

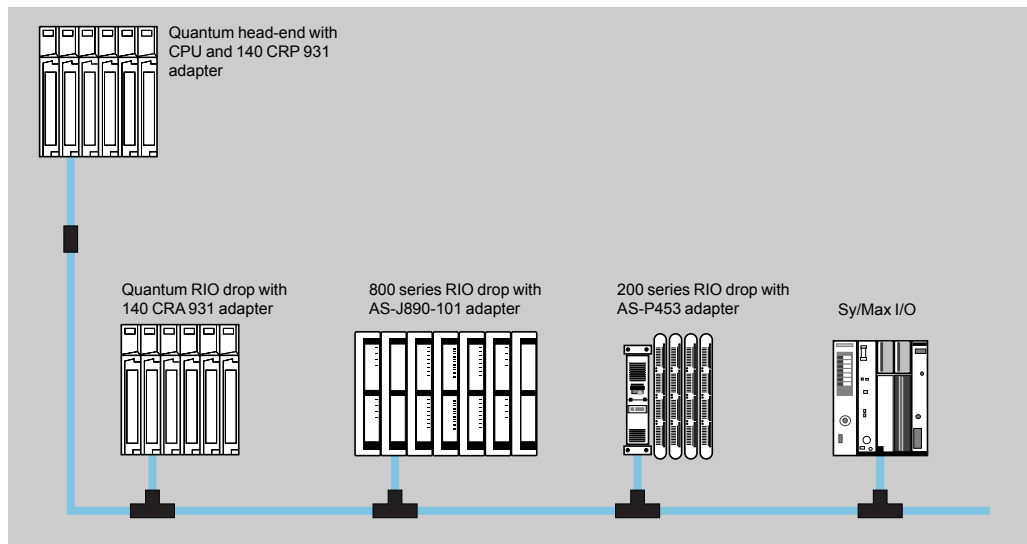
# Modicon Quantum automation platform

## I/O architectures Remote I/O

### Presentation

For applications that require I/O drops remotely mounted, highest I/O performance, and/or connectivity to existing Modicon remote I/O installations, the Modicon Quantum provides a remote I/O (RIO) architecture solution.

Based on the S908 remote I/O network technology, this network is compatible with existing installations of Modicon I/O products, including the 800 and 200 Series I/O modules and Sy/Max I/O. New installations can incorporate an installed base of these devices for reduced installation costs.



RIO architecture on a coaxial cabling scheme that provides long-distance capability, up to 4,572 km (15,000 ft) with CATV cable or longer with optional fiber optic cable. It is a high-performance network at 1,544 Mbit/s for high I/O data throughput. The RIO cable system consists of a linear trunk line, with line taps and drop cables running to each remote drop. Up to 31 remote drops are configurable. Each drop can support up to 128 I/O words (64 words in/64 words out).

### Modicon segment scheduler

The Modicon segment scheduler complements the high performance of the RIO network by interleaving I/O servicing and logic solving to create the fastest system throughput available.

The segment scheduler breaks application programs into logical segments, then schedules I/O servicing to occur in conjunction with the segment's associated logic solving. Inputs are read prior to logic being solved and outputs are written after logic is solved. This eliminates the need to wait for an entire scan before outputs are set, giving a faster system response than comparable control systems. As a result, there is no performance penalty for using RIO - it is as fast as local I/O. For most systems, throughput of local or remote I/O can be estimated at no less than two times scan (assumes measurement of input and output times through 24 V d.c. modules). All analog and register values are updated automatically, as fast as discrete I/O, without user programming.

### Compatibility with the 800 and 200 Series I/O products

For forward integration from existing Modicon systems, the Quantum Automation Series is compatible with the 800 and 200 Series I/O products. Using the same RIO head end interface, it connects to 800 Series I/O via the P890300 RIO adapter, and to 200 Series I/O via the P453/J290 and P451/J291 RIO adapters.

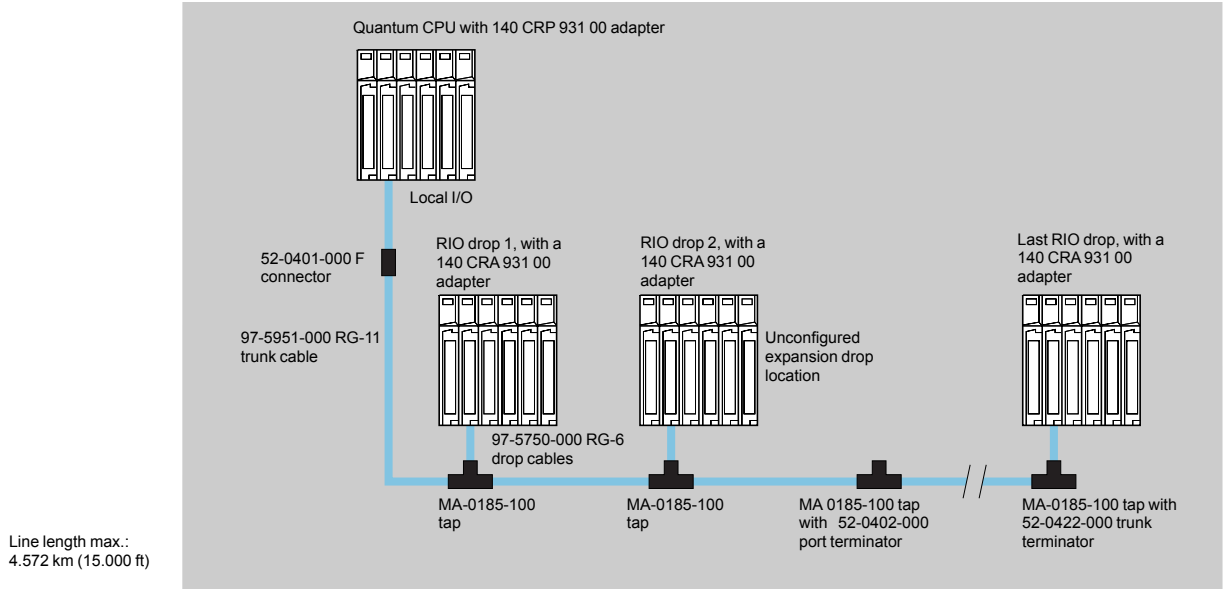
Other standard Modicon components are also compatible with this system, including network taps (MA-0185-100) and splitters (MA-0186-100). Quantum remote I/O also supports drops of Sy/Max I/O.

### Rules of configuration

To ensure a valid configuration, add up the required backplane current (in mA) for all modules at each I/O remote location, and ensure the total is less than the available power in the selected power supply.

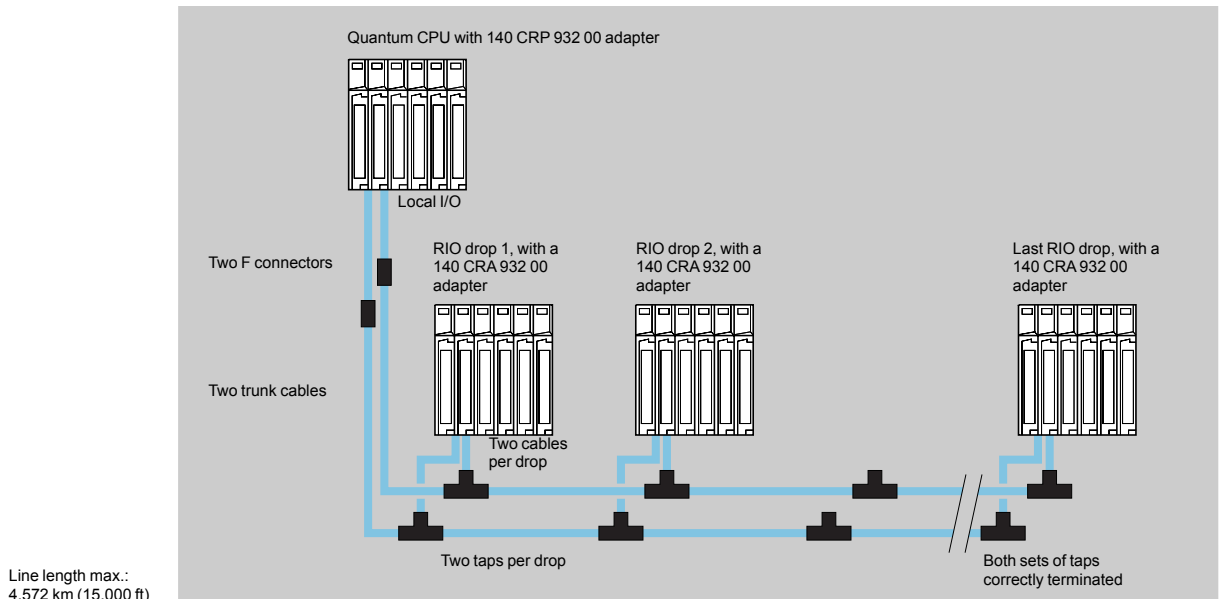
#### RIO cable topologies

##### A single-cable RIO topology



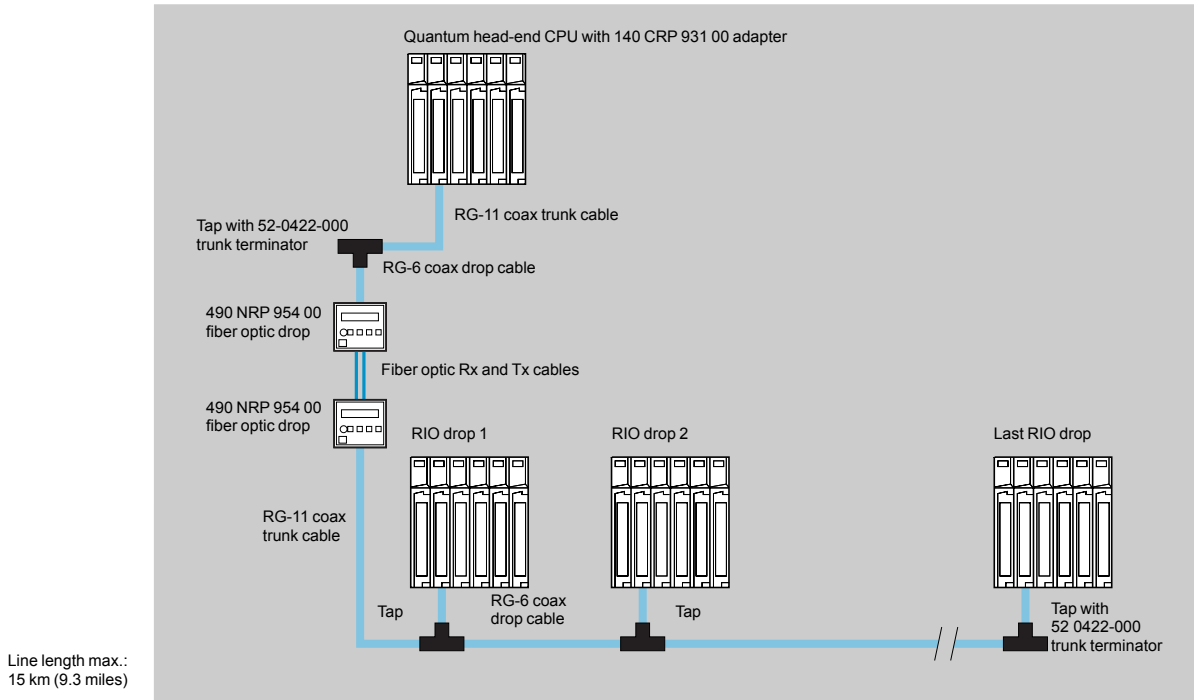
An MA-0185-100 tap is required for every drop on the system to electrically isolate the drop from the trunk and protect the system from impedance mismatches and cable disconnections. A minimum signal strength of 14 dB is required between the trunk and each drop to ensure correct operation. The signal loss on the trunk cable as it crosses the tap is less than 1dB. A total of 35 dB is available from the head-end RIO processor. The entire cabling architecture must not exceed this system limit. For systems that require high availability, a redundant-cable option is available to protect the system from cable breaks and damaged connectors. With two cables connected between the host and each drop, a single cable break does not disrupt communications. If a cable break occurs, a health bit is set to indicate the problem node and faulty cable. For preventative maintenance, the system also provides retry counters for all communication transactions to all nodes. High retry counts on a cable in a specific node could indicate connection problems that can be scheduled and corrected prior to unwanted downtime.

##### A redundant-cable RIO topology



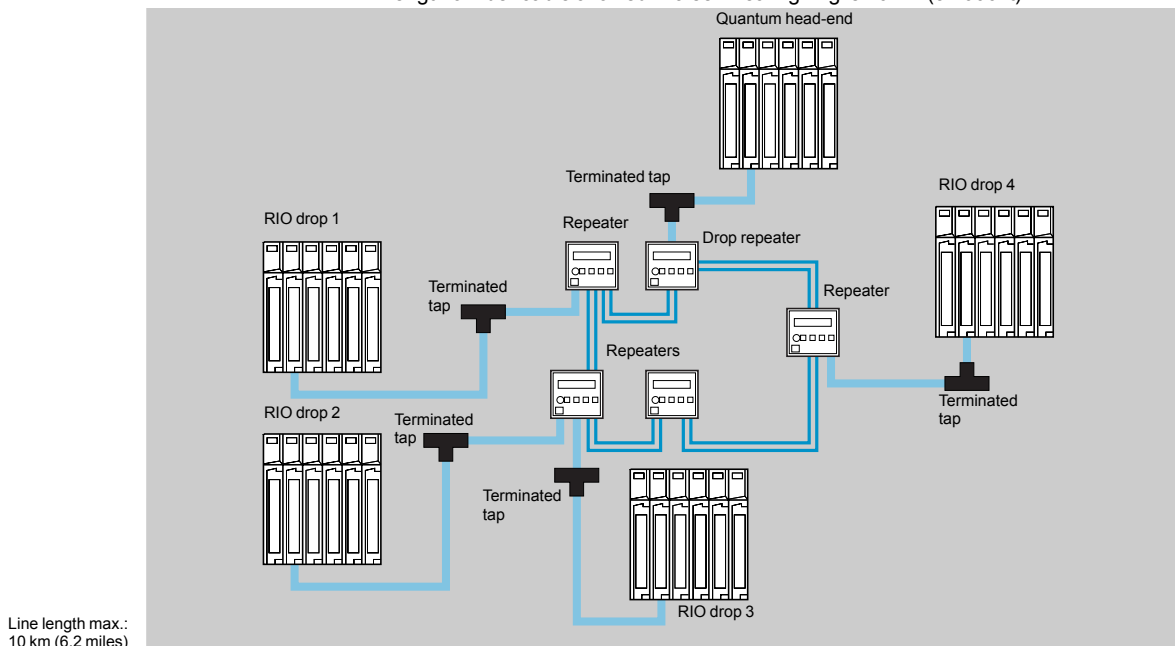
#### Point-to-point RIO communications with fiber optic repeaters

Fiber optic repeaters are available to enhance network noise immunity and increase cable distance to as much as 15 km (9.3 miles). These optic repeaters convert the twisted-pair cable to standard 62.5/125 μm fiber optic while maintaining the full dynamic range of the network.



#### A “self-healing” ring topology with fiber optic repeaters

Multiple 490 NRP 954 00 fiber optic repeaters can be interconnected in a closed loop ring so that if a break occurs anywhere in the ring the network can reconfigure itself. The RIO signal is sent down both legs of the ring by the drop repeater to the head repeaters. When a signal is received on one Rx line, the other Rx channel is blanked, this prevents the same signal from being transmitted twice in the ring. The maximum length of fiber cable allowed in a self-healing ring is 10 km (32 000 ft).



Head-end and drop adapter characteristics						
Model		140 CRP 931 00	140 CRP 932 00	140 CRA 931 00	140 CRA 932 00	
Type		Head-end		Drop adapter		
Drop type		Quantum, 200/500/800 series or Symax (any mix)		-		
I/O type		-		Quantum		
Modules/drop		31 drop adapters max.		27 I/O modules max.		
Words/drop		64 in/64 out words				
ASCII		2 ports per drop, 32 ports (16 drops), max. (requires use of AS-P892-000, AS-J892-101/102, or AS-J290-0X0 at the RIO drops).		-		
Coax termination	$\Omega$	Internal 75				
Coax shield		Tied to chassis ground		Capacitor to ground		
Data transfer rate	Mbit/s	1.544				
Dynamic range	dB	35				
Isolation	---	500 V coaxial cable, center conductor to ground				
Cable connections	Single cable	One "F" type female connector (right angle adapter)				
	Redundant cable	Two "F" type female connectors (right angle adapter)				
General	Holdup time	-		Software configurable NOTE: In the event of a communication loss with the remote processor, output modules during this time will retain their last operating state. Input module data will be held in the system controlling CPU. After this time, output modules will assume their predefined timeout states and inputs will be zeroed by the CPU.		
	Diagnostics	Power Up Memory check LAN controller check		Power Up and Runtime Executive checksum RAM address/data		
	Maximum number of CRP supported by the controller	1 head-end per Quantum CPU		-		
	Bus current requirement	mA mA	One channel: 600 Dual channel: 750			
	Power dissipation	W W	One channel: 3 Dual channel: 3.8			
Agency approvals		UL 508, CSA 22.2-142, cUL, FM Class 1 Div.2, CE				

### Fiber optic cable considerations

To use a fiber optic link in a RIO network, consider the following when selecting fiber optic cable from a vendor:

- For most applications, 62.5/125  $\mu\text{m}$  fiber is recommended because of its relatively low loss and low signal distortion. However, in high optical power applications, such as those that use splitters or star couplers, the 100/140  $\mu\text{m}$  fiber should be used.
- Wherever possible, select a multiconductor cable. It is inexpensive; it provides a backup path in case a cable gets cut in the process of pulling it; and you can use the extra path for voice, video, or other communications.

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## I/O architectures

### Remote I/O

#### Adapter modules

Description	Cable	Reference	Weight kg (lb)
Quantum RIO head-end adapter (1 max.)	Single-cable	140 CRP 931 00	–
	Redundant-cable	140 CRP 932 00	–
Quantum RIO drop adapter (31 max.)	Single-cable	140 CRA 931 00	–
	Redundant-cable	140 CRA 932 00	–
RIO drop	Fiber optic	490 NRP 954 00	–

#### Connection cables

Description	Use/length	Reference	Weight kg (lb)
RG-6 coaxial quad shield cable (sold by the roll)	Drop cable 320 m (1000 ft)/roll	97 5750 000	–
RG-11 coaxial quad shield cable (sold by the roll)	Trunk cable 320 m (1000 ft)/roll	97 5951 000	–
Preassembled drop cable (with F connectors, self-terminating F adapter, and quad shield RG-6 cable)	15 m (50 ft)	AS MBII 003	–
	42 m (140 ft)	AS MBII 004	–

#### Backplane accessories <sup>(1)</sup>

Description	Use/length	Reference	Weight kg (lb)
Backplane expander module	–	140 XBE 100 00	–
Expander cables module	1 m	140 XCA 717 03	–
	2 m	140 XCA 717 06	–
	3 m	140 XCA 717 09	–

(1) For backplanes 12...16 slots, see page 48201/3.

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Description		Quantity	Reference	Weight kg (lb)
<b>Tap</b> (connects the drop cable to the trunk cable)		1	<b>MA 0185 100</b>	–
<b>Heand-end repeater</b> (a signal from a single – cable for two-cable use) for ring topology		–	<b>MA 0186 100</b>	–
<b>Tap terminator</b> (for unused drop locations)		1	<b>52 0402 000</b>	–
<b>Trunk terminator</b> (for last tap on the network)		1	<b>52 0422 000</b>	–
<b>F connector cassette</b>	For RG-6 cable	10	<b>MA 0329 001</b>	–
	For RG-11 cable	6	<b>490 RIO 002 11</b>	–
<b>Right-angle F adapter for semi-rigid cable</b>		1	<b>52 0480 000</b>	–
<b>BNC connector for RG-6 cable</b>		1	<b>043509446</b>	–
<b>F-to-BNC adapter for RG-11 cable</b>		1	<b>52 0614 000</b>	–
<b>BNC jack to male F connector</b> (with J890/J892 drop adapters)		1 j	<b>52 0724 000</b>	–
Cabling accessories				
<b>BNC in-line terminator</b>		1	<b>60 0513 000</b>	–
<b>Ground block</b>		1	<b>60 0545 000</b>	–
<b>Coaxial cable stripping tool</b>	For RG-6 cable	1	<b>490 RIO 004 00</b>	–
	For RG-11 cable	1	<b>490 RIO 0S4 11</b>	–
<b>Replacement blade pack</b>	RG-6 cable	2 b	<b>490 RIO 004 06</b>	–
	RG-11 cable	–	Consult our regional sales office	–
<b>Crimping tools</b>	F connector on RG-6 cable	1	<b>60 0544 000</b>	–
	F connector on RG-11 cable	1	<b>490 RIO 0C4 11</b>	–
	BNC connector on RG-6 cable	1	<b>043509432</b>	–
<b>Cable cutter</b>		1	<b>60 0558 000</b>	–