Quantum using EcoStruxure™ Control Expert

Change Configuration On The Fly User Guide

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

At a Glance

Document Scope

This manual provides information on the Quantum Change Configuration On The Fly (CCOTF) function.

The CCOTF function is for:
- Standalone systems
- Hot Standby systems

Validity Note

This document is valid for EcoStruxure™ Control Expert 14.0 or later.

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Title of documentation	Reference number
EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual	35006144 (English), 35006145 (French), 35006146 (German), 35013361 (Italian), 35006147 (Spanish), 35013362 (Chinese)
EcoStruxure™ Control Expert, Operating Modes	33003101 (English), 33003102 (French), 33003103 (German), 33003104 (Spanish), 33003696 (Italian), 33003697 (Chinese)
EcoStruxure™ Control Expert, System Bits and Words, Reference Manual	EIO0000002135 (English), EIO0000002136 (French), EIO0000002137 (German), EIO0000002138 (Italian), EIO0000002139 (Spanish), EIO0000002140 (Chinese)
Modicon Quantum, Update Procedure, User Guide	EIO0000002381 (English)
EcoStruxure™ Control Expert, OS Loader, User Manual	35006156 (English), 35006157 (French), 35006158 (German), 33003672 (Italian), 35006159 (Spanish), 33003673 (Chinese)
Quantum using EcoStruxure™ Control Expert, Hardware Reference Manual	35010529 (English), 35010530 (French), 35010531 (German), 35013975 (Italian), 35010532 (Spanish), 35012184 (Chinese)
Quantum EIO, Remote I/O Modules, Installation and Configuration Guide	S1A48978 (English), S1A48981 (French), S1A48982 (German), S1A48983 (Italian), S1A48984 (Spanish), S1A48985 (Chinese)

Title of documentation	Reference number
Quantum using EcoStruxure™ Control Expert, Hot Standby System, User Manual	35010533 (English), 35010534 (French), 35010535 (German), 35013993 (Italian), 35010536 (Spanish), 35012188 (Chinese)
Grounding and Electromagnetic Compatibility of PLC Systems, Basic Principles and Measures, User Manual	33002439 (English), 33002440 (French), 33002441 (German), 33003702 (Italian), 33002442 (Spanish), 33003703 (Chinese)

You can download these technical publications and other technical information from our website at *www.schneider-electric.com/en/download*.

Part I
Introduction to Quantum Change Configuration On The Fly

Overview

This part describes the Change Configuration On The Fly (CCOTF) function in Quantum systems.

What Is in This Part?

This part contains the following chapters:

Chapter 1
CCOTF Presentation

Overview

This chapter describes the Quantum CCOTF function and compatibilities.

What Is in This Chapter?

This chapter contains the following sections:

Section 1.1
CCOTF General Information

Overview

This section presents general requirements for the Quantum CCOTF function.

What Is in This Section?

This section contains the following topics:

General Requirements for Quantum CCOTF

Overview

CCOTF allows modifications of a PLC I/O configuration in RUN mode.

The changes that can be made in the local drop or a S908 RIO drop are as follows:

- add a discrete or analog module in a free slot
- delete a discrete or analog module
- modify the configuration and adjustment parameters of a module

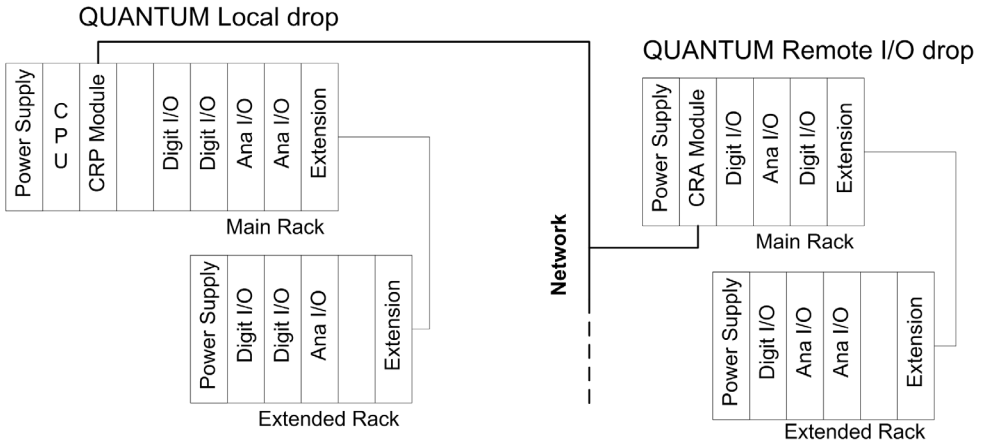
The changes that can be made in an Ethernet IO drop are as follows:

- add a Quantum or Modicon M340 EIO drop
- add a discrete or analog module in a free slot
- delete a discrete or analog module
- modify the configuration and adjustment parameters of a module

The RIO drops management in a Quantum system is based on:

- a network:
  - S908 network *(see Quantum using EcoStruxure™ Control Expert, Hardware, Reference Manual)* in an S908 Quantum system
  - Ethernet network *(see Quantum EIO, Remote I/O Modules, Installation and Configuration Guide)* in a Quantum Ethernet I/O Quantum system
- communication modules:
  - a CRP module, placed in the local drop
  - a CRA module, placed in each RIO drop

The following graphic shows an example of Quantum standalone architecture with a Quantum RIO drop:



Hardware Requirements

The CCOTF function is not available for safety Quantum PLCs.

Control Expert Requirements

NOTE: Unity Pro is the former name of Control Expert for version 13.1 or earlier.

The minimum Control Expert/Unity Pro software versions required to use CCOTF in a:

- Standalone system is:
  - Local drop or S908 RIO drops: Unity Pro XL, XLS 5.0 or higher
  - Quantum Ethernet IO drop: Unity Pro XL 6.0 or higher
  - Modicon M340 Ethernet IO drop: Unity Pro XL 7.0 or higher
- Hot Standby system is:
  - Local drop with S908 RIO drops: Unity Pro XL, XLS 4.1 or higher
  - Local drop with Quantum Ethernet IO drops: Unity Pro XL 6.0 or higher
  - Local drop with Modicon M340 Ethernet IO drops: Unity Pro XL 7.0 or higher

Firmware Requirements

The minimum firmware versions required to use the CCOTF function with a local or S908 RIO drop are:

Module Type	Reference	Firmware Version
Standalone CPU	140 CPU 311 10	SV2.80 or later
	140 CPU 434 12A/U	SV2.80 or later
	140 CPU 534 14A/B/U	SV2.80 or later
	140 CPU 651 50	SV2.80 or later
	140 CPU 651 50 S	SV2.80 or later
	140 CPU 651 60	SV2.80 or later
	140 CPU 652 60	SV2.80 or later
	140 CPU 658 60	SV3.20 or later
Hot Standby CPU	140 CPU 671 60	SV2.70 or later
	140 CPU 672 60	SV2.80 or later
	140 CPU 672 61	SV2.80 or later
	140 CPU 678 61	SV3.20 or later
S908 RIO module	140 CRA 93x 00	SV2.00 or later **NOTE:** Modules PV03 and later can be upgraded *(see page 51)* to allow CCOTF function.
	140 CRP 93x 00	SV2.00 or later **NOTE:** Modules PV01 and later can be upgraded to allow CCOTF function.

The minimum firmware versions required to use the CCOTF function with an Ethernet IO drop are:

Module Type	Reference	Firmware Version	CCOTF Function
Standalone CPU	140 CPU 651 50	• SV3.00 or later • SV3.10 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	Limited
	140 CPU 651 60	• SV3.00 or later • SV3.10 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	Limited
	140 CPU 652 60	• SV3.00 or later • SV3.10 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	Full
	140 CPU 658 60	• SV3.20 or later	Full
Hot Standby CPU	140 CPU 671 60	• SV3.00 or later • SV3.10 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	Limited
	140 CPU 672 60	• SV3.00 or later • SV3.10 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	Full
	140 CPU 672 61	• SV3.00 or later • SV3.10 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	Full
	140 CPU 678 61	• SV3.20 or later	Full
Ethernet IO module	140 CRP 312 00	• SV1.00 or later • SV2.00 or later (to manage add Ethernet IO drop + Modicon M340 Ethernet IO drops)	
	140 CRA 312 00	• SV1.00 or later	
	BMX CRA 312 10	• SV1.00 or later	

CCOTF function level description:

- Limited: 1 x 140 CRP 312 •• module in the system, no add drop functionality, 16 Ethernet IO drops maximum
- Full: 1 x 140 CRP 93x 00 (S908) + 1 x 140 CRP 312 •• (EIO) modules in the system, add drop functionality, 31 Ethernet IO drops maximum.

General Advice for Using CCOTF

Recommendation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

Do not manipulate a module that is supplied by a dangerous voltage. Read and understand the preventive measures that are described in the Grounding and Electromagnetic Compatibility of PLC Systems *(see Grounding and Electromagnetic Compatibility of PLC Systems, Basic Principles and Measures, User Manual)* user manual.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

RISK OF UNEXPECTED EQUIPMENT BEHAVIOR

Before doing any CCOTF modification, ensure that your system responds appropriately. Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

Take these recommendations into account before adding an Ethernet RIO drop or adding / removing a module from the local or RIO drop:

- Adding an Ethernet RIO drop in a Quantum Ethernet I/O system:
  - configure the Ethernet RIO drop in Control Expert
  - connect the Ethernet RIO drop in the system
  - write the sequences of application program to manage the new Ethernet RIO drop
- Adding a module in the Control Expert configuration:
  - configure the module in Control Expert
  - plug the module in the hardware configuration
  - write the sequences of application program to manage the new module
- Removing a module from the configuration:
  - remove the sequence of application program that is related to the removed module
  - unplug the module from the hardware configuration
  - remove the module from the Control Expert configuration

NOTE: Adding, through a CCOTF operation, a Discrete Module supporting both Discrete Inputs and Discrete Outputs (e.g. 140 DDM 390 00, 140 DDM 690 00) in a local drop or S908 Remote I/O drops, leaves the Module inactive and the Value of Discrete Inputs not updated in the PLC Memory when the task output update is inhibited with %SW9 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)*.

Quantum System Configuration Overview

A Quantum configuration can have:

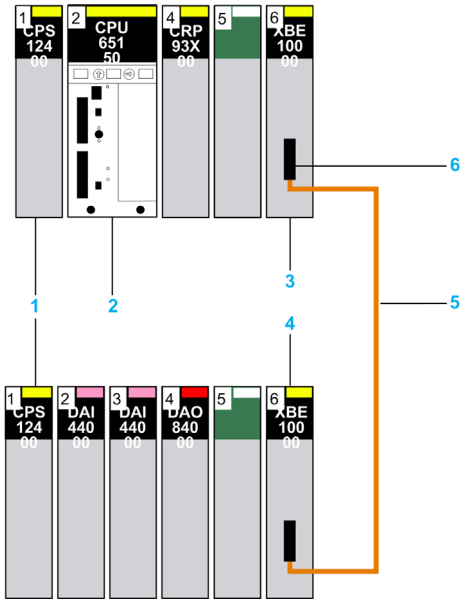
- a local drop and S908 Remote I/O drops in an S908 system
- a local drop and Ethernet Remote I/O drops in a Quantum Ethernet I/O system
- a local drop with S908 Remote I/O drops and Ethernet Remote I/O drops

The local drop and each remote I/O drop can be made of two racks (backplanes):

- The Main (Primary) rack contains the CPU and the Remote I/O drop adapter
- The Extended (Secondary) rack is linked to the main rack with two backplane expanders

CCOTF modifications can be performed on the main rack or the extended rack.

The picture below shows the elements that can be part of a Quantum drop:



1 Power Supplies (140 CPS ••• ••)
2 CPU (140 CPU ••• ••) or RIO adapter
3 First backplane Expander (140 XBE 100 00)
4 Second backplane Expander (140 XBE 100 00)
5 Backplane expander Cable (140 XCA 717 0•)
6 Cable end marked as “Primary”

Number of CCOTF Modifications

Validating a CCOTF modification requires a **Build Changes** in Control Expert.

The number of CCOTF modifications allowed in one CCOTF transaction (a transaction is defined by the operations done between two **Build Changes**) depends on the system:

- In a local drop or S908 RIO drops, 1 modification is allowed by transaction.
- In a Quantum Ethernet RIO drop:
  - 1 add Ethernet RIO drop is allowed by transaction
  - 4 add or 4 delete modules modifications are allowed by transaction (in the same drop)
  - 1 parameter modification is allowed by transaction (in the same drop)
- In a Modicon M340 Ethernet RIO drop:
  - 1 add Ethernet RIO drop is allowed by transaction
  - 4 add or 4 delete modules modifications are allowed by transaction (in the same drop)
  - Parameters (Configuration or Adjustment) modifications are allowed on 4 channels of the same module, in the same drop, by transaction.
    A parameter modification on 1 channel causes this channel to be reset.
  - 1 Modicon M340 Ethernet RIO drop module application specific function parameter modification is allowed by transaction (BMX EHC ••• module only)

The number of modifications allowed is available in both the **Standard connected mode** as well as in the **Virtual connected mode** *(see EcoStruxure™ Control Expert, Operating Modes)*.

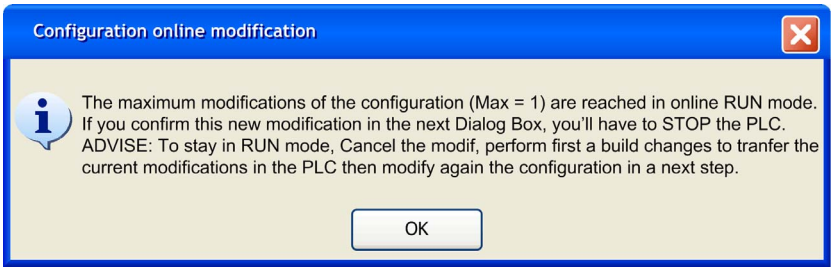
The number of CCOTF modifications allowed in a transaction respect a hierarchy:

- An add Ethernet RIO drop allows to add various module and modify the modules parameter within the same transaction.
- An add module in an Ethernet RIO drop allows to modify the added module parameters within the same transaction. 3 other modules can be added within the same transaction.
- A parameter modification performed on a Modicon M340 channel in an Ethernet RIO drop allows parameters modifications to be performed on 3 other channels on the same module, in the same drop, within the same transaction.
  No higher level CCOTF modification is allowed within the same transaction: no add or delete module nor add drop are authorized after an initial parameter modification. A **Build Changes** must be performed before performing a higher level CCOTF modification.

To perform more than one CCOTF transaction it is necessary to proceed in several steps:

- perform a **Build Changes**
- transfer the current modifications in the PLC before doing next modifications.

The picture below shows what happens if the number of allowed CCOTF modifications is exceeded in a Quantum system with S908 RIO drops:



NOTE: A CCOTF modification is valid with these two actions:

- Adding / Deleting / Modifying a module or adding an Ethernet RIO drop in the Control Expert configuration screen is carried out.
- Performing a **Build Changes** of the modifications.

Example of a CCOTF Modification

Recommended CCOTF modification procedure:

Step	Action
1	Insert a new module in a free slot of the Control Expert configuration screen.
2	Modify the parameters of this module.
3	Validate the parameters modification.

NOTE: These 3 actions are considered as one CCOTF modification and require one build change to be considered as a completed transaction.

NOTE: Program modifications (add, delete or modify a sequence of code) are not considered part of the CCOTF modification. Only I/O configuration modifications (if they are allowed) are counted as CCOTF modifications.

Limitations

For eX80 modules, the CCOTF limitations are unchanged until last Control Expert version.

Quantum ERIO modules that are configured with an M580 PLC have these limitations:

- You can add an online Quantum ERIO drop only for M580 and M580 Hot Standby PLCs.
- You can add or remove only discrete and analog Quantum I/O modules.
- You can add or remove these expert modules:
  - 140 ERT 854 10
  - 140 ERT 854 20
  - 140 ERT 854 30
- You cannot add or remove these modules:
  - GEN ANA IO
  - 140 NRP 312 00
  - 140 NRP 312 01
  - 140 XBE 100 00
  - 140 EHC 105 00
  - 140 EHC 202 00
  - GEN IO
  - 140 ESI 062 10

Section 1.2
CCOTF Allowed Actions and Diagnosis

Overview

This section describes CCOTF allowed actions and System Words and Bits for a Quantum local drop, S908 RIO drop and Ethernet RIO drop.

What Is in This Section?

This section contains the following topics:

Local Drop and S908 RIO Drop Allowed Actions and Diagnosis

CCOTF Allowed Actions

These actions can be done on discrete or analog modules in a Quantum local drop and a Quantum S908 RIO drop (both main or extended racks) that are in the RUN mode:

- Add a module in a drop:
  - Add a new module
  - Copy/Paste a module in the same S908 RIO drop.
    The Copy/Paste is done from and to the main or extended drop rack. The new module has the parameter values of the copied module.
- Delete a module from a drop
- Modify module parameters

NOTE:

- It is not possible to move a module with the CCOTF function.
- Not all module parameters can be modified (including, for example, its **I/O data type**: State Ram or Device DDT).

Control Expert Connection Ports

The table below indicates the possible connection points for CCOTF modifications, which depend on the physical connection link between the computer and the Quantum system:

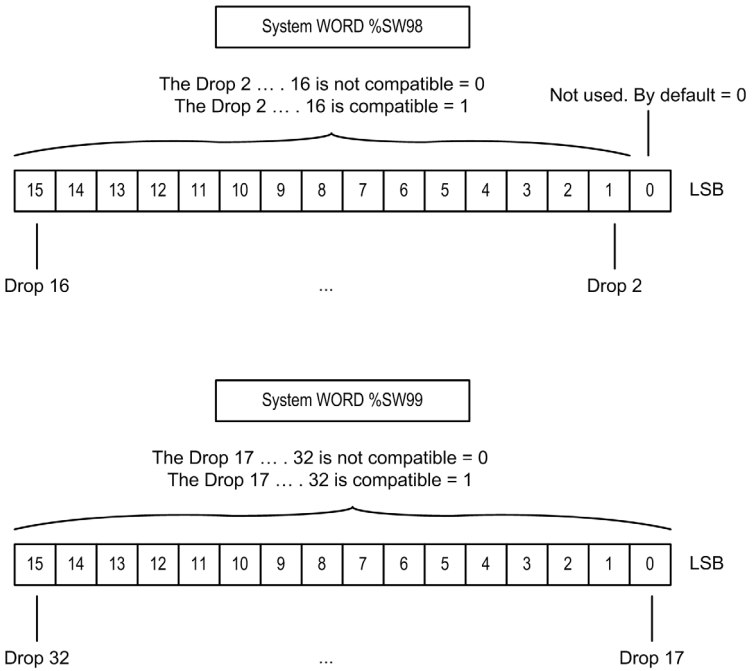
Physical link	Module available for connection
Modbus Serial	140 CPU ••• module
Modbus Plus	140 CPU ••• module
USB	140 CPU ••• module
Ethernet	140 CPU ••• module (if available)
	140 NOE ••• communication module

%SW98 and %SW99 S908 CRA Module Compatibility System Words

NOTE: All S908 RIO drops configured in the S908 RIO bus must be CCOTF compatible. This means that the corresponding bits in the system word %SW98 and %SW99 must be set to 1. No CCOTF modification is allowed if one of the S908 RIO drops configured in the S908 RIO bus is not CCOTF compatible.

NOTE: 800 Series I/O and Sy/Max I/O are not CCOTF compatible. When the CCOTF function is configured, neither 800 Series I/O nor Sy/Max I/O must be connected to the S908 RIO bus.

The following graphic shows the content of %SW98 and %SW99 system Status Register words *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* used to diagnose the S908 CRA modules compatibility:



%SW100 CCOTF Modifications Counting System Word

The system word %SW100 is incremented each time a CCOTF modification is performed in the local drop or in an S908 RIO drop.

The system word value is reset to 0 on each transition from STOP to RUN mode.

%SW100 = XXYY, where:

- XX is incremented each time a CCOTF modification is done in RUN mode in an S908 RIO drop,
- YY is incremented each time a CCOTF modification is done in RUN mode in the local drop.

Status Bits

The status bit of a module is set to 0 while the module is configured but not present. The status bits are in the system words %SW180 to %SW339 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)*. This impacts the system bits %S118 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* or %S119 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* and %S10 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* for local and S908 RIO drops.

On the other hand, when a parameter is changed, the module is re-started and status bit is set to 0 during several ms. This also impacts the system bits `%S118` or `%S119` and `%S10` for local and S908 RIO drops.

NOTE: When adding, deleting or modifying parameters in one module, the other modules available in the system are not impacted and their status bit remain at 1.

Ethernet RIO Drop Allowed Actions and Diagnosis

CCOTF Allowed Actions

These actions can be done in a Quantum Ethernet RIO system that is in the RUN mode:

- Add a Quantum or Modicon M340 Ethernet RIO drop
- In a Quantum Ethernet RIO drop (both main or extended racks):
  - Add a new module *(see page 34)* in a drop
  - Copy/Paste a module *(see page 34)* in the same Ethernet RIO drop.
    The Copy/Paste is done from and to the main or extended drop rack. The new module has the parameter values of the copied module.
  - Delete a module *(see page 34)* from a drop
  - Modify module *(see page 34)* parameters
- In a Modicon M340 Ethernet RIO drop (both main or extended racks):
  - Add a new module *(see page 35)* in a drop
  - Copy/Paste a module *(see page 35)* in the same Ethernet RIO drop.
    The Copy/Paste is done from and to the main or extended drop rack. The new module has the parameter values of the copied module.
  - Delete a module *(see page 35)* from a drop
  - Modify module *(see page 35)* parameters
  - Modify module application specific function parameter (BMX EHC ••• module only)

NOTE: It is not possible to move a module with the CCOTF function.

Control Expert Connection Ports

The table below indicates the possible connection points for CCOTF modifications, which depend on the physical connection link between the computer and the Quantum system:

Physical link	Module available for connection
Modbus Serial	140 CPU ••• module
Modbus Plus	140 CPU ••• module
USB	140 CPU ••• module
Ethernet	140 CPU ••• module (if available)
	140 NOE 771 •• communication module
	140 CRA 312 00 module on a Quantum Ethernet RIO drop or BMX CRA 312 10 module on a Modicon M340 Ethernet RIO drop (service port) (1.).
	Dual ring switch located in the Ethernet RIO network main ring (1.).
	Switches located in the Ethernet RIO network sub-rings (1.).
1. **NOTE:** A configured 140 NOC 780 00 distributed I/O head module must be interlinked with the 140 CRP 312 00 remote I/O head module in the local drop.	

NOTE: Customers may use 140 NOE 771 •• modules on the local rack instead of the 140 NOC 780 00 DIO head module.

%SW66 Ethernet RIO CCOTF Status Word

The system word %SW66 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* holds the Ethernet RIO CCOTF function status.

`%SW66` = XXYY, where:

- XX is associated with the Ethernet RIO CCOTF status code (Succeed, Not completed, etc.).
- YY is associated with the Ethernet RIO CCOTF processing status (Idle, In progress, Completed, etc.).

%SW101 Ethernet RIO CCOTF Modifications Counting System Word

The system word %SW101 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* is incrementing each time an Ethernet RIO drop CCOTF modification is performed in a PLC.

The system word value is reset to 0 on cold-start, warm-start or after an application download.

`%SW101` = XXYY, where:

- XX is reserved.
- YY is incrementing each time an Ethernet I/O configuration modification is done in RUN mode.

%SW152 to %SW153 Ethernet RIO Drop Error Status System Words

The %SW152 to %SW153 Quantum system words *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* hold the Ethernet RIO drops error status.

%SW641 to %SW702 Ethernet RIO Drop Modules Health Status System Words

The %SW641 to %SW702 Quantum system words *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* hold the Ethernet RIO drop modules health status.

Status Bits

When adding a module, the health bit of the module is set to 0 during the time where the module is configured but not present. The health bits are in the system words %SW641 to %SW702 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)*. This impacts the system bits%S117 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* and %S10 *(see EcoStruxure™ Control Expert, System Bits and Words, Reference Manual)* for Ethernet RIO drops.

On the other hand, when a parameter is changed, the module is re-started and status bit is set to 0 during several ms. This also impacts the system bits `%S117` and `%S10` for Ethernet RIO drops.

NOTE: When adding, deleting or modifying parameters in one module, the other modules available in the system are not impacted and their health bit remain at 1.

Impact of a CCOTF Modification on the State RAM

Overview

When a **discrete output** module is inserted in RUN in a Quantum configuration, all the output bits associated to this module in the state RAM *(see EcoStruxure™ Control Expert, Operating Modes)* are set to 0 (and all forced bits are immediately unforced).

When an **analog output** module is inserted in RUN in a Quantum configuration, all the output words associated to this module in the state RAM *(see EcoStruxure™ Control Expert, Operating Modes)* are set to 0.

When a **discrete or analog input** module is inserted in RUN in a Quantum configuration, all the input bits or words associated to this module in the state RAM *(see EcoStruxure™ Control Expert, Operating Modes)* are kept in the same state (including forced bits).

Section 1.3
CCOTF Compatible Modules

Overview

This section describes CCOTF compatible modules and bus management.

What Is in This Section?

This section contains the following topics:

Quantum Hardware Compatibility

Ethernet RIO Drop Compatibility

A compatible Quantum Ethernet RIO drop must contain a 140CRA31200 Ethernet communication module.

Analog and Discrete Modules Compatibility

The table below lists the Quantum I/O modules that can be added / deleted / modified in RUN mode:

Analog Modules	Discrete Modules		
140 ACI 030 00	140 DDI 153 10	140 DAI 543 00	140 DAO 840 10
140 ACI 040 00	140 DDI 353 00	140 DAI 553 00	140 DAO 842 10
140 ACO 020 00	140 DDI 353 10	140 DAI 740 00	140 DAO 842 20
140 ACO 130 00	140 DDI 364 00	140 DAI 753 00	140 DAO 853 00
140 AII 330 00	140 DDI 673 00	140 DSI 353 00	140 DRA 840 00
140 AII 330 10	140 DDI 841 00	140 DDO 153 10	140 DRC 830 00
140 AIO 330 00	140 DDI 853 00	140 DDO 353 00	140 DVO 853 00
140 AMM 090 00	140 DAI 340 00	140 DDO 353 01	140 DDM 390 00
140 ARI 030 10	140 DAI 353 00	140 DDO 353 10	140 DDM 690 00
140 ATI 030 00	140 DAI 440 00	140 DDO 364 00	140 DAM 590 00
140 AVI 030 00	140 DAI 453 00	140 DDO 843 00	140 DII 330 00
140 AVO 020 00	140 DAI 540 00	140 DDO 885 00	140 DIO 330 00
		140 DAO 840 00	

NOTE: On a S908 network, 800 Series I/O modules and Sy/Max I/O modules are not compatible with the CCOTF function.

140 ERT 854 10 and 140 ERT 854 20 Modules

In an Ethernet RIO drop, 140 ERT 854 10 and 140 ERT 854 20 modules (expert family devices) are compatible with the CCOTF function and can be added / deleted / modified in RUN mode.

Quantum Safe Modules

Hot Swapping Quantum Safe modules (140 AII 330 00, 140 AII 330 10, 140 AIO 330 00, 140 DII 330 00 and 140 DIO 330 00) is not allowed by the intrinsic safety standards.

However, if such modules already exist in an application, the CCOTF function can be used on these modules for changing their configuration parameters.

Modicon X80 Drop Hardware Compatibility

Ethernet RIO Drop Compatibility

A compatible Modicon X80 drop must contain a BMXCRA31210 Ethernet communication module.

NOTE: The BMXCRA31200 Ethernet communication module does not manage the CCOTF function.

Analog and Discrete Modules Compatibility

The table below lists the Modicon X80 I/O modules that can be added / deleted / modified in RUN mode in a Quantum Ethernet I/O system:

Analog Modules	Discrete Modules		
BMX AMI 0410	BMX DAI 0805	BMX DDI 1602	BMX DDM 16022
BMX AMI 0800	BMX DAI 0814	BMX DDI 1603	BMX DDM 16025
BMX AMI 0810	BMX DAI 1602	BMX DDI 1604	BMX DDM 3202 K
BMX ART 0414[1]	BMX DAI 1603	BMX DDI 3202 K	BMX DRA 0804
BMX ART 0814	BMX DAI 1604	BMX DDI 6402 K	BMX DRA 0805
BMX AMO 0210	BMX DAI 1614	BMX DDO 1602	BMX DRA 0815
BMX AMO 0410	BMX DAI 1615	BMX DDO 1612	BMX DRA 1605
BMX AMO 0802	BMX DAO 1605	BMX DDO 3202 K	BMX DRC 0805
BMX AMM 0600	BMX DAO 1615	BMX DDO 6402 K	

NOTE: [1]Firmware V2.1 equal or higher must be installed

Expert and Communication Modules Compatibility

The table below lists Modicon X80 modules compatibility:

Module	CCOTF Action Compatibility
BMX EHC 0200	• Modify configuration and adjustment parameters • Modify application specific function
BMX EHC 0800	

CCOTF Bus Management Compatibility

Bus and Drop Compatibility

The modifications can be done only in the Quantum local drop, Quantum RIO drops connected to the S908 network or Quantum RIO drops connected to the Ethernet network in a Quantum Ethernet I/O system.

It is not possible to do any change on the DIO Bus in RUN.

The **online modification in RUN** option must be validated in the Control Expert CPU configuration screen *(see page 47)* to allow CCOTF modifications.

If 800 Series I/O and Sy/Max I/O are connected to the S908 RIO network, an error is displayed by Control Expert during the build process.

This table describes the bus and drop compatibility with the CCOTF function:

Type of Drop			Modifications Authorized in RUN mode
LOCAL Drop	Main RACK		Yes
	Extended RACK		Yes
S908 RIO Drop	Sy/Max drop		No
	800 Series drop		No
	Quantum drop	Main RACK	Yes
		Extended RACK	Yes **NOTE:** It is not possible to add an extended rack with the CCOTF function.
Ethernet RIO Drop	Quantum drop	Main RACK	Yes
		Extended RACK	Yes **NOTE:** It is not possible to add an extended rack with the CCOTF function.
	Modicon M340 drop	Main RACK	Yes
		Extended RACK	Yes **NOTE:** It is not possible to add an extended rack with the CCOTF function.
DIO Bus			No

Chapter 2
System Upgrade to Use CCOTF

Overview

This chapter describes how to replace your hardware or upgrade your firmware to take advantage of the CCOTF function for Quantum system.

It is necessary for the Quantum system to be stopped during the upgrade procedure.

The system upgrade can be done with:
- a temporary STOP (few minutes required) for changing the hardware modules
- a complete STOP for upgrading the CPU, Copro and CRP/CRA firmware

NOTE: To download the CPU, Copro, CRA and CRP firmware, please access to Schneider Electric web site www.schneider-electric.com.

⚠ WARNING

SYSTEM NO LONGER ACTIVE

Before stopping the system, always positively confirm that there is no critical operation in progress.

The system is no longer active.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

What Is in This Chapter?

This chapter contains the following sections:

Section 2.1
Standalone System Upgrade

Overview

This section describes how to replace your hardware or upgrade modules firmware to take advantage of the CCOTF function for a Quantum standalone system.

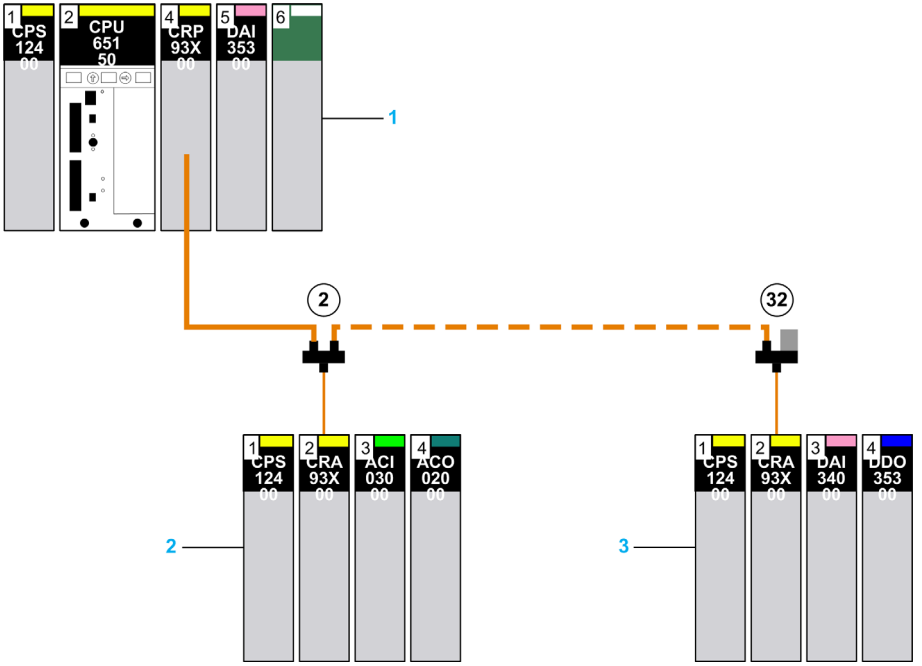
What Is in This Section?

This section contains the following topics:

Principle

General

The picture below shows an example of a Quantum standalone configuration to be upgraded to be CCOTF compatible:



1 PLC
2 Drop number 2
3 Drop number 32

In order to make a Quantum configuration CCOTF compatible, there are several steps to follow:

Step	Action
1	Replace the hardware *(see page 41)* or upgrade the firmware *(see page 51)* for the CPU and S908 CRP (in a Quantum system with S908 RIO drops).
2	Modify the application.
3	(In a Quantum system with S908 RIO drops, replace the hardware *(see page 43)* or upgrade the firmware *(see page 52)* for all the S908 CRA modules connected to the RIO bus.

Quantum Ethernet RIO Communication Modules

To benefit from the latest CCOTF function actions, Quantum CPU and Ethernet RIO communication module (140 CRP 312 00) need to be updated to the latest version *(see page 18)*:

Step	Action
1	Replace the hardware *(see page 41)* or upgrade the firmware *(see page 51)* for the CPU and Quantum Ethernet CRP (in a Quantum system with Ethernet RIO drops).
2	Modify the application.

Modicon M340 Ethernet RIO communication module (BMXCRA31210) is CCOTF compatible.

Replacing Standalone Hardware Modules

Replacing PLC Procedure

This procedure describes how to replace the modules in a standalone local drop to be CCOTF compatible:

Step	Action
1	Upload the application program running on the Quantum CPU to Control Expert.
2	Export the application in the XEF format on the Control Expert workstation.

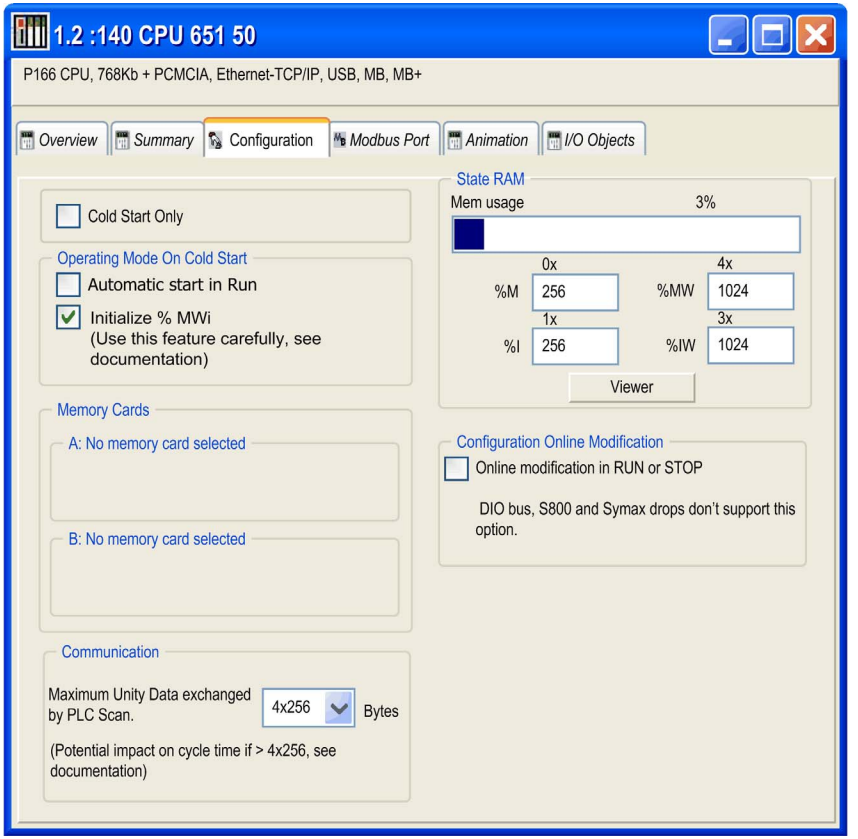
⚠ WARNING

LOSS OF COMMUNICATION

Before changing the mode of PLC to STOP, always confirm that there is no critical operation in progress. The system is no longer active.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

4	Stop the PLC and power it off.
5	If using a PCMCIA card, remove it then remove its batteries to empty the card.
6	In a Quantum system with: ● S908 RIO drops, disconnect the S908 RIO cables from the S908 CRP module (140 CRP 93* 00). ● Ethernet RIO drops, disconnect the Ethernet cables from the Quantum Ethernet CRP module (140 CRP 312 00).
7	Replace hardware or upgrade *(see page 51)* the CPU firmware with a compatible version: ● V2.80 (or higher firmware version) for a local drop with S908 RIO drops ● V3.10 (or higher firmware version) for a local drop with Ethernet RIO drops
8	In a Quantum system with: ● S908 RIO drops, replace hardware or upgrade *(see page 51)* the S908 CRP firmware with a compatible version V2.00 (or higher firmware version). ● Ethernet RIO drops, replace hardware or upgrade *(see page 51)* the Quantum Ethernet CRP firmware with a compatible version V2.00 (or higher firmware version).
9	Power on the PLC.
10	If using a PCMCIA card, insert the batteries in the PCMCIA card and then insert the PCMCIA card in the CPU. **NOTE:** The CPU must be in the **No Conf** state.
11	Import the XEF file of the application into Control Expert.
12	In the Local Bus editor replace the current version of the CPU with the new firmware CPU version.

13	Click on the **Online modification in Run** check box in the CPU configuration screen to enable the new function. The dialog below shows the check box in the Configuration tab: 
14	Rebuild the application using **Rebuild all**. The CPU is in STOP mode.
15	Download the application to the CPU while the CPU is in the STOP mode. At the end of the application download, all the application data in the PLC have their initial values.
16	In a Quantum system with: ● S908 RIO drops, reconnect the S908 RIO cable to the S908 CRP module. ● Ethernet RIO drops, reconnect the Ethernet cables to the Quantum Ethernet CRP module.

⚠ WARNING
LOSS OF DATA At the end of the application download, all the application data in the PLC have their initial values. Before changing the mode of the PLC to RUN, always confirm that the application can restart with initial values. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

17	Connect Control Expert to the PLC and put the PLC in the RUN mode.

Replacing the S908 CRA Modules in a Quantum System with S908 RIO Drops

Replacing S908 CRA modules in the S908 RIO drops can only be done after the local drop of the PLC has been updated to be CCOTF compatible with upgraded CPU and S908 CRP modules.

The following table represents the procedure to replace an S908 CRA (140 CRA 93* 00):

Step	Action
1	Make sure that a powered off RIO drop is supported by the application.
2	Power off the S908 RIO drop.
3	Disconnect the S908 RIO cable from the S908 CRA module.
4	Replace hardware or upgrade *(see page 51)* the S908 CRA firmware with a compatible version V2.00 (or higher firmware version).
5	Reconnect the S908 RIO cable on the S908 CRA module.
6	Power on the S908 RIO drop.

Repeat steps 2 through 7 for all S908 RIO drops.

NOTE: To allow CCOTF modifications, all S908 RIO drops configured on the RIO bus must be CCOTF compatible *(see page 27)*.

Section 2.2
Hot Standby System Upgrade

Overview

This section describes how to replace your hardware or upgrade modules firmware to take advantage of the CCOTF function for Quantum Hot Standby system.

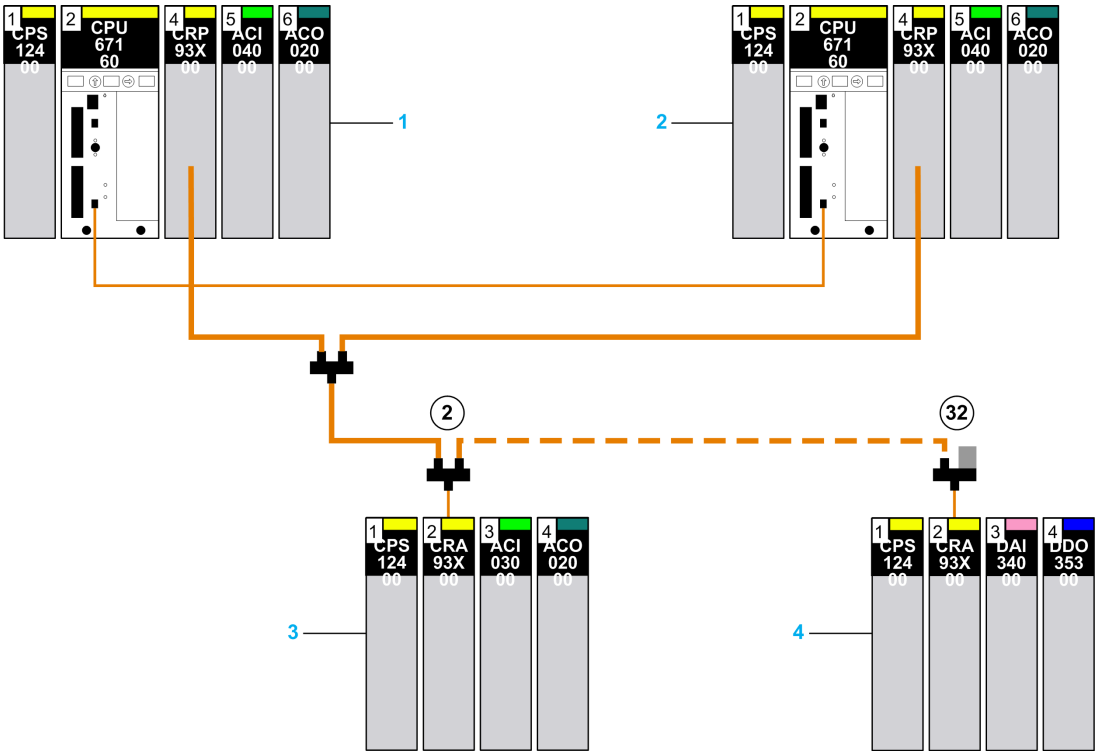
What Is in This Section?

This section contains the following topics:

Principle

General

The picture below shows an example of a Quantum Hot Standby configuration to be upgraded to be CCOTF compatible:



1 Primary PLC (PLC A)
2 Standby PLC (PLC B)
3 Drop number 2
4 Drop number 32

In order to make a Quantum Hot Standby configuration CCOTF compatible, there are several steps to follow:

Step	Action
1	Replace the hardware *(see page 47)* or upgrade the firmware *(see page 51)* for the CPU and S908 CRP (in a Quantum system with S908 RIO drops) in Standby PLC B.
2	Replace the hardware *(see page 50)* or upgrade the firmware *(see page 51)* for the CPU and S908 CRP (in a Quantum system with S908 RIO drops) in Primary PLC A.
3	Modify the application in both PLCs.
4	In a Quantum system with S908 RIO drops, replace the hardware *(see page 50)* or upgrade the firmware *(see page 52)* for all the S908 CRA modules connected to the RIO bus.

Quantum Ethernet RIO Communication Modules

To benefit from the latest CCOTF function actions, Quantum CPU and Ethernet RIO communication module (140 CRP 312 00) need to be updated to the latest version *(see page 18)*:

Step	Action
1	Replace the hardware *(see page 47)* or upgrade the firmware *(see page 51)* for the CPU and Quantum Ethernet CRP (in a Quantum system with Ethernet RIO drops) in Standby PLC B.
2	Replace the hardware *(see page 50)* or upgrade the firmware *(see page 51)* for the CPU Quantum Ethernet CRP (in a Quantum system with Ethernet RIO drops) in Primary PLC A.
3	Modify the application.

Modicon M340 Ethernet RIO communication module (BMXCRA31210) is CCOTF compatible.

Replacing Hot Standby Hardware Modules

Overview

The modules must be replaced in the following order:

- Standby PLC *(see page 47)* (PLC B in this example)
- Primary PLC *(see page 50)* (PLC A in this example)
- S098 CRA modules *(see page 50)* in the S908 RIO drops (in a Quantum system with S908 RIO drops)

Replacing PLC B Procedure

The procedure below describes how to replace the modules in the Standby PLC:

Step	Action
1	Make sure that the application program running on the Quantum Hot Standby CPUs has been exported in the XEF format and is available on the computer. If not, upload the application program from one of the two PLCs to Control Expert.
2	Export the application in the XEF format on the Control Expert workstation.

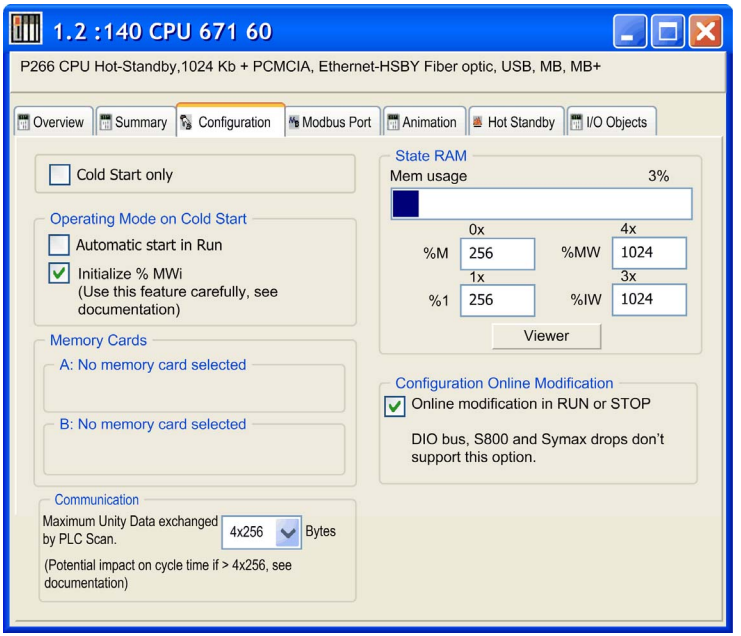
⚠ WARNING

SYSTEM NO LONGER ACTIVE NOR REDUNDANT

Before stopping the system, always positively confirm that there is no critical operation in progress. The system is no longer active nor redundant.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Step	Action
4	Stop the Standby PLC (PLC B) and power it off. **NOTE:** At this point, the system is no longer operating redundantly.
5	If using a PCMCIA card, remove it then remove its batteries to empty the card.
6	Disconnect the fiber optic sync link cable on CPU B.
7	In a Quantum system with: ● S908 RIO drops, disconnect the S908 RIO cables from the S908 CRP B module (140 CRP 93* 00). ● Ethernet RIO drops, disconnect the Ethernet cables from the Quantum Ethernet CRP B module (140 CRP 312 00).
8	Replace hardware or upgrade *(see page 51)* the CPU B firmware with a compatible version: ● V2.70 (or higher firmware version) for local drop with S908 RIO drops ● V3.10 (or higher firmware version) for local drop with Ethernet RIO drops

Step	Action
9	In a Quantum system with: ● S908 RIO drops, replace hardware or upgrade *(see page 51)* the S908 CRP B firmware with a compatible version V2.00 (or higher firmware version). ● Ethernet RIO drops, replace hardware or upgrade *(see page 51)* the Quantum Ethernet CRP B firmware with a compatible version V2.00 (or higher firmware version).
10	Power on PLC B.
11	When using a PCMCIA card, insert the batteries in the PCMCIA card and then insert the PCMCIA card in CPU B. **NOTE:** The CPU must be in a **No Conf** state.
12	Import the XEF file of the application.
13	In the Local Bus editor replace the current version of the CPU with the new firmware CPU version.
14	Click on the **online modification in Run** check box in the CPU configuration screen to enable the new function. The dialog box below shows the check box in the Configuration Tab: 
15	Rebuild the application using **Rebuild all** and download into CPU B. The CPU is in STOP mode.
16	In a Quantum system with: ● S908 RIO drops, reconnect the S908 RIO cable to the S908 CRP B module. ● Ethernet RIO drops, reconnect the Ethernet cables to the Quantum Ethernet CRP B module.

Step	Action
17	Connect the fiber optic sync link cable onto the CPU B.
18	Connect Control Expert to PLC A.

⚠ WARNING

LOSS OF COMMUNICATION

Before changing the mode of PLC A to STOP, always confirm that there is no critical operation in progress. The system is no longer active nor redundant.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

19	Stop PLC A. **NOTE:** The system is no longer active nor redundant.
20	Connect Control Expert to PLC B.

⚠ WARNING

UNEXPECTED APPLICATION BEHAVIOR - LOSS OF DATA

At the end of the application download, all the application data in the PLC B have their initial value. Before changing the mode of PLC B to RUN, always confirm that the application can restart with initial values.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

21	Put the PLC B in RUN mode.
22	Ensure that PLC B becomes the Primary.

Changing PLC A Procedure

This procedure follows **Changing PLC B Procedure** and describes how to replace the PLC A:

Step	Action
1	Power off PLC A that is in STOP mode. **NOTE:** At this point, the system is no longer operating redundantly.
2	If using a PCMCIA card, remove it then remove its batteries to empty the card.
3	Disconnect the fiber optic sync link cable on CPU A.
4	In a Quantum system with: ● S908 RIO drops, disconnect the S908 RIO cables from the S908 CRP A module (140 CRP 93* 00). ● Ethernet RIO drops, disconnect the Ethernet cables from the Quantum Ethernet CRP A module (140 CRP 312 00).
5	Replace hardware or upgrade *(see page 51)* the CPU A firmware with a compatible version: ● V2.70 (or higher firmware version) for local drop with S908 RIO drops ● V3.10 (or higher firmware version) for local drop with Ethernet RIO drops
6	In a Quantum system with: ● S908 RIO drops, replace hardware or upgrade *(see page 51)* the S908 CRP A firmware with a compatible version V2.00 (or higher firmware version). ● Ethernet RIO drops, replace hardware or upgrade *(see page 51)* the Quantum Ethernet CRP A firmware with a compatible version V2.00 (or higher firmware version).
7	Power on PLC A.
8	When using a PCMCIA card, insert the batteries in the PCMCIA card and then insert the PCMCIA card in CPU A. **NOTE:** The CPU must be in a **No Conf** state.
9	In a Quantum system with: ● S908 RIO drops, reconnect the S908 RIO cable to the S908 CRP A module. ● Ethernet RIO drops, reconnect the Ethernet cables to the Quantum Ethernet CRP A module.
10	Connect the fiber optic sync link cable onto the CPU A.
11	An automatic transfer from Primary to Standby is done.
12	Make sure PLC A runs as Standby.

Replacing the S908 CRA Modules in a Quantum System with S908 RIO Drops

Replacing S908 CRA modules in the S908 RIO drops must only be done after the local drop of the Primary PLC *(see page 50)* and the Standby PLC *(see page 47)* have been updated with upgraded CPUs and S908 CRP modules.

To replace the S908 CRA module, follow the procedure described in the CCOTF with a standalone system dedicated chapter. *(see page 43)*

Section 2.3
Firmware Upgrade

Upgrading the Firmware

CPU/Copro Compatibility

The Copro (co-processor) in the 140 CPU ••• module is a processor dedicated to:

- embedded Ethernet link management in high-end standalone CPUs in a standalone system
- Hot Standby fiber optic link management in a Hot Standby system

The Copro firmware version depends on the Quantum CPU firmware version.

The table below shows the CPU and Copro firmware required to be CCOTF compatible:

System	Quantum CPU Firmware Version	Copro Firmware Version
Standalone	V2.80	V2.80 to V2.89
	V3.00	V3.00 to V3.09
	V3.10	V3.00 to V3.09
Hot Standby	V2.70	V2.70 to V2.79
	V2.80	V2.80 to V2.89
	V3.00	V3.00 to V3.09
	V3.10	V3.10

CPU Firmware Upgrade

The CPU firmware download is done through Modbus or Modbus Plus, using the OS Loader tool *(see EcoStruxure™ Control Expert, OS Loader, User Manual)*.

The procedure to follow is described in the Modicon Quantum, Update Procedure, User Guide.

Copro Firmware Upgrade

The Copro firmware download is done through Modbus or Modbus Plus, using the OS Loader tool *(see EcoStruxure™ Control Expert, OS Loader, User Manual)*.

The procedure to follow is described in the Modicon Quantum, Update Procedure, User Guide.

S908 CRP Firmware Upgrade

The S908 CRP firmware download is done through Modbus or Modbus Plus, using the OS Loader tool *(see EcoStruxure™ Control Expert, OS Loader, User Manual)*.

The procedure to follow is described in the Modicon Quantum, Update Procedure, User Guide.

S908 CRA Firmware Upgrade

The S908 CRA firmware download is done through Modbus or Modbus Plus, using the OS Loader tool *(see EcoStruxure™ Control Expert, OS Loader, User Manual)*.

The procedure to follow is described in the Modicon Quantum, Update Procedure, User Guide.

Quantum Ethernet CRP Firmware Upgrade

The Quantum Ethernet CRP firmware download is done through Ethernet, using the OS Loader tool *(see EcoStruxure™ Control Expert, OS Loader, User Manual)*.

The procedure to follow is described in the Modicon Quantum, Update Procedure, User Guide.

Chapter 3
Quantum CCOTF Performance

Key Performance

Cycle Time Impact

The table below describes the cycle time, which depends on the modification done:

Modification	Maximum Time impact
Inserting a new module	30% of the Mast Task cycle time
Deleting a module	30% of the Mast Task cycle time
Modifying parameters of an existing module	30% of the Mast Task cycle time

NOTE: The percentage varies depending on the cycle time. For cycle time lower than 80 ms, the max time impact could be higher.

NOTE: A CCOTF modification only impacts the module concerned.

Time to Complete a CCOTF Modification in a RIO drop

To understand how a CCOTF modification is performed, the following points have to be considered:

- A CCOTF modification is managed at the Mast task frequency.
- When a CCOTF modification is done in a RIO drop, several specific requests are sent to the CPU in order to modify the CPU memory area containing the I/O drop configuration. This modification is performed when the **Build Changes** button is selected in Control Expert.
- Memory areas containing all the I/O drop configurations are contiguous in the CPU memory, if the CCOTF modification is related to the first RIO drop, all the other memory areas related to the other RIO drops have to be shifted in the CPU memory.
  If the CCOTF modification is related to the last RIO drop, only the area of this drop is modified.
  An important consequence of this point is that a CCOTF modification in the last RIO drop will require less Mast task cycles than a CCOTF modification in the first RIO drop.
- Inserting a new module is completed when the status bit of this module is set to 1.

NOTE: The worst case possible is to add a new module in the first RIO drop. The time needed by the system to complete a CCOTF modification is lower than 4 seconds.

Part II
Using CCOTF with a Standalone System

Overview

This part describes using CCOTF with a Quantum standalone system.

What Is in This Part?

This part contains the following chapters:

Chapter 4
Add Ethernet RIO Drop

Overview

This chapter describes the procedure to add a Quantum Ethernet RIO drop or a Modicon M340 Ethernet RIO drop in a Quantum standalone system.

What Is in This Chapter?

This chapter contains the following topics:

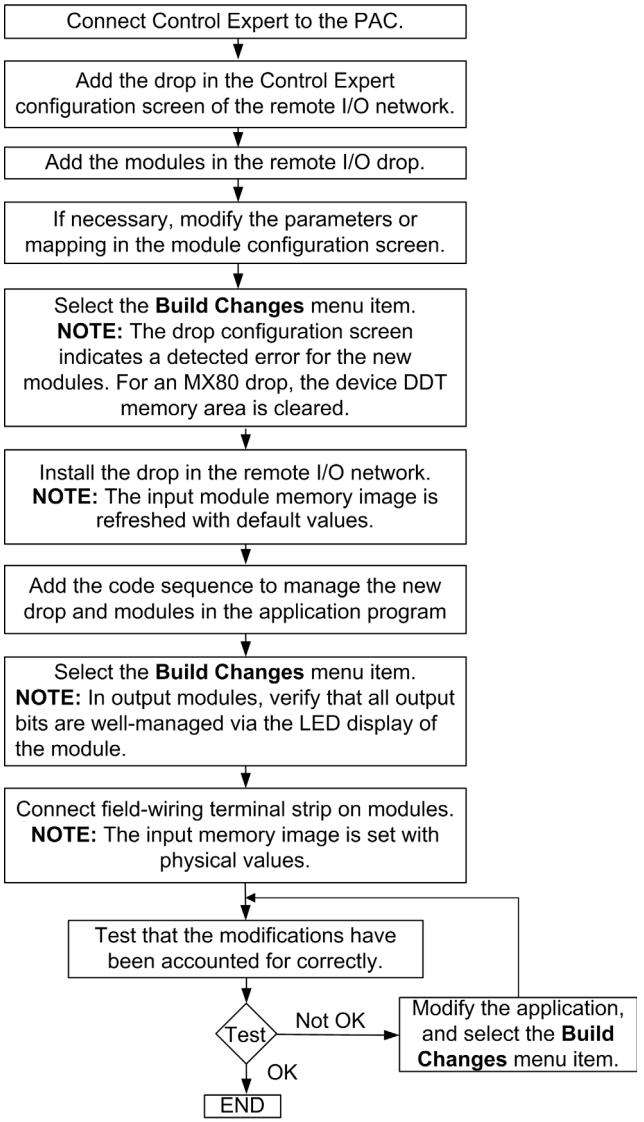
Adding an RIO Drop Using the Standard Connected Mode

Introduction

NOTICE
UNINTENDED EQUIPMENT OPERATION ● Verify that the margin between watchdog timers and task execution times is great enough to handle the increased processing time required to support the CCOTF modification. ● Anticipate performance decrease due to the increased traffic resulting from the new RIO drop in the system. **Failure to follow these instructions can result in equipment damage.**

Adding an RIO Drop

This describes the process of adding an RIO drop using the **standard connected mode**:



NOTE: An RIO drop contains 1 or 2 racks (linked with a backplane expander cable).

Add a Remote I/O Drop in a Standalone System While in the Virtual Connected Mode

Prerequisite

⚠ WARNING

RISK OF UNEXPECTED EQUIPMENT BEHAVIOR

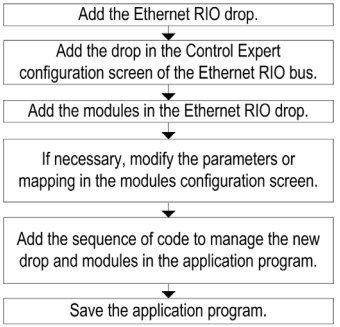
Before doing any CCOTF modification, ensure that your system responds appropriately. Modifications made when the **On line modification in RUN or STOP** check box is selected can have an immediate impact on the process.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Addition in Offline Mode

In this mode, it is possible to modify the I/O configuration when the application is offline. The application that is downloaded onto the PACs has to be generated with the **Virtual connected mode** check box enabled in the **Project settings → General → Build settings**.

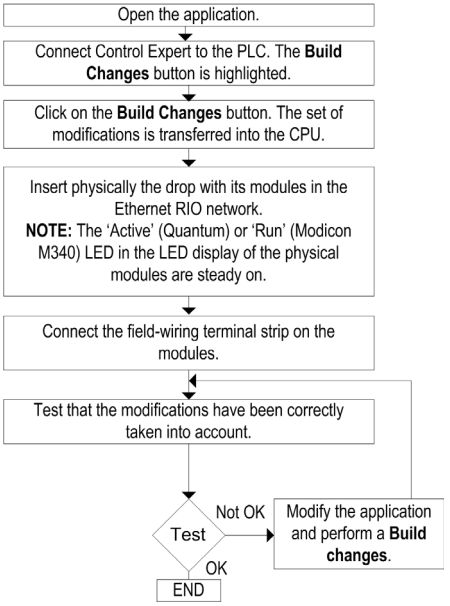
The following flow-chart describes the action to be done when adding a remote I/O drop while in the **OFFLINE** Virtual Connected Mode:



NOTE: A remote I/O drop contains 1 or 2 racks (linked with a backplane expander cable).

Addition When Connected to the Quantum Remote I/O System

The following flow-chart describes the action to be done when adding a remote I/O drop while in the **CONNECTED** Virtual Connected Mode:



Chapter 5
Add/Delete Modules

Overview

This chapter describes the procedures to add or delete modules in a local, S908 RIO or Ethernet RIO drop of a Quantum standalone system.

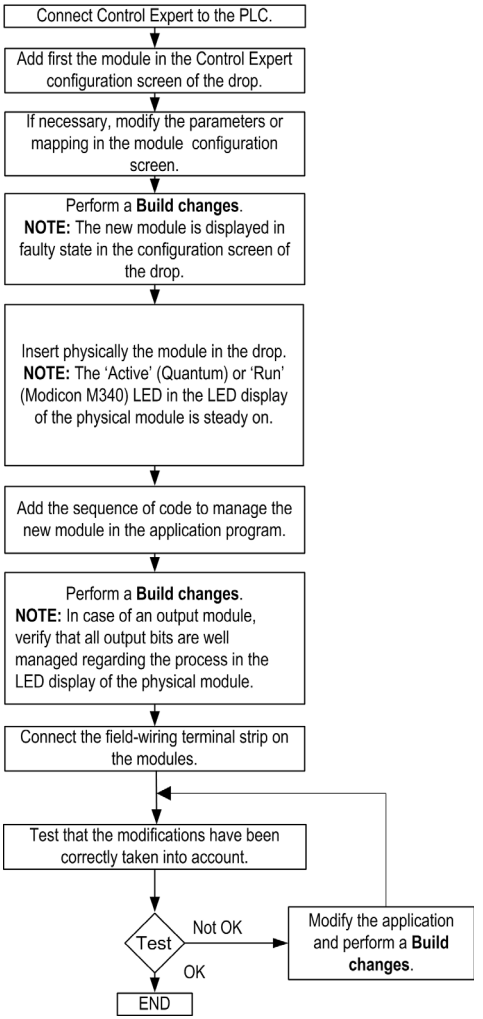
What Is in This Chapter?

This chapter contains the following topics:

Add/Delete a Module in a Standalone System while in the Standard Connected Mode

Addition

The following flow-chart describes the action to be done when adding a module while in the Standard Connected Mode:

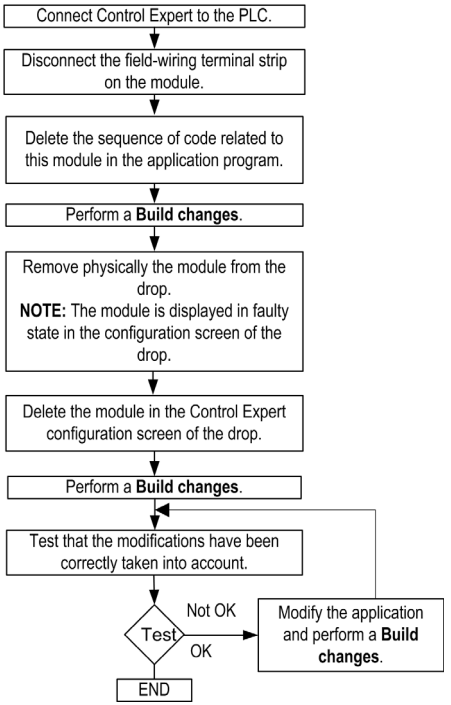


NOTE: One Ethernet RIO drop can have up to 4 modules added in one CCOTF transaction.

Deletion

⚠ WARNING
POSSIBLE UNEXPECTED EQUIPMENT BEHAVIOR
Remove the field wiring terminal strip on the module before deleting a module.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when deleting a module while in the Standard Connected Mode:



NOTE: One Ethernet RIO drop can have up to 4 modules deleted in one CCOTF transaction.

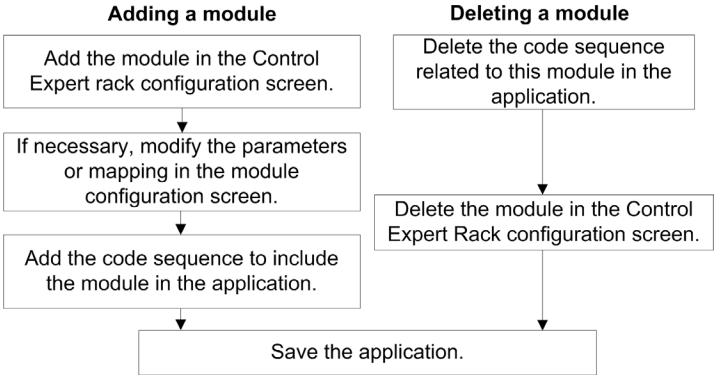
NOTE: A Modicon M340 discrete module with time stamped channels in a Modicon M340 Ethernet RIO drop can not be deleted.

Add/Delete a Module in a Standalone System while in the Virtual Connected Mode

Addition/Deletion in Offline Mode

In this mode, it is possible to modify the I/O configuration when the application is offline. The application that is downloaded onto the PLCs has to be generated with the **Virtual connected mode** check box enabled in the **Project settings → General → Build settings**.

The following flow-chart describes the action to be done when adding or deleting a module while in the **OFFLINE** Virtual Connected Mode:



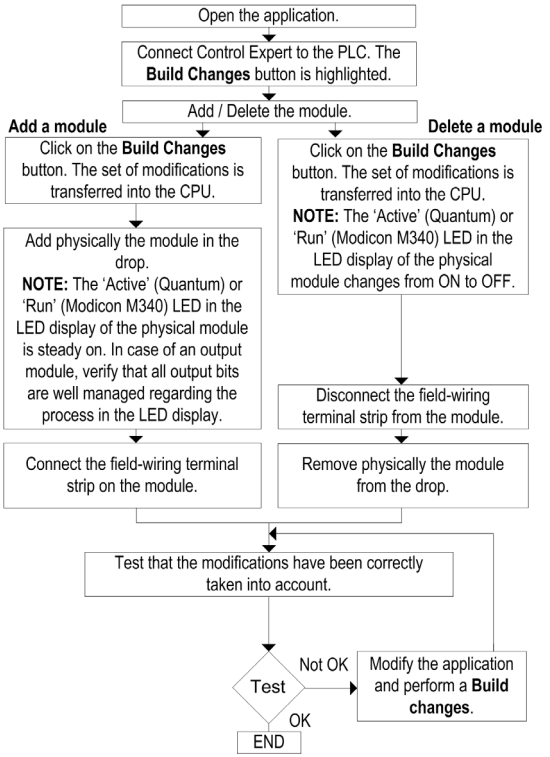
NOTE: One Ethernet RIO drop can have up to 4 modules added/deleted in one CCOTF transaction.

NOTE: A Modicon M340 discrete module with time stamped channels in a Modicon M340 Ethernet RIO drop can not be deleted.

Addition/Deletion when Connected to the Quantum System

⚠ WARNING
POSSIBLE UNEXPECTED EQUIPMENT BEHAVIOR Remove the field wiring terminal strip on the module before deleting a module. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following flow-chart describes the action to be done when adding or deleting a module while in the **CONNECTED** Virtual Connected Mode:



Chapter 6
Modify Module Parameters

Overview

This chapter describes the procedures to modify module parameters in a local, S908 RIO or Ethernet RIO drop of a Quantum standalone system.

What Is in This Chapter?

This chapter contains the following topics:

General

Parameter Types

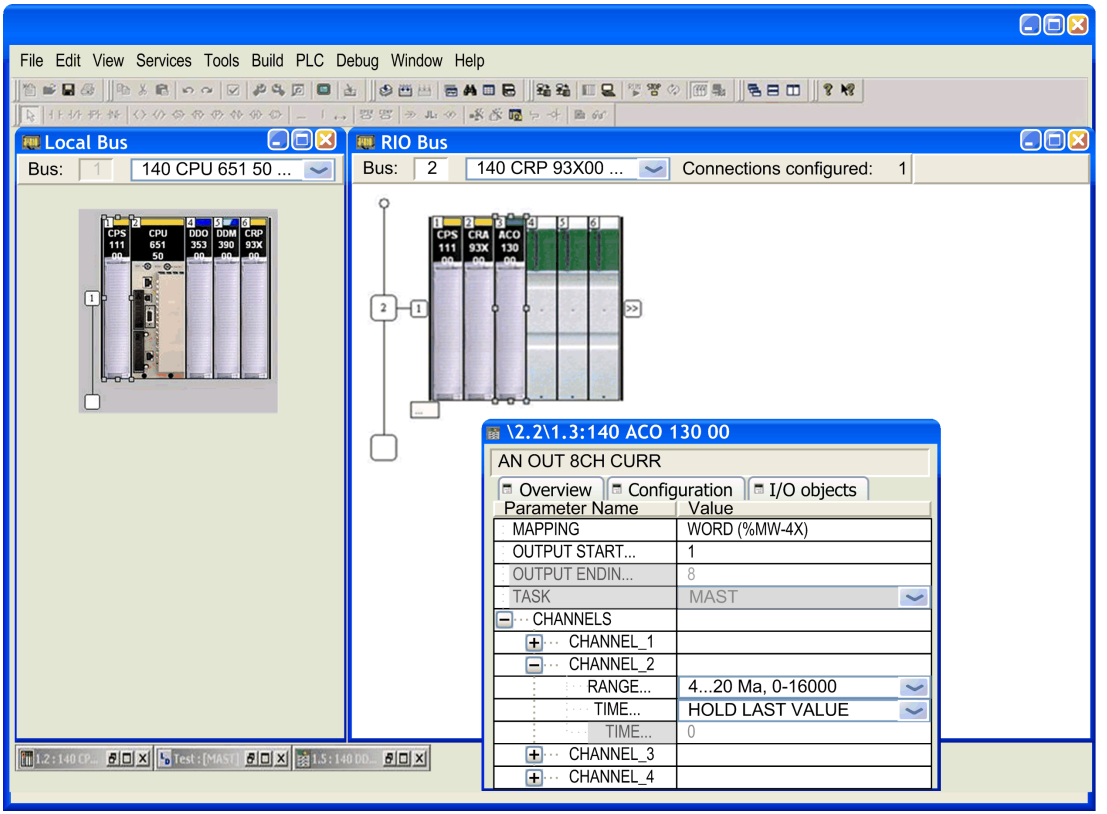
There are two kinds of parameters to take into account:

Configuration parameters linked to the application memory mapping or the CPU operating system
Example: input/output starting and ending addresses, mapping, task, etc.

Adjustment parameters that impact module behavior
Example: input/output type, timeout value, filter selection, dual mode, output shut down state, automatic restart, fail state, fallback value, data format, channels, input/output range, etc.
(see EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual)

NOTE: In a pre-existing module only the **adjustment parameters** can be modified.
In a newly inserted module all parameters can be modified before the **Build changes**.

This dialog box shows the **configuration parameters** screen:



Modicon M340 Ethernet RIO Drop Modules

Modicon M340 modules parameter modification causes a channel reset on the following modules type:

- analog I/O modules: modified channel reset
- BMX EHC 0200 and BMX EHC 0800 modules: modified channel reset
- discrete I/O modules: group of channels containing the modified channel reset

BMX EHC 0200 and BMX EHC 0800 modules use specific parameters with the following type: **Application Specific Function** (Example: frequency mode, event counting mode, one shot counter mode, modulo loop...). The application specific functions can be modified with the CCOTF function.

Modify Module Parameters in a Standalone System while in the Standard Connected Mode

Parameter Modifications

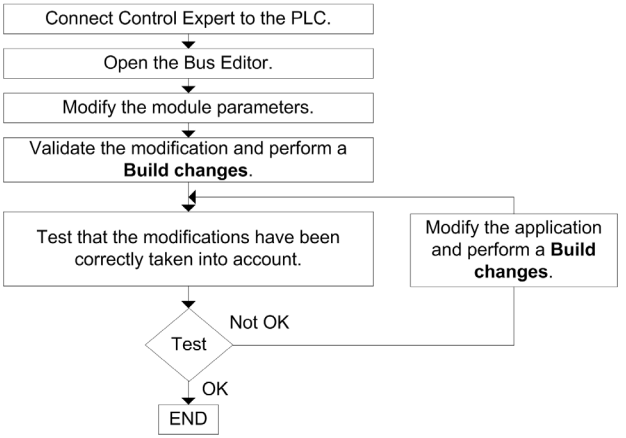
⚠ WARNING

RISK OF UNEXPECTED EQUIPMENT BEHAVIOR

Before doing any CCOTF modification, ensure that your system responds appropriately. Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when modifying module parameters *(see page 70)* while in the Standard Connected Mode:



Modify Module Parameters in a Standalone System while in the Virtual Connected Mode

Parameter Modifications in Offline Mode

It is possible to modify the I/O configuration and the application offline. The application that is downloaded in the PLCs has to be generated with the **Virtual Connected Mode** check box enabled in the **Project settings** dialog box.

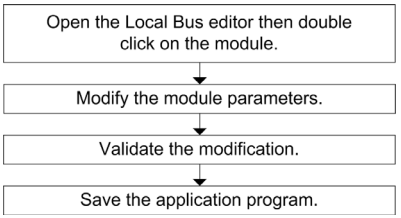
⚠ WARNING

RISK OF UNEXPECTED EQUIPMENT BEHAVIOR

Before doing any CCOTF modification, ensure that your system responds appropriately. Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

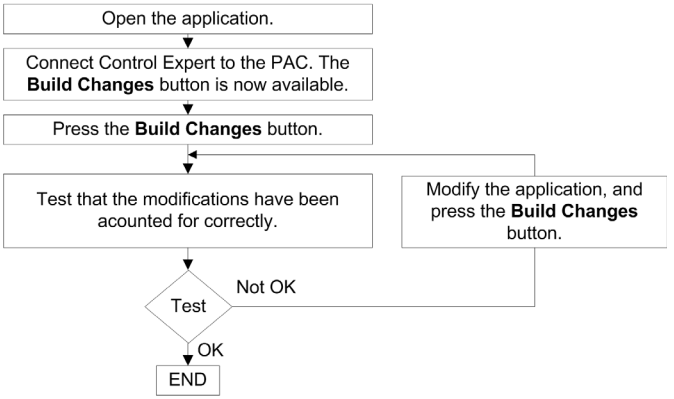
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when modifying module parameters *(see page 70)* from a standalone drop while in the **OFFLINE** Virtual Connected mode:



Parameter Modifications when Connected to the Quantum System

The following flow-chart describes the action to be done when modifying module parameters from a standalone drop while in the **CONNECTED** Virtual Connected Mode:



Chapter 7
CCOTF Troubleshooting

General Troubleshooting List

Overview

If a CCOTF modification can not be performed on Quantum Standalone system, check the following potential problems and their solutions in the table below:

Potential Problem	Solution
The CPU does not have operating system version 02.80 or higher.	Replace the CPU module with a CCOTF compatible CPU or upgrade the operating system.
The S908 CRP module does not have firmware version 02.00 or higher.	Replace the S908 CRP module with a CCOTF compatible S908 CRP or upgrade the firmware.
The S908 CRA modules in all Quantum RIO drops connected to the RIO link do not have firmware version 02.00 or higher.	Replace the S908 CRA module with a CCOTF compatible S908 CRA or upgrade the firmware.
Unity Pro V5.0 or higher version is not installed. **NOTE:** Unity Pro is the former name of Control Expert for version 13.1 or earlier.	Install Control Expert V14.0 or higher version.
The processor type is not replaced in the Control Expert configuration tab.	Replace the non CCOTF processor by the CCOTF corresponding processor in the Control Expert configuration table.
The **Online modification in RUN** check box is not selected.	Check **Online modification in RUN** in the CPU configuration tab *(see page 41)*.
PLC has an application that is not CCOTF compatible.	The application must be rebuilt (`Build -> Rebuild All` menu in Control Expert) and downloaded in both PLCs after changing the processor and checking the **Online Modification in RUN** check box.
At least one Quantum S908 RIO drop is not compatible with the CCOTF function.	Check that all Quantum S908 RIO drops that are configured in the application have their corresponding bits at 1 in `%SW98` and `%SW99` (except drops not powered on).
A Quantum S908 RIO drop that has been upgraded has its corresponding bit at 0 in %SW98 or %SW99.	Power off then power on the S908 RIO drop.
A new CCOTF modification is not allowed.	Wait until previous CCOTF modification is completed.
The Ethernet CRP is not ready.	Try to make the CCOTF modification again.

Potential Problem	Solution
The Ethernet CRA connection is not always available.	Check the Ethernet connections of all the communication modules involved in the Ethernet RIO daisy chain ring.
Ethernet RIO drop connection is lost during the CCOTF modification.	The drop is automatically re-configured with the new configuration when the connection with the Ethernet CRP is established.

NOTE: A Quantum S908 RIO drop which does not contain any I/O module has its corresponding bit at 0 in %SW98 or %SW99, but CCOTF modifications are not blocked.

Part III
Using CCOTF with a Hot Standby System

Overview

This part describes using CCOTF with a Quantum Hot Standby System.

What Is in This Part?

This part contains the following chapters:

Chapter 8
Introduction to CCOTF with a Hot Standby System

Hot Standby CCOTF Actions

Overview

CCOTF function allows modifications when the PLC is in RUN *(see page 17)* mode.

NOTE: Local I/O can be used but they are not part of the redundant system in a Quantum Hot Standby *(see Quantum using EcoStruxure™ Control Expert, Hot Standby System, User Manual)* system environment.

NOTE: The CCOTF modification can only be done if the module is compatible *(see page 34)*.

⚠ WARNING
UNEXPECTED EQUIPMENT BEHAVIOR
Always transfer the application to the Standby PLC after modifying the configuration in the Primary PLC.The application in both PLCs must be the same.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

S908 RIO Drop Specifics

The application transfer from Primary to Standby PLC after one CCOTF transaction is recommended. However, transferring the application after more than one CCOTF transaction will not generate an S908 RIO drop reset if a Switchover occurs.

Two system Status Register Words: %SW98 and %SW99 allow to manage the S908 CRA compatibility *(see page 27)*.

A CCOTF modification can only be performed on the Primary PLC with the other PLC in Standby state.

NOTE: In an S908 system, Control Expert can be connected to the Primary or the Standby PLC. Connection to the Primary is preferred.

Ethernet RIO Specifics

If a Switchover occurs after a CCOTF transaction and before the application transfer, the Ethernet RIO drop gets the configuration from the new Primary (configuration preceding the CCOTF modification). The output values of the modified drop depend on the Primary application, no glitch or bump will appear on the outputs.

⚠ WARNING

UNEXPECTED EQUIPMENT BEHAVIOR

Make sure that your system responds appropriately if the drop takes back its previous configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The application must be transferred from Primary to Standby PLC after one CCOTF transaction. Transferring the application after more than one CCOTF transaction can lead to the Ethernet RIO drop reset if a Switchover occurs.

⚠ WARNING

UNEXPECTED EQUIPMENT BEHAVIOR

Ensure that your application program does not operate a Switchover before starting any CCOTF modification.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

A CCOTF modification can only be performed on the Primary PLC with the other PLC in Standby state.

NOTE: In an Ethernet RIO system, Control Expert can only be connected to the Primary PLC.

Application Program Mismatch Bit `%SW60.3`

Before doing any CCOTF modification, make sure that the system word %SW60.3 *(see Quantum using EcoStruxure™ Control Expert, Hot Standby System, User Manual)* is set to 1.

The logic mismatch command behavior depends on the Quantum system:

- In a local or S908 RIO drop, if system bit `%SW60.3` is not set to 1, the Standby PLC goes to the OFFLINE state after the first CCOTF modification and no other CCOTF modifications are allowed.
- In an Ethernet RIO drop, is system bit `%SW60.3` is not set to 1, CCOTF modifications are not allowed

Number of CCOTF Modifications Allowed

Validating a CCOTF modification requires a Build Changes in Control Expert.

The number of CCOTF modifications allowed *(see page 22)* in one CCOTF transaction depends on the system.

Chapter 9
Add Ethernet RIO Drop

Overview

This chapter describes the procedure to add a Quantum Ethernet RIO drop or a Modicon M340 Ethernet RIO drop in a Quantum Hot Standby system.

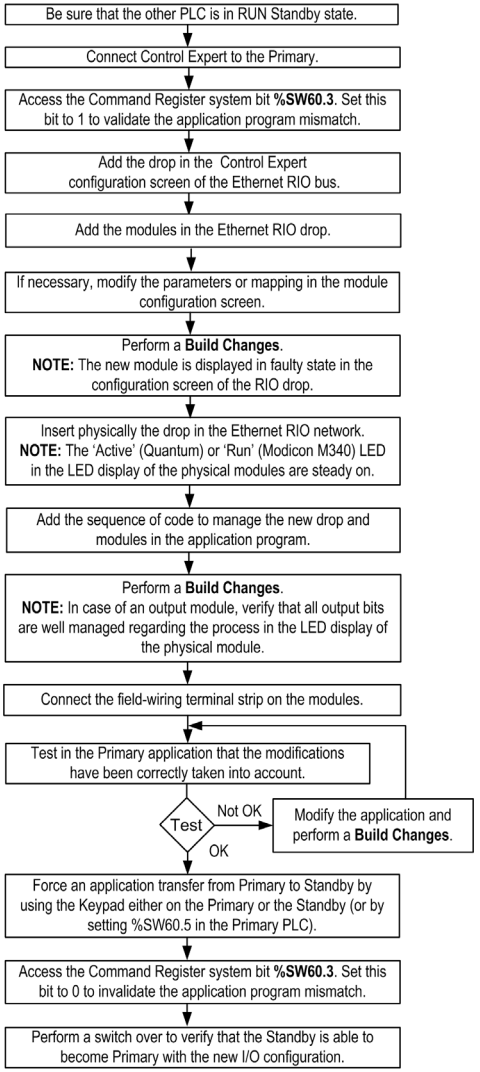
What Is in This Chapter?

This chapter contains the following topics:

Add an Ethernet RIO Drop in a Hot Standby System while in the Standard Connected Mode

Addition

The following flow-chart describes the action to be done when adding an Ethernet RIO drop while in the Standard Connected Mode:



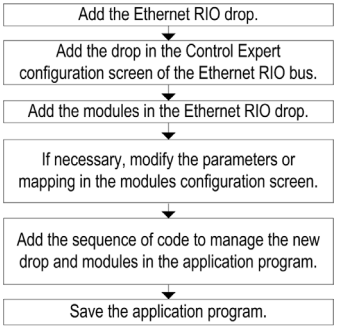
NOTE: 1 Ethernet RIO drop contains 1 or 2 racks (linked with a backplane expander cable).

Add an Ethernet RIO Drop in a Hot Standby System while in the Virtual Connected Mode

Addition in Offline Mode

In this mode, it is possible to modify the I/O configuration while the application is offline. The application that is downloaded onto the PLCs has to be generated with the **Virtual connected mode** check box enabled in the **Project settings → General → Build settings**.

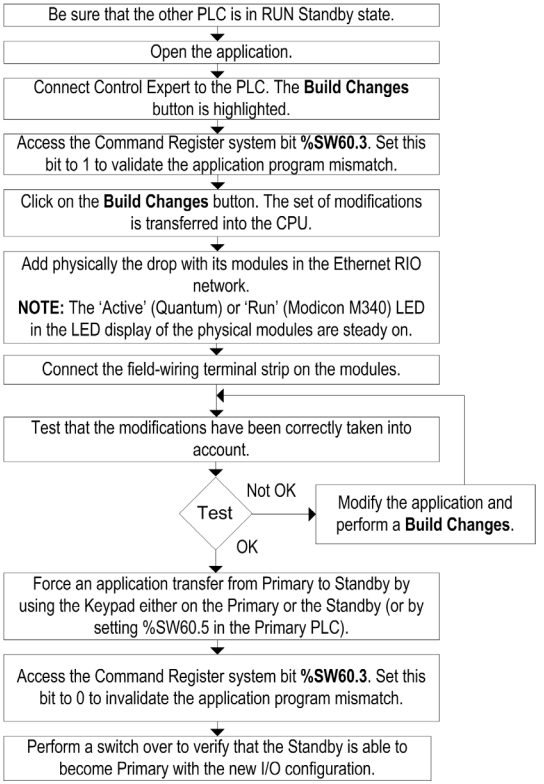
The following flow-chart describes the action to be done when adding an Ethernet RIO drop in a Hot Standby system while in the **OFFLINE** Virtual Connected Mode:



NOTE: 1 Ethernet RIO drop contains 1 or 2 racks (linked with a backplane expander cable).

Addition when Connected to the Quantum System

The following flow-chart describes the action to be done when adding an Ethernet RIO drop in a Hot Standby system while in the **CONNECTED** Virtual Connected Mode:



Chapter 10
Add/Delete Modules

Overview

This chapter describes adding and deleting modules in a Quantum Hot Standby system.

What Is in This Chapter?

This chapter contains the following sections:

Section 10.1
Add/Delete Modules in the Local Drop

Overview

This section describes adding and deleting modules in the local drop with a Quantum Hot Standby system.

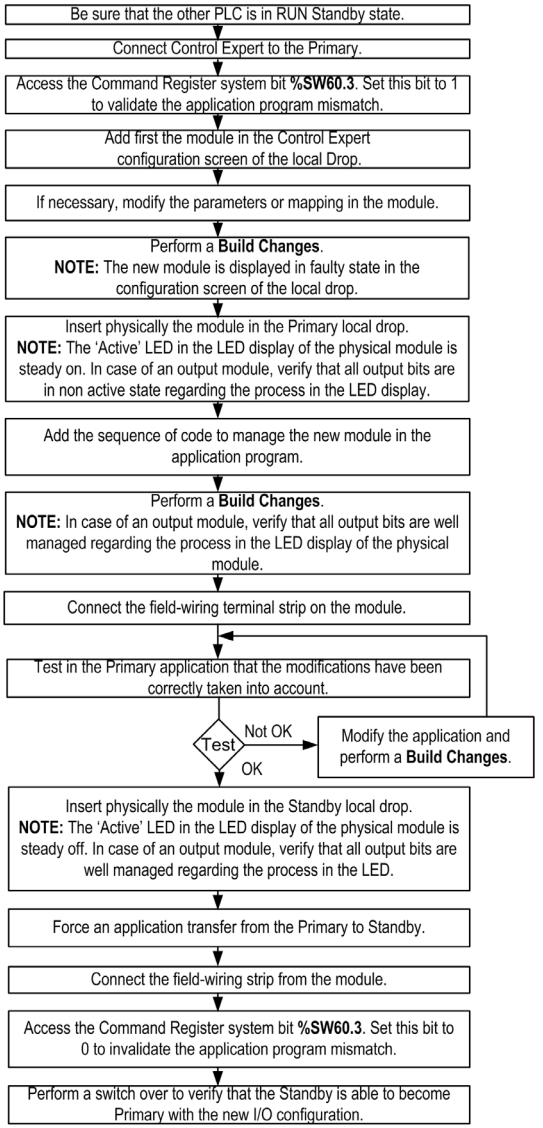
What Is in This Section?

This section contains the following topics:

Add/Delete a Module in a Hot Standby Local Drop while in the Standard Connected Mode

Addition

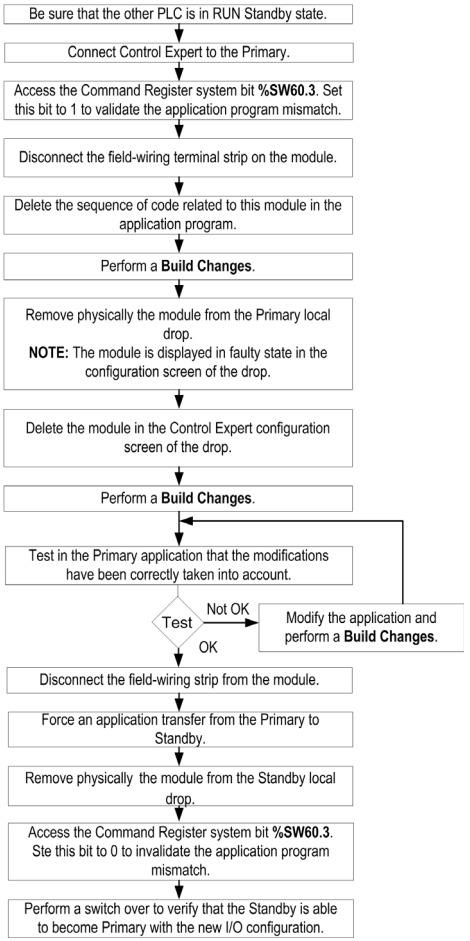
The following flow-chart describes the action to be done when adding a module in the local drop while in the Standard Connected Mode:



Deletion

⚠ WARNING
POSSIBLE UNEXPECTED EQUIPMENT BEHAVIOR Remove the field wiring terminal strip on the module before deleting a module. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following flow-chart describes the action to be done when deleting a module from the local drop while in the Standard Connected Mode:

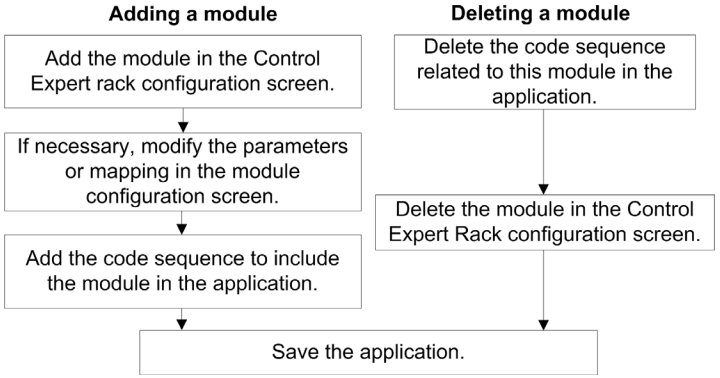


Add/Delete a Module in a Hot Standby Local Drop while in the Virtual Connected Mode

Addition/Deletion in Offline Mode

In this mode, it is possible to modify the I/O configuration when the application is offline. The application that is downloaded onto the PLCs has to be generated with the **Virtual connected mode** check box enabled in the **Project settings → General → Build settings**.

The following flow-chart describes the action to be done when adding or deleting a module in the local drop while in the **OFFLINE** Virtual Connected Mode:



Addition/Deletion when Connected to the Quantum System

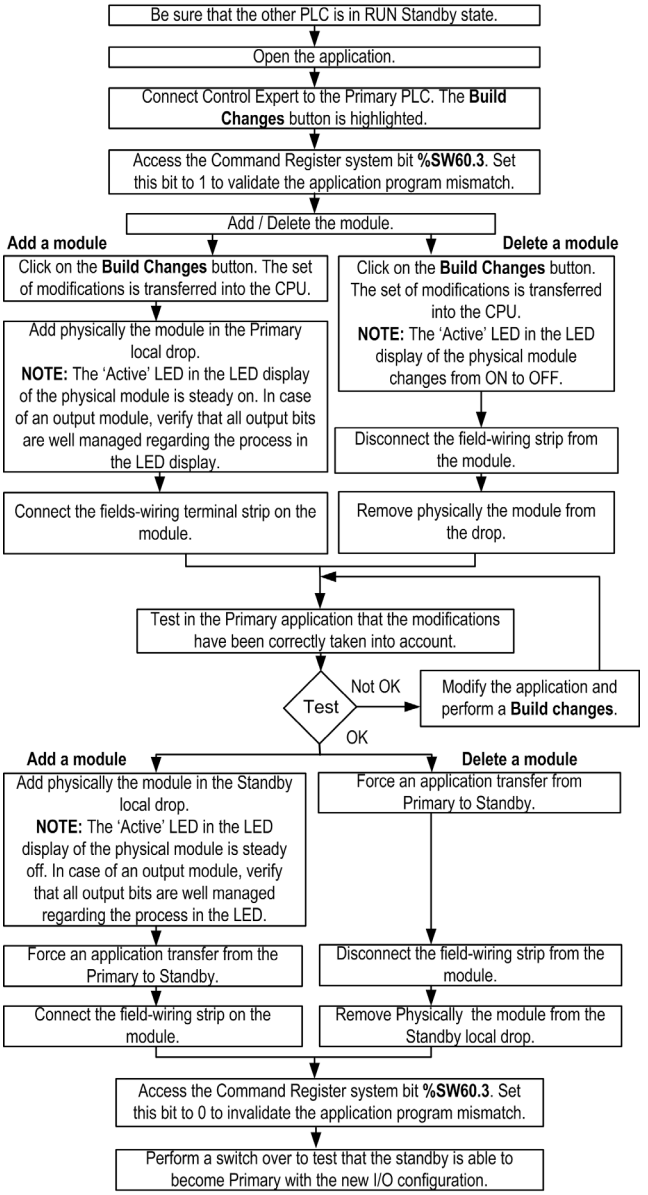
⚠ WARNING

POSSIBLE UNEXPECTED EQUIPMENT BEHAVIOR

Remove the field wiring terminal strip on the module before deleting a module.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when adding or deleting a module in the local drop while in the CONNECTED Virtual Connected Mode:



Section 10.2
Add/Delete Modules in an S908 or Ethernet RIO Drop

Overview

This section describes adding and deleting modules in an S908 RIO drop or Quantum Ethernet RIO drop with a Quantum Hot Standby system.

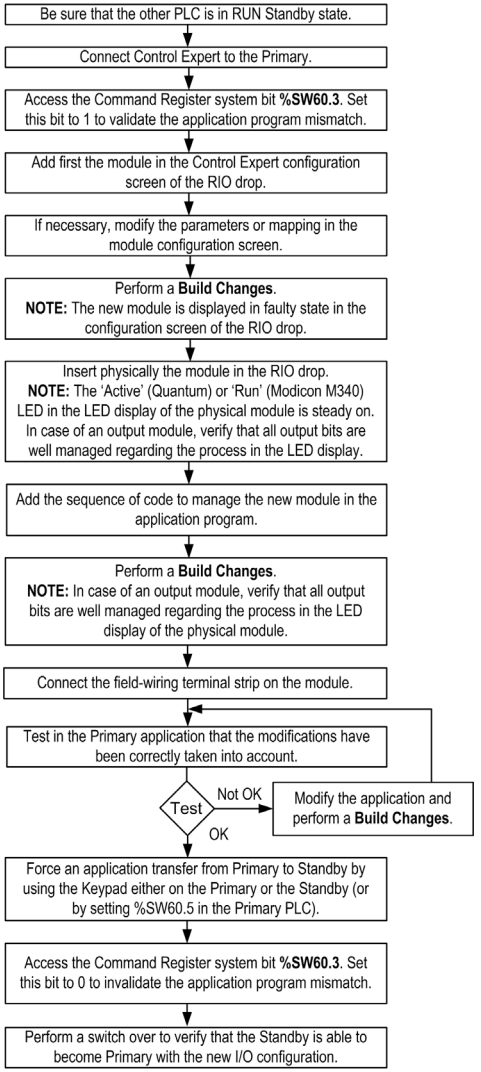
What Is in This Section?

This section contains the following topics:

Add/Delete a Module in a Hot Standby S908 RIO Drop or Quantum Ethernet RIO Drop while in the Standard Connected Mode

Addition

The following flow-chart describes the action to be done when adding a module in a RIO drop while in the Standard Connected Mode:



NOTE: One Ethernet RIO drop can have up to 4 modules added in one CCOTF transaction.

Deletion

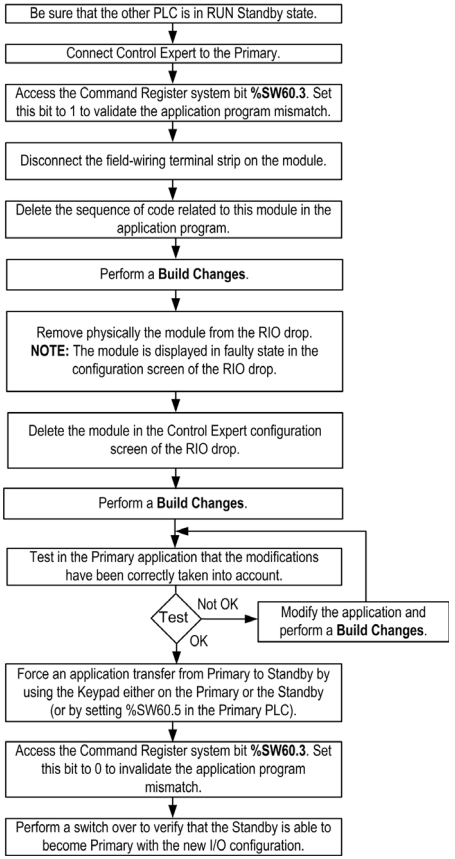
⚠ WARNING

POSSIBLE UNEXPECTED EQUIPMENT BEHAVIOR

Remove the field wiring terminal strip on the module before deleting a module.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when deleting a module from a RIO drop while in the Standard Connected Mode:



NOTE: One Ethernet RIO drop can have up to 4 modules deleted in one CCOTF transaction.

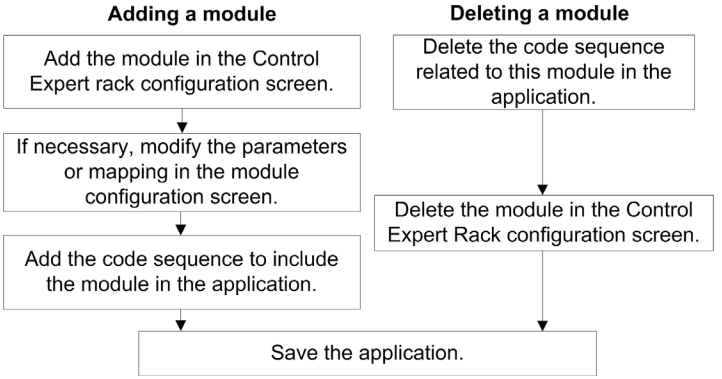
NOTE: A Modicon M340 discrete module with time stamped channels in a Modicon M340 Ethernet RIO drop can not be deleted.

Add/Delete a Module in a Hot Standby S908 RIO Drop or Quantum Ethernet RIO Drop while in the Virtual Connected Mode

Addition/Deletion in Offline Mode

In this mode, it is possible to modify the I/O configuration while the application is offline. The application that is downloaded onto the PLCs has to be generated with the **Virtual connected mode** check box enabled in the **Project settings → General → Build settings**.

The following flow-chart describes the action to be done when adding or deleting a module in a Hot Standby system while in the **OFFLINE** Virtual Connected Mode:



NOTE: One Ethernet RIO drop can have up to 4 modules added/deleted in one CCOTF transaction.

NOTE: A Modicon M340 discrete module with time stamped channels in a Modicon M340 Ethernet RIO drop can not be deleted.

Addition/Deletion when Connected to the Quantum System

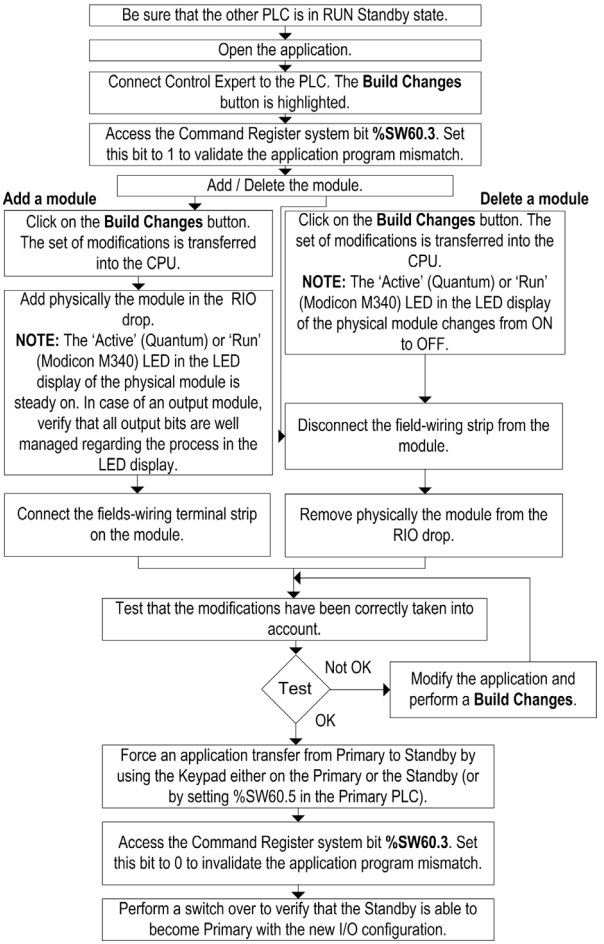
⚠ WARNING

POSSIBLE UNEXPECTED EQUIPMENT BEHAVIOR

Remove the field wiring terminal strip on the module before deleting a module.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when adding or deleting a module in a Hot Standby system while in the **CONNECTED** Virtual Connected Mode:



Chapter 11
Modify Module Parameters

Overview

This chapter describes the procedures to modify module parameters in a local, S908 RIO or Ethernet RIO drop of a Quantum Hot Standby system.

Various types of parameters can be modified *(see page 70)* and Modicon M340 Ethernet RIO drop modules may have specific parameters and behavior *(see page 71)*.

What Is in This Chapter?

This chapter contains the following topics:

Modify Module Parameters in a Hot Standby Drop while in the Standard Connected Mode

Parameter Modifications

⚠ WARNING

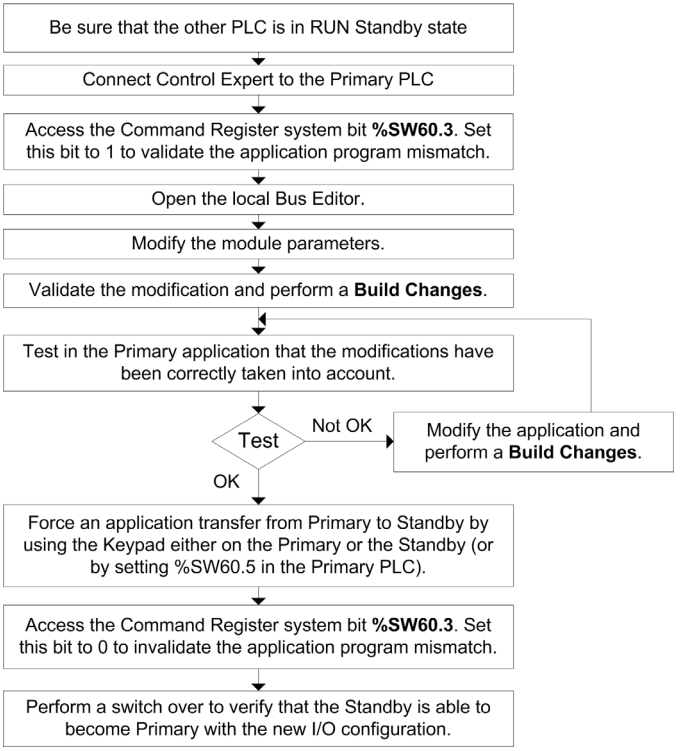
RISK OF UNEXPECTED EQUIPMENT BEHAVIOR

Before doing any CCOTF modification, ensure that your system responds appropriately. Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

The following flow-chart describes the action to be done when modifying module parameters while in the Standard Connected Mode:



Modify Module Parameters in a Hot Standby Drop while in the Virtual Connected Mode

Parameter Modifications in Offline Mode

It is possible to modify the I/O configuration and the application offline. The application that is downloaded in the PLCs has to be generated with the **Virtual Connected Mode** check box enabled in the **Project settings** dialog box.

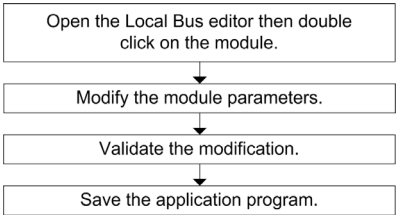
⚠ WARNING

RISK OF UNEXPECTED EQUIPMENT BEHAVIOR

Before doing any CCOTF modification, ensure that your system responds appropriately. Modifications made when the **on line modification in RUN** check box is selected can have an immediate impact on the process.

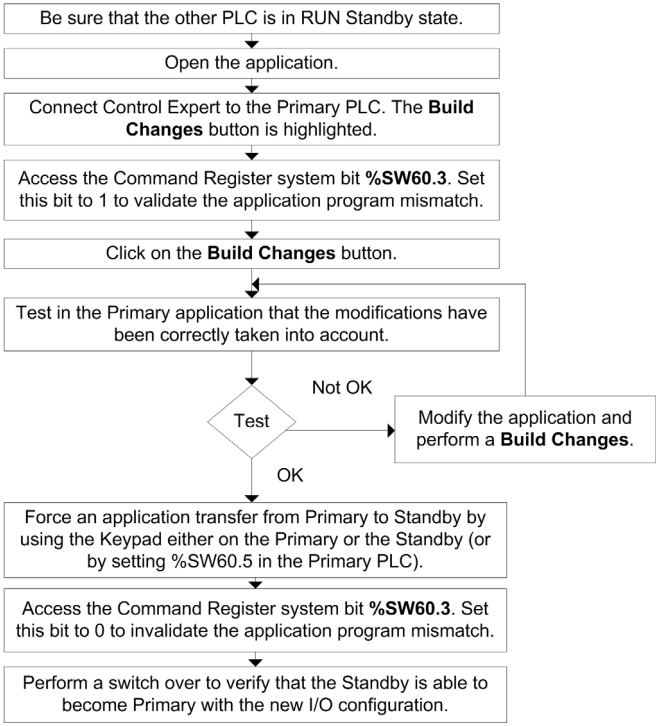
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following flow-chart describes the action to be done when modifying module parameters while in the **OFFLINE** Virtual Connected Mode:



Parameter Modifications while Connected to the Quantum System

The following flow-chart describes the action to be done when modifying module parameters while in the **CONNECTED** Virtual Connected Mode:



Chapter 12
CCOTF Troubleshooting

Troubleshooting List

Overview

If a CCOTF modification cannot be performed in the Quantum Hot Standby system, check the following potential problems and their solutions in the table below:

Problem	Solution
The system is running as a Standalone system, without redundancy.	Verify that one PLC is in RUN Primary state and the other is in RUN Standby state.
Unity Pro 4.1 or higher version is not installed. **NOTE:** Unity Pro is the former name of Control Expert for version 13.1 or earlier.	Install Control Expert V14.0 or higher version.
At least one of the two PLCs has an application that is not CCOTF compatible.	The application must be rebuilt (`Build -> Rebuild All` menu in Control Expert) and downloaded in both PLCs after changing the processor and checking the **Online Modification in RUN** check box.
CCOTF modification is not allowed.	The system must be running in a Hot Standby configuration (one PLC is in RUN Primary state and the other in RUN Standby state).
CCOTF modification is not allowed in an Ethernet RIO drop.	Verify that Control Expert is connected to the Primary PLC.
	Verify that the **application program mismatch** bit %SW60.3 is set to 1. *(see page 80)*
A new modification generating more than one mismatch in an Ethernet RIO drop is done.	Transfer the application from Primary to Standby before doing the new modification (Control Expert proposes an application transfer when trying the new modification). If no application transfer is performed and a Switchover occurs, glitches or bumps may appear on the output *(see page 80)*.

If the potential problem is not described above, refer to the CCOTF general Troubleshooting list *(see page 75)*.

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