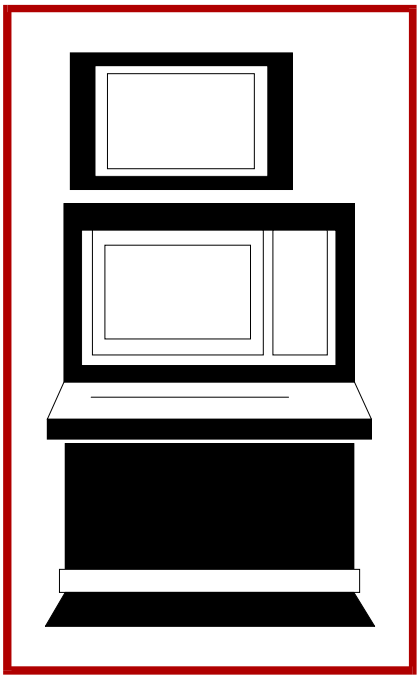
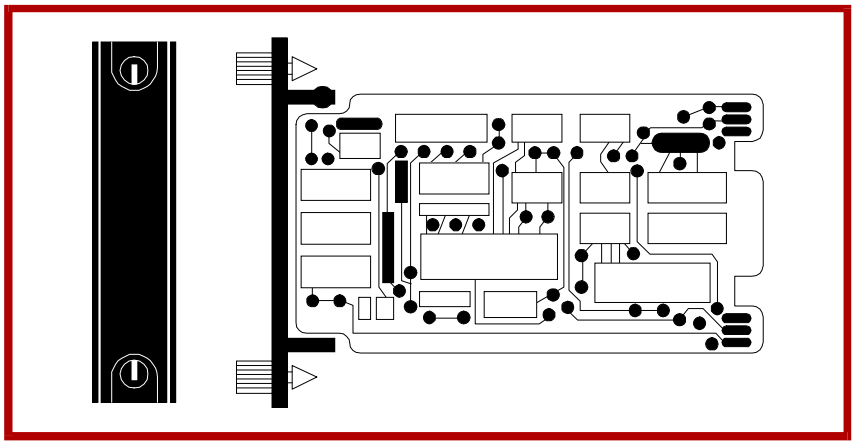
Bailey® infi 90®

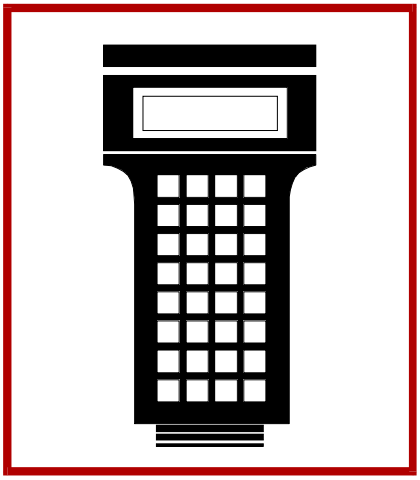
IMCIS12/IMQRS12

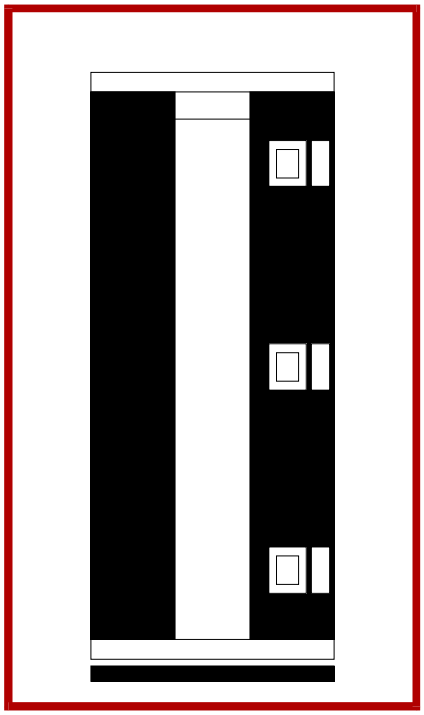
Instruction

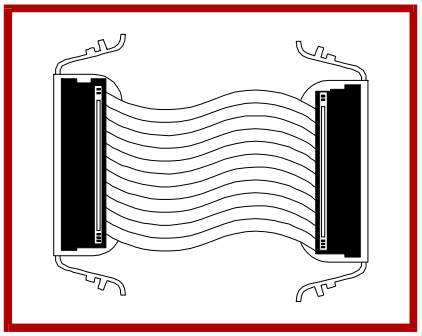
Control I/O Module and Quick Response I/O Module

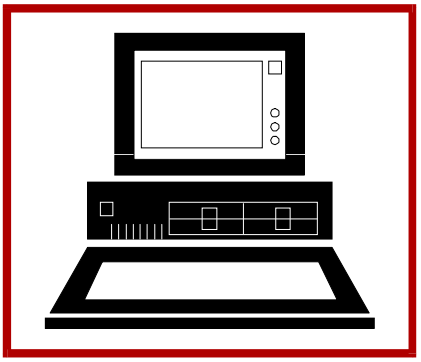












Bailey Process Control and Automation Solutions from Elsag Bailey Group

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

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

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

WARNING

INSTRUCTION MANUALS

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.

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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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Preface

The IMCIS12 Control I/O and IMQRS12 Quick Response I/O modules bring process field signals into the INFI 90 OPEN® Strategic Process Management System, and output INFI 90 OPEN signals to the process.

The IMCIS12 and IMQRS12 modules are the functional equivalent of the IMCIS02 and IMQRS02 modules with the restriction that the digital inputs on the IMCIS02 and IMQRS02 modules offer selectable debounce filter times of 1.5 milliseconds (fast) and 17 milliseconds (slow), and the IMCIS12 and IMQRS12 modules offer only the 17 milliseconds (slow) debounce filter time. The slow debounce filter is used in the majority of digital input applications. Several advantages of the IMCIS12 and IMQRS12 modules include EMI protection circuitry and a digital input and output voltage selection of 48 VDC.

This instruction explains the I/O module specifications and operations. It details the procedures necessary to complete setup, installation, maintenance, troubleshooting and replacement of the CIS and QRS modules.

The system engineer or technician using the CIS or QRS module should read and understand this instruction before installing and operating the I/O module. A complete understanding of the INFI 90 OPEN system is beneficial to the user.

List of Effective Pages

Total number of pages in this instruction is 55, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through vii	Original
1-1 through 1-10	Original
2-1 through 2-7	Original
3-1 through 3-8	Original
4-1 through 4-2	Original
5-1 through 5-4	Original
6-1 through 6-4	Original
7-1	Original
8-1	Original
A-1 through A-4	Original
B-1 through B-2	Original
C-1 through C-3	Original
Index-1 through Index-2	Original

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

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

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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.
SPECIFIC WARNINGS	Disconnect power before installing dipshunts on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock. (p. 3-7) Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard. (p. 6-2) Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board. (p. 6-2) There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death. (p. 6-4) If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist. (p. 6-4)

Trademarks and Registrations

Registrations and trademarks used in this document include:

® INFI 90	Registered trademark of Elsag Bailey Process Automation
® INFI-NET	Registered trademark of Elsag Bailey Process Automation

SECTION 1 - INTRODUCTION

OVERVIEW

The IMCIS12 Control I/O and IMQRS12 Quick Response I/O modules bring four analog and three digital process field signals into the INFI 90 OPEN system for processing and monitoring. They output four digital and two analog signals for process control. The control I/O (CIS) and quick response I/O (QRS) modules are interfaces between the process and the INFI 90 OPEN Strategic Process Management System.

The IMCIS12 and IMQRS12 modules are functionally the same; however, the QRS module provides approximately ten times faster response for the analog inputs. By doing this, the input signal noise rejection is lower for the QRS module than it is for the CIS module. The process requirements determine the module to use for your application.

> **NOTE:** In this instruction, any reference to I/O module means either IMCIS12 module or IMQRS12 module.

Control modules (e.g., MFP modules) perform the control functions; I/O modules provide the I/O to the control modules.

This manual explains the purpose, operation and maintenance of the I/O module. It addresses handling precautions and installation procedures. Figure 1-1 illustrates the INFI 90 OPEN communication levels and the position of the CIS and QRS modules within these levels.

INTENDED USER

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

MODULE DESCRIPTION

The CIS and QRS modules consist of a single printed circuit board (PCB) that occupies one slot in a module mounting unit (MMU). Jumpers on the printed circuit board configure each of the analog inputs, analog outputs and digital inputs. Analog inputs can also be configured on its respective termination unit (TU) or termination module (TM).

Two captive screws on the faceplate secure the module to the MMU. Two front panel LEDs indicate the module status.

The I/O module has three connection points for external signals and power (P1, P2 and P3). P1 connects to a common (ground) and +5 VDC and ±15 VDC power (refer to Table 5-2). P2 connects the module to the control module through the I/O expander bus (refer to Table 5-3). The field I/O signals are exchanged through connector P3 using a cable connected to a TU or TM (refer to Table 5-4). The terminal blocks (physical connection points) for field wiring are on the TU or TM.

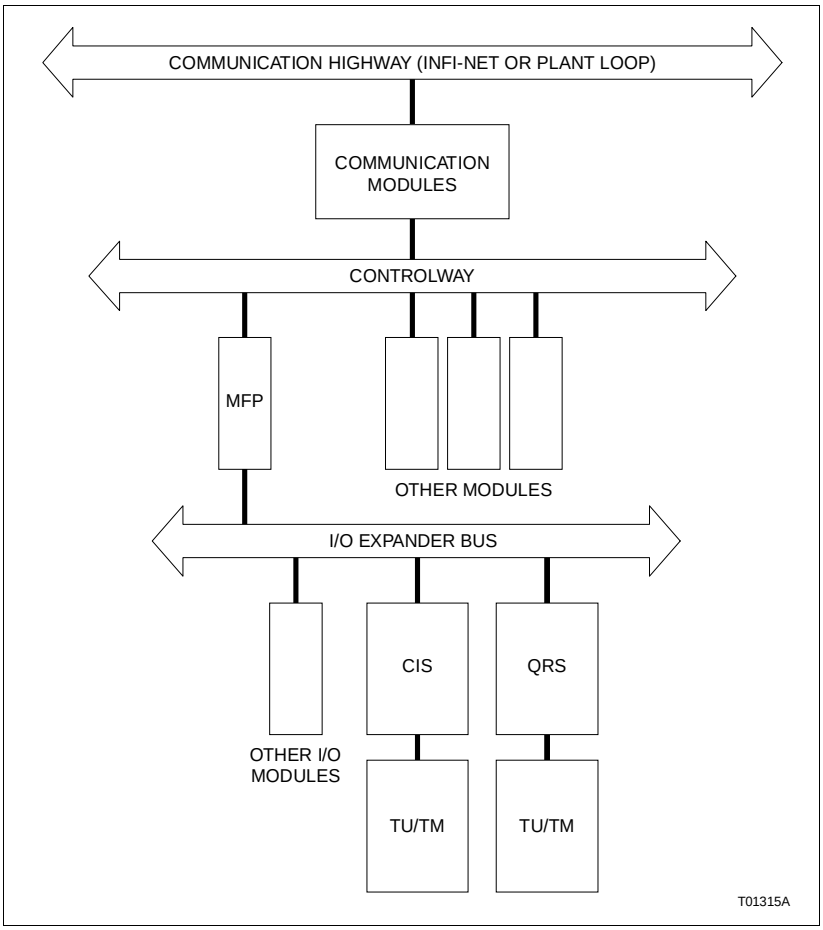


Figure 1-1. INFI 90 OPEN Communication Levels

The I/O module accepts digital signals of 24 VDC, 48 VDC, 125 VDC and 120 VAC. Individual voltage jumpers on the module configure each input. A fixed response time (17 milliseconds) allows the INFI 90 OPEN system to compensate for process field device debounce time. It outputs digital signals of 24 VDC that can sink 250 milliamperes at 24 VDC and 125 milliamperes at 48 VDC.

It accepts analog signals of one to five VDC (single ended or differential). Its respective termination unit (TU) or termination module (TM) converts a four to 20-milliampere current to a voltage that is sent to the I/O module. The analog output mode

is selectable; jumpers select current or voltage mode for each analog output depending on the process requirements.

The two front panel LEDs provide a visual indication of the module status to aid in system test and diagnostics. The I/O module can be removed or installed without powering the system down.

INSTRUCTION CONTENT

This instruction is divided into eight sections and three appendices. Read this instruction before installing or operating the IMCIS12 or IMQRS12 module. A summary of section content follows:

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

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

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

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

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

Maintenance — Contains scheduled maintenance tasks and procedures.

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

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

Appendices — Appendix A provides configuration information for the NTCS04 termination unit. Appendix B provides configuration information for the NICS01 termination module. Appendix C provides a quick reference for switch and jumper locations and settings.

HOW TO USE THIS MANUAL

Read this instruction before handling the IMCIS12 or IMQRS12 module. Refer to a specific section for information as needed.

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

2. Do the steps in the installation section.

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

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

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

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

DOCUMENT CONVENTIONS

The □ in a nomenclature item indicates variables for that position, e.g., IMCIS□2.

GLOSSARY OF TERMS AND ABBREVIATIONS

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

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
EWS	Engineering work station.
Function Code (FC)	An algorithm which manipulates specific functions. These functions are linked together to form the control strategy.
I/O Expander Bus	Parallel communication bus between the control and I/O modules.
MFP	Multi-function processor module. A multiple loop controller with data acquisition and information processing capabilities.
MMU	Module mounting unit. A card cage that provides electrical and communication support for INFI 90 OPEN/Network 90 modules.
OIS	Operator interface station. Integrated operator console with data acquisition and reporting capabilities. It provides a digital access into the process for flexible control and monitoring.
TM	Termination module. Provides input/output direct connection between plant equipment and the INFI 90 OPEN/Network 90 modules.
TU	Termination unit. Provides input/output direct connection between plant equipment and the INFI 90 OPEN/Network 90 modules.

REFERENCE DOCUMENTS

Table 1-2 lists Elsag Bailey instructions for equipment that is referenced in this instruction.

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 (IMMFP03/03B)
I-E96-209	Logic Master Module (IMLMM02)
I-E96-409	Termination Module (NICS01)
I-E96-442	Termination Unit (NTCS04)
WBPEEUI200502A0	Module Mounting Unit (IEMMU11/12/21/22)
WBPEEUI220756A0	Operation, Operator Interface Station (40 Series) IIOIS43

NOMENCLATURE

Table 1-3 contains the control I/O module nomenclature used in this instruction.

Table 1-3. Nomenclature

Nomenclature	Description
IMCIS12	Control I/O module
IMQRS12	Quick response I/O module

RELATED HARDWARE

Refer to Table 1-4 for modules and equipment that can be used with a control I/O module:

Table 1-4. Related Hardware

Nomenclature	Description
IMMFP01/02/03/03B	Multi-function processor module
IMLMM02	Logic master module
NICS01	Termination module, control I/O

Table 1-4. Related Hardware (continued)

Nomenclature	Description
NTCS04	Termination unit, control I/O
NKTM01	Cable, termination module
NKTU01/11	Cable, termination unit
NKTU02/12	Cable, termination module

SPECIFICATIONS

Table 1-5 contains specifications relative to the IMCIS12 and IMQRS12 modules.

Table 1-5. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Power Requirements</td><td></td></tr>
<tr><td>Voltage</td><td>5 VDC (±5%)
+15 VDC (-2.5%, +5%)
-15 VDC (-5%, +2.5%)
+24 VDC (±10%) (supplied via P3 connector from termination unit)</td></tr>
<tr><td>Current</td><td><table><tr><th>Current</th><th>Typical</th><th>Maximum</th></tr><tr><td>+5 V</td><td>265 mA</td><td>332 mA</td></tr><tr><td>+15 V</td><td>27 mA</td><td>35 mA</td></tr><tr><td>-15 V</td><td>23 mA</td><td>30 mA</td></tr><tr><td>+24 V</td><td>46 mA</td><td>50 mA</td></tr></table></td></tr>
<tr><td>Dissipation (logic only)</td><td><table><tr><th>Current</th><th>Typical</th><th>Maximum</th></tr><tr><td>+5 V</td><td>1.33 W</td><td>1.66 W</td></tr><tr><td>+15 V</td><td>405 mW</td><td>525 mW</td></tr><tr><td>-15 V</td><td>345 mW</td><td>450 mW</td></tr><tr><td>+24 V</td><td>1.10 W</td><td>1.2 W</td></tr></table></td></tr>
<tr><td>Overvoltage category for I/O</td><td>II, per IEC 1010-1</td></tr>
</table>

Table 1-5. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Digital I/O</td><td></td></tr>
<tr><td>Digital inputs</td><td>3, optically isolated</td></tr>
<tr><td>Voltages (±10%) (jumper selectable)</td><td>
<table>
<tr><th>24 VDC</th><th>48 VDC</th><th>125 VDC</th><th>120 VAC</th></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 32.2 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>
</td></tr>
<tr><td>Current (typical)</td><td></td></tr>
<tr><td>Turn-on voltage (minimum)</td><td></td></tr>
<tr><td>Tun-off voltage (maximum</td><td></td></tr>
<tr><td>Maximum input current at minimum turn-on</td><td></td></tr>
<tr><td>Off-leakage current (maximum)</td><td></td></tr>
<tr><td>DC response time (debounce filter)</td><td></td></tr>
<tr><td>Digital outputs</td><td>4, open collector, optically isolated</td></tr>
<tr><td>Off output voltage</td><td>$V_{I/O}$ (nominal 24 VDC or 48 VDC)</td></tr>
<tr><td>On output voltage</td><td>1.5 VDC maximum</td></tr>
<tr><td>Off output current</td><td>10 µA maximum</td></tr>
<tr><td>On output current</td><td>250 mA maximum at 24 VDC; 125 mA maximum at 48 VDC</td></tr>
<tr><td>Analog I/O</td><td></td></tr>
<tr><td>Analog inputs</td><td>4, 1-5 VDC (differential/single ended) or 4-20 mA</td></tr>
<tr><td>TU/TM configured to accept:</td><td>1 powered or unpowered current (4-20 mA)
Single ended or differential voltage (1-5 VDC)</td></tr>
<tr><td>Input impedance</td><td>>1 MΩ</td></tr>
<tr><td>Common mode voltage</td><td>±10 VDC</td></tr>
<tr><td>IMCIS12</td><td></td></tr>
<tr><td>Normal mode rejection</td><td>>76 db at 50/60 Hz</td></tr>
<tr><td>Common mode rejection</td><td>90 db from DC to 60 Hz</td></tr>
<tr><td>Response time per channel (100% step change)</td><td>2.4 sec to 95% of final value</td></tr>
<tr><td>IMQRS12</td><td></td></tr>
<tr><td>Normal mode rejection</td><td>37 db at 50/60 Hz</td></tr>
<tr><td>Common mode rejection</td><td>53 db from DC to 60 Hz</td></tr>
<tr><td>Response time per channel (100% step change)</td><td>0.27 sec to 95% of final value</td></tr>
<tr><td>A/D resolution</td><td>12 bits for analog inputs</td></tr>
</table>

Table 1-5. Specifications (continued)

Property	Characteristic/Value
Analog I/O *(continued)*	
Analog outputs	2, 4-20 mA or 1-5 VDC
Output load - current load	600 Ω/600 mH (maximum)
Output load - voltage load	>1 kΩ
D/A resolution	10 bits for analog outputs
Analog accuracy	
Input at 25°C (77°F) standard condition	
Terminal based linearity	±0.03% of full scale range
Repeatability	±0.03% of full scale range
Deadband	±0.03% of full scale range
Accuracy	±0.1% of full scale range
Output at 25°C (77°F) standard condition	
Terminal based linearity	±0.1% of full scale range
Repeatability	±0.05% of full scale range
Accuracy	±0.15% of full scale range (voltage mode) ±0.25% of full scale range (current mode)
Temperature effect 0° to 70°C (32° to 158°F)	±0.002% of full scale range/°C
Input cross talk rejection (channel to channel)	50 db (min.) at 25°C (77°F)/-78 db (typ) at 25°C (77°F)
Mounting	Occupies one slot in a standard INFI 90 OPEN module mounting unit (MMU)
Environmental	
Ambient temperature (per IEC-68-2-1, 2,14)	Temperature rating within the cabinet or enclosure applies. INFI 90 OPEN internal cabinet rating: 0° to 70° C (32° to 158° F)
Relative humidity (per IEC68-2-3)	5% to 95% up to 55°C (131°F) (noncondensing) 5% to 45% at 70°C (158°F) (noncondensing) Pollution degree: 1 (no condensation)
Atmospheric pressure	Sea level to 3 km (1.86 miles)
Air quality (per ISA S71.04, Class LA, LB, LC - level 1)	Noncorrosive

Table 1-5. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Isolation
(per 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">Digital Input</td></tr>
<tr><td>Insulation resistance (100/500 VDC)</td><td>100 MΩ</td><td>N/A</td></tr>
<tr><td>Dielectric VAC (45 to 65 Hz) or VDC</td><td>1.4 kV rms/1 min. 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">Digital Output</td></tr>
<tr><td>Insulation resistance (100/500 VDC)</td><td>100 MΩ</td><td>N/A</td></tr>
<tr><td>Dielectric VAC (45 to 65 Hz) or VDC</td><td>1 kV rms/1 min. 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>
<tr><td colspan="3">Analog Input/Output</td></tr>
<tr><td>Insulation resistance (100/500 VDC)</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Dielectric VAC (45 to 65 Hz) or VDC</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Impulse voltage (1.2/50 µS)</td><td>N/A</td><td>±1 kVp</td></tr>
</table>
</td></tr>
<tr><td>Electromagnetic compatibility</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
</td></tr>
</table>

Table 1-5. Specifications (continued)

Property	Characteristic/Value
Magnetic and electromagnetic fields *(continued)*	
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 1 GHz (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
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:
EMC96 Directive 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 61010-1 Safety Requirement 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 (nonhazardous) location per CSA 22.2 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 AND OPERATION

INTRODUCTION

This section explains the inputs, outputs, logic power and connections for the IMCIS12 and IMQRS12 modules. The CIS and QRS modules are process field I/O interfaces for a multi-function processor (MFP) module. The I/O module circuitry performs the following functions:

- Analog to digital (A/D) conversion. It changes analog inputs to digital values the MFP can process.
- Digital to analog (D/A) conversion. It changes the MFP digital values to analog voltage or current signals to control process field devices.
- Accepts digital field inputs and isolates the module circuitry from the process.
- Outputs digital signals to process field devices and isolates the module circuitry from the process.

The MFP communicates with its I/O modules on a parallel I/O expander bus as shown in Figure 1-1. It references the address set by I/O address dipswitch (S1). Figure 2-1 is a block diagram of the CIS and QRS modules.

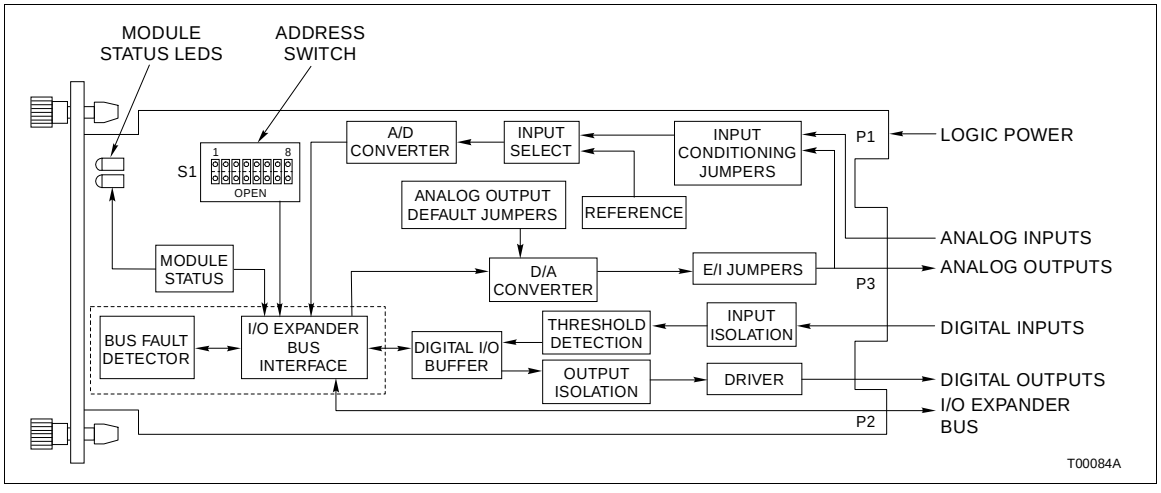


Figure 2-1. Block Diagram

ANALOG I/O

The CIS and QRS modules can input four separate analog signals configurable as voltage (one to five VDC) single ended or differential, or current (four to 20 milliamperes) field powered. It allows for a common mode (inputs change together proportionally) differential voltage of ±10 VDC. The I/O module output mode is selectable: current or voltage.

Analog Inputs

The input conditioning block consists of two pole input filters that reduce input signal noise (Fig. 2-2). Refer to Table 1-5 for normal mode rejection (differential change) and common mode rejection specifications for the differential inputs. The input conditioning block consists of an I/E conversion resistor and a configuration jumper (for each channel) to configure the I/O module to input current or voltage (single ended or differential).

The input select block consists of an analog multiplexer and an inverting difference amplifier. The multiplexer selects one of the four inputs or the reference block inputs (calibration voltages). The difference amplifier converts the selected input to a single ended signal.

The A/D converter block circuit changes the input signal to a 12-bit value that is sent to the I/O expander bus interface. This value is an analog count that corresponds to the input voltage. Nominal input range is 1 to 5 VDC (4 to 20 milliamps); however, it allows for a 0.75 to 5.25 VDC (3 to 21 milliamp) input range which is ±6.25 percent of the nominal input range span (4 VDC).

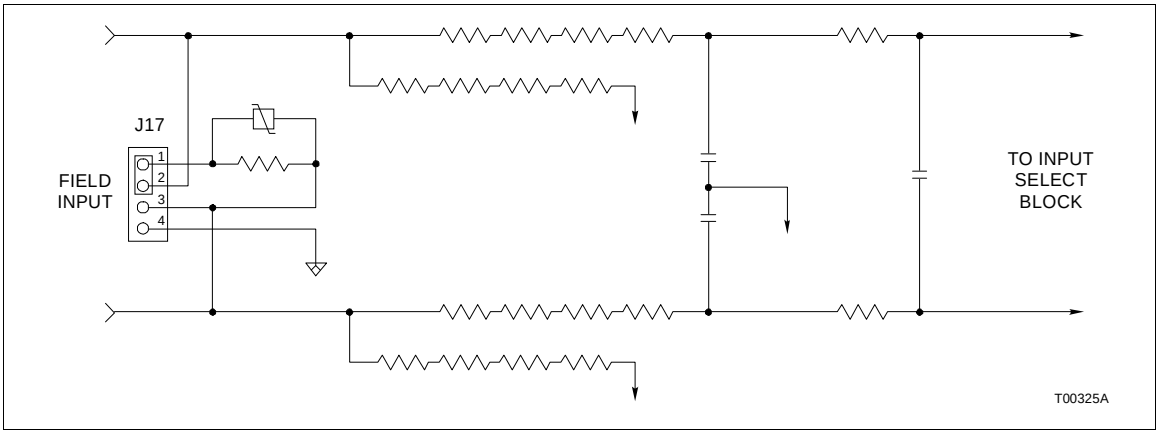


Figure 2-2. Analog Input Circuit Example

Analog Input Circuit Calibration

The reference block generates accurate 1 VDC and 5 VDC signals. The I/O module does not have potentiometers to adjust zero offset and gain for the A/D converter circuits. Instead, the MFP reads the reference voltages once per minute to calibrate the zero percent (1 VDC) and 100 percent (5 VDC) points; this calibration automatically corrects the measured values. It is performed continuously to correct for drift and temperature variations.

Analog Outputs

The D/A converter block is two separate D/A converters (Figure 2-3). A 4-bit microcontroller converts and checks data integrity from the MFP. Each D/A converts a 10-bit digital value (analog count) from the microcontroller to an analog output (one to five VDC). To check module circuit integrity, the outputs are fed back to the analog input section. The feedback values (analog output digital values) are compared to the values that were sent to the analog output section to test the output quality. This tests for an output circuit failure or an open loop between the control module and I/O module.

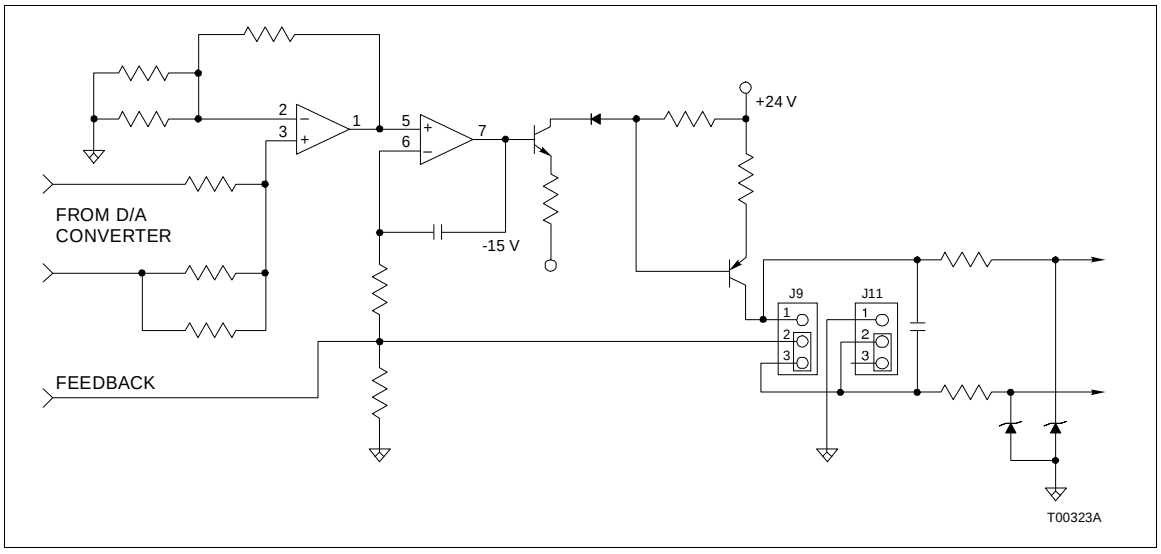


Figure 2-3. Analog Output Circuit Example

The analog output default jumpers set the output values during system start-up or *time-out* (refer to ***BUS FAULT TIMER*** in this section). The analog outputs will go to zero percent or 100 percent output, or they will hold their current values depending on the setting of the default jumpers. Refer to ***Analog Output Default Jumpers (J7, J8, J12, J14, J10, J16)*** in Section 3 for details.

NOTE: All the analog output activities are under microcontroller control.

The analog output mode jumpers set the type of output, either current or voltage. If current mode is selected, the E/I circuits on the I/O module convert the voltage from the D/A converter to a current output. Refer to ***Analog Output Mode Jumpers (J9, J11, J13, J15)*** in Section 3 for details.

DIGITAL I/O

The CIS and QRS modules can input three separate digital signals and output four separate digital signals. Digital inputs are voltages of 24 VDC, 48 VDC, 125 VDC or 120 VAC. These voltages indicate an energized (ON) field device; a zero volt input indicates a de-energized (OFF) field device. The I/O module digital outputs can switch 24 VDC at 250 milliamperes or 48 VDC at 125 milliamperes.

The I/O module has a fixed propagation (speed) of 17 milliseconds for DC inputs to allow for contact debounce time. Jumpers on the I/O module select the working voltage level and DC or AC mode for each input. Refer to digital input jumper settings ***Digital Input Jumper Settings (J1, J2, J3, J4, J5, J6)*** in Section 3.

Digital Inputs

Current limiters and optocouplers in the isolation block isolate the three field inputs from the module circuitry (Fig. 2-4). The threshold detection block circuits test the input voltage to determine if it is at the proper voltage level to indicate an energized (closed) or de-energized (open) state for the field device. These values are sent to the digital I/O buffer block. Jumpers J1 through J6 on the I/O module select the input voltage and input mode (DC or AC).

Digital Outputs

The output isolation block consists of optocouplers to isolate the control logic circuits from the process (Fig. 2-5). Four open collector transistors that can sink a 250 mA load for 24 VDC or a 125 mA load for 48 VDC make up the driver block.

Digital I/O Buffer

The digital I/O buffer block is a buffer and register that hold the values of the digital inputs and outputs. The I/O expander bus interface writes digital data to the register for output by the driver block circuits, and reads the digital input values from the buffer.

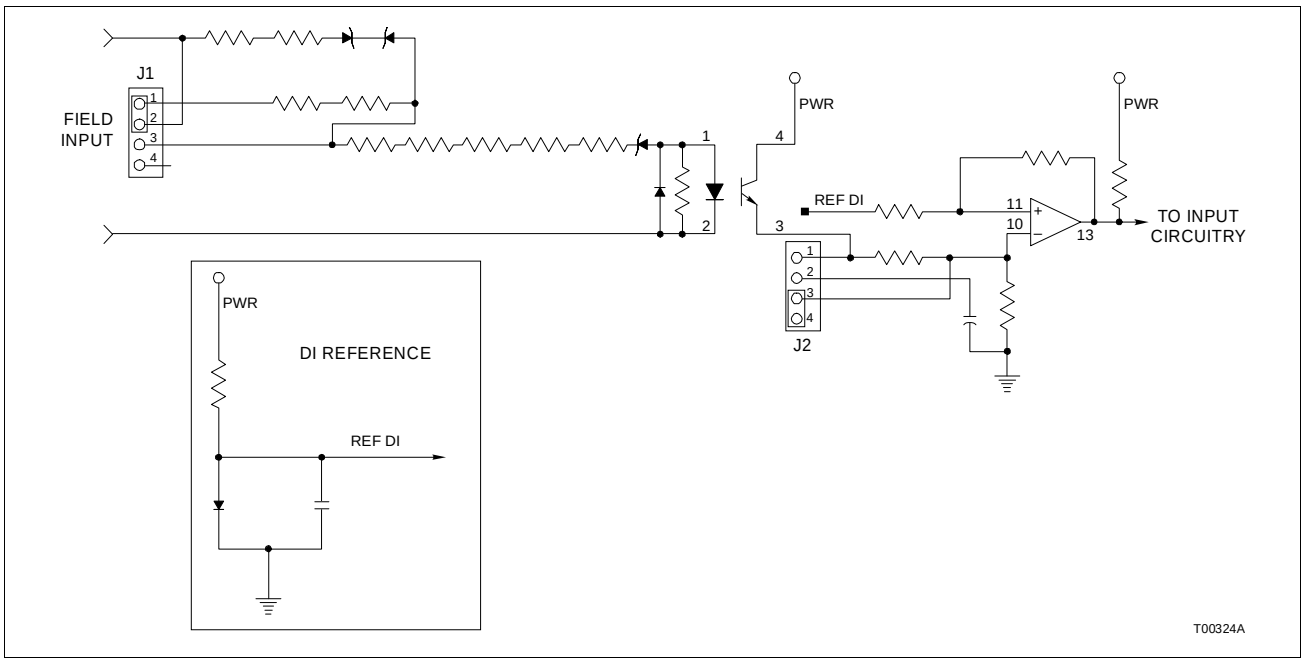


Figure 2-4. Digital Input Circuit Example

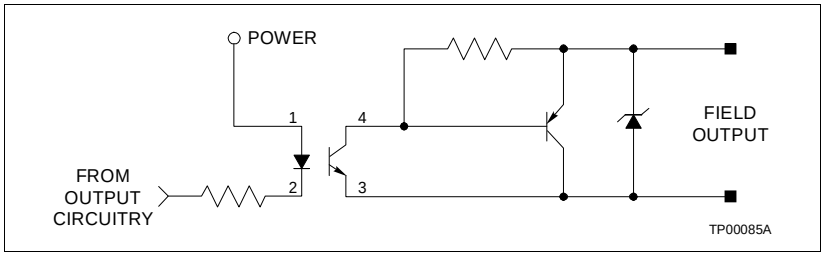


Figure 2-5. Digital Output Circuit Example

I/O CIRCUIT CONNECTIONS

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

I/O EXPANDER BUS

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

The I/O expander bus is parallel signal lines located on the module mounting unit (MMU) backplane. A 12-position dip-shunt placed in a connection socket on the MMU backplane

connects the bus between the control and I/O modules. Cable assemblies can extend the bus to six MMUs.

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

UNIVERSAL I/O EXPANDER BUS INTERFACE

The CIS and QRS modules use a custom gate array to perform the I/O expander bus interface function. All the control logic and communication protocol are built into an integrated circuit (IC). This IC provides the following functions:

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

MODULE DATA

Function Code (FC) 79 in the MFP configuration accesses the CIS or QRS module on the I/O expander bus. It also allows the MFP to automatically read input data or status data from the I/O module, and write output data to it. This data is output by buffer circuits to the I/O expander bus interface (Fig. 2-1). The I/O module address in FC 79 must be the same as the address set on I/O address dipswitch (S1).

I/O Data

I/O data is analog input, digital input, and digital and analog output readback values that the MFP reads from the I/O module. It is also analog and digital output values that the MFP sends to the module. The MFP uses this data to monitor and control a process, and verify I/O module operation.

Analog input data consists of analog counts from the A/D converter. Analog counts are digital values that correspond to analog signals; the A/D performs the conversion. The signals converted include the four analog inputs, two reference voltages (1 VDC and 5 VDC) and two analog output readback values. The MFP reads each of these count values once every execution cycle. Each analog input count value corresponds to an analog input voltage. Reference voltage values are read by the MFP to verify A/D converter integrity. It reads the two analog output values to adjust the analog outputs and check for output circuit failures.

The MFP reads a one byte value that consists of digital output readback values and digital input values. The digital input values indicate the digital input states. Each bit corresponds to one input; the bit value reflects the state of that input, either open (logic 0) or closed (logic 1). Digital output readback data reflects the output states. The MFP uses this data to verify that the outputs are correct. Each bit corresponds to one output; a logic 1 indicates an active (ON) output, a logic 0 indicates an inactive (OFF) output.

Status Data

Status data is an 8-bit data value that identifies the I/O module and indicates the default values set by the analog output default jumpers. The MFP reads the identification bits (four MSB) to verify the I/O expander bus communication integrity and MFP configuration. It reads the default bits (four LSB) to determine the default states set for the analog outputs in the event of a *time-out.*

LOGIC POWER

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

BUS FAULT TIMER

The bus fault timer is a one-shot timer that is reset by the I/O expander bus clock; the MFP generates the bus clock. If the bus clock stops (indicating a MFP error), the bus fault timer *times out* in 10 milliseconds. This will disable the digital outputs and set the analog outputs to their default values (set by jumpers). A red front panel status LED indicates a bus fault (*time-out*).

STATUS LED INDICATORS

Two front panel module status LED indicators show the operating state of the CIS and QRS modules. Circuits on the I/O module determine the module status and light the appropriate LED. Refer to Section 4 for explanations of the LED indications and to Section 5 for corrective actions to take.

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains the procedures required to place the IMCIS12 and IMQRS12 modules into operation. It includes instructions on setting the address selection switch, jumper selections for analog I/O and digital inputs, physical installation and wiring and cable connections. Do ***not*** proceed with operation until you read, understand and complete the steps in the order in which they appear.

SPECIAL HANDLING

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

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

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

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

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

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

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

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

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

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

UNPACKING AND INSPECTION

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

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

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

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

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

SETUP/PHYSICAL INSTALLATION

Prior to installation, set the module dipswitches and install jumpers to configure the I/O. The termination unit (TU) or termination module (TM) must also be configured to accept the field device signals and output the CIS or QRS signals to the process.

Address Selection Switch (S1)

The CIS and QRS modules 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 multi-function processor (MFP) and must be the same as the address set in the MFP configuration (Function Code 79 specification S1).

The address is set by the eight position address dipswitch (S1) shown in Figure 3-1. The six right switch positions (3 through 8) of S1 set the six bit 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 address switch S1.

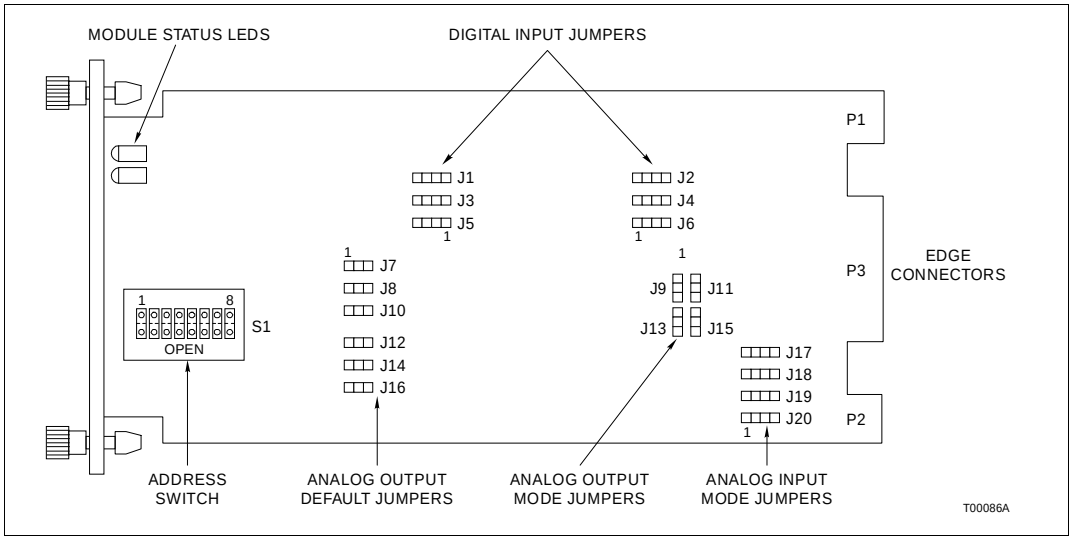


Figure 3-1. Switch and Jumper Locations

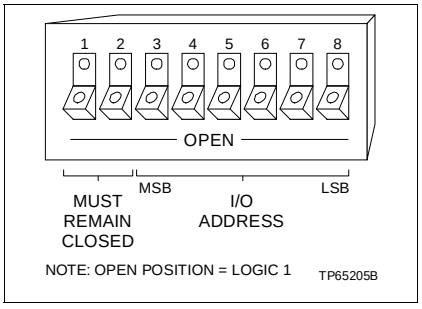


Figure 3-2. Address Select Switch (S1)

Table 3-1. S1 Address Switch Settings

ADDR	MSB 3	4	5	6	7	LSB 8	ADDR	MSB 3	4	5	6	7	LSB 8
0	0	0	0	0	0	0	14	0	0	1	1	1	0
1	0	0	0	0	0	1	15	0	0	1	1	1	1
2	0	0	0	0	1	0	16	0	1	0	0	0	0
3	0	0	0	0	1	1	17	0	1	0	0	0	1
4	0	0	0	1	0	0	18	0	1	0	0	1	0
5	0	0	0	1	0	1	19	0	1	0	0	1	1
6	0	0	0	1	1	0	20	0	1	0	1	0	0
7	0	0	0	1	1	1	21	0	1	0	1	0	1
8	0	0	1	0	0	0	22	0	1	0	1	1	0
9	0	0	1	0	0	1	23	0	1	0	1	1	1
10	0	0	1	0	1	0	24	0	1	1	0	0	0
11	0	0	1	0	1	1	25	0	1	1	0	0	1
12	0	0	1	1	0	0	26	0	1	1	0	1	0
13	0	0	1	1	0	1	27	0	1	1	0	1	1

Table 3-1. S1 Address Switch Settings (continued)

ADDR	MSB 3	4	5	6	7	LSB 8	ADDR	MSB 3	4	5	6	7	LSB 8
28	0	1	1	1	0	0	46	1	0	1	1	1	0
29	0	1	1	1	0	1	47	1	0	1	1	1	1
30	0	1	1	1	1	0	48	1	1	0	0	0	0
31	0	1	1	1	1	1	49	1	1	0	0	0	1
32	1	0	0	0	0	0	50	1	1	0	0	1	0
33	1	0	0	0	0	1	51	1	1	0	0	1	1
34	1	0	0	0	1	0	52	1	1	0	1	0	0
35	1	0	0	0	1	1	53	1	1	0	1	0	1
36	1	0	0	1	0	0	54	1	1	0	1	1	0
37	1	0	0	1	0	1	55	1	1	0	1	1	1
38	1	0	0	1	1	0	56	1	1	1	0	0	0
39	1	0	0	1	1	1	57	1	1	1	0	0	1
40	1	0	1	0	0	0	58	1	1	1	0	1	0
41	1	0	1	0	0	1	59	1	1	1	0	1	1
42	1	0	1	0	1	0	60	1	1	1	1	0	0
43	1	0	1	0	1	1	61	1	1	1	1	0	1
44	1	0	1	1	0	0	62	1	1	1	1	1	0
45	1	0	1	1	0	1	63	1	1	1	1	1	1

1 = OPEN; 0 = CLOSED

Analog Output Default Jumpers (J7, J8, J12, J14, J10, J16)

The analog output default jumpers determine the I/O module analog output default values. These are the values or levels for the analog outputs during system start-up (power up) or bus fault error (time-out).

Select either a zero percent or 100 percent power up output. Selecting zero percent will output four milliamps or one VDC; selecting 100 percent will output 20 milliamps or five VDC.

If the bus fault timer expires (times out), the digital outputs de-energize and the analog outputs change to the default value selected. A time-out occurs when the I/O module does not receive a clock signal from the MFP. The time-out options are to ***hold*** or ***go to power up state***. The outputs will stay at their current values during a time-out if the ***hold*** option is selected; they will change to the power up values (zero or 100 percent) if the ***go to power up state*** is selected.

Refer to Figure 3-1 for location of the jumpers and Table 3-2 for jumper settings.

NOTE: Jumpers J10 and J16 are not required.

Table 3-2. Analog Output Default Jumpers

Analog Output	Time-Out Option			Power-Up State		
	Jumper	Go To Power-Up	Hold	Jumper	0%	100%
1	J8	2-3	1-2	J7	2-3	1-2
2	J14	2-3	1-2	J12	2-3	1-2

Analog Output Mode Jumpers (J9, J11, J13, J15)

The analog output mode jumpers select the mode of each analog output. The mode can be set to current (four to 20 milliamperes) or voltage (one to five VDC). Refer to Figure 3-1 for location of jumpers and Table 3-3 for jumper settings.

Table 3-3. Analog Output Mode Jumpers

Analog Output	Jumper	Current Mode	Voltage Mode
1	J9, J11	2-3	1-2
2	J13, J15	2-3	1-2

Analog Input Mode Jumpers (J17, J18, J19, J20)

The analog input mode jumpers select the mode of each analog input. The mode can be set to current (four to 20 milliamperes) or voltage (one to five VDC) either differential voltage or single-ended voltage mode.

Selection of the analog input mode can be made at the termination unit or at the module. Use one of the following procedures.

1. At the module, set the analog input jumpers (J17, J18, J19 and J20) to the differential voltage mode shown in Table 3-4 (jumpers removed). Select the desired analog input dipshunt configuration at the termination unit. Refer to Appendix A and Appendix B.

2. At the termination unit, use the dipshunt configuration for differential voltage mode. For the NTCS04 TU, refer to Appendix A. For the NICS01 TU, refer to Appendix B. Set the analog input jumpers (J17, J18, J19, and J20) on the module to the proper analog input desired. Refer to Table 3-4 for jumper settings. Refer to Figure 3-1 for location of jumpers.

Table 3-4. Analog Input Mode Jumpers

Analog Input	Jumpers	Current Mode[1]	Voltage Mode (Single Ended)	Voltage Mode[2] (Differential)
1, 2, 3, 4	J17, J18, J19, J20	1-2	3-4	—

NOTE:
1. Field/system powered analog inputs depend on TU/TM configuration.
2. Do not install jumpers for this configuration.

Digital Input Jumper Settings (J1, J2, J3, J4, J5, J6)

Jumpers J-1 through J-6 set the input voltage and the input mode (AC or DC).

The input configure on DC mode has a fixed propagation speed (17 millisecond response time). There are four terminals at each of these jumper locations. Refer to Figure 3-1 for location of jumpers and Table 3-5 to determine the jumper settings. Place a jumper across the pins shown in the table.

Table 3-5. Digital Input Jumper Settings

Digital Input	Jumper	120 VAC	125 VDC	48 VDC	24 VDC
1	J1 J2	1-2 3-4	2-3 3-4	2-3 1-2	2-3 2-3
2	J3 J4	1-2 3-4	2-3 3-4	2-3 1-2	2-3 2-3
3	J5 J6	1-2 3-4	2-3 3-4	2-3 1-2	2-3 2-3

Digital Output Configuration

The four digital outputs of the I/O module do not require any settings.

Termination Unit/Module Configuration

A termination unit (TU) or termination module (TM) connects the field device wiring to the INFI 90 OPEN system. The terminal blocks (connection points) are located on the TU/TM.

Configure the TU/TM to accept the field inputs that are sent to the I/O module, and to output the I/O signals that are sent to the process field device. Refer to the appendices to determine the configuration procedure.

Physical Installation

NOTE: This section provides instructions pertaining to the physical installation of the control I/O only. For complete cable and TU/TM information, refer to the appropriate instruction manual (Table 1-2).

The IMCIS12 and IMQRS12 modules insert into a standard INFI 90 OPEN module mounting unit (MMU) and each occupies one slot. Use the following installation procedures.

1. Verify the slot assignment of the module.

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

2. Verify that a dipshunt is in the I/O expander bus socket on the MMU backplane between the I/O module and the control 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 I/O module. The latches should snap securely into place.

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

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

WIRING CONNECTIONS AND CABLING

The CIS and QRS modules have three card edge connectors to supply power, connect I/O expander bus communication and provide digital I/O (P1, P2, P3 respectively).

Wiring

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

Cable Connections

The CIS and QRS modules use either a NTCS04 (termination unit) or NICS01 (termination module) for termination. Refer to Figure 3-3 to determine the correct cables.

FUSING

The CIS and QRS modules do not have any on board fusing requirements.

PREOPERATING ADJUSTMENTS

The CIS and QRS modules do not require any adjustments prior to operation.

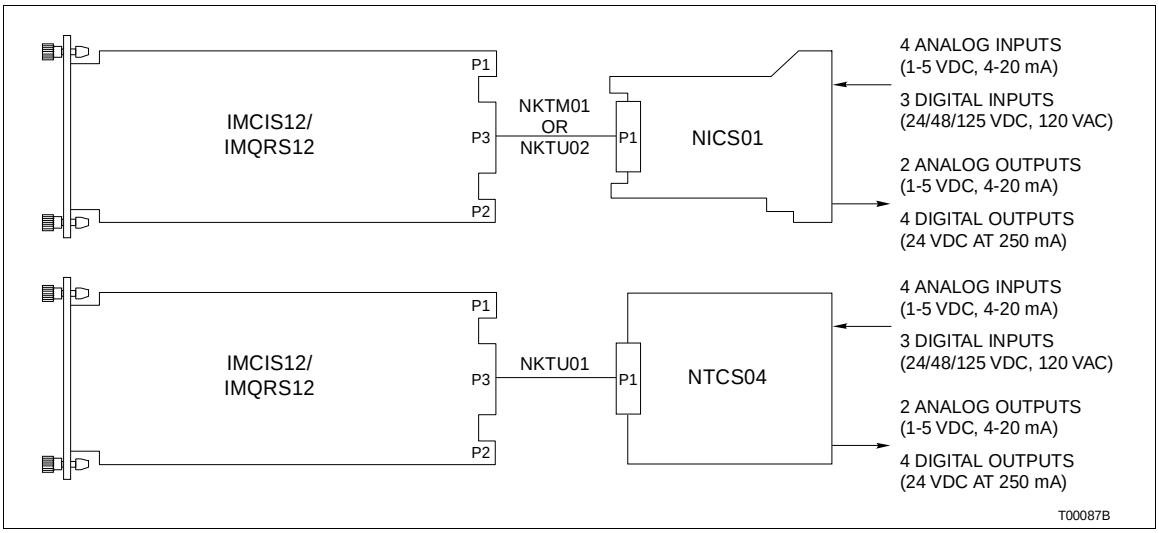


Figure 3-3. Cable Connections and Termination

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section explains the front panel indicator and start-up procedures for the IMCIS12 and IMQRS12 modules.

MODULE STATUS INDICATOR

The CIS and QRS modules have two (red/green) LEDs visible through the module front panel. When lit, the green LED indicates a good I/O module status. If the LED is red, it indicates a bad I/O module status. The location of the LED indicators is shown in Figure 4-1. Table 4-1 explains the three states of the status LED indicators. Refer to Section 5 to determine corrective actions.

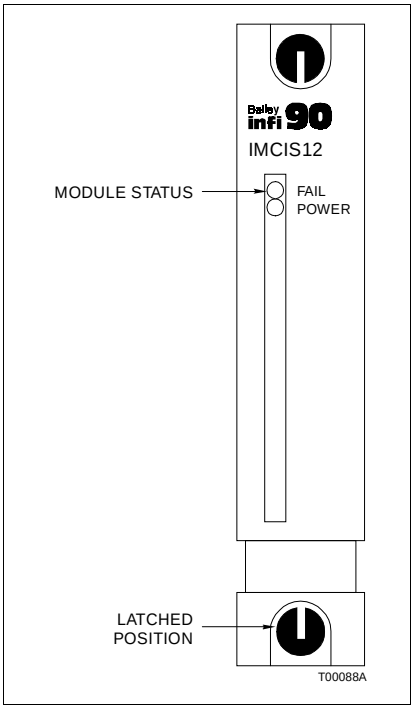


Figure 4-1. Front Panel Indicators

Table 4-1. Status LED Indicator

LED	Indication
Solid green (POWER)	Enabled and communicating with MFP
Off	No power or not enabled
Solid red (FAIL)	Bus fault timer error (time-out)

START-UP PROCEDURES

The multi-function processor (MFP) controls the start-up of the CIS and QRS modules; it is fully automatic. Function Code (FC) 79 in the MFP configuration enables the I/O module. Specification S1 (FC 79) is the I/O module address. It must be the same as the address set on the I/O module address switch (S1). The front panel LED (solid green) verifies that the module is enabled and communicating.

FUNCTION CODE CONFIGURATION

Configure the control module so that the CIS or QRS module will operate within the system control strategy. To configure the control module, the following instruction manuals are necessary.

- Instruction manual for the operator interface/configuration device in the system (i.e., OIS, CTM, EWS).
- Function Code Application Manual.
- Instruction manual for the control module in the system.

Refer to Table 1-2 for a listing of applicable instruction manuals.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section explains the error indications and corrective actions for the IMCIS12 and IMQRS12 modules.

ERROR INDICATIONS AND CORRECTIVE ACTION

Status of the CIS and QRS modules can be obtained through an INFI 90 OPEN operator interface (e.g., Operator Interface Station, Engineering Work Station, Configuration and Tuning Terminal) or the front panel module status LED indicators.

When using an operator interface, check the control module for good quality on output N+9 of function code (FC) 79; 0 = good status, 1 = bad reference status, I/O failed to respond.

Status LED

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

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

Table 5-1. Status LED Indications and Correction Actions

LED State	Indication	Probable Cause	Corrective Action
Solid Green (POWER)	I/O module operating normally and communicating with MFP	Normal operation	No action required
Off	I/O module not enabled	Address set on address switch S1 not the same as address in MFP configuration FC 79, spec S1	Change address on address switch S1 to correspond with FC 79, spec S1 ***- or -*** Change address in FC 79, spec S1 to correspond with address switch S1
		Dipshunt not properly installed between MFP and I/O module	Verify dipshunt is installed properly (no bent pins) in I/O expander bus socket on MMU backplane between MFP and I/O module
		MFP configuration is not correct	Verify FC 79 is in MFP configuration
	No power to I/O module	Module not completely inserted in MMU	Verify module is completely inserted in MMU: faceplate flush with MMU and captive retaining screws latched
Red (FAIL)	Bus fault timer error (time-out)	I/O expander bus clock failure	Check MFP for proper operation

Table 5-1. Status LED Indications and Correction Actions (continued)

LED State	Indication	Probable Cause	Corrective Action
Red (FAIL) (continued)	Bus fault timer error (time-out)	Dipshunt not installed between MFP and I/O module	Verify dipshunt is installed in the I/O expander bus socket on the MMU back-plane between MFP and I/O module

Control Module Errors

The multi-function processor (MFP) performs status checks on the I/O module. An error will appear in the report function of an operator interface. Refer to the appropriate instruction manual for the operator interface you are using for an explanation of these reports.

Function Code (FC) 79 output block N+9 in the MFP configuration is the I/O module status flag (logic 0=good; logic 1=bad). Use an operator interface to monitor this block. If the status flag is a logic 1, check the front panel module status LED and the operator interface report function to determine corrective actions.

> **NOTE:** If FC 79 specification S19 is set to 0, the MFP will *trip* when the CIS or QRS module fails or the analog input reference voltages are out of tolerance. Changing specification S19 to a 1 will allow the MFP to continue to operate if any I/O module error condition exists.

Analog input reference error

The MFP generates an ANALOG INPUT REFERENCE ERROR if the I/O module reference voltages (1 VDC and 5 VDC) used to calibrate the analog input zero offset and gain are not within tolerance or the analog inputs are not within tolerance.

1. Check the analog inputs to verify that their voltages are within specifications (1 to 5 VDC).

2. Check the analog inputs to verify that their common mode voltage is within specifications (±10 VDC).

If the analog inputs are correct, replace the CIS or QRS module.

Missing slave module error

The address set on address switch (S1) and in the MFP configuration must be the same. The MFP generates a MISSING SLAVE MODULE ERROR if they do not match. Verify that the address set on switch S1 is the same as the address in FC 79 specification S1. If not:

1. Remove the module and change the setting of switch S1 to correspond with the MFP configuration (refer to the Section 3 for the procedures to set an address and to install an I/O module). ***- or -***

2. Modify the address in the MFP configuration (FC 79 specification S1) to correspond with the address set on switch S1. Use an INFI 90 OPEN operator interface to modify the configuration (for procedures on how to modify a function code specification, refer to the appropriate instruction manual for the operator interface you are using).

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

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

MODULE PIN CONNECTIONS

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

Table 5-2. P1 Power Pin Connections

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

NC = Not Connected
PFI = Power Fail Interrupt

Table 5-3. P2 Expander Bus Connections

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

NC = Not Connected

Table 5-4. P3 I/O Pin Connections

Signal	Pin (+)	Pin (-)
Digital Output 1	A	1
Digital Output 2	B	2
Digital Output 3	C	3
Digital Output 4	D	4
NC	E	5
Digital Input 1	F	6
Digital Input 2	H	7
Digital Input 3	J	8
+24 VDC	K	9
Analog Output 1	L	10
Analog Output 2	M	11
Analog Input 1	N	12
Analog Input 2	P	13
Analog Input 3	R	14
Analog Input 4	S	15

NC = Not Connected

SECTION 6 - MAINTENANCE

INTRODUCTION

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

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

Personnel performing preventive maintenance should meet the following qualifications.

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

PREVENTIVE MAINTENANCE SCHEDULE

Table 6-1 is the preventive maintenance schedule for the IMCIS12 and IMQRS12 modules. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Instructions for tasks that require further explanation are covered under ***PREVENTIVE MAINTENANCE PROCEDURES***.

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

EQUIPMENT AND TOOLS REQUIRED

The tools and equipment required for maintenance procedures are:

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

Table 6-1. Preventive Maintenance Schedule

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

PREVENTIVE MAINTENANCE PROCEDURES

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

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

Printed Circuit Board Cleaning

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

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

WARNING

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

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

GENERAL CLEANING AND WASHING

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

To wash the printed circuit board:

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

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

EDGE CONNECTOR CLEANING

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

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

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

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

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

To clean tarnished or deeply stained edge connector contacts:

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

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

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

4. Wipe clean with a lint free cloth.

Checking Connections

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

WARNING

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

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

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

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

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

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement procedures for an IMCIS12 and IMQRS12 modules. There are no special tools required to replace CIS and QRS modules.

MODULE REPAIR/REPLACEMENT PROCEDURES

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

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

2. Gently slide the module out of the MMU.

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

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

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

6. Return to normal operation.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Elsag Bailey Process Automation 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 at your facility, order replacement parts from a Elsag Bailey Process Automation sales office. Provide the following information.

1. Part description, part number and quantity.

2. Model and serial number (if applicable).

3. Elsag Bailey instruction number and page number of part reference.

TRAINING

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

TECHNICAL DOCUMENTATION

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

APPENDIX A - TERMINATION UNIT (NTCS04) CONFIGURATION

INTRODUCTION

The IMCIS12 and IMQRS12 modules can use an NTCS04 for termination. The termination unit can handle four analog inputs, two analog outputs, three digital inputs and four digital outputs. Dipshunts on the termination unit configure the I/O.

> **NOTE:** There is no dipshunt socket to configure for the digital outputs on the NTCS04.

Figures A-1 shows the NTCS04 configuration sockets (dipshunts). Refer to this figure when connecting field wiring to the NTCS04 termination unit. Refer to Tables A-1 through A-4 to determine the dipshunt strapping.

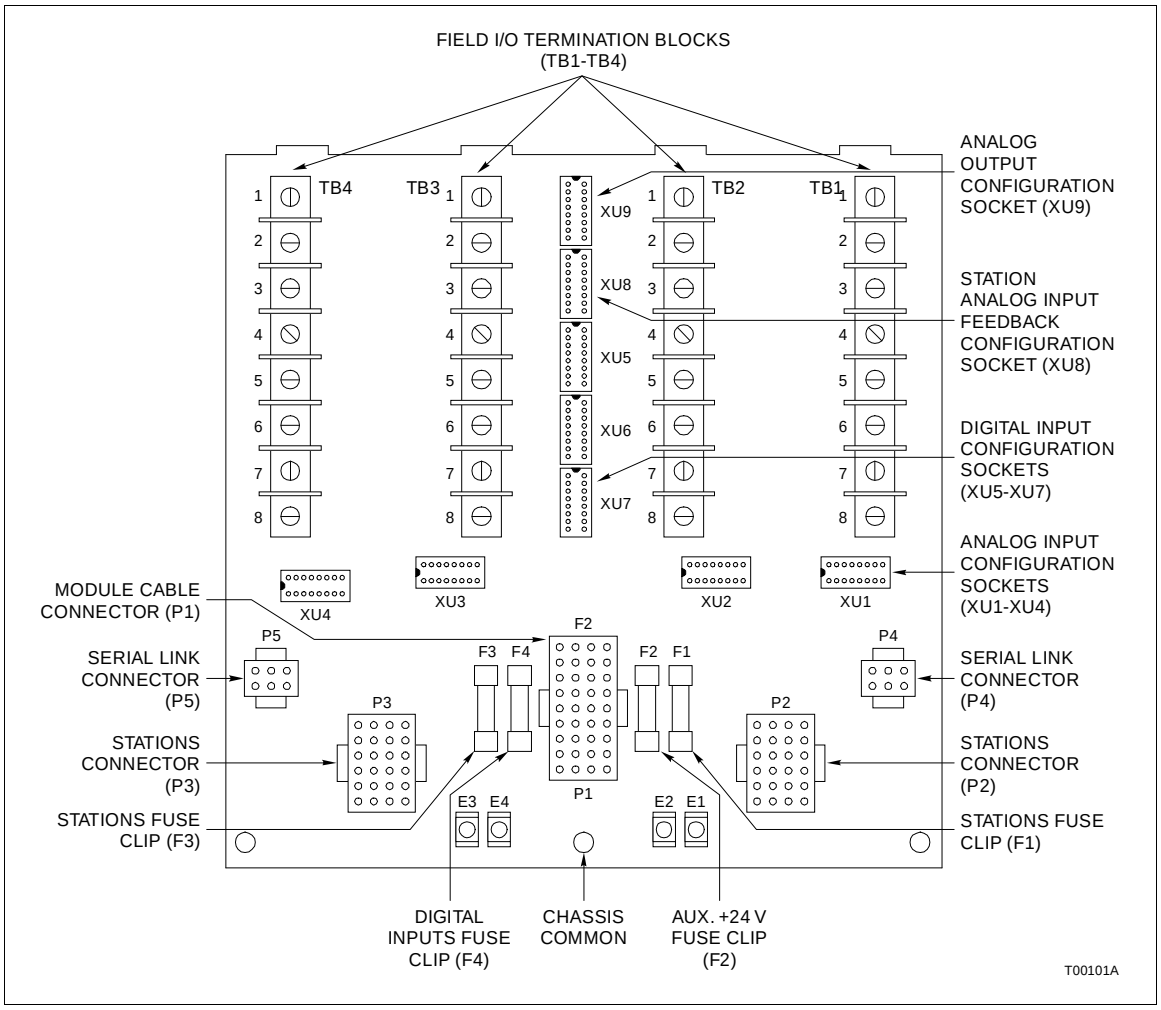


Figure A-1. NTCS04 Termination Unit Layout

Table A-1. Analog Input Dipshunt Configuration

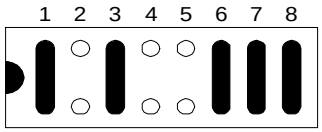
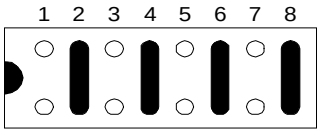
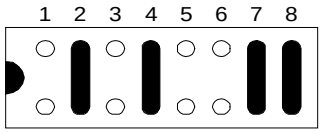
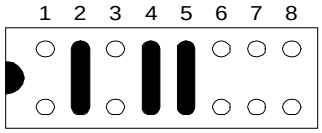
Application/Signal Type	Dipshunt Configuration XU1-XU4
System powered (4-20 mA)	
Externally powered (4-20 mA)	
Single ended voltage (1-5 VDC)	
Differential voltage (1-5 VDC)	

Table A-2. Analog Input Destination for Station Feedback

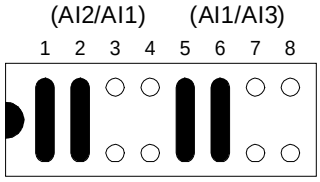
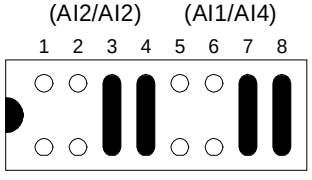
Application/Signal Type	Dipshunt Configuration XU8 (Station Designator/Analog Input)
Station No. 1 (P2 connector) Station/termination unit A/I designation	
Station No. 2 (P3 connector)	

Table A-3. Analog Output Dipshunt Configuration

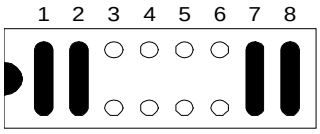
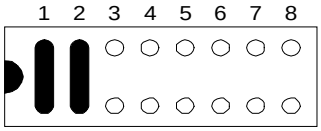
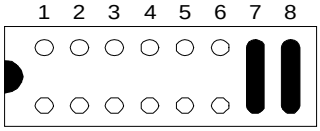
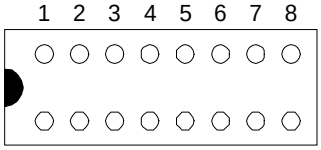
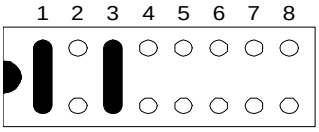
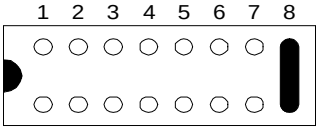
Application/Signal Type	Dipshunt Configuration XU9
Both outputs in voltage mode	
Output 1 in voltage mode, output 2 in current mode	
Output 1 in current mode, output 2 in voltage mode	
Both outputs in current mode (no dip-shunt required)	

Table A-4. Digital Input Dipshunt Configuration

Application/Signal Type	Dipshunt Configuration XU5-XU7
System powered E3/E4	
Field powered[1]	 TP27118A

NOTE:
1. Using the field device to complete the path to ground is commonly referred to as ***switching neutral***. Using the field device to complete the path to the I/O module is referred to as ***switching hot***. If switching hot is the desired method, the field powered dipshunt configuration must be used. If system power is required, it should be wired as a field source. Refer to Figure A-2 for an example of switching hot and switching neutral.

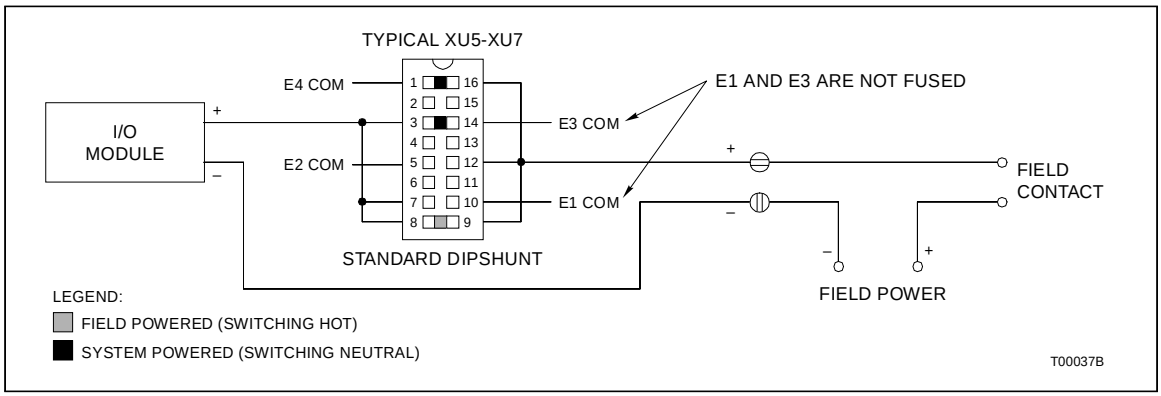


Figure A-2. Switching Hot vs. Switching Neutral

APPENDIX B - TERMINATION MODULE (NICS01) CONFIGURATION

INTRODUCTION

The IMCIS12 and IMQRS12 modules can use an NICS01 for termination. The termination module can handle four analog inputs, two analog outputs, three digital inputs and four digital outputs. Dipswitches on the termination module configure the I/O. Refer to Table B-1 to determine the dipswitch settings. Figure B-1 shows terminal assignments for the digital and analog I/O signals. Refer to this figure when connecting field wiring to the NICS01.

NOTE: There are no dipswitches to configure for the digital I/O on the NICS01.

Table B-1. NICS01 Dipswitch Configuration

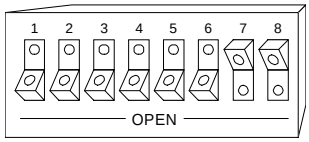
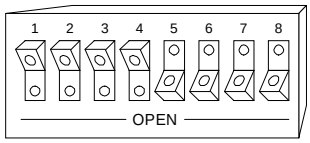
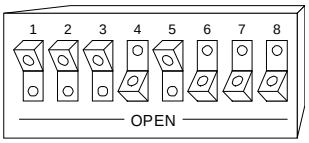
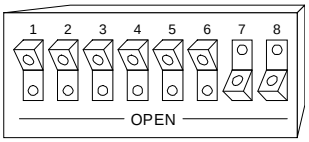
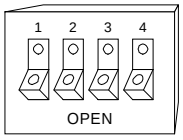
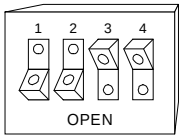
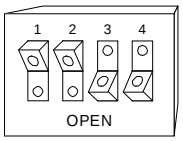
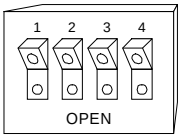
Analog Input	
Application/Signal Type	**Dipswitch Configuration S1-S4**
System powered (4-20 mA)	
Externally powered (4-20 mA)	
Single ended voltage (1-5 VDC)	
Differential voltage (1-5 VDC)	

Table B-1. NICS01 Dipswitch Configuration (continued)

Analog Output	
Application/Signal Type	**Dipswitch Configuration S5**
Both outputs in voltage mode	
Output 1 in voltage mode, output 2 in current mode	
Output 1 in current mode, output 2 in voltage mode	
Both outputs in current mode	

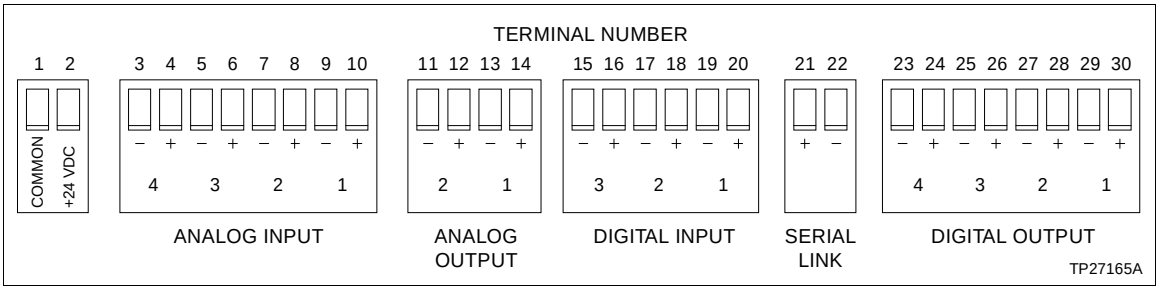


Figure B-1. NICS01 Terminal Assignments

APPENDIX C - QUICK REFERENCE

INTRODUCTION

This section provides a source for reference information. It contains the jumper and switch locations for the IMCIS12 and IMQRS12 modules. Refer to Section 3 for a complete description of jumper and switch settings.

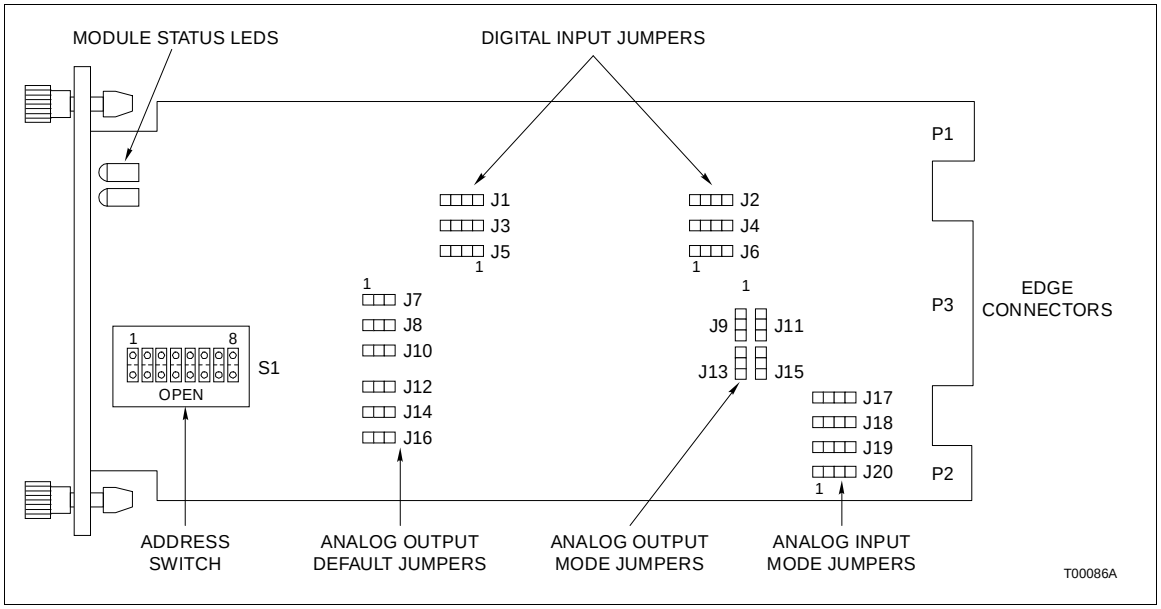


Figure C-1. Switch and Jumper Locations

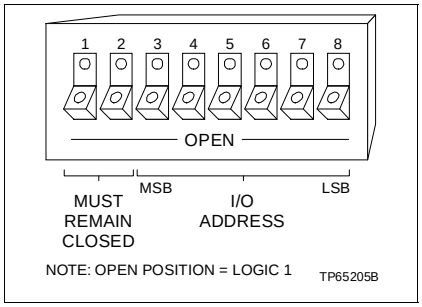


Figure C-2. Address Select Switch (S1)

Table C-1. S1 Address Switch Settings

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

1 = OPEN; 0 = CLOSED

Table C-2. Analog Output Default Jumpers

Analog Output	Time-Out Option			Power-Up State		
	Jumper	Go To Power-Up	Hold	Jumper	0%	100%
1	J8	2-3	1-2	J7	2-3	1-2
2	J14	2-3	1-2	J12	2-3	1-2

Table C-3. Analog Output Mode Jumpers

Analog Output	Jumper	Current Mode	Voltage Mode
1	J9, J11	2-3	1-2
2	J13, J15	2-3	1-2

Table C-4. Analog Input Mode Jumpers

Analog Input	Jumpers	Current Mode[1]	Voltage Mode (Single Ended)	Voltage Mode[2] (Differential)
1, 2, 3, 4	J17, J18, J19, J20	1-2	3-4	—

NOTE:
1. Field/system powered analog inputs depend on TU/TM configuration.
2. Do not install jumpers for this configuration.

Table C-5. Digital Input Jumper Settings

Digital Input	Jumper	120 VAC	125 VDC	48 VDC	24 VDC
1	J1 J2	1-2 3-4	2-3 3-4	2-3 1-2	2-3 2-3
2	J3 J4	1-2 3-4	2-3 3-4	2-3 1-2	2-3 2-3
3	J5 J6	1-2 3-4	2-3 3-4	2-3 1-2	2-3 2-3

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