

# Modicon™ Quantum™ Ethernet I/O automation platform

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Electric™



# Modicon™ Quantum™ Ethernet I/O automation platform

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## Quantum™ Ethernet I/O

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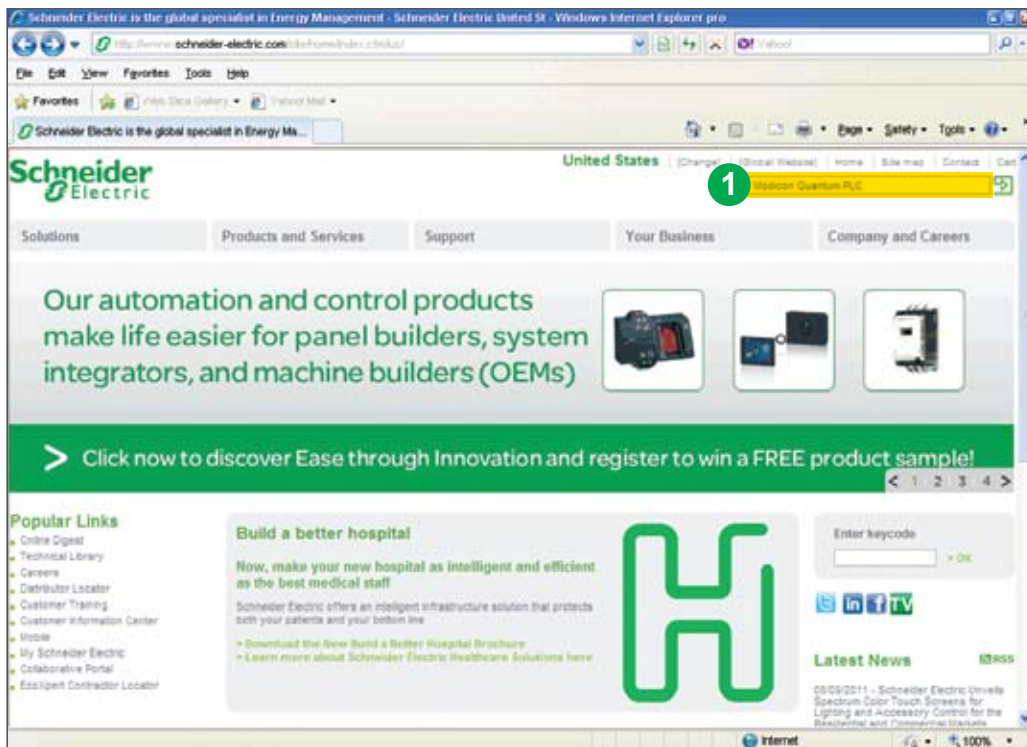
## Unity™ Pro software

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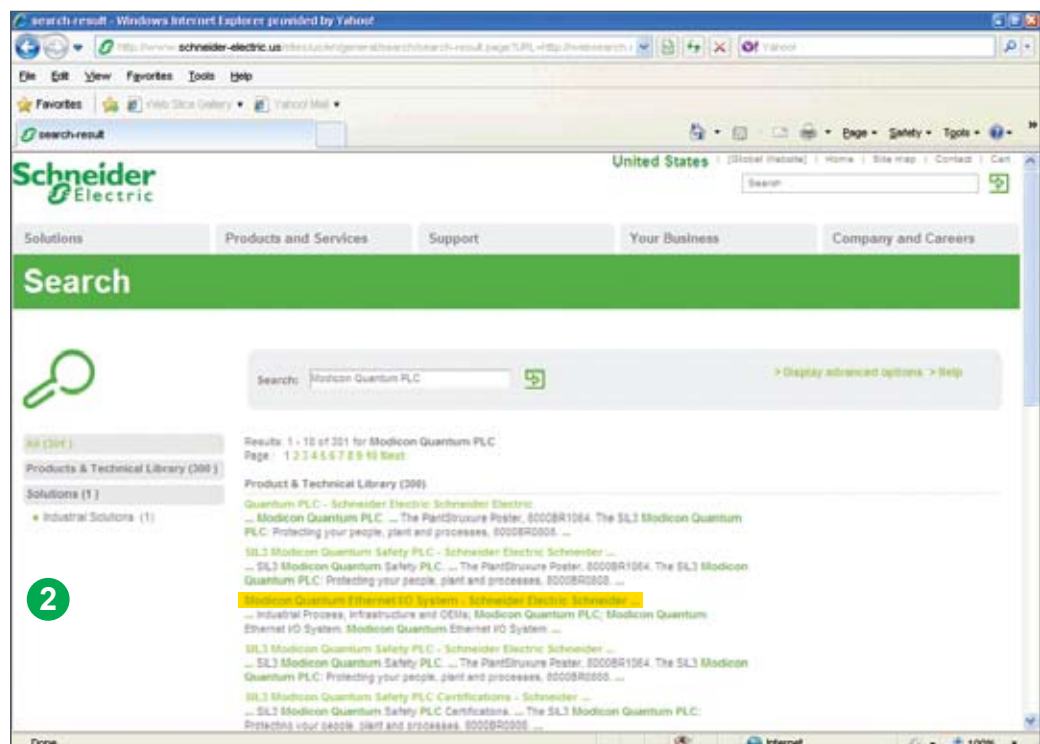


Go online to [www.schneider-electric.com](http://www.schneider-electric.com) for technical information about products listed in this catalog, including:

To learn more about Modicon™ Quantum™ Ethernet I/O products, follow these steps...



1 Go to: [www.schneider-electric.com](http://www.schneider-electric.com) and enter “**Modicon Quantum PLC**” in the Search Box.



2 On the Search results page, select the third listing under “Product & Technical Library (300)” entitled **Modicon Quantum Ethernet I/O System - Schneider Electric Schneider...**



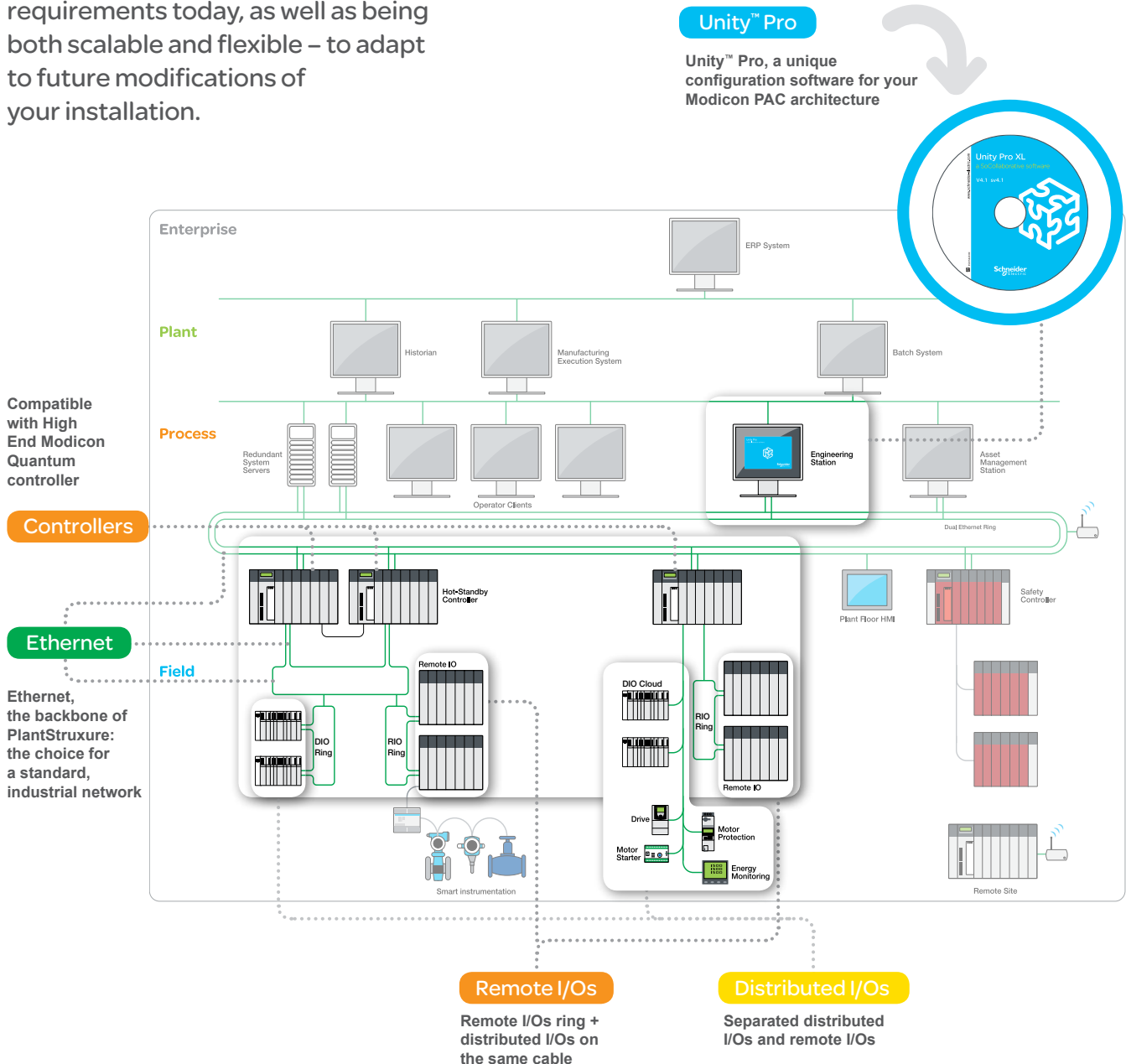
**3** Explore the “Modicon Quantum Ethernet I/O System” page. Click on the new features, including: System Layout, Remote I/O Components, Architecture Examples and Ethernet I/O Benefits – Why is it important?

# The improved Modicon™ Quantum™ controller

The Modicon Quantum Ethernet I/O (QEIO) automation platform is designed to meet the requirements of both the industrial automation and process industries.

An integral part of the PlantStruxure™ architecture, Modicon Quantum Ethernet I/O supports remote I/O architectures that meet your physical requirements today, as well as being both scalable and flexible – to adapt to future modifications of your installation.

PlantStruxure™ is a collaborative architecture that allows industrial and infrastructure companies to meet their automation needs and, at the same time, deliver on growing energy management requirements. In a single environment, measured energy and process data can be analyzed and used to optimize your plant's performance. PlantStruxure is not only easy to engineer and simple to maintain, it delivers a detailed snapshot of what is happening in your process. It integrates easily with third party devices and provides added value in the form of historian and manufacturing execution system functionalities. In short, PlantStruxure helps you drive increased return on assets while meeting your application needs.



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## Standard

Ethernet is an open industrial standard. EtherNet/IP (promoted by ODVA) has been chosen for QEIO as a long-lasting universal standard. Standard network infrastructure devices, tools, and network analyzers simplify maintenance and training.



## Available

High operational availability is the requirement for many systems today. QEIO solutions can continue to operate in the event of an interrupted connection at a single device, helping to keep your process running with minimal disruption.



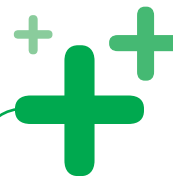
## Scalable

When your application evolves, the QEIO solution grows alongside it, adapting to the life cycle of your installation without extensive modifications. The addition of sensors/actuators and other devices is simplified thanks to the versatility of Modicon Quantum Ethernet I/O.



## Simple

I/Os are managed by one single configuration software – Unity™ Pro.



### Compatible with your installed systems

QEIO uses the same standard I/O modules as existing Quantum S908 systems, providing migration solutions at a lower cost.

## Modicon™ Quantum™ Ethernet RIO (QEIO)



### Head End adaptor 140 CRP 31200

- Front display for diagnostics in compliance with ODVA standard
- Port to link to Ethernet module to mix DIO and RIO on the same cable
- Service port to connect PC, local HMI or DIO devices
- 2 ports for Daisy chain loop



### Drop adaptor 140 CRA 31200

- Rotary switches to configure drop address
- Service port to connect a PC, local HMI or DIO cloud
- 2 ports for Daisy chain loop



## Dual ring switch (DRS)

ConneXium™ range extended manageable switch

### DRS 8 ports (TCSESM083F23F1)

- 8 copper

### DRS 8 ports (TCSESM063F2CU1)

- 6 copper
- 2 fiber optic multimode
  - Long distance up to 2 km

### DRS 8 ports (TCSESM063F2CS1)

- 6 copper
- 2 fiber optic single mode
  - Long distance up to 15 km



Predefined, tested, and validated configurations save time and increase performance...

# Choose flexibility and high perf

The QEIO solution is built around existing Modicon™ Quantum™ technology, and utilizes SE I/O modules. This solution's flexibility allows I/O architectures to be designed to meet the requirements of a wide range of control applications. The choice of an I/O bus architecture based on Ethernet functionality eliminates the limitations of traditional, proprietary network topologies, while providing a high level of performance.

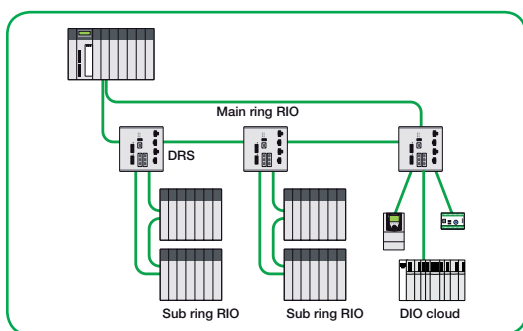


## Flexible

### > For the design of your architecture

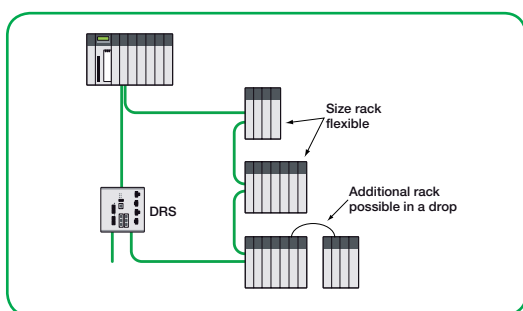
Choice of topologies:

- RIO: Daisy chain loop
- DIO: Ring, star and bus



### > For the size of RIO drop and DIO

Up to 31 drops of QEIO. Each drop can be 1 or 2 racks, each rack 4 to 16 slots. Future evolution of QEIO will allow Modicon M340 to be used as I/O drops to further expand the flexibility.

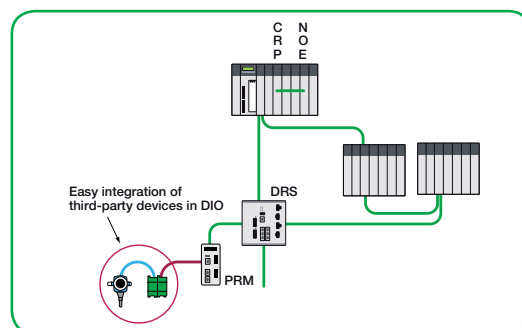


### > For the online modification of your installation

Add an I/O module without stopping your process using the Change Configuration on the Fly (CCOTF) function of Unity™ Pro. Benefit from the continuity of communication with your SCADA due to the OPC Factory Server during the online changes.

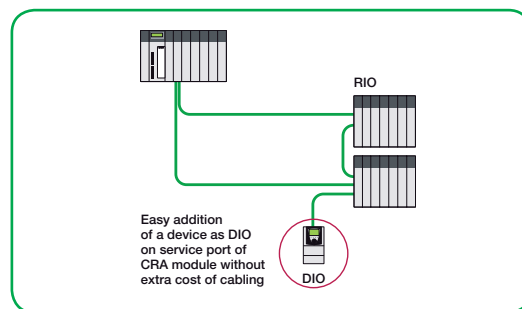
### > For the connection of your instrumentation

Easy addition of instrumentation thanks to FDT / DTM technology.



### > For the future extension of DIO

No need to add cables – just connect your new DIO island to the existing QEIO network via service port or switch. It's possible to mix DIO and RIO on the same media.





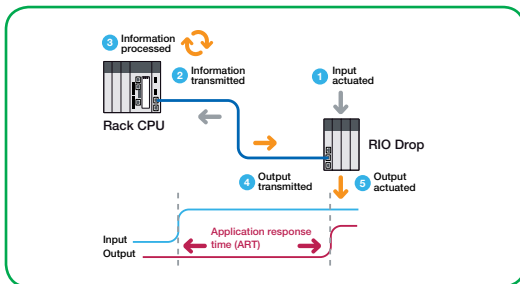
# Performance in your architecture...



## High Performance

### > The Quality of Service (QoS) function provides deterministic operation of QEIO

- For large I/O configurations, performance is better than many proprietary RIO buses
- Improved communications between SCADA and the Modicon™ Quantum™ PAC are possible thanks to the OPC Factory server.



Predictable application response time



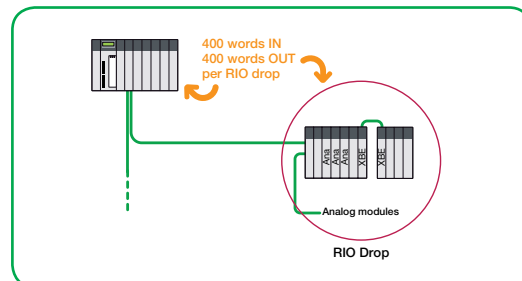
## Fewer constraints

### > Be connected everywhere via the embedded service ports on the CRA/CRP modules

- Unity™ Pro: maintenance or modification of application (connection via NOE module)
- HMI: No extra design cost to add an HMI (connection via NOE module)
- DIO cloud to connect your IO devices without additional hardware

### > Design phase is easier

- No limit to the number of analog modules per drop



Increased bandwidth between SCADA & PAC

**x12**

for a solution on OPC

More I/O capacity per remote I/O drop

**x6**

and more...



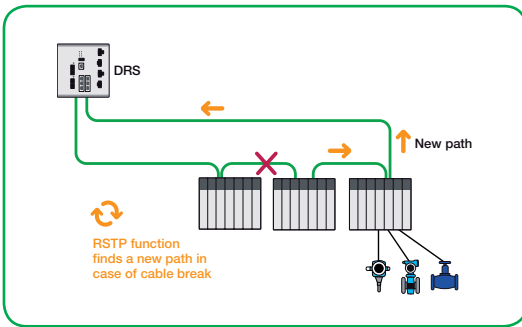
## High availability

### > With hot-standby CPU

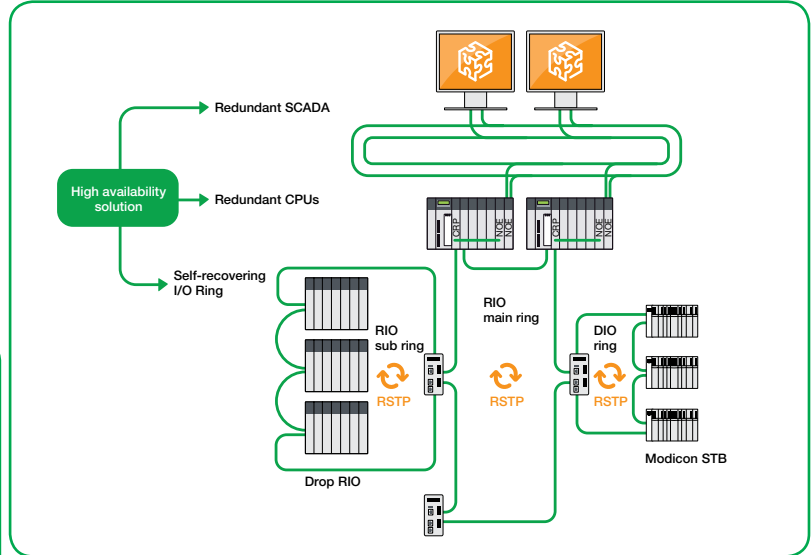
Choose the Modicon™ Quantum™ HSBY CPU compatible with the QEIO solution.

### > With RIO Daisy chain loop

RIO communication modules include a dual Ethernet port. These 2 copper ports provide RIO communications and cable redundancy.



If the network is disrupted, the network loop will recover in < 50 ms.



Up to **1.5 MB** of data can be exchanged between HSBY Modicon Quantum CPUs every program scan.

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## Long-term investment

- PlantStruxure™ solution
- Modicon platform
- Based on Ethernet
- Compatible with current Modicon M340™ technologies (as DIO)



## Easy access

- Web page view of RIO network
- Program viewer via FactoryCast™

### Quantum ERIO Statistics Available



- Easy to monitor health of QERIO via browser
- Both CRA and CRP statistics available
- Rack viewer function for Quantum available on Ethernet module 140 NOE 77111
- > Be connected everywhere with mobile technology

# See what your automation architecture can do!

Thanks to PlantStruxure™ Quantum™ Ethernet solutions, your processes are efficient, whatever the stage of your architecture development. And, you'll enjoy reliable and efficient automation and control solutions.



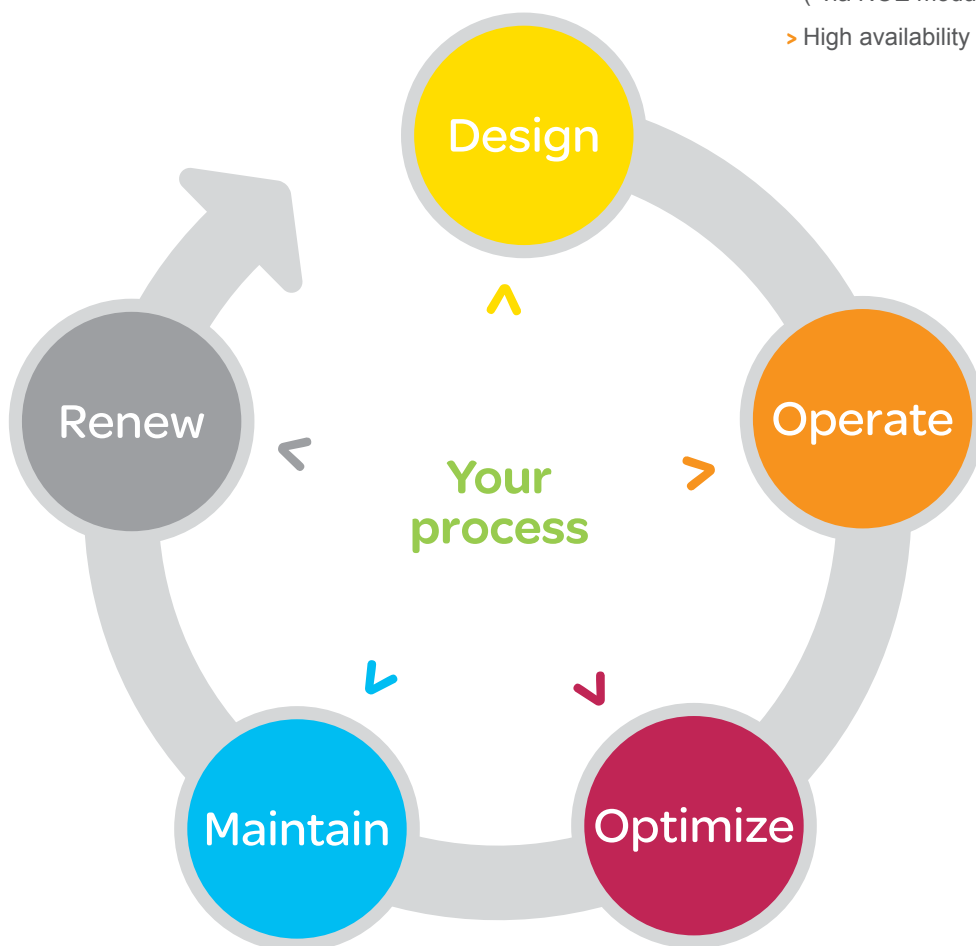
## > Ethernet topology: Daisy chain loop, ring, star, bus

- > Copper or fiber optic: EMC and distance
- > ConneXium™ Dual ring switch (DRS), up to 2 levels of RSTP rings, and up to 16 independant RSTP rings
- > Unity™ Pro (DFB, 5 IEC langages, simulation)



## > Continuity of communication with SCADA (OFS)

- > CCOTF (Change Configuration on the Fly)
- > Transparent access: web view of RIO in NOE web pages
- > Services port: access from anywhere or on CRA/CRP for local HMI\*, Unity\*, ConneXium (\*via NOE module)
- > High availability solutions



## > Optimally sized modular drops

- > No limit to number of analog modules per drop: I/O drop increased (400 words IN, 400 words OUT)
- > Data exchange 1.5 MB HSBY CPU
- > Predictable ART (application response time)
- > 12X bandwidth SCADA



## > QEIO uses the same I/O modules as Quantum S908, so installed base can migrate by changing only CRA/CRP modules and wiring CRA/CRP

- > Flexible architecture



## > Standard Ethernet tools for maintenance: ConneXview™, HiVision, Wireshark®

- > Web RIO vision via the rack viewer function in NOE module
- > Program viewer
- > Access to standard Unity maintenance key values

# Modicon™ Quantum™ Ethernet I/O automation platform

## I/O architectures

### Introduction

The Modicon™ Quantum™ Ethernet I/O automation platform provides an I/O architecture solution over Ethernet.

Modicon Quantum Ethernet I/O solution includes:

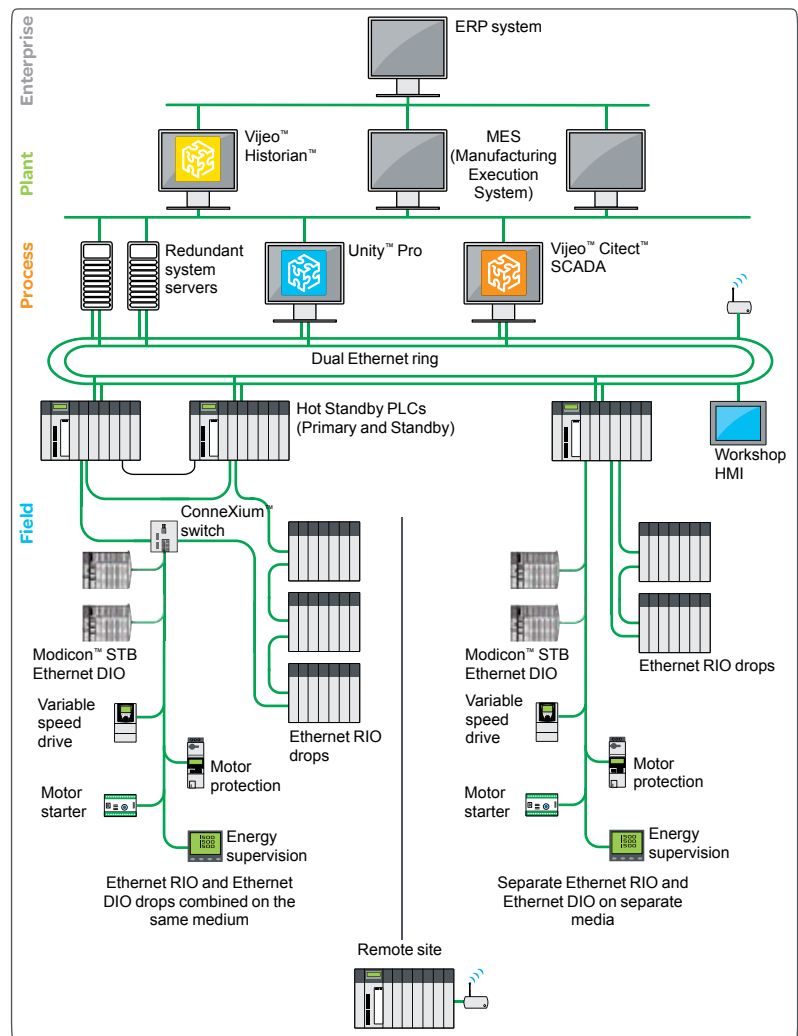
- Ethernet remote I/O (RIO)
- Ethernet distributed devices (DIO)
- CRP Ethernet head adaptor
- CRA Ethernet drop adaptor
- Three managed switches from the ConneXium™ offer (1) whose parameters can be set using predefined configuration files for immediate use

Numerous different architectures are possible, such as:

- Ethernet RIO architectures with or without ConneXium managed switches
- Architectures with separate or combined Ethernet RIO and Ethernet DIO devices
- Hot Standby (HSBY) architectures

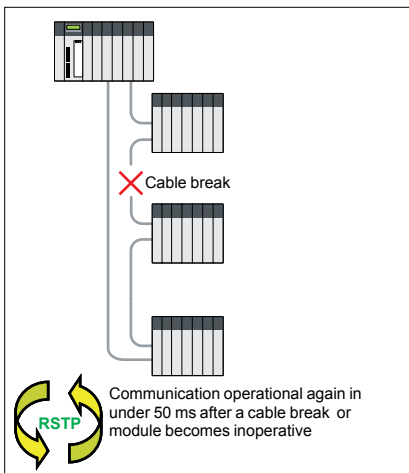
This solution also includes numerous options and functions as standard, providing:

- High process availability, with the option of connecting Ethernet RIO and Ethernet DIO in a daisy chain loop
- Deterministic data exchanges between the PLC and the Ethernet RIO
- Remote service with a SERVICE port available on the CRP Ethernet head adaptor and CRA Ethernet drop adaptor



Typical architecture

(1) The use of switches other than those detailed in these Quantum Ethernet I/O pages is not supported.



RSTP protocol

### Introduction (continued)

#### Advantages

##### Flexibility, availability of combinations and deterministic operation

- Flexibility of Ethernet topologies provides many different options to meet the needs of numerous applications.
- Ability to combine Ethernet RIO and DIO devices on the same medium enables:
  - Reduced wiring costs
  - Up to 31 Ethernet RIO drops and 128 Ethernet DIO devices
- Deterministic nature of data exchanges between the PLC and the Ethernet RIO allows the system response time to be calculated for the Ethernet RIO, regardless of the number of Ethernet DIO devices.

##### Increased process performance and availability

- High performance levels exceeding the current limits for Modicon™ Quantum™ architectures (S908 network) with 400 input words and 400 output words per drop (instead of 64 input words and 64 output words for the S908 architecture)
- High overall process availability in Hot Standby architectures with:
  - Primary ring and secondary ring topologies using the Ethernet ports on the CRP Ethernet head adaptor and CRA Ethernet drop adaptor
  - RSTP (Rapid Spanning Tree Protocol) for the primary ring or secondary ring, enabling a ring to self-heal in less than 50 ms if there is a cable break or a module becomes inoperative

#### Remote debugging

CRP Ethernet head adaptors and CRA Ethernet drop adaptors have 3 or 4 connection ports, depending on the module:

- 2 DEVICE NETWORK ports for daisy chain loop connection of Ethernet RIO
- 1 SERVICE port supporting a rate of 5 Mbps for connecting Ethernet DIO devices, up to a maximum of 20 Mbps for Ethernet DIO ports:
  - Local HMI (Magelis™ terminal, etc.) (1)
  - One or more Ethernet DIO devices
  - PC with Unity Pro software (2) for debugging an application remotely
  - Network diagnostics with the ConneXview™ or HiVision software, or other network analysis tools (Port Mirroring, etc.)
- 1 INTERLINK port on the CRP Ethernet head adaptor (see page 16)

#### Online configuration modification with the CCOTF function

The CCOTF (Change Configuration On The Fly) function enables I/O modules to be added to or removed from a Quantum PLC configuration in RUN mode.

It also enables the configuration parameters of pre-existing and new I/O modules to be modified online.

These changes are possible on the Quantum local rack and on RIO drops (Ethernet or S908 networks).

This CCOTF function avoids interruptions to processes and helps reduce production costs.

#### Compatibility with references in the Quantum catalog

Quantum Ethernet I/O offer is fully compatible with the references in the Quantum offer (CPUs, power supply, I/O modules, racks).

This compatibility simplifies:

- Implementation of Ethernet I/O architectures
- Migration from a S908 network architecture to a Quantum Ethernet I/O architecture

#### Rack Viewer function

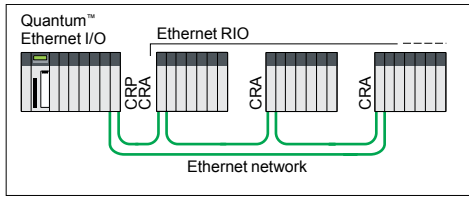
Rack Viewer function provides access to Ethernet RIO data via a web browser. Function requires the 140NOE77111 Ethernet communication module.

#### Predefined configurations for ConneXium managed switches

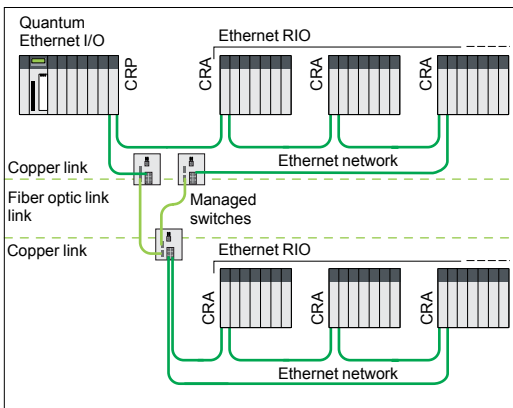
Use of ConneXium managed switches specifically for Quantum Ethernet I/O architectures is simplified using 7 predefined configuration files (included on the Unity™ Pro ≥ V6.0 DVD). These configurations are optimized to meet the requirements of the majority of Ethernet architectures (see page 17).

(1) Please refer to the "Human-Machine Interfaces" catalog.

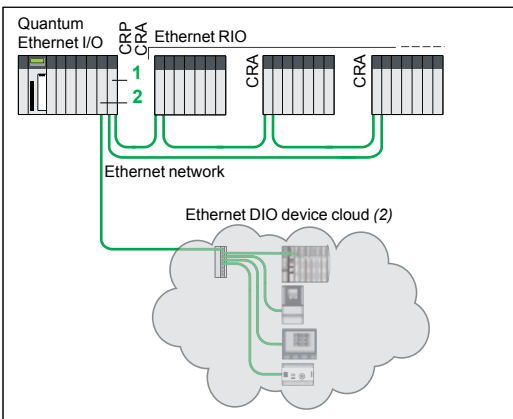
(2) Requires Unity Pro Extra Large software ≥ V6.0.



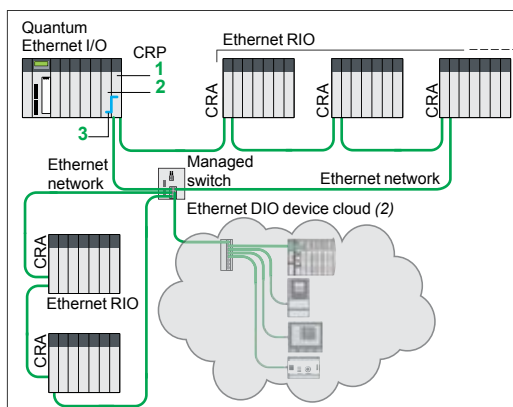
Ethernet RIO architecture without ConneXium managed switches



Ethernet RIO architecture with ConneXium™ managed switches



Architecture with separate Ethernet RIO and Ethernet DIO devices



Architecture with combined Ethernet RIO and Ethernet DIO devices

### Types of Quantum™ Ethernet I/O architecture (1)

Quantum Ethernet I/O can be used in three types of architecture:

- Ethernet RIO architectures
  - Without ConneXium™ managed switches
  - With ConneXium managed switches
- Ethernet RIO and Ethernet DIO device architectures
  - Separate Ethernet RIO and Ethernet DIO devices
  - Combined Ethernet RIO and Ethernet DIO devices
- Quantum Ethernet I/O Hot Standby architectures

### Ethernet RIO architectures

#### Ethernet RIO without ConneXium managed switches

Simple Ethernet RIO architecture specifically for applications requiring discrete I/O, analog I/O or the 140ERT85410 multifunction input module. Maximum distance between each rack is 100 m.

#### Ethernet RIO with ConneXium managed switches

Ethernet RIO architecture specifically for applications requiring discrete or analog I/O. Integration of ConneXium managed switches allows drops to be located remotely using a fiber optic link:

- Over long distances (more than 100 m)
- In environments subject to a great deal of interference
- Connecting sites that do not share the same earth ground point where a potential difference between the sites may exist.

Each switch also allows the management of a secondary Ethernet RIO ring.

### Ethernet RIO and Ethernet DIO devices (2)

#### Separate Ethernet RIO and Ethernet DIO devices

Conventional architecture with Ethernet RIO and Ethernet DIO devices on two isolated networks:

- The Ethernet RIO are connected to the PLC via the 140CRP31200 Ethernet head adaptor (1).
- The Ethernet DIO devices are connected via the 140NOE771●● or 140NOC77100 Ethernet communication module (2).

#### Combined Ethernet RIO and Ethernet DIO devices

This architecture has the advantage of being able to combine Ethernet RIO and Ethernet DIO devices on the same physical network.

It allows a ConneXium managed switch to be connected from the 140CRP31200 Ethernet head adaptor (1). This switch is used for addressing the Ethernet RIO and the Ethernet DIO devices. The entire network is connected to the CRP Ethernet head adaptor (1). A TCSECN3M3M1S4/1S4U Ethernet Interlink cable (3) between the 140CRP31200 Ethernet head adaptor (1) and the 140NOE771●● Ethernet communication module (2) is used to access the communication module functions.

The Ethernet DIO devices (standalone devices and devices connected in a daisy chain loop) should be connected directly to a ConneXium managed switch.

For simple architectures without switches, the Ethernet DIO devices can also be connected directly to the SERVICE ports on the CRP Ethernet head adaptor and CRA Ethernet drop adaptor.

This architecture features:

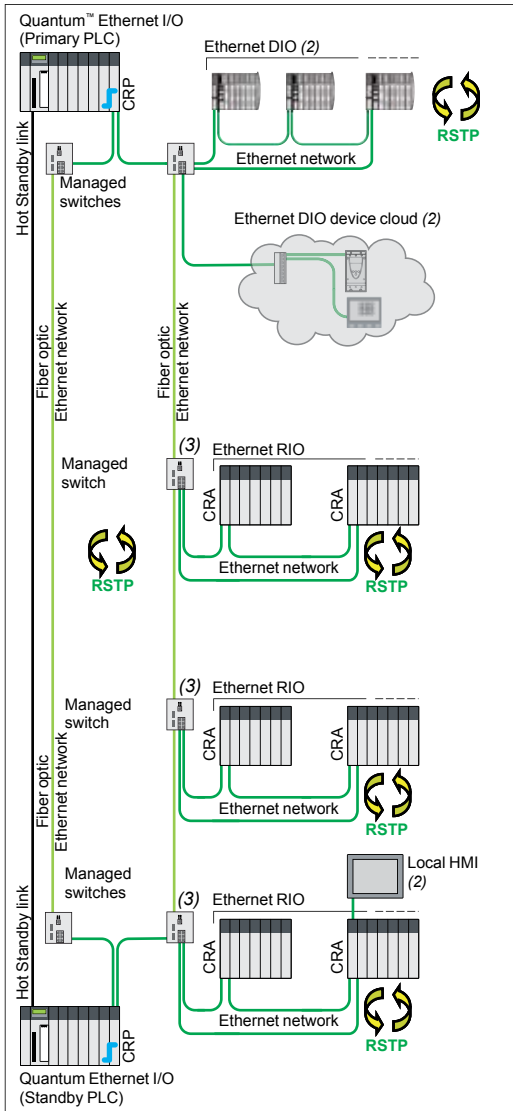
- Reduced wiring costs
- Deterministic data exchanges between the PLC and the Ethernet RIO
- High availability of Ethernet DIO devices that can be connected in daisy chain loop topology (limited to devices compatible with this type of architecture)

Maximum distance between each ConneXium managed switch:

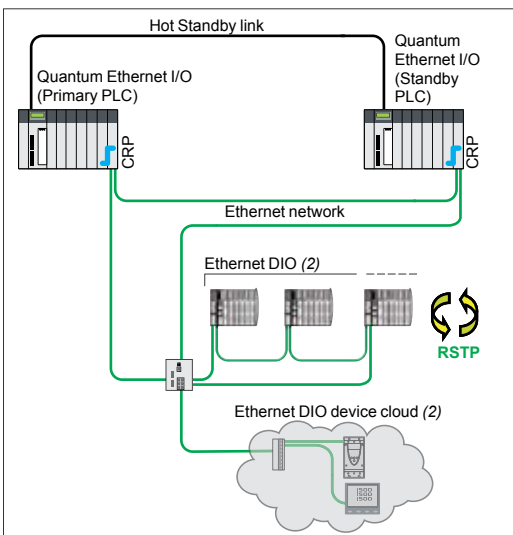
- 100 m with copper medium
- 2 km with multimode fiber optic medium
- 15 km with single mode fiber optic medium

(1) Requires Unity™ Pro Extra Large software ≥ V6.0.

(2) Please refer to the relevant product catalogs on our website [www.schneider-electric.com](http://www.schneider-electric.com).



Long distance Quantum Ethernet I/O Hot Standby architecture



Quantum Ethernet I/O Hot Standby architecture with Ethernet DIO devices, with no CRA Ethernet drop adaptor

### Types of Quantum™ Ethernet I/O architecture (1) (continued)

#### Ethernet Hot Standby

The Unity Hot Standby system is used for demanding applications that require the availability of the control/command system, as no interruption of the process can be tolerated.

The Ethernet Hot Standby architecture helps to ensure global availability of the Hot Standby CPU and Ethernet I/O devices.

At the heart of this architecture are two PLC racks (Primary and Standby) with identical hardware configurations, based on 140CPU67●6● Unity Hot Standby CPUs, connected via a high-speed fiber optic cable. The volume of data exchanged between the Primary and Standby PLCs can reach 1.5 MB depending on the CPU.

The Primary PLC executes the application program and controls the I/O, while the Standby PLC remains in the background.

In the event that the primary PLC becomes inoperative, the standby system switches over automatically, changing over execution of the application program and control of the I/O to the Standby PLC with an up-to-date data context. Once the changeover is complete, the Standby PLC becomes the Primary PLC. Once the inoperative PLC has been repaired and reconnected to the standby system, it takes the role of the Standby PLC. The changeover is performed smoothly at the outputs and is completely transparent to the process.

The Hot Standby system with Unity™ Pro software increases productivity by minimizing process downtime.

#### Hot Standby system based on Ethernet RIO architecture

The Hot Standby system based on the remote I/O (RIO) architecture is used for sensitive processes that require an I/O control takeover time within the region of the PLC scan time.

As the RIO drops are synchronized with the PLC CPU scan time, the CPU changeover is carried out smoothly at the outputs, i.e. it is bumpless.

Maximum distance between each ConneXium managed switch:

- 100 m with copper medium
- 2 km with multimode fiber optic medium
- 15 km with single mode fiber optic medium

#### Hot Standby system based on Ethernet DIO device architecture

In this type of Hot Standby architecture with no Ethernet RIO, the CRA Ethernet drop adaptor is not required. Only a CRP Ethernet head adaptor is needed in each PLC (Primary and Standby).

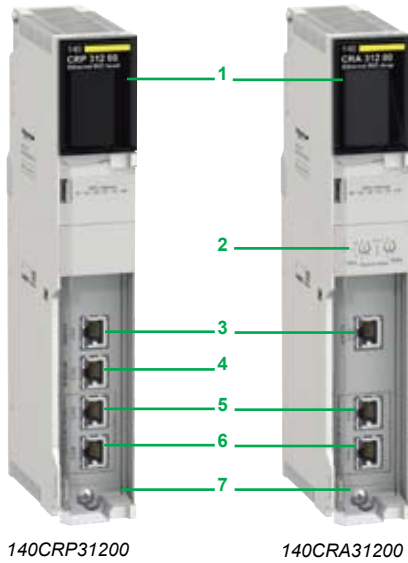
(1) Requires Unity Pro Extra Large software ≥ V6.0.

(2) Please refer to the relevant product catalogs on our website [www.schneider-electric.com](http://www.schneider-electric.com).

(3) As well as the secondary ring, an Ethernet DIO device cloud can be connected to each switch.

# Modicon™ Quantum™ Ethernet I/O automation platform

CRP Ethernet head adaptors  
CRA Ethernet drop adaptors



140CRP31200

140CRA31200

## CRP Ethernet head adaptors and CRA Ethernet drop adaptors

(1) (2)

### Introduction

Ethernet I/O architecture requires the use of the following Ethernet modules:

- 140CRP31200 Ethernet head adaptor installed in the Quantum™ rack
- 140CRA31200 Ethernet drop adaptor installed in each Ethernet RIO drop

Each of these modules is connected by an Ethernet cable equipped with RJ45 connectors. The dual RJ45 port on each module simplifies daisy chain loop connections that offer the added advantages of RSTP functionality. Each module uses one slot in the rack.

These modules are also available in a conformal coating version for harsh environments with the application of Humiseal 1A33.

### Capacity of each Quantum Ethernet I/O architecture

- 1 Quantum CPU drop that can have one primary rack and one secondary rack (3)
- Maximum of 31 Ethernet DIO drops (each drop can comprise one primary rack and one secondary rack) (3) (4)
- Distance:
  - 100 m between each drop
  - 2 km between each ConneXium™ managed switch with a multimode fiber optic cable (5)
  - 15 km between each ConneXium managed switch with a single mode fiber optic cable (5)
- Maximum of 15 ConneXium managed switches (4)
- 1 secondary ring level per switch
- Maximum of 128 Ethernet DIO devices

### Description

- 1 Display block indicating the module status
- 2 On 140CRA31200 module: rotary switches for addressing Ethernet RIO drops (00 to 159)
- 3 Dedicated RJ45 SERVICE port for remote service tools such as a PC with Unity Pro (6) and/or ConneXview™ or HiVision network diagnostics tools, or with network analysis tools (Port Mirroring, etc.), HMI terminal, etc. This port can also be used to connect:
  - Ethernet DIO such as Modicon™ STB I/O (7)
  - Compatible devices such as Altivar™ variable speed drives
- 4 RJ45 INTERLINK port on 140CRP31200 module for connecting the Interlink cable
- 5 RJ45 DEVICE NETWORK port for connection to the Ethernet network
- 6 RJ45 DEVICE NETWORK port for connection to the Ethernet network
- 7 Removable hinged door

### Ethernet communication module and Ethernet head adaptor combination

Modicon Quantum Ethernet I/O allows for a combined Ethernet RIO and Ethernet DIO device architecture (see page 14).

This solution simply requires the TCSECN3M3M1S4/1S4U Ethernet Interlink cable (10) to be connected between the 140NOE771●● Ethernet communication module (8) (RJ45 port) and the 140CRP31200 Ethernet head adaptor (9) (INTERLINK port 4).

### Description

- 8 Ethernet communication module 140NOE771●●
- 9 Ethernet head adaptor 140CRP31200
- 10 Ethernet Interlink cable TCS ECN3M3M1S4/1S4U (1 m)

(1) For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) Requires Unity™ Pro Extra Large software ≥ V6.0.

(3) Requires two 140XBE10000 rack expansion modules (one in the primary rack and one in the secondary rack) and a 140XCA7170● extension cable (1, 2 or 3 m) for connecting these two modules. (see page 25).

(4) Each ConneXium switch counts as two Ethernet RIO drops.

(5) See page 17.

(6) To connect Unity Pro to the Services port 3 the 140NOE771●● Ethernet communication module (8) and TCSECN3M3M1S4/1S4U Ethernet Interlink cable (10) are required.

(7) Please refer to the "Modicon™ STB IP 20 distributed I/O" catalog.



140NOE771 ●●/140 CRP 31200



# Modicon™ Quantum™ Ethernet I/O automation platform

## ConneXium™ managed switches

### Predefined configuration files



TCSESM083F23F1



TCSESM063F2CU1  
TCSESM063F2CS1

#### ConneXium™ managed switches (1)

##### Introduction

There are three ConneXium managed switch models available specifically for Quantum™ Ethernet I/O architectures. They are required in the following situations:

- For remote racks located at a distance of more than 100 m
- Use of fiber optic media:
  - For remote racks located over long distances: 2 km (multimode optical fiber) or 15 km (single mode optical fiber)
  - In environments subject to interference
  - Between sites with different earth ground potentials
- Architectures with combined Ethernet RIO and Ethernet DIO devices

##### ConneXium managed switches specific to medium

ConneXium managed switch	Copper port	Multimode fiber optic port	Single mode fiber optic port	Distance between switches
	RJ45 shielded connectors	Duplex SC connectors		
TCSESM083F23F1	1: 8 ports 10/100 BASE-TX	–	–	100 m
TCSESM063F2CU1	3: 6 ports 10/100 BASE-TX	2: 2 ports 10/100 BASE-FX	–	2 km
TCSESM063F2CS1	3: 6 ports 10/100 BASE-TX	–	2: 2 ports 10/100 BASE-FX	15 km

##### Predefined configuration files (2)

For ease of implementation of these switches, 7 predefined configuration files are available for building validated and tested architectures.

These configuration files are included as standard on the Unity™ Pro V6.0 DVD. The parameters of the switch(es) present on the Ethernet network can then be easily set with the chosen configuration using a PC equipped with a web browser or Ethernet Switch Configurator software. The switch is configured immediately. Ethernet Switch Configurator software is also available on the ConneXium Resource CD-ROM.

Each switch can have a different configuration depending on application requirements.

The table below gives the corresponding Ethernet network topology and compatible switches for each predefined configuration.

##### List of configuration files and compatibility for each switch type

File (2)	Ethernet network topology (1) (3) (devices connected/medium)	Use with switches		
		TCSESM083F23F1	TCSESM063F2CU1	TCSESM063F2CS1
C1	<ul style="list-style-type: none"> <li>■ Primary ring/copper</li> <li>■ ERIO secondary ring/copper</li> <li>■ EDIO clouds/copper</li> </ul>			
C2	<ul style="list-style-type: none"> <li>■ Primary ring/copper</li> <li>■ EDIO secondary ring/copper</li> <li>■ EDIO clouds/copper</li> </ul>			
C3	<ul style="list-style-type: none"> <li>■ Primary ring/fiber optic</li> <li>■ ERIO secondary ring/copper</li> <li>■ EDIO clouds/copper</li> </ul>			
C4	<ul style="list-style-type: none"> <li>■ Primary ring/fiber optic</li> <li>■ EDIO secondary ring/copper</li> <li>■ EDIO clouds/copper</li> </ul>			
C5	<ul style="list-style-type: none"> <li>■ Primary ring/copper, fiber optic</li> <li>■ ERIO secondary ring/copper</li> <li>■ EDIO clouds/copper</li> </ul>			
C6	<ul style="list-style-type: none"> <li>■ Primary ring/copper, fiber optic</li> <li>■ EDIO secondary ring/copper</li> <li>■ EDIO clouds/copper</li> </ul>			
C15	<ul style="list-style-type: none"> <li>■ Primary ring long distance Hot Standby link/copper and fiber optic</li> </ul>			

Compatible  Not compatible

(1) The functions described are only available with the three ConneXium managed switches mentioned on this page (TCSESM083F23F1/063F2CU1/063F2CS1).

(2) These configurations can be used in Ethernet Hot Standby architectures.

(3) ERIO (Ethernet RIO); EDIO (Ethernet DIO)

# Modicon™ Quantum™ Ethernet I/O automation platform

## ConneXium™ managed switches

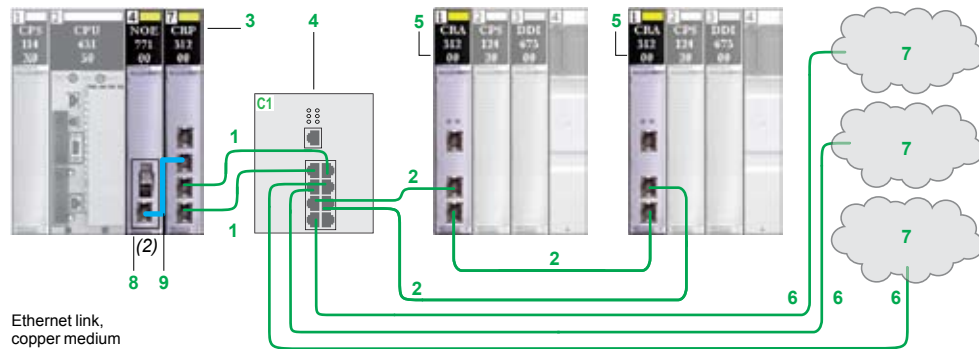
### Example topologies

#### ConneXium™ managed switches (continued)

##### Predefined configuration files (continued)

##### Example topology with predefined configuration file C1 (1)

One of the main advantages of Quantum™ Ethernet I/O is the ability to connect the Ethernet RIO remote drops in a secondary ring. These I/O are controlled by the PLC in the same way as those connected on the primary ring. This type of architecture makes it possible to increase the distance between remote I/O drops while isolating the devices located on a secondary ring from those on the primary ring.



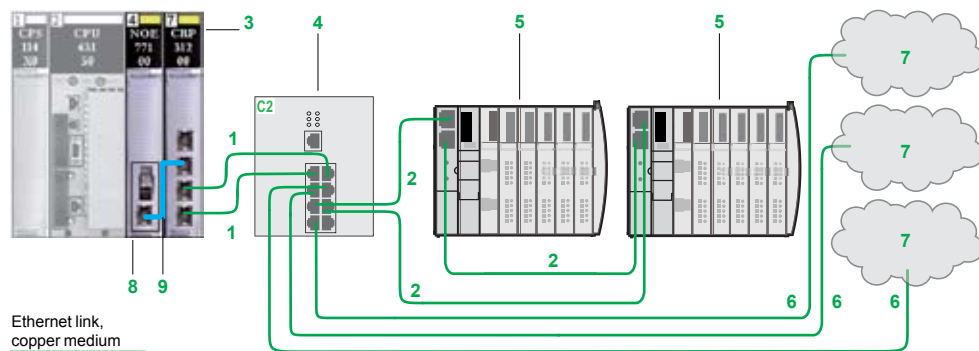
Ethernet link, copper medium

- 1 Primary ring, copper medium
- 2 Ethernet RIO secondary ring, copper medium
- 3 Ethernet head adaptor 140CRP31200 installed in the Quantum rack
- 4 ConneXium switch TCSESM083F23F1 with predefined configuration file C1
- 5 Ethernet drop adaptor 140CRA31200 installed in each Ethernet RIO drop (3).
- 6 Connection to Ethernet DIO device cloud, copper medium
- 7 Ethernet DIO device cloud (4)
- 8 Ethernet communication module 140NOE771●● (2)
- 9 Ethernet Interlink cable TCSECN3M3M1S4/1S4U (1 m) (2)

##### Example topology with predefined configuration file C2 (1)

With Quantum Ethernet I/O, the Ethernet DIO can be installed to make use of daisy chain loop architecture. The use of dedicated ConneXium managed switches specific to the predefined configurations means that Ethernet DIO device clouds can be connected to a secondary ring that will restore communication in under 50 ms in the event of a cable break or a module becomes inoperative.

**Note:** ConneXium switches apply a low priority to exchanges with Ethernet DIO devices, thus allowing deterministic data exchanges between the PLC and the Ethernet RIO.



Ethernet link, copper medium

- 1 Primary ring, copper medium
- 2 Ethernet DIO secondary ring, copper medium
- 3 Ethernet head adaptor 140CRP31200 installed in the Quantum rack
- 4 ConneXium switch TCSESM083F23F1 with predefined configuration file C2
- 5 Modicon STB Ethernet DIO (4) (5)
- 6 Connection to Ethernet DIO device cloud, copper medium
- 7 Ethernet DIO device cloud (4)
- 8 Ethernet communication module 140NOE771●●
- 9 Ethernet Interlink cable TCSECN3M3M1S4/1S4U (1 m)

(1) Non-exhaustive example. For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) The Ethernet communication module 8 and Ethernet Interlink cable 9 are only required if there are Ethernet DIO devices in the architecture.

(3) Each Ethernet RIO drop can comprise a primary and a secondary rack.

(4) Requires the Ethernet communication module 8 and Ethernet Interlink cable 9.

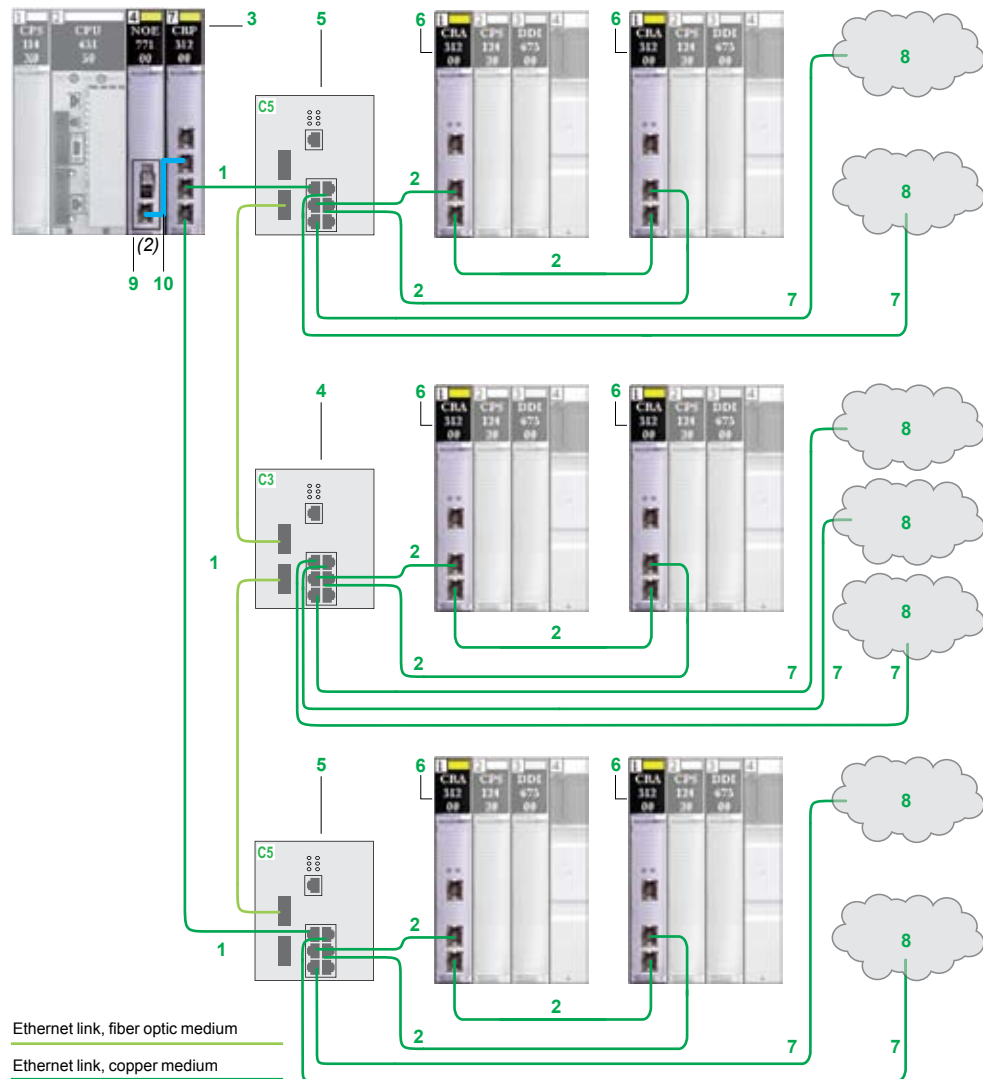
(5) Please refer to the "Modicon™ STB IP 20 distributed I/O" catalog.

#### ConneXium™ managed switches (continued)

##### Predefined configuration files (continued)

##### Example topology with predefined configuration files C3 and C5 (1)

In some applications, two consecutive Ethernet RIO drops may be located up to 15 km apart. Such distances can be achieved, depending on the type of ConneXium managed switch, using single mode or multimode optical fibers in the primary ring of the Quantum™ Ethernet I/O network.



- 1 Primary ring, copper/fiber optic medium
- 2 Ethernet RIO secondary ring, copper medium only
- 3 Ethernet head adaptor 140CRP31200 installed in the Quantum rack
- 4 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C3
- 5 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C5 (3)
- 6 Ethernet drop adaptor 140CRA31200 installed in each Ethernet RIO drop (4)
- 7 Connection to Ethernet DIO device cloud, copper medium only
- 8 Ethernet DIO device cloud (5)
- 9 Ethernet communication module 140NOE771●● (2)
- 10 Ethernet Interlink cable TCS ECN3M3M1S4/1S4U (1 m) (2)

(1) Non-exhaustive example. For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).  
 (2) The Ethernet communication module 9 and Ethernet Interlink cable 10 are only required if there are Ethernet DIO devices in the architecture.  
 (3) Also see page 21 (C3) or pages 21 and 23 (C5).  
 (4) Each Ethernet RIO drop can comprise a primary and a secondary rack.  
 (5) Requires the Ethernet communication module 9 and Ethernet Interlink cable 10.

# Modicon™ Quantum™ Ethernet I/O automation platform

## ConneXium™ managed switches

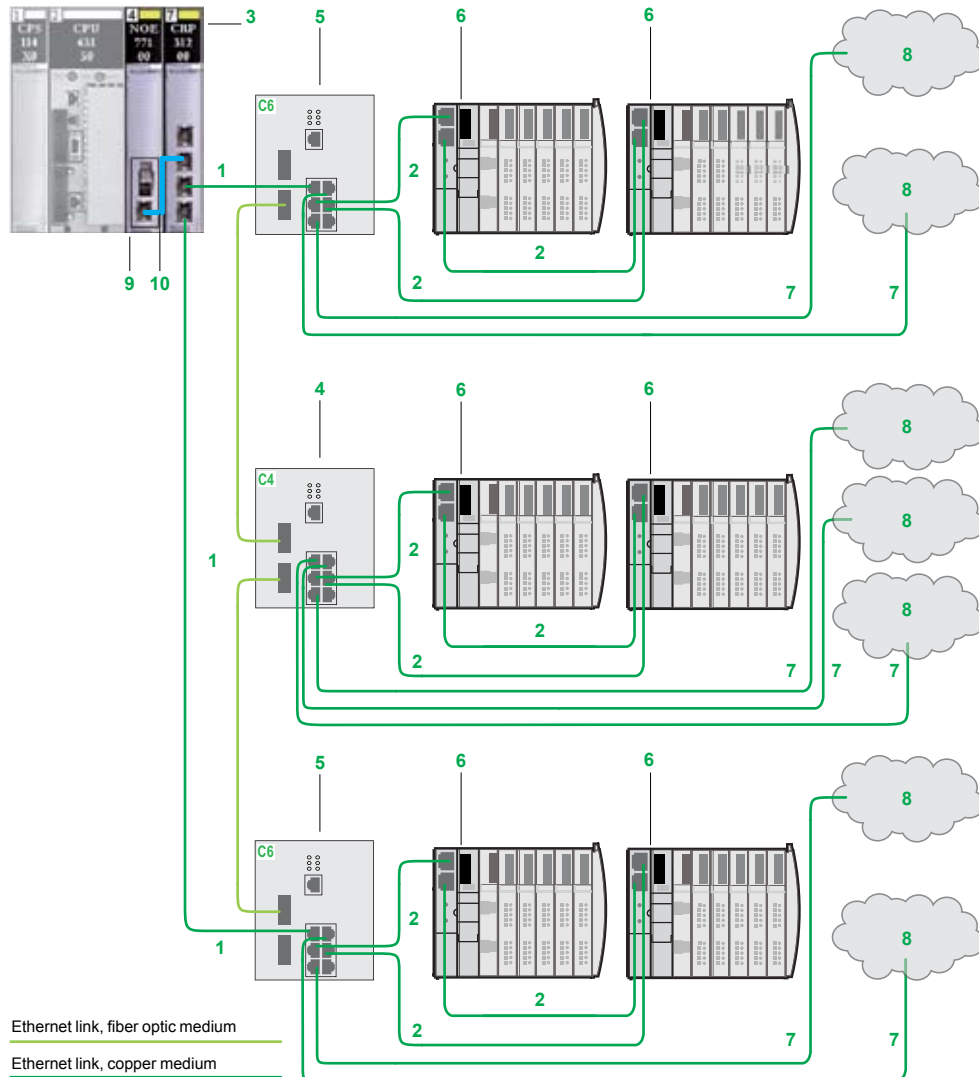
### Example topologies

#### ConneXium™ managed switches (continued)

##### Predefined configuration files (continued)

##### Example topology with predefined configuration files C4 and C6 (1)

In some Quantum™ Ethernet I/O architectures, two consecutive Ethernet DIO devices may be located up to 15 km apart. In others, the environment may require the use of a wiring system with low sensitivity to electromagnetic waves. The use of single mode or multimode optical fibers in the primary ring is appropriate in such cases.



- 1 Primary ring, copper/fiber optic medium
- 2 Ethernet DIO secondary ring, copper medium only
- 3 Ethernet head adaptor 140CRP31200 installed in the Quantum rack
- 4 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C4 (2)
- 5 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C6 (2)
- 6 Modicon™ STB Ethernet DIO (3) (4)
- 7 Connection to Ethernet DIO device cloud, copper medium only
- 8 Ethernet DIO device cloud (3)
- 9 Ethernet communication module 140NOE771●●
- 10 Ethernet Interlink cable TCS ECN 3M3M 1S4/1S4U (1 m)

(1) Non-exhaustive example. For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) Also see page 22.

(3) Requires the Ethernet communication module 9 and Ethernet Interlink cable 10.

(4) Please refer to the "Modicon STB IP 20 distributed I/O" catalog.

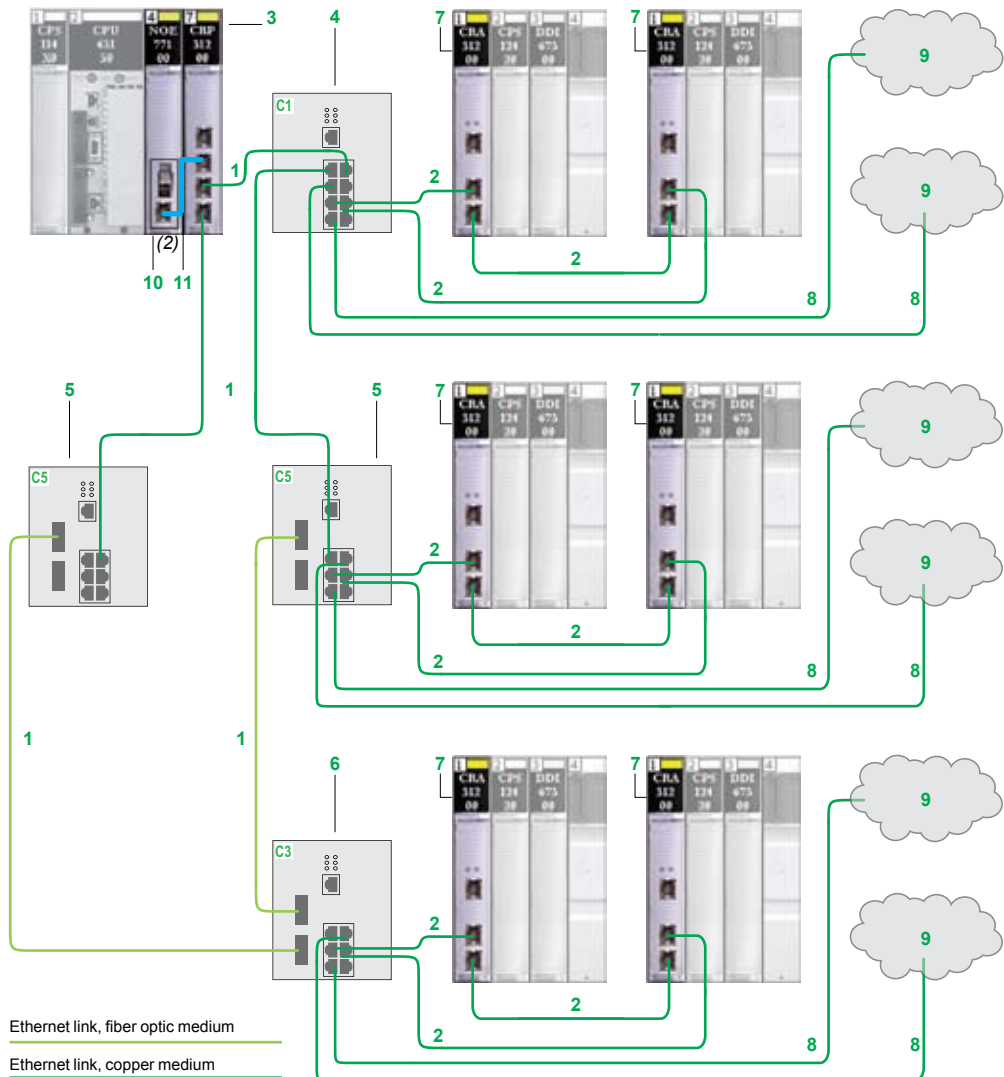
#### ConneXium™ managed switches (continued)

##### Predefined configuration files (continued)

##### Example topology with predefined configuration files C5, C1 and C3 (1)

A common use of this preconfiguration is for interfacing a copper link with a fiber optic link on the primary ring or interfacing a fiber optic link with a copper link. This type of architecture makes it possible to have Ethernet DIO or Ethernet RIO drops some distance away from the PLC.

The switch preconfiguration also enables Ethernet RIO and/or several Ethernet DIO device clouds to be connected to a secondary ring.



- 1 Primary ring, copper/fiber optic medium
- 2 Ethernet RIO secondary ring, copper medium only
- 3 Ethernet head adaptor 140CRP31200 installed in the Quantum rack
- 4 ConneXium switch TCSESM083F23F1 with predefined configuration file C1 (3)
- 5 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C5 (3)
- 6 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C3 (3)
- 7 Ethernet drop adaptor 140CRA31200 installed in each Ethernet RIO drop (4)
- 8 Connection to Ethernet DIO device cloud, copper medium only
- 9 Ethernet DIO device cloud (5)
- 10 Ethernet communication module 140NOE771 (2)
- 11 Ethernet Interlink cable TCS ECN 3M3M 1S4/1S4U (1 m) (2)

(1) Non-exhaustive example. For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) The Ethernet communication module 10 and Ethernet Interlink cable 11 are only required if there are Ethernet DIO devices in the architecture.

(3) Also see page 18 (C1) or page 19 (C3 and C5).

(4) Each Ethernet RIO drop can comprise a primary and a secondary rack.

(5) Requires the Ethernet communication module 10 and Ethernet Interlink cable 11.

# Modicon™ Quantum™ Ethernet I/O automation platform

## ConneXium™ managed switches

### Example topologies

#### ConneXium™ managed switches (continued)

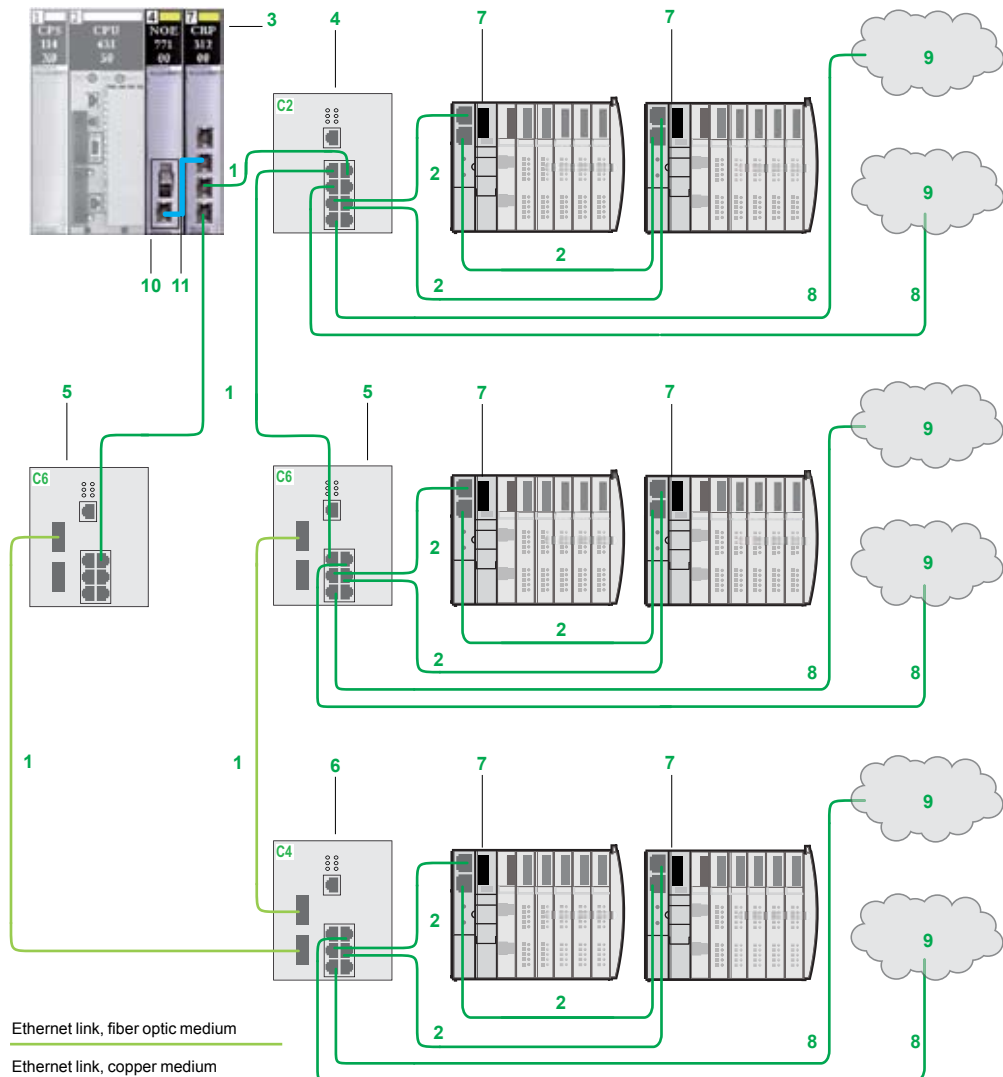
##### Predefined configuration files (continued)

##### Example topology with predefined configuration files C6, C2 and C4 (1)

A common use of this preconfiguration is for interfacing a copper link with a fiber optic link on the primary ring and interfacing a fiber optic link with a copper link.

This preconfiguration of the ConneXium managed switch also enables Ethernet DIO device clouds to be connected to the secondary ring.

**Note:** ConneXium switches apply a low priority to exchanges with Ethernet DIO devices, thus allowing deterministic data exchanges between the PLC and the Ethernet RIO.



- 1 Primary ring, copper/fiber optic medium
- 2 Ethernet DIO secondary ring, copper medium only
- 3 Ethernet head adaptor 140CRP31200 installed in the Quantum™ rack.
- 4 ConneXium switch TCSESM083F23F1 with predefined configuration file C2 (2)
- 5 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C6 (2)
- 6 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C4 (2)
- 7 Modicon™ STB Ethernet DIO (3) (4)
- 8 Connection to Ethernet DIO device cloud, copper medium only
- 9 Ethernet DIO device cloud (3)
- 10 Ethernet communication module 140NOE771●●
- 11 Ethernet Interlink cable TCSECN3M3M1S4/1S4U (1 m)

(1) Non-exhaustive example. For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) Also see page 18 (C2) or page 20 (C4 and C6).

(3) Requires the Ethernet communication module 10 and Ethernet Interlink cable 11.

(4) Please refer to the "Modicon STB IP 20 distributed I/O" catalog.

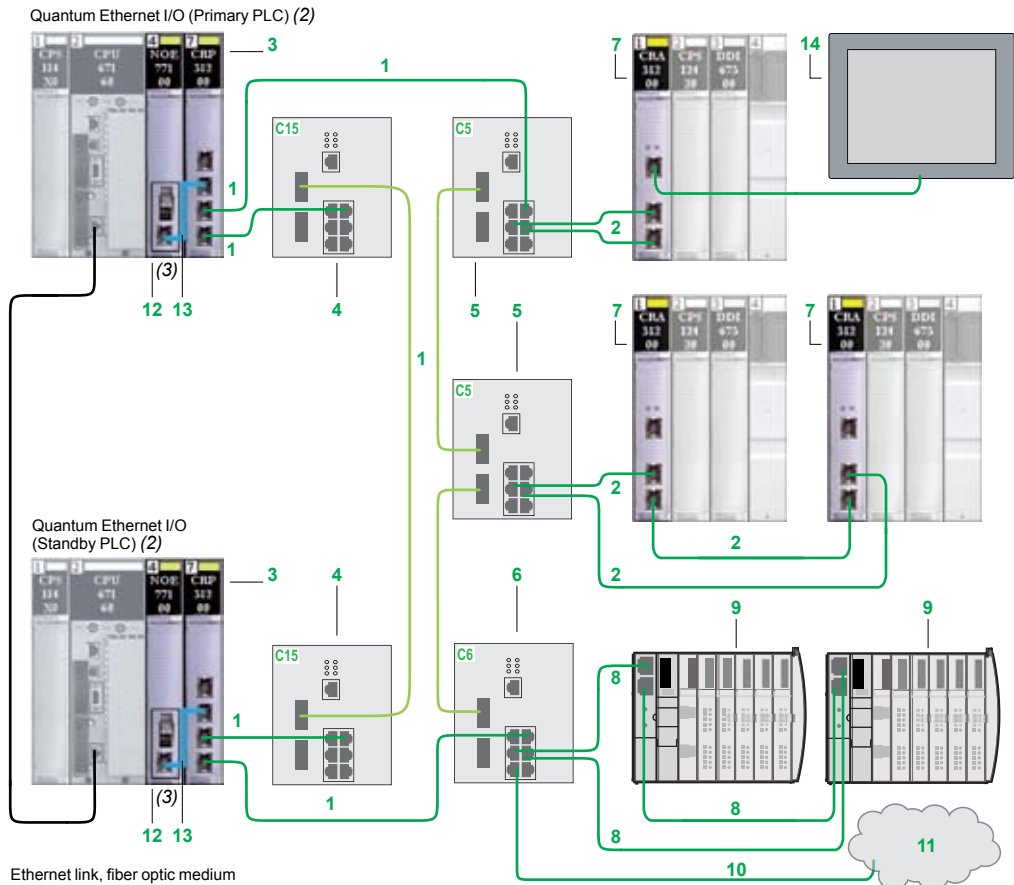
#### ConneXium™ managed switches (continued)

##### Predefined configuration files (continued)

##### Example topology with predefined configuration files C15, C5 and C6 (1)

Some Hot Standby architectures require the use of two Quantum™ Ethernet I/O PLCs located several kilometers apart (up to 15 km with the 140CPU67261 CPU).

In tunnels, for example, the two PLCs can be located one at each end. The switches are connected by a fiber optic link. These switches are connected to the CRP Ethernet head adaptor or CRA Ethernet drop adaptor via a copper link.



Ethernet link, fiber optic medium

Ethernet link, copper medium

Hot Standby link, fiber optic medium

- 1 Primary ring, copper/fiber optic medium
- 2 Ethernet RIO secondary ring, copper medium only
- 3 Ethernet head adaptor 140CRP31200 installed in the Primary and Standby Quantum PLC racks
- 4 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C15
- 5 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C5 (4)
- 6 ConneXium switch TCSESM063F2CU1/CS1 with predefined configuration file C6 (4)
- 7 Ethernet drop adaptor 140CRA31200 installed in each Ethernet RIO drop (5)
- 8 Ethernet DIO secondary ring, copper medium only
- 9 Modicon™ STB Ethernet DIO (6) (7)
- 10 Connection to Ethernet DIO device cloud, copper medium only
- 11 Ethernet DIO device cloud (6)
- 12 Ethernet communication module 140NOE771●● (3)
- 13 Ethernet Interlink cable TCSECN3M3M1S4/1S4U (1 m) (3)
- 14 Local HMI terminal connected to the Ethernet drop adaptor 140CRA31200 (8)

(1) Non-exhaustive example. For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) Requires the Quantum 140CPU67160 or 140CPU67261 CPU.

(3) The Ethernet communication module 12 and Ethernet Interlink cable 13 are only required if there are Ethernet DIO devices in the architecture.

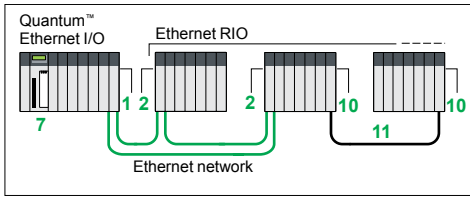
(4) Also see pages 18 to 22.

(5) Each Ethernet RIO drop can comprise a primary and a secondary rack.

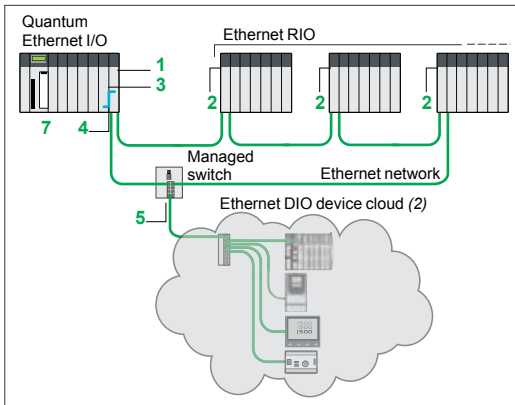
(6) Requires the Ethernet communication module 12 and Ethernet Interlink cable 13.

(7) Please refer to the "Modicon STB IP 20 distributed I/O" catalog.

(8) Please refer to the "Human-Machine Interfaces" catalog.



Ethernet RIO architecture without ConneXium™ managed switches



Architecture with combined Ethernet RIO and Ethernet DIO devices

### References (1)

#### Ethernet head and drop adaptors (2)

Description	Item (3)	Reference (4) (5)	Weight kg
<b>Ethernet head adaptor</b> 1 adaptor per Quantum™ Ethernet I/O CPU rack ■ Bus current required: 1 A ■ SERVICE port: 5 Mbps max., up to 20 Mbps for Ethernet DIO ports	1	140CRP31200	–

<b>Ethernet drop adaptor</b> 1 adaptor per primary rack in each Ethernet RIO drop ■ Bus current required: 1 A ■ SERVICE port: 5 Mbps max., up to 20 Mbps for Ethernet DIO ports	2	140CRA31200	–
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#### Dedicated ConneXium™ managed switches (8) (9)

Copper port	Multimode fiber optic port	Single mode fiber optic port	Item (3)	Reference (4) (7)	Weight kg
RJ45 shielded connectors	Duplex SC connectors				
8 x 10/100 BASE-TX ports	–	–	5	TCSESM083F23F1	1.000
6 x 10/100 BASE-TX ports	2 x 10/100 BASE-FX ports	–	6	TCSESM063F2CU1	1.000
–	–	2 x 10/100 BASE-FX ports	6	TCSESM063F2CS1	1.000

#### Ethernet communication modules and cables (2)

Description	Item (3)	Reference (4) (6)	Weight kg
<b>Ethernet TCP/IP network communication modules</b> Required if there are Ethernet DIO devices in the architecture	Transparent Ready class B30	3 140NOE77101	0.345
	Transparent Ready class C30	3 140NOE77111	0.345

<b>Ethernet Interlink cables</b> Required for an architecture with combined Ethernet RIO and Ethernet DIO devices. To be connected between the Ethernet 140NOE771 ●1 communication module and the 140CRP31200 head adaptor Length 1 m	Standard version	4 TCSECN3M3M1S4	–
	UL version	4 TCSECN3M3M1S4U	–

#### Standard Quantum CPUs

CPU	Memory (max.)	Item (3)	Reference (4) (6)	Weight kg
<b>Clock frequency</b>	<b>RAM</b>	<b>Program (with located variables)</b>	<b>Program with PCMCIA card</b>	
<b>MHz</b>	<b>MB</b>	<b>KB</b>	<b>KB</b>	<b>kg</b>
166 MHz	2	768	7168	7 140CPU65150
266 MHz	2	1024	7168	7 140CPU65160
	4	3072	7168	7 140CPU65260

(1) For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).

(2) - Requires Unity™ Pro Extra Large software ≥ V6.0 (see page 25).

- Ethernet DIO network: 128 Ethernet DIO devices max.

(3) For items 8 to 11, see page 25.

(4) Conformal Coating version available for harsh environments with the application of Humiseal 1A33. In this case, add the letter "C" to the end of the reference.

(5) Certifications (1): CE, CEI/EN 61131-2, UL 508, CSA 22.2 No. 142, CSA 22.2 No. 213 (Haz Loc Class I Div 2), EtherNet/IP (by ODVA).

(6) Certifications (1): CE, UL 508, CSA 22.2 No. 142, cUL, FM Class 1 Div. 2.

(7) Certifications (1): CE, IEC/EN 61131-2, IEC 61850-3, UL 508, UL 1604 class 1 division 2, CSA 22.2 No. 214 (cUL), CSA 22.2 No. 213 class 1 division 2 (cUL), GL, C-Tick, LR, BV.

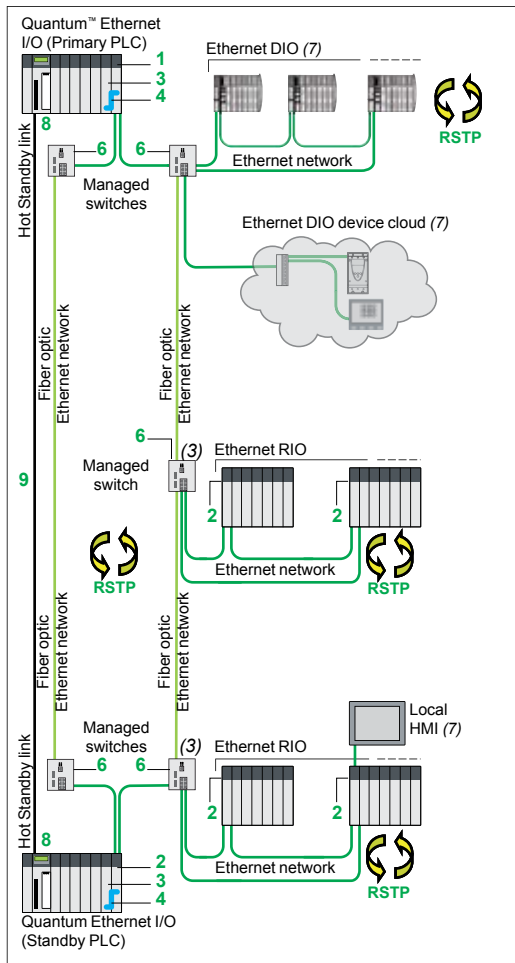
(8) ConneXium managed switches validated for Quantum Ethernet I/O architectures.

(9) Predefined configuration files included on Unity Pro ≥ V6.0 DVD.

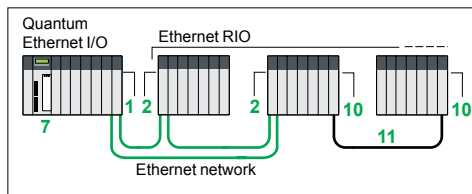


# Modicon™ Quantum™ Ethernet I/O automation platform

Ethernet Hot Standby topology  
Rack extension for Ethernet RIO drop



Long distance Quantum Ethernet I/O Hot Standby architecture



Ethernet RIO architecture without ConneXium™ managed switches

## References (1) (continued)

### Quantum™ Hot Standby CPUs

Hot Standby CPU	Memory (max.)	Item (2)	Reference (3) (4)	Weight	
<b>Clock frequency</b>	<b>RAM</b>	<b>Program (with located variables)</b>	<b>Program with PCMCIA card</b>	<b>kg</b>	
<b>MHz</b>	<b>MB</b>	<b>KB</b>	<b>KB</b>		
266 MHz	2	1024	7168	8	
(5)	4	3072	7168	8	
				<b>140CPU67160</b>	–
				<b>140CPU67261</b>	–

### Fiber optic cable for Hot Standby architecture

Description	Length m	Item (2)	Reference	Weight kg
<b>62.5/125 µm multimode fiber optic cables</b>	3	9	490NOR00003	–
equipped with MT-RJ connectors	5	9	490NOR00005	–
For interconnecting the Ethernet ports on 140CPU67160 Primary and Standby CPUs (8)	15	9	490NOR00015	–
<b>9/125 µm single mode fiber optic cable</b>	5	9	VDIF0646463505	–
equipped with LC connectors				
For interconnecting the Ethernet ports on 140CPU67261 Primary and Standby CPUs (8)				
<b>9/125 µm single mode fiber optic cable</b>	5	–	VDIF0626463505	–
equipped with LC and SC connectors				
For connecting a PC, via a ConneXium™ managed switch (6), to the Ethernet port on the 140CPU67261 CPU (8) (for updating the firmware, for example)				

### Rack extension for Ethernet RIO drop

Description	Length m	Item (2)	Reference	Weight kg
<b>Rack expansion module</b>	–	10	140XBE10000(3)(4)	–
2 modules: 1 for the primary rack, 1 for the secondary rack				
<b>Cable for rack expansion module</b>	1	11	140XCA71703	–
	2	11	140XCA71706	–
	3	11	140XCA71709	–

## Requirements for a Quantum Ethernet I/O architecture (1)

The table below gives the minimum hardware and software requirements for setting up a Quantum Ethernet I/O architecture.

Description of the hardware or software required	Version	Item (2)
<b>Unity™ Pro Extra Large software</b>	≥ 6.0	–
<b>Ethernet head adaptor 140CRP31200</b>	–	1
<b>Ethernet drop adaptor 140CRP31200</b>	–	2
<b>ConneXium managed switches</b>	Firmware ≥ 6.0	5, 6
<b>TSCESM083F23F1/063F2CU1/063F2CS1</b>		
<b>Quantum CPUs 140CPU65150/65160/65260</b>	Firmware ≥ 3.0	7
<b>Quantum Hot Standby CPUs 140CPU67160/67261</b>	Firmware ≥ 3.0	8
<b>Ethernet communication modules</b>		
<b>140NOE77101</b>	Firmware ≥ 4.9 (6)	3
<b>140NOE77111</b>	Firmware ≥ 5.0 (6)	3

(1) For additional specifications, see our website [www.schneider-electric.com](http://www.schneider-electric.com).  
 (2) For items 1 to 7, see page 24.  
 (3) Conformal Coating version available for harsh environments with the application of Humiseal 1A33. In this case, add the letter "C" to the end of the reference.  
 (4) Certifications (1): CE, UL 508, CSA 22.2 No. 142, cUL, FM Class 1 Div. 2.  
 (5) Maximum data exchange volume:  
 - 140CPU67160: 1 MB  
 - 140CPU67261: 1.5 MB  
 (6) For management of Ethernet DIO devices via Ethernet communication module.  
 (7) Please refer to the relevant product catalogs on our website [www.schneider-electric.com](http://www.schneider-electric.com).

Unity™ Pro programming software for Modicon™ M340™ M, Premium™ P, Quantum™ Q and SIL 3 Quantum S platforms and Modicon distributed I/O D



<b>IEC 61131-3 languages</b>	Instruction List (IL)	M - D	M - P - D	
	Ladder (LD)	M - D	M - P - D	
	Structured Text (ST)	M - D	M - P - D	
	Function Block Diagram (FBD)	M - D	M - P - D	
	Sequential Function Chart (SFC)/Grafcet	M - D	M - P - D	
<b>LL984 Ladder Logic language</b>				
<b>Programming services</b>	Multitask programming (Master, fast and event-triggered)	M - D	M - P - D	
	Multitask programming (Master, fast, auxiliary and event-triggered)			
	Functional view and function modules	M - D	M - P - D	
	DFB editor and instances	M - D	M - P - D	
	DDT compound data editor	M - D	M - P - D	
	Data structure instances and tables	M - D	M - P - D	
	EF and EFB libraries	M - D	M - P - D	
	User-definable control loops		P (TSXP572●) - D	
	Programmable control loops (with process control FB library)	M - D	M - P - D	
	Safety function block libraries			
	Motion function block (MFB) libraries	M - D	M - P - D	
	Hot Standby PLC redundancy system		P (TSXP5724M) - D	
	System diagnostics	M - D	M - P - D	
	Application diagnostics	M - D	M - P - D	
	Diagnostics with location of detected error source	M - D	M - P - D	
	Bus and network configuration to slave devices (Modicon distributed I/O, etc)	M - D	M - P - D	
	<b>Debugging and display services</b>	PLC simulator	M - D	M - P - D
		Hypertext link animations in graphic languages	M - D	M - P - D
		Step by step execution, breakpoint	M - D	M - P - D
Watchpoint		M - D	M - P - D	
Runtime screens		M - D	M - P - D	
Diagnostic viewer		M - D	M - P - D	
<b>Other services</b>	Creation of hyperlinks	M - D	M - P - D	
	XML import/export	M - D	M - P - D	
	Application converters (Concept™, PL7™)	M - D	M - P - D	
	Update utilities for PLC and Advantys™ operating systems	M - D	M - P - D	
	Communication drivers for Modicon platforms	M - D	M - P - D	
	Unity Pro servers - Openness			
	Online modification of configuration			
	Application imports (Modsoft™, Concept™, ProWORX™) written in LL984 language			
	<b>UDE support OFS exchanges</b>	Dynamic exchange with third-party tools, OFS		
		Static exchange via XML/XVM export files	M - D	M - P - D
<b>Compatible Modicon platforms</b>	Modicon M340 CPUs M	No exceptions	No exceptions	
	Premium CPUs P	-	TSXP57C●0244/0244M TSXP57104/1634/154M TSXP57204/2634/254M TSXH5724M	
	Quantum CPUs Q	-	-	
	SIL 3 Quantum CPUs S	-	-	
<b>Compatible Modicon distributed I/O D</b>				
	STB, OTB, FTB, FTM, ETB, Momentum		STB, OTB, FTB, FTM, ETB, Momentum	
<b>Software name</b>		<b>Unity Pro Small</b>	<b>Unity Pro Medium</b>	
<b>Unity Pro software type</b>		<b>UNYSPUSF●CD60</b>	<b>UNYSPUMF●CD60</b>	
<b>Page</b>		46	47	

Unity™ Pro programming software for Modicon™ M340™ M, Premium™ P, Quantum™ Q and SIL 3 Quantum S platforms and Modicon distributed I/O D



M - P - Q - D	M - P - Q - D	M - P - Q - D
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No exceptions	No exceptions	No exceptions
TSXP57C●0244/0244M TSXP57104/1634/154M TSXP57204/2634/254M	TSXP57304/3634/354M TSXP574634/454M TSXH5724/44M	TSXP57C●0244/0244M TSXP574634/454M TSXP575634/554M TSXP5 6634M TSXH5724/44M
140CPU31110 140CPU43412U 140CPU53414U	140CPU31110 140CPU43412U 140CPU53414U	140CPU65150/60 140 CPU 652 60 140CPU67160 140CPU67261
-	-	140CPU65160S 140CPU67160S
STB, OTB, FTB, FTM, ETB, Momentum		STB, OTB, FTB, FTM, ETB, Momentum
<b>Unity Pro Large</b>	<b>Unity Pro Extra Large</b>	<b>Unity Pro XLS</b>
<b>UNYSPULF●CD60</b>	<b>UNYSPUEF●CD60</b>	<b>UNYSPUXF●CD41</b>
47	48	

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Unity Pro

### Introduction

Unity™ Pro is the common programming, debugging and runtime software for Modicon™ M340™, Premium™ and Quantum™ PLCs.

Unity Pro is a robust, multi-tasking software offering the following features:

- Five IEC 61131-3 programming languages and the LL984 editor
- Integrated, customizable DFB library
- PLC simulator on PC for program validation prior to installation
- Built-in tests and diagnostics
- Wide range of online services

### FDT/DTM function

Unity Pro enables integration of fieldbus architectures into engineering control systems using FDT/DTM technology:

- FDT (*Field Device Tool*) is the container that supports the device DTMs.
- DTM (*Device Type Manager*) is the configuration tool for devices with integrated graphic interfaces. It contains the properties specific to each device.

In addition to the FDT/DTM standard, Unity Pro uses specific information from the Master DTM created for the Profibus Remote Master (PRM) module and the Modbus/TCP and EtherNet/IP network module BMXNOC0401.

Use of the Master DTM allows Unity Pro to perform the following actions:

- Manage the PLC I/O scan
- Create the application variables based on the description of the process objects from the connected DTM devices
- Manage synchronization with the PLC configuration
- Create a generic DTM from the description files (GSD or EDS)

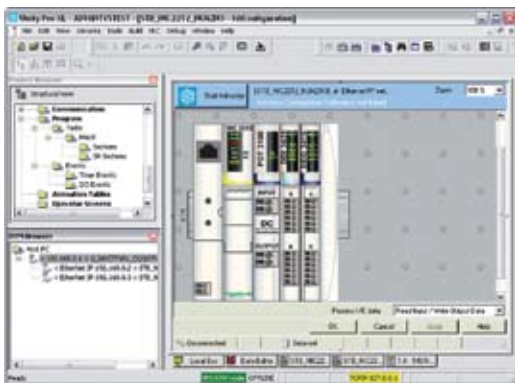
The DTM configuration is stored in the PLC memory so that the application can be downloaded in its entirety. It is also saved in the PLC project file (STU) and the archive file (STA).

A third-party DTM can be installed in the DTM hardware catalog.

The DTM hardware catalog can be used to sort or filter the DTMs according to various criteria such as Device, Vendor, Groups or Protocols.

The DTM Browser in Unity Pro:

- Displays the fieldbus topologies in a tree structure
- Allows the user to configure the DTM devices:
  - Add and delete DTMs
  - Connect and disconnect DTMs to/from their physical devices
  - Display and print the properties of a DTM
  - Transfer DTM configuration data to and from the physical device
  - Functions specific to the DTM, via the Device menu



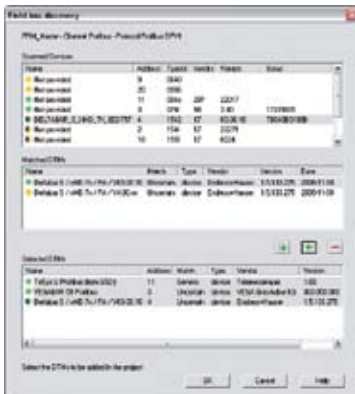
DTM editor (Modicon STB island)



DTM hardware catalog



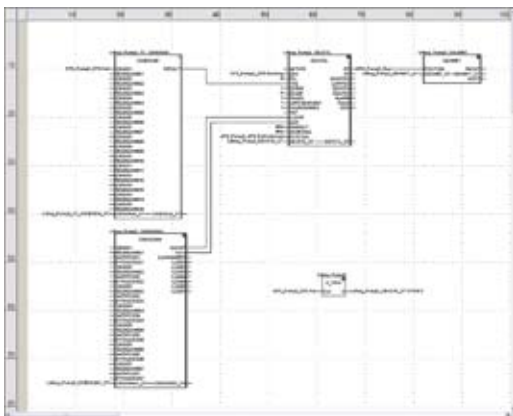
DTM browser and DTM context menu



Fieldbus lookup screen

### FDT/DTM function (continued)

The fieldbus lookup function scans the physical devices in a fieldbus network and adds the selected devices to the DTM Browser.



FBD language editor

### The five IEC languages

The five graphical or textual languages available in Unity™ Pro are used for programming Modicon™ M340™, Premium™ and Quantum™ automation platforms.

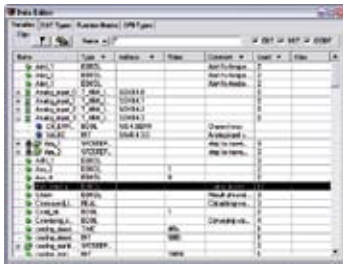
The three graphical languages are:

- Ladder (LD)
- Function Block Diagram (FBD)
- Sequential Function Chart (SFC) or Grafcet

The two textual languages are:

- Structured Text (ST)
- Instruction List (IL)

For these five languages, you can use the standard set of instructions compliant with IEC standard 61131-3 to create applications that can be transferred from one platform to another. Unity Pro software also provides extensions to this standard set of instructions. As they are specific to Modicon M340, Premium and Quantum PLCs, these extensions support the development of more complex applications to maximize the potential of the specific features of each of these platforms.



Data Editor

### Data editor

The data editor can be accessed from the structural view of the project and provides a single tool for performing the following editing tasks:

- Declaration of data including variables and function blocks (declaration of their type, instances and attributes)
- Use and archiving of function block data types in different libraries
- Hierarchical view of data structures
- Searching, sorting and filtering of data
- Creation of a hyperlink to access a description from any variable comment

The data is displayed under four tabs:

- “Variables” tab for the creation and management of the following data instances: bits, words, double words, inputs/outputs, tables and structures
- “DDT Types” tab for the creation of derived data types (tables and structures)
- “Function Blocks” tab for the declaration of EFBs and DFBs
- “DFB Types” tab for the creation of DFB user function block data types

Each data element has several attributes, of which:

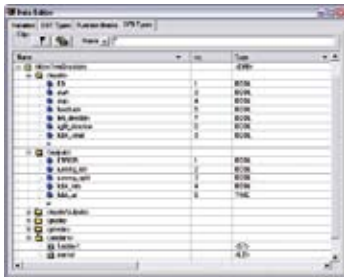
- The variable name and type are mandatory
- The comment, physical address in the memory and initial values are optional

The data editor columns can be configured (number of columns, order). The attributes associated with a variable can be displayed in a properties window.

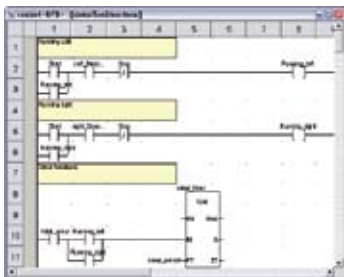
This editor can be accessed at any time during programming by selecting variables for data modification or creation.



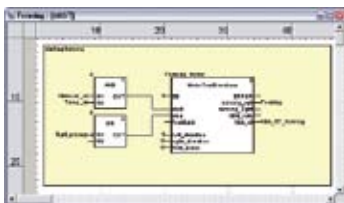
Data properties



Design



Creating the code



Use within the program

### DFB user function blocks

Using Unity™ Pro software, users can create their own function blocks for specific application requirements on Modicon™ M340™, Premium™ and Quantum™ platforms.

Once created and saved in the library, these user function blocks can be reused as easily as EFBs (Elementary Function Blocks).

These user function blocks can be used to structure an application. They are used when a program sequence is repeated several times in the application or for freezing a standard programming routine. They can be read-only or read/write. They can be exported to other Unity Pro applications.

Using a DFB in one or more applications:

- Simplifies program design and entry
- Improves program readability and understanding
- Facilitates program debugging (variables handled by the DFB are identified in the data editor)
- Enables the use of private variables specific to the DFBs that are independent of the application

A DFB is set up in several stages:

- DFB is designed by assigning a name, a set of parameters (inputs, outputs, public and private internal variables) and a comment to it via the data editor.
- Code is created in one or more sections of the program, with the following languages selected according to requirements: Structured Text, Instruction List, Ladder or Function Block Diagram (ST, IL, LD or FBD).
- DFB may be stored in a library with an associated version number.
- DFB instance is created in the data editor or when the function is called in the program editor.
- This instance is used in the program in the same way as an EFB (the instance can be created from within the program).



Standard function block libraries

### Function block libraries

The function and function block libraries manager contains the elements provided with Unity™ Pro software. Functions and function blocks are organized into libraries consisting of families. Depending on the type of PLC selected and the processor model, users will have a subset of these libraries available to write their applications. However, the "Base Lib" library contains a set of functions and function blocks with compatibility that is independent of the platforms. In particular, it contains the blocks compliant with IEC 61131-3.

The "Base Lib" library is structured into families:

- Timers and counters
- Process control on integers
- Table management
- Comparison
- Date and time management
- Logic processing
- Mathematical processing
- Statistical processing
- Character string processing
- Type-to-type data conversion

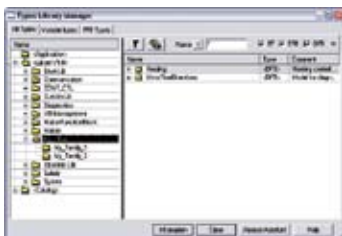
The "Base Lib" library covers standard automation functions and is supplemented by other, more application-specific libraries and platform-specific functions:

- **Communication library**, providing an easy means of integrating programs for communication between PLCs and HMIs, using the PLC application program. Like other function blocks, these EFBs can be used to exchange data between PLCs or to deliver data to be displayed on an HMI.
- **Process control library**. The CONT\_CTL library can be used to set up process-specific control loops. It offers controller, derivative and integral control functions plus additional algorithms, such as EFBs for calculating mean values, selecting a maximum value, detecting edges or assigning a hysteresis to process values, etc.
- **Diagnostics library**. Can be used to monitor actuators and contains EFBs for active diagnostics, reactive diagnostics, interlocking diagnostics, permanent process condition diagnostics, dynamic diagnostics, and monitoring of signal groups.
- **I/O management library**, providing services to handle information exchanged with hardware modules (data formatting, scaling, etc)
- **Motion Function Blocks library**, containing a set of predefined functions and structures to manage motion controlled by drives and servo drives connected on CANopen.
- **Motion library**, for motion control and fast counting
- **System library**. Provides EFBs for the execution of system functions, including evaluation of scan time, availability of several different system clocks, SFC section monitoring, display of system state, management of files on the memory cartridge of the Modicon™ M340™ processor, etc.
- Finally, a library named "obsolete", containing function blocks used by legacy programming software needed to perform application conversions.

### Management of user standards

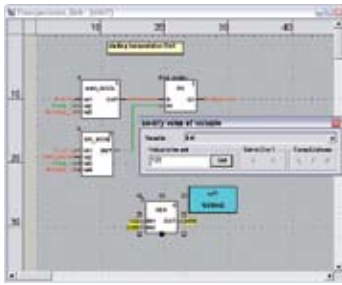
Users can create libraries and families to store their own DFBs and DDTs. This enhancement allows users to take advantage of programming standards adapted to their needs, along with version management. This means that it is possible to:

- Check the version of elements used in an application program against those stored in the library
- Perform an upgrade, if necessary

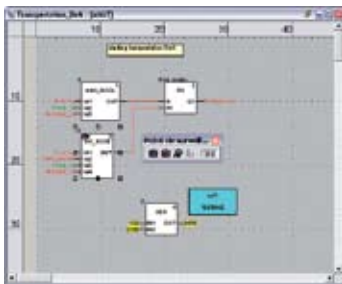


User libraries

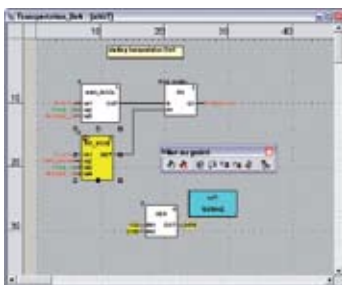




Dynamic animation/adjustment



Watchpoint



Breakpoint/step-by-step

### Debugging tools

Unity™ Pro software offers a complete set of tools for debugging Modicon™ M340™, Premium™ or Quantum™ applications. A tool palette provides direct access to the main functions:

- Dynamic program animation
- Setting of watchpoints or breakpoints (not authorized in event-triggered tasks)
- Step-by-step program execution. A function in this mode enables section-by-section execution. Instruction-by-instruction execution can be launched from the previous breakpoint. Three execution commands are therefore possible when the element to be processed is a subroutine (SR) or DFB user block instance:
  - Step Into: This command is used to move to the first element of the SR or DFB.
  - Step Over: This command is used to execute the entire SR or DFB.
  - Step Out: This command is used to move to the next instruction after the SR or DFB element.
- Independent execution of the master (MAST), fast (FAST), auxiliary (AUX) and event-triggered (EVTi) tasks

### Animation of program elements

Dynamic animation is managed section by section. A button on the toolbar is used to activate or deactivate animation for each section.

When the PLC is in RUN, this mode can be used to view, simultaneously:

- The animation of a program section, regardless of the language used
- The variables window containing the application objects created automatically from the section viewed

### Animation table

Tables containing the variables of the application to be monitored or modified can be created by data entry or initialized automatically from the selected program. These tables can be stored in the application and retrieved from there at a later date.

### Debugging DFB user function blocks

The parameters and public variables of these blocks are displayed and animated in real time using animation tables, with the possibility of modifying and forcing the required objects.

In exactly the same way as with other program elements, the watchpoint, breakpoint, step-by-step execution and program code diagnostics functions can be used to analyze the behavior of DFBs. Setting a breakpoint in a DFB instance stops execution of the task containing this block.

### Debugging in Sequential Function Chart (SFC) language

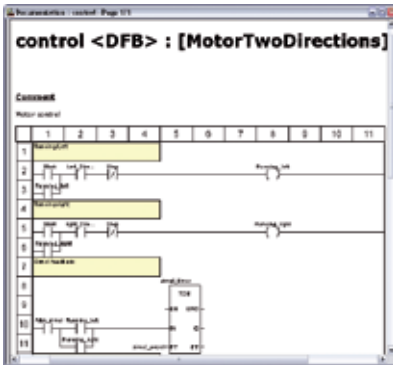
The various debugging tools are also available in SFC language. However, unlike other sections (IL, ST, LD or FBD) a SFC section executed step-by-step does not stop execution of the task, but instead freezes the SFC chart. Several breakpoints can be declared simultaneously within a single SFC section.



Simulator control panel

### PLC simulator

Unity™ Pro's integrated simulator can be used to test the application program for Modicon™ M340™, Premium™ or Quantum™ PLCs from the PC terminal without having to connect to the PLC processor. The functions provided by the debugging tools are available for debugging the master, fast and auxiliary tasks. Because the simulator does not manage the PLC I/O, animation tables can be used to simulate the state of inputs by forcing them to 0 or 1. The simulator can be connected to third-party applications via an OPC server with OFS (*OPC Factory Server*) software.



Accessing the documentation editor

### Documentation editor

The documentation editor is based on the Documentation Browser that shows the file structure in tree form. It allows the application file to be printed on any graphics printer accessible under Windows® and using True Type technology, in A4 or US letter print format. The documentation editor supports the creation of user-specific files using the following headings:

- Title page
- Contents
- General information
- Footer
- Configuration
- EF, EFB and DFB type function blocks
- User variables
- Communication
- Project structure
- Program
- Animation tables and cross-references
- Runtime screens

# Modicon™ Quantum™ Ethernet I/O automation platform

Unity™ Pro software

Small / Medium / Large / Extra Large / XLS

Integrated diagnostics

## Diagnostics integrated in Modicon™ M340™, Premium™ and Quantum™ automation platforms

### Introduction

#### System diagnostics



Processor for system bits and words

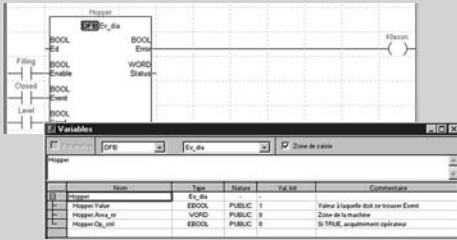


In-rack I/O modules

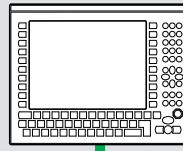


Remote I/O modules on FIPIO™ or CANopen™

#### Application diagnostics



#### Diagnostics viewers



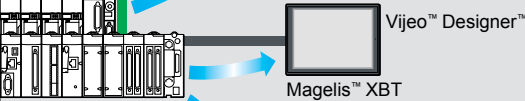
Vijeo™ Citect™  
Thin client Magelis iPC

Ethernet TCP/IP

Higher-level MES

Cell level

Machine level



Vijeo™ Designer™  
Magelis™ XBT

Quantum™,  
Premium™,  
Modicon™ M340™



Unity™ Pro  
PC

Diagnostics offer for Modicon M340, Premium and Quantum platforms is based on the following three components:

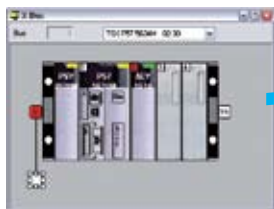
- System diagnostics
- DFB and EFB diagnostic function blocks (for system and application diagnostics)
- Error message display system, called viewers, supplied as a standard component of Magelis XBT terminals, Vijeo Citect supervisory software and Unity Pro setup software

### System diagnostics

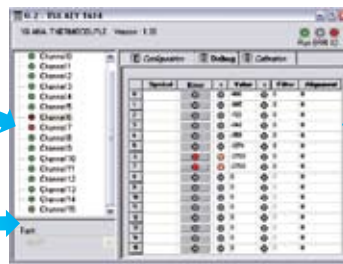
The system diagnostics for Modicon M340, Premium and Quantum platforms support the monitoring of system bits/words, I/O modules and SFC minimum and maximum step activity times. By simply choosing the relevant option during application configuration, any event will generate time-stamped messages logged in the diagnostic buffer of the PLC.

These events are displayed automatically in a diagnostics viewer (1) without requiring any additional programming.

With Unity Pro integrated diagnostics, this function can be used to perform first level diagnostics of the elements in the configuration, up to and including each I/O module channel.



Configuration level



Module level



Viewer window (example with Unity Pro software)



Channel level

(1) Diagnostics viewers are tools for displaying and acknowledging diagnostic error messages. They are supplied as a standard component of Unity Pro and Vijeo Designer software, with Magelis terminals and with the PLC Web server that can be accessed via a thin client Magelis iPC.

### Modifying the program with the PLC in RUN mode

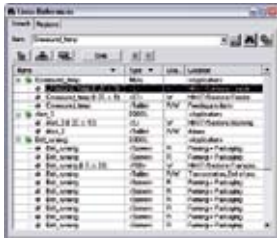
With Unity™ Pro, changes can be made to the program when the PLC connected to the programming terminal is in RUN mode. These modifications are performed with the following operations:

- The application contained in the PLC is transferred to the PC terminal running Unity Pro, if necessary.
- Program changes are prepared. These program modifications can be of any type and in any language (IL, ST, LD, FBD and SFC), for example, addition or deletion of SFC steps or actions. The code of a DFB user function block can also be modified (however, modification of its interface is not permitted).
- These program changes are updated in the PLC (in RUN mode).

This function makes it possible to add or modify program code and data in different parts of the application in one single modification session (thus resulting in a unified, consistent modification with respect to the controlled process). This increased flexibility affects the amount of program memory required.

### Cross-references function

Unity Pro's cross-references function is available in standalone mode (offline) and when connected to the PLC in Run (online). This allows users to view the elements of a PLC application when searching for any type of variable. This view indicates where the declared variable is used, as well as how it is used (for writing, reading, etc). This function also provides access to the Search/Replace function for variable names. The variable search can be initialized from any editor (language, data, runtime screen, animation table, etc).



Cross-references table

### Import/export function

The import/export function available in Unity Pro supports the following operations from the structural and functional project views:

- Via the import function, reuse in the current project any part of a project created previously
- Via the export function, copying any part of the current project to a file for subsequent reuse

The files generated during export are generally in XML format (1). However, in addition to XML, variables can be exported and imported in the following formats:

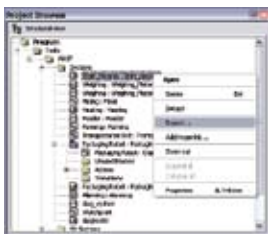
- .xvm format compatible with OFS data server software
- Source format, in an .scy file compatible with PL7 development software
- Text format with separator (TAB) in a .txt file for compatibility with any other system

During an import, a wizard can be used to reassign data to new instances of:

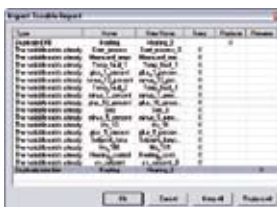
- DFBs
- DDTs
- Simple data

In addition, when a functional module is imported, the data associated with animation tables and runtime screens is also reassigned.

The XML import function also supports the transfer of a Modicon™ M340™, Premium™ or Quantum™ PLC configuration prepared in the SIS Pro costing and configuration tool, for use when creating a project in Unity Pro. This import function spares the user from having to redefine the PLC configuration when the PLC has already been configured with the SIS Pro tool.



Data export shortcut menu



Data import wizard

(1) XML language is an open, text-based language that provides structural and semantic information.

#### Application converters

Unity™ Pro integrated conversion tools can be used to convert PLC applications – created with Concept™ and PL7™ programming software – to Unity Pro applications.

##### Concept/Unity Pro converter (Quantum PLC)

Performed with a Concept application V2.5 or later, the conversion is accomplished by exporting the application to an ASCII file in Concept.

The export file is converted to a Unity Pro source file automatically, and this source file is then analyzed by Unity Pro. At the end of the procedure, a conversion report is generated and an output window displays any detected conversion errors and provides direct access to the part of the program to be modified.

The Concept application converter then converts the application to Unity Pro. These converted applications should be tested and corrected if necessary, to help ensure optimum operation

##### PL7/Unity Pro converter (Premium PLC)

This conversion is performed with a PL7 application V4 or later (Premium PLC). To perform the conversion, export the source file (the application or user function blocks) in PL7.

The conversion procedure is similar to that of the Concept conversion described above.

**Note:** Applications created with Concept, Modsoft™ and ProWORX™ can be converted to LL984. Consult your Customer Care Center.

#### Operating system update utilities

The OS-Loader software is designed for updating operating systems on Premium™ and Quantum™ platforms. It is supplied with Unity Pro software.

It is used to upgrade Unity processors and modules as well as to upgrade PL7 or Concept processors and modules to make them compatible with Unity Pro.

OS-Loader software supports:

- Premium processors
- Quantum processors
- Ethernet communication modules
- EtherNet/IP communication modules

The operating system updates are performed as follows:

- Uni-Telway™ RS 485 terminal link for Premium processors
- Modbus™ or Modbus Plus terminal link for Quantum processors
- Ethernet TCP/IP network for integrated Ethernet port on Premium processors and Premium and Quantum Ethernet modules

**Note:** For Modicon M340, this service is provided by Unity Loader.

#### Online modification of the Quantum configuration

This function, also called *Change Configuration On The Fly (CCOTF)*, is used to modify the Quantum configuration online (with application in RUN mode), which involves:

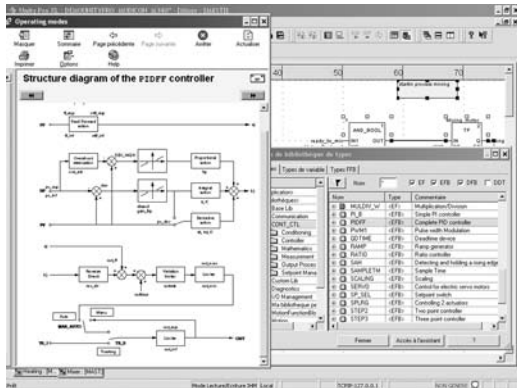
- Addition or removal of discrete or analog I/O modules
- Modification of configuration parameters of discrete or analog I/O modules (already present or newly installed)

The CCOTF function is supported by standalone CPUs for three types of I/O architecture (local, RIO, DIO) using version 5.0 or greater of Unity Pro, and for Hot Standby CPUs using version 4.1 or greater of Unity Pro

Validation of the CCOTF function is done using the Unity Pro configuration screen. A confirmation screen appears when the configuration has been modified online.



Configuration screen



CONT\_CTL, programmable process control integrated in Unity Pro

### Process control in machines

Unity™ Pro contains CONT\_CTL, a library of 36 function blocks used to create control loops for machine control.

Requirements for closed loop control functions in machines are adequately met by Modicon™ M340™, Premium™ and Quantum™ platforms due to the wealth of functions in the library and the flexibility of linking function blocks together through programming. This solution helps to eliminate the need for external controllers and simplifies the overall control architecture of the machine, as well as its design, installation, commissioning and operation.

The EFs or EFBs can be used in Unity Pro languages (LD, ST, IL and FBD). FBD is particularly suitable for accessing control processing operations in Unity Pro through its wizard for entering and viewing parameters and function block variables.

### CONT\_CTL library functions

The library consists of five function families:

- Input data conditioning
- Controllers
- Mathematical functions
- Process value processing
- Output value processing

#### Input data conditioning

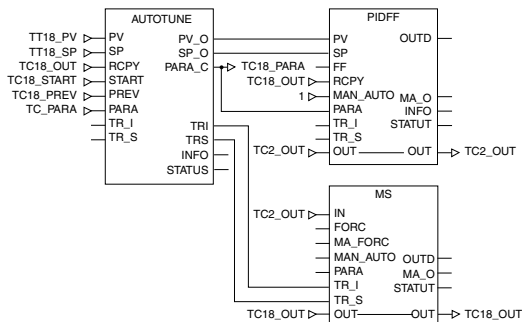
DTIME	Pure delay time
INTEGRATOR	Integrator with limiting
LAG_FILTER	First order time lag
LDLG	Lead/lag function with smoothing
LEAD	Lead function with smoothing
MFLOW	Mass flow calculation based on the measurement of differential pressure or flow speed with pressure and temperature compensation
QDTIME	Dead time term
SCALING	Scaling
TOTALIZER	Integrator (typically of flow) until a limit (typically a volume) is reached, with automatic reset
VEL_LIM	Velocity limiter, with manipulated variable limiting

#### Controllers

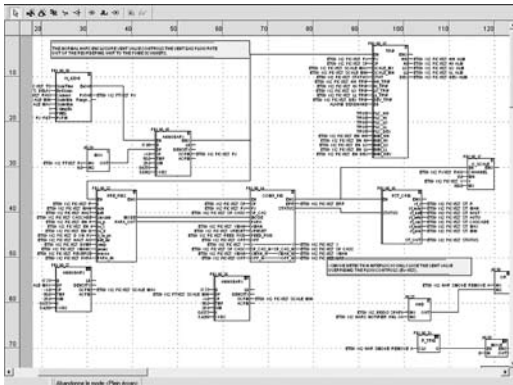
PI_B	Basic PI controller: PI algorithm with a mixed structure (series/parallel)
PIDFF	Complete PID controller: PID algorithm with a parallel or mixed structure (series/parallel)
AUTOTUNE	Automatic tuner setting for the PIDFF (complete PID) controller or the PI_B (basic PI) controller <ul style="list-style-type: none"> <li>■ Identification using Ziegler Nichols type method</li> <li>■ Modelling based on first order process</li> <li>■ Building of control parameters with criterion for prioritizing either the reaction time to disturbance (dynamic) or the stability of the process</li> </ul>
IMC	Model-based controller. The model is a first order model with delay. This controller is useful: <ul style="list-style-type: none"> <li>■ When there are serious delays compared with the main time constant of the process; this scenario cannot be satisfactorily resolved by standard PID process control</li> <li>■ For regulating a non-linear process</li> </ul> IMC can handle any stable and aperiodic process of any order
SAMPLETM	Control of controller startup and sampling
STEP2	Simple two-position controller
STEP3	Three-position controller for temperature regulation

#### Mathematical functions

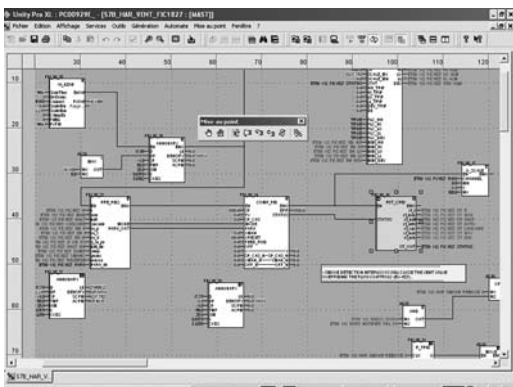
COMP_DB	Comparison of two values, with dead zone and hysteresis
K_SQRT	Square root, with weighting and threshold, useful for linearization of flow measurements
MULDIV_W	Weighted multiplication/division of 3 numerical values
SUM_W	Weighted summing of 3 numerical values



Example: PID controller with MS manual control



Programming in Unity Pro in offline mode



Programming in online mode

### Process value processing

AVGMV	Moving average with mounted number of samples (50 max.)
AVGMV_K	Moving average with constant correction factor, 10,000 samples max.
DEAD_ZONE	Dead zone
LOOKUP_TABLE1	Linearization of characteristic curves using first-order interpolation
SAH	Detection of a rising edge
HYST_XXX	Detection of high threshold with hysteresis (1)
INDLIM_XXX	Detection of high and low thresholds with hysteresis (1)

### Output value processing

MS	Manual control of an output
MS_DB	Manual control of an output with dead zone
PWM1	Control via pulse width modulation
SERVO	Control for servo motors
SPLRG	Control of two split range actuators

### Setpoint management

RAMP	Ramp generator, with separate ascending and descending ramps
RATIO	Ratio controller
SP_SEL	Selection of setpoint value: local (operator) or remote (processing)

### Setting up process control function blocks

Based on the sequencing of function blocks, the FBD language integrated in Unity Pro is a programming language particularly suitable for building control loops. Designers can use FBD to easily associate blocks from the CONT\_CTL library with their own DFB blocks written in Unity™ Pro's ST, IL or LD language, or in C language.

### Debugging, operation

Unity Pro's standard debugging services (see page 33) are available. In particular, the Modicon™ M340™ processor simulator can be used to check correct execution of processing offline.

### Compatibility

The CONT\_CTL control function block library is available in Unity Pro. It is compatible with processors in the Modicon M340, Premium™, and Quantum™ processors.

### Optional specialized libraries

The CONT\_CTL control function block library can be supplemented with optional specialized libraries, to meet specific needs such as predictive control, fuzzy logic controller, HVAC and mass flow calculation.

### Resources

The technical documentation provides many examples of how to set up programmable process control function blocks in FBD, LD, IL and ST languages.

The techniques for adjusting process control loops are described in the document "Process control, Unity V3.0" available online at [www.schneider-electric.com](http://www.schneider-electric.com)

(1) XXX according to the type of variable: DINT, INT, UINT, UDINT, REAL

# Modicon™ Quantum™ Ethernet I/O automation platform

Unity™ Pro software

Small / Medium / Large / Extra Large / XLS

## Communication drivers

Commonly used communication drivers for M340™, Premium™ and Quantum™ platforms are installed at the same time as the Unity™ Pro software.

Unity Pro includes the following drivers that can be installed as required (1):

Protocol - Hardware	Windows® XP Professional	Windows Vista® Business 32-bit edition
		Windows 7 32-bit and 64-bit editions
Ethway™ - Ethernet		
Fip - FPC10 ISA card		
Fip - FPC20 PCMCIA card		
Fip adaptor - CUSBFIP		
ISAway™ - PCX57 ISA card		
Modbus™ Serial - COM port		
Uni-Telway™ - COM port		
Uni-Telway - SCP114 PCMCIA card		
USB for high end PLC		
XIP - XWay on TCP/IP		

Driver available     Driver not available

## Unity™ Developer's Edition, advanced open access

Advanced open access, intended for experienced IT engineers, supports the development of interfaces between Unity and expert tools, as well as specific user-defined functions.

This type of development requires experience in the following IT areas:

- C++ or Visual Basic languages
- Client/server architectures
- XML and COM/DCOM technologies
- Database synchronization

As a supplement to the Unity Pro Extra Large software (2), the UDE (Unity Developer's Edition) development kit **UNYUDEVFUCD21E** enables the development of customized solutions. In addition to the development kit, the Unity servers and accompanying documentation are also provided.

Unity Developer's Edition is compatible with:

- Unity Pro Extra Large
- Modicon™ M340™ processors
- Premium™ Unity processors
- Quantum™ Unity processors

(1) Also available separately under reference **TLXCDDR20M**.

(2) Only the Unity Pro Extra Large version enables dynamic database management for data to be exchanged with the OFS data server or a third-party tool.



# Modicon™ Quantum™ Ethernet I/O automation platform

Unity™ Pro software

Small / Medium / Large / Extra Large / XLS

## Upgrade kits for Concept™, PL7™ Pro and ProWORX™ software

The Concept, PL7 Pro and ProWORX upgrade kits allow users who already have one of these programs from the installed base and who have a current subscription to obtain Unity™ Pro version V4.1 software at a reduced price.

These upgrades are only available for licenses of the same type (e.g. from Concept XL group license to Unity Pro Extra Large group license).

## Composition and Windows® OS compatibility

Unity Pro multilingual software packages are compatible with Windows XP (32-bit), Windows Vista (32-bit) and Windows 7 (32-bit and 64-bit) operating systems.

They include:

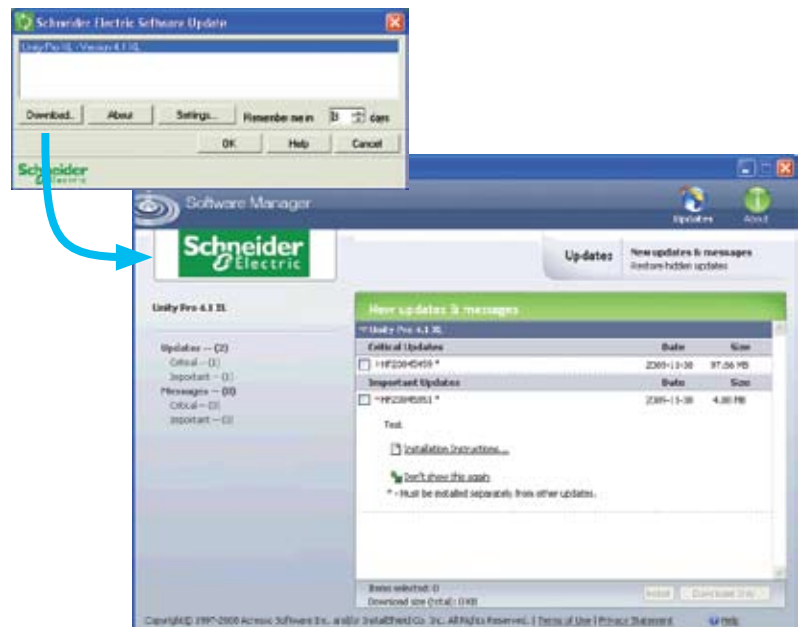
- Documentation in electronic format in six languages (English, French, German, Italian, Spanish and Chinese)
- Converters for converting applications created with Concept and PL7 Pro programming software
- PLC simulator

Cables for connecting the processor to the programming PC must be ordered separately.

## Unity Pro update

Customers are notified automatically when a new Unity Pro update becomes available.

They can then access the Software Updates Manager directly, download the update and install it locally on their workstation.



**Note:** The latest firmware versions are available for download from our website [www.schneider-electric.com](http://www.schneider-electric.com).



Unity Pro

### Unity™ Pro XLS

In addition to the functions of Unity Pro Extra Large, Unity Pro XLS provides a set of specific verification and protection function blocks to facilitate the creation and debugging of SIL 3 Quantum™ projects. For a description of these specifications and their setup, as well as the functional limitations provided for within the framework of SIL 3 certifiable safety projects according to IEC 61508 – refer to the document entitled “*Quantum Safety PLC, Safety Reference Manual*” 01/2010, No. 3303879.03 – approved by TÜV Rheinland and available at [www.schneider-electric.com](http://www.schneider-electric.com).

The Unity Pro XLS programming tool is certified compliant with the requirements of IEC 61508 for managing SIL 3 applications with SIL 3 Quantum **140CPU65160S/67160S** PLCs.

It offers the complete range of functions required to program an SIL 3 project:

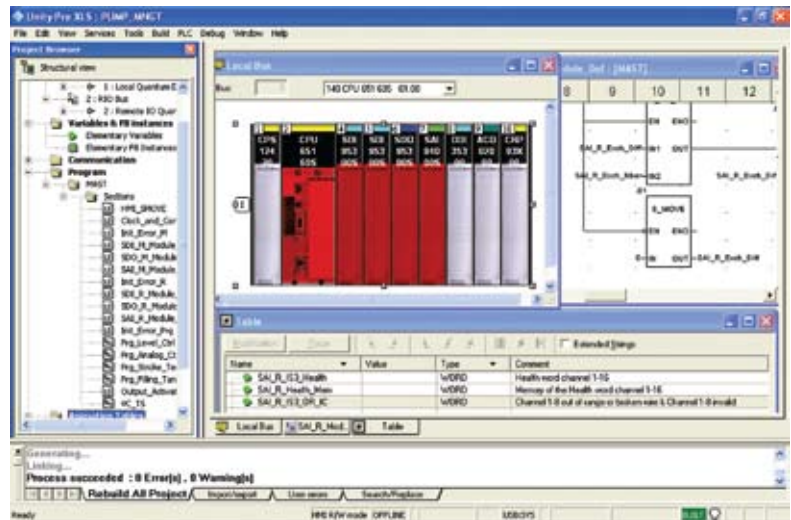
- In-depth diagnostics
- Project protection

During project creation, it is the selection of the Quantum processor that determines whether or not the project created will be a safety project.

Unity Pro XLS is capable of processing the Unity Pro application types. No other programming tool is needed on the computer.

To program a safety project, Unity Pro XLS provides two IEC 61131-3 programming languages:

- Function Block Diagram (FBD)
- Ladder language (LD)



### Safety program structure

A safety project is programmed entirely in a master task (MAST).

It is not possible to:

- Program FAST, TIMER, INTERRUPT or AUX tasks
- Use subroutines (SR sections)

Provided by Northeast Power Systems, Inc.  
[www.nepsi.com](http://www.nepsi.com)

#### Unity™ Pro XLS (continued)

##### Language elements

Unity Pro XLS provides a set of specific, certified functions and function blocks. These are available in the “Unity Pro safety function block library”.

Available language elements include:

- Elementary data types (EDTs): BOOL, EBOOL, BYTE, WORD, DWORD, INT, UINT, DINT, UDINT and TIME
- Simple tables used exclusively for Ethernet Global Data communication
- Direct addressing, for example, writing to %MW memory via a coil in Ladder language (LD)
- Located variables

##### Floating point instructions:

With Unity Pro XLS version 4.1 or later, numerical floating point instructions can be used.

##### Project verification options

Unity Pro XLS provides the following different options for the checks performed by the language analyzer:

- Unused variables
- Variables written multiple times
- Unassigned parameters
- FB instances used multiple times
- Address overlapping

### Unity™ Pro XLS (continued)

#### Project protection options

Unity Pro XLS provides protective functions to help prevent unauthorized access to safety projects, to the SIL 3 Quantum™ PLC and to Unity Pro XLS.

- The application password, defined when the project was created, is requested:
  - When the application file is opened
  - Upon connection to the SIL 3 Quantum PLC



- The safety editor integrated in Unity Pro XLS is used to define the access rights and the list of authorized functions for each user, in particular:
  - Creation and modification of the application password
  - Activation of maintenance mode
- Adjustment of the auto-lock period

#### Functions and function blocks for SIL 3 Quantum applications

Unity Pro XLS provides a set of elementary functions (EFs) and elementary function blocks (EFBs) certified for use in SIL 3 applications:

- Standard functions certified for SIL 3 applications include:
  - Mathematical functions and functions for manipulating data from the unrestricted memory area in the safety logic
  - Comparison functions
  - Logic functions, rotations, shift operations
  - Statistical functions
  - Timer and counter setup
  - Type conversions
- Specific functions for safety architectures include:
  - High availability setup: choice of two inputs from a redundant discrete I/O module or a redundant analog input module
  - Hot Standby PLC redundancy setup: to cause the two processors involved in a hot standby configuration to change roles from primary to standby and standby to primary respectively. The objective is to verify the capacity of each processor to take over in case the other processor becomes inoperative. With Unity Pro XLS, this function can very easily be programmed in the application by setting up the S\_HSBY\_SWAP elementary function from the library.

### Unity™ Pro XLS (continued)

#### Special features and procedures

##### Software tool self-test

Unity Pro XLS provides the option of running a self-test to verify that the software components installed have not been corrupted, for example, due to a hard disk failure. This self-test is based on a CRC calculation.

Unity Pro XLS checks the version and CRC of:

- Its DLLs
- The safety FFB library database
- The hardware catalog database

Unity Pro XLS self-tests are performed on a user request, for example:

- After installing or uninstalling any program on the computer
- Before loading the final application program onto the SIL 3 Quantum PLC
- Before modifying the application program executed on the SIL 3 Quantum PLC

##### Time-stamping binary files

With Unity Pro XLS, every binary file generated for a safety project features a version management field that provides the date and time when it was generated. This information is useful for verifying the project.

##### Downloading a project to Unity Pro XLS

It is possible to download a safety project from the PLC to Unity Pro XLS under the following conditions:

- This must have been defined as an option for the project.
- The user must know the application password to establish a connection to the SIL 3 Quantum PLC.
- The SIL 3 Quantum PLC must be placed in maintenance mode to perform the download.

##### Unrestricted memory

The unrestricted memory area contains bits and words that are not protected against write operations from external equipment such as HMI terminals and PLCs.

- It is located at the beginning of the memory.
- Its size can be configured with Unity Pro XLS.
- Values cannot be used directly in the unrestricted memory area and can only be used in conjunction with specific function blocks S\_MOVE\_BIT and S\_MOVE\_WORD.

Unity Pro XLS checks in both the application edit and generation phases that only data from the unrestricted memory area is used at the input of the function blocks S\_MOVE\_BIT and S\_MOVE\_WORD.

Also, Unity Pro XLS provides a useful list of cross-references, allowing easy identification of the way variables are used, and verification of the application of this rule.

**Note:** For safety applications, it is common practice to verify the correct transfer of data by writing the data twice (to two different variables) and then comparing it.

# Modicon™ Quantum™ Ethernet I/O automation platform

Unity™ Pro software

Small / Medium / Large / Extra Large / XLS



Unity Pro

## References

### Unity™ Pro Small, Medium, Large, Extra Large and XLS software packages

These software packages are for programming and setting up Unity automation platforms. The software is available in five versions:

- **Unity Pro Small** (see page 46)
- **Unity Pro Medium** (see page 47)
- **Unity Pro Large** (see page 47)
- **Unity Pro Extra Large** (see page 48)
- **Unity Pro XLS** (see page 48)

### Upgrade kits for Concept™, PL7™ Pro and ProWORX™ software

These upgrade kits allow users who already have these software programs from the installed base and who have a **current subscription** to obtain Unity Pro version V4.1 software at a reduced price. These upgrades are only available for licenses of the same type (e.g. from Concept XL group license to Unity Pro Extra Large group license).

See pages 47 and 48.

### Composition and Windows OS compatibility

Unity Pro multilingual software packages are compatible with Windows® XP (32-bit), Windows Vista (32-bit) and Windows 7 (32-bit and 64-bit) operating systems.

They include:

- Unity Pro V5.0 DVD in six languages (English, French, German, Italian, Spanish and Chinese)
- Unity Loader V2.2 CD
- Ethernet/IP Configuration V1.1 CD (not included with Unity Pro Small)
- Advantys V5.5 configuration software CD
- DVD containing the documentation in electronic format in six languages (English, French, German, Italian, Spanish and Chinese)
- One-year services subscription

## Unity Pro Small version 6.0 software

For Modicon M340

For distributed I/O: **Modicon ETB, FTB, FTM, OTB, STB, Momentum**

### Unity Pro Small version 6.0 software packages (1)

Description	License type	Reference	Weight kg
<b>Unity Pro Small software packages</b>	Single (1 station)	<b>UNYSPUSFUCD60</b>	–
	Group (3 stations)	<b>UNYSPUSFGCD60</b>	–
	Team (10 stations)	<b>UNYSPUSFTCD60</b>	–
<b>Software upgrades from:</b> - Concept S - PL7 Micro - ProWORX NxT/32 Lite	Single (1 station)	<b>UNYSPUSZUCD60</b>	–
	Group (3 stations)	<b>UNYSPUSZGCD60</b>	–
	Team (10 stations)	<b>UNYSPUSZTCD60</b>	–

### License type extensions for Unity Pro Small version 6.0

From	To	Reference	Weight kg
Single (1 station)	Group (3 stations)	<b>UNYSPUSZUGCD60</b>	–
Group (3 stations)	Team (10 stations)	<b>UNYSPUSZGTC60</b>	–

(1) For compatibility of Unity software/automation platforms and distributed I/O, refer to the selection guide on page 26.

# Modicon™ Quantum™ Ethernet I/O automation platform

Unity™ Pro software  
Medium / Large



Unity Pro

## Unity™ Pro Medium version 6.0 software

For Modicon™ M340™

For Modicon Premium™: **TSX570● to 2●**

For distributed I/O: **Modicon ETB, FTB, FTM, OTB, STB, Momentum™**

### Unity Pro Medium version 6.0 software packages (1)

Description	License type	Reference	Weight kg
<b>Unity Pro Medium software packages</b>	Single (1 station)	<b>UNYSPUMFUCD60</b>	–
	Group (3 stations)	<b>UNYSPUMFGCD60</b>	–
	Team (10 stations)	<b>UNYSPUMFTCD60</b>	–
<b>Software upgrades from:</b> - Concept S, M - PL7 Micro, Junior - ProWORX NxT/32 Lite	Single (1 station)	<b>UNYSPUMZUCD60</b>	–
	Group (3 stations)	<b>UNYSPUMZGCD60</b>	–
	Team (10 stations)	<b>UNYSPUMZTCD60</b>	–

### License type extensions for Unity Pro Medium version 6.0

From	To	Reference	Weight kg
Single (1 station)	Group (3 stations)	<b>UNYSPUMZUGCD60</b>	–
Group (3 stations)	Team (10 stations)	<b>UNYSPUMZGTC60</b>	–

### Upgrade to Unity Pro Medium from Unity Pro Small

Type of upgrade The number of stations is unchanged	Reference	Weight kg
Small to Medium Single (1 station)	<b>UNYSPUMZSUCD60</b>	–
Small to Medium Group (3 stations)	<b>UNYSPUMZSGCD60</b>	–
Small to Medium Team (10 stations)	<b>UNYSPUMZSTCD60</b>	–

## Unity Pro Large version 6.0 software

For Modicon M340

For Modicon Premium: **TSX570● to 4●**

For Modicon Quantum: **140CPU31110/43412U/53414U**

For distributed I/O: **Modicon ETB, FTB, FTM, OTB, STB, Momentum**

### Unity Pro Large version 6.0 software packages (1)

Description	License type	Reference	Weight kg
<b>Unity Pro Large software packages</b>	Single (1 station)	<b>UNYSPULFUCD60</b>	–
	Group (3 stations)	<b>UNYSPULFGCD60</b>	–
	Team (10 stations)	<b>UNYSPULFTCD60</b>	–
	Site (≤ 100 users)	<b>UNYSPULFFCD60</b>	–
<b>Software upgrades from:</b> - Concept S, M - PL7 Micro, Junior, Pro - ProWORX NxT/32 Lite	Single (1 station)	<b>UNYSPULZUCD60</b>	–
	Group (3 stations)	<b>UNYSPULZGCD60</b>	–
	Team (10 stations)	<b>UNYSPULZTCD60</b>	–
	Site (≤ 100 users)	<b>UNYSPULZFC60</b>	–

### License type extensions for Unity Pro Large version 6.0

From	To	Reference	Weight kg
Single (1 station)	Group (3 stations)	<b>UNYSPULZUGCD60</b>	–
Group (3 stations)	Team (10 stations)	<b>UNYSPULZGTC60</b>	–

### Upgrade to Unity Pro Large from Unity Pro Medium

Type of upgrade The number of stations is unchanged	Reference	Weight kg
Medium to Large Single (1 station)	<b>UNYSPULZMUCD60</b>	–
Medium to Large Group (3 stations)	<b>UNYSPULZMGCD60</b>	–
Medium to Large Team (10 stations)	<b>UNYSPULZMTC60</b>	–

(1) For compatibility of Unity software/automation platforms and distributed I/O, refer to the selection guide on page 26.

# Modicon™ Quantum™ Ethernet I/O automation platform

Unity™ Pro software  
Extra Large / XLS



Unity Pro

## Unity™ Pro Extra Large version 6.0 software

For Modicon™ M340™  
For Modicon Premium™: **TSX570● to 6●**  
For Modicon Quantum™: **140CPU31110/43412U/53414U/65150/65160/65260/67160/67261**  
For distributed I/O: **Modicon ETB, FTB, FTM, OTB, STB, Momentum™**

### Unity Pro Extra Large version 6.0 software packages (1)

Description	License type	Reference	Weight kg
<b>Unity Pro Extra Large software packages</b>	Single (1 station)	<b>UNYSPUEFUCD60</b>	–
	Group (3 stations)	<b>UNYSPUEFGCD60</b>	–
	Team (10 stations)	<b>UNYSPUEFTCD60</b>	–
	Site (≤ 100 users)	<b>UNYSPUEFFCD60</b>	–
<b>Software upgrades from:</b> - Concept S, M, XL - PL7 Micro, Junior, Pro - ProWORX NxT Lite, Full - ProWORX 32 Lite, Full	Single (1 station)	<b>UNYSPUEZUCD60</b>	–
	Group (3 stations)	<b>UNYSPUEZGCD60</b>	–
	Team (10 stations)	<b>UNYSPUEZTCD60</b>	–
	Site (≤ 100 users)	<b>UNYSPUEZFC60</b>	–

### License type extensions for Unity Pro Extra Large

From	To	Reference	Weight kg
Single (1 station)	Group (3 stations)	<b>UNYSPUEZUGCD60</b>	–
Group (3 stations)	Team (10 stations)	<b>UNYSPUEZGTC60</b>	–

### Upgrade to Unity Pro Extra Large from Unity Pro Large

Type of upgrade The number of stations is unchanged	Reference	Weight kg
Large to Extra Large Single (1 station)	<b>UNYSPUEZLUCD60</b>	–
Large to Extra Large Group (3 stations)	<b>UNYSPUEZLGC60</b>	–
Large to Extra Large Team (10 stations)	<b>UNYSPUEZLTC60</b>	–

## Unity Pro XLS version 4.1 software

For Modicon M340  
For Modicon Premium: **TSX570● to 6●**  
For Modicon Quantum: **140CPU31110/43412U/53414U/65150/65160/65260/67160/65160S/67160S**  
For distributed I/O: **Modicon ETB, FTB, FTM, OTB, STB, Momentum**

### Unity Pro XLS version 4.1 software packages (1)

Description	License type	Reference	Weight kg
<b>Unity Pro XLS software packages</b>	Single (1 station)	<b>UNYSPUXFUCD41</b>	–
	Group (3 stations)	<b>UNYSPUXFGCD41</b>	–
	Team (10 stations)	<b>UNYSPUXFTCD41</b>	–
	Site (≤ 100 users)	<b>UNYSPUXFFCD41</b>	–
<b>Software upgrades from:</b> - Concept S, M, XL - PL7 Micro, Junior, Pro - ProWORX NxT Lite, Full - ProWORX 32 Lite, Full	Single (1 station)	<b>UNYSPUXZUCD41</b>	–
	Group (3 stations)	<b>UNYSPUXZGCD41</b>	–
	Team (10 stations)	<b>UNYSPUXZTCD41</b>	–
	Site (≤ 100 users)	<b>UNYSPUXZFC41</b>	–

(1) For compatibility of Unity software/automation platforms and distributed I/O, refer to the selection guide on page 26.





Unity Pro

Unity™ Pro software			
Description	License type	Reference	Weight kg
<b>Unity Developer's Edition</b>			
<b>UDE Unity Developer's Edition</b> For automating repetitive tasks or generating source code automatically from third-party applications Available for Unity Pro Small, Medium, Large, Extra Large and XLS	Single (1 station)	UNYUDEVFUCD21E	–

Unity Pro documentation, separate parts			
Documentation for Unity Pro version 6.0			
Description	License type	Reference	Weight kg
<b>Hardware and software manuals (on DVD)</b> Platform setup for: - Modicon™ M340™ - Premium™ - Quantum™ - Momentum™ Electromagnetic compatibility of networks and fieldbuses Software setup for: - Unity Pro - Function block libraries	Multilingual (English, French, German, Italian, Spanish, Chinese)	UNYUSE909CDM	–

Separate parts					
Description	From CPU	To PC port	Length	Reference	Weight kg
<b>PC connection cables</b> (PC to PLC)	USB mini B port BMXP341000/20●0/20●02	USB port	1.8 m	<b>BMXXCAUSBH018</b>	0.065
			4.5 m	<b>BMXXCAUSBH045</b>	0.110
	Mini-DIN port Premium TSX571●/2●/3●/4●	RS 232D (9-way SUB-D connector)	2.5 m	<b>TSXPCX1031</b>	0.170
		USB port (USB/RS 485 converter)	0.4 m	<b>TSXCUSB485</b> (2)	0.144
		USB port (mini-DIN/RJ45 cordset)	2.5 m	<b>TSXCRJMD25</b> (2)	0.150
Modbus port, 15-way SUB-D Quantum 140CPU31110 140CPU43412A 140CPU53414A	RS 232D	3.7 m	<b>990NAA26320</b>	0.300	
	(9-way SUB-D connector)	15 m	<b>990NAA26350</b>	0.180	
USB port Premium TSX575●/6● Quantum 140CPU6●1	USB port	3.3 m	<b>UNYXCAUSB033</b>	–	
	Modbus RJ45 connector port Quantum 140CPU6●1	RJ45 connector	1 m	<b>110XCA28201</b>	–
			3 m	<b>110XCA28202</b>	–
		6 m	<b>110XCA28203</b>	–	
<b>PC connection cables</b> (PC SUB-D to Modicon STB I/O)	HE13 connector Modicon STB I/O network interface module (NIM)	RS 232D (3) (9-way SUB-D connector)	2 m	<b>STBXCA4002</b>	0.210
<b>USB/SUB-D adaptor</b> (PC USB to Modicon STB I/O)	HE13 connector Modicon STB I/O network interface module (NIM) with STBXCA4002 cable (4)	USB port (4)	–	<b>SR2CBL06</b>	0.185



BMX XCA USB H0●●



TSX PCX 1031



TSX USB 485

(1) For compatibility of Unity software/automation platforms and distributed I/O, refer to the selection guide on page 26.

(2) The **TSXCUSB485** converter requires use of the **TSXCRJMD25** mini-DIN/RJ45 cordset.

(3) For connection on a USB port, use the **SR2CBL06** cable (4).

(4) Adaptor equipped with a USB connector (PC end) and a 9-way SUB-D connector (STBXCA4002 cable end); requires the **STBXCA4002** cable (9-way SUB-D/HE 13) for connection to the HE13 connector on the Modicon STBNIM.

110XCA28201	49	UNYSPUMZGTCD60	47
110XCA28202	49	UNYSPUMZSGCD60	47
110XCA28203	49	UNYSPUMZSTCD60	47
140CPU65150	24	UNYSPUMZSUCD60	47
140CPU65160	24	UNYSPUMZTCD60	47
140CPU65260	24	UNYSPUMZUCD60	47
140CPU67160	25	UNYSPUMZUGCD60	47
140CPU67261	25	UNYSPUSFGCD60	46
140CRA31200	24	UNYSPUSFTCD60	46
140CRP31200	24	UNYSPUSFUCD60	46
140NOE77101	24	UNYSPUSZGCD60	46
140NOE77111	24	UNYSPUSZGTCD60	46
140XBE10000	25	UNYSPUSZTCD60	46
140XCA71703	25	UNYSPUSZUCD60	46
140XCA71706	25	UNYSPUSZUGCD60	46
140XCA71709	25	UNYSPUXFFCD41	48
490NOR00003	25	UNYSPUXFGCD41	48
490NOR00005	25	UNYSPUXFTCD41	48
490NOR00015	25	UNYSPUXFUCD41	48
990NAA26320	49	UNYSPUXZFC41	48
990NAA26350	49	UNYSPUXZGCD41	48
BMXXCAUSBH018	49	UNYSPUXZTCD41	48
BMXXCAUSBH045	49	UNYSPUXZUCD41	48
SR2CBL06	49	UNYUDEVFUCD21E	49
STBXCA4002	49	UNYUSE909CDM	49
TCSECN3M3M1S4	24	UNYXCAUSB033	49
TCSECN3M3M1S4U	24	VDIF0626463505	25
TCSESM063F2CS1	24	VDIF0646463505	25
TCSESM063F2CU1	24		
TCSESM083F23F1	24		
TSXCRJMD25	49		
TSXCUSB485	49		
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UNYSPUEFFCD60	48		
UNYSPUEFGCD60	48		
UNYSPUEFTCD60	48		
UNYSPUEFUCD60	48		
UNYSPUEZFC41	48		
UNYSPUEZGCD60	48		
UNYSPUEZGTCD60	48		
UNYSPUEZLUCD60	48		
UNYSPUEZLTCD60	48		
UNYSPUEZLUCD60	48		
UNYSPUEZTCD60	48		
UNYSPUEZUCD60	48		
UNYSPUEZUGCD60	48		
UNYSPULFFCD60	47		
UNYSPULFGCD60	47		
UNYSPULFTCD60	47		
UNYSPULFUCD60	47		
UNYSPULZFC41	47		
UNYSPULZGCD60	47		
UNYSPULZGTCD60	47		
UNYSPULZMGCD60	47		
UNYSPULZMTC41	47		
UNYSPULZMUCD60	47		
UNYSPULZTCD60	47		
UNYSPULZUCD60	47		
UNYSPULZUGCD60	47		
UNYSPUMFGCD60	47		
UNYSPUMFTCD60	47		
UNYSPUMFUCD60	47		
UNYSPUMZGCD60	47		

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