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Overview

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Introduction

The VMICLB-5565 is the ControllLogix compatible member of GE Fanuc Embedded Systems’s family of Reflective Memory, real-time fiber-optic network products. Two or more VMICLB-5565s and the other members of the Reflective Memory family can be integrated into a network using standard fiber-optic cables. Each board in the network is referred to as a node.

Reflective Memory allows computers, workstations, PLCs and other embedded controllers with different architectures and dissimilar operating systems to share data in real-time. The VMIxxx-5565 family of Reflective Memory is fast, flexible and easy to operate. Data is transferred by writing to memory (SDRAM), which appears to reside globally in all boards on the network. Onboard circuitry automatically performs the transfer to all other nodes with little or no involvement of the host processor or system. A block diagram of the VMICLB-5565 is shown in Figure 1 on page 13.
Features

- High speed, easy-to-use fiber-optic network (2.12 Gbaud serially)
- No host processor involvement in the operation of the network
- Redundant Mode of Operation
- Up to 256 nodes
- Connectivity with multimode fiber up to 300 meters
- Dynamic packet size, 4 to 64 bytes of data per packet
- Transfer rate 43MB/s (4 byte packet) to 174MB/s (64 byte packet)
- 64MB SDRAM Reflective Memory
Figure 1 VMICLB-5565 Block Diagram
Figure 2  Typical Reflective Memory Network
Basic Operation

Each node (VMIxxx-5565 Reflective Memory boards) in the network is interconnected using fiber-optic cables in a daisy chain loop. The transmitter of the first board is tied to the receiver of the second board. The transmitter of the second board is tied to the receiver of the third, and so on, until the loop is completed back at the receiver of the first board. Each node must have a unique node ID, which is accomplished using an eight (8) position onboard switch (S1). The order of the node IDs is unimportant; the node IDs have to be unique (i.e. no two nodes can have the same node ID).

A transfer of data over the network is initiated by a write to onboard SDRAM from the host system. When the write to the SDRAM is occurring, circuitry on the VMICLB-5565 automatically writes the data, along with other pertinent information, into the transmit FIFO. From the transmit FIFO, a transmit circuit retrieves the data and forms it into variable length packets from 4 to 64 bytes, which pass over the fiber-optic interface to the receiver of the next board. When data is received, a circuit opens the packets and stores the data in the board’s receive FIFO. From the receive FIFO, a third circuit writes the data into local onboard SDRAM at the same relative location in memory as that of the originating node. The third circuit also simultaneously routes the data into the board’s own transmit FIFO. From there, the process is repeated until the data returns to the receiver of the originating node. At the originating node, the data packet is removed from the network.

Front Panel LED Indicators

There are three LED indicators located on the front panel of the Reflective Memory Module and three LEDs and a four-character alphanumeric display located on the front panel of the Intelligent Interface Module (IIM). See “Front Panel Indicators and Display” on page 30.

Reflective Memory RAM

The actual onboard Reflective Memory SDRAM is available as 64MB. The offset address range is $0 to $3FFFFFF for the 64MB of Reflective Memory.
Redundant Transfer Mode of Operation

The VMICLB-5565 is capable of operating in a redundant transfer mode. The board is configured for redundant mode when the jumper shunt between pins 1 and 2 of jumper E5 is removed. While in the redundant transfer mode, each packet will be transferred twice, regardless of the dynamic packet size. The receiving circuitry of each node on the network evaluates each of the redundant transfers. If no errors are detected in the first transfer, it is used to update the onboard memory and the second transfer is discarded. However, if the first transfer does contain an error, the second transfer is used to update the onboard memory provided it has no transmission errors. If errors are detected in both transfers, the transfers will not be used and the data is completely removed from the network.

Statistically, redundant transfer mode greatly reduces the chance that any data is dropped from the network. However, the redundant transfer mode also reduces the effective network transfer rates. The single Lword (4 byte) transfer rate drops from the non-redundant rate of 43MB/s to approximately 20MB/s. The 16 Lword (64 byte) transfer rate drops from the non-redundant rate of 174MB/s to the redundant rate of 87MB/s.

Rogue Packet Removal Operation

A rogue packet is a packet that does not belong to any node on the network. Recalling the basic operation of Reflective Memory, one node originates a packet on the network in response to a memory write from the host. The packet is transferred around the network to all nodes until it returns to the originating node. It is then a requirement of the originating node to remove the packet from the network. If, however, the packet somehow gets altered as it passes through another node or if the originating node begins to malfunction, then the originating node may fail to recognize the packet as its own and will not remove the packet from the network. In this case, the packet will continue to traverse the network.

Rogue packets are extremely rare. Their existence indicates a malfunctioning board due to true component failure, or due to operation in an overly harsh environment. Normally, the solution is to isolate and replace the malfunctioning board and/or improve the environment. However, some users prefer to tolerate sporadic rogue packets rather than halt the system for maintenance provided the rogue packets are removed from the network.

To provide tolerance to rogue packet faults, the VMICLB-5565 contains circuitry which allows it to operate as one of two Rogue Masters. A Rogue Master alters each packet as it passes through from another node. If the same packet returns to the Rogue Master a second time, the Rogue Master recognizes that it is a rogue packet and removes it from the link. When a rogue packet is detected, a rogue packet fault flag is set. The assertion of the rogue packet fault flag can be used to inform the host that the condition exists.

The VMICLB-5565 has two rogue masters, Rogue Master 0 and Rogue Master 1, provided to cross check each other. Rogue Master 0 is enabled by removing the jumper shunt between pins 3 and 4 of jumper block E5. Rogue Master 1 is enabled by removing the jumper shunt between pins 5 and 6 of jumper E5. Just as two boards in a network should not have the same node ID, two boards in the same network should not be set as the same Rogue Master. Otherwise, one of the two will erroneously remove packets originated by the other.
Physical Description and Specifications

Refer to Product Specification, 800-435565-000 available from:

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Huntsville, AL 35803-3308, USA
(256) 880-0444
(800) 322-3616
FAX: (256) 882-0859
www.gefanucembedded.com
Safety Summary

The following general safety precautions must be observed during all phases of the operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of this product.

GE Fanuc Embedded Systems assumes no liability for the customer's failure to comply with these requirements.

Ground the System

To minimize shock hazard, the chassis and system cabinet must be connected to an electrical ground. A three-conductor AC power cable should be used. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet.

Do Not Operate in an Explosive Atmosphere

Do not operate the system in the presence of flammable gases or fumes. Operation of any electrical system in such an environment constitutes a definite safety hazard.

Keep Away from Live Circuits

Operating personnel must not remove product covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Do Not Service or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do Not Substitute Parts or Modify System

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to GE Fanuc Embedded Systems for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

Warnings, such as the example below, precede only potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING: Dangerous voltages, capable of causing death, are present in this system. Use extreme caution when handling, testing, and adjusting.
Overview

Safety Symbols Used in This Manual

**STOP:** This symbol informs the operator that a practice or procedure should not be performed. Actions could result in injury or death to personnel, or could result in damage to or destruction of part or all of the system.

**WARNING:** This sign denotes a hazard. It calls attention to a procedure, a practice, a condition, which, if not correctly performed or adhered to, could result in injury or death to personnel.

**CAUTION:** This sign denotes a hazard. It calls attention to an operating procedure, a practice, or a condition, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the system.

**NOTE:** Calls attention to a procedure, a practice, a condition or the like, which is essential to highlight.
CHAPTER 1

Configuration and Installation

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Introduction

This chapter describes the installation and configuration of the board. Cable configuration and board layout are illustrated in this chapter.
Unpacking Procedures

**CAUTION:** Some of the components assembled on GE Fanuc Embedded Systems’ products may be sensitive to electrostatic discharge and damage may occur on boards that are subjected to a high-energy electrostatic field. When the board is placed on a bench for configuring, etc., it is suggested that conductive material should be inserted under the board to provide a conductive shunt. Unused boards should be stored in the same protective boxes in which they were shipped.

Upon receipt, any precautions found in the shipping container should be observed. All items should be carefully unpacked and thoroughly inspected for damage that might have occurred during shipment. The board(s) should be checked for broken components, damaged printed circuit board(s), heat damage, and other visible contamination. All claims arising from shipping damage should be filed with the carrier and a complete report sent to GE Fanuc Embedded Systems together with a request for advice concerning the disposition of the damaged item(s).
Switch (S1) Configuration and Location

Prior to installing the VMICLB-5565 into the chassis, the node ID must be configured by setting Switch S1 for the desired node ID (see Figure 1-1 below). Each node in the network must have a unique node ID. See Figure 1-4 on page 24 for the location of Switch S1. Switch S1 is a bank of eight switches, which correspond to 8 node ID select signal lines. The 8 node ID select lines permit any node ID from 0 to $FF (255 decimal). Switch S1 position 1 corresponds to the least significant node ID line and position 7 corresponds to the most significant node ID line. When the switch position is ON the binary node ID line is low (0), while the OFF position sets the binary node ID line high (1). Table 1-1 below provides examples of possible node IDs.

Table 1-1  Example Node ID

<table>
<thead>
<tr>
<th>LSB</th>
<th>MSB</th>
<th>Node ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pos. 0</td>
<td>Pos. 1</td>
<td>Pos. 2</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Figure 1-1  Switch S1 Layout
Jumper E5 Configuration

Prior to installing the VMICLB-5565 in the host system, Jumper E5 must be configured for the appropriate mode of operation. Jumper E5 controls three functions on the board:

1. Pins 1 and 2 select the non-redundant (fast) or redundant network transfer modes.
2. Pins 3 and 4 enable or disable the Rogue Master 0 function.
3. Pins 5 and 6 enable or disable the Rogue Master 1 function.

Pins 7, 8, 9 and 10 are currently reserved and should not be used. Table 1-2 details the functions selected by the installation or removal of the jumper shunts. The default factory configuration is all jumper shunts installed (except pins 7, 8, 9 and 10).

NOTE: Pins 7, 8, 9 and 10 of Jumper E5 are not used (reserved), and should not have jumper shunts installed.

<table>
<thead>
<tr>
<th>E5 Pins</th>
<th>Installed/Omitted</th>
<th>Function/Mode Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2</td>
<td>Installed</td>
<td>Non-redundant (Fast) network transfer mode selected</td>
</tr>
<tr>
<td></td>
<td>Omitted</td>
<td>Redundant network transfer mode selected</td>
</tr>
<tr>
<td>3 to 4</td>
<td>Installed</td>
<td>Rogue Master 0 function disabled</td>
</tr>
<tr>
<td></td>
<td>Omitted</td>
<td>Rogue Master 0 function enabled</td>
</tr>
<tr>
<td>5 to 6</td>
<td>Installed</td>
<td>Rogue Master 1 function disabled</td>
</tr>
<tr>
<td></td>
<td>Omitted</td>
<td>Rogue Master 1 function enabled</td>
</tr>
<tr>
<td>7 through 10</td>
<td>None</td>
<td>These pins are RESERVED, NO jumper shunt should be installed</td>
</tr>
</tbody>
</table>

Figure 1-2 Jumper E5 Pinout
Accessing Jumper E5

To configure jumper E5, remove the left side panel to access the jumper. The following procedure outlines the removal and installation of the panel.

1. Disconnect the fiber-optic cables and remove the VMICLB-5565 from the chassis (if applicable).

2. Using a #1 Phillips Head screwdriver, remove the two screws securing the left side panel to the case (see Figure 1-3 below). Remove the side panel and locate jumper E5 (see Figure 1-4 on page 24 for location of jumper E5).

3. Configure jumper E5 for the desired mode of operation (i.e., redundant, non-redundant, Rogue Master 0 and Rogue Master 1). See “Jumper E5 Configuration” on page 22.

4. Replace the side panel, securing it with the two screws removed in step 2.

![Figure 1-3 Accessing Jumper E5](image-url)
Figure 1-4 VMICLB-5565 Jumper and Switch Location
Physical Installation

CAUTION: Do not install or remove the board while power is applied.

Host ControlLogix sites vary widely in appearance and board installation procedures. GE Fanuc Embedded Systems recommends examining the host system installation procedures prior to installing this board. The following procedure outlines the installation of the VMICLB-5565 into a ControlLogix chassis with an available slot.

1. Select two empty adjacent slots for installation in the chassis. Ensure that the node ID has been set prior to installation. See “Switch (S1) Configuration and Location” on page 21. Also to set up the board for the desired mode of operation, see Jumper E5 Configuration section on page 22. See “Setup of the VMICLB-5565” on page 28.

2. Press the VMICLB-5565 modules firmly onto the backplane connector, (refer to Figure 1-5 for installation of the VMICLB-5565). Remove the dust cap from the transceiver and connect the fiber-optic cable.

3. Installation is complete, apply power.

Figure 1-5 Installing the VMICLB-5565
Cable Configuration

The VMICLB-5565 is available with a multimode fiber-optic interface. Figure 1-6 is an illustration of the ‘LC’ type multimode fiber-optic connector.

Cable Specification:

- Simplex, multimode, graded index glass fiber
- Core diameter = 62.5 ±3μM
- Cladding diameter = 125 ±2μM
- Jacket outer diameter = 3.0mm ±.1mm
- Attenuation: 4.0dB/Km (max) at 850nm, 1.75dB/Km (max) at 1300nm
- Bandwidth: 160 to 300MHz-Km (min) at 850nm, 300 to 700MHz-Km (min) at 1300nm
- UL type OFNR, CSA type OFN FT4

Connector Specification:

- Compatible with NTT LC standard and JIS C 5973 compliant
- Ceramic ferrule
- Insertion loss: 0.35dB (max) multi-mode
- Fiber clad diameter: 125μM
- Jacket diameter: 3.0mm
- Temperature range: -20 °C to +85 °C

Cable Length Specification:

- Multimode maximum cable length is 300 meters using 50μm core fiber-optic cables.
- Single-mode maximum cable length is 10 kilometers using 9μm core fiber-optic cables.

CAUTION: When the fiber-optic cables are not connected, the supplied dust caps need to be installed to keep dust and dirt out of the optics. Do not power up the VMICLB-5565 without the fiber-optic cables installed. This could cause eye injuries.
VMICLB-5565 Connectivity

Figure 1-7 Example: Four Node Ring Connectivity
Setup of the VMICLB-5565

Requirements

- RSLogix 5000 version 8 or later
- ControlLogix controller (1756-L1, 1756-L55, 1756-L63, etc.)
- ControlLogix rack and power supply

Features

- Scheduled connection used for maximum performance
- Read and write any location within Reflective Memory
- Send and receive network interrupts 1 - 4 and reset
- Example code for ControlLogix controller included (RLL)

Installation

This section describes the installation of the module and the example code.

Software

1. Start RSLogix 5000 and open the file VMICLB_Sample.ACD.

NOTE: If you have an older version of RSLogix 5000, you may need to open VMICLB_Sample.L5K instead.

2. Edit the controller properties to match your system configuration (controller type and slot, rack size, etc.).

3. The I/O Configuration contains a module named VMICLB-5565. Edit the module properties to set the module slot number to match your system configuration. The slot number should be set to the rightmost slot (i.e., the 56SAM slot) of the two. The module properties are shown in Figure 1-8 on page 29. The VMICLB-5565 module uses the 1756 Generic Module profile.

4. The Connection Parameters must be set as shown in Figure 1-8 on page 29. Do not edit these values.

5. Select the Connection tab to set the Requested Packet Interval (RPI). The RPI determines the rate at which data is transferred to and from the module. 1.0ms is the suggested setting (see Figure 1-9 on page 29).
6. Click OK to exit the Module Properties and save your changes.

7. The MainProgram contains example code to assist in using the Reflective Memory module. The routines whose names begin with ‘RFM_’ can be used without modification. The other routines are samples that demonstrate how to interface with the module. None of the sample routines will be executed unless the MainRoutine is modified to enable them. See the comments in the MainRoutine and Sample Code section on page 37 for more information.

8. Download the program to your ControlLogix controller.
Front Panel Indicators and Display

This section describes the various indicators and the display on the front panel of the modules. These indicators provide status information that may be useful for troubleshooting problems.

![Image of Front Panel Indicators and Display]

**Alphanumeric Display**

A four-character alphanumeric display is located on the front of the IIM. This display provides status information. On a normal module reset, the sequence shown below will be displayed.

---

**NOTE:** Some of the following messages are displayed very briefly and may be difficult to see.

1. Blank (for approximately 15 seconds after reset)
2. INIT (device driver is initializing)
3. DDOK (device driver initialized successfully)
4. OK (backplane is ready to communicate)
5. VMICLB-5565 (scrolling across display for a couple of seconds)
6. -OK- (ready to accept commands from controller)

If the fiber optic ring is broken, the following message will scroll across the display (replacing -OK-):

ERROR - CHECK RING
Intelligent Interface Module LEDs

**OK Indicator LED**

The OK LED has three possible states, as described Table 1-3 below:

<table>
<thead>
<tr>
<th>OK LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Power is OFF</td>
</tr>
<tr>
<td>Red</td>
<td>Major fault - may indicate a hardware failure.</td>
</tr>
<tr>
<td>Green</td>
<td>Normal</td>
</tr>
</tbody>
</table>

**USR Indicator LED**

The USR LED is used to indicate the status of the connection to the ControlLogix controller, as described Table 1-4:

<table>
<thead>
<tr>
<th>USR LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No connection</td>
</tr>
<tr>
<td>Green</td>
<td>Connection to controller has been established</td>
</tr>
</tbody>
</table>

Reflective Memory Module LEDs

**SIGDET Indicator LED**

The SIGDET LED will be ON if the fiber optic receiver detects light. If it is OFF, this indicates a problem with the fiber optic ring.

**OWNDAT Indicator LED**

The OWNDAT LED will be ON if the card has detected its own data returning on the fiber optic ring. If it is OFF, this may indicate a problem with the fiber-optic ring.

**STATUS Indicator LED**

The STATUS LED is an activity indicator. It will flash when the ControlLogix controller accesses the Reflective Memory.
Module Interface

This section describes the interface between the ControlLogix controller and the VMICLB-5565 Reflective Memory Module.

Module Connection

For maximum performance, the controller communicates with the VMICLB-5565 via a scheduled connection. To set up the connection, the 1756 Generic Module type is used, as shown in the Software section on page 28. The I/O Configuration defines the connection parameters, including the input, output, and status image sizes. The connection parameter values shown in the Software section on page 28 must be used for the module to operate correctly. These values are shown in Table 1-5 below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Instance</th>
<th>Size (bytes)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>1</td>
<td>476</td>
<td>Input image (data read from module)</td>
</tr>
<tr>
<td>Output</td>
<td>2</td>
<td>488</td>
<td>Output image (data written to module)</td>
</tr>
<tr>
<td>Config</td>
<td>4</td>
<td>0</td>
<td>Not used</td>
</tr>
<tr>
<td>Status In</td>
<td>5</td>
<td>8</td>
<td>Status input data used to signal pending network interrupts and errors</td>
</tr>
<tr>
<td>Status Out</td>
<td>6</td>
<td>N/A</td>
<td>No data (heartbeat only)</td>
</tr>
</tbody>
</table>

Input and Output Images

The ControlLogix controller exchanges data with the module using the input and output images defined by the module connection. In ControlLogix, the maximum size of the input and output images are 500 and 496 byte, respectively. The input and output images contain a variety of variables used to coordinate and synchronize the communications between the controller and the module.

Two user-defined data types are provided to simplify access to the data in the input and output images, named RFMIN_STRUC and RFMOUT_STRUC respectively. These structures are shown in Figure 1-11 below and Figure 1-12 on page 34.

To ensure image integrity and simplify access to the variables within the input and output images, the Synchronous Copy (CPS) instruction is used in the MainProgram to copy the input and output images to data structures of the associated type.
RFMIN_STRUC defines the data contained in the VMICLB-5565 input image. The ControlLogix controller reads the input image from the module once each RPI.
RFMOUT_STRUC defines the data contained in the VMICLB-5565 output image. The ControlLogix controller writes the output image to the module once each RPI.
Status Input Image

The status input image is used to indicate pending network interrupts and errors. In the controller, the status image is addressed as Local:slotnum:S.Data[boffset], where slotnum is the module’s slot number and boffset is the byte offset. The status image data is defined below:

Table 1-6  Module Status Input Image

<table>
<thead>
<tr>
<th>Byte Offset</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>This byte indicated the current mode status. See Table 1-7.</td>
</tr>
<tr>
<td>1</td>
<td>Reserved</td>
</tr>
<tr>
<td>2</td>
<td>This byte identifies the module fault mode.</td>
</tr>
<tr>
<td>3</td>
<td>Reserved</td>
</tr>
<tr>
<td>4, 5</td>
<td>Bytes 4 and 5 together form a 16-bit word that contains the last module error (byte 4 is the LSB). A module error may be generated when an invalid request is received from the controller. 0x0000 indicates that no errors have occurred.</td>
</tr>
<tr>
<td>6</td>
<td>Byte 6 is a bit array used to indicate pending network interrupts. If a bit is set (1), then a network interrupt of the associated type has been received and is waiting in the queue to be retrieved. Bits 1 - 4 correspond to network interrupts 1 - 4 respectively. Bit 5 corresponds to the reset interrupt. Bits 0, 6 and 7 are not used. See Table 1-8.</td>
</tr>
<tr>
<td>7</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

Table 1-7  Module Status Byte

<table>
<thead>
<tr>
<th>Module Status Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The module is operating with no faults.</td>
</tr>
<tr>
<td>1</td>
<td>A module fault has been detected. The Fault Code identifies the type of fault. See Table 1-8</td>
</tr>
<tr>
<td>255 (0xFF)</td>
<td>The ControlLogix controller is unable to establish a connection with the VMICLB-5565 module.</td>
</tr>
</tbody>
</table>

Table 1-8  Fault Codes

<table>
<thead>
<tr>
<th>Fault Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Fault</td>
</tr>
<tr>
<td>3</td>
<td>Unable to access Reflective Memory card</td>
</tr>
<tr>
<td>6</td>
<td>Operating system error</td>
</tr>
<tr>
<td>7</td>
<td>Error reading Reflective Memory</td>
</tr>
</tbody>
</table>
Table 1-8 Fault Codes (Continued)

<table>
<thead>
<tr>
<th>Fault Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Error writing Reflective Memory</td>
</tr>
<tr>
<td>9</td>
<td>Error reading from connection</td>
</tr>
<tr>
<td>10</td>
<td>Error writing to connection</td>
</tr>
<tr>
<td>11</td>
<td>Fiber optic ring error</td>
</tr>
</tbody>
</table>

Table 1-9 Network Interrupt Status Bits

<table>
<thead>
<tr>
<th>Status Image Bit Address</th>
<th>Network Interrupt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local:slotnum:S.Data[6].1</td>
<td>1</td>
</tr>
<tr>
<td>Local:slotnum:S.Data[6].2</td>
<td>2</td>
</tr>
<tr>
<td>Local:slotnum:S.Data[6].3</td>
<td>3</td>
</tr>
<tr>
<td>Local:slotnum:S.Data[6].4</td>
<td>4</td>
</tr>
<tr>
<td>Local:slotnum:S.Data[6].5</td>
<td>Reset</td>
</tr>
</tbody>
</table>

NOTE: slotnum is the VMICLB-5565 module’s rightmost slot number.
Sample Code for the ControlLogix processor is provided to illustrate the usage of the VMICLB-5565 module. The routines that are prefixed with “RFM_” may be used without modification, if desired. These routines are described in this section.

Initialization

The controller must synchronize with the VMICLB-5565 module before commands can be issued. The RFM_Init routine performs this function.

RFM_Init

The RFM_Init routine should be called during the first scan. This routine initializes various control variables in the module output image in order to synchronize the module with the controller. None of the other routines should be called during the first scan.

Input and Output Image Updates

In order to ensure image integrity, the Synchronous Copy (CPS) instruction is used to copy data to and from the VMICLB_5565 module’s input and output images. The user-defined structures RFMIN_STRUC and RFMOUT_STRUC are used to simplify access to the data and control variables within the images.

At the beginning of each program scan, the CPS instruction should be used to copy the VMICLB-5565 module’s input image into the RfmInput structure. At the end of each scan, another CPS instruction should be used to copy the RfmOutput structure to the module’s output image.

Reading Reflective Memory

Two routines are provided to simplify reading from Reflective Memory: RFM_ReadDataReq and RFM_ReadData. These routines are described in the following sections.

RFM_ReadDataReq

RFM_ReadDataReq posts a read request to the VMICLB-5565 module. This routine has two input parameters, described in Table 1-10. A maximum of 464 byte of Reflective Memory can be read at a time.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DINT</td>
<td>RfmReadOffset</td>
<td>32-bit offset within Reflective Memory at which to start read</td>
</tr>
<tr>
<td>2</td>
<td>INT</td>
<td>RfmReadLength</td>
<td>Number of bytes of Reflective Memory to read (464 byte maximum)</td>
</tr>
</tbody>
</table>
RFM_ReadDataReq has one return parameter of type INT. If the routine successfully posts the read request, the return parameter value will be one (1). If one (1) is returned, the program should then call RFM_ReadData to retrieve the data from the module.

If the routine cannot post the request (the module is still busy processing a previous request), the return parameter value will be zero (0). If zero (0) is returned, the routine will be retried at a later time.

**RFM_ReadData**

RFM_ReadData retrieves the data requested by a previous call to RFM_ReadDataReq. This routine has no input parameters.

RFM_ReadData has one return parameter of type INT. If the read request has completed, the return parameter value will be one (1). If 1 is returned, the Reflective Memory data read from the module will be in the RfmReadData array.

If the read request has not completed, the routine will return zero (0). If zero (0) is returned, the routine will be retried at a later time.

**Writing Reflective Memory**

Writing Reflective Memory is a bit simpler, and only a single routine is needed: RFM_WriteData.

**RFM_WriteData**

RFM_WriteData posts a request to write data to the Reflective Memory. This routine has two input parameters, described in Table 1-11 below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DINT</td>
<td>RfmWriteOffset</td>
<td>32-bit offset within Reflective Memory at which to start write</td>
</tr>
<tr>
<td>2</td>
<td>INT</td>
<td>RfmWriteLength</td>
<td>Number of bytes of Reflective Memory to write (464 byte maximum)</td>
</tr>
</tbody>
</table>

The data to be written to Reflective Memory must be copied into the array RfmWriteData before RFM_WriteData is called. Up to 464 byte of data may be written at a time.

RFM_WriteData has one return parameter of type INT. If the routine successfully posts the write request, the return parameter value will be 1.

If the routine cannot post the request (the module is still busy processing a previous request), the return parameter value will be zero (0). If zero (0) is returned, the routine should be retried at a later time.
Receiving Network Interrupts

Network interrupts that are received by the VMICLB-5565 module are queued until the controller retrieves them. When a network interrupt is in the queue, a corresponding bit is set in the status image. The controller can poll these bits to determine whether any network interrupts have been received. These status bits and the corresponding network interrupts are shown in Table 1-9 on page 36.

Two routines are provided to retrieve network interrupts: RFM_GetNetIntReq and RFM_GetNetInt.

RFM_GetNetIntReq

RFM_GetNetIntReq posts a request to retrieve a queued network interrupt from the VMICLB-5565 module. This routine has one input parameter, described in Table 1-12 below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SINT</td>
<td>RfmRxIntType</td>
<td>Network interrupt type to retrieve. 1-4 correspond to network interrupts 1-4, and 5 corresponds to Reset.</td>
</tr>
</tbody>
</table>

RFM_GetNetIntReq has one return parameter of type INT. If the routine successfully posts the request, the return parameter value will be one (1). If 1 is returned, the program should then call RFM_GetNetInt to retrieve the network interrupt data from the module.

If the routine cannot post the request (the module is still busy processing a previous request), the return parameter value will be zero (0). If zero (0) is returned, the routine should be retried at a later time.

RFM_GetNetInt

RFM_GetNetInt retrieves the network interrupt data requested by a previous call to RFM_GetNetIntReq. This routine has no input parameters.

RFM_GetNetInt has four return parameters as shown in Table 1-13 below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INT</td>
<td>One (1) if the request has completed, zero (0) if the request is pending</td>
</tr>
<tr>
<td>2</td>
<td>SINT</td>
<td>Network interrupt type. If zero (0), then the queue was empty.</td>
</tr>
<tr>
<td>3</td>
<td>SINT</td>
<td>Sending node ID</td>
</tr>
<tr>
<td>4</td>
<td>DINT</td>
<td>Network interrupt data</td>
</tr>
</tbody>
</table>
Sending Network Interrupts

The controller may send a network interrupt to a node on the fiber optic network. The routine `RFM_SendNetInt` is provided for this purpose.

**RFM_SendNetInt**

`RFM_SendNetInt` posts a request to send a network interrupt to a node. This routine has three input parameters, described in Table 1-14 below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Type</th>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SINT</td>
<td>RfmTxIntType</td>
<td>Network interrupt type to send (1 - 5)</td>
</tr>
<tr>
<td>2</td>
<td>SINT</td>
<td>RfmTxIntNode</td>
<td>Destination node ID</td>
</tr>
<tr>
<td>3</td>
<td>DINT</td>
<td>RfmTxIntData</td>
<td>Network interrupt data</td>
</tr>
</tbody>
</table>

`RFM_SendNetInt` has one return parameter of type INT. If the routine successfully posts the write request, the return parameter value will be one (1).

If the routine cannot post the request (the module is still busy processing a previous request), the return parameter value will be zero (0). If zero (0) is returned, the routine should be retried at a later time.

**Diagnostic Functions**

The network interrupt routines may also be used for diagnostic purposes. Special values for the network interrupt type parameter are used to select the diagnostic functions.

**Reading Module Registers**

Several VMICLB-5565 hardware registers may be read using the `RFM_GetNetIntReg / RFM_GetNetInt` routines. The network interrupt type parameter is used to select which register is to be read. The register data is returned in the network interrupt data return parameter. The sending node ID return parameter is not used.

The valid values for the network interrupt type parameter (for the `RFM_GetNetIntReq` routine) are shown in Table 1-15.
Table 1-15  Interrupt Type Parameter Values Used to Read Diagnostics Information

<table>
<thead>
<tr>
<th>Network Interrupt Type</th>
<th>Register Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>129</td>
<td>LCSR1</td>
<td>Read Local Control and Status Register 1 (32-bit)</td>
</tr>
<tr>
<td>130</td>
<td>LISR</td>
<td>Read Local Interrupt Status Register (32-bit)</td>
</tr>
<tr>
<td>131</td>
<td>Board ID</td>
<td>Read Board ID Register (8-bit)</td>
</tr>
<tr>
<td>132</td>
<td>Board Revision</td>
<td>Read Board Revision Register (8-bit)</td>
</tr>
<tr>
<td>133</td>
<td>Node ID</td>
<td>Read Node ID Register (8-bit)</td>
</tr>
</tbody>
</table>

Writing Module Registers

**WARNING:** Writing to the VMICLB-5565 hardware registers is not advised, as disruption of the module’s normal operation may result. This function should only be used by experts with a full understanding of the hardware and operation of the module.

Two VMICLB-5565 hardware registers may be written using the RFM_SendNetInt routine. The network interrupt type parameter is used to select which register is to be written. The data to be written to the register is passed in the network interrupt data parameter. The destination node ID parameter is not used.

The valid values for the network interrupt type parameter (for the RFM_SendNetInt routine) are shown in Table 1-16.

Table 1-16  Interrupt Type Parameter Values Used to Read Diagnostics Information

<table>
<thead>
<tr>
<th>Network Interrupt Type</th>
<th>Register Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>129</td>
<td>LCSR1</td>
<td>Write Local Control and Status Register 1 (32-bit)</td>
</tr>
<tr>
<td>130</td>
<td>LISR</td>
<td>Write Local Interrupt Status Register (32-bit)</td>
</tr>
</tbody>
</table>
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Maintenance

This section provides information relative to the care and maintenance of GE Fanuc Embedded Systems’ products. If the product malfunctions, verify the following:

- System power
- Software
- System configuration
- Electrical connections
- Jumper or configuration options
- Boards are fully inserted into their proper connector location
- Connector pins are clean and free from contamination
- No components of adjacent boards are disturbed when inserting or removing the board from the chassis
- Quality of cables and I/O connections

If products must be returned, contact GE Fanuc Embedded Systems for a Return Material Authorization (RMA) Number. **This RMA Number must be obtained prior to any return.** RMAs are available at rma@gefanuc.com.

Contact GE Fanuc Embedded Systems Customer Care at 1-800-GEFANUC (or 1-800-240-7782) or 1-780-401-7700, or E-mail: support.embeddedsystems@gefanuc.com
Maintenance Prints

User level repairs are not recommended. The drawings and tables in this manual are for reference purposes only.