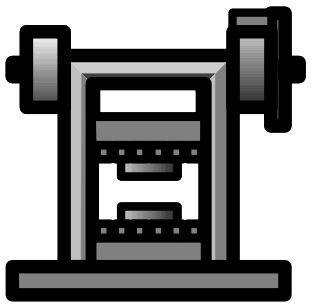
Allen-Bradley

Clutch/Brake Control System

PLC-5 Series

(Cat. No. 6556-Pxxxx)

Design Manual



ClutchBrake™

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

Summary of Changes

Software Revision 1.3 Series B

Wiring Changes

Important: Revision 1.3 software cannot be operated on a machine wired for Revision 1.2 (or earlier) software without changing the wiring for power distribution (sheet 1 of 9) and module group 4 (sheet 8 of 9).

Summary of Changes

We revised this manual to reflect wiring changes and the upgrade to software revision 1.3 as follows:

Chapter:	We Made These Changes:	in Section Title:
1	Referred to Rockwell 6200 *and* AI5 software	The Application Package
4	Added: • Inch Output Enabled, B151/28 • Initiate Auto Single Stroke, B151/29	Command Bits
	Included 6200 *and* AI5 software procedures	Steps to Write Ladder logic
	Corrected a bit error in Figure 4.17	Programming Command Bits
	Added ANSI requirement to Figure 4.19	
	Clarified the description	Exchanging Processor Data
5	Referred to 6200 *and* AI5 software procedures	throughout
6	Added procedure to convert from NC to NO	Controller OK Relay Contacts
7	Simplified the RCLS zones for easier setup and faster response	Setting Up Position Monitoring (also described in chapter 2)
	Retained revision 1.2 logic for indication of shaft position, but explained its operation as different from the simplified RCLS zones.	How Bits Indicate Shaft Position
	Added this section.	How Transition Faults Stop the Press
	Revised the fault codes for simplified RCLS	Troubleshoot Position Monitor
8	Changed Controller OK test per appendix G, H	Static Wiring Test
	Revised tests for Air Pressure, Main Motor, Motion, and Chair Break	Switch Tests
A	Revised the diagrams to include starting the press from any position.	Operational Diagrams
B	Deleted the feedback diagram for air pressure	Timing Diagrams
C	Revised fault codes for controller OK and RCLS	Troubleshooting, Fault Codes
E	Differentiated between reserved and usable	Reserved Data Files
G	Rewired the Controller OK relay	Pwr Distribution (sheet 1 of 9)
	Added Input 16: Control Check Power	Module Group 4 (sheet 8 of 9)
H	Rewired the Controller OK relay	Pwr Distribution (sheet 1 of 9)
	Added Input 16: Control Check Power	Module Group 4 (sheet 8 of 9)

Software Revision 1.2

Hardware Changes

Important: Revision 1.2 software cannot be operated on a machine wired for Revision 1.1 (or earlier) software without this change:

You must move the pressure switch from the port line of the clutch/brake valve to the pressure line. This is because we changed the logic of the clutch/brake pressure switch from “cycles with the clutch/brake valve” to “must be ON to run the press”.

Additional New Features

Category:	For These New Features:	Use Bits B151/:	See Example*:
Control Bits	**Delayed start** (alternate programming of original control bit)	5	Figure 4.4
	“Soft” clutch and brake to provide smoother starts and stops	16, 17, 19, and 22	Figure 4.14
	Valve stems enabled to omit the wiring of unused valve-stem feedback	20 and 21	Figure 4.15
	Remote fault reset to clear a C/B software fault from a remote PB	23	Figure 4.16
	Software micro-inch mode to select this mode remotely	24	Figure 4.17
	Automatic single-stroke mode to start a cycle in this mode remotely	25 and 26	Figure 4.18, 19
	Armed for remote automatic continuous mode to start on demand	25 and 27	Figure 4.18, 20
Press Operation	Start Continuous Mode from Any Point in the Press Cycle	n/a	in chapter 8 and appendix A
Programming Examples	Brake Monitor	n/a	Figure 4.27
	Variable–speed Top Stop	n/a	Figure 4.28
	Ladder Logic to Guard Against Reverse-motion Faults (Resolver Inputs)	n/a	Figure 7.6
Troubleshooting	Troubleshoot the Setup of Your Position Monitoring Devices	n/a	in chapter 7

***** Figure numbers refer to this revision of the manual (revision 1.3 dated October 1996).

Software Revision 1.1

Important: Revision 1.1 software cannot be operated on a machine wired for Revision 1.0 software without this change:

You must change the type of chain break switch from normally-closed-held-open to normally-open held-closed. This is because we changed the chain break logic from “input goes ON” for a chain break to “input goes OFF”. (See wiring drawing sheet 8, module group 4.)
This change remains throughout subsequent software revisions.

Table of Contents

Summary of Changes . . . . . **soc–i**

Software Revision 1.3 Series B . . . . . soc–i
Software Revision 1.2 . . . . . soc–ii
Software Revision 1.1 . . . . . soc–ii

Using This Manual **P–1**

Information in the Appendices P–2
Concerning Rockwell Programming Software P–2

Overview of the Clutch/Brake Control System **1–1**

Manual Objectives P–1
Qualifications for Applying this Product P–1
Summary of Installation Tasks P–1
We've Simplified Your Wiring Documentation P–2
Terms and Abbreviations P–3

Chapter Objectives **1–1**

The Application Package 1–1
Software and Documentation 1–1
Typical Hardware (for the cat. no. 6556-PxxxK Application Package) 1–2
Related Safety Information 1–2
Control by Redundant Processors 1–3
How the Software Controls Your Press 1–4
Organization of Program Files 1–4
Scanning Program Files 1–4
Protected Memory in PLC-5/x6 Processors 1–6
Passwords and Levels of Memory Protection 1–6
Functional Block Diagram 1–7
Modes of Control System operation 1–7
Clutch/Brake Control Functions 1–8
Required Input Switches 1–9
Choice of Position Monitoring Devices 1–10
Control System Outputs 1–10
System Response Time 1–10
Internal Timers 1–11
Options to Suit Your Application 1–12
Selecting Factory Configured Options 1–12
Programming Ladder-logic Commands 1–12
Wiring Your Control System 1–13
Wiring Drawings 1–13

Information on Diskette 1–13
Control System Specifications 1–14

Define Your Control System Characteristics 2–1

Chapter Objectives 2–1
1. Verify Your Factory-configured Options 2–1
2. Assign Valves to Specific Outputs 2–2
3. Select the Type of Valve Fault Detection 2–2
4. Select the Type of Position Sensor 2–3
Rotary Cam Limit Switches 2–3
Resolver 2–3
5. Record On/Off Positions of Rotary Cam Limit Switches 2–4
6. Select Input Switches 2–4
7. Select Command Bits for C/B Interface Logic 2–4
8. Select Other Options 2–6
9. Reduce Watchdog Timer Presets (Optional) 2–6
1. Verify Your Factory-configured Options 2–7
2. Assign Outputs 2–7
3. Record the Type(s) of Valve Fault Detection 2–8
4. Select the Type and Location of Position Monitors 2–8
5. Record On/Off Positions of Rotary Cam Limit Switches 2–8
6. Select Input Switches 2–9
7. Select Optional Command Bits for C/B Interface Logic 2–10
8. Select Options That Affect System Wiring 2–11
9. Reduce Watchdog Timer Presets as an Option 2–12
10. Select Options That Require Programming 2–13

Customize the Wiring to Suit Your Application 3–1

Chapter Objectives 3–1
How to Customize the Default Wiring 3–1
Install Your Wiring Drawing Diskettes 3–2
Generalized Instructions to Customize Your Wiring 3–3
Customizing an Ungrounded AC System 3–3
Customize a Grounded AC System 3–12
Notes 3–20

Write Ladder Logic 4–1

Chapter Objectives 4–1
Overview of Memory Organization 4–1
Reserved Program and Data Files 4–2
How Command Bits Act On Control Logic in Protected Memory . . . 4–2
Select from These Command Bits 4–3
Steps to Write Ladder Logic 4–5
Programming Command Bits 4–6
"Soft" Clutch and Brake 4–13
Exchanging Data Between Processors 4–18
Using Fault and Prompt Bits 4–19
Programming Shorter Presets for Your Internal Timers 4–20
Programming Press-ready-to-start Indicators 4–22
Programming a Brake Monitor (patent pending) 4–22
Selecting the Interrupt Period 4–22
Programming a Variable-speed Top Stop 4–28

Assigning Passwords to Your Program and Data Files . . . 5–1

Chapter Objectives 5–1
What Can Privilege Classes Protect? 5–1
How We Assigned Privileges to Privilege Classes 5–2
Privilege Classes 5–2
Data Table Privileges 5–3
Program File Privileges 5–4
Communication Channel Privileges 5–5
Assigning Passwords to Classes 5–6
Gaining Access to Protected Memory Files 5–6

Install and Wire the Clutch/Brake Control System 6–1

Chapter Objectives 6–1
Set Jumpers and Switches 6–1
PLC-5/x6 Processors 6–2
Jumper and Switch Settings for I/O Chassis A and B 6–4
Keying the Backplane 6–4
1771-ID16 Input Modules 6–5
Install PLC Processors, I/O Modules, and Power Supplies 6–5
Connect PLC Processors and Programming Terminal 6–7
Convert Controller OK Relay Contacts from N.O. to N.C. 6–8
Wire Your Control System 6–8

Set Up or Simulate Rotary Cam Limit Switches 7–1

Chapter Objectives 7–1
Setting Up Position Monitoring Devices 7–1
Setup If Using Rotary Cam Limit Switches (omit if using only resolvers) 7–4
Setup If Using Resolvers (omit if using only RCLSs) 7–4
Ladder Logic to Simulate Rotary Cam Limit Switches 7–5
How Bits Indicate Shaft Position 7–8
How Transition Faults Stop the Press 7–9
Troubleshoot the Setup of Your Position Monitoring Devices 7–10
Notes 7–12

Test Your Clutch/Brake Control System 8–1

Chapter Objectives 8–1
Static Wiring Tests 8–1
Controller OK Test 8–1
CRM Relay Test 8–2
Seal Relay Test 8–2
Crowbar Relay Test (If using crowbar relays) 8–3
Test Run Buttons (all four stations) 8–3
Test Inch Buttons 8–4
Test Stop-on-top and Arm Continuous Buttons 8–4
Test Mode Selector Switch 8–4
Valves and Valve Feedback 8–5
Dynamic Tests of Operating Modes 8–8
Inch Mode 8–8
Single-stroke Mode 8–9
Continuous Mode with Arm Continuous 8–9
Continuous Mode with Stroke-and-a-half 8–10
Switch Tests 8–10
Air Pressure Switch 8–10
Main Motor Forward Switch 8–11
Motion Detector Switch 8–11
Chain Break Switch 8–12

Description of Operating Modes A–1

Operating Modes of the Clutch/Brake Controller A–1
Off A–1
Remote Mode A–1
Inch and Micro-inch Modes A–2
Single Stroke Mode A–3
Continuous Mode A–6

Feedback Timing Diagrams B–1

Timing Diagrams for Control System Feedback B–1
Notes B–2

Troubleshooting with Fault Codes, Operator Prompts, and Snapshot Status Bits C–1

Troubleshooting with Fault Codes C–1
Prompts for Operating the Press C–6
Troubleshooting with Snapshot Status Bits C–9
Notes C–10

Classes of Memory Protection D–1

Class Privileges D–1
Read/Write Access by Class D–1
Program Files D–1
Data Files D–2

Mapping of Data and Program Files E–1

Reserved Data Files E–1
Reserved Files E–1
Useable Data E–2
Reserved Program Files E–2

Programming Considerations for PLC-5 Processors F–1

Purpose of this Appendix F–1
Program Scan: How the Processor Scans a Program F–1
How the Processor Scans the Program F–2
The Processor: F–2
Affect Your Ladder Logic Has on the Program Scan F–2
Instructions F–2
Processor Family F–3
Data Format F–4
Addressing F–4
How to Program a Faster Response F–5
Program a Faster Response with Special Instructions F–5
Scan Logic Only When Needed F–6
Other Considerations F–6
Using Subroutines F–6
How Subroutines Are Scanned F–7
Using Immediate I/O Instructions F–9
Passing Data Into and Out of a Subroutine F–9
Working With Data F–10
Types of Data F–10
Addressing Your Data F–10

Creating Data Storage Files F–11
Directly Creating Data Storage Files F–11
Data Storage Created by Assigning Addresses F–11

Wiring Drawings for an Ungrounded System G–1
Wiring Drawings G–1

Wiring Drawings for a Grounded System H–1
Wiring Drawings H–1

Using This Manual

Manual Objectives

This manual shows you how to apply the Clutch/Brake Application Package (cat. no. 6556-Pxxxx) to your mechanical stamping press. The manual helps you design, install, and test the clutch/brake control system and interface it with optional auxiliary press functions.

Qualifications for Applying this Product

Only qualified installers should apply the Clutch/Brake Application Package to a mechanical stamping press. We assume that the installation team includes:

- a professional stamping press builder or re-builder knowledgeable in press and press control standards
- a programmer experienced with programmable controllers (especially with the Allen-Bradley PLC-5® family of processors)
- an electrical technician skilled in installing electronic equipment

Summary of Installation Tasks

Before starting the installation, we suggest that you familiarize yourself with the information in this manual. We summarize the tasks that your integration team will perform as follows:

These Tasks:	Are Covered in:
• Browse through the overview in chapter 1 • Browse through the entire manual and appendices	All chapters All appendices
• Select control options for the stamping press • Define control system characteristics	Chapter 2 and Appendices A, B
• Customize the wiring drawings to match control options	Chapter 3
• Program the interface to clutch/brake control logic • Write ladder logic for auxiliary press functions	Chapter 4 and Appendix E
• Assign passwords to guard against unauthorized access	Chapter 5 and Appendix D
• Install processors and I/O modules in I/O chassis • Connect cables • Wire the control system according to selected options	Chapter 6 and wiring drawings
• Set up rotary cam limit switches or resolvers • If using resolvers, simulate cam limit switches.	Chapter 7
• Test system wiring • Test press operation	Chapter 8 Appendices A, C

Information in the Appendices

The last part of the manual contains appendices. Appendix A contains these descriptions of control system operating modes:

- inch, and micro-inch
- single stroke
- continuous

Other appendices include:

- timing diagram of control system feedback, in Appendix B
- fault codes to help you debug the control system, in Appendix C
- operator prompts to help you run the press, in Appendix C
- class privileges and read/write access by class, in Appendix D
- reserved data files and program files, in Appendix E
- programming considerations for PLC-processors, in Appendix F
- wiring drawings for ungrounded ac power distribution, in Appendix G
- wiring drawings for grounded ac power distribution, in Appendix H

We've Simplified Your Wiring Documentation

Wiring drawings are included on diskette so that you can modify them with your own Computer Aided Drafting (CAD) system. They are stored in these file formats:

- AutoCAD, Release 11.0 (.DWG)
- INTERCHANGE Software (.DXF)

Choose the one that matches your CAD system.

There are two sets of wiring drawings: one for ungrounded, the other for grounded ac power distribution. Select the set you will use and dispose of the other to avoid confusion.

We include fold-out wiring drawings in a separate package that accompanies this manual, and a duplicate set in Appendices G and H.

Concerning Rockwell Programming Software

We included both versions of Rockwell software on diskette:

- Series 6200
- Series AI5

Throughout the manual, we tell you the version of software that applies to the software procedures.

Terms and Abbreviations

You should become familiar with these abbreviated terms. For complete definitions of clutch/brake terms, refer to ANSI B11.1-1988 section 3.

Category	Term	Definition
Hardware	active pin	run station wiring that provides a signal to indicate that pairs of run buttons are active, not replaced by dummy plugs (optional feature)
	brake-time monitor	a solid-state device that monitors press stopping time at any point in the stroke
	buttons	palm-type pushbutton switches used by an operator for starting and stopping the press
	dummy plug	jumpers used in place of a run station when removing a run station from the press control circuit
	resolver	a solid-state device that detects and transmits the angular position of the press drive shaft
	run station	a press operator's point of operation that typically contains a pair off pushbuttons to start the press
Operating Mode	continuous	lets the control system maintain continuous stroking after an operator starts the press
	inch	lets an operator move the press intermittently by pressing and releasing a pair of inch buttons
	micro inch	the same as Inch but at a slower speed. Requires a separate drive assembly and a separate set of outputs
	off	disables operation of the clutch/brake control system when not in operation
	single stroke	lets the operator run one complete press stroke, usually started at the top
Press Cycle	anti-tie-down	prevents the press from starting if the system detects that an operator has tied down a RUN or INCH button. After all buttons are released, the operator must press both RUN or INCH buttons at the same time.
	downstroke	the part of the press cycle when the press travels from the near-top to the near-bottom position
	interrupted stroke	lets the operator stop the press quickly by releasing a RUN button during a downstroke in single-stroke or continuous mode.
	bottom	the part of the press cycle when the die is closed
	near top	the part of the press cycle when the press is at the top of its stroke
	on-the-hop	option that lets an operator continue stroking in single-stroke mode by pressing run buttons on each upstroke
	stop-on-top	a command designed to stop the press at the top of its stroke
	stroke-and-a-half	a method to initiate continuous stroking where an operator holds down the run buttons for 1-1/2 press cycles
	upstroke	the part of the press cycle when the press travels from the near-bottom to the near-top position
Rotary Cam Limit Switch	RCLS -	a switch that rides a rotating cam to provide information on the position of the press drive shaft
	anti-repeat	a part of the control system designed to limit press operation to a single cycle if the actuating means is held actuated. Anti-repeat requires the release of all means of actuation before a repeat stroke can occur
	brake monitor	a part of the control system designed to prevent the next stroke if stopping time or distance exceeds a preset
	takeover	a part of the control system designed to allow upstroke without the operator holding the run buttons
Valves	clutch valve	the main valve that controls the flow of air to the clutch/brake mechanism
	auxiliary valve	valve used in addition to the clutch valve such as for dump, "soft" clutch/brake, etc
	dump valve	the valve that vents a large volume of air to/from the clutch/brake mechanism
	solenoid valve	an on/off electrically-driven valve
	valve stem feedback	a signal from a switch on the valve stem that tells when the valve is open or closed
	fault detection (for valves)	external: designed so a signal from an external valve-stem switch detects when the valve is malfunctioning internal: the valve is designed to turn itself off in the event of valve failure

Notes

Overview of the Clutch/Brake Control System

Chapter Objectives

This chapter acquaints you with the Allen-Bradley clutch/brake control system for part-revolution mechanical stamping presses with a friction clutch/brake mechanism. Topics include:

- The Application Package
- Related Safety Documentation
- Control by Redundant Processors
- How the Software Controls Your Press
- Protected Memory in PLC-5/x6 Processors
- Functional Block Diagram
- Modes of Control System Operation
- Options to Suit Your Application
- Wiring Drawings
- Information on Diskette
- Choice of Position Monitoring Devices
- Input Switches
- Control System Outputs
- Internal Timers
- System Response Time
- Control System Specifications

ATTENTION: This control system is designed for use only with mechanical stamping presses having a part-revolution friction brake. Applying this control system to any other type of press could result in personal injury and/or damage to equipment.

The Application Package

The 6556 series Application Packages consists of the following:

Software and Documentation

- diskette of ladder logic that controls the clutch/brake mechanism
- diskette of wiring drawings in AutoCAD (Release 11.0) and DXF formats
- user manual including fold-out wiring drawings
- pocket-sized operator's guide

In addition, you must use Rockwell 6200 Series Software (revision 5.11 or later) or AI5 Software (revision 7.20 or later). You can program the clutch/brake control system with an IBMXT/AT compatible computer.

Typical Hardware (for the cat. no. 6556-PxxxK Application Package)

- PLC-5/46 processor (scanner mode, chassis A)
- PLC-5/26 processor (adapter mode, chassis B)
- two 1771-A2B 8-slot I/O chassis
- six 1771-ID16 16-point isolated input modules
- two 1771-OD16 16-point isolated output modules
- two 1771-P4S slot power supplies
- six 700-P400 master control and seal relays

Important: You must provide various input switches to the clutch/brake control system. We cover this in chapter 2.

Related Safety Information

You are responsible for the safety of the entire installed control system and for meeting all applicable laws, codes, and safety requirements. The application package deals only with the electrical control portion of the clutch/brake device.

ATTENTION: As the installer of this control system, you must be knowledgeable of ANSI B11.1 regarding mechanical power presses, OSHA 1910.217, and other applicable standards pertaining to safety recommendations related to:

- machine construction
- general electrical
- machine guarding
- point-of-operation guards, light curtains gates, 2-hand switches

In addition to local codes and laws, you are responsible for the safety recommendations detailed in all applicable codes and standards including:

- 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 (available from American National Standards Institute 1430 Broadway NY, NY 10018-3363)
- NFPA No. 79, Electrical Standard for Metalworking Machine Tools
- CAN/CSA-Z142-M90 Code for Punch Press and Brake Press Operation: Health, Safety, and Guarding Requirements (Canadian Standards Assoc. 178 Rexdale Blvd. Rexdale (Toronto) Ontario Canada M9W 1R3)

Also refer to *Important User Information* inside the front cover.

Without this knowledge, your control system could be unsafe, resulting in possible personal injury and/or damage to equipment.

Control by Redundant Processors

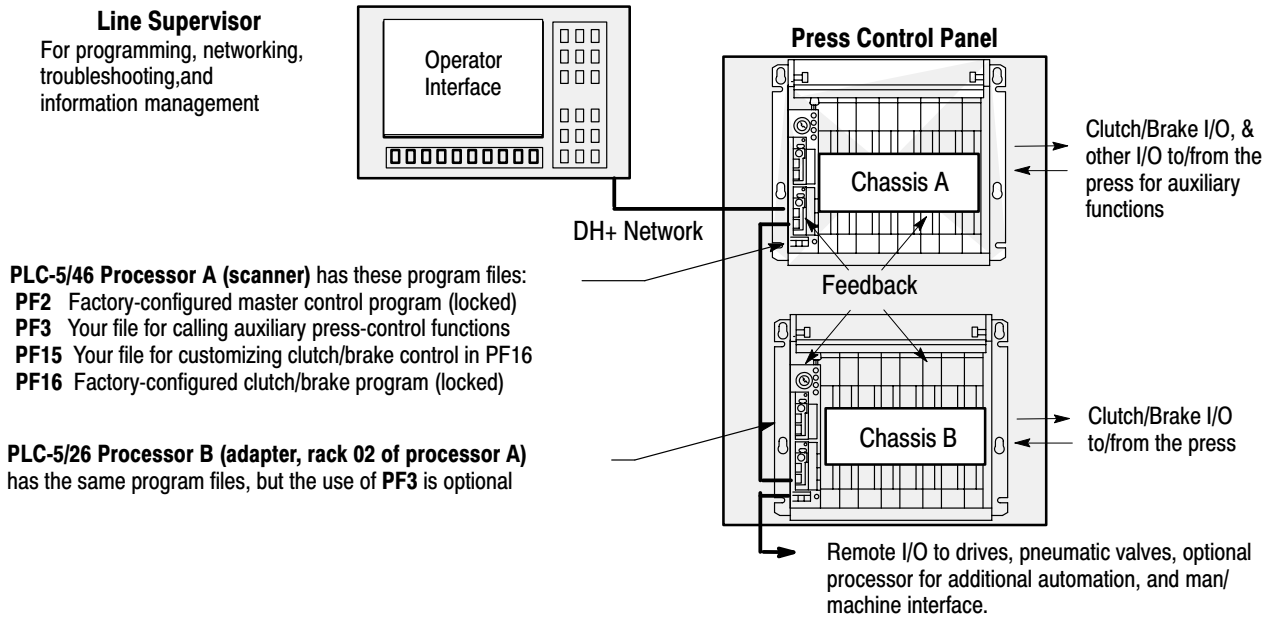
The clutch/brake control system uses two independent PLC-5/x6 processors (Figure 1.1), such as but not limited to:

- PLC-5/46 processor operating in scanner mode in chassis A
- PLC-5/26 processor operating in adapter mode in chassis B

Both processors monitor all clutch/brake I/O and exchange information regarding machine status. They are linked by hardwired I/O and a communication channel so that if one processor detects a condition different from that detected by the other, its control logic is designed to declare a fault and turn off all outputs to press valves. The other processor is designed to follow suit.

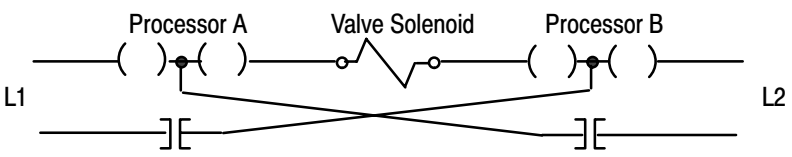
Chassis A or B may contain additional optional I/O modules for other press functions. Otherwise, I/O modules in both chassis are identical.

Figure 1.1
Typical Architecture for Redundant Control



Dual processors control outputs to clutch/brake valves. To illustrate the redundant control concept, we show how processor outputs are linked to processor inputs (Figure 1.2) where –( )– are processor outputs, and –] [– are processor inputs:

Figure 1.2
Redundant Control of Processor Outputs for Ungrounded AC Power



How the Software Controls Your Press

The clutch/brake control system can control the entire press because you can add your own ladder logic for other press functions. Factory-protected logic for control of the clutch/brake mechanism is stored in locked program files (PF2 and PF16). You store your own clutch/brake interface logic in an unlocked program file (PF15). Either processor can use program file (PF3) to call subroutines (PFxx) or to directly control auxiliary press functions that you program.

Organization of Program Files

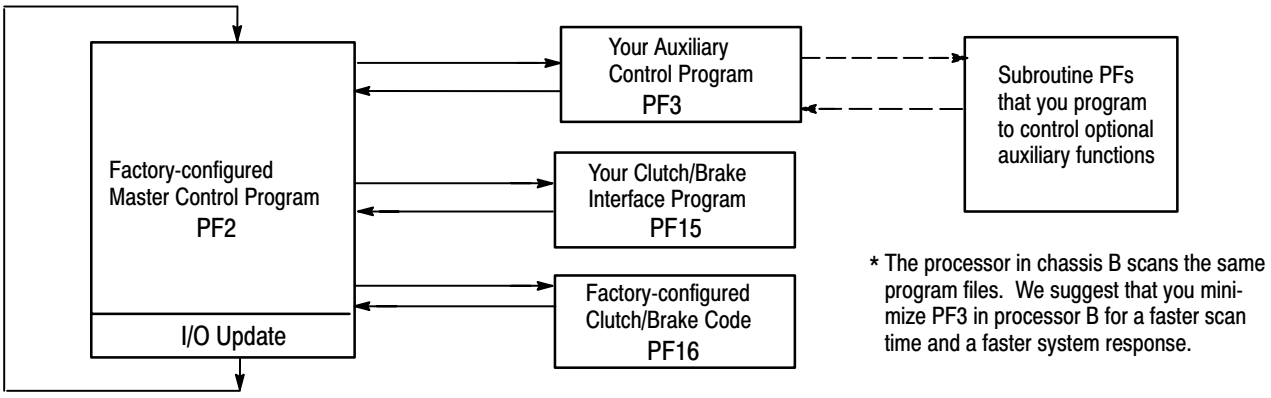
We organized selected program files in both PLC-5/x6 processors as follows to control the clutch/brake and other press functions:

Program File	Description (Processor in Chassis A)	Description (Processor in Chassis B)
PF2 (Locked)	Factory-configured Master Control Program	Identical to the processor in chassis A
PF3	Used to program or call subroutines to control auxiliary press functions, such as automation valve, die protection, etc.	Optional but available for application programming, independent of the processor in chassis A
PF15	Used to program the clutch/brake interface with machine sequencing to customize the clutch/brake code in PF16	Similar to the processor in chassis A
PF16 (Locked)	Factory-configured clutch/brake code	Identical to the processor in chassis A
PFxx	Subroutines to control auxiliary press functions	Same as PF3

Scanning Program Files

Both PLC-5/x6 processors scan assigned program files shown in Figure 1.3.

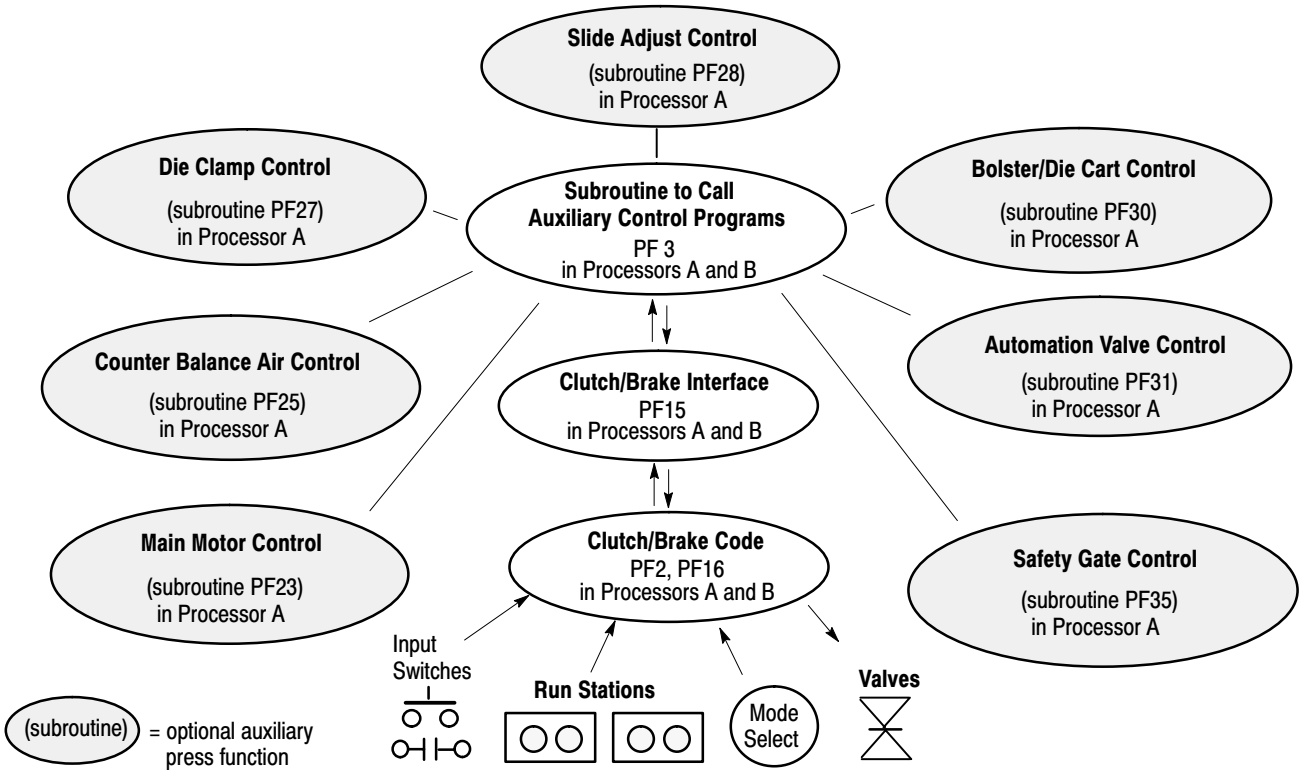
Figure 1.3
Program Scan for the Processor in Chassis A*



* The processor in chassis B scans the same program files. We suggest that you minimize PF3 in processor B for a faster scan time and a faster system response.

The Clutch/Brake Application Package includes the clutch/brake code in PF2 and PF16. You program the remaining machine applications (Figure 1.4).

Figure 1.4
Example Software Architecture of a Press Control System with Auxiliary Press Functions



To facilitate standardized programming, we suggest that you use the following program file numbers for auxiliary press functions:

PF4	Initialization	PF21	Spare	PF36	Slide Lock Control
PF5	Analog	PF22	Auto Die Change Control	PF37	Turnover Control
PF6	Lube/Hydraulic	PF23	Main Motor Control	PF38	Prebender/Rotator Control
PF7	Mode Change	PF24	Inch Motor Control	PF39	Nest Station Control
PF8	Slide Angle	PF25	Counter Balance Air Control	PF40	Exit Conveyor Control
PF9	Spare	PF26	Cushion Air Control	PF41	Scrap Chute Control
PF10	Part Transfer Monitor	PF27	Die Clamp Control	PF42	Temperature Control
PF11	Die Identification	PF28	Slide Adjust Control	PF43	Spare
PF12	Recipe Management	PF29	Cushion Stroke Adjust Control	PF44	Stack/Roll Feeder Control
PF13	Fault Response	PF30	Bolster/Die Cart Control	PF45	Spare
PF14	Spare	PF31	Automation Valve Control	PF46	Production Data
PF17	Operator Interface	PF32	PTO Control	PF47	Lamp Check
PF18	Supervisor Interface	PF33	Transfer/Electronic Feeder Control	PF48	Spare
PF19	Feeder Blank/Roll Interface	PF34	Crossbar Control	PF49	Automation Compensation
PF20	Automation Interface	PF35	Safety Gate Control		

Protected Memory in PLC-5/x6 Processors

Security

When programmed with either version of Rockwell programming software, PLC-5/x6 processors provide enhanced security. Designated program files, such as those storing factory-configured clutch/brake control logic, are locked at the factory. You can read them but you *cannot:*

- edit locked program files of a PLC-5/x6 processor
- restore PLC-5/x6 programs to other PLC-5 processors

Other program files in the PLC-5/x6 processors are available for your application programming.

Programs written for PLC-5/x6 processors are transferrable between PLC-5/x6 processors only with the Rockwell software used to write the original program.

Passwords and Levels of Memory Protection

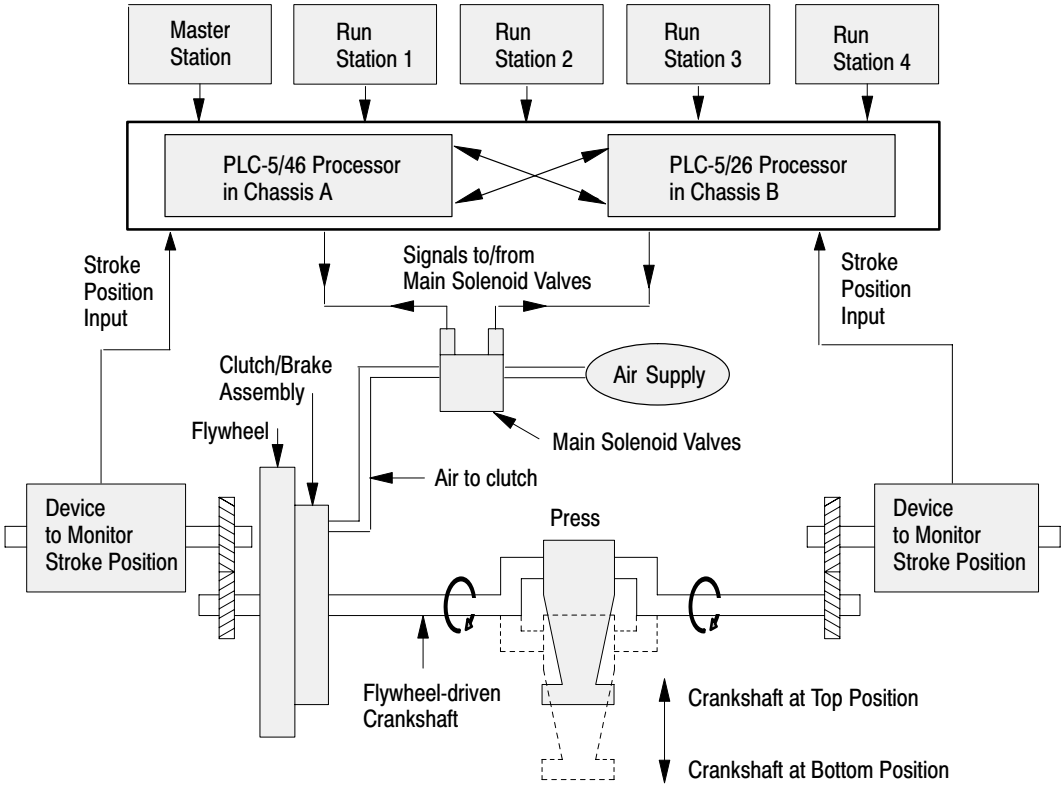
Either version of Rockwell software and PLC-5/x6 processors provide four levels of memory protection. The password to the highest level (including, access to program files PF2 and PF16) is kept confidential at the factory. We pre-assigned access privileges to other levels. They include a read-only privilege at the lowest level. You create your own passwords for the three lower levels.

We show you how to assign privileges and passwords in chapter 5.

Functional Block Diagram

The functional block diagram in Figure 1.5 shows the relationships between various mechanical components of a stamping press and the control system.

Figure 1.5
Functional Block Diagram



Modes of Control System operation

You select the mode of control system operation with a selector switch. In accordance with ANSI B11.1 Section 4.12.4.1, the means of selecting the operational mode must be capable of being fixed by a supervisor. Typically, this is interpreted as to mean a keyswitch.

This Mode	Lets you:
Off	Disable operation of the clutch/brake control system when not in operation
Inch	Move the press up or down to the desired position with Inch pushbuttons (or by ladder logic) to set up dies and tooling (not intended for production)
Micro-inch	Same as Inch but at a slower speed. Requires a separate drive assembly and operates from a separate set of outputs
Single	Cycle the press through a single uninterrupted stroke (from top to bottom to top) with RUN buttons, with or without on-the-hop
Continuous	Run the press with uninterrupted stroking for production operation
Remote	Select Inch, Micro-inch, Single, Auto Single, or Continuous mode, remotely Simulate inch and run buttons, and arm for continuous on demand
Die Change	Run die change, only

Clutch/Brake Control Functions

Clutch/brake control functions are summarized in Table 1.A.

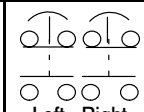
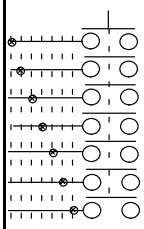
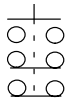
Table 1.A
Summary of Clutch/Brake Control Functions

Control Function	Operating Mode	Description
Selector Switch	Off	Prevents energization of clutch/brake outputs.
	Inch	Lets the operator jog the press through through successive parts of the 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 a low speeds (1 spm typical) for setting up dies. You must supply a separate drive and clutch/brake assembly to drive the shaft at low press speeds, bypassing the flywheel.
	Single-stroke	Lets the operator jog the press through one complete cycle stopping on top, by holding both RUN buttons until completion of the down stroke.
	Continuous	Lets the operator run the press continuously until stopped by a stop-on-top command, or until a fault is detected. The method to start the press is a factory configured option: • close the ARM CONTINUOUS switch and press both RUN buttons in all active stations within five seconds. • hold both RUN buttons for half a stroke until take-over (run-on) cams close (or for 1-1/2 strokes if so configured).
	Remote	Lets you program the selection of these modes remotely: • inch • micro-inch • single stroke • automatic single stroke • continuous Lets you program automatic press motion with: • simulate inch buttons • simulate run buttons • arm for continuous on demand
On-the-hop	Single-stroke	Lets the operator recycle the press without stopping by releasing and pressing both RUN buttons during a specific portion of the upstroke. (factory-configured option)
Stop-on-top (cycle stop)	Continuous	Lets the operator stop the press at top of stroke (after the take-over cam signal turns off).
Interrupted stroke	Single-stroke or Continuous	Lets the operator stop the press quickly by releasing a RUN button during a downstroke.
Anti-tie-down	All	Prevents the press from starting if the system detects that an operator has tied down one or more RUN buttons. After all RUN buttons are released, the operator must press both RUN buttons at a station at the same time. The same applies to the pair of INCH buttons.
Anti-repeat	Single-stroke	Limits press operation to a single stroke, even if the operator continues to press both RUN buttons. The operator must release and press them again to start the next stroke.
	Inch	Limits press operation to a single stroke when using a pair of INCH buttons.
Motion detector	Single-stroke or Continuous	Configurable option designed to detect press motion from a hardware or software input.
Brake Monitor	All	Configurable option designed to prevent restarting the press when the system detects a faulty-brake signal from the brake monitor cam (BCAM) or from a time-based input.

Required Input Switches

The clutch/brake control system requires input switches. Table 1.B lists representative types. Select the right input switches for your application.

Table 1.B
Required Input Switches

Device	Symbol	Purpose	Type	Allen-Bradley Type	Qty
Palm Buttons for Run Stations		• Lets press operators start the press • Assures 2-hand operation Note: Position RUN buttons at least 24" apart., and RUN stations in accordance with ANSI B11.1 appendix A.	Momentary pushbuttons dual contact normally closed (N.C.) and normally open (N.O.)	(2) Articulated Palm Buttons 800P-F2CA	up to 4 pairs
Left-hand Inch		• Lets you inch the press up or down Note: Position INCH buttons at least 24" apart.	Momentary pushbuttons dual contact N.C. and N.O	Articulated Palm Buttons 800P-F2CA	1
Right-hand Inch		• Lets you inch the press up or down Note: Position INCH buttons at least 24" apart.	Momentary pushbuttons dual contact N.C. and N.O.	Articulated Palm Buttons 800P-F2CA	1
Stop on Top		• Stops press at top during continuous stroking	Momentary pushbutton single N.C. contact	Yellow Mushroom-head 800T-D9B	1
E-Stop		• Stops the press immediately Note: Wire switches in series as needed.	Momentary pushbutton single N.C. contact	Jumbo Mushroom-head 800T-FXP16RA5	1 or more
Mode Select		• Lets you select the operating mode: Off Inch Micro-inch Single Continuous Remote Die Change	Rotary, 7-position key lockable	N/A	1
Arm Continuous		• Lets you begin a multi-second time window to start continuous mode.	Momentary pushbutton single N.O. contact	Black Momentary Pushbutton 800T-A2A	1
Main Motor Forward Interlock		• Monitors whether motor-forward starter is engaged. If not, it opens to prevent running the press in single or continuous mode.	N.O. auxiliary contact for forward motor starter	Motor Starter Auxiliary Contact 595-A	2
Air Pressure		• Monitors maintained signal of C/B air pressure • Must be ON to run single or continuous cycles	N.O. single-throw pressure switch	Pressure Switch 836-C8JX321	1
Motion Detector Interlock		• Detects if motion is stopped in single or continuous mode. Note: If using resolvers, you program this function.	N.O. single contact	N/A	2
Control Reset		• Lets you manually reset power to valve solenoids at power up or after an E-stop.	Momentary pushbutton single N.O. contact	800T-A2A	1
Clutch/Brake Power Reset		• Lets you manually reset clutch power (and crowbars if used) on power up or after E-stop.	Momentary pushbutton triple contact 1 N.O. and 2 N.C.	800T-A2B	1
Chain Break		• Monitors the chain drive. Note: When it detects breakage, it opens to stop a downstroke or to prevent starting the press.	N.O. limit switch, held closed	Limit Switch 802M-AY5 with Operating Lever 802MC-W1A	1

Choice of Position Monitoring Devices

Purchased separately, you have a choice of dual position monitors:

- rotary cam limit switches
- resolvers
- combination of both

If using rotary cam limit switches, we recommend:

- a pair of Allen-Bradley Cat. No. 803-B94 or 803-P94

If using a resolver, we recommend one of these solutions:

- AMCI Series 1700 AMCI Resolver, and Absolute Resolver Input Module that plugs into the 1771 I/O chassis
- NSD VRE–P062 Resolver and VE–2A Single Turn Converter (decoder) that connects to a high-speed input module such as a 1771-IBD.

Control System Outputs

The clutch/brake control system is designed with three pairs of outputs available for your application:

Use these Valve Outputs	for these Functions	Notes
clutch	clutch/brake valves	For clutch or clutch/brake valves
auxiliary	auxiliary valves	You can program these outputs in unison with or in opposition to C/B valve outputs
micro-inch	separate micro-inch drive	Used in micro-inch mode only

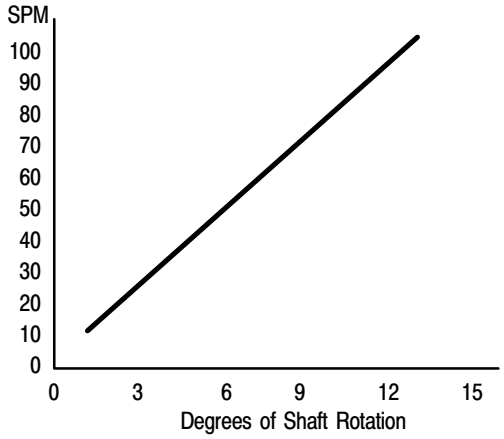
System Response Time

The worst case time required for the clutch/brake control to respond to a change of input depends on the sum of these response times: (excluding scan time for auxiliary press functions that you can compute from corresponding ladder logic)

Response Time	Delay (ms)
1771-ID16 input module	2
PLC-5/x6 scan time for typical control logic	10
1771-OD16 triac switching time	9
Total response time	21

The number of degrees that the shaft continues to rotate, beyond the moment when the input changes, depends on the speed of rotation. The greater the speed (strokes per minute), the further the shaft rotates before a command from the control system is applied. The response time of 21 ms is represented in degrees of shaft rotation that increases as press speed increases (Figure 1.6).

Figure 1.6
Shaft Rotation for a 21 ms Response Time of the Clutch/Brake Control System



Important: When estimating the braking distance in degrees of rotation, you must add the response time of the control system (Figure 1.6) to the specified downstroke or upstroke braking distance of your press.

If you program additional ladder logic for other press functions in processor A or B, you will increase the scan time of that processor. Program scans in both processors are not synchronized, so minimize the scan time of one processor.

ATTENTION: You are responsible for system response time. The combination of fast press stroking and additional program logic could extend the stopping time, resulting in possible death, personal injury, and/or damage to the press and/or tangential machinery.

Where fast press stroking and considerable program logic are required for your application, consider an independent PLC-5 processor for other press functions.

Internal Timers

The clutch/brake control program contains timers with factory-set presets. You may change timer presets to time out faster, but never slower than the factory-set presets. See chapter 4. Examples of internal timers include:

Type of Timer	Preset (sec)
Anti-tiedown	3
Motion Detector	3
Arm Continuous	5
Clutch or Auxiliary Valve Feedback	1

Options to Suit Your Application

To customize the control system to suit your application, we help you:

- select your factory-configured options
- program your clutch/brake interface with ladder-logic commands
- wire your control system

Selecting Factory Configured Options

When you purchased your Application Package, you designated factory-configured options by a coded catalog number (6556-Pxxxx) from combinations of these features:

Order Code:	Option:	Lets You:
A S	Method to Start Continuous Mode	• for Armed Continuous: start continuous stroking by pressing the Arm Continuous button and all active run buttons for at least 1/2 stroke. Or, • for Stroke-and-a-half: start continuous stroking by holding run buttons into the second stroke. If released *before* the second closure, the press comes to a stop at the top; if *after* the second closure, the press keeps running
H or 0	On the Hop	stroke the press in single mode without stopping by releasing and again pressing run buttons when in the upstroke zone
P or 0	Active Pin	include or exclude active pin wiring to detect the absence of a run station
K, M, M1, M3	Hardware Kit	select PLC-5/x6 processors, power supplies, and I/O for clutch/brake control

Programming Ladder-logic Commands

To customize the control system to your application, we help you program any combination of the following command bits that interface to the protected clutch/brake control program. See chapter 4.

To program this objective	Use these command bits	B151/
Simulate rotary cam limit switches when using resolvers instead of RCLSs	brake monitor (BCAM) take-over (TCAM) anti-repeat (ACAM)	00 01 02
Interface press and machine functions during automatic continuous mode	permit cycle start permit run permit downstroke or delayed start permit upstroke top stop permit inch simulate inch buttons simulate run buttons arm for continuous on demand inch output enabled initiate automatic single stroke	03 04 05 06 07 08 09 25 27 28 29
Select operating mode remotely with your ladder logic	remote inch mode remote single-stroke mode remote continuous mode remote micro-inch mode remote automatic single-stroke mode	10 13 14 24 26
Monitor clutch pressure and press motion	clutch pressure ON press in motion motor running forward	11 12 18

To program this objective	Use these command bits	B151/
Apply crowbar	enable crowbar relay	15
Sequence the operation of auxiliary valves	aux valve 1 cycles with clutch valve aux valve 2 cycles with clutch valve	16 17
Turn clutch and brake valves on/off with "soft" operation	aux valve 1 cycles with clutch valve aux valve 2 cycles with clutch valve auxiliary valve 1 enabled auxiliary valve 2 enabled	16 17 19 22
Omit valve-stem feedback when using valves with internal fault detection	auxiliary valve stems enabled C/B valve stems enabled	20 21
Reset processor following C/B fault	fault reset	23

Wiring Your Control System

Your application determines the wiring options to your control system: (We show you how to customize your wiring in chapter 3.)

- four or fewer run stations
- micro inch and/or micro inch feedback
- valve-stem feedback or valves with internal fault detection
- hardware or software motion detection
- crowbar shutdown
- grounded or ungrounded ac power

Wiring Drawings

To facilitate wiring your control system, we include drawings for:

- Wiring to I/O modules for grounded and ungrounded ac power
- Power distribution and relay backup circuits

Fold-out drawings accompany your manual as a separate package. We include duplicate wiring drawings in appendices G and H.

Information on Diskette

Software diskettes in your C/B Application Package consist of:

Diskette	Contents
C/B Control Logic for Processors A and B (about 2K words, each for PF2 and PF16)	**Program Files PF2 and PF16**: Factory-configured proprietary ladder logic for controlling the clutch/brake mechanism. Processors in chassis A and B monitor press inputs and feedback from the opposite I/O chassis; and control outputs to press solenoid valves. **Program File PF15:** Empty file that you program to integrate C/B control with that for the rest of the stamping press. **Program File 3:** Empty file that you program to call subroutines for the control of, or to directly control, auxiliary machine functions.
Wiring Drawings in AutoCAD and DXF formats	**System wiring**: Software version of all wiring drawings. Use it as the base to document all application wiring. Both AutoCAD release 11.0 (.DWG) and Interchange format (.DXF) files are included.

Control System Specifications

Type of processor
- PLC-5/x6 master processor
- PLC-5/x6 redundant processor

Type of ac power:
- grounded
- ungrounded

Mode selections
- off
- inch
- single stroke
- continuous
- remote
- micro-inch
- die change

Type of valves
- external fault detection
- internal fault detection

Valve outputs
- two clutch valves
- two auxiliary valves
- two micro-inch valves

Position monitoring inputs
- two rotary cam limit switch assemblies
- two resolver assemblies
- one of each of the above

Machine inputs
- top stop
- motion detector
- clutch/brake air pressure
- motor forward
- CRM
- CRM power

Number of run stations
- four or fewer

Response time of C/B control
- from switched input to turned-OFF output: 21ms typical (excluding other functions)

Command bits for clutch/brake logic

• simulate ACAM	B151/00
• simulate BCAM	B151/01
• simulate TCAM	B151/02
• permit cycle start	B151/03
• permit run	B151/04
• permit downstroke (delayed start)	B151/05
• permit upstroke	B151/06
• top stop	B151/07
• permit inch	B151/08
• simulate inch buttons	B151/09
• remote inch mode	B151/10
• clutch pressure on	B151/11
• press in motion	B151/12
• remote single-stroke mode	B151/13
• remote continuous mode	B151/14
• enable crowbar relay	B151/15
• auxiliary valve 1 cycles with clutch	B151/16
• auxiliary valve 2 cycles with clutch	B151/17
• motor running forward	B151/18
• auxiliary valve 1 enabled	B151/19
• auxiliary valve stems enabled	B151/20
• C/B valve stems enabled	B151/21
• auxiliary valve 2 enabled	B151/22
• fault reset	B151/23
• remote micro-inch mode	B151/24
• simulate run buttons	B151/25
• remote automatic single-stroke mode	B151/26
• arm for continuous on demand	B151/27
• inch output enabled	B151/28
• initiate automatic single stroke	B151/29

Environmental conditions
- Operating Temperature 0 to 60°C (32 to 140°F)
- Storage Temperature –40 to 85°C (–40 to 185°F)
- Relative Humidity 5 to 95% (without condensation)

Designed to comply with
- ANSI – B11.1
- OSHA – 1910.217
- CSA – CAN/CSA-Z142-M90

Define Your Control System Characteristics

Chapter Objectives

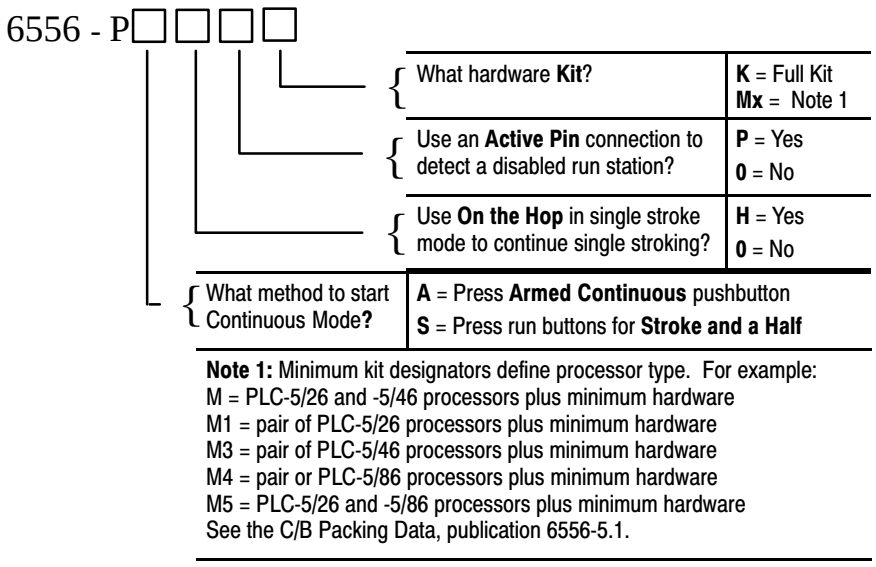
This chapter helps you complete the design of your Clutch/Brake Control System by specifying design characteristics on a worksheet as follows:

- verify your factory-configured options
- assign valves to specific outputs
- select the type of valve fault detection
- select input switches
- select the type of position sensor
- select command bits for your clutch/brake interface logic
- select other options
- select watchdog timer presets (optional)
- record on/off positions of rotary cam limit switches

Use the worksheet at the end of the chapter to record your selections. The numbered section headings match those on the worksheet.

1. Verify Your Factory-configured Options

To verify your choice of factory-configured options, inspect the label on the software diskette in your Application Package to be sure it matches the catalog number that you ordered.



2. Assign Valves to Specific Outputs

Each processor has three pairs of outputs for press valves (6 outputs per processor, 12 outputs per system). The pairs are:

- Clutch 1 and Clutch 2 (Clutch and Brake)
- Auxiliary 1 and Auxiliary 2
- Micro-inch 1 and Micro-inch 2

Assign your press valves to specific outputs as follows:

If your press has	Then use these outputs
one set of valves for clutch and brake	Clutch 1 and Clutch 2 for both
auxiliary valves for other functions such as "soft" C/B and/or dump valves	Clutch 1 for clutch, Clutch 2 for brake Auxiliary 1 and Auxiliary 2 for other
one additional set of valves for micro-inch	Micro-inch 1 and micro-inch 2 for micro-inch

Important: If using dump valves to assist in controlling the brake, you can program whether dump valves turn ON/OFF in unison with or opposite to clutch valves. We cover this under Command Bits in chapter 4.

Record your assignment of control system outputs on the worksheet.

3. Select the Type of Valve Fault Detection

There are two types of valve fault detection:

- internal – the valve checks itself for failure
- external – the control system checks a valve-actuated switch on the spool or stem to verify that the valve cycles every stroke

The type of fault detection determines whether you use valve-stem feedback:

If Your Valves Have This Fault Detection	Then the Valve	And your control system
internal	• closes automatically when it detects a fault • will NOT open unless both solenoids work in unison • has NO valve-stem switches	omits valve-stem feedback
external	• has valve-stem switches • provides an external signal of its valve position (when valve is open, switch is ON)	must have valve-stem feedback

Important: If one or more valves have valve-stem feedback, all valves must have it or simulate it. We show you how in chapter 3.

Record the type of valve fault detection and valve-stem feedback.

4. Select the Type of Position Sensor

The control system uses dual independent position sensors to monitor the slide position. You select the type of position sensor from:

- dual rotary cam limit switches (RCLS)
- dual resolvers (with RCLSs simulated in ladder logic)
- combination of both

Rotary Cam Limit Switches

These switches monitor the position of the slide by riding rotating cams. The switches open or close according to the cam geometry that you can adjust to represent the six rotational zones in the press cycle.

You must use two independent switch assemblies, one wired to chassis A, the other to chassis B, with these limit switches:

- brake monitor (BCAM)
- takeover (TCAM)
- anti-repeat (ACAM)

Device	Symbol	Purpose	Type
Anti-repeat (ACAM)		**In Single Mode:** Monitors press motion to limit operation to a single stroke if operators hold RUN buttons too long.	1 N.O. contact (2 switches per system)
Brake Monitor (BCAM)		**In Single or Continuous Mode:** Monitors the slide position where the press comes to a stop. Designed to prevent the press from starting if it stops too late	1 N.O. contact (2 switches per system)
Take-over (TCAM)		**In Single Mode:** Lets the press complete a stroke when operators release run buttons after downstroke. **In Continuous Mode**: Lets the press continue stroking. Stops the press at the end of a stroke when commanded.	1 N.O. contact (2 switches per system)

If using rotary cam limit switches, record the fact on the worksheet. We assist you in setting up your rotary cam limit switches in chapter 7.

Resolver

Resolvers monitor the position of the press slide electronically, so are free from contact failure. We recommend either group of resolver devices:

- AMCI Series 1700 resolver and interface module (for I/O chassis)
- NSD VRE-P062 resolver, VE-2A decoder, and 1771-IBD input module

When using resolvers, you must simulate the action of cam limit switches with ladder logic. We assist you in doing this in chapter 7. We reserved slots 0 and 1 of I/O chassis A and B for resolver input modules. This slot location helps you isolate ac and dc input signals.

If using resolvers, record the brand and model on the worksheet.

5. Record On/Off Positions of Rotary Cam Limit Switches

During installation of your rotary cam limit switches, you must set the on and off positions of these switches (Figure 2.1). Use the initial on/off positions specified by the press manufacturer.

Figure 2.1
Guidelines for Setting the On/Off Positions of the Rotary Cam Limit Switches

Set Up or Simulate Rotary Cam Limit Switches as Follows:

(A) During downstroke, BCAM must be On.

(B) During upstroke, TCAM must be On and BCAM must be Off.

(C) During upstroke, ACAM must cycle from On to Off to On while TCAM is On.

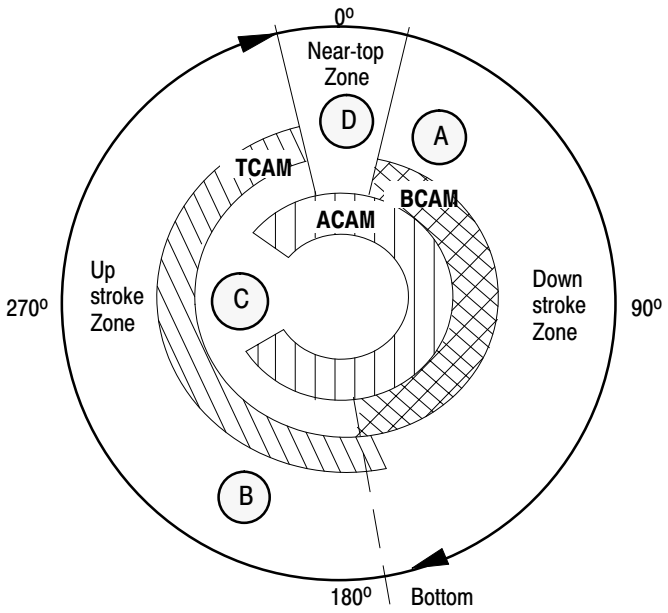
(D) Near top, BCAM and TCAM must be Off while ACAM remains On.

Other Conditions:

The software is designed to fault if/when it detects:
a. ACAM, BCAM, and TCAM are OFF all at the same time.
b. BCAM is On when ACAM is Off.
c. ACAM does not cycle while TCAM is On during upstroke.

ACAM should remain On for the entire stroke except for an On/Off/On cycle while TCAM is On during upstroke.

The dual sets of contacts need not cycle at the same moment. An offset of up to 1 second is acceptable. You can reduce this preset.



Important: See your press manufacturer's recommendations for On/Off settings of ACAM, BCAM, and TCAM switches

Write down initial on/off positions of cam limit switches on the worksheet. We tell you how to set up your rotary cam limit switches in chapter 7.

6. Select Input Switches

The control system monitors input switches as listed on the worksheet. As you review this list, record the quantity and location of each switch that you will use. We left space if you need additional switches.

7. Select Command Bits for C/B Interface Logic

Command bits (Table 2.A) that you program in file PF15 let you interface your application to the clutch/brake code in PF16. These bits let you:

- simulate RCLS for resolver inputs
- program operator interface functions
- interface machine functions during automatic continuous mode
- use auxiliary valves for operations such as "soft" clutch and brake
- simulate inch and/or micro-inch buttons during setup
- monitor clutch pressure and press motion
- select the operating mode from a remote selector
- control and monitor other functions

Table 2.A
Command Bits for Your Clutch/Brake Interface

To program this feature	Program these bits in PF15 Name	Address
Simulate rotary cam limit switches for resolver input	Brake Monitor	B151/00
	Takeover	B151/01
	Anti-repeat	B151/02
Operator interface and press automation (robotic functions in automatic continuous mode)	Permit Run	B151/04
	Permit Cycle Start	B151/03
	Permit Downstroke	B151/05
	Permit Upstroke	B151/06
	Top Stop	B151/07
	Simulate Run Buttons	B151/25
	Arm for Continuous on Demand	B151/27
	Inch Output Enabled	B151/28
	Initiate Automatic Single Stroke	B151/29
Simulate inch or micro-inch buttons during start up or for automatic die change	Permit Inch	B151/08
	Simulate Inch Buttons	B151/09
	Remote Inch Mode	B151/10
	Remote Micro-inch Mode	B151/24
Monitor clutch pressure and press motion	Clutch Pressure OK	B151/11
	Press in Motion	B151/12
	Main Motor Forward	B151/18
Select operating mode remotely with your ladder logic (Main selector switch must be switched to remote mode.)	Remote Inch Mode	B151/10
	Remote Single-stroke Mode	B151/13
	Remote Continuous Mode	B151/14
	Remote Micro-inch Mode	B151/24
	Remote Automatic Single-stroke Mode	B151/26
Reset processor with keyswitch after C/B fault	Fault Reset	B151/23
Enable the crowbar relay circuit As a last resort for an E-Stop condition, the processor sets a bit that closes a relay to dead-short the ac line. This is designed to trip the circuit breaker supplying the control system.	Enable Crowbar Relay	B151/15
Soft clutch and brake operation	Aux Valve 1 Cycles with Clutch Outputs	B151/16
	Aux Valve 2 Cycles with Clutch Outputs	B151/17
	Aux Valve 1 Enabled	B151/19
	Aux Valve 2 Enabled	B151/22
Required programming if you: omit auxiliary valves, and/or use valves without valve-stem switches	Aux Valve 1 Enabled	B151/19
	Aux Valve 2 Enabled	B151/22
	Aux Valve Stems Enabled	B151/20
	C/B Valve Stems Enabled	B151/21

Record the command bits required for your application on the worksheet. We present examples of how to use these bits in chapter 4.

8. Select Other Options

We provide you with wiring drawings on paper and diskette for ac power:

- grounded
- ungrounded

Important: Select the type of ac wiring system used for your press. Discard the other set of drawings on paper and diskette to avoid confusion.

Other options relate to the way you:

- wire your control system for application options
- program ladder logic in PF15

We tell you how to implement these options in chapters 3 and 4.

Refer to the list of options and corresponding wiring drawings and/or command bits in the worksheet. Browse through the wiring drawings and select wiring-related options on the worksheet.

9. Reduce Watchdog Timer Presets (Optional)

You may program shorter watchdog timer presets but never longer presets. We show you how in chapter 4. On the worksheet, check the timers you want to change and record their shorter presets.

Configuration Worksheet

1. Verify Your Factory-configured Options

Do this by inspecting the label on the software diskette in your Application Package and matching it to your order number, such as cat. no. 6556-PA[1]H[2]P[3]K[4]:

Factory-configured Options (by Cat. No.)		Code	Ordered	Received
[1] Method to Start	Arm continuous PB, or	A		
Continuous Mode	Stroke-and-a-half	S		
[2] On-the-hop	With this feature	H		
	Omit this feature	0		
[3] Active Pin	With active pin, or	P		
in Run Stations	Omit active pin	0		
[4] Hardware Kit	Full kit	K		
	Minimum bundle [1]	M, M1-M5		

[1] For hardware lists of various kits, see the C/B Packing Data, publication 6556-5.1.

2. Assign Outputs

Match 1771-OD16 outputs to your clutch/brake valves. For output wiring, refer to wiring drawing sheet 9.

Output	1771-OD16 Address	Your Designation
Clutch 1	AO:005/02 and BO:005/02	
Clutch 2 (Brake)	AO:005/03 and BO:005/03	
Auxiliary 1	AO:005/06 and BO:005/06	
Auxiliary 2	AO:005/07 and BO:005/07	
Micro-inch 1	AO:005/12 and BO:005/12	
Micro-inch 2	AO:005/13 and BO:005/13	
Auxiliary valves in unison with_ or in opposition to ___clutch valves.		
If not used, set corresponding command bit		

3. Record the Type(s) of Valve Fault Detection

Important: If using a mix of valves having external and internal fault detection, you must:

- use valve-stem feedback on all valves with external fault detection
- simulate valve-stem feedback on valves with internal fault detection

Press Valves	External	Internal	Reference
Clutch 1 & 2			Sheets 8 and 9
Auxiliary 1 & 2			
Micro-inch 1 & 2			

Valve–stem feedback? yes_____ no_____

4. Select the Type and Location of Position Monitors

Record the type of position monitor and to which I/O chassis it will be wired. If using resolvers, record the rack/group/slot number (rack address) of the resolver input module.

Position Monitor	Chassis A	Chassis B
Rotary Cam Limit Switches		
Resolver and Input Module(s) • AMCI Series 1700 Resolver and Input Module		
• NSD VE-2A, VRE-P062, 1771-IBD		

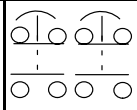
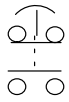
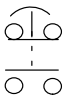
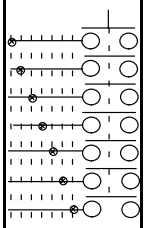
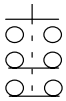
5. Record On/Off Positions of Rotary Cam Limit Switches

Write down the press manufacturer's recommended on/off positions for rotary cam limit switches (RCLSs) or for resolver simulation. You may adjust them later.

Name of RCLS	ON @ ^{o}Rotation	OFF @ ^{o}Rotation
Brake Monitor (BCAM)		
Takeover (TCAM)		
Anti-repeat (ACAM)		

6. Select Input Switches

Record the quantity and locations of your input switches.

Device	Symbol	Purpose	Type	Qty	Location
Palm Buttons for Run Stations (1 pr./station)		• Used by press operators to start the press in single or continuous mode. • Assures 2-hand operation of the press in single or continuous mode (located more than 24" apart). • Position RUN stations per ANSI B11.1 appendix A	Momentary pushbuttons dual contact normally closed N.C. and normally open N.O.		
Left-hand Inch		• Lets you inch the press up or down. • Assures 2-hand operation of the press when positioned more than 24" from other button.	Momentary pushbuttons dual contact N.C. and N.O		
Right-hand Inch		• Lets you inch the press up or down. • Assures 2-hand operation of the press when positioned more than 24" from other button.	Momentary pushbuttons dual contact N.C. and N.O.		
Stop on Top		• Turns clutch output OFF at the next top of stroke. • No effect in single mode.	Momentary pushbutton single NC contact		
E-Stop		• Wire in series. • Distribute as needed to stop press quickly. • You are responsible for meeting applicable codes.	Momentary pushbutton single N.C. contact		
Mode Select		• Lets you select the operating mode: Off Inch Micro-inch Single Continuous Remote Die Change	Rotary, 7-position key lockable		
Arm Continuous		• Lets you begin a 5-second time window to start continuous mode.	Momentary pushbutton single N.O. contact		
Main Motor Forward Interlock		• Monitors whether motor-forward starter is engaged. If not, it opens to prevent running the press in single or continuous mode.	N.O. auxiliary contact for forward motor starter		
Air Pressure		• Monitors maintained signal of C/B air pressure • Must be ON to run single or continuous cycles	N.O. single-throw pressure switch		
Motion Detector Interlock		• Detects press motion in single or continuous mode. • Must cycle ON/OFF with press motion • If using resolvers, program this function.	N.O. single contact		
Control Reset		• Lets you manually reset power to valve outputs at power up or after an E-stop.	Momentary pushbutton single N.O. contact		
Clutch/Brake Power Reset		• Lets you manually reset clutch power (and crowbars if used) on power up or after an E-stop.	Momentary pushbutton triple contact 1 N.O. and 2 N.C.		
Chain Break Indicator		• Monitors the chain drive. When it detects breakage, it opens to stop a downstroke or to prevent starting the press.	N.O. limit switch, held closed		

7. Select Optional Command Bits for C/B Interface Logic

Select command bits for your clutch/brake interface (PF15).
We grouped bits by similar kind. For logic examples, see chapter 4.

Important: Some bits are listed more than once, based on usage.

To:	Use this Control Bit:	At Addr.	✓
Simulate the brake-monitor (BCAM) with a resolver	Brake Monitor [1]	B151/00	
Simulate the take-over (TCAM)	Take-over [1]	B151/01	
Simulate the anti-repeat (ACAM)	Anti-repeat [1]	B151/02	
Enable run buttons	Permit Cycle Start	B151/03	
Monitor safety interlocks	Permit Run	B151/04	
Enable press motion in downstroke, after pressing buttons	Permit Downstroke (Delayed Start)	B151/05	
Stop press operation in upstroke	Permit Upstroke	B151/06	
Turn OFF clutch output at next top zone	Top Stop	B151/07	
Start the press automatically in remote automatic modes	Simulate Run Buttons	B151/25	
Start the arming timer for continuous on demand	Arm for Continuous on Demand	B151/27	
Start inch with inch buttons *and* this bit set remotely	Inch Output Enabled	B151/28	
Lets you start auto single stroke without cycling the press	Initiate Automatic Single Stroke	B151/29	
Allow inching	Permit Inch	B151/08	
Simulate hardwired inch buttons during setup	Simulate Inch Buttons	B151/09	
Allow simulated inch buttons during setup	Remote Inch Mode	B151/10	
Allow simulated micro-inch buttons during setup	Remote Micro-inch Mode	B151/24	
Simulate a pressure switch with an analog input	Clutch Pressure On	B151/11	
Simulate a motion switch with a resolver input	Press in Motion [1]	B151/12	
Simulate a motion switch with a drive input	Main Motor Forward	B151/18	
Select the operating mode remotely with your ladder logic.	Remote Inch Mode	B151/10	
(Main selector switch must be switched to remote mode.)	Remote Single-stroke Mode	B151/13	
	Remote Continuous Mode	B151/14	
	Remote Micro-inch Mode	B151/24	
	Remote Automatic Single-stroke Mode	B151/26	
Use a pushbutton to reset the processor after a C/B fault	Fault Reset	B151/23	
Enable the crowbar relay circuit to dead-short the ac line	Enable Crowbar Relay	B151/15	
Determine the sequencing of auxiliary valve operation	Aux Valve 1 Cycles with Clutch Outputs	B151/16	
(Also used with bits 19 and 22 for “soft ” C/B valves.)	Aux Valve 2 Cycles with Clutch Outputs	B151/17	
Program “soft” clutch and and brake valve operation	Aux Valve 1 Enabled	B151/19	
(Also used to delete the use of auxiliary valves 1 and 2.)	Aux Valve 2 Enabled	B151/22	
Delete valve-stem feedback when using valves with internal fault detection	Aux Valve Stems Enabled	B151/20	
	C/B Valve Stems Enabled	B151/21	
	[1] for resolver inputs, only		

8. Select Options That Affect System Wiring

Check the ac distribution system wiring you will use:
ungrounded _____ (appendix G) , or grounded _____ (appendix H)

Important: To avoid confusion from two sets of drawings, remove and/or discard the *unused* set (printed and electronic versions).

Check which of the following options are applicable.

If	Then	Refer to Wiring	Refer to Logic	✓
Using the crowbar relay circuit	Enable its ladder logic by setting bit B151/15.		Figure 4.12	
Not using the crowbar relay circuit	Omit the wiring for the crowbar relay circuit. Remove from wiring drawings.	sheets 1, 2, 9	N/A	
Replacing the clutch/brake air pressure switch with an analog sensor	Omit switch wiring. Rewire the input. Modify the drawings. Simulate the switch with ladder logic.	sheet 2	Figure 4.9	
Replacing the main motor forward switch with a drive feedback		sheet 2	Figure 4.13	
Replacing the motion detector switch with a resolver signal		sheet 2	Figure 4.10	
Using fewer than four run stations	Omit the wiring of unused stations. Remove from wiring drawings.	sheet 7	N/A	
You did NOT purchase the active-pin option	Omit the wiring for active pin. Remove from wiring drawings.	sheet 7	N/A	
You purchased the stroke-and-a-half option	Omit the wiring for the arm continuous button. Remove from wiring drawings.	sheet 7	N/A	
Using valves with internal fault detection	Omit valve-stem switch wiring. Remove from wiring drawings. Enable ladder logic by setting bits B151/20 and/or 21.	sheet 8	Figure 4.15	
Using fewer than seven operating modes	Rewire the mode selector switch. Remove unused wiring from wiring drawings.	sheet 8	N/A	
Not using auxiliary valves	Enable ladder logic by setting bits B151/19 and/or 22. Omit output wiring, and remove from wiring drawings.	sheet 9	N/A	
Not using micro-inch valves	Omit output wiring of micro-inch valves. Remove from wiring drawings.	sheet 9	N/A	

9. Reduce Watchdog Timer Presets as an Option

Check the timers you want to change and record shorter presets (in seconds).

Timer	Preset	✓	New Preset
Data Highway Heartbeat	1		
Triac Feedback Watchdog	3		
Crowbar Relay Weld	1		
Crowbar Relay Failed to Turn On	1		
Seal Relay Watchdog	1		
E-Stop Relay Failed to Turn On	1		
E-Stop Weld	1		
No Valid Mode Selected	3		
Clutch/Brake Mode Mismatch	2		
Station # 1 Anti-tiedown	3		
Station # 2 Anti-tiedown	3		
Station # 3 Anti-tiedown	3		
Station # 4 Anti-tiedown	3		
Inch Button Anti-tiedown	3		
Clutch/Brake Air Pressure	3		
Clutch/Brake Air Pressure Exhausted	3		
BCAM Soft Cam Compare	3		
TCAM Soft Cam Compare	1		
ACAM Soft Cam Compare	1		
Motion Detector Watchdog	3		
Motion Detector Permissive	3		
Micro-inch Feedback Valve 1 Off	1		
Micro-inch Feedback Valve 2 Off	1		
Micro-inch Feedback Valve 1 On	1		
Micro-inch Feedback Valve 2 On	1		
Arm Continuous Button	5		
Arm for Continuous on Demand	300		
Clutch 1 Failed to Turn On	1		
Clutch 1 Failed to Turn Off	1		
Clutch 2 Failed to Turn On	1		
Clutch 2 Failed to Turn Off	1		
Clutch Valve-stem 1 Failed to Turn On	1		
Clutch Valve-stem 1 Failed to Turn Off	1		
Clutch Valve-stem 2 Failed to Turn On	1		
Clutch Valve-stem 2 Failed to Turn Off	1		
Auxiliary Valve 1 Failed to Turn On	1		
Auxiliary Valve 1 Failed to Turn Off	1		
Auxiliary Valve 2 Failed to Turn On	1		
Auxiliary Valve 2 Failed to Turn Off	1		
Auxiliary Valve-stem 1 Failed to Turn On	1		
Auxiliary Valve-stem 1 Failed to Turn Off	1		
Auxiliary Valve-stem 2 Failed to Turn On	1		
Auxiliary Valve-stem 2 Failed to Turn Off	1		
Automatic Single-stroke Time Out	3		

10. Select Options That Require Programming

We give you examples to help you program the following options:

If	Then	Refer to Logic	✓
Using delayed-start logic	Program your own logic in PF15.	Figure 4.4	
Using a “soft” clutch and brake		Figure 4.14	
Starting remote automatic single-stroke cycles		Figure 4.18, 19	
Starting remote automatic continuous on demand		Figure 4.18, 20	
Exchanging data between processors		Figure 4.23	
Using fault and prompt bits		Figure 4.24	
Using shorter presets for internal timers		Figure 4.25	
Using press ready-to-start indicators		Figure 4.26	
Using a brake monitor		Figure 4.27	
Using variable-speed top stop		Figure 4.28	

Notes

Customize the Wiring to Suit Your Application

Chapter Objectives

In this chapter, we present default configurations of the control system, and show you how to modify them to meet your application requirements. We:

- list default wiring configurations and modifications you can make
- explain how to install wiring drawing diskettes on your hard drive
- explain how to perform the wiring modifications
- give example figures showing completed modifications

How to Customize the Default Wiring

Here are the modifications that you can make to customize the wiring of the control system to suite your application.

For This Category	Use This Default Configuration	Or, Modify Your Wiring Drawings to:
rotary cam limit switches	hardwired switches	replace RCLSs with resolvers
crowbar	hardwired relays (you must set B151/15)	delete the crowbar relay circuit
air pressure	hardwired switch	replace with an analog pressure sensor
main motor forward	hardwired switch	replace with a drive feedback
motion detector	hardwired switch	replace with resolver input
run stations	use all four	delete up to three
active pin	active pin is wired	delete active pin wiring
arm continuous	hardwired switch	replace arm continuous with stroke-and-a-half
valve stem feedback	valves with external fault detection	use valves with internal fault detection
press mode selector	7-position switch	delete unused selector positions
auxiliary valves	use auxiliary valves for “soft ” C/B or dump	delete them
micro-inch valves	use micro-inch buttons and valves	delete them

We organized the modifications by I/O module group number according to the wiring drawing on which the configuration is presented. Modifications are also grouped according to:

- ungrounded ac system power
- grounded ac system power

Install Your Wiring Drawing Diskettes

We provide you with wiring drawings on diskette so you can install them on your computer and modify them electronically according to the options that you choose for your application.

- DWG -AutoCAD (release 11.0)
- DXF - File Interchange

Follow this procedure to install your wiring drawings and to select the format that suits your computer.

1. Insert the Clutch/Brake Wiring Drawings diskette.
2. Change to “a” drive.
3. At the “a” prompt, type **Install C:**
   You get the Select the Appropriate Drawings window.
4. To select ungrounded and/or grounded ac wiring drawings, cursor to your choice of:
   - ungrounded
   - grounded
   - both

   Then press **[ENTER]**.
   You get the Select Appropriate File Types window.
5. To select the type of file, cursor to your choice of:
   - DXF - File Interchange
   - DWG -AutoCAD (release 11.0)
   - both

   Then press **[ENTER]**.
   This installs the file(s) in the following subdirectories
   - \6556\UNGROUND
   - \6556\GROUNDED
6. Refer to your CAD system instructions for the procedure to access these files.

Generalized Instructions to Customize Your Wiring

To customize the wiring drawings to suit your application:

1. Select the modifications that apply to your application from tables on left-hand pages in this section.
2. Follow the instructions for the modification.
   Some modifications require that you write ladder logic to replace the function of the deleted wiring, or that you wire an input terminal to a power rail.
3. Observe the corresponding example wiring diagram on the right-hand page that results from making the modification.

We present instructions according to I/O module group because the wiring for each I/O module group is presented on a separate drawing in your set of wiring drawings.

Customizing an Ungrounded AC System

Important: If using *grounded* ac power, skip to the next section.

ATTENTION: To guard against unexpected machine operation with possible injury to personnel and/or machinery damage, do not modify the wiring of system power distribution (sheet 1 of 9) except as follows:

1. Deletion of crowbar relays.
2. Enter your own wiring in the EMERGENCY STOP BY CUSTOMER zone 01-12 for such switches as:
   - E-Stop pushbuttons
   - die block
   - C/B air pressure
   - counterbalance air pressure

I/O Module Group 2 (sheet 6 of 9) Ungrounded AC Power

For this modification	Make these changes	And see
Replace RCLSs with resolvers	**1.** Delete the three pairs of limit switches (RLCSs) at input terminals [1], [3], and [5]. **2.** Wire input terminals [1], [3], and [5] to power rails (wire high): for rack A00 to 105L1, for rack B00 to 105L2. **3.** Write ladder logic to simulate the action of the rotary cam limit switches.	Figure 3.1 Figure 7.5
Delete Crowbar Relays	**1.** Delete wiring crowbar relay feedback to input terminal [25] for chassis A and B. We deleted the wiring (Figure 3.2) and added the label *(Reserved, Do Not Use)*. **2.** Delete Crowbar Relays A and B from the Power Distribution Drawing (sheet 1 of 9) **3.** See Module Group 5. Delete Crowbar Relays and wiring from output terminal 33 for chassis A and B. We deleted the wiring (Figure 3.12) and added the label *(Reserved, Do Not Use)*.	Figure 3.2 Figure 3.3 Figure 3.12
Delete Clutch/Brake Air Pressure Switch	**1.** Delete the clutch/brake air pressure switch at input terminal [33] for chassis A. **2.** Wire input terminal [33] of chassis A and B to power rail 105L1 (wire high). **3.** Write ladder logic to monitor clutch/brake air pressure.	Figure 3.4 Figure 4.9
Delete Main Motor Forward Switch	**1.** Delete the main motor forward switches at input terminal [35] for chassis A and B. **2.** Wire input terminal [35] to the power rail (wire high): for rack A00 to 105L1, for rack B00 to 105L2. **3.** Write ladder logic to monitor the device that detects forward motion.	Figure 3.4 Figure 4.13
Replace Motion Detector Switch with Ladder Logic	**1.** Delete the motion detector switches at input terminal [37] for chassis A and B. **2.** Wire input terminal [37] to the power rail (wire high): for rack A00 to 105L1, for rack B00 to 105L2. **3.** Write ladder logic to simulate the action of the motion detector switch.	Figure 3.4 Figure 4.10
Seal Relay, C/B Power Reset and Feedback, CRM and CRM Power Feedback	**1.** No modifications allowed. You must wire these inputs as shown on sheet 2 of 9 for the control system to work correctly.	N/A

Figure 3.1
Replace RCLSs with Ladder Logic (Module Group 2)

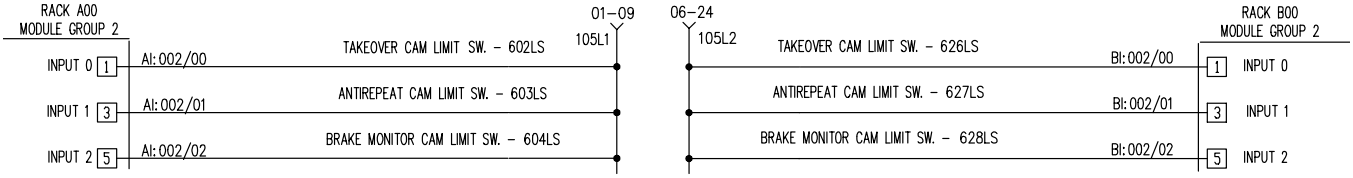


Figure 3.2
Delete Crowbar Relay Feedback (Module Group 2)

Figure 3.3
Delete Crowbar Relay (Power Distribution) (Module Group 2)

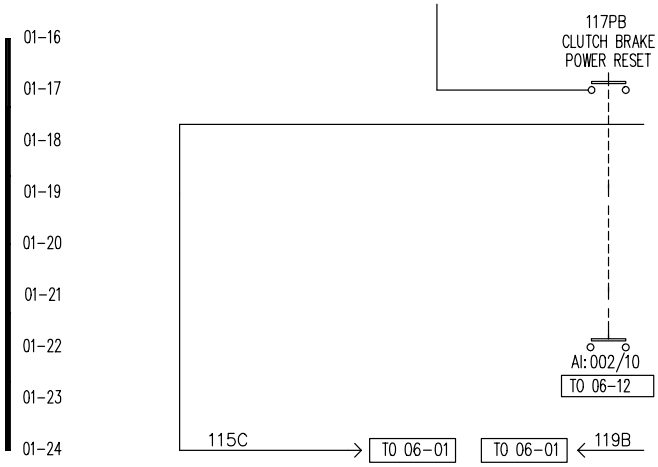
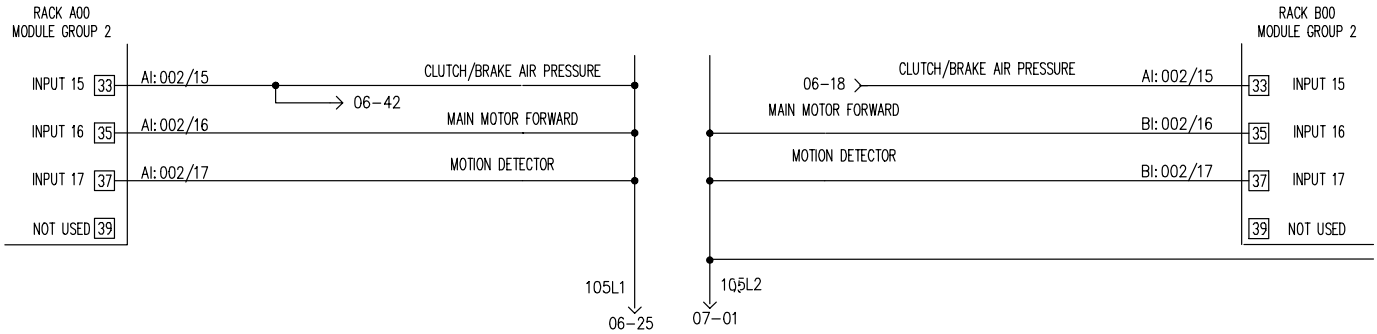


Figure 3.4
Delete Clutch/Brake Air Pressure, Main Motor Forward, and Motion Detector Switches (Module Group 2)



I/O Module Group 3 (sheet 7 of 9) Ungrounded AC Power

For this modification	Make these changes	Then see
Delete run station 1 (You must have at least one active run station)	**1.** Delete the right run station pushbutton switch wired to input terminal [1] for chassis A and to input terminal [3] for chassis B. **2.** Wire input terminal [1] for chassis A and input terminal [3] for chassis B to the power rail 105L1 (wire high). **3.** Delete the left run station pushbutton switch wired to input terminal [3] for chassis A and to input terminal [1] for chassis B. **4.** Wire input terminal [3] for chassis A and input terminal [1] for chassis B to the power rail 105L2 (wire high). **5.** Delete active pin wiring from input terminal [5] and from power rail 105L1 for chassis A and B.	Figure 3.5
Delete run stations 2, 3, and/or 4 (You must have at least one active run station)	**1.** Delete the right run station pushbutton switch wired to input terminal [7], [15], or [23] for chassis A and to input terminal [11], [17], or [25] for chassis B (respectively). **2.** Wire input terminal [7], [15], or [23] for chassis A and input terminal [11], [17], or [25] for chassis B (respectively) to the power rail 105L1 (wire high). **3.** Delete the left run station pushbutton switch wired to input terminal [11], [17], or [25] for chassis A and to input terminal [7], [15], or [23] (respectively) for chassis B. **4.** Wire input terminal [11], [17], or [25] for chassis A and input terminal [7], [15], or [23] for chassis B (respectively)to the power rail 105L2 (wire high). **5.** Delete active pin wiring from input terminal [13], [21], or [27] and from power rail 105L1 for chassis A and B.	Figure 3.6
Delete active pin (factory-configured option)	If you ordered the factory-configured option of *NO* active pin: **1.** Delete active pin wiring from input terminals [5], [13], [21], and [27] and from power rail 105L1 for chassis A and B. We deleted the wiring (Figure 3.6) and added the label *(Reserved, Do Not Use)*.	Figure 3.6
Delete Arm Continuous (factory-configured)	**1.** Remove the arm continuous switch and wiring at input terminal [37] in chassis A and B. We deleted the wiring (Figure 3.7) and added the label *(Reserved, Do Not Use)*.	Figure 3.7
Stop on top Left/Right Inch	**1.** No modifications allowed. You must wire these inputs as shown on sheet 7 of 9 for the control system to work correctly.	N/A

Figure 3.5
Delete Run Station 1 (Module Group 3)

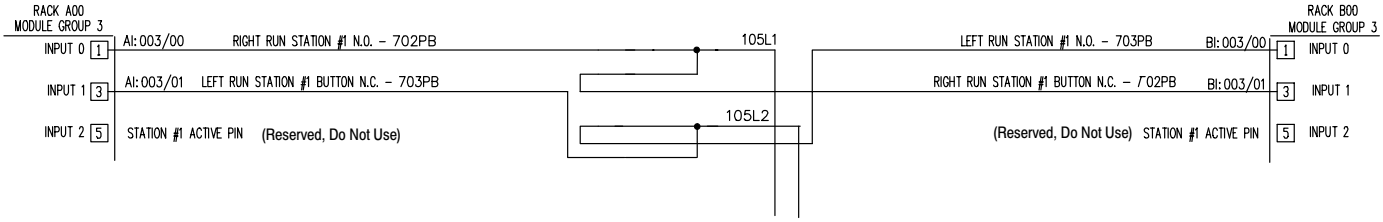


Figure 3.6
Delete Run Stations and Active Pin (Module Group 3)

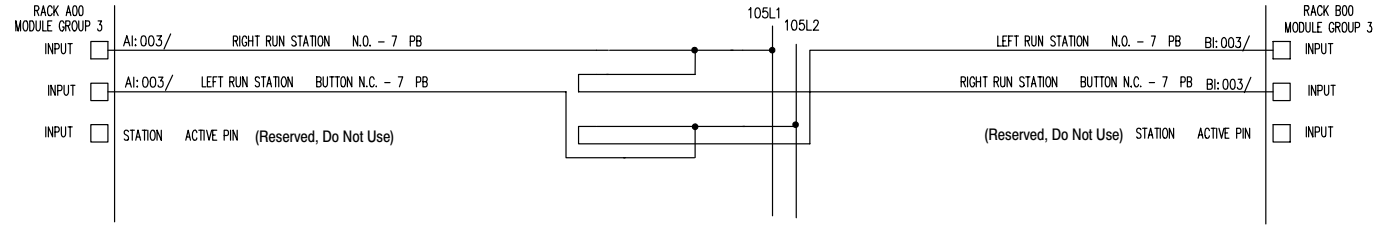
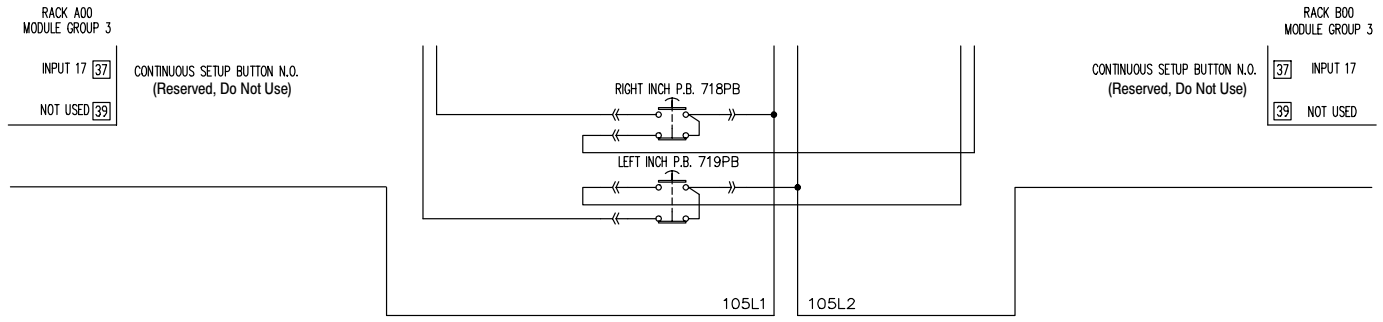


Figure 3.7
Delete Arm Continuous Switch (Module Group 3)



I/O Module Group 4 (sheet 8 of 9) Ungrounded AC Power

For this modification	Make these changes	Then see
Use Micro-inch Valves With Internal Fault Detection or, Delete Micro-inch Valves	**1.** Delete micro-inch valve-stem limit switches and wiring from input terminals [1] and [3]. We deleted the wiring (Figure 3.8) and added the label *(Reserved, Do Not Use).* **2.** If deleting the micro-inch valves, remove output wiring in module group 5.	Figure 3.8 Figure 3.11
Use C/B Valves With Internal Fault Detection	**1.** Delete clutch valve-stem limit switches and wiring from input terminals [5] and [7]. We deleted the wiring (Figure 3.8) and added the label *(Reserved, Do Not Use).* **2.** **Important:** Write ladder logic to reset bit B151/21 (C/B Valve Stems Enabled).	Figure 3.8 and Figure 4.15
Use Auxiliary Valves With Internal Fault Detection or, Delete Auxiliary Valves	**1.** Delete auxiliary valve-stem limit switches and wiring from input terminals [11] and [13]. We deleted the wiring (Figure 3.8) and added the label *(Reserved, Do Not Use).* **2.** **Important:** Write ladder logic to reset bit B151/20 (Auxiliary Valve Stems Enabled). **3.** If deleting the auxiliary valves, remove output wiring in module group 5.	Figure 3.8 and Figure 4.15 Figure 3.10
Delete Unused Selector Switch Positions	**1.** You must retain at least the OFF position as shown on sheet 8 of 9. Label unused selector switch inputs on wiring drawings *(Reserved, Do Not Use).* **2.** Delete wiring from unused switch positions to corresponding input terminals. Use successive switch positions (leave no blank positions). For example, 1 = off, 2 = inch, 3 = single, 4 = continuous, 5 = die change, 6 and 7 = not used.	Figure 3.9
Chain Break	**1.** Required for chain-driven position monitoring device as shown on sheet 8 of 9.	N/A

Figure 3.8
Delete Valve-stem Feedback for Clutch, Auxiliary, and/or Micro-inch Valves (Module Group 4)

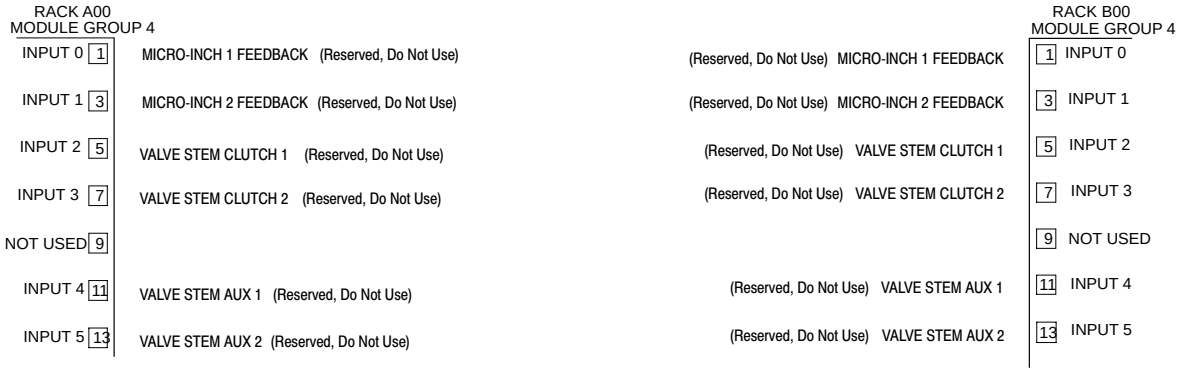
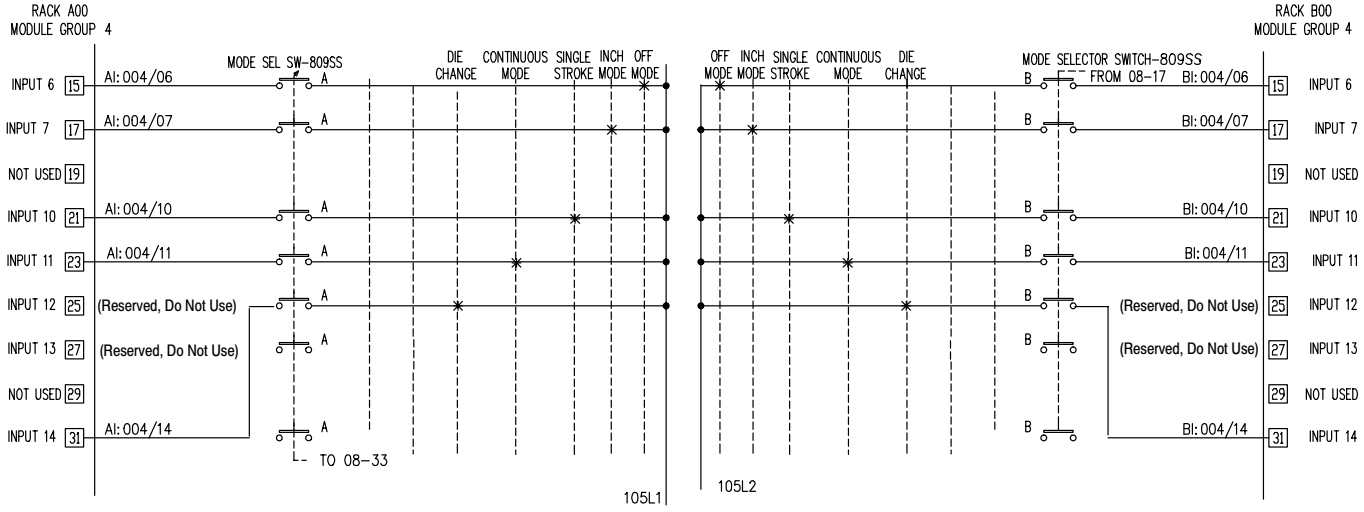


Figure 3.9
Delete Unused Selector Switch Positions (Module Group 4)



I/O Module Group 5 (sheet 9 of 9) Ungrounded AC Power

For this modification	Make these changes	Then see
Use Valves With Internal Fault Detection	No change to output wiring in I/O group 5. **1. Important:** Write ladder logic to reset bit B151/20 (Auxiliary Valve Stems Enabled). Write ladder logic to reset bit B151/21 (C/B Valve Stems Enabled).	Figure 4.15
Delete Auxiliary Valve Outputs	**1.** Delete Auxiliary Valve 1 and wiring from output terminal [15] for chassis A and B. **2.** Delete Auxiliary Valve 2 and wiring from output terminal [17] for chassis A and B. We deleted the wiring (Figure 3.10) and added the label *(Reserved, Do Not Use)*. **3. Important:** Write ladder logic to reset bit B151/19 (Auxiliary Valve 1 Enabled). Write ladder logic to reset bit B151/22 (Auxiliary Valve 2 Enabled).	Figure 3.10 Figure 4.15
Delete Micro-inch Valve Outputs	**1.** Delete Micro-inch Valve 1 and wiring from output terminal [25] for chassis A and B. **2.** Delete Micro-inch Valve 2 and wiring from output terminal [27] for chassis A and B. We deleted the wiring (Figure 3.11) and added the label *(Reserved, Do Not Use)*.	Figure 3.11
Delete Crowbar Relay Outputs	**1.** Delete Crowbar Relays and wiring from output terminal [33] for chassis A and B. We deleted the wiring (Figure 3.12) and added the label *(Reserved, Do Not Use)*.	Figure 3.12
Clutch 1 and 2 Outputs Controller OK Seal Relay	**1.** No modifications allowed. You must wire these inputs as shown on sheet 9 of 9 for the control system to work correctly.	N/A

Figure 3.10
Delete Auxiliary Valve Outputs (Module Group 5)

Figure 3.11
Delete Micro-inch Valve Outputs (Module Group 5)

Figure 3.12
Delete Crowbar Relay Outputs (Module Group 5)

Customize a Grounded AC System

To customize the wiring of I/O module groups 2-5 to suit your application, refer General Instructions to Customize Your Wiring (page 3), and follow the instructions below. Instructions and examples are on facing pages.

Important: If using *ungrounded* ac power, go back to the previous section.

ATTENTION: To guard against unexpected machine operation with possible injury to personnel and/or machinery damage, do not modify the wiring of system power distribution (sheet 1 of 9) except as follows:

1. Deletion of crowbar relays.
2. Enter your own wiring in the EMERGENCY STOP BY CUSTOMER zone 01-12 for such switches as:
   - E-Stop pushbuttons
   - die block
   - air pressure for C/B and counterbalance

I/O Module Group 2 (sheet 6 of 9) Grounded AC Power

For this modification	Make these changes	And see
Replace RCLSs with resolvers	**1.** Delete the three pairs of limit switches (RLCSs) at input terminals [1], [3], and [5]. **2.** Wire input terminals [1], [3], and [5] to power rail 108L1 (wire high). **3.** Write ladder logic to simulate the action of the rotary cam limit switches.	Figure 3.13 Figure 7.5
Delete Crowbar Relays	**1.** Delete wiring crowbar relay feedback to input terminal [25] for chassis A and B. We deleted the wiring (Figure 3.14) and added the label *(Reserved, Do Not Use)*. **2.** Delete Crowbar Relays A and B from the Power Distribution Drawing (sheet 1 of 9) **3.** See Module Group 5. Delete Crowbar Relays and wiring from output terminal 33 for chassis A and B. We deleted the wiring (Figure 3.24) and added the label *(Reserved, Do Not Use)*.	Figure 3.14 Figure 3.15 Figure 3.24
Delete Clutch/Brake Air Pressure Switch	**1.** Delete the clutch/brake air pressure switch at input terminal [33] for chassis A. **2.** Wire input terminal [33] of chassis A and B to power rail 108L1 (wire high). **3.** Write ladder logic to monitor clutch/brake air pressure.	Figure 3.16 Figure 4.9
Delete Main Motor Forward Switch	**1.** Delete the main motor forward switches at input terminal [35] for chassis A and B. **2.** Wire input terminal [35] to power rail 108L1 (wire high). **3.** Write ladder logic to monitor the device that detects forward motion.	Figure 3.16 Figure 4.13
Replace Motion Detector Switch with Ladder Logic	**1.** Delete the motion detector switches at input terminal [37] for chassis A and B. **2.** Wire input terminal [37] to power rail 108L1 (wire high). **3.** Write ladder logic to simulate the action of the motion detector switch.	Figure 3.16 Figure 4.10
Seal Relay, C/B Power Reset and Feedback, CRM and Feedback	**1.** No modifications allowed. You must wire these inputs as shown on sheet 1 of 9 for the control system to work correctly.	N/A

Figure 3.13
Replace RCLSs with Ladder Logic (Module Group 2)

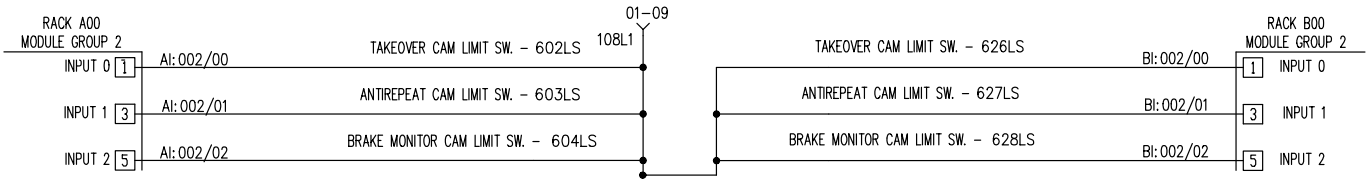


Figure 3.14
Delete Crowbar Relay Feedback (Module Group 2)

Figure 3.15
Delete Crowbar Relay (Power Distribution)

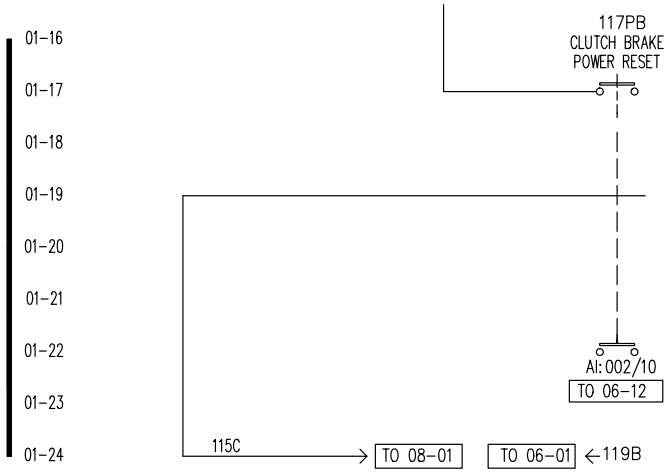
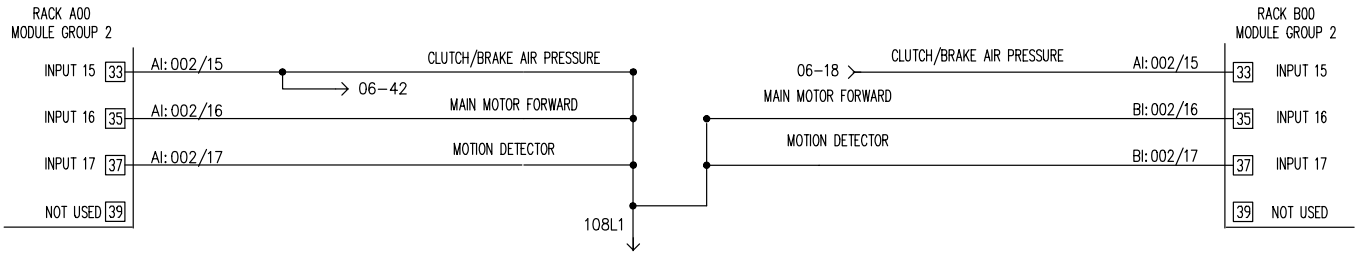


Figure 3.16
Delete Clutch/Brake Air Pressure, Main Motor Forward, and Motion Detector Switches (Module Group 2)



I/O Module Group 3 (sheet 7 of 9) Grounded AC Power

For this modification	Make these changes	And see
Delete run station 1 (You must have at least one active run station)	**1.** Delete the right run station pushbutton switch wired to input terminal [1] for chassis A and to input terminal [3] for chassis B. **2.** Wire input terminal [1] for chassis A and input terminal [3] for chassis B to the power rail 108L1 (wire high). **3.** Delete the left run station pushbutton switch wired to input terminal [3] for chassis A and to input terminal [1] for chassis B. **4.** Wire input terminal [3] for chassis A and input terminal [1] for chassis B to the power rail 108L2 (wire high). **5.** Wire input terminal [5] for the station 1 active pin for chassis A and B to power rail 108L1 (wire high).	Figure 3.17
Delete run stations 2, 3, and/or 4 (You must have at least one active run station)	**1.** Delete the right run station pushbutton switch wired to input terminal [7], [15], [23] for chassis A and to input terminal [11], [17], [25] for chassis B. **2.** Wire input terminal [7], [15], [23] for chassis A and input terminal [11], [17], [25] for chassis B to the power rail 108L1 (wire high). **3.** Delete the left run station pushbutton switch wired to input terminal [11], [17], [25] for chassis A and to input terminal [7], [15], [23] for chassis B. **4.** Wire input terminal [11], [17], [25] for chassis A and input terminal [7], [15], [23] for chassis B to the power rail 108L2 (wire high). **5.** Wire input terminal [13], [21], [27] for the station 2 active pin for chassis A and B to power rail 108L1 (wire high).	Figure 3.18
Delete active pin (factory-configured option)	If you ordered the factory-configured option of *NO* active pin: **1.** Delete active pin wiring from input terminals [5], [13], [21], and [27] and from power rail 108L1 for chassis A and B. We deleted the wiring (Figure 3.18) and added the label *(Reserved, Do Not Use)*.	Figure 3.18
Delete Arm Continuous (factory-configured)	**1.** Delete the arm continuous switch and wiring at input terminal [37] in chassis A and B. We deleted the wiring (Figure 3.19) and added the label *(Reserved, Do Not Use)*.	Figure 3.19
Stop on top Left/Right Inch	**1.** No modifications allowed. You must wire these inputs as shown on sheet 7 of 9 for the control system to work correctly.	N/A

Figure 3.17
Delete Run Station 1 (Module Group 3)

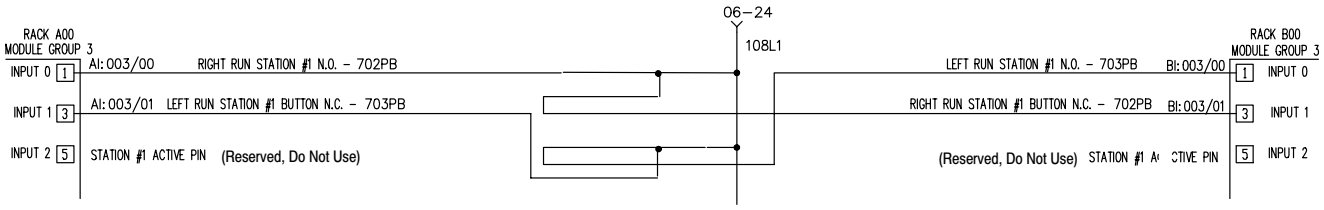


Figure 3.18
Delete Run Stations and Active Pin (Module Group 3)

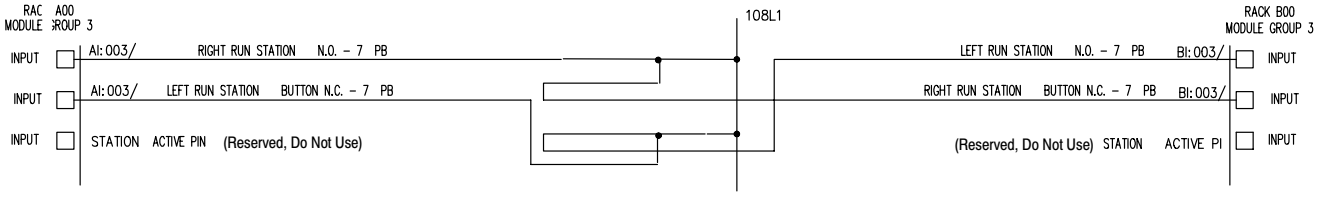
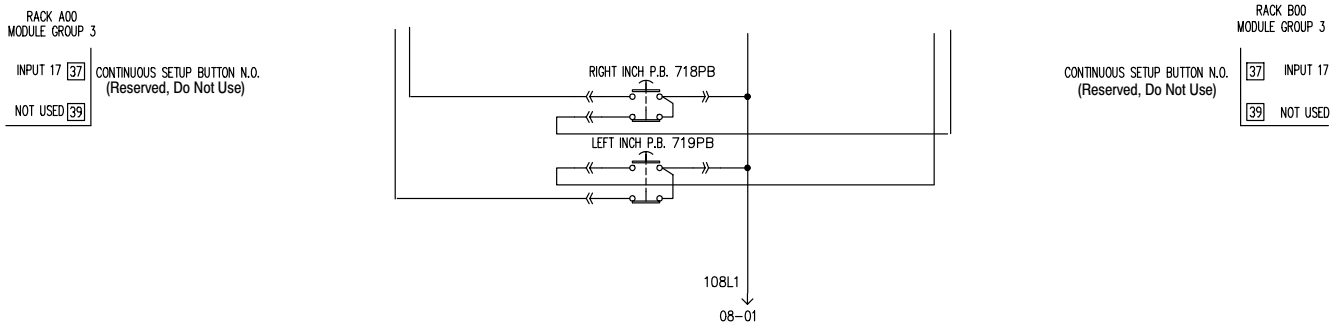


Figure 3.19
Delete Arm Continuous Switch (Module Group 3)



I/O Module Group 4 (sheet 8 of 9) Grounded AC Power

For this modification	Make these changes	And see
Use Micro-inch Valves With Internal Fault Detection or, Delete Micro-inch Valves	**1.** Delete micro-inch valve-stem limit switches and wiring from input terminals [1] and [3]. We removed the wiring (Figure 3.20) and added the label *(Reserved, Do Not Use).* **2.** If deleting the micro-inch valves, delete output wiring in module group 5.	Figure 3.20 Figure 3.23
Use C/B Valves With Internal Fault Detection	**1.** Delete clutch valve-stem limit switches and wiring from input terminals [5] and [7]. We removed the wiring (Figure 3.20) and added the label *(Reserved, Do Not Use).* **2.** **Important:** Write ladder logic to reset bit B151/21 (C/B Valve Stems Enabled).	Figure 3.20 and Figure 4.15
Use Auxiliary Valves With Internal Fault Detection or, Delete Auxiliary Valves	**1.** Delete auxiliary valve-stem limit switches and wiring from input terminals [11] and [13]. We removed the wiring (Figure 3.20) and added the label *(Reserved, Do Not Use).* **2.** **Important:** Write ladder logic to reset bit B151/20 (Auxiliary Valve Stems Enabled). **3.** If deleting the auxiliary valves, remove output wiring in module group 5.	Figure 3.20 and Figure 4.15 Figure 3.22
Delete Unused Selector Switch Positions	**1.** You must retain at least the OFF position as shown on sheet 8 of 9. Label unused selector switch inputs on wiring drawings *(Reserved, Do Not Use)*. **2.** Delete wiring from unused switch positions to corresponding input terminals. Use successive switch positions (leave no blank positions). For example, 1 = off, 2 = inch, 3 = single, 4 = continuous, 5 = die change, 6 and 7 = not used.	Figure 3.21
Chain Break	**1.** Required for chain-driven position monitoring device as shown on on sheet 8 of 9.	N/A

Figure 3.20
Delete Valve-stem Feedback for Clutch, Auxiliary, and/or Micro-inch Valves (Module Group 4)

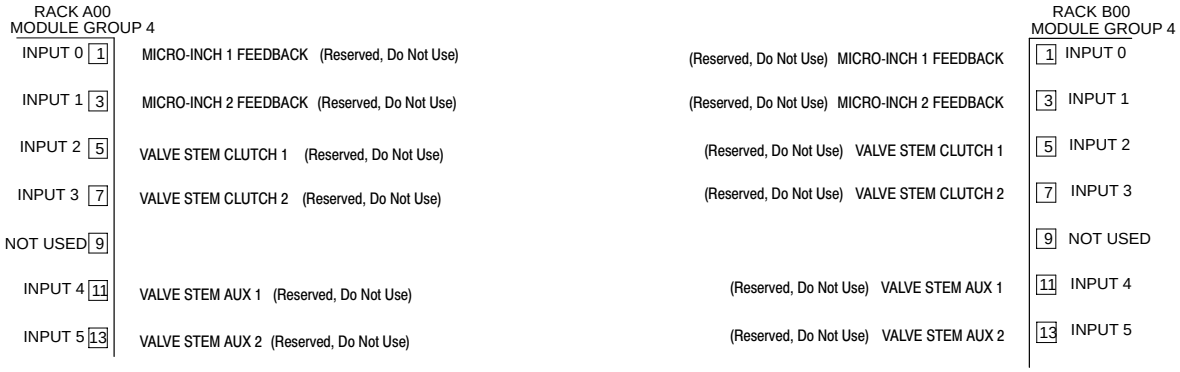
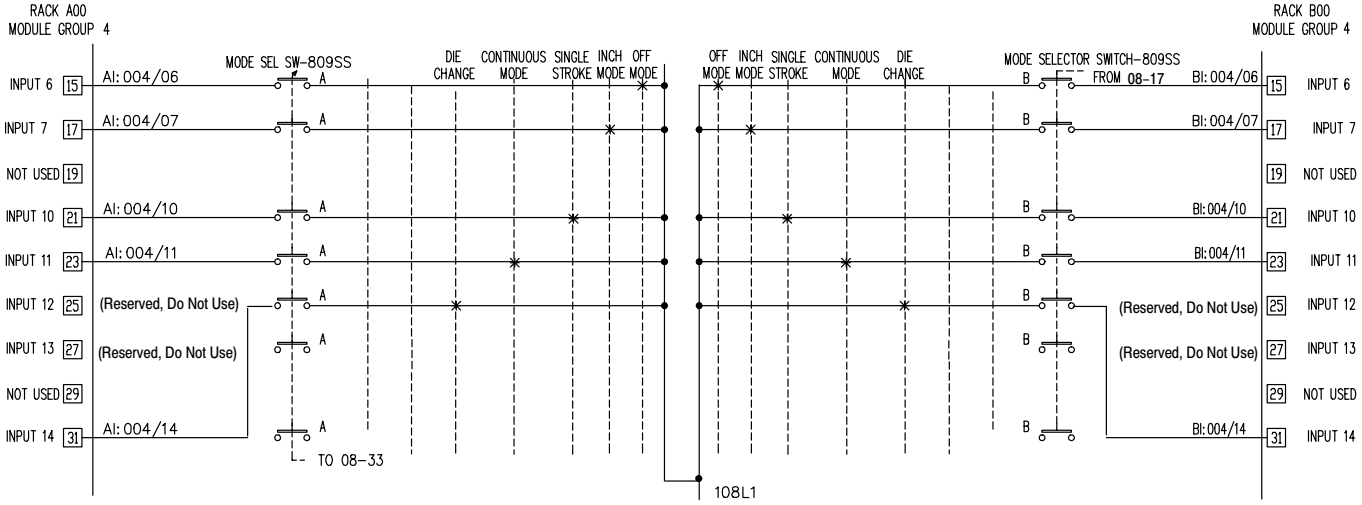


Figure 3.21
Delete Unused Selector Switch Positions (Module Group 4)



I/O Module Group 5 (sheet 9 of 9) Grounded AC Power

For this modification	Make these changes	And see
Use Valves With Internal Fault Detection	No change to output wiring in I/O group 5. **1. Important:** Write ladder logic to reset bit B151/20 (Auxiliary Valve Stems Enabled). Write ladder logic to reset bit B151/21 (C/B Valve Stems Enabled).	Figure 4.15
Delete Auxiliary Valve Outputs	**1.** Delete Auxiliary Valve 1 and wiring from output terminal [15] for chassis A and B. **2.** Delete Auxiliary Valve 2 and wiring from output terminal [17] for chassis A and B. We deleted the wiring (Figure 3.22) and added the label *(Reserved, Do Not Use)*. **3. Important:** Write ladder logic to reset bit B151/19 (Auxiliary Valve 1 Enabled). Write ladder logic to reset bit B151/22 (Auxiliary Valve 2 Enabled).	Figure 3.22 Figure 4.15
Delete Micro-inch Valve Outputs	**1.** Delete Micro-inch Valve 1 and wiring from output terminal [25] for chassis A and B. **2.** Delete Micro-inch Valve 2 and wiring from output terminal [27] for chassis A and B. We deleted the wiring (Figure 3.23) and added the label *(Reserved, Do Not Use)*.	Figure 3.23
Delete Crowbar Relay Outputs	**1.** Delete Crowbar Relays and wiring from output terminal [33] for chassis A and B. We deleted the wiring (Figure 3.24) and added the label *(Reserved, Do Not Use)*.	Figure 3.24
Clutch 1 and 2 Outputs Controller OK Seal Relay	**1.** No modifications allowed. You must wire these inputs as shown on sheet 9 of 9 for the control system to work correctly.	N/A

Figure 3.22
Delete Auxiliary Valve Outputs (Module Group 5)

Figure 3.23
Delete Micro-inch Valve Outputs (Module Group 5)

Figure 3.24
Delete Crowbar Relay Outputs (Module Group 5)

Notes

Write Ladder Logic

Chapter Objectives

To help you write ladder logic to customize the operation of your clutch/brake control system, we present the following information:

- overview of memory organization for processors A and B
- data files reserved for control system data
- how command bits act on control logic in protected memory
- select from these command bits
- steps to write ladder logic
- programming command bits
- using fault and prompt bits
- exchanging data between processors with the scanner/adapter channel
- programming shorter presets for your internal timers
- programming press-ready-to-start indicators
- programming a brake monitor
- programming a variable-speed top stop

Important: We suggest that you study the entire chapter *before* you begin writing your logic.

Overview of Memory Organization

Your clutch/brake control system has dual PLC-5/x6 processors: one in I/O chassis A, the other in chassis B. Memory organization is similar in both processors. Program files PF2 and PF16 are factory programmed and password protected for "read only". You will program your clutch/brake interface in program file PF15, and your machine-related functions such as for robotics, lubrication, and die change in pre-assigned subroutine files.

We organized processor memory as follows:

Program File	Description (Processor in Chassis A)	Description (Processor in Chassis B)
PF2	Factory-configured Master Control Program (Locked)	Identical to processor in chassis A
PF3	Used to call subroutines to control auxiliary press functions, such as automation valve, die protection, robotics, etc.	Optional but available for application programming, independent of processor in chassis A
PF15	Where you program the clutch/brake interface with machine sequencing to customize the clutch/brake code in PF16	Similar to processor in chassis A
PF16	Factory-configured clutch/brake code (read, only)	Identical to processor in chassis A
Other Subroutines	Pre-assigned subroutines that you write for application programming (as needed). You call these subroutines from PF3.	Available for application programming, independent of processor A

Reserved Program and Data Files

Allen-Bradley has adopted certain conventions for assigning press-control functions to specific subroutine files. For standardization, we suggest that you assign subroutine files and corresponding data files for press-control functions in addition to the clutch/brake as listed in Appendix E.

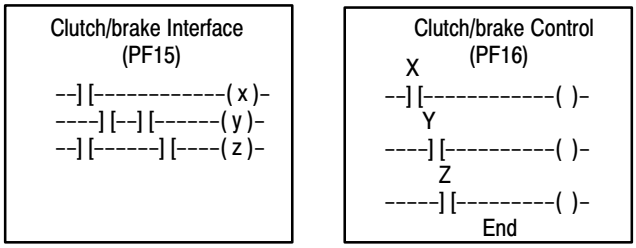
We recommend that in program file PF3, you call a subroutine for each press-control function with Jump to Subroutine, Subroutine, and Return instructions. We designed the software with this in mind.

Important: For standardization when programming your press-control requirements, we recommend that you follow the assigned files as listed in Appendix E.

How Command Bits Act On Control Logic in Protected Memory

Command bits, B151/00-29, let you customize the operation of your clutch/brake control system to include control of press operations beyond that of the clutch/ brake mechanism alone. Their use is optional. The clutch/brake control system will control the clutch/brake mechanism without them. If you selected *no* command bits for your press application in chapter 2, skip to *Exchanging Data Between Processors* for required programming later in this chapter.

In both processors, your interface program (PF15) contains your ladder logic that interfaces with the clutch/brake control logic in protected memory (PF16). You control operations in the clutch/brake control logic (PF16) by manipulating inputs to that logic by outputs from your clutch/brake interface logic (PF15). For example, output command bits x, y, and z from your interface ladder logic in PF15 are inputs X, Y, and Z to the clutch/brake control logic in PF16.



Typically, the processors in chassis A and B must see identical conditions or declare a fault.

Important: We programmed input rungs for command bits at the end of protected memory in PF16. The command bits used for these inputs are described in the next table. Most are held ON unless your custom ladder logic in PF15 turns them OFF. Exceptions are noted in the next table: they are held OFF unless turned ON.

Select from These Command Bits

You may program one or more of the following command bits in Program File 15 to customize the operation of your press. Your control system will control the clutch/brake mechanism even if you program *none* of them.

Important: Protected memory in PF2 sets these bits to default status. These bits are turned ON every scan *with these exceptions:* Where noted by [1] below, these bits are turned OFF every scan.

Bit	Address	ON/OFF States	Example Application	Example Ladder Logic
ACAM, BCAM, and TCAM	B151/00, /01, /02	Refer to chapter 7, Figure 7.1.	Monitor the shaft position during press strokes.	Refer to chapter 7, Figure 7.5.
Permit Cycle Start	B151/03	ON – must be ON to enable run buttons OFF– may turn OFF after the press starts	If not set prior to pressing Run buttons, operator must release and re-press them.	LS (home) B151/03 --] [----------( )-
Permit Run	B151/04	ON – must be ON before pressing run buttons OFF – turns OFF press outputs in single and continuous mode	Use to ensure that safety interlocks are in safe state before enabling Run buttons.	Interlocks B151/04 --] [--] [--] [--] / [-----( )-
Permit Downstroke	B151/05	ON – last logical condition to start downstroke OFF – prevents movement in downstroke zone	Use with run buttons for delayed start: Run buttons can be pressed and held until this bit is set.	Timer DN B151/05 --] [----------( )-
Permit Upstroke	B151/06	ON – must be ON during upstroke (when on take-over cam) OFF – stops upstroke	Halts upstroke if a mechanical device is in a danger zone.	LS (danger) B151/06 --] [----------( )-
Top Stop	B151/07	ON – must be ON to start continuous stroking OFF– turns clutch output OFF at next stroke top	Halts continuous stroking.	Remote cycle stop B151/07 --] [----------( )-
Permit Inch	B151/08	ON – must be ON to inch the press OFF – stops inch motion	Permissive switches must be OK to start or continue inch motion.	Permissives B151/08 --] [--] [--] / [---------( )-
Simulate Inch Buttons	B151/09 [1]	Used with remote inch mode (bit 10) and remote micro-inch mode (bit 24): ON – simulates pressing manual inch buttons OFF – simulates releasing inch buttons	Simulates the pressisng of manual inch buttons.	Inch Logic B151/09 --] [--] / [----------( )-
Remote Inch Mode	B151/10 [1]	ON – lets your logic switch the mode to inch OFF – inhibits use of bit 09, Simulate Inch, and logic must select another remote mode.	Allows automatic inch motion with Simulated Inch Buttons (bit 09).	Enable B151/10 --] [----------( )-
Clutch Pressure ON	B151/11	ON – must turn ON for single/continuous stroking. OFF – disables press outputs at loss of pressure (must be OFF to start single or continuous)	For analog input: Must turn ON to detect that press is powered.	| GEQ | B151/11 | |----------( )-
Press in Motion	B151/12	ON – must be ON for single/continuous stroking OFF – disables press outputs at loss of motion (must be OFF to start single or continuous)	Must turn ON within preset (3 sec) of C/B power to detect that the press is moving.	Centrifugal Sw B151/12 --] [----------( )-
Remote Single Mode	B151/13 [1]	ON – lets your logic switch the mode to single OFF – prevents same. When OFF, your logic must select another remote mode.	Set main selector switch to remote and use automation-simulated run buttons.	Master Control Remote Selector B151/13 --] [---------- ---( )-
Remote Continuous Mode	B151/14 [1]	ON – lets logic switch the mode to continuous OFF – prevents same. When OFF, your logic must select another remote mode.	Automated presses are cycled from a master controller (or from a line supervisor).	Master Control Remote Selector B151/14 --] [----------( )-
Enable Crowbar Relay	B151/15 [1]	ON – crowbar relay circuit is enabled OFF – crowbar relay circuit is passive	Supplements E-Stop. Shorts L1 to L2 if seal relay does not open.	B151/15 ----------( )-

[1] **Important:** These bits are held OFF in ladder logic unless your custom ladder logic turns them ON.

Bit	Address	ON/OFF States	Example Application	Example Ladder Logic
Auxiliary Valve 1 Cycles with Clutch Valve	B151/16	ON – auxiliary valve energizes with clutch valves OFF – energizes with brake valves	Controls the order in which press valves sequence.	B151/16 ----------( )-
Auxiliary Valve 2 Cycles with Clutch Valve	B151/17	ON – auxiliary valve energizes with clutch valves OFF – energizes with brake valves		B151/17 ----------( )-
Main Motor Forward	B151/18	ON – simulates main motor in forward direction OFF – simulates main motor stopped or reversed	Uses rotational signals from a DC drive to detect motor rotation	Drive Status B151/18 --] [--] / [----------( )-
Auxiliary Valve 1 Enabled	B151/19	ON – default for using corresponding hardware and standard wiring OFF – tells software to ignore corresponding hardware inputs because they are absent.	When NOT using hardware/wiring: **1.** Program a rung for the bit. **2.** Delete hardware and wiring. **3.** Correct your wiring drawings: **Figures 3.10, 3.11, 3.21, 3.22** **4.** Write ladder logic similar to Figure 4.15.	B151/19 ----------(U)-
Auxiliary Valve Stems Enabled	B151/20			B151/20 ----------(U)-
C/B Valve Stems Enabled	B151/21			B151/21 ----------(U)-
Auxiliary Valve 2 Enabled	B151/22			B151/22 ----------(U)-
Fault Reset	B151/23 [1]	ON – enables a 1-shot-clear of faults and prompts OFF – must cycle to off before the next 1-shot	Clears all fault and prompt bits. Latched bits will re-appear.	PB Enable B151/23 --] [----------( )-
Remote Micro-inch Mode	B151/24 [1]	ON – lets the logic switch the mode to micro-inch OFF – inhibits Simulate Inch Button, bit 09 Logic must select another remote mode.	Allows automatic micro-inch motion with Simulated Inch Button, bit 09.	Enable B151/24 --] [----------( )-
Simulate Run Buttons for: Auto Single Mode	B151/25 [1]	ON – initiates automatic start of single-stroke cycle from near top position. OFF – Must cycle ON/OFF every cycle.	Operator must cycle one stroke in automatic single-stroke mode. Then set this bit to start next cycle.	Enable B151/25 --] [----------( )-
Continuous on Demand		ON – initiates automatic start of continuous mode OFF – prevents same	Your logic must set this bit within 5 minutes of setting bit 27.	
Remote Automatic Single-Stroke	B151/26 [1]	ON – lets the logic switch the mode to auto single OFF – prevents same. When OFF, your logic must select another remote mode.	Allows automatic single stroke with Simulated Run Button, bit 25.	Enable B151/26 --] [----------( )-
Armed for Continuous on Demand	B151/27 [1]	ON – in remote continuous mode, arms C/B logic for 5 min to start continuous on demand. OFF – toggles after timed out	Set bit 25 after setting this bit (27). For a completely automatic press. Ingores mechanical run buttons.	Enable B151/27 --] [----------( )-
Inch Output Enabled	B151/28	ON – last logical condition to start inch OFF – prevents starting inch, or stops it once ON.	Use with inch buttons, pressed and held until this bit is set.	Enable B151/28 --] [----------( )-
Initiate Automatic Single Stroke	B151/29 [1]	ON – lets you start the press in auto single mode without first cycling the press. OFF – operator must start auto single mode by cycling the press with Run buttons.	Used in remote operation (with bits 25, 26, and 27) Refer to Figure 4.19	Enable B151/29 --] [----------( )-

[1] **Important:** These bits are held OFF in ladder logic unless your custom ladder logic turns them ON.

Important: We designed the clutch/brake code in PF16 with the requirement that you must program most of the command bits with nearly identical logic and hardware conditions for processors A and B. The following table designates which command bits do NOT have that requirement:

Logic and Hardware Conditions Can be *Different* for Processors A and B For These Bits:			
Permit cycle start	(B151/03)	Permit upstroke	(B151/06)
Permit run	(B151/04)	Permit cycle start	(B151/08)
Permit downstroke	(B151/05)	Press in motion	(B151/12)

Steps to Write Ladder Logic

Follow these guidelines when writing ladder logic for your C/B interface in PF15. We present programming examples afterwards.

1. Install your programming software on your hard drive. Use instructions in the manual that accompanied your software.
2. Execute the following procedure to install program files onto your hard drive (from the diskette in your Application Package).
   a. Insert the diskette into drive A.
   b. Change to “a” drive.
   c. To install program files: at the “a” prompt, type **Install C:**
   If using 6200 Software, installs to C:\IPDS\ARCH\PLC5
   If using AI5 software, installs to C:\PLC5\PROGS
3. Rename our program files *only if using AI5 software* as follows: (If using 6200 series software, skip this step. You can download a PLC-5/86 program to a PLC-5/26 or -5/46 processor.)

If Processor A Is This Type:	Make This the Default File:	By Renaming It:	If Processor B Is This Type:	Make This the Default File:	By Renaming It:
PLC-5/26	Pxxx_A26.x5	Pxxx_A.x5	PLC-5/26	Pxxx_B26.x5	Pxxx_B.x5
PLC-5/46	Pxxx_A46.x5	Pxxx_A.x5	PLC-5/46	Pxxx_B46.x5	Pxxx_B.x5
PLC-5/86	Pxxx_A.x5	n/a	PLC-5/86	Pxxx_B.x5	n/a

Important: With AI5 software, you can download a program file of designated type only to that type of processor. Select the program for your designated processor and rename it so you can download and view the program with comments and symbols.

4. List all operations that you must program, and assign them to:
   - your interface program file (PF15)
   - main program file (PF3) We do NOT provide examples for this.
   - subroutines to PF3 We do NOT provide examples for this.
5. Identify and map the program and data files that we provide (see appendix E) that your application requires.
6. For clutch/brake logic, review programming examples and command-bit descriptions to be sure that you understand associated logic.
7. Write your own ladder logic. If adding other press-control functions, use the pre-assigned subroutines. **Attention:** Be sure to program the scanning of your subroutines in the correct sequence. Otherwise, possible unexpected motion could cause damage, injury, or death.
8. Thoroughly check your ladder logic, data and I/O addresses.
9. Check your ladder logic against the worksheet in chapter 2 to verify that you programmed all required functions.
10. When your programming is free of errors, make a back-up copy of your software diskette.

Programming Command Bits

We present programming examples for command bits B151/03-B151/29.

ATTENTION: You are responsible for your own application logic. If using our examples, do so only after modifying them to suit your application. Direct use or misapplication of these examples could result in unexpected machine motion with possible personal injury and/or damage to equipment.

Command Bit or Function	B151/	Logic
Permit Cycle Start	03	Figure 4.1
Permit Run	04	Figure 4.2
Permit Downstroke	05	Figure 4.3
or Delayed Start		Figure 4.4
Permit Upstroke	06	Figure 4.5
Top Stop	07	Figure 4.6
Permit Inch	08	Figure 4.7
Simulate Inch Button	09*	Figure 4.8
Remote Inch Mode	10*	
Clutch Pressure ON	11	Figure 4.9
Press in Motion	12	Figure 4.10
Mode Change from Remote Selector	13*, 14 *	Figure 4.11
Enable Crowbar Relay	15 *	Figure 4.12
Auxiliary Valve Cycles with Clutch Valve	16, 17	
Main Motor Forward	18	Figure 4.13
Control “Soft” Clutch and Brake Operation	15, 16, 19, 22	Figure 4.14
Indicate Absence of Physical Inputs	19, 20, 21, 22	Figure 4.15
Fault Reset	23 *	Figure 4.16
Remote Micro-inch Mode	24*	Figure 4.17
Simulate Run Buttons	25 *	Figure 4.18
Remote Automatic Single-stroke Mode	26 *	Figure 4.19
Arm for Continuous on Demand	27 *	Figure 4.20
Inch Output Enabled	28	Figure 4.21
Initiate Automatic Single Stroke	29 *	Figure 4.22

* Program these bits by turning them ON. Program all other bits by turning them OFF.

We present these additional programming examples under separate headings later in this chapter:

How to Exchange Scanner Data Between Processors	Figure 4.23
Using Fault and Prompt Bits (Generate BCD Number)	Figure 4.24
Programming Shorter Presets for Internal Timers	Figure 4.25
Programming Press Ready-to-start Indicators	Figure 4.26
Programming a Brake Monitor	Figure 4.27
Programming a Variable Speed Top Stop	Figure 4.28

To start press motion, we recommend that you use the following bits:

- B151/03 – permit cycle start
- B151/04 – permit run
- B151/05 – permit downstroke (or delayed start)

Figure 4.1
Example of the Permit Cycle Start Command B151/03

Use this command in single or continuous mode to ensure that the piece is in place before pressing Run buttons to start the press. Include B160/60 if you want to start only from the near-top position.

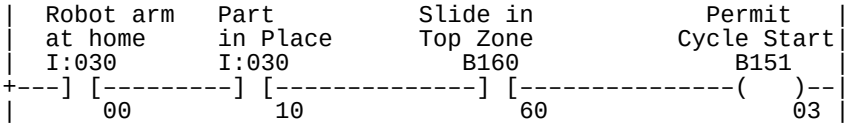


Figure 4.2
Example of the Permit Run Command B151/04

Use this command in single or continuous mode to ensure that safety interlocks are in a safe state.

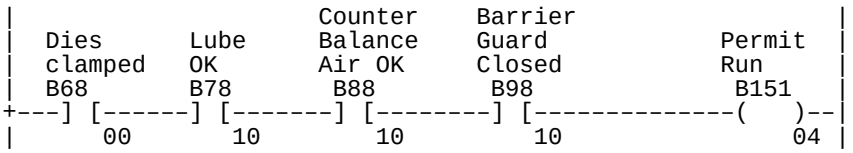


Figure 4.3
Example of the Permit Downstroke Command B151/05

Use the downstroke command in any mode to start the downstroke after all other conditions are met for starting press motion.

Figure 4.4
Example of the Delayed Start Command With B151/05

You can program a delayed start initiated by the AND of part-in-place and all-Run-buttons-pressed.

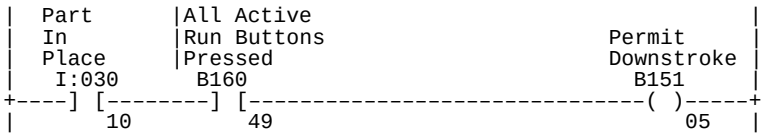


Figure 4.5
Example of the Permit Upstroke Command B151/06

Use the upstroke command in any mode to prevent or stop an upstroke.

Figure 4.6
Example of the Top Stop Command B151/07

Use the top stop command in continuous mode to halt the press at the next top of stroke. It is typically asserted from a remote master controller.

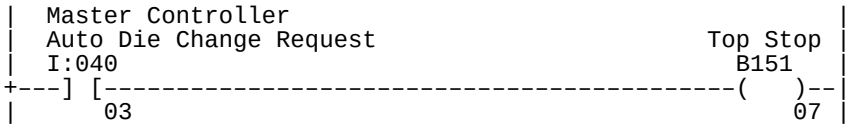


Figure 4.7
Example of the Permit Inch Command B151/08

Use the permit inch command to allow inching (used to inch the press to bottom during manual die change in this example).

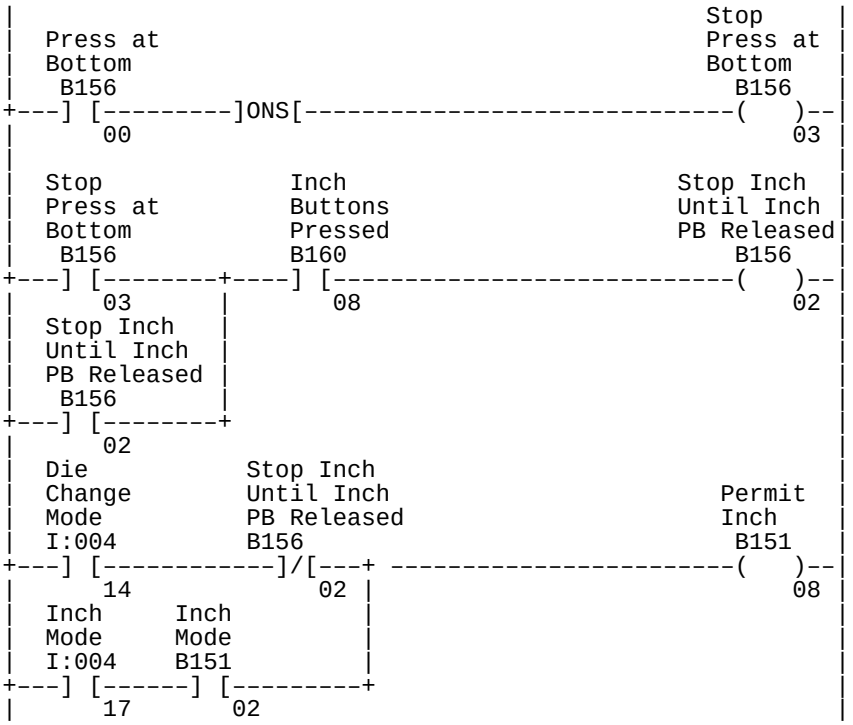


Figure 4.8
Example Commands to Simulate Inch Buttons B151/09 and Select Remote Inch Mode B151/10

Use these two command bits in an automatic operation. (In this example, they are used to inch the press to bottom.)

Important: The main selector switch must be in remote mode.

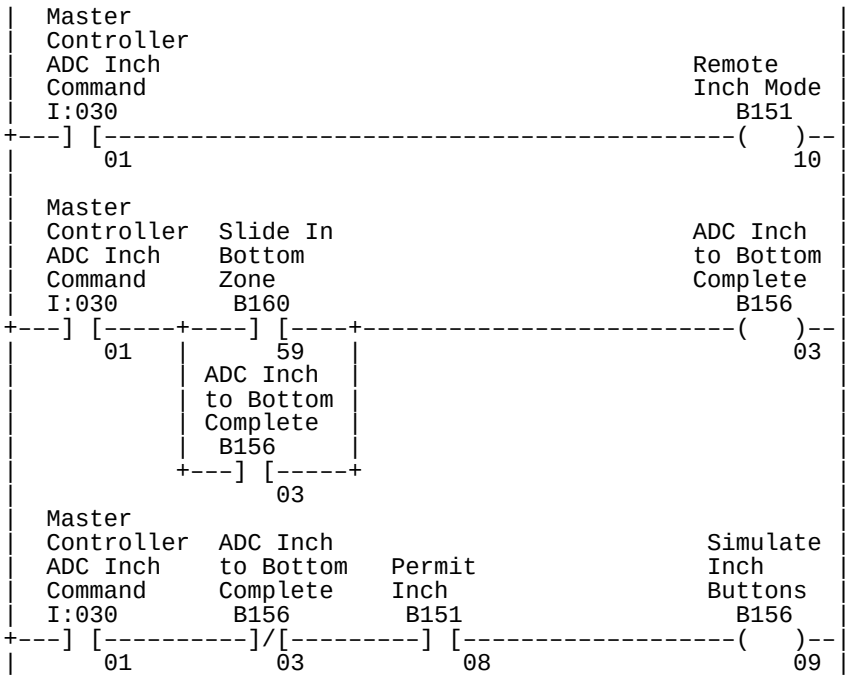


Figure 4.9
Example of the Command for Clutch Pressure ON B151/11

Use the signal from a pressure transmitter and 1771-IFE module to detect that clutch/brake air pressure reached setpoint.

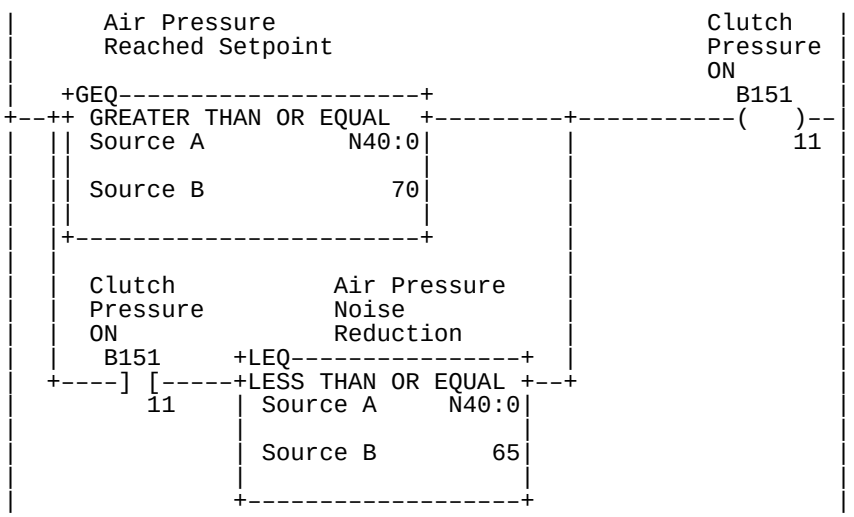


Figure 4.10
Example of the Command for Press in Motion B151/12

Use the press in motion command to detect shaft motion with a resolver module in slot zero (at address I:000).

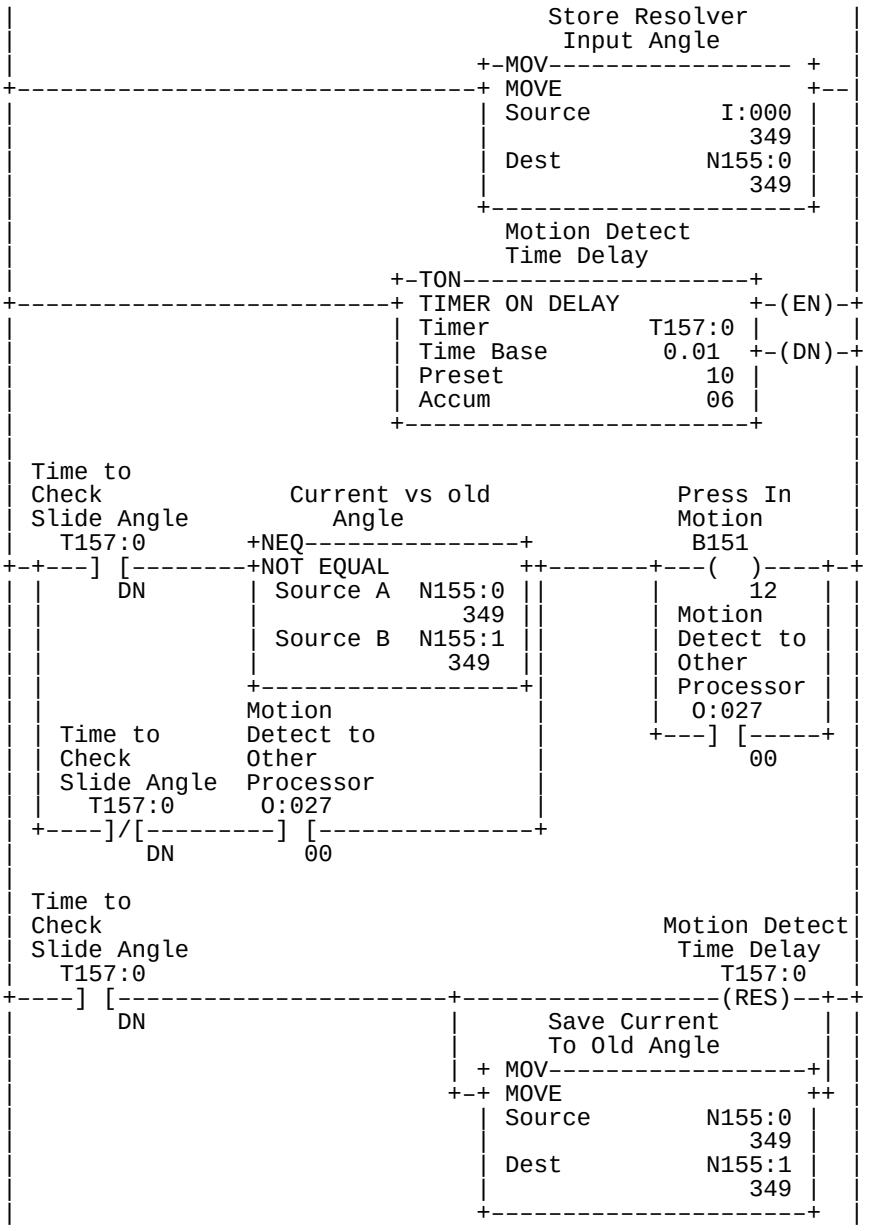


Figure 4.11
Example Commands to Select Single Mode B151/13 and Continuous Mode B151/14 from a Remote Selector

Use these mode-select command bits to change operating mode from a remote location such as a master controller.

Important: The main selector switch must be in remote mode.

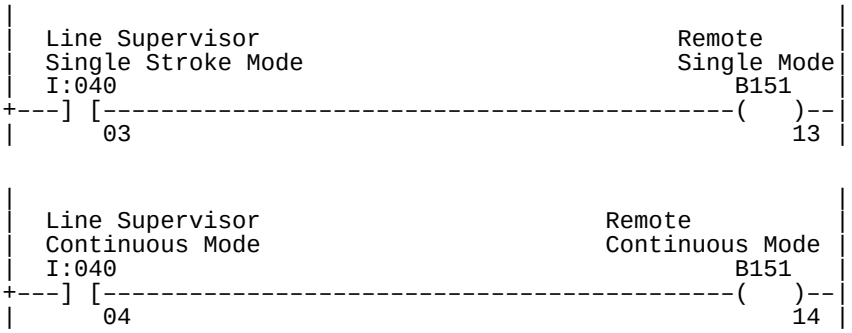


Figure 4.12
Example Commands to Enable Crowbar Relay B151/15 and to Let Auxiliary Valves Cycle With Clutch Valves B151/16 and B151/17

Program these command bits unconditionally to suit your application. Use the Always False Instruction (AFI) to maintain B151/16 and/or B151/17 in the OFF state.

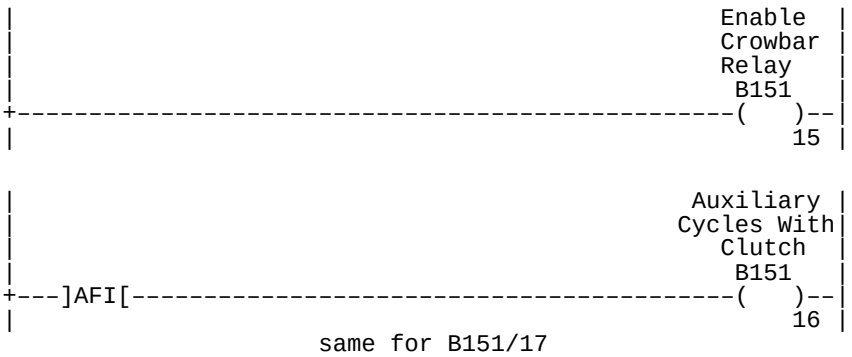
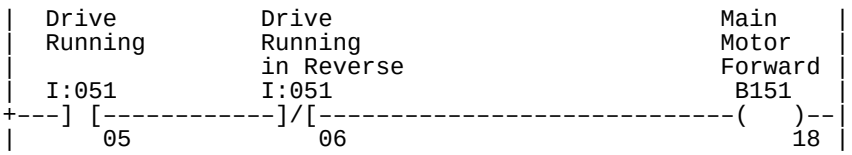


Figure 4.13
Example off the Command for Main Motor Forward B151/18

Use this command bit to detect motor rotation. In this example, rotational status signals from an A-B dc drive are inputs to an input module at I:051.

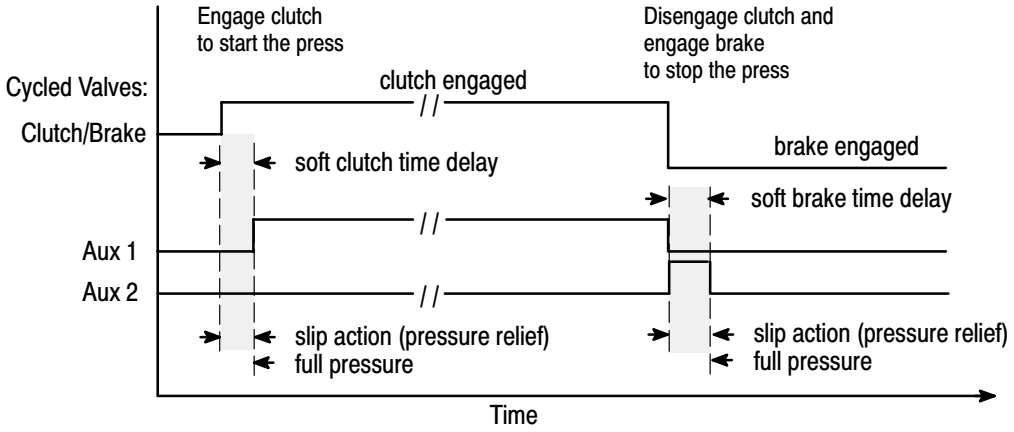


"Soft" Clutch and Brake

A "soft" clutch/brake provides smoother starting and stopping of press motion. The clutch and brake are activated with a 2-step valve sequence using auxiliary pressure-relief valves in series with the main clutch/brake valves. You preset auxiliary-valve time delays to:

- provide a brief interval of pressure-relieved slip action
- turn auxiliary valves ON or OFF for full pressure at time-out

You select time-delay presets in the range of 0.1 – 1.0 seconds according to the speed of the press, as shown in the following example timing diagram:



To program a soft clutch and brake, use control bits B151/16, 17, 19, and 22.

Important: The sequence and logic of these bits are application dependent. For example:

Bit: B151/	Bit Function	Note
16	Auxiliary 1 Cycles With Clutch	remains ON to energize with clutch valve
17	Auxiliary 2 Cycles With Clutch	remains OFF to energize with brake valve
19	Auxiliary 1 Enabled	valve relieves pressure when OFF
22	Auxiliary 2 Enabled	valve relieves pressure when ON

Sequence of Events	Bit 19	Bit 22	Aux 1	Aux 2
clutch valve energized	OFF	OFF	OFF	OFF
soft clutch timer timed out	ON	ON	ON	OFF
clutch valve de-energized and brake engaged	ON	ON	OFF	ON
soft brake timer timed out	OFF	OFF	OFF	OFF

Figure 4.14
Example Commands to Control “Soft” Clutch and Brake Operation
B151/16, B151/17, B151/19, and B151/22

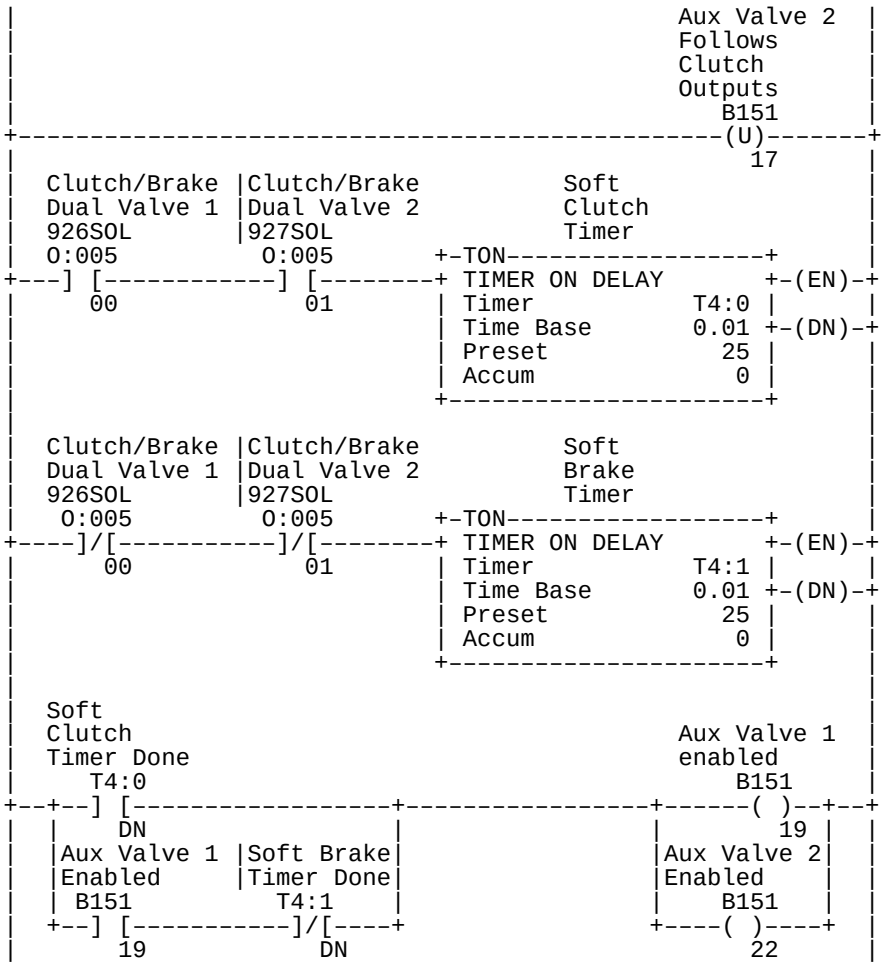


Figure 4.15
Example Commands to Indicate the Absence of Physical Inputs B151/20, B151/21, and Physical Outputs B151/19, B151/22

When customizing your design to omit certain valve hardware wiring, program the following command bits unconditionally to tell the software to ignore corresponding physical inputs that are absent:

Program this bit	When
B151/19 Aux Valve 1 Enabled	Auxiliary valve 1 is not used
B151/20 Aux Valve Stems Enabled	Auxiliary valves have no valve stem switches
B151/21 C/B Valve Stems Enabled	C/B valves have no valve stem switches
B151/22 Aux Valve 2 Enabled	Auxiliary valve 2 is not used

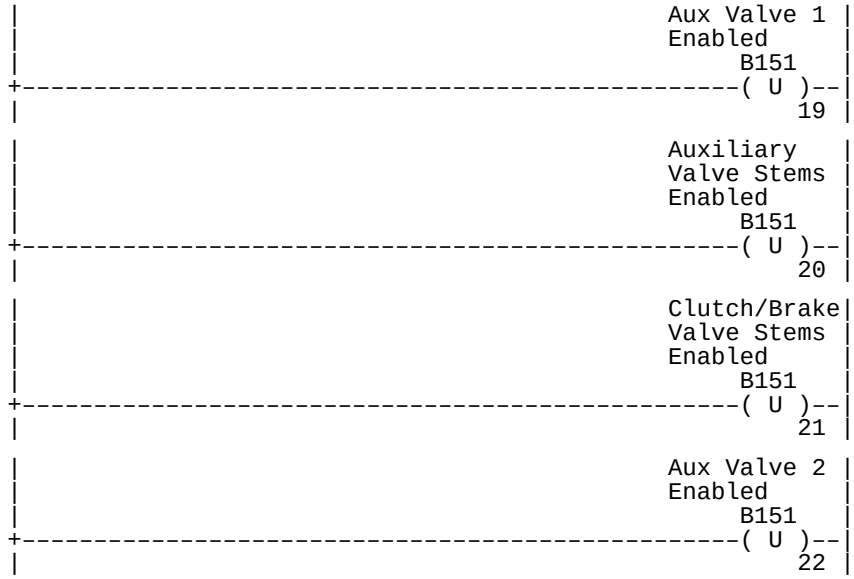


Figure 4.16
Example of the Command to Clear a Fault Generated by C/B Software B151/23

You can clear a processor fault by switching the press mode selector to OFF. As an alternative, you can use a remote pushbutton to clear a processor fault by programming bit B151/23 as follows:

Figure 4.17
Example Commands to Select Remote Micro-inch Mode B151/24 and Simulate Inch Buttons B151/09

Use these two command bits in an automatic operation.
(In this example, they are used to inch the press to bottom.)
Important: The main selector switch must be in remote mode.

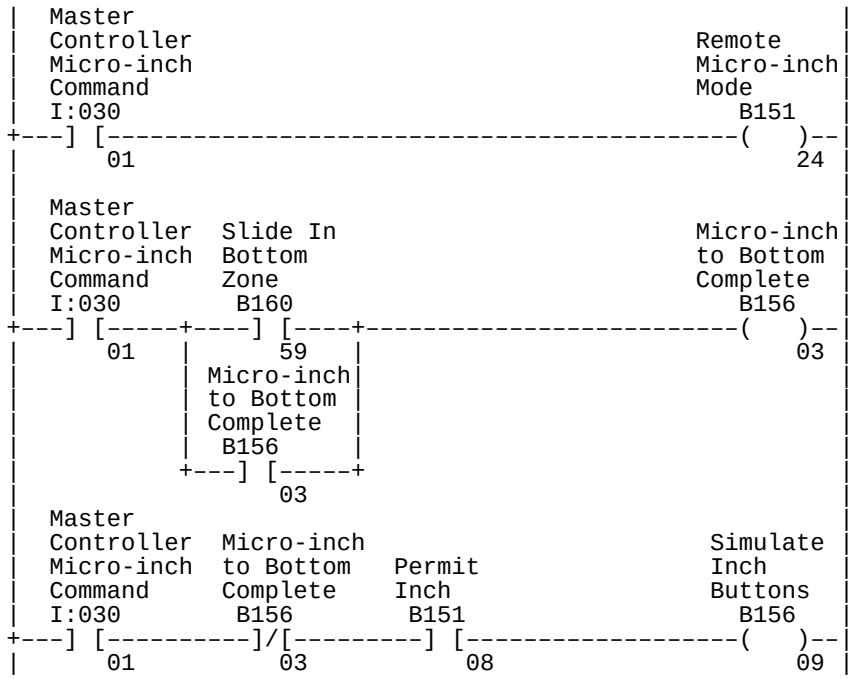
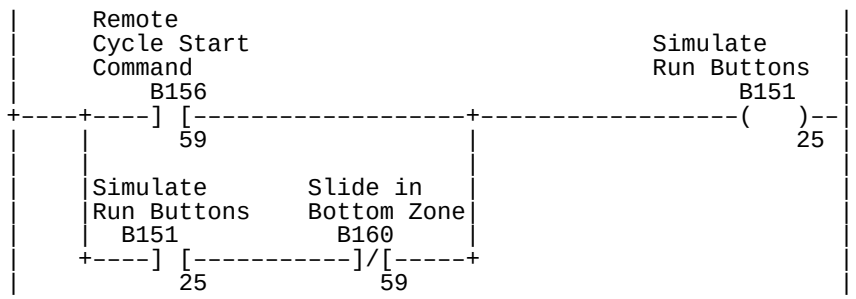


Figure 4.18
Example Command to Start Remote Automatic Press Motion with Simulated Run Buttons B151/25

Use this command bit to *start* either of two remote automatic operations:

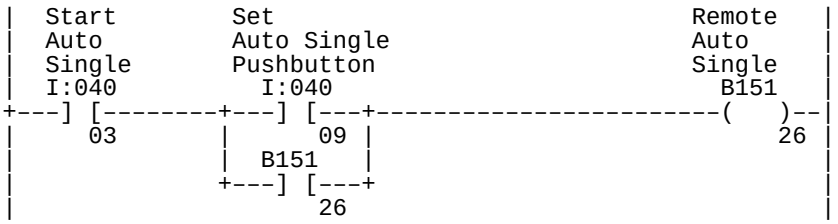
- with B151/26 to select remote automatic single-stroke (Figure 4.19)
- with B151/27 to arm for remote continuous on demand (Figure 4.20)



Important: Before starting remote automatic single stroke with this bit, an operator must first cycle the press through one complete stroke in automatic single-stroke mode and stop on top with mechanical run buttons.

Figure 4.19
Example Command to Select Automatic Single-stroke Mode from a Remote Selector B151/26

Use this command bit to switch press mode to auto single-stroke from a remote selector. Start the press with bit B151/25 (Figure 4.18). **ANSI B11.1** requires that your logic include a setup/reset action or operator decision prior to the manual actuation of the operator control(s).

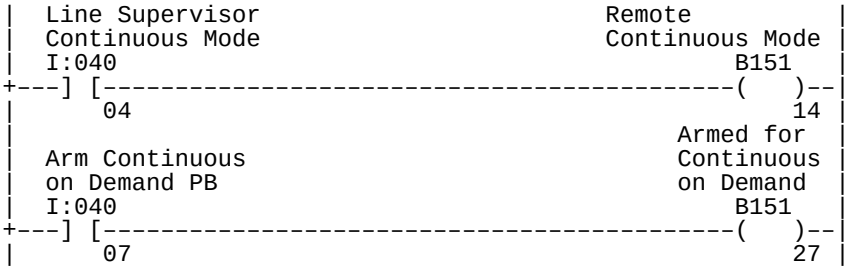


Important: To select press operating modes remotely (from a remote selector such as a hardware or software line supervisor), an operator must select remote mode with the main selector switch. Then your software can select from the following mode-select bits *one at a time*:

- remote inch (bit 10)
- remote single stroke (bit 13)
- remote continuous (bit 14)
- remote micro–inch (bit 24)
- remote automatic single stroke (bit 26)

Figure 4.20
Example Command to Arm for Automatic Continuous on Demand B151/27

Use these commands bits to switch the press mode to remote continuous mode from a remote selector and start the armed-for-continuous timer. Use bit B151/25 (Figure 4.18) to start press motion after arming.



When B151/27 is turned ON, it starts a 5-minute one-shot timed interval in which your logic must simulate pressing run buttons by setting B151/25. Use B151/27 under these conditions:

- completely automated press with run buttons ignored
- remote continuous mode
  (bit 14 = ON and manual selector switch in remote mode)

Figure 4.21
Example Command to Start Inch Mode After Pressing Inch Buttons B151/28

Use this bit as the last logical condition to start inch motion in combination with pressing Inch buttons manually.

Figure 4.22
Example Command to Allow Immediate Press Start in Auto Single Mode B151/29

Use this bit in automatic single stroke mode to start press motion without first cycling the press manually with Run buttons.

Exchanging Data Between Processors

PLC-5 processors have a unique feature that transfers data between processors in a scanner mode/adapter mode configuration. The clutch/brake software uses channel 1B and rack address 02 on the remote I/O network to transfer required information between processors. The C/B software configures the processor in chassis A for scanner mode and the processor in chassis B for adapter mode.

Important: For the adapter-mode processor (chassis B), we have changed the adapter-mode configuration of channel 1B from rack 03 (default) to rack 02. For more information, refer to the documentation that accompanied your programming software.

ATTENTION: If your application requires additional I/O racks on this network, use rack addresses *other than* rack 02, and take care *not to excessively load the network and extend system response time.* Either could cause unpredictable machine response with possible personal injury and/or equipment damage.

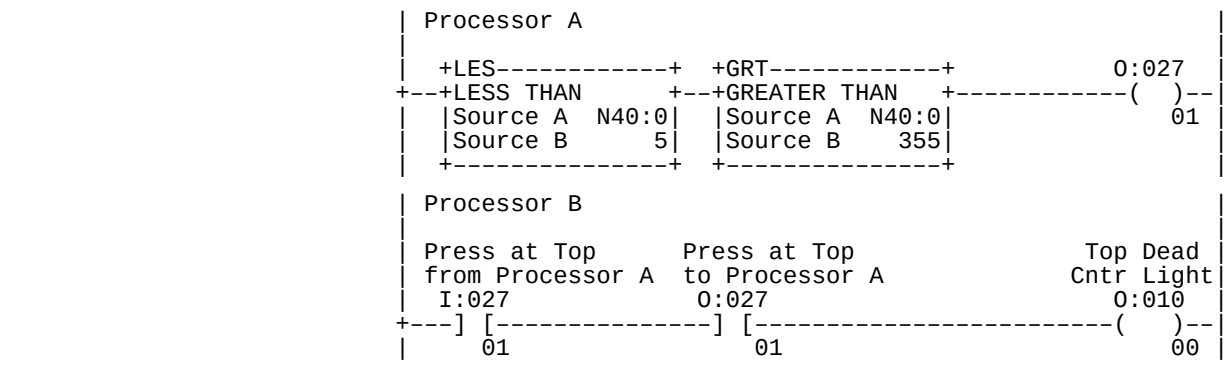
If you want to transfer discrete data bits between processors in chassis A and B, we reserved one I/O image table word (O:27) for you to use.

The processors exchange information as follows:

- an output in processor A = an input in processor B (O:027/03 in processor A = I:027/03 in processor B)
- an input in processor A = an output in processor B (I:027/03 in processor A = O:027/03 in processor B)

For example, if processor A monitors position with resolver inputs and processor B controls all pilot lights for press operational status, processor A could transmit the status of top dead center to processor B as follows (Figure 4.23):

Figure 4.23
Example Logic to Exchange Data Over a Scanner/Adapter Channel



Using Fault and Prompt Bits

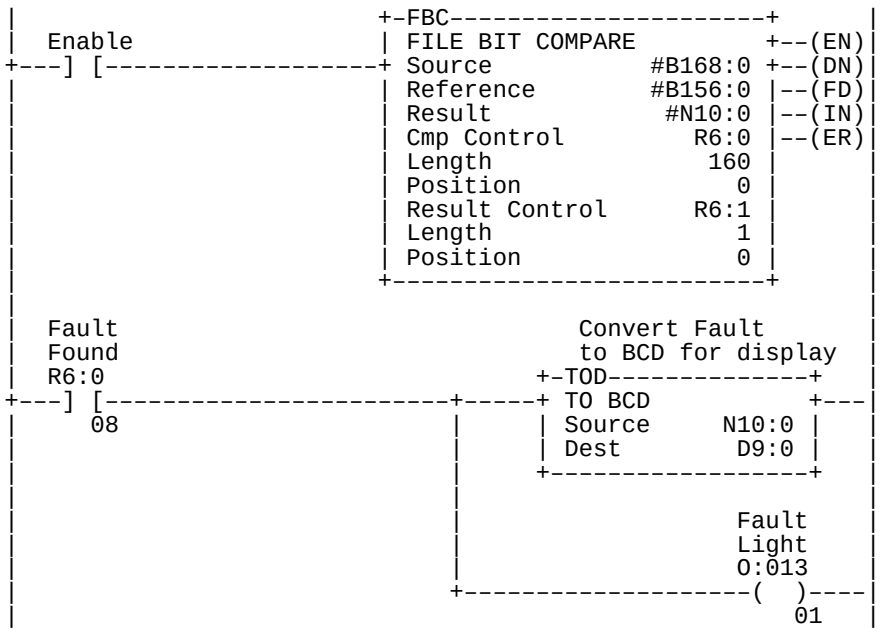
We designed internal diagnostics such that when control logic detects fault conditions or other conditions worthy of attention, it sets a corresponding bit in either of two bit files:

- fault bits in B168/0-B168/159
- prompt bits in B169/0-B169/80

We provide you with a look-up table that states the type of fault and suggests what to do to correct it. Refer to Appendix E and the Operators Guide for identical look-up tables.

We suggest that you design a method to monitor these bits and display the triggered condition, depending on the type of operator interface you use. The following logic (Figure 4.24) generates a BCD fault number whenever control logic sets a fault or prompt bit:

Figure 4.24
Example Logic to Generate a BCD Fault Number



Important: In the FBC instruction above, B156:0 is a 10-word file cleared to zero. R6:0/09 (IN) is set for single-fault detection.

For additional information on the FBC instruction, refer to the instruction set documentation for your programming software.

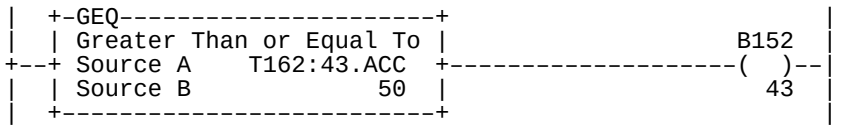
Programming Shorter Presets for Your Internal Timers

If you need to shorten presets of internal timers, do this in program file 15. For each timer that you want to change, add a rung as follows (Figure 4.25):

- input instruction = GEQ (greater than or equal to)
  Source A is the address of the timer whose preset you want to change.
  Source B is the new preset (base = .01 sec)
- output instruction = Bit address associated with the timer

For example, the following example shortens the timeout value for *Clutch A Failed to Turn OFF* from 1 second to 1/2 second.

Figure 4.25
Example Logic to Shorten a Timer Preset



This is the list of internal timers.
The time base is 0.01 second for all timers.

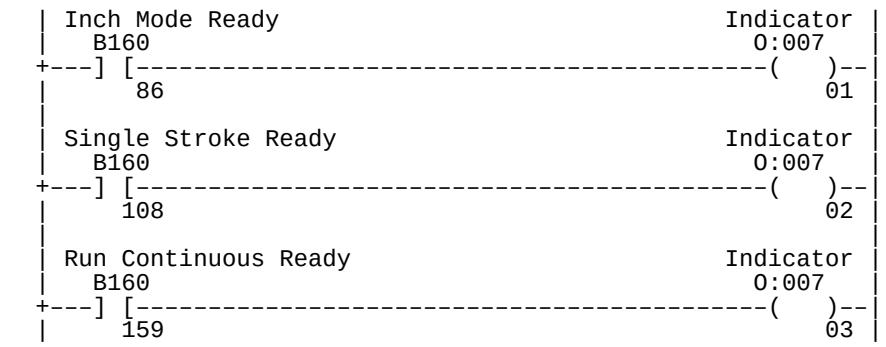
Timer	Preset	Your Preset	Address	Bit
Crowbar Relay Weld	100		T162:2	B152/2
Crowbar Relay Failed to Turn On	100		T162:3	B152/3
Seal relay Failed to Turn On	100		T162:5	B152/5
Seal Relay Weld	100		T162:6	B152/6
E-Stop Relay Failed to Turn On	100		T162:7	B152/7
E-Stop Weld	100		T162:8	B152/8
No Valid Mode Selected	300		T162:10	B152/10
Clutch/Brake Mode Mismatch	200		T162:11	B152/11
Station # 1 Anti-tiedown	300		T162:12	B152/12
Station # 2 Anti-tiedown	300		T162:13	B152/13
Station # 3 Anti-tiedown	300		T162:14	B152/14
Station # 4 Anti-tiedown	300		T162:15	B152/15
Multiple Active Station Anti-tiedown	300		T162:16	B152/16
Inch Button Anti-tiedown	300		T162:17	B152/17
Clutch/Brake Air Pressure	300		T162:19	B152/19
Clutch/Brake Air Pressure Exhausted	300		T162:20	B152/20
BCAM Soft Cam Compare	100		T162:21	B152/21
TCAM Soft Cam Compare	100		T162:22	B152/22
ACAM Soft Cam Compare	100		T162:23	B152/23
Motion Detector Watchdog	300		T162:28	B152/28
Uncommanded Motion Detected	300		T162:29	B152/29
Micro-inch Feedback Valve A Off	100		T162:30	B152/30
Micro-inch Feedback Valve B Off	100		T162:31	B152/31
Micro-inch Feedback Valve A On	100		T162:32	B152/32
Micro-inch Feedback Valve B On	100		T162:33	B152/33
Arm Continuous Button	500		T162:35	B152/35
Arm for Continuous on Demand	30,000		T162:36	B152/36
Clutch 1 Failed to Turn On	100		T162:42	B152/42
Clutch 1 Failed to Turn Off	100		T162:43	B152/43
Clutch 2 Failed to Turn On	100		T162:44	B152/44
Clutch 2 Failed to Turn Off	100		T162:45	B152/45
Clutch Valve-stem 1 Failed to Turn On	100		T162:46	B152/46
Clutch Valve-stem 1 Failed to Turn Off	100		T162:47	B152/47
Clutch Valve-stem 2 Failed to Turn On	100		T162:48	B152/48
Clutch Valve-stem 2 Failed to Turn Off	100		T162:49	B152/49
Auxiliary Valve 1 Failed to Turn On	100		T162:50	B152/50
Auxiliary Valve 1 Failed to Turn Off	100		T162:51	B152/51
Auxiliary Valve 2 Failed to Turn On	100		T162:52	B152/52
Auxiliary Valve 2 Failed to Turn Off	100		T162:53	B152/53
Auxiliary 1 Valve-stem Failed to Turn On	100		T162:54	B152/54
Auxiliary 1 Valve-stem Failed to Turn Off	100		T162:55	B152/55
Auxiliary 2 Valve-stem Failed to Turn On	100		T162:56	B152/56
Auxiliary 2 Valve-stem Failed to Turn Off	100		T162:57	B152/57
Automatic Single-stroke Time-out	300		T162:58	B152/58

Programming Press-ready-to-start Indicators

When starting multiple presses in a transfer line, you can program ladder logic in program file PF15 that indicates when the clutch/brake control modes are ready to start (Figure 4.26). Examine the following "ready" bits that tell when permissives are satisfied to start running the press:

Bit Name	Bit Address
inch mode ready	B160/86
single stroke ready	B160/108
run continuous ready	B160/159

Figure 4.26
Example Logic to Indicate the Press is Ready to Start

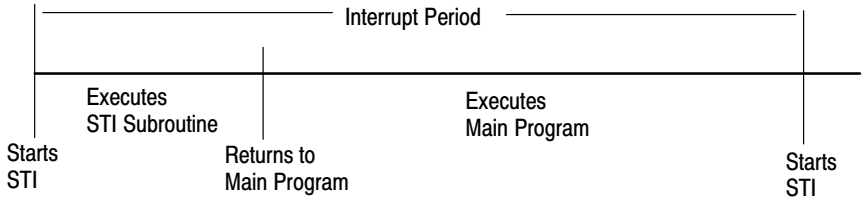


Programming a Brake Monitor (patent pending)

The brake monitor program is designed to monitor and compute stopping time. This example program is contained in a selectable timed interrupt (STI) subroutine with a 2 ms interrupt. The program detects stopping time by counting the number of interrupts from when the brake is applied until press motion stops. The accuracy is ± one interrupt period (± 2 ms in this example).

Selecting the Interrupt Period

The example program scan jumps to the STI subroutine every interrupt period, executes the subroutine, returns to the main program, and continues executing the main program until interrupted again.

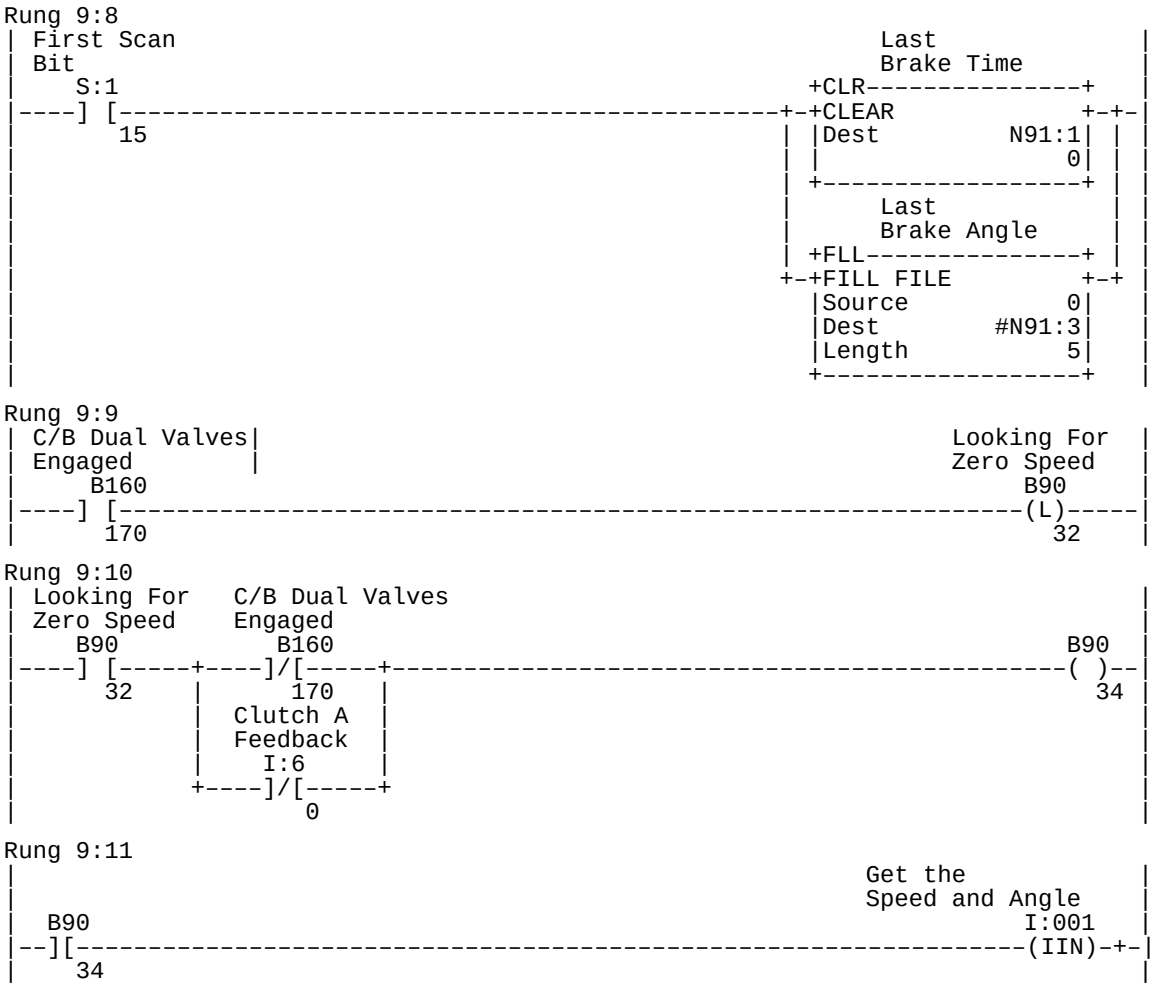


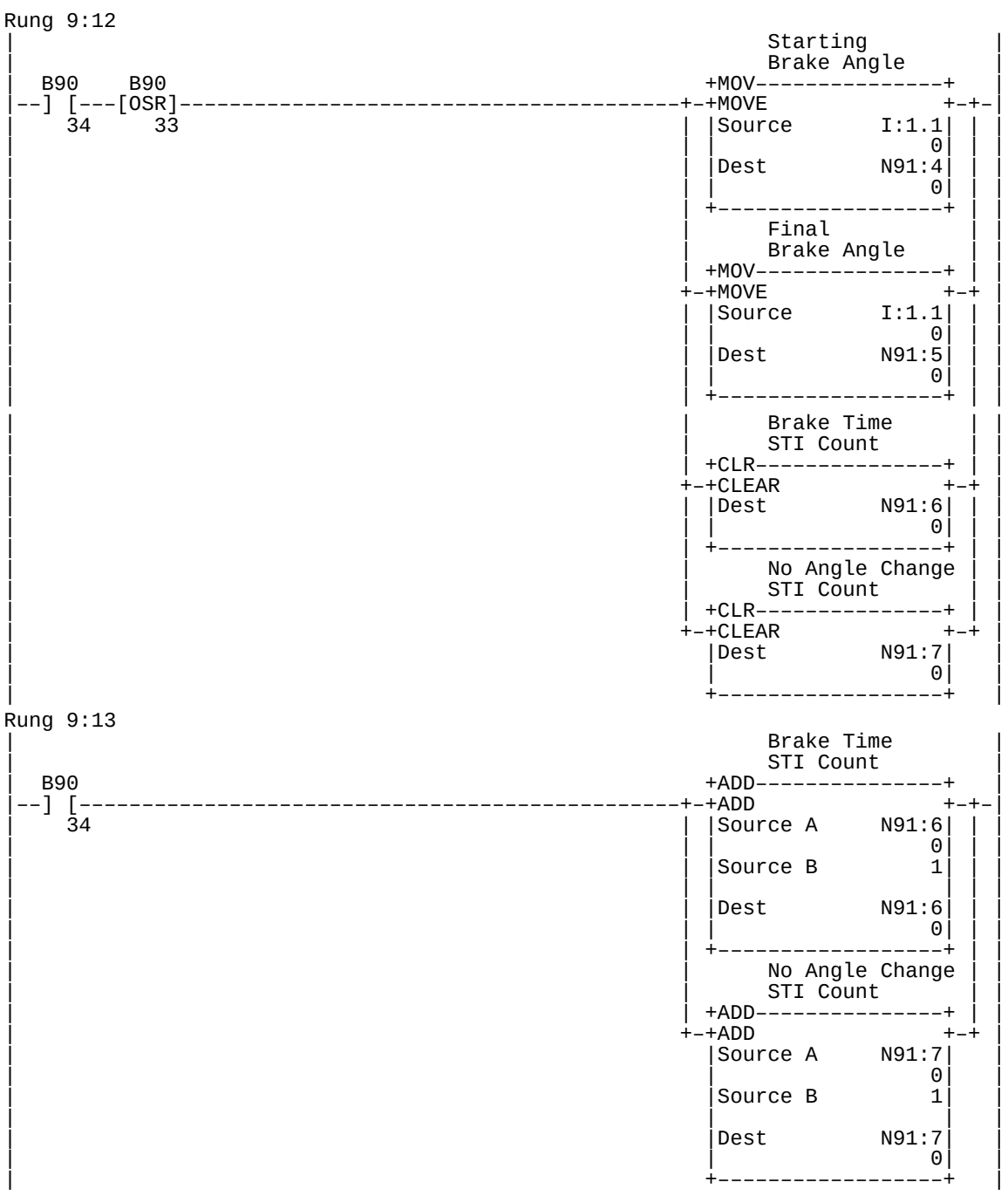
The time required to execute the example STI program (Figure 4.27) is about 1/2 ms, so we suggest an STI interrupt interval of about 2 ms. The shorter you make the STI interrupt interval to increase the accuracy of the brake monitor, the less time remains to execute the main program so its overall execution time increases.

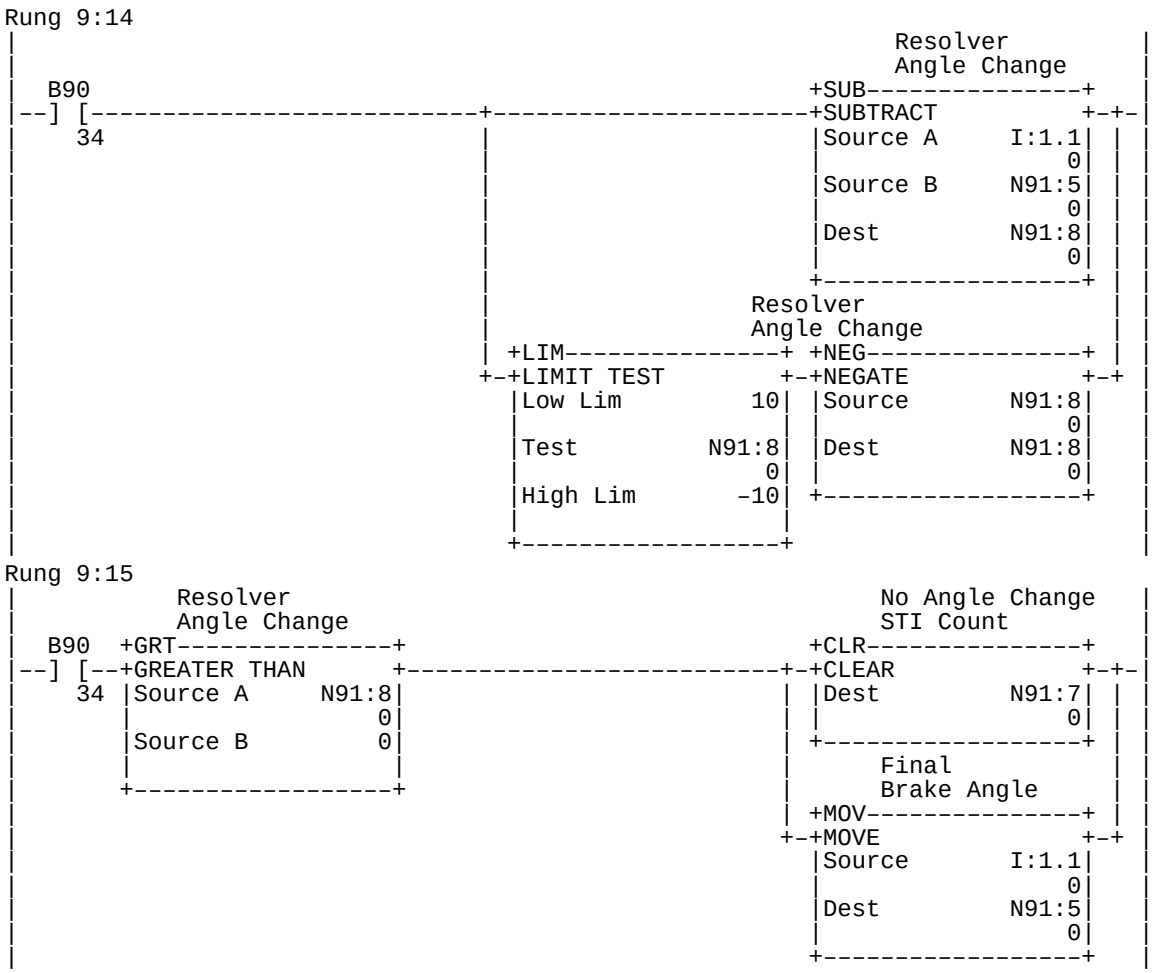
The program uses the following words:

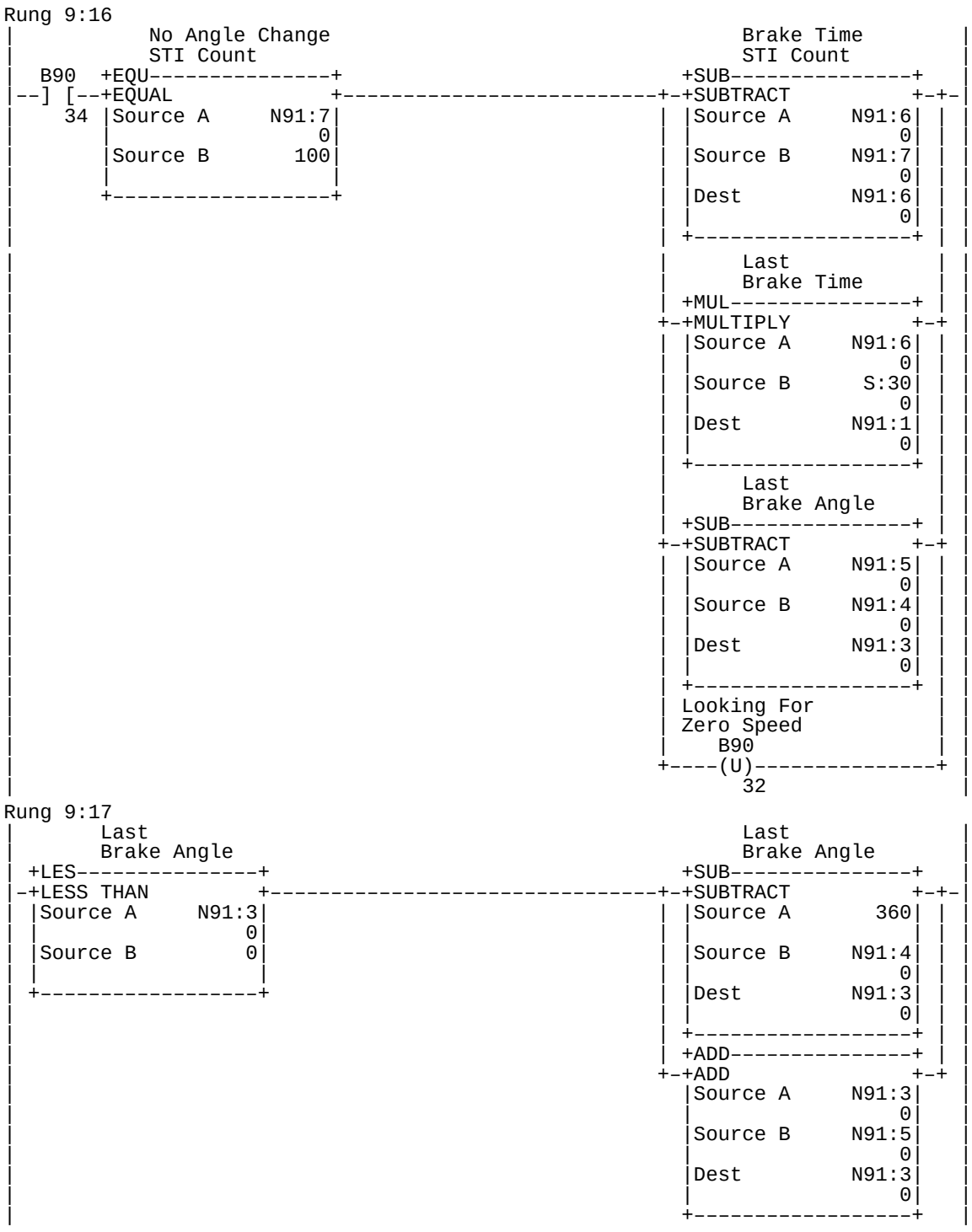
Address	Description
N91:1	last brake time
N91:3	last brake angle
N91:4	starting brake angle
N91:5	final brake angle
N91:6	STI count for brake time
N91:7	STI count for no angle change
N91:8	resolver angle change

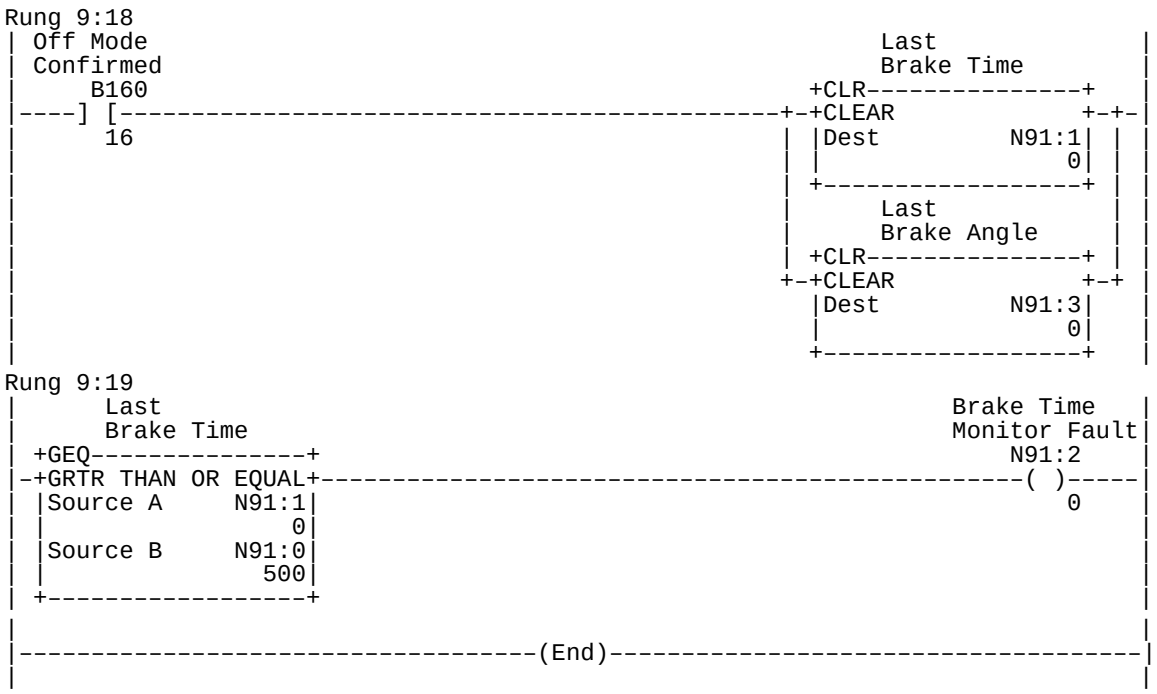
Figure 4.27
Example Brake Monitor Program




Rung 9:12
B90
34
B90
[OSR]
33
Starting
Brake Angle
MOV
MOVE
Source I:1.1
0
Dest N91:4
0
Final
Brake Angle
MOV
MOVE
Source I:1.1
0
Dest N91:5
0
Brake Time
STI Count
CLR
CLEAR
Dest N91:6
0
No Angle Change
STI Count
CLR
CLEAR
Dest N91:7
0
Rung 9:13
B90
34
Brake Time
STI Count
ADD
ADD
Source A N91:6
0
Source B 1
Dest N91:6
0
No Angle Change
STI Count
ADD
ADD
Source A N91:7
0
Source B 1
Dest N91:7
0


Rung 9:14
B90
34
Resolver
Angle Change
SUB
SUBTRACT
Source A I:1.1
0
Source B N91:5
0
Dest N91:8
0
Resolver
Angle Change
LIM
LIMIT TEST
Low Lim 10
Test N91:8
0
High Lim -10
NEG
NEGATE
Source N91:8
0
Dest N91:8
0
Rung 9:15
B90
34
Resolver
Angle Change
GRT
GREATER THAN
Source A N91:8
0
Source B 0
No Angle Change
STI Count
CLR
CLEAR
Dest N91:7
0
Final
Brake Angle
MOV
MOVE
Source I:1.1
0
Dest N91:5
0


Rung 9:16
No Angle Change
STI Count
B90
EQU
EQUAL
34
Source A
N91:7
0
Source B
100
0
Brake Time
STI Count
SUB
SUBTRACT
Source A
N91:6
0
Source B
N91:7
0
Dest
N91:6
0
Last
Brake Time
MUL
MULTIPLY
Source A
N91:6
0
Source B
S:30
0
Dest
N91:1
0
Last
Brake Angle
SUB
SUBTRACT
Source A
N91:5
0
Source B
N91:4
0
Dest
N91:3
0
Looking For
Zero Speed
B90
(U)
32
Rung 9:17
Last
Brake Angle
LES
LESS THAN
Source A
N91:3
0
Source B
0
Last
Brake Angle
SUB
SUBTRACT
Source A
360
Source B
N91:4
0
Dest
N91:3
0
ADD
ADD
Source A
N91:3
0
Source B
N91:5
0
Dest
N91:3
0


Rung 9:18
Off Mode
Confirmed
B160
16
Last
Brake Time
CLR
CLEAR
Dest
N91:1
0
Last
Brake Angle
CLR
CLEAR
Dest
N91:3
0
Rung 9:19
Last
Brake Time
GEQ
GRTR THAN OR EQUAL
Source A
N91:1
0
Source B
N91:0
500
Brake Time
Monitor Fault
N91:2
0
(End)

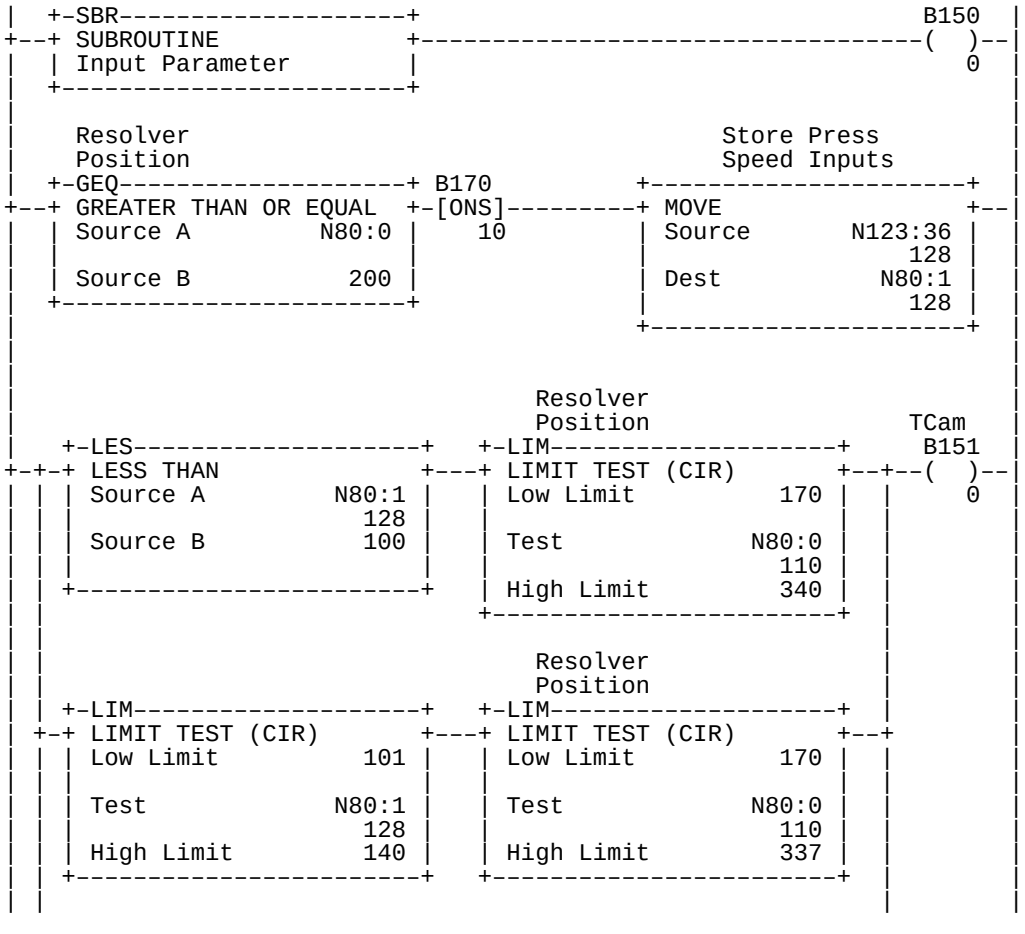
Programming a Variable-speed Top Stop

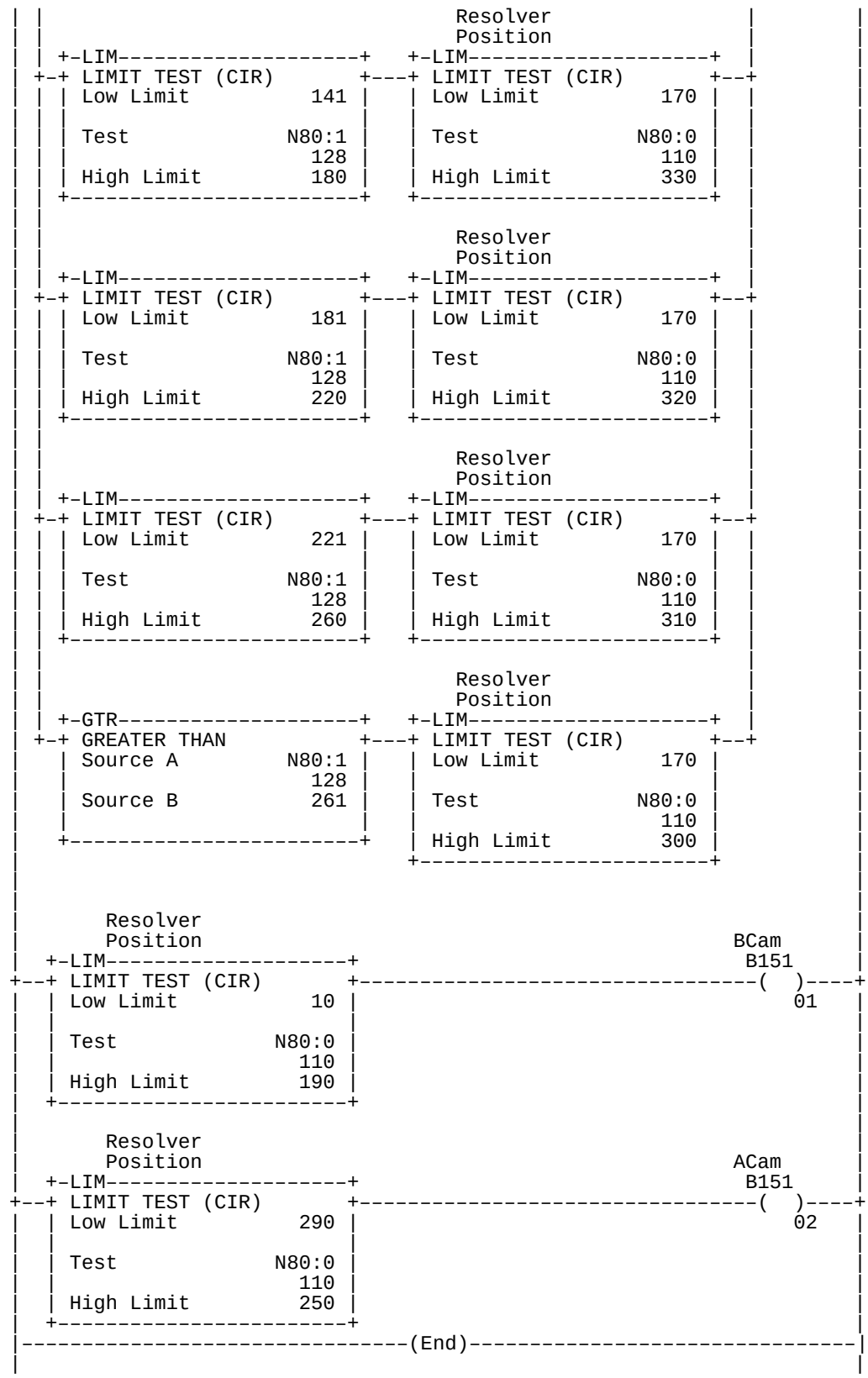
The purpose of the variable-speed top stop program is to make the press stop at the top when commanded, regardless of press speed. Requirements of this program are the following:

- You must use a resolver as a position monitoring device
- Your program must simulate the action of rotary cam limit switches
- Your program should adjust the TCAM setting only during downstroke. Shifting the TCAM in any other zone of the press cycle may trigger a software cam-transition fault.

In the following example program (Figure 4.28), N123:36 holds the press speed which is buffered once per stroke at 90º. The LES and GTR instructions in the TCAM rung are used for backing the TCAM OFF position from 340 to 300º for increasing press speeds of 10 to 26 SPM.

Figure 4.28
Example Program for a Variable-speed Top Stop




Resolver Position
LIM
LIMIT TEST (CIR)
Low Limit 141
Test N80:1 128
High Limit 180
LIMIT TEST (CIR)
Low Limit 170
Test N80:0 110
High Limit 330
Resolver Position
LIM
LIMIT TEST (CIR)
Low Limit 181
Test N80:1 128
High Limit 220
LIMIT TEST (CIR)
Low Limit 170
Test N80:0 110
High Limit 320
Resolver Position
LIM
LIMIT TEST (CIR)
Low Limit 221
Test N80:1 128
High Limit 260
LIMIT TEST (CIR)
Low Limit 170
Test N80:0 110
High Limit 310
Resolver Position
GTR
GREATER THAN
Source A N80:1 128
Source B 261
LIM
LIMIT TEST (CIR)
Low Limit 170
Test N80:0 110
High Limit 300
Resolver Position
LIM
LIMIT TEST (CIR)
Low Limit 10
Test N80:0 110
High Limit 190
BCam B151 01
Resolver Position
LIM
LIMIT TEST (CIR)
Low Limit 290
Test N80:0 110
High Limit 250
ACam B151 02
(End)

Notes

Assigning Passwords to Your Program and Data Files

Chapter Objectives

Program and data files of PLC-5/x6 processors can be protected from unauthorized access by assigning privileges and a password to each of four privilege classes. We have assigned these at the factory.

This chapter explains how:

- we assigned privileges to privilege classes
- we restricted access to certain program and data files
- you assign your own passwords to privilege classes 2-4
- you gain access to protected memory files

What Can Privilege Classes Protect?

Privilege classes can control read/write access to:

- data files
- program files
- communication channels

They can also protect the control system from unauthorized changes such as:

- modifying privileges
- uploading/downloading processor memory
- forcing bits on/off
- changing processor mode

How We Assigned Privileges to Privilege Classes

The software is factory–configured for access privileges for security. We assigned:

- privileges to privilege classes
- read or read/write access to program and data files

Class 1 has all privileges. The password to class 1 is held confidential at the factory. We assigned privileges to classes 2-4 at the factory, and withheld the privilege to modify privileges from these classes.

Important: As a result of withholding the capability to modify privileges in classes 2-4, you *cannot* modify privileges on the following screens:

- Privilege screen
- Data File Privilege screen
- Program File Privilege screen

Since you cannot modify privileges, our purpose in describing access to these screens is informational: to show you how we assigned privileges. We did this to protect the proprietary clutch/brake control program and data files.

Important: With this privilege structure, you may create program and data files for your own ladder logic. You will have RW access to them.

Privilege Classes

We assigned combinations of privileges to each of four different classes from all privileges (class 1) to fewest privileges (class 4). To view the Privilege screen that allocates privileges, type **Alt P** from any screen.

You get the Privilege Class Information screen. We assigned the following privileges to classes 1-4 at the factory. (X = privilege allowed)

Privileges \ Privilege Class Names		Class1	Class2	Class3	Class4
Modify Privileges		X			
Create/Delete Data Files		X	X	X	
Create/Delete Program Files		X	X	X	
Download Blocks of Processor Memory	(Logical Write)	X	X	X	X
Download All Processor Memory	(Physical Write)	X	X	X	X
Upload Blocks of Processor Memory	(Logical Read)	X	X	X	X
Upload All Processor Memory	(Physical Read)	X	X	X	X
Change Processor Mode		X	X	X	X
Force I/O		X	X	X	
Force I/O in Sequential Function Charts		X	X	X	
Clear Memory		X			
Restore Memory from Archive		X	X	X	
Edit On-line		X	X	X	

Data Table Privileges

We assigned R (read only) or RW (read/write) privileges to classes 1-4 for controlling access to data files. To view the Data Table Privileges screen that allocates these privileges, follow this procedure for 6200 series software (the procedure for AI5 software would be similar):

1. Start at the Main Menu.
2. Press **[F7] - General Utility**.
   The system displays the General Utility screen.
3. Press **[F1] - Memory Map**.
   The system displays the Memory Map screen.
4. Press **[F2] - Modify Privileges.**
   You get the Data Table Privileges screen.

We assigned the following privileges for classes 1-4 at the factory.

File	Type	Class 1	Class 2	Class 3	Class 4
0	O output	RW	RW	RW	RW
1	I input	RW	RW	RW	RW
2	S status	RW	RW	RW	RW
3	B binary or bit	RW	RW	RW	RW
4	T timer	RW	RW	RW	RW
5	C counter	RW	RW	RW	RW
6	R control	RW	RW	RW	RW
7	N integer	RW	RW	RW	RW
8	F floating point	RW	RW	RW	RW
9-19	reserved for customer	RW	RW	RW	RW
20	B binary or bit	RW	R	R	R
21	T timer	RW	R	R	R
22-28	reserved for customer	RW	RW	RW	RW
29	N integer	RW	R	R	R
30-149	reserved for customer	RW	RW	RW	RW
150	B binary or bit	RW	RW	RW	RW
151	B binary or bit	RW	RW	RW	RW
152	B binary or bit	RW	RW	RW	RW
153-159	reserved for customer	RW	RW	RW	RW
160	B binary or bit	RW	R	R	R
161	N (only in processor B)	RW	R	R	R
162	T timer	RW	R	R	R
163	BT block transfer	RW	R	R	R
164	N integer	RW	R	R	R
165	R control	RW	R	R	R
166	N integer	RW	R	R	R
167	N integer	RW	R	R	R
168	B binary or bit	RW	R	R	R
169	B binary or bit	RW	R	R	R

Program File Privileges

We assigned R (read only) or RW (read/write) privileges to classes 1-4 for controlling access to program files. To view the Program File Privileges screen that allocates these privileges, follow this procedure for 6200 series software (the procedure for AI5 software would be similar):

1. Start at the Main Menu.
2. Press **[F1] - Processor Functions**.
   The system displays the Processor Functions screen.
3. Press **[F2] - Modify Privileges**.
   You get the Program File Privileges screen.

We assigned the following privileges for classes 1-4 at the factory.

File	Name	Type	Class 1	Class 2	Class 3	Class 4
0		system	RW	RW	RW	RW
1		undefined	RW	RW	RW	RW
2	MAIN	ladder	RW	R	R	R
3	USER MAIN	ladder	RW	RW	RW	RW
4		undefined	RW	RW	RW	RW
5		undefined	RW	RW	RW	RW
6		undefined	RW	RW	RW	RW
7		undefined	RW	RW	RW	RW
8		undefined	RW	RW	RW	RW
9		undefined	RW	RW	RW	RW
11		undefined	RW	RW	RW	RW
12		undefined	RW	RW	RW	RW
13		undefined	RW	RW	RW	RW
14		undefined	RW	RW	RW	RW
15	CB INTERFACE	ladder	RW	RW	R	R
16	CB CONTROL	ladder	RW	R	R	R

Communication Channel Privileges

We assigned class 4 as the default privilege class for channel communication, and R (read only) or RW (read/write) privileges to classes 1-4 for controlling channel access.

Important: Default class privileges cannot be assigned to scanner or adapter channels; just to channel 0 or any channel configured for a DH^+ network (for communication with a programming terminal).

To view the Channel Privileges screen that allocates these privileges, follow this procedure for 6200 series software (the procedure for AI5 software would be similar):

1. Start at the Main Menu.
2. Press **[F7] - General Utility**.
   The system displays the General Utility screen.
3. Press **[F4] - Channel Overview**
   The system displays the Channel Overview screen.
4. Press **[F2] - Channel Privileges**
   You get the Channel Privileges screen.

We assigned privileges for classes 1-4 at the factory. (RW=read/write, R=read only for CB code)

		Default Priv. Class	Class 1	Class 2	Class 3	Class 4
Channel 0:	System (P-2-P)	Class 4	RW	RW	RW	RW
Channel 1A:	DH+	Class 4	RW	RW	RW	RW
Channel 1B:	Scanner Mode	Class 4	RW	RW	RW	RW
Channel 2A:	unused	Class 4	RW	RW	RW	RW
Channel 2B:	unused	Class 4	RW	RW	RW	RW
Channel 3A:	N/A					
Offline:		Class 4				

Assigning Passwords to Classes

You can assign a password to each of classes 2, 3, and 4. We suggest that you distribute passwords within your organization based on the:

- access that each password allows
- responsibilities of password users within your organization

Important: Only class 1 privileges include modifying privileges of other classes. The password for class 1 is maintained confidential at the factory. Neither a customer nor any authorized Allen-Bradley sales/service representative can obtain this password. This lets us maintain protection of the factory-configured clutch/brake code.

We assigned the password [RETURN] to classes 2-4 at the factory. You can change this password with the following procedure for 6200 series software (the procedure for AI5 software would be similar):

1. Start at the Program Directory for Processor screen.
2. Press **[F7] – General Utility**
   The system displays a new set of function keys.
3. Press **[F5] – Privileges**
   The system displays the Privilege Class Information screen.
4. Press **[F1] – Modify Password** to assign a password to each class.
   The system displays the Modify Privilege Class Password window.
5. For each class you want to use, type
   - class name (for example, Class 2)
   - old password (if one exists)
   - new password (8 characters max, A-z, 0-9, and _)
   - verify new password
2. Repeat steps 2 and 3 as needed for the other classes (Class 3-4).
3. When finished assigning passwords, press **[ESC]**.
   The system displays the General Utility screen.

Gaining Access to Protected Memory Files

When you first attempt to edit program or data files, you will be denied access. You must establish yourself as a class 2 or class 3 user to edit program and data files respectively for those classes. To do so, follow this procedure for 6200 series software (the procedure for AI5 software would be similar):

1. From any screen below the Menu (the highest level) screen, press these keys at the same time: **[Alt] P**
   You get the **Select New Privilege Class** window.
2. Type your privilege class name (class 2 or class 3) and press **[Enter]**.
   The cursor moves to the password entry field.
3. Type your password for that privilege class and press **[Enter]**.
   Now, you can access all functions available for that class.

Install and Wire the Clutch/Brake Control System

Chapter Objectives

In this chapter, we assume that the press is ready for installation of its control system. We help you install it with these steps:

- set jumpers and switches
- install PLC processors, I/O modules, and power supplies
- connect PLC processors and programming terminal
- wire ac power distribution to the controller
- convert controller OK relay contacts from N.O. to N.C.
- wire your control system

Important: Installing and/or checking other press functions such as lubrication systems, slide adjustments, dies, cushions, counter balances, and clamps, are beyond the scope of this chapter. We encourage you to contact your press manufacturer for that information.

Set Jumpers and Switches

We help you set jumpers and switches on these components:

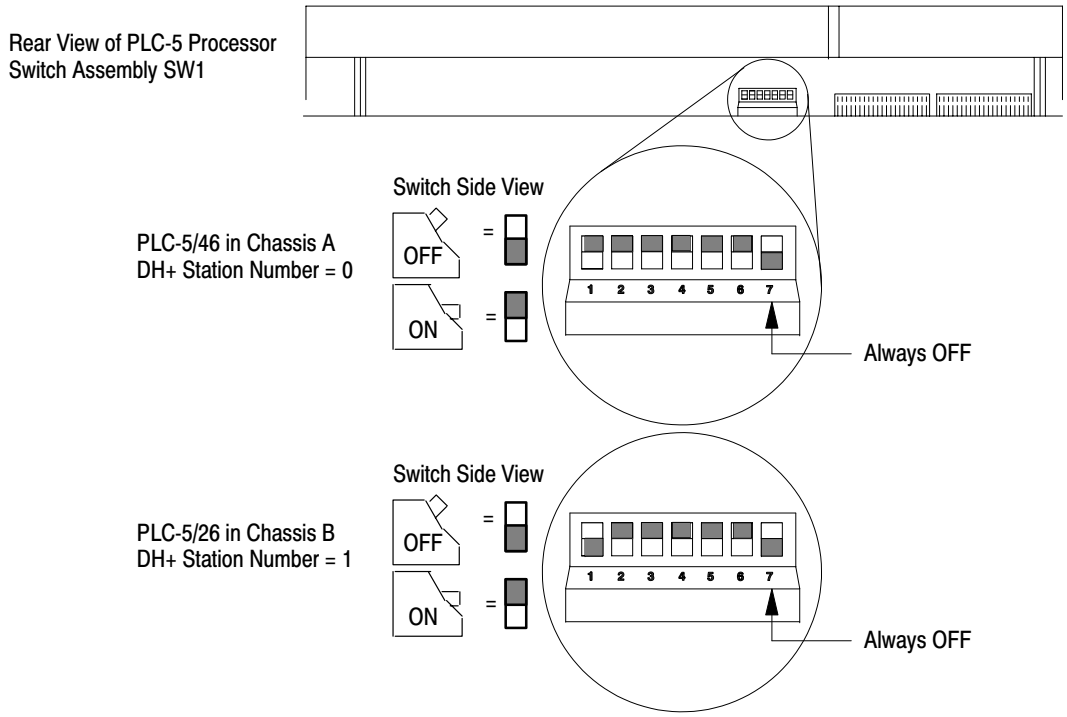
- PLC-5/x6 processors
- 1771 I/O chassis A and B
- 1771-ID16 input modules

Output module, 1771-OD16, has no jumpers or switches.

PLC-5/x6 Processors

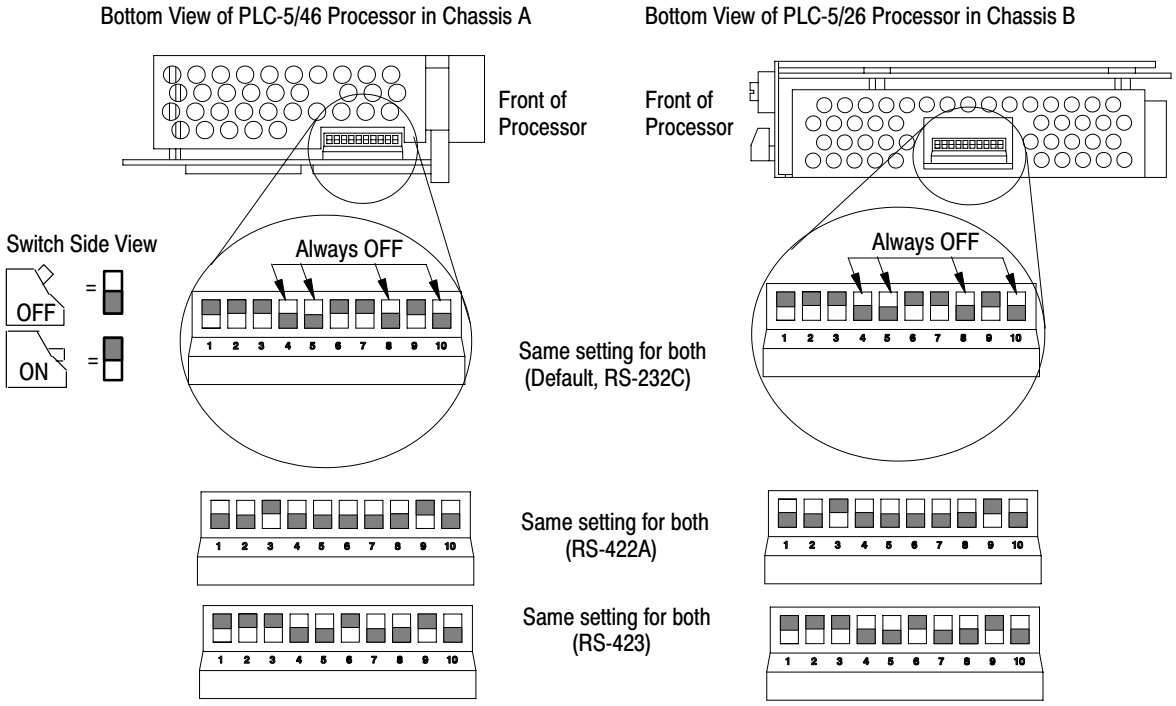
You may set the DH+ station number (channel 1A) for PLC-5/46 and PLC-5/26 processors respectively to 0 and 1 so they can communicate (Figure 6.1). You may modify these switch settings if you application requires it.

Figure 6.1
Setting the DH+ Station Numbers with SW1



Leave the serial-port configuration for channel 0 at default for RS-232C with SW2 (Figure 6.2) unless your application requires RS-422A or RS-423.

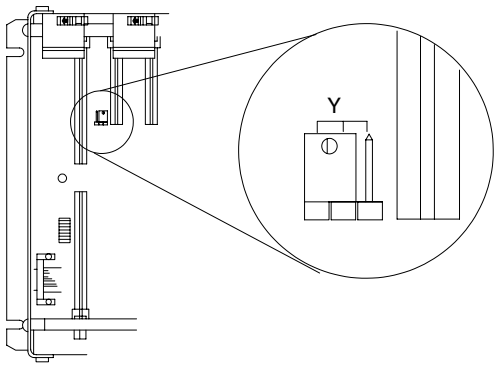
Figure 6.2
Serial-port Setting with SW2



Jumper and Switch Settings for I/O Chassis A and B

Locate the jumper and switch assembly on the left-hand inside backplane (Figure 6.3). Set them identically in chassis A and B.

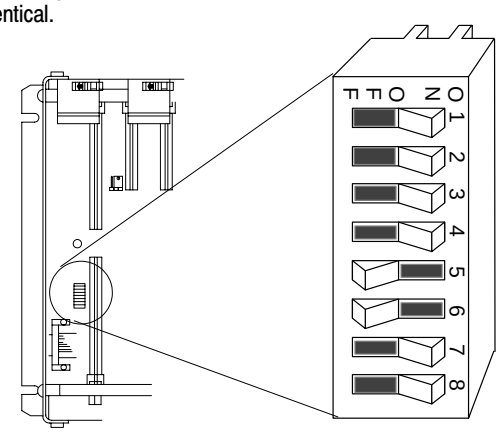
Figure 6.3
Jumper and Switch Settings for I/O Chassis A and B



Leave jumper at the "Y" (default) position for the plug-in power supply module.

Important: When using a power supply module, you cannot augment power to the chassis with an external power supply.

Important: Settings for chassis A and B must be identical.



Set switches by pressing rocker arms.
Press in OFF side for "off" and ON side for "on".

OFF - Chassis outputs are turned off when fault is detected

OFF
OFF
- Always OFF

OFF
ON
- 1-slot addressing

ON
OFF
- EEPROM does not transfer, processor faults

OFF - RAM protected against writes and edits

Keying the Backplane

Install keying bands, supplied with your I/O chassis, in numerical locations so backplane slots will accept only the designated processor or I/O module:

Left-most	Slots 0, 1	Slot 2	Slot 3	Slot 4	Slot 5
Processor	Resolver	1771-ID16	1771-ID16	1771-ID16	1771-OD16
between: 40 and 42 54 and 56	Depends on module. See specs.	between: 10 and 12 14 and 16	between: 10 and 12 14 and 16	between: 10 and 12 14 and 16	between: 22 and 24 34 and 36

1771-ID16 Input Modules

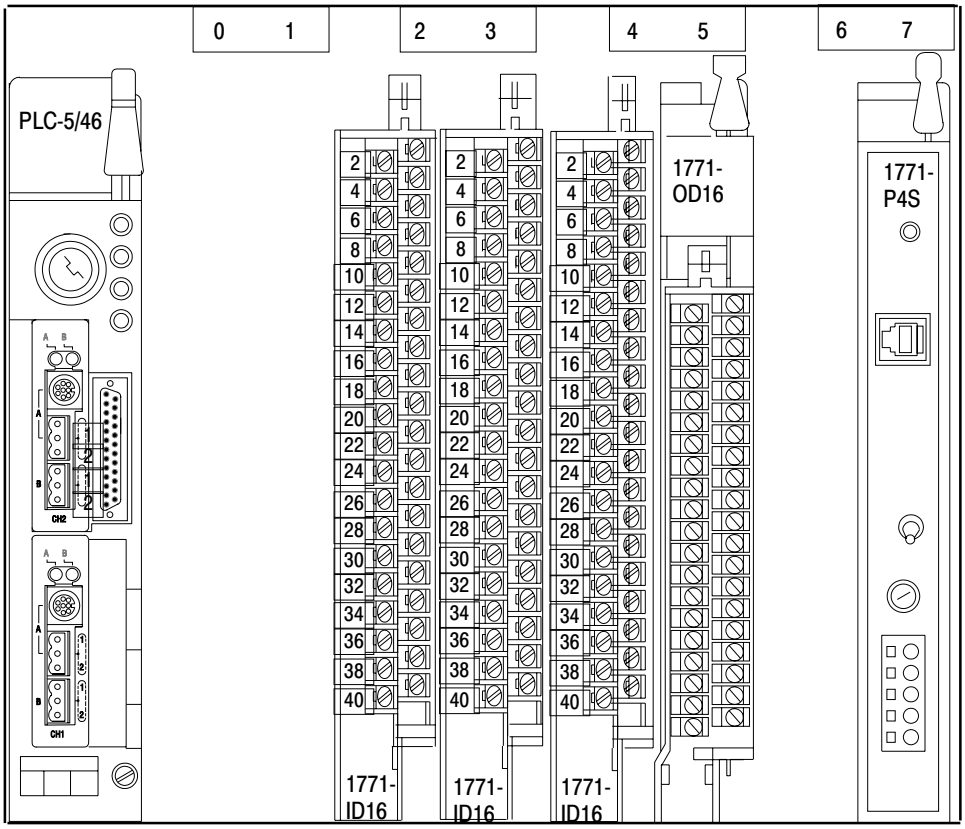
These modules have an input filter with a configurable time constant. It is factory set to the faster response time. Leave jumpers JPR1 and JPR2 in their factory-set position. If you need additional information, refer to the Product Data publication 1771-2.189.

Install PLC Processors, I/O Modules, and Power Supplies

Install processors and modules in designated slots of chassis A (Figure 6.4) and chassis B (Figure 6.5) as follows:

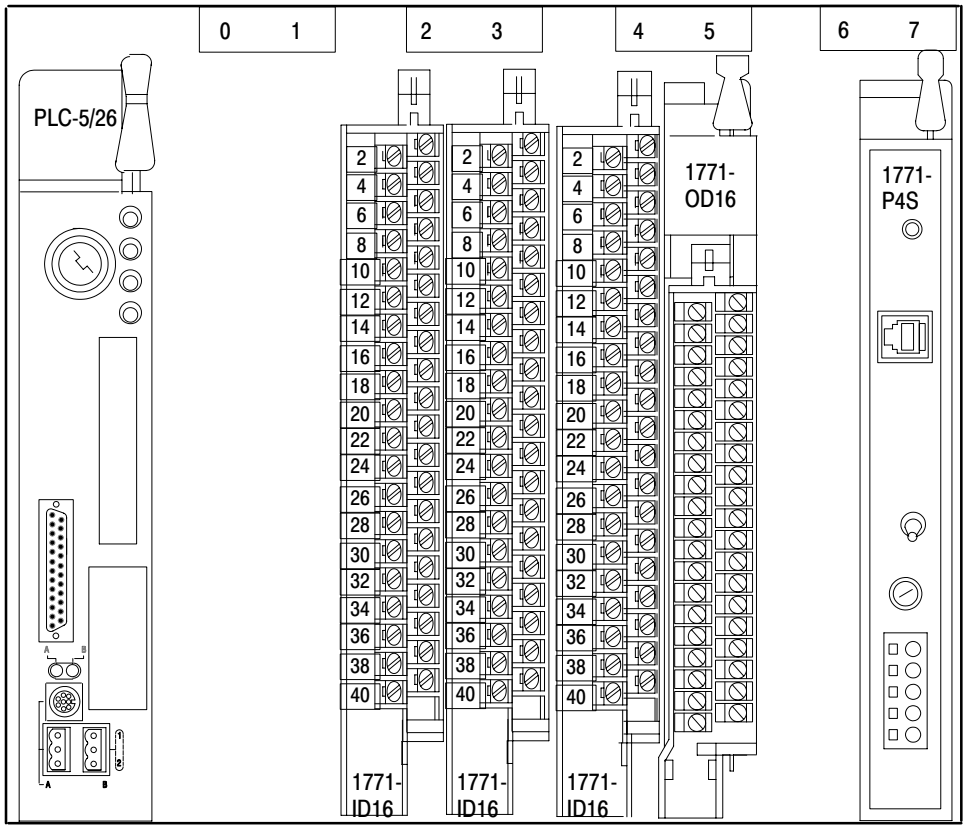
Slot	Chassis A	Chassis B
	PLC-5/46	PLC-5/26
0, 1	Reserved for your use	Reserved for your use
2-4	Isolated Input Module 1771-ID16	Isolated Input Module 1771-ID16
5	Isolated Output Module 1771-OD16	Isolated Output Module 1771-OD16
6	Reserved for your use	Reserved for your use
7	Slot Power Supply 1771-P4S	Slot Power Supply 1771-P4S

Figure 6.4
Module Locations in Chassis A



We suggest that you use slots 0 and 1 for low-level dc input modules such as a resolver input module. This helps segregate dc and ac signals.

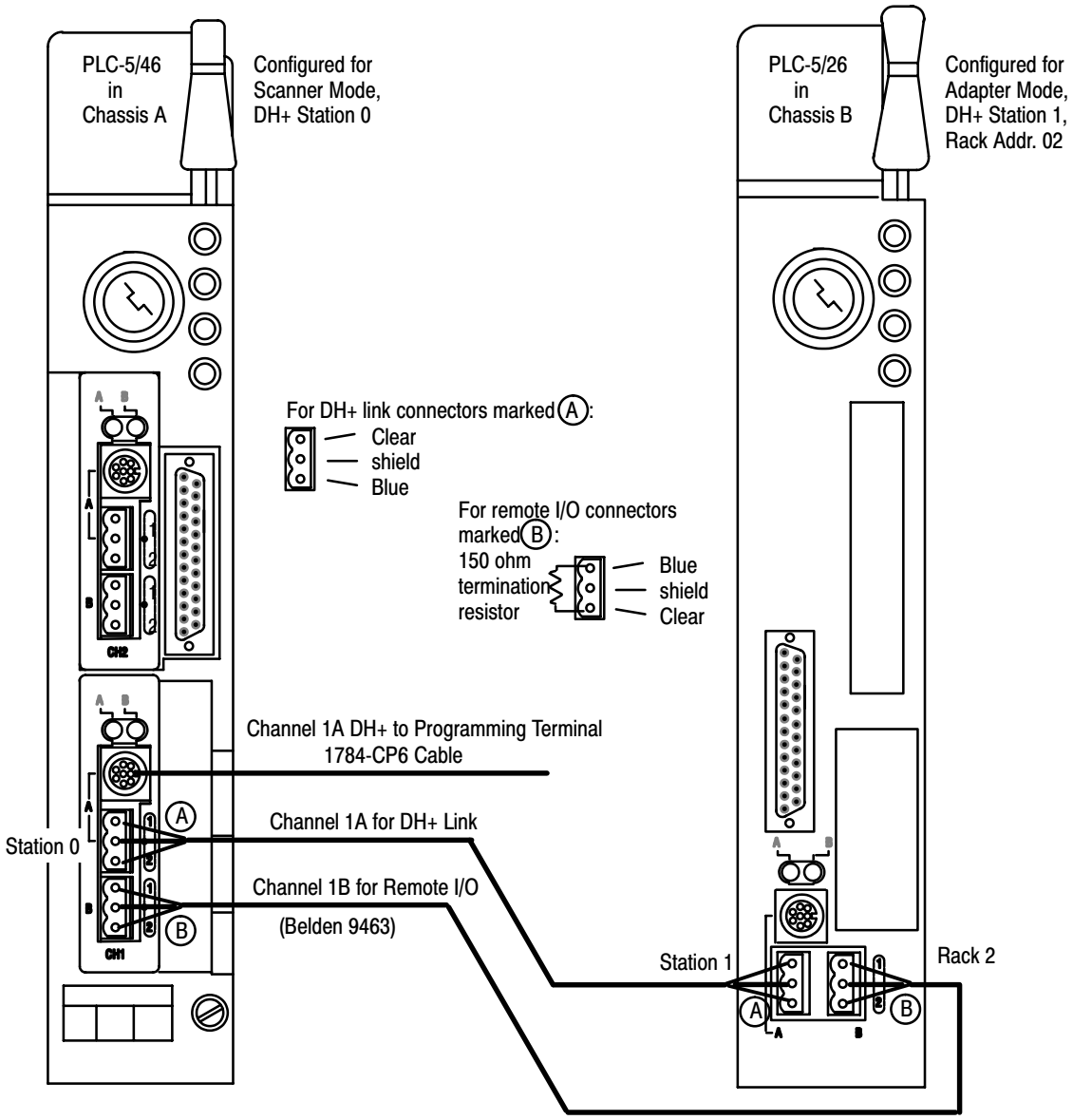
Figure 6.5
Module Locations in Chassis B



Connect PLC Processors and Programming Terminal

Connect PLC processors in chassis A and B with Belden 9463 cables, and the programming terminal with a 1784-CP6 cable (Figure 6.6) as follows:

Figure 6.6
Typical Connections Between Processors



Convert Controller OK Relay Contacts from N.O. to N.C.

The default mode of 700P relay contacts as shipped in this package is normally open (N.O.). You must convert the contacts to the normally closed (N.C.) mode. To do this, remove each of the relay cartridges and flip the screw terminals to the N.C. position as follows:

1. Remove the coverplate by unscrewing the two captive screws.
2. Remove the red crossbar by unscrewing its captive screw.
3. Remove each relay cartridge from the housing by inserting a screwdriver blade under a screw-terminal pressure plate and prying out the cartridge.
4. On the relay cartridge, locate the screw terminals and corresponding contact–mode symbols –| |– for N.O. and –|/|– for N.C.
5. To convert the contacts from N.O. to N.C. mode:
   - **A.** Unscrew the screw terminals 2 turns.
   - **B.** Flip each of the screw terminals from the –| |– (N.O.) position to the –|/|– (N.C.) position.
6. Insert the relay cartridges into the case so the screw terminals (now in the N.C. position) face front and are accessible.
7. Reassemble the red crossbar and coverplate, and securely tighten the captive screws.

For additional information, refer to the Instruction Sheet that accompanied the 700P relay.

Wire Your Control System

Wire your control system according to wiring drawings at the end of this manual. We provide you with two sets of wiring drawings.

- ungrounded ac power
- grounded ac power

Choose the set that matches the ac power distribution of your press.

For	See
Power Distribution	sheet 1 of 9
Module Group 2	sheet 6 of 9
Module Group 3	sheet 7 of 9
Module Group 4	sheet 8 of 9
Module Group 5	sheet 9 of 9

Wire the power supplies according to instructions that accompanied them.

Set Up or Simulate Rotary Cam Limit Switches

Chapter Objectives

In this chapter, we help you:

- set up your position monitoring (RCLS) devices.
- read status bits in ladder logic to indicate shaft position
- use transition fault bits to stop the press
- simulate RCLSs with ladder logic
- troubleshoot the setup of your RCLSs

Setting Up Position Monitoring Devices

The control system can monitor the rotational position of the press stroke with either of these position-monitoring devices:

- dual assemblies containing rotary cam limit switches
- dual resolvers that require ladder logic to simulate cam limit switches

Important: With either method, you must use dual independent positional inputs with the same settings so that:

- brake-monitor contacts must close at a point that indicates unsafe brake wear, and open in the near-bottom zone after the take-over contacts close
- take-over contacts must close after the press has closed in the near-bottom zone and open at a point that allows the press to stop at the top
- anti-repeat contacts open during mid-upstroke for at least 75ms.

Position-monitor inputs should operate as follows (Table 7.A):

Table 7.A
Operation of Cam Limit Switches

This Cam	In this Mode	With these Conditions	Provides a Signal That:
Anti-Repeat (ACAM)	On-the-hop in Single stroke	Cams open momentarily after run buttons are released past bottom	Prevents a second stroke unless run buttons are pressed a second time
Take-over (TCAM)	Inch or Single stroke	Cams open in near-top zone	Turns OFF triac outputs for stopping the press at top of stroke (stop-on-top)
	Continuous	Cams open in near-top zone after stop-on-top command	
	Single stroke or Continuous	Cams close near bottom just when (or before) BCAM opens	Lets the press complete a single stroke or run continuously after run buttons are released
Brake-monitor (BCAM)	Single Stroke or Continuous	When press stops in downstroke beyond BCAM closure	Indicates that braking distance is excessive. Turns OFF solenoid outputs to prevent restart.

Important: Figure 7.1 shows relationships required by control system software. To determine exact settings for actual or simulated limit switches, refer to recommendations provided by the press manufacturer.

Important: Any variation from this scheme will cause one or more transition faults where the software is designed to shut down the system. You can vary the ON/OFF times, but not the sequence nor overlap of signals. This is particularly important during start up. If necessary, refer to Troubleshooting the Setup of Your Position Monitoring Devices at the end of this chapter.

Figure 7.1
Guidelines for Setting Up the On/Off Positions of the Rotary Cam Limit Switches

Set Up or Simulate Rotary Cam Limit Switches as Follows:

(A) During downstroke, BCAM must be On.

(B) During upstroke, TCAM must be On and BCAM must be Off.

(C) During upstroke, ACAM must cycle from On to Off to On while TCAM is On.

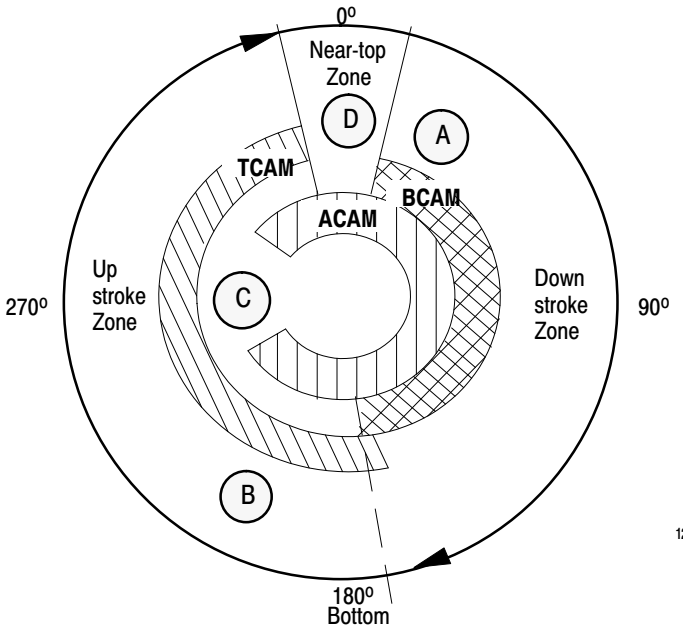
(D) Near top, BCAM and TCAM must be Off while ACAM remains On.

Other Conditions:

The software is designed to fault if/when it detects:
a. ACAM, BCAM, and TCAM are OFF all at the same time.
b. BCAM is On when ACAM is Off.
c. ACAM does not cycle while TCAM is On during upstroke.

ACAM should remain On for the entire stroke except for an On/Off/On cycle while TCAM is On during upstroke.

The dual sets of contacts need not cycle at the same moment. An offset of up to 1 second is acceptable. You can reduce this preset.



Important: See press manufacturer's recommendations for:
* Near-top Zone
* Bottom
* On/Off settings of ACAM, BCAM, and TCAM switches

As an example, we show typical ON/OFF settings for rotary cam limit switches or resolver rotational signals in Table 7.B. Use this table to record the settings for position monitoring on your press.

Table 7.B
Example Settings for Your Rotary Position Monitor

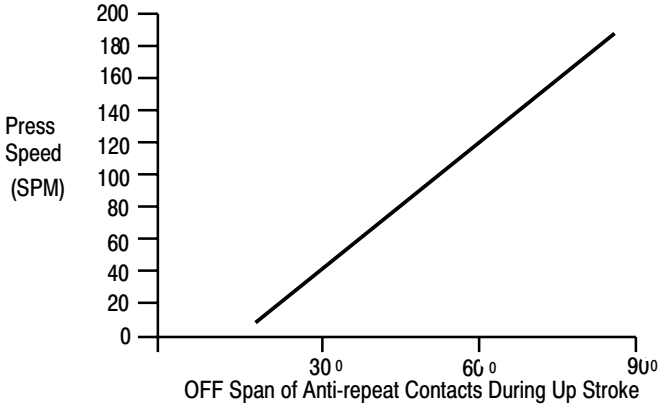
This RCLS:	Turns ON at a position:	Turns OFF at a position:	Typical ON OFF:	Your [1] ON OFF:
BCAM	• near top, beyond which the software detects a faulty brake	• when overlapped by TCAM in ON position	10º 190º	
TCAM	• near bottom • when or before BCAM turns OFF	• that lets the press will stop correctly on top • before BCAM turns ON	170º 350º	

This RCLS:	Turns ON at a position:	Turns OFF at a position:	Typical ON OFF:	Your [1] ON OFF:
ACAM	• Remains ON for the entire stroke except of an Off span during upstroke (Figure 7.2)		290° 250°	

[1] **Important:** To determine exact settings, refer to recommendations provided by the press manufacturer.

Set the ACAM-off span to the number of degrees (0^0 - 90^0) according to the speed of the press (0-200 strokes per minute) from Figure 7.2. ACAM contacts should remain open for at least two program scans.

Figure 7.2
Anti-Repeat Contacts: Up-stroke ON-span vs. Press Speed



Important: When using RCLSs, you must also use the hardware motion detector for the subject chassis (A or B or both). Do NOT delete the motion detector switch (I/O module group 2, Figure 3.4 or 3.16) and do NOT write ladder logic for motion detection with a resolver input (Figure 4.10).

Important: To set up your real or simulated ACAM, BCAM, and TCAM on/off positions according to Figure 7.1 and Table 7.B, go to the next page.

Setup If Using Rotary Cam Limit Switches (omit if using only resolvers)

If using rotary cam limit switches, follow these steps:

1. Set up the cam angles for each RCLS switch assembly as described above. Use on/off settings recommended by the press manufacturer.

Important: Mount these assemblies on opposite ends of the crankshaft that drives the slide so a mismatch will occur if the crankshaft breaks.

2. Wire one assembly to the 1771-ID16 input module in module group 2, chassis A. Repeat for chassis B. Refer to Wiring Drawings, sheet 6.
3. The ladder logic for RCLS is included in the clutch/brake code, stored in protected memory.

Some applications combine one RCLS assembly with one resolver. If this applies to your application, go to the next section to set up the resolver. If not using resolvers, ignore the remainder of this chapter because resolvers do not apply to your application.

Setup If Using Resolvers (omit if using only RCLSs)

If using rotary cam limit switches, follow these steps:

- AMCI resolver connected to an AMCI interface module (Figure 7.3)
- NSD resolver, decoder, and 1771-IBD input module (Figure 7.4)

Follow these steps as applicable:

1. Install resolvers, one on each end of the crankshaft that drives the slide, so they can detect crankshaft breakage. The same applies to a resolver-RCLS combination. Refer to installation instructions provided by the resolver manufacturer.
2. Install a resolver input module into module group 0 and/or 1 of an I/O chassis. Use module group 0 for a 1-slot input module, or module groups 0 and 1 for a 2-slot input module.

   If using a pair of resolvers, repeat for the other I/O chassis. Refer to installation instructions provided by the manufacturer of the resolver input module.
3. Wire the resolver, converter module (if applicable), and input module for the respective I/O chassis. Refer to wiring instructions provided by the manufacturer.

Figure 7.3
AMCI Resolver and Interface Module

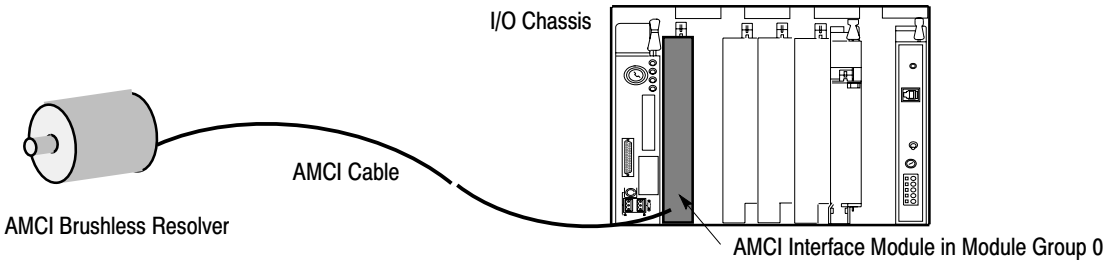
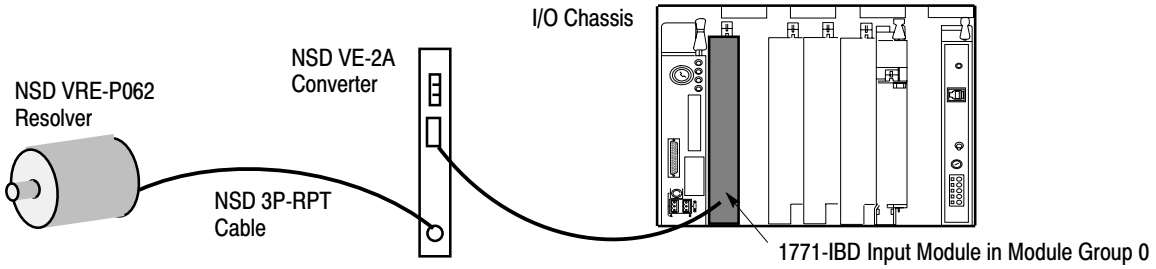


Figure 7.4
NSD Resolver and Converter with 1771-IBD Input Module



4. Repeat step 3 if using dual resolvers.
5. For one or both I/O chassis with a resolver input, remove RCLSs from circuit wiring by jumpering RCLS inputs to respective power rails. For instructions to do this, refer to wiring customization instructions, Module Group 2 (sheet 2) in chapter 3 of this manual.
6. Study the RCLS operation shown in Figure 7.1 and Table 7.B. You will need to simulate RCLS operation with ladder logic. We show you how in the next section.

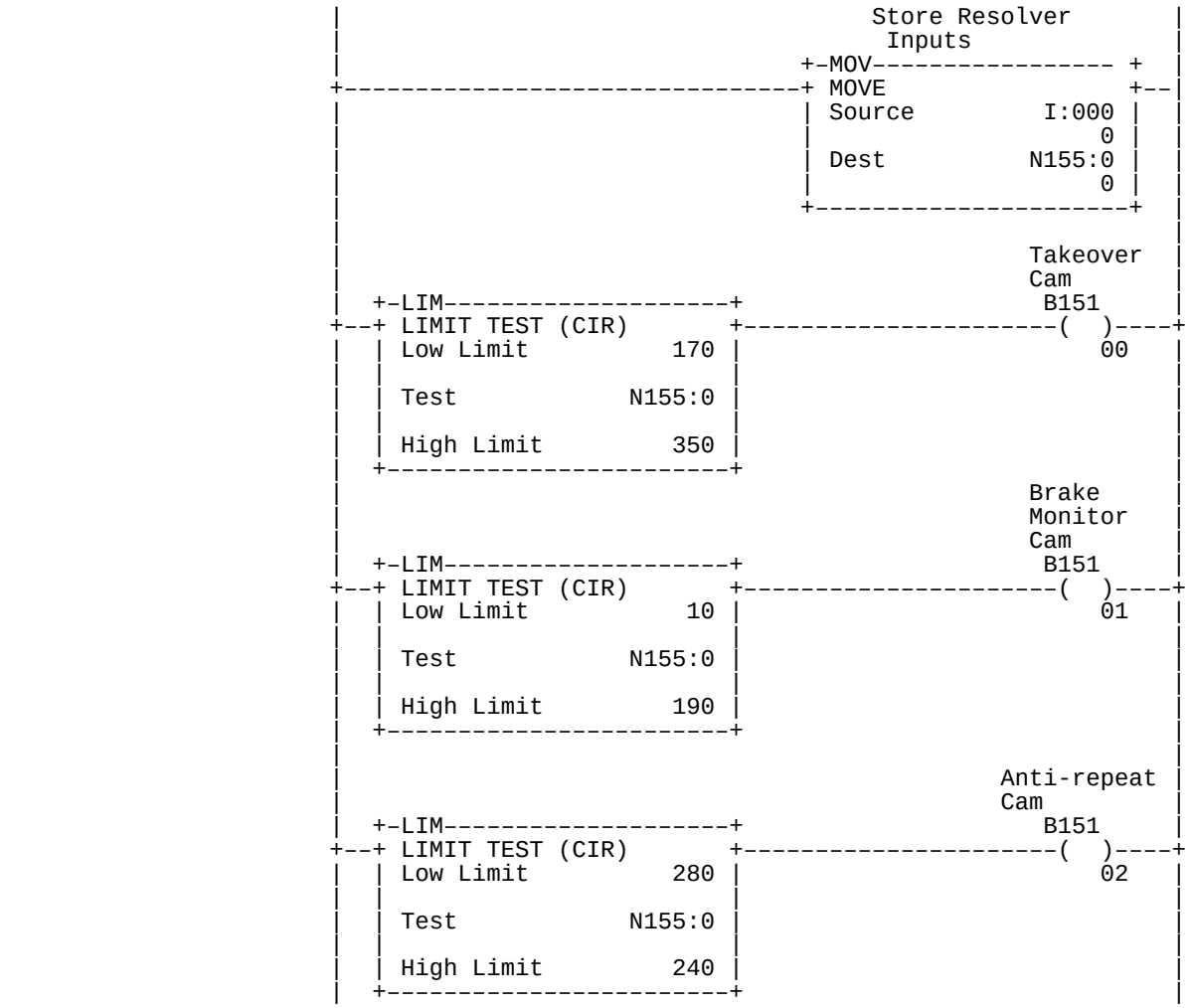
Ladder Logic to Simulate Rotary Cam Limit Switches

If using resolver inputs, you must program all three of the following command bits to simulate rotary cam limit switches shown in Figure 7.1:

Bit	Address	ON/OFF States
BCAM	B151/00	ON – in downstroke OFF– in all other zones
TCAM	B151/01	ON – in upstroke (and ACAM-open zone) OFF – in all other zones
ACAM	B151/02	ON – in all zones except ACAM-open zone OFF – in ACAM open zone (for at least 75 ms.)

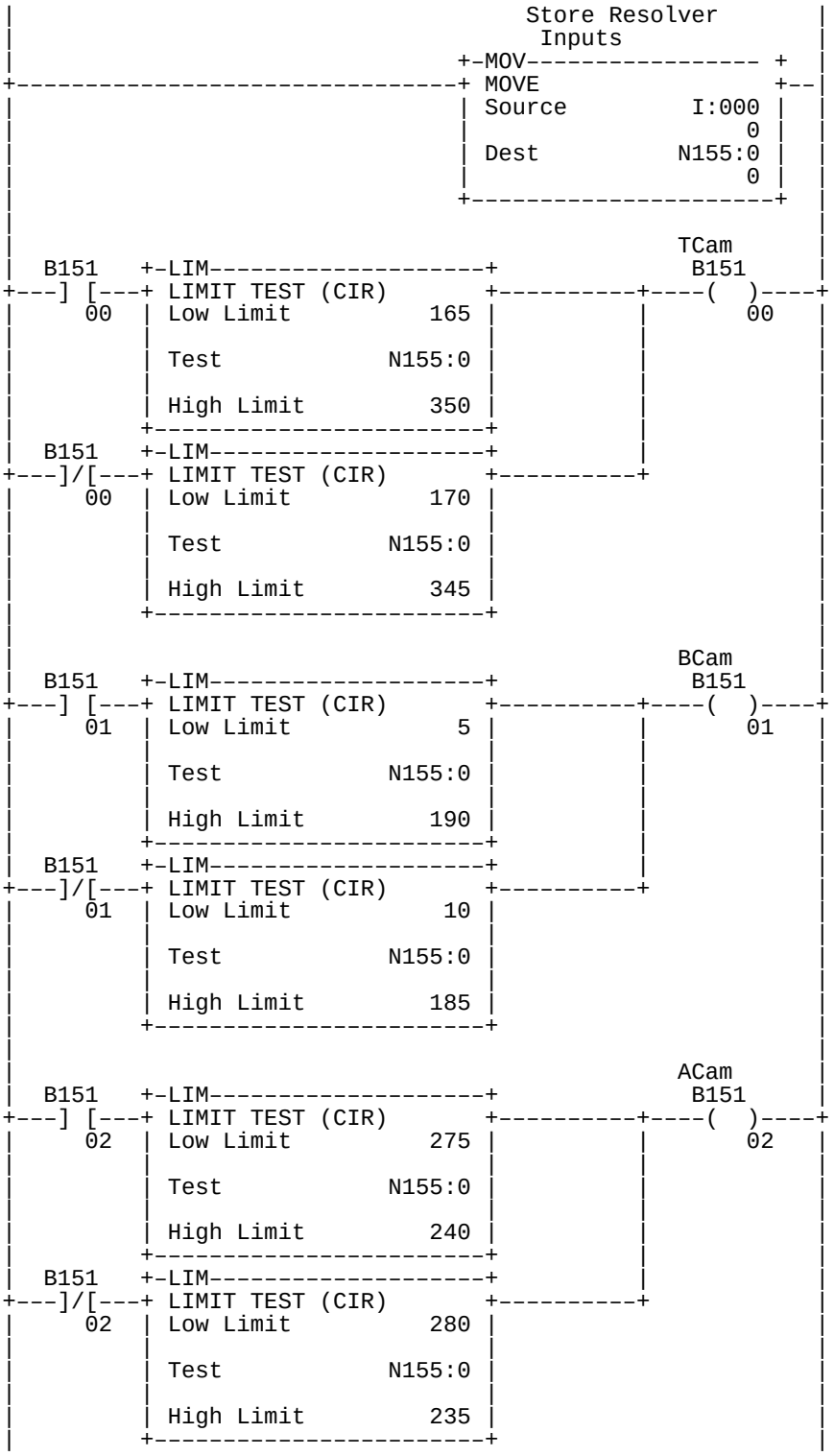
We present ladder logic to simulate rotary cam limit switches (Figure 7.5). Use software bits TCAM (B151/00), BCAM (B151/01), and ACAM (B151/02) to simulate hardware cams when using resolver or encoder inputs. (We assume that the resolver module is in slot 0 at address I:000.)

Figure 7.5
Ladder Logic to Simulate RCLSs When Using Resolver Inputs



If NOT using anti-backlash couplings and you experience reverse-motion faults (Faults 033 and 113) due to gear chatter, you may need to modify your ladder logic to shift cam turn ON and turn OFF positions back about 5º instantly at each transition to compensate for gear chatter (Figure 7.6).

Figure 7.6
Ladder Logic to Guard Against Reverse-motion Faults When Using Resolvers



How Bits Indicate Shaft Position

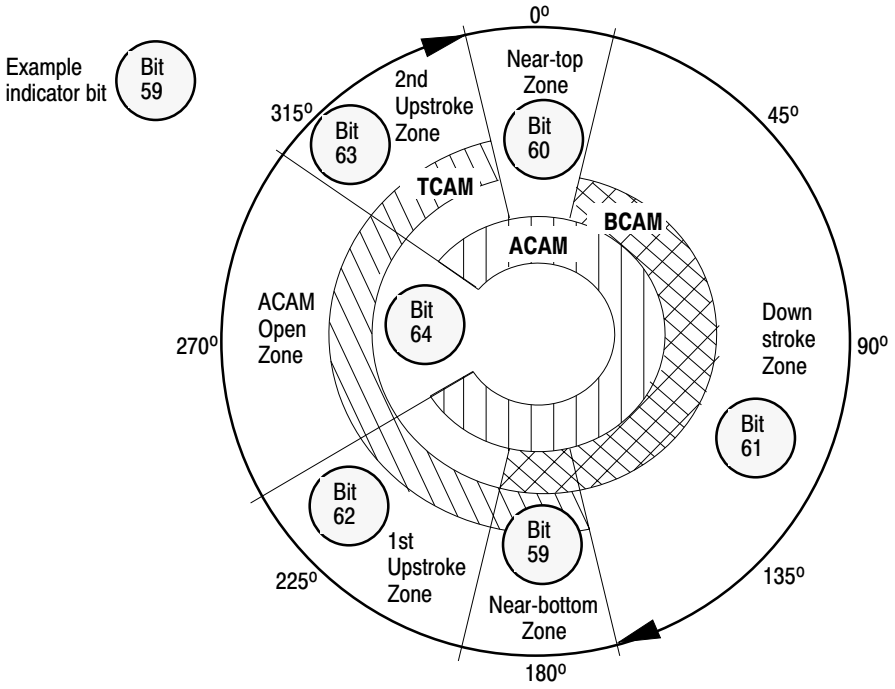
The software sets bits to indicate which of six zones the shaft is rotating through during a press stroke.

Important: The software reads these zones according to the on/off positions of ACAM, BCAM, and TCAM switches that you set (Figure 7.1) mechanically for hardware switches or that the software reads from resolver inputs if using resolvers to simulate your RCLSs.

The zones and corresponding indicator bits in bit file B160 are shown in the following table and in Figure 7.7.

While the shaft is in this zone:	The software sets this bit:
Top	B160/ 60
Downstroke	61
Near Bottom	59
First Upstroke	62
ACAM Open	64
Second Upstroke	63

Figure 7.7
Zones of Rotation That Indicate Shaft Position During a Press Stroke and Corresponding Indicator Bits



Read these bits in your ladder logic to indicate shaft position.

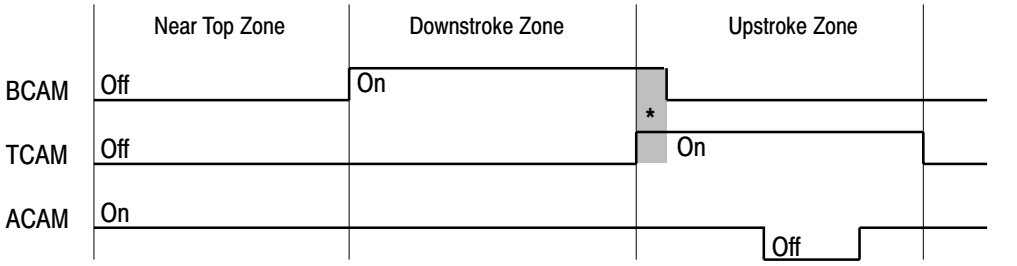
How Transition Faults Stop the Press

The software is designed to fault when it sees conditions other than the correct progression of these three rotational zones during a press stroke:

- Top zone
- Downstroke
- Upstroke

Important: The software reads these zones according to the on/off positions of ACAM, BCAM, and TCAM switches that you set (Figure 7.1) mechanically for hardware switches or that the software reads from resolver inputs if using resolvers to simulate your RCLSs.

During each stroke, the rotary cam limit switches must cycle as follows (linear representation of Figure 7.1):



* BCAM and TCAM can transition within the same scan or overlap their On states.

When the software detects any one of the following fault conditions, it is designed to turn outputs off and set the corresponding fault bit in B168:

When the software detects this condition:	It turns outputs Off and sets this fault bit for Processor A	and this fault bit for Processor B (B168/xxx):
All three limit switches go Off	026	106
BCAM turns Off before TCAM turns On (at bottom)	28	108
BCAM On when ACAM is Off	26, 33	106, 113
ACAM does not cycle during upstroke	034	114

Important: The ladder logic for turning outputs off and setting fault bits is factory configured for you. No programming is required.

Important: For suggestions on troubleshooting your position monitoring devices, continue to the next section. For the complete listing of fault codes, refer to appendix C, Fault Codes and Operator Prompts.

Troubleshoot the Setup of Your Position Monitoring Devices

The processor monitors signals from your position monitoring devices to ensure that the motion:

- is in the forward direction
- progresses through the correct sequence of real or simulated cams
  - downstroke
  - upstroke
  - near top

When the processor detects a malfunction in the operation of position monitoring devices, it faults and sets one or more of the following fault bits to help you troubleshoot the fault.

We recommend that you program a method to display bit numbers of detected faults. Then, you can respond quickly by looking them up in the following tables (taken from appendix C):

Faults Detected by Processor A

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
026*	Illegal RCLS Combination	Software/hardware cams produced invalid combination.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
027*	Forward Transition from Top	Software/hardware cams did not go from top to downstroke.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
028*	Forward Transition from Downstroke	Software/hardware cams did not enter upstroke.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
029*	Forward Transition from Upstroke	Software/hardware cams did not enter near top zone.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
033*	Forward Shaft Position Transition Faults	Any of 027-029 detected.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
034*	ACAM Upstroke	ACAM did not cycle in upstroke.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
041*	Brake Monitor Cam Mismatch Between Processors	Processor A sees the BCAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
042*	Takeover Cam Mismatch Between Processors	Processor A sees the TCAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
043*	Anti-repeat Cam Mismatch Between Processors	Processor A sees the ACAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
044*	Cam Mismatch Fault	Any of 041-043 detected.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.

* To clear this latched fault bit, you must turn the mode-select switch to OFF.

Faults Associated with Processor B

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
106*	Illegal RCLS Combination	Software/hardware cams produced invalid combination.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
107*	Forward Transition from Top	Software/hardware cams did not go from top to downstroke.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
108*	Forward Transition from Downstroke	Software/hardware cams did not enter upstroke.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
109*	Forward Transition from Upstroke	Software/hardware cams did not enter near top zone.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
113*	Forward Shaft Position Transition Faults	Any of 107-109 detected.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
114*	ACAM Upstroke	ACAM did not cycle in upstroke.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
121*	Brake Monitor Cam Mismatch Between Processors	Processor A sees the BCAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
122*	Takeover Cam Mismatch Between Processors	Processor A sees the TCAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
123*	Anti-repeat Cam Mismatch Between Processors	Processor A sees the ACAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.
124*	Cam Mismatch Fault	Any of 121-123 detected.	Press will stop or not run in single or continuous mode.	Check software cam logic or hardware cams for proper operation or settings.

* To clear this latched fault bit, you must turn the mode-select switch to OFF.

Notes

Test Your Clutch/Brake Control System

Chapter Objectives

Once you have completed the installation and programming of your clutch/brake controller, test it to verify proper operation. We give you the procedures in this chapter for the following:

- Static Wiring Tests
- Dynamic tests of operating modes
- Switch Tests

ATTENTION: Before starting this chapter, be sure that:
- installation of all clutch/brake control hardware is complete
- clutch/brake wiring is complete
- control system is in compliance with all applicable standards

Otherwise, personal injury and/or property damage could result.

Static Wiring Tests

This section describes the following static wiring tests:

- Controller OK
- CRM
- Seal Relay
- Crowbar Relay
- Run Buttons
- Inch Buttons
- Stop-on-top Button
- Arm Continuous Button
- Mode selector Switch
- Valves and Valve Feedback

Controller OK Test

This is an internal test. The C/B software is designed to detect and indicate a fault in the controller OK relay circuit should one occur. See fault codes 003 and 083 in appendix C.

CRM Relay Test

1. Power up the system.
2. Visually and with a voltmeter, verify that:
   – CRMA and CRMB relays are *not* energized (no ac on wire # 112A)
   – outputs to all press valves do *not* have power
3. Reset the E-Stop circuit by pressing the Control Reset button.
4. Visually and with a voltmeter, verify that:
   – CRM relays *are* energized (120v ac across 112A and 105L2)
   – outputs to all press valves do *not* have power
5. Reset control power by pressing the Clutch/Brake Power Reset button.
6. With a voltmeter, verify that all press valve outputs have power. (120v ac across 115C and 119B)
7. Press the E-Stop button.
8. Visually and with a voltmeter, verify that seal relays and CRM relays are de-energized. (no ac across 115C and 119B)

Seal Relay Test

1. Power up the system.
2. Reset the E-Stop circuit by pressing the Control Reset button.
3. With a voltmeter, verify that:
   – seal relays are *not* energized
   – outputs to all press valves do *not* have power
4. Reset control power by pressing the Clutch/Brake Power Reset button.
5. Visually and with a voltmeter, verify that:
   – seal relays *are* energized
   – outputs to all press valves *have* power
   (120v ac across 115C and 119B)

Crowbar Relay Test (If using crowbar relays)

1. Power up the system.
2. Reset the E-Stop circuit by pressing the Control Reset button.
3. Reset control power by pressing the C/B Power Reset button.
4. Verify that crowbar relays are *not* energized by observing that their output LEDs are OFF at Module Group 5 output 15 in chassis A and B.
5. Verify that you have enabled the use of the crowbar circuit by your ladder rung in PF15 that sets B151/15 unconditionally ON.
6. Press the E-Stop button to shut down power.
7. Reset the E-Stop circuit by pressing the Control Reset button.
8. Verify that crowbar relays energize and then go OFF. Do this by observing their output LEDs at Module Group 5 output 15 in chassis A and B when you restore control power in step 9.
9. Restore control power by pressing the C/B power reset button and verify crowbar relay operation (step 8).

Test Run Buttons (all four stations)

Test Run-button wiring by observing input LEDs in Module Group 3. Check the OK? box after verifying that the LED indication is correct.

For This Condition	In Module Group 3 These Input LEDs are OFF	OK ?	In Module Group 3 These Input LEDs are ON	OK ?
Run stations wired with dummy plugs.	Chassis A and B If using active pin: Inputs 2, 5, 10, 13		Chassis A and B Inputs 0, 1, 3, 4, 6, 7, 11, 12	
Run stations wired with run buttons.	Chassis A and B Inputs 0, 3, 6, 11		Chassis A and B Inputs 1, 4, 7, 12 If using active pin: Inputs 2, 5, 10, 13	
Station 1 Right-hand Run button pressed.	Chassis B, Input 1		Chassis A Input 0	
Station 2 Right-hand Run button pressed.	Chassis B, Input 4		Chassis A, Input 3	
Station 3 Right-hand Run button pressed.	Chassis B, Input 7		Chassis A, Input 6	
Station 4 Right-hand Run button pressed.	Chassis B, Input 12		Chassis A, Input 11	
Station 1 Left-hand Run button pressed.	Chassis A, Input 1		Chassis B, Input 0	
Station 2 Left-hand Run button pressed.	Chassis A, Input 4		Chassis B, Input 3	
Station 3 Left-hand Run button pressed.	Chassis A, Input 7		Chassis B, Input 6	
Station 4 Left-hand Run button pressed.	Chassis A, Input 12		Chassis B, Input 11	

Test Inch Buttons

Test Inch-button wiring by observing input LEDS in Module Group 3. Check the OK? box after verifying that the LED indication is correct.

For This Condition	In Module Group 3 This Input LED is OFF	OK ?	In Module Group 3 This Input LED is ON	OK ?
Right-hand Inch button pressed.	Chassis B, Input 16		Chassis A, Input 15	
Left-hand Inch button pressed.	Chassis A, Input 16		Chassis B, Input 15	
Left and Right Inch buttons *not* pressed	Chassis A and B, Input 15		Chassis A and B, Input 16	

Test Stop-on-top and Arm Continuous Buttons

Test the wiring of these buttons by observing input LEDS in Module Group 3 for chassis A and B. Check the OK? box after verifying that the LED indication is correct.

For This Condition	In Module Group 3 This Input LED is OFF	OK ?	In Module Group 3 This Input LED is ON	OK ?
Stop-on-top *not* pressed	N/A		Input 14	
Stop-on-top pressed	Input 14		N/A	
Arm Continuous *not* pressed	Input 12		N/A	
Arm Continuous pressed	N/.A		Input 12	

Test Mode Selector Switch

Test the wiring of this switch by observing input LEDS in Module Group 3 for chassis A and B. Check the OK? box after verifying that the LED indication is correct.

For This Mode-select Position	In Module Group 3 These Input LEDs are OFF	In Module Group 3 This Input LED is ON	OK ?
Off	All of 6, 7, 10, 11, 12, 13, 14	Input 6	
Inch	except for the input that	Input 7	
Single	is turned ON.	Input 10	
Continuous		Input 11	
Remote		Input 12	
Micro-inch		Input 13	
Die Change		Input 14	

Valves and Valve Feedback

Test output wiring and input feedback to/from press valves by "ringing out" your I/O connections using the following table. Check the OK? box after verifying each connection.

Important: Disconnect one side of each solenoid valve to guard against current flow through solenoids. Reconnect them when done.

For Ungrounded AC Wiring

From Chassis A			To Chassis B & Solenoids		OK?
Mod Grp	Wire Number	Term	Mod Grp	Term	–
5	AO:005/00	1	2	13	
5	AO:005/01	3	2	15	
5	AO:005/02	5	N/A	"A" 904SOL	
5	AO:005/03	7	N/A	"B" 905SOL	
5	AO:005/04	11	2	7	
5	AO:005/05	13	2	11	
5	AO:005/06	15	N/A	"A" 909SOL	
5	AO:005/07	17	N/A	"B" 910SOL	
5	AO:005/10	21	4	1	
5	AO:005/11	23	4	3	
5	AO:005/12	25	N/A	"A" 914SOL	
5	AO:005/13	27	N/A	"B" 915SOL	

From Chassis B			To Chassis A & Solenoids		OK?
Mod Grp	Wire Number	Term	Mod Grp	Term	–
5	BO:005/00	1	2	13	
5	BO:005/01	3	2	15	
5	BO:005/02	5	N/A	"A" 904SOL	
5	BO:005/03	7	N/A	"B" 905SOL	
5	BO:005/04	11	2	7	
5	BO:005/05	13	2	11	
5	BO:005/06	15	N/A	"A" 909SOL	
5	BO:005/07	17	N/A	"B" 910SOL	
5	BO:005/10	21	4	1	
5	BO:005/11	23	4	3	
5	BO:005/12	25	N/A	"A" 914SOL	
5	BO:005/13	27	N/A	"B" 915SOL	

From Chassis A			To Chassis B		OK?
Mod Grp	Wire Number	Term	Mod Grp	Term	–
4	AI:004/02	5	4	"A" 804LS	
			4	5	
4	AI:004/03	5	4	"B" 805LS	
			4	7	
4	AI:004/04	5	4	"A" 807LS	
			4	11	
4	AI:004/05	5	4	"B" 808LS	
			4	13	

For Grounded AC Wiring

From Chassis A			To Chassis B		OK?
Mod Grp	Wire Number	Term	Mod Grp	Term	–
5	AO:005/00	1	5	2	
			2	13	
5	AO:005/01	3	5	4	
			2	15	
5	AO:005/04	11	5	12	
			2	7	
5	AO:005/05	13	5	14	
			2	11	
5	AO:005/10	21	5	22	
			4	1	
5	AO:005/11	23	5	24	
			4	3	

From Chassis B			To Solenoids & Chassis A		OK?
Mod Grp	Wire Number	Term	Mod Grp	Term	–
5	BO:005/00	1	5	“A” 925SOL	
			2	13	
5	BO:005/01	3	5	“B” 926SOL	
			2	15	
5	BO:005/04	11	5	“A”931SOL	
			2	7	
5	BO:005/05	13	5	“B”932SOL	
			2	11	
5	BO:005/10	21	5	“A”936SOL	
			4	1	
5	BO:005/11	23	5	“B”937SOL	
			4	3	

From Chassis A			To Solenoids & Chassis B		OK?
Mod Grp	Wire Number	Term	Mod Grp	Term	–
4	AI:004/02	5	4	“A” 804LS	
			4	5	
4	AI:004/03	5	4	“B” 805LS	
			4	7	
4	AI:004/04	5	4	“A” 807LS	
			4	11	
4	AI:004/05	5	4	“B” 808LS	
			4	13	

Dynamic Tests of Operating Modes

This section tests ladder logic in PF15 for press operation in these modes:

- inch
- single-stroke
- continuous, started by arm-continuous or stroke-and-a-half

Important: We assume that you have downloaded your ladder programs with 6200 Software (Revision 4.4 or later) into processors A and B.

Important: If the press control system faults or does not operate as expected in this procedure, read the resulting fault or prompt bit with your programming terminal and refer to Appendix C for:

- fault codes in bit file B168 for troubleshooting
- prompts in bit file B169 for operating the press

Important: The software must see real or simulated position monitor signals as described in chapter 7. Otherwise, one or more transition faults are designed to shut down the system. You can vary the ON/OFF times, but not the sequence nor overlap of signals. This is particularly important during start up. Fault bits B168/026-033 and B168/106-113 indicate which position monitor signals are missing or out of sequence.

Test dynamic press operation with the following procedures:

Inch Mode

1. Switch both processors to run mode.
2. Power up the system by pressing the Control Rest and Clutch/Brake Power Reset buttons.
3. Visually and with a voltmeter, verify that seal relays and CRM relays are energized.
4. Place the mode selector switch in inch mode.
5. Concurrently, press and hold both Inch buttons.
6. Observe that the press cycles and stops on top.
7. Release the Inch buttons and press again for 1-2 seconds.
8. Observe that the press cycles until you release an Inch button, at which time the press stops.

Single-stroke Mode

1. Select inch, and inch the press to the top.
2. Place the mode selector switch in single-stroke mode.
3. Press and hold Run buttons for more than 1/2 stroke.
4. Observe that the press cycles and stops on top.
5. Release the Run buttons and press again.
   This time release Run buttons in the downstroke.
6. Observe that the press stops immediately.
7. Bring the press to top by pressing Run buttons and release in upstroke.
8. Repeat steps 3 and 4.
   This time hold Run buttons for the entire cycle.
9. Observe that the press runs through one stroke and stops at the top.

Continuous Mode with Arm Continuous

1. Place the mode selector switch in continuous mode.
2. Press the Arm Continuous button.
3. Immediately press Run buttons, and release after downstroke.
4. Observe that the press continues to cycle.
5. Press the Stop-on-top button.
6. Observe that the press completes the cycle and stops on top.
7. Attempt to start the press (at step 3) but wait until after 5 seconds (or until after the Arm-continuous timer has timed out) before pressing Run buttons.
8. Observe that the press does not start.
9. Repeat steps 3 through 7.

Continuous Mode with Stroke-and-a-half

1. Place the mode selector switch in continuous mode.
2. Press and hold Run buttons for 1-1/2 strokes before releasing them.
3. Observe that the press continues to cycle.
4. Press the Stop-on-top button.
5. Observe that the press completes the cycle and stops on top.
6. Attempt to start the press, but hold Run buttons for less than 1-1/2 strokes.
7. Observe that the press starts and then stops when you release Run buttons.

If You Release Run Buttons	the Press
in first or second downstroke	stops immediately
in first upstroke	stops at the top

8. Bring the press to top by pressing Run buttons, and release in upstroke.
9. Repeat steps 3 through 6.

Switch Tests

This section tests the following switches in the clutch/brake control system:

- air pressure
- main motor forward
- motion detector
- chain break

Air Pressure Switch

1. Remove the air pressure switch input from chassis A:
   - wire # AI:002/15
   - module group 2
   - terminal 33
2. Place the mode selector switch in single-stroke mode.
3. Attempt to start the press. Observe that it will not start and that fault codes 39 and 119 are indicated.

4. Reconnect the air pressure switch input to chassis A (step 1).
5. Remove the switch input from chassis B to repeat the test.
   - wire # AI:002/15
   - module group 2
   - terminal 33
6. Attempt to start the press. Observe it will not start and that fault codes 39 and 119 are indicated.
7. Reconnect the air pressure switch input to chassis B (step 5).

Main Motor Forward Switch

1. Remove the main motor forward switch input from chassis A:
   - wire # AI:002/16
   - module group 2
   - terminal 35
2. Place the mode selector switch in single-stroke mode.
3. Attempt to start the press. Observe that it will not start and that *prompt* codes 13 and 93 are indicated.
4. Reconnect the main motor forward switch input.
5. Remove the switch input from chassis B to repeat the test.
   - wire # AI:002/16
   - module group 2
   - terminal 35
6. Repeat steps 3 and 4.

Motion Detector Switch

1. Remove the motion detector switch input from chassis A:
   - wire # AI:002/17
   - module group 2
   - terminal 37
2. Place the mode selector switch in single-stroke mode.
3. Start the press. Observe that it stops before reaching bottom and fault codes 48 and 128 are indicated. If the press reaches bottom, shorten timer preset T162:28 by programming B152/28 to a value that stops the press in downstroke. If necessary, refer to chapter 4.
4. Reconnect the motion detector switch input to chassis A (step 1).

5. Remove the switch input from chassis B to repeat the test.
   - wire # AI:002/17
   - module group 2
   - terminal 37
6. Start the press and observe that it stops before reaching bottom.
7. Reconnect the switch input to chassis B (step 5).

Chain Break Switch

1. Place the mode selector switch in continuous mode.
2. Start and run the press.
3. Simulate tripping the chain break limit switch as if the chain had broken. Observe that the press stops immediately. Do this by shorting the chain-break input high. (Short input terminal 37 of module group 4 to high in chassis A or B).
4. With the simulated condition of step 3, attempt to start the press. Observe that the press does not start and that fault codes 47 and 127 are indicated.
5. Return the chain-break input to its normal condition, and attempt to start the press. Observe that it starts and that fault codes 47 and 127 are absent.

Description of Operating Modes

Operating Modes of the Clutch/Brake Controller

You can select any one of the following operating modes with the mode selector switch:

- Off
- Remote
- Inch
- Micro-inch
- Single stroke
- Continuous stroking

Off

When an operator selects OFF, the control system is designed to turn off all outputs to press valves.

Remote Mode

When an operator switches the mode selector switch to Remote mode, the control system can operate in the following modes when enabled by the corresponding mode-select command bit in your ladder logic (PF15):

- remote inch mode B151/10
- remote single-stroke mode B151/13
- remote continuous mode B151/14
- remote micro-inch mode B151/24
- remote automatic single stroke B151/26

For examples of enabling remote modes, refer to ladder logic in chapter 4, Figures 4.8, 4.11, 4.17, 4.18, 4.19, 4.20.

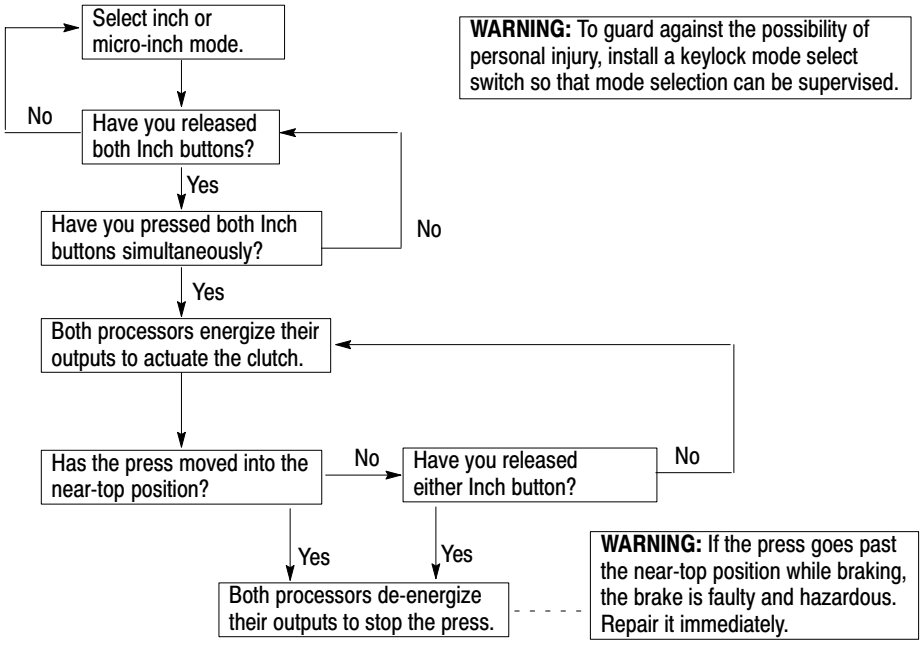
Next, we describe the remaining operating modes with flow charts.

Inch and Micro-inch Modes

Before entering single or continuous mode, use inch or micro-inch mode to jog the press to the near-top position to set up the machine. Use micro-inch mode only if your press is equipped with a separate micro-inch drive.

With either mode, the press stops when it moves into the near-top position or when you release an Inch button (Figure A.1).

Figure A.1
Typical Operational Sequence for Inch or Micro-Inch Mode



NOTE: Use inch or micro-inch mode to position the press near the top. You may jog the press up or down. The press stops when it moves into the near-top position or when you release an Inch button.

Single Stroke Mode

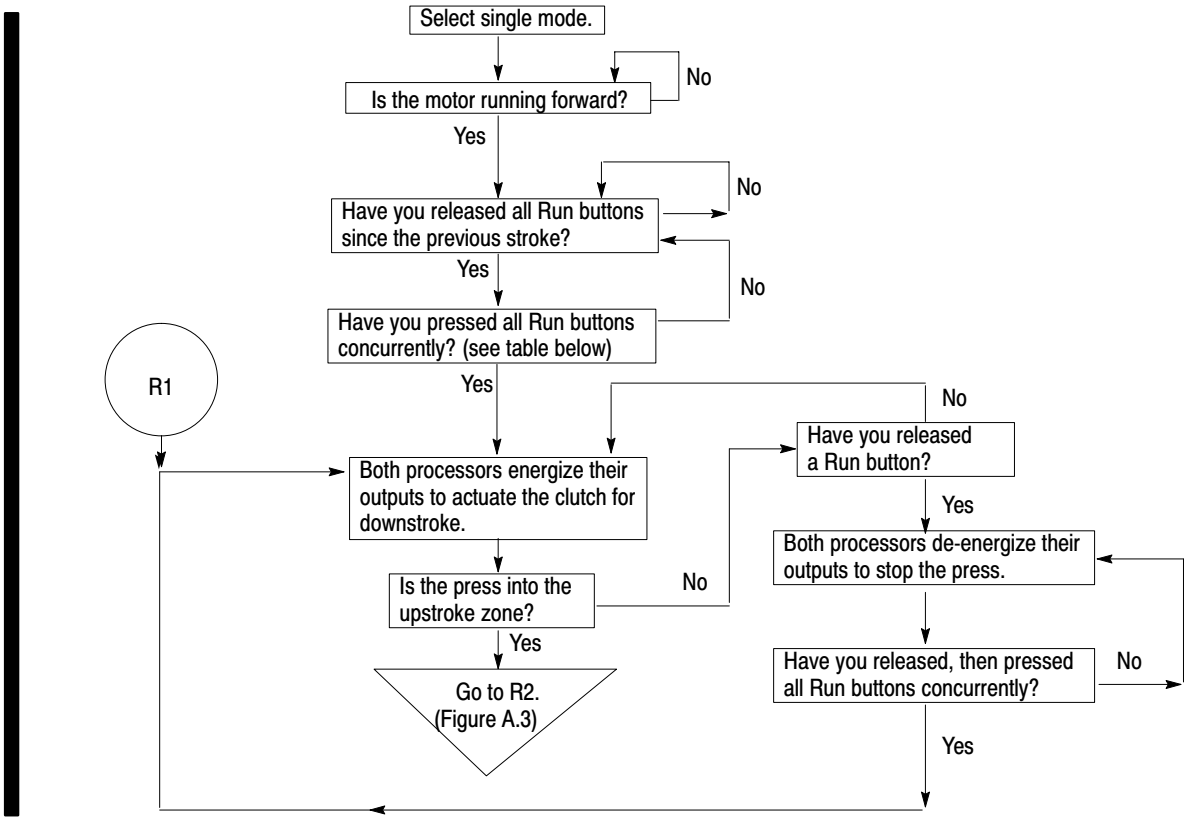
Single stroke mode is designed to stroke the press once, from top to bottom to top, with the concurrent use of all active run buttons. Once the press reaches the takeover cam (TCAM), operators can release Run buttons without stopping the press it continues to the near-top position.

During downstroke, releasing a Run button stops the press (Figure A.2). To restart the press, press the Run buttons.

Once the press reaches the takeover cam, the press continues automatically through the upstroke (Figure A.3).

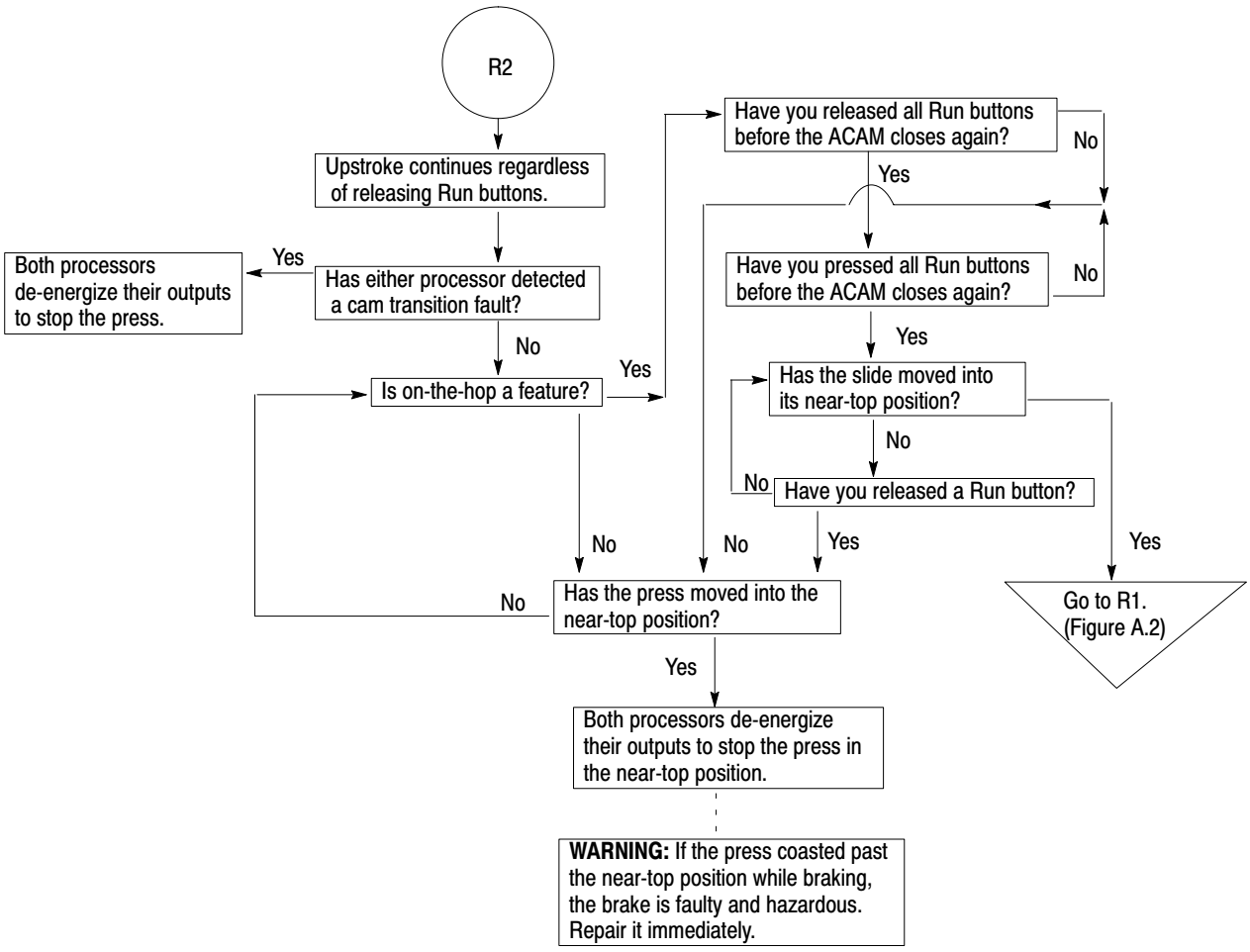
If you purchased software with on-the-hop, you can start another cycle without stopping the press if you release all Run buttons. Then, press and hold Run buttons during the upstroke.

Figure A.2
Typical Operational Sequence for Downstroke in Single Mode



For This Mode:	Replace Run Buttons With:	Bit Number:
Remote Inch	Simulate Inch Buttons Command Bit	B151/09
Remote Micro–inch		
Remote Automatic Single	Simulate Run Buttons Command Bit	B151/25
Continuous on Demand		

Figure A.3
Typical Operational Sequence for Upstroke in Single Mode



NOTE: The press continues automatically through upstroke, then stops. If your software includes on-the-hop, you can start another cycle without stopping at the top. Do this by releasing, then pressing and holding all Run buttons during upstroke.

Continuous Mode

When you want to run your press continuously, ready the press as follows for starting from any position in the press cycle:

- select continuous mode
- press the arm continuous button (Figure A.4) if you have this feature
- press all active Run buttons within 5 seconds (within the preset time)

In first downstroke, releasing a Run button stops the press (Figure A.5).

If the slide has not entered the upstroke zone, you can resume downstroke within 5 seconds of pressing the Arm Continuous button. (The Arm Continuous preset could be less than 5 seconds.) After 5 seconds (the press is stopped), you must restart continuous mode with the arming sequence.

If the slide entered the upstroke zone the first time and your press does NOT have stroke-and-a-half (Figure A.6):

- when both TCAMs come on, you may release a Run button and the press will continue stroking

If the press is configured for stroke-and-a-half:

- continue holding the Run buttons until the press runs through downstroke a second time
- releasing a Run button early in downstroke stops the press, and first downstroke conditions apply
- releasing a Run button during first upstroke stops the press when it reaches the top

Once in continuous stroking operation, the press stops at the next near-top position whenever it receives a stop-on-top command (Figure A.7). However, the press stops immediately whenever:

- either processor detects a trip or stop condition
- a required condition or command bit is removed
- an operator presses the E-stop button

Figure A.4
Typical Operational Sequence to Prepare to Start Continuous Mode

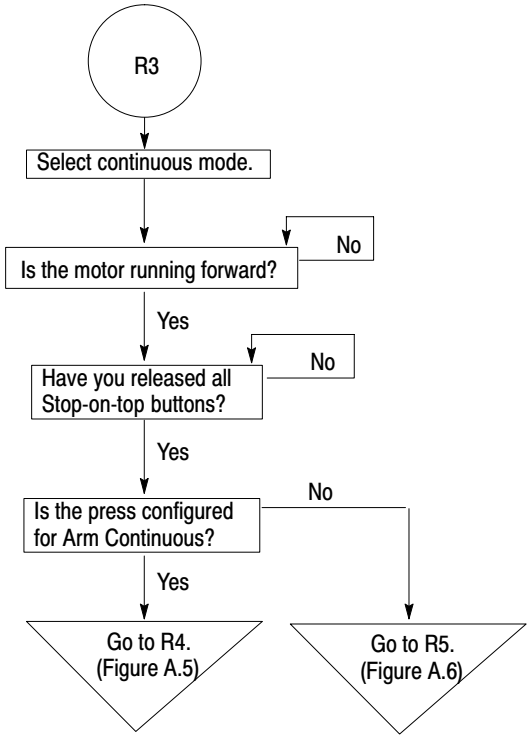
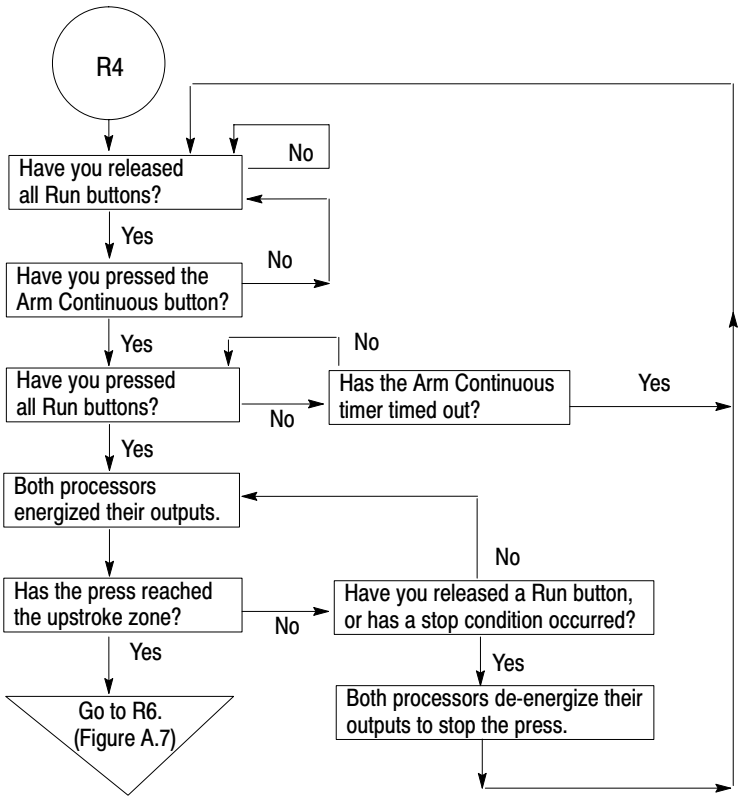
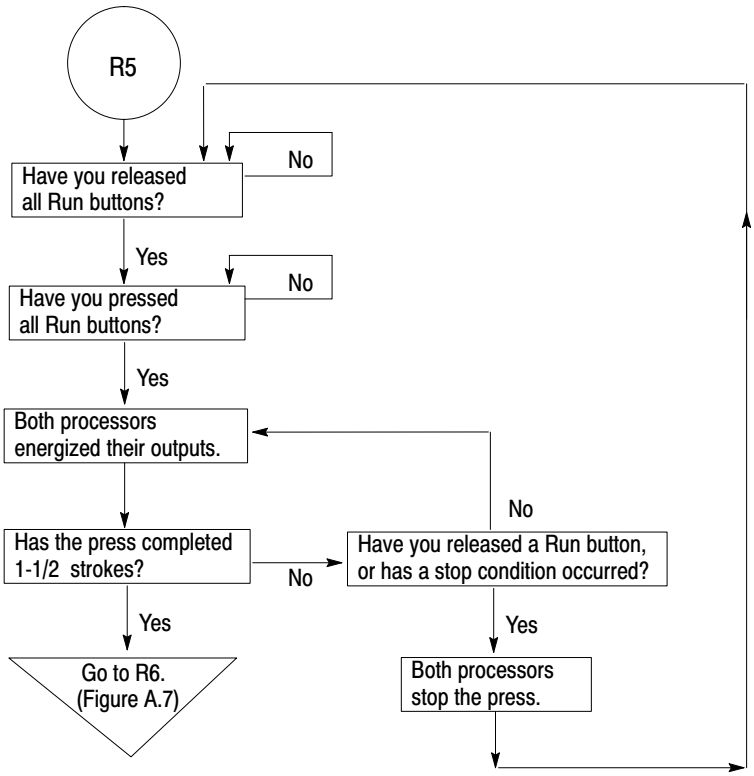


Figure A.5
Typical Operational Sequence for Arm Continuous in Continuous Mode



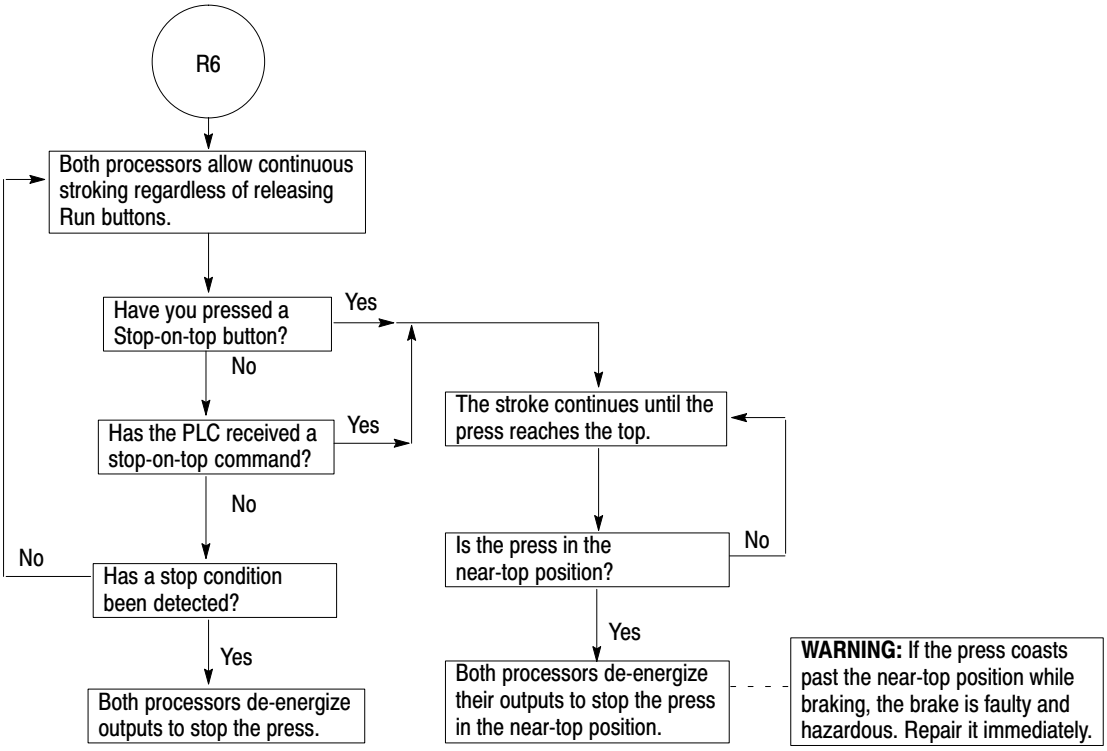
NOTE: Releasing a Run button during first downstroke stops the press. If the slide has not entered the upstroke zone, you can resume downstroke within 5 seconds of pressing the Arm Continuous button. (The Arm Continuous preset could be less than 5 seconds.) After 5 seconds (the press is stopped), you must restart continuous mode with the arming sequence.

Figure A.6
Typical Operational Sequence for Stroke-and-a-half in Continuous Mode



NOTE: Stroke-and-a-half requires you to hold all Run buttons until downstroke is completed a second time. Releasing a Run button beforehand stops the press. To restart, release and press all Run buttons.

Figure A.7
Typical Operational Sequence To Stop Continuous Stroking



NOTE: The press strokes continuously until you press a Stop-on-top button, the PLC processor receives a stop-on-top command, or a stop condition is detected.

Feedback Timing Diagrams

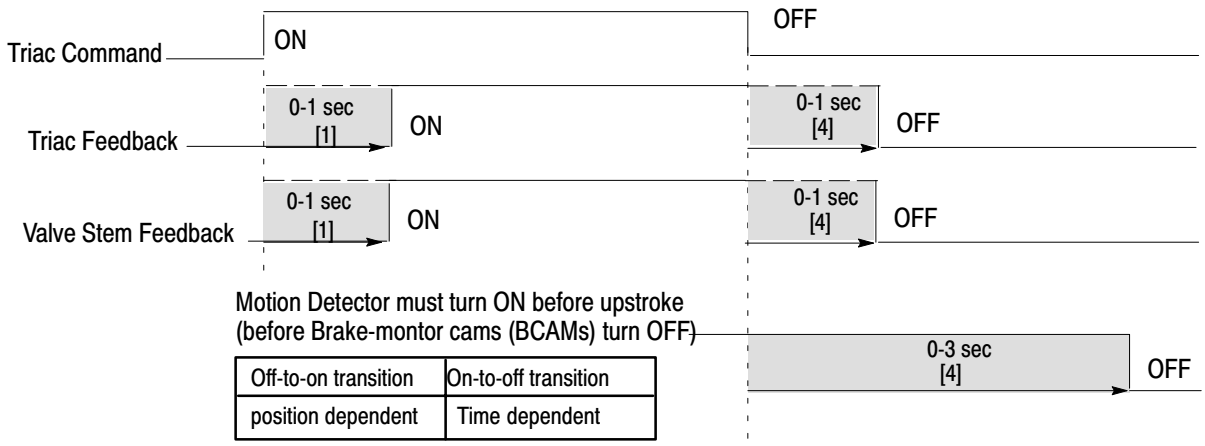
Timing Diagrams for Control System Feedback

We define the controller's feedback response time for these signals:

- triac and valve-stem feedback
  (where valve-stem feedback pertains to main, auxiliary, and/or micro-inch valves with external fault detection)
- motion detector feedback

When PLC-5/x6 processors command triacs ON or OFF, they check that feedback signals (triac, valve stem, and motion detector) have turned ON or OFF in the order shown and within the times shown.

This feedback signal:	Has a turn-on time measured from off-to-on transition of:	and a turn-off time measured from on-to-off transition of:
Triac	[1] triac command	[4] triac command
Valve-stem	[2] triac feedback	
Motion Detector	Turns ON before upstroke (Before BCAMs turn OFF)	



If and when a PLC-5/x6 processor 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 arm of 1771-OD16 output module.

If your main valves have external fault-detection with valve-stem switches and you configured for valve-stem feedback, you have two options for the other solenoid valve inputs:

- they also must have external valve-stem switches and feedback, or
- if they have internal fault detection, you must simulate external valve-stem feedback for them (See wiring drawings 8 and 9)

Notes

Troubleshooting with Fault Codes, Operator Prompts, and Snapshot Status Bits

Troubleshooting with Fault Codes

Whenever a PLC-5/x6 processor detects a fault, it sets a corresponding bit *Bit File 168* in the data table. We list the conditions that for which the software is designed to detect and signal a fault.

We recommend that you program a method to display bit numbers of detected faults. Then, you can respond quickly by looking them up in the following table.

Faults Associated with Processor A

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
000	Processor A Communication Timeout	Remote I/O link (channel 1B) failed.	C/B power is de-energized.	Check remote I/O cable to chnl 1B. Check port configuration.
001*	Crowbar Relay A Weld Fault	Crowbar relay A welded closed.	C/B power is de-energized and will not turn ON.	Check crowbar relay, wiring, and operation of input module in slot 2.
002*	Crowbar Relay A Failed to Turn ON	Crowbar relay A failed to close.	C/B power will not turn ON.	Check crowbar relay, wiring, and operation of input module in slot 2.
003*	Controller OK relay test failed	Not wired according to latest drawings	C/B power will not turn ON.	Change wiring per SW revision 1.3.
004*	Seal Relay A Timeout Fault	Seal relay A failed to close.	C/B power will not turn ON.	Check seal relay, wiring, and operation of input module in slot 2.
005*	Seal Relay A Weld Fault	Seal relay A welded closed.	C/B power is de-energized and will not turn ON.	Check seal relay, wiring, and operation of input module in slot 2.
006*	E-Stop Relay Failed to Turn ON.	E-Stop relay failed to close.	C/B power will not turn ON.	Check E-Stop relay circuit and operation of input module in slot 2.
007*	E-Stop Relay Weld Fault	CRMA relay welded closed.	C/B power is de-energized and will not turn ON.	Check E-Stop relay circuit and operation of input module in slot 2.
008	No Valid Mode	Mode-select failed.	C/B power will not turn ON.	Check mode selector switch, wiring, and operation of input module in slot 4.
009*	Processor Mode Mismatch	Each processor sees a different mode.	Press will not stroke.	Check mode selector switch, wiring, and operation of input module in slot 4.
010	Processor A Station 1 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
011	Processor A Station 2 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
012	Processor A Station 3 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
013	Processor A Station 4 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
014	Processor A Station 1 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
015	Processor A Station 2 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.

* To clear this latched fault bit, you must enable the fault reset bit or turn the mode-select switch to OFF.

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
016	Processor A Station 3 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
017	Processor A Station 4 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
018	Processor A Run Stations Tiedown	Among run stations, others must be pressed after the first is pressed.	Press will not start a stroke in single or continuous mode.	Press all run stations within timed interval. Check button wiring.
019-023 Spare				
024	Inch Button Tiedown	Inch button held too long before pressing other Inch button.	Press will not inch.	Release, then press inch buttons simultaneously. Check button wiring.
025*	Automatic single-stroke cycle start fault	Automatic single-stroke not initiated	Press will stop or not run.	Check logic of your automatic single-stroke cycle start.
026*	Illegal RCLS Combination	Software/hardware cams produced invalid combination.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
027*	Forward Transition from Top	Software/hardware cams did not go from top to downstroke.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
028*	Forward Transition from Downstroke	Software/hardware cams did not enter upstroke.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
029*	Forward Transition from Upstroke	Software/hardware cams did not enter near top zone.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
030-032 Spare				
033*	Forward Shaft Position Transition Faults	Any of 027-029 detected.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
034*	ACAM Upstroke	ACAM did not cycle in upstroke.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
035-038 Spare				
039*	C/B Air Pressure Not Detected	Software detected no air pressure after energizing main valves.	Clutch valves are de-energized.	Check I/O wiring. Check air pressure switch.
040 Spare				
041*	Brake Monitor Cam Mismatch Between Processors	Processor A sees the BCAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
042*	Takeover Cam Mismatch Between Processors	Processor A sees the TCAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
043*	Anti-repeat Cam Mismatch Between Processors	Processor A sees the ACAM while processor B does not.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
044*	Cam Mismatch Fault	Any of 041-043 detected.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
045	Spare			
046*	Brake Monitor Fault	On a stop-on-top command, the press slid onto the BCAM zone before stopping.	Press cannot operate in single or continuous mode until it stops in the near top zone.	Check the brake and brake monitor cam settings.
047*	Chain Break Fault	Software detected a fault..	Press cannot operate.	Check chain break switch and wiring.
048*	No Motion Detected	Upon command to move, no motion was detected.	The press will not start in single or continuous mode.	Check motion detector switch, wiring, and motion detector logic.
049 Spare				
050*	Uncommanded Motion Detected	Motion was detected when no motion was commanded.	C/B outputs are de-energized.	Check motion detector switch, wiring, and motion detector logic.
051	At Rest Inch Button Tiedown	On switching to inch, the software detected a held inch button.	The press will not inch.	Check prompts for reasons why press will not inch. Check inch button wiring.

* To clear this latched fault bit, you must enable the fault reset bit or turn the mode-select switch to OFF.

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
052	At Rest Run Button Tiedown	On switching to run, the software detected a held run button.	The press will not run in single or continuous mode.	Check prompts for reasons why press will not run. Check run button wiring.
053	At Rest Run Button Tiedown	Arm Continuous button was not pressed before Run buttons	The press will not start in continuous mode.	Press the Arm Continuous button before pressing the Run buttons.
054*	Micro-inch Valve 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
055*	Micro-inch Valve 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
056*	Micro-inch Valve 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle in micro-inch mode.	Check valve and valve wiring.
057*	Micro-inch Valve 2 Failed to Turn ON	Valve failed to energize when output was turned ON	Press will not cycle in micro-inch mode.	Check valve and valve wiring.
058*	Aux Valve 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
059*	Aux Valve 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
060*	Aux Valve 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
061*	Aux Valve 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
062*	Aux Valve Stem 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
063*	Aux Valve Stem 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
064*	Aux Valve Stem 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
065*	Aux Valve Stem 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
066*	Clutch Valve 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
067*	Clutch Valve 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
068*	Clutch Valve 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
069*	Clutch Valve 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
070*	Clutch Valve Stem 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
071*	Clutch Valve Stem 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
072*	Clutch Valve Stem 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
073*	Clutch Valve Stem 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
074*	Clutch Valve Fault	Any of 054-073 detected.	C/B power is removed.	Check valve and valve wiring.
075-079 Spare				

* To clear this latched fault bit, you must enable the fault reset bit or turn the mode-select switch to OFF.

Faults Associated with Processor B

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
080	Processor B Communication Timeout	Remote I/O link (channel 1B) failed.	C/B power is de-energized.	Check remote I/O cable to chnl 1A. Check port configuration.
081*	Crowbar Relay B Weld Fault	Crowbar relay B welded closed.	C/B power is de-energized and will not turn ON.	Check crowbar relay, wiring, and operation of input module in slot 2.
082*	Crowbar Relay B Failed to Turn ON	Crowbar relay B failed to close.	C/B power will not turn ON.	Check crowbar relay, wiring, and operation of input module in slot 2.
083*	Controller OK relay test failed	Not wired according to latest drawings	C/B power will not turn ON.	Change wiring per SW revision 1.3.
084*	Seal Relay B Timeout Fault	Seal relay B failed to close.	C/B power will not turn ON.	Check seal relay, wiring, and operation of input module in slot 2.
085*	Seal Relay B Weld Fault	Seal relay B welded closed.	C/B power is de-energized and will not turn ON.	Check seal relay, wiring, and operation of input module in slot 2.
086*	E-Stop Relay Failed to Turn ON.	E-Stop relay failed to close.	C/B power will not turn ON.	Check E-Stop relay circuit and operation of input module in slot 2.
087*	E-Stop Relay Weld Fault	CRMB relay welded closed.	C/B power is de-energized and will not turn ON.	Check E-Stop relay circuit and operation of input module in slot 2.
088	No Valid Mode	Mode-select failed.	C/B power will not turn ON.	Check mode selector switch, wiring, and operation of input module in slot 4.
089*	Processor Mode Mismatch	Each processor sees a different mode.	Press will not stroke.	Check mode selector switch, wiring, and operation of input module in slot 4.
090	Processor B Station 1 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
091	Processor B Station 2 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
092	Processor B Station 3 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
093	Processor B Station 4 Not Active nor Bypassed	Run button failure or improper wiring.	Prevents single or continuous stroking.	Check run buttons and wiring.
094	Processor B Station 1 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
095	Processor B Station 2 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
096	Processor B Station 3 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
097	Processor B Station 4 Tiedown	Run button held too long before pressing other Run button.	Press will not start a stroke in single or continuous mode.	Release, then press run buttons simultaneously. Check button wiring.
098	Processor B Run Stations Tiedown	Among run stations, others must be pressed after the first is pressed.	Press will not start a stroke in single or continuous mode.	Press all run stations within timed interval. Check button wiring.
099-103 Spare				
104	Inch Button Tiedown	Inch button held too long before pressing other Inch button.	Press will not inch.	Release, then press inch buttons simultaneously. Check button wiring.
105*	Automatic single-stroke cycle start fault	Automatic single-stroke not initiated	Press will stop or not run.	Check logic of your automatic single-stroke cycle start.
106*	Illegal RCLS Combination	Software/hardware cams produced invalid combination.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
107*	Forward Transition from Top	Software/hardware cams did not go from top to downstroke.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.

* To clear this latched fault bit, you must enable the fault reset bit or turn the mode-select switch to OFF.

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
108*	Forward Transition from Downstroke	Software/hardware cams did not enter upstroke.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
109*	Forward Transition from Upstroke	Software/hardware cams did not enter near top zone.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
110-112 Spare				
113*	Forward Shaft Position Transition Faults	Any of 107-109 detected.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
114*	ACAM Upstroke	ACAM did not cycle in upstroke.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
115-118 Spare				
119*	C/B Air Pressure Not Detected	Software detected no air pressure after energizing main valves.	Clutch valves are de-energized.	Check I/O wiring. Check air pressure switch.
120 Spare				
121*	Brake Monitor Cam Mismatch Between Processors	Processor B sees the BCAM while processor A does not.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
122*	Takeover Cam Mismatch Between Processors	Processor B sees the TCAM while processor A does not.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
123*	Anti-repeat Cam Mismatch Between Processors	Processor B sees the ACAM while processor A does not.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
124*	Cam Mismatch Fault	Any of 121-123 detected.	Press will stop or not run in single or continuous mode.	Check soft cam logic or hard cams for proper operation or settings.
125 Spare				
126*	Brake Monitor Fault	On stop-on-top command, the press slid into BCAM zone before stopping.	Press cannot operate in single or continuous mode until it stops in the near top zone.	Check the brake and brake monitor cam settings.
127*	Chain Break Fault	Software detected a fault.	Press cannot operate.	Check chain break switch, wiring
128*	No Motion Detected	Upon command to move, no motion was detected.	The press will not start in single or continuous mode.	Check motion detector switch, wiring, and motion detector logic.
129 Spare				
130*	Uncommanded Motion Detected	Motion was detected when no motion was commanded.	C/B outputs are de-energized.	Check motion detector switch, wiring, and logic.
131	At Rest Inch Button Tiedown	On switching to inch, the software detected a held inch button.	The press will not inch.	Check prompts for reasons why press will not inch. Check inch button wiring.
132	At Rest Run Button Tiedown	On switching to run, the software detected a held run button.	The press will not run in single or continuous mode.	Check prompts for reasons why press will not run. Check run button wiring.
133	At Rest Run Button Tiedown	Arm Continuous button was not pressed before Run buttons	The press will not start in continuous mode.	Press the Arm Continuous button before pressing the Run buttons.
134*	Micro-inch Valve 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
135*	Micro-inch Valve 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
136*	Micro-inch Valve 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle in micro-inch mode.	Check valve and valve wiring.
137*	Micro-inch Valve 2 Failed to Turn ON	Valve failed to energize when output was turned ON	Press will not cycle in micro-inch mode.	Check valve and valve wiring.

* To clear this latched fault bit, you must enable the fault reset bit or turn the mode-select switch to OFF.

B168/	Suggested Message	Cause of Fault	Effect of Fault	How to Correct the Fault
138*	Aux Valve 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
139*	Aux Valve 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
140*	Aux Valve 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
141*	Aux Valve 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
142*	Aux Valve Stem 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
143*	Aux Valve Stem 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
144*	Aux Valve Stem 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
145*	Aux Valve Stem 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
146*	Clutch Valve 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
147*	Clutch Valve 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
148*	Clutch Valve 2 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
149*	Clutch Valve 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
150*	Clutch Valve Stem 1 Failed to Turn ON	Valve failed to energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
151*	Clutch Valve Stem 1 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
152*	Clutch Valve Stem 2 Failed to Turn OFF	Valve failed to de-energize when output was turned ON.	Press will not cycle.	Check valve and valve wiring.
153*	Clutch Valve Stem 2 Failed to Turn OFF	Valve failed to de-energize when output was turned OFF.	C/B power is removed.	Check valve and valve wiring.
154*	Clutch Valve Fault	Any of 134-153 detected.	C/B power is removed.	Check valve and valve wiring.
155-159 Spare				

* To clear this latched fault bit, you must enable the fault reset bit or turn the mode-select switch to OFF.

Prompts for Operating the Press

Whenever a PLC-5/x6 processor detects conditions worthy of a prompt, it sets corresponding bits in *Bit File 169* in the data table. We list conditions for which the software is designed to detect and signal a prompt.

We recommend that you program a method to display bit numbers of detected prompt conditions. Then, you can respond quickly by looking them up in the following table.

Prompts Associated with Processor A

B169/	Suggested Message	Cause of the Prompt Condition	Effect of Prompt Condition	How to Correct the Condition
000 Spare				
001	E-Stop actuated	E-stop button was pressed, or E-stop circuit failed.	CRM and seal relays opened.	Release E-stop btn. Press control power and C/B power reset btns.
002-004 Spare				
005	Software inch mode enabled	You pressed an inch button when *software inch mode* bit was set	Hardware inch buttons void when this bit is set.	Release hardware inch buttons.
006	Software inch mode is not enabled.	Inch mode selected but *software inch mode* bit is not set.	Valve outputs turn OFF.	Set the *software inch mode* bit.
007	Downstroke stopped by software.	*Permit downstroke* bit was reset while the press was in downstroke.	Valve outputs turn OFF.	Set the *permit downstroke* bit, and inch the press to near-top position.
008	Upstroke stopped by software.	*Permit upstroke* bit was reset while the press was in upstroke.	Valve outputs turn OFF.	Set the *permit upstroke* bit, and inch the press to near-top position.
009	Permit start is not enabled.	The *permit start* bit is not set.	Press will not start in single or continuous mode.	Set the *permit start* bit.
010	Permit run is not enabled.	The *permit run* bit is not set.	Valve outputs turn OFF, or will not energized.	Set the *permit run* bit, and inch the press to near-top position.
011-012 Spare				
013	Main motor is not running forward.	Main motor not running forward in single or continuous mode.	Valve outputs turn OFF.	Start the main motor (forward).
014	C/B power is not reset.	Seal relay is not closed.	Valve outputs remain OFF.	Clear faults. Press control power and C/B power reset buttons.
015	Press is not in near-top position.	Press is not in near-top position.	You cannot stroke in single or continuous mode.	Inch the press to near-top position.
016	All run buttons are not released.	The press has stopped and all run buttons are not released.	You cannot start the press.	Release all run buttons.
017	Release inch buttons.	The press has stopped and inch buttons are not released.	None	Release inch buttons.
018	Cycle start bit has not been toggled.	The *cycle start* bit has not been toggled	Press will not cycle in automatic single-stroke mode	Toggle the cycle start bit.
019	Software stop-on-top is enabled.	The *stop-on-top* bit is set.	The press will complete the cycle and stop at top.	None
020	Stop-on-top button is pressed.	Stop-on-top button is pressed.	The press will complete the cycle and stop at top.	None
021	Continuous mode not armed.	You did not press the arm continuous button.	You cannot start the press in continuous mode.	Press the arm continuous button.
022	Release inch buttons	You did not release inch buttons after reaching the top.	You cannot start the press until you release the buttons.	Release the inch buttons.
023	Downstroke Disabled.	*Permit downstroke* bit should be set when starting the press.	You cannot start the press in single or continuous mode.	Set the *permit downstroke* bit.
024 Spare				
025	Proc. B not requesting inch mode.	Processor B not requesting inch mode	You cannot inch.	Check remote I/O wiring.
026	Proc. B not engaging inch mode.	Processor B not engaging inch mode.	You cannot inch.	Check remote I/O wiring.
027	Proc. B not engaging single mode.	Processor B not engaging single mode	You cannot start single stroke	Check remote I/O wiring.
028	Proc. B not requesting arm contin.	Processor B not requesting arm contin.	You cannot start continuous.	Check remote I/O wiring.
029	Proc. B not engaging contin mode.	Processor B not engaging contin mode	You cannot start continuous.	Check remote I/O wiring.
030-078 Spare				
079	Processor A or B detected a fault.	Processor A or B detected a fault.	See *fault* table in Appendix C.	See *fault* table.

Prompts Associated with Processor B

B169/	Message	Cause of the Prompt Condition	Effect of Prompt Condition	How to Correct the Condition
080	Spare			
081	E-Stop actuated	E-stop button was pressed, or E-stop circuit failed.	CRM and seal relays opened.	Release E-stop btn. Press control reset and C/B power reset btns.
082-084	Spare			
085	Software inch mode enabled.	You pressed an inch button when the *software inch mode* bit was set.	Hardware inch buttons void when this bit is set.	Release hardware inch buttons.
086	Software inch mode is not enabled.	Inch mode selected but *software inch mode* bit is not set.	Valve outputs turn OFF.	Set the *software inch mode* bit.
087	Downstroke stopped by software.	*Permit downstroke* bit was reset while the press was in downstroke.	Valve outputs turn OFF.	Set the *permit downstroke* bit, and inch the press to near-top position.
088	Upstroke stopped by software.	*Permit upstroke* bit was reset while the press was in upstroke.	Valve outputs turn OFF.	Set the *permit upstroke* bit, and inch the press to near-top position.
089	Permit start is not enabled.	The *permit start* bit is not set.	Press will not start in single or continuous mode.	Set the *permit start* bit.
090	Permit run is not enabled.	The *permit run* bit is not set.	Valve outputs turn OFF.	Set the *permit run* bit, and inch the press to near-top position.
091-092	Spare			
093	Main motor is not running forward.	Main motor not running forward in single or continuous mode.	Valve outputs turn OFF.	Start the main motor (forward).
094	C/B power is not reset.	Seal relay is not closed.	Valve outputs remain OFF.	Clear faults. Reset control power.
095	Press is not in near-top position.	Press is not in near-top position.	You cannot stroke in single or continuous mode.	Inch the press to near-top position.
096	All run buttons are not released.	The press has stopped and all run buttons are not released.	You cannot start the press.	Release all run buttons.
097	Release inch buttons.	The press has stopped and inch buttons are not released.	None	Release inch buttons.
098	Cycle start bit has not been toggled.	The *cycle start* bit has not been toggled	Press will not cycle in automatic single-stroke mode	Toggle the cycle start bit.
099	Software stop-on-top is enabled.	The software *stop-on-top* bit is set.	The press will complete the cycle and stop at top.	None
100	Stop-on-top button pressed.	The stop-on-top button is pressed.	The press will complete the cycle and stop at top.	None
101	Continuous mode not armed.	You did not press the arm continuous button.	You cannot start the press in continuous mode.	Press the arm continuous button.
102	Release inch buttons	You did not release inch buttons after reaching the top.	You cannot start the press until you release the buttons.	Release the inch buttons.
103	Downstroke disabled.	*Permit downstroke* bit should be set when starting the press.	You cannot start the press in single or continuous mode.	Set the *permit downstroke* bit.
104	Spare			
105	Proc. A not requesting inch mode.	Processor A not requesting inch mode.	You cannot inch.	Check remote I/O wiring.
106	Proc. A not engaging inch mode.	Processor A not engaging inch mode.	You cannot inch.	Check remote I/O wiring.
107	Proc. A not engaging single mode.	Processor A not engaging single mode	You cannot start single stroke	Check remote I/O wiring.
108	Proc. A not requesting arm contin.	Processor A not requesting arm contin.	You cannot start continuous.	Check remote I/O wiring.
109	Proc. A not engaging contin mode.	Processor A not engaging contin mode	You cannot start continuous.	Check remote I/O wiring.
110-158	Spare			
159	Processor A or B detected a fault.	Processor A or B detected a fault.	See *fault* table in Appendix C.	See *fault* table.

Troubleshooting with Snapshot Status Bits

The primary means of troubleshooting the clutch/brake control system is by means of reading fault codes and operator prompts as presented earlier in this appendix or in the Operator's Guide, publication 6556-6.9.1 for PLC processors.

We present the following troubleshooting strategy as an alternative. Whenever the processors turn off outputs to the main clutch/brake valves such as due to detecting a fault, the control program takes a snapshot of the bit logic controlling the press the instant the outputs are turned off.

You can use this information to troubleshoot the cause of the shutdown. Do this by comparing the status of the snapshot bits with what the status should have been according to your ladder logic. Start at the last rung controlling main valve outputs and work backwards until you find all discrepancies.

The snapshot status of bit logic is stored in file N167:21 as follows: (The processor substitutes actual status for illustrated bit status 0000.)

Real-time	Storage	15 Snapshot Status 0
N168: 0	N167: 0	0000 0000 0000 0000
1	1	0000 0000 0000 0000
2	2	0000 0000 0000 0000
⋮	⋮	
9	9	0000 0000 0000 0000
N160: 0	10	0000 0000 0000 0000
1	11	0000 0000 0000 0000
2	12	0000 0000 0000 0000
⋮	⋮	
19	29	0000 0000 0000 0000
20	30	0000 0000 0000 0000
21	31	0000 0000 0000 0000

Notes

Classes of Memory Protection

Class Privileges

We have assigned privileges to four classes of memory protection. Class 1 has access to all processor functions. The password for class 1 is kept confidential at the factory. We show you how to assign your own passwords to classes 2-4 in chapter 5.

Privilege	Class 1	Class 2	Class 3	Class 4
Modify privileges	X			
Create/delete data table files	X	X	X	
Create/delete program files	X	X	X	
Write/edit ladder files	X	X	X	X
Download ladder files	X	X	X	X
Read ladder files	X	X	X	X
Upload ladder files	X	X	X	X
Change processor mode	X	X	X	X
Force I/O	X	X	X	
Force I/O in Sequential Function Charts	X	X	X	
Clear memory	X			
Restore	X	X	X	
Edit on line	X	X	X	

Read/Write Access by Class

We have assigned the following R = Read W = write access by class to clutch/brake control program and data files (files not listed are not protected):

Program Files

File	Name	Type	Class 1	Class 2	Class 3	Class 4
0	n/a	system	RW	RW	RW	RW
2	main	ladder	RW	R	R	R
3	user main	ladder	RW	RW	RW	RW
15	C/B interlock	ladder	RW	RW	R	R
16	C/B control	ladder	RW	R	R	R

Data Files

File	Type	Class 1	Class 2	Class 3	Class 4
0	output	RW	RW	RW	RW
1	input	RW	RW	RW	RW
2	status	RW	RW	RW	RW
3	bit	RW	RW	RW	RW
4	timer	RW	RW	RW	RW
5	counter	RW	RW	RW	RW
6	control	RW	RW	RW	RW
7	integer	RW	RW	RW	RW
8	floating point	RW	RW	RW	RW
20	bit	RW	R	R	R
21	timer	RW	R	R	R
150	bit	RW	RW	RW	RW
151	bit	RW	RW	RW	RW
152	bit	RW	RW	RW	RW
160	bit	RW	R	R	R
162	timer	RW	R	R	R
163	block transfer	RW	R	R	R
164	integer	RW	R	R	R
165	control	RW	R	R	R
166	integer	RW	R	R	R
167	integer	RW	R	R	R
168	bit	RW	R	R	R
169	bit	RW	R	R	R

Mapping of Data and Program Files

Reserved Data Files

We designed the software using selected data files. Some of these files are locked. We present this information with two purposes:

- overall mapping of data reserved for the control system
- useable data for your application

Reserved Files

When mapping your data table for controlling press operations, do NOT use the following data files.

Type of File and Address:	Do NOT use. Read-only File. Reserved for:
I/O Image Table	
I:002 – I:004	Input words monitored by PF16
I:020 – I:025	Scanner cross-checking between processors
I:026	Scanner word reserved for future use
O:005	Output bits controlled by PF16
O:020 – O:025	Scanner cross-checking between processors
O:026	Scanner word reserved for future use
Bit Files	
B20 – B29	Bits used in PF2
B160 – 169	Bits used in PF16
Block Transfer Files	
BT163	Block transfer words for PF16
Control Register	
R165	Control words used in PF16
Integer Files	
N160-N169	Integer words used in PF16
Timer Files	
T21	Timers used in PF2
T162	Timers used in PF16

Useable Data

When writing ladder logic for your control system, you may write to the following data files for their intended purpose:

Use These Files:	For:
B150:0	Programmable output bits in PF15
B151:0, 1	Programmable command bits in PF15
B152	Other bits for you to use in PF15
B168:0-9	Read-only fault bits in PF16 for troubleshooting
B169:0-9	Read-only prompt bits in PF16
I:027, O:027	Programmable data exchange between processors
N22-N29	Integer words for other press functions
N30-N39	Integer words for you to use in PF3
N40-N149	Integer words for other press functions
N153-N159	Integer words for you to use in PF15
N170-N499	Integer words for other press functions

We describe how to use these files in chapter 4.

Reserved Program Files

We designed the software using selected program files.

Important: For standardization, we suggest that you program your ladder logic for the control of the clutch/brake and other press functions in the program and subroutine files listed below. If your application requires additional press-control functions not listed, assign them to subroutine files labeled “Spare”.

Processor A	Processor B
PF2 Processor Control Program [1]	PF2 Processor Control Program [1]
PF15 Your Clutch/Brake Interface	PF15 Similar to Processor A
PF16 Clutch/Brake Control [1]	PF16 Identical to Processor A [1]
PF3 Your Main Control Program and Subroutine Director to the following Optional PFs:	PF3 (Available if needed)
PF4 Initialization	
PF5 Analog	
PF6 Lube/Hydraulic	We suggest that you minimize programming in processor B for faster processor (and system) response time.
PF7 Mode Change	
PF8 Slide Angle	
PF9 Spare	
PF10 Part Transfer Monitor	
PF11 Die Identification	
PF12 Recipe Management	
PF13 Fault Response	
PF14 Spare	
PF17 Operator Interface	
PF18 Supervisor Interface	
PF19 Feeder Blank/Roll Interface	
PF20 Automation Interface	

[1] = locked read-only file

Processor A	Processor B
PF21 Spare	
PF22 Auto die Change Sequencer	
PF23 Main Motor Control	
PF24 Inch Motor Control	
PF25 Counter Balance Air Control	
PF26 Cushion Air Control	
PF27 Die Clamp Control	
PF28 Slide Adjust Control	
PF29 Cushion Stroke Adjust Control	
PF30 Bolster/Die Cart Control	
PF31 Automation Device Control	
PF32 PTO Control	
PF33 Transfer/Electronic Feeder Control	
PF34 Crossbar Control	
PF35 Safety Gate Control	
PF36 Slide Lock Control	
PF37 Turnover Control	
PF38 Prebender/Rotator Control	
PF39 Nest Station Control	
PF40 Exit Conveyor Control	
PF41 Scrap Chute Control	
PF42 Temperature Control	
PF43 Spare	
PF44 Stack/Roll Feeder Control	
PF45 Spare	
PF46 Production Data	
PF47 Lamp Check	
PF48 Spare	
PF49 Automation Compensation	

We give programming examples for PF15 in chapter 4.

Notes

Programming Considerations for PLC-5 Processors

Purpose of this Appendix

The purpose of this appendix is to help you make correct decisions when writing ladder logic for controlling machine functions.
We divided this guide into these sections:

- Program Scan: How the Processor Scans a Program
- What Affect Does Your Ladder Logic Have on Program Scan?
- How to Program a Faster Response
- What are Subroutines and Why Use Them?
- Working with Data
- Troubleshooting the Clutch/Brake Controller

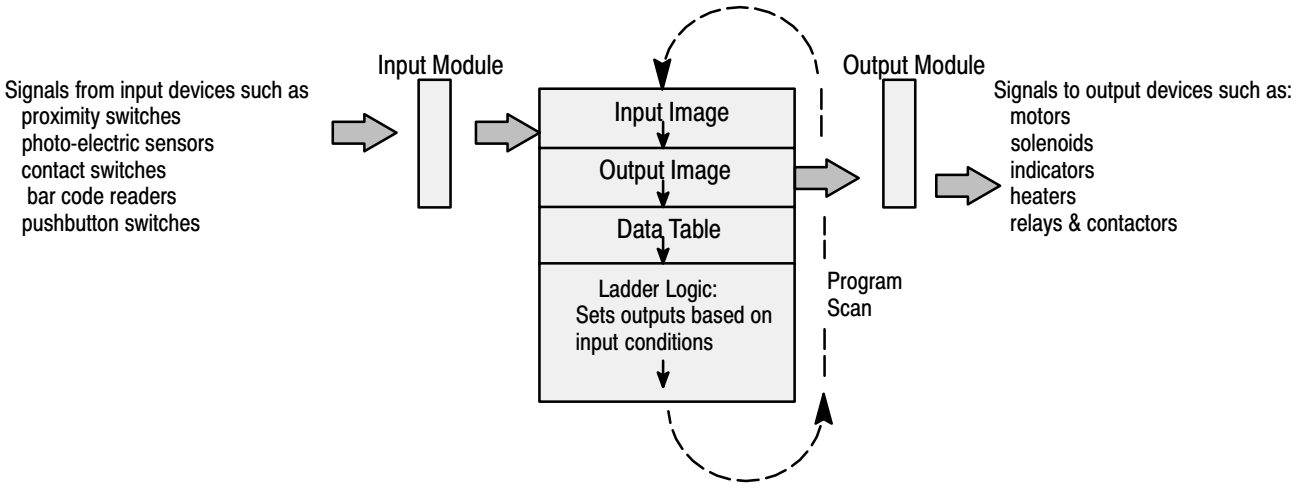
For additional information on these topics, refer to the 1785 PLC-5 Programmable Controllers User Manual, publication 1785-6.5.12.

Program Scan: How the Processor Scans a Program

What is the Program Scan?

The program scan is the mechanism by which the processor operates. It is sequential, occurring as fast as 100 times per second.
Here is what the processor does during the program scan (Figure F.1):

Figure F.1
The program scan lets the processor monitor inputs and control outputs based on decisions programmed by your ladder logic.



How the Processor Scans the Program

The Processor:

1. **Monitors Inputs**
   Monitors the status of input devices by means of input modules. (The off/on or analog signal of each input appears as a corresponding 0/1 or BCD bit pattern in the input image table.)
2. **Controls Outputs**
   Controls the status of output devices by means of output modules. (Sets outputs to an off/on or analog value according to the 0/1 or BCD bit pattern stored in the output image table for the corresponding output device.)
3. **Executes Ladder Logic**
   Manipulates data, makes decisions, and/or controls outputs based on the status of inputs according to your ladder logic instructions.

Affect Your Ladder Logic Has on the Program Scan

Time is the issue. A shorter program scan gives a faster system response. Each of the following contributes to the time required for a program scan.

- Instructions
- Processor Family
- Data format
- Addressing

Instructions

Each instruction contributes a small portion of time to the program scan. The processor operates on some instructions very quickly, but takes longer operating on others. Whether the instruction is true or false also affects instruction execution time (Table F.A).

Table F.A
Typical Execution Times for Selected Instructions for PLC-5/11, 20, 30 Processors

Type of Instruction	If False (approx μs)	If True (approx μs)
relay, such as examine, energize, latch, and unlatch	0.2	0.4
timer and counter	3	4
arithmetic, such as add, subtract, multiply, divide	1.5	4 – 12
trig functions, such as sin, cos, tan,	1.5	375 – 500
move and compare	1	4
shift register, such as shift left/right, load, and unload bit dependent, where n = number of bits operated on	4	10 + n(0.025)
immediate I/O: time to queue up for processing	1	300 – 360
process control, such as PID gain computation	3	500 – 900
block transfer: (transfer time for 10-word transfer, first in queue, 1 full remote logical rack, 57.6K baud)	3	500 – 1000

Processor Family

Some processor families are faster at executing selected groups of instructions than other processor families (Table F.B).

Table F.B
Comparing Processors for Typical "If True" Execution Times

Type of Instruction	PLC-5/11, 20, 30, 40, 80	PLC-5/10, 12, 15, 25
relay, such as examine, energize, latch, and unlatch	0.4	1.5
timer and counter	4	30 – 44
arithmetic, such as add, subtract, multiply, divide	4 – 12	18 – 82
trig functions, such as sin, cos, tan,	375 – 500	cannot do it
move and compare	4	26 – 63
shift register, such as shift left/right, load, and unload depends on number of bits or words operated on	10 + n(0.025) n = number of bits	90 +4w w = # of words
subroutine jump/return instructions (p = # of parameters)	12 + 4p	56 + 21p
immediate I/O: time to queue up for processing	300 – 360	160 – 200
process control, such as PID gain computation	500 – 900	600
block transfer: (transfer time for 10-word transfer, first in queue, 1 full remote logical rack, 57.6K baud)	500 – 1,000	600

Data Format

The processor operates faster when you use integer data as compared with floating-point data (Table F.C).

Table F.C
Comparing Data Types for Typical "If True" Execution Times for Selected Instructions for PLC-5/11, 20, 30, 40, 80 Processors

Type of Instruction	Integer	Floating-point
arithmetic, such as add, subtract, multiply, divide	4 – 12	4 – 36
trig functions, such as sin, cos, tan,	cannot use integer	375 – 500
compare	4 – 6	5 – 8
process control, such as PID gain computation	500 – 900	880 – 1150

Addressing

The processor operates faster with direct addressing. Other types of addressing take longer (Table F.D) and (Table F.E).

Table F.D
Typical Additional Instruction Execution Times for Indirect Addressing for PLC-5/10, 12, 15, 25 Processors

For This Type of Data	When the Instruction Address contains an Indirect Address for a Bit or Element, Add: [1]	When the File Address in the *Expression or Destination* Contains an Indirect Address for the File or Element Number, Add: [1]
bit	60 us	
integer	42 us	45 us
floating–point	62 us	48 us
timer, counter, or control	43 us	48 us
conversion (integer-to-float)	72 us	

[1] Add only the larger time if the address contains two indirect addresses.

Table F.E
Typical Additional Instruction Execution Times for Various Types of Addressing for PLC-5/11, 20, 30, 40, 60, 80 Processors

For This Type of Address	With This Type of Data	Add for Each Operand [1]
indexed	integer floating-point timer, counter, control	1 us 2 us 2.5 us
immediate	integer floating-point	0.2 us 1 us
indirect		7 + 0.1(# words) us
conversion	such as float-to-integer	6 us

1 An operand is an instruction parameter such as source, destination, length, etc.

How to Program a Faster Response

Here are some suggestions for programming a faster response:

- program a faster response with special instructions
- scan logic only when needed with program control instructions
- use single transfer for up to 16 bits (one word) at a time per rung
- other considerations

Program a Faster Response with Special Instructions

Rather then trying to minimize program scan time, consider responding faster with special programming techniques such as:

- program critical inputs and outputs with Immediate Input (IIN) and Immediate Output (IOT) instructions where the processor interrupts the program scan to immediately monitor the subject input or control the subject output each time it scans these instructions in your ladder logic
- program critical logic with a Selectable Timed Interrupt (STI) file where the processor interrupts and suspends the normal program scan at periodic intervals to scan this subroutine. You preset the interval.

With either technique, the processor suspends the program scan while executing each of these instructions. The resulting program scan is longer but the processor responds more quickly where/when needed.

Scan Logic Only When Needed

Use program control instructions to reduce program scan time with these techniques:

- program a jump forward (or back) to avoid scanning portions of your ladder logic not required under certain programmed conditions
- program a jump to a subroutine (and a return) when you require intermittent use of a block of ladder logic. The processor scans it only when needed

Use Single Transfer When Possible

When transferring data between the processor and I/O modules, the use of single transfer programming is faster than block transfer for up to 1-word transfers per rung, even if you add extra rungs for transferring more words.

Other Considerations

Other considerations for a faster program scan are:

- select a faster processor
- dedicate an additional processor to critical functions
- put critical I/0 in the *local* I/O chassis rather than in a remote I/0 chassis
- minimize the use of remote I/O chassis
- minimize the queuing of block transfer instructions
- put most frequently accessed data in lower file addresses (under word 254)
- minimize the number of and size of gaps between program file numbers
- use integer data rather than floating-point data
- use direct addressing
- select faster instructions (arithmetic instructions are faster than compute)

Using Subroutines

What Are Subroutines?

A subroutine is a block of ladder logic stored in a separate program file. Generally, it performs a specific function independently. The use of subroutines helps you:

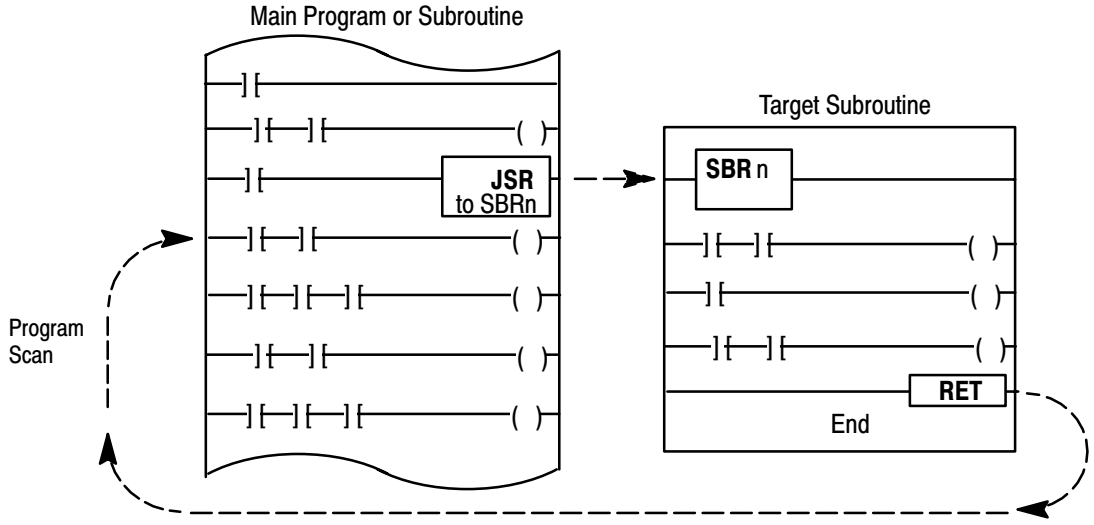
- simplify your ladder logic
- subdivide it into independent functions for custom re-engineering
- organize it for easier troubleshooting
- save scan time

How Subroutines Are Scanned

Subroutines are accessed from your main program file or from other subroutines (nested) by means of these instructions (Figure F.2):

- Jump To Subroutine (JSR) – located anywhere in your ladder logic
- Subroutine (SBR) – the first instruction in the subroutine file and the target of the JSR instruction (directs the processor scan to the subject subroutine)
- Return (RET) – returns the processor scan to the rung immediately following the originating JSR instruction

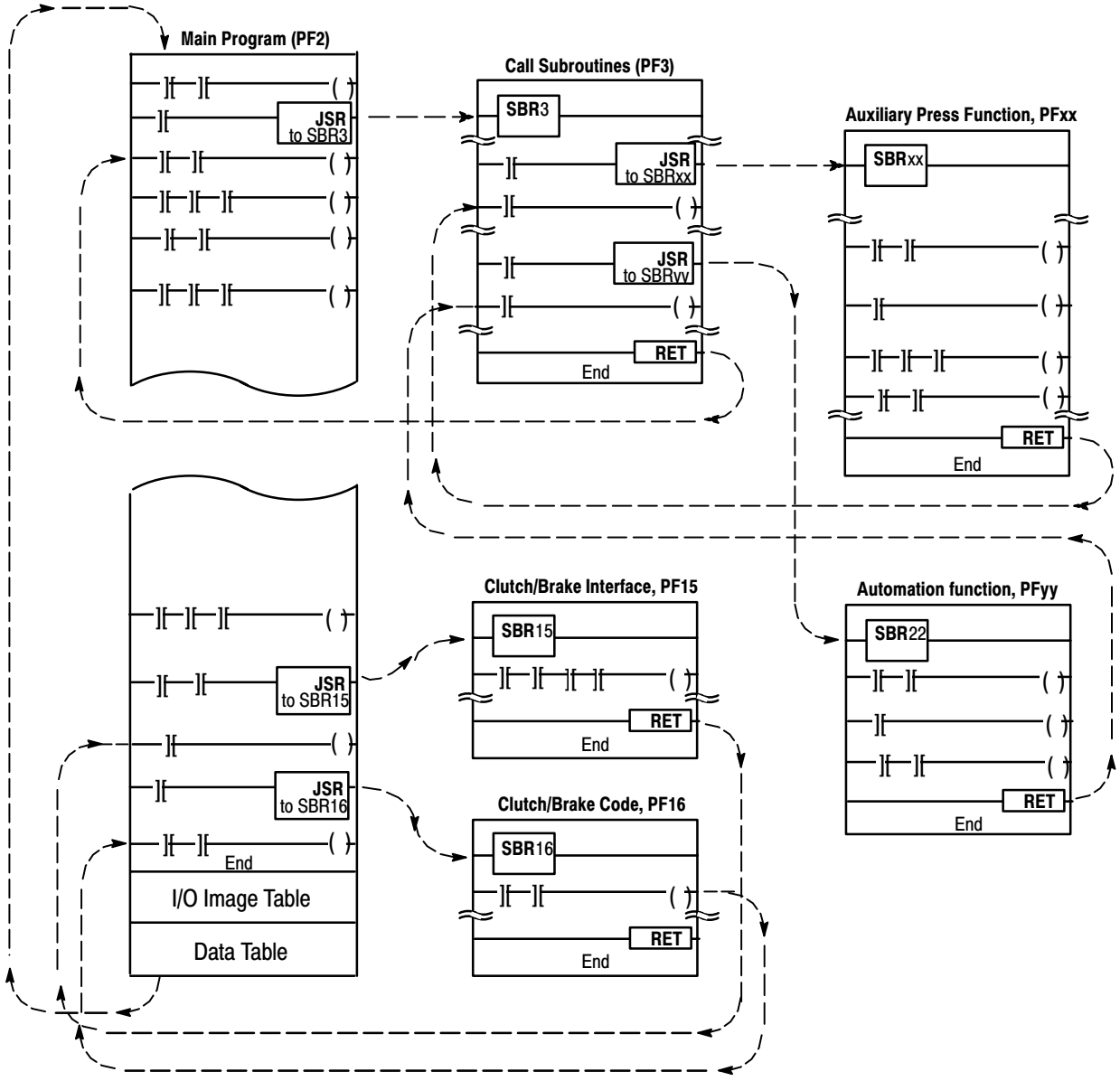
Figure F.2
Program Scan for an Example Jump to Subroutine and Return



You may add subroutines to the clutch/brake ladder program. For example, the program scan for the following program files is shown in Figure F.3.

- Main Program, PF2
- Call Subroutines, PF3
- Clutch/Brake Interface, PF15
- Clutch/Brake Code, PF16
- Auxiliary Press Function, PFxx
- Automation Function, PFyy

Figure F.3
Scan of the Allen-Bradley Clutch/Brake Ladder Program



With subroutine programming, you can:

- update critical I/O within the subroutine with immediate I/O instructions
- pass data into and out of a subroutine

Using Immediate I/O Instructions

Immediate I/O instructions are *output* instructions that, when enabled, interrupt the program scan to update a specified word of I/O image table. You would program them immediately ahead of rungs that examine I/O that are critical to the subroutine. Otherwise, all I/O image tables are updated only after the processor has completed scanning the main program and all enabled subroutines.

This instruction,	when enabled, updates:	For the local chassis, the processor:	For a remote chassis, the processor:
Immediate Input (IIN)	a word of input image bits	sets input image bits to the current states of inputs before continuing the program scan	updates the input image with the latest input states from the remote I/O buffer (from the most recent remote I/O scan)
Immediate Output (IOT)	an I/O group of outputs	sets outputs to the current states of output image bits before continuing the program scan	updates the remote I/O buffer with the current states of the output image bits (makes these states immediately available for the next remote I/O scan)

Passing Data Into and Out of a Subroutine

The jump-to-subroutine instruction JSR and return instruction RET let you pass data to and receive data from a subroutine. You can pass integer or floating-point numbers (program constants) or designate addresses to/from which integer or floating-point numbers (variables) can be passed. Examples of passing data include:

- pass variables to the subroutine for mathematical computations, and return the result for use in the main program
- pass presets to a generic subroutine for multiple recipe operations

This instruction	lets you:	by specifying in the instruction:
Jump-to-subroutine (JSR)	pass Input Parameters to the subroutine	• integer or floating-point constants • addresses in the main program from which parameter are passed
	receive Return Parameters from the subroutine	• addresses in the main program to which parameters are returned
Subroutine (SBR)	store Input Parameters	• storage addresses in the subroutine
Return (RET)	return parameters to the main program	• addresses in the subroutine from which parameters are returned

Working With Data

Understanding the types of data that your processor handles and how your processor stores them may help you:

- conserve memory
- achieve a faster processor data scan

Types of Data

The types of data that your processor handles depend on the processor, but essentially falls into three categories: bit, word, and element.

Data are stored in files, which are blocks of data of similar type. Some types of data can be stored in more than one type of file. Each type of file has an ID letter to identify it in an address.

Type of Data	Description	Type of File	File ID
bit	smallest unit of data: 0/1, on/off, set/reset	bit I/O image	B I or O
word	16 bits: can represent a numeric value, such as with binary coded decimal (BCD) For example: 0000 0000 0000 0110 = 6	I/O image status integer	I or O S N
element	a multiple number of words For example: timer element = 3 words (preset, accumulated, control/status bits)	timer [1] counter [1] control [1]	T C R

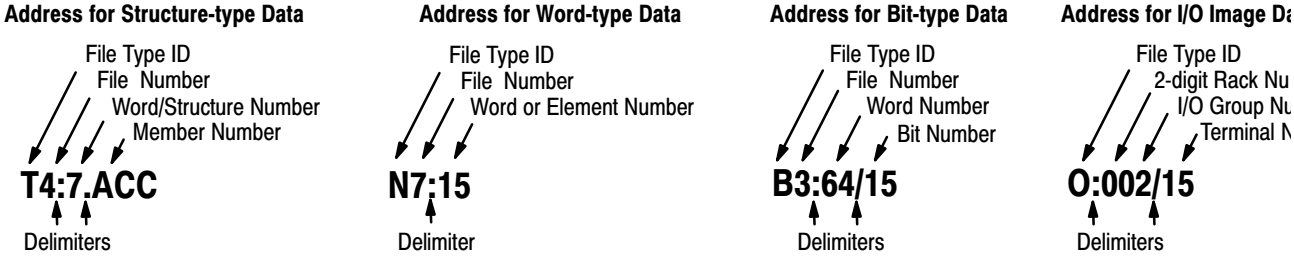
[1] Each timer, counter, or control element uses three words

Addressing Your Data

Logical address formats (Figure F.4) vary depending on the type of data. Addresses contain these characters:

- file type (ID)
- file number
- delimiter to separate address numbers
- number (location) of the structure, word, bit, and/or I/O hardware

Figure F.4
Typical Address Formats



Creating Data Storage Files

You create data storage files in two ways:

- by directly creating data storage files
- each time you assign an address to an instruction

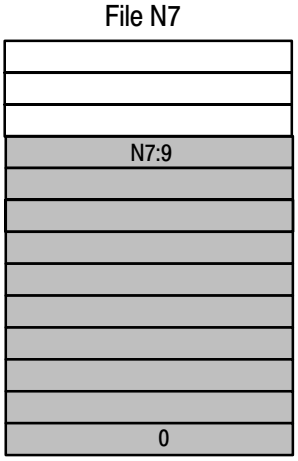
Good programming techniques suggest that you keep data storage areas as small as possible to minimize scan time and avoid wasting memory storage.

Directly Creating Data Storage Files

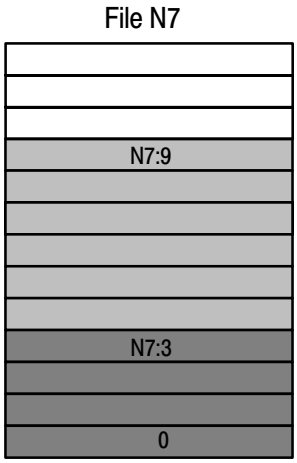
You create data storage files with your programming terminal by entering the file address of the highest numbered element that you want in the file.

For example: If you create a file by entering the address N7:9, the processor allocates to that address all words (or elements) from that address down to zero (10 words) or down to the next lower assigned address. If the next lower assigned address was N7:3, your file at address N7:9 would include six words down to N7:3 (Figure F.5).

Figure F.5
How the Processor Allocates Data Storage When You Create a File or Assign an Address



If there is no other address for File N7, assigning an address of N7:9 creates a 10-word file.



If you previously created File N7:3, assigning an address of N7:9 creates a 6-word file down to word 3.

Data Storage Created by Assigning Addresses

When you assign an address to an instruction, the processor allocates memory storage in a data file. The processor creates the data file automatically. The size of the file is equal to the number of elements, words, or bits from the assigned address down to zero or down to the next lower assigned address.

For example, if your first assigned timer in your program has the address T4:99, the processor allocates storage for timers T4:99 down to T4:0 *whether you use them or not.* Since each timer address uses three words (timers are 3-word elements), your timer address of T4:99 has created a 300 word data storage file.

As another example: if you assign the address N7:9 to store a word (or element), the processor opens a file from that address down to zero or down to the next lower assigned address. If the next lower address was N7:3, address N7:9 would include all words down to N7:3 (Figure F.5).

For further information, refer to either of these programming manuals:

- PLC-5 Programming Software, Instruction Set Reference, publication 1785-6.1
- PLC-5 Programmable Controllers, User Manual, publication 1785-6.2.12

Use this template for your appendices. If it were not for the different running head, this would read like any other chapter.

Wiring Drawings for an Ungrounded System

Wiring Drawings

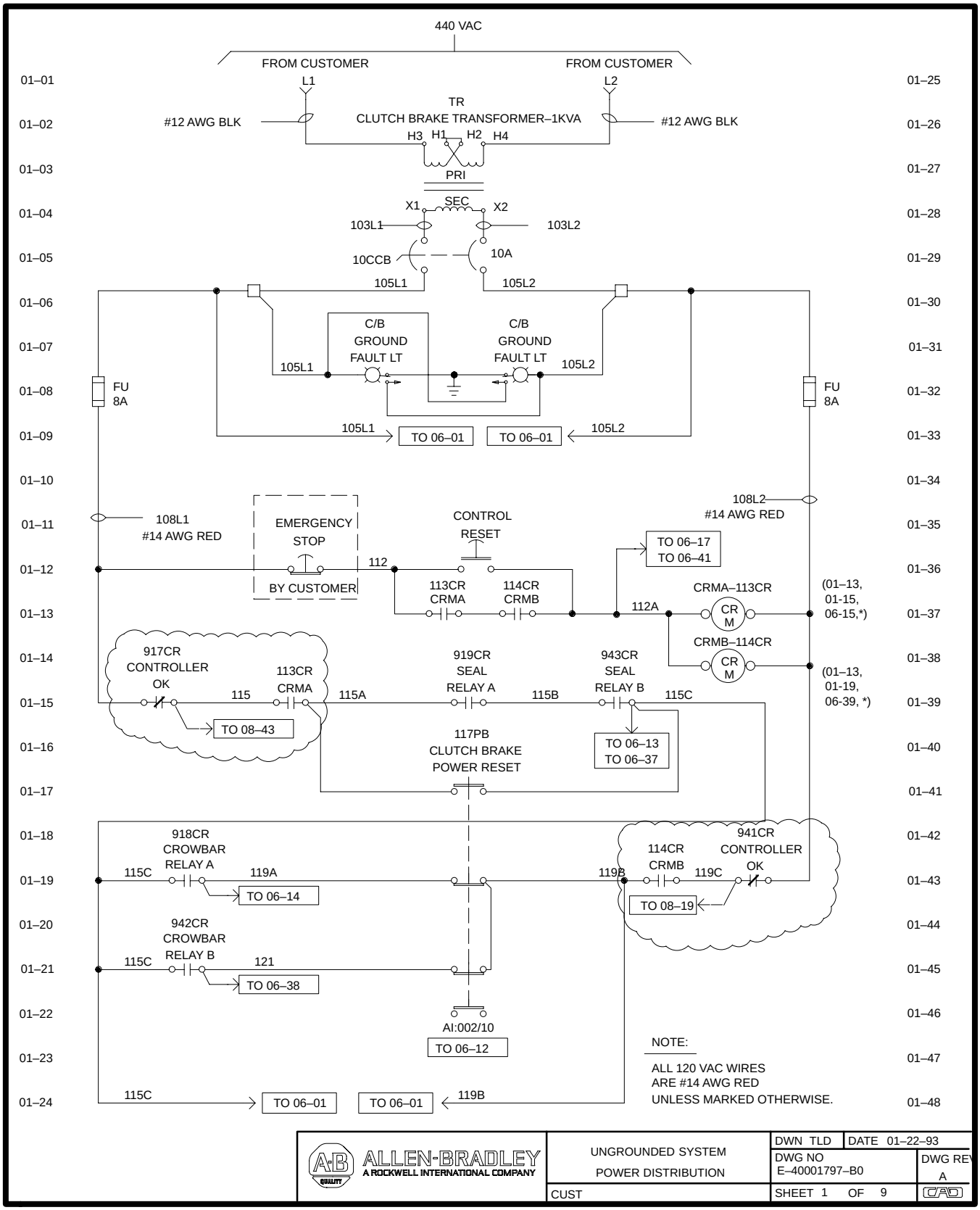
The wiring option of your Clutch/Brake Application Package included either one of two choices:

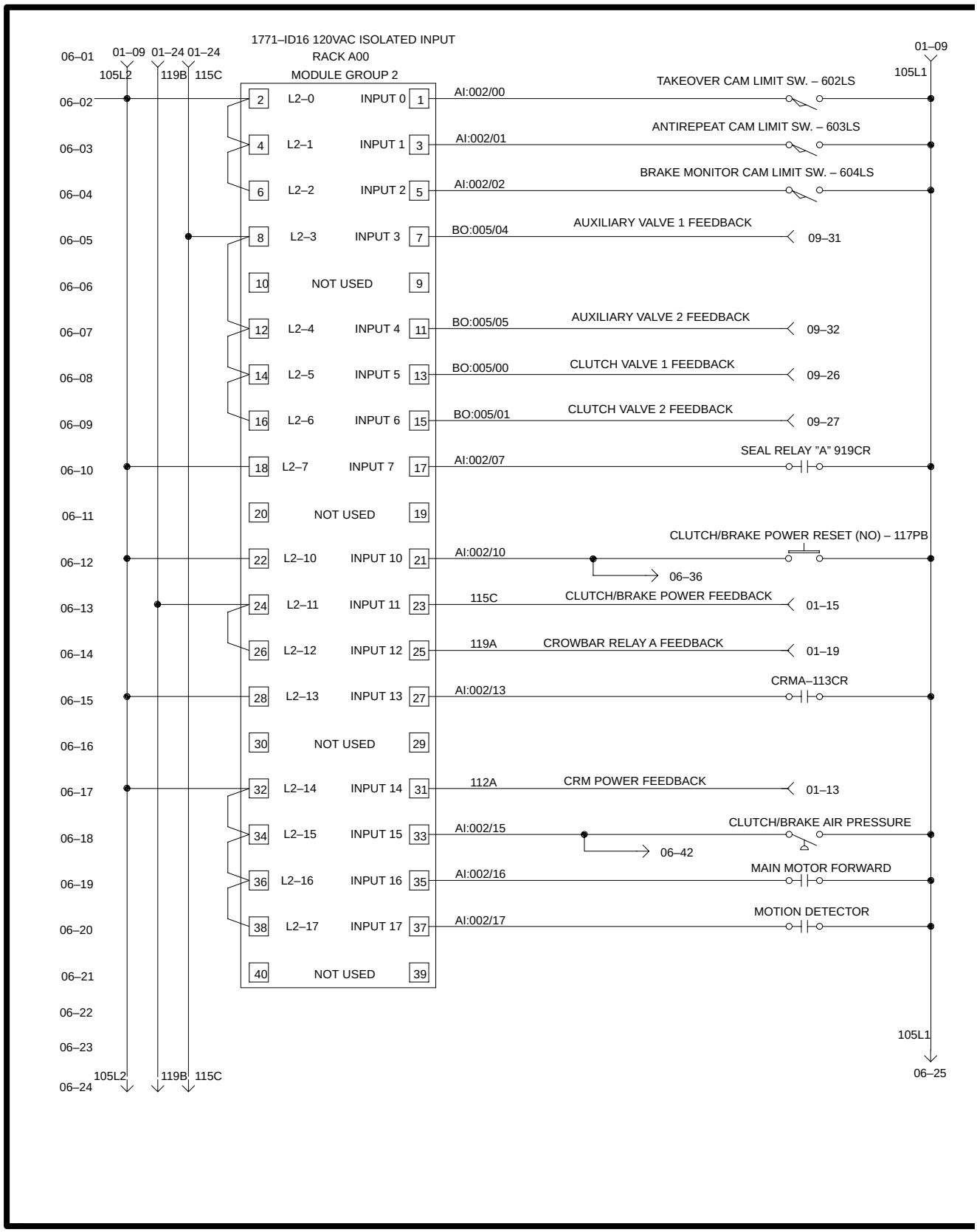
- ungrounded system I/O wiring (this appendix), or
- grounded system I/O wiring (appendix F)

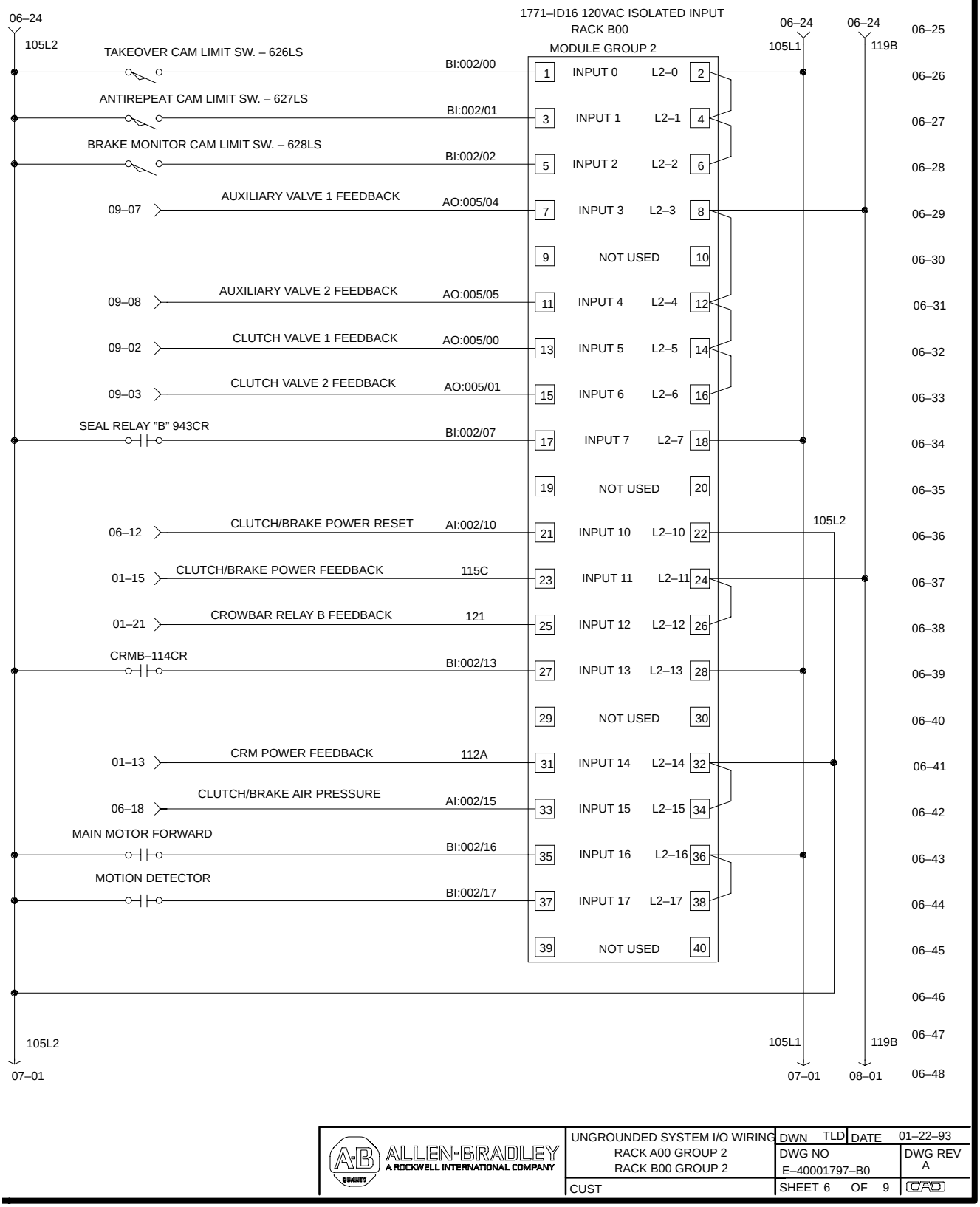
We present the following wiring drawings for I/O racks A00 and B00 for ungrounded system I/O wiring. (See Appendix H for the Grounded System.)

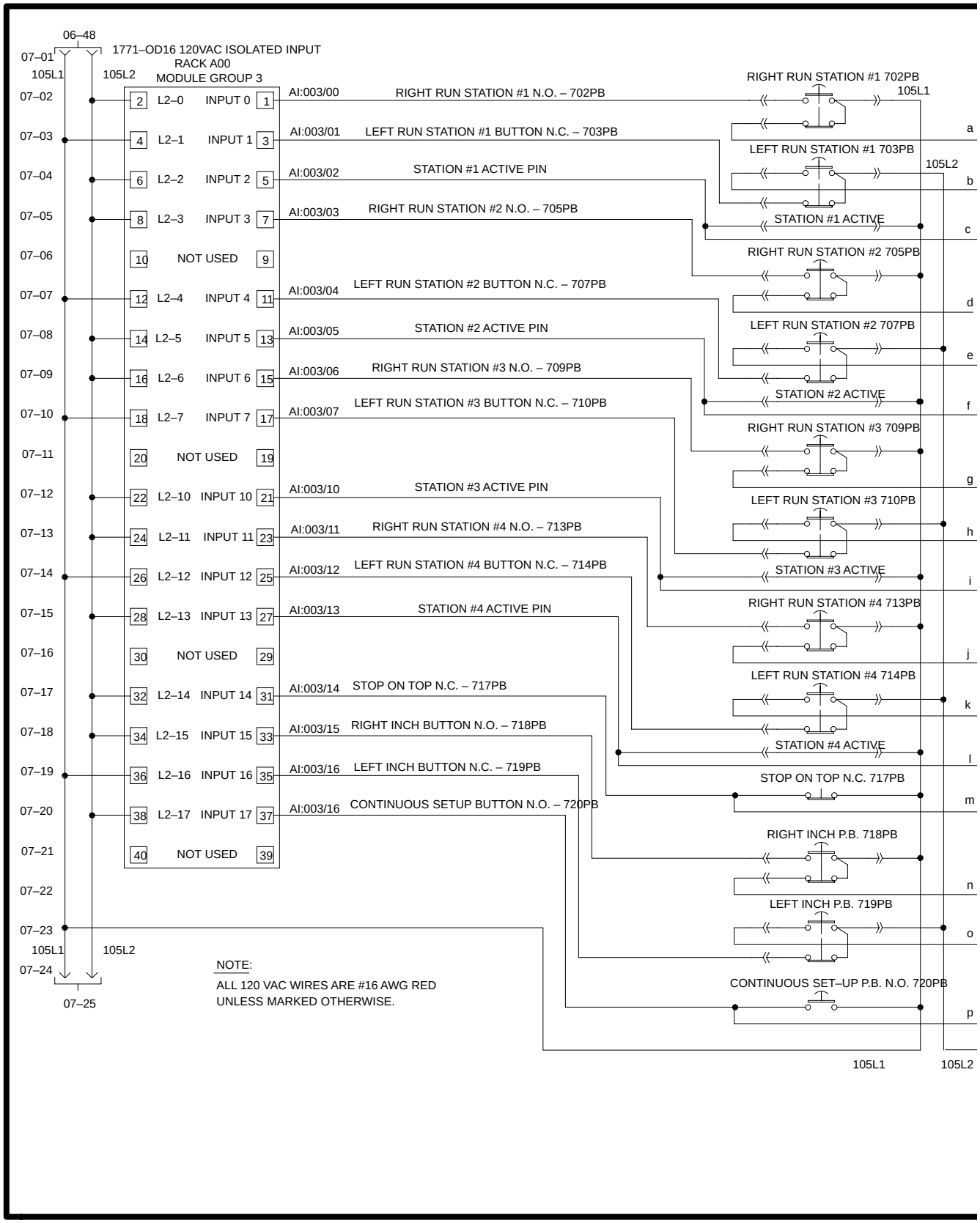
Sheet	Title
1 of 9	Power Distribution
2, 3, 4, 5 of 9	*omitted* because they are not wiring drawings
6 of 9	System I/O, Rack Group 2
7 of 9	System I/O, Rack Group 3
8 of 9	System I/O, Rack Group 4
9 of 9	System I/O, Rack Group 5

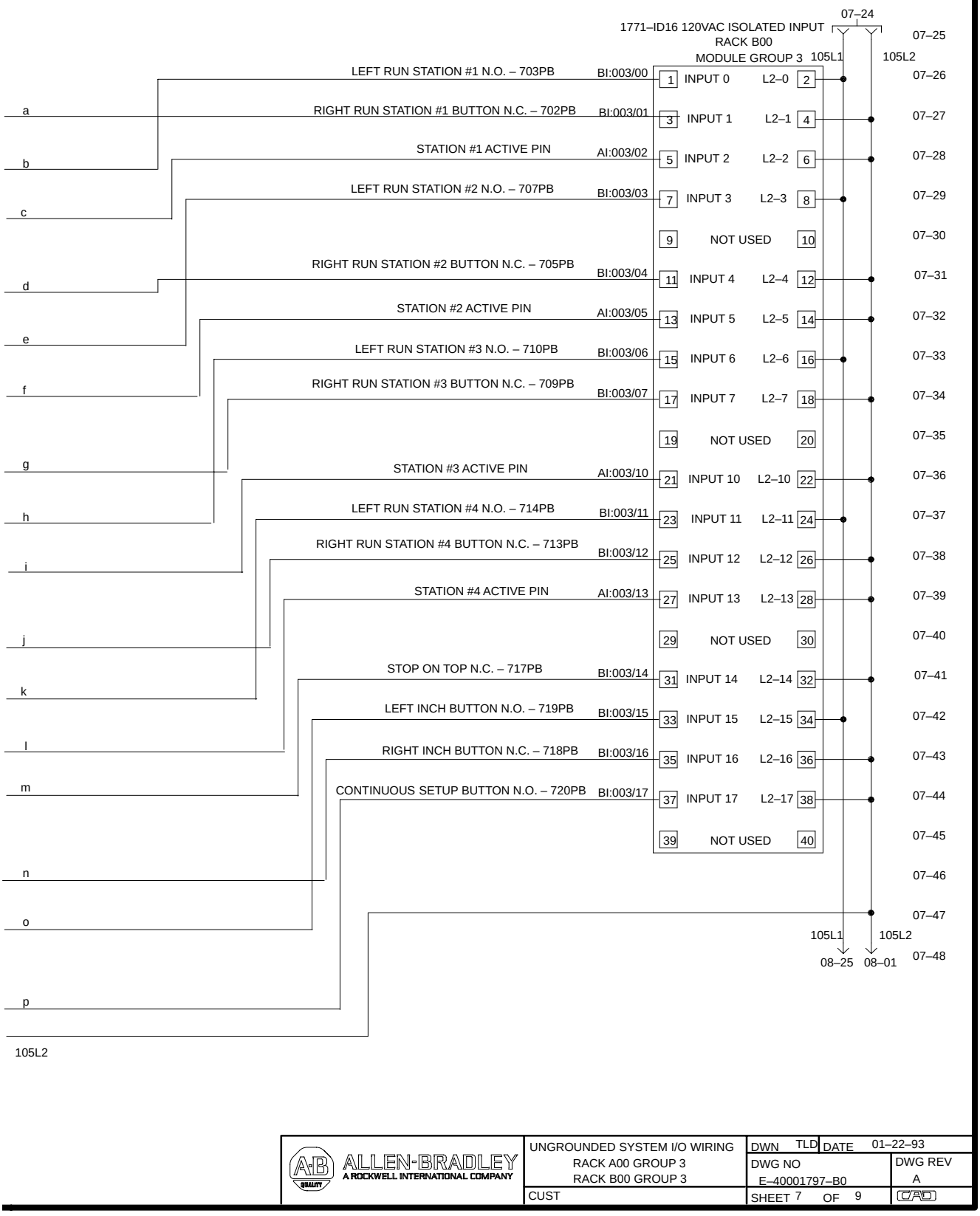
Notes

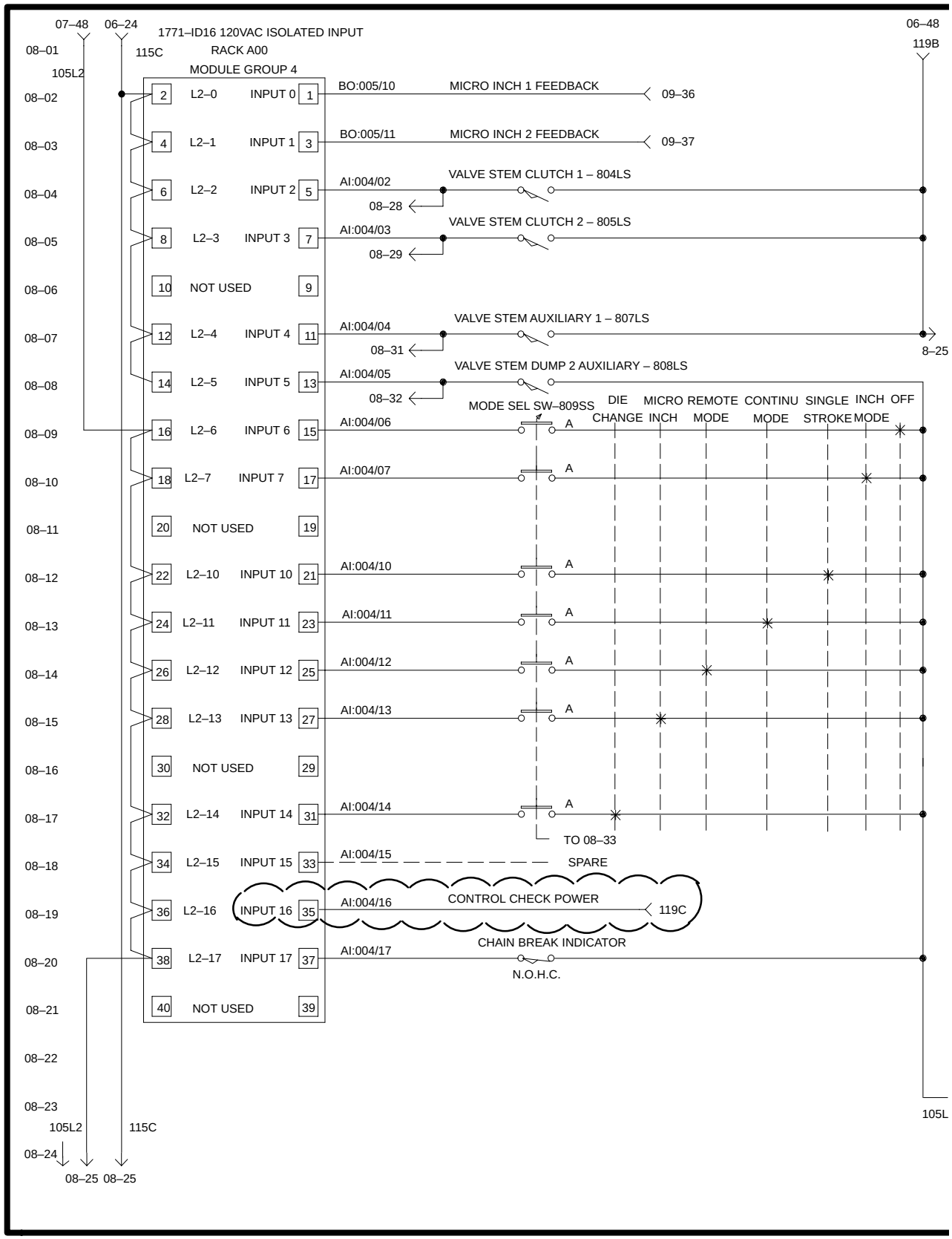

440 VAC
FROM CUSTOMER
FROM CUSTOMER
L1
L2
TR
CLUTCH BRAKE TRANSFORMER–1KVA
#12 AWG BLK
#12 AWG BLK
H3 H1 H2 H4
PRI
SEC
X1
X2
103L1
103L2
10CCB
10A
105L1
105L2
C/B GROUND FAULT LT
C/B GROUND FAULT LT
FU 8A
FU 8A
TO 06–01
TO 06–01
108L1 #14 AWG RED
108L2 #14 AWG RED
EMERGENCY STOP
BY CUSTOMER
CONTROL RESET
112
TO 06–17
TO 06–41
113CR CRMA
114CR CRMB
112A
CRMA–113CR
CRMB–114CR
(01–13, 01-15, 06-15,*)
(01–13, 01-19, 06-39, *)
917CR CONTROLLER OK
113CR CRMA
115
115A
919CR SEAL RELAY A
115B
943CR SEAL RELAY B
115C
TO 08–43
117PB CLUTCH BRAKE POWER RESET
TO 06–13
TO 06–37
918CR CROWBAR RELAY A
115C
119A
TO 06–14
941CR CONTROLLER OK
114CR CRMB
119B
119C
TO 08–19
942CR CROWBAR RELAY B
115C
121
TO 06–38
AI:002/10
TO 06–12
115C
TO 06–01
TO 06–01
119B
NOTE:
ALL 120 VAC WIRES ARE #14 AWG RED UNLESS MARKED OTHERWISE.
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY
UNGROUNDED SYSTEM
POWER DISTRIBUTION
CUST
DWN TLD
DATE 01–22–93
DWG NO E–40001797–B0
DWG REV A
SHEET 1 OF 9
CAD

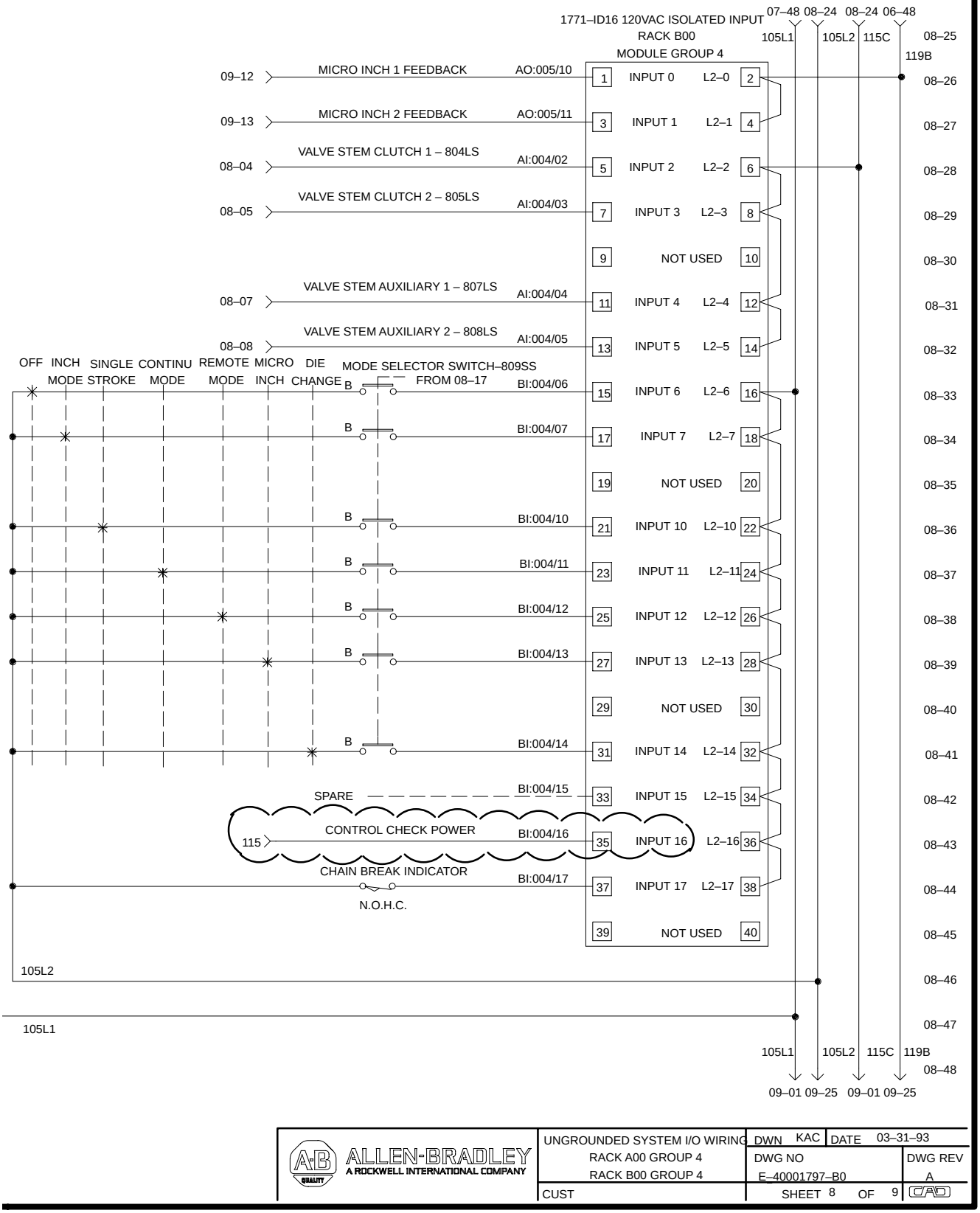

1771–ID16 120VAC ISOLATED INPUT
RACK A00
MODULE GROUP 2
01–09 105L2
01–24 119B
01–24 115C
01–09 105L1
2 L2–0 INPUT 0 1
4 L2–1 INPUT 1 3
6 L2–2 INPUT 2 5
8 L2–3 INPUT 3 7
10 NOT USED 9
12 L2–4 INPUT 4 11
14 L2–5 INPUT 5 13
16 L2–6 INPUT 6 15
18 L2–7 INPUT 7 17
20 NOT USED 19
22 L2–10 INPUT 10 21
24 L2–11 INPUT 11 23
26 L2–12 INPUT 12 25
28 L2–13 INPUT 13 27
30 NOT USED 29
32 L2–14 INPUT 14 31
34 L2–15 INPUT 15 33
36 L2–16 INPUT 16 35
38 L2–17 INPUT 17 37
40 NOT USED 39
AI:002/00
TAKEOVER CAM LIMIT SW. – 602LS
AI:002/01
ANTIREPEAT CAM LIMIT SW. – 603LS
AI:002/02
BRAKE MONITOR CAM LIMIT SW. – 604LS
BO:005/04
AUXILIARY VALVE 1 FEEDBACK
09–31
BO:005/05
AUXILIARY VALVE 2 FEEDBACK
09–32
BO:005/00
CLUTCH VALVE 1 FEEDBACK
09–26
BO:005/01
CLUTCH VALVE 2 FEEDBACK
09–27
AI:002/07
SEAL RELAY "A" 919CR
AI:002/10
CLUTCH/BRAKE POWER RESET (NO) – 117PB
06–36
115C
CLUTCH/BRAKE POWER FEEDBACK
01–15
119A
CROWBAR RELAY A FEEDBACK
01–19
AI:002/13
CRMA–113CR
112A
CRM POWER FEEDBACK
01–13
AI:002/15
CLUTCH/BRAKE AIR PRESSURE
06–42
AI:002/16
MAIN MOTOR FORWARD
AI:002/17
MOTION DETECTOR
105L1
06–25
06–01
06–02
06–03
06–04
06–05
06–06
06–07
06–08
06–09
06–10
06–11
06–12
06–13
06–14
06–15
06–16
06–17
06–18
06–19
06–20
06–21
06–22
06–23
06–24

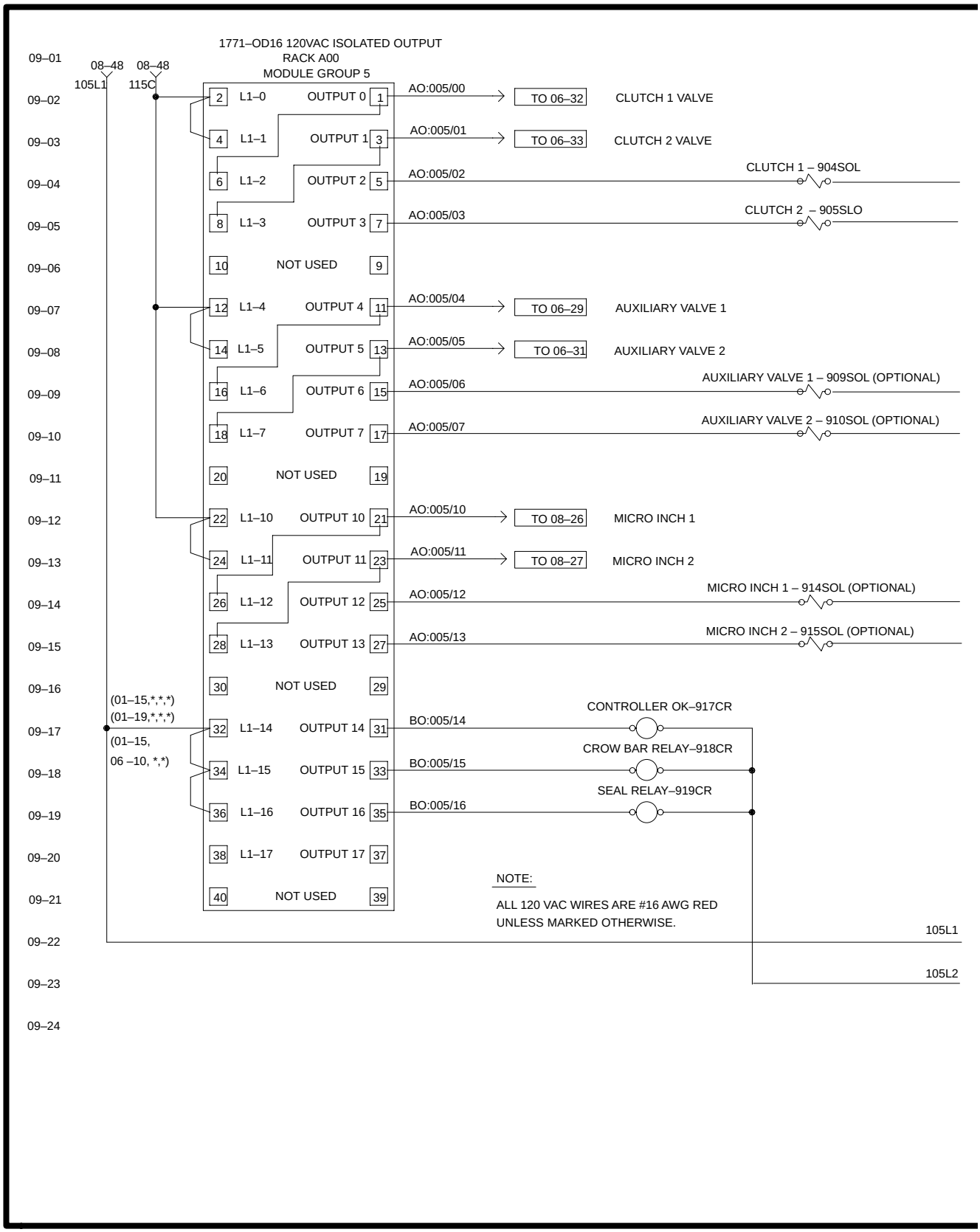

1771–ID16 120VAC ISOLATED INPUT
RACK B00
MODULE GROUP 2
06–24
105L2
TAKEOVER CAM LIMIT SW. – 626LS
BI:002/00
ANTIREPEAT CAM LIMIT SW. – 627LS
BI:002/01
BRAKE MONITOR CAM LIMIT SW. – 628LS
BI:002/02
09–07
AUXILIARY VALVE 1 FEEDBACK
AO:005/04
09–08
AUXILIARY VALVE 2 FEEDBACK
AO:005/05
09–02
CLUTCH VALVE 1 FEEDBACK
AO:005/00
09–03
CLUTCH VALVE 2 FEEDBACK
AO:005/01
SEAL RELAY "B" 943CR
BI:002/07
06–12
CLUTCH/BRAKE POWER RESET
AI:002/10
01–15
CLUTCH/BRAKE POWER FEEDBACK
115C
01–21
CROWBAR RELAY B FEEDBACK
121
CRMB–114CR
BI:002/13
01–13
CRM POWER FEEDBACK
112A
06–18
CLUTCH/BRAKE AIR PRESSURE
AI:002/15
MAIN MOTOR FORWARD
BI:002/16
MOTION DETECTOR
BI:002/17
1 INPUT 0 L2–0 2
3 INPUT 1 L2–1 4
5 INPUT 2 L2–2 6
7 INPUT 3 L2–3 8
9 NOT USED 10
11 INPUT 4 L2–4 12
13 INPUT 5 L2–5 14
15 INPUT 6 L2–6 16
17 INPUT 7 L2–7 18
19 NOT USED 20
21 INPUT 10 L2–10 22
23 INPUT 11 L2–11 24
25 INPUT 12 L2–12 26
27 INPUT 13 L2–13 28
29 NOT USED 30
31 INPUT 14 L2–14 32
33 INPUT 15 L2–15 34
35 INPUT 16 L2–16 36
37 INPUT 17 L2–17 38
39 NOT USED 40
06–24
105L1
06–24
119B
06–25
06–26
06–27
06–28
06–29
06–30
06–31
06–32
06–33
06–34
06–35
105L2
06–36
06–37
06–38
06–39
06–40
06–41
06–42
06–43
06–44
06–45
06–46
06–47
06–48
105L2
07–01
105L1
07–01
119B
08–01
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY
UNGROUNDED SYSTEM I/O WIRING
RACK A00 GROUP 2
RACK B00 GROUP 2
CUST
DWN TLD
DATE 01–22–93
DWG NO E–40001797–B0
DWG REV A
SHEET 6 OF 9

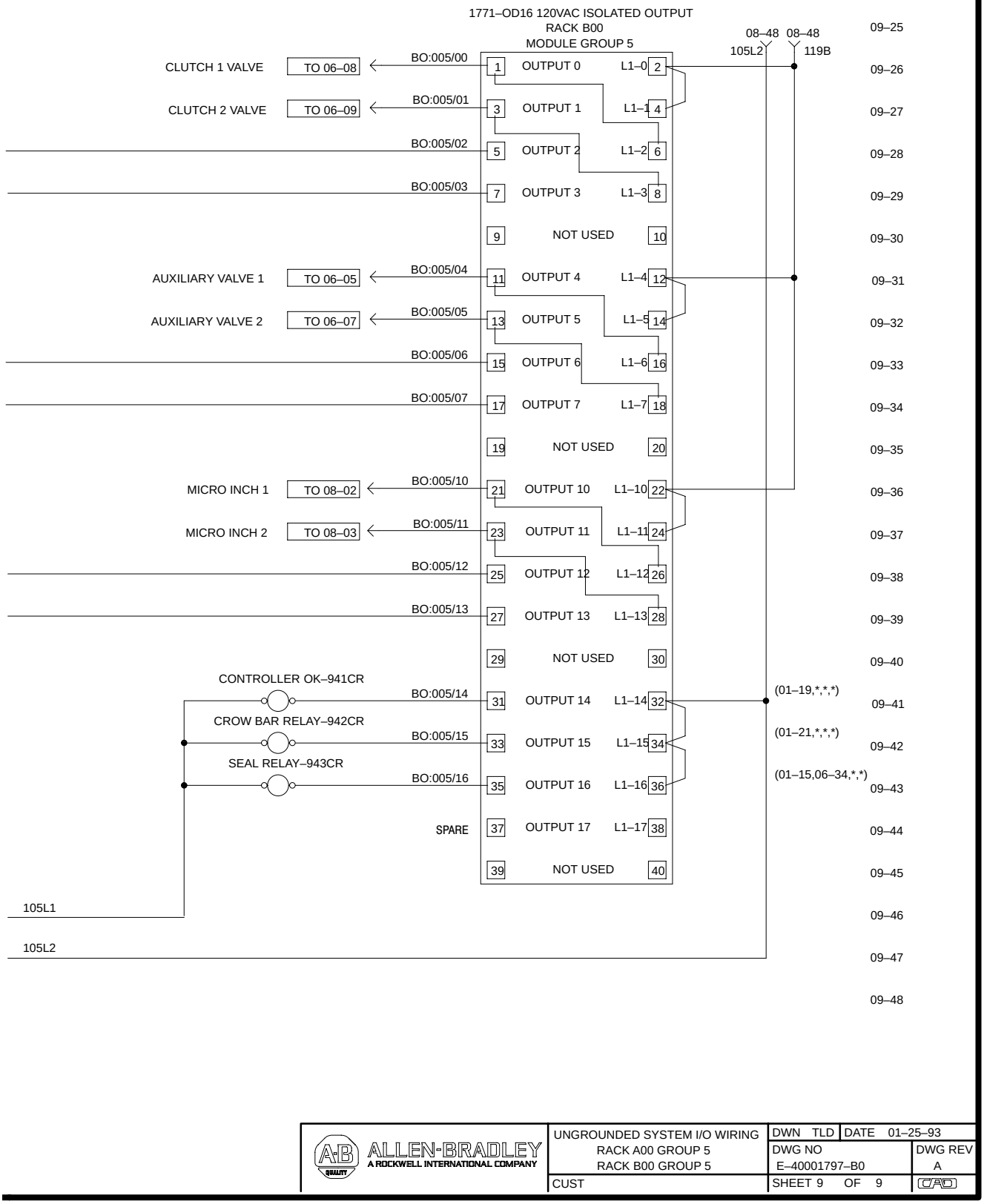

06–48
07–01
1771–OD16 120VAC ISOLATED INPUT
RACK A00
MODULE GROUP 3
105L1
105L2
07–02
07–03
07–04
07–05
07–06
07–07
07–08
07–09
07–10
07–11
07–12
07–13
07–14
07–15
07–16
07–17
07–18
07–19
07–20
07–21
07–22
07–23
07–24
07–25
2 L2–0 INPUT 0 1
4 L2–1 INPUT 1 3
6 L2–2 INPUT 2 5
8 L2–3 INPUT 3 7
10 NOT USED 9
12 L2–4 INPUT 4 11
14 L2–5 INPUT 5 13
16 L2–6 INPUT 6 15
18 L2–7 INPUT 7 17
20 NOT USED 19
22 L2–10 INPUT 10 21
24 L2–11 INPUT 11 23
26 L2–12 INPUT 12 25
28 L2–13 INPUT 13 27
30 NOT USED 29
32 L2–14 INPUT 14 31
34 L2–15 INPUT 15 33
36 L2–16 INPUT 16 35
38 L2–17 INPUT 17 37
40 NOT USED 39
AI:003/00
RIGHT RUN STATION #1 N.O. – 702PB
AI:003/01
LEFT RUN STATION #1 BUTTON N.C. – 703PB
AI:003/02
STATION #1 ACTIVE PIN
AI:003/03
RIGHT RUN STATION #2 N.O. – 705PB
AI:003/04
LEFT RUN STATION #2 BUTTON N.C. – 707PB
AI:003/05
STATION #2 ACTIVE PIN
AI:003/06
RIGHT RUN STATION #3 N.O. – 709PB
AI:003/07
LEFT RUN STATION #3 BUTTON N.C. – 710PB
AI:003/10
STATION #3 ACTIVE PIN
AI:003/11
RIGHT RUN STATION #4 N.O. – 713PB
AI:003/12
LEFT RUN STATION #4 BUTTON N.C. – 714PB
AI:003/13
STATION #4 ACTIVE PIN
AI:003/14
STOP ON TOP N.C. – 717PB
AI:003/15
RIGHT INCH BUTTON N.O. – 718PB
AI:003/16
LEFT INCH BUTTON N.C. – 719PB
AI:003/16
CONTINUOUS SETUP BUTTON N.O. – 720PB
NOTE:
ALL 120 VAC WIRES ARE #16 AWG RED
UNLESS MARKED OTHERWISE.
RIGHT RUN STATION #1 702PB
LEFT RUN STATION #1 703PB
STATION #1 ACTIVE
RIGHT RUN STATION #2 705PB
LEFT RUN STATION #2 707PB
STATION #2 ACTIVE
RIGHT RUN STATION #3 709PB
LEFT RUN STATION #3 710PB
STATION #3 ACTIVE
RIGHT RUN STATION #4 713PB
LEFT RUN STATION #4 714PB
STATION #4 ACTIVE
STOP ON TOP N.C. 717PB
RIGHT INCH P.B. 718PB
LEFT INCH P.B. 719PB
CONTINUOUS SET–UP P.B. N.O. 720PB
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p


1771–ID16 120VAC ISOLATED INPUT
RACK B00
MODULE GROUP 3
07–24
07–25
105L1
105L2
LEFT RUN STATION #1 N.O. – 703PB
BI:003/00
1 INPUT 0 L2–0 2
07–26
a
RIGHT RUN STATION #1 BUTTON N.C. – 702PB
BI:003/01
3 INPUT 1 L2–1 4
07–27
b
STATION #1 ACTIVE PIN
AI:003/02
5 INPUT 2 L2–2 6
07–28
c
LEFT RUN STATION #2 N.O. – 707PB
BI:003/03
7 INPUT 3 L2–3 8
07–29
9 NOT USED 10
07–30
RIGHT RUN STATION #2 BUTTON N.C. – 705PB
BI:003/04
11 INPUT 4 L2–4 12
07–31
d
STATION #2 ACTIVE PIN
AI:003/05
13 INPUT 5 L2–5 14
07–32
e
LEFT RUN STATION #3 N.O. – 710PB
BI:003/06
15 INPUT 6 L2–6 16
07–33
RIGHT RUN STATION #3 BUTTON N.C. – 709PB
BI:003/07
17 INPUT 7 L2–7 18
07–34
f
19 NOT USED 20
07–35
STATION #3 ACTIVE PIN
AI:003/10
21 INPUT 10 L2–10 22
07–36
g
LEFT RUN STATION #4 N.O. – 714PB
BI:003/11
23 INPUT 11 L2–11 24
07–37
h
RIGHT RUN STATION #4 BUTTON N.C. – 713PB
BI:003/12
25 INPUT 12 L2–12 26
07–38
i
STATION #4 ACTIVE PIN
AI:003/13
27 INPUT 13 L2–13 28
07–39
29 NOT USED 30
07–40
j
STOP ON TOP N.C. – 717PB
BI:003/14
31 INPUT 14 L2–14 32
07–41
k
LEFT INCH BUTTON N.O. – 719PB
BI:003/15
33 INPUT 15 L2–15 34
07–42
l
RIGHT INCH BUTTON N.C. – 718PB
BI:003/16
35 INPUT 16 L2–16 36
07–43
m
CONTINUOUS SETUP BUTTON N.O. – 720PB
BI:003/17
37 INPUT 17 L2–17 38
07–44
39 NOT USED 40
07–45
n
07–46
o
07–47
105L1
105L2
08–25
08–01
07–48
p
105L2
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY
UNGROUNDED SYSTEM I/O WIRING
RACK A00 GROUP 3
RACK B00 GROUP 3
DWN TLD
DATE 01–22–93
DWG NO E–40001797–B0
DWG REV A
CUST
SHEET 7 OF 9
CAD


07–48
06–24
1771–ID16 120VAC ISOLATED INPUT
RACK A00
MODULE GROUP 4
115C
105L2
06–48
119B
08–01
08–02
08–03
08–04
08–05
08–06
08–07
08–08
08–09
08–10
08–11
08–12
08–13
08–14
08–15
08–16
08–17
08–18
08–19
08–20
08–21
08–22
08–23
08–24
2 L2–0 INPUT 0 1
BO:005/10
MICRO INCH 1 FEEDBACK
09–36
4 L2–1 INPUT 1 3
BO:005/11
MICRO INCH 2 FEEDBACK
09–37
6 L2–2 INPUT 2 5
AI:004/02
VALVE STEM CLUTCH 1 – 804LS
08–28
8 L2–3 INPUT 3 7
AI:004/03
VALVE STEM CLUTCH 2 – 805LS
08–29
10 NOT USED 9
12 L2–4 INPUT 4 11
AI:004/04
VALVE STEM AUXILIARY 1 – 807LS
08–31
8–25
14 L2–5 INPUT 5 13
AI:004/05
VALVE STEM DUMP 2 AUXILIARY – 808LS
08–32
MODE SEL SW–809SS
DIE CHANGE
MICRO INCH
REMOTE MODE
CONTINU MODE
SINGLE STROKE
INCH MODE
OFF
16 L2–6 INPUT 6 15
AI:004/06
A
18 L2–7 INPUT 7 17
AI:004/07
A
20 NOT USED 19
22 L2–10 INPUT 10 21
AI:004/10
A
24 L2–11 INPUT 11 23
AI:004/11
A
26 L2–12 INPUT 12 25
AI:004/12
A
28 L2–13 INPUT 13 27
AI:004/13
A
30 NOT USED 29
32 L2–14 INPUT 14 31
AI:004/14
A
TO 08–33
34 L2–15 INPUT 15 33
AI:004/15
SPARE
36 L2–16 INPUT 16 35
AI:004/16
CONTROL CHECK POWER
119C
CHAIN BREAK INDICATOR
38 L2–17 INPUT 17 37
AI:004/17
N.O.H.C.
40 NOT USED 39
105L
105L2
115C
08–25 08–25


1771–ID16 120VAC ISOLATED INPUT
RACK B00
MODULE GROUP 4
07–48 08–24 08–24 06–48
105L1 105L2 115C 119B
08–25
09–12 MICRO INCH 1 FEEDBACK AO:005/10
09–13 MICRO INCH 2 FEEDBACK AO:005/11
08–04 VALVE STEM CLUTCH 1 – 804LS AI:004/02
08–05 VALVE STEM CLUTCH 2 – 805LS AI:004/03
08–07 VALVE STEM AUXILIARY 1 – 807LS AI:004/04
08–08 VALVE STEM AUXILIARY 2 – 808LS AI:004/05
OFF INCH MODE SINGLE STROKE CONTINU MODE REMOTE MODE MICRO INCH DIE CHANGE
MODE SELECTOR SWITCH–809SS FROM 08–17
BI:004/06
BI:004/07
BI:004/10
BI:004/11
BI:004/12
BI:004/13
BI:004/14
BI:004/15
BI:004/16
BI:004/17
SPARE
CONTROL CHECK POWER
115
CHAIN BREAK INDICATOR
N.O.H.C.
INPUT 0 L2–0
INPUT 1 L2–1
INPUT 2 L2–2
INPUT 3 L2–3
NOT USED
INPUT 4 L2–4
INPUT 5 L2–5
INPUT 6 L2–6
INPUT 7 L2–7
NOT USED
INPUT 10 L2–10
INPUT 11 L2–11
INPUT 12 L2–12
INPUT 13 L2–13
NOT USED
INPUT 14 L2–14
INPUT 15 L2–15
INPUT 16 L2–16
INPUT 17 L2–17
NOT USED
08–26 08–27 08–28 08–29 08–30 08–31 08–32 08–33 08–34 08–35 08–36 08–37 08–38 08–39 08–40 08–41 08–42 08–43 08–44 08–45 08–46 08–47 08–48
105L2
105L1
105L1 105L2 115C 119B
09–01 09–25 09–01 09–25
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY
UNGROUNDED SYSTEM I/O WIRING
RACK A00 GROUP 4
RACK B00 GROUP 4
CUST
DWN KAC DATE 03–31–93
DWG NO E–40001797–B0
DWG REV A
SHEET 8 OF 9
CAD


1771–OD16 120VAC ISOLATED OUTPUT
RACK A00
MODULE GROUP 5
08–48
105L1
08–48
115C
09–01
09–02
09–03
09–04
09–05
09–06
09–07
09–08
09–09
09–10
09–11
09–12
09–13
09–14
09–15
09–16
09–17
09–18
09–19
09–20
09–21
09–22
09–23
09–24
2 L1–0 OUTPUT 0 1
AO:005/00
TO 06–32
CLUTCH 1 VALVE
4 L1–1 OUTPUT 1 3
AO:005/01
TO 06–33
CLUTCH 2 VALVE
6 L1–2 OUTPUT 2 5
AO:005/02
CLUTCH 1 – 904SOL
8 L1–3 OUTPUT 3 7
AO:005/03
CLUTCH 2 – 905SLO
10 NOT USED 9
12 L1–4 OUTPUT 4 11
AO:005/04
TO 06–29
AUXILIARY VALVE 1
14 L1–5 OUTPUT 5 13
AO:005/05
TO 06–31
AUXILIARY VALVE 2
16 L1–6 OUTPUT 6 15
AO:005/06
AUXILIARY VALVE 1 – 909SOL (OPTIONAL)
18 L1–7 OUTPUT 7 17
AO:005/07
AUXILIARY VALVE 2 – 910SOL (OPTIONAL)
20 NOT USED 19
22 L1–10 OUTPUT 10 21
AO:005/10
TO 08–26
MICRO INCH 1
24 L1–11 OUTPUT 11 23
AO:005/11
TO 08–27
MICRO INCH 2
26 L1–12 OUTPUT 12 25
AO:005/12
MICRO INCH 1 – 914SOL (OPTIONAL)
28 L1–13 OUTPUT 13 27
AO:005/13
MICRO INCH 2 – 915SOL (OPTIONAL)
30 NOT USED 29
(01–15,*,*,*)
(01–19,*,*,*)
(01–15,
06 –10, *,*)
32 L1–14 OUTPUT 14 31
BO:005/14
CONTROLLER OK–917CR
34 L1–15 OUTPUT 15 33
BO:005/15
CROW BAR RELAY–918CR
36 L1–16 OUTPUT 16 35
BO:005/16
SEAL RELAY–919CR
38 L1–17 OUTPUT 17 37
40 NOT USED 39
NOTE:
ALL 120 VAC WIRES ARE #16 AWG RED
UNLESS MARKED OTHERWISE.
105L1
105L2



ALLEN-BRADLEY A ROCKWELL INTERNATIONAL COMPANY	UNGROUNDED SYSTEM I/O WIRING RACK A00 GROUP 5 RACK B00 GROUP 5	DWN TLD DATE 01–25–93 DWG NO E–40001797–B0	DWG REV A
	CUST	SHEET 9 OF 9	CAD

Notes

Wiring Drawings for a Grounded System

Wiring Drawings

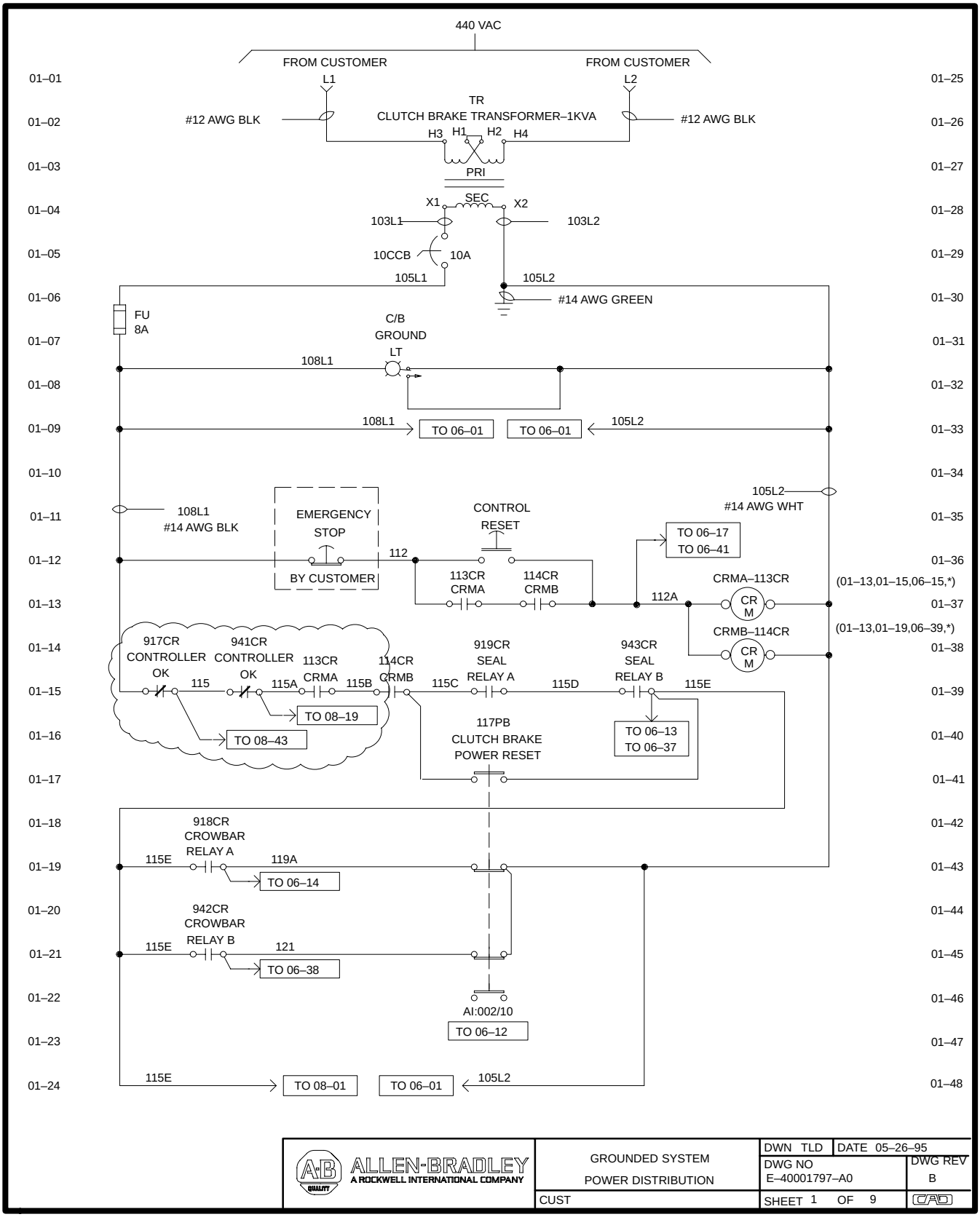
The wiring option of your Clutch/Brake Application Package included either one of two choices:

- grounded system I/O wiring (this appendix), or
- ungrounded system I/O wiring (appendix G)

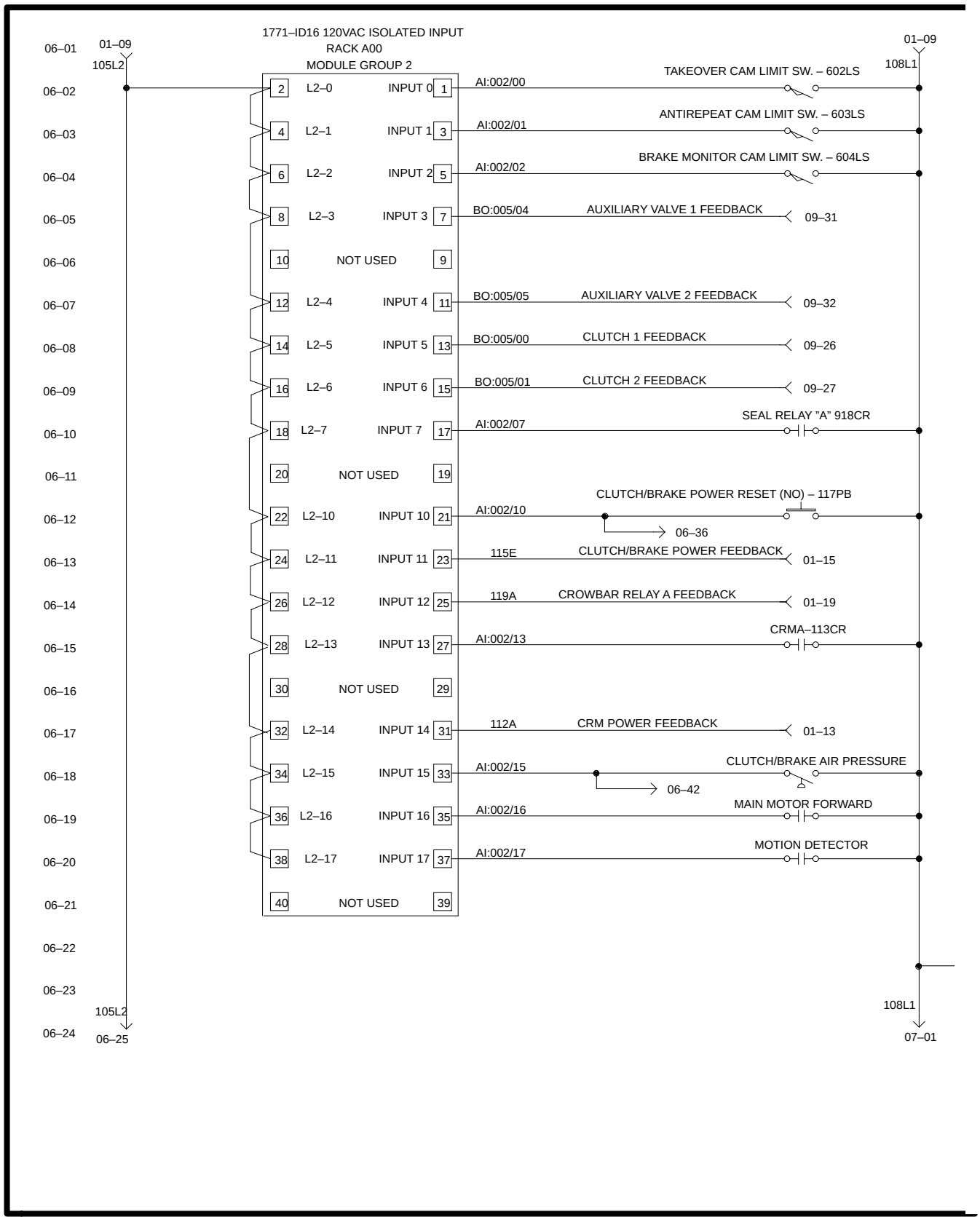
We present the following wiring drawings for I/O racks A00 and B00 for grounded system I/O wiring. (See Appendix G for the Ungrounded System.)

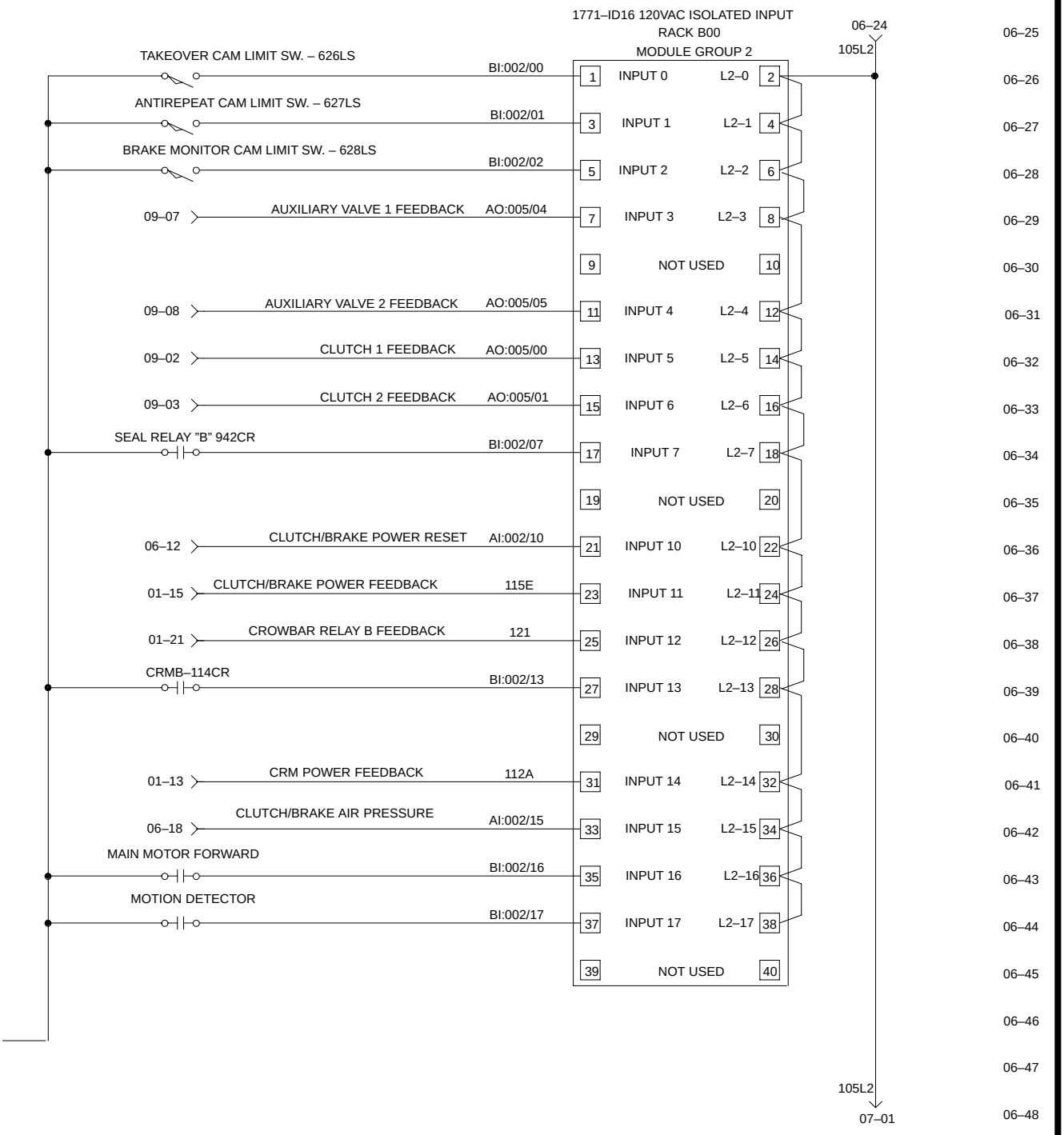
Sheet	Title
1 of 9	Power Distribution
2, 3, 4, 5 of 9	*omitted* because they are not wiring drawings
6 of 9	System I/O, Rack Group 2
7 of 9	System I/O, Rack Group 3
8 of 9	System I/O, Rack Group 4
9 of 9	System I/O, Rack Group 5

Notes

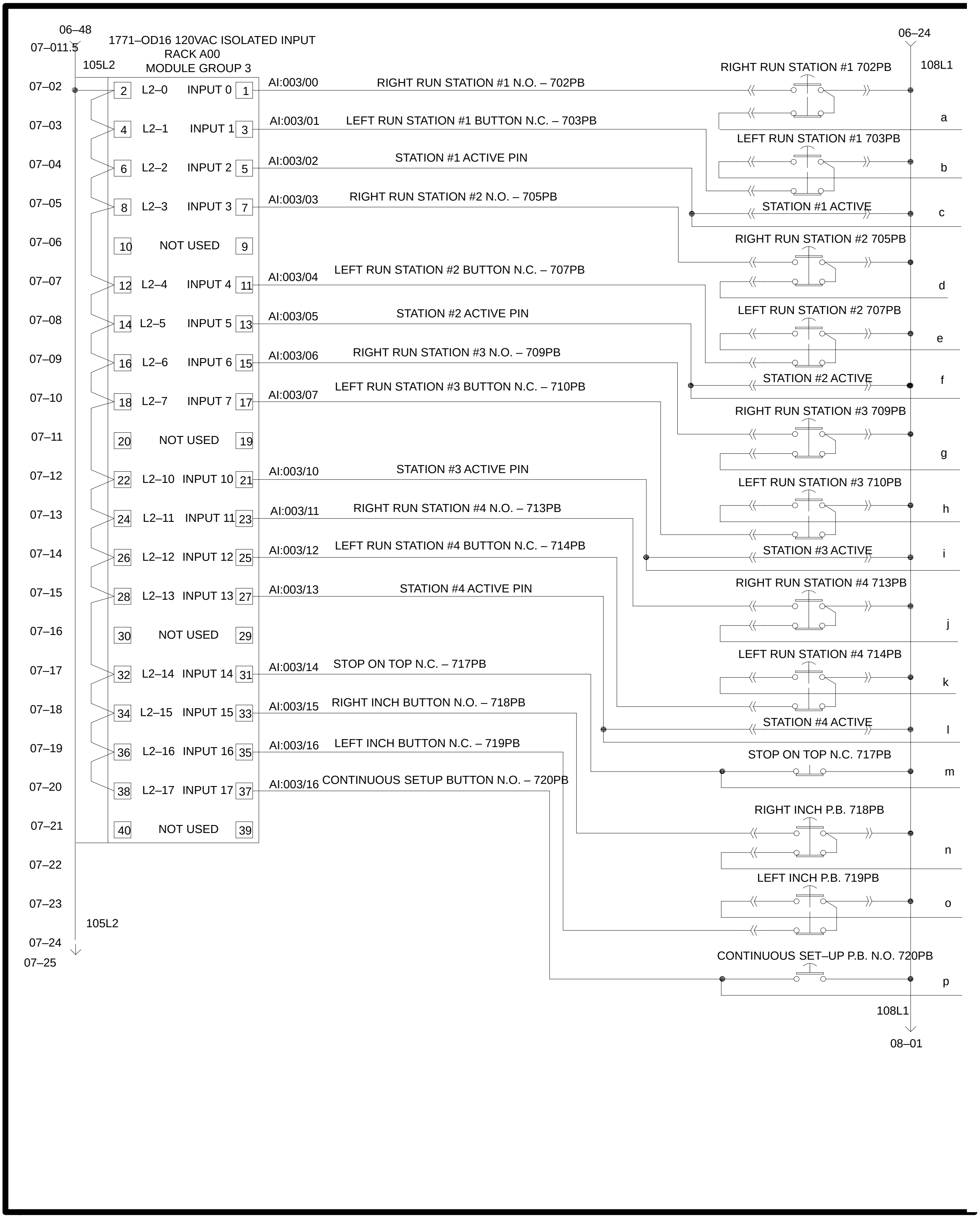


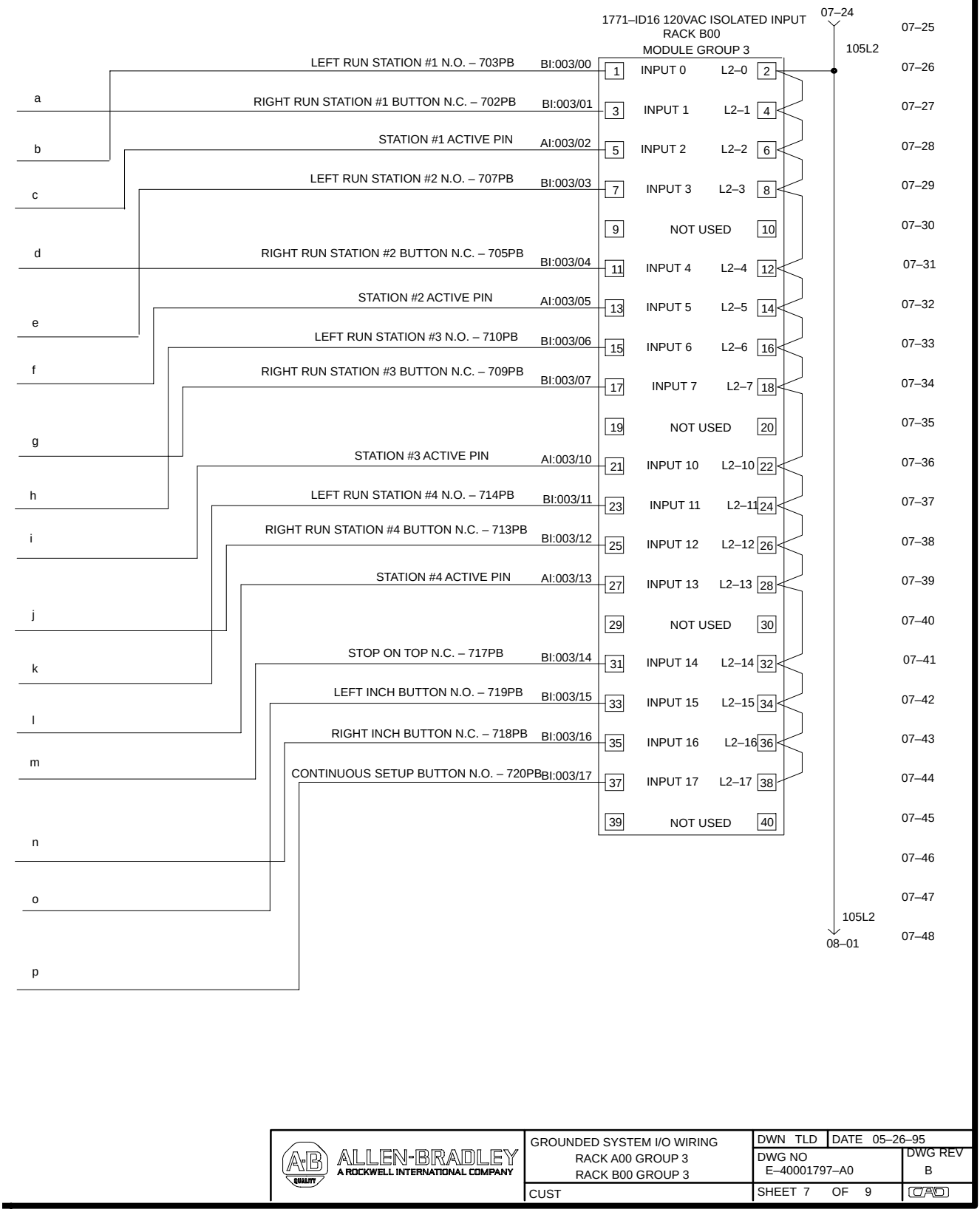
ALLEN-BRADLEY A ROCKWELL INTERNATIONAL COMPANY	GROUNDED SYSTEM POWER DISTRIBUTION	DWN TLD	DATE 05–26–95
		DWG NO E–40001797–A0	DWG REV B
	CUST	SHEET 1 OF 9	CAD

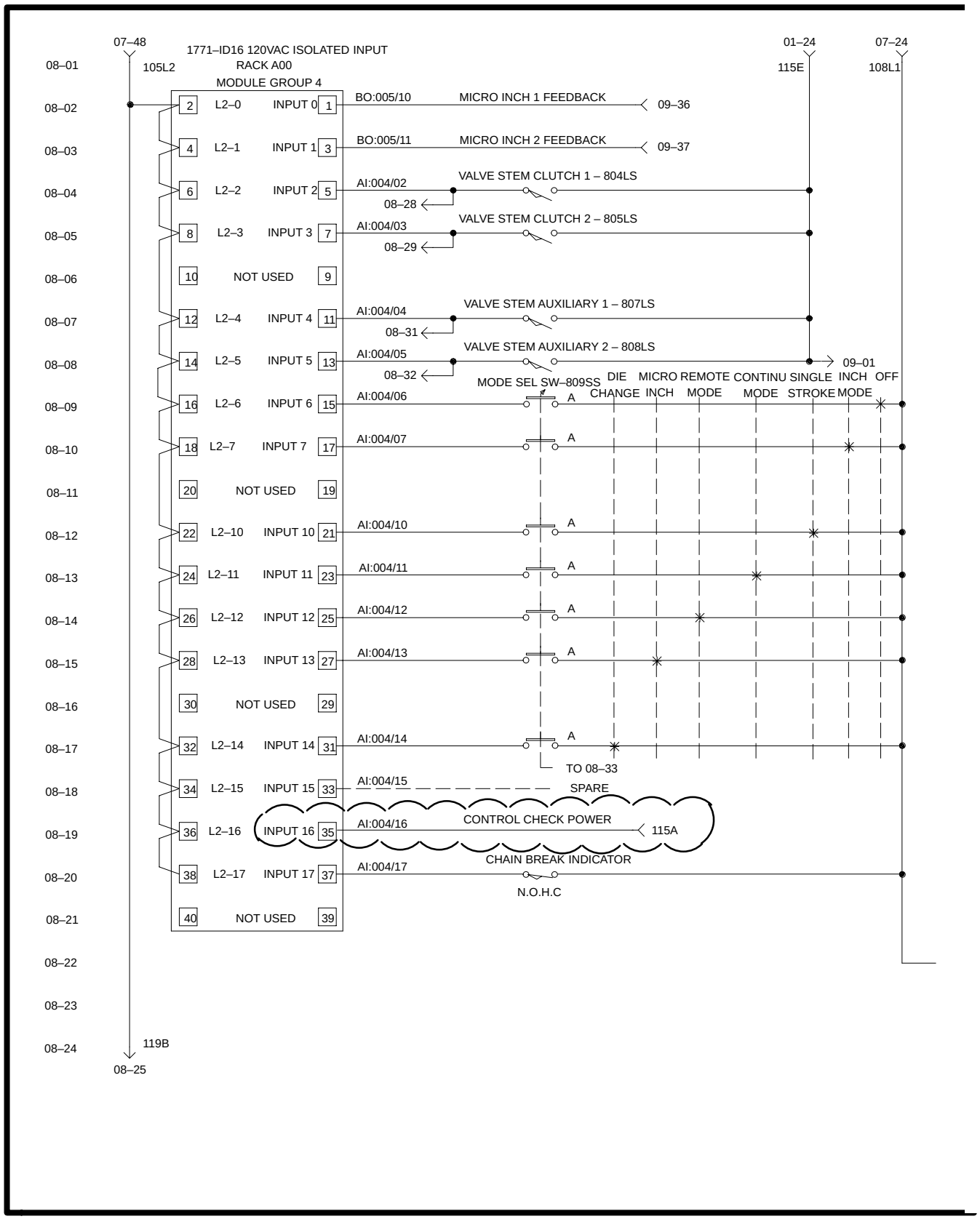

1771–ID16 120VAC ISOLATED INPUT
RACK A00
MODULE GROUP 2
01–09
105L2
01–09
108L1
105L2
06–25
108L1
07–01
2 L2–0 INPUT 0 1
AI:002/00
TAKEOVER CAM LIMIT SW. – 602LS
4 L2–1 INPUT 1 3
AI:002/01
ANTIREPEAT CAM LIMIT SW. – 603LS
6 L2–2 INPUT 2 5
AI:002/02
BRAKE MONITOR CAM LIMIT SW. – 604LS
8 L2–3 INPUT 3 7
BO:005/04
AUXILIARY VALVE 1 FEEDBACK
09–31
10 NOT USED 9
12 L2–4 INPUT 4 11
BO:005/05
AUXILIARY VALVE 2 FEEDBACK
09–32
14 L2–5 INPUT 5 13
BO:005/00
CLUTCH 1 FEEDBACK
09–26
16 L2–6 INPUT 6 15
BO:005/01
CLUTCH 2 FEEDBACK
09–27
18 L2–7 INPUT 7 17
AI:002/07
SEAL RELAY "A" 918CR
20 NOT USED 19
22 L2–10 INPUT 10 21
AI:002/10
CLUTCH/BRAKE POWER RESET (NO) – 117PB
06–36
24 L2–11 INPUT 11 23
115E
CLUTCH/BRAKE POWER FEEDBACK
01–15
26 L2–12 INPUT 12 25
119A
CROWBAR RELAY A FEEDBACK
01–19
28 L2–13 INPUT 13 27
AI:002/13
CRMA–113CR
30 NOT USED 29
32 L2–14 INPUT 14 31
112A
CRM POWER FEEDBACK
01–13
34 L2–15 INPUT 15 33
AI:002/15
CLUTCH/BRAKE AIR PRESSURE
06–42
36 L2–16 INPUT 16 35
AI:002/16
MAIN MOTOR FORWARD
38 L2–17 INPUT 17 37
AI:002/17
MOTION DETECTOR
40 NOT USED 39
06–01
06–02
06–03
06–04
06–05
06–06
06–07
06–08
06–09
06–10
06–11
06–12
06–13
06–14
06–15
06–16
06–17
06–18
06–19
06–20
06–21
06–22
06–23
06–24

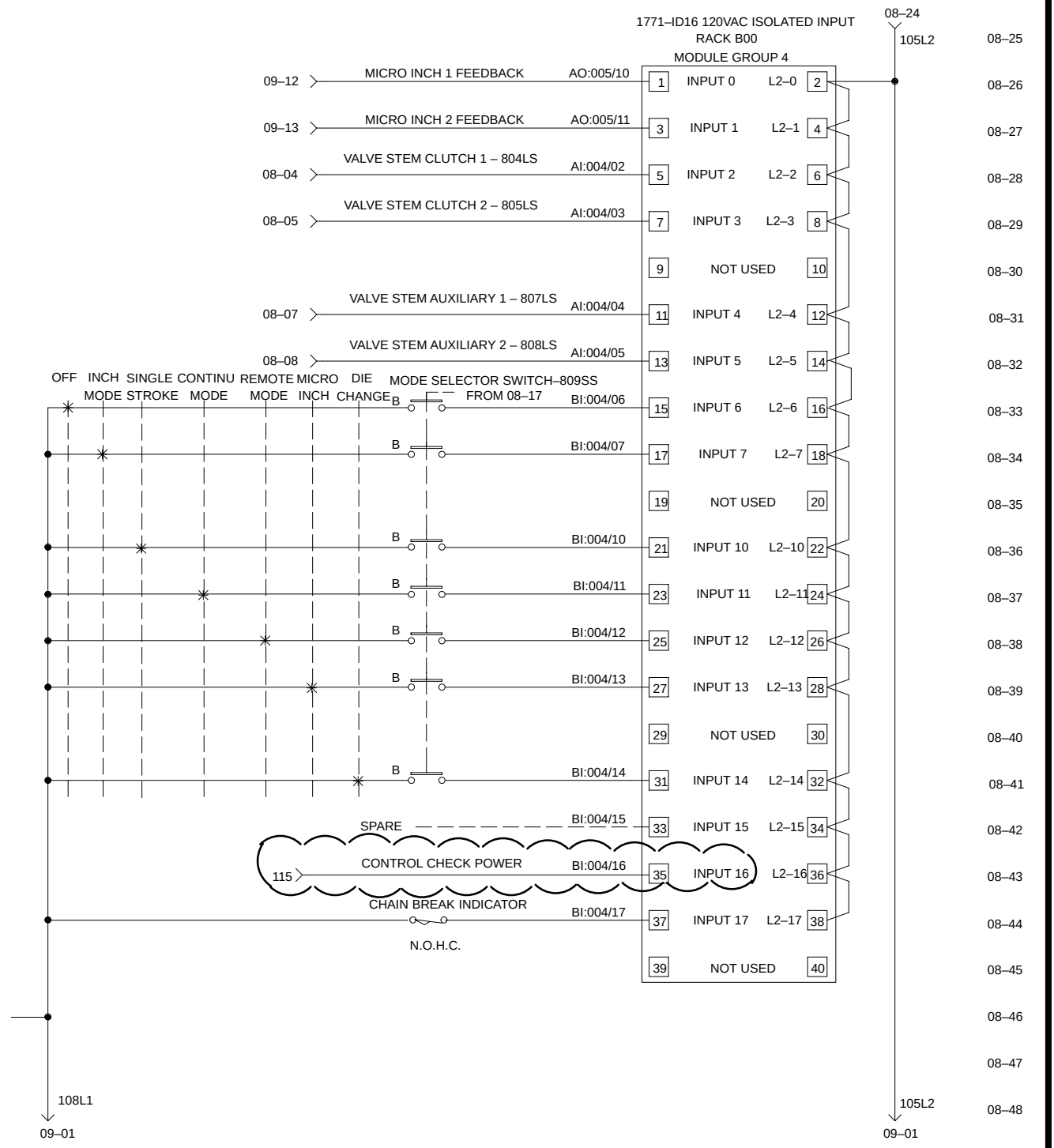


ALLEN-BRADLEY A ROCKWELL INTERNATIONAL COMPANY	GROUNDED SYSTEM I/O WIRING RACK A00 GROUP 2 RACK B00 GROUP 2 CUST	DWN TLD DATE 05–26–95 DWG NO E–40001797–A0 DWG REV B SHEET 6 OF 9 CAD	

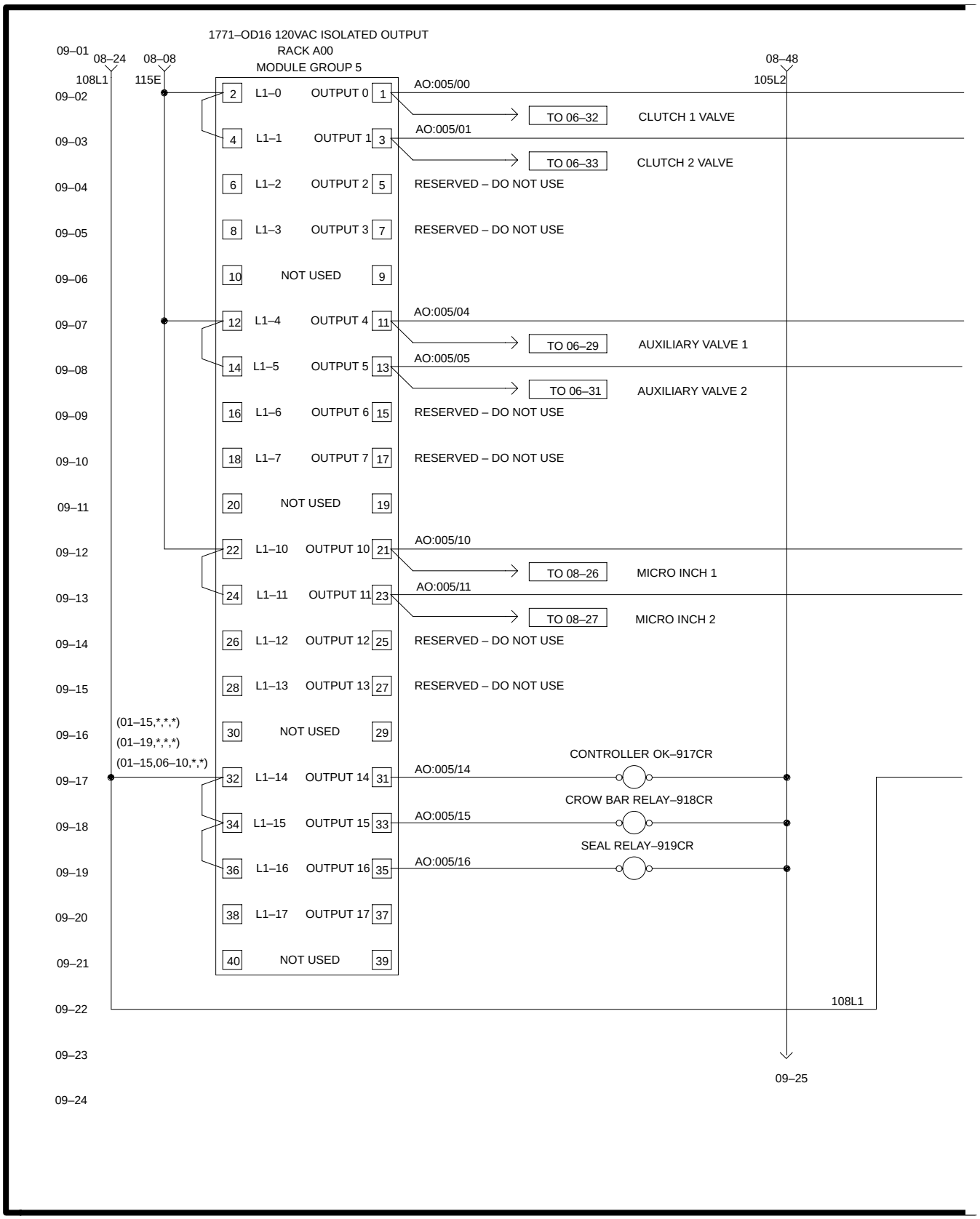

06–48
07–011.5
1771–OD16 120VAC ISOLATED INPUT
RACK A00
MODULE GROUP 3
105L2
06–24
108L1
07–02
07–03
07–04
07–05
07–06
07–07
07–08
07–09
07–10
07–11
07–12
07–13
07–14
07–15
07–16
07–17
07–18
07–19
07–20
07–21
07–22
07–23
07–24
07–25
2 L2–0 INPUT 0 1
4 L2–1 INPUT 1 3
6 L2–2 INPUT 2 5
8 L2–3 INPUT 3 7
10 NOT USED 9
12 L2–4 INPUT 4 11
14 L2–5 INPUT 5 13
16 L2–6 INPUT 6 15
18 L2–7 INPUT 7 17
20 NOT USED 19
22 L2–10 INPUT 10 21
24 L2–11 INPUT 11 23
26 L2–12 INPUT 12 25
28 L2–13 INPUT 13 27
30 NOT USED 29
32 L2–14 INPUT 14 31
34 L2–15 INPUT 15 33
36 L2–16 INPUT 16 35
38 L2–17 INPUT 17 37
40 NOT USED 39
AI:003/00 RIGHT RUN STATION #1 N.O. – 702PB
AI:003/01 LEFT RUN STATION #1 BUTTON N.C. – 703PB
AI:003/02 STATION #1 ACTIVE PIN
AI:003/03 RIGHT RUN STATION #2 N.O. – 705PB
AI:003/04 LEFT RUN STATION #2 BUTTON N.C. – 707PB
AI:003/05 STATION #2 ACTIVE PIN
AI:003/06 RIGHT RUN STATION #3 N.O. – 709PB
AI:003/07 LEFT RUN STATION #3 BUTTON N.C. – 710PB
AI:003/10 STATION #3 ACTIVE PIN
AI:003/11 RIGHT RUN STATION #4 N.O. – 713PB
AI:003/12 LEFT RUN STATION #4 BUTTON N.C. – 714PB
AI:003/13 STATION #4 ACTIVE PIN
AI:003/14 STOP ON TOP N.C. – 717PB
AI:003/15 RIGHT INCH BUTTON N.O. – 718PB
AI:003/16 LEFT INCH BUTTON N.C. – 719PB
AI:003/16 CONTINUOUS SETUP BUTTON N.O. – 720PB
RIGHT RUN STATION #1 702PB
a
LEFT RUN STATION #1 703PB
b
STATION #1 ACTIVE
c
RIGHT RUN STATION #2 705PB
d
LEFT RUN STATION #2 707PB
e
STATION #2 ACTIVE
f
RIGHT RUN STATION #3 709PB
g
LEFT RUN STATION #3 710PB
h
STATION #3 ACTIVE
i
RIGHT RUN STATION #4 713PB
j
LEFT RUN STATION #4 714PB
k
STATION #4 ACTIVE
l
STOP ON TOP N.C. 717PB
m
RIGHT INCH P.B. 718PB
n
LEFT INCH P.B. 719PB
o
CONTINUOUS SET–UP P.B. N.O. 720PB
p
105L2
108L1
08–01

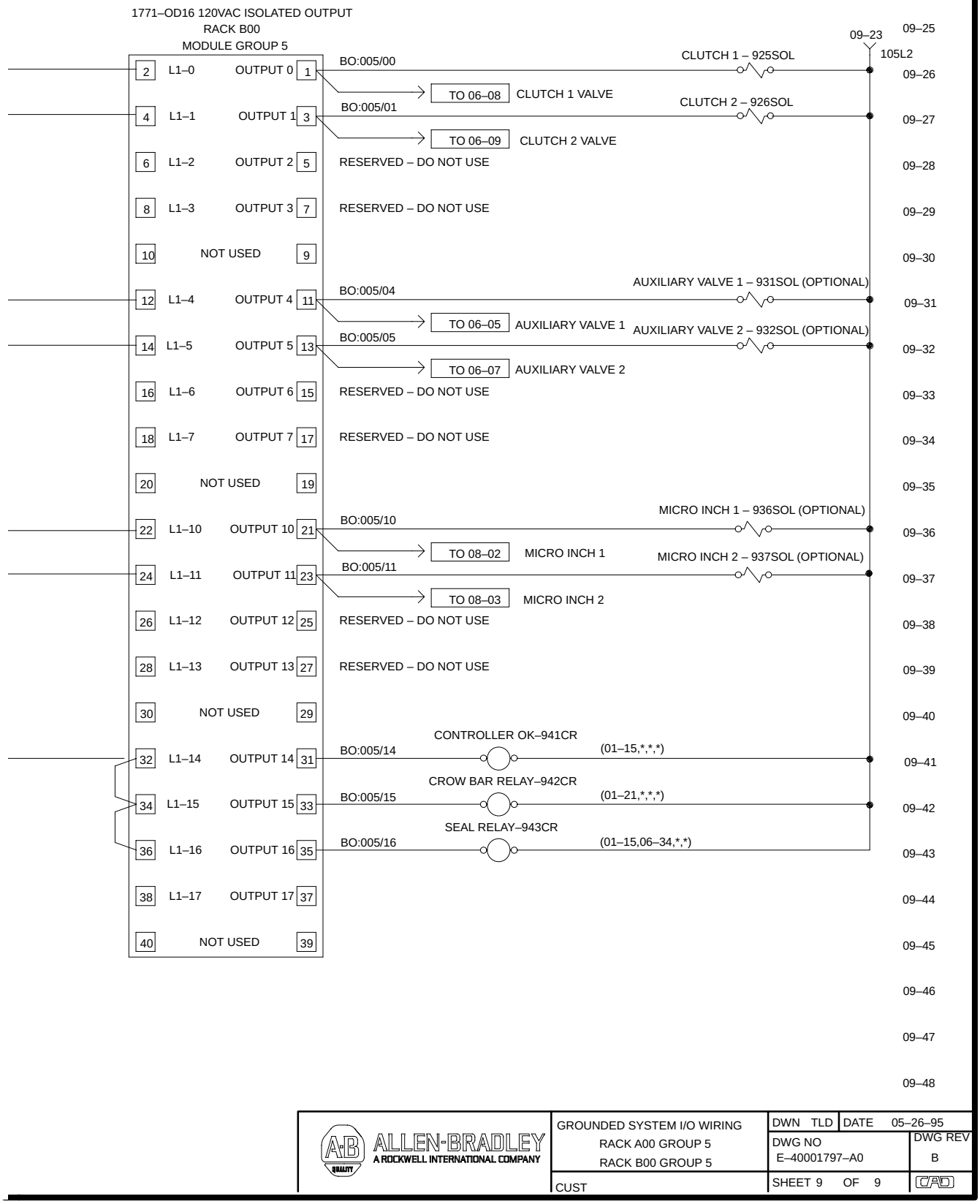

1771–ID16 120VAC ISOLATED INPUT
RACK B00
MODULE GROUP 3
07–24
105L2
LEFT RUN STATION #1 N.O. – 703PB
BI:003/00
RIGHT RUN STATION #1 BUTTON N.C. – 702PB
BI:003/01
STATION #1 ACTIVE PIN
AI:003/02
LEFT RUN STATION #2 N.O. – 707PB
BI:003/03
RIGHT RUN STATION #2 BUTTON N.C. – 705PB
BI:003/04
STATION #2 ACTIVE PIN
AI:003/05
LEFT RUN STATION #3 N.O. – 710PB
BI:003/06
RIGHT RUN STATION #3 BUTTON N.C. – 709PB
BI:003/07
STATION #3 ACTIVE PIN
AI:003/10
LEFT RUN STATION #4 N.O. – 714PB
BI:003/11
RIGHT RUN STATION #4 BUTTON N.C. – 713PB
BI:003/12
STATION #4 ACTIVE PIN
AI:003/13
STOP ON TOP N.C. – 717PB
BI:003/14
LEFT INCH BUTTON N.O. – 719PB
BI:003/15
RIGHT INCH BUTTON N.C. – 718PB
BI:003/16
CONTINUOUS SETUP BUTTON N.O. – 720PB
BI:003/17
1 INPUT 0 L2–0 2
3 INPUT 1 L2–1 4
5 INPUT 2 L2–2 6
7 INPUT 3 L2–3 8
9 NOT USED 10
11 INPUT 4 L2–4 12
13 INPUT 5 L2–5 14
15 INPUT 6 L2–6 16
17 INPUT 7 L2–7 18
19 NOT USED 20
21 INPUT 10 L2–10 22
23 INPUT 11 L2–11 24
25 INPUT 12 L2–12 26
27 INPUT 13 L2–13 28
29 NOT USED 30
31 INPUT 14 L2–14 32
33 INPUT 15 L2–15 34
35 INPUT 16 L2–16 36
37 INPUT 17 L2–17 38
39 NOT USED 40
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
07–25
07–26
07–27
07–28
07–29
07–30
07–31
07–32
07–33
07–34
07–35
07–36
07–37
07–38
07–39
07–40
07–41
07–42
07–43
07–44
07–45
07–46
07–47
07–48
105L2
08–01
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY
GROUNDED SYSTEM I/O WIRING
RACK A00 GROUP 3
RACK B00 GROUP 3
CUST
DWN TLD
DATE 05–26–95
DWG NO E–40001797–A0
DWG REV B
SHEET 7 OF 9
CAD


07–48
1771–ID16 120VAC ISOLATED INPUT
RACK A00
MODULE GROUP 4
105L2
01–24
115E
07–24
108L1
08–01
08–02
08–03
08–04
08–05
08–06
08–07
08–08
08–09
08–10
08–11
08–12
08–13
08–14
08–15
08–16
08–17
08–18
08–19
08–20
08–21
08–22
08–23
08–24
2 L2–0 INPUT 0 1
BO:005/10
MICRO INCH 1 FEEDBACK
09–36
4 L2–1 INPUT 1 3
BO:005/11
MICRO INCH 2 FEEDBACK
09–37
6 L2–2 INPUT 2 5
AI:004/02
VALVE STEM CLUTCH 1 – 804LS
08–28
8 L2–3 INPUT 3 7
AI:004/03
VALVE STEM CLUTCH 2 – 805LS
08–29
10 NOT USED 9
12 L2–4 INPUT 4 11
AI:004/04
VALVE STEM AUXILIARY 1 – 807LS
08–31
14 L2–5 INPUT 5 13
AI:004/05
VALVE STEM AUXILIARY 2 – 808LS
08–32
09–01
MODE SEL SW–809SS
DIE CHANGE
MICRO INCH
REMOTE MODE
CONTINU MODE
SINGLE STROKE
INCH MODE
OFF
16 L2–6 INPUT 6 15
AI:004/06
A
18 L2–7 INPUT 7 17
AI:004/07
A
20 NOT USED 19
22 L2–10 INPUT 10 21
AI:004/10
A
24 L2–11 INPUT 11 23
AI:004/11
A
26 L2–12 INPUT 12 25
AI:004/12
A
28 L2–13 INPUT 13 27
AI:004/13
A
30 NOT USED 29
32 L2–14 INPUT 14 31
AI:004/14
A
TO 08–33
34 L2–15 INPUT 15 33
AI:004/15
SPARE
36 L2–16 INPUT 16 35
AI:004/16
CONTROL CHECK POWER
115A
38 L2–17 INPUT 17 37
AI:004/17
CHAIN BREAK INDICATOR
N.O.H.C
40 NOT USED 39
119B
08–25



ALLEN-BRADLEY A ROCKWELL INTERNATIONAL COMPANY	GROUNDED SYSTEM I/O WIRING RACK A00 GROUP 4 RACK B00 GROUP 4	DWN KAC	DATE 05–26–95
		DWG NO E–40001797–A0	DWG REV B
	CUST	SHEET 8 OF 9	CAD


1771–OD16 120VAC ISOLATED OUTPUT
RACK A00
MODULE GROUP 5
09–01
08–24
108L1
08–08
115E
08–48
105L2
09–02
09–03
09–04
09–05
09–06
09–07
09–08
09–09
09–10
09–11
09–12
09–13
09–14
09–15
09–16
09–17
09–18
09–19
09–20
09–21
09–22
09–23
09–24
09–25
2 L1–0 OUTPUT 0 1
AO:005/00
TO 06–32
CLUTCH 1 VALVE
4 L1–1 OUTPUT 1 3
AO:005/01
TO 06–33
CLUTCH 2 VALVE
6 L1–2 OUTPUT 2 5
RESERVED – DO NOT USE
8 L1–3 OUTPUT 3 7
RESERVED – DO NOT USE
10 NOT USED 9
12 L1–4 OUTPUT 4 11
AO:005/04
TO 06–29
AUXILIARY VALVE 1
14 L1–5 OUTPUT 5 13
AO:005/05
TO 06–31
AUXILIARY VALVE 2
16 L1–6 OUTPUT 6 15
RESERVED – DO NOT USE
18 L1–7 OUTPUT 7 17
RESERVED – DO NOT USE
20 NOT USED 19
22 L1–10 OUTPUT 10 21
AO:005/10
TO 08–26
MICRO INCH 1
24 L1–11 OUTPUT 11 23
AO:005/11
TO 08–27
MICRO INCH 2
26 L1–12 OUTPUT 12 25
RESERVED – DO NOT USE
28 L1–13 OUTPUT 13 27
RESERVED – DO NOT USE
30 NOT USED 29
(01–15,*,*,*)
(01–19,*,*,*)
(01–15,06–10,*,*)
CONTROLLER OK–917CR
32 L1–14 OUTPUT 14 31
AO:005/14
CROW BAR RELAY–918CR
34 L1–15 OUTPUT 15 33
AO:005/15
SEAL RELAY–919CR
36 L1–16 OUTPUT 16 35
AO:005/16
38 L1–17 OUTPUT 17 37
40 NOT USED 39
108L1


1771–OD16 120VAC ISOLATED OUTPUT
RACK B00
MODULE GROUP 5
2 L1–0 OUTPUT 0 1
4 L1–1 OUTPUT 1 3
6 L1–2 OUTPUT 2 5
8 L1–3 OUTPUT 3 7
10 NOT USED 9
12 L1–4 OUTPUT 4 11
14 L1–5 OUTPUT 5 13
16 L1–6 OUTPUT 6 15
18 L1–7 OUTPUT 7 17
20 NOT USED 19
22 L1–10 OUTPUT 10 21
24 L1–11 OUTPUT 11 23
26 L1–12 OUTPUT 12 25
28 L1–13 OUTPUT 13 27
30 NOT USED 29
32 L1–14 OUTPUT 14 31
34 L1–15 OUTPUT 15 33
36 L1–16 OUTPUT 16 35
38 L1–17 OUTPUT 17 37
40 NOT USED 39
BO:005/00
TO 06–08 CLUTCH 1 VALVE
BO:005/01
TO 06–09 CLUTCH 2 VALVE
RESERVED – DO NOT USE
RESERVED – DO NOT USE
BO:005/04
TO 06–05 AUXILIARY VALVE 1
BO:005/05
TO 06–07 AUXILIARY VALVE 2
RESERVED – DO NOT USE
RESERVED – DO NOT USE
BO:005/10
TO 08–02 MICRO INCH 1
BO:005/11
TO 08–03 MICRO INCH 2
RESERVED – DO NOT USE
RESERVED – DO NOT USE
CONTROLLER OK–941CR
BO:005/14
(01–15,*,*,*)
CROW BAR RELAY–942CR
BO:005/15
(01–21,*,*,*)
SEAL RELAY–943CR
BO:005/16
(01–15,06–34,*,*)
09–23
105L2
CLUTCH 1 – 925SOL
CLUTCH 2 – 926SOL
AUXILIARY VALVE 1 – 931SOL (OPTIONAL)
AUXILIARY VALVE 2 – 932SOL (OPTIONAL)
MICRO INCH 1 – 936SOL (OPTIONAL)
MICRO INCH 2 – 937SOL (OPTIONAL)
09–25
09–26
09–27
09–28
09–29
09–30
09–31
09–32
09–33
09–34
09–35
09–36
09–37
09–38
09–39
09–40
09–41
09–42
09–43
09–44
09–45
09–46
09–47
09–48
ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY
GROUNDED SYSTEM I/O WIRING
RACK A00 GROUP 5
RACK B00 GROUP 5
CUST
DWN TLD
DATE 05–26–95
DWG NO E–40001797–A0
DWG REV B
SHEET 9 OF 9
CAD

Notes

Rockwell Automation

Allen-Bradley

Allen-Bradley, a Rockwell Automation Business, has been helping its customers improve productivity and quality for more than 90 years. We design, manufacture and support a broad range of automation products worldwide. They include logic processors, power and motion control devices, operator interfaces, sensors and a variety of software. Rockwell is one of the world's leading technology companies.

Worldwide representation.

Argentina • Australia • Austria • Bahrain • Belgium • Brazil • Bulgaria • Canada • Chile • China, PRC • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic • Denmark • Ecuador • Egypt • El Salvador • Finland • France • Germany • Greece • Guatemala • Honduras • Hong Kong • Hungary • Iceland • India • Indonesia • Ireland • Israel • Italy • Jamaica • Japan • Jordan • Korea • Kuwait • Lebanon • Malaysia • Mexico • Netherlands • New Zealand • Norway • Pakistan • Peru • Philippines • Poland • Portugal • Puerto Rico • Qatar • Romania • Russia–CIS • Saudi Arabia • Singapore • Slovakia • Slovenia • South Africa, Republic • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • United Arab Emirates • United Kingdom • United States • Uruguay • Venezuela • Yugoslavia

Allen-Bradley Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444

Publication 6556-6.5.1 – October 1996
Supersedes Publication 6556-6.5.1 – October 1995

PN 955128-04