AutoMax™ R-Net Processor Module

M/N 57C429

Instruction Manual J2-3000

RELIANCE ELECTRIC

The information in this user's manual is subject to change without notice.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRIC CODE AND ALL OTHER APPLICABLE CODES. WIRING, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

RELIANCE STRONGLY RECOMMENDS THE USE OF AN EXTERNAL, HARDWIRED EMERGENCY STOP CIRCUIT OUTSIDE THE PROGRAMMABLE CONTROLLER CIRCUITRY. THE EMERGENCY STOP CIRCUIT MUST DISABLE THE SYSTEM IN CASE OF IMPROPER OPERATION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

WARNING

THE R-NET SYSTEM IS DESIGNED TO CONTINUE OPERATING IF ONE OR MORE NODES ON THE NETWORK FAILS OR IS TAKEN OFF LINE. IF CERTAIN DATA MUST BE TRANSFERRED RELIABLY TO ENSURE SAFE OPERATION, THEN THE USER MUST ADD SOFTWARE HANDSHAKING IN THE APPLICATION PROGRAM THAT WILL DETECT LOSS OF COMMUNICATION. FAILURE TO OBSERVE THIS PRECAUTION COULD CAUSE BODILY INJURY.

CAUTION

THIS MODULE CONTAINS STATIC-SENSITIVE COMPONENTS. 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 by Reliance® Electric Industrial Company.

The AutoMax R-Net Processor module (M/N 57C429) provides the means for an AutoMax/DCS 5000 rack to communicate over the R-Net industrial network. The R-Net network allows AutoMate® Processors, AutoMax/DCS 5000 Processors, and/or other devices (mini-computers, color graphics terminals, etc.) to communicate with each other to create a distributed control or centralized data-gathering system. The AutoMax R-Net Processor can support up to four AutoMax/DCS 5000 Processors in one rack. R-Net views the rack as one node consisting of an AutoMate Processor.

Each AutoMax R-Net Processor module contains a 16K byte dual-port memory for storing the data that is transmitted over the network. The dual-port memory contains an image modeled on a subset of AutoMate registers. Data received from the network is placed into the AutoMate image area by defining the destination as an AutoMate address. Data is transmitted from the AutoMate image area over the network using a subset of AutoMate communications commands. The dual-port memory can be accessed by the on-board CPU as well as over the backplane bus by any Processor in the rack through application programs.

The remainder of this manual describes the functions and specifications of the AutoMax R-Net Processor module. It also includes a detailed overview of installation and servicing procedures, as well as examples of programming methods.

1.1 Additional Information

You must be familiar with all the instruction manuals that describe your system configuration. This may include, but is not limited to, the following:

- J-3075 R-Net APPLICATION MANUAL
- J-3600 DCS 5000 ENHANCED BASIC LANGUAGE INSTRUCTION MANUAL
- J-3601 DCS 5000 CONTROL BLOCK LANGUAGE INSTRUCTION MANUAL
- J-3602 DCS 5000 LADDER LOGIC LANGUAGE INSTRUCTION MANUAL
- J-3630 ReSource AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL VERSION 1.0
- J-3649 AutoMax CONFIGURATION TASK INSTRUCTION MANUAL
- J-3650 AutoMax PROCESSOR INSTRUCTION MANUAL
- J-3675 AutoMax ENHANCED BASIC LANGUAGE INSTRUCTION MANUAL
- J-3676 AutoMax CONTROL BLOCK LANGUAGE INSTRUCTION MANUAL
- J-3677 AutoMax LADDER LOGIC INSTRUCTION MANUAL

- J-3684 ReSource AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL VERSION 2.0
- J-3750 ReSource AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL VERSION 3.0
- J2-3009 R-Net CABLE INSTALLATION MANUAL
- Other instruction manuals applicable to your hardware configuration.
- Your personal computer and DOS instruction manuals
- IEEE 518 GUIDE FOR THE INSTALLATION OF ELECTRICAL EQUIPMENT TO MINIMIZE ELECTRICAL NOISE INPUTS TO CONTROLLERS.

1.2 Related Hardware and Software

M/N 57C429 contains the AutoMax R-Net Processor Module. It is used with the following hardware and software (purchased separately):

1. M/N 57C395 ReSource AutoMax Programming Executive software Version 3.0.
2. M/N 57C390 or 57C391 ReSource AutoMax Programming Executive software Version 2.0.
3. M/N 57C304 or 57C305 ReSource AutoMax Programming Executive software Version 1.0.
4. M/N 57C300 or 57C301 ReSource DCS 5000 Programming Executive software.
5. M/N 57C430 AutoMax Processor.
6. M/N 57C407 DCS 5000 Processor.
7. M/N 61C126 or 61C128 ReSource Portable Computer, or other IBM-compatible personal computer running DOS Version 3.1 or later.
8. M/N 61C127 RS-232C ReSource Interface Cable. This cable is used to connect the personal computer to the Processor module. Item 7 above includes this cable, but it can also be purchased separately.
9. M/N 45C70 Coax BNC Tee Connector. This is required at each node for connection to coaxial cabling.
10. M/N 45C71 Coax BNC 75 Ohm Terminating Load. All coax systems require a terminating load at both ends of the cable.

2.0 MECHANICAL/ELECTRICAL DESCRIPTION

This section describes the mechanical and electrical characteristics of the AutoMax R-Net Processor module.

2.1 Mechanical Description

The AutoMax R-Net Processor module is a printed circuit assembly that plugs into the backplane of the AutoMax/DCS 5000 rack. The module consists of the printed circuit board, faceplate, and protective enclosure. On the back of the module are two edge connectors that attach to the system backplane. The faceplate contains ejector tabs at the top and bottom to simplify removing the module from the rack. See figure 2.1 for the module faceplate.

The BNC connector on the faceplate provides the means to connect the module to the R-Net network. The two rotary switches select the AutoMax R-Net module node number in hexadecimal. The upper switch represents the most significant digit and the lower switch represents the least significant digit of the node number value. Eight LEDs on the faceplate indicate the status of the AutoMax R-Net Processor module and the R-Net network. The LEDs are defined as follows:

READY	(yellow)	When lit, indicates the CPU is working properly within the limits of its internal diagnostics and the internal watchdog is being reset.
XMIT	(yellow)	When lit, indicates the module is transmitting via the coax.
RECV	(yellow)	When lit, indicates the module is receiving via the coax.
COM OK	(yellow)	When lit, indicates the module's transmit and receive circuits have passed power-up diagnostics.
1st COM ER	(red)	When lit, indicates fault code 8 or CRC error.
2nd COM ER	(red)	When lit, indicates fault code 4.
3rd COM ER	(red)	When lit, indicates fault code 2.
4th COM ER	(red)	When lit, indicates fault code 1 or lost token timeout.

Fault code numbers are valid during power-up diagnostics or if the Ready LED turns off. The condition causing the fault can be determined by adding the fault codes.

COM ER No. 8	0	0	0	0	0	0	1	1	1	1	1	1	1
COM ER No. 4	0	0	0	1	1	1	0	0	0	1	1	1	1
COM ER No. 2	0	1	1	0	0	1	0	1	1	0	0	1	1
COM ER No. 1	1	0	1	0	1	1	1	0	1	0	1	0	1
Fault Code No.	1	2	3	4	5	7	9	10	11	12	13	14	15

The resulting number indicates one of the following fault conditions:

1 - EPROM checksum error
2 - Scratchpad RAM failure
3 - Dual port memory failure
4 - Node number switch setting greater than 250
5 - Communication circuit failure
9 - Local watchdog interrupt
10 - Software test (negative buffer length detected)
11 - Software test (message length = 0 detected)
12 - Unused interrupt detected
13 - Attempt was made to access a word on an odd byte (address error)
14 - System watchdog interrupt
15 - Bus error (R-Net module unable to reconstruct where to execute after unsuccessful attempt to access dual port memory.)

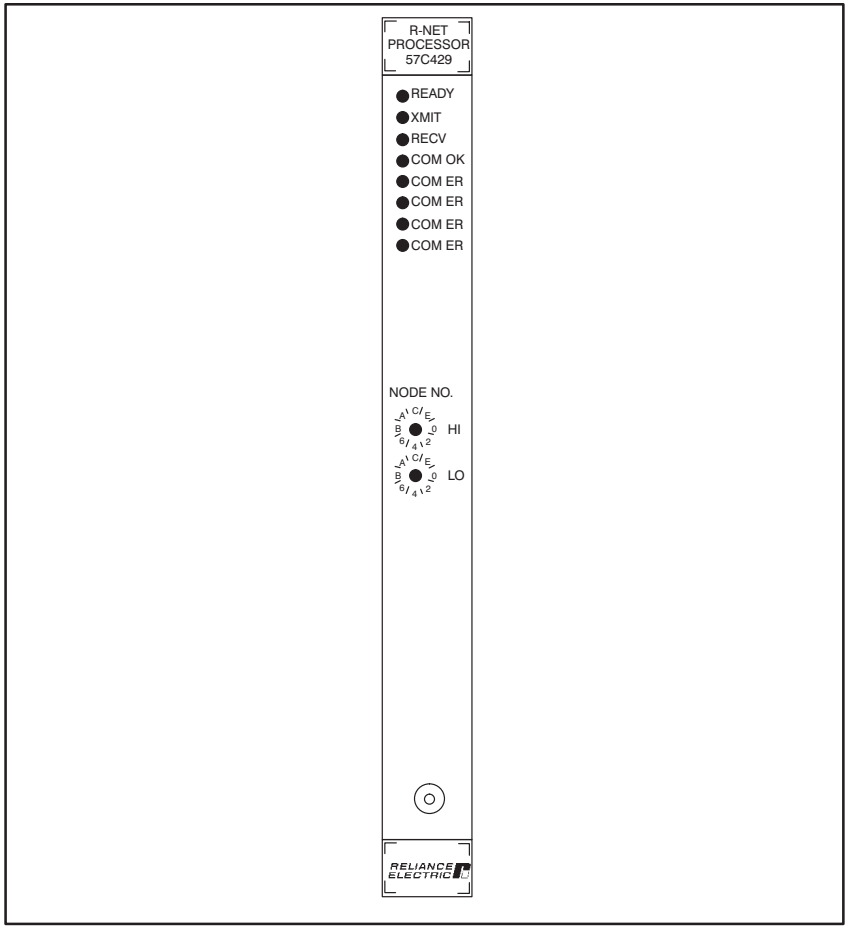

Figure 2.1 - AutoMax R-Net Processor Module Faceplate

2.2 Electrical Description

Network operation is controlled by a Motorola 68010 CPU/direct memory access (DMA)/serial I/O architecture. 16K bytes of dual-port memory is provided to store the network variables. All program application data is sent and received by the AutoMax R-Net Processor module's CPU. All handshaking, error-checking, and AutoMate command interpretation is also handled by the AutoMax R-Net Processor module; no additional load is put on the main Processor module(s) for communication.

The module contains a watchdog timer which is enabled when power is turned on to the module. The on-board CPU must reset the watchdog timer within a specified time or the CPU will shut down and the READY LED on the faceplate will turn off.

At power-up, the red LEDs on the faceplate will turn on as the module performs a lamp test. The on-board CPU then performs diagnostics on the EPROM, scratchpad RAM, the dual port memory, and the transmit and receive circuits. The CPU also reads the value of the node number switches at this time. The red LEDs will light to indicate which test is being performed. If there is a fault during the diagnostic, the on-board CPU will stop, the watchdog will time out, and the pattern of the red LEDs will indicate the code of the fault condition. The fault code is also written to register 60 in the dual port memory. If all diagnostics are passed, the red LEDs will turn off.

Run-time fault conditions detected by the on-board CPU after power-up are indicated by fault codes 9-15. If a fault is detected, the READY LED will turn off and the corresponding fault code will be displayed. The fault code is also written to register 60 in the dual port memory. All of the above fault conditions are fatal and require that the rack be powered down and back up to recover.

The red LEDs also signal two non-fatal communication errors during network operation. The top and bottom red LEDs will flash on and off to indicate a CRC error or lost token timeout, respectively. Refer to section 5.0 for the procedure used to isolate the cause of a communication error.

2.2.1 R-Net Industrial Network

R-Net is an asynchronous baseband coaxial cable network system arranged in a multidrop configuration. Network access is granted using a token-passing scheme. Each network node controls the network in turn. When a node has the token, it can transfer data to any or all nodes on the network. When the transaction is complete, the token is passed to the next consecutive node on the network. Data is transmitted over the network via an RG-59 or RG-11 coaxial cable at a rate of 800 kilobits per second utilizing the AutoMate communications protocol. Up to 32 AutoMate controllers and/or other devices may be connected to the R-Net network. The maximum cable length is 6000 feet using RG-11/U cable. The minimum cable length between adjacent drops is 50 feet.

3.0 INSTALLATION

This section describes how to install and replace the AutoMax R-Net Processor module. For more information regarding the R-Net network, refer to the R-Net Application Manual (J-3075).

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WARNING

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

WARNING

ALTHOUGH THE R-NET NETWORK INCLUDES CRC CHECKSUMS AND OTHER DIAGNOSTICS TO ENSURE THE INTEGRITY OF DATA TRANSFERRED, IT IS POSSIBLE FOR BAD DATA TO PASS WITHOUT DETECTION IN CASES WHERE NOISE IS INDUCED WHICH IS NOT RANDOM BUT RESEMBLES VALID DATA. ADHERE TO THESE INSTALLATION INSTRUCTIONS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

CAUTION

THIS MODULE CONTAINS STATIC-SENSITIVE COMPONENTS. 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.

3.1 Wiring

The installation of wiring should conform to all applicable codes. To reduce the possibility of noise interfering with the control system, exercise care when installing wiring from the system to external devices. For detailed recommendations, refer to IEEE Standard 518 (Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers). For network cable installation procedures, refer to the R-Net Cable Installation Manual (J2-3009).

3.2 Initial Installation

Use the following procedure to install the module:

Step 1. Stop any application tasks that may be running.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED, DISCONNECT AND LOCK OUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 2. Turn off power to the system. All power to the rack, as well as all power to the wiring leading to the rack, should be off.

Step 3. 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 4. Insert the module into the desired slot in the rack. The module can reside in any slot in an AutoMax/DCS 5000 rack containing at least one Processor. Use a screwdriver to secure the module into the rack.

Step 5. Set the drop number of the R-Net module using the two rotary switches on the module faceplate. The upper switch is the most significant digit and the lower switch is the least significant digit. The decimal node number value must be converted to hexadecimal. Only settings 0 to 250 (0 to FA hexadecimal) are valid. Fault code 4 will be displayed at power-up if the switches are set to a value greater than 250. If the node number is less than 16 (decimal), the upper switch must be set to zero. Refer to Appendix D for the node number conversion chart.

The node number settings are recognized only at power-up. Therefore, make sure each node on the network has a unique node number before power is applied. If more than one device is given the same node number, all of the devices having the same node number will attempt to transmit at the same time resulting in line transmission collisions and loss of data.

Step 6. Connect the Tee connector (M/N 45C70) to the BNC connector on the face of the module.

Step 7. Connect the coaxial cable to the Tee connector. If this is the last node on the network, place a 75 ohm terminating load (M/N 45C71) on the remaining side of the Tee connector.

Step 8. Turn on power to the rack. An internal diagnostic routine is automatically executed by the module. If an error is encountered, the pattern of red LEDs will indicate the fault code. If all diagnostics are passed, the red LEDs will turn off.

If the rotary switches are set to an invalid node number, fault code 4 will be displayed after power-up. To clear this fault code, refer to section 5.2.

3.3 Module Replacement

Use the following procedure to replace the R-Net module.

Step 1. Stop any application tasks that may be running.

DANGER

THIS EQUIPMENT IS AT LINE VOLTAGE WHEN A-C POWER IS CONNECTED, DISCONNECT AND LOCK OUT ALL UNGROUNDED CONDUCTORS OF THE A-C POWER LINE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 2. Disconnect the Tee connector from the R-Net module.

Step 3. Turn off power to the rack.

Step 4. Use a screwdriver to loosen the screws that hold the module in the rack. Take the module out of the slot in the rack.

Step 5. Take the new 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 6. Insert the module into the rack, making sure it is well-seated in the rack.

Step 7. Set the node number of the module by using the two rotary switches on the module faceplate. The upper switch is the most significant digit, the lower switch is the least significant digit.

Step 8. Attach the Tee connector to the module faceplate.

Step 9. Turn on power to the rack.

4.0 PROGRAMMING

This section describes how the data is organized in the AutoMax R-Net Processor module and provides examples of how the module is accessed by the application software. For more detailed information on programming, refer to the AutoMax Programming Reference binder (J-3659) and the DCS 5000 Programming Reference binder (J-3611).

4.1 Register Organization

The dual port memory in the R-Net module contains status and control registers, the AutoMate image area, and a command buffer area. Refer to figure 4.1 for the dual port memory register assignment.

Register 0 - 63	Status and Control	(64 16-bit Words)
Register 64 - 2623	AutoMate Image	(2560 16-bit Words)
Register 2624 - 3583	Not Used	(960 16-bit Words)
Register 3584 - 4095	Command Buffer	(512 16-bit Words)

Figure 4.1- Dual Port Memory Register Assignment

4.1.1 Status and Control Registers

Registers 0 - 63 of the dual port memory are status and control registers. All registers are Read/Write and can be accessed by an application task or monitored using the I/O Monitor function of the AutoMax Programming Executive. For more information regarding the I/O Monitor function, refer to the AutoMax Programming Executive Instruction Manual. Refer to figure 4.2 for register assignment.

CAUTION

REGISTERS 0-3 AND 62-63 CONTROL THE OPERATION OF THE GATEWAY_CMD_OK@ FUNCTION AND SHOULD NOT BE ALTERED. IT IS THE PROGRAMMER'S RESPONSIBILITY TO ENSURE THAT THESE REGISTERS ARE NOT WRITTEN TO BY AN APPLICATION TASK. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.

Register	Function
0	Reserved for System Use
1	Reserved for System Use
2	Reserved for System Use
3	Reserved for System Use
4	Drops On Line Status Bit 15-0
5	Drops On Line Status Bit 31-16
6	Drops On Line Status Bit 47-32
7	Drops On Line Status Bit 63-48
8	Reserved for System Use
9	Reserved for System Use
10	Reserved for System Use
11	Reserved for System Use
12	Node Number
13	Slot Number
14	Messages Received Count
15	Receive Timeouts Count
16	CRC Error Count
17	Overrun Error Count
18	Illegal Message Count
19	Messages Transmitted Count
20	Lost Token Count
21	Maximum Node Number
22	Response Timeout in Seconds
23	Current Token Time
24	Maximum Token Time
25	Reserved for System Use
:	
49	Reserved for System Use
50	Transmit Global Data Enabling Register for AutoMate Image Register 71
51	Transmit Global Data Enabling Register for AutoMate Image Register 72
52	Transmit Global Data Enabling Register for AutoMate Image Register 73
53	Transmit Global Data Enabling Register for AutoMate Image Register 74
54	Reserved for System Use
:	
59	Reserved for System Use
60	LED Error Code
61	Reserved for System Use
62	Reserved for System Use
63	Reserved for System Use

Figure 4.2- Status and Control Registers

4.1.1.1 Registers 4 - 7 (Drops On Line Status)

Registers 4 - 7 indicate which drops are active on the R-Net network. This register will display only up to node 63; nodes 64-250 cannot be displayed.

4.1.1.2 Register 12 (Node Number)

The value of the node number switch settings (0-250) on the module faceplate is stored in this register. The on-board CPU reads the value of the switch settings only at power-up.

4.1.1.3 Register 13 (Slot Number)

Register 13 indicates the slot location of the AutoMax R-Net Processor module.

4.1.1.4 Register 14 (Messages Received Count)

Register 14 indicates the number of messages received by the AutoMax R-Net Processor module since power-up. This register will increment (up to 32767) as messages are received. This register is reset to zero at power-up or can be reset by the user.

4.1.1.5 Register 15 (Receive Timeouts Count)

The AutoMax R-Net Processor module expects to receive a response to a message within the time period specified by register 22. If a response is not received, a receive timeout occurs and is logged in this register (up to 32767). This register is reset to zero at power-up or can be reset by the user.

4.1.1.6 Register 16 (CRC Error Count)

CRC (Cyclic Redundancy Check) is an error detection scheme to insure the validity of the data that is sent and received. This register will increment (up to 32767) if a CRC error occurs. This value will ideally remain zero. This register is reset to zero at power-up or can be reset by the user.

4.1.1.7 Register 17 (Overrun Error Count)

Overrun errors are caused by receiving too many bits of data in a transmission frame. (This is typically caused by missing a stop bit.) This register will increment (up to 32767) if an overrun error occurs. This value will ideally remain zero. This register is reset to zero at power-up or can be reset by the user.

4.1.1.8 Register 18 (Illegal Message Count)

Register 18 will increment (up to 32767) each time a message frame is received that did not contain enough bits of data. This can be caused by transmission problems or improper protocol. This value will ideally remain zero. This register is reset to zero at power-up or can be reset by the user.

4.1.1.9 Register 19 (Messages Transmitted Count)

This register increments (up to 32767) each time a message is transmitted from the AutoMax R-Net Processor module. This register resets to zero at power-up or can be reset by the user.

4.1.1.10 Register 20 (Lost Token Count)

This register increments (up to 32767) when no activity is detected on the network within 10 ms.

4.1.1.11 Register 21 (Maximum Node Number)

This register defines the number of nodes on the network. At power-up, the AutoMax R-Net Processor CPU will set this location to 7 more than the node address (up to 250). For efficient operation,

this register should be set to the highest number node that is on the system plus 1. Nodes on the network should be numbered consecutively to avoid unnecessary delays in transmission on the network. The maximum node number value should be identical in all devices connected to the R-Net network.

4.1.1.12 Register 22 (Response Time in Seconds)

Register 22 defines the time in seconds in which a response must be received from a command initiated by the GATEWAY_CMD_OK@ function. A value of either zero or one is considered to be one second.

4.1.1.13 Register 23 (Current Token Time)

This register indicates the length of time in milliseconds between the last token possession and the current token possession.

4.1.1.14 Register 24 (Maximum Token Time)

This register indicates the maximum amount of time (in milliseconds) that has occurred between token possessions since power-up. This register may be reset by the user.

4.1.1.15 Registers 50 - 53 (Transmit Global Data Enabling Registers)

These registers are used with Global Data registers 121-124 (AutoMate image registers 71-74). Setting bits in these registers enables corresponding bits in the Global Data registers to be broadcast over the network. Refer to section 4.1.2.1 for information regarding globals.

4.1.1.16 Register 60 (LED Error Code)

This register contains the value of any error code displayed on the module faceplate.

4.1.2 AutoMate Image Registers

Registers 64 - 2623 are used to emulate a portion of the register space of an AutoMate. Refer to figure 4.3 for the register assignment of the AutoMate image area. Note that AutoMate register addresses 1000 to 1777 do not exist. If an address within this range is specified by the GATEWAY_CMD_OK@ function, an “address out of range” error will be returned.

All registers are Read/Write and can be accessed as words or bits. None of the AutoMate image registers are retentive, i.e., data will not be retained upon loss of power.

Multibus®	DUAL PORT MEMORY	R-Net
Registers 64-575		AutoMate Registers 0000.00 - 0777.17 (octal)
Registers 576-2623		AutoMate Registers 2000 - 5777 (octal) (16-bit registers)

Figure 4.3- Register Assignment for AutoMate Image Area

AutoMax/DCS 5000 variables are mapped to the AutoMate image area during configuration and can be accessed by any task in any AutoMax/DCS 5000 Processor in the rack. (Refer to section 4.3 for more information regarding configuration). When AutoMax/DCS 5000 variables are referenced in application tasks, the data is directly obtained from/written to the AutoMate image. When data is received from the network, it is interpreted by the AutoMax R-Net Processor and placed into the AutoMate image. Data transmitted over the network is also obtained from the AutoMate image.

Register values may be read using the I/O Monitor function of the AutoMate Programming Executive software. However, the AutoMate image register number must be converted to the register number required by the I/O Monitor function (i.e., the actual memory address that corresponds to the AutoMate image address.)

To calculate the I/O Monitor register number for AutoMate image registers 0 through 777, first convert the AutoMate image register number from octal to decimal and then add 64.

Example:

AutoMate Image Register 137
137 (octal) = 95 (decimal)
95 + 64 = I/O Monitor Register 159

To calculate the I/O Monitor register number for AutoMate image registers 2000 through 5777, first convert the AutoMate image register number to decimal and then subtract 448.

Example:

AutoMate Image Register 3025
3025 (octal) = 1557 (decimal)
1557 - 448 = I/O Monitor Register 1109

Refer to the AutoMax Programming Executive instruction manual for more information regarding the I/O Monitor function.

4.1.2.1 Globals

Global coils are used to communicate between various AutoMate Programmable Controllers when they are connected via the R-Net network. Each AutoMate has a dedicated group of addresses for this function. Refer to figure 4.4. When a global coil is programmed in one node, its status is broadcast to all nodes on the network every token.

A15	A15E	A20	A30	A40	AutoMate Image
13.00	71.00	71.00	71.00	1771.00	71.00
13.01	71.01	71.01	71.01	1771.01	71.01
13.02	71.02	71.02	71.02	1771.02	71.02
13.03	71.03	71.03	71.03	1771.03	71.03
13.04	71.04	71.04	71.04	1771.04	71.04
13.05	71.05	71.05	71.05	1771.05	71.05
13.06	71.06	71.06	71.06	1771.06	71.06
13.07	71.07	71.07	71.07	1771.07	71.07
13.10	71.10	71.10	71.10	1771.10	71.10
13.11	71.11	71.11	71.11	1771.11	71.11
13.12	71.12	71.12	71.12	1771.12	71.12
13.13	71.13	71.13	71.13	1771.13	71.13
13.14	71.14	71.14	71.14	1771.14	71.14
13.15	71.15	71.15	71.15	1771.15	71.15
13.16	71.16	71.16	71.16	1771.16	71.16
13.17	71.17	71.17	71.17	1771.17	71.17
14.00	72.00	72.00	72.00	1772.00	72.00
14.01	72.01	72.01	72.01	1772.01	72.01
14.02	72.02	72.02	72.02	1772.02	72.02
14.03	72.03	72.03	72.03	1772.03	72.03
.	.	.	.	.	.
.	.	.	.	.	.
14.16	72.16	72.16	72.16	1772.16	72.16
14.17	72.17	72.17	72.17	1772.17	72.17
15.00	73.00	73.00	73.00	1773.00	73.00
15.01	73.01	73.01	73.01	1773.01	73.01
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
15.16	73.16	73.16	73.16	1773.16	73.16
15.17	73.17	73.17	73.17	1773.17	73.17
	74.00	74.00	74.00	1774.00	74.00
	74.01	74.01	74.01	1774.01	74.01
	74.02	74.02	74.02	1774.02	74.02
	.	.	.	.	.
	.	.	.	.	.
	.	.	.	.	.
	74.15	74.15	74.15	1774.15	74.15
	74.16	74.16	74.16	1774.16	74.16
	74.17	74.17	74.17	1774.17	74.17
Total 48	64	64	64	64	64

Figure 4.4- Global Address Table

Four registers in the AutoMate image area are defined as Global Data Registers. They are as follows:

Dual Port Register	**Description**
121	AutoMate Image Register 71
122	AutoMate Image Register 72
123	AutoMate Image Register 73
124	AutoMate Image Register 74

When enabled by the Transmit Global Data Enabling Registers (registers 50-53), the individual points within these registers are broadcast to all other drops on the network. A global coil is enabled by setting its corresponding bit in the Transmit Global Data Enabling Registers.

WARNING

IT IS THE USER'S RESPONSIBILITY TO ENSURE THAT ANY GIVEN GLOBAL BIT IS ENABLED TO BE TRANSMITTED IN ONLY ONE DROP. FAILURE TO DO SO WILL CAUSE RANDOM BEHAVIOR OF THE GLOBAL DATA. UNEXPECTED MACHINE MOVEMENT COULD RESULT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR DAMAGE TO THE EQUIPMENT.

Example:

Transmit Global Data Enabling Register 50

17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	(octal)
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	(decimal)

0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0

Global Data Register 121 (AutoMate Image Register 71)

17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	(octal)
15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	(decimal)

1	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0

In the above example, bits .13 and .07 (octal) have been set in Transmit Global Data Enabling Register 50. Therefore, the status of bits .13 and .07 (octal) of the corresponding Global Data Receiving Register, register 121 (AutoMate image register 71), is now global and will remain global until a zero is written to bits .13 and .07 in register 50. When not enabled by the Transmit Global Data Enabling Registers, bits in registers 71.00 - 74.17 are used as global inputs.

In figure 4.5, when global coil 1771.00 is executed in the A40 Node 0, its status is passed to the R-Net processor. When Node 0 gets the token (access to network), the status of all global coils from Node 0 are sent over the network. The information is received by all the R-Net processors as well as the AutoMax R-Net Processor. When the AutoMate 30 and the AutoMax (Nodes 1 and 2) do their next scan, contact 71.00 (A30) and 71.00 (AutoMax) will assume the new status as determined by global coil 1771.00. When Node 0 is finished, the token is passed to Node 1. From Node 1, it is passed to Node 2 and then back to Node 0.

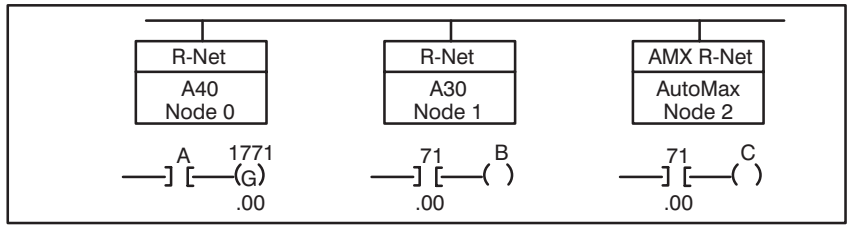


Figure 4.5- Use of Global Coils

4.1.3 Command Buffer Area

The command buffers in the dual port memory are used to store the commands for the AutoMax R-Net Processor module that are generated by the GATEWAY_CMD_OK@ function. The buffers are controlled by the GATEWAY_CMD_OK@ function and are not used by the user.

4.2 Command Codes

The AutoMax R-Net Processor module communicates over R-Net using the AutoMate communications protocol. A subset of the AutoMate command codes is supported to specify what action is to be taken by the AutoMax R-Net Processor module. These codes are used in the BASIC program and are initiated by executing a GATEWAY_CMD_OK@ function. The AutoMax R-Net Processor module can initiate only commands 1 through 4. However, it can respond to all of the commands listed below when initiated by an AutoMate.

OCTAL CODE	COMMAND NAME	AutoMate INSTRUCTION
001	Read Point	
002	Write Point	
003	Read Register	GETRNT
004	Write Register	SNDRNT
013	Read Register List	
014	Write Multiple Points	
050	Who Are You	

4.2.1 Read Point

The Read Point command (001) is used to read the value of any single bit within a register. When initiated by the GATEWAY_CMD_OK@ function, this command will transfer up to 640 sequential bits from an AutoMate register, starting at any bit position, to any bit position in the AutoMax R-Net Processor module's AutoMate image registers. Because of the processing time required to align the bits, it is more efficient to transfer multiples of 16 bits with the Read Register command (003).

4.2.2 Write Point

The Write Point command (002) is used to write a "1" or "0" into any bit location within a register without affecting any other bits in that register. When initiated by the GATEWAY_CMD_OK@ function, this command will transfer up to 640 sequential bits from the AutoMax R-Net Processor module's AutoMate image registers, starting at any bit position, to any bit position in an AutoMate register. Because of the processing time required to align the bits, it is more efficient to transfer multiples of 16 bits with the Write Register command (004).

4.2.3 Read Register

The Read Register command (003) is used to read data in up to 120 sequential registers. When initiated by the GATEWAY_CMD_OK@ function, this command will transfer 16-bit data from AutoMate registers to the AutoMax R-Net Processor module's AutoMate image registers. Note that the AutoMate register number and the AutoMate image register number must not contain a bit designation (e.g., 2000.01).

When initiated by an AutoMate GETRNT instruction, the Read Register command is sent to the AutoMax R-Net module. The AutoMax R-Net module responds with values from the AutoMate image area. To make data available to the GETRNT instruction, an application task must first move it into the AutoMate image area.

4.2.4 Write Register

The Write Register command (004) is used to write data to up to 120 sequential registers. When initiated by the GATEWAY_CMD_OK@ function, this command will transfer 16-bit data from the AutoMax R-Net Processor module's AutoMate image registers to any legal AutoMate registers. Note that the AutoMate register number and the AutoMate image register number must not contain a bit designation.

When initiated by an AutoMate SNDRNT instruction, the Write Register command is sent to the AutoMax R-Net module. The AutoMax R-Net module writes the data into the AutoMate image area. To use data sent by the SNDRNT instruction, an application task must read it from the AutoMate image area.

4.2.5 Read Register List

The Read Register List command (013) is used by AutoMate to read multiple non-sequential registers in the AutoMax R-Net Processor module's AutoMate image area up to a maximum of 120 registers. This command cannot be initiated by the AutoMax R-Net Processor.

4.2.6 Write Multiple Points

The Write Multiple Points command (014) is used by AutoMate to write a "1" or "0" into specific bits or points within a number of AutoMate image registers without affecting other bits in those registers. A maximum of 40 registers can be written to per command. This command cannot be initiated by the AutoMax R-Net Processor.

4.2.7 Who Are You

The Who Are You (050) command is used by AutoMate to determine what Processors are active on the network. This command cannot be initiated by the AutoMax R-Net Processor.

4.3 Data Update Rate

The data update rate (the time it takes to pass the token completely around the network) is displayed in register 23 (current token time) and register 24 (maximum token time). Refer to sections 4.1.1.13 and 4.1.1.14, respectively, for more information regarding these registers.

4.4 Configuration

Before running any application tasks, the system must be configured. The major function of configuration is to assign meaningful symbolic names to physical points in the system. This feature allows you to construct application tasks using variable names instead of actual physical locations.

The variables defined during configuration are termed common variables. These are made available to BASIC and Control Block application tasks using the COMMON statement. For Ladder Logic/PC tasks, you use the PC task editor to designate them common.

When configuring the AutoMax R-Net Processor module, variable names are assigned to memory locations in the dual port memory. Once variables have been defined, they are accessible to any task on any Processor in the rack. In AutoMax Version 3.0 systems, the AutoMax R-Net Processor module is configured as a Generic module. To configure the AutoMax R-Net Processor module, refer to the ReSource AutoMax Programming Executive Instruction Manual (J-3750).

In AutoMax Versions 1.0, 2.0, and all versions DCS 5000, a configuration task must be created and loaded onto the Processor in the rack before any application task can be executed. The Status and Control Registers are defined using IODEF statements. These variables are not transmitted over R-Net. Memory locations within the AutoMate image area are defined using RNETDEF statements. Refer to the Configuration Task Instruction Manual (J-3649) for AutoMax Version 1.0, 2.0, or DCS 5000 systems.

The following is the format of the RNETDEF statement:

```
nnnn        RNETDEF var_name[SLOT=slot number,   &
            REGISTER=register number]
```

where:

nnnn = configuration task line number.

var_name = name of the register or bit. The name must conform to the system naming conventions for reals, integers (%), double precision integers (!) or Booleans (@).

slot number = slot number of the AutoMax R-Net Processor Module. This number may range from 0 to 15.

register number = the octal register number in the following form:

```
            0000.BB
```

where 0000 is the register number in octal, and BB is the bit number in octal. The bit number may range from 0 to 17.

4.5 GATEWAY_CMD_OK@ Function

Application programs communicate with the AutoMax R-Net Processor module by defining the AutoMate image registers in the dual port memory as described above. Commands to read and write data over the network are initiated from the BASIC task by executing the GATEWAY_CMD_OK@ function. GATEWAY_CMD_OK@ is a Boolean function that performs data transfers and returns a TRUE status if the operation is successful. If the function is FALSE, the

returned status will contain an error code. Refer to figure 4.6 for error codes returned by the GATEWAY_CMD_OK@ function.

Error Code	Description
00 =	Error Free
01 =	Invalid Command Number
02 =	Invalid Parameter/Incorrect Parameter Number
03 =	Address Out of Range
04 =	Count Error
05 =	Reserved for System Use
06 =	Reserved for System Use
07 =	Reserved for System Use
08 =	Illegal Data in Response Message
09 =	Response Timeout Error
10 =	Reserved for System Use
:	
22 =	Reserved for System Use
23 =	Illegal Register Number
24 =	Illegal Number of Registers
25 =	Illegal Command Number
26 =	Illegal Point
28 =	Illegal Slot Number

Figure 4.6- GATEWAY_CMD_OK@ Returned Status Error Codes

The task's next instruction will not be executed until the response is returned or the GATEWAY_CMD_OK@ function times out. Therefore, the GATEWAY_CMD_OK@ function should not be used in a scanned task (i.e., a task that can time out).

The format of the GATEWAY_CMD_OK@ functions is as follows:

GATEWAY_CMD_OK@(STATUS%, CMD_CODE%, AM_DROP%, & AM_REG$, GTWY_VAR!, NUM_REGS$)

where:

STATUS% is an integer variable name only. It defines the variable name where the resulting gateway command status is stored. The status value will contain a zero if successful or an error code if unsuccessful.

CMD_CODE% is a variable name or expression. This is the command (1-4) sent to the AutoMax R-Net Processor module.

AM_DROP% is a variable name or expression. This is the device for which the command is intended. The slot number for the AutoMate is always encoded in the high byte of the word; the low byte contains the drop number. (For AutoMate 15/15E and 20/20E Processors, the slot number is always 0.)

AM_REG$ is a variable name or expression. This variable is a string describing the starting register in the AutoMate which is to be read or written.

GTWY_VAR! is a variable name (used with the VARPTR! function) or expression. This is the physical address of the first register in the AutoMax R-Net Processor module's AutoMate image area from which or to which data is to be read or written.

NUM_REGS% is a variable name or expression. This defines the number of registers or bits to be transferred.

4.6 Sample Application Program

The following application program example illustrates the use of the GATEWAY_CMD_OK@ function to initiate a Read Point command.

As described in section 4.4, R-Net network variables on the R-Net Processor module must be defined before they can be accessed by an application task. Below is an example of a configuration task required for defining R-Net network variables in AutoMax Version 1.0, 2.0, and DCS 5000 systems. Note that AutoMax Version 3.0 systems do not require you to write a configuration task; all variables are defined using the Software Configurator in the Programming Executive software. In the following configuration task, DSTPNT defines the slot and register number of the AutoMax R-Net Processor module where the data will be written.

```
10      TASK RDPNT[TYPE=BASIC, PRIORITY=5, SLOT=1, &
        CRITICAL=FALSE]
20      RNETDEF DSTPNT@[SLOT=5, REGISTER=405.04]
30      END
```

BASIC or Control Block Task:

In this program, command code 1 (Read Point) is used to read the value of bit location 55.04 of an AutoMate Processor located in slot 1 of node 3 of the R-Net network. The value of this bit location is then transferred back to the AutoMax R-Net Processor that initiated the command and is written to bit location 405.04 in the AutoMate image area.

```
10      LOCAL STATUS%, CMD_CODE%, AM_DROP%,        &
        GTWY_VAR!, NUM_REGS%, BOOL@, AM_REG$
15      COMMON DSTPNT@
20      CMD_CODE%=1
30      AM_DROP%=103H
40      AM_REG$="55.04"
50      GTWY_VAR! = VARPTR!(DSTPNT@)
60      NUM_REGS% = 1
70      BOOL@ = GATEWAY_CMD_OK@(STATUS%,           &
        CMD_CODE%, AM_DROP%, AM_REG$, GTWY_VAR!,&
        NUM_REGS%)
80      DELAY 2 SECONDS
90      GO TO 70
32767   END
```

5.0 DIAGNOSTICS AND TROUBLESHOOTING

This section describes how to troubleshoot the AutoMax R-Net Processor module. If the problem cannot be corrected using the procedures below, the unit is not user-serviceable.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

5.1 Bus Error

Problem: Error code 31 or 56-58 appears on a Processor module's LED display. These errors indicate the system has a problem accessing the module through the backplane bus. Possible causes of a bus error are a missing module, a module in the wrong slot, or a malfunctioning module.

Use the following procedure to isolate a bus error:

Step 1. Verify that the module is in the correct slot.

Verify that the slot number being referenced in the application tasks agrees with the slot number defined during configuration.

Step 2. Verify that the hardware is working correctly.

One at a time, swap out the AutoMax R-Net Processor module, the Processor module(s), and the backplane. After each swap, determine if the problem has been corrected before swapping out the next item.

5.2 Invalid Node Number

Problem: The red LEDs on the module faceplate display error code 4 at power-up. This error indicates an invalid node number. This will only occur if the node number on the rotary switches is greater than 250.

Use the following procedure to clear the error code:

Step 1. Enter the correct node number on the rotary switches.

Step 2. Cycle power to the rack.

5.3 Communication Line Failure

Problem: The top and/or bottom red LEDs on the module faceplate flash on and off. This indicates a CRC error or lost token timeout, respectively, signaling a communication line failure. The RECV LED may also be off indicating a communication line failure. The cause of a communication failure is a lack of integrity along the high speed line. Error parameters (RECEIVE TIMEOUTS, CRC, OVERRUN, ILLEGAL MESSAGE, LOST TOKEN) are logged in the AutoMax R-Net module's status and control registers. A few errors may accumulate over a period of time, such as a few days; but, when these parameter values increase consistently over a short period of time, there is a problem with the integrity. Use the following procedure to isolate the cause of a communication failure:

Step 1. Verify the node number is unique and the rotary switches are set correctly. Verify the switch settings on the module correspond to the node number value in register 12. The AutoMax R-Net module reads the value of these switches only at power-up. If any changes are made to the switches, you must cycle power to the rack in order for the new settings to be recorded in this register.

Step 2. Verify the network connections to each module are secure. Check the connection between the BNC connector on the faceplate and the Tee connector. Check the connection between the Tee connector and the coax cable.

Step 3. Verify the network cabling is terminated correctly. There must be a line terminator at each end of the network.

Step 4. Verify that the network cabling does not exceed the maximum allowable length given its electrical characteristics.

Step 5. Verify a minimum network cable length of 50 feet between any two nodes.

Step 6. Verify the cable installation between nodes conforms to the guidelines described in the R-Net Cable Installation Manual (J2-3009) to inhibit excessive noise disturbances. Verify the cable between nodes is not kinked or severed.

Appendix A

Technical Specifications

Ambient Conditions

- Storage temperature: −40°C to 85°C
- Operating temperature: 0°C to 55°C
- Humidity: 5 - 90%, non-condensing
- Altitude: 3300 feet (1000 meters) without derating

Dimensions

• Height	11.75”	298.45 mm
• Width	1.25”	31.75 mm
• Depth	7.375” 8.375”	187.325 mm 212.724 mm with Tee connector
• Weight	2.0 lbs	9 kg

Maximum Power Dissipation

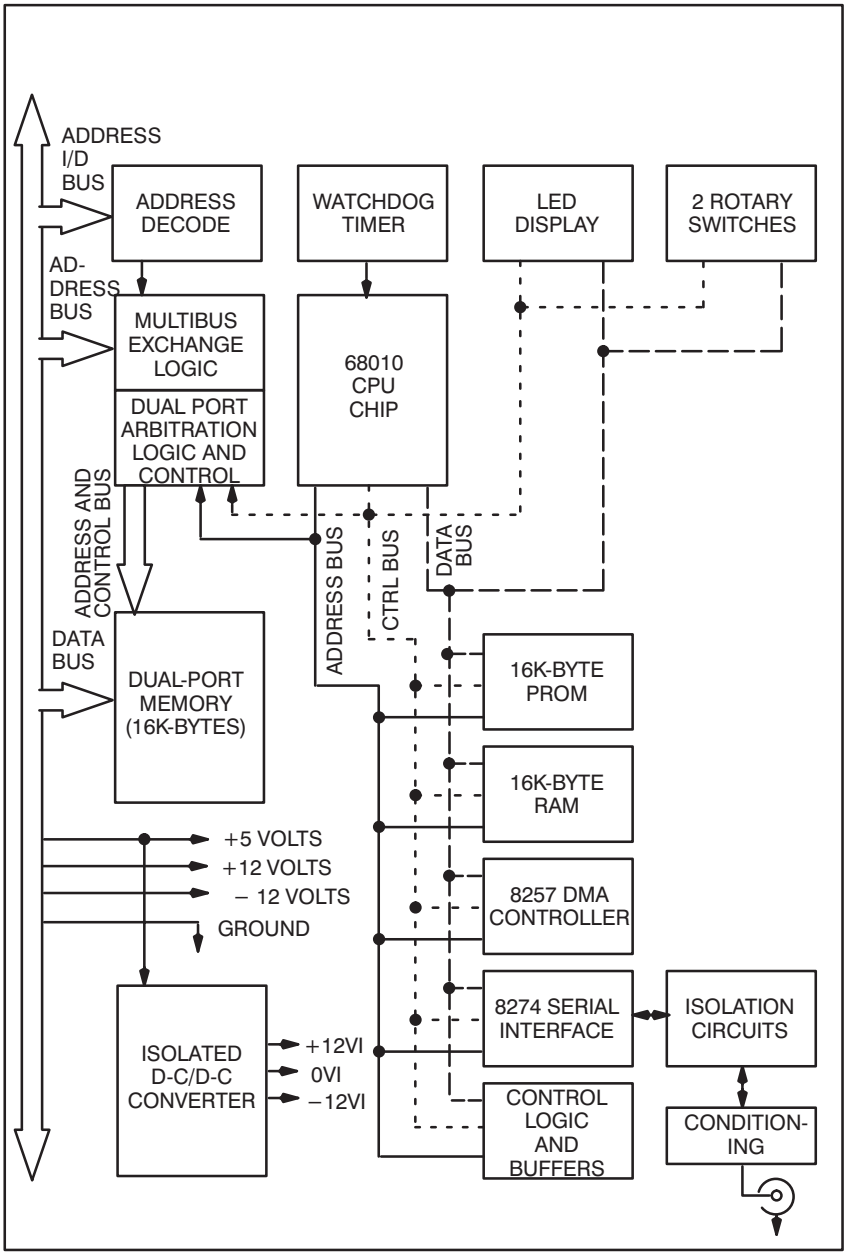
- 20 Watts

System Power Requirements

- 5V @ 2.5 Amps
- +12V @ 30 mA

Appendix B

Module Block Diagram



Appendix C

Error Codes

Power-Up Errors

The following error codes are displayed (using a pattern of COM ER LEDs) while the AutoMax R-Net Processor module performs power-up diagnostics:

1 - EPROM checksum error
2 - Scratchpad RAM failure
3 - Dual port memory failure
4 - Node number switch setting greater than 250
5 - Communication circuit failure

Error codes 1-3 and 5 will require replacement of the AutoMax R-Net Processor module.

Run-Time Errors

The following error codes are displayed if any of the indicated faults are detected:

9 - Local watchdog interrupt
10 - Software test (negative buffer length detected)
11 - Software test (message length = 0 detected)
12 - Unused interrupt detected
13 - Attempt was made to access a word on an odd byte (address error)
14 - System watchdog interrupt
15 - Bus error (R-Net module unable to reconstruct where to execute after unsuccessful attempt to access dual port memory.)

Appendix D

Node Number Conversion Chart

ND NO.	SW HI	SW LO	ND NO.	SW HI	SW LO	ND NO.	SW HI	SW LO	ND NO.	SW HI	SW LO	ND NO.	SW HI	SW LO	ND NO.	SW HI	SW LO
0	0	0	40	2	8	80	5	0	120	7	8	160	A	0	200	C	8	240	F	0
1	0	1	41	2	9	81	5	1	121	7	9	161	A	1	201	C	9	241	F	1
2	0	2	42	2	A	82	5	2	122	7	A	162	A	2	202	C	A	242	F	2
3	0	3	43	2	B	83	5	3	123	7	B	163	A	3	203	C	B	243	F	3
4	0	4	44	2	C	84	5	4	124	7	C	164	A	4	204	C	C	244	F	4
5	0	5	45	2	D	85	5	5	125	7	D	165	A	5	205	C	D	245	F	5
6	0	6	46	2	E	86	5	6	126	7	E	166	A	6	206	C	E	246	F	6
7	0	7	47	2	F	87	5	7	127	7	F	167	A	7	207	C	F	247	F	7
8	0	8	48	3	0	88	5	8	128	8	0	168	A	8	208	D	0	248	F	8
9	0	9	49	3	1	89	5	9	129	8	1	169	A	9	209	D	1	249	F	9
10	0	A	50	3	2	90	5	A	130	8	2	170	A	A	210	D	2	250	F	A
11	0	B	51	3	3	91	5	B	131	8	3	171	A	B	211	D	3			
12	0	C	52	3	4	92	5	C	132	8	4	172	A	C	212	D	4			
13	0	D	53	3	5	93	5	D	133	8	5	173	A	D	213	D	5			
14	0	E	54	3	6	94	5	E	134	8	6	174	A	E	214	D	6			
15	0	F	55	3	7	95	5	F	135	8	7	175	A	F	215	D	7			
16	1	0	56	3	8	96	6	0	136	8	8	176	B	0	216	D	8			
17	1	1	57	3	9	97	6	1	137	8	9	177	B	1	217	D	9			
18	1	2	58	3	A	98	6	2	138	8	A	178	B	2	218	D	A			
19	1	3	59	3	B	99	6	3	139	8	B	179	B	3	219	D	B			
20	1	4	60	3	C	100	6	4	140	8	C	180	B	4	220	D	C			
21	1	5	61	3	D	101	6	5	141	8	D	181	B	5	221	D	D			
22	1	6	62	3	E	102	6	6	142	8	E	182	B	6	222	D	E			
23	1	7	63	3	F	103	6	7	143	8	F	183	B	7	223	D	F			
24	1	8	64	4	0	104	6	8	144	9	0	184	B	8	224	E	0			
25	1	9	65	4	1	105	6	9	145	9	1	185	B	9	225	E	1			
26	1	A	66	4	2	106	6	A	146	9	2	186	B	A	226	E	2			
27	1	B	67	4	3	107	6	B	147	9	3	187	B	B	227	E	3			
28	1	C	68	4	4	108	6	C	148	9	4	188	B	C	228	E	4			
29	1	D	69	4	5	109	6	D	149	9	5	189	B	D	229	E	5			
30	1	E	70	4	6	110	6	E	150	9	6	190	B	E	230	E	6			
31	1	F	71	4	7	111	6	F	151	9	7	191	B	F	231	E	7			
32	2	0	72	4	8	112	7	0	152	9	8	192	C	0	232	E	8			
33	2	1	73	4	9	113	7	1	153	9	9	193	C	1	233	E	9			
34	2	2	74	4	A	114	7	2	154	9	A	194	C	2	234	E	A			
35	2	3	75	4	B	115	7	3	155	9	B	195	C	3	235	E	B			
36	2	4	76	4	C	116	7	4	156	9	C	196	C	4	236	E	C			
37	2	5	77	4	D	117	7	5	157	9	D	197	C	5	237	E	D			
38	2	6	78	4	E	118	7	6	158	9	E	198	C	6	238	E	E			
39	2	7	79	4	F	119	7	7	159	9	F	199	C	7	239	E	F			

Appendix E

R-Net Network Specifications

Network Organization

- Peer-to-peer

Media Access Protocol

- Token passing

Physical Configuration

- Bus

Maximum Number of Drops

- 32

Data Rate

- 800 Kbits/sec

Coaxial Cable Options

- RG-59/U coaxial cable
- RG-11/U coaxial cable

Maximum Cable Length

- 3000 feet using Belden 9259 RG-59/U cable
- 6000 feet using Belden 8213 RG-11/U cable

Minimum Cable Length Between Adjacent Drops

- 50 feet

For additional information

1 Allen-Bradley Drive
Mayfield Heights, Ohio 44124 USA
Tel: (800) 241-2886 or (440) 646-3599
http://www.reliance.com/automax

www.rockwellautomation.com

Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions
Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Headquarters for Dodge and Reliance Electric Products
Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
Europe/Middle East/Africa: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 6356-9077, Fax: (65) 6356-9011

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