PACSystems Control System Overview

The PACSystems controller environment combines performance, productivity, openness and flexibility. The PACSystems control system integrates advanced technology with GE Fanuc's existing systems. The result is seamless migration that protects your investment in I/O and application development.

PACSystems is driven by Machine Edition programming software, which provides a universal engineering development environment for all programming, configuration and diagnostics of PACSystems. A PACSystems CPU is programmed and configured using the programming software to perform real time control of machines, processes, and material handling systems. The CPU communicates with I/O and smart option modules through a rack-mounted backplane. It communicates with the programmer and/or HMI devices via the Ethernet ports (may be embedded for RX7i) or via the serial ports 1 and 2 using GE Fanuc SNP-X, Serial I/O, or Modbus RTU slave protocols.

PACSystems CPU Models

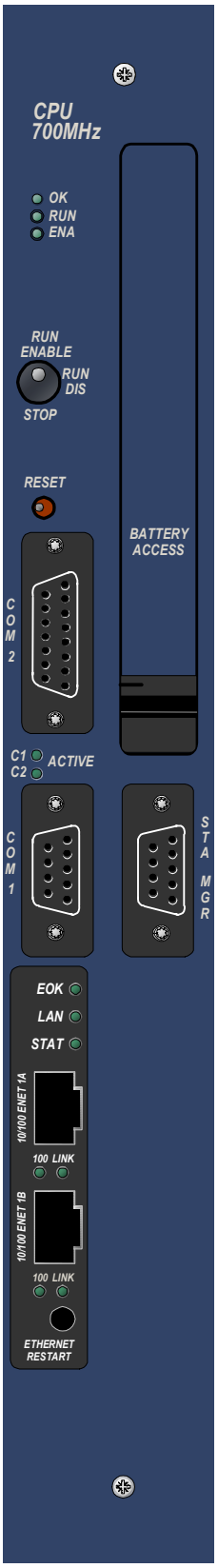
Family	*Catalog Number*	*Description*
RX3i	IC695CPU310	300MHz CPU
RX7i	IC698CPE010	300Mhz CPU with embedded Ethernet interface
	IC698CPE020	700Mhz CPU with embedded Ethernet interface
	IC698CRE020	700MHz Redundancy CPU with embedded Ethernet interface

PACSystems CPU models have the following features in common:

- Programming in Ladder Diagram and C.
- Floating point (real) data functions.
- Configurable data and program memory.
- 10 Mbytes of battery-backed RAM for user data (program, configuration, register data, and symbolic variable) storage
- 10 Mbytes of non-volatile built-in flash memory for user data (program, configuration, register data, and symbolic variable) storage. Use of this flash memory is optional.
- Battery backup for program, data, and time of day clock.
- Configurable Run/Stop mode switch.
- Embedded RS-232 and RS-485 communications.
- Up to 512 program blocks. Maximum size for a block is 128KB.
- Auto Located Symbolic Variables, which allows you to create a variable without specifying a reference address.
- Bulk memory area accessed via reference table %W. The upper limit of this memory area can be configured to the maximum available user RAM.
- Larger reference table sizes, compared to Series 90 CPUs: 32Kbits for discrete %I and %Q and up to 32K words each for analog %AI and %AQ.
- Test Edit mode that allows you to easily test modifications to a running program.

RX7i Features and Specifications

- **IC698CPE010:** 300MHz CPU microprocessor
- **IC698CPE020:** 700MHz CPU microprocessor
- **IC698CRE020:** 700MHz CPU microprocessor with redundancy



Indicators

Five CPU LEDs indicate the operating status of various CPU functions.

The Ethernet Interface indicators consist of seven light emitting diodes (LEDs). All are single-color green LEDs controlled by the Ethernet interface.

- Module OK (EOK)
- LAN online (LAN)
- Status (STAT)
- Two activity LEDS (LINK)
- Two speed LEDS (100)

The **EOK**, **LAN**, and **STAT** LEDs are grouped together and indicate the state and status of the Ethernet interface.

Each Ethernet port has two green LED indicators, **Link** and **100**. The **LINK** LED indicates the network link status and activity. This LED is illuminated when the link is physically connected and blinks when traffic is detected at the port. Note that traffic at the port does not necessarily mean that traffic is present at the Ethernet interface, since the traffic may be going between ports of the switch. The **100** LED indicates the network data speed (10 or 100 Mb/sec). This LED is illuminated if the network connection is 100 Mbps.

LED operation is described in the following tables.

Error Checking and Correction

The redundancy CPU, IC698CRE020, is shipped with error checking and correction (ECC) enabled. Enabling ECC results in slightly slower system performance, primarily during power-up, because it uses an extra 8 bits that must be initialized. If you upgrade the firmware on a non-redundancy CPU model IC698CPE020 to support redundancy, you must set the ECC jumper to the enabled state as described in the installation instructions provided with the upgrade kit. This feature is not available for other CPUs in the PACSystems family

For details on ECC, refer to the *PACSystems Hot Standby CPU Redundancy User's Guide,* GFK-2308.

Specifications

For environmental specifications, see "RX7i General Specifications" in Appendix A of the *RX7i Installation Manual,* GFK-2223.

IC698CPE010, IC698CPE020, and IC698CRE020	
Battery: Memory retention	5 years at 20°C (68°F) 40 days nominal without applied power
Program storage	Up to 10 Mbytes of battery-backed RAM 10 Mbytes of non-volatile flash user memory
Current required from 5V bus	CPE010: 3.2 Amps nominal CPE020, CRE020: 4.5 Amps nominal
Operating Temperature	CPE010: 0 to 50°C (32°F to 122°F 0 to 60°C (32°F to 140°F) with fan tray CPE020, CRE020: 0 to 60°C (32°F to 140°F), fan tray required
Floating point	Yes
Boolean execution speed, typical CPE010 CPE020	 0.195ms per 1000 Boolean contacts/coils 0.14ms per 1000 Boolean contacts/coils
Time of Day Clock accuracy Elapsed Time Clock (internal timing) accuracy	Maximum drift of 9 seconds per day 0.01% maximum
Embedded communications	RS-232, RS-485, Ethernet interface
Serial Protocols supported	Modbus RTU Slave, SNP, Serial I/O To determine availability for a given firmware version, please refer to the *Important Product Information* document provided with the CPU.
Ethernet Ports	Embedded auto-sensing 10/100 Mbps half/full duplex Ethernet interface
VME Compatibility	System designed to support the VME64 standard ANSI/VITA 1
Program blocks	Up to 512 program blocks. Maximum size for a block is 128KB.
Memory (For a detailed listing of memory areas, refer to chapter 7.)	*%I and %Q:* 32Kbits for discrete *%AI and %AQ:* configurable up to 32Kwords *%W:* configurable up to the maximum available user RAM *Symbolic:* configurable up to 10 Mbytes
Error Checking and Correction	CRE020 only.

IC698CPE010, IC698CPE020, and IC698CRE020	
Ethernet Interface Specifications	
Web-based data monitoring	Up to 16 web server and FTP connections (combined)
Ethernet data rate	10Mb/sec and 100Mb/sec
Physical interface	10BaseT RJ45
WinLoader support	Yes
Number of EGD configuration-based pages	255
Time synchronization	SNTP
Selective consumption of EGD	Yes
Load EGD configuration from PLC to programmer	Yes
Remote Station Manager over UDP	Yes
Local Station Manager (RS-232)	Dedicated RS-232 port
Configurable Advanced User Parameters	Yes

Chapter 3

CPU Configuration

The PACSystems CPU and I/O system is configured Machine Edition Logic Developer-PLC programming software.

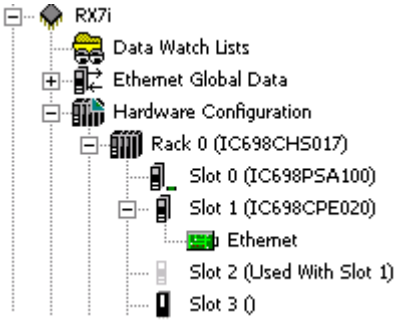
The CPU verifies the actual module and rack configuration at power-up and periodically during operation. The actual configuration must be the same as the programmed configuration. Deviations are reported to the CPU alarm processor function for configured fault response. Refer to the *Machine Edition Logic Developer-PLC Getting Started Manual*, GFK-1918 and the online help for a description of configuration functions.

Note: An IC698CPE020 can be easily converted to a CRE020 by installing different firmware and moving a jumper. Detailed instructions are included in the firmware upgrade kit for CRE020.

Configuring the CPU

To configure the CPU using the Logic Developer-PLC programming software, do the following:

1. In the Project tab of the Navigator, expand your PACSystems Target, the hardware configuration, and the main rack (Rack 0).
2. Right click the CPU slot and choose Configure. The Parameter Editor window displays the CPU parameters.



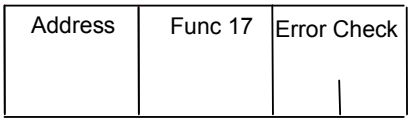
Note: An RX7i CPU must be installed in slot 1. The RX3i CPU occupies two slots and can be installed in any pair of slots except the two highest numbered slots in the rack.
For details on migrating Series 90-30 applications to RX3i, refer to Appendix C.

3. To edit a parameter value, click the desired tab, then click in the appropriate Values field. Refer to “Configuration Parameters” on page 3-2 for information on these fields.
4. Store the configuration to the PLC so these settings can take effect. For details, see “Storing (Downloading) a Configuration” on page 3-15.

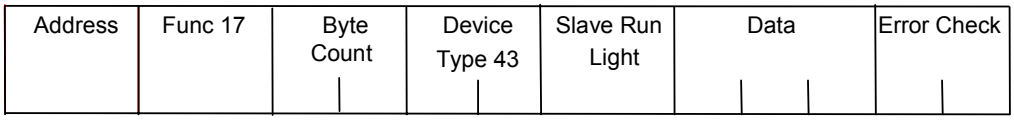
Note: The embedded Ethernet Interface is displayed in a subslot of the CPU slot. For details on configuring the embedded Ethernet Interface, refer to chapter 4.

Message (17): Report Device Type

Format:



Query



Normal Response

Query:

The Report Device Type query is sent by the master to a slave in order to learn what type of programmable control or other computer it is.

- An address of zero is not allowed as this cannot be a broadcast request.
- The function code is 17.

Response:

- The byte count field is one byte in length and is equal to 5.
- The device type field is one byte in length and is equal to 43 (hexadecimal) for the PACSystems
- The slave run light field is one byte in length. The slave run light byte is equal to OFFH if the CPU is in RUN mode. It is equal to 0 if the CPU is not in RUN mode.
- The data field contains three bytes. For PACSystems CPUs, the first byte is the Minor Type, and the remaining bytes are zeroes. The minor types are shown in the following table.

Response Data (Minor Type)	***Device Type Description***
02	RX7i 300Mhz CPU (IC698CPE010)
04	RX7i 700Mhz CPU (IC698CPE020)
05	RX7i 700Mhz Redundant CPU (IC698CRE020)
06	RX7i 600Mhz CPU (IC698CPE030)
08	RX7i 1.6Ghz CPU (IC698CPE040)
0A	RX3i 300Mhz CPU (IC695CPU310)

Function Group	Function	CPE 010				CPE 020			
		Enabled	Disabled	Increment	Size	Enabled	Disabled	Increment	Size
	ACOS	4.5	1.0	-	-	1.9	0.5	-	-
	ATAN	3.7	1.0	-	-	1.6	0.5	-	-
	Logarithmic:				-				
	LOG	3.4	1.0	-	-	1.5	0.4	-	-
	LN	3.5	1.0	-	-	1.5	0.4	-	-
	EXPT	-	-	-	-	-	-	-	-
	EXP	4.6	1.0	-	-	1.8	0.4	-	-
	Comparison:								
	EQ_REAL	5.2	2.1	-	-	2.2	0.9	-	-
	NE_REAL	5.2	2.1	-	-	2.2	0.9	-	-
	GT_REAL	5.1	2.1	-	-	2.2	0.9	-	-
	GE_REAL	5.1	2.1	-	-	2.2	0.9	-	-
	LT_REAL	5.1	2.1	-	-	2.2	0.9	-	-
	LE_REAL	5.1	2.1	-	-	2.2	0.9	-	-
	CMP_REAL	-	-	-	-	-	-	-	-
	Data Move:								
	MOVE_REAL	4.2	1.5	-	-	1.7	0.7	-	-
	Conversion:								
	REAL_TO_INT	3.6	1.1	-	-	1.5	0.5	-	-
	REAL_TO_UINT	3.6	1.1	-	-	1.5	0.5	-	-
	REAL_TO_DINT	3.9	1.1	-	-	1.6	0.5	-	-
	INT_TO_REAL	3.5	1.3	-	-	1.5	0.6	-	-
	UINT_TO_REAL	3.5	1.3	-	-	1.5	0.6	-	-
	DINT_TO_REAL	3.2	1.1	-	-	1.4	0.5	-	-
	REAL_TRUN_INT	-	-	-	-	-	-	-	-
	REAL_TRUN_DINT	-	-	-	-	-	-	-	-
	DEG_TO_RAD	3.1	1.0	-	-	1.3	0.4	-	-
	RAD_TO_DEG	3.1	1.0	-	-	1.3	0.4	-	-
	BCD4_TO_REAL	3.5	1.3	-	-	1.7	0.6	-	-
	BCD8_TO_REAL	3.6	1.1	-	-	1.6	0.5	-	-

Boolean Execution Times

Boolean execution speed, typical	
IC695CPU310	0.195ms per 1000 Boolean contacts/coils
IC698CPE010	0.195ms per 1000 Boolean contacts/coils
IC698CPE020	0.14ms per 1000 Boolean contacts/coils

Communications

Category	*Series 90-70*	*Series 90-30*	*PACSystems*
Communicating with Machine Edition	Modem, serial port, and Ethernet.	Same as Series 90-70.	Ethernet supported on all versions. Serial port supported on later versions. refer to the *Important Product Information* document for a specific CPU firmware version.
Ethernet adapters	Ethernet Interface Module IC697CMM742, in any rack.	CPUs 364 and 374 have an embedded Ethernet interface. Ethernet Interface Module IC693CMM321, in any rack.	IC698CPE010, IC698CPE020, and IC698CRE020 have an embedded Ethernet daughterboard. Ethernet module IC698ETM001 in RX7i main rack only. Maximum number: 3. Ethernet module IC695ETM001 in RX3i main rack only. Maximum number: 4.
Configuring Ethernet	Involves temporarily connecting your computer to the PLC by serial cable.	Same as Series 90-70.	Can use the Set Temporary IP Address utility for a temporary connection, during which the permanent IP address can be set. Later versions support serial connection. Refer to the *Important Product Information* document for a specific CPU firmware version.
Web-based data monitoring	Not supported.	Not supported.	Up to 16 web server and FTP connections (combined)
Network routing	Supported through CMM742 Ethernet Interface configuration.	Not supported.	Not supported.
Serial ports	Can be used to communicate with Machine Edition. Provide SNP, Disabled, and Custom modes. Refer to the Serial Communications User's Manual, GFK-0582.	Same as Series 90-70.	Ports 1 and 2 provide serial interfaces to external devices. Port 1 is also used for firmware upgrades. The third on-board serial port is used as the Ethernet station manager port. . Provide RTU Slave, Message, and SNP Slave, Serial I/O, and Available modes.
Serial port default protocol	SNP	SNP	Modbus RTU.
Serial port communications from C applications	Scanf and Printf.	Same as Series 90-70.	ANSI-style read/write.