Modicon Quantum automation platform

I/O architectures

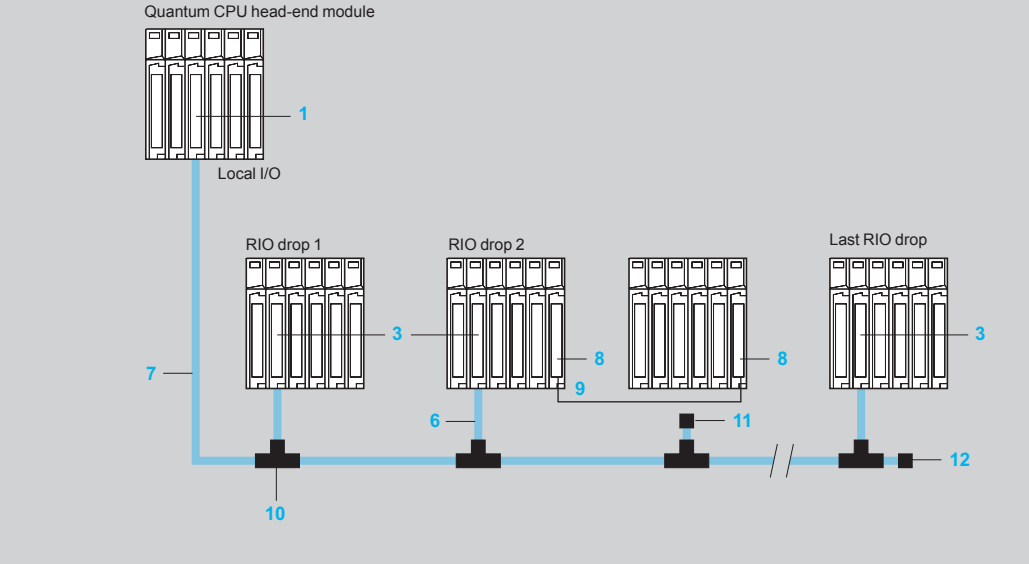
Remote I/O (RIO)

S908 bus

Topologies

Single-cable topology

Line length 4.572 km max.



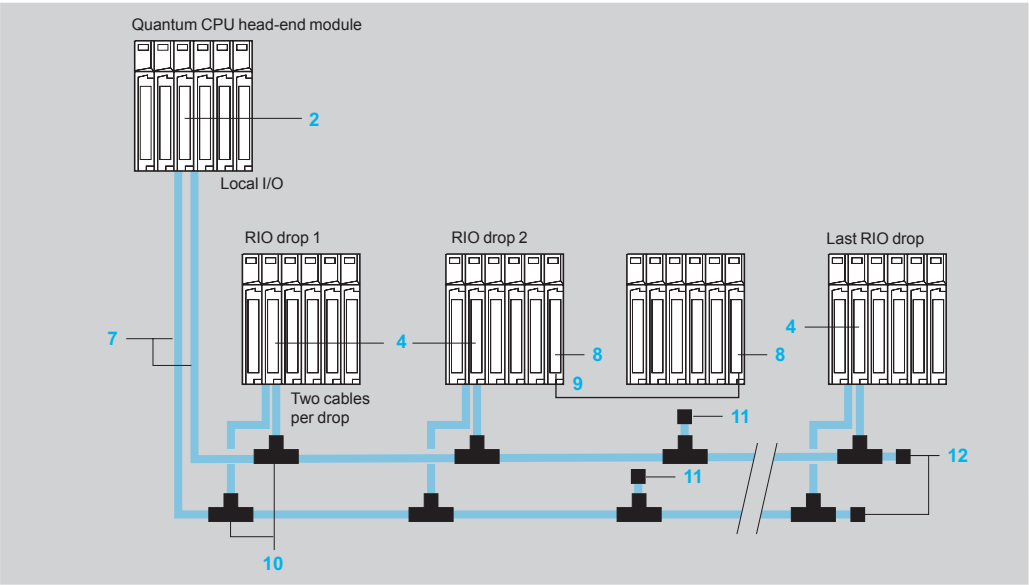
1 **140CRP93100** RIO head adaptor
2 **140CRP93200** RIO head adaptor (redundant)
3 **140CRA93100** RIO drop adaptor
4 **140CRA93200** RIO drop adaptor (redundant)
5 **140NRP95400** or **140NRP95401C** RIO drop optical fibre repeater
6 RG-6 coaxial cable (drop)
7 RG-11 coaxial cable (trunk)
8 **140XBE10000** rack expansion module
9 **140XCA7170●** cable for expansion module
10 **MA0185100** T-connector 2 x RG-11/1 x RG-6
11 **520402000** RG-6 terminator for T-connector
12 **520422000** RG-11 trunk cable terminator for T-connector

A **MA0185100** T-connector 10 is required for each I/O drop on the system to electrically isolate the drop from the trunk cable and to protect the system from impedance mismatches and cable disconnections. A minimum signal strength of 14 dB is required between the trunk cable and each I/O drop to ensure correct operation. The signal loss on the trunk cable is less than 1 dB as it crosses a T-connector. A total of 35 dB is available from the head-end RIO CPU. The whole cabling architecture must not exceed this system limit.

For systems that require high availability, a solution with redundant cable is available, to provide protection against cable breaks and damaged connectors. With two cables connected between the host and each drop, the first cable break does not disrupt communication. If a cable break occurs, a status bit is set to 1 to indicate the problem drop or the faulty cable. For preventive maintenance, the system also provides counter values for all communication transactions to all drops. High counter values on a cable in a specific drop could indicate connection problems. This will enable corrective work to be scheduled before there is unwanted downtime.

RIO topology with redundant cable

Line length 4.572 km max.



Modicon Quantum automation platform

I/O architectures

Remote I/O (RIO)
S908 bus

Topologies (continued)

Point-to-point RIO communication with optical fibre repeaters

140NRP95400 optical fibre repeaters **5** or **140NRP95401C** enhance network noise immunity and allow significantly increased cable lengths.

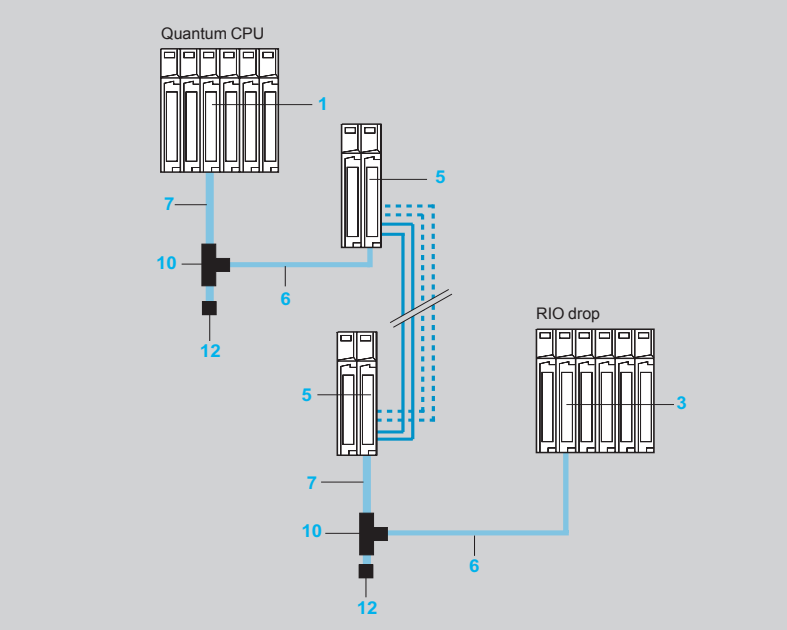
These repeaters enable a standard 62.5/125 µm or 9/125 µm single mode optical fibre cable to be used instead of an RG-6/RG-11 coaxial cable, while maintaining the dynamic range of the network.

Up to 12 repeaters can be daisy-chained, creating bus architectures over fifteen or so kilometres or redundant ring architectures over a perimeter of fifteen or so kilometres.

As these optical fibre repeaters are in Quantum module format, they can be used as *standalone* devices with a single power supply in a 3-slot rack (for example replacing **140NRP95400** or **140NRP95401C** repeaters, with which they are fully compatible) or directly incorporated in the Quantum racks, which provides a more compact configuration and enables the redundant power supplies of the Quantum PLC to be used.

Optical fibre repeaters used as *standalone devices*

Line length 16 km max.

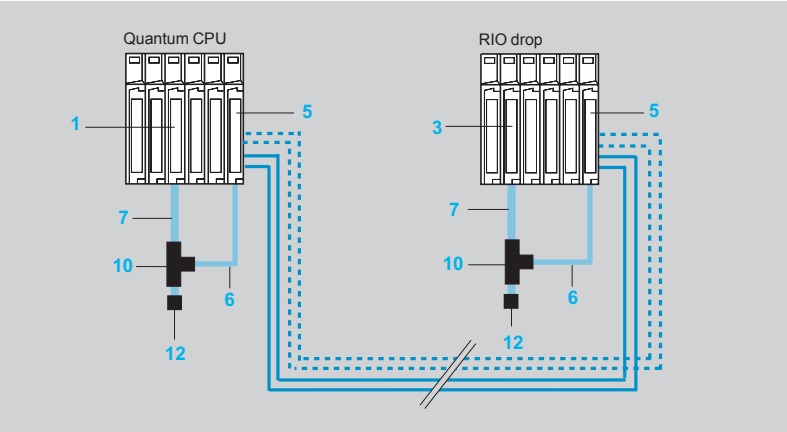


1 **140CRP93100** RIO head adaptor
2 **140CRP93200** RIO head adaptor (redundant)
3 **140CRA93100** RIO drop adaptor
4 **140CRA93200** RIO drop adaptor (redundant)
5 **140NRP95400** or **140NRP95401C** RIO drop optical fibre repeater
6 RG-6 coaxial cable (drop) *(1)*
7 RG-11 coaxial cable (trunk) *(1)*
8 **140XBE10000** rack expansion module
9 **140XCA7170●** cable for expansion module
10 **MA0185100** T-connector 2 x RG-11/1 x RG-6 *(1)*
11 **520402000** RG-6 terminator for T-connector
12 **520422000** RG-11 trunk cable terminator for T-connector *(1)*

(1) The connection between the CRP/CRA and NRP modules in the same rack, with 2 coaxial cables 7 and 6, the T-connector 10 and the T-connector terminator 12, can be replaced by a connection with a single RG-6 coaxial cable 6, if the distance between the modules is less than 30 cm.

Optical fibre repeaters incorporated in the Quantum racks

Line length 16 km max.



Modicon Quantum automation platform

I/O architectures

Remote I/O (RIO)

S908 bus

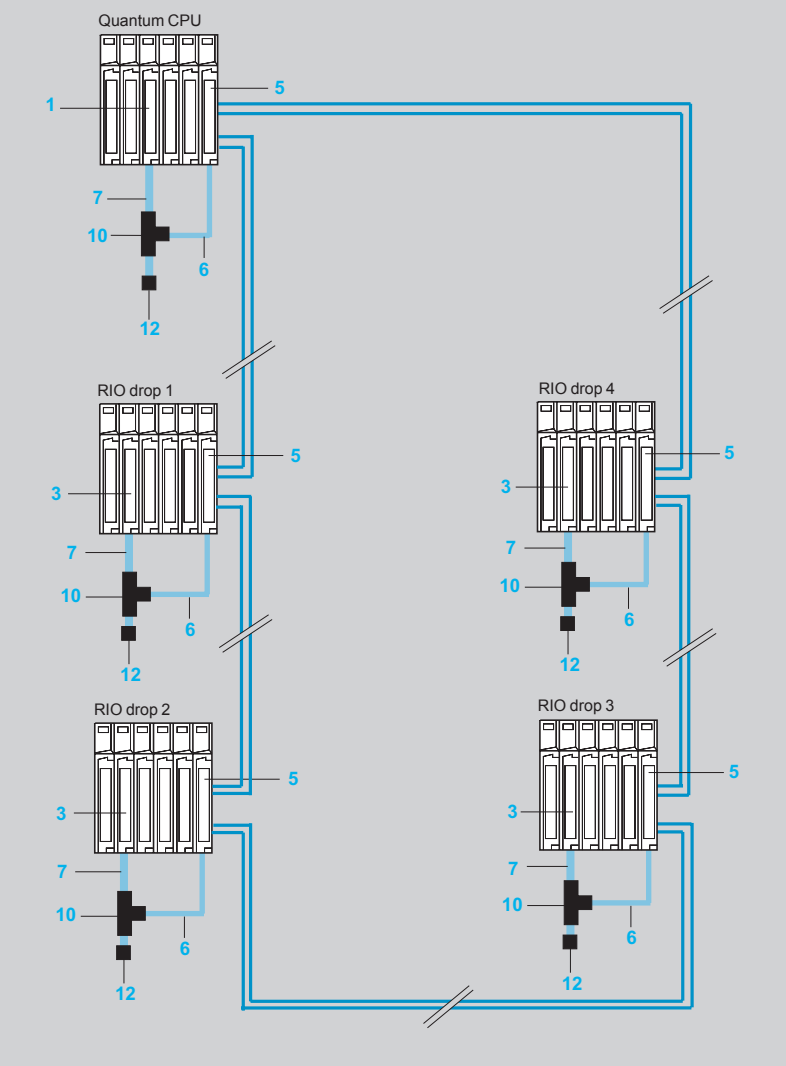
Topologies (continued)

"Self-healing" ring topology with optical fibre repeaters

Several **140NRP95400** or **140NRP95401C** optical fibre repeaters can be interconnected to form a ring, so that if a break occurs anywhere on the ring, the network can reconfigure itself.

The RIO signal is sent by the drop repeater to the head repeaters, in both legs of the ring. When a signal is received on one Rx line, the other Rx channel is blanked, which prevents the same signal being transmitted twice on the ring.

Line length 16 km max.



1 **140CRP93100** RIO head adaptor
2 **140CRP93200** RIO head adaptor (redundant)
3 **140CRA93100** RIO drop adaptor
4 **140CRA93200** RIO drop adaptor (redundant)
5 **140NRP95400**
or **140NRP95401C** RIO drop optical fibre repeater
6 RG-6 coaxial cable (drop) *(1)*
7 RG-11 coaxial cable (trunk) *(1)*
8 **140XBE10000** rack expansion module
9 **140XCA7170●** cable for expansion module
10 **MA0185100** T-connector 2 x RG-11/1 x RG-6 *(1)*
11 **520402000** RG-6 terminator for T-connector
12 **520422000** RG-11 trunk cable terminator for T-connector *(1)*

*(1) The connection between the CRP/CRA and NRP modules in the same rack, with 2 coaxial cables **7** and **6**, the T-connector **10** and the T-connector terminator **12**, can be replaced by a connection with a single RG-6 coaxial cable **6**, if the distance between the modules is less than 30 cm.*

Note on optical fibre cables

To use a optical fibre link on a RIO network, the following points must be taken into consideration when selecting the optical fibre cable from a supplier:
■ For most applications, 62.5/125 µm fibre is recommended because of its relatively low loss and signal distortion. However, for high optical power applications, such as those using splitter boxes or star couplers, 100/140 µm fibre should be used.
■ Whenever possible, select a multiconductor cable. For a small additional cost this provides a backup solution in case a fibre breaks during installation.

Modicon Quantum automation platform

I/O architectures
Remote I/O (RIO)
S908 bus

Adaptor modules

Description	Cable	Safety	Bus current required	Power dissipation	Item (4)	Reference	Weight kg/lb
Quantum RIO head adaptor (max. 1) *(1)*	Single coaxial	–	600 mA	3 W	1	**140CRP93100**	–
	Redundant coaxial	Non-interfering	750 mA	3.8 W	2	**140CRP93200**	–
Quantum RIO drop adaptor (max. 31) *(1)*	Single coaxial	–	600 mA	3 W	3	**140CRA93100**	–
	Redundant coaxial	Non-interfering	750 mA	3.8 W	4	**140CRA93200**	–
RIO drop optical fibre repeater *(2)*	Multimode optical fibre	Non-interfering	500 mA	2.5 W	5	**140NRP95400**	–
	Single mode optical fibre	Non-interfering	750 mA	5 W	5	**140NRP95401C**	–

Connection cables

Description	Use/ length	Item (4)	Reference	Weight kg/lb
RG 6 quad shield coaxial cable	Drop cable, 320 m/*1047.87 ft* per reel	6	**975750000**	–
RG 11 quad shield coaxial cable	Trunk cable 320 m/*1049.87 ft* per reel	7	**975951000**	–
Pre-assembled drop cable (supplied with F connectors, line termination impedance and quad shield RG 6 cable)	15 m/ *49.21 ft*	–	**ASMBII003**	–
	42 m/ *137.79 ft*	–	**ASMBII004**	–

Rack accessories *(3)*

Description	Length	Item (4)	Reference	Weight kg/lb
Rack expansion module	–	8	**140XBE10000**	–
Cables for rack expansion module	1 m/ *3.28 ft*	9	**140XCA71703**	–
	2 m/ *6.56 ft*	9	**140XCA71706**	–
	3 m/ *9.84 ft*	9	**140XCA71709**	–

(1) Approvals: UL 508, CSA 22.2-142, cUL, FM Class 1 Div. 2, CE.
(2) Module can be declared and configured in Unity Pro Small/Medium/Large/Extra Large version ≥ 6.0.
(3) For racks with 3 to 16 slots, see page 1/17.
(4) For item numbers, see pages 2/27 to 2/29.

PTI

Qualification testing is a process carried out at regular intervals that is designed to determine whether the system needs to be overhauled in its entirety or only partially.
The PTI (*Proof Test Interval*) is the time interval between two qualification tests.

Example 1: Safety loop

With:
- 1 discrete input module
- 1 discrete output module
- 1 independent CPU

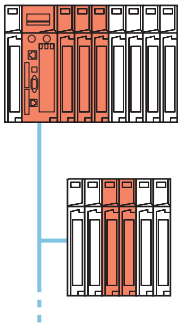
The Quantum Safety PLC is involved in the safety loop to the following extent:
0.2 + 1.1 + 0.2 = 1.5%.
The sensors and actuators account for 98.5%.

Example 2: Redundant safety loop

With 2 sensors:
- 2 redundant analog input modules
- 2 redundant discrete output modules
- 2 high-availability CPUs (Hot Standby)

The Quantum Safety PLC is involved in the safety loop to the following extent:
0.2 + 1.1 + 0.2 = 1.5%.
The sensors and actuators account for 98.5%.

***Note**: Each pair of identical modules is actually only represented once, as the sole purpose of redundancy is to increase availability.*
Therefore, only 1 module from each pair will be active within the safety loop.



Unity Pro XLS supports a combination of safety I/O and non-interfering I/O.

Non-interfering modules

Certain I/O modules from the Quantum catalog can be used in a safety architecture without interfering with the safety process.
Unlike the safety modules, these modules, which are referred to as “non-interfering”, are not responsible for any safety functions.
The following is a list of Quantum non-interfering modules which are fully compatible with a Quantum Safety configuration *(1), and the corresponding conformal coating version for each modules are also compatible (2)*:

Type	Reference
RIO head adaptor	**140CRP93200**
RIO drop adaptor	**140CRA93200**
RIO drop optical fibre repeater	**140NRP95400**
	140NRP95401C
Ethernet module	**140NOE77111**
16-slot rack	**140XBP01600**
10-slot rack	**140XBP01000**
6-slot rack	**140XBP00600**
Discrete inputs	**140DDI35300**
Discrete outputs	**140DDO35300**
Analog inputs	**140ACI04000**
Analog outputs	**140ACO02000**
Multifunction input module	**140ERT85420**
40-way terminal block	**140XTS00200**
	140XTS00100
Optical repeater	**140NRP95400**

Treatment for severe environments

Safety CPUs **140CPU6●160S** and safety I/O modules **140SD●95300S** and **140SAI94000S** have a “Humiseal 1A33” coating which makes them suitable for operation in severe environments (see page 8/2).
Non-interfering modules and racks compatible with safety PLCs are also available in a Conformal Coating version with the same treatment (see pages 8/2 to 8/9).

These modules and racks with protective coating have an additional letter “**C**” at the end of the reference of the standard module.

(1) Non-interfering modules certified by TÜV Rheinland, please consult our website www.schneider-electric.com.
*(2) Except for 40-way terminal block **140XTS00200**, **140XTS00100**.*

CPUs: page 1/2 | I/O architectures: page 2/6 | I/O: page 3/2 | Communication: page 5/2

Modicon Quantum automation platform
Hot Standby safety architectures

140CPU67160S

References

Hot Standby safety CPU with Unity Pro XL Safety

Hot Standby CPU		Application memory (max.)		Optical fibre	Communication ports	Safety	Reference	Weight
Clock speed	Coprocessor	Available internal RAM (with located variables)	With PCMCIA card	Type and max. distance				
MHz		KB	KB					kg/lb
266 MHz	Yes, integrated Ethernet TCP/IP, use reserved for Hot Standby	1024	7168	multimode 2 km	1 Modbus *(1)* 1 Modbus Plus 1 USB 1 Ethernet 100 Mbps port (dedicated Hot Standby port)	Yes	**140CPU67160S**	–

140NOE77111

Associated modules

Description	Type of architecture	Topology	Transparent Ready	No. *(2)*	Safety	Reference	Weight kg/lb
RIO head adaptor	Remote I/O (RIO) and mixed I/O	Redundant cable	–	3	Non-interfering	**140CRP93200** **140CRP93200C**	–
RIO drop adaptor				15	Non-interfering	**140CRA93200** **140CRA93200C**	–
RIO drop optical fibre repeater *(3)*	Remote I/O (RIO)	Multimode optical fibre (single or redundant)	–	–	Non-interfering	**140NRP95400** **140NRP95400C**	–
		Single mode optical fibre (single or redundant)	–	–	Non-interfering	**140NRP95401C**	–
Ethernet Modbus/TCP network module	Mixed	Bus or ring (copper or optical fibre)	Class C30	–	Non-interfering	**140NOE77111** **140NOE77111C**	–

(1) RS 232/RS 485 Modbus port.
(2) For item numbers, see page 6/16.
(3) Module can be declared and configured in Unity Pro XLSafety version 7.0 and later. This module can however be used with earlier versions of Unity Pro XLS without being declared.

***Note**: For all accessories and connections, see page 2/35.*

6

Modicon Quantum automation platform
Non-interfering modules


140CPS12420


140CRP93200


140NOE77111

Non-interfering modules and racks *(1)*

The following Quantum non-interfering modules are fully compatible with the Quantum safety modules.

Power supply module

Input voltage	Output current	Type	Safety	Reference	Weight kg/ lb
115/230 V ∼	11 A	Redundant	SIL3 certified	**140CPS12420**	0.650/ *1.433*
24 V ⎓	8A	Redundant	Non-interfering	**140CPS22400**	0.650/ *1.433*

Discrete input module

Description	Voltage	Modularity	Logic	Safety	Reference	Weight kg/ lb
4 groups of 8 inputs	**24 V ⎓**	32 inputs	Positive	Non-interfering	**140DDI35300**	0.300/ *0.661*

Discrete output module

Description	Voltage	Modularity	Logic	Safety	Reference	Weight kg/ lb
4 groups of 8 outputs	**24 V ⎓**	32 outputs	Positive	Non-interfering	**140DDO35300**	0.450/ *0.992*

Analog input module

Description	Range	Safety	Reference	Weight kg/ lb
16 high level channels 0…25,000 points, single-pole	0...20 mA 0...25 mA 4...20 mA	Non-interfering	**140ACI04000**	0.300/ *0.661*

Analog output module

Description	Range	Safety	Reference	Weight kg/ lb
4 current channels 12-bit	4...20 mA	Non-interfering	**140ACO02000**	0.300/ *0.661*

Multifunction input module

Description	Function	Safety	Reference	Weight kg/ lb
Multifunction input module	32 discrete inputs, supplied between 24 V and 125 V ⎓ Status logging - 500 Hz counting 1 clock signal input	Non-interfering	**140ERT85420**	0.450/ *0.992*

Modules

Description	Type of architecture	Topology	Transparent Ready	Safety	Reference	Weight kg/ lb
Quantum RIO head adaptor (1 max.)	Remote I/O (RIO) and mixed I/O	Redundant cable	–	Non-interfering	**140CRP93200**	–
Quantum RIO drop adaptor (31 max.)					**140CRA93200**	
RIO drop optical fibre repeater	Remote I/O (RIO)	Multimode optical fibre (single or redundant)	–	Non-interfering	**140NRP95400**	–
		Single mode optical fibre (single or redundant)	–	Non-interfering	**140NRP95401C**	–
Ethernet TCP/IP network module	Mixed	Bus or ring (copper Class C30 or optical fibre)		Non-interfering	**140NOE77111**	0.345/ *0.761*

Racks

Description	Number of positions	Safety	Reference	Weight kg/ lb
Racks for: **- Local I/O modules** **- Remote I/O modules** **- Distributed I/O modules**	6	Non-interfering	**140XBP00600**	0.640/ *1.411*
	10	Non-interfering	**140XBP01000**	1.000/ *2.205*
	16	Non-interfering	**140XBP01600**	1.600/ *3.527*

(1) For non-interfering modules certified by TÜV Rheinland, please consult our website www.schneider-electric.com.

CPUs: page 1/2 | I/O architectures: page 2/6 | I/O: page 3/2 | Communication: page 5/2

Modicon Quantum automation platform

Treatment for severe environments
"Conformal Coating"
I/O architectures

"Conformal Coating" remote I/O (RIO) modules (1)

Description	Cable	Safety	Certified ATEX Zone 2/22	Reference	Weight kg/lb
Quantum RIO head adaptor (1 max.)	Single cable	–	Yes	**140CRP93100C**	–
	Redundant cable	Non-interfering	Yes	**140CRP93200C**	–
	Redundant cable	Non-interfering	Yes	**140CRP31200C**	–
Quantum RIO drop adaptor (31 max.)	Single cable	–	Yes	**140CRA93100C**	–
	Redundant cable	Non-interfering	Yes	**140CRA93200C**	–
	Redundant cable	–	Yes	**140CRA31200C**	–

Quantum Ethernet drop optical fibre repeater (2)

Description	Cable	Safety	Certified ATEX Zone 2/22	Reference	Weight kg/lb
Ouantum Ethernet drop optical fibre repeater (3)	Multimode optical fibre (single or redundant)	–	–	**140NRP31200C**	–
	Single mode optical fibre (single or redundant)	–	–	**140NRP31201C**	–

RIO drop optical fibre repeater (2)

Description	Cable	Safety	Certified ATEX Zone 2/22	Reference	Weight kg/lb
RIO drop optical fibre repeater (3)	Multimode optical fibre (single or redundant)	Non-interfering	Yes	**140NRP95400C**	–
	Single mode optical fibre (single or redundant)	Non-interfering	Yes	**140NRP95401C**	–

"Conformal Coating" distributed I/O (DIO) modules

Description	Medium	Type of medium	Certified ATEX Zone 2/22	Reference	Weight kg/lb
DIO head-end adaptors no. 2 and no. 3 (4)	Single	Twisted pair cable	–	**140NOM21100C**	–
	Redundant	Twisted pair cable	Yes	**140NOM21200C**	–
	Single	Optical fibre cable	Yes	**140NOM25200C**	–

Description	Medium	Built-in power supply	Certified ATEX Zone 2/22	Reference	Weight kg/lb
DIO drop adaptors	Single	115/230 V ∿	–	**140CRA21110C**	–
		24 V ⎓	Yes	**140CRA21120C**	–
	Redundant	115/230 V ∿	–	**140CRA21210C**	–
		24 V ⎓	Yes	**140CRA21220C**	–

(1) For connection cables and rack accessories, see page 2/31.
(2) For topologies, see pages 2/32 and 2/33.
(3) Module declarable and configurable in Unity Pro Small/Medium/Large/Extra Large version 6.0 and later.
(4) For Modbus Plus network cables and accessories, see pages 5/48 to 5/53. For presentation, see page 5/44.