PACSystems™ RX3i

IC695CMU310

Max-ON Hot-Standby Redundancy CPU

GFK-2420J
November 14, 2008

The RX3i Max-ON CPU IC695CMU310 provides Hot-Standby CPU redundancy using two RX3i systems. The redundant controllers exchange operating data by way of one or two dedicated Ethernet LANs. Each RX3i system in a Max-On application consists of:

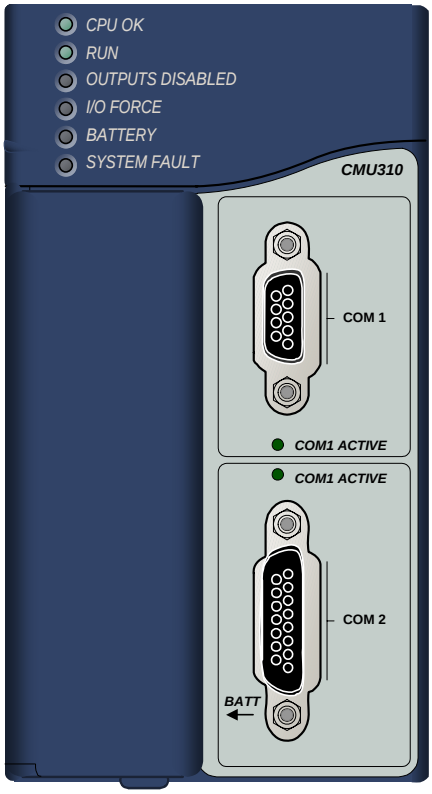
- the Max-ON CPU (IC695CMU310)
- an RX3i Universal Backplane (IC695CHS0xx)
- an RX3i power supply (IC695PSxxxx)
- one or more RX3i Ethernet modules (IC695ETM001)
- Max-ON application software
- Optional Series 90-30 expansion backplanes.
- PACSystems RX3i and/or Series 90-30 modules, as appropriate for the application.

The Max-ON CPU is compatible with a wide range of RX3i and Series 90-30 modules, backplanes, and other equipment, as listed in the *PACSystems RX3i Hardware and Installation Manual,* GFK-2314.

Max-ON redundancy applications include fuel loading, standby power generation, boiler systems, and manufacturing systems. The proprietary Max-ON software provides subroutines for synchronization of variables, program equivalence testing, selection of master CPU, and diagnostics. When using Max-ON redundancy, transfer of control from the Master to the Backup can take two to three CPU logic scans. I/O states are maintained during the transfer. Max-ON redundancy is not suitable for SIL 2 or 3 applications.

Features

- Programming in Ladder Diagram, Structured Text, Function Block Diagram, and C.
- Auto-located Symbolic Variables that can use any amount of user memory.
- 10 Mbytes of battery-backed user memory and 10 Mbytes of non-volatile flash user memory. Use of this flash memory is optional.
- Access to bulk memory via reference table %W.
- Reference table sizes include 32Kbits for discrete %I and %Q and up to 32Kwords each for analog %AI and %AQ.
- Up to 512 program blocks. Maximum size for a block is 128KB.
- Test Edit mode to check changes to a running program.
- Bit-in-word referencing.
- Battery-backed calendar clock.
- In-system upgradeable firmware.
- Two serial ports: RS-485 and RS-232.
- CPU and module firmware upgrades via Winloader through CPU's RS-232 or RS-485 serial port.



Ordering Information

Description	Catalog Number
PACSystems RX3i Max-ON CPU	IC695CMU310
Lithium Battery Pack	IC698ACC701
Auxiliary Battery Module (optional)	IC693ACC302
RX3i Power Supply, 40 Watt High Capacity Universal AC Power Supply	IC695PSA040
RX3i Power Supply, 40 Watt High Capacity 24 VDC Power Supply	IC695PSD040
RX3i Multi-Purpose Power Supply, 40 Watt High Capacity Universal AC	IC695PSA140
RX3i Multi-Purpose Power Supply, 40 Watt High Capacity 24 VDC	IC695PSD140
[Optional] RS-232 Cable	IC200CBL001
Rx3i Standard 12 Slot Backplane	IC695CHS012
Rx3i Standard 16 Slot Backplane	IC695CHS016

Note: For Conformal Coat option, please consult the factory for price and availability.

Specifications

Battery: Memory retention	For estimated battery life under various conditions, refer to the *PACSystems CPU Reference Manual,* GFK-2222.
Program storage	Up to 10 Mbytes of battery-backed RAM 10 Mbytes of non-volatile flash user memory
Power requirements	+3.3 VDC: 1.25 Amps nominal +5 VDC: 1.0 Amps nominal
Operating Temperature	0 to 60°C (32°F to 140°F)
Floating point	Yes
Boolean execution speed	0.195ms per 1000 Boolean contacts/coils, typical
Time of Day Clock accuracy	Maximum drift of 2 seconds per day
Elapsed Time Clock (internal timing) accuracy	0.01% maximum
Embedded communications	RS-232, RS-485
Serial Protocols supported	Modbus RTU Slave, SNP, Serial I/O
Backplane	Dual backplane bus support: RX3i PCI and 90-30-style serial
PCI compatibility	System designed to be electrically compliant with PCI 2.2 standard
Program blocks	Up to 512 program blocks. Maximum size for a block is 128KB.
Memory	*%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

For environmental specifications and compliance to standards (for example, FCC or European Union Directives), refer to the *PACSystems RX3i Hardware and Installation Manual,* GFK-2314.

Release History

Catalog Number	*FW Revision*	*Comments*
IC695CMU310-CK	5.60	Supports the IC695PMM335 PACMotion Multi-Axis Motion Controller. Adds the other new features listed on page 3. Corrects problems listed on page4.
IC695CMU310-CJ	5.50	Supports Run-mode store of EGD. Adds support for LREAL data type.
IC695CMU310-CH	5.03	Corrects problem of Corrupted User Memory issue after a power cycle. Corrects problem in 5.02 firmware only, in which loss of certain IC694 and IC693 modules in an expansion rack caused the outputs of similar modules in all expansion racks to be disabled when the “Loss of Module” fault was configured as diagnostic.
IC695CMU310-BG	5.02	Fixed an issue where certain IC694/IC693 modules in the main backplane did not transition to stop mode after a “Loss of Module” fault was logged.
IC695CMU310-BF	5.00	Supports Scan_Set_IO, Quality Function Blocks, Optional UDF Parameters, IEC Transitionals, SNPT Network time sync.
IC695CMU310-BE	3.83	Supports PACSystems RX3i Serial Communications Modules IC695CMM002 and CMM004.
IC695CMU310-BD	3.82	
IC695CMU310-BC	3.81	Supports eight ETM modules in main backplane
IC695CMU310-AB	3.52	
IC695CMU310-AA	3.51	Initial Release

Important Product Information for this Release

Firmware release 5.60 adds support for the PACMotion Multi-Axis Motion Controller, IC695PMM335, in addition to other new features, listed in "New Features and Enhancements in Release 5.60," below. This release also corrects the issues listed in "Problems Resolved by Release 5.60" on page 4.

This release supports Proficy Process Systems (PPS) release 1.50 and later.

Updates

IC695CMU310 is field upgradeable to firmware version 5.60 using the firmware upgrade utility and upgrade kit 44A753019-G09, which can be downloaded from http://support.gefanuc.com/.

RX3i Max-ON CPU Functional Compatibility

Programmer Version	Proficy® Machine Edition Logic Developer 5.9 is required to use the new Release 5.60 features with the RX3i CPU. Proficy® Machine Edition Logic Developer 5.8 is required to use the new Release 5.50 features with the RX3i CPU. Proficy® Machine Edition Logic Developer 5.7 is required to use the new Release 5.0 features with the RX3i CPU. Proficy Machine Edition Logic Developer 5.5 SIM 1 is required to enable use of the RX3i Max-ON CPU. Proficy Machine Edition Logic Developer 5.5 with Service Pack 1 is required to use the eight ETM feature with the RX3i Max-On CPU.
C Toolkit Compatibility	C Toolkit Release 5.50 is required to use the new LREAL data type. C Toolkit Release 5.00 Build 16C1 is required when the PACSystems CPU contains firmware Release 5.00 or later. C Toolkit Release 3.50 Build 34A1 is required for PACSystems RX3i Max-ON CPU Note: ALL C blocks must be recompiled using the new toolkit before downloading to a CPU that contains Release 5.00 firmware.
COMMREQ to PBM300	The behavior of the COMMREQ fault output on a COMMREQ sent to the PROFIBUS master module IC695PBM300 is compatible with the Series 90-30 CPU366 PROFIBUS Master.
Recommended IC200ALG240 revision	When a VersaMax™ system Genius® Network Interface Unit (IC200GBI001) interoperates with a Genius Bus Controller located in a PACSystems RX3i, and the VersaMax system contains an IC200ALG240 Analog Input Module, it is recommended to update the IC200ALG240 firmware to Revision 1.10 or later. Use firmware update kit 44A752313-G01, available in Knowledge Base Article i023269 at globalcare.gefanuc.com.

New CPU Features and Enhancements in Release 5.60

- **New Module Support** - The IC695PMM335 motion module and FTB001 Fiber I/O Terminal Block are now supported.
- **Diagnostic Logic Block** - To assist with commissioning and diagnostics, the Proficy Machine Edition software provides the capability to program one diagnostic logic block that can be downloaded to the RX3i CPU and executed without altering the main program logic.
- **MOVE_DATA and EQ_DATA function blocks** – These functions enable data in structured variables to be copied and compared.
- **PLCopen Compliance** – The RX3i CPU and PMM335 motion modules now support 56 new PLCopen compliant motion functions and function blocks. Details of these function blocks can be found in the *PACMotion Multi-Axis Motion Controller User's Manual,* GFK-2448.

Problems Resolved by Release 5.60

Subject	Description
Errors when downloading a DSM324 Local Logic program.	In previous versions, an attempt to download a Local Logic program file with a length that is a multiple of the transfer buffer size will fail. When this happens, the error codes *31 group 16* and *140 group 121* are displayed and the DSM324's module status code reports the error 0XF0A3, "Local Logic Program Constant Terminator Error." Release 5.6 fixes this issue.
Erroneous logging of Constant Sweep Time Exceeded faults when using multiple GBCs in an RX3i with Constant Sweep window mode.	When using multiple GBCs in an RX3i with window mode set for Constant Sweep, Constant Sweep Time Exceeded faults are reported. The revision addresses erroneous logging of the fault, however there are cases where the fault will occur.
Attempting a run-mode store, upload, or verify of a large project may result in Machine Edition disconnecting.	For projects with long block names and a large number of program blocks, run-mode store, upload or verify operations over an Ethernet connection may fail and Machine Edition may disconnect with "Error 8097: Server Error - Transfer Error: Remote disconnect has occurred. [0x6A][0x02]" This issue has been resolved in release 5.6.

Known Restrictions for this Release

Subject	Description
Max-ON software	Automatic report generation is not available. A work-around is to use the information that is displayed in the Status Window. The text may be selected and copied and pasted into another application.
Battery installation	When installing a new battery, when there currently is no battery installed, the battery must be installed while the CPU has power. Failing to follow this procedure could result in the CPU not powering up. If a battery is installed while power is off (and there was no battery previously installed), and the CPU fails to power up, simply remove the battery, power cycle the CPU and then install the battery.
Hot Swapping some Analog modules slowly results in modules not being recognized	Occasionally during a hot insertion (hot swap) of IC695 Non-Isolated Analog Input Modules, input channels may take up to 2 seconds to reflect actual input values after the module ok bit is enabled in the module status word. This only occurs when hot insertion has been done slowly (i.e. approximately 1.5 seconds to insert the module)
Ethernet Disconnect During Word for Word Change	If the Ethernet connection is broken during a word–for-word change, the programmer may not allow a subsequent word-for-word change after reconnecting. Recommendation: go offline and then back online again.
Simultaneous Clears, Loads and Stores Not Supported	Multiple programmers may not change CPU contents at the same time. The programming software may generate an error during the operation. Simultaneous loads from a single CPU are allowed. When using Machine Edition Version 5.50, which adds Monitor and Programmer Modes, simultaneous Clear and Stores cannot be attempted.
Hardware Configuration Not Equal After Changing Target Name	If a hardware configuration is stored to flash that sets "Logic/Config Power up Source" to "Always Flash" or "Conditional Flash" and the name of the target is subsequently changed in the programming software, the hardware configuration will go Not Equal and will not Verify as equal.
Controller and IO Fault Tables May Need to be Cleared Twice to Clear Faulted State	Both Controller and IO fault tables may need to be cleared to take the CPU out of Stop/Fault mode. If one of the tables contains a recurring fault, the order in which the tables is cleared may be significant. Recommendation: if the CPU is still in Stop/Fault mode after both tables are cleared, try clearing the fault tables again.
Setting Force On/Off by Storing Initial Value	After a force on or force off has been stored to the CPU, it cannot be switched from force on to force off or vice-versa by downloading initial values. Recommendation: turn off the force by doing a download, and then change the force on or off by another download.

Subject	*Description*
Number of Active Programs Returned as Zero	The SNP request Return Controller Type and ID currently returns the number of active programs as zero.
Serial I/O Failure at 115K During Heavy Interrupt Load	Rarely, data corruption errors occur during serial communications when running at 115K if there is a heavy interrupt load on the CPU. Recommendation: under heavy load applications, restrict serial communications to 57K or lower.
SNP ID not always provided	The CPU's SNP ID does not appear in the Machine Edition programmer Show Status display. Service Request 11 will always return zeros.
Second programmer can change logic while in Test & Edit mode	While currently active in a Test and Edit session using Machine Edition on one PC, Machine Edition running on another PC is not prevented from storing new logic to the RX3i.
Must Have Logic If Powering-Up From Flash	If no user logic exists in the CPU RAM when a write to flash is performed, the CPU may not properly load from flash after a power cycle. In order to guarantee proper power up from flash, insure that both hardware configuration and logic have been stored to RAM before writing to flash.
CPU may not detect low-battery condition	A battery with very low capacity may still have a terminal voltage high enough to report that it is a good battery. When the battery starts supplying the memory power (battery backup), the battery voltage quickly drops to unacceptable levels, and it may fail. Recommendation: replace batteries in accordance with the guidelines provided in the *CPU Reference Manual*, GFK-2222. In addition, logic and hardware configuration can be saved to flash.
Two loss of module faults for Universal Analog Module	Occasionally, the hot removal of the Universal Analog Input Module (IC695ALG600) results in two "Loss of I/O Module" faults instead of one.
Power up of Series 90-30 HSC module may take up to 20 seconds	As power is applied to a 90-30 High-Speed Counter, the "module ready" bit in the status bits returned each sweep from the module may not be set for as long as 20 seconds after the first CPU sweep, even though there is no "loss of module" indication. I/O data exchanged with the module is not meaningful until the module has set this bit.
Informational fault at power up	Intermittently during power-up, an Informational non-critical CPU software fault may be generated with fault extra data of 01 91 01 D6. This fault has no effect on normal operation of the CPU. But if the hardware watchdog timer expires after this fault and before power has been cycled again, the outputs of I/O modules may hold their last state, rather than defaulting to zero.
Extended Memory Types for I/O Triggers	%R, %W and %M cannot be used as I/O triggers.
Possible Machine Edition inability to connect	Infrequently, an attempt to connect a programmer to an CPU via Ethernet is unsuccessful. The normal connection retry dialog is not displayed. Recommendation: Reboot the computer that is running the programmer.
SNP Update Datagram message	If an Update Datagram message requests 6 or fewer bits or bytes of data, the CPU returns a Completion Ack without Text Buffer. The protocol specifies that the returned data should be in the Completion Ack message, but it may not be.
GBC30 may not resume operation after power cycle	In rare instances, a GBC30 in an expansion backplane may not resume normal operation after a power cycle of either the expansion backplane or the main backplane.
Configuration of third-party modules	Do not specify a length of 0 in the configuration of a third-party module. The module will not work properly in the system.
Power supply status after CPU firmware update	The CPU reports a "Loss of or missing option module" fault for the IC695PSD140 RX3i power supply following an update of CPU firmware. The slot appears empty in the programmer's online status detail view. The power supply continues to operate normally. Recommendation: Power cycle to restore normal status reporting.
Power supply status after power cycling	Rarely, turning a power supply on or off may not result in an add or loss fault. Also, the slot will appear empty in the programmer's online status detail view. The power supply continues to operate normally. Power cycle to restore normal status reporting.
Don't use multiple targets	If the hardware configuration is stored from one target and logic is stored from a different target, powering-up from flash will not work. The observed behavior is that, following a power up from flash, ME reports hardware configuration and logic "not equal".

Subject	Description
Missing "Loss of terminal block" fault	The IC695ALG600/608/616 analog input modules do not produce a "Loss of terminal block" fault if the hardware configuration is stored or the module is hot-inserted when the terminal block is not locked into place.
Sequence Store Failure	Writing a very large hardware configuration to flash may cause a "Sequence Store Failure" error. To work around this error, either: 1. Perform an explicit clear of flash prior to performing the write. 2. Increase the operation timeout used by ME prior to performing the write.
IC694MDL754: Must configure module status bits	Always configure 16 bits of module status when using this module. Configuring 0 bits of module status will result in invalid data in the module's ESCP status bits.
IC695ALG600 Lead Resistance Compensation setting	A configuration store operation fails if a channel is configured for 3-wire RTD with Lead Resistance Compensation set to Disabled. A Loss of Module fault is logged in the I/O Fault table at the end of the store operation. Recommendation: to recover the lost module, change the configuration to enable Lead Resistance Compensation and power-cycle the module.
C Toolkit PlcMemCopy Documentation Incorrect	This routine does allow the destination and source pointers to be outside of reference memory. If the destination points to discrete reference memory, overrides and transitions will be honored. Note that the header for PlcMemCopy has been updated in Release 3.50 of the C toolkit.
WinLoader may stop operating	On computers running Windows 2000 and using some versions of Symantec Antivirus protection, WinLoader will "lock up" if used in advanced mode. Recovery requires cycling the computer's power.
Test and Edit Cancellation	While in Test and Edit mode, selecting Cancel will cause the RX3i to lose communications with the programmer—requiring a power cycle to restore operation. The remedy is to accept all Test and Edit changes.
Logic and HWC not equal after power cycle	If the Hardware Config from Target 1, with Logic/Configuration Power-up Source and Data Source both set to "Always from Flash," is stored in Flash, then Logic and Hardware Config from Target 2, with Logic/Configuration Power-up Source both set to "Always from RAM," is stored to RAM and there is a good battery, then when power is cycled the programmer may show that Logic and Hardware Config are not equal. The remedy is to clear Flash and then store the Logic and Hardware Config from Target 2.

Operating Notes

Subject	Description
Undefined Symbols in C Blocks	In Release 5.00 or later, if an attempt is made to download a C block containing undefined symbols, the download will fail. Machine Edition will display the following message in the Feedback Zone: Error 8097: Controller Error – Controller aborted the request [0x05][0xFF] Prior to Release 5.00, C blocks containing undefined symbols could be successfully downloaded, but if they were executed the CPU would transition to Stop/Halt mode.
Length of Serial I/O buffer	(Release 5.0 or later) The "Set Up Input Buffer Function" will always allocate a buffer containing 2049 bytes. This is one byte more than previous PACSystems releases.
Changing IP Address of Ethernet Interface While Connected	Storing a hardware configuration with a new IP address to the RX3i while connected via Ethernet will succeed, then immediately disconnect because the RX3i is now using a different IP address than the Programmer. You must enter a new IP address in the Target Properties in the Machine Edition Inspector window before reconnecting.
Duplicate Station Address for Modbus Will Conflict with Other Nodes	The default serial protocol for the RX3i is Modbus RTU. The default Station Address is 1. If the CPU is added to a multi-drop network, care must be taken that the CPU is configured with a unique Station Address. Nodes with duplicate Station Addresses on the same network will not work correctly.
Timer Operation	Care should be taken when timers (ONDTR, TMR, and OFDTR) are used in program blocks that are NOT called every sweep. The timers accumulate time across calls to the sub-block unless they are reset. They function like timers operating in a program with a much slower sweep than the timers in the main program block. For program blocks that are inactive for long periods of time, the timers should be programmed to account for this catch up feature. Related to this are timers that are skipped because of the use of the JUMP instruction. Timers that are skipped will NOT catch up and will not accumulate time while they are skipped.
Constant Sweep	Constant Sweep time, when used, should be set at least 10 milliseconds greater than the normal sweep time to avoid any over-sweep conditions when monitoring or performing on-line changes with the programmer. Window completion faults will occur if the constant sweep setting is not high enough.
Large Number of COMMREQs Sent to Module in One Sweep Causes Faults	A large number of COMM_REQs (typically more than 8) sent to one module in the same sweep may cause Module Software faults to be logged in the Controller fault table. The fault group is MOD_OTHR_SOFTWR (16t, 10h) and the error code is COMMREQ_MB_FULL_START (2). The “FT” output of the function block is also set. Recommendation: Spread multiple COMMREQs to the same module across multiple sweeps so that fewer (typically 8 or less) are sent to the module in each sweep. Also, check the FT output parameter for errors. If the FT output is set (an error has been detected), the COMMREQ could be re-issued by the application logic.
C Block Standard Math Functions Do Not Set errno	In C Blocks, standard math functions (e.g. sqrt, pow, asin, acos) do not set errno to the correct value and do not return the correct value if an invalid input is provided.
Hot Swap	Hot Swap of power supplies or CPUs is not supported.
Upgrading Firmware	1. Upgrading CPU firmware with the WinLoader utility may fail when multiple IO modules are in the main rack, due to the time required to power-cycle the rack system. If the upgrade fails, move the CPU to a rack without IO modules and restart the upgrade process. 2. Winloader initial connect baud rate is fixed at 19200 baud. Note that the firmware download will occur at 115.2K baud by default. 3. If you have hyperterm open on a port, and then try to use Winloader on the same port, Winloader will often say “Waiting for Target” until the hyperterm session is closed.
Serial Port Configuration COMMREQs	In the following combination of circumstances, serial communications with the CPU may become impossible: ▪ User configuration disables the Run/Stop switch ▪ User configures the power up mode to Run or Last ▪ Logic is stored in FLASH and user configures CPU to load from FLASH on power up ▪ User application issues COMMREQs that set the protocol on both of the serial ports to something that does not permit communications to the ME programmer.

Subject	Description
Incorrect COMMREQ Status For Invalid Program Name	The program name for PACSystems is always "LDPROG1". When another program name is used in a COMMREQ accessing %L memory, an Invalid Block Name (05D5) error is generated.
FANUC I/O Master and Slave operation	Scan sets on the master do not work properly for the first operation of the scan set after entering RUN mode. They work properly for subsequent scans. After downloading a new hardware configuration and logic, a power cycle may be required to resume FANUC I/O operation. Use CPUs of similar performance in FANUC I/O networks. If a master or slave is located in an RX3i system, the other CPUs should be RX3is or Series 90-30 CPU374s. Repeated power up/down cycles of an expansion backplane containing FANUC I/O slaves may result in failure of the slaves' operation, with the RDY LED off.
Lost count at power up for Serial IO Processor	The serial IO Processor (IC693APU305) will lose the first count after every power up or every time the module receives a configuration.
COMMREQ Status Words Declared in Bit Memory Types Must Be Byte-Aligned	Prior to release 3.50, the CPU allowed configuration of COMMREQ Status Words in bit memory types on a non-byte-aligned boundary. The firmware adjusted references to the next-lowest byte boundary before updating status bits, overwriting the bits between the alignment boundary and specified location. Now, COMMREQ Status Words in bit memory types must be byte-aligned. Specify the appropriate aligned address (%I1) to ensure that the utilized location is appropriate

Installation in Hazardous Locations

- EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C & D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY
- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
- WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND
- WARNING - EXPLOSION HAZARD - DO NOT CONNECT OR DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.