

Modicon Quantum automation platform

Unity processors



Presentation

Modicon Quantum CPUs are a family of high-performance programmable controllers based on 486 and Pentium processors, and are compatible with Unity Pro software. Some of the features implemented in these CPUs include:

- Superior scan times and I/O throughput.
- Ability to handle interrupts, timed and I/O based.
- Handling of Fast task, as well as a Master task.
- Memory expansion through PCMCIA cards.
- Multiple communication interfaces embedded in the CPU.
- A user-friendly diagnostic and operation LCD display on the front panel of high-end models.

The processors offered can be differentiated by their memory capacities, processing speeds and communication options.

Memory backup, protection and expansion

The CPUs store the application program in a battery-backed internal RAM. The battery is located on the front of the module and can be serviced while the CPU is running.

To protect the application program from inadvertent changes during operation, the processors feature a key switch on the front panel. This key switch can also be used to start and stop the CPU. The **140 CPU 311 10** processor only has a memory-protect slide switch.

A memory protection bit, to be set in configuration mode, is also available to lock any program modification (via the programming PC or downloads).

High-end processors **140 CPU 651 50/60** and **140 CPU 671 60** have 2 slots for a PCMCIA card:

- An upper slot (no. 0) to receive memory extension cards (programs, symbols, constants and/or data files).
- A lower slot (no. 1) to receive memory extension cards specific to the data files.

Built-in communication ports

Quantum CPUs support:

- Two Modbus RS 232 ports (Modbus RS 485 with **140 CPU 651 00** and **140 CPU 671 60** processors)
- One Modbus Plus port

Depending on the model, Quantum processors can include:

- A 10BASE-T/100BASE-TX Ethernet TCP/IP port (RJ45 connection)
- A USB port for connecting a programming terminal

LCD display

Some CPU models have an LCD display (2 lines of 16 characters) with brightness and contrast controls. Through a keypad and the display the CPUs can be diagnosed, some configuration parameters can be set and the CPUs can be started and stopped.

Hot Standby (redundancy)

The Quantum **140 CPU 671 60** processor is dedicated to managing Hot Standby functionality. It has an Ethernet 100 Mbps fiber optic link and the Hot Standby function can be diagnosed through the LCD display.

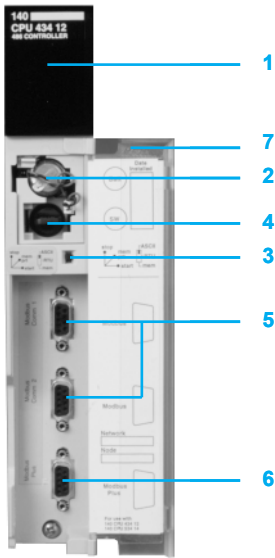
Quantum application design and installation

Installation of these Quantum processors requires:

- Unity Pro Large or Extra Large programming software. This software is compatible with the Premium platform.
- Optionally, as required:
 - Unity Application Generator (UAG) specialist software for modeling and generating process applications
 - Unity EFB toolkit software for developing EF and EFB function block libraries in C language
 - Unity SFC View software for display and diagnostics of applications written in Sequential Function Chart (SFC) language

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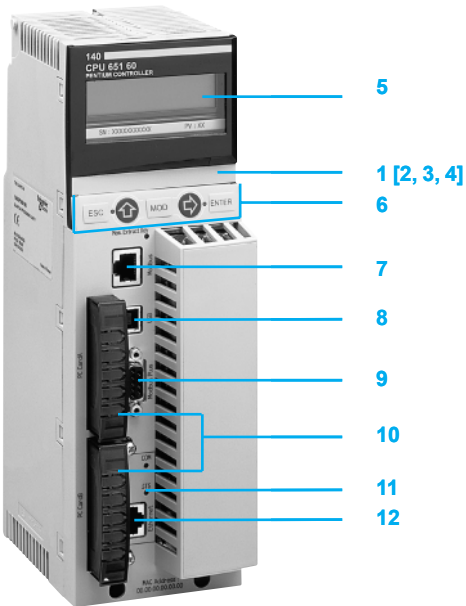
140 CPU 434 12U/534 14U

Description

Basic processors

The **140 CPU 311 10** and **140 CPU 434 12U** processor front panels comprise:

- 1 A display unit consisting of 7 LEDs:
 - Ready LED (green): the CPU has passed the power-up diagnostic tests
 - Run LED (green): the CPU has been started and is solving logic
 - Modbus LED (green): communications are active on the Modbus port
 - Modbus Plus LED (green): communications are active on the Modbus Plus port
 - Mem Prt LED (orange): write-protected memory (activated memory protection switch)
 - Bat Low LED (red): the battery needs replacing or is not present
 - Error A LED (red): indicates communications error on the Modbus Plus port
- 2 One backup battery slot
- 3 One slide switch for selecting the Modbus port communication parameters
 - One slide switch (140 CPU 311 10 model) to write-protect the memory.
- 4 One key-operated switch (140 CPU 434 12U model):
 - Stop position: the programmable controller is stopped and program modifications are not authorized
 - Mem Prt position: the programmable controller is either stopped or is running and program modifications are not authorized
 - Start position: the programmable controller is either stopped or is running and program modifications are authorized
- 5 Two 9-pin female SUB-D connectors for connecting to the Modbus bus
- 6 One 9-pin female SUB-D connector for connecting to the Modbus Plus network
- 7 A removable, hinged door with customer identification label.



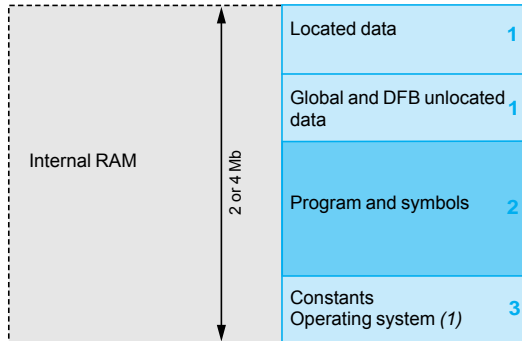
140 CPU 651 50/60

High-performance processors

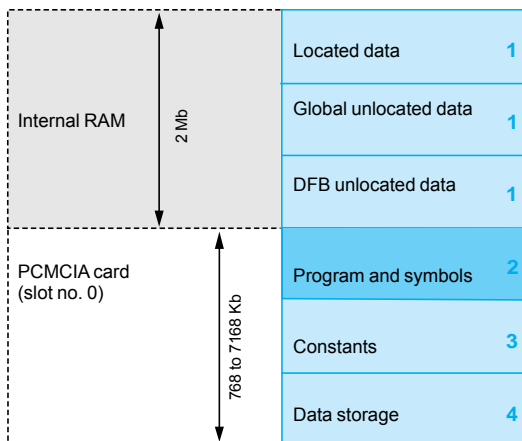
The **140 CPU 651 50**, **140 CPU 651 60** and **140 CPU 671 60** processor front panels comprise:

- 1 An LCD display cover, providing access to:
- 2 A key switch:
 - Unlocked: all system menu operations are able to be invoked and all changeable module parameters are able to be modified by the operator via the LCD and keypad, memory protection is off.
 - Locked: no system menu operations are able to be invoked and all changeable module parameters are read only, memory protection is on.
- 3 One backup battery slot.
- 4 One 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 One 9-pin female SUB-D connector for connecting to the Modbus Plus network.
- 10 Two slots for PCMCIA memory extension cards.
- 11 Two LEDs:
 - COM LED (green): indicates Ethernet activity (140 CPU 651 50/60 models), indicates Hot Standby primary or secondary station activity (140 CPU 671 60 model)
 - ERR LED (red): indicates Ethernet collision (140 CPU 651 50/60 models), indicates communications error between Hot Standby primary and secondary stations (140 CPU 671 60 model).
- 12 An RJ45 connector for connecting to the Ethernet network (140 CPU 651 50/60 model).
 - One MT-RJ fiber optic connector for interconnecting the primary and secondary PLCs in the Hot Standby architecture (140 CPU 671 60 model).

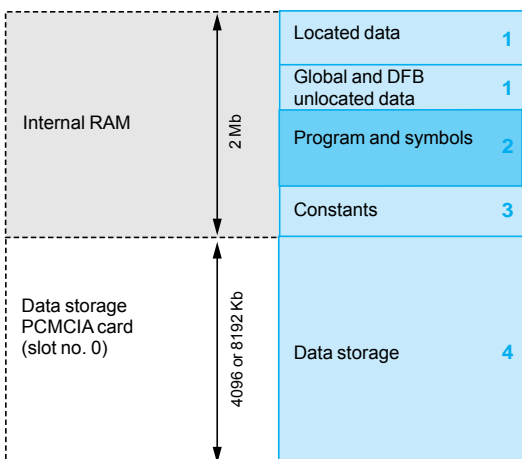
Processor without a PCMCIA memory card



Processor with PCMCIA memory card in slot no. 0



Processor with data storage type memory card in slot no. 0



Memory structure

The application memory is divided into memory areas physically distributed in the internal RAM memory and on 1 or 2 PCMCIA memory extension cards (only on **140 CPU 651 50/60** and **140 CPU 671 60** processors):

- 1 Application data area always in the internal RAM. This area is broken down into 2 types of data to be used according to the user's habits and choices:
 - Located data corresponding to data defined by an address (for example, %MW237) with which a symbol may be associated (for example, Counting_rejects)
 - Unlocated data corresponding to data defined only by a symbol. This type of addressing removes the memory "mapping" management constraints because addresses are assigned automatically
 - DFB unlocated data corresponding to DFB user function blocks. The size of this object zone is limited only by the available memory in integrated RAM.
- 2 Application program and symbols area in the internal RAM or in the PCMCIA memory card (descriptor, executable code of tasks and application symbol database).
- 3 Constants area in the internal RAM or in the PCMCIA memory card (constant words, initial values and configuration).
- 4 Area for storing additional data that can be used for distributed applications to store information such as production data and manufacturing recipes (only on **140 CPU 651 50/60** and **140 CPU 671 60** processors).

According to the application memory size requirements, two memory structures are possible depending on whether the Quantum processor (140 CPU 651 50/60 or 140 CPU 671 60 models) has 0, 1 or 2 PCMCIA memory extension cards:

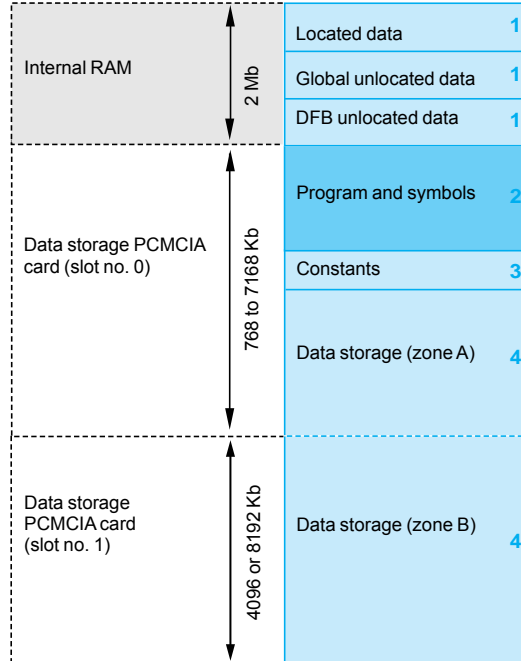
- Application in internal RAM, the application is completely loaded into the processor's battery-backed internal RAM (2), the capacity of which depends on the processor model.
- Application in the PCMCIA card, whereby the internal RAM is reserved for the application data. The PCMCIA memory card contains the program space (program areas, symbols and constants). Certain types of PCMCIA memory card also utilize the data file storage area.

The presence of the symbols area with the program area is optional. Having the application symbols database on the PLC means that, when connected to a programming terminal not containing any applications, all the elements needed to debug or upgrade this PLC are available within the PLC.

(1) Only for **140 CPU 311 10/434 12U** processors.

(2) The internal RAM memory is backed up by a cadmium nickel battery. The RAM memory cards are protected by a Lithium battery.

Processor with 2 PCMCIA memory cards in slots no. 0 and no. 1



Memory structure (continued)

Extension of the file storage area

With the **TSX MRP F004M/F008M** file storage memory cards (4096 or 8192 Kb):

- A file storage area can be provided when the application is completely loaded in the internal RAM.
- The memory space can be freed up for the program when the application is in the PCMCIA card.

The Unity Pro programming software assists the application designer with management of the structure and the occupation of memory space in the Quantum PLC.

Protecting the application

Whatever the PLC memory structure:

- The application located in the internal RAM or in the PCMCIA card can be protected in order to prohibit its access (read or modify program) in online mode with Unity Pro.
- A memory protection bit, to be set in configuration mode, is also available to lock any program modification (via the programming terminal or downloads).

Quantum programmable controllers have been developed to comply with the main national and international standards in respect of the electronic equipment used in process automation. See pages 43511/2 to X0010/3 “Standards, certification and environmental conditions”.

Characteristics and performance

Type of processor			140 CPU 311 10	140 CPU 434 12U	140 CPU 651 50	140 CPU 651 60	140 CPU 671 60	
Maximum configuration	No. of racks with 2/3/4/6/10/16 slots	Local I/O	2					
		Remote I/O	31 drops x 2 racks					
		Distributed I/O	63 drops x 1 rack/3 networks					
Inputs/Outputs (1)	Discrete I/O	Local I/O	Unlimited (27 slots max.)		Unlimited (26 slots max.)			
		Remote I/O	31,744 inputs and 31,744 outputs					
		Distributed I/O	8000 inputs and 8000 outputs per network					
	Analog I/O	Local I/O	Unlimited (27 slots max.)		Unlimited (26 slots max.)			
		Remote I/O	1984 inputs and 1984 outputs					
		Distributed I/O	500 inputs and 500 outputs per network					
	Application-specific I/O	Intrinsic safety, counter, motion control I/O, high-speed interrupt inputs, serial link, accurate time stamping						
Communications	No. of option modules (in local rack)	Ethernet, Modbus Plus, Profibus DP, SERCOS, SY/Max	2	6				
	Maximum no. of Modbus connections		2 integrated RS (2)	2 integrated RS 232 Modbus/ASCII	1 integrated RS 232/485 Modbus/ASCII			
		Modbus Plus	1 integrated, 2 max. in local rack	1 integrated, 6 max. in local rack				
		Ethernet TCP/IP	2 max. in local rack	6 max. in local rack	1 integrated, 6 max. in local rack			
		Profibus DP	2 max. in local rack	6 max. in local rack				
		AS-Interface	Unlimited (27 slots max.) in local rack, 4 in remote drop, 2 in distributed drop		Unlimited (26 slots max.) in local rack, 4 in remote drop, 2 in distributed drop			
		USB	-		1 port reserved for programming PC			
Functions	Redundancy	Power supplies, remote I/O networks, Modbus Plus, Ethernet TCP/IP, CPUs						
	Process control	Yes						
	Hot Standby	-				Yes		
Memory capacity without PCMCIA card	Internal RAM	Mb	2	4	2			
	Program and unlocated data (min.)	Kb	400	800	512	1024		
	Located data and config. (max.)	Kb	148	256				
Memory capacity with PCMCIA card	Program	Kb	-		7168			
	Configuration and located/unlocated data (max.)	Kb	-		512	1024		
Maximum size of memory object areas	Flash	Kb	1152		-			
	Located internal bits (%Mi)	bits	51,712	65,528				
	Located internal data	Kb	19.3	130				
	Unlocated internal data	Kb	548	1056	512/768 (with/no PCMCIA)	1024		
Key switch	Start/Stop/Mem prot		-	Yes		-		
	Mem prot on/off		-	-		Yes		
Slide switch	Mem prot/off		Yes	-				
	Com port: ASCII/RTU/Mem		Yes	-				
Application structure	Master task		1 cyclic/periodic					
	Fast task		1 periodic					
	Auxiliary tasks		0		4			
	Interrupt tasks	Max. number		64		128		
		I/O Interrupt		64		128		
	Timer Interrupt		16		32			
Execution time for one instruction (3)	Boolean	μ s	0.12...0.585		0.0525...0.075			
	On word	μ s	0.12...0.585		0.045...0.06			
	On fixed-point arithmetic	μ s	0.10...0.27		0.045...0.06			
	Floating point	μ s	0.10...0.27	0.48...0.56		0.40...0.50		
No. of Kinstructions executed by ms	100% boolean	Kins/ms	1.86		10.28			
	65% boolean and 35% numerical	Kins/ms	2.49		9.91	10.07		
System overhead	MAST task	ms	1					
	FAST task	ms	0.2					
Bus current required		mA	1300	1800	3300	3800	3900	

(1) The maximum values of number of discrete and analog I/O are not cumulative.

(2) 2 RS 232/485 Modbus/ASCII integrated links

(3) Threshold values according to the type of instructions.

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140 CPU 311 10



140 CPU 651 00



TSX C USB 232



990 NAD 211 00



990 NAD 218 00



TSX C USB MBP

Unity CPUs

Processor		Memory (max.)			Communication ports	Reference	Weight
Clock speed	Coprocessor	RAM	Program	Program with PCMCIA card.			
MHz		Mb	Kb	Kb			kg
66	Built-in math processor	2	548	–	2 Modbus RS 232 1 Modbus Plus	140 CPU 311 10	–
	Built-in math processor	2	1056	–	2 Modbus RS 232 1 Modbus Plus	140 CPU 434 12U	–
166	Yes, built-in Ethernet TCP/IP	2	768	7168	1 Modbus (1) 1 Modbus Plus 1 USB 1 Ethernet TCP/IP	140 CPU 651 50	–
266	Yes, built-in Ethernet TCP/IP	2	1024	7168	1 Modbus (1) 1 Modbus Plus 1 USB 1 Ethernet TCP/IP	140 CPU 651 60	–
					1 Modbus (1) 1 Modbus Plus 1 USB 1 Hot Standby port (100 Mbps)	140 CPU 671 60	–

(1) Modbus RS 232/RS 485 port.

PCMCIA memory extension cards

Quantum 140 CPU 651 50/60 and 140 CPU 671 60 processors can accept up to 2 memory extension cards. However, the useful memory capacity is limited to the maximum size defined for the processor model. See pages 48281/2 and 48281/3.

Connection cordsets

Description	Use		Length	Reference	Weight
	From processor	To PC port			
Connection cordsets for PC terminal	Modbus port, 9-pin SUB-D for: 140 CPU 311 10, 140 CPU 434 12U	RS 232 (9-pin SUB-D connector)	3.7 m	990 NAA 263 20	0.300
			15 m	990 NAA 263 50	1.820
		USB port	0.4 m	TSX C USB 232 (1) ▲	0,145
	Modbus port, RJ45 for: 140 CPU 6●1 ●0	RJ45 connector	1 m	110 XCA 282 01	–
			3 m	110 XCA 282 02	–
6 m			110 XCA 282 03	–	
	USB port	0.4 m	TSX C USB 232 (2) ▲	0,145	
Connection cordsets for Modbus Plus network	Modbus Plus port, 9-pin SUB-D for: 140 CPU 311 10, 140 CPU 434 12U Elbowed connector (left side)	Modbus Plus tap (3)	2.4 m	990 NAD 211 10	–
			6 m	990 NAD 211 30	–
	Modbus Plus port, 9-pin SUB-D for: 140 CPU 6●1 ●0 Straight connector	Modbus Plus tap (3)	2.4 m	990 NAD 218 10	–
			6 m	990 NAD 218 30	–
Modbus Plus / USB converter	Modbus Plus tap (3)	USB port	0.4 m	TSX C USB MBP (4) ▲	0,186
Adaptator	RJ45 connector for 140 CPU 6●1 ●0	RS 232 (9-pin SUB-D connector)	–	110 XCA 203 00	–

(1) With TSX C USB 232 converter, use the 990 NAA 263 20/30 cordset.

(2) With TSX C USB 232 converter, use the 110 XCA 203 00 adaptator and 110 XCA 282 0● cordset.

(3) Modbus Plus tap: 990 NAD 230 20/21 (IP 20) or 990 NAD 230 10 (IP 65).

(4) With TSX C USB MBP converter, use the 990 NAD 211 10/30 or 990 NAD 218 10/30 cordset.

▲ Available 3rd quarter of 2006