

PACSystems™ RX3i

IC695CPU320-AB

Central Processing Unit

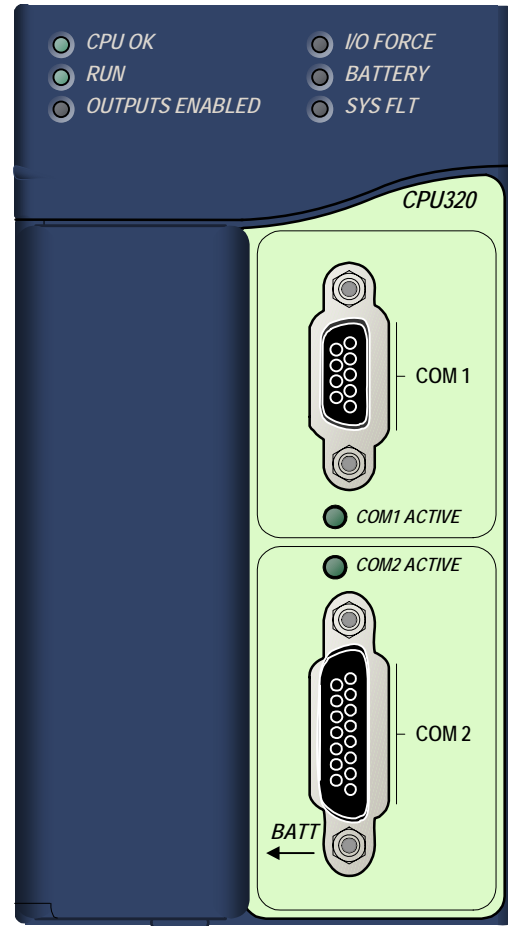
GFK-2488A
February 1, 2008

The RX3i CPU can be used to perform real time control of machines, processes, and material handling systems. The CPU communicates with the programmer and HMI devices via a serial port using SNP Slave protocol. It communicates with I/O and smart option modules over a dual backplane bus that provides:

- High-speed, PCI backplane for fast throughput of new advanced I/O.
- Serial backplane for easy migration of existing Series 90-30 I/O

Features

- Contains 64 Mbytes of battery-backed user memory and 64 Mbytes of non-volatile flash user memory.
- Provides access to bulk memory via reference table %W.
- Configurable data and program memory.
- Programming in Ladder Diagram, Structured Text, Function Block Diagram, and C.
- Supports auto-located Symbolic Variables that can use any amount of user memory.
- Reference table sizes include 32Kbits for discrete %I and %Q and up to 32Kwords each for analog %AI and %AQ.
- Supports most Series 90-30 modules and expansion racks. For a list of supported I/O, Communications, Motion, and Intelligent modules, see the *PACSystems RX3i System Manual*, GFK-2314.
- Supports up to 512 program blocks. Maximum size for a block is 128KB.
- In-system upgradeable firmware.
- Two serial ports: an RS-485 serial port and an RS-232 serial port.
- Ethernet communications via the rack-based Ethernet Interface module (IC695ETM001). For details on Ethernet capabilities, refer to *TCP/IP Ethernet Communications for PACSystems User's Manual*, GFK-2224.
- PLC time synchronization to SNTP Time Server on Ethernet network when used with Ethernet Release 5.0 or later module.



Ordering Information

Description	Catalog Number
RX3i 1GHz Celeron M CPU	IC695CPU320
Auxiliary Battery Module	IC693ACC302
RX3i Power Supplies 40 Watt High Capacity Universal AC 40 Watt High Capacity 24 VDC For additional power supplies, see the <i>PACSystems RX3i System Manual</i> , GFK-2314.	IC695PSA040 IC695PSD040
[Optional] RS-232 Cable	IC200CBL001
Rx3i Standard 12 Slot Rack	IC695CHS012
Rx3i Standard 16 Slot Rack	IC695CHS016
Note: For Conformal Coat option, please consult the factory for price and availability.	

CPU320 Specifications

Battery: Memory retention	Estimated 30 days using an IC693ACC302 Auxiliary Battery Module at 20°C. For details on the operation of the Auxiliary Battery Module, refer to the datasheet, GFK-2124. Note: The IC698ACC701 Lithium Battery Pack is not compatible with the CPU320.
Program storage	Up to 64 Mbytes of battery-backed RAM 64 Mbytes of non-volatile flash user memory
Power requirements	+3.3 VDC: 1.0 Amps nominal +5 VDC: 1.2 Amps nominal
Operating Temperature	0 to 60°C (32°F to 140°F)
Floating point	Yes
Boolean execution speed, typical	0.047 ms per 1000 Boolean contacts/coils
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 64 Mbytes

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

Product Documentation

PACSystems CPU Reference Manual, GFK-2222

TCP/IP Ethernet Communications for PACSystems User's Manual, GFK-2224

TCP/IP Ethernet Communications for PACSystems Station Manager Manual, GFK-2225

PACSystems RX3i System Manual, GFK-2314

C Programmer's Toolkit for PACSystems User's Manual, GFK-2259

Proficy® Machine Edition Getting Started, GFK-1868

Proficy® Logic Developer – PLC, GFK-1918

Release Information

Firmware release 5.11 resolves an issue where Series 90-30 Smart modules in the main rack do not transition to stop mode after a Loss of Module fault is logged. For details refer to "CPU Problems Resolved by Firmware Version 5.11" on page 4.

Release History

Catalog Number	Firmware Version	Date
IC695CPU320-AB	5.11	Feb, 2008
IC695CPU320-AA	5.10	Nov. 2007

Upgrades

The IC695CPU320 can be upgraded to firmware version 5.11 using upgrade kit 82A1145-MS10-000-A2, available at <http://www.gefanuc.com/support>.

CPU Functional Compatibility

Subject	Description
Programmer Version Requirements	Proficy® Machine Edition Logic Developer 5.70 SIM2 Build A is required to use the Release 5.10 features with the RX3i CPU320
C Toolkit Compatibility	C Toolkit Release 5.00 Build 16C1 is required when the PACSystems CPU contains firmware Release 5.00 or later. Note: <i>All</i> C blocks must be recompiled using the new toolkit before downloading to a PLC CPU that contains Release 5.00 or later firmware.
Backplanes, power supplies and system modules	As listed in the <i>PACSystems RX3i System Manual</i> , GFK-2314C or later.
Series 90-30 Expansion Rack Compatibility	The PACSystems RX3i supports Series 90-30 expansion racks, both local and remote. PACSystems RX3i CPUs do not operate in a Series 90-30 Rack.
Series 90-30 Main Rack Compatibility	Series 90-30 Main Racks cannot be used in a PACSystems RX3i system. Series 90-30 CPUs do not operate in PACSystemsRX3i Racks.
Isolated 24V power	In applications that use the IC69xALG220/221/222, consult <i>PACSystems RX3i System Manual</i> , GFK-2314 for details of wiring the 24V power.
COMMREQ to PBM300	In Release 3.0, the behavior of the COMMREQ fault output on a COMMREQ sent to the PROFIBUS master module IC695PBM300 had been changed to be compatible with the Series 90-30 CPU366 PROFIBUS Master. Previously, the fault output is enabled when the module receives a COMMREQ and it is busy. Now, the busy condition does not result in the fault output enabled.

Subject	Description
Recommended IC200ALG240 revision	<p>When a VersaMax™ system Genius® Network Interface Unit (IC200GBI001) interoperates with a Genius Bus Controller located in a PACSystems PLC, and the VersaMax system contains an IC200ALG240 Analog Input Module, it is recommended to update the IC200ALG240 firmware to at least Revision 1.10.</p> <p>However, it is preferable to update the IC200ALG240 firmware to Revision 1.20, which contains resolutions for all issues found after Revision 1.10.</p> <p>Upgrade kits are available at http://www.gefanuc.com/support. Use firmware update kit 44A752313-G01 to update the IC200ALG240 firmware to Revision 1.10, or upgrade kit 44A752313-G02 to update the IC200ALG240 firmware to Revision 1.20.</p>
Configuration of IC694MDL754	<p>Always configure 16 bits of module status when using this module.</p> <p>Configuring 0 bits of module status will result in invalid data in the module's ESCP status bits.</p>

Problems Resolved by Firmware Version 5.11

Subject	Description
Series 90-30 Smart Modules in a main rack now correctly transition to stop mode after a "Loss of Module" fault is logged.	<p>The initial release of the RX3i CPU320 did not notify a Series 90-30 Smart Module in the main rack when the CPU transitioned to STOP mode if the CPU had logged a Loss of Module fault against that Smart Module. When this condition occurred any Series 90-30 Smart module that had a "Loss of Module" fault logged against it continued to drive outputs when the CPU (and the System) had stopped.</p> <p>This issue is corrected in Release 5.11</p>

CPU Restrictions and Open Issues

Subject	Description
Hot swapping some analog modules slowly causes these modules to delay in reporting input values.	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 delay has only occurred when the 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 due to the fact that it thinks another programmer is currently attached. If this occurs, you should go offline and then back online again.
Simultaneous clears, loads and stores not supported	Currently, PACSystems CPUs do not support multiple programmers changing CPU contents at the same time. The programming software may generate an error during the operation. Simultaneous loads from a single PLC are allowed.
Hardware configuration not equal after changing target name	If the user stores a hardware configuration to flash that sets "Logic/Config Power up Source" to "Always Flash" or "Conditional Flash" and then subsequently changes the name of the target in the programming software, the hardware configuration will go Not Equal and will not Verify as equal.
PLC and IO fault tables may need to be cleared twice to clear faulted state	Both PLC 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 are cleared may be significant. 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	Once a force on or force off has been stored to the PLC, the user cannot switch from force on to force off or vice-versa directly by downloading initial values. The user can 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	Rare data corruption errors have been seen on serial communications when running at 115K under heavy interrupt load on the PLC. Under heavy load applications, users should restrict serial communications to 57K or lower.
SNP ID not always provided	Unlike the Series 90-30, the RX3i CPU's SNP ID will 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 PLC.
Must have logic if powering-up from flash	If the application will configure the CPU to retrieve the contents of flash memory at power-up, be sure to include logic along with hardware configuration when saving to flash memory. Otherwise, after the write to flash memory is completed, if power is removed from the CPU then turned back on, the CPU will not retrieve the hardware configuration saved in flash memory during the next power-up, and the Machine Edition programmer will report "Config NE" (configuration not equal) after reconnecting to the CPU.
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 HSC may take as long as 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 PLC sweep, even though there is no "loss of module" indication. I/O data exchanged with the module is not meaningful until this bit is set by the module. For details, see "Data Transfer Between High Speed Counter and CPU" in the <i>Series 90-30 High Speed Counter User's Manual</i> , GFK-0293C.
Info 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 will have no effect on the normal operation of the PLC. But, if the hardware watchdog timer expires after this fault and before power has been cycled again, then the outputs of I/O modules may hold their last state, rather than defaulting to zero.
Extended memory types for IO triggers	%R, %W and %M cannot be used as IO triggers.
Possible Machine Edition inability to connect	Infrequently, an attempt to connect a programmer to a PLC via Ethernet will be unsuccessful. The normal connection retry dialog will not be displayed. Rebooting the computer that is running the programmer will resolve the behavior.
SNP Update Datagram message	If an Update Datagram message requests 6 or less bits or bytes of data, the PLC will return a Completion Ack without Text Buffer. The protocol specifies that the returned data will be in the Completion Ack message, but it may not be.
Series 90-30 GBC may not resume operation after power cycle	In rare instances, a Series 90-30 Genius Bus Controller module in an expansion rack may not resume normal operation after a power cycle of either the expansion rack containing the GBC module or the main rack. To recover the GBC, the expansion rack containing the GBC must be power cycled.
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 PLC will report a "Loss of or missing option module" fault for the IC695PSD140 RX3i power supply following an update of PLC CPU firmware. 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.
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.

Subject	Description
Do not use multiple targets	In a system in which 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".
Missing "Loss of terminal block" fault	The IC695ALG600/608/616 analog input modules do not produce a "Loss of terminal block" fault when hardware configuration is stored or the module is hot-inserted, and the terminal block is not locked into place.
Sequence Store Failure	In systems with very large hardware configurations, it is possible to encounter a "PLC Sequence Store Failure" error when writing the configuration to flash. To work around this error, either: <ol style="list-style-type: none"> 1. Perform an explicit clear of flash prior to performing the write. 2. Increase the operation timeout used by Machine Edition software 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 will fail if a channel is configured for 3-wire RTD and Lead Resistance Compensation is set to Disabled. A Loss of Module fault will be logged in the I/O Fault table at the end of the store operation. To recover the lost module, change the configuration to enable Lead Resistance Compensation and power cycle the module
WinLoader may stop operating	On computers running Windows 2000 and using some versions of Symantec Antivirus protection, WinLoader will fail if used in advanced mode. Recovery requires cycling the computer's power.
Simultaneous upload and download failure	While downloading a Machine Edition folder to the target over a serial connection established between a Machine Edition session and the target, a simultaneous upload from the same target in a second Machine Edition session established over Ethernet will fail with Error 8523: Unknown Upload Exception.

Issues Related to the IC693DNM200 DeviceNet Master Module

Please see GFK-2194D or later for open issues related to the IC693DNM200 DeviceNet Master Module.

CPU Operational Notes

Subject	Description
Length of Serial I/O buffer	(Release 5.10 or later) The "Set Up Input Buffer Function" always allocates a buffer containing 2049 bytes. This is one byte more than previous PACSystems releases.
Important Installation Instructions for Battery	<p>An IC693ACC302 battery module is recommended for use with the CPU. When installing the battery, do not connect the battery until the CPU is installed in the rack and the rack is powered on. The battery may then be attached to either of the two terminals in the battery compartment. Once that is done, the CPU may be powered down and normal battery back up operation will begin. To save battery life, do not connect the battery for the first time until the CPU is powered up.</p> <p>Note: If installing a battery when there currently is no battery installed, the battery must be installed while the CPU has power. Failure 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, remove the battery, power cycle the CPU and then install the battery.</p> <p>Small batteries that fit in the battery compartment on the faceplate are not recommended for use with the CPU.</p>

Subject	Description
Indication of low battery capacity	When power is cycled to a PLC with a battery attached, a "Corrupted user memory" fault (group 130, error code 7) will appear in the CPU fault table when the battery capacity is low.
LD-PLC operations	Machine Edition LD-PLC no longer supports a function that connects to the PLC, downloads, then disconnects from the PLC. The connect and download functions are now separate. To perform a download to the PLC, you must first connect to the PLC.
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 PLC is added to a multi-drop network, care must be taken that the PLC 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. This means that 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 large periods of time, the timers should be programmed in such a manner as 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 therefore not accumulate time in the same manner as if they were executed every sweep.
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 COMMREQs (typically greater than 8) sent to a given board in the same sweep may cause Module Software faults to be logged in the PLC fault table. The fault group is MOD_OTHR_SOFTWR (16t, 10h) and the error code is COMMREQ_MB_FULL_START (2). When this occurs, the "FT" output of the function block will also be set. To prevent this situation, COMMREQs issued to a given board should be spread across multiple sweeps so that only a limited number (typically 8 or less) of COMMREQs are sent to a given board in each sweep. In addition, the FT output parameter should be checked for errors. If the FT output is set (meaning an error has been detected), the COMM_REQ 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.
Upgrading firmware	<p>The process of upgrading the CPU firmware with the WinLoader utility may fail when multiple IO modules are in the main rack, due to the time it takes to power cycle the rack system. If the upgrade process fails, move the CPU to a rack without IO modules and restart the upgrade process.</p> <p>The Winloader initial connect baud rate is fixed at 19200 baud. Note that the firmware download will occur at 115.2K baud by default.</p> <p>Note that 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.</p>
Hot Swap	Hot Swap of power supplies or CPUs is not supported in this release

Subject	Description
No serial communication with CPU	<p>Warning</p> <p>The following combination of circumstances may render serial communications with the CPU impossible:</p> <ul style="list-style-type: none"> Ethernet module is not present in main rack. 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 powerup. User application issues COMMREQs that set the protocol on both serial ports to something that does not permit communications to the Machine Edition programmer.
Incorrect COMMREQ status for invalid program name	The program name for PACSystems is always "LDPROG1". When another program name is used in a COMM_REQ accessing %L memory, an Invalid Block Name (05D5) error is generated.
FANUC I/O Master and Slave operation	<p>Scan sets on the master do not work properly for the first operation of the scan set after entering RUN mode. They do work properly for subsequent scans.</p> <p>After downloading a new hardware configuration and logic, a power cycle may be required to resume FANUC I/O operation.</p> <p>Use PLCs of similar performance in FANUC I/O networks. If a master or slave is located in an RX3i system, the other PLCs should be RX3is or Series 90-30 CPU374s.</p> <p>Repeated power up/down cycles of an expansion rack containing FANUC I/O slaves may result in failure of the slaves' operation, with the RDY LED off.</p>
Lost count at power up for Special IO Processor	The special 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	In previous releases, the CPU allowed configuration of COMMREQ Status Words in bit memory types on a non-byte-aligned boundary. Even though the given reference was not byte-aligned, the firmware would adjust it the next-lowest byte boundary before updating status bits, overwriting the bits between the alignment boundary and specified location. To ensure that the application operates as expected, release 3.50 requires configuration of COMMREQ Status Words in bit memory types to be byte-aligned. For example if the user specified status bit location of %I3, the CPU aligns the status bit location at %I1. Release 3.50 firmware requires the user to specify the appropriate aligned address (%I1) to ensure that the utilized location is appropriate for their application. Note that the actual reference location utilized is not changed, but now is explicitly stated for the user.

Installation in Hazardous Locations

The following information is for products bearing the UL marking for Hazardous Locations:

- 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.
- 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
- The tightening torque range for the control terminals is 9.6-11.5 in. lb. Use only wire rated for 90°C. Be sure to observe any additional ratings that are provided with the modules.