115V AC/DC Input Module

M/N 6* C501

Instruction Manual J2-3097

RELIANCE ELECTRIC

The information in this instruction manual is subject to change without notice.

WARNING

THIS UNIT AND ITS ASSOCIATED EQUIPMENT MUST BE INSTALLED, ADJUSTED AND MAINTAINED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. READ AND UNDERSTAND THIS MANUAL AND OTHER MANUALS APPLICABLE TO THE EQUIPMENT IN YOUR INSTALLATION. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

WARNING

INSERTING OR REMOVING THIS MODULE OR ITS CONNECTING CABLES MAY RESULT IN UNEXPECTED MACHINE MOTION. POWER TO THE MACHINE SHOULD BE TURNED OFF BEFORE INSERTING OR REMOVING THE MODULE OR ITS CONNECTING CABLES. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

CAUTION: This module contains static-sensitive components. Careless handling can cause severe damage.

Do not touch the connectors on the back of the module. When not in use, the module should be stored in an anti-static bag. The plastic cover should not be removed. Failure to observe this precaution could result in damage to or destruction of the equipment.

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1.0 INTRODUCTION

The products described in this instruction manual are manufactured or distributed by Reliance Electric Company or its subsidiaries.

The 115V AC/DC input module accepts up to a maximum of sixteen 115 volt control signals as found in DCS 5000, AutoMax and AutoMate systems. The input signals may be 50 or 60 hertz AC or DC. Inputs have 2500 volt isolation to logic common. The module contains four isolated commons, each having four inputs.

Typically, this module is used to input on/off signals from devices such as relay contacts, limit switches, push-buttons, and selector switches.

This manual describes the functions and specifications of the module. It also includes a detailed overview of installation and servicing procedures, as well as examples of programming methods.

Related publications that may be of interest:

- J-3031 AutoMate 30 Hardware Instruction Manual
- J-3063 AutoMate Programming Executive Instruction Manual
- J-3141 AutoMate 40 Hardware Instruction Manual
- J-3150 AutoMate 30/40 Software Reference
- J-3650 AutoMax Processor Module Instruction Manual
- J-3675 AutoMax Enhanced BASIC Language Instruction Manual
- J-3676 AutoMax Control Block Language Instruction Manual
- J2-3094 AutoMax Enhanced Ladder Language Instruction Manual
- J2-3102 AutoMax Programming Executive Instruction Manual, Version 4.1
- IEEE 518 Guide for the Installation of Electrical Equipment To Minimize Electrical Noise Inputs to Controllers from External Sources

2.0 MECHANICAL/ELECTRICAL DESCRIPTION

The following is a description of the faceplate LEDs, field termination connectors, and electrical characteristics of the I/O connectors.

2.1 Mechanical Description

The input module is a printed circuit board assembly that plugs into the backplane of the DCS 5000/Autoflex or Autoflex rack. It consists of a printed circuit board, a faceplate, and a protective enclosure. The faceplate contains tabs at the top and bottom to simplify removing the module from the rack. Module dimensions are listed in Appendix A.

The faceplate of the module contains a female connector socket and sixteen LED indicators that show the status of the inputs. Input signals are brought into the module via a multi-conductor cable assembly (MAN 57C370 or MAN 45C175); see Appendix D). One end of this cable attaches to the faceplate connector, while the other end of the cable has stake-on connectors that attach to a terminal strip for easy field wiring. The faceplate connector socket and cable plug are keyed to prevent the cable from being plugged into the wrong module.

On the back of the module are two edge connectors that attach to the system backplane.

2.2 Electrical Description

The input module contains 16 input circuits for 115 volt AC/DC logic signals. Each group of four circuits shares a single isolated common. Each input circuit has 2500 volt isolation to logic common. Refer to the block diagram in Appendix B.

Each input circuit consists of an optical isolator and RC filters to eliminate spurious signals. A circuit diagram is shown in figure 2.1.

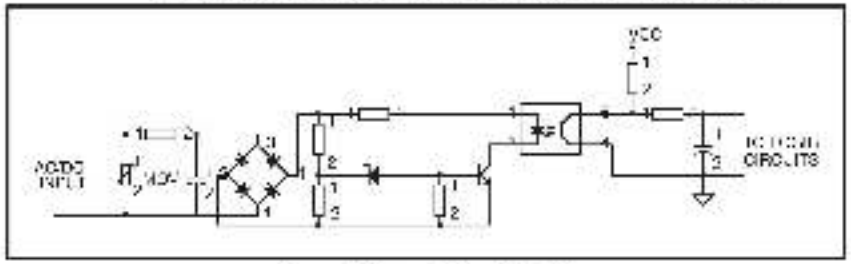


Figure 2.1 - Typical Input Circuit

There are 16 LED indicators on the faceplate of the module. They are numbered sequentially from zero through 15, corresponding to the bits in the register. See figure 2.2.

The LED indicators display the status of the logic level circuitry. A lit LED indicates that both the input circuit and the logic level circuitry are operating correctly.

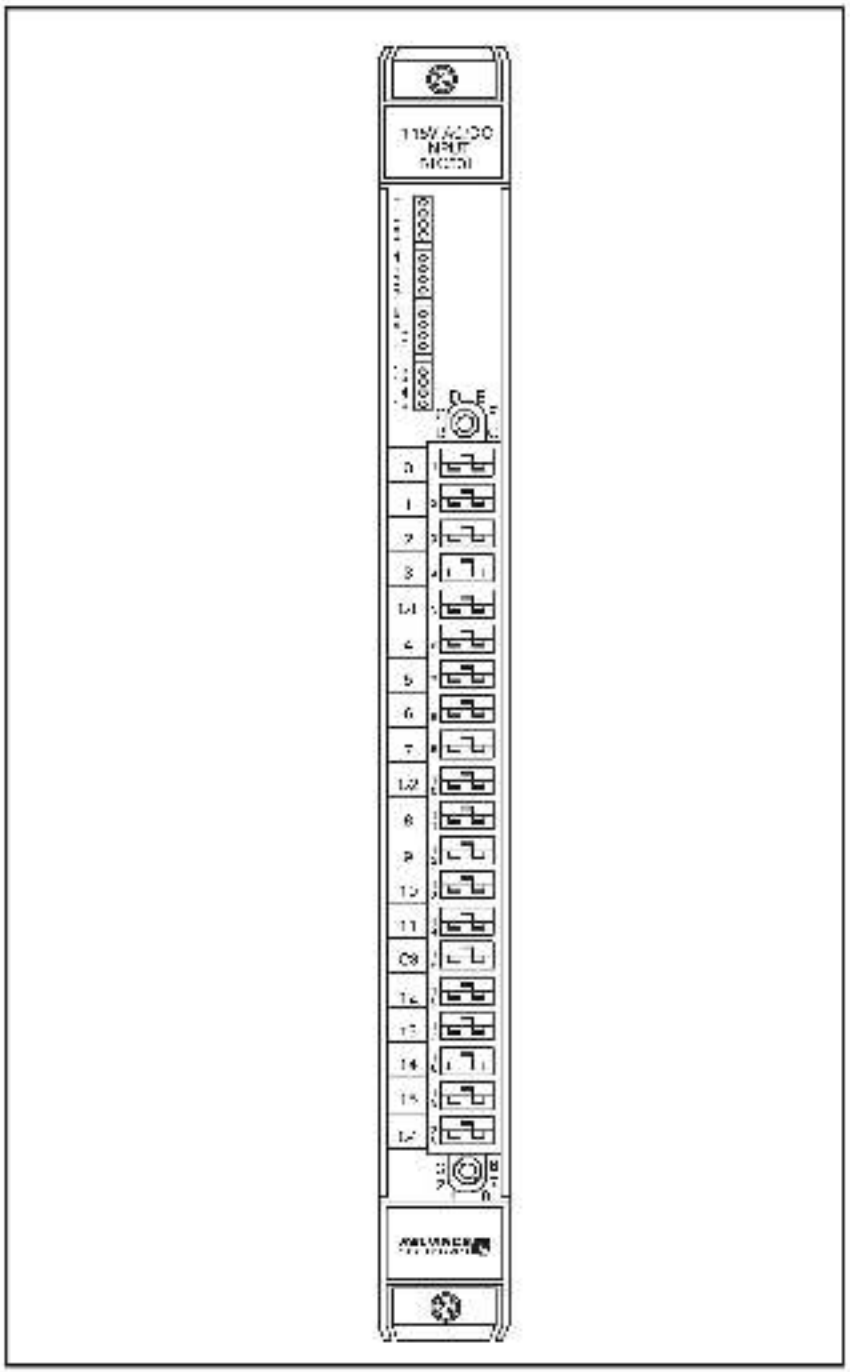


Figure 2.2 Module Faceplate

3.0 INSTALLATION

This section describes how to install and remove the module and its cable assembly.

3.1 Wiring

The installation of wiring should conform to all applicable codes.

To reduce the possibility of electrical noise interfering with the proper operation of the control system, exercise care when installing the wiring from the system to the external devices. For detailed recommendations refer to IEEE 518.

3.2 Initial Installation

Use the following procedure to install the module:

Step 1. Turn off power to the system. All power to the rack as well as all power to the wiring leading to the module should be off.

Step 2. Mount the terminal strip (P/N 57C572, 61C505, or 61C506) on a panel. The terminal strip should be mounted to permit easy access to the screw terminals. Make certain that the terminal strip is close enough to the rack so that the cable reaches between the terminal strip and the module.

Step 3. Fasten field wires to the terminal strip. Typical field connections for 115 VAC inputs are shown in figure 3.1.

Refer to Appendix C for the arrangement of terminal board connections. Make certain that all field wires are securely fastened.

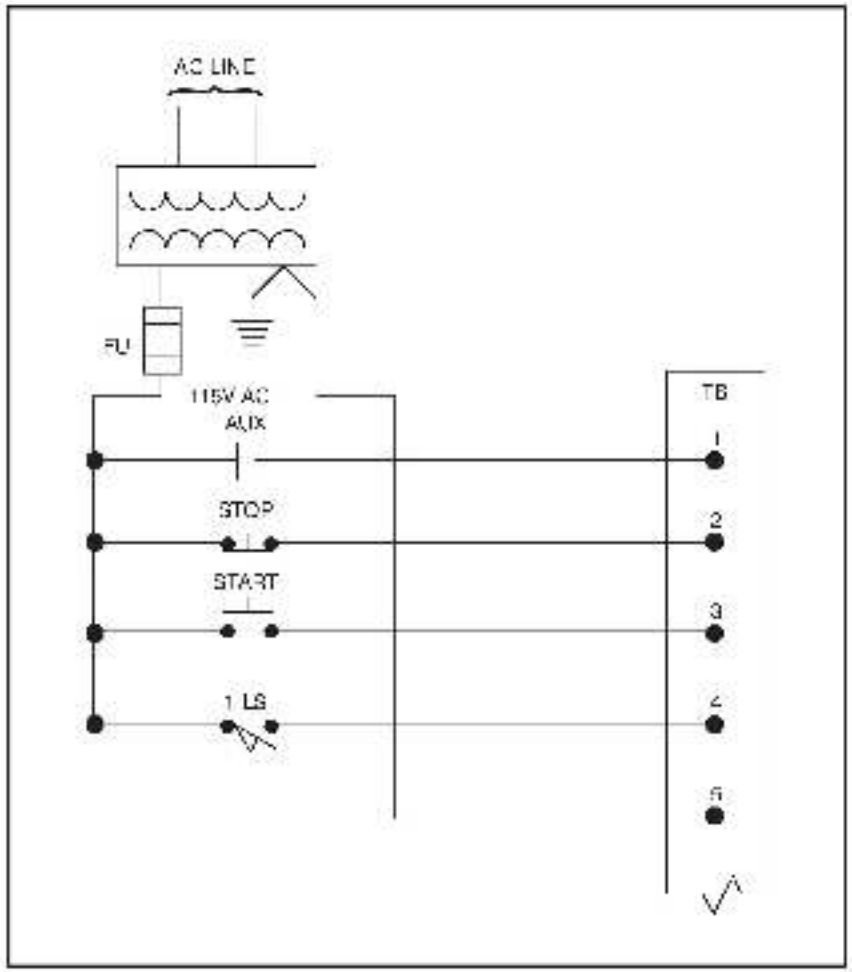


Figure 3.1 - Typical Field Signal Connections for 115V AC Inputs

Step 4. Take the module out of its shipping container. Take it out of the anti-static bag, being careful not to touch the connectors on the back of the module.

Step 5. Insert the module into the desired slot in the rack. Use a screwdriver to secure the module into the slot.

Step 6. Attach the field terminal connector (P/N 57C370, 61C505, or 61C506) to the mating part on the module. Make certain that the connector keys are oriented properly and that the connector is the proper one for this module. Use a screwdriver to secure the connector to the module.

Note that both the module and the terminal strip connector are equipped with "keys." These keys should be used to prevent the wrong cable from being connected to a module in the event that the connector needs to be removed for any reason and then re-attached later.

At the time of installation, rotate the keys on the module and the connector so that they can be connected together securely. It is recommended that, for modules so equipped, the keys on each successive module in the rack be rotated one position to the right of the keys on the preceding module.

If you use this method, the keys on each connector will be positioned in such a way as to fit together only with a specific module, and there will be little chance of the wrong connector being attached to a module.

Step 7 Turn on power to the system.

Step 8 Verify the installation by connecting the programming terminal to the system and running the ReSource Software.

Stop all programs that may be running.

Use the MONITOR I/O function in DCS 5000/AutoMax systems or POINT MONITOR function in AutoMate systems.

Toggle each of the input devices connected to the input module one at a time to verify that the installation has been completed correctly.

3.3 Module Replacement

Use the following procedure to replace a module:

Step 1 Turn off power to the rack and all connections.

Step 2 Use a screwdriver to loosen the screws holding the connector to the module. Remove the connector.

Step 3 Loosen the screws that hold the module in the rack. Remove the module from the slot in the rack.

Step 4 Place the module in the anti-static bag it came in, being careful not to touch the connectors on the back of the module. Place the module in the cardboard shipping container.

Step 5 Take the new module out of the anti-static bag, being careful not to touch the connectors on the back of the module.

Step 6 Insert the module into the desired slot in the rack. Use a screwdriver to secure the module into the slot.

Step 7 Attach the field terminal connector (IMN57C370, 61C505, or 61C506) to the mating half on the module. Make certain that the connector keys are oriented correctly and that the connector is the proper one for this module (see step 6 in 3.2, Initial Installation). Use a screwdriver to secure the connector to the module.

Step 8 Turn on power to the rack.

4.0 PROGRAMMING

This section describes how data is organized in the module and provides examples of how the module is accessed by the application software. For more detailed information, refer to the Enhanced BASIC Programming Instruction manual (J-3673) for DCS 5000/AutoMax systems or the AutoMate 3000 Software Reference instruction manual (J-3150) for AutoMate systems.

4.1 Register Organization

The data in the module is organized as one 16 bit register. The software allows you to define the module as a single register (up to 16 bits) by referencing the entire module as a unit, or as up to 16 individual bits by treating each of the bits separately. Refer to figure 4.1.

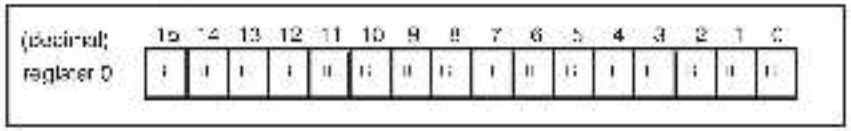


Figure 4.1 - Organization of Register Bits

4.2 Use In DCS 5000/AutoMax Systems

This section describes how to use the module in DCS 5000/AutoMax Systems.

4.2.1 Configuration

Before any application programs can be written, you must configure, or set, the definitions of system-wide variables, i.e. those that must be globally accessible to all tasks.

For DCS 5000 and AutoMax Version 2.1 and earlier, you define system-wide variables by writing a Configuration task. For AutoMax version 3.0 and later, you define system-wide variables using the AutoMax Programming Executive. After these variables are defined, you can generate the configuration file automatically, which eliminates the requirement to write a configuration task for the rack. If you are using AutoMax Version 2.1 or earlier, refer to Appendix E for examples that show how to define variables in the configuration task. If you are using AutoMax Version 3.0 or later, see the AutoMax Programming Executive instruction manual for information about configuring variables.

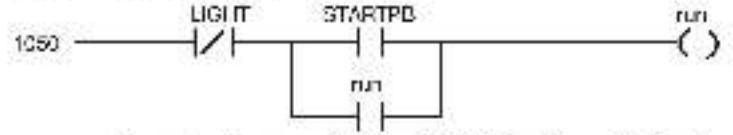
4.2.2 Reading Data in Application Tasks

For an input module to be referenced by application software, you must assign symbolic names to the physical hardware.

Each application program that references the symbolic names assigned to the input module in configuration must declare those names COMMON (or global in ladder programs created using Version 1.0 or later and the AutoMax Programming Executive).

The frequency with which tasks read their inputs and write their outputs depends on the language being used. Ladder logic and control block tasks read inputs once at the beginning of each scan and write outputs once at the end of scan. BASIC tasks read an input and write an output for each reference.

4.2.2.1 Ladder Logic Task Example



The symbolic names LIGHT and STARTPB reference the input modules. The trailing at symbol "@" is not used in ladder logic tasks. The symbolic name "run" is local to the ladder logic task and does not have I/O associated with it. Refer to your Ladder Logic Instruction manual for more information.

4.2.2.2 BASIC Task Example

```
1000        COMMON      LIGHT@          ;Fault light
1010        COMMON      STARTPB@        ;Start Push-button
2000        LOCAL RUN@  ;Line run
3000        !
4000        !
5000        RUN@ = NOT LIGHT@ AND ( STARTPB@ OR
            RUN@)
5500        !
6000        END
```

The symbolic names LIGHT@ and STARTPB@ reference the input modules. The symbolic name RUN@ is local to the BASIC task and does not have I/O associated with it. Refer to the Enhanced BASIC Language Instruction Manual (J-3673) for more information.

4.2.2.3 Control Block Task Example

```
2400        COMMON STARTPB@             ;Start push-button
2500        LOCAL MOMENTARY@            ;Momentary output
3000        !
5000        CALL TRANSITION( INPUT=STARTPB@,
            OUTPUT=MOMENTARY@)
5500        !
6000        END
```

The symbolic name STARTPB@ references the input module. The symbolic name MOMENTARY@ is local to the control block task and does not have I/O associated with it. Refer to the Control Block Language Instruction Manual (J-3678) for more information.

4.2.3 Restrictions on Use In DCS 5000/AutoMax Systems

This section describes limitations and restrictions on the use of this module in DCS 5000/AutoMax systems.

The 115V AC/DC Input module is a read only module. Attempts to write to it will cause a bus error (severe system error). The following are examples from programs that write to the module and should therefore be avoided:

a. Referencing the module from a coil in a ladder logic task.

b. Referencing the module on the left side of an equal sign in a LET statement in a control block or BASIC task.

c. Referencing the module as an output in a control block function.

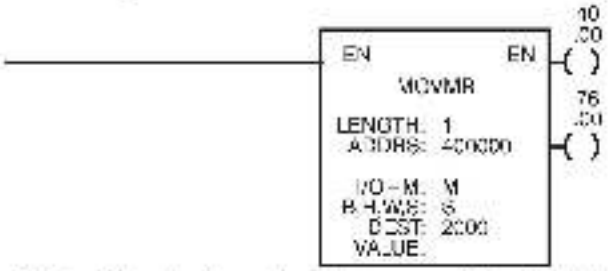
4.3 Use In AutoMate Systems

In AutoMate systems, the 115V AC/DC Input module is accessed using the MOVMR instruction block. This block reads the data from the module and places it into a destination register, which, depending upon the register chosen, can then be accessed as a register or as a register and as individual bits. Note that the module cannot be used in a remote rack in AutoMate systems.

Register 3765 in an AutoMate 30 Processor and register 17565 in an AutoMate 40 Processor indicate whether there is a missing or improperly seated module in the rack. The slots in the rack correspond to the bits in the register, which are set to 1 (on) when a module is missing or seated improperly. A set bit in either register 3765 or 17565 will not, however, affect the execution of the application program.

4.3.1 Ladder Diagram Example

The following sample MOVMR instruction block is used to access a 115V AC/DC input module located in slot 4 of an AutoMate rack that contains an AutoMate 30 Processor. The data from the module will be stored in register 2000.



Note that the coil address shown in the example is not valid for an AutoMate 40 Processor.

4.3.2 Restrictions on Use in AutoMate Systems

The module cannot be used in remote racks within an AutoMate system.

5.0 DIAGNOSTICS AND TROUBLESHOOTING

This section explains how to troubleshoot the module and field connections.

5.1 Incorrect Data

Problem: The data is either always off, always on, or different than expected. The possible causes of this are a module in the wrong slot, a programming error, or a malfunctioning module. It is also possible that the inputs are either not wired or wired to the wrong device. Use the following procedure to isolate the problem.

Step 1 Verify that the input module is in the correct slot and, for DCS 5000/AutoMax systems, that the I/O definitions are correct.

Verify that the slot number being referenced agrees with the actual slot number of the module. In the DCS 5000/AutoMax systems, the module's register number is always zero. Verify that the bit number refers to the proper bit. Note that the bit number and the wire number are not the same.

For remote I/O installations, (DCS 5000/AutoMax systems only) also verify that the master slot and remote drop number are defined correctly.

Step 2 Verify that the input is wired to the correct device.

Confirm that all connections at the terminal strip are tight. Connect a voltmeter to the proper points on the terminal strip and toggle the device. The voltmeter should alternate between 0 and 115 volts. If this does not happen, there is a problem with either the external device, the power supply, or the wiring to the terminal strip.

Check the cable for continuity between the faceplate connector and the terminal strip.

Step 3 Verify that the module can be accessed.

Connect the programming terminal to the system and run the ReSource Software. Use the MONITOR I/O function in DCS 5000/AutoMax systems, or the POINT MONITOR function in AutoMate systems. Toggle the input device to determine whether the bit is changing state.

If the programmer is able to read the input, the problem is in the application software (proceed to step 4). If the programmer cannot read the inputs, the problem is in the hardware (proceed to step 5).

Step 4 Verify that the user application program is correct.

For DCS 5000/AutoMax systems verify that the application program has references the symbolic names associated with the module has declared these names COMMON (or global in V4.0 and later ladder tasks) in application tasks.

Verify that the symbolic name in question is being referenced in the application program. This can be done indirectly by monitoring the name with the VARIABLE MONITOR function in the ReSource Software.

For both DCS 5000/AutoMax systems and AutoMan systems, verify that the program reading the module is executing fast enough to catch all of the input changes.

Step 5. Verify that the hardware is working correctly.

Toggle the input device. Verify that the LED associated with the particular bit is also toggling. If it is not, the input circuit on the module is malfunctioning.

Verify the hardware functionality by systematically swapping out modules. If the problem is not corrected after each swap, replace the original item before swapping out the next item.

- To test local I/O, first replace the input module. Next, replace the Processor module(s). If the problem persists, take all of the modules out of the backplane except one Processor module and the input module. If the problem is now corrected, one of the other modules in the rack is malfunctioning. Reconnect the other modules one at a time until the problem reappears. If none of these tests reveals the problem, replace the backplane.
- To test remote I/O (DCS 5000/AutoMax systems only), first verify that the remote I/O system is communicating with the drop that contains the input module being tested. Next, determine whether the input module is the only module that is not working. If more than one module is not working correctly, the problem most likely lies in the remote I/O system.
- To test the remote rack, first replace the input module. Next, replace the slave remote I/O module. If the problem persists, take all of the modules out of the remote backplane except the slave remote I/O module and the input module. If the problem is now corrected, one of the other modules in the rack is malfunctioning. Reconnect the other modules one at a time until the problem reappears. If the problem proves to be neither in the remote I/O system nor in the remote rack, try replacing the backplane.

5.2 Bus Error

Problem: A "31" or "50" through "58" appears on the Processor module's LED. In DCS 5000/AutoMax systems. In AutoMate systems, a "1" appears in any slot location if register 3761 of an AutoMate 30 or register 17561 of an Automate 10. This error message indicates that there was a bus error when the system attempted to access the module. The possible causes of this error are a missing module, a module in the wrong slot, or a malfunctioning module. It is also possible that the user is attempting to write to registers on the module. Refer to the instruction manual for the Processor module in the rack for more information. Use the following procedure to isolate a bus error.

Step 1 Verify that the input module is in the correct slot and, for DCS 5000/AutoMax systems, that the I/O definitions are correct.

Verify that the slot number being referenced agrees with the actual slot number of the module. In DCS 5000/AutoMax systems, this module's register number is always zero. Verify that the bit number refers to the proper bit. Note that the bit number and wire number are not the same.

For remote I/O installations, (DCS 5000/AutoMax systems only) also verify that the master slot and remote drop number are defined correctly.

Step 2 Verify that the module can be accessed.

Connect the programming terminal to the system and run the ReSource Software. Use the MONITOR I/O function to display register 0 in DCS 5000/AutoMax systems. In AutoMate systems, use the POINT MONITOR function to display the point. If the programmer is able to monitor the inputs, the problem lies in the application software (proceed to step 3). If the programmer cannot monitor the inputs, the problem lies in the hardware (proceed to step 4).

Step 3 Verify that the user application program is correct.

This module cannot be written to. If a BASIC task causes the bus error, the error log will contain the statement number in the task where the error occurred. If a Ladder Logic or Control Block task caused the error, you will need to search the task for any instances where you used an input as a ladder logic coil or wrote to it in a control block task.

In AutoMate systems, search the task for any instances where you used an input as a coil.

Step 4 Verify that the hardware is working correctly.

Verify the hardware functionality by systematically swapping out the input module, Processor module(s), and backplane. If the problem is not corrected after each swap, replace the original item before swapping out the next item.

For remote I/O installations (DCS 5000/AutoMax systems only), systematically swap out the input module, the slave remote module, and the backplane. After each swap, if the problem is not corrected, replace the original item before swapping out the next item.

Appendix A

Technical Specifications

Ambient Conditions

- Storage temperature: −40°C - 85°C
- Operating temperature: 0°C - 60°C
- Humidity: ≤ 90% non condensing

Maximum Module Power Dissipation

- Watts: 10

Dimensions

- Height: 11.75 inches
- Width: 1.25 inches
- Depth: 7.375 inches

System Power Requirements

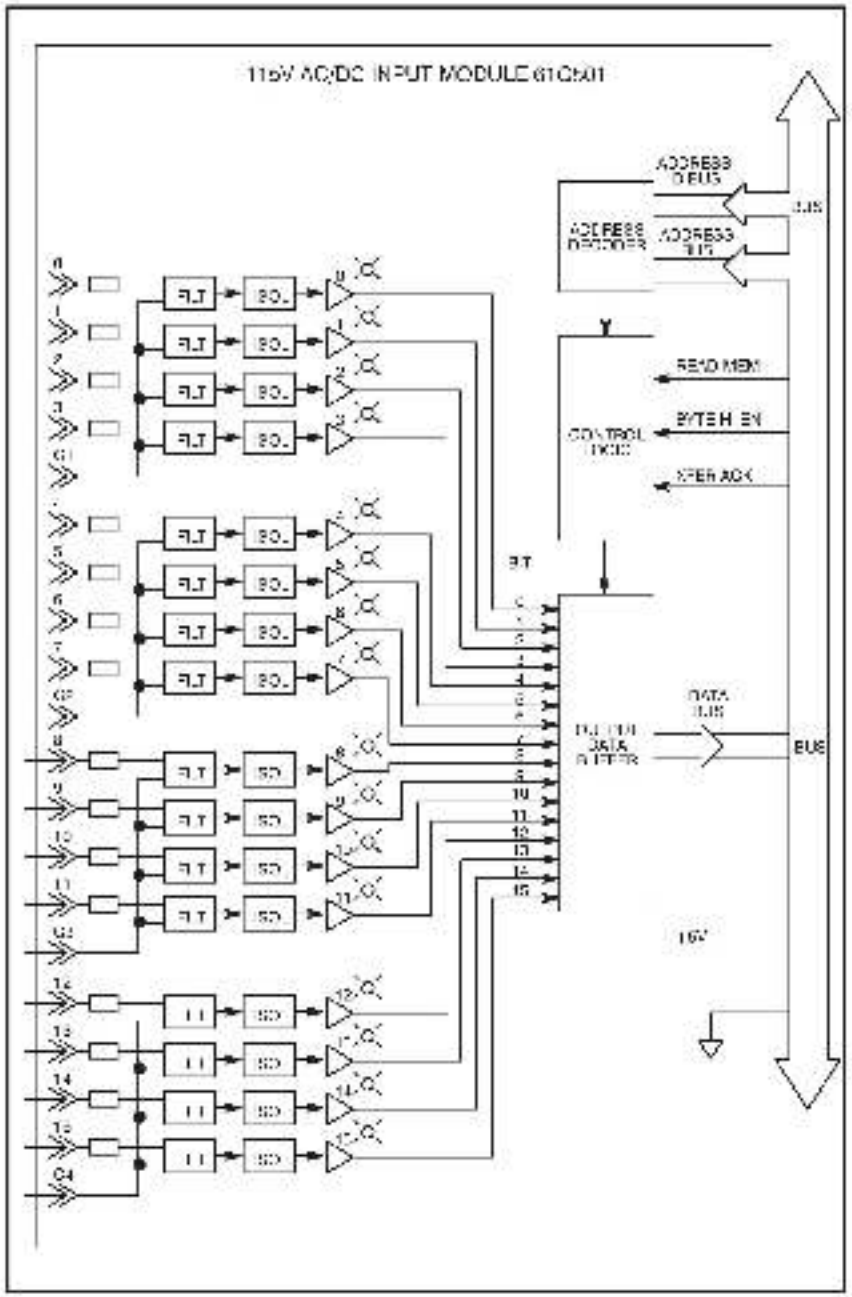
- +5 volts: 1A

Input Circuit

- Number of inputs: 16
- Maximum operating voltage: 130V AC rms/DC
- Minimum turnon voltage: 95V AC rms/DC
- Maximum turnoff voltage: 50V AC rms/DC
- Typical input current: 11 mA at 95V & 60 Hz
15 mA at 130V & 60 Hz
1.6 mA at 95V DC
2.3 mA at 130V DC
- Maximum input delay: 30 msec at 115V AC
20 msec at 115V DC
- Four inputs per isolated common
- 2500 volt isolation between logic common and input power
- Maximum input wire length: 1000 feet

Appendix B

Module Block Diagram



Appendix C

Field Connections

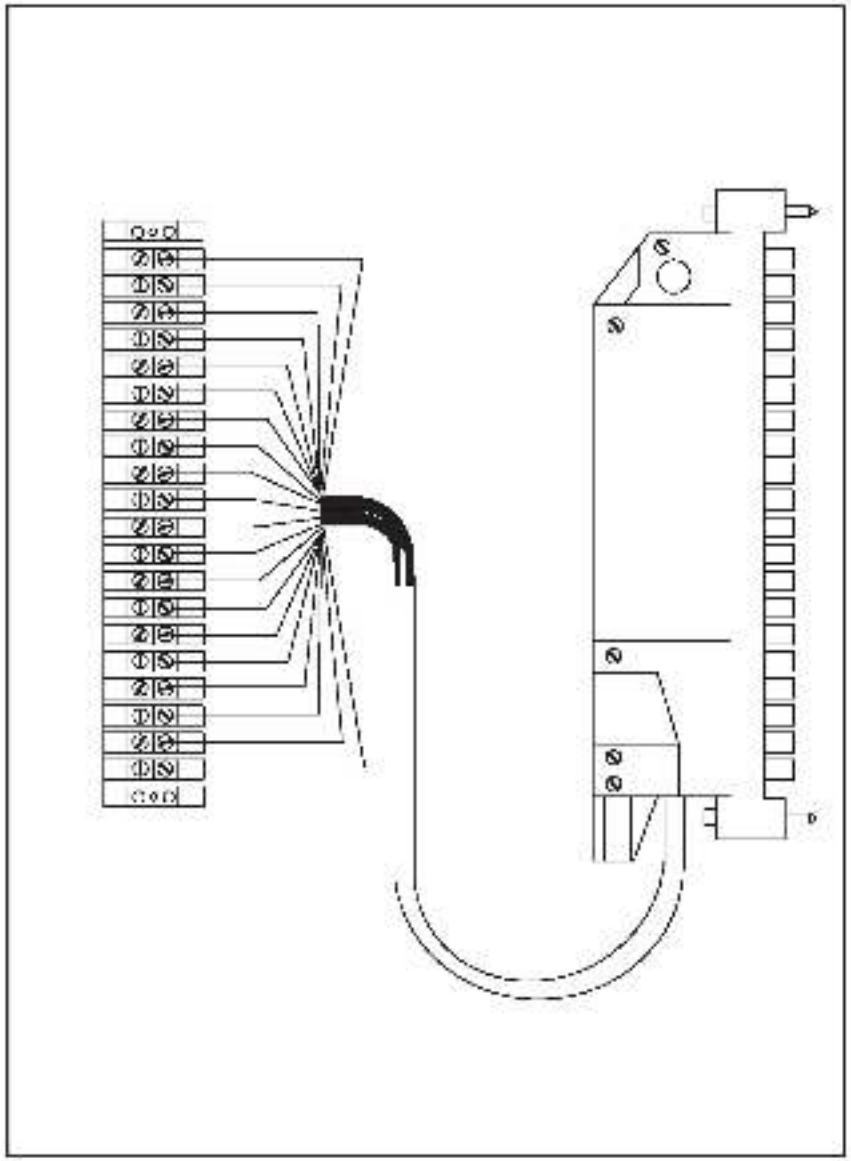
Terminal Board Number	Reg. 0 Bit
1	0
2	1
3	2
4	3
5 (common)	
6	4
7	5
8	6
9	7
10 (common)	
11	8
12	9
13	10
14	11
15 (common)	
16	12
17	13
18	14
19	15
20 (common)	

Appendix D

Related Components

57C370 – Terminal Strip/Cable Assembly

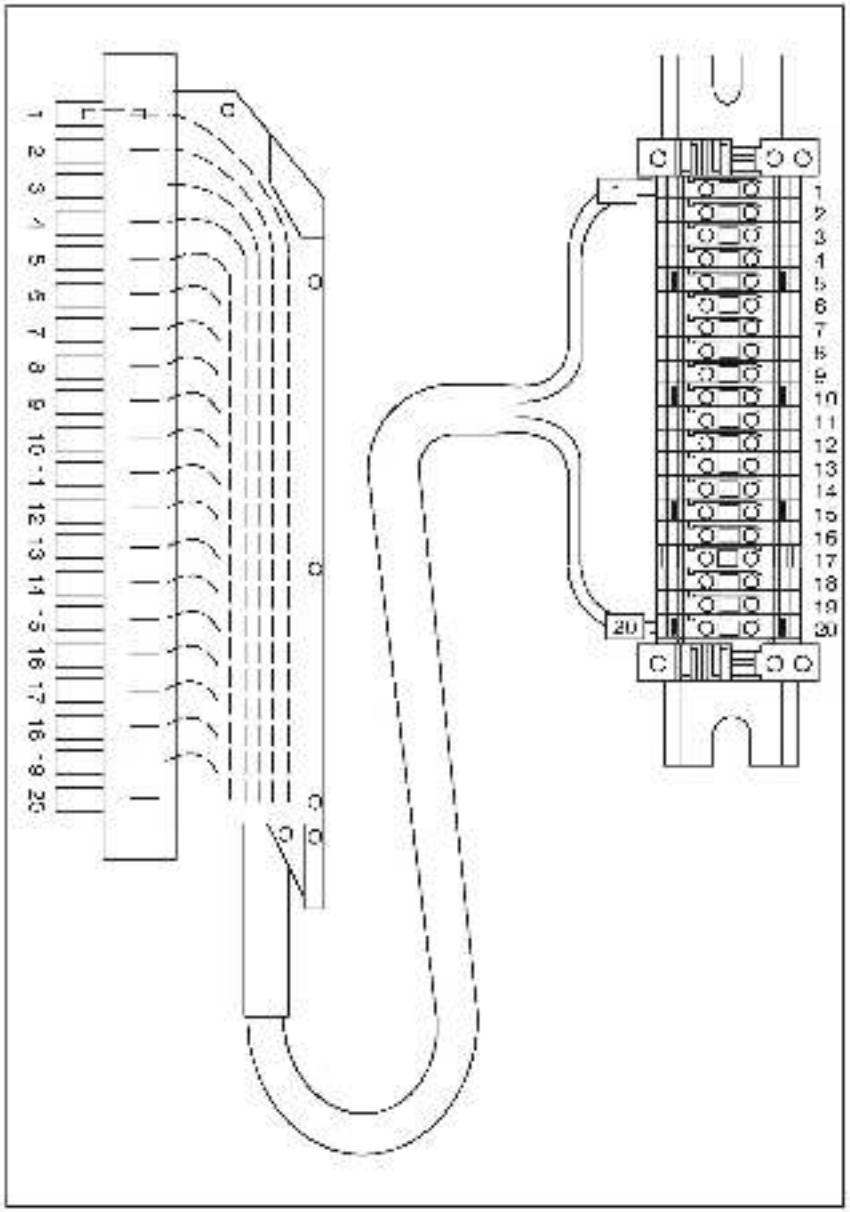
This assembly consists of a NEMA-style terminal strip, cable, and mating connector. It is used to connect field signals to the faceplate of the input circuits.



Appendix D
Continued

1" Cable — DIN-style Terminal Strip/Cable Assembly (Fused)

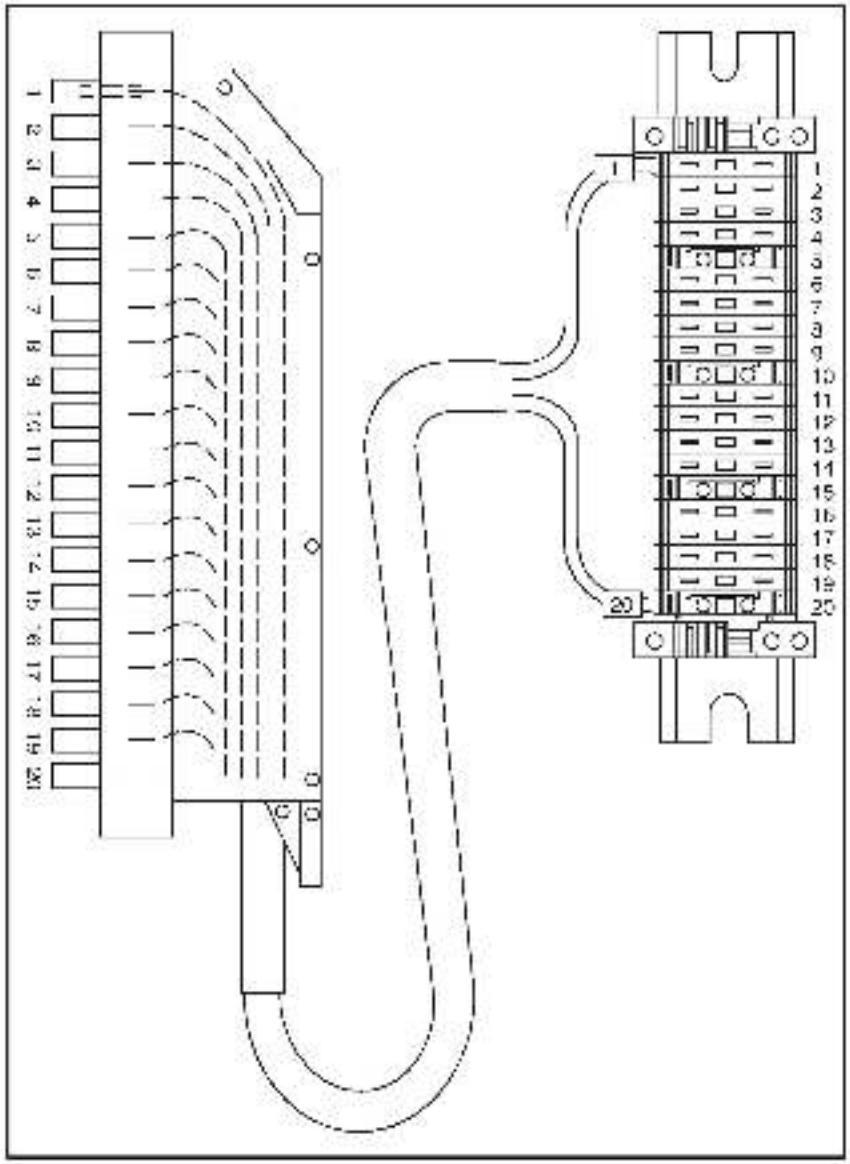
This assembly consists of a DIN-style terminal strip with fuses, cable, and mating connector. It is used to connect field signals to the faceplate of the input module.



Appendix D
Continued

1756-CJB — DIN-style Terminal Strip/Cable Assembly (Fused)

This assembly consists of a DIN-style terminal strip, cable, and mating connector. It is used to connect field signals to the faceplate of the input module

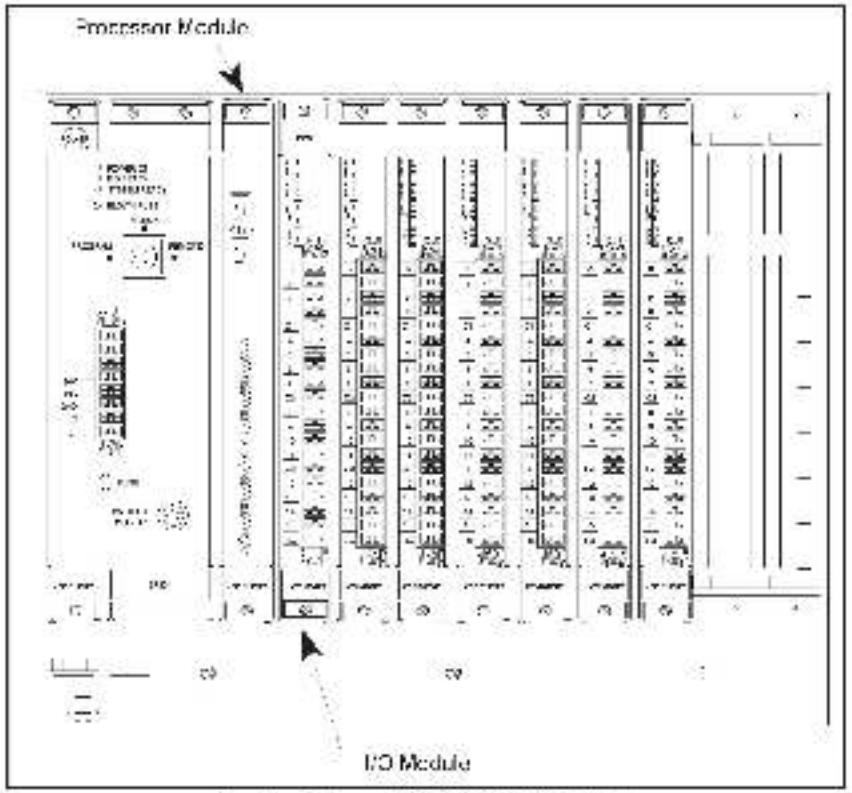


Appendix E

Defining Variables in the Configuration Task

Local I/O Definition

This section describes how to configure the input module when it is located in the same rack (i.e., the local rack) as the Processor module that is interrogating it. Refer to the figure below. Note that this procedure is used only if you are using the AutoMax Programming Executive software version 2.1 or earlier.



Module in a Local DCS 5000/AutoMax Rack

Single Register Reference

Use the following method to reference all 16 inputs as a single register. Only one statement is necessary in the configuration task for the entire module. The symbolic name of the register should be as meaningful as possible:

[name] IODEF SYMBOLIC_NAME2% [SLOT=s, REGISTER=0]

Appendix E
Continued

Bit Reference

Use the following method to reference individual inputs on the module. A maximum of 16 statements can be included in the configuration task (one for each bit). The symbolic name of each bit should be as meaningful as possible.

mmmm IODEF SYMBOLIC_NAME@[SLOT=s, REGISTER=0, BIT=b]

where:

mmmm - BASIC statement number. This number may range from 1-32767.

SYMBOLIC_NAME% - A symbolic name chosen by the user and ending with (%). This indicates an integer data type, and all references will access the entire module.

SYMBOLIC_NAME@ - A symbolic name chosen by the user and ending with (@). This indicates a boolean data type, and all references will access bit number 0 only.

s - Slot number that the module is plugged into. This number may range from 2-15.

REGISTER - Always zero for this module.

b - Used with boolean data types only. Specifies the bit in the register that is being referenced. This number may range from 0-15.

Examples Of Local I/O Definitions

The following statement assigns the symbolic name POSITION% to the input module located in slot 4:

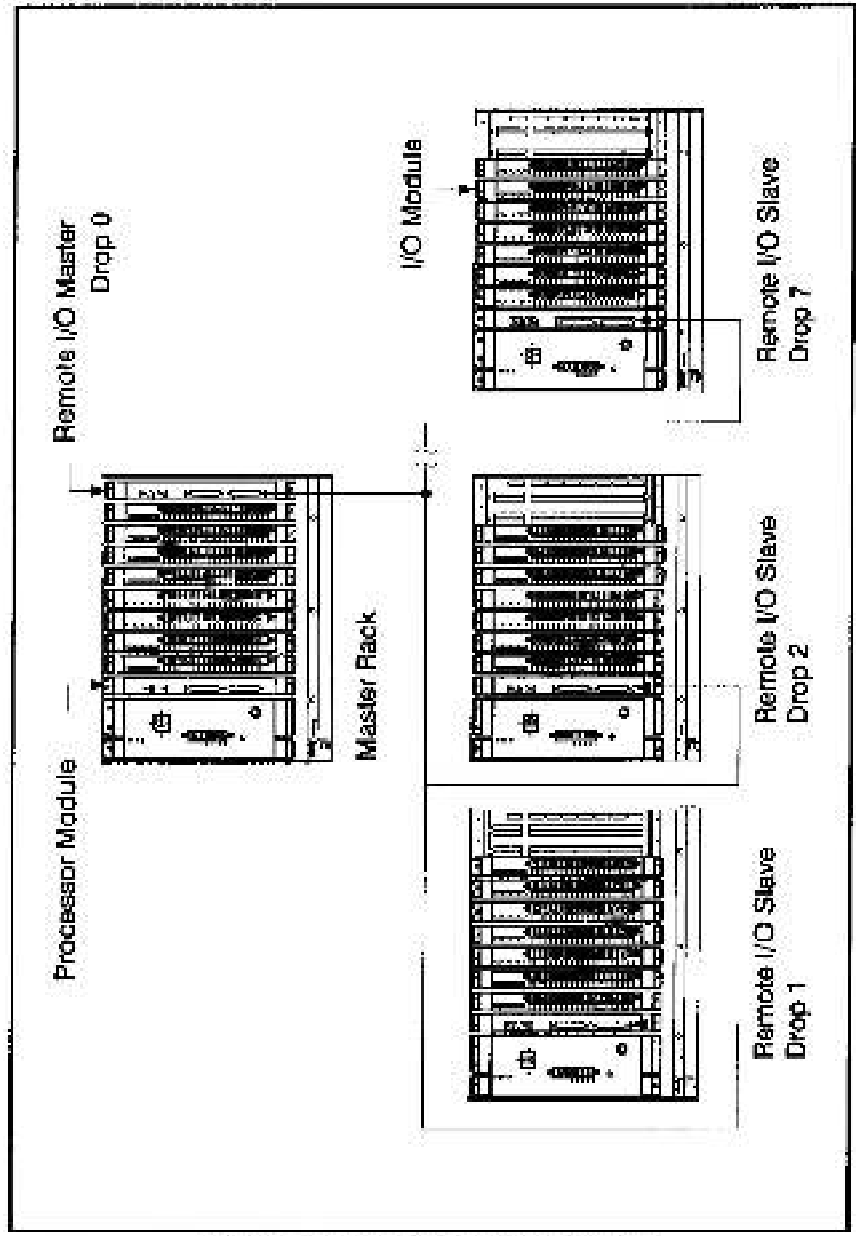
1020 IODEF POSITION%[SLOT=4, REGISTER=0]

The following statement assigns the symbolic name LIGHT to bit 9 on the input module located in slot 7:

2050 IODEF LIGHT[SLOT=7, REGISTER=0, BIT=9]

Remote I/O Definition

This section describes how to configure the module when it is located in a rack that is remote from the Processor module referencing it. Refer to the following figure.



Modules in a Remote DCS 5000/AutoMax Rack

Appendix E
Continued

Single Register Reference

Use the following method to reference all 16 bits as a single register. Only one statement is required in the configuration task for the entire module. The symbolic name of the register should be as meaningful as possible.

nnnnn RIO DEF SYMBOLIC_NAME%,[MASTER_SLOT=m,
DROP=d, SLOT=s, REGISTER=0]

Bit Reference

Use the following method to reference individual bits on the module. A maximum of 16 statements can be included in the configuration task (one for each bit). The symbolic name of each bit should be as meaningful as possible.

nnnnn RIO DEF SYMBOLIC_NAME@[MASTER_SLOT=m,
DROP=d, SLOT=s, REGISTER=0 BIT=b]

where:

nnnnn - BASIC statement number. This number may range from 1-32767.

SYMBOLIC_NAME% - A symbolic name chosen by the user and ending with (%). This indicates an integer data type, and all references will access the entire module.

SYMBOLIC_NAME@ - A symbolic name chosen by the user and ending with (@). This indicates a boolean data type, and all references will access bit number "b" only.

m - Slot number that the master remote I/O module is plugged into. This number may range from 0-15.

d - Drop number of the slave remote I/O module that is in the same rack as the input module. This number may range from 1-7.

s - Slot number that the module is plugged into. This number may range from 0-15.

REGISTER - Always zero for this module.

b - Used with boolean data types only. Specifies the bit in the register that is being referenced. This number may range from 0-15.

Examples Of Remote I/O Definitions

The following statement assigns the symbolic name LEVEL% to the input module located in slot 4 of remote I/O drop 3. This remote drop is connected to the remote I/O system whose master is located in slot 10 in the master rack:

1020 RIO DEF LEVEL% [MASTER_SLOT=10, DROP=3,
SLOT=4, REGISTER=0]

The following statement assigns the symbolic name STARTPB@ to bit 3 on the input module located in slot 7 of remote I/O drop 2. This remote drop is connected to the remote I/O system whose master is located in slot 6 in the master rack:

3030 RIO DEF STARTPB@[MASTER_SLOT=6, DROP=2
SLOT=7, REGISTER=0, BIT=3]

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