symphony™

Instruction
Harmony Series

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

IMCIS22 and IMQRS22

ABB

Preface

The IMCIS22 Control I/O and IMQRS22 Quick Response I/O Modules are Harmony rack I/O modules that are part of the Symphony Enterprise Management and Control System. The modules bring four analog and three digital process field signals into the system for processing and monitoring. The I/O modules output four digital and two analog signals for process control.

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 IMCIS22 and IMQRS22 modules.

NOTE: The IMCIS22 and IMQRS22 modules are fully compatible with existing INFI 90® OPEN Strategic Enterprise Management Systems.

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Equipment Environment
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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 module mounting unit 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. 6-3)

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. 6-3)

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)

Support Services

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Safety Summary

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Safety Summary

Electrostatic Sensitive Device
Devices labeled with this symbol require special handling precautions as described in the installation section.

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 module mounting unit 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. 6-3)

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. 6-3)

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)

Support Services

ABB will provide assistance in the operation and repair of its products. Requests for sales or application services should be made to your nearest sales or service office. ABB can also provide installation, repair and maintenance contract services.

When ordering parts, use nomenclature or part numbers and part descriptions from equipment manuals. Parts without a description must be ordered from the nearest sales or service office. Recommended spare parts lists, including prices are available through the nearest sales or service office.

ABB has modern training facilities available for training your personnel. On-site training is also available. Contact your nearest ABB sales office for specific information and scheduling.

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® INFI 90	Registered trademark of Elsag Bailey Process Automation

Preface

The IMCIS22 Control I/O and IMQRS22 Quick Response I/O Modules are Harmony rack I/O modules that are part of the Symphony Enterprise Management and Control System. The modules bring four analog and three digital process field signals into the system for processing and monitoring. The I/O modules output four digital and two analog signals for process control.

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 IMCIS22 and IMQRS22 modules.

NOTE: The IMCIS22 and IMQRS22 modules are fully compatible with existing INFI 90® OPEN Strategic Enterprise Management Systems.

List of Effective Pages

Total number of pages in this instruction is 53, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through viii	Original
1-1 through 1-9	Original
2-1 through 2-11	Original
3-1 through 3-7	Original
4-1 through 4-2	Original
5-1 through 5-4	Original
6-1 through 6-4	Original
7-1	Original
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NOTE: Changed text or tables are indicated by a vertical bar adjacent to the changed area. Changed figures are indicated by a vertical bar next to the figure caption. The date appears beside the page number.

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Introduction

Section 1

Overview

The IMCIS22 Control I/O Module and the IMQRS22 Quick Response I/O Module bring four analog and three digital process field signals into the system for processing and monitoring. They output four digital and two analog signals for process control. The IMCIS22 module and the IMQRS22 module are interfaces between the process and the Symphony Enterprise Management and Control System.

The IMCIS22 and IMQRS22 modules are functionally the same; however, the IMQRS22 module provides approximately 10 times faster response for the analog inputs. By doing this, the input signal noise rejection is lower for the IMQRS22 module than it is for the IMCIS22 module. The process requirements determine the module to use for the application.

> **NOTE:** In this instruction, any reference to I/O module means both the IMCIS22 module and the IMQRS22 module.

Controllers perform the control functions; I/O modules provide the I/O to the controller.

Figure 1-1 shows a Harmony area controller and the Harmony rack controllers using the rack I/O modules for I/O interface.

Intended User

Personnel installing, operating, or maintaining the I/O modules should read this instruction before performing any installation, operation, or maintenance procedures. Installation requires an engineer or technician with experience handling electronic circuitry. Those working with the digital output module should have experience working with and know the precautions to take around AC/DC power. A knowledge of the Symphony system and electronic principles is also required.

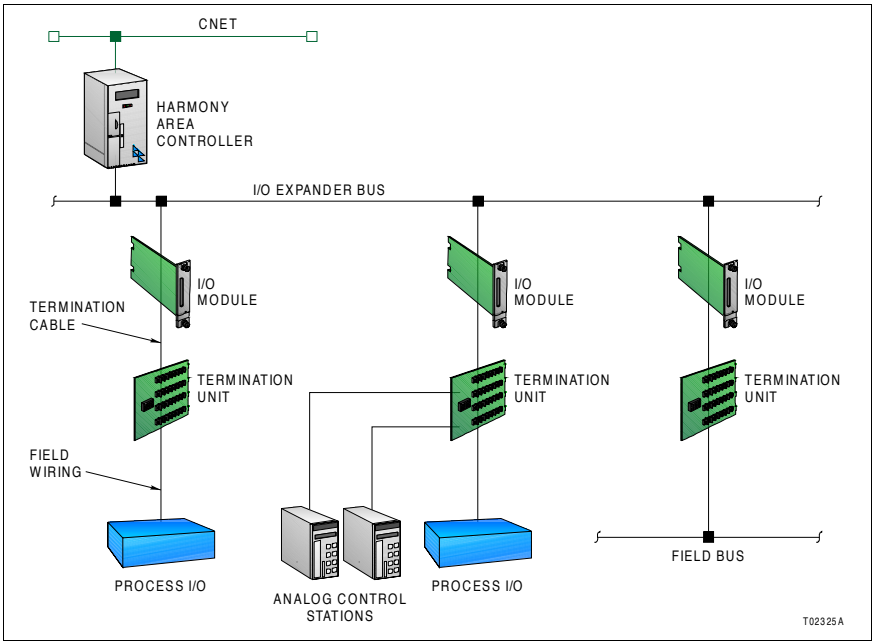


Figure 1-1. Harmony Rack I/O Architecture

Instruction Content

This instruction consists of the following sections:

Introduction	Contains a brief description, general usage information and technical specifications.
Description and Operation	Uses block diagrams 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 startup procedures.

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

Maintenance — Contains scheduled maintenance tasks and procedures.

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

How to Use this Instruction

Read this instruction in sequence. It is important to become familiar with the entire contents of this instruction before using the modules. Refer to a specific section for information as needed.

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

2. Perform 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.

Document Conventions

The ? in a nomenclature or a part number 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 ABB Automation or have a definition that is different from standard industry usage.

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
Controlway	High speed, redundant, peer-to-peer communication link. Used to transfer information between intelligent modules within a Harmony control unit.
Cnet	Symphony system advanced data communication highway.
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 Harmony rack controllers and rack I/O modules.
Module mounting unit (MMU)	A card cage that provides electrical and communication support for Harmony rack modules.
Termination unit (TU)	Provides input/output connection between plant equipment and the Harmony rack modules.

Reference Documents

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

Table 1-2. Reference Documents

Number	Document
WBPEEUI200502??	Module Mounting Unit (IEMMU11/12/21/22)
WBPEEUI210504??	Symphony Function Code Application Manual
WBPEEUI260037??	Controller/Station Termination Unit (NTCS04)

Related Hardware

Table 1-3 lists related nomenclature to the I/O modules.

Table 1-3. Related Nomenclature

Nomenclature	Description
IEMMU11, IEMMU12, IEMMU21, IEMMU22	Module mounting unit
NFTP01	Field termination panel
NTCS04	Termination unit

Specifications

Table 1-4 contains specifications relative to the IMCIS22 and IMQRS22 modules.

Table 1-4. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Power requirements

Operating voltage

Current

Power dissipation (logic only)</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)

<table><tr><th>Current</th><th>Typical</th><th>Maximum</th></tr><tr><td>+5 V</td><td>100 mA</td><td>180 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>65 mA</td></tr></table>
<table><tr><th>Current</th><th>Typical</th><th>Maximum</th></tr><tr><td>+5 V</td><td>0.5 W</td><td>0.9 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>1.56 W</td></tr></table></td></tr>
<tr><td>Overvoltage category
(II per IEC 61010-1)</td><td>I for circuits above150 V
II for circuits below150 V</td></tr>
<tr><td>Digital inputs

Voltages (±10%)
Current (typical)
Turn-on voltage (min.)
Tun-off voltage (max.)
Maximum input current at minimum turn-on
Off-leakage current (max.)

DC response time</td><td>3, optically isolated

<table><tr><th>120 VAC</th><th>24 VDC</th><th>48 VDC</th><th>125 VDC</th></tr><tr><td>6 mA</td><td>5.5 mA</td><td>4.7 mA</td><td>4.5 mA</td></tr><tr><td>81 VAC</td><td>19.5 VDC</td><td>26.7 VDC</td><td>90.5 VDC</td></tr><tr><td>45 VAC</td><td>13 VDC</td><td>13 VDC</td><td>55 VDC</td></tr><tr><td>3.8 mA at 81 VAC</td><td>4 mA at 19.5 VDC</td><td>2 mA at 26.7 VDC</td><td>2.4 mA at 90.5 VDC</td></tr><tr><td>1.6 mA (at V_{in} ≤45 VAC 60 Hz)</td><td>50 nA (at V_{in} ≤10.5 VDC)</td><td>50 nA (at V_{in} ≤10.5 VDC)</td><td>1 μA (at V_{in} ≤50.8 VDC)</td></tr><tr><td colspan="4">17 ms (fixed)</td></tr></table></td></tr>
</table>

Table 1-4. Specifications *(continued)*

Property	Characteristic/Value
Digital outputs	4, open collector, optically isolated
Off output voltage	$V_{I/O}$ (nominal 24 ±10% VDC or 48 ±10% VDC)
On output voltage	1.5 VDC maximum
Off output current	10 μA maximum
On output current	250 mA maximum at 24 VDC; 125 mA maximum at 48 VDC
Analog inputs	4, 1-5 VDC (differential/single ended) or 4-20 mA
Termination unit configured:	1 powered or unpowered current (4-20 mA) Single ended or differential voltage (1-5 VDC)
Input impedance	>1 MΩ
Common mode voltage	±10 VDC
IMCIS22	
Normal mode rejection	>76 db at 50/60 Hz
Common mode rejection	90 db from DC to 60 Hz
Response time per channel (100% step change)	2.4 sec to 95% of final value
IMQRS22	
Normal mode rejection	37 db at 50/60 Hz
Common mode rejection	53 db from DC to 60 Hz
Response time per channel (100% step change)	0.27 sec to 95% of final value
A/D resolution	12 bits for analog inputs
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
Current limiting Short circuit protection	50 mA (nominal)
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

Table 1-4. Specifications *(continued)*

Property	Characteristic/Value
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° to158°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 module mounting unit
Environmental	
Ambient temperature (per IEC-68-2-1, 2,14)	Temperature rating within the cabinet or enclosure applies. 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
Atmospheric pressure	Sea level to 3 km (1.86 mi)
Air quality (per ISA S71.04 Class LA, LB, LC - level 1)	Noncorrosive
Isolation (per IEC 61010-1, IEC 60255-5, IEC 60060) Channel to channel and channel to logic	

Test	Common Mode	Normal Mode
Digital input/output		
Insulation resistance (100/500 VDC)	100 MΩ	N/A
Dielectric VAC (45 to 65 Hz) or VDC	1.4 kV rms/1 min. or 1.95 kV DC/1 min.	N/A
Impulse voltage (1.2/50 μS)	±2.55 kVp	±1 kVp
Analog input/output		
Impulse voltage (1.2/50 μS)	N/A	±1 kVp

Table 1-4. Specifications *(continued)*

<table>
<tr><th>Property</th><th>Characteristic/Value</th></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 61000-4-5, EN 61000-4-5)</td><td>±2 kVp</td><td>±1 kVp</td></tr>
<tr><td>Fast transient bursts (IEC 61000-4-4, 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 61000-4-12, EN 61000-4-12)</td><td>±1 kVp</td><td>±0.5 kVp</td></tr>
<tr><td>Ring wave (IEC 61000-4-12, EN 61000-4-12)</td><td>±2 kVp</td><td>±1 kVp</td></tr>
</table>
</td></tr>
<tr><td>Electrostatic discharge (IEC 61000-4-2, EN 61000-4-2)</td><td>Contact: ±6 kV
Air: ±8 kV</td></tr>
<tr><td>Magnetic and electromagnetic fields</td><td></td></tr>
<tr><td>Power frequency magnetic field (IEC 61000-4-8, EN 61000-4-8)</td><td>Continuous: 30 A/m (rms)
Short duration: 300 A/m (rms)</td></tr>
<tr><td>Pulse magnetic field (IEC 61000-4-9, EN 61000-4-9)</td><td>Peak value: 300 A/m</td></tr>
<tr><td>Damped oscillatory magnetic field, 0.1 MHz and 1 MHz (IEC 61000-4-10, EN61000-4-10)</td><td>Peak value: 30 A/m</td></tr>
<tr><td>Radiated radio-frequency electromagnetic field, 80 MHz to 1 GHz (IEC 61000-4-3)</td><td>Unmodulated rms: 10 V/m
Amplitude modulated: 80% AM (1 kHz)</td></tr>
<tr><td>Radiated radio-frequency field, 900 ±5 MHz (ENV 50204)</td><td>Unmodulated rms: 10 V/m
Pulse modulated: Duty cycle 50%
Rep. cycle 200 Hz</td></tr>
<tr><td>Radio-frequency common mode 0.15 MHz to 80 MHz (IEC 61000-4-6)</td><td>Unmodulated rms: 10 V/rms
Amplitude modulated: 80% AM (1 kHz)
Source impedance: 150 Ω</td></tr>
<tr><td>Emission test RF radiated fields, 30 MHz to 1000 MHz (EN 55011)</td><td>Class A</td></tr>
</table>

Table 1-4. Specifications *(continued)*

Property	Characteristic/Value
CE Mark Declaration	This product, when installed in a Symphony cabinet, complies with the following directives/standards requested for CE marking:
EMC 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)	Approval for the following categories. Nonincendive for: Class I, Division 2, Groups A, B, C, D Class II, Division 2, Group F,G

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

Description and Operation

Section 2

Introduction

This section explains the inputs, outputs, logic power and connections for the IMCIS22 and IMQRS22 modules. The I/O modules are process field I/O interfaces for a Harmony controller. The I/O module circuitry performs the following functions:

- Analog to digital (A/D) conversion. It changes analog inputs to digital values the controller can process.
- Digital to analog (D/A) conversion. It changes the controller 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 controller 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 I/O modules.

Module Description

The I/O modules consist of a single printed circuit board that occupies one slot in a module mounting unit. 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.

Two captive screws on the faceplate secure the module to the module mounting unit. 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 (Table 5-2). P2

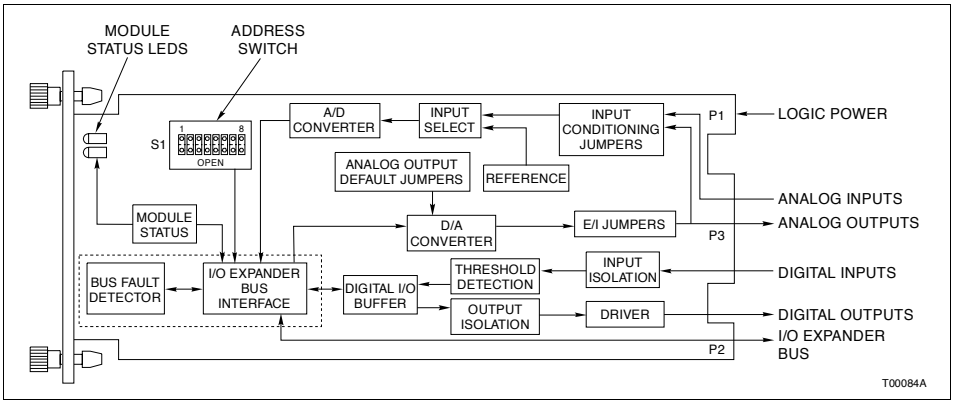


Figure 2-1. Block Diagram

connects the module to the controller through the I/O expander bus (Table 5-3). The field I/O signals are exchanged through connector P3 using a cable connected to a termination unit (Table 5-4). The terminal blocks (physical connection points) for field wiring are on the termination unit.

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 system to compensate for process field device debounce time. The output digital signals of 24 VDC that can sink 250 milliamperes at 24 VDC and 125 milliamperes at 48 VDC.

The I/O module accepts analog signals of 1 to 5 VDC (single ended or differential). Its respective termination unit converts a 4 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 off.

Analog I/O

The I/O modules can input four separate analog signals configurable as voltage (1 to 5 VDC) single ended or differential, or current (4 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 1-4 for normal mode rejection (differential change) and common mode rejection specifications for the differential inputs. The input conditioning block consists of an I/E (current or voltage) conversion resistor and a configuration jumper (for each channel) to configure the I/O module to input current or voltage (single ended or differential).

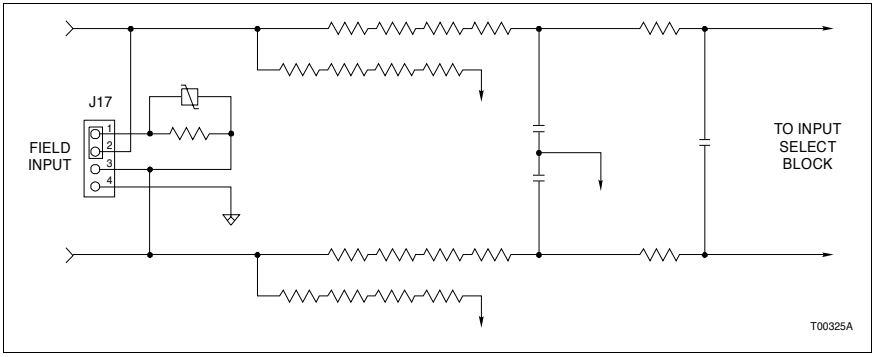


Figure 2-2. Analog Input Circuit

The input select block consists of an analog multiplexer and an inverting difference amplifier. The multiplexer selects one of the 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 milliampere); however, it allows for a 0.75 to 5.25 VDC (three to 21 milliampere) input range which is ±6.25 percent of the nominal input range span (4 VDC).

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 controller 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 four-bit microcontroller converts and checks data integrity from the controller. Each D/A converts a 10-bit digital value (analog count) from the microcontroller to an analog output (1 to 5 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 controller and I/O module.

The analog output default jumpers set the output values during system startup 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 Mode Jumpers (J9, J11, J13, J15)*** 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 I/E 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.

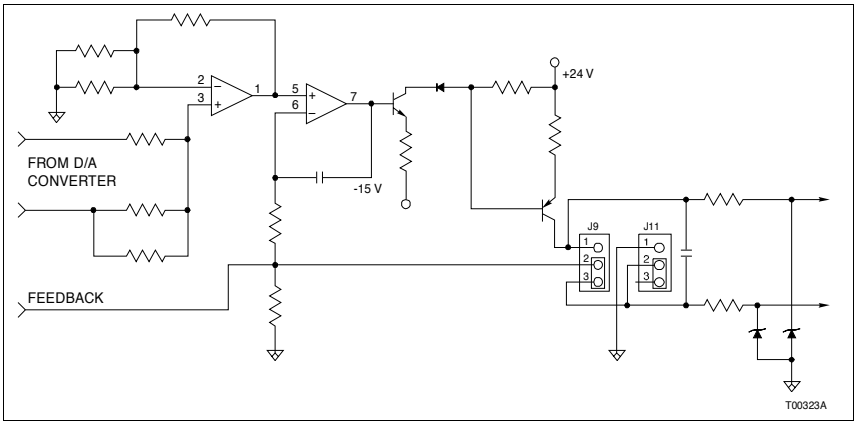


Figure 2-3. Analog Output Circuit

Digital I/O

The I/O 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 120VAC. 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 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 (on) or de-energized (off) 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.

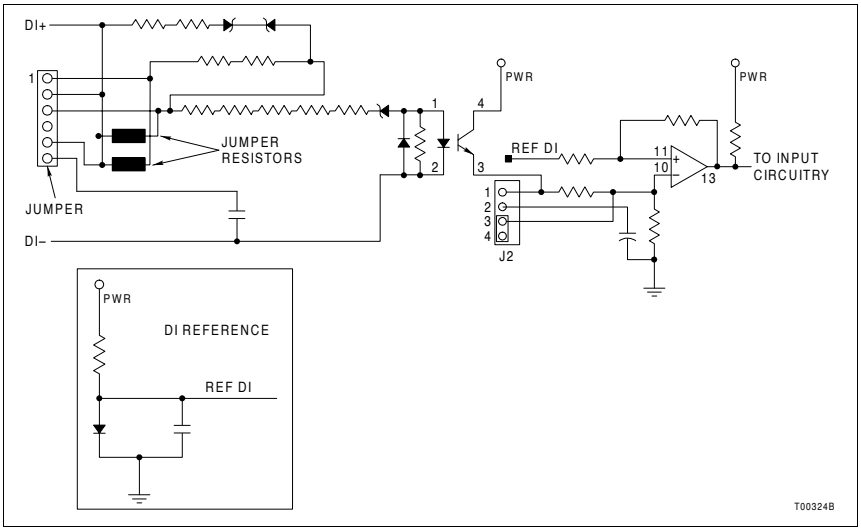


Figure 2-4. Digital Input Circuit

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 milliampere load for 24 VDC or a 125 milliampere load for 48 VDC make up the driver block.

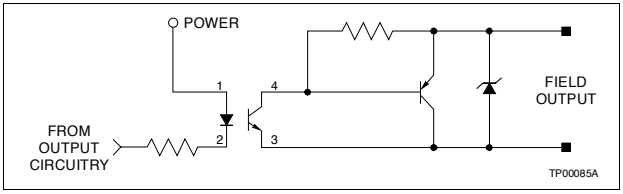


Figure 2-5. Digital Output Circuit

Digital I/O Buffer

The digital I/O buffer block is a buffer and register that holds 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.

I/O Circuit Connections

The I/O signals connect to the 30-pin card edge connector P3 of the I/O modules using a termination cable from a termination unit. It also supplies +24 VDC power to operate the analog output circuits.

I/O Expander Bus

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

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

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

I/O Expander Bus Interface

The I/O 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.

This intergrated circuit provides the following functions:

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

Module Data

Function code 79 in the controller configuration accesses the I/O module on the I/O expander bus. It also allows the controller to automatically read input data or status data from the I/O module, and write output data to it. This data is output by the 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 controller reads from the I/O module. It is also analog and digital output values that the controller sends to the I/O module. The controller 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 controller 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 controller 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 controller 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 zero) or closed (logic one). Digital output readback data reflects the output states. The controller

uses this data to verify that the outputs are correct. Each bit corresponds to one output; a logic one indicates an active (on) output, a logic zero indicates an inactive (off) output.

Status Data

Status data is an eight-bit data value that identifies the I/O module and indicates the default values set by the analog output default jumpers. The controller reads the identification bits (four MSB) to verify the I/O expander bus communication integrity and controller 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 I/O module 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 controller generates the bus clock. If the bus clock stops (indicating a controller 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 I/O module status LED indicators show the operating state of the I/O 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.

Mounting Hardware

Harmony rack I/O modules and termination units mount in standard ABB Automation enclosures (CAB-01, CAB-04, CAB-12). The number of modules that can be mounted in a single cabinet varies.

An IEMMU11, IEMMU12, IEMMU21, or IEMMU22 Module Mounting Unit and an NFTP01 Field Termination Panel (FTP) are used for module and termination unit mounting respectively (Fig. 2-6). The mounting unit and termination panel both attach to the side rails in standard 483-millimeter (19-inch) enclosures. Front mount and rear mount MMU versions are available to provide flexibility in enclosure mounting.

A module mounting unit is required to mount and provide power to rack-mounted modules. The unit is for mounting controllers, I/O modules, and communication interface modules. The MMU backplane connects and routes:

- Controlway.
- I/O expander bus.
- Logic power to control, I/O, and interface modules.

The Controlway and I/O expander bus are internal cabinet, communication buses. Communication between rack controllers and communication interface modules is over Controlway.

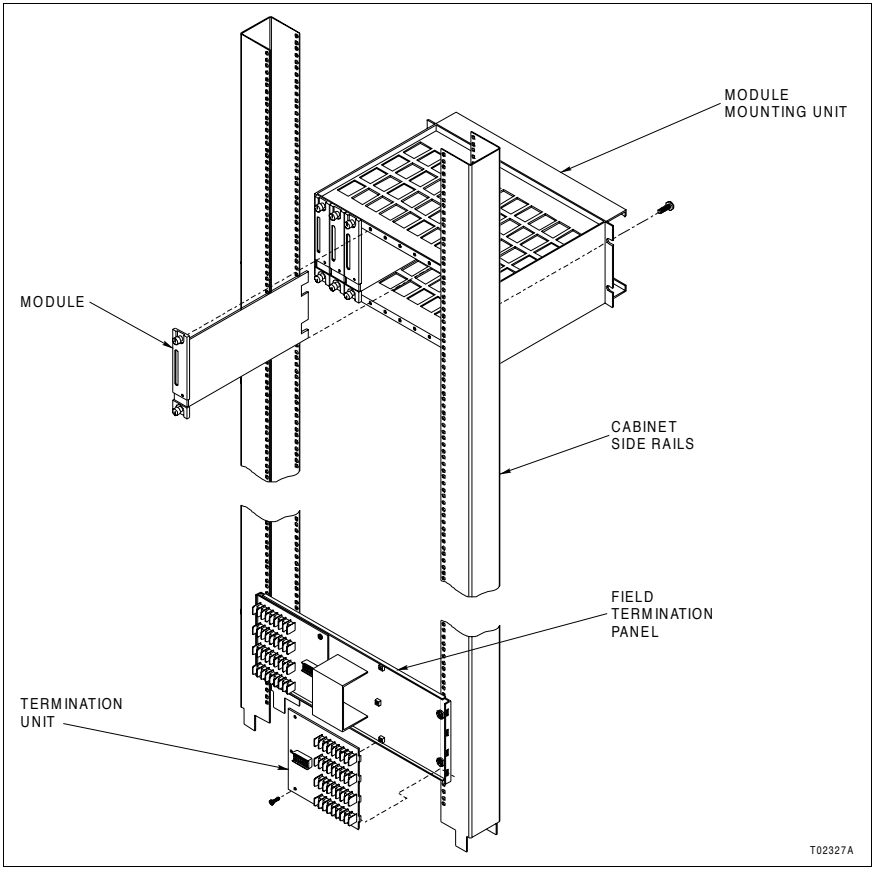


Figure 2-6. Mounting Hardware

Installation

Section 3

Introduction

This section explains the procedures required to place the IMCIS22 module or IMQRS22 module 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

Observe these steps when handling electronic circuitry:

1. ***Use Static Shielding Bag.*** Keep an assembly in its static shielding bag until 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 Semiconductors.*** Verify that all devices connected to the module are properly grounded before using them.

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

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

7. ***Use a Grounded Wrist Strap.*** Use the ABB Automation field static kit (part number 1948385A1 - consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipative work surface) when working with modules. The kit grounds a technician and the static dissipative work surface to the same ground point to prevent damage to the circuitry by electrostatic discharge. Connect the wrist strap to the

appropriate grounding plug on the power supply or to an unpainted portion of the enclosure with the alligator clip. The wrist strap must be effectively connected to the earth grounding electrode system through the AC safety ground.

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

Unpacking and Inspection

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

2. Notify the nearest ABB 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 and Physical Installation

Prior to installation, set the module dipswitches and install jumpers to configure the I/O modules. The termination unit must also be configured to accept the field device signals and output the I/O module signals to the process.

Address Selection Switch (S1)

The I/O module can have one of 64 addresses (address 0 to 63) on the I/O expander bus. This address uniquely identifies the module to the controller and must be the same as the address set in the controller configuration (FC 79, specification S1).

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

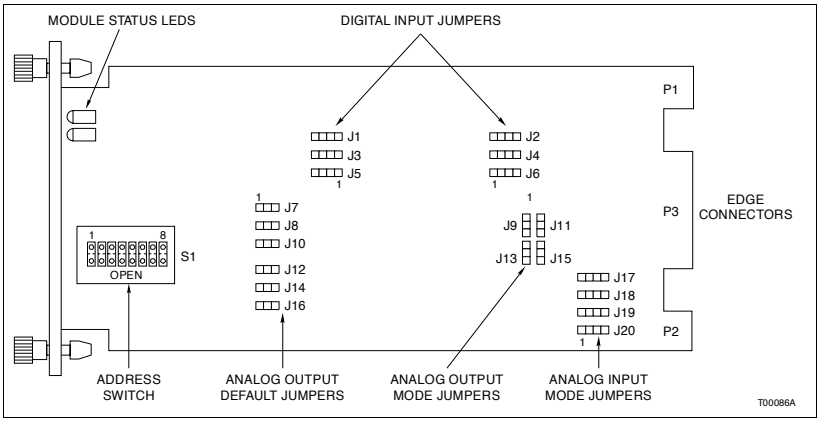


Figure 3-1. Module Layout

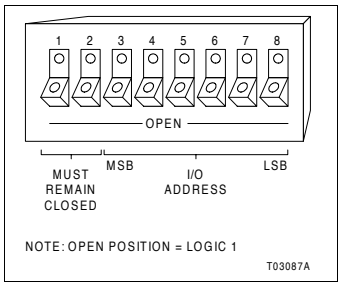


Figure 3-2. Address Switch S1 Settings

Table 3-1. S1 Address Switch Settings Examples

ADDR	MSB					LSB
	3	4	5	6	7	8
5	0	0	0	1	0	1
15	0	0	1	1	1	1
32	1	0	0	0	0	0

NOTE:
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 startup (power up) or bus fault error (time-out).

Select either a zero percent or 100 percent power up output. Selecting zero percent will output 4 milliamperes or 1 VDC; selecting 100 percent will output 20 milliamperes or 5 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 controller. 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 (4 to 20 milliamperes) or voltage (1 to 5 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 (4 to 20 milliamperes) or voltage (1 to 5 VDC) either differential voltage or single-ended voltage mode.

Select the analog input mode at the termination unit or at the I/O module. Use one of the following procedures.

1. At the I/O 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 analog input dipshunt configuration at the termination unit. Refer to Appendix A.

2. At the termination unit, use the dipshunt configuration for differential voltage mode. Refer to Appendix A. 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 termination unit 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). The I/O module requires jumper settings for both the working voltage and the correct DC or AC mode selections. Refer to Figure 3-1 for location of jumpers and Table 3-5 to determine the jumper settings. Position a jumper across the pins shown in the table.

Digital Output Configuration

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

Table 3-5. Digital Input Jumper Settings

Digital Input	Jumper	120 VAC	125 VDC	48 VDC	24 VDC
1	J1 J2	1-2 5-6	2-3 3-4	2-3 1-2	2-3 2-3
2	J3 J4	1-2 5-6	2-3 3-4	2-3 1-2	2-3 2-3
3	J5 J6	1-2 5-6	2-3 3-4	2-3 1-2	2-3 2-3

Termination Unit Configuration

A termination unit connects the field device wiring to the system. The terminal blocks (connection points) are located on the termination unit.

Configure the termination unit to accept the field inputs that are sent to the I/O module, and to output the I/O module signals that are sent to the process field device. Refer to Appendix A 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 termination unit information, refer to the appropriate instruction manual (Table 1-1).

The I/O modules insert into a standard module mounting unit and each occupies one slot. The installation procedures are:

1. Verify the slot assignment of the module.

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

2. Verify that a dipshunt is in the I/O expander bus socket on the backplane between the I/O module and the controller.

3. Connect the hooded end of the termination cable from the termination unit to the module mounting unit 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 module mounting unit. Gently slide the I/O module in until the front panel is flush with the top and bottom of the mounting unit frame.

5. Push and turn the two captive retaining screws on the I/O 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 I/O module.

Wiring Connections and Cabling

The I/O 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 I/O module in the module mounting unit 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 controler. P1 and P2 connection require no additional wiring or cabling.

> **NOTE:** You must install a dipshunt on the backplane of the module mounting unit to connect the I/O expander bus between the I/O module and the controller. Locate the I/O modules so the I/O expander bus can connect the modules or they will not communicate.

Cable Connections

The I/O modules use a NTCS04 termination unit for termination. Refer to Figure 3-3 to determine the correct cables.

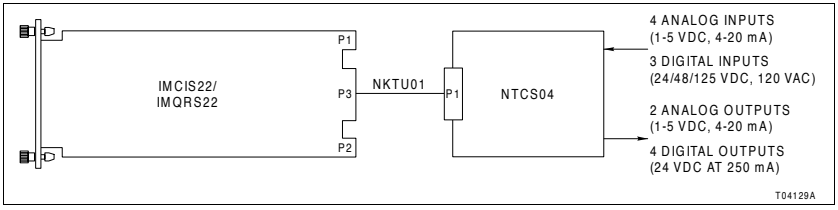


Figure 3-3. Cable Connections and Termination

Operating Procedures

Section 4

Introduction

This section explains the front panel indicator and startup procedures for the IMCIS22 module and IMQRS22 module.

Module Status Indicator

The I/O modules have two (red/green) LEDs visible through the I/O 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.

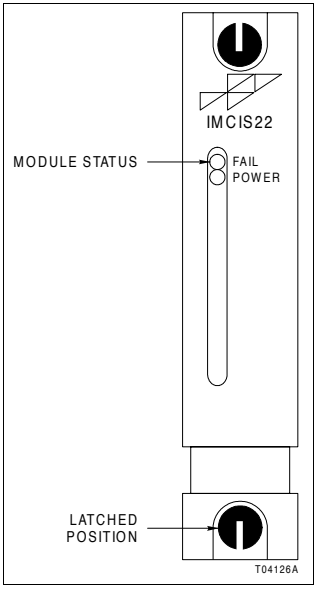


Figure 4-1. Front Panel

Table 4-1. Status LED Indicator

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

Startup Procedures

The controller controls the startup of the I/O modules; it is fully automatic. FC 79 in the controller 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 controller so that the I/O module will operate within the system control strategy. To configure the controller, refer to the appropriate controller instruction.

Troubleshooting

Section 5

Introduction

This section explains the error indications and corrective actions for the IMCIS22 module and IMQRS22 module.

Error Indications and Corrective Action

Status of the I/O modules can be obtained through a human system interface, such as a workstation running Conductor NT software or the front panel status LED indicators.

When using a human system interface, check the controller for good quality on output N+9 of FC 79; 0 = good status, 1 = bad reference status, I/O failed to respond.

Module Status LEDs

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 I/O 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 controller	Normal operation	No action required
Off	I/O module not enabled	Address set on address switch S1 not the same as address in controller 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

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

LED State	Indication	Probable Cause	Corrective Action
Off *(continued)*	I/O module not enabled	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 module mounting unit 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 the module mounting unit	Verify module is completely inserted in the module mounting unit: faceplate flush with module mounting unit and captive retaining screws latched
Red (fail)	Bus fault timer error (time-out)	I/O expander bus clock failure	Check MFP for proper operation
		Dipshunt not installed between MFP and I/O module	Verify dipshunt is installed in the I/O expander bus socket on the module mounting unit backplane between MFP and I/O module

Controller Errors

The controller performs status checks on the I/O module. An error will appear in the report function of a human system interface. Refer to the appropriate instruction manual for the human system interface you are using for an explanation of these reports.

FC 79 output block N+9 in the controller configuration is the I/O module status flag (logic zero=good; logic one=bad). Use a human system interface to monitor this block. If the status flag is a logic one, check the front panel module status LED and the human system interface report function to determine corrective actions.

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

Analog input reference error

The controller 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 I/O module.

Missing slave module error

The address set on address switch (S1) and in the controller configuration must be the same. The controller 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 controller configuration (refer to the ***Address Selection Switch (S1)*** in Section 3 for the procedures to set an address and to install an I/O module).

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

The controller generates a missing slave module error if the I/O expander bus is not connected to the I/O module. Verify the bus connection on the module mounting unit backplane.

If 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

Maintenance

Section 6

Introduction

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. It is recommended 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 I/O 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. Various applications may require special attention.

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.	

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.
- Nonabrasive eraser.

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 workstations. 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 a nonabrasive eraser 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 are secure.

Repair and Replacement

Section 7

Introduction

This section explains the replacement procedures for the IMCIS22 and IMQRS22 modules. There are no special tools required to replace the I/O modules.

Module Repair and Replacement

If an I/O module is faulty, replace it with a new one. ***Do not*** try to repair the module; replacing components may affect the module performance. The module can be removed 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 module mounting unit.

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 I/O module, align the replacement I/O module with the guide rails in the module mounting unit. Gently slide it in until the front panel is flush with the top and bottom of the module mounting unit 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.

NTCS04 Termination Unit

Appendix A

Introduction

The IMCIS22 module and IMQRS22 module use a NTCS04 termination unit for termination. The NTCS04 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 module.

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

Figure A-1 shows the NTCS04 termination unit configuration sockets (dipshunts). Refer to this figure when connecting field wiring to the NTCS04 termination unit. Figure A-2 shows a standard dipshunt with jumper positions for switching hot and switching neutral. Refer to Tables A-1 through A-4 to determine the dipshunt strapping.

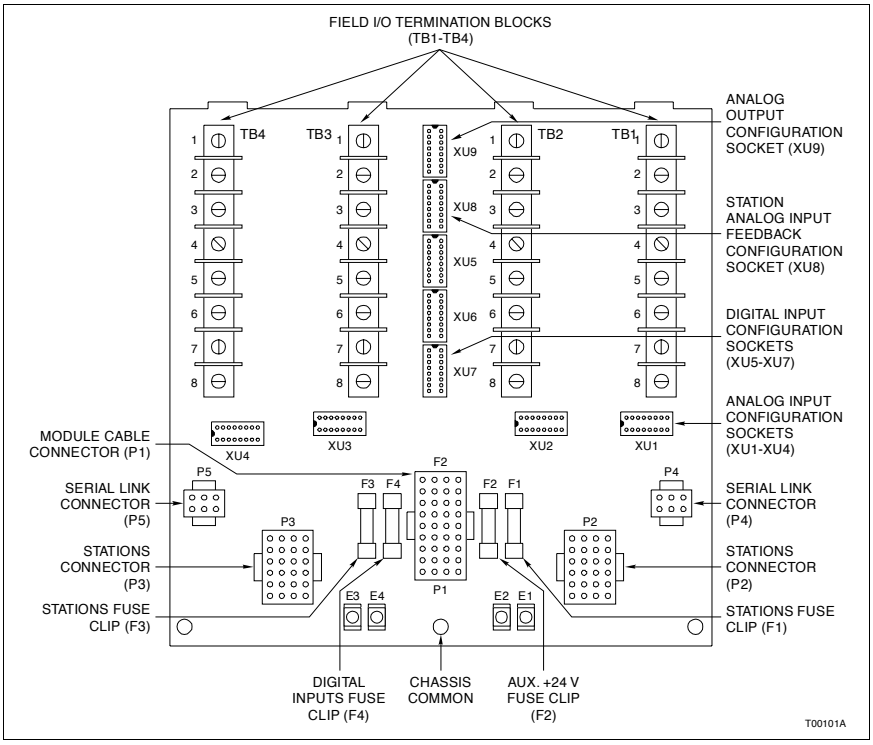


Figure A-1. NTCS04 Termination Unit Layout

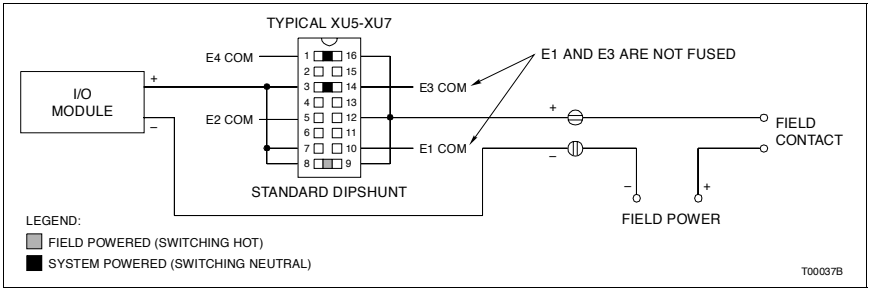


Figure A-2. Switching Hot vs. Switching Neutral

Table A-1. Analog Input Dipshunt Configuration

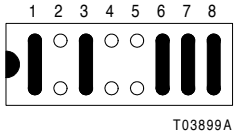
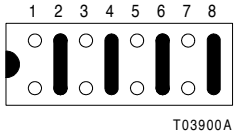
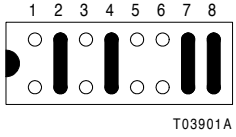
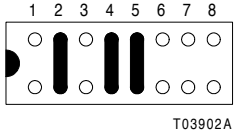
Application/Signal Type	Dipshunt Configuration XU1-XU4
System powered (4-20 mA)	
Externally powered (4-20 mA)	
Single ended voltage (1-5 VDC)	
Differential voltage (1-5 VDC)	

Table A-2. Analog Input Destination for Station Feedback

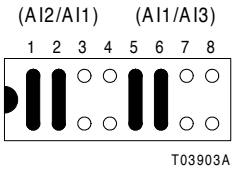
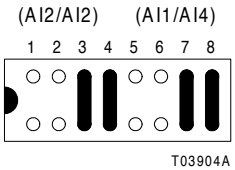
Application/Signal Type	Dipshunt Configuration XU8 (Station Designator/Analog Input)
Station no. 1(P2 connector) Station/termination unit A/I designation	
Station no. 2 (P3 connector)	

Table A-3. Analog Output Dipshunt Configuration

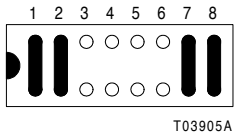
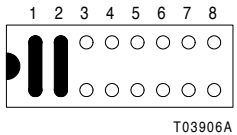
Application/Signal Type	Dipshunt Configuration XU9
Both outputs in voltage mode	
Output 1 in voltage mode, output 2 in current mode	

Table A-3. Analog Output Dipshunt Configuration *(continued)*

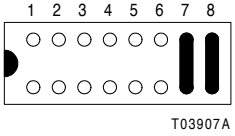
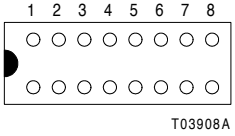
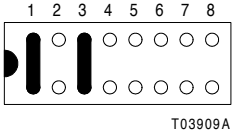
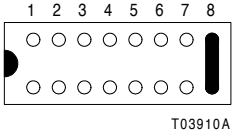
Application/Signal Type	Dipshunt Configuration XU9
Output 1 in current mode, output 2 in voltage mode	
Both outputs in current mode (no dipshunt required)	

Table A-4. Digital Input Dipshunt Configuration

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

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.

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