



**EXPERION LX**  
**RELEASE 511**

## C300 Controller User's Guide

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## ABOUT THIS DOCUMENT

This guide provides information that will assist you in planning and designing activities, as well as the installation, operation, and troubleshooting of C300 Process Controllers in a PlantCruise system.

Starting with R501, C300 controllers (Hardware model – CC-PCNT02) provide an expanded functionality of large memory capacity, primarily to support the Profit Controller. CC-PCNT02, with the in-built firmware, is interoperable with CC-PCNT01 and enables easy synchronization,

### 1.1 Revision History

Revision	Date	Description
A	August 2019	Initial release of the document.

## C300 CONTROLLER PURPOSE

This section provides a quick comparison of C200 and C300 Controller features and reference to topics in this book for a given task related to using the C300 Controller with the Experion system.

### ATTENTION

The C300 Controller can be used with the Universal Input/Output (UIO) module for replacing the TPS components such as Basic Controller (CB) and Extended Controller (EC). For more information about the usage of the C300 Controller with the Universal Input/Output (UIO) module, see *Series 8 I/O User's Guide*.

- [C300 Controller and C200 Controller comparison](#)
- [Getting started](#)

## 2.1 C300 Controller and C200 Controller comparison

The C300 Controller provides design improvements and greater operational capabilities for process control over the chassis-based C200 controller. The following table is a listing that compares design features and operational improvements of the C300 Controller with the C200 controller.

### ATTENTION

The C300 - 20mS CEE Controller has all the features as the C300 - 50ms Controller with exceptions related to the faster execution speed (20ms). The C300 - 20mS CEE controller supports only the Series 8 I/O modules. Two new Series C I/O Modules (Speed Protection Module (SPM) and Servo Valve Positioner Module (SVPM)) are only supported by the C300 - 20mS CEE Controller.

The C300 - 20mS CEE controller is only intended for Honeywell Turbine Control Solutions.

Controller Feature	Comparison
<i>Form Factor</i>	<p><b>C200</b> - Chassis-based controller with plug-in modules for Control Processor, I/O Link Interface, Redundancy, FTE interface, Fieldbus, other I/O and control modules.</p> <p><b>C300</b> - A single control module that plugs into an Input Output Terminal Assembly (IOTA). Control module functions include a Control processor, two I/O Link interfaces,</p>

Controller Feature	Comparison
	Redundancy functions, and FTE interfaces.
<i>Memory (RAM)</i>	<p><b>C200</b> - 4MB User Memory</p> <p><b>C300</b> - 16MB User Memory</p>
<i>Redundancy</i>	<p><b>C200</b> - Two identically-equipped controller chassis that contain two Redundancy Modules (RM) provide controller redundancy.</p> <p><b>C300</b> - Controller redundancy function is built in. A second C300 Controller and redundancy cable is all that is required for redundant controller operation. (No RMs)</p>
<i>I/O Link Interface</i>	<p><b>C200</b> - An I/O Link Interface plug-in Module (IOLINK) installed in the controller chassis is required to connect PMIO I/O to the controller CPM.</p> <p><b>C300</b> - Two I/O Link interfaces are built in to the controller. Each I/O Link can connect with either PMIO I/O or Series 8 I/O modules.</p> <p><b>Note:</b> C300 - 20mS CEE Controller supports only Series 8 I/O modules.</p>
<i>Communications Interface to supervisory network</i>	<p><b>C200</b> - Ethernet or Fault Tolerant Ethernet plug-in modules are needed to connect to respective Ethernet and FTE communication networks. ControlNet Interface plug-in module is needed to connect with other ControlNet nodes.</p> <p><b>C300</b> - Ethernet interface is built into the controller and supports both Ethernet and redundant FTE communications. No ControlNet interface.</p>
<i>Peer-to-Peer Connections</i>	<p><b>C200</b> - Ethernet or Fault Tolerant Ethernet Bridge plug-in modules are needed to connect to respective Ethernet and FTE networks. ControlNet Interface plug-in module is needed to connect with other ControlNet nodes.</p> <p><b>C300</b> - Ethernet interface is built into the controller to support both Ethernet and redundant FTE communications. C300 connection to C200 controller is made through an FTE Bridge module installed in the C200 chassis. No ControlNet interface.</p> <p><b>Note:</b> C300 - 20mS CEE Controller does not support peer-to-peer connection with C200E.</p>
<i>Function Blocks</i>	<p><b>C200 and C300</b> - Both Controllers use the same standard Experion function block types for control strategy execution. There are some exceptions.</p>

Controller Feature	Comparison
	<b>Note:</b> C300 - 20mS CEE Controller supports only limited function blocks. For more information refer to <a href="#">Series 8 control hardware</a> .
<i>Engineering Tools</i>	<b>C200 and C300</b> - Both controllers use the same engineering tools utilities and applications for maintenance tasks (except NTools). The CTools engineering utility is used to upgrade C300 firmware and extract files containing diagnostic data when troubleshooting problems.

## 2.2 Getting started

The following table lists some of the tasks covered in this document that are related to implementing a C300 Controller in your Experion R300 system or later. If you are viewing this document online, just click the reference to jump to the topic in this document.

- [What task do you want to perform?](#)

### 2.2.1 What task do you want to perform?

If you want to ...	Then, see this topic ...
Plan and design a C300 Controller installation	<a href="#">C300 Controller planning and design</a>
Know more about C300 hardware	<a href="#">Series 8 control hardware</a> <a href="#">Identify C300 Controller components</a>
Know more about C300 Controller performance	<a href="#">C300 Controller performance data</a>
Install and wire C300 Controller hardware	<a href="#">C300 Controller installation</a>
Upgrade Controller firmware	<a href="#">Upgrading C300 Controller firmware</a>
Create C300 Controller and CEE function blocks	<a href="#">C300 Controller configuration</a>
Configure CEE function blocks	<a href="#">Configure CEEC300 block</a>
Configure IOLINK function blocks	<a href="#">Configure IOLINK function blocks</a>
Configure a Secondary C300 Controller	<a href="#">Configure a Secondary C300 Controller block</a>
Convert a Non-redundant C300 Controller to a redundant controller	<a href="#">Convert a non-redundant C300 Controller to a redundant controller</a>

If you want to ...	Then, see this topic ...
Convert a redundant C300 Controller to a Non-redundant controller	<a href="#">Convert a redundant C300 Controller to a non-redundant controller</a>
Reset Controller Device Index	<a href="#">Reset Device Index and IP address of a controller</a>
View configuration parameter descriptions	<a href="#">C300 configuration form reference</a>
Load function blocks to C300 components	<a href="#">Load C300 Controller Configuration</a>
Reload components from Project	<a href="#">Reloading components from project</a>
Review C300 Controller start up routines	<a href="#">C300 Controller start up</a>
Review C300 Controller operating indications	<a href="#">C300 faceplate indicators/displays</a>
Shutdown a C300 Controller	<a href="#">Initiating C300 Controller shutdown</a>
Activate the Controller's CEE	<a href="#">Activate C300 Controller's CEE</a>
View Controller operations	<a href="#">Viewing controller operation and status in Control Builder</a> <a href="#">Using Station displays</a>
Review C300 controller operating behaviors Time management, Watchdog Timer	<a href="#">C300 operating behaviors</a>
Controller processing overload behavior and recovery	<a href="#">C300 Controller processing overload behavior</a>
Review C300 Controller redundancy functionality	<a href="#">C300 redundancy operation</a>
Review C300 Controller maintenance and replacement procedures	<a href="#">C300 Controller maintenance</a>
Investigate a cause of a problem	<a href="#">C300 Controller troubleshooting</a>
Install and wire C300 Controller hardware	<a href="#">C300 Controller installation</a>
Review C300 Controller redundancy functionality	<a href="#">C300 redundancy operation</a>

## C300 CONTROLLER PLANNING AND DESIGN

This section includes information about system planning and design of the C300 Controller. The following topics are presented here.

- [Review Experion system capabilities](#)
- [Control Hardware Planning Guide](#)
- [Series 8 control hardware](#)
- [Identify C300 Controller components](#)
- [C300 Controller performance data](#)

### 3.1 Review PlantCruise. system capabilities

Read the *Overview* document so that you understand the basic concepts and terminology, and appreciate the capabilities of PlantCruise.

Complement the information in this document with the data in the *Server and Client Planning Guide* to cover all aspects of PlantCruise installation.

For planning and design topics for Engineering Station and clients as well as information about adding third-party controllers, see the *Server and Client Planning Guide*.

- [Planning for system security](#)

#### 3.1.1 Planning for system security

System security must be achieved at all levels in the Experion system to manage security threats.

For details on security related planning, refer to the *Network and Security Planning Guide*.

For controller hardware specific security planning, refer to the chapter *Securing controller hardware* of the *Network and Security Planning Guide*.

### 3.2 Control Hardware Planning Guide

Refer to the *Control Hardware Planning Guide* for a general discussion of planning activities for Experion Control hardware that covers:

- Initial planning and design
- Control network considerations
- Control hardware configuration
- Site selection and planning
- Control processing considerations
- Application licensing considerations

## 3.3 Series 8 control hardware

Series 8 control hardware consists of the following system components:

- **C300 Controller** is a distributed process controller and I/O gateway for the Experion system.
- **Series 8 Input/Output Modules** that feature HART-capable AI and AO modules, and a low level Mux AI module. Digital input modules that support high voltage AC and 24V DC inputs.
- [Series 8 form factor](#)
- [C300 Controller](#)
- [C300 controller model CC-PCNT02 – Enhanced Functionality](#)
- [C300 Controller execution environments](#)

### 3.3.1 Series 8 form factor

All Series 8 control hardware is constructed using the same form factor; that is, the C300 Controller modules, Series 8 I/O modules, and Series 8 FIMs all mount on their associated Input Output Termination Assemblies (IOTAs), which are installed on channel hardware specifically designed to support Series 8 hardware installation. The module's circuit board assemblies are housed in a plastic case with a round faceplate that identifies the module type and model number along with status LEDs and a four-character alphanumeric display. The IOTA contains connectors that accept the associated control module and the various I/O connectors for cables that connect to other Series 8 control hardware. Below figure shows an example of the design.

Figure 3.1 Series 8 form factor example



For more details about Series 8 I/O, Level1 Switch and FIM modules refer to the following documents:

- *Series 8 I/O User's Guide*
- *Series C Mark II I/O User's Guide*
- *Series 8 Fieldbus Interface Module User's Guide.*

### 3.3.2 C300 Controller

The C300 Controller is constructed using the Series 8 form factor that employs an Input Output Termination Assembly (IOTA) and an electronics module which mounts and connects to the IOTA. This smaller controller footprint and ease of installation provides greater value for PlantCruise users.

The C300 Controller fully supports configuration, load and execution of the standard function blocks. Note that there are a few exceptions defined below.

## Exceptions

The following function blocks are *not* supported by the C300 Controller:

- The LIOM function block set.
- CAB related function blocks other than the Custom Data Block (CDB)

### 3.3.3 C300 - 20mS CEE Controller

The C300 - 20mS CEE Controller uses the same Controller Module and IOTA as the C300 - 50ms controller. It uses a different firmware image that supports faster control execution. The C300 - 20 mS CEE supports Speed Protection Module (SPM) that monitors turbine speed inputs, analog inputs, and digital status inputs, and controls digital outputs and a single analog output. Servo Valve Positioner (SVP) Module monitors valve position either with LVDT/RVDT interface or analog input and two digital inputs, and controls the valve movement either with servo coil current or analog output.

The C300 - 20mS CEE Controller fully supports configuration, load and execution of the standard function blocks supported in the C300 - 50ms Controller. Note that there are a few exceptions defined below.

## Exceptions

The C300 - 20 controller does not support the following function blocks.

- LIOM function block set
- Custom Data Block (CDB)
- Profibus Gateway Module (PGM2) function blocks
- SIM C300 20ms function block
- FIM4 function block
- Wireless Device Manager (WDM) function blocks
- Sequential Control Module (SCM) function block
- Recipe Control Module (RCM) function block
- Unit Control Module (UCM) function block
- Phase Block
- Series A - Serial Interface Module (SIM) (for third party integration)
- Series H module
- Profibus I/O Module
- PMIO function blocks
- Exchange blocks
- Change Execute (CHGEXEC) Block
- Fieldbus blocks
- DeviceNet blocks
- Profibus blocks
- American Gas Association (AGA) blocks
- A-B Drive Interface Library
  - Legacy SCANport Drives
  - PowerFlex Drives

- JAGXTREME block library
  - JAGXCHAN
  - JAGXTERM
- QIMPACT Library block
  - QIPACCHAN
  - QIPACTERM

**ATTENTION**

C300-20ms controller does not support peer-to-peer communication with the following:

- FIM4
- Profibus Gateway Module (PGM2)
- C200E
- Wireless Device Manager (WDM)

## C300 Controller redundancy

The C300 Controller may operate in both non-redundant and redundant configurations. Redundant operation requires a second identical controller and connecting cables, which is the typical configuration. The switchover time from the active primary controller to the backup controller of a redundant pair is less than 500 milliseconds.

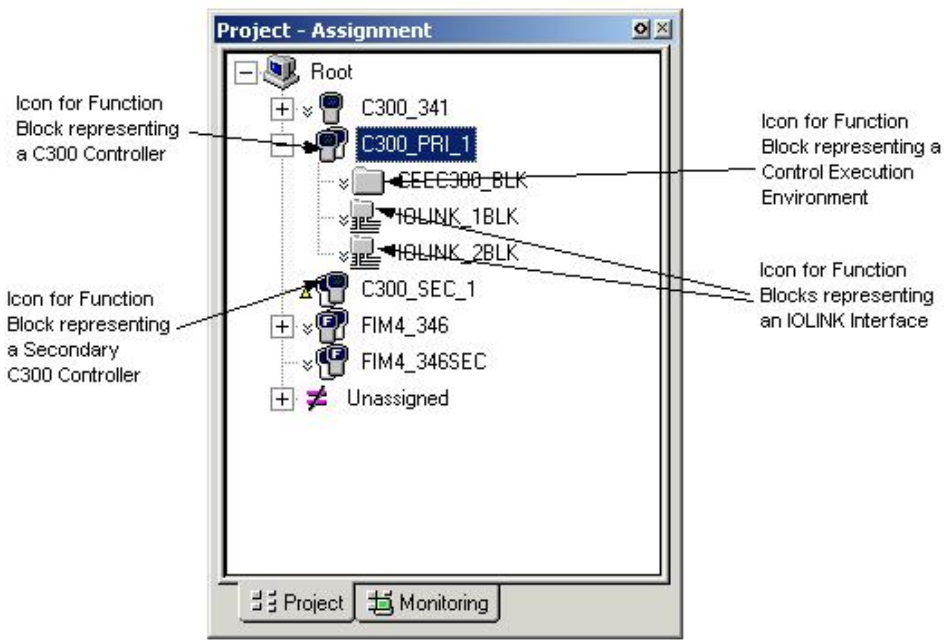
**ATTENTION**

The switchover time from the active primary C300-20ms controller to the backup C300-20ms controller of a redundant C300-20ms controller pair is less than 200 milliseconds.

## C300 Controller block

When a C300 Controller block is added to the Project tree in Control Builder, a graphic representation of a controller module and its resident function blocks appears as shown in Figure 2. The function blocks that are contained in the controller support multiple execution environments. A Control Execution Environment block (CEEC300) and two IOLINK blocks are contained in the controller and appear under the controller. When the controller block is configured as redundant, the secondary controller block is added in the Project tree.

Figure 3.2 Redundant C300 Controller block in the Project tree



### 3.3.4 C300 controller model CC-PCNT02 – Enhanced Functionality

Beginning with R501, a new C300 controller model with enhanced functionality: the CC-PCNT02, has been introduced to meet the demand for expanded memory and to address the ASIC hardware (Spartan-II E FPGA) obsolescence.

While the initial release of C300 (CC-PCNT01) contained a Processor board with 32 MB of main Memory and Application board that used the Spartan-II E FPGA family, the new release of C300 (CC-PCNT02) gets 64 MB of main Memory and an Application board that uses the Spartan-3A FPGA family ASIC.

The enhanced memory enables the CC-PCNT02 to provide extended functionalities such as support for Profit Controller and Ethernet Interface Module (IEC & EIP) blocks. Besides this, there is no significant change in the functionality offered by the CC-PCNT02 model compared to CC-PCNT01.

The CC-PCNT02 may be used as a compatible field replacement for CC-PCNT01 by installing the current-release firmware image with Ctools. The following table summarizes the supported releases and the firmware required to enable CC-PCNT02 to either work with enhanced functionality or only replace CC-PCNT01.

In the Release	CC-PCNT02 behavior will be	When flashed with the firmware
R501	Exactly as CC-PCNT01	C300.lcf
As CC-PCNT02 (that is, with extended functionality)	PCNT02.lcf	boot2x; app2
R310.3 to R432	Exactly as CC-PCNT01 (that is, as a replacement for an existing CC-PCNT01 only)	

**NOTE**

See the appropriate release SCN for details of applicable firmware and required upgrade procedures.

What this essentially means is, in R501, the CC-PCNT02 can run compatible firmware that includes application image types: 20 ms, 50 ms, or 50ms\_EHB, and be the exact equivalent of a CC-PCNT01.

In R501, when the CC-PCNT02 is running compatible firmware with the application image type 50ms\_Extended, it acquires extended functionality to support Profit Control and EIP blocks.

See the BeAware ADVISORY BW2016-19\_introducing\_c300\_cc-pcnt02 for a description of conditions under which the CC-PCNT02 C300 can be used to replace a CC-PCNT01 C300, and restrictions on migration.

For more information about migration and interoperability considerations between CC-PCNT02 and CC-PCNT01, see the *C300 and Series C IO Modules On-Process Migration Guide* and *C300 and Series C IO Modules Off-Process Migration Guide*.

## Identifying the CC-PCNT02

You can identify a CC-PCNT02 by using one or a combination of these three methods:

1. 1. On the front display of the module – Marked as CC-PCNT02
2. Check the module in FTE Status Display and in Ctools. You will see:
  - C300V2, if it is PCNT01
  - C300V3, if it is PCNT02 with PCNT01 compatible firmware
  - C300V3E, if it has extended functionality firmware

**NOTE**

In releases prior to R501, this information is not shown in FTE Status Display and in Ctools but as shown for any PCNT01 model.

3. In Control Builder, on the Hardware Information tab of the C300 Module Property block, Hardware version is displayed as
  - Version 3 for PCNT02
  - Version 2 for PCNT01

In R501, after installing the new controller and flashing the current-release firmware image, on the controller's **Main** tab, under **Controller Capability Configuration**, ensure that the **Extended Functionality** checkbox (CAPABILITY parameter) is selected.

This checkbox is already checked if you have migrated to the CC-PCNT02 from the CC-PCNT01 and you have flashed it with the PCNT02.lcf firmware.

Also, under **Controller Capability** (CTRLCAPABILITY parameter), the actual capability of the controller is shown. This is a read-only parameter and could have one of the following values:

- 50ms – Indicates CC-PCNT02 is running as CC-PCNT01
- 20ms – Indicates CC-PCNT02 is running as CC-PCNT01
- 50ms\_EHB – Indicates CC-PCNT02 is running as CC-PCNT01
- 50ms\_Extended – Indicates the CC-PCNT02 is running as CC-PCNT02.

**NOTE**

The 50ms\_Extended firmware includes the 50ms\_EHB firmware.

### 3.3.5 C300 Controller execution environments

The C300 Controller supports three Execution Environment (EE) function blocks. One is the Control EE block (CEEC300) The IOLINK blocks in the C300 support connection and communications with all I/O modules.

#### CEE function block

The Control Execution Environment (CEEC300) block is a function block which uses the same library of block types. The CEEC300 block provides an execution and scheduling environment in which Control Modules (CMs) and Sequential Control Modules (SCMs) execute user-configured control strategies. Existing control strategies can be ported to a C300 controller, although manual editing of these strategies is required to support the C300 controller configuration. The CEEC300 block contains a peer-to-peer communications layer which is used to communicate between other controllers.

### 3.3.6 I/O modules supported by the C300 Controller

The C300 Controller supports all Series A chassis-based I/O modules, all Series 8 I/O modules and all PMIO I/O modules that are qualified for use in Experion. Series A I/O modules are connected to the C300 through a Fault Tolerant Ethernet Bridge (FTEB) module which is installed in a C200 controller or remote I/O chassis. See FTE Bridge (FTEB) Topologies in the *Control*

*Hardware Planning Guide* for an example of this connection. Some Series A modules are implemented in a Control Component Library (CCL).

Series 8 I/O and PMIO modules are connected to the C300 by a pair of I/O Link Interfaces. Two IO Link interfaces, which are redundant, provide connection between the C300 controller and associated I/O modules. Each IO links can be configured to support Series 8 I/O modules or PMIO I/O modules.

See the following resources for listings of the supported I/O modules:

- **PMIO Modules** - Planning Your Input/Output Processor (IOP) Cards in the control Hardware Planning Guide.
- **Series C I/O Modules** - Available Series 8 I/O modules in the Series 8 IO User's Guide.

### 3.3.7 I/O Modules supported by the C300 - 20mS CEE Controller

The C300 - 20mS CEE Controller supports all Series C I/O modules that are supported by C300 - 50ms controller. In addition, the C300 - 20mS CEE controller supports two new Series C I/O modules - Speed Protection Module (SPM) and Servo Valve Positioner Module (SVPM). See Series C I/O Topologies in the *Control Hardware Planning Guide* for an example of this connection.

The C300 Controller is connected to the associated I/O hardware modules by a pair of I/O Link Interface cables. Each IO link can be configured to support Series C I/O modules.

For a list of supported I/O modules, see in the *Series C I/O User's Guide*.

## 3.4 Identify C300 Controller components

### ATTENTION

The C300 - 20mS CEE controller components are same as the C300 - 50ms controller. The C300 - 20mS CEE controller is intended for Honeywell Turbine Control Solutions.

The following table identifies the C300 Controller components and its associated components. The C300 Controller supports non-redundant and fully redundant operation. Redundancy is built in to the controller, so that just adding another controller and a redundancy cable; a redundant controller pair is achieved. Note that the 'CC' designation on the model number indicates the printed wiring boards are conformally coated for additional protection from the environment, (CU = uncoated).

**Table 3.1 Series 8 Hardware components**

Series 8 Component	Description	Model Number
<i>C300 Controller Module</i>	A distributed process controller and I/O gateway for the PlantCruise system. Module contains printed circuit assemblies, status indicators and a display, inside in a plastic housing. Module mounts to its Input Output Termination Assembly (IOTA).	CC-PCNT01
		CC-PCNT02
		CU-PCNT01
	The CC-PCNT02 hardware supports enhanced functionality with expanded memory. It is interoperable with CC-	

Series 8 Component	Description	Model Number
	PCNT01.If you replace an existing CC-PCNT01 with CC-PCNT02, the firmware provides an easy synchronization of both the controllers. This hardware is required for the enhanced R501 features of Profit Controller.	
<i>C300 Controller Input Output Termination Assembly (IOTA)</i>	Provides the connection point for the C300 Controller module and all cable terminations to the controller, (FTE, IOLink, Redundancy, Battery, and Time Source cable terminations). Provides 24 Vdc power distribution to the controller module.  Note: The C300 Controller IOTA supports only one controller module.	CC-TCNT01 CU-TCNT01
<i>9 Port FTE Control Firewall Module</i>	Provides FTE distribution to the cabinet network nodes, (other C300 Controllers and Series 8 FIMs)	CC-PCF901 CU-PCF901
<i>9 Port Control Firewall IOTA</i>	Provides connection for the eight FTE cables from in-cabinet controllers and Series 8 FIMs. The 9 <sup>th</sup> port provides an uplink to the FTE supervisory network. Provides 24 Vdc power distribution to the CF9 module.	CC-TCF901 CU-TCF901
<i>FTE Cable</i>	STP CAT5 Cable with RJ 45 connectors for FTE connections.	
2 m (6.5 ft) (Y) = Yellow coded boots (G) = Green coded boots	51305482-102 (Y) 513054820202 (G)	
5 m (16 ft)	51305482-105 (Y) 513054820205 (G)	
10 m (33 ft)	51305482-110 (Y) 513054820210 (G)	
20 m (65.5 ft)	51305482-120 (Y)	

Series 8 Component	Description	Model Number
	51305482-220 (G)	
<i>Redundancy Cable</i>	STP CAT5 Cable with RJ 45 connectors joining primary and secondary controllers.	51305482-xxx
<i>IOLink Cable</i>	Multidrop cable assemblies to connect the I/O modules of a controller IOLink.	xxxxxxxx-xxx
<i>Battery Cable</i>	Multidrop twisted pair cable to connect battery power to controllers.	xxxxxxxx-xxx
<i>IOTA Channel Supports</i>	Aluminum channels that provide a mounting medium for the IOTA Channel.	CC-MCHN01
<i>IOTA Channel</i>	Assembly for mounting the Series 8 hardware IOTAs. Channels contain power and grounding busbars are mounted onto IOTA channel supports.	CC-MCAR01
<i>Power Supply, Non-redundant no Battery Back Up</i>	24 Vdc, 20 A power supply. Provides non-redundant power to Channel busbars and Series 8 IOTAs.	CC-PWRN01
<i>Power Supply Redundant, no Battery Back Up</i>	24 Vdc, 20 A fully redundant power supply. Provides redundant power to Channel busbars and Series 8 IOTAs.	CC-PWRR01
<i>Power Supply, Redundant with Battery Back Up</i>	24 Vdc, 20 A fully redundant power supply with battery back up. Provides redundant power to Channel busbars and Series 8 IOTAs.	CC-PWRB01
<i>COTS Power Supply (Meanwell) Redundant, no Battery Back Up</i>	24 Vdc, 20 A COTS power supply. Provides redundant power to channel busbars and Series 8 IOTAs.	CU-PWMR20
<i>COTS Power Supply (Meanwell) Non-redundant, no Battery Back Up</i>	24 Vdc, 20 A COTS power supply. Provides non-redundant power to channel busbars and Series 8 IOTAs.	CU-PWMN20
<i>COTS Power Supply (Phoenix Contact) Redundant, no Battery Back Up</i>	24 Vdc, 20 A COTS power supply. Provides redundant power to channel busbars and Series 8 IOTAs.	CU-PWPR20
<i>COTS Power Supply (Phoenix Contact) Non-redundant, no Battery</i>	24 Vdc, 20 A COTS power supply. Provides non-redundant power to channel busbars and Series 8 IOTAs.	CU-PWPN20