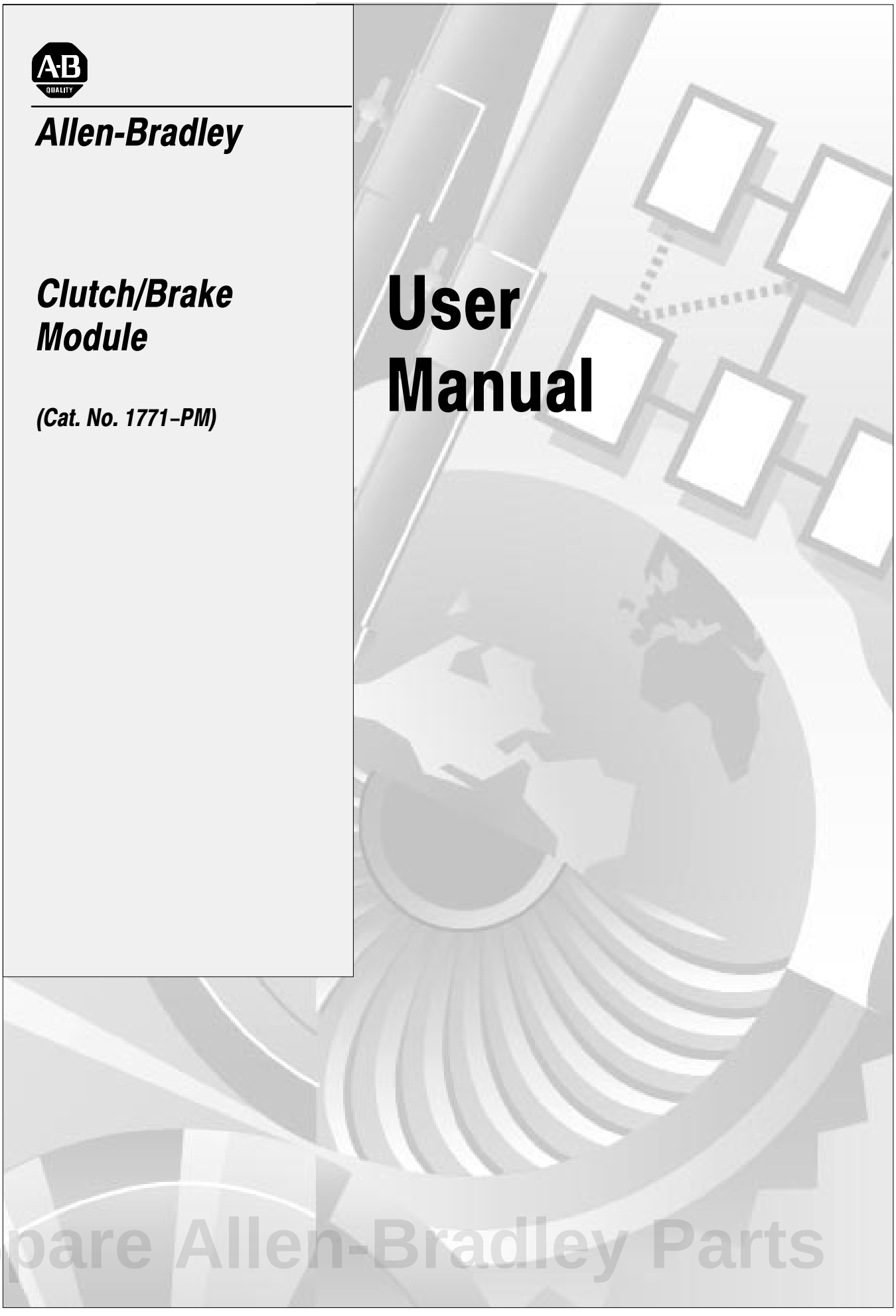


Allen-Bradley

Clutch/Brake Module

(Cat. No. 1771–PM)

User Manual

Table of Contents

Chapter 1

Introduction

Chapter Objectives

This chapter will help you become familiar with the:

- objectives of this manual
- procedure for using this manual

Objectives Of This Manual

We have written this manual to help an electrical engineering technician, or any person with a similar background:

- design a clutch/brake controller for a mechanical power press using the 1771-PM clutch/brake module.
- install the clutch/brake controller
- troubleshoot the clutch/brake controller

How To Use This Manual

The overall safety of your mechanical power press rests upon your knowledge of this manual and other referenced documents. Moreover, the ease with which you can understand each chapter rests upon your knowledge of previous chapters.

To simplify your installation and maintenance tasks, we recommend that you become familiar with this entire manual before installing your clutch/brake controller. The following suggestions should help you use this manual:

- Before reading this manual, scan through it. This will help you understand its organization.
- Before installing your clutch/brake controller, read this manual thoroughly. You should also read other publications that we refer.
- While installing or troubleshooting your clutch/brake controller, use this manual as a reference.

Terminology

We define new terms where they first appear in this manual. You should be familiar with the following terms because we use them throughout this manual.

- a **press** is a mechanical (part revolution) power press that is actuated by a clutch and stopped by a brake
- a **clutch/brake controller** is an Allen-Bradley controller, which includes chassis A and B, two Clutch/Brake Modules (cat. no. 1771-PM), and associated I/O modules.
- a **press system** includes your mechanical power press, clutch/brake controller, and all associated wiring and components.
- a **PLC** is any Allen-Bradley programmable controller that has 1771 remote I/O operation.
- **TCAM** is the acronym for Top-Stop-Check Cam switch
- **ACAM** is the acronym for Anti-repeat Cam switch
- **RCAM** is the acronym for Run-on Cam switch

Firmware Revision Record

The firmware has been revised as follows:

Firmware Revision	Change in operation
A/B	Micro-inch added
A/C	None (corrected intermittent stoppage in continuous mode)
A/D	Motion detector time-out increased to 4 sec
A/E	None (corrected intermittent communications problem)

Chapter 2

Press System Description

Chapter Objectives

This chapter will help you become familiar with:

- major components of a typical press system
- safety requirements for a press system

System Components

A press system, as referred to in this manual, includes:

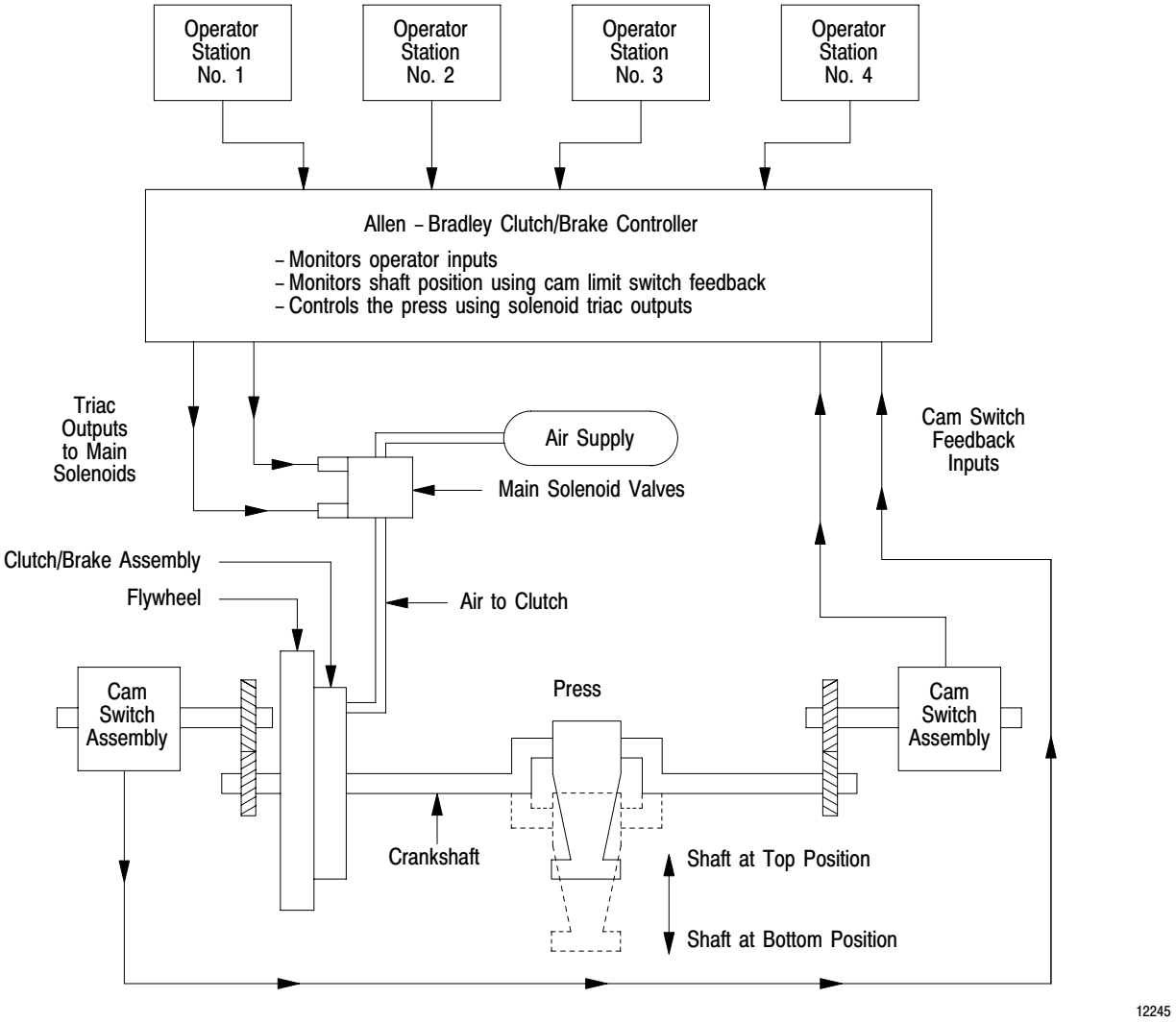
- a mechanical power press
- an Allen-Bradley clutch/brake controller
- all associated control panels and operator stations
- all associated output and feedback devices
- all wires and cables that interconnect system components

A functional block diagram of a typical press system is shown in Figure 2.1. This figure shows general relationships between major components. Specific functional relationships vary according to the requirements of your particular press system. For details, refer to;

- chapters 3 thru 7 of this manual
- technical documentation provided by your press manufacturer
- ANSI B11.1, American National Standard for Machine Tools, Mechanical Power Presses, Construction, Care, and Use

Important: Use an Allen-Bradley clutch/brake controller only with a mechanical power press that has a part-revolution clutch. A part-revolution clutch can be disengaged at any position of the shaft. This allows your clutch/brake controller to stop the press at any position. In contrast, a full-revolution clutch can be disengaged and stop the press only at the top position of the stroke.

Figure 2.1
Functional Block Diagram



Related Safety Documentation

This manual concentrates on safety considerations relative to the clutch/brake controller. Study this entire manual and all technical documentation provided by the press manufacturer before you install your press system. In addition to local codes and laws, follow the safety requirements detailed in the following publications:

- OSHA Regulations, Title 29-Labor, Chapter XVII, Section 1910.217, Mechanical Power Presses
- ANSI B11.1, American National Standard for Machine Tools, Mechanical Power Presses, Construction, Care, and Use
- NFPA No. 79, Electrical Standard for Metalworking Machine Tools

Chapter 3

Clutch/Brake Controller Hardware

Chapter Objectives

This chapter will help you become familiar with the:

- hardware components of your Allen-Bradley clutch/brake controller
- functional relationships between your PLC and clutch/brake controller
- interconnections between your PLC and clutch/brake controller
- switch settings that configure your clutch/brake controller and establish its rack addresses

General Hardware Considerations

For details on how to install the I/O chassis and modules, refer to the installation publications that apply to your particular PLC. These publications, listed in our Publications Index (publication SD-499), discuss general layout rules, mounting dimensions, enclosure considerations, module keying, and field wiring arm connection technique.

Important: If you are using a large mechanical power press that generates high levels of shock and vibration, we recommend that you shock-mount each I/O chassis of your clutch/brake controller.

Important: Electrostatic discharge can damage integrated circuits or semi conductors in the PM Module if you touch backplane connector pins or internal components.

CAUTION: Rid yourself of charge before handling the module by touching a grounded object.

Description of your Clutch/Brake Controller

Your clutch/brake controller consists of chassis A and B connected to your PLC in a serial chain with remote I/O chassis, as shown in Figure 3.1. Table 3.A. lists required and optional clutch/brake controller hardware.

Chassis A and B are similar to remote I/O chassis. The major difference is that the left-most slot of chassis A and B contains a clutch/brake module. In contrast, the left-most slot of an I/O chassis contains an I/O adapter module.

Figure 3.1
Overview of a Clutch/Brake Controller

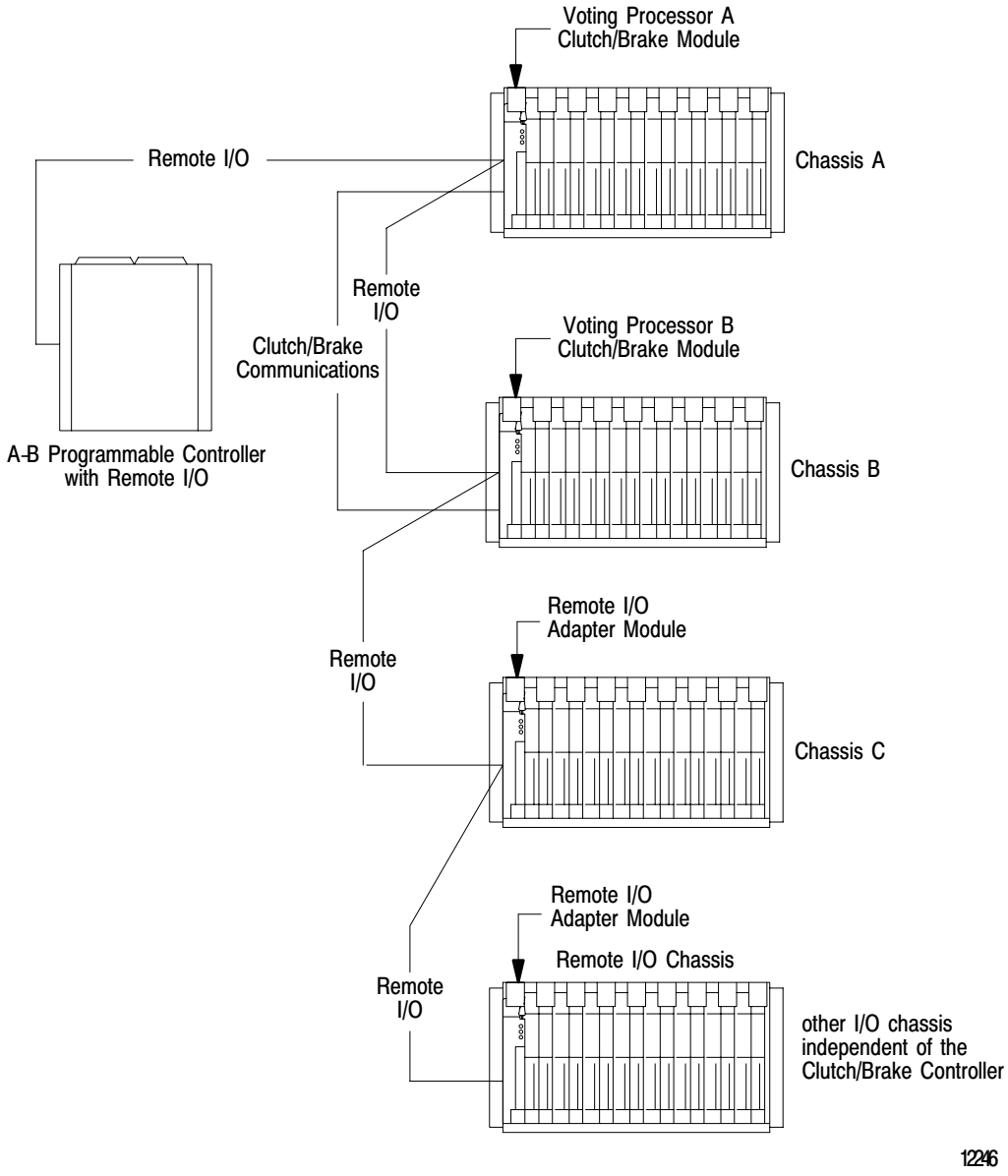


Table 3.A
Required and Optional Hardware

Quantity	Item	Cat. No.	Function
Important: (You must use 8-point modules with 2-slot addressing)			
	Required Hardware		
2	Clutch/Brake Module	1771-PM	Monitors and controls the press
2	Wiring Arm	1771-WB	Connections to 1771-PM
2	I/O Chassis	1771-A2B	Contains the modules
10	120V AC Input Modules	1771-IA	Monitors press inputs
2	120V AC Isolated Output Modules (Series C)	1771-OD	Controls press outputs
	Optional Hardware		
2	120V AC Output Modules	1771-OA	Display of diagnostic messages
1	120AC Output Module	1771-OA	Controls optional indicators
2	120V AC Input Modules	1771-IA	Dump valve circuit
2	120V AC Isolated Output Modules (Series C)	1771-OD	Dump valve and/or micro-inch circuit
2	I/O chassis	1771-A4B	Substitute chassis when using the optional dump valve circuit.
1	120V AC Output Module	1771-OA	Micro-inch indicator
2	120V AC Input Modules	1771-IA	Micro-inch circuit
2	120V AC Input Modules	1771-IA	Additional operator stations

Clutch/brake modules operate in parallel to monitor and control your press. Clutch/brake modules are also called “voting processors” because they must always have a consensus. Unless both voting processors constantly agree that they sense identical conditions in your clutch/brake press system, either or both voting processors stop press motion or prevent it from starting.

Your clutch/brake controller monitors and controls your press. Although your PLC does not control your press, it does configure and enable the clutch/brake controller. Your PLC ladder program can monitor inputs to, and the status of, your clutch/brake controller. This allows your PLC to control other indicators, machines, or processes related to your press system.

In addition to chassis A and B, you must connect your PLC to at least one local or remote I/O chassis, chassis C. You need two, three, or four inputs at a local or remote I/O chassis.

Important: You must use 2-slot addressing and 8-point (single-density) I/O modules.

Twinaxial Cable Connections

Typical twinaxial cable connections of your clutch/brake controller are shown in Figure 3.2. Connect your clutch/brake controller to your PLC as part of its remote I/O distribution network. Use Twinaxial Cable (cat.no. 1770-CD) and Terminators (cat. no. 1770-XT).

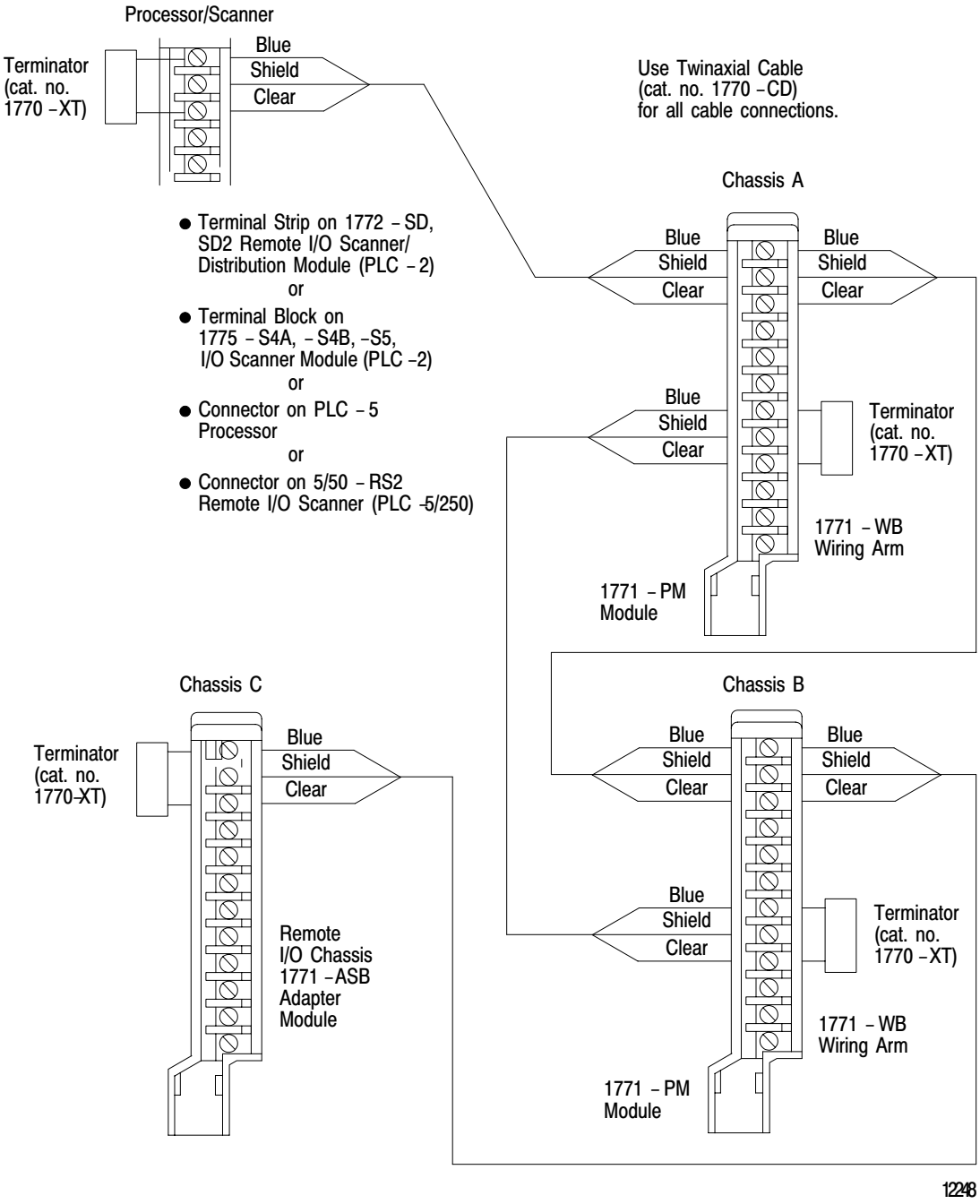
Connect chassis A next to chassis B in the serial chain as shown in Figure 3.2. You may connect one or more remote I/O chassis in the same serial chain. Also, you may connect remote I/O chassis to other distribution channels at the I/O scanner module of your PLC.

Connect four Terminator Resistors (cat. No. 1770-XT) as shown in Figure 3.2. Connect one at:

- the scanner module
- the last chassis, whether it is a clutch/brake chassis or a remote I/O chassis
- each end of the cable that connects chassis A and B at terminals 7, 8 and 9 of the 1771-PM module field wiring arms

For more information on how to connect remote I/O channels, refer to the installation publications that apply to your particular PLC. Also refer to Product Data of the Remote I/O Adapter Module. These publications are listed in our Publications Index (publication SD499)

Figure 3.2
Typical Twinaxial Cable Connections



Multiple Clutch/Brake Controllers

Although this manual describes a single clutch/brake controller, you may connect your PLC to multiple controllers, each controlling a separate press. Each clutch/brake controller uses two remote I/O racks for chassis A and B. For example, since a PLC-3 controller can support as many as 32 I/O racks, you may connect it to as many as 15 clutch/brake controllers with two additional I/O racks for modules in chassis C.

Panel Switches and Operator Stations

You can operate your press using up to four operator stations and an optional control panel. Installations vary according to the type of mechanical press and its application requirements. The number of stations, control switches contained in each, and the control panel could be as follows:

Assembly	Control Switches	Notes
Control Panel and/or Station 1	Mode select	1
	Arm continuous	1
	Stop-on-top	1 and/or 3
	L/R Inch	2
	Press enable	3
	Reset latched messages	3
	Lamp test	3
	L/R Run	2
	E-Stop	2
Stations 2 thru 4	L/R Run	2
	Stop On Top	2 and/or 3
	E-Stop	2

1 Connect these switches to input modules in chassis A and B (Figure 6.10).
2 Connect these switches to input modules in chassis A and B (Figures 6.11 thru 6.12).
3 These switches are inputs for command rungs (Figures 4.6 thru 4.8). Connect these switches to input modules in remote I/O chassis C (Figure 6.15).

Interlock Switches

Various interlock switches are required for safety as specified in ANSI B11.1. The locations, types, and quantities vary with the type of mechanical press and its application requirements. Use these interlock switches to prevent the press from starting or to stop the press when operation could cause injury to personnel or damage to the press.

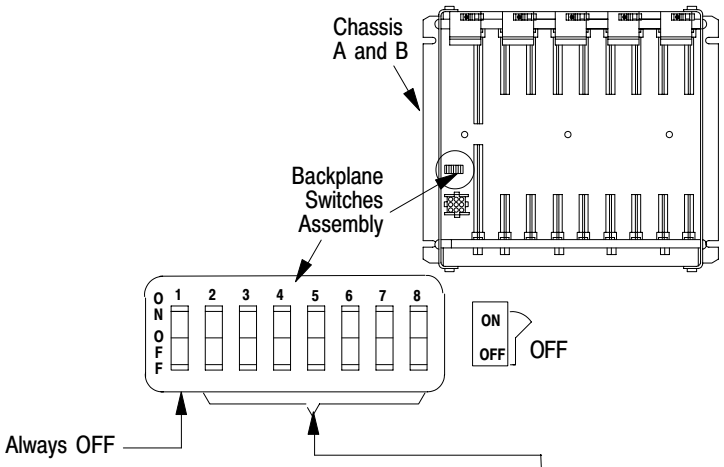
Interlock Switch	Quantity	Reference
Barrier guard	1 or more	Figures 6.10 and 6.15
Press interlock	1	Figures 6.1 and 6.5
Motion detector	1	Figure 6.2 and 6.6
Main motor forward	1	Figure 6.10
Cam limit switch assembly	2	Figure 6.9
top-stop-check (TCAM) run-on (RCAM) anti-repeat (ACAM)		

Configuring Your Clutch/Brake Controller

You have flexibility in selecting clutch/brake controller functions. You may select any of the following functions according to your application requirements by setting switches on the I/O chassis.

- Operator station 3 and 4
- Motion detector feedback
- Valve stem feedback
- Air pressure feedback
- Ungrounded or grounded AC power
- On-the-hop
- Half stroke, or Stroke-and-a-half
- Dump valve circuit
- Micro-inch

Figure 3.3
Backplane Switch Settings



Switch No:	Position:	Function:
2	ON	Use Stations 3 and 4
	OFF	Stations 3 and 4 not used
3	ON	Use Motion Detector Feedbck
	OFF	Motion Detector Feedback not used
4	ON	Use Valve Stem Feedback
	OFF	Valve Stem Feedback not used
5	ON	Use Air Pressure Feedback
	OFF	Air Pressure Feedback not used
6	ON	Ungrounded AC Power
	OFF	Grounded AC Power
7	ON	Use On-The-Hop
	OFF	On-The-Hop not used
8	ON	Use Half-Stoke
	OFF	Use Stroke-And-A-Half

IMPORTANT: Make backplane switch settings in chassis A and B identical.

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Important: There is no backplane switch setting to configure the optional dump valve circuit. You configure the optional dump valve circuit by inserting dump valve modules (cat. no. 1771-OD and 1771-IA) into module group 4, slots 0 and 1, respectively of chassis A and B. You must also set bit 14 unconditionally in your configuration rungs.

Important: To configure your clutch/brake controller for Micro-inch, see chapter 4 “Module Group 5, Slot 0 Reserved for Micro-inch”.

Important: Your PLC ladder program must include unconditioned configuration rungs that set or reset configuration bits to match the settings of backplane switches. Refer to chapter 4.

Rack Address of Chassis A and B

Establish the address of chassis A and B in each clutch/brake module so the PLC can communicate with it. Use valid rack addresses as determined by your PLC.

Switch assembly SW-1 determines the rack address. It is located under a sliding cover plate on the left side of the clutch/brake module near the top. Loosen the two screws holding the cover plate and slide it open. Locate switch assembly SW-1 at the top of the printed circuit board as shown in Figure 3.4.

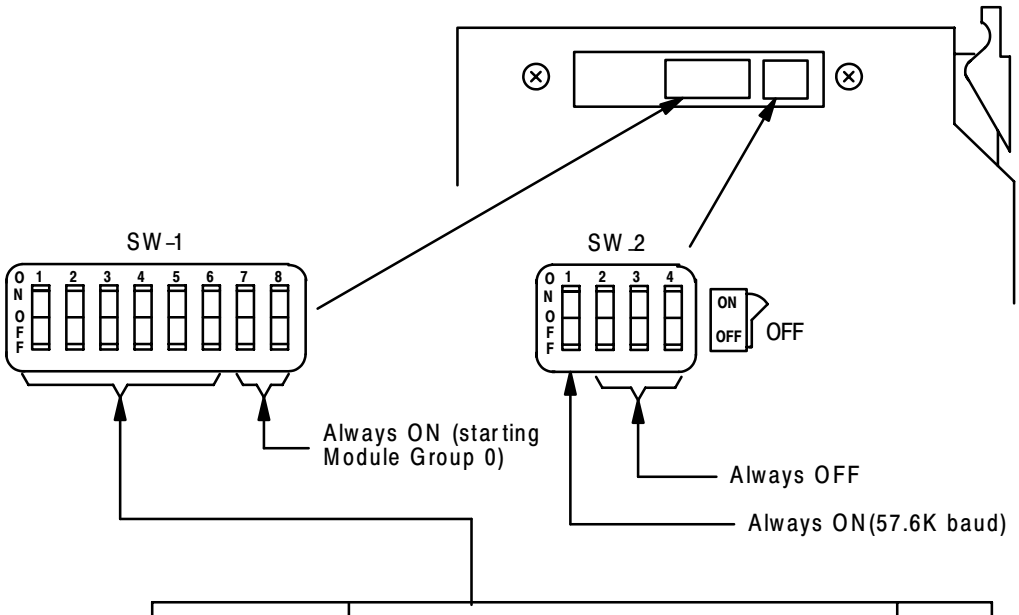
Using switch assembly SW-1, designate chassis A and B as follows:

Chassis A - any rack address having position 6 OFF
Chassis B - next consecutive upper or lower rack address

Important: If your ladder program monitors rack adapter fault bits for each chassis containing a clutch/brake module, the fault bits will indicate a faulted rack whenever the module trips power to I/O swingarms. This is because clutch/brake modules stop all communciation with the PLC until they verify that swingarm power has been disconnected.

Important: Always configure I/O racks assigned to clutch/brake controllers as <u>full</u> racks, so the PLC can write configuration bits to each PM chassis in Module Group 7.

Figure 3.4
Rack Address Switch Setting on 1771-PM Module



Rack Addresses		Switch Assembly SW-1 Position						
PLC-2/30 PLC-5/25	PLC-3 PLC-5/250	1	2	3	4	5	6	Chassis
1	00	on	on	on	on	on	on	B
2	01	on	on	on	on	on	off	A
3	02	on	on	on	on	off	on	B
4	03	on	on	on	on	off	off	A
5	04	on	on	on	off	on	on	B
6	05	on	on	on	off	on	off	A
7	06	on	on	on	off	off	on	B
	07	on	on	on	off	off	off	A
	10	on	on	off	on	on	on	B
	11	on	on	off	on	on	off	A
	12	on	on	off	on	off	on	B
	13	on	on	off	on	off	off	A
	14	on	on	off	off	on	on	B
	15	on	on	off	off	on	off	A
	16	on	on	off	off	off	on	B
	17	on	on	off	off	off	off	A
	20	on	off	on	on	on	on	B
	21	on	off	on	on	on	off	A
	22	on	off	on	on	off	on	B
	23	on	off	on	on	off	off	A
	24	on	off	on	off	on	on	B
	25	on	off	on	off	on	off	A
	26	on	off	on	off	off	on	B
	27	on	off	on	off	off	off	A
	30	on	off	off	on	on	on	B
	31	on	off	off	on	on	off	A
	32	on	off	off	on	off	on	B
	33	on	off	off	on	off	off	A
	34	on	off	off	off	on	on	B
	35	on	off	off	off	on	off	A
	36	on	off	off	off	off	on	B
	37	on	off	off	off	off	off	A

NOTE: Chassis A and B must have consecutive rack addresses.

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For example, if you choose rack address 2 for chassis A, you must choose rack address 1 or 3 for chassis B.

Set the rack address in each clutch/brake module. Place a label on each clutch/brake module to identify in which chassis, A or B, it belongs.

Important: Chassis A and B rack addresses must be unique. No I/O chassis can have the same rack address as either chassis A or B. This restriction prohibits using the rack address of either chassis A or B for any complementary I/O chassis (a chassis with the same module addresses but having input modules where chassis A and B have output modules, and output modules where chassis A and B have input modules). This restriction also prohibits using the rack address of either chassis A or B for any partial remote I/O chassis (a chassis that starts with module group 2, 4, or 6). (Refer to chapter 4, Module Group 7, PLC Command Rungs, for reasons why you must restrict the use of this address.)

Triacs of your clutch/brake controller turn on in sequential order. Triacs connected to the high AC power line (L1) turn on before those in the triac-solenoid string connected to the low AC power line (L2). If the addresses are reversed, the triacs will turn on out of sequence, and the clutch/brake controller will not operate.

Setting the Communication Rate

Set switch 1 on switch assembly SW-2 to the ON position. This sets the module's communication rate at 57.6K baud. Be sure that you set the communication rate of both 1771-PM modules and the processor's scanner to 57.6K baud, as well.

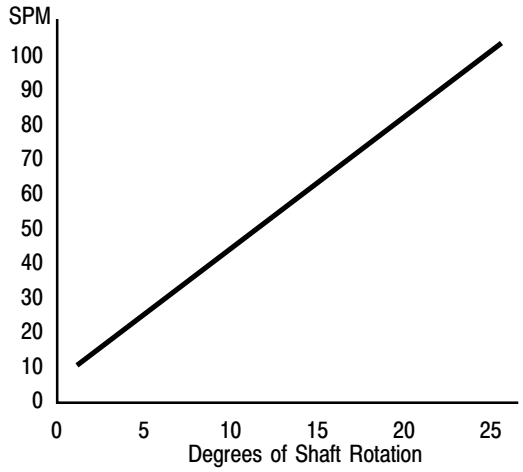
Response Time

The worst case time required for the clutch/brake controller to respond to a change of input depends on Module-response and triac-switching times:

Characteristic	Delay (ms)
1771-IA module response time	26
1771-PM module response time	10
Triac switching time	8
Total response time	44

The number of degrees that the shaft continues to rotate, beyond the moment in time when the input changes, depends on the speed of rotation. The greater the number of strokes per minute (SPM), the further the shaft rotates before a command from the clutch/brake controller is applied. The response time of 44ms is represented in degrees of shaft rotation that increases as the rate of press operation increases (Figure 3.5).

Figure 3.5
Response Time of Clutch Brake Controller



Important: When estimating the braking distance in degrees of rotation, add the response time of the controller (Figure 3.5) to the specified downstroke or upstroke braking distance of your press.

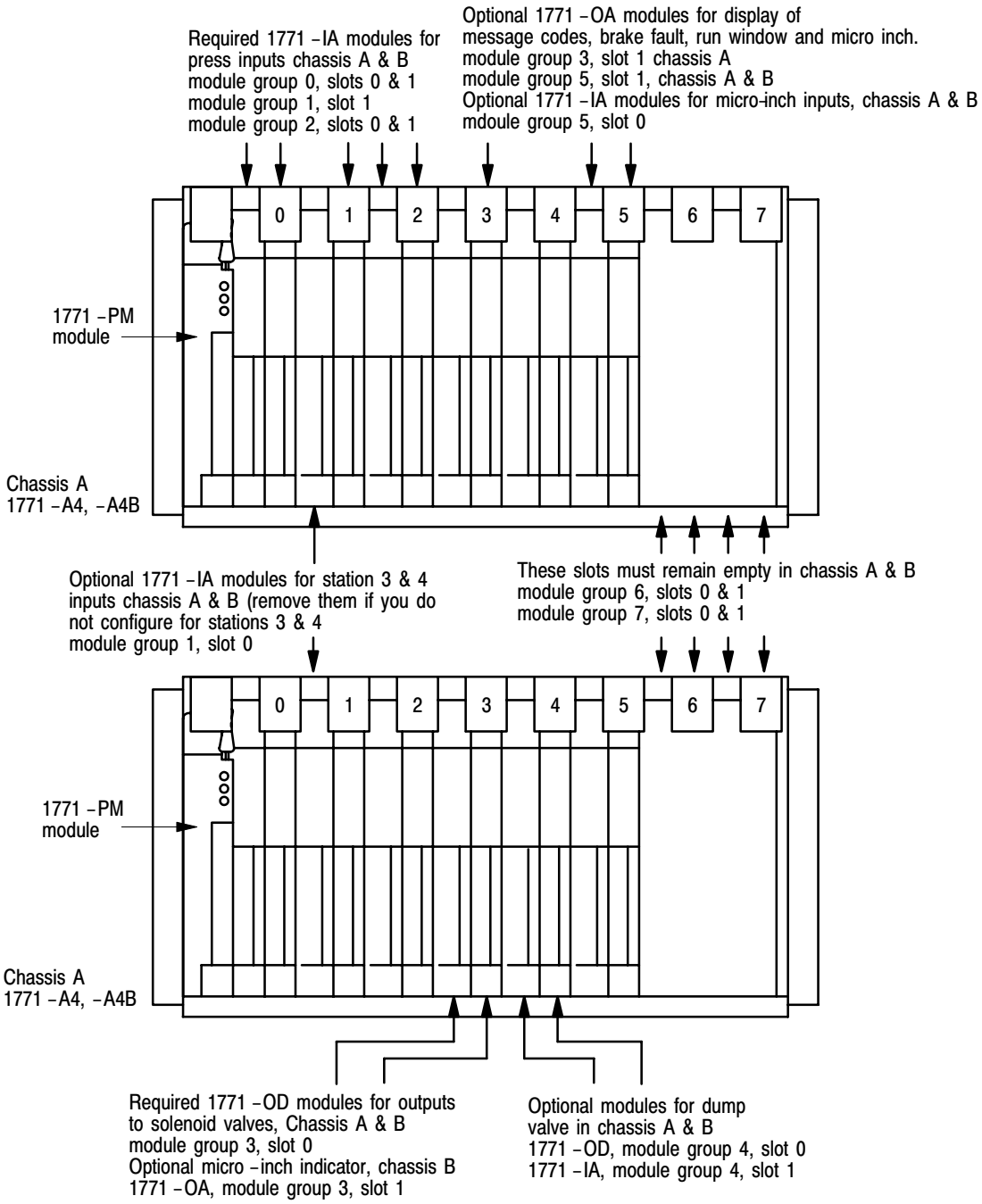
Module Placement

Locations of all clutch/brake controller modules are shown in Figure 3.6. Note that some of these modules are optional.

CAUTION: Do not place any I/O module in module groups 6 or 7 of chassis A or B. These module group locations are non-functional and reserved for future use. If you use a slot power supply, install it in module group 7.

Important: Use series C or later 1771-OD modules because they have improved electrical noise immunity. Refer to Electrical Noise Suppression, in chapter 6, for a method of suppressing surge transient noise.

Figure 3.6
Module Locations



Important: Use 1771-A2, -A2B chassis when not using optional dump valves, display of diagnostic message codes, nor micro-inch inputs.

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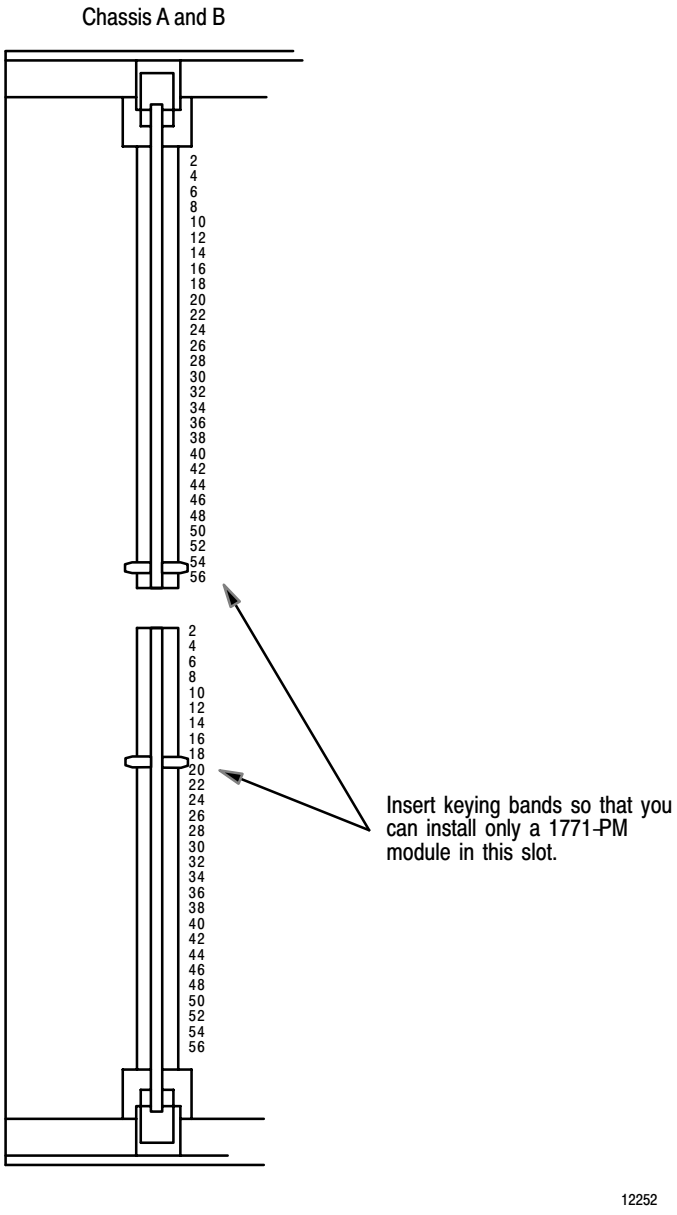
Keying

Install the keying bands on the I/O chassis backplane connector as shown in Figure 3.7. After you install keying bands in chassis A and B, you can insert only a clutch/brake module in the left-most slot of chassis A and B.

Figure 3.7
Keying



Chapter 4

PLC Ladder Programming

Chapter Objectives

This chapter will help you become familiar with:

- programming fundamentals as they relate to your clutch/brake controller
- the need for press configuration rungs
- relationships between your press configuration rungs and backplane switch settings
- relationships between configuration rungs and voting processor firmware
- the option of monitoring the press through your PLC ladder program
- the option of using PLC report generation to display messages that you have stored.

Programming Fundamentals

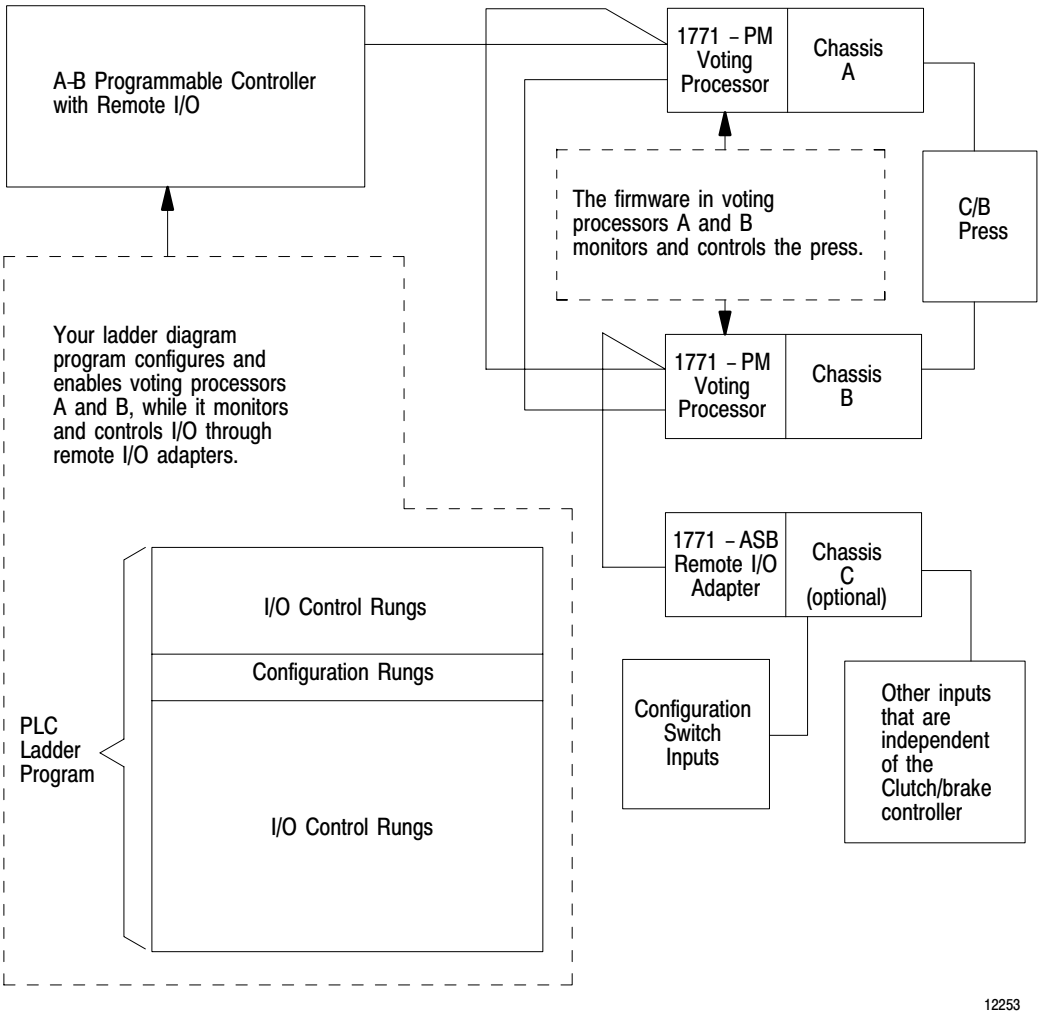
Your PLC ladder program is composed of instructions that you enter into PLC memory. These instructions are organized into rungs. They typically monitor inputs and control outputs.

Your PLC ladder program does not control your clutch/brake controller, but it does configure and enable it. Although your ladder program cannot control any clutch/brake controller outputs, it controls output image table bits to configure and enable the voting processors. Your ladder program may examine input image table bits to monitor clutch/brake controller functions as we will explain later.

This chapter concentrates on PLC ladder programming that relates to your clutch/brake controller. For more details on ladder programming, refer to the programming manual that applies to your PLC processor. These publications are listed in our Systems Division Publication Index (publication SD499).

PLC ladder programming is described in this chapter as it relates to clutch/brake controller hardware and voting processor firmware (Figure 4.1).

Figure 4.1
Overview of Clutch/Brake Controller



Configuration Rungs

You have flexibility in selecting clutch/brake controller functions by setting/resetting configuration bits. Use any of the following functions according to your application requirements:

Functions	Bit
Stations 3 and 4	01
Motion detector feedback	02
Valve stem feedback	03
Air pressure feedback	04
Ungrounded or grounded AC power	05
On-the-hop	06
Half-stroke or Stroke-and-a-half	07
Dump valve circuit	14

You enable various functions by programming configuration rungs to set (turn on) or reset (turn off) configuration bits 01 thru 07 and 14 in the output image table word for module group 7, chassis A and chassis B. Bit addresses are shown in Figure 4.2. Example configuration rungs are shown in Figure 4.3 through Figure 4.5. Program your configuration rungs according to the requirements of your press system.

Be sure to set or reset each configuration bit 01 thru 07 and 14 with unconditioned rungs. They contain only output instructions, such as latch, unlatch, or output energize. Bits set by these rungs do not change during press operation. The latching or unlatching of these bits must correspond with backplane switch settings covered in chapter 3.

Figure 4.2
Bit addresses of Output Image Table Word for Module Group 7 of Chassis A & B

PLC–2/20 PLC–2/30	PLC–3 PLC–5/250	PLC–5
0y7/xx	Oyy7/xx	O:y7/xx
where yy = rack address per Figure 3.4 xx = bit number 00 – 17		
Important: Do not use bits 00 and 15–17 for any purpose.		

Figure 4.3
Example PLC Configuration Rungs for Bits 01 thru 07 and 14 (PLC-2 Family)

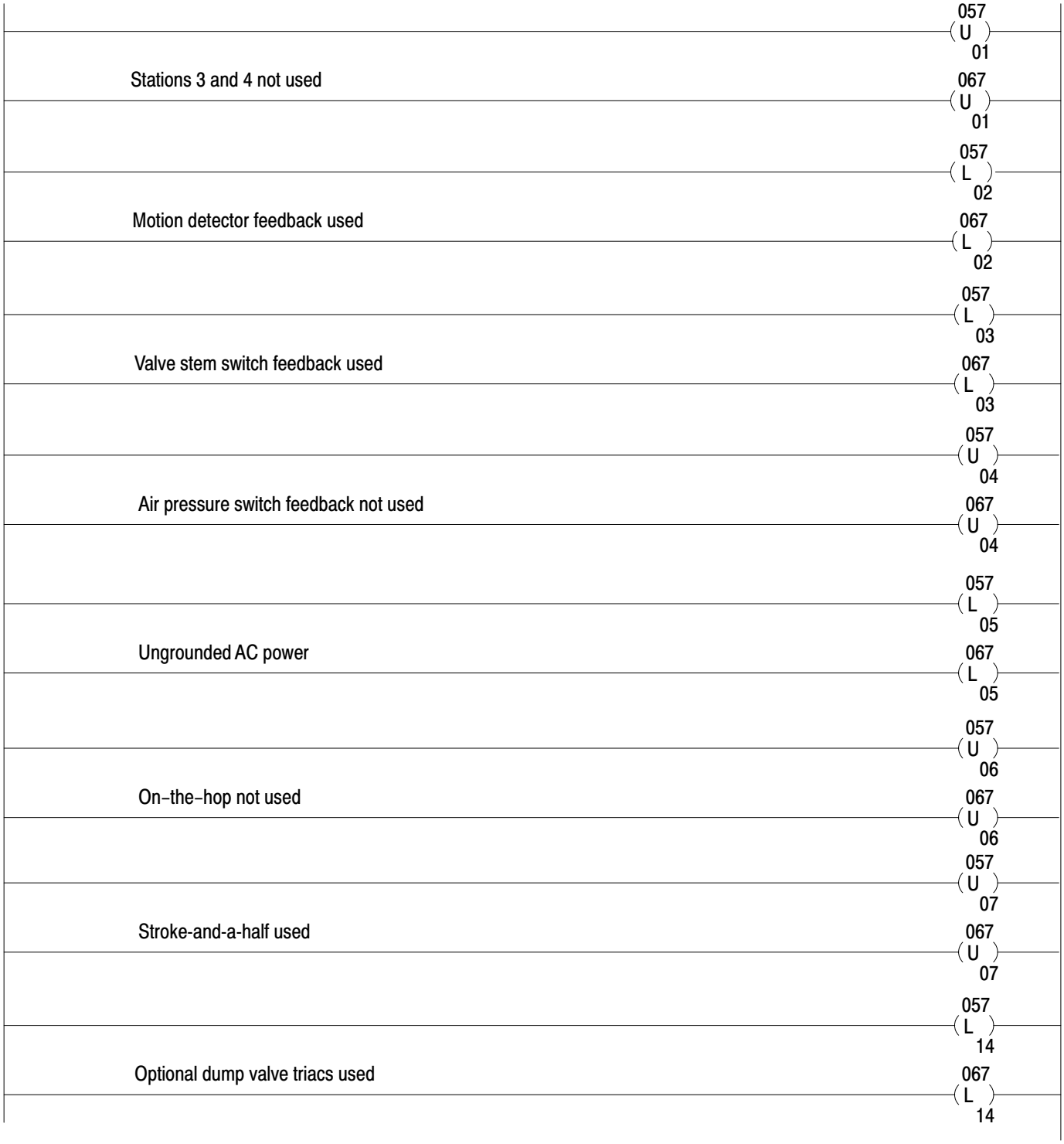
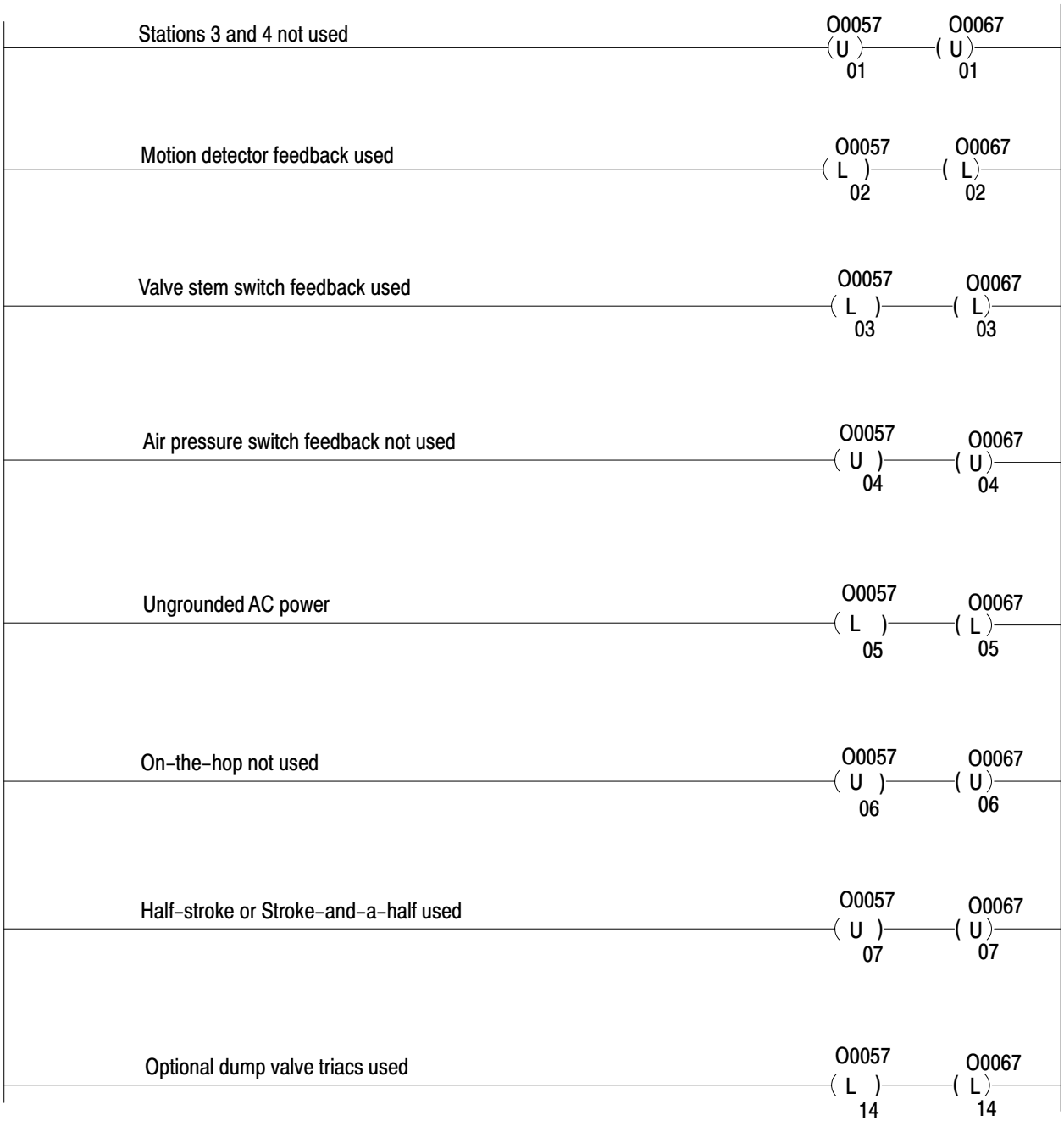


Figure 4.4
Example PLC Configuration Rungs for Bits 01 thru 07 and 14 (PLC-3 and PLC-5/250)



NOTE: Unconditionally latch or unlatch bits 0 through 7 and 14 for chassis A and B as shown to use these functions.

Use this address format for PLC-5/250 processors

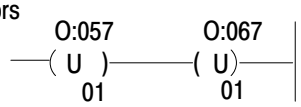
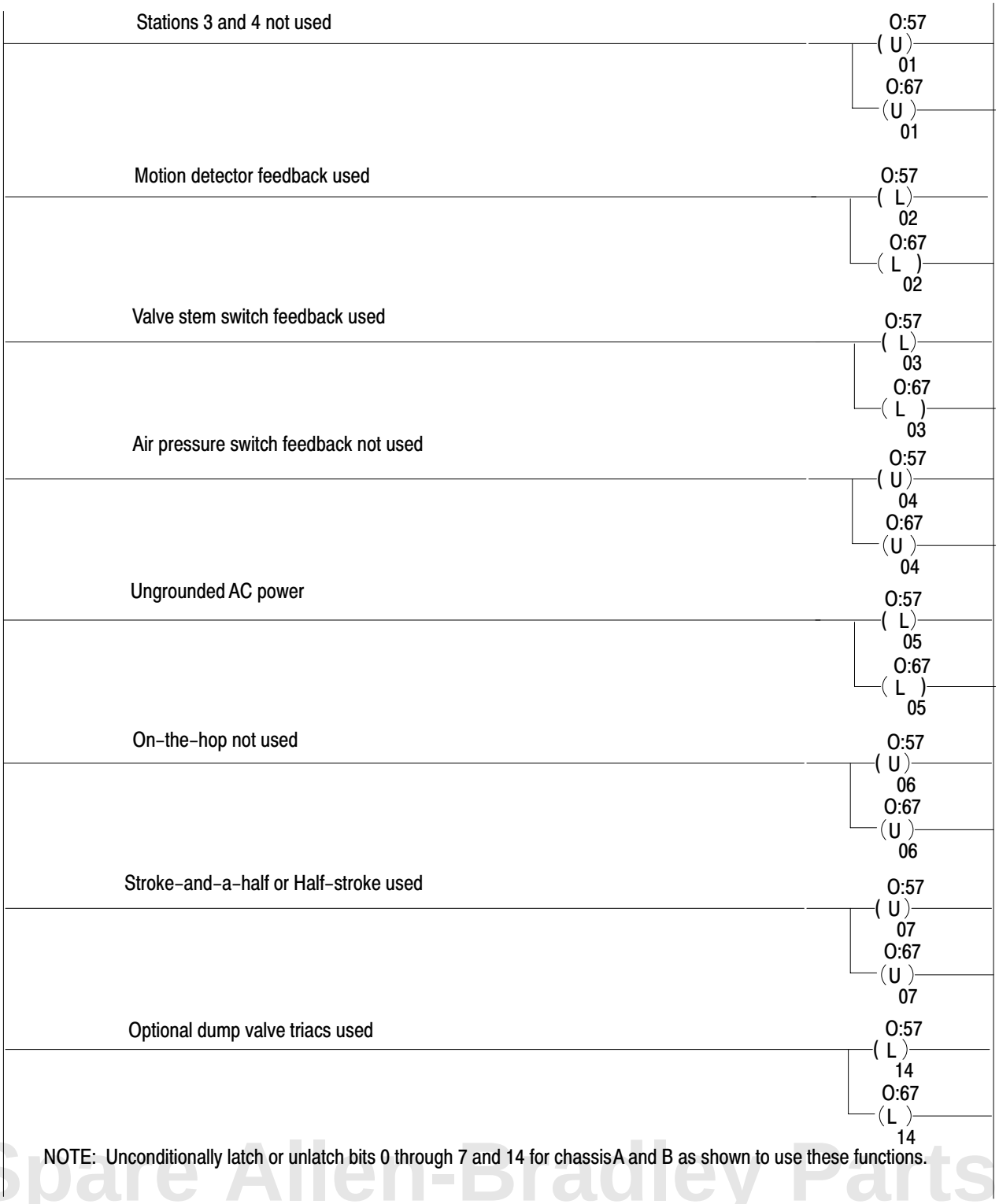


Figure 4.5
Example PLC Configuration Rungs for Bits 01thru 07 and 14 (PLC-5 family)



NOTE: Unconditionally latch or unlatch bits 0 through 7 and 14 for chassis A and B as shown to use these functions.

Matching Configuration Bits and Backplane Switches

As listed in Table 4.A, backplane switch positions 2 thru 8 correspond with configuration bits 01 thru 07. The voting processors in your clutch/brake modules allow press operation only if the set (on) and reset (off) states of configuration bits in your program correctly match the ON and OFF settings of corresponding backplane switches. The voting processors check for correct configuration when you apply power to your clutch/brake controller or change its mode of operation using the mode select switch.

Table 4.A
Corresponding Backplane Switch Settings and Configuration Bits

Backplane Switch Settings (figure 3.3)		Configuration Bits		Backplane switch settings and configuration bits must be identical
Pos.	**Setting**	**Bit:**	**Status:**	**Function:**
2	ON	01	Set	Use Stations 3 and 4
	OFF		reset	Stations 3 and 4 not used
3	ON	02	set	Use Motion Detector Feedback
	OFF		reset	Motion Detector Feedback not used
4	ON	03	set	Use Valve Stem Feedback
	OFF		reset	Valve Stem Feedback not used
5	ON	04	set	Use Air Pressure Feedback
	OFF		reset	Air Pressure Feedback not used
6	ON	05	set	Ungrounded AC Power
	OFF		reset	Grounded AC Power
7	ON	06	set	Use On-The-Hop
	OFF		reset	On-The-Hop not used
8	ON	07	set	Use Half-stroke
	OFF		reset	Use Stroke-And-A-Half
Module Group 4 Slot 1, Chassis A&B 1771-IA		14	Set	Use Dump Valve Outputs
Module Group 4 Slot 1, Chassis A&B is EMPTY			reset	Dump Valve Outputs not used

PLC Command Rungs

Your ladder diagram program can send four commands to the clutch/brake controller by setting command bits 10-13 in the output image word for module group (MG) 7, Slot 1 for I/O chassis A and B:

Command	Bit
Press enable	10
Stop-on-top	11
Reset latched messages	12
Lamp test	13

These commands can be issued manually by an operator pushing a switch, or automatically by a switch closure in your machinery. They function as follows:

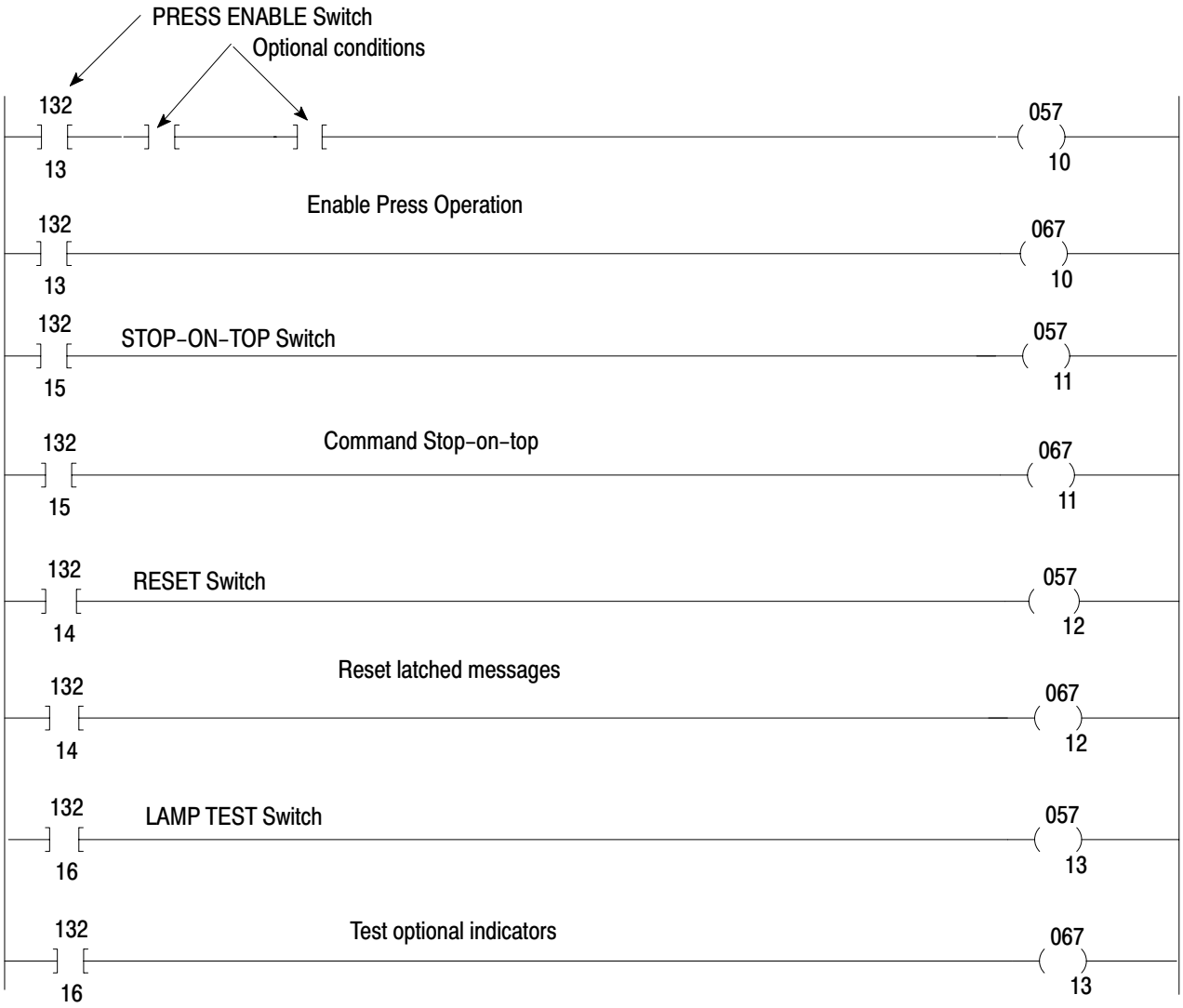
Output	Status	Condition Controlled by PM Module
Press Enable Bit 10	must be ON	To enable motion in any mode
	OFF	Immediately turns OFF triac outputs
Stop-on-top (Continuous mode, only) Bit 11	off-to-on transition	Turns OFF solenoid outputs the next time the run-on cam switches open
	must be OFF	To start or maintain continuous stroking
Reset Latched Message Bit 12	off-to-on transition [1]	Clears any latched or tripped message code shown in MG 5, Slot 1, as long as the condition that caused the message no longer exists.
Lamp Test Bit 13	ON	Turns ON all these outputs Brake Fault , Run Window, Micro-inch Message, and other diagnostic message lamps
	OFF	Turns OFF these outputs

[1] Holding this bit ON may inhibit the capture of subsequent L or t messages.

Bit addresses for these command bits are shown in Figure 4.2. Example PLC command rungs are shown in Figure 4.6 through Figure 4.8.

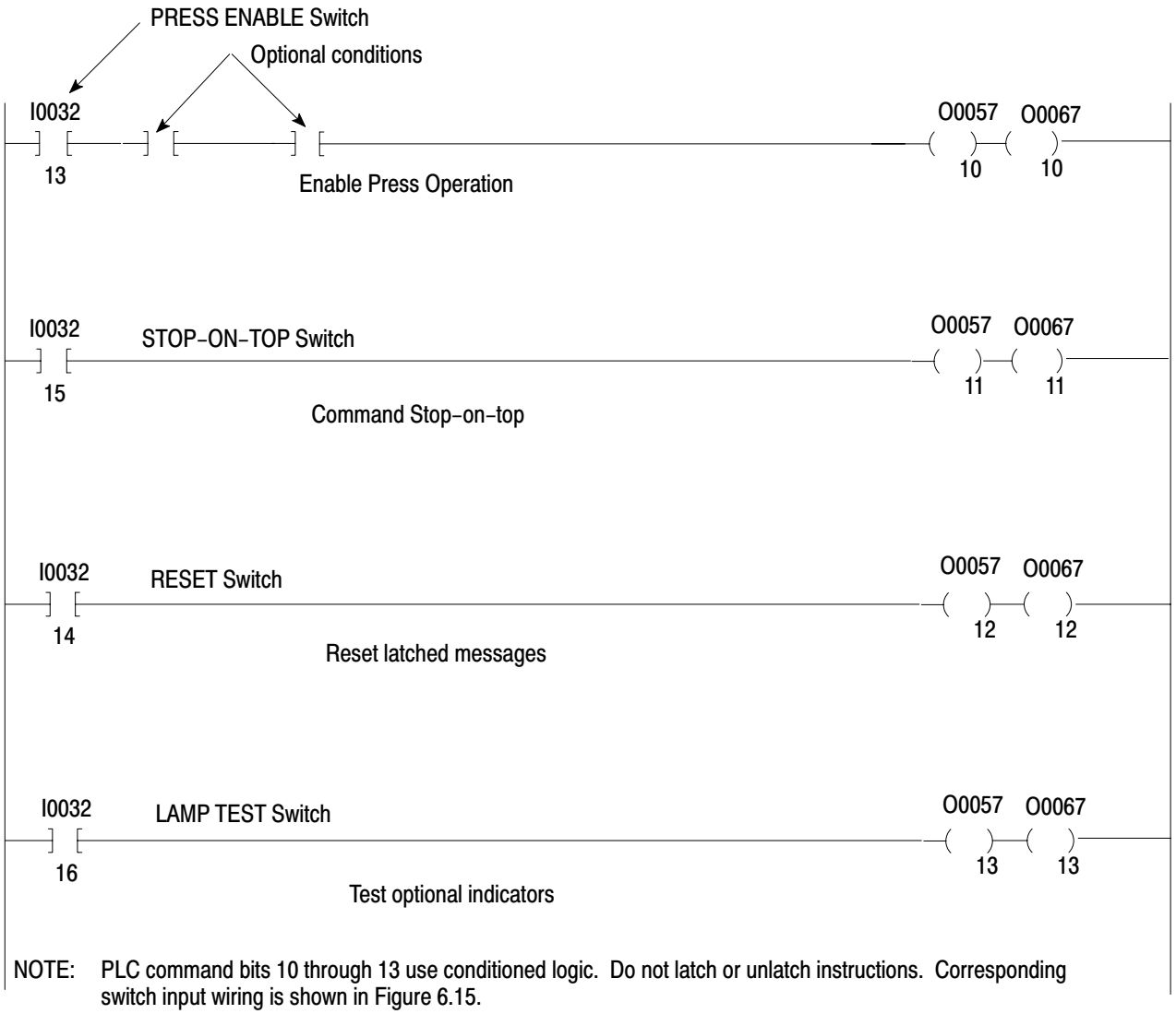
To enable these commands, write ladder program rungs that are conditioned with examine-on/examine-off instructions to monitor corresponding switch inputs wired to I/O chassis C. You can use any available discrete module terminals (excluding those in chassis A or B) for these inputs (Figure 6.15). For additional information refer to chapter 6, Inputs to Chassis C .

Figure 4.6
Example PLC Command Rungs for Bits 10 thru 13 (PLC-2 Family)



NOTE: PLC command bits 10 through 13 use conditioned logic. Do not latch or unlatch instructions. Corresponding switch input wiring is shown in Figure 6.15.

Figure 4.7
Example PLC Command Rungs for Bits 10 thru 13
(PLC-3 and PLC-5/250)



NOTE: PLC command bits 10 through 13 use conditioned logic. Do not latch or unlatch instructions. Corresponding switch input wiring is shown in Figure 6.15.

Use this address format for PLC–5/250 processors

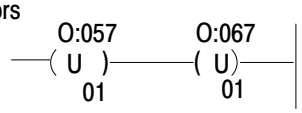
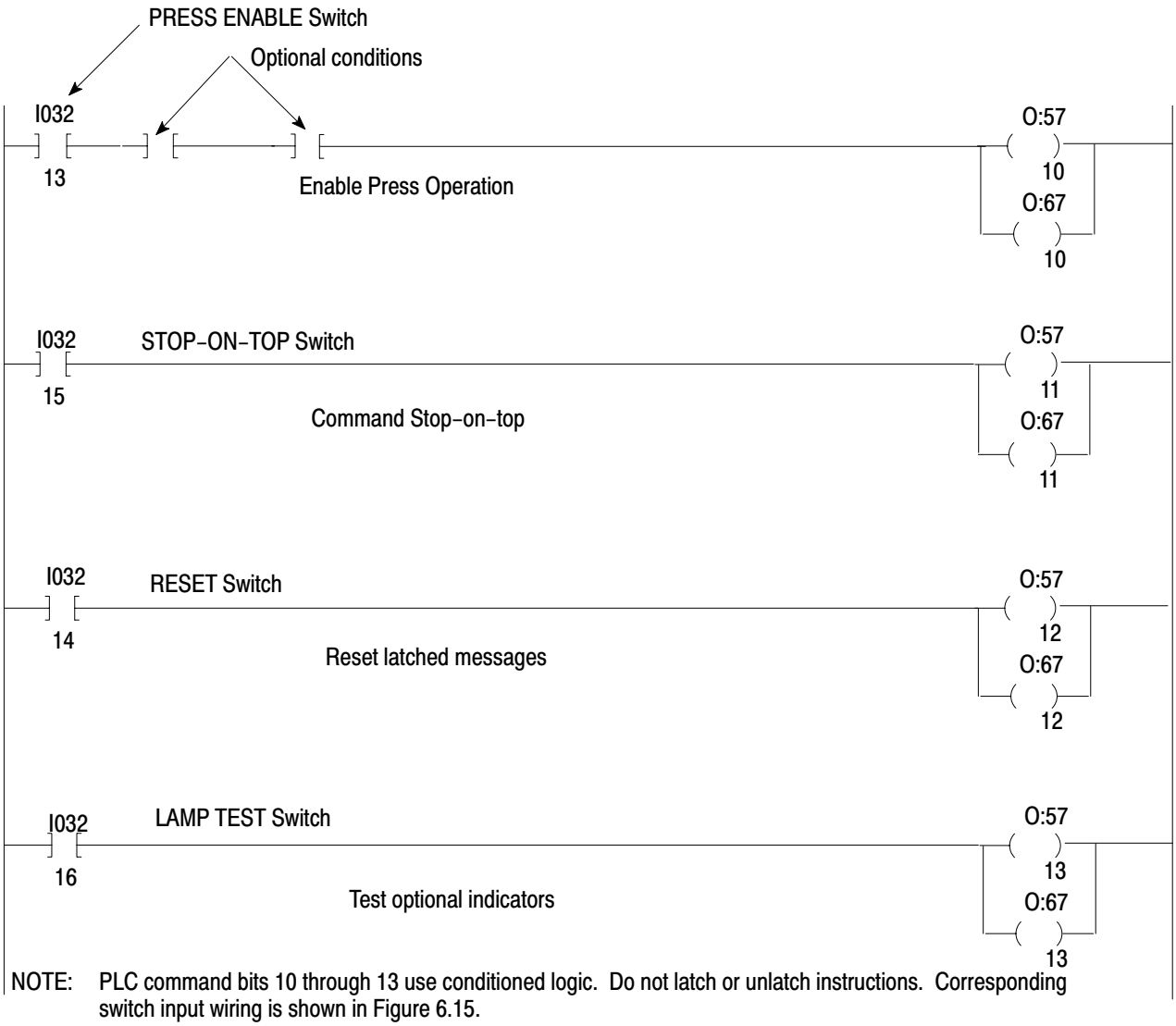


Figure 4.8
Example PLC Command Rungs for Bits 10 thru 13 (PLC-5)

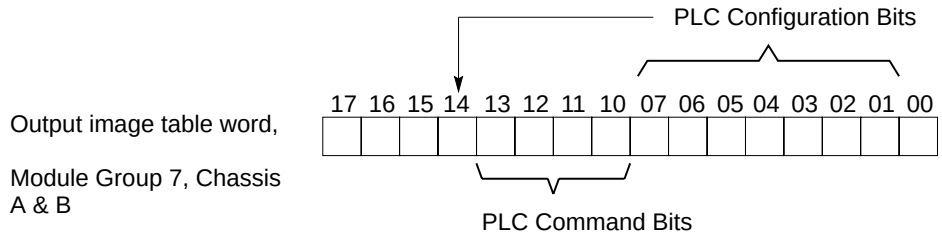


NOTE: PLC command bits 10 through 13 use conditioned logic. Do not latch or unlatch instructions. Corresponding switch input wiring is shown in Figure 6.15.

Summary of PLC Configuration and Command Rungs

We summarize the bits in module group 7 used for determining configuration requirements and enabling operator commands (Figure 4.9).

Figure 4.9
Functions of PLC Configuration and Command Bits



Bit No:	Function:	Bit Status		Type of Rung:
		Set	Reset	
01	Stations 3 and 4	Used	Not Used	Unconditioned
02	Motion Detector Feedback	Used	Not Used	Unconditioned
03	Valve Stem Feedback	Used	Not Used	Unconditioned
04	Air Pressure Feedback	Used	Not Used	Unconditioned
05	AC Power Configuration	Ungrounded	Grounded	Unconditioned
06	On-The-Hop	Used	Not Used	Unconditioned
07	Stroke-and-a-half or Half-stroke	Not Used	Used	Unconditioned
10	Press Enable (PLC Command)	Enabled	Disabled	Conditioned
11	Stop-On-Top (PLC Command)	Enabled	Disabled	Conditioned
12	Latched Messages (PLC Command)	Enabled	Disabled	Conditioned
13	Lamp Test (PLC Command)	Enabled	Disabled	Conditioned
14	Dump Valve Triacs	Used	Not used	Unconditioned

NOTES: Do not use bits 00 and 15 - 17 for any purpose.
See Figure 4.2 for bit addresses
See Figure 4.3 through 4.8 for programming

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Module Group 5, Slot 0 Reserved for Micro-Inch

Important: Use module group 5, slot 0 only if your mechanical power press is equipped for micro-inch.

When you insert an input module (1771-IA) into this slot of chassis A and B, the processor recognizes micro-inch inputs at terminals 0, 1, 2. For the wiring of these terminals refer to chapter 6, Figure 6.4 or Figure 6.8.

Module Groups 6 and 7 Reserved for Data Storage

Module group 6 is non-functional and reserved for future use.

Your program must use the output image table word associated with module group 7 as a storage word for configuring your clutch/brake modules (Figure 4.9). The processor transmits configuration data to the clutch/brake modules in each I/O scan.

CAUTION: Do not assign any I/O module to module group 7 of the rack address assigned to chassis A and B. Unexpected press operation will occur with possible damage to equipment and/or injury to personnel. However, you may install a slot power supply in module group 7, if needed.

Important: Be sure to assign full rack addresses for chassis A and B, regardless of whether you are using the optional dump valve and/or micro-inch circuit. This guards against assigning an I/O module to module group 7.

Refer to Rack Address of Chassis A and B, in chapter 3, for instructions on assigning rack addresses.

Monitoring Clutch/Brake Controller Inputs and Outputs

Your PLC ladder program cannot control outputs of your clutch/brake controller. However, your PLC ladder program can monitor any clutch/brake controller input or output because the I/O image table of chassis A and B is in the PLC data table.

Input image table bit addresses for chassis A and B are listed in tables A thru F in appendix 1. You may monitor these addresses. However, do not examine them as conditions for configuration rungs shown in Figures 4.3 through Figure 4.5. If you do, PM modules may stop the press. Then you must cycle power to restart.

For an example of monitoring a clutch/brake controller function, assume that you wish to turn on a indicator while your clutch/brake controller is in continuous mode. You would wire your CONTINUOUS indicator to a terminal of an output module in any I/O chassis. You would also program a rung with one examine-on instruction and one output-energize instruction:

- the examine-on instruction monitors input image bit 03 for module group 0 chassis A or B.
- the output energize instruction controls the CONTINUOUS indicator.

Important: Do not store data in unused data table addresses for chassis A and B. These are reserved for future enhancements for the clutch/brake controller.

Report Generation

Your PLC ladder program can monitor clutch/brake controller functions for report generation. This allows you to display, through an RS-232-C peripheral device, any of the following:

- operator instructions
- status reports
- fault correction procedures
- diagnostic message codes

The clutch/brake module generates diagnostic message codes presented in table 7.C. Use them to generate messages that you have stored in PLC memory. These messages can be troubleshooting instructions to your press operators. For detailed descriptions of report generation, see the following publications:

For PLC-2 family processors:

- PLC-2 Family Report Generation Module (cat. no. 1770-RG) User's Manual (publication 170-815)

For PLC-3 processors:

- I/O Scanner-Message Handling Module (cat. no. 1775-S4B) User's Manual (publication 1775-6.5.3)
- Peripheral Communications Module (cat. no. 1775-GA) User's Manual (publication 1775-6.5.4)

For PLC-5 family processors:

- BASIC Module (cat. no. 1771-DB) User's Manual (publication 1771-6.5.34)

Summary of Clutch/Brake Controller Functions

You should now be familiar with required and optional PLC ladder programming needed to configure and monitor your clutch/brake controller. Complete your ladder diagram programming addresses after you have wired your press system as described in chapter 6. Clutch/brake controller functions (Table 4.B) are summarized on the next page.

Table 4.B
Summary of Clutch/Brake Controller Functions

Function or Command	Operating Mode	Description
-	Off	Clutch/brake controller locks out press motion
-	Inch	The operator can jog the press through a complete cycle by pressing and releasing the pair of INCH buttons. If INCH buttons are held, the press will stop at the top of its stroke.
-	Micro-inch	This mode of operation lets you run your press at low speeds (1 to 5spm) for setting up dies and making trial runs. You must supply a separate drive and clutch/brake assembly to drive the shaft with full tonnage capacity at low press speeds, by-passing the flywheel.
-	Single-stroke [1]	The press completes one cycle and then stops on top, provided the operator holds both RUN buttons until completion of the down stroke.
-	Continuous [1]	Operators must assert the ARM CONTINUOUS switch and all station RUN buttons within five seconds, and then hold the RUN buttons for half a stroke (or 1 1/2 strokes) if so configured to start the press in continuous mode. Thereafter, the press runs until stopped by a stop-on-top command, or when a fault is detected.
Stop-on-top (cycle stop)	Continuous	This command, from a switch wired to the clutch/brake controller or from the PLC, stops the press at a predetermined point.
On-the-hop	Single-stroke	Releasing and pressing both RUN buttons during a specific portion of the upstroke causes the press to continue running onto the next stroke without stopping. This is a configurable option.
Half-stroke or Stroke-and-a-half	Continuous	The operator must press both RUN buttons for 1/2 or 1 1/2 press cycles before the press can run on its own. This is a configurable option. Run buttons must be held until Run-on (take-over) Cams are made.
[1] Cam limit switches must indicate that the press is in the near-top position before motion can start in single or continuous mode.		

Function or Command	Operating Mode	Description
Interrupted stroke	Continuous	If an operator releases a RUN button during a down stroke, the press stops immediately. If within five seconds of stopping, an operator releases both RUN buttons and presses them again, the press continues the downstroke. If more than five seconds elapses, the operator must inch the press to top, select continuous mode, and follow the first Continuous procedure above..
Interrupted stroke	Single-stroke	Same as Continuous mode except there is no time limit on re-applying the RUN button.
Anti-tie-down	All	The press will not start if you tie down one or more RUN buttons. After all RUN buttons are released, the operator must press both RUN buttons at a station simultaneously, and/or operators at active stations must press all RUN buttons within five seconds of each other to start the press. The same applies to the pair of INCH buttons.
Anti-repeat	Single-stroke	The press is limited to a single stroke, even if the operator continues to press both RUN buttons. The operator must release both RUN buttons and press them again to start press motion.
	Inch	The same applies to a pair of INCH buttons as described for Single-stroke.
Motion detector	Single-stroke Continuous	The clutch/brake controller detects press motion using your motion detector which provides a 120AC input signal. This is a configurable option.
Top-stop-Check	All	The clutch/brake controller signals a worn or faulty brake by monitoring the Top-stop-check cam inputs. Should it see the Top-stop-check cam closed after a normal cycle stop has been initiated and before the press comes to a top stop, it prevents the press from restarting and energizes the brake-fault output.

Chapter 5

Voting Processor Firmware

Chapter Objectives

This chapter will help you become familiar with:

- operation of your voting processor firmware
- operational sequences for controlling your press

Operation of Voting Processors

A clutch/brake controller has two clutch/brake modules, one in chassis A and the other in chassis B. Each clutch/brake module contains firmware that makes it function as a voting processor. Both voting processors contain identical firmware programs that independently monitor your clutch/brake controller I/O while controlling the press.

While running their firmware programs, both voting processors constantly "vote" on the status of your press. Both voting processors must always have a consensus. If they find that they don't agree on their perceived conditions of your press, they either stop the press or prevent it from starting.

Also, both voting processors constantly check their communication channels. Press motion is stopped or inhibited if either voting processor detects a loss of communications with the PLC or the other voting processor. A failure in one voting processor is immediately seen as a communication loss by the other voting processor.

Finally, voting processors control the operational sequences that your operators must perform in inch, single, and continuous modes.

Emergency Shut Down

Each voting processor (PM module) controls one seal relay and one crowbar relay. All E-STOP switches are connected in series with seal relay contacts. If any of these contacts opens or if the PM module detects a trip condition, solenoid power is disconnected. If a PM module detects that solenoid power should be off when on, it turns on the crowbar relay to blow the solenoid power line fuses. At clutch/brake start, both PM modules test their crowbar relays without blowing the line fuses. Wiring diagrams in chapter 6 show these connections.

Fault Monitoring

PM modules continuously monitor your clutch/brake system for a trip or stop condition. Either condition halts and/or prevents press operation.

For this condition	PM modules remove solenoid power by
Trip	Removing power from field wiring arms
Stop	Turning off outputs from the output module controlling the solenoids

Trip condition - A PM module turns off swing arm output power by de-energizing its seal relay output when it detects these trip conditions:

- lost communications with the other PM module for 100ms
- a change in wiring of operator stations 1 thru 4
- a short or open solenoid triac
- short or open solenoid
- feedback [1] connections are wired but not configured
- feedback connections are configured but not wired
- feedback signals are not working correctly

[1] feedback from valve stem switches, air pressure sensors, and motion detector contacts

Whenever a PM module detects a trip condition, it:

- trips power to the wiring arms of the I/O chassis
- sets rack fault bits
- stops communication with the PLC

If programmed to monitor rack fault bits, the PLC sees the clutch/brake I/O chassis as faulted until both PM modules verify that power to wiring arms has been removed. Then they resume communications automatically.

Stop condition - A PM module stops the press or prevents it from starting by turning off output triacs to solenoid valves when it detects stop conditions such as:

- lost communications with the other PM module for 50ms
- lost communications with the PLC for one second
- cam limit switch signals out of sequence
- barrier guard opened during continuous mode

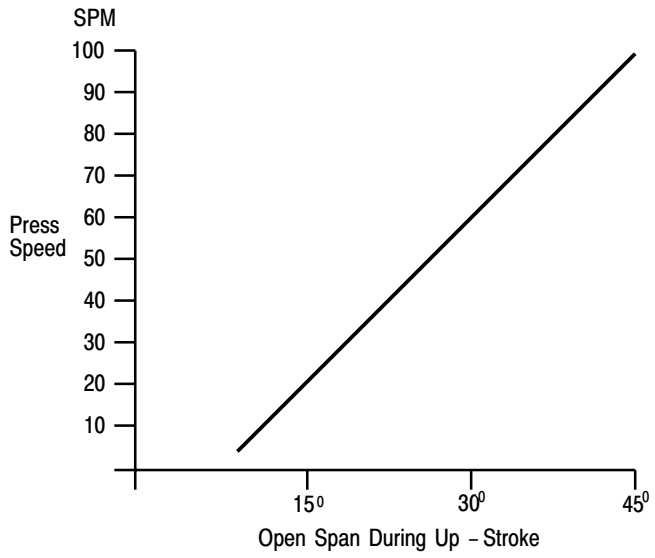
This is described further in Chapter 7, Diagnostic Message Codes.

Operation of Cam Limit Switches

The PM Module uses cam limit switches to determine press slide position. (Figure 5.1 and Table 5.A). You set two independent cam limit switch assemblies to the same settings so that:

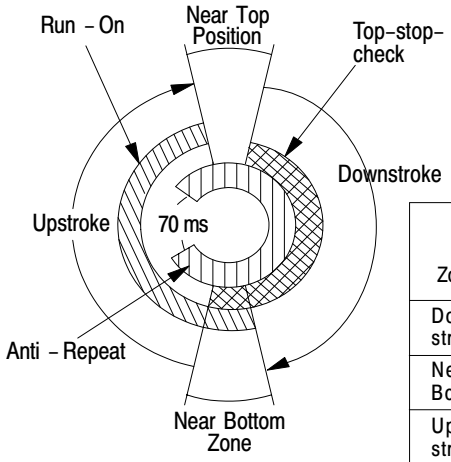
- run-on contacts are closed in the near bottom and upstroke zones
- top-stop-check contacts are closed in the downstroke and near-bottom zones
- anti-repeat contacts open during mid-upstroke for at least 70ms. Set the open span to the approximate number of rotational degrees (10^0 - 45^0) according to the speed of the press (1spm - 100spm).

Up-Stroke Span vs. Press Speed for Anti-Repeat Contacts



The anti-repeat cam is not required while operating in inch or micro-inch mode. However, before entering any operating mode, the PM module checks that at least one cam limit switch is closed at any point in the cycle.

Figure 5.1
Cam Limit Switch Settings



NOTE:
Install two mechanically independent cam limit switch assemblies each with three cams and three limit switches. Set the assemblies to similar settings according to the requirements of your press.

You can set cam limit switches to other configurations provided they meet the make/break conditions listed below:

Zone	Cam Limit Switch Settings			Comments
	Top–Stop –Check	Run-On	Anti– Repeat	
Down– stroke	MAKE	BREAK	MAKE	Top-stop-check contacts must make (not necessarily at the same time) before run-on contacts make, or the controller faults.
Near Bottom	MAKE	MAKE	MAKE	Run-on contacts must make (not necessarily at the same time) before Top-stop-check contacts break, or the controller faults.
Up– stroke	BREAK	MAKE	MAKE	Top-stop-check contacts must break (not necessarily at the same time) before anti-repeat contacts break or the controller faults.
	BREAK	MAKE	BREAK	Anti-repeat contacts must break for at least 70ms during upstroke, then make before run-on contacts break, or the controller faults.
	BREAK	MAKE	MAKE	Anti-repeat contacts must make (not necessarily at the same time) before run-on contacts break, or the controller faults.
Near Top	BREAK	BREAK	MAKE	Run-on contracts must break (not necessarily at the same time) before Top-stop-check contacts make or the controller faults.
Refer to Diagnostic Messages, table 7.C. Hex codes 80 thru AA, for descriptions of faults caused by cam limit switches.				

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Table 5.A
Operation of Cam Limit Switches

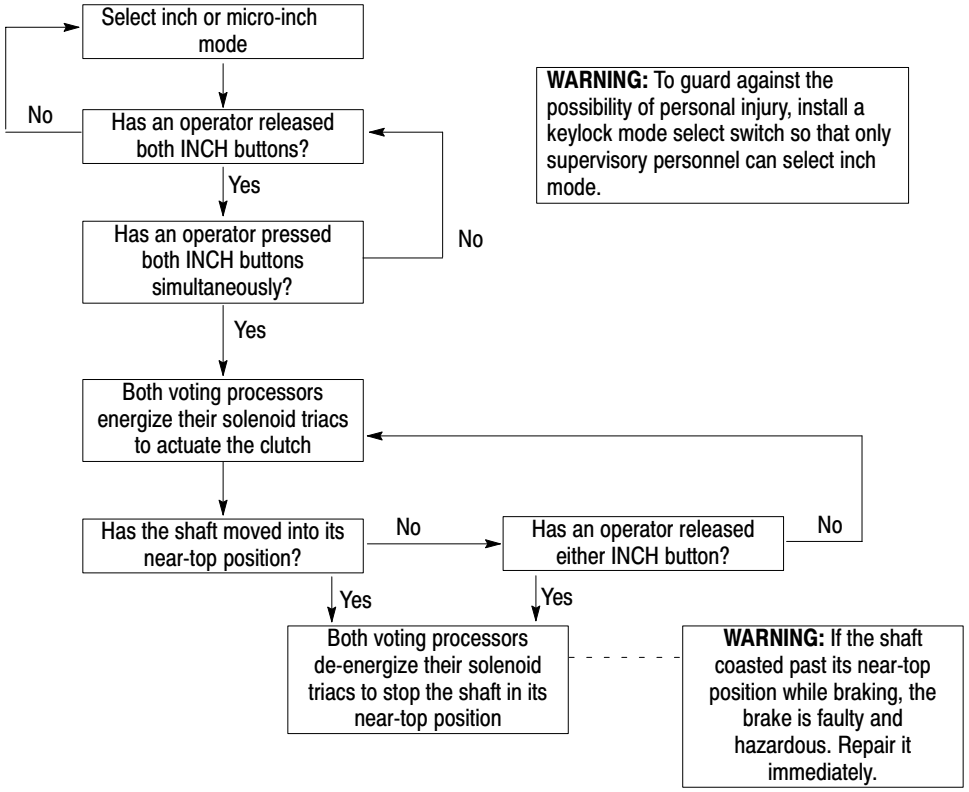
This Cam	In this Mode	With these Conditions	Provides the PM Module a Signal:
Anti-Repeat	On-the-hop single stroke	Run buttons released past bottom	To allow a second stroke when run buttons are pressed a second time
Run-on	Inch and Micro-inch (forward) and Single stroke	Cam opens at near-top position	To turn OFF triac output for stop-on-top (cycle stop)
	Continuous	Cam opens at near-top position after stop-on-top command	
	Single stroke and Continuous	Cam closes at near-bottom position	To let operator release any depressed run buttons without interrupting a single stroke or continuous stroking
Top-Stop Check	any	Cam closes during stop-on-top	To energize a Brake Fault output to warn that the brake is faulty (Hazardous Condition)
	Inch and Micro-inch (reverse)	Cam opens in near-top position	To turn OFF solenoid outputs to stop the cycle

Clutch/Brake Operating Modes

Inch and Micro-inch Modes

Use inch or micro-inch mode before entering single or continuous mode to position the shaft near the top, or for machine tool set-up. You may jog the shaft either forward or in reverse. The shaft stops when it moves into the near top position or when you release an INCH button.

Figure 5.2
Operational Sequence for Inch or Micro-Inch Mode



NOTE: Use inch or micro-inch mode to position the shaft near the top. Operators may jog the shaft in either direction. The shaft stops when it moves near top position or when an operator released an INCH button.

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Single Stroke Mode

Use single-stroke mode to actuate the press through a single cycle.

During the downstroke (Figure 5.3)

- releasing a RUN button stops the press
- if the shaft did not enter the near bottom zone, you may resume the downstroke
- if the shaft entered the near bottom zone, you must inch the press back to the near top position before restarting

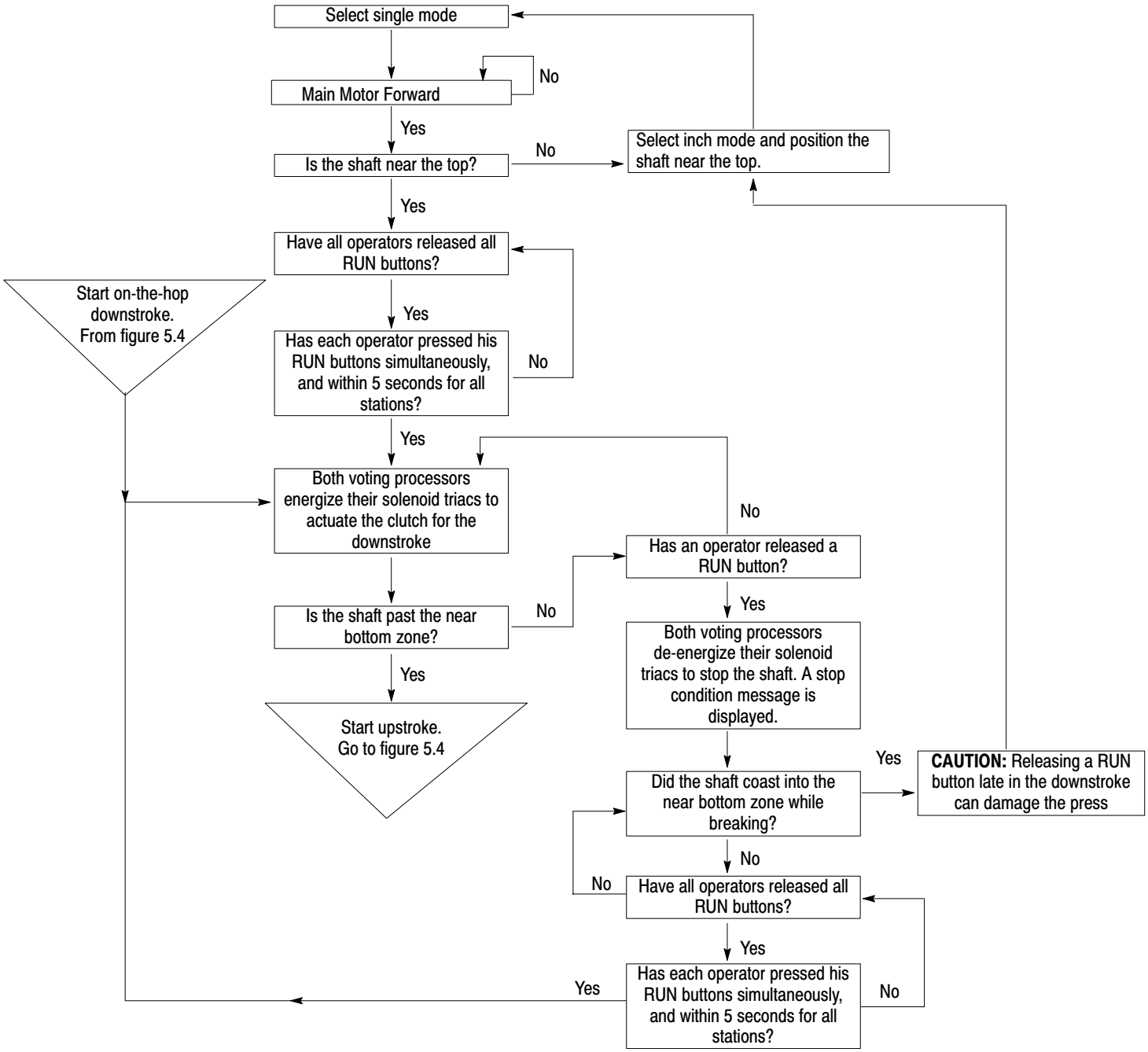
During the upstroke (Figure 5.4)

- the shaft continues automatically through the upstroke

If you enabled on-the-hop , you can start another cycle without stopping the press if you

- release all RUN buttons after the near bottom position
- press all RUN buttons after the anti-repeat contacts open during the upstroke

Figure 5.3
Operational Sequence for Downstroke in Single Mode



NOTE: Releasing a RUN button during the downstroke stops the press. If the shaft does not reach the near-bottom zone, operators may resume the downstroke. If the shaft reaches the near-bottom position, an operator must inch the press back to the near-top position.

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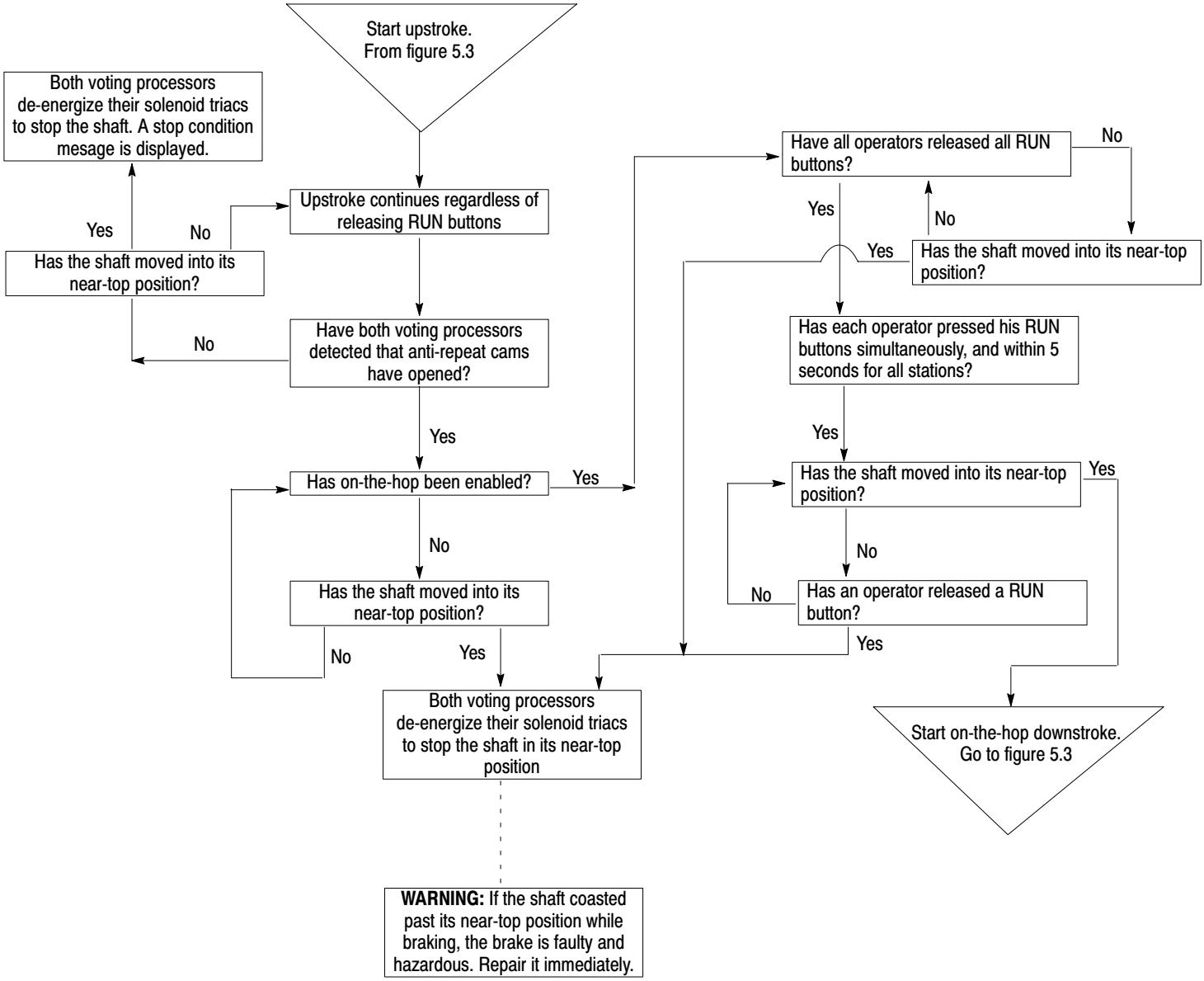
Figure 5.4
Operational Sequence for Upstroke in Single Mode



NOTE: The shaft continues automatically through its upstroke, then stops. If on-the-hop has been enabled, operators can start another downstroke without stopping at the top. Do this by releasing all RUN buttons after the downstroke. Then, press all RUN buttons after the anti-repeat contacts open on the upstroke.

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Continuous Mode

Select continuous mode when you want to run your press continuously. Do this as follows:

- inch the press to the near top position
- close the barrier guard(s)
- select continuous mode, and
- press the ARM CONTINUOUS button (Figure 5.5)

During the first downstroke (Figure 5.6).

- releasing a RUN button or opening a barrier guard stops the press
- if the shaft did not enter the near bottom zone, you may resume the downstroke within five seconds after a stop
- if the shaft entered the near bottom zone and is stopped, you must inch the press to the near top position and press the ARM CONTINUOUS button in order to restart press operation.

During the first upstroke (without stroke-and-a-half) (Figure 5.7)

- releasing a RUN button does not stop the press
- opening a barrier guard stops the press
- if the shaft did not stop in the near top position, inch it there and repeat the procedure from the beginning

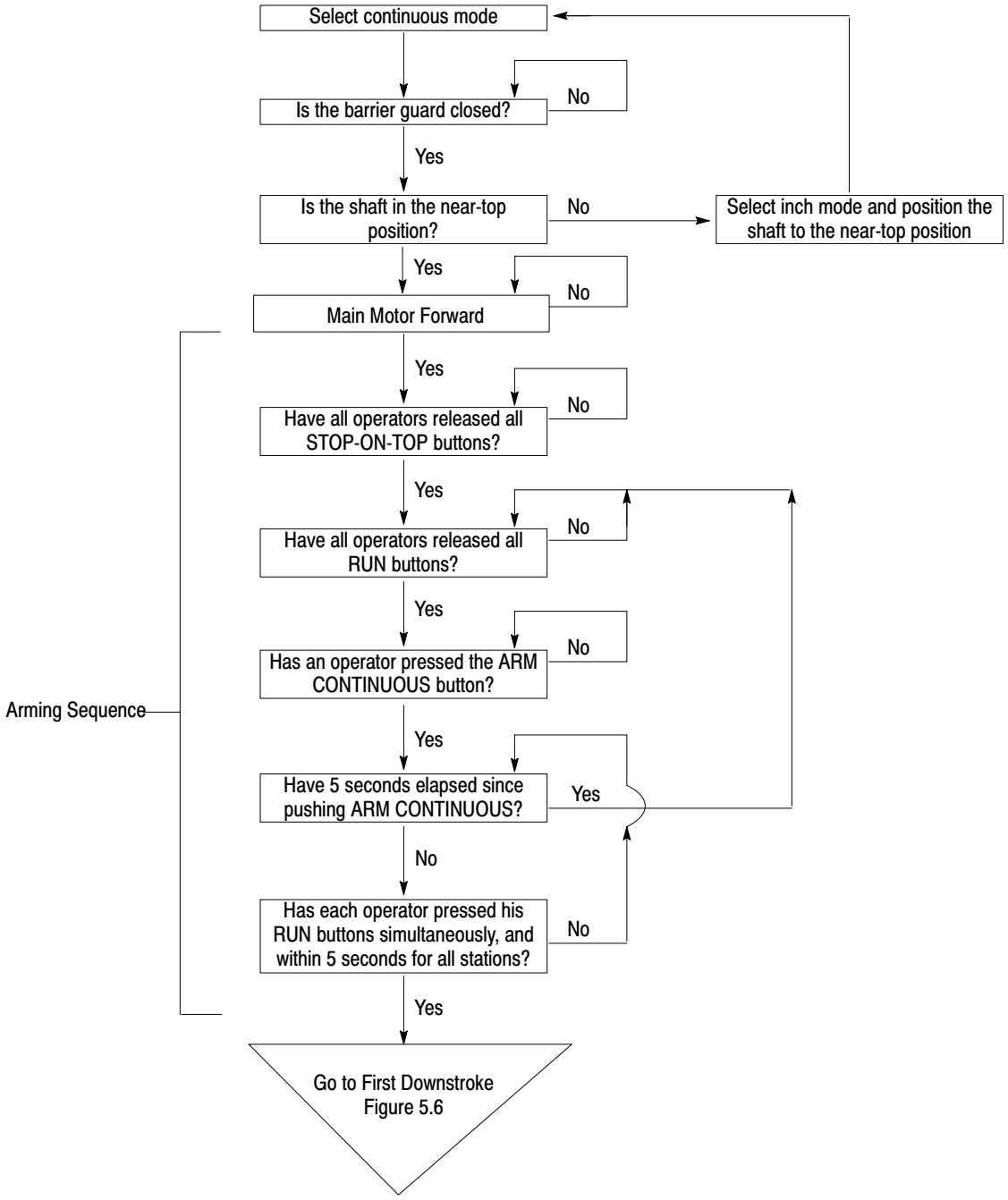
If you configured for half-stroke or stroke-and-a-half requirement

- continue holding the RUN buttons until the shaft runs through the first (or second) downstroke and first (or second) near bottom position
- releasing a RUN button stops the press, and first downstroke conditions apply

Once in continuous operation (NO TAG), the press stops whenever

- you press stop-on-top
- the PLC transfers a stop-on-top command
- a barrier guard opens
- either voting processor detects a trip or stop condition

Figure 5.5
Operational Sequence for Starting Continuous Mode



NOTE: The arming sequence guards against accidently starting operation in continuous mode.

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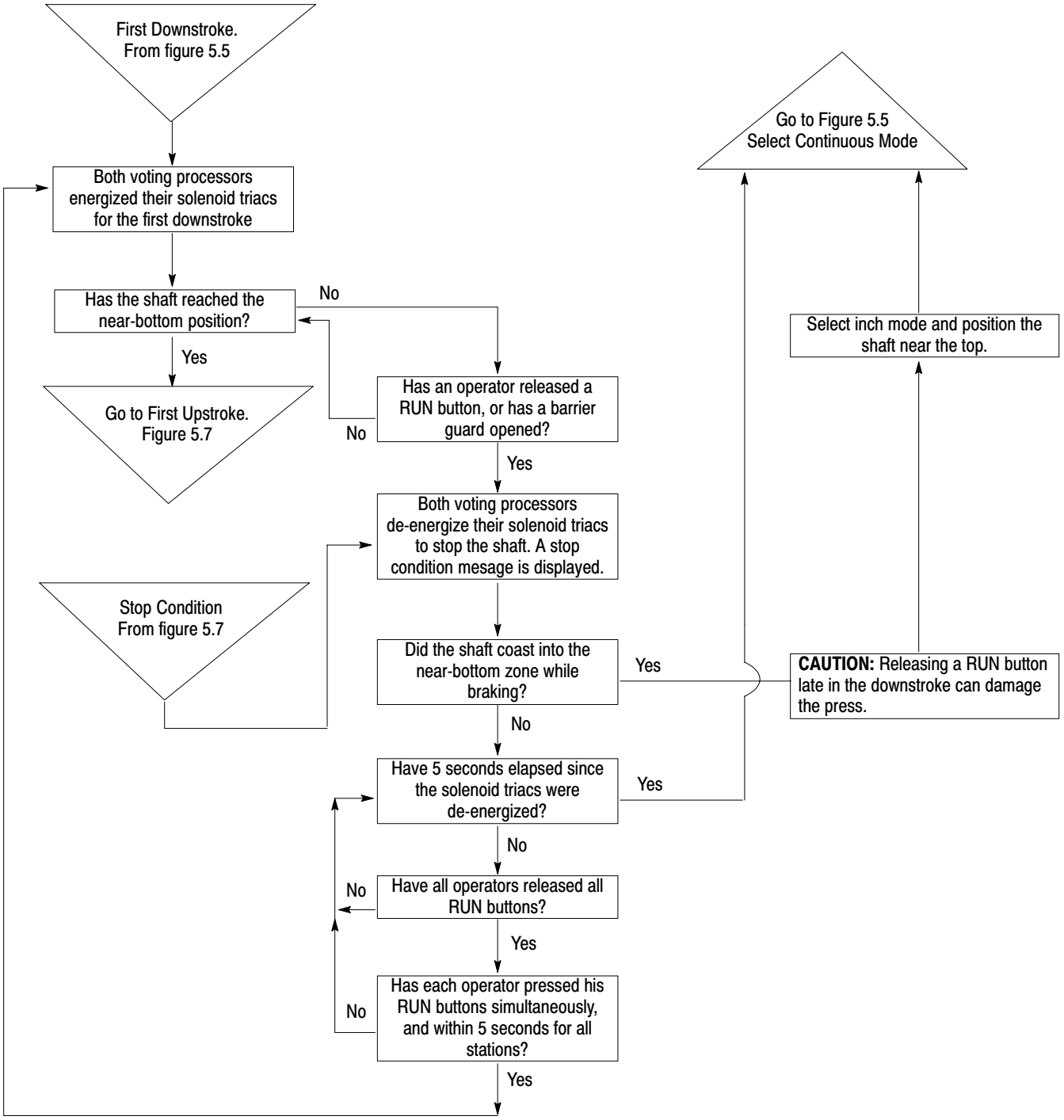
Figure 5.6
Operational Sequence for First Downstroke in Continuous Mode



NOTE: Releasing a RUN button during the first downstroke stops the press. If the shaft has not entered the near bottom zone, operators can resume the downstroke within 5 seconds of releasing a RUN button. After 5 seconds, operators must restart continuous mode by means of the arming sequence.

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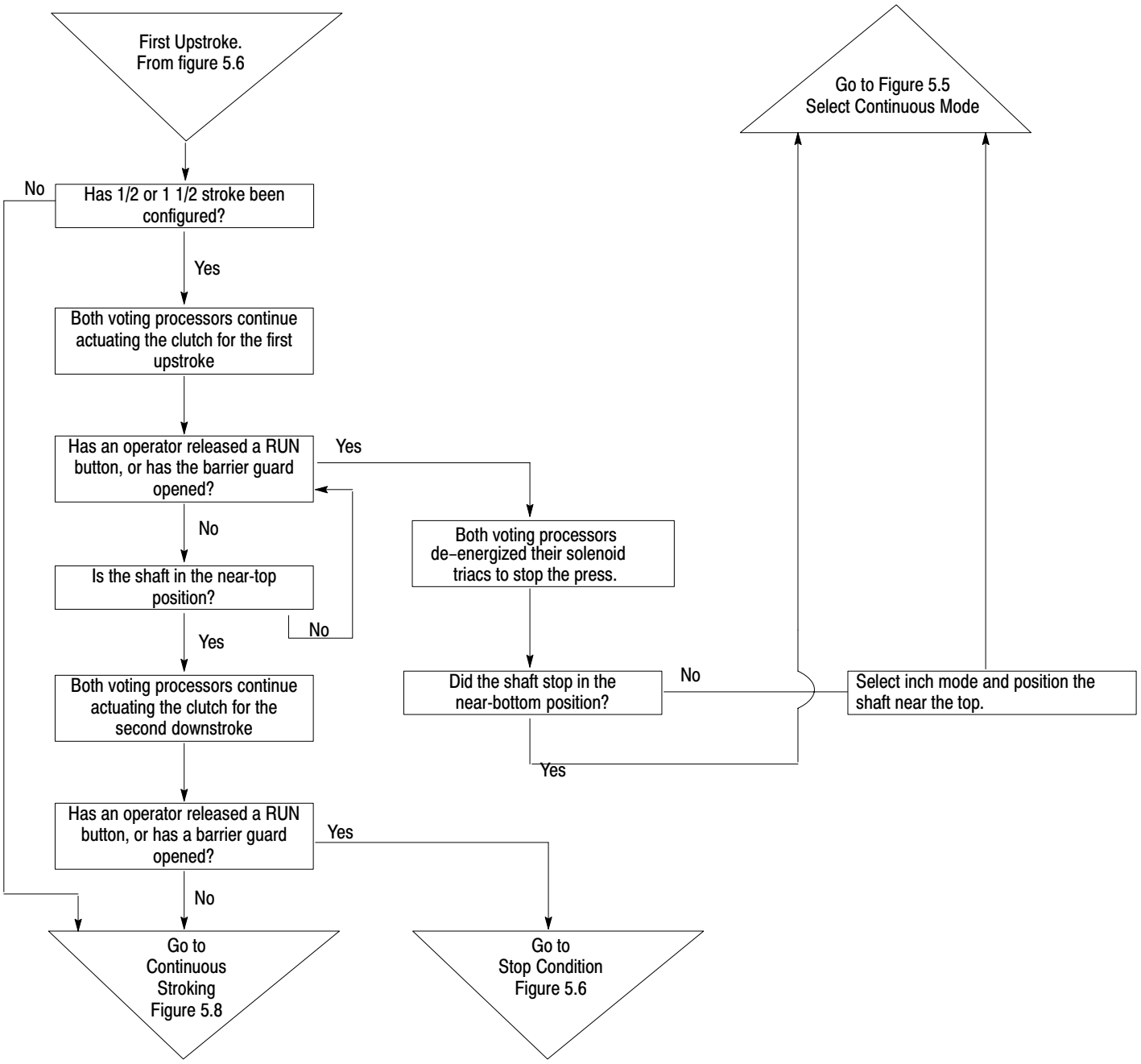
Figure 5.7
Operational Sequence for First Upstroke and Second Downstroke in Continuous Mode



NOTE: Half-stroke or Stroke-and-a-half requires all operators to hold all RUN buttons until the first or second downstroke is completed. Releasing a RUN button during the (first) upstroke requires restarting continuous mode at the arming sequence. Releasing a RUN button in the first or second downstroke requires restarting as if an operator had stopped the press in the first downstroke.

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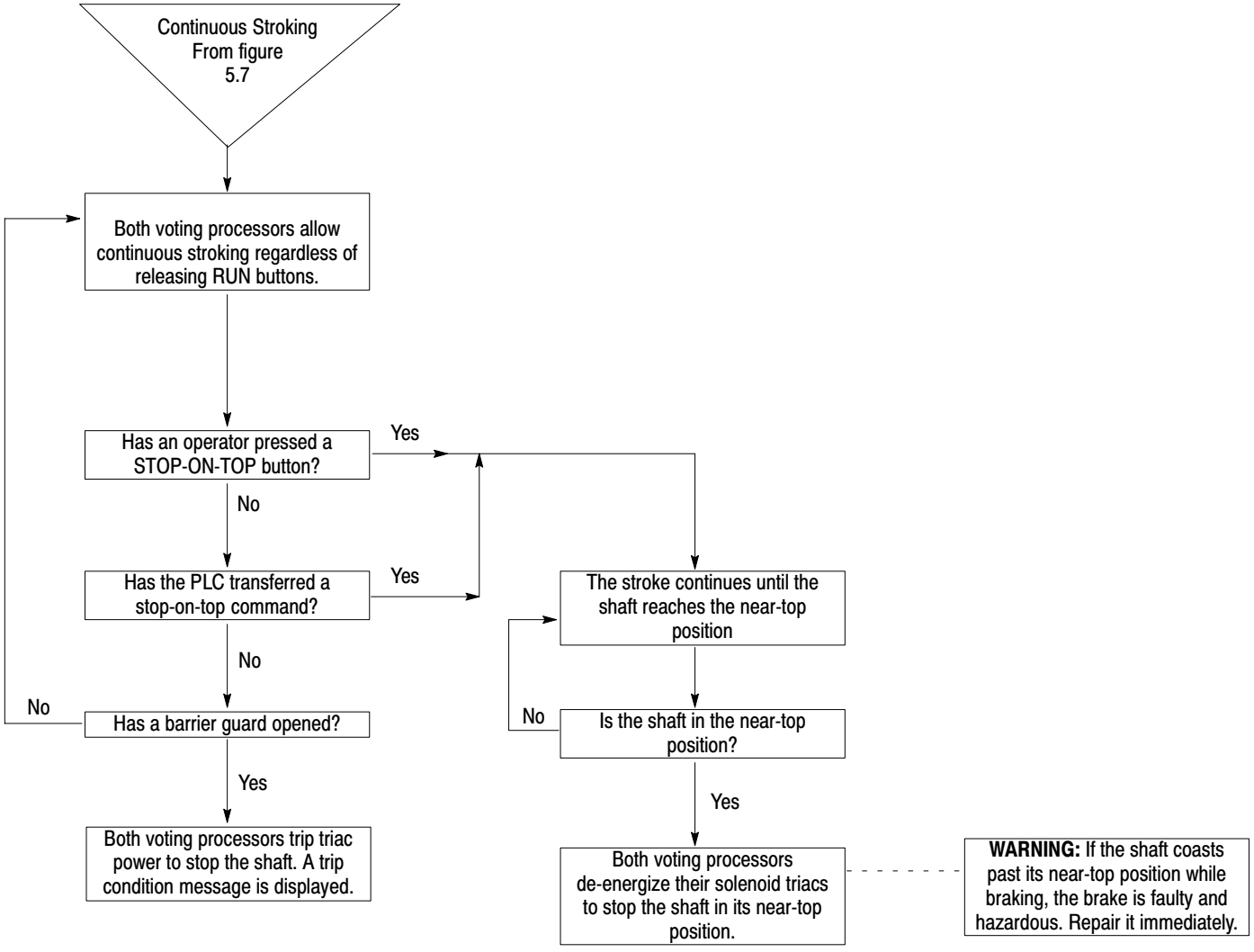

NOTE: The press strokes continuously until an operator presses a STOP-ON-TOP button, the PLC transfers a stop-on-top command, or barrier guard opens.

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Chapter 6

Connections to Field Wiring Arms

Chapter Objectives

This chapter will help you:

- Connect the field wiring arms of chassis A and B
- install either ungrounded or grounded 120V AC power distribution

Installation Considerations

Before continuing, be sure that you configured your clutch/brake controller chassis and modules as shown in chapter 3. For installation details, refer to the installation publication for your processor. These publications are listed in our Publications Index (publication SD499).

In order to design, build, install, and operate a safe press system, you should also refer to other publications. In addition to local codes and laws, adhere to safety requirements detailed in the following publications.

- OSHA Regulations, Title 29-Labor, Chapter XVII, Section 1910.217, Mechanical Power Presses
- ANSI B11.1, American National Standard for Machine Tools, Mechanical Power Presses, Construction, Care and Use
- NFPA No. 79, Electrical Standard for Metalworking Machine Tools

Electrical Connections and Safety Requirements

Some electrical connections are mandatory, others are optional. If you omit mandatory connections or electrical components, you violate safety requirements discussed and referred to in this manual.

For AC Power That Is	Use This Mandatory Figure	For these Connections
Ungrounded	6.1	AC Power and Crowbar Test Inputs Press Interlock Switch
Ungrounded or	6.3	Main and Auxiliary Valve Solenoids Crowbar and Seal Relays MOV Surge Suppression
Grounded	6.5	AC Power and Crowbar Test Inputs Press Interlock Switch
Grounded	6.7	Main and Auxiliary Valve Solenoids Crowbar and Seal Relays MOV Surge Suppression

Use This Mandatory Figure	For These Connections
6.9	Cam Limit Switch Assemblies
6.10	Main Motor Forward Barrier Guard Stop-on-top Arm Continuous Mode Select Switch
6.11	Operator Stations 1 & 2 Dummy Plugs Inch Pushbutton Switches

WARNING: To guard against injury to personnel and damage to your press, connect your clutch/brake controller exactly as shown in these figures.

The connections for optional features are shown in the following figures:

Use this Figure	For These Optional Connections
6.2 or 6.6	Switches on Main Valve Stems Air Pressure Sensors Motion Detector
6.4 or 6.8	Dump and/or Micro-inch Valves
6.12	Operator Stations 3 & 4 Dummy plugs
6.13	Diagnostic Message Display
6.14	Brake Fault Indicator Run Window Indicator Micro-inch Indicator

Important: Use 14 AWG stranded copper wire with 3/64-inch insulation for all solenoid and relay coil connections to the 1771-OD modules. We also recommend the same wire size for all field wiring arm connections.

Control Power

Connect your clutch/brake controller to either an ungrounded AC power configuration (Figure 6.1) or a grounded AC power configuration (Figure 6.5). Either figure shows two separately fused 120V AC power circuits. Power lines 3L1 and 3L2 provide power to the field wiring arms at module group 3, slot 0 and module group 4, slot 0 in chassis A and B. Power lines 2L1 and 2L2 provide power to all other field wiring arms, the PLC power supply, and chassis A and B power supplies.

Either AC power configuration lets your PLC, clutch/brake controller, and inputs remain on after solenoid power has been disconnected as shown in Figure 6.1 or Figure 6.5. Disconnecting solenoid power stops press operation. Solenoid power is disconnected if an E-Stop switch opens, a seal relay trips, or a crowbar relay turns on. When solenoid power is disconnected, both voting processors continue to run and generate diagnostic message codes. Status indicators of input modules continue to show which switches are on or off. Therefore, either AC power configuration lets you more easily troubleshoot most problems that cause your press to shut down.

Important: Be sure that your clutch/brake controller is properly grounded to provide greater safety and reduced electrical noise interference. For details, refer to PLC Grounding (publication 1770-4.1).

E-Stop Switches, Seal Relays, and Crowbar Relays

The E-Stop circuit allows an operator or a voting processor to quickly stop the press. Connect all E-Stop switches and contacts in series with seal A and B contacts, as shown in Figure 6.1 or Figure 6.5.

WARNING: To guard against possible injury to personnel and damage to your press, connect seal relays, crowbar relays, and operator station E-Stop switches exactly as shown in Figure 6.1 and Figure 6.3 or Figure 6.5 and Figure 6.7.

You may connect any number of additional E-Stop switches and contacts in series with the mandatory operator station E-Stop switches. These can include, but are not limited to, remote E-Stop switches, air pressure switch contacts, and relay contacts for monitoring the power supply.

Install at least one E-Stop switch at each operator station. Then, any operator who sees a problem can press an E-Stop switch to stop the press. Also when either voting processor detects a fault, it de-energizes its seal relay to stop the press.

Opening any E-Stop switch or de-energizing either seal relay removes AC power (3L1) from main valve solenoids A and B, auxiliary valve solenoids A and B, dump valve solenoids A and B, crowbar relays A and B, and seal relays A and B, as shown in Figure 6.1, Figure 6.3 and Figure 6.4 or Figure 6.5, Figure 6.7 and Figure 6.8. When either voting processor detects that 3L1 is off, it immediately commands its seal relay to remain de-energized. If either voting processor detects that 3L1 is still on after commanding its seal relay to de-energize, it energizes its crowbar relay. This shorts 3L1 to 3L2, which blows the 3L1 and 3L2 line fuse or fuses.

Crowbar Test Inputs

Crowbar tests inputs, shown in Figure 6.1 or Figure 6.5, allow the voting processors to test their crowbar relays without blowing the 3L1 and 3L2 line fuse or fuses. This test occurs while you push the START button shown in Figure 6.1 or Figure 6.5.

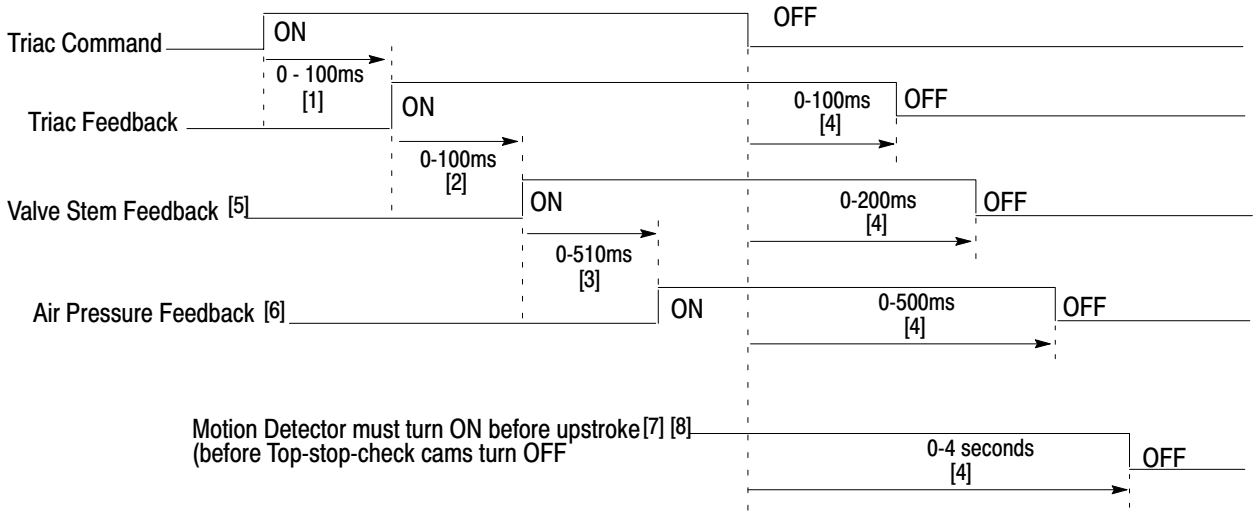
To allow for the crowbar test, you should press the START button (break-before-make pushbutton switch) for more than one-half second. As you begin pressing the START button, its two sets of N.C. (normally closed) contacts open first, isolating crowbar A and B relay contacts from 3L2. As you press the START button all the way in, its N.O. (normally open) contacts close, applying 3L1 power to module group 3, slot 0. Before you release the START button, each voting processor briefly energizes its crowbar relay and checks, through its crowbar test input, that the relay turns on then off. Each voting processor energizes its seal relay only after its crowbar relay is tested as working correctly. At any time after you release the START button, either crowbar relay can blow the 3L1 and 3L2 line fuse or fuses shown in Figure 6.1 and Figure 6.5.

Optional Hardwire Inputs

Connect optional hardwire inputs as needed to chassis A and B so voting processors can monitor any of the following inputs:

Input	Terminal	MG	Slot	Figure
Main Valve Stem	0	2	0	6.2 or 6.6
Motion Detector	1	2	0	
Air Pressure	2	2	0	
Auxiliary Valve Stem	7	2	0	
Micro-inch Valve Stem	1	5	0	6.4 or 6.8
Micro-inch Air Pressure	2	5	0	6.4, 6.8
Dump Valve Stem	4	4	1	6.4, 6.8

When connected these inputs function as follows:



[1] Time window for faultless operation measured from Triac Command off-to-on transition
[2] Time window for faultless operation measured from Triac Feedback off-to-on transition
[3] Time window for faultless operation measured from Valve Stem feedback off-to-on transition
[4] Time window for faultless operation measured from on-to-off transition of the Triac Command. On-to-off transitions need not occur sequentially.
[5] Applies to Main, Auxiliary, Dump, and Micro-inch valves
[6] Applies to Main, Micro-Inch, Auxiliary, and Dump (if configured) solenoids
[7] Motion Detector transition off-to-on is position dependent, on-to-off is time dependent
[8] Applies to firmware revision A/D and later

For additional valve stem requirements, see section title Internal/External Fault Detection

When PM modules command triacs ON or OFF, they check that feedback signals (triac, valve stem, air pressure, and motion detector) have turned ON or OFF in the order shown and within the times shown.

If and when a PM module detects that a triac or feedback signal has not turned ON or OFF within the times shown, it trips seal relay output to remove power from the wiring arms of 1771-OD output modules.

Be sure that you configure your clutch/brake controller accordingly by setting your backplane switches (chapter 3) and programming your configuration bits (chapter 4).

Connect either one or both motion detector switches and either one or both pressure switches if so configured.

If your main valves have external fault detection switches and you configured for valve stem feedback, all other clutch/brake solenoid valves must have external valve stem feedback. If auxiliary valve solenoids have internal fault detection (do not have valve stem switches), jumper terminal 7 to terminal 0, Module group 2, slot 0 (Figure 6.2 or 6.6) in chassis A and B.

Internal/External Fault Detection

There are two general types of solenoid valves: those with external fault detection, and those with internal fault detection.

Solenoid valves with external fault detection have switches on the valve stems which you use to feed back the status of valve stems to your clutch/brake controller. The firmware in your clutch/brake module performs the fault detection.

A valve with external fault detection, Figures 6.2 or 6.6, provides an external signal of its valve position. When the valve is energized, the external signal is “on”. Interfacing this type of valve to the clutch/brake system requires:

- enabling valve stem feedback with backplane switches (Figure 3.3)
- enabling valve stem feedback in PC configuration rungs (Figure 4.3)

If you configure for valve stem feedback, all valves must have valve stem feedback or simulate it (have their respective terminals jumpered to the input terminals of the main valve stem switches for simulated inputs).

Solenoid valves with internal fault detection close automatically when the valves detect a mechanical fault. They have no valve stem switches. When using this type of solenoid valve, do not configure your clutch/brake controller for valve-stem fault detection.

A valve with internal fault detection mechanically assures that both solenoids energize in unison before the valve passes air. Should a fault occur and only one side energizes, the valve will not pass air. Some valves of this type have a poppet valve which blows and vents to the atmosphere. The poppet valve must be manually reset.

Optional Valve Stem Switches, Motion Detectors, and Air Pressure Switches

All switches shown in Figure 6.2 or Figure 6.6 are optional. Decide which ones you will use. Then, configure your clutch/brake controller accordingly.

Optional Valve-stem Feedback

If main and auxiliary valve solenoids do not have valve-stem switches, then consider omitting valve-stem feedback. If either one has valve-stem switches, consider using valved-stem feedback. Then if some valves do not have valve-stem feedback, you must simulate valve-stem feedback for the valve(s) without valve-stem switches.

Follow these instructions if using valve-stem feedback:

If Using	Then
Valve-stem feedback	1) Enable valve-stem feedback with - backplane switches (Figure 3.3) - PC configuration rungs (Figure 4.4) 2) All valves must use (or simulate) it. 3) Wire valve-stem switch circuits to 2L1 (Figure 6.2 or 6.6)
Valve-stem feedback, but Main or Aux valve is NOT equipped with external fault detection (has internal detection)	Modify above as follows: 1) Omit wiring the valve-stem switch circuit to 2L1 for that valve (Figure 6.2 or 6.6). 2) Simulate feedback for that valve by jumpering terminals 0 and 7 in chassis A, the same in chassis B.
No valve-stem feedback	1) Do not enable it 2) Do not wire valve-stem switches 3) Do not jumper terminals for simulation

Optional Motion Detectors and Air Pressure Switches

For either one of these optional features, you may use a single switch or redundant switches (Figure 6.2 or 6.6):

For this wiring	And this feature	Follow these instructions
Single-switch	Motion detector	Connect the jumper between terminal 1 (chassis A) and terminal 1 (chassis B)
	Air pressure	Connect the jumper between terminal 2 (chassis A) and terminal 2 (chassis B)
	either of above	Omit dotted-line wiring for redundant-switch circuits
Redundant-switch	Motion detector	Remove the jumper between terminal 1 (chassis A) and terminal 1 (chassis B)
	Air pressure	Remove the jumper between terminal 1 (chassis A) and terminal 1 (chassis B)
	either of above	Add dotted-line wiring for redundant-switch circuits (for motion detector and/or air pressure)

Main Valve Solenoids A and B

Connect main valve solenoids A and B as shown in Figure 6.3 or Figure 6.7 with these connections:

- feedback from main valve solenoid triacs that allows both voting processors to monitor the on or off state of each triac, and check for shorted or open triacs, and open or shorted main valve solenoids.
- load resistors, LRA and LRB, for triac feedback from main valve solenoids A and B
- crowbar relay coils and seal relay coils

If your main valves use valve stem switches for external fault detection, you must configure for valve stem fault detection by setting backplane switches (chapter 3) and programming configuration bits (chapter 4). Then, your optional auxiliary and/or dump valves must also use valve stem switches. If not, you must simulate their inputs by jumpering their input terminals to the input terminals for the main valve stem switches.

If your valves have internal fault detection (no valve stem switches), do not configure for valve stem fault detection, and delete valve stem input connections from Figure 6.4 or Figure 6.8 and Figure 6.2.

Each main valve solenoid should draw at least 60mA. If not, connect an appropriate load resistor in parallel with it. For neatness and safety, we recommend that you connect feedback and load resistors only at convenient terminal strips, not at the field wiring arms.

Optional Auxiliary Valve Solenoids

Use auxiliary valve solenoids when you want to boost the volume of air to the clutch/brake assembly. Do this by placing auxiliary valves in parallel with main valves in your high pressure air line.

If you use auxiliary valves, connect auxiliary valve solenoids A and B shown in Figure 6.3 for ungrounded solenoids, or Figure 6.7 for grounded solenoids. If you don't use one or both auxiliary valve solenoids, you must connect a 2k ohm, 15W resistor in place of each. Figure 6.3 or Figure 6.7 also shows connections for:

- feedback from auxiliary valve solenoid triacs that allows both voting processors to monitor the on or off state of each triac, and check for shorted or open triacs and shorted or open auxiliary valve solenoids.
- load resistors, LRA and LRB, for triac feedback from auxiliary valve solenoids.

Each auxiliary valve solenoid should draw at least 60mA. If not, connect an appropriate load resistor in parallel with it. For neatness and safety, we recommend that you connect the feedback resistor and the load resistor only at convenient terminal strips, not at the field wiring arms.

If you use auxiliary valves with internal fault detection (no valve stem switches) but you have configured for external fault detection, simulate the inputs of the auxiliary valve stem switches. Do this by jumpering the input terminals of field wiring arms for auxiliary valve stem switches to the input terminals for the main valve stem switches. Jumper terminal 7 to terminal 0, module group 2, slot 0, for chassis A and B (Figure 6.2).

Optional Dump Valve Solenoids

Use optional dump valves and solenoids when you want to accelerate the evacuation of air from the clutch/brake assembly.

If you use dump valves, install two output modules (cat. no. 1771-OD, series C or later). Place them in module group 4, slot 0, chassis A and B to control the dump valve solenoids. Also install two input modules (cat. no. 1771-IA). Place them in module group 4, slot 1, chassis A and B to monitor feedback inputs from the dump valve solenoids. Set configuration bit 14 unconditionally as shown in Figure 4.3, Figure 4.4 or Figure 4.5.

Connect dump valve solenoids and valve stem switches (if you use them) as shown in Figure 6.4 for ungrounded solenoids, or Figure 6.8 for grounded solenoids.

Each dump valve solenoid should draw at least 60mA. If not, connect an appropriate load resistor in parallel with it. For neatness and safety, we recommend that you connect the load resistor only at convenient terminal strips, not at the field wiring arms.

If you use dump valves with internal fault detection (no valve stem switches) but you have configured for external fault detection, simulate the inputs of the dump valve stem switches. Do this by jumpering the input terminals of field wiring arms for dump valve stem switches to the input terminals for the main valve stem switches. Jumper terminal 4, module group 4, slot 1 (Figure 6.4 or Figure 6.8) to terminal 0, module Group 2, slot 0 (Figure 6.2 or Figure 6.6) for chassis A and B.

Optional Micro-inch Valve Solenoids

Micro-inch mode lets you run your press at low speed (1 to 5 strokes per minute) for setting up dies and making trial runs. Micro-inch mode requires that you provide a separate drive and clutch/brake assembly to drive the shaft with the flywheel bypassed. Micro-inch mode functions only when the main clutch/brake assembly is inoperative, and vice versa. The advantage of the micro-inch mode operation is full press tonnage capacity at low press speeds. Other characteristics include:

- Micro-inch motion is initiated using INCH buttons.
- Micro-inch solenoid valves function only when the mode select switch is in the MICRO-INCH position.
- Diagnostic codes for micro-inch mode are listed in the look-up table. They are 9-bit binary (3-digit hex) as compared with 8-bit binary (2-digit hex) for all other diagnostic codes.
- Voting processors inhibit main valve, auxiliary valve, and dump valve solenoids whenever you use micro-inch. Voting processors monitor these outputs in micro-inch mode to verify they are not on or shorted.

Connect valve solenoids A and B for micro-inch mode as shown in Figure 6.4 for ungrounded solenoids and Figure 6.8 for grounded solenoids. If you do not use micro-inch, no connections are needed. Figure 6.4 and Figure 6.8 also show connections for:

- feedback from micro-inch valve solenoid triacs that allows both voting processors to monitor the on or off state for each triac, check for shorted or open triacs, and shorted or open solenoids of the micro-inch valves.
- load resistors, LRA and LRB, for triac feedback from micro-inch valve solenoids.
- switch inputs for the mode select switch, valve stem switches, and pressure switch for micro-inch circuits.

Each solenoid valve should draw at least 60mA. If not, connect an appropriate load resistor in parallel with it. For neatness and safety, we recommend that you connect feedback and load resistors only at convenient terminal strips, not at the field wiring arms.

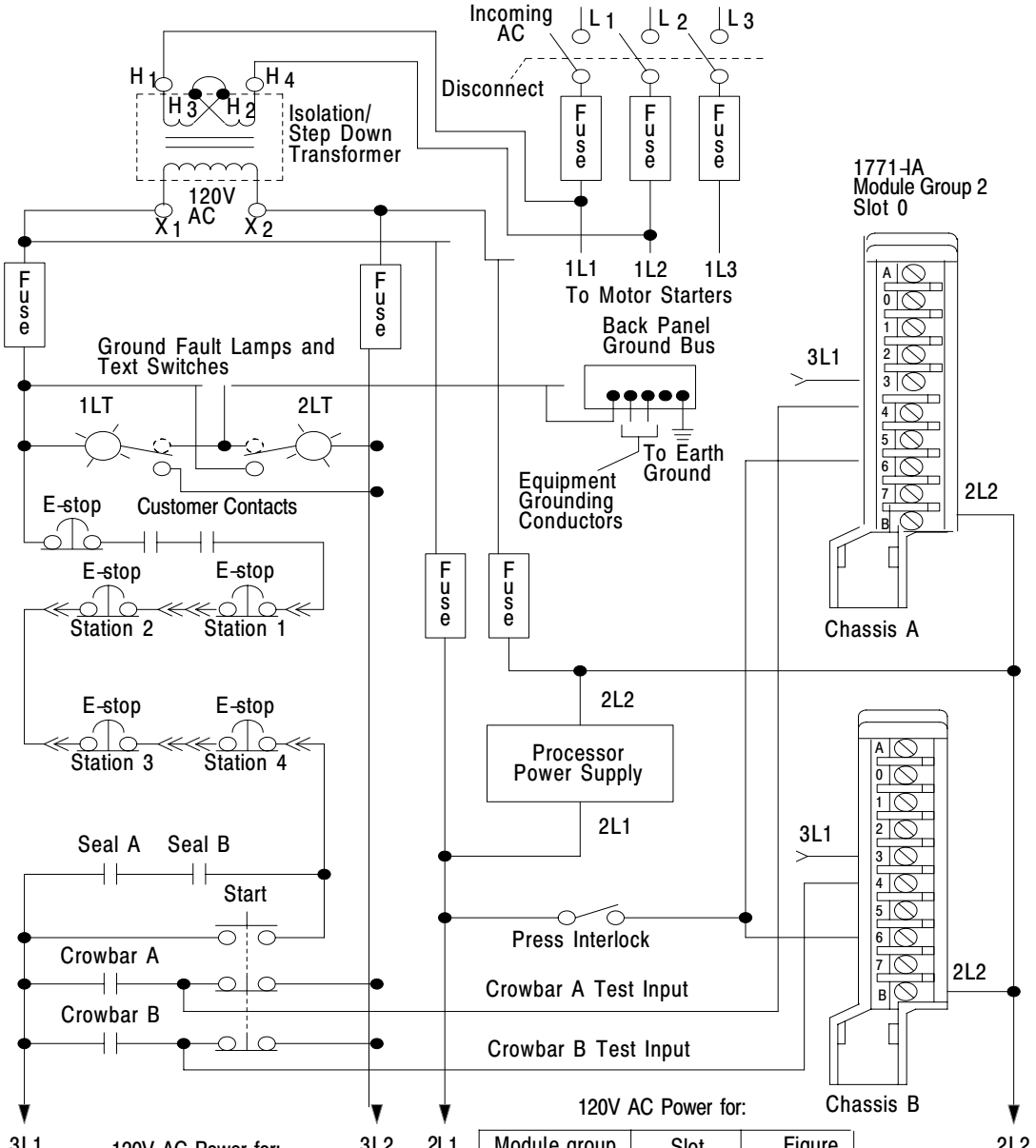
Select the same type of solenoid valve for micro-inch as you select for main and auxiliary solenoid valves (internal or external fault detection).

Electrical Noise Suppression

Use series C or later 1771-OD output modules because they have improved electrical noise immunity.

To provide additional immunity against surge transient noise, we recommend that you connect metal oxide varistors (MOVs) to the triac outputs of your 1771-OD modules for main and auxiliary valve solenoids, and dump valve solenoids, if used. Typical connections are shown for auxiliary valve solenoids for ungrounded AC power (Figure 6.4)) and grounded AC power (Figure 6.8). Connect the MOVs as close to the field wiring arm terminals as possible. In the grounded AC power configuration, make connections to 3L2 (not located on the field wiring arm) as short as possible.

Figure 6.1
Ungrounded AC Power Connections, Crowbar Test Inputs, and Press Interlock Switch



120V AC Power for:

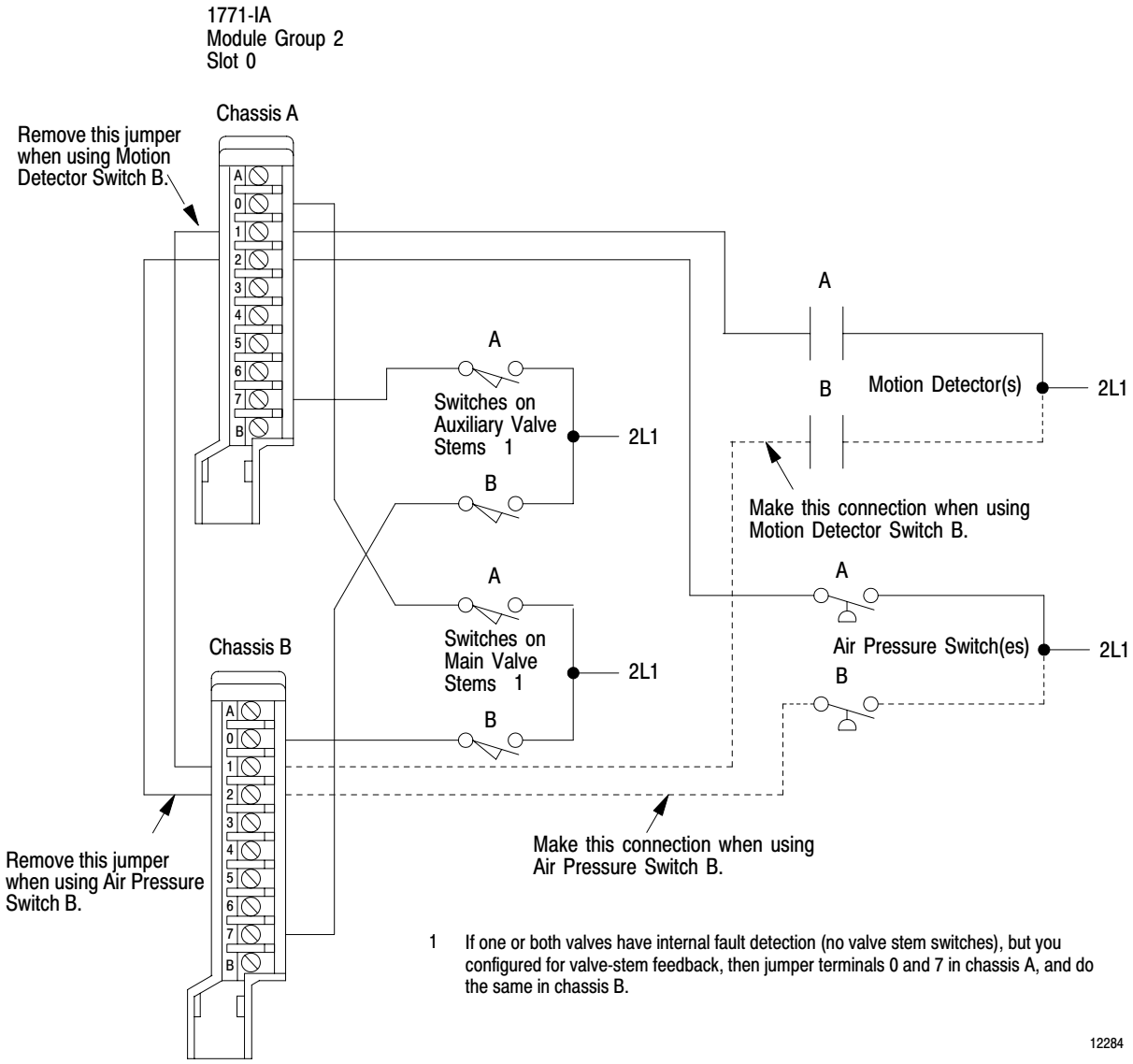
Module group	Slot	Figure
3	0	6.3
4	0	6.4

120V AC Power for:

Module group	Slot	Figure
0	0	6.10
0	1	6.11
1	0	6.12
1	1	6.9
2	0	6.2
2	1	6.3
3	1	6.14
4	1	6.4
5	0	6.4
5	1	6.13

12268

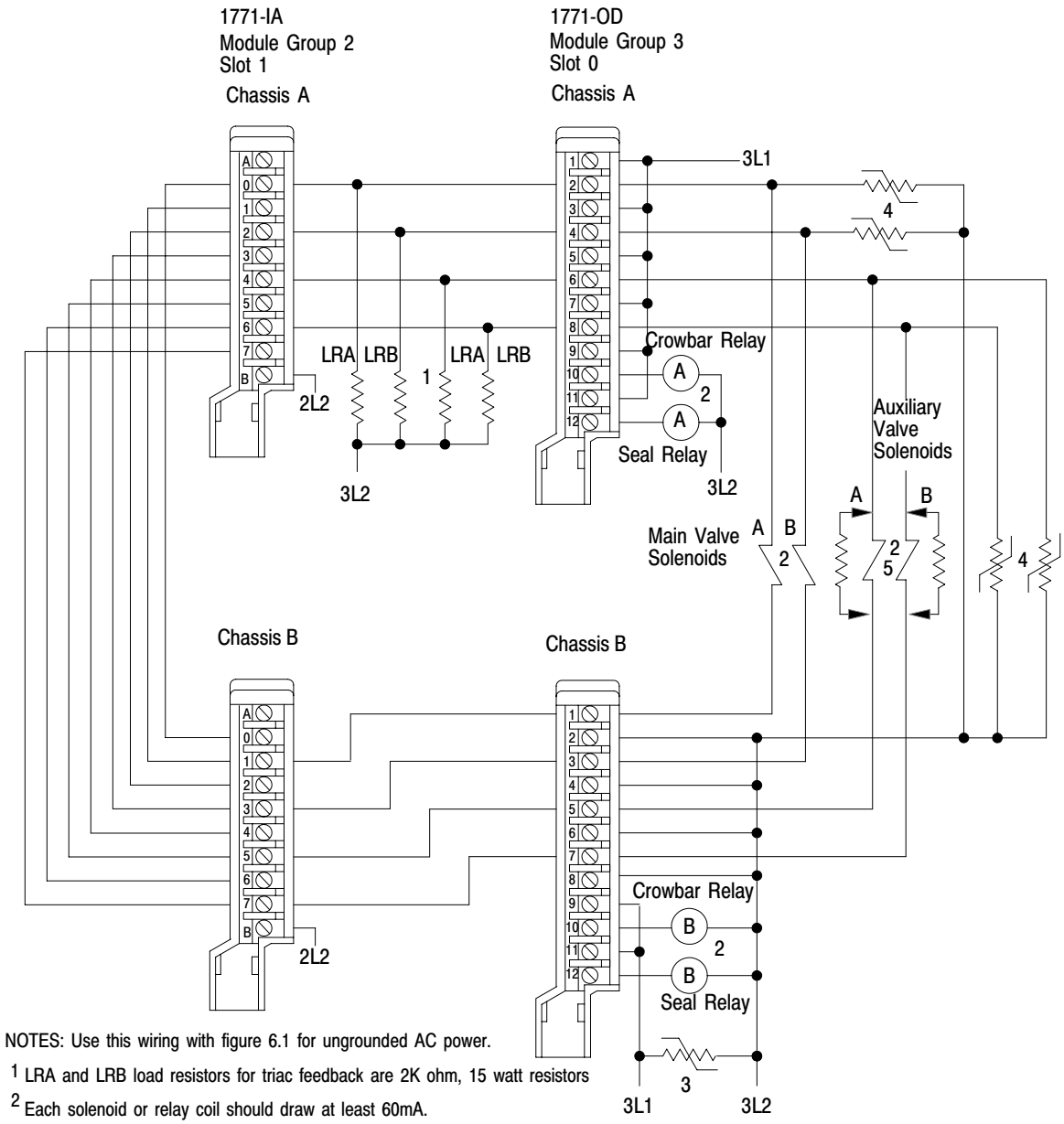
Figure 6.2
Connections for Optional Switches on Main Valve Stems, Air Pressure Sensors, and Motion Detectors (Ungrounded AC Power)



1 If one or both valves have internal fault detection (no valve stem switches), but you configured for valve-stem feedback, then jumper terminals 0 and 7 in chassis A, and do the same in chassis B.

12284

Figure 6.3
Connections for Main and Auxiliary Valve Solenoids, MOV Surge Suppression, Crowbar and Seal Relays (Ungrounded AC Power)



NOTES: Use this wiring with figure 6.1 for ungrounded AC power.

1 LRA and LRB load resistors for triac feedback are 2K ohm, 15 watt resistors

2 Each solenoid or relay coil should draw at least 60mA.

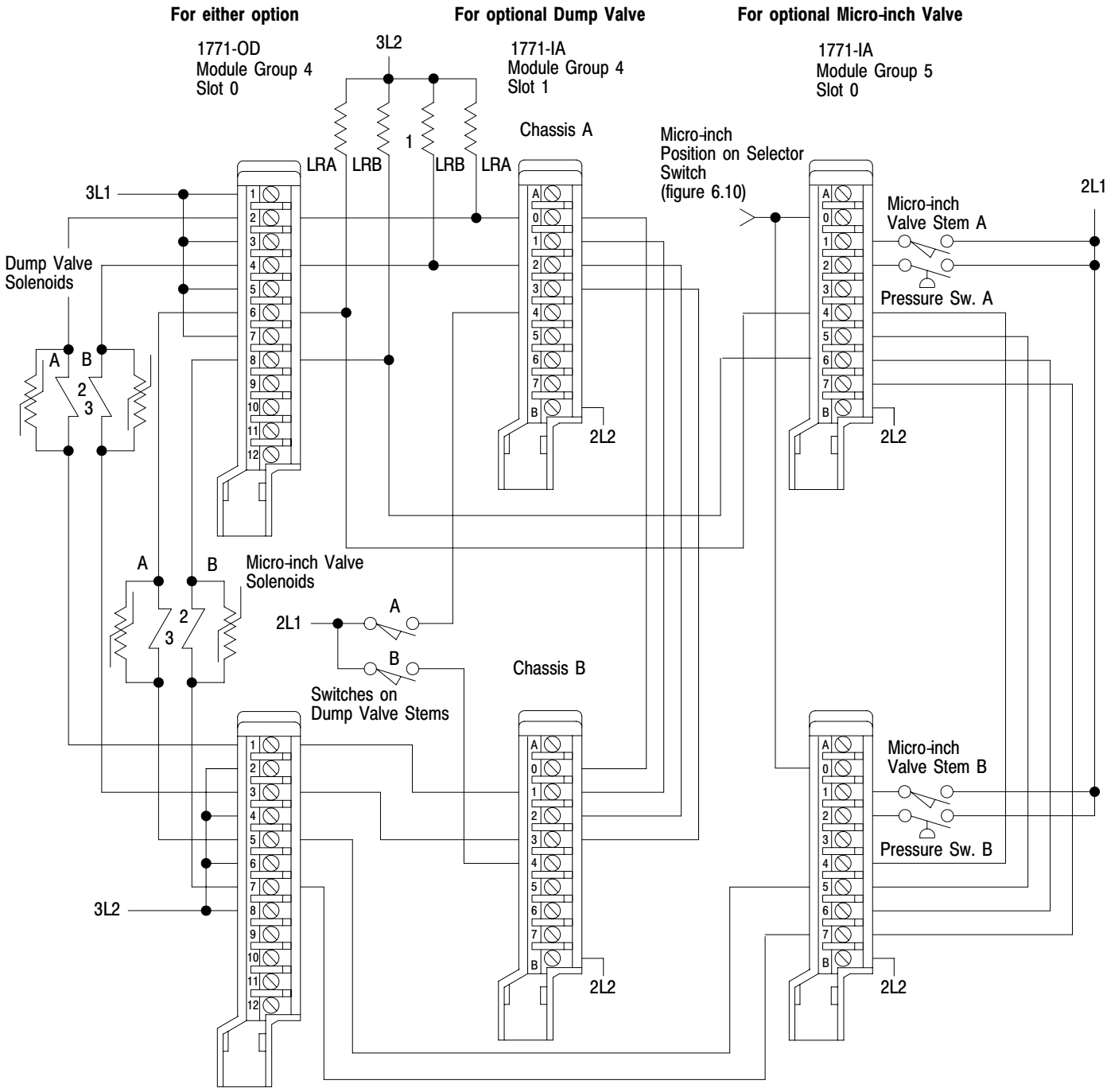
3 Connect one MOV between 3L1 and 3L2 for electrical noise suppression.

4 Connect one MOV to the 3L1 side of each solenoid load and to 3L2 for electrical noise suppression.

5 If solenoid are not used, replace with 2K ohm, 15 watt resistors.

17882

Figure 6.4
Connections for Optional Dump and/or Micro-inch Valve Solenoids with MOV Surge Suppression (Ungrounded AC Power)



NOTES: Use this wiring with figure 6.1 for ungrounded AC power.

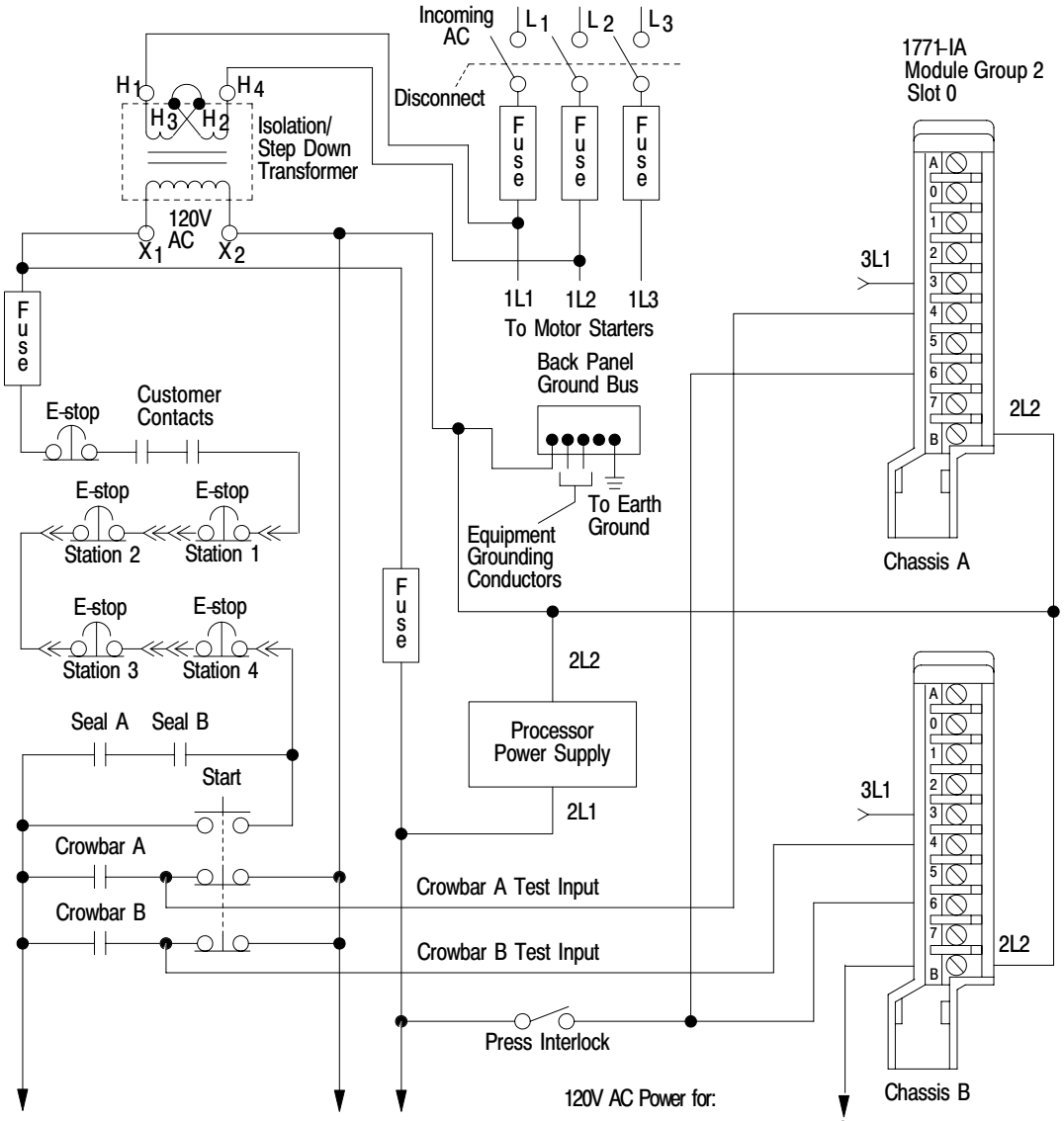
1 LRA and LRB load resistors for triac feedback are 2K ohm, 15 watt resistors

2 Each solenoid or relay coil should draw at least 60mA.

3 Connect one MOV to the 3L1 side of each solenoid load and to 3L2 for electrical noise suppressii ss

17881

Figure 6.5
Grounded AC Power Connections, Crowbar Test Inputs, and Press Interlock Switch



120V AC Power for:

Module group	Slot	Figure
3	0	6.7
4	0	6.8

120V AC Power for:

Module group	Slot	Figure
0	0	6.10
0	1	6.11
1	0	6.12
1	1	6.9
2	0	6.5
2	1	6.7
3	1	6.14
4	1	6.8
5	0	6.8
5	1	6.13

Figure 6.6
Connections for Optional Switches on Main Valve Stems, Air Pressure Sensors, and Motion Detectors (Grounded AC Power)

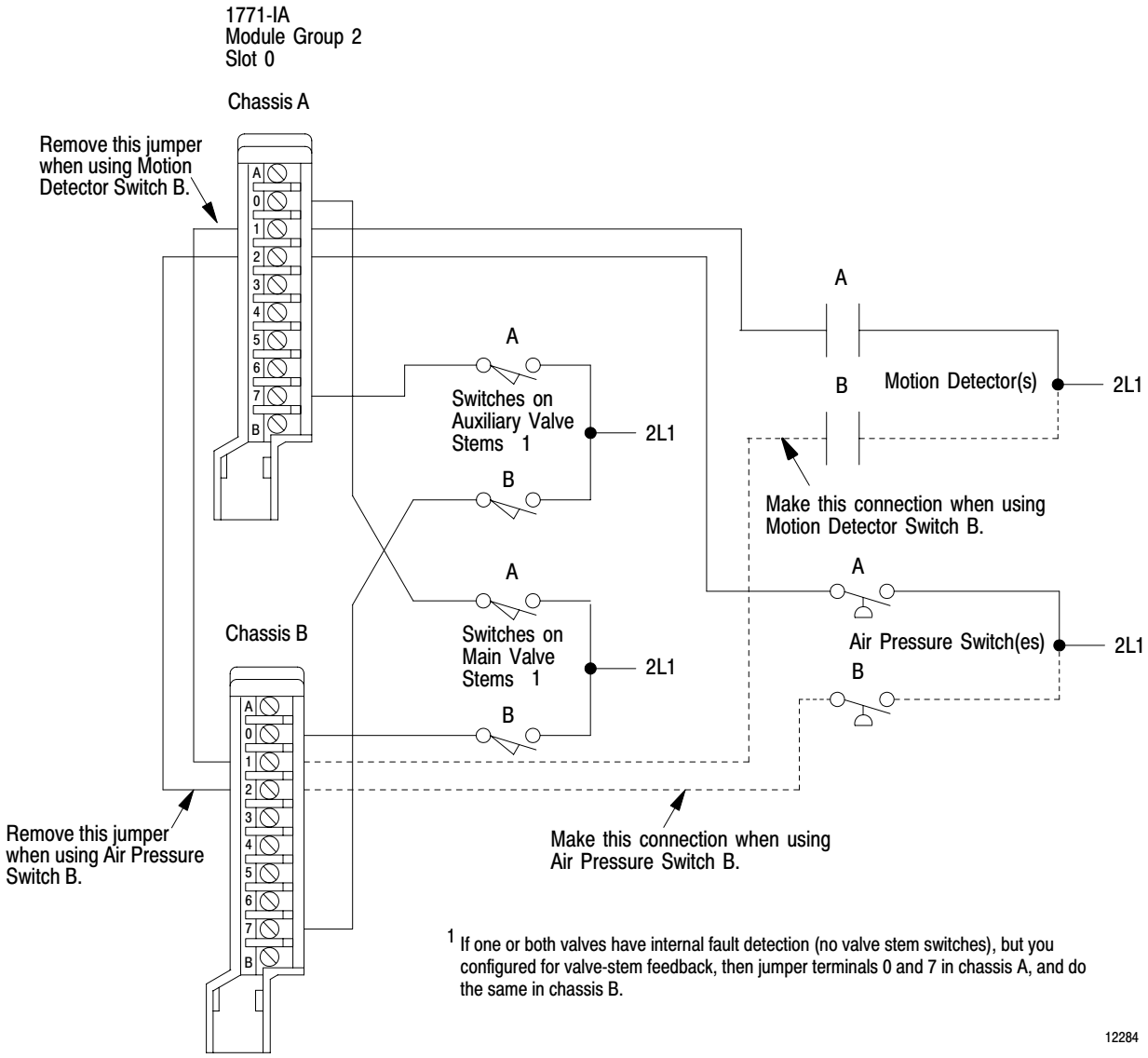
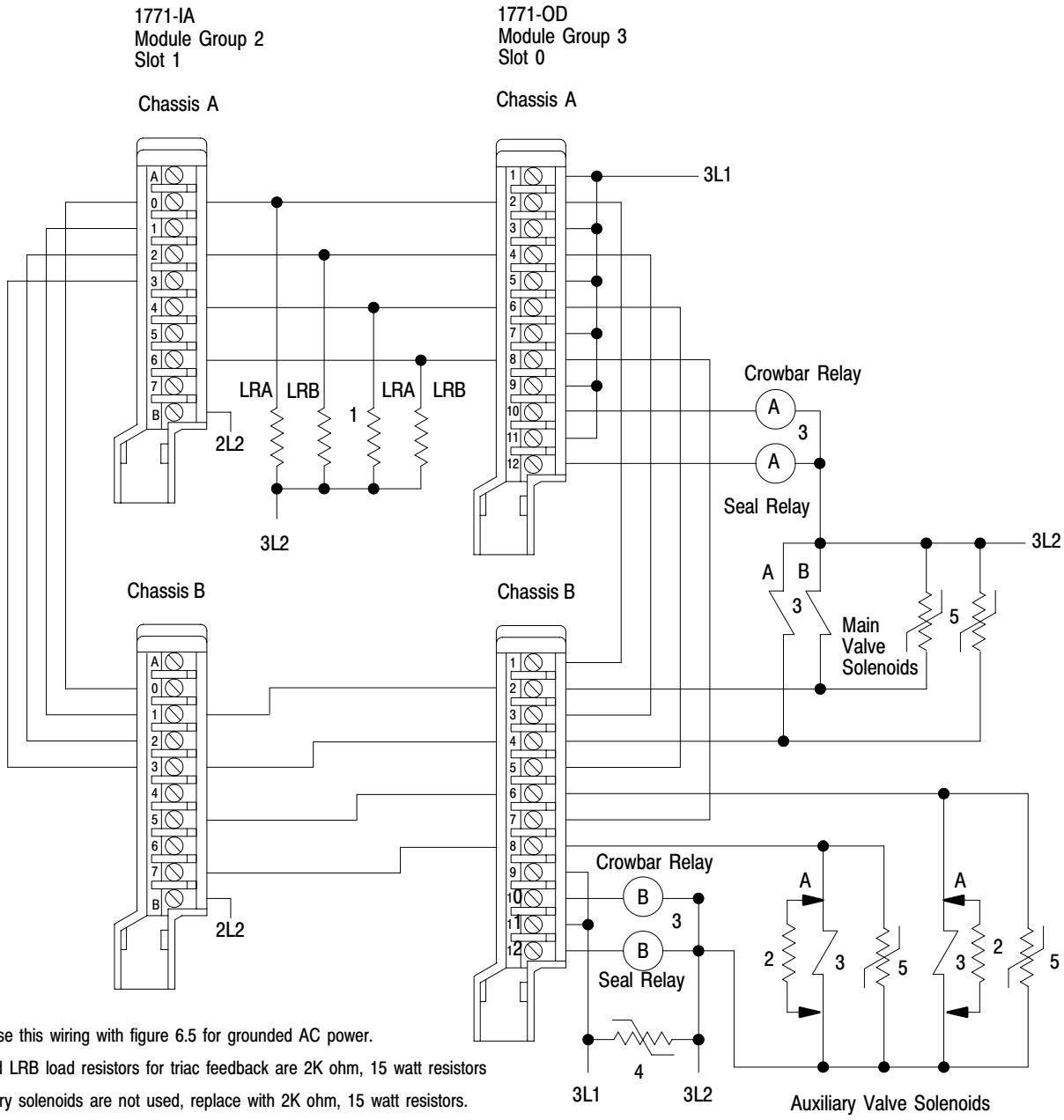


Figure 6.7
Connections for Main and Auxiliary Valve Solenoids, Crowbar and Seal Relays, and MOV Surge Suppression (Grounded AC Power)



NOTES: Use this wiring with figure 6.5 for grounded AC power.

1 LRA and LRB load resistors for triac feedback are 2K ohm, 15 watt resistors

2 If auxiliary solenoids are not used, replace with 2K ohm, 15 watt resistors.

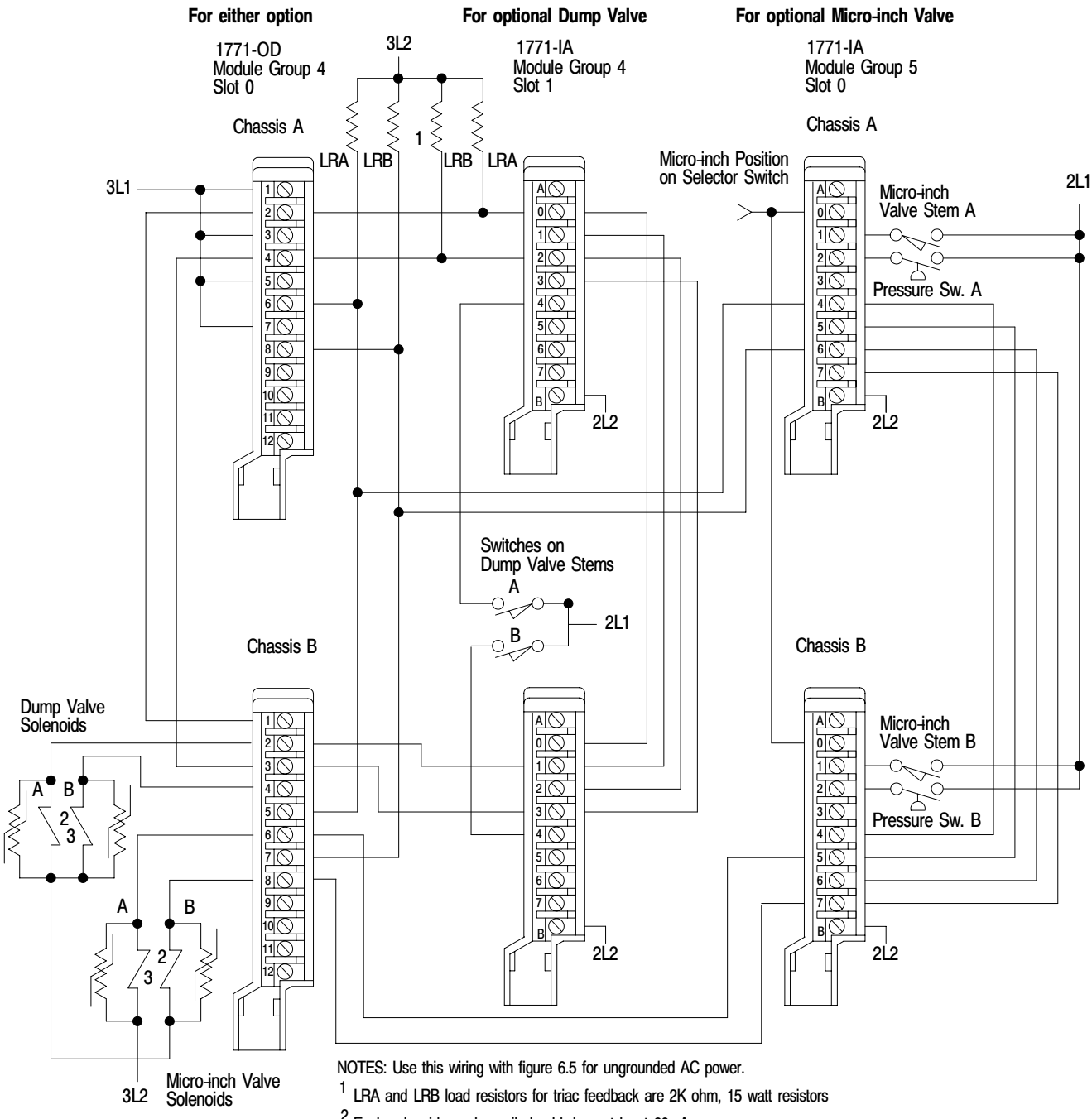
3 Each solenoid or relay coil should draw at least 60mA.

4 Connect one MOV between 3L1 and 3L2 for electrical noise suppression.

5 Connect one MOV to the 3L1 side of each solenoid load and to 3L2 for electrical noise suppression.

17890

Figure 6.8
Connections for Optional Dump and/or Micro-inch Valve Solenoids with MOV Surge Suppression (Grounded AC Power)



NOTES: Use this wiring with figure 6.5 for ungrounded AC power.

1 LRA and LRB load resistors for triac feedback are 2K ohm, 15 watt resistors

2 Each solenoid or relay coil should draw at least 60mA.

3 Connect one MOV to the 3L1 side of each solenoid load and to 3L2 for electrical noise suppression.

17889

Cam Limit Switches

Install two separate cam limit switch assemblies each with three cams and three cam limit switches. Connect cam limit switches exactly as shown in Figure 6.9. This allows each voting processor to monitor its own limit switches for:

- top-stop-check (TCAM)
- run-on (RCAM)
- anti-repeat (ACAM)

Each cam limit switch assembly must be independently driven by the press shaft through a separate coupling device. Couple each cam limit switch assembly to the shaft through a separate direct coupling, a separate gear assembly, or a separate chain assembly.

WARNING: To guard against injury to personnel and damage to your press, install two separate cam limit switch assemblies that are independently driven by the press shaft through separate coupling devices.

Two separate cam limit switch assemblies allow your clutch/brake controller to stop press motion in case there is a failure within either cam limit switch assembly or a breakage in either coupling device.

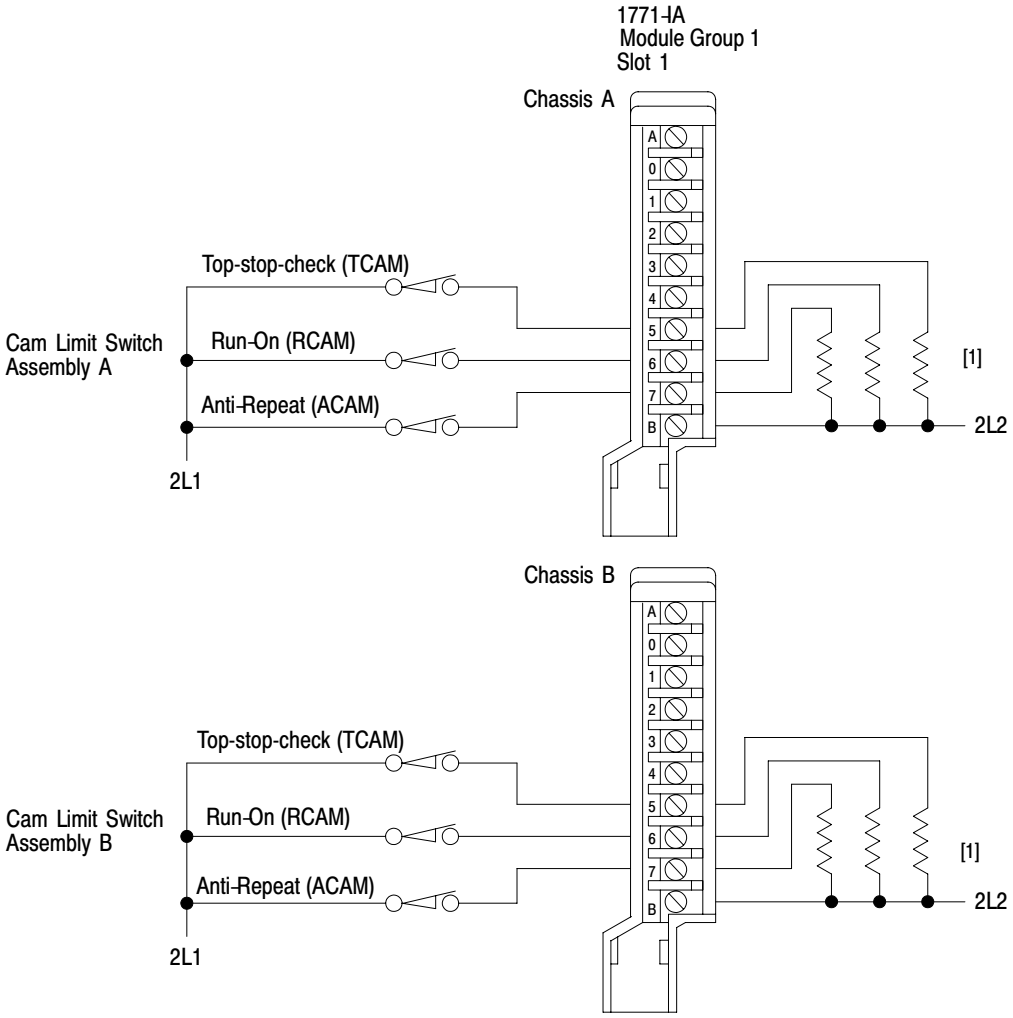
Set each pair of cam limit switches to similar settings as shown in Figure 5.1. If the settings are not similar, the voting processors can disagree on their perceived shaft zones and cause nuisance shutdowns.

We recommend the Allen-Bradley Rotating Cam Limit Switch (cat. no. 803-P3). This rugged duty cam limit switch assembly is well suited for press applications. For ordering information, see the Allen-Bradley Industrial Control Catalog or contact your local Allen-Bradley sales engineer or distributor.

Because the Cat. No. 803-P3 is an industrial grade heavy-duty limit switch, we recommend that it switch a power circuit drawing at least 0.25 Amp. Install a 470 or 500 ohm 50-watt load resistor in parallel with the AC input to generate this current.

You need to mount the resistors on the subpanel to keep dissipated heat (from resistors) away from modules, and because the resistor's axial leads are not compatible with the wiring arm.

Figure 6.9
Connections for Cam Limit Switch Assemblies



[1] 470 ohm 50 watt ± 1%, or 500 ohm ± 5% on seperate terminal strip.

12278

Required Hardwire Inputs

Connect hardwire inputs in parallel to chassis A and B so each voting processor can monitor the following inputs in parallel:

Input	Terminal	MG	Slot	Figure
Mode Select Switch	0-3	0	0	6.10
Main Motor Forward	4	0	0	
Barrier Guard	5	0	0	
Stop-on-top	6	0	0	
Arm Continuous	7	0	0	
Press Interlock	6	2	0	6.1, 6.5

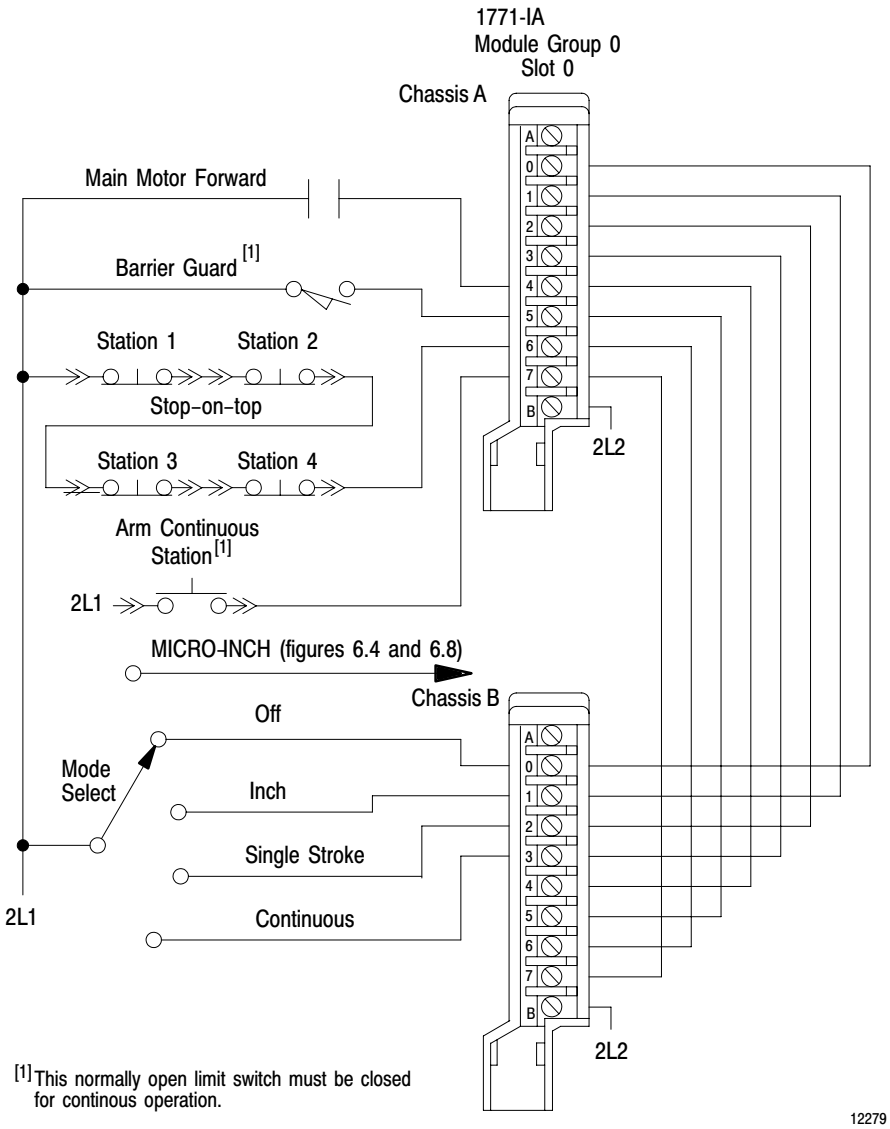
When connected, these inputs function as follows:

This Input	With PM in this Mode	With this Status	The PM module:
Mode Select (terminals 0-3)	Determines the mode	ON	detects the selected mode
Main Motor Forward (terminal 4)	Inch or Micro-inch	ON or OFF	uses these signals to determine proper CAM action
	Single stroke and Continuous	ON	detects one of the permissives to start or maintain a stroke
		if turned OFF after motion has started	immediately turns OFF solenoid outputs
Barrier Guard (terminal 5)	Continuous	OFF	prevents press from starting, or stops it immediately
Arm Continuous (terminal 7)	Continuous, only	momentary (less than 3 sec)	Each ON/OFF transition starts a 5-sec period in which you must press all active RUN buttons to start continuous stroking. Pressing Arm Continuous again within 5 seconds starts another 5-sec period.
Press Interlock (terminal 6) chassis A & B MG 2, Slot 0	any	ON if turned OFF	detects one of the permissives to start or maintain a stroke after transition immediately stops the press, or prevents it from starting

WARNING: To guard against injury to personnel, wire you barrier guard switch exactly as shown in Figure 6.10. Conform to all requirements for safeguarding the point of operation of your press as detailed in OSHA Regulations, Title 29-Labor, Chapter XVII, Section 1910.217.

If you have more than one operator station, connect the STOP-ON-TOP buttons in series.

Figure 6.10
Connections for Main Motor Forward, Barrier Guard, Stop on Top, Arm Continuous, and Mode Select Switches



Inch Buttons and Plug-In Operator Stations

Connect the (NC) and (NO) contacts of each INCH button to opposite chassis exactly as shown in Figure 6.11. This allows both voting processors to monitor and cross check both INCH buttons for correct operation. You may locate the INCH buttons at an operator control panel. However, they are not part of any plug-in operator station. Wire them directly as shown in Figure 6.11.

Plug-in operator stations 1 thru 4 and dummy plugs that you may use to bypass these stations are shown in Figure 6.11 and Figure 6.12. You may alter this configuration according to the number of bypassable stations that you need for your press system.

If all run stations are bypassed, you may still operate in inch or micro-inch mode using INCH buttons.

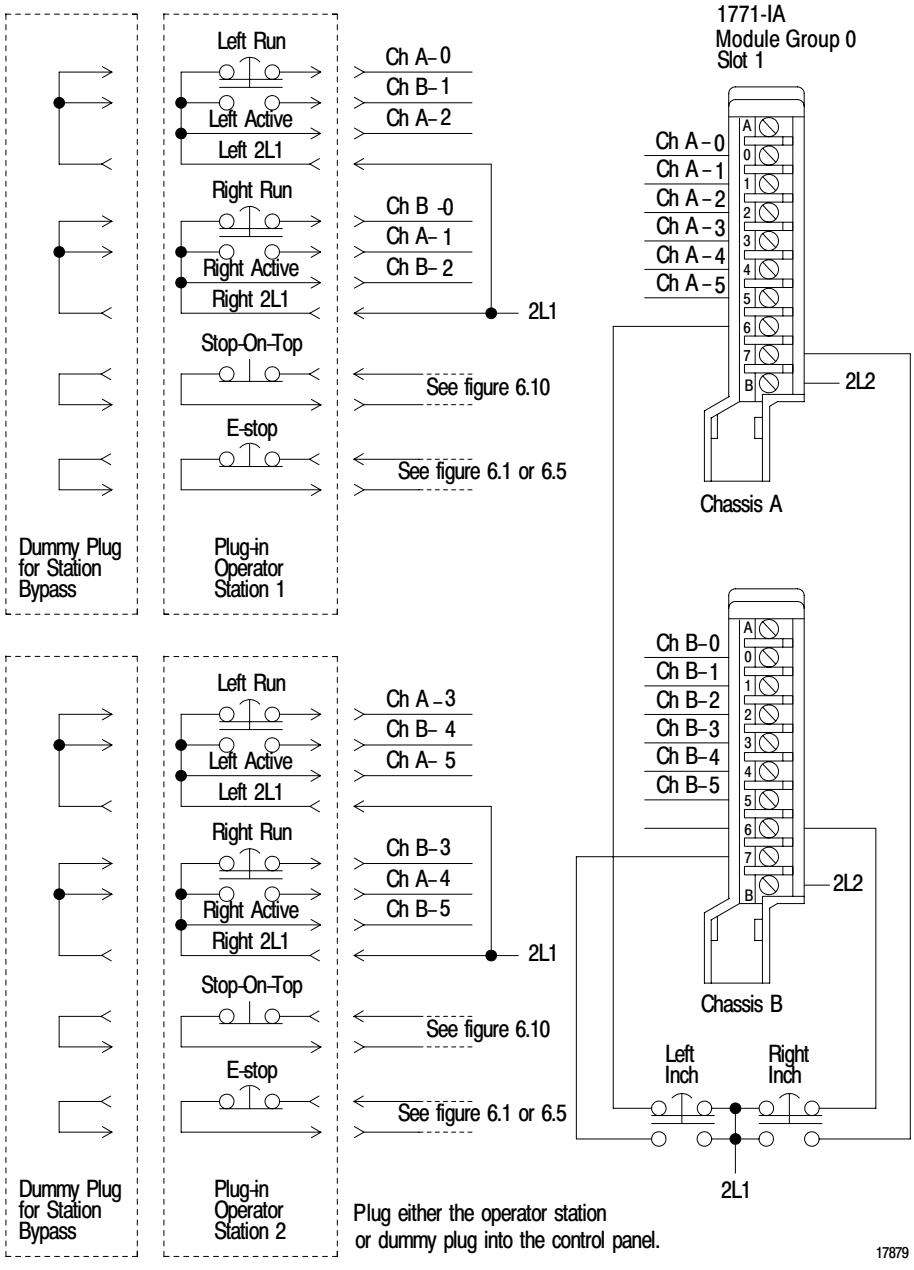
For example, if you have only one operator station, you may wire station 1 as shown in Figure 6.11, using direct wiring instead of operator station plug connections. However, you must also bypass station 2, using direct wiring instead of dummy plug connections. In other words, to bypass station 2, you may simply connect terminals 3 and 4 of each field wiring arm to 2L1.

For another example, if you have three operator stations, and only station 2 will be in constant use, build and wire plug-in stations 1 and 3 as shown in Figure 6.11 and Figure 6.12. Directly wire station 2 according to Figure 6.11. Directly wire station 4 bypass according to Figure 6.12. You must also build and wire the dummy plugs for stations 1 and 3.

Important: Configure or do not configure stations 3 and 4 through backplane switch settings as described in chapter 3 and PLC configuration bits as described in chapter 4. If you configure plug-in station 3 and/or station 4, but do not use either or both, you must bypass the unused station(s) with a dummy plug(s). If you have not configured for stations 3 and 4, you need not place a 1771-IA module in module group 1, slot 0, chassis A and B.

Connect the (NC) and (NO) contacts of each RUN button to opposite chassis exactly as shown in Figure 6.11 and Figure 6.12 for all stations. This allows both voting processors to monitor and cross check all RUN buttons for correct operation.

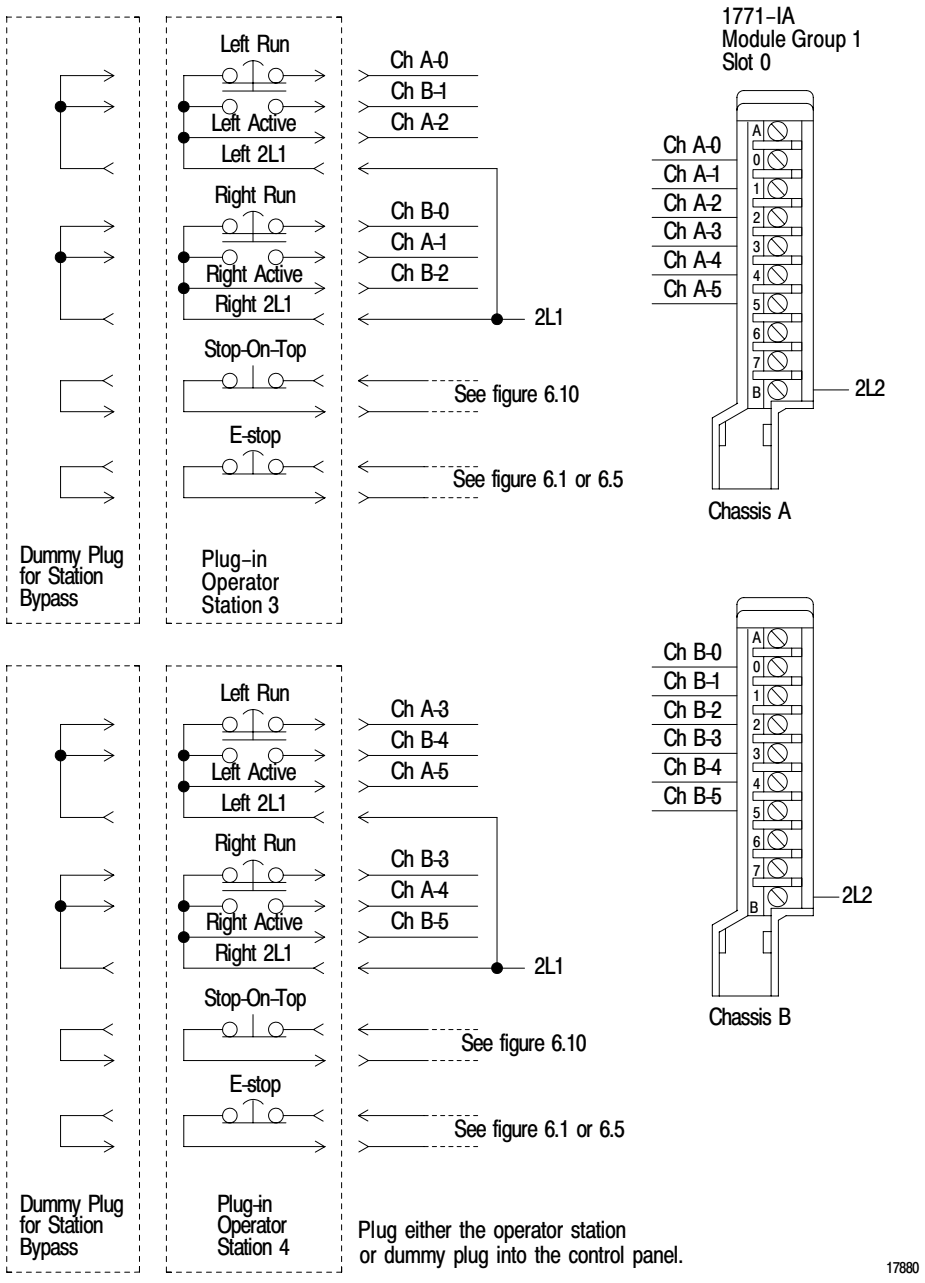
Figure 6.11
Connections for Operator Stations 1 and 2, Dummy Plugs, and Inch Pushbutton Switches



IMPORTANT:

For These Connections	See Figures
E – STOP	6.1 or 6.5
STOP-ON-TOP	6.10

Figure 6.12
Connections for Operator Stations 3 and 4, and Dummy Plugs



IMPORTANT:

For These Connections	See Figures
E - STOP	6.1 or 6.5
STOP-ON-TOP	6.10

Important: When mounting RUN and INCH buttons, ensure that:

- all RUN buttons and both INCH buttons are either guarded or flush-head pushbutton switches, such as Allen-Bradley Bulletin 800P Palm Operated Pushbuttons. You can operate guarded buttons only by reaching through their guard rings.
- the distance between each left RUN or INCH button and its corresponding right RUN or INCH button is great enough to allow operation of both buttons only by both hands.
- all RUN and INCH buttons are located at greater than minimum safe distance from the point of operation of your press as specified in OSHA Regulations, Title 29-Labor, Chapter XVII, Section 1910.217, and ANSIB11.1, section 5.3 Formulas for calculating the minimum safe distance are included.

Optional Binary Display

Use the optional diagnostic binary display shown in Figure 6.13 to troubleshoot your press. Chapter 7 lists the diagnostic messages.

We recommend Allen-Bradley Small Pilot Lights, Transformer Type (cat. no. 800T-PS16R) with 1771-OA Output Modules. You may order color caps separately (red is standard):

Red = cat. no. 800T-N122R
Green = Cat. no. 800T-N122G
Amber = cat. no. 800T-N122A
Blue = cat. no. 800T-N122B
White = cat. no. 800T-N122W
Clear = cat. no. 800T-N122C

You may also want to order Small Pilot Light Guards (cat. no. 800T-N226), to protect the caps against accidental breakage.

Optional Indicators

STOP-ON-TOP FAULT - tells an operator that the brake is faulty. If the shaft overshoots the near top position in inch, single, or continuous mode, both voting processors prohibit clutch actuation, and turn on this indicator. (See Table 5.a and Figure 6.14)

RUN WINDOW - turns on when starting the press in these modes:

- single-stroke: When both RUN buttons have been pressed at one station, other active stations have 5 seconds to press their RUN buttons as shown by this indicator.

- continuous: Each ON/OFF transition of the ARM CONTINUOUS button starts a 5-second period in which you must press all active RUN buttons to start continuous stroking as shown by this indicator. Pressing the ARM CONTINUOUS button again within 5 seconds (after the transition) starts another

Important: Press the momentary ARM CONTINUOUS button less than 3 seconds. Pressing it for a longer time may inhibit its function and require you to release and press it again.

MICRO-INCH - turns on when voting processors detect an error in micro-inch mode and display a diagnostic message code which is displayed by means of the diagnostic message display. Use look-up table 7.C to determine the fault or error.

You can use the micro-inch output in two ways:

- to turn on the MICRO-INCH indicator
- to set the most significant bit in a 9-bit binary output.

Diagnostic codes for micro-inch mode are 9-bit binary (3-digit hex) with 1 as the first digit (Figure 6.14). Diagnostic message codes for all other modes are 8-bit binary (2-digit hex). (Figure 6.13)

Figure 6.13
Connections for Optional Diagnostic Message Display

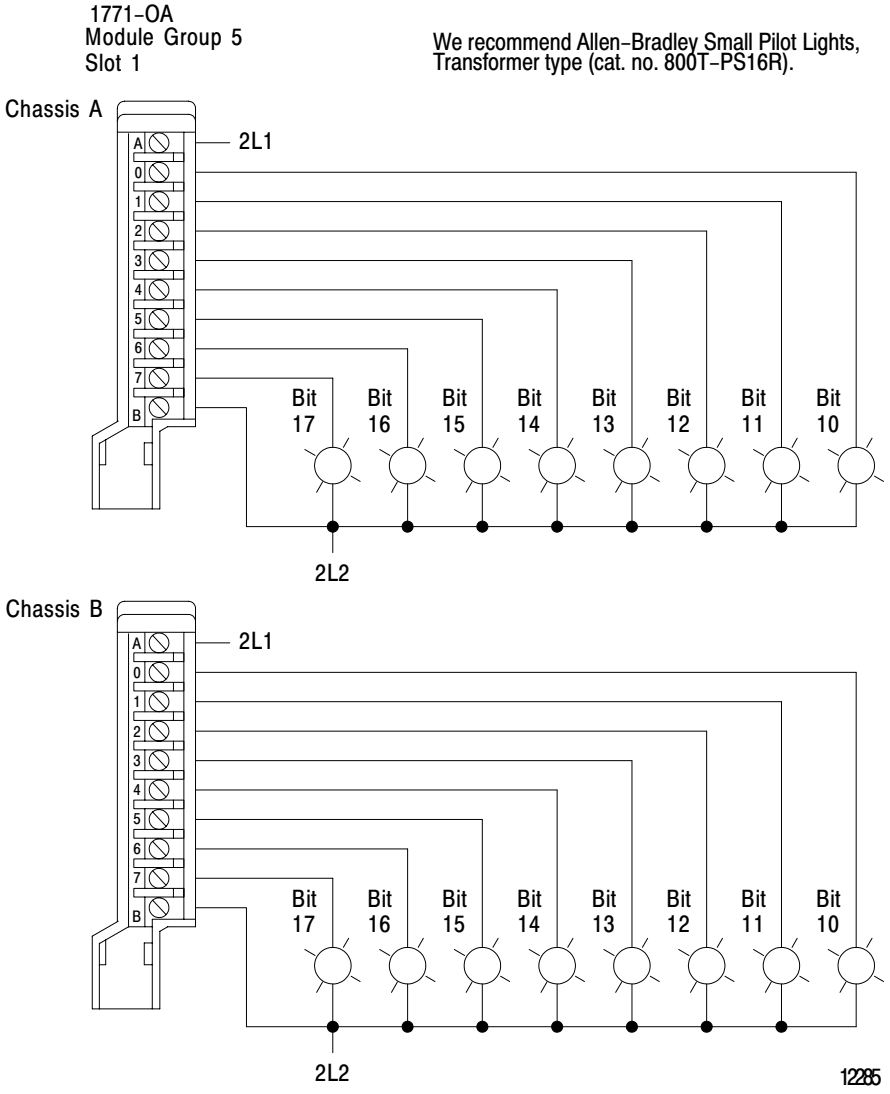
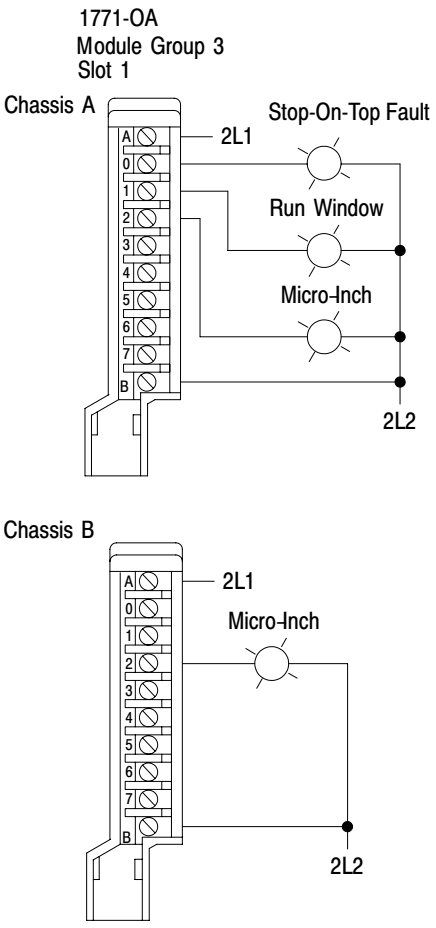


Figure 6.14
Connections for Brake Fault, Run Window, and Micro-Inch Indicators



W recommend Allen-Bradley Small Pilot Lights, Transformer type (cat. no. 800T -PS16R).

Lamp Test

When you configure the lamp test feature, you can check that all indicators are working by pressing the LAMP TEST switch connected to chassis C. The clutch/brake controller energizes the outputs to the following indicators while the lamp test input is on:

- Module Group 5, Slot 1, Chassis A and B for the diagnostic display
- Module Group 3, Slot 1, Chassis A and B for BRAKE FAULT, RUN WINDOW, and MICRO-INCH indicators.

Since hex (hexadecimal) numbers are easier than binary for people to read, you may want to display hex message codes. You may provide a device to convert the eight-digit binary outputs of chassis A and B, module group 2, slot 1 to two-digit hex displays. Select output modules that provide proper voltage to the device. For assistance, contact your local Allen-Bradley sales engineer or distributor.

In chapter 7, we describe other methods of displaying hex message codes.

Inputs to Chassis C

Chassis C provides for these functions:

- reset latched messages
- lamp test
- customer interlock (redundant to Figure 6.1 or 6.5)
- barrier guard (redundant to Figure 6.10)
- stop-on-top (redundant to Figures 6.11 and 6.12)

This chassis is optional because you can:

- omit redundant functions
- use alternatives for the non-redundant functions

As alternatives, you can program the PLC to transfer the message reset bit (bit 14) and/or the lamp test bit (bit 16) to the clutch/brake modules to provide those functions. If already using A-B's PanelView ®, use that operator interface to implement these functions.

If you use chassis C, follow these steps:

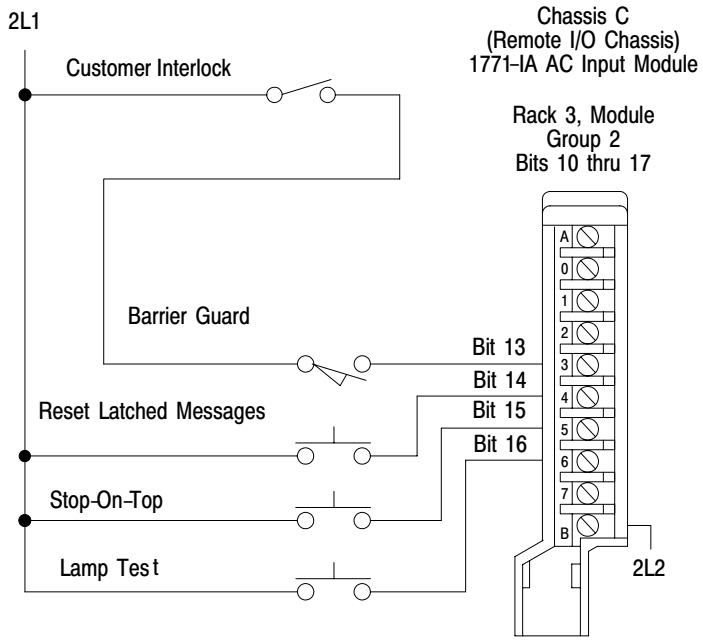
1. Wire PLC command switches as shown in Figure 6.15

2. Include command rungs, Figure 4.6, 4.7, or 4.8.

3. Set the backplane switches of chassis C to a valid rack address for your PLC and clutch/brake system.

Chassis C can be any remote or local I/O chassis connected to your PC. Refer to sections titled “Panel Switches and Operator Stations”in chapter 3, and “Configuration Rungs” in chapter 4, for additional information.

Figure 6.15
Connections for Optional PLC Command Switches[1]



[1] To write the ladder program to implement the use of these switches, refer to Figure 4.6, Figure 4.7 or Figure 4.8.

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Chapter 7

Troubleshooting

Chapter Objectives

After you have read all previous chapters, this chapter can help you:

- safely isolate and correct problems in your press system
- interpret diagnostic messages generated by your clutch/brake controller
- use the module indicators in chassis A and B while troubleshooting your press system

Troubleshooting Considerations and Requirements

This chapter explains troubleshooting techniques and refers to previous chapters. We recommend that you read the entire manual and all technical documentation provided by the press manufacturer before troubleshooting any problem with your press system.

We also recommend that you adhere to the safety requirements detailed in local code and laws and in the following publications:

- OSHA Regulations, Title 29-Labor, Chapter XVII, Section 1910.217, Mechanical Power Presses
- ANSI B11.1, American National Standard for Machine Tools, Mechanical Power Presses, Construction, Care, and Use
- NFPA No. 79, Electrical Standard for Metal working Machine Tools

Familiarity with this documentation makes your troubleshooting not only safer, but easier as well.

Troubleshooting with LED's

Use these figures and tables when troubleshooting with LED indicators

Reference	Description
Figure 7.1	Location of LED indicators
Figure 7.A	How to read the PM Module's ACTIVE indicator
Figure 7.B	How to read the PM Module's I/O RACK FAULT and CBM FAULT indiators
Figure 7.2	How to troubleshoot with LED indicators

Figure 7.1
Module Indicators for Chassis A or B

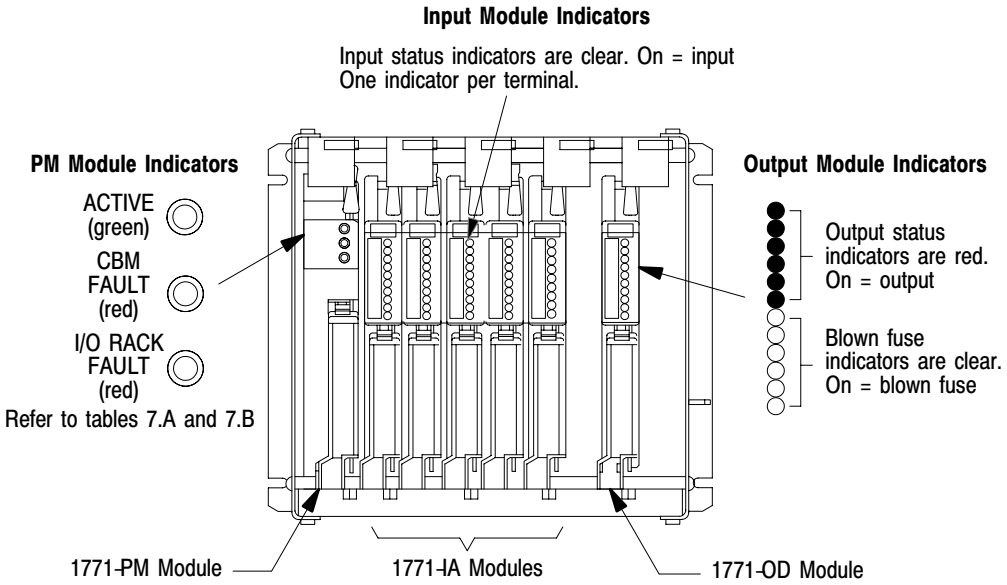


Table 7.A
ACTIVE Indicator

If the ACTIVE indicator is blinking, identify the problem by the number of blinks. There are 2 sets of blinks:

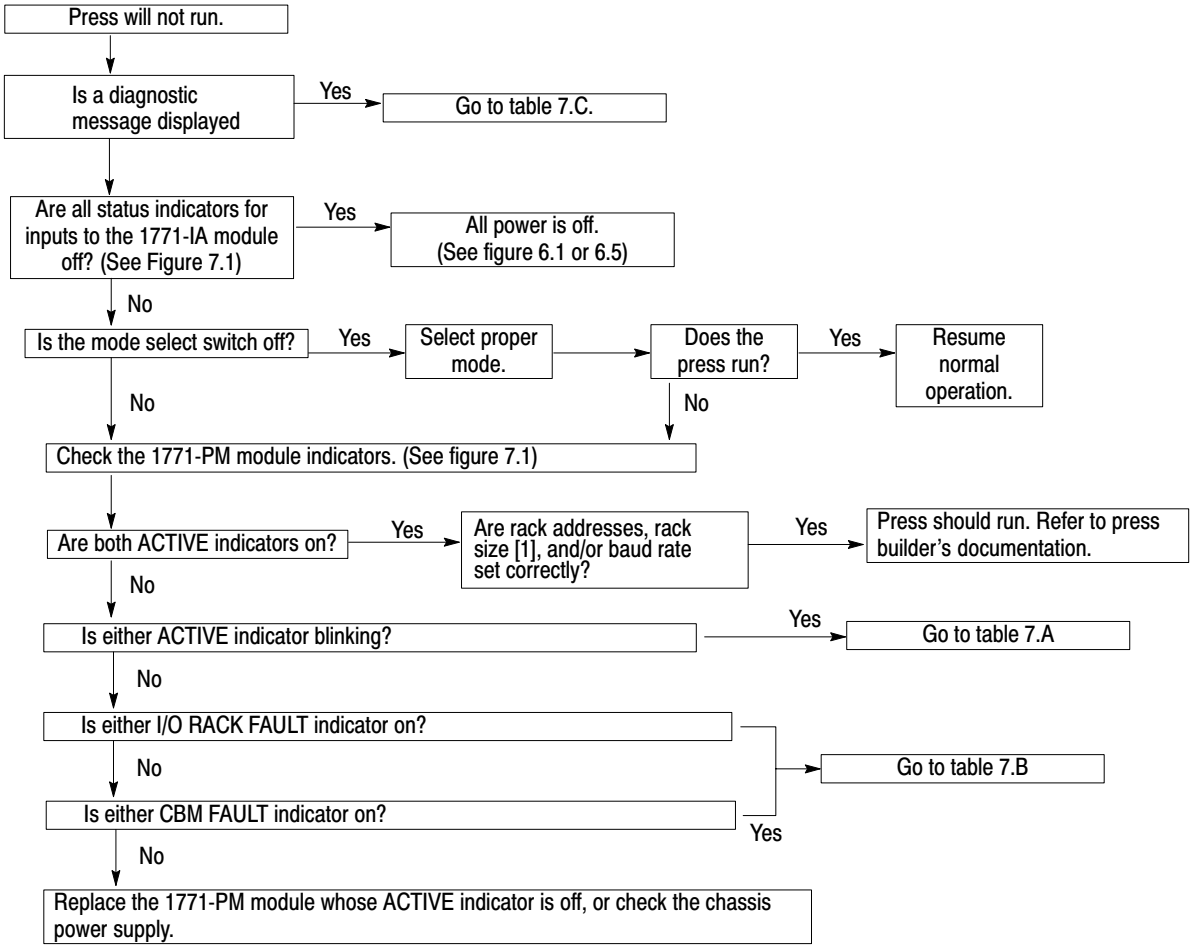
first set of blinks → short pause → second set of blinks → long pause
repeat continuously

Number of Blinks		Problem	Correction
1st Set	2nd Set		
1	3	Faulty RAM	Replace 1771-PM module
1	4	Faulty PROM	Replace 1771-PM module
2	1	Illegal rack address	Set the 1771-PM module switches as detailed in chapter 3
2	3	The 1771-PM modules contain different firmware	Install 1771-PM modules with identical revision codes
3	2	Missing a 1771-PM module at power up	Install and fully seat both 1771-PM modules
3	4	Illegal interrupt	Cycle power Replace 1771-PM module
4	1	Firmware fault	Replace 1771-PM module
4	3	Lost communications between 1771-PM modules, or watchdog timed out	Check connections between 1771-PM modules or Replace 1771-PM module

Table 7.B
I/O RACK FAULT and CBM FAULT Indicators

I/O RACK FAULT	CBM FAULT	Problem	Correction
On	**Off**	Intermittent electrical noise, faulty 1771-PM module, or shorted I/O chassis backplane	Cycle power Replace 1771-PM module Replace each I/O module one at a time Replace I/O chassis
On or OFF	**On**	Intermittent electrical noise or faulty 1771-PM module	Cycle power Replace 1771-PM module

Figure 7.2
Troubleshooting Flowchart for Module Indicators



[1] The controller will not operate if you manually configure chassis A and B to a half rack

Warning: To guard against injury to personnel, open and lock the main power disconnect before adjusting, replacing, or repairing any mechanical or electrical component in your press system. This consists of the press, clutchbrake, controller, and all associated wiring and control panels.

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General Troubleshooting Procedure

Although the procedure for troubleshooting your clutch/brake controller varies with each problem, use the following steps as a general procedure:

1. Examine Figure 7.2 and NO TAG.

2. Answer questions in Figure 7.2 and NO TAG until you see a reference to another figure or table. Table 7.C lists diagnostic codes.

3. Place a bookmark at Figure 7.2 or NO TAG and go to the figure or table that it referred to in step 2. That figure or table might contain other references. Therefore you may need several bookmarks while working among various figures and tables throughout this manual. Table 7.D is your primary reference.

4. Isolate the problem using the guidelines in Figure 7.2, or NO TAG, Table 7.C, and other references.

5. Correct the problem.

WARNING: To guard against injury to personnel or damage to your press, open and lock the main power disconnect to turn off all AC and DC power before:

- manually turning the press shaft
- adjusting or repairing any moving parts in your press
- repairing or replacing any wiring in your press system, including any field wiring arm or cable connections
- replacing any electronic or electrical components, such as clutch/brake controller and I/O modules, power supplies, or chassis
- replacing blown fuses in your press system

Troubleshooting Hints

Diagnostic codes are specific and point to the exact input or output device that controls PM operation. When your system is wired as outlined in this manual, you can identify the cause of a fault as follows:

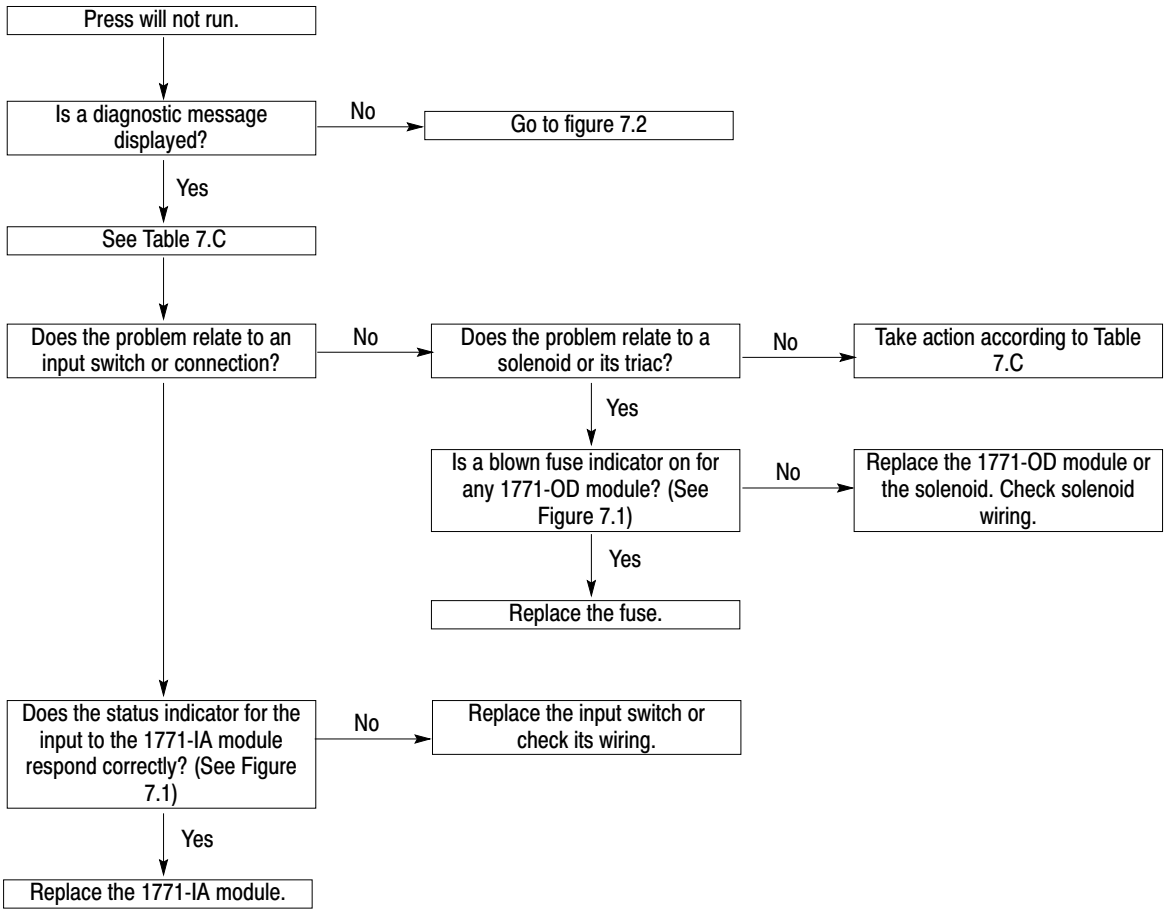
1. Review the section “Diagnostic diagnostic message codes”, below.

2. Note the diagnostic code for <u>both</u> PM modules

3. Determine the input or device causing the fault from the section/sub-section heading in Table 7.D where the fault code was tabulated and from other figures or tables referred to.

4. Interpret the messages. Was this output supposed to be on? Was that device supposed to be off?

Figure 7.3
Troubleshooting Flowchart for Diagnostic diagnostic message codes



Warning: To guard against injury to personnel, open and lock the main power disconnect before adjusting, replacing, or repairing any mechanical or electrical component in your press system. This consists of the press, clutchbrake, controller, and all associated wiring and control panels.

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5. Trace wire leads and/or inspect the faulted device.

If you wired the PM system in a manner other than outlined in this manual, faults are more difficult to track. Proceed as follows:

1. Determine if the fault and corresponding diagnostic code was caused by alterations in system wiring, i.e., if the fault is a run station fault, are the run stations wired directly to the PM system or through auxiliary chassis controlled by the programmable controller? If the latter is the case, you should look at the programmable controller's ladder program.

2. Determine if you have an I/O problem. The PM module can only diagnose its own I/O level. That is, it alerts you to the exact input or output within the system that it "sees" as incorrect. You must interpret from there.

Troubleshooting Example

Assume that your press is running normally, then stops suddenly. For this example, we will follow the general troubleshooting procedure.

1. Examine Figure 7.2 and Figure 7.3.

2. The first question asked in both figures is whether a diagnostic message is displayed. For this example, we assume that chassis A and B are displaying these diagnostic messages:

- chassis A 0010 1001 (hex 29)
- chassis B is displaying 0010 1000 (hex 28)

Because your answer is yes, see Table 7.D to define the problem.

3. In Table 7.D you find that:

- Binary 0010 1001 (hex 29) is a T-type (trip condition) message that tells us: Station 1 active connection is open (for alternate chassis). Check wiring. (figure 6.11).
- Since chassis A is displaying this message, the alternate chassis is chassis B.
- Binary 0010 1000 (hex 28) is the same message. It is for the chassis displaying the message, chassis B in this case.

In Table 7.C, the numbers in parentheses are figure references. In this example, both messages refer to Figure 6.11. Therefore, place a bookmark at Table 7.D and go to that figure.

4. Figure 6.11 shows station 2 active connections for both chassis:

- Left Active connects to terminal 5 of field wiring arm for module group 0, slot 1 in chassis A.
- Right Active connects to terminal 5 of field wiring arm for module group 0 slot 1 in chassis B.

Since you learned in step 3 that the problem relates to chassis B, you can concentrate on the Right Active connection.

5. To further isolate the problem, place a bookmark at Figure 6.11 and return to Figure 7.3. The next question in this figure asks: Does the problem relate to an input switch or connection? In this example, your answer is yes, which leads you to another question. Does the status indicator for the input to the 1771-IA module respond correctly? (See Figure 7.1).

6. Figure 7.1 shows you where to find the input status indicators. For this example, assume that the input status indicator in chassis B for module group 0 slot 1, terminal 5 is off.

As shown in Figure 6.11, the Right Active connection is jumpered as long as Plug-In Operator Station 2 is plugged in. Therefore, the indicator for Right Active should be on.

7. Return to NO TAG. Since this indicator is off, your answer is no to the question: Does the input status indicator respond correctly? NO TAG tells you to replace the input switch or check its wiring.

8. Correct the problem after first opening and locking the main power disconnect. Inspect and test the Right Active connection (Figure 6.11). For this example, you find a broken wire in Plug-In Operator Station 2. Repair the broken wire then, close the main disconnect and return the press to normal operation.

Display of Diagnostic Message Codes

When the PM module detects a condition, it immediately generates the corresponding message code. You can display diagnostic message codes with an optional display device connected to output modules in these locations in chassis A and B:

- module group 5, slot 1 (8-bit binary code)
- module group 3, slot 1, bit 2 (9^{th} bit for micro-inch)

When using micro-inch mode, diagnostic diagnostic message codes are 9-digit binary (3-digit hex) rather than 8-digit binary (2-digit hex) for other diagnostic message codes. The most significant bit (bit 9) indicates a micro-inch code. When set, 2-digit hex codes XX become 3-digit hex codes 1XX for micro-inch.

You can display diagnostic message codes in 9-digit binary, or use an optional binary-to-hex converter and display diagnostic message codes in easy-to-read hexadecimal notation. No programming is required. Just install output modules in those locations and connect display devices (Figures 6.13 and Figures 6.14).

You can also view diagnostic message codes with an Allen-Bradley programming or display terminal using the data monitor feature:

If using this processor	Use this device
PLC-2 family	Industrial Terminal (1770-T3) Hand-held Terminal (1770-T11)
PLC-3 family	Industrial Terminal (1770-T4) Data access panel on the front of the processor or 1784-T45, -T47, or -T50 Programming Terminal
PLC-5 family	1784-T45 ,-T47, or -T50 Programming Terminal
PLC-5/250	1784-T45, -T47, or -T50 Programming Terminal

Types of Diagnostic Message Codes

PM modules detect operational and equipment faults, and indicate corresponding diagnostic message codes for more than 250 detected conditions. Diagnostic diagnostic message codes refer to specific inputs or outputs, such as a contact on a switch or cam. Upon detecting a condition, each PM module generates its own diagnostic code. Quick succession of events may cause each PM module to detect a different condition, one condition resulting from the other.

PM modules generate three types of diagnostic message codes according to the severity of the condition:

Code	Type	Priority	Method of reset
N	non-latched	least	Clears itself when conditions no longer exist
L	latched	moderate	Correct the condition Press the RESET LATCHED MSG pushbutton
L	latched followed by ”0D”	moderate	Correct the condition Restore power Inch the press to near-top position Push the RESET LATCHED MSG pushbutton Press the START button
T	tripped	highest	Correct the condition Press the RESET LATCHED MSG pushbutton Press the START button

Non-latched Messages (lowest priority)

Non-latched messages occur when the PM module detects an error condition while the press is idle (clutch/brake solenoids are OFF) and the control seal relays are either open or closed. The PM module:

- prevents press operation as long as the error is present

After you correct the error conditions, the PM module automatically clears the message and readies itself for operation. These messages are typically related to a wiring error or equipment malfunction.

Example: A broken or loose wire on the active line of Run Station 1 (Figure 6.13) could cause the PM module to generate the following message code:

Error 10 (Hex)
Check RUN button signals. Activate or bypass the station.

Latched Messages (medium priority)

Latched messages occur when the PM module detects error conditions while the press is running (clutch/brake solenoids are ON). The module:

- stops press motion immediately
- latches ON a diagnostic message
- turns OFF solenoid valve triacs (seal relays remain closed)

The latched-message condition remains until you correct the problem and press the RESET LATCHED MSG pushbutton wired to chassis C. Typical error conditions are equipment failures or improper mechanical adjustments.

Example: If the barrier guard switch should open while the press is running in continuous mode, the PM module would immediately turn OFF the solenoid valve triacs and generate the following message code:

> **Error 09** (Hex)
> Barrier guard dropout or absent

Latched Messages Followed by “0D” (corrective intervention)

Whenever a diagnostic message code is followed by the ”0D” message code, the maintenance technician must reset the PM system by removing control power, and then re-applying power. This forces the technician to correct the problem before press operation can continue.

Standard Corrective Action

Because the ”0D” message code accompanies a variety of other diagnostic message codes, we recommend a standard corrective action. Use it when correcting faults for “OD” diagnostic message codes presented in Table 7.C.

- Check for proper cam setting and operation. (Refer to Figure 5.1 in this manual.)
- Check for bad or frozen cam contacts
- If more than one cam assembly is used for multi-speed press operation, check switching of these cams.
- Check for proper wiring of cam switches.
- Check for proper wiring of I/O module swing arms.

Re-starting the Press

You re-start the press with this procedure:

1. When the “OD” message is displayed, press ESTOP to drop the seal relays.

   Message code “50” is displayed (swingarm power dropout)

2. Press the START button.

3. Press the RESET LATCHED MSG button.

4. Select INCH mode if not already selected.

5. Inch the press to the near-top position.

Types of “OD” Diagnostic Message Codes

The “OD” diagnostic message code accompanies the following type of diagnostic messages.

Type of Message	Hex Code
Downstroke	066 - 067
Upstroke	068 - 069
Brake or Motion Detector	072 - 079, 07A
Cam Limit Switch	
Near Top Position	080 - 085
Transition to Downstroke	086 - 089
Downstroke	08A - 08F
Transition to Near Bottom Zone	090 - 093
Near Bottom Zone	094 - 099
Transition to Upstroke	09A - 09D
Upstroke	09E - 09F, 0A0 - 0A3
Transition to Near Top Position	0A4 - 0A7
Hardware or Cable	0F1 - 0F3

Trip-condition Message (highest priority)

Trip-condition messages occur anytime the PM module detects a fault condition that casts doubt on the system's ability to:

- measure the press's shaft angle
- control power to the solenoid valve triacs

When it detects this type of fault, the PM module immediately:

- stops press motion
- opens the seal relays

If it detects that the seal relays did not open, it

- blows the main power fuses with crowbar relays

The trip-condition fault remains until you correct the problem and press the RESET LATCHED MSG pushbutton wired to chassis C. Typical fault conditions are due to system configuration, feedback signals, run stations, or triacs. After corrrecting the fault condition, get back into operation with the same steps as 0D Latched Message, above.

Example: If the motion detection input (Figure 6.2) should turn ON while the press is operating, and you did not configure for motion detection, the PM module would generate the following message:

> **Error BB (Hex)**
> Motion detector signal present though motion detector feedback is not configured.

Message-code Priority

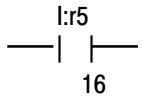
Diagnostic diagnostic message codes are not queued. When the PM module detects multiple latched or tripped message conditions, it sends the highest priority message code to the processor so your ladder logic can process it, and to pre-determined slots in its I/O chassis so output modules can display it. When you correct the condition and press the MESSAGE RESET button, the PM module sends the next highest priority message code if an error condition still exists. A message code of higher priority overrides a message code of lower priority. For error conditions of equal priority, the PM module sends the message code corresponding to the first detected condition.

Processing Diagnostic Message Codes

If you want to maintain a record of diagnostic message codes or process them for reasons other than display, you can write ladder logic to examine the 9-bit binary message code that PM modules return to the processor. Do this by examining bits in the input image table corresponding to:

- module group 5, slot 1 (8-binary code)
- module group 3, slot 1, bit 2 (9^{th} bit for micro-inch)

For example, examine a bit as follows:



where r is the I/O rack number

If recording a history of diagnostic message codes such as stored in a FIFO stack, we suggest that you record only diagnostic message codes that exist for longer than one second and disregard all diagnostic message codes resulting from transient conditions of shorter duration. This guards against storing no-fault status diagnostic message codes such as generated during start-up.

Diagnostic Message Codes (Table 7.C)

Table 7.C explains message codes generated by PM modules.

For each message code, the table states:

- type of diagnostic message
- the problem causing the diagnostice message to be displayed
- recommended corrective action

In Table 7.C we use mnemonics for cam switches for the sake of brevity as follows:

- ACAM: anti-repeat cam switch
- RCAM: run-on cam switch
- TCAM: sto-top-check cam switch

Table 7.C
Diagnostic Message Codes Associated with the "0D" Message Code

MISCELLANEOUS MESSAGES

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
01	N	IMPROPER MODE SELECTION The PM module expects to see one of the allowable press modes (off, inch, micro-inch, single, continuous, within 0.1 sec's after swingarm power is sealed in, and will only allow one mode at any given time.	Check selector switch wiring in figure 6.10 and operation. Check wiring to swing-arm. Check I/O module for correct operation.
02	N	ALL STATIONS BYPASSED In the single stroke or continuous mode, the PM will not allow the press to cycle if all operator run stations are bypassed. At least one station must be present. Inch and micro-inch modes will operate with all run stations bypassed.	Check station wiring in figures 6.11 and 6.12. Check swing-arm wiring and I/O module for proper operation.
03	N	SHAFT NOT AT TOP. CAN NOT ENTER SINGLE OR CONTINUOUS MODE The PM is selected to go into the single or continuous mode, but the cam switches, which indicate shaft position, are telling the PM that the press is not at the top.	Check for proper cam settings in figure 5.1. Check for proper cam wiring in figure 6.9. Inch press to the top position.
04	N	AWAITING RELEASE OF ALL RUN BUTTONS FOR ENTERING SINGLE OR CONTINUOUS MODES	Release all run buttons. Check for proper operation of all buttons. Check button wiring in figures 6.11 and 6.12.
05	N/L	MAIN MOTOR FORWARD CONTACT DROPOUT OR ABSENT The main motor forward input needs to be on in order to enter single or continuous modes. Once in single or continuous mode, the press will stop if that input goes off.	Check feedback contact and wiring in figure 6.10. Check swing-arm wiring and I/O module for proper operation.
06	N	ACAM OPEN, PREVENTING ENTRY INTO SINGLE OR CONTINUOUS MODE.	Check wiring of ACAM in figure 6.9 and check ACAM position in figure 5.1.
07	N	AWAITING RELEASE OF ALL STOP-ON-TOP BUTTONS FOR ENTERING CONTINUOUS MODE. You must release STOP-ON-TOP buttons of **all** active stations before the PM can switch to another mode of press operation.	Check RUN button wiring figures 6.11 and 6.12.
08	N	AWAITING RELEASE OF ARM CONTINUOUS BUTTON FOR ENTERING CONTINUOUS MODE. You must release the ARM CONTINUOUS button and press the RUN buttons of **all** active stations before the PM can switch to continuous mode.	Check ARM CONTINUOUS button wiring figure 6.10.
09	L	BARRIER GUARD DROPOUT OR ABSENT. Press stops operation.	Check for faulty switch, broken wire, etc. figure 6.10.

MISCELLANEOUS MESSAGES (cont'd)

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
0A	N/L	PC ENABLE DROPOUT OR ABSENT *LATCHED MESSAGE The PC enable bit from the processor must be maintained to the PM while in any mode other than off. The PM must also see the PC enable bit maintained while switching to off mode. *NON LATCHED MESSAGE The PM must first see the PC enable bit go on before it sees any request to change modes. If this does not happen, this message will occur.	When the PM is actually in the off mode, the PC enable bit may be turned off. This condition should be used as a status prompt that indicates the user program has not given final permission to enter the selected mode. Check programming in figure4.6.
0B	N	STOP-ON-TOP SIGNAL FROM PC PREVENTING ENTRY TO CONTINUOUS MODE. PM module is still receiving STOP-ON-TOP command from the PC processor. This command must be absent before PM can enter continuous mode.	Check ladder logic (figure 4.6, 4.7, 4.8).
0C	N	AWAITING RELEASE OF INCH BUTTONS FOR ENTERING INCH MODE. Inch-button inputs must indicate that both inch buttons have been released, then pushed again before its PM Module will allow inching motion. This is the ante-tie-down feature of the PM Module. refer to figures 5.2 and 6.11.	Refer to figure 5.2. Check wiring in figure 6.11.
0D	N		
0E	N	PC RUN MODE DROPOUT OR ABSENT PC processor is not in RUN mode, probably due toa processor fault.	Correct processor fault. Switch to RUN mode.
0F	N	PRESS INTERLOCK DROPOUT OR ABSENT	Check wiring of press interlock switch in figure 6.1 or 6.5.
10	N	CHECK RUN BUTTON SIGNALS. MAKE STATION ACTIVE OR BYPASSED.	The cactive-station input is absent, but the PM module is detecting a change-of-state of operator RUN buttons. Check station #1 (figure 6.11).
15	N	MAKE LEFT AND RIGHT ACTIVE CONNECTIONS IDENTICAL.	Check station #1 (figure 6.11).

STATION MESSAGES

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
6A	N	"AWAITING RELEASE OF ALL ACTIVE RUN BUTTONS" OCCURS UNDER THE FOLLOWING CONDITIONS: 1. If after pressing 1 active run button and then not pressing all active run buttons within 5 seconds. After an additional 5 seconds the message will occur. 2. During single stroke mode and at the end of a normal stroke, the PM is looking for all active run buttons to be released within 1 second of de-energizing clutch valve outputs. 3. After the arm continuous button is released, if all active station run buttons are not released within 0.1 second.	
		IN GENERAL, THESE MESSAGES OCCUR TO PREVENT THE FOLLOWING: 1 ANTI-TIE DOWN - The PM requires that both buttons be released if both were pressed and then one has been released. There is no time delay for this condition to cause a trip message. The PM also requires that once one button is pressed, the other button needs to be pressed within 0.5 seconds to continue to operate without a problem. 2. Indication of change in the station active/bypass state or nc/no contact wiring.	Check for proper wiring of station run buttons. Check for proper operation of run button contacts.
6B	N	AWAITING RELEASE OF BOTH INCH BUTTOns.	You must press, release, and press again both INCH buttons before PM can allow further press motion.
6C	N	AWAITING RELEASE OF ARM CONTINUOUS BUTTON.	After releasing the ARM CONTINUOUS button, you have 5 seconds to press all RUN buttons before the PM can enter continuous mode.
6D	N	CONTINUOUS CYCLE NOT ARMED.	You cannot enter continuous mode until you press the ARM CONTINUOUS button. You must release it before pressing all RUN buttons within 5 seconds.
6E	N	AWAITING PC TO INHIBIT STOP-ON-TOP SIGNAL.	The PM module is still receiving the STOP-ON-TOP command. It must cease before the PM can enter continuous mode. Check your ladder logic (figure 4.6, 4.7, or 4.8).
6F	N	AWAITING RELEASE OF ALL STOP-ON-TOP BUTTONS.	You must release the STOP-ON-TOP buttons of all active stations before the PM can start any press motion resulting from pressing RUN buttons.

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
DOWNSTROKE MESSAGES			
66 67 (ALT)	L	ANTI-REPEAT CAM SWITCH OPEN DURING DOWNSTROKE During downstroke and before the near bottom zone, the anti-repeat cam is on, the brake monitor cam is on, and the run-on cam is off. This message will occur if the PM sees the anti-repeat cam signal go off during downstroke.	See Standard Corrective Action **
UPSTROKE MESSAGES			
68 069 (ALT)	L	"RUN-ON CAM OPENED BEFORE SEEING THE ANTI-REPEAT CAM TRANSITION OT OFF" Once the press is in the near bottom zone, the PM needs to see a off-on transition of the anti-repeat cam signal during the up-stroke. If the run-on cam opens before this transition, this message will occur.	See Standard Corrective Action **
70	N	RUN BUTTON RELEASED DURING FIRST UPSTROKE IN CONTINUOUS MODE. INCH TO TOP.	This message appears when you select stroke-and-a-half for entering continuous mode you release one (or both) RUN buttons during the first upstroke. You must enter INCH mode and inch the press to the top to continue normal press operation.
71	N	SHAFT NEAR TOP. INCH TO TOP.	You cannot enter single or continuous mode unless the press is at proper "near top" starting position. (figure 5.1). Check CAM switch wiring. (figure 6.9).
BRAKE OR MOTION DETECTOR MESSAGES			
72 73	L	"BRAKE OVERRUN" "BRAKE OVERRUN - INCH BACK TO TOP" If the press has not stopped within the open window of the near top position, this indicates that the press has traveled too far. Code 73 means that the press was in the single stroke or continuous mode and now must be inched back to the near top position.	Check alignment of the run-on and brake monitor cams to conform to fig. 5.1 in the PM manual, and to assure adequate and safe stopping distance before reaching the brake monitor cam. Check the condition of the brake.
074 075	L	"MOTION DETECTOR SIGNAL IS LATE OR MISSING" "MOTION DETECTOR SIGNAL DISAPPEAR ON UP-STROKE. The motion detector input signal must come on by the time the brake monitor cam goes off. This message will also occur when the press is in a up-stroke and the motion detector signal disappears.	Check for the proper dip switch settings. Check for proper cam configuration and operation. Check for proper motion detector feedback.
076	L	"MOTION DETECTOR SIGNAL DISAPPEARANCE DURING ON-HOP DOWNSTROKE" A successful on-hop operation was achieved, and during the down-stroke, the motion detector signal was missing for a time period greater than 0.11 seconds.	Check for proper cam configuration and operation (see fig. 5.1). Check for proper motion detector feedback.

BRAKE OR MOTION DETECTOR MESSAGES (cont'd)

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
077 078	L	"MOTION DETECTOR SIGNAL DISAPPEARANCE ON 2ND DOWNSTROKE" "MOTION DETECTOR SIGNAL DISAPPEARANCE DURING CONTINUOUS CYCLE" Proper motion detection must be seen for press operation to continue.	Check for proper cam configuration and operation (fig. 5.1). Check for proper motion detector feedback signal. *Requires stopping and existing continuous mode. Inch to near top zone to start next single/continuous stroke.
079 07A	L	"MOTION DETECTOR SIGNAL DISAPPEARS AT NEAR BOTTOM" "MOTION DETECTOR SIGNAL DISPAPPEARS AT NEAR TOP" The motion detector signal must come on by the time the brake monitor cam opens in the near bottom zone, and must remain on to continue stroking. This message will also occur when the press is in an upstroke and the motion detector signal disappears.	Check for proper cam configuration and operation (fig. 5.1). Check for proper motion detector feedback.
07B	T	"MOTION DETECTOR SIGNAL COMES ON WHILE PRESS IS STOPPED"	Check for a faulty motion detector or a shorted wire condition. Check for proper clutch operation.
07C	T	"MOTION DETECTOR SIGNAL REMAINS ON AFTER PRESS STOPS" The motion detector signal needs to drop out within 4 seconds after clutch solenoid outputs are de-energized.	Check for a faulty motion detector or a shorted wire condition. Check for proper clutch operation.
080 081 082 083	L	"BRAKE MONITOR AND RUN-ON CAM SWITCHES ARE BOTH CLOSED" "BRAKE MONITOR FOR THIS CHASSIS AND RUN-ON CAM FOR THE OTHER CHASSIS BOTH CLOSED" "BRAKE MONITOR FOR THE OTHER CHASSIS AND RUN-ON CAM FOR THIS CHASSIS BOTH CLOSED" "ALT BRAKE MONITOR AND RUN-ON CAM SWITCHES ARE BOTH CLOSED" There should not be any overlap of the brake monitor and run-on cam switches at the near top position.	Check for proper cam configuration and operation (See fig. 5.1). Check for a faulty cam limit switch.

BRAKE OR MOTION DETECTOR MESSAGES (cont'd)

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
084 085	L	"RUN-ON CAM SWITCH CLOSED, SHOWING REVERSE MOTION" (ALT CHASSIS) Both the run-on and brake monitor cams were off signaling the press was in the near top position, and then the run-on cam switch signal came on again. *Note - Can only occur if the main motor forward input is on.	Check for proper cam operation. Check for proper operation of pc logic. Check clutch operation.
CAM LIMIT SWITCH - TRANSITION TO DOWNSTROKE MESSAGES			
086 087 088 089	L	"RUN ON CAM SWITCH CLOSED" (ALT CHASSIS) The press is in transition to down-stroke (brake monitor cam on and run-on cam off), and the run-on cam came back on. BCAM SWITCH BOUNCED WHEN TURNING ON. CONTACTS WORN OR DIRTY.	See Standard Corrective Action ** 1. Replace BCAM contacts. 2. Press Reset-latched-msg PB (0D code appears) 3. Cycle swingarm power and restart press.
CAM LIMIT SWITCH - DOWNSTROKE MESSAGES			
08A 08B 08C 08D	L	"BRAKE MONITOR OPENED WHEN RUN-ON CAM SWITCH IS CLOSED" "LOCAL BRAKE MONITOR OPEN REMOTE RUN-ON CAM SWITCH CLOSED" "REMOTE BRAKE MONITOR OPEN LOCAL RUN-ON CAM SWITCH CLOSED" "REMOTE BRAKE MONITOR OPEN REMOTE RUN-ON CAM SWITCH CLOSED" The PM needs to see the downstroke, near bottom, and upstroke cam conditions in order for correct opertion. This message indicates that the PM saw a downstroke and then a upstroke without passing through the near bottom zone.	See Standard Corrective Action **
08E 08F	L	"BRAKE MONITOR CAM SWITCH OPEN AND RUN-ON CAM SWITCH OPEN SHOWING REVERSE MOTION" (ALT CHASSIS) During single stroke or continuous mode, only forward motion is allowed. When the press was in the downstroke, the brake monitor cam and the run-on cam switches were on, signaling a transition from downstroke directly to the near top zone.	See Standard Corrective Action **. Also check for proper clutch operation.

CAM LIMIT SWITCH - TRANSITION TO NEAR BOTTOM ZONE MESSAGES			
HEX CODE	**TYPE**	**PROBLEM**	**CORRECTIVE ACTION**
090 091	L	"BRAKE MONITOR CAM SWITCH OPEN" (ALT CHASSIS) The PM logic was in a momentary zone transition state between downstroke and near bottom zones. Before being able to fully transition into the near bottom zone, the brake monitor cam turned off, signaling instead, a transition to the upstroke.	See Standard Corrective Action **
092 093	L	"RUN-ON CAM BOUNCED OR MOTION REVERSED" (ALT CHASSIS) During single stroke or continuous mode, only forward motion is allowed. When the press is in the near bottom zone, the brake monitor cam and the run-on cam switches are closed. The PM then sees the run-on cams open before the brake monitor opens, signaling a reverse back to the downstroke position.	See Standard Corrective Action **. Also check for proper clutch operation.
CAM LIMIT SWITCH - NEAR BOTTOM ZONE MESSAGES			
094 095 096 097	L	"BRAKE MONITOR AND RUN-ON CAM SWITCHES BOTH OPEN" "LOCAL BRAKE MONITOR AND REMOTE RUN-ON CAM SWITCHES BOTH OPEN" "REMOTE BRAKE MONITOR AND LOCAL RUN-ON CAM SWITCHES BOTH OPEN" (ALT CHASSIS FOR 094) The PM is presently in the near bottom zone of the stroke (run-on and brake monitor cam switches on). This message occurs when the PM sees an incorrect transition directly to the near top zone (run-on and brake monitor cam switches off), without going through the upstroke.	See Standard Corrective Action **
098 099	L	"RUN-ON CAM SWITCH OPEN SHOWING REVERSE MOTION" (ALT CHASSIS) During single stroke or continuous mode, only forward motion is allowed. This message occurs when the press is in the near bottom zone, and then the run-on cam switch opens before the brake monitor cam opens, signaling reverse motion.	See Standard Corrective Action **. Also check for proper clutch operation.
09A 09B	L	"RUN-ON CAM SWITCH OPEN" (ALT CHASSIS) The PM logic was momentarily in a zone transition state between the near bottom and up-stroke zones. Before being able to fully transition to the upstroke, the PM saw the run-on cam signal go off.	See Standard Corrective Action **

CAM LIMIT SWITCH - NEAR BOTTOM ZONE MESSAGES (cont'd)

HEX CODE	TYPE	PROBLEM	CORRECTIVE ACTION
09C 09D	L	"BRAKE MONITOR CAM SWITCH BOUNCED OR MOTION REVERSED" (ALT CHASSIS) During single stroke or continuous mode, only forward motion is allowed. This message occurs when the PM sees a transition to upstroke (run-on cam on, brake monitor cam off) and then sees the brake monitor cam come back on, before the run-on cam opens.	See Standard Corrective Action **. Also check for proper clutch operation.
CAM LIMIT SWITCH - UPSTROKE MESSAGES			
09E 09F 0A0 0A1	L	"BRAKE MONITOR CLOSED WHEN RUN-ON CAM SWITCH OPENED" "LOCAL BRAKE MONITOR CLOSED WHEN REMOTE RUN-ON CAM SWITCH OPENED" "REMOTE BRAKE MONITOR CLOSED WHEN LOCAL RUN-ON CAM SWITCH OPENED" "REMOTE PM'S BRAKE MONITOR SIGNAL IS ON WHEN REMOTE PM'S RUN-ON CAM SIGNAL IS OFF" The PM saw that the press was in a upstroke (run-on cam on and brake monitor cam going off), and then saw an incorrect zone transition to downstroke (run-on cam off and brake monitor cam on), without going through the near top zone.	See Standard Corrective Action **
0A2 0A3	L	"BRAKE MONITOR CAM SWITCH CLOSED SHOWING REVERSE MOTION" (ALT CHASSIS) During single stroke or continuous mode, only forward motion is allowed. The PM saw that the press was in an upstroke, and then saw an incorrect zone transition back to the near bottom zone.	See Standard Corrective Action **. Also check for proper clutch operation.
CAM LIMIT SWITCH - TRANSITION TO NEAR TOP ZONE MESSAGES			
0A4 0A5	L	"BRAKE MONITOR CAM SWITCH CLOSED" (ALT CHASSIS) The PM logic was momentarily in a zone transition state between the upstroke and near top zones. Before being able to fully transition to the near top zone, the brake montior cam signal came on, signaling instead, a zone transition to downstroke.	See Standard Corrective Action **. Also check for a possible brake problem.

CAM LIMIT SWITCH - TRANSITION TO NEAR TOP ZONE MESSAGES (cont'd)			
HEX CODE	**TYPE**	**PROBLEM**	**CORRECTIVE ACTION**
0A6 0A7	L	"RUN-ON CAM SWITCH BOUNCED OR MOTION REVERSED" (ALT CHASSIS) During single stroke or continuous mode, only forward motion is allowed. The PM saw that it was in transition to the near top zone, and then saw the run-on cam input come back on possible showing reverse motion.	See Standard Corrective Action **. Also check for proper clutch operation.
DIAGNOSTIC MESSAGES			
F1	L	"LOST COMMUNICATION BETWEEN 1771-PM MODULES"	Check rack communication cable. Cycle rack power.
F2	L	"LOST COMMUNICATION TO PROGRAMMABLE CONTROLLER"	Check rack communication cable. Check for proper rack and scanner configuration. Check for potential electrical noise problem. Cycle rack power.
AA	L	ALL CAM SWITCHES TURN OFF.	1. Disconnected ground to 1771-IA module. Disconnected power to CAM switches,. disconnected swingarm to 1771-IA. bad 1771-IA module. 2. Press Reset-latched-msg PB.
A8	N	CAM SWITCHES CANNOT DETECT SHAFT POSITION.	Same as AA except not a latched-message code.
A9	N	ALL CAM SWITCHES ARE OFF. NEVER DETECTED ON.	Same as A8.

Complete Listing of diagnostic message codes

The complete diagnostic message table is divided into sections and subsections common to a device, operating condition, or hardware condition to assist your troubleshooting. When a diagnostic condition is detected and a message code is displayed, look for the problem in the section/subsection in which the message code is tabulated. Table 7.D also refers you to figures and/or tables to assist you in determining the cause of the fault condition.

We present a complete list of diagnostic message codes to assist in troubleshooting. They are grouped as follows:

- Press operation
  - Stations 1, 2, 3, and 4
  - Inch button
- Valve stem inputs not configured
- Downstroke fault
- Upstroke fault
- Fault in setup for continuous mode
- Faulty brake or motion detector
- Faulty cam limit switch
- General faults
- Configuration error
- Motion detector and pressure switch faults
- Triac faults
- Fault in valve stem feedback
- Hardware or cable faults
- Micro-inch diagnostic codes

Table 7.D
Diagnostic Messages

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message N = Non-latched L = Latched T = Trip Condition	**Code** P = at Power-up Alt = Alternate chassis Ethr = Either chassis Top = Top chassis Bot = Bottom chassis

Hex Code		**Type**	**Diagnostic Message (figure References)**
			Press Operation Inhibited
01		N	Improper mode selection (6.12)
02		N	All stations bypassed. (6.13 thru 6.16)
03		N	Shaft not near top. Can not enter single or continuous mode. (5.1, 6.11)
04		N	Awaiting release of all RUN buttons for entering single or continuous mode. (6.13 thru 6.16)
05		N	Main motor forward dropout or absent (6.12)
06		N	Anti-repeat cam switch open, preventing entry to single or continuous mode (5.5, 6.11)
07		N	Awaiting release of all STOP-ON-TOP buttons for entering continuous mode. (5.5, 6.12)
08		N	Awaiting release of ARM CONTINUOUS button for entering continuous mode.(5.5, 6.12)
09		N	Barrier guard dropout or absent. (5.5, 6.12)
0A		N	PC enable dropout or absent. (4.5, 4.7)
0B		N	Stop-on-top signal from PC preventing entry to continuous mode. (4.5, 4.7)
0C		N	Awaiting release of INCH buttons for entering inch mode. (5.2, 6.13)
0D		N	Awaiting solenoid power to reset stop condition. Press E-STOP, then START buttons. (6.1, 6.6)
0E		N	PC run mode dropout or absent.
0F		N	Press interlock dropout or absent. (6.2, 6.7)
			Station 1 (Figure 6.13)
10		N	Check RUN button signals. Make station active or bypassed.
11		N	RUN button not released. Check (NO) contacts.
12Alt		N	RUN button not released. Check (NO) contacts.

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message N = Non-latched L = Latched T = Trip Condition	**Code** P = at Power-up Alt = Alternate chassis Ethr = Either chassis Top = Top chassis Bot = Bottom chassis

Hex Code		**Type**	**Diagnostic Message (figure References)**
13		N	RUN button not released. Check (NC) contacts.
14Alt		N	RUN button not released. Check (NC) contacts.
15	P	N	Make left and right active connections identical.
16	P	N	(NC) RUN button is open. Check button or wiring.
17	P	N	(NO) RUN button is shorted. Check button or wiring.
18		T	Active input changed from closed to open. Check wiring.
19	Alt	T	Active input changed from closed to open. Check wiring.
1A		T	(NC) RUN button bypass is open. Check wiring
1B	Alt	T	(NC) RUN button bypass is open. Check wiring
1C		T	(NO) RUN button bypass is open. Check wiring
1D	Alt	T	(NO) RUN button bypass is open. Check wiring
1E			Not Used.
1F			Not Used
			Station 2 (Figure 6.14)
20		N	Check RUN button signals. Make station active or bypassed.
21		N	RUN button not released. Check (NO) contacts.
22	Alt	N	RUN button not released. Check (NO) contacts.
23		N	RUN button not released. Check (NC) contacts.
24	Alt	N	RUN button not released. Check (NC) contacts.
25	P	N	Make left and right active connections identical.
26	P	N	(NC) RUN button is open. Check button or wiring.
27	P	N	(NO) RUN button is shorted. Check button or wiring.

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message N = Non-latched L = Latched T = Trip Condition	**Code** P = at Power-up Alt = Alternate chassis Ethr = Either chassis Top = Top chassis Bot = Bottom chassis

Hex Code		**Type**	**Diagnostic Message (figure References)**
28		T	Active input changed from closed to open. Check wiring.
29	Alt	T	Active input changed from closed to open. Check wiring.
2A		T	(NC) RUN button bypass is open. Check wiring
2B	Alt	T	(NC) RUN button bypass is open. Check wiring
2C		T	(NO) RUN button bypass is open. Check wiring
2D	Alt	T	(NO) RUN button bypass is open. Check wiring
2E			Not Used.
2F			Not Used
			Station 3 (Figure 6.15)
30		N	Check configuration of RUN button signals. Make station active or bypassed
31		N	RUN button not released. Check (NO) contacts.
32	Alt	N	RUN button not released. Check (NO) contacts.
33		N	RUN button not released. Check (NC) contacts.
34	Alt	N	RUN button not released. Check (NC) contacts.
35	P	N	Make left and right active connections identical.
36	P	N	(NC) RUN button is open. Check button or wiring.
37	P	N	(NO) RUN button is shorted. Check button or wiring.
38		T	Active input changed from closed to open. Check wiring.
39	Alt	T	Active input changed from closed to open. Check wiring.
3A		T	(NC) RUN button bypass is open. Check wiring
3B	Alt	T	(NC) RUN button bypass is open. Check wiring
3C		T	(NO) RUN button bypass is open. Check wiring

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message N = Non-latched L = Latched T = Trip Condition	**Code** P = at Power-up Alt = Alternate chassis Ethr = Either chassis Top = Top chassis Bot = Bottom chassis

Hex Code		**Type**	**Diagnostic Message (figure References)**
3D	Alt	T	(NO) RUN button bypass is open. Check wiring
3E		N	Station signals present though not configured.
3F	Alt	N	Station signals present though not configured.
			Station 4 (Figure 6.16)
40		N	Check configuration of RUN button signals. Make station active or bypassed
41		N	RUN button not released. Check (NO) contacts.
42	Alt	N	RUN button not released. Check (NO) contacts.
43		N	RUN button not released. Check (NC) contacts.
44	Alt	N	RUN button not released. Check (NC) contacts.
45	P	N	Make left and right active connections identical.
46	P	N	(NC) RUN button is open. Check button or wiring.
47	P	N	(NO) RUN button is shorted. Check button or wiring.
48		T	Active input changed from closed to open. Check wiring.
49	Alt	T	Active input changed from closed to open. Check wiring.
4A		T	(NC) RUN button bypass is open. Check wiring
4B	Alt	T	(NC) RUN button bypass is open. Check wiring
4C		T	(NO) RUN button bypass is open. Check wiring
4D	Alt	T	(NO) RUN button bypass is open. Check wiring
4E			Not Used.
4F			Not Used
			Inch button (Figure 6.13)

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message N = Non-latched L = Latched T = Trip Condition	**Code** P = at Power-up Alt = Alternate chassis Ethr = Either chassis Top = Top chassis Bot = Bottom chassis

Hex Code		**Type**	**Diagnostic Message (figure References)**
50			Swingarm power absent
51		N	INCH button not released. Check (NO) contacts.
52	Alt	N	INCH button not released. Check (NO) contacts.
53		N	INCH button not released. Check (NC) contacts.
54	Alt	N	INCH button not released. Check (NC) contacts.
55	P	N	INCH button not released. Check (NC) contacts.
56	P, Alt	N	INCH button not released. Check (NC) contacts.
57	P	N	INCH button not released. Check (NC) contacts.
58	P, Alt	N	INCH button is not released. Check (NO) contacts).
59			Not used.
			Valve Stem Inputs Not Configured
5A		T	Main valve stem input is present but not configured. (6.17)
5B	Alt	T	Main valve stem input is present but not configured. (6.17)
5C		T	Auxiliary valve stem input is present but not configured. (6.17)
5D	Alt	T	Auxiliary valve stem input is present but not configured. (6.17)
5E		T	Dump valve stem input is present but no configured. (6.4, 6.9)
5F	Alt	T	Dump valve stem input is present but no cinfigured. (6.4, 6.9)
			Downstroke Fault
60		L	RUN button in station 1 released too late in the downstroke.(5.3,5.6,6.13)
61		L	RUN button in station 1 released too late in the downstroke.(5.3,5.6,6.13)
62		L	RUN button in station 1 released too late in the downstroke.(5.3,5.6,6.13)

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
0110 0011	63	L		RUN button in station 1 released too late in the downstroke.(5.3,5.6,6.13)
0110 0100	64	N		Anti-repeat cam switch open while awaiting start or restart of downstroke (6.11)
0110 0101	65	N	Alt	Anti-repeat cam switch open while awaiting start or restart of downstroke (6.11)
0110 0110	66	L		Anti-repeat cam switch open during downstroke (6.11)
0110 0111	67	L	Alt	Anti-repeat cam switch open during downstroke (6.11)
				Upstroke Fault
0110 1000	68	L		Run-on cam switch opened too soon, or anti-repeat cam switch closed continuously. (6.11)
0110 1001	69	L	Alt	Run-on cam switch opened too soon, or anti-repeat cam switch closed continuously. (6.11)
0110 1010	6A	N		Awaiting release of all RUN button. (6.13 thru 6.16)
0110 1011	6B	N		Awaiting release of all RUN button. (6.13 thru 6.16)
				Fault in Set-up for Continuous Mode
0110 1100	6C	N		Awaiting release of ARM CONTINUOUS button. (5.5, 6.12)
0110 1101	6D	N		Continuous cycle not armed. (5.5)
0110 1110	6E	N		Awaiting PC to inhibit stop-on-top signal. (4.5, 4.7)
0110 1111	6F	N		Awaiting release of all STOP-ON-TOP buttons. (6.12)
0111 0000	70	N		RUN button released during first upstroke in continuous mode. Inch to op. (5.7,6.13 thru 6.16)
0111 0001	71	N		Shaft not near top. Inch to top. (5.1)
				Faulty Brake or Motion Detector
0111 0010	72	N		Faulty brake. reset swingarm power. (5.2, 5.4, 5.8)
0111 0011	73	N		Faulty brake. reset swingarm power and inch to top. (5.2, 5.4, 5.8)
0111 0100	74	L		Motion detector signal missing at start of downstroke. (5.1, 6.17)
0111 0101	75	L		Motion detector signal missing during upstroke. (5.1, 6.17)

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message N = Non-latched L = Latched T = Trip Condition			**Code** P = at Power-up Alt = Alternate chassis Ethr = Either chassis Top = Top chassis Bot = Bottom chassis	
Binary	**Hex**	**Type**	**Code**	**Diagnostic Message (figure References)**
0111 0110	76	L		Motion detector signal missing during on-the-hop downstroke. (5.1, 6.17)
0111 0111	77	L		Motion detector signal missing during second downstroke. (5.1, 6.17)
0111 1000	78	L		Motion detector signal missing during continuous cycle. (5.1, 6.17)
0111 1001	79	L		Motion detector signal missing at near bottom. (5.1, 6.17)
0111 1010	7A	L		Motion detector signal missing at near top. (5.1, 6.17)
0111 1011	7B	T		Motion detector signal comes on while press is stopped. (6.17)
0111 1100	7C	T		Motion detector signal remains on after press stops. (6.17)
0111 1101	7D			Not used.
0111 1110	7E			Not used
0111 1111	7F			Not used
				Faulty Cam Limit Switch
Near Top Position (Figures 5.1, 6.11)				
1000 0000	80	L		Brake monitor and run-on cam switches both closed.
1000 0001	81	L		Brake monitor for this chassis and run-on cam switch for the other chassis both closed.
1000 0010	82	L		Brake monitor for this chassis and run-on cam switch for the other chassis both closed.
1000 0011	83	L	Alt	Brake monitor and run-on cam switches both closed.
1000 0100	84	L		Run-on cam switch closed, showing reverse motion.
1000 0101	85	L	Alt	Run-on cam switch closed, showing reverse motion.
Transition to Downstroke (Figures 5.1, 6.11)				
1000 0110	86	L		Run-on cam switch closed.
1000 0111	87	L	Alt	Run-on cam switch closed.

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
1000 1000	88	L		Brake monitor cam switch bounced or motion reversed.
1000 1001	89	L	Alt	Brake monitor cam switch bounced or motion reversed.
Downstroke (Figures 5.1, 6.11)				
10001010	8A	L		Brake monitor open when run-on cam switch is closed.
1000 1011	8B	L		Brake monitor for this chassis open when run-on cam switch for the other chassis is closed.
1000 1100	8C	L		Brake monitor for this chassis open when run-on cam switch for the other chassis is closed.
1000 1101	8D	L	Alt	Brake monitor open when run-on cam switch is closed.
1000 1110	8E	L		Brake monitor can switch open, showing reverse motion.
1000 1111	8F	L	Alt	Brake monitor can switch open, showing reverse motion.
Transition to Near Bottom Zone (Figures 5.1, 6.11)				
1001 0000	90	L		Brake monitor cam switch open.
1001 0001	91	L	Alt	Brake monitor cam switch open.
1001 0010	92	L		Run-on cam switch bounced or motion reversed.
1001 0011	93	L	Alt	Run-on cam switch bounced or motion reversed.
Near Bottom Zone (Figures 5.1, 6.11)				
1001 0100	94	L		Brake monitor and run-on cam switches both open.
1001 0101	95	L		Brake monitor for this chassis and run-on cam switch for the other chassis both open.
1001 0110	96	L		Brake monitor for this chassis and run-on cam switch for the other chassis both open.
1001 0111	97	L	Alt	Brake monitor and run-on cam switches both open.
1001 1000	98	L		Run-on cam switch open, showing reverse motion.
1001 1001	99	L	Alt	Run-on cam switch open, showing reverse motion.

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
Transition to Upstroke (Figures 5.1, 6.11)				
1001 1010	9A	L		Run-on cam switch open.
1001 1011	9B	L	Alt	Run-on cam switch open.
1001 1100	9C	L		Brake monitor cam switch bounced or motion reversed.
1001 1101	9D	L	Alt	Brake monitor cam switch bounced or motion reversed.
Upstroke (Figures 5.1, 6.11)				
1001 1110	9E	L		Brake monitor closed when run-on cam switch opened.
1001 1111	9F	L		Brake monitor for this chassis closed when run-on cam switch for the other chassis is open.
1010 0000	A0	L		Brake monitor for this chassis closed when run-on cam switch for the other chassis is open.
1010 0001	A1	L	Alt	Brake monitor closed when run-on cam switch is open.
1010 0010	A2	L		Brake monitor cam switch closed, showing reverse motion.
1010 0011	A3	L	Alt	Brake monitor cam switch closed, showing reverse motion.
Transition to Near Top Zone (Figures 5.1, 6.11)				
1010 0100	A4	L		Brake monitor cam switch closed.
1010 0101	A5	L	Alt	Brake monitor cam switch closed.
1010 0110	A6	L		Run-on cam switch bounced or motion reversed.
1010 0111	A7	L	Alt	Run-on cam switch bounced or motion reversed.

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
1011 1100	BC	T		Air pressure signal present though air pressure feedback is not configured.
1011 1101	BD	T		Air pressure signal on when triacs are off.
1011 1110	BE	T		Air pressure signal on when triacs are on.
1011 1111	BF	T		Air pressure signal remains after triacs turn off.
				Triac Fault
1100 0000	C0	T	Ethr	Triac 0 on when commanded off. [1]
1100 0001	C1	T	Ethr	Triac 1 on when commanded off. [1]
1100 0010	C2	T	Ethr	Triac 2 on when commanded off. [1]
1100 0011	C3	T	Ethr	Triac 3 on when commanded off. [1]
1100 0100	C4	T	Ethr	Triac 6 on when commanded off. [1]
1100 0101	C5	T	Ehtr	Triac 7 on when commanded off. [1]
1100 0110	C6	T	Bot	Triac 0 on when commanded off. [1]
1100 0111	C7	T	Bot	Triac 1 on when commanded off. [1]
1100 1000	C8	T	Bot	Triac 2 on when commanded off. [1]
1100 1001	C9	T	Bot	Triac 3 on when commanded off. [1]
1100 1010	CA	T	Bot	Triac 6 on when commanded off. [1]
1100 1011	CB	T	Bot	Triac 7 on when commanded off. [1]
1100 1100	CC	T	Top	Triac 0 off when commanded off. [1]
1100 1101	CD	T	Top	Triac 1 off when commanded off. [1]
1100 1110	CE	T	Top	Triac 2 off when commanded off. [1]
1100 1111	CF	T	Top	Triac 3 off when commanded off. [1]
1101 0000	D0	T	Top	Triac 6 off when commanded on. [1]

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
1101 0001	D1	T	Top	Triac 7 off when commanded on. [1]
1101 0010	D2	T	Ethr	Triac 0 off when commanded on. [1]
1101 0011	D3	T	Ethr	Triac 1 off when commanded on. [1]
1101 0100	D4	T	Ethr	Triac 2 off when commanded on. [1]
1101 0101	D5	T	Ethr	Triac 3 off when commanded on. [1]
1101 0110	D6	T	Ethr	Triac 6 off when commanded on. [1]
1101 0111	D7	T	Ethr	Triac 7 off when commanded on. [1]
1101 1000	D8	T	Top	Triac 0 remains on after turned off. [1]
1101 1001	D9	T	Top	Triac 1 remains on after turned off. [1]
1101 1010	DA	T	Top	Triac 2 remains on after turned off. [1]
1101 1011	DB	T	Top	Triac 3 remains on after turned off. [1]
1101 1100	DC	T	Top	Triac 6 remains on after turned off. [1]
1101 1101	DD	T	Top	Triac 7 remains on after turned off. [1]
				Fault in Valve Stem Feedback
1101 1110	DE	T		Main valve stem signal on when triacs are off. [1]
1101 1111	DF	T	Alt	Main valve stem signal on when triacs are off. [1]
1110 0000	E0	T		Aux. valve stem signal on when triacs are off. [1]
1110 0001	E1	T	Alt	Aux. valve stem signal on when triacs are off. [1]
1110 0010	E2	T		Dump valve stem signal on when traics are off. [1]
1110 0011	E3	T	Alt	Dump valve stem signal on when traics are off. [1]
1110 0100	E4	T		Main valve stem signal off when triacs are on. [1]
1110 0101	E5	T	Alt	Main valve stem signal off when triacs are on. [1]

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
1110 0110	E6	T		Aux. valve stem signal off when triacs are on. [1]
1110 0111	E7	T	Alt	Aux. valve stem signal off when triacs are on. [1]
1110 1000	E8	T		Dump valve stem signal off when traics are on. [1]
1110 1001	E9	T	Alt	Dump valve stem signal off when traics are on. [1]
1110 1010	EA	T		Main valve stem signal remains on after triacs turn off. [1]
1110 1011	EB	T	Alt	Main valve stem signal remains on after triacs turn off. [1]
1110 1100	EC	T		Aux. valve stem signal remain on after triacs turn off. [1]
1110 1101	ED	T	Alt	Aux. valve stem signal remain on after triacs turn off. [1]
1110 1110	EE	T		Dump valve stem signal remains on after traics tuirn off. [1]
1110 1111	EF	T	Alt	Dump valve stem signal remains on after traics tuirn off. [1]
				Hardware or Cable Fault
1111 0000	F0	T	Alt	Chassis power tripped or chassis restarted. (6.1, 6.6)
1111 0001	F1	L		Lost communications between 1771-PM modules. Reset latched message, check cables, or cycle power. (3.3)
1111 0010	F2	L		Lost communications with PC. Reset latched mesage, check cables, or cycle power. (3.3)
1111 0011	F3	L	Alt	Lost communications with PC. Reset latched mesage, check cables, or cycle power. (3.3)
1111 0100	F4	N		Lost communications between 1771-PM modules. [2]
1111 0101	F5	N		Hardware fault in 1771-PM module. Replace it.
1111 0110	F6	N		Turn off backplane switch 1. (3.4)
1111 0111	F7	N		Hardware fault in 1771-PM module. [2]
1111 1000	F8	N		Not used
1111 1001	F9	N		Hardware fault in 1771-PM module. [2]
1111 1010	FA	N		1771-PM modules must be same revision.
1111 1011	FB	N		Hardware fault in 1771-PM module. Replace it.

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
1111 1100	FC	N		Backplane error. Replace chassis. [2]
1111 1101	FD	N		Hardware fault in 1771-PM module. [2]
1111 1110	FE	N		Hardware fault in 1771-PM module. [2]
1111 1111	FF	N		Power-up other 1771-PM module.
				Micro-inch Diagnostic Codes (Examine module group 3, slot 1, bit 2, chassis A and B for MSB)
1 0101 1010	15A	T		Micro-inch valve stem input is present though not configured.
1 0101 1011	15B	T	Alt	Micro-inch valve stem input is present though not configured.
1 1011 1100	1BC	T		Micro-inch clutch pressure input is present though not configured.
1 1011 1101	1BD	T		Micro-inch clutch pressure input is present when triacs are off.
1 1011 1110	1BE	T		Micro-inch clutch pressure input is off when triacs are on.
1 1011 1111	1BF	T		Micro-inch clutch pressure input remains on after triacs turn off.
1 1100 0000	1C0	T	Ethr	Triac 8 is on when commanded off.
1 1100 0001	1C1	T	Ethr	Triac 9 is on when commanded off.
1 1100 0110	1C6	T	Bot	Triac 8 is on when commanded off.
1 1100 0111	1C7	T	Bot	Triac 9 is on when commanded off.
1 1100 1100	1CC	T	Top	Triac 8 is off when commanded on.
1 1100 1101	1CD	T	Top	Triac 9 is off when commanded on.
1 1101 0010	1D2	T	Ethr	Triac 8 is off when commanded on.
1 1101 0011	1D3	T	Ethr	Triac is off when commanded on.

diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
1 1101 1000	1D8	T	Ethr	Triac 8 remains on after triacs turn off.
1 1101 1001	1D9	T	Ethr	Triac 9 remains on after triacs turn off.
1 1101 1110	1DE	T		Micro-inch valve stem input is on when triacs are off.
1 1101 1111	1DF	T	Alt	Micro-inch valve stem input is on when triacs are off.
1 1110 0100	1E4	T		Micro-inch valve stem input is off when triacs are on.
1 1110 0101	1E5	T	Alt	Micro-inch valve stem input is off when triacs are on.
1 1110 1010	1EA	T		Micro-inch valve stem input remains on after triacs turn off.
1 1110 1000	1E8	T	Alt	Micro-inch valve stem input remains on after triacs turn off.
1 1111 1111	1FF	N		Lamp test in progress

[2] Refer to ACTIVE indicator (table 7.A) or FAULT indicators (table 7.B).

Summary

Now that you have read this chapter, you should have a general idea of how to safely troubleshoot your press system. This chapter showed you how to interpret the diagnostic diagnostic message codes and status indicators of your clutch/brake controller. It also referred you to the associated connection diagrams for locating the fault.

Diagnostic diagnostic message codes in Table 7.C

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
Other Cam Limit Switch Faults (Figures 5.1, 6.11)				
1010 1000	A8	N	P	Cam switches cannot determine shaft position. Inch to top.
1010 1001	A9	N	P	All cam switches are open.
1010 1010	AA	L		Cam switches cannot determine shaft position. Inch to top.
				General Faults
1010 1011	AB	N		Not used.
1010 1100	AC	L		Crowbar test input is ON. Check wiring of crowbar testt circuit
1010 1101	AD	N		Awaiting turn off of crowbar relay test.
1010 1110	AE	N		Awaiting turn off of crowbar relay test.
1010 1111	AF	N		Awaiting solenoid power.
				Configuration Error
1011 0000	B0	N	Alt	Configuration error in alternate module. Configure it correctly or match inputs to your configuration.
1011 0001	B1	N		Turn off backplane switch 1.
1011 0010	B2	N		Stations 3 and 4 configuration bitr and backplane switch mismatched
1011 0011	B3	N		Motion detector configuration bit and backplan switch mismatched.
1011 0100	B4	N		Valve stem switch configuration bit and backplance switch mismatched.
1011 0101	B5	N		Air pressure switch configuration bit and backplane switch mismatched.
1011 0110	B6	N		Ungrounded/grounded AC power configuration bit and backplane switch mismatched.
1011 0111	B7	N		On-the-hop configuration bit and backplane switch mismatched.
1011 1000	B8	N		Stroke-and-a-half configuration bit and backplane switch mismatched.
1011 1001	B9	N		Dump valve configuration bit disagrees with corresponding I/O modules in chassis.
1011 1010	BA	N		An I/O input module is missing.

Diagnostic message codes are displayed by indicators connected to module group 5, slot 1 (figure 6.18), or by displaying the corresponding data table word using the industrial terminal.

Use this table in conjunction with figure 7.1 and figure references shown in parentheses.

Type of Message
N = Non-latched
L = Latched
T = Trip Condition

Code
P = at Power-up
Alt = Alternate chassis
Ethr = Either chassis
Top = Top chassis
Bot = Bottom chassis

Binary	Hex	Type	Code	Diagnostic Message (figure References)
				Motion Detector and Pressure Switch Faults (Figures 3.4, 6.17)
1011 1011	BB	T		Motion detector signal present though motion detector feedback is not configured.
1011 1100	BC	T		Air pressure signal present though air pressure feedback is not configured.
1011 1101	BD	T		Air pressure signal on when triacs are off.
1011 1110	BE	T		Air pressure signal on when triacs are on.
1011 1111	BF	T		Air pressure signal remains after triacs turn off.

Appendix A

Bit Monitoring Addresses

Use the addresses in the following tables to monitor press operation. Address digits a, b, and c are rack address digits. Assign them as required by your application. For PLC–2/20, –2/30 processors, rack addresses are 1 thru 7. For PLC–3 processors, rack addresses are 00 thru 77. Refer to Rack Addresses of Chassis A and B, chapter 3.10 for further information.

Module Group 0

Slot 0, 1771–IA, Figure 6.10

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Selector switch OFF position	1a0/00	1b0/00	10ab0/00	10ac0/00
1	Selector switch INCH position	1a0/01	1b0/01	10ab0/01	10ac0/01
2	Selector switch SINGLE position	1a0/02	1b0/02	10ab0/02	10ac0/02
3	Selector switch CONTINUOUS position	1a0/03	1b0/03	10ab0/03	10ac0/03
4	Main motor forward (NO) contactor	1a0/04	1b0/04	10ab0/04	10ac0/04
5	Barrier guard in position (NO) limit sw.	1a0/05	1b0/05	10ab0/05	10ac0/05
6	Stop–on–top (NC) contacts	1a0/06	1b0/06	10ab0/06	10ac0/06
7	Arm continuous (NO) contacts	1a0/07	1b0/07	10ab0/07	10ac0/07

Slot 1, 1771–IA, Figure 6.11

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Station 1 left RUN (NC) contacts right RUN (NC) contacts	1a0/10	1b0/10	10ab0/10	10ac0/10
1	Station 1 right RUN (NO) contacts left RUN (NO) contacts	1a0/11	1b0/11	10ab0/11	10ac0/11
2	Station 1 left Active right Active	1a0/12	1b0/12	10ab0/12	10ac0/12
3	Station 2 left RUN (NC) contacts right RUN (NC) contacts	1a0/13	1b0/13	10ab0/13	10ac0/13
4	Station 2 right RUN (NO) contacts left RUN (NO) contacts	1a0/14	1b0/14	10ab0/14	10ac0/14
5	Station 2 left Active right Active	1a0/15	1b0/15	10ab0/15	10ac0/15
6	Left INCH (NC) contacts Right INCH (NC) contacts	1a0/16	1b0/16	10ab0/16	10ac0/16
7	Right INCH (NO) contacts Left INCH (NO) contacts	1a0/17	1b0/17	10ab0/17	10ac0/17

Module Group 1

Slot 0, 1771–IA, Figure 6.12

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Station 3 left RUN (NC) contacts right RUN (NC) contacts	1a1/00	1b1/00	10ab1/00	10ac1/00
1	Station 3 right RUN (NO) contacts left RUN (NO) contacts	1a1/01	1b1/01	10ab1/01	10ac1/01
2	Station 3 left Active right Active	1a1/02	1b1/02	10ab1/02	10ac1/02
3	Station 4 left RUN (NC) contacts right RUN (NC) contacts	1a1/03 1b1/03		10ab1/03 10ab1/03	
4	Station 4 right RUN (NO) contacts left RUN (NO) contacts	1a1/04	1b1/04	10ab1/04	10ac1/04
5	Station 4 left Active right Active	1a1/05	1b1/05	10ab1/05	10ac1/05
6	Not Used				
7	Not Used				

Slot 1, 1771–IA, Figure 6.9

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Not Used				
1	Not Used				
2	Not Used				
3	Not Used				
4	Not Used				
5	Top–stop–check Cam A (NC) limit switch Cam B (NC) limit switch	1a1/15	1b1/15	10ab1/15	10ac1/15
6	Run–on Cam A (NC) limit switch Cam B (NC) limit switch	1a1/16	1b1/16	10ab1/16	10ac1/16
7	Anti–Repeat Cam A (NC) limit switch Cam B (NC) limit switch	1a1/17	1b1/17	10ab1/17	10ac1/17

Module Group 2

Slot 0, 1771–IA, Figures 6.1 and 6.2 or 6.5 and 6.6

Term.	Function		Addresses			
			PLC–2/30 Chassis		PLC–3 Chassis	
			A	B	A	B
0	Input from Main Valve Stem (NO)	Switch A* Switch B*	1a2/00	1b2/00	10ab2/00	10ac2/00
1	Input from Motion Detector (NO)	Contacts A* Contacts B*	1a2/01	1b2/01	10ab2/01	10ac2/01
2	Input from Air Pressure (NO)	Switch A* Switch B*	1a2/02	1b2/02	10ab2/02	10ac2/02
3	Power Monitor, Mod Grp 3, Slot 0	Chassis A Chassis B	1a2/03	1b2/03	10ab2/03	10ac1/03
4	Crowbar Test Input	Crowbar A Crowbar B	1a2/04	1b2/04	10ab2/04	10ac2/04
5	Not Used					
6	Feedback from Press Interlock Switch		1a2/06	1b2/06	10ab2/06	10ac/06
7	Input from Aux. Valve Stem (NO)	Switch A* Switch B*	1a2/07	1b2/07	10ab2/07	10ac/07
* Optional						

Slot 1,1771–IA, Figure 6.3 or 6.7

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Feedback input from Triac 0 Chassis A	1a2/10	1b2/10	10ab2/10	10ac2/10
1	Feedback input from Triac 0 Chassis B	1a2/11	1b1/11	10ab/211	10ac2/11
2	Feedback input from Triac 1 Chassis A	1a2/12	1b2/12	10ab2/12	10ac2/12
3	Feedback input from Triac 1 Chassis B	1a2/13	1b2/13	10ab2/13	10ac2/13
4	Feedback input from Triac 2 Chassis A	1a2/14	1b2/14	10ab2/14	10ac2/14
5	Feedback input from Triac 2 Chassis B	1a2/15	1b2/15	10ab2/15	10ac2/15
6	Feedback input from Triac 3 Chassis A	1a2/16	1b2/16	10ab2/16	10ac2/16
7	Feedback input from Triac 3 Chassis B	1a2/17	1b2/17	10ab2/17	10ac2/17

Module Group 3

Slot 0, 1771–OD, Figure 6.3 or 6.7

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
1 & 2	Triac 0 for Main Solenoid A	1a3/00	1b3/00	10ab3/00	10ac3/00
3 & 4	Triac 1 for Main Solenoid B	1a3/01	1b3/01	10ab3/01	10ac3/01
5 & 6	Triac 2 for Auxiliary Solenoid A	1a3/02	1b3/02	10ab3/02	10ac3/02
7 & 8	Triac 3 for Auxiliary Solenoid B	1a3/03	1b3/03	10ab3/03	10ac3/03
9 & 10	Triac 4 for Crowbar Relay A Relay B	1a3/04	1b3/04	10ab3/04	10ac3/04
11 & 12	Triac 5 for Seal Relay A Relay B	1a3/05	1b3/05	10ab3/05	10ac3/05

Slot 1, 1771–OA, Figure 6.14

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	BRAKE FAULT Indicator	1a3/10		10ab3/10	
1	RUN WINDOW Indicator	1a3/11		10ab3/11	
2	MICRO–INCH Indicator	1a3/12	1b3/12	10ab3/12	10ac3/1
3–7	Not Used				

Module Group 4

Slot 0, 1771–OD, Figure 6.4 or 6.8

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
1 & 2	Triac 6 for Dump Solenoid A	1a4/00	1b4/00	10ab4/00	10ac4/00
3 & 4	Triac 7 for Dump Solenoid B	1a4/01	1b4/01	10ab4/01	10ac4/01
5 & 6	Triac 8 for Micro–inch Solenoid A	1a4/02	1b4/02	10ab4/02	10ac4/02
7 & 8	Triac 9 for Micro–Inch Solenoid B	1a4/03	1b403	10ab4/03	10ac4/03
9 & 12	Not Used	1a4/04	1b4/04	10ab4/04	10ac4/04

Slot 1, 1771–IA, Figure 6.4 or 6.8

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Feedback input from Triac 6 Chassis A	1a4/10	1b5/10	10ab4/10	10ac4/10
1	Feedback input from Triac 6 Chassis B	1a4/11	1b4/11	10ab4/11	10ac4/11
2	Feedback input from Triac 7 Chassis A	1a4/12	1b4/12	10ab4/12	10ac4/12
3	Feedback input from Triac 7 Chassis B	1a4/13	1b4/13	10ab4/13	10ac4/13
4	Input from Dump Valve Stem (NO) Switch A* Switch B*	1a4/14	1b4/14	10ab4/14	10ac4/14
5–7	Not Used				
* Optional					

Module Group 5

Slot 0, 1771–IA, Figure 6.4 or 6.8

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Selector Switch MICRO–INCH position	1a5/00	1b5/00	10ab5/00	10ac5/00
1	Input from Micro–inch valve stem	1a5/01	1b5/01	10ab5/01	10ac5/01
2	Input from Micro–inch pressure switch	1a5/02	1b5/02	10ab5/02	10ac5/02
3	Not used	1a5/03	1b5/03	10ab5/03	10ac5/03
4	Feedback input from Triac 8 Chassis A	1a5/04	1b5/04	10ab5/04	10ac5/04
5	Feedback input from Triac 8 Chassis B	1a5/05	1b5/05	10ab5/05	10ac5/05
6	Feedback input from Triac 9 Chassis A	1a5/06	1b5/06	10ab5/06	10ac5/06
7	Feedback input from Triac 9 Chassis B	1a5/07	1b5/07	10ab5/07	10ac5/07

Slot 1, 1771–OA, Figure 6.13

Term.	Function	Addresses			
		PLC–2/30 Chassis		PLC–3 Chassis	
		A	B	A	B
0	Bit 10	1a5/10	1b5/10	10ab5/10	10ac5/10
1	Bit 11	1a5/11	1b5/11	10ab5/11	10ac5/11
2	Bit 12	1a5/12	1b5/12	10ab5/12	10ac5/12
3	Bit 13	1a5/13	1b5/13	10ab5/13	10ac5/13
4	Bit 14	1a5/14	1b5/14	10ab5/14	10ac5/14
5	Bit 15	1a5/15	1b5/15	10ab5/15	10ac5/15
6	Bit 16	1a5/16	1b5/16	10ab2/16	10ac2/16
7	Bit 17	1a5/17	1b5/17	10ab2/17	10ac2/17

Appendix **B**

I/O FROM /TO LISTS

In the following tables of from/to lists, we use the notation CGST to designate field wiring arm terminals, where

C = chassis A or B
G = module group
S = slot number
T = terminal number

For example, a connection to chassis A, module group 3, slot 1, terminal 12 would be designated A3112.

I/O From/TO List for Figure 6.1
3L1 Power, Crowbar Test and press Interlock Inputs

From	To
A203	3L1
A204	Crowbar as (NO) contact
A206	B206
A20B	2L2
B203	3L1
B204	Crowbar B (N)) contact
B206	Press Interlock Switch
B20B	2L2

I/O From/To List for Figure 6.2
Main Solenoids, Crowbar and Seal–In Relays (Ungrounded AC Power)

From	To	From	To
A210	A302	A302	LRA
A210	B210	A302	Main Valve Soelnoid A
A211	B211	A304	LRB
A212	A304	A304	Main Valve SOlenoid B
A212	B212	A3010	Crowbar Relay A
A213	B213	A3012	Seal Relay A
A21B	2L2		
		B301	Main Valve Solenoid A
B211	B301	B303	Main Valve Solenoid B
B213	B303	B3010	Crowbar Relay B
B21B	2L2	B3012	Seal Relay B

I/O From/To List for Figure 6.3
Auxiliary Valve Solenoids (Ungrounded AC Power)

From	To	From	To
A214	A306	A301	3L1
A214	B214	A301	A303
A215	B215	A303	A305
A216	A308	A305	A307
A216	B216	A306	LRS
A217	B217	A306	Auxiliary Valve Solenoid A
		A307	A309
		A308	LRB
		A308	Auxilialry Valve Solenoid B
		A309	A3011
		B303	B304
B215	B305	B304	B306
B217	B307	B305	Auxiliary Valve SOlenoid A
		B306	B308
		B307	Auxiliary Valve SOlenoid B
		B309	3L2
		B3011	B3011
			3L1

I/O From/To List for Figure 6.4
Dump Valve Solenoids (Ungrounded AC Power)

From	To	From	To
A401	3L1	A410	B410
A401	A403	A411	B411
A402	Dump Valve Solenoid A	A412	B412
A042	A410	A413	B413
A402	LRA		
A404	Dump Valve Solenoid B	A414	Switch on Dump Valve Stem A
A404	A412	A41B	2L2
A404	LRB		
		B41B	Switch on Dump Valve Stem B
B401	Dump Valve Solenoid A	B41B	2L2
B401	B411		
B402	B404		
B403	Dump Valve Solenoid B		
B403	B413		
B404	3L2		

I/O From/To List for Figure 6.5
Micro–Inch Valve Solenoids (Ungrounded AC Power)

From	To	From	To
A401	3L1	A500	Micro–inch Position on Selector Switch (figure .12)
A401	A403	A500	B500
A403	A405	A501	Micro–inch Valve Stem Switch
A405	A407	A502	B504
A406	A504	A504	B505
A406	LRA	A505	B506
A406	Micro–inch Valve Solenoid A	A506 A507	B507
A408	A506	A50B	2L2
A408	LRB		
A408	Micro–inch Valve Solenoid B		
B402	B404	B501	Micro–inch Valve Stem Switch
B404	B406	B502	Micro–inch Pressure Switch
B405	Micro–inch Valve Solenoid A	B50B	2L2
B406	B505		
B407	Micro–inch Valve Solenoid B		
B407	B507		
B408	3L2		

I/O From/To List for Figure 6.6
3L1 Power, Crowbar Test, and Press Interlock Inputs (Grounded AC Power)

From	To
A203	3L1
A204	Crowbar as (NO) contact
A206	B206
A20B	2L2
B203	3L1
B204	Crowbar B (N)) contact
B206	Press Interlock Switch
B20B	2L2

I/O From/To List for Figure 6.7
Main Solenoids, Crowbar and Seal–in Relays (Grounded AC Power)

From	To	From	To
A210	A302	A302	LRA
A210	B210	A302	B301
A211	B211	A304	LRB
A212	A304	A304	B303
A212	B212	A3010	Crowbar Relay A
A213	B213	A3012	Seal Relay A
A21B	2L2		
		B302	Main Valve Solenoid A
B211	B302	B303	Main Valve Solenoid B
B213	B303	B3010	Crowbar Relay B
B21B	2L2	B3012	Seal Relay B

I/O From/To List for Figure 6.8
Auxiliary Valve Solenoids (Grounded AC Power)

From	To	From	To
A214	A306	A301	3L1
A214	B214	A301	A303
A215	B215	A303	A305
A216	A308	A305	A307
A216	B216	A306	LRA
A217	B217	A306	B305
		A307	A309
		A308	B307
		A308	LRB
		A309	A3011

I/O From/To List for Figure 6.9
Dump Valve Solenoids (Grounded AC Power)

From	To	From	To
A401	3L1	A410	B410
A401	A403	A411	B411
A402	B401	A412	B412
A042	LRA	A413	B413
A402	A410		
A404	B403	A414	Switch on Dump Valve Stem A
A404	LRB	A41B	2L2
A404	A412		
		B414	Switch on Dump Valve Stem B
B402	B411		2L2
B402	Dump Valve Solenoid A		
B404	B413		
B404	Dump Valve Solenoid B		

I/O From/TO List for Figure 6.10
Micro–Inch Valve Stem Solenoids (Grounded AC Power)

From	To	From	To
A401	3L1	A500	Micro–inch Position on Selector Switch (figure .12)
A401	A403		
A403	A405	A500	B500
A405	A407	A501	Micro–inch Valve Stem Switch
A406	B405	A502	Micro–inch Pressure Switch
A406	A504	A504	B504
A406	LRA	A505	B505
A408	B407	A506	B506
A408	A506	A507	B507
A408	LRB	A50B	2L2
B406	Micro–inch Valve Solenoid B	B502	
B406	B505	B50B	
B408	Micro–inch Valve Solenoid B		
B408	B507		

I/O From/To List for Figure 6.11
Cam Limit Switches

From	To
A115	Brake Monitor Cam Limit Swich A
A116	Run–on Cam Limit Switch A
A117	Anti–repeat Cam Limit Switch A
A11B	2L2
B115	Brake Monitor Cam Limit Switch B
B116	Run–on Cam Limit Switch B
B117	Anti–repeat Cam Limit Switch B
B11B	2L2

I/O From/To List for Figure 6.12
Mode Select Switch, Main Motor Forward,
Barrier Guard, Stop–on–Top, and Arm Continuous

From	To
A000	B000
A001	B001
A002	B002
A003	B003
A004	Main Motor Forward contactor
A004	B004
A005	Barrier Guard switch
A005	B005
A006	Stop–on–top switch in Station 4
A006	B006
A007	Arm Continuous switch in Station 1
A007	B007
A00B	2L2
B000	OFF position in Mode Select switch
B001	INCH position in Mode Select switch
B002	SINGLE position in Mode Select switch
B003	CONTINUOUS position in Mode Select switch
B00B	2L2

I/O From/To List for Figure 6.13
Operator Station 1

From	To
A010	Left RUN button (NC) contact)
A011	Right RUN button (NO) contact
A012	Left Active jumper connection
A016	Left INCH button (NC) contact
A017	Right INCH button (NO) contact
A01B	2L2
B010	Right RUN button (NC) contact
B011	Left RUN button (NO) contact
B012	Right Active jumper connection
B016	Right INCH button (NC) contact
B017	Left INCH button (NO) contact
B01B	2L2

I/O From/To List for Figure 6.14
Operator Station 2

From	To
A013	Left RUN button (NC) contact)
A014	Right RUN button (NO) contact
A015	Left Active jumper conection
B013	Right RUN button (NC) contact
B014	Left RUN button (NO) contact
B015	Right Active jumper conection

I/O From/To List for Figure 6.15
Operator Station 3

From	To
A100	Left RUN button (NC) contact)
A101	Right RUN button (NO) contact
A102	Left Active jumper conection
A10B	2L2
B100	Right RUN button (NC) contact
B101	Left RUN button (NO) contact
B102	Right Active jumper conection
B10B	2L2

I/O From/To List for Figure 6.16
Operator Station 4

From	To
A103	Left RUN button (NC) contact)
A104	Right RUN button (NO) contact
A105	Left Active jumper conection
B103	Right RUN button (NC) contact
B104	Left RUN button (NO) contact
B105	Right Active jumper conection

I/O From/To List for Figure 6.17
Main and Auxiliary Valve Stem,
Motion Detector, and Air Pressure Switches

From	To
A200	Switch on Main Valve Stem A
A201	Motion Detector A
A201	B201 (make this connection when NOT using Motion Detector B)
A202	Air Pressure Switch A
A202	B202 (make this connection when NOT using AIr Pressure Switch B)
A207	Switch on Auxiliary Valve Stem A
B200	Switch on Main Valve Stem B
B201	Motion Detector B (if used)
B202	AIr Pressure Switch B (if used)
B207	Switch on Auxiliary Valve Stem B

I/O From/To List for Figure 6.18
Diagnostic Message Display

From	To
A51A	2L1
A510	Output indicator for bit 10
A511	Output indicator for bit 11
A512	Output indicator for bit 12
A513	Output indicator for bit 13
A514	Output indicator for bit 14
A515	Output indicator for bit 15
A516	Output indicator for bit 16
A517	Output indicator for bit 17
A51B	2L2
B51A	2L1
B510	Output indicator for bit 10
B511	Output indicator for bit 11
B512	Output indicator for bit 12
B513	Output indicator for bit 13
B514	Output indicator for bit 14
B515	Output indicator for bit 15
B516	Output indicator for bit 16
B517	Output indicator for bit 17
B51B	2L2

I/O From/List for Figure 6.19
Connections for Optional Indicators

From	To	From	To
A31A	2L1	B31A	2L1
A310	BRAKE FAULT indicator	B312	MICRO–INCH indicator
A311	RUN WINDOW indicator	B31B	2L2
A312	NICRO–INCH indicator		
A31B	2L2		

I/O From/To List for Figure 6.20
Connections for PC Command Switches

From	To
C213	Barrier Guard (NO) switch contact
C214	Reset Latched Messages (NO) switch
C215	Stop–on–top (NO) switch contact
C216	Lamp Test (NO) switch contact
C21B	2L2

NOTE: We have chosen rack 3, module group 2 for the address of this module in remote I/O chassis C. Choose your own address based on your application requirements.

R

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V

W

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