SECTION 1 - INTRODUCTION

OVERVIEW

The Universal Analog Input Slave Module (IMASI03) performs analog input signal processing for up to 16 input channels and sends this information to a Multi-Function Processor (IMMFP01/02/03) in the INFI 90® System.

This manual explains the purpose, operation, maintenance, handling precautions and installation procedures of the slave module.

INTENDED USER

System engineers and technicians should read this manual before installing the IMASI03 module. Put the module into operation only after reading and understanding the information in this manual. Refer to the ***Table of Contents*** to find specific information. Refer to the ***HOW TO USE THIS MANUAL*** entry in this section to get started.

MODULE DESCRIPTION

The IMASI03 is a single printed circuit board that occupies one slot in an INFI 90 Module Mounting Unit (MMU). Two captive latches on the module faceplate secure it to the MMU. The slave module has three card edge connectors for external signals and power: P1, P2 and P3. P1 connects to the supply voltages. P2 connects the IMASI03 to the slave expander bus, over which it communicates with the MFP.

Connector P3 carries the inputs from the input cable plugged into the termination unit (TU) or termination modules (TM). The terminal blocks for field wiring are on the TU/TM.

The single dipswitch on the IMASI03 module sets the address for the slave or selects on-board tests. Refer to Section 3 for the steps to set the module address. Refer to Section 6 for the on-board tests. Be sure to check the switch setting before putting the module into the MMU.

Jumpers configure the type of analog input signals. Refer to Section 3 for the correct setting of these jumpers.

Figure 1-1 shows the INFI 90 communication levels.

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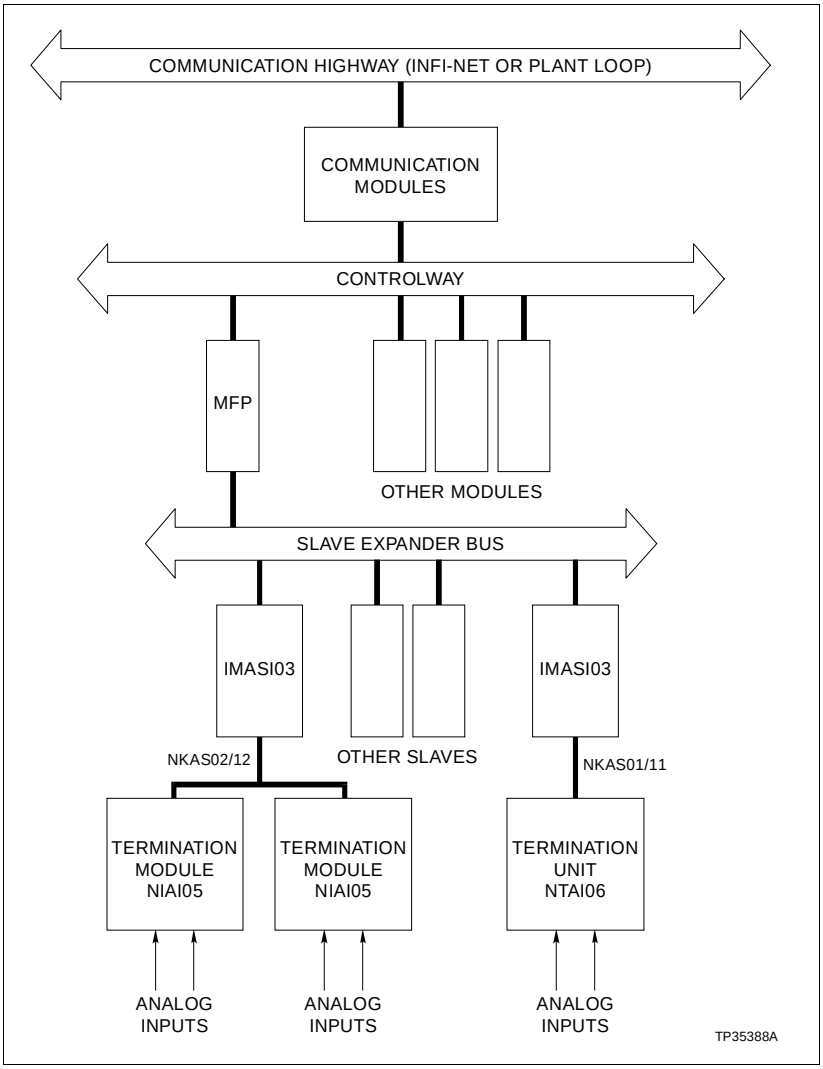

Figure 1-1. INFI 90 Communication Levels

FEATURES

The design of the IMASI03 module, as with all INFI 90 modules, allows for flexibility in creating a process management system. Refer to the ***NOMENCLATURE*** entry of this section to see the list of devices that can be used with the slave module in an INFI 90 system.

- The IMASI03 conditions (filters, amplifies and isolates) up to 16 analog input signals.
- The IMASI03 converts analog signals to digital values, adds compensation and corrections as needed, and provides digital values to the MFP through the slave expander bus.

- Each channel is individually programmable for these input types:

  E, J, K, L, N (14 AWG), N (28 AWG), R, S, T, U thermocouples.
  Chinese type E and Chinese type S thermocouples.
  Millivolt (-100 to +100 mV).
  3-wire RTDs (10, 100 U.S., 100 European, 120 and Chinese 53 Ohm).
  High level (-10 to +10 V).
  Current (4-20 mA).

- Resolution of the analog-to-digital conversion process is programmable over a range from 16 to 24 bits.

- Input type and channel resolution may be selected independently for each channel, permitting any mix of inputs on a single IMASI03 module.

- Channel isolation and open input detection are provided for each channel.

- Input circuit offset, gain and nonlinearity errors are recorded during a one time factory calibration procedure. These measurements provide error compensation during normal operation. The slave does automatic recalibration during normal operation to compensate for component aging and temperature drift. No user calibration is ever required.

- Engineering units conversion to degrees C or F is automatically calculated on all input signals that are thermocouple or RTD types. These conversions correct for nonlinearities in the conversion to temperature units using industry standard linearization tables.

- The slave scales the block output value to engineering units for low and high level voltage inputs. Input type and zero and span values are specified in function code 216.

- Thermocouple inputs have cold junction compensation. Each termination device has a built-in cold junction reference. The cold junction reference applied to thermocouple inputs may be this built-in reference or it may be a remote reference read from another input from this or another slave.

- The slave compensates for lead wire resistance in the connection between the thermocouple, RTD or low level voltage input signals.

- The IMASI03 can be removed or installed without turning off power to the system.

INSTRUCTION CONTENT

This manual has nine sections and three appendices.

Introduction — Is an overview of the IMASI03 module: features, description and specifications.

Description and Operation — Explains the module operation and input circuits.

Installation — Contains the cautions to observe when handling IMASI03 modules. It shows the steps to install and connect the module before applying power. This section also covers switch and jumper settings.

Configuration and Calibration — Presents steps to configure slave inputs for specific input types and how to field calibrate an input channel for a specific input type.

Operating Procedures — Explains the operator interface to the IMASI03.

Troubleshooting — Describes the IMASI03 error codes and explains how to test the IMASI03.

Maintenance — Has a schedule for taking care of the IMASI03. This schedule can be used for all the modules in the MMU.

Repair/Replacement Procedures — Contains the cautions and steps for removing and replacing modules from the MMU.

Support Services — Provides a list of information to present when ordering parts from the local Bailey Controls sales office. It explains other areas of support that Bailey Controls provides.

Appendix A — Shows the jumper settings, terminal wiring for the NIAI05 termination module and the cabling needed for the IMASI03.

Appendix B — Shows the jumper settings, terminal wiring for the NTAI06 termination unit and the cabling needed for the IMASI03.

Appendix C — Describes the applications, specifications and block outputs for function codes 215, 216 and 217.

HOW TO USE THIS MANUAL

Read this manual before handling the IMASI03 module. Refer to the sections in this list as needed for more information.

1. Read Section 5 before connecting the IMASI03.
2. Read Section 2.

3. Read and follow the steps in Section 3.

4. Read and follow the configuration steps in Section 4.

5. Refer to Section 6 for what to do if a problem occurs.

6. Refer to Section 7 for the scheduled steps needed to maintain the IMASI03.

7. Refer to Section 8 for steps to replace a module.

8. Use Section 9 to order parts. This section also explains some of the many services Bailey offers.

GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
A/D Conversion	Analog-to-digital conversion; process of generating a digital, (numeric) value representing the magnitude of an analog signal.
Analog Signal	A variable input signal that may be any value within a given range.
Cold Junction Reference	The ambient temperature at the bimetal junction of terminated thermocouple wires.
Common Mode Isolation	Indicates the ability to isolate common mode voltages between inputs and outputs and protect a measurement circuit from damage up to a maximum specified voltage level. Also indicates the ability to reject the common mode voltage by a specified amount (in units of dB at a specific frequency, such as 60 Hz).
Configuration	A control strategy with function blocks.
Controlway	A redundant peer-to-peer communication path for point data transfer between intelligent modules within a process control unit.
Digital Signal	A discrete input signal having only ON and OFF states.
Digital Value	The representation of a value by some number of digital bits that is capable of being read by a microprocessor.
Dipshunt	Dual in-line package with shorting bars.
Dipswitch	A dual in-line package that contains single pole switches.
Dual Port RAM (DPRAM)	SRAM shared by two devices. Either device can write or read to the SRAM simultaneously through separate address and data ports.
EWS	Engineering Work Station; an integrated hardware and software personal computer system for configuring and monitoring INFI 90 modules and systems.
Function Code (FC)	An algorithm that defines specific functions. These functions link together to form the control strategy.
FTP	Field Termination Panel.

GLOSSARY OF TERMS AND ABBREVIATIONS (continued)

Term	Definition
High Level Voltage	For IMASI03 applications, high level voltage inputs are values between -10 and +10 Volts.
INFI-NET	Advanced data communication highway for the INFI 90 system having 250 node capacity.
LED	Light Emitting Diode; the module front panel indicator that shows status and error messages.
LSB	Least Significant Bit; the bit of a binary number that carries the least numerical weight.
Low Level Voltage	For IMASI03 applications, low level voltage inputs are values between -100 millivolts and +100 millivolts.
Master Module	One of a series of controller modules designed to interface with field processes through a slave module. The Multi-Function Processor is an example.
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 modules.
MSB	Most Significant Bit; the bit of a binary number that carries the most numerical weight.
Normal Mode Rejection	Indicates the ability to reject normal mode voltage (differential + to - Voltage) by a specified amount (in units of dB at a specified frequency, such as 60 Hz).
NVRAM	Nonvolatile random access memory; memory whose data does not change when power is removed.
OIS	Operator Interface Station; integrated operator console with data acquisition and reporting capabilities. It provides a window into the process for flexible control, tuning and monitoring.
PCU	Process Control Unit; rack type industrial cabinet that contains master, slave and communication modules, their communication paths and power supplies.
PROM	Programmable read only memory.
RAM	Random Access Memory.
RTD	Resistance Temperature Detector. A sensing device that changes resistance based on changes of ambient temperature.
SRAM	Static Random Access Memory.
Slave Expander Bus	A parallel address/data bus used for communication between the master module and the slave.
Thermocouple	A bimetal sensor used for temperature measurements.

GLOSSARY OF TERMS AND ABBREVIATIONS *(continued)*

Term	Definition
TM	Termination Module; provides input/output connection between plant equipment and the INFI 90 process modules. The termination module slides into the Termination Mounting Unit (TMU).
TMU	Termination Mounting Unit.
TU	Termination Unit; provides input/output connection between plant equipment and the INFI 90 process modules. The termination unit is mounted flat on a Field Termination Panel (FTP).

REFERENCE DOCUMENTS

Number	Description
I-E93-900-20	Function Code Application Manual
I-E93-916	Engineering Work Station (EWS)
I-E96-110	Operator Interface Station (IIOIS20)
I-E96-201	Multi-Function Processor (IMMFP01)
I-E96-202	Multi-Function Processor (IMMFP02)
I-E96-203	Multi-Function Processor (IMMFP03)
I-E96-440	Termination Unit Manual (NTAI06)
I-E96-441	Termination Module Manual (NIAI05)

NOMENCLATURE

The following modules and equipment can be used with the IMASI03 module:

Number	Description
IMMFP01/02/03	Multi-Function Processor Module
NIAI05	Termination Module
NKAS02/12	Cables, Termination Module
NTAI06	Termination Unit
NKAS01/11	Cables, Termination Unit

SPECIFICATIONS

Power Consumption

+ 5 VDC typical 300 mA, maximum 450 mA
+ 15 VDC typical 130 mA, maximum 150 mA
- 15 VDC typical 35 mA, maximum 50 mA

Analog Input Types

Analog Input Channels	16 independently configured channels
Thermocouples	Type E, J, K, L, N (14 AWG), N (28 AWG), R, S, T, U Chinese type E and Chinese type S
3-Wire RTD	100 Ohm platinum: U.S. Lab. Standard 100 Ohm platinum: U.S. Industry Standard 100 Ohm platinum: European Standard 120 Ohm nickel 10 Ohm copper Chinese 53 Ohm copper
Millivolt	-100 mV to +100 mV, o to 100 mV
High Level	1-5 VDC, 0-5 VDC, 0-10 VDC -10 VDC to +10 VDC, or user specified range within -10 VDC and +10 VDC
Current	4-20 mA, system or external powered.

High Level Voltage Analog Accuracy

4-20 mA Current Inputs — Add 0.025% to high level voltage analog error values

25^{o} C Ambient Operating Temperature
Power Supplies at Nominal Values
Zero Lead Wire Resistance
Full Scale Range (FSR) = 20.0 V

Resolution	Error (Two Standard Deviations From Mean)		Typical Noise (Reading Stability)	
Bits	± Percent FSR	± Millivolts	± Percent FSR	± Millivolts
16	0.05	10	0.02	4
18	0.04	8	0.015	3
20	0.03	6	0.0125	2.5
22	0.02	4	0.005	1
24	0.015	3	0.0025	0.5

SPECIFICATIONS *(continued)*

Low Level Voltage Analog Accuracy

25° C Ambient Operating Temperature
Power Supplies at Nominal Values
Zero Lead Wire Resistance
Full Scale Range (FSR) = 200.0 mV

Resolution	Error (Two Standard Deviations From Mean)		Typical Noise (Reading Stability)	
Bits	± Percent FSR	± Millivolts	± Percent FSR	± Millivolts
16	0.05	100	0.03	60
18	0.03	60	0.025	50
20	0.025	50	0.02	40
22	0.025	50	0.015	30
24	0.025	50	0.01	20

Resistance Analog Accuracy

25° C Ambient Operating Temperature
Power Supplies at Nominal Values
Zero Lead Wire Resistance
Full Scale Range (FSR) = 500 Ohms

Resolution	Error (Two Standard Deviations From Mean)		Typical Noise (Reading Stability)	
Bits	± Percent FSR	± Ohms	± Percent FSR	± Ohms
16	0.1	0.5	0.06	0.3
18	0.075	0.375	0.06	0.3
20	0.07	0.35	0.03	0.3
22	0.06	0.3	0.03	0.15
24	0.05	0.25	0.03	0.15

Cold Junction Reference Accuracy	± 0.5° C
Software Temperature Linearization Accuracy	± 0.1° C

SPECIFICATIONS (continued)

Maximum Lead Wire Resistance Effect	
Voltage Input	
Uncompensated	1 microvolt of error per Ohm of lead wire resistance
Compensated	0.1 microvolt of error per Ohm of lead wire resistance
3-Wire Resistance Inputs	
Uncompensated	0.020 Ohms of error per Ohm of lead wire resistance
Compensated	0.008 Ohms of error per Ohm of lead wire resistance
Resolution	Programmable, 16 to 24 bits, in steps of two over full scale resolution

Resolution (Bits of A/D)	Resolution (Percent of A/D Span)	Typical A/D Conversion Times Per Channel
16	0.0015	30 ms
18	0.00038	175 ms
20	0.000095	175 ms
22	0.000024	450 ms
24	0.000006	2000 ms

Temperature Effect	
(0 - 70° C)	± 0.003% of full scale range per degree C maximum
Power Supply Effect	
Over Operating Range (± 15 Volt Supplies)	± 0.003% of full scale range per Volt maximum
Input Setting	
Time	0.5 seconds to within 1% after full scale step change
Input Impedance	10 MOhm minimum
Common Mode Isolation	
Continuous AC Voltage (Absolute Maximum)	250 VRMS
Channel/Channel (Absolute Maximum)	250 VRMS
50/60 Hz Rejection (Minimum)	-110 dB

SPECIFICATIONS (continued)

Normal Mode Rejection	
Peak or Continuous Voltage (Absolute Maximum)	± 15 VDC
50/60 Hz AC Rejection (Minimum)	-80 dB
Environment	
Electromagnetic	No values available at this time.
Radio Frequency Interference	Keep cabinet doors closed. Do not use communication equipment closer than 2 meters from the cabinet.
Ambient Temperature	0 to 70^{o} C (32 to 158^{o} F)
Relative Humidity	5% to 95% up to 55^{o} C (131^{o} F) (noncondensing) 5% to 45% at 70^{o} C (158^{o} F) (noncondensing)
Atmospheric Pressure	Sea level to 3 km (1.86 miles) (86 kPa to 108 kPa)
Air Quality	Noncorrosive
Mounting	Occupies a single slot in a standard INFI 90 Module Mounting Unit (MMU).
Shipping Weight	1.146 kg (2.5 lb)
Container Size	27.94 cm x 35.56 cm x 5.54 cm (11 in. x 14 in. x 3 in.)
Certification	CSA certified for use as process control equipment in an ordinary (nonhazardous) location.
	Complies with IEEE-472 Surge withstand test.

NOTE: Absolute maximum ratings indicate limits beyond which damage to the device may occur and device operation is not guaranteed.

Specifications are subject to change without notice.