IMPORTANT PRODUCT INFORMATION

READ THIS INFORMATION FIRST

Product: PACSystems™ RX3i CPU with Firmware Version 2.50

IC695CPU310-AA

This document contains information that is not available in any other publication; therefore, we recommend that you read and save it for future reference.

This is the initial release of the RX3i CPU310.

Version Identification

Hardware Identification	
Catalog Number	**Circuit Board ID**
IC695CPU310-AA	CP4A1

Firmware Identification	
Firmware ID	**Version**
CPU Primary	2.50 Build 26A4
	BOC Build 24A1
CPU Boot	2.50 Build 25A3

CPU Programmable Parts	
Part ID	*Revision*
BIOS	f4_r05
MCU	f4_r05
FPGA	X05
SDRAM CPLD	C
HW rev EPROM	f4_r05

Product Documentation

PACSystems CPU Reference Manual, GFK-2222

PACSystems RX3i Hardware and Installation Manual, GFK-2314

TCP/IP Ethernet Communications for the PACSystems, GFK-2224

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

CIMPLICITY® Machine Edition Getting Started, GFK-1868

Logic Developer – PLC Programming Software Getting Started, GFK-1918

Datasheet, PACSystems RX3i CPU, GFK-2316

IPI, PACSystems RX3i CPU, GFK-2329 (this document)

CPU Functional Compatibility

Subject	Description
Programmer Version Requirements	CIMPLICITY® Machine Edition Logic Developer 5.0 or later must be used to configure and program the RX3i.
C Toolkit Compatibility	The C Toolkit for PACSystems is distributed with CIMPLICITY® Machine Edition Logic Developer 5.0 or greater. Toolkit build 50A1 or later is required for use with the RX3i. Please note: The Series 90 Toolkit (IC641SWP709/719) is not compatible with PACSystems.

Series 90-30 Module Compatibility	The PACSystems RX3i supports the following Series 90-30 modules:
	
	    Discrete Input Modules: IC693ACC300, IC693MDL230/231/240/241/632/634/645/646/648/654/655
	
	    Discrete Output Modules: IC693MDL310/330/340/390/730/731/732/733/734/740/741/742/748/752/753/760/930/931/940
	
	    Discrete Combinational: IC693MAR590, IC693MDR390
	
	    Analog I/O Modules: IC693ALG220/221/222/223/390/391/392/442
	
	    High Speed Counter: IC693APU300
	
	    FANUC I/O Link: IC693BEM320, IC693BEM321
	
	    Motion Control: IC693DSM314
	
	All other Series 90-30 modules are not currently supported.

IC694 (blue) Module Compatibility	The PACSystems RX3i supports the following IC694 modules:
	
	    IC694ACC300, IC694MDL230/231/240/241/632/634/645/646/654/655
	
	    Discrete Output Modules: IC694MDL310/330/340/390/732/734/740/741/742/752/753/930/931/940
	
	    Analog I/O Modules: IC694ALG220/221/222/223/390/391/392/442
	
	    High Speed Counter: IC694APU300
	
	    Motion Control: IC694DSM314
	
	    Expansion Backplanes: IC694CHS392/398
	
	Expansion Power Supplies: IC694PWR321/330/331

Series 90-30 Expansion Rack Compatibility	The PACSystems RX3i supports local and remote Series 90-30 expansion racks. 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 *PACSystems RX3i Hardware and Installation Manual*, GFK-2314 for details of wiring the 24V power.

New CPU Features and Enhancements

Release 2.50 of the RX3i CPU provides the following new features and enhancements compared to the family of Series 90-30 CPUs:

■ Non-volatile flash (10Mbyte) and battery-backed user memory (up to 10 Mbytes).

■ A new register/WORD reference table (%W) that is configurable up to 4Mbytes.

■ Auto-located Symbolic Variables that can use any amount of user memory.

■ Larger reference table sizes, which include 32 Kbits for discrete %I and %Q and up to 32K words each for analog %AI and %AQ.

■ Support for new Rx3i modules, as well as Series 90-30 discrete and analog I/O, and High Speed Counter.

■ Application compatibility with PACSystems RX7i applications.

■ Up to 512 program blocks. Maximum size for a block is 128KB.

■ Online Edit and Test modes that allow editing and testing of logic changes that are permitted for a Run Mode Store.

■ Bit-in-word referencing that allows you to specify individual bits in a WORD reference in retentive memory as inputs and outputs of Boolean expressions, function blocks, and calls that accept bit parameters.

■ CPU over temperature status bit.

■ Two serial ports: one RS-485 serial port and one RS-232 serial port – neither are isolated.

CPU Restrictions and Open Issues

Subject	Description
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.
Power Cycle During Online Edit	If the user stores a folder to flash that is configured to power up from flash and then subsequently power is cycled in the middle of a Online Edit session, the programmer will still indicate that the Online Edit session is in progress after the power cycle. The user should cancel the Online Edit session to continue.
Power Cycle During Write to Flash	If the CPU is power cycled during the process of writing to flash, and is configured to power up from flash, a fault will be generated on power up.
Hardware Configuration Not Equal After Changing Target Name	If the user stores a hardware configuration to flash which indicates that "Logic/Config Power up Source" is set 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 is 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.
Storing Large Numbers of Blocks to Flash	Currently, storing logic with approximately 200 blocks or more to flash may fail, due to the programmer timing out.
Number of Active Programs Returned as Zero	The SNP request Return Controller Type and ID currently returns the number of active programs as zero.
Over Sweep Condition in Constant Sweep Mode	When the PLC is configured for Constant Sweep mode, a consistent over sweep condition can cause the programmer to lose communications with the PLC. The user must insure that when Constant Sweep mode is configured, sufficient buffer is allowed for communications to occur with the programmer.
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.
RAND_MAX and rand() Function Incompatible	In the C Toolkit, the RAND_MAX system variable is defined as a 32-bit integer. However, the rand() function returns a 16-bit integer. By definition, rand() should return an integer between 0 and RAND_MAX.
Firmware Update Attempt to Incorrect Module	If an attempt to load Ethernet module firmware is inadvertently directed to a slot containing a different type of module (for example, an analog module) WinLoader will fail with the error "Target is unable to enter boot mode. Serial communications error: Request timed out". After this error occurs, the CPU will be in an invalid state and should be power cycled.
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.

Subject	Description
Second programmer can change logic while in Test & Edit mode	While currently active in a Test and Edit session using CIMPLICITY Machine Edition on one PC, CIMPLICITY Machine Edition running on another PC is not prevented from storing new logic to the PLC.
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 do 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 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.
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.
Avoid Ethernet module resets	Resetting the Ethernet module, either by Service Request 24 or by the restart pushbutton, will cause some of the CPU's internal memory to be consumed if EGD is configured. The problem becomes more pronounced with larger EGD configurations. Power-cycling the system will recover the internal memory.
Service Request 24 results in different fault messages	When Service Request 24 is used to reset a module in the RX3i system, a Reset of I/O Module fault appears in the PLC fault table. For RX7i systems, two faults appear: Reset of I/O Module and Loss of I/O Module.
Configuration mismatch with unsupported module causes PLC sequence store failure	If you attempt to store a hardware configuration to the CPU that has a module configured for a slot that physically contains an unsupported module, the store will fail with a sequence store failure.
Overtemp thresholds are too low	The CPU has two thresholds for operating temperature: normal and critical. These thresholds are intended to be set at 58ºC and 63ºC respectively, but the current thresholds are 55ºC and 60ºC. These thresholds are determined under worst case thermal operating conditions (minimal air flow with hot modules on either side of the CPU).
	When the operating temperature of the CPU exceeds the normal operating temperature, the system variable #OVR_TMP (%SA8) turns ON. (To turn it OFF, clear the PLC fault table or reset the PLC.) This fault (fault group 0x18, error code 0x0001) is configurable to be diagnostic or fatal (default configuration is for diagnostic).
	A second overtemp threshold will cause a fatal error (fault group 0x0D, error code 0x00A8) when the CPU has exceeded the critical temperature point just prior to hardware failure.
Conditions for Changing Sweep Mode	In PACSystems, users can change sweep mode parameters while the CPU is running only if they have previously stored logic (stop mode, Run Mode store, or word-for-word change) during the current connection. Performing a Test/Edit operation removes the ability to change sweep mode parameters, until another store of logic (stop mode, RMS, or WFW change) is done.
Power Supply Firmware Version Reported Incorrectly	The information presented for the power supply in CIMPLICITY Machine Edition's Device Information Details window will say "N/A" (not applicable), rather than supply the version information for the firmware in the power supply.

CPU Operational Notes

Subject	Description
Slot numbering, power supply placement, CPU placement and reference	1. The A/C Power-Supply (IC695PSA040) for the RX3i is a doublewide module whose connector is left justified as viewed when installed in a rack. It cannot be located in Slot 11 of a 12-slot rack nor Slot 15 of a 16-slot rack. No latch mechanism is provided for the last (right-most) slot in a rack, therefore it is not possible to place the power-supply in the second to last slot. 2. The RX3i CPU (IC695CPU310) is a doublewide module whose connector is right justified as viewed when installed in a rack. It is referenced for configuration and by user logic applications by the leftmost slot that it occupies. For example, if the RX3i CPU has its physical connector inserted into slot 4, which means it occupies slots 3 and 4, the CPU is referenced as being located in slot 3. The referenced location of the CPU is not determined by what slot the physical connector is located in, but rather by the left most slot occupied by the entire module. 3. Due to item #2 above, the RX3i CPU may be located in Slot 0 of a rack (physical connector in Slot 1). In addition the CPU cannot be located in Slot 11 of a 12-slot rack nor Slot 15 of a 16-slot rack, since doing so would require the physical connector to be located in the slot reserved for an expansion module. 4. When migrating a Series 90-30 CPU system to a PACSystems RX3i CPU, be aware that to maintain the Slot 1 location of the CPU, only a singlewide power-supply may be used in Slot 0. Currently, the only available singlewide power-supply is a DC power-supply (IC695PSD040). Therefore, if the application using an existing Series 90-30 system must maintain a Slot 1 CPU and uses an AC power-supply, the RX3i system must have the RX3i AC power-supply located in a slot to the right of the RX3i CPU in Slot 1. 5. In deciding to place the CPU in slots other than Slot 1, the user should be aware of the possible application migration issues that could arise. The following table lists the areas that could be affected when migrating an application from one CPU slot to another.

Item Affected		How Affected
User Logic	Service Request #15 (Read Last-Logged Fault Table Entry)	Location of CPU faults will not be the standard 0.1 location, but will reflect the slot the CPU is located in. User logic that decodes fault table entries retrieved by these service requests may need updating.
	Service Request #20 (Read Fault Tables)	
	Communications Request (Commreq)	Commreqs directed to the CPU (e.g. those directed to the serial ports of the CPU) will need to be updated with the correct CPU slot reference.
H/W Configuration	CPU Slot location	Slot location of the CPU must be updated in the HW Configuration to reflect the CPU's true location.
Fault Tables	Faults logged for the CPU	The location of faults logged for the CPU in the fault table will not be the standard 0.1 (rack.slot) location, but will reflect the CPU's actual slot.
External Devices	*Series 90 PLCs*	
	Remote Series 90 PLCs that use SRTP Channels COMMREQs expect the CPU to be in slot 1. To support communications with Series 90 SRTP clients such as Series 90 PLCs using SRTP Channels, the RX3i internally redirects incoming SRTP requests destined for {rack 0, slot 1} to {rack 0, slot 2}, provided that the CPU is located in rack 0 slot 2 (and the remote client has not issued an SRTP Destination service on the connection to discover the rack and slot of the CPU). This special redirection permits Series 90-30 applications that expect the power supply to be located leftmost and the CPU to be located to the right of the power supply to function. Attempts to establish channels with CPUs in slots other than 1 or 2 will fail if initiated from Series 90 PLCs.	
	HMI and External Communication Devices	
	All external communication devices that interact with the CPU should be checked for compatibility with CPU slot locations other than slot 1. Problems may arise with, but are not limited to, initial connection sequences and fault reporting. CIMPLICITY Machine Edition View customers should select "GE SRTP" as their communications driver – it can communicate with a CPU in any slot.	
	Host Communications Toolkit (HCT)	
	Applications that utilize the Host Communications Toolkit may require updated drivers.	

Subject	Description
Important Installation Instructions for Battery	A battery is shipped with the CPU unit behind the battery door on the faceplate but it is not connected. Do not connect the battery until the CPU is installed in the rack and the rack 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. If the battery is installed before the CPU is powered up, it will drain the battery 10 times faster until power is applied. To save battery life, do not connect the battery for the first time until the CPU is powered up.
LD-PLC operations	Machine Edition LD-PLC does not allow a user to perform operations that change the PLC until explicitly connecting to the target device. For example, to perform a download to the PLC, you must first connect to the PLC.
Logic Executed in Row Major Instead of Column Major	Logic execution in PACSystems RX3i is performed in row major order (similar to the Series 90-30). This is different from the Series 90-70, that executes in column major order. This means that some complicated rungs may execute slightly differently on PACSystems RX3i and Series 90-70. For specific examples, see the programming software on-line help.
NaN Handled Differently Than in 90-30	The PACSystems RX3i CPU may return slightly different values for Not A Number as compared to Series 90-30 CPUs. In these exception cases (e.g., 0.0/0.0), power flow out of the function block is identical to Series 90-30 operation and the computed value is still Not A Number.
PID Algorithm Improved	The PID algorithm used in PACSystems has been improved and therefore PID will function slightly differently on PACSystems RX3i than on the Series 90-30. The differences are that the elapsed time is computed in 100 µS instead of 10 mS units. This smooths the output characteristic, eliminating periodic adjustments that occurred when the remainder accumulated to 10mS. Also, previous non-linear behavior when the integral gain is changed from some value to 1 repeat/second was eliminated.
Some Service Requests different from 90-30 or no longer supported	Service Requests 6, 15, and 23 have slightly different parameters. Refer to GFK-2222. PACSystems PLCs support Service Request 26/30 functionality via fault locating references. The first word of a Service Request command block is required to contain a zero. On the Series 90-30, this value was ignored. Please note: the parameter to the service request must be the address of the location containing the zero. Service Requests 48 and 49 are no longer supported (there is no auto-restart) because most faults can be configured to be not fatal.
IL and SFC	IL and SFC are not available.
DO I/O Instruction	The Series 90-30 Enhanced DO I/O instruction is converted to a standard DO I/O instruction (the ALT parameter is discarded and ignored.)
END Instruction	The Series 90-30 END instruction is not supported. Alternate programming techniques should be used.
Non-nested JUMP, LABEL, MCR, & ENDMCR Instructions	Non-nested JUMPs, LABELs, MCRs, & ENDMCRs are translated to the corresponding nested JUMPs, LABELs, MCRs, & ENDMCRs when converting from Series 90-30 to PACSystems RX3i.
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 CME Inspector window before reconnecting.

Subject	Description
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 COMM_REQs Sent to Module in One Sweep Causes Faults	A large number of COMM_REQs (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, COMM_REQs issued to a given board should be spread across multiple sweeps so that only a limited number (typically 8 or less) of COMM_REQs 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	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. Winloader initial connect baud rate is fixed at 19200 baud. Note that the firmware download will occur at 115.2K baud by default. 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.
Hot Swap	Hot Swap of power supplies or CPUs is not supported in this release.
Single Power Supply	Use only one power supply in an RX3i main rack.