Modicon Quantum automation platform

Catalog

November 2015



Schneider Electric

Modicon Quantum automation platform
Unity Pro Hot Standby CPUs

Automation platform for Unity Pro software offer			Applications with redundancy (Hot Standby)	
				
Number of racks 3/4/6/10/16 slots	Local I/O		–	
	Remote I/O (RIO)		31 drops of 2 racks (1 main + 1 expansion)	
Maximum discrete I/O *(1)*	Local I/O		–	
Maximum analog I/O *(1)*	Local I/O		–	
Application-specific modules			High-speed counter, interrupt inputs, serial link, accurate time stamping	
Number of communication modules and axes (in local rack)	Ethernet TCP/IP, Modbus Plus, Profibus DP, Sy/Max Ethernet, SERCOS, all combinations		6	
Bus connections	Modbus		1 integrated RS 232/485 Modbus RTU/ASCII port	
	AS-Interface actuator/sensor bus		Limited number: 4 on local rack, 4 on remote rack (RIO)	
	Profibus DP *(2)*		6 “option” modules on local rack	
Network connections	Modbus Plus		1 integrated port, 6 “option” modules on local rack *(3)*	
	Ethernet TCP/IP		1 integrated 100BASE-FX Hot Standby multimode port *(4)*, 6 “option” modules on local rack *(6)*	
	USB		1 port reserved for programming PC	
Redundancy			Power supplies, remote I/O network, Modbus Plus modules, Ethernet TCP/IP modules, Profibus module	
Hot Standby			Yes	
Application structure	Master task		1 cyclic/periodic	
	Fast task		–	
	Auxiliary tasks		–	
	Interrupt tasks	Max. number	–	
		I/O interrupt	–	
		Timer interrupt	–	
Number of Kinstructions executed per ms	100% Boolean		10.28 Kinst/ms	
	65% Boolean and 35% numerical		10.07 Kinst/ms	
Memory capacity without PCMCIA card	IEC program and data		512 KB	1024 KB
Memory expansion with PCMCIA card	Program		Up to 7168 KB	
	Data		512 KB	1024 KB
	File storage		8 MB (PCMCIA expansion in CPU slot no. 0 and/or no. 1)	
Bus current required			2160 mA	
Functional safety certification			–	
Approvals			UL 508, CSA 22.2-142, FM Class 1 Div 2, CE, ATEX Zone 2/22 *(7)*	
Type of Quantum CPU			**140CPU67060**	**140CPU67160**
Page			1/12	

(1) The maximum values for the number of discrete I/O and analog I/O depend on the topologies used (remote I/O, distributed I/O, etc.). For more information, please consult our website www.schneider-electric.com.
(2) Profibus DP module by our partner Prosoft (Collaborative Automation Partner Program).
(3) Modbus Plus modules: Only the first 2 of the 6 modules feature the full range of functions.
(4) Max. distance between the 2 Hot Standby CPUs: Up to 4 km (see our website www.schneider-electric.com).

Applications with redundancy (Hot Standby)				
				
–				
31 drops of 2 racks (1 main + 1 expansion)				
–				
–				
High-speed counter, interrupt inputs, serial link, accurate time stamping				
6				
1 integrated RS 232/485 Modbus RTU/ASCII port				
Limited number: 4 on local rack, 4 on remote rack (RIO)				
6 “option” modules on local rack				
1 integrated port, 6 “option” modules on local rack *(3)*				
1 integrated 100BASE-FX Hot Standby multimode port *(4)*, 6 “option” modules on local rack *(6)*		1 integrated 100BASE-FX Hot Standby single mode port *(5)*, 6 “option” modules on local rack *(6)*		
1 port reserved for programming PC				
Power supplies, remote I/O network, Modbus Plus modules, Ethernet TCP/IP modules, Profibus module				
Yes				
1 cyclic/periodic				
–				
–				
–				
–				
–				
10.28 Kinst/ms				
10.07 Kinst/ms				
3072 KB				11 MB
Up to 7168 KB				Up to 11264 KB
3072 KB				1536 KB
8 MB (PCMCIA expansion in CPU slot no. 0 and/or no. 1)				
2500 mA				
–				
UL 508, CSA 22.2-142, FM Class 1 Div 2, CE, ATEX Zone 2/22 *(7)*				
140CPU67260		**140CPU67261**		**140CPU67861**
1/12				

(5) Max. distance between the 2 Hot Standby CPUs: Up to 16 km.
(6) With a maximum of a network head adaptor with integral router (140NOC78100).
(7) Only Conformal Coating versions are ATEX Zone 2/22 certified. For more information, see pages 8/2 to 8/9.

Modicon Quantum automation platform
Hot Standby system
Unity Pro

Presentation

The Hot Standby system is compatible with Unity Pro software, and provides Quantum CPUs with the high level of availability required by the most critical process applications, in terms of availability of their control system.

At the centre of the system are two Quantum PLC racks, commonly known as the “Primary” PLC and the “Standby” PLC. Their hardware configurations must be identical (same modules in each local rack). The key element, on each of them, is the **140CPU67●●●** CPU, which is specially designed for Hot Standby architectures with Unity Pro software.
These Hot Standby CPUs are double-slot modules, which combine the central processor unit function with that of the redundant coprocessor in the same housing.

The “Primary” PLC executes the application program and controls the I/O. The “Standby” PLC stays in the background, ready to take over if necessary.
The “Standby” PLC is connected to the “Primary” PLC via a high speed optical fibre link (100 Mbps) integrated in the CPU:
- For **140CPU67060, 140CPU67160** or **140CPU67260** CPUs, a 62.5/125 µm, multimode optical fibre link is used, with a maximum distance between CPUs of 4 km (depending on the CPU product version. See our website www.schneider-electric.com)
- For **140CPU67261** and **140CPU67861** CPUs, an ITU-T G.652, single mode optical fibre link, known as being the SMF standard (1310 nm) is used, with a maximum distance between CPUs of 16 km

It is via this optical fibre link that the user application data is updated cyclically on the “Standby” PLC.

In a Quantum Hot Standby architecture, it is possible to update the CPU firmware without stopping the process.

In the event of an unexpected failure affecting the “Primary” PLC, 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 faulty PLC has been repaired and reconnected to the standby system, it takes the role of the “Standby” PLC.

Using the Hot Standby system with Unity Pro software means there is a smooth changeover from primary to standby at the outputs. The changeover is transparent for the process, which will continue to be managed without any permanent ill-effects from the occurrence of a hardware failure. The Hot Standby system with Unity Pro software therefore increases productivity by minimizing downtime.

Modicon Quantum automation platform
Hot Standby system
Unity Pro

Function

■ **Application program memory space**

All the memory space reserved for the application program is managed by the Hot Standby system with Unity Pro.

The five CPUs dedicated to Hot Standby applications (**140CPU67060**, **140CPU67160**, **140CPU67260**, **140CPU67261** and **140CPU67861**) have an embedded RAM memory (512 KB, 1024 KB, 3072 KB and 11,264 KB respectively). Except for **140CPU67861**, the RAM memory in these CPUs can be increased to 7.168 MB by adding a PCMCIA memory card (see page 1/15).

■ **Configuration**

The installation of the application program does not differ fundamentally from installing a single PLC program. It essentially uses the information provided by a dedicated dialogue box, filled in during the configuration of the system.

■ **Mini-terminal on front panel**

The **140CPU67060, 140CPU67160, 140CPU67260, 140CPU67261** and **140CPU67861** CPUs are double-slot modules, with a mini-terminal at the top of the front panel. Equipped with an LCD screen and navigation buttons, it has a special sub-menu for the standby system. It can be used for example to check the status of the PLC, or to force the PLC to active or inactive standby state.

■ **System registers**

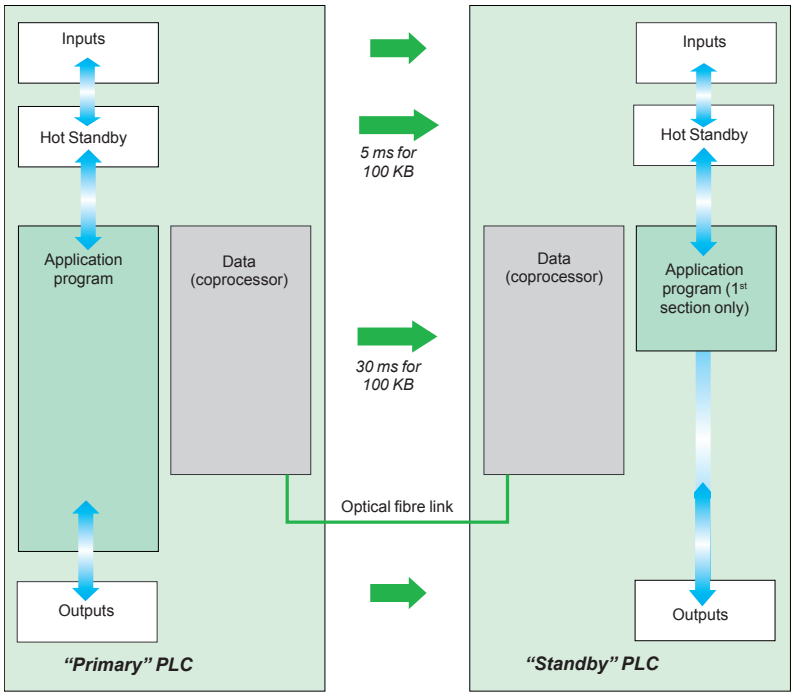
Control of the standby system is managed by an internal register called the Command Register, carried by a system word. This Command Register accepts user requests, expressed via the configuration dialogue box and/or via the mini-terminal on the front panel. This Command Register can be used in particular to disable acknowledgement of commands made from the mini-terminal.

Feedback on the status of the standby system is given by a Status Register, which is also carried by a system word.

■ **Function blocks**

Standard function blocks are provided in the Unity Pro programming environment, making it possible to read/write to the Command Register and read the Status Register, by individually identifying each of the bits carrying a particular function.

■ **Cyclic transfer of the application context**

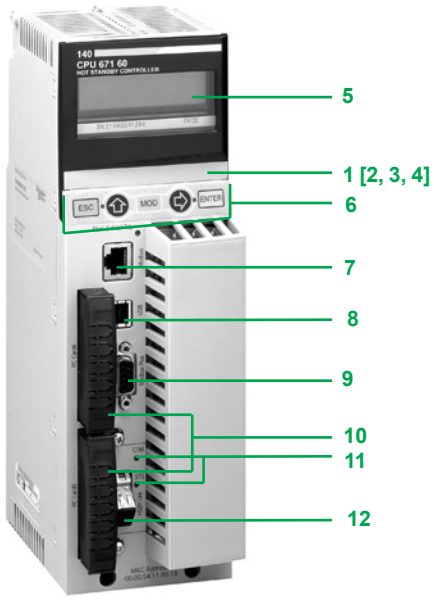


At the start of each scan cycle, the content of the data memory in the "Primary" PLC is transferred to the "Standby" PLC via the optical fibre link, at the same time as the contents of the I/O state tables are transferred to it. The Hot Standby system is thus able to transfer all the 128 KB made available to receive the located variables (RAM State) from the "Primary" PLC to the "Standby" PLC. As far as unlocated application variables are concerned, and also application data such as DFB instance data, for example, up to 512 KB can be transferred.

Modicon Quantum automation platform

Hot Standby system

Unity Pro



140CPU67160



Mini operator dialogue terminal

Hot Standby CPUs

The front panel of **140CPU67060, 140CPU67160, 140CPU67260, 140CPU67261** and **140CPU67861** Hot Standby CPUs comprises:

1 An LCD display cover, providing access to:

2 A key switch:
- □ Unlocked: All system operations can be invoked and all changeable module parameters can be modified via the LCD and keypad. The memory is not write-protected.
- □ Locked: No system operations can be invoked and all changeable module parameters are read-only. The memory is write-protected. This state increases data security.

3 One backup battery slot

4 A reset button (Restart)

5 An LCD display (2 lines of 16 characters) with brightness and contrast controls.

6 A 5-button keypad with 2 LEDs *(ESC, ENTER, MOD, ⇧, ⇨)*

7 An RJ45 connector for connecting to the Modbus bus

8 A type B female USB connector for connecting the programming PC terminal

9 A 9-way female SUB-D connector for connecting to the Modbus Plus network

10 Two slots for PCMCIA memory expansion cards *(1)*

11 Two LEDs:
- □ COM LED (green): activity on the Hot Standby primary or secondary drop
- □ ERR LED (red): communication error between the Hot Standby primary and secondary drops

12 A optical fibre connector for interconnecting the primary and secondary PLCs in the Hot Standby architecture:
- □ An MT-RJ multimode optical fibre connector for the **140CPU67060**, **140CPU67160** and **140CPU67260**
- □ An LC single mode optical fibre connector for the **140CPU67261** and **140CPU67861**

Mini operator dialogue terminal

The mini operator dialogue terminal, located on the front of the **140CPU67060, 140CPU67160, 140CPU67260, 140CPU67261** and **140CPU67861** Hot Standby CPUs, gives the user direct information (RUN, STOP, No Conf) on the PLC status, without a programming terminal.
It can also be used to display, and if necessary to modify, a certain number of operating parameters, using the 5 navigation buttons: ESC, ENTER, MOD, ⇧ and ⇨.

Four main command functions are accessible from a menu/sub-menu tree structure:
- Quantum PLC operating mode: **PLC Operations**
- Communication port parameter settings: **Communications**
- System information: **System Info**
- LCD screen settings: **LCD Settings**

The **PLC Operations** menu is used to execute the following commands:
- Start PLC
- Stop PLC
- Init PLC

It can also be used to go into the **Hot Standby** sub-menu offering commands specific to the standby system.

It is possible to display (**State** sub-menu) the active/inactive state (with regard to standby) of the PLC which the user is working on, and this sub-menu also offers the option of forcing (**Mode** sub-menu) this PLC to active/inactive state.

The other sub-menus are:
- **Order:** delivers topological information on the current PLC
- **Diag:** gives, if necessary, error information on the state of the standby system
- **Transfer:** is used to transfer the content of the “Primary” PLC memory to that of the “Standby” PLC, for updating

(1) Except for 140CPU67861, which is already equipped with the large RAM memory size up to 11 MB, only the lower slot is available for PCMCIA memory expansion cards.

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Hot Standby system
Unity Pro

Architecture

Time-critical processes: remote I/O architecture (RIO)

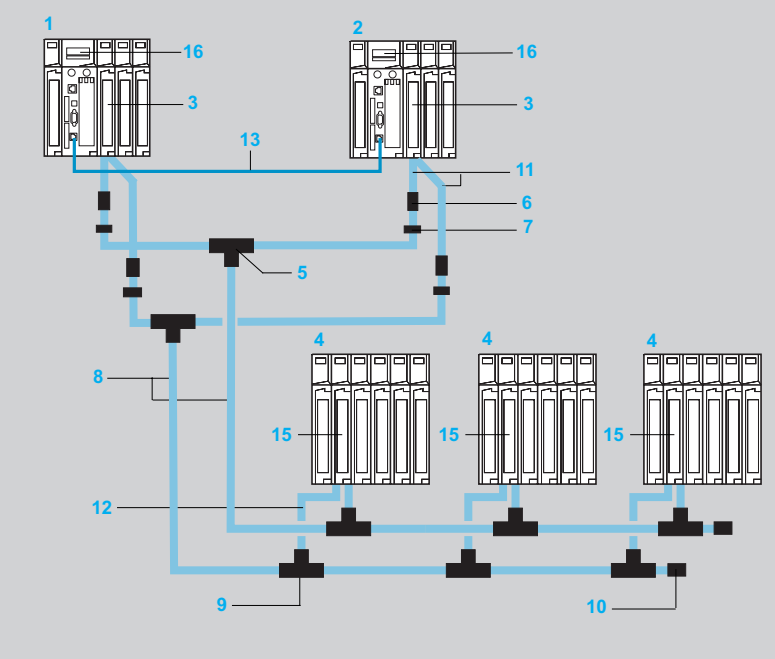
For sensitive processes, requiring an I/O control takeover time within the region of the PLC scan time, an I/O architecture based on RIO (Remote I/O) native topology should be chosen by default.

The scanning of RIO drops is synchronous with the CPU scan time. As a result, the RIO architecture provides a smooth CPU changeover with regard to the outputs, i.e. bumpless.

RIO drops, consisting of Quantum modules, are recognized and configured from the Unity Pro software programming environment.

A **MA0186100** splitter box 5 is used to enable I/O exchanges between the RIO drops 4 and the "Primary" 1 and "Standby" 2 PLCs.
The **520411000** line impedances 6 are used to maintain a suitable line when it is necessary to disconnect one of the I/O CPUs. The optional **600545000** earthing terminals 7 are used to maintain the earthing of the coaxial cable in these conditions.

The availability of this I/O system can be reinforced by using a dual-medium I/O wiring system. It is possible to transpose these I/O drops on an optical ring (single or dual), using optical repeaters.



1 "Primary" Quantum PLC
2 "Standby" Quantum PLC
3 **140CRP93200** RIO head adaptor (redundant)
4 RIO drop
5 **MA0186100** splitter box for coaxial cable
6 **520411000** line impedance
7 **600545000** earthing terminal
8 RG-11 coaxial trunk cable
9 **MA0185100** T-connector 2 x RG-11/1 x RG-6
10 **520422000** RG-11 trunk cable terminator for T-connector
11 RG-6 coaxial cable (0.3 m/*0.98 ft*)
12 RG-6 drop coaxial cable (2.4 m/*7.87 ft*)
13 Optical fibre cable (3/5/15 m or *9.84/16.40/49.21 ft*)
14 **140NOE771●1** or **140NOC78●00** Ethernet network module, depending on type of architecture (not shown)
15 **140CRA93200** RIO drop adaptor (redundant)
16 **140CPU67●6●** Hot Standby CPU

***Note**: for items 1, 2, …15, see pages 2/41 to 2/42.*

The components are available in kits.
For example, the configuration illustrated above can be created using:
- 1 splitter kit **140CHS32000**
- 4 head adaptor connection kits **RPXKITCRP**
- 6 drop kits **RPXKIT6F**
- 1 RG-11 coaxial trunk cable: for example, a 320 m reel **975951000**

(see page 2/31)

Modicon Quantum automation platform
Hot Standby system
Unity Pro



140CPU67160

References

Hot Standby CPU with Unity Pro

Hot Standby CPU		Application memory capacity (max.)		Communication ports	Optical fibre	Reference	Weight kg/*lb*
Clock speed	Coprocessor	Internal RAM available (with located variables)	With PCMCIA card		Type and max. distance		
MHz		KB	KB				
266	Yes, integrated Ethernet TCP/IP, use reserved for Hot Standby	512	7168	1 Modbus *(1)* 1 Modbus Plus 1 USB 1 Hot Standby port (100 Mbps) *(2)*	Multimode, 2 km	**140CPU67060**	1.424/ *3.139*
	Yes, integrated Ethernet TCP/IP, use reserved for Hot Standby	1024	7168	1 Modbus *(1)* 1 Modbus Plus 1 USB 1 Hot Standby port (100 Mbps) *(2)*	Multimode, 2 km	**140CPU67160**	1.424/ *3.139*
	Yes, integrated Ethernet TCP/IP, use reserved for Hot Standby	3072	7168	1 Modbus *(1)* 1 Modbus Plus 1 USB 1 Hot Standby port (100 Mbps) *(2)*	Multimode, 2 km	**140CPU67260**	1.424/ *3.139*
	Yes, integrated Ethernet TCP/IP, use reserved for Hot Standby	3072	7168	1 Modbus *(1)* 1 Modbus Plus 1 USB 1 Hot Standby port (100 Mbps) *(3)*	Single mode, 16 km	**140CPU67261**	1.424/ *3.139*
	Yes, integrated Ethernet TCP/IP, use reserved for Hot Standby	11264	–	1 Modbus *(1)* 1 Modbus Plus 1 USB 1 Hot Standby port (100 Mbps) *(2)*	Single mode, 16 km	**140CPU67861**	1.424/ *3.139*



140NOE771●1

Description	Type of architecture	Topology	Characteristic	Item *(4)*	Safety	Reference	Weight kg/*lb*
RIO head adaptor modules	Remote I/O (RIO) and mixed I/O	Single cable	–	3	–	**140CRP93100**	–
		Redundant cable	–	3	Non-interfering	**140CRP93200**	–
		Redundant cable	–	3	Non-interfering	**140CRP31200**	–
Ethernet Modbus TCP/IP network modules *(5)*	Distributed I/O on Modbus TCP/IP	Bus or ring (copper or optic fibre)	Transparent Ready: Class B30	14	–	**140NOE77101**	0.345/ *0.761*
			Transparent Ready: Class C30	14	Non-interfering	**140NOE77111**	0.345/ *0.761*
Ethernet DIO head adaptor module Required if there are Ethernet DIO devices in the architecture *(5)*	Mixed distributed I/O	Bus or ring (copper or optic fibre)	–	15	–	**140NOC78000**	0.554/ *1.221*
Ethernet head-end adaptor module Required if there is a control network in the architecture	Mixed distributed I/O	Bus or ring (copper or optic fibre)	Integrated router	15	–	**140NOC78100**	0.554/ *1.221*



140NOC78000/78100

(1) RS 232/RS 485 Modbus port.
(2) Ethernet 100 Mbps port for multimode optical fibre.
(3) Ethernet 100 Mbps port for multimode optical fibre.
(4) For item numbers, see diagram on page 2/39.
(5) The 140NOE771 Ethernet Modbus TCP modules ●1 in installed bases can also manage Ethernet DIO devices in a Quantum Ethernet I/O system. These modules do however have performance restrictions which are not present in the 140NOC78000 module. In particular, only a 140NOE771●1 module can be part of the Quantum Ethernet I/O network; please consult our Customer Care Centre.

Overview: page 2/6 | Quantum Ethernet I/O: page 2/14 | S908 bus: page 2/30 | Presentation: page 2/34

Modicon Quantum automation platform
Hot Standby system
Unity Pro



490NOR000●●

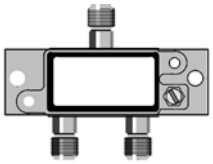
References (continued)

Optical fibre cables for Hot Standby architectures

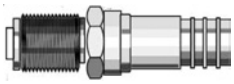
Description	Use/composition	Length m/*ft*	Item *(2)*	Reference	Weight kg/*lb*
Optical fibre cables for interconnecting the Ethernet ports on the **140CPU67160** **140CPU67260** CPUs ("Primary" and "Standby") *(1)*	62.5/125 µm multimode optical fibre cable, equipped with MT-RJ connectors	3/ *9.84*	13	**490NOR00003**	–
		5/ *16.40*	13	**490NOR00005**	–

Connection kits

Description	Composition and item no. *(2)*	Reference	Weight kg/*lb*
Connection kit for 140CRP93●00 head adaptor modules	Comprising: - 1 RG 6 coaxial cable 11 (length 0.3 m) equipped with type F female connectors - 1 600545000 earthing terminal 7	**RPXKITCRP**	–
RIO drop kit	Comprising: - 1 MA0185100 T-connector 9 for RG-11/RG-6 coaxial cables with 520422000 trunk cable terminator 10 - 2 RG-6 coaxial cables 12 (length 2.4 m) equipped with type F female connectors	**RPXKIT6F**	–



MA0186100



520411000



600545000

Description	Use/composition	Length	Item *(2)*	Reference	Weight kg/*lb*
Splitter box for coaxial cable	T-connector for joining sections of RG-6 coaxial cable coming from two 140CRP93200 head adaptor modules. Forms the start of the RIO links.	–	5	**MA0186100**	–
Line impedance for RG-6 coaxial cable	Crimp-type adaptor for RG-6 RIO coaxial cable. Used to maintain a suitable RIO line on disconnection of the cable coming from the head adaptor (140CRP93200). Connection at both ends on female connector.	–	6	**520411000**	–
Earthing terminal for RG-6/RG-11 coaxial cable	Earthing terminal for RIO coaxial cable. Used to maintain earthing of the RIO line on disconnection of the cable coming from the head adaptor (140CRP93200). Connection at both ends on female connector.	–	7	**600545000**	–

(1) Additional optical fibre cable choices (type, length, etc.) are available in the Schneider Electric Accessories range. For more information, please consult our website www.schneider-electric.com.

(2) For item numbers, see diagram on page 2/39.

(3) For other RG connection accessories, see pages 2/31 and 2/32.

PlantStruxure

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MKTED2120701EN

November 2015 - V3.0