Interbus-S Slave System Configuration and Program EEPROM
for use with the
GE Fanuc Series 90-30 Model 323 Programmable Controller

Preliminary User Manual
HE693PRM323

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Interbus-S System EEPROM for the GE Fanuc Series 90-30 PLC

Table of Contents

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SECTION 1: Introduction

The HE693PRM323 kit consists of this manual and a pre-programmed EEPROM device (Electrically Erasable Programmable Read-Only Memory). This device is designed for installation into a GE Fanuc Series 90-30 Programmable Logic Controller. The HE693PRM323 (PRM323) is compatible only with 90-30 model IC693CPU323 (10-slot, 10 MHz). Also available from Horner is the similar HE693PRM313, compatible only with the 90-30 model IC693CPU313 (5-slot 10 MHz).

When installed and in operation, the PLC system that utilizes the PRM323 provides several key application features:

- Interbus-S data width is based on installed I/O module requirements (pseudo auto-configuration)
- Up to 9 words of Interbus-S process data
- Rack I/O module configuration is reported to host controller as process data.
- PLC run status is reported to host controller as process data and (if stopped) IBS module error
- PLC module faults are reported to host controller as process data and IBS module error
- PLC fault type and slot are reported to host controller as process data
- Host error acknowledgment clears PLC fault table

1.1 EEPROM Installation

As stated above, the PRM323 is installed in a model 323 90-30 PLC rack.

1   The PRM323 can be installed into a rack prior to mounting the rack. The modules in slots 1, 2 and 3 must be removed (if present) to gain access to the EEPROM socket.

2   If a program exists in the 90-30 that must be saved, do this prior to installing the PRM323 device.

3   Make sure that the 90-30 rack power is OFF!

4   The EEPROM device is static-sensitive, it is recommended that you wear a grounded anti-static wrist strap while handling the device.

5   The PRM323 device will be installed into the socket nearest slot 2, labeled "PROGRAM PROM". It is important that the device be installed in the correct orientation. Pin #1 of the PRM323 is indicated by either a notch on one end of the device or by a detent on one corner.

6   Carefully and gently lay the PRM323 on the socket and ensure that all of the pins are properly lined up in the socket.

7   Apply even downward force on the center of the device until it snaps into the socket securely.

8   Re-install the modules that were removed in step 1 above.

9   When power is applied to the 90-30 rack, the PRM323 application will load and execute.

SECTION 2: Operation

This section provides an overview of the requirements, capabilities and limitations of the PRM323 system.

2.1   Required I/O Module Configuration

Figure 2-1 below illustrates the I/O module configuration required by the PRM323 application.

Power Supply	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6
	Horner Electric HE693-IBS100 Interbus-S Interface Module	GE Fanuc IC693-BEM320 I/O Link Module	Generic 16-pt Discrete Input Module	Generic 16-pt Discrete Input Module	Generic 16-pt Discrete Input Module	Generic 16-pt Discrete Input Module
Required/Optional	Required	Required	Optional	Optional	Optional	Optional
Process data references	I/O 1	I/O 2-5	I 6	I 7	I 8	I 9

Slot 7	Slot 8	Slot 9	Slot 10
Generic 16-pt Discrete Output Module	Generic 16-pt Discrete Output Module	Generic 5/8-pt Discrete Output Module	Generic 5/8-pt Discrete Output Module
Optional	Optional	Optional	Optional
O 6	O 7	O 8 High byte	O 8 Low byte

Figure 2-1 Required Configuration for the Model 323 90-30 PLC Rack

The PRM323 requires that slot 1 contain the HE693IBS100 Interbus-S Slave Module, and that slot 2 contain a GE Fanuc IC693BEM320 I/O Link Module. Slots 3 through 6 can be empty, or can accept a generic 16 point discrete input module. Note that modules should be "left-justified", slot 3 should be filled first, followed by slot 4, etc. Slots 7 and 8 can be empty, or can accept 16 point discrete output modules. Again, slot 7 must contain a module if slot 8 is used. Slots 9 and 10 can be empty, or can accept 5/8 point discrete output modules. Slot 9 must contain a module if slot 10 is used.

2.2   Process Data Allocation

Table 2-1 below illustrates the only valid configuration options for slots 3 through 6. There are a total of 5 legal combinations:

Slot 3	Slot 4	Slot 5	Slot 6	Total # PD words
Empty	Empty	Empty	Empty	5
16-pt In	Empty	Empty	Empty	6
16-pt In	16-pt In	Empty	Empty	7
16-pt In	16-pt In	16-pt In	Empty	8
16-pt In	16-pt In	16-pt In	16-pt In	9

Table 2-1 Legal Input Module Configurations and Process Data Allocation

Table 2-1 below illustrates the only valid configuration options for slots 7 through 10. There are a total of 9 legal combinations:

Slot 7	Slot 8	Slot 9	Slot 10	Total # PD words
Empty	Empty	Empty	Empty	5
16-pt Out	Empty	Empty	Empty	6
16-pt Out	16-pt Out	Empty	Empty	7
Empty	Empty	5/8-pt Out	Empty	8
16-pt Out	Empty	5/8-pt Out	Empty	8
16-pt Out	16-pt Out	5/8-pt Out	Empty	8
Empty	Empty	5/8-pt Out	5/8-pt Out	8
16-pt Out	Empty	5/8-pt Out	5/8-pt Out	8
16-pt Out	16-pt Out	5/8-pt Out	5/8-pt Out	8

Table 2-2 Legal Output Module Configurations and Process Data Allocation

As illustrated above, the IBS100 Interbus-S Interface module occupies the first Interbus-S process data word for the remote Interbus-S drop. The BEM320 I/O link module occupies the next 4 process data words (words 2 through 5). The remaining allocation of process data words is dependent on the I/O modules installed. As shown in table 2-1 and 2-2, the number of process data words allocated by the PRM323 will be between 5 and 9 words inclusive, dependent on the complement of installed I/O modules.

Any of the Input module configurations can be used with any of the Output module configurations. Note, however, that the number of process data words configured will be that required by the greater of the two configurations. For example, if slot 3 contains an input module and slots 4, 5 and 6 are empty, the input configuration will only require 6 process data words. But, if slot 9 contains a 5/8 point output module and slots 7, 8 and 10 are empty, the output configuration will require 8 process data words, therefore the system is configured to transfer 8 process data words.

The PRM323 system will interrogate the module slots at power-up and will allocate the process data words based on the results of that initial interrogation.

Review figure 2-1 to determine the process data mapping for each module slot.

2.3   System Status Word

The PRM323 system uses the first process data word (allocated to the IBS100 module in slot 1) to report several system status values.. The upper byte of the status word contains the following bit fields:

Bit 16	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9
PLC RUN	Number of 16-pt Inputs			# 16-pt Outputs		# 5/8 pt Outputs	

Bits 10-9:   **# 5/8 pt Outputs** - This field will contain the binary number of 5/8 point output modules installed in slots 9 and 10 (00, 01, or 10).

Bits 12-11:   **# 16 pt Outputs** - This field will contain the binary number of 16 point output modules installed in slots 7 and 8 (00, 01, or 10).

Bits 15-13:   **Number of 16-pt Inputs** - This field will contain the binary number of 16 point input modules installed in slots 3 through 6 (000, 001, 010, 011 or 100).

Bit 16:   **PLC RUN** - This bit will be set if the PLC CPU is in RUN mode. The PLC CPU will only enter STOP mode if a fatal fault occurs, or if STOP mode is selected using a Series 90-30 configuration tool.

2.4   PLC Module Faults

The PRM323 system continuously monitors the PLC I/O fault table. If any module generates a module fault in the PLC I/O fault table, the PRM323 system reports the error in two ways:

1.   An Interbus-S "Module Error" is generated

2.   The PLC fault group code and module slot will be reported to the host controller in the lower byte of the System Status Word.

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Fault Slot				Fault Group Code			

The Fault Slot field will contain a value that indicates the I/O slot reporting the fault, it will contain a binary value between 1 and 10 inclusive. The fault group code will contain one of the values from Table 2-2.

Fault code	Fault Group
3	Loss of, or missing I/O module
7	Addition of, or extra I/O module
9	IOC or I/O bus fault
10	I/O module fault

Table 2-2 Module-level Faults

2.5   Interbus-S Module Errors

As described above, the PRM323 system will generate an Interbus-S module error whenever a PLC I/O fault occurs. The system will also generate this error if a PLC CPU transition from RUN to STOP mode is detected by the Interbus-S interface module, or if the PLC CPU does not enter RUN mode within 5 seconds after power-up.

The Interbus-S module error will be latched until the host controller acknowledges the error. The host can issue a module error acknowledgment in either of 2 ways:

1.   The host controller can issue a "Quit Module Error" or a "Quit All Error" command.

2.   The host controller can set the Clear faults bit of the System Command/Control (bit 8 of the first process data word).

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Clear Flts				Reserved			

To clear the module error using the System Command/Control word, the Clear faults bit should be set for at least 100mS to ensure that the transition is detected by the PRM323 system.

Note that when **either** of the 2 fault clearing methods is used, **both** the Interbus-S module error is cleared **and** the PLC I/O fault table is cleared.

2.6   Interbus-S activity watchdog

The PRM323 system incorporates an Interbus-S activity watchdog that monitors the output "valid" signal from the host controller. If the host controller does not issue an output valid signal for 250mS, the PRM323 system will disable all of the discrete outputs in the rack (including those on the I/O link module). Inputs to the host are maintained even if the inactivity watchdog timer expires.

2.7   Anomalies

2.7.1   Power-up configuration

When the PRM323 system powers up, it takes up to 5 seconds to execute it's diagnostics and enter RUN mode. During this time, the Interbus-S interface module (IBS100) will be configured to transfer 1 process data word (the System Status Word), and only the most significant bit (PLC RUN status) will be meaningful. When the PLC enters RUN mode following the diagnostics, the IBS100 module will be reconfigured for the amount of process data dictated by the I/O configuration in the rack.

2.7.2   PLC I/O faults at power-up

If a discrete I/O module is installed in the system, but due to some fault condition, does not report its presence to the PLC CPU at power-up, no fault will be generated to the host controller. Additionally, the process data word width could be calculated improperly because of missing module. I/O module loss and addition faults are cleared at power-up and only get transferred to the host controller if they occur **after** the PLC has entered RUN mode.

It is therefore the responsibility of the host controller application to verify that the I/O complement reported in the upper byte of the System Status Word matches the expected I/O configuration for the given PRM323 system, and if it does not match, handle the exception at the host application level.

2.7.3   PLC I/O faults at run-time

If multiple PLC I/O faults occur before the first fault is acknowledged, the **first** fault is latched and reported. When the fault is acknowledged, the entire PLC I/O fault table is cleared. If additional faults were present when the clear was issued, they are lost forever.

2.7.4   Slot 10 module presence

The 10-slot 90-30 model CPU firmware (version 6.5 and earlier) contains a problem that does not allow an application to interrogate slot 10's module presence status. GE Fanuc is aware of this problem and will subsequently fix it. Until their new firmware is available, the PRM323 system will report the same module presence status for slot 10 that it does for slot 9. The PRM323 system EEPROM already contains the proper slot 10 interrogation routine and will not need to be changed when the new GE Fanuc firmware is available.

NOTES