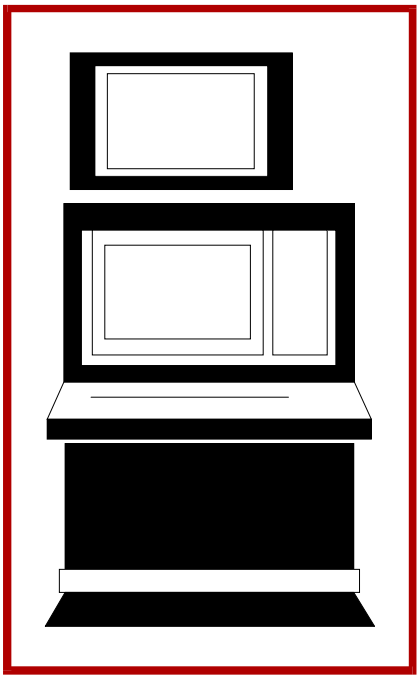
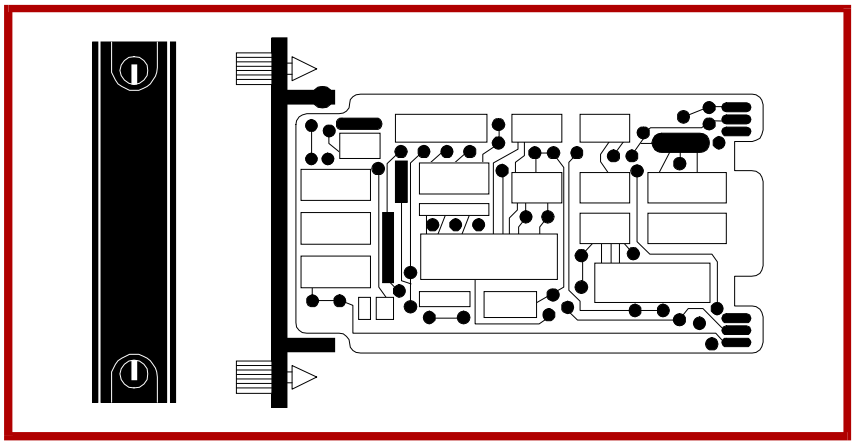
Bailey® infi 90®

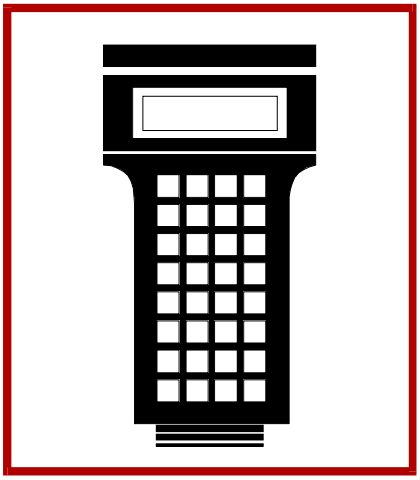
E96-303

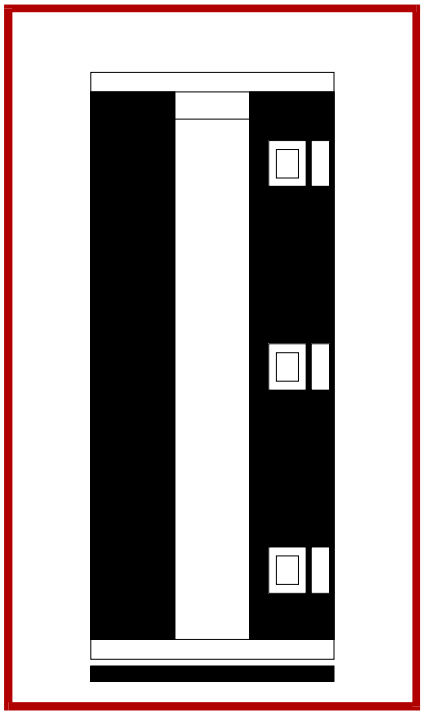
Instruction

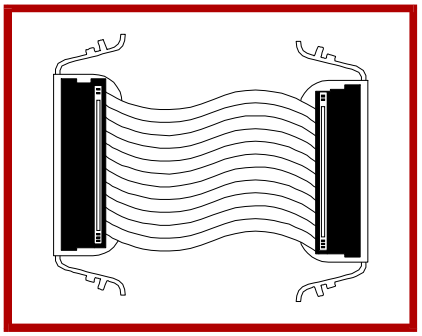
Analog Slave Output Module
(IMASO01)

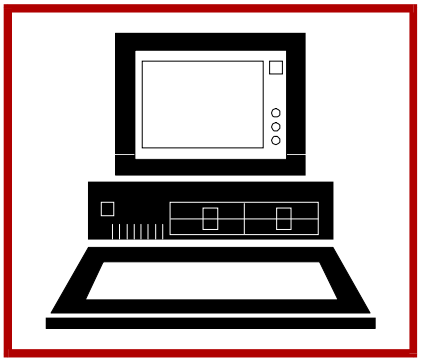












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CAUTION notices apply to hazards or unsafe practices that could result in property damage.

NOTES highlight procedures and contain information that assists the operator in understanding the information contained in this instruction.

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Preface

The Analog Slave Output module (IMASO01) outputs fourteen analog signals from the INFI 90 Process Management System to process field devices. Master modules use these outputs to control a process.

This instruction explains the slave module features, specifications and operation. It details the procedures to follow to set up and install an Analog Slave Output (ASO) module. It explains troubleshooting, maintenance and module replacement procedures.

The system engineer or technician using the ASO should read and understand this instruction before installing and operating the slave module. In addition, a complete understanding of the INFI 90 system is beneficial to the user.

This instruction includes updated information that covers changes to the specification of the ASO module.

List of Effective Pages

Total number of pages in this instruction is 38, consisting of the following:

Page No.	Change Date
Preface	31 March 1993
List of Effective Pages	31 March 1993
iii through vii	Original
1-1 through 1-4	Original
1-5	31 March 1993
2-1 through 2-6	Original
3-1 through 3-6	Original
4-1 through 4-2	Original
5-1 through 5-4	Original
6-1	Original
7-1	Original
8-1	Original
A-1 through A-3	Original
B-1 through B-2	Original

When an update is received, insert the latest changed pages and dispose of the superseded pages.

NOTE: On an update page, the changed text or table is indicated by a vertical bar in the outer margin of the page adjacent to the changed area. A changed figure is indicated by a vertical bar in the outer margin next to the figure caption. The date the update was prepared will appear beside the page number.

Safety Summary

GENERAL WARNINGS	**Equipment Environment** All components, whether in transportation, operation or storage must be in a noncorrosive environment. **Electrical Shock Hazard During Maintenance** Disconnect power or take precautions to ensure that contact with energized parts is avoided when servicing. **Special Handling** This module uses Electrostatic Sensitive Devices (ESD).

SPECIFIC WARNINGS	Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock. (p. 3-5, 5-3) The outputs go to 0% at start-up. On error detection, these outputs will change to a fixed value. This value must be selected by the user (and configured in the MFP) to ensure safe operation when error conditions occur. (p. 3-2)

Sommaire de Sécurité

AVERTISSEMENT D'ORDRE GENERAL	**Environment de l'equipement** Nes pas soumettre les composantes a une atmosphere corrosive lors du transport, de l'entreposage ou de l'utilisation. **Risques de chocs electriques lor de l'entretien** S'assurer de debrancher l'alimentation ou de prende les precautions necessaires a eviter tout contact avec des composants sours tension lors de l'entretien. **Precautions de Manutention** Ce module contient des composantes sensibles aux decharges electro-statiques.

AVERTISSEMENT D'ORDRE SPECIFIQUE	Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire moretiles. (p. 3-5, 5-3) Les signaux de sortie prennent automatiquement la valeur de 0% au moment demarrage. Quand une erreur est decelee, ces signaux prennent une valeur fixe. Cette valeur doit etre affectee par l'utilisateur (et configuree dans le MFP), de sorte a assurer un fonctionnement sur en cas d'erreur. (p. 3-2)

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SECTION 1 - INTRODUCTION

OVERVIEW

The Analog Slave Output module (IMASO01) outputs fourteen separate analog signals that the INFI 90 system uses to control a process. It is an interface between the process and the INFI 90 Process Management System. Master modules perform the control functions; slave modules provide the I/O.

This manual explains the purpose, operation and maintenance of the slave module. It addresses handling precautions and installation procedures. Figure 1-1 illustrates the INFI 90 communication levels and the position of the ASO module within these levels.

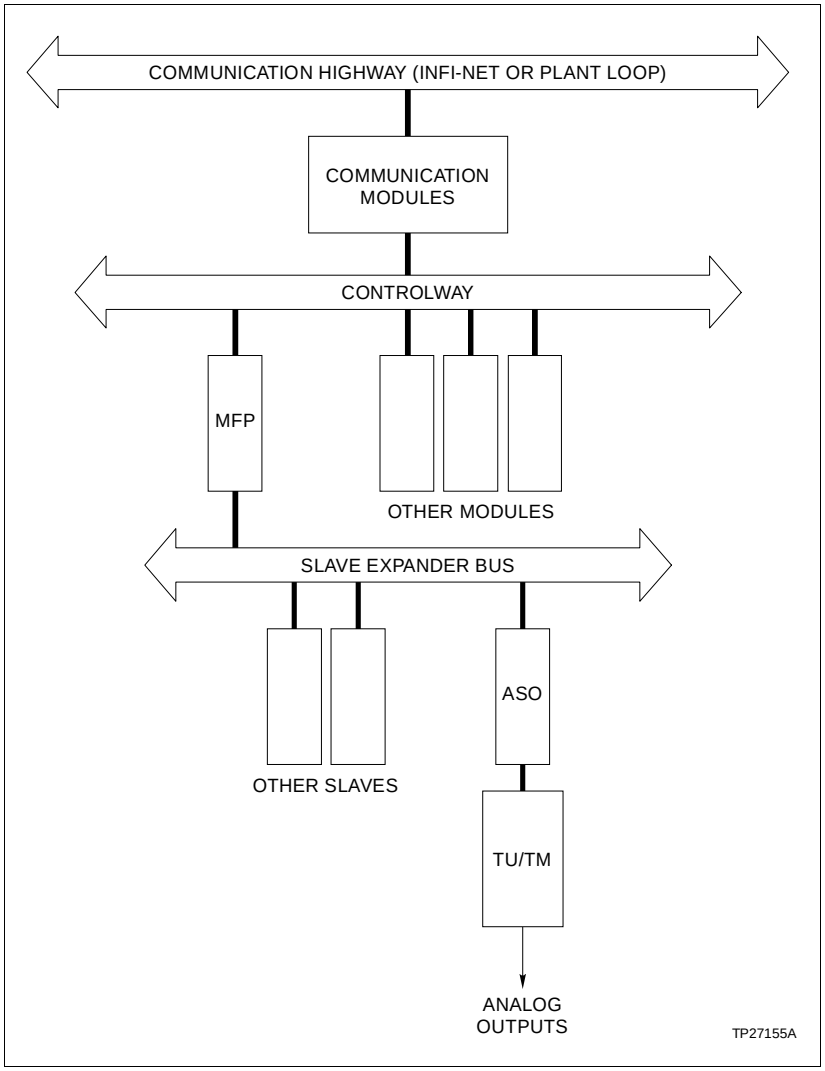


Figure 1-1. INFI 90 Communication Levels

INTENDED USER

System engineers and technicians should read this manual before installing and operating the ASO module. A module ***SHOULD NOT*** be put into operation until this instruction is read and understood. You can refer to the Table of Contents to find specific information after the module is operating.

MODULE DESCRIPTION

The ASO consists of a single printed circuit board (PCB) that occupies one slot in a Module Mounting Unit (MMU). Dipswitches on the PCB configure each of the analog outputs. Two captive screws on the faceplate secure the module to the MMU. A front panel LED indicates the module status.

The slave module has three connection points for external signals and power (P1, P2 and P3). P1 connects to logic power that drives the module circuits (refer to Table 5-2). P2 connects it to the slave expander bus to communicate with a Multi-Function Processor (MFP) module (refer to Table 5-3). The analog signals are output through connector P3 using a cable connected to a Termination Unit (TU) or Termination Module (TM) (refer to Table 5-4). The terminal blocks (physical connection points) for field wiring are on the TU/TM.

FEATURES

The modular design of the ASO, as with all INFI 90 modules, allows for flexibility when you are creating a process management strategy. It outputs fourteen analog signals that an MFP uses to control a process.

The ASO analog outputs are signals of 1 to 5 VDC or 4 to 20 mA. Individual switches configure the mode (current or voltage) for each output. This capability allows the INFI 90 system to match the process requirements.

The front panel LED provides a visual indication of the module status to aid in system test and diagnosis. You can remove or install an ASO module without powering the system down.

INSTRUCTION CONTENT

This manual consists of eight sections. ***Introduction*** is an overview of the ASO module: Features, description and specifications. ***Description and Operation*** explains the module operation and output circuitry. ***Installation*** describes precautions to observe when handling ASO modules, and setup procedures required before module operation. This section discusses switch settings, and installation procedures. ***Operating Procedures*** explains the front panel indicator and start-up of the

slave module. ***Troubleshooting*** describes the error indications and corrective actions to take. ***Maintenance*** has a maintenance schedule for the slave module. ***Repair/Replacement Procedures*** details the procedures to replace a slave module. ***Support Services*** provides replacement part ordering information. It explains other areas of support that Bailey Controls provides.

HOW TO USE THIS MANUAL

Read this manual through in sequence. It is important to become familiar with the entire contents of this manual before using the ASO. The manual is organized in sections to enable you to find specific information quickly.

1. Read and do the steps in Section 1.

2. Read Section 4 before powering up the module.

3. Refer to Section 5 if a problem occurs.

4. Refer to Section 6 for scheduled maintenance requirements.

5. Use Section 8 when ordering replacement parts.

GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
Analog	A continuous time signal with an infinite number of values.
CTT	Configuration and Tuning Terminal; hand held module that provides a local means for system configuration, tuning and diagnostics.
Configuration	A control strategy with function blocks.
Controlway	A redundant peer-to-peer communication path for status and point data transfer between intelligent modules within a process control unit.
Dipshunt	Dual in-line package with shorting bars.
Dipswitch	A dual in-line package that contains single pole switches.
EWS	Engineering Work Station; an integrated hardware and software personal computer system for configuring and monitoring INFI 90 modules.
Function Block	A function code located in the user defined memory of a multi-function processor.
Function Code	An algorithm which defines specific functions. These functions are linked together to form the control strategy.
LED	Light Emitting Diode; the module front panel indicator that shows status and error messages.

GLOSSARY OF TERMS AND ABBREVIATIONS *(continued)*

Term	Definition
LSB	Least Significant Bit; the bit of a binary number that carries the least numerical weight.
Master Module	One of a series of controller modules designed to direct field processes through a slave module. The multi-function processor is an example.
MFP	Multi-Function Processor Module; a multiple loop controller with data acquisition and information processing capabilities.
MMU	Module Mounting Unit; a card cage that provides electrical and communication support for INFI 90 modules.
MSB	Most Significant Bit; the bit of a binary number that carries the most numerical weight.
OIS	Operator Interface Station; integrated operator console with data acquisition and reporting capabilities. It provides a window into the process for flexible control and monitoring.
PAL	Programmable Array Logic; an integrated circuit that performs logic functions based on a program that is downloaded to it.
PCU	Process Control Unit; rack type industrial cabinet that contains master, slave and communication modules, and their communication paths.
RAM	Random Access Memory; processor memory that has both read and write capability. This memory is volatile; its contents are lost when power is removed.
Slave Expander Bus	Parallel address/data bus between the master module and the slave that point data and slave status data are exchanged over.
TM	Termination Module; provides input/output connection between plant equipment and the INFI 90 process modules. The termination module slides into a slot in the termination mounting unit.
TU	Termination Unit; provides input/output connection between plant equipment and the INFI 90 process modules. The termination unit is a flat circuit board for panel mounting.

NOMENCLATURE

The following modules and equipment can be used with an ASO:

Nomenclature	Hardware
IMMFP01/02	Multi-Function Processor Module
NTDI01	Termination Unit
NIDI01	Termination Module
NKTU01	Cable, Termination Unit
NKTU02	Cable, Termination Module
NKTM01	Cable, Termination Module

SPECIFICATIONS

Power Requirements	
Voltage	+5 VDC ±5% +15 VDC ±5% -15 VDC ±5% +24 VDC ±10% (from termination unit/termination module)
Current Consumption	480 mA (+5 VDC) 200 mA (+15 VDC) 195 mA (-15 VDC) 310 mA (+24 VDC)
Power Dissipation	3.75 watts @ +5 VDC 5.25 watts @ +15 VDC 3.75 watts @ -15 VDC
D/A Resolution	10 bits for analog outputs
Output Accuracy	≤0.15% (voltage mode) ≤0.25% (current mode)
Output Load	750 ohms maximum (current mode) 22 kilohms minimum (voltage mode)
Current Limiting	
Short Circuit Protection	50 mA (nominal) output current limit
Surge Protection	Meets IEEE-472-1974 Surge Withstand Capability Test[1]
Mounting	Occupies one slot in standard INFI 90 Module Mounting Unit.
Environmental	
Ambient Temperature	0^{o} to 70^{o} C (32^{o} to 158^{o} F)
Relative Humidity	0% to 95% up to 55^{o} C (131^{o} F)(non-condensing) 0% to 45% at 70^{o} C (158^{o} F)(non-condensing)
Altitude	Sea Level to 3 Km (1.86 miles)
Air Quality	Non-corrosive
Certification	CSA certified for use as process control equipment in an ordinary (non-hazardous) location.

NOTE: 1. Do not use the NKTM01 cable when compliance with IEEE-472-1974 is necessary.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

REFERENCE DOCUMENTS

Document Number	Description
I-E92-501-2	Configuration and Tuning Terminal
I-E93-916	Engineering Work Station
I-E96-100	Operator Interface Station
I-E96-200	Function Code Application Manual
I-E96-201	Multi-Function Processor (IMMFP01)
I-E96-202	Multi-Function Processor (IMMFP02)
I-E96-410	Digital I/O Termination Module (NIDI01)
I-E96-424	Digital I/O Termination Module (NTDI01)

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section explains the output circuitry, control logic, data, logic power and connections for the Analog Slave Output (ASO) module. The ASO is an analog signal interface between a Multi-Function Processor (MFP) or Multi-Function Controller (MFC) module and process field devices. A master module communicates with its slave module on a 12-line slave expander bus as shown in Figure 1-1. Each slave on the bus has a unique address set by its slave address dipswitch (S1).

Analog output signals are either 1 to 5 VDC or 4 to 20 mA. The process requirements determine the output mode (current or voltage). These signals, sent to the process, control field devices.

MODULE BLOCK DIAGRAM

The ASO circuits control the fourteen analog outputs, and transmit slave operating status back to an MFP module. Figure 2-1 is a block diagram of the ASO module. It illustrates signal flow through the module. Figure 2-2 shows the analog output circuit.

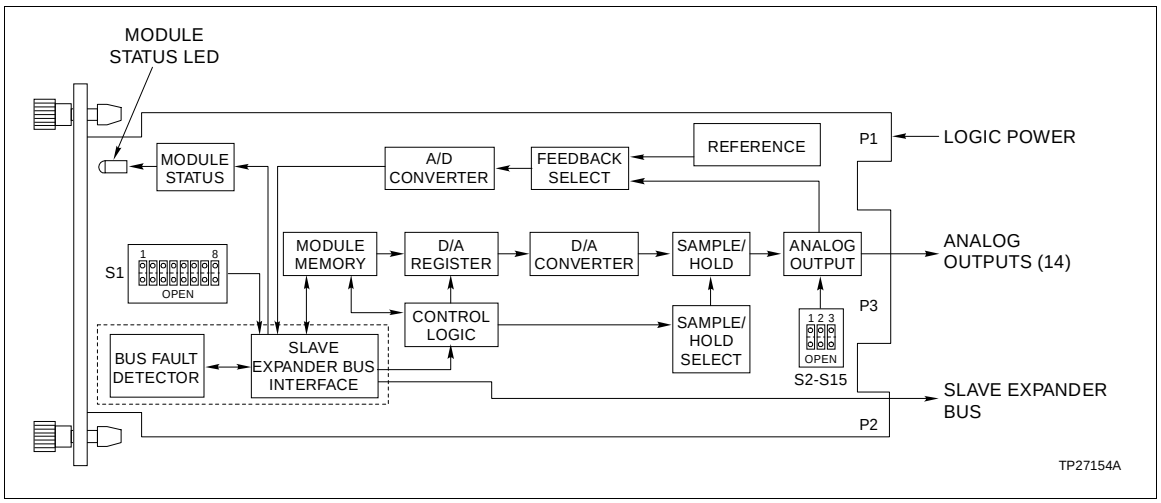


Figure 2-1. Analog Slave Output Module Block Diagram

Analog Output Circuits

The analog output block consists of fourteen separate output circuits that develop the analog outputs. They are closed loop current/voltage output circuits that monitor and adjust the output as compared to the sample/hold (S/H) output demand.

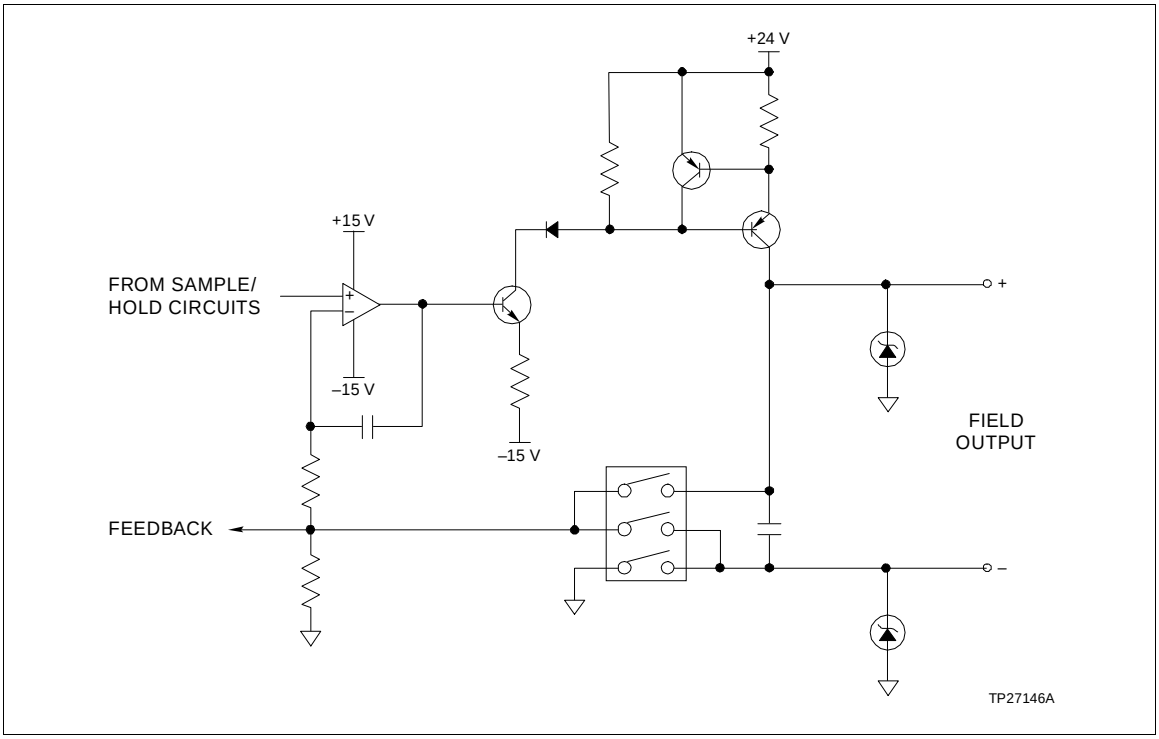


Figure 2-2. Analog Output Circuit

This compensates for supply voltage variation and unknown load impedance. All outputs automatically go to 0 percent (1 VDC or 4 mA) at start-up.

Output mode is selectable for each output channel: current (4 to 20 mA) or voltage (1 to 5 VDC). Switches S2 through S15 select the mode for channels 1 through 14 respectively. Refer to Section 3 for switch settings. A current limiter in each output circuit provides short circuit protection. For a short condition, it limits the output current to 50 mA.

Control Logic

The module memory block is a Dual Port RAM (DPRAM) that acts as a buffer between the MFP and the analog output channels. An MFP writes output and default values to the DPRAM for each of the output channels through the slave expander bus interface. Two sided (dual port) operation allows the MFP module and ASO circuits to access the DPRAM simultaneously. The MFP is given priority when it and the ASO attempt to access the same memory location.

Programmable Array Logic (PAL) circuits in the control logic block provide module control for both normal and default operation. These circuits cycle through the DPRAM, write output data (analog count) to the D/A converter and select the S/H circuits. They also monitor the bus fault (*time-out*) signal to

determine when the default states should be used. Refer to ***BUS FAULT TIMER*** in this section for further explanation of *time-out*. The PAL cycles the DPRAM and the S/H circuits through each output channel. It selects only one output channel and its corresponding S/H circuit at a time.

Output Logic

Defining Function Code (FC) 149 in the MFP configuration establishes the output values; this function code defines only seven outputs. Two function blocks must be linked, using specification 2 (FC 149), to define all fourteen outputs. The MFP sends an analog count value to the ASO for each of the analog outputs. These counts are determined by FC 149.

The ASO sets each output based on its analog count (digital value); the D/A converter changes this count to an analog signal that it sends to the S/H block. An analog count from the DPRAM is held in the D/A register until the D/A converter is ready for it. The S/H select block is a multiplexer that selects the appropriate S/H circuit. The selected circuit corresponds to the current output channel; the output channel and S/H circuit selection are controlled by the PAL. S/H circuits sample the analog signal and hold its value while the PAL sequences through the rest of the channels. During normal operation, this sequence repeats continuously for each of the output channels.

Readback Logic

The feedback select block is a multiplexer that selects one of the output feedback signals or the reference voltages. An A/D converter changes these signals to analog count values the MFP reads through the slave expander bus interface. Each channel is read separately. These values allow the MFP to adjust the outputs and check for output circuit failures. It does this by comparing the values against the data written to each output. Reading the reference voltage count values allows the MFP to check A/D converter operation.

Default Operation

A *time-out* condition causes the ASO module to go to default operation. The PAL puts the module into default operation when it receives a bus fault signal from the slave expander bus interface. Each output goes to its default state (0 percent, 100 percent or *hold*); FC 149 (specifications 11 through 17) define each output default state. This FC defines only seven channels; two function blocks must be linked to define all fourteen channels.

The PAL reads default data from the DPRAM to control the output data that is sent to the D/A converter during a bus stall (*time-out*) condition. A 0 percent option causes the D/A register

to clear and output all zeros to the converter; this causes the outputs to go to 0 percent (1 VDC or 4 mA). A 100 percent option causes the D/A register to output all ones; this causes the outputs to go to 100 percent (5 VDC or 20 mA). If a *hold* option is selected, the ASO module uses the last value stored in memory. It updates the outputs with the last value to keep them at their current states (*hold*).

OUTPUT CIRCUIT CONNECTIONS

The output signals connect to the 30-pin card edge connector P3 of the ASO using a termination cable from a TU/TM. P3 also supplies +24 VDC power to operate the analog output circuits.

SLAVE EXPANDER BUS

The INFI 90 slave expander bus is a high speed synchronous parallel bus. It provides a communication path between master modules and slave modules. The master module provides the control functions and the slave module provides the I/O functions. The P2 card edge connector of the slave and master module connect to the bus.

The slave expander bus is twelve parallel signal lines located on the Module Mounting Unit (MMU) backplane. A 12-position dipshunt placed in a connection socket on the MMU backplane connects the bus between the master and slave modules. Cable assemblies can extend the bus to up to six MMUs.

A master module and its slaves form an individual subsystem within a Process Control Unit (PCU). The slave expander bus between master/slave subsystems must be separated. Leaving a dipshunt socket empty or not connecting the MMUs with cables separates them.

UNIVERSAL SLAVE EXPANDER BUS INTERFACE

The ASO uses a custom gate array to perform the slave expander bus interface function. All the control logic and communication protocol are built into an integrated circuit (IC). This IC provides the following functions:

- Address comparison and detection.
- Function code latching and decoding.
- Read strobe generation.
- Data line filtering of bus signals.
- On-board bus drivers.

MODULE DATA

FC 149 in the master module configuration accesses the ASO on the slave expander bus. Specifically, it allows the MFP to automatically read status data and readback data from the slave module, and write output data to it. FC 149 defines only seven outputs; two function blocks must be linked together (specification 2) to define all fourteen outputs. The slave address in FC 149 must be the same as the address set on the slave address dipswitch (S1).

Status Data

Status data is one 8-bit byte consisting of module identification and status information. Slave module identification is in the four most significant bits (MSB). It identifies the slave module, and verifies the slave expander bus communication integrity and MFP configuration.

Also included in the status byte is information concerning the slave operating status. The MFP uses this information to determine if the slave has been removed and reinserted or powered down or has ever had data written to it. A remove/reinsert or power down clears default information from the slave memory. If the status byte reflects any of these conditions, the MFP downloads the information needed for default operation. The LED state is read back to the MFP in the status byte to verify proper indication.

Readback Data

This data consists of analog output readback values that the MFP reads to verify ASO module operation. The A/D converter changes analog output feedback signals from each output and the reference voltages (1 VDC and 5 VDC) to analog count values. The MFP reads each of these count values once every execution cycle. It reads the fourteen readback values to allow adjustment of the analog outputs and to check for output circuit failures. It reads the reference voltages to calibrate and verify A/D converter operation.

Output Data

Output data is a 2-byte value consisting of an analog output count and default values. The MFP writes this data to the DPRAM each execution cycle for each of the fourteen outputs. The count sets the analog outputs during normal operation. Default values are sent to the PAL to set the outputs during a *time-out*; the default values are selected in the MFP configuration (Function Code 149).

LOGIC POWER

Logic power (+5 VDC and ±15 VDC) drives the ASO circuits. It connects through the top 12-pin card edge connector (P1) shown in Figure 2-1. P3 supplies +24 VDC to operate the analog output circuits.

BUS FAULT TIMER

The bus fault timer is a one-shot timer that is reset by the slave expander bus clock; the master module generates the bus clock. If the clock stops (indicating a master module error or failure), the bus fault timer times out in 10 milliseconds. This causes the analog outputs to change to their default values. The front panel status LED turns red to indicate a bus fault (*time-out*).

STATUS LED INDICATOR

A front panel module status LED indicator shows the operating state of the ASO. Circuits on the ASO determine the module status and light the LED accordingly. It lights green to indicate normal operation. Section 4 explains the indications and Section 5 explains corrective actions to take.

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains what you must do before you put the Analog Slave Output module (IMASO01) into operation. ***DO NOT PROCEED*** with operation until you read, understand and do the steps in the order in which they appear.

> **NOTE:** Refer to Product Instruction I-E93-911 for termination device wiring instructions.

SPECIAL HANDLING

> **NOTE:** Always use Bailey's Field Static Kit (P/N 1948385A2 - consists of wrist strap, ground cord assembly, alligator clip) when working with modules. The kit is designed to connect a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

The Analog Slave Output (ASO) module uses electrostatic sensitive devices. Follow Steps 1 through 4 when handling:

1. Keep the module in its special anti-static bag until you are ready to install it in the system. Save the bag for future use.

2. Ground the anti-static bag before opening.

3. Verify that all devices connected to the module are properly grounded before using them.

4. Avoid touching the circuitry when handling the module.

UNPACKING AND INSPECTION

1. Examine the hardware immediately to verify it has not been damaged in transit.

2. Notify the nearest Bailey Controls Sales Office of any such damage.

3. File a claim for any damage with the transportation company that handled the shipment.

4. Use the original packing material and container to store the hardware.

5. Store the hardware in an environment of good air quality, free from temperature and moisture extremes.

SETUP/PHYSICAL INSTALLATION

WARNING	**The outputs go to 0% at start-up. On error detection, these outputs will change to a fixed value. This value must be selected by the user (and configured in the MFP) to ensure safe operation when error conditions occur.**
AVERTISSEMENT	**Les signaux de sortie prennent automatiquement la valeur de 0% au moment demarrage. Quand une erreur est decelee, ces signaux prennent une valeur fixe. Cette valeur doit etre affectee par l'utilisateur (et configuree dans le MFP), de sorte a assurer un fonctionnement sur en cas d'erreur.**

You must set the address dipswitch (S1) and the analog output mode switches (S2 through S15) ***BEFORE*** installing or operating the ASO module. Its respective Termination Unit (TU) or Termination Module (TM) must be configured to output the analog signals from the ASO to the field devices.

Slave Address Selection Switch (S1)

The ASO can have one of 64 addresses (address 0 to 63) on the slave expander bus. This address uniquely identifies the slave to the master module and must be the same as the address set in the master module configuration (Function Code (FC) 149 specification 1).

The address is set by the eight position address dipswitch (S1) shown in Figure 3-1. The six right switch positions (3 through 8) of S1 set the six bit ASO address. Positions 1 and 2 are not used and must remain in the closed position (see Figure 3-2). Table 3-1 is a binary address conversion table for setting S1.

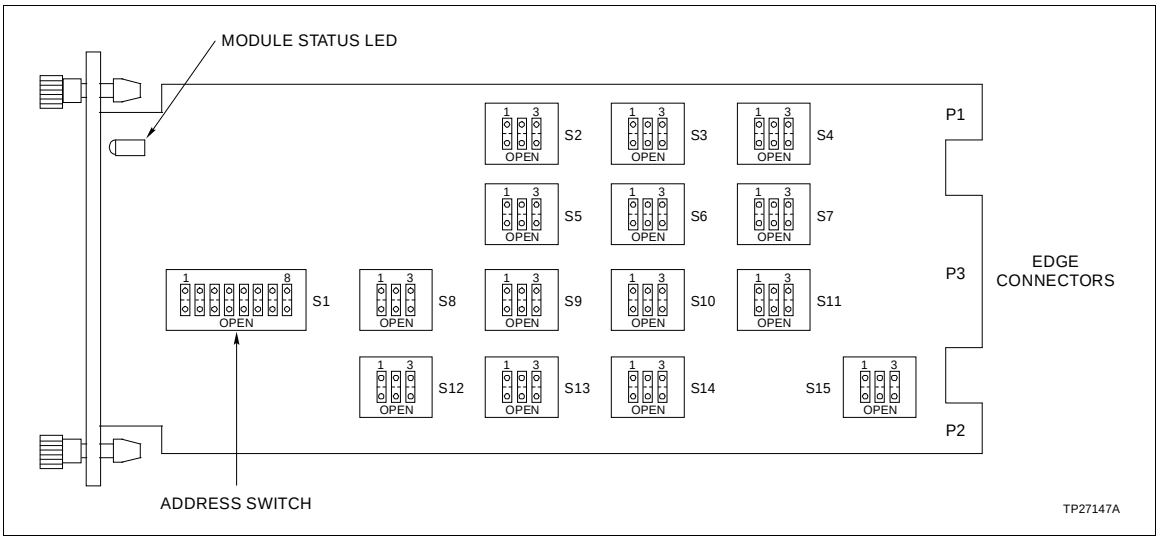


Figure 3-1. Analog Slave Output Module

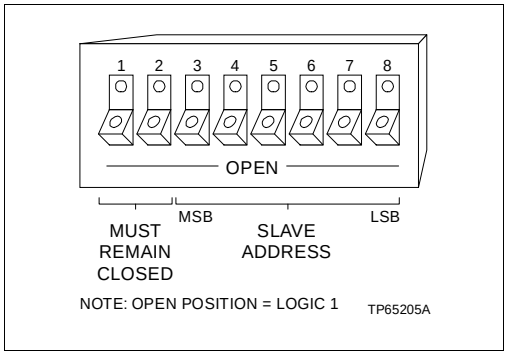


Figure 3-2. Address Select Switch (S1)

Table 3-1. Address Switch Settings (S1)

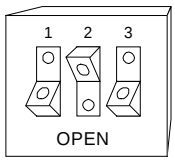
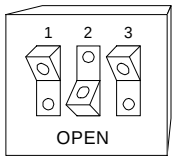
Addr	MSB					LSB	Addr	MSB					LSB
	3	4	5	6	7	8		3	4	5	6	7	8
0	0	0	0	0	0	0	32	1	0	0	0	0	0
1	0	0	0	0	0	1	33	1	0	0	0	0	1
2	0	0	0	0	1	0	34	1	0	0	0	1	0
3	0	0	0	0	1	1	35	1	0	0	0	1	1
4	0	0	0	1	0	0	36	1	0	0	1	0	0
5	0	0	0	1	0	1	37	1	0	0	1	0	1
6	0	0	0	1	1	0	38	1	0	0	1	1	0
7	0	0	0	1	1	1	39	1	0	0	1	1	1
8	0	0	1	0	0	0	40	1	0	1	0	0	0
9	0	0	1	0	0	1	41	1	0	1	0	0	1
10	0	0	1	0	1	0	42	1	0	1	0	1	0
11	0	0	1	0	1	1	43	1	0	1	0	1	1
12	0	0	1	1	0	0	44	1	0	1	1	0	0
13	0	0	1	1	0	1	45	1	0	1	1	0	1
14	0	0	1	1	1	0	46	1	0	1	1	1	0
15	0	0	1	1	1	1	47	1	0	1	1	1	1
16	0	1	0	0	0	0	48	1	1	0	0	0	0
17	0	1	0	0	0	1	49	1	1	0	0	0	1
18	0	1	0	0	1	0	50	1	1	0	0	1	0
19	0	1	0	0	1	1	51	1	1	0	0	1	1
20	0	1	0	1	0	0	52	1	1	0	1	0	0
21	0	1	0	1	0	1	53	1	1	0	1	0	1
22	0	1	0	1	1	0	54	1	1	0	1	1	0
23	0	1	0	1	1	1	55	1	1	0	1	1	1
24	0	1	1	0	0	0	56	1	1	1	0	0	0
25	0	1	1	0	0	1	57	1	1	1	0	0	1
26	0	1	1	0	1	0	58	1	1	1	0	1	0
27	0	1	1	0	1	1	59	1	1	1	0	1	1
28	0	1	1	1	0	0	60	1	1	1	1	0	0
29	0	1	1	1	0	1	61	1	1	1	1	0	1
30	0	1	1	1	1	0	62	1	1	1	1	1	0
31	0	1	1	1	1	1	63	1	1	1	1	1	1

1= OPEN ; 0=CLOSED

Analog Output Mode Switch (S2 through S15)

Switches S2 through S15 configure the analog output mode (current or voltage) for outputs 1 through 14 respectively. Current mode is 4 to 20 mA; voltage mode is 1 to 5 VDC. Figure 3-1 shows the switch locations on the ASO. Determine the output mode requirements for each analog output for your application; set dipswitch positions 1 through 3 of the analog output switches to the positions shown in Table 3-2.

Table 3-2. Analog Output Mode Switch Settings

Mode	Switches S2-S15
Voltage	
Current	

Termination Unit/Module Configuration

A TU/TM connects the field device wiring to the INFI 90 system. The terminal blocks (connection points) are located on the TU/TM. You must configure the TU/TM to output the ASO signals that are sent to the process field device. Refer to the appendices to determine the configuration for your application.

Physical Installation

NOTE: Section 3 provides instructions pertaining to the physical installation of the slave only. For complete cable and TU/TM information, refer to Termination Unit Manual I-E93-911.

The ASO module inserts into a standard INFI 90 Module Mounting Unit (MMU) and occupies one slot. To install:

1. Verify the slot assignment of the module.

WARNING	**Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock.**
AVERTISSEMENT	**Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire moretiles.**

2. Verify that a dipshunt is in the slave expander bus socket on the MMU backplane between the slave and master module.

3. Connect the hooded end of the termination cable from the TU/TM to the MMU backplane. To do this, insert the connector into the backplane slot in the same slot as the one assigned to the slave module. The latches should snap securely into place.

4. Align the module with the guide rails in the MMU; gently slide the module in until the front panel is flush with the top and bottom of the MMU frame.

5. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module. (To remove the module, turn the module retaining screws to the unlatched position and gently slide it out).

WIRING CONNECTIONS AND CABLING

The ASO has three card edge connectors to supply logic power, establish slave expander bus communication and provide analog outputs (P1, P2 and P3 respectively).

Wiring

Installing the module in the MMU connects the slave module to logic power (+5 VDC, ±15 VDC), necessary to drive the circuitry, at P1. It also connects P2 to the slave expander bus for communication with the MFP. P1 and P2 connection require no additional wiring or cabling.

> **NOTE:** You must install a dipshunt on the backplane of the MMU to connect the slave expander bus between the slave module and master module. Locate the modules so the bus can connect the modules or they will not communicate.

Cable Connections

The IMASO01 uses either an NTDI01 or NIDI01 for termination. See Figure 3-3 to determine the cables to use with the TU/TM you are using.

FUSING

The ASO does not have any on board fusing requirements.

PRE-OPERATING ADJUSTMENTS

You do not have to make any adjustments to the ASO prior to operating.

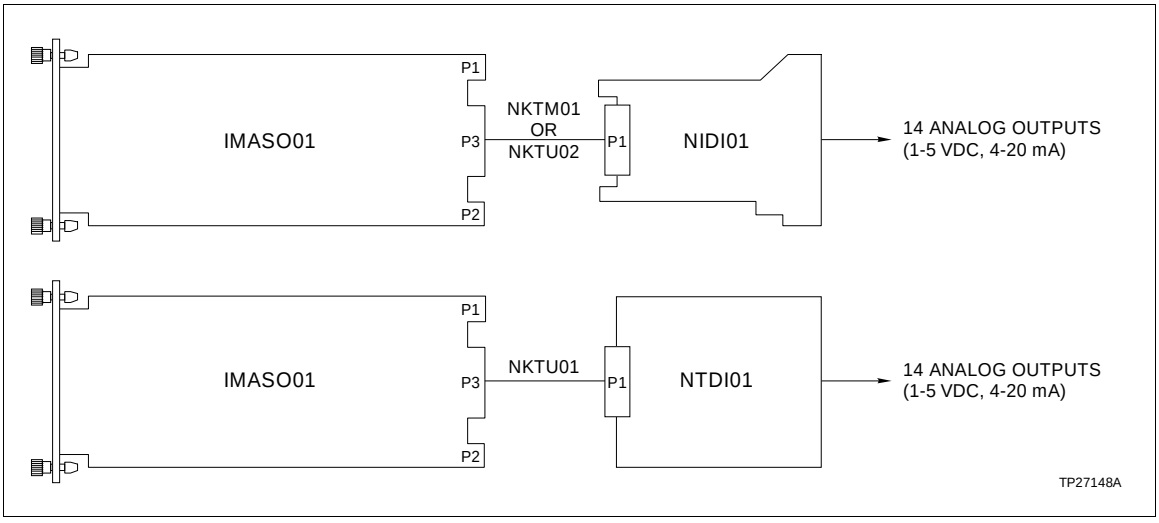


Figure 3-3. IMASM01 Cable Connections and Termination

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section explains the front panel indicator and start-up procedures for the Analog Slave Output module (IMASO01).

MODULE STATUS INDICATOR

The Analog Slave Output (ASO) module has a front panel module status LED indicator to aid in system test and diagnosis. The location of the indicator is shown in Figure 4-1. Table 4-1 explains the three states of the status LED indicator (refer to Section 5 to determine corrective actions).

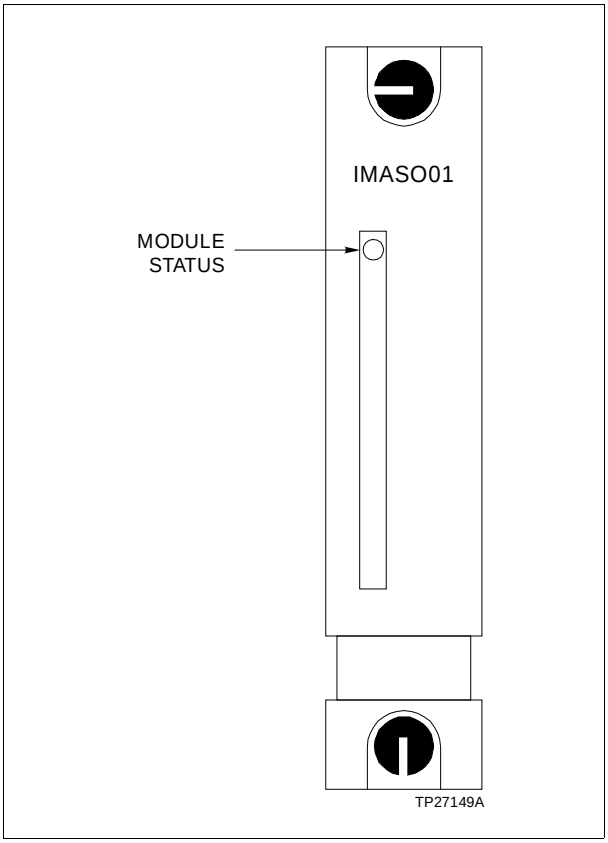


Figure 4-1. IMASO01 Front Panel

Table 4-1. IMASO01 Status LED Indicator

LED	Indication
Solid Green	Enabled and communicating with master module
Off	No power or not enabled
Solid Red	Bus fault timer error (*time out*)

START-UP PROCEDURES

The Multi-Function Processor (MFP) controls the start-up of the ASO module; it is fully automatic. Function Code (FC) 149 in the MFP configuration enables the ASO. Specification 1 (FC 149) is the slave module address. It must be the same as the address set on the address dipswitch (S1). The front panel LED (solid green) verifies that the module is enabled and communicating.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section explains the error indications and corrective actions for the Analog Slave Output (ASO) module.

ERROR INDICATIONS AND CORRECTIVE ACTION

You can obtain the status of the ASO through an INFI 90 operator interface (e.g., Operator Interface Station, Engineering Work Station, Configuration and Tuning Terminal) or the front panel module status LED indicator.

Status LED

The front panel status LED has three states to indicate normal operation and error conditions. Table 5-1 lists ASO status LED states, error indications, probable causes and corrective actions.

NOTE: If the corrective actions in Table 5-1 do not correct a problem with the ASO module, replace it.

Master Module Errors

The Multi-Function Processor (MFP) performs status checks on the ASO. An error will appear in the report function of an operator interface. Refer to the Product Instruction for the operator interface you are using for an explanation of these reports.

Function Code (FC) 149 output block N+7 in the MFP configuration is the ASO status flag (logic 0=good; logic 1=bad). You can use an operator interface to monitor this block. If the status flag is a logic 1, check the front panel module status LED and the operator interface report function to determine corrective actions.

NOTE: If FC 149 specification 3 is set to 0, the MFP will trip when the ASO module fails. Changing specification 3 to a 1 allows the MFP to continue to operate if any ASO error condition exists.

Table 5-1. Status LED Indications and Corrective Actions

LED State	Indication	Probable Cause	Corrective Action
Solid Green	Slave module operating normally and communicating with master module	Normal operation	No action required
Off	Slave module not enabled	Address set on S1 not the same as address in master module configuration FC 149 spec 1	Change address on S1 to correspond with FC 149 spec 1 OR Change address in FC 149 spec 1 to correspond with S1
		Dipshunt not properly installed between master module and slave module	Verify dipshunt is installed properly (no bent pins) in slave expander bus socket on MMU backplane between master and slave module
		Master module configuration is not correct	Verify FC 149 is in master module configuration
	No power to slave module	Module not completely inserted in MMU	Verify module is completely inserted in MMU: faceplate flush with MMU and captive retaining screws latched
Red	Bus fault timer error (*time-out*)	Slave expander bus clock failure	Check master module for proper operation
		Dipshunt not installed between master and slave module	Verify dipshunt is installed in the slave expander bus socket on the MMU backplane between master and slave module

The address set on address switch (S1) and in the MFP configuration must be the same. The MFP generates a MISSING SLAVE MODULE error if they do not match. Verify that the address set on S1 is the same as the address in FC 149 specification 1. If not:

1. Remove the module and change the setting of S1 to correspond with the MFP configuration (refer to Section 3 for the procedures to set an address and to install a slave module).

OR

2. Modify the address in the MFP configuration (FC 149 specification 1) to correspond with the address set on S1. Use an Infi 90 operator interface to modify the configuration (for procedures on how to modify a function code specification, refer to the Product Instruction for the operator interface you are using).

WARNING	**Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock.**
AVERTISSEMENT	**Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire moretiles.**

The MFP generates a MISSING SLAVE MODULE error if the slave expander bus is not connected between it and the slave module. Verify the bus connection on the MMU backplane.

If you determine the slave module is faulty, replace it with a new one. Refer to Section 7 for procedures to replace an ASO module.

MODULE PIN CONNECTIONS

The slave module has three connection points for external signals and power (P1, P2 and P3). Tables 5-2, 5-3 and 5-4 show the pin connections.

Table 5-2. P1 Power Pin Connections

Pin (P1)	Connection	Pin (P1)	Connection
1	+5 VDC	7	+15 VDC
2	+5 VDC	8	-15 VDC
3	NC	9	PFI
4	NC	10	PFI
5	Common	11	NC
6	Common	12	NC

PFI=Power Fail Interrupt
NC=Not Connected

Table 5-3. P2 Expander Bus Connections

Pin (P2)	Signal	Pin (P2)	Signal
1	Data 1	7	Data 7
2	Data 0	8	Data 6
3	Data 3	9	Clock
4	Data 2	10	Sync
5	Data 5	11	NC
6	Data 4	12	NC

NC=Not Connected

Table 5-4. P3 Output Pin Connections

Signal	Pin(+)	Pin(-)	Signal	Pin(+)	Pin(-)
AO1	A	1	AO8	K	9
AO2	B	2	AO9	L	10
AO3	C	3	AO10	M	11
AO4	D	4	AO11	N	12
AO5	E	5	AO12	P	13
AO6	F	6	AO13	R	14
AO7	H	7	AO14	S	15
NC	—	8	+24 VDC	J	—

AO=Analog Output
NC=Not Connected

SECTION 6 - MAINTENANCE

INTRODUCTION

The Analog Slave Output (ASO) module requires limited maintenance. This section contains a maintenance schedule.

MAINTENANCE SCHEDULE

Perform the tasks in Table 6-1 at the specified intervals.

Table 6-1. Maintenance Schedule

Task	Interval
Clean and tighten all power and grounding connections	Every 6 months or during plant shutdown, whichever occurs first
Use a static safe vacuum cleaner to remove dust from: Modules Module Mounting Unit Fan Assembly Power Entry Panel	Every 6 months or during plant shutdown, whichever occurs first

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement procedures for an Analog Slave Output (ASO) module. There are no special tools required to replace an ASO module.

MODULE REPAIR/REPLACEMENT PROCEDURES

If you determine the ASO is faulty, replace it with a new one. ***DO NOT*** try to repair the module; replacing components may affect the module performance. You can remove the module while system power is supplied. To replace a module:

1. Push and turn the two front panel captive retaining screws one half turn to unlatch the module. It is unlatched when the slots on the screws are vertical and the open end of the slots face away from the module.

2. Gently slide the module out of the MMU.

3. Configure the replacement module switch settings. Ensure they are set the same as the original module.

4. In the same slot assignment as the original module, align the replacement module with the guide rails in the MMU; gently slide it in until the front panel is flush with the top and bottom of the MMU frame.

5. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module.

6. Return to normal operation.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls is ready to help in the use, application and repair of its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

When making repairs at your facility, order replacement parts from a Bailey sales office. Provide this information:

1. Part description, part number and quantity.

2. Model and serial numbers (if applicable).

3. Bailey instruction manual number, page number and reference figure that identifies the part.

When you order standard parts from Bailey Controls, use part numbers and descriptions from the Recommended Spare Parts Lists. You must order parts without commercial descriptions from the nearest Bailey Controls sales office.

TRAINING

Bailey Controls has a modern training facility that provides service and repair instruction. This facility is available for in-plant training of your personnel. Contact a Bailey Controls sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

You can obtain additional copies of this manual from the nearest Bailey sales office at a reasonable charge.

APPENDIX A - TERMINATION UNIT (NTDI01) CONFIGURATION

INTRODUCTION

The IMASO01 uses an NTDI01 for termination. Dipshunts on the Termination Unit (NTDI01) configure the analog outputs that are sent to the process. The Analog Slave Output (ASO) module outputs are 4 to 20 mA or 1 to 5 VDC depending on the ASO module configuration.

Figures A-1 and A-2 show the NTDI01 dipshunt without strapping, and the analog signal path from the ASO module to the field device for a termination unit application. These figures show an application using an IMASO01, NTDI01 and an external load. Refer to Table A-1 to determine the dipshunt strapping to configure your application. Figure A-3 shows the terminal assignments for the analog output signals. Refer to this figure when connecting field wiring to the NTDI01.

NOTE: Dipshunt socket XU8 does not require a dipshunt for this application.

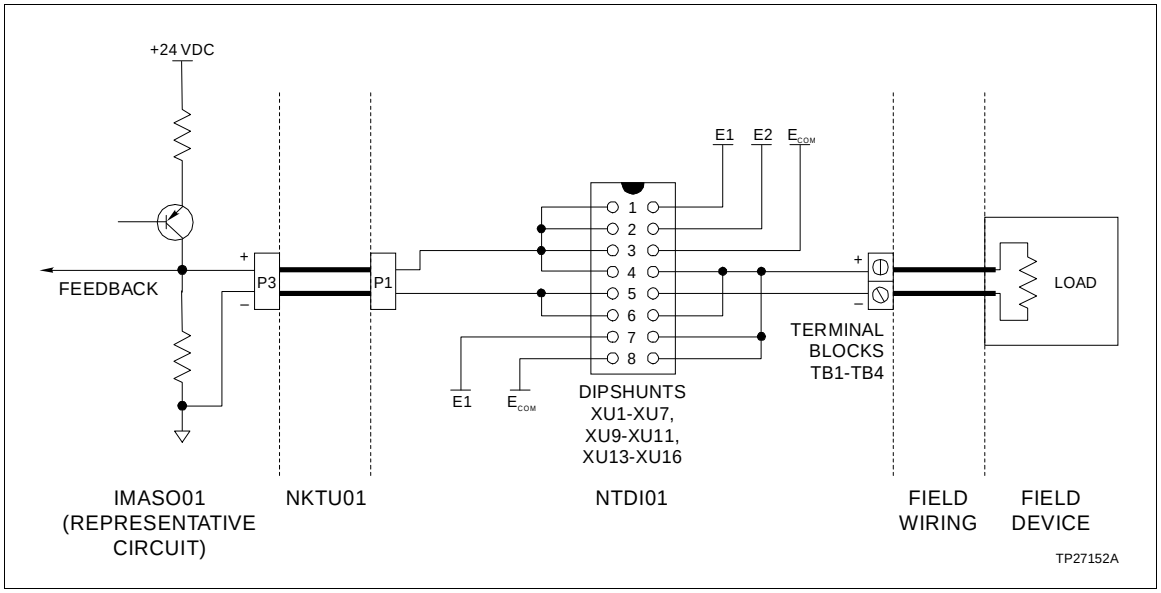


Figure A-1. NTDI01 Circuit Diagram (Voltage Mode)

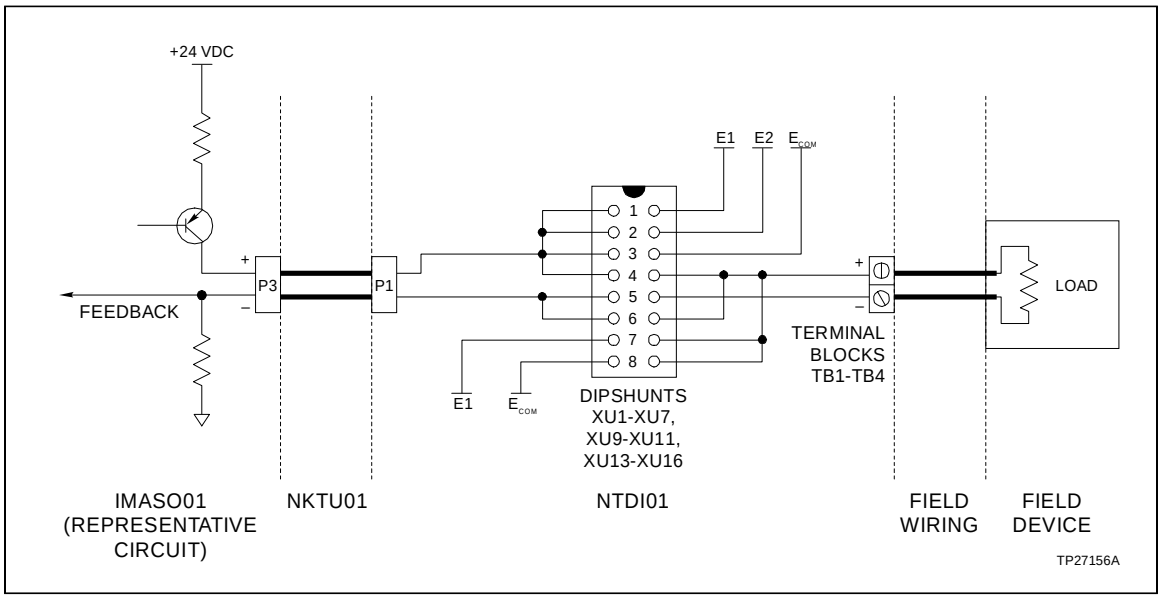


Figure A-2. NTDI01 Circuit Diagram (Current Mode)

Table A-1. NTDI01 Dipshunt Configuration

Application/Signal Type	Dipshunt Configuration
Output Signals 1-5 VDC 4-20 mA	XU1-XU7, XU9-XU11, XU13-XU16 1 2 3 4 5 6 7 8
24 VDC Power to Slave	XU12 1 2 3 4 5 6 7 8
Signal Routing for Channels 6 and 13	XU17 1 2 3 4 5 6 7 8 TP27151A

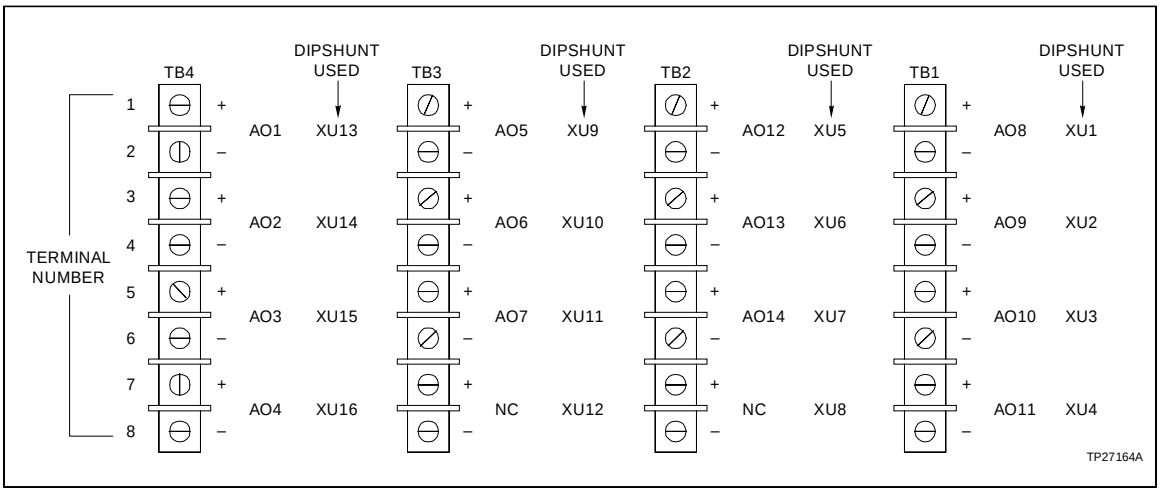


Figure A-3. NTDI01 Terminal Assignments

APPENDIX B - TERMINATION MODULE (NIDI01) CONFIGURATION

INTRODUCTION

The IMASO01 uses an NIDI01 for termination. Jumpers on the Termination Module (NIDI01) configure the analog outputs that are sent to the process. The Analog Slave Output (ASO) module outputs are 1 to 5 VDC or 4 to 20 mA depending on the ASO module configuration.

Figures B-1 and B-2 show the NIDI01, and the analog signal path from the ASO module to the field device for a termination module application. These figures show an application using an IMASO01, NIDI01 and an external load. Refer to Table B-1 to determine the jumper setting to configure your application. Figure B-3 shows the terminal assignments for the analog output signals. Refer to this figure when connecting field wiring to the NIDI01.

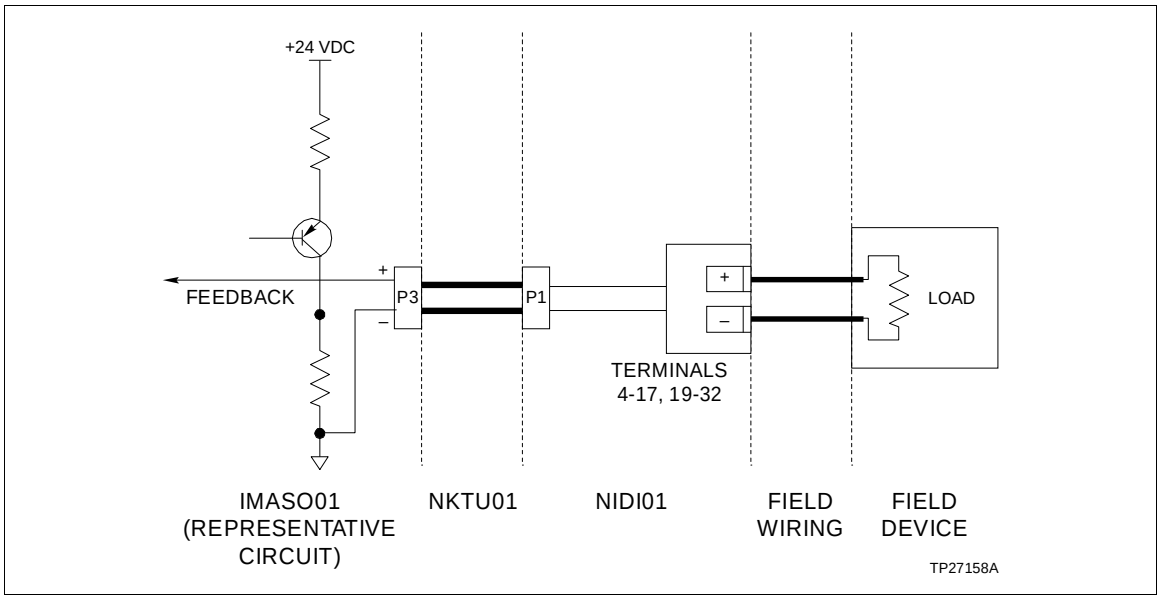


Figure B-1. NIDI01 Circuit Diagram (Voltage Mode)

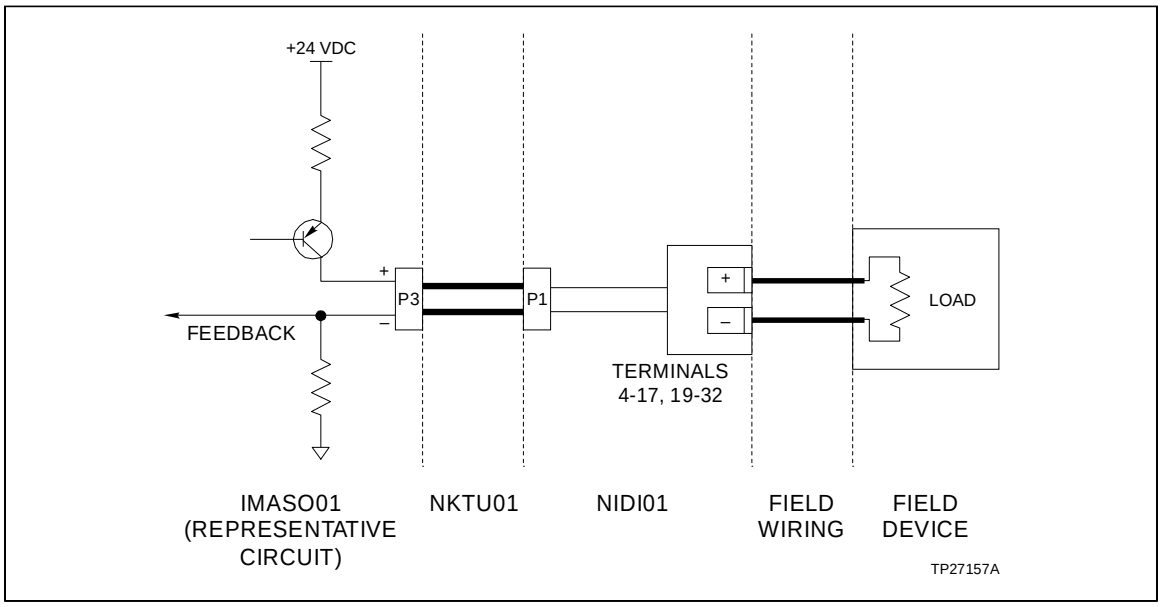
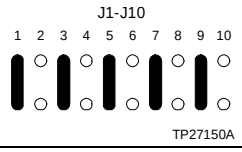


Figure B-2. NIDI01 Circuit Diagram (Current Mode)

Table B-1. NIDI01 Jumper Configuration

Application/Signal Type	Jumper Configuration
1-5 VDC, 4-20 mA	

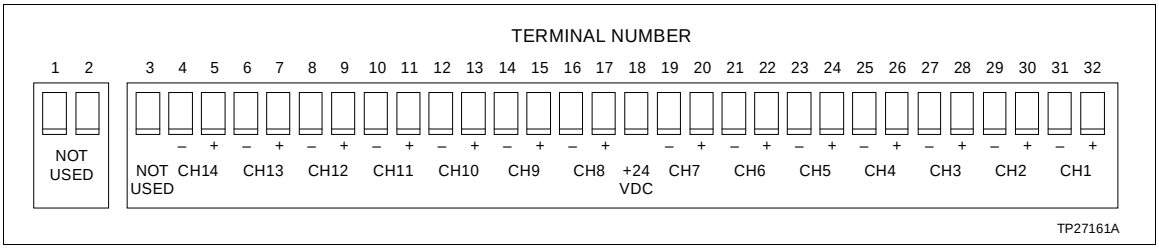


Figure B-3. NIDI01 Terminal Assignments

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AMERICAS
29801 Euclid Avenue
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Telefax 1-216-585-8756

ASIA/PACIFIC
152 Beach Road
Gateway East #20-04
Singapore 189721
Telephone 65-391-0800
Telefax 65-292-9011

EUROPE, AFRICA, MIDDLE EAST
Via Puccini 2
16154 Genoa, Italy
Telephone 39-10-6582-943
Telefax 39-10-6582-941

GERMANY
Graefstrasse 97
D-60487 Frankfurt Main
Germany
Telephone 49-69-799-0
Telefax 49-69-799-2406

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