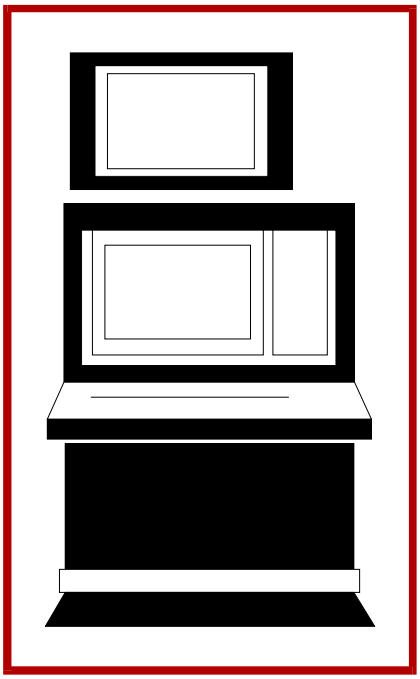
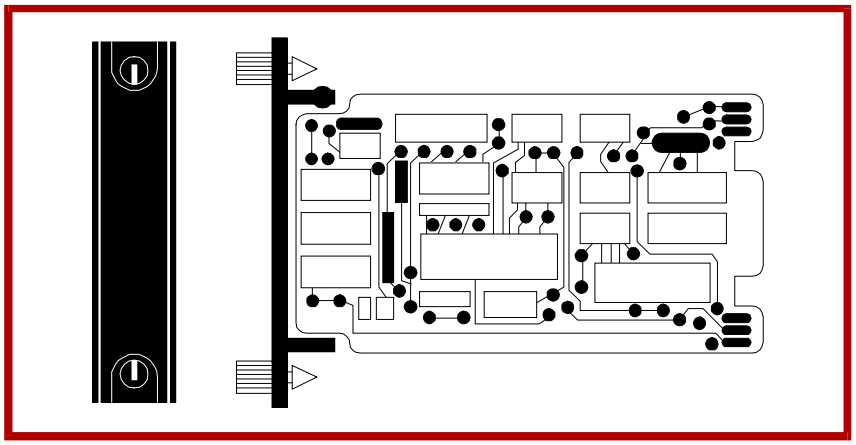
Bailey® infi 90®

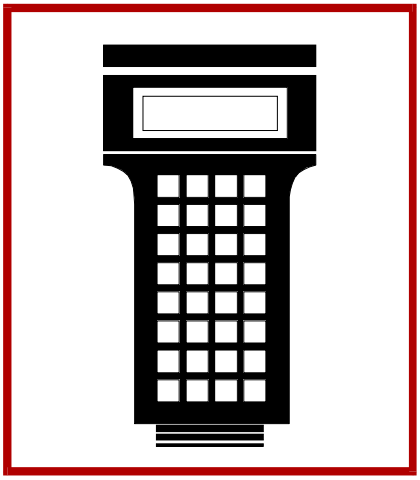
IMAS011

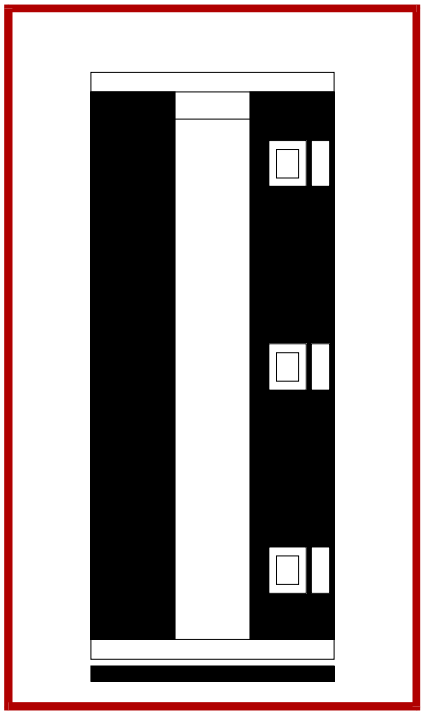
Instruction

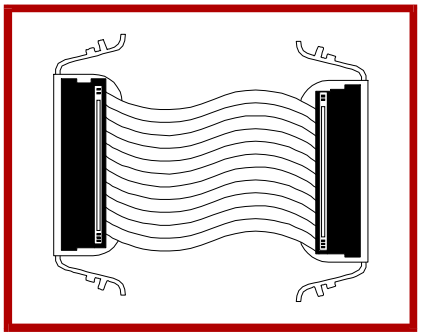
Analog Output Module

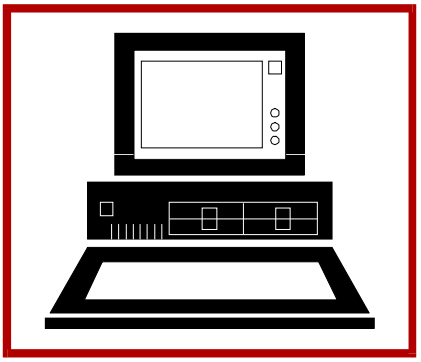












Bailey® Process Control and Automation Solutions from Elsag Bailey Group

WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

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.

WARNING

INSTRUCTION MANUALS

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MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

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Preface

The IMASO11 Analog Output (ASO) module outputs fourteen analog signals from the INFI 90® OPEN Strategic Process Management System to process field devices. Control modules (i.e., MFP, multifunction processor or MFC, multifunction controller) use these outputs to control a process.

This instruction explains the analog output module features, specifications and operation. It details the procedures to set up and install an analog output 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 output module. In addition, a complete understanding of the INFI 90 OPEN system is beneficial to the user.

The IMASO11 Analog Output Module can be used as a direct replacement of the IMASO01 Analog Output Module.

List of Effective Pages

Total number of pages in this instruction is 45, consisting of the following:

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

Table of Contents

Table of Contents (continued)

List of Figures

List of Tables

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 on the MMU backplane (I/O expander bus). Failure to do so could result in severe or fatal shock. (p. 3-5, 5-3) The outputs go to zero percent 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) Never clean electrical parts of components with live power present. Doing so exposes you to an electrical shock hazard. (p. 6-2) Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board. (p. 6-2) There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death. (p. 6-4) If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist. (p. 6-4)

Trademarks and Registrations

Registrations and trademarks used in this document include:

® INFI 90	Registered trademark of Elsag Bailey Process Automation
® Network 90	Registered trademark of Elsag Bailey Process Automation

SECTION 1 - INTRODUCTION

OVERVIEW

The IMASO11 Analog Output (ASO) module outputs fourteen separate analog signals that the INFI 90 OPEN system uses to control a process. It is an interface between the process and the INFI 90 OPEN Strategic Process Management System. Control modules perform the control functions; input/output modules provide the I/O.

This manual explains the purpose, operation and maintenance of the IMASO11 output module. It addresses handling precautions and installation procedures. Figure 1-1 illustrates the INFI 90 OPEN communication levels and the position of the ASO module within these levels.

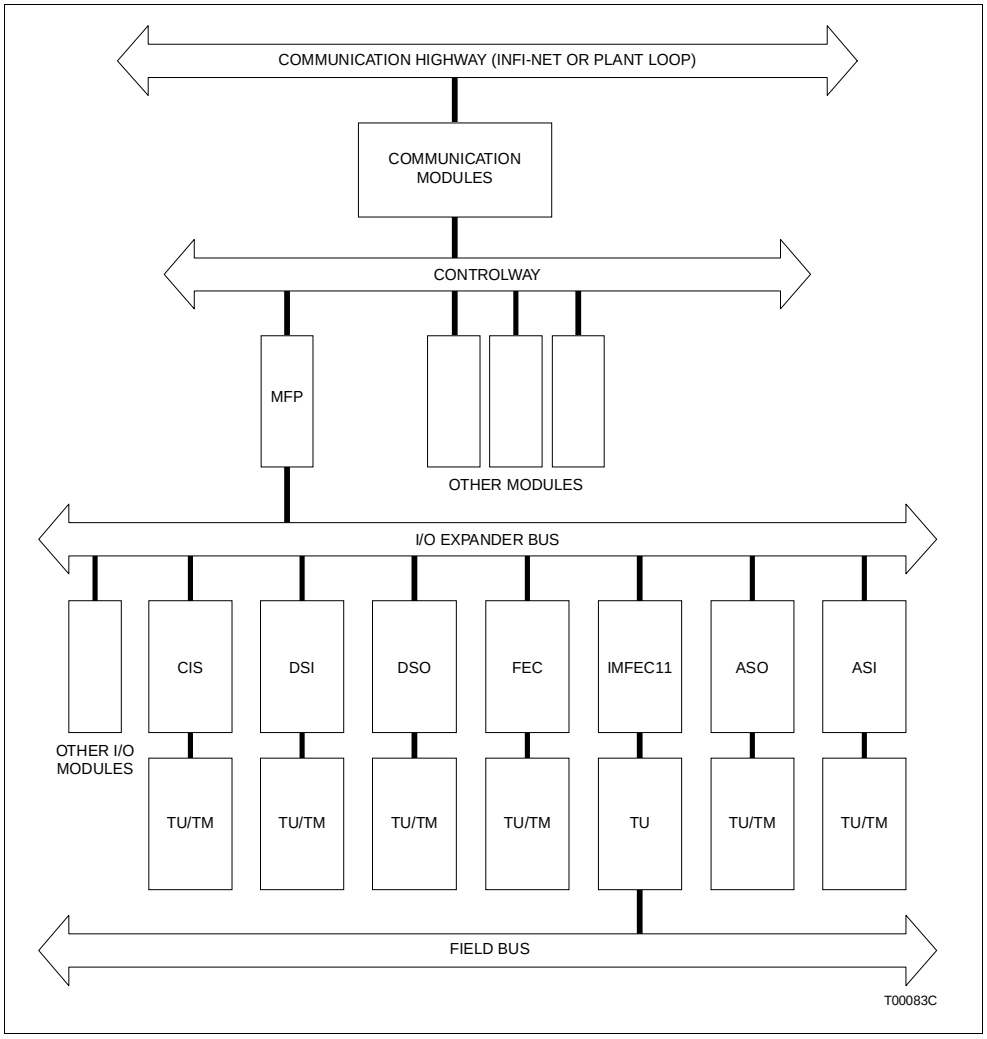


Figure 1-1. INFI 90 OPEN Communication Levels

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 module consists of a single printed circuit board (PCB) that occupies one slot in a module mounting unit (MMU). Jumpers on the PCB configure each of the analog outputs. Two captive screws on the faceplate secure the module to the MMU. Two front panel LEDs indicate the module status.

The ASO 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 I/O expander bus to communicate with a multifunction 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 OPEN modules, allows for flexibility when you are creating a process management strategy. It outputs fourteen analog signals that a multifunction processor (MFP) uses to control a process.

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

Each output reads back the signal to the field to insure accurate operation and eliminate the need to calibrate outputs. Additionally, each output is current limited to prevent damage from short circuits. The user can also select one of three default states.

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 instruction is divided into eight sections and three appendices. Read this instruction before installing or operating the

IMASO11 analog output module. A summary of section content follows:

Introduction — Contains a brief description, general usage information and technical specifications.

Description and Operation — Uses block diagrams and schematics to explain module operation and input circuitry.

Installation — Covers the preliminary steps to install the module and prepare for operation. It covers address switch settings, jumper settings, mounting, wiring connections, cabling and preoperational checks.

Operating Procedures — Provides information on front panel indicators and start-up procedures.

Troubleshooting — Explains the meaning of error indications and contains troubleshooting procedures.

Maintenance — Contains scheduled maintenance tasks and procedures.

Repair and Replacement Procedures — Contains procedures that explain how to replace the module.

Support Services — Explains the services and training that Elsag Bailey makes available to their customers.

Appendices — Appendix A provides configuration information for the NTDI01 termination unit. Appendix B provides configuration information for the NIDI01 termination module. Appendix C provides a quick reference for switch and jumper locations and settings.

HOW TO USE THIS MANUAL

Read this instruction before handling the IMASO11 analog output module. Refer to a specific section for information as needed.

1. Read the operating procedures section before installing the module.

2. Do the steps in the installation section.

3. Refer to the troubleshooting section to resolve problems if they occur.

4. Refer to the maintenance section for scheduled maintenance requirements.

5. Refer to the repair and replacement procedures to replace a module.

6. Use the support services section for information on ordering spare modules and warranty information.

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-1 includes those terms and abbreviations that are unique to Elsag Bailey or have a definition that is different from standard industry usage.

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
Control module	Directs field processes through an I/O module; the multifunction processor is an example.
Controlway	A redundant peer-to-peer communication path for status and point data transfer between intelligent modules within a process control unit.
EWS	Engineering work station. An integrated hardware and software personal computer system for configuring and monitoring INFI 90 OPEN modules.
Function block	The occurrence of a function code at a block address of a module.
Function code	An algorithm which manipulates specific functions. These functions are linked together to form the control strategy.
I/O expander bus	Parallel communication bus between the control and I/O modules.
MFP	Multifunction 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 OPEN/Network 90® modules.
OIS	Operator interface station. Integrated operator console with data acquisition and reporting capabilities. It provides a digital access into the process for flexible control and monitoring.
TM	Termination module. Provides input/output connection between plant equipment and the INFI 90 OPEN/Network 90 modules.
TU	Termination unit. Provides input/output connection between plant equipment and the INFI 90 OPEN/Network 90 modules.

NOMENCLATURE

Table 1-2 contains the analog output module nomenclature used in this instruction.

Table 1-2. Nomenclature

Nomenclature	Description
IMASO11	Analog output module (ASO)

RELATED HARDWARE

Refer to Table 1-3 for modules and equipment that can be used with an ASO module.

Table 1-3. Related Hardware

Nomenclature	Hardware
IEMMU11/12/21/22	Module mounting unit
IMMFC03/04/05	Multifunction controller module
IMMFP01/02/03/03B	Multifunction processor module
NTDI01	Termination unit
NIDI01	Termination module
NKTU01	Cable, termination unit (PVC)
NKTU11	Cable, termination unit (non PVC)
NKTU02	Cable, termination module (PVC)
NKTU12	Cable, termination module (non PVC)
NKTM01	Cable, termination module

REFERENCE DOCUMENTS

Table 1-4 lists documents that contain information relevant to the ASO module and this instruction.

Table 1-4. Reference Documents

Document Number	Description
I-E92-501-2	Configuration and Tuning Terminal, Type CTT02
I-E96-800	Engineering Work Station
I-E96-192-1	Operation manual, Operator Interface Station (40 Series) IIOIS42
I-E96-200	Function Code Application Manual
I-E96-201	Multi-Function Processor (IMMFP01)
I-E96-202	Multi-Function Processor (IMMFP02)
I-E96-203	Multi-Function Processor (IMMFP03/03B)
I-E96-211	Multi-Function Controller (IMMFC03)
I-E96-212	Multi-Function Controller (IMMFC04)
I-E96-213	Multi-Function Controller (IMMFC05)
I-E96-410	Digital I/O Termination Module (NIDI01)
I-E96-424	Digital I/O Termination Unit (NTDI01)
WBPEEUI200501A0	Module Mounting Unit (IEMMU11/12/21/22)
WBPEEUI220756A0	Operation manual, Operator Interface Station (40 Series) IIOIS43

SPECIFICATIONS

Table 1-5 lists the IMASO11 analog output module specifications.

Table 1-5. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Analog outputs</td><td>14, 1 to 5 VDC and 4-20 mA</td></tr>
<tr><td>D/A resolution</td><td>10 bits for analog outputs</td></tr>
<tr><td>Output accuracy</td><td>≤0.15% (voltage mode)
≤0.25% (current mode)</td></tr>
<tr><td>Output load</td><td>750 ohms maximum (current mode)
22 kilohms minimum (voltage mode)</td></tr>
<tr><td>Overvoltage category</td><td>III for outputs per ANSI/ISA S82.01-1994</td></tr>
<tr><td>Current limiting
Short circuit protection</td><td>
50 mA (nominal) output current limit</td></tr>
<tr><td>Power requirements
Voltage

Current consumption (typical)

Power dissipation (typical)

</td><td>
+5 VDC ±5%
+15 VDC ±5%
-15 VDC ±5%
+24 VDC ±10% (from termination unit/termination module)
250 mA (+5 VDC)
100 mA (+15 VDC)
90 mA (-15 VDC)
310 mA (+24 VDC)
1.5 W at +5 VDC
2 W at +15 VDC
1.75 W at -15 VDC
8 W at 24 VDC</td></tr>
<tr><td>Overvoltage category</td><td>I for power per ANSI/ISA S82.01-1994</td></tr>
<tr><td>Electromagnetic Compatibility

Conducted transients</td><td>
<table>
<tr><th>Test</th><th>Common Mode</th><th>Normal Mode</th></tr>
<tr><td>Pulse voltage test (1.2/50 µS) (IEC 801-5)</td><td>2 kVp</td><td>1 kVp</td></tr>
<tr><td>Line frequency wave (50 Hz)</td><td>50 Vp</td><td>N/A</td></tr>
<tr><td>Low voltage wave train (Sweep from 10 KHz to 1 MHz)</td><td>50 Vp</td><td>N/A</td></tr>
<tr><td>Damped 1 MHz oscillatory wave (IEC 1000-4-12)</td><td>1 kVp</td><td>0.5 kVp</td></tr>
<tr><td>Electrical fast transient/burst (IEC 801-4)</td><td>1 kVp</td><td>N/A</td></tr>
<tr><td>Conducted RF interferences (IEC 801-6 level 3)</td><td>10 V RMS</td><td>N/A</td></tr>
</table>
Keep cabinet doors closed. Do not use communication equipment closer than 2 m (6 ft) from the cabinet.
</td></tr>
<tr><td>Mounting</td><td>Occupies one slot in standard INFI 90 OPEN module mounting unit.</td></tr>
</table>

Table 1-5. Specifications (continued)

Property	Characteristic/Value
Environmental	
Ambient temperature	0° to 70° C (32° to 158° F)
Relative humidity	0% to 95% up to 55° C (131° F)(noncondensing) 0% to 45% at 70° C (158° F)(noncondensing) Pollution degree: I (no condensation)
Altitude	Sea level to 3 km (1.86 miles)
Air quality	Noncorrosive
CE mark declaration	This product, when installed in an INFI 90 OPEN cabinet, complies with the following Directives/Standards for CE marking.
EMC96 Directive 89/336/EEC	EN50082-2 Generic Immunity Standard - Part 2: Industrial Environment EN50081-2 Generic Emission Standard - Part 2: Industrial Environment
Low Voltage Directive 73/23/EEC	EN61010-1 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements
Certification	
Canadian Standards Association (CSA)	Certified for use as process control equipment in an ordinary (nonhazardous) location.
Factory Mutual (FM) (pending)	Approval for the following categories: Nonincendive for: Class I Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section explains the output circuitry, control logic, data, logic power and connections for the IMASO11 analog output (ASO) module. The ASO module is an analog signal interface between a multifunction processor (MFP) or multifunction controller (MFC) module and process field devices. A control module communicates with its I/O module on an I/O expander bus as shown in Figure 1-1. Each I/O module on the bus has a unique address set by its address dipswitch (S1).

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

MODULE BLOCK DIAGRAM

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

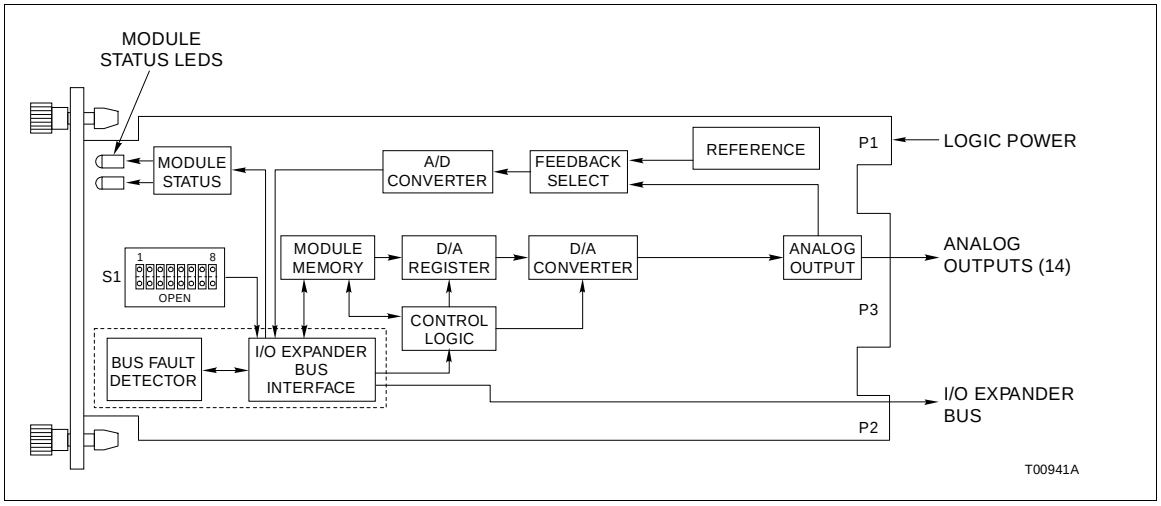


Figure 2-1. Analog Output Module Block Diagram

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 D/A converter output demand. 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 milliamps) or voltage (1 to 5 VDC). Jumpers J1 through J28 select the mode for channels 1 through 14. Refer to Section 3 for jumper settings. A current limiter in each output circuit provides short circuit protection. For a short condition, it limits the output current to 50 mA.

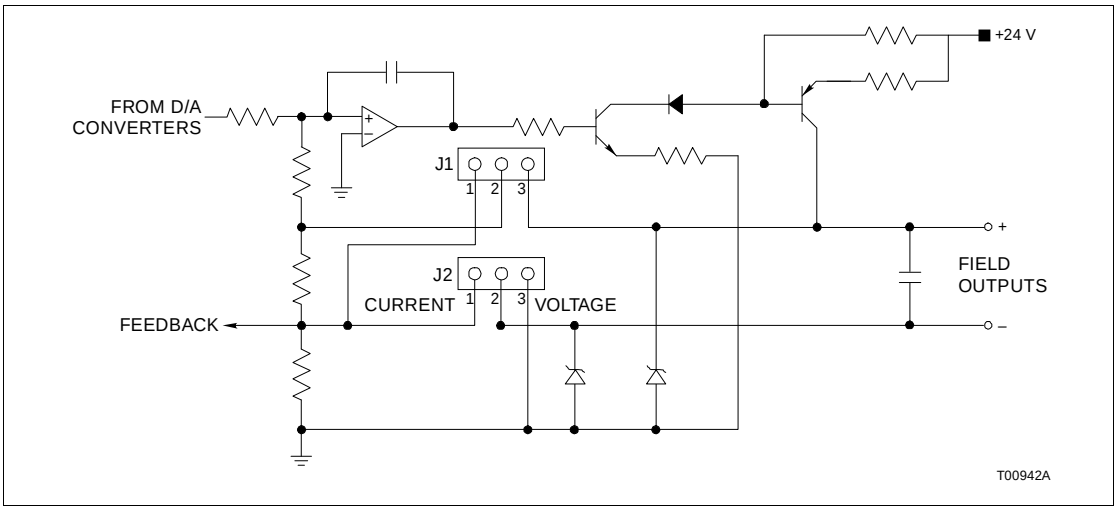


Figure 2-2. Analog Output Circuit

Control Logic

The module memory block is RAM that acts as a buffer between the MFP and the analog output channels. An MFP writes default values to the RAM for each of the output channels through the I/O expander bus interface.

Programmable array logic (PAL) circuits in the control logic block provide module control for both normal and default operation. These circuits write output data (analog count) to the D/A converter. 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*.

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 S2 (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 (one for each channel) changes this count to an analog signal that it sends to the output circuit.

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 I/O 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 I/O expander bus interface. Each output goes to its default state (0 percent, 100 percent or *hold*); FC 149 (specifications S11 through S17) define each output default state. This function code defines only seven channels; two function blocks must be linked to define all fourteen channels.

The PAL reads default data from the RAM 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 converter to go to zero percent (one VDC or four milliamps). A 100 percent option causes the D/A converter to go to 100 percent (five VDC or 20 milliamps). If a *hold* option is selected, the ASO module uses the last value stored in the D/A converter register.

OUTPUT CIRCUIT CONNECTIONS

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

I/O EXPANDER BUS

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

The I/O expander bus is 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 control and I/O modules. Cable assemblies can extend the bus to up to six MMUs.

A control module and its I/O modules form an individual subsystem within a process control unit (PCU). The PCU being a rack type industrial cabinet that contains the control, I/O and communication modules, and their communication paths. The I/O expander bus between control and I/O subsystems must be separated. Leaving a dipshunt socket empty or not connecting the MMUs with cables separates them.

I/O EXPANDER BUS INTERFACE

The ASO uses a custom gate array to perform the I/O 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 control module configuration accesses the ASO on the I/O expander bus. Specifically, it allows the MFP to automatically read status data and readback data from the I/O module, and write output data to it. FC 149 defines only seven outputs; two function blocks must be linked together (specification S2) to define all fourteen outputs. The I/O address in FC 149 must be the same as the address set on the analog output module address dipswitch (S1).

Status Data

Status data is one eight-bit byte consisting of module identification and status information. Analog output module identification is in the four most significant bits (MSB). It identifies the I/O module, and verifies the I/O expander bus communication integrity and MFP configuration.

Also included in the status byte is information concerning the I/O module operating status. The MFP uses this information to determine if the I/O module 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 I/O module 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 (one VDC and five 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 two-byte value consisting of an analog output count and default values. The MFP writes this data to the A/D converter register each execution cycle for each of the fourteen outputs. The count sets the analog outputs during normal operation. Default values are sent to memory (RAM) 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 I/O expander bus clock; the control module generates the bus clock. If the clock stops (indicating a control 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 FAIL LED turns red to indicate a bus fault (*time-out*).

STATUS LED INDICATORS

Two front panel module status LED indicators show the operating state of the ASO. Circuits on the ASO determine the module status and light the LEDs accordingly. A solid green (POWER) LED indicates normal operation. A solid red (FAIL) LED indicates a bus fault timeout. 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 IMASO11 Analog Output (ASO) module into operation. ***DO NOT PROCEED*** with operation until you read, understand and do the steps in the order in which they appear.

SPECIAL HANDLING

> **NOTE:** Always use the Elsag Bailey field static kit (part number 1948385?1), consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipating work surface when working with static sensitive devices. The kit is designed to connect the technician and the static dissipating work surface to the same ground point to prevent damage to the static sensitive devices by electrostatic discharge.

Use the static grounding wrist strap when installing and removing modules. Static discharge may damage static sensitive devices on modules in a cabinet. Use grounded equipment and static safe practices when working with static sensitive devices.

1. ***Use Static Shielding Bag.*** Keep the module in its static shielding bag until you are ready to install it in the system. Save the bag for future use.

2. ***Ground Bags before Opening.*** Before opening a bag containing an assembly with static sensitive devices, touch it to the equipment housing or ground to equalize charges.

3. ***Avoid Touching Circuitry.*** Handle assemblies by the edges; avoid touching the circuitry.

4. ***Avoid Partial Connection of Static Sensitive Devices.*** Verify that all devices connected to the modules are properly grounded before using them.

5. ***Ground Test Equipment.***

6. ***Use an Antistatic Field Service Vacuum.*** Remove dust from the cards if necessary.

7. ***Use a Grounded Wrist Strap.*** Connect the wrist strap to the appropriate grounding plug.

8. ***Do Not Use Lead Pencils to Set Dipswitches.*** To avoid contamination of switch contacts that can result in unnecessary circuit board malfunction, do not use a lead pencil to set a dipswitch.

UNPACKING AND INSPECTION

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

2. Notify the nearest Elsag Bailey 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 zero percent 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.**

You must set the address dipswitch (S1) and the analog output jumpers (J1 through J28) ***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.

Address Selection Switch (S1)

The ASO can have one of 64 addresses (address 0 to 63) on the I/O expander bus. This address uniquely identifies the I/O module to the control module and must be the same as the address set in the control module configuration (Function Code (FC) 149 specification S1).

Table 3-1 is a binary address conversion table for setting S1. 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 (refer to Figure 3-2).

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

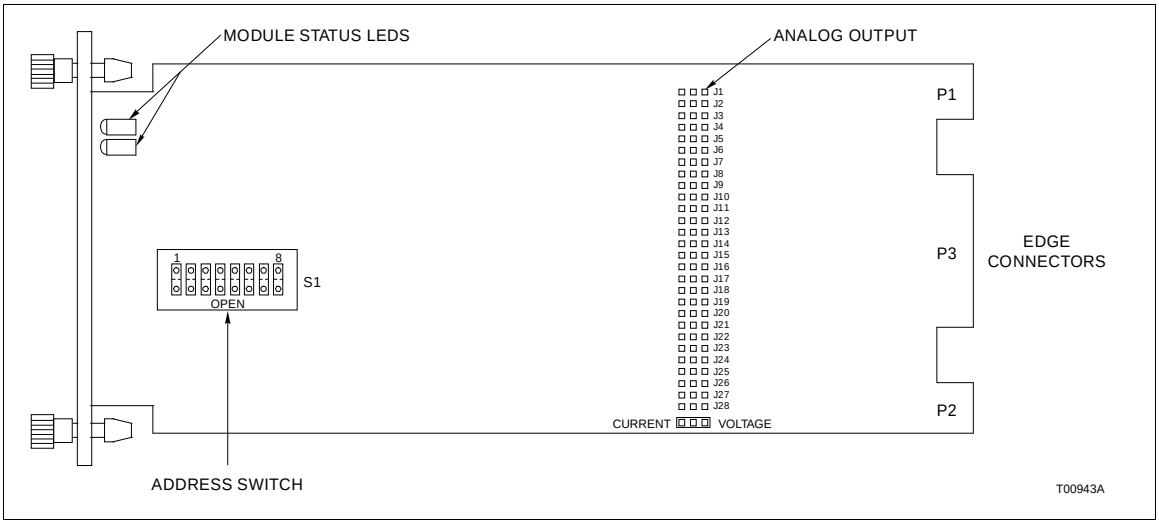


Figure 3-1. Analog Output Module

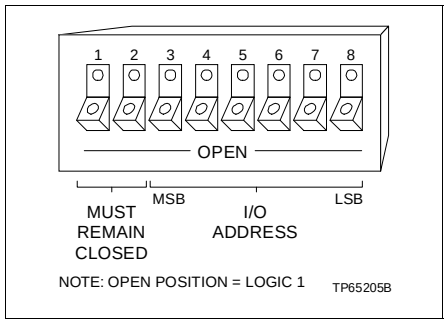


Figure 3-2. Address Select Switch (S1)

Analog Output Jumpers (J1 through J28)

Jumpers J1 through J28 configure the analog output mode (current or voltage) for outputs 1 through 14. Current mode is four to 20 mA; voltage mode is one to five VDC. Figure 3-1 shows the jumper locations on the ASO board. Determine the output mode requirements for each analog output for your application; set jumpers to the positions shown in Table 3-2.

Each jumper has a left pin, center pin and right pin. For current, position the jumper on the left and center pins (1-2). For voltage, the jumper would be on the center and right pins (2-3).

Termination Unit/Module Configuration

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

Table 3-2. Analog Output Module Jumper Settings

Channel	Jumpers	Current	Voltage
1	J1,J2	1-2	2-3
2	J3,J4	1-2	2-3
3	J5,J6	1-2	2-3
4	J7,J8	1-2	2-3
5	J9,J10	1-2	2-3
6	J11,J12	1-2	2-3
7	J13,J14	1-2	2-3
8	J15,J16	1-2	2-3
9	J17,J18	1-2	2-3
10	J19,J20	1-2	2-3
11	J21,J22	1-2	2-3
12	J23,J24	1-2	2-3
13	J25,J26	1-2	2-3
14	J27,J28	1-2	2-3

Physical Installation

The ASO module inserts into a standard INFI 90 OPEN module mounting unit (MMU) and occupies one slot. To install:

1. Verify the slot assignment of the module.

WARNING	**Disconnect power before installing dipshunts on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

2. Verify that a dipshunt is in the I/O expander bus socket on the MMU backplane between the analog output module and the control module (MFP).

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 analog output 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.

WIRING CONNECTIONS AND CABLING

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

Wiring

Installing the module in the MMU connects the analog output module to logic power (+5 VDC, ±15 VDC), necessary to drive the circuitry, at P1. It also connects P2 to the I/O 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 I/O expander bus between the I/O module and control module. Locate the modules so the bus can connect the modules or they will not communicate.

Cable Connections

The IMASO11 module uses either an NTDI01 or NIDI01 for termination. Refer to 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.

PREOPERATING ADJUSTMENTS

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

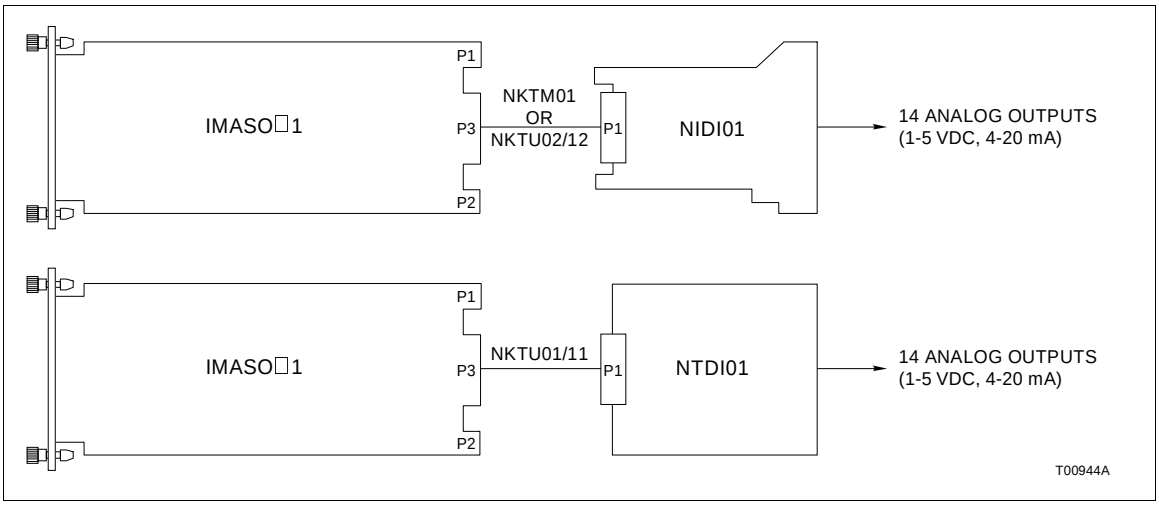


Figure 3-3. IMASO11 Cable Connections and Termination

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section explains the front panel indicators and start-up procedures for the IMASO11 Analog Output module.

MODULE STATUS INDICATOR

The analog output (ASO) module has two front panel module status LED indicators to aid in system test and diagnosis. The location of the LEDs is shown in Figure 4-1. Table 4-1 explains the three states of the status LED indicators (refer to Section 5 to determine corrective actions).

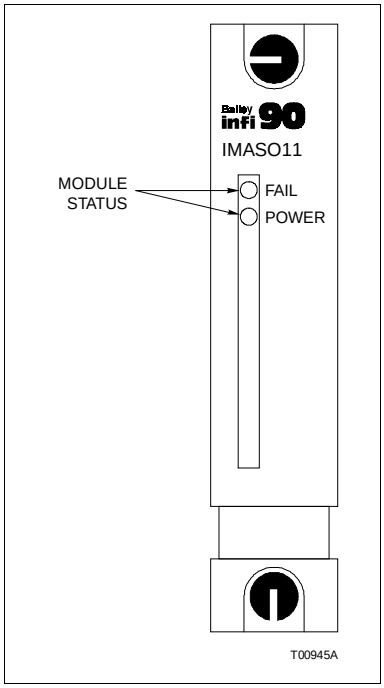


Figure 4-1. IMASO11 Front Panel

Table 4-1. Status LED Indicators

Red LED	Green LED	Indication
OFF	OFF	No power or not enabled.
OFF	ON	Enabled and communicating with control module.
ON	OFF	Bus fault timer error (time-out)
ON	ON	Not allowed.

START-UP PROCEDURES

The multifunction 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 S1 (FC 149) is the I/O module address. It must be the same as the address set on the analog output module address dipswitch (S1). The front panel solid green LED verifies that the module is enabled and communicating.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section explains the error indications and corrective actions for the IMASO11 Analog Output (ASO) module.

ERROR INDICATIONS AND CORRECTIVE ACTION

You can obtain the status of the ASO module through an INFI 90 OPEN operator interface (e.g., OIS operator interface station, EWS engineering work station, CTT configuration and tuning terminal) or the front panel module status LED indicators.

Status LED

The front panel status LEDs have three states to indicate normal operation and error conditions. Table 5-1 lists ASO module 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.

Control Module Errors

The multifunction processor (MFP) performs status checks on the ASO module. 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 module 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 LEDs and the operator interface report function to determine corrective actions.

> **NOTE:** If FC 149 specification S3 is set to 0, the MFP will trip when the ASO module fails. Changing specification S3 to a 1 allows the MFP to continue to operate if any ASO module error condition exists.

Table 5-1. Status LED Indications and Corrective Actions

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

The address set on ASO 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 S1. If not:

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

- or -

2. Modify the address in the MFP configuration (FC 149 specification S1) to correspond with the address set on ASO module switch S1. Use an INFI 90 OPEN 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 on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

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

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

MODULE PIN CONNECTIONS

The ASO 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 reliability of any stand-alone product or control system is affected by the maintenance of the equipment. Elsag Bailey recommends that all equipment users practice a preventive maintenance program that will keep the equipment operating at an optimum level.

This section presents procedures that the customer should be able to perform on site. These preventive maintenance procedures should be used as a guideline to assist in establishing good preventive maintenance practices.

Personnel performing preventive maintenance should meet the following qualifications.

- Maintenance personnel should be qualified electrical technicians or engineers that know the proper use of test equipment.
- Maintenance personnel should be familiar with the module mounting unit, have experience working with process control systems, and know what precautions to take when working on live AC and/or DC systems.

PREVENTIVE MAINTENANCE SCHEDULE

Table 6-1 is the preventive maintenance schedule for the IMASO11 analog output module. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Instructions for tasks that require further explanation are covered under ***PREVENTIVE MAINTENANCE PROCEDURES***.

NOTE: The preventive maintenance schedule is for general purposes only. Your application may require special attention.

EQUIPMENT AND TOOLS REQUIRED

Tools and equipment required for maintenance procedures are:

- Antistatic vacuum.
- Screwdriver (medium length).
- Isopryl alcohol (99.5 percent electronic grade).
- Distilled water.
- Compressed air.
- Foam tipped swabs.
- Lint free cloths.
- Eberhard Faber (400A) pink pearl eraser.

Table 6-1. Preventive Maintenance Schedule

Task	Frequency
Check cabinet, module mounting unit backplane assembly, output module and termination device for dust. Clean as necessary using an antistatic vacuum. If circuit board cleaning is necessary, refer to procedure.	Every six months or during plant shutdown, whichever occurs first.
Check all signal, power and ground connections that are associated with the output module. Verify that they are secure. Refer to procedure.	

PREVENTIVE MAINTENANCE PROCEDURES

This section covers tasks from Table 6-1 that require specific instructions or further explanation.

- Cleaning printed circuit boards and edge connectors.
- Checking signal, power and ground connections.

Printed Circuit Board Cleaning

There are several circuit board cleaning procedures in this section. These procedures cover circuit board cleaning and washing, cleaning edge connectors and circuit board laminate between edge connectors. Use the procedures that meet the needs of each circuit board. Remove all dust, dirt, oil, corrosion or any other contaminant from the circuit board.

Do all cleaning and handling of the printed circuit boards at static safe work stations. Always observe the steps under ***SPECIAL HANDLING*** in Section 3 when handling printed circuit boards.

WARNING

Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard.

Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board.

GENERAL CLEANING AND WASHING

If the printed circuit board needs minor cleaning, remove dust and residue from the printed circuit board surface using clean, dry, filtered compressed air or an antistatic field service vacuum cleaner.

To wash the printed circuit board:

1. Clean the printed circuit board by spraying or wiping it with isopropyl alcohol (99.5% electronic grade). Use a foam tipped swab to wipe the circuit board.

2. Remove excess solvent by using compressed air to blow it free of the circuit board.

EDGE CONNECTOR CLEANING

1. Use a solvent mixture of 80% isopropyl alcohol (99.5% electronic grade) and 20% distilled water.

2. Soak a lint free cloth with the solvent mixture.

3. Work the cloth back and forth parallel to the edge connector contacts.

4. Repeat with a clean cloth that is soaked with the solvent mixture.

5. Dry the edge connector contact area by wiping with a clean lint free cloth.

To clean tarnished or deeply stained edge connector contacts:

1. Use an Eberhard Faber (400A) pink pearl eraser or equivalent to remove tarnish or stains. Fiberglass or nylon burnishing brushes may also be used.

2. Minimize electrostatic discharge by using the 80/20 isopropyl alcohol/water solution during burnishing.

3. Do not use excessive force while burnishing. Use only enough force to shine the contact surface. Inspect the edge connector after cleaning to assure no loss of contact surface.

4. Wipe clean with a lint free cloth.

Checking Connections

NOTE: Power to the cabinet should be off while performing this preventive maintenance task.

WARNING

There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death.

If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist.

Check all signal wiring, power and ground connections within the cabinet to verify their integrity. When checking connections, always turn a screw, nut or other fastening device in the direction to tighten only. If the connection is loose, it will be tightened. If the connection is tight, the tightening action will verify that it is secure. There must not be any motion done to loosen the connection.

1. Verify that all power connections within the cabinet are secure.

2. Verify that all wiring connections to the termination unit, or termination module are secure.

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement procedures for an IMASO11 analog output (ASO) module. There are no special tools required to replace an ASO module.

MODULE REPAIR/REPLACEMENT PROCEDURES

If you determine the ASO module 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 and jumper settings. Make certain 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

Elsag Bailey 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 an Elsag 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 Elsag Bailey, use part numbers and descriptions from the recommended spare parts lists. You must order parts without commercial descriptions from the nearest Elsag Bailey sales office.

TRAINING

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

TECHNICAL DOCUMENTATION

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

APPENDIX A - TERMINATION UNIT (NTDI01) CONFIGURATION

INTRODUCTION

The IMASO11 can use an NTDI01 for termination. Dipshunts on the termination unit configure the analog outputs that are sent to the process. The 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 IMASO11, 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.

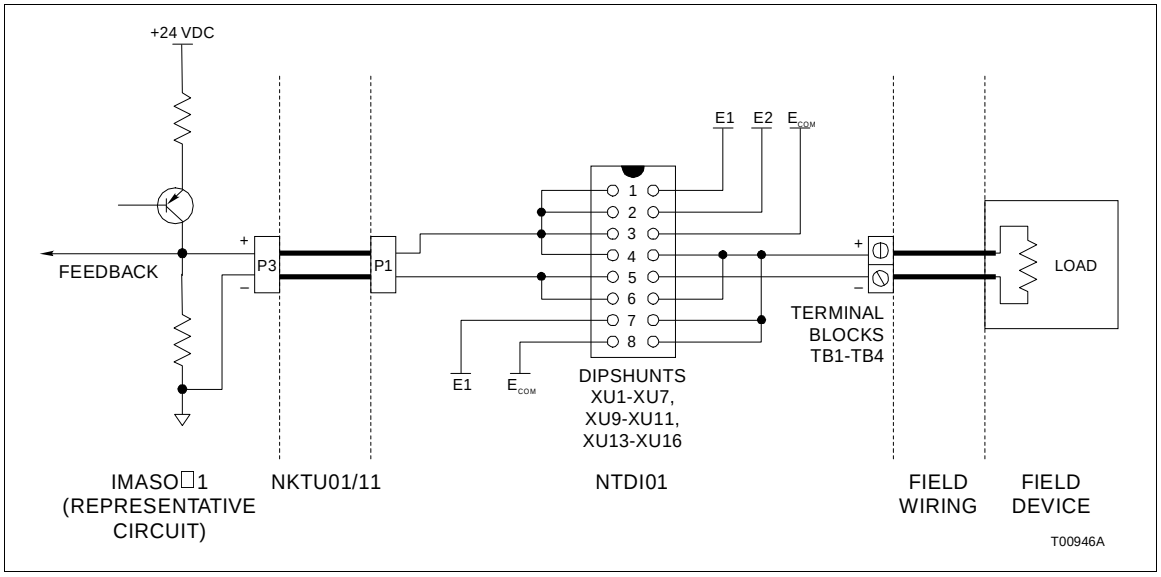


Figure A-1. NTDI01 Circuit Diagram (Voltage Mode)

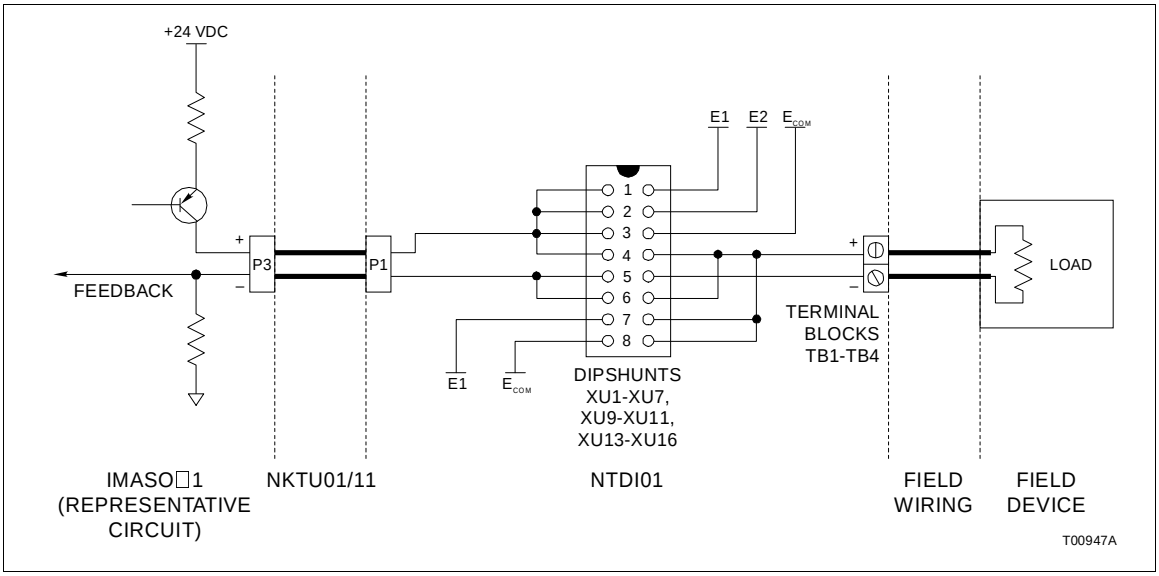


Figure A-2. NTDI01 Circuit Diagram (Current Mode)

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 I/O module NOTE: Power for the IMASO11 module must come from the E1 connector.	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

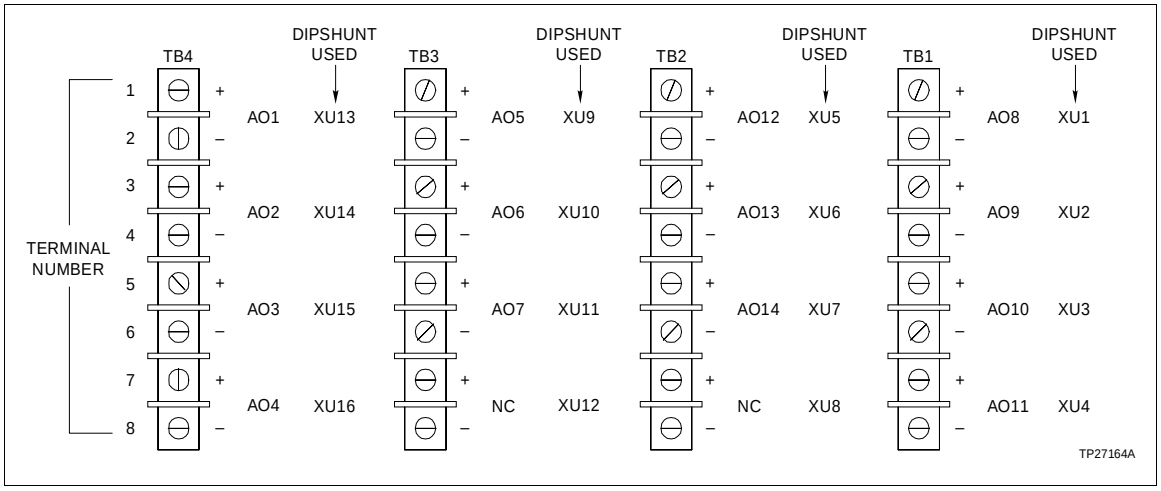


Figure A-3. NTDI01 Terminal Assignments

APPENDIX B - TERMINATION MODULE (NIDI01) CONFIGURATION

INTRODUCTION

The IMASO11 can use an NIDI01 for termination. Jumpers on the termination module (NIDI01) configure the analog outputs that are sent to the process. The 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 IMASO11, 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.

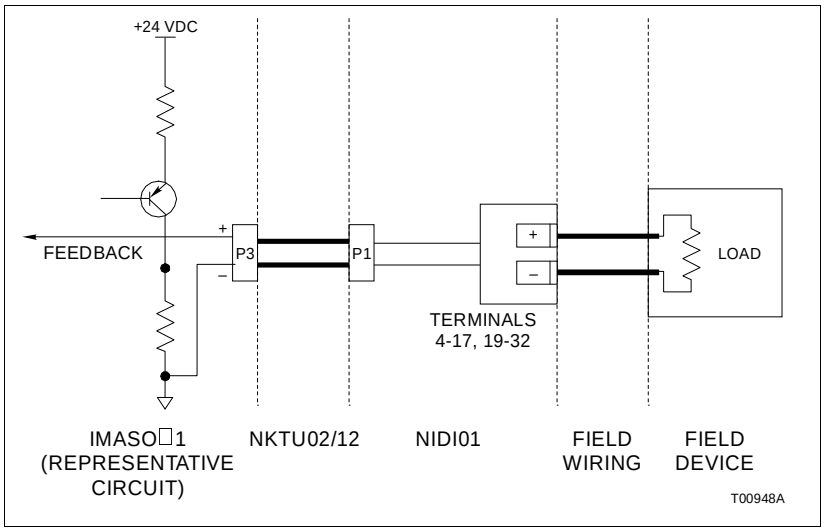


Figure B-1. NIDI01 Circuit Diagram (Voltage Mode)

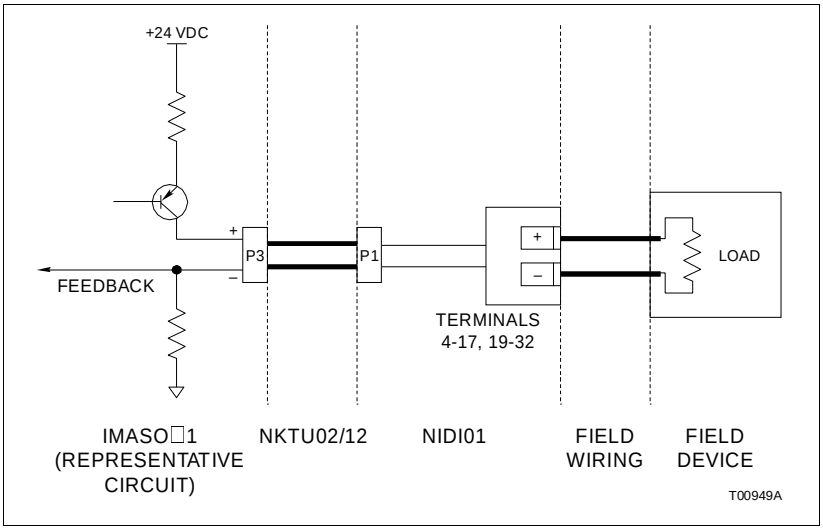
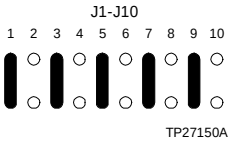


Figure B-2. NIDI01 Circuit Diagram (Current Mode)

Table B-1. NIDI01 Jumper Configuration

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

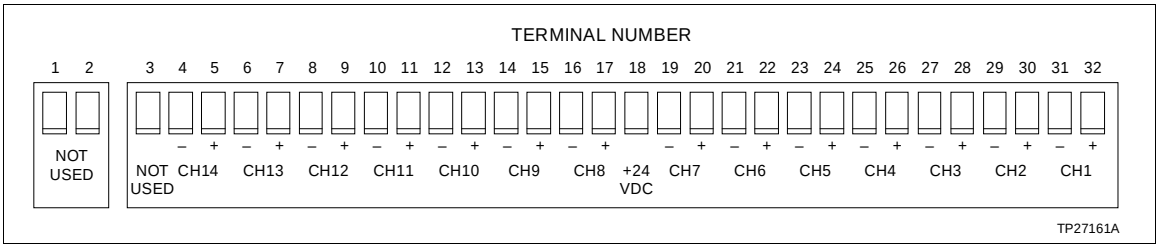


Figure B-3. NIDI01 Terminal Assignments

APPENDIX C - QUICK REFERENCE

INTRODUCTION

This section provides a source for reference information. It contains the jumper and switch locations for the IMASO11 analog output module. Refer to Section 3 for a complete description of jumper and switch settings.

Table C-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

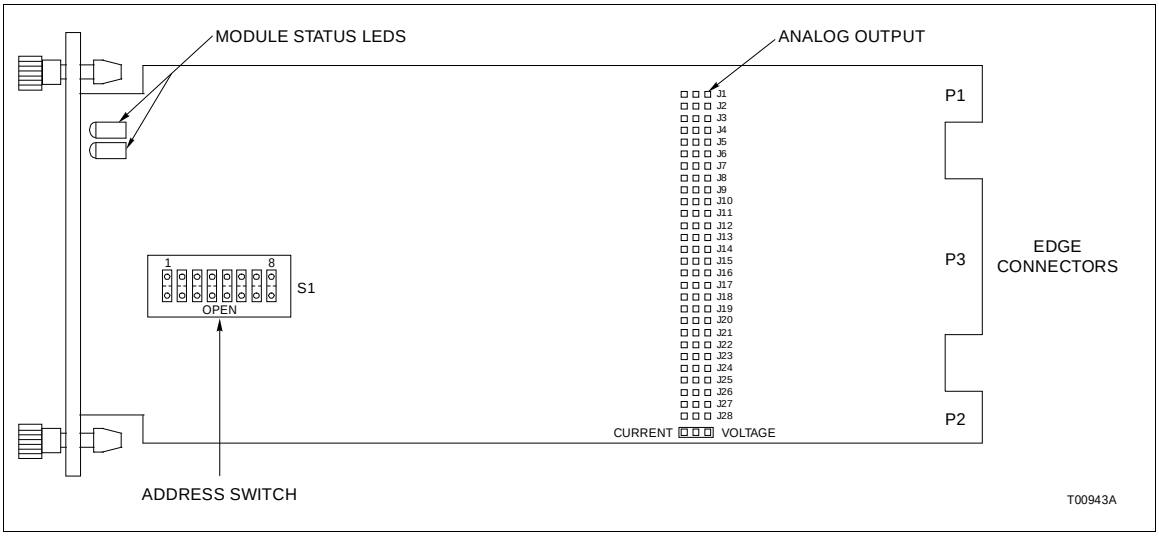


Figure C-1. Switch and Jumper Locations

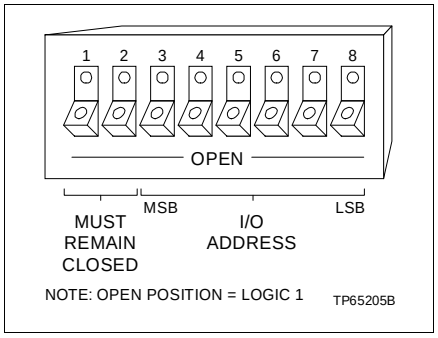


Figure C-2. Address Select Switch (S1)

Table C-2. Analog Output Mode Jumper Settings

Channel	Jumpers	Current	Voltage
1	J1,J2	1-2	2-3
2	J3,J4	1-2	2-3
3	J5,J6	1-2	2-3
4	J7,J8	1-2	2-3
5	J9,J10	1-2	2-3
6	J11,J12	1-2	2-3
7	J13,J14	1-2	2-3
8	J15,J16	1-2	2-3
9	J17,J18	1-2	2-3
10	J19,J20	1-2	2-3
11	J21,J22	1-2	2-3
12	J23,J24	1-2	2-3
13	J25,J26	1-2	2-3
14	J27,J28	1-2	2-3

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