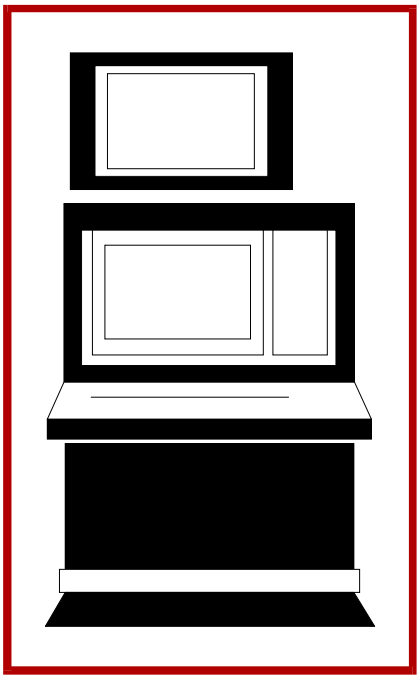
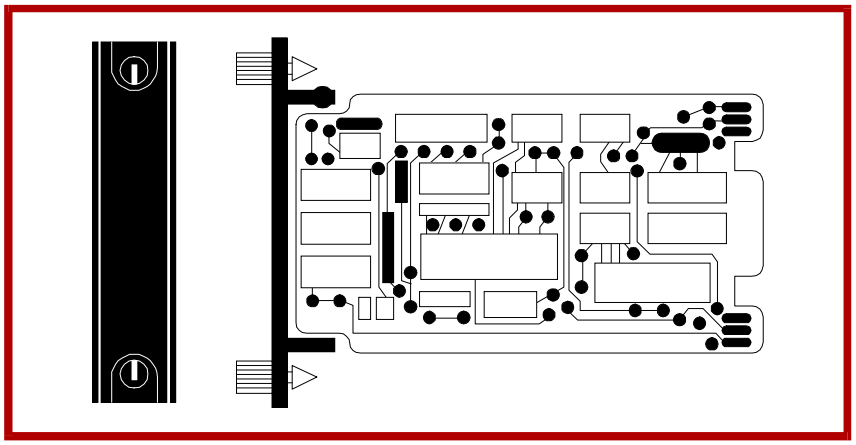
Bailey® infi 90®

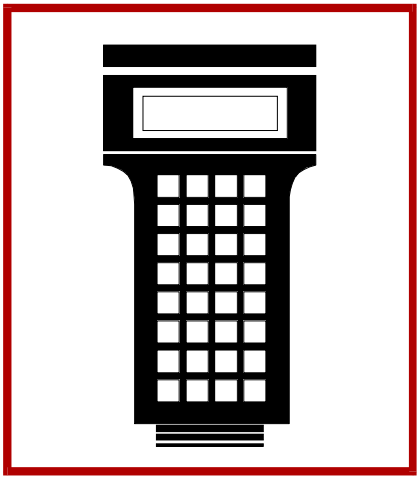
E96-310

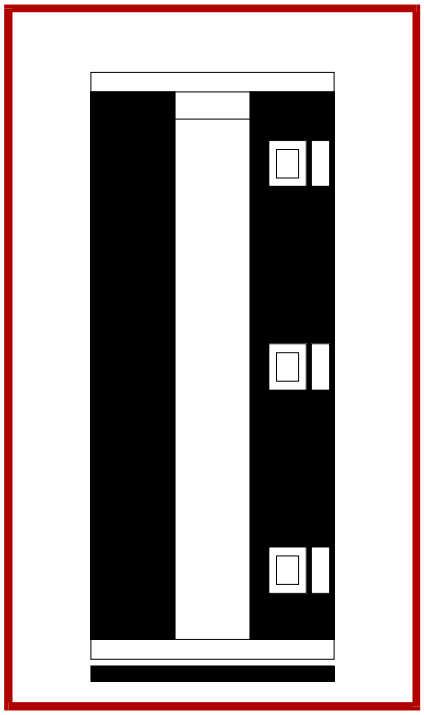
Instruction

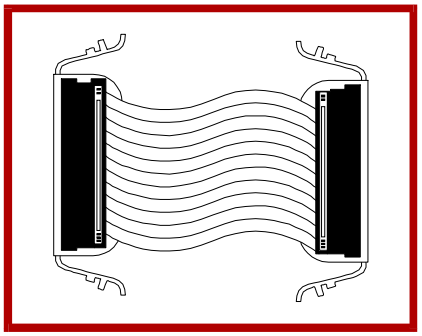
Digital Output Module
(IMDSO01/02/03)

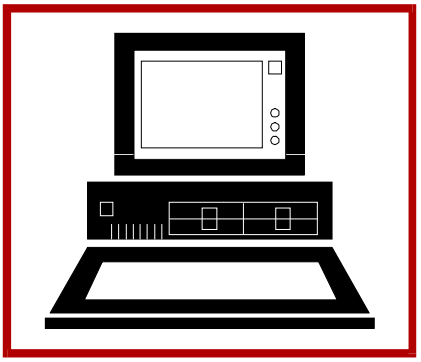












Bailey Process Control and Automation Solutions from Elsag Bailey Group

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

DO NOT INSTALL, MAINTAIN, OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING, AND FOLLOWING THE PROPER **Bailey Controls** INSTRUCTIONS AND MANUALS; OTHERWISE, INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA AROUND SUCH EQUIPMENT. PRUDENT PRACTICE DICTATES THAT SIGNS SHOULD BE POSTED IN THE VICINITY OF THE EQUIPMENT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT.

POSSIBLE PROCESS UPSETS

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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PERTURBATIONS DU PROCÉDÉ

L'ENTRETIEN DOIT ÊTRE ASSURÉ PAR UNE PERSONNE QUALIFIÉE EN CONSIDÉRANT L'ASPECT SÉCURITAIRE DES ÉQUIPEMENTS CONTRÔLÉS PAR CE PRODUIT. L'AJUSTEMENT ET/OU L'EXTRACTION DE CE PRODUIT PEUT OCCASIONNER DES À-COUPS AU PROCÉDÉ CONTRÔLE LORSQU'IL EST INSÉRÉ DANS UNE SYSTÈME ACTIF. CES À-COUPS PEUVENT ÉGALEMENT OCCASIONNER DES BLESSURES OU DES DOMMAGES MATÉREILS.

NOTICE

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Preface

The IMDSO01, IMDSO02 and IMDSO03 Digital Output Modules (DSO) output eight separate digital signals from the INFI 90® Process Management System to a process. Control modules use these outputs to control (switch) process field devices.

This instruction explains the DSO module features, specifications and operation. It also includes installation and troubleshooting procedures for each module.

The system engineer or technician using the modules should read and understand this instruction before installing any modules. In addition, a complete understanding of the system is beneficial.

There are four types of DSO modules. This instruction discusses the IMDSO01, IMDSO02 and IMDSO03 modules. Refer to the appropriate instruction for information about the IMDSO04 Digital Output Module.

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List of Effective Pages

Total number of pages in this manual is 42, consisting of the following:

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

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

NOTE: On an updated page, the changed text or table is indicated by a vertical bar in the outer margin of the page at 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 insure that contact with energized parts is avoided when servicing. **Special Handling** This module uses electrostatic sensitive devices.
SPECIFIC WARNINGS	Disconnect power before installing dipshunts on the module mounting unit backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock. (p. 3-4) 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. 6-1) 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. 7-1)
SPECIFIC CAUTIONS	Disable the module output signals before removing the module. Damage to the module may result. (p. 5-1, 7-1)

Sommaire de Sécurité

AVERTISSEMENTS D'ORDRE GÉNÉRAL	**Environnement de l'équipement** Ne pas soumettre les composants à une atmosphère corrosive lors du transport, de l'entreposage ou l'utilisation. **Possibilité de chocs électriques durant l'entretien** Débrancher l'alimentation ou prendre les précautions pour éviter tout contact avec des composants sous tension durant l'entretien. **Precautions de manutention** Ce module contient des composantes sensibles aux decharges electro-statiques.
AVERTISSEMENTS D'ORDRE SPÉCIFIQUE	Interrompez l'alimentation avant d'installer des dipshunts sur le fond de panier du châssis de montage des modules. Sinon, tout contact avec cette zone entraîne des risques d'électrocution sérieuse ou fatale. (p. 3-4) Des lunettes de protection devraient être portées lors de travail avec des solvants nettoyants. Lorsqu'on enlève les solvants des circuits imprimés à l'aide d'air comprimé, les éclaboussures de solvant pourraient causer des blessures aux yeux. (p. 6-1) Si des circuits d'entrée ou de sortie sont alimentés à partir de sources externes, ils présentent un risque de choc électrique même lorsque l'alimentation du système est débranchée du panneau d'entrée d'alimentation. Le cas échéant, un avertissement signalant la présence de sources d'alimentation multiples doit être apposé sur la porte de l'armoire. (p. 7-1)
ATTENTIONS D'ORDRE SPÉCIFIQUE	Il est nécessaire de désactiver les signaux de sortie du module avant de le retirer de sa position. Un manquement à cette précaution pourrait endommager le module. (p. 5-1, 7-1)

SECTION 1 - INTRODUCTION

OVERVIEW

The IMDSO01, IMDSO02 and IMDSO03 Digital Output (DSO) Modules output eight isolated digital signals from the INFI 90 system to control a process. The signals provide digital switching (on or off) for process field devices. Control modules perform the control functions and I/O modules provide the input and output signals. Figure 1-1 illustrates the position of the DSO module within the INFI 90 architecture.

The DSO modules all function and operate the same. The only difference is in the output switching capability and associated fusing.

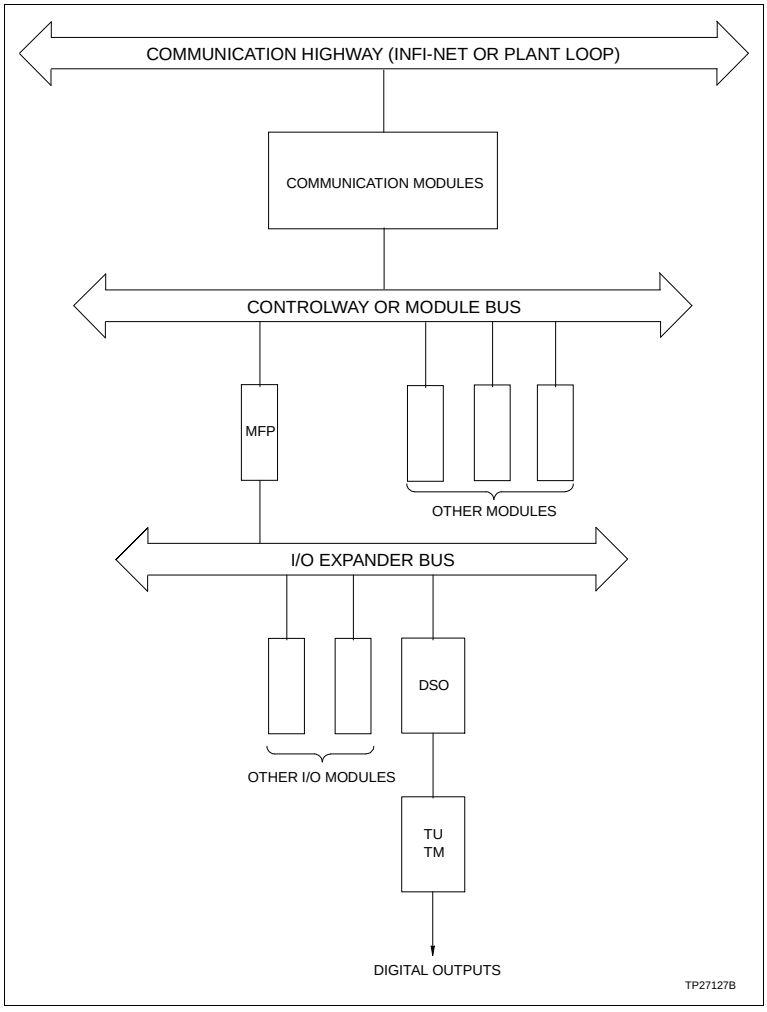

Figure 1-1. IMDSO01, IMDSO02 and IMDSO03 Applications

INTENDED USER

Personnel installing, operating or maintaining the DSO module should read this instruction before performing any installation, operation or maintenance procedures. Installation requires an engineer or technician with experience handling electronic circuitry and who is familiar with live I/O circuits.

MODULE DESCRIPTION

The DSO module is an I/O module that outputs eight separate digital signals through solid state relays mounted on the circuit board. These outputs can be used to control devices that in turn control the process.

The DSO module is a single printed circuit board that occupies one slot in the module mounting unit. The circuit board contains circuitry, fuses and solid state relays that enable it to control field devices that control the process.

Two captive latching screws on the faceplate secure the DSO module to the module mounting unit. There are ten LEDs on the faceplate that display module status, fuse status and the status of each output.

The DSO module has three card edge connectors for external signals and power (P1, P2 and P3). Connector P1 connects to the common and +5 VDC power. Connector P2 connects the DSO module to the I/O expander bus. Connector P3 passes the digital output signals through a cable that is connected to a termination device. The output signals are wired from the termination device to the controlled field device.

FEATURES

The DSO module has the following features:

- The DSO module provides eight separate digital output signals.
- The three DSO modules allow for the switching of three voltage ranges of signals. The IMDSO01 module switches voltages of 24 to 240 VAC. The IMDSO02 module switches voltages of four to 60 VDC. The IMDSO03 module switches voltages of five to 160 VDC.
- Front panel LEDs provide a visual indication of the module status to aid in system testing and troubleshooting.
- User-defined default states.

INSTRUCTION CONTENT

This instruction consists of eight sections and two appendices.

Introduction — Provides an overview of the DSO modules. It contains a module description, features and specifications.

Description and Operation — Explains module operation.

Installation — Covers handling guidelines and explains how to configure the modules before placing them into operation.

Operating Procedures — Provides information about normal module operation.

Troubleshooting — Explains how to troubleshoot the modules using error codes and lists the corrective action.

Maintenance — Contains a maintenance schedule for the modules.

Repair/Replacement Procedures — Explains how to replace the modules.

Support Services — Explains the customer training Bailey Controls Company provides and information about ordering replacement parts.

Appendices — Provide information on termination unit and module configuration.

HOW TO USE THIS INSTRUCTION

Read this instruction in sequence. It is important to become familiar with the entire contents of this instruction before using the modules. This instruction is organized to enable quick information retrieval.

1. Perform all steps in the installation section.

2. Thoroughly read the operating procedures section before applying power to the process control unit interfaces.

3. Refer to the troubleshooting section if a problem occurs. This section will help to diagnose and correct a problem.

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

5. Go to the repair/replacement procedures section to find instructions on how to replace a module.

6. Refer to the support services section for a list of replacement parts and warranty information.

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-1 lists the terms and abbreviations used in this manual that are unique to Bailey Controls Company.

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
I/O Expander Bus	Parallel communication bus between the controller and I/O modules.
Process Control Unit	A node on the plant wide communication network containing control and I/O modules.
Termination Module	Provides input/output connection between plant equipment and the INFI 90/ Network 90® modules.
Termination Unit	Provides input/output connection between plant equipment and the INFI 90/ Network 90 modules.

REFERENCE DOCUMENTS

Table 1-2 lists the documents that provide additional information for related hardware and software. Refer to them as needed.

Table 1-2. Reference Documents

Document Number	Title
I-E96-200	Function Code Application Manual
I-E96-201	IMMFP01 Multi-Function Processor Module
I-E96-202	IMMFP02 Multi-Function Processor Module
I-E96-203	IMMFP03 Multi-Function Processor Module
I-E96-209	IMLMM02 Logic Master Module
I-E96-313	IMDSO04 Digital Output Module
I-E96-410	NIDI01 Digital Input Termination Module
I-E96-424	NTDI01 Digital I/O Termination Unit

NOMENCLATURE

Table 1-3 lists equipment associated with the DSO modules.

Table 1-3. Nomenclature

Nomenclature	Description
IEMMU01/02/04	Module mounting unit
IMLMM02	Logic master module
IMMFP01/02/03	Multi-function processor module
NFTP01	Field termination panel

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Table 1-3. Nomenclature (continued)

Nomenclature	Description
NIDI01	Digital input termination module
NKTU01	Termination cable, IMDSO01/02/03 to NTDI01 (PVC)
NKTU02	Termination cable, IMDSO01/02/03 to NIDI01 (PVC)
NKTU11	Termination cable, IMDSO01/02/03 to NTDI01 (non-PVC)
NKTU12	Termination cable, IMDSO01/02/03 to NIDI01 (non-PVC)
NTDI01	Digital I/O termination unit
NTMU01/02	Termination mounting unit

SPECIFICATIONS

Refer to Table 1-4 for the specifications of the DSO modules.

Table 1-4. Specifications

Property	Characteristic/Value
IMDSO01	
Power requirements	+5.00, ± 0.25 VDC at 150 mA; 0.75 W nominal
Max. load voltage	24 VAC to 240 VAC
Max. load current	3.0 A at 25°C (77°F) 2.0 A at 50°C (122°F) 1.0 A at 70°C (158°F)
Max. off leakage current	8.5 mA at 120 VAC, 25°C (77°F) 17.5 mA at 240 VAC, 25°C (77°F)
Max. on voltage drop	3.0 V at 3.0 A, 25°C (77°F) with 0.3-m (1-ft) long termination device cable
Max. surge current	50 A for 1 cycle
IMDSO02	
Power requirements	+5.00, ± 0.25 VDC at 150 mA; 0.75 W nominal
Max. load voltage	4 VDC to 60 VDC[1]
Max. load current	3.0 A at 25°C (77°F) 2.5 A at 50°C (122°F) 1.5 A at 70°C (158°F)
Max. off leakage current	1.0 mA at 70°C (158°F)
Max. on voltage drop	2.9 V at 3.0 A, 25°C (77°F) with 0.3-m (1-ft) long termination device cable
Max. surge current	5 A for 1 second
IMDSO03	
Power requirements	+5.00, ± 0.25 VDC at 150 mA; 0.75 W nominal
Max. load voltage	5 VDC to 160 VDC[2]
Max. load current	1.0 A at 25°C (77°F) 0.9 A at 50°C (122°F) 0.5 A at 70°C (158°F)
Max. off leakage current	2.0 mA at 70°C (158°F)

Table 1-4. Specifications (continued)

Property	Characteristic/Value
IMDSO03 *(continued)*	
Max. on voltage drop	2.1 V at 1.0 A, 25°C (77°F) with 0.3-m (1-ft) long termination device cable
Max. surge current	2 A for 1 second
All IMDSO01/02/03	
Isolation	300 VRMS between output and logic circuitry and between outputs. CSA approved for 300 V isolation.
Mounting	Occupies one slot in standard INFI 90 module mounting unit.
Electromagnetic/radio frequency interference	Values not available at this time. Keep cabinet doors closed. Do not use communication equipment any closer than 2 meters from the cabinet.
Ambient temperature	0° to 70°C (32° to 158°F)
Relative humidity	5% to 90% up to 55°C (131°F) (noncondensing) 5% to 40% above 55°C (131°F) (noncondensing)
Atmospheric pressure	Sea level to 3 km (1.86 mi.)
Air quality	Noncorrosive
Installation category	Category III
Certification	CSA certified for use as process control equipment in an ordinary (nonhazardous) environment
	Factory Mutual approved for use in Class I, Division 2, hazardous locations.

NOTES:

1. The open fuse detection circuitry may not function for load voltages below 10 VDC.
2. The open fuse detection circuitry may not function for load voltages below 24 VDC.

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section explains the digital output circuitry, control logic, data, logic power, and connections for the IMDSO01, IMDSO02 and IMDSO03 Digital Output Module (DSO). The DSO module is a digital signal interface between a control module (multi-function processor module, multi-function controller module, or logic master module) and process field devices. The control module communicates with its DSO module on the I/O expander bus as shown in Figure 1-1. Each DSO module on the I/O expander bus has a unique I/O expander bus address. The address of a DSO module is set by dipswitch S1.

DIGITAL OUTPUTS

Digital signals have two states, on or off. The DSO digital outputs switch voltages of 24 to 240 VAC (IMDSO01 module), four to 60 VDC (IMDSO02 module) or five to 160 VDC (IMDSO03 module). These voltages energize (turn on) or de-energize (turn off) field devices. The type of process field devices determines which DSO module to use.

FUNCTIONAL BLOCK DIAGRAM

The DSO module consists of registers, buffers and interface circuits. They control the digital output switching and transmit operating status to a control module. Solid state relays provide the switching functions. Figure 2-1 is a block diagram of the DSO module. It illustrates signal flow through the module.

Digital Output Circuits

The digital output block consists of eight solid state relays that function as digital output switches. The digital output block also includes fuses that protect the module circuitry and field devices from current surges and short circuits. Each of the three DSO module variants have different output switching capabilities and fusing. The solid state relays on a DSO module determine the voltage switching capability of that module. All the relays are normally open or de-energized until a signal from the data selector block causes the relay circuit to close or energize. Figure 2-2 shows the digital output circuit.

The data selector block drives the solid state relays. It uses data from the output register or default register to open or

close them. The relays follow the output of the registers. During normal operation, the DSO module selects the output register data. Its outputs also turn the front panel output status LEDs on or off. A logic one is inverted by the output block circuits to energize a relay and light an LED. A logic zero de-energizes a relay and turns an LED off.

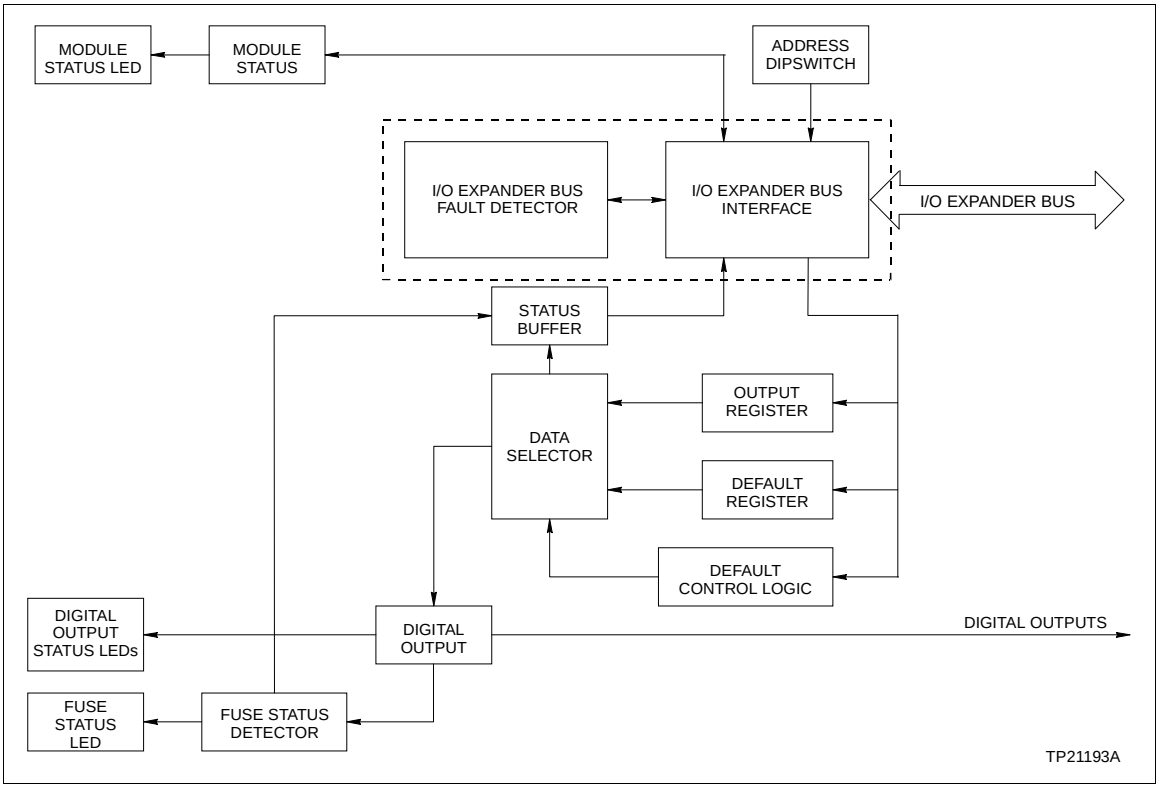


Figure 2-1. Digital Output Module Block Diagram

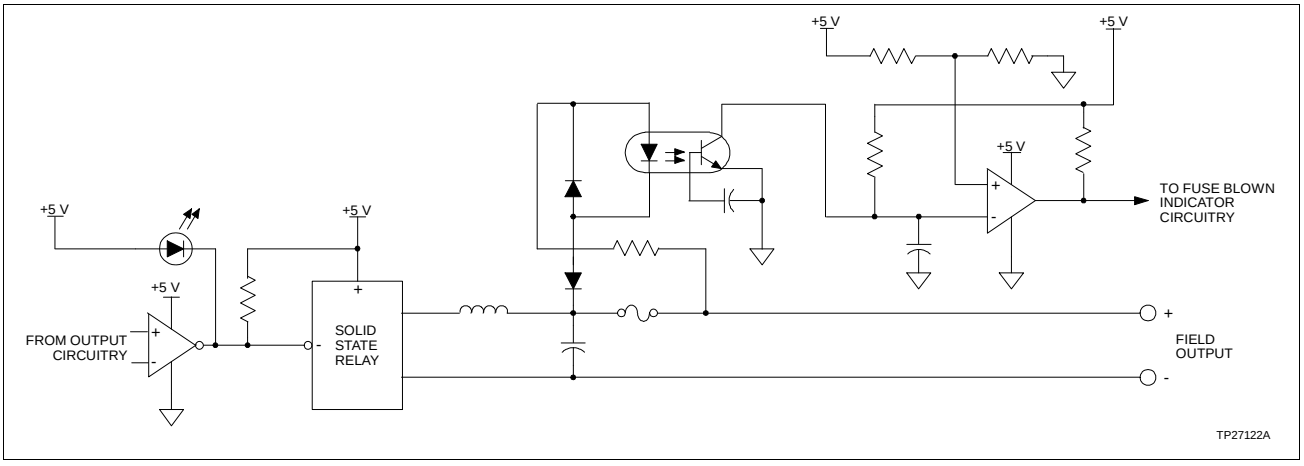


Figure 2-2. Digital Output Circuit

Output Control Logic

An output register holds the output data that is sent to the solid state relays. The I/O expander bus interface writes control module data to this register. This data, sent to the data selector block, sets the relay states for normal operation.

Default data from the control module is sent to the default register. The control module configuration sets the default values (function code 128). The default register is reset to logic zeros during power up to drive the output relays to a de-energized state. Function code 128 in the control module configuration selects the output values used to drive the output circuits in the event of a control module failure (time-out condition). If function code 128 is not defined, the outputs will go to a de-energized state during a time-out condition. Refer to ***BUS FAULT TIMER*** for further explanation of a time-out condition.

The default control logic block is a one-bit latch register. It sends a signal to the data selector block to select either the default register data or the output register data during a time-out condition (indicating a control module error). This signal is dependent on the control module configuration (function code 83, specification S2). The bus fault detector in the I/O expander bus interface checks for a time-out condition. During a time-out condition, the data selector block normally selects the default register data. If a hold option is selected in function code 83, the control logic block sends a logic one to override the data selector. It causes the data selector to drive the relays with output register data instead of default data to maintain the outputs at their current values.

Status Logic

Optocouplers in the fuse status detector block isolate the digital outputs from the I/O module circuits. The fuse status detector block also has circuits that test the individual fuse conditions to indicate a blown (open) or good fuse. This block sends the individual fuse state signals to a status buffer and an OR gate. Blown fuses cause the OR gate to output a signal that lights the front panel blown fuse LED indicator. It also sets a bit in a status buffer to indicate to the control module that the fuse LED is lit.

When field and power wiring are connected to the appropriate termination unit or module, the blown fuse detection circuitry is enabled in IMDSO01 modules. For IMDSO02 and IMDSO03 modules, the blown fuse detection circuitry for each output is operational only when the solid state relay of the output is energized. The energized relay provides a current path for the isolated I/O supply voltage that drives the blown fuse detection circuits. When a fuse blows, it is detected by the circuits and latched. This latched output lights the front panel fuse status

LED and is input to the module status buffer. A module reset (remove and insert) clears the latch. Removing the module to replace the fuse resets the fuse status.

The status buffer block provides module status information to the control module. This information is output states, fuse status, and module identification and status. The control module reads this data through the I/O expander bus interface. Refer to ***MODULE DATA*** for an explanation of the data.

OUTPUT CIRCUIT CONNECTIONS

The output signals connect to edge connector P3 of the DSO module using a cable from a termination device. The IMDSO02 and IMDSO03 modules require that proper polarity be observed when wiring DC field signals. Polarity of AC signals does not affect switching (IMDSO01 module).

I/O EXPANDER BUS

The INFI 90 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 I/O functions. The P2 edge connector of the I/O and control modules connects to the bus.

The I/O expander bus is 12 parallel signal lines located on the module mounting unit backplane. A 12-position dipshunt placed in a connection socket on the module mounting unit backplane connects the bus between the control and I/O modules. Cable assemblies can extend the bus to additional module mounting units within a cabinet.

A control module and its I/O modules form an individual subsystem within a process control unit. The I/O expander bus between subsystems must be separated. Leaving a dipshunt socket empty or not connecting the module mounting units with cables separates the subsystems.

UNIVERSAL I/O EXPANDER BUS INTERFACE

The DSO module 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. This integrated circuit 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

Function code 83 in the control module configuration accesses the DSO module on the I/O expander bus. It also allows the control module to automatically read status data from the I/O module, and write output data to it. The I/O module address in function code 83 must be the same as the address set on the I/O expander bus address dipswitch (dipswitch S1).

Status Data

Status data consists of three eight-bit bytes read by the control module. The first byte contains readback data that reflects the state of the solid state output relays. Each bit of this data corresponds to the digital output state (on or off). The second byte is the fuse status; each bit reflects the condition of a fuse (logic one = blown fuse, logic zero = good fuse). The third byte is the module identification and module status. I/O module identification is in the four most significant bits (MSB). It identifies the I/O module to the control module. It also verifies the I/O expander bus communication integrity and the control module configuration. I/O module status is the least significant bit (LSB). During initialization, the control module writes data to the output register and default register, and forces this bit to a logic one. A reset or time-out condition (bus fault error) resets it to a logic zero. Default data is normally written only during control module start-up. The control module reads the module status bit to test for a change in the state of the module. It uses this bit as a signal to rewrite data to the module to insure that proper default values are in the default register. A fuse LED status bit reflects the state of the LED: logic one (on), logic zero (off).

Output Data

Output data is an eight-bit byte sent to the output registers. Each bit of the digital output byte corresponds to one output. The bit value reflects the state of the output. Logic one turns a field device on; logic zero turns it off.

Default Data

Default data is an eight-bit byte sent to the default registers. It is set by the control module configuration (function code 128). The function of this data is the same as the output data but is used only when a time-out condition occurs.

LOGIC POWER

Logic power (+5 VDC) drives the DSO module circuits. It connects through edge connector P1 shown in Figure 3-1.

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 ten milliseconds. This causes the digital outputs to change to their default values. A red front panel status LED indicates a bus fault (time-out condition).

STATUS LED INDICATOR

A faceplate module status LED indicator shows the operating state of the DSO module. Circuits on the DSO module determine the module status and light the LED accordingly. The operating procedures section explains the indications, and the troubleshooting section explains corrective actions to take.

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains what must be done before placing a DSO module into operation. Read, understand and complete the steps in the order they appear before operating the module.

SPECIAL HANDLING

Observe the following steps when handling electronic circuitry:

> **NOTE:** Always use Bailey's field static kit (part number 1948385_1 - consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipative work surface) when working with the modules. The kit grounds a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

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

2. ***Ground Bag Before Opening.*** Before opening a bag containing an assembly with semiconductors, touch it to the equipment housing or a ground to equalize charges.

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

4. ***Avoid Partial Connection of Semiconductors.*** 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 module if necessary.

7. ***Use a Grounded Wrist Strap.*** Connect the wrist strap to the appropriate grounding plug on the power entry panel. The grounding plug on the power entry panel is connected to cabinet chassis ground.

8. ***Do Not Use Lead Pencils to Set Dipswitches.*** To avoid contamination of dipswitch 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 for shipping damage.

2. Notify the nearest 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.

TERMINATION DEVICE CONFIGURATION AND INSTALLATION

Verify the NIDI01 Digital Input Termination Module or NTDI01 Digital I/O Termination Unit is properly configured and installed before installing the DSO module. Appendices A and B contain quick reference information about jumper settings, circuit board layout, and cable connections for these termination devices. Refer to the NIDI01 termination module or NTDI01 termination unit instruction for more complete installation information.

SETUP AND PHYSICAL INSTALLATION

This section explains how to configure and install the DSO module. The module has one configurable dipswitch and eight fuses. See Figure 3-1 for dipswitch and fuse locations.

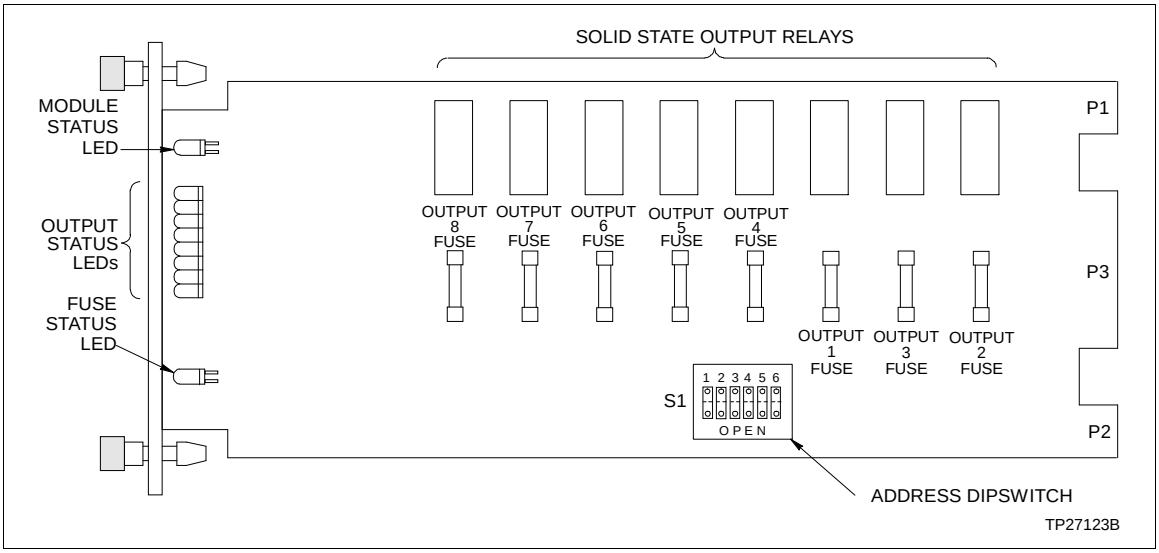


Figure 3-1. DSO Dipswitch and Fuse Locations

Dipswitch S1 Settings

Dipswitch S1 sets the I/O expander bus address of the DSO module. This address uniquely identifies the DSO module to the control module and must be the same as the address set in the control module function block (function code 83, specification S1) configuration.

Dipswitch S1 is a six-pole address dipswitch. Pole one is the most significant bit and pole six is the least significant bit. Valid addresses are zero to 63 (refer to Table 3-1). Record the dipswitch S1 settings in the space provided.

Table 3-1. DSO Dipswitch S1 Settings

Address Example	Dipswitch Pole (Binary Value)					
	1 (32)	2 (16)	3 (8)	4 (4)	5 (2)	6 (1)
0	0	0	0	0	0	0
31	0	1	1	1	1	1
63	1	1	1	1	1	1
User setting						

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Fuses

The DSO module contains eight fuses, one for each output. These fuses protect the module and equipment connected to the module from current surges and short circuits. Table 3-2 lists the types of fuses used in the IMDSO01, IMDSO02 and IMDSO03 modules. Verify the fuses are of the proper type and are installed.

NOTE: A fuse does not need to be installed for unused digital outputs.

Table 3-2. Fuse Ratings

Module Type	Fuse Number	Fuse Type
IMDSO01	194776_24001	4.0 A, 250 V, slow-blow
IMDSO02	194776_13001	3.0 A, 250 V, normal
IMDSO03	194776_11501	1.5 A, 250 V, normal

Physical Installation

The DSO module inserts into a standard INFI 90 module mounting unit and occupies one slot.

Before installing the DSO module, verify the following:

1. Dipswitch S1 is properly configured.

2. All required fuses are functional and properly installed.

3. The appropriate termination device is properly installed.

To install the DSO module:

1. Verify the DSO slot assignment in the module mounting unit.

WARNING	**Disconnect power before installing dipshunts on the module mounting unit backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**
AVERTISSEMENT	**Interrompez l'alimentation avant d'installer des dipshunts sur le fond de panier du châssis de montage des modules. Sinon, tout contact avec cette zone entraîne des risques d'électrocution sérieuse ou fatale.**

2. Verify that a 24-pin dipshunt is installed in the I/O expander bus sockets between the module mounting unit slot to be used by the DSO module and the slot to be used by the appropriate control module.

3. Remove any 24-pin dipshunts from the I/O expander bus sockets that would connect the DSO module to any control module other than the appropriate control module.

4. Attach the hooded end of the NKTU01, NKTU02, NKTU11 or NKTU12 cable to the module mounting unit backplane cable connector opening for the DSO module.

5. Guide the top and bottom edges of the module along the top and bottom rails of their assigned slots in the module mounting unit.

6. Push on the faceplate until the rear edge of the module is firmly seated in the module mounting unit backplane connector.

7. Turn the 2 latching screws $^{1}/_{2}$-turn to lock the module in place. The module is locked in place when the open end of the slots on the latching screws faces the center of the faceplate.

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section explains the faceplate LEDs and what they mean. See Figure 4-1 for the location of the faceplate LEDs on the IMDSO01 module. The IMDSO02 and IMDSO03 modules have the identical faceplate as the IMDSO01 module except for the module nomenclature.

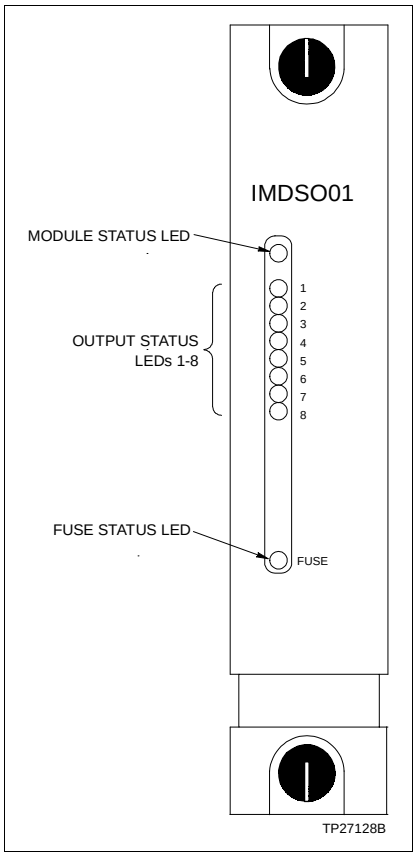


Figure 4-1. DSO Faceplate LEDs

LED INDICATORS

The DSO module has ten faceplate LEDs. The top LED is the module status LED. The eight LEDs in the middle are the output status LEDs. The bottom LED is the fuse status LED.

Module Status LED

The module status LED is a two-color (red and green) LED. It shows the operating condition of the DSO module. There are three possible operating conditions:

Off No power is being supplied to the DSO module or it is not enabled by the control module.

Solid Green DSO module is enabled by and communicating with the control module.

Solid Red I/O expander bus fault timer error (time-out condition).

Output Status LEDs

There are eight output status LEDs. Each LED indicates the status of the digital output corresponding to the number printed to the right of the LED. There two possible states for each LED:

Off The output is not energized and represents a logic zero.

Solid Red The output is energized and represents a logic one.

Fuse Status LED

The fuse status LED shows condition of the output fuses (when enabled) for the active outputs on the DSO module. There are two possible states for the fuse status LED:

Off All output fuses are operating properly.

Solid Red One or more of the output fuses has failed.

START-UP PROCEDURES

The start-up of the DSO module is controlled by the function block configuration of the control module. Specification S1 of function code 83 in the control module configuration tells the control module the address of the DSO module. The DSO address dipswitch settings must match this address or the DSO module will not be enabled. Refer to the ***Function Code Application Manual*** for more information.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section explains the error indications and corrective actions for the IMDSO01, IMDSO02 and IMDSO03 Digital Output Modules (DSO).

ERROR INDICATIONS

Troubleshooting is limited to viewing the faceplate LEDs and the module status report from any INFI 90 operator interface. Refer to the product instruction for the operator interface used for information about accessing module status reports.

Module Status LED

The module status LED has three possible states to indicate normal operation and error conditions. Table 5-1 lists the LED states, error indication, probable causes, and corrective actions.

CAUTION	**Disable the module output signals before removing the module. Damage to the module may result.**
ATTENTION	**Il est nécessaire de désactiver les signaux de sortie du module avant de le retirer de sa position. Un manquement à cette précaution pourrait endommager le module.**

Table 5-1. Module Status LED Error Indications and Corrective Actions

LED State	Error Indication	Probable Cause	Corrective Action
Green	I/O module operating normally and communicating with the control module	Normal operation	No action required
Off	I/O module not responding	Address set by dipswitch S1 not the same address in control module configuration (specification S1 of function code 83)	Change address on dipswitch S1 to match address in specification S1 of function code 83 ***or*** Change address in specification S1 of function code 83 to match address set by dipswitch S1
		Dipshunt not installed between control module and I/O module	Verify dipshunt is properly installed in the I/O expander bus socket on the module mounting unit backplane between the control module and the I/O module

Table 5-1. Module Status LED Error Indications and Corrective Actions (continued)

LED State	Error Indication	Probable Cause	Corrective Action
Off *(continued)*	I/O module not responding *(continued)*	Control module in configure mode	Put control module into execute mode
		Control module configuration not correct	Verify function code 83 is in the control module configuration
	No power to I/O module	I/O module not completely inserted in module mounting unit	Verify I/O module is completely inserted in the module mounting unit (faceplate flush with module mounting unit and latching screws in the locked position)
Red	I/O expander bus fault timer error (time-out condition)	I/O expander bus clock failure	Verify the control module is operating properly
		Control module bad	Replace control module
		Bad I/O module	Replace I/O module
		Dipshunts not installed between control module and I/O module	Verify dipshunt is properly installed in the I/O expander bus socket on the module mounting unit backplane between the control module and the I/O module

NOTE: Replace the DSO module if the corrective actions listed in this table do not correct the problem.

Fuse Status LED

The fuse status LED has two possible states to indicate the condition of the digital output fuses. When the fuse status LED is on (illuminated red), one or more of the fuses are faulty. When the fuse status LED is off (not illuminated), all output fuses are functioning properly. Refer to the repair/replacement procedures section for detailed information about replacing fuses.

CONTROL MODULE ERRORS

The control module performs status checks on the DSO module. If this status check finds the status of the DSO module bad, the control module will report the bad condition to the operator interface. If the I/O expander bus address of the I/O module does not match the address configured in the control module function block configuration, the control module generates a *MISSING I/O MODULE* error. If the I/O expander bus is not connected between the control module and the I/O module, the control module generates a *MISSING I/O MODULE* error.

EDGE CONNECTORS

Tables 5-2, 5-2, and 5-2 list the DSO edge connector pin assignments.

Table 5-2. Edge Connector P1 Pin Assignments

Pin	Signal	Pin	Signal
1	+5 VDC	2	+5 VDC
3	Unused	4	Unused
5	Common	6	Common
7	Unused	8	Unused
9	Power fail interrupt	10	Power fail interrupt
11	Unused	12	Unused

Table 5-3. Edge Connector P2 Pin Assignments

Pin	Signal	Pin	Signal
1	Data bit 1	2	Data bit 0
3	Data bit 3	4	Data bit 2
5	Data bit 5	6	Data bit 4
7	Data bit 7	8	Data bit 6
9	Clock	10	Sync
11	Unused	12	Unused

Table 5-4. Edge Connector P3 Pin Assignments

Pin	Signal	Pin	Signal
1	Digital output 1 (+)	A	Digital output 1 (–)
2	Unused	B	Unused
3	Digital output 2 (+)	C	Digital output 2 (–)
4	Unused	D	Unused
5	Digital output 3 (+)	E	Digital output 3 (–)
6	Unused	F	Unused
7	Digital output 4 (+)	H	Digital output 4 (–)
8	Unused	J	Unused
9	Digital output 5 (+)	K	Digital output 5 (–)
10	Unused	L	Unused
11	Digital output 6 (+)	M	Digital output 6 (–)
12	Unused	N	Unused
13	Digital output 7 (+)	P	Digital output 7 (–)
14	Unused	R	Unused
15	Digital output 8 (+)	S	Digital output 8 (–)

SECTION 6 - MAINTENANCE

INTRODUCTION

WARNING	**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.**
AVERTISSEMENT	**Des lunettes de protection devraient être portées lors de travail avec des solvants nettoyants. Lorsqu'on enlève les solvants des circuits imprimés à l'aide d'air comprimé, les éclaboussures de solvant pourraient causer des blessures aux yeux.**

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. Bailey Controls Company 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 can be performed on-site. These preventive maintenance procedures should be used as guidelines to assist you in establishing good preventive maintenance practices. Select the minimum steps required to meet the cleaning needs of your system.

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 DSO module, have experience working with process control systems, and know what precautions to take when working on live electrical systems.

PREVENTIVE MAINTENANCE SCHEDULE

Table 6-1 is the preventive maintenance schedule for the DSO module. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Some tasks in Table 6-1 are self explanatory. Instruction 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.

Table 6-1. Preventive Maintenance Schedule

Task	Frequency
Check cabinet air filters. Clean or replace them as necessary. Check the air filter more frequently in excessively dirty environments.	3 months
Check cabinet and module for dust. Clean as necessary using an antistatic vacuum.	
Check all DSO signal, power and ground connections. Verify that they are secure. Refer to the procedure.	
Check DSO circuit boards, giving special attention to power contacts and edge connectors. Clean as necessary. Refer to the procedure.	12 months
Complete all tasks in this table.	Shutdown

EQUIPMENT AND TOOLS REQUIRED

Listed below are the tools and equipment required for maintenance procedures.

- Antistatic vacuum.
- Clean, lint free cloth.
- Compressed air.
- Eberhard Faber (400A) pink pearl eraser.
- Fiberglass or nylon burnishing brush.
- Foam tipped swab.
- Flat head screwdriver suitable for terminal blocks.
- Isopropyl alcohol (99.5 percent electronic grade).
- Natural bristle brush.

PREVENTIVE MAINTENANCE PROCEDURES

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

- Cleaning printed circuit boards.
- 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, and cleaning 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.

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.

Another method of washing the printed circuit board is:

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

2. When the circuit board is clean, remove excess solvent by using compressed air to blow it free of the circuit board.

EDGE CONNECTOR CLEANING

To clean edge connector contacts:

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 the contacts clean with a lint free cloth.

Checking Connections

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.

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

Verify that all cable connections are secure.

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

WARNING	**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.**
AVERTISSEMENT	**Si des circuits d'entrée ou de sortie sont alimentés à partir de sources externes, ils présentent un risque de choc électrique même lorsque l'alimentation du système est débranchée du panneau d'entrée d'alimentation. Le cas échéant, un avertissement signalant la présence de sources d'alimentation multiples doit être apposé sur la porte de l'armoire.**

CAUTION	**Disable the module output signals before removing the module. Damage to the module may result.**
ATTENTION	**Il est nécessaire de désactiver les signaux de sortie du module avant de le retirer de sa position. Un manquement à cette précaution pourrait endommager le module.**

Repair procedures are limited to module replacement. If the DSO module fails, remove and replace it with another. This section also explains how to replace a failed digital output fuse. Verify that the replacement module dipswitch is set the same as that of the failed module.

MODULE REPLACEMENT PROCEDURE

Follow Steps 1 through 8 to replace the DSO module. Observe the steps listed in ***SPECIAL HANDLING*** in Section 3 when handling the module.

1. Verify all digital output signals from the associated control module are disabled.

2. Turn the 2 latching screws on the defective module $^{1}/_{2}$-turn either way to release them.

3. Grasp the screws and slide out the module.

4. Set the dipswitch on the replacement module to match the settings of the defective module.

5. Verify the appropriate digital output fuses are installed.

6. Hold the module by the faceplate and slide it into the assigned slot; push until the rear edges of the module are firmly seated in the backplane connectors.

7. Turn the 2 latching screws on the module 1/2-turn to lock the module in place. Modules are locked into the module mounting unit when the open end of the slots on the latching screws faces the center of the module faceplate.

8. Enable the digital output signals from the associated control module.

FUSE REPLACEMENT PROCEDURE

Follow Steps 1 through 8 to replace a digital output fuse on the DSO module. Observe the steps listed in ***SPECIAL HANDLING*** in Section 3 when handling the module.

1. Verify all digital output signals from the associated control module are disabled.

2. Turn the 2 latching screws on the defective module 1/2-turn either way to release them.

3. Grasp the screws and slide out the module.

4. Remove the faulty digital output fuse.

5. Insert a new digital output fuse into the appropriate fuse holder.

6. Hold the module by the faceplate and slide it into the assigned slot; push until the rear edges of the module are firmly seated in the backplane connectors.

7. Turn the 2 latching screws on the module 1/2-turn to lock the module in place. Modules are locked into the module mounting unit when the open end of the slots on the latching screws faces the center of the module faceplate.

8. Enable the digital output signals from the associated control module.

TERMINATION UNIT OR MODULE REPLACEMENT PROCEDURE

To replace the following termination devices, refer to the appropriate instructions for step by step replacement procedures and spare parts information:

- NTDI01 Digital I/O Termination Unit.
- NIDI01 Digital Input Termination Module.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

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

REPLACEMENT PARTS AND ORDERING INFORMATION

When making repairs, order replacement parts from a Bailey Controls Company sales office. Provide this information:

1. Part description, part number and quantity.

2. Model and serial numbers (if applicable).

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

Order parts without commercial descriptions from the nearest Bailey Controls Company sales office. Table 8-1 provides a list of spare parts.

Table 8-1. Spare Parts List

Part Number	Description
194776_11501	Fuse, 250 V, 1.5 A normal, 1.25 in. by 0.25 in.
194776_13001	Fuse, 250 V, 3 A normal, 1.25 in. by 0.25 in.
194776_24001	Fuse, 250 V, 4 A slow blow, 1.25 in. by 0.25 in.
NIDI01	Digital input termination module
NKTU01	Termination unit cable, IMDSO0☐ to NTDI02 (PVC)
NKTU02	Termination module cable, IMDSO0☐ to NIDI02 (PVC)
NKTU11	Termination unit cable, IMDSO0☐ to NTDI02 (non-PVC)
NKTU12	Termination module cable, IMDSO0☐ to NIDI02 (non-PVC)
NTDI02	Digital I/O termination unit

NOTE: It is impractical to specify a recommended quantity of spare parts because Bailey custom designs every system. Contact Bailey Controls Company for help determining the quantity of spare parts to keep on hand for your particular system.

TRAINING

Bailey Controls Company has a modern training facility available for training your personnel. On-site training is also available. Contact a Bailey Controls Company sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

Additional copies of this instruction, or other Bailey Controls Company instructions, can be obtained from the nearest Bailey Controls Company sales office at a reasonable charge.

APPENDIX A - NTDI01 TERMINATION UNIT CONFIGURATION

INTRODUCTION

The IMDSO01, IMDSO02 and IMDSO03 Digital Output Modules (DSO) can use the NTDI01 Digital I/O Termination Unit (TDI) for termination. Figure A-1 shows the location of dipshunt sockets, fuses, connectors and terminals on the TDI circuit board. Dipshunts on the TDI unit are used to switch between three possible ways of powering each digital output. Dipshunt sockets XU1, XU3, XU5, XU7, XU9, XU11, XU13, and XU15 correspond to digital outputs one through eight. All other dipshunt sockets should not have a dipshunt installed. Table A-1 shows the possible dipshunt configurations. Figure A-2 shows the termination assignment and polarity for each of the digital output signals. Refer to this figure when connecting field wiring to the TDI unit. Figure A-3 shows the cable connections required when using the TDI unit with a DSO module. This information is provided as a quick reference guide for personnel installing the TDI unit. Refer to the NTDI01 instruction for complete information.

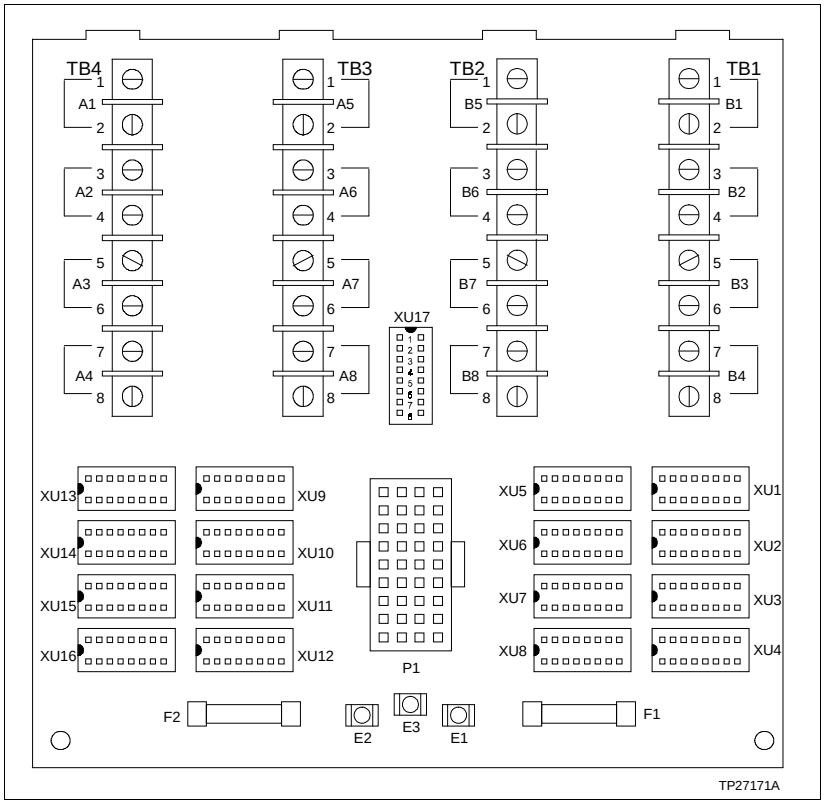
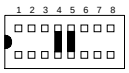
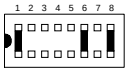
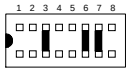
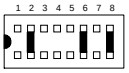


Figure A-1. NTDI01 Component Locations

Table A-1. NTDI01 Dipshunt Configurations

Application/Signal Type	Dipshunt Configuration XU1, 3, 5, 7, 9, 11, 13, 15
Externally powered	
System powered from E1	
System powered from E1 (IMDSO02/03)	
System powered from E2 (IMDSO01 only)	

NOTES:

1. XU17 does not require a dipshunt for this application.
2. Care must be taken when powering solid state relay loads through the E1 and E2 connectors. The traces on the termination unit (circuit board revision L or greater) allow for 3 A. Previous revisions allow for 2 A only. Exceeding this current can damage the termination unit printed circuit board. Where higher current is required, use the externally powered configuration.

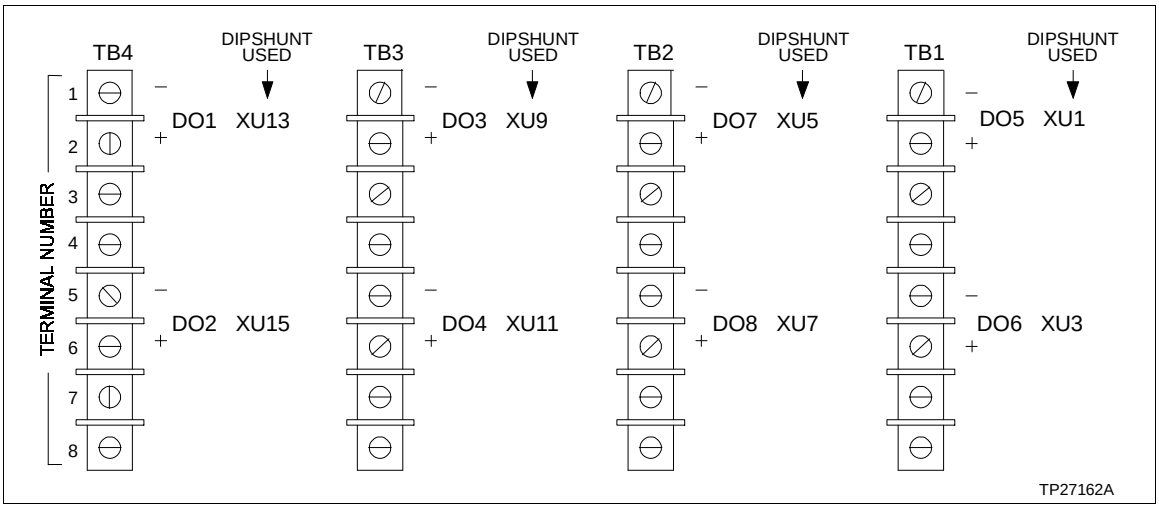


Figure A-2. NTDI01 Terminal Block Assignments

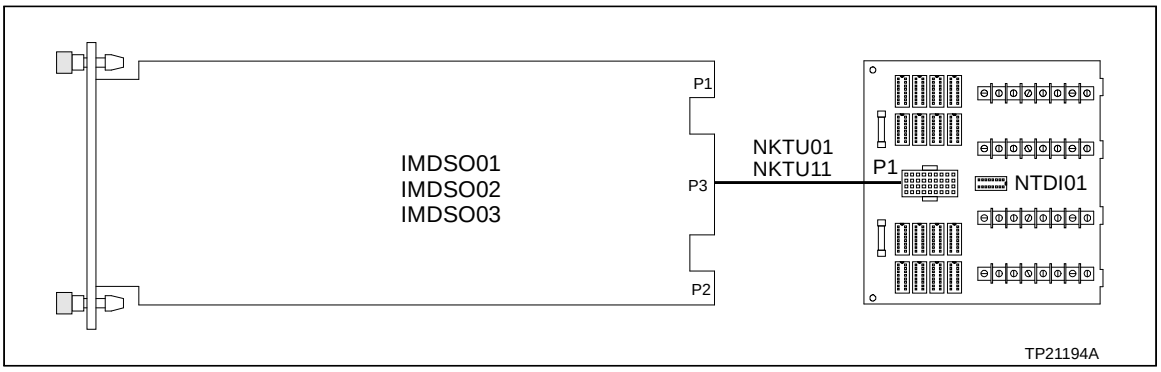


Figure A-3. NTDI01 Unit to IMDSO01, IMDSO02 and IMDSO03 Module Connections

APPENDIX B - NIDI01 TERMINATION MODULE CONFIGURATION

INTRODUCTION

The IMDSO01, IMDSO02 and IMDSO03 Digital Output Modules (DSO) can use the NIDI01 Digital Input Termination Module (IDI) for termination. Figure B-1 shows the location of jumpers, terminals and edge connectors on the IDI circuit board. Jumpers on the IDI module are used to configure the digital outputs that are sent to the process. When using the DSO module with the IDI module, only IDI jumper J9 should be connected. All other pins should remain unconnected. Figure B-2 shows the termination assignment and polarity for each of the digital outputs. Refer to this figure when connecting field wiring to the IDI module. Figure B-3 shows the cable connection required when using the IDI module with a DSO module. This information is provided as a quick reference guide for personnel installing the IDI module. Refer to the NIDI01 instruction for complete information.

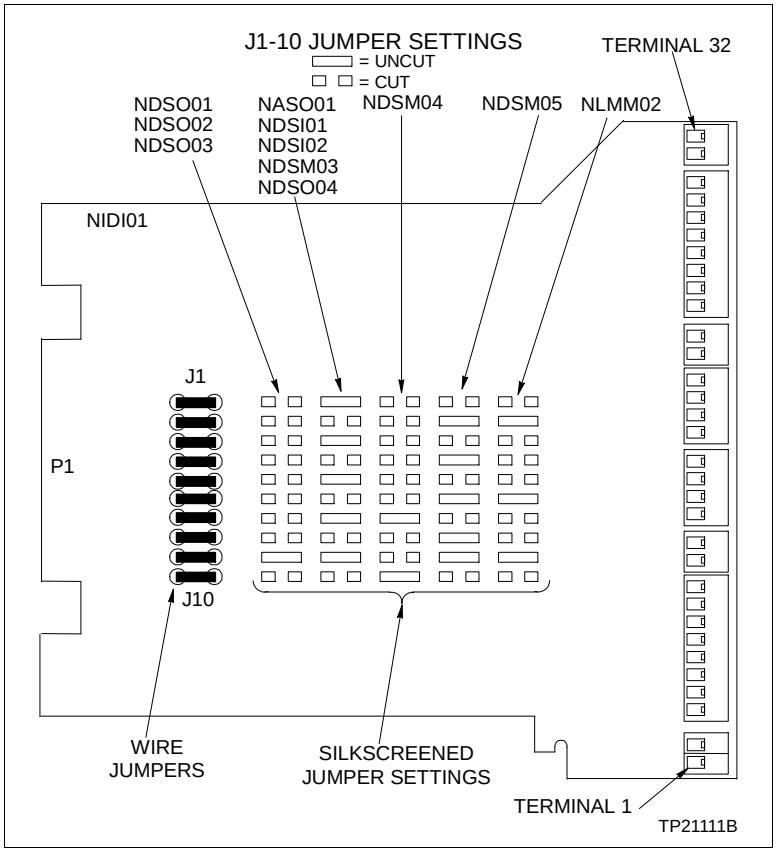


Figure B-1. NIDI01 Component Locations

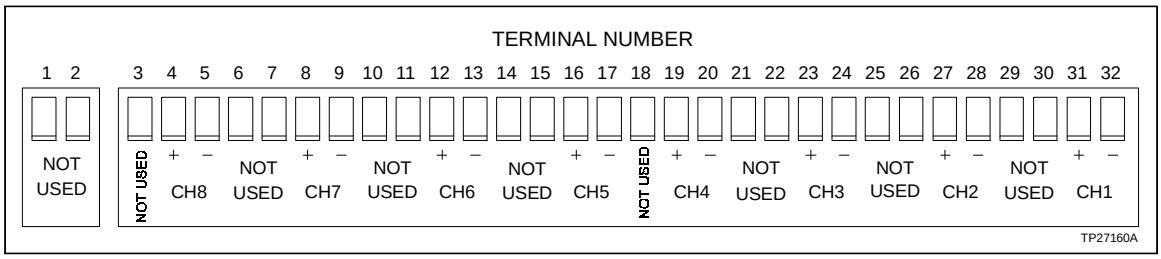


Figure B-2. NIDI01 Terminal Block Assignments

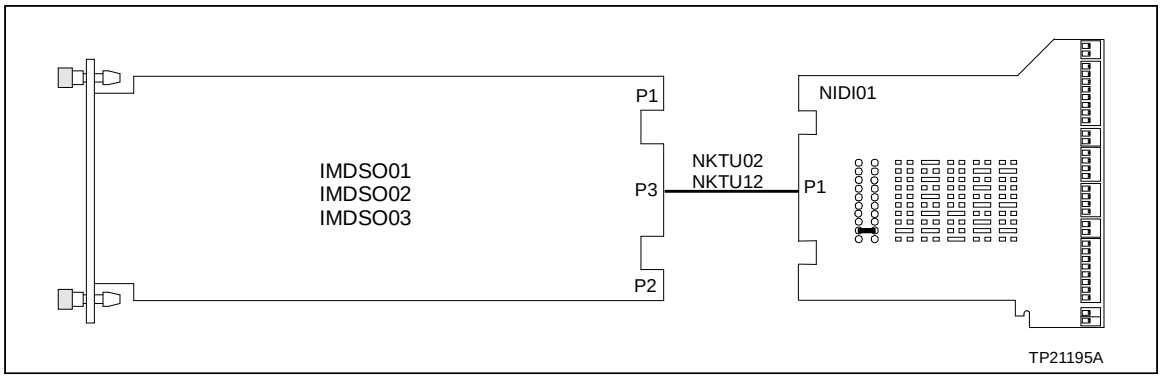


Figure B-3. NIDI01 Module to IMDSO01, IMDSO02 and IMDSO03 Module Connections

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