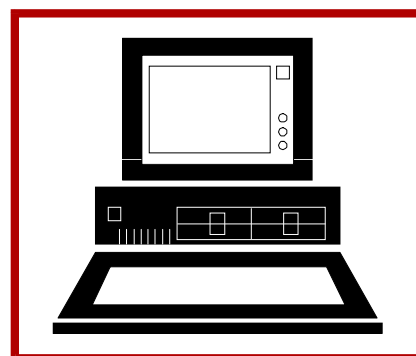
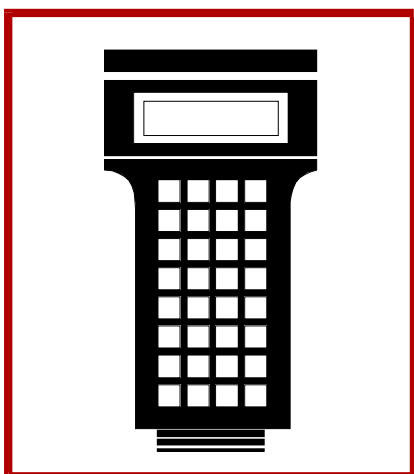
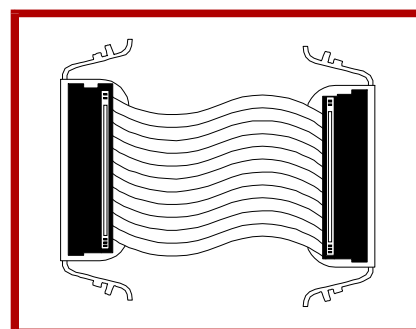
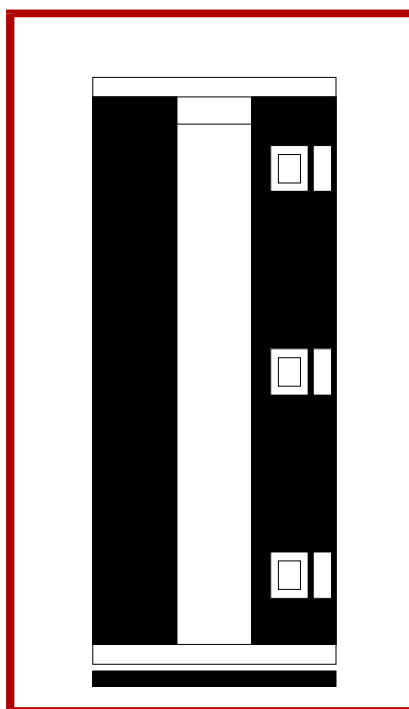
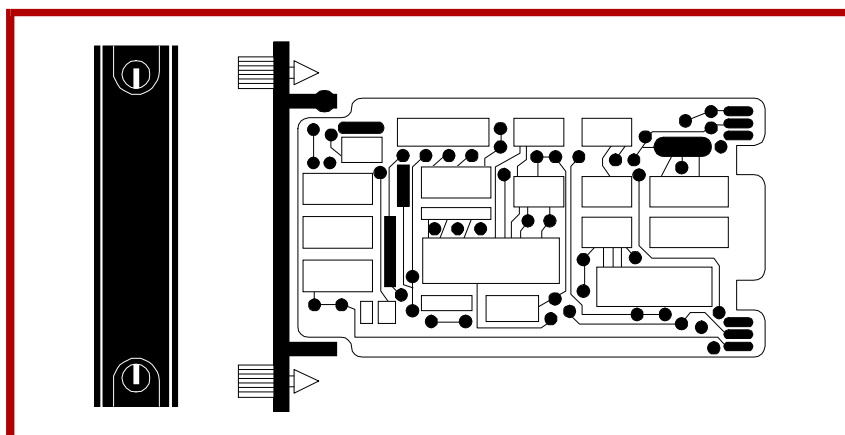
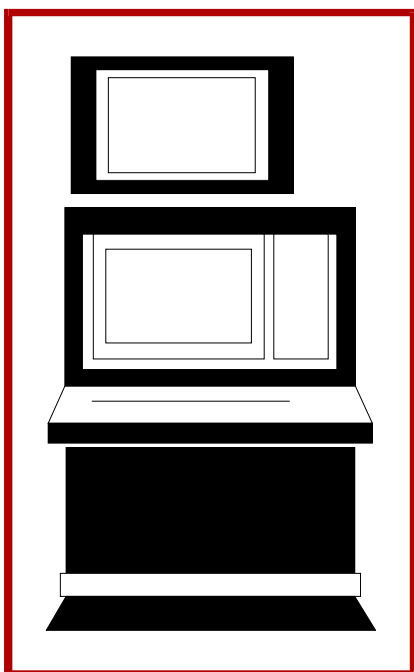


E96-308

Bailey®  
**infi 90**

# Instruction

## Pulse Input Slave Module (IMDSM04)



**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 **Elsag Bailey** 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.

## AVERTISSEMENT

### MANUELS D'OPÉRATION

NE PAS METTRE EN PLACE, RÉPARER OU FAIRE FONCTIONNER L'ÉQUIPEMENT SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS RÉGLEMENTAIRES DE **Elsag Bailey**. TOUTE NÉGLIGENCE À CET ÉGARD POURRAIT ÊTRE UNE CAUSE D'ACCIDENT OU DE DÉFAILLANCE DU MATÉRIEL.

### PERTURBATIONS PAR FRÉQUENCE RADIO

LA PLUPART DES ÉQUIPEMENTS ÉLECTRONIQUES SONT SENSIBLES AUX PERTURBATIONS PAR FRÉQUENCE RADIO. DES PRÉCAUTIONS DEVRONT ÊTRE PRISES LORS DE L'UTILISATION DU MATÉRIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRÉCAUTIONS À PRENDRE DANS CE CAS SOIENT SIGNALÉES AUX ENDROITS VOULUS DANS VOTRE USINE.

### 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 MATÉRIELS.

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## Preface

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The Pulse Input Slave Module (IMDSM04) is an interface used to bring eight separate process field signals into the Infi 90 process management system. These pulse inputs are used by master modules to monitor and control a process.

This instruction explains the slave module features, specifications and operation. It details the procedures you must follow to set up and install an IMDSM04 module, and explains status indicators that help in system test and diagnosis.

The system engineer or technician using the IMDSM04 should read and understand this instruction before installing and operating the slave module. In addition, a complete understanding of the Infi 90 system is beneficial.

## List of Effective Pages

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

<b>Page No.</b>	<b>Change Date</b>
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 3-7	Original
4-1	Original
5-1 through 5-2	Original
6-1	Original
7-1	Original
8-1	Original
A-1 through A-3	Original
B-1 through B-3	Original

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

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

## Safety Summary

---

**GENERAL  
WARNINGS****Equipment Environment**

All components, whether in transportation, operation or storage, must be in a noncorrosive environment.

**Electrical Shock Hazard During Maintenance**

Disconnect power or take precautions to insure that contact with energized parts is avoided when servicing.

**Special Handling**

This module uses Electrostatic Sensitive Devices (ESD).

**SPECIFIC  
WARNINGS**

Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock. (p. 3-6)

**SPECIFIC  
CAUTIONS**

Damage to the DSM may result if you select voltage range 1 for an input using a preamplifier. (p. 3-4)

---

## 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**

Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire morelles. (p. 3-6)

**ATTENTIONS  
D'ORDRE  
SPÉCIFIQUE**

La selection de la gamme 1 de tension dans le cas d'une entree utilisant un preamplificateur pourrait entrainer des dommages au module DSM. (p. 3-4)

---

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# SECTION 1 - INTRODUCTION

## OVERVIEW

The Pulse Input Slave Module (IMDSM04) brings eight separate pulse signals into the Infi 90 system for processing and monitoring. It interfaces process field inputs with the Infi 90 Process Management System. Master modules provide the control functions; slave modules provide I/O to the master modules.

This manual explains the purpose, operation and maintenance of the Pulse Input Slave Module (DSM). It addresses handling precautions and installation procedures. Figure 1-1 illustrates the Infi 90 communication levels and the position of the DSM module within these levels.

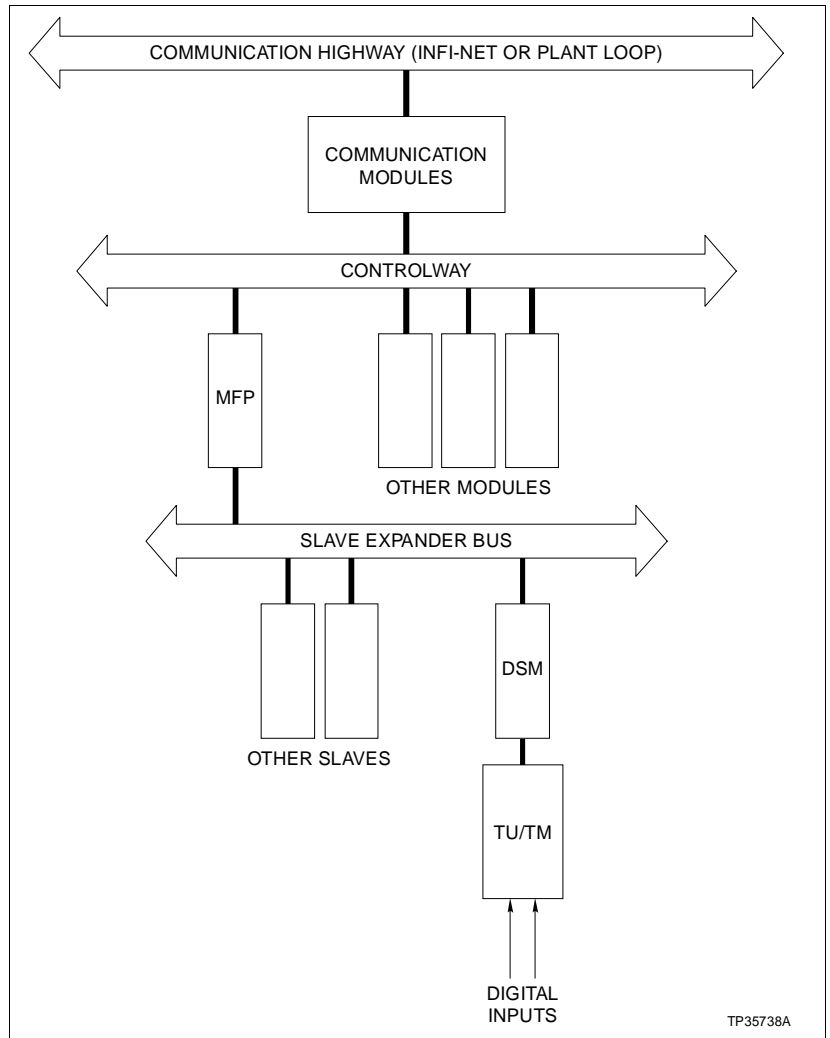


Figure 1-1. Infi 90 Communication Levels

---

**INTENDED USER**

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

---

**MODULE DESCRIPTION**

The DSM has a single printed circuit board that occupies one slot in a Module Mounting Unit (MMU). Two captive screws on the module faceplate secure the DSM to the MMU. The slave module has three card edge connectors for external signals and power (P1, P2 and P3). P1 connects to common (ground) and +5 VDC power (refer to Table 5-1). P2 connects the module to the slave expander bus to communicate with a master module (refer to Table 5-2). The pulse signals input through connector P3 using a cable connected to a Termination Unit (TU) or Termination Module (TM) (refer to Table 5-3). The terminal blocks (physical connection points) for field wiring are on the TU/TM.

Each input can respond to either 4 to 6 VDC or 21.6 to 27 VDC and either the rising or falling edge of the signal. In addition, channels 1 and 2 can be routed through preamplifiers so they can respond to inputs from 50 mV (peak to peak) to 10 V (peak to peak).

The DSM set up information goes into an MFP using function codes. Use either a configuration tuning module or an operator interface unit. Function codes start the three modes of DSM operation. The three operating modes are: Totalize, Frequency, or Period. Configure the MFP to set the DSM inputs for one of these modes. Refer to **Section 4** for more information.

---

**FEATURES**

The DSM is an active interface device that supplies data to the Infi 90 Multi-Function Processor (MFP). The DSM conditions, converts and processes pulse inputs such as low level amplitude pulses, sinewaves, logic level pulses, or contact closures into digital signals. Applications for the DSM include: turbine flowmeters, tachometers, Wattmeters, proximity sensors and counters. One slave provides eight independent pulse or frequency inputs to the master module. The input signals are optically isolated. The DSM also Interfaces to existing Network 90 Multi-Function Controllers (MFCs).

The modular design of the DSM, as with all Infi 90 modules, allows for flexibility when you are creating a process management system strategy. It can bring eight separate pulse signals in three voltage ranges. Two ranges are 4 to 6 VDC and 21.6 to 27 VDC (the 21.6 to 27 VDC range allows connection of dry

contact inputs). The third range is input to the preamplifiers on channels 1 and 2 (for low level pulse inputs between 50 millivolts and 10 Volts peak to peak). The DSM connects inputs to the Infi 90 system without separate converters.

You can select individual voltage and response time with jumpers on the module to configure each input. Selectable response times (fast or slow) allow the Infi 90 system to compensate for process field device debounce time.

The slave provides 16 bit resolution in the input channels for frequencies up to 50 kilohertz. It makes high resolution measurements of low frequency signals at selected rates for periods between 20 microseconds and 655 x 10<sup>3</sup> seconds. The slave can count the number of rising or falling edges of input signals and measure the time between the pulse edges. Refer to [Section 2](#) for more information.

---

## INSTRUCTION CONTENT

This manual has eight sections.

<b>Introduction</b>	Is an overview of the DSM: Features, description and specifications.
<b>Description and Operation</b>	Explains the module operation and input circuitry.
<b>Installation</b>	Describes precautions to observe when handling DSM modules and setup procedures required before module operation. This section also discusses switch and jumper settings, and installation procedures.
<b>Operating Procedures</b>	Explains the start-up of the slave module.
<b>Troubleshooting</b>	Describes the error indications and corrective actions to take.
<b>Maintenance</b>	Has a maintenance schedule for the slave module.
<b>Repair/Replacement Procedures</b>	Describes how to replace a slave module.
<b>Support Services</b>	Provides replacement part ordering information. It explains other areas of support that Bailey Controls provides.

---

## HOW TO USE THIS MANUAL

Read this manual before handling the DSM module. Refer to the sections in this list as needed for more information.

1. Read [Section 4](#) before you connect the IMDSM05.
2. Read and do the steps in [Section 3](#).

3. Refer to **Section 5** for what to do if a problem occurs.
4. Refer to **Section 6** for the scheduled steps needed to maintain the DSM.
5. Refer to **Section 7** for how to replace a module.
6. Refer to **Section 8** for how to order parts. This section also describes some of the services Bailey Controls offers.

---

## GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
<b>Configuration</b>	A control strategy with function blocks.
<b>Controlway</b>	A redundant peer-to-peer communication path for point data transfer between intelligent modules within a process control unit.
<b>Digital</b>	A discrete input signal having only on and off states.
<b>Dipshunt</b>	Dual in-line package with shorting bars.
<b>Dipswitch</b>	A dual in-line package that contains single pole switches.
<b>EWS</b>	Engineering Work Station; an integrated hardware and software personal computer system for configuring and monitoring Infi 90 modules and systems.
<b>Function Code</b>	An algorithm that defines specific functions. These functions link together to form the control strategy.
<b>LED</b>	Light Emitting Diode; the module front panel indicator that shows status and error messages.
<b>LSB</b>	Least Significant Bit; the bit of a binary number that carries the least numerical weight.
<b>Master Module</b>	One of a series of controller modules designed to direct field processes through a slave module. The Multi-Function Processor is an example.
<b>MFP</b>	Multi-Function Processor Module; a multiple- loop controller with data acquisition and information processing capabilities.
<b>MMU</b>	Module Mounting Unit; a card cage that provides electrical and communication support for Infi 90 modules.
<b>MSB</b>	Most Significant Bit; the bit of a binary number that carries the most numerical weight.
<b>OIS</b>	Operator Interface Station; integrated operator console with data acquisition and reporting capabilities. It provides a window into the process for flexible control and monitoring.
<b>PCU</b>	Process Control Unit; rack type industrial cabinet that contains master, slave and communication modules, and their communication paths.

**GLOSSARY OF TERMS AND ABBREVIATIONS** (continued)

<b>Term</b>	<b>Definition</b>
<b>Pulse Inputs</b>	Pulse inputs for the IMDSM04 may be low level amplitude pulses, sinewaves, logic level pulses, or contact closures into digital signals. Examples are: turbine flowmeters, tachometers, Wattmeters, proximity sensors and counters.
<b>Slave Expander Bus</b>	Parallel address/data bus between the master module and the slave.
<b>TM</b>	Termination Module: Provides input/output connection between plant equipment and the Infi 90 process modules. The termination module slides into a slot in the termination mounting unit.
<b>TU</b>	Termination Unit: Provides input/output connection between plant equipment and the Infi 90 process modules. The termination unit is a flat circuit board for panel mounting.

**REFERENCE DOCUMENTS**

<b>Document Number</b>	<b>Document</b>
I-E96-201	Multi-Function Processor (IMMFP01)
I-E96-202	Multi-Function Processor (IMMFP02)
I-E96-209	Logic Master Module (IMLMM02)
I-E93-911	Termination Unit Manual
I-E96-110	Operator Interface Station
I-E96-701	Engineering Work Station
I-E92-501-2	Configuration and Tuning Terminal
I-E93-900-20	Function Code Application Manual

**NOMENCLATURE**

The following modules and equipment can be used with a DSM module:

<b>Nomenclature</b>	<b>Hardware</b>
IMMFP01/02/03	Multi-Function Processor Module
NIDI01	Termination Module, Digital Inputs
NTDI01	Termination Unit, Digital Inputs
NKTM01	Cable, Termination Module
NKTU02	Cable, Termination Module
NKTU01	Cable, Termination Unit

## SPECIFICATIONS

<b>Power Supply</b>	
Voltages:	$\pm 5$ VDC Logic Supply $\pm 5\%$ $\pm 24$ VDC I/O Supply + 12%, -10%
Current Consumption:	5 VDC                    1.4 Amps typical, 1.5 Amps maximum 24 VDC                    62 mA typical, 70 mA maximum
<b>Inputs</b>	
Input Voltages:	Range 1, 5 VDC Supply: 4.0 VDC to 6.0 VDC Range 2, 24 VDC Supply: 21.6 VDC to 27.0 VDC Range 3, Preamplifiers: 50 mV (peak to peak) to 10 V (peak to peak)
Max. Input Signal Current at Max. Input Voltage:	Range 1: 14.8 mA at 6 VDC Range 2: 8.4 mA at 24 VDC Range 3: 0.4 mA at 10 V (peak to peak)
Logic 1 Input Voltages:	Range 1: 4 VDC minimum, 6 VDC maximum Range 2: 21.6 VDC minimum, 27 VDC maximum Range 3: 25.0 mV peak minimum, 5 V peak maximum
Logic 0 Input Voltages:	Range 1: 0 V minimum, 1.0 V maximum Range 2: 0 V minimum, 2.0 V maximum Range 3: -5 V peak in., -25.0 mV peak maximum
<b>Debounce Times</b>	ON time 8.5 milliseconds (typical) OFF time 8.5 milliseconds (typical)
<b>Input Signal Frequency Limit</b>	Upper frequency limit for using debounce: 40Hz
<b>Mode Accuracy</b>	Totalize: $\pm 0$ Counts Frequency Count: $\pm 1$ Count Period Determination: $\pm 1$ Count
<b>Maximum Input Frequency</b>	50 kHz (at 50% duty cycle)
<b>Timebase Accuracy</b>	$\pm 0.033\%$
<b>Isolation Voltage</b>	150 V RMS channel to channel 350 V RMS inputs to logic
<b>Surge Withstand</b>	Meets requirements of IEEE Surge Capability Standard 472-1974, on all debounced inputs  <b>NOTE:</b> If you select a preamplifier for a channel, the counter associated with that channel may increment during surge pulsing.
<b>Mounting</b>	Uses 1 slot in Infi 90 Module Mounting Unit.
<b>Environmental</b>	
Electromagnetic/ Radio Frequency Interference	No values available at this time. Keep cabinet doors closed. Do not use communication equipment closer than 2 meters from the cabinet.
Ambient Temperature	0° to 70° C (32° to 158° F)
Relative Humidity	5% to 95% up to 55° C (131° F) (non-condensing) 5% to 45% at 70° C (158° F) (non-condensing)
Atmospheric Pressure	Sea level to 3 km (1.86 miles)
Air Quality	Noncorrosive
<b>Certification</b>	CSA certified for use as process control equipment in an ordinary (nonhazardous) location.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

## SECTION 2 - DESCRIPTION AND OPERATION

### INTRODUCTION

This section explains the inputs and input circuitry, control logic, logic power and connections for the Pulse Input Slave Module (DSM). The DSM is a digital input interface to a Multi-Function Processor (MFP) module. The slave has eight pulse input circuits that condition process signals, see Figure 2-1. Input signals are processed, stored and sent to the master module. The master module communicates with its slave module on a 12-line slave expander bus shown in Figure 2-2. Each slave on the slave expander bus has a unique address set by the slave address dipswitch.

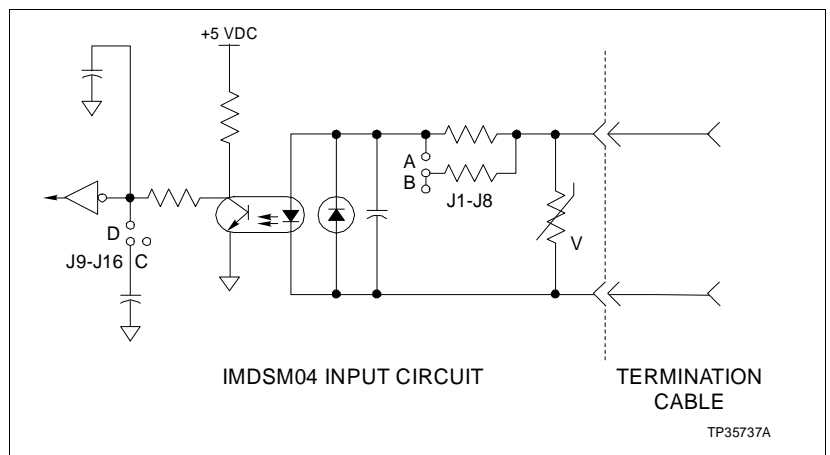


Figure 2-1. Input Circuit

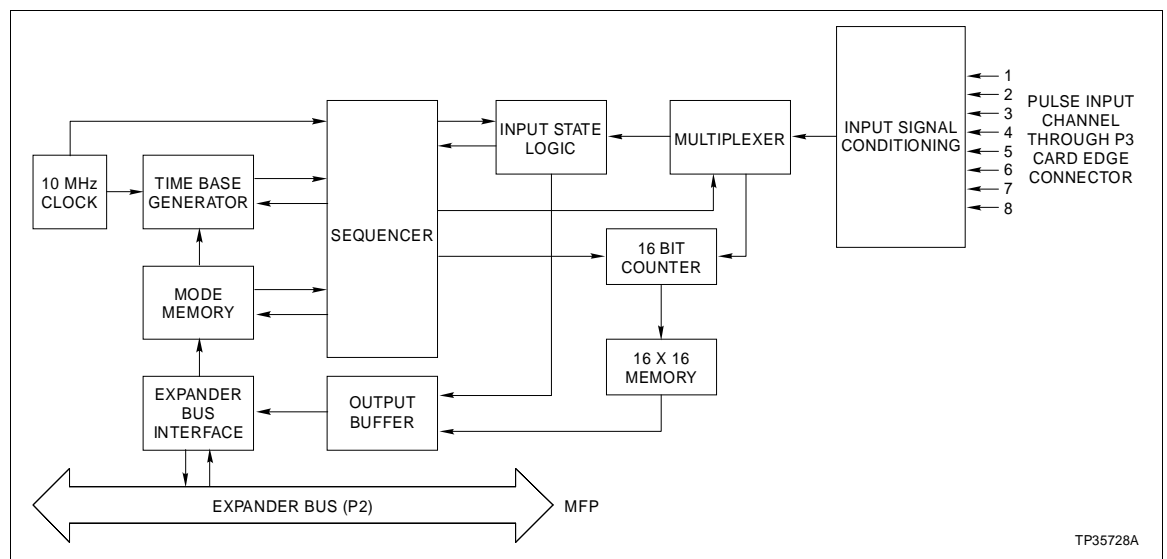


Figure 2-2. Module Block Diagram



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## OPERATING MODES

After installing the DSM, enter the module address and the input specifications into the MFP along with the normal operating configuration. Use either an Engineering Work Station (EWS), Operator Interface Station (OIS), Configuration Tuning Module (CTM) or a Configuration Tuning Terminal (CTT). Enter the DSM specifications into a MFP using the appropriate function codes for the three modes of DSM operation. The three operating modes are: **Totalize** (FC 104), **Frequency** (FC 103), or **Period** (FC 102). Configure the MFP to set the DSM inputs for one of these modes.

---

### *Totalize Operating Mode*

In Totalize mode, the DSM counts the total number of pulses of an input up to 65,534 or until the master resets the counter. The MFP module sends a request to the DSM (at a user specified rate). The slave replies with a running total of the number of input pulses it has accumulated for each channel in the totalize mode. The MFP can read a channel or read and reset a channel.

---

### *Frequency Operating Mode*

In Frequency mode, the DSM counts the number of input pulses or cycles that occur in a preset period on a channel. The measurement range is 0.15 millihertz to 50 kilohertz, selectable in one of 5 range segments. The range segments are specified by the function code parameters. The DSM reads the value and sends it to the MFP when the MFP sends a request. The resolution of the DSM depends on your application.

---

### *Period Operating Mode*

In Period mode, the DSM will count the number of time-base pulses that occur during the period of an input pulse. Each input channel can use a different time-base clock to measure the period of the input signal. The time-base pulses may be set to 0.1 millisecond, 1.0 millisecond, 10 milliseconds, 0.1 second, 1.0 second, or 10 seconds. The resolution of the DSM depends on your application.

---

## INPUT MODES

Each of the eight input channels can be set to one of two possible modes. A third mode is possible for channels 1 and 2 in which the inputs may be routed to preamplifiers on the DSM to sense low level signals. The three modes are: externally powered normal logic level input, internally powered contact input and low level input (only on channels 1 and 2).

---

***Externally Powered Normal Logic Level Input Mode***

Set up the externally powered normal logic level input mode with self powered input circuits isolated from the pulse processing circuits. There are two available ranges that may be set by jumpers J1 through J8 on the module. Range 1 is 4.0 VDC to 6.0 VDC and range 2 is 21.6 VDC to 27 VDC.

---

***Internally Powered Contact Input Mode***

The 24 VDC input and output power supply uses the internally powered contact input mode. It is used to sense open and closed conditions in the input circuit. Set up this mode by making proper dipshunt connections on the termination unit. Voltage range 2 must be selected on the module for this mode.

---

***Low Level Input Mode***

The Low Level input mode (only for channels 1 and 2) detects differential input voltage. Voltages can range from 50 millivolts (p-p) to 10 Volts (p-p). Set voltage ranges by routing the inputs through preamplifiers. Switch the preamplifiers in or out with slide switches S2 and S3 on the DSM. An input voltage of 25 millivolts or more is a logic one in the module, and a voltage of less than -25 millivolts is a logic 0. To select this range you also must select range 2.

The input isolation block has current limiters and optocouplers to isolate the sixteen field inputs from the module circuitry. All inputs pass through high-speed, open collector, opto-isolators. The input signals go through the Schmitt-trigger inverters to enhance the pulse definition.

Between the opto-isolators and the inverters are RC circuits that produce an 8.5 millisecond debounce time delay. Connect jumpers J9 through J16 for the time delay. The input circuits provide 350 Volts RMS isolation between input and logic circuits, and 150 Volts RMS isolation between input channels.

The DSM can be divided into functional modules, see Figure 2-2. These modules provide the control functions in the DSM.

---

***MODULE DESCRIPTION***

Figure 2-2 shows the DSM block diagram to illustrate signal flow through the module. The input circuits connect to the termination unit that connects them through the termination unit cable to the P3 edge connector on the DSM.

---

**Multiplexer and Input State Circuitry**

The eight conditioned input signals from the Schmitt-trigger inverters are time-division multiplexed to use a single 16-bit counter. A channel counter increments the multiplexer. Each channel processes in turn every 7.2 microseconds (every 7.8 microseconds if a slave expander bus transaction takes place). The channel counter spends about 900 nanoseconds processing each input before moving onto the next channel.

When the multiplexer selects a channel, an 8-bit shift register stores the input state (0 or 1). The register shifts for each channel sample. The 8-bit register will hold the previous input state for each complete count. The MFP may read the present input state.

---

**Time Base Generation**

The six time-base signals generated here are multiplexed for greatest resolution for the sampled input. The choice recorded in the mode memory determines the time-base signal selected. Present and previous time-base pulse states are stored for use in determining count completion.

---

**Slave Expander Bus Interface**

The expander bus interface translates the 8-bit bidirectional expander bus into two 8-bit unidirectional internal busses; one input and one output. Information is communicated over the expander bus by sending either three or five bytes in sequence depending on the operation. The operations that the MFP can request from the DSM are: read module type status, read input states, write channel configuration, read channel and reset and read channel.

The expander bus interface receives an 8-bit module address from the MFP and compares it to the address set on S1. If the addresses match, then the module will respond to the bytes that follow. If the function code byte specifies a read operation, the interface will send the selected information from the output buffer.

---

**Count and Output Memory**

There is only one 16 bit counter. All 8 input channels share the counter. A 16-bit memory location stores the count value associated with each channel. The memory (count memory) takes up one-half of a 16 x 16 memory array made up of four RAM memory chips.

The other half the memory array (output memory) stores the final or total accumulated count. Whenever the MFP reads a

channel, the 16-bit count value in output memory for that channel is transferred into an output buffer comprised of two output memory buffer chips.

The output buffer is enabled at the appropriate time to place the count value into the expander bus. If the operation is a reset-read, after transferring the count value, the buffer clears both the count memory and the output memory for that channel. The count will be flagged as invalid if the count is not complete. The count will not be valid until at least one input pulse is complete, but will always be valid by the end of the second pulse.

---

***Mode Memory***

The mode memory stores the information that determines how each input is to be handled. Each input can be set for one of three modes: totalization, frequency or period. The mode for an input can be set so that the circuitry counts on either the rising or falling part of the signal. The frequency mode can be set for three ranges and the period mode can be set for one of six ranges.

The mode memory occupies one-half of an 8 x 16 memory array. The other half is the data valid memory. The array stores the information here necessary to decide if the data valid bit should be set or not.

---

***Sequencer***

Three programmable array logic integrated circuits (ICs) make up the sequencer. The sequencer is the control center for the DSM. It provides all the timing signals needed by the other circuit blocks.

---

***Inputs***

Digital field inputs are voltages of either 4 to 6 VDC, 21.6 to 27 VDC, 50 millivolts and 10 Volts (peak to peak). These voltages indicate an energized (ON) field device; a 0 Volt input indicates a de-energized (OFF) field device. Jumpers on the DSM select the voltage level and debounce for each input. The Installation section explains the jumper connections.

---

***Input Section***

The field inputs connect to the termination unit. It sends them through the termination unit cable to the P3 edge connector on the DSM. Each of the eight input channels can be set to one of two possible modes. A third mode is possible for channels 1 and 2. Inputs may be routed to preamplifiers on the DSM to sense low level signals. The Installation section covers the specific connections needed for each mode.

---

**Power Supply**

The MMU supplies +5 VDC power for digital circuitry to connector P1. If input 1 or 2 uses a preamplifier, then the 24 VDC I/O supply must be connected to the E1 terminal of the termination unit. That power goes to the DSM through the termination cable to edge connector P3.

---

**Connector Functions**

The DSM has 3 standard edge connectors along the rear of the circuit board. The 12 pin connector (P1) supplies the module's +5 VDC logic power from the MMU backplane. The 12 pin connector on the lower side of the module is (P2). It connects the DSM04 to the expander bus through a 12 strap dipshunt mounted on the MMU backplane. The 8 input signals flow into the 30 pin connector (P3) through a termination unit cable from the termination unit.

---

## SECTION 3 - INSTALLATION

---

### **INTRODUCTION**

This section explains what you must do before you put the Pulse Input Slave Module (IMDSM04) into operation. **DO NOT PROCEED** with operation until you read, understand and do the steps in the order in which they appear.

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

---

### **SPECIAL HANDLING**

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

The Pulse Input Slave Module (DSM) uses electrostatic sensitive devices. Follow Steps 1 through 4 when handling:

1. Keep the module in its special anti-static bag until you are ready to install it in the system. Save the bag for future use.
2. Ground the anti-static bag before opening.
3. Verify that all devices connected to the module are grounded before using them.
4. Avoid touching the circuitry when handling the module.

---

### **UNPACKING AND INSPECTION**

1. Examine the hardware immediately to check for damage in transit.
2. Notify the nearest Bailey Controls Sales Office of any such damage.
3. File a claim for any damage with the transportation company that handled the shipment.
4. Use the original packing material and container to store the hardware.
5. Store the hardware in an environment of good air quality, free from temperature and moisture extremes.

SETUP

Before installation, set the address of the DSM and install jumpers to configure the inputs. Configure the Termination Unit (TU) or Termination Module (TM) to accept the field device signals. Figure 3-1 shows the positions of the switches and jumpers on the DSM circuit board:

- Module address switch.
- Preamp select switches S2 and S3.
- Voltage select jumpers J1 through J8.

**Slave Address Selection Switch (S1)**

The DSM is a high power slave. You can use up to 20 high power slaves per master module connected to the slave expander bus.

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

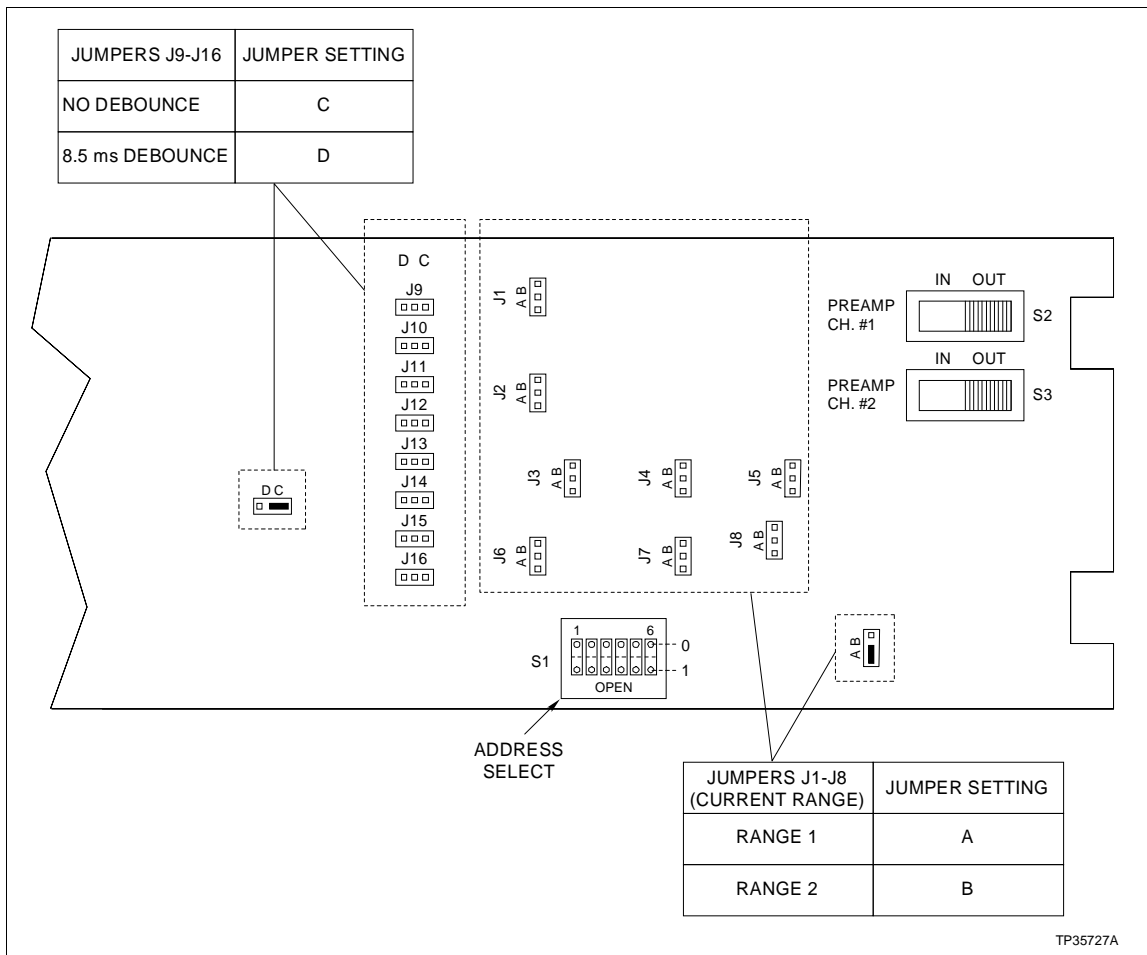


Figure 3-1. Switches and Jumpers

Set the address through 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 address. The unused positions (1 and 2) remain in the closed position (see Figure 3-1). Table 3-1 is a binary address conversion table for setting S1.

Table 3-1. Address Switch Settings (MFP/LMM)

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



**Setting Preamp Select Switches S2 and S3**

Use switches S2 and S3 to route the channel 1 and channel 2 inputs through preamplifiers on the DSM. S2 and S3 route low level input signals. With a preamplifier switched in, the respective input will register a logic 1 for a differential voltage of 25 millivolts peak, and allows inputs of up to 5 volts peak. Figure 3-1 shows the position of S2 and S3 on the DSM. To use a preamplifier for an input, move its slide switch to the in position, shown in Figure 3-1. S2 switches the preamplifier in or out of input channel 1 and S3 switches the preamplifier in or out of input channel 2.

If you switch the preamplifiers into either input, select range 2 with the voltage selection jumper for that input channel. The 24 volts DC I/O power must be connected to the termination unit as described in the appendix for the termination unit used.

<b>CAUTION</b>	<b>Damage to the DSM may result if you select voltage range 1 for an input using a preamplifier.</b>
<b>ATTENTION</b>	<b>La selection de la gamme 1 de tension dans le cas d'une entree utilisant un preamplificateur pourrait entrainer des dommages au module DSM.</b>

**Input Jumper Settings**

Jumpers J-1 through J-8 set the input voltage levels and jumpers J-9 through J-16 set the DC voltage response time (speed). The DC inputs have two propagation (speed) choices to allow for debounce time: a slow response setting (8.5 millisecond debounce time) or fast response setting (no debounce time). There are three terminals at each jumper location. Refer to Tables 3-2 and 3-3 to select the jumper settings for your application; place a jumper across the pins shown in the table. Figure 3-1 shows the location of the jumpers on the DSM.

*Table 3-2. Voltage Jumpers Selections*

Input Channel	Jumper	Range 1 Connection	Range 2 Connection
1	J1	A	B
2	J2	A	B
3	J3	A	B
4	J4	A	B
5	J5	A	B
6	J6	A	B
7	J7	A	B
8	J8	A	B

Range 1: logic 0 = 0 to 1 VDC; logic 1 = 4 to 6 VDC  
 Range 2 : logic 0 = 0 to 2 VDC; logic 1 = 21.6 to 27 VDC

Table 3-3. Debounce Jumpers Selections

Input Channel	Jumper	No Debounce Connection	Debounce Connection
1	J9	C	D
2	J10	C	D
3	J11	C	D
4	J12	C	D
5	J13	C	D
6	J14	C	D
7	J15	C	D
8	J16	C	D

---

**Connecting Voltage Selection Jumpers**

There are two input voltage ranges to select by jumpers J1 through J8. Range 1 will register a logic 1 for an input of 4 VDC up to 6 VDC. Range 2 will register a logic 1 input for a voltage level of 21 VDC to 27 VDC. The jumpers are plastic blocks that fit onto posts on the DSM board. Complete the jumper connections by putting the jumpers onto the two pins closest to the desired letter on the circuit board. See Figure 3-1. Table 3-2 lists the possible jumper connections.

---

**Connecting Debounce Jumpers**

Jumpers J9 through J16 allow connection of a RC circuit into an input circuit to slow its response time. This is useful to prevent false triggering from switched inputs due to bounce. An input that has a jumper in the debounce position will have a delay to an input transition of about 8.5 milliseconds. This delay restricts input frequencies to about 40 Hertz.

Figure 3-1 shows the position of the jumpers on the DSM. Table 3-3 lists the Jumper connections.

---

**Termination Unit/Module Configuration**

A TU/TM connects the field device wiring to the Infi 90 system. The TM/TU has the terminal blocks (connection points).

You must configure the TU/TM to accept the field inputs sent to the DSM module. Refer to [Appendix A](#) or [Appendix B](#) to select the configuration for your application.

---

### Physical Installation

**NOTE:** The Installation section provides instructions about the physical installation of the slave only. For complete cable and TU/TM information, refer to Termination Unit Manual I-E93-911.

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

1. Verify the slot assignment of the module.

#### WARNING

**Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock.**

#### AVERTISSEMENT

**Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire morelles.**

2. Verify that a dipshunt is in the slave expander bus socket on the MMU backplane between the slave and master module.
3. Connect the hooded end of the termination cable from the TU/TM to the MMU backplane. To do this, insert the connector into the backplane slot in the same slot as the one assigned to the slave module. The latches should snap securely into place.
4. Align the module with the plastic guide rails in the MMU. Carefully slide the module in until the front panel is flush with the top and bottom of the MMU frame.
5. Tighten the two captive retaining screws on the module face plate. (To remove the module, unscrew the module retaining screws and gently slide out).

---

### WIRING CONNECTIONS AND CABLING

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

---

#### Wiring

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

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

**Cable Connections**

The DSM uses either a NTDI01 or NIDI01 for termination. See Figure 3-2 to find the cables to use with the TU/TM you are using.

**FUSING**

The DSM does not have any on board fusing requirements.

**PRE-OPERATING ADJUSTMENTS**

You do not have to make any adjustments to the DSM before operating.

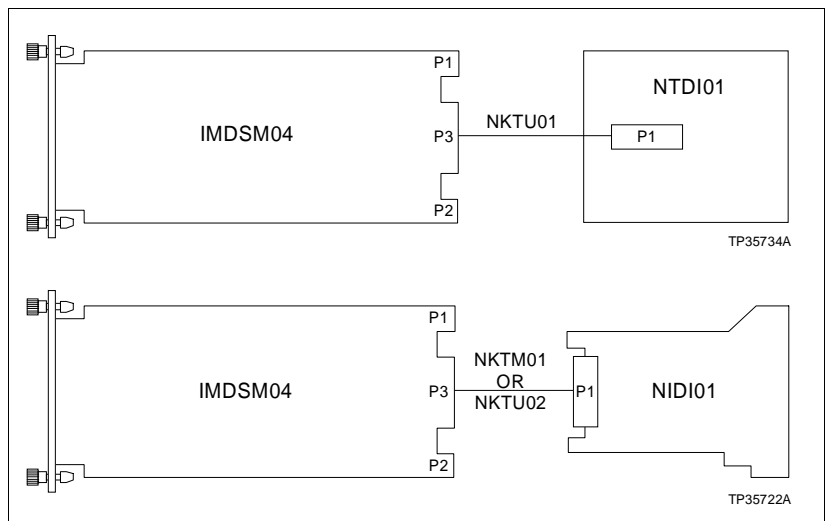


Figure 3-2. IMDSM04 Cable Connections

---

## SECTION 4 - OPERATING PROCEDURES

---

### *INTRODUCTION*

This section explains the start-up for the Pulse Input Slave Module (IMDSM04).

---

### *START-UP*

After installing the DSM, enter the module address and the input specifications into the MFP with the normal setup values. To enter the specifications, use either an Engineering Work Station (EWS), Operator Interface Station (OIS), Configuration Tuning Module (CTM) or a Configuration Tuning Terminal (CTT). Enter the DSM specifications into an MFP with function code 102 for the PERIOD mode, 103 for the FREQUENCY mode and 104 for the TOTALIZATION mode. Refer to Function Code Reference Manual (I-E93-900-20) for the specifications that must be entered. Most of these specifications are self explanatory.

When using the frequency mode, there are six ranges available. The output of the DSM is the number of input cycles in a specified period. The MFP scales the counts to give a direct frequency parameter that may be used in control schemes. Frequency ranges available are: 0.1 Hz to 6.55 kHz for a 10 second count period, 1.0 Hz to 50 kHz for a 1.0 second count period, 10.0 Hz to 50 kHz for a 0.1 second count period.

The other three frequency ranges in the frequency mode set the DSM to the period mode. These ranges are 0.1 Hz to 1.5 kHz, 10 Hz to 15 kHz and 10.0 to 150 kHz. The DSM output count is then scaled by the MFP to give a frequency operating parameter.

---

## SECTION 5 - TROUBLESHOOTING

---

### *INTRODUCTION*

This section explains the error indications and corrective actions for the Pulse Input Slave Module (DSM).

---

### *ERROR MESSAGES AND CORRECTIVE ACTION*

You can obtain the status of the DSM by checking the master module for good quality on its input blocks. Use any Infi 90 operator interface (e.g., Operator Interface Station, Engineering Work Station, Configuration and Tuning Terminal) to do this.

---

### *MASTER MODULE ERRORS*

The address set on address switch (S1) and in the master module setup must be the same. The master module will generate a MISSING SLAVE MODULE error if they do not match. Verify that the address set on S1 is the same as the address in Function Code (FC) 84 specification 1. If not:

1. Remove the module and change the setting of S1 to match the module setup (refer to the Installation Section for the procedures to set an address and to install a slave module)

OR

2. Modify the address in the module setup (FC 84 specification 1) to match the address set on S1. Use an Infi 90 operator interface to modify the setup (for procedures on how to modify a function code specification, refer to the product instruction for the operator interface you are using).

The master module will generate a MISSING SLAVE MODULE error for a master or slave module disconnected from the slave expander bus. Verify the bus connection on the MMU backplane.

**NOTE:** The master module will trip when the DSM module fails. Changing the function specification will cause the master module to operate when a slave fails.

If the DSM is faulty, replace it with a new one. You can remove the module with system power on.

Refer to the Installation Section for the procedures to install a module. Refer to [Section 7](#) for the procedures to remove a module.

---

**MODULE PIN CONNECTIONS**

The slave module has three connection points for external signals and power (P1, P2 and P3). Tables 5-1, 5-2 and 5-3 show the pin connections.

*Table 5-1. P1 Power Pin Connections*

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

*Table 5-2. P2 Slave 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	+ 5 VDC
6	Data 4	12	Ground

*Table 5-3. P3 Input Signal Pin Connections*

IMDSM04		NIDI01	
P3 Pin Number	Input Channel	TB1 Terminal	P1 Pin Number
A	1+	32	2
1	1-	31	1
B	2+	30	4
2	2-	29	3
C	3+	28	6
3	3-	27	5
D	4+	26	8
4	4-	25	7
K	5+	17	18
9	5-	16	17
L	6+	15	20
10	6-	14	19
M	7+	13	22
11	7-	12	21
N	8+	11	24
12	8-	10	23
15	24 VDC+	2	29
S	Common	1	30

---

## SECTION 6 - MAINTENANCE

---

### **INTRODUCTION**

The Pulse Input Slave (DSM) requires limited maintenance. This section contains a maintenance schedule.

---

### **MAINTENANCE SCHEDULE**

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

*Table 6-1. Maintenance Schedule*

<b>Task</b>	<b>Interval</b>
Clean and tighten each power and ground connection.	Every 6 months or at plant shutdown, whichever occurs first.
Use static safe vacuum cleaner to remove dust from: Modules Module Mounting Unit Fan Assembly Power Entry Panel	Every 6 months or at plant shutdown, whichever occurs first.



---

## SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

---

### *INTRODUCTION*

This section explains the replacement steps for a Pulse Input Slave Module (DSM). There are no special tools required to replace a DSM.

---

### *MODULE REPAIR/REPLACEMENT*

If the DSM 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. Ensure they are set the same as the original module.
4. In the same slot assignment as the original module, align the replacement module with the plastic 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. (To remove the module, turn the module retaining screws to the unlatched position and gently slide out).
6. Return to normal operation.

---

## SECTION 8 - SUPPORT SERVICES

---

### ***INTRODUCTION***

Bailey Controls helps you apply and repair its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

---

### ***REPLACEMENT PARTS AND ORDERING INFORMATION***

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

1. Part description, part number and quantity.
2. Model and serial numbers (if applicable).
3. Bailey instruction manual number, page number and reference figure that identifies the part.

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

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### ***TRAINING***

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

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### ***TECHNICAL DOCUMENTATION***

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

# APPENDIX A - NTDI01 TERMINATION UNIT CONFIGURATION

## INTRODUCTION

The IMDSM04 uses an NTDI01 for termination. Dipshunts on the termination unit (NTDI01) configure the digital inputs. The Pulse Input Slave Module (DSM) accepts inputs of 4 to 6 VDC, 21.6 to 27 VDC and 50 millivolts to 10 Volts peak to peak.

Figure A-1 shows the dipshunts and terminal blocks on the termination unit.

## CONFIGURING INPUTS

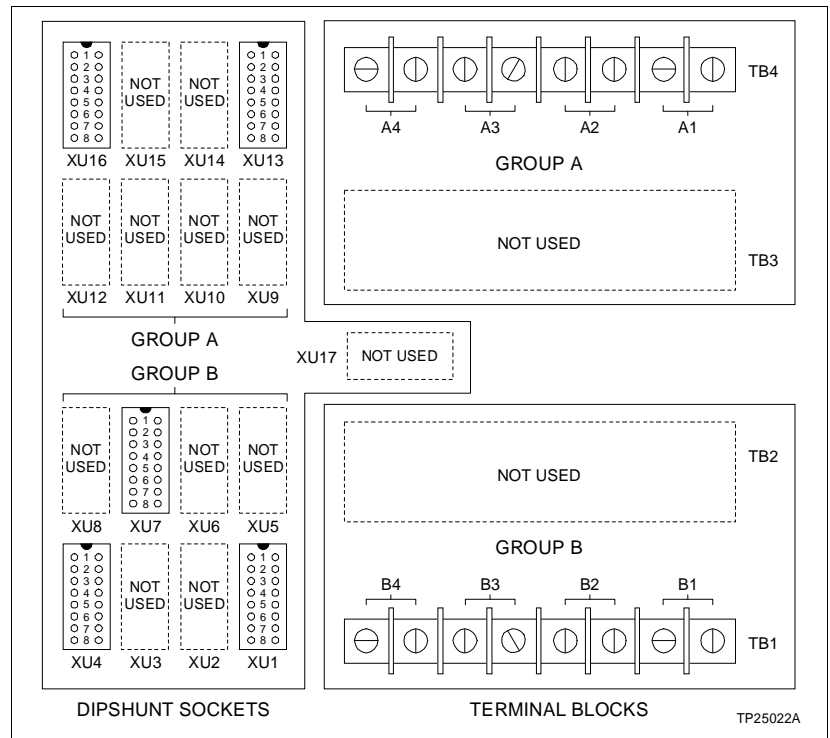


Figure A-1. Dipshunts and Terminal Blocks

Figure A-2 shows the input circuit with the dipshunts, terminal blocks and I/O circuits on the DSM. Figure A-2 also shows the dipshunt connection to the NKTU01 cable that plugs from the termination unit to B1 on the DSM.

Figure A-3 shows dipshunt configuration for the possible NTDI01 applications.

XU7 connects the 24 VDC I/O power to the preamplifiers on the DSM. If no preamplifiers are used do not install XU7. Figure A-4 shows the terminal assignments for the termination unit.

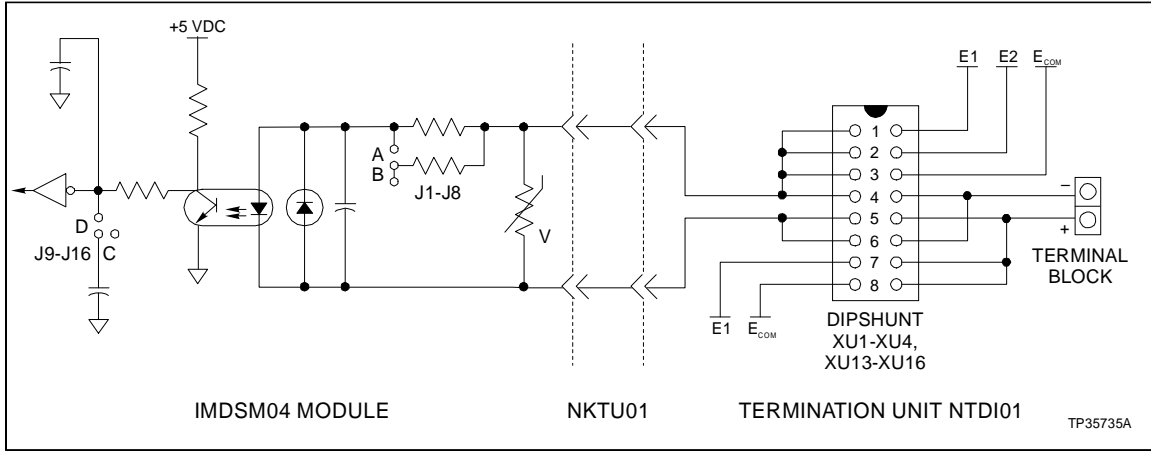


Figure A-2. Dipshunt Installed for NTDI01

Application Signal Type	Dipshunt Configuration XU1-XU4, XU13-XU16	Dipshunt Configuration XU7
Powering an External Load		
Sinking an External Load		

Figure A-3. Dipshunt Configurations for NTDI01

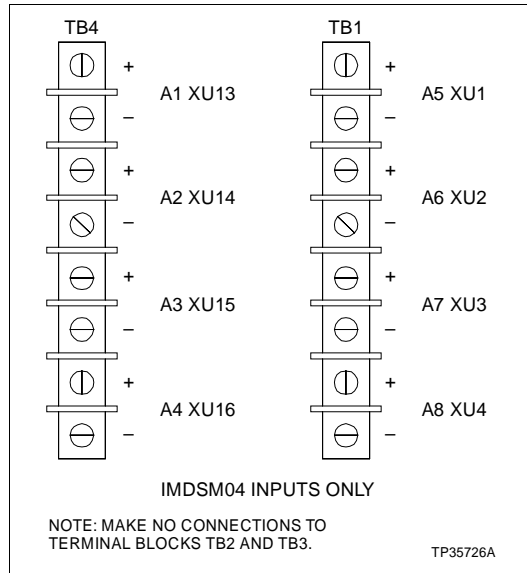


Figure A-4. Terminal Assignments for NTDI01

Check the switch and jumper settings on the DSM and the dipshunts on the termination unit. Figure A-5 shows the installation for the DSM and cables.

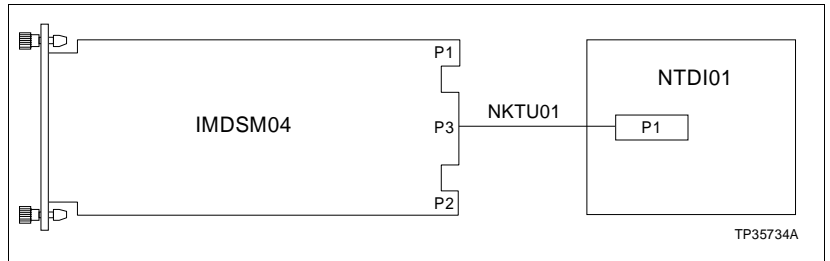


Figure A-5. Cable Connections for NTDI01

# APPENDIX B - NIDI01 TERMINATION MODULE CONFIGURATION

## INTRODUCTION

The IMDSM04 uses an NIDI01 for termination. Jumpers on the termination module (NIDI01) configure the digital inputs to the DSM. The Pulse Input Slave Module (DSM) accepts inputs of 4 to 6 VDC, 21.6 to 27 VDC and 50 millivolts to 10 Volts peak to peak.

## INPUT CIRCUITS FOR NIDI01

Input circuits to the NIDI01 must be externally powered. Figure B-1 shows the schematic for a single input circuit. The voltage from the input must match the input circuits requirements of the respective input channel of the DSM. Figure B-2 shows the connector pins associated with each input channel. After connecting the power supply, connect the field wiring to the terminal block using wire sized from number 22 AWG to number 14 AWG. Route the wires so they will not interfere with the plastic front cover.

Digital input lines should be twisted pairs of multi-stranded wires with low leakage installation. Input lines should be shielded. Usually it is not necessary to ground each pair of wires. Ground the shields to the panel or chassis holding the termination unit. The twisted pairs of input lines must be run in separate conduit as lines carrying AC or greater than 50 Volt Amps DC from switched outputs (digital output relays).

Figure B-1 shows an example of an input circuit and termination module.

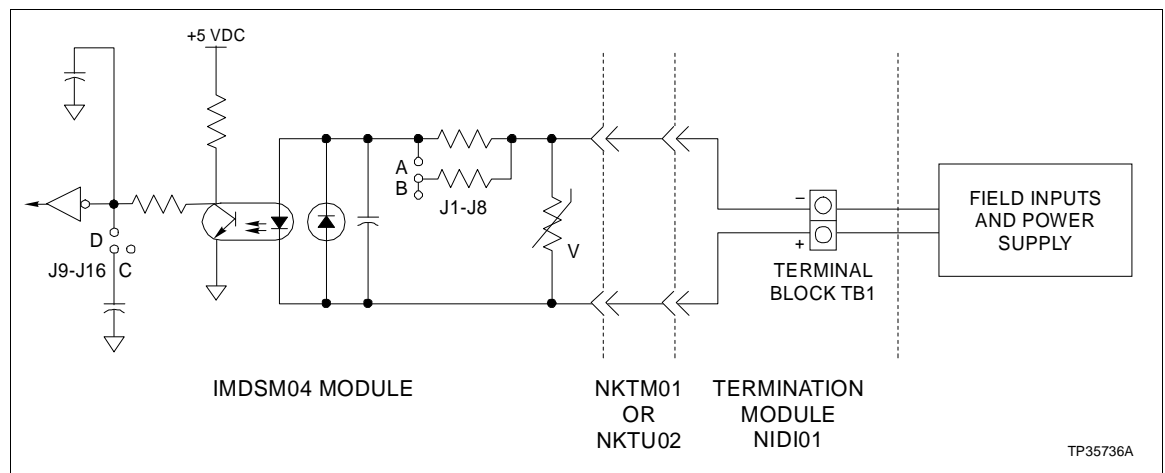


Figure B-1. Input Circuit

**CONFIGURING INPUTS FOR NIDI01**

Installing the NIDI01 includes these steps: setting up the compatibility jumpers (J1 through J10), connecting the termination unit cable, connecting the power supply and connecting the input circuits. Jumpers J1 through J10 must be configured to make the NIDI01 compatible with the DSM. For this application, jumpers J1 through J9 should be broken. If the preamplifiers on the DSM input channels 1 and 2 are not going to be used, break jumper J10. Figure B-2 shows the termination assignments for the termination unit. Figure B-3 shows the jumper configuration For NIDI01.

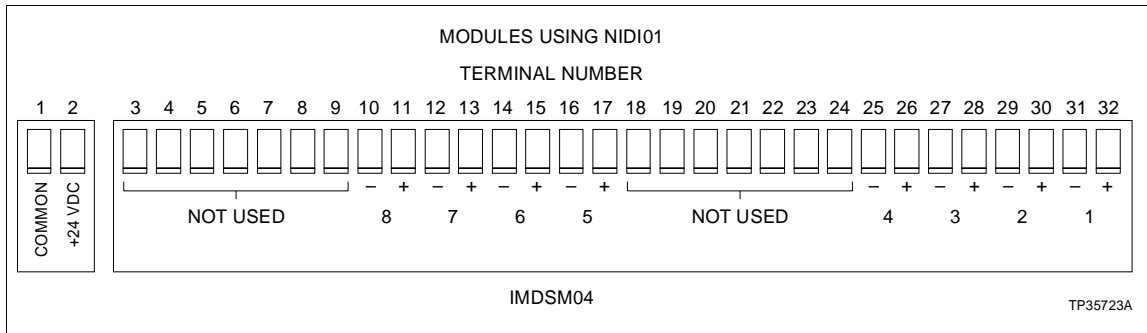


Figure B-2. Termination Assignments for NIDI01

Application Signal Type	Number of I/O	Jumper Configuration J1 - J10	Connecting Cable																														
0 to 6 VDC 0 to 27 VDC -5 to +5 VDC	8/0	<table style="margin-left: auto; margin-right: auto;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td> </tr> <tr> <td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td> </tr> </table> <p style="text-align: center;">TP21513A</p>	1	2	3	4	5	6	7	8	9	10	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	NKTM01 or NKTU02
1	2	3	4	5	6	7	8	9	10																								
○	○	○	○	○	○	○	○	○	○																								
○	○	○	○	○	○	○	○	○	○																								

Figure B-3. Configuration Summary for NIDI01

**CONNECTING THE POWER SUPPLY FOR NIDI01**

The power supply connection to the NIDI01 only needs to be made if you use the preamplifiers on the DSM input channels 1 and 2. Input circuits cannot be powered through the termination unit. They must be externally powered. If you use the preamplifiers, connect the 24 VDC I/O power supply positive terminal to terminal 2 of the NIDI01. Then connect the common power supply lead to terminal 1 of the NIDI01. Use number 14 AWG multi-stranded wire. Figure B-4 shows the connections for the power supply. Figure B-5 shows the cable connections for the NIDI01.

# NIDI01 TERMINATION MODULE CONFIGURATION

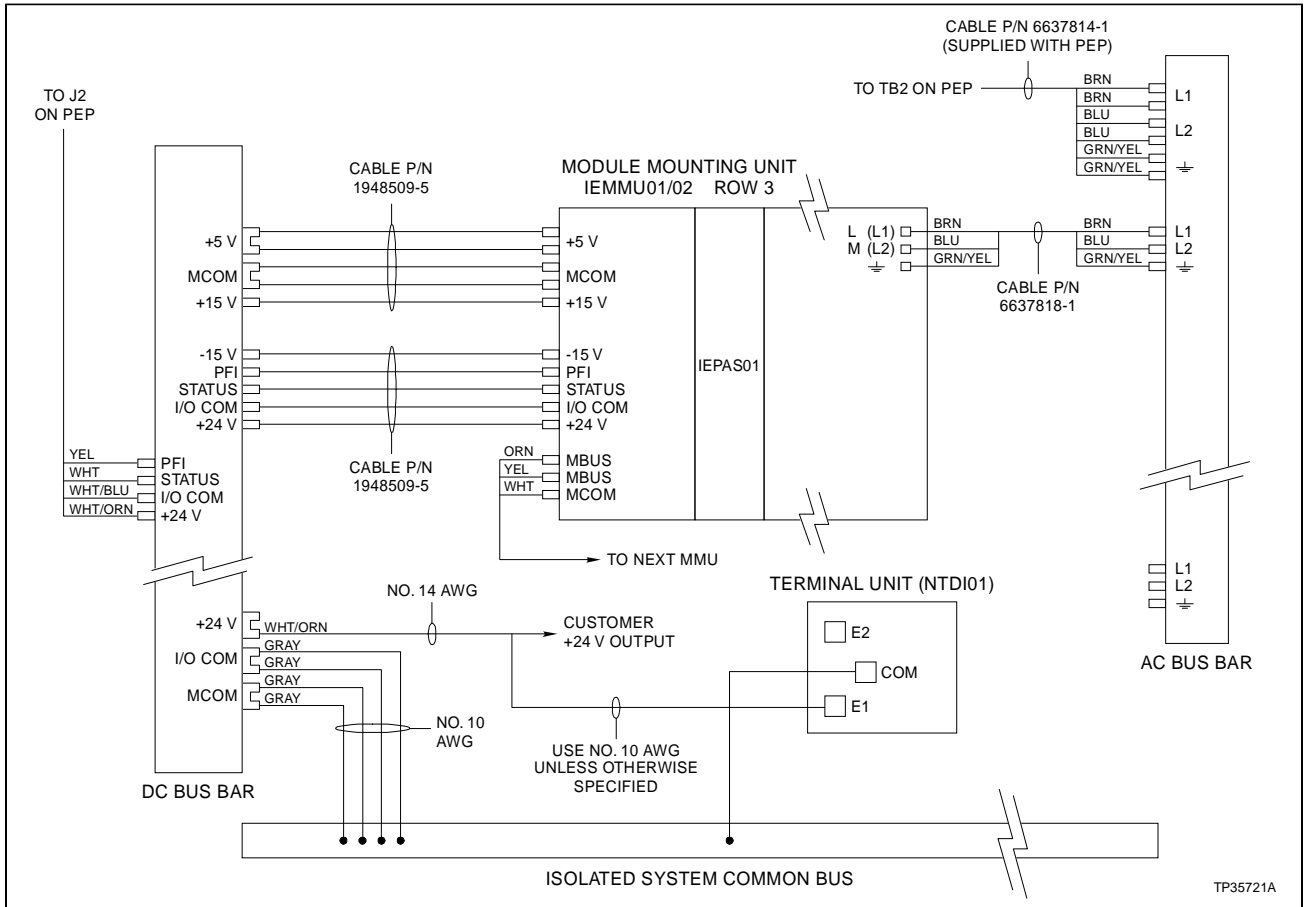


Figure B-4. Power Supply Connections for NIDI01

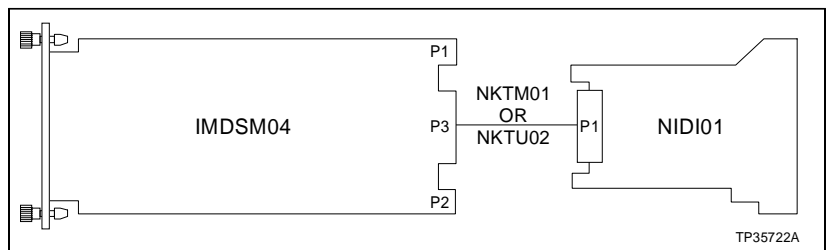


Figure B-5. Cable Connections for NIDI01



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