Allen-Bradley

User Manual

Omega Series Configurable Press Control System

(Cat. No. 6556-SCBK3 and 6556-SCBK3DC)

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.

Using This Manual

Manual Objectives

This manual describes how to apply the 6556-SCBK3 or 6556-SCBK3DC Clutch/Brake (C/B) Control Kit, including Programmable Limit Switch (PLS) and Die Monitor (DM) functions to your mechanical stamping press. The manual helps you install, test, and operate the control.

Other Required Publications

To complete the installation of this clutch/brake control system, you will need to use these publications, some of which accompany other Rockwell Automation products in the system:

To Do This:	Use this Publication	Pub #
complete the overall installation	Omega Series Configurable Press Control System (this manual)	6556-6.5.11
use PanelView 600 Operator Interface to set up and operate the system	Clutch/Brake PanelView 600 Operating Instructions	6556-5.8
wire the control system	ac or dc Wiring Drawings (6556503 and 6556503DC)	6556-2.15
understand the non–programmable aspect of your SLC 5/03 processors	Read This First	6556-6.5.11 RN1
mount the I/O chassis	Modular Chassis Install Instructions	1746-5.8
install the system power supply	Power Supply Install Instructions	1746-5.1
install the isolated link coupler	Link Coupler Install Instructions	with coupler
install digital I/O modules	I/O Module Install Instructions	1746-5.3
install the resolver		with resolver
install the resolver input module		with module
install the tonnage module (optional)		with module
install the analog I/O module (optional)		with module

Qualifications for Applying this Product

Only qualified installers should apply this control to a mechanical stamping press. We assume that the installation team includes:

- professional stamping press builder or re-builder, knowledgeable in press control and press-control standards
- technician, skilled in installing electronic control equipment

Recommendation to Help You Install the System

The descriptions of operation of this control system and its associated resolver, die monitor (DM) and programmable limit switch (PLS) functions are important to understanding how this system works. We recommend that you review and understand the Overview (chapter 1) before starting to install this system. You may also want to browse through this manual, the wiring drawings, and the PanelView 600 Operating Instructions before starting this project.

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.

Term	Definition
ACAM anti-repeat RCLS	a device designed to limit press operation to a single cycle if the actuating means is held actuated.
bottom position	the part of the press cycle where the dies are closed
BCAM brake monitor RCLS	a device designed to prevent the next stroke if stopping time or distance exceeds a preset
buttons	palm-type pushbutton switches used by an operator for starting and stopping the press
clutch/brake valve	the main valve that controls the flow of air to the clutch/brake mechanism
continuous mode	the mode where the control maintains continuous stroking after an operator starts the press
DM die monitor	a combination of switches and logic used to protect automation machinery and stamping dies from damage if/when a part deviates from its intended path thru a sequence of progressive dies
downstroke zone	the part of the press cycle when the press travels from near-top zone (through bottom) to the upstroke zone
fault detection for valves	*internal:* valve is designed to turn itself off when it faults.
grounded ac power	ac power distribution where the “L2” side of the ac line is grounded
inch mode	a mode that lets an operator move the press incrementally by pressing and releasing run-station buttons
near top zone	the part of the press cycle when the press is at the top of its stroke
PLS programmable limit switch	a switch, synchronized with the rotary position of a crankshaft, to cycle an output on/off at precise positions
RCLS - rotary cam limit switch	a switch that rides a rotating cam to provide information on the position of the press crankshaft
resolver	an electro-mechanical device that precisely monitors the angular position of a rotating shaft
run station	a press operator’s point of operation that typically contains a pair off pushbuttons to start or stop the press
single-stroke mode	a mode that allows the operator to run one complete press stroke, usually started at the top
SLC™ small logic controller	a Rockwell Automation (Allen-Bradley) programmable controller
solenoid valve	an on/off electrically-driven valve
TCAM takeover RCLS	a device designed to allow upstroke without the operator holding the run/inch buttons
top stop	a command designed to stop the press at the top of its stroke
upstroke zone	the part of the press cycle when the press travels from the end of downstroke to the near-top position

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Overview

Chapter Objective

The purpose of this chapter is to acquaint you with your Allen-Bradley Clutch/Brake Control (cat. no. 6556-SCBK3 or -SCBK3DC). Topics include:

- Contents of the kit 1
- About this control system 2
- Control by redundant processors 3
- Link couplers 3
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Contents of the Kit

Clutch/brake control kit (cat. no. 6556-SCBK3 or -SCBK3DC) includes:

Hardware Included		for -SCBK3	for -SCBK3DC	Hardware *That You Provide*
SLC-5/03	(2)	1747-L532	1747-L532	Input Switches and Run Stations (application dependent)
Link Coupler (DH-45)	(2)	1747-AIC	1747-AIC	Rotary Cam Limit Switche (1, if used)
Power Supply	(2)	1746-P2	1746-P2	Resolver (minimum of 1)
7-slot I/O Chassis	(1)	1746-A7	1746-A7	Resolver Input Module (minimum of 1)
10-slot I/O Chassis	(1)	1746-A10	1746-A10	Solenoid Valves (4) with Internal Fault Detection
Input Module	(4)	1746-IA16 (ac)	1746-IB16 (dc)	Operator Interface (1) PanelView 600 (6556-SPV600)
Input Module	(1)	1746-ITV16	1746-ITV16	Tonnage Module (optional, 2 max)
Output Module	(2)	1746-OA16	1746-OB16	Analog I/O Module (1, optional)
Relay Output Module	(2)	1746-OX8	1746-OX8	
Relays	(4)	700-P400A1	700DC-F310Z24	

Important: The purchase of this kit includes the license to use this control on *one* stamping press.

About This Control System

This is a pre-programmed SLC-based control system that provides for:

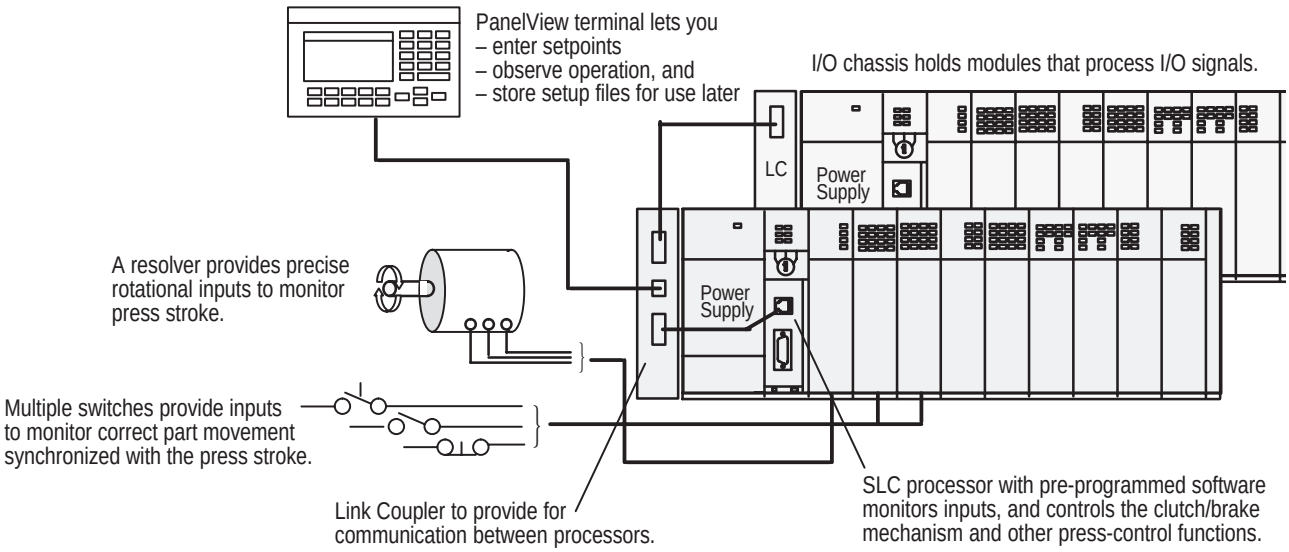
- Clutch/brake Control – for controlling a mechanical stamping press

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

- Die Monitoring – permissives designed to monitor the proper progression of the part and to prevent the die from closing upon detecting a part mis-alignment or mal-function of part transfers
- Programmable Limit Switches – that you use to turn outputs on or off at precise crankshaft positions synchronized with crankshaft rotation monitored by a resolver
- Tonnage Monitoring – optional modules to accept strain-gage inputs to monitor the pressure generated on the stamped part
- Other features
  – diagnostics for SLC-based troubleshooting
  – recipe management for storing up to 20 setups
  – production monitor for indicating progress during a production run
  – lube for automatic or manual lubrication of the press

This SLC-based control system consists of:

- two SLC 5/03 processors with factory-installed control software
- two I/O chassis with input and output modules
- two link couplers for inter-processor communication
- PanelView Operator Interface Terminal



Control by Redundant Processors

This clutch/brake control uses two independent SLC 5/03 processors, one in chassis A and the other in chassis B. Both processors monitor all clutch/brake I/O and exchange information about machine status. They are linked by hardwired I/O and a pair of Link Couplers (1747-AIC), 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.

Link Couplers

Link couplers (cat. no. 1747-AIC) provide communication between processors in chassis A and B. They also provide communication between the PanelView 600 Operator Interface and both processors. For additional information, refer to wiring drawings, sheet 4, and the instructions that accompanied the link couplers.

Protected Memory in SLC 5/03 Processors

The logic of this control is pre-programmed and burned into processor memory at the factory. It cannot be changed except by return to Allen-Bradley. You cannot program these clutch/brake processors.

Modes of C/B Operation

An operator can select the mode of clutch/brake operation with a selector switch located on a control panel. In accordance with ANSI B11.1 Section 4.12.4.1, the selection of operating mode must be lockable.

This Mode:	Lets the Operator:
Off	Disable operation of the clutch/brake control when the press is not in operation.
Inch	Jog the press through through successive parts of the cycle by pressing and releasing the pair of run/inch buttons. If the buttons are held, the press will stop at the top of its stroke.
Single-stroke	Run the press through one complete cycle by holding both run/inch buttons until completion of the down stroke.
Continuous	Run the press continuously until stopped by a stop-on-top command, or until a fault is detected. To start the press, you press the ARM CONTINUOUS switch and then press the pair of run/inch buttons within five seconds.

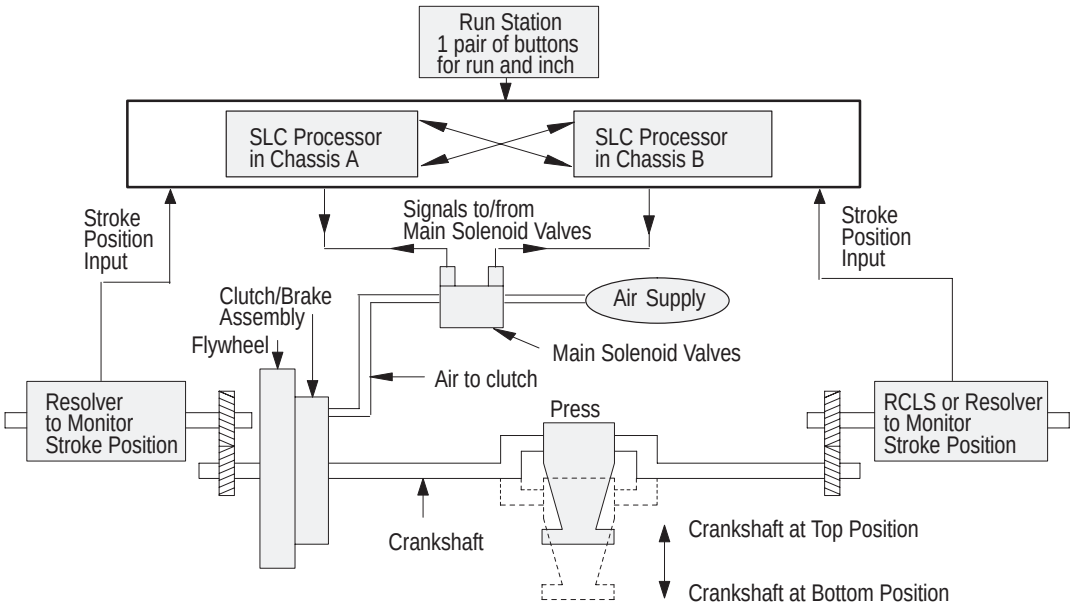
C/B Control Functions

Clutch/brake control functions are summarized in the following table.

Control Function:	Operating Mode:	Description:
Stop-on-top (cycle stop)	Continuous	Lets the operator stop the press at top of stroke
Interrupted stroke	Single or Continuous	Lets the operator stop the press by releasing a run/inch button during downstroke.
Anti-tie-down	All	Prevents the press from starting a new stroke if the control detects that an operator has tied down the run/inch buttons. After run/inch buttons are released, the operator must press both buttons at the same time.
Anti-repeat	Single-stroke or Inch	Limits press operation to a single stroke, even if the operator continues to press both run/inch buttons. The operator must release and press them again to start the next stroke.
Motion detector	Single or Continuous	Detects press motion from a hardware or software input.
Brake Monitor	All	Prevents restarting the press when the control detects an over-travel condition.

Functional Block Diagram

The functional block diagram in shows the relationships between mechanical components of a stamping press and the C/B control.



Resolvers

The control system requires at least one resolver and resolver input module to precisely monitor the crankshaft's rotational position for clutch/brake control and PLS operation. We recommend the following, purchased separately:

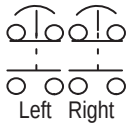
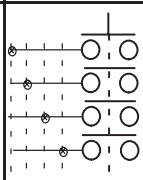
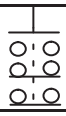
- resolver: Rockwell Automation 846–SJDN1CG–R3
- resolver input module: Helm HM571–RES

Rotary Cam Limit Switches

You may use a rotary cam limit switche as the redundant input to monitor the crankshaft's position. We recommend Allen-Bradley Cat. No. 803-P775 that you purchase separately.

Panel Switches and Input Switches

The clutch/brake control requires the panel and input switches listed below. You purchase them separately.

Device	Symbol	Purpose	Type	Allen-Bradley Type	Qty
Palm Buttons for Run Station		Lets press operators start the press Assures 2-hand operation Note: Position run/inch buttons at least 24" apart., and the run station 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	1 pair
Stop on Top		Stops press at top during continuous stroking No effect in single mode	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 Single Continuous	Rotary, 4-position key lockable	800T-N61KF4C	1
Arm Continuous		Lets you begin a timed interval within which 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 Clutch/Brake air pressure. Note: Switch must be ON to engage the clutch.	N.O. single throw from pressure switch	Pressure Switch 836-C8JX321	1
Motion Detector Interlock		Detects if motion is stopped in single or continuous mode.	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 on power up or after E-stop.	Momentary pushbutton triple contact 1 N.O. and 2 N.C.	800T-A2B	1

C/B Outputs

The clutch/brake control has two pairs of outputs from each I/O chassis (chassis A and B) for your clutch/brake valves.

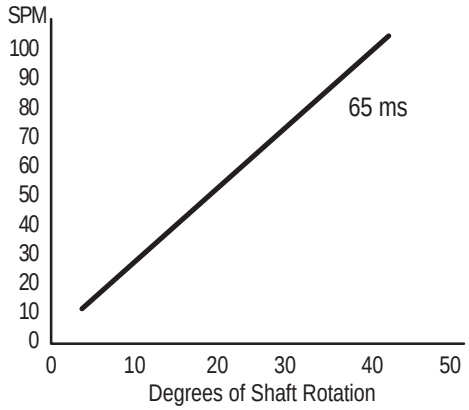
The control is designed to operate with valves that have *internal* fault detection. There are no inputs for valve-stem feedback.

C/B 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:

Device:	Delay (ms):
Input Module 1746-IA16 response time	45
Processor scan of C/B code (2k words)	10
Output Module 1746-OX8 switching time	10
Total worst-case response time	65

The number of degrees that the shaft continues to rotate beyond the moment at which 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 is applied. We graphed the degrees of shaft rotation vs press speed for a response time of 65 ms.



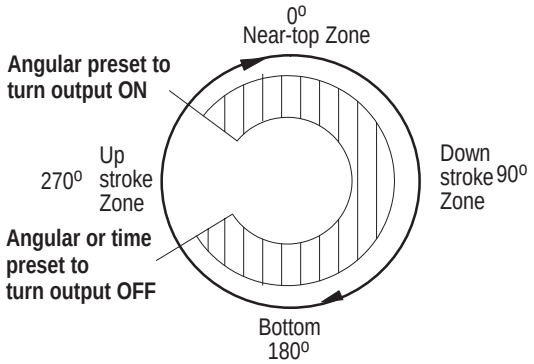
Important: When estimating the braking distance in degrees of rotation, you must add the rotation occurring during system response time to the specified downstroke braking distance. (For example, at 100 SPM, the shaft rotates 39º during a 65 ms system response time plus the braking distance.)

Programmable Limit Switch (PLS)

The Allen-Bradley Programmable Limit Switch is factory-programmed ladder logic that lets you time or sequence outputs according to precise and repeatable positions of a crankshaft. Crankshaft positions are monitored by a resolver. You can use PLS outputs to integrate auxiliary press machinery such as lifters, grippers blow-off valves, and inter-press automation into your stamping press control system. (See chapter 3 for wiring PLS outputs.)

How a PLS Channel Works

Using the PanelView 600 Operator Interface, you preset the rotational position (preset angle) at which you want the PLS output to turn ON. You also select how you want the PLS output to turn OFF: by preset angle or preset time. The output module in chassis A, slot 4 controls the outputs to your application.



Then, you can select your application-specific PLS output to trigger:

- part movement between presses in a transfer line
- die automation devices such as grippers and lifters
- monitoring correct part movement with a DM track function

Die Monitoring (DM)

Allen-Bradley Die/Automation Monitoring is factory-programmed ladder logic designed to let you monitor a variety of conditions synchronized with the rotation of a stamping press crankshaft. The logic is designed to detect the absence, mis-alignment, or unwanted presence of material moving through an automated stamping process. Crankshaft positions are monitored by a resolver. (See chapter 3 for wiring DM inputs.) You enter setups with the PanelView PV600 Operator Interface. The software and associated hardware:

- monitor a variety of logical inputs to detect deviant conditions
- set a fault upon detection of a deviant condition

You select whether the fault automatically initiates a warning, stop-on-top, stop-now condition, or whether the fault is ignored.

How a DM Channel Works

You select one of several operational modes for a DM input, such as:

- cyclic
- in-position
- transfer
- static

As long as the logic detects expected conditions, no action is taken. When the logic detects a deviant condition, it sets a fault.

For example, in cyclic mode an input switch is expected to close within a preset zone of rotation that we call a window.

Cyclic Mode Transition Diagram	Expected Transition Occurs Within Window	Input is NOT ALLOWED When Sensor:	Which Results in a Fault SIGNAL Sent After:
	Sensor turns ON then OFF within window a-b (Pulse-type signal)	1. stays ON beyond the window	window goes OFF
		2. turns ON outside the window	sensor turns ON
		3. remains OFF for the cycle	next window goes ON

You can use a DM input to monitor:

- an individual station for a part in correct position (in-position mode)
- a sequence of stations for the progression of a part (transfer mode)

The software provides up to 16 DM selectable input channels. You connect DM inputs to the 1746-ITV input module in chassis A, slot 6.

Tonnage Monitoring

The optional tonnage monitor lets you view either two or four tonnage points upon each closure of the die. The PanelView 600 Operator Interface displays a set of tonnage screens that lets you:

- set up and calibrate tonnage channels
- view absolute tonnage and deviation from benchmark tonnage with each closure of the die
- set alarms to indicate when detected tonnage exceeds upper or lower limits

We recommend the following tonnage monitor, purchased separately:

- tonnage input module: Helm HM604–TSM
- tonnage sensors and secondary calibration standard, also from Helm

Related Safety Information

You are responsible for the safety of the installed press control, and for meeting all applicable laws, codes, and safety requirements. This control deals only with electrical control portions of the C/B mechanism.

ATTENTION: The installer of this control must follow 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-curtain 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.

Specifications for the Clutch/Brake Control

Type of processors
pair of SLC 5/03 processors
(preprogrammed, non-programmable)

Type of power
grounded ac (6556-SCBK3)
dc (6556-SCBK3DC)

C/B mode selections
off
inch
single stroke
continuous

Valve outputs
two clutch/brake valves

Type of valves
internal fault detection

Position monitoring inputs
at least one resolver input, and
one additional resolver, or
one additional rotary cam limit switch assembly

Response time
65 ms worst case
from switched input to turned-OFF output

Machine inputs
top stop
E-stop
run station (1)
mode select (rotary switch)
clutch/brake air pressure
motor forward interlock
motion detector interelock
arm for continuous on demand
control reset
C/B power reset

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
NFPA No. 79

Specifications for Programmable Limit Switches and Die Monitoring

Programmable Limit Switches	
Number of PLS channels	8
Channel input preset range	0-359°
Channel output response turn OFF based on choice of	0-359° or time (ms)

Die Monitoring	
Number of DM channels	16
Operating Modes	cyclic in-position transfer static
Output responses	warning stop on top stop now ignore

Quick Start

Use this chapter as an abbreviated procedure for getting setting up the clutch/brake control, PLS and/or DM functions; or as an overview if you need more information.

Procedure for Clutch/Brake Control

1.	Verify That You have All of the Hardware Shipped in the Kit	this manual chapter 1

Hardware Included	for -SCBK3	for -SCBK3DC	Hardware *That You Provide*
• SLC-5/03 (2) • Link Coupler (DH-45) (2) • Power Supply (2) • 7-slot I/O Chassis B (1) • 10-slot I/O chassis A • Input Module (4) • Output Module (2) • Relay Output Module (2) • Relays (4)	1747-L532 1747-AIC 1746-P2 1746-A7 1746-A10 1746-IA16 (ac) 1746-OA16 1746-OX8 700-P400A1	1747-L532 1747-AIC 1746-P2 1746-A7 1746-A10 1746-IB16 (dc) 1746-OB16 1746-OX8 700DC-F310Z24	• Input Switches & Run Station (Application Dependent) • Resolver and resolver input module (minimum of one set) • Rotary Cam Limit Switch assembly (one set if used) • Solenoid Valves (4) with Internal Fault Detection • PanelView 600 Operator Interface (6556-SPV600)

2.	Mount the I/O Chassis	publication 1746-5.8

3.	Install the Power Supply	publication 1746-5.1

4.	Install the Link Coupler	instructions in LC box

5.	Install SLC Processors and I/O Modules for Chassis A and B	publication 1747-6.2

Important: You must identify Processor A (by its label), and install it in the 10-slot chassis A. Installing the wrong processor in chassis A or B will result in a processor fault at power up.

Slot	Chassis A (10-slot)	Chassis B (7-slot)
0	SLC 5/03 Processor A 1747-L532	SLC 5/03 Processor B 1747-L532
1	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)
2	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)
3	Resolver Input Module (required)	Resolver Input Module (optional)
4	Output Module 1746-OA16	Output Module 1746-OB16
5	Isolated Relay Output Module 1746-OX8	Isolated Relay Output Module 1746-OX8
6	Input Module for Die Monitor 1746-ITV16	optional I/O Module 1746-NIO4V for: – auto counterbalance – variable-speed press drive – shut-height adjustment
7	spare	
8	optional Tonnage Module Helm HM579-TSM	
9	optional Tonnage Module Helm HM579-TSM	

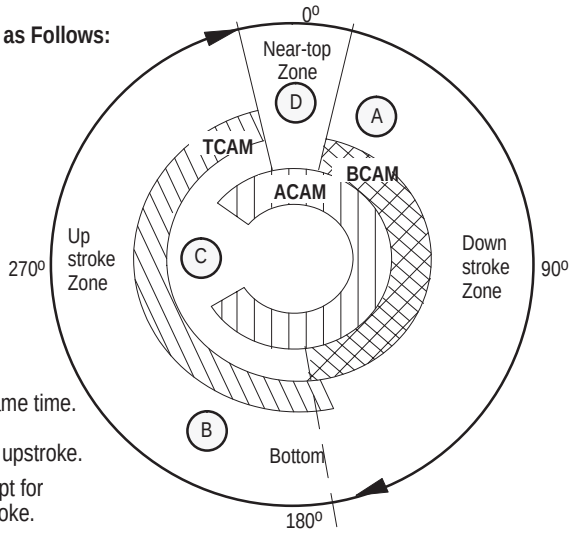
6.	Install C/B Input Switches and the Resolver (You wire them in step 9.)	n/a

Description:	Type:
run station, inch/run	palm button
E-stop	
mode selection	rotary, key-lockable
top stop	push button
arm continuous	
E-stop reset	
C/B power reset	
main motor forward	N.O. single contact
motion detector	
air pressure	
resolvers or resolver & RCLS	See chapter 1.

7.	Set Up (if used) or Simulate Rotary Cam Limit Switches	this manual chapter 1

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.

Dual sets of contacts need not cycle at same moment. An offset of up to 1 second is acceptable.

Important: See press manufacturer's recommendations for on/off settings of ACAM, BCAM, and TCAM switches.

8.	Connect the Cables	this manual chapter 3

You must make the cable that connects the two link couplers. See the Installation Instructions that accompanied the link coupler for the terminations. The cable uses a pair of 6-pin phoenix connectors.

Use this cable:	to connect:	notes:
that you make	between link couplers in chassis A and B	see coupler installation instructions
1747-C11	Link coupler to the SLC processor	came with the link coupler, two required

9.	Wire the I/O Modules, RCLS, and Input Switches	chapter 3 and Wiring Dwgs.

For wiring instructions, refer to chapter 3 and Wiring Drawings (publication 6556-2.15)

10.	**Test Clutch/Brake Circuits**	**chapter 4**

ATTENTION: Be sure that all C/B hardware is installed before starting this step.

11.	**Test Clutch/Brake Operation**	**chapters 5**

Procedures for Setting Up PLS and DM Channels

1.	**Familiarize yourself with PLS and DM operation.**	**Chapters 1 & 6**

2.	**If using DM, determine your DM requirements.**	**Chapter 6**

Determine the quantity of DM input channels, their modes, types of input switches, and their locations.
We provide worksheet A for your convenience.
Wire DM input switches to the 1746-ITV16 input module in chassis A, slot 6.

3.	**If using PLS, determine your PLS requirements.**	**Chapter 6**

Determine the quantity of PLS channels, turn-ON presets, and turn-OFF angle or time.
We provide worksheet B for your convenience.
Wire PLS outputs from the 16-point output module in chassis A, slot 4, pts 8-15.

4.	**Use the PanelView 600 Operator Interface to set up system configuration, DM and PLS channels, the resolver, passwords, and variable-speed compensation**	**Operating Instr. 6556-5.8**

Refer to the referenced publication for System, DM, and PLS setup procedures. They include:
– System Configuration
– Active PLS/DM setups, on line
– Recipe PLS/DM setups, offline
– System Monitoring

5.	**Test DM and PLS channels.**	**Chapter 7**

Use procedures in chapter 7 and screens described in the PanelView 600 Operating Instructions to test:
– DM and PLS channels
– resolver inputs
– transfer-mode channels

Notes:

Installing and Wiring

Chapter Objective

In this chapter, we help you install the C/B control with these steps:

- if using the dc version 1
- check hardware 1
- mount the I/O chassis 1
- install the power supply 1
- install the isolated link coupler 1
- install SLC processors and I/O modules 2
- set up rotary cam limit switches 3
- install C/B input switches and resolver(s) 5
- connect chassis cables 5
- wire your C/B control 6
- wiring considerations 7

If Using the DC Version

We provide wiring drawings (publication 6556-2.15) for two versions: grounded ac (drawing set 6556503) and dc (drawing set 6556503DC). The dc version has these changes in respect to the ac version:

- replace input module 1746-IA16 with 1746-IB16 in slots 1 and 2
- replace output module 1746-OA16 with 1746-OB16 in slot 4
- replace wiring drawing set 6556503 with 6556503DC

Check Hardware

To check the contents of the kit, refer to Contents of Kit in chapter 1. If items are missing, contact your local salesperson or distributor.

Mount the I/O Chassis

To mount the 7-slot and 10-slot I/O chassis (Cat. No. 1746-A7 and 1746-A10), refer to publication 1746-5.8, SLC 500 Modular Chassis Installation Instructions. Look for this publication in the product box.

Install the Power Supply

To install the power supply (Cat. No. 1746-P2), refer to publication 1746-5.1, SLC 500 Power Supplies Installation Instructions. Look for this publication in the box that contained the power supply. The power supply slides into card guides on the left side of the I/O chassis.

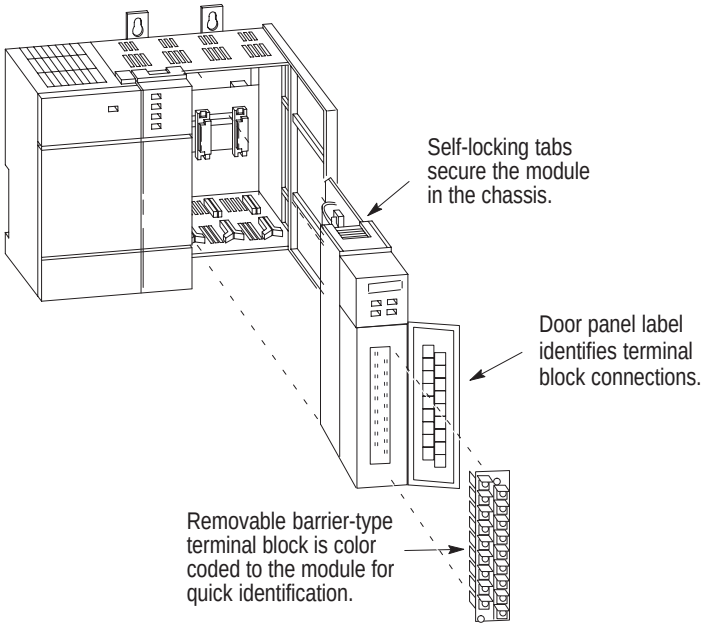
Install the Isolated Link Coupler

To install the link coupler (Cat. No. 1747-AIC), refer to publication *Installation Instructions for the SLC500 Isolated Link Coupler* shipped with it. Mount the coupler. adjacent to the power supply on the panel holding the I/O chassis. Keep the instruction sheet handy because you will use it to fabricate and connect cables.

Install SLC Processors and I/O Modules

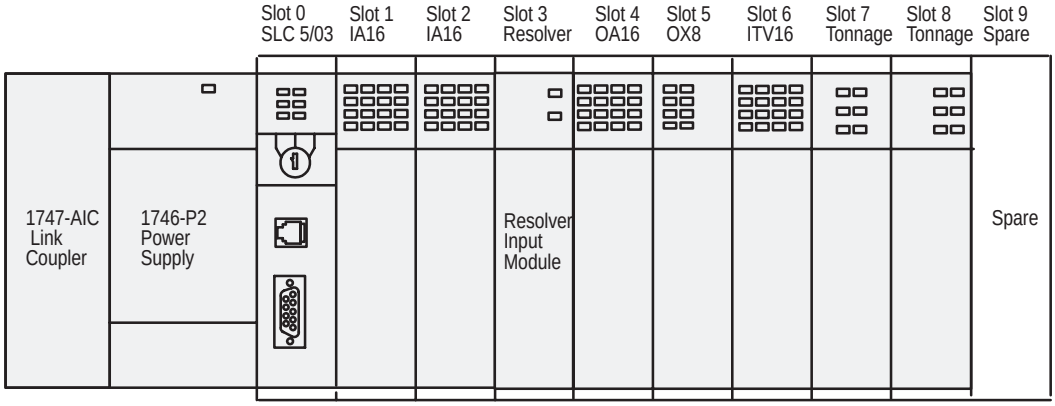
Install the SLC processors and I/O modules in designated slots of each I/O chassis A and B.

Important: You must insert the SLC processor labeled “A” into the 10-slot chassis A, and the processor labeled “B” into the 7-slot chassis B. If reversed, the processors will fault at power up.

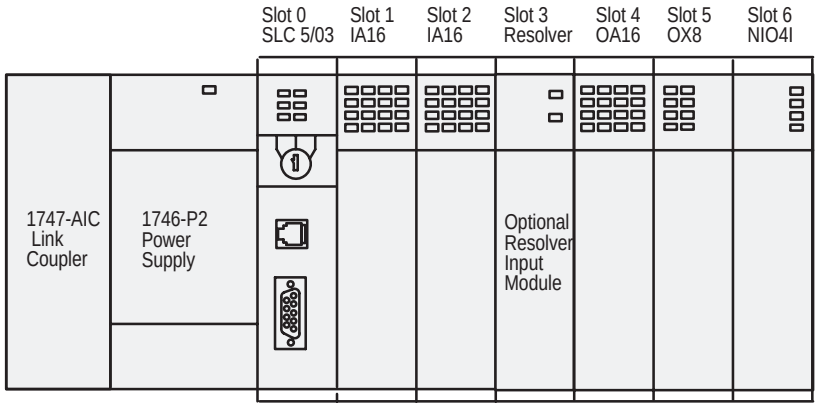


Chassis A

Slot	Description of Module	Slot	Description of Module
0	Processor A 1747-L532 SLC-5/03	5	Isolated Relay Output Module 1746-OX8
1	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)	6	Input Module 1746-ITV16
2	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)	7	Tonnage Module (optional) Helm HM579-TSM
3	Resolver Input Module (Helm HM571-RES)	8	Tonnage Module (optional) Helm HM579-TSM
4	Output Module 1746-OA16 or 1746-OB16 (dc)	9	Spare



Chassis B			
Slot	**Description of Module**	**Slot**	**Description of Module**
0	Processor B 1747-L532 SLC-5/03	4	Output Module 1746-OA16 or 1746-OB16
1	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)	5	Isolated Relay Output Module 1746-OX8
2	Input Module 1746-IA16 (ac) or 1746-IB16 (dc)	6	I/O Module 1746-NIO4I (optional)
3	Resolver Input Module (optional) Helm HM571-RES		



Set Up Rotary Cam Limit Switches

To set up (or simulate with a resolver) rotary cam limit switches, set up the cam angles for each switch assembly as described below and according to the press manufacturer's installation instructions.

Important: Mount these assemblies on opposite ends of the crankshaft so a mismatch (fault) will occur if the crankshaft breaks.

- brake-monitor (BCAM) contacts close at a point that lets the system detect an increase in braking distance
- take-over (TCAM) contacts close at bottom to let the press complete a stroke, and open during upstroke to let the press stop at the top
- anti-repeat (ACAM) contacts limit press operation to a single stroke in single-stroke mode

This Cam:	In this Mode:	With these Conditions:	Provides a Signal That:
Anti-Repeat (ACAM)	Inch or Single stroke	Cams open and close in upstroke	Prevents a second stroke in these modes
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.

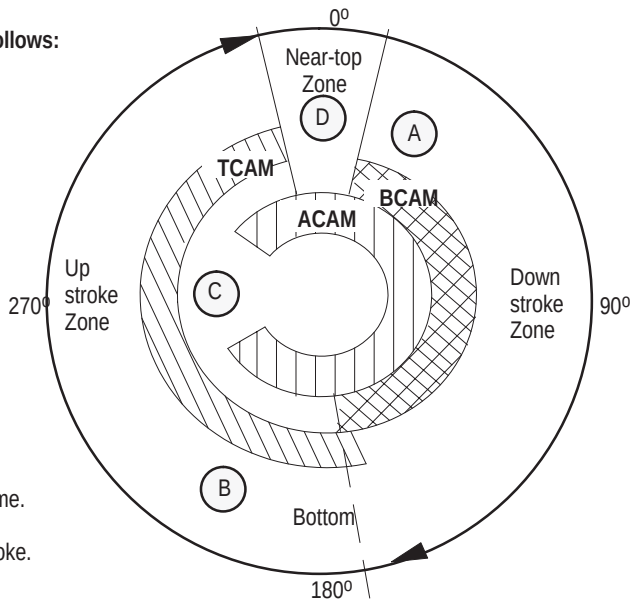
Set Up or Simulate Rotary Cam Limit Switches as Follows:

Ⓐ During downstroke, BCAM must be On.

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

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

Ⓓ 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.

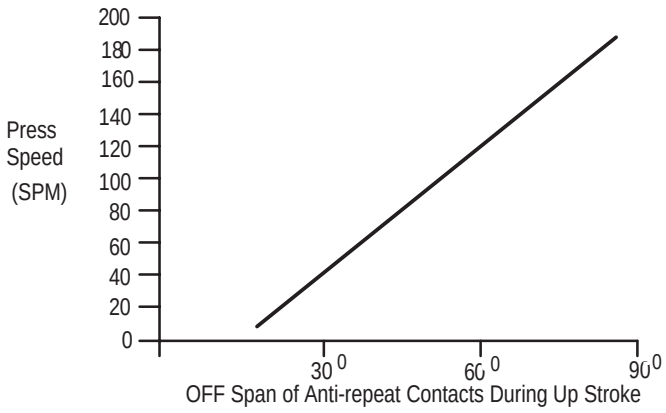
Important: See press manufacturer's recommendations for:
* Near-top Zone
* Bottom
* On/Off settings of ACAM, BCAM, and TCAM switches

As an example, we show typical ON/OFF settings for rotary cam limit switches in the following table where you can write down your initial settings.

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 stop correctly on top • before BCAM turns ON	170º 350º	
ACAM	• Remains ON for entire stroke except for an Off span during upstroke (see graph)		290º 250º	

[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).



Install C/B Input Switches and Resolver(s)

Verify that your press has the following switches, required inputs to your clutch/brake control. Refer to chapter 1 for switch specifications.

Description:	Type:
run station, inch/run	palm button
E-stop	
mode selection	rotary, key-lockable
top stop	push button
arm continuous	
E-stop reset	
C/B power reset	
main motor forward	N.O. single contact
motion detector	
air pressure	
position monitor	two resolvers, or one resolver and one RCLS assembly

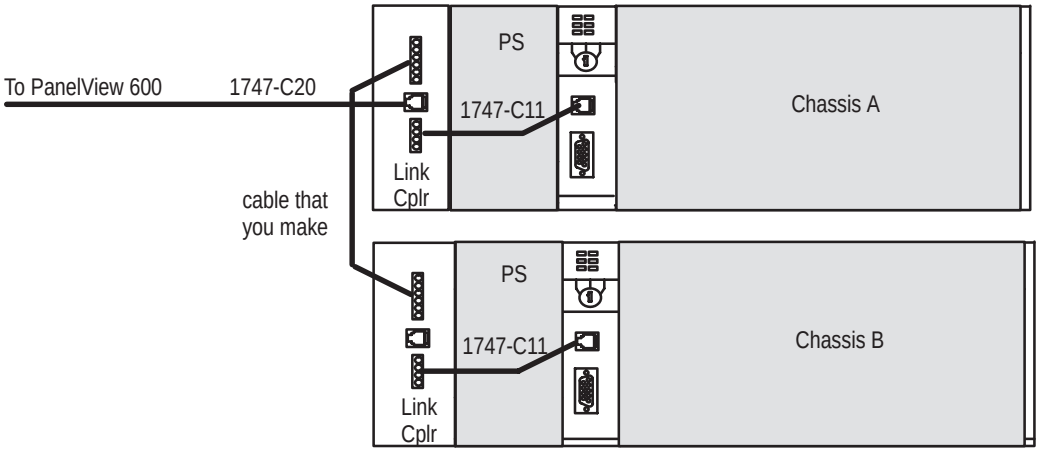
Follow manufacturer recommendations when installing the resolver(s). Mount position monitors at opposite ends of the crank-shaft axis.

If using:	Connect them as follows:
a pair of resolvers	resolver input modules in chassis A and B
one resolver and one RCLS assembly	resolver to chassis A, RCLS assembly to chassis B

Connect Chassis Cables

Connect cables as shown. You must make the cable that connects between the two link couplers. See the Installation Instructions that accompanied the link coupler for the terminations. The cable uses a pair of 6-pin phoenix connectors.

Use cable:	to connect:	notes:
1747-C11	Link coupler to the SLC processor	came with link coupler, 2 required
1747-C20	PanelView 600 to Link Coupler	came with PanelView 600
that you make	between link couplers in chassis A and B	see coupler installation instructions



Wire Your C/B Control

We provide wiring drawings (publication 6556-2.15) for the ac (6556503) and dc (6556503DC) versions of this control. Wire your I/O modules and ac or dc power distribution according to those drawings.

Inputs and outputs by I/O module and chassis slot are as follows:

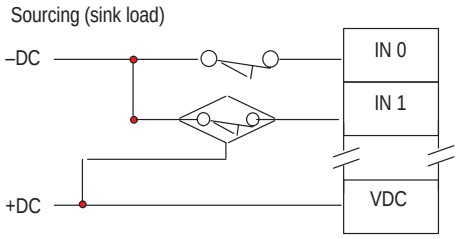
For	In I/O Chassis	See Sheet
Power distribution	n/a	1 of 14
Cabling for Link Coupler and Processor	A and B	4 and 5 of 14
Inputs to 1746-IA16 (1746-IB16) • CRM relay • main motor forward, reverse • C/B mode select • Run/Inch buttons • clutch valve 1 feedback • top stop • arm continuous • fault reset • seal relay • C/B air pressure • main motor start, stop, and reverse (feedback) • ACAM, BCAM, TCAM (chassis B, only if used)	A and B slot 1	6 of 14
Inputs to 1746-IA16 (1746-IB16) for I/O cross-checking • feedback from various relays • feedback from RCLS • heartbeat	A and B slot 2	7 of 14
Helm HM571-RES resolver input module(s) (required for chassis A, optional for chassis B)	slot 3	8 of 14
1746-OA16 terminals 0-7 for I/O cross-checking • seal relay • BCD mode • ACAM, BCAM, TCAM • clutch output ON • heartbeat 1746-OA16 pts 8-15 for PLS outputs 1746-OA16 pts 8-9 for optional counterbalance outputs	A and B slot 4 chassis A, only chassis B, only	9 of 14
1746-OX8 Outputs • clutch valve outputs and feedback • PLC OK relay and feedback • main motor forward/reverse outputs • indicator outputs	A and B slot 5	10 of 14
1746-ITV16 for DM Inputs 1746-NIO4V optional I/O module for counterbalance pressure, shut height position, and variable-speed drive	chassis A, slot 6 chassis B, slot 6	11 of 14
Helm HM604-TSM tonnage module (optional)	chassis A, slots 7, 8	12 and 13 of 14
Spare	chassis A, slot 9	14 of 14

Wire power supplies and other electrical devices according to instructions that accompanied them.

Wiring Considerations

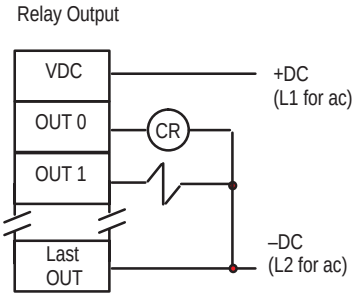
DM Inputs

Wire die monitor (DM) inputs to the 1746-ITV16 input module in chassis A, slot 6. This module sources current (the load is a sink). Connect 2-wire or 3-wire input switches as follows:



PLS Outputs

Wire PLS outputs to a 1746-OW16 relay-contact output module in chassis A, slot 4, terminals 8-15 as follows:



I/O for Automatic Counterbalance and Variable-speed Press Drive and Shut-height Adjustment

Wire these optional features to the 1746-NIO4V module in chassis B, slot 6. Wire its I/O as shown above. Module characteristics include:

# Inputs:	Input Specs:	# Outputs:	Output Range
2	0 to +10 V dc –10 to +10V dc @ –20 to +20 mA @ 16-bit resolution ± 16,384 counts 60 ms response 10Hz input filter	2	0 to +10V dc 14-bit resolution

Notes:

C/B Circuit Testing

Chapter Objective

Once you have completed the installation of your clutch/brake control and wired your I/O devices, use this chapter to check circuit wiring.

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

Otherwise, personal injury or property damage could result.

Testing Circuits and Failure-mode Operation

This section describes the following tests:

- PLC OK (failure mode) 1
- CRM Relay 2
- Seal Relay (circuit) 2
- Seal Relay (failure mode) 3
- Run/inch Buttons 3
- Stop-on-top Button 4
- Arm Continuous Button 4
- Mode Selector Switch 4
- Rotary Cam Limit Switches 4
- Resolver(s) and Resolver Input Module(s) 4

PLC OK Test (failure mode)

This test verifies the correct failure-mode operation of the PLC OK relay for chassis A. You will repeat this procedure for chassis B.

1. With power off, jumper the wired contacts of PLC OK relay (1010CR).
2. Power up.
3. Press the C/B Control Reset button to energize the CRM relay.
4. Press (and momentarily hold) the C/B Power Reset button.
5. Verify that:
   – the PLC OK relay is NOT energized (red plunger is not recessed)
   – "PLC OK Check Failed" prompt is displayed on PanelView screen
6. Shut off system power.
7. Remove the jumper.
8. Repeat steps 1-7 for chassis B (PLC OK relay 1033CR).

CRM Relay Test (circuit)

This test verifies that pressing the E-stop button will de-energize the seal and CRM relays.

1. Power up.
2. Visually and with a voltmeter, verify that:
   – CRMA relay is *not* energized
   – outputs to all press valves are Off.
3. Reset the E-Stop circuit by pressing the Control Reset button.
4. Visually and with a voltmeter, verify that:
   – CRM relay is energized
   – outputs to all press valves are Off
5. Reset control power by pressing the C/B Power Reset button.
6. With a voltmeter, verify that power rails to C/B outputs are energized.
7. Press the E-Stop button.
8. Visually and with a voltmeter, verify that seal relay and CRM relay are de-energized.

Seal Relay Test (circuit)

This test verifies that when the seal relay is off, press valves are off; and when the seal relay is on, outputs to press valves are energized.

1. Power up (if not already powered up).
2. Reset the E-Stop circuit by pressing the Control Reset button.
3. With a voltmeter, verify that:
   – seal relay is *not* energized
   – outputs to all press valves are Off
4. Reset control power by pressing the C/B Power Reset button.
5. Visually and with a voltmeter, verify that:
   – seal relay is energized
   – power rails to C/B outputs are energized
6. Shut off system power.

Seal Relay Test (failure mode)

This test verifies the correct failure-mode behavior of the seal relay.

1. With power off, place a jumper across the wired contacts of seal relay (1031CR).
2. Power up.
3. Reset the E-Stop circuit by pressing the Control Reset button.
4. Verify that:
   – the seal relay is NOT energized (red plunger is not recessed)
   – PLC OK relay is energized (red plunger is recessed)
   – "Seal Relay Weld Fault" prompt is displayed on PanelView screen
5. Shut off system power and *remove* the jumper.
6. Restore system power.
7. Reset control power by pressing the C/B Power Reset button.
8. Verify that:
   – CRM relay is energized (red plunger is recessed)
   – there is NO fault message
9. Press (and momentarily hold) the C/B Power Reset button.
10. Verify that the seal relay is energized (red plunger is recessed)
11. Shut off system power.

Test Run/Inch Buttons (run station)

Test the wiring of Run/Inch buttons by observing LEDs in slots 1 and 2. Check each OK? box after verifying that the LED indication is correct.

For This Condition	Slot 1 Input LED Is OFF	Slot 1 Input LED Is ON	OK?	Slot 2 Input LED Is OFF	Slot 2 Input LED Is ON	OK?
Right Run/Inch button is *pressed*	A, Input 5				B, Input 5	
Left Run/Inch button is *pressed*	B, Input 5				A, Input 5	
Both Run/Inch buttons *not* pressed		A & B, Input 5		A & B, Input 5		

Test Top Stop and Arm Continuous Buttons

Test the wiring of these buttons by observing input LEDs in slot 1. Check each OK? box after verifying that the LED indication is correct.

For This Condition	Slot 1 Input LED Is OFF ON	OK?
Top Stop *not* pressed	A & B, Input 7	
Top Stop pressed	A & B, Input 7	
Arm Continuous *not* pressed	A & B, Input 8	
Arm Continuous pressed	A & B, Input 8	

Test Mode Selector Switch

Test the wiring of this switch by observing input LEDs in slot 1. Check each OK? box after verifying that the LED indication is correct.

For This Mode-select Position	Slot 1 Input LEDs Are OFF	Slot 1 Input LED Is ON	OK?
Inch (input 2)	A & B: Inputs 2, 3, 4 except for the selected input	A & B, only the selected input	
Single (input 3)			
Continuous (input 4)			

Test Rotary Cam Limit Switches

Test the wiring of the RCLSs by observing input LEDs in slots 1 and 2. Check each OK? box after verifying that the LED indication is correct.

For This Condition	Slot 1 Input LED Is OFF ON	OK?
ACAM, BCAM, TCAM at rest	B, Inputs 13, 14 B, Input 15	
ACAM, BCAM, TCAM actuated	B, Inputs 13, 14 B, Input 15	

Test Resolver(s) and Resolver Input Module(s)

Test the wiring of the resolver(s) according to instructions from the manufacturer.

Testing C/B Operation

Chapter Objective

Once you have checked the wiring of your clutch/brake control, use this chapter to test its operation. Tests include:

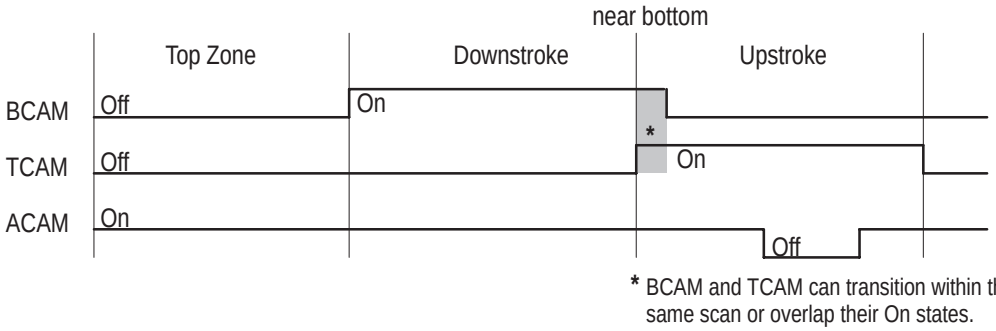
- troubleshoot the setup of your RCLS assemblies 1
- tests the operating modes 2
- test the switches 3

Troubleshooting the Setup of Your RCLS Assemblies

We recommend that you test the rotary cam limit switches (RCLS) in Inch mode. The processor monitors RCLS signals to ensure that the motion progresses through the correct sequence of:

- downstroke
- upstroke
- top zone

During each stroke, rotary cam limit switches must cycle through these zones.



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

Important: The software reads the zones according to the on/off status of ACAM, BCAM, and TCAM switches that you set mechanically. When the software detects any one of the following fault conditions, it is designed to turn outputs off and set the corresponding PanelView messages for detected fault conditions.

Use the following look-up table to take corrective action.

Processor Faults

Msg #	PanelView 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 near top to downstroke.		
028*	Forward Transition from Downstroke	Software/hardware cams did not enter upstroke.		
029*	Forward Transition from Upstroke	Software/hardware cams did not enter near top zone.		
033*	Forward Shaft Position Transition Faults	Any of 027-029 detected.		
034*	ACAM Upstroke	ACAM did not cycle in upstroke.		
041*	BCAM Mismatch Between Processors	One processor sees the BCAM while the other does not.		
042*	TCAM Mismatch Between Processors	One processor sees the TCAM while the other does not.		
043*	ACAM Mismatch Between Processors	One processor sees the ACAM while the other does not.		
044*	Cam Mismatch Faults	Any of 041-043 detected.		
046*	Brake Monitor Fault	On a top-stop command, the press slid onto BCAM before stopping.	Press cannot operate in single or continuous mode.	Check the brake and brake monitor cam settings.

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

Test the Operating Modes

Here are procedures to test dynamic operation of the press in these modes:

- inch
- single-stroke
- continuous with the arm-continuous method to start this mode

Important: If the press control faults or does not operate as expected, read the fault or prompt message and see Appendix B for:

- faults for troubleshooting
- prompts for operating the press

Inch Mode

1. Place the mode selector switch in inch mode.
2. Power up by pressing the Control Rest and C/B Power Reset buttons.
3. Verify that seal relays and CRM relays are energized.
4. Concurrently, press and hold both run/inch buttons.
5. Observe that the press cycles and stops on top.
6. Release the run/inch buttons and press again for 1-2 seconds.
7. Observe that the press cycles until you release a button, then stops.

Single-stroke Mode

1. Place the mode selector switch in single-stroke mode.
2. Press and hold run/inch buttons for more than 1/2 stroke.
3. Observe that the press cycles and stops on top.
4. Release run/inch buttons and press again. Then release in downstroke.
5. Observe that the press stops immediately.
6. Bring the press to top by pressing run/inch buttons and release in upstroke.
7. Repeat steps 2 and 3. This time hold run/inch buttons for the entire cycle.
8. 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/inch 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. Return to step 2 and press the Arm continuous button. This time, wait for 5 seconds (or until the Arm-continuous timer has timed out) before pressing run/inch buttons.
8. Observe that the press does not start.
9. Repeat steps 2 through 6 for a final verification.

Test the Switches

Test the following switches with an operating clutch/brake control:

- C/B air pressure
- motion detector
- main motor forward

C/B Air Pressure Switch

1. Remove the C/B air pressure switch input from chassis A at slot 1 – terminal 12.
2. Place the mode selector switch in single-stroke mode.
3. Attempt to start the press and observe that it does not start.
4. Reconnect the air pressure switch input to chassis A (step 1).
5. Remove the switch input from chassis B (slot 1 – terminal 12) to repeat the test.
6. Attempt to start the press and observe that it does not start.
7. Reconnect the air pressure switch input to chassis B (step 5).

Motion Detector Switch

1. Remove the motion detector switch input from chassis B at slot 2 – terminal 0.
2. Place the mode selector switch in single-stroke mode.
3. Start the press and observe that it stops before reaching bottom. If the press reaches bottom, the circuit is not functioning correctly.
4. Reconnect the motion detector switch input to chassis B.

Main Motor Forward Switch

1. Remove the main motor forward switch input from chassis A at slot 1 – terminal 11.
2. Place the mode selector switch in single-stroke mode.
3. Attempt to start the press and observe that it does not start.
4. Reconnect the main motor forward switch input.
5. Remove the switch input from chassis B (slot 1 – terminal 11) to repeat the test.
6. Repeat steps 3 and 4.

Determining Your DM and PLS Requirements

Objectives

This chapter helps you:

- select DM operating modes 1
- apply DM “windows” 2
- select DM output responses 3
- use DM worksheet 3
- select PLS operating modes 5
- use PLS worksheet 5

Important: For instructions on using PanelView 600 screens to configure DM and PLS channels, refer to the panelView 600 Operating Instructions (publication 6556-5.8).

Operation of DM Modes

The purpose of DM channels is to verify that predictable conditions in your press operation take place. When the software detects a fault condition, it sets a selected output response. You select the type of mode for each channel from the following:

- cyclic
- in-position
- transfer
- static

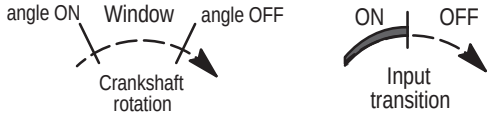
Use the following table to help you select the types of channel modes required for your application.

When Input Signals Are:	We Call This Mode:	Used, For Example To:
Synchronized with crankshaft rotation, and detected within a zone or rotation (window)	Cyclic or In-position	detect parts in position, or parts ejected
Synchronized with crankshaft rotation as parts are moved through multiple transfer locations	Transfer	verify the progression of the part from one transfer location to the next
Independent of press stroke	Static	detect the end of stock

Definition of Window and Description of Modes

Window Input signals for Cyclic (CYC) and In-position (POS) modes are synchronized with the rotation of the crankshaft, and must be detected within a zone of crankshaft rotation. We call this zone a window. For example, a part-detect signal could be expected within a window of 80-110^{o} to indicate that a part was inside a die before it was hit by a stroke.

When the software detects input signals that are different from those described here, the software generates a fault signal. We graphically define these (window) inputs as follows:



Cyclic (CYC) Use this mode to verify that a pulse from the sensor (OFF-ON-OFF) occurred within the window once each stroke. For example, use it to detect that a part moved past a monitor.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When Sensor:	Which Results in a Fault Signal Sent After:
	Sensor turns ON then OFF within window	1. stays ON beyond window	window goes OFF
		2. turns ON outside window	sensor turns ON
		3. remains OFF for the cycle	next window goes ON

In-position (POS) Use this mode to verify that the sensor signal remained ON within the entire window once each stroke. The signal must cycle OFF outside the window. Use it to detect if ejector and other automation parts are retracted to home position.

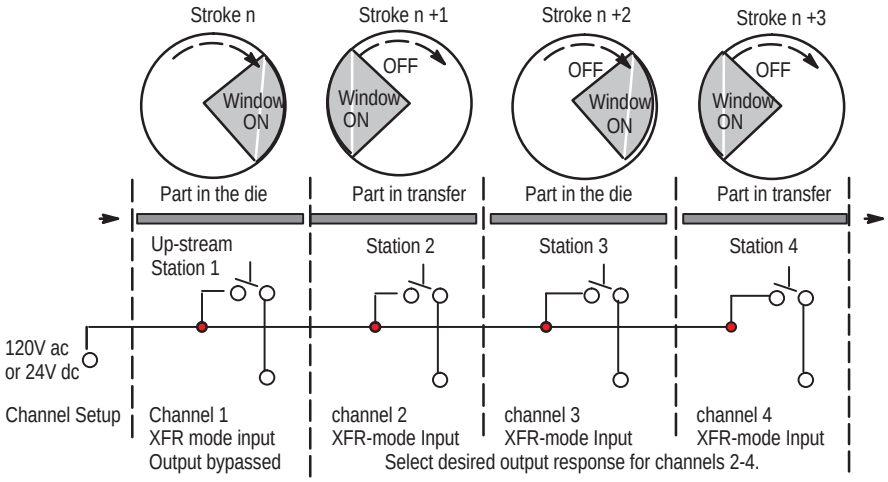
Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When the Sensor Signal:	Which Results in a Fault signal Sent After:
	Sensor turns ON before, and OFF after window	1. turns OFF before window goes OFF	sensor turns OFF
		2. does not turn OFF outside window	next window goes ON
		3. remains OFF for the cycle	next window goes OFF

Transfer Mode (XFR) Use transfer mode to monitor the transfer of a part in a transfer press, from one transfer location to the next for each stroke of the press. Typically, each transfer location has an ***in-position*** sensor. The logic of transfer mode is similar to that of a first-in-first-out (FIFO) shift register. It monitors sensor stations in sequence, a pair at a time.

Important – When setting up XFR-mode channels, you must:

1. Assign consecutive channels to consecutive sensor stations in the sequence.
2. Configure the first input in the transfer-mode sequence (upstream input) as the first channel in the sequence with its output bypassed
3. Configure remaining channel outputs for the desired fault response.

In the following 4-station example, the software looks for signals from in-position switches to be in correct state when the window is ON. It monitors the up-stream station 1 and station 2 as a pair. Then, it monitors consecutive pairs of stations (stations 2 & 3, 3 & 4, etc.)



Static Mode (STC) Use this mode to detect that an event occurred independent of the press stroke. When a static-mode input turns Off, the programmed output is turned On. For example, use it to detect end of stock.

Output Responses for DM Channels

When the software detects a channel fault, it displays the channel number and type of fault on a PanelView screen. The software also sets a fault response that you select from the following:

- warning (PanelView 600 displays alarm banner on the active screen)
- stop on top
- stop now
- output by-passed (no fault response)
  for XFR-mode up-stream station or channels not used

Worksheet A for DM Channels

Use this worksheet to identify your DM channels.
Write down these items in the space provided:

- Purpose of DM channel
- Mode of DM channel (by code)
- Type of input switch
- Location of input switch
- Output response (by code)

We repeat the codes for channel mode and output response:

Channel Mode	Code	Channel mode	Code
Cyclic	CYC	Transfer	XFR
In-position	POS	Static	STC

Output Response	Code
Warning	WRN
Stop on Top	ST
Stop Now	SN
Bypass	BP

Job Name

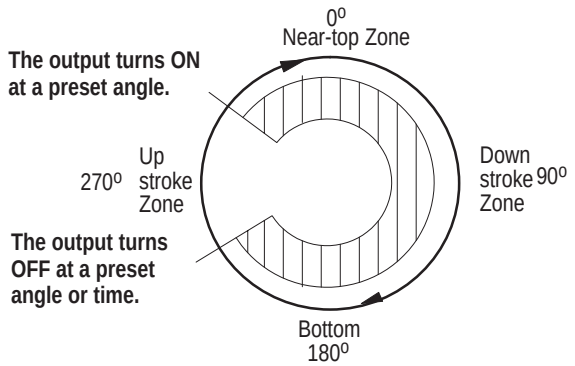
#	Purpose of DM Channel	Type of Switch / Device	Location of Switch / Device	Mode	Output
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Operation of the Programmable Limit Switch (PLS)

Allen-Bradley Programmable Limit Switch software is designed to turn outputs ON and OFF at precise crankshaft positions synchronized with crankshaft rotation monitored with a resolver. You can preset up to 8 ON/OFF settings at angles from 0-359º. You can also turn the output OFF with a timer.

A PLS output turns ON and OFF according to how you configure it. For example:

Turn ON a PLS Output with a:	Turn OFF a PLS Output with a:
crankshaft ON angle that you preset	crankshaft OFF angle that you preset, or
	PLS timer that you preset



As a result, you can use PLS outputs to effectively control auxiliary press machinery such as lifters, grippers blow-off valves, and inter-press automation by programming your application-specific output responses.

The output of each PLS channel is directed to the 1746-OA16 module in chassis A, slot 4, points 8-15 for PLS channels 1-8.

Worksheet B for PLS Channels

Use this worksheet to identify your PLS channels.
Write down these items in the space provided:

- Name of the PLS-controlled function
- Preset angle to turn ON
- Preset time or angle to turn OFF
- Output point to control the function
  (1746-OA16, points 8-15, in chassis A, slot 4)

Job Name

slot 4 Output Pt	PLS-controlled Function	Preset ON Angle (0–359º)	Preset OFF Angle or Time (ms)
8			
9			
10			
11			
12			
13			
14			
15			

Testing DM and PLS Channels

Objectives

This chapter gives you procedures for testing the following:

- Data monitor (DM) channel 1
- DM transfer-mode channel 2
- Resolver inputs 3
- Programmable limit switch (PLS) channel 3

Testing a DM Channel

In this procedure, you test one channel at a time to verify:

- signal thru-put is correct from the input switch into the data table
- that the software detects and indicates a channel fault
- that the software and wiring are set up to reset a fault

Use these screens:
Active DM screen to enter values, and Status screen for fault prompts.

Observe or set up the following initial conditions before starting, regardless of how you intend to use each channel later.

- all DM channels are set for by-pass mode (Active DM screen)
- all DM channel outputs are set for by-pass mode (Active DM screen)
- the fault prompt states “Channels 1-16 Cleared” (Status screen)

Important: Your SLC processor must be programmed, and in Run mode.

Start with channel 1.

1. Close the input switch.
2. From the Active DM screen, select
   – channel mode = static
   – channel output = warning
3. Go to the Status screen.
4. Open the input switch.
5. Observe the fault prompt “Channel 1 Warning”.
   If you do not see a warning on the Status screen, check for errors in input switch wiring (chapter 3).
6. Close the input switch.
7. Press the fault reset pushbutton.
8. Observe that the fault prompt returns to “Channels 1-16 Cleared”.

Important: Repeat this procedure for each operational DM channel.

Testing DM Transfer-mode Channels

Test the series of channels that you assigned as transfer mode to verify that you have correctly set them up.

Before you begin, be sure that:

- **Important:** you tested all your DM channels as described above to verify DM channel mapping and wiring
- the entry station is set up correctly with a bypassed output;
  – its channel number is the first in the series of XFR-mode channels
  – its output mode is set to “by-passed”
  – its window is set correctly
  (A part must be in position throughout the window.)
- you set up your sequence of XFR-mode channels with:
  – consecutive (uninterrupted) channel numbers
  – window On/Off setpoints
  (A part must be in position throughout the window.)
  – channel mode = transfer mode
  – output mode = stop now (top stop or warning)
- channel switches are actuated in the same order as their channel numbers, ie channel 1 switch first, channel 2 switch second, etc.)

Follow this procedure:

1. With the press in motion, transfer a part through the first two stations: [channel 1 with bypassed output & channel 2].
2. Stop the press.
   If the part transfers correctly, the software should not indicate a fault.
   If it does, check that the window turn On and Off settings are correct.
3. Restart the press and transfer the part to the next station, either stopping at each station or completing the series of stations.
   The software should not indicate a fault.
   If it does, check that the window turn On and Off settings are correct.
4. As appropriate, stop the press and *safely* remove a part.
5. Restart the press and machinery. When the crankshaft position reaches the next window, the software should indicate a fault at the next station because the part is missing. Observe fault prompt on Status screen.
6. To resume transfer-mode operation:
   - Press the Resume Operation pushbutton.
     (This pushbutton resets the logic of the remaining transfer-mode channels according to the status of the errant part: you can remove it or place it back in position to resume operation.)
   - Press the fault reset pushbutton.
   - Restart the press. If the software faults, check wiring of the Resume Operation pushbutton (chapter 3).

Testing the Resolver Input

In this procedure, you observe that the angular position of the crankshaft matches the observed die position of the stamping press.

Use these screens:
Active PLS/DM menu to read indicated crankshaft position

1. Jog the press through one stroke.
2. Observe that reported position matches the crankshaft position. Top dead center and bottom are the best positions to observe.

   If the press position is not reported, refer to the manufacturer's troubleshooting information for your resolver and resolver input module. Also check for errors in resolver input wiring (chapter 3)

   If the reported press position shows rotation in a direction opposite to the crankshaft, reverse the resolver input wires.

Testing a PLS Channel

Test one channel at a time to verify signal thru-put from the data table to the output module (or output device).

Use these screens:
Active PLS to turn On each channel.
(You also observe the channel LED indicator to verify that the output turned ON. You may also observe the output device that you wired to the output terminal for each channel.)

Observe or set up the following initial conditions before starting.

- all PLS channel setpoints are cleared (Active PLS screen)
- all PLS channels are OFF

1. From the Active PLS screen, cursor to PLS channel 1.

ATTENTION: Before going to step 2, be aware that when you turn ON a PLS channel, the PLS output may turn on immediately.

2. Turn on PLS channel 1 with an up/down arrow key, plus return key.
3. At the output module, observe that the LED indicator for PLS channel 1 turned on (or that the output device turned on).

   If the output LED for the channel did not turn on (or the output device did not turn on), check for errors in wiring of your output device (chapter 3)

4. Turn off the PLS channel with an up/down arrow key plus return key.
5. Cursor to the next channel and repeat steps 1-4 until you have tested all PLS channels wired into your system.

Notes:

Description of Operating Modes

Clutch/Brake Operating Modes

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

- Off
- Inch
- Single stroke
- Continuous stroking

Off

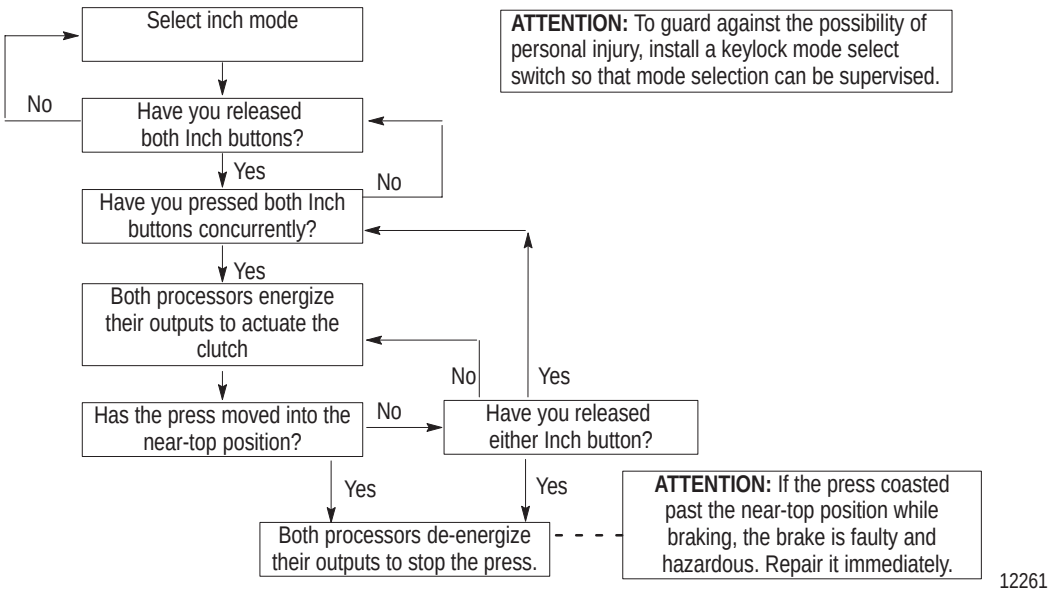
When an operator selects OFF, the control system is designed to:

- turn off all outputs to press valves.
- reset faults

Inch Mode

Before entering single or continuous mode, use inch mode to jog the press to the near-top position to set up the machine. The press stops when it moves into the near-top position or when you release a run/inch button (Figure A.1).

Figure A.1
Typical Operational Sequence for Inch Mode



Single Stroke Mode

Single stroke mode is designed to stroke the press once, from top to bottom to top, with the concurrent use of the run/inch buttons. Once the press reaches the takeover cam (TCAM), the operator can release the run/inch buttons without stopping the press. It continues to the near-top position.

In downstroke, releasing a run/inch button stops the press (Figure A.2). Then, if the press did not enter the upstroke zone (TCAM On), you may resume downstroke by again pressing run/inch buttons.

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

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

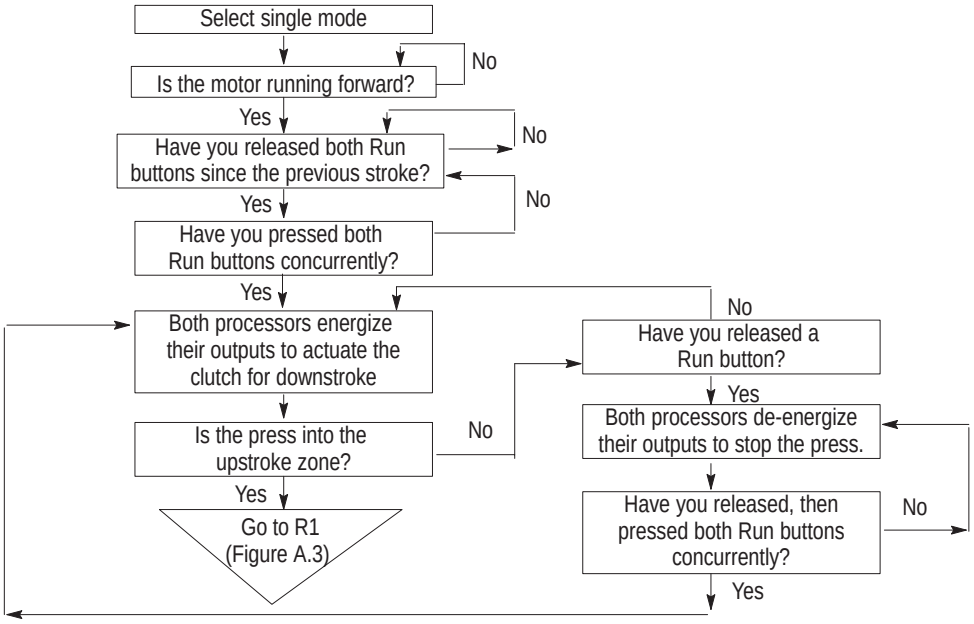
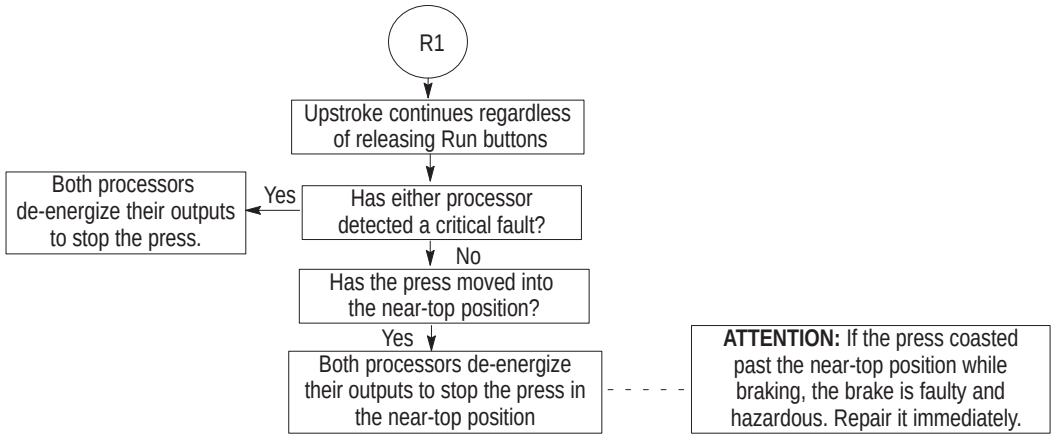


Figure A.3
Typical Operational Sequence for Upstroke in Single Mode



Continuous Mode with Arm Continuous

To run your press continuously, ready the press as follows:

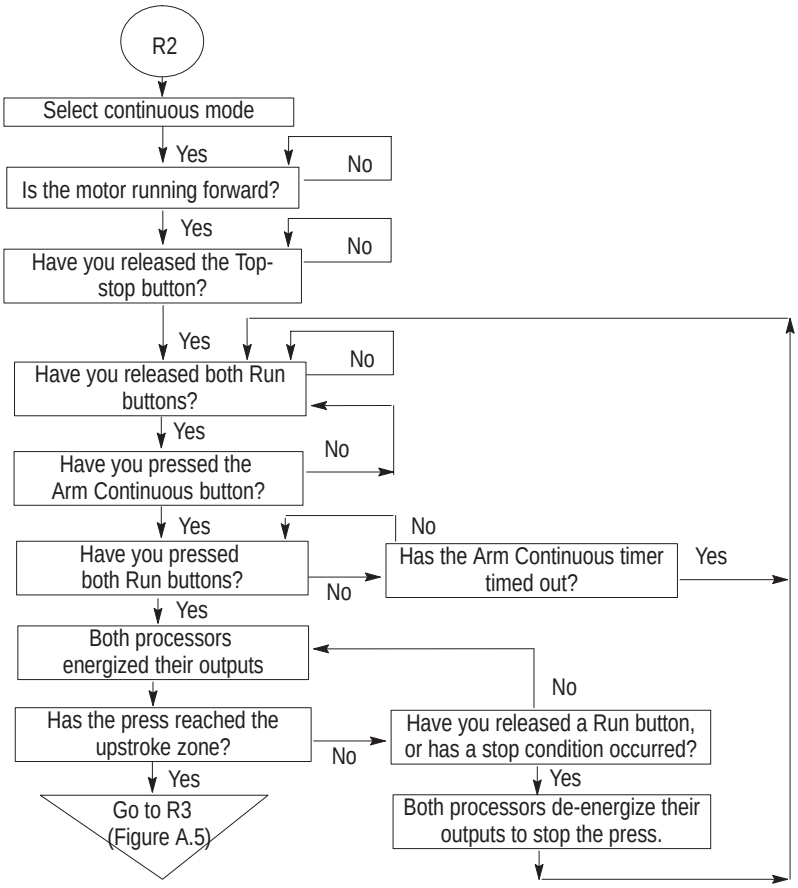
- select continuous mode
- press the arm continuous button
- press both run/inch buttons within 5 seconds

During the first downstroke (Figure A.4), releasing a run/inch button stops the press. Then, if the press did not enter the upstroke zone (TCAM still off), you may resume downstroke within 5 seconds if you release and press both run/inch buttons again. If 5 seconds passes and the press stops, you must press the arm continuous button and run/inch buttons again to restart.

During the first upstroke (Figure A.4) when TCAMs come on, you may release run/inch buttons and the press will continue stroking. If you start the press in upstroke, you must press the arm continuous button and then hold run/inch buttons for a complete cycle until next upstroke.

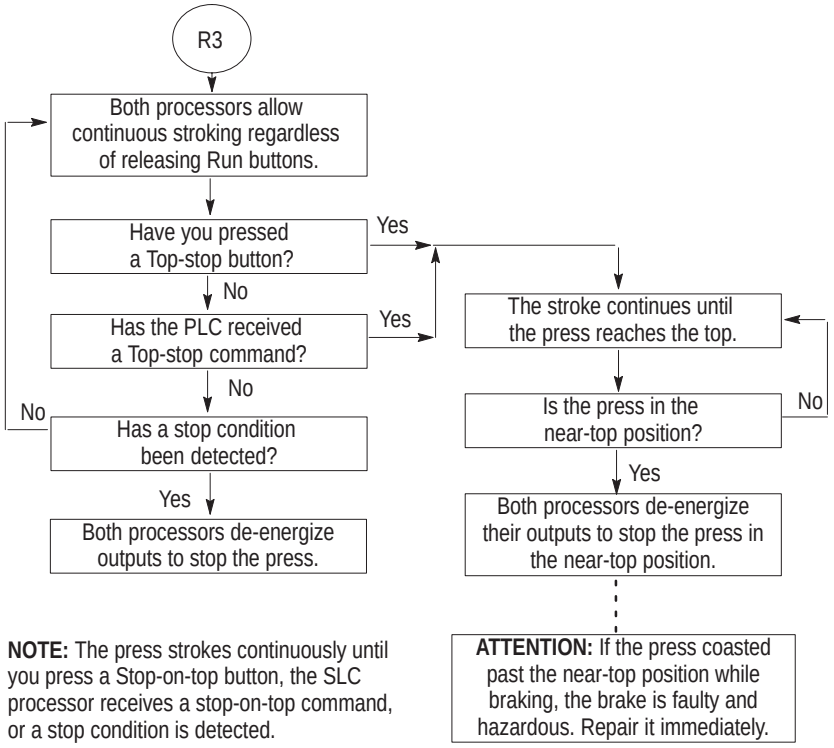
Once in continuous stroking operation (Figure A.5), the press stops at the next near-top position whenever it receives a stop-on-top command. However, the press stops immediately whenever either processor detects a trip or stop condition or a required condition is removed.

Figure A.4
Typical Operational Sequence to Start 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. After 5 seconds (and the press is stopped), you must restart continuous mode with the arming sequence.

Figure A.5
Typical Operational Sequence for Continuous Stroking



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

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