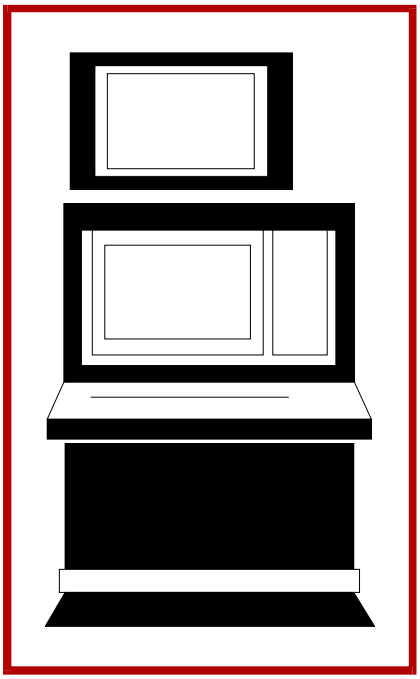
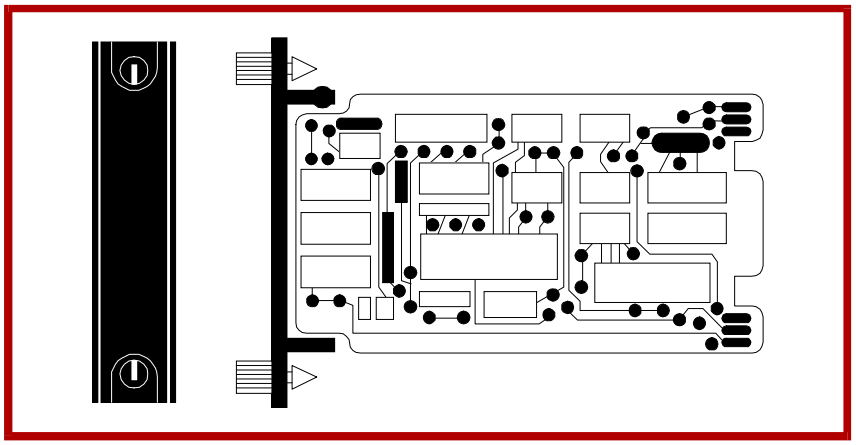
Bailey® infi 90®

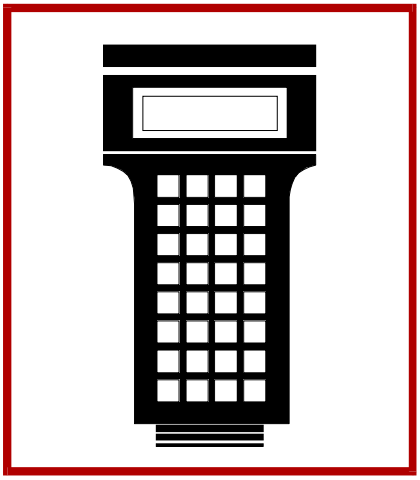
E96-209

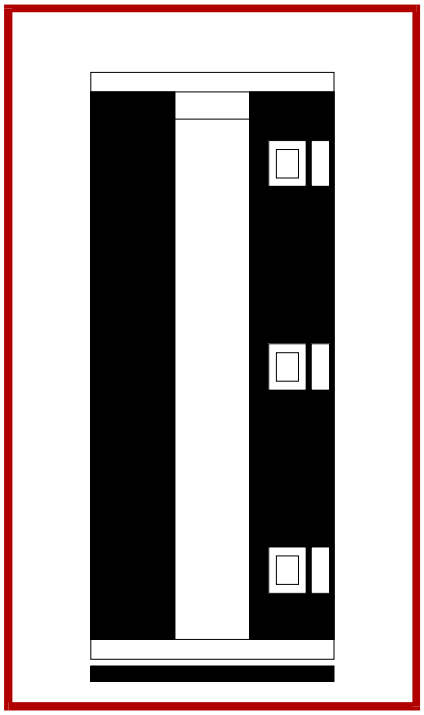
Instruction

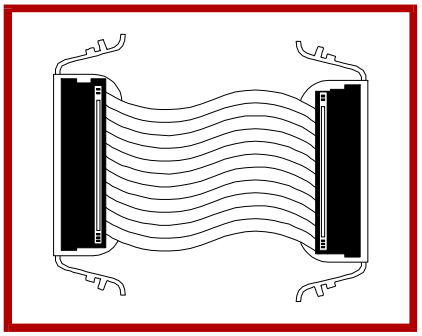
Logic Master Module
(IMLMM02)

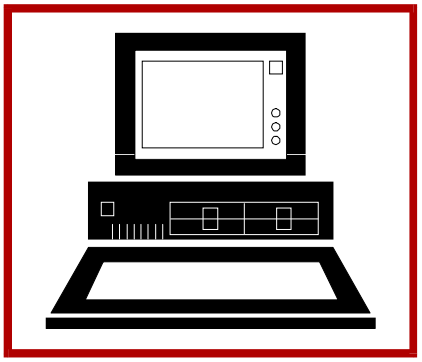












Bailey Process Control and Automation Solutions from Elsag Bailey Group

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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POSSIBLE PROCESS UPSETS

MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

AVERTISSEMENT

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PERTURBATIONS DU PROCÉDÉ

L'ENTRETIEN DOIT ÊTRE ASSURÉ PAR UNE PERSONNE QUALIFIÉE EN CONSIDÉRANT L'ASPECT SÉCURITAIRE DES ÉQUIPEMENTS CONTRÔLÉS PAR CE PRODUIT. L'AJUSTEMENT ET/OU L'EXTRACTION DE CE PRODUIT PEUT OCCASIONNER DES À-COUPS AU PROCÉDÉ CONTRÔLE LORSQU'IL EST INSÉRÉ DANS UNE SYSTÈME ACTIF. CES À-COUPS PEUVENT ÉGALEMENT OCCASIONNER DES BLESSURES OU DES DOMMAGES MATÉREILS.

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Preface

The purpose of this document is to provide the user with installation, configuration, operating and troubleshooting information on the INFI 90® Logic Master Module (IMLMM02). The following hardware, as it applies, is mentioned as well:

Termination Units/modules:	NTDI01, NTDO02, NIDI01, NIDO01
Termination Unit Cables:	NKTU01, NKTM01, NKTU02
Digital Slave Modules:	IMDSM04, IMDSM05,} IMDSI02, IMDSO01, IMDSO02, IMDSO03, IMDSO04

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List of Effective Pages

Total number of pages in this manual is 36, consisting of the following:

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

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

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

Safety Summary

GENERAL WARNINGS	**Equipment Environment** All components, whether in transportation, operation or storage must be in a noncorrosive environment. **Electrical Shock Hazard During Maintenance** Disconnect power or take precautions to ensure that contact with energized parts is avoided when servicing. **Special Handling** This module uses Electrostatic Sensitive Devices (ESD).
SPECIFIC WARNINGS	Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock. (p. 3-6).

Sommaire de Sécurité

AVERTISSEMENTS D'ORDRE GÉNÉRAL	Environment de l'equipement Nes pas soumettre les composantes a une atmosphere corrosive lors du transport, de l'entreposage ou de l'utilisation. Risques de chocs electriques lor de l'entretien S'assurer de debrancher l'alimentation ou de prende les precautions necessaires a eviter tout contact avec des composants sours tension lors de l'entretien. Precautions de Manutention Ce module contient des composantes sensibles aux decharges electro-statiques.

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

Table of Contents

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SECTION 1 - INTRODUCTION

OVERVIEW

The Logic Master Module (IMLMM02) is an INFI 90 module that performs multiple calculating and control functions. The LMM contains onboard circuitry for eight digital inputs and eight digital outputs. It also interfaces with up to 64 digital I/O slaves through the slave expander bus for additional I/O capability. The logic master module communicates with other intelligent modules in the system by means of the module bus. The module bus provides a means to configure, tune, monitor, and acquire data.

INTENDED USER

System engineers and technicians should read this manual before installing and operating the logic master module. A module should ***NOT*** be put into operation until this instruction is read and understood. Refer to the Table of Contents or Index to find specific information after the module is operating.

MODULE DESCRIPTION

The logic master module is a user-configured device that performs digital control schemes. It communicates with digital slave modules for inputs and outputs, and has a capacity to handle a maximum of 1,024 I/O points. This microprocessor based module resides in the INFI 90 system and provides the ability to perform sequential logic control functions per the system requirements. The module can be configured to any control strategy desired using standard configuration tools and a defined library of function codes. I/O is interfaced using digital input slaves.

MODULE APPLICATION

Control schemes are designed with operations from the INFI 90 Function Code Library, and stored in the module's on-board memory.

In addition to executing control schemes, the module performs self-tests, security functions and bus interfacing.

INSTRUCTION CONTENT

This manual consists of eight sections:

Introduction Is an overview of the LMM: Features, description and specifications.

Description and Operation Explains module operation, input and control circuitry, and configuration function codes.

Installation Describes precautions to observe when handling modules, and setup procedures required before module operation. This section discusses switch and jumper settings, and installation procedures.

Operating Procedures Explains the front panel indicator, and start-up of the master module.

Troubleshooting Describes the error indications and corrective actions to take.

Maintenance Has a maintenance schedule for modules and other INFI 90 assemblies.

Repair/Replacement Procedures Details the procedures to replace an LMM.

Support Services Provides replacement part ordering information. It explains other areas of support that Bailey Controls provides.

HOW TO USE THIS MANUAL

Read this manual through in sequence. It is important to become familiar with the entire contents of this manual before using the LMM. The manual is organized in sections to enable finding specific information quickly.

1. Read and do the steps in Section 3.
2. Refer to Section 4 to evaluate operating indications.
3. Refer to Section 5 if a problem occurs.
4. Refer to Section 6 for scheduled maintenance requirements.
5. Use Section 8 when ordering replacement parts.

REFERENCE DOCUMENTS

Number	Document
I-E93-900-20	Function Code Application Manual
I-E93-903	Configuration and Tuning Module
I-E93-911	Termination Unit Manual
I-E96-308	Pulse Input Slave Module
I-E96-309	Digital Slave Module
I-E96-310	Digital Slave Output
I-E96-313	Digital Slave Output

GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Description
CTM	Configuration and Tuning Module. Provides a local means for system configuration, tuning, and monitoring of intelligent masters over module bus.
CTT	Configuration and Tuning Terminal. A handheld module with the same functionality as the Configuration and Tuning Module.
Checksum	A value computed from a data stream by treating each element as a number and computing the sum of the elements.
Configuration	The act of setting up equipment to accomplish specific functions or a list of parameters associated with such a setup.
Controlway	High speed, redundant, peer-to-peer communication link. Used to transfer information between intelligent modules within a process control unit.
Dipshunt	Dual in-line package with shorting straps.
Dipswitch	A dual in-line package that contains switches.
EWS	Engineering Work Station.
Executive Block	Fixed function block that determines overall module operating characteristics.
Function Block	The occurrence of a function code at a block address of a module.
Function Code	An algorithm which manipulates specific functions. These functions are linked together to form the control strategy.
LED	Light Emitting Diode.
LSB	Least Significant Bit. The bit of a binary number that carries the least numerical weight.
Master Module	One of a series of controller modules designed to direct field processes through a slave module. The multi-function processor is an example.
MFT	Machine Fault Timer. Reset by the processor during normal operation. If not reset regularly, the MFT times out and the module stops.
MMU	Module Mounting Unit. A card cage that provides electrical and communication support for INFI 90/Network 90 modules.
Module Bus	Peer-to-peer communications link used to transfer information between intelligent modules within the process control unit.
MSB	Most Significant Bit. The bit of a binary number that carries the most numerical weight.
NVRAM	Nonvolatile random access memory. Retains stored information when power is removed.
Node	A point of interconnection to a network.

GLOSSARY OF TERMS AND ABBREVIATIONS *(continued)*

Term	Description
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.
PCU	Process Control Unit. A node on the plant wide communication network containing master and slave modules.
Plant Loop	Network 90 data communication highway.
RAM	Random Access Memory. Contents are lost when power is removed.
ROM	Read Only Memory. Contents remain when power is removed.
Slave Expander Bus	Parallel communication bus between the master and slave modules.
TM	Termination Module. Provides input/output connection between plant equipment and the INFI 90/Network 90 modules.
TU	Termination Unit. Provides input/output connection between plant equipment and the INFI 90/Network 90 modules.

NOMENCLATURE

The following is a list of related hardware:

Nomenclature	Hardware
Master Module	
IMLMM02	Logic Master Module
I/O Modules	
IMDSM04	Pulse Input Slave Module
IMDSM05	Digital Input Slave Module
IMDSO01/02/03/04	Digital Slave Output
IMDSI02	Digital Slave Input
Termination Units	
NTDI01	Digital Input
NTDO02	Digital Output
Termination Modules	
NIDI01	Digital Input
NIDO01	Digital Output
Cables	
NKTU01	Cable from NTDI01/NTDO02 to IMLMM02
NKTM01	Cable from NIDI01/NIDO01 to IMLMM02
NKTU02	Cable from NIDI01/NIDO01 to IMLMM02

SPECIFICATIONS

Memory		
Random Access Memory (RAM)		16 Kbytes
Read Only Memory (ROM)		32 Kbytes
Nonvolatile Random Access Memory (NVRAM)		8 Kbytes
Power Requirements		
Voltage		+5 VDC (±5%)
Current		525 mADC (maximum) 450 mADC (nominal)
Input Voltage Ranges		
24 VDC	Logic High Logic Low	16.3 VDC (minimum) 6.0 VDC (maximum)
125 VDC	Logic High Logic Low	78 VDC (minimum) 26 VDC (maximum)
120 VAC	Logic High Logic Low	102 VACrms (minimum) 20 VACrms (maximum)
Input Current Ranges		
24 VDC	Logic High Logic Low	1.70 mADC (typical) 1.94 mADC @ 27 VDC (maximum) 400 µADC (maximum)
125 VDC	Logic High Logic Low	1.82 mADC (typical) 2.02 mADC @ 135 VDC (maximum) 400 µADC (maximum)
120 VAC	Logic High Logic Low	1.74 mAACrms (typical) 1.94 mAACrms @ 132 VACrms (maximum) 380 µAAC (maximum)
Output Voltage		
Logic High Logic Low		$V_{I/O}$ (24 VDC) 2.4 VDC (maximum)
Output Current		
Logic High Logic Low		10 µADC (maximum) 250 mADC (maximum)
Channel to Channel Isolation Voltage		250 VAC
Channel to Logic Isolation Voltage		250 VAC
Channel Isolation Voltage (Normal Mode)		120 VAC
Surge Protection		Meets IEEE-472-1974 Surge Withstand Capability Test
Execution Rates		10 to 40 milliseconds with internal resolution in 10 millisecond increments. For periods greater than or equal to 50 milliseconds, the internal resolution is in 50 millisecond increments.

SPECIFICATIONS (continued)

Certification	CSA certified for use as process control equipment in an ordinary (nonhazardous) location.
Environmental	
Ambient Temperature	0° to 70° C (32° to 158° F)
Relative Humidity	0% to 95% up to 55° C (131° F) (noncondensing) 0% to 45% at 70° C (158° F) (noncondensing)
Altitude	Sea Level to 3 Kilometers (1.86 miles)
Air Quality	Noncorrosive
Mounting	Occupies one slot in a standard INFI 90 Module Mounting Unit.

Specifications are subject to change without notice.

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section explains the functions, module circuitry, data and connections for the Logic Master Module (IMLMM02). It also details the function codes available to configure an LMM.

FUNCTIONAL OPERATION

The logic master module consists of six major sections. They are Memory, Module Bus Interface, Machine Fault Timer, Slave Expander Bus Interface, Digital Inputs/Outputs, and the Microprocessor, Timing and Control section. See Figure 2-1.

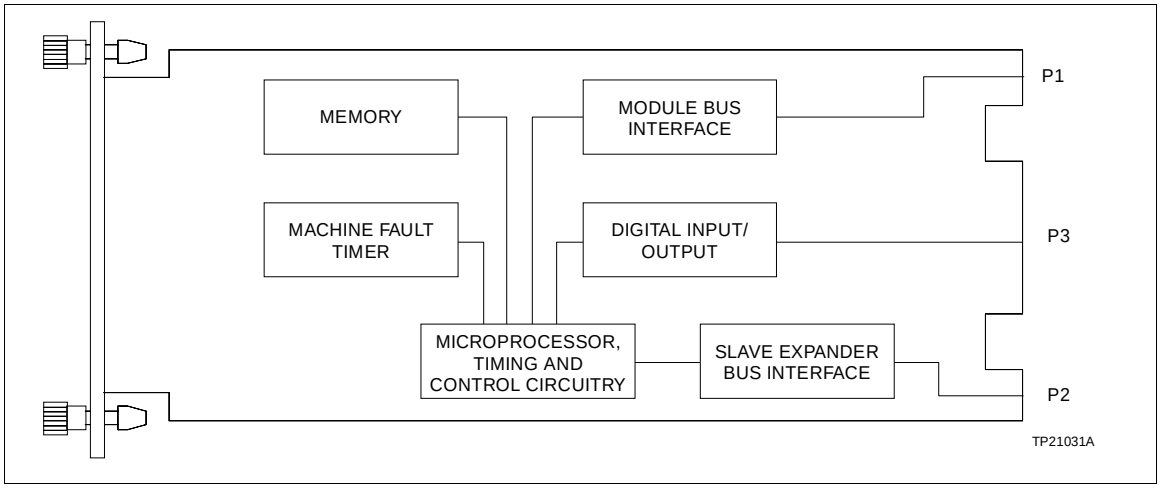

Figure 2-1. Logic Master Module Block Diagram

Microprocessor, Timing, and Control Circuitry

The logic master module uses a 68B09E microprocessor integrated circuit operating at two megahertz. Based on the program in ROM and the configuration in NVRAM, the processor controls the functions of the I/O circuitry, slave expander bus and module bus communication, as well as performing onboard checks to verify internal integrity. Additional circuitry provides the proper timing and clocks to run the processor and other functions.

Module Bus Interface

The module bus interface on the logic master module allows it to communicate with other INFI 90 modules in the same PCU. Every module on the module bus has a unique address that

identifies the module. The device address for the logic master module is set via an eight position dipswitch.

NOTE: The LMM cannot communicate over the controlway.

Slave Expander Bus Interface

The slave expander bus interface on the logic master module allows it to communicate with up to 64 digital slave modules that interface with additional I/O based on the user's requirements. The LMM reads and writes data and control information to the slave modules over the slave expander bus. Each slave module has a unique slave expander bus address that must match that specified in the LMM's configuration. Dipshunts must be configured and installed on the MMU backplane between the LMM and associated slave modules. Refer to Section 3 of this manual for details.

Memory

The onboard memory is 32K bytes of read only memory (ROM), 16K bytes of random access memory (RAM) and 8K bytes of nonvolatile random access memory (NVRAM).

The ROM contains the function code library and the operating system. The RAM serves two purposes: holding an operating copy of the configuration when the module is in the execute mode of operation and providing temporary storage for in-process algorithms. The NVRAM contains the permanent copy of the user's configuration. The logic master module's NVRAM has the capacity for approximately 1,024 function blocks.

Machine Fault Timer

The Machine Fault Timer (MFT) is a resettable one-shot timer that must be periodically retriggered by the microprocessor. Several conditions detected by the microprocessor will keep it from retriggering the MFT. They are:

1. Trip Block activated.
2. Failure of ROM checksum.
3. Failure of diagnostics at reset/power up time.

When the MFT is allowed to time-out, the microprocessor is halted. The LMM will not respond over the module bus, and the status LED changes to a solid red color. In addition, the digital outputs are de-energized.

In the event of an NVRAM checksum failure, the module will indicate error status. This means that the status LED will flash on and off green, and will continue to execute all algorithms. The module will enter error mode when reset.

Digital Inputs/Outputs

There are eight digital inputs and eight digital outputs on-board. The inputs are jumper-selectable to be energized by 24 VDC, 125 VDC or 120 VAC. The inputs are optically-isolated; outputs are optically-isolated open-collector type. The I/O signals are routed to the NTDI01/NTDO02 TU or the NIDI01/NIDO01 TM through the NKTU01, NKTM01, or NKTU02 cable connection on the P3 card edge connector.

SECURITY FUNCTIONS

Two types of security functions are performed: module security and control input security. Module security is provided by a Machine Fault Timer (MFT) that is periodically reset by the microprocessor. If, for whatever reason, the timer is not reset, it shuts the module down, turns the front panel status LED red, de-energizes the digital outputs and prevents the NVRAM from being erased or written to. Control input security is provided by adding Function Code 31 (TEST QUALITY) to the configuration. Each function block assigned Function Code 31 can test the quality of up to four inputs. If the inputs are good, the output of the TEST QUALITY block is set to Logic 0. If any of the inputs are bad, the output of the block is set to Logic 1. Logic within the configuration can initiate the necessary alarms or appropriate actions.

Additionally, on-line tests are performed to verify proper hardware operation. If any of these tests fail, the timer is not reset and status LED turns red. NVRAM errors are handled differently since the module executes from a copy of the configuration located in RAM. If an NVRAM checksum error is detected, the module continues operating; however, the status LED flashes green. After resetting the module, it will enter the error mode.

CONFIGURATION

A configuration must be defined to determine the operations an LMM performs on its input signals. This section explains the function codes that can be used with an LMM. Function codes are software algorithms that can be configured to define specific tasks. A function block in memory has a reference number (block address) that can be used as an input reference by other function blocks. The LMM processes defined function blocks in ascending order.

> **NOTE:** This instruction contains function codes specific to the IMLMM02 only. The function codes defined in this section reflect the function codes that were available at the time the instruction was created. Refer to the latest ***Function Code Application Manual*** for additional function codes.

Function Blocks

NOTE: Refer to the ***Function Code Application Manual, I-E93-900-20*** for the specifications and outputs of the LMM function codes.

The range of function blocks for the logic master module is 0 through 1,023. Blocks 0 through 23 are reserved for the executive block and outputs of all the fixed address system blocks. The executive block handles overall module operation. The fixed address system block outputs can be used anywhere in the configuration. Blocks 24 through 1,023 are user-assignable. Table 2-1 lists the outputs of the executive block.

Table 2-1. Executive Function Block Outputs

Block Number	Outputs
0	Logic 0
1	Logic 1
2	Reserved
3	-100.0
4	-1.0
5	0.0
6	1.0
7	100.0
8	Maximum negative value
9	Maximum positive value
10	Start-up complete flag (0=no, 1=yes)
11	Reserved
12	System free time percent (updated every second)
13	Revision level
14	Reserved
15	Task no. 1 elapsed time of previous cycle (seconds)
16	Task no. 1 elapsed time of current cycle (seconds)
17	Task no. 1 processor utilization percent
18	NVRAM memory utilization percent
19	RAM memory utilization percent[1]
20-23	Reserved

NOTE: 1. The memory utilization percent for RAM is valid when block no. 10 output = 1.

Function Codes

The control strategy is designed with operations from the INFI 90 Function Code Library residing in ROM. Each code has a set of parameters with default values. Change these values to meet the requirements of your application. Table 2-2 lists the

executable functions. The block numbers column is the range of user-assignable block numbers.

Table 2-2. Function Codes

Function Code	Description	Block Numbers
2	Manual Set Constant	24-1023
7	Square Root	24-1023
10	High Select	24-1023
11	Low Select	24-1023
12	High/Low Compare	24-1023
14	Sum-4 Inputs	24-1023
15	Sum-2 Inputs with Gain	24-1023
16	Multiply	24-1023
17	Divide	24-1023
25	Analog Input/Module Bus	24-1023
26	Analog Input/Plant Loop	24-1023
30	Analog Output/Plant Loop	24-1023
31	Test Quality	24-1023
32	Trip	24-1023
33	Not	24-1023
34	Memory (Set, Reset)	24-1023
35	Time Delay	24-1023
36	Qualified OR - 8 Input	24-1023
37	AND - 2 Input	24-1023
38	AND - 4 Input	24-1023
39	OR - 2 Input	24-1023
40	OR - 4 Input	24-1023
41	Digital Input/Module Bus	24-1023
42	Digital Input/Plant Loop	24-1023
45	Digital Output/Plant Loop	24-1023
46	Digital Input List (8)/XR	24-1016
49	Digital Output Buffer (NOP)	24-1023
50	Manual Set Switch	24-1023
59	Transfer, Digital	24-1023
61	Blink	24-1023
62	Remote Control Memory	24-1023
64	Digital Input List (8)/Module Bus	24-1016
65	Digital Sum - 4 Input	24-1023
83	Digital Output Group	24-1023
84	Digital Input Group	24-1016

Table 2-2. Function Codes (continued)

Function Code	Description	Block Numbers
85	Up/Down Counter	24-1021
87	Logic Station Interface	24-1023
88	Logic Station	24-1015
101	XOR - 2 Input	24-1023
105	Executive	1
106	Segment Control Block	15,24-1019
107	Group I/O Definition	24-831
110	5 Input Rung	24-1023
111	10 Input Rung	24-1023
112	20 Input Rung	24-1023
114	BCD Input	24-1023
115	BCD Output	24-1023
116	Jump/Master Control Relay	24-1023
119	Boolean Signal Multiplexer	24-1023
120	Real Signal Multiplexer	24-1023
161	Sequence Generator	24-1013
162	Segment Buffer/Digital	24-1020
163	Segment Buffer/Analog	24-1020

SECTION 3 - INSTALLATION

INTRODUCTION

This section explains what you must do before you put the Logic Master Module (IMLMM02) into operation. ***DO NOT*** proceed with operation until you read, understand and do the steps in the order in which they appear.

SPECIAL HANDLING

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

The LMM uses electrostatic sensitive devices. Follow Steps 1 through 4 when handling:

1. Keep the module in its special anti-static bag until you are ready to install it in the system. Save the bag for future use.

2. Ground the anti-static bag before opening.

3. Verify that all devices connected to the module are properly grounded before using them.

4. Avoid touching the circuitry when handling the module.

UNPACKING AND INSPECTION

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

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

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

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

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

SETUP/PHYSICAL INSTALLATION

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

This section explains the procedures to set switches and jumpers, and install the LMM. After installing this module, a configuration must be created to define the functions an LMM will perform.

NOTE: The slave expander bus must be connected between the LMM and associated slave modules before they can communicate; refer to ***Slave Expander Bus Connection*** in this section.

Logic Master Module Installation

1. Setting the address and hardware operating mode on the Module Address Switch (S2).

2. Setting the digital input jumpers for the type of digital input.

3. Connecting cables.

4. Installing the module.

Figure 3-1 shows the location of the hardware configuration switch and edge connectors.

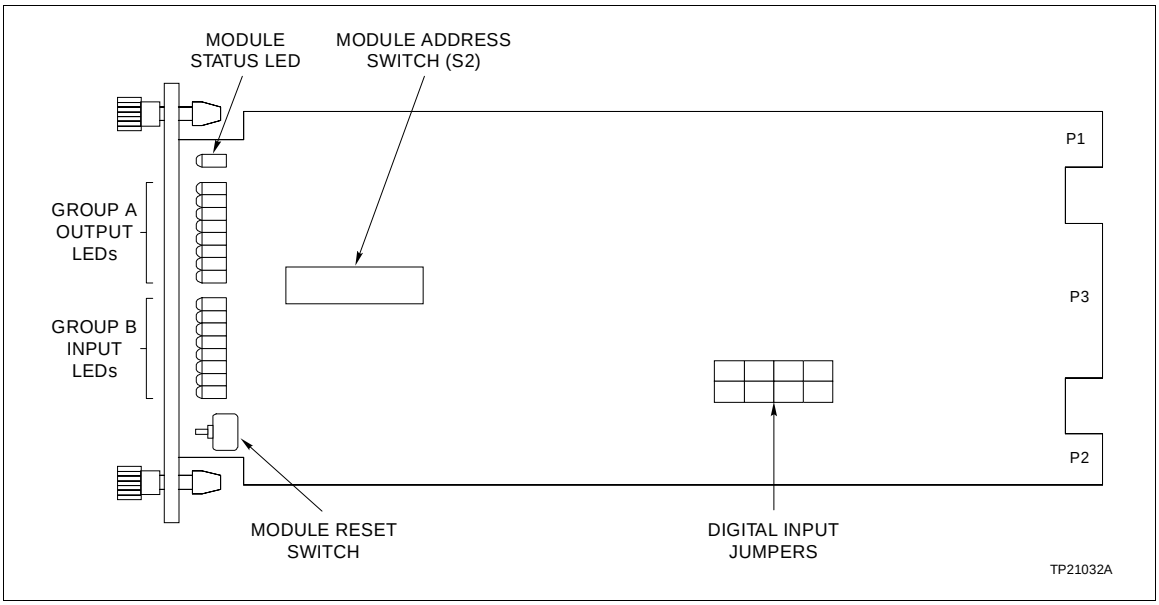

Figure 3-1. Logic Master Module

MODULE ADDRESS SWITCH (S2) SETTINGS

The module address switch sets the hardware operating states (run modes or diagnostic modes) and module address of the LMM. Figure 3-1 shows the location of S2. During normal operation, dipswitch positions 1 through 3 set the run mode and positions 4 through 8 set the module address as shown in Figure 3-2. Refer to the troubleshooting section for the diagnostics settings.

NOTE: For INFI 90 dipswitches, OPEN or OFF have the same meaning.

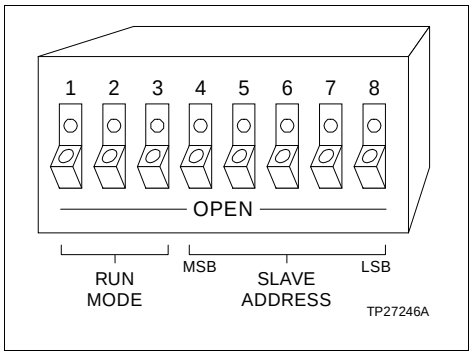

Figure 3-2. Module Address Switch (S2)

Run Mode Setting

Table 3-1 shows the run modes that can be set with dipswitch positions 1 through 3. Determine the requirements for the application and set the switches accordingly. The run modes are:

Normal Normal mode designates normal operation.

Table 3-1. Run Mode Settings (S2)

Positions			Mode	Meaning
1	2	3		
0 0	0 0	0 1	Normal Normal	Normal Run Disable Checksums
0 0	1 1	0 1	Normal Normal	Initialize NVRAM Compress NVRAM
1 1	0 0	0 1	Diagnostic Unused	Continue on Error
1 1	1 1	0 1	Unused Diagnostic	Normal Diagnostic Mode, Halt on Error

NOTE: 1=OPEN (OFF); 0=CLOSED (ON)

Initialize NVRAM

Initialize NVRAM is set to clear any existing configuration from nonvolatile random access memory (NVRAM). This initializes the NVRAM prior to entering a configuration, and should be done before loading a new configuration. The LMM status LED will blink green to indicate that initialization is complete.

Disable Checksums

NOTE: This setting is for troubleshooting purposes ONLY. The switch should NOT be set to this position during normal operation.

Disable checksums prevents a ROM checksum error from halting the module.

Compress NVRAM

The configured function blocks are moved to the ***top*** of memory; unconfigured or free blocks are moved to the ***bottom***.

Address Setting

An LMM can have one of 32 addresses (0 to 31) on the module bus. This address uniquely identifies the LMM to other INFI 90 devices. Determine the address for the LMM, and set dipswitches 4 through 8 to the corresponding positions shown in Table 3-2.

NOTE: The address must be a unique address within a PCU. Normally, addresses 0, 1, and 31 are not used for an LMM since these are reserved.

Table 3-2. Module Address Settings (S2)

Addr	MSB				LSB	Addr	MSB				LSB
	4	5	6	7	8		4	5	6	7	8
*0	0	0	0	0	0	16	1	0	0	0	0
*1	0	0	0	0	1	17	1	0	0	0	1
2	0	0	0	1	0	18	1	0	0	1	0
3	0	0	0	1	1	19	1	0	0	1	1
4	0	0	1	0	0	20	1	0	1	0	0
5	0	0	1	0	1	21	1	0	1	0	1
6	0	0	1	1	0	22	1	0	1	1	0
7	0	0	1	1	1	23	1	0	1	1	1
8	0	1	0	0	0	24	1	1	0	0	0
9	0	1	0	0	1	25	1	1	0	0	1
10	0	1	0	1	0	26	1	1	0	1	0
11	0	1	0	1	1	27	1	1	0	1	1
12	0	1	1	0	0	28	1	1	1	0	0
13	0	1	1	0	1	29	1	1	1	0	1
14	0	1	1	1	0	30	1	1	1	1	0
15	0	1	1	1	1	*31	1	1	1	1	1

NOTE
1=OPEN (OFF)
0=CLOSED (ON)
*=RESERVED

DIGITAL INPUT JUMPER SETTINGS

There are eight on-board jumpers (J1 through J8) that select the type of digital input signals (24 VDC, 125 VDC, or 120 VAC) being monitored.

1. Jumper pins 1 and 2 together to configure the inputs for 125 VDC or 120 VAC signals.

2. Jumper pins 2 and 3 together to configure the inputs for 24 VDC signals.

Inputs can be configured independently of each other; outputs are 24 VDC only. Refer to Figure 3-1 for jumper locations.

PHYSICAL INSTALLATION

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

NOTE: Configure the LMM configuration switch ***BEFORE*** installing.

1. 1. Verify the slot assignment of the module.

2. Connect the hooded end of a termination cable (NKTU01, NKTU02 or NKTM01) to the MMU backplane. To do this, insert the connector into the backplane slot of the same slot assigned to the LMM. The latches should snap securely into place. Refer to ***Cable Connections*** in this section.

3. 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.

4. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module. (To remove the module, turn the module retaining screws to the unlatched position and gently slide it out).

Termination Unit/Module Configuration

The termination unit is the interface between process I/O and the module. Several different types are used with the logic master module. The type of I/O and slave module used are the criteria for selecting one of the following:

NTDI01 General purpose digital I/O; interfaces field digital I/O.

NTDO02 Connects field wiring from AC or DC loads to solid state relays driven by the IMDSM05 or IMDSO04.

NIDI01 High density, modular version of the NTDI01. Jumper selectable for slave type.

NIDO01 High density, modular version of NTDO02. Interfaces field digital I/O to digital slaves, provides onboard power distribution for outputs. Jumper selectable for slave type.

Slave Expander Bus Connection

When an LMM is used with slave modules, they make up a master/slave subsystem within a Process Control Unit (PCU). The slave expander bus, located on the MMU backplane, must be connected to provide a communication path between an LMM and its slaves connected to the bus. The modules must be installed in adjacent slots to provide the connection capability.

WARNING	**Disconnect power before installing dipshunts for slave modules on the MMU backplane (slave expander bus). Failure to do so could result in severe or fatal shock.**
AVERTISSEMENT	**Couper l'alimentation avant d'installer les dipshunts sur la plaque arriere du chassis de montage de modules (MMU). Toute negligence a cet egard constitue un risque de choc pouvant entrainer des blessures graves, voire moretiles.**

To connect the slave expander bus, insert a 12 strap dipshunt (all straps intact) into the MMU backplane socket between each slave, and the slaves and master module. The sockets on either side of the LMM and slave module group should not have dipshunts; this separates the master/slave subsystems. For further information on the MMU, refer to ***Module Mounting Unit Product Instruction, I-E93-910-4***.

WIRING CONNECTIONS AND CABLING

An LMM and slave modules have three card edge connectors (P1, P2 and P3) to provide power, establish communication and connect external signals. Cables connect the external signals to the modules from termination units or modules.

Wiring

Installing any of these modules in the MMU connects P1 of the module to logic power (+5 VDC) necessary to operate the logic circuitry, P2 to the slave expander bus, and P3 to field inputs/outputs. P1 also connects the LMM to the module bus for communication with other modules. P1 and P2 connections require no additional wiring or cabling.

Cable Connections

Three cables connect the I/O to the LMM. The cable required depends on the associated hardware being used to provide support for the LMM functions.

- Digital inputs/outputs from an NTDI01 or NTDO02 Termination Unit to the LMM.
- Digital inputs/outputs from an NIDI01 or NIDO01 Termination Module to the LMM.

CONFIGURATION

Once the LMM is installed, a configuration must be defined to determine the operations an LMM performs on its input signals. The description and operation section explains the function codes available to configure a Logic Master Module (IMLMM02). For further explanation of these function codes and their specifications, or further explanation of function blocks and configurations, refer to the ***Function Code Application Manual, I-E93-900-20***.

> **NOTE:** The NVRAM should be initialized BEFORE entering a configuration into the module. This can be done using the operator interface or the module address switch (S2).

Use an operator interface (EWS, OIS, etc.) to enter a configuration into module memory. The module must be placed in configure mode to enter values into function code specifications. After entering all values, change the mode to execute. If any errors exist in the configuration, the module will not go into execute. Instead, the status LED will continue to blink green and the operator interface will indicate error mode. The cause of the configuration error can be determined by reading status information from the LMM. Refer to the product instruction for the operator interface you are using for procedures to change mode, configure a module and view status messages.

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section explains the modes of operation, front panel indicators and start-up procedures for the Logic Master Module (IMLMM02).

MODES OF OPERATION

The logic master module (LMM) has three modes of operation: EXECUTE, CONFIGURE, and ERROR mode. The mode can be changed using an operator interface. A description of each mode follows.

Configure Mode

The configure mode is used to enter or update the control strategy.

Execute Mode

The execute mode is the normal mode of operation. In this mode, the module executes the control strategy, updates the outputs and communicates over the module bus and slave expander bus.

Error Mode

The error mode occurs when a hardware or software error is detected (refer to the troubleshooting section for corrective action).

LED INDICATORS

Front panel module status indicators on the LMM provide a visual indication of module operation.

Status LED

The LMM has a single status LED indicator. The status LED has three states: solid green, flashing green and solid red. Solid green means that the module is operating properly, executing control strategies, updating outputs, etc. Flashing green means that the module has been put in the configure mode, or that a nonfatal error situation exists. Solid red means that a fatal error has occurred (again, refer to the troubleshooting section for corrective action). Figure 4-1 shows the location of the status LED.

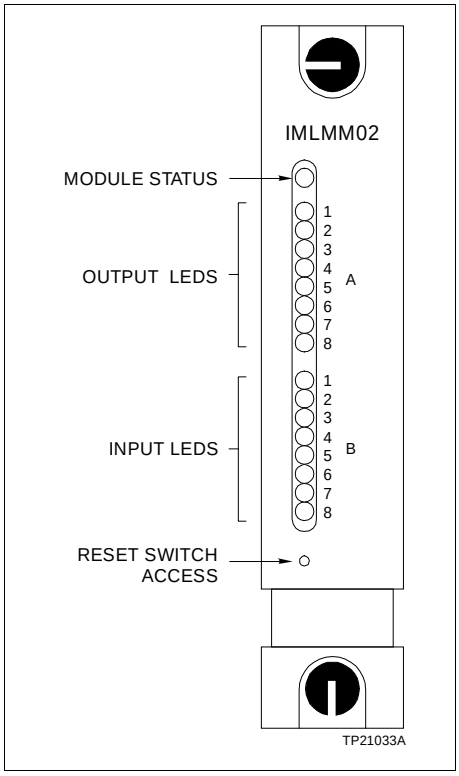

Figure 4-1. LMM Front Panel

Input/Output LEDs

Group A and Group B LEDs are numbered one through eight. When an output is active, its corresponding Group A LED is red. When an input is active, its corresponding Group B LED is red.

RESET SWITCH

The reset switch is used to reset the module. Press the switch once when the module is in the execute mode and the outputs will go back to their default state. If the status LED is flashing green when the module is in the execute mode and the reset switch is pressed, the module will go into the error mode. At this point, any of the INFI 90 interface units can be used to interrogate the module to find the cause of the error.

START-UP PROCEDURES

After the logic master module has been prepared (i.e., address set, input jumpers set, configured) and installed in the module mounting unit, it is ready to be used. Using one of the INFI 90 interface units, put the module in the execute mode. The status LED should be solid green. This means that the configuration has valid parameters, and the module is performing as it should. If the status LED is not solid green, refer to the troubleshooting section for corrective action.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section explains the error indications and corrective actions for the Logic Master Module (IMLMM02).

> **NOTE:** If the corrective actions in this section do not correct a problem with these modules, replace the module or contact your nearest Bailey Controls representative. Refer to the repair/replacement section for procedures to replace an LMM.

ERROR INDICATIONS AND CORRECTIVE ACTION

The status of the LMM can be obtained through an operator interface or the front panel LED indicators. An operator interface can also be used to verify the input values sent to the LMM from a slave module. Operator interfaces include the Configuration and Tuning Module (CTM), Configuration and Tuning Terminal (CTT), Operator Interface Station (OIS), Management Command System (MCS) or Engineering Work Station (EWS).

Logic Master Module Indicators

The LMM has a single status LED indicator. This indicator shows either normal operating conditions or error conditions.

Status LED

The status LED indicates both normal and error conditions for the LMM. Table 5-1 summarizes the LED states, probable causes and corrective actions to take for the different indications. An explanation of the error indications follows.

Solid Red

A solid red LED indicates a fatal error has occurred. With this type of error, the modules halts all operation and does not communicate over the module bus. Without communication over the module bus, the module status bytes cannot be accessed. The module should be replaced with a configured backup.

Blinking Green

The LED blinking green indicates that the module has detected an error in configuration when attempting to go from configure to execute mode. The module status bytes can be monitored to identify the configuration error (refer to Table 5-2).

The LMM also enters this error mode if an NVRAM error occurs while in execute mode. In this case the LMM continues to operate unless an additional error condition causes it to halt. The

module uses its current configuration to maintain operation; the configuration cannot be modified (i.e., tuned) in this mode.

Table 5-1. LMM Module Mode LED Indications and Corrective Actions

LED State	Indication	Probable Cause	Corrective Action
Solid Green	Module in EXECUTE mode. No errors exist.	Normal operation.	No corrective action required.
Blinking Green	Module in CONFIGURE mode.	Normal operation.	Use configuration tool to enter the control strategy.
	Module in EXECUTE mode.	A nonfatal error such as self-test routine failure or NVRAM error has occurred	Ensure the system is shut down or in a safe state. Push the **RESET** pushbutton. The module is now in ERROR mode. Use configuration tool to obtain the status word indicating the error. Refer to Table 5-2.
Red	Module in ERROR mode. LMM does not communicate with modules on module bus. Status bytes cannot be read.	A fatal error has occurred	Replace module or contact nearest Bailey Controls representative.
Off	No power to LMM.	Microprocessor or related hardware failure.	Replace module or contact nearest Bailey Controls representative.

STATUS BYTES

The LMM status bytes provide information concerning the slave modules and LMM inputs. The status bytes display as hexadecimal values on the CTT, and are available by displaying the module address and pressing the **NEXT** key. On the OIS, MCS or EWS, the status bytes can be accessed by displaying the module status screen. Table 5-2 interprets the bits presented in the module status bytes.

Table 5-2. Module Status Bytes

Byte	Bit							
	7	6	5	4	3	2	1	0
1	ES	MODE		TYPE=7				
2	FTX	MOV	RIO	LIO		NVF	NVI	DSS
3	Bytes 3 to 5 combine to define other errors.							
4								
5								

Table 5-2. Module Status Bytes (continued)

Field	Field Size or Value			Description
BYTE 1				
ES	80			Error Summary (0=OK, 1=ERRORS), 11=EXT)
MODE	60			Module Mode (00=CFG, 10=ERR
TYPE	1F			Module Type Code =(C)^{16}
BYTE 2				
FTX	80			First Time in Execute (0=NO, 1=YES)
MOV	40			Memory Overflow (0=NO, 1=YES)
RIO	20			Summary Remote Input Status (0=OK, 1=BAD)
LIO	10			Summary Local Input Status (0=OK, 1=BAD)
EEF	04			Summary NVRAM Failure State (0=OK, 1=BAD)
EEI	02			Summary NVRAM Initialized State (0=OK, 1=BAD)
DLS	01			Digital Logic Station Status (0=GOOD, 1=BAD)
BYTE 3-5	3	4	5	
	01	01	-	NVRAM Error: Write Failure
		02	-	Checksum Failure
		03	-	Bad Data
		FF	-	Reset During Write
	03	(1)	(2)	MISSING SLAVE MODULE (1), (2) = Slave Address
	05	(1)	(2)	CONFIGURATION ERROR - UNDEFINED BLOCK (1), (2) = Block Making Reference
	06	(1)	(2)	CONFIGURATION ERROR - INPUT DATA TYPE IS INCORRECT (1), (2) = Block Making Reference
	07	(1)	(2)	INSUFFICIENT MEMORY IN REMOTE MODULE (1), (2) = Block Number of Digital Input List
	08	(1)	(2)	TRIP BLOCK ACTIVATED (1), (2) = Block Number of TRIP Block
	0A	-	-	TOO MANY SEGMENT CONTROL BLOCKS
	0C	-	-	CONFIGURATION ERROR - SEQUENCING TOO COMPLEX

NOTE: All numbers in bytes 4 and 5 are encoded in BCD with (1) = most significant byte and (2) = least significant byte.

Example: Block number 1024, (1) = 10, (2) = 24.

CONNECTOR PINOUTS

Tables 5-3 to 5-5 show the pinouts for the LMM edge connectors.

Table 5-3. P1 Pinout

Pin	Signal	Pin	Signal
1	+5 VDC	2	+5 VDC
3	NC	4	NC
5	Common	6	Common
7	+15 VDC	8	-15 VDC
9	PFI	10	PFI
11	Module Bus	12	Module Bus

NOTE: PFI = Power Fail Interrupt

Table 5-4. P2 Pinout

Pin	Signal	Pin	Signal
1	Data Bit D1	2	Data Bit D0
3	Data Bit D3	4	Data Bit D2
5	Data Bit D5	6	Data Bit D4
7	Data Bit D7	8	Data Bit D6
9	Clock	10	Sync
11	Default	12	Reset

Table 5-5. P3 Pinout

Pin	Signal	Pin	Signal
1	Digital Output 0+	A	Digital Output 0-
2	Digital Output 1+	B	Digital Output 1-
3	Digital Output 2+	C	Digital Output 2-
4	Digital Output 3+	D	Digital Output 3+
5	Digital Output 4+	E	Digital Output 4-, 5-
6	Digital Output 5+	F	NC
7	Digital Output 6+	H	Digital Output 6-, 7-
8	Digital Input 7-	J	Digital Output 7+
9	Digital Input 0-	K	Digital Input 0-
10	Digital Input 1-	L	Digital Input 1-
11	Digital Input 2-	M	Digital Input 2+
12	Digital Input 3-	N	Digital Input 3+
13	Digital Input 4-	P	Digital Input 4+, 5+
14	Digital Input 5-	R	NC
15	Digital Input 6-	S	Digital Input 6+, 7+

SECTION 6 - MAINTENANCE

INTRODUCTION

The Logic Master Module (IMLMM02) requires limited maintenance. This section contains a maintenance schedule.

MAINTENANCE SCHEDULE

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

Table 6-1. Maintenance Schedule

Task	Interval
Clean and tighten all power and grounding connections.	Every 6 months or during plant shutdown, whichever occurs first.
Use a static safe vacuum cleaner to remove dust from: Modules Module Mounting Unit Fan Assembly Power Entry Panel Termination Units/Modules	

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

This section explains the replacement procedures for a Logic Master Module (IMLMM02). There are no special tools required to replace these modules.

MODULE REPAIR/REPLACEMENT PROCEDURES

If you determine an LMM 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 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 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.

6. Return to normal operation.

NOTE: When replacing an LMM, a new configuration must be loaded into the module.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls is ready to help in the use, application and repair of its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

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

1. Part description, part number and quantity.

2. Model and serial numbers (if applicable).

3. Bailey instruction manual number, page number and reference figure that identifies the part.

Order parts without commercial descriptions from the nearest Bailey Controls sales office.

Table 8-1. Spare Parts List

Description	Part No.
Jumper	1946984A1

TRAINING

Bailey Controls has a modern training facility that provides service and repair instruction. Service and repair training courses can also be delivered in your plant to train your service personnel. Contact a Bailey Controls sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

Additional copies of this manual, or other Bailey Controls manuals, can be obtained from the nearest Bailey sales office at a reasonable charge.

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