AutoMate® Interface Module (M/N 57C417)

Industrial CONTROLS

Instruction Manual J2-3053



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

DANGER

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THE USER IS RESPONSIBLE FOR CONFORMING WITH ALL APPLICABLE LOCAL, NATIONAL, AND INTERNATIONAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVER-CURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO DESERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

THE USER MUST PROVIDE AN EXTERNAL, HARDWIRED EMERGENCY STOP CIRCUIT OUTSIDE THE PROGRAMMABLE CONTROLLER CIRCUITRY, THIS CIRCUIT MUST DISABLE THE SYSTEM IN CASE OF IMPROPER OPERATION. UNCONTROLLED MACHINE OPERATION MAY RESULT IF THIS PROCEDURE IS NOT FOLLOWED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

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.

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 menufactured or distributed by Reliance Electric industrial Company.

The AutoMate Interface module (M/N S7C417) is used as an interface hetween an AutoMax® system and an AutoMate system via an BS-232 ink utilizing the AutoMate Communication protocol. The module can be connected to several AutoMate devices; on B Not 7 Gateway Interface Head ('MIN 45C27 or M/N 45C28) for access to the B Net Network, a Serial Communication Processor (M/N 45C203) for communicating with one or more AutoMate Processors in an AutoMate rack, or directly to an AutoMate Processor. The AutoMate Interface module can also be used to connect the AutoMax rack directly to operator interface products such as ShopMax or PanelMax, or to a host computer. Note that when the AutoMax Interface module is connected directly to an operator interface device (HS-232 connection), the AutoMate Interface module acts only as a slave and cannot initiate communication. It will only rescond to commands from the operator Interface. Figure 1.1 Illustrates a link between an AutoMax rack and an R-Net Gateway Interface Heed and a link between an AutoMax rack and an operator Interface device. See appendix C for the RS-232 cable connections.



Figure 1.1 - Interfacing the AutoMax System to AutoMate Devices

The AutoMate Interface module can be placed in any slot in an AutoMax rack that contains at least one AutoMax Processor, and can communicate with up to four AutoMax Processors in that rack through its dual-port memory. The AutoMax rack containing the AutoMate Interface module appears as a single AutoMate 40H look-alike as viewed from the RS-232 link. Each AutoMax Processor has access to the lock-alike AutoMate 40H registers through the AutoMax rack backplane. The AutoMate interface module will transfer riate hetween the 40H image and remote equipment we a subset of AutoMate communication protocol commands (listed in section 4.5). The individual commane formats are described in AutoMate instruction menuals.

The remainder of this manual describes the functions and specifications of the AutoMate Interface module. It also includes a detailed description of module installation and servicing procedures, as well as 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-3028 AutoMate R-Net CATEWAY INSTRUCTION MANUAL
- J-3098 SERIAL COMMUNICATION MODULE INSTRUCTION MANUAL
- J-3150 AutoMate 30/40 SOFTWARE REFERENCE MANUAL.
- J-3636 COMMON MEMORY MODULE INSTRUCTION MANUA_
- J-3649 AutoMax CONTIGURATION TASK INSTRUCTION MANUAL
- J-3650 AutoMax PROCESSOR MODULE INSTRUCTION MANUAL
- J-3660 AutoMax VAX DRIVER INSTRUCTION MANUAL.
- J-3869 AutoMax Pooket Reference
- J-3675 AutoMax ENHANCED BASIC LANGUAGE INSTRUCTION MANUAL
- J-3681 ReSource[™] AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL VERSION 2.0
- J-3692 ISOLATION SHORT HAUL MODEM INSTRUCTION MANUAL
- * J-3750 ReSource AutoMax PHOGHAMMING EXECUTIVE N8TRUCTION MANUAL VERSION 3
- J2-3045 Resource AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL VERSION 3.3
- IEEE 518 GUIDE FOR THE INSTALLATION OF ELECTRICAL EQUIPMENT TO MINIMIZE ELECTRICAL NOISE INPLITS TO CONTROLLERS
- Your personal computer and DOS operating system manual(s)
- Other instruction manuals applicable is your hardware configuration

1.2 Related Hardware and Software

M/N 57C417 contains one AutoMate Interface Module. The module can be used with the following hardware and software:

- 1. M/N 570430A, 570431, 570435 AutoMax Processor.
- M/N 61C127 R5-232C ReSource Interface Cable. This cable is used to connect the personal computer to the AutoMax Processor module.
- M/N 57C413 or M/N 57C428 Common Memory Module. This module is used when there is more than one AutoMax Processor module in a rack.
- M/N 57C382 leolation Short Haul Modern. Two Short Haul Moderne are used cert application. These moderns provide isolation for the communications port on the AutoMate Interface module and allow the signal to be transmitted over distances greater than 15 meters (approximately 50 feet).
- M/N 57C383 Module Interface Cable. This cable is used to connect the AutoMate Interface module to a Short. Haut Modern, it can also be used to connect the AutoMate device to a Short Haut modern (if the AutoMate device has a 25-pin D-shell connector).
- (various model numbers) ReSource AutoMax Programming Executive software.

2.0 MECHANICAL/ELECTRICAL DESCRIPTION

This sect on describes the mechanical and electrical characteristics of the AutoMate Interlate module.

2.1 Mechanical Description

The AutoMate Interface module is a printed circuit assembly that plugs into the backelane of the AutoMax Back. The module consists of a printed circuit baard, faceplate, and protective enclosure. The faceplate contains ejector tabs at the top and pottom to simplify removing the module from the rack. See figure 2.1 for an illustration of the module faceplate.



Figure 2.1 - AutoMate Interface Module Faceplate

The 25-pin D-shell connector on the faceblate supports the RS-282 compatible social port. The two thumbwheel switches on the faceplate are used to set the drop number (00-99) in decimal. The upper thumbwheel switch represents the most significant digit; the lower thumbwheel switch represents the least significant digit; the lower thumbwheel switch represents the least significant digit; the back of the module are two edge connectors that attach to the system backplane.

For diagnostic purposes, the faceptate contains a seven-segment LED which displays error codes. The error codes are defined in appendix 0. A green status LED (labeled "OK") on the faceptate indicates when the module is operational (ON) or should be replaced (OFF).

2.2 Electrical Description

The AutoMate Interface module contains a microprocessor that communicates with one port of the module's dual port memory, while the other port interfaces with the AutoMax Processors through the rack backplane. A block diagram is shown in appendix B.

The module contains a watchdog timer which is enabled when power is turned on to the module. The on-board microprocessor must reset the watchdog timer within a specified time or the module will shut down and the status LED tabeled "OK" on the tabelate will turn off.

At power-up, the on-board microprocessor will run diagnostics on the CPU, EPROM, RAM, serial I/O, memory management unit, and dual port memory, as well as perform system-level diagnostics. As each test is run, a number is written out to the seven-segment display. If there is a fault during the diagnostics, the microprocessor will halt, the watchcog will time out, and the seven-segment display will show the code of the falled diagnostic. See append × D for a list of error codes.

3.0 INSTALLATION

This section provides instructions for how to install the AutoMateinterface module and its cable assembly.

3.1 Wiring

DANGER

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

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.

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.

> Step 2. Turn off power to the rack. All power to the rack as well as all power to the wiring leaping to the rack should be off.

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.

- Step 3. Take the module out of its shipping container. Take it out of the shill-elatic 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, making sure if is well seated in the rack. The module may reside in any a of in the rack. Use a screwdriver to secure the module into the rack.
- Step 5. Set the drop number of the AutoMate Interface module using the two thombwheel switches on the module faceblate. The upper switch is the most significant digit and the lower switch is the least significant digit. Note that if the AutoMate Interface module is connected to R Net Gateway Interface Head (M/N 4aC27 or M/N 4aC28), the drop number set on the module faceplate must be the same as the drop number set on the R-Net Gateway Interface Head.
- Step 6. If the communications link is less than 50 feet in length, you can connect the AutoMate Interface module directly to the remote device. Connect one end of the interface cable (M/N 57C383) or a cable you have built according to the phout in Appendix C to the 25-pin connector on the module faceplate and the other end to the connector on the remote device.

If the communications link is over 50 feet in length, connectione and of the interface cable (M/N 570383) to the 25-pin connector on the module faceplate and the other and to a Short Haul Modern (M/N 570382). Connect the other Short Haul Modern to the connector on the AutoMate hardware using an interface cable (M/N 570383) or a cable you have built according to the plocul in appendix 0. Connect the two moderns using two twisted pairs of solid or stranded conductors. See Instruction manuel J-3692 for modern wiring natructions.

Step 7. Turn on power to the AutoMax rack. An internal diagnostic mut ne will automatically be executed by the module. If an error is encountered, an error code will be displayed an the seven segment LED. If the grean status LED is OFF and no seven segment error code is displayed, a local watchdog failure has occurred and the module must be mplaced. If elegnoshe fault ende 0 through 9 er h is displayed, the AutoMata Interface module must be mplaced. (Refer to appondix D for a description of the error codes.)

If the thumbwheel switches are set to an invalid drop number, fault code 'W will be displayed on the seven-segment LED on the module lacep ate alter power-up. To clear the invalid drop number fault code, refer to section 5.2.

Step 5. Verify the installet on by monitoring registers on the module. Refer to appendix G.

3.3 Module Replacement

Use the following procedure to replace the AutoMate Interlace 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.

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Step 2.	Turn off power to the rack. All power to the rack as well as all power to the wiring leaving to the rack should be off.
Step 3.	Disconnect the cable from the module faceplate.

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

CAUTION

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- Step 5. Take the new module out of its shipping container. Take it out of the ant -static bag, being careful not to fouch the connectors on the back of the module.
- Step Iδ. Insert the module into the rack, πaking sure it is we iseated in the rack.
- Step 7. Set the drop number of the module by using the two shumbwheel excitches on the module laceptate. The upper excitch is the most significant digit; the lower excitch is the least significant digit.
- Step 8. Attach the cable to the module feceplate.
- Step 9. Turn on power to the rack. After the power up diagnostics are completed, the green status LED will go on.
- Step 10. Verily the installation by monitoring registers on the module. Refer to append x C.

4.0 PROGRAMMING

The AutoMate Interface module operates in full duplex mode, it will respond to incoming commands from the remote device as well as initiate commands from AutoMax application tasks. All data transfers between the AutoMate 405 image and the link are accomplished without the intervention of any AutoMax tasks.

This section describes how the data is organized in the 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-8686).

4.1 Register Organization

WARNING

REGISTERS AND BITS IN THE AutoMate INTERFACE MODULE THAT ARE DESCRIBED AS "READ ONLY" OR "FOR SYSTEM USE ONLY" MUST NOT BE WRITTEN TO BY THE USER. WRITING TO THESE REGISTERS AND BITS MAY RESULT IN IMPROPER SYSTEM OPERATION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

> The AutoMate Interface module contains a due port memory that can be accessed through the AutoMax rack backplane by application tasks running on the AutoMax Processor as well as by the software that manages the AutoMate device. The dual port memory contains the status and control data, the AutoMax 40E image data, and the command message buffer area. The dual port memory map is shown in figure 4.1. The Status and Control and AutoMate 40E Data image registers are described in section 4.1.1 and 4.1.2.



Figure 4.1 - Dual Port Memory Map

4.1.1 Status and Control Registers

All registers in the status and control region are for system use only with the exception of 20-24. Other registers may be read by the programmer for status information. Refer to figure 4.2 for status and control register assignments.

Read Write	Reg. #	Description
nav.	0	Status and Control Register 1
BAW	1	Status and Control Register 2
R/W	2	Status and Control Register 3
BAV	з	Status and Control Register 4
R/O	4	Device Status (bit 0)
R/O	5-11	Notused
R/O	12	Oropi number
R/O	13	Keyswitch mode (keyswitch position 1 = memory
		protect, $2 = setuc$, $3 = program)$
R/O	14	Messages received
R/O	15	Receive timeputs
R/O	18	CRC/parity errors
R/O	17	Overnue errors
R/O	18	Framing errors
R/O	19	Messages transmitted
BAV	23	unk Configuration/Update Request
BAW	21	Link Baud Rate
BOW	22	Response Timeout (seconds)
BAV	23	Maximum number of nodes
BAV*	24	ACK/NAK Timeous (100 ms. increments)
BAO	25 49	Notused
B/O	50-59	Used for Display Mode
B/Q	60	Software Part Number
B/O	61	Ravision Lovel (ASCII)
BAQ	62 63	Interface Card Identification (ASCII 'GTWY')
 Register 24 i AutoMate Inter Only. 	is Reac/Write rface module	for version B/M 67417-K (and later) of the . For earlier versions of the module, register 24 is Read

Figure 4.2 - Status and Control Register Assignments

Register 4. the device status register, defines the state of the link configuration.



Register 12 contains the crop number set on the laceplate of the module.

Register 18 contains the status of the keyewitch on the Power Supply in the AutoMax rack.

Registers 14-19 are error and status registers that should be monitored to ensure the communication link is functioning property.

Hegister 20 is the link configuration/update request register. The module continually monitors this register and will recontigure the link any time the update fleg (bits 0-7) is set. When bit 15 is set (Decug model, the first 10 bytes of the last message received will be stored in registers 50-54, and the first 10 bytes of the last message transmitted will be stored in registers 55-59. See appendix F for how to monitor registers 50-59. Figure 4.3 illustrates register 20.



Figure 4.3 - Link Configuration/Update Request

Register 21 defines the baud rate for the RS-232 link. Acceptable baud rates are 1200, 2/00, 4800, 9600, and 19200. The baud rate specified must be consistent with the device on the other end of the link.

Begister 22 defines the time in which a response must be received from a request command initiated by the BASIC function GATEWAY CMD OK® in an AutoMax application program (see section 4.4). The units are seconds and the range of acceptable values is 1-10 (default = 1). It is recommended that you set the response timeout period to at least three times the ACK/NAK timeout period. For example, it you set the ACK/NAK response time to 400 mised, you should set the response timeout to 2 seconds.

Register 23 defines the maximum number of hodes on the network and must be specified when the RS 232 link is connected to an R Net Gateway. The value should be set to one higher than the highest note number on the network (default – 255). Notes on the network should be number consecutively to avoid defays in transmission on the network.

Register 24 defines the time that the AutoMate Interface module will wait for an ACK/NAK response from the device on the other end of the link. The value is expressed in units of 100 milliseconds and the range of acceptable values is 1-30 (default = 3). Note that this register may be written to only if you are have version B/M 57417-K (and later) of the module installed in the rack. (The 3/M number accesses on the label attached to the side of the module's protective enclosure). If you are using B/M 57417-K (or false) and your version of the AutoMax Programming Executive software (V3.0 - V3.2) does not support register 24, add the module to the rack as a generic module (M/N GEN32K) instead of as M/N 67C417.

The ACK/NAK Timeout period for earlier versions of the module la fixed at 300 milliseconds. If you attempt to write to this register when using an earlier version of the module, you will receive a "31" error code (Stop All).

Registers 50-61 are used to aid in diagnosing communication problems with the interface. These registers are described in appendix E

4.1.2 AutoMate 40E Image

The I/O Image in the dual port memory appears as a subset of the AutoMate 40E registers. Figure 4.4 provides a map of the AutoMate 40E image sreas in the dual port memory along with access limitations.



+igure 4.4 - AutoMate 40E Image Memory Mep.

In AutoMax Programming Executive software Version 2.1 and earlier, the AutoMate 40F register image on the AutoMate Interface module's dual port is mapped via RNETDEF statements in the rack's configuration task. See section 4.5 for more information. In AutoMax Programming Executive software Version 3.0 and later, the AutoMate Interface module is configured by using the Programming Executive software. Any variables contained in the rack configuration are eccessible by any task on any AutoMax Processor in the rack.

Note that not all registers or oblis in the image will behave as the AutoMate 40E registers in AutoMate systems. None of the discrete nutbuts or registers will be retentive. All of the AutoMate 40E register image's registers are readable from the AutoMate device. However, it will not be possible to write to the discrete inputs (0400.00 0777.17) or output registers (2000-3777) from the AutoMate device, or to write to the discrete outputs from the Multipus backplane. When AutoMax variables are referenced in AutoMax application tasks, the data is directly obtained from or written to the AutoMate 40E register/image. Not all AutoMate 40E register/a need to be mapped to AutoMax variables; only those used in AutoMax application tasks need to be configured in the rack configuration. Only the AutoMate 40E registers described in this instruction manual can be mapped to an AutoMax variable. (Register: 1000-1177 and 6000 and above are not implemented).

The registers in the AutoMate Interface AutoMate 40- image may be displayed using the AutoMax Programming Executive's Monitor I/O function. Refer to J-3685, J-S750, or J2-S045 for detailed instructions.

4.2 Commands from Remote Devices Supported by the AutoMate Interface Module

The succed of the AutoMate communication protocol command codes succorted by the module consists of the following commands. The AutoMate Interface module will not respond to other incoming commands on the link. Refer to figure 4.5.

Octal Code	Command Name	Register Restrictions
001	Read Point	0.00.0777.17
002	Write Point	0.00 to 377.17
003	Read Register(s)	(none)
004	Write Register(a)	4000 to 5777
013	Read Register List	(none)
014	Write Multiple Pointa	D 10 377
050	Who Are You	N/A

Figure 4.5 -AutoMate Command Codes Supported by the AutoMate Interface Module

4.3 Commands Initiated by the AutoMate Interface Module

Figure 4.6 describes the commands used by the AutoMax Processor In the GATEWAY_CMD_CK@ function to initiate a command on the AutoMate Interface module. These four commands correspond to the AutoMate communication protocol command codes listed under "AutoMate Command" and are described in detail below. Note that when the AutoMate Interface module is connected directly to an operator Interface device (e.g., ShopMax, PanelMax, PC Link module, etc.) via an RS-232 link, the AutoMate Interface module functions as a slave only and cannot Initiate commands. It will only respond to commands from the operator Interface device. See section 4.5 for more Information on the CATEWAY_CMD_OK@ function.

GATEWAY_CMD_OK@ Cind. Number	Command Description	Command
1	Read Discrete Data from AutoMate	001,003
2	Write Discrete Data to AutoMate	002,014
3	Read Register Data from AutoMate	DOS
4	Write Register Data to AutoWate	004
1	-	
255	(all others undefined)	

Figure 4.6 Commands Used with GATEWAY_CMD_OK@

Command 1 will transfer discrete (bit) data from the remote Auto-Materievide to the Auto-Mate Interface module's Discrete Output data area. The Auto-Mate register number may be any legal register, while the Auto-Mate Interface register destination must be within the Discrete Output registers (000.0-377.17). The transfer size is the number of bits to transfer from the Auto-Mate device. The maximum transfer size for this command is 1052 bits.

Note that this command a lows the transfer of sequential bits from the AutoMate register starting at any point number (.xx) in the register to any bit postion in an AutoMate Interface module register. However, the processing time to align bits is very time-consuming. It is more efficient if the point number and bit number are the same. The most efficient method is to transfer multiples of 16 bits using the Read Register command (Command 3).

Command 2 will bransfer discrete (cli) data from either of the AutoMate Interface discrete data areas to any AutoMate devices's legal register(s). The AutoMate Interface variable may be assigned to either the Discrete Output (0.00-377.17) or Discrete Input (400.00-777.17) areas. The transfer size is the number of bits to transfer to the AutoMate device.

Note that although this command requires approximately the same processing time as the Reec command (Command 1), it must transmit three times as much data for the same number of cits because the AutoMate Write Masked Register command is used. Writing multiples of 16 bits using the Write Register command (Command 3) is more efficient and also allows more bits to be upcated (1952 vs. 640) in one message.

Commend S will transfer the value of any legal AutoMete register(s) to the AutoMate Interface module's Output Register or Discrete Output data area. The AutoMate register number must not contain a bit designation (.xx), while the AutoMate Interface module's variable must be essigned to registers 0.377 or 4000-5777. The transfer size is the number of 18-bit values to transfer from the AutoMate device, and must not exceed 122. Note that if data is being written into the AutoMate interface's Discrete area, the value is name of the first bit written to must specify oit 0 in a 16-bit word.

Command 4 will transfer 16-bit data from any AutoMate Interface data area to any legal AutoMate register(s). The AutoMate register number must not contain a bit designation (xo). The transfer size is the number of 16 bit values to transfer to the AutoMate device, and must not exceed 122. Note that if data is being transferred from the AutoMate Interface's Discrete areas, the variable name of the bit to begin with must be bit 0 in a 16-bit word.

4.4 Data Update Rate

The time required for a data transfer between the AutoMate Interface module and a remore device is dependent on the following parameters:

- Formulation of the request message from the GATEWAY_CMD_OK@ function (if used).
- Transmission time of a request message on the RS-232 link.
- Transmission time of a request message on the R-Net link.
- · Turn-around time at the destination.
- Transmission time of a response measage on the RF-Net link.
- Transmission time of a response message on the RS-232 link.
- Processing of a response message.

Appendix H describes methods for estimating the time required for transmitting request and response messages.

4.5 AutoMax Application Programming

Application programs communicate with the AutoMate Interface module by defining the AutoMate 40E image registers in the module's dual port memory. In AutoMax Executive Version 3.0 and later, you define these registers using the Variable Configurator application in the Programming Executive software. If you are using AutoMax Executive Version 2.1 or earlier, configuration is done using RNETDEF statements in the rack configuration task. The format for the RNETDEF statement is as follows:

nnnn RNETDEF var name[SLOT-slot number, & REGISTER-register number]

where:

mmn - configuration task line number.

var name - Integer or boolean variable.

slot number = slot number of the AutoMate Interface module. This number may range from 0 to 16.

register number = register number on the I/O module. The formal of the register number is an octal number split in the following form:

CO00.BB

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

Registers reserved for integer variables:

Register Number	BaecoA sudifium	R-NET Access
2000 to 3777 4000 to 5777	reac/write reac/write	read only read/write
Registers res	arved for boolean va	riables:
Register Number	Multibus Access	R NET Access
0000.00 to 03/7.17 400.00 to 777.17	read only read/write	reac/write read only

Commands to the module are in Lated from the AutoMax system in a BASIC application program using the GATEWAY_CMD_OK@ function:

GATEWAY_CMD_OK@(status%, cmd_code%, slave_drop%, & slave_regG, master_varl. num_regs%)

where:

statue is an integer variable representing the location where the resulting command status is stored; atatue will contain a zero if the transfer operation is successful and an error code if it is unauccessful. The error code listing is found in accendix E.

cmd_ocde is a variable name or expression of type integer representing the command sent to the interface module; the commands available are found in Figure 4.6. slave_drop is a variable name or expression of type integer representing the device address (a.g., node number) of the hardware the interface module is communicating with. The high byte of this variable contains the alot number of the AutoMate Processor. The low byte of this variable depends on the remota device. See table 4.1 below for examples.

slave_reg is a variable name or expression of type string representing the starting register in the device that is to be read from or written to. The formet of this parameter is dependent on the module used.

master_var is a variable name or expression of type couble integer, representing the actual hexadeoirnal address of the first location that is to be read from or written to in the Interface module.

num_regs is variable name or expression of type integer that collines the number of bits or registers (16 bits each) to be transferred; cmd_code determines whether the variable represents bits or registers. Note that if you are transferring couble integer (32 bit) variables, the num_regs parameter must specify the number of 16 bit variables to move. For example, if you want to move two double integer variables starting at address 270480H, num_regs must be equal to 4.

Table 4.1 - Slave Drop Parameter Examples

Slave Drop Parameter				
High Byte	Low Byte	Direct Connection	Indirect Connection	
3	8:17	R-Net Galeway M/N 45C27	AutoMete 40 in slot 3 via R-Net Processor in slot 9 P Net Processor rode # = 8	
5	0;2	AutoMate 30 in slot 5	(none)	
3	1060	Serial Communication Processor in slot 10	AutoMate / 0 in elot 3	
۵	6%	PanelMax, Shop Vax. or PC Link with node # 6 assigned	(nunc)	

(1) Node number of the R-Net Processor.

(2) Not a network connection; defaults to 0.

(3) Slot number of the Serial Communications Processor.

(4) Node number assigned to the operator interface device.

The GATEWAY CMD OK® function will be true if the operation was successfully completed. 1 the function is false, the inturned status parameter will contain an error code. See appendix E for the error codes returned by the GAI EWAY CMD OK® function. See J-3675 for more information about BASIC language programming.

4.6 Link Configuration

The link between the AutoMate Interface module and an AutoMate Serial device is established through an AutoMax BASIC explication task. The program must first set the baud rate for the link in Status and Control register 21, then set the AutoMate Interface Link Configuration/Update flag In register 20. Bit 8 of register 20 must be equal to zero (0).

The link between the AutoMate Interface module and an R-Net Gateway Head is established in two steps: first by configuring the AutoMate Interface seria. (O poin and then by setting the R-Net Gateway Head parameters. The BASIC application program must first set the baud rate for the link in Status and Control register 21, followed by the Resconse Limeout value in register 29, the number of nodes on the R-Net network in register 28, and lastly, the AutoMate Interface Link Configuration/Tipdate flag in register 20. Bit 8 of register 20 must be equal to one (1).

When power is applied to the rack, the AutoMate Interface module wit automatically run its diagnostic tests. After the tests have been completed successfully, a "C" will be displayed on the 7-segment LED. When the module detects a non-zero Update Flag, it will attempt to configure the serial port on the AutoMate Interface module. A successful configuration will be indicated by bit 1 of register 4 being set equal to one (1). The module will then read bit 8 of register 20.

If register 20, bit 8 is a "1" (R-Net Ink), the module will initiate a Set Gateway Parameters command (047). Bit 2 of register 4 will be set to indicate that the command has been initiated. Command 0/7 will be tranem tied continuously until a response is received from the R-Net Gateway Head. When a response is received, bits 0 and 3 of register 4 will be set and the "C" status code on the AutoMate Interface module's seven-segment LED will be turned off.

If register 20, bit 8 is a "0" (Ser al Comm./AutoMate link), bit 0 of register 4 will be set and the "C" status once on the AutoMate Interface module's seven-segment LED will be turned off.

The two BASIC task examples that follow present the Configuration task and BASIC statements required to configure the AutoMate Interface module for two different operating conditions. Note that the link configuration (register 20) must be the last variable defined in the BASIC program.

Example 1

The AutoMate Interface module is connected to a Serial Communitation module and the link will operate at 9600 baud with no parity and one stop bit. The resconse timeout is set to 2 seconds. The number of notes is not applicable in this mode.

If you are using AutoMax Programming Executive software Version 2.1 or earlier, the following statements would appear in the Configuration task. If you are using AutoMax Programming Executive software Version 3.0 or tater, these registers would be defined using the Variable Configurator within the Programming Executive.

040	IODEF	LINK CONF% SLOT - 5, REC STER - 201
060	IODEF	BAUD RATES SLOT - 5, RECISTER - 21
060	IODEF	RESP_TIME%[SLOT = 5, REGISTER = 22]
		이 가슴에 많은 것으로 물건이 했다. 것은 것은 것은 것이 가지 않는 것은 것은 것을 것이 없는 것을 했다.

The BASIC application task would contain the following statements:

```
.

100 RESP_TIME% = 2

110 BAUD_RATE% = 9600

120 LINK_CONF% = 00FFH
```

Example 2

:

:

The AutoMate Interface module is connected to an R Net Gateway Head. The link will operate at 19200 baud with even parity and one supplit. The default value for response timoout is used and the number of nodes is set to 10.

If you are using AutoMax Programming Executive software Version 2.1 or earlier, the following statements would appear in the Configuration task. If you are using AutoMax Programming Executive software Version 3.0 or later, these registers would be defined using the Variable Configurator within the Programming Executive.

040	IDDEF	LINK CONF&I SLOT - 5, REGISTER - 20
050	IDDEF	BAUD RATE% SLOT - 5, REGISTER - 211
OBO	IDDEF	NBR RODES% SLOT - 5, REGISTER - 22
:0		

The BASIC application task would contain the following statements:

100 NRR NODES% - 10 110 HAUD RATES - 19200 120 UNK CONE% - STEEH

5.0 DIAGNOSTICS AND TROUBLESHOOTING

This section describes how to troubleshoot the AutoMate Interface module. See appendix D for a list of the error codes thet can be displayed by the module. If the problem cannot be corrected using the procedures below, the unit s 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 The OK LED is Off

Problem: The green OK status LFD on the AutoMate Interface module faceplate is off. This LED should be on when the module has passed its internal diagnostics after power up. If the green OK status LED is off, and no error code is displayed, a local watchdog failure has nectured. Try cycling power to the tack, if the OK status LFD remains off, replace the module.

5.2 Invalid Drop Number

Problem: Error code 'A' appears on the AutoMate Interface module's LED display at power-up. This error code indicates an invalid propnumber. Use the following procedure to clear the error code:

- Step 1. Turn off all power to the rack.
- Step 2. Set the correct drop number on the thumbwheel switches. Recall that the drop number is interpreted as a decimal number.
- Step 3. Turn on power to the rack.

5.3 Transmission Link Failures

Problem: Error code "09" is returned by the CATEWAY_CMD_OK@ function. This error code indicates a Response Timeout

Step 1. Verify that the cable connections to each station are secure. Check the cable connection at the AutoMate Interface module faceclate and at the remote cevice.

Step 2. Increase the values in registers 22 and 24.

See sectiona 5.3.1 and 5.3.2 for information on rack failure and remote device failure.

5.3.1 Rack Fallure

If the AutoMax Processor in the rack that contains the AutoMate interface module tails or issues a STOP ALL command idears all outputs in the rack), the entire image in the AutoMate Interface module s dual port memory will be cleared. The module will remain off-line for at least 1 second to allow the application task to recognize that it went off-line.

5.3.2 Remote Device Failure

When the AutoMate Interface module operates in a slave mode, i.e., where it only responds to incoming reduest messages, a failure in the remote device cannot be detected by the module tself (except during the link configuration process with an P-Net Gateway Heed). When the AutoMate Interface module is initiating request messages, a link failure would be indicated by a Response Timeout error (see section 5.3).

5.4 Bus Error

Problem: Error code "31" appears on a Processor module's LED display. These errors indicate the system has a problem accessing a module in the rack though the backplane cus. A cus error may be caused by removal of an I/O module, an I/O module failure, or a rack cackplane failure.

Use the following procedure to solate a cus error:

Step 1. Verify that all the modules are in the correct stats.

Verify for each module that the slot number being referenced in the application tasks agrees with the slot number ceffred during configuration.

- Step 2. If the module is connected to an R-Net Head, verify the cmp number set on the AutoMate Interface module is the same as the node number on the AutoMate device to which it is connected. Recall that the drop number on the module is in decimal notation.
- Step 3. Verify that the application software is correct.

Verify that the application software is not attempting to write to READ ONLY registers on the module.

Step 4. Verify that the hardware is working correctly.

DANGER

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

Make certain that power is off before removing any module from the rack. Systematically replace the AutoMate Interface module, the Processor module(a), and the backplane one at a time with a corresponding module known to be operating correctly. After replacing each module or assembly, if the problem is no, corrected, replace the original item before going on to the next item.

Appendix A

Technical Specifications

AutoMate Interface Module M/N 57C417

Amblent Conditions

- Storage Temperature: 0° C to 60° C
- Operating temperature: -40°C to 85°C.
- Hum dity: 5% to 95%, non-condensing.
- Altitude: 1000 meters (3300 faet) without cereting.

Dimensiona

- Height: 29.85 cm (11.75 inches)
- Width: 3.18 cm (1.25 inches)
- Depth: 18.73 c⊤ (7.375 inches).
- Weight 0.9 kg (2 pounds)

Maximum Power Dissipation

. 20 W

System Power Requirements

- 15 VOC 2.5 A
- +12 VDC 53 mA
- –12 VDC 7.5 mA

Appendix B

Block Diagram



Appendix C

RS-232 Port Pinout



Appendix D

AutoMate Interface Module 7-Segment LED Error Codes

- CPU failed power-up disgnostic
- 1 EPROM talled power-up diagnostic
- 2 RAM failed power-up diagnostic

0

- 3 CTC tailed power-up diagnostic
- SIO port failed power-up diagnoalic
- 5 DMA failed power-up disgnostic
- 6 Dual port memory failed power-up diagnost c
- 7 Memory management unit failed power-up diagnostic.
- 9 Paralle /O por. failed power-up diagnostic
- A Invalic station number. Hardware failure.
- Watchdog timer failed power-up diagnostic.
- C Communication line failure. Displayed only if the link has not been configured by the AutoMax application program.
- System (backplane) watchdog lailed; board is operational but will not transmit or receive any data until the watchdog is reset.
- E Power laiture. This code is normally present from the time that allow voltage is detected until power is completely lost.

After the rack is powered up, if any diagnostic fault code remains displayed (0-9, or b), the AutoMate Interface module must be replaced.

Appendix E

GATEWAY_CMD_OK@ Error Codes

AutoMate Device Response Errors

- 01 (not defined)
- 02 No ACK received from remote
- 05 Contention on remote devices
- 04 Local port disabled
- 05 (not defined)
- (not definee)
- (07 (not defined)
- 08 Illegal data in response message
- 09 Response timeout
- 10 ACK/NAK timeout
- 11 NAK 1' Checksum error
- 12 NAK 2' Buffer ful
- 1S NAK '3' Illegal formet
- 14 NAK 41 Gateway not configured

GATEWAY CMD OK& Errors

- 20 Dual port adcress error
- 21 Interface module not found or not accessible
- 22 No evailable Interface channel
- 23 Illegal register number
- 24 Illegal number of registers
- 25 Illegal command number
- 26 Illegal command number/register set
- 27 Illegal register number/humber of registers
- 26 Illegal drop number

Appendix F

Monitoring Dual Port Registers 50-59

The AutoMate Interface module has the ability to display portions of both the received and transmitted commands to aid in diagnosing communication problems with the Interface.

When the 'Debug' mode is selected by setting register 20, bit 15, the first 10 bytes of the last message received are stored in registers 55-50. The contents of of the last message transmitted are stored in registers 55-50. The contents of either set of registers may be a request or response message, depending on where the request was initiated. The cual port registers should be displayed in hexadecimal notation using the AutoMax Programming Executive software Monitor I/O application. The data appears in dual port memory as follows:

Reg. 00/65	DST	SRC	Destination node # / Source node #
Reg. 51/56	PCRL	FR#	Protocol (SCH) / Frame number Reg.
82/67	DST.SLT	SRC.SLT	Destination slot / Source slot Reg.
53/58	CMD	spare	Command number Reg.
34/59	byte 9	hyte 10	(commanc dependent)

The first eight bytes of a message will be shown as above. The interpretation of bytes 9 and 10 is dependent on the Command byte as well as whether the message is a request or response. The most significant bit of the Command byte is set if the message is a response message. If the message is an error response, the two most significant bits are set.

Appendix G

Converting AutoMate Image Register Numbers to Decimal Format for Monitoring

The registers in the AutoMate Interface dual port memory A40E image may be cisplayed using the AutoMax Programming Executive software Monitor I/O application. The table below shows the beginning and ending corresponding octal and decimal register ranges.

AutoMate Register	Monitor I/Q Register
009.00 - 000.17	64
377.00 - 377.17	319
400.00 - 400.17 	320
777.03 777.17	575
2000	576
3777	1599
4000	1600
5777	2623

1

In the AutoMate Interface module, AutoMate registers 0.00 through 777.17 are single-bit registers. Therefore, each Monitor I/O register contains 16 AutoMate ciscrete bits (points). The lower number AutoMate point (.00) is stored in the least-significant bit (bit 0) of the Monitor I/O register. To calculate the Monitor I/O register number for AutoMate registers 0 through 777, convert the AutoMate register number from octai to decimal and add 64. For example,

AutoMate register = 137 137 (octal) = 95 (cecimal) Monitor /O register = 95 + 64 = 159

To convert an AutoMate Interface module integer register (2000- 6777) to a Monitor I/O register, convert the AutoMate register from octal to dorimal and subtract 448. For example,

AutoMate register = 3325 3025 (cetal) = 1557 (dacimal) Montor /O register = 1557 - 448 = 1109

Appendix H

Calculating Message Transmission Times

This appendix describes how to estimate the time required for transmission of messages, with the exception of R-Net transmission times.

RS-232 Link

Regardless of where the request massage originates, the transmission time for a message on the RS-232 link, in milliseconds, may be approximated from the following equation:

TIME (rns) = (C * B * 1000) / Baud Rate

where:

- C = Number of characters in the message
- B Number of bits per character (normally 10 if no parity; 11 if parity is specified)

The number of chorecters in a message is dependent on the message type (command code, described in section 4.5) and the number of registers being transmitted. Refer to Table H.1.

AutoMale Command	Request	Response
901	17	14
002	18	13
202	16	13 + (2 * NR)
004	15 I (2 * NR)	13
910	12 + (2 * NR)	13 + (2 * NR)
014	13 + (6 * NR)	13
350	13	27

Table H.1	 Message 	Length
-----------	-----------------------------	--------

where:

NR = Number of Registers being transmitted

Incoming Request Messages

For the AutoMate Interface module, the turn around time for an incoming request message is dependent on the number of messages already queued for processing. There may be up to three messages in the queue that must be processed before the latest incoming request can be processed.

Once the request message processing is begun, the time required is dependent on the number of registers in the response message. Table H.2 provides an estimate of the processing time: Table H.2 - Request Message Processing Time

AutoMate Command	Time (in milliseconds)
001	l = 2.7
(102	t - 2.8
003	1 = (0.035 * NR) - 1.7
(104	t = (0.039 * NB) = 1.7
013	L = (0.25 * NRJ + 1.7
014	t = (0.32 * NB) + 1.7
050	t = 2.8

where:

NR = Number of Regelers

Recuest Message Inflated from an Application Task

When a request message is formulated using the GATEWAY_CMD_OK(j) function, there may be a delay before the message is transmitted, depending on how many messages (maximum of three) are already queued for transmission. Likewise, when the response is received, up to three messages may be queued for processing before the current response is processed.

The time required to formulate the request message using the CATEWAY_CMD_OK@ function is as follows:

Command	Time (in milliseconds)
1	t = 1.5
2	t = (0.015 * NP) 1 1.50 (maximum)
	t = (0.008 * NP) + 1.50 (minimum)
3	t = 1.15
4	t = (0.035 * NH) + 1.15

where:

- NP Number o' Points (bits) in the request
- NR = Number of Registers in the request

The time required to process the response message in the AutoMate Interface module is as follows:

Command Time (in milliseconds)

where:

NP - Number of Pointe (bits) in the response.

NR - Number of Registers in the reaconse

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For additional information

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