is 120% For safety reasons, once the hard limit (200%) is reached, the power supply must shutdown the DC output (0 volts). | No component rating should be exceeded during an overcurrent condition. |

| 24V Power down | When 24V rail falls below 19V, the output voltage shall monotonically decrease until a reapplication of the AC line input for proper system shutdown/operation |
|--|--|
| STABILITY UNDER BROWNOUT CONDITIONS | When the Input AC line voltage is below the minimum operating limit (e.g., between 0 and 85 VAC) the power supply will not be damaged. The difference between the power-up and power-down thresholds shall be 10% of the low line operating limits |
| Soft Start feature | Rise Time: > 10ms |

Reverse voltage protection

The Rail-UIO-IOTA power conditioning PWA (51307106-175) is mounted on the rail-mounted UIO assembly, which is provided with the reverse protection feature. This feature protects the rail-mounted UIO modules from the reverse polarity.

Routing of DC power lines

Each rail-mounted UIO requires a separate pair of +24V DC and GND lines from the fused Terminal Strip. The power lines are routed in the system tray of rail-mounted UIO. See **Figure: DC power line wiring through system tray** in the section "Wiring connections" on page 301 for illustration.

8.5.1 Fused Terminal Block

The Terminal Block is fused and the typical fuse rating for powering a single rail-mounted UIO module is as follows:

- Typical operating current: 15 Amps
- VDC: >30V
- Operating temperature: -40 to 70 degC
- · Fast acting, Glass type removable fuse from the terminal block is preferred
- Meets the UL/CSA 248-14 standard
- I²t rating > 950 Amphere² second
- Fuse should meet the local agency approval requirements

8.5.2 Circuit Breaker

The AC input line to the DC power system must be protected by an appropriately sized circuit breaker.

Compliance

Power wiring must conform to the local electric code like NEC and CEC or any other local electric code.

8.6 Agency approvals

The rail-mounted UIO has the following agency approvals. These agency markings are applied on the Rail-UIO product level and not on the non-standard cabinets in which Rail-UIO are mounted.

- CE and CTick: Applicable at individual component level Power conditioner PWA and Base tray
- HAZLOC (Class 1/Div 2) CSA, FM, ATEX, IECx: Applicable at rail-mounted UIO product level.

8.7 Environmental Conditions

| Consideration | Operating Limits (1) | Storage Limits (1a) |
|---------------------------|--|------------------------------------|
| Ambient Temp Range | -40 to +70°C | -40 to 85°C |
| Temp. Rate of Change | <= 1°C/min. | <=5°C/min. |
| Relative Humidity (2) | 5 to 95% (non condensing) (3) | 5 to 95%, (non condensing) (3) |
| Corrosives | G3 Standard (ISA S71.04) – Denoted by "CC-" model number | G3 |
| Ingress Protection | IP 20 NEMA 1 | IP 20 NEMA 1 |
| EMC | Emissions: | N/A |
| | EN61326-1: 2006 | |
| | EN55011:2009+A1:2010 Class A | |
| | Immunity: | |
| | EN61326-1:2006 | |
| | Harmonics: EN61000-3-2 | |
| | Flicker: EN61000-3-3 | |
| EMI | 10 V/M ⁽⁴⁾ | N/A |
| ESD | 8kV 20x once/5 seconds (5) | N/A |
| Vibration | Sinusoidal (6) | Random (7) |
| (3 axes) | 10 to 60 Hz | 10 to 60 Hz |
| | 0.5g Max acceleration | 1g Max acceleration |
| | 0.1 inches displacement | 0.1 inches displacement |
| Mechanical Shock (3 Axes) | 0.5g max for a duration of 30ms max | 20g max for a duration of 30ms max |

•

Attention

- (1) Operating Limits define the range of operating conditions within which the system is designed to operate.
 Performance characteristics are defined when operating in this state. Refer to ANSA/ISA D 51.1 for more information.
 - Transportation and Storage Limits define the range of conditions to which the system may be subjected without permanent damage to the equipment. Performance is not guaranteed in this state. Refer to ANSA/ISA D 51.1 for more information.
- (2) This rating applies to the internal ambient temperature of the enclosure with the doors closed.
- (3) The maximum relative humidity spec applies up to 40°C. Above 40°C, the RH spec is de-rated to 55% to maintain constant moisture content.
- (4) Measured with the field strength meter near the surface of the electronics with doors open.
- (5) Applied to items those are likely to be in contact with discharge sources (For example, human body) during typical maintenance actions.
- (6) 10 Hz is approximate exact crossover frequency is determined by the intersection of the displacement and acceleration.
- (7) Composite Transportation Test Curve--encompassing maximum Random Vibration power spectral density values associated with ground, air, and sea transportation environments.

The rail-mounted UIO is not designed to meet the Marine Application requirement.

8.8 Rail-mounted UIO module assembly

Installation declarations



Attention

This equipment shall be installed in accordance with the requirements of the National Electrical Code (NEC), ANSI/NFPA 70, or the Canadian Electrical Code (CEC), C22.1. It is supplied as "open equipment" that is intended to be mounted on a sub-panel within an enclosure. The suitability of the enclosure and installed system shall be acceptable to the local "authority having jurisdiction," as defined in the NEC, or "authorized person" as defined in the CEC.

Electrostatic discharge can damage integrated circuits or semiconductors if you touch connector pins or tracks on a printed wiring board.

- Touch a grounded object to discharge static potential.
- · Wear an approved wrist-strap grounding device.
- Do not touch the wire connector or connector pins.
- Do not touch circuit components.
- If available, use a static safe workstation.
- When not in use, keep the component in its static shield box or bag.



Attention

Unless the location is known to be non-hazardous, do not perform the following while the control system is powered.

- Connect or disconnect cables
- Install or remove components
- · Install or remove isolators

8.8.1 Assembling the base tray



Attention

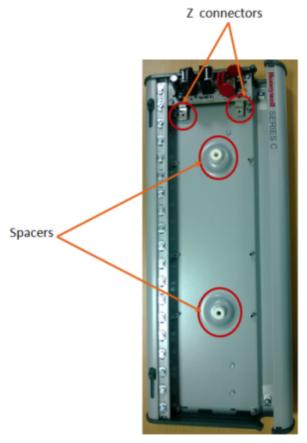
This procedure is applicable for both 12 inch and 18 inch IOTA boards.

Prerequisites

- · Power supply is installed
- · Control firewall is installed
- All wiring and pre-fabricated cables are available and labeled, as applicable
- Ensure all power is turned off at the installation location
- · Mounting hardware is supplied with the components

To assemble the base tray

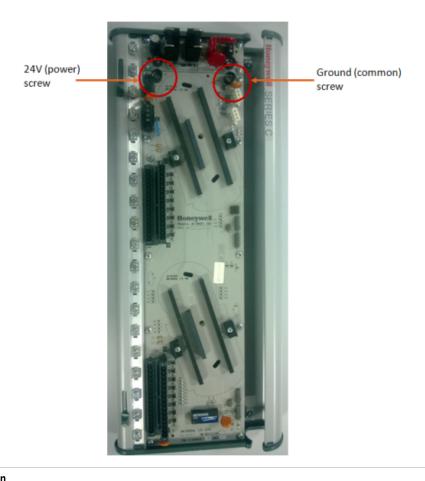
1 Locate the Spacers on the emboss cut on base tray as shown in the following figure:



- 2 Assemble the IOTA Printed Circuit Board Assembly (PCBA) on the base tray using the IOTA mounting screws as follows:
 - Select the desired mounting location on the base tray and align mounting holes in IOTA with screw-hole locations on the base tray. Ensure that component side of IOTA is facing up.
 - 18 inch IOTA board 10 mounting screws
 - While mounting 18 inch IOTA board, it is recommended to secure the three mounting screws on one side (either left or right) and then secure the other side.

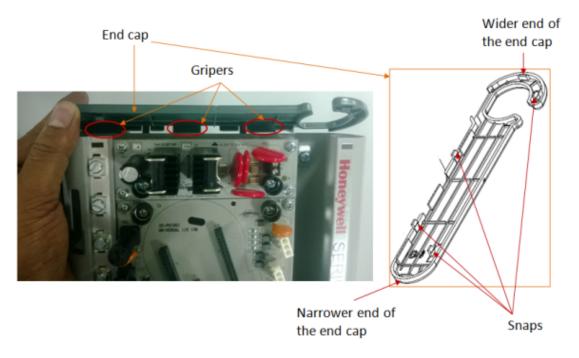
Attention

- It is not recommended to secure the four corner screws and the two middle screws. It might cause bowing of the board and effect the alignment of the IOTA board to the base tray holes.
- 3 Secure the 24V (power) and Ground (common) screws on IOTA PCBA with power supply board through Z connectors.



Attention

- The following steps 4 to 7 are optional and you can follow those steps only if you want to replace the end caps.
- 4 [Optional] Adjust the end cap gripers to base tray such that the gripers are on top and the snaps are at bottom.



- 5 [Optional] Press the end cap into the base tray.
- 6 [Optional] Align both the narrower end and wider end of the end cap to the base tray and press. Ensure that the snap is aligned below the base tray and snap it.



7 [Optional] Repeat the steps 4 through 6 to mount the other end cap on the other end.

8.9 Mounting base tray assembly on DIN rail

The following figure illustrates the graphical representation of mounting instructions.

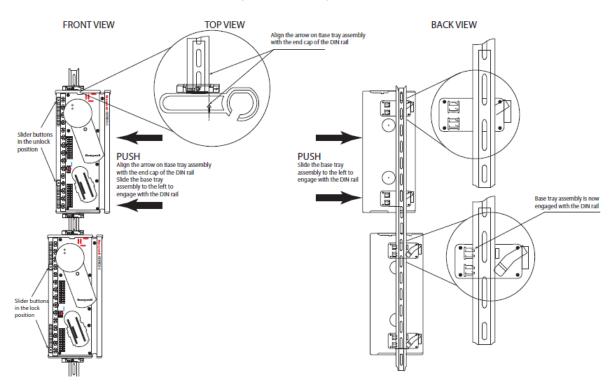


Figure 162: Mounting instructions

For additional details on mounting instructions, refer to the HPS Support website, http://www.honeywell.com/ps.



Attention

The following procedure is applicable for both 12 inch and 18 inch IOTA boards.

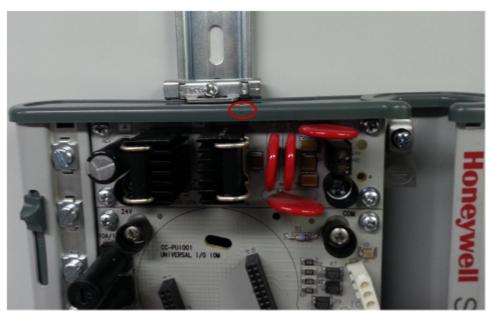
To mount the base tray assembly on DIN rail

- 1 On the DIN rail mounting base, assemble the IOTA, rail-UIO-IOTA power conditioning PWA, and end caps as per the Series C mounting method.
- 2 On a vertically-mounted DIN rail, mount the stopper at the bottom of the DIN rail.



Attention

- Before mounting base tray assembly on DIN rail, ensure that both the sliders are unlocked.
- 3 Ensure that both the slider knobs are pointed toward the upper position of the slot and then mount the base tray assembly on DIN rail.
- 4 Use the arrow on the end caps as a reference and align the end cap to the DIN rail as in the following figure.



5 Slide the base tray assembly toward the left to engage with the DIN rail. Push both the sliders downwards till it reaches the maximum position at the bottom to lock the base tray assembly on the DIN rail.



- **6** Push the base tray assembly down till it supports on the DIN rail stopper.
- 7 Mount another DIN rail stopper on the top of the base tray assembly to fix the base tray tightly.
- 8 Mount the UIO module on IOTA base tray. For more details about mounting the UIO module, refer to the section *Mounting UIO module on the IOTA*.
- 9 Connect the system cables (IOLINK cables, power supply cables, and the grounding wires) on the right of the rail-mounted UIO module. In addition, connect the field wire cables through cable duct on the left of the rail-mounted UIO module. For more details about wiring connections, refer to the section *Wiring connections*.

8.10 Mounting UIO module on the IOTA

Prerequisites

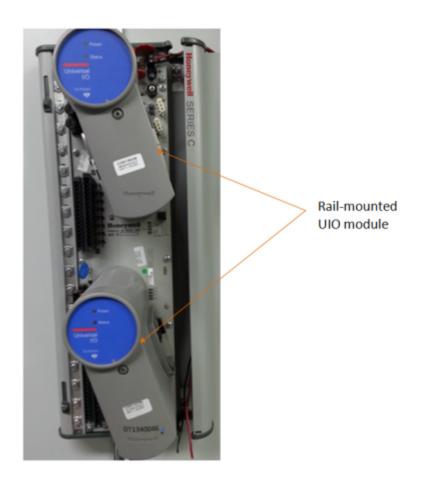
- IOTA is mounted on the base tray
- · Power supply is installed
- · Control firewall is installed
- All wiring and pre-fabricated cables are available and labeled as applicable
- Ensure that power is turned off at the location of UIO installation
- Mounting hardware is supplied with the components

To mount UIO module on IOTA

- 1 Insert the UIO module into IOTA board and ensure that the circuit board matches properly with the IOTA board connector.
- **2** Secure the module to the:
 - IOTA board with two screws located at each side of the plastic cover.
 - Base tray with the long gray plastic screw located at the front of the module. This is applicable only if this provision exists.

Attention

- Ensure that the lifting lever, which is available with the UIO module, should be in vertical position to ensure
 proper insertion of the IOM with the IOTA.
- Only use a #2 Phillips screwdriver to carefully loosen or tighten the long gray plastic screw. Do not use either
 a #1 Phillips screwdriver or a battery-powered screwdriver to remove or install the plastic screw as this can
 damage the screw head.



8.11 Grounding and power connections

Attaching the IOTA board

The non-standard Honeywell cabinet allows rail-mounted UIO assembly to support the attachment of the IOTA boards. After power and chassis connections, grounding is provided to the IOTA board. The following figure illustrates the sequence for power connections.

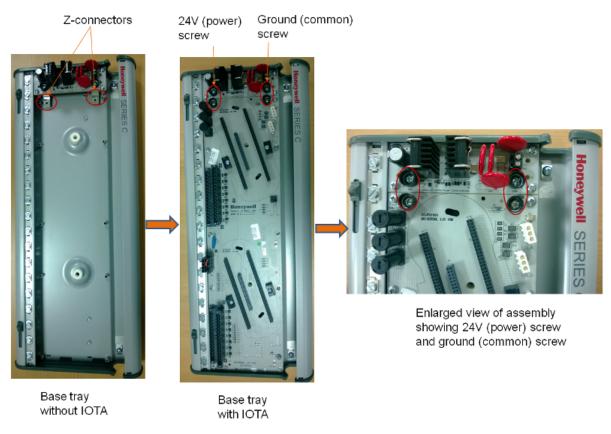


Figure 163: Power connections

The following diagram illustrates the grounding connections.



Figure 164: Grounding connections

Testing the power at the IOTA screw

Attention

Extreme care must be taken when testing the power at the IOTA screw. Improper testing can result in an electrical short circuit, which will affect all modules attached to the base tray assembly. Never use a test probe at an unattached IOTA's 24V screw hole. The probe can potentially touch the back channel assembly causing a short circuit.

The following locations are recommended for testing power:

- Preferred location if IOTAs are attached
 - Center of the screw that attaches the IOTA to the rail-UIO-IOTA power conditioning PWA.
- Preferred location if IOTAs are NOT attached
 - Center of the screw of the top connection terminal for power cable.

Insert the test probe at the center of the screw that attaches the IOTA to the 24V power connection.

8.12 Wiring connections

Wiring connection details of IOTA

The following table provides details about UIO modules, associated IOTAs, and ancillary hardware.

| IOM block type | IOM model number | IOTA model number | | IOTA supported FTAs or ancillary cards |
|----------------|------------------|-------------------|--------------------|--|
| UIO | CC-PUIO01 | CC-TUIO01 | UIO, Non-Redundant | None |
| | | CC-TUIO11 | UIO, Redundant | |

The following figure illustrates the wiring drawing of rail-mounted UIO module assembly.

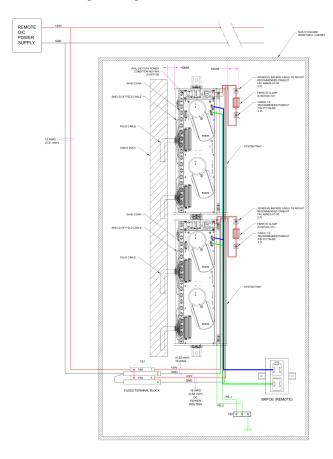
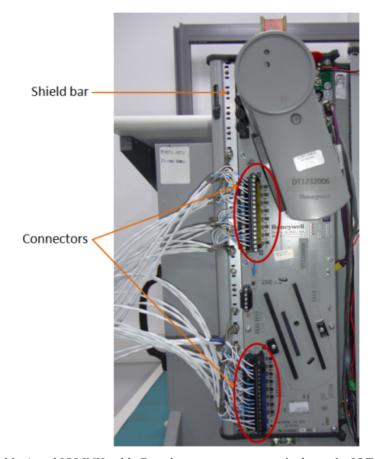


Figure 165: DC power line wiring through system tray

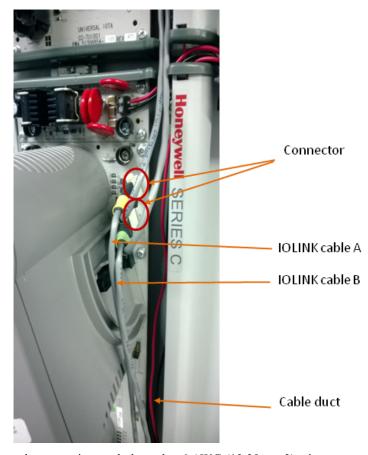
8.12.1 Connceting wires and cables

To connect wires and cables

1 Shielded field cables are connected to the connector and the cable shields are connected to the shield bar of the base tray.



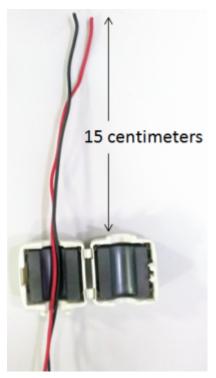
2 Connect IOLINK cable A and IOLINK cable B to the connectors respectively on the IOTA board. Ensure that all IOLINK cables and power cables are pulled through the cable duct in the base tray.



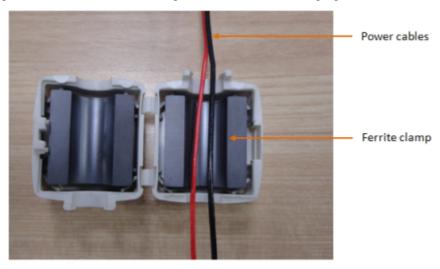
3 Connect the chassis to the protective earth through a 6 AWG (13.29 mm2) wire.



- 4 Before connecting the power cables from the power supply to the connector, wind the power cables as follows:
 - Place the ferrite clamp in such a way that the distance between ferrite clamp and end of the power cables is 15 centimeters. However, end of the power cables are connected to rail-UIO-IOTA power conditioning PWA. The guage of the wire is 18 AWG (0.82 mm2), which is used for Ferrite clamp wounding.



b Place the power cables on the ferrite clamp as shown in the following figure.



c Wind the power cables on the ferrite clamp as shown in the following figure.



d Wind the four turns on the ferrite clamp as shown in the following figure.



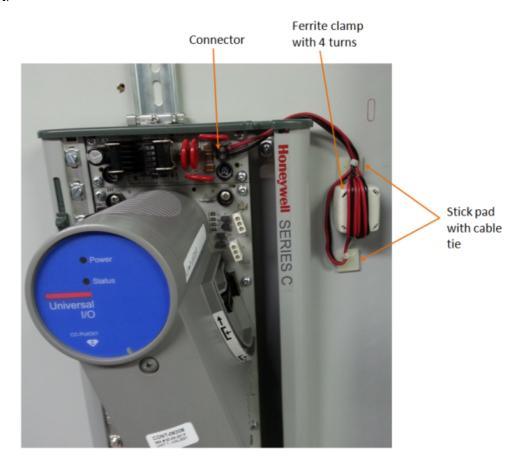
e Lock the ferrite clamp as shown in the following figure.



f A Ferrite clamp with 4 turns wound together as shown in the following figure.



5 Connect the power cables from the power supply to the connector on the rail-UIO-IOTA power conditioning PWA



8.13 Removing rail-mounted UIO module

Prerequisites

Before removing the rail-mounted UIO module, consider the following:

- Remove all the field wire cables that are connected to the module.
- · Remove ground wires.
- Remove the power supply connections from the assembly.

To remove rail-mounted UIO module

1 Push both the sliders upward till it reaches the maximum position to unlock the module on the DIN rail.



2 Slide the rail-mounted UIO module assembly towards the right to disengage from the DIN rail and remove it.

8.14 Replaceable spare parts

The following table lists the replaceable spare parts.

| Part number | Spare part name | |
|--------------|--|--|
| 51307106-175 | RAIL UIO-IOTA POWER INPUT-PWA | |
| 51507343-101 | FERR RND CBL SNAP 8.5-10.5MM GRY | |
| 51454430-100 | BASE, SERIES C MOUNTING FOR 18" IOTA | |
| 51307110-100 | END CAP, BASE, TOP, SERIES C MOUNTING | |
| 51307110-101 | END CAP, BASE, BOTTOM, SERIES C MOUNTING | |
| 51307156-100 | ASSEMBLY, DIN ADAPTER, SERIES C MOUNTING | |
| 51454430-101 | BASE, SERIES C MOUNTING FOR 12" IOTA | |

9 Series C I/O Configuration Form Reference

When an IOM block is placed on the Project tab in Control Builder, its associated channel blocks are assigned to the IOM. The following applies to that IOM block:

- You assign each IOM to the IOLINK block (that represents the I/O Link network on which the IOM resides).
- All of the common configuration parameters specific to IOMs are located on the Main Tab of the IOM's configuration form.
- 'Grayed' parameters are either view-only runtime parameters or non-applicable configuration parameters
- The QVCS tab becomes visible when this option is obtained and enabled.

Related topics

```
"Determining Series C I/O block redundancy" on page 310
```

[&]quot;Switchover and Secondary readiness" on page 311

[&]quot;Failure conditions and switchover" on page 312

[&]quot;Configuration tools to create control strategies" on page 313

[&]quot;Configuring the Main tab - IOM block" on page 314

[&]quot;Configuring Server History tab - IOM block" on page 317

[&]quot;Configuring Server Displays tab - IOM block" on page 320

[&]quot;Configuring Control Confirmation tab - IOM block" on page 323

[&]quot;Configuring Identification tab - IOM block" on page 325

[&]quot;Configuring QVCS tab - IOM block" on page 327

[&]quot;Configuring the Calibration tab - IOM block" on page 329

[&]quot;Configuring HART Status tab - IOM block" on page 331

[&]quot;Configuring the Configuration tab - Channel block" on page 332

[&]quot;Configuring the Configuration tab - PI channel block" on page 333

[&]quot;Configuring Channel Configuration tab - UIO/UIO-2 module block" on page 335

[&]quot;UIO/UIO-2 DI channel block configuration" on page 337

[&]quot;Configuring the Configuration tab - UIO/UIO-2 DO channel block" on page 339

[&]quot;Configuring HART Configuration tab - Channel block" on page 341

[&]quot;Configuring HART Device Status tab - Channel block" on page 343

[&]quot;Configuring HART Identification tab - Channel block" on page 344

[&]quot;Configuring HART Variables tab - Channel block" on page 346

[&]quot;Configuring HART Notifications tab - Channel block" on page 348

[&]quot;Configuring Dependencies tab - Channel block" on page 349

[&]quot;Configuring Template Defining tab - Channel block" on page 350

9.1 Determining Series C I/O block redundancy

The IOM blocks represent instances of the I/O Module hardware that reside on the I/O Link network. There is a specific IOM block for each I/O Module type supported in Experion.

The IOM block is used to:

- configure the network address (the IOMNUM) of the IOM device.
 - If the IOM is configured to be redundant, you enter only one IOMNUM. In either case, only one block is created which handles communication to and from both physical IOMs.
 - The hardware design uses a set of push-in IOMNUM identifiers to reduce the chance of duplicate IOMNUMs on the same link.
 - Each IOM block generates system events and alarms for soft failures, IOM synchronization, and IOM switchover.

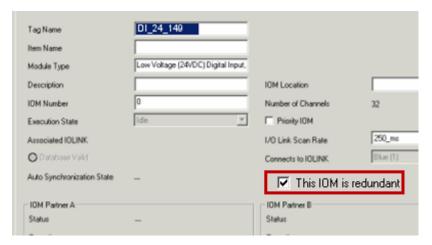


Figure 166: Defining redundancy from the Main tab

9.2 Switchover and Secondary readiness

A switchover describes the process where a Secondary Series C module assumes the Primary state, and the Primary Series C module assumes the appropriate Secondary state of readiness, depending upon what triggered the switchover. A switchover can be triggered immediately upon the detection of a fault in the Primary or upon the receipt of an operator command.

The ability of a Secondary Series C module to take over the assigned control functions of the Primary depends upon which one of the following readiness states reflects its current state.

Table 98: Redundancy state and module readiness

| If Secondary redundancy state is | Then, the Secondary module |
|----------------------------------|--|
| NotSynced Not synchronized | Cannot assume the Primary state. This is a state of non-readiness. Switchover has not occurred. Ensure redundancy has been selected on the IOMs Main tab. |
| FoInProg | Cannot assume the Primary State. In this state, the Secondary module |
| SwapInProg | is copying database information from the Primary. |
| Synchronizing | |
| Syncd | Can assume the Primary state upon switchover. In this state, the |
| Synchronized | database in the Secondary is aligned with the database in the Primary. The Secondary closely tracks database changes to maintain its synchronization with the database of the Primary. Otherwise, the Secondary will revert to a Not Synchronized state. |

9.3 Failure conditions and switchover

Attention

When any failure that results in a switchover occurs in a Secondary module, the Secondary module loses synchronization.

In addition to the failure conditions, this event is reported as diagnostic notification:

- Loss of view of redundant partner on network.
- Loss of private path connection from Primary to Secondary (lonely event).

The following table identifies failure conditions that result in a switchover and those that do not.

Table 99: Failure conditions that result in switchover

| Failure conditions that result in a switchover | Failure conditions that do not | |
|---|---------------------------------------|--|
| | result in a switchover | |
| Power to Primary module fails. | One or all cables fail. | |
| An IOLINK to the Primary Series C module is lost. | One or all network conditioners fail. | |
| Primary Series C module fails. | All supplied power to the link fails. | |

9.4 Configuration tools to create control strategies

The Experion Control Builder application creates control strategies that use Series C I/O data. In developing a valid control strategy, the following activities are required to be supported by Control Builder:

- · create hardware blocks,
- · associate blocks,
- · assign modules,
- · assign devices, and
- · load components.

Regardless of what tool is used to configure Series C I/O, the IOM must be present during configuration load. If the IOM is not present load errors will occur and a subsequent reload or checkpoint restore will be required.

Refer to the Control Building Guide to create control strategies.

9.5 Configuring the Main tab - IOM block

The following configuration information pertains to the Main tab for all Series C module types.

- Redundancy is determined by checking the, This IOM is redundant check box.
- The QVCS tab becomes visible when this option is obtained and enabled.
- · All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24b Block, Configuration form - Main tab.

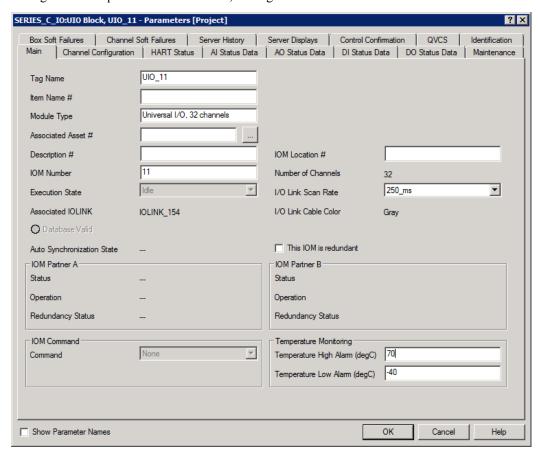


Figure 167: Main tab

The parameters of the Main tab is listed in the following table.

Table 100: Main tab parameters

| Plain text | Parameter name | User configurable | Notes |
|-------------|----------------|-------------------|--|
| Tag Name | TAGNAME | Project Only | System assigned or user configured unique name. Consisting of up to 40 characters and at lease one character must be a letter (A-Z). |
| Item Name | ITEMNAME | Project Only | A non-unique name by which an entity is known within the context of the enterprise model. |
| Module Type | IOMTYPE | No | This non-configurable parameter is a description of the respective I/O module |

| Plain text | Parameter name | User configurable | Notes |
|-----------------------------------|------------------------|-------------------|--|
| Associated Asset | ASSOCASSET | Yes | Allows user to select an asset from those configured in the Enterprise Model Database to set the Scope of Responsibility (SOR) for the point. |
| Description | DESC | Yes | Used to specify descriptive text for the function block. Appears on both detail and group displays. |
| IOM Number | IOMNUM | Yes | This parameter value must be unique on a specific I/O Link, and its range must be between 1 and 40. If IOMNUM=0 and the IOP block is assigned to an I/O Link block, Control Builder automatically defaults the IOMNUM to the next available value on the I/O Link. |
| Execution State | IOMSTATE | No | Defines execution state |
| Associated IOLINK | IOLINK | No | Defines associated IOLINK |
| Database Valid | | No | Defines if database is valid |
| IOM Location | IOPLOCATION | Yes | Identifies the user-entered location (within the plant) where this IOM can be found. |
| Number of Channels | NUMCHANS | No | The number of channels available in the IOM |
| I/O Link Scan Rate | SCANRATE | Yes | Defines scan rate |
| I/O Link Cable Color | IOLINKCOLOR | No | Defines cable color. See |
| | | | "I/O Link Address Jumpers" on page 63 for color listing. |
| This IOM is redundant | IOREDOPT | Yes | Module is part of redundant pair. |
| Status | IOMSTSA | No | Defines status of IOM: |
| | | | Idle, OK, No Response |
| Operation | IOMOPER | No | Defines operation status of IOM: |
| | | | Primary, Secondary |
| Redundancy Status | REDDATA | No | Defines if redundancy is enabled |
| Frequency 60/50Hz (AI LLMUX only) | FREQ6050 | Yes | User-configured power supply determination: |
| | | | 50Hz or 60Hz (AI-LLMUX, DIHV) |
| Command | IOMCOMMAND | No | Swap primary, reset errors, etc. |
| DI Mode | DIMODE | Yes | Defines the mode of the DI-24V and DI-SOE modules to be Normal, SOE, or Low Latency |
| Configured Prover Signal | CONFIGPROVERSIGN AL | Yes | Provides the user the ability to specify on any given Pulse Input Module the signal stream to output to the prover signal screw pair. Only dual streams can be selected. |
| Actual Prover Signal | ACTUALPROVERSIG NAL | No | Provides the user or a program the actual signal stream being output to the prover signal screw pair. |

| Plain text | Parameter name | User configurable | Notes |
|-----------------------------|-----------------|-------------------|---|
| Maintain Selection on Fault | MAINTAINONFAULT | Yes | Provides the user the ability to specify the action to be taken by the system in case of a special condition or faults in the module or its ability to output the selected stream to the prover signal. |
| Temperature High Alarm | TEMPHILM | Yes | Enables the user to configure the temperature value in the range from low limit to +70.0. |
| Temperature Low Alarm | TEMPLOLM | Yes | Enables the user to configure the temperature value in the range from -40.0 to high limit. |

Prerequisites

- Control Builder is running
- A Series C I/O control module was created

To configure the Main tab

- 1 Enter a **Tag Name** that is more meaningful to you than its default pre-assigned number (ex. Test Strategy DI Module).
- 2 Item name is based on relationship established in Enterprise Builder
- 3 Enter the **Module Type**.
- 4 Click the ___ button to the right of the **Associated Asset** box. The **Point Selection** dialog box appears.
 - The Fourt Selection dialog box appears.
- Select an asset from those configured in the Enterprise Model Database to set the Scope of Responsibility (SOR) for the point.
 - **Note**: No validation is done at the configuration time. If you enter an asset that does not exist in the points database, the associated asset for the point reverts to the server point. If the asset does exist but is not an area-enabled asset, then the first area-enabled asset up the tree is used for the SOR of that device. A subsequent upload of that device point to Control Builder returns the area-enabled asset and not the original non-assignable asset entered.
- 6 Enter an optional **Module Description** to explain the I/O Module's function
- 7 Enter appropriate values for **IOM Number** to match the plug-in IOM jumper number. If necessary, press F1 to access on-line help for assistance during this step.
- 8 If redundancy is required, check the **This IOM** is redundant check box.
- 9 If you have configured a Pulse Input Module, select the **Maintain On Fault** check box, if required. This parameter provides you the ability to specify the action to be taken by the system in case of a special condition or faults in the module or its ability to output the selected stream to the prover signal.
 - **Note:** You must perform the remainder of the pulse proving configuration at runtime. For more information, refer to the section "Enabling pulse proving in Pulse Input Module" on page 474.
- 10 If you have configured a Universal Input/Output Module, configure the **Temperature High Alarm** value and **Temperature Low Alarm** value in degree Celsius.
 - **Note:** By default, the values of **Temperature High Alarm** and **Temperature Low Alarm** are +70 and -40, respectively.
- 11 Proceed to the following procedures to configure parameters on the remaining tabs for the module, or click OK to accept only the changes made so far and return to the Project tree.

9.6 Configuring Server History tab - IOM block

The following configuration information pertains to the Server History tab for the following modules:

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM
- UIO
- UIO-2

All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Server History tab.

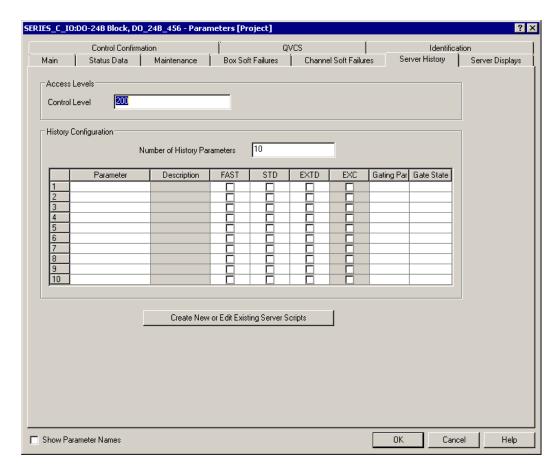


Figure 168: Server History tab

The parameters of the Server History tab are listed in the following table.

Table 101: Server History tab parameters

| Plain text | Parameter name | User configurable | Notes |
|---------------------------------|----------------|-------------------|--|
| Control Level | SCANCTRLLVL | Yes | Indicates Server control level to be associated with this function. |
| Number of History Parameters | HIST.NUMPARAMS | Yes | Defines number of history parameters to be included in History Configuration table. |
| Parameter | HIST.PARAM | Yes | Valid parameter name for a parameter associated with the given point that is to be collected and stored as historical data at predetermined intervals. |
| Description | | No | Provides a brief description of the entered parameter. |
| FAST | HIST.FAST | Yes | Select the Fast type of history collection. |
| STD | HIST.STD | Yes | Select the Standard type of history collection. |
| EXTD | HIST.EXTD | Yes | Select the Extended type of history collection. |
| EXC | HIST.EXC | Yes | Select the Exception type of history collection. |
| | | (Station only) | |

| Plain text | Parameter name | User configurable | Notes |
|---|----------------|-------------------|---|
| Gating Parameter | | Yes | Optional gating parameter to define conditions under which data for this parameter should be collected. |
| Gate State | | Yes | Defines gate state for configured gating parameter. |
| Create New or Edit Existing Server Scripts (Button) | | N/A | Launch the Server scripting configuration utility. |

Prerequisites

- · Control Builder is running
- A Series C I/O control module was created

To configure the Server History tab.

- 1 Under the **Server History** tab, enter the appropriate information for **Control Level** along with values for appropriate parameters related to history collection and archiving. If necessary, press F1 to access on-line help for assistance during this step.
- 2 Proceed to the following procedures to configure parameters on the remaining tabs for I/O Module, or click OK to accept only the changes made so far and return to the Project tree.

9.7 Configuring Server Displays tab - IOM block

The following configuration information pertains to the Server Displays Failure tab for the following modules:

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM
- UIO
- UIO-2

All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Server Displays tab.

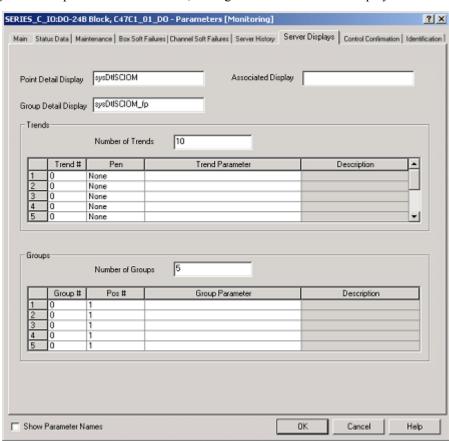


Figure 169: Server Display tab

The parameters of the Server Displays tab are listed in the following table.

Table 102: Server Display tab parameters

| Plain text | Parameter name | User configurable | Notes |
|----------------------|-----------------|-------------------|--|
| Point Detail Display | SCANPNTDTL | Yes | By default, a Display template is already entered into Point Detail Display box (for example, sysDtlFTEB.dsp). This template can be used for creating your own display or it can be used as is, provided that your function block name matches name built into detail display that is supplied as a template. |
| Group Detail Display | SCANGRPDTL | Yes | By default, a Display template is already entered into the Group Detail Display box (for example, sysGrpFTEB.dsp). This template can be used for creating your own display or it can be used as is, provided that your function block name matches name built into detail display that is supplied as a template |
| Associated Display | SCANASSOCDSP | Yes | Name of the Server display to be associated with this function block. |
| Number of Trends | TREND.NUMPARAMS | Yes | Defines the number of trend parameters to be included in the Trends Configuration table. |
| Trend # | - | Yes | Defines Trend number to be associated with this trend parameter |
| Trend Position | | Yes | Defines position of the pen that will be used to trace assigned parameter on Station Trend display. |
| Trend Parameter | - | Yes | Valid parameter name for a parameter associated with given point that is configured for history collection. |
| Description | - | No | Provides a brief description of the entered parameter. |
| Number of Groups | GROUP.NUMPARAMS | Yes | Defines the number of group parameters to be included in Groups Configuration table. |
| Group # | - | Yes | Defines Group number to be associated with this group parameter. |
| Pos # | - | Yes | Defines number of position configured parameter will occupy in the Station Group display. |
| Group Parameter | - | Yes | Valid parameter name for a parameter associated with the given point that is configured in the system. |
| Description | - | No | Provides a brief description of the entered parameter. |

Prerequisites

- · Control Builder is running
- · A Series C I/O control module was created

To configure the Server Displays tab.

1 Under the Server Displays tab, enter the appropriate information to specify related Point Detail Display, Group Detail Display, and Associated Display along with values for appropriate parameters to define Trends and Groups for display. If necessary, press F1 to access on-line help for assistance during this step 2 Click OK on the configuration form to accept all configuration selections made on each configuration tab and to return to the Project tree.

9.8 Configuring Control Confirmation tab - IOM block

The Control Confirmation tab is common to all configuration forms for tagged blocks in Control Builder. If you have an optional Electronic Signature license, you can configure electronic signature information for the tagged block through this tab on the block's configuration form in Control Builder.

The Electronic Signature function aligns with the identical Electronic Signatures function that is initiated through Quick Builder and Station for Server points.

When this block is loaded to a controller,

- its control confirmation configuration (electronic signatures) is also loaded to the Server
- you can view the control confirmation configuration for this tagged object in Station and also make changes to it.
 - If you make changes through Station, you must initiate an Upload or Upload with Contents function through the Controller menu in Control Builder for the object in the Monitoring tab to synchronize changes in the Engineering Repository Database (ERDB).

The following configuration information pertains to the Control Confirmation tab for all Series CI/O modules.

Control Confirmation is enabled by checking the Control Confirmation check box.

All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Control Confirmation tab.

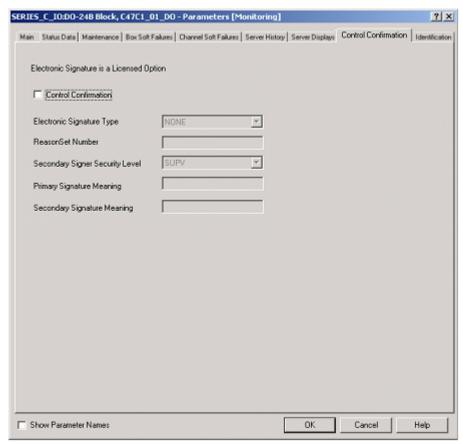


Figure 170: Control Confirmation tab

Prerequisites

- Control Builder is running
- · A Series C I/O control module was created

To configure the Control Confirmation tab.

- 1 Under the **Control Confirmation** tab, check or clear the Control Confirmation check box. If necessary, press F1 to access on-line help for assistance during this step.
- 2 If the Control Confirmation check box is checked, the Electronic Signature Type drop-down list is enabled, with the options to select:
 - NONE
 - SINGLE
 - DOUBLE
- 3 Proceed to the following procedures to configure parameters on the remaining tabs for I/O Module, or click OK to accept only the changes made so far and return to the Project tree.

9.9 Configuring Identification tab - IOM block

The following configuration information pertains to the Identification tab for all Series C I/O modules.

All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Identification tab.

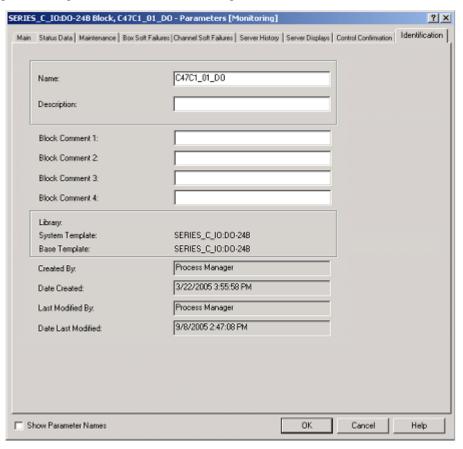


Figure 171: Identification tab

The parameters of the Identification tab are listed in the following table.

Table 103: Identification tab parameters

| Plain text | Parameter name | User configurable | Notes |
|---|--|----------------------|---|
| Name | NAME | Yes | Unique block name consisting of up to 40 characters to identify the block. At least one character in the name must be a letter (A-Z). |
| Description | DESC | Yes | Descriptive text appears on detail and group displays to uniquely describe this particular function block |
| Block Comment 1 Block Comment 2 Block Comment 3 | BLCKCOMMENT1 BLCKCOMMENT2 BLCKCOMMENT3 | Yes | Comment to be associated with this block consisting of up to 40 characters. |
| Block Comment 4 | BLCKCOMMENT4 | | |

| Plain text | Parameter name | User | Notes |
|--------------------|----------------|--------------|--|
| | | configurable | |
| Library | - | No | Identifies Control Builder Library that is source of template. |
| System Template | - | No | Identifies System Template that is source for this block. |
| Base Template | - | No | Identifies Base Template that is used for this block. |
| Created By | CREATEDBY | No | Identifies user who created block, if operator security is implemented. Otherwise, may just show Default login. |
| Date Created | DATECREATED | No | Shows date and time template was created. If this block is in Version Control System, shows date and time initial version of template was created. |
| Last Modified By | MODIFIEDBY | No | Identifies user who made last modifications to block, if operator security is implemented. Otherwise, may just show default login. If this block is in Version Control System, modifications apply to last version of block. |
| Date Last Modified | VERSIONDATE | No | Shows date and time last modification was made to block's configuration. If this block is in Version Control System, modification date and time applies to last version of block. |

Prerequisites

- Control Builder is running
- A Series C I/O control module was created

9.10 Configuring QVCS tab - IOM block

Qualification and Version Control System (QVCS) provides version management for all tagged objects and a customer defined lifecycle management.

The following configuration information pertains to the QVCS tab for the following modules:

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM
- UIO
- UIO-2

Note: No user-defined configuration setting on the QVCS tab.

All illustrations used in the procedure are for example purposes only

The following is an example of a DI-24 Block, Configuration form - QVCS tab.

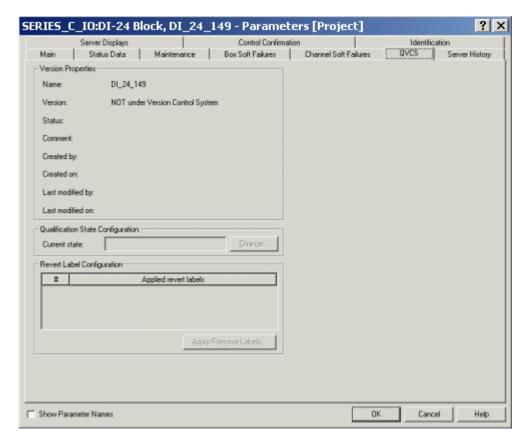


Figure 172: QVCS tab

Prerequisites

- The optional QVCS license has been obtained and enabled
- Control Builder is running
- A Series C I/O control module was created

9.11 Configuring the Calibration tab - IOM block

The following configuration information pertains to the Calibration tab for the following modules:

- AI-HART
- AI-HL
- AI-LLMUX
- AO
- AO-HART
- SP
- SVP

Calibration can only be done from Monitoring.

The Execution State must be set to IDLE before enabling and modifying calibration status.

All illustrations used in this procedure are for illustration purposes only

The following is an example of an AI-HART Block, Configuration form - Calibration tab.

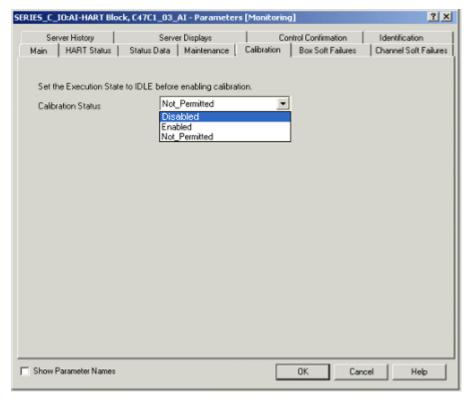


Figure 173: Calibration tab

Prerequisites

- · Control Builder is running
- A Series C I/O control module was created

To configure the Calibration Status

- 1 Select either:
 - Disabled indicates disabling Calibration

• Enabled indicates enabling Calibration

Not Permitted indicates the Execution State of the IOM is still in the RUN state, which does not allow you to select Disable or Enable. Changing the Execution State of the IOM to IDLE allow you to modify the Calibration Status.

2 Proceed to the following procedures to configure parameters on the remaining tabs for the module, or click OK to accept only the changes made so far and return to the Project tree.

9.12 Configuring HART Status tab - IOM block

The following configuration information pertains to the HART Status tab for the following:

- AI-HART
- AI-HL
- AO
- AO-HART
- UIO
- UIO-2

Note: No user-defined configuration setting on the HART Status tab and there are no configuration items in HART status tab.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI-HART Block, Configuration form - HART Status tab.

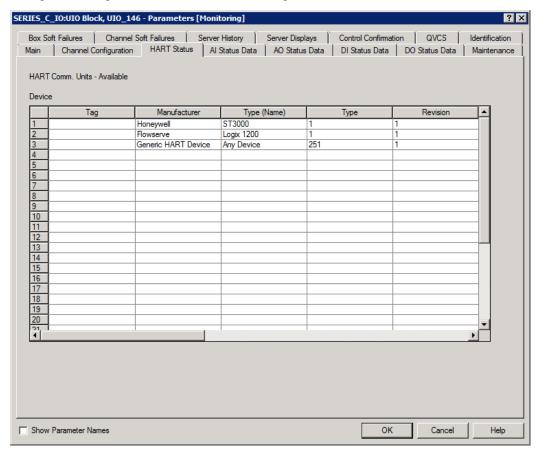


Figure 174: HART Status tab

Prerequisites

• A Series C I/O control module is created

9.13 Configuring the Configuration tab - Channel block

The following configuration information pertains to the Configuration tab for Series C I/O Analog Input or Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AO Channel Block, Configuration form - Configuration tab.

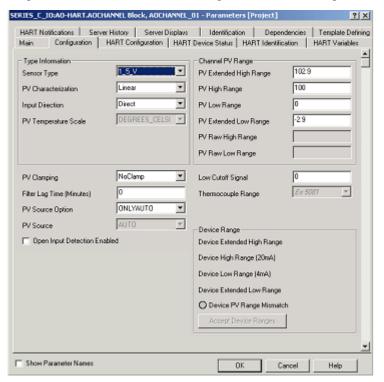


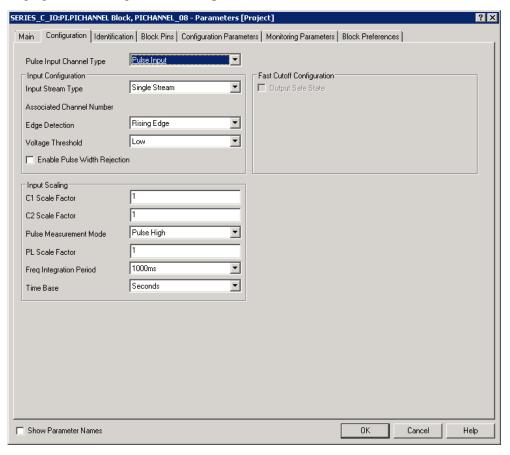
Figure 175: Configuration tab

Prerequisites

• A Series C I/O control module is created

9.14 Configuring the Configuration tab - PI channel block





To configure the Configuration tab

- 1 Click the Configuration tab of the channel block.
 The Configuration tab configuration form appears. The value Pulse Input is selected by default in the Pulse Input Channel Type box.
- 2 Select the pulse input type in the **Pulse Input Channel Type** box. The available options are as follows:
 - Pulse Input- You can configure all eight channels as pulse input channel types.
 - Pulse Input with Fast Cutoff- You can only configure channel 7 and channel 8 for fast cutoff applications.

The following parameters in the **Main** tab of the PI channel block are enabled after the module is loaded when the input type is **Pulse Input with Fast Cutoff**.

- Output Safe State (SAFEOUTPUT)
- Target Value (TV)
- TV Processing Run Flag (TVPROC)
- Output State (SO)
- Bad Output State Flag (BADSO)
- SO Command OFF (SOCMDOFF)
- SO Command ON (SOCMDON)

Note: These parameters are disabled when the input type is selected as **Pulse Input**.

- 3 Select the input stream type in the **Input Stream Type** box. You can select one of the following:
 - Single Stream You can select this option for all channels.
 - **Dual Stream** You can select this option only for odd-numbered channels.

When you configure a channel for **Dual Stream**, its associated even-numbered channel number appears in the **Associated Channel Number** box.

For example, if you have configured channel 1 for dual stream, the channel number 2 appears in the **Associated Channel number** box.

Attention

- When you select the pulse input channel type as **Pulse Input with Fast Cutoff** for Fast Cutoff channels (channel 7 and channel 8), **Single Stream** is selected by default and is non-editable.
- When you select the pulse input channel type as **Pulse Input**, you can configure **Dual Stream** on the Fast Cutoff channels (channel 7 and channel 8).
- Dual Stream option is not applicable for Fast Cutoff channels (channel 7 and channel 8) when the Pulse
 Input Channel type as Pulse Input with Fast Cutoff. In this scenario, the option Single Stream is selected
 by default and is non-editable.
- If you select the Input Stream Type as Dual Stream for odd-numbered channels, then you cannot configure
 their associated even numbered channels. For example, if you have configured channel 1 as Dual Stream, you
 cannot configure channel 2. In addition, the associated channel does not appear in the tree view if you have
 configured the channel for Dual Stream.
- If the CM already contains the even-numbered channel and you try to configure its associated odd-numbered
 channel as Dual Stream, an error message appears. You need to delete the associated even-numbered channel
 from the CM. For example, if a CM contains channel 3 and channel 4, and you try to configure channel 3 as
 Dual Stream, an error message appears. You need to delete channel 4 to configure channel 3 as Dual Stream.
- When a channel is configured for Dual Stream, the Status Data tab of the PIM does not display any values for
 the associated channel in the Monitoring view. For example, if you have configured channel 3 for Dual
 Stream, the channel 4 row in the Status Data tab does not display any values.
- 4 Select the **Enable Pulse Width Rejection** check box if you want the pulse widths less than a specified duration to be excluded from counting.
 - Note: Refer to the Series C Spec and Tech data for the specific duration.
- 5 Refer to the *Control Builder Parameter Reference* document for more information on configuring other parameters.
- 6 Click OK.

9.15 Configuring Channel Configuration tab - UIO/UIO-2 module block

The Channel Configuration tab enables you to configure the channel types of the UIO/UIO-2 module. The following figure is an example of the Channel Configuration tab of the UIO/UIO-2 module.

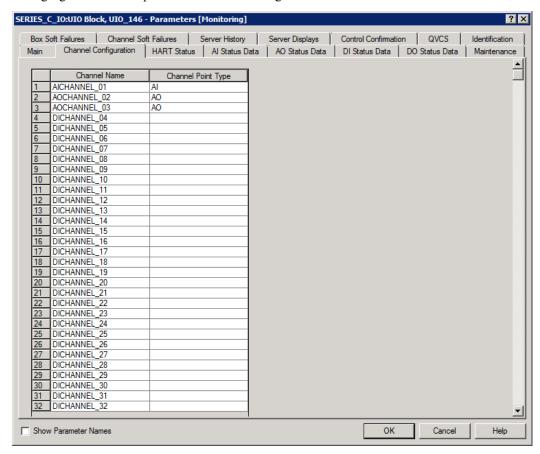


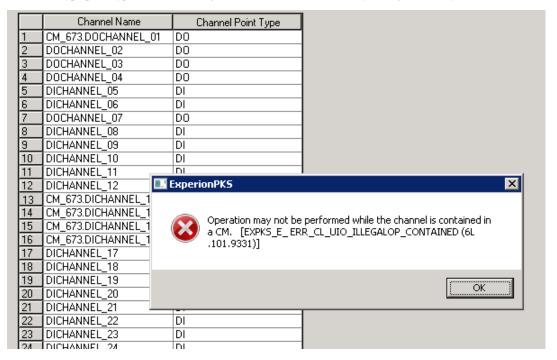
Figure 176: Channel Configuration tab

To configure the Channel Configuration tab

- 1 From the Monitoring view, right-click the UIO channel and click Block Properties. The UIO channel configuration form appears.
- Click the Channel Configuration tab.The Channel Configuration tab configuration form appears. The point type is selected as DI, by default.

Attention

The channel type/point type cannot be changed if the UIO channel is already configured in any Control Module.



3 Select the point type for each Channel Name.

Note: When the channels are configured in the Channel Configuration tab, the respective status data tabs (AI Status Data, AO Status Data, DI Status Data, and DO Status Data) are updated with the channel configuration information.

Attention

- You can also configure the channel type from the Project view by performing the following steps.
 - 1. Right-click the channel name.
 - Click Channel Type Setting and click channel type.
 Channel Type Setting option does not appear in the Control Builder if a UIO channel is already configured in any Control Module.
- 4 Click OK.

9.16 UIO/UIO-2 DI channel block configuration

The Configuration tab enables you to configure the DI channels for pulse counting functionality.

The following figure is an example of the Configuration tab of the UIO-DI channel.

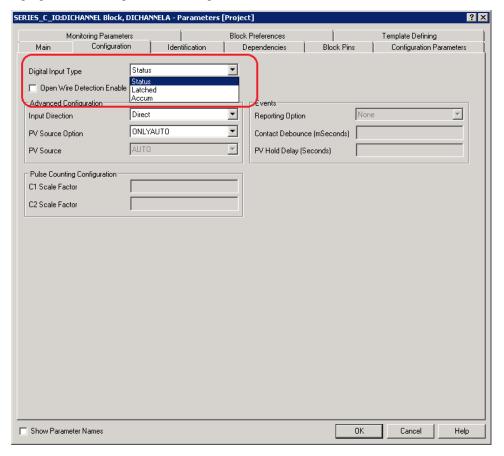


Figure 177: Configuration tab - UIO-DI channel

9.16.1 Configuring the DI channel for pulse counting

DI channel pulse counting functionality is configured for pulse counting.

Prerequisites

For UIO, you can configure up to four channels only on DI channels 15 to 18 for pulse counting.

For UIO-2, you can configure up to four of any of the available 32 channels configured as DI for pulse counting.

To configure the Configuration tab

- 1 From the Project view, right-click the UIO-DI channel and then click **Block Properties**. The UIO-DI channel configuration form appears.
- 2 Click the Configuration tab.
- 3 Configure the **Digital Input Type** as "Accum."
- 4 Click OK.

Results

The DI channel is configured for pulse counting.

9.17 Configuring the Configuration tab - UIO/UIO-2 DO channel block

The Configuration tab enables you to configure the DO channels for ganging.

The following figure is an example of the Configuration tab of the UIO-DO channel.

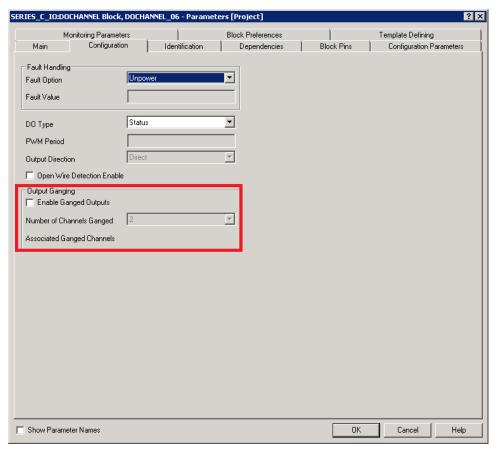


Figure 178: Configuration tab - UIO-DO channel

9.17.1 Configuring the DO channel for ganging

Prerequisites

Adjacent channel that are being ganged must be configured as DO channel types and not contained individually in other Control Modules.

- For UIO, up to four channels (2, 3 or 4) channels can be ganged within any four adjacent channels. For example: you can gang channels 4 and 5 or 4, 5 and 6 or 4, 5, 6 and 7. However, channels 32 and 1 cannot be ganged.
- For UIO-2, DO ganging within the following eight channel number groups is possible: 1 4, 5 8, 9 12, 13 16, 17 20, 21 24, 25 28, and 29 32. However, ganging across these groups is NOT possible. For example, ganging channels 3, 4, and 5 is not possible as they do not belong to the same channel group Ch 1 to 4 or Ch 5 to 8.

To configure the Configuration tab

1 From the Project view, right-click the UIO-DO channel and click **Block Properties**. The UIO-DO channel configuration form appears.

2 Click the Configuration tab.

The Configuration tab configuration form appears.

- 3 Select the Enable Ganged Outputs check box.
 - The Number of Channels Ganged drop-down list is enabled for configuration.
- 4 Select the number of channels to be ganged from the Number of Channels Ganged drop-down list.
- 5 Click OK.

Results

The DO channel is configured for ganging.

9.18 Configuring HART Configuration tab - Channel block

The following configuration information pertains to the HART Configuration tab for all Series C I/O Analog Input and Analog Output modules.

The parameter HALARMENABLE is added to HART configuration tab in the channel block and:

- is enabled by default
- in addition, can be changed from monitoring side, irrespective of the channel point execution state of the IOM module state.

Attention

When HALARMENABLE is disabled

- all the existing HART events / alarms from that channel block are disabled
- further generation of the HART alarms / events are terminated.

Note: This parameter affects only the HART alarm / event behavior. The LED device status in the HART device status tab is not impacted by the state of HALARMENABLE.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Configuration tab.

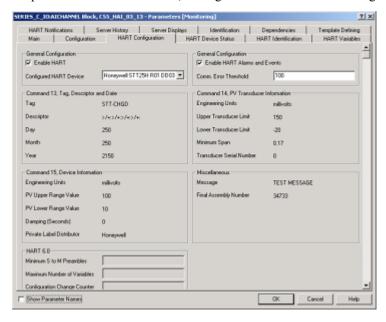


Figure 179: HART Configuration tab

The parameters of the HART Configuration tab are listed in the following table.

Table 104: HART Configuration tab parameters

| Plain text | Parameter name | User configurable | |
|-------------------------------|----------------|-------------------|--|
| General configuration | | | |
| Enable HART | HENABLE | Yes | |
| Enable HART Alarms and Events | HALARMENABLE | Yes | |
| Configured HART Device | HCFGDEV | Yes | |
| Comm. Error Threshold | HCOMTHRS | Yes | |

| Plain text | Parameter name | User configurable | |
|-------------------------------------|----------------|-------------------|--|
| Command 13, tag descriptor and date | | | |
| Tag | HTAG | No | |
| Descriptor | HDESC | No | |
| Day | HDAY | No | |
| Month | HMONTH | No | |
| Year | HYEAR | No | |
| Command 14, tag descriptor and date | | | |
| Engineering Units | HTDEU | No | |
| Upper Transducer Limit | HTDURL | No | |
| Lower Transducer Limit | HTDLRL | No | |
| Minimum Span | HTDMINSPAN | No | |
| Transducer Serial Number | HTDSN | No | |

Prerequisites

• A Series C I/O control module is created

9.19 Configuring HART Device Status tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Device Status tab.

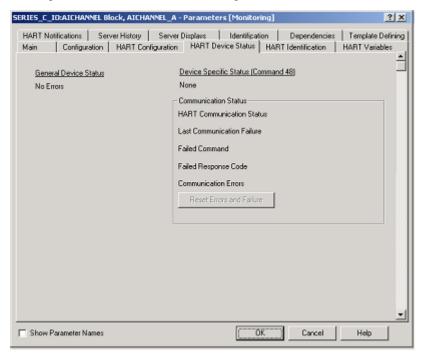


Figure 180: HART Device Status tab

The parameters of the HART Device Status tab are listed in the following table.

Table 105: HART Device Status tab parameters

| Plain text | Parameter name | User configurable |
|----------------------------|----------------|-------------------|
| Communication Status | | |
| HART Communication Status | HCOMSTS | No |
| Last Communication Failure | HCOMFAIL | No |
| Failed Command | HCMDFAIL | No |
| Failed Response Code | HCMDRESP | No |
| Communication Errors | HNCOMERR | No |

Prerequisites

A Series C I/O control module was created

9.20 Configuring HART Identification tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O Analog Input and Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Identification tab.

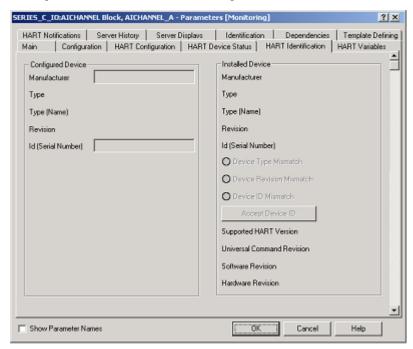


Figure 181: HART Identification tab

The parameters of the HART Identification tab are listed in the following table.

Plain text Parameter name User configurable Configured device Manufacturer **HDVMFGCD** No HDVTYPCD Type No **HDVTYPCDNAME** Type (Name) No **HDVRREVCD** Revision No Id (Serial number) **HDEVIDCD** No Installed device Manufacturer **HDEVMFG** No **HDEVTYP** No Type

No

No

No

No

HDEVTYPNAME

HDEVRREV

HDEVMISM

HDVID

Table 106: HART Identification tab

Type (Name)

Id (Serial number)

Device Type Mismatch

Revision

| Plain text | Parameter name | User configurable |
|----------------------------|----------------|-------------------|
| Device Revision Mismatch | HREVMISM | No |
| Device ID Mismatch | HDEVIDFL | No |
| Accept Device ID | ACCEPTDEV | No |
| Supported HART Version | HARTVERSION | No |
| Universal Command Revision | HUCMREV | No |
| Software Revision | HSWREV | No |
| Hardware Revision | HHWREV | No |

Prerequisites

- Control Builder is running
- A Series C I/O control module was created

9.21 Configuring HART Variables tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O Analog Input or Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Variables tab.

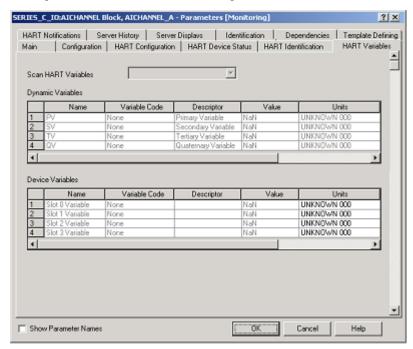


Figure 182: HART Variables tab

The parameters of the HART Variables tab are listed in the following table.

Table 107: HART Variables tab parameters

| Plain text | Parameter name | User configurable | | |
|---------------------|------------------|-------------------|--|--|
| Scan HART Variables | HSCANCFG | Yes | | |
| Dynamic variables | | | | |
| Name | HDYNNAME | Yes | | |
| Variable Code | HDYNDVC | Yes | | |
| Descriptor | HDYNDSC | Yes | | |
| Value | HDYNVAL | Yes | | |
| Units | HDYNEU | Yes | | |
| | Device variables | | | |
| Name | HSLOTNAME | No | | |
| Variable Code | HSLOTDVC | Yes | | |
| Descriptor | HSLOTDSC | Yes | | |
| Value | HSLOTVAL | No | | |
| Units | HSLOTEU | No | | |

Prerequisites

- Control Builder is running
- A Series C I/O control module was created

9.22 Configuring HART Notifications tab - Channel block

After importing the Device Description and assigning the device type to the channel, you can modify the Command 48 string notification types of the channel from the Project view. However, after modifying the notification types, you must user Load or Load values while Active option.

The following configuration information pertains to the Identification tab for all PM I/O Analog Input and Analog Output modules.

All illustrations used in the procedure are for example purposes only

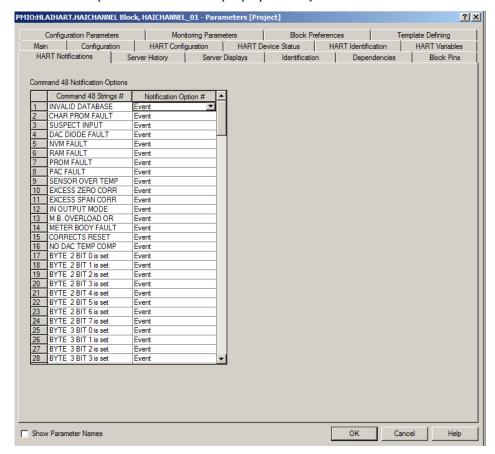


Figure 183: HART Notifications tab

The parameters of the HART Notifications tab are listed in the following table.

Table 108: HART Notifications tab parameters

| Plain text | Parameter name | User configurable |
|---------------------|----------------|-------------------|
| Command 48 Strings | HCMD48STRINGS | No |
| Notification Option | HCMD48NOTIFY | Yes |

For more information about modifying notification option, refer to HART I/O Implementation Guide.

9.23 Configuring Dependencies tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O Analog Input and Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AO Channel block, Configuration form - Dependencies tab.

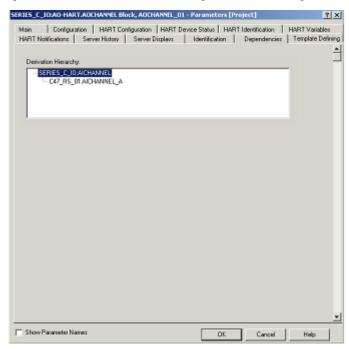


Figure 184: Dependencies tab

Prerequisites

• A Series C I/O control module is created

9.24 Configuring Template Defining tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O Analog Input and Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AO Channel Block, Configuration form - Template Defining tab.

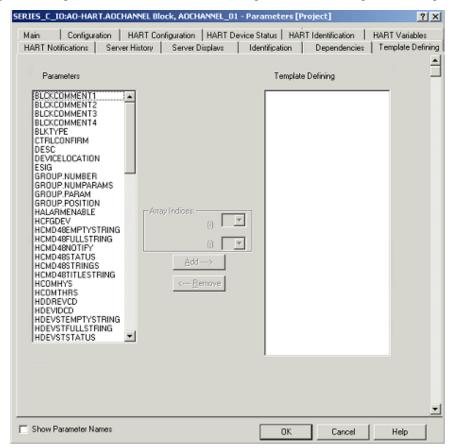


Figure 185: Template Defining tab

Prerequisites

• A Series C I/O control module is created

10 Series C I/O Configuration

Related topics

- "Adding an IOM to Project" on page 352
- "Assigning an IOM to an IOLINK" on page 355
- "Converting the Spares to specific channel type" on page 356
- "Assigning the channel to IOM by instantiation" on page 358
- "Assigning the channel to IOM through Bulk Edit" on page 359
- "Adding an IOC block to a Control Module using the Library tab" on page 360
- "Assigning an IOC block to an IOM using the Function Block Assignment Dialog box" on page 361
- "Unassigning an IOC block from an IOM using the Function Block Assignment Dialog box" on page 367
- "Configuring I/O channels in a control strategy using IOREFERENCES blocks" on page 368
- "Field Calibration of the AI and AO modules" on page 370
- "Defining Channel blocks" on page 371
- "Defining AI Channel Blocks" on page 380
- "Defining AO Channel Blocks" on page 387
- "Defining DI Channel Blocks" on page 390
- "Defining DO Channel Blocks" on page 393
- "Electronic Short-Circuit Protection (DO-24V only)" on page 398
- "Defining SP-AI Channel Blocks" on page 400
- "Defining SP-AO Channel Blocks" on page 404
- "Defining SP-DI Channel Blocks" on page 407
- "Defining SP-DO Channel Blocks" on page 409
- "Defining SP-SPEED Channel Blocks" on page 413
- "Defining SP-SPDVOTE Channel Blocks" on page 417
- "Defining SVP-AI Channel block" on page 419
- "Defining SVP-DI Channel Block" on page 425
- "Defining SVP-Regulatory Control Block" on page 427
- "Defining SVP-AO Channel Block" on page 435
- "Defining UIO Channel Blocks" on page 439

10.1 Adding an IOM to Project

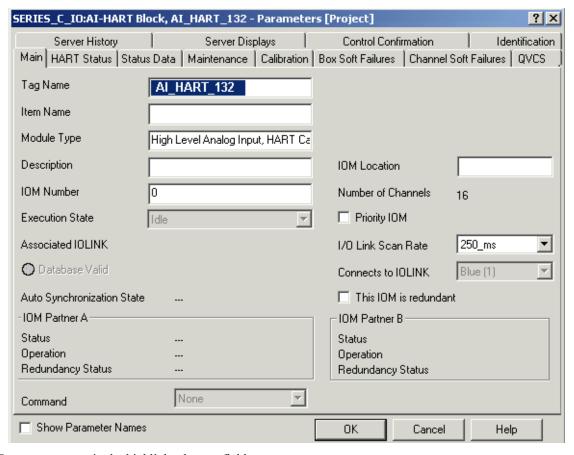
The following IOMs are added to the Project tab using the either the File menu method or the Drag and Drop method:

- AI-HART High Analog Input, HART Capable, 16 channels
- AI-HL High Level Input, 16 channels
- AI-LLMUX Low Level Analog Input Mux, 64 channels
- AI-LLAI Low Level Analog Input Mux, 16 channels
- · AO Analog Output, 16 channels
- AO-HART Analog Output, HART Capable, 16 channels
- DI-24 Low Voltage (24VDC) Digital Input, 32 channels
- DI-HV High Voltage Digital Input, 32 channels
- DI-SOE Digital Input Sequence of Events, 32 channels
- DO-24B Bussed Low Voltage Digital Output, 32 channels
- SP Speed Protection Module, 26 channels
- SVP Servo Valve Positioner Module, 8 channels
- PIM Pulse Input Module
- UIO Universal I/O, 32 channels

10.1.1 Using the File menu method

To add an IOM to the Project tab by the File menu method:

- 1 Click File > New > I/O Modules > Series C I/O.
 Result: A list of the available Series C I/O block types is displayed.
- 2 Select a block types from the drop down list. A Block Parameters configuration form is displayed



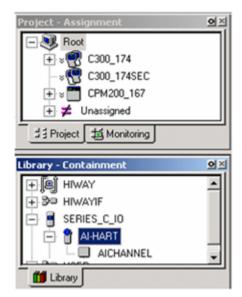
- 3 Type a new name in the highlighted name field.
- 4 Click the OK button. A new IOM instance is created in the Project tab.



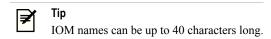
10.1.2 Using the drag and drop method

To add an IOM to the Project tab by the drag and drop method:

1 Drag an IOM icon from the Library tab to an open area on the Project tab. Name New Function Block(s) dialog appears.



- 2 Accept or type a new tag name in the Destination column.
- 3 Click the Finish button. The IOM is displayed in the Project tab.



10.2 Assigning an IOM to an IOLINK

The following are the different ways to assign the IOMs to an IOLINK.

- Assigning an IOM to an IOLINK using the Assignment dialog box (from Unassigned items)
- Assigning an IOM to an IOLINK using the drag-and-drop mechanism (from Unassigned items)
- · Assigning an IOM to an IOLINK using the drag-and-drop mechanism (from Library view)

Prerequisites

The IOM is created and exists under **Unassigned** in the Project view.

To assign an IOM to an IOLINK using Assignment dialog box

1 Choose **Edit** > **Execution Environment Assignment**, or click **assignment button** in the tool bar. The **Execution Environment Assignment** dialog box appears.



Tip

You can also use "Shift key and click" or "Ctrl +A" to select multiple items in **Available Modules** and **Assigned Modules** lists.

- 2 Click the desired IOM to be assigned to a given IOLINK from the **Available Modules** list. The selected IOMs are highlighted and the configured IOLINKs appear in the **Assign To** list.
- 3 Accept default IOLINK selection or click desired IOLINK in the **Assign To** list. Ensure that you select the correct IOLINK from the list.
- 4 Click Assign.

The assigned IOMs appear in the **Assigned Modules** list.



Attention

You can repeat the same procedure for the remaining IOMs.

5 Click Close.

The assigned components appear under the IOLINK folder in the Project view.

To assign an IOM to an IOLINK using the drag-and-drop mechanism (from Unassigned items)

- 1 Double-click the IOLINK in the Project view. The IOLINK configuration form appears.
- 2 Configure the I/O Family (IOLINKTYPE) as "SERIES C8 IO" for Series C modules.
- 3 Click OK.
- 4 Drag the IOMs from the Unassigned items to the IOLINK. You must assign the IOMs to the corresponding IOLINK.



Attentior

If you try to assign a PM I/O to an IOLINK configured as "SERIES_C8_IO," then an error message appears.

The assigned components appear under the IOLINK folder in the Project view.

10.3 Converting the Spares to specific channel type

By default, while creating the IOMs, the I/O channels associated with the PM I/O or the Series C IOM appear as "SPARE." A Spare represents a channel number that has not been designated as used. The Spare does not support configuration and cannot be renamed. The Spare is represented by a different icon (highlighted in the figure) in the tree view. The following figure displays the representation of the Spares and the IOMs in the Project view.

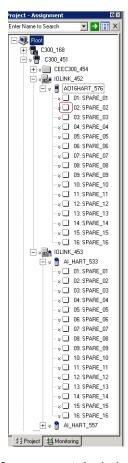


Figure 186: Spare representation in the Project view

You can convert the Spare to the respective supported channels by one of the following options.

- Using the Channel Type Setting option
- Using the Channel Configuration tab of the IOM's configuration form

After a Spare has been converted to a channel, the channel may be configured and referenced by a CM or an SCM.



Attention

The Spares of an Universal Input/Output (UIO) module can be converted to one of following channels.

- AI
- AO
- DI
- DO



Attention

The channel type can be modified only if the channel is not used in any control strategies and the channel is not loaded.

The procedure explained here is common for all PM I/O, Series C I/O, and Simulation I/O channels.

Prerequisites

IOM is created.

To assign a channel by converting the Spares using the Channel Type Setting option

- 1 In the Project view, right-click any Spare of the PM I/O or the Series C I/O, and click **Channel Type Setting**.
- 2 Click the appropriate sub menu option.

The Spare is replaced with a channel of the selected type.



Attention

The SIM IOM does not support the conversion of Spare to specific channel type.

To assign a channel by converting the Spares using the configuration form

- 1 In the Project view, double-click the PM I/O module or the Series C module. The configuration form of the IOM appears.
- 2 Click the Channel Configuration tab.
- 3 Select the Channel Point Type (PNTTYPE) for each Channel Name (CHNLNAME).
- 4 Click OK.

The Spares are converted to a specific channel type. In addition, the parameters of the specific channel type are auto-populated.

10.4 Assigning the channel to IOM by instantiation

Prerequisites

An empty slot is available for associating the instantiated channel.

To assign a channel to an IOM by instantiating the channel

- 1 In Library view, locate the PM I/O or Series C IOM.
- 2 Expand the IOM type, right-click a channel, and then click **Instantiate**.

The channel configuration form appears.

The IOPTYPE of the channel is set based on selected IOM type.

- 3 (Optional) If you know the IOPTYPE to which the instantiated channel to be assigned, then perform the following steps.
 - a Select the IOPTYPE from the Associated IOP Type (IOPTYPE) list.
 - **b** Select the **Associated IOP (IOP)** using the point picker.
 - c Click OK.
- 4 If you do not know the IOPTYPE to which the instantiated channel needs to be assigned, click **OK**. The instantiated channel appears in the Unassigned view.
- 5 Select the Associated IOP (IOP) using the point picker.
- 6 Type the Channel Number (CHANNUM).
- 7 Click OK.

The channel is assigned to the IOM.

10.5 Assigning the channel to IOM through Bulk Edit

Bulk Edit can be used to assign the PM I/O and the Series C I/O channels from one IOM to another IOM. In addition, Bulk Edit can be used to move the channels from Unassigned view to the corresponding IOMs.



Attention

This procedure is identical for the PM I/O, Series C I/O, and SIM I/O channels.

To assign the channel to IOM through Bulk Edit

- 1 Choose Tools > Bulk Edit Parameters > Create Bulk Edit List The Create Bulk Edit List dialog box appears.
- 2 Select the channel blocks to be assigned or moved from the **Available Points** list. You can sort the channel blocks by using the column header (**Types**).
- 3 Click the arrow to move the selected channel blocks from the **Available Points** list to the **Selected Points**
- 4 Select the following parameters from the Available Parameters.
 - Channel Number (CHANNUM)
 - Associated IOP (IOP)

Attention

If you are assigning or moving a channel to a SIM IOM, then select and edit only the Associated IOP (IOP) parameter from the configuration form. The selected channel is automatically assigned or moved to the SIM IOM. However, if you are moving or assigning a channel from SIM IOM to another IOM, then you must specify both the Associated IOP (IOP) and Channel Number (CHANNUM) parameters.

- 5 Click the arrow to move the selected parameters from the **Available Parameters** list to the **Selected Parameters** list.
- 6 Set the name and the path for storing the spreadsheet.
- 7 Click Save.
- 8 Click Close.
- 9 Open the spreadsheet, and then specify the new IOP names and the channel numbers.



Attention

Before specifying the channel number, ensure that a spare is available in the selected IOM.

- 10 Save the spreadsheet, and then close it.
- 11 Choose Tools > Bulk Edit Parameters > Read Bulk Edit List

The **Read Bulk Edit List** dialog box appears.

- 12 Browse to the path where you have saved the spreadsheet.
- 13 Click Update Project, and then click Start.

The selected list is read and the status is displayed.

14 Click Close.

The channels are assigned or moved to the specified IOMs. If there are any errors, then the errors are displayed in the errors grid and the channels are not assigned or moved.

10.6 Adding an IOC block to a Control Module using the Library tab

You can integrate IOC blocks into control strategies without assigning them to an IOM. This ability provides hardware independent control building.

IOC blocks cannot be added to Control Modules already assigned to a FIM.

The Control Module cannot be loaded until all IOC blocks have been assigned to IOM blocks.



Attention

The Series C I/O channel blocks can be associated to a CM only from the Library view.

Prerequisites

- Control Builder is running
- Controller was created, CM was created, IOM was added and assigned to an IOLINK

To add an I/O channel block to a Control Module from Library view

- Double-click the Control Module.
 The Control Module chart appears.
- 2 Drag the I/O channel block from the Library view to the CM. The I/O channel block appears on the CM chart for configuration.



Attention

- The Control Module cannot be loaded until all its containing PM I/O or Series C I/O channel blocks have been assigned to IOM blocks.
- In the CM chart view, the channel name displays the 40 characters on the faceplate of the channel block.

10.7 Assigning an IOC block to an IOM using the Function Block Assignment Dialog box

Each I/O that you have identified must be associated with an appropriate analog I/O block or digital I/O block. This association establishes a connection between the physical IOM and the control strategy.



Attention

An I/O channel cannot be assigned to an IOM, if the channel is loaded.

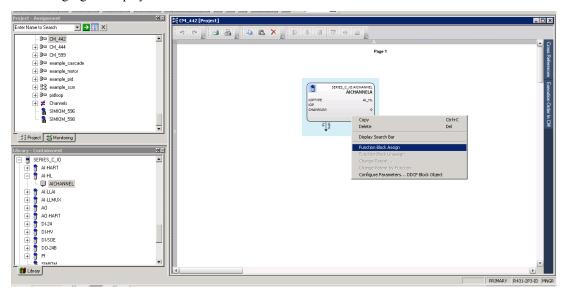
All illustrations used in the procedure are for example purposes only.

Prerequisites

Ensure that a channel of a respective channel type is available.

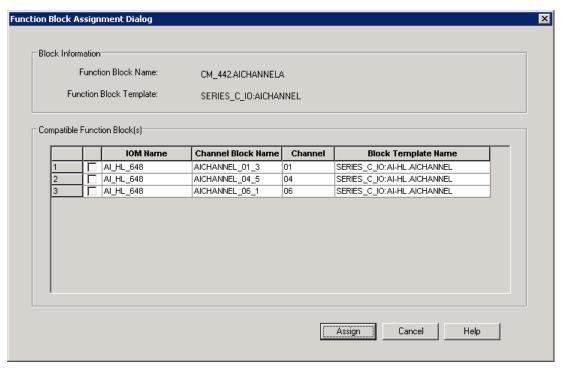
To assign an I/O channel block to IOM

- 1 Double-click the Control Module in the Project view.
- 2 Right-click an I/O channel block that is configured in the CM. The following figure displays I/O channel is contained in the CM.



3 Click Function Block Assign.

The **Function Block Assignment** dialog box that lists the compatible I/O channel blocks associated with the IOM assigned to an IOLINK appears.



4 Select the check box for the desired channel in the IOM list.



- You cannot assign an I/O channel to an IOM that is currently loaded to the IOLINK and appears in the Monitoring view.
- A Control Module cannot be loaded unless all of its I/O channel blocks have been assigned to IOM blocks.
- 5 Click Assign.

The selected I/O channel block is assigned to the selected IOM.



- For identification of unused I/O channels, see, "Identification of unused I/O channels" on page 362.
- 6 Click Yes on the confirmation dialog box.
 The Function Block Assignment dialog box closes.
- 7 Save and close the CM.

10.7.1 Identification of unused I/O channels

The identification of the I/O channel names after unassignment or deletion is explained in the following table to make the identification of unused I/O channels simpler.

| Channel type and scenarios | Behavior prior to R431 | Behavior in R431 and later |
|---|--|--|
| PMI/O or Series C I/O channels – Deletion of an assigned channel, | Channel name changes to its default name. | Deleting an unassigned channel does not impact the tree view. |
| unassignment of a channel, deletion of a CM that contains a channel | For example, if "AICHANNEL_01 is renamed as "AICHANNEL_TEST" after assignment, the channel name changes to "AICHANNEL_01" in all the scenarios mentioned. However, in the Chart view, the channel name is retained as "AICHANNEL_TEST." • Before channel assignment *** AICHANNEL_01 • After assignment and renaming of a channel *** CM_7798.AICHANNEL_TEST • After unassignment or deletion of an assigned channel or after deletion of a CM that contains a channel | Deleting an assigned channel changes the channel representation in the tree view to channel name provided in the configuration. However, if the same channel name already exists in the tree view, then a number is added as a suffix to the channel name. Deleting a CM containing a channel changes the channel representation in the tree view to channel name provided in the configuration. However, if the same channel name already exists in the tree view, then a number is added as a suffix to the channel name. For example, a channel is assigned to a CM and you have deleted the channel. In this scenario, the channels are represented as follows: Assigned I/O channel contained by a CM O1: CM_294.AICHANNELA |
| | | Unassigned I/O channel contained by a CM |
| | | 01: AICHANNELA |
| PMI/O or Series C I/O channels – Deletion of a referenced channel, unassignment of a referenced channel, deletion of a CM that references a channel | Not applicable | Deleting an assigned channel changes the channel representation in the tree view to channel name provided in the configuration. However, if the same channel name already exists in the tree view, then a number is added as a suffix to the channel name. |
| | | Deleting a CM containing a channel changes the channel representation in the tree view to channel name provided in the configuration. However, if the same channel name already exists in the tree view, then a number is added as a suffix to the channel name. |
| | | For example, a channel is assigned to a CM and you have deleted the channel. In this scenario, the channels are represented as follows: |
| | | Assigned I/O channel referenced by a CM |
| | | □ 08: AICHANNEL_08 [CM_294] |
| | | Unassigned I/O channel referenced by a CM |
| | | ; ☐ 08: AICHANNEL_08 |

| Channel type and scenarios | Behavior prior to R431 | Behavior in R431 and later |
|---|--|--|
| HART-enabled I/O channels – Deletion of an assigned channel, unassignment of a channel, deletion of a CM that | HART icon changes to the default icon type for the channel in all the scenarios mentioned. | Deleting a HART-enabled unassigned channel does not impact the tree view. Deleting a HART-enabled channel |
| contains a channel | | changes the channel representation in the tree view to channel name provided |
| | HAICHANNEL_01 After assignment and renaming of a channel | in the configuration. However, if the same channel name already exists in the tree view, then a number is added as a suffix to the channel name. |
| | ·⊗ 🏝 TC0012_HAI | Deleting a CM containing a HART- enabled channel changes the channel representation in the tree view to |
| | After unassignment or deletion of an assigned channel or after deletion of a CM that contains a channel | channel name provided in the configuration. However, if the same channel name already exists in the tree view, then a number is added as a suffix to the channel name. |
| | HAICHANNEL_01 | For example, a HART-enabled channel is assigned to a CM and you have deleted the channel. In this scenario, the channels are represented as follows: |
| | | Assigned HART I/O channel contained by a CM |
| | | 05: AICHANNELA_2 |
| | | Unassigned HART I/O channel contained by a CM |
| | | 3 05: AICHANNELA |
| | | Assigned HART I/O channel referenced by a CM |
| | | 3 08: AICHANNEL_08 [CM_294] |
| | | Unassigned HART I/O channel referenced by a CM |
| | | 3 08: AICHANNEL_08 |

Note: In case the channel name conflicts during any of the scenarios mentioned, "_1" is suffixed with the channel name. For example, if "AICHANNEL_01" already exists in the unassigned list, the channel name is changed to "AICHANNEL_01_1."

10.7.2 Identification of ganged DO channels

When the DO channels are ganged together, the name of the DO channel in which ganging is configured is replaced with the Control Module name in the Project view. For example, if the DO channels 7 to 10 are ganged then the name of the DO channel 10 is replaced as CMname.DOchannel7. In addition, the remaining DO channels disappear in the Project view.

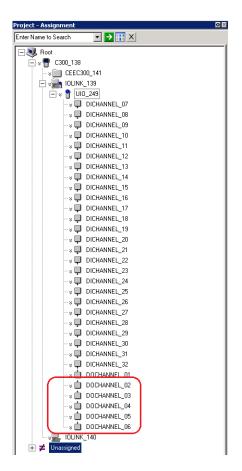


Figure 187: Appearance of DO channels before ganging



Figure 188: Appearance of DO channels after ganging

10.8 Unassigning an IOC block from an IOM using the Function Block Assignment Dialog box

To unassign a channel block from the IOM

- 1 Double-click the CM in which the channel block is configured. The Control Module appears.
- 2 Right-click I/O channel block and then click Function Block Unassign. The I/O channel block is unassigned from the IOM and the associated channel number. When the channel block is unassigned, the IOP field becomes blank and the CHANNUM field value changes to 0 on the block's faceplate.
- 3 Save and close the Control Module.



Attention

You cannot load a Control Module with an unassigned I/O channel block.

10.9 Configuring I/O channels in a control strategy using IOREFERENCES blocks

The I/O channels are configured in a control strategy using the Reference blocks.

10.9.1 IOREFERENCES blocks for I/O channels

I/O Reference blocks are available as basic function blocks and they provide a mechanism to the CM for referencing the Input/Output channel of the supported I/O families or parameter values of any block. The references can be made to the PM I/O channels, Series C I/O channels, or parameter values of any block. The Reference blocks in strategies eliminate the dependency between the strategies and IOMs.

Types of Reference blocks

There are four types of Reference blocks listed under the IOREFERENCES library. The types of Reference blocks are:

- 1. AIREF (Analog Input Reference) block
- 2. AOREF (Analog Output Reference) block
- 3. DIREF (Digital Input Reference) block
- 4. DOREF (Digital Output Reference) block

For more information about Reference blocks and configuring the I/O channels using Reference blocks, see *Control Builder Components Theory* and *Control Builder Components Reference*.

The following parameters are used for configuring the Reference blocks.

- **Reference Type (REFTYPE):** Used for specifying the type of interface for a Reference block.
- **Reference (REF):** Used for specifying the actual reference. Based on the REFTYPE configuration, the reference can be a channel or a parameter.
- Channel Type (CHANTYPE): Used for setting to a specific channel type that can be referenced when REFTYPE is configured as "SERIES_C_IO" or "PMIO."

For more information about these parameters, see Control Builder Parameter Reference.

10.9.2 Associating the channel to IOREFERENCES block

Prerequisites

Channels are configured. They may be unassigned, assigned to a SIM IOM, or assigned to an IOM and channel number.

To associate a PM I/O or a Series C I/O channel to the IOREFERENCES block

- 1 Double-click the Control Module.
- 2 Drag the Reference block from the **IOREFERENCES** library to the CM. The Reference block appears in the CM for configuration.
- 3 Double-click the Reference block to which you want to associate the channel. The Reference block configuration form appears.
- 4 Select the Reference Type (REFTYPE) from the list.
 For more information about configuring the Reference Type (REFTYPE) parameter for each Reference block, see Control Builder Components Theory.
- 5 Click the point picker next to the **Reference** (**REF**) parameter, and then select the channels available from the list.

Attention

- Only valid selections are presented in the point picker list. When a reference is manually entered, the following errors are detected.
 - An invalid channel type is selected for the **Reference (REF)** parameter.
 - The referenced channel is already configured by another reference block in Project view.
 - The selected channel does not exist or the channel name is changed.
 - The selected channel is configured in another server.
 - The CM cannot be loaded unless a **Reference (REF)** parameter has been configured and the channel has been assigned to a SIM IOM or an IOM and channel number.
- 6 (Optional) Click the point picker next to the **Channel Type (CHANTYPE)** parameter. The corresponding channel type is updated.
- 7 Click OK.

The channel is associated to the Reference block.

10.10 Field Calibration of the Al and AO modules

This section describes the field calibration procedure for the AI-HL, AI-HART, AO, and AO-HART modules.



Attention

Configuration mismatch warning message appears when you configure CALIBSTS parameter and loads AO-HART module FB to AO-HART (Cx-PAOH51) module or AI-HART module FB to one modem AI-HART (Cx-PAIH51) module.

To perform field calibration of the Al-HL, Al-HART, AO and AO HART modules

- 1 From the IOM block Main tab, set the Execution State (IOMSTATE parameter) to IDLE.
- 2 From the Calibration tab, set the Calibration State (CALIBSTS parameter) to Enabled. Verify the IOM status LED is switched off indicating that IOM has entered calibration mode.
 - NOTE: Both the top and bottom modules enter a calibration mode in a redundant configuration.
- 3 Connect the calibration voltage source to IOTA terminal block TB3 (and TB4 if redundant) and adjust the voltage to 5Vdc (4.9995 5.0005Vdc).
 - NOTE: CAL terminals blocks are marked as TB2 and TB3 in the case of AO.
- 4 Short the two calibration pads marked as CAL1 (and CAL2 if redundant) in the IOTA. Result: The LED blinks two times and switches off.
- 5 Short the CAL pads again.
 - Result: The LED blinks three times and the IOM automatically reboots within a few seconds.
- 6 Check that:
 - CALIBSTS has changed automatically back to Disabled state,
 - IOMSTATE is IDLE, and
 - the status LED is steady green.

If the status LED is blinking, check for any CALBABRT softfail that indicates bad calibration.

7 Disconnect the calibration voltage-source wiring and inform the operator that the IOM field calibration is complete.



Attention

UIO channels do not require the field calibration.

10.11 Defining Channel blocks

Each Series C I/O channel (IOC) block represents a single I/O point within an I/O module (which can be either input or output). There are certain attributes and parameters that are common to all I/O channel blocks. The Series C IOC block has a point execution state, similar to the PM IOC block. This allows for easy reconfiguration of a single channel without disrupting the operation of the entire IOM.



Tip

In the TPS environment, a channel block is equivalent to one slot in the IO processor.

Each IOC block must have an 'assignment' block and 'containment' block in order for it to be loadable. The following table describes these blocks.

Table 109: I/O Channel block type

| Block name | Description |
|-------------|---|
| Assignment | IOC is associated with a specific slot number on an IOM block |
| Containment | IOC exists in a Control Module |

10.11.1 Common features of I/O channel blocks

There are certain attributes and parameters that are common to all I/O channel blocks. The following section identifies these common features.

10.11.2 Defining Mode and Attribute settings

The MODE parameter determines the operating mode for the channel block. These modes apply to both DO and AO channel blocks.

Operators are only permitted to change MODE if:

- · MODEPERM is set to Permit, and
- REDTAG is set to Off

Note: Mode Permissive = Indicates if the operator can change the mode of a function block Red Tag - Allows the user to set the FB as being 'out-of-service'; this indicates that the FB or the associated control strategy needs repair, or is being repaired.

The following modes apply to the MODE parameter.

Table 110: Mode parameter - channel block

| Operating mode | Description |
|----------------|--|
| Manual (Man) | Provides direct control over the output value of the channel, regardless of any continuous control strategy. |
| Cascade (Cas) | Data point receives its output value from a primary data point. |

The MODEATTR (mode attribute) parameter determines who has authority to change certain parameters on the function block.

The following modes apply to the MODEATTR parameter.

Table 111: Mode Attribute parameter - channel block

| Operating mode | Description | |
|----------------|---|--|
| Operator | Operator supplies the output value and mode for the channel | |
| | (operator access level). | |
| Program | Program supplies the output value and mode for the channel | |
| | (program access level). | |

10.11.3 Defining load attributes

When defining the load attributes, the channel block copies:

- the Normal Mode parameter (NMODE) into the MODE parameter, and
- the Normal Mode attribute (NMODATTR) into the MODEATTR parameter

CONSIDERATIONS:

Possible entries for the NMODE parameter:

- Man
- Cas
- None

Possible entries for the NMODATTR parameter

- Operator
- Program
- None

To define the channel block and copy the NMODE (normal mode) and NMODATTR attributes

Press the NORM button on the integrated keyboard (IKB).
 OR

Press the Operator Entry Panel (OEP) at the operator station.

2 The content of the NMODE is copied into the MODE parameter and becomes the mode for the channel block.

The content of the NMODATTR is also copied into the MODEATTR parameter and becomes the mode for the channel block.

10.11.4 Defining Fault State Handling and Fault Option settings

AO and DO channel blocks are configured so that 'if the communication between the controller and the I/O module is disrupted for 10 to 20 seconds,' the upstream control strategy is assumed to have failed. The FAULTOPT parameter allows you to specify the behavior of an individual output when a fault condition exists.

Table 112: Channel block fault conditions and results

| Fault conditions exist when | Result |
|--|--|
| Loss of communications due to: | All outputs on the IOM, regardless of their PTEXEST |
| C300 failure | value, transition to their respective FAULTOPT states, within 8 seconds. |
| IOLEE failure | within 6 seconds. |
| Dual IOL cable failure | |
| CEE failure, but IOLEE is up and running | |

NOTE: REDTAG configuration overrides FAULTOPT configuration. Channels with REDTAG configured to ON holds the output in FAULTED state, regardless of FAULTOPT configuration.

The following figure illustrates where the output is directed to either the normal location or a Fault location.

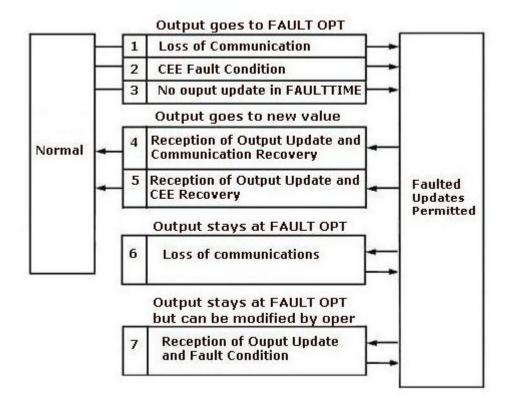


Figure 189: AO and DO fault state (FAULTST) transitions

Specific fault state handling depends upon the parameter settings for MODE and MODEATTR. Refer to the tables below for AO and DO settings.

MODEATTR **FAULTSTATE** Source Destination Mode transitions PID.OP AO.OP Cas Operator or Program 1, 2, 3, 5, 7 PIDER.OP AO.OP Cas Operator or Program 1, 2, 3, 5, 7 PID-PL.OP AO.OP Cas Operator or Program 1, 2, 3, 5, 7 PIDFF.OP AO.OP Cas Operator or Program 1, 2, 3, 5, 7 **SCM** AO.OP Program 1, 2, 3, 5, 7 Man AO.OP User Man Operator 1, 4, 6

Table 113: AO fault handling

Table 114: DO fault handling

| Source | Destination | Mode | MODEATTR | FAULTSTATE |
|----------|-------------|------|----------|----------------------------|
| | | | | transitions |
| PID.OP | DO.OP | Cas | N/A | 1, 2, 3, 5, 7 ¹ |
| PIDER.OP | DO.OP | Cas | N/A | 1, 2, 3, 5, 7 ¹ |

| Source | Destination | Mode | MODEATTR | FAULTSTATE |
|-----------|-------------|------|----------|----------------------------|
| | | | | transitions |
| PID-PL.OP | DO.OP | Cas | N/A | 1, 2, 3, 5, 7 ¹ |
| PIDFF.OP | DO.OP | Cas | N/A | 1, 2, 3, 5, 7 ¹ |
| PosProp. | DO.OFFPULSE | Cas | N/A | 1, 2, 3, 5, 7 ² |
| RAISETIME | | | | |
| PosProp. | DO.OFFPULSE | Cas | N/A | 1, 2, 3, 5, 7 ² |
| LOWERTIME | | | | |
| PosProp. | DO.ONPULSE | Cas | N/A | 1, 2, 3, 5, 7 ² |
| RAISETIME | | | | |
| Posprop. | DO.ONPULSE | Cas | N/A | 1, 2, 3, 5, 7 ² |
| LOWERTIME | | | | |
| DevCtl.PO | DO.OFFPULSE | Cas | N/A | 1, 2, 3, 5, 7 |
| DevCtl.PO | DO.ONPULSE | Cas | N/A | 1, 2, 3, 5, 7 |
| DevCtl.DO | DO.SO | Cas | N/A | 1, 2, 3, 5, 7 |
| Logic | DO.SO | Cas | N/A | 1, 2, 3, 5, 7 |
| SCM | DO.OP | Man | Program | 1, 2, 3, 5, 7 |
| SCM | DO.SO | Man | Program | 1, 2, 3, 5, 7 |
| User | DO.OP | Man | Operator | 1, 4, 6 |
| User | DO.SO | Man | Operator | 1, 4, 6 |

The FAULTOPT parameter determines the behavior of an individual output value when a fault condition exists. The following modes apply to the FAULTOPT parameter:

Table 115: FAULTOPT parameter settings

| Operating mode | Description | AO channels | DO channels |
|-----------------|--|----------------------------------|--|
| Hold | Holds output at last good value | Applicable to all configurations | Applicable to all configurations |
| Unpower | Output goes to an unpowered value | Applicable to all configurations | Applicable to all configurations |
| Power | Output goes to a powered value | Not applicable to AO channels | Not applicable to DO channels for PWM operation. |
| Use Fault Value | Output goes to the value specified by the FAULTVALUE parameter | | Not applicable to DO channel configured for STATUS, ONPULSE or OFFPULSE operation. |

The FAULTOPT configuration also defines the state of the output in case of total IOM hard failure also. This feature is mainly applicable to the DO channels configured for STATUS operation.

10.11.5 FAULTED state and IOM hard failure

Total IOM hard failure means:

- dual IOM failure in the case of redundant setup
- assumes that there is no disruption 24V power to the I/O modules

The following table summarizes the state of the output for all applicable output configurations in the case of transitioning to FAULTED state or on total IOM failure.

Table 116: IOM hard failure and output state

| | Unpower | P Hold o w e r | Fault value | |
|----------------------|-----------|----------------------------|--|--|
| AO | | | | |
| Faulted state | 0mA | Not applicable | Hold last good OP value | Hold fault value without OP directions |
| Total IOM Failure | 0mA | Not applicable | 0mA | 0mA |
| DO STATUS | | | | |
| Faulted state | Drive LOW | Drive HIGH | Hold last good SO value | Not applicable |
| Total IOM Failure | Drive LOW | Drive HIGH | Hold last good SO value | Not applicable |
| DO PWM | | | | |
| Faulted state | Drive LOW | Not applicable | Continues of PWM as per the last good Op value. | Continues of PWM as per the fault value. |
| Total IOM Failure | Drive LOW | Not applicable | Terminates the PWM and drive LOW. | Terminates the PWM and drive LOW. |
| DO ONPULSE/C | FFPULSE | | | |
| Faulted state | Drive LOW | Drive HIGH | Proceeds to the normal completion of any ongoing pulse and hold quiescent state. | Not applicable |
| Total IOM Failure | Drive LOW | Drive HIGH | Terminates any on-going pulse immediately and hold quiescent state. | Not applicable |

10.11.6 Defining PV Source selection settings

The PVSOURCE parameter allows you to determine the source of the PV for the data channel.

Table 117: PV Source settings

Auto Al channel's Range Checking and Filtering circuit provides PV, or DI channel's PVAUTO parameter provides PV Man PV can be entered manually, or Sub PV can come from a sequence program

Additionally, the PVSRCOPT parameter determines if it is permissible to change the PV source to a source other than Auto.

The following modes apply to the PVSRCOPT parameter.

Table 118: PVSRCOPT settings

| Operating mode | Description |
|----------------|--|
| OnlyAuto | allows the PV to be set only Automatically |
| All | allows the manual setting of PV |

10.11.7 Defining the REDTAG settings

The REDTAG parameter allows you to set channel as being 'out of service' indicating that this channel or its associated control loops needs repair, or is being repaired. Once a channel is put in the red tag condition, its output is frozen at the last value.

REDTAG can only be set and cleared when:

- MODE = MAN
- MODATTR = Operator

Table 119: REDTAG settings

| When channel is placed in REDTAG condition | Result | |
|--|--|--|
| Channel output | is frozen at last value (including MODE and MODATTR) | |
| | The value of OP takes precedence over the FAULTOPT settings. | |
| Channels | cannot be deleted | |
| | • can be reloaded | |
| | - the load produces errors for PNTTYPE, MODE, and | |
| | MODEATTR because the parameters could not be | |
| | set on the load. | |

10.11.8 Enabling HART in HART 6.0 and later version devices

The HART Protocol compliments traditional 4-20mA analog signaling and supports two way digital communications to intelligent process control devices. Applications include:

- remote process variable interrogation,
- · cyclical access to process data, parameter setting, and
- diagnostics.

For more information, visit www.hartcomm.org.

10.11.9 Features and capabilities - HART 6.0 and later version devices

HART 6.0 and later version device features and capabilities are designed to:

- improve support for multi-variable and valve / actuator type devices;
- enhance status and diagnostics,
- increase interoperability;
- extended commissioning / troubleshooting capabilities; and
- security measures to confirm any configuration change.

HART 6.0 and later version device functionality that is supported in Series C through Control Builder includes the following:

| Function | Description | |
|--------------------------------|---|--|
| Device variable classification | Provides master applications with a simple mechanism to determine the number and type of process related variables (pressure, temperature, etc.) within a device. | |
| Extended device status | Provides additional device status alerts such as 'Device Needs Maintenance.' | |
| Device variable status | Enables field devices to self-validate and report on the quality of the data in the command response (good, poor, bad, fixed). | |
| Long Tag | New Long Tag with international (ISO Latin 1) characters allows consistent implementation of the longer tag names required by many industry users. The specifications currently reflect the length of this tag to be 32 characters. | |
| Configuration change counter | Improved mechanism for master applications to determine that a field device configuration has been changed. Protects integrity of plant configuration databases. | |
| Device Families | Establishes standard commands and status indicators for devices based on the type of process measurement. Initial Device Families include Temperature and PID Control. | |
| Transducer Trim Commands | New Common Practice commands for performing transducer trim (calibration) operations. | |
| Sub-Devices | Simple mechanism using Common Practice Commands to support 'HART device within a HART device' functionality. Potential uses include flow computers and multi-channel temperature devices. | |
| Block Data Transfer | An updated mechanism to support the movement of large blocks of data, such as device configuration information, between masters and field devices. | |
| Catch Device Variable | Simple mechanism to support the sharing of process data between field devices on the same HART network. Allows a listening field device to capture process data from another field device to be used in calculations such as tank gauging, flow computers or PID control functions. | |
| Write Device Variable | New Command to support forcing the digital value for any Device Variable to a specific value to aid in commissioning and troubleshooting. | |
| Lock Device | New Commands to allow a master application to lock the 'local' front panel of a field device while performing remote configuration functions. | |
| Squawk and Find Device | New commands to support commissioning and troubleshooting of HART devices in multi-drop and multi-pair cable installations. | |

Series C I/O IOMs do not have an independent HART device block. Instead, the HART data is fully contained within an AI or AO block and:

- enabled when HENABLE parameter is set to TRUE (This is done on the AI channel block HART Configuration tab)
- becomes an Experion 'tagged' entity and can generate alarms based on its 'tagged' name in Station.

When AI and AO channel blocks are enabled, five additional HART tabs become exposed. These tabs are used exclusively for details about the attached HART device and are identical for AI and AO channels. These tabs are:

| HART Configuration | HART Identification | HART Notifications |
|--------------------|---------------------|--------------------|
| HART Device Status | HART Variables | |

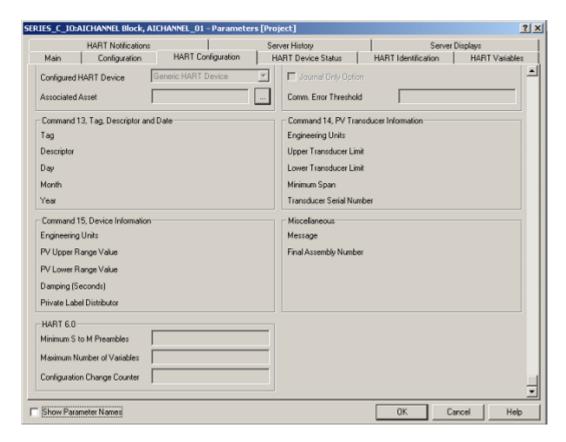


Figure 190: Series C I/O AI or AO - HART tabs

AI and AO channel blocks also have two additional tabs that appear on all tagged Experion blocks. They are the Server History and Server Displays tab. These tabs also become exposed when HART is enabled.

10.11.10 Parameters exposed after HART is enabled

For the most part, the Series CI/O HART parameters are identical to their PM I/O HART counterparts. The following table displays parameters that are only exposed when HART is enabled - all located on the Configuration tab.

Table 120: HART parameters

| Parameter | Works the same as PMIO |
|-----------|------------------------|
| ACCEPTRNG | Yes |
| URL, | Yes |
| URV | Yes |
| LRV | Yes |
| LRL | Yes |
| HPVMISM | Yes |

NOTE: Only 1-5V sensor type will be supported when HART is enabled.

10.11.11 Comparing parameters between Series C and PMIO

HPVCHAR, which is used in PM I/O, is not used in Series C I/O. PVCHAR are used instead, and only valid enumerations (depending on the settings for HENABLE and IOM TYPE) are displayed to you.

Some HART parameters are only valid for HART Protocol Version 6. Series C IOMs support HART 6.0 and later version device features such as Extended Device Status, Configuration Change Counter, Variable Status and Classification Codes. The current release of Series C I/O supports these HART 6.0 and later version device parameters:

| Parameter | Tab | Description |
|-------------|-----------|---|
| HMAXDEVVARS | | Indicates the last device variable code supported by the device. Information can be used by the host applications. |
| HNCFGCHG | | Configuration change counter is a counter maintained by HART 6.0 and later version device which is incremented every time configuration is changed. This is improvement over the single 'configuration changed bit' in previous HART releases |
| HNSMMINPRE | | Minimum number of preamble bytes to be sent with the response from device to the IOM. Series C IOMs take advantage of this configuration if supported by the device to minimize the bytes sent from device in response messages. |
| HDYNCC | Variables | Dynamic / device variable classification code |
| HDYNST | Variables | Dynamic / device variable classification code |
| HSLOTCC | Variables | Dynamic / device variable classification code |
| HSLOTST | Variables | Dynamic / device variable classification code |

10.11.12 Parameter values not copied during Block Copy

IOP and CHANNUM are the only configuration parameter values not copied during a Block Copy operation.

10.12 Defining Al Channel Blocks

The AI channel block represents a single analog input point on either an AI-HART or AI-LLMUX or AI-LLAI I/O Module. The type of analog input IOM needed is based on the:

- type of field sensor that is providing the input to the channel
- PV characterization options you select (as listed in the table in Determining PV Characterization):

Channels contained within AI-HL and AI-HART IOM is generally used for control points. Channels located in the AI-LLMUX or AI-LLAI IOM are generally used for data acquisition points.

The analog input channel converts an analog PV signal received from a field sensor to engineering units for use by other function blocks in the C300, and by the rest of Experion.

To accomplish this function, the analog input channel, as displayed in figure below, performs:

- · Analog-to digital conversion
- · PV characterization
- Open Wire Detection on 4-20 mA inputs (configured as 1-5V) only
- · Range Checking and PV filtering
- PV source selection

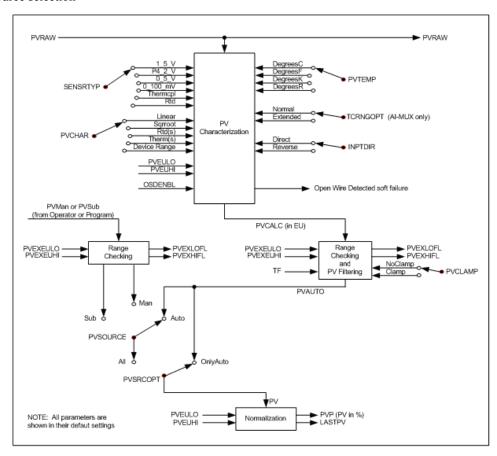


Figure 191: Analog Input conversion

10.12.1 Determining PV Characterization - Al Channel blocks

Attention

Series C AI channels do not support the HART PV Characterization (HPVCHAR) parameter. These configuration options are selected using the PVCHAR parameter.

The PV signal received from the field is characterized based on the entries that you make for the parameters:

- SENSRTYP
- **PVCHAR**
- PVTEMP
- INPTDIR, and
- TCRNGOPT

The input PV signal is:

- 1. Converted to a raw PV signal (PVRAW) whose units can be %, ratio, millivolts, microvolts, or milli ohms depending on the entry made for the SENSRTYP parameter
- 2. then converted to the engineering units

The engineering unit conversions that are performed in the AI-HL, AI-HART and AI-LLMUX/AI-LLAI points are listed in the table below.

Table 121: Al engineering unit conversions

| ensor type | Al Module | PVCHAR | PVRAW | |
|------------|-----------|--------|-------|--|

| Sensor type | Al Module | PVCHAR | PVRAW | PVCALC | Bad PV detection |
|---|--|-----------------------------------|------------|-------------|---|
| (SENSRTYP) | type | Options | (note 1) | (note 2) | |
| 0-5-V (0 to 5 volts) | AI-HL ⁶ AI-HART (PAIH01 only) | Linear square rt. | percent | EU | Range check on PVCALC |
| P4_2_V (0.4 to 2 volts) | AI-HL ⁶ AI-HART (PAIH01 only) | Linear square rt. | percent | EU | Range check on PVCALC. Checks for open input |
| 1_5_V (1 to 5 volts and 4 to 20 mA) ⁵) | AI-HL ⁶ AI-HART | Linear square rt. Device Range | percent | EU | Range check on PVCALC. Checks for open input |
| 0_100_mV (0 to 100 mV) | AI- LLMUX/AI- LLAI | Linear | millivolts | EU (note 3) | Range check on PVCALC |
| Thermcpl (Thermocouple) | AI- LLMUX/AI- LLAI | See PVCHAR for complete list | microvolts | EU | Range check on PVCALC. Open thermocouple detection |
| RTD | AI- LLMUX/AI- LLAI | See PVCHAR for complete list | milliohms | EU | Range check on PVCALC |

LEGEND:

EU = Engineering Units

AI-HL = High Level Analog input

AI-HART = HART capable, High Level Analog input

AI-LLMUX Low Level Analog Multiplexer

AI-LLAI = Low Level Analog input

PVCALC = Calculated PV

PVCHAR = PV Characterization

PVRAW = PV received from field and converted to digital form by the A/D converter

Notes

- 1. PVRAW is the voltage signal at the IOTA as a percentage of the voltage range for the sensor type. The exceptions are as follows
 - a. For a thermocouple sensor type, PVRAW is in microvolts, after reference junction compensation. If an open thermocouple is detected, PVRAW is set to NaN.
 - b. For an RTD sensor type, PVRAW is in milliohms, after lead-wire compensation. If an open RTD is detected, PVRAW is set to NaN.
 - c. For a 0-100 millivolt sensor type, PVRAW is the IOTA voltage input for the slot.
- 2. If the diagnostics determine that the A/D converter has failed, PVRAW of the slot is set to NaN.
- 3. The normal operating range for PVRAW is configured by you (for a thermocouple 0% = PVRAWLO, 100% = PVRAWHI.
- 4. AI HL does not support PVCHAR of DeviceRange.
- 5. PVCHAR of DeviceRange, SystemRange and SystemRange And SQRT are supported when HART Enabled on AI-HART. When HART is enabled, 0_5_V and P4_2_V are not available because HART communication is 4 to 20 mA.
- 6. When 4-20mA signal is connected to AI-HART or AI-HL, the Sensor Type 1 5 V should be used.
- When Cx-PAIN01 is used for AI-HL, only 4-20mA input is supported. Voltage input is not available. Sensor Type will be fixed to '1_5_V' on the configuration.
- 8. AI-HART (Cx-PAIH51) module supports only 1_5_V option. If you configure SENSRTYP in AICHANNEL other than 1_5_V and load to one modem AI-HART (Cx-PAIH51) module, the configuration mismatch warning message appears. After loading the module, the SENSRTYP parameter value appears as 1_5V always irrespective of configured value.

10.12.2 Determining Linear Conversion - Al Channel blocks

The PVRAW value is converted to a floating-point number. The output value of the linear conversion is PVCALC, which is calculated based on the raw input span (for 0-100 mV sensor type only), and the engineering unit span.

The state of the input direction parameter (INPTDIR) is taken into consideration during the calculation of PVCALC as follows:

For 0-100 mV sensor types, when INPTDIR is Direct:

$$PVCALC = \frac{(PVRAW - PVRAWLO)}{(PVRAWHI - PVRAWLO)} * (PVEUHI - PVEULO) + PVEULO$$

For 0-5V, 0.42V, and 1-5V, sensor types, when INPTDIR is Direct:

$$PVCALC = \frac{PVRAW}{100} * (PVEUHI - PVEULO) + PVEULO$$

For 0-100 mV sensor types, when INPTDIR is Reverse:

$$PVCALC = PVEUHI - \frac{(PVRAW - PVRAWLO)}{(PVRAWHI - PVRAWLO)} * (PVEUHI - PVEULO)$$

For 0-5V, 0.42V, and 1-5V, sensor types, when INPTDIR is Reverse:

$$PVCALC = PVEUHI - \frac{PVRAW}{100} * (PVEUHI - PVEULO)$$

10.12.3 Determining Square Root Conversion - Al Channel blocks

The square-root calculation is applied to the PVRAW input such that

100% of span = 1.0

The square-rooted value is then converted to engineering units based on the configured PV engineering-unit range values.

(For example, square root of 100% = 100%; square root of 50% = 70.71%.)

The output value of the square-root conversion is PVCALC, which is calculated based on the state of the input direction parameter (INPTDIR) as follows

If PVR AW? 0.0 and INPTDIR is Direct:

$$PVCALC = PVEULO + \sqrt{\frac{PVRAW}{100}} * (PVEUHI - PVEULO)$$

If PVR AW < 0.0 and INPTD IR is Direct:

$$PVCALC = PVEULO - \sqrt{\frac{-PVRAW}{100}} * (PVEUHI - PVEULO)$$

If PVR AW? 0.0 and INPTDIR is Reverse:

$$PVCALC = PVEUHI - \sqrt{\frac{PVRAW}{100}} * (PVEUHI - PVEULO)$$

If PVR AW < 0.0 and INPTD IR is Reverse:

$$PVCALC = PVEUHI + \sqrt{\frac{-PVRAW}{100}} * (PVEUHI - PVEULO)$$

10.12.4 Determining Thermal Conversion - Al Channel blocks

Thermal linearization is performed on thermocouple and RTD input types. All thermocouples (#therm) listed in the PVCHAR parameter definition, are supported by the analog input point. The range of the thermocouple type used with the AI-LLMUX/AI-LLAI channel can be increased by selecting Extended as the entry for the TCRNGOPT parameter.

The AI-LLMUX/AI-LLAI channels calculate the reference junction compensation from the measured reference junction output level. This value is stored and then later converted back to microvolts, with respect to 0 degrees C, for each thermocouple that is to be compensated. The cold-junction reference compensation (PVREFJN) parameter is expressed in microvolts for the specified thermocouple and is added to the microvolt value for PVRAW.

All RTDs (*RTD) listed in the PVCHAR parameter definition, are supported by the analog input point:

For an RTD, the AI-LLMUX/AI-LLAI channels calculate the lead-wire compensation and then subtract the value from PVRAW. The maximum allowable lead-wire resistance and intrinsic safety barrier resistance for the RTDs are listed in the table below.

Maximum allowable lead resistance -Maximum allowable intrinsic safety Note 1 barrier resistance (units are ohms) (units are ohms) RTD type **Entire loop Entire loop** Per leg Per leg Pt:100 DIN characterization 20 10 18 18 Pt:100 JIS characterization 20 10 18 18 Ni: 120 Edison type 7 characterization 10 18 20 18 Cu: 10 SEER Standard characterization 20 10 0

Table 122: RTD lead wire characteristics

| | Maximum allowable lead resistance - Note 1 (units are ohms) | | Maximum allowable intrinsic safety barrier resistance (units are ohms) | |
|-----------------------------|---|---------|--|---------|
| RTD type | Entire loop | Per leg | Entire loop | Per leg |
| Cu: 50 Ohm characterization | 20 | 10 | 18 | 18 |

Note 1: Proper compensation for lead-wire resistance depends on the resistance being equal in each leg of the RTD. This includes resistance due to lead-wire resistance and intrinsic safety barriers. No provision is made to compensate for lead-wire resistance mismatch or intrinsic safety-barrier resistance mismatch. Both the lead resistance and the intrinsic-safety-barrier resistance are allowed simultaneously when connected to an RTD in a Division 1 area.

10.12.5 Open Wire Detection - Al Channel blocks

The open wire diagnostic detects and annunciates broken field wires. In addition, a seemingly valid PV from a channel diagnosed as having a broken-wire will not be made available (thus preventing incorrect control action). Open Wire Detection is available with AI-HART module.

If open wire detection is enabled (OWDENBL = ON) and the IOM detects the broken-wire condition, then

- Soft Failure 179 'Open Wire Detected' is generated, and
- PVRAW and PVAUTO will consequently be set to NaN.



Attention

Open wire detection is not supported in AI-HART (Cx-PAIH51) module. The configuration mismatch warning message appears when you select the OWDENBL option and loads AICHANNEL FB to AI-HART (Cx-PAIH51) module. After loading the module, the channel can be activated. However, the OWDENBL parameter value appears as 'FALSE.'

10.12.6 Checking and Filtering PV Range - Al Channel blocks

PV range checking ensures that the PVCALC output of PV characterization is within the limits defined by parameters PVEXEULO and PVEXEUHI. If either of the limits is violated, the output of the PVAUTO is set to NaN if clamping has not been specified. If clamping has been specified, the output of the PVAUTO is clamped to PVEXEUHI or PVEXEULO, except when PVRAW, PVCALC, and PVAUTO will consequently be set to NaN.



Attention

Honeywell recommends you to configure the current for HLAI (CC-TAIX01) modules from -6.9% to $\pm 102.9\%$ of the 4-to-20 mA range. If you configure the current above $\pm 102.9\%$ then the PVEXEUHI goes to NaN.

If the range-checked and filtered value is less than the value specified by the user-configured LOCUTOFF parameter, the final output called PVAUTO is forced to PVEULO.

First-order filtering is performed on PVCALC, as specified by the user through parameter TF (filter lag time).

10.12.7 Comparing parameters between Series C and PMIO that support Al

The following parameters are:

- specific to AI and found on various tabs on the AI channel block, and
- work identically to the same named PM I/O counterparts.

| Al supported parameters for current Series C I/O | | | | |
|---|--|--|--|--|
| that work identically to the same named PM I/O parameters | | | | |
| SENSRTYP PVCLAMP DECONF PVSRCOPT | | | | |

| Al supported parameters for current Series C I/O | | | | |
|--|---|---------|----------|--|
| | that work identically to the same named PM I/O parameters | | | |
| PVCHAR | LOCUTOFF | URL | PV | |
| INPTDIR | PVTEMP | URV | PVSOURCE | |
| PVEUHI | TF | LRV | LASTPV | |
| PVEULO | PVRAWHI | LRL | PVCALC | |
| PVEXEUHI | PVRAWLO | DAMPING | PVEXHIFL | |
| PVEXEULO | TCRNGOPT | CJTACT | PVEXLOFL | |
| | | | PVRAW | |

The following are parameters that support Series C AI and work differently than the same named PM I/O counterparts.

| Al supported parameters for current Series C I/O | | |
|---|--|--|
| that work differently than the same named PM I/O parameters | | |
| PVCHAR PVSTS | | |

10.13 Defining AO Channel Blocks

The AO channel block represents a single analog output point on the AO-HART Modules. The AO channel block converts the output value (OP) to a 4-20 mA output signal for operating final control elements such as valves and actuators in the field. The OP parameter value can be controlled from an Experion regulatory point, the operator, or an SCM.

To convert the OP value to a 4-20 mA signal, the AO channel performs:

- Direct/Reverse Output Function
- Nonlinear Output Characterization

The following is a functional diagram of the analog output channel block.

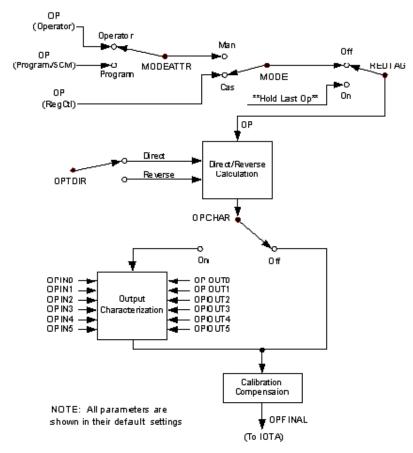


Figure 192: Analog Output conversion

10.13.1 Determining Direct/Reverse Output - AO Channel blocks

The OPTDIR parameter allows you to specify whether the output of the data point is:

- direct acting (where 4 mA = 0%, and 20 mA = 100%), or
- reverse acting (where 4 mA = 100%, and 20 mA = 0%).

The default mode is direct acting.

10.13.2 Determining Output Characterization - AO Channel blocks

Output characterization is an optional function that can be implemented by setting parameter OPCHAR to ON. When OPCHAR is set to ON, the analog output point interpolates linearly between the two nearest values. The interpolated value becomes the output value OPFINAL.

Further, output characterization allows you to specify an output transfer function, using configurable X-Y coordinates that provide five linear segments as displayed below. The length of each segment is variable according to the coordinates OPOUT0-5 and OPIN0-5. The end points of the curve are fixed at coordinates OPOUT0, OPIN0 (at -6.9%) and OPOUT5, OPIN5 (at 106.9%). These coordinates are fixed at these values to ensure that neither the characterization function nor its inverse can provide output values, which are outside the -6.9% to 106.9% range. You enter the values for OPOUT1-4 and OPIN1-4 to achieve the desired curve.

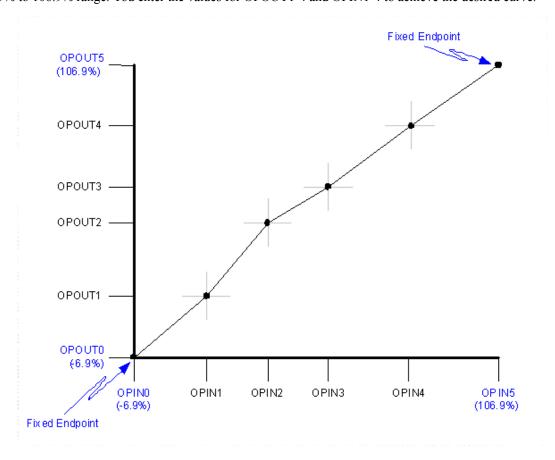


Figure 193: Determining fixed endpoint

10.13.3 Determining Calibration Compensation - AO Channel blocks

The final stage of output processing in the analog output point is calibration compensation. This is accomplished in the data point using internal offset and scale constants. The output value OPFINAL is then routed to the field through the IOTA.

10.13.4 Determining Modes - AO Channel blocks

The MODE parameter determines the operating mode for the channel block. The following operating modes are applicable to the both AO and DO channel blocks:

- Manual (Man) provides the operator or the program with direct control over the output value of the channel, regardless of any continuous control strategy.
- Cascade (Cas) data point receives its output value from a primary data point.

10.13.5 Determining Output Verification - AO Channel blocks

Outputs are verified by periodically reading back the value on the output screw and comparing the read back value with the database value. This includes an independent A-to-D conversion for the read back value.

10.13.6 Comparing parameters between Series C and PMIO that support AO

The following parameters are:

- · specific to AO and found on various tabs on the AO channel block, and
- work identically to the same named PM I/O counterparts.

| AO supported parameters for current Series C I/O that work identically to the same named PM I/O parameters | |
|--|---------------|
| OPTDIR | INITVAL |
| OPCHAR | OPFINAL |
| OPOUT1, OPOUT2, OPOUT3, OPOUT4 | COMMFAILFL |
| OPIN1, OPIN2, OPIN3, OPIN4 | OPIN0, OPOUT0 |
| OP | OPIN5, OPOUT5 |

10.14 Defining DI Channel Blocks

The DI channel block represents a single digital input point on one of the following I/O Modules: DI-24, DI-HV, and DI-SOE. This digital input channel converts a digital PVRAW signal received from the field to a PV that can be used by other data points in the Experion system.

Bad PV Flag-Control strategies can test for a bad Digital Input PV. Parameter BADPVFL is set ON when:

- The PV source has been switched to Substituted, and the channel is Inactive or the module is Idle.
- The PV source is Auto and the PV is not being updated, because the channel is Inactive or the module is idle or there is a channel soft failure.

The digital input channel can also be configured as a status input or a latched input.

The following is a functional diagram of the digital input channel.

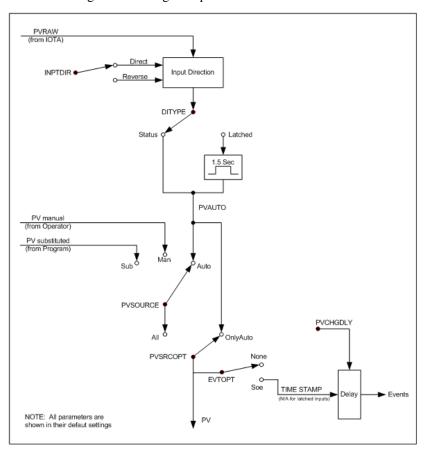


Figure 194: Digital input conversion

10.14.1 Determining Status Digital Input channel - DI Channel blocks

For this digital input type, the PVAUTO value represents the state of the raw input signal after the direct/reverse conversion is performed. The status digital input channel is selected by:

• entering Status for the DITYPE parameter and this block can be configured for PV source selection.

The current PV state is available as an input to logic blocks and other Experion control functions blocks.

PV Source Selection - The PV source parameter (PVSOURCE) option determines the source of the PV for a status input channel. The source can be:

- the PV input from the field (PVRAW),
- the PV state entered by the operator (PV manual), or
- it can be supplied by a user program (PV substituted).

PVSOURCE has no effect on the latched options of the digital input channel. If PVSOURCE is AUTO, PV tracks PVRAW.

10.14.2 Determining Latched Digital Input channel - DI Channel blocks

To capture the occurrence of momentary digital inputs, such as from push buttons, the digital input channel is configured as a latched input.

Configuring the channel as latched is accomplished by setting:

DITYPE to Latched.

When configured as a latched input channel, an input pulse that is on for a minimum of 40 milliseconds is latched true for 1.5 seconds. This ensures that any control function block that needs to monitor this input executes at least once during the time that the signal is latched on.

When the DITYPE is set latch, the EVTOPT cannot be SOE and vice versa.

10.14.3 Comparing parameters between Series C and PMIO that support DI

The following parameters are:

- specific to DI and found on various tabs on the DI channel block, and
- work identically to the same named PM I/O counterparts.

| DI supported parameters for current Series C I/O | |
|---|---------|
| that work identically to the same named PM I/O parameters | |
| DITYPE | PVRAW |
| PV | BADPVFL |

The following are parameters that support Series C DI and work differently than the same named PM I/O counterparts.

| | DI supported parameters for current Series C I/O | | | |
|---|---|--|--|--|
| | that work differently than the same named PM I/O parameters | | | |
| Ī | PVSTS | | | |

10.14.4 Open Wire Detection - DI Channel blocks

The open wire diagnostic detects and annunciates broken field wires. In addition, a seemingly valid PV from a channel diagnosed as having a broken-wire will not be made available (thus preventing incorrect control action).

The Digital Input module requires the installation of a bleed resistor (approx. 22k ohm) at the switching device between the 24VDC source and the terminal providing the switched signal. If this resistor is not installed and open wire detection is enabled (OWDENBL = ON) a false open wire alarm will be generated whenever the input device is not closed (i.e., PVRAW = OFF).

If open wire detection is enabled (OWDENBL = ON) and the IOM detects the broken-wire condition, then

PVCALC will be NaN, in which case, PVAUTO will be NaN.

- Soft Failure 179 'Open Wire Detected' is generated, and
- PVRAW and PVAUTO will consequently be set to OFF.

Note that Open Wire Detection is supported only with the 24VDC IOTAs and not for the following:

- The high voltage DI modules
- · The DI-SOE module
- The GI-IS IOTAs

If a GI-IS IOTA (CC-GDILxx) is used, open wire detection as described above may not be used.

- In these cases, OWDENBL must be set to OFF for all channels.
- As an alternative to Series C open wire detection, you may use the Line Fault Detection (LFD) feature of the MTL Switch/Proximity Detector Interfaces.

MTL Switch/Proximity Detector Interface is the third party equipment from MTL which enables safe-area loads to be controlled by switch or proximity detectors located in a hazardous area. Two replay output are provided. Independent phase reversal control allows an alarm condition to be signaled for either state of the sensor. A selectable line fault detects (LFD) facility detects an open or short circuit in either field circuit. It is not part of any agency certification or CE certification.

- If LFD is enabled (through a switch on the device) for any channel, two resistors must be installed: a 22k ohm resistor across the switch and a 680-ohm resistor in series with the power supply lead. This feature detects both open and short circuits. When LFD is enabled and a line fault is detected the MTL device illuminates an LED indicator and forces the channel data to OFF.
- If a MTL4510, MTL4511, or MTL4516 device is used, there is no indication to EPKS.
- If the MTL4517 is used channel 31 is energized to ON. Note that for the MTL4517 if any channel has LFD enabled channel 31 is not available for use as a general purpose input - for the other three devices channel 31 is always available.

Attention

Open wire detection is not supported in DI (Cx-PDIL51) module. The configuration mismatch warning message appears when you select the OWDENBL option and loads DICHANNEL FB to AI-HART (Cx-PDIL51) module. After loading the module, the channel can be activated. However, the OWDENBL parameter value appears as 'FALSE.'

10.15 Defining DO Channel Blocks

The digital output channel provides a digital output to the field, based on the origin of the input and the configured parameters.

There are four types of digital output points:

- status output (SO) the default type,
- pulse-width modulated (PWM) output,
- pulse-on output (PULSEON), and
- pulse-off output (OFFPULSE)

The DOTYPE parameter determines the output type. The PWM type is used in combination with RegCtl algorithms to provide true proportional control. The status and pulsing output types are for digital outputs that are connected to device control blocks.

Actual output action can be:

- status,
- latched or
- · momentary

It is dependant on the configuration of the device control point.

A functional diagram of the digital output channel is displayed below.

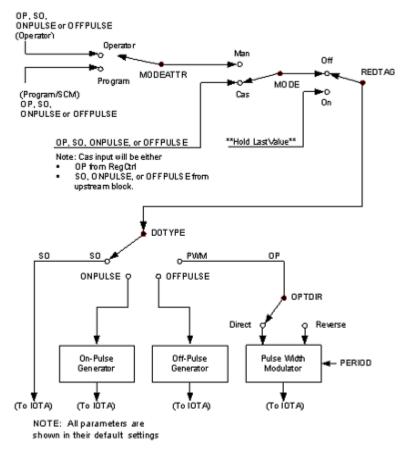


Figure 195: Digital output conversion

10.15.1 Determining Status Output type - DO Channel blocks

The status output type can be controlled from a:

- · device control block output,
- · logic block output, or
- RegCtl block (that has been configured for the PosProp algorithm) as determined by the parameter connection.

10.15.2 Determining Pulse Width Modulated (PWM) Output type

The PWM output type can receive its input from an Experion regulatory block through a user-configured output connection. The length of the pulse is derived from the OP parameter provided by the regulatory block. Because OP is in percent, the percent value becomes the percent on time for the pulse whose period (1.0 to 120.0 seconds) is specified by the PERIOD parameter, as displayed below.

The output direction of the output signal can be configured to be direct or reverse acting by using the OPTDIR parameter.

The pulse on-time for direct and reverse acting outputs is calculated as follows:

For direct action:

$$PulseOnTime = \frac{OP\%*PERIOD}{100}$$

For reverse action:

$$PulseOnTime = \frac{100 - OP\% * PERIOD}{100}$$

If the value of OP is less than 0%, it is clamped to 0%; an OP with a value greater than 100% is clamped to 100%.

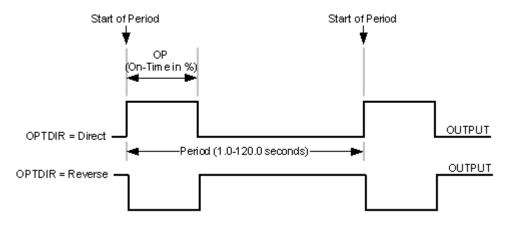


Figure 196: Pulse Width Modulated Output

10.15.3 Determining On-Pulse and Off-Pulse Output type - DO Channel blocks

The On-Pulse and Off-Pulse output types can be controlled from:

- a device control block output,
- a RegCtl block (that has been configured for the PosProp algorithm) as determined by the parameter connection.

Pulsed operation (pulse on or pulse-off) can be obtained by linking the output connections to the ONPULSE and OFFPULSE parameters, respectively.

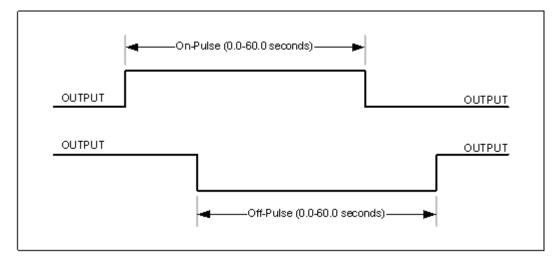


Figure 197: On-Pulse and Off-Pulse Output types



Tip

Standalone DO channels configured for On-Pulse or Off-Pulse are not supported. These blocks must have a parameter connection to an upstream block. SCM writes or other writes using Program access level are not permitted.

The Status Output (SO) setting is impacted by the ONPULSE and OFFPULSE parameters as indicated in the following table.

Table 123: Status Output settings

| Parameter | Status Output (SO) setting | If SO is set to 0.0 |
|-----------|------------------------------|------------------------------|
| ONPULSE | On - for specified duration | SO is immediately set to OFF |
| OFFPULSE | Off - for specified duration | SO is immediately set to ON |

To provide consistent and safe behavior, the following occurs when setting DOTYPE to either ONPULSE or OFF PULSE.

Table 124: Setting DOTYPE to ONPULSE or OFFPULSE

| If | Then |
|--------------------|--|
| MODE is MAN | the ONPULSE and OFFPULSE parameters only accept operator writes. (Program access level writes and NOT all other writes are accepted.) operator access level writes to SO are accepted and writing SO terminates an active pulse. |
| PTEXECST is ACTIVE | changing MODE to CAS sets the output to the quiescent state |
| PTEXECST is ACTIVE | always sets the output to the quiescent state |

10.15.4 Determining Initialization Request Flag - DO Channel blocks

The request to initialize a DO channel is accomplished through the INITREQ or PWMINITREQ parameters.

Table 125: DO channel initialization

| The following is set to ON | And | | |
|----------------------------|---|--|--|
| INITREQ | Control strategies in Experion cannot manipulate the output. | | |
| | Device Control blocks and Position Proportional control algorithms are automatically forced to initialize when outputting to a Digital Output channel. | | |
| | When one or more of the following is true: | | |
| | - the IOMSTATE is IDLE, or | | |
| | StandbyMan is Active, or | | |
| | - PTEXECST is INACTIVE | | |
| | - channel MODE is set to MAN, or | | |
| | there is a soft failure and the point is not working | | |
| | NOTE: Device Control blocks and Position Proportional control algorithms are automatically forced to initialize when outputting to a Digital Output channel whose INITREQ is ON | | |

10.15.5 Determining Modes - DO Channel blocks

The MODE parameter determines the operating mode for the channel block. The following operating modes are applicable to the both DO and AO channel blocks:

- Manual (Man) provides the operator or the program with direct control over the output value of the channel, regardless of any continuous control strategy.
- Cascade (CAS) data point receives its output value from a primary data point.



Tip

Operators are only permitted to change MODE if MODEPERM is set to Permit and REDTAG is set to off.

10.15.6 Determining Output Verification - DO Channel blocks

Outputs are verified by periodically reading back the value on the output screw and comparing the read back value with the database value. This includes an output wiggle (for the safety system) to prove they are not stuck in any one state.

10.15.7 Determining Over-current protection - DO Channel blocks

Digital outputs are protected from inadvertent over-current conditions. If a DO channel consumes more current than it should the IOM posts a soft failure and sheds to manual control. Supervisor intervention is required to return the channel to normal operation. Over-current conditions are typically the result of a shorted device or capable.

10.15.8 Comparing parameters between Series C and PMIO that support DO

The following parameters are:

- specific to DO and found on various tabs on the DO channel block.
- work identically to the same named PM I/O counterparts.

| DO supported parameters for current Series C I/O that work identically to the same named PM I/O parameters | | | | |
|--|--|--|--|--|
| | | | | |

| DO supported parameters for current Series C I/O | | | |
|---|-------------------|--------|--|
| that work identically to the same named PM I/O parameters | | | |
| SO | ONPULSE, OFFPULSE | PERIOD | |
| SOREADFAIL | OP, OPINITVAL | | |

10.16 Electronic Short-Circuit Protection (DO-24V only)

The behavior of the Series C Digital Output - 24V with Electronic Short Circuit Protection (in the presence of wiring faults) causes a DO channel that draws more current than is permitted, to activate the IOM hardware's electronic short-circuit protection mechanism causing that channel to go unpowered. The feature applies to these specific model numbers:

- CC-PDOB01 Digital Output IO Module (IOM) (32 channels at 24V)
- CC-TDOB01 DO IOTA (32 channels at 24V)
- CC-TDOB11 DO IOTA Redundant (32 channels at 24V)



Attention

Output short circuit detection is not supported if channel is configured for pulse output type

10.16.1 Non-redundant Configuration

When the electronic short-circuit protection mechanism activates and the channel goes unpowered the non-redundant IOM:

- detects the output inconsistency and generates Soft Failure 23 Failure in OP circuit/field wiring detected by AO/DO
- detects the over current and generates: Soft Failure 180 Output Short Circuit Detected
- sets:
 - the output to unpowered
 - Shed Mode to Manual control.
 - Shed ModeAttr to Operator.

You should expect to see:

- · Two Soft Failures
 - Soft Failure 23 Failure in OP circuit/field wiring detected by AO/DO
 - Soft Failure 180 Output Short Circuit Detected
- The output unpowered
- The channel in Manual mode

10.16.2 Redundant Configuration

The firmware in a Primary IOM of a redundant pair notices the output miscompare and signals the Secondary IOM to assume the role of the Primary IOM (assuming the Secondary is synced).

The most common cause for the DO over-current is a failure in the field there is a minor probability that the IOM itself might be the cause of the problem. Given this, it is a common behavior for Series C IOMs to always switchover in an attempt to localize the fault.



Tip

Note that the Primary switchover in most cases is done before actually experiencing the over current condition.

If the cause for the DO over-current is a failure in the field, then the new Primary will see the same output miscompare problem, and react like a non-redundant module would - it will:

- Detect the output miscompare generate Soft Failure 23 Failure in OP circuit/field wiring detected by AO/DO.
- Detect the over current and generate Soft Failure 180 Output Short Circuit Detected
- Set the output to unpowered.

- Shed Mode to Manual control.
- Shed ModeAttr to Operator.

You should expect to see:

- One Soft Failure posted from the former Primary:
- Soft Failure 23 Failure in OP circuit/field wiring detected by AO/DO
- A IOM Failover event

The following are likely if the fault was in the field:

- Two Soft Failures posted by the new Primary:
 - Soft Failure 23 Failure in OP circuit/field wiring detected by AO/DO Soft Failure 180 Output Short Circuit Detected
- The output unpowered
- The channel in Manual mode
- The former Primary's output miscompare Soft Failure will Return To Normal once both modules synchronize.

10.16.3 Electronic Short-Circuit Fault Recovery

To return the channel to normal operation the shorted device or shorted wiring must be corrected.

10.16.4 To clear the short-circuit fault:



CAUTION

Immediately after the IOM detects the fault and the DO Channel is set to OFF, it should be safe to perform maintenance action.

Once the DO channel is set ON, no maintenance action can occur.

- 1 Find and clear the wiring fault. This must be done prior to attempting to restore the DO channel to oncontrol.
 - NOTE: The fault may exist at various locations including the IOM, IOTA, external field devices and wiring connecting these devices. After attempting to clear the fault at any of these locations, Step 2 below should be followed.
- 2 Once the actual fault has been cleared, your appropriate plant personnel can restore the DO Channel to normal operation by setting the DO while still in Manual or setting the mode to Cascade and resuming DO writes (programmatically based on user strategy).
- 3 This concludes this procedure.

10.17 Defining SP-Al Channel Blocks

The SP - AI channel block represents a single analog point on Speed Protection (SP) module. The type of analog input IOM needed is based on the:

- type of field sensor that is providing the input to the channel
- PV characterization options you select (as listed in the table in determining PV Characterization):

The analog input channel converts an analog signal received from a field sensor to PV with appropriate engineering units for use by other function blocks in the C300 - 20mS CEE Controller, and by the rest of Experion. To accomplish this function, the analog input channel performs:

- Analog-to digital conversion
- · PV characterization
- · Range Checking and PV filtering
- · PV source selection
- · Open Wire Detection

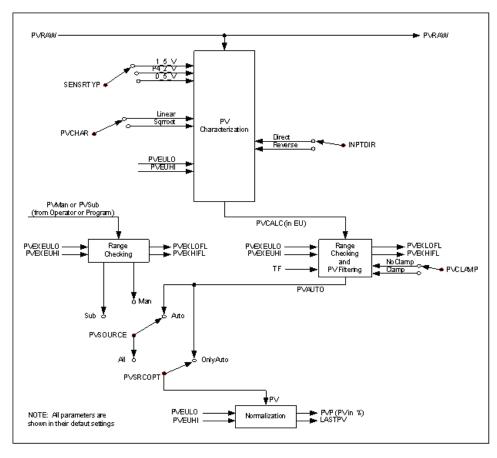


Figure 198: Speed Analog Input conversion

10.17.1 Determining PV Characterization - SP-Al Channel blocks

The PV signal received from the field is characterized based on the entries that you make for the following parameters:

- SENSRTYP
- PVCHAR

- PVTEMP, and
- INPTDIR

The input PV signal is:

- 1. converted to a raw PV signal (PVRAW) whose units can be %, ratio, milli-volts, micro-volts, or milli-ohms depending on the entry made for the SENSRTYP parameter,
- 2. then converted to the engineering units.

Table 126: SPM - AI engineering unit conversions

| Sensor type | Al Module | PVCHAR | PVRAW | PVCALC | Bad PV detection |
|----------------------------|-----------|-----------------------------------|----------|----------|--|
| (SENSRTYP) | type | Options | (note 1) | (note 2) | |
| 0-5-V (0 to 5 volts) | SP-AI | Linear square rt. | percent | EU | Range check on PVCALC |
| P4_2_V (0.4 to 2 volts) | SP-AI | Linear square rt. | percent | EU | Range check on PVCALC. Checks for open input |
| 1_5_V (1 to 5 volts) | SP-AI | Linear square rt. Device Range | percent | EU | Range check on PVCALC. Checks for open input |

LEGEND:

EU = Engineering Units

SPM-AI = Speed Protection Module - Analog Input

PVCALC = Calculated PV

PVCHAR = PV Characterization

PVRAW = PV received from field and converted to digital form by the A/D converter

Notes:

- 1. PVRAW is the voltage signal at the IOTA as a percentage of the voltage range for the sensor type. The exceptions are as follows
- 2. If the diagnostics determine that the A/D converter has failed, PVRAW of the slot is set to NaN.
- 3. The normal operating range for PVRAW is configured by you
- 4. SPM-AI does not support PVCHAR of DeviceRange.
- 5. When 4-20mA signal is connected to SPM-AI, the Sensor Type 1 5 V must be used.

10.17.2 Determining Linear Conversion - SP-AI Channel blocks

The PVRAW value is converted to a floating-point number. The output value of the linear conversion is PVCALC, which is calculated based on the raw input span, and the engineering unit span.

The state of the input direction parameter (INPTDIR) is taken into consideration during the calculation of PVCALC as follows:

For 0-5V, 0.42V, and 1-5V, sensor types, when INPTDIR is Direct:

$$PVCALC = \frac{PVRAW}{100} * (PVEUHI - PVEULO) + PVEULO$$

For 0-5V, 0.42V, and 1-5V, sensor types, when INPTDIR is Reverse:

$$PVCALC = PVEUHI - \frac{PVRAW}{100} * (PVEUHI - PVEULO)$$

10.17.3 Determining Square Root Conversion - SP-Al Channel blocks

The square-root calculation is applied to the PVRAW input such that 100% of span = 1.0

The square-rooted value is then converted to engineering units based on the configured PV engineering-unit range values. (For example, square root of 100% = 100%; square root of 50% = 70.71%.)

The output value of the square-root conversion is PVCALC, which is calculated based on the state of the input direction parameter (INPTDIR) as follows.

If PVR AW? 0.0 and INPTDIR is Direct:

$$PVCALC = PVEULO + \sqrt{\frac{PVRAW}{100}} * (PVEUHI - PVEULO)$$

If PVRAW < 0.0 and INPTD IR is Direct:

$$PVCALC = PVEULO - \sqrt{\frac{-PVRAW}{100}} * (PVEUHI - PVEULO)$$

If PVR AW? 0.0 and INPTDIR is Reverse:

$$PVCALC = PVEUHI - \sqrt{\frac{PVRAW}{100}} * (PVEUHI - PVEULO)$$

If PVR AW < 0.0 and INPTD IR is Reverse:

$$PVCALC = PVEUHI + \sqrt{\frac{-PVRAW}{100}} * (PVEUHI - PVEULO)$$

10.17.4 Open Wire Detection - SP-Al Channel blocks

Open Wire Detection is available in the SP_AI channel. The open wire diagnostic detects and annunciates broken field wires. In addition, a seemingly valid PV from a channel diagnosed as having a broken-wire is not made available (thus preventing incorrect control action).

If open wire detection is enabled (OWDENBL = ON) and the IOM detects the broken-wire condition, then

- Soft Failure 179 'Open Wire Detected' is generated, and
- PVRAW and PVAUTO are consequently set to NaN.

10.17.5 Checking and Filtering PV Range - SP-Al Channel blocks

PV range checking ensures that the PVCALC output of PV characterization is within limits defined by parameters PVEXEULO and PVEXEUHI. If either of the limits is violated and clamping is not specified, the output of PVAUTO is set to NaN. If clamping has been specified, the output of PVAUTO is clamped to PVEXEUHI or PVEXEULO, except when PVRAW, PVCALC, and PVAUTO are consequently set to NaN.

If the range-checked and filtered value is less than the value specified by the user-configured LOCUTOFF parameter, the final output PVAUTO is forced to PVEULO.

You can perform first-order filtering on PVCALC, through parameter TF (filter lag time).

10.18 Defining SP-AO Channel Blocks

The SP - AO channel block represents a single analog output point on the SP - AO Module. The SP - AO channel block converts the Output (OP) into a 4-20 mA output signal for operating final control elements such as valves and actuators in the field.

Note: The SP - AO can also function as a normal Series C AO channel.

To convert the OP value to a 4-20 mA signal, the SP - AO channel performs,

- Direct/Reverse Output Function
- Nonlinear Output Characterization

Attention

SP_AO channel can also accept inputs from the following channels of the same SPM IOM.

- PV value from SP_AI channel
- PV value from any SP SPEED channels
- · Voted PV1 and voted PV2 from the SP SPDVOTE channel

The SP - AO channel block also supports the following functionalities.

- 1. Supports direct writes of values generated within the IOM. The OP parameter can be connected to one of the following output parameters when it is configured as a block pin.
 - a. VOTPVx (x=1 or 2)
 - b. PV of any speed channels, or
 - c. PV of any AI channel
- 2. Default value for MODE is set to 'CAS' and that of MODATTR is set to 'PROGRAM.'

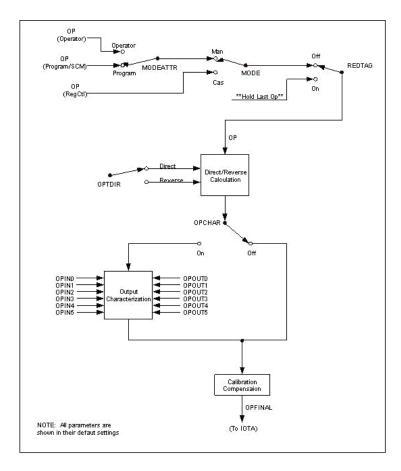


Figure 199: Speed Analog Output conversion

10.18.1 Determining Direct/Reverse Output - SP-AO Channel blocks

The OPTDIR parameter allows you to specify whether the output of the data point is:

- direct acting (where 4 mA = 0%, and 20 mA = 100%), or
- reverse acting (where 4 mA = 100%, and 20 mA = 0%).

By Default, the OPTDIR parameter is set to 'Direct.'

10.18.2 Determining Output Characterization - SP-AO Channel blocks

Output characterization is an optional function that can be implemented by setting parameter OPCHAR to ON. When OPCHAR is set to ON, the analog output point interpolates linearly between the two nearest values. The interpolated value becomes the output value OPFINAL.

Further, output characterization allows you to specify an output transfer function, using configurable X-Y coordinates that provide five linear segments as displayed below. The length of each segment is variable according to the coordinates OPOUT0-5 and OPIN0-5. The end points of the curve are fixed at coordinates OPOUT0, OPIN0 (at -6.9%) and OPOUT5, OPIN5 (at 106.9%). These coordinates are fixed at these values to ensure that neither the characterization function nor its inverse can provide output values, which are outside the -6.9% to 106.9% range. You enter the values for OPOUT1-4 and OPIN1-4 to achieve the desired curve.

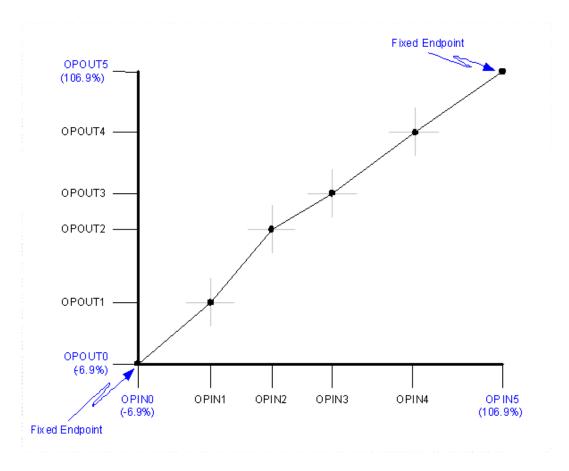


Figure 200: Determining fixed endpoint

10.18.3 Determining Calibration Compensation - SP-AO Channel blocks

The final stage of output processing in the analog output point is calibration compensation. This is accomplished in the data point using internal offset and scale constants. The output value OPFINAL is then routed to the field through the IOTA.

10.18.4 Determining Modes - SP-AO Channel blocks

The MODE parameter determines the operating mode for the channel block. The following operating modes are applicable to SPM - AO and SPM - DO channel blocks:

- Manual (Man) provides the operator or the program with direct control over the output value of the channel, regardless of any continuous control strategy.
- Cascade (CAS) data point receives its output value from a primary data point.
- Normal reflects the NMODEATTR and NMODE parameter values, which was configured.

10.18.5 Determining Output Verification - SP-AO Channel blocks

Outputs are verified by periodically reading back the value on the output screw and comparing the read back value with the database value. This includes an independent A-to-D conversion for the read back value.

10.19 Defining SP-DI Channel Blocks

The DI channel block represents a single digital input point on the SP - DI channel block. The SP - DI channel block converts a digital PVRAW signal received from the field to a PV that can be used only for Turbine Control solutions.



Attention

The SP - DI channel block does not support DISOE and DIMODE parameter.

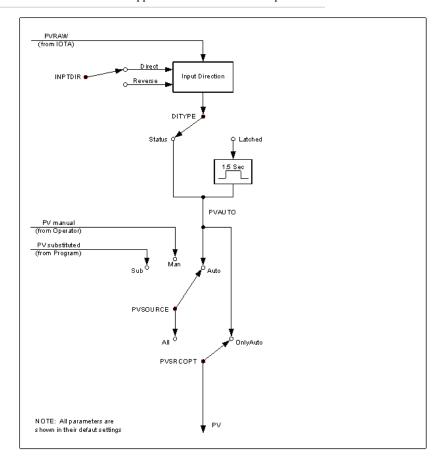


Figure 201: Speed Digital Input conversion

10.19.1 Determining Status Digital Input Channel - SP-DI Channel blocks

For this digital input type, the PVAUTO value represents the state of the raw input signal after the direct/reverse conversion is performed. The status digital input channel is selected by setting the DITYPE parameter to 'Status,' and this block can be configured for PV source selection.

The current PV state is available as an input to logic blocks and other Experion control function blocks. It is also available for SP - DO permissive check configuration parameters.

PV Source Selection - The PV source parameter (PVSOURCE) option determines the source of the PV for a status input channel. The source can be

- PV input from the field (PVRAW),
- · PV state entered by the operator (PV manual), or
- PV supplied by a user program (PV substituted).

PVSOURCE has no effect on the DITYPE of the digital input channel if PVSOURCE is AUTO, and PV tracks PVRAW.

10.19.2 Determining Latched Digital Input Channel - SP-DI Channel blocks

To capture the occurrence of momentary digital inputs, such as from push buttons, the digital input channel is configured as a latched input.

Configuring the channel as latched is accomplished by setting:

DITYPE to 'Latched'

When the digital input channel is configured as a latched input channel, an input pulse that is ON for a minimum of 5 milliseconds is latched TRUE for 1.5 seconds. This ensures that any control function block, that needs to monitor this input, executes at least once during the time that the signal is latched.

10.19.3 Open Wire Detection - SP-DI Channel blocks

The SP - DI channel supports open wire diagnostics to detect and annunciate broken field wires. In addition, PV is displayed as 'BAD' to prevent incorrect control action.

Ensure that a bleed resistor (\sim 22k ohm) resistor is installed at the switching device providing the switched signal. If this resistor is not installed and open wire detection is enabled (OWDENBL = ON), a false open wire alarm is generated whenever the input device is not closed (i.e., PVRAW = OFF).

If open wire detection is enabled and the IOM detects the broken-wire condition,

- · Soft Failure 179 'Open Wire Detected' is generated, and
- · PVRAW and PVAUTO is set to OFF

The DI channel supports PV flag with reset option, which can be used as an interlock option in the SPD - DO channel block.

Note: When PV is set to 'OFF,' PV.FLWRST is still set to 'ON' until you set RESETTRIP to 'ON.'

10.20 Defining SP-DO Channel Blocks

The digital output channel provides a digital output to the field, based on the origin of the input and the configured parameters.

There are two types of digital output points:

- status output (SO) the default type, and
- on-pulse output (ONPULSE)

•

Attention

Normally Open (NO), Normally Closed (NC), and RTN are provided for four relay contacts for customized configurations. You must use appropriately rated fuses in the relay output."

The DOTYPE parameter determines the output type. The status and on pulse output types are for digital outputs that are connected to device control blocks.

Actual output action can be any one of the following depending on the configuration of the device control point.

- status or
- · latched

The SP - DO channel block supports multiple interlock checks prior to DO change. Eight interlock check parameters are available and are set to 'OFF' by default. The interlock check parameters can be connected with any one of the following flags.

- PV and PV.FLWRST of any DI Channel block of the same SP IOM only.
- XXXX. FL, where XXXX can be any one of VOTPVxHIALM, VOTROCxPOSHIALM, VOTPVxHHALM or VOTROCxPOSHHALM - x=1 and 2, of local SP - SPDVOTE channel.
- XXXX. FLWRST, where XXXX can be any one of VOTPVxHHALM or VOTROCxPOSHHALM x=1 and 2, of local SP SPDVOTE channel.
- YYYY. FL, where YYYY can be any one of PVHIALM, ROCPOSHIALM, PVHHALM or ROCPOSHHALM of local SP - SPEED channel.
- YYYY. FLWRST, where YYYY can be any one of PVHHALM or ROCPOSHHALM of local SP SPEED channel.

•

Attention

- The interlock parameters (11 to 18) that are not connected are not used for interlock processing.
- The response time of the DO trip achieved using the interlock configuration is faster than that of the alarms
 reported using any function blocks such as FLAG or DIGACQ blocks. Hence, the TripValue displayed in the
 Station for the Data Acquisition Block alarms and the PV at the time when the DO was tripped may not
 necessarily be same.
- LastTripReason parameter does not hold the value when the SPM power cycle happens. To retain the LastTripReason value, perform the following:
- 1. connect the alarm flags that are configured as interlocks to a FirstOut block
- 2. Use the same alarm flags for determining the interlock, which caused the trip in SPM.

A functional diagram of the digital output channel is displayed.

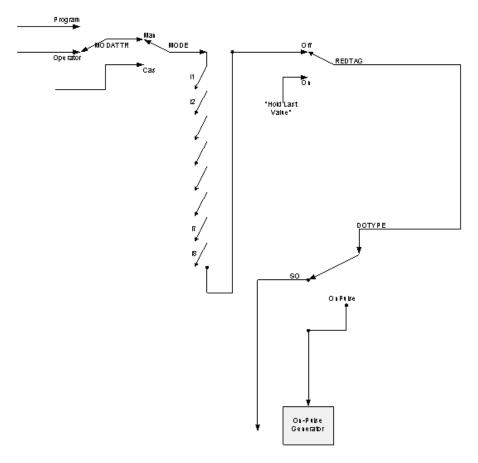


Figure 202: Speed Digital Output conversion

10.20.1 Determining Status Output type - SP-DO Channel blocks

The status output can be controlled in two different ways.

- 1. The status output type can be controlled from a
- device control block output,
- · logic block output, or
- RegCtl block (that has been configured for the PosProp algorithm)

if the MODE parameter is configured as 'CAS'

- 1. The status output can also be controlled, along with the interlock source parameters configured for this channel,
- · by an operator

if the MODE parameter is configured as 'MAN' and MODATTR parameter is configured as 'OPERATOR.'

10.20.2 Determining On - Pulse Output type - SP-DO Channel blocks

The On - Pulse output type can be controlled from a:

- device control block output,
- logic block output, or
- RegCtl block (that has been configured for the PosProp algorithm) as determined by the parameter connection.

If the ONPULSE is configured as 30 seconds, Status Output (SO) is set to 'ON.' After 5 seconds, if the ONPULSE is re-configured as 20 seconds, the SO is set to 'ON' for next 20 seconds. This occurs because of the remaining 25 seconds of the previous timer count is ignored.

If the SP - DO is configured with permissive and output type as 'ONPULSE,' then

- SP DO is set to 'ON' for the ONPULSE timer duration only if the permissive are strong state during the timer period.
- SP DO is set to 'OFF' if the permissive go to weak state during the ONPULSE timer period, and it remains 'OFF' even the permissive become strong within initial ONPULSE period.

Pulsed operation (ONPULSE) can be obtained by linking the output connection to the ONPULSE parameter.

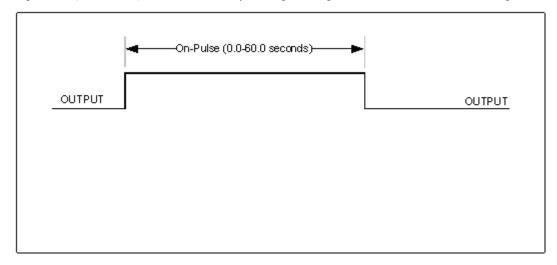


Figure 203: Speed Digital On Pulse Output



Tip

Standalone DO channels configured for On-Pulse or Off-Pulse are not supported. These blocks must have a parameter connection to an upstream block. SCM writes or other writes using Program access level are not permitted.

The Status Output (SO) setting is impacted by the ONPULSE parameter as indicated in the following table.

Table 127: Status Output settings

| Parameter | Status Output (SO) setting | If ONPULSE is set to 0.0 | | |
|-----------|---|------------------------------|--|--|
| ONPULSE | On - for specified duration (0.0 to 60.0 seconds) | SO is immediately set to OFF | | |

To provide consistent and safe behavior, the following occurs when setting DOTYPE to ONPULSE.

Table 128: Setting DOTYPE to ONPULSE

| If | Then | |
|--------------------|--|--|
| MODE is MAN | the ONPULSE parameter only accepts operator writes. (Program access level writes and NOT all other writes are accepted.) | |
| | operator access level writes to SO are accepted and writing SO terminates an active pulse. | |
| PTEXECST is ACTIVE | changing MODE to CAS sets the output to the INACTIVE state | |
| PTEXECST is ACTIVE | always sets the output to the INACTIVE state | |

10.20.3 Determining Initialization Request Flag - SP-DO Channel blocks

The request to initialize a SP - DO channel is accomplished through the INITREQ or PWMINITREQ parameters.

Table 129: SP - DO channel initialization

| If | Then |
|----------------------|---|
| INITREQ is set to ON | Control strategies in Experion cannot manipulate the output. Device Control blocks and Position Proportional control algorithms are automatically forced to initialize when sending output to a SP - DO channel. When one or more of the following is true: the IOMSTATE is IDLE, or StandbyMan is Active, or PTEXECST is INACTIVE channel MODE is set to MAN, or |
| | there is a soft failure and the point is not working NOTE: Device Control blocks and Position Proportional control algorithms are automatically forced to initialize when sending output to a SP - DO channel whose INITREQ is ON. |

10.20.4 Determining Modes - SP-DO Channel blocks

The MODE parameter determines the operating mode for the channel block. The following operating modes are applicable to the SP - DO and SP - AO channel blocks:

- Manual (Man) provides the operator or the program with direct control over the output value of the channel, regardless of any continuous control strategy.
- Cascade (CAS) data point receives its output value from a primary data point.



Tip

- The default value of MODATTR is OPERATOR.
- The default value of MODE is MAN.

10.20.5 Fail-safe configuration - SP-DO Channel blocks

The recommended fail-safe configuration for the SP DO channel is:

- READY flag of DO is set 'ON' for normal operation only if all the interlocks are met.
- READY flag of DO is set to 'OFF' for trip operation if there is any failure in any of the interlocks.

10.21 Defining SP-SPEED Channel Blocks

The speed channel converts pulse signal received from a field sensor to a PV value in engineering units for use by the SPM, other function blocks in the C300, and by the rest of the Experion system. In addition to speed computation, the block also computes Rate Of Change (ROC) of the PV.

The Speed Channel performs the following functions.

- PV computation and Diagnostics
- Range Checking and PV filtering
- · PV source selection
- Alarm Processing
- · Reverse Rotation
- Flow measurement

10.21.1 PV computation for speed measurement

There are two types of PV computation.

- Calculated PV (PVCALC)
- Rate Of Change (ROC) of PV (ROCPV)

The input PV signal is

- 1. converted to a raw signal (PVRAW), whose unit is Pulse per Second (pps)
- 2. then converted to a floating number, which is the value of PVCALC in RPM/min.

The PVCALC is calculated for speed measurement as follows:

PVCALC = ((PVRAW*60)/C1)*C2

where,

- C1 is the number of teeth on the wheel (TOOTHCNT)
- C2 is gear reduction factor (GEARRATIO)

Simultaneously, ROCPV is also calculated in RPM/Min from the input signal.

The following flow diagram indicates how the pulse signal from sensor is processed to generate PVRAW and ROCPV.

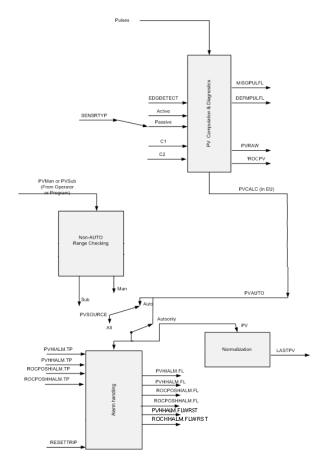


Figure 204: Speed Channel - SPEED signal conversion

10.21.2 Configuring the SP_SPEED channel to measure speed

Perform the following steps on the **Configuration** tab of the SP_SPEED channel's configuration form to measure the speed.

• In the **Type Information** section, configure the MEASUREMENTTYPE parameter as 'Speed_Measurement.'

The parameters related to the speed measurement are enabled in the Configuration tab.

10.21.3 Determining PV Source Selection - SP-SPEED Channel blocks

PV source option parameter (PVSRCOPT) allows you to change the PV source to a source other than AUTO, as follows:

- If the PVSRCOPT parameter is set to ALL, the PVSOURCE can be manually set.
- If the PVSRCOPT parameter is set to ONLYAUTO, the PV tracks PVCALC value.

The PVSOURCE parameter allows you to select the source of the PV for the data channel, as follows:

- If the PVSOURCE parameter is set to AUTO, the PV tracks PVCALC value.
- PV can be manually entered PV (when PVSOURCE is set to 'Man') or
- PV can be directly fetched from a sequence program (when PVSOURCE is set to 'Sub').

10.21.4 Detecting Speed Input Failure

The speed channel's input may fail due to sensor failure, open wire or if the wheel moves away from sensors, and so on. In such scenarios,

- if previous speed PV is less than 200 RPM, speed channel
 - sets PV to 0, and
 - generates the 'No Pulse Input' soft failure,

and the speed channel's 'Zero Speed Detection Flag' is set to 'ON'.

- if previous speed PV is greater than 200 RPM, speed channel
 - sets PV to NaN, and
 - generates 'No Pulse Input' soft failure,

and the speed channel's 'Zero Speed Detection Flag' is not set to 'ON'.

10.21.5 Detecting Reverse Rotation

Reverse rotation is checked by monitoring the phase lag between SP_SPEED channels. Following is the prerequisite to detect the reverse rotation during installation.

• Two SP_SPEED channels that are used for reverse rotation detection are mounted to have a 90 degree (+/-10 degree tolerance) phase difference between the pulses.

Note: If the phase difference between the pulses from SPEED channels changes substantially, reverse rotation detection may not work. In this scenario, the probe positions may need to be adjusted.

The direction of positive turbine rotation is recorded during normal turbine operation when the turbine speed exceeds 500 RPM. The reverse rotation flag is set to ON when there is a phase change observed consistently between the two speed channels for few rotations.

10.21.6 Measuring flow in the turbine flow meters

With R410, SP_SPEED channel can be configured to measure the flow in the turbine flow meters. The flow PV is computed using the following formula.

PV = (PVRAW/ KFACTOR)*TIMEBASE

where the Timebase can be configured as any one of the following:

- /Second, Timebase = 1
- /Minute, Timebase = 60
- /Hour, Timebase = 3600
- /Day, Timebase = 86400

10.21.7 Configuring the SP_SPEED channel to measure the flow

Perform the following steps on the **Configuration** tab of the SP_SPEED channel's configuration form to measure the flow in the turbine flow meters.

1 In the **Type Information** section, configure the MEASUREMENTTYPE parameter as 'Flow_Measurement.' The parameters related to the flow measurement are enabled in the **Configuration** tab.

- 2 In the **PV Configuration** section, configure TIMEBASE parameter as any one of the following based on your requirement.
 - \Second
 - \Minute
 - \Hour
 - \Day
- 3 In the **Flow Information** section, ensure that the ORDEROFKFACTOR parameter is configured as '1st Order'
- 4 In the Flow Information section, type the value of the KFACTOR as required for flow meter.

10.22 Defining SP-SPDVOTE Channel Blocks

The SP - SPDVOTE channel block accepts multiple inputs (PV1, PV2, PV3, and PV4) from the SP - SPEED block of the parent IOM to compute Voted PVs (VOTPV1 and VOTPV2) and Voted ROCs (VOTROC1 and VOTROC2). It generates alarms such as over speed/acceleration, for the Voted PV or ROC.

Attention

You are recommended to use the DATAACQ block for generating alarms such as over speed, over acceleration, under speed, and under acceleration, using the SP SPEED and SP SPDVOTE PV parameters.

The Voted PV can be connected to

- any function blocks that are running in C300 20mS CEE Controller, or
- OP parameter of SP AO channel in the same SPM.

The SP-SPDVOTE channel allows you to configure all flags for generating alarms or processing control logic.

The output pins can be connected to the interlock parameters of the parent IOM's SP - DO channel and it can be used as a trip signal.



Attention

SP_SPDVOTE block pins PV1, PV2, PV3, and PV4 accept connections only from the PV pins of local SP_SPEED channel block pins. All other connections to PV1, PV2, PV3 and PV4 pins of SP_SPDVOTE logic block are blocked.

10.22.1 Voting Logic Algorithm Execution

There are two different pairs of output.

- Voted PVs (VOTPV1 and VOTPV2)
- Voted ROCs (VOTROC1 and VOTROC2)

These output are obtained by processing the inputs received from the SPEED block. The inputs are processed using the voting logic. This block supports two groups of voting logic.

- Voting Logic Group 1
- Voting Logic Group 2

A maximum of 3 channels can be configured as part of each voting group. The selection is based on GRPxVOTCHENB[1..4], where x = 1 or 2.



Attention

If the total number of valid inputs is less than the configured inputs (GRPxMIN), the VOTPVx (x = 1, or 2) is set to NaN.

It is possible to configure the same channel to both voting groups.

The algorithm sets

- The flag (GRPxIGNORD x=1, 2) indicating if any of the inputs is ignored by the voting logic.
- The Individual flags for each input indicating if it was ignored (GRPxIGNORDFL [1..4] x=1, 2).

The voted PV processing is explained as follows.

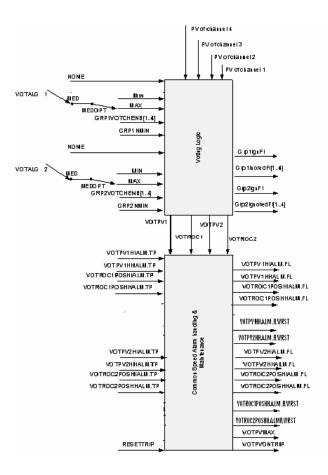


Figure 205: Voting logic algorithm execution

To configure the voting logic algorithm, perform the following steps.

- 1. Select Median (MED) as the voting algorithm (set VOTALGx = Med). The VOTALGx is set to 'NONE' by default. When 'NONE' is selected, the processing of voted PV, ROC and alarm processing is disabled for that particular group.
- 2. Select the number of channels for specific voting logic group using GRPxVOTCHENB[1..4] parameter, where x = 1 or 2.
- 3. Select the number of minimum valid inputs using GRPxNMIN parameter, where x=1, 2. The GRPxNMIN parameter can be 1, 2 or 3.
- 4. If the GRPxNMIN is set as 3, the output of the voting block (VOTPVx) is the median of the 1, 2, and 3 inputs.

Note: If any of the Speed channel's PV is NaN, the output of the voting block (VOTPVx) is also NaN, and VOTPVxSTS = BAD.

5. If the GRPxNMIN is set as 2, the output of the voting block (VOTPVx) is based on 'MEDOPT parameter status.' The MEDOPT parameter can be 'MIN' or 'MAX'

Note: If any of the Speed channel's PV is NaN, the output of the voting block (VOTPVx) is also NaN, VOTPVxSTS = BAD



Attention

Same combination of channels must not be configured for voting logic groups.

Example:

If the channel 1, 2, and 3 is configured for the voting logic group 1, the same channels must not configured for the voting logic group 2.

10.23 Defining SVP-Al Channel block

The SVP - AI channel block represents a single analog point on Servo Valve Positioner (SVP) module. The type of analog input IOM needed is based on the:

- type of field sensor that is providing input to the channel
- PV characterization options you select (as listed in the table 'Determining PV Characterization'):



Attention

In SVPM, position inputs in the input channels must be configured using the SENSRTYP parameter.

The analog input channel converts an analog signal received from a field sensor to PV with appropriate engineering units for use by other function blocks in the C300 - 20mS CEE Controller and by the rest of Experion. To accomplish this function, the analog input channel, performs:

- Analog-to digital conversion
- · PV characterization
- · Range checking and PV filtering
- PV source selection
- Open wire detection

10.23.1 Determining PV Characterization if SENSRTYP is configured as 'LVDT' or 'RVDT' or 'Resolver'

The PV signal received from the field is characterized based on the entries that you make for the SENSRTYP parameter.

The input PV signal is converted to a raw PV signal (PVRAW) whose units can be % in case of LVDT/RVDT and degree in case of Resolver.

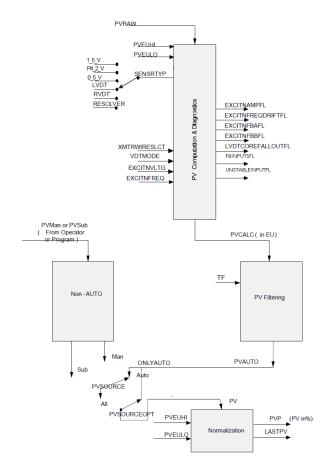


Figure 206: SVP -AI PV processing when it is configured for LVDT or RVDT or Resolver

The following parameters are enabled only when SENSRTYP is set to 'LVDT' or 'RVDT' or 'Resolver.'

- Transducer Wire Select (XMTRWIRESLCT)
- Position Mode Select (VDTMODE)
- Excitation Voltage
 - For Resolver: ranges from 1.1 vrms to 8 vrms
 - For LVDT/RVDT: ranges from 3 vrms to 8 vrms
- Excitation Frequency ranges from 1000 Hz to 3200 Hz
- Calibration Value (CALIBVAL) used for VDT calibration.

The VDTMODE parameter values are explained based on the XMTRWIRESLCT parameter values.

| Transducer Wiring Scheme (XMTRWIRESLCT) | Supported Modes (VDTMODE) | |
|--|---------------------------|--|
| 3_WIRE | A | |
| 4_WIRE | A | |
| 5_WIRE | (A-B), (A-B)/(A+B) | |
| 6_WIRE | (A-B), (A-B)/(A+B) | |
| | ARCTAN(A/B) | |
| Note: If the SENSDTVD is configured as 'Decalyor' the VDTMODE parameter is set as 'A DCTAN(A/D)' and the | | |

Note: If the SENSRTYP is configured as 'Resolver,' the VDTMODE parameter is set as 'ARCTAN(A/B)' and the XMTRWIRESLCT parameter is set as '6_WIRE.'

Table 130: SVP - Al engineering unit conversions

| Sensor type | Al Channel | PVCHAR | PVRAW | PVCALC | Bad PV detection |
|-------------|------------|-----------------------------------|----------|----------|------------------------|
| (SENSRTYP) | type | Options | (note 1) | (note 2) | |
| 4-20mA | SVP-AI | Linear square rt. Device Range | percent | EU | Range check on PVCALC. |
| LVDT | SVP-AI | Not applicable | percent | percent | Range check on PVCALC |
| RVDT | SVP-AI | Not applicable | percent | percent | Range check on PVCALC |
| Resolver | SVP-AI | Not applicable | degree | degree | Not applicable |

LEGEND:

EU = Engineering Units

SVP-AI = Servo Valve Positioner Module - Analog Input

PVCALC = Calculated PV

PVCHAR = PV Characterization

PVRAW = PV received from field and converted to digital form by the A/D converter

Notes:

- 1. PVRAW is the voltage signal at the IOTA as a percentage of the voltage range for the sensor type.
- 2. If the diagnostics determine that the A/D converter has failed, PVRAW of the slot is set to NaN.

10.23.2 Determining PV Source Selection - SVP-AI Channel blocks

PV Source Selection - The PV source parameter (PVSOURCE) option determines the source of the PV for a status input channel. The source can be

- PV input from the field (PVRAW),
- PV state entered by the operator (PV manual), or
- PV supplied by a user program (PV substituted).

10.23.3 Determining Linear Conversion - SVP-Al Channel blocks

The PVRAW value is converted to a floating-point number. The output value of the linear conversion is PVCALC, which is calculated based on the raw input span, and the engineering unit span.

Note: The state of the input direction parameter (INPTDIR) is not taken into consideration during the calculation of PVCALC for all sensor types except Resolver as follows:

$$PVCALC = \frac{PVRAW}{100} * (PVEUHI - PVEULO) + PVEULO$$

The PVCALC is calculated for Resolver interface as follows:

10.23.4 Determining PV Characterization if SENSRTYP is configured other than 'LVDT' or 'RVDT' or Resolver

The PV signal received from the field is characterized based on the entries that you make for the parameters:

- SENSRTYP
- PVCHAR
- INPTDIR

The input PV signal is:

- converted to a raw signal (PVRAW) whose units can be %, ratio, millivolts, microvolts, or milliohms depending on the entry made for the SENSRTYP parameter,
- and, then converted to engineering units.

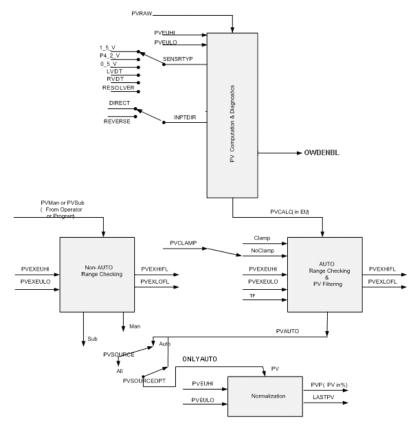


Figure 207: SVP -AI PV processing when it is configured other than LVDT/RVDT or Resolver

10.23.5 Determining Square Root Conversion - SVP-Al Channel blocks

The square-root calculation is applied to the PVRAW input such that

100% of span = 1.0

The square-rooted value is then converted to engineering units based on the configured PV engineering-unit range values.

(For example, square root of 100% = 100%; square root of 50% = 70.71%.)

The output value of the square-root conversion is PVCALC, which is calculated as follows

If PVRAW? 0.0 and 4-20mA is selected:

$$PVCALC = PVEULO + \sqrt{\frac{PVRAW}{100}} * (PVEUHI - PVEULO)$$

For more information, refer to the following sections in Defining SP - AI Channel block section.

- 1. "Determining PV Characterization SP-AI Channel blocks" on page 400
- 2. "Determining Linear Conversion SP-AI Channel blocks" on page 401
- 3. "Determining Square Root Conversion SP-AI Channel blocks" on page 402

10.23.6 Detecting Open Wire - SVP-Al Channel blocks

The open wire diagnostic detects and annunciates broken field wires. In addition, a seemingly valid PV from a channel diagnosed as having a broken-wire is not made available (thus preventing incorrect control action).

If open wire detection is enabled (OWDENBL = ON) and the IOM detects the broken-wire condition, then

- Soft Failure 179 'Open Wire Detected' is generated, and
- PVRAW and PVAUTO is consequently set to NaN.

10.23.7 Checking and Filtering PV Range - SVP-Al Channel blocks

PV range checking ensures that the PVCALC output of PV characterization is within the limits defined by parameters PVEXEULO and PVEXEUHI. If either of the limits is violated, the output of the PVAUTO is set to NaN if clamping has not been specified. If clamping has been specified, the output of the PVAUTO is clamped to PVEXEUHI or PVEXEULO, except when PVRAW, PVCALC, and PVAUTO is consequently set to NaN.

If the range-checked and filtered value is less than the value specified by the user-configured LOCUTOFF parameter, the final output called PVAUTO is forced to PVEULO.

First-order filtering is performed on PVCALC, as specified by the user through parameter TF (filter lag time).

10.23.8 Configuring the SVP_AI channel for angular measurement using Resolver

With R410, SVP AI channel can be configured to perform angular measurement using the Resolver.

Perform the following steps in the SVP_AI channel's configuration form to measure the angle using the Resolver.

- 1 In the **Type Information** section of the **Configuration** tab, configure the SENSRTYP parameter as 'Resolver.'
- 2 On the **Position Configuration** tab, verify the following steps.
 - a Ensure that the XMTRWIRESLCT parameter is set as '6 WIRE.'
 - **b** Ensure that the VDTMODE parameter is set as 'ARCTAN(A/B).'

Attention

In a redundant SVP IOM setup, even if one of the modules is faulty, you have to replace it and re-configure the actual angle to calculate the offset value. This is because, the new module does not have the angle offset value. You must configure the present PV value of the primary SVP IOM as the actual angle for calculating the offset value.

10.23.9 Configuring angle offset value

The PVRAW parameter in SVP_AI channel displays the raw value of the measured angle from the Resolver. An offset can be applied to the raw angle using the parameters ACTUALANGLE and APPLYOFFSET.

To add an offset to the raw angle and indicate the same in PV, perform the following steps.

- 1 In the Resolver Angle Offset section of the Position Configuration tab, enter the actual angular position in the Actual Angle (ACTUALANGLE) box.
- 2 Click APPLYOFFSET.

The offset value is internally calculated and is retained even if the SVP module is powered off

Consider that the Resolver PV displays 30 degree and you want to modify the actual angle as 75 degree. In this scenario, configure ACTUALANGLE as 75 degree and click APPLYOFFSET. As a result, the PV displays 75 degrees by internally applying a new offset to PVRAW.

10.24 Defining SVP-DI Channel Block

The DI channel block represents a single digital input point on the SVP - DI channel block. The SVP - DI channel block converts a digital PVRAW signal received from the field to a PV that can be used only for Turbine Control solutions.

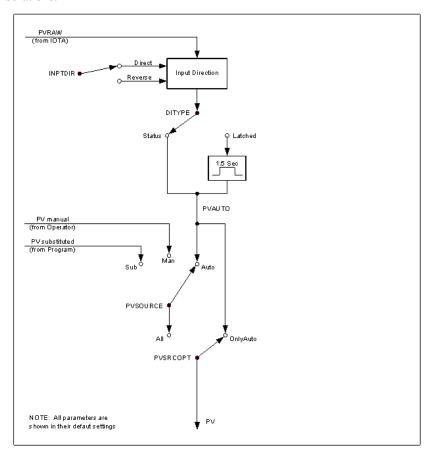


Figure 208: SVP - Digital Input conversion

10.24.1 Determining Status Digital Input Channel - SVP-DI Channel blocks

For this digital input type, the PVAUTO value represents the state of the raw input signal after the direct/reverse conversion is performed. The status digital input channel is selected by setting the DITYPE parameter to 'Status,' and this block can be configured for PV source selection.

The current PV state is available as an input to logic blocks and other Experion control function blocks.

PV Source Selection - The PV source parameter (PVSOURCE) option determines the source of the PV for a status input channel. The source can be

- the PV input from the field (PVRAW),
- the PV state entered by the operator (PV manual), or
- it can be supplied by a user program (PV substituted).

PVSOURCE has no effect on the DITYPE of the digital input channel. If PVSOURCE is AUTO, PV tracks PVRAW.

10.24.2 Determining Latched Digital Input Channel - SVP-DI Channel blocks

To capture the occurrence of momentary digital inputs, such as from push buttons, the digital input channel is configured as a latched input.

Configuring the channel as latched is accomplished by setting:

· DITYPE to 'Latched'

When configured as a latched input channel, an input pulse that is on for a minimum of 5 milliseconds is latched TRUE for 1.5 seconds. This ensures that any control function block, that needs to monitor this input, executes at least once during the time that the signal is latched.

10.24.3 Low Latency Mode - SVP-DI Channel blocks

The DIMODE parameter is not supported in SVP-IOM. The DI channel's inputs are sampled and processed every 5 msec to meet latency requirements.

10.24.4 Open Wire Detection - SVP-DI Channel blocks

The SVP - DI channel supports open wire diagnostics to detect and annunciate broken field wires. In addition, a valid PV from a channel, which is received diagnosed as having a broken-wire, is made unavailable.

Ensure that a bleed resistor (\sim 22k ohm) resistor is installed at the switching device providing the switched signal. If a resistor is not installed and open wire detection is enabled (OWDENBL = ON), a false open wire alarm is generated whenever the input device is not closed (i.e., PVRAW = OFF).

If open wire detection is enabled and the IOM detects the broken-wire condition,

- · Soft Failure 179 'Open Wire Detected' is generated, and
- PVRAW and PVAUTO is consequently set to OFF

10.25 Defining SVP-Regulatory Control Block

The SVP - REGCTL block supports the regulatory algorithm along with some of the C300 PID block features. It accepts PV as input from one of the local SVP_AI channels. It accepts Set Point (SP) from the AUXILIARY function blocks if the MODE parameter is set to 'Cascade.'

Following diagram depicts how the SVP REGCTL block processes the input.

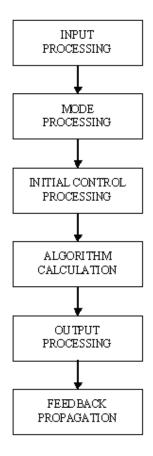


Figure 209: SVP - REGCTL block processing diagram

Attention

SVP_REGCTL accepts inputs (PV1 and PV2) only from the SVP_AI channel of the same IOM/local IOM. Further, the SVP REGCTL channel accepts the SetPoint (SP) value only from the AUXILIARY function blocks.

10.25.1 PV and SP Processing

The SVP REGCTL block accepts the following inputs.

- Process Variables (PV1 and PV2) from the SVP_AI channel based on the PVSOURCE configuration.
- Set Point value from the AUXILIARY function blocks that reside in the C300 20mS CEE Controller when the MODE is set to 'Cascade.'

Process Variable (PV) Processing – fetches the input values (PV1 and PV2) from the SVP_AI channel based on the status (PV1STS and PV2STS) of the input values and gives the output PV value. The inputs PV1 and PV2 act based on the selection of preferred PV source (PREFPVSRC) parameter.

Set Point (SP) Processing – obtains the SP value from the AUXILIARY function blocks when the MODE is set to 'Cascade' and processes it to perform SP limit checking, SP value must be within the engineering unit range defined by PVEUHI and PVEULO.

10.25.2 PV handling when PVSTS is BAD

- 1. If the PVxSTS (x=1, 2) is set to 'BAD',
 - the PVSTSFL.BAD is set to 'ON' in the SVP REGCTL channel,
 - MODE is set to 'MAN' in the SVP AO channel.
 - the calculated variable (CV) is set to 'NaN' to invoke Bad Control processing.
 - the BADCTLFL is set to 'High.'

Note:

- When the PV is 'Bad,' AO Mode change is prohibited until PVSTS returns to 'Normal' if the MODE was in 'Shed'
- When the PV returns to 'Normal,' the channel remains in 'Manual' mode if the MODE was in 'Shed.' You
 must manually change the MODE to 'Normal.'
- 1. If the PVxSTS (x=1, 2) is set to 'Normal',
 - the PV value is normal in SVP AI channel, and
 - the PVSTSFL.NORM is set to 'ON' in the SVP REGCTL channel.

10.25.3 Set Point (SP) Limit checking

This ensures that the SP value does not exceed the configured limits. The limits are

- SPHILM SP high limit
- SPLOLM SP low limit

The limit values can be changed only if the status of the channel is 'InActive.' If the SP limits are changed, the network Anti-Reset Windup status (ARWNET) is recalculated.

If the SP value is beyond the range specified by SPHILM and SPLOLM limits,

- the SP is clamped to the appropriate limit, and
- the appropriate 'limit exceeded' flag (SPHIFL or SPLOFL) is set.

Following table explains about the SVP_REGCTL block behavior when the SP value exceeds the limits (SPHILM and SPLOLM) and the tolerance (SPTOL).

Limits Exceeded Tolerance Exceeded (SPTOL) SVP_REGCTL Behavior Scenario Yes Yes Raise or Lower keys A warning message displays as 'SP value is clamped.' Yes No A warning message displays as 'SP value is clamped.' No SP value is set to a new Yes value without confirming the tolerance. No No SP value is set to a new value.

Table 131: SVP - REGCTL SetPoint processing

10.25.4 Determining and handling modes

Mode identifies the source of stores that is accepted by the inputs (SP and OP) of a SVP_REGCTL block. SVP_REGCTL block supports two modes of operation.

MODE = Manual (Man)

The OP can be stored by the operator. The SVP_REGCTL holds its last OP value instead of computing the OP value, and sets input windup status (ARWNET) to 'HiLo.'

Note:

- The SVP REGCTL does not initialize when its mode is changed.
- The SVP_REGCTL block does not support 'AUTO' mode, and you can store the SP value to the when the MODE is set to 'MAN.'

MODE=Cascade (CAS)

The SVP REGCTL block obtains its input from the AUXILIARY function blocks, and calculates OP.

Mode Attribute (MODEATTR)

Lets you set the block's mode attribute. MODEATTR determines if values to the output (OP) can be stored when the block's MODE is 'MAN.' The MODEATTR can be

- OPERATOR only operator can store the value to OP or SP as specified by MODE.
- PROGRAM this mode is not allowed, as the SVP REGCTL block does not accept the input from SCM.

The default selection is OPERATOR.

Permit Operator Mode Changes (MODEPERM)

Lets you specify if operators are permitted to make MODE changes or not. The default is 'Enabled' (selected). A store to MODE does not change the NORMMODE.

Normal Mode (NORMMODE) and Normal Mode Attribute (NORMMODEATTR)

NORMMODE - Lets you specify the MODE of the SVP_REGCTL block derived at runtime. You can configure the NORMMODE and NORMMODEATTR values by clicking 'NORM' in the Station Display.

The supported selections for the NORMMODE are:

- NONE
- CAScade
- MANual

The default selection is 'NONE.'

NORMMODEATTR - Lets you specify the mode attribute (MODEATTR) when the Control to Normal function is initiated through the Station display.

The supported selections for the NORMMODEATTR are:

- NONE
- OPERATOR
- PROGRAM

The default selection is 'NONE.'

10.25.5 Initial Control Processing

This function directly fetches the OP (INITVAL) value from the SVP_AO block to the SVP_REGCTL block. In the SVP AO block, the OP value can be changed when the MODE is set to 'MAN.' Based on the OP value from

the SVP_AO block, this function performs initialization and windup activities for the SVP_REGCTL block. In addition, it sets the SVP_REGCTL output range (CVEUHI and CVEULO) to the SVP_AO block output range.

10.25.6 Control Initialization

The SVP_REGCTL block brings initialization requests from its secondary through BACKCALCIN. In addition, the secondary may propagate one shot initialization requests to this block. This function requests a primary to initialize by updating the corresponding INITREQ and INITVAL parameters. Normally, the SVPREGCTL block's OP is initialized to the SVP_AO's initialization value. However, if the initialization value exceeds the OP limits, this function clamps the OP to the violated limit.

Initial Control Processing performs the following processing, based on the value of INITMAN.

- When INITMAN changes from 'Off' to 'On': Requests the SVP_REGCTL block's windup status to be recalculated and later propagated to the primary.
- When INITMAN is 'ON': Initializes the SVP REGCTL block's output (OP).
- When INITMAN changes from 'On' to 'Off': Initializes the SVP_REGCTL block's output (OP), and
 requests its windup status to be recalculated.

This function requests the primary to initialize itself if any one of the following is true:

- · SVP REGCTL block is inactive.
- SVP_REGCTL is in initialization.
- · SVP REGCTL is not in the Cascade.
- CVEUHI or CVEULO are Bad.

10.25.7 Algorithms



Attentior

SAFEOP and OUTIND parameters are not supported for SVP_REGCTL channel.

The SVP REGCTL block executes the following algorithms.

- Equation A (Eq A) algorithm supports time-out processing and time-out monitoring.
- Equation E (Eq E) algorithm supports both time-out processing and output biasing.

10.25.8 Output biasing process

This function enforces an output bias to the calculated Controlled Variable (CV).

The OPBIAS is the sum of the user-specified fixed bias (OPBIAS.FIX) and a calculated floating bias (OPBIAS.FLOAT). The purpose of the floating bias is to provide a bump less transfer when the function block initializes or changes mode as long as the SVP_REGCTL channel is the first initializable channel.

If the algorithm is configured as Equation E, the output bias (OPBIAS) is added to the algorithm's Calculated Value (CV) and the result is stored in CV. CV is later checked against the OP limits and then if the limits are not exceeded CV is copied to the output.

- OPBIAS is recomputed under the following conditions to avoid a bump in the output. (Note that the SVP_REGCTL channel only applies OPBIAS.FLOAT to the output for the latter two conditions, when it is the first initializable block.)
 - When the function block starts up (that is, goes Active).
 - When the function block initializes (for example, the secondary requests initialization).
 - When the mode changes to Cascade.

• A

Attention

When MODE is '; Manual,' OPBIAS is not used (because OP is not calculated). Consequently, when MODE changes to Manual, OPBIAS is not recomputed.

- You can store to OPBIAS only if the function block is inactive or MODE is 'Manual.' Hence, prevent a bump in OP is prevented when the bias is changed.
- When you store values to OPBIAS, the following occurs.
 - Total bias (OPBIAS) and fixed bias (OPBIAS.FIX) are both set to a new value.
- There are no limit checks applied when you store the OPBIAS. However, after the bias is added to the calculated variable (CV), the result is compared against the OP limits and clamped, if necessary.
- You can store to OPBIAS.FIX only if the function block is inactive and SVP_REGCTL is configured with the control algorithm equation as 'E.' When you store to OPBIAS.FIX, the following occurs.
 - Total bias (OPBIAS) and fixed bias (OPBIAS.FIX) are both set to a new value.

10.25.9 Time-out monitoring

If MODE is set to 'Cascade,' SVP_REGCTL channel monitors its SP input value (that is, primary input) for time-out. If a valid SP value is not received within the predefined time, the SVP_REGCTL channel invokes time-out processing. The time-out time (in seconds) is specified by TMOUTTIME.

- Enable time-out monitoring by setting TMOUTTIME to a non-zero value.
- Disable time-out monitoring by setting TMOUTTIME to zero.

10.25.10 Time-out processing

A time-out can occur for several reasons communication error, inactivation of primary block, and so on. If an input times-out, SVP_REGCTL channel performs setting a time-out flag (TMOUTFL), requesting the primary block to initialize, and shedding the SVP_REGCTL channel to a predefined mode (TMOUTMODE).

If MODE is set to 'Cascade' and the SP time-out, the SVP REGCTL channel performs the following:

- Sets a time-out flag (TMOUTFL).
- Requests the primary to initialize.



Attention

In SVP_REGCTL channel, the primary can be an ENHGENLIN block and AUXILIARY Function block from C300-20mS CEE Controller and no initialization happens to it.

The SVP_REGCTL block supports mode-shedding on time out. In such cases, SVP_REGCTL sheds the mode to 'Manual,' and the mode does not return to 'Cascade,' even if the primary block returns a valid value.

10.25.11 Anti-reset windup status

The SVP_REGCTL channel maintains anti-reset windup status for its output (ARWOP) and each of its initializable inputs (ARWNET). ARWOP indicates if OP can be raised or lowered. When ARWNET is set to 'Hilo,' stores to SP are not limited, rather this is the status propagated to the primary. The only limiting anti-reset windup status ever does is to stop integral action in one or both directions on regulatory channels.

The SVP_REGCTL channel uses ARWOP parameter to restrict integral control. When ARWOP contains a value other than 'Normal,' the SVP_REGCTL channel stops integral control in the windup direction. Integral, proportional, and derivative control continues in the other direction. However, Windup status has no impact on proportional and derivative control.

10.25.12 Mode shedding on timeout

The SVP_REGCTL block sheds the MODE to 'MAN' in case of manual intervention. Accordingly, the SVP_REGCTL does not change the MODE to 'CAS' while fetching a good value from the primary.



Attention

- While disconnecting the IOLINK cables, INITREQ parameter of SVP_AO channel configured as 'Incremental' is
 set to 'ON' and INITMAN parameter of SVP_REGCTL channel is set to 'ON'. Hence, SP timeout does not occur
 and the MODE parameter of the SVP_REGCTL channel does not shed to Timeout mode, and the MODE
 parameter of the SVP_AO channel is set to 'MAN'.
- The shedding of MODE to 'MAN' is dependent on the SP timeout configuration. If the SP timeout is configured as 1 second, the SVP_REGCTL sheds MODE to 'MAN' on IOLINK cable removal or controller RRR during communication failure. However, if the SP timeout is configured to a value other than 1 second, SVP_REGCTL does not shed its mode during communication failure (IOLINK cable removal or RRR of controller).

10.25.13 Output Processing

Output Processing derives a control output value (OP) from the calculated variable (CV). It involves the following functions:

- OP limiting and clamping
- OP direction



Attention

SVP_REGCTL channel OP value can only be connected to the OP of the SVP_AO channel when the OPACTION parameter is configured as 'Incremental.'

10.25.14 Bad Control Processing

This function helps to take a decision when the CV changed from good-to-bad or bad-to-good.

If the CV is 'Bad'

The CV can be set to 'NaN' if the SVP REGCTL PV is bad or the CV range (CVEUHI/CVEULO) is bad.

The SVP REGCTL block performs the following actions when the CV changes from good-to-bad.

Sets BADCTLFL to 'ON' to indicate that a Bad Control condition exists.



Tip

- The SVP_REGCTL block performs the following when the CV is set to 'Bad.'
- requests its primary to initialize if the MODE is shed to 'MAN.'
- indicates to its primary that it is wound-up (ARWET = HiLo) and does not request the primary to initialize if the MODE is not shed to 'MAN.'
- CV is prohibited to change its value until CV returns to good if the MODE was shed to 'MAN.'
- The SVP REGCTL block performs the following when the CV changes from 'Bad' to 'Good.'
- remains at 'MAN' mode and continuously sends INITREQ to it primary if the MODE sheds to 'MAN.' You must change the SVP REGCTL's MODE to normal.
- clears it wind-up condition and performs a one-shot initialization if the MODE is not shed to 'MAN.' In addition, it requests the primary to perform the one-shot initialization.

If the CV is 'Good'

The SVP_REGCTL block determines if the CV is represented in terms of percentage or engineering units (EUs). If the CV is in EUs, it is converted to percentage.

10.25.15 Output Limiting

This function enforces the following limit checks to the OP value because the MODE is not 'MAN.'

- Normal high or low limits (OPHILM and OPLOLM) define normal high and low levels for the OP value. If another function block or user program attempts to store an OP value that exceeds OPHILM or OPLOLM, the value is clamped to the limit. Only the operator is allowed to store an OP value that exceeds these limits. The following flags are set when the operator stores the OP value.
 - 'normal limit exceeded' flag (OPHIFL or OPLOFL)
 - 'OP Anti-Reset Windup status'
- Extended high or low limits (OPEXHILM and OPEXLOLM) define the extended high and low limits
 for OP. If the operator attempts to store an OP value that exceeds OPEXHILM or OPEXLOLM, the value is
 clamped to the limit.



Attention

Default OP limit values for the SVP_REGCTL channel is same as the C300-PID block even if the SVP_AO channel's OP limit values are 0% and 100% when the SVP_AO is configured as 'Incremental.'

The SVP_REGCTL block behavior for these limits is summarized in the following table, taking the tolerance limit (OPTOL) into consideration.

| Scenario | Limits Exceeded | Tolerance Exceeded (OPTOL) | SVP_REGCTL Behavior |
|---------------------|-----------------|----------------------------|--|
| Raise or Lower keys | Yes | Yes | A warning message displays as 'OP value is clamped.' |
| | Yes | No | A warning message displays as 'OP value is clamped.' |
| | No | Yes | OP value is set to a new value without confirming the tolerance. |
| | No | No | OP value is set to a new value. |
| Operator entry | Yes | Yes | An error message displays as 'Limit exceeded error (Previous value retained)' |
| | Yes | No | An error message displays as 'Limit exceeded error (Previous value retained)'. |
| | No | Yes | OP value is set to a new value along with the confirmation from the tolerance. |
| | No | No | OP value is set to a new value. |

Table 132: SVP - REGCTL OP value processing

10.25.16 Windup processing and handling

SVP_REGCTL block maintains anti-reset windup status for its output (ARWOP) and each of its initializable inputs (ARWNET). ARWOP indicates if OP can be raised or lowered. The following table lists the possible values for ARWOP and ARWNET parameters.

Table 133: SVP - REGCTL ARWOP and ARWNET processing

| If the ARWOP and ARWET value is | Then, the associated parameter is |
|---------------------------------|---|
| Normal | free to move in either direction. |
| Hi | at its high limit and it may only be lowered. |
| Lo | at its low limit and it may only be raised. |
| HiLo | may not move in either direction. |

• **ARWNET computation** - When ARWNET is set to 'HiLo,' stores to SP are not limited, rather this is the status propagated to the primary. The only *limiting* anti-reset windup status ever does is to stop integral action in one or both directions on regulatory channels. For any other regulatory control type block, ARWNET is not used for any kind of limiting. The ARWNET is computed as follows:

Table 134: SVP - REGCTL ARWNET status

| If Any of the Following are True | Then, ARWNET Equals |
|--|---------------------|
| This block is inactive. | HiLo |
| The ARWOP equals HiLo. | |
| This block is in Manual mode (MODE = Man). | |
| The calculated value (CV) range (CVEUHI / CVEULO) is NaN. | |
| The CV is NaN. | |
| This block is connected to a non-initializable primary. | |
| The ARWOP equals Hi. | Hi |
| The input from the primary is at a high limit. For example, SPHIFL = On. | |
| The ARWOP equals Lo. | Lo |
| Note: If CTLACTN is set to 'Reverse,' ARWNET tracks ARWOP, but if CTLACTN is set to 'Direct', 'ARWNET is the opposite of ARWOP. | |
| The input from the primary is at a low limit. For example, SPLOFL = On. | |

• ARWOP computation - SVP_REGCTL block uses ARWOP parameter to restrict integral control. When ARWOP contains a value other than 'Normal,' the SVP_REGCTL stops integral control in the windup direction. Integral, proportional and derivative control continues in the other direction. However, Windup status has no impact on proportional and derivative control. The SVP_REGCTL block fetches the AO's windup status through SECDATA during Control Initialization to recompute its ARWOP. The conditions within the function block, such as output being at its high limit, also affect the ARWOP. The ARWOP is computed as follows:

Table 135: SVP - REGCTL ARWOP status

| If any of the following is true | Then, ARWOP Equals |
|--|--------------------|
| This block is inactive. | HiLo |
| This block is in initialization (INITMAN = On). | |
| The block's output is at its high limit (OPHIFL = On). | Hi |
| The block's output is at its low limit (OPLOFL = On). | Lo |

10.26 Defining SVP-AO Channel Block

SVP_AO channel supports unipolar and bipolar current outputs in addition to the standard 4-20mA analog output. It converts the output value (OP) to the output signal for operating the final control elements, such as valves and actuators, in the field. It accepts inputs only from ENHGENLIN block executing in the C300 - 20mS CEE Controller.

To convert the OP value to a configured signal value, the SVP AO channel performs

- Direct/Reverse Output Function
- Nonlinear Output Characterization

Note: Unipolar/bipolar does not support direction function and non-linear output characterization.



Attention

- SVP_AO channel accepts inputs from the AUXILIARY function blocks only if the OPACTION parameter is
 configured as 'FullValue.' SVP_AO channel accepts inputs from the SVP_REGCTL channel, the ENHGENLIN
 block, and the AUXILIARY function blocks when the OPACTION parameter is configured as 'Incremental.'
- Both SVPM channels must have the same output type. The output type can be 4-20mA outputs or coil outputs. There are no mutual dependencies in the coil outputs. The two channels can have unipolar or bipolar currents and different ranges of outputs.

10.26.1 Determining Output Characterization - SVP-AO Channel block

Output characterization can be implemented only if the OPACTION parameter is configured as 'FullValue.' The OP value is calculated when the OPACTION parameter is configured as 'FullValue' as follows:

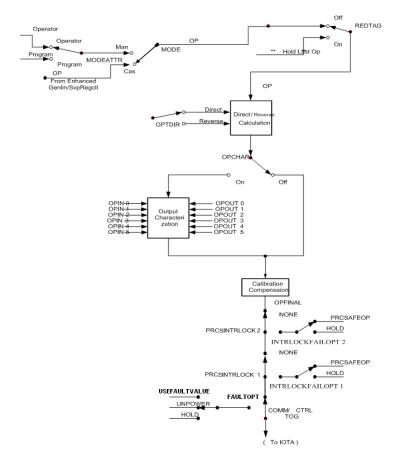


Figure 210: SVP - AO block execution diagram when OPACTION is 'FullValue'

The OP value is calculated when the OPACTION parameter is configured as 'Incremental' as follows:

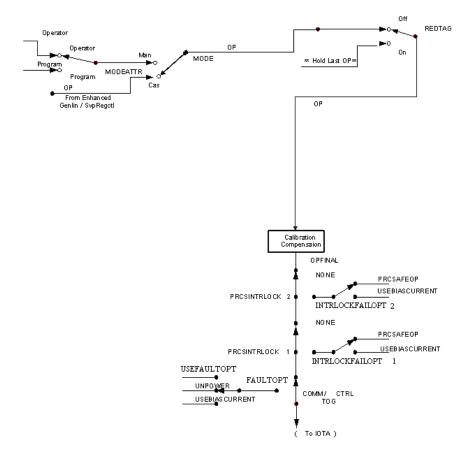


Figure 211: SVP - AO block execution diagram when OPACTION is 'Incremental'

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Attention

When the SVP IOM is in 'IDLE' or the channel is in 'INACTIVE',

- The SVP AO channel configured as Incremental drives the output configured in the FAULTOPT parameter.
- The SVP AO channel is configured as FullValue, the SVP AO channel retains the output.

If any changes made to the FAULTOPT parameter when the SVP IOM is in 'IDLE' or the channel is in 'INACTIVE,' the change replicates on the SVP AO channel screws.

10.26.2 Determining Direct/Reverse Output - SVP-AO Channel block

The OPTDIR (output direction) parameter allows you to specify whether the output of the data point is 'Direct or Reverse' when OPACTION is configured as 'FullValue.' When OPACTION is configured as 'Incremental,' the OPTDIR is grayed out and its value is 'Direct.' The following table lists the OP value mapping based on the OPTDIR value.

Table 136: SVP - AO OPTDIR processing

| OPTDIR value | OP value mapping |
|-----------------------------------|-----------------------------|
| Direct | OP 0% maps to OPLOCURRENT |
| | OP 100% maps to OPHICURRENT |
| Reverse OP 0% maps to OPHICURRENT | |
| | OP 100% maps to OPLOCURRENT |

10.26.3 Determining Modes - SVP-AO Channel block

The MODE parameter determines the operating mode for the channel block. The following operating modes are applicable to the both AO and DO channel blocks:

- Manual (Man) provides the operator or the program with direct control over the output value of the channel, regardless of any continuous control strategy.
- Cascade (CAS) data point receives its output value from a primary data point.

However, if the OPACTION is configured as 'Incremental' and MODE is changed to 'MAN,' the AO drives OPBIASCURRENT, until the operator manually enters a new OP value.

Attention

- MODE is set to 'SHED' if the SVPM is restarted.
- The SVP IOM shortly loses synchronization and resynchronizes when the MODE of SVP_AO channel sheds to 'MAN.' This scenario is applicable to only when the SVP_AO channel is configured as 'Incremental.' Due to this, the soft failures are regenerated on the secondary SVP IOM.

10.27 Defining UIO Channel Blocks

The functionality of the UIO channel blocks is identical to that of the existing AI, AO, DI, and DO channel blocks. Depending on the channel configuration in the UIO module, each channel block represents one of the AI, AO, DI, and DO channel block.

For more information about each channel blocks, refer to the following sections in this document.

- AI channel block "Defining AI Channel Blocks"
- AO channel block "Defining AO Channel Blocks"
- DI channel block "Defining DI Channel Blocks"
- DO channel block "Defining DO Channel Blocks"

The functionality of UIO-2 channel blocks is identical to that of UIO channel blocks with the following exceptions:

- Supports pulse counting on up to four of any of the 32 channels that are configured as DI.
- Supports DO ganging within the following eight channel number groups: 1 4, 5 8, 9 12, 13 16, 17 20, 21 24, 25 28, and 29 32. However, ganging across these groups is NOT possible.

10.27.1 Example configuration for DO channel ganging

To configure the DO channel for ganging

- 1 Click File > New >I/O Modules > Series_C_I_O > UIO Universal I/O, 32 channels. The UIO module appears in the Project view under the Unassigned items.
- 2 Assign the UIO module to an IOLINK that is configured as "SERIES C IO TYPE."
- 3 From the Project view, right-click the UIO channel and then click **Block Properties**. The UIO channel configuration form appears.
- 4 Click the Channel Configuration tab.

The Channel Configuration tab configuration form appears. The point type is selected as DI, by default.

5 Configure the **Channel Point Type** as DO for which ganging needs to be enabled.



Attention

An error message appears if you try to change the channel type when the channel is configured in any Control Module.

- 6 Click OK.
- 7 Click File > New > Control Module.

The Control Module chart opens.

- 8 Drag the DO channel from the Project view to the Control Module chart.
- 9 Double-click the DO channel.

The DO channel configuration form appears.

10 Click the Configuration tab.

The **Configuration** tab configuration form appears.

11 Select the Enable Ganged Outputs check box.

The Number of Channels Ganged drop-down list is enabled for configuration.

- 12 Select the number of channels to be ganged from the **Number of Channels Ganged** drop-down list. You may encounter errors if one of the following scenarios exists.
 - Adjacent channel is not configured as DO channel.
 - DO channel, which needs to be configured for ganging, is already configured in any Control Module.

- 13 Click OK.
- 14 Save and close the Control Module chart.
- 15 Assign and load the Control Module.

Results

The channels are ganged as per configuration.

10.27.2 Example configuration for pulse counting functionality

To configure DI channel for pulse counting functionality

- 1 Click File > New >I/O Modules > Series_C_I_O > UIO Universal I/O, 32 channels. The UIO module appears in the Project view under the Unassigned items.
- 2 Assign the UIO module to an IOLINK that is configured as "SERIES_C_IO_TYPE."
- 3 Click File > New > Control Module.
 - The Control Module chart opens.
- 4 Go to the library and drag and drop the DI channel (15 to 18) in the CM, then assign it to the desired IOM/channel number.



Note

For UIO-2 only, you can choose from any of the available 32 channels configured as DI, a maximum of four as pulse counting channels.

- 5 Double-click the DI channel.
 - The DI channel configuration form appears.
- 6 Click the Configuration tab.
 - The Configuration tab configuration form appears.
- 7 Configure the **Digital Input Type** as "Accum."
- 8 Click OK.
- 9 Save and close the Control Module chart.
- 10 Assign and load the Control Module.

Results

The configured channels are set up for pulse counting.

11 Series C I/O Loading

Experion provides the ability to build control strategies offline, without being connected to the actual controller components. The process of transferring the control strategy to the actual working components in the field is called the load operation.

The load operation;

- copies configuration data from the control strategy that is stored in the Engineering Repository Database (ERDB) to the assigned controller component in the system architecture
- assures that the planned system matches the actual one
- confirms that the communication addresses and physical location assignments specified for components through Control Builder configuration match the actual addresses and locations of components in the system.

Related topics

- "Loading an IOLINK" on page 442
- "Loading the IOM block the first time" on page 443
- "Loading the individual I/O channels" on page 447
- "Behavior of IOMs and CMs under version control" on page 448
- "Common I/O block load activities" on page 449
- "Loading a Control Module" on page 450
- "Setting Priority IOMs" on page 452

11.1 Loading an IOLINK

The C300 block must be loaded before any assigned IOM blocks. Loading the C300 block automatically loads its associated configured IOLINK function blocks.

Refer to Loading IOLINK in the C300 Controller User Guide for information about loading the C300 block and corresponding IOLINK block.

11.1.1 Upload error conditions

The following conditions return/reload operation errors:

- The C300 is not present.
- The IOM is not present.
- The CM is ACTIVE.
- The IOM's Execution State is RUN and the IOC block's Point Execution State is ACTIVE.

11.2 Loading the IOM block the first time

The I/O channel blocks are loaded when the respective IOM is loaded. This operation loads all loadable configuration parameters (residing in either the C300 or the IOM device). An error message is displayed if there is any validation fails. The load returns errors if the C300 or IOM or both are not present.

The following figure displays a simplified graphical representation of what happens during the load operation.

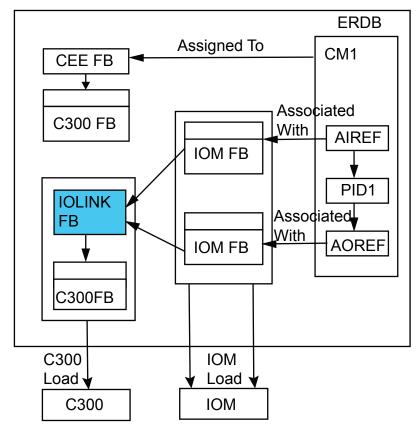


Figure 212: Loading the IOM block the first time

Prerequisites

- Ensure that I/O Modules are installed and capable of communicating with the Server.
- Ensure the parent controller is already loaded.

To load an IOM

- 1 In the Project view, click the desired IOM block icon.
- 2 Right-click the IOM and then click **Load**. Or, click the **J** load button in the tool bar. The **Load Operation** dialog box appears.
 - Attention
 - If there is any validation failure, then the **Validation before load** dialog box appears. If you still want to continue the load, then click **Continue**. Otherwise, click **Cancel** to resolve the validation errors before loading the IOP/ IOM.
- 3 Click OK.

The IOM block load starts. The Load dialog box displays the progress and the respective information.



Tip

You can also check load progress through the four-LED display on the front panel of the IOM. The display changes from NODB to NOEE to OK upon a successful Load.

If errors are detected, then the errors are displayed in the **Load** progress dialog box and you can continue the load or cancel, depending on the nature of the error. It is recommended that you cancel the load and identify and fix the errors. Each message includes an error code in parentheses. Note the last number in the string. For more information about the error code, see *Control Builder Error Code Reference*.

4 Once the load completes and the dialog box closes, click the Monitoring view. IOP/IOM icons now appear in Monitoring view. The default state for a loaded IOP/IOM is active or color code green.



Attention

When you load the imported IOMs, ensure that all the channel type (PNTTYPE) is identical with the loaded channels. If the channel type is not identical, then the corresponding channels must be deleted from the Monitoring view before loading the imported IOM.

11.2.1 Loading with the IOM block missing on the IOLINK

IOM blocks can be loaded without the IOM present on the link, but the following occurs:

- Errors are returned on load and the IOM icon appears red in the Monitoring Tab.
 Refer to "Reviewing the Series C I/O block icons in Control Builder" on page 456 to view icon appearance based on current status.
- Since the IOM is responsible for error checking the loaded data, you must either reload the IOM or perform a checkpoint restore when the IOM later appears on the I/O Link.

11.2.2 Reloading the IOM block from Project or Monitoring

The behavior of the IOM when the IOM is reloaded from the Project view or the Monitoring view is explained as follows:

- 1. IOM block is loaded first.
- 2. All the channels are reloaded as dependents while loading the IOM.
- 3. The channel that is configured using the containment method is not reloaded while loading the IOM. However, this channel is loaded as a dependent while loading the CM.

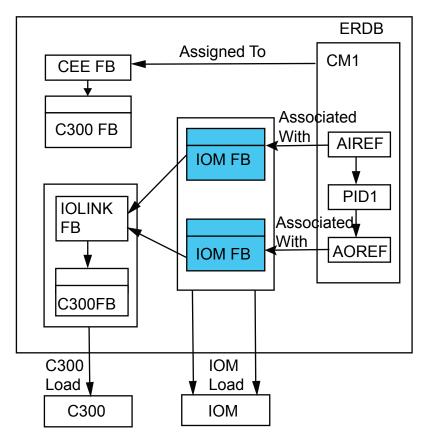


Figure 213: Reloading the IOM block

11.2.3 Reviewing IOM re-configuration rules



Attention

You are prohibited from altering the IOPTYPE and IOMNUM parameters while the IOM exists on the Monitoring Tab. You can only change them after the IOM is explicitly deleted from the Monitoring Tab.

The following section lists the specific IOM re-configuration rules.

Table 137: IOM re-configuration rules

If the IOM is in the RUN state, you:

- 1. Cannot delete the IOM.
- 2. Cannot re-configure non-redundant IOM to redundant IOM.
- 3. Cannot re-configure redundant IOM to a non-redundant IOM.
- 4. Cannot re-configure the primary IOM to a different location.
- 5. Cannot re-configure the secondary IOM to a different location.
- 6. Cannot change the IOM scan rate.

Note: If you load the IOM and inactivate the IOM as part of the load, you are able to perform items 1 through 6.

If the IOM is NOT in the RUN state, you:

- 1. Can delete the IOM from the Monitoring Tab (but only if all CMs containing channels of this IOM have been deleted from the Monitoring Tab).
- 2. Can re-configure non-redundant IOM to redundant IOM pair.
- 3. Can re-configure redundant pair as non-redundant.
- 4. Can re-configure the primary IOM to a different location.
- 5. Can re-configure the secondary IOM to a different location.
- 6. Can change the IOM scan rate.

11.3 Loading the individual I/O channels



Attention

Only the channels are loaded and the spares are excluded from the load. However, you cannot load a channel that is configured using the containment method.

You cannot load unassigned channels.

Prerequisites

Ensure that the parent controller is loaded.

To load the individual I/O channels

1 In the Project view, right-click the desired I/O channel block and then click **Load**. Or, click the **load** button in the tool bar.

The **Load Operation** dialog box appears.



Attention

If there is any validation failure, then the **Validation before load** dialog box appears. Though you can continue with the load, it is always recommended that you resolve the validation errors before loading the I/O channel.

2 Click OK.

The I/O channel block load starts. The Load dialog box displays the progress and the respective information.



Tip

- You can also check the load progress through the four-LED display on the front panel of the I/O Link Interface Module. The display changes from NODB to NOEE to OK upon a successful load.
- If errors are detected, then they are displayed in the Load progress dialog box and you can continue the load
 or cancel, depending on the nature of the error. It is recommended that you cancel the load and identify and
 fix the errors. Each message includes an error code in parentheses. For more information about the error
 code, see Control Builder Error Code Reference.
- 3 Click the Monitoring view after the load is complete and the dialog box is closed.
 I/O channel block icons now appear in Monitoring view. The default state for a loaded I/O channel is active or color code green.

11.4 Behavior of IOMs and CMs under version control

IOM version mismatch between the Project view and Monitoring view

When you load the channel, the IOM is also loaded along with the channel. The IOM is loaded as LWA if the IOM does not have the delta flag. The LWA icon is displayed for the IOM in the **Load Operation** dialog.

From the Project view, if you load or reload a channel assigned to an IOM that is under version control, then the following channels belonging to the same IOM are also loaded as dependents:

- Unloaded channels are loaded.
- Channels having delta flag are inactivated and loaded.
- Channels with "Load While Active" changes are "Loaded While Active".

In addition, the IOM to which the channels are assigned is also selected as dependent for load. However, the LWA icon is displayed in the **Load Operation** dialog box for the IOM and for the channel which has LWA changes.

11.5 Common I/O block load activities

11.5.1 Uploading the I/O block

Upload of Series C I/O blocks does not differ from the upload of other Experion blocks. All loadable parameter values are read from the IOM and updated in the Monitoring database.

The upload operation uploads data for the selected objects from the controller to the Monitoring Engineering Repository Database (ERDB). Upload of data for the selected objects from the server to the ERDB also can be performed.

Usually, after performing an upload to the database, you should also update the data to Project so that both the Monitoring and the Project databases agree.

Refer to Using Upload command in the Control Building Guide for information about uploading.

11.5.2 Update to Project

Update to Project Series C I/O blocks does not differ from update to Project of other Experion blocks. All loadable parameter values are copied from the Monitoring tab to the Project tab.

11.5.3 Reviewing the Update function

A major part of the hierarchical building, CM/SCM containment allows the user to contain CM(s) or /SCM(s) into another CM.

If a projected CM/SCM is updated to project:

- All its projected parameters are checked to ensure that the projection chain downwards to the origin is valid, which includes the validation of both origin parameters and projected connections.
- Read only connections are not updated to project directly. Only projected connections will be updated.
- In addition, the Update operation fails for any reason, the projected parameter will remain, but the origins of the projected parameter will be emptied.

11.5.4 Using IOM Checkpoint

Checkpoint of Series C I/O blocks does not differ from checkpoint of other blocks being checkpointed.

Refer to Checkpoint Replaces Snapshot in the Control Building Guide to review checkpoint information.

11.6 Loading a Control Module

All illustrations used in the procedure are for example purposes only.



Attention

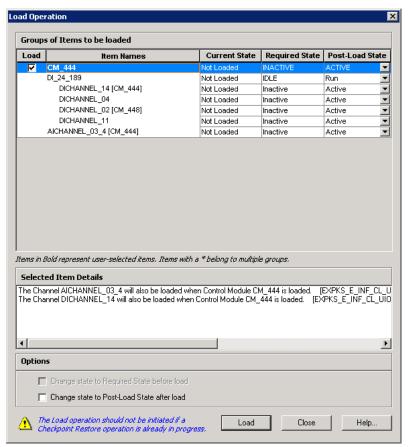
Before attempting to load any CM or SCM components, be sure its control chart is **not** open in Control Builder.

Prerequisites

- Control Builder is running.
- This procedure assumes that the CPM is installed and capable of communicating with the Server.

To load a CM

Right-click the CM and then click Load.
 The Load Operation dialog box appears.



Observe that the dependent channels are automatically selected for load in the **Group of Items to be** Loaded list.



Attention

- If you have referenced any input channels from a different controller, then an information icon is displayed in the **Info** column.
- If you load any swapped output channels, then a warning icon is displayed in the Info column.

2 Click OK.

The Load dialog box appears.

If errors are detected during the load, then they are displayed in the **Load** dialog box. It is recommended that you cancel the load and identify and fix the errors. Each error message includes an unique error code in parentheses. For more information about the error code number, see *Control Builder Error Code Reference*.

Once the load completes and the dialog box closes, click the Monitoring view to view the loaded CM.

Attention

If you try to load the CM/SCM/RCM having non-CEE references from the Control Builder connected to the secondary server, the following error message appears. "Block Load Failed"

Hence, you must always load the CM/SCM/RCM having non-CEE references from the Control Builder that is connected to the primary server. In addition, if there is any switch-over between the servers close the Control Builder and open the Control Builder that is connected to the new primary server.

3 (Optional, if the CM is loaded in inactive state) In the Monitoring view, right-click the loaded CM and then click Activate > Selected Items' (s) Content (s).

The CM is activated and the CM icon color changes to "Green."



Attention

If you swap the references in the CMs, then you must the load the CM. For example, consider that CM1 is configured with an AIREF1 block referencing an AICHANNEL1 and CM2 that is configured with an AIREF2 block referencing an AICHANNEL2. CM1 and CM2 are loaded. In this scenario, if you swap the references (AIREF1 references AICHANNEL2 and AIREF2 references AICHANNEL1) between the CM1 and CM2, then you must reload one of the CMs and the other CM is loaded as dependent.

11.6.1 Upload error conditions

The following conditions return/reload operation errors:

- The C300 is not present.
- The IOM is not present.
- The CM is ACTIVE.
- The IOM's Execution State is RUN and the IOC block's Point Execution State is ACTIVE.

11.6.2 Reloading the CM from Project or Monitoring

Reloading a CM from the Monitoring Tab or the Project Tab:

- · reloads IOC blocks to their associated IOM devices, and
- reloads the standard Experion blocks within the CM to the assigned CEE

11.7 Setting Priority IOMs

To improve control loop latency in Series C I/O Modules, there is an optional selection that supports the IO Link interface and Control Execution Environment (CEE) in the C300 Controller. The Priority IOM option is available for:

- all standard Series C IOMs supported by the C300 Controller and IO Link interface,
- except for the AI-LLMUX

A Priority IOM is designated or configured through the IOM Function Block Form using the modules I/O Link Scan Rate selection. This option applies to all the channels of the IOM. The IOM is added to a list of modules, which appear on the associated IOLINK configuration form.

A parameter (NUMPRIORITYIOM - Priority IOMs) on the IOLINK Function Block form (Main Tab) shows the number of configured IOMs with this attribute activated.

11.7.1 To set the Priority IOM

- 1 Double-click the I/O Module in Control Builder tree view. Main tab appears.
- 2 From I/O Link Scan Rate, select Priority_IOM
- 3 This completes this task.

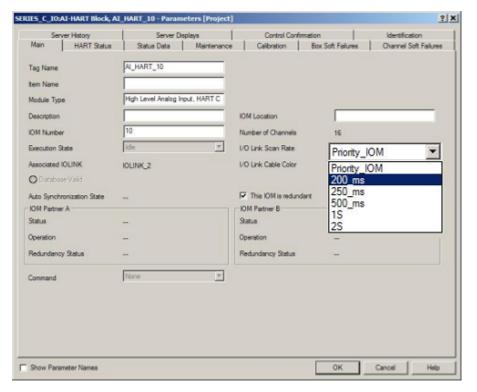


Figure 214: Setting Priority IOM

IOMs designated as Priority_IOM

- consume a relatively larger I/O Link bandwidth than other IOMs
- is given preference within the controller
- Input Process Data from these IOMs is fetched so that it is coordinated with control execution and is triggered at a point that minimizes the latency between data fetch and its use in control algorithms

• Data scanned from an output to a channel on an IOM with the Priority IOM on, is expedited in its passage through the I/O Link interface

The following I/O Link Unit table lists the amount of IO Link bandwidth used for both Priority and normal IOM configuration.

| IO Modules | IOM Scan | Cycles | Link Units |
|---|-----------|--------|------------|
| | Rate (mS) | | per Module |
| Digital Input Modules | Priority | 20 | 52 |
| Digital Input Modules | 200 | 5 | 15 |
| Digital Input Modules | 250 | 4 | 13 |
| Digital Input Modules | 500 | 2 | 8 |
| Digital Input Modules | 1000 | 1 | 5 |
| Digital Input Modules | 2000 | 0.5 | 4 |
| Digital Output Modules | Priority | 1 | 5 |
| Digital Output Modules | All | 1 | 5 |
| AI-HART | Priority | 20 | 100 |
| AI-HART | 200 | 5 | 27 |
| AI-HART | 250 | 4 | 22 |
| AI-HART | 500 | 2 | 13 |
| AI-HART | 1000 | 1 | 8 |
| AI-HART | 2000 | 0.5 | 5 |
| AI-MUX | 200 | 5 | 86 |
| AI-MUX | 250 | 4 | 69 |
| AI-MUX | 500 | 2 | 36 |
| AI-MUX | 1000 | 1 | 20 |
| AI-MUX | 2000 | 0.5 | 11 |
| Analog Output Modules (includes BackCalc) | Priority | 1 | 7 |
| Analog Output Modules (includes BackCalc) | All | 1 | 7 |
| Any Secondary IOM | All | 1 | 3 |
| SCM Reads per second | N/A | N/A | 0.7 |
| SCM Writes per second | N/A | N/A | 2 |
| Channel connections | CM Exec | Cycles | Link Units |
| | Rate (mS) | | per Module |
| AO Connections (Output writes) | 50 | 20 | 14 |
| AO Connections (Output writes) | 100 | 10 | 7 |
| AO Connections (Output writes) | 200 | 5 | 4 |
| AO Connections (Output writes) | 500 | 2 | 1 |
| AO Connections (Output writes) | 1000 | 1 | 1 |
| AO Connections (Output writes) | 2000 | 0.5 | 0 |
| DO SO Connections | 50 | 20 | 12 |
| DO SO Connections | 100 | 10 | 6 |
| DO SO Connections | 200 | 5 | 3 |

| IO Modules | IOM Scan | Cycles | Link Units |
|--------------------|-----------|--------|------------|
| | Rate (mS) | | per Module |
| DO SO Connections | 500 | 2 | 1 |
| DO SO Connections | 1000 | 1 | 1 |
| DO SO Connections | 2000 | 0.5 | 0 |
| DO PWM Connections | 50 | 20 | 30 |
| DO SO Connections | 200 | 5 | 3 |
| DO SO Connections | 500 | 2 | 1 |
| DO SO Connections | 1000 | 1 | 1 |
| DO SO Connections | 2000 | 0.5 | 0 |
| DO PWM Connections | 50 | 20 | 30 |
| DO PWM Connections | 100 | 10 | 15 |
| DO PWM Connections | 200 | 5 | 8 |
| DO PWM Connections | 500 | 2 | 3 |
| DO PWM Connections | 1000 | 1 | 2 |
| DO PWM Connections | 2000 | 0.5 | 1 |

12 Series C I/O Operations

The following section describes the typical activities that you may be required to perform during normal operations while using Control Builder.

12.1 Reviewing the Series C I/O block icons in Control Builder

After loading the containing CM, the I/O channel block icon appears in the Control Builder monitoring tree. It exists under the containing CM and under the assigned IOM block. In the case of redundancy, a secondary IOM is visible in the monitoring tree.



Tip

The icon's appearance is based on the ICONSTATE parameter

Table 138: Channel block icons

| If icon is | Then, it represents | |
|---|--|--|
| COMM error or CONFIG mismatch error - Primary State | | |
| , red | Non-redundant Non-redundant | |
| . both red | No primary or secondary | |
| front red | No primary, secondary not synched | |
| back yellow | | |
| RUN - Primary State | | |
| 1 green | Non-redundant. | |
| both green | Primary, synchronized | |
| front green | Primary, secondary not synched | |
| back yellow | | |
| front green back red | Primary, no secondary | |
| IDLE - Primary State | | |
| ↓ blue | Non-redundant Non-redundant | |
| 1 both blue | Primary, synched | |
| front blue | Primary, secondary not synched | |
| back yellow | | |
| 11/1 front blue | Primary, no secondary | |
| back red | | |
| No Database and IDLE - Primary State | | |
| g yellow | Non-redundant Non-redundant | |
| nt both yellow | Primary, secondary may or may not be synched | |
| front yellow | Primary, no secondary | |
| back red | | |

12.2 Reviewing the IOLINK block icons in Control Builder

The following table summarizes the various appearances that an IOLINK block icon can assume based on view and current IOLINK state. IOLINK blocks apply only to the primary or non-redundant IOM block, and do not have matching blocks for secondary IOM.

Table 139: IOLINK icons

| If Icon is | Then, it represents |
|-----------------------|--|
| Project tab | |
| gray | IOLINK associated with configured non-redundant or primary IOM. |
| Monitoring tab | |
| gray/arrow | Control Builder / Control Data Access (CDA) server is currently establishing communication to the IOLINK |
| blue | IOLINK is inactive. |
| yellow | IOLINK is initializing. |
| green | IOLINK is active. |
| green/asterisks | IOLINK is active and uncommissioned devices exist on the H1 network. |
| red/black exclamation | Communication to the IOLINK is unavailable |
| red/white exclamation | Communication to the IOLINK is available, but the IOLINK is in a failed state. |

12.3 Reviewing the block icons in Control Builder

The following table summarizes the various appearances that a block icon can assume based on view and current block state. The faceplate of the block will vary to reflect the block type.

Table 140: Block icons

| If Icon is | Then, it represents |
|-------------------|--|
| Project tab | |
| gray | Block added to Project. |
| Monitoring tab | |
| gray/arrow | Control Builder / Control Data Access (CDA) server is currently establishing communication to the block. |
| green | Block is active |
| blue blue | Block is inactive |
| , red/exclamation | Block is offnet. Communications with the block is unavailable. |

12.4 Reviewing the channel icons in Control Builder

The following table summarizes the various appearances that a channel icon can assume based on view and current block state.

Table 141: Channel icons

| If Icon is | Then ICONSTAE parameter value is |
|---------------|---|
| • yellow | Database is invalid |
| ı. red | Error |
| • blue | Block is active |
| green | Active |
| 💍 yellow/HART | Database is invalid and HART is enabled |
| 🚡 red/HART | Error and HART is enabled |
| 👗 blue/HART | Inactive and HART is enabled |
| green/HART | Active and HART is enabled |

12.5 Series C I/O LED Descriptions

The following figure and table identify and describe the LED indicators on the IOM.



Figure 215: Series C I/O LED indicators

Table 142: I/O LED descriptions

| lf | ls | Then, it means that |
|------------|--------------------------|--|
| Power LED | Off | IOM is not receiving power. |
| | | ACTION: Check that module is properly installed or that the IOTA fuse for the module is not blown. |
| | Green | IOM is powered. |
| Status LED | Off | There is an IOM fault or the LED is bad. |
| | | The module is in a hard failure state. In this state, the module cannot be used to gather information from or send information to attached field devices. |
| | | ACTION: A user must either cycle power to the module or replace the module to correct the failure. |
| | Green | IOM operation is Okay. |
| | | Primary Run/Idle |
| | | The module is operating 100% correctly, and the module if commanded; will either gather inputs from the attached field devices or send outputs to the attached field devices. Note: When used in a redundant I/O system, a module with a green LED is often referred to as the primary I/O module. |
| | Green - flashing | Primary Run/Idle with Soft Failure |
| | (toggle once per second) | The module is operating, but it is operating in a diminished state as one or more soft failures have been identified. |

| lf | ls | Then, it means that |
|----|---|---|
| | Amber | The module is either not configured or operating as a secondary. |
| | | Not Configured - The module has not been configured. |
| | | Secondary - The module is operating 100% correctly as the secondary module. This does not imply that it is synchronized with the primary IOM. |
| | Amber - flashing (toggle once per second) | Not Configured with Soft Failure - The module has not been configured and is operating with one or more active soft failures. |
| | | Secondary with Soft Failure- The module is operating as the secondary module in a diminished state as one or more soft failures have been identified. |
| | Red | Power-on - The device is in a non-standard, transient state and not controlling any part of your plant or process. |
| | | Module has just started and power-on self-test is running. During this time, there is no communication to the module. |
| | Red - flashing (toggle once per second) | The device is in a non-standard, transient state and not controlling any part of your plant or process. |
| | | Alive, Ready for Firmware Upgrade - The module is ready to receive an update to its internal programming instructions. |
| | Red - fast flashing, (toggle one quarter (1/4) second) | The device is in a non-standard, transient state and not controlling any part of your plant or process. |
| | | Alive, Firmware Upgrade in Progress - The module is receiving an update to its internal programming instructions. Do not remove power to the module. |
| | Off | Failed - The module has hard failed. The module is no longer communicating and must be power cycled or replaced. |
| | | DO channels transition to the configured fault state. If field power is lost, all outputs go unpowered. |
| | | AO channels will go unpowered. |

12.6 Powering up the IOM

Upon power up, the IOM:

- is set to IDLE state with an invalid database (DBVALID = INVALID)
- remains in this state until the IOLINK function block (C300) instructs it to change. This is due to the fact that the C300 contains all of the IOM's configuration information.

If the IOM was:

- never previously loaded, the IOM:
 - remains IDLE with an invalid database.
- · previously was loaded, then
 - the C300 reloads the IOM, and restores it to the last state before power down occurred.

Therefore, upon powering up the IOM:

- · any previously loaded channel blocks are reloaded and
- the IOM and channel blocks are set to idle, or run as they were previously set before the IOM lost power.

12.7 Activating a control strategy from the Monitoring tab

Activation of control strategy components from the Monitoring Tab should be performed in the following order to avoid possible load process data alarms.

Order Typical loaded icon in Monitoring tab Component CEEC300 CEEC300 1 **P** C300_07 CEE 07 🛂 IOLINK_CIO 🋂 IOLINK_PMIO IOM AI HART IOC 3a CM1.AICHANNEL 1 HART Enabled IOC HAI DEVICE 2 3b 4 CM or SCM pidloop

Table 143: Sequence of activating components - Monitoring tab

12.7.1 Starting an IOM

Database security is provided to prevent you from starting an IOM that has an invalid database. As part of the IOM load:

- the IOM database is made valid. A checkpoint restore also makes the database valid.
- Once the IOM database is valid, you set the IOM Execution State (IOMSTATE) parameter to RUN.
- An IOM cannot be switched from IDLE to RUN unless its database is valid.

12.7.2 Issuing Shutdown command

The following occurs when issuing the Shutdown command (through the IOMCOMMAND parameter):

- field output terminals go unpowered for all channels.
- INITREQ is asserted on all associated Output channel blocks.
- the IOM icon in the Monitor Tab becomes RED.
- The detail display shows Alive state.

The following also occurs:

• an active 'IOP State Changed to Alive' alarm in Station System Summary.

• the **Status** LED of the IOP flashes RED.

12.8 Activating HART

The Series C I/O's fundamental AI and AO channel blocks support HART communications protocol. To enable HART, you must assign the channel to a HART IOM, and set HENABLE to TRUE. Other than this difference, the enabled channel is identical to a PM I/O HART enabled channel.

Refer to "Enabling HART in HART 6.0 and later version devices" to review Series C configuration form tabs and parameter availability for HART.

Refer to the HART I/O Implementation Guide for complete HART configuration instructions based on PM I/O.

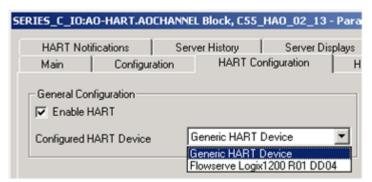
12.8.1 Assigning a channel to HART - Series C

Prerequisites

· A control module is created

To assign a channel to HART

- 1 Double-click the AI or AO channel block. The channel block configuration form opens.
- 2 Select the HART Configuration tab from the configuration form.
- 3 Select the ENABLE HART (HENABLE parameter).



- 4 To assign the channel block to a specific device, select a device from the pull-down menu.
- 5 Click OK to accept changes and close the configuration form.

12.8.2 Enabling HART Alarm and Events - Series C

A new selection is added to HART Configuration tab in the channel block, **Enable HART Alarm and Events** (HALARMENABLE parameter).

Refer to "HART alarms/events" on page 570 to review the alarms that are available to be displayed on the HART Configuration tab for a channel block.

12.8.3 Disabling HART Alarm and Events

When the parameter HALARMENABLE is disabled, (Enable HART Alarm and Events deselected):

- all the existing HART events / alarms from that channel block are disabled
- further generation of the HART alarms / events are terminated

Note: Changing this parameter affects only the HART alarm / event behavior and the LED update of the device status in the HART device status tab happens as usual regardless of the state of HALARMENABLE.

To disable HART Alarm and Events:

- 1 Double-click the AI or AO channel block. The channel block configuration form opens.
- 2 Select the HART Configuration tab from the configuration form.
- 3 Deselect the Enable HART Alarm and Events (HALARMENABLE parameter).

12.8.4 Migrating HART IO modules to/from non-HART IO modules

Although AI-HART and AI-HL (Cx-PAIX01) uses the same IOTA, migration must be performed offline because the block configuration is different for both modules. The hardware change is only the module replacement. The firmware image is same for both modules.

The AO-HART and AO (Cx-PAOX01) migration is identical to the AI-HART and AI-HL migration.

Prerequisites

- Not all channels of the module are HART-enabled.
- Assume the new IOM would use the same IOM address. The difference of PAIX-01 and PAIN-01 is noted.

To migrate a non-HART module to/from HART module

- 1 From Control Builder, inactivate the IO Module and Channels.
- 2 From the Monitoring view, inactivate and delete all CMs that contain the IO channels.
- 3 Delete the IOM block from the Monitoring view.
- 4 From the Project view, note the IOM address and change it to some unused address.
- 5 Create the new IOM block and set the address to the one you noted.
- 6 For each IO channel, un-assign the existing IOM and assign the new IOM using the same channel slot.
- 7 Delete the old IOM from Project view.
- 8 Replace the hardware. That is, the IO Module /and the IOTA.
 - If the AI-HL is PAIN-01, replace the IOTA also. Set the address accordingly.
 - If the IOTA is redundant, replace the both IO Modules.
- **9** Load the appropriate firmware from CTools.
- 10 Load the IOM.
- 11 Load the CMs.
- 12 Activate the IO Module, Channels and CMs.

12.8.5 Migrating between different Model Numbers of Modules without HART

Migration between Cx-PAIX01 and Cx-PAIN01 is off-line because the IOTAs are different. It is impossible to mount the different model numbers on one IOTA. However, block configuration (IOM FB and IOC FB) is the same

Migration between Cx-PAOX01 and Cx-PAON01 is similar.

The following is step-by-step instruction to migrate between different model numbers of modules without HART:

Prerequisites

Assume that all AI channels are 4-20mA.

To migrate between Model Numbers of Modules without HART

1 Inactivate the IOM and its channels.

- 2 Replace the hardware and the IOTA. The IOM address must remain the same.
- 3 Load the appropriate firmware using C Tools.
- 4 Load the IOM block.
- 5 Activate the IOM and its channels.

12.9 IOM configuration values not copied during Block Copy operation

The following subset of the IOM configuration parameter values are not copied during a Block Copy operation.

| Uncopied IOM configuration parameters during a Block Copy | | | | |
|---|-----------|--------|----------|--|
| IOLINKNAME | IOLINKNUM | IOMNUM | CHNLNAME | |

12.10 SOE Scenarios

The DEBOUNCE parameter specifies the minimum time input remaining at a new state, thus creating a PV change. This timer prevents the 'nuisance PV change events' by not creating the events until the input settle.

This parameter:

- may be set from 1msec intervals up to 50msec
- with zero msec indicating no debounce (all transitions logged)

NOTE: Inputs are sampled every msec. In the figure below, points A, B, C, D, E and F are identified to illustrate the behavior of the IOM at that point of time.

12.10.1 Input chatter scenario

- DEBOUNCE parameter is set to 4ms
- The Previous valid event was with PV = LOW.
- Input is scanned every 1msec.

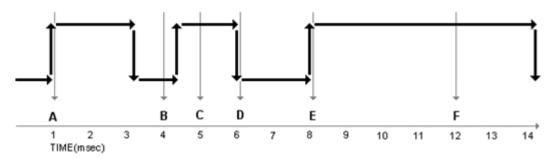


Figure 216: SOE input chatter scenario

| Point | Typical action | | |
|-------|---|--|--|
| A | Action: State change detected at A | | |
| | Result: The time stamp is stored | | |
| В | Action: At B, the state change is detected before the DEBOUNCE counter reaches the target | | |
| | Result: The DEBOUNCE counter is set to 0 | | |
| C | Action: At C, State change is detected before the DEBOUNCE counter reaches the target | | |
| | Result: The DEBOUNCE counter is set to 0 | | |
| D | Action: At D, State change is detected before DEBOUNCE counter reaches the target | | |
| | Result: The DEBOUNCE counter is set to 0 | | |
| E | Action: At E, State change is detected before the DEBOUNCE counter reaches the target | | |
| | Result: The DEBOUNCE counter is set to 0 | | |
| F | Action: At F, the state is the same as it was at 4msec back | | |
| | Result: DEBOUNCE counter is incremented and it is now 4. The DEBOUNCE counter is equal to the target value (=4msec) and the state is same as that when the time stamp was stored, an Event with time stamp stored at A will be posted | | |

NOTE: In the above scenario, if the DEBOUNCE is set to 0, SoeEvt event is reported at every state the change is detected. With reference to the above figure, state change events are reported at, 3, 5, 6 and 8 msec on the time scale given. However, with the DEBOUCE set to 4, there is only one event reported at point F.

12.10.2 PVCHGDLY scenarios

The PVCHGDLY parameter filters nuisance events by not reporting the events logged when the timer is active. It is specified in 1 second increments in the range of 0 to 60 seconds.

The below figure illustrates how PVCHGDLY filters nuisance event reporting.

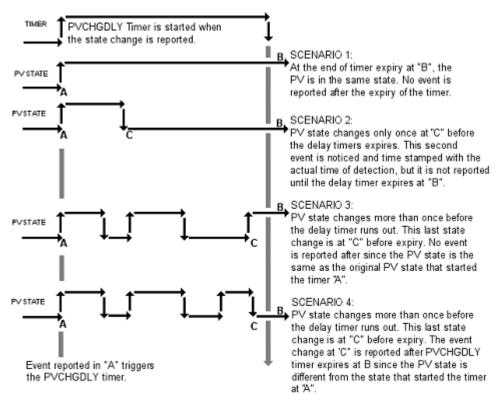


Figure 217: SOE PV Change Delay Scenario

12.10.3 PV State Change event Regeneration

Regeneration is initiated when the:

- module goes off the link and comes back again
- · redundant modules are switched over
- redundant controllers are swapped
- alarm reporting is enabled from disabled state in Station

When the regeneration is requested:

- the IOM regenerates events that are reported in the last 20 sec from the time of the ReGen request
- if there are too many events exceeding the regeneration buffer, then the number of events regenerated is limited to the capacity of the buffer. This can impact recording the events in last 20 secs.

The regenerated events have a timestamp of the actual event and therefore, you can see duplicate events after the event regeneration has occurred.

12.11 SOE Events configuration

The following table displays the EVTOPT and DIMODE dependencies:

Table 144: Table EVTOPT and DIMODE dependency

| DIMODE | Configurable value of EVTOPT parameter |
|-------------|--|
| SOE | None, SOE |
| Normal | None |
| Low Latency | None |

The following occurs to the EVPTOPT with regards to the DISOE:

| lf | Then |
|---|---|
| EVTOPT = None (Default Value) | the DI-SOE IOM is Normal (DI-24V mode) or the Low Latency mode |
| | DI channels of DI-SOE IOM operating in SOE mode do not report SOE events and vice versa |
| If you change the EVTOPT value to SOE when the | the following error is reported: |
| DIMODE parameter has either Normal or Low Latency | 'EVTOPT incompatible with module's DIMODE' |

12.11.1 SOE Events

The following table identifies the SOE event types and descriptions available:

| Event type | Description | | |
|----------------|---|--|--|
| SoeEvt | When the DIMODE parameter on IOM FB is configured to SOE and EVTOPT parameter on DI channel block configured to SOE: | | |
| | • state changes detected by the IOM are reported as 'SoeEvt' events with 0.1ms time resolution on SOE Event Summary display | | |
| | • these events have msec resolution on Event Summary display however; the tool tip on the Event summary display displays time in 0.1msec resolution | | |
| SoeLost | When there is a burst of state change events, it can cause the module SOE event buffer to overflow. Under these circumstances: | | |
| | IOM posts a 'SoeLost' event in the PVCL | | |
| | You see a 'SoeLost' reported against the module in the SOE Event Summary page | | |
| | • The event informs you that there are some events lost during this time | | |
| SoeEvtNotCorr | When there is a state change event fetched from the IOM after the communication between C300 and IOM had been lost for about 60sec or more: | | |
| | • the 'SoeEvtNotCorr' event is reported with the latest time (current time of the time source) | | |
| SoeLostNotCorr | When there is a 'SoeLost' event fetched from the IOM after the communication between C300 and IOM had lost for about 60sec or more: | | |
| | • the 'SoeLostNotCorr' event is reported with the latest time stamp (current time of the time source) | | |

12.12 DIMODE and OWDENBL related scenarios

The following are examples of the DIMODE parameter when modified in different views.

| IOM | View | DIMODE | Description |
|-----------------|------------|---|--|
| DI24V, DISOE | Project | Old value: Normal some channels have OWDENBL = TRUE New value: LowLatency | Throws an error: 'DIMODE cannot be configured as 'LowLatency,' if Open Wire Detection of any channel is enabled' Clear any channels with OpenWire Detection enabled. Change again and configuration changes successfully. |
| DI24V, DISOE | Project | Old value: • LowLatency New value: • Normal | Configuration changes successfully |
| DI24V | Monitoring | Old value: • LowLatency New value: • Normal | Throws an error: 'Invalid access level ' |
| DI24V | Monitoring | Old value: • Normal New value: • LowLatency | Throws an error: 'Invalid access level ' |
| DISOE | Monitoring | Old value: • LowLatency/Normal/ SOE New value: • LowLatency/Normal/ SOE | Throws an error: 'Invalid access level ' |
| DISOE | Project | Old value: | Throws an error: 'DIMODE incompatible with EVTOPT on one or more channels' Reload the CMs with channel block after changing EVTOPT to NONE on the channels with option SOE. Reload the IOM. Configuration is loaded successfully |
| DISOE | Project | Old value: • LowLatency New value: • SOE | Configuration changes successfully. |

12.12.1 Low Latency Mode

When the DIMODE parameter in DI24V and DI-SOE IOM FB is set to LowLatency, the channel's inputs are sampled and processed every 5 msec for better response times when using Discrete Loops that require low latency responses. In the case of DI-SOE, SOE event generation is not supported when DIMODE is LowLatency. This mode will also not support Open Wire Detection.

12.12.2 OWDENBL changes in Project View

The following Open Wire Detection changes occur when the initial value of DIMODE = LowLatency DIMODE and is modified:

- Changing the OWDENBL parameter value to TRUE is not allowed in LowLatency and SOE modes.
- If this is done, the following error is displayed: 'Open Wire Detection cannot be enabled if DIMODE of IO Module is configured as LowLatency or SOE.'

12.13 Enabling pulse proving in Pulse Input Module

To improve metering accuracy, turbine meters used for custody transfer purposes are often "proved" in situ using the real process fluid at the correct flow rate. When a meter is being proved, its flow is diverted such that the prover is downstream and in series with the meter. Thus the same flow passes through the meter and the prover in series.

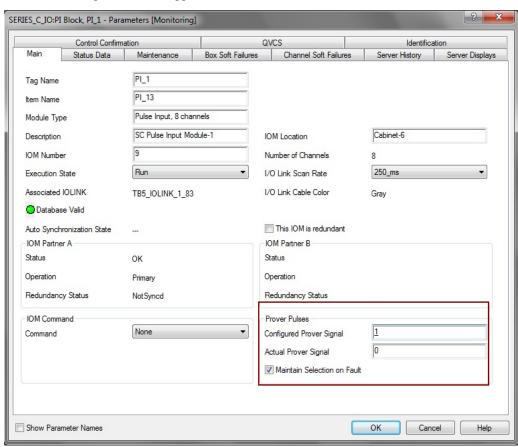
The prover is basically a length of pipe. Inside the pipe is a sphere which is driven around the pipe by the pressure of the flow. In a bi-directional prover, the sphere can move in the forward or reverse direction as determined by the position of the 4-way valve. As the sphere moves around the pipe, it passes sphere detection switches. The swept volumes between all sphere switch combinations (that is 1 and 3, 1 and 4, 2 and 3 and 2 and 4) are determined offline and are known extremely accurately. The sphere switches are used to turn on and off a copy of the good pulses from the meter being proved. Thus a total number of pulses can be obtained versus a known swept volume and so the actual K factor of the meter being proved can be determined.

Prerequisites

- The PI channel is configured for Dual Stream.
- The PIM module is loaded.

To enable pulse proving in PIM

1 Double-click the PIM in the Monitoring view. The PIM module configuration form appears.



2 Enter the configured prover signal (signal stream to output to the prover signal screw pair on a given PI module) in the **Configured Prover Signal** box. The possible channel numbers that you can enter are 0, 1, 3, 5, or 7.

The actual prover signal (the actual signal stream being output to the prover signal screw pair) appears in the **Actual Prover Signal** box. The possible channel numbers that can appear are 0, 1, 3, 5, or 7.

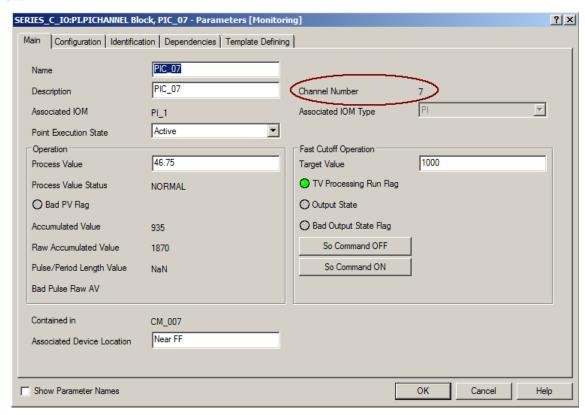
3 Click OK.

12.14 Enabling Fast Cutoff mechanism in PI channel block

Prerequisites

- Channel 7 and/or channel 8 are configured for Fast Cutoff operation.
- · Pulse Input Module is loaded.

The following figure illustrates a sample PI channel block **Main** tab configuration form from the Monitoring view.



To enable the Fast Cutoff configuration

1 Double-click the PI channel block (channel 7 or 8) from the Monitoring view. The Configuration form appears.

Note: The following parameters are enabled if you have selected the pulse input type as Pulse Input with Fast Cutoff.

- Output Safe State (SAFEOUTPUT)
- Target Value (TV)
- TV Processing Run Flag (TVPROC)
- Output State (SO)
- Bad Output State Flag (BADSO)
- SO Command OFF (SOCMDOFF)
- SO Command ON (SOCMDON)
- 2 Reset the accumulated value.

You can reset the accumulated value using the RESETFL (Reset Command Flag).

3 Set the Output State value to a non-safe state value.

4 Enter the target value in the **Target Value** box.

Note:

- When you enter a target value and if the Output State is set to the non-safe state value, fast cutoff functionality is enabled. When fast cutoff functionality is enabled, TVPROC parameter is set to ON.
- When the accumulated value reaches or exceeds the target value, the hardware sets the output to the configured safe state.

Attention

- After the target value has been stored, the fast cutoff functionality is disabled and the TVPROC is set to OFF if any of the following is true.
 - The Output State is set to the safe-state. This occurs in the following scenarios:
 - The PIM block is inactivated.
 - A communication fault occurs.
 - Output State is manually set by the operator.
 - Output State is set by another block.
 - The accumulated value is reset.
 - The accumulated value reaches the target value.
- 5 Refer to the Control Builder Parameter Reference document for more information on other parameters.
- 6 Click OK.

12.15 Monitoring I/O modules

12.15.1 Main tab - DI channel block

From the Monitoring view, you can only monitor the parameters of the channels that are configured for pulse counting functionality.

The following is an example of the DI channel block configured for pulse counting functionality.

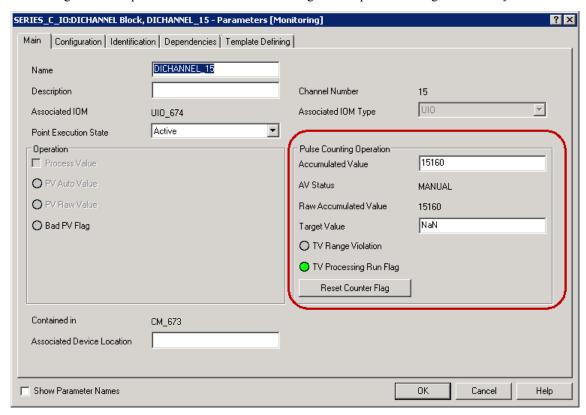


Figure 218: Main tab —UIO-DI channel

As illustrated in the figure, the parameters listed in the Pulse Counting Operation section can be monitored.

12.15.2 Al Status Data tab

You can only monitor the parameters of the channels that are configured as AI from the Channel Configuration tab

The following is an example of the AI channel block configured in the UIO module.

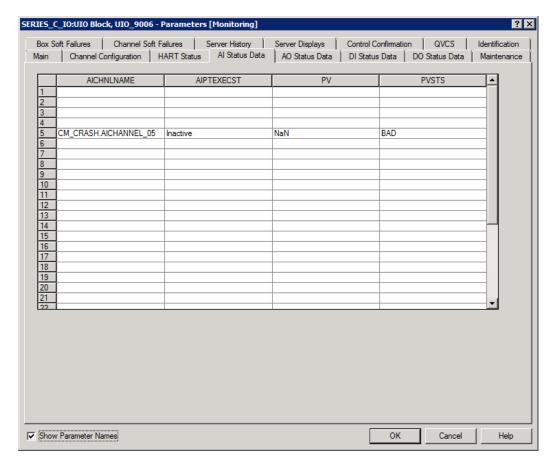


Figure 219: Al Status Data tab

As illustrated in the figure, channel 5 is configured as AI channel in the UIO module.

12.15.3 AO Status Data tab

From the Monitoring view, you can only monitor the parameters of the channels that are configured as AO in the Channel Configuration tab.

The following is an example of the AO channel block configured in the UIO module.

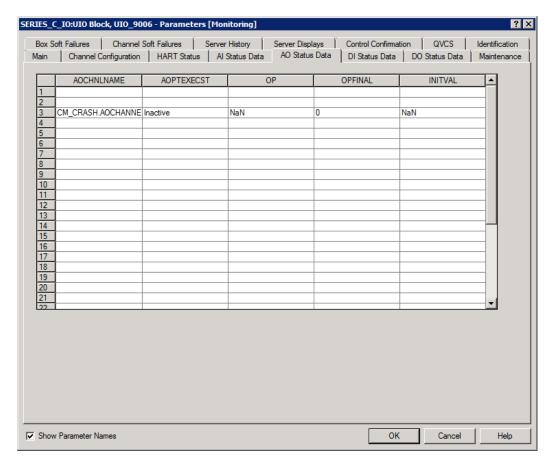


Figure 220: AO Status Data tab

As illustrated in the figure, the channel 3 is configured as AO channel in the UIO module.

12.15.4 DI Status Data tab

From the Monitoring view, you can only monitor the parameters of the channels that are configured as DI in the Channel Configuration tab.

Starting with R430, when the DI channel type (DITYPE) is configured as "Accum," applicable parameters such as AV, are available for monitoring.

The following is an example of the DI channel block configured in the UIO module.

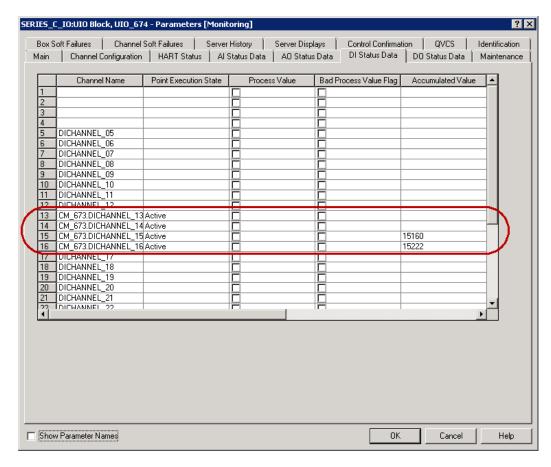


Figure 221: DI Status Data tab

As illustrated in the figure, the accumulated value is displayed for the DI channels that are configured for pulse counting.

12.15.5 DO Status Data tab

From the Monitoring view, you can only monitor the parameters of the channels that are configured as DO in the Channel Configuration tab.

The following is an example of the DO channel block configured in the UIO module.

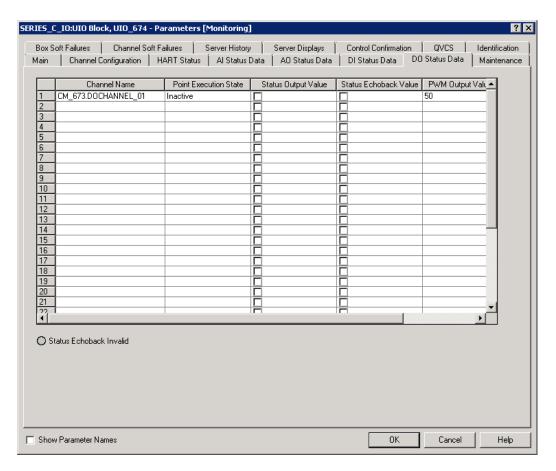


Figure 222: DO Status Data tab

As illustrated in the figure, the channel 1 is configured ganging in the UIO module.

12.15.6 Status Data tab

You cannot configure any **Status Data** tab parameters from the Project view. You can only monitor the parameters from the Monitoring view. You can only monitor the status of the following I/O modules from the Monitoring view.

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM

The following is an example of a DO-24B Block, Configuration form - Status Data tab.

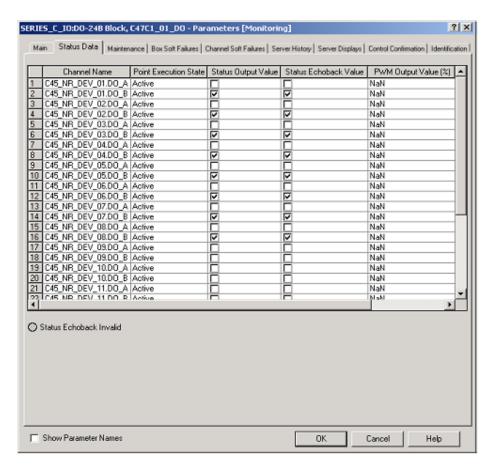


Figure 223: Status Data tab

12.15.7 PIM Status Data tab

The following figure displays a sample Status Data tab of the PIM from the Monitoring view.

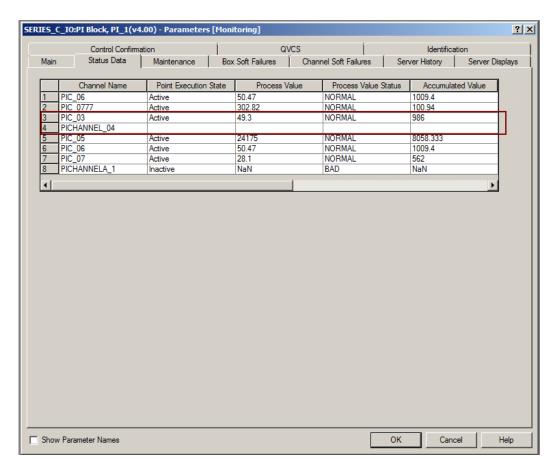


Figure 224: Status Data tab of a PIM

As illustrated, channel 3 is configured for Dual Stream. Therefore, the row for channel 4 does not display any values.

12.15.8 Maintenance tab

The following configuration information pertains to the Maintenance tab for the following module types:

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM
- UIO

Maintenance can only be done from Monitoring.

All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Maintenance tab.

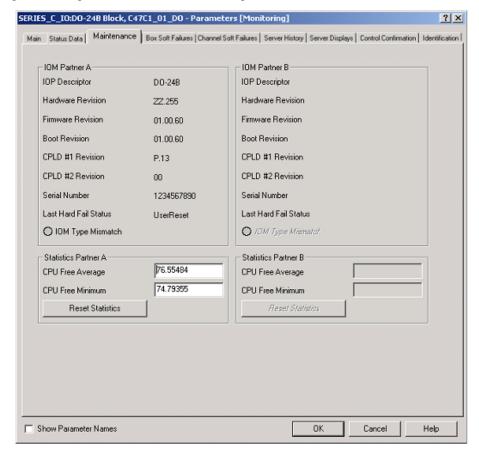


Figure 225: Maintenance tab

Prerequisites

A Series C I/O control module is created

To Reset Statistics on the Maintenance tab

- 1 From the Statistics Partner frame, monitor the CPU Free Average and CPU Free Minimum settings. To reset statistics to their default values, proceed to the next step.
- 2 Click Reset Statistics to reset CPU Free Average and CPU Free Minimum to their default settings.

12.15.9 UIO Maintenance tab

The following figure displays an example Maintenance tab of the UIO from the Monitoring view.

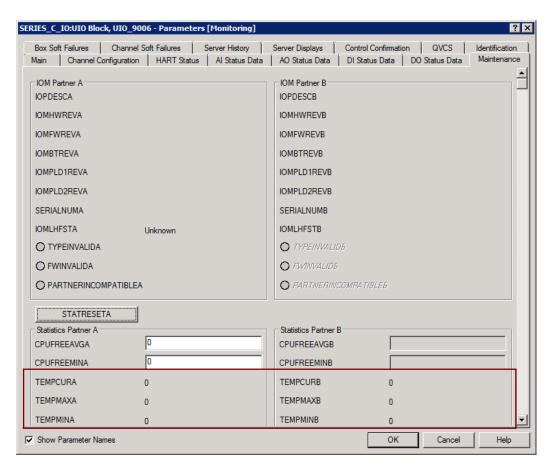


Figure 226: Maintenance tab

As illustrated in the figure, the temperature-related parameters of the UIO module can be monitored from the Monitoring view.

12.15.10 UIO – 2 Maintenance tab

For UIO-2, the information displayed is different from that displayed in case of UIO. Hardware information (for both redundant and non-redundant setups) is displayed.

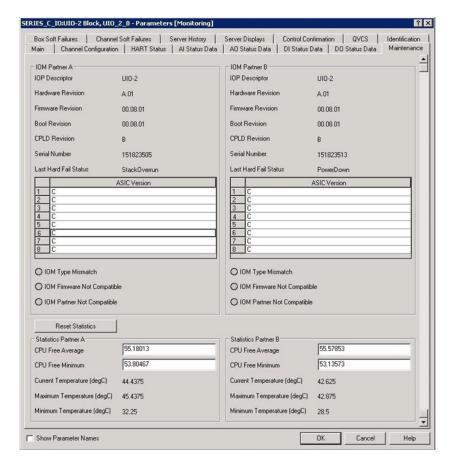


Figure 227: UIO-2 Maintenance tab

12.15.11 Box Soft Failures tab

The following configuration information pertains to the Box Soft Failures tab for the following modules:

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AC
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM
- UIO

Note: No user-defined configuration setting on the Box Soft Failures tab.

All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Box Soft Failures tab.

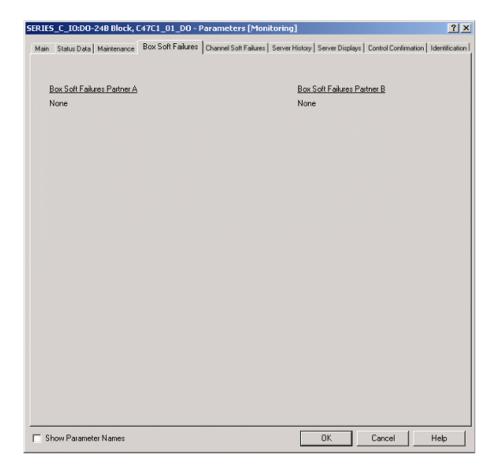


Figure 228: Box Soft Failures tab

Prerequisites

• A Series C I/O control module is created

12.15.12 Channel Soft Failures tab

The following configuration information pertains to the Channel Soft Failures tab for the following modules:

- AI-HART
- AI-HL
- AI-LLMUX
- AI-LLAI
- AO
- AO-HART
- DI-HV
- DI-24
- DI-SOE
- DO-24B
- SP
- SVP
- PIM
- UIO

Note: No user-defined configuration setting on the Channel Soft Failures tab.

• All illustrations used in the procedure are for example purposes only

The following is an example of a DO-24B Block, Configuration form - Channel Soft Failures tab.

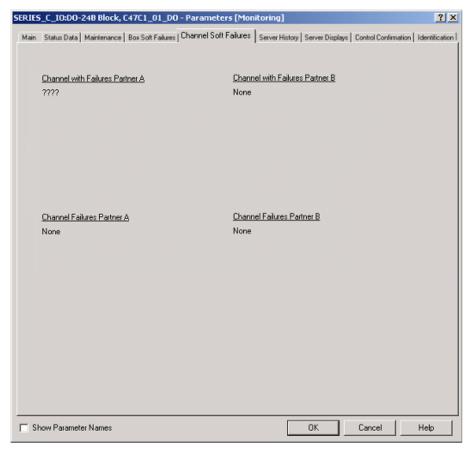


Figure 229: Channel Soft Failures tab

When the DO channel is configured for ganging and a soft failure occurs in one of the ganged DO channel, the soft failure is reported with the respective DO channel number. For example, consider that the DO channel 1 to 4 are configured for ganging and a soft failure (for example, open wire is detected) occurs in the DO channel 3. In this scenario, the soft failure is reported with the DO channel 3.

12.15.13 HART Device Status tab - Channel block

The following configuration information pertains to the HART Device Status tab.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Device Status tab.

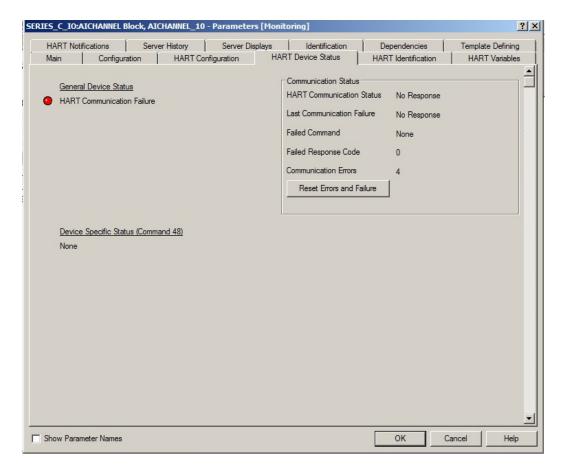


Figure 230: HART Device Status tab

The parameters of the HART Device Status tab are listed in the following table.

Table 145: HART Device Status tab parameters

| Plain text | Parameter name | User configurable |
|----------------------------|----------------|-------------------|
| Communication Status | | |
| HART Communication Status | HCOMSTS | No |
| Last Communication Failure | HCOMFAIL | No |
| Failed Command | HCMDFAIL | No |
| Failed Response Code | HCMDRESP | No |
| Communication Errors | HNCOMERR | No |

Prerequisites

• A Series C I/O control module is created

12.15.14 HART Identification tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O Analog Input and Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Identification tab.

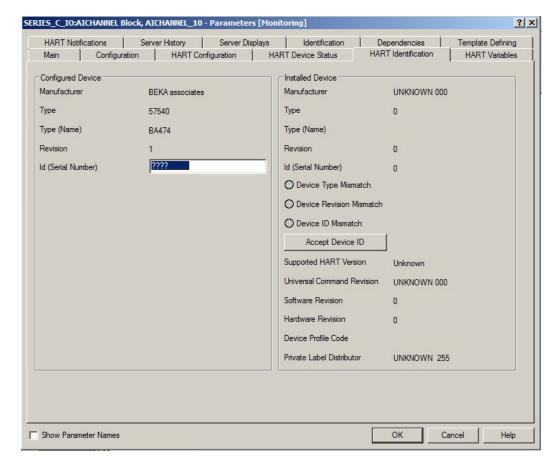


Figure 231: HART Identification tab

The parameters of the HART Identification tab are listed in the following table.

Table 146: HART Identification tab

| Plain text | Parameter Name | User Configurable | | |
|--------------------|----------------|-------------------|--|--|
| Configured device | | | | |
| Manufacturer | HDVMFGCD | No | | |
| | HDVMFGCD7 | No | | |
| Туре | HDVTYPCD | No | | |
| | HDVTYPCD7 | No | | |
| Type (Name) | HDVTYPCDNAME | No | | |
| Revision | HDVRREVCD | No | | |
| Id (Serial number) | HDEVIDCD | No | | |
| Installed device | | | | |
| Manufacturer | HDEVMFG | No | | |
| Туре | HDEVTYPE | No | | |
| | HDEVTYPE7 | No | | |
| Type (Name) | HDEVTYPNAME | No | | |
| Revision | HDEVRREV | No | | |
| Id (Serial number) | HDVID | No | | |

| Plain text | Parameter Name | User Configurable |
|----------------------------|----------------|-------------------|
| Device Type Mismatch | HDEVMISM | No |
| Device Revision Mismatch | HREVMISM | No |
| Device ID Mismatch | HDEVIDFL | No |
| Accept Device ID | ACCEPTDEV | No |
| Supported HART Version | HARTVERSION | No |
| Universal Command Revision | HUCMREV | No |
| Software Revision | HSWREV | No |
| Hardware Revision | HHWREV | No |
| Device Profile Code | HDEVPROFILE | No |
| Private Label Distributor | HPVTLDST | No |

Prerequisites

- · Control Builder is running
- A Series C I/O control module was created

12.15.15 HART Variables tab - Channel block

The following configuration information pertains to the Identification tab for all Series C I/O Analog Input or Analog Output modules.

All illustrations used in the procedure are for example purposes only

The following is an example of an AI Channel Block, Configuration form - HART Variables tab.

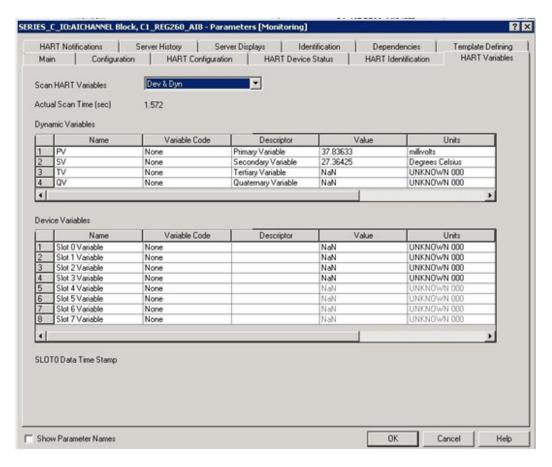


Figure 232: HART Variables tab

The parameters of the HART Variables tab are listed in the following table.

Table 147: HART Variables tab parameters

| Plain text | Parameter name | User configurable |
|---|--|---------------------------------------|
| Scan HART Variables | HSCANCFG | No |
| Only for UIO-2, the Scan HART Variable end of this table. | es are configurable as described here. A s | creenshot of the same is shown at the |
| Scan HART Variables | HSCANCFG | Yes |
| | | Status Only |
| | | Device Only |
| | | Dynamic Only |
| | | Dev & Dyn |
| Dynamic variables | | |
| Name | HDYNNAME | Yes |
| Variable Code | HDYNDVC | Yes |
| Descriptor | HDYNDSC | Yes |
| Value | HDYNVAL | Yes |
| Units | HDYNEU | Yes |
| Device variables | | |

| Plain text | Parameter name | User configurable |
|-----------------------|----------------|-------------------|
| Name | HSLOTNAME | Yes |
| Variable Code | HSLOTDVC | Yes |
| Descriptor | HSLOTDSC | Yes |
| Value | HSLOTVAL | Yes |
| Units | HSLOTEU | Yes |
| Slot0 Data Time Stamp | SLOT0TS | No |

Prerequisites

- Control Builder is running
- A Series C I/O control module was created

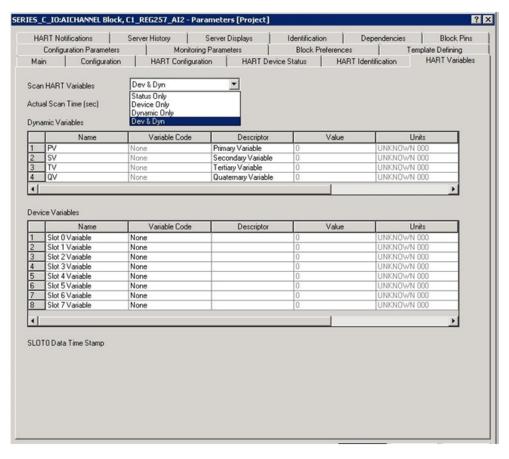


Figure 233: HART Variables tab — Scan HART Variables

12.16 Calibrating the DC output voltage for a Meanwell redundant system

To calibrate the DC output voltage for a Meanwell redundant system, perform the following steps.

- 1 After assembling the power supply and redundancy module, ensure the following:
 - Separate breakers are provided for each power supply.
 - Both the power supplies are in off state.
 - There are no loose connections.
- 2 Turn on the breaker of the power supply 2.



Multimeter to monitor DC Voltage



Note: For the power supply 2, if the LED labeled as 'DC OK' is on, then it indicates that the power supply is on.

- 3 Connect multi-meter to measure DC output voltage of power supply 2 at the terminal block. Refer above figure.
- 4 Adjust the potentiometer (labeled as' +V ADJ 'on the power supply) to set voltage at the terminal block to 25.0 volts.
- 5 Turn off the power supply 2 and Turn on power supply 1.
- **6** Repeat steps 3 to 5 for power supply.
- 7 Turn on power Supply 2.

Note: When both the power supplies are on, check the DC output voltage at the terminal block must be 25V.

12.17 Calibrating the DC output voltage for a non-redundant Meanwell system

To calibration the DC output voltage for a non-redundant Meanwell system, perform the following steps.

- 1 After assembling the power supply in a non-redundant power system, ensure the following:
 - Separate breaker is provided for power supply.
 - Power supply is in off state.
- **2** Turn on the breaker of the power supply 2.
 - Note: For the power supply 2, if the LED labeled as 'DC OK' is on, then it indicates that the power supply is on.
- 3 Connect multi-meter to measure DC output voltage of power supply 2 at the terminal block.
- 4 Adjust the potentiometer (labeled as' +V ADJ 'on the power supply) to set voltage at the terminal block to 25.0 volts.

12.18 Calibrating the DC output voltage for a Phoenix redundant power system

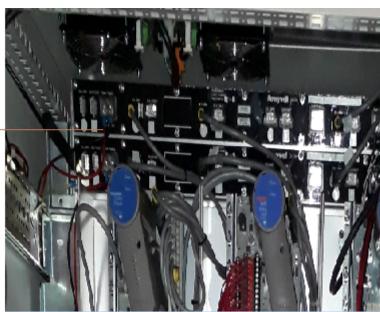
To calibrate the DC output voltage for a Phoenix redundant power system, perform the following steps.

To calibrate the DC output voltage for a Phoenix Contact redundant option

- 1 After assembling the power supply and redundancy module, perform the following:
 - Ensure separate breakers are provided for each power supply.
 - Check that both the power supplies are in off state.
 - Ensure there are no loose connections.
 - Switch on the breaker of power supply 2.
- 2 Observe that the LED labeled as **DC OK** of power supply 2 is on. See the following figure in which the LED is indicated as **DC OK**.



3 Connect the multimeter to measure DC output voltage of power supply 2 at the terminal block . See the following figure.



Multimeter to monitor DC Voltage

- 4 Adjust the potentiometer (labeled as" 18-29.5 V "on the power supply) to set voltage to 25.0 volts on terminal block.
- 5 Switch off the power supply 2 and then switch on the power supply 1.
- **6** Repeat the above steps for the power supply 1.
- 7 Switch on the power supply 2.
- 8 When both the power supplies are on, check the DC output voltage at terminal block. The output voltage should be 25V.

To calibrate the DC output voltage for a Phoenix Contact redundant option

- 1 After assembling the power supply and redundancy module, perform the following:
 - Ensure separate breakers are provided for each power supply.
 - Check that the power supply is in off state.
 - Ensure there are no loose connections.
- 2 Observe that the LED labeled as **DC OK** of power supply 2 is on. See the following figure in which the LED is indicated as **DC OK**.



3 Connect the multimeter to measure DC output voltage of power supply 2 at the terminal block . See the following figure.



Multimeter to monitor DC Voltage

- 4 Adjust the potentiometer (labeled as" 18-29.5 V "on the power supply) to set voltage to 25.0 volts on terminal block.
- 5 When the power supply is on, check the DC output voltage at terminal block. The output voltage should be 25V.

12.19 Power up the COTS power system

When you turn on the Series C system for the first time, you must always confirm that the DC output voltage of the power system must be within the range of 24V to 26 V.

Following are the tools required to power up the power system.

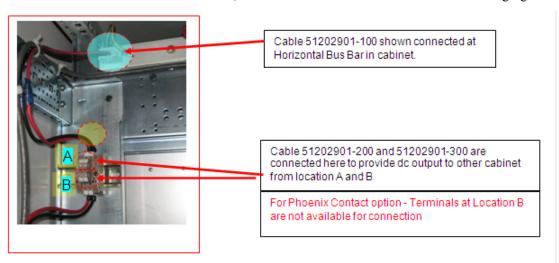
- · Flat head screw driver
- · Digital multi-meter

Before you turn on the COTS power system, ensure the following:

- There must be no loose connections.
- AC power is connected to an COTS power system through the circuit breaker. Circuit breaker facilitate turning On/Off of the power supply.
- Applicable local safety and agency requirements are fulfilled.
- All safety and grounding requirements applicable to series C system are complied.

To confirm the DC output voltage of the power system

- 1 Remove the connector or connectors on horizontal bus bar in cabinet.
- 2 Remove the cables from the horizontal bus bar, 24 volts is disconnected as shown in the following figure.



- 3 Turn on the power supply or power supplies using the circuit breaker.
- 4 Check that the LED is labeled as 'DC OK 'of the power supply is on.
- 5 Measure the voltage on the terminal block with help of Digital Multi-meter. The voltage must be in the range of 24V to 26V.
- 6 Turn off the power system and then reconnect the connector or the connectors removed from the horizontal bus bar.
- 7 Initial check of the power system must be complete.

13 Series C I/O Link Fiber Optic Extenders (FOE)

The Fiber Option Extender modules support the extension of the I/O link beyond the Series C Cabinet with the C300, enabling remote applications of the Series C I/O.

The following two types of FOEs are qualified to be used with Experion depending on the distance between the controller and the IO modules.

- · Multi-mode FOE
- · Single mode FOE

You can select the appropriate FOE based on your requirement.

Related topics

"Overview of multi-mode FOE" on page 502

"FOE Installation" on page 505

"Component mounting sequence" on page 507

"Defining the Fiber Optic topology" on page 511

"Single mode fiber optic extender" on page 515

"Defining the single mode fiber optic topology" on page 526

13.1 Overview of multi-mode FOE

The Fiber Optic module and IOTA board are built exclusively for Honeywell by a third party company. With a Series C I/O Link Fiber Optic Extender (FOE) module, the ability exists to connect the C300 controller to remote:

- Series C I/O and
- PM I/O

The FOE has the following capabilities:

- To connect one local cabinet to two remote I/O sites.
 - If more than two remote sites exist, multiple FOE modules may be installed in the local cabinet.
- Has two fiber optic ports sets, FO1 and FO2,
 - each set having both a receive (Rx) and transmit (Tx) connector.
- An IOLINK connector for connecting to the copper IOL.

Note: The same FOE module cannot be used for both types Series C and PM I/O concurrently.

The following FOE connections can be made:

| Fiber optic port connections | • | Series C: FOE modules to FOE modules PM I/O: FOE modules to PM I/O Link Extender |
|------------------------------|---|---|
| IOLINK (copper) connections | • | Series C: FOE modules to copper IOLINK |

13.1.1 Fiber Optic Extender assembly

The Fiber Optic Extender assembly consists of components that include the FOE module and the FOE IOTA board, along with the FOE interface cable. This assembly is installed in a control cabinet on vertically mounted carriers, specially designed for Series C control hardware. The following figure shows the features of the FOE and its associated IOTA board.

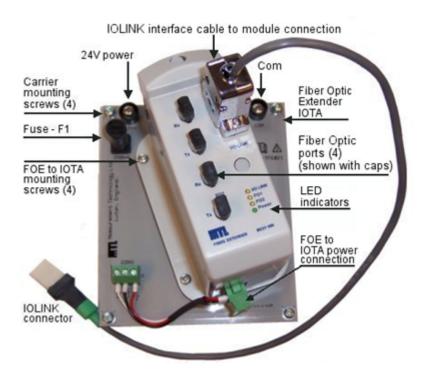


Figure 234: Fiber Optic Extender assembly

Table 148: FOE module and IOTA summary

| Item | Description | |
|-----------------------------|---|--|
| IOTA board 6-inch | | |
| F1 | Fuse | |
| 24V power | Power connection to carrier | |
| Com | Ground connection to carrier | |
| FOE Power connector | Plug for FOE power cable connection | |
| Fiber Optic Extender module | | |
| IOLINK connector | IOLINK connector | |
| Fiber optic ports (2 sets) | FO1 - Rx (receive) and Tx (transmit) connectors | |
| | FO2 - Rx (receive) and Tx (transmit) connectors | |
| | Either set can be used interchangeably. | |
| LED indicators | Power and communication indicators for the module | |

13.1.2 FOE features

The following table lists the features available with the Fiber Optic Extender.

| Feature | Description | |
|------------------|---------------------|---|
| Supported family | Series C and PM I/O | |
| Topology types | Point-to-point | Two systems (nodes) connected by a single cable set. |
| | Daisy chain | Multiple systems connected in a serial manner. Each module acts like 'a repeater' allowing greater fiber distances. |

| Feature | Description | | |
|-------------------------|---|--|--|
| | Star Sometimes compared to a 'chicken foot' | Topology whereby all nodes are individually connected to a central connection point. More cable is needed, but if one cable fails, the rest of the nodes remain operational. | |
| Optical budget | 8db min 15db typical | | |
| Distance | Between FOEs with standard cables 1.5 km with premium cable 2.0 km Daisy chain max 8 km PM I/O 10 km Series C | | |
| Module mounting options | IOTADIN rail (with user supplied power) | | |
| Fiber Optic ports | 2 | | |
| Power options | Series C - IOTA External power system (DIN rail mounting option) | | |
| Power supply options | 20 to 30V at 85mA to 74mA max | | |
| Ambient temperature | Operating: -20 to +70 degrees C | | |
| | Storage: -20 to +85 degrees C | | |
| Corrosives | G3 per ISA specification S71.04-1985 | | |
| Relative humidity | 0% to 90% RH | | |
| Fiber type | Multi-mode | | |
| | Fiber core diameter 62.5 μm | | |
| | Fiber cladding diameter 125 | μm | |
| | Connector type ST type | | |

13.1.3 Fiber Optic redundancy

Since both Series C and PM I/O links are redundant, FOE modules are always installed in pairs . Therefore, two independent fiber cables (one for Link A and one for Link B) are required between each local and remote connection.

13.1.4 FOE assembly certification details

The individual elements of the code are explained by reference to the items below.

- Class I, Division 2, Groups A, B, C, D
- Class I, Zone 2, AEX nA IIC
- II 3G EEx nA IIC
- ATEX EEx nA IIC T4

13.2 FOE Installation

The procedures in this guide assume that you have completed all pertinent planning activities as outlined in the *Control Hardware Planning Guide*.

13.2.1 Handling components - ESD

Electrostatic discharge can damage integrated circuits or semiconductors if you touch the connector pins.



Electrostatic discharge

Follow these guidelines when you handle a module:

- · Touch a grounded object to discharge static potential,
- Wear an approved wrist-strap grounding device,
- · Do not touch the connector pins,
- If available, use a static safe workstation

13.2.2 Work practices

Before installation, follow these work practices when performing general tasks:

- Ensure that all installation work is to be carried out in accordance with local standards, codes of practice and site regulations and any other special requirements stated in this manual.
- Check that all module functions are correct for the application
- Take care to avoid damaging the pins at all connector interfaces
- Ensure that AC mains supplies have been isolated.
- It is recommended that some form of mechanical assistance is used for lifting and supporting the enclosure when installing it.

13.2.3 Hazardous areas

This subsection describes the considerations that should be given to Zone 2 and Division 2 hazardous environments of the equipment prior to its installation.

Work activities in a Zone 2 and Division 2 hazardous area are restricted in order to avoid ignition of explosive gas/air mixtures.

13.2.4 Operations

The equipment must only be installed, operated and maintained by trained competent personnel.

13.2.5 Checking and Maintenance

The installation and maintenance must be carried out in accordance with all appropriate international, national and local standard codes of practice and site regulations in accordance with the instructions contained in this manual.

13.2.6 Installation

The installation must comply with the appropriate European, national and local regulations, which may include reference to the IEC code of practice IEC 60079-14. In addition, particular industries or end users may have specific requirements relating to the safety of their installations and these requirements must be met. For the

majority of installations the Directive 1999/92/EC [the ATEX Directive - safety of installations] is also applicable.

13.3 Component mounting sequence

It is required that the installation be done in the following sequence:

- 1. Mount the FOE module onto the IOTA
- 2. Connect the FOE module's power cable to the module
- 3. Remove the IOTA F1 fuse.
- 4. Mount the FOE module assembly to the carrier
- 5. Connect the I/O link cable.
- 6. Re-install the IOTA F1 fuse.

13.3.1 Mounting the FOE module onto the IOTA

Prerequisites

It is required to attach the FOE module to the IOTA prior to its mounting to the carrier. The following also needs to be established:

All wiring and pre-fabricated cables are available and labeled as applicable.

To mount the module onto the IOTA

- 1 Align the FOE screws (located on the flange) with the holes on the IOTA. See Figure 234.
- 2 Tighten the four screws that attach the base of the FOE module to the IOTA board (using a Phillips screw-driver).
- 3 This completes the procedure.

13.3.2 Connecting the FOE module's power cable to the module

Typically, the FOE power cable does not require any adjustment or maintenance. If there is a power issue with the FOE module, a loose contact or disconnected power cable may be the cause. If the power cable is damaged the IOTA board requires replacing.

Prerequisites

Before connecting the FOE module's power cable to the module refer to the FOE connection rules.

To connect the FOE power cable to the module

- 1 Ensure the power cable connector is properly aligned with the plug on the module.
- **2** Press the plug firmly into the connector.
- 3 Using a small slotted screwdriver, fasten the screws on the cable connector to the FOE module.
- 4 This completes the procedure.

13.3.3 Removing the FOE IOTA F1 fuse



Attentior

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the **F1** fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the **F1** fuse can be re-installed.

To remove the FOE IOTA F1 fuse

- 1 Using a small slotted screwdriver, place the tip into the slot on the fuse cap
- 2 Rotate the cap counter clockwise, a quarter-turn. Remove the cap that also holds the fuse. Place fuse and fuse cap aside in a safe place for reuse in a later assembly step.
- 3 This completes the procedure.

13.3.4 Mounting the FOE module/IOTA assembly to the carrier

Prerequisites

Before installing the FOE module/IOTA assembly in the cabinet, ensure that:

All wiring and pre-fabricated cables are available.



Attention

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the **F1** fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the **F1** fuse can be re-installed.

To mount the FOE module/IOTA assembly to the carrier

- 1 Ensure the F1 fuse is removed.
- 2 Make sure each of the 4 carrier mounting screws have their spacers secured by the plastic retaining washers.
- 3 Select the desired mounting location on the carrier and align the mounting holes in the IOTA with the screw-hole locations on the carrier.
- 4 Using a #2 Phillips screwdriver, secure the FOE assembly to carrier using the 4 corner carrier mounting screws.
- Tighten the two power screws, connecting the IOTA board to the vertical bus bars on the channel carrier assembly:
 - +24 V power screw
 - · Com ground screw
- 6 This completes the procedure.

13.3.5 Connecting the IOLINK interface cable to the FOE module



Attention

The lOLINK interface cable should be connected before powering the FOE module.

Prerequisites

Before connecting the FOE module's IOL interface cable to the module:

Refer to FOE connection rules.

To connect the IOLINK interface cable to the FOE module

- 1 Ensure the IOLINK interface cable connector is properly aligned with the connector on the FOE module.
- 2 Press plug firmly into the connector.
- **3** Fasten the screws on the cable connector to the FOE module.
- 4 This completes the procedure.

13.3.6 Re-installing the FOE IOTA F1 fuse

Attention

The fuse, F1, can be removed or replaced only after verifying that the location is non-hazardous.

To re-install the FOE IOTA F1 fuse

- 1 Using the fuse and cap from section 13.3.3, place the fuse in the fuse cap and insert it back into the fuse holder on the IOTA board.
- 2 Tighten the fuse cap rotating it clockwise a quarter-turn, using a small slotted screwdriver.
- 3 This completes the procedure.

13.3.7 Connecting the fiber optic cables to the FOE module



Attention

Unused optical ports should always have protective covers on them to prevent dust and other contaminants from accumulating on the glass fiber optic interfaces.

Fiber-optic ST-type connectors may be removed, or replaced, while active and in a Zone 2 or Division 2 hazardous area

Clean and inspect the fiber optic cable endfaces per IEC-61300-3-35 at time of installation or any time the fiber cables are removed and reinstalled into the FOE Tx/Rx ports. Do not skip this critical step. A 200x/400x optical fiber microscope is required for verification. Failure to meet specification may result in communication errors or undesired operation.

Prerequisites

Before connecting the FOE module's power cable to the module:

Refer to FOE connection rules.

To connect the FOE cables to the FOE module

1 Ensure the dust caps are removed from the ST optical ports on the FOE module. Remove the dust caps by rotating the cap counter-clockwise to disengage from the locking tab.



2 Carefully insert the ST connector of the fiber optic cable onto the proper FOE port.

Top Port

FO1 - Rx (receive) and Tx (transmit) connectors

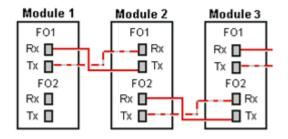
Bottom Port

FO2 - Rx (receive) and Tx (transmit) connectors

FOE Cable Guidelines

- FO1 and FO2 ports may be used interchangeably. However, the Rx and Tx connections of a given cable set must be terminated on the same port.
- The cable end attaches to Rx on one module and to the Tx on the other module.

Note: The figure below illustrates how to connect the fiber optic ports on the FOE modules in daisy chain.



Attention

Do not connect fiber cables between FO1 and FO2 on the same fiber optic module. Improper operation will result.

13.3.8 FOE connection rules



Attention

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the F1 fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the F1 fuse can be re-installed.

The power and cable connections to the FOE are allowable under the following conditions:

| Connecting and discounting | Rule | |
|--------------------------------|---|--|
| Power | Removing fuse F1 from the IOTA powers down the FOE module. | |
| IOLINK cable under power | The IOLINK cable between the C300 and the FOE module can be removed or replaced while under power only after verifying that the location is a non-hazardous area. | |
| Fiber optic cables under power | Fiber-optic ST-type connectors may be removed, or replaced, while active and in a Zone 2 or Division 2 hazardous area. | |

13.3.9 LED indicators

The following table defines the LEDs located on the Fiber Optic Extender module.

Table 149: FOE LED descriptions

| Indicator | Color | LED off | LED on |
|------------|--------|----------------------------------|---|
| Power | Green | Power fail | Power OK |
| O FO 1 | Yellow | Communication signal not present | Communication signal present on Rx channel |
| O FO 2 | Yellow | Communication signal not present | Communication signal present on Rx channel |
| O I/O LINK | Yellow | Communication signal not present | Communication signal present on RS485 port. |

13.4 Defining the Fiber Optic topology

There are three different FOE topologies supported. These topologies are:

- Daisy chain
- Tree
- Star

Attention

The following figure is an example how the FOE can be deployed in a variety of topologies for both the Series C and PM I/O environment. This graphic is not to depict any restrictions with regards to FOE capacity or cable length.

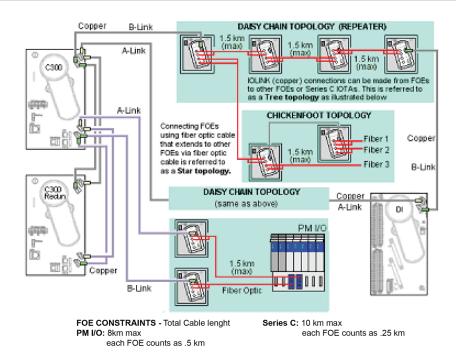


Figure 235: Example of possible FOE usage

13.4.1 FOE capacity

The FOE can be deployed and combined in a variety of topologies. The following list can be used as a general guideline of supported environments and FOE capacities.

| Environment | Hardware | Capacity |
|--------------|--------------|---------------------------------------|
| Series C I/O | Cable length | 10 km max - each FOE counts as .25 km |
| PM I/O | Cable length | 8 km max - each FOE counts as .5 km |

13.4.2 Required hardware

Depending on your topology, the following Series C hardware is required to achieve remote I/O accessibility: Component

Fiber Optic Extender IOTA

- Fiber Optic Extender module
- · Fiber optic cables

FOE interface cables - 0.5M length for both Series C & PM I/O

- Gray (pair) for IOL1
- Violet (pair) for IOL2

13.4.3 Fiber Optic Extender interface cable

The Series C interface cable has a different electrical keying than its PM I/O counterpart. Therefore, the specific cable type must be used for each I/O family.



Attention

The proper interface cable must be used for either the Series C or the PM I/O topology. Use of the incorrect cable will result in faulty and/or corrupted IOL communications.

The fiber link is a passive subsystem and is essentially transparent to the system operation. It does not increase or decrease traffic or impact other capabilities of the I/O system. In addition, the following designations occur for these cables:

| Interface | Cable color | A-link band color | B-link band color |
|-----------|-------------|-------------------|-------------------|
| IOL1 | Gray | Yellow | Green |
| IOL2 | Violet | Yellow | Green |

13.4.4 Fiber optic cable - length factors

The maximum run of the fiber optic cables is limited by the optical power budget of 8db. Standard cables support 1.5 km while premium cable supports 2 km runs.

13.4.5 FOE topologies - Daisy chain topology

A daisy chain topology allows the remote I/O connection to be extended and can be utilized several times - if maximum flight delay times of data passing between the C300 controller and I/O are not exceeded.

When Series C daisy chaining,

the electrical port requires no interface cable to be attached. This applies if:

- · daisy chaining Series-C link traffic, and
- I/O is not present at the repeating location.

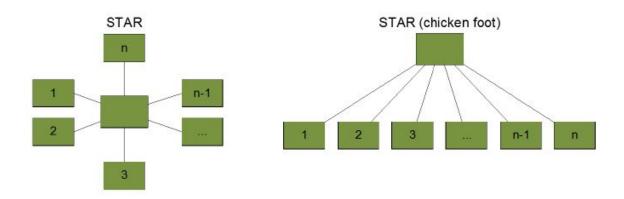
When PM I/O daisy-chaining,

an interface cable must always be connected to the electrical port. This is because the cable keys the FOE for the PM mode of operation

A repeater function also extends the remote I/O similar to the daisy chain technique, but relies on the optical ports of two FOE modules to provide the interconnection.

13.4.6 FOE topologies - Star topology

The figures below illustrate the **STAR** topology whereby remote FOE nodes are individually connected to a central connection point (e.g. the C300). This topology has the advantage in that if one cable or cable set fails, the rest of the remote nodes remain operational. For this reason STAR is the most widely used configuration. The STAR is sometimes referred to as a **chicken foot** topology.



13.4.7 Maximum flight delay times

The I/O link communication protocol imposes a constraint between the C300 controller and the most distant I/O location, known as maximum flight delay time. This places a limit on the combined number of FOEs, and cumulative fiber cable length permitted in any IOL path. Note that these flight delay times constrain the distance regardless of the use of multi-mode versus single-mode fiber. In another words, the maximum distance are stated below regardless of the use of multi-mode versus single-mode fiber. This constraint varies for:

Series C - maximum cable length is 10 km

PM I/O - maximum cable length is 8 km

13.4.8 Fiber optic budget considerations



Attention

Fitting terminations to fiber optic cable requires special equipment and techniques. In order to obtain the best results, a trained person should perform this operation in accordance with the manufacturer's instructions. For these reasons, the following installation instructions do not include detailed procedures for this process.

Testing of the quality (loss) of the terminations should be carried out at each stage.

13.4.9 Standard I/O link extender maximum cable span calculation

The following calculation MUST be used to ensure that the number of planned splices and the cable choice supports the necessary cable span distance.

| The maximum cable span calculation (in km) is as follows: | |
|---|---|
| Max Span = | (Available Optical Power - Losses in Splices)/(Max Loss per Cable Type) |

The calculations or values for each of the above variables are described below.

13.4.10 Available standard I/O link extender optical power

The available optical power calculation is as follows:

| Transmit Power - Minimum Receiver Sensitivity - Power Loss Over Time = | | |
|--|--|--|
| Available Optical Power | | |
| where for a Standard I/O Link Extender: | | |

| Transmit Power = - 16.0 dB |
|---|
| Minimum Receiver Sensitivity = - 24.0 dB |
| Power Loss Over Time = 2.5 dB |
| Example calculation for a Standard I/O Link Extender using 62.5 micron cable: |
| (- 16.0 dB) - (- 24.0 dB) - (2.5 dB) = 5.5 dB Available Optical Power |



Attention

Because the maximum transmitter output level is -7 dB, and the maximum receiver input level is -10 dB, the receiver may be overdriven on a short link and may require a 3 dB attenuator. Connector allowances for the transmitter and receiver are included in the above power declaration.

13.4.11 Losses in splices

The table below is used for the following Losses in Splices calculation.

Losses in Splices = Number of Splices x Maximum Loss per Splice

| Standard Extender I/O cable type | Average Loss | Maximum loss |
|----------------------------------|---------------|---------------|
| | per type (dB) | per type (dB) |
| Fusion | 0.2 | 0.3 |
| Mechanical | 0.3 | 0.5 |
| ST-connector | 0.5 | 0.9 |

Examples: Max. span calculation for cables with fusion or mechanical splices:

Variable values: Available optical power = 5.5 dB, two splices.

| Two fusion splices | (5.5 dB) - (2 splices x 0.3 dB max loss per splice) / (4 dB/km) = 1.22 km |
|-------------------------|---|
| Two mechanical splices: | (5.5 dB) - (2 splices x 0.5 dB max loss per splice) / (4 dB/km) = 1.12 km |

13.4.12 Honeywell ST-type connector cable assemblies

Honeywell can provide short fiber optic ST-type connector cable assemblies. You order by part number and cable length.

13.4.13 Link A and B cable length differences

The maximum difference in fiber optic cable length between Link A and Link B must be less than 500 meters (1640 feet) to limit the communications delay difference between Link A and Link B.

13.4.14 Allowable standard I/O Link extender cable signal loss

The Standard I/O Link Extender cable:

- Must have a total signal loss equal to or less than -5.5 dB at a wavelength of 850 nanometers.
- Fiber loss is measured at 22 degrees $C \pm 3$ degrees and is usually stated as a mean value.
- Individual fiber losses may be as much as 25% greater than the mean.

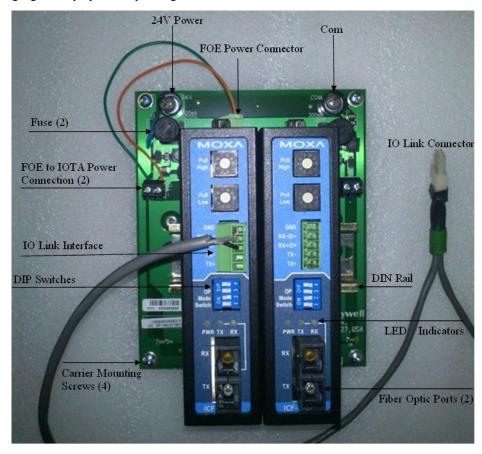
13.5 Single mode fiber optic extender

The single mode fiber optic module is built by a third-party company and the IOTA by Honeywell for use with Experion Series C I/O Family or HPM I/O Family. The single mode FOE supports the extension of the I/O Link beyond the Series C Cabinet with the C300, enabling remote applications of the Series C I/O and PM I/O.

The single mode FOE is available in two mounting options.

- IOTA The FOE modules are mounted on the dedicated IOTA board and installed within the Series C
 Control Cabinet on vertically mounted carrier channel assemblies
- DIN RAIL The FOE modules are mounted on the DIN rail within the cabinet.

The following figure displays a sample single mode FOE and its IOTA.



The single mode fiber optic extender can be used as a cabinet to cabinet repeater, supporting a network architecture similar to the following:

- Cabinet 1: Last Series C IOTA on IOLINK network in Cabinet 1===RS485===[MOXA ICF-1150]---fiber
- Cabinet 2: [MOXA ICF-1150]===RS485===[1st SC IOTA]==RS485===[last SC IOTA]===RS485===[MOXA ICF-1150]---fiber
- · Cabinet 3: [MOXA ICF-1150], and so on

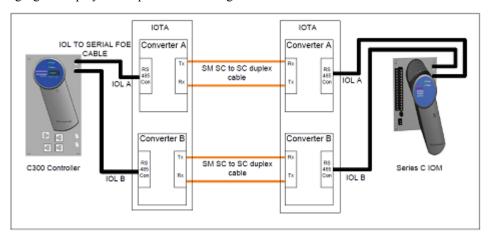
13.5.1 Key features of single mode FOE

- Single mode fiber that can extend the IOLINK up to 10 km.
- Three-way communication: RS-232, fiber and RS-422/485.
- · Rotary switch to change the pull high/low resistor value

- Extend RS-232/422/485 transmissions up to 440 km with single-mode. However, FOE module on IOTA supports up to 10 km only.
- Reverse power protection.
- Support baud rate up to 921.6 Kbps.
- · Class I, Div. II certification.

The single mode fiber optic converter extends RS232/422/485 transmission up to 10km long with single mode fiber.

The following figure displays a sample IO link arrangement.



13.5.2 Key features of single mode converter

- Fiber optic support for Honeywell IO Link optional speed selection for 750/375 kbits/s.
- Provides fiber to copper conversion and re-transmitted fiber signals.
- The optical power emitted is less than 0.5mW.
- · CE marked.

| Features | Description | |
|-------------------------|--|--|
| Supported family | Series C, Process Manager | |
| Topology types | Point-to-point | |
| | A single cable connecting two devices | |
| Optical budget | 15dB typical | |
| Distance | Between FOEs with standard cables 10 km | |
| Module mounting options | • IOTA | |
| | DIN rail (with user supplied power) | |
| Fiber optic ports | 2 | |
| Power options | Series C - IOTA | |
| | External power system (DIN rail mounting option) | |
| Power supply options | 18 to 30VDC with a maximum of 127mA per terminal block | |
| Ambient temperature | Operating: -40 to +85 degrees C | |
| | Storage: -40 to +85 degrees C | |
| Relative humidity | 5% to 95% RH (non-condensing) | |

| Features | Description |
|------------|---------------------------------|
| Fiber type | Single Mode |
| | Fiber core diameter - 9um |
| | Fiber cladding diameter - 125um |
| | Connector type - SC |

13.5.3 Single mode FOE installation

This equipment may be mounted in a hazardous area, in which case it must be installed, operated and maintained by competent personnel. Such personnel shall have undergone training, which included instruction on the various types of protection and installation practices, the relevant rules and regulations and on the general principles of area classification.

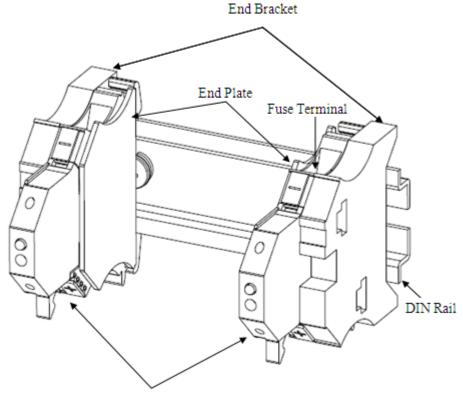
The SM FOE may be mounted in a safe area, a Zone 2 or a Class I, Division 2, Groups A-D T4 hazardous area.

13.5.4 Mounting the single mode FOE on the DIN rail

It is assumed for the purposes of these installation instructions that the mounting channel is already fitted in a cabinet or enclosure that already provides a suitable environment for the IOTAs and their associated equipment. Such an environment will be suitable for the SM FOE and its IOTA. The following mounting instructions may be used for purposes of mounting FOE / IOTA.

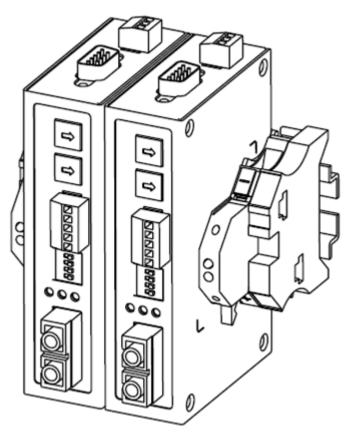
To mount the module on the DIN rail

1 Position the FOE module with DIN rail guide on the upper edge of DIN rail as displayed in the following figure.



Terminal Block with Fuse Holder

- 2 Push it in with downward motion to fix.
- 3 Position the DIN rail guide on the terminal block with fuse holder next to the FOE module as displayed in the following figure and push it in to attach to the DIN rail.



4 Place the end bracket next to the terminal block on the DIN rail in the same way as the FOE module and fasten the screw in the center.

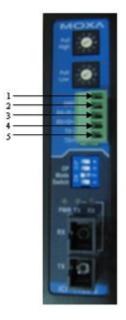
13.5.5 Single mode FOE IOLINK interface cable details

The following table provides information on the Honeywell interface cable to be used with FOE module.

| I/O type | Operating speed | Honeywell cable part number |
|-----------------------------|-----------------|-----------------------------|
| SC Series (IOTA option) | 750 kbits/s | 51202789-900, 51202789-901 |
| SC Series (DIN rail option) | | 51202789-910, 51202789-911 |

13.5.6 Single mode FOE IOLINK connection

The following figure displays the 5-pin screw terminal connector located on the front view of the FOE module.

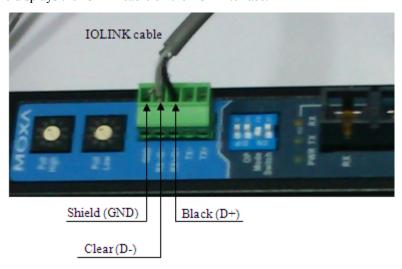


To make the connection, connect the free ends of the IO Link cable 51202789-9xx into the 5-pin screw terminal connector on the front face of the FOE module.

Refer to the following table to connect the IO link cable into the 5-pin screw terminal connector.

| Pin | FOE Terminal | Description | Cable cover color |
|-----|---------------------|-------------|-------------------|
| 1 | GND | Ground | No cover |
| 2 | D- | DATA - | Clear |
| 3 | D+ | DATA + | Black |
| 4 | Not to be connected | NA | NA |
| 5 | Not to be connected | NA | NA |

The following figure displays the IO link cable on the FOE interface.



13.5.7 FOE fiber connections

There is one pair of SC type fiber terminals on each FOE.

• RX (Receive) and TX (Transmit)

When not used, these SC terminals should be protected by plastic caps.

To make the fiber optic link, connect the TX of one FOE to the RX of the other FOE and vice versa. This can be done by aligning the notch on the fiber optic connector in the cable with the SC connector on the FOE module and pushing it in gently to lock.

The function of TX, RX pair is identical on both the FOE modules and either module can be used interchangeably. Ensure to insert the correct cable into the TX or RX connector.

13.5.8 Power connection details for the single mode FOE on IOTA

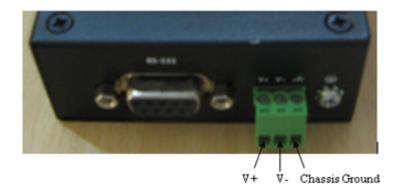
The FOE receives its input power from the IOTA through the terminal block. Two separate terminal blocks are provided on the IOTA for powering the two FOE modules.

| FOE mounting option | Honeywell part number |
|---------------------|-----------------------|
| | (power cable) |
| IOTA | 51202930-100 |

The following table provides information on connecting the FOE Power terminal block and the IOTA screw terminal connector TB1/TB2.

| Wire color | TB1 pin | TB2 pin | FOE pin | Description |
|------------|---------|---------|---------|----------------------------|
| Red | 1 | 2 | V+ | +24V |
| Black | 2 | 3 | V- | COM |
| Yellow | 3 | 1 | h | Chassis / Safety Ground |

The following figure displays the top view of the FOE module. It contains the DB-9 connector for RS232 communication, a 3-pin terminal block for input power and a screw for safety ground connection.



Attention

The safety ground on the FOE module must be wired to the chassis ground of the system cabinet.

13.5.9 Connecting the power cables to the single mode FOE on DIN rail

The FOE modules mounted on the DIN rail can derive power from one of the following power supply options.

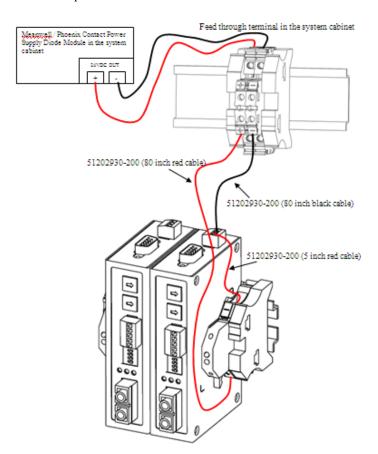
- · Meanwell/Phoenix Contact
- TDI

The following table provides information on the power supply options and the appropriate Honeywell part number.

| Power supply option | Honeywell part number |
|--------------------------|-----------------------|
| | (power cable) |
| Meanwell/Phoenix Contact | 51202930-200 |
| TDI | 51202948-100 |
| | (Two FOE modules) |
| TDI | 51202948-200 |
| | (One FOE module) |

13.5.10 Using Meanwell/Phoenix Contact power supply

The following figure illustrates the power connections to the FOE module from Meanwell/Phoenix Contact.

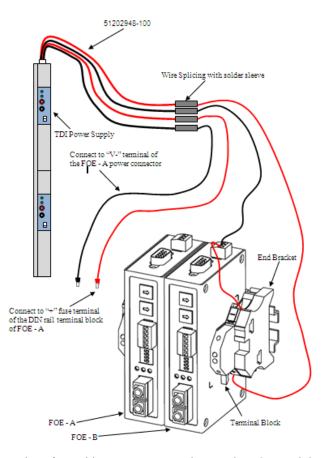


Refer to the following instructions for making power connections from Meanwell/Phoenix Contact to the FOE module on DIN rail.

- 1. Connect the power cable 51202930-200 (two red and one black cable) to the terminal block on DIN rail. Perform the following steps to do so:
 - Open the fuse holder using the lever provided.
 - Insert the ferrule of the cable into the fuse terminal on the side.
 - Fasten the screw inside the terminal block, below the fuse holder.
- 2. Connect one end of the 5-inch red cable into the fuse terminal marked '-' on the terminal block and the other end to the 'V+' terminal of the power connector on the FOE module. You can do so by inserting the ferrule inside the terminal and fastening the corresponding screw inside the terminal block.
- 3. Connect the 80-inch red cable from the '+' terminal of the feed through terminal block in the system cabinet to the fuse terminal marked '+' on the terminal block on DIN rail.
- 4. Connect the 80-inch black cable from the '-' terminal of the feed through terminal block in the system cabinet to the 'V-' terminal of the power connector on the FOE module.

13.5.11 Using TDI power supply

The following figure illustrates the power connections from TDI power supply to the FOE module.



Refer to the following instructions for making power connections to the FOE module on DIN rail from TDI power supply option.

- 1. Mate the power connector of the 51202948-100/51202948-200 to the free output port on top of the TDI power supply as displayed in the figure.
- 2. Connect the power cable 51202948-100/51202948-100 to the terminal block on DIN rail. Perform the following to do so:

Open the fuse holder using the lever provided.

Insert the ferrule of one of the two red cables into the fuse terminal marked '+'.

Fasten the corresponding screw inside the terminal block, below the fuse holder.

- 1. Connect one of the two black cables to the 'V-' terminal of the power connector on the FOE module.
- 2. Connect one of the free ends of the 5-inch red cable into the '-' fuse terminal of the terminal block on DIN rail and the other end to the 'V+' terminal of the power connector on the FOE module.
- 3. Repeat steps 2 through 4 to make power connections to the other FOE module.

13.5.12 Replacing the FOE fuse on the terminal block when FOE is mounted on DIN rail

To replace the FOE fuse on the terminal block when the FOE is mounted on the DIN rail

- 1 Using the lever provided on the terminal block, open the fuse holder.
- 2 Remove the fuse from the fuse holder.
- 3 Replace the fuse by positioning it in the fuse holder, press and fit.
- 4 Close the fuse holder and press the lever to lock.

13.5.13 Removing the FOE module from the DIN rail

To remove the FOE module from the DIN rail

- 1 Power down the FOE module by opening the fuse holder of the terminal block using the lever and removing the fuse
- 2 Remove all the cables before detaching the FOE modules. Perform the following steps to do so.
 - a Unscrew and remove the cable (HPN 51202930-200) running from the feed through terminal of the system cabinet to the '+' fuse terminal of the terminal block (Meanwell/Phoenix Contact power supply only).
 - **b** Remove the power connector of the cable (HPN 51202948-100/51202948-200) from the power supply by releasing the lock in the side and pulling it out gently (TDI power supply only).
 - c Unfasten the screw of the '-' fuse terminal of the terminal block on DIN rail and remove the cable.
 - d Unfasten the screw of the 'V+' terminal of power connector on the FOE module and remove the cable.
 - e Unfasten the screw of the '-' terminal of the feed through terminal block and remove the cable.
 - f Unfasten the screw of the 'V-' terminal of power connector on the FOE module and remove the cable.
 - **g** Remove the fiber optic cables from the FOE module by pulling it out gently.
 - h Unscrew and remove the I/O Link cable (HPN 51202789-910 / 51202789-911) from the FOE module or remove the I/O Link connector by pulling it out.
- 3 Unfasten the screw in the center of the end bracket and remove it by slightly lifting and pulling it out.
- 4 Push the FOE module slightly downwards and slide it out at the lower edge of DIN rail.



WARNING

Powering off both FOE modules accidently may halt the IOL communication completely and can lead to dangerous situation in plant. You must ensure to turn off the power of suspected FOE and should remove it without disturbing the functional FOE. Ensure to notify plant operators while performing this operation.

13.5.14 Single mode FOE configuration

Rotary switches are provided on the FOE module to set the Pull High/Low resistor settings. The DIP switches are provided for setting the FOE operating mode.

13.5.15 Pull High/Low resistor setting

The Pull High/Low resistors are provided on the FOE module for impedance matching which may vary with multi-drop or daisy-chain connection. The default settings are 1K for both the switches. To set a different value,

turn the dial with the arrow head pointing at the required position. The following figure displays the Pull High/Low Resistors.



Figure 236: Pull High/Low Resistors

The following table lists the correct resistor setting against each position for the two use-case scenarios (150K and 10K). If the adapter is located such that its copper port is connected to the Controller (HPPM or C300) then position 0 (150K ohms) should be selected. If the adapter is located such that its copper port is connected only to IOPs/IOMs then position 1 (10K ohms) should be selected. Settings for "pull high" and "pull low" are always the matched (both the same).

Table 150: PULL High Resistor setting

| PULL High | PULL High Resistor | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|-----|---|
| Position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Ohm | 150K | 150K 10K 4.7K 3.3K 1K 909 822 770 500 485 | | | | | | | 485 | |
| 150K | Use this position for adapters connected in a system that contain a C300 Controller/HPPM. | | | | | | | | | |
| 10K | Use this position for adapters connected in a system that contain I/O module only. | | | | | | | | | |

Table 151: PULL Low Resistor setting

| PULL Low | PULL Low Resistor | | | | | | | | | |
|----------|---|---|---|---|---|---|---|-----|---|---|
| Position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Ohm | 150K 10K 4.7K 3.3K 1K 909 822 770 500 485 | | | | | | | 485 | | |
| 150K | Use this position for adapters connected in a system that contain a C300 Controller/HPPM. | | | | | | | | | |
| 10K | Use this position for adapters connected in a system that contain I/O module only. | | | | | | | | | |

13.5.16 DIP switch settings

Four DIP switches are located in the front face of the FOE. The following table provides information on the DIP switch settings. The DIP switch settings on the converter are displayed in the DIP switch column in the table. You must set the switches in the direction as indicated by the arrows.

| Description | Setting | SW 1 | SW 2 | SW 3 | SW 4 | Required? | DIP switch |
|---------------|------------------|------|------|------|------|---------------|------------|
| Communication | RS-422 | ON | OFF | - | - | Not Supported | |
| protocol | 2-wire RS-485 | OFF | ON | - | - | Yes | N DIP |
| | 4-wire RS-485 | OFF | OFF | - | - | Not Supported | M DIP |

| Description | Setting | SW 1 | SW 2 | SW 3 | SW 4 | Required? | DIP switch |
|--------------------|----------------|------|------|------|------|---------------|------------|
| Fiber mode | Ring | - | - | ON | - | Not Supported | |
| | Point to Point | | | OFF | | Yes | Mode op OP |
| 120-ohm terminator | Enable | - | - | - | ON | Not Supported | - |
| | Disable | - | - | - | OFF | Yes | ON DP |

13.6 Defining the single mode fiber optic topology

The single mode fiber optic extender supports point-to-point topology.



Attention

The following figure is an example how the FOE can be deployed in point-to-point topology for series environment. This graphic is not to depict any restrictions with regards to FOE capacity or cable length.

Daisy Chain topology is not supported.

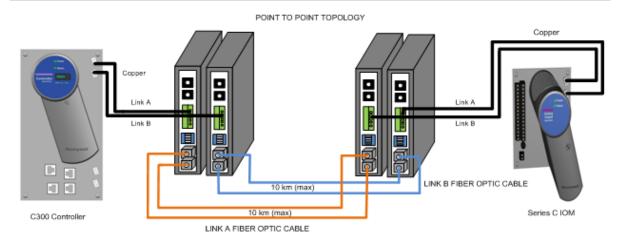


Figure 237: Single mode fiber optic topology

13.6.1 FOE capacity

The following list can be used as a general guideline of supported environments and FOE capacities.

| Environment | Hardware | Capacity |
|-------------------------|--------------|-----------|
| Series C I/O or HPM I/O | Cable length | 10 km max |

13.6.2 Required hardware

Depending on the requirement, the following Series C hardware is required to achieve remote I/O accessibility:

Component

- · Fiber Optic Extender IOTA
- Fiber Optic Extender module
- Fiber optic cables

FOE interface cables - 0.5M length for Series C

- Gray (pair) for IOL1
- Violet (pair) for IOL2

Refer to the Key features of single mode FOE section for more information on the compatible fiber optic cables.

13.6.3 Fiber Optic Extender interface cable

Specific cable types must be used for the fiber optic interface.

Attention

The proper interface cable must be used for the Series C topology. Use of the incorrect cable results in faulty and/or corrupted IOL communications.

The fiber link is a passive subsystem and is essentially transparent to the system operation. It does not increase or decrease traffic or impact other capabilities of the I/O system. In addition, the following designations occur for these cables:

| Cable | Cable color | A-link tab color | B-link tab color |
|-------|-------------|------------------|------------------|
| IOL1 | Gray | Yellow | Green |
| IOL2 | Violet | Yellow | Green |

13.6.4 Fiber optic cable - length factors

The maximum run of the fiber optic cables is limited by the optical power budget of 15dB. Standard cables support 10 km.

13.6.5 Standard I/O link extender maximum cable span calculation

The following calculation MUST be used to ensure that the number of planned splices and the cable choice supports the necessary cable span distance.

| | The maximum cable span calculation (in km) is as follows: |
|------------|---|
| Max Span = | (Available Optical Power - Losses in Splices)/(Max Loss per Cable Type) |

13.6.6 Available standard I/O link extender optical power

The available optical power calculation is as follows:

| | Transmit Power - Minimum Receiver Sensitivity - Power Loss Over Time = | | | | | |
|---------|--|--|--|--|--|--|
| Availal | ble Optical Power | | | | | |
| wl | here for a Standard I/O Link Extender: | | | | | |
| ' | Transmit Power = - 35.0 dB | | | | | |
| | Minimum Receiver Sensitivity = - 55.0 dB | | | | | |
| | Power Loss Over Time = 5 dB | | | | | |
| | Example calculation for a Standard I/O Link Extender using 9 micron cable: | | | | | |
| | (- 35.0 dB) - (- 55.0 dB) - (5 dB) = 15 dB Available Optical Power | | | | | |

13.6.7 Losses in splices

The following table is used for the following Losses in Splices calculation.

Losses in Splices = Number of Splices x Maximum Loss per Splice

| Standard Extender I/O cable type | Average Loss | Maximum loss |
|----------------------------------|---------------|---------------|
| | per type (dB) | per type (dB) |
| Fusion | 0.2 | 0.3 |
| Mechanical | 0.3 | 0.5 |

| Standard Extender I/O cable type | Average Loss | Maximum loss |
|----------------------------------|---------------|---------------|
| | per type (dB) | per type (dB) |
| ST-connector | 0.3 | 0.9 |

Examples: Max. span calculation for cables with fusion or mechanical splices:

Variable values: Available optical power = 15 dB, two splices.

| Two fusion splices | (15 dB) - (2 splices x 0.3 dB max loss per splice) / (0.4 dB/km) >> 10 km |
|--|---|
| Two mechanical splices: (15 dB) - (2 splices x 0.5 dB max loss per splice) / (0.4 dB/km) >> 10 km | |

13.6.8 Link A and B cable length differences

The maximum difference in fiber optic cable length between Link A and Link B must be less than 500 meters (1640 feet) to limit the communications delay difference between Link A and Link B.

13.6.9 Allowable standard I/O Link extender cable signal loss

The Standard I/O Link Extender cable:

- Must have a total signal loss equal to or less than 15 dB at a wavelength of 1310 nanometers.
- Fiber loss is measured at 22 degrees C ±3 degrees and is usually stated as a mean value.
- Individual fiber losses may be as much as 25% greater than the mean.

14 Series C Migrating from PMIO to Series C I/O

Related topics

"Determining Series C I/O vs. PMIO functionality" on page 530

[&]quot;Migrating channels blocks from PMIO to Series C I/O" on page 532

14.1 Determining Series C I/O vs. PMIO functionality

The Series C I/O is designed to allow integration with legacy of PM I/O family or replacement of the legacy PM I/O family. As such, many PM I/O concepts are directly carried forward into Series C I/O. Some notable concepts that are NOT directly carried forward are included in the table below.

Table 152: Comparing Series C and PM I/O functionality

| Topic | PM I/O | Series C I/O | |
|--|---|---|--|
| | supported | supported | |
| Experion | Yes | Yes | |
| PlantScape | Yes | No | |
| TPS | Yes | No | |
| Nomenclature | IOP | IOM | |
| | I/O Processor | I/O Module | |
| Physical address - how to derive | Uses file and card concept | Address derived from IO Link address jumper tile on IOTA | |
| DISOE | 'Off Normal' alarms and events supported | 'Off Normal' alarms and events NOT supported | |
| Enumeration sorting | By ordinal value | Alphabetically, unless otherwise stated. | |
| FAILOPT or FAULT[*] | FAILOPT is a IOP-wide configuration, making it same to all | In Series C FAILOPT is replaced with the following: | |
| | channels in an IOP | FAULTOPT, and | |
| | | • FAULTVALUE | |
| | | this can be set individually for every output channel. | |
| Firmware - remotely downloaded in Experion | No - contact TAC for support | Yes - using CTools application | |
| HART I/O | PMIO supported four separate AI, AO, HAI and HAO channel blocks. AI and AO channel blocks could not be configured for HART operation | In Series C I/O, AI and AO channel blocks can be configured for HART operation. No separate HAI and HAO channel blocks will be supported. | |
| HART 5.0 compliant | Yes | Yes | |
| HART 6.0 and later compliant | Yes | Yes | |
| IO redundancy | All IOP types supported except: | All IOM types supported except: | |
| | • DI | AI -LLMUX | |
| | • DO16 | | |
| | • LLAI | | |
| | • LLMUX | | |
| | • RHMUX | | |
| IOLINK connection | Yes (see Note 1) | Yes (see Note 2) | |
| | Through C200 controller and IOLIM or C300 controller | C300 controller only | |
| | PM I/O and Series C I/O cannot exist on the same IOLINK | PM I/O and Series C I/O cannot exist on the same IOLINK | |

| Topic | PM I/O | Series C I/O |
|--|-------------------------|--|
| | supported | supported |
| IOTA slots | Any combination allowed | Upper - always IOMA |
| | | Lower - always IOMB |
| | | Non-redundant configurations only IOMA can be used. |
| LLMUX maximum channels | 32 | 64 |
| PNTFORM (FULL and COMPONENT points) is supported | Yes | No |
| | | The most powerful FULL point features have been incorporated into Series C I/O channel blocks. |
| Open Wire Detection for Inputs Detect/ | No | Yes. |
| sense open sensor (open wire) | | The HART Analog Output IOM detects open wire by virtue of its analog read back check. |
| | | DI 24V and DISOE IOM in Normal mode support Open Wire Detection. |

^{*} Specifications for the availability of HART data, including availability through an IOM switchover are tightened for Series C I/O.

Notes:

- Physical address is a function of the 'file number' and 'card number'. The file number is determined by a user jumper configuration. Logical address is assigned by user. Both addresses must be configured in the module block and they are independent of one another. The physical address block configuration must match the physical attributes.
- 2. Logical address is determined by a user jumper configuration. The physical address is a function of the logical address and is not visible to the user. Only the logical address must be configured in the module block. The logical address block configuration must match the jumper configuration.

14.2 Migrating channels blocks from PMIO to Series C I/O

The high-level user-related configuration and operational differences between PM I/O channels and Series C I/O channels are best seen by examining differences between the parameters for each I/O family.

With the exception of HART based channels, PM I/O uses a single channel block with a multitude of options and tabs to represent channels defined on multiple IOPs. For example:

- PM I/O uses the same AICHANNEL block for channels contained within HLAI, LLAI, LLMUX, RHMUX and STIMV IOPs.
- Series C I/O has the ability to morph an AICHANNEL block for use with many IOMs types. Tabs of the parameter form that are not used for some IOM types are hidden.

Series C I/O HART enabled channels now can be morphed to/from a standard AI or AO channel block. The following also applies:

- · On an IOP switchover,
 - HART digital data could take as long as 48 seconds to be refreshed.
- · For Series C IOM,

HART digital data is refreshed within twice the module's SCANRATE time.

Table 153: Comparing Series C and PM I/O parameters

| PM I/O IOC parameter | Series C I/O IOC parameter | Change from PM I/O channel/comment | |
|----------------------|----------------------------|---|--|
| SENSRTP | SENSRTP | A list of valid values for the particular AI channel type is always | |
| PVCHAR | PVCHAR | provided. You are NEVER displayed or allowed to select an invalid value for any particular AI channel type. | |
| | | Refer to the Control Builder Parameter Reference guide for parameter specific information. | |
| PNTTYPE | (removed) | Parameter is deleted. Some TPS 'FULL' point parameters are now part of Series C I/O channel blocks. | |
| SLWSRCRCID | (removed) | Parameter was deleted. SLIDEWIRE sensor type is not supported in Series C I/O. SLIDEWIRE sensor type was not implemented in PM I/O. However, the parameter was defined. | |
| PVRAWHI | PVRAWHI | These parameters are valid only for AICHANNELS that exist on | |
| PVRAWLO | PVRAWLO | AI-LLMUX IOMs. | |
| HPVCHAR | PVCHAR | The PM I/O functionality provided by setting HPVCHAR to 'Device Range' is provided by the setting PVCHAR to 'Device Range.' | |
| ACCEPTRNG | ACCEPTRNG | The text on this push button changed from 'Accept Device Ranges' to 'Sync. Device and PV Ranges'. | |
| HPVMISM | HPVMISM | While HPVMISM generated an alarm in PM I/O, it is a simple Boolean flag in Series C I/O. | |
| FAILOPT | FAULTOPT | In PM I/O, FAILOPT is a read/write parameter for IOP blocks. In | |
| | FAULTVALUE | addition, the FAILOPT value applies to all channels on that IOP and FAILOPT is a read only parameter for channel blocks. In | |
| | FAULTST | Series C I/O, each channel has its own fault option and a set of 'fault' related parameters. | |
| | | Additionally, there are a significant number of enhancements related to handling AO and DO channel faults. When migrating from PMIO you are encouraged to obtain a thorough understanding of the AO and DO channels before migrating to Series C I/O. | |

| PM I/O IOC parameter | Series C I/O IOC parameter | Change from PM I/O channel/comment |
|----------------------|----------------------------|--|
| (not implemented) | HDYNCC | PM I/O does not support HART version 6.0. Series C I/O supports |
| | HDYNST | these parameters for HART version 6.0. |
| | HMAXDEVVARS | |
| | HNCFGCHG | |
| | HNSMMINPRE | |
| | HSLOTCC | |
| | HSLOTST | |
| PIUOTDCF | OWDENBL | Made OWDENBL the consistent name for enabling Open Wire Detection Enable. In addition, OWDENBL is valid for DI channels on DI-24 IOMs and AI channels. |
| PVSOURCE | PVSOURCE | In PM I/O, these parameters were only on DI channels whose |
| PVSRCOPT | PVSRCOPT | PNTFORM was set to FULL. In Series C I/O, these parameters now used on all DI channels regardless of PNTFORM and on al AI channels. |
| (not used) | MODE | In PM I/O, these parameters were not used. In Series C I/O, they |
| | MODEPERM | are valid for AO and DO channel blocks. |
| NMO | NMODE | |
| | NMODATTR | |
| | MODEATTR | |
| | REDTAG | |

15 Series C I/O Troubleshooting

This section offers checks that you can make to help isolate a problem. The checks are arranged in no particular order.

Related topics

"Self-test diagnostics at power-up" on page 536

"IOLINK - loss of communication problems" on page 537

"IOLINK - re-establishing communications" on page 538

"FOE Troubleshooting" on page 539

15.1 Self-test diagnostics at power-up

P

Tip

Unlike C300, the Series C I/O modules do not have an alphanumeric display for displaying test codes.

Series C I/O modules run the following self-tests (transparent to the user) every time the module boots up following a power-on, reset, or reboot.

- After the hardware and memory initializations AI, AO, and LLMUX IOMs reload the FPGA (field-programmable gate array) image from the flash memory to the FPGA.
- All IOMs check the validity of the application image by computing the CRC (Cyclic Redundancy Check) of
 the flash memory where application image is stored. If the CRC comparison is valid, the module transfers to
 the application mode. Otherwise, the module stays in the boot mode waiting for a firmware download
 operation.
- In the application mode hardware and memory is re-initialized for application operation and module ID set by the address jumpers is checked.

Modules then execute a series of self-diagnostics as listed below (any failure-detected results in hard fail of the IOM.)

- CPU: Checks the CPU registers by writing and reading back specific patterns and execution of a set of logical operations.
- RAM contents: Test patterns are written and read back to all RAM locations. This test ensures that each RAM bit can store and retrieve 0 and 1 without any error.
- Address lines: CPU address lines are tested by walking 1's and 0's. This test ensures that each address lines can be changed independent of others.
- Flash contents: CRC of the application image is checked again.
- Stack: A test pattern is written to the top of the stack, which is confirmed read back. This pattern is used for the background stack diagnostics during normal operation of the module.

During the normal operation, the above self-diagnostics run as low-priority background activity.

- Application specific database objects are created and task scheduler is initialized. Watchdog circuitry and IOL are enabled and normal operation of the module begins.
- There are application specific diagnostic routines that run during the normal operation, which normally runs at a higher rate and priority. Examples of application specific diagnostics are:
 - Checking the integrity of calibration data
 - Redundancy diagnostics in redundantly configured modules
 - Reference voltage tests in analog modules
 - Open wire detection
 - Short circuit detection in DO modules

15.2 IOLINK - loss of communication problems

IOMs can experience a loss of communication with the IOLINK function block for several reasons. The two most common reasons are:

- the C300 losing power, or
- a fault in the IOLINK cable

Whenever an IOM can no longer communicate with a C300, the channels contained within the IOM use the following:

- · FAULT parameters
 - FAULTOPT, and
 - FAULTVALUE
- and a separate IOM internal fail-safe timeout to ensure that the channel is in the appropriate fail-safe setting.

15.3 IOLINK - re-establishing communications

Once communication between a C300 and an IOM is re-established, the C300 determines if the databases between the C300 and IOM are identical. If they are different and the IOM's DBVALID flag is true, (indicating that the IOM configuration has been maintained through the period of loss of communication), then the C300 uploads the configuration from the IOM.

If the IOM's DBVALID is false (indicating the IOM configuration is not maintained through the period of communication) and if C300 has a copy of last valid IOM configuration, then the C300 downloads the configuration to the IOM. This warm restore mechanism replaces the warm start mechanism in PM IOPs.

15.4 FOE Troubleshooting

This section identifies some common problems with the Fiber Optic Extender and describes how you might fix them.



Attention

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the **F1** fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the **F1** fuse can be re-installed.

The Fiber Optic Extender does not exhibit a large number of errors that are directly attributed to the FOE. Knowledge of your system's setup is critical in determining the potential source of disruption to communication and process. Failures beyond the point of the FOE may indicate a functionality issue with the FOE.

15.4.1 Loss of power

The isolator has lost power supply communications to I/O has failed.

Diagnostic check

Power to the isolators has failed. Communications to I/O has been discontinued.

- System Alarm Summary alarms displayed
- · Green LED on isolator is off.

Cause

Power fuse is blown on the GI/IS IOTA.

Solution

If there is no obvious reason for the failure of the fuse on the GI/IS IOTA, then the isolator must be suspected of having a fault and must be replaced and its functionality checked in a non-hazardous area. If the isolator is known not to be the reason for the failure of the fuse, then it is permitted to replace the fuse without isolating the power to the IOTA.

Cause

C300 controller has lost power.

Solution

Refer to C300 'Loss of power' instructions.

Cause

Main power source has been disconnected or shut down either manually or temporarily by *brownout* or *blackout* condition.

Solution

Re-connect the main power source or turn it On or wait for temporary brownout or blackout condition to pass.

Cause

The 24 Vdc power supply failed or power cable has been disconnected or failed.

Solution

Replace the 24 Vdc power supply or re-connect/replace the power cable.

15.4.2 Loss of communication

The remote I/O communication is lost or behaving erratically. The Fiber Optic Extender module yellow LEDs are not on/blinking.

Diagnostic check

Remote I/O communications is lost.

- · System Alarm Summary alarms displayed
- Green LED on FOE module is on.
- · Yellow LED on FOE module is off
- Erratic behavior of I/O connections/communications beyond a specific FOE.

Cause

Possible loose cable connection:

Solution

Check the following cable connections:

- IOLINK CABLE
 - From C300 to FOE module IOLINK connector
- · Fiber optic cable
 - From FOE module to FOE module
 - From FOE module to PM I/O Link Extender card

Cause

Power is lost to the FOE module, C300 controller or entire control cabinet.

Solution

Refer to 'Loss of power' troubleshooting information.

Cause

FOE module is malfunctioning.

Solution

Replace FOE module.

16 Series C I/O Maintenance

Related topics

"Series C recommended spares" on page 542

[&]quot;Replacing a Series C IOTA" on page 549

[&]quot;Replacing an I/O module" on page 550

[&]quot;FOE recommended spares" on page 551

[&]quot;FOE Maintenance" on page 552

16.1 Series C recommended spares

The following table provides replacement parts, or parts that you may want to keep on hand for backup.

16.1.1 IOM removal and installation under power

The IOM has been designed to permit removal and installation under power (RIUP) without damaging the module or interrupting IOTA communications. Notice should be taken on how this may impact the active process.



CAUTION

We recommend that you proceed with extreme caution whenever replacing any component in a control system. Be sure the system is offline or in a safe operating mode.

Component replacements may also require corresponding changes in the control strategy configuration through Control Builder, as well as downloading appropriate data to the replaced component.

Refer to "Replacing an I/O module" on page 550 for IOM replacement and cautionary information.

Table 154: Recommended spare parts

| Part name | | Part numb | er | | Description | | | |
|---------------------------------|---------|--------------------------|-----------|-------------------------------------|-------------------------|--|--|--|
| ANALOG INPUT | | | | | | | | |
| Series C AI IOM | | CC- PAIH01 | | Series C Analog Input Module | | | | |
| | | CC-PAIH02 | CC-PAIH02 | | ART Differenti | al Analog Input Module | | |
| | | CC-PAIX02 | | Series C n | on-HART Diffe | rential Analog Input Module | | |
| | | CC-PAIN01 | | Series C n | on-HART Analo | og Input Module | | |
| | | CC-PAIH51 | | Series C A | nalog Input Mo | dule | | |
| IOTA | | | | | | | | |
| Non-Redundant. IOTA | L | CC- TAIX01 | | Analog In | out, non-redund | ant, coated | | |
| | | 51308363-175 | | | | | | |
| | | Cx-TAIX51 | | Analog Input, non-redundant, coated | | | | |
| | | 51306979-175 | | | | | | |
| Redundant. IOTA | | CC- TAIX11 | | Analog Input, redundant, coated | | | | |
| | | 51308365-175 | | | | | | |
| Terminal plug-in assen | nbly | | | · | | | | |
| 16-terminal block plug assembly | g-in | 51506273-216 | | 2 per IOTA | | | | |
| 4-terminal block plugassembly | in | 51506269-204 | | 1 per IOTA | | | | |
| Fuses | | | | | | | | |
| Description | Part ni | umber Quantit | | v | Reference designator | Function | | |
| Fuse 750 mA, 5x20, fast acting | 511905 | 0582-175 1 per r IOTA | | n-red. | F1 | The fuse covers the IOM and the power feeds to the field wiring. A blown fuse interrupts power to these. | | |

| Part name | | Part numb | per | Description | | | |
|----------------------------------|----------|--------------|------------------|----------------------------------|-------------------------|--|--|
| | | | 2 per re | d. IOTA | F1 | F1 covers upper IOM | |
| | | | | | F2 | F2 covers lower IOM | |
| | | | | | | If one fuse is blown power is interrupted to the IOM, but field wiring continues to receive power from other fuse. | |
| ANALOG OUPUT | | | | | <u>'</u> | | |
| Series C AO IOM CO | | CC- PAOH01 | | Series C | HART Analog O | output Module | |
| | | CC-PAOX01 | | Series C | non-HART Anal | og Output Module | |
| | | CC-PAON01 | | Series C | non-HART Anal | og Output Module | |
| | | CC-PAOH51 | | Series C | HART Analog O | output Module | |
| IOTA | | | | • | | | |
| AO | | CC-TAOX01 | | Analog C | Output, non-redur | ndant, coated | |
| Non-Redundant. IOTA | 1 | 51308351-175 | | | | | |
| | | Cx-TAOX51 | | Analog C | Output, non-redur | ndant, coated | |
| | | 51306983-175 | | | | | |
| AO Redundant. IOTA | | CC- TAOX11 | | Analog Output, redundant, coated | | | |
| | | 51308353-175 | | | | | |
| | | Cx-TAOX61 | | Analog Output, redundant, coated | | | |
| | 513069 | | | | | | |
| Terminal plug-in asser | nbly | | | | | | |
| 16-pin terminal plug-i | n | 51506273-216 | | 2 per non-redundant IOTA | | | |
| assembly | | | | 2 per red | redundant IOTA | | |
| Fuses | | | | | | | |
| Description | Part nı | ımber | Quantit | v | Reference designator | Function | |
| Fuse 1A Fast acting 5x20mm | 511905 | 582-210 | 1 per no IOTA | n-red. | F2 | Standby Manual connector fuse | |
| | | | 1 per re | d. IOTA | F3 | | |
| Fuse 2A Fast acting 5x20mm | 511905 | 582-220 | 1 per no IOTA | n-red. | F1 | Module fuse | |
| | | | 2 per re | d. IOTA | F1, F2 | | |
| ANALOG INPUT LO | | /EL | | | | | |
| Series C AI Low Leve | l IOM | CC-PAIM01 | | Series C | Low Level Modu | ıle | |
| IOTA | | | | | | | |
| AI Low Level | | CCTAIM01 | I | Level, nor | n-redundant, | | |
| | | 51305959-175 | coated | | | | |
| Connector block assen | | T | | | | | |
| Connector Block Asse Position | embly, 6 | 51195775-100 | | 4 per IO | ΓΑ | | |
| Fuse | | | | | | | |
| Description | Part nı | ımber | Quantit | v | Reference designator | Function | |

| Part name | | Part number | er | | [| Description |
|--------------------------|---------|------------------|----------|-----------------------------------|-------------------------|-----------------------------|
| FUSE, 0.25 Amp, | 511905 | 82-125 | 4 per IO | TA | F3 | Power to FTA 1 only |
| Quick Blo, 5x20mm | | | | | F4 | Power to FTA 2 only |
| | | | | | F5 | Power to FTA 3 only |
| | | | | | F6 | Power to FTA 4 only |
| FUSE, 1 Amp, Quick | 511905 | 82-210 | 2 per IO | TA | F1 | Power to module electronics |
| Blo, 5x20mm | | | | | F2 | Switched power to all FTAs |
| LOW LEVEL ANALO | OG INF | PUT | | | | |
| Series C Low Level AI | IOM | CC-PAIL51 | | Series C I | Low Level Modu | ıle |
| IOTA | | | | | | |
| Low Level AI | | | CC | Low Leve | el AI, non-redun | dant, coated |
| IOTA | | | TAIL5 | | | |
| | | | 513071 | | | |
| | | | 92 | | | |
| Connector block assem | bly | 1 | 1 | | | |
| Connector Block Assen | nbly, 6 | 51195775-100 | | 4 per IOT. | A | |
| Position | | | | | | |
| Fuse | | | Ι. | | T | T_ |
| Description | Part ni | ımber | Quantity | | Reference designator | Function |
| FUSE, 0.25 Amp, | 511905 | 582-125 4 per IO | | TA | F3 | Power to FTA 1 only |
| Quick Blo, 5x20mm | | | | | F4 | Power to FTA 2 only |
| | | | | | F5 | Power to FTA 3 only |
| | | | | | F6 | Power to FTA 4 only |
| FUSE, 1 Amp, Quick | 511905 | 82-210 | 2 per IO | TA | F1 | Power to module electronics |
| Blo, 5x20mm | | | | | F2 | Switched power to all FTAs |
| DIGITAL INPUT 24V | 7 | | | | | |
| Series C DI-24 IOM | | CC- PDIL01 | | Series C 24V Digital Input Module | | |
| | | CC-PDIL51 | | Series C 2 | 24V Digital Inpu | t Module |
| IOTA | | | | | | |
| DI-24V | | CC- TDIL0 | | 24V Digit | al Input, non-rec | dundant, coated |
| Non-Redundant. IOTA | | 51308371-175 | | | | |
| | | Cx-TDIL51 | | 24V Digit | al Input, non-rec | dundant, coated |
| | | 51306969-175 | | | | |
| DI-24V Redundant. IO | TA | CC- TDIL11 | | 24V Digit | al Input, redund | ant, coated |
| | | 51308373-175 | | | | |
| | | Cx-TDIL61 | | 24V Digit | al Input, redund | ant, coated |
| | | 51306967-175 | | | | |
| Terminal plug-in assem | bly | | | | | |
| 16-terminal plug-in asse | embly | 51506273-216 | | 2 per non- | redundant IOTA | Λ |
| | | | | 2 per redundant IOTA | | |

| Part name Part nu | | Part number | er | | Description | | |
|---|-------------|---------------------------|------------------------|---|---|--|--|
| 4-terminal plug-in asse | mbly | 51506269-204 | | 1 per non- | n-redundant IOTA | | |
| | | | 1 per redu | | ndant IOTA | | |
| Fuses | | | | | | | |
| Description | Part number | | Quantity | | Reference designator | Function | |
| Fuse 0.5A Fast acting 511905 5x20mm 511905 | | 82-150 | 3 per non-red. IOTA | | F1 | Fuse for field power if system power is connected through TB3, in series with F3 | |
| | | | | | F2 | Top IOM kernel | |
| | | | | | F3 | Fuse for field power if external power is connected through TB3 | |
| | | | 4 per rec | d. IOTA | F1 | Fuse for field power if system power is connected through TB3, in series with F4 | |
| | | | | | F2 | Top IOM kernel | |
| | | | | | F3 | Bottom IOM kernel | |
| | | | | | F4 | Fuse for field power if external power is connected through TB3 | |
| DIGITAL OUTPUT | 24V | | | | - | | |
| Series C DO IOM | | CCPDOB01 | | Series C I | Digital Output M | odule | |
| | | CC-PDOD51 Series | | Series C I | Digital Output M | odule | |
| IOTA | | | | - | | | |
| 24V DO | | CCTDOB01 | CCTDOB01 24V Digit | | Digital Output, bussed, non-redundant | | |
| Non-Redundant IOTA | | 51308371-175 Cx-TDOD51 | | 24V Digital Output, bussed, non-redundant | | | |
| | | | | | | | |
| | | 51306975-175 | | | | | |
| 24V DO Redundant IC | TA | CCTDOB11 | | 24V Digital Output, bussed, redundant, coated | | | |
| | | 51308373-175 | | | | | |
| | | Cx-TDOD61 | | 24V Digit | 24V Digital Output, bussed, redundant, coated | | |
| | | 51306973-175 | | | | | |
| Terminal plug-in assen | | T | | | | | |
| 16-terminal plug-in ass | sembly | 51506273-216 | | ^ | er non-redundant IOTA | | |
| | | | | _ | per redundant IOTA | | |
| 4-terminal plug-in asse | mbly | 51506269-204 | | 1 ^ | redundant IOTA | L | |
| | | | | 1 per redu | indant IOTA | | |
| Fuses | | | T | | | | |
| Description | Part nı | ımber | Quantity | , | Reference designator | Function | |
| Fuse 10A Fast acting 5x20mm | 511905 | 0582-310 1 p | | n-red. | F1 | Fuse for field power if system power is connected through | |
| | | | 1 per rec | | F1 | - | |
| Fuse 5A Fast Acting 5x20mm | 511905 | 82-250 | 1 per non-red. IOTA | | F2 | Fuse for field power if system power is connected via TB3 | |

| 5x20mm DIGITAL INPUT - HIG Series C DI-24 IOM IOTA 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | CC-DIHV01 CC-TDI110 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | 1 per red 1 per not IOTA 2 per red | n-red. d. IOTA Series C I 120VAC I | F1 F2 F2, F3 Digital Input Hig | Fuse for IOM kernel Top IOM kernel Bottom IOM kernel h Voltage I/O Module | |
|--|--|---|---|--------------------------------|--|--|
| 5x20mm DIGITAL INPUT - HIG Series C DI-24 IOM IOTA 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | CC-TDI110 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | IOTA | Series C I | F2, F3 Digital Input Hig | Top IOM kernel Bottom IOM kernel h Voltage I/O Module | |
| Series C DI-24 IOM IOTA 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | CC-DIHV01 CC-TDI110 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | 2 per red | Series C I | F3 Digital Input Hig | Bottom IOM kernel h Voltage I/O Module | |
| Series C DI-24 IOM IOTA 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | CC-DIHV01 CC-TDI110 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | | 120VAC 1 | Digital Input Hig | h Voltage I/O Module | |
| Series C DI-24 IOM IOTA 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | CC-DIHV01 CC-TDI110 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | | 120VAC 1 | | | |
| IOTA 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | CC-TDI110 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | | 120VAC 1 | | | |
| 120VAC DI Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | | | Digital Input, nor | n-redundant coated | |
| Non-Redundant. IOTA 120VAC DI Redundant. IOTA 240VAC DI | 51308394-175 CC-TDI120 51308396-175 CC-TDI220 | | | Digital Input, nor | n-redundant coated | |
| 120VAC DI Redundant. IOTA 240VAC DI | CC-TDI120 51308396-175 CC-TDI220 | | 12014 63 | | i i daniani, vonten | |
| Redundant. IOTA 240VAC DI | 51308396-175 CC-TDI220 | | 100174 (7.1 | | | |
| 240VAC DI | CC-TDI220 | | 120VAC 1 | Digital Input, red | lundant, coated | |
| | | | | | | |
| | | | 240VAC 1 | Digital Input, nor | n-redundant, coated | |
| Non Redundant IOTA | 51308394-275 | | | | | |
| 240VAC DI | CC-TDI230 | | 240VAC 1 | Digital Input, nor | n-redundant, coated | |
| Redundant IOTA | 51308396-275 | 08396-275 | | | | |
| 120VAC DI | CC-TDI151 | | 120VAC Digital Input, non-redundant, coated | | | |
| Non Redundant IOTA | 51307536-176 | | | | | |
| Terminal plug-in assembly | ly | | | | | |
| 16-terminal plug-in assembly 51506273-216 | | | 2 per non- | -redundant IOTA | | |
| | | | 2 per redu | ındant IOTA | | |
| Fuse | | | 1 | | | |
| Description Po | Part number | Quantity | , | Reference designator | Function | |
| Fuse 0.5A Fast acting 51 5x20mm | 1190582-150 | 1 per noi IOTA | n-red. | F1 | +24vdc power for IOM | |
| | | 2 per red | d. IOTA | F1 | +24vdc power for top IOM | |
| | | | | F2 | +24vdc power for bottom IOM | |
| DIGITAL OUTPUT HIG | GH VOLTAGE RELAY | | | | | |
| Series C DO IOM | CC- PDOB01 | | Series C I | Digital Output M | odule | |
| DO Relay Extender | 51308380 | | Series C Digital Output Relay Extender | | | |
| DO-HV Relay Non- | CC- TDOR01 | | Digital Output High Voltage, relay, non-redundant, coated | | | |
| Redundant. IOTA | 51308376-175 | | | | | |
| DO-HV Relay Redundant | t. CC- TDOR11 | | Digital Output High Voltage, relay, redundant, coated | | | |
| IOTA | 51308378-175 | | | | | |
| Miscellaneous | · | | • | | | |
| Jumper Link | 30731551-001 | | 32 per DO | Relay Extender | ī | |
| Slim Power Relay 24VDC (Tyco) | C 51506348-100 | | 32 per DO | Relay Extender | : | |
| 16-terminal plug-in assem | nbly 51506273-216 | | 4 per DO | Relay Extender | | |
| Fuses | · | | | | | |

| Part name | Part number | | | Description | | | |
|---------------------------------|-------------|--------------|------------------------------|--|---------------------------------|---|--|
| Description | Part nı | ımber | Quantity | , | Reference designator | Function | |
| Fuse 1A Fast acting 5x20mm | l l | | 1 per non-IOTA | | F2 | When this fuse blows, the 24V to DO IOM (Application Board) | |
| | | | 1 per rec | l. IOTA | F1 | stops. It covers energizing current for 32 relay coils. | |
| Fuse 0.5A Fast acting 5x20mm | 511905 | 82-150 | 1 per no IOTA | n-red. | F1 | Covers current to kernel board. | |
| | | | 2 per rec | l. IOTA | F2 | Top IOM kernel | |
| GENERAL | | | | | F3 | Bottom IOM kernel | |
| Fuse holder | | 51506443-100 | | | | | |
| UNIVERSAL IO | | | | | | | |
| Series C UIO IOM | | CC-PUIO01 | | Series C U | Jniversal IO Mo | dule | |
| IOTA | | | | | | | |
| Non-Redundant. IOTA | | CC-TUIO01 | | Universal | IO, non-redunda | ant, coated | |
| Redundant IOTA | | CC-TUIO11 | | Universal | Universal IO, redundant, coated | | |
| Terminal plug-in assen | ibly | | | | | | |
| 16-terminal block plug | -in | 51506273-301 | | white on black connector - TB1 upper row | | | |
| assembly | | 51506273-303 | | white on black connector - TB2 upper row | | | |
| | | 51506273-305 | | black on v | white connector - | TB1 lower row | |
| | | 51506273-307 | | black on v | white connector - | TB2 lower row | |
| 4-terminal block plug-i | n | 51506269-104 | 1 per redundant IOTA for TB3 | | ТВ3 | | |
| Fuses | | | | | | | |
| Description | Part nı | ımber | Quality | | Reference designator | Function | |
| Fuse 10A, 5x20mm, time lag | 511905 | 82-310 | 1 per rec | d. IOTA | F1 | Fuse for field power | |
| Fuse 1A, 5x20mm, time lag | 511905 | 82-210 | 2 per rec | d. IOTA | F2 F3 | Fuse for top IOM kernel Fuse for bottom IOM kernel | |
| UNIVERSAL IO-2 | | | l | | | | |
| Series C UIO-2 IOM | | CC-PUIO31 | | Series C U | Jniversal IO Mo | dule-2 | |
| IOTA | | | | | | | |
| Non-Redundant. IOTA | | CC-TUIO31 | | Universal | IO-2, non-redun | dant, coated | |
| Redundant IOTA | | CC-TUIO41 | | Universal | IO-2, redundant | , coated | |
| Terminal plug-in assen | ably | | | | | | |
| 16-terminal block plug | -in | 51506273-301 | · | white on b | olack connector - | TB1 upper row | |
| assembly | | 51506273-303 | | white on b | olack connector - | TB2 upper row | |
| | | 51506273-305 | | black on v | white connector - | TB1 lower row | |
| | | 51506273-307 | | black on v | white connector - | TB2 lower row | |
| 4-terminal block plug-iassembly | n | 51506269-104 | | 1 per redu | ndant IOTA for | TB3 | |
| Fuses | | | | | | | |

| Part name Part num | | mber | | | escription | | | |
|--|-------------|--------|-----------|----------|-------------------------|----------------------------|--|--|
| Description | Part nu | mber | Quality | | Reference designator | Function | | |
| Fuse 10A, 5x20mm, time lag | 511905 | 82-310 | 1 per rec | l. IOTA | F1 | Fuse for field power | | |
| Fuse 1A, 5x20mm, time lag | 511905 | 82-210 | 2 per rec | l. IOTA | F2 | Fuse for top IOM kernel | | |
| PULSE INPUT MOD | III E | | | | F3 | Fuse for bottom IOM kernel | | |
| | - | | | I | | | | |
| Series C PIM | CC-PPI | X01 | | Series C | Pulse Input Mod | ule | | |
| IOTA | | | | | | | | |
| IOTA | (CC-TPIX11) | | | Redunda | Redundant IOTA | | | |
| Fuses | | | | | | | | |
| Description | Part number | | | | Reference des | Reference designator | | |
| Fuse 1A Fast acting 5x20mm (replaceable fuses) | 511905 | 82-210 | | | F1, F2, F3 | | | |
| Relays | | | | | | | | |
| | Part nu | mber | | | | | | |
| K1, K2 | 511905 | 16-134 | | | | | | |
| (solid state fast-cutoff replaceable relays) | | | | | | | | |
| Plug-in connectors | | | | | | | | |
| | Part nu | mber | | | | | | |
| TB1 | 515062 | 73-216 | | | | | | |
| TB2, TB3 | 515062 | 69-104 | | | | | | |

16.2 Replacing a Series C IOTA



Attention

Replacing the Series C IOTA requires that the IOM be in an inactive off-process state.



WARNING

Replacing a GI/IS IOTA and all associated activities may only be performed when the area has been determined to be non-hazardous.

To replace a Series C IOTA

- 1 To remove the I/O module, refer to the following procedure
- 2 Label and disconnect all cables from the IOTA board connectors.
- 3 To remove the IOTA board do the following:



CAUTION

The IOTA power and ground screws can bind during installation or removal if the mounting screws are fully secured before the power/ground screws are installed.

Recommended sequence:

- 1. Remove the IOTA from the carrier by loosening the IOTA's mounting screws only half-way.
- 2. Remove the screw from the left side of the IOTA board that connects to the 24 Vdc bus bar.
- 3. Remove the screw from the right side of the IOTA board that connects to the GND bus bar.
- 4. Completely remove the IOTA's mounting screws
- 5. Place screws, washers and spacers in a secure place for potential reuse.
- 4 Mount the new I/O IOTA board on the carrier, and refer to the following procedure.
- 5 Insert the I/O module onto IOTA board making sure that the I/O circuit board mates properly with the IOTA board connector.
 - Refer to the following procedure, .
- 6 The I/O module boots-up into IDLE state.
- 7 In Control Builder, perform a 'Load with Contents'.

16.3 Replacing an I/O module



CAUTION

We recommend that you proceed with extreme caution whenever replacing any component in a control system. Be sure the system is offline or in a safe operating mode.

Component replacements may also require corresponding changes in the control strategy configuration through Control Builder, as well as downloading appropriate data to the replaced component.

Prerequisites

You have logged onto Control Builder with sufficient security level to make control strategy changes.

- You can remove and install the Series C IOM under power.
- Be sure you take ESD hazard precautions when handling the module and IOTA.

To replace an I/O module

- 1 Loosen the screws:
 - at each side of the plastic cover that secures the I/O module to the IOTA board, and
 - the long gray plastic screw located on the module's face. It is not necessary to completely remove this screw.



CAUTION

Only use a #2 Phillips screwdriver to carefully loosen or tighten the long gray plastic screw. **Do not use** either a #1 Phillips screwdriver or a battery-powered screwdriver to remove or install the plastic screw as this can damage the screw head.

- 2 Remove the I/O module from the IOTA board and connector.
- 3 Insert the new I/O module onto IOTA board making sure that the I/O circuit board mates properly with the IOTA board connector.
- 4 Secure the module to the:
 - · IOTA board
 - using the two metal screws at the plastic cover
 - tightening the long gray plastic screw. See **CAUTION** in Step 1.
 - Carrier with the long screw that is inserted into the hole on the face of the module's plastic cover.

The new I/O module boots-up to the IDLE state.

- 5 Load firmware which is the same version as was running in the old controller.
- 6 In Control Builder, perform a 'Load with Contents".

16.4 FOE recommended spares

The following table provides replacement parts, or parts that you may want to keep on hand for backup.

Table 155: Recommended spare parts

| Part name | Part number Description | | | | | | |
|-----------------------------|-------------------------|--|----------------|-------------------------|-----------------|--|--|
| Fiber Optic Extender | module | | | | | | |
| Fiber optic Extender | 8937-HN | P37-HN Fiber Optic Extender module 2km | | | | | |
| module | | CC-PFE221 | - Honeywell mo | odel number | | | |
| Fiber optic Extender module | ICF-1150-S-SC-T | Fiber Optic Extender module 10 km | | | | | |
| Fiber Optic Extender | IOTA | | | | | | |
| Fiber Optic Extender | 8939-HN | 6 inch FOE I | OTA | | | | |
| IOTA | | CC-TFE021 - Honeywell model number | | | | | |
| Cables | | | | | | | |
| SC IOL cable | CC-KFSGR5 | 0.5M FOE to Series C I/O link interface cable - Gray | | | | | |
| | CC-KFSVR5 | 0.5M FOE to Series C I/O link interface cable - Violet | | | | | |
| PM IOL cable | CC-KFPGR5 | 0.5M FOE to | PM I/O link in | terface cable - Gray | y | | |
| | CC-KFPVR5 | 0.5M FOE to | PM I/O link in | terface cable - Viol | et | | |
| Fuses | | | | | | | |
| Description | Part number | | Quantity | Reference designator | Function | | |
| Fuse | Two replacement opt | Two replacement options. | | F1 | Power to module | | |
| | • 216.250P Littelfo | • 216.250P Littelfuse | | | electronics | | |
| | • S501-250-R Coo | per Bussman | | | | | |

16.5 FOE Maintenance

Remote I/O requires a minimum of maintenance. A regular inspection program is advised, but the frequency of inspections depends largely upon the environmental conditions in which the equipment normally operates.

The following should be periodically checked:

- all cables and wires attached to the FOE module
- evidence of any tampering or unauthorized modifications

The FOE module and IOTA cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer.

16.5.1 Replacing the FOE IOTA F1 fuse

Refer to the FOE recommended spares section in this document for the proper replacement fuse to be used.



Attention

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the **F1** fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the **F1** fuse can be re-installed.

To replace the FOE IOTA F1 fuse

- 1 Using a small slotted screwdriver, place the tip into the slot on the fuse cap (The cap is the fuse holder).
- 2 Rotate the cap counter clockwise, a quarter-turn. Remove cap that also holds the fuse.
- 3 Replace the fuse in the fuse holder and insert back into the fuse container on the IOTA board.
- 4 Tighten the fuse cap rotating it clockwise a quarter-turn using the screwdriver.
- 5 This completes the procedure.

16.5.2 Replacing the FOE fuse on the terminal block when FOE is mounted on DIN rail

To replace the FOE fuse on the terminal block when the FOE is mounted on the DIN rail

- 1 Using the lever provided on the terminal block, open the fuse holder.
- 2 Remove the fuse from the fuse holder.
- **3** Replace the fuse by positioning it in the fuse holder, press and fit.
- 4 Close the fuse holder and press the lever to lock.

16.5.3 Replacing the FOE module on the IOTA

If the FOE module needs replacing or requires mounting on the IOTA, do the following.

Prerequisites

The IOTA has been previously removed or is missing from the IOTA board



Attention

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the **F1** fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the **F1** fuse can be re-installed.

To replace the FOE module on the IOTA

- 1 Align the FOE screws (located on the flange) with the holes on the IOTA.
- 2 Tighten the four screws that attach the base of the FOE module to the IOTA board (using a small Phillips screwdriver).
- 3 Connect the power cable from the IOTA board to the connector at the bottom of the module.
- 4 This completes the procedure.

16.5.4 Removing the FOE module from the DIN rail

To remove the FOE module from the DIN rail

- 1 Power down the FOE module by opening the fuse holder of the terminal block using the lever and removing the fuse
- 2 Remove all the cables before detaching the FOE modules. Perform the following steps to do so.
 - a Unscrew and remove the cable (HPN 51202930-200) running from the feed through terminal of the system cabinet to the '+' fuse terminal of the terminal block (Meanwell/Phoenix Contact power supply only).
 - **b** Remove the power connector of the cable (HPN 51202948-100/51202948-200) from the power supply by releasing the lock in the side and pulling it out gently (TDI power supply only).
 - c Unfasten the screw of the '-' fuse terminal of the terminal block on DIN rail and remove the cable.
 - d Unfasten the screw of the 'V+' terminal of power connector on the FOE module and remove the cable.
 - e Unfasten the screw of the '-' terminal of the feed through terminal block and remove the cable.
 - f Unfasten the screw of the 'V-' terminal of power connector on the FOE module and remove the cable.
 - **g** Remove the fiber optic cables from the FOE module by pulling it out gently.
 - h Unscrew and remove the I/O Link cable (HPN 51202789-910 / 51202789-911) from the FOE module or remove the I/O Link connector by pulling it out.
- 3 Unfasten the screw in the center of the end bracket and remove it by slightly lifting and pulling it out.
- 4 Push the FOE module slightly downwards and slide it out at the lower edge of DIN rail.



WARNING

Powering off both FOE modules accidently may halt the IOL communication completely and can lead to dangerous situation in plant. You must ensure to turn off the power of suspected FOE and should remove it without disturbing the functional FOE. Ensure to notify plant operators while performing this operation.

16.5.5 Removing the FOE assembly from the carrier

If the FOE assembly needs replacing and therefore, requires removal from the carrier, do the following.



Attention

Prior to installing or servicing the FOE assembly (FOE module on the IOTA) to the carrier, the **F1** fuse needs to be removed. After mounting the FOE assembly to the carrier and securing the power and ground screws, the **F1** fuse can be re-installed.

To remove the FOE assembly from the carrier

- 1 Using a #2 Phillips screw-driver, loosen the two power screws, connecting the IOTA board to the vertical bus bars on the channel carrier assembly:
 - +24 V power screw
 - · Com ground screw
- 2 Disconnect the IOLINK cable from the end that attaches to either the C300 or I/O IOTA.

- 3 Remove the FOE assembly from the carrier using a #2 Phillips screwdriver.
- 4 This completes the procedure.

16.5.6 Hazardous Area Cable Requirements

For U.S. installations, section 770-53 (d) of NEC Article 770 states that 'Cables installed in hazardous (classified) locations shall be any type indicated in Table 770-53.' This table is reproduced below.

| Cable type | Permitted substitutions |
|------------|-----------------------------|
| OFNP | None |
| OFCP | OFNP |
| OFNR | OFNP |
| OFCR | OFNP, OFCP, OFNR |
| OFNG, OFN | OFNP, OFNR |
| OFCG, OFC | OFNP, OFCP, OFNR, OFNG, OFN |

The cable types are described in the following table:

| Cable | Cable type | Reference |
|---------|---|-------------------------|
| marking | | (NEC Article 770) |
| OFNP | Nonconductive optical fiber plenum cable | 770-51(a) and 770-53(a) |
| OFCP | Conductive optical fiber plenum cable | 770-51(a) and 770-53(a) |
| OFNR | Nonconductive optical fiber riser cable | 770-51(b) and 770-53(b) |
| OFCR | Conductive optical fiber riser cable | 770-51(b) and 770-53(b) |
| OFNG | Nonconductive optical fiber general-purpose cable | 770-51(c) and 770-53(c) |
| OFCG | Conductive optical fiber general-purpose cable | 770-51(c) and 770-53(c) |
| OFN | Nonconductive optical fiber general-purpose cable | 770-51(d) and 770-53(c) |
| OFC | Conductive optical fiber general-purpose cable | 770-51(d) and 770-53(c) |

Nonconductive fiber optic cable is defined as cable containing no metallic members and no other electrically conductive materials.

Conductive fiber optic cable is defined as cable containing non-current-carrying

conductive members such as metallic strength members, metallic vapor barriers and metallic armor or sheath.

16.5.7 Cable jacket Building Code Requirements

Building code requirements frequently do not allow cables with polyethylene jackets. Jackets of polyvinyl chloride are frequently restricted to conduits, while fluoropolymer or other approved jacked material is required for use in cable trays and air plenums. Cable with suitable jacket material must be selected for the application.

16.5.8 Cable temperature variation considerations

Where ambient temperature variations are 20°C or greater on a daily basis, the life of the fibers can be significantly reduced. In applications where the ambient temperature is not controlled, loose buffered cable must be specified.

16.5.9 Spare fiber cable recommendation

A minimum of two cable fibers is required for each link, one for transmit and one for receive. The following characteristics apply to fiber optic cable spares:

- As insurance against future damage, such as fiber breakage, or encountering excessive loss in any one fiber, the inclusion of spare fibers is recommended. 100% cable replacement is recommended.
- Indoor 62.5 Micron Cable is used for indoor cabling. Indoor cables are available with 2, 4, or 6 fibers.
- Outdoor 62.5 Micron Cable is used for outdoor cabling. Outdoor aerial and direct burial cables are available with 4, 6, or 8 fibers.

17 Series C Power Sub-System Connections and Alarm Indications

Related topics

"Series C DC Power Connections and Indicators" on page 558

"Series C Power Sub-System LED Indications" on page 566

"Series C Power Sub-System Alarm Contacts and LED Activation Levels" on page 568

17.1 Series C DC Power Connections and Indicators

The following figures illustrate the typical DC power and battery backup connections made in Series C cabinets with RAM Charger Assembly 51199932-100 and 51199932-200, respectively; as well as the associated LED indicators. See the or "Connecting the Power System alarm cable for RAM Charger Assembly 51199932-200" section for more information about the alarm connections for 24Vdc Digital Inputs.

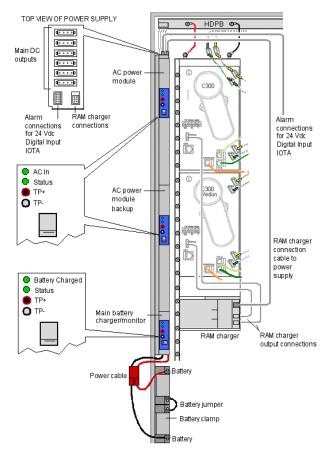


Figure 238: Typical dc power and battery backup connections in Series C cabinet with RAM Charger 51199932-100

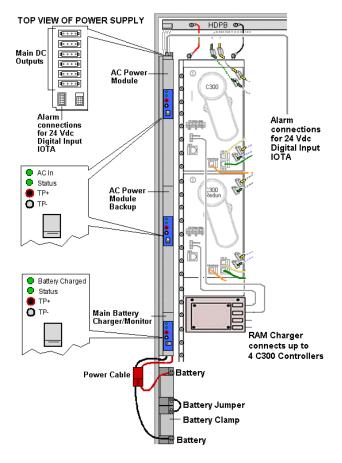


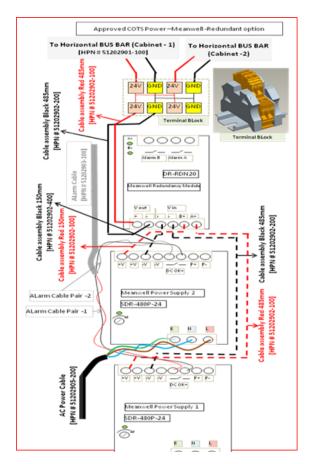
Figure 239: Typical dc power and battery backup connections in Series C cabinet with RAM Charger 51199932-200

With R410, the COTS power system is available, which is a low cost power system used to power Series C system. The Commercial Off-the-Shelf (COTS) power system is available in the following two configurations.

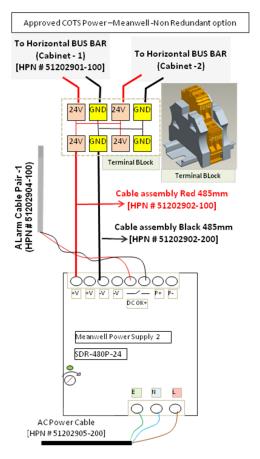
- COTS power redundant system, which consists of the following:
 - Two power supply modules
 - Redundancy module
 - Terminal block
 - Mechanical hardware
 - Cable kit
- COTS power non-redundant system, which consists of the following:
 - Power supply module
 - Terminal block
 - Mechanical hardware
 - Cable kit

Following are the two types of COTS power system that are available.

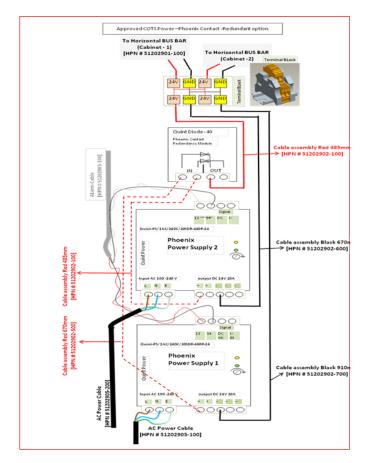
- COTS Power- Meanwell redundant (20A) and Meanwell non-redundant (20A)
- COTS Power-Phoenix redundant (20A) and Phoenix non-redundant (20A)



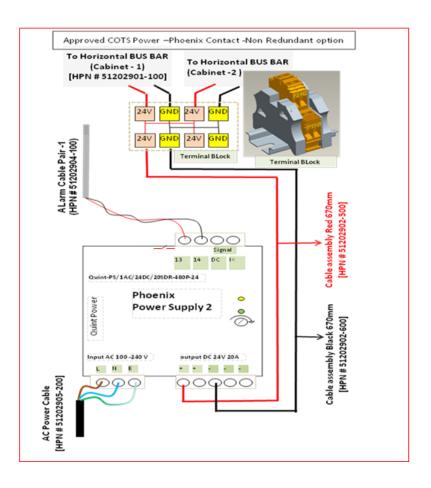
The following figure displays the connection diagram for COTS Power-Meanwell redundant system. The following diagram displays the connection diagram for COTS power-Phoenix redundant system.



The following diagram displays the connection diagram for COTS Power Meanwell non-redundant system.

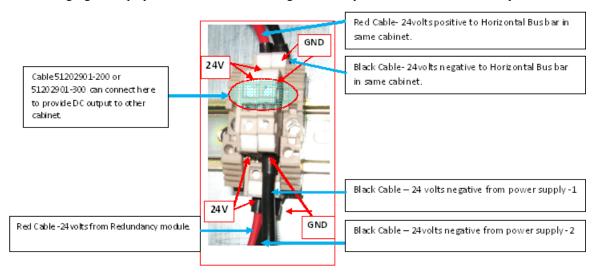


The following diagram displays connection for the COTS power-Phoenix non-redundant system.

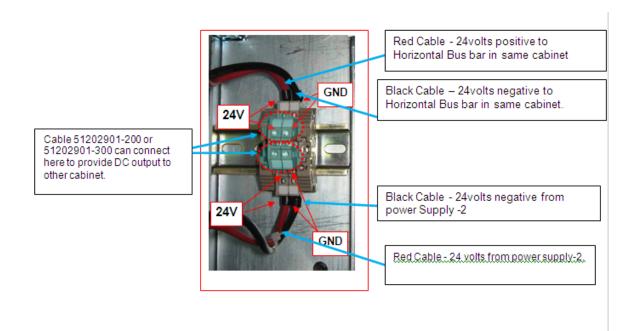


17.1.1 Terminal block connections - Meanwell power system

The following figure displays the terminal block wiring for COTS power Meanwell redundant system.

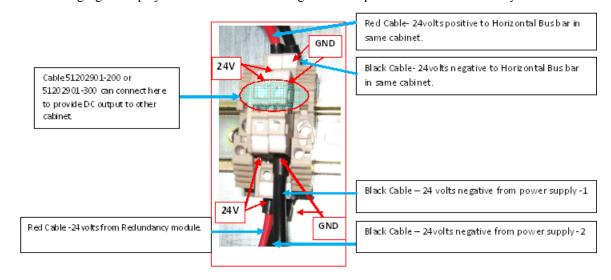


The following figure displays the terminal block wiring for COTS power Meanwell non-redundant system.

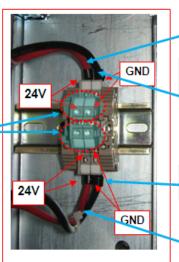


17.1.2 Terminal block connections - Phoenix power system

The following figure displays the terminal block wiring for COTS power Phoenix redundant system.



The following figure displays the terminal block wiring for COTS power Phoenix non-redundant system.



Cable 51202901-200 or 51202901-300 can connect here to provide DC output to

other cabinet.

Red Cable - 24volts positive to Horizontal Bus bar in same cabinet

Black Cable - 24volts negative to Horizontal Bus bar in same cabinet.

Black Cable - 24volts negative from power Supply -2

Red Cable - 24 volts from power supply-2.

17.2 Series C Power Sub-System LED Indications

The following table summarizes the Light Emitting Diode (LED) indications provided by the various Series C power sub-system components.

| LED Name -Color | | LED State | | | | | | |
|-------------------------------------|--------|--|---|---|--|---|--|--|
| | | OFF | | ON | V | | ting | |
| AC Power Module Ind | icator | s (per supply) | | | | | | |
| AC IN - Green | | AC input is lost (for any reason) | | AC input is within specified range | | N/A | N/A | |
| Status - Green | | DC output voltage is out of specifications (on anode side of isolating ORing diode), A greater current than specified is being pulled from the power supply, and/or | | within spec | oly output is iffied voltage, e, and current | indic even supp by th | nas failed. (This ator must also be OFF if a failed fan in one ly is being windmilled e airflow from the fan in ljacent supply.) | |
| | | reached tempe | Power supply has reached temperatures above specified limits. | | | | | |
| Main Battery Backup | Charg | ger/Regulator/Mo | nitor Indica | tors | | | | |
| Status - Green | | reason), | | Power supply output is within the specified voltage, | | Fan has failed. (This indicator must also be OFF | | |
| | | • Battery charger senses an over-voltage on the batteries, | | temperature, and current limits. | | even if a failed fan in one supply is being <i>windmilled</i> by the airflow from the fan in an adjacent supply.) | | |
| | | Battery charge over-current v charging the b | vhile | | | an aujacent suppry.) | | |
| | | Battery charger senses an over-temperature condition, | | | | | | |
| | | Batteries are r or | not present, | | | | | |
| | | Temperature s missing or no connected. | | | | | | |
| Battery Charged - Green | l | Main battery in or discharged. | | Battery output is capable of supplying the specified | | N/A | | |
| | | Battery is not off voltage. | at the top- | for the spec | age and current eified time. | | | |
| Ram Battery Backup (| Charg | er/Monitor Indica | tor (511999 | 32-100 Only | ') | ı | | |
| Status - Green | | Main battery is missing, orBattery is not charged | | Battery output is capable of supplying the specified output voltage and current | | N/A | | |
| Cots Dower Magnesoll | ontic | yet | | for the specified time. | | | | |
| Cots Power -Meanwell LED Name-Color | | Located on | LED State | | | | | |
| EED Tunic-Color | | Located on | OFF | ON | | | Blinking | |

| LED Name -Colo | r | | LED State | | | | |
|----------------------|---------|-----------------------|---|---|---|--|--|
| A+/Green | Redu | ndancy Module | No input DC voltage at terminal Vin-A+ | DC voltage input at terminal Vin-A+ is within specified limit. | NA | | |
| B+/Green | Redu | ndancy Module | No input DC voltage at terminal Vin-B+. | DC voltage input at terminal Vin-B+ is within specified limit. | NA | | |
| DC OK | - 1 | rSupply1, rsupply2 | Power supply DC output voltage is less than the 90% of specified voltage | Power supply DC output voltage is within specified voltage. | | | |
| Cots Power - Phoenix | x Conta | ct option | | | | | |
| LED Name-Color | LED | Located on | LED State | | | | |
| | | | OFF | ON | Blinking | | |
| DC OK / Green | - 1 | rSupply1, rsupply2 | NA | Power supply DC output voltage is within specified voltage | Power supply DC output voltage is less than the 90% of Specified Voltage | | |
| Boost / Amber | | rSupply1, rsupply2 | Load current is less than the specified current | Load current is greater than specified current | NA | | |

Note: Alarm opens if:

- Battery voltage is less than 3.5 volts,
- Input voltage to the charger is less than 14 volts,
- Battery pack has been removed, or
- Battery is still being charged (not in the top-off state).

17.2.1 Series C Power Sub-System LED indications - Meanwell power system

| LED ON | The output voltage reaches the adjusted output voltage |
|---------|---|
| LED OFF | The output voltage drop below 90% of adjusted output voltage. |

17.2.2 Series C Power Sub-System LED indications - Phoenix power system

DC OK LED

| LED ON | The output voltage reaches the adjusted output voltage | |
|--------------|---|--|
| LED Flashing | The output voltage is below 90% of adjusted output voltage. | |
| LED OFF | NO DC output voltage | |

BOOST LED

| LED ON | The Load current > 20Amp |
|---------|--------------------------|
| LED OFF | The Load current < 20Amp |

17.3 Series C Power Sub-System Alarm Contacts and LED Activation Levels

Each power supply and the main battery backup regulator/charger, and the RAM battery backup charger provide an alarm contact. The alarm contact opens if any of the LED indicators listed in the previous section are **not** in the normal (ON) state. The alarm contact is electrically isolated from all other circuitry so that it can be series connected by the user with alarms in other devices.

Use a hermetically sealed electromechanical relay. The alarm contacts are rated for 24 Volts ac or dc at 0 to 65 mA non-inductive load. An alarm condition is signaled by an open contact (1000 ohms or more); and a no alarm condition is signaled by a closed contact (10 ohms or less).

The following table provides a functional description of the activation levels for a given LED indicator.

| LED Name | Functional Description | | |
|---|--|--|--|
| AC Power Module Indicators (per supply) | | | |
| AC IN | The LED turns ON when the AC input voltage is sufficient to start the unit. This is guaranteed to occur when the input voltage has risen to 85 Vac, but it could occur at a lower voltage, depending on output loading and unit-to-unit variations. Once the unit starts, the LED remains ON through the entire AC input voltage range. The LED will turn OFF at the point where the power supply shuts down. For a fully loaded supply, this is guaranteed not to occur until the input voltage descends below 85 Vac. This voltage can be considerably lower, if the unit is lightly loaded and depending on unit-to-unit variations. The unit does not shut down when the AC input range is exceeded unless there is a failure in the power supply. | | |
| Status | The LED turns ON when output voltage is within the operating range. The LED turns OFF when the DC voltage is increased to above 26.4 Vdc and the power supply shuts down due to an over-voltage condition. (Based on manufacturer's tests, the actual data range for over-voltage is 26.4 to 30 Vdc.) The LED turns OFF during output overload, which is reached when the load is increased to over 26 A and results in the unit shutting down. | | |
| Main Battery Backup | Charger/Regulator/Monitor Indicators | | |
| Status | The LED turns ON when both the input and battery voltages are within operating range. The LED will remain ON until the battery reaches the Low-Voltage Drop-out point (32 Vdc) and the unit turns OFF along with the LED (output will still be regulated at 25 Vdc during battery discharge). The LED turns OFF when the battery voltage is above 45.5 Vdc. (Based on manufacturer's tests, the actual data range for over-voltage is 45.5 to 48.5 Vdc.) | | |
| Battery Charged | The LED operation is based on both battery charge voltage and battery charge current. The battery charge voltage must be above 40 Vdc and the battery charge current must be below 1 A for the LED to be ON. If both of these conditions are not met, the LED will be OFF. | | |

18 Series C I/O Alarms and Failures

Related topics

"Reviewing IOM alarms generated by the C300" on page 570

"Reviewing IOM soft failures" on page 571

"IOM hard failures" on page 591

"IOM Behavior during Hard Failures" on page 592

"Getting further assistance" on page 593

18.1 Reviewing IOM alarms generated by the C300

The IOM block reports diagnostic alarms in the event of an IOM hardware failure or a change in the IOM redundancy state. The IOM alarms that the C300 presents are listed in the notification table below.

Table 156: IOM alarms displayed by the C300 controller

| Notification type | Auxiliary descriptor text | |
|-------------------|---------------------------|--|
| Diagnostic alarm | Communication error | |
| | Configuration mismatch | |
| | No response | |
| System info event | IOM power on | |
| | IOM switchover | |

18.1.1 HART alarms/events

In addition to the existing PMIO functionality, the following are added to Series C HART IOMs.

18.1.2 Field device status notifications

Field device status notifications has one more extra byte called 'extended device status notifications.' This byte is supported only by HART 6.0 and later version devices.

Currently, only the following two bits of this byte are defined.

| Extended device condition/bit | Туре | Definition |
|-------------------------------|-------|---|
| Maintenance required / Bit 0 | Alarm | Device requires maintenance. |
| Device variable alert / Bit 1 | Alarm | Any device variable is in alarm or warning state. |

18.1.3 HALARMENABLE

A new parameter - HALARMENABLE - is added to HART configuration tab in the channel block. This parameter is by default enabled and can be changed from Monitoring side, irrespective of the channel point execution state of the IOM module state.

When HALARMENABLE is disabled, all the existing HART events / alarms from that channel block are disabled and further generation of the HART alarms / events are terminated.

This parameter affects only the HART alarm / event behavior. The LED update of the device status in the HART device status tab happens regardless of the state of HALARMENABLE.

18.2 Reviewing IOM soft failures

The IOM reports device soft failures to Experion Server and located on the Control Builder configuration forms under the Soft Failures tab.

The table below lists all IOM soft failures and identifies those that appear within Experion. Since Series C I/O is not slated for use with TPS, soft failures related to TPS are not be provided by Series C I/O modules.

The SOFTFAIL1A, SOFTFAIL1B, SOFTFAIL2A and SOFTFAIL2B parameters are used to view an IOM's soft failures. For a list of channels in failure, use the CHNLWFAILA and CHNLWFAILB parameters.

18.2.1 01 STCOVRUN

Sample time clock overrun

Diagnostic check

Investigate a possible I/O Link problem

Cause

Sample time clock overrun

Solution

Investigate a possible I/O Link problem or excessive IOL activity. Check C300, IOL cables, IOMs and IOL budgets. Call TAC if the alarm persists or repeatedly occurs.

18.2.2 02 REQOFLOW

IOP task request overflow - excessive IOL activity

Diagnostic check

Check IOL activity

Cause

IOP task request overflow - excessive IOL activity

Solution

Call TAC for assistance.

18.2.3 06 FTAMISSG

LLMUX, power adaptor, or DO Relay IOM config. is missing relay adapter board

Diagnostic check

Check for missing items defined below.

Cause

If LLMUX, power adapter missing or if DO Relay IOM configuration is missing relay adapter board.

Solution

Install the FTA or relay adapter. If an FTA is present, replace the FTA or check the FTA cable. (Note: For the LLMux, this code refers to the Power Adapter assembly. RTD and TC FTAs are diagnosed by error Codes 50 and 51.)

18.2.4 07 EECKSMER

EEPROM checksum error - IOM probably not calibrated

Diagnostic check

EEPROM checksum error - IOM probably not calibrated

Cause

EEPROM (used to hold calibration information in Analog Input and Analog Output IOPs) checksum failure. It usually means an Analog Output IOM is not calibrated properly.

Solution

Calibrate the Analog Input or Analog Output IOM (refer to the 'IOM Calibration Procedures' section for the procedure). If the error persists, replace the IOM.

18.2.5 08 EECNTERR

EEPROM counter error-too many writes

Diagnostic check

Check EEPROM counter.

Cause

EEPROM counter error. The number of writes to EEPROM has exceeded the safe number (10,000). This could also indicate the IOM has not been calibrated because a virgin EEPROM will fail this test.

Solution

Calibrate the Analog Input or Analog Output IOM (refer to the 'IOM Calibration Procedures' section for the procedure). If the error persists, replace the IOM.

18.2.6 09 EEFLAGER

EEPROM flag error - incomplete EEPROM write resulting in uncalibrated IOM

Diagnostic check

Check EEPROM.

Cause

EEPROM flag error - incomplete EEPROM write resulting in uncalibrated IOM.

Solution

Calibrate the Analog Input or Analog Output IOM (refer to the 'IOM Calibration Procedures' section for the procedure). If the error persists, replace the IOM.

18.2.7 21 INPTFAIL

Input point failed diagnostic

Diagnostic check

Cause

Input point failed diagnostic

Solution

18.2.8 23 OUTPUTFL

Failure in output circuit / field wiring detected by AO or DO.

Diagnostic check

Check field wiring and the fuses on the IOTA.

Cause

Failure in output circuit / field wiring detected by AO or DO.

Solution

Check field wiring and the fuses on the IOTA. If it is good, try replacing the IOTA and/or the appropriate IOM card.

18.2.9 24 STCKLIM

IOM firmware stack usage is dangerously close to its limit.

Diagnostic check

Stack reaching limit.

Cause

IOM firmware stack usage is dangerously close to its limit.

Solution

Reduce activity on this IOM - inactivate control strategies. Call TAC for assistance.

18.2.10 26 DIAGCTFL

IOM diagnostic circuit failure

Diagnostic check

IOM diagnostic circuit failure.

Cause

IOM diagnostic circuit failure.

For AI IOM, 'noise' on the input may cause this error.

Solution

Reset the IOM. If reset does not clear the error, replace the appropriate IOM.

For AI IOM, check for 'noise' on the input.

18.2.11 31 FTAMSMCH

LLMUX FTA type mismatch with channel configuration.

Diagnostic check

Check channel block configuration.

Cause

LLMUX FTA type mismatch with channel configuration.

Solution

Re-configure the channel block or replace the FTA.

18.2.12 32 VZERO-FL

Zero reference voltage out of range in AI and AO IOMs

Diagnostic check

Zero reference failure.

Cause

Zero reference voltage out of range in AI and AO IOMs

Solution

Replace the IOM.

18.2.13 33 BADRJVAL

Reference junction value bad

Diagnostic check

Cause

Reference junction value bad

Solution

18.2.14 36 FTA1FAIL

LLMUX:FTA 1 has a soft failure

Diagnostic check

Check LLMUX FTA 1

Cause

LLMUX FTA 1 has a soft failure.

Solution

Check LLMUX FTA 1

18.2.15 37 FTA2FAIL

LLMUX FTA 2 has a soft failure

Diagnostic check

Check LLMUX FTA 2

Cause

LLMUX FTA 2 has a soft failure.

Solution

Check LLMUX FTA 2

18.2.16 38 CALBABRT

Calibration of a module has aborted due to a failure

Diagnostic check

Cause

Calibration of a module has aborted due to a failure

Solution

18.2.17 39 BADCALRF

Internal calibration test voltages out of range.

Diagnostic check

None - Internal calibration test voltages out of range.

Cause

Internal calibration test voltages out of range.

Solution

Replace AI or AO IOM.

18.2.18 41 VREFFAIL

Reference voltage out of range

Diagnostic check

Check reference voltage

Cause

Internal 5V reference out of range in AI or internal AA55 reference test failed in the case of DI.

Solution

Replace the AI or DI IOM.

18.2.19 42 ADOUTUDF

Analog to digital conversion on this Analog Input channel is out of range.

Diagnostic check

Check input wiring.

Cause

Analog to digital conversion on this Analog Input channel is out of range.

Solution

Check the input wiring at the IOTA; possible open contact. Otherwise, replace the IOM.

18.2.20 43 ADOUTCAL

AI or AO IOM is out of calibration.

Diagnostic check

Check AI or AO IOM calibration

Cause

AI or AO IOM is out of calibration.

Solution

Calibrate or replace the IOM (refer to the 'IOP Calibration Procedures' section).

18.2.21 44 BADFLREG

AO module failure selection register is bad

Diagnostic check

Cause

AO module failure selection register is bad

Solution

18.2.22 45 BDSNDLTC

Secondary latch failure

Diagnostic check

Cause

Secondary latch failure

Solution

18.2.23 46 BDOUTBFR

Output disable buffer failure.

Diagnostic check

Cause

Output disable buffer failure

Solution

18.2.24 47 VCALFAIL

Calibration reference voltage out of range.

Diagnostic check

Cause

Calibration reference voltage out of range

Solution

18.2.25 48 F1NOTCAL

FTA1 not calibrated.

Diagnostic check

Cause

FTA1 not calibrated

Solution

18.2.26 49 F2NOTCAL

FTA2 not calibrated.

Diagnostic check

Cause

FTA2 not calibrated

Solution

18.2.27 50 F1COM_FL

LLMUX FTA 1 communication failure.

Diagnostic check

LLMUX FTA 1 communication failure.

Cause

LLMUX FTA 1 communication failure.

Solution

Check the connection from the Power Adapter to FTA 1. If the FTA is missing, install the FTA. If the FTA is present, replace the FTA.

18.2.28 51 F2COM_FL

LLMUX FTA 2 communication failure.

Diagnostic check

LLMUX FTA 2 communication failure 2.

Cause

LLMUX FTA 2 communication failure.

Solution

Check the connection from the Power Adapter to FTA 2. If the FTA is missing, install the FTA. If the FTA is present, replace the FTA.

18.2.29 52 F1 IDERR

LLMUX FTA 1 identification failure.

Diagnostic check

LLMUX FTA 1 identification failure.

Cause

LLMUX FTA 1 identification failure.

Solution

Verify/correct the FTA pinning.

18.2.30 53 F2_IDERR

LLMUX FTA 2 identification failure.

Diagnostic check

LLMUX FTA 2 identification failure.

Cause

FTA 2 identification failure

Solution

Verify/correct the FTA pinning.

18.2.31 54 F1VREFFL

LLMUX FTA 1 reference voltage failure

Diagnostic check

LLMUX FTA 1 reference voltage failure

Cause

LLMUX FTA 1 reference voltage failure

Solution

Replace the FTA.

18.2.32 55 F2VREFFL

LLMUX FTA 2 reference voltage failure

Diagnostic check

LLMUX FTA 2 reference voltage failure

Cause

LLMUX FTA 2 reference voltage failure

Solution

Replace the FTA.

18.2.33 56 F1CAL_FL

LLMUX FTA 1 calibration failure.

Diagnostic check

LLMUX FTA 1 calibration failure.

Cause

LLMUX FTA 1 calibration failure.

Solution

Re-calibrate the FTA.

18.2.34 57 F2CAL_FL

LLMUX FTA 2 calibration failure.

Diagnostic check

LLMUX FTA 2 calibration failure.

Cause

LLMUX FTA 2 calibration failure.

Solution

Re-calibrate the FTA.

18.2.35 58 LOSTSYNC

IOP lost synchronization with its primary

Diagnostic check

Cause

IOP lost synchronization with its primary

Solution

18.2.36 59 WRITENBL

AO/DO write enable protection failure.

Diagnostic check

Cause

AO/DO write enable protection failure

Solution

18.2.37 60 MLTINPFL

Multiple input failure detected.

Diagnostic check

Cause

Multiple input failure detected

Solution

18.2.38 61 REDNDIAG

Redundancy hardware diagnostic failure.

Diagnostic check

Redundancy hardware diagnostic failure.

Cause

Redundancy hardware diagnostic failure.

Solution

Replace the IOMs one at a time following database synchronization.

18.2.39 63 WRONG_HW

IO redundancy configured on non-supportive hardware rev.

Diagnostic check

Cause

IO redundancy configured on non-supportive hardware rev

Solution

18.2.40 64 HWFIFOFL

Hardware FIFO diagnostic failed - PVs set BAD - replace IOP.

Diagnostic check

Cause

Hardware FIFO diagnostic failed - PVs set BAD - replace IOP

Solution

18.2.41 65 PRVRAMFL

Private RAM diagnostic failed - PVs set BAD - replace IOP.

Diagnostic check

Cause

Private RAM diagnostic failed - PVs set BAD - replace IOP

Solution

18.2.42 66 SOECLKFL

SOE clock failed - PVs set BAD - replace IOP

Diagnostic check

Cause

SOE clock failed - PVs set BAD - replace IOP

Solution

18.2.43 67 PVVALDFL

PV validation diagnostic failed - PVs set BAD - replace IOP.

Diagnostic check

Cause

PV validation diagnostic failed - PVs set BAD - replace IOP

Solution

18.2.44 68 SOECNTFL

SOE counter diagnostic failed - PVs set BAD - replace IOP.

Diagnostic check

Cause

SOE counter diagnostic failed - PVs set BAD - replace IOP

Solution

18.2.45 69 DTPATHFL

Data path failure.

Diagnostic check

Cause

Data path failure

Solution

18.2.46 70 DTPATHTO

Data path time out.

Diagnostic check

Cause

Data path time out

Solution

18.2.47 71 STMACHFL

State machine diagnostic failure - PVs set BAD - replace IOP.

Diagnostic check

Cause

State machine diagnostic failure - PVs set BAD - replace IOP

Solution

18.2.48 72 PIFAULTY

Bad personality image.

Diagnostic check

Cause

Bad personality image

Solution

18.2.49 161 HMODEM1

HART hardware error detected against DUART channel 1 or modem 1.

Diagnostic check

None - HART hardware error detected

Cause

HART hardware error detected against DUART channel 1 or modem 1.

Solution

Replace the IOM.

18.2.50 162 HMODEM2

HART hardware error detected against DUART channel 2 or modem 2.

Diagnostic check

None - HART hardware error detected

Cause

HART hardware error detected against DUART channel 2 or modem 2.

Solution

Replace the IOM.

18.2.51 163 HMODEM3

HART hardware error detected against DUART channel 3 or modem 3.

Diagnostic check

None - HART hardware error detected

Cause

HART hardware error detected against DUART channel 3 or modem 3.

Solution

Replace the IOM.

18.2.52 164 HMODEM4

HART hardware error detected against DUART channel 4 or modem 4.

Diagnostic check

None - HART hardware error detected

Cause

HART hardware error detected against DUART channel 4 or modem 4.

Solution

Replace the IOM.

18.2.53 165 HDIAGTO

HART processor diagnostic task under-run.

Diagnostic check

Cause

HART processor diagnostic task under-run.

Solution

18.2.54 166 HSTACKHI

HART processor program stack above 90% usage level.

Diagnostic check

Cause

HART processor program stack above 90% usage level.

Solution

18.2.55 167 FTA3FAIL

LLMUX: FTA 3 has a Soft failure.

Diagnostic check

Check FTA 3.

Cause

LLMUX: FTA 3 has a Soft failure.

Solution

Check FTA 3. This soft failure is introduced in Series C.

18.2.56 168 FTA4FAIL

LLMUX: FTA 4 has a Soft failure.

Diagnostic check

Check FTA 4.

Cause

LLMUX: FTA 4 has a Soft failure.

Solution

Check FTA 4. This soft failure is introduced in Series C.

18.2.57 169 F3NOTCAL

FTA3 not calibrated.

Diagnostic check

Cause

FTA3 not calibrated

Solution

18.2.58 170 F4NOTCAL

FTA 4 not calibrated.

Diagnostic check

Cause

FTA4 not calibrated

Solution

18.2.59 171 F3COMFL

LLMUX FTA 3 communication failure.

Diagnostic check

LLMUX FTA 3 communication failure.

Cause

LLMUX FTA 3 communication failure.

Solution

Check the connection from the Power Adapter to FTA 1. If the FTA is missing, install the FTA. If the FTA is present, replace the FTA. This soft failure is introduced in Series C.

18.2.60 172 F4COMFL

LLMUX FTA 4 communication failure.

Diagnostic check

LLMUX FTA 4 communication failure.

Cause

LLMUX FTA 4 communication failure.

Solution

Check the connection from the Power Adapter to FTA 2. If the FTA is missing, install the FTA. If the FTA is present, replace the FTA. This soft failure is introduced in Series C.

18.2.61 173 F3IDERR

LLMUX FTA 3 identification failure.

Diagnostic check

Verify/correct the FTA pinning.

Cause

LLMUX FTA 3 identification failure.

Solution

Verify/correct the FTA pinning. This soft failure is introduced in Series C.

18.2.62 174 F4IDERR

LLMUX FTA 4 identification failure.

Diagnostic check

Verify/correct the FTA pinning.

Cause

LLMUX FTA 4 identification failure.

Solution

Verify/correct the FTA pinning. This soft failure is introduced in Series C.

18.2.63 175 F3VREFFL

LLMUX FTA 3 reference voltage failure.

Diagnostic check

None

Cause

LLMUX FTA 3 reference voltage failure.

Solution

Replace the FTA. This soft failure is introduced in Series C.

18.2.64 176 F4VREFFL

LLMUX FTA 4 reference voltage failure.

Diagnostic check

None

Cause

LLMUX FTA 4 reference voltage failure.

Solution

Replace the FTA. This soft failure is introduced in Series C.

18.2.65 177 F3CALFL

LLMUX FTA 3 calibration failure.

Diagnostic check

Check FTA calibration

Cause

LLMUX FTA 3 calibration failure.

Solution

Re-calibrate the FTA. This soft failure is introduced in Series C.

18.2.66 178 F4CALFL

LLMUX FTA 4 calibration failure.

Diagnostic check

Check FTA calibration

Cause

LLMUX FTA 4 calibration failure.

Solution

Re-calibrate the FTA. This soft failure is introduced in Series C.

18.2.67 179 OPENWIRE

Open wire / sensor detected.

Diagnostic check

Check the field wiring and IOTA connections.

Cause

Open wire / sensor detected.

Solution

Check the field wiring and IOTA connections.

18.2.68 180 DOVRCRNT

DO channel detected a short circuit or over current situation.

Diagnostic check

Check the field wiring and IOTA connections.

Cause

DO channel detected a short circuit or over current situation.

Solution

Check the field wiring and IOTA connections.

18.2.69 181 FTAPOWFL

LLMUX IOM is not able to power the FTAs.

Diagnostic check

LLMUX IOM is not able to power the FTAs.

Cause

LLMUX IOM is not able to power the FTAs.

Solution

Replace the IOM. This soft failure is introduced in Series C.

18.2.70 182 DPADIAFAIL

IOL Address Diag Failure

Diagnostic check

IOL address diagnostic failure

Cause

IOL address diagnostic failure

Solution

Check IOM number at device index switch. Ensure correct assignment. If not correct, reset to correct device index number. Reset IOM.

18.2.71 183 RDBKRGDIAGFL

Readback Register Diagnostic Failure

Diagnostic check

Readback register diagnostic failure

Cause

Readback register diagnostic failure

Solution

Internal hardware problem. Replace the IOM.

18.2.72 184 WDTDIAGFAIL

Watch Dog Timer Diagnostic Failure

Diagnostic check

Watch Dog Timer diagnostic failure

Cause

Watch Dog Timer diagnostic failure

Solution

Replace the module.

18.2.73 185 RLYEXTBDMSSNG

Relay Extension Board Missing

Diagnostic check

Relay Extension Board missing

Cause

Relay Extension Board missing

Solution

Ensure Relay Board is properly installed.

18.2.74 186 REDHWFAIL

Redundancy hardware failure

Diagnostic check

Cause

Redundancy Hardware Failure

Solution

18.2.75 187 HARTCHANFAIL

IOM or IOTA HART channel failure.

Diagnostic check

Cause

IOM or IOTA HART Channel Failure

Solution

18.3 IOM hard failures

The IO module will hard fail or crash when a fatal fault is detected. A fatal fault is a malfunction (either hardware or software) that is so severe that safe and reliable control of the process is in jeopardy.

IOM reports device hard failures on the Configuration Form's Maintenance tab for the IOMLHFSTA / IOMLHFSTB parameters.

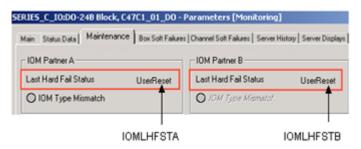


Figure 240: Location of hard failure message

To review the FAULTED state of AO and DO failures see, "FAULTED state and IOM hard failure"

To recover from an IO module hard failure

1 Reset the IO module using the **User Reset Contacts** located on the IOTA.



NOTE: The DO outputs with FAULTOPT set to HOLD continue to HOLD the FAULTOPT state during the user reset operation through the contacts.

- 2 Record the Last Hard Fail Status code.
 - This is located on the Configuration Form's Maintenance tab for the IOMLHFSTA / IOMLHFSTB parameters.
- 3 Record the **IOM firmware** and **hardware revisions** located on the Configuration Form's Maintenance tab:
 - Hardware Revision of the failed IO module.
 - Firmware Revisions (Boot Image and Application Image) of the failed IO module.
 - Release number of the Experion system in which the IO module was operating.
- 4 Extract the C300 Controller internal logs using the CTool Application.
- 5 Extract the **IOM internal logs** (trace and crash logs) using the CTool Application.
- 6 Report the problem to Honeywell TAC and provide all data captured in Steps 2-5.

18.4 IOM Behavior during Hard Failures

When the IOM hard fails and switch over to the Secondary does not take place:

- For a DO module:
 - all field output terminals for channels with DOTYPE = STATUS go to the configured fault state.
 - the field output terminals for channels with other DOTYPE go unpowered.
- · For an AO module, all field output terminals go unpowered
- INITREQ is asserted on all associated Output Channel Blocks
- the IOM icon in the Monitor tab becomes RED
- the Detail Display shows No Response

There also is:

- an active 'IOP State Changed to No Response' alarm in Station System Summary.
- the Status LED of the IOP is OFF.

The following codes can appear for the IOMLHFSTA and IOMLHFSTB parameters.

Table 157: IOM hard failures

| Code | Name | Cause/description | Al | AO | DI | DO | LLMUX |
|------|-------------------|--|----|----|----|----|-------|
| 00 | UNKNOWN | Unknown failure. | X | X | X | X | X |
| 01 | POWERDOWN | IOM was powered down or a loss of 24v power to the IOM was detected | X | X | X | X | X |
| 02 | INVPRGEXEC | Invalid program execution | X | X | X | X | X |
| 04 | RAMCNTERR | RAM contents diagnostics failed | X | X | X | X | X |
| 05 | RAMADRERR | RAM address diagnostics failed | X | X | X | X | X |
| 06 | DPAERROR | IOM was changed while the IOM is powered | X | X | X | X | X |
| 09 | IOLJABBER | IOL jabber circuit fired | X | X | X | X | X |
| 11 | BADPGJMP | Illegal value case control in the IOM firmware | X | X | X | X | X |
| 17 | DMT_TMOUT | Dead man cell timer expired. IOM firmware task scheduling corrupted. | X | X | X | X | X |
| 25 | OPCNTRLHW FAIL | Output control hardware failure | | X | | X | |
| 26 | AOOTPTMUX FAIL | AO output control MUX failure | | X | | | |
| 27 | ASCRCFAIL | Flash contents diagnostics failed | X | X | X | X | X |
| 31 | STCKOVRUN | IOM firmware stack overrun | X | X | X | X | X |
| 32 | WDTTIMEOUT | IOM firmware watchdog timeout | X | X | X | X | X |
| 35 | IOMUSER RESET | User triggered reset | X | X | X | X | X |

18.5 Getting further assistance

The following table lists other documents and sections that contain troubleshooting information for other Experion subsystems.

All of these documents are available from Knowledge Builder. Some documents are also supplied as part of Station Help. For documents that can be accessed directly from this page, click on the link, otherwise look for the document within Knowledge Builder.

| Document/Section | Comments |
|---|---|
| Experion R300 > Reference | There is a separate interface reference for each type of controller other than the Process Controller, for example, the <i>ASEA Interface Reference</i> . |
| | Most of these references contain an interface-specific troubleshooting section. |
| Experion R300 > Reference > TPS Integration Guide > Troubleshooting | Troubleshooting an integrated system that uses Experion 'TPS Integration' option. |
| Experion R300 > Reference > Control Builder Error Codes Reference | Describes error codes generated from within Control Builder. |
| Experion R300 > Troubleshooting and Maintenance > Control Hardware Troubleshooting and Maintenance Guide | The main repository for troubleshooting, maintenance and repair of Process Controllers. |
| Experion R300 > Configuration > DeviceNet Interface Implementation Guide > Troubleshooting DeviceNet Status Failures | Describes error codes generated from DeviceNet Interface Board. |
| Experion R300 > Configuration > Fault Tolerant Ethernet Bridge User's Guide > Service > Troubleshooting | Troubleshooting FTE bridges. |
| Experion R300 > Installation and Upgrades > Fault Tolerant Ethernet Installation and Service Guide > Troubleshooting FTE Nodes | Troubleshooting FTE nodes. |
| Experion R300 > Reference > Honeywell TDC 3000 Data Hiway Interface Reference > TDC error codes and Troubleshooting | Troubleshooting TDC 3000 Hiway problems. |
| Experion R300 > Configuration > Qualification and Version Control System User Guide > QVCS Troubleshooting | Troubleshooting QVCS. |
| Experion R300 > Configuration > SafeView User's Guide > Appendix D - SafeView Error Messages | Describes the meaning of SafeView configuration errors. |
| Experion R300 > Reference > Server Scripting Reference > Server scripting error messages | Describes the meaning of error messages in the server log specific to server scripting. |
| Experion R300 > Configuration > System Management Configuration Guide > Troubleshooting System Management | Describes the meaning of System Management Configuration errors. |
| Experion R300 > Configuration > System Management Configuration Guide > System Event Server > Troubleshooting SES configuration | Describes the meaning of SES Configuration errors. |
| Experion R300 > Configuration > System Management Configuration Guide > System Performance Server > Troubleshooting SPS configuration | Describes the meaning of SPS Configuration errors. |
| Experion R300 > Planning and Design > Planning, Installation, and Service for WS360 | Troubleshooting workstation nodes used in Experion and TPN. |

18.5.1 Guidelines for requesting support

If you cannot resolve a problem by using this guide, you can request support from your Honeywell Solutions Support Center. When requesting support, please supply as many relevant details about the problem by referring to Gathering information for reporting problems to Honeywell to obtain the problem-related information.

19 Series C I/O Galvanically Isolated / Intrinsically Safe Hardware

The procedures in this section are intended to give you the ability to perform basic tasks with the Galvanically Isolated / Intrinsically Safe (GI/IS) module such as installing procedures and considerations.

The GI/IS assembly consists of:

- IOTA board specific for GI/IS usage
- IOM module Series C type
- Isolators Allows for the interfacing of field devices in hazardous areas and/or where galvanic isolation is required. Field wiring is accomplished through plug-in style connectors.
- Terminal plugs connectors that allow the field wiring to be installed



Figure 241: GI/IS board assembly

Related topics

"GI/IS IOTA models" on page 596

19.1 GI/IS IOTA models

The GI/IS IOTAs have with the following features:

- Non-redundancy 6-inch IOTA
- Redundancy 12-inch IOTA
- · High density
- supporting MTL45xx galvanically isolated isolators

The following table lists the GI/IS IOTAs and their corresponding isolators.

Table 158: GI/IS IOTAs and Isolators

| IOTA Model | Size | Redundant | High Density | Channels | Isolator | Isolator |
|--------------------------|-----------|-------------------|--------------|----------|----------|----------|
| | | | | | | quantity |
| ANALOG INPUT | | | | | | |
| CC-GAIX11 | 12 | Yes | No | 16 | MTL4541 | 16 |
| | | | Yes | 16 | MTL4544 | 8 |
| CC-GAIX21 | 6 | No | Yes | 16 | MTL4544 | 8 |
| TEMPERATURE | | | | | | |
| CC-GAIX11 | 12 | Yes | No | 16 | MTL4575 | 16 |
| ANALOG OUTPUT | | 1 | | | | |
| CC-GAOX11 | 12 | Yes | No | 16 | MTL4546C | 16 |
| | | | Yes | 16 | MTL4549C | 8 |
| CC-GAOX21 | 6 | No | Yes | 16 | MTL4549C | 8 |
| DIGITAL INPUT | | 1 | | | | |
| CC-GDIL01 | 12 | Yes | No | 32 | MTL4511 | 16 |
| CC-SDXX01 | 12 | | No | | MTL4511 | 16 |
| Expander | | | | | | |
| CC-GDIL11 | 12 | Yes | No | 32 | MTL4516 | 16 |
| CC-GDIL11 | 12 | Yes | No | 30* | MTL4517* | 15* |
| and Line Fault detection | | | | | | |
| CC-GDIL21 | 6 | No | Yes | 32 | MTL4510 | 8 |
| DIGITAL OUTPUT | | 1 | | | | |
| CC-GDOL11 | 12 | Yes | No | 32 | MTL4521 | 16 |
| CC-SDXX01 | 12 | | No | | MTL4521 | 16 |
| Expander | | | | | | |
| DUMMY ISOLATOR | | • | | <u>'</u> | | <u>'</u> |
| Terminates unused connec | etors. Ca | an be used on all | GI/IS IOTAs. | | MTL4599 | varies |

^{*}When using the MTL4517's only 30 DI channels are available and a MTL4599 is required in channels 31 and 32. In order to see the line fault detect indicator:

- Channel 31 is configured as a DI input for alarms
- Channel 32 is not available for use as an input.

Refer to "Open Wire Detection - DI Channel blocks" for GI-IS limitations and usage.

19.1.1 Line-Fault Detection (LFD) - Digital Input GI/IS only

In the event of an open or shorted circuit in the field wiring, the resistance sensed at the input to the Galvanic Isolation Module is a high value. This permits the readback of the **Digital Input IOMs** to detect the open or shorted field circuit and indicate a wiring problem to the user.

An open wire is defined as a resistance of 7k ohms, or greater and shorted wire is defined as less than 55-ohms resistance.

The following GI/IS isolators support line fault detection for Digital Input:

- MTL4510 has LED indicator on isolator when line fault detection occurs
- MTL4511 has LED indicator on isolator when line fault detection occurs
- MTL4516 has LED indicator on isolator when line fault detection occurs
- MTL4517 has LED indicator on isolator and reports line fault detection back to the system

IF LFD is enabled (through a switch on the device) for any channel two resistors must be installed - a 22k resistor across the switch 680 resistor in series with the power supply lead. This feature detects both open and short circuits.

20 GI/IS Power and Grounding Requirements

The power requirement for the IOTAs is a nominal +24 Vdc.

Related topics

"Grounding and power considerations -GI/IS IOTA boards" on page 600

20.1 Grounding and power considerations -GI/IS IOTA boards

The Series C cabinet allows mounted carriers that support the attachment of the IOTA boards. By making these connections, power and chassis grounding is provided to the IOTA board.

20.1.1 Testing for power for GI/IS



CAUTION

Extreme care should be taken when testing for power at the Series C bus bars. Improper testing can result in an electrical short, which will impact all modules attached to the channel carrier assembly.

Never use a test probe at an unattached IOTA's 24V screw hole. The probe can potentially touch the back channel assembly causing a short.

The following locations are recommended for testing power:

Preferred location if IOTAs are attached

Center of the screw that attaches the IOTA to the 24V bus bar.

Preferred location if IOTAs are NOT attached.

• Center of the screw of top connection terminal for power cable.



WARNING

Testing for power at the Series C bus bars must only be conducted when the area has been verified to be nonhazardous.

20.1.2 Testing for power at the GI/IS IOTA screw

Refer to the **Caution** above at "Testing for power" on page 68

- 1 Insert the test probe at the center of the screw that attaches the IOTA to the 24V power connection.
- 2 Verify that a nominal +24V dc is present.
- 3 This concludes this procedure.

20.1.3 Testing for power at 24V bus bar top terminal for the GI/IS



WARNING

Testing for power at the Series C bus bars must only be conducted when the area has been verified to be nonhazardous.

Refer to Caution above at "Testing for power" on page 68.

- 1 Carefully pull the red cap from the top of the terminal. It remains attached to the power cable.
 - Insert the test probe at the center of the screw to the 24V power terminal.
- 2 Carefully pull the black cap from the top of the terminal. It remains attached to the ground cable. Insert the test probe at the center of the screw to the COM ground terminal.
- 3 Replace the both caps.
- 4 This concludes this procedure.

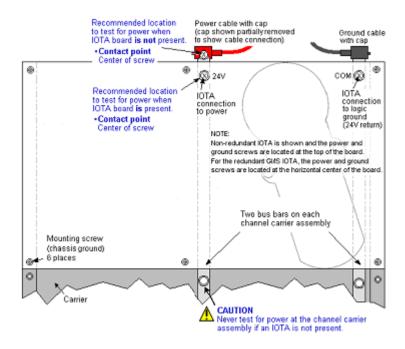


Figure 242: GI/IS Grounding and power connections

21 GI/IS Installation

Related topics

- "GI/IS Shield Connection Options" on page 604
- "Installing the GI/IS IOTA onto the carrier" on page 605
- "Installing the IOM onto the GI/IS IOTA" on page 606
- "Installing the isolator" on page 607
- "Setting Operation mode through Digital Input isolator DIP switches" on page 609
- "MTL4510" on page 610
- "MTL4511 / 4516 / 4517" on page 612
- "Field Wiring Connections" on page 613
- "Screw-terminal wiring" on page 614

21.1 GI/IS Shield Connection Options

Shielded field wiring is not required for any of the Series C GI/IS IOTAs. If shielded field wiring is used, the shield connections must follow these rules:

- 1. The shield must only be terminated at one end. That is, if the shield is terminated at the field device, it must not be terminated in the cabinet, and vice versa.
- 2. If the shield is to be terminated in the cabinet, the connection must be made to the vertical shield bar to the left of the IOTA tray.
- 3. Any shield bars used for GI/IS shields must be used for GI/IS wiring only, and must be connected to a dedicated IS ground system."

21.2 Installing the GI/IS IOTA onto the carrier

The mounting of the GI/IS IOTA is similar to the standard Series C IOTA with the exception that there is an additional set of mounting screws to accommodate the wider GI/IS IOTA. You select the desired mounting location on carrier and then align the mounting holes in the IOTA with screw-hole locations on the carrier.



Tip

The IOMs and isolators should be removed prior to installing the IOTA onto the carrier. This allows for easier installation of the IOTA.

- 6 inch GI/IS IOTA board 6 mounting screws
- 12 inch GI/IS IOTA board 9 mounting screws

When mounting the 12 inch IOTA board, it is recommended to:

- secure the mounting screws on one side (either left or right)
- secure the mounting screws in the middle
- · and then secure the other side



Attention

Securing the corner screws and then the middle screws may cause bowing of the board and impact the alignment of the IOTA board to the carrier holes and is not recommended.

Refer to the following instructions to see how the IOTA is mounted: .

Refer to the following graphic to see how GI/IS IOTA board is mounted: "Figure 242: GI/IS Grounding and power connections".

21.3 Installing the IOM onto the GI/IS IOTA

The mounting of the IOM on a GI/IS IOTA is similar to mounting the IOM on the standard Series C IOTA. Refer to the following instructions to see how the IOM is mounted on the IOTA:

21.4 Installing the isolator

The isolator can be installed with or without the field wiring connected to the terminals. There is no special sequence required for connecting the isolators to the IOTA board, although starting with the upper most available connector allows for ease of making the connection.

Refer to "Preparing the isolator for installation" on page 608



Attention

Make sure the isolator is fully seated on the board by firmly pushing down on it.

- The black side tabs secure the isolator mechanically to the IOTA.
- More importantly, the gray bottom connector on the isolator needs to be fully seated on the IOTA to ensure a true electrical connection.

To install the isolator

- 1 Properly align isolator into connectors.
- **2** Push down firmly on the isolator allowing the connector to be securely seated. The side tabs located on the IOTA lock the isolator in place.
- 3 This concludes this procedure.



Figure 243: Mounting a module onto an IOTA

21.4.1 Precautions

Make sure that all installation work is carried out in accordance with all relevant local standards, codes of practice and site regulations.

Check that the hazardous-area equipment complies with the descriptive system document.

If in doubt, refer to the certificate/catalog for clarification of any aspects of intrinsic safety, or contact MTL or your local MTL representative for assistance.



WARNING

Replacing an isolator must only be performed when the area has been determined to be non-hazardous.



WARNING

When installing MTL4500 Series isolators it is essential to make sure that intrinsically safe and non-intrinsically safe wiring is segregated as required by a nationally accepted authority or as described in IEC 60079-14, ANSI/ISA RP12.6 or DIN VDE-165.



WARNING

When plugging isolators onto an IOTA and hazardous-area terminal plugs onto the isolators, check the identification labels to make sure the items match correctly. It is recommended that the connector is identified by the same tag number as the matching isolator.

21.4.2 Preparing the isolator for installation

Ensure proper isolator is used for the appropriate IOTA.

Refer to GI/IS IOTAs and Isolators table for proper Isolator and IOTA association table.

Attention

MTL4575 - For thermocouple inputs requiring cold junction compensation a blue terminal plug HAZ-CJC hazardousarea (with integrated CJC sensor) is necessary.

Refer to the following: Terminal wiring connections table.

To prepare the isolator for installation

- 1 Terminate hazardous area circuits on blue connector(s).
- 2 Segregate intrinsically safe and non-intrinsically safe cables as required by a nationally accepted authority or as described in PD60079.14:2000 (BS5345 is now obsolescent) ISA RP 12.6 or DIN/VDE-0165.
- 3 This concludes this procedure.

21.4.3 Installing the isolator

The isolator can be installed with or without the field wiring connected to the terminals. There is no special sequence required for connecting the isolators to the IOTA board, although starting with the upper most available connector allows for ease of making the connection.

Refer to "Preparing the isolator for installation" on page 608

Attention

Make sure the isolator is fully seated on the board by firmly pushing down on it.

- The black side tabs secure the isolator mechanically to the IOTA.
- More importantly, the gray bottom connector on the isolator needs to be fully seated on the IOTA to ensure a true electrical connection.

To install the isolator

- 1 Properly align isolator into connectors.
- **2** Push down firmly on the isolator allowing the connector to be securely seated. The side tabs located on the IOTA lock the isolator in place.
- 3 This concludes this procedure.



Figure 244: Mounting a module onto an IOTA

21.5 Setting Operation mode through Digital Input isolator DIP switches

Different modes of operation are available with the DI isolators and these are set using internal DIP switches, accessible through vents on the edge of the module.

₹

Tip

Set switches to the required mode before installation.

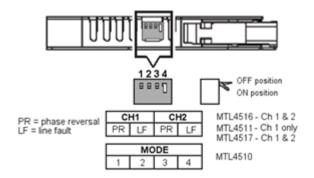


Figure 245: DI module switch setting

To set the DIP switches

- 1 Toggle the appropriate switch (refer to the DIP switch setting tables) using a small slotted screw-driver.
- 2 This concludes this procedure.

 See the following tables that define the appropriate DIP switch settings for the various Digital Input isolators.

21.6 MTL4510

This four-channel digital isolator has solid state output switches in a safe-area that respond to input switches in a hazardous area. The way they respond depends upon the switch settings.

Table 159: MTL4510 isolator DIP switch settings

| Mode | o/p 1 | SW1-4 | o/p 2 | o/p 3 | o/p 4 | I/p type |
|------|-------|----------|---------|---------|---------|-----------------|
| 0 | 0000 | chA | chB | chC | chD | switch |
| 1 | 0001 | chA rev. | chB | chC | chD | |
| 2 | 0010 | chA | chB rev | chC | chD | |
| 3 | 0011 | chA | chB | chC rev | chD | |
| 4 | 0100 | chA | chB | chC | chD rev | |
| 5 | 0101 | chA rev | chB | chC rev | chD | |
| 6 | 0110 | chA | chB rev | chC | chD rev | |
| 7 | 0111 | chA rev | chB rev | chC rev | chD rev | |
| 8 | 1000 | chA | chB | chC | chD | prox detector + |
| 9 | 1001 | chA rev | chB | chC | chD | LFD |
| 10 | 1010 | chA | chB rev | chC | chD | |
| 11 | 1011 | chA | chB | chC rev | chD | |
| 12 | 1100 | chA | chB | chC | chD rev | |
| 13 | 1101 | chA rev | chB | chC rev | chD | |
| 14 | 1110 | chA | chB rev | chC | chD rev | |
| 15 | 1111 | chA rev | chB rev | chC rev | chD rev | |

Table 160: Module input/output operation

| Operation | Input value | Direct acting | Reverse acting | LFD | LED | Relay/ output | MTL4511/MTL4717 LFD relay |
|--------------|-------------|---------------|----------------|-----|-----|----------------------|------------------------------|
| Normal | <1.2mA | On | - | On | Off | De-energized / On | De-energized |
| | >2.1mA | On | - | On | On | Energized / Off | De-energized |
| | <1.2mA | - | On | On | On | Energized / Off | De-energized |
| | >2.1mA | - | On | On | Off | De-energized / On | De-energized |
| Broken line | <50uA | On | - | On | Off | De-energized / On | Energized |
| | <50uA | - | On | On | Off | De-energized / On | Energized |
| | <50uA | On | - | Off | Off | De-energized / On | De-energized |
| | <50uA | - | On | Off | On | Energized / Off | De-energized |
| Shorted line | 6.5mA | On | - | On | Off | De-energized / On | Energized |
| | 6.5mA | - | On | On | Off | De-energized / On | Energized |

| Operation | Input value | Direct acting | Reverse acting | LFD | LED | Relay/ output | MTL4511/MTL4717 LFD relay |
|-----------|-------------|---------------|----------------|-----|-----|----------------------|------------------------------|
| | 6.5mA | On | - | Off | On | Energized / Off | De-energized |
| | 6.5mA | - | On | Off | Off | De-energized / On | De-energized |

21.7 MTL4511 / 4516 / 4517

For switch sensor inputs, with LFD selected, make sure resistors (22k ohms and 680 ohms) are fitted.

Table 161: MTL4511 isolator DIP switch settings

| Mode | | Functionality |
|------|------|------------------------------------|
| 0 | 0000 | Phase reversal and LFD not enabled |
| 1 | 1000 | Phase reversal enabled |
| 2 | 0100 | Line Fault Detection enabled |

Table 162: MTL4516 isolator DIP switch settings

| | Mode | Functionality | | | |
|---|------|------------------------------------|--|--|--|
| 0 | 0000 | Phase reversal and LFD not enabled | | | |
| 1 | 0001 | Ch1 Phase reversal enabled | | | |
| 2 | 0010 | th1 Line Fault Detection enabled | | | |
| 3 | 0100 | Ch2 Phase reversal enabled | | | |
| 4 | 1000 | Ch2 Line Fault Detection enabled | | | |

Table 163: MTL4517 isolator DIP switch settings

| Mode | | Functionality |
|------|------|------------------------------------|
| 0 | 0000 | Phase reversal and LFD not enabled |
| 1 | 0001 | Ch1 Phase reversal enabled |
| 2 | 0010 | Ch1 Line Fault Detection enabled |
| 3 | 0100 | Ch2 Phase reversal enabled |
| 4 | 1000 | Ch2 Line Fault Detection enabled |

21.8 Field Wiring Connections

The GI/IS IOTAs do not have field terminal connectors mounted directly on the IOTAs; instead, field wires are connected to screw-clamp terminals that mate with the connector on the individual Galvanic Isolation module.



Tip

The terminal plugs are keyed to be inserted in specific openings in the isolator. The label on the terminal plug gives an indication into which isolator openings the plug fits.



Attention

When using crimp ferrules for the hazardous and non-hazardous (safe) signal connectors the metal tube length should be 12mm and the wire trim length 14mm.

To install the terminal plug into the isolator

- 1 Align the terminal plug's openings and alignment tabs to match the pins and openings on the isolator. The label on the terminal plug identifies into which isolator openings it must be inserted.
- 2 Firmly press the terminal plug in the isolator ensuring a snug fit.
- 3 This concludes this procedure.

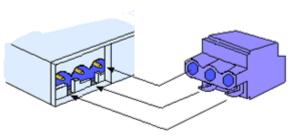


Figure 246: Inserting the terminal plug into the isolator

21.8.1 Isolator plug-in capability

The isolator connector's plug-in capability allows:

- for the field wiring to be connected to the terminal plug while the terminal plug is not connected to the isolator. This allows for a possibly easier field wire-to-terminal plug process.
- replacement of the isolator and retaining the field wiring connection to the terminal plug. After the isolator is replaced, the terminal plug can be re-inserted into the new isolator.

21.8.2 Isolator removal



WARNING

Replacing an isolator must only be performed when the area has been determined to be non-hazardous.

A failed isolator or GI/IS IOTA is replaced simply by unplugging the field wire terminal plug on the isolator, then removing and replacing the isolator/IOTA. The individual wires do not have to be disconnected from the terminal plug.

21.8.3 Screw-clamp terminals

Compression-type terminal connectors are specified for the terminal plugs.

21.9 Screw-terminal wiring

The following table defines the layout of the terminal plugs that support their corresponding isolators.

Table 164: Terminal wiring connections

| Isolator | 2 | 3 | Ref. | Terminal wiring |
|--|------|------|------|--|
| | wire | wire | pt. | |
| MTL4510 - four channel, multifunctional digital | X | | | Two-wire field device |
| MTL4511 - single channel, LFD | X | | | connection |
| MTL4516 - two channel, LFD | X | | | Only used |
| MTL4517 - two channel, LFD and phase reversal | X | | | with MTL4510 |
| MTL4521 - loop-powered, IIC | X | | | |
| MTL4541 - single channel | X | X | | Three-wire field device |
| MTL4544 - two channel | X | X | | connection |
| MTL4546C - single channel, HART valve positioners, LFD | X | | | 000 |
| MTL4549C - two channel, HART valve positioners, LFD | X | | | HAZ-CJC connector |
| MTL4575 - single channel, temperature converter | | | X | Junction compensation terminal shielded |
| MTL4599 - dummy isolator | n/a | n/a | n/a | Reference point senses temperature of wire |

22 GI/IS IOTA Pinouts

Related topics

"GI/IS Analog Input IOTA Model CC-GAIX11" on page 616

"GI/IS Analog Input IOTA Model CC-GAIX21" on page 618

"Analog Output GI/IS IOTAs" on page 623

"GI/IS Analog Output IOTA Model CC-GAOX11" on page 624

"GI/IS Analog Output IOTA Model CC-GAOX21" on page 626

"24 Vdc Digital Input GI/IS IOTAs" on page 628

"GI/IS Digital Input IOTA Model CC-GDIL01" on page 629

"GI/IS Digital Input IOTA Model CC-GDIL11" on page 631

"GI/IS Digital Input IOTA Model CC-GDIL21" on page 634

"GI/IS Digital Output IOTA Model CC-GDOL11" on page 637

"GI/IS Digital I/O Expander Model CC-SDXX01" on page 641

22.1 GI/IS Analog Input IOTA Model CC-GAIX11

The model CC-GAIX11 Analog Input IOTA accommodates up to sixteen 4-20 mA input signals. This IOTA supports redundancy and allows galvanically isolated inputs from the following isolators:

- MTL4541 single channel 4-to-20 mA isolator with HART®
- MTL4544 dual channel 4-to-20 mA isolator with HART®
- MTL4575 thermocouple/RTD isolating converter with 4-to-20 mA output (or something similar).
- MTL4599 dummy, terminates unused connectors

22.1.1 CC-GAIX11 Analog Input IOTA

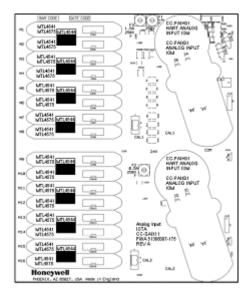


Figure 247: CC-GAIX11 Analog Input IOTA

22.1.2 CC-GAIX11 Analog Input IOTA connection diagram

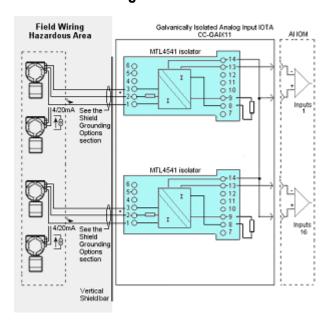


Figure 248: CC-GAIX11 Analog Input IOTA connection diagram

22.2 GI/IS Analog Input IOTA Model CC-GAIX21

The model CC-GAIX21 Analog Input IOTA accommodates up to sixteen high level dc signals. This IOTA does not support redundancy and allows galvanically isolated inputs from the MTL4544 (two channel) isolator.

- MTL4544 dual channel 4-to-20 mA isolator with HART®
- MTL4599 dummy, terminates unused connectors

Refer to "GI/IS IOTA models" on page 596 for a complete list of supported Series C IOTA and their corresponding isolators.

22.2.1 CC-GAIX21 Analog Input IOTA

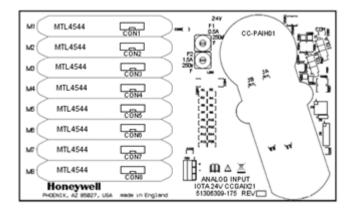


Figure 249: CC-GAIX21 Analog Input IOTA

22.2.2 CC-GAIX21 Analog Input IOTA connection diagram

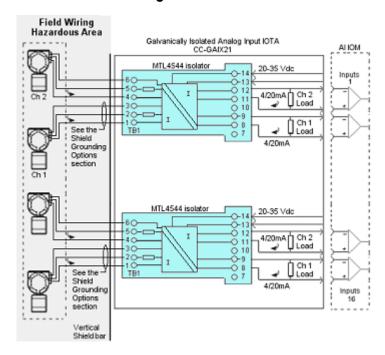


Figure 250: CC-GAIX21 Analog Input IOTA connection diagram

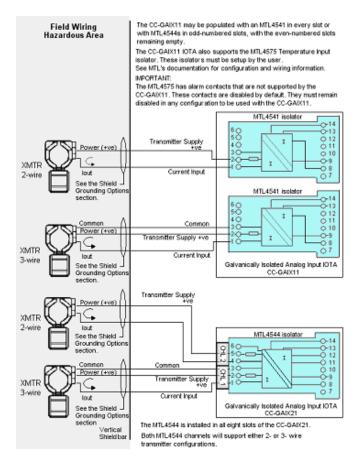


Figure 251: Transmitter Field Wiring to CC-GAIX11/GAIX21 IOTAs

22.2.3 Analog Input supported isolators

The following table defines important distinctions between the various isolators and the Analog Input IOTAs they support.

Table 165: Al IOTAs and their supporting isolators

| Item | MTL4541 | MTL4544 | MTL4575 |
|------------------------------------|--|--|--|
| | CC-GAIX11 | CC-GAIX11 | CC-GAIX11 |
| | | CC-GAIX21 | |
| Maximum current | 51mA at 24V | 95mA at 24V | 60mA at 24V |
| consumption (with 20mA signal) | | | 50mA at 20V |
| J.B.I | | | 35mA at 35V |
| Maximum power dissipation | 0.7W at 24V | 1.4W at 24V | 0.7W at 24V |
| within isolator (with 20mA signal) | | | 1.2W at 35V |
| Isolation | 250V ac between hazardous | 250V ac between | Three port isolation |
| | area and safe/power supply circuits | hazardous area and safe/ power supply circuits | 250V ac between safe- and hazardous-area circuits. Input |
| | 100V ac between safe and power supply circuits | 100V ac between safe and power supply circuits | circuit's floating. |

| Item | MTL4541 | MTL4544 | MTL4575 |
|--|---|---|--|
| | CC-GAIX11 | CC-GAIX11 | CC-GAIX11 |
| | | CC-GAIX21 | |
| Temperature drift | <0.8μA/degrees C | <0.8μA/degrees C | Inputs: |
| | | | mV/THC: ±0.003% of input value/°C |
| | | | THC line resistance: 600Ωmax |
| | | | RTD: ±7mΩ/°C |
| | | | Output: ±0.6μA/°C |
| Safety description | Terminals 2 to 1 and 3: | Terminals 2 to 1 and 3, | Terminals 5 and 6 |
| | Vo=28V Io=93mA Po=651mW Um = 253V rms or dc Terminals 1 to 3: | and 5 to 4 and 6: | Non-energy-storing apparatus ≤1.2V, ≤0.1A, ≤20µJ and ≤25mW.Can be connected without further certification |
| | | Vo=28V | |
| | | Io=93mA | |
| | | Po=651mW | into any IS loop with an |
| | | Um = 253V rms or dc | open-circuit voltage not more than 10V. |
| | Non-energy-storing apparatus ≤1.2V, ≤0.1A, ≤20µJ and | Terminals 1 to 3 and 4 to 6 | Terminals 1 and 2 |
| ≤25mW;ca without fur any IS loop | ≥1.2 V, ≥0.1 A, ≥20µ and ≤25mW; can be connected without further certification into any IS loop with an open-circuit voltage <28V | Non-energy-storing apparatus ≤1.2V, ≤0.1A, ≤20µJ and ≤25mW; can be connected without further certification into any IS loop with an open-circuit voltage <28V | Vo=7.2V Io=8mA Po=144mW Um = 253V rms or = dc |
| | | | Configuration socket Vi=11.2V |
| | | | Ii=12mA |
| | | | Pi=280mW |
| | | | Vo=7.2V |
| | | | Io=14.5mA |
| | | | Po=26mW |

22.2.4 MTL4541 / 4544

The following isolators are available for Analog Input GI/IS IOTAs.

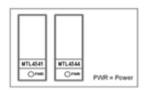


Figure 252: Analog Input - MTL4541 and MTL4544 isolator LED indicators

22.2.5 MTL4575

Before placing the isolator into operation, the interface unit must be configured for the particular application

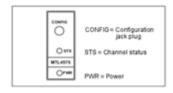


Figure 253: Temperature - MTL4575 isolator LED indicators

22.2.6 Testing Temperature Converter- MTL4575

- 1. Connect a link between terminals 1 and 5.
- 2. Connect 2-wire transmitter between terminals 2(+ve) and 4(-ve). Both outputs will now repeat the current in the transmitter loop.

(Note: HART data is transferred through channel 1)

3. This completes this procedure.

The following table lists the isolator's LED status and description.

 LED status
 Description

 ON
 Unit working normally

 Slow flash
 Output of 1mA, module in low alarm or downscale drive

 Fast flash
 Output of 21mA, module in high alarm or upscale drive

 Off
 No power to unit

Table 166: MTL4575, power and status information

22.2.7 Default configuration

Unless ordered differently, every MTL4575 module is supplied with the following default configuration.

- Input Type K thermocouple
- Linearization enabled
- · Units degrees C
- · CJ Compensation enabled
- Damping value 0 seconds
- Smoothing value 0 seconds
- Output zero 0 degrees C
- Output span 250 degrees C
- · Tag and description fields blank
- Open circuit alarm set high (upscale)
- Transmitter failure alarm set low (downscale)
- CJ failure alarm set low (downscale)
- Line frequency 50Hz

22.2.8 Configuration using PCS45/PCL45

The PCS45 software, used in conjunction with PCL45 serial link, is the method to configure the MTL4575 isolators. Instructions are contained within the configuration software.

Refer to the following: "PCS45 Configuration Software".

22.2.9 Field Wiring Input Signals

Each Galvanic Isolation Module on the AI IOTA provides a floating dc source for energizing conventional 2-wire or 3-wire, 4-20 mA transmitters. The Galvanic Isolation Module accurately converts the input current into a 1 to 5 volt output signal to the associated IOM.

22.2.10 Field Wiring Input Signals

Each Galvanic Isolation Module on the AI IOTA provides a floating dc source for energizing conventional 2-wire or 3-wire, 4-20 mA transmitters. The Galvanic Isolation Module accurately converts the input current into a 1 to 5 volt output signal to the associated IOM.

22.3 Analog Output GI/IS IOTAs

The galvanically isolated Analog Output (AO) IOTAs isolate up to sixteen 4-20 mA signals that can drive current-to-pressure (I/P) transducers, position actuators, or any load between 90 and 800 ohms from the associated Analog Output IOM. Additionally, bi-directional HART® communications with 4-20mA field devices and HART® hand-held communicators are supported.

The GI/IS Analog Output (AO) IOTAs provide the following features:

- An Intrinsically Safe (IS) interface directly to hazardous-area processes
- Galvanic Isolation (GI) eliminating the high integrity ground required for Zener barriers
- Compact design for reduced cabinet space
- A reduced total installed cost compared to separate Zener barrier or isolator approaches
- The plug-in MTL isolators on the IOTAs, incorporate both the galvanic isolation and intrinsic safety functions and additionally provide:
 - Single loop integrity (MTL4546C)
 - Ease of maintenance
 - Simplified wiring, because hazardous field wiring can be brought directly to the isolators on the IOTAs, eliminating the need for separate IS barriers

Two models are available:

CC-GAOX11 - Redundant Analog Output IOTA

CC-GAOX21 - Non-Redundant Analog Output IOTA

22.4 GI/IS Analog Output IOTA Model CC-GAOX11

The model CC-GAOX11 Analog Output IOTA provides up to sixteen 4-20 mA output channels. This IOTA supports redundancy and accepts the following GI/IS isolators:

- MTL4546C one channel HART® with open wire detection
- MTL4549C two channel HART® with open wire detection
- MTL4599 dummy, terminates unused connectors

Refer to "GI/IS IOTA models" on page 596 for a complete list of supported Series C IOTA and their corresponding isolators.

22.4.1 CC-GAOX11 Analog Output IOTA

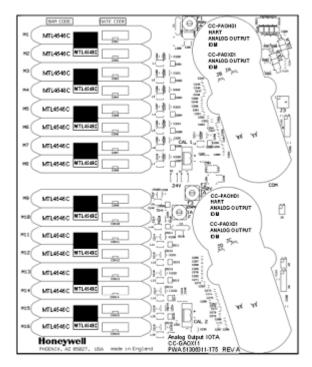


Figure 254: CC-GAOX11 Analog Output IOTA

22.4.2 CC-GAOX11 Analog Output IOTA connection diagram

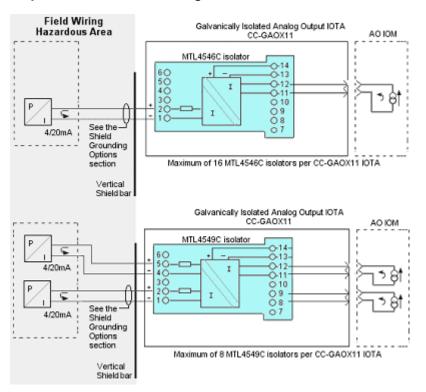


Figure 255: CC-GAOX11 Analog Output IOTA connection diagram

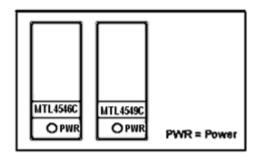


Figure 256: Analog Output - MTL4546C and MTL4549C LED indicators

22.5 GI/IS Analog Output IOTA Model CC-GAOX21

The model CC-GAOX21 Analog Output IOTA provides up to sixteen 4-20 mA output channels. This IOTA does not support redundancy and accepts only the dual-channel GI/IS isolator below:

- MTL4549C two channel HART® with open wire detection.
- MTL4599 dummy, terminates unused connectors

Refer to "GI/IS IOTA models" on page 596 for a complete list of supported Series C IOTA and their corresponding isolators.

22.5.1 CC- GAOX21 Analog Output IOTA

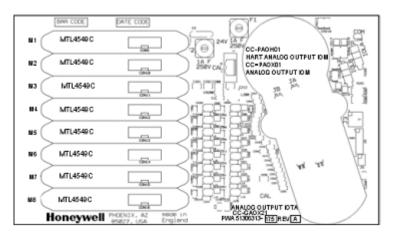


Figure 257: CC-GAOX21 Analog Output IOTA

22.5.2 CC-GAOX21 Analog Output IOTA connection diagram

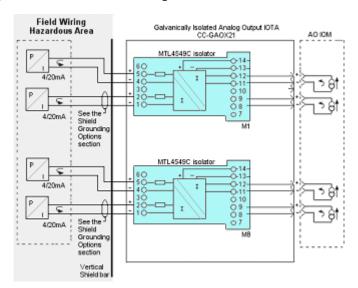


Figure 258: CC-GAOX21 Analog Output IOTA connection diagram

22.5.3 Analog Output supported isolators

The following table defines important distinctions between the various isolators and the Analog Output IOTAs they support.

Table 167: AO IOTAs and their supporting isolators

| Item | MTL4546C | MTL4549C | |
|--|---|---|--|
| | CC-GAOX11 | CC-GAOX11 | |
| | | CC-GAOX21 | |
| Power requirement, Vs | 35mA at 24V | 70mA at 24V | |
| Maximum power dissipation within isolator (with 20mA signal) | 0.8W at 24V | 1.6W at 24V | |
| Isolation | 250V ac between hazardous area and safe/power supply circuits | 250V ac between hazardous area and safe/ power supply circuits | |
| Temperature drift | <1.0μA/degrees C | <1.0μA/degrees C | |
| Safety description | Vo=28V | Vo=28V | |
| | Io=93mA | Io=93mA | |
| | Po=651mW | Po=651mW | |
| | Um = 253V rms or dc | Um = 253V rms or dc | |

22.6 24 Vdc Digital Input GI/IS IOTAs

The galvanically isolated Digital Input (DI) IOTAs isolate up to thirty-two 24V signals that allows galvanically isolated inputs from-switches and proximity detectors.

22.6.1 Input signal phase and IOTA features

The phase of the input signals is selectable on the model CC-GDIL01, CC-GDIL11 and CC-GDIL21 IOTAs, allowing the alarm condition to be chosen for either state of the sensor. This is accomplished with two switches, one for each input on the top of the galvanic isolators.

22.7 GI/IS Digital Input IOTA Model CC-GDIL01

The model CC-GDIL01 Digital Input IOTA accommodates up to thirty-two 24V high level dc signals. This IOTA supports redundancy and allows galvanically isolated inputs from the following isolators:

- MTL4511 one channel with line fault detection
- MTL4599 dummy, terminates unused connectors

Refer to "GI/IS IOTA models" on page 596 for a complete list of supported Series C IOTA and their corresponding isolators.

22.7.1 CC-GDIL01 Digital Input IOTA

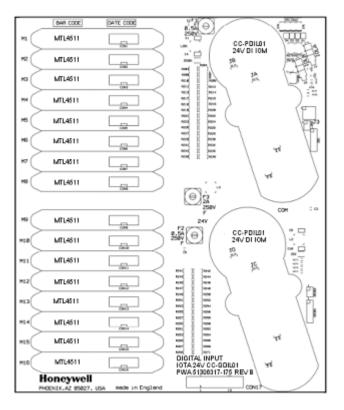


Figure 259: CC-GDIL01 Analog Output IOTA

22.7.2 CC-GDIL01 Digital Input IOTA connection diagram

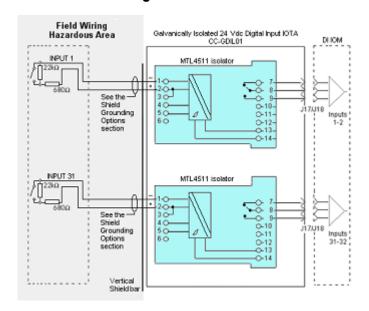


Figure 260: CC-GDIL01 Analog Output IOTA connection diagram

22.8 GI/IS Digital Input IOTA Model CC-GDIL11

The model CC-GDIL11 Digital Input IOTA accommodates up to thirty-two 24V high level dc signals. This IOTA supports redundancy and allows galvanically isolated inputs from the following isolators:

- MTL4516 two channel with line fault detection
- MTL4517 two channel with line fault detection and phase reversal
- MTL4599 dummy, terminates unused connectors

Refer to "GI/IS IOTA models" on page 596 for a complete list of supported Series C IOTA and their corresponding isolators.

The model CC-GDIL11 Digital Input (DI) IOTA accommodates up to 32 switch or proximity detector inputs from a hazardous area, isolates the signals, and presents them to the associated 24 Vdc Digital Input IOM in a safe area. The IOTA is similar to the model CC-GDIL01 IOTA, except the phase of the galvanic isolator's input to output signals are not selectable on the module, and the module's signal outputs are solid-state, instead of contacts. In addition, the IOTA has no auxiliary output connector.

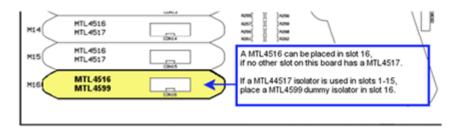


Figure 261: CC-GDIL11 DI and isolator usage

22.8.1 CC-GDIL11 Digital Input IOTA

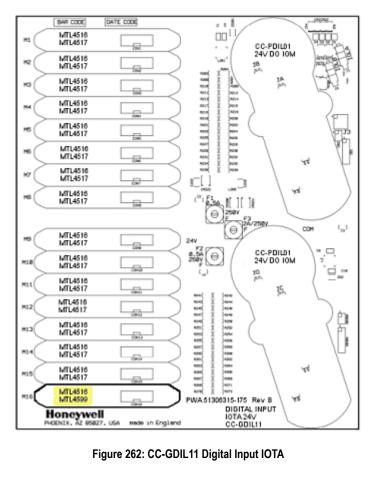


Figure 262: CC-GDIL11 Digital Input IOTA

22.8.2 CC-GDIL11 Digital Input IOTA connection diagram

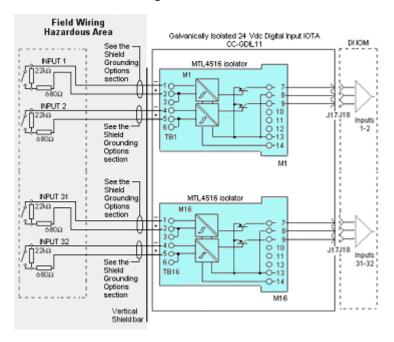


Figure 263: CC-GDIL11 Digital Input IOTA connection diagram

22.9 GI/IS Digital Input IOTA Model CC-GDIL21

The model CC-GDIL21 Digital Input IOTA accommodates up to thirty-two 24V high level dc signals. This IOTA does not support redundancy and allows galvanically isolated inputs from the following isolators:

- MTL4510 four channel multi-function digital input with line fault detection
- MTL4599 dummy, terminates unused connectors

22.9.1 CC-GDIL21 Digital Input IOTA

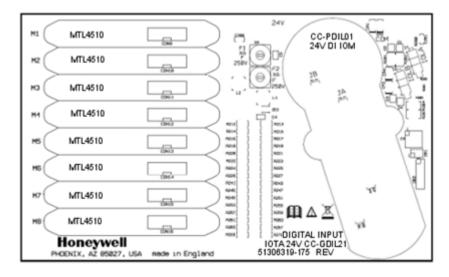


Figure 264: CC-GDIL21 Digital Input IOTA

22.9.2 Model CC-GDIL21 Digital Input IOTA connection diagram

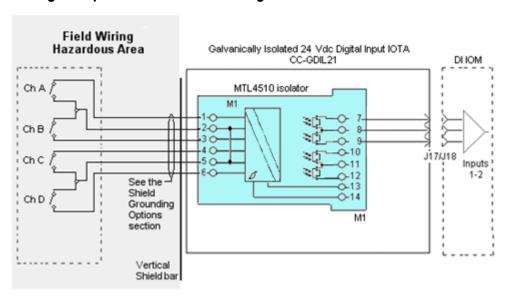


Figure 265: CC-GDIL21 Digital Input IOTA connection diagram

22.9.3 Digital Input supported isolators (MTL4510 / 4511 / 4516 / 4517)

If an internal fault is detected, all outputs and channel LEDs turn off and the red Fault LED turns on. LEDs are provided to indicate the output status (STS), a line fault (LFD) and power supply status (PWR).

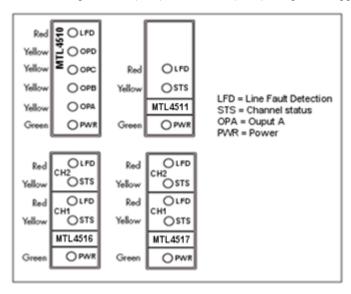


Figure 266: Digital Input - MTL451x isolator LED indicators

22.9.4 Digital Input isolator characteristics

The following table defines important distinctions between the various isolators and the Digital Input IOTAs they support.

| Item | MTL4510 | MTL4511 | MTL4516 | MTL4517 |
|---|--|---|---|---|
| | CC-GDIL21 | CC-GDIL01 | CC-GDIL11 | CC-GDIL11 |
| | | CC-SDXX01 | | |
| Maximum current | 30mA at 24V | 35mA at 20V | 40mA at 20V | 40mA at 20V |
| consumption (with 20mA signal) | | 30mA at 24V | 35mA at 24V | 35mA at 24V |
| 20mm Signar) | | 20mA at 35V | 30mA at 35V | 30mA at 35V |
| Maximum power dissipation within isolator (with 20mA signal) | 0.88W at 24V | 0.72W at 24V | 0.84W at 24V | 0.84W at 24V |
| Isolation | 250V ac between power supply , hazardous-area and safe-area | 250V ac or dc between power supply , hazardous-area circuits and relay outputs | 250V ac or dc between power supply , hazardous-area circuits and relay outputs | 250V ac between safe- and hazardous- area circuits. |

Table 168: DI IOTAs and their supporting isolators

| Item | MTL4510 | MTL4511 | MTL4516 | MTL4517 |
|--------------------|----------------|----------------|----------------|---------------|
| | CC-GDIL21 | CC-GDIL01 | CC-GDIL11 | CC-GDIL11 |
| | | CC-SDXX01 | | |
| Safety description | Vo = 10.5V | Vo = 10.5V | Vo = 10.5V | Vo = 10.5V |
| | Io = 14mA | Io = 14mA | Io = 14mA | Io = 14mA |
| | Po = 37mW | Po = 37mW | Po = 37mW | Po = 37mW |
| | Um = 253V rms | Um = 253V rms | Um = 253V rms | Um = 253V rms |
| | or dc | or dc | or dc | or dc |

22.10 GI/IS Digital Output IOTA Model CC-GDOL11

The model CC-GDOL11 24 Vdc Digital Output (DO) IOTA can drive up to 32 channels in a hazardous area. The load can be a solenoid or an alarm, as well as a non-energy storing 'simple apparatus,' such as an LED.

This IOTA allows galvanically isolated inputs from the following isolators:

• MTL4521 - loop-powered, IIC

22.10.1 CC-GDOL11 Digital Output IOTA

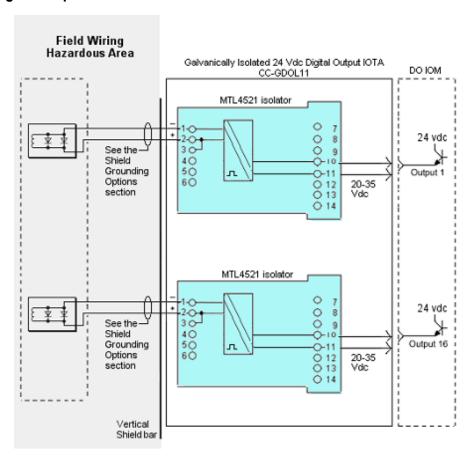


Figure 267: CC-GDOL11 Digital Output IOTA assembly layout

Digital Output supported isolator characteristics (MTL4521)

The following table defines basic features for the MTL4521 DI isolator. A 24V logic signal applied across terminals 8 and 9 allows the solenoid/alarm to be operated by the control input. If the logic signal is disconnected, the solenoid/alarm is off.

Table 169: DO IOTA and its supporting isolator

| Item | MTL4521 |
|---|-------------|
| | CC-GDOL11 |
| Maximum current consumption | 90mA at 24V |
| Maximum power dissipation within isolator | 1.4W at 24V |

| Item | MTL4521 |
|--------------------|----------------------------------|
| | CC-GDOL11 |
| Safety description | Vo=25V |
| | Io=147mA |
| | Po=919mW |
| | Um = 253V rms or dc |
| LED status | On = Output state 12.8v at 48 mA |

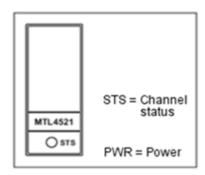


Figure 268: Digital Output - MTL4521 isolator LED indicators

22.10.2 CC-GDOL11 Digital Output IOTA

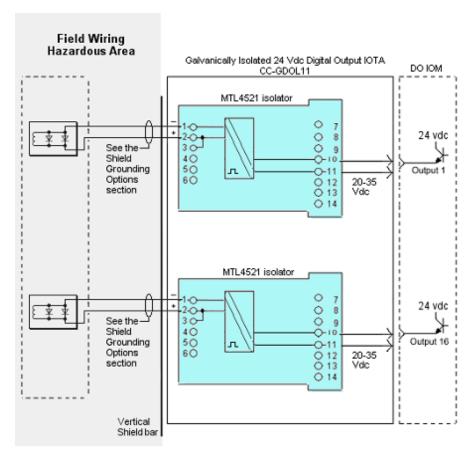


Figure 269: CC-GDOL11 Digital Output IOTA assembly layout

Digital Output supported isolator characteristics (MTL4521)

The following table defines basic features for the MTL4521 DI isolator. A 24V logic signal applied across terminals 8 and 9 allows the solenoid/alarm to be operated by the control input. If the logic signal is disconnected, the solenoid/alarm is off.

Table 170: DO IOTA and its supporting isolator

| Item | MTL4521 |
|---|----------------------------------|
| | CC-GDOL11 |
| Maximum current consumption | 90mA at 24V |
| Maximum power dissipation within isolator | 1.4W at 24V |
| Safety description | Vo=25V |
| | Io=147mA |
| | Po=919mW |
| | Um = 253V rms or dc |
| LED status | On = Output state 12.8v at 48 mA |

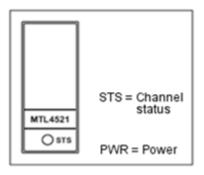


Figure 270: Digital Output - MTL4521 isolator LED indicators

22.11 GI/IS Digital I/O Expander Model CC-SDXX01

The GI/IS Digital Input/Output Expander board is displayed below. There are two versions of the CC-SDXX01 IOTA board available. The change between the two versions is solely based on changing the labels corresponding to the channels:

- Rev A board shows labels M1 through M16
- Rev B board shows labels M17 through M32

This IOTA allows galvanically isolated inputs from the following isolators:

- MTL4511 one channel with line fault detection
- MTL4521 loop-powered, IIC
- MTL4599 dummy, terminates unused connectors

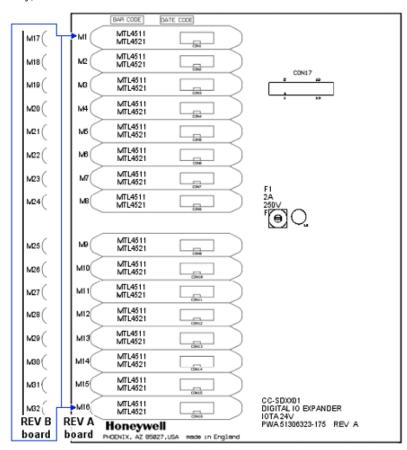


Figure 271: CC-SDXX01 Digital Output IOTA assembly layout

23 PCS45 Configuration Software

The PC-Configuration software (PCS45) allows the configuration of the MTL4575 Temperature converter isolator. Data is transmitted from the PC to the temperature converter through the PC-link PCL45 (USB).



WARNING

Not FM or CSA approved

The MTL PCL45USB pc link to the MTL4575 Temperature Converter is not approved by either FM or CSA. Therefore, the device **cannot** be used in North America (or those locations requiring FM or CSA) unless both:

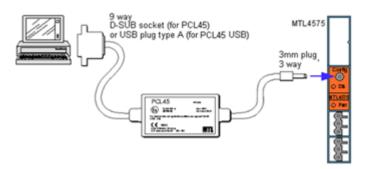
- the area where the cabinet is located (or the 4575 Converter) and
- the field devices connected to the 4575 converter are verified to be nonhazardous.

ATEX Certified

The PCL45USB is ATEX certified; however, the certification only applies to the outputs of the link that allow it to be connected to the 4575 with field wiring connections installed (and the field devices can be located in Zone 0 or Zone 1).

The ATEX certification for the link:

- does not allow the link to be located in a Zone 2 locations
- the cabinet, and or the 4575, must be within a verified nonhazardous location for the link to be connected to the 4575 Converter.



Parameters can be configured, for example sensor type, measuring range and alarm signals. These can then be saved and later used to configure other MTL4575s isolators.

For diagnostic purposes, the software allows the user to:

- look at the input and output values or
- monitor parameters over a period of time

Example: The output can be set to various currents, without affecting the input, allowing the safe area equipment to be checked or calibrated.

Operating PCS45 in Demo mode maintains all the functionality of the software but requires no connection to a temperature converter.

Related topics

"PCS45 Operating Modes" on page 645

"Troubleshooting the PSC45 software" on page 654

23.1 PCS45 Operating Modes

The following operating modes are selectable.

| Mode | Description |
|-------------------|--|
| Offline | No connection is made between the software and the isolator. Therefore, changes in the configuration of the software will not be downloaded to the isolator. |
| Online | A connection is made between the software and the isolator. Any changes made to the configuration of the isolator are downloaded immediately to that isolator. The data seen in the software is identical to that in the isolator. |
| Demo | The 'on-line' operation and the data exchange with the transmitter are simulated. This mode can be used for training purposes. |
| Edit | In the 'off-line' operation, the configuration data can be edited and saved into a file on the hard drive or disk. This mode can be used in order to generate the configuration for several transmitters in the project phase. |
| Restricted access | The configuration details for the isolator can only be viewed or printed. Editing of the configuration settings is not allowed. Files can be loaded into the software, but when files are saved they have the filename 'DEMO.D45," this cannot be altered. |
| Full access | Full access is required when configuration changes to the isolator are to be made. To save the configuration file, any filename can be used. |
| | Note: The software doesn't always indicate the operational mode it is currently in. |

23.1.1 Data format

PCS45 software saves configuration data as a .D45 file extension.

23.1.2 Data flow

The PCS45 software creates and manages a copy of the transmitter's configuration data string on the computer and controls the exchange of this data between the computer/disk and the transmitter. The data flow between the copies of this data structure depends upon the operational mode.

Within the PCS45 application the following occurs:

- Various displays within the application enable the contents of these data structures to be viewed and altered.
- After a change has been made and accepted the data values are tested before the data is transferred to the data structure.
- A copy of the configuration data held in the software can be saved into or accepted from a file at any time, but the operation mode will always change to 'off-line.'
 - In the 'off line' mode, no data is automatically transferred between the software and the temperature converter.
- When changes have been accepted in the 'online' operation mode, data is transmitted straight into the non-volatile memory of the temperature converter.
 - If there are any errors during this data transfer the operation mode changes to 'off-line' because coherent configurations cannot be expected.
- In the demo mode, data is not transferred to the temperature converter, and any exchange is simulated.

23.1.3 Temperature converter

The temperature converter takes an mV or signal from either a thermocouple or RTD in hazardous area, and converts this to a 4/20mA signal in the safe area.

The isolator is programmable by the PCS45 software and PCL45 hardware, which configures input types, output spans, alarms, etc.

23.1.4 PC-link - PCL45 and PCL45USB

The PC-link:

- Allows data to be exchanged between the PC and the Temperature converter.
- Is ATEX certified. This allows the configuration of the MTL4575 isolator while remaining part of the hazardous area circuit.

The PCL45USB device:

• Is powered from the computer and is ready for communication immediately after the physical connection has been established.

The PCL45 device:

- Is powered from the RS232 and from the Temperature converter data lines.
- The serial port on a computer must be able to supply \pm 8Vat 3mA.



Tip

A minimum connection time of 15 seconds has to be allowed before data can be exchanged between the PC and the isolator.

23.1.5 Export and Print file

The export and print file is composed of the current isolator configuration settings. The following is an example of an export and/or print file.

| Converter type: | MTL5073 |
|---------------------------|-------------|
| Manufacturer's ident. | MTL Group |
| Software revision | 7 |
| Hardware revision | 7.000 |
| Tag name | DEMO |
| Descriptor | DESCRIPTION |
| Date | 15.12.99 |
| Input type | E type THC |
| Process units | °C |
| Linearization | on |
| Cold Jm. Comp. | on |
| Point 4mA | 10.0 °C |
| Point 20mA | 200.0 °C |
| Damping time constant | 0.0 s |
| Smoothing time constant | 2 s |
| Filter frequency | 50 Hz |
| Open circuit alarm level | off |
| Cold Jm failure alarm | off |
| Transmitter failure alarm | off |
| Created on: | 21/8/00 |

23.1.6 Damping and smoothing

Damping and smoothing are both filter functions, which are configurable, and have different effects on the way the input signal is processed.

- Damping causes conventional single-pole, low-pass filtering that is similar to an R-C network.
- Smoothing causes a more 'intelligent' damping where small changes (noise) are heavily suppressed and large (tendency) changes are processed normally.

Although, high damping values will greatly suppress noise and make the output signal stable, it causes a slow response time. The smoothing function avoids this disadvantage by removing the filtering while there are very large signal changes on the input.

Higher damping values are recommended for slow input signals requiring high levels of stability, while fast signals require lower damping values. If in doubt, some experimentation will yield the best results.

23.1.7 Alarm signals

Alarm signals can be configured to drive analog output currents outside the working range.

- The low alarm changes the output current to 1.00 mA and
- The **high** alarm changes the current to 21.00mA.

There are three types of fault that trigger an alarm response:

- O/C Alarm alarm is signaled if an open circuit in the field is detected.
- Tx Fail alarm signaled if a fault is detected.
- Cj Fail alarm signaled if a fault is detected with the Cj sensor.

Meanwell power system

To monitor the DC voltage, a free relay contact is provided labeled as 'DC OK.'

| Relay contact close | The output voltage reaches the adjusted output voltage |
|---------------------|--|
| Relay contact open | The output voltage below 90% of adjusted output voltage. |

Relay Contact Ratings - 60V dc/0.3Amp

30V dc/1Amp

30V ac /0.5 Amp

The alarm signal can be connected to external circuit or can be connected to Series C Digital Input module.

Phoenix power system

To monitor the DC output voltage a free Relay contact is provided .It is numbered as 13, 14 with sign of relay contact.

| Relay contact closed | The output voltage reaches the adjusted output voltage |
|----------------------|---|
| Relay contact open | The output voltage drop below 90% of adjusted output voltage. |

Relay Contact Ratings - 30 volts dc/1Amp

30 volts ac /1Amp

The alarm signal can be connected with external circuit or can be connected to Series C Digital Input module.

23.1.8 Trip output value

The Trip Output Value function is not supported by Honeywell IOTAs, and can cause improper operation.

- All MTL4575 isolators used with Honeywell IOTAs must have this feature set to 'Off' (identified in the PCS45 software's Configure Output Data dialog box as Trip/EBD/Off).
- The default state for this feature is 'Off' for MTL4575 isolators purchased from MTL or through Honeywell.

23.1.9 Menus

PCS45 configuration software's menu sand their default submenus are listed in the table below. The actual list may vary depending on the nature of the activity you are currently attempting.

The accesses to some of the functions are restricted and only after the correct password has been entered access can be gained.

The password is used to protect the configuration data of the Isolators. Without a password you can only view the configuration of the modules. After entering the password, you have unrestricted access to change the settings of the configuration data.



Attention

The default password is 'MTL' for all new installations of the PCS45 software and can be changed using Options/ Change Password menu.

| Menu | Submenu | Function | |
|------------|--|---|--|
| File | Allows access to the following submenus: | | |
| | - New | Creates a new data record with all parameters set to defaults | |
| | - Open | Allows loading of previously saved configurations. The configuration data can be edited and saved without being on-line. | |
| | - Save | Saves the current configuration settings that can later be loaded back into the software and upload to other transmitters. Access is password restricted, unless in demonstration mode. | |
| | - Save as | When saving configuration data first time 'Save as' allows the user to specify a filename using the file extension '*.D45'. | |
| | - Import | Information in text form can be imported back into the PCS45 software similar to opening a .D45 file. The three column text file requires only the information in the second column. | |
| | - Export | The configuration data can be saved as a text file with three columns containing the parameter name, value and units. This file can later be imported into other software packages. | |
| | - Print | Prints configuration settings. | |
| | - Exit | Closes PCS45 software. | |
| Connection | Allows access to the following submenus: | | |
| | - Establish | A connection is established that brings the temperature converter on-line and uploads all the configuration information that is stored in the isolator. The uploaded data is tested and the device type, operating status and TAG name are displayed in the status indicator bar. | |
| | | Any changes made to the configuration in PCS45 will be automatically downloaded to the isolator once the changes have been saved. | |
| | | In demo mode, the connection is simulated. All the data is taken from default values. | |

| Menu | Submenu | Function | | |
|-------------|--|--|--|--|
| | - Disconnect | Breaks the connection between the PCS45 software and the Isolator and will put PCS45 into the 'off-line' mode. The TAG name will still show in the information bar, until a new configuration file has been loaded. | | |
| Display | Allows access to the following submenus: | | | |
| | - Basic config. | The following data is displayed: | | |
| | | Manufacturers Ident. | | |
| | | Device Type. | | |
| | | Software revision. | | |
| | | Hardware revision. Tag name | | |
| | | Tag name.Descriptor | | |
| | | • Date | | |
| | | No changes to configuration data can be carried out in this window. To make a configuration change go to the 'Device data' menu (a password is required). | | |
| | - Input config. | The following data is displayed: | | |
| | | Input type. | | |
| | | Process units. | | |
| | | Linearization. | | |
| | | Cold Junction Compensation (CJC). | | |
| | | No changes to configuration data can be carried out in this window. To make a configuration change go to the 'Device data' menu (a password is required). | | |
| | - Output config. | The following data is displayed: | | |
| | | • Point 4mA. | | |
| | | Point 20mA. | | |
| | | Damping time constant. Support time constant. Considerations assume that | | |
| | | Smoothing time constant.Filter frequency. | | |
| | | Open Circuit alarm level. | | |
| | | Cold Junction alarm level. | | |
| | | Transmitter alarm level. | | |
| | | No changes to configuration data can be carried out in this window. To make a configuration change go to the 'Device data' menu (a password is required). | | |
| Diagnostics | Allows access to the following submenus: | | | |
| | - Set output | Sets the output of the Temperature converter to a known current value for loop testing purposes. | | |
| | | • Current value range: between 0.000mA and 22.250mA. | | |
| | | Once window is closed the output returns to the current value, dependent upon the process variable. | | |
| | | Only can be activated, if the process variable is not monitored by a closed-loop control system. | | |
| | - Reset | Resets the hardware in the temperature converter by clearing the internal buffer. | | |
| | | If the Temperature converter was running in a temporary state, e.g. at a set current output and the PCL45 (PC-Link) was accidentally disconnected the temperature converter would remain in this mode until the Reset function is used to return the temperature converter back to its normal operation. | | |
| | | Only can be activated if the process variable is not monitored by a closed-loop control system. | | |

| Menu | Submenu | Function | |
|-------------|--|--|--|
| | - Status | Shows the condition of the three alarm signals and the two status bytes, with this data being refreshed every second. | |
| | | The three alarm signals show either: | |
| | | On in front of a red background for an alarm condition or | |
| | | Off with a green background if there are no faults. | |
| | | In the status window: | |
| | | • if the first status byte does not equal 0 there is a configuration error, and | |
| | | • if the second byte does not equal \$00 then there is an interface error. | |
| | - Monitor | Shows the current value of the following with a bar graph display for the Process Variable. The display is refreshed every two seconds. | |
| | | Process Value - displays the reading for the primary variable. | |
| | | Output current - display the value of the loop current. | |
| | | Cold Junction Value - displays the reading for the temperature of the Cj. | |
| | | The Cold junction temperature is only displayed with a thermocouple input. | |
| | - Data-Logger | Allows the user to record either the Process Variable or Output current to a file for future viewing in a separate software package, e.g. spread sheet. | |
| | | The data logger has: | |
| | | a default setting of measuring the Process Variable for 10 seconds with 100 reading points and | |
| | | a decimal point separator that can be altered by user. | |
| | | The settings available are: | |
| | | Variable to measure - Process variable or Output current. | |
| | | Interval type - seconds or minutes. | |
| | | Length of interval. | |
| | | Number of points. | |
| | | • Filename | |
| | | Separator type - decimal point or comma. | |
| | | The data is saved to the file when logging is interrupted or recording has finished. If the software is in demo mode then the filename used is DEMO.DAT. | |
| Device data | Allows access to the following submenus: | | |

| Menu | Submenu | Function |
|------|-----------------|--|
| | - Calibrate | Used to re-calibrate the output of the Temperature converter. |
| | | To perform this function a milli-ammeter with an accuracy of \pm 1mA or better needs to be connected to the output of the temperature converter. |
| | | The temperature converter does the following: |
| | | compares the output current with the actual current seen on the meter |
| | | • calculates the adjustment needed to correct the error, and stores these values in non-volatile memory. |
| | | At first the temperature converter: |
| | | • sets its output to 4.000 mA ,and then |
| | | the user enters the reading from the meter |
| | | • the converter then sets the output to 20.000 mA, and |
| | | finally, the user enters the value seen on the meter |
| | | Once this procedure is complete, the temperature converter calculates the adjustment needed. |
| | | The access to this feature is unlocked when the password is entered as it interrupts the functional dependency between input and output. |
| | | This may only be activated if the process variable is not monitored by a closed-loop control system. |
| | - Basic config. | Allows configuration of the basic parameters of the temperature converter, only appears if the password has been previously entered. |
| | | This window shows the following data: |
| | | Manufacturers Ident (read-only) |
| | | Device Type (read-only) |
| | | Software revision (read-only) |
| | | Hardware revision (read-only) |
| | | • Tag name. |
| | | • Descriptor |
| | | • Date |
| | | The Tag name and Descriptor have a maximum character length of 8 and 16 characters respectively. All lower case letters in these fields are converted to upper case automatically and illegal characters are suppressed. |
| | | The date is displayed with 2 digits for the day and month and 4 digits for the year). A calendar is also give, which is opened using the arrow at the right hand side of the text box. |

| Menu | Submenu | Function | |
|---------|----------------------|---|--|
| | - Input config | Allows configuration of input parameters of the temperature converter, only appears if a password has been entered previously. | |
| | | This window shows the following data: | |
| | | Input type. | |
| | | Process units. | |
| | | Linearization. | |
| | | Cold Junction Compensation. | |
| | | When a RTD or mV input type is selected the Cold junction compensating and failure alarm (in the Output config. menu) are automatically disabled. | |
| | | Selecting mV disables: | |
| | | Cold junction compensating | |
| | | Failure alarm | |
| | | • The selection of the Process units and automatically sets them to mV. | |
| | | When an RTD input is selected: | |
| | | Disables cold junction compensating | |
| | | Disables failure alarm | |
| | | and the linearization is turned off, the process units are automatically set to ohms. | |
| | - Output config. | Allows setting of output parameters for the temperature converter, only appears if the password has been entered previously. | |
| | | This window shows the following data: | |
| | | • 4 mA point. | |
| | | • 20 mA point. | |
| | | Damping time constant. | |
| | | • Smoothing time constant. | |
| | | • Filter frequency - 50 or 60Hz. | |
| | | Cold junction failure alarm - off, low or high. Open circuit alarm - off, low or high. | |
| | | Open circuit alarm - off, low or high.Transmitter failure alarm - off, low or high. | |
| | - Save to device | Allows the configuration data to be transferred from the PC to the transmitter. | |
| | - Save to device | Allows for the re-purposing of the saved temperature settings. | |
| | | After saving, the transfer of the configuration data happens automatically if on- line. This window is password protected. | |
| | - Compare to device | Allows a comparison of the configuration data held within the software to the data in the temperature converter. | |
| | | After saving, the comparison of data occurs automatically, if online. | |
| Options | Allows access to the | the following submenus: | |

| Menu | Submenu | Function | |
|------|----------------------|---|--|
| | - Change password | The password is used to protect the configuration data of the Isolators. | |
| | | Without a password: | |
| | | You can only view the configuration of the modules. | |
| | | After entering the password: | |
| | | You have unrestricted access to change configuration settings. | |
| | | Default password for PCS45 software is MTL | |
| | | To change the password: | |
| | | 1. Select Options, Change Password. | |
| | | 2. Enter the current password. You will then be asked to enter the new password and confirm this new password. Once the new password has been accepted, it is stored permanently onto the PC. | |
| | | Note: The password is not case sensitive. | |
| | - Language | Enables the software to be configured for the following languages. | |
| | | • English | |
| | | • German | |
| | | • French | |
| | - Port selection | With the PCS45 application running, the PCL45 USB connected and this option selected the correct port is automatically scanned. | |
| | | Allows you to configure the serial port, If the PCL45 PC-link is used. | |
| | | To select a port: | |
| | | 1. Choose Options < Port selection | |
| | | 2. Select one of the listed ports (ex. COM1) Note: The software detects which serial ports are available, but it is up to the user to ensure the correct serial port is being used. | |
| | | Note: Care has also to be taken to ensure the data lines can supply \pm 8V @ 3mA, to the PC-link PCL45. | |
| | | The application may operate in Demo mode. This mode maintains all the functionality of the software but does not require a connection to the temperature converter. | |
| | - Error indication | Allows selection of the following errors to be displayed: | |
| | | • Defect | |
| | | Disturbed | |
| | | • Exception | |
| Help | Allows access to the | following submenus: | |
| | - Contents | Open embedded help file for the software | |
| | - Online Help | Provides Online Help info | |
| | - Information | Displays support and software version information | |

23.2 Troubleshooting the PSC45 software

23.2.1 Interface error

Using the Diagnostic -> Status menu interface errors is monitored. The following is a listing of interface error messages.

| Error | Description |
|-------|--|
| \$02 | buffer overflow |
| \$08 | longitudinal parity error. |
| \$10 | framing error. |
| \$20 | overrun error. |
| \$40 | vertical parity error. |
| \$80 | interface error (always set when an error has occurred). |

In case an interface error does occur, do the following checks can be carried out.

- Ensure the correct COM port has been selected.
- Check the connections at both ends of PCL45.
- Check the COM port has the capability to drive +/- 8V at 3mA.

23.2.2 Configuration error

Using the Diagnostic -> Status menu configuration errors are monitored.

The following is a listing of configuration error messages.

| Error | Description |
|-------|----------------------|
| 2 | invalid selection |
| 3 | data value too high |
| 4 | data value too low |
| 5 | not enough data |
| 14 | span value too small |
| 16 | access refused |
| 64 | unknown command |

Note: Error messages 5 or 64 indicate an interface error.

23.2.3 Device defective or causing problems error

Using the Diagnostic -> Status menu configuration errors that have occurred if the isolator is in exception or causing problems are displayed. The message is a hexadecimal value with followed types of errors (where for example value \$03 means \$02 + \$01). The following is a listing of configuration error messages

| Error | Description | | |
|-------|---|--|--|
| \$01 | input signal outside of the measuring range | | |
| \$02 | current output 'frozen' | | |

| Error | Description |
|-------|--|
| \$08 | more status data detected |
| \$10 | not enough data |
| \$20 | cold start (reset) detected |
| \$04 | current output halted |
| \$40 | configuration changed |
| \$80 | device is defective The message 'device defective' (\$80) will also show up if there is a power failure while programming. Until correct configuration, the isolator will remain in the defective mode. An error is indicated on the temperature converter by a flashing green 'PWR LED' |

The messages \$01 to \$40 do not show the defect, but only information about the reason for the exception or disturbance.

23.2.4 Device exception status error

The isolator is in exception status or disturbed.

The most frequent reason for exception status indicated by a flashing PWR LED is caused from operating the isolator with unconnected sensor (e.g. at the lab desk or during start-up). The unit periodically tests for line faults. If a fault is detected, an error alarm is released and the analogue output is set according to the alarm configuration. In this situation, either the error message should be ignored or a sensor must be attached to the isolator.

An exception (no defect, no disturbance) also occurs if the device status is requested in the following situations:

- - immediately after a cold start (reset)
- immediately after a change of the configuration

24 GI/IS Maintenance

Related topics

- "GI/IS recommended spares" on page 658
- "Repair" on page 661
- "Replacing an GI/IS IOTA" on page 662
- "Replacing an IOM on the GI/IS IOTA" on page 664
- "Replacing the isolator" on page 665
- "Replacing fuses on a GI/IS IOTA" on page 666

24.1 GI/IS recommended spares

The following table provides replacement parts, or parts that you may want to keep on hand for backup.

Table 171: GI/IS Recommended spare parts

| Part name | Part number | | Description | |
|-----------------------|--------------|------------------------------|-------------------------|--------------|
| GI/IS Analog Input I | OTA | | | |
| AI IOTA | CC-GAIX11 | Analog Input, redundant | | |
| Redundant | | | | |
| AI IOTA | CC-GAIX21 | Analog Input, non-redun | dant | |
| Non-Redundant | | | | |
| Fuse | , | | | |
| Description | Part number | Quality | Reference designator | Function |
| Fuse 0.5A | 51190582-150 | 2 per CC-GAIX11 | F1 | Used for |
| Fast acting | | | | upper IOM |
| 250V | | | F2 | Used for |
| | | | | lower IOM |
| 1 per CC-GAIX21 | F1 | Used for IOM | | |
| Fuse 1.5A | 51190582-215 | 1 per CC-GAIX11 | F3 | Used for the |
| Fast acting | | | | isolators |
| 250V | | 1 per CC-GAIX21 | F2 | Used for the |
| | | | | isolators |
| GI/IS Analog Output | IOTA | | | |
| AO IOTA | CC-GAOX11 | Analog Output, redundant | | |
| Redundant | | | | |
| AO IOTA | CC-GAOX21 | Analog Output, non-redundant | | |
| Non-Redundant | | | | |
| Fuse | | | | |
| Description | Part number | Quality | Reference designator | Function |
| Fuse 1A | 51190582-210 | 3 per CC-GAOX11 | F1 | Used for |
| | | | | upper IOM |
| | | | F2 | Used for |
| | | | | lower IOM |
| F3 | Used for the | | | |
| | isolators | | | |
| 2 per CC-GAOX21 | F1 | Used for | | |
| | | the IOM | | |
| | F2 | Used for the | | |
| | | isolators | | |
| GI/IS Digital Input I | OTA | | | |

| Part name | Part number | | Description | |
|-----------------------------|--------------|---------------------------|-------------------------|--------------------|
| DI IOTA | CC-GDIL01 | Digital Input, redundant | | |
| Redundant | | | | |
| DI IOTA | CC-GDIL11 | Digital Input, redundant | | |
| Redundant | | | | |
| DI IOTA | CC-GDIL21 | Digital Input, non-redund | ant | |
| Redundant | | | | |
| Fuse | · | · | | |
| Description | Part number | Quality | Reference designator | Function |
| Fuse 0.5A | 51190582-150 | 2 per CC-GDIL01 | F1 | Used for upper IOM |
| | | | F2 | Used for |
| | | | | lower IOM |
| | | 2 per CC-GDIL11 | F1 | Used for |
| | | | | upper IOM |
| F2 | Used for | | | |
| | lower IOM | | | |
| 1 per CC-GDIL21 | F1 | Used for the IOM | | |
| Fuse 2A | 51190582-220 | 1 per CC-GDIL01 | F3 | Used for the |
| | | | | isolators |
| | | 1 per CC-GDIL11 | F3 | Used for the |
| | | | | isolators |
| Fuse 1AF | 51190582-210 | 1 per CC-GDIL21 | F2 | Used for the |
| | | | | isolators |
| GI/IS Digital Output | IOTA | | | |
| DO IOTA | CC-GDOL11 | Digital Output, redundant | | |
| Redundant | | | | |
| Fuse | | | | |
| Description | Part number | Quality | Reference designator | Function |
| Fuse 5A | 51190582-250 | 1 per CC-GDOL21 | F1 | Used for the IOM |
| | | | F2 | Used for the |
| | | | | isolators |
| GI/IS Digital I/O Exp | | | | |
| Digital I/OI | CC-SDXX01 | Digital Input/Output Expa | ander | |
| Expander | | | | |
| Fuse | | | | |
| Description | Part number | Quality | Reference designator | Function |
| Fuse 2A | 51190582-220 | 1 per CC-SDXX01 | F1 | Used for the |
| | | | | isolators |
| MTL GI/IS isolator | | | | |

| Part name | Part number | Description |
|-----------|-------------|---|
| MTL4510 | | Switch/ Proximity Detector Interface - |
| | | four-channel, multi-function digital input |
| MTL4511 | | Switch/ Proximity Detector Interface - |
| | | single channel, with line fault detection |
| MTL4516 | | Switch/ Proximity Detector Interface - |
| | | two-channel, with line fault detection |
| MTL4517 | | Switch/ Proximity Detector Interface - |
| | | two-channel with line fault detection and phase reversal |
| MTL4521 | | Solenoid/Alarm Driver - loop-powered, IIC |
| MTL4541 | | Repeater Power Supply - |
| | | 4/20mA, smart, for 2- or 3-wire transmitters with open wire detection |
| MTL4544 | | Repeater Power Supply - |
| | | two channel, 4/20mA, smart, for 2- or 3- wire transmitters with open wire detection |
| MTL4546C | | Isolating Driver - |
| | | 4-20mA HART valve positioners with open wire detection |
| MTL4549C | | Isolating Driver - |
| | | two-channel, for 4-20mA HART® valve positioners with open wire detection |
| MTL4575 | | Temperature Converter - |
| | | THC (with early burn-out detection) or RTD input |
| MTL4599 | | Dummy isolator |

24.2 Repair

The isolator and IOTA cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer

24.3 Replacing an GI/IS IOTA



WARNING

Replacing a GI/IS IOTA and all associated activities may only be performed when the area has been determined to be non-hazardous.



CAUTION

We recommend that you proceed with extreme caution whenever replacing any component in a control system. Be sure the system is offline or in a safe operating mode.

Component replacements may also require corresponding changes in the control strategy configuration through Control Builder, as well as downloading appropriate data to the replaced component.

The replacing of the GI/IS IOTA is different from the replacing the standard Series C IOTA with regards to the following areas:

- the isolators and terminal plugs must be moved to the new IOTA, and
- there is an additional set of mounting screws to accommodate the wider GI/IS IOTA.



Attention

Replacing the GI/IS IOTA requires that the IOM is in an inactive off-process state.

To replace an GI/IS IOTA

- 1 Loosen the screws:
 - at each side of the plastic cover that secures the I/O module to the IOTA board, and
 - the long gray plastic screw located on the module's face. It is not necessary to completely remove this screw.



CAUTION

Only use a #2 Phillips screw-driver to carefully loosen or tighten the long gray plastic screw. Do not use either a #1 Phillips screw-driver or a battery powered screw-driver to remove or install the plastic screw as this can damage the screw head.

- 2 Remove the I/O module from the IOTA board and connector.
- 3 Label and disconnect all cables from the IOTA connectors.
- 4 Note which terminal plugs are connected to which isolator/channel to make reconnection easier after the IOTA is replaced.

Remove the terminal plugs (retaining the field wiring) from the isolators.

Do not remove the isolators at this time.

5 Loosen the screws that secure the IOTA board to the carrier and remove the IOTA board.

To remove 24 V power to the IOTA board do the following:

- Loosen the screw from the left side of the IOTA board that connects to the 24 Vdc bus bar.
- Loosen the screw from the right side of the IOTA board that connects to the GND bus bar.
- 6 Mount new I/O IOTA board on the carrier at the same position as the old IOTA board. Secure with screws.
- 7 Move the isolators from the old IOTA to the new IOTA preserving the original configuration.
- 8 Attach the appropriate terminal plugs to the appropriate isolators.
- 9 Reconnect the cables (removing labels if they were utilized) to the IOTA connectors
- 10 To reconnect power to the IOTA board through the COM and 24 Vdc bus bars, do the following:
 - Install screw through right side of IOTA board to tap into the **GND** bus bar of carrier.
 - Install screw through left side of IOTA board to tap into the 24 V bus bar of carrier.

11 Insert the I/O module onto IOTA board making sure that the I/O circuit board mates properly with the IOTA board connector.

Secure the module to the:

- IOTA board with two screws located at each side of the plastic cover.
- Carrier with the long screw that is inserted into the hole on the face of the module's plastic cover.
- 12 The I/O module will boot-up into IDLE state.
- 13 In Control Builder, perform a 'Load with Contents'.

Refer to the following instructions to see how to replace a Series C IOTA: "Replacing a Series C IOTA" on page 549

24.4 Replacing an IOM on the GI/IS IOTA



CAUTION

We recommend that you proceed with extreme caution whenever replacing any component in a control system. Be sure the system is offline or in a safe operating mode.

Component replacements may also require corresponding changes in the control strategy configuration through Control Builder, as well as downloading appropriate data to the replaced component.

The removing of the IOM on a GI/IS IOTA is similar to removing the IOM on the standard Series C IOTA.

Refer to the following instructions to see how the IOM is removed on the IOTA: "Replacing an I/O module" on page 550.

24.5 Replacing the isolator



WARNING

Replacing an isolator must only be performed when the area has been determined to be non-hazardous.

The isolator can be removed under the following conditions:

- · keeping the terminal plug and field wiring connected to the isolator, or
- removing the terminal plug with the field wires still connected to it.

To remove the isolator

- 1 Unclip the latch nearest the CE mark on the isolator label.
- 2 Rotate the isolator away from this latch.
- **3** When the isolator is unplugged from the power connector, move the isolator clear of the other latch and remove.
- 4 This concludes this procedure.



Figure 272: Removing a module from an IOTA

24.6 Replacing fuses on a GI/IS IOTA

Refer to the GI/IS recommended spares section in this document for the proper replacement fuse.



WARNING

Replacing any GI/IS IOTA fuse must only be performed when the area has been determined to be non-hazardous.

To replace fuses on a GI/IS IOTA

- 1 Using a small slotted screw-driver, place the tip into the slot on the fuse cap.
- 2 Rotate the cap counter clockwise, a quarter-turn. Remove the cap that also holds the fuse.
- 3 Remove the fuse, ensuring an appropriate replacement is available. Properly discard the defective fuse.
- 4 Insert the fuse in the cap and replace the fuse holder on the IOTA board.
- 5 Tighten the fuse cap by rotating it clockwise a quarter-turn using the screw-driver.
- 6 This completes the procedure.

25 GI/IS Troubleshooting

This section identifies some common problems with the GI/IS and describes how you might fix them.

26 ATEX Information

Related topics

"General" on page 670

"Isolators safety parameters" on page 672

26.1 General

The following information is in accordance with the Essential Health and Safety Requirements (Annex II) of the EU Directive 94/9/EC [the ATEX Directive - safety of apparatus] and is provided for those locations where the ATEX Directive is applicable.

In common with all other electrical apparatus installed in hazardous areas, the GI/IS assembly must only be installed, operated and maintained by competent personnel. Such personnel shall have undergone training, which included instruction on the various types of protection and installation practices, the relevant rules and regulations, and on the general principles of area classification. Appropriate refresher training shall be given on a regular basis. [See clause 4.2 of EN 60079-17].

This apparatus meets the requirements of associated electrical apparatus in accordance with EN 50020 and EN 50014. Additionally, the apparatus meets the Category 3 requirements of protection 'n' in accordance with EN 50021

This apparatus provides protection against all the relevant additional hazards referred to in Annex II of the Directive, such as those in clause 1.2.7.

26.1.1 Installation

The installation must comply with the appropriate European, national and local regulations, which may include reference to the IEC code of practice IEC 60079-14. In addition, particular industries or end users may have specific requirements relating to the safety of their installations and these requirements must be met. For the majority of installations the Directive 1999/92/EC [the ATEX Directive - safety of installations] is also applicable.

26.1.2 Inspection and maintenance

Inspection and maintenance should be carried out in accordance with European, national and local regulations which may refer to the IEC standard IEC 60079-17. In addition, specific industries or end users may have specific requirements, which should also be met.

26.1.3 Repair

The isolator and IOTA cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer

26.1.4 Marking

MTL4500 Series isolators carry approval certificate numbers.

Each device is also CE marked with the Notified Body Identification Number of 1180 and carries the following information:

- Company logo
- Company Name and Address
- · Product Number and Name
- · Certificate Number
- Ex Classification (where applicable)
- Schematic diagram
- Safety description parameters
- Ambient temperature range

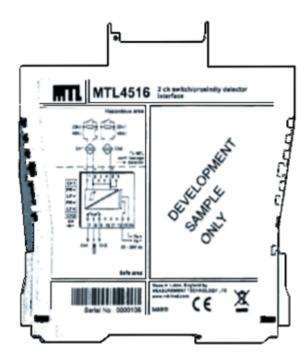


Figure 273: Typical MTL45xx series isolator label

26.2 Isolators safety parameters

Table 172: MTL4500 safety parameters

| Model | Terminals | V | mA | mW |
|----------|-----------|--------------------|-----------|----------|
| MTL4510 | | 10.5 | 14 | 37 |
| MTL4511 | | 10.5 | 14 | 37 |
| MTL4516 | | 10.5 | 14 | 37 |
| MTL4517 | | 10.5 | 14 | 37 |
| MTL4521 | | 25 | 14 | 37 |
| MTL4541 | | 28 | 93 | 651 |
| MTL4544 | | 28 | 93 | 651 |
| MTL4546C | | 28 | 93 | 651 |
| MTL4549C | | 28 | 93 | 651 |
| MTL4599 | | Non-energy storing | | |
| MTL4575 | 5 & 6 | Non-energy storing | | |
| | 1& 2 | 7.2 | 8 | 144 |
| | config | Vi = 11.2 | Li = 12 | Pi = 280 |
| | | $V_0 = 7.2$ | Lo = 14.5 | Po= 26 |

27 Notices

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For the purpose of submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.

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• Send an email to security@honeywell.com.

or

• Contact your local Honeywell Process Solutions Customer Contact Center (CCC) or Honeywell Technical Assistance Center (TAC) listed in the "Support" section of this document.

Support

For support, contact your local Honeywell Process Solutions Customer Contact Center (CCC). To find your local CCC visit the website, https://www.honeywellprocess.com/en-US/contact-us/customer-support-contacts/Pages/default.aspx.

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