

## 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.

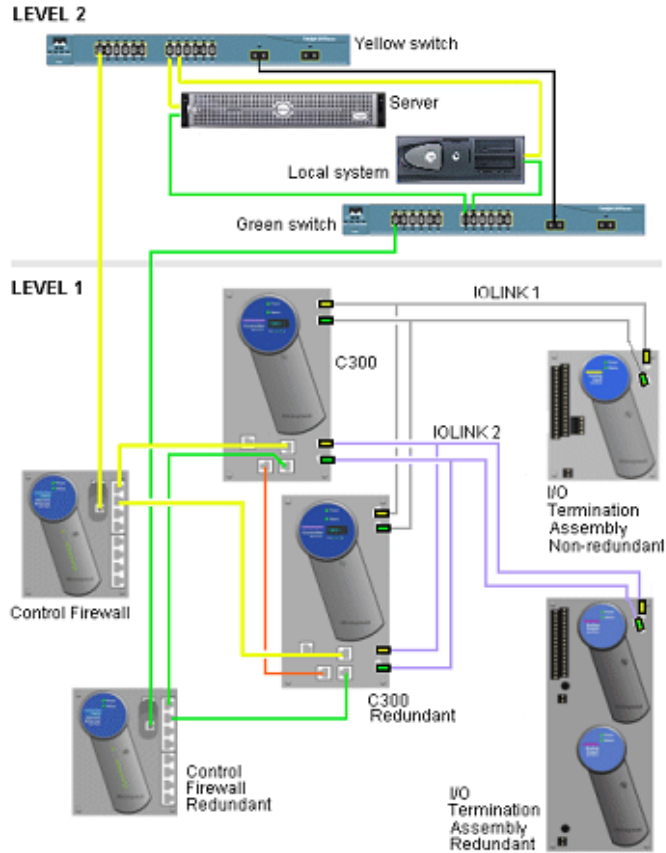


Figure 5: Series C I/O and C300 topology

### 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 PM I/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 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 <sup>1</sup>	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 <sup>2</sup>	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		
CC-PUIO31	UIO	Universal Input/Output Module	32		
Series C Mark II IOM					
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	
CC-PAOH51	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 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

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-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 <sup>(1)</sup>
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. <ul style="list-style-type: none"> <li>• 1-5 V</li> <li>• 0-5V</li> <li>• 0.4-2V</li> </ul>	Supports only 1-5 V sensor type.
Supports the following input types. <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current (2-wire or self-powered transmitters)</li> </ul>	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. <ul style="list-style-type: none"> <li>• 0 to 5V</li> <li>• 1 to 5V</li> <li>• 0.4 to 2V</li> <li>• 4-20 mA (through 250 <math>\Omega</math>)</li> </ul>	Supports only 4-20 mA (through 200 $\Omega$ ) 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.
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	AI-LLAI module Cx-PAIM51
Supports 64 input channels.	Supports 16 input channels.
Supports the following RTD types. <ul style="list-style-type: none"> <li>Pt: 100 ohm DIN 4376</li> <li>Pt: 100 ohm JIS C-1604</li> <li>Ni: 120 ohm ED #7</li> <li>Cu: 10 ohm SEER</li> </ul>	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.
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	<ul style="list-style-type: none"> <li>• &lt;=K for AI_HART and AI_HL</li> <li>• &lt;=H for AO and AO_HART</li> </ul>	<ul style="list-style-type: none"> <li>• &gt;=M for AI_HART and AI_HL</li> <li>• &gt;=J for AO and AO_HART</li> </ul>	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	<ul style="list-style-type: none"> <li>• &lt;=K for AI_HART and AI_HL</li> <li>• &lt;=H for AO and AO_HART</li> </ul>	<ul style="list-style-type: none"> <li>• &gt;=M for AI_HART and AI_HL</li> <li>• &gt;=J for AO and AO_HART</li> </ul>	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: <ol style="list-style-type: none"> <li>1. Migrate to the latest patch applicable for the release.</li> <li>2. Migrate the applicable controllers</li> <li>3. Update the firmware of the older hardware revision module.</li> <li>4. Verify that the firmware versions of both the modules are indicated as “Green” in CTools.</li> </ol>

#### 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