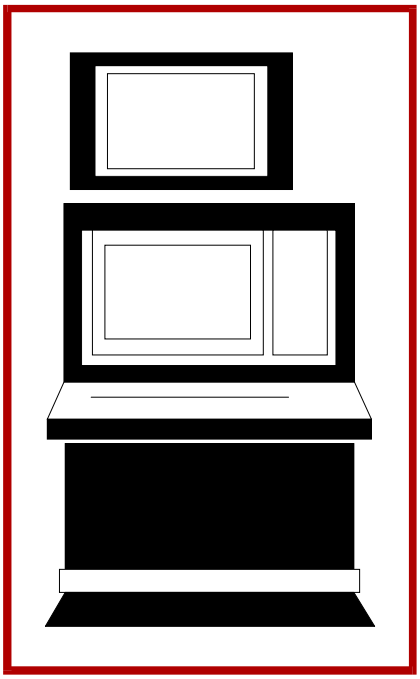
Bailey® infi 90®

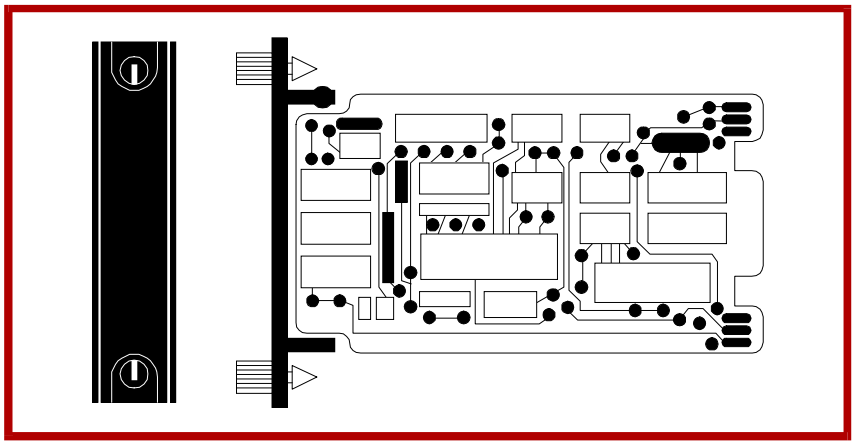
IMDSI1□

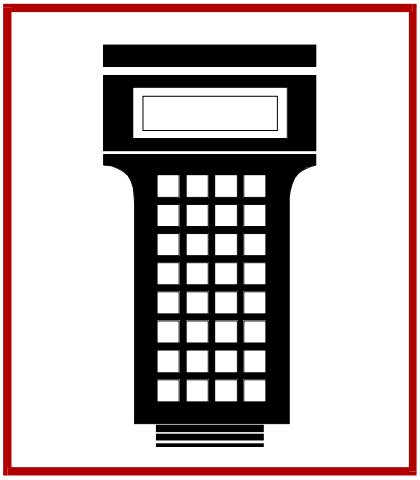
Instruction

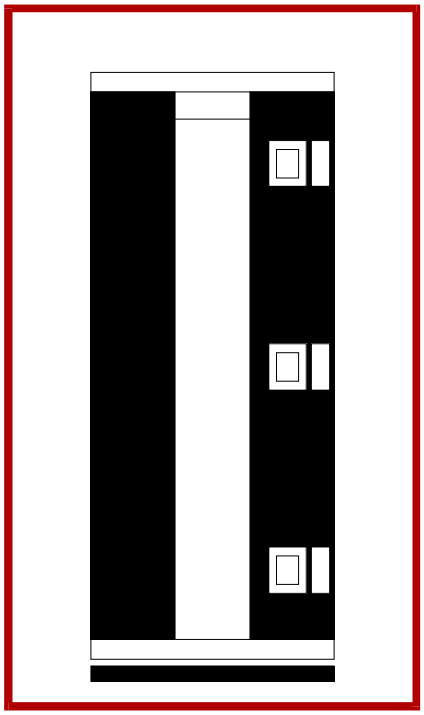
Digital Input Modules

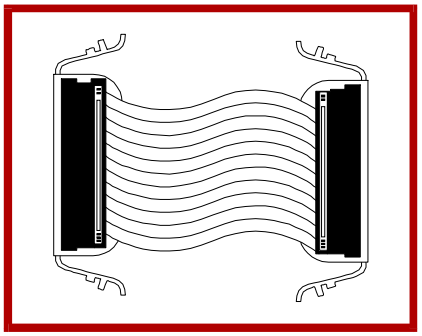
IMDSI12, IMDSI13, IMDSI14, IMDSI15

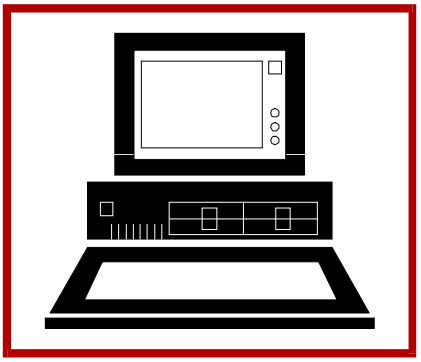












Bailey Process Control and Automation Solutions from Elsag Bailey Group

Preface

The IMDSI1□ Digital Input Module is an interface used to bring 16 separate process field signals into the INFI 90® OPEN Strategic Process Management System. These digital inputs are used by control modules to monitor and control a process.

This instruction explains the digital input module specifications and operation for the IMDSI12, IMDSI13, IMDSI14 and IMDSI15 modules. It details the procedures necessary to complete setup, installation, maintenance, troubleshooting and replacement of the module.

The IMDSI12 is the functional equivalent of the existing IMDSI02 module except that the IMDSI12 only offers a 17 millisecond debounce filter time. Any of the IMDSI1□ modules may be used as a direct replacement for the IMDSI02 module, with the correct jumper settings. For example, an IMDSI13 module may be substituted for an IMDSI02 module that has all its jumpers set for 24 VDC with a 17 millisecond debounce filter.

The system engineer or technician using the IMDSI1□ digital input module should read and understand this instruction before operating the module.

SECTION 1 - INTRODUCTION

OVERVIEW

The IMDSI1□ Digital Input modules provide 16 separate digital signals into the INFI 90® OPEN system for processing and monitoring. It interfaces process field inputs with the INFI 90 OPEN Strategic Process Management System. A contact closure or switch is an example of a device that supplies a digital signal. Control modules provide the control functions; I/O modules provide the inputs and outputs. Four variations of the IMDSI1□ modules are presented in this instruction:

- IMDSI12 - 24 VDC, 48 VDC, 125 VDC or 120 VAC inputs.
- IMDSI13 - 24 VDC inputs.
- IMDSI14 - 48 VDC inputs.
- IMDSI15 - 125 VDC or 120 VAC inputs.

The IMDSI12 is the functional equivalent of the existing IMDSI02 module with the restriction that the IMDSI02 offers selectable debounce filter times of 1.5 milliseconds (fast) and 17 milliseconds (slow) and the IMDSI12 module offers only the 17 milliseconds (slow) debounce filter time. The slow debounce filter is used in the majority of digital input applications.

Any of the IMDSI1□ modules may be substituted in place of an IMDSI02 where appropriate jumper settings are used. For example, an IMDSI13 module may be substituted for an IMDSI02 module that has all its jumpers set for 24 VDC with a slow debounce filter.

Figure 1-1 shows the INFI 90 OPEN communication levels and the position of the digital input modules within these levels.

INTENDED USER

This instruction is written for engineers, technicians and system designers as a source of technical information on the IMDSI1□ digital input modules. This instruction should be used by those planning to purchase, install, operate, troubleshoot, maintain or replace these modules. Those working with the digital input modules should have experience working with and know the precautions to take around AC/DC power. A knowledge of the INFI 90 OPEN system and electronic principles is also required.

Table 1-2. Reference Documents

Number	Document
I-E92-501-2	Configuration and Tuning Terminal (CTT)
I-E96-192-1	Operation, 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/IMMFP03B)
I-E96-209	Logic Master Module (IMLMM02)
I-E96-211	IMMFC03 Multi-Function Controller
I-E96-212	IMMFC04 Multi-Function Controller
I-E96-213	IMMFC05 Multi-Function Controller
I-E96-424	Termination Unit (NTDI01)
I-E96-410	Termination Module (NIDI01)
WBPEEUI200501A0	Module Mounting Unit (IEMMU11/12/21/22)
WBPEEUI220756A0	Operation, Operator Interface Station (40 Series) IIOIS43

NOMENCLATURE

Table 1-3 contains the digital input module nomenclature used in this instruction.

Table 1-3. Nomenclature

Nomenclature	Description
IMDSI12	Digital input module (24 VDC, 48 VDC, 125 VDC or 120 VAC input)
IMDSI13	Digital input module (24 VDC input)
IMDSI14	Digital input module (48 VDC input)
IMDSI15	Digital input module (125 VDC or 120 VAC input)

RELATED HARDWARE

Table 1-4 contains related hardware associated with the IMDSI1□ digital input module.

Table 1-4. Related Hardware

Nomenclature	Description
IEMMU11/12/21/22	Module mounting unit
NIDI01	Termination module, digital input
NKTM01/02	Cable, termination module (PVC)
NKTU01	Cable, termination unit (PVC)
NKTU02	Cable, termination module (PVC)

Table 1-4. Related Hardware (continued)

Nomenclature	Description
NKTU11	Cable, termination unit (non PVC)
NKTU12	Cable, termination module (non PVC)
NTDI01	Termination unit, digital input

SPECIFICATIONS

Table 1-5 contains the specifications for the IMDSI1□ digital input module.

Table 1-5. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Power consumption</td><td>95 mA at 5 VDC (typical), 115 mA maximum</td></tr>
<tr><td>Overvoltage category on inputs</td><td>II, per IEC 1010-1</td></tr>
<tr><td>Digital inputs</td><td>16 channels
<table>
<tr><th colspan="4">IMDSI12</th></tr>
<tr><th>IMDSI13</th><th>IMDSI14</th><th colspan="2">IMDSI15</th></tr>
<tr><td>24 VDC</td><td>48 VDC</td><td>125 VDC</td><td>120 VAC</td></tr>
<tr><td>5.5 mA</td><td>4.7 mA</td><td>4.5 mA</td><td>4.8 mA</td></tr>
<tr><td>16.8 VDC</td><td>20.1 VDC</td><td>69.3 VDC</td><td>54 VAC</td></tr>
<tr><td>13 VDC</td><td>29 VDC</td><td>58 VDC</td><td>48 VAC</td></tr>
<tr><td>4 mA at 14.7 VDC</td><td>4 mA at 32 VDC</td><td>4 mA at 68.4 VDC</td><td>3 mA at 53.8 VAC</td></tr>
<tr><td>7 µA (at V_{in} ≤12 VDC)</td><td>10 µA (at V_{in} ≤12 VDC)</td><td>10 µA (at V_{in} ≤60 VDC)</td><td>10 µA (at V_{in} ≤60 VAC)</td></tr>
<tr><td colspan="4">17 ms (fixed)</td></tr>
</table>
Voltage (±10%)
Current
Turn-on voltage (min)
Tun-off voltage (max)
Maximum input current at minimum turn-on
Off-leakage current (max)
DC response time (debounce filter)</td></tr>
<tr><td>Communication interface</td><td>Passive contact input interface read by the MFP or logic master module (LMM) via the I/O expander bus</td></tr>
<tr><td>Mounting</td><td>Occupies one slot in a standard INFI 90 OPEN module mounting unit (IEMMU)</td></tr>
<tr><td>Environmental</td><td></td></tr>
<tr><td>Ambient temperature (per IEC 68-2-1, 2,14)</td><td>Temperature rating within the cabinet or enclosure applies. INFI 90 OPEN internal cabinet rating: 0° to 70° C (32° to 158° F)</td></tr>
<tr><td>Relative humidity (per IEC 68-2-3)</td><td>5% to 95% up to 55° C (131° F), noncondensing
5% to 45% at 70° C (158° F), noncondensing
Pollution degree: 1 (no condensation)</td></tr>
<tr><td>Atmospheric pressure</td><td>Sea level to 3 Km (1.86 miles)</td></tr>
<tr><td>Air quality (per ISA S71.04, Class LA, LB, LC - level 1)</td><td>Noncorrosive</td></tr>
</table>

Table 1-5. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Isolation
(IEC 1010-1, IEC 255, IEC 60)

Channel to channel and channel to logic</td><td>
<table>
<tr><th>Test</th><th>Common Mode</th><th>Normal Mode</th></tr>
<tr><td colspan="3">IMDSI12/15</td></tr>
<tr><td>Insulation resistance (100/500 VDC)</td><td>100 MΩ</td><td>N/A</td></tr>
<tr><td>Dielectric VAC (45 - 65 Hz) or VDC</td><td>1.4 kV rms/1min. or 1.95 kV DC/1min.</td><td>N/A</td></tr>
<tr><td>Impulse voltage (1.2/50 µS)</td><td>±2.55 kVp</td><td>±1 kVp</td></tr>
<tr><td colspan="3">IMDSI13/14</td></tr>
<tr><td>Insulation resistance (100/500 VDC)</td><td>100 MΩ</td><td>N/A</td></tr>
<tr><td>Dielectric VAC (45 - 65 Hz) or VDC</td><td>1 kV rms/1min. or 1.5 kV DC/1min.</td><td>N/A</td></tr>
<tr><td>Impulse voltage (1.2/50 µS)</td><td>±2 kVp</td><td>±1 kVp</td></tr>
</table>
</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>Voltage/current surge (1.2/50 µS to 8/20 µS) (IEC 1000-4-5, EN 61000-4-5)</td><td>±2 kVp</td><td>±1 kVp</td></tr>
<tr><td>Fast transient bursts (IEC 1000-4-4, EN 61000-4-4)</td><td>±2 kVp</td><td>N/A</td></tr>
<tr><td>Damped oscillatory wave, 0.1 MHz and 1 MHz (IEC 1000-4-12, EN 61000-4-12)</td><td>±2 kVp</td><td>±1 kVp</td></tr>
<tr><td>Ring wave (IEC 1000-4-12, EN 61000-4-12)</td><td>±2 kVp</td><td>±1 kVp</td></tr>
</table>

Electrostatic discharge (IEC 1000-4-2, EN 61000-4-2)
Contact: ±6 kV
Air: ±8 kV

Magnetic and electromagnetic fields

Power frequency magnetic field (IEC 1000-4-8, EN 61000-4-8)
Continuous: 30 A/m (rms)
Short duration: 300 A/m (rms)

Pulse magnetic field (IEC 1000-4-9, EN 61000-4-9)
Peak value: 300 A/m

Damped oscillatory magnetic field, 0.1 MHz and 1 MHz (IEC 1000-4-10, EN 61000-4-10)
Peak value: 30 A/m

Radiated radio-frequency electromagnetic field, 80 MHz to 1GHz (ENV 50140)
Unmodulated rms: 10 V/m
Amplitude modulated: 80% AM (1 kHz)

Radiated radio-frequency field, 900 ±5 MHz (ENV 50204)
Unmodulated rms: 10 V/m
Pulse modulated: Duty cycle 50%
Rep. cycle 200 Hz
</td></tr>
</table>

Table 1-5. Specifications

Property	Characteristic/Value
Magnetic and electromagnetic fields *(continued)*	
Radio-frequency common mode, amplitude modulated, 0.15 MHz to 80 MHz (ENV 50141)	Unmodulated rms: 10 V/m Amplitude modulated: 80% AM (1 kHz) Source impedance: 150 Ω
Emission test RF radiated fields, 30 MHz to 1000 MHz (ENV 55011)	Class A
CE Mark Declaration	This product, when installed in an INFI 90 OPEN cabinet, complies with the following directives/standards requested for CE marking:
EMC 89/336/EEC	EN50081-2 Generic Emission Standard - Part 2: Industrial Environment EN50082-2 Generic Immunity Standard - Part 2: Industrial Environment
Low Voltage Directive 73/23/EEC	EN 61010 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements
Certifications	
CSA (Canadian Standards Association)	Certified for use as process control equipment in an ordinary (non-hazardous) location per CSA C22.2 No. 1010.1-92
FM (Factory Mutual) (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

INTRODUCTION

This section explains the inputs and input circuitry, control logic, logic power and connections for the IMDSI1□ Digital Input modules. The DSI is a digital input interface to a multi-function processor (MFP), multi-function controller (MFC), or logic master module (LMM). These control modules provide the control functions. A control module communicates with its I/O modules on a I/O expander bus as shown in Figure 1-1. Each I/O module on the I/O expander bus has a unique address set by address dipswitch S1 (Fig. 2-1).

INPUTS

Digital field inputs are voltages of 24 VDC, 48 VDC, 125 VDC or 120 VAC rms. These voltages indicate an energized (ON) field device; a 0 volt input indicates a de-energized (OFF) field device. The DSI have a fixed input debounce filter for DC inputs to allow for contact debounce time (17 millisecond response time).

The IMDSI13 (+24 VDC) module and the IMDSI14 (+48 VDC) module have a fixed configuration and do not require any jumper selections. The IMDSI15 (+125 VDC/120 VAC) module has jumpers to select DC or AC mode. The IMDSI12 (+24, +48, +125 VDC or 120 VAC) module has jumpers to select the DC or AC mode and jumpers to select the working voltage. Refer to the Installation section for an explanation of the jumper connections.

> **NOTE:** Due to the number of pins on the P3 connector, twelve inputs are separate while the remaining two pairs share input terminals. The positive (+) side of point 7 and 8 are tied together in each group (refer to Table 5-3). These points must use the same contact voltage (24 VDC, 48 VDC, 125 VDC or 120 VAC) set by the jumpers on the IMDSI12 module, or according to the relevant IMDSI1□ module working voltage.

Input Circuits

Figure 2-1 is a block diagram illustrating signal flow through the module. The input isolation block consists of current limiters and optocouplers to isolate the 16 field inputs from the module circuitry. The input circuits provide 1500 VDC isolation between input and logic circuitry and other input channels. Refer to Table 1-5.

Digital input high impedance provides additional (passive) protection from high energy transients of field digital inputs.

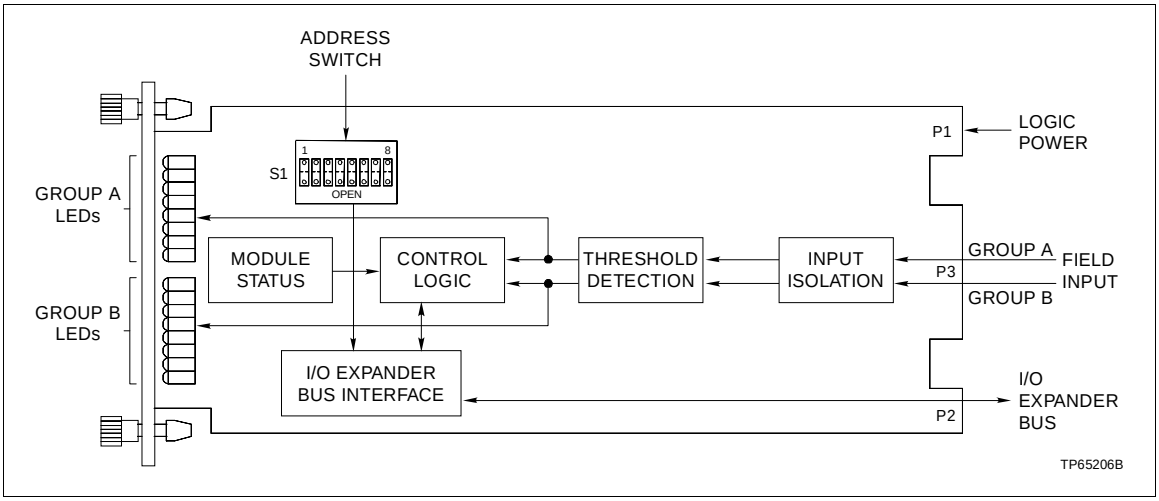


Figure 2-1. Digital Input Module Block Diagram

Input signal path and low isolation capacitance allow protection against fast transient-burst disturbance.

The threshold detection block circuits test the input voltage to determine if it is at the proper voltage level to indicate an ON or OFF state. The output of this comparator is sent to a read buffer in the control logic block. If an input is energized, it also causes a corresponding input status LED on the front panel to light.

The control logic block consists of buffers that hold the input and status byte values. The I/O expander bus interface allows the control module to read these bytes.

Input Circuit Description

When an input signal is present at the proper voltage level, a zener diode conducts (turns on) to cause current flow through an optocoupler. Configurable jumpers (on IMDSI12) or fixed resistors (on IMDSI13, IMDSI14 or IMDSI15) select the turn-on threshold and input voltage.

The optocoupler output causes a comparator output to go low. This lights a corresponding status LED on the module front panel to indicate an energized input; the I/O expander bus interface transmits a logic 1 to the control module on the I/O expander bus. When no input signal is present, no current flows through the optocoupler. The front panel LED does not light and the DSI transmits a logic 0 on the bus. Figure 2-2 shows the digital input circuit.

NOTE: The components inside the dashed boxes in Figure 2-2 are mounted only on the module versions stated in the note.

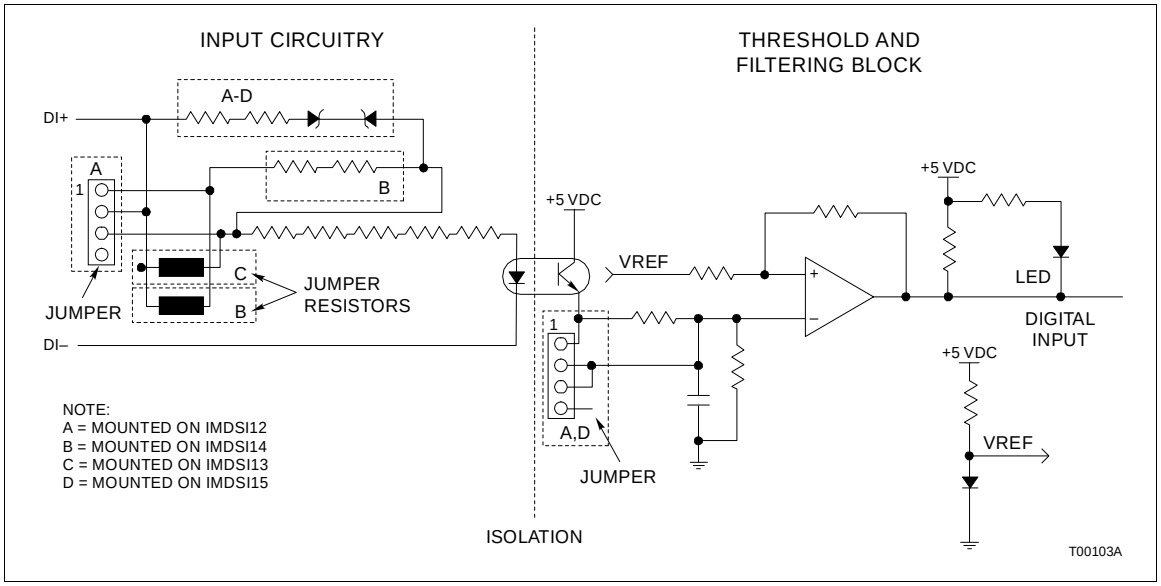


Figure 2-2. Digital Input Module Circuitry

Input Circuit Connections

The contact input signals connect to the 30-pin card edge connector (P3), shown in Figure 2-1, using a termination cable from a termination unit or termination module.

CONTROL LOGIC

Function Code (FC) 84 in the control module configuration accesses the DSI on the I/O expander bus. It also allows the control module to automatically read point (input) data or status data from the DSI. This data is output by the buffer circuits (control logic) to the I/O expander bus interface (Fig. 2-1). The I/O address in FC 84 must be the same as the address set on address dipswitch (S1).

Point Data Byte

Point data is two 8-bit bytes. Each byte corresponds to group A or group B inputs. Each bit of data represents one input. The bit value reflects the state of that input, either open (logic 0) or closed (logic 1).

Status Byte

The status byte ensures module integrity. It makes sure I/O expander bus communication and control module configuration are correct. The control module reads the status byte and compares it to an expected value. If a mismatch occurs, it flags the error and marks the point as bad quality.

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

Before installation, set the module S1 address switch and install jumpers to configure the digital inputs. Configure the termination unit (TU) or termination module (TM) to accept the field device signals.

Address Selection Switch (S1)

The DSI 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 84 specification S1).

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

Digital Input Jumper Settings

The IMDSI13 and IMDSI14 modules have fixed configurations, thus no jumper settings are required. The IMDSI12 (24/48/125 VDC or 120 VAC) module requires jumper settings for both the working voltage and the DC or AC mode selections. The IMDSI15 (125 VDC/120 VAC) module requires jumper settings for the DC or AC mode selection.