4 Output 0-10 Volt Analog Rail Module (M/N 61C368)

Industrial CONTROLS

Instruction Manual J-3695-2



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

WARNING

ONLY QUALIFIED ELECTRICAL PERSONNEL WHO ARE 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.

WARNING

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

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1.0 INTRODUCTION

The products described in this instruction manual are manufactured by Reliance Electric Industrial Company.

The 4 Output 0-10 Voll Analog Bail module allows you to output four 0-10V analog eignals from AutoMate*, AutoMax* and DCS 5000 systeme. Typically, the Analog Bail module is used with potentiometers, valve actuators, pressure or flow transducers, and meters in both drive control systems and process control systems.

The Analog flail module is hardware-configurable by means of a tanoptate switch to emulate one of two types of devices. AutoMate Halls of AutoMate Local Heads. In some herdware configurations, the type of interface device evallable for the Analog Rail module will determine the mode of operation that can be selected (see figure 1.1).

The Analog Rail module operates in Local Head mode when it is connected directly to one of the processor's four (/O parts in AutoMate systems, to en AutoMate Local I/O Processor, or to one of the four I/O parts of the DOS 5000/AutoMax Remote (/O Head in OCS 5000/AutoMax systems. The Analog Rail data will take up four registers in the host when operating in Local Head mode.

The module operates in Hell mode when it is connected to one I/O port of a Local I/O Head, which in turn is connected to one I/O port of an AutoMate processor. The Analog Rail module will ancarpy one register of the host in Rail motor. The Rail mode is used to expand the I/O address space available through the tront I/O port of the crocessor by multiplexing each group of four analog points through the Local VO Head I/O BAR Stool (V) have a systems.

The Analog Hall module operates in Rail mode when it is connected to one (/O port of the Power Module Interface (PMI) Processor (S/M 60000), which is in turn connected to a Universal Drive Controller (UDC) incidute (M/N 57552) which resides in an AutoMaxrack.

The remainder of this manual describes the functions and spacifications of the module. It also includes a detailed overview of instellation and boubleshooting procedures, as well as examples of configuration and programming.

1.1 Additional Information

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

- J-3031 AutoMale 30 PROCESSOR HARDWARF INSTRUCTION MANUAL
- J-3033 AutoMale LDCAL I/O PROCESSOR INSTRUCTION MANUAL
- -3037 AutoMate REMOTE I/O HEAD INSTRUCTION MANUAL
- J-305S AutoMate PROGRAMMING EXECUTIVE INSTRUCTION MANUAL
- J-3120 AutoMate 20 USER'S MANUAL.

- J-3141 AutoMate 40 CONTROL PROCESSOR INSTRUCTION MANUAL
- J-3150 AutoMate 30/40 SOFTWARE REFERENCE MANUAL.
- J-5649 DCS 5000/AutoMax CONFIGURATION TASK INSTRUCTION MANUAL
- J-S6S0 AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL
- J-3600 DCS 5000 ENHANCED BASIC LANGUAGE INSTRUCTION MANUAL
- J 3675 AutoMax ENHANCED BASIC LANGUAGE INSTRUCTION MANUAL
- J-3601 DCS 5000 CONTROL BLOCK LANGUAGE INSTRUCTION MANUAL.
- J-3676 AutoMax CONTROL BLOCK LANGUAGE INSTRUCTION MANUAL
- J-3602 DCS 5000 LADDER LOGIC LANGUAGE INSTRUCTION MANUAL
- J-3577 AutoMax LADDER LOGIC LANSHAGE INSTRUCTION MANUAL
- J-3671 AutoMede LOCAL I/O HEAD INSTRUCTION MANUAL.
- J-375D AutoMax PROGRAMMING EXECUTIVE INSTRUCTION MANUAL VERSION 3.0
- J2-S045 AutoMax PHOGRAMMING EXECUTIVE VEHSION 3.3.
- S-S006 D-C DRIVE CONFIGURATION AND PROGRAMMING INSTRUCTION MANUAL
- S-3008 POWER MODULE INTERFACE RACK INSTRUCTION MANUAL
- Your personal computer and UOS operating system manual(s).
- IEEE 518 GUIDE FOR THE INSTALLATION OF FLECTHICAL EQUIPMENT TO MINIMIZE ELECTRICAL NOISE INPUTS TO CONTROLLERS

1.2 Related Hardware and Software

The 4 Output 0-10V Analog flail module, M/N 61C386, contains the following:

- 1. One 4 Output © 10V Analog Bail module
- 2. One I/O Rail cable: M/N 4505
- Two plug connectors: 12-point connector part no. 419434-2Fl 4-point connector part no. 419434-1Fl
- One .25A fuse (installed in the module): part no. 64676-23J
- One .75A fuse: (required for operation on 24 VDC): part no. 04676 23Q
- 6. Two cable retainer clips

The Analog Bail module can be configured with the hardware (purchased separately) listed in figure 1.1.

Host	Model	Operating Mode
DCS 5000/AcadMax Remote I/O Head	M/N 67C380	Local Head
AutoMate 20, 20E	M/N 45C20, 45C21, 45C220, 45C221, 45C224, 45C225	Local Head or Rail *
AutoMate 80, 80F	M/N 45C301, 45C305, 45C307	Local Head or Rail *
AutoMate 40, 40E	M/N 45C410, 45C411	Local Head or Rail *
AutoMate Cocal I/O Processor	M/N 45C200B (and later versions)	Loca: Head
AutoMate Remote I/O Head	M/N 45C37, 45C3B	Local Head
Power Module Interface Processor	R/M 60000	Reil
 Direct connection to through an AutoMa 81C23 (Rail mode). Rail module for Rail 30, or 40 Processor 	a the Processors (Local He le Local I/O Head, M/N 460 Note that it is also permiss mode even if it is connecte	at mode) or connection 322, 61 G22, 61 C22A, nr ibin to configure the Anslog to directly to an AutoMate 20,

Figure 1.1 - Analog Rell Module Hardware Configuration

2.0 MECHANICAL/ELECTRICAL DESCRIPTION

The following sections describe the mechanical and electrical characteristics of the Analog Hell module.

2.1 Mechanical Description

The Analog Rail module is a soft contained electronic module containing two dust digital to analog nerverters providing four output charmels. The module is housed in a protective metal enclosure designed for panel mounting. See figure 2.1.



Figure 2.1 - Analog Rall Module Faceplate

The faceplate of the modulo contains three electrical connectors sabeled "input", "Analog Outputs", and "Input Power" (reading top to collorit). The lop connector is used for connection to the I/O port. A cable (M/N 45C5) is provided for this purpose. The second connectur, tabeled "Analog Outputs", is a numbered, 12-point removable plug connector with screw type terminal points. Three successive terminal points are reserved for each channel's connection to external hardware. The "Analog Output" terminals are designed for 14-22 AWG wire.

The third connector on the faceplate, also a randvable plug connector with screw type terminal points, is used for input power. The terminal points are labeled. The top two points are used if the power source is 24 VDC. The bottom two points are used if the power source is 120 VAC. The 'Input Power' terminals are designed to use 14 AWC wire. A terminal stud for connecting a grounding conductor is provided on the bottom of the right-head incurring flange.

The module laceptate also contains two LEDs, a mode switch, and a fuse holder and fuse. The LED labeled "PWR OK" indicates that the I/O port, like external prover source, and the internally-generated voltages necessary for operation of the module are present. The "COM OK" LED indicates whether all four channels are successfully communicating with the host.

The switch labeled "Mood" is used to sclott between "Local Head" and "Rail" mode. Note that the position of the switch is read only unce at the time power is turned on to the Reliance device that is connected to the Anakag Rail module. The mode will remein fixed as long as this device is powered up.

As shipped from the factory, the fuse holder on the bottom of the faceplate contains a .25A fuse for 120 VAC input power. If input power will be 24 VDC, you need to replace the fuse with the .75A fuse included along with the Analog Rell module.

2.2 Electrical Description

The Analog Hall module contains loar output channels that can output 0-10V analog signals propurtional to a value of 0 to 4005. Note that at a digital output = 4096, the output rolls over to zero again. Negetive output values cannot be accommodated.

The D/A conversions are triggered by the actual I/O update sequences. The conversion rate is therefore dependent upon the scen time of the application task. See figure 2.2 for a typical output circuit.



Figure 2.2 Typical Output Circuit

The Analog Hall module is factory calibrated and requires no offset/gain adjustment. All four analog output channels and referenced to the same common. This common is isolated from oath the external power supply and the I/O port connection.

The module incorporates extensive diagnostics. In Ball mode, check bits are monitored for accuracy on every transfer of data between the host and the modulo. In Local Head mode, parity bits are monitored for accuracy on every transfer of data. A Ball fault LED on the processor, Remote Head, or Cocal Head will be illuminated *d* the check bits or party bits are wrong and ell transmission will stop effect in ratios, whore n is a value determined by the host s activare (average n = 4 for AutoMax; AutoMate n = 2).

In the event of a rall fault, all outputs wit be set to 0. The "COM OK" LED on the module will go off. If any power required by the module, i.e., the +5 Volts from the VO port required for communication, the external power supply, or the power required by the Analog Output section, is not within specified limits, all outputs will be set to 0 and the "PWH OK" LED will go off.

3.0 INSTALLATION

This section describes how to install and replace the Analog Pall mucule. Note that analog signals are sensitive to variations in temperature. The Analog Rail module is designed to perform optimally at room temperature, approximately 25°C, in all cases, the ambient temperature of the instellation must be meintained in the range specified in Appendix A to ensure the highest possible accurecy.

DANGER

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

DANGER

DO NOT TOUCH THE CONNECTORS ON THE FACEPLATE IF THERE IS POWER ON THE WIRES ATTACHED TO THE PLUG CONNECTOR SCREW TERMINALS. ALWAYS TURN OFF POWER BEFORE HANDLING A CONNECTOR THAT IS WIRED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BOOLY INJURY OR LOSS OF LIFE.

WARNING

UNEXPECTED OUTPUT CHANGES MAY RESULT IF AN ANALOG RAIL IS PLUGGED INTO A LOCAL I/O HEAD THAT IS COMMUNICATING WITH A PROCESSOR. ANY HARDWARE CONFIGURATION CHANGES MUST BE MADE ONLY WITH THE LOCAL I/O INTERFACE CABLE (M/N 45C8) DISCONNECTED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INLURY.

CAUTION

THE ANALOG BAIL MODULE IS DESIGNED TO BE POWERED BY EITHER 24 VDC OR 120 VAC. CONNECT THE PROPER POWER SOURCE TO THE MODULE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.

3.1 Wiring

To reduce the possibility of electrical noise interfering with the properoperation of the control system, exercise care when matalling the wiring between the module and the external hardware.

Use shickles twisted pair for all wring between the Analog Raf include and the external hareware. Helden 1 8761 or an equivalent cable type is recommended. Cable lengths should be limited to 50 feet maximum. For detailed recommendations refer to IDEE 518.

3.2 Initial Installation

Use the following procedure to install the Analog Rail module.

Step 1. Using the mounting dimensions shown in figure 3.1, prepare the necessary mounting provisions on the panel. The module is designed to be mounted vertically using four #10 or M5 bolts or study. Multiple modules should be mounted side by side. The flange width of two modules side by side is sufficient to dissipate the heat produced by the modules. The modules can also be mounted one acove the other, but alnow this hordware configuration does not allow the most efficient heat dissipation, the minimum clearance between the nuclue cleasars is 3°. See figure 3.1.



Figure 3.1 - Mounting Dimensions

Step 2. If the power supply you are using is 24 VDC, replace the factory-installed .25A fuse with the .75A fuse that came in the shipping box with the module. Use a screwdriver to release the fuse holder located on the Analog Pail module faceplete. Pull the fuse holder out of the module.

Take the 25A tuse out of the fuse holder and replace it with the .75A fuse. Re-insert the fuse holder into the module. Tam the screwdriver clockwise walls pressing down on the fuse holder. The fuse holder must be flush against the faceplate.

- Step 3. Mount the Analog Rail on the panel and attach it securely with #10 (M5) stude or brits.
- Step 4. Make certain that no voltage is present on line wires that will be used to provide 120 VAC or 24 VDC power to the Anatog Rail module. Use either a 129 VAC or 24 VDC power supply, but not both.
- Step 5. Using 14 AWG wire, connect input power to the scrow terminals on the "input Power" plug connector on the taceplete as shown below. Strip of approximately 5/16" of neutation from the wires.

24	VDC	POWer	

Signal	Terminal Label	Terminal Number
24 VDC -	DC	10 State Sta
24 VDC +	132.1	2

CONVERT Downer

11-2	IN C VHOT ONBI	
Signal	Terminel Label	Terminal Number
120 VAC - [nautral]	1.2/N	э
120 VAC 1 (hnt)		4

Step 6. Use the stud marked "GND" (ground) on the bottom right flange of the module to connect a ground wire.

DANGER

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

- Step 7. Turn off all power to any external hardware that will provide input signals to the module or be powered by the module.
- Sinp 8. Attach a retainer clip to the connector at each end of the I/O Hail cable (M/N 4505). Note that faceptate connectors have stote that correspond to the part of the retainer clip that protrudes away from the cable connector. The retation clip is used to assure a tight connection between the cable and faceptate connectors.

Stop 9. Using 14-22AWG wire, connect external hardware to the "Analog Output" plug connector on the taceplate as shown below. Strip off approximately 5/16" insulation from the wires.

Channel	Terminal Number	Terminal Label	Signal
a	1	V-OUT	0-10V+ output
	2	Common	common
	3	(no labal)	(enleid; no connection)*
3	4	V-OUT	0-10V+ output
	5	Common	common
	8	(no label)	(shield; no connection)*
2	7	V-OUT	0-10V+ output
	8	Comman	commun
	9	(na labet)	(shieki; no connection)*
3	10	V-OUT	0-10V+ ostpol
	11	Common	common
	12	(no label)	(shield; no connection)*

 This pin makes no electrical connection to the Analog Rail printed circuit board.

> Slep 10. For the four output channels, connect a shield whe from the external hardware to the third terminal (terminals 3, 6, 9, and 12, respectively). Insert a jumper between terminals 2 and 3, 5 and 6, 8 and 9, and 11 and 12. The shield whe at the external hardware and of the cable should be out short and taped back to prevent any oldstrical contact. See figure 3.2.



Figure 3.2 - Typical Recommended Output Shielding Methods

- Slep 11. Turn of power to the Reliance device that will be connected to the Analog Ball module.
- Step 12. Set the "Mode" switch on the laceplate of the module to the desired position.
- Stap 13. Connect the I/O Hall cable between the Analog Hall crimitoticm laboled "Input" and an I/O port on the Heliance device that will communicate with the module. Furn on power to the Reliance device that will nommunicate with the module. Recall that the Mode switch is road each time the Heliance device connected to the Analog Rail module is powered up.
- Step 14. The Analog Sail installation is now ready for tasting. Inspect all work to assure that the installation has been performed property.
- Step 15. Turn on power to the "Input Power" wiring. Turn on power to the external hardware.
- Stop 15. Varify that the hardware has been installed correctly. Before testing, insure that the external hardware will not respond to output signals from the Analog Bail module.

WARNING

BE CAREFUL WHEN WRITING TO THE OUTPUTS TO INSURE THAT NO UNEXPECTED MACHINE MOTION WILL RESULT. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY OR DAMAGE TO EQUIPMENT.

> For AutoMato systems, you must configure the AutoMate processor using the AutoMate Programming Exacutive (APX) before testing. See section 4.0 for more information. After configuring the module, use the APX Point Monitor function to test the module. You can test the Analog Rail module output channels by writing a value between 0 and 4095 to those channels and, with a votmeter, verifying that the output on the terminal points (0 to 10V) is proportional.

> For DCS 5000, AutoMax, or Distributed Power D-C Drive systems, use the DCS 5000 or AutoMax Programming Executive software (/O Monitor function, respectively. Test output channels by writing a value between 0 and 4065 to those channels and using a volumeter to varify that the signal on the terminal points (0 to 10V) is proportional.

3.3 Module Replacement

Use the following procedure to replace the mocula.

- Step 1. Stop any application programs that are running.
- Stop 2. Turn off power to the externs: hertiware connected to the butput channels on the faceptate of the module.
- Step 3. Turn off power to the Analog Rail module (129 VAC or 24 VDC).
- Step 4. Turn oll power to the Reference device connectors to the Analog Rail module.
- Stop 5. Disconnect the I/O Harl cable from the Analog Harl module.
- Step 6. Without disconnecting the wiring, remove the 12-point terminal from the faceptate and set aside.
- Step 7. Without disconnecting the wiring, remove the 4-point terminal from the taceplate and set aside. Disconnect the ground wire from the bottom right-hand lisinge.
- Step 8. Loosen the screws that hold the Analog Hail module to the panel and remove the module.
- Step 9. If the power supply you are using is 24 VBC, you need to replace the factory-installed .25A tuse in the new module with the .25A tuse that came in the salipping box with the module. Use a screwdriver to release the fuse holder located on the Analog Rail module faceplate. Pull the fuse holder out of the module.

Take the .25A tuse out of the fuse holder and replace it with the .75A tuse. He-insert the tuse holder into the modulo. Turn the screwdriver clockwise while pressing down on the fuse holder at the same time. The tuse holder must be flush against the facepsate.

 Step 10. Remove the two plug connectors from the lacep ate of the new module by pulling them firmly away from the faceplate.

- Step 11. Place the new module over the pattern drilled and attach it securely to the wall with #10 or M5 atuds or builts.
- Step 12. Attach the original 12 point and 4-point connectors with wiring to the faceplate of the module. Use the stud marked "GND" (ground) on the bottom right flange of the module to connect a ground wire.
- Step 13. Set the "Mode" switch on the faceplate of the module to the desired position.
- Step 14. Curricct the I/O Rail cable between the Analog Hall connection labeled "Input" and any rail connector on the Seliance device that will communicate with the module. Turn on power to the Reliance device that will communicate with the module. Recall that the Mode switch is read each thro the Reliance device connected to the Analog Rail module is powered up. If applicable, re-connect the cable between the Local I/O Head, or the SCS 5000/AutoMax Remote I/O Hisod, and the heat.
- Stop 'S. Jurn on power to the Analog Rall module 'Input Power' connections.
- Step 16. Turn on power to the external hardware connected to the Analog Pall module.
- Step 17. Varify that the hardware has been installed correctly. Before testing, insure that the external hardware carnul respond to output signals from the Analog Rail module.

WARNING

BE CAREFUL WHEN WRITING TO THE OUTPUTS TO INSURE THAT NO UNEXPECTED MACHINE MOTION WILL RESULT FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY OF DAMAGE TO EQUIPMENT.

> For AutoMate systems, use the APX Point Monitor function to test the module. You can test the Analog Hall module sulput channels by writing a value between 0 and 4095 to those channels and, with a voltmeter, verifying that the sulput on the terminal points (3 to 10V) is proportional.

> Fur DCS 5000, AutoMax, or Distributed Power D-C Drive systems, use the fJCS 5000 or AutoMax Programming Executive software I/O Monitor function, respectively. Test, output channels by writing a value between 0 anti 4095 to those channels and using a voltmeter to verify that the algost on the terminal points (0 to 10V) is proportional.

4.0 PROGRAMMING

I his section describes how the data is organized in the module and provides examples of how the module is accessed by application programs.

When creating application programs, the programmer should estimate the magnitude of output values because they must be in the apecified range of the Analog Bail module (0-4095).

Hocall that at a digital output = 4096, the output rolls river in zero again. The programmer must include limits in the application software to ensure that the data sent to output channels is always in the specified range.

4.1 Analog Rall Module in AutoMate Systems

This section describes how the Analog Ball le used with AutoMate systems. Local Head mode allows ell four channels on the readule to be updated at the end of the scan (normal I/O update rate in this configuration), or during the acar using AOUT blocks (see section 4.1.4). Ball mode allows only one channel to be updated at the end of the scan (normal I/O update rate in this configuration), or all four channels to be updated during the scan if AOUT blocks are used.

4.1.1 Configuring the AutoMale Processor for Use with the Analog Reil Module

Configuration is the process of describing in software how the inardware and software in the system are related. The Analog Rall modele is configured using the AutoMate Programming Executive. (APX) software, M/N 45C130 or 45C131. Select CONFIGURE SYSTEM from the main menu to create the configuration.

Note that the Analog Bail module can also be configured using the AutoMate Programming System (APS) sollware, M/N 46C134, 45C141, 45C142, or 45C143. Refer to instruction manual J2-3041 for additional information.

The Analog Bell module is configured depending upon the mode in which 4 is being used. See figures 4.1, 4.2, 4.3, 4.4, and 4.5 for how to configure the Analog Bell for use with AutoMate processors. The sample configurations are shown as they appear no the APX screen. Unless otherwise noted, all references to the AutoMate 20, 30, and 40 will also apply to the 20E, 30F and the 40F, respectively.

Analog Rall Module with AutoMate 20 . (Local Head Mode or Rail Mode)

AutoMate 20 registers reserved for port configuration:

2734	Port D of AutoMate	20

- 2736 Port 1 of AutoMate 20
- 2736 Port 2 of AutoMate 20
- 2787 Port S of AutoMate 20

Local Head Mode

Enter the value 64XX for the register representing the port to which the Analog Rail module is connected, where XX is a value from 00-14*. The XX value represents the first register in a set of four contiguous registers that will be used to store data for the port.

Hail Mode

Enter the value 16XX for the register representing the port to which the Analog Pail module is connected, where XX is a value from 00-17*. The XX value represents the register that will be used to multiplex data through the UC port.

"Values are in octal notation

Figure 4.1 - Configuration for Analog Rail Module with AutoMate 20



Figure 4.2 - Sample Configurations for Analog Rait Module Connected Directly to AutoMate 30 or 40



Figure 4.3 - Sample Configuration for Analog Rail Module Connected to AutoMate 30 or 40 Through Local VO Head



Figure 4.4 - Sample Configuration for Analog Rall Module with AutoMate Local I/O Processor



Figure 4.5 - Sample Configuration for Analog Hell Mocula with AutoMate Remote I/O Head

4.1.2 AutoMate Programming In Rall Mode

In Rail mode, the Analog Rail module is imaged in one (/0 register of the processor. Opta from one of the four channels will occupy the register as a function of the channel select bits. The active channel is updated at the end of each scan. For the output channels, the data in the register must be in the format shown in figure 4.6 prior to the I/O update.



Figure 4.6 - Rail Mode Register Image for Output Channels

The Analog Rail module data may also be accessed in the middle of the scan (as opposed to the end of the scan, which is the normal mode of operation for digital rail (O) using the appropriate number of Analog Out (AOUT) blocks. The AOUT block will set the channel select bits appropriately. See section 4.1.4 for more information about the AOUT block.

Note that the AOUT block is supported for the AutoMate S0E M/N 45C224 and 45C225, but not the AutoMate 20 (M/N 45C20, 45C21, 45C220, 45C221) by APX Version 3.0.

For processors that do not support the AOUT block, you can use the MOVE block to move data in and out of the registers assigned and to determine the channel select bits. The I/O update will occur automatically at the end of each scan. See Appendix C for a sample AutoMate program that writes to the Analog Rat module without using AOUT blocks.

4.1.3 AutoMate Programming in Local Head Mode

In Local Heed mode, the module is imaged in four I/O registers of the processor. Data from all four channels is always available and will be updated at the end of each scan. For the output channels, the data in the register must be in the format shown in figure 4.7 prior to the I/O update.



Figure 4.7 Local Hoad Register Image for Output Channers

The Analog Rall module data may also be accessed in the middle of the scan (as opposed to the end of the scan) using the appropriate number of Analog Out (AOU1) blocks. See section 4.1.4 for more internation about the AQUT block.

Note that the ADUT block is supported for the AutoMate 20C M/N 45C224 and 45C225, but not the AutoMate 20 (M/N 45C20, 45C21, 45C220, 45C221) by APX Version 3.0.

For processors that do not support the AOUT block, you can use the MOVE block to move data in and out of the registers assigned. The I/O update will occur automatically at the end of each scan. See Appendix C for a sample AutoMate program that writes to the Analog Rail module without using AOUT blocks.

4.1.4 Analog Out (AOUT) Instruction Block

The AOUT block is used to write outputs to the Analog Rail module. ADUT blocks are supported for the 205 processor. The AOUT block makes it possible to update the channels on the Analog Rail module during the scan instead of at the end of the scan (the standard AutoMate VO update). The block also makes it possible to update all four channels during the scan in Rail mode, a hardware configuration which would otherwise allow only one channel on the module to be updated. The formal of the block is shown in figure 4.8.



Figure 4.8 - AOUT Instruction Block

4.2 Analog Rail Module in DCS 5000/AutoMax Systems

This section describes how the Analog Rail module is used with DCS 5000/AutoMax systems.

4.2.1 Configuring the Analog Rall Module with a DCS 5000/AutoMax Remote I/O Head

The Analog Rell motiule is used in the Local Head mode when the host is a DCS 5000/AutoMax Permote I/D Head. For AutoMax Version 3.0 or later, the Analog Rail module is configured using the AutoMax Programming Executive. Refer to instruction manual J 3750 for more information. For DCS 5000 or AutoMax Version 2.1 or earlier, the module is defined in the configuration task for the master rack using the DCS 5000 or AutoMax Programming Executive software. See instruction manual J 8549 for more information on the configuration task.

Use the HIODEF statement to define each channel on the Analog Bail module as a separate register. Use the following format for the RIODEF statement:

where: where:

mmmy - Configuration task line number; range 1-32767.

- name. Symbolic name of channel, anding with % (integer) for registers. @ (booleans) for bits.
- Slot in rack containing DCS 6000/AutoMax master remote I/O module; range 0-18.
- Drop number of DCS 5000/AutoMax Ramote VO Head; range 1-7.
- Communication port on the DCS 5000/AutoMax Remote I/O Head to which the Analog Rait module or Local I/O Head is connected; range () 3.
- Register number; range 0-3.

r

 Optional field defining the bit position within the register rximbar; range 0-15.

4.2.2 Configuring the Analog Rall Module with a Power Module Interface Processor Host

The Analog Rail modulo is used in the Rail mode when the host is a Power Module Interface (HMI) Processor. Beginning with AutoMax Version 3.3, the Analog Rail module is configured using the AutoMax Programming Executive. Refer to instruction menual J2-3045 for more information.

5.0 DIAGNOSTICS AND TROUBLESHOOTING

DANGER

THE REMAINING STEPS ARE MADE WITH POWER ON. EXERCISE EXTREME CAUTION BECAUSE HAZARDOUS VOLTAGE EXISTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

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 BODILY INJURY.

WARNING

INSERTING OR REMOVING THIS PRODUCT OR IT'S CONNECTING CABLES MAY RESULT IN UNEXPECTED MACHINE MOTION. POWER TO THE MACHINE SHOULD BE TURNED OFF BEFORE INSERTING OR REMOVING THE PRODUCT OR IT'S CONNECTING CABLES. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

> This section explains how to troubleshoot the Analog Hall module. If you cannot corract the problem using the instructions below, the unifis not user-serviceable.

5.1 Both LEDs on the Faceplate are Off

Problem: The "PWR OK" and "COM OK" LEDs on the faceplate are off. This problem can indicate that the unit is not receiving the 1.5V from the processor or Local or Flemote Head, the 120 VAC or 24 VICC from the external power supply, or both within the spacified ranges. This problem can also indicate that the power supply tisse (75A or .25A) has blown or that the module is mathemationing.

Step 1 Stop any application programs or tasks that are running. Use a voltmeter to measure the input power (120 VAC or 24 VDC) to the module. Verify that the power source is providing 120 VAC or 24 VDC, whichever is appropriate.

DANGER

VOLTAGE IS PRESENT ON THE PLUG CONNECTOR TERMINALS, DISCONNECT THE POWER AT THE SOURCE BEFORE TOUCHING THE PLUG CONNECTOR TERMINALS, FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

DO NOT TOUCH THE CONNECTORS ON THE FACEPLATE IF THERE IS POWER ON THE WIRES ATTACHED TO THE PLUG CONNECTOR SCREW TERMINALS. ALWAYS TURN OFF POWER BEFORE HANDLING A CONNECTOR THAT IS WIRED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- Step 2. Turn off power to the module. Verify that the input power connector is connected securely to the taceplete. Verify that the I/O Ball cable connections are light at both ends.
- Step 3. Turn on power to the module. If the LFDs are still off, fry replacing the I/O Raf cable. Check that the input connector pins are not bent.
- Step 4. If the L+Us are still off, turn off priver to the module and replace the power supply fuse on the front panel following the directions below.

CAUTION

MAKE CERTAIN THAT THE ANALOG BAIL MODULE CONTAINS THE PROPER FUSE FOR THE POWER SUPPLY BEING USED. USE A .24 A PUSE FOR 120 VAC POWER AND A .75A FUSE FOR 24 VDC POWER. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.

- a) Use a screwdi iver to release the fuse holder located on the Analog Bail module taceptate. Pull the tuse holder out of the module.
- b) Take the old fuse cut of the fuse holder and replace 4 with the new fuse. Use a .25A fuse for 120 VAC power and a .75A fuse for 24 VDC power. See Appendix A for the fuse type and rating.
- c) Re-insert the fase holder into the module. Turn the screwdriver clockwise while pressing down on the luss holder. The fase holder must be flash against the faceplato.
- Step 5. Tarn on power to the module. If both LFDs still do not light, replace the module.

5.2 The "COM OK" LED is Off

Problem: The "COM OK" LED on the faceplate is off. This LED signifies whether there is communication between the Analog Bail and the host. The LED should be not if communication is taking place. The possible causes of this problem are incorrect configuration, a disconnected or mailunctioning I/O Bail cable, a mellunctioning host, or a mellunctioning Analog Bail module. After verifying that the configuration of the Analog Bail is correct, follow the steps below to solate the problem.

DANGER

VOLTAGE IS PRESENT ON THE PLUG CONNECTOR TERMINALS. DISCONNECT THE POWER AT THE SOURCE BEFORE TOUCHING THE PLUG CONNECTOR TERMINALS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

DO NOT TOUCH THE CONNECTORS ON THE PACEPLATE IF THERE IS POWER ON THE WIRES ATTACHED TO THE PLUG CONNECTOR SCREW TERMINALS. ALWAYS TURN OFF POWER BEFORE HANDLING A CONNECTOR THAT IS WIRED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

- Step 2. Verify that the connections on both ends of the *i*/O Rail capte are tight. Check that the input connector pins are not bent.
- Step 3. Turn on power to the module. The "COM OK" LEU should be illuminated if communication is taking place. If the LED attil does not illuminate, turn off power to the module and replace the I/O Rail cable.
- Stop 4. If applicable, try to reset the condition by disconnecting and then re-connecting the cable between the host and the Local (/O Head, the AutoMate Remote I/O Head, or the

DCS 5000/AutoMax Remule (/O Head, Troubleshool the host if recessary. If the problem is still not corrected, replace the Analog Bail module.

5.3 Incorrect Data

Problem: The data (signal) being read or written is always on, always oil, or different than expected. The possible causes of this problem are incorrect configuration, a programming error, a disconnected or malfunctioning I/O ftail cable, disconnected or metunctioning wiring to the external hardware, malfunctioning externs: herdware or a malfunctioning Analog flail module. After verifying that the configuration of the module is correct, follow the steps below to isolate the problem.

Step 1. Stup any application programs or lasks that are running and turn off power to the Analog Ball module.

- Step 1. Verify that the application program(s) is correct. Check to see that the program is referencing the correct registers (AutoMate) or symbolic names (DCS 5000/AutoMax). Verify that the data being output is within the specified limits.
- Step 2. Stop any application tasks that are running. Ium off power to the Analog Rail module.
- Step 3. Try to clear the condition by blaconneoling and then re-connecting the I/O Rat cable. Make certain the connections are tight. If applicable, check the connections between the host and the Local I/O Head, the AutoMate Reincte I/O Head, or the DCS 5000/AutoMax Remote I/O Head. Check that the input connector plas are not bent.
- Step 4. Turn off power to the external hardware. Verify that the wiring to the external hardware is tight and functioning correctly.
- Step 5. Turn on power to the external hardware. Before letting, make certain that Pie external hardware cannol respond to output signals from the Analog Rail module.

For output channels, use the Executive software to write a value between 0 and 4095 to the channe's. Use a voltmeter to verify that the signal on the terminal points is proportional to the value. If the signal is being converted correctly, there is a problem with the external hardware or wiring.

Step 5 Troubleshoot the external hardware, the wiring, and the host.

Appendix A

Technical Specifications

Amblent Conditions

- Storage temperature: ~40°C to 85°C ~40°F to 185°F
- Operating temperature (at the module): 0°C to 60°C 32°F to 140°F
- Hunvidity: 5-90% non-condensing

Dimensiona

- Heighl: 9.25 Inches (23.5 cm)
- Width: 2.94 Inches (7.5 cm)
- Depth: 7.75 Inchas (19.1 cm including plug-in connectors)
- Weight 4.5 lbs (2.1 kg)

Maximum Recommended Cable Length for Analog Signal Wiring

50 leet (Belden 6761 or equivalent type)

Maximum Power Dissipation

4.5 Watts

Communication Power Requirements

> 5V: 250 mA (supplied by host through I/O Reit cable).

Analog Circuit Power Supply

(use either 120 VAC or 24 VDC supply)

- 120 VAC supply: SI2 132V acceptable range (+15%/-20%) Maximum current: 150 mA
- 24 VDC supply: 20 32V ecceptable range (+33%+-16%) Maximum current: 350 mA

Fuse Types and Rating

- MDQ 250 VAC .25A (for 120 VAC power)
- MDQ 250 VAG .75A (for 24 VDC power)

Maximum Source kVA

• 10

Appendix A (Continued)

Output Channels

- Operating range: 0 10 VDG (short-circuit protected)
- Number of channels: 4 (single-ended)
- Number of commons: 1 (shared among all 4 channels).
- Resolution: 12 bits binary
- Non-Triearity: ± 1 LSB maximum
- Accuracy: ± 0.08% of full scale at 25°C maximum.
- Thermal Brift: 20 ppm/degree C
- Type of cenverler 2 dual OACs on a monolithic IC
- · Speed of conversion: Scan Dependent
- · Maximum output current: 20 mA at 16W output
- Output settling time: 100 user: max into 10K Ohm 1000pF Inad
- Minimum load resistance: 000 Ohms
- Maximum load capacitance: 1000 pF maximum including cabing capacitance to talk dowce
- Isolation of analog, section from host and input power: 2500V RMS



Appendix C

Sample AutoMate Program

The following AutoMate program sequences can be used to interface to an AutoMate Processor shat does not support the AOUT block. Over a period of four scans, the program below maps registers 40 through 43 to the four channels of an Analog Bail module in Bail mode.

Registers Used

45

- D Register that is configured to be updated at the end of scan.
- 40 Value to output to channel 0
- 41 Value to output in channel 1
- 42 Value to output to channel 2
- 43 Value to output to channel 3
- 44 Counter to select channel to operate this scan.
 - Coils

End of Scan.





If nounter = 1 then move the data in register 41 to register 0.



If counter = 2 then move the data in register 42 to register 0.



Appendix C (Continued)

If counter = 3 than move the cata in register 43 to register 0.



At the End of the Scan

Select which channel to culput at the end of ecan.



Increment counter 0, 1, 2, 3 and then back to 0.



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For additional information

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