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 PM I/O.

Table 5: Available I/O modules

IOM model names	IOM block name	Description	# of chnls	Similar to PMIO type	IOP model names
CU-PAIH01 CC-PAIH01	AI-HART	High Level Analog Input with HART (supports differential inputs on only channel 13 through channel 16) Refer to Attention	16	HLAIHART	
CC-PAIH02	AI-HART	High Level Analog Input with HART ((supports differential inputs on all 16 channel)	16	HLAIHART	
CC-PAIX02	AI-HART	High Level Analog Input with Differential/Single-ended non-HART (supports differential inputs on all 16 channels)	16	HLAI	
CC-PAIX01	AI-HL	High Level Analog Input with Differential non-HART (supports differential inputs on only channel 13 through channel 16) Refer to Attention	16	HLAI	
CU-PAIN01 CC-PAIN01	AI-HL	High Level Analog Input with non-HART	16	HLAI	
CC-PAIH51	AI-HART	1 Modem, High Level Analog Input with HART	16	HLAIHART	
CU-PAON01 CC-PAON01	AO	Analog Output with non-HART	16	AO16	
CU-PAOX01 CC-PAOX01	AO	Analog Output with non-HART Refer to Attention	16	AO16	
CU-PAIM01 CC-PAIM01	AI-LLMUX[1]	Low Level Analog Input Mux	64	LLMUX	
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 CC-PAOH01	AO-HART	Analog Output with HART	16	AO16HART	
CC-PAOH51	AO-HART	1 Modem, Analog Output with HART	16	AO16HART	
CU-PDIH01 CC-PDIH01	DI-HV	High Voltage Digital Input (IOM supports both 120 and 240 volts AC)	32	DI	
CU-PDIL01 CC-PDIL01	DI-24	Low Voltage Digital Input (24 volts DC)	32	DI or DI24V	
CC-PDIL51	DI-24	Low Voltage, Digital Input (24 volts DC)	32	DI	
CU-PDIS01 CC-PDIS01	DI-SOE	Low Voltage Digital Input (24 volts DC)	32	DISOE	Mx-PDIS12
CU-PDOB01 CC-PDOB01	DO-24B[2]	Bussed Low Voltage Digital Output (24 volts DC)	32	DO_32	
CC-PDOD51	DO-24B	Bussed Low Voltage, Digital Output (24 volts DC)	32	DO32	
CU-PSOE01 CC-PSOE01	DI-SOE	Low Voltage Digital Input SOE (24 volts DC)	32	DISOE	
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		

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)

3.3.1 Compatibility matrix between AI modules and differential AI 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
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-Redundant IOTA	AI			HART	No. of differential inputs
			4-20ma	1-5V	0-5V		
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-Redundant IOTA	IS	No. of differential inputs
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-Redundant IOTA	AO 4-20mA	HART	IS
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 AI-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. • 1-5 V • 0-5V • 0.4-2V	Supports only 1-5 V sensor type.
Supports the following input types. • Voltage • Current (2-wire or self-powered transmitters)	Supports only current (2-wire or self-powered transmitters) input type.
Supports 16 input channels (single ended or differential).	Supports all single-ended input channels.
Supports the following input range. • 0 to 5V • 1 to 5V • 0.4 to 2V • 4-20 mA (through 250 Ω)	Supports only 4-20 mA (through 200 Ω) inputs.
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.

AI-HART module Cx-PAIH01	AI-HART module Cx-PAIH51
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 AI-LLAI modules Cx-PAIM01 and Cx-PAIM51

AI-LLMUX module Cx-PAIM01	AI-LLAI module Cx-PAIM51
Supports 64 input channels.	Supports 16 input channels.
Supports the following RTD types. • Pt: 100 ohm DIN 4376 • Pt: 100 ohm JIS C-1604 • Ni: 120 ohm ED #7 • Cu: 10 ohm SEER	Supports a new RTD type, CU50Rtd, in addition to the RTD types supported by the AI-LLMUX.
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.

AI-LLMUX module Cx-PAIM01	AI-LLAI module Cx-PAIM51
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.
-
- X is U or C

  (U = Standard Assembly and C = Corrosion Protected Assembly)
- 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.

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.

Release	Hardware revisions of old modules	Hardware revisions of new modules	Considerations and actions for replacing or pairing modules
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.

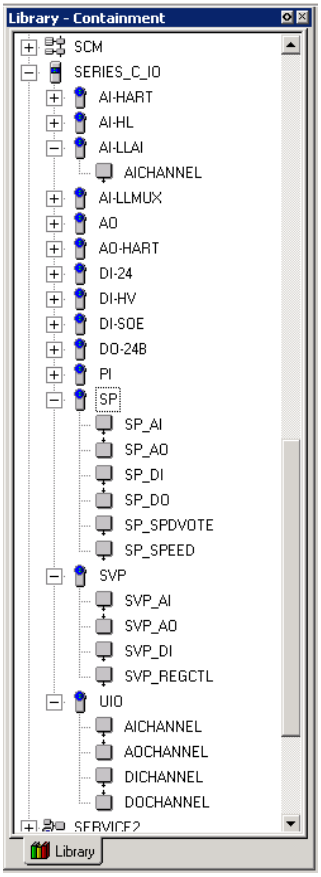


Figure 6: Series C I/O library

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

3.4.3 Inspecting channel function blocks

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

Table 6: 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
AOCHANNEL	• AO • AO-HART • UIO
DICHANNEL	• DI-HV • DI-24 • DI-SOE • UIO
DOCHANNEL	• DO-24B[2] • UIO
SP_AI SP_AO SP_DI SP_DO SP_SPDVOTE SP_SPEED	• SP
SVP_AI SVP_AO SVP_REGCTL SVP_DI	• SVP

Channel block name	Associated with IOM blocks
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).

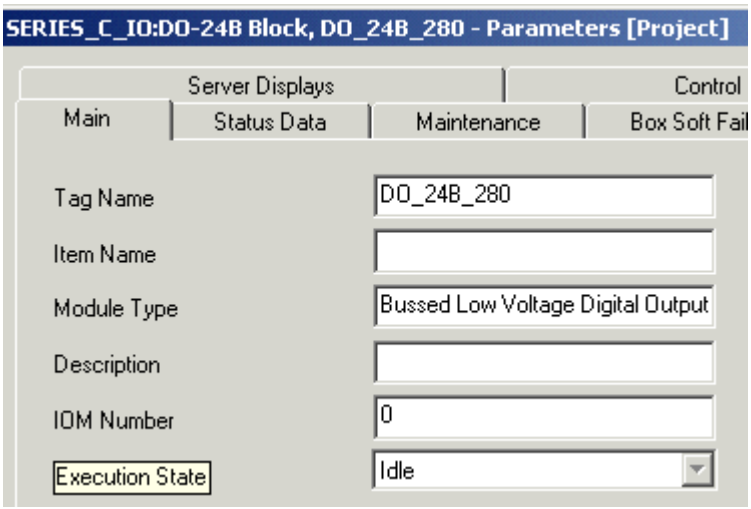


Figure 7: Execution State

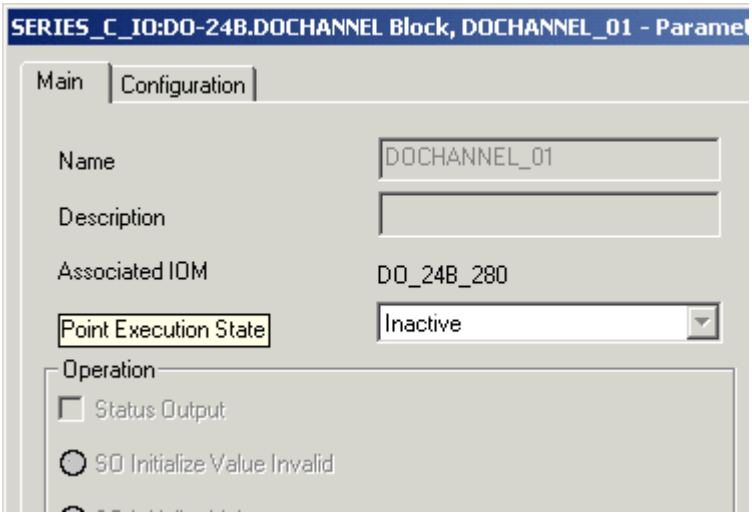


Figure 8: Point Execution State

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.

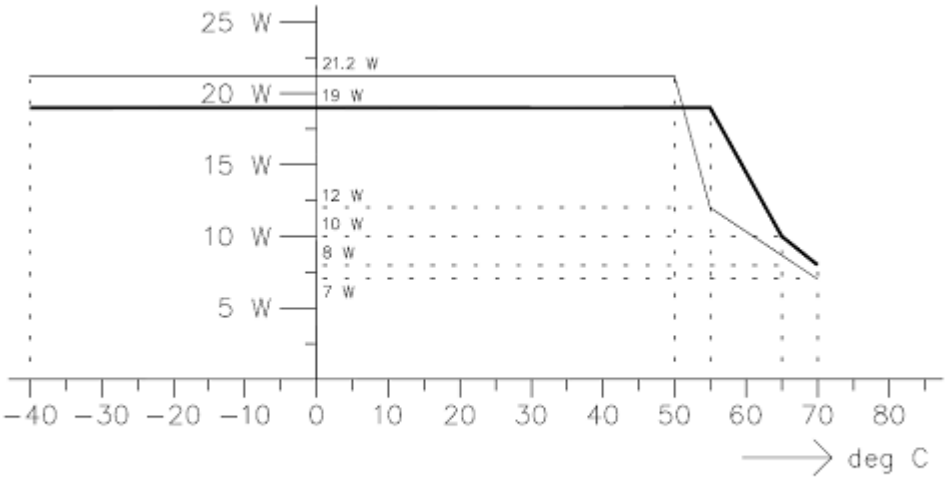
Table 7: Dissipation Calculation

Dissipation contributor	Max. dissipation per channel (W)	Number of configured channels	Dissipation (W)
Kernel logic			5.5
DI w/ OWD; field impedance ≥ 5 kΩ	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

The following graph displays the maximum outside module temperature versus the internal power dissipation.



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 8: Dissipation Calculation

Estimated Ambient [°C]		**50**		
Dissipation Contributor		**Temperature Rise per channel [°C]**	**Number of channels (Total not to exceed 32)**	**Channel Contribution to Temperature Rise [°C]**
DI	Closed contact	0.91	0	0.00
DO	<500 mA	1.06	0	0.00

Estimated Ambient [°C]		**50**		
Dissipation Contributor		**Temperature Rise per channel [°C]**	**Number of channels (Total not to exceed 32)**	**Channel Contribution to Temperature Rise [°C]**
AI	<20 mA	1.42	0	0.00
AO	<22 mA, 220 ohms	1.56	0	0.00
Total Number of Configured Channels			0	
High Temperature Limit Setting [°C]				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 9: 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.

Table 10: Link Unit utilization rates

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

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.

Table 11: I/O parameters scanned when the IOM is loaded

IOM block	Scanned parameters
AI-xxx	PV, PVSTS
AO-xxx	OP, INITREQ
DI-xxx	PVFL, BADPVFL
DO-xxx	SO, INITREQ, OP

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.

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 60
“Installing the Series C IOTA on the carrier” on page 63
“Mounting the I/O module on the IOTA” on page 65
“Grounding and power considerations - IOTA boards” on page 66
“Connecting IOMs and field devices through I/O Termination Assemblies” on page 68
“Powering the Series C system” on page 72
“Fusing - Series C IOTA boards” on page 73

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.

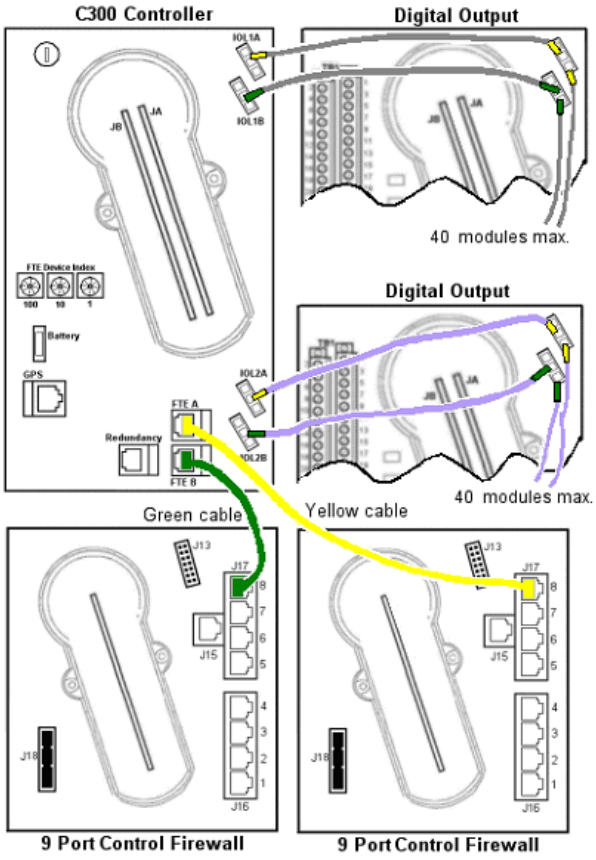


Figure 9: Series C board connections

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 12: 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

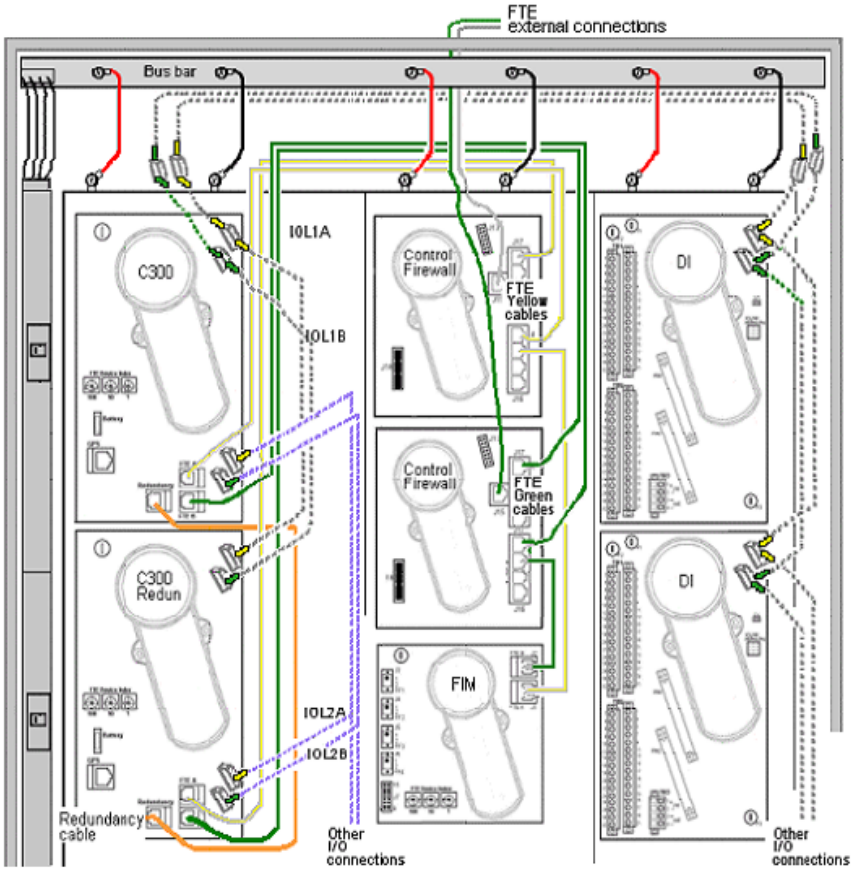


Figure 10: Series C cabling

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.

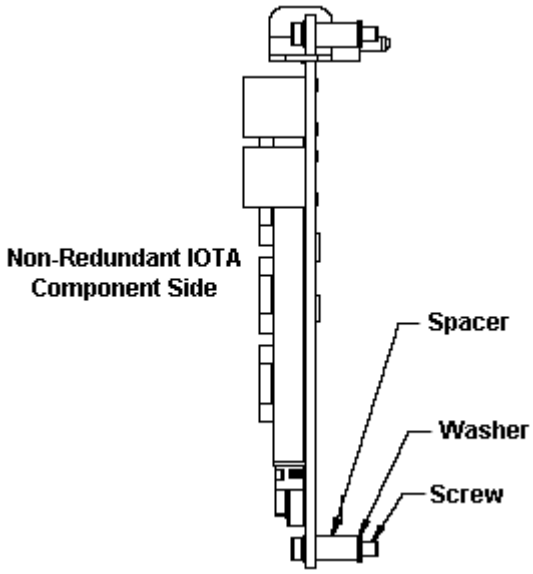
Securing the four corner screws and the two middle screws may cause bowing of the board and impact the alignment of the IOTA board to the carrier holes and is not recommended.

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:

1. 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.
2. Install the 24V (power) and ground (common) **screws fully into the bus bars**, torquing the screws to 5-inch pounds.
3. Finish installing the IOTA by **tightening the IOTA's mounting screws only full-way**, torquing the screws to 3-inch pounds


Non-Redundant IOTA
Component Side
Spacer
Washer
Screw

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.

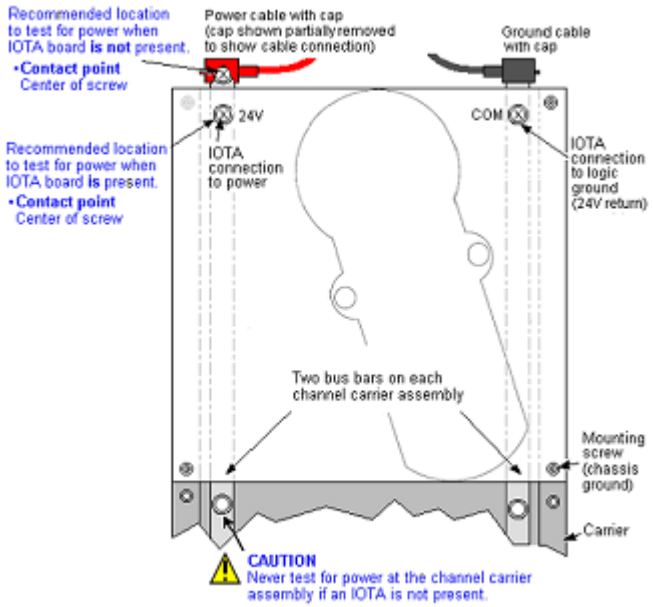


Figure 11: Grounding and power connections

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 13: IOM types and ancillary hardware

If IOM type is	Then the ancillary hardware
DO Digital Output	takes the output signal and drives a set of relays
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 582

Table 14: 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 Refer to Attention	Cx-TAIX01	AI, non-redundant	None
		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/ Single-ended	CC-PAIH02	Cx-TAIX01	Analog Input, Non-redundant, 4 ch. differential	None
		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, no differential, 4-20 mA only	MTL4541 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 Refer to Attention	Cx-TAIX01	AI, Non-redundant	None
		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 Differential/ Single-ended	CC-PAIX02	CC-TAIX01	AI, non-redundant	None
		CC-TAIX11	AI, redundant	None
		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] (note 1a)	LLMUX, non-redundant, non-coated	Mx-TAMT04 Mx-TAMR04 Mx-TAMT14
AI-LLAI	Cx-PAIM51	Cx-TAIM51	LLAI, non-redundant, non-coated	None
Cx-TAIM21[5]	LLMUX, non-redundant, non-coated	Mx-TAMT03[1] Mx-TAMR03[1] Mx-TAMT13 Mx-TAMT04 Mx-TAMR04 Mx-TAMT14		
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

IOM block type	IOM model number	IOTA model number	IOTA description [7]	IOTA supported FTAs or ancillary cards
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
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 (note 4)	Cx-TDIL01	DI-24V, non-redundant	None
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-redundant	Cx-SD0R01[2] (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	
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)	

IOM block type	IOM model number	IOTA model number	IOTA description [7]	IOTA supported FTAs or ancillary cards
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.