



SY/MAX[®]
RIO Adapter Module
Class 8030 Type CRM931

User's Manual

WARNING

UNINTENTIONAL EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, or apply this product.

Failure to observe this precaution can result in death or serious injury.

CAUTION

EQUIPMENT DAMAGE HAZARD

To avoid improper handling of equipment:

1. Never remove this device while power is ON. Turn power supply switch to OFF and wait until all indicating lights are off before removing.
2. Do not subject to static discharge. This module contains electronic components that are very susceptible to damage from electrostatic discharge.

Failure to observe this precaution can result in equipment damage.

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Electrical equipment should be serviced only by qualified electrical maintenance personnel. No responsibility is assumed by Square D for any consequences arising out of the use of this material.

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1 OVERVIEW

1.1 GENERAL INFORMATION

The Class 8030 Type CRM931 RIO adapter module provides a communication interface between a Quantum processor and remote SY/MAX[®] I/O on the RIO network. This interface provides the means for the processor to read and write to the input and output signals of SY/MAX Class 8030 rack-mounted I/O.

The RIO adapter module resides in register slot 1 of the remote SY/MAX Class 8030 Type RRK100, 200, or 300 register rack and Class 8030 Type HRK100, 150, or 200 digital rack assemblies and allows control of SY/MAX Class 8030 discrete and intelligent I/O by a Quantum processor.

Information exchanged between the RIO adapter module and the RIO head includes register data, I/O module identification, and bus status.

Modicon's RIO network is a high-speed (1.544 Mb/s) local area network (LAN) which uses commercially available coaxial cable and CATV media technology.

PLC communicators service their drop adapters only at the end of logic segments. Multiple logic segments may be serviced in one scan. Updating RIO drop data at the end of a segment ensures consistent data throughout the segment. A CRC16 message frame check assures that RIO drop messages will arrive at the proper destination node.

As a high-speed LAN, RIO drops must support applications that are time critical. With respect to speed, RIO has several advantages over other proprietary PLC communication methods:

- RIO data transfer speed is predictable because of HDLC protocol implementation.
- Message collisions do not occur because only one node transmits at a given time.
- Each drop has high data integrity due to the frame check sequence and error checking at the physical protocol layer.

The RIO network supports communications between a PLC and one or more drops of I/O modules that are dispersed throughout a local area—e.g., a manufacturing or processing facility. The RIO head or processor, a master node, initiates all messages on the RIO network. All other nodes on the network communicate with the RIO head via RIO adapter modules located at the drops.

The CRM931 RIO adapter module is compatible with a Modicon Quantum or E984-785 Programmable Logic Controller (PLC) when inserted in a remote SY/MAX Class 8030 Type HRK or Type RRK rack. The remote rack must be part of a Modicon S908 RIO system.

Modicon Modsoft Software, Revision 2.31 or later, is required to use the CRM931 RIO adapter module.

Contact a Square D distributor for upgrade information.

1.2 RIO DROP MODULE FEATURES

Figure 1 on page 3 shows the CRM931 RIO adapter module.

The module offers the following features:

- User-selectable rotary switches identify the RIO drop module as one of up to 31 drops per RIO head. See Table 4 on page 10.
- 128 addressable registers [64 input and 64 output] are available per RIO drop.
- Four LEDs indicate status of the RIO adapter module. See “GENERAL INFORMATION” on page 19.
- Data transfer rate equals 1.544 Mb/s.
- One “F” type female connector with a right angle adapter provides one-channel external communication.
- Continuous I/O updates information even when power or communication is lost to one or more additional drops.

1.3 WHERE TO FIND ADDITIONAL INFORMATION

The following documents contain information regarding cabling and installation:

- *Modicon Remote I/O Cable System Planning and Installation Guide* (#890 USE 101 00)
- *Modicon Modsoft Programmer User Manual* (#890 USE 105 00)

Note: This system is not compatible with I/O Network Passport Systems.

1.4 TERMINOLOGY USED IN THIS MANUAL

Table 1 lists some common terms for Square D automation products and the terms for similar Modicon products.

Table 1: Equivalent Terms

Square D	Modicon
LI (Local Interface)	RIO Head
RI (Remote Interface)	RIO Adapter Module
LI/RI System	RIO Network
Remote Racks	RIO Drops
Halt	Stopped
Rack Addressing	I/O Mapping

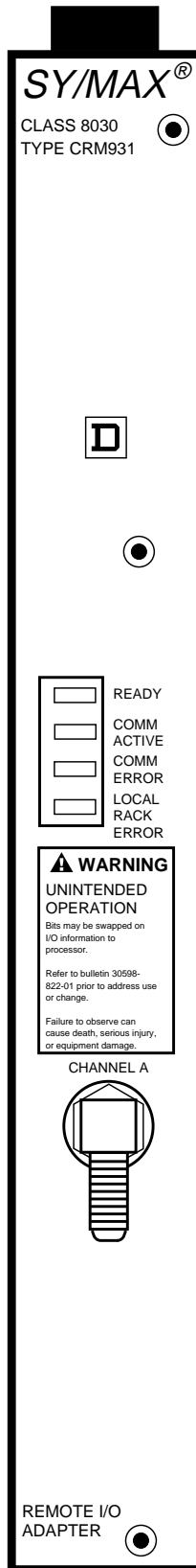


Figure 1 CRM931 RIO Adapter Module Front Panel Features

Notes:

2 SPECIFICATIONS

2.1 COMPLIANCE INFORMATION

The CRM931 RIO adapter module complies with requirements of UL 508, CSA C22-2, and Factory Mutual Class 1 Division 2 Hazardous Locations.

2.2 ELECTRICAL SPECIFICATIONS

Current Draw on SY/MAX Power Supply:

Class 8030 Type CRM931	750 mA (typical); 900 mA (maximum)
Undervoltage Lockout Circuit	Halts and resets the CRM931 RIO adapter module and removes it from the RIO network when the incoming DC supply voltage falls below approximately 4.6 VDC.

2.3 ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature:

Operational	32 to 140° F (0 to 60° C)
Storage	-13 to 176° F (-25 to 80° C)

Humidity:

5 - 95%, non-condensing

2.4 PHYSICAL SPECIFICATIONS

Dimensions:

Width: 1.5" (3.8 cm)
Height: 12.1" (30.7 cm)
Depth: 6.6" (16.8 cm)

Weight:

2.8 pounds (1.27 kg)

2.5 FUNCTIONAL SPECIFICATIONS

2.5.1 Register Capabilities

The CRM931 has a maximum of 128 (64 input and 64 output) registers available for external I/O addressing.

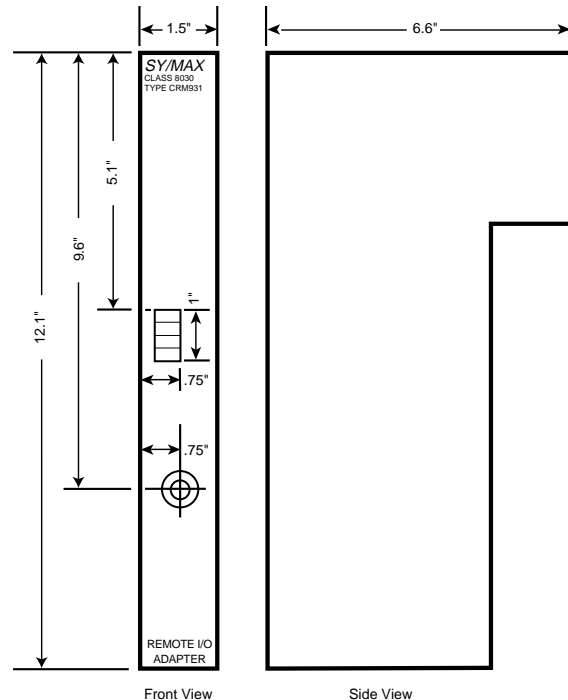


Figure 2 CRM931 Dimensions

2.5.2 Communications Capabilities

Method

Half-duplex, NRZI-encoded synchronous, with the RIO head acting as the polling master.

Transmission rate

1.544 Mb/s. Message packet integrity ensured with a 16-bit CRC; other flagged error conditions include message time-outs (no reply), collisions, and improper replies.

Isolation

500 VDC, transformer coupled.

Distance

4,000 feet/1,200 meters maximum.

2.5.3 Supported Processor Types

Table 2: RIO Processors With RIO Capabilities

PLC Type	Hardware	Dynamic Range	Maximum RIO Drops
984A 984B 984X AT-984 MC-984 Q-984 984-485E/K 984-685E		Not Supported	
984-785E/K/D	S908 slot mount module with AS-Q908-016 Executive E785 with SW-E785-Q00 Executive	32 dB	15
140 CPU 113 02	140 CRP 931 or 140 CRP 932 Quantum module	32 dB	31
140 CPU 113 03			
140 CPU 213 04			

2.5.4 Compatibility with SY/MAX Racks

The CRM931 module operates only in register slot 1 of these rack model numbers:

Class 8030 Type RRK-100, RRK-200, and RRK-300

Class 8030 Type HRK-100, HRK-150, and HRK-200

CAUTION

UNINTENDED EQUIPMENT ACTION

Using any rack other than Class 8030 Type RRK-100, RRK-200, and RRK-300 or Class 8030 Type HRK-100, HRK-150, and HRK-200 can cause erratic operation.

Failure to observe this instruction can result in injury or equipment damage.

Physically place one and only one RIO head, or network manager, into the Modicon processor rack. Refer to *Modicon Remote I/O Cable-System Planning and Installation Guide* (890 USE 101 00) for information on Modicon installation requirements.

All CRM931 modules on the RIO network must be in slot 1 of their respective remote drops. Each CRM931 module that acts as a remote interface, or network subscriber, must be connected to the RIO network and uniquely addressed. Refer to *Modicon Remote I/O Cable-System Planning and Installation Guide* (890 USE 101 00) for information on Modicon installation requirements.

All CRM931 modules on the RIO network must have a drop setting. Wiring for “end of the wire” CRM931 modules must have transmission line termination.

Other configuration setup parameters are set during rack addressing in the programming environment.

2.6 RESPONSE TIMES

Product response times vary according to the system configuration used. Table 3 lists typical response times that correspond to a configuration of DC input and DC output and a one-line program with one input and one output rung.

Table 3: Response Times

Type of System	Response Time *
SY/MAX (LI/RI)	8.2 - 18.2 ms
All Quantum	1.8 - 14.8 ms
Quantum Processor with SY/MAX remote rack	1.7 - 14.7 ms

* Due to the varied and integral nature of PLC system set-ups, the response times should be used only as a guide. Differences in scan times produce variance.

Notes:

3 INSTALLATION

3.1 GENERAL INFORMATION

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

To prevent possible equipment damage, remove power from local or remote racks before inserting or removing any component, including interface modules and communication cable.

Failure to observe this instruction can result in injury or equipment damage.

The RIO system allows Quantum or E984-785 PLCs to control inputs and outputs that are not installed in the same rack as the processor. The RIO adapter module applies the ladder logic decisions of the processor corresponding to the range of output addresses under the RIO adapter module's control. Through the RIO head, the RIO adapter module then reports the states of the inputs back to the processor.

The RIO adapter module implements control of both decisions based on the operating state of the processor and the state of associated outputs (when the processor halts).

Special control bit options also allow the RIO adapter module to maintain the last state of the outputs (FREEZE) or assume a pre-determined value in the event of a transmission failure.

3.2 KEYING THE RACK

To prevent modules from being put in different slots than the ones for which they were originally configured, each register slot should be keyed. An optional keying pin kit, Class 8030 Type CBP104, is available for this purpose. The keying pin can be inserted manually into the slot with the keying pin insertion tool (included in the kit). Figure 3 illustrates correct positioning of the keying pin for the RIO drop.

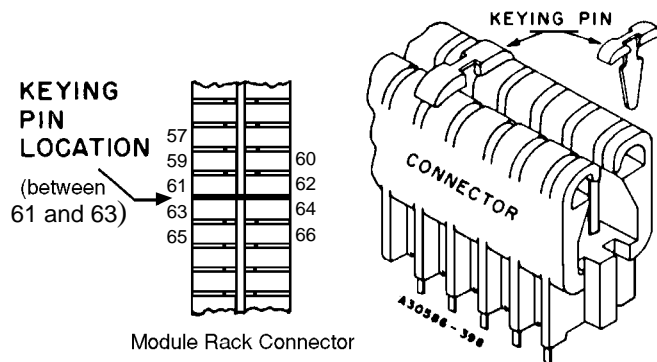


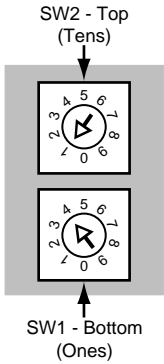
Figure 3 Keying the Rack

3.3 SETTING MODULE SWITCHES

The rear panel of the RIO adapter module contains two rotary switches. These switches set the RIO drop addresses (refer to Table 4). SW2, the top switch, sets the tens digit; SW1, the bottom switch, sets the ones (units) digit. The illustration in Table 4 shows the correct setting for a sample of drop address 14.

Table 4: RIO Drop Switches

SW1 and SW2 RIO Drop Address Settings		
Drop Address	SW2	SW1
1 - 9	0	1 - 9
10 - 19	1	0 - 9
20 - 29	2	0 - 9
30 - 32	3	0 - 2



Note: If a local drop is attached to a local rack, the address "1" is unavailable. If "0" or an address greater than 32 is selected, the RIO drop module displays a flashing Comm Error LED to indicate an error condition. Only addresses 1 - 32 are valid.

3.4 INSTALLING THE MODULE

The RIO adapter module must be placed in register slot 1 of a remote rack. The 5 VDC power required for the CRM931 is provided through the edge connector of the rack.

The CRM931 module should first be inserted in the register slot until firmly seated against the mounting stud (located at the top of the rack), then tightened with the captive screw (at the bottom of the module). These connections are important, not only to provide mechanical support but also to establish an electrical ground for the module.

3.5 WIRING THE CRM931 FOR THE RIO NETWORK

Minimum drop cable - 8.5 feet (2.5 m)

Maximum drop cable - 164 feet (50 m)

For more information, refer to the *Modicon Remote I/O Cable System Planning and Installation Guide* (#890 USE 101 00).

All drop adapters connect to a coaxial drop cable via either an F connector or a BNC connector.

Disconnection of a drop cable (without in-line termination) from an adapter while the network is running introduces the possibility of network errors and data transfer delays. For more details on this and other aspects of cable system termination, see the *Modicon Remote I/O Cable System Planning and Installation Guide* (#890 USE 101 00).

3.6 POWERING UP THE RIO ADAPTER MODULE

When power is first applied to the RIO adapter module, all LEDs turn **On**.

Upon power-up, self-diagnostic routines are run within the RIO adapter module. Successful completion of self diagnostics indicates that the module should be operational. If self diagnostics detect an error condition, COMM ERROR or LOCAL RACK ERROR LED stays **On**.

The RIO drop waits for the RIO head to handshake and initiate communication before transmitting a message.

If valid RIO head/RIO drop communications for an addressed drop cannot be established, the RIO head generates an error.

3.7 RIO DROP HARDWARE START-UP CHECKLIST

Refer to Section 3.3 and Table 4. When first installing or replacing an RIO adapter module, use the following checklist:

- Ensure power to the remote rack is **Off** before removing or installing RIO drop adapter.
- Ensure the switches are set for the correct drop number (see Section 3.3).
- Review Section 3.4 before inserting and securing RIO drop adapter with the captive screw.
- Review Section 3.5 before making field wiring connections.
- Verify that coaxial cable connectors are attached tightly and wires are unbroken.
- Re-apply power and verify proper operation.

WARNING

UNINTENTIONAL EQUIPMENT OPERATION

- Be sure switch settings for the drop correspond with the correct drop number. Improperly set switches can cause equipment to act in an unpredictable manner.
- An improperly coded drop number:
 - when not a rack-addressed drop, will be ignored.
 - when addressing is identical for two or more drops, may create a situation in which either two drops conflict or one drop responds while the other does not. The RIO head may not detect identical drops for all situations.

Failure to observe this precaution can result in death, serious injury, or equipment damage.

Notes:

4 OPERATION

▲ WARNING

UNINTENTIONAL EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product.

Failure to observe this precaution can result in death, serious injury, or equipment damage.

4.1 GENERAL INFORMATION

The RIO adapter module (RIO drop) implements the logical decisions of the Quantum or E984-785 PLC to control remote I/O analog and/or digital input and output modules by way of serial communications with an RIO head.

See Section 2.5.4 for compatibility with SY/MAX racks.

The RIO adapter module has four LEDs to indicate the status of the communications link, drop behavior, and module operation. See Table 14 on page 19 in this bulletin for a summary of each LED state.

The RIO system, a serial multi-drop system limited to a single polling master per link, ensures that each remote device can only exchange information with one RIO head.

The RIO head receives register updates from the CPU Quantum or E984-785 PLC, serializes this information, and transmits it to remote devices on the link. The RIO drop scans its local rack and returns input data to the RIO head. Each RIO drop must be set for a unique number (see Table 4 on page 10) in order for the drop to respond selectively to the appropriate messages.

Information exchanged between RIO drop and RIO head includes register data, I/O module identification, and bus status.

4.2 RIO DROP REGISTERS

The RIO drop (Class 8030 Type CRM931) has a total of 128 on-board data registers (64 input and 64 output) that can be rack addressed to individual slots of the drop. If this limit is exceeded, Modsoft will flag a mapping error while programming. At run time, the SY/MAX CRM931 will flag an error if the module code for any register in an I/O module changes after initialization of the module.

4.3 REMOTE I/O BEHAVIOR

When the system is operating normally, communication between the RIO head and its associated RIO drops occurs only when the CPU scans the program. When scanning is halted, outputs controlled by the RIO drop are either frozen or placed in a pre-determined state.

4.4 RACK ADDRESSING

The CRM931 module is compatible with both SY/MAX Register (RIM, ROM) Modules and SY/MAX Digital (HIM, HOM) Modules and can coexist on an S908 remote network with other CRM931 modules and S908 drops.

The SY/MAX CRM931 module converts all supported SY/MAX module IDs to their corresponding Modicon Module IDs. Modicon Module IDs have an associated set number of input and output registers mapped to them. A CRM931 module has one ID when located in slot 1 of a register rack and one of four IDs when located in slot 1 of a digital rack. The digital rack ID allows for the maximum possible number of digital module input and output registers to be mapped to it.

Table 5 lists the Modicon Module IDs for CRM931. Table 6 and Table 7 illustrate one of many possible configurations.

Table 5: CRM931 Modicon Module IDs

Rack Type (Slot 1)	ID	Max. Input Registers	Max. Output Registers
Register Rack (any size)	8030 CRM931 RG	64	64
Digital Rack (16 slot)	8030 CRM931 DG8	8	8
Digital Rack (8 slot)	8030 CRM931 DG4	4	4
Digital Rack (4 slot)	8030 CRM931 DG2	2	2
Digital Rack (2 slot)	8030 CRM931 DG1	1	1

Table 6: Sample Hardware Configuration

Rack Type: RRK-100 or RRK-200			
Slot 1	Slot 2	Slot 3	Empty Register Slots
CRM931	RIM123	ROM121	—

Table 7: System Addressing

System Addressing	Comments
Drop Number = 2	
Slot Number 1 = -----	Because this is a register rack, no registers are assigned.
Slot Number 2 = 300001 - 300008	This address assigns the analog inputs to addresses 300001 to 300008 for the RIM123 module.
Slot Number 3 = 400001 - 400004	This address assigns the analog outputs to addresses 400001 to 400004 for the ROM121 module.

Note: The CRM931 translates all supported SY/MAX I/O module registers to Modicon I/O mapping. This includes the input/output register mapping, register data format, and error register content. SY/MAX discrete mapping assigns point 16 to the registers' Most Significant Bit (MSBit). Modicon discrete mapping assigns point 1 to the registers' MSBit. The module converts SY/MAX register data to the Modicon register data format based on the I/O Module type as defined in Modsoft. For modules with discrete point I/O, the bits are reversed (1->16...16->1) to match Modicon format. Because I/O Modules with whole register data are transferred as words instead of bits, no bit reversing is performed. The I/O module ID determines whether or not register data in a slot are reversed.

4.5 USING A MODICON PLC WITH A SY/MAX I/O MODULE

Table 8: Bit Reversal

SY/MAX			Modicon			Module Type	Bits Reversed
I/O Points Active	Register (Binary) Pattern MSB LSB	Register (Dec.) Value	I/O Points Active	Register (Binary) Pattern MSB LSB	Register (Dec.) Value		
1	0000000000000001	1	16	0000000000000001	1	Analog I/O	No
16	1000000000000000	- 32767	1	1000000000000000	- 32767	Analog I/O	No
3,7,15	0100000001000100	16452	2,10,14	0100000001000100	16452	Analog I/O	No
1	0000000000000001	1	1	1000000000000000	- 32767	Discrete I/O	Yes
16	1000000000000000	- 32767	16	0000000000000001	1	Discrete I/O	Yes
3,7,15	0100000001000100	16452	3,7,15	0010001000000010	8706	Discrete I/O	Yes

Take precautions when using the CRM931 module with SY/MAX modules that are assigned Type 3x or 4x registers used in a BIT mode (rather than as a WORD [numbers]). The BIT structure of a Modicon Quantum or E984-785 PLC places the first bit in the left-most position (MSBit) of a 16-bit word. A SY/MAX PLC places the first bit in the right-most position (LSBit). When the bits are not reversed by the CRM931, i.e. analog module, and the I/O mapped is registered and used in a bit manner, i.e. status of a module, the SY/MAX bit 1 will become a Modicon bit 16.

The Class 8030 Type RIM126 Eight Channel Isolated Analog-Thermocouple Input Module, for example, has the following parameters when used in a CRM931 equipped rack:

I/O Mapping = 12 consecutive Type 3x registers

- The first 8 registers are used as the analog input values.
- The next 4 registers are used in a bit mode for module status and dip-switch positions.

In this example, which I/O Maps the RIM126 to registers 300005 through 300016, registers 300005 through 300012 show the values of the input signals from the field analog devices. The PLC directly uses the numerical values with no adjustments.

Bits 9 through 16 of input register 30013 can be used by the user's logic program to determine a thermocouple open input condition on any of the input channels. Bits 9 through 16 (ascending) in the Modicon Quantum or E984-785 PLC are equivalent to bits 8 through 1 (descending), respectively, in a SY/MAX controller. If an existing SY/MAX ladder logic program is being converted to a Quantum or E984-785 PLC, it is possible that the SY/MAX program used the numerical (word) value of the register to determine an open circuit status. One example of determining this status is an IF instruction using the assigned register to compare status against a known numerical value equaling a bit pattern. An alternate method would be to use the SY/MAX register bits as contacts within the program. When this type of program is converted to a Modicon Quantum or E984-785 PLC, the bit numbers are reversed.

Table 8 illustrates SY/MAX and Modicon mapping for discrete and analog I/O modules. This relationship must be observed carefully when setting up a remote I/O system with a CRM931 module. Table 12 on page 17 shows the supported SY/MAX modules, the number of associated I/O registers, and whether all of the registers in that module are reversed.

4.5.1 SY/MAX Register I/O Modules

SY/MAX Register I/O modules are mapped to Modicon register addresses in the same manner as Modicon I/O modules. The following example illustrates I/O mapping. Register address space is separate from discrete address space. Therefore, the two address spaces do not overlap.

Table 9: Mapping for SY/MAX I/O Modules in a Register Rack

Module Example	Register Slot Number	Register Module Type		Register Addressing	Discrete Addressing
RIM101	2	16 point input	—	—	100001 - 100016
ROM221	3	—	16 point output	—	000001 - 000016
ROM871	5	—	64 point output	—	000017 - 000080
ROM271	6	—	16 point output	—	000081 - 000096
RIM361	7	16 point input	—	—	100017 - 100032
RIM101	8	16 point input	—	—	100033 - 100048
RIM127	9	12 channel resistance input	—	300001 - 300014 400001 - 400002	—

4.5.2 SY/MAX Digital I/O Modules

SY/MAX Digital I/O modules are mapped to the CRM931 module in register slot 1 of the remote rack. Since the number and combination of installed digital I/O modules can greatly vary, a digital rack has a set number of input and output registers assigned to it. This number is determined by the number of slots in the rack. For example, the HRK200 rack uses the maximum possible value of eight input and eight output registers. Empty registers have a zero value and no effect. The CRM931 module has a different ID code for a digital rack than for a register rack. Therefore, the registers may be assigned to slot 1. The SY/MAX digital I/O points are assigned to Modicon I/O discrete points, according to slot location, in the standard SY/MAX rack addressing manner. The following example illustrates I/O mapping. Discrete output modules have their sensed value read back in their corresponding input registers.

Table 10: Mapping for SY/MAX I/O Modules in a Digital Rack

Module Example	Register Slot Number	Register Module Type		Register Addressing	Discrete Addressing
CRM931 DG8	1	128 point input (potential)	128 point output (potential)	—	000001 - 000128 100001 - 100128

Table 11: Mapping for SY/MAX Digital I/O Modules

Digital Slot Number	Digital Module Type		Discrete Addressing
1	8 point input	—	100001 - 100008
2	—	8 point output	000009 - 000016 100009 - 100016
3	empty	—	—
4	—	8 point output	000025 - 000032 100025 - 100032

Table 11: Mapping for SY/MAX Digital I/O Modules (Continued)

Digital Slot Number	Digital Module Type		Discrete Addressing
5	—	8 point output	000033 - 000040 100033 - 100040
6	8 point input	—	100041 - 100048

Table 12: SY/MAX Register I/O Modules

Name	Description	Registers		Code		Reverse Bits
		Input [3X]	Output [4X]	SY/MAX	Modicon	
8030CRM931 RG	Modicon Remote Interface (Reg Rack)	0	0	N/A	2000	—
8030CRM931 DG8	Modicon Remote Interface (Dig 8 Rack)	8	8	N/A	2007	Yes
8030CRM931 DG4	Modicon Remote Interface (Dig 4 Rack)	4	4	N/A	2001	Yes
8030CRM931 DG2	Modicon Remote Interface (Dig 2 Rack)	2	2	N/A	2002	Yes
8030CRM931 DG1	Modicon Remote Interface (Dig 1 Rack)	1	1	N/A	2003	Yes
8030RIM101	16 Function 120 V AC/DC Input	1	0	E0	20E0	Yes
8030RIM331	32 Function 24 V DC Input	2	0	E1	20E1	Yes
8030RIM361	16 Function 240 V AC/DC Input	1	0	E0	20E0	Yes
8030RIM731	64 Function 24 V AC/DC Input	4	0	ED	20ED	Yes
8030ROM221	16 Function 120 V AC Output	0	1	A0	20A0	Yes
8030ROM271	16 Function 120 V AC Output Relay	0	1	AF	20AF	Yes
8030ROM301	16 Function 85 - 140 V AC Output	1	0	E5	20E5	Yes
8030ROM421	16 Function 35 - 140 V AC Output	0	1	A5	20A5	Yes
8030ROM431	16 Function 240 V AC Output	0	1	A0	20A0	Yes
8030ROM441	32 Function 24 V DC Output	0	2	A1	20A1	Yes
8030ROM871	64 Function Relay Output	0	4	AD	20AD	Yes
8030RIM121	4 Function Analog Input	4	0	C1	20C1	No
8030RIM123	8 Channel High Speed Analog Input	8	0	C3	20C3	No
8030RIM125	16 Function Analog Input	16	0	C1	20C1	No
8030RIM126	8 Function Analog, Thermocouple Input	12	0	C7	20C7	No
8030RIM127	12 Channel RTD Input	14	2	CD	20CD	No
8030RIM131	High Speed Counter	4	12	C8	20C8	No
8030RIM144	Multiplexed BCD Input	16	0	C6	20C6	No
8030ROM121	4 Function Analog Output	0	4	82	2082	No
8030ROM122	4 Function Isolated Analog Output	0	4	84	2084	No
8030ROM131	Stepper Motor Controller	4	12	8A	208A	No
8030ROM141	Multiplexed BCD Output	0	16	8E	208E	No

Table 13: SY/MAX Digital I/O Modules

Name	Description	Registers	
		Input	Output
8030HIM101	8 Function 120V AC Input	0.5	0
8030HIM102	6 Function 120V AC/DC Isolated Input	0.5	0
8030HIM131	8 Function 12 - 24V AC/DC Input	0.5	0
8030HIM141	8 Function 48V AC/DC Input	0.5	0
8030HIM151	8 Function TTL Input	0.5	0
8030HIM161	8 Function 240V AC/DC Input	0.5	0
8030HIM191	8 Function Input Simulator	0.5	0
8030HIM310	4 Function Fiber Optic Input	0.5	0
8030HOM211	8 Function 12 - 50V AC Output	0	0.5
8030HOM221	8 Function 120V AC Output	0	0.5
8030HOM222	6 Function 120V AC Isolated Output	0	0.5
8030HOM231	8 Function 240V AC Output	0	0.5
8030HOM232	6 Function 240V AC Isolated Output	0	0.5
8030HOM241	8 Function 9 - 55V DC Output	0	0.5
8030HOM251	8 Function 60 - 160V DC Output	0	0.5
8030HOM261	8 Function TTL Output	0	0.5
8030HOM271	8 Function Reed Relay Output	0	0.5

5 TROUBLESHOOTING

5.1 GENERAL INFORMATION

This section provides troubleshooting information about the RIO adapter module. Some Local and Remote Interface (RIO head/RIO drop) system problems can be diagnosed using Table 14 and Table 15. Table 14 explains the RIO drop front panel LED states, and Table 15 lists possible I/O system conditions and their associated RIO drop front panel LED states.

Table 14: LED Indicators and Descriptions for the RIO Drop Module

LED	COLOR	INDICATION WHEN ON
READY	Green	Module has passed power up diagnostics.
COMM ACTIVE	Green	Module is communicating on the RIO network.
COMM ERROR	Red	Communication error on Channel A.
LOCAL RACK ERROR	Red	Unable to communicate with one or more modules.

When initially installing or replacing an RIO adapter module, follow the checklist given in Section 3.7. After completing these steps, initialize communications with the RIO head in one of the following ways:

- Cycle power to CPU rack while processor is in HALT (preferred) or RUN.
- Command the processor to go from HALT to RUN.

Communication initialization to the RIO adapter module requires rack addressing the logical channel and drop number that correspond to the RIO adapter module's physically coded drop number (see Table 4). If proper rack addressing does not occur, the processor and RIO head will not look for the RIO adapter and communication will never occur. Illumination of the COMM ACTIVE LED confirms successful communication initialization.

When the hardware is installed and configured properly, the most common problem associated with an RIO adapter module which is properly communicating with its RIO head but not controlling its associated I/O, lies in the rack addressing of the drop.

Note: For register racks, no registers should be assigned to the RIO drop itself (slot 1), but should instead be assigned to the remote slots in which the other modules reside. See examples in Chapter 4 of the RIO head instruction bulletin. For digital racks, all digital registers are assigned to the CRM931 (slot 1).

⚠ WARNING

UNINTENTIONAL EQUIPMENT OPERATION

- Be sure switch settings for the drop correspond with the correct drop number. Improperly set switches can cause equipment to act in an unpredictable manner.
- An improperly coded drop number:
 - when not a rack-addressed drop, will be ignored.
 - when addressing is identical for two or more drops, may create a situation in which either two drops conflict or one drop responds while the other does not. The RIO head may not detect identical drops for all situations.

Failure to observe this precaution can result in death, serious injury, or equipment damage.

5.2 PROGRAMMING EQUIPMENT

Connect Modicon Modsoft Software, Revision 2.31 or later, to the Modicon Quantum or E984-785 PLC in the main CPU rack. This connection allows the user to program the slot and assign registers to any SY/MAX module that is installed in a SY/MAX remote rack with a CRM931 remote adapter module. All programming functions must be performed through the Modicon Quantum or E984-785 PLC.

Table 15: System Conditions and Corresponding RIO Drop LED States

POSSIBLE CONDITION	READY	COMM ACTIVE	COMM ERROR	LOCAL RACK ERROR	COMMENTS
Normal Operation	ON	ON	OFF	OFF	CPU in Run or Rack Address mode
Normal Operation	ON	OFF	OFF	OFF	CPU not communicating with drop
Module or backplane error	ON	ON	OFF	ON	Problem exists in CRM931's rack
Communications error	ON	—	ON	OFF	Communication problem between head and drop
RIO module error	OFF	—	—	—	Malfunction within the CRM931 module
PROM checksum error	ON	7 flashes	—	—	Error code 6301H*
RAM data test error	ON	6 flashes	—	—	Error code 6401H*
RAM address test error	ON	5 flashes	—	—	Error code 6501H*
Power down interrupt	ON	4 flashes	—	—	Error code 6601H*
LAN chip test error	ON	4 flashes	—	—	Error code 6602H*
Receive abort timeout	ON	4 flashes	—	—	Error code 6603H
Transmission loop timeout	ON	4 flashes	—	—	Error code 6604H*
Transmission DMA error	ON	4 flashes	—	—	Error code 6605H*
Receive initialization error	ON	4 flashes	—	—	Error code 6606H*
Receive DMA transfer error	ON	4 flashes	—	—	Error code 6607H*
Receive dumped data error	ON	4 flashes	—	—	Error code 6609H*

Table 15: System Conditions and Corresponding RIO Drop LED States (Continued)

POSSIBLE CONDITION	READY	COMM ACTIVE	COMM ERROR	LOCAL RACK ERROR	COMMENTS
Receive DRQ line hung	ON	4 flashes	—	—	Error code 660AH or 660CH*
Power-up LAN controller error	ON	4 flashes	—	—	Error code 660DH*
RIO module not in slot #1	ON	3 flashes	—	—	Error code 6701H*
Drop address out of range error	ON	3 flashes	—	—	Drop address must not be 0 or greater than 33
Rack module asserting error	ON	3 flashes	—	—	One or more of the I/O modules in the rack has flagged an error

* An internal error register contains the error codes. Use Modsoft panel software to access these codes. Refer to the Modsoft instruction manuals for more information.

5.3 UNDERVOLTAGE LOCKOUT CIRCUIT (ULC) OPERATION

When incoming line power is interrupted under normal conditions, the system power supply generates an ACFAIL signal which causes all modules in the rack (including the RIO adapter) to execute an orderly shutdown sequence. All outputs associated with the failed rack turn **Off**. Note that although other modules may require battery backup, the RIO adapter module does not.

The RIO adapter module is designed with an onboard DC Undervoltage Lockout Circuit that monitors the incoming DC voltage level (between the power supply and the rack). If the incoming DC voltage falls below 4.6 VDC, the RIO adapter module enters a HALT state and no longer communicates with either the RIO head or its associated I/O. All module outputs and LEDs turn off.



SQUARE D