Allen-Bradley

Pro-Set 200

(Cat. No. 6500-PS2102)

Design Manual

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. “Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls” (Publication SGI-1.1) describes some important differences between solid state equipment and hard–wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this manual.

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.

Attentions help you:

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

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

What's New In this Document?

This document has undergone no major changes since the February 1998 printing. Changes to this document are marked with a revision bar in the margin of the page. It is advised that you thoroughly read this manual before upgrading from Release 1.00, 1.08, or 1.01.

Release 1.02 Changes to Ladder Logic

Release 1.02 contains modifications to ladder logic files 4 and 96. The new code corrects the Ejector Not Retracted alarm and M0 file synchronization problem.

ATTENTION: This software is a starting point for an injection molding system. The user5 must modify the software to comply with any applicable standards governing the final product application.

What if You Need More Help?

If you have any questions regarding Release 1.01, call Pro-Set 200 Technical Support at: (440) 646–6800.

Notes

Using Pro-Set™ 200 Documentation

What's in this Preface?

This preface describes how to use this manual as part of the Pro-Set 200 documentation set, including:

- how to use the documentation set
- who should use this manual
- how to use this manual
- what abbreviations, acronyms, and initialisms are used in this manual
- what conventions are used in this manual
- what other publications are available
- what to do next

How to Use the Documentation Set

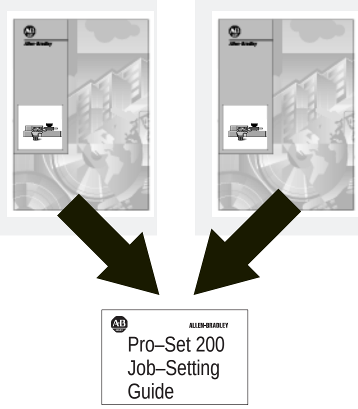
Use this documentation to install and use your Pro-Set 200 System:

Pro-Set 200 Design Manual (6500-UM001A–US–P)
Intended for design engineers

✓ Set up hardware and software
✓ Customize your system
✓ Configure profiles
✓ Determine sensor and valve operation
✓ Use mold part recipes

Pro-Set 200 Data Table Reference Manual (6500-RM001A–US–P)
Intended for design engineers

✓ Become familiar with data table locations for all Pro-Set 200 data files



Pro-Set 200 Job–Setting Guide (6500-QR001A–US–P)
Intended for machine operators

✓ Enter setpoints on process profile screens
✓ View and acknowledge alarms

Who Should Use This Manual?

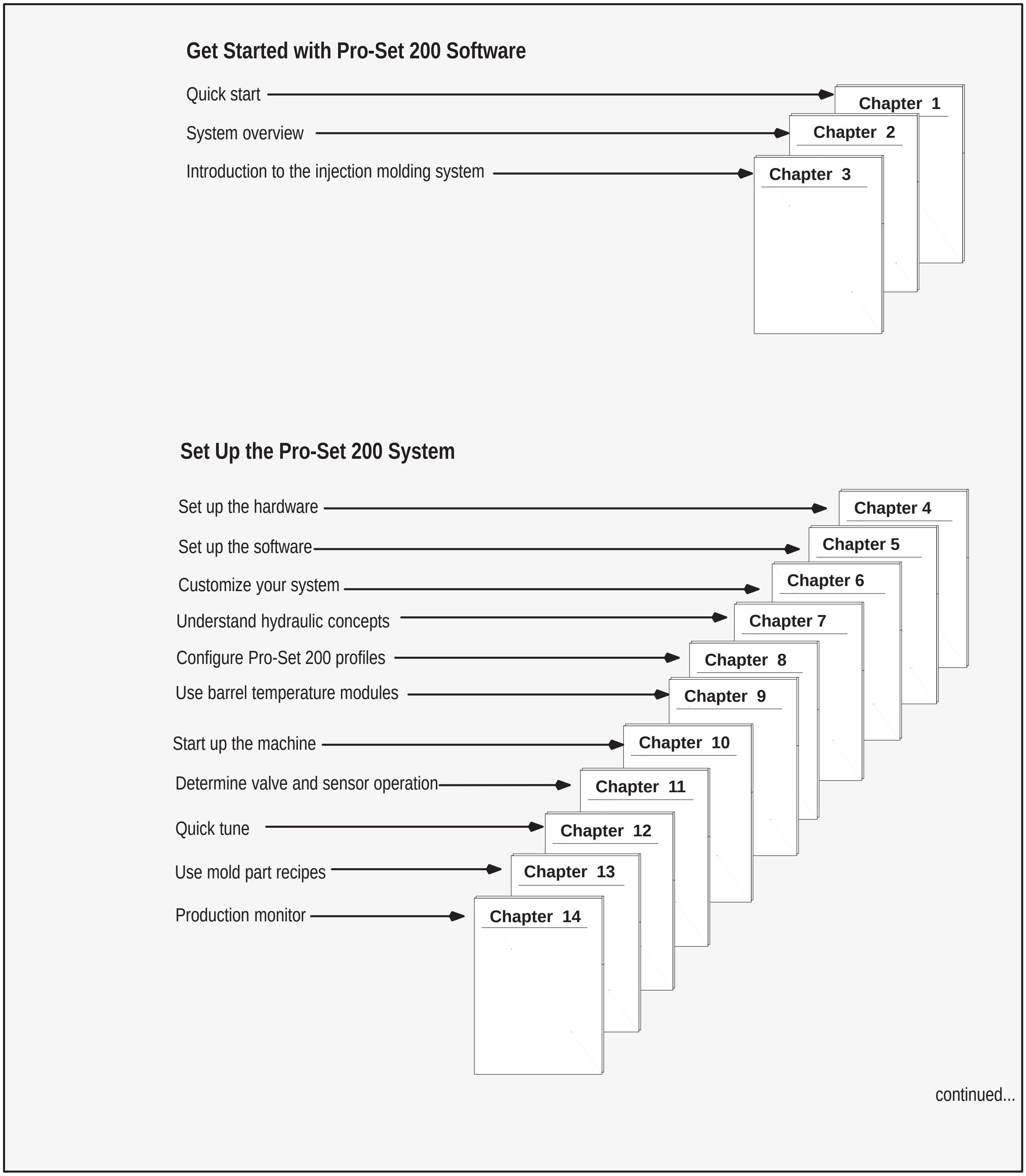
Use this manual if you are an engineer who designs, builds, and configures plastic molding machinery. You should:

- understand the injection molding process
- be familiar with Allen-Bradley SLC™ family of controllers
- be familiar with the fast analog modules (1746-FIO4V or 1746-FIO4I)
- be familiar with the barrel temperature control module (1746-BTM)
- be familiar with PanelView™ 550 or 900 operator terminals
- be able to write and interpret the ladder logic required to control your application
- have a basic knowledge of hydraulics, including the ability to read the hydraulic diagrams for your injection molding machine

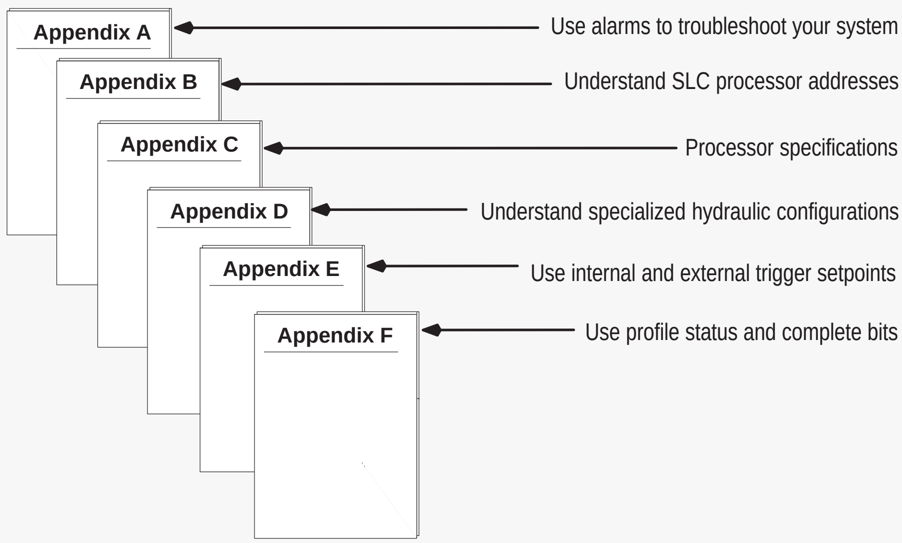
Contact your local Allen-Bradley representative for more information about available training courses concerning Allen-Bradley products.

How Do I Use This Manual?

We designed this manual so you can follow it to customize your system.



For Reference



What Abbreviations, Acronyms, and Initialisms Are Used in this Manual?

Throughout this manual, we use abbreviations, acronyms, or initialisms. Use this table to become familiar with our terminology.

This:	stands for:
CV	Control Value
EOI	Electronic Operator Interface
ERC2	Expert Response Compensation (version 2.0)
I/O	Input/output
K	Kilobyte; 1024 (2^{10}) bytes
Kp	In–shot correction factor
LCD	Liquid Crystal Display
LPMP	Low Pressure Mold Protect
LED	Light-Emitting Diode
MB	Megabyte; 1,048,576 bytes, or 1024K
PSI	Pounds/Square Inch
PV	Process Value
RAM	Random-access memory
SEG	Segment
SLC	Small Logic Controller
SP	Set Point
SPI	Society of the Plastics Industry
STI	Selectable Timed Interrupt
Vel	Velocity

What Conventions Are Used in This Manual?

In this manual, we use these conventions:

We call your attention to helpful information like this:

► Use RSLogix 500 programming software to edit the Pro-Set 200 ladder logic.

We show examples like this:

Example:

This convention presents an example.

We show pathnames, commands, and filenames like this:

`\AB\PBWIN\PS200\ps2s101.pba`

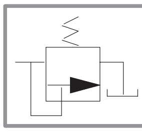
We show **variable text that you type** like this:

`filename.pva`
or
`FILENAME.PVA`

We show active menu selections like this:

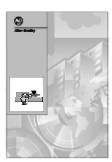
1. From the **Comm** menu, select **Communications Hardware**.

We show concept information like this:



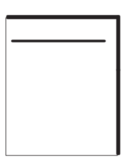
Concept: The load pressure is 200 PSI and will not increase until an additional load is added.

We show references to other Allen-Bradley manuals like this:



This table shows you some other publications you might need if you have other questions about Pro-Set 200 software.

We show references to a chapter within the same manual like this:



This chapter can help you to get started modifying Pro-Set 200 software for your application.

What Screen and Text Settings Are Used in This Manual?

When discussing and using examples of RSLogix 500 programming software, we expect you to follow these conventions:

- Font type: Times New Roman
- Font size: 10
- Display: 800 x 600
- Colors: 256

What Other Publications Are Available?

This table lists other publications you might need for more information about Pro-Set 200 software.

Publication:	Publication Number:
Pro-Set 200 Job–Setting Guide	6500-QR001A–US–P
Pro-Set 200 Data Table Reference Manual	6500-RM001A–US–P
SLC 500 Modular Hardware Style Installation and Operation Manual	1747-6.2
Getting Started with PanelBuilder 550/900 Software	2711-6.2
PanelView 550/900 Operator Terminals	2711-6.1
PanelBuilder 550/900 Software	2711-6.0
Barrel Temperature Control Module User Manual	1746-6.10
RSLogix 500 Step by Step Guide for Project Development	9399-RLOSSG
SLC 500 MicroLogix™ 1000 Instruction Set Reference Manual	1747-6.15

Contacting Technical Support

Pro-Set 200 technical support can be contacted at: (440) 646–6800.

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Pro-Set 200 System Quick Start

What's in This Chapter?

This chapter can help you get started using Pro-Set 200 software with your application. Because it is a start-up guide, this chapter ***does not*** contain detailed explanations about the procedures listed. We provide references to other chapters in this book where you can get more information.

This chapter:

- explains what to do before you begin
- provides procedures to get you started

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, *always read the referenced chapters* and other recommended documentation before trying to apply the information.

Before You Begin

Before you begin, make sure that you:

- understand the injection molding process
- are familiar with Allen-Bradley SLC family of controllers
- are familiar with the fast analog modules (1746-FIO4V or 1746-FIO4I)
- are familiar with the barrel temperature control module (1746-BTM)
- are familiar with PanelView 550/900 operator terminals
- are able to write and interpret the ladder logic required to control your application
- have a basic knowledge of hydraulics, including the ability to read the hydraulic diagrams for your injection molding machine

Contact your local Allen-Bradley representative for more information about available training courses concerning Allen-Bradley products.

Project Planning

Project planning is absolutely necessary for a successful installation of Pro-Set 200, and cannot be overemphasized. Although details concerning the installation will vary from customer to customer, there are three main areas of the project plan that will remain the same. You will need qualified expertise in the areas of electrical engineering, hydraulic engineering and mechanical engineering.

The following sections address these main project areas in limited detail, and are designed to be a starting point for you to create a detailed project plan. If you are lacking expertise in any of the following areas, we suggest that you hire a qualified consultant.

Electrical Components of the Project Plan

For the electrical components of your project plan, you will need personnel capable of accomplishing the following:

- Reviewing existing electrical schematics of your injection molding machine
- Developing new electrical schematics based on existing schematic and improvements for Pro-Set 200
- Creating bill of materials based on review and development of electrical schematics
- Mounting, wiring, and testing of the complete electrical system
- Programming Pro-Set 200 using PanelView and RSLogix500

Hydraulic Components of the Project Plan

For the hydraulic components of your project plan, you will need personnel capable of accomplishing the following:

- Understanding the intricate details involved in sizing and setting up valves specifically for injection molding machines
- Reviewing existing hydraulic schematics of your molding machine
- Developing new hydraulic schematics based on existing schematics and improvements for Pro-Set 200
- Creating a bill of materials based on review and development of hydraulic schematics
- Mounting, plumbing, and testing of the hydraulic system

Mechanical Components of the Project Plan

For the mechanical components of your project plan, you will need personnel capable of accomplishing the following:

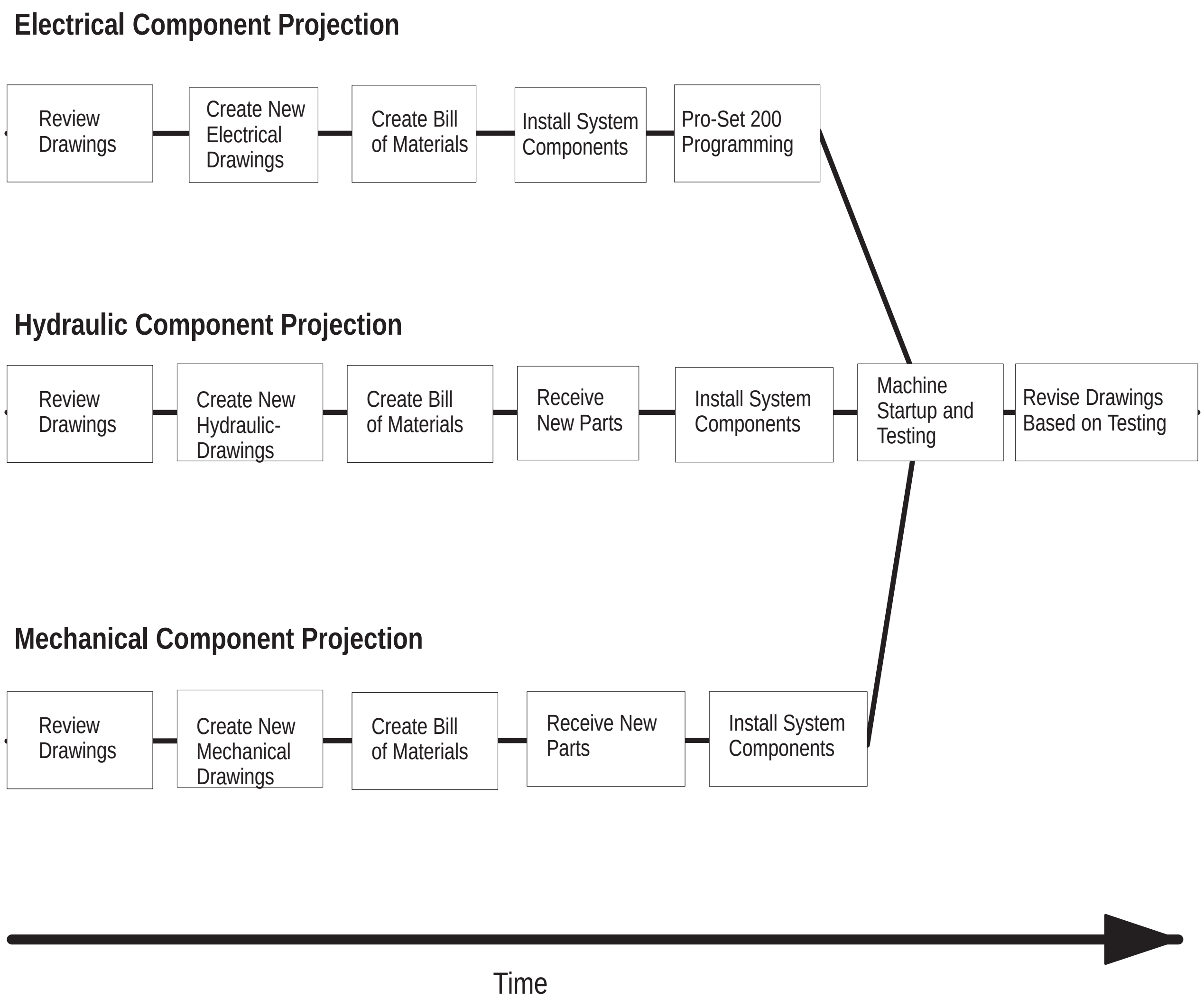
- Determining necessary mechanical rebuild
- Creating a bill of materials based on rebuild specifications
- Installing and testing of rebuild

Other Project Plan Considerations

Consider the following when creating your project plan:

- Communication between system experts
- Lead times for ordering new parts/equipment
- System testing

Simplified Pro-Set 200 Project Plan



The above illustration is a simplified example of an installation plan for Pro-Set 200. Your actual project plan should be detailed to include every reasonable factor that may influence the success of your installation.

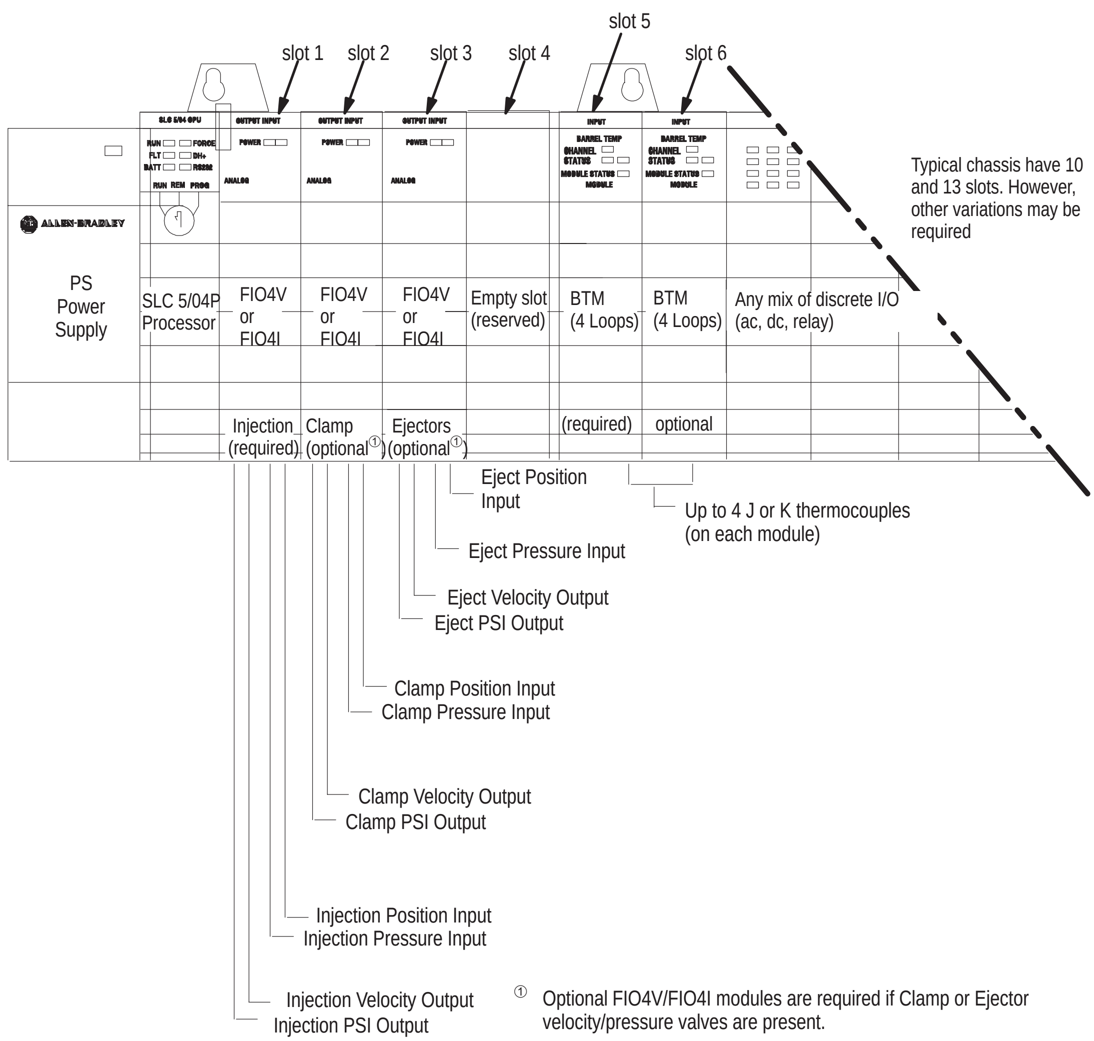
Procedures

1.	**Plan for the project.**	

2.	**Set up the hardware.**	**Reference**

- ✓ Determine the layout of the I/O chassis.
- ✓ Ground the chassis.
- ✓ Install the power supply.
- ✓ Install the SLC processor.
- ✓ Install the I/O modules.
- ✓ Connect the programming terminal to the SLC processor.
- ✓ Connect the PanelView terminal to the SLC processor.

Chapter 4
(Setting Up the Hardware)



① Optional FIO4V/FIO4I modules are required if Clamp or Ejector velocity/pressure valves are present.

3.	Install the software.	Reference

- ✓ Install PanelBuilder software.
- ✓ Install RSLogix 500 software.
- ✓ Install the Pro-Set 200 software.

Chapter 5
(Setting Up the Software)

The:	**Are stored in this default location:**
PanelView screens	`c:\AB\PBWIN\PS2102`
ladder programs	`c:\RSI\Logix500\Project\PS2102`

4.	Customize your system.	Reference

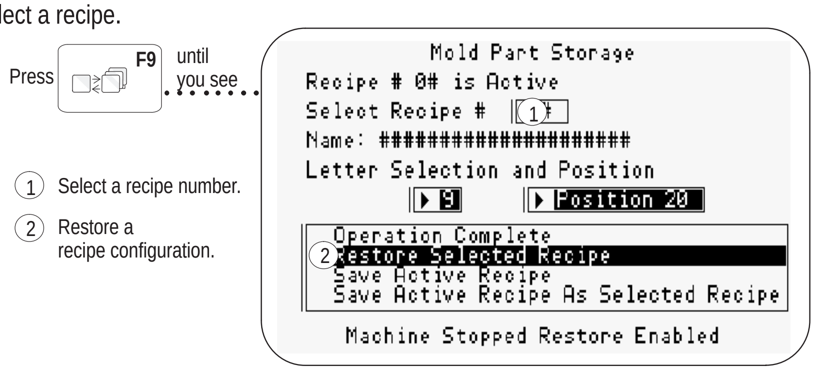
- ✓ Customize ladder logic.
- ✓ Modify the I/O definition file (file 2).
- ✓ Modify initialization file (file 3).
- ✓ Modify files 8, 9, 12, 15, 20, and 99 if the fast analog modules and BTM are not in the standard slot (see page 1–5).
- ✓ Customize/modify PanelView screens. (*optional*)

Chapter 6
(Customizing Your System)

5.	Configure Pro-Set 200 Profiles.	Reference

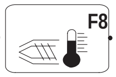
- ✓ Load the Pro-Set 200 configuration screens (`ps2c102`).
- ✓ Select a recipe.

Chapter 8
(Configuring Pro-Set 200 Profiles)

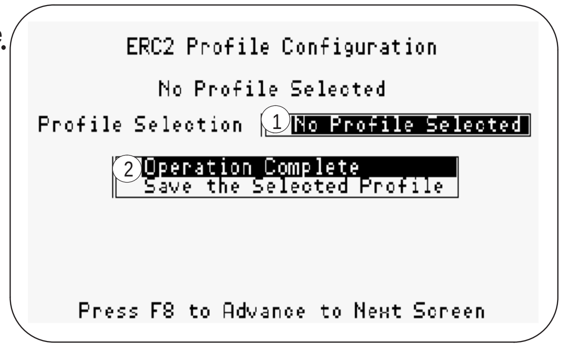


1. Select a recipe number.
2. Restore a recipe configuration.

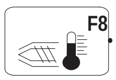
✓ Configure profiles.

Press 

until you see



1. Select a profile.
2. Save a profile's configuration (reads Operation Complete after Save)

Press 

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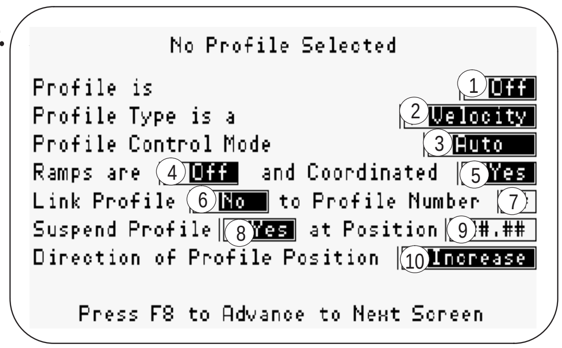
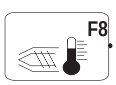


1. Turn profiles on and off.
2. Select profile type.
3. Select profile control mode.
4. Turn ramps on and off.
5. Select whether ramps are coordinated.
6. Select whether to link to another profile.
7. Set link profile identification.
8. Use suspend profile.
9. Set the position at which to suspend profile.
10. Set the direction of profile position.

Press 

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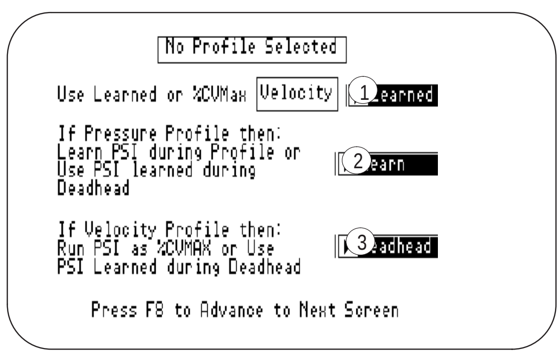


1. Select learned or %CV Max.
2. Select a pressure valve source for pressure profiles.
3. Select a pressure valve source for velocity profiles.

✓ Configure deviation alarm limits.

6. Configure the Barrel Temperature Module (BTM). — Reference

✓ Configure the BTM for use.

Chapter 9
(Using Barrel Temperature Modules)

7. Start Up the Machine. — Reference

✓ Load the Pro-Set 200 setup screens (`ps2s102`).

✓ Starting with the clamp phase, go to the setup screens for each phase and enter values that tell the SLC processor the following valve parameters:
- pressure nameplate (max) values for the valves
- whether the output signal is in volts dc or mA
- maximum velocity values for outputs to each valve (second screen)
- enter jog values

✓ Verify correct hydraulic operation, and make sure the jog setpoints that you loaded are in control of your machine.

Chapter 10
(Starting Up the Machine)

8. Determine sensor and valve operation. — Reference

For the injection, clamp, and eject phases:

✓ Span inputs.

✓ Enter minimum and maximum forward and retract values.

✓ Span outputs to remove upper and lower deadbands.

✓ Save machine setup data.

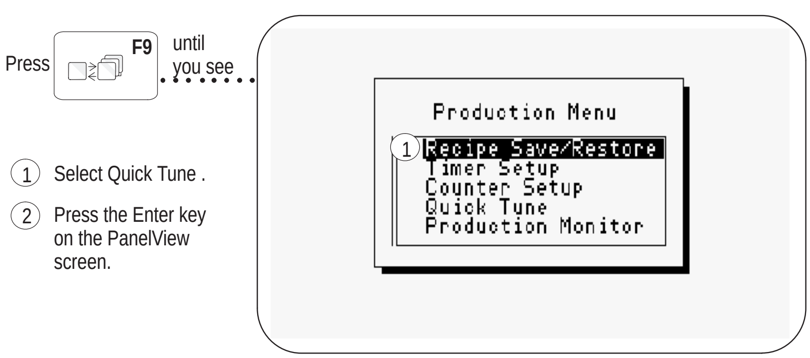
✓ Configure primary controller variables.

Chapter 11
(Determining Sensor and Valve Operation)

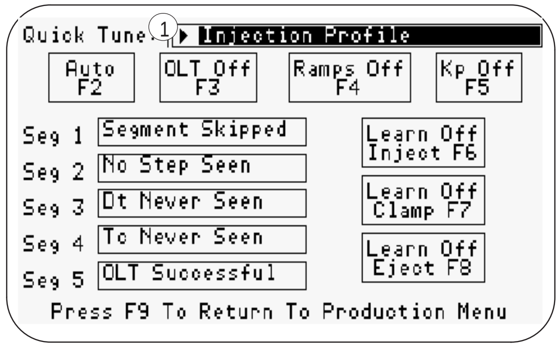
9. Complete the Quick Tune Procedure. — Reference

Chapter 12
(Quick Tune Procedure)

✓ Select Quick Tune from the Production Menu.



✓ Choose a profile.



1 Select a profile to tune.
2 Press the Enter key on the PanelView screen

Follow Coarse Tune Procedure:

✓ Make certain that Kp is off (press F5)

✓ Make certain that each profile being tuned is set to the Manual Mode (press F2)

✓ Set Ramps OFF (press F4)

✓ Set OLT (Open Loop Test) ON (press F3)

✓ Run a complete cycle and check to see of all active segments OLT successfully. If not, refer to page 12-7 for corrective actions. **All profile OLTs must be successful before continuing to the next step**.

✓ Set OLT OFF (press F3)

✓ Set Ramps ON (press F4)

✓ Turn learning on (press F6, F7, or F8)

✓ Set the profile in Auto Mode (press F2)

✓ Run 4 cycles

✓ Continue to chapter 12 for the Fine Tune procedure

10.	**Use mold part recipes.**	**Reference**

✓ Name mold part recipes.
✓ Save and restore mold recipes.
✓ Increase the number of mold part recipes.

Chapter 13
(Using Mold Part Recipes)

11.	**Using Production Monitor Screens.**	**Reference**

✓ Accessing Production Monitor Screens
✓ Using Production Monitor Screens
✓ Status Indicators.

Chapter 14
(Using Production Monitor Screens)

What’s Next?

In the next chapter, we cover the system overview.

System Overview

What's in This Chapter?

This chapter presents an overview of the Pro-Set 200 Injection Molding Control System. This chapter explains:

- what Pro-Set 200 does
- the components of a molding control system
- how Pro-Set 200 works
- the capabilities of Pro-Set 200
- what you need to do

What Does the Pro-Set 200 System Do?

Pro-Set 200 system:

- lets you control and monitor the injection molding process
- lets you set up the control system to match your machine
- lets you monitor machine capability
- lets you perform general machine diagnostics

The SLC 5/04P processor contains enhanced firmware that controls an injection molding machine. The molding sequence is configured and controlled by placing machine configuration and operation data in the SLC 5/04P data table. This data is written to the data table from the ladder logic and operator interface. The following tables outline the features of Pro-Set 200:

What is ERC2?

Expert Response Compensation (ERC2) is a model predictive control algorithm for control of pressure and flow loops (injection, clamp, and ejectors). It:

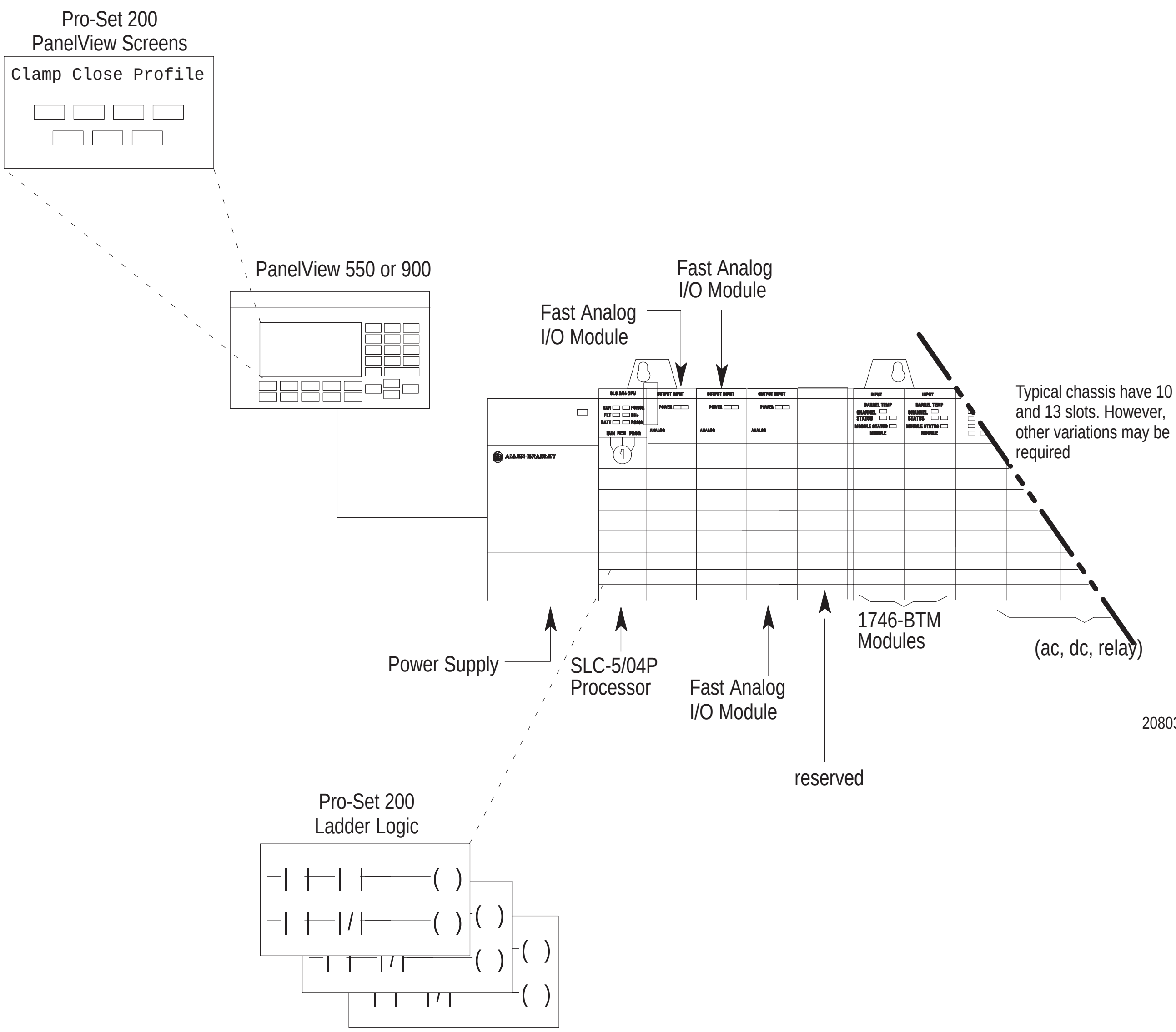
- eliminates the need to manually tune the pressure and flow loops for the clamp and injection units
- minimizes overshoot and steady state error
- provides comprehensive control over pressure and velocity profiles
- provides machine performance metrics

The ERC2 algorithms are embedded in the SLC 5/04P processor and are part of the operating system. ERC2 algorithms receive data in the form of pressure and position information from the ladder logic included in Pro-Set 200. This information is used to calculate new output values (pressure and flow).

The data that the ERC2 uses comes from the data table in the SLC 5/04P processor. This data is written to the data table from the ladder logic and operator interface.

What Are the Components of a Molding Control System?

To create an automated molding control system, you need the components shown below. The Pro-Set 200 ladder logic program and PanelView screens, when used with these components, let you create profiles to control the plastic molding process. This system also provides production flexibility and reporting capabilities.



You need:	To:
1747-5/04P processor	execute the sequence logic which controls the injection molding machine. Embedded within this processor are the ERC2 (for a explanation of ERC2, see page 2–1) algorithms which control the pressure and flow valves for the injection, clamp, and ejector phases. Appendix C contains the specifications for the SLC 5/04P processor.
1746-FIO4V or 1746-FIO4I modules	accept position and pressure feedback in the form of 0–10v or 4–20 milliamp signals and provide analog signals out to the proportional valves which control the flow and pressure. (Use FIO4V modules if your valves require +/– 10 volt control signals; use FIO4I modules if your proportional valves require 4–20 milliamp control signals). You need a least one FIO4V or FIO4I module for each controlled phase (pressure and position inputs and pressure and flow outputs).
1746-BTM modules	provide temperature control for the barrel of the injection molding machine. These modules contain specialized start-up and auto-tuning algorithms which have been optimized for barrel temperature control. Each module controls four temperature loops using either J or K thermocouples (grounded or ungrounded). The ladder logic and PanelView screens accommodate eight temperature loops; if you need more, expand the logic. **Important:** The BTM modules do not have analog or digital outputs on them. You need to use 4 discrete or analog outputs from another output module for each BTM module.
PanelView 550/900	modify profiles, configure temperature setpoints, set/pull cores, examine alarms bits, view production data, etc. **Important:** Be sure that time critical functions are not controlled by the PanelView.
Pro-Set 200 software, which contains:	
• ladder logic	works in conjunction with the ERC2 algorithms which are embedded in the SLC 5/04P processor. The ladder logic program contains sequence logic for the injection, clamp, and ejector phases. Modify this logic to accommodate your specific machine.
• PV550/PV900 screens	operate the machine (configure profiles, modify/monitor temperatures, save/restore recipes), perform calibration, and perform troubleshooting. Although these screen sets are fairly complete, you may wish to modify them for your specific machine features.
Miscellaneous discrete input and output modules	monitor limit switches; control heaters; control directional valves, pilot lights, push buttons, control manual functions and machine modes, etc. Pro-Set 200 can accommodate all discrete I/O modules in the SLC 500 product line, including 120 vac input and output modules, 24 vdc I/O, relay contact output modules, etc. If you want to use block I/O modules with Pro-Set 200, you need to write ladder code to support the 1747-SN subscanner module which communicates with the block I/O. **Important:** Be sure that time critical functions are not controlled by the PanelView.

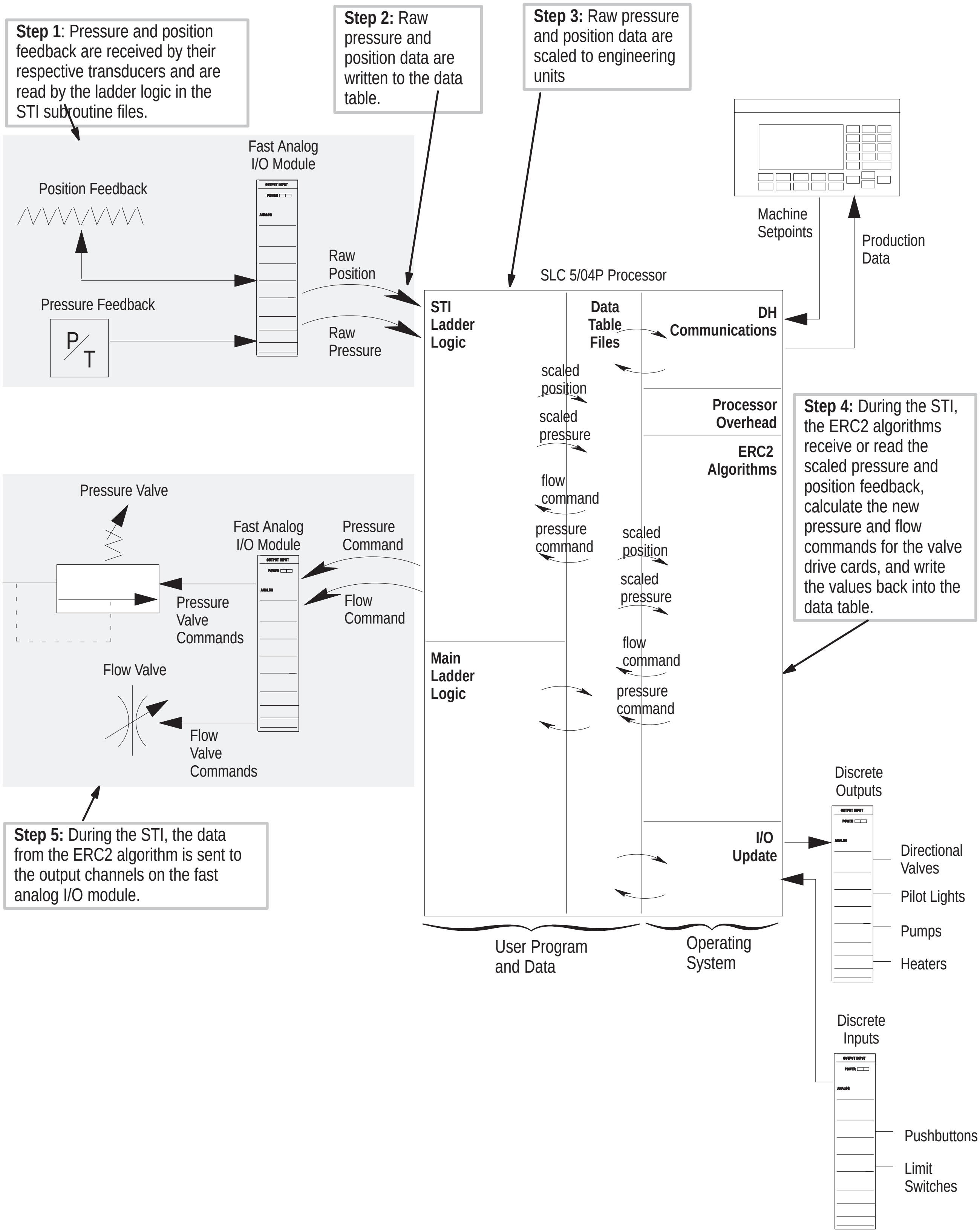
Sensors Used with Pro-Set 200

For every phase that Pro-Set 200 controls, there must be at least one corresponding position transducer. Pro-Set 200 accommodates pressure and position transducers which have a range of either 4–20 milliamps or 0–10 volts through the use of high speed analog input modules (1746-FIO4V and 1746-FIO4I). .

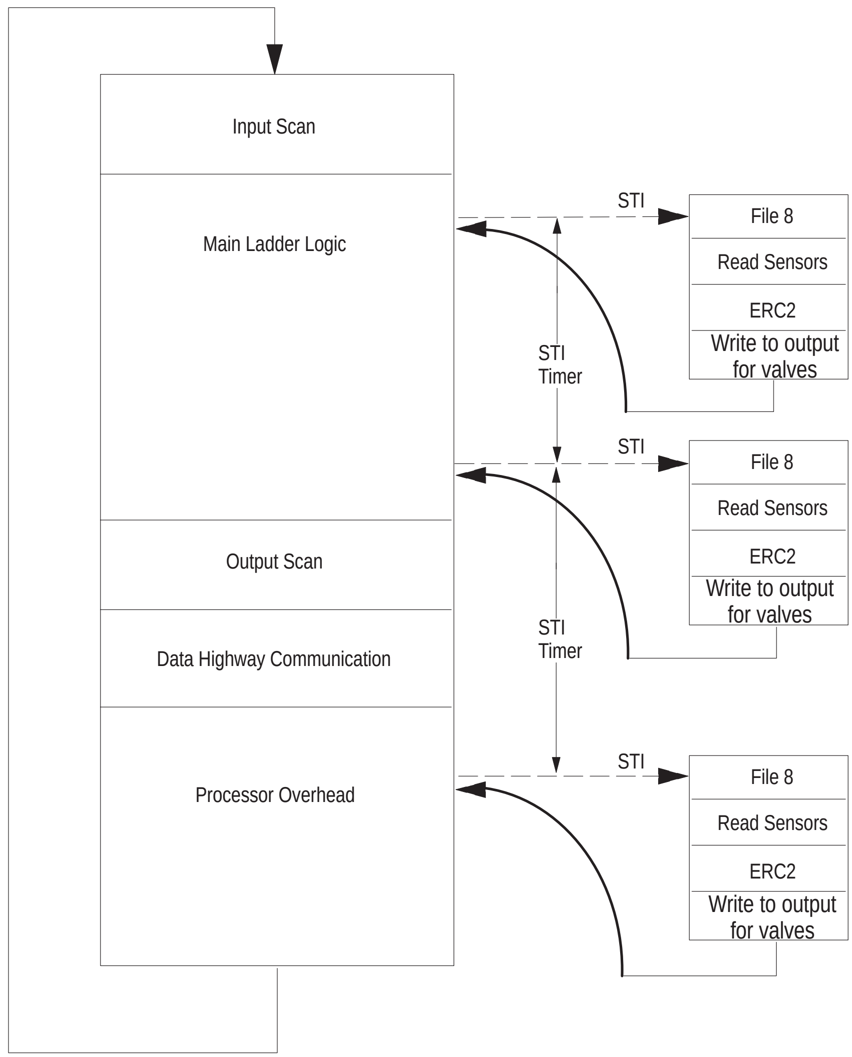
Important: At a minimum you must have an injection position transducer and a clamp position transducer. Pro-Set 200 does not work with limit switches on the clamp and inject unit. Limit switches are supported for ejector control only

How Does Pro-Set 200 Work?

The following diagram illustrates how Pro-Set 200 works.



The following diagram illustrates the Pro-Set 200 program scan and STI interrupts.



What are the Capabilities of Pro-Set 200?

Pro-Set 200 controls all three phases of the injection molding machine:

- injection phase
- clamp phase
- ejector phase

You can select open or closed loop control for any profile in the injection, clamp, or ejector phase. You can also select either velocity or pressure control for any of the profiles in the process. The following table lists the controllable profiles and the number of segments in each profile:

Injection Phase		
Profile:	**Number of Segments:**	**Default Type of Control:**
Injection	5	Velocity
Pack	2	Pressure
Hold	2	Pressure
Pre-Decompress	1	Velocity
Plastication	5	Pressure
Post-Decompression	1	Velocity
Clamp Phase		
Profile:	**Number of Segments:**	**Type of Control:**
Close	3	Velocity
Clamp LPMP	1	Pressure
Tonnage	1	Pressure
Low Hold	1	Pressure
Decompress	1	Pressure
Clamp Open	4	Velocity
Ejector Phase		
Profile:	**Number of Segments:**	**Type of Control:**
Ejector Forward	2	Velocity
Ejector Reverse	1	Velocity
Tip Stroke	1	Velocity

In addition, Pro-Set 200 also comes complete with other basic features including: pre-programmed alarms, ladder logic, and operator screens:

Other Basic Features	
Eject multi–stroke capability	Die height fwd/retract logic
Manual, semi–automatic, and full automatic mode machine code	Autotune heat/cool
SPI cores; A,B,C,D set/pull	Eject by limit switch or linear postion
Overall cycle timer	Idle cycle timer
Dry cycle (clamp only)	Tonnage deadband window
Automatic clamp injection/tuning	

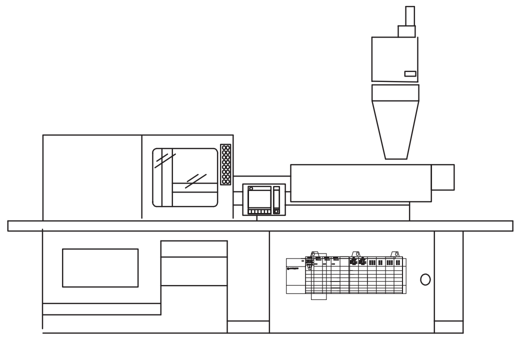
Supplied Alarms	
Short shot alarm	Purge guard opened in cycle alarm
Inhibit screw rotation with low temperature interlock alarm	Tonnage loss alarm
	Mode inhibit alarm
Die height overstroke alarm	Tonnage malfunction alarm
Gate opened in cycle alarm	Ejector not retracted alarm
Safety flap malfunction alarm	Clamp not full open alarm
Temperature deviation alarms	Low psi mold protect alarm
Profile not capable alarm	Temperature interlock code alarm
Clamp forward overstroke inhibit alarm	Core not set/pulled alarm
Clamp not in correct position for ejector alarm	Injection unit not forward alarm
Multiple permit bit check alarm	

Supplied Logic and Programming	
31 pre–engineered operator screens	Pre–engineered setup and configuration screens
Clamp close permissive logic	Clamp close tonnage permissive logic
Clamp low hold permissive logic	Clamp decompress permissive logic
Clamp open permissive logic	Ejector forward permissive logic
Ejector tip–stroke permissive logic	Ejector retract permissive logic
Injection forward permissive logic	Pre–decompress permissive logic
Plastication permissive logic	Post–decompress permissive logic
Cure timer permissive logic	Injection high–volume delays
Clamp open delays	Clamp full automatic mode
Full open delay timer	Clamp open/close suspend support
Injection suspend support	Sensor software over–travel code
Hydraulic pre–fill logic	

What Do I Need to Do?

As an Allen-Bradley injection molding customer, you:

- detail a project plan to organize your installation
- provide the injection molding machine and its hydraulics



- modify the ladder logic that:
  - controls sequential machine operation not included in Pro-Set 200
  - handles permissives
  - responds to hard-wired safeties and E-stops
- modify the PanelView 550/900 screens (optional)
- determine profile setpoints, process limits, and other application-specific parameters used by the SLC 5/04P processor to control your injection molding process
- comply with ANSI B151.1-1984 safety standards

What's Next?

In the next chapter, we introduce the injection molding process.

Introduction to the Injection Molding Process

What's in This Chapter?

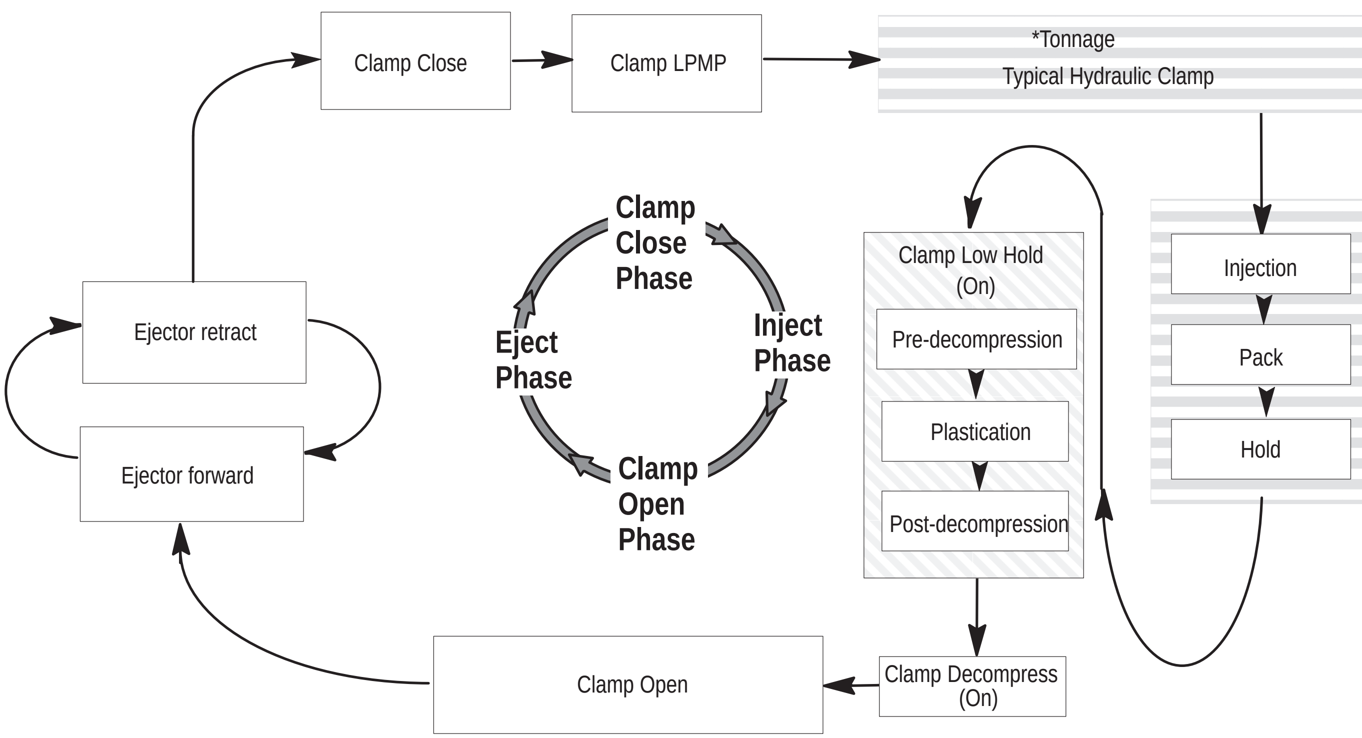
This chapter introduces the Pro-Set 200 Injection Molding Control System. Read this chapter before you set up molding profiles, so that you are familiar with:

- the injection molding process
- controlling the molding process with the SLC 5/04P processor

What is the Injection Molding Process?

To properly configure molding profiles, you must understand the injection molding process. This diagram helps you understand the four main phases of the injection molding process:

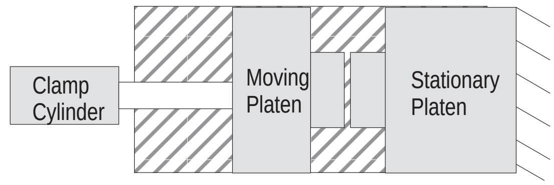
- clamp close
- inject
- clamp open
- eject



*Tonnage can vary between toggle and hydraulic machines. For this hydraulic example, tonnage is held until the clamp low hold profile is permitted. The difference between toggle tonnage and hydraulic tonnage is outlined later in this chapter.

Clamp Close

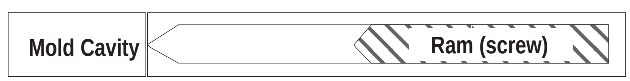
During the clamp close phase, the clamping cylinder pushes the moving platen toward the stationary platen to close the mold.



Inject

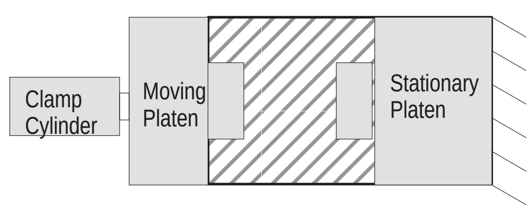
During the inject phase, the injection ram advances to shoot plastic into the mold cavity, pressurizes it to fill any voids (pack), and holds pressure as the part cools.

Then the injection ram (screw) rotates to reload plastic for the next shot. The screw acts like an auger by forcing plastic down the screw flights in front of the screw tip. As plastic is pushed in front of the screw tip, the ram is forced to retract. We call this plastication. The distance the injection ram moves is the shot size.



Clamp Open

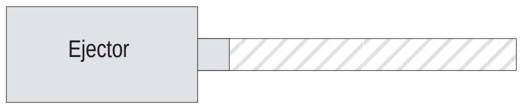
During the clamp open phase, the clamping cylinder pulls the moving platen from the stationary platen to open the mold.



Eject

During the eject phase of the operation, the ejector plate in the mold advances the ejector pins to the ejector forward position to eject the part from the mold

and then the ejector pins are retracted to the ejector retracted position.



How is the Injection Molding Process Controlled?

The SLC 5/04P processor lets you solve complex molding problems by controlling each phase of the injection molding process.

You can vary the velocity or pressure of the injection ram, clamp, or ejector to achieve quality parts with rapid machine cycles.

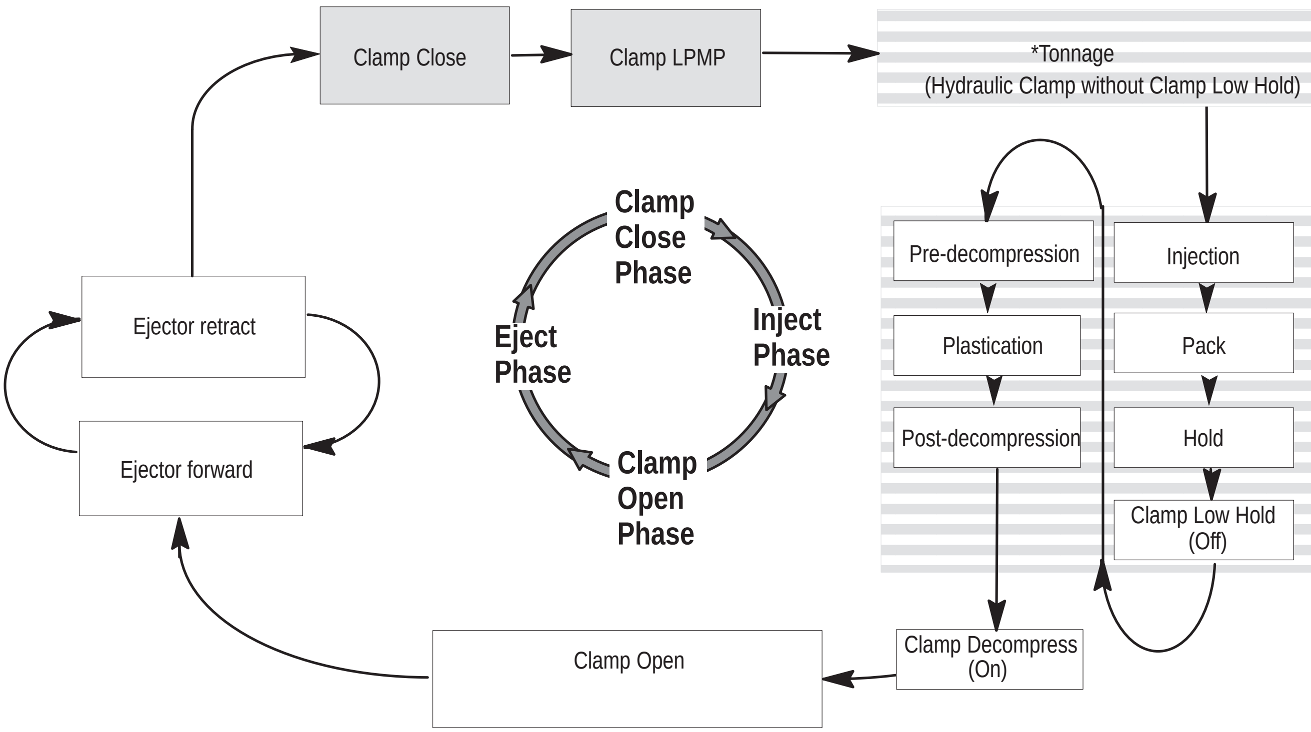
You can select the SLC 5/04P processor to control different operations on the molding machine. The SLC 5/04P processor communicates with fast analog cards to read critical inputs and send outputs to the corresponding valves. These fast analog cards can be used to control these machine phase combinations:

- **inject phase —** injection, pack, hold, pre-decompression, plastication, and post-decompression profiles
- **clamp phase —** clamp close, clamp low pressure mold protect, clamp tonnage, clamp low hold, clamp decompress, and clamp open profiles
- **ejector phase —** ejector forward, ejector tip stroke, and ejector retract profiles

Let’s take a closer look at each of the phases in the order they occur in the machine cycle, and discuss how you can control each phase using profiles.

Clamp Close

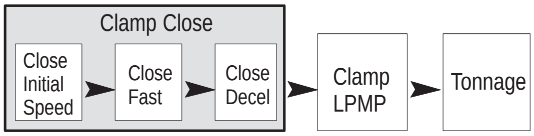
During clamp close, the mold closes.

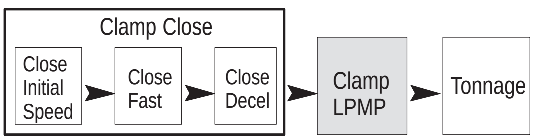


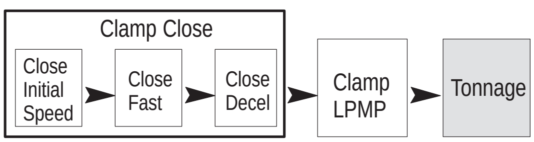
*For this hydraulic example, tonnage is held until the clamp decompress profile is permitted. Instead of moving from tonnage to clamp low hold, tonnage is maintained throughout.

Clamp Close Phase

During clamp close, the moving platen advances or moves forward toward the stationary platen. During the clamp close phase there are three profiles. They are:

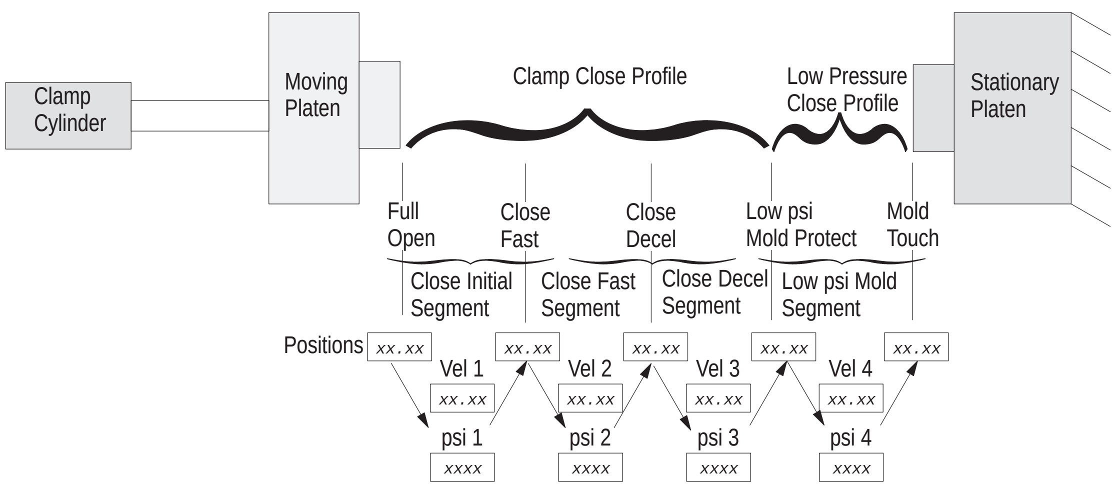






Profile:	Description:
clamp close	This profile is made up of three segments: • **close initial speed segment** – use this segment to enter an initial speed and pressure setting that starts the clamp moving. You can use this segment to smoothly start accelerating the clamp. • **close fast segment** – use this segment to traverse the clamp close quickly toward the stationary platen. This segment occurs after the close initial segment is complete. There are some machines that do not require a close initial segment, and can be set up to start the closing segment immediately with the close fast segment. • **close decel segment** – use this segment to tell the clamp to begin the deceleration before beginning the LPMP close profile. There are some machines that do not require a close decel segment; in these cases, omit this segment.
clamp LPMP	Use this profile to decelerate the moving platen as it approaches the stationary mold half. This profile is very important and is used to sense if a part is stuck in the mold. Adjust the pressure for the profile high enough to make it to full closed position if no parts are stuck in the mold but low enough not to make it to full closed if a part is lodged in the mold. If a part is stuck, the machine should not continue to smash the part and make it to the full closed position.
tonnage	Use this profile to adjust the tonnage pressure that the machine builds on the clamp. The tonnage profile occurs after the molds are closed and while injection occurs. Tonnage is usually handled differently between hydraulic clamping machines and mechanical (toggle) clamping machines.

You can change the clamp velocity or pressure in each profile.



After completing the low psi mold profile, you can program the SLC 5/04P processor to:

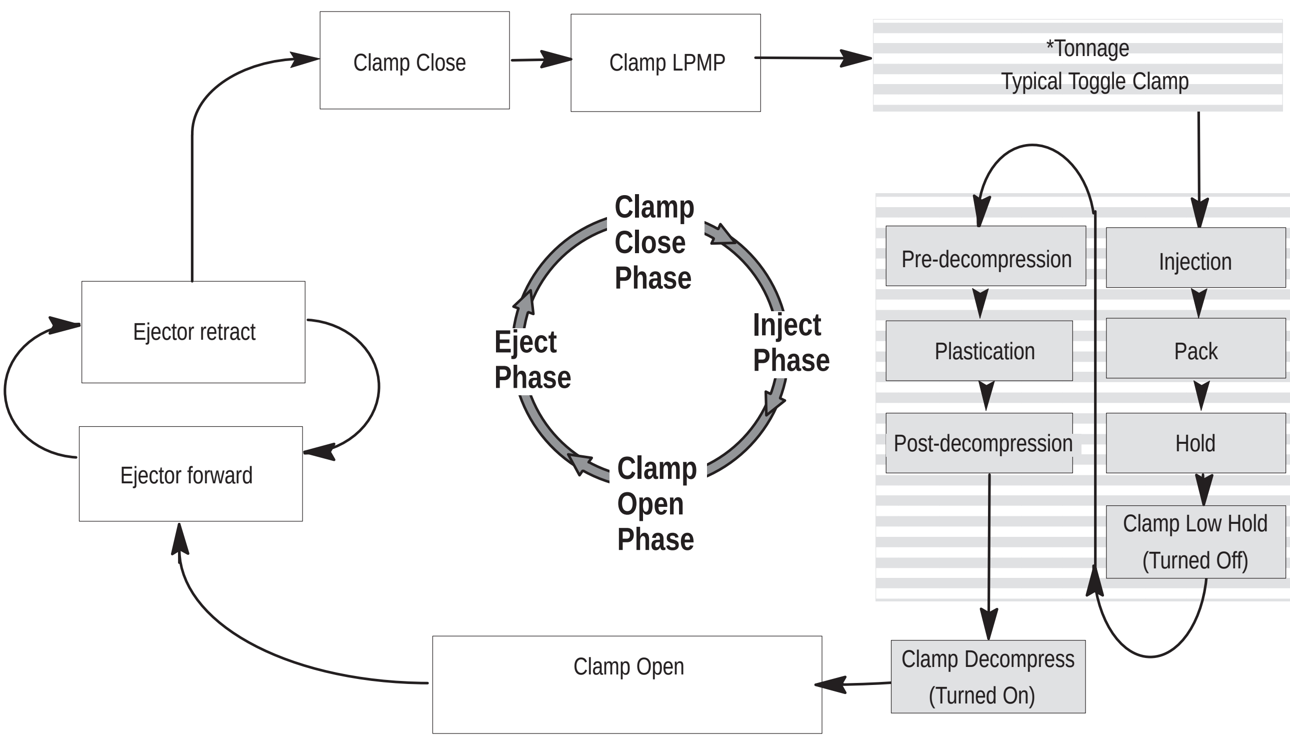
- automatically execute the tonnage profile
- wait for the ladder logic to command the cycle to continue

Tonnage

Tonnage differs from machine to machine according to the type of clamping mechanism being used. In a mechanical clamping system, (toggle) tonnage is applied to lock the toggles. In the case of a typical toggle machine, clamp low hold is usually unnecessary and can be turned off. Clamp decompress can be used to gradually release pressure on the toggle before going to clamp open. In the case of a hydraulic clamping system, clamp low hold and clamp decompress are optional and may be turned on if desired. Tonnage is used to begin the injection phase, and can be sensed by pressure transducer, pressure switch, limit switch, or by position.

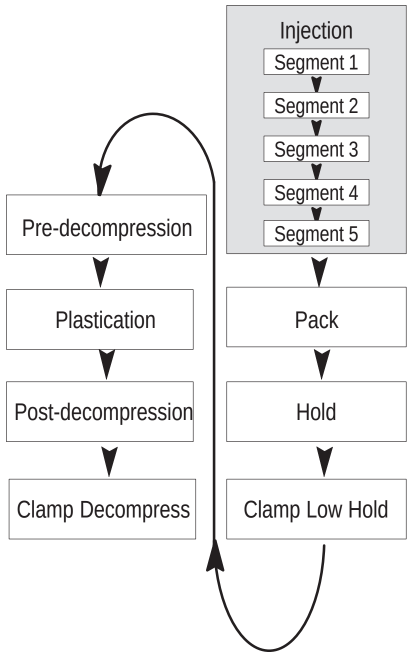
Inject Phase

During the inject phase, the ram injects plastic into the mold, pressurizes the plastic to fill voids, and reloads the barrel with plastic for the next shot. This diagram shows the steps of the inject phase.



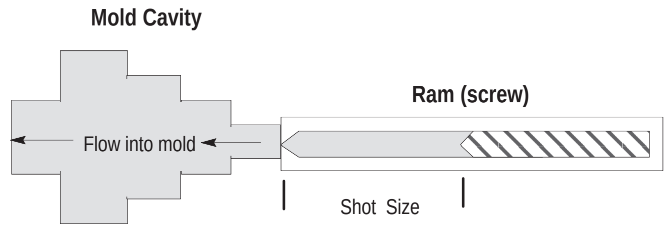
*This example demonstrates a typical toggle clamp tonnage profile. Tonnage begins after clamp LPMP and continues throughout the inject phase. No clamp low hold is necessary, and has been turned off. Clamp decompress is turned on to gradually release toggle pressure prior to opening.

▶ Clamp low hold and decompress are actually part of the clamp profile, but we show them here to make it clear how the process works.



Injection Profile

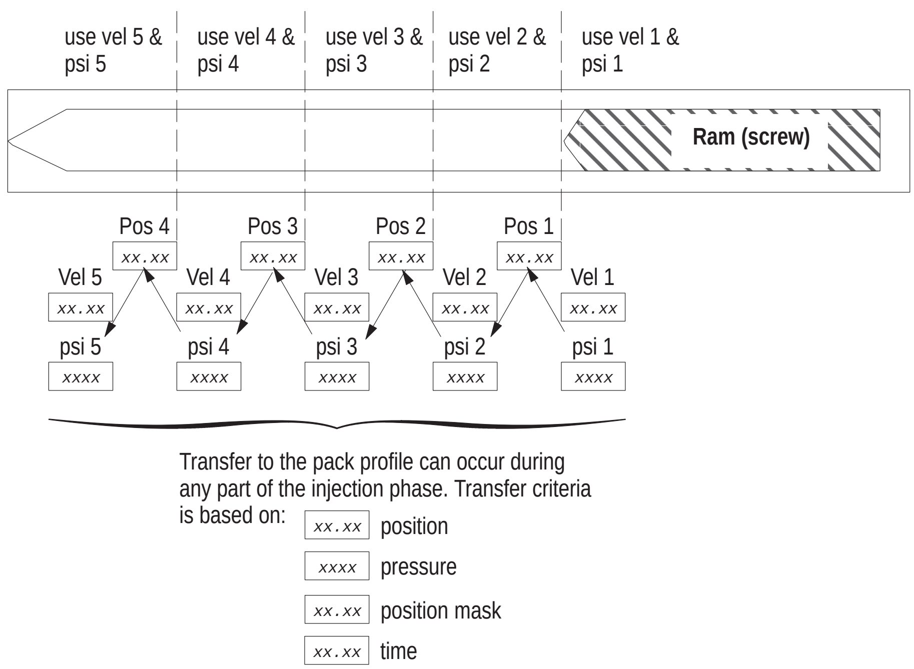
During injection, the ram or screw injects plastic into the mold cavity. The ram or screw should force plastic through the mold cavity as fast as possible without flashing the mold or burning plastic as it goes through the mold gates.



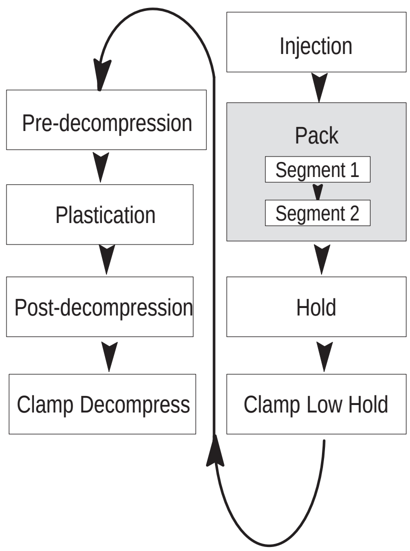
To control this process, you can vary the velocity or pressure of the injection ram with the injection profile, as shown in the illustration below. The table that follows the illustration describes the injection profiles that you can select.

There is a corresponding velocity setpoint and pressure setpoint associated with each position setpoint. You use the corresponding velocity and pressure setpoints to go from one position to the next (and to the next profile). Transfer is a transition to the next selected profile.

Injection Profile



With this profile:	You control injection:	With 5 segments distributed over the:
velocity vs. position	speed	length of the shot size
pressure vs. position	pressure	length of the shot size



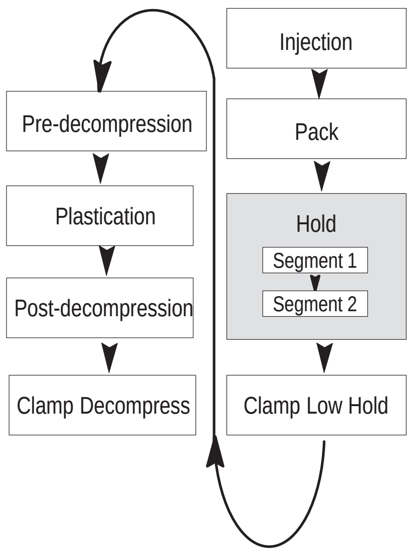
Pack Profile

The pack profile lets the molding machine finish packing plastic into the mold by filling any voids left after the injection phase. Pack can be thought of as a final fill phase.

Pro-Set 200 controls the pack profile with a pressure vs. time or velocity vs. position profile. You can control either:

- the hydraulic pressure against the ram, or
- pack velocity

In most typical applications, after the last segment of the pack profile is complete, Pro-Set 200 automatically begins the hold phase.



Hold Profile

The hold profile maintains pressure on the plastic as the part cools. You should adjust the pressure so that:

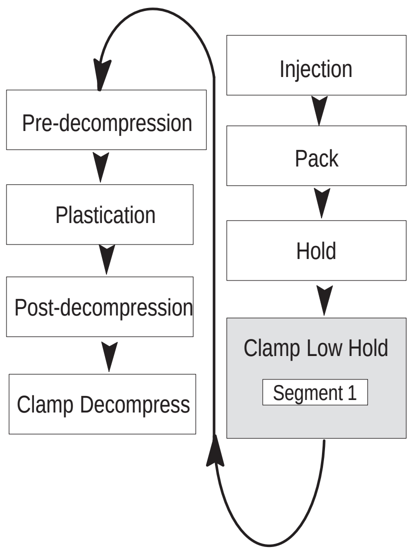
- the ram does not continue to fill the part, or
- the ram does not back up

You can use the hold profile to hold enough pressure on the plastic to allow the part to cure; do **not** use the hold profile to fill the part. If the ram does not have enough pressure during this segment, the ram will “bounce” backwards and cause possible shrinkage or “sinks” in the parts. You can hold at predetermined pressures and times throughout the hold profile.

Pro-Set 200 controls the hold profile with a pressure vs. time segment. You can control the hydraulic pressure against the ram.

Typically, after the last segment of the hold profile is complete, you can program the SLC 5/04P processor so that it automatically:

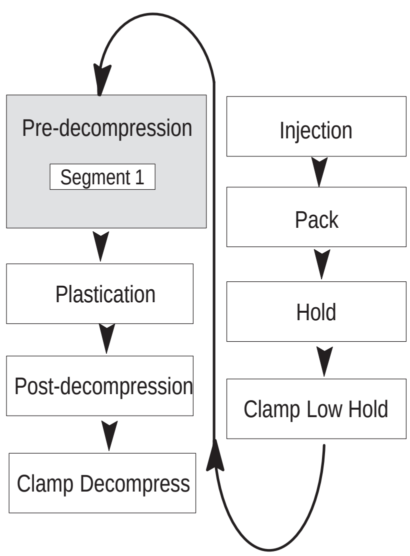
- starts the optional pre-decompression movement
- skips the pre-decompression movement if none is required
- starts the plastication profile immediately, or
- waits for a command from Pro-Set 200 ladder logic to continue (default selection)



Clamp Low Hold Profile (Typically Hydraulic Clamp Only)

The clamp low hold profile is typically turned off for a toggle clamp machine. For a hydraulic clamp machine it is active after the hold profile is complete. The clamp low hold profile is designed to allow the hydraulic clamp pressure to be reduced while decompression or plastication phases are occurring. This can be thought of as an energy savings feature if you want to lower the clamp pressure while the part is curing. If you do not want to reduce the pressure during this phase, set the pressure and velocity setpoints equal to the clamp tonnage setpoint.

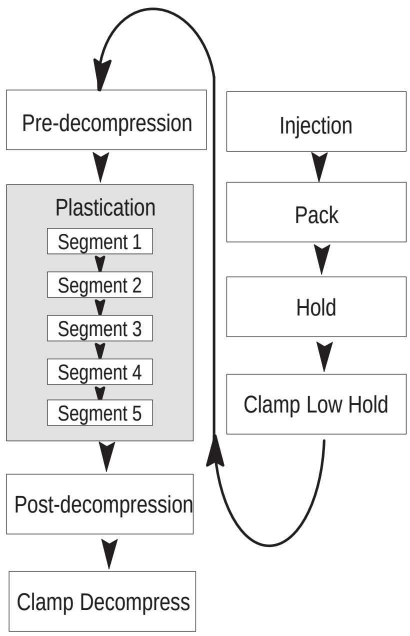
Clamp low hold is actually part of the clamp profile, but we show it here to clarify how the injection process works.



Pre-decompression Profile *(optional)*

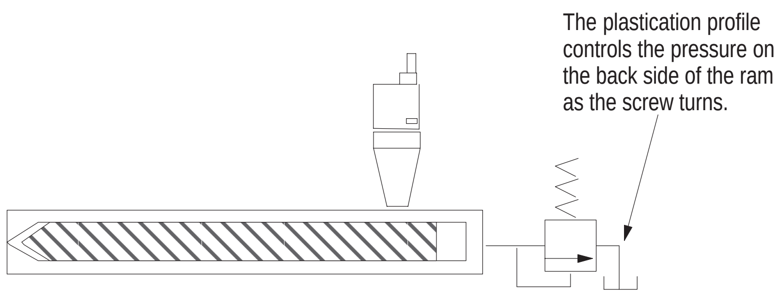
Pre-decompress is the single backward movement of the ram or screw before plastication occurs. This profile is also referred to as suckback.

After pre-decompression is complete, you can program Pro-Set 200 either to start the plastication profile immediately or to wait for a command from the ladder logic to continue.



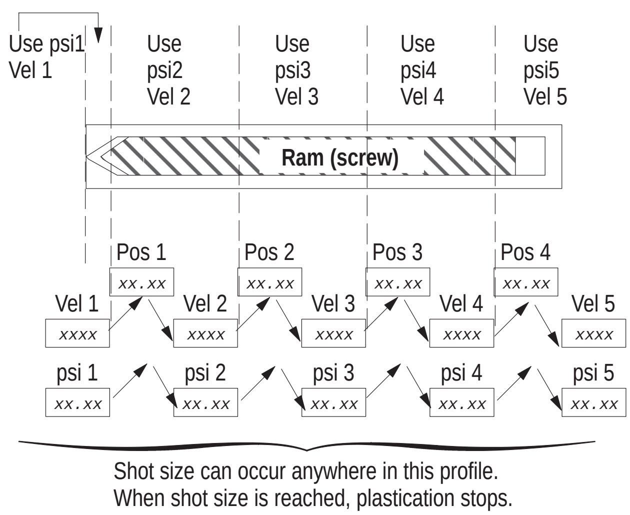
Plastication Profile

During plastication, the molding machine reloads by drawing plastic pellets into the barrel containing the screw. As the screw rotates, it moves plastic down the flights. Barrel heat, combined with the friction generated by the rotating screw, helps to liquify the plastic. As plastic moves down the screw flights, the plastic starts to build up in front of the screw tip.

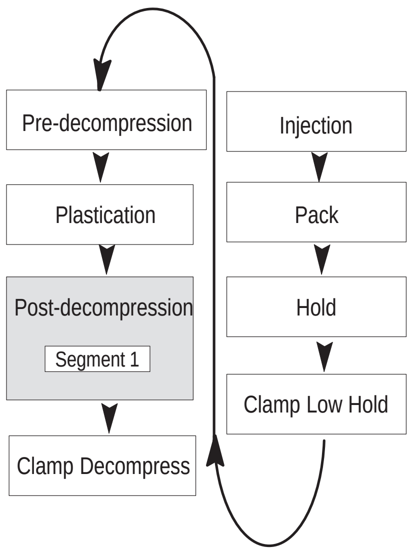


As the plastic builds up in front of the screw tip, the material pushes the screw backwards. The screw is tied to an injection cylinder (ram). The plastication profile controls backpressure on the ram by controlling the flow of hydraulic oil leaving the cylinder. This pressure profile allows you to control the amount of pressure applied to the plastic as the screw turns.

You can use plastication profiles to achieve the desired backpressure with respect to the distance of the length of the shot. You can control the backpressure by using pressure vs. position.



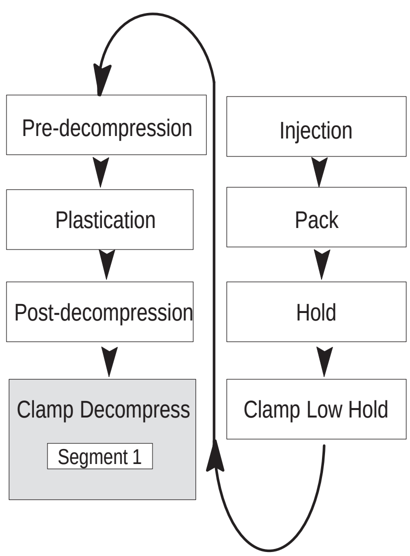
After the last segment of the plastication profile is complete, the SLC 5/04P processor either immediately starts the post-decompression profile or waits for a command from the ladder logic before continuing.



Post-decompression Profile *(optional)*

This single backward movement of the ram guards against the plastic running into the open mold during the clamp profiles (drooling). This profile is also referred to as plastic decompress or suckback.

To configure this profile, you define a length of the post-decompression pull-back of the ram.



Clamp Decompression Profile

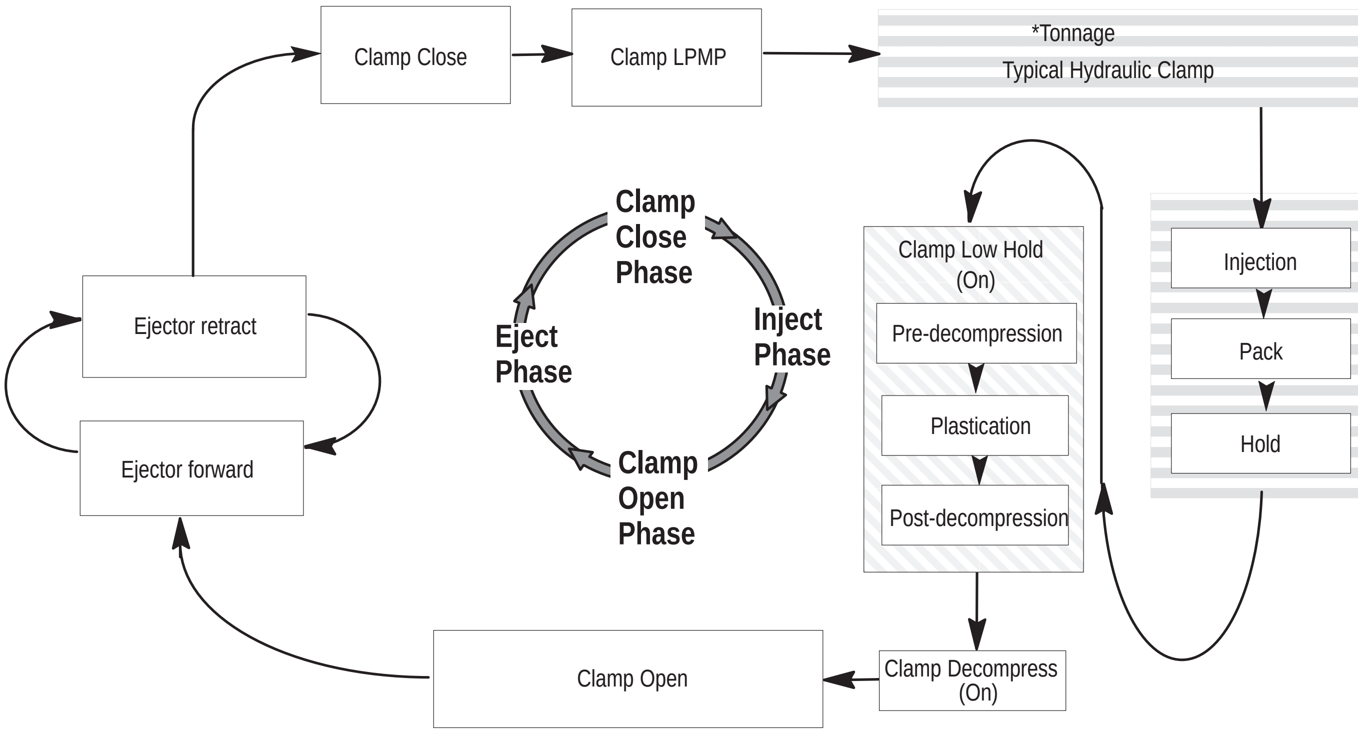
The clamp decompression profile is active before the clamp begins to open. This profile allows the clamp pressure on a hydraulic clamp to decay before opening. Typically, a hydraulic or toggle clamp machine opens more smoothly if the pressure on the clamp cylinder is allowed to bleed down to a minimum before trying to open the clamp.

Pro-Set 200 contains a cure timer. A cure timer allows a part to cool. The clamp will not decompress until the timer expires.

Clamp decompress is actually part of the clamp profile, but we show it here to clarify how the injection process works.

Clamp Open Phase

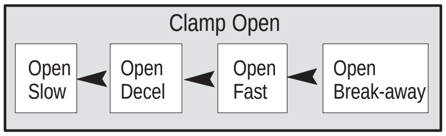
During the clamp open phase, the mold opens in preparation to eject the part.



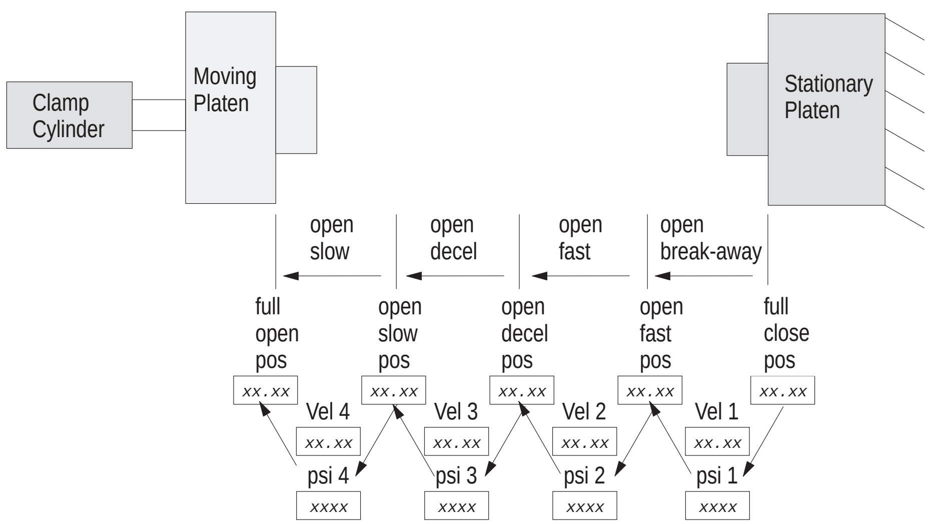
*Tonnage can vary between toggle and hydraulic machines. For this hydraulic example, tonnage is held until the clamp low hold profile is permitted.

Clamp Open Profile

The clamp open profile is divided into four segments.



Profile:	Description:
clamp open	This profile is made up of four segments: • **open breakaway segment** – the clamp cylinder moves the platen from the full close to the open fast position. The segment allows you to enter separate pressure and flow valves for the initial opening. This is normally set up to open the clamp slowly with enough pressure to break away the mold halves. • **open fast segment** – this segment occurs after the open breakaway segment is complete and is used to save cycle time. Once the clamp reaches the open fast position, the clamp travels quickly to the open decel position. This segment also has separate pressure and flow settings to allow flexibility. • **open decel segment** – during open decel, the clamp decelerates to the open slow position. Some machines may not require this step • **open slow segment** – the open slow segment allows the clamp to smoothly move to the full open position.



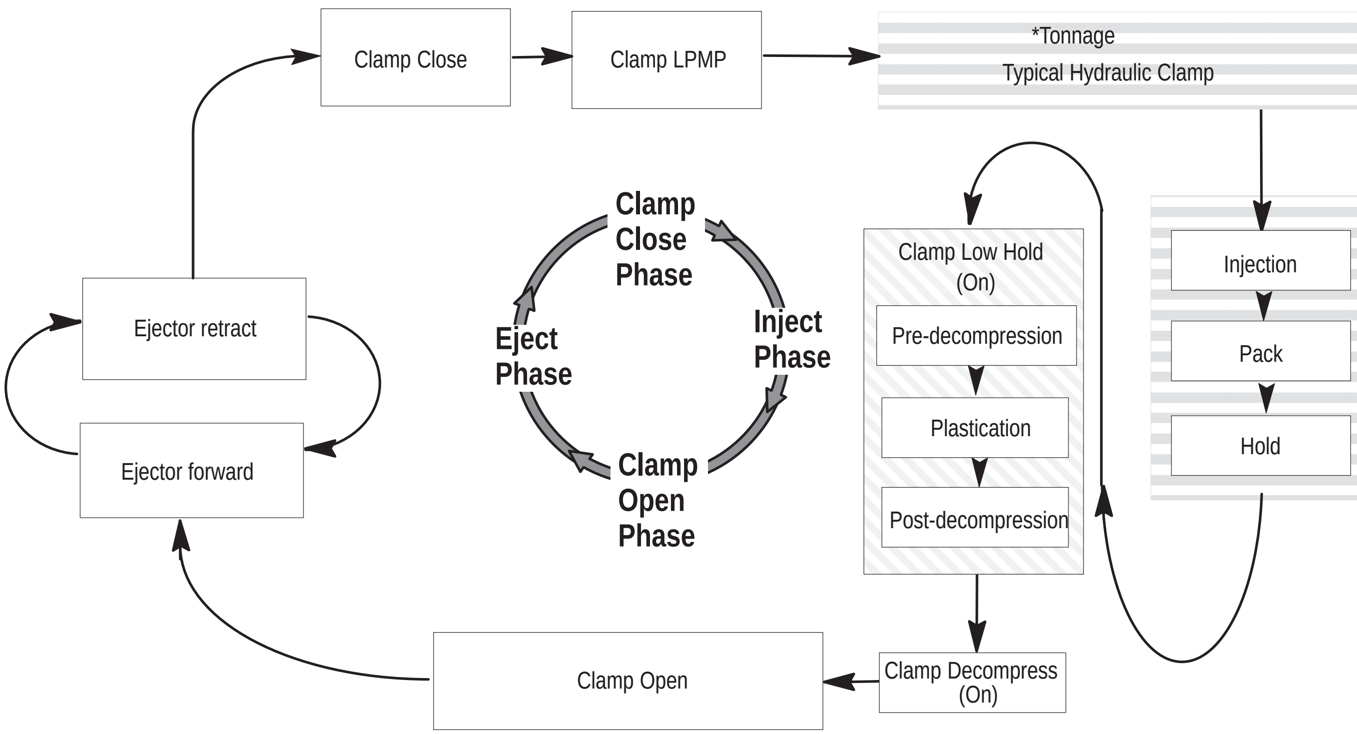
You can specify positions in your clamp open profile that let you:

- pull cores
- add or remove pumps to change available volume
- stop for a part retrieval device, then finish opening
- start the ejectors before the mold is fully open

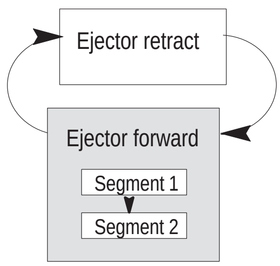
You can specify the pressure and flow setpoints for all segments in this profile.

Eject Phase

During the eject phase, the part is ejected (pushed) from the mold. You can advance and retract the ejector in a single step or in multiple steps using open-loop control.



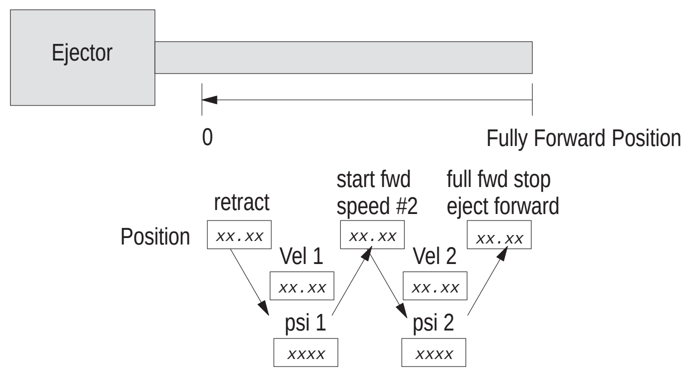
*Tonnage can vary between toggle and hydraulic machines. For this hydraulic example, tonnage is held until the clamp low hold profile is permitted.



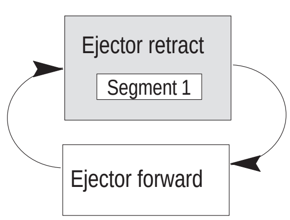
Ejector Forward Profile

The ejector forward profile moves the ejector pins toward a configured position to eject the part from the mold.

The standard Pro-Set 200 ejector profile shown below allows the ejector plate to be extended at two different velocities and pressures. As the ejector begins to extend, velocity 1 and pressure setpoint 1 become active. Once the ejector reaches the start forward speed position 2, the velocity 2 and pressure setpoint 2 remain active until the full forward position is reached.

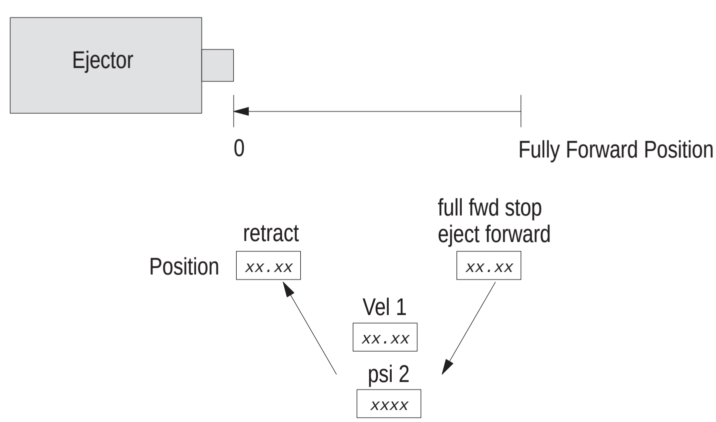


You can choose to advance the ejector while the clamp is still opening or wait until the clamp is fully open.



Ejector Retract Profile

The ejector retract profile moves the ejector pins back into the mold. The figure below shows a typical retract profile. Once the retract profile is active, the ejector plate is commanded to retract at the selected velocity and pressure. These setpoints remain active until the ejectors reach the fully retracted setpoint.



Use an ejector retract profile to control the ejector moving back into the mold with either velocity or pressure.

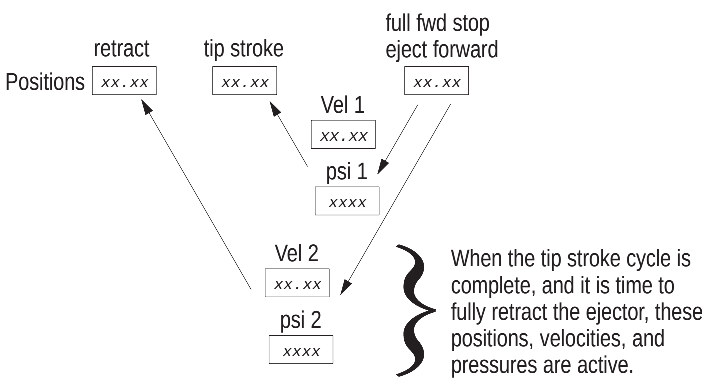
Other Eject Features

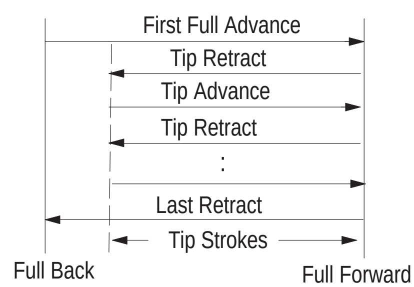
Pro-Set 200 lets you:

- use multistroking to repeat ejector cycles automatically. Multistroking is controlled automatically from the ladder logic.
- use an ejector forward dwell timer to pause the ejector after each ejector forward stroke. This feature lets a robot pick off a part when the ejectors are fully extended.
- use ejector tip strokes to shake the part off the ejector. You can program interim single-segment advance and retract tip strokes that occur after the first advance stroke and before the last retract stroke.

Note: If you are using limit switches to detect injector position, the tip stroking feature is **not** available.

During a tip stroke cycle the ejector retracts to the tip stroke position and Vel 1 and psi 1 are active. Once the tip stroke cycle is complete and the ejector pins are ready to fully retract, Vel 2 and psi 2 are active until the ejector pins fully retract.





What’s Next?

In the next chapter, we explain how to set up the hardware for your Pro-Set 200 system.

Setting Up the Hardware

What's in This Chapter?

This chapter explains how to set up the hardware for your Pro-Set 200 system. It tells you how to:

- determine the modules' position in the I/O chassis
- ground the chassis
- install the power supply
- install the SLC 5/04P processor
- install the I/O modules
- connect the programming terminal to the SLC 5/04P processor
- connect the PanelView terminal to the programming terminal
- wire the I/O modules
- configure the rack
- configure the power supply
- configure the I/O modules

Compliance to European Union Directives

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives:

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2
  EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2
  EMC – Generic Immunity Standard, Part 2 – Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131–2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

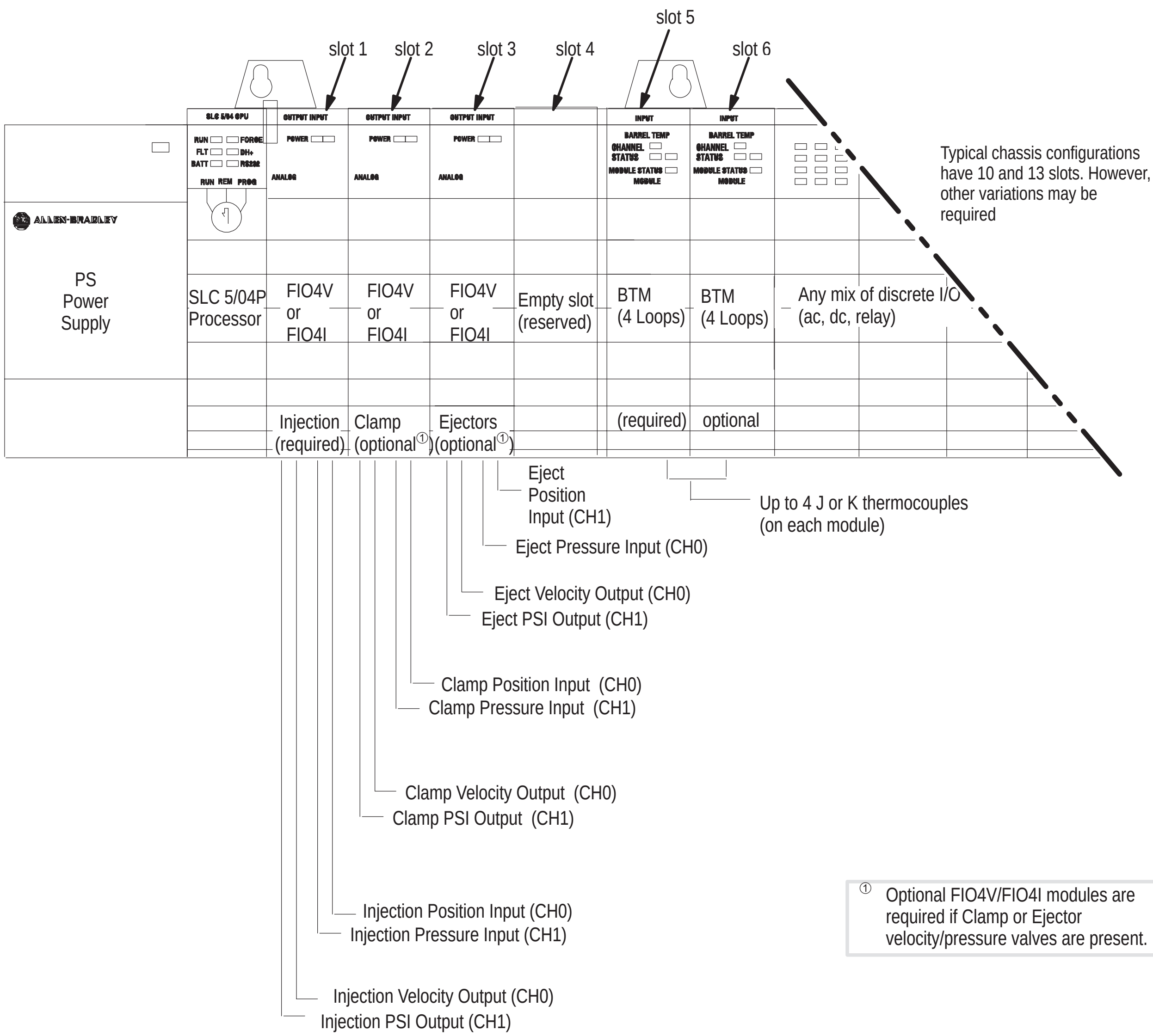
For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity
- Guidelines for Handling Lithium Batteries
- Automation Systems Catalog

Determining the Layout of the I/O Chassis

Here is the recommended module layout for a basic system with I/O modules.

Figure 4.1 Module Layout



Module:	Location:	Function:	Inputs:	Outputs:
FIO4V ①	slot 1	injection	position, psi	velocity, psi
FIO4V ①	slot 2	clamp	position, psi	velocity, psi
FIO4V ①	slot 3	ejectors	position, psi	velocity, psi
—	slot 4	reserved	—	—
BTM	slot 5	barrel temp.	thermocouple	separate module
BTM	slot 6	barrel temp.	thermocouple	separate module (optional)

① Indicates that you can also use an FIO4I.

Understanding How Pro-Set 200 Ladder Logic Relates to the Module Positions in the I/O Chassis

The baseline Pro-Set 200 ladder logic accommodates the module locations shown in figure 4.1. Pro-Set 200 uses a variety of MOV (Move), COP (Copy), IOM (Immediate Output), and IIM (Immediate Input) instructions in conjunction with the fast analog and BTM modules.

Important: We do not recommend changing the locations of the fast analog modules and BTM modules located in the first six slots of the I/O chassis because it increases the number of changes that you must make to the ladder program.

If you want to change the locations for the fast analog modules and BTM modules (first six slots), modify the MOV, COP, IOM, and IIM instructions contained in these files:

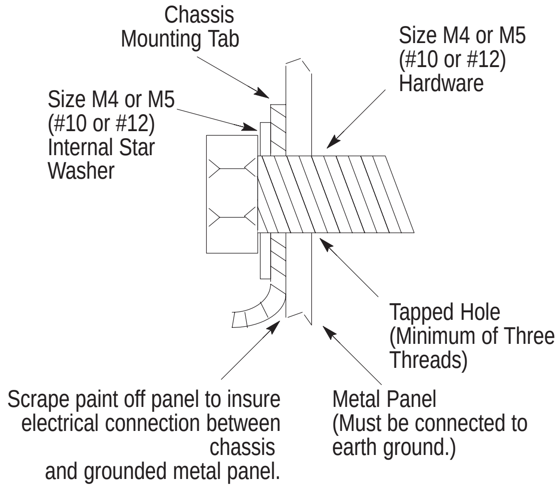
- file 2
- file 3
- file 8
- file 9 (if inject analog card is not in slot 1)
- file 12 (if clamp analog card is not in slot 2)
- file 15 (if ejector analog card is not in slot 3)
- file 20 (software travel limits/loss of sensor if analog cards are not in assigned slots)
- file 99 (if BTM modules are not in slots 5 and 6)

Grounding the Chassis

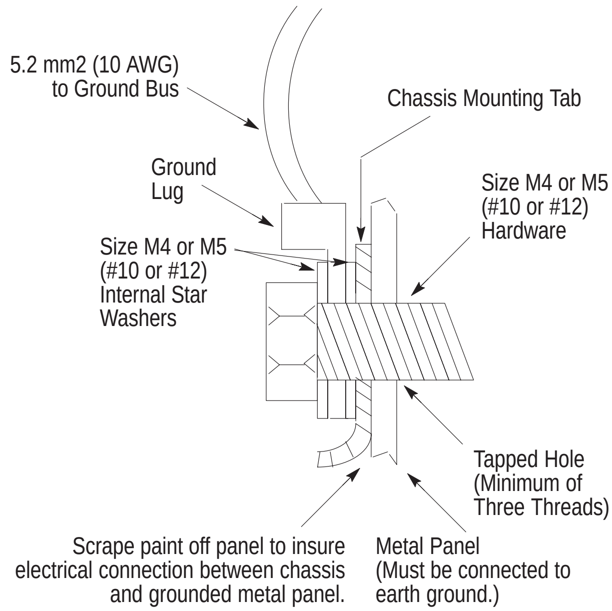
Grounding Guidelines

In solid-state control systems, grounding helps limit the effects of electrical noise due to electromagnetic interference (EMI).

Normal Electrical Noise Conditions



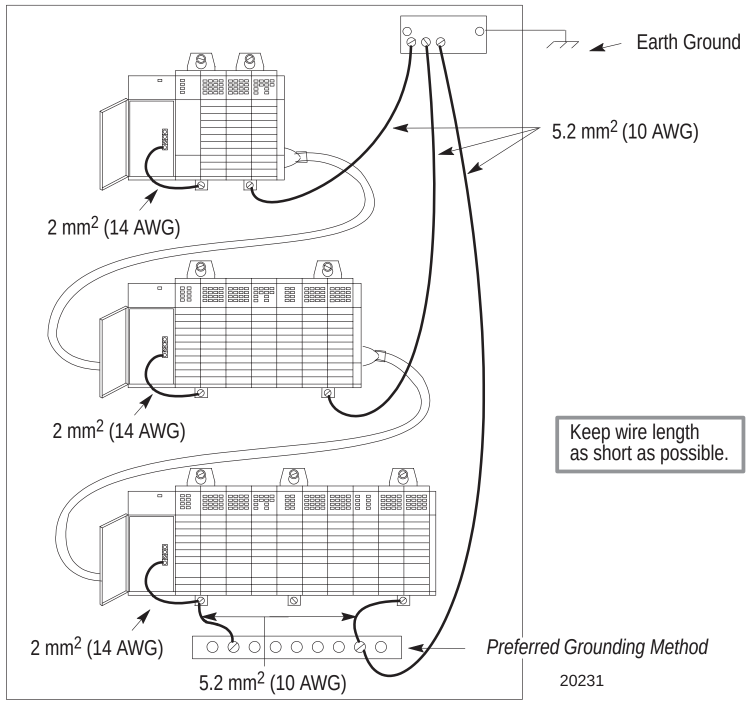
Severe Electrical Noise Conditions



For more information about grounding the chassis, see the SLC 500 Modular Hardware Style Installation and Operation Manual, publication number 1747-6.2.

Running Ground Connections

This figure shows you how to run ground connections from the chassis to the ground bus. Two acceptable grounding methods are shown; we recommend using a ground bus because it reduces the electrical resistance at the connection.



ATTENTION: You must properly ground the 1746 chassis, the enclosure, and other control devices. Observe all applicable codes and ordinances when wiring the system.

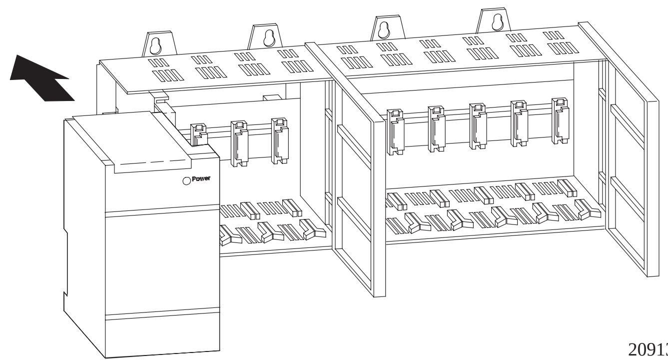
You should run ground connections from the chassis and power supply on each adapter and expansion unit to the ground bus. Exact connections will differ between applications.

United States: An authoritative source on grounding requirements for most installations is the National Electrical Code. Also, see Allen-Bradley Programmable Controller Grounding and Wiring Guidelines, publication number 1770-4.1.

Installing the Power Supply

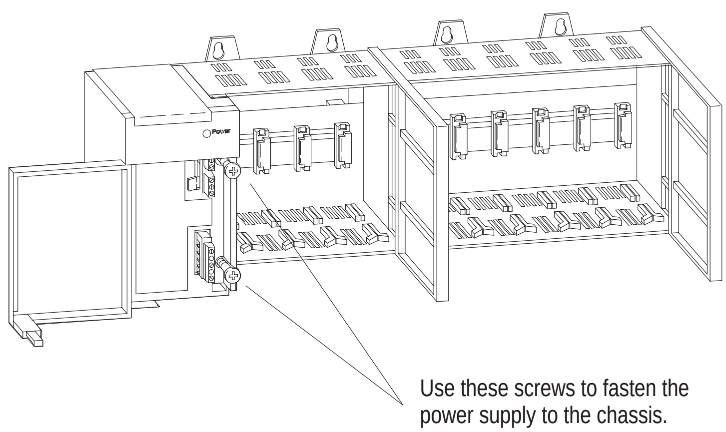
To install the power supply, do the following:

1. Align the circuit board of the power supply with the card guides on the left side of the chassis, and slide the power supply in until it is flush with the chassis.



20913–M

2. Fasten the power supply to the chassis.

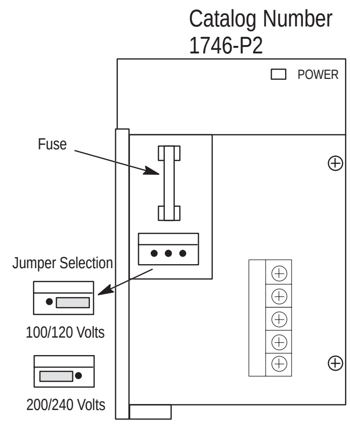


20913–M

3. If you are using a 1746-P2 power supply, make a jumper selection for 120/240V ac.

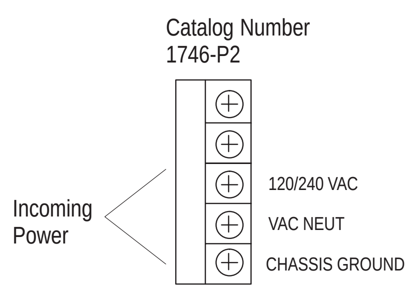
4. Place the input voltage jumper to match the input voltage.

ATTENTION: Set the input jumper before applying power. Hazardous voltage is present on exposed pins when power is applied; contact with the pin may cause injury to personnel.



5. Wire the power to power supply.

ATTENTION: Turn off incoming power before connecting wires; failure to do so could cause injury to personnel and/or equipment.



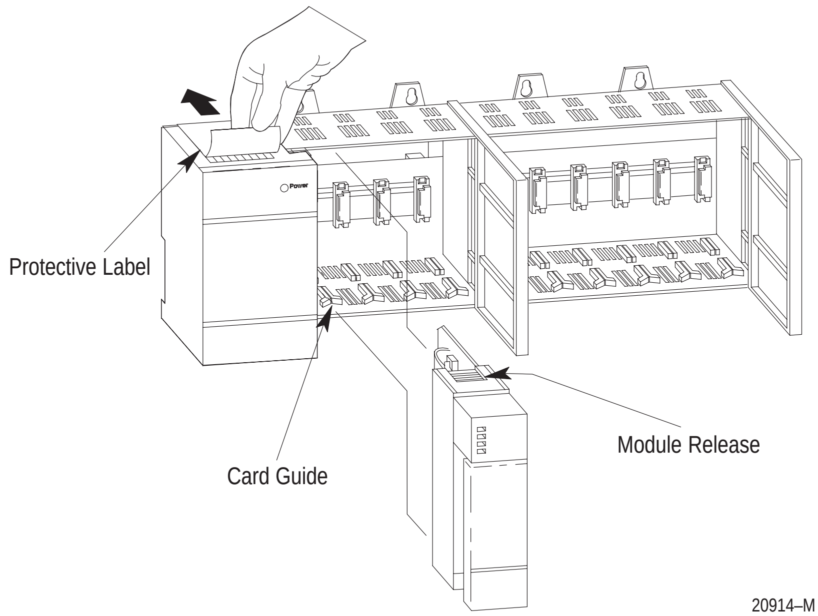
For more information about installing the power supply, see the SLC 500 Modular Hardware Style Installation and Operation Manual, publication number 1747-6.2.

Installing the SLC 5/04P Processor

To install the processor, do the following:

1. Make sure system power is off.
2. Insert the processor into the 1746 chassis.

Important: You must insert the SLC 500 modular processors into the left slot (slot 0), as shown below. Remove the protective label after installing the processor.

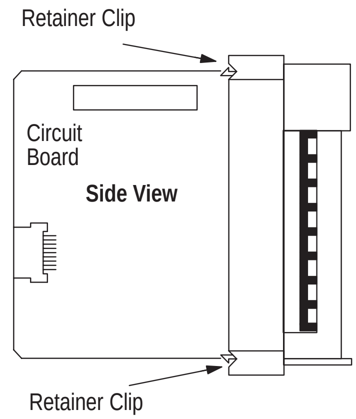


For more information about installing the SLC 5/04P processor, see the SLC 500 Modular Hardware Style Installation and Operation Manual, publication number 1747-6.2.

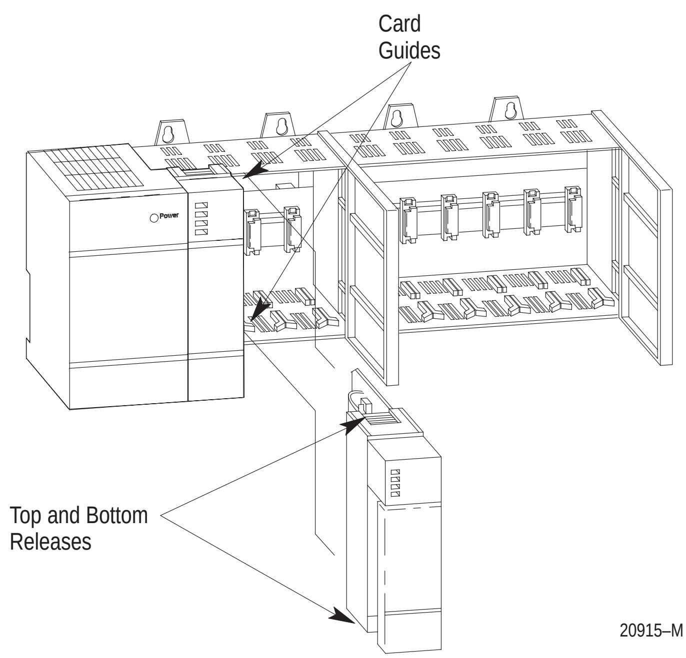
Installing the I/O Modules

To install the I/O modules, do the following for each module:

1. Align the circuit board of the module with the card guide in the chassis.



2. Gently slide the module in until both top and bottom retainer clips are secured.



For more information about installing the I/O modules, see the SLC 500 Modular Hardware Style Installation and Operation Manual, publication number 1747-6.2.

Connecting the Programming Terminal to the SLC 5/04P Processor

Installing the Programming Terminal Interface Card

If you have a:	See:
1784-KT card	Communication Interface Module (1784-KT/B) Installation Instructions, publication 1784-2.31 to install the 1784-KT communication card
1784-KTX card	Communication Interface Card (1784-KT/B) Installation Instructions, publication 1784-6.5.22 to install the 1784-KTX communication card
1784-KTXDcard	Communication Interface Card (1784-KT/B) Installation Instructions, publication 1784-6.5.22 to install the 1784-KT communication card
1784-PCMK card	PCMK Communication Card User Manual, publication 1784-6.5.19 to install the 1784-PCMK communication card

Connecting the Programming Terminal Interface Card to the SLC 5/04P Processor

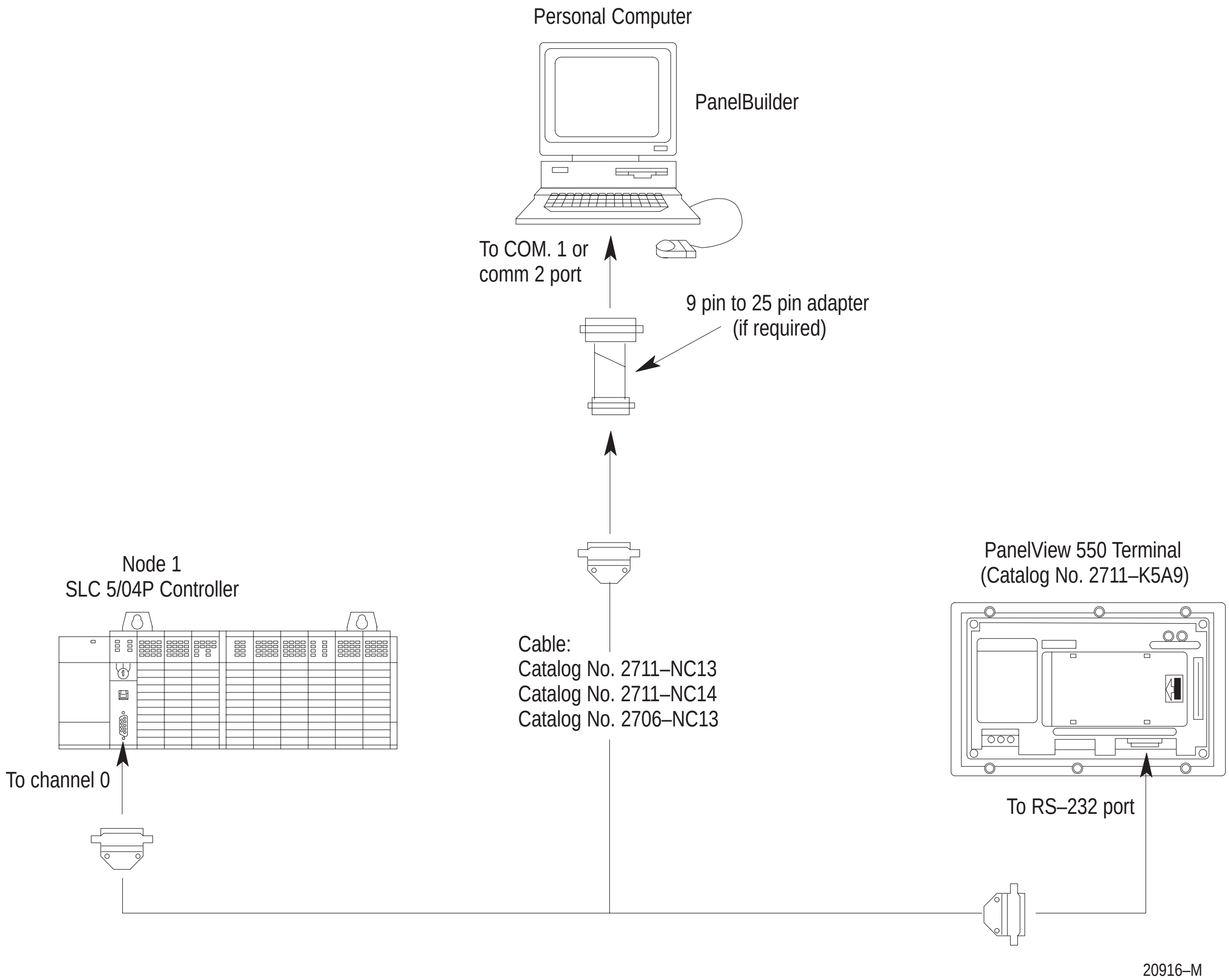
If you have a:	See::
1784-KT card	Communication Interface Module (1784-KT/B) Installation Instructions, publication 1784-2.31 to connect the 1784-KT communication card to the SLC 5/04P processor
1784-KTX card	Communication Interface Card (1784-KT/B) Installation Instructions, publication 1784-6.5.22 to install the 1784-KTX communication card to the SLC 5/04P processor
1784-KTXDcard	Communication Interface Card (1784-KT/B) Installation Instructions, publication 1784-6.5.22 to install the 1784-KT communication card to the SLC 5/04P processor
1784-PCMK card	PCMK Communication Card User Manual, publication 1784-6.5.19 to connect the programming terminal interface card to the SLC 5/04P processor

Connecting the PanelView Terminal to the Programming Terminal and SLC 5/04P Processor

PanelView 550

On the RS-232 version of the PanelView 550 terminal (2711-K5A9, series E for version 2.0 or greater), use the following cables to transfer PanelBuilder 550 applications between the RS-232 port of the terminal and the RS-232 port of a personal computer and communicate to the SLC 5/04P controller.

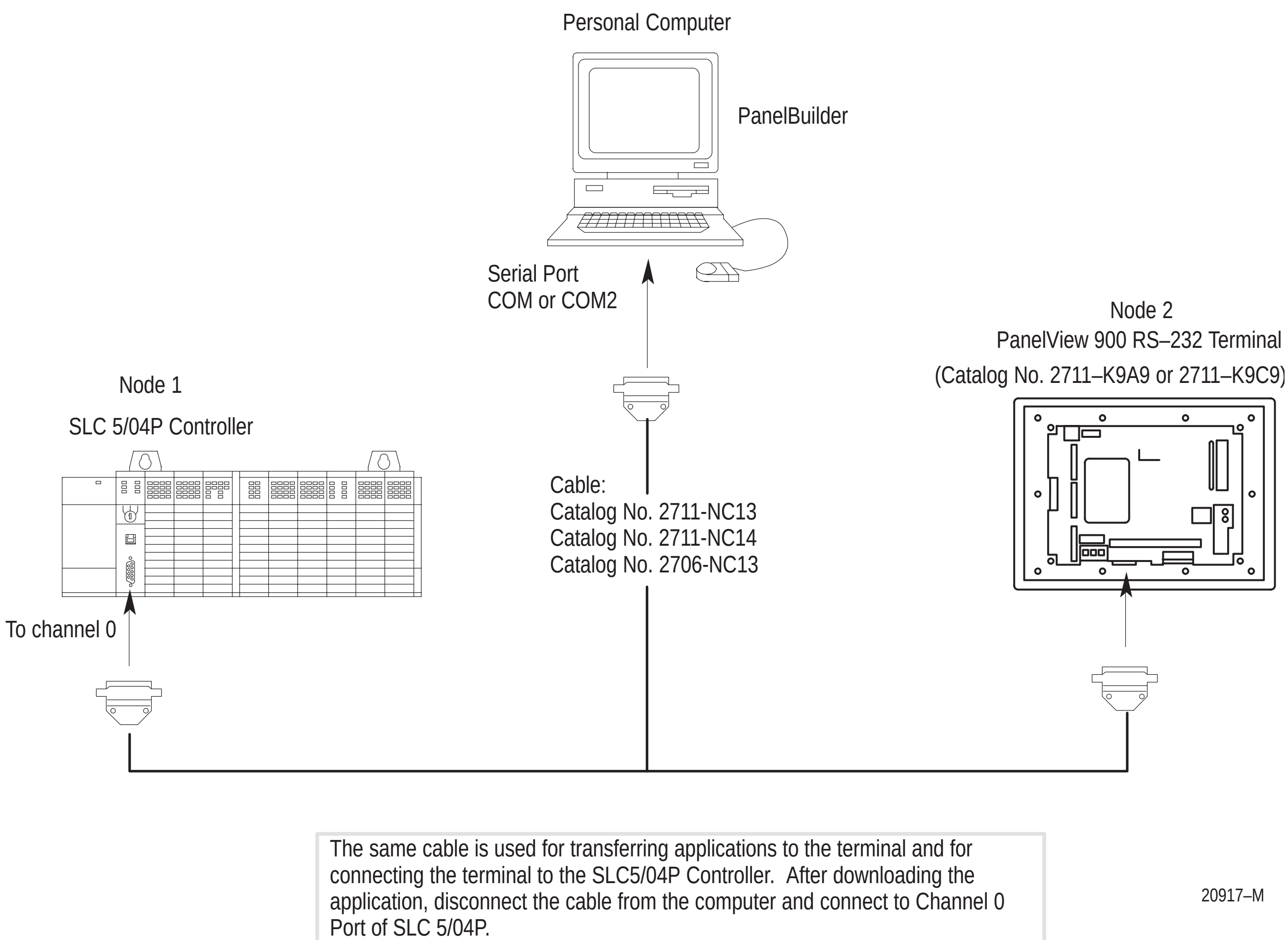
- 16.4 foot (5 meter) catalog no. 2711-NC13
- 32.7 foot (10 meter) catalog no. 2711-NC14
- 10 foot (3 meter) catalog no. 2706-NC13



For more information about connecting a PanelView 550 terminal to the programming terminal, see PanelView 500 Operator Terminals User Manual, publication number 2711-6.1.

PanelView 900

On the RS-232 version of the PanelView 900 monochrome terminal (2711-K9H9 firmware version 2.0 or greater)and color terminal (2711–K9C9 firmware version 2.0 or greater), use the following cables to transfer PanelBuilder 900 applications between the RS-232 port of the terminal and the RS-232 port of a personal computer and communicate to the SLC 5/04P controller.



For more information about connecting a PanelView 900 terminal to the programming terminal, see PanelBuilder/PanelView 900 Operator Terminal Getting Started Guide, publication number 2711-6.2.

Pro-Set 200 Function Key Legend Kits

The following describes the function key legend kits that are available for the PanelView 550 and PanelView 900 keypad terminals. These legend kits contain:

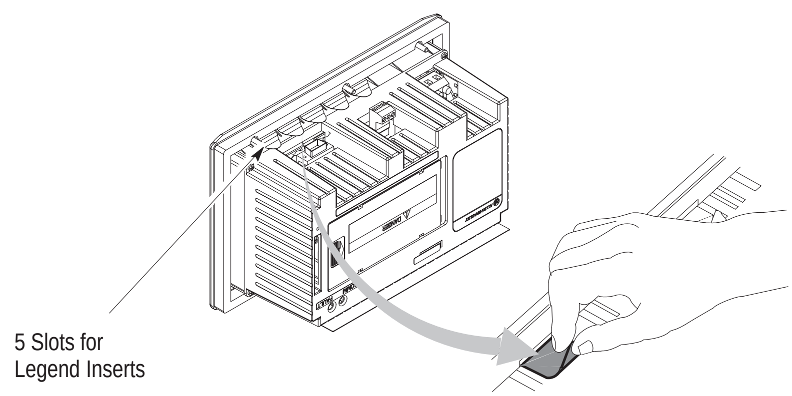
- a set of preprinted labels
- a set of blank labels

Using the blank labels, you can create your own custom labels for the function keys on these terminals, and then use them to identify keys associated with screen objects.

PV550 Function Key Legend Kit (Catalog No. 6500-PS2LBL5)

The legend kit for the PanelView 550 terminal contains 5 inserts that are preprinted on one side with the labels F1 - F10, with SPI symbols for various machine functions (e.g., clamp close, injection, alarm, etc.). You can create custom labels using the other set of inserts.

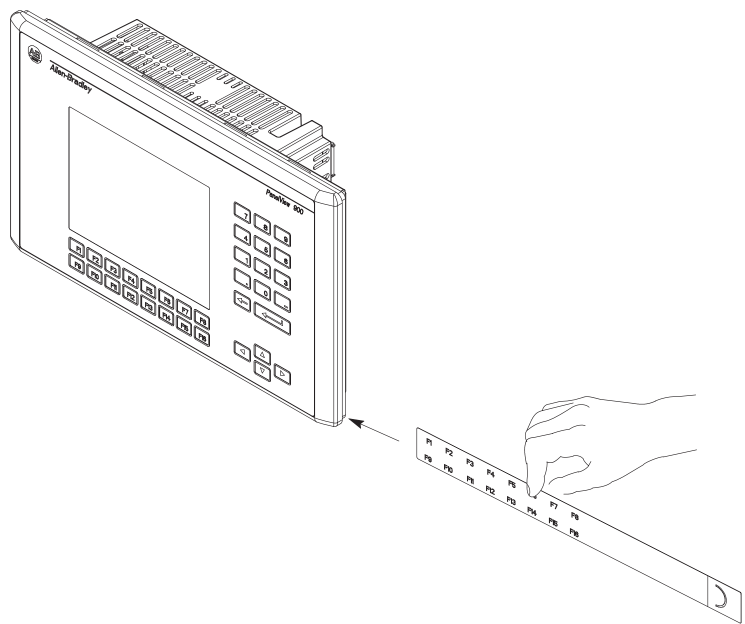
The following diagram illustrates how to insert the function key legends into the PanelView 550 terminal.



PV900 Function Key Legend Kit (Catalog Nos. 6500-PS2LBL9C and 6500-PS2LBL9M)

The legend kit for the PanelView 900 terminal contains 1 insert that is preprinted on one side with the labels F1 - F16, with SPI symbols for various machine functions (e.g., clamp close, injection, alarm, etc.). You can create custom labels using the other set of inserts.

The following diagram illustrates how to insert the function key legend into the PanelView 900 terminal.



Important: Catalog No. 6500-PS2LBL9C is used for color PanelView 900 terminals; 6500-PS2LBL9M is used for monochrome

Wiring the Fast Analog I/O Modules

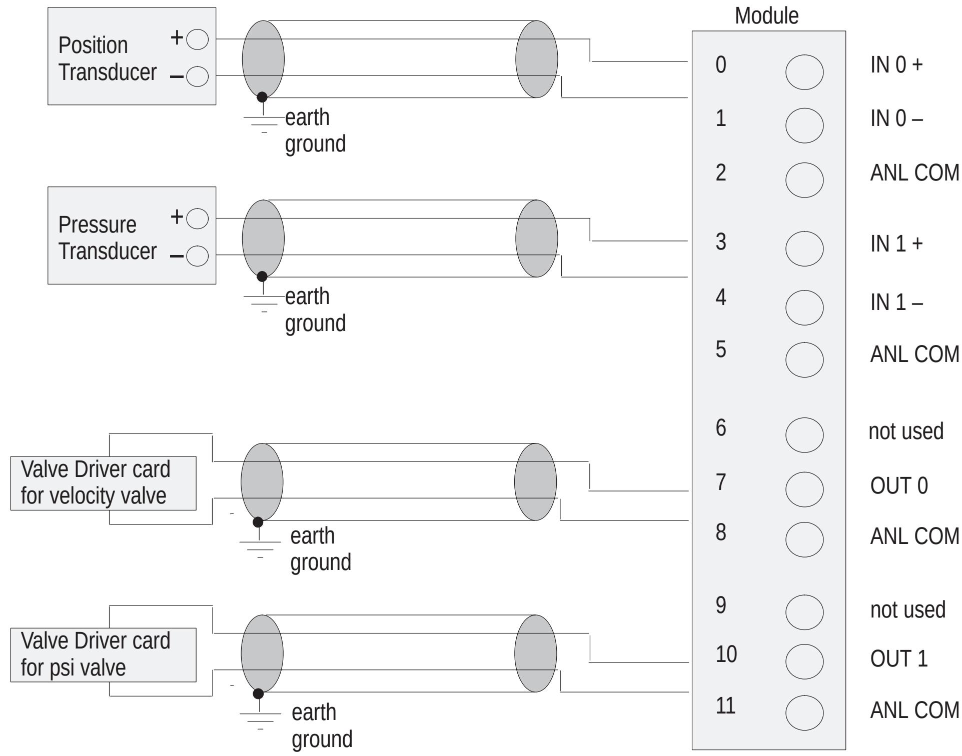
Wiring 1746-FIO4V or -FIO4I Modules

Important: Remember:

- to connect only one end of the cable shield to earth ground
- that channels are not isolated from each other; all analog commons are connected together internally
- that the module does not provide loop power for analog inputs
- to use a power supply that matches the transmitter (sensor) specifications

For each axis (injection, clamp, ejectors), wire the 1746-FIO4V or 1746-FIO4I module like this:

Use Belden 8762 cable or equivalent.



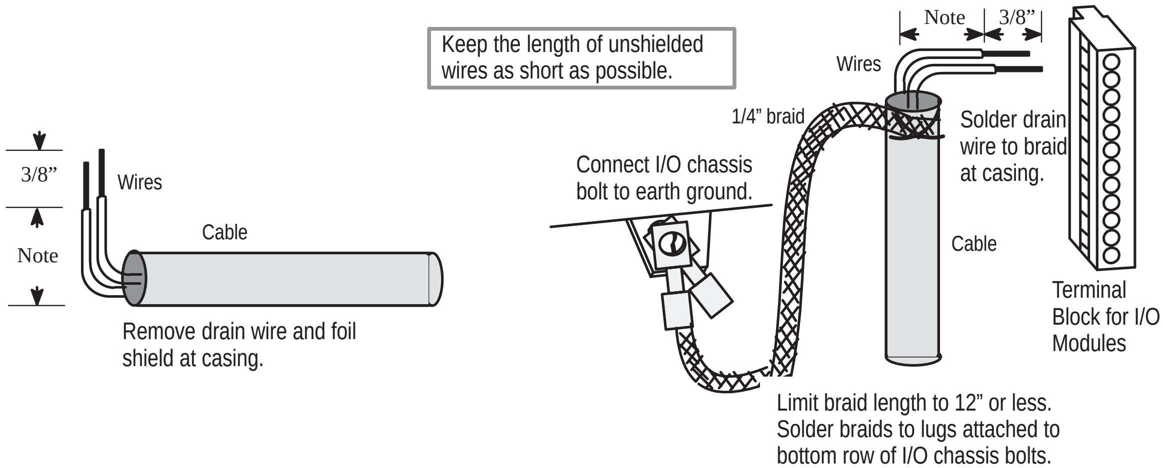
Grounding the Cable Shield

In CE applications, use the following to ground the shields on the fast analog modules:

- ground the cable shield to the earth ground at only one end
- use 1/4 inch (6.35mm) wide braid for grounding the cable shield
- keep all unshielded wires as short as possible
- ground the opposite end instead (ground one end only) if noise persists

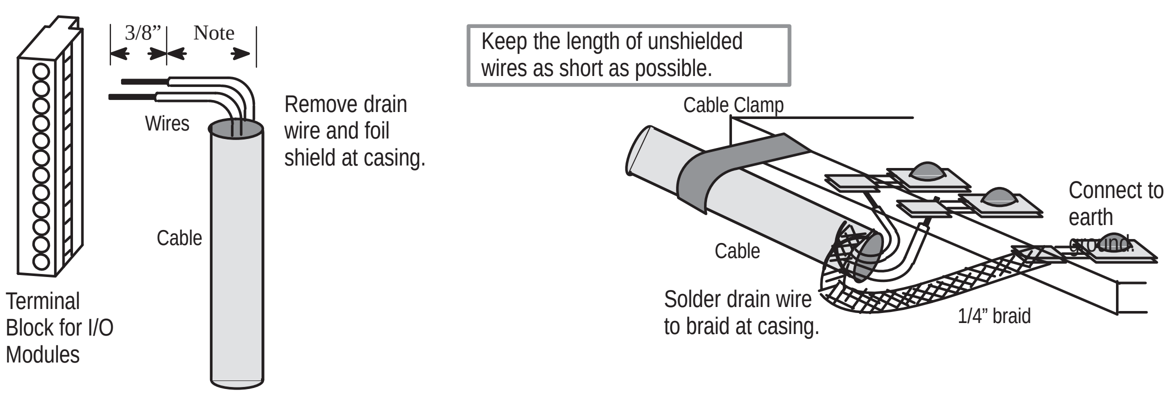
For cable shields grounded at the I/O chassis (input channels), do this:

Ungrounded End at Source Device **Grounded End at I/O Chassis**



For cable shields grounded at the I/O device (output channels), do this:

Ungrounded End at Output of Module **Grounded End at I/O Device**



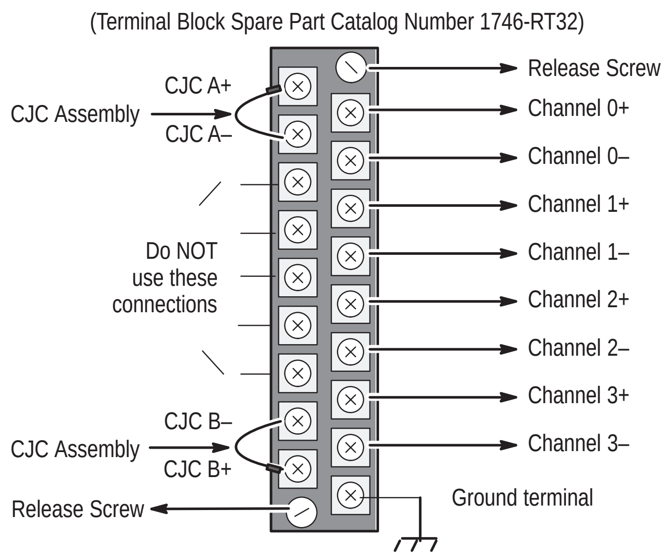
For more information about wiring a 1746-FIO4V or 1746-FIO4I module, see SLC 500 Fast Analog I/O Module User Manual, publication number 1746-6.9.

Wiring the 1746-BTM Modules

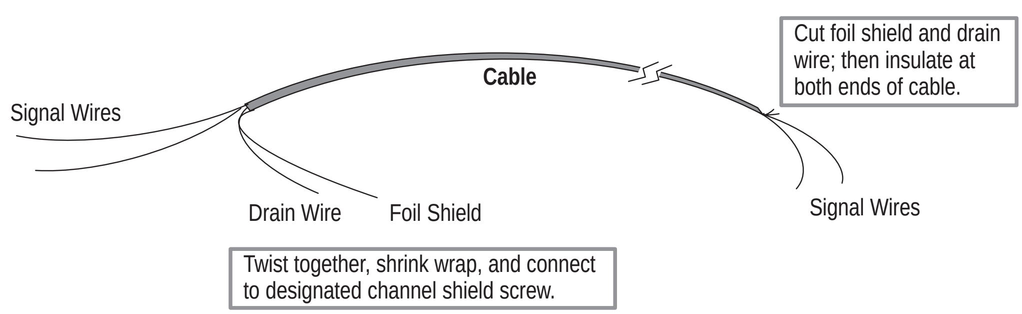
The BTM module contains a green, 18-position, removable terminal block. The terminal pin-out is shown below.

ATTENTION: Disconnect power to the SLC 5/04P processor before attempting to install, remove, or wire the removable terminal wiring block.

To avoid cracking the removable terminal block, alternate the removal of the slotted terminal block release screws.



After the module is properly installed in the chassis, follow the wiring procedure using the proper thermocouple extension cable.



To wire the module, follow these steps.

1. At each end of the cable, strip some casing to expose individual wires.

2. Trim signal wires to 5-inch lengths beyond the cable casing. Strip about 3/16 inch (4.7 mm) of insulation to expose the ends of the wires.

3. At the module-end of the cables:
   – extract the drain wire and signal wires
   – remove the foil shield
   – bundle the input cables with a cable strap

4. Connect drain wires together and solder them to a 3/8 inch (9.5 mm) wire braid, 12 inches (304.8 mm) long.
   Keep drain wires as short as possible.

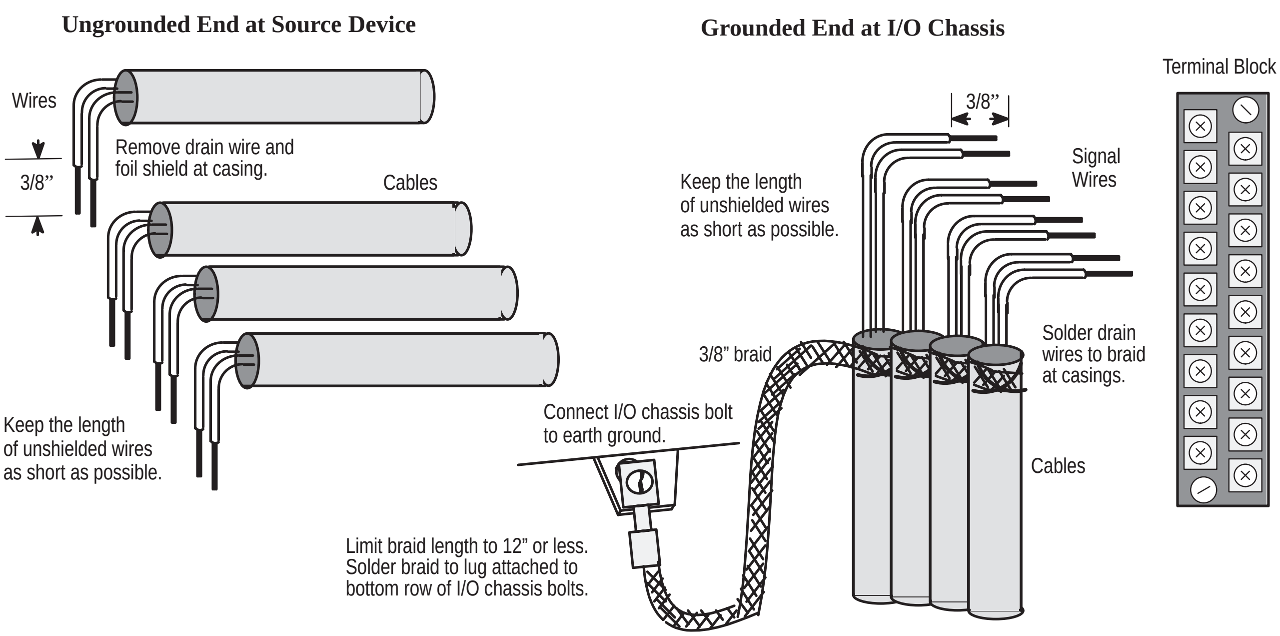
5. Connect the 3/8" wire braid to the nearest chassis mounting bolt.

6. Connect the signal wires of each channel to the terminal block .
   Important: Only after verifying that your connections are correct for each channel, trim the lengths to keep them short. Avoid cutting leads *too* short.

7. At the source–end of cables from mV devices:
   – remove the drain wire and foil shield
   – apply shrink wrap as an option
   – connect to mV devices keeping the leads short

Important: If noise persists, try grounding the opposite end of the cable, instead. (Ground one end only.)

Cable Preparation and Connections to Minimize Electrical Noise Interference



For more information about wiring a 1746-BTM module, see the Barrel Temperature Control Module user manual, publication number 1746-6.10.

Installing Pro-Set 200 Software

What's in This Chapter?

This chapter explains how to set up the software for your Pro-Set 200 system. It helps you:

- understand what is shipped on the Pro-Set 200 software disk set
- understand what the software and hardware requirements are
- locate publications to help you install the software

Understanding the Pro-Set 200 Software Disk Set

Pro-Set 200 contains five floppy disks:

This diskette:	Contains These Files:	That Let You:
Ladder Logic Disk 3 of 3	• Pro-Set 200 Ladder Logic Files • rung, address, and symbol comments	• monitor and modify system logic • understand the ladder program
PanelView 550 Screens Disk 1 of 1	Pro-Set 200 screens to be displayed on the PanelView 550, including: • operator screens (`ps2o102.pva` and `ps2o102.pba`) • setup screens (`ps2s102.pva` and `ps2s102.pba`) • BTM configuration screens (`ps2b102.pva` and `ps2b102.pba`) • configuration screens (`ps2c102.pba` and `ps2c102.pva`)	• modify temperature, velocity, and pressure setpoints • span input sensors and output valves • define BTM mode and gain values during setup • define profile types
PanelView 900 Screens Disk 1 of 1	Pro-Set 200 screens to be displayed on the PanelView 900, including: • operator screens (`ps2o102.pva` and `ps2o102.pba`) • setup screens (`ps2s102.pva` and `ps2s102.pba`) • BTM configuration screens (`ps2b102.pva` and `ps2b102.pba`) • configuration screens (`ps2c102.pba` and `ps2c102.pva`)	• modify temperature, velocity, and pressure setpoints • span input sensors and output valves • define BTM mode and gain values during setup • define profile types

ATTENTION: This software is a starting point for an injection molding system. The user5 must modify the software to comply with any applicable standards governing the final product application.

Software Requirements

Before you install Pro-Set 200 software, make sure you have this additional software:

Important: Pro-Set 200 software runs on Microsoft Windows® 95 only.

To:	You will need:
run PanelBuilder and RSLogix 500 software	Microsoft Windows 95
modify Pro-Set 200 PanelView screens	PanelBuilder software, catalog no. 2711-ND3, version 2.3.1 or later
modify Pro-Set 200 ladder logic code	RSLogix 500 programming software, version 2.00.57

Neither PanelBuilder software nor RSLogix 500 programming software is supplied with Pro-Set 200; you must order these items separately. Contact your Rockwell Automation or Rockwell Software representative for more information.

Important: This procedure does not tell you how to install or run PanelBuilder or RSLogix 500 software. For more information on these packages, refer to these manuals:

For information on:	Refer to:
RSLogix 500 software	the instructions enclosed with RSLogix 500 software
PanelBuilder software	PanelBuilder 550/900 Software, publication number 2711-6.0

Hardware Requirements

We recommend that you install Pro-Set 200 software on an IBM-compatible personal computer that has at least:

- a 60 MHz pentium processor
- 15 Megabytes available hard drive space for PanelBuilder software
- 8 Megabytes available hard drive space for RSLogix programming software
- 7 Megabytes available hard drive space for Pro-Set 200 software
- 16 Megabytes RAM

Installing the Software

To install Pro-Set 200 software, refer to the Installation Instructions, publication number 6500-IN001A–US–P, supplied with the Pro-Set 200 diskettes.

What's Next?

In the next chapter, we explain how to customize your system.

Chapter 6

Customizing Your System

What's in This Chapter?

This chapter helps you customize the software for your molding machine. It helps you:

- understand Pro-Set 200 ladder files
- customize your ladder logic
- understand ladder logic
- use machine sequence bar charts
- customize/modify PanelView screens

ATTENTION: This software is a starting point for an injection molding system. The user5 must modify the software to comply with any applicable standards governing the final product application.

Understanding Pro-Set 200 Ladder Files

Before you begin modifying the Pro-Set 200 ladder logic, it's important to understand how the ladder files work. The figure on the next page shows the relationship of each ladder file in Pro-Set 200.

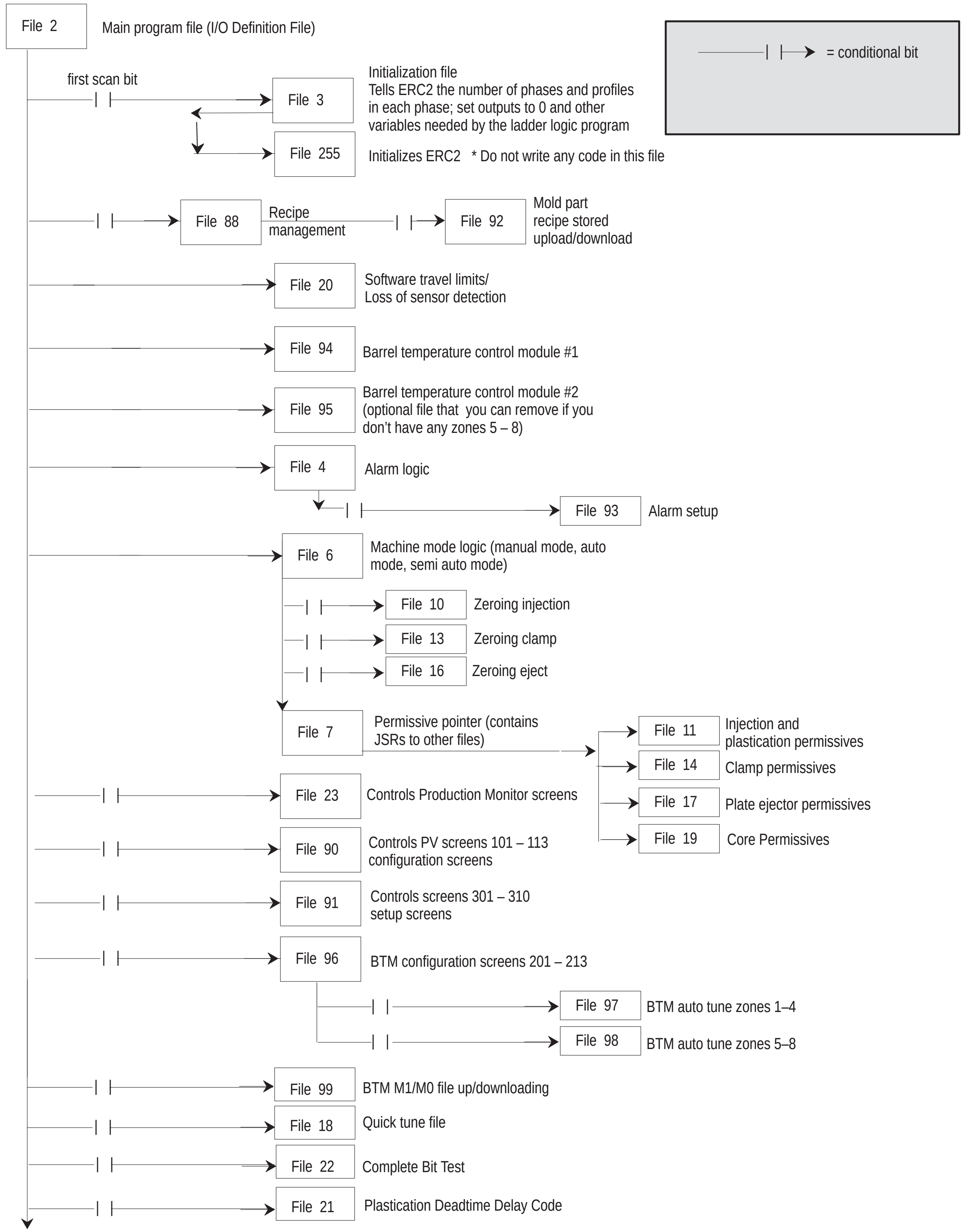
Pro-Set 200 ladder logic contains code that controls the injection ram, clamp, and ejectors. The ladder logic files contain:

- machine mode code (i.e., manual, semi-automatic, and full-automatic modes)
- simple machine alarms (such as "gate opened in cycle," "plastication short shot")

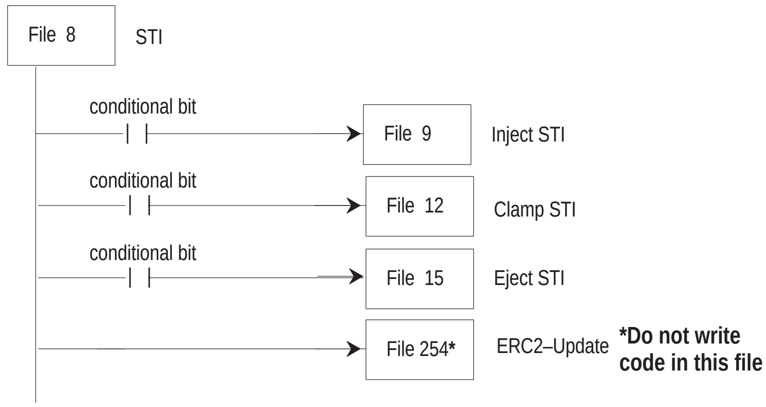
To use the supplied ladder logic you must modify file 2 (the I/O definition file) to do the following:

- identify input and output addresses used with your machine.
- define the specific inputs you want to use (for example, a front gate closed limit switch)
- use profile status bits to define the specific outputs you want to use (for example, a solenoid)

Next, you must modify file 8 (the STI file) to direct the control signals from ERC2 to the appropriate Fast Analog card. Finally, you may also modify file 3 to initialize your specialty cards on power–up.


File 2
Main program file (I/O Definition File)
= conditional bit
first scan bit
File 3
Initialization file
Tells ERC2 the number of phases and profiles
in each phase; set outputs to 0 and other
variables needed by the ladder logic program
File 255
Initializes ERC2 * Do not write any code in this file
File 88
Recipe
management
File 92
Mold part
recipe stored
upload/download
File 20
Software travel limits/
Loss of sensor detection
File 94
Barrel temperature control module #1
File 95
Barrel temperature control module #2
(optional file that you can remove if you
don't have any zones 5 – 8)
File 4
Alarm logic
File 93
Alarm setup
File 6
Machine mode logic (manual mode, auto
mode, semi auto mode)
File 10
Zeroing injection
File 13
Zeroing clamp
File 16
Zeroing eject
File 7
Permissive pointer (contains
JSRs to other files)
File 11
Injection and
plastication permissives
File 14
Clamp permissives
File 17
Plate ejector permissives
File 19
Core Permissives
File 23
Controls Production Monitor screens
File 90
Controls PV screens 101 – 113
configuration screens
File 91
Controls screens 301 – 310
setup screens
File 96
BTM configuration screens 201 – 213
File 97
BTM auto tune zones 1–4
File 98
BTM auto tune zones 5–8
File 99
BTM M1/M0 file up/downloading
File 18
Quick tune file
File 22
Complete Bit Test
File 21
Plastication Deadtime Delay Code

Pro-Set 200 ladder logic also makes use of an STI file. This STI file (file 8) is used to control the operation of the clamp, injection, and ejector logic as well as the ERC2 algorithms. The STI file interrupts the main ladder program logic every 10 milliseconds.



Notice the following relationships between the files in the figures:

- Files 5 and 95 are optional files you can remove if your application does not require certain functionality. Removing these files frees up memory in the SLC 5/04P processor which can be used for other purposes.
- The initialization file for the ladder code and ERC2 algorithms is located in file 3. This file is scanned when the first scan bit is set. File 3 also contains a JSR to file 255 to initialize ERC2. This occurs when the processor is first powered up or when the keyswitch is turned from PROG to RUN.
- Do not program any ladder logic in files 254 and 255

Customizing Ladder Logic

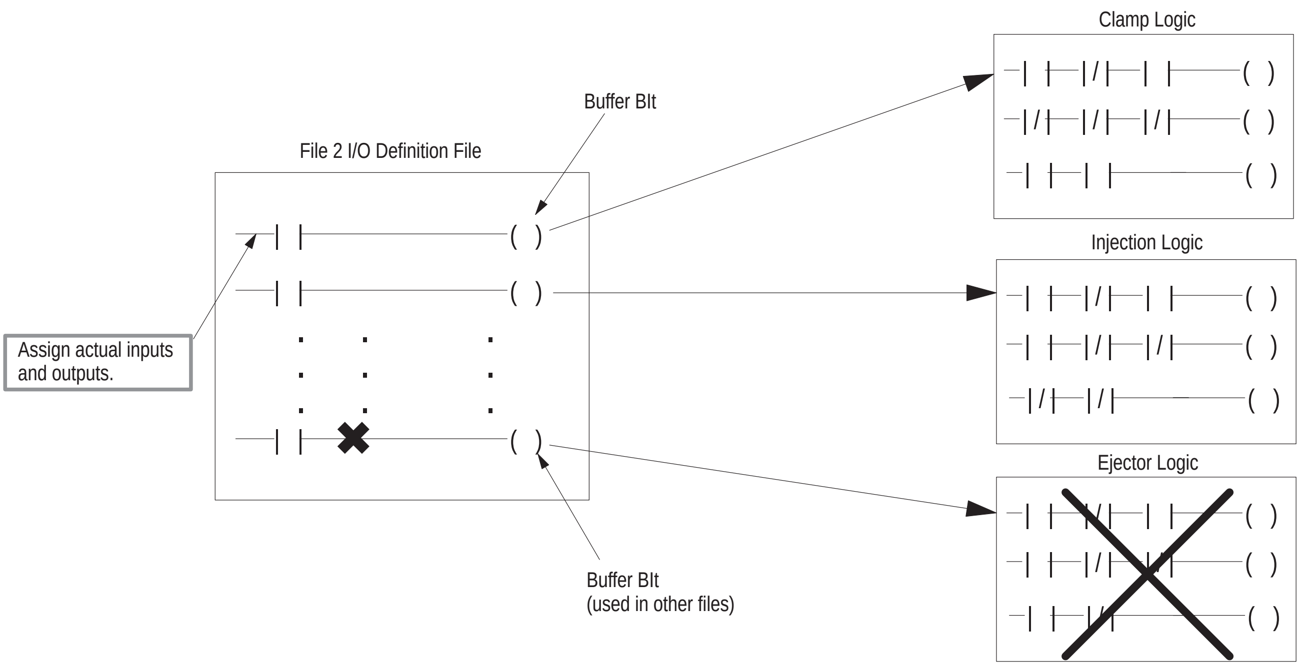
You must modify Pro-Set 200 ladder logic (file 2, 3 and 8) to match your molding machine.

File Number:	File Description:	Customize If:	Changes Needed:
2	I/O definition	always	change I/O address
3	initialize	• non-commanded value output counts are required to be a different value than zero • your analog cards are not placed in the Pro-Set 200 standard configuration (see page 4–2) • removing or adding BTMs • you do not have all three analog cards to control injection, clamp, and ejectors	• revise source value in MOV statements from zero to desired value • revise analog output addresses • Remove or add rungs relative to BTM • delete unused outputs
4	alarms	• you want to change the operation of the standard Pro-Set 200 alarms • you want to add alarms to the system	• user -specific • user- specific
5	power gate	your machine has power gates. Allen-Bradley does not supply logic for power gates. It is up to you to provide this logic.	user-specific
6	machine modes	you want to modify the Pro-Set 200 standard machine mode logic	user-specific
7	permissive pointer	your application does not use all phases or cores	remove the appropriate JSR statement
8	STI file	• your fast analog card(s) differ from the standard Pro-Set 200 configuration (see page 4–2) • your application requires additional analog output logic • your application requires special analog output logic	• change fast analog module addresses • user-specific • user-specific
9	inject STI	your injection position and/or pressure sensor is not wired to the analog card in slot 1	change the I/O address to match your card address
10	injection interpolation file	different velocity and/or pressure minimums and maximums are required for each profile	change appropriate minimum/maximum CV and/or PV ladder rung.
11	injection permissive	• you want to change deadheaded segment logic • you want to modify how the injection phase permissive bits work • you want to change how the short shot alarm functions • you want to modify how the jog bit(s) function	• modify ladder code (user-specific) • user-specific • user-specific • user-specific
12	clamp STI	your clamp position and/or pressure sensor is not wired to analog card in slot 2	change I/O address to match your card address
13	clamp interpolation file	different velocity and/or pressure minimums and maximums are required for each profile	change appropriate minimum/maximum CV and/or PV ladder rung
14	clamp permissive	you want to modify how clamp phase permissive bits work	user-specific
15	eject STI	your ejector position and/or pressure sensor is not wired to the analog card in slot 3	change I/O address to match your card address
16	eject interpolation file	different velocity and/or pressure minimums/maximums are required for each profile	change appropriate minimum/maximum CV and/or PV ladder rung
17	ejector permissive	you want to modify how ejector phase permissive bits work	user-specific
18	quick tune	do **not** modify	

File Number:	File Description:	Customize If:	Changes Needed:
19	core permissive	you need different core sequences. The Pro-Set 200 standard core sequences are: • SPI A, B, C, D set • SPI A, B, C, D pull	user-specific
20	loss of sensor	• you want different limit values for a loss of sensor for injection, clamp, or ejector position or pressure sensors. The standard Pro-Set 200 program checks for a count value of minimum to a count value of maximum for a sensor loss. • your fast analog cards differ from the standard Pro-Set 200 configuration (see page 4–2)	• modify corresponding limit value • change fast analog module addresses
21	plastication deadtime delay	do **not** modify	
22	complete bit test	do **not** modify	
88	mold part	do **not** modify	
90	configuration (screen management)	do **not** modify	
91	setup (screen management)	do **not** modify	
92	storage	you need to add files or data table information to a recipe	add MOV and or COPY instructions as needed
93	alarm setup (alarms for Pro-Set 200)	do **not** modify	
94	temperature zones 1 – 4 (BTM)	you do not have a BTM in slot 5	remove file if not using a BTM
95	temperature zones 5 – 8 (BTM)	you do not have a BTM in slot 6	remove file if not using a BTM
96	BTM configuration	• you do not have BTMs • you have moved the BTMs from the Pro-Set 200 standard configuration (see page 4–2) • you do not have both BTMs	• remove files • modify the “M” location to match the output address • remove the ladder rung that references the unused module
97	auto tune 1–4	you do not have BTMs for zones 1–4	remove file
98	auto tune 5–8	you do not have BTMs for zones 5–8	remove file
99	M1/M0 up/download	• you have moved the BTMs from the Pro-Set 200 standard configuration • you are not using both BTMs • you are adding BTMs	• modify the “M” location to match the output address • remove the ladder rung that references the unused module • expand code to accommodate more BTMs
254	ERC2 enable	do **not** modify	Do not code here
255	initialize ERC2	do **not** modify	Do not code here

Modifying Program File 2 (I/O Definition File)

The I/O definition file contains buffer bits that are used to drive the logic in the remainder of the Pro-Set 200 ladder logic. You need to replace the buffer bits with actual inputs and outputs in the I/O definition file. The following picture shows how Pro-Set 200 works:



Examine each rung in program file 2:

- Read the rung comment.
- Look for the @ symbol in the address comment.
  The @ symbol identifies the address that needs your attention.

Based on rung comments and the @ symbol, decide how each rung matches your application as follows:

- Remove the rung.
- Do not remove the rung.
- Modify the rung.

  For example:

Figure 6.1 Example

```
|           Do Not Remove This Rung!!                                          |
|This Rung Jumps to Subroutine #20 Which Performs Loss of Sensor Checking      |
|                                                 Jump to Loss of              |
|                                                 Sensor Routine               |
|                                                   +---JSR-----------------+   |
|--------------------------------------------------+ Jump to Subroutine   +---|
|                                                   | SBR File Number  U:20|   |
|                                                   +----------------------+   |
```

- Retain the rung and replace the input contact address (B9:0/xx – B9:5/xx) identified by the **@** symbol with your real input address.

  For example:

Figure 6.2 Example

```
|Motors Running Input - Remove this rung if this input is not installed,      |
|or retain this rung and assign your own real input address.                  |
| @ Motors                                                        Motors      |
|  Running                                                        Running     |
|   Input                                                         Input       |
|      B9:0                                                          B9:0     |
|------] [----------------------------------------------------------(  )-----|
|       4                                                             4       |
```

- Retain the rung and replace the output coil address (B9:13/xx – B9:16/xx) identified by the @ symbol with your real output address.

  For example:

Figure 6.3 Example

```
|Clamp Close Profile Active: This will remain energized from Clamp Close      |
|Initial to Clamp Close Decel.  Remove this rung if Clamp Close profile active |
|bit is not required, or retain this rung and assign your own real output     |
|address, or use this bit to build additional ladder logic.                   |
|                                                              @ Clamp Close  |
|      Clamp                                                       Profile     |
|   Close Profile                                                  Active      |
|      Active                                                   Output Bits    |
|      B146:1                                                        B9:13     |
|------] [----------------------------------------------------------(  )-----|
|       15                                                           12       |
```

- Build additional logic to support the conditions required to control your real outputs.

► If you need to add additional logic, place the logic at the end of file 2, but before the First Scan rung and the Clear Minor Overflow Math Error rungs.

Using Optional Features in Pro-Set 200

The following are included in the Pro-Set 200 I/O definition file. Review this list of features and determine if your application requires them.

To modify the I/O definition file, do the following:

1. Print a copy of file 2 to examine.
2. Review the I/O definition file (program files) in conjunction with your sequence bar charts.
3. Mark up the printed copy of the I/O definition file so that it accommodates the requirements of your sequence bar chart.

4. Using your RS Logix 500 programming software, modify file 2.
5. After you have made the required modifications, print out another copy of the I/O definition file.
6. Ensure that your modifications are correct.

Pro-Set 200 Required/ Optional Inputs and Outputs

The following are required or optional I/O for Pro-Set 200:

Pro-Set 200 Features:	Out-of-the-Box Optional/Required:	Input:	Output:	Reserved, Additional Programming Required: ①
Manual	R	X		
Semi	R	X		
Auto	O/R	X		
Manual Lights	O		X	
Semi Lights	O		X	
Auto Lights	O		X	
Motors Running	R	X		
Clamp Open Overstroke	O	X		
Front Safety Gate Closed	R	X		
Motors Running Light	O		X	
Safety Ratchet Up Input	R	X		
Safety Ratchet Down Input	R	X		
Front Gate Open	R	X		
Mold Set Switch	O	X		
Clamp Open Push Button/Selector Switch	R	X		
Clamp Close Push Button/Selector Switch	R	X		
Clamp at Tonnage Pressure Switch	O	X		
Clamp Locked Limit Switch (Toggle Clamp)	O	X		
Clamp Decompress Switch	O	X		
Clamp Close Solenoid	O		X	
Clamp Open Solenoid	O		X	
Clamp Proportional Valves	R		X	X
Additional Pump Solenoids	O		X	
Plate (Hyd) Ejector Retract Push Button/Selector Switch	O	X		
Plate (Hyd) Ejector Forward Push Button/Selector Switch	O	X		
Hydraulic (Plate) Ejector Proportional Valve	O		X	
Core Set Push Button/Selector Switch	O	X		
Core Pull Push Button/Selector Switch	O	X		
Core Set Limit Switch	R	X		
Core Pull Limit Switch	R	X		
Inject Forward Push Button/Selector Switch	R	X		
Inject Retract Push Button/Selector Switch	R	X		
Screw Rotate Push Button/Selector Switch	O	X		
Inject/Screw Unit Off/On (Dry Cycle)	O	X		

Pro-Set 200 Features:	Out-of-the-Box Optional/Required:	Input:	Output:	Reserved, Additional Programming Required: [1]
Inject Unit Forward Limit Switch	O	X		
Inject Unit Retract Limit Switch	O	X		
Inject Unit Forward Push Button/Selector Switch	R	X		
Inject Unit Retract Push Button/Selector Switch	O	X		
Purge Guard Closed	O	X		
Inject Forward Solenoid	O		X	
Pack Solenoid	O		X	
Hold Solenoid	O		X	
Inject Retract Solenoid	O		X	
Inject Proportional Valves	R		X	
Screw Rotate Solenoid	O		X	
Back psi Solenoid	O		X	
Inject Unit Forward Solenoid	O		X	
Inject Unit Retract Solenoid	O		X	
Barrel Heat on Switch	R	X		X
Malfunction Reset Push Button	O	X		
Malfunction Beacon Light	O		X	
Malfunction Audible Alarm	O		X	
Clamp Enable Solenoid	O		X	
Ejector Enable Solenoid	O		X	
Die Height Forward Push Button	O	X		
Die Height Retract Push Button	O	X		
Die Height Forward Solenoid	O		X	
Die Height Retract Solenoid	O		X	
Die Height Forward Overstroke Limit Switch	O	X		
Die Height Retract Overstroke Limit Switch	O	X		
Linear Transducer Clamp	R	X		
Linear Transducer Injection	R	X		
Linear Transducer Eject	R/O[2]			
Pressure Transducer Clamp	O		X	
Pressure Transducer Injection	R		X	
Pressure Transducer Ejectors	O		X	

[1] If your application does not have this feature, you can make this feature optional instead of required. However, to do so, you need to write additional ladder logic that is not included in this manual.

[2] If your application uses limit switches for ejectors, the linear transducer is not required. If your ejectors require position feedback you will use a linear transducer.

► If you require power gates, you need to write the ladder logic yourself. Program file 5 has been set aside for this purpose; there is a JSR to file 5 from file 2 that already exists.

► You can edit other files to implement custom features in your ladder program.

Using Machine Sequence Bar Charts

This section:

- provides an example that shows how to use the Pro-Set 200 ladder logic and the data table with a machine sequence bar chart
- shows how to write and modify the Pro-Set 200 ladder logic for an injection, clamp open, and clamp close bar chart

This section shows an example of a machine sequence chart. Most machine manufacturers provide a sequence chart to show when solenoids should be energized and de-energized. The example shows typical directional solenoids and proportional signals required for our example machine. The SLC code examples show how to modify the code to make the example machine operate as specified in the bar chart. Most of these conditions are provided in the I/O definition file (file 2) of the SLC code. All you need to do is substitute the solenoids in place of the "dummy" ranges as required.

Getting Started

To get started:

1. Print a copy of file 2 (I/O definition file) from the Pro-Set 200 ladder logic.
2. Get a copy of the bar chart which shows the sequencing of the solenoids which control the hydraulic valves for your machine
3. Based on the requirements of your bar chart, modify file 2 to perform the necessary control actions.

In some cases, your machine may have special control requirements which are not handled in file 2. In these cases, write custom ladder logic. Use the Data Table Reference Manual, publication number 6500-RM001A–US–P, supplied with the Pro-Set 200 documentation set as a guide in writing this logic.

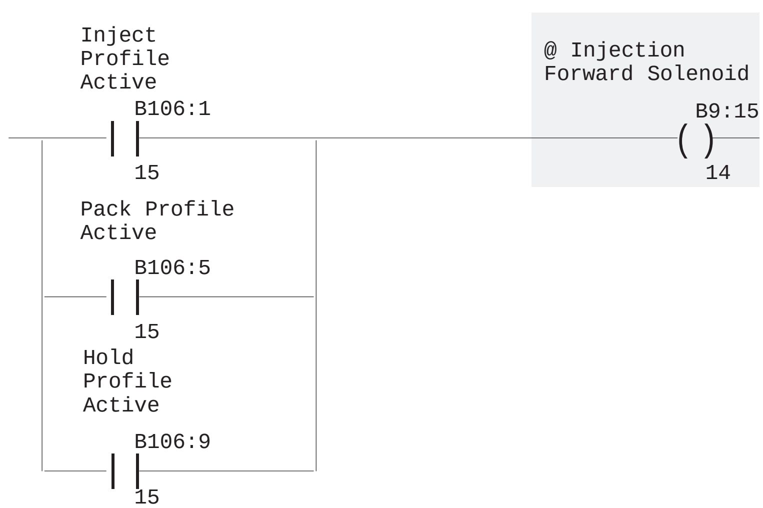
Modifying Pro-Set 200 Ladder Logic for an Injection Sequence Bar Chart

The following diagram shows a bar chart for the injection phase for a hypothetical molding machine. This is an example of a simple machine and should be used as for reference only.

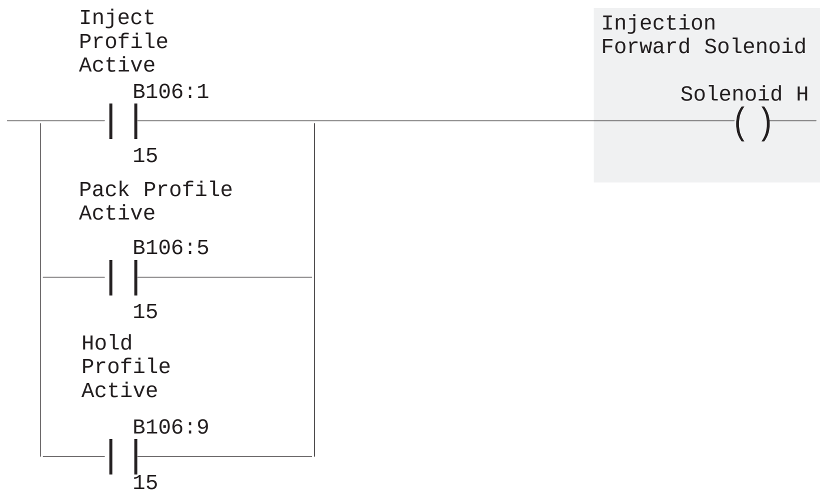
Solenoid Name:	Solenoid Description:	Injection Forward:	Pack:	Hold:	Pre-Decompression:	Plastication:	Post Decompression:
Solenoid H	directional						
Solenoid I	pump load						
Solenoid J	pump load						
Solenoid K	proportional 0 to +10VDC						
Solenoid L	proportional 0 to –10VDC						
Solenoid M	proportional pressure valve 0 to +10VDC						
Solenoid N	directional						
Solenoid O	directional						

Solenoid H

This row shows solenoid H, a directional control valve, is ON for all of the injection forward, pack and hold profiles. It is OFF during the pre-decompression, plastication, and post decompression profiles. The I/O definition file contains this rung which supports these logic conditions.



Modify this rung to include solenoid H as shown below:



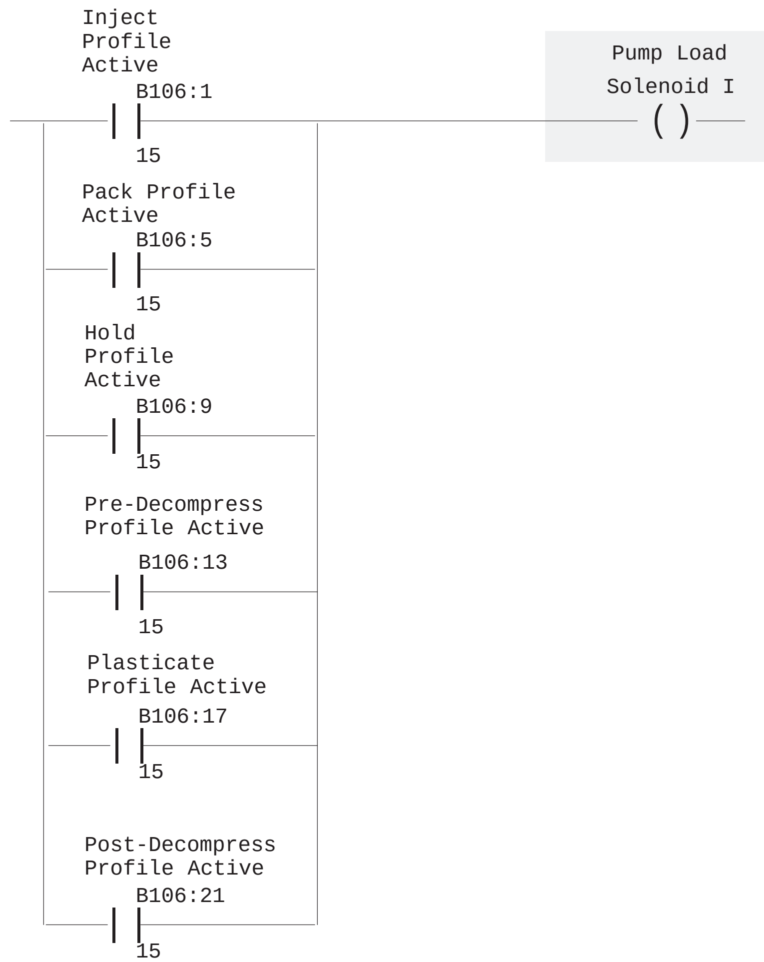
Solenoid I

This row shows a condition in which solenoid I is continuously energized through the entire injection cycle. Since the I/O definition does not provide any rungs which fit these logic conditions, you need to write ladder logic.

Since the requirement shown on the bar chart is for solenoid I to remain ON during all of the various profile segments, use the profile active bits for each phase to accomplish this task. Refer to Appendix F for details concerning active bits.

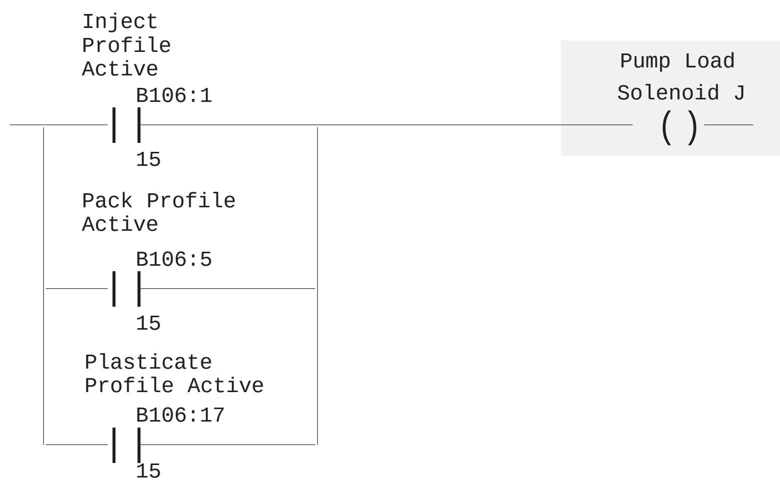
▶ The profile active bits are ON during the time when any segment in that phase is ON. For example, the injection profile active bit B106:1/0 is ON during the entire time that the injection profile is being executed. This means that it will be ON if any of the injection segments are active.

Using the profile active bits for each phase energizes the pump load solenoid for inject, pack, hold, pre–decompress, plasticate, and post–decompress:



Solenoid J

This row shows conditions in which solenoid J is ON during the injection forward, pack and plastication profiles, and OFF all other times. Since the I/O definition file does not include any rungs that match these requirements, you need to write the ladder logic. By using the profile active bits, you can create the following ladder logic:



Solenoid K and L

These rows show solenoid K and L, which are proportional valves that controls flow valves. If you use the recommended hardware layout shown in chapter 3, you do not need to modify any programming. Pro-Set 200 contains ladder logic in files 3, 8, 9, and 20 which handle these outputs.

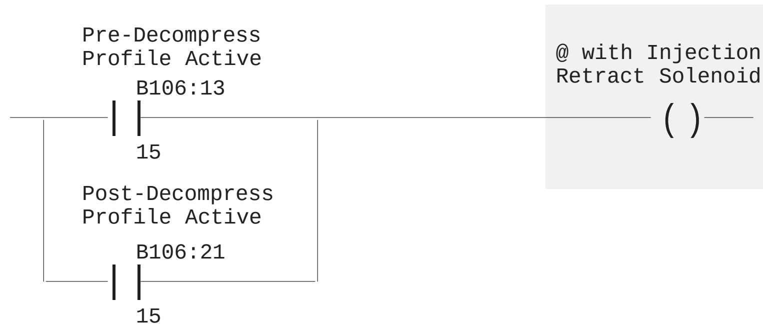
► If you have not used the recommended layout, you need to change the rungs in files 3, 8, 9, and 20, which write to these outputs.

Solenoid M

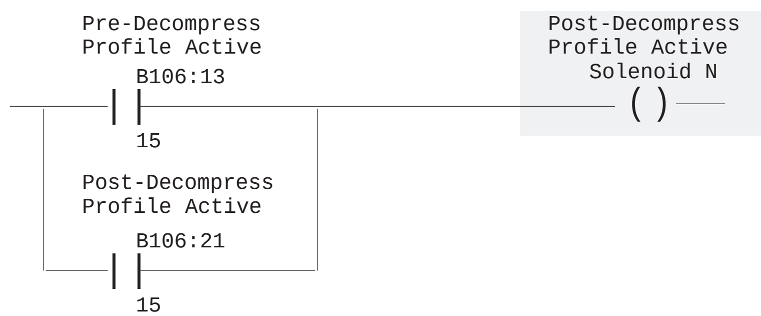
This row shows a proportional valve, solenoid M, which controls the injection pressure. If you use the recommended Pro-Set 200 layout, you do not need to do any programming.

Solenoid N

This row shows a directional control valve, solenoid N, which is energized only during the pre-decompression and post-decompression profiles. The I/O definition file contains the following ladder rung which supports these logic conditions:



Modify this rung to include solenoid N as shown below:



Solenoid O

This row shows a directional control valve, solenoid O, which is energized during the plastication profile. The I/O definition file contains the following rung which has this condition:

Modify this rung to include solenoid O as shown below:

Modifying Pro-Set 200 Ladder Logic for a Clamp Close Sequence Bar Chart

The following table shows a clamp close sequence bar chart for a hypothetical molding machine:

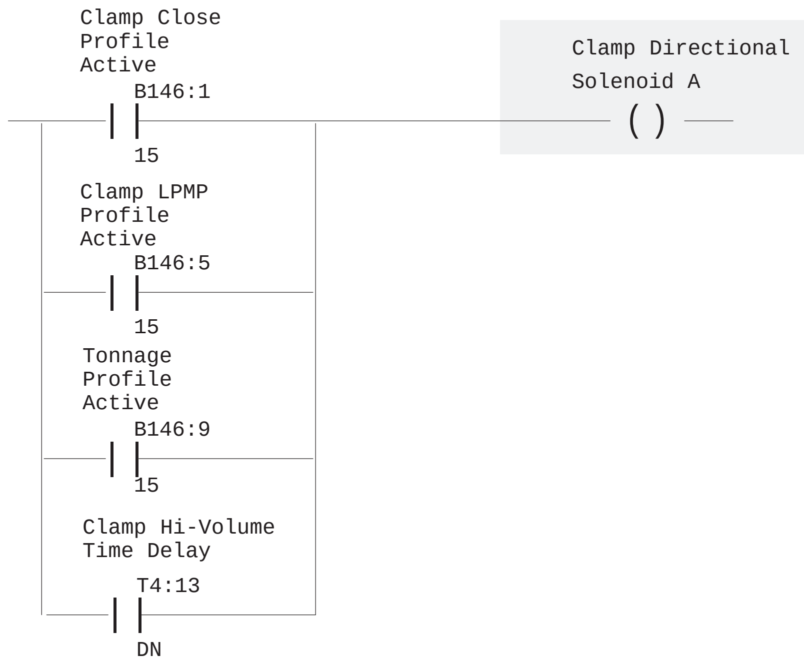
Solenoid Name	Solenoid Description:	Clamp Close Initial:	Clamp Initial Time Delay for Pump Volume	Clamp Close Fast:	Deceleration:	Low Pressure Mold Protect	Clamp Tonnage:
Solenoid A	directional						
Solenoid B	pump load						
Solenoid C	pump load						
Solenoid D	bidirectional proportional flow valve 0 to +10VDC						
Solenoid E	bidirectional proportional flow valve 0 to –10VDC						
Solenoid F	proportional pressure valve 0 to +10VDC						

Solenoid A and B

These rows show directional control solenoids A and B, which are ON for the duration of the clamp close sequence. Since the I/O definition file does not contain logic which meets these conditions, you need to write your own logic. There are two methods you can use to meet these control requirements:

- method 1: use profile active bits
- method 2: use individual segment active bits for all segments in a profile

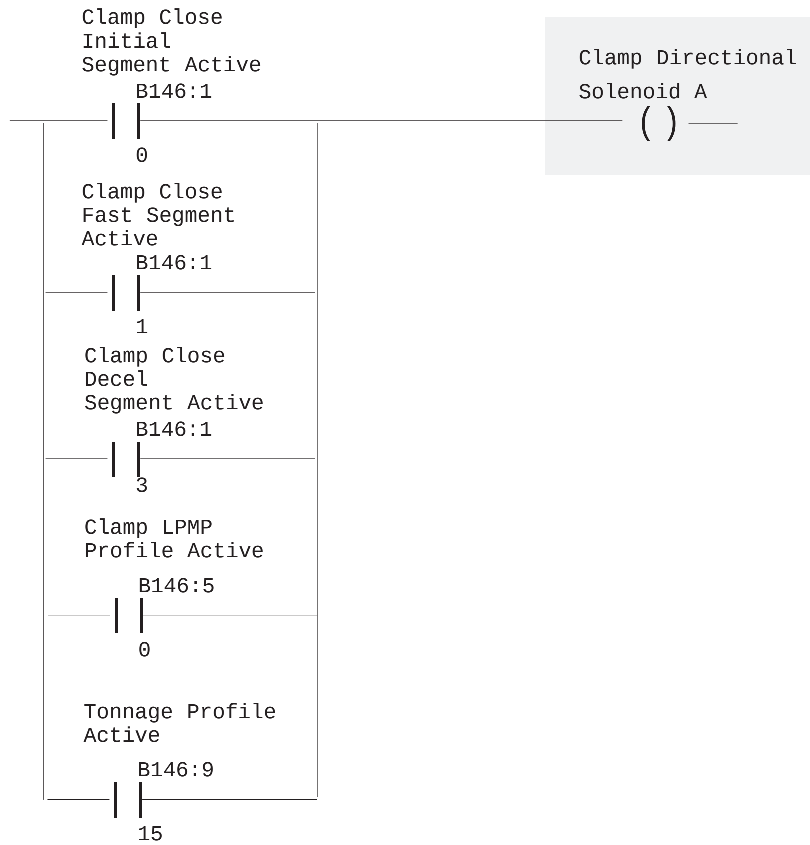
Method 1
The following ladder logic shows the technique for using profile active bits for solenoid A and B:



The advantage of this method is that the profile active bits remain ON for each segment in the phase. Instead of using 3 individual segment active bits to control the clamp close profile (i.e., clamp close initial segment active, clamp close fast segment active, clamp close decel segment active), you can use the clamp close profile active bit instead. The clamp close profile active bit remains ON as long as any of the segment bits are ON.

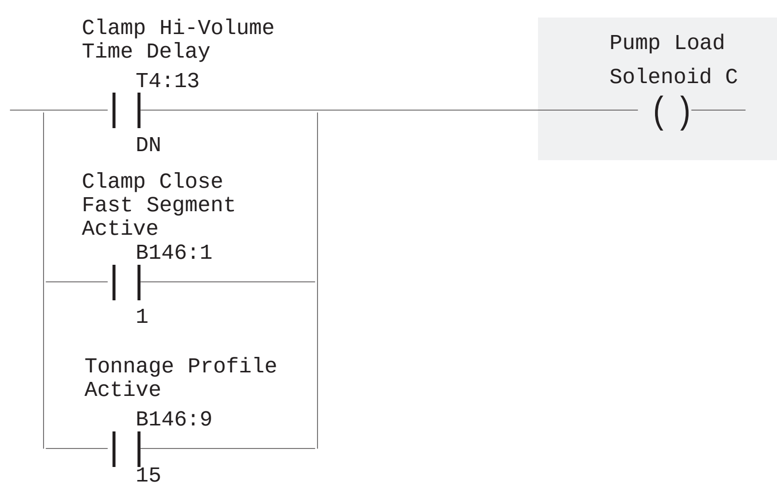
Method 2

The following ladder logic shows an equivalent logic circuit using the individual segment active bits:



Solenoid C

This row shows solenoid C, which is a pump load that is only active during the close initial, clamp close fast and clamp tonnage profiles. You need to write the logic shown below:



Solenoid D

These rows show a proportional control valve, solenoid D, which performs flow control of the clamp hydraulic circuit. If you use the standard Pro-Set 200 layout as shown in chapter 3, you do not need to write any ladder logic to support this solenoid. If you have changed the physical hardware layout, you need to modify files 3, 8, 12, and 20.

Solenoid F

This row shows a proportional pressure valve, solenoid F, which controls clamp pressure. If you have used the standard Pro-Set 200 layout, you do not need to write any ladder logic to support this valve.

Modifying Pro-Set 200 Ladder Logic for a Clamp Open Sequence Bar Chart

The following table shows a clamp open sequence bar chart for a hypothetical molding machine:

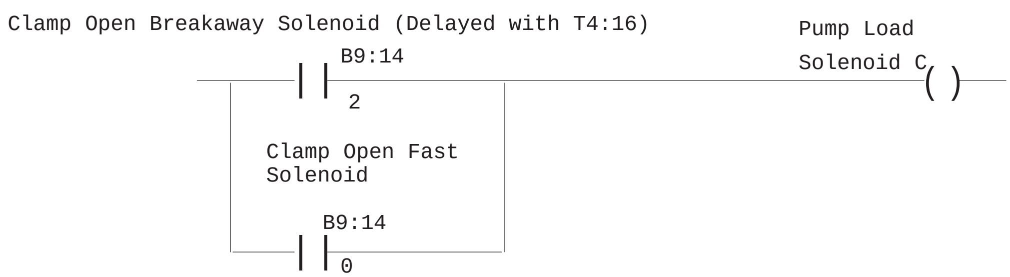
Solenoid Name	Solenoid Description:	Clamp Open Breakaway:	Breakaway Time Delay for Pump Volume:	Clamp Open Fast:	Clamp Open Deceleration:	Clamp Open Slow
Solenoid A	directional					
Solenoid B	pump load					
Solenoid C	pump load					
Solenoid D	bidirectional proportional flow valve 0 to +10VDC					
Solenoid E	bidirectional proportional flow valve 0 to –10VDC					
Solenoid F	proportional pressure valve 0 to +10VDC					
Solenoid G	directional					

Solenoid A, B, and G

These rows show solenoids A, B and G, all of which are ON during the entire clamp open sequence. You can modify your logic as follows:

Solenoid C

This row shows a pump load, solenoid C, which requires a breakaway time delay, and is also active during the clamp open fast segment. Because the I/O definition file (file 2) does not contain a bit to enable this functionality, you must write ladder logic, as shown in the following example.



Solenoid E and F

This row shows proportional control valve, solenoid E, which performs flow control of the clamp hydraulic circuit, and solenoid F which controls pressure. If you use the standard Pro-Set 200 layout as shown in chapter 3, you do not need to write any ladder logic to support this solenoid. If you have changed the physical hardware layout, you need to modify files 3, 8, and 12.

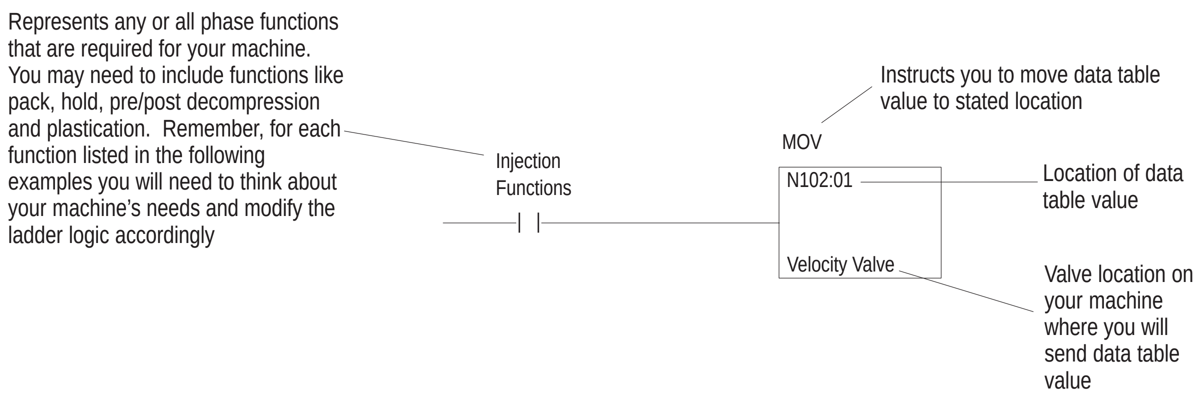
If you want to change the locations for the fast analog modules and BTM modules (first six slots), modify the MOV, COP, IOM, and IIM instructions contained in these files:

- file 2
- file 3
- file 8
- file 9 (if inject analog card is not in slot 1)
- file 12 (if clamp analog card is not in slot 2)
- file 15 (if ejector analog card is not in slot 3)
- file 99 (if BTM modules are not in slots 5 and 6)
- file 20 (software travel limits/loss of sensor if analog cards are not in assigned slots)

How to Modify Your Analog STI Code to Support Your Valve Configurations

It should go without saying that there are an unlimited number of valve combinations, however, there are a number of combinations that are generally encountered. The following are examples of common valve configurations and the basic necessary ladder logic customization that is needed to allow Pro-Set 200 to perform. This is to provide basic examples of how your ladder logic will need to be manipulated for using other valve combinations than those supplied by Pro-Set 200.

For the examples, the following conventions apply:



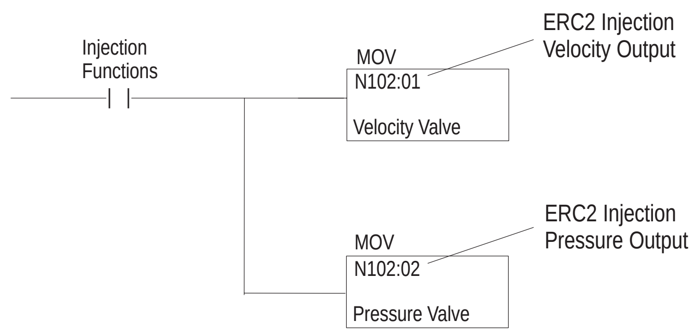
2 Valve Configurations

Many smaller machines have only single velocity and pressure valves. These two-valve machines can range from both valves controlling only injection functions to both valves controlling injection, clamp, and ejector speeds and pressures. The following examples show the concepts of how to modify the analog section of the STI file to support a two-valve system.

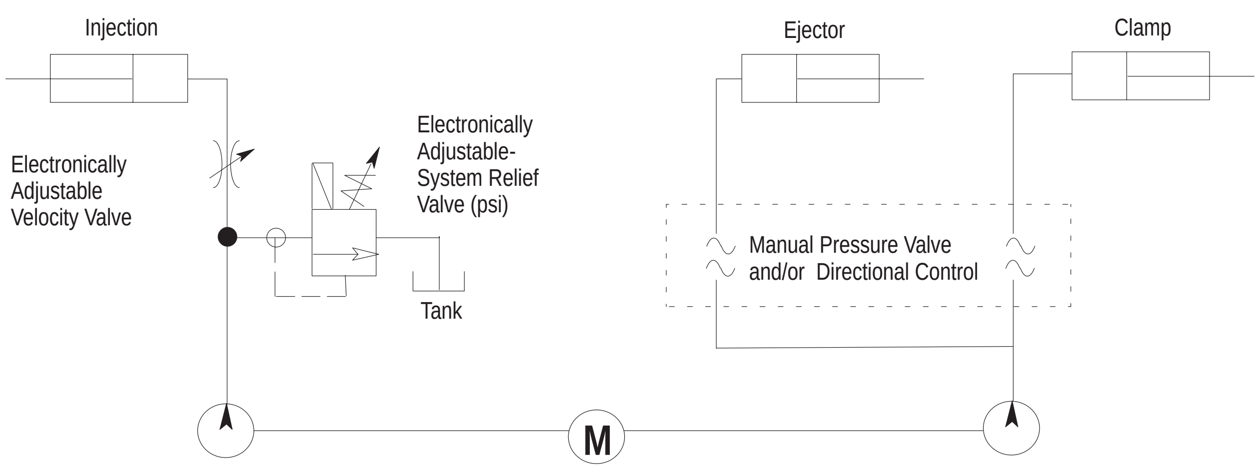
Injection Only

The following example describes the ladder logic modifications necessary for a simple 2 valve configuration for injection only. To help understand the relationship between the ladder logic modifications and the hydraulic configuration, see the following examples.

Ladder Logic Modifications: 2 Valves, Injection Only



Conceptual Model of 2 Valves, Injection Only

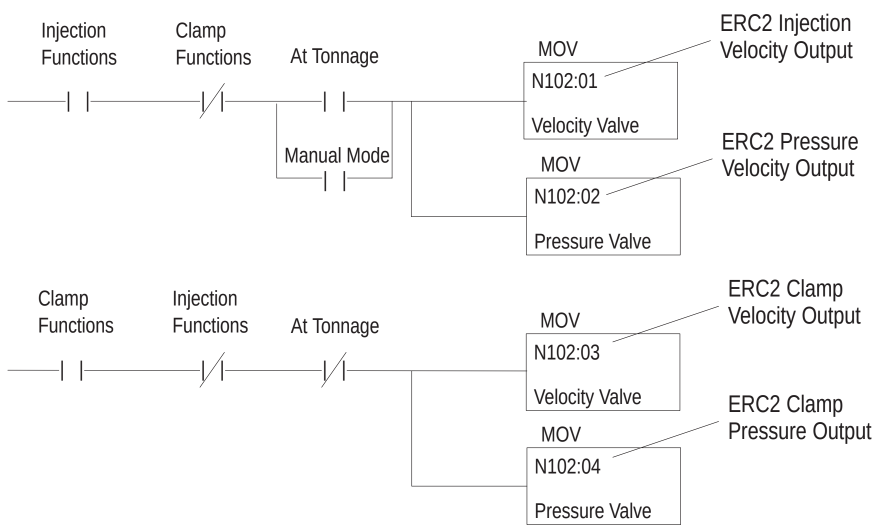


This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

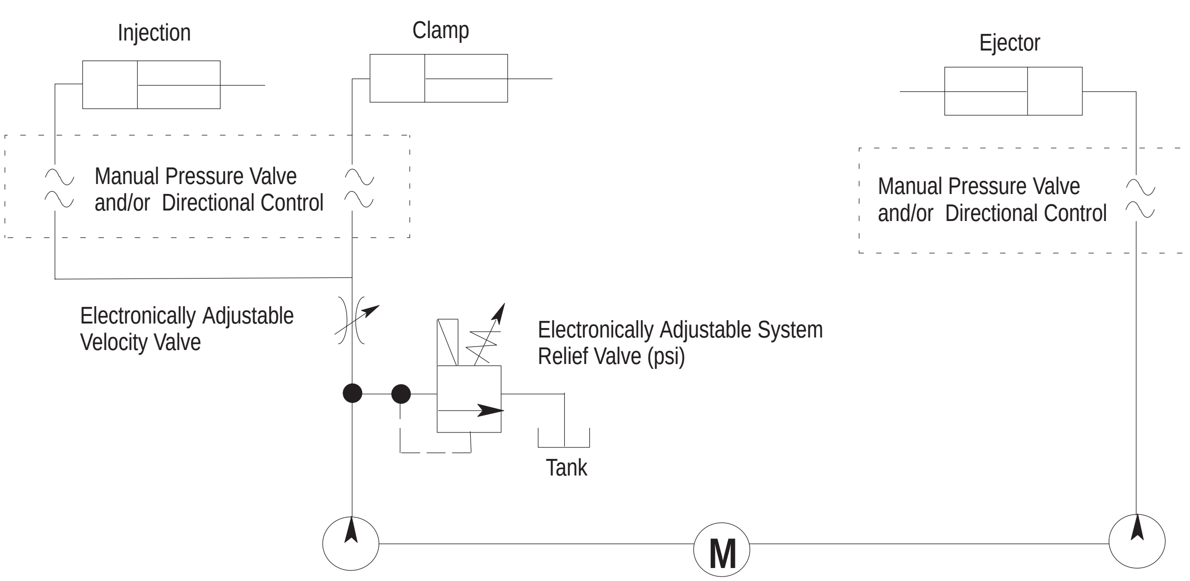
Injection and Clamp

The following example describes ladder logic modifications for a 2 valve configuration for injection and clamp. To help understand the relationship between the ladder logic modifications and the hydraulic configuration, see the example on the opposite page.

Ladder Logic Modifications: 2 Valves, Injection and Clamp



Conceptual Model of 2 Valves, Injection and Clamp

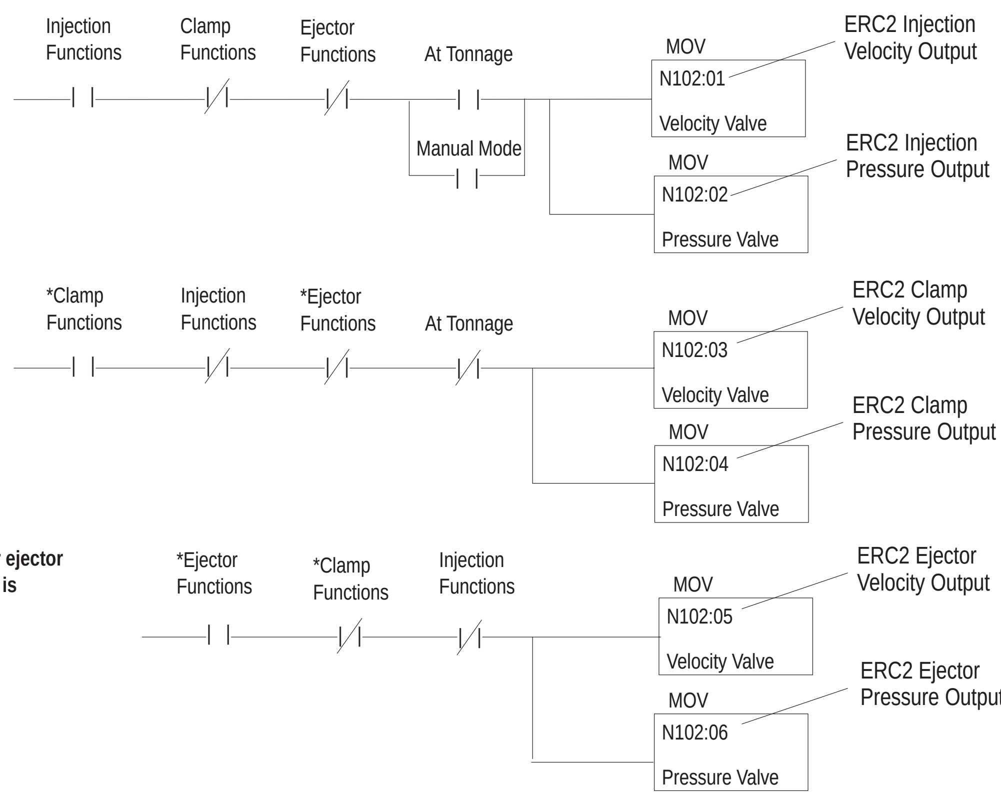


This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

Injection, Clamp and Ejectors

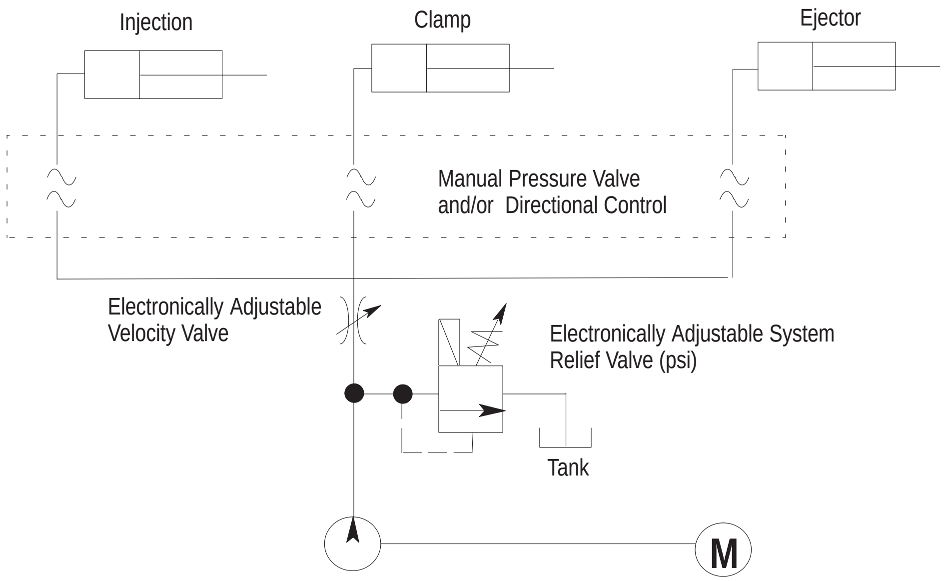
The following example describes ladder logic modification for a two-valve configuration set for injection, clamp and eject. Understand that for this configuration you must prioritize clamp or ejector functions. To help understand the relationship between the ladder logic modifications and the hydraulic configuration, see the following examples.

Ladder Logic Modifications: 2 Valves, Injection, Clamp and Ejectors



***You must prioritize clamp or ejector functions (i.e. clamp velocity is more important than eject)**

Conceptual Model of 2 Valves, Injection, Clamp and Ejector



This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

3 Valve Configurations

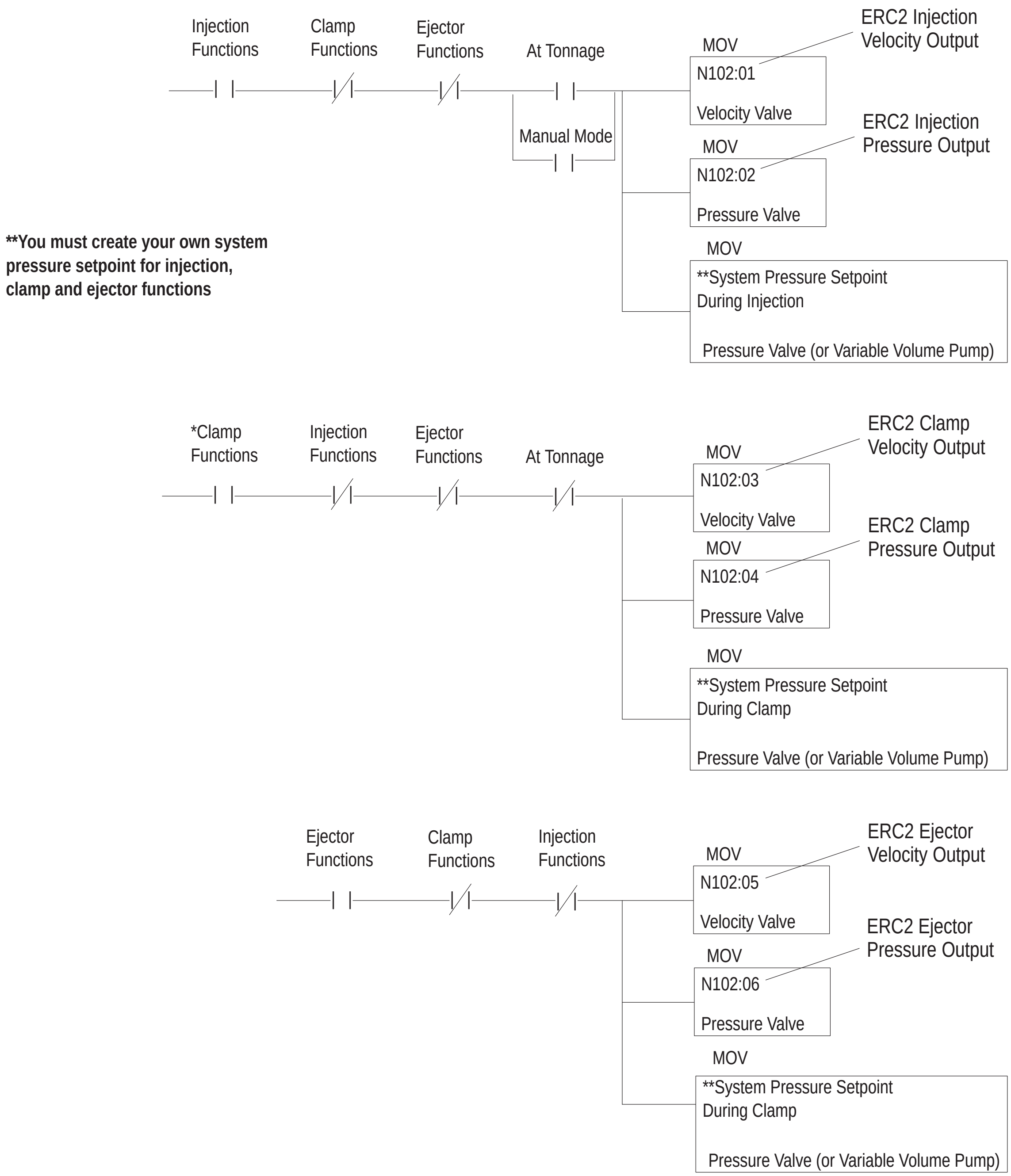
Many machines have three analog valves to control machine movements. The following section provide examples of some three-valve configurations and the ladder logic modifications necessary. In addition, common configuration questions are proposed as a means of discovering key configuration points

1 System Pressure Valve, 1 Velocity Valve and 1 Pressure Valve (Variation A1 and A2)

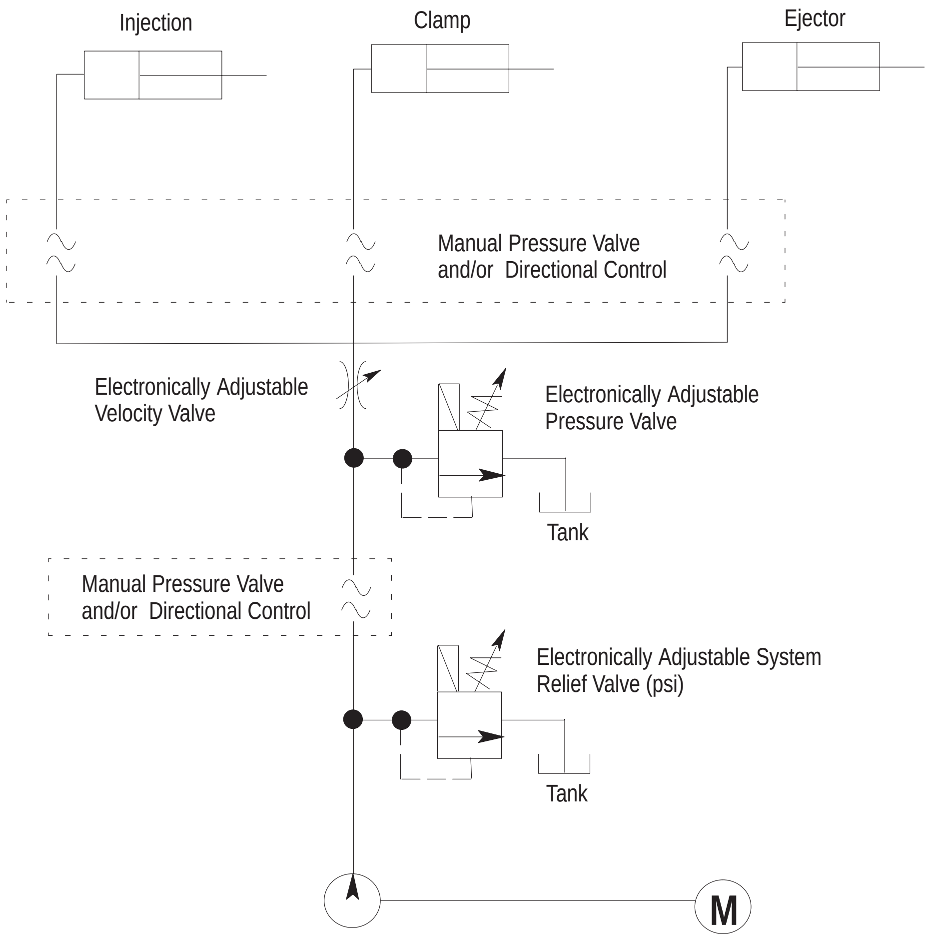
Some systems will have system pressure valve (or a variable volume pump), a velocity valve to control the axis speed, and an additional pressure valve downstream. Key configuration questions are:

- During injection, what is the system pressure valve setting?
- During clamp, what is the system pressure valve setting?
- During eject, what is the system pressure valve setting
- During clamp, is the system pressure valve used to control the clamp pressure valve? If so, should you send N102:04 to this valve?
- During eject, is the system pressure valve used to control the eject pressure valve? If so, should you send N102:06 to this valve?
- Is the system pressure valve set higher than the other pressure valves during all movements?
- Do you treat manual mode any different than semi or full automatic mode?

Ladder Logic Modifications: 3 Valve Variation A1 and A2

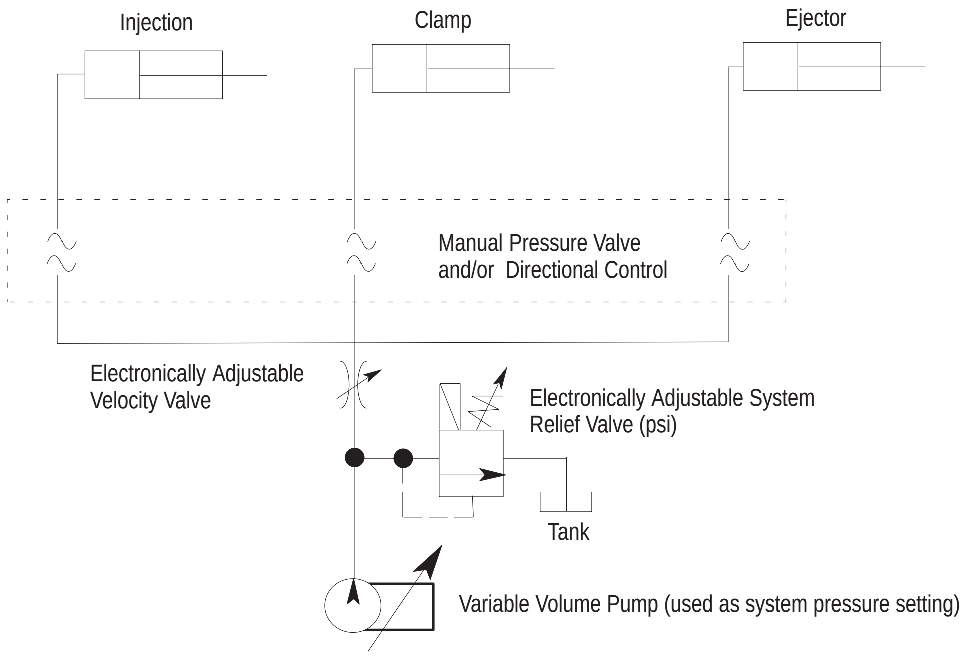


Conceptual Model of 3 Valve Variation A1: 1 System Pressure Valve, 1 Velocity Valve and 1 Pressure Valve for Injection, Clamp and Ejector



This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

Example: 3 Valve Variation A2: 1 Variable Volume Pump, 1 Velocity Valve and 1 Pressure Valve for Injection, Clamp and Ejector



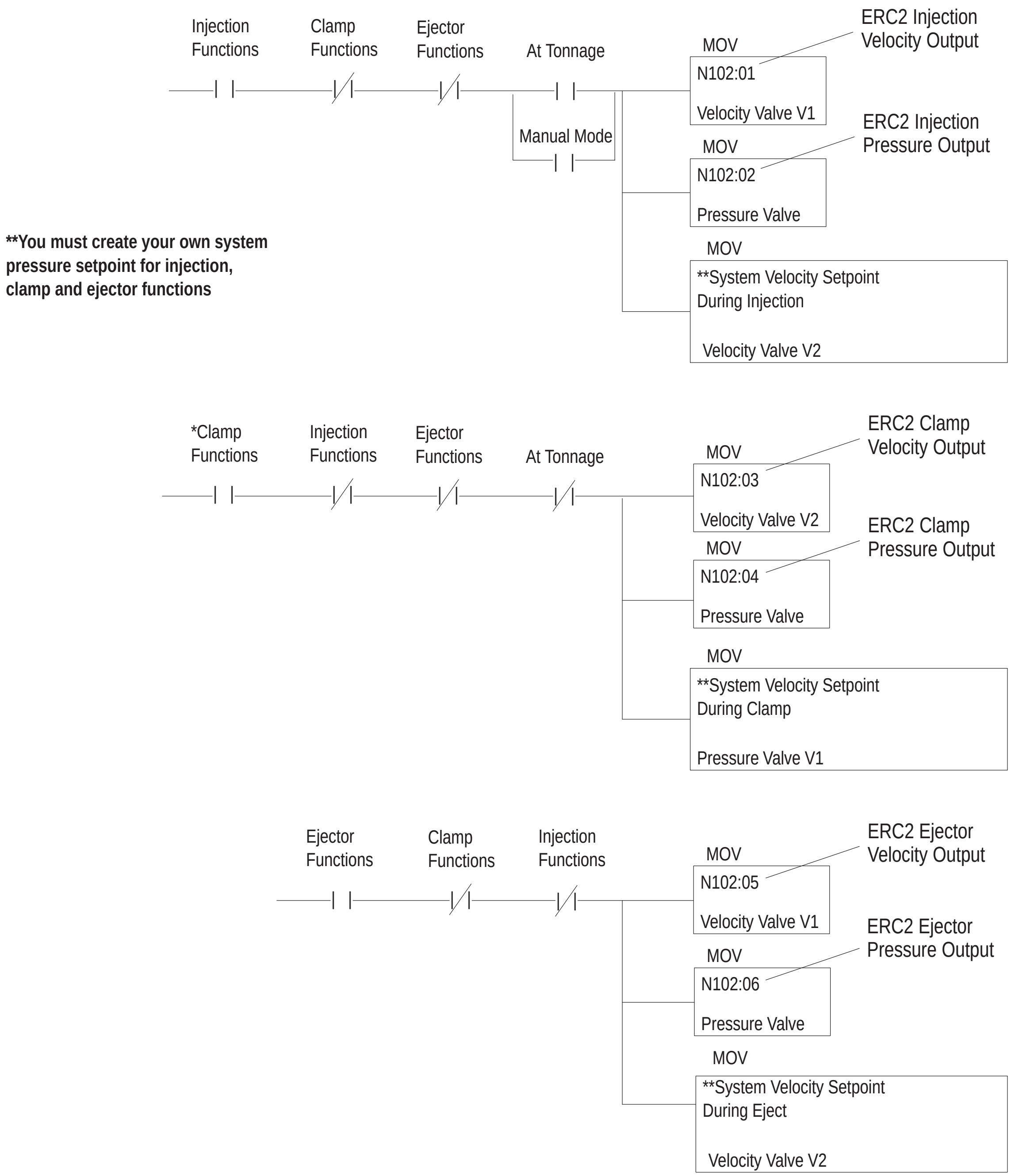
This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

1 Pressure Valve for Clamp, Injection and Ejector; 1 Velocity Valve for Clamp; 1 Velocity Valve for Clamp Injection and Ejector (Variation B)

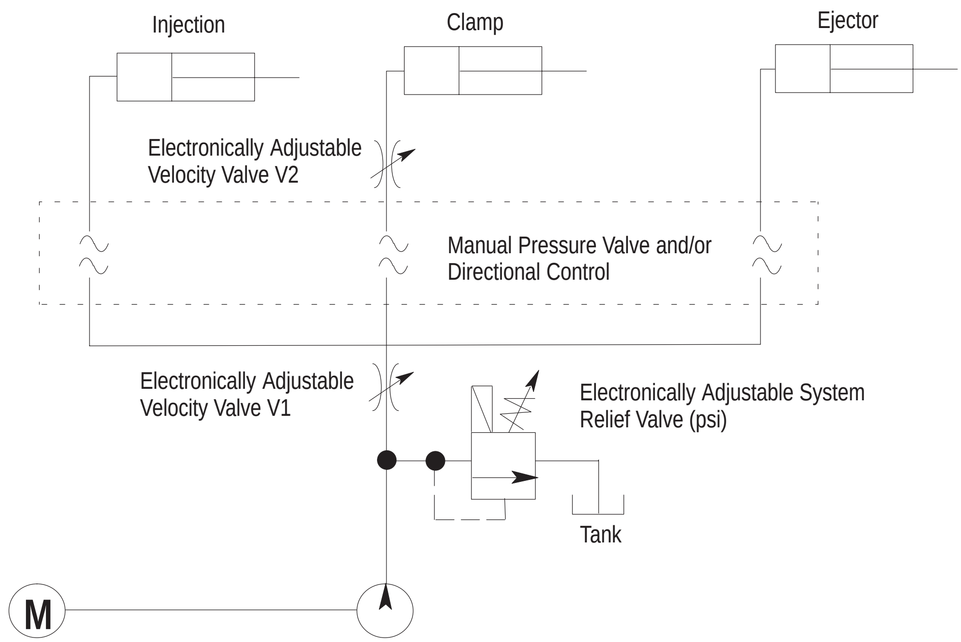
Key configuration questions are:

- What is done with the second clamp value during injection?
- During clamp movement, must one velocity value be moved so that the other can control clamp velocity?
- During ejection, what happens to the clamp velocity valves?
- If the clamp and ejectors are moving simultaneously, what should their valves be set at?
- Do you treat manual mode differently than semi or full automatic mode?

Ladder Logic Modifications: 3 Valve Variation B



Conceptual Model of 3 Valve Variation B: 1 Pressure Valve for Clamp, Injection, and Ejector; 1 Velocity Valve for Clamp; 1 Velocity Valve for Clamp, Injection, and Ejector



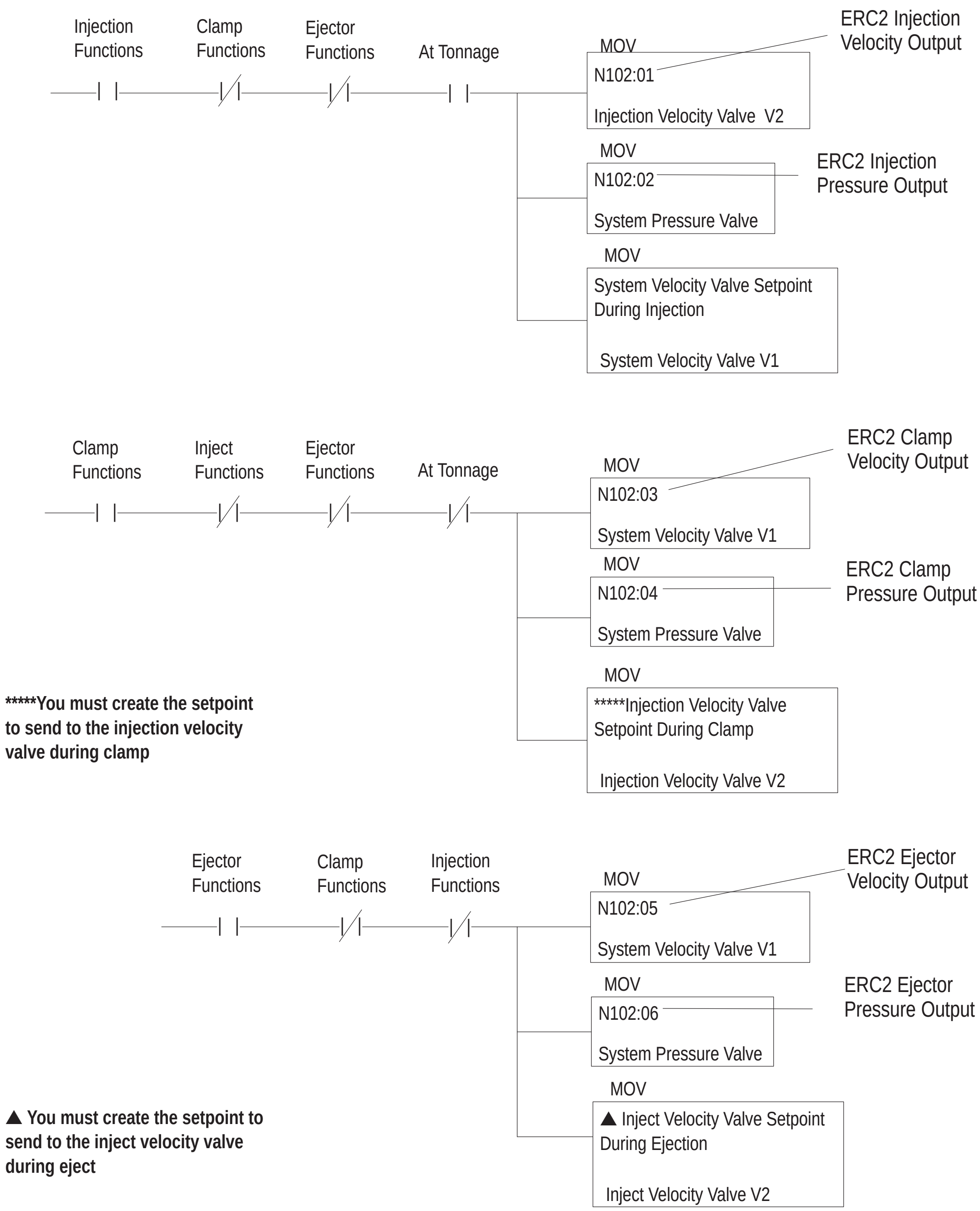
This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

1 System Pressure Valve for Clamp, Injection and Ejector; 1 Velocity Valve for Injection; 1 System Velocity Valve for Clamp, Injection and Ejector (Variation C)

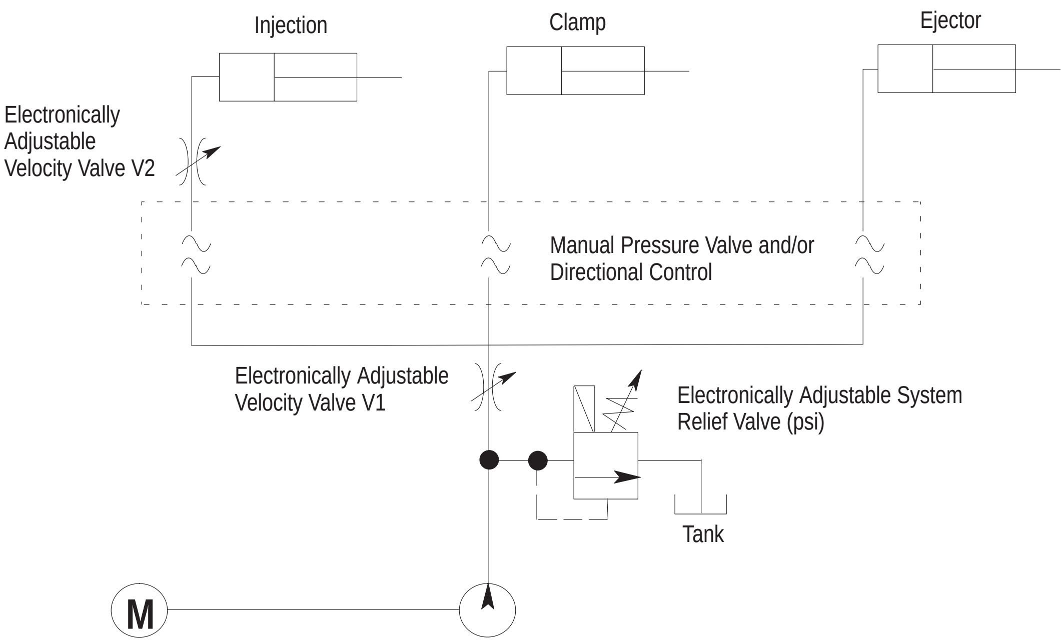
If your system is configured in this way, there are a number of questions that you must answer before you can begin configuration. Key configuration questions are:

- During injection, which valve will control speed, and must you move one valve out of the way?
- During clamp functions, what is done with the injection velocity valve?
- During ejector functions, what will be done with the injection velocity valve?
- What is done is the clamp and ejectors are moving simultaneously?
- Do you treat manual mode differently than semi or full automatic mode?

Ladder Logic Modifications: 3 Valve Variation C



Conceptual Model of Variation C: 1 Pressure Valve for Clamp, Injection, and Ejector; 1 Velocity Valve for Injection; 1 Velocity Valve for Clamp, Injection, and Ejector



This conceptual model is intended to be used as an aid in understanding ladder code modifications for the example scenario. It is not a complete hydraulic diagram.

Turning Analog Outputs Off

For analog outputs, the last value sent out to the channel will remain there until you change the value.

ATTENTION: Incorrect use of analog outputs can lead to personal injury or death, property damage, or economic loss. If you do not understand the details of turning analog outputs off, contact technical support at: 1–(440)–646–6800

This means that if you were to write a rung of logic as follows:

32767 will be sent out to the output card when inject forward is active. If you turn inject forward off the preceding rung is now false.

This does not mean the output will return to zero. Until the processor scans a new value for the output card, the value will remain the same. To return the output to zero you must add a rung of logic as follows:

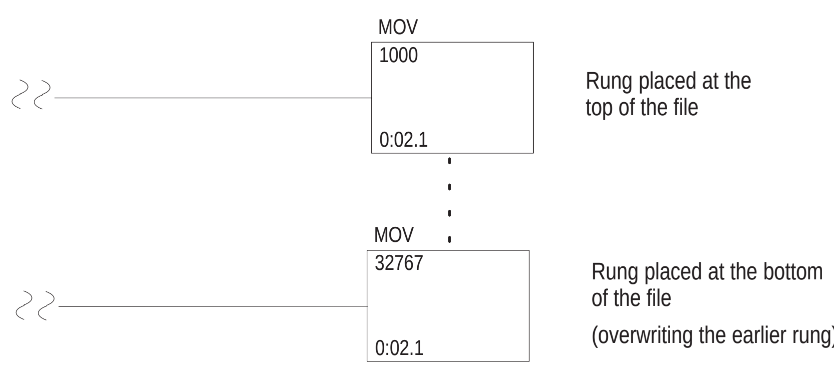
This is true for any analog output values that you send to the valves. If you write ladder code to send values out to an analog output you must also write logic to turn the analog output off.

Correct Placement of Analog Rungs Is Crucial

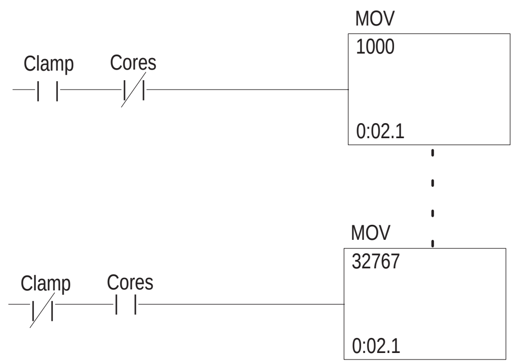
Before you write your analog code, you should carefully plan the placement of the rungs.

ATTENTION: Incorrect placement of analog rungs can lead to personal injury or death, property damage, or economic loss. If you do not understand the details of analog rung placement, contact technical support at: 1–(440)–646–6800

The SLC scans the program from top to bottom, and the last value sent to an output register will be sent to the card.



This is critical because it is possible to send a value to the analog output, only to overwrite it by a later rung of code (as shown above). You should write the code so that only one “MOV” instruction may be active (as shown below).



In this example, the code is properly written: only one instruction may be active at a time

Customizing/Modifying PanelView Screens

You can edit other files and screens as necessary to customize your system. You can:

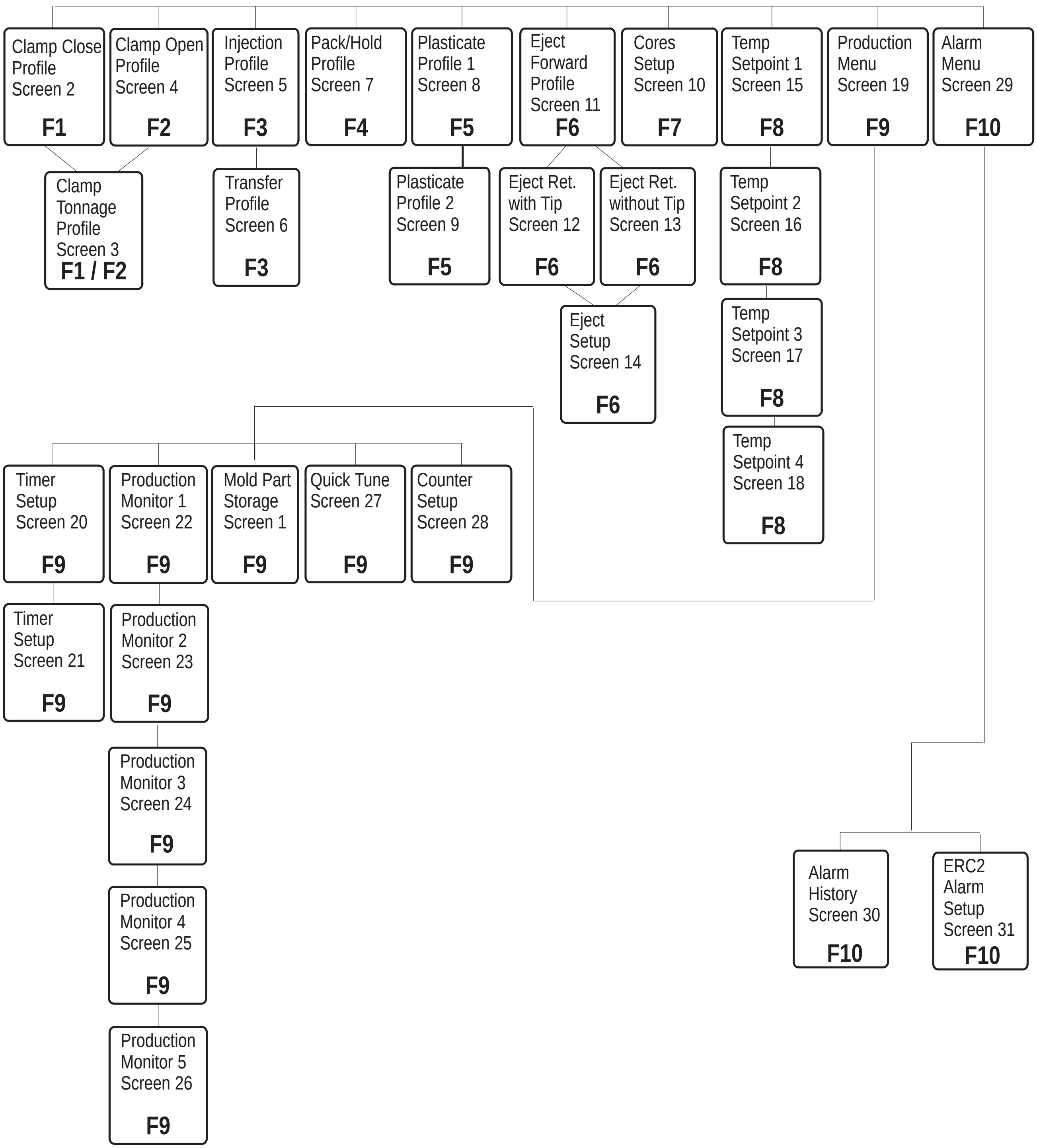
- change position/location of any object on any screen
- add objects
- build your own screens

If you change screen numbers, check the ladder logic. Certain screens call program files with Jump to Subroutine instructions (JSRs). Use RSLogix 500 software to search for N88:12 (current screen tag from PanelView) and modify Compare instructions to reflect screen number changes.

Pro-Set 200 PanelView Screens

Layout for Pro-Set 200 Operator Screens

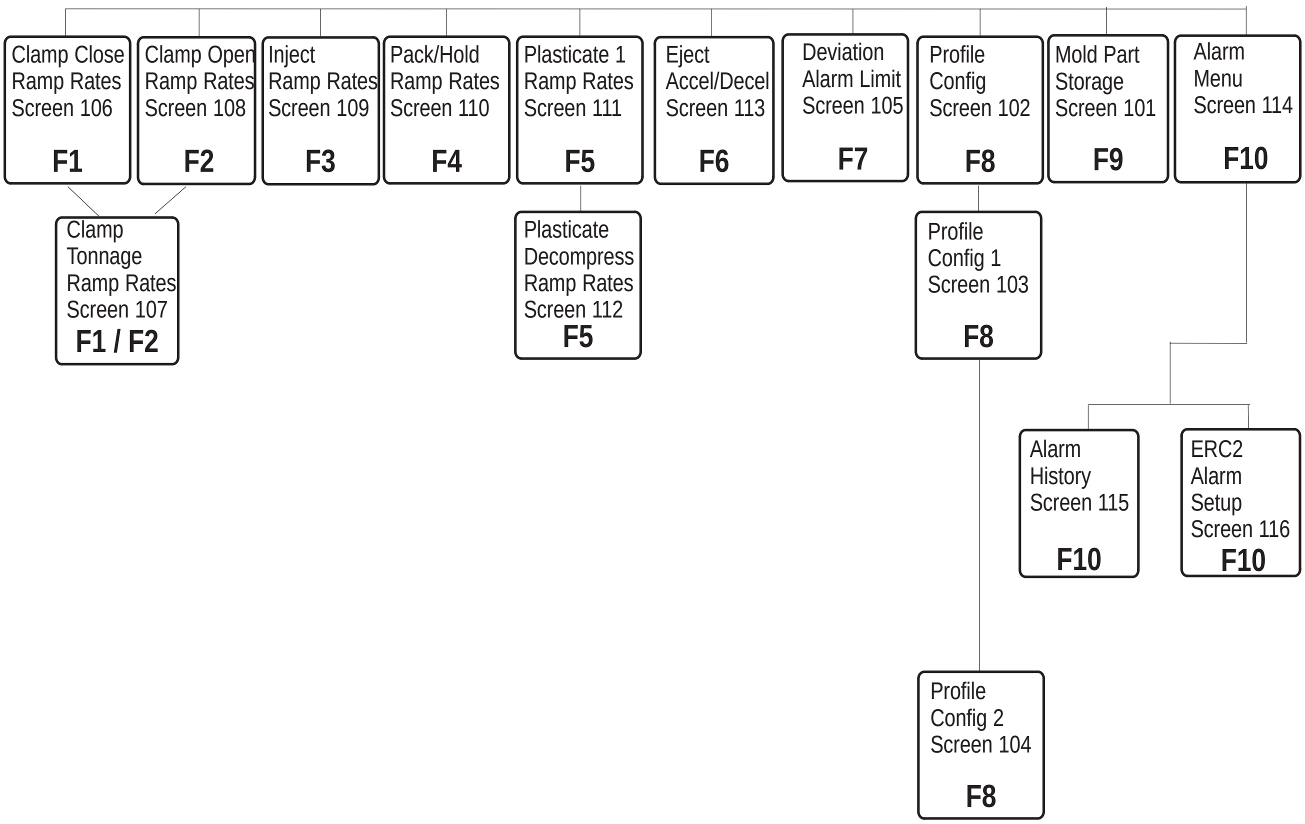
This screen layout applies to the ps2o102.pva and ps2o102.pba files shipped on the PanelView screens disk. After the initial power-up sequence of the PanelView terminal, the Pro-Set 200 Title Screen appears.



Layout for Pro-Set 200 Configuration Screens

This screen layout applies to the `ps2c102.pva` and `ps2c102.pba` files on the PanelView screens disk.

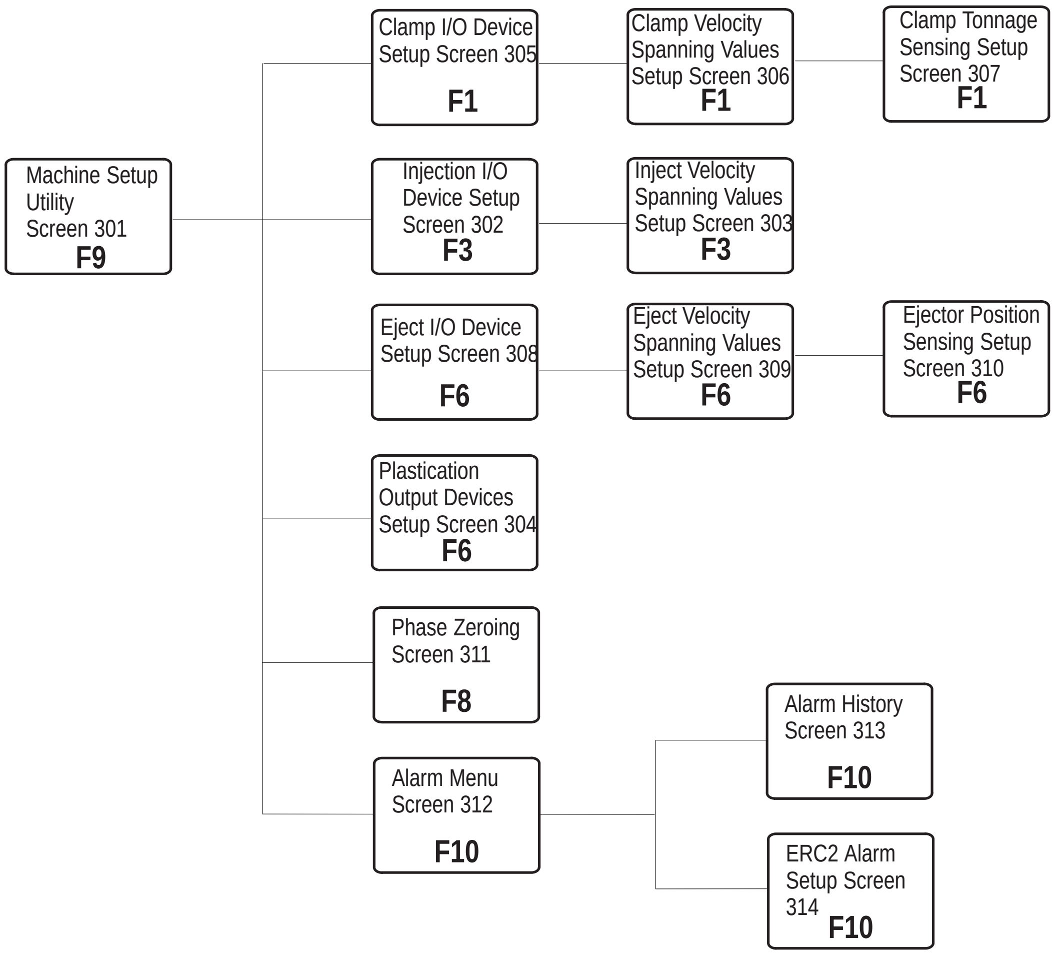
After the initial power-up sequence of the PanelView terminal, the Pro-Set 200 Title Screen appears.



Layout for Pro-Set 200 Setup Screens

This screen layout applies to the `ps2s102.pva` and `ps2s102.pba` files on the PanelView screens disk.

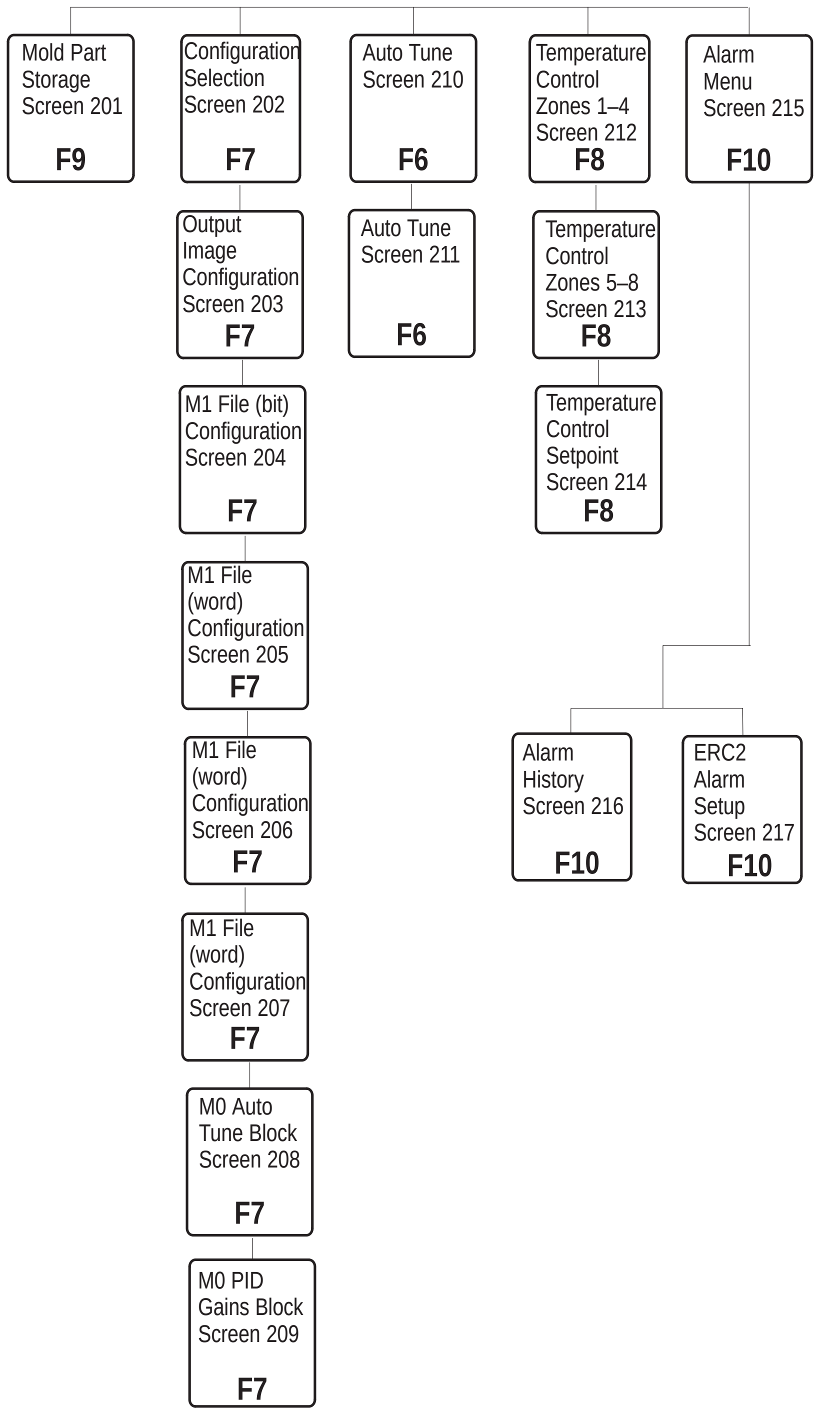
After the initial power-up sequence of the PanelView terminal, the Pro-Set 200 Title Screen appears.



Layout for Pro-Set 200 BTM Screens

This screen layout applies to the `ps2b102.pva` and `ps2b102.pba` files on the PanelView screens disk.

After the initial power-up sequence of the PanelView terminal, the Pro-Set 200 Title Screen appears.



Optimizing Screen Update Time

The PanelView sends groups of data in packets. The more packets which need to be sent over the DH485 link, the longer the time required to update a screen. The following are some suggestions for reducing the number of packets which must be sent. These suggestions apply to read-only data (data which is read from the SLC), objects such as multistate indicators, message displays, numeric data displays, and bar graphs.

Scanning Control Tags

Tags fall into two different categories:

- those that are constantly scanned, such as control tags in the Terminal Setup Dialog
- those that are scanned only when needed, such as when a screen is displayed

Any control tag assigned in terminal setup is scanned no matter what screen is being displayed, which requires additional DH485 packet(s). If you do not need the control tags in terminal setup, do not assign tag addresses to them.

Minimizing the Number of Data Packets

A packet can have only 40 words of data. In order to minimize the number of packets, the 40 words must be contiguous and in the same scan class. By contiguous, we mean that they must be consecutive words in the same SLC data table file.

For example, N7:0 – N7:39 is a contiguous packet of data. In this case, only 1 packet of data needs to be sent, provided that all of the data is in the same scan class.

PanelView terminals provide 9 different scan classes. However, those scan classes can be reduced to 3 major groups:

Group:	Update Rate:	Update Frequency:
scan classes 1, 2, and 3	high	updated on every pass of the scanner
scan classes 4, 5, and 6	medium	updated on every other pass of the scanner
scan classes 7, 8, and 9	low	updated on every fourth pass of the scanner

In order to minimize the number of packets, make sure the data is in the same scan class, and in the same group of 40 words.

For example, in order to minimize the number of packets to one packet of data, put all of the data in the file range N7:0 – N7:39, and put that file range in scan class 1, 2, or 3.

Setting the Maximum Node Address

In general, you should set the maximum node address (configured on the terminal address screen) to the lowest number possible. We recommend you set it at the maximum node address of any device present on the DH485 network. For example, assign node address one to the SLC 5/04 P processor and node 2 to the PanelView terminal.

Recommendations

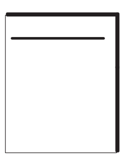
Important: Keep in mind the following when modifying PanelView screens.

- Don't reuse the tag names.
- Create a `.pva` file that is not uploadable to conserve PanelView memory. Do this by adding the following lines after the upload section in the PB550.ini file, and be careful to type in correct case as shown:

```
[upload]
UploadableApp=0
```

- Do not change addresses/tag names because they are used extensively within the Pro-Set 200 ladder logic.
- If you want to add more screens, you need to download with minimal amounts of information. That way you'll have more memory to add screens.

What's Next?



In the next chapter, we explain hydraulic concepts.

Understanding Hydraulic Pressure and Flow Concepts

What's in This Chapter?

This chapter helps you understand the the following:

- pressure differential and its effect on flow rates
- load pressure concepts
- relief valve settings and how they affect flow rates
- load pressure and its effect on flow rate
- deadheaded pressure vs. learned pressure during a profile
- hydraulic configurations that Pro-Set 200 supports

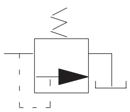
The Relationship Between Hydraulics and Pro-Set 200

The relationship between the hydraulics of any injection molding machine and Pro-Set 200 cannot be overemphasized - the success of an efficiently functioning machine depends on this successful interaction. It is possible to correctly setup Pro-Set 200 on a machine, and because of poor hydraulic design, still have an inefficient, poorly-functioning machine. Unfortunately, Pro-Set 200 cannot make up for poor hydraulic design.

This chapter was written to assist someone with substantial hydraulic knowledge as it is specifically applied to injection molding machines. This chapter is not designed to teach you hydraulic design for injection molding machines. If you are unfamiliar with hydraulics as they apply to injection molding machines, you are strongly advised to contact the machine manufacturer or contract your hydraulic work to a qualified hydraulics engineer.

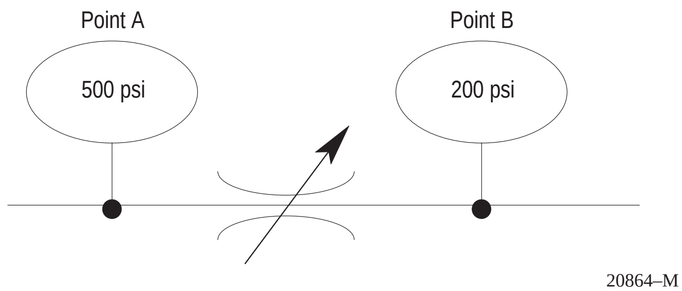
Understanding Pressure Differential and the Effects on Flow Rates

In a hydraulic system, a pressure differential is the difference in pressure between two points in the system. Figure 7.1 shows the measured pressure between point A and point B has a pressure differential of 300 psi.

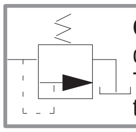


Concept: The measured pressure at point A is 500 psi. The pressure after the flow control valve is 200 psi; therefore, the pressure differential between the two points is 300 psi.

Figure 7.1 Pressure Differential Example



Flow through an orifice such as the flow control valve in Figure 7.1 is affected by the pressure differential. The greater the pressure differential across this orifice, the greater the actual flow. If you measured only 100 psi at point B in Figure 7.1, the flow across the flow control valve would be greater:



Concept: The greater the pressure differential, the greater the flow. The lower the pressure differential, the lower the flow.

Figure 7.2 Load Pressure Example

```
500 psi – 100 psi = 400 psi pressure differential
```

If the load pressure was measured at point B to be 400 psi, the flow across the valve would be less:

```
500 psi – 400 psi = 100 psi pressure differential
```

The main point is that flow is related to the pressure differential, however, it is not a direct relationship. You cannot expect to double the pressure and make the cylinder go twice as fast. The reason for this can be found in the equation of flow relating to a pressure drop across an orifice:

$$Q = C_d A_o \sqrt{\frac{2\Delta P}{\rho}}$$

Where:

$Q =$ Flow ($in^3/\sec$)

$C_d =$ Orifice discharge coefficient

$A_o =$ Area of orifice (in^2)

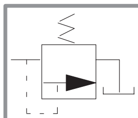
$\Delta P =$ Pressure drop across the orifice (lbs/in^2)

$\rho =$ Density of the fluid passing through the orifice ($lbs - \sec^2/in^4$)

Notice that ΔP is buried in a square root function. This means that it is not possible to double the pressure and achieve twice the flow.

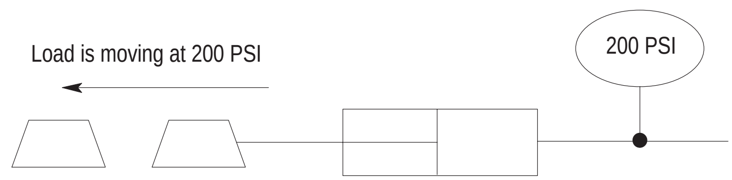
Understanding Load Pressure Concepts

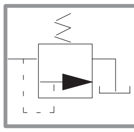
The load pressure is the amount of pressure (psi) required to move the load. In an injection molding machine, the load pressure is always changing as the plastic is being pushed into the mold cavity. The pressure measured at the injection cylinder will not go above the load pressure. If the injection cylinder is pushing against a load that requires 200 psi to move the load, the pressure measured at the cylinder will not go above 200 psi until the required load pressure increases. Example Figure 7.3 assumes that a fixed amount of oil is being supplied to the cylinder and no additional pressure is being applied to the load end of the cylinder:



Concept: The load pressure is 200 PSI and will not increase until an additional load is added.

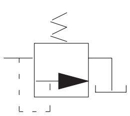
Figure 7.3 Load Pressure Example





Concept: The load pressure is the amount of pressure to move the load.

Figure 7.4 shows an additional load and the pressure required to move the increased load. You can only control pressures only up to 400 psi at the injection cylinder because the load pressure is 400 psi. In this example, if you entered an injection profile setpoint of 600 psi, you would not achieve the setpoint because the required load pressure is only 400 psi.



Concept: The pressure measured at the cylinder will not go above the load pressure assuming no additional pressure is being applied to the opposite side of the cylinder.

Figure 7.4 Additional Load Example

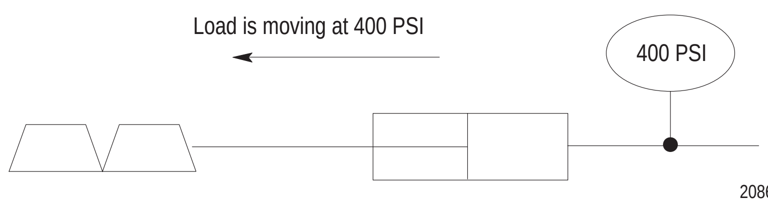
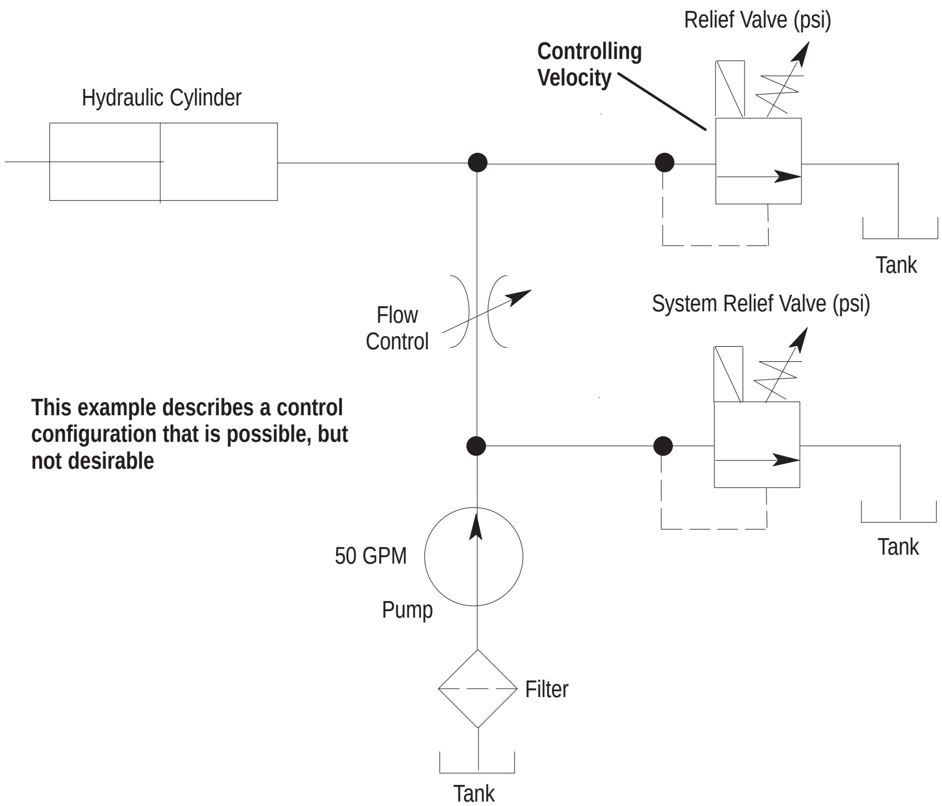


Figure 7.5 Pressure Controlled Velocity Example



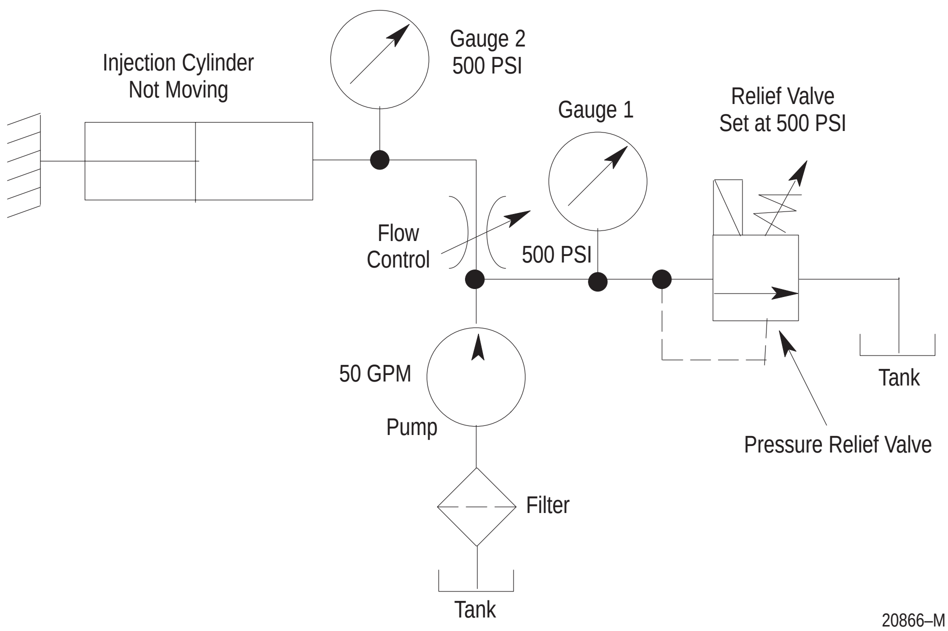
This example describes a control configuration that is possible, but not desirable

It is important to understand that if you are controlling an injection molding machine using pressure control and your hydraulic relief valve is plumbed without a flow control between the cylinder and relief valve, pressure control will be based only on load pressure. In this case the relief valve is used to control velocity and the machine will perform poorly. An example of this configuration is described by Figure 7.5

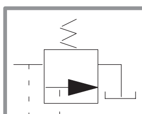
Understanding Deadheaded Pressure Readings

Earlier we learned that the greater the pressure differential across an orifice, such as a flow control valve, the greater the flow. However, in the Figure 7.6 the oil from the pump dumps across the relief valve circuit when the hydraulic cylinder stops moving, and the pressure measured at the relief valve and at the cylinder is approximately the same – this is referred to as deadheaded pressure.

Figure 7.6 Deadheaded Pressure Example



Stated another way, if the hydraulic cylinder is pushing against a load, and the pressure in the system is low enough that no movement occurs, the relief valve will open once the system pressure reaches the set value (500 psi). Once the relief valve is open, the pressure of the injection cylinder circuit (measured at gauge 2) and the relief valve circuit (measured at gauge 1) are the same. During this state, the entire system measures the value of the pressure relief valve and the pressure differential between gauge 1 and gauge 2 is zero. Deadheaded pressure is the pressure measured during this state, when the oil flow of the cylinder circuit has all but stopped, yet continues to flow across the relief valve circuit.



Concept: Deadheaded pressure is the pressure that is measured when the cylinder has stopped moving.

The purpose for learning deadheaded pressure values is that regardless of where the hydraulic pressure transducer is located, the true characteristics of the pressure relief valve can be determined. By ensuring the cylinder is not moving during the profile, you are guaranteeing that pressure drops are not occurring between the transducer and the pressure relief valve.

Controlling Velocity Using Relief Valves and Flow Control Valves

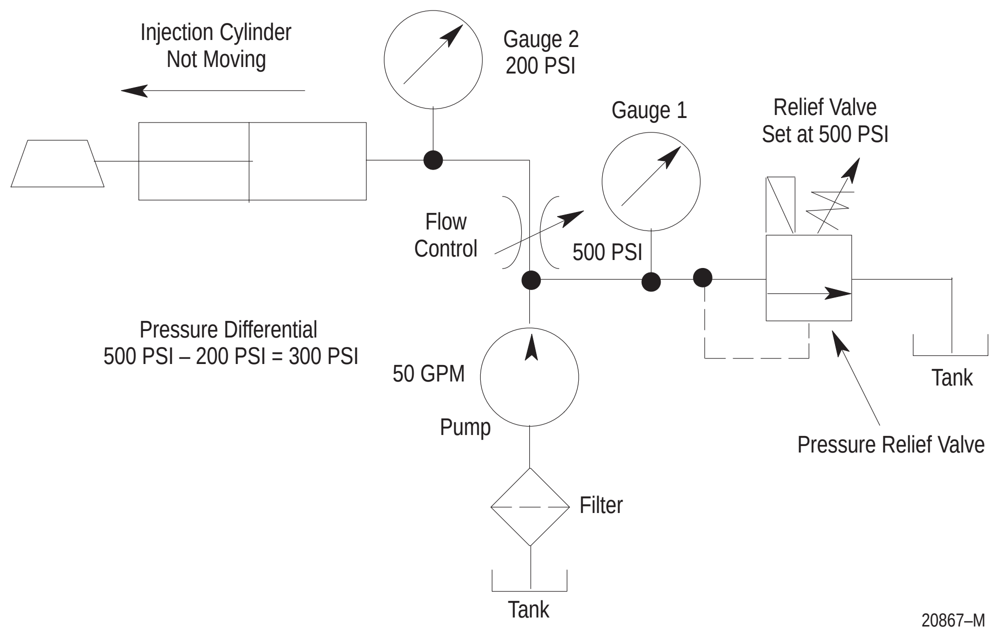
As stated earlier, the velocity of the cylinder can be controlled by adjusting the relief valve. Unfortunately, controlling cylinder velocity with a relief valve may yield poor results. One reason is that the characteristic of a pressure valve applied to velocity control is not linear – you can't double the pressure setting and expect double the velocity. Also, when the relief valve setting is increased as a means of increasing velocity, once the cylinder has stopped moving the psi relief valve may be set to high for your application. To put it simply, the pressure relief valve is incapable of simultaneously controlling velocity and effectively regulating system pressure.

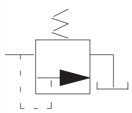
The most reliable and effective way to increase cylinder velocity is to increase the flow to the cylinder through the use of a flow control valve located between the cylinder and the relief valve. Increasing the flow to the cylinder by adjusting the flow control valve will increase cylinder velocity as long as there is enough pressure to overcome the load. This is the preferred method for adjusting the velocity of the cylinder. Controlling velocity with a flow control valve is preferred because the characteristic of flow is usually more linear, which results in better control characteristics. In addition, using the flow control valve to regulate velocity allows the relief valve to safely regulate system pressure.

Understanding Relief Valve Settings and How They Affect Flow Rates

Figure 7.7 analyzes a moving cylinder.

Figure 7.7 Moving Cylinder Example





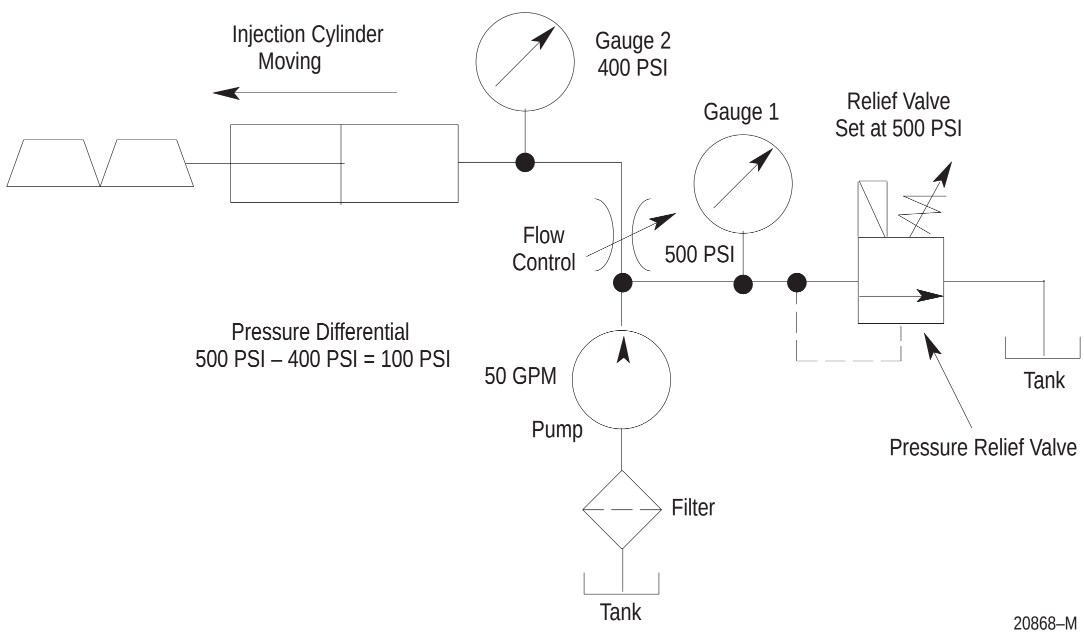
Concept: The greater the pressure differential across an orifice, such as a flow control valve, the greater the flow to the cylinder.

In Figure 7.7, the pressure relief valve is set to 500 psi and the load pressure is 200 psi. The amount of flow to the cylinder is limited by the setting of the pressure relief valve and thus the velocity of the cylinder is controlled. If you increase the pressure relief valve setting, it increases the pressure differential, resulting in increased flow of oil and increased cylinder velocity.

Load Pressure and its Affects on Flow Rate

You can increase the flow of oil to a cylinder by increasing the pressure valve setting. In an injection molding machine, however, load pressures are always changing and this affects the pressure differential. An increase in the pressure differential increases flow, while a decrease in the pressure differential decreases flow. Look at Figure 7.8, and compare the pressure differential to Figure 7.7; the flow to the cylinder is less, therefore the velocity of the cylinder is slower.

Figure 7.8 Pressure Differential Example



Deadheaded Pressure Vs. Learned Pressure During a Phase

The SLC 5/04P processor allows you to select a method of pressure control. The SLC 5/04P processor has the ability to:

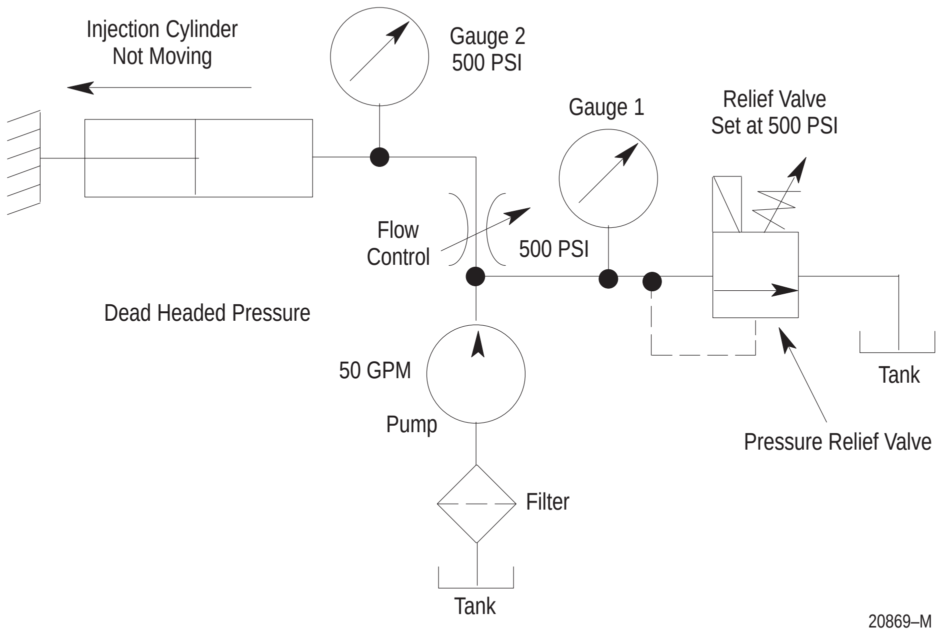
- learn or adapt the pressure during the current phase
- **or** apply the learned deadheaded pressure

The next section explains a pressure profile. Pressure profiles control the pressure applied to a cylinder, not the velocity of the cylinder.

Using Deadheaded Pressure

Deadheaded pressure is measured when the cylinder has stopped moving and all the oil is being dumped over the pressure relief valve (see Figure 7.9).

Figure 7.9 Deadheaded Pressure Example



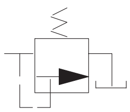
We know that when a cylinder has stopped moving, the pressure measured at the cylinder and the pressure measured at the relief valve will be approximately the same. This can be a valuable tool for limiting the pressure once the cylinder has stopped its motion. If the cylinder has stopped moving and we read the pressure at the cylinder, we can learn the characteristics of the pressure relief valve.

If the cylinder is moving, we cannot learn the correct pressure limits and characteristics of the pressure valve because of the pressure drop across all orifices.

Learning Pressure During the Cycle

Learning pressure during the cycle is a mode of control that should not be done while the cylinder is moving. The exception is that you can learn pressure settings during profiles that have no movement, such as clamp tonnage, injection hold, etc.

The Pro-Set 200 system, if selected to `Learn Pressure During Cycle`, tries to adapt the pressure to achieve the requested pressure setpoint. You should select this mode only if there is no movement occurring during the profile.



Concept: If you learn the pressure while the cylinder is moving, you run the risk of the pressure valve setting being too high once the cylinder has stopped moving.

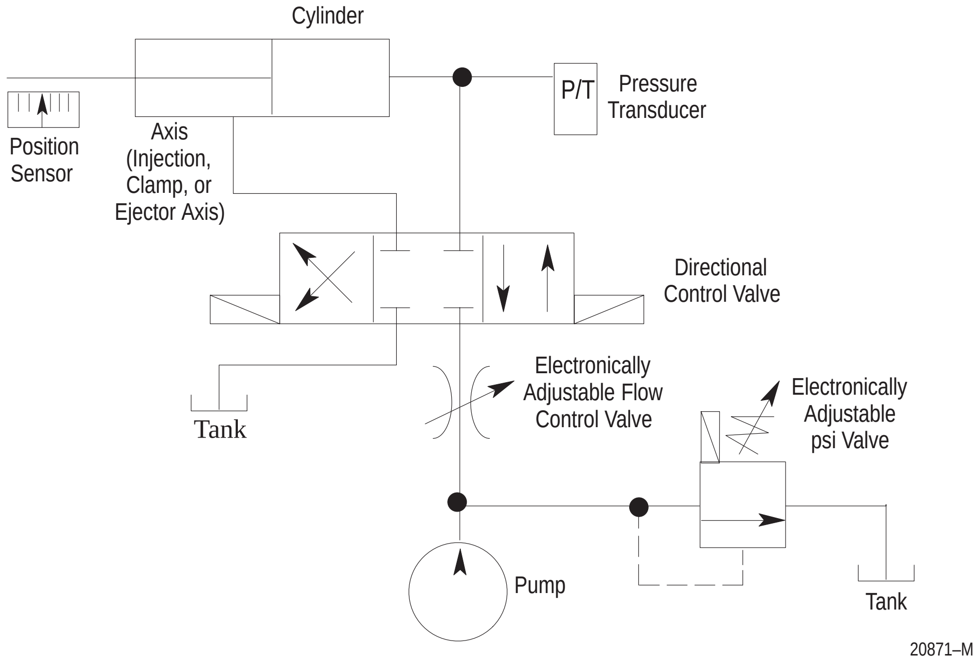
If you select the Pro-Set 200 system to `Learn Pressure During Cycle` and the cylinder is moving, you risk the relief valve being set too high once the cylinder has stopped moving.

In summary, to control the velocity of a cylinder setup the profile as a velocity profile. To control pressure, setup the profile as a pressure profile.

What Hydraulic Configurations Does Pro-Set 200 Support?

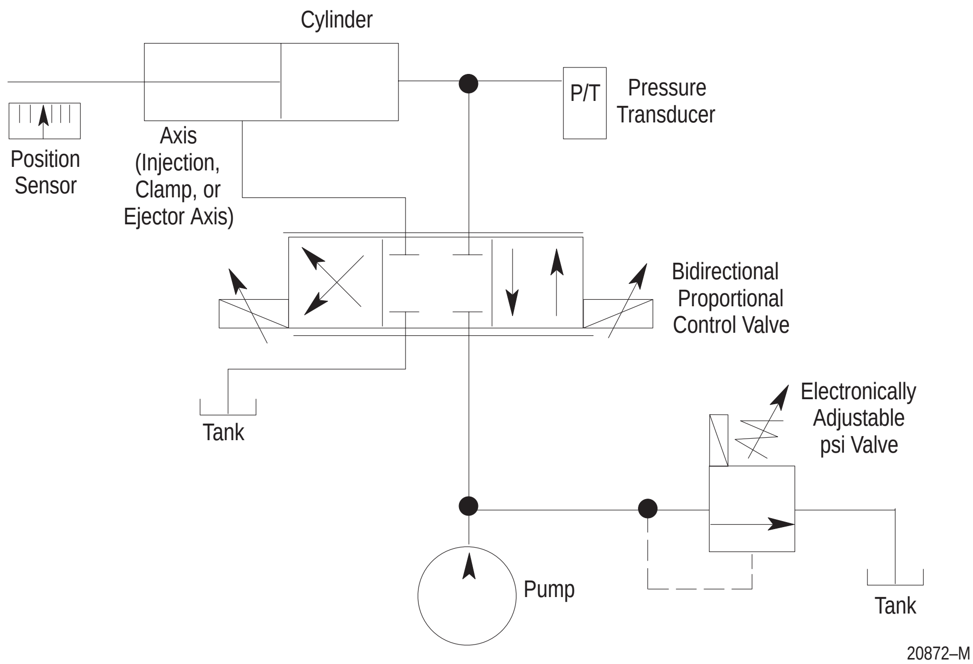
Pro-Set 200 is designed to provide open or closed loop control signals to the proportional valves controlling the pressure and flow circuits on an injection molding machine. While Pro-Set 200 has the capability to control proportional pressure and flow values for all 3 axes, the minimum Pro-Set 200 configuration controls the injection axis. Pro-Set 200 handles hydraulic configurations which have separate proportional valves for pressure and flow. Figures 7.10, 7.11, and 7.12 show these configurations.

Figure 7.10 Pro-Set 200 Typical Hydraulic Configuration with a Directional Control Valve



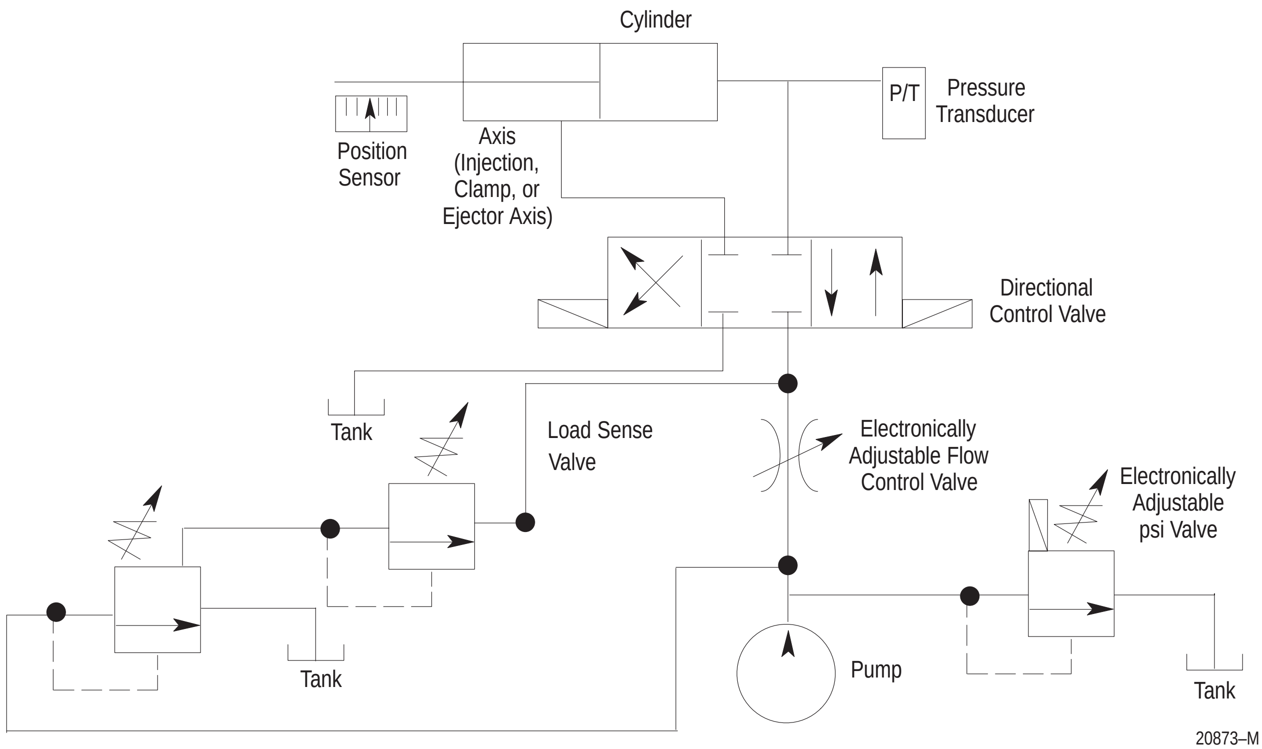
This:	Does this:
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–10 volts or 4–20 milliamps proportional to the pressure
Directional Control Valve	switches the cylinder from a forward or reverse position
Electronically Adjustable Flow Control Valve	controls the flow (velocity)
Electronically Adjustable psi Valve	controls the pressure in the circuit

Figure 7.11 Pro-Set 200 Typical Hydraulic Configuration with a Bi-directional Control Valve



This:	Does this:
Bi–directional Proportional Control Valve	• proportionally controls the flow (velocity) of the axis • can change direction
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–10 volts or 4–20 milliamps proportional to the pressure
Electronically Adjustable psi Valve	controls the pressure in the circuit

Figure 7.12 Pro-Set 200 Typical Hydraulic Configuration with a Load Sense Valve and Directional Control Valve

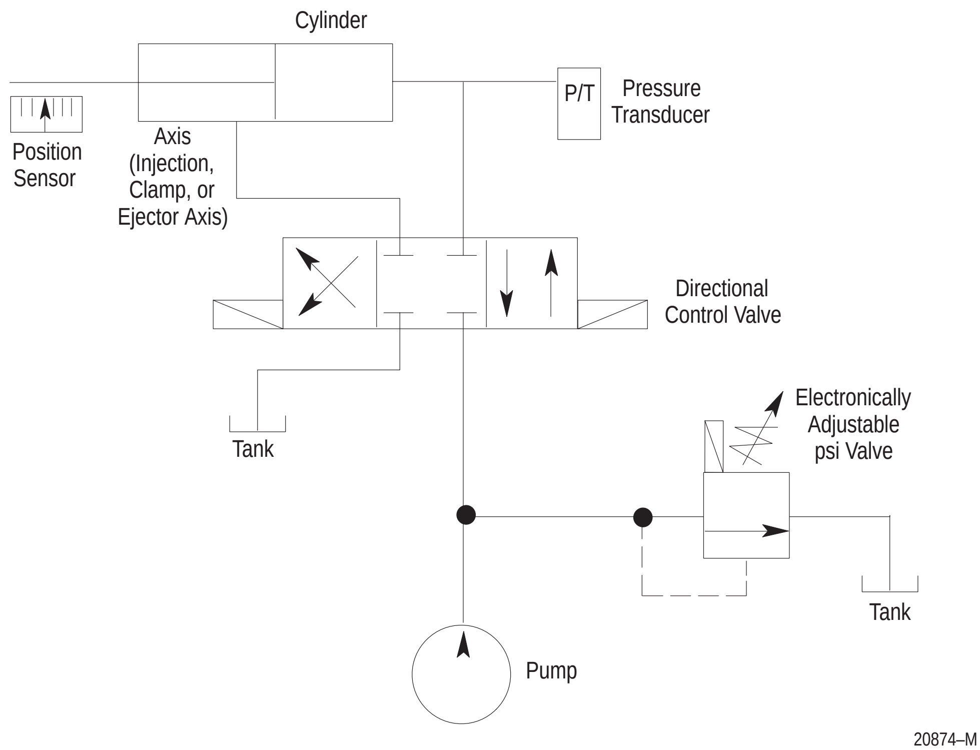


This:	Does this:
Load Sense Valve	keeps constant pressure across the flow control value if there are big changes in the load due to viscosity changes in the material
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–10 volts or 4–20 milliamps proportional to the pressure
Directional Control Valve	switches the cylinder from a forward or reverse position
Electronically Adjustable Flow Control Valve	controls the flow (velocity)
Electronically Adjustable psi Valve	controls the pressure in the circuit

Pro-Set 200 also has the capability to perform velocity control of an axis using a pressure valve, instead of the traditional velocity control valve. The following figure shows this configuration.

Important: Figure 7.13 is **not** the preferred method of controlling an injection molding machine. You may not see the desired results with this type of hydraulic configuration.

Figure 7.13 Pro-Set 200 Hydraulic Configuration Using a Pressure Valve



This:	Does this:
Directional Control Valve	switches the cylinder from forward or reverse
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–1–10 volts or 4–20 milliamps proportional to the pressure
Electronically Adjustable psi Valve	controls the pressure in the circuit

Other Hydraulic Configurations

Some machines require that only the injection portion of the machine be controlled by Pro-Set 200. In these applications you may want to leave the existing clamp and ejector directional control valves intact. In cases such as these, you can still use many of the bits in Pro-Set 200 which indicate which phase is active. However, you must also supply a linear positioning device for the clamp and ejector. You also need to write your own ladder logic for controlling the sequencing of the clamp and ejector hydraulics.

In Appendix D, “Specialized Hydraulic Configurations Supported by Pro-Set 200,” we show other hydraulic configuration that Pro-Set 200 can support. The configuration shown in this appendix require you to write additional ladder logic.

What’s Next?

In the next chapter, we explain how to configure Pro-Set 200 profiles.

Configuring Pro-Set 200 Profiles

What's in This Chapter?

This chapter explains how to:

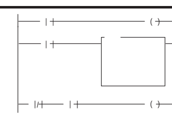
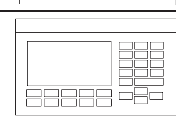
- select a recipe
- configure profiles
- configure primary controller variables

Before You Begin Configuring Profiles

The bits that determine configuration information are located in configuration word 0 and word 1 of the setpoint block for each of the profiles. The locations of the setpoint blocks are listed in the following table:

Profile:	Data Table Location:	Profile:	Data Table Location:
Injection	N109	Tonnage	N157
Pack	N113	Low Hold	N161
Hold	N117	Decompress	N165
Pre-Decompress	N121	Clamp Open	N169
Plastication	N125	Ejector Forward	N189
Post-Decompress	N129	Ejector Retract	N193
Clamp Close	N149	Eject Tip Stroke	N197
Clamp LPMP	N153		

You can configure these bits through either PanelView screens or ladder logic programming software.

To configure these bits using:	Use this column throughout this section:
ladder logic programming software	
PanelView screens	

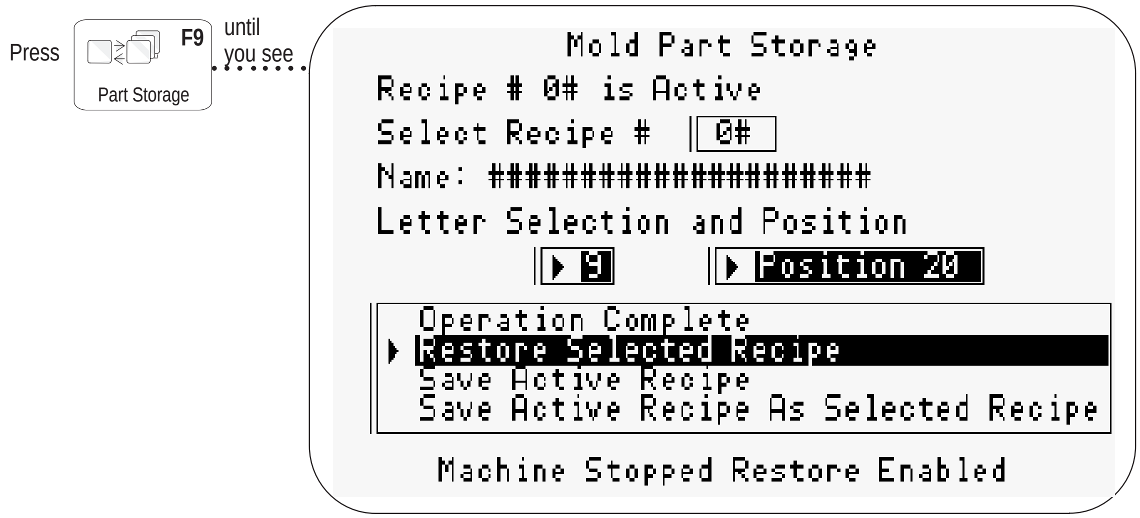
ATTENTION: Do ***not*** change these bits while the machine is performing a cycle or it could result in unpredictable operation. Modify these bits while the machine is idle.

Accessing the PanelView Configuration Screens

Access the Pro-Set 200 configuration screens by loading this file:

```
ps2c102.pva
```

Selecting a Recipe



From this screen, you can:	See page:
select a recipe number	8–2
restore and save a recipe configuration	8–3

Select Recipe # 0#

Selecting a Recipe Number

Use this field to select a recipe number. Pro-Set 200 is configured from the factory to support up to 5 recipes.

To select a recipe number, do the following:

1. Cursor to this field Select Recipe # 0# by using the left and right arrow keys
2. Press the enter key

   The scratch pad appears.

   Enter value 0
   (1 to 5)

3. Enter the new recipe number, 1 through 5
4. Press the enter key

   The recipe name associated with the recipe number appears in the name area. The recipe does not become active until you perform a restore function.

Saving a Recipe Configuration

To save a recipe configuration that you made changes to, do the following:

1. Cursor to this field

```
  Restore Selected Recipe
▸ Save Active Recipe
  Save Active Recipe As Selected Recipe
```

   by using the left and right arrow keys

2. Select `Save Active Recipe` by using the up and down arrow keys

3. Press the enter key to save the active recipe

```
  Restore Selected Recipe
▸ Save Active Recipe
  Save Active Recipe As Selected Recipe
```

Restoring and Saving a Recipe Configuration

Use this field to save or restore a recipe configuration.

Restoring a Recipe Configuration

Restoring a recipe will make the selected recipe the active recipe. To restore a recipe configuration, do the following:

1. Cursor to this field

```
  Restore Selected Recipe
▸ Save Active Recipe
  Save Active Recipe As Selected Recipe
```

   by using the left and right arrow keys .

2. Select `Restore Selected Recipe` by using the up and down arrow keys .

3. Press the emter key to restore the selected recipe to the active recipe.

Saving Active Recipe As Selected Recipe

To save an active recipe as a selected recipe, do the following:

1. Cursor to this field `Select Recipe #` `0#` by using the left and right arrow keys

2. Press the enter key

The scratch pad appears.

```
Enter value          0
(1 to 5)
```

3. Enter the recipe number (1 through 5) which you want to save the active recipe to.

4. Press the enter key .

5. Cursor to this field

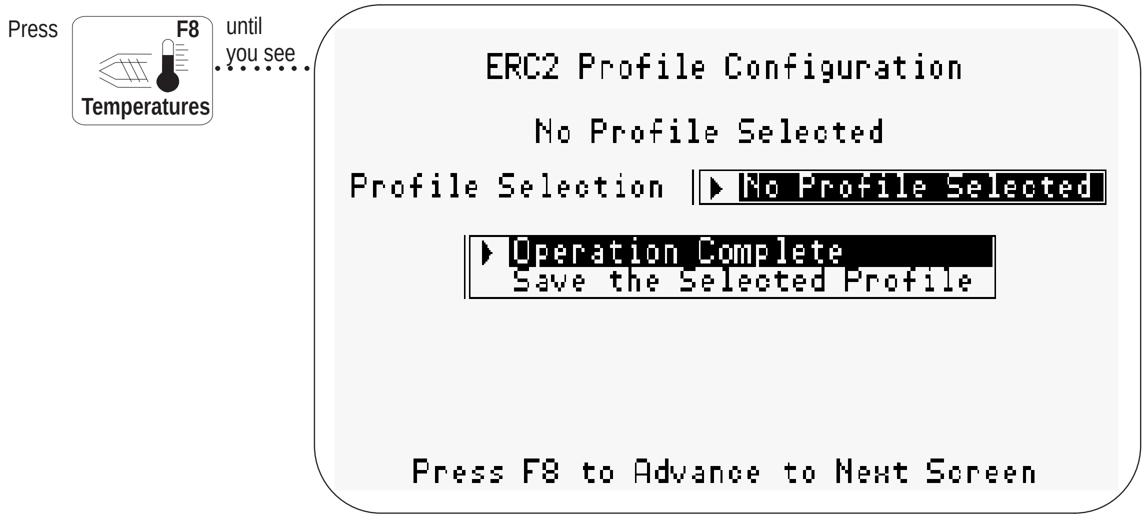
```
  Restore Selected Recipe
▸ Save Active Recipe
  Save Active Recipe As Selected Recipe
```

by using the left and right arrow keys

6. Select `Save Active Recipe As Selected` by using the up and down arrow keys

7. Press the enter key

Configuring Profiles

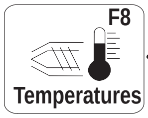


Selecting a Profile

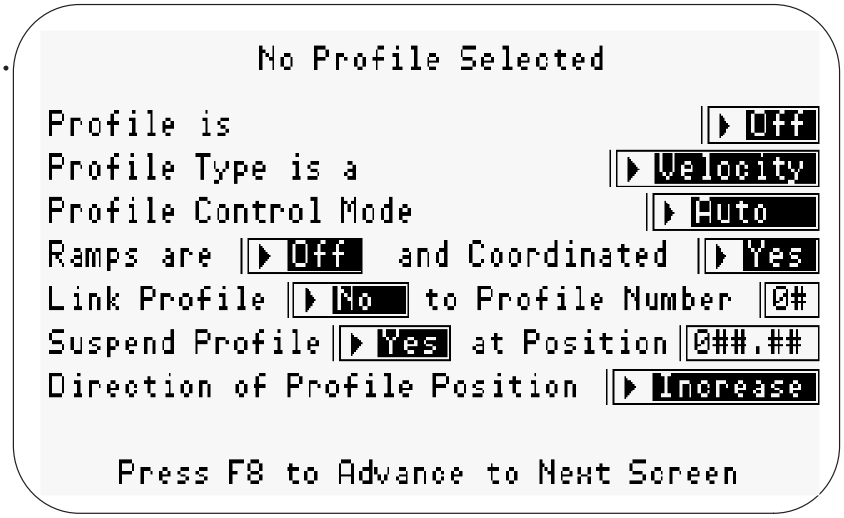
Select the profile that you want to configure. Select any of these profiles:

Profile:	Phase:
• injection • pack • hold • pre-decompress • plastication • post-decompress	injection
• clamp close • clamp LPMP • tonnage • low hold • decompress • clamp open	clamp
• eject forward • eject tip stroke • eject retract	eject

Press



until you see



From this screen, you can:	See page:
select a profile	8–5
turn profiles on or off	8–7
select velocity or pressure control	8–7
select auto or manual mode	8–8
turn ramps on or off	8–8
coordinate ramps	8–13
link to another profile	8–14
set link profile identification	8–17
use suspend profile	8–17
select the direction of the profile position	8–19

Modifying Ladder Logic if You Have Less Phases or Profiles

The baseline Pro-Set 200 ladder logic accommodates a maximum Pro-Set 200 system. A standard system includes injection, clamp, and eject phases with the following:

- 6 profiles in the injection phase
- 6 profiles in the clamp phase
- 3 profiles in the eject phase

If your application has less than three phases and/or profiles, modify the ladder logic in file 3 to decrease the number of phases and/or profiles.

Profile is ▶ Off

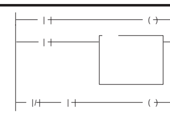
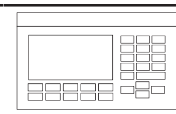
Turning Profiles On or Off

Use this field to turn profiles on or off.

Word 0 of the Setpoint Block

0000 0000 0000 0001

bit 0

To:		
enable profiles	set bit 0 = 1	select ▶ On
disable profiles Turn profiles off when you are not going to use a profile. For example, if you are not going to use the pack profile (go from injection to hold), turn the profiles bit to 0 for the pack profile.	set bit 0 = 0	select ▶ Off

Profile Type is a ▶ Velocity

Selecting Velocity or Pressure Profile

Use this selection to tell Pro-Set 200 that the profile is either a velocity or pressure profile.

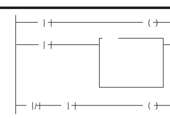
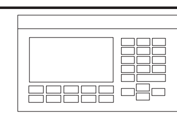
In a velocity profile, Pro-Set 200 controls the velocity closed loop and uses open loop control on pressure. Use velocity for profiles that use motion, such as injection.

In a pressure profile, Pro-Set 200 controls the pressure closed loop and uses open loop control on velocity. Use pressure for profiles that do not use motion, such as hold.

Word 0 of the Setpoint Block

0000 0000 0000 0010

bit 1

To indicate that the profile type is a:		
pressure profile	set bit 1 = 1	select ▶ Pressure
velocity profile	set bit 1 = 0	select ▶ Velocity

`Profile Control Mode ▶ Auto`

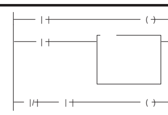
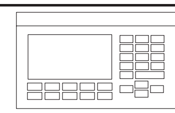
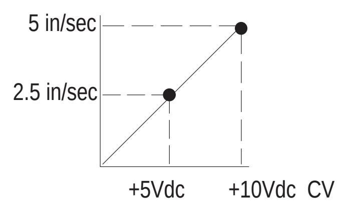
Selecting Auto or Manual Mode

When you select either of these modes (auto or manual), Pro-Set 200 applies this selection globally to the profile. For example, if you select manual (open loop mode) for the injection profile, then all 5 segments of the injection profile will use open loop control. However, you are not limited to run other profiles associated with the phase in manual mode. The other profiles in the injection phase (pack, hold, plastication, pre and post decompress) can still be controlled via ERC2 (Auto Mode).

Word 0 of the Setpoint Block

0000 0000 0000 1000

bit 3

To choose:		
auto mode (ERC2)	set bit 3 = 0 If you select this mode, the control output is determined by bits 4, 5, and 6 in word 0 and bit 14 in word 1.	select ▶ Auto
manual mode (open loop control)	set bit 3 = 0 If you select manual mode, the control output is calculated through interpolation (we refer to this as %CV Max) If you select this option, the SLC 5/04P processor does not try to correct any errors during the shot or movement; it interpolates the output percentage based on the %CV max curve. For example, if you select this option, and the maximum speed of the profile is 5 in/sec at +10Vdc, and you enter a 2.5 in/sec setpoint, the controller outputs +5Vdc: 	select ▶ Manual

`Ramps are ▶ Off and Coordinated ▶ No`

Turning Ramps On or Off

Ramping is useful to smooth out jerking motion that results from quick increases in pressure or flow. You can selectively apply ramping to any process profile. Pro-Set 200 applies individual velocity and pressure ramp rates at the beginning of each profile segment to reach setpoint. There are two optional ramp rates:

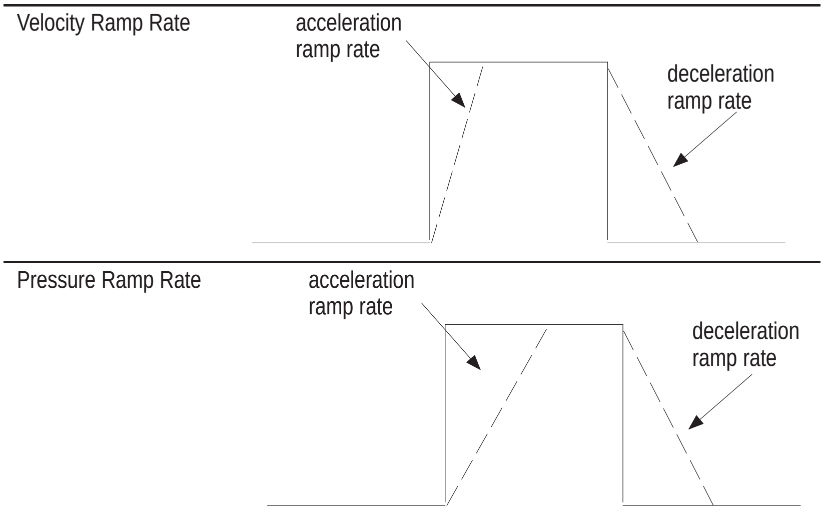
- acceleration ramp rates
- deceleration ramp rates

Ramping works like this:

- Ramping is supported for all phases.
- Each profile segment has its own acceleration and deceleration ramp rate.

- A ramp value of zero disables ramping. Setpoint steps immediately to segment setpoint.
- Ramp values are stored as part of the mold part storage information.
- Velocity ramp values have a range from 0 to 327 inches/second/second (including deceleration ramps)
- Pressure ramp values have a range from 0 to 32767 psi/second

Every profile step has its own acceleration and deceleration ramp rates for both velocity and pressure.



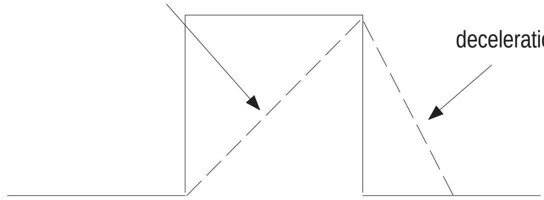
Using Ramps

If required by your application, you can configure Pro-Set 200 to ramp both velocity and pressure during a profile. Pro-Set 200 applies configured ramp rates at the beginning of each profile segment for both velocity and pressure to reach setpoint.

Apply ramping with the following considerations:

- Disable ramp rates while tuning applicable pressure and velocity loops.
- Ramp rates control selected and unselected valves. Although you may be controlling velocity, you can also ramp injection pressure during an injection profile.

- When using ramping, make the acceleration and deceleration rates as aggressive as possible. If the rates are too slow, the setpoint might not be attained; this could cause a segment to short alarm.



- Make sure that valve driver cards with ramping have ramping disabled.

Selectively Enabling Ramping

To selectively enable ramping:

1. Set the profiles that require ramping to 1 (bit 7, word 0 of the setpoint block).
2. Set the ramp rates for those segments that do not require ramping to 0.

Example: Selectively Enabling Ramping

If your machine requires ramping only for the beginning and ending segments of the injection profile such as:

Word 0 of the Setpoint Block

0000 0000 1000 0000

bit 7

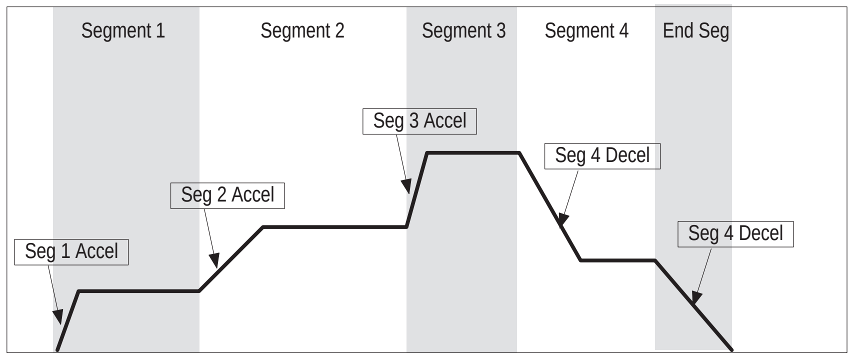
Segment:	Ramping required?
1	yes
2	no
3	no
4	no
5	yes

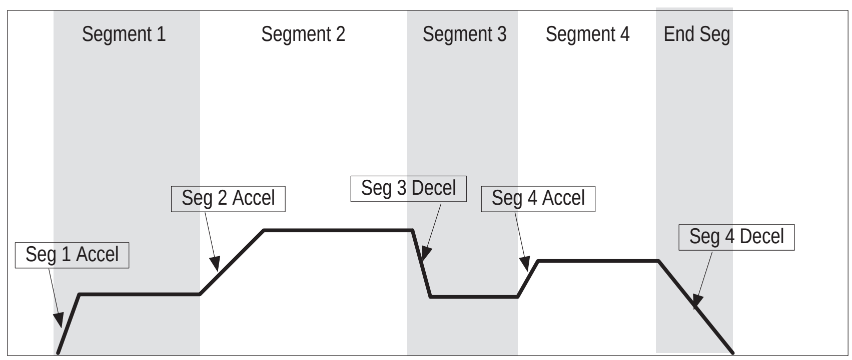
then enable ramping for the injection profile (global ramping) and put a zero value (no ramp) in those segments that do not need ramping:

Segment:	Ramping required?	Ramp rate:	Data table location:
1	yes	2000	N109:34,35
2	no	0	N109:42,43
3	no	0	N109:50,51
4	no	0	N109:58,59
5	yes	2000	N109:66,57

Ramp Acceleration and Deceleration

The following diagrams illustrate which ramp setpoint is applied during the ramp for various segments. These diagrams assume the Permit bit (example B101:1/0) remains set for the entire profile and the profile is not linked to another profile. This is typical of a clamp open profile.



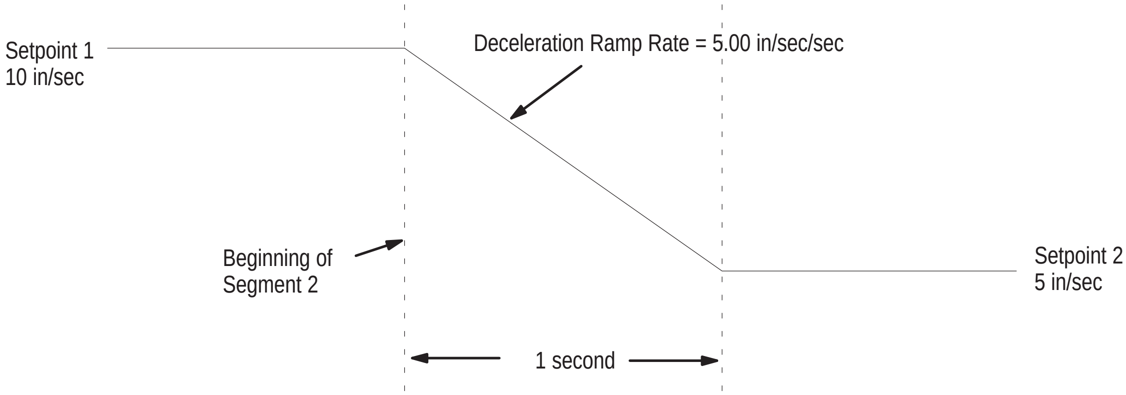


To stop a profile prior to the completion of all of its segments, turn off its profile permit bit. For example, to stop injection mid-profile, turn off B101:1/0. No ramp is used in this case. The valve outputs are immediately set to the values in phase setpoint block emergency-stop values (N104:0, N104:1).

If a ramp (graceful stop) is desired, use the suspend/resume feature instead of turning off the profile permit bit. At any time during a profile, if the current position (N105:0) is past the suspend profile position setpoint (N109:4), the profile is configured to suspend (N109:0/9), and the resume bit (B101:2/2) is not set, the valves ramp to the end of profile setpoints (N109:16, N09:17) using the ramp rate configured in the currently active segment.

Understanding the Ramping Formula

The following diagram shows the ramping formula.



Assumption: Ramp of 5 in/sec/sec
Total time to ramp to new setpoint = (New–Old)/Ramp Rate
Time required to ramp to new setpoint in this example = (10 in/sec – 5 in/sec) / (5 in/sec/sec) = 1 sec

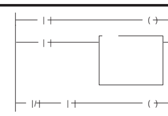
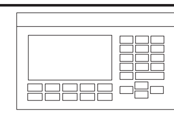
Setting Ramps to On or Off

Use this field to turn ramps on and off for the entire profile.

Word 0 of the Setpoint Block

0000 0000 **1**000 0000

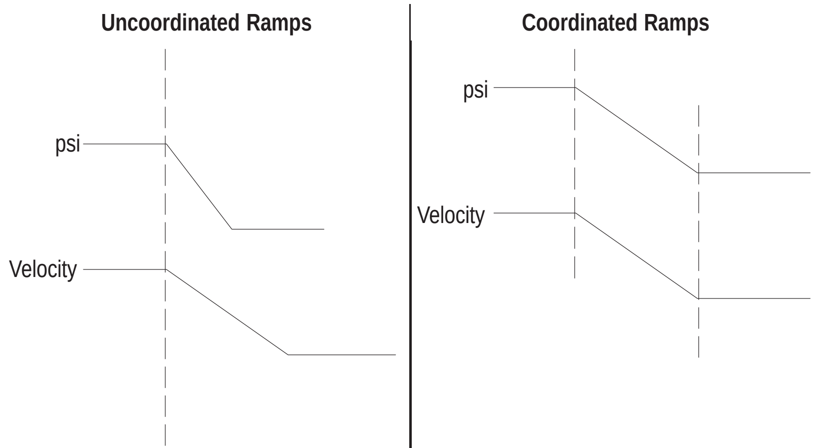
bit 7

To:		
turn on ramps	set bit 7 = 1	select ▶ **On**
turn off ramps	set bit 7 = 0	select ▶ **Off**

Ramps are ▶ Off and Coordinated ▶ No

Coordinating Ramps

The following diagram shows the difference between coordinated and uncoordinated ramps.



With uncoordinated ramping, psi and velocity setpoints may end ramps at different times.

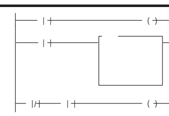
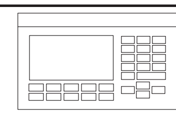
With coordinated ramps, ERC2 picks the ramp rate of the primary controlled variable and applies it to both outputs.

This selector allows the ramps for both the pressure and the velocity valve to end at the same time regardless of the amount of ramp rates applied to each control variable. If, during the profile, the pressure valve has a longer ramp than that of the velocity valve, both outputs are coordinated to reach the end of the ramp at the same time.

Word 0 of the Setpoint Block

0010 0000 0000 0000

bit 13

To:		
coordinate ramps	set bit 13 = 1	select ▶ On
use independent ramps	set bit 13 = 0	select ▶ Off

Link Profile ▶ No to Profile Number 0#

Linking to Another Profile

Profile linking ties related setpoint blocks together. It tells the ERC2 algorithms what the next profile block will be by pointing to the permissive bit pattern of the next profile. For example, inject, pack, and hold are usually linked together to provide seamless transitions from inject to pack to hold. Pro-Set 200 automatically starts the linked profile when the current profile ends. The permissive bit for the linked profile does not need to be set.

Conceptually, linking several profiles combines all of the segments into one continuous profile. Do ***not*** link profiles if:

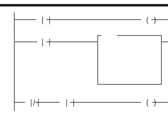
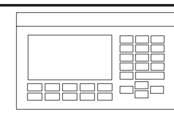
- you are changing the direction of the axes of motion
- you are using a different valve set to control the next action
- you are ***not*** using a profile in the same phase as the current profile
- the current profile does ***not*** end on position or time (for example, tonnage, clamp low hold, or decompress)

In most cases you will probably use the default values for profile linking. You can change profile linking to skip certain machine phases. For example, you could eliminate the pack phase and go from the injection profile directly to the hold profile.

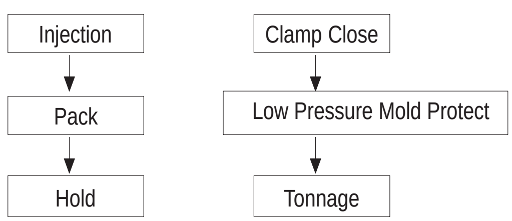
Word 0 of the Setpoint Block

0000 0001 0000 0000

bit 8

If you:		
want to link to the next profile	set bit 8 = 1 When linking is selected, Pro-Set 200 links to the profile shown in word 2 of the setpoint block.	select ▶ Yes
do not want to link to the next profile	set bit 8 = 0	select ▶ No

The out-of-the-box factory defaults for profile linking are:



You can link other profiles together if your application requires it. The profile link words are located in the setpoint block for each profile. The following table shows the data table locations and default values for the link profile word.

Profile:	Data Table Location:	Comments:
Injection	N109:2	Default value: 0000 0000 0000 0010 (Pack bit permissive pattern as in B101:1)
Pack	N113:2	Default value: 0000 0000 0000 0100 (Hold bit permissive pattern as in B101:1)
Hold	N117:2	
Pre-Decompress	N121:2	
Plastication	N125:2	
Post Decompress	N129:2	
Clamp Close	N149:2	Default value: 0000 0000 0000 0010 (Clamp LPMP bit permissive pattern as in B101:4)
Clamp LPMP	N153:2	Default value: 0000 0000 0000 0100 (Clamp Tonnage bit permissive pattern as in B101:4)
Clamp Tonnage	N157:2	
Clamp Low hold	N161:2	
Clamp Decompress	N165:2	
Clamp Open	N169:2	

▶ Notice that the link profile bit pattern is the same pattern found in B101 (permissive block).

Injection Phase Link Pattern Table

Injection	0000 0000 0000 0001	Profile Link Pattern
Pack	0000 0000 0000 0010	
Hold	0000 0000 0000 0100	
Pre-Decompress	0000 0000 0000 1000	
Plastication	0000 0000 0001 0000	
Post-Decompress	0000 0000 0010 0000	

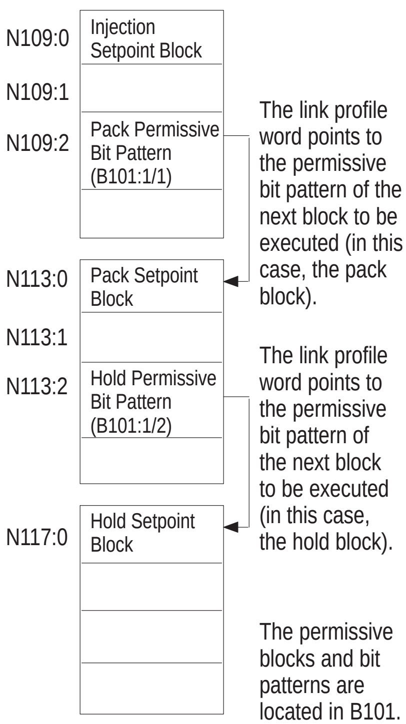
Clamp Phase Link Pattern Table

Close	0000 0000 0000 0001	Profile Link Pattern
LPMP	0000 0000 0000 0010	
Tonnage	0000 0000 0000 0100	
Low Hold	0000 0000 0000 1000	
Decompress	0000 0000 0001 0000	
Open	0000 0000 0010 0000	

Ejector Phase Link Pattern Table

Eject Forward	0000 0000 0000 0001	Profile Link Pattern
Eject Retract	0000 0000 0000 0010	
Eject Tip Stroke	0000 0000 0000 0100	

Example: Profile Linking



To link the injection profile to the pack profile and the pack profile to the hold profile, do this:

1. Set N109:0/8 = 1.

   This enables profile linking for the injection profile; the injection profile is linked to the pack profile. Note that this is the default out-of-the-box configuration for Pro-Set 200.

2. Place the permissive bit pattern for the pack profile in the link profile identification word in the injection setpoint block:

   N109:02 = 0000 0000 0000 0010

   The link profile word in the injection setpoint block contains the permissive bit pattern for the pack profile.

3. Set N113:0/8 = 1.

   This enables profile linking for the pack profile; the pack profile is linked to the hold profile. Note that this is the default out-of-the-box configuration for Pro-Set 200.

4. Place the permissive bit pattern for the hold profile in the link profile identification word in the back setpoint block:

   N113:02 = 0000 0000 0000 0100

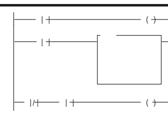
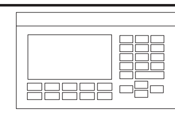
   The link profile word in the pack setpoint block contains the permissive bit pattern for the hold profile.

Link Profile ▶ No to Profile Number 0#

Setting Link Profile Identification

Use this field to specify the profile that you want to link to. In order to use this field, enable profile linking (set bit 8 in configuration word 0). For information about enabling profile linking, see page 8–14.

ATTENTION: You can only link profiles in the same phase. For example, you can link the pack profile to the hold profile since both of these profiles are in the injection phase. However, you can not link the hold profile to the clamp open profile because these two profiles are in different phases.

To:		
enable linking	enter 1 to link to injection enter 2 to link to pack enter 4 to link to hold enter 8 to link to pre-decompress enter 16 to link to plastication enter 32 to link to post-decompress enter 1 to link to clamp close enter 2 to link to clamp LPMP enter 4 to link to clamp tonnage enter 8 to link to clamp low low hold enter 16 to link to clamp decompress enter 32 to link to clamp open enter 1 to link to ejector forward enter 2 to link to ejector retract enter 4 to link to ejector tip stroke	
disable linking	enter 0	enter 0

Suspend Profile ▶ No at Position 0#.##

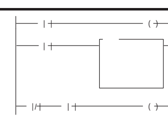
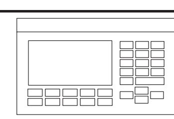
Using the Suspend Profile at Position

Use this field to enable or disable the suspend profile capability. If this capability is enabled, you can stop the phase at the position defined in configuration word 3 of the setpoint block. You can enter the interrupt profile position setpoint in the configuration screen.

Word 0 of the Setpoint Block

0000 0010 0000 0000

bit 9

To:		
enable the interrupt profile capability	set bit 9 = 1	select ▶ Yes
disable the interrupt profile capability	set bit 9 = 0	select ▶ No

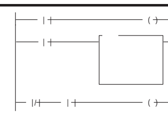
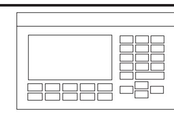
Suspend Profile ▶No at Position 0#.##

Setting the Suspend Profile Position

The suspend profile position:

- stops the motion of the a phase. During the period of time when the movement of the phase is stopped, you can perform special operations, such as setting cores.
- is used in conjunction with the resume bits to restart the motion of the phase.
- ramps to end of profile setpoints (words 16 and 17 of setpoint block)

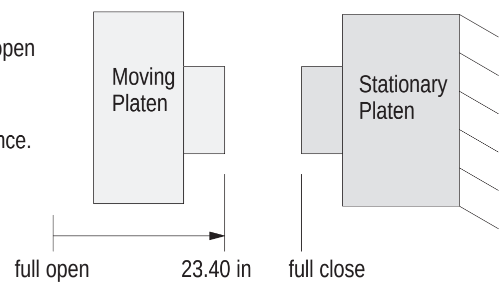
You must enable the suspend profile position.

To:		
suspend (i.e., stop) the profile segment that is being executed at the suspend position in word 3 of the setpoint block	set bit 9 = 1	select ▶ Yes
execute the profile without interruption	set bit 9 = 0	select ▶ No

Example: Suspend Profile Position

You can:

1. Move the clamp from the full open position to 23.4 inches.
2. Stop.
3. Perform a special core sequence.
4. Resume movement to the full close position.



The clamp open setpoint block (located in N169:0) contains the following information:

Clamp Open Setpoint Block

N169:0	Configuration word 0 = 0000 0010 0000 0000
N169:3	Suspend Profile Position = 2340

The resume bit in this example looks like this:

During the close sequence, but BEFORE the clamp actually stops, the resume bit, located in the dynamic phase permit block (B101), looks like this:	B101:5/2	0000 0000 0000 0000
AFTER your core sequence has been executed, the resume bit, located in the the dynamic phase permit block, looks like this:	B101:5/2	0000 0000 0000 0100

▶ You can selectively suspend the motion of a phase by using the resume bit. For instance, if you want the phase to stop if some event did not occur but wanted the phase to continue if the event did occur, program the resume bit off until the event occurs. If the event occurs before reaching the suspend profile position, turn the resume bit on and the phase will not stop at the interrupt position but will continue moving.

Direction of Profile Position ▶ Decrease

Selecting the Direction of the Profile Position

Use this field to tell the SLC 5/04P processor whether to expect an increasing position profile or a decreasing position profile. For example, the injection profile is a decreasing position profile because the profile begins at a larger injection position and moves towards the injection zero point. The plastication profile is an increasing position profile because as the screw rotates, the position increases until shot size is reached. The following table shows typical position values.

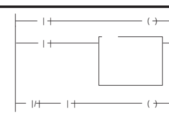
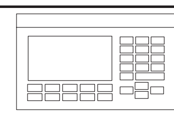
Profile:	Expected Position Value:	Profile:	Expected Position Value:
Injection	decreasing	Tonnage	decreasing
Pack	decreasing	Low Hold	decreasing
Hold	decreasing	Decompress	increasing
Pre-Decompress	increasing	Clamp Open	increasing
Plastication	increasing	Ejector Forward	increasing
Post-Decompress	increasing	Ejector Tip Stroke	decreasing
Clamp Close	decreasing	Eject Retract	decreasing
Clamp LPMP	decreasing		

To select the direction of the profile position, do one of the following:

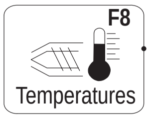
Word 0 of the Setpoint Block

0000 0100 0000 0000

bit 10

To tell the SLC 5/04P processor to expect an:		
increasing position profile	set bit 10 = 0	select ▶ Increase
decreasing position profile	set bit 10 = 1	select ▶ Decrease

Configuring Primary Controller Variables

Press 

until you see

No Profile Selected

Use Learned or %CVMax Velocity ▶ Learned

If Pressure Profile then:
Learn PSI during Profile or
Use PSI learned during
Deadhead ▶ Learn

If Velocity Profile then:
Run PSI as %CVMAX or Use
PSI Learned during Deadhead ▶ Deadhead

Press F8 to Advance to Next Screen

From this screen, you can:	See page:
select learned or %CV Max	8–20
select the pressure value source for pressure profile	8–21
select the pressure value source for velocity profile	8–22

Use Learned or %CVMax Velocity ▶ Learned

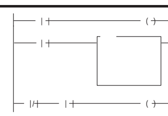
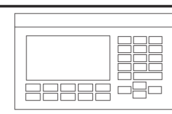
Selecting Learned or %CV Max

Use this field to define if the SLC 5/04P processor uses the learned value or %CV Max (interpolated open loop value) to control primary variable (depends on which selection you made for profile type).

Word 0 of the Setpoint Block

0000 0000 0001 0000

bit 4

To select:		
learned value	set bit 4 = 0	select ▶ Learned
	This option tells the SLC 5/04P processor to use the special ERC2 algorithm during the profile. We recommend that you select this option (set this bit to zero or select `Learned`).	
%CV max	set bit 4 = 1	select ▶ %CV

```
If Pressure Profile then:
Learn PSI during Profile or
Use PSI learned during
Deadhead
```

▶ Learn

Selecting a Pressure Value Source for Pressure Profiles

Use this field when you are running a pressure profile in automatic control mode (the profile is set to `Auto` on page 8–8).

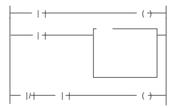
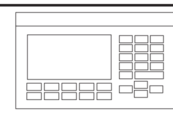
The SLC 5/04P processor allows you to select a method of pressure control. The SLC 5/04P processor has the ability to:

- learn or adapt the pressure during the current profile
- **or** apply the learned dead headed pressure

Word 0 of the Setpoint Block

0000 0000 0010 0000

bit 5

To have ERC2 learn pressure during:		
deadheaded conditions	set bit 5 = 1 This is the preferred method if there is any motion during the profile (e.g., plastication).	select ▶ deadhead
the performance of this profile	set bit 5 = 0 This is the preferred method if there is no motion during the profile (e.g., clamp tonnage).	select ▶ Learn

If Velocity Profile then:
Run PSI as %CVMAX or Use
PSI Learned during Deadhead

▶ Deadhead

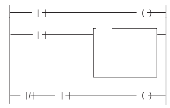
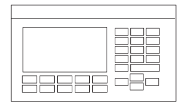
Selecting a Pressure Value Source for Velocity Profiles

Use this selector for velocity profiles to determine how the pressure output will be calculated.

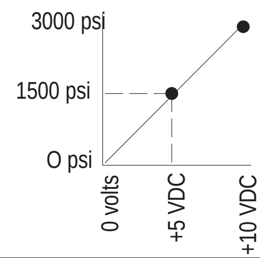
Word 0 of the Setpoint Block

0000 0000 0100 0000

bit 6

To control the pressure valve based on:		
the values learned during the deadheaded condition	set bit 0 = 1	select ▶ Deadheaded
	If you are running a velocity profile, and you want the pressure valve to be set to a value that was derived by Pro-Set 200 during a deadheaded profile, then set the selector to this option. The SLC 5/04P processor applies a voltage to the pressure valve that reflects what the processor has learned during a deadheaded profile.	
%CV Max	set bit 0 = 0	select ▶ %CV Max
	If you are running a velocity profile, and you want the pressure valve set based on the min/max settings you have defined, then set the selector to this option. The output to the pressure valve will be based on the %CV Max curve.	

If you defined 3000 psi as the max pressure at +10 VDC, and you request 1500 psi, the SLC 5/04P processor outputs +5 VDC.



Making and Recording Your Selections

In the following tables, we show you system default values for each field in each phase. We also provide blank tables so you can record your machine selections for reference.

Injection Phase (Defaults)

Selector:	Injection:	Pack:	Hold:	Pre-Decomp:	Plasticate:	Post-Decomp:
Profile `Off` / `On`	On	On	On	On	On	On
Active profile is `Velocity / psi`	Velocity	psi	psi	Velocity	psi	Velocity
Profile in `Auto` or `Manual`						
Ramps `Off` / `On`	On	On	On	On	On	On
Ramps coordinated `No` / `Yes`	No	No	No	No	No	No
Link to another profile `No` / `Yes`	Yes	Yes	No	No	No	No
Suspend profile `No` / `Yes`	No	No	No	No	No	No
Direction of profile : `Decrease` / `Increase`	Decrease	Decrease	Decrease	Increase	Increase	Increase
Use `Learned` / `%CV Max` on primary controlled variable	Learned	Learned	Learned	Learned	Learned	Learned
If psi is selected variable then `Learn psi` / `use Deadhead`	Learn	Learn	Learn	Learn	Deadhead	Learn
If velocity is selected variable then `Run psi as %CV Max` / `Use Deadhead psi`	*%CV Max	*%CV Max	*%CV Max	*%CV Max	*%CV Max	*%CV Max

* These files are initially set to %CV Max for machine setup purposes. After the machine has been jogged and run in a %CV Max, you may want to run the profiles using ERC2

Injection Phase (Your Selections)

Selector:	Injection:	Pack:	Hold:	Pre-Decomp:	Plasticate:	Post-Decomp:
Profile `Off` / `On`						
Active profile is `Velocity` / `psi`						
Profile in `Auto` or `Manual`						
Ramps `Off` / `On`						
Ramps coordinated `No` / `Yes`						
Link to another profile `No` / `Yes`						
Suspend profile `No` / `Yes`						
Direction of profile : `Decrease` / `Increase`						
Use `Learned` / `%CV Max` on primary controlled variable						
If psi is selected variable then `Learn psi` / `use Deadhead`						
If velocity is selected variable then `Run psi as %CV Max` / `Use Deadhead psi`						

Clamp Phase (Defaults)

Selector:	Clamp Close:	Clamp LPMP:	Tonnage:	Low Hold:	Decompress:	Clamp Open:
Profile `Off` / `On`	On	On	On	On	On	On
Active profile is `Velocity` / `psi`	Velocity	psi	psi	psi	psi	Velocity
Profile in `Auto` or `Manual`						
Ramps `Off` / `On`	On	On	On	On	On	On
Ramps coordinated `No` / `Yes`	No	No	No	No	No	No
Link to another profile `No` / `Yes`	Yes	Yes	No	No	No	No
Suspend profile `No` / `Yes` (*controlled by core programming)	No*	No*	No	No	No	No*
Direction of profile : `Decrease` / `Increase`	Decrease	Decrease	Decrease	Decrease	Increase	Increase
Use `Leaned` / `%CV Max` on primary controlled variable	Learned	Learned	Learned	Learned	Learned	Learned
If psi is selected variable then `Learn psi` / `use Deadhead`	Learn	Deadhead	Learn	Learn	Learn	Learn
If velocity is selected variable then `Run psi as %CV Max` / `Use Deadhead psi`	%CV Max	%CV Max	% CV Max	% CV Max	%CV Max	%CV Max

Clamp Phase (Your Selections)

Selector	Clamp Close:	Clamp LPMP:	Tonnage:	Low Hold:	Decompress:	Clamp Open:
Profile `Off` / `On`						
Active profile is `Velocity / psi`						
Profile in `Auto` or `Manual`						
Ramps `Off` / `On`						
Ramps coordinated `No` / `Yes`						
Link to another profile `No` / `Yes`						
Suspend profile `No` / `Yes`						
Direction of profile : `Decrease` / `Increase`						
Use `Learned` / `%CV Max` on primary controlled variable						
If psi is selected variable then `Learn psi` / `use Deadhead`						
If velocity is selected variable then `Run psi as %CV Max` / `Use Deadhead psi`						

Eject Phase (Defaults)

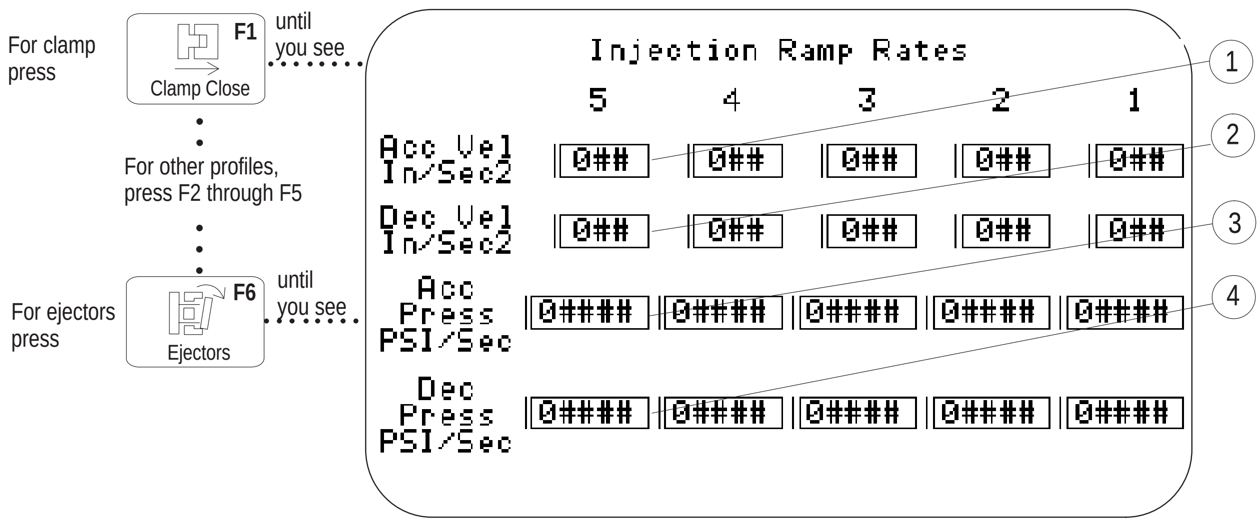
Selector:	Eject Forward:	Eject Retract:	Eject Tip Stroke:
Profile `Off` / `On`	Velocity	Velocity	Velocity
Active profile is `Velocity / psi`	On	On	On
Profile in `Auto` or `Manual`	Manual	Manual	Manual
Ramps `Off` / `On`	On	On	On
Ramps coordinated `No` / `Yes`	No	No	No
Link to another profile `No` / `Yes`	No	No	No
Suspend profile `No` / `Yes`	No	No	No
Direction of profile : `Decrease` / `Increase`	Increase	Decrease	Decrease
Use `Learned` / `%CV Max` on primary controlled variable	Learned	Learned	Learned
If psi is selected variable then `Learn psi` / `use Deadhead`	Learn	Learn	Learn
If velocity is selected variable then `Run psi as %CV Max` / `Use Deadhead psi`	%CV Max	%CV Max	%CV Max

Eject Phase (Your Selections)

Selector:	Eject Forward:	Eject Retract:	Eject Tip Stroke:
Profile `Off` / `On`			
Active profile is `Velocity / psi`			
Profile in `Auto` or `Manual`			
Ramps `Off` / `On`			
Ramps coordinated `No` / `Yes`			
Link to another profile `No` / `Yes`			
Suspend profile `No` / `Yes`			
Direction of profile : `Decrease` / `Increase`			
Use `Learned` / `%CV Max` on primary controlled variable			
If psi is selected variable then `Learn psi` / `use Deadhead`			
If velocity is selected variable then `Run psi as %CV Max` / `Use Deadhead psi`			

Setting Ramp Rates

Once you have completed configuring your profiles, you may set up ramp rates. To go to a profile's ramp rate setup screen, press the function key of the profile ramp rate you want to configure. We show the injection ramp rate screen for reference.

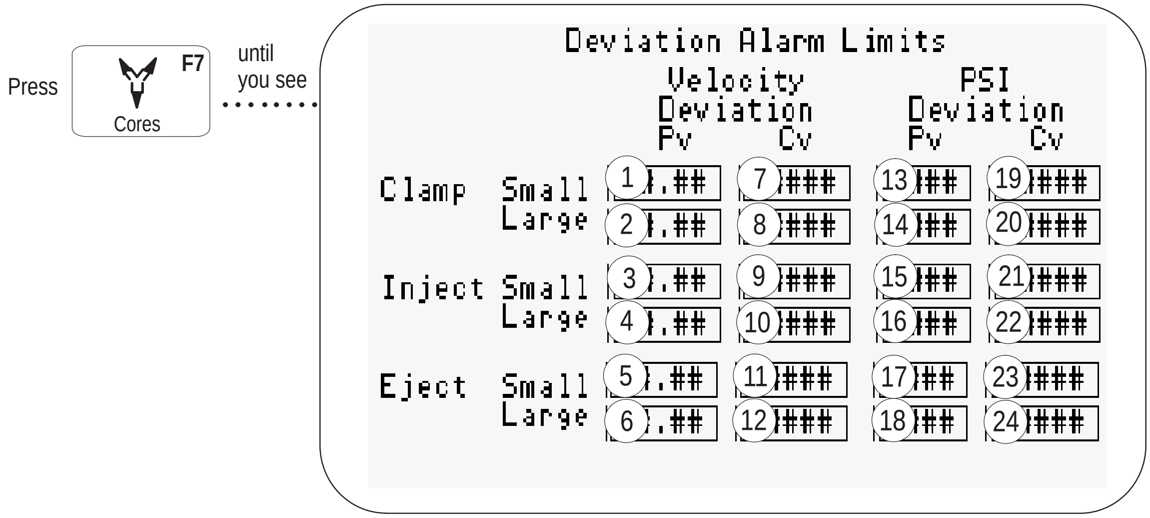


Enter these configuration values for each segment on each ramp rates screen.

▶ Enter a zero to step immediately to the new setpoint in this segment.

In this field:	Do this:
1	Enter the ramp rate for increasing velocity setpoints. For example, if the previous segment velocity setpoint is 5.00 in/sec and this segment velocity setpoint is 10.00 in/sec, and you want to ramp from 5.00 in/sec to 10.00 in/sec over one second, then enter 5.00 in/sec^2. Range: 0 – 327 in/sec/sec
2	Enter the ramp rate for decreasing velocity setpoints. For example, if the previous segment velocity setpoint is 10.00 in/sec and this segment velocity setpoint is 5.00 in/sec, and you want to ramp from 5.00 in/sec to 10.00 in/sec over one second, then enter 5.00 in/sec^2. Range: 0 – 327 in/sec/sec
3	Enter the ramp rate for increasing pressure setpoints. For example, if the pressure setpoint in the previous segment is 1000 psi and the setpoint in this segment is 200 psi, and you want to reach the new setpoint in two seconds, enter 400 psi/sec. Range: 0 – 32767
4	Enter the ramp rate for decreasing pressure setpoints. For example, if the previous segment psi setpoint is 1000 and this segment's psi setpoint is 0 psi, and you want the ramp to take 0.5 second, enter 2000 psi/sec. Range: 0 – 32767

Configuring Deviation Alarm Limits



The deviation alarm limits screens allows you to set up small and large deviations for clamp, injection, and ejection pressure and velocity. Refer to Appendix A for details regarding deviations.

Enter these configuration values.

In this field:	Do this:
1	Enter the clamp velocity small deviation PV in a range from 0 to 99.99
2	Enter the clamp velocity large deviation PV in a range from 0 to 99.99
3	Enter the injection velocity small deviation PV in a range from 0 to 99.99
4	Enter the injection velocity large deviation PV in a range from 0 to 99.99
5	Enter the ejection velocity small deviation PV in a range from 0 to 99.99
6	Enter the ejection velocity large deviation PV in a range from 0 to 99.99
7	Enter the clamp velocity small deviation CV in a range from 0 to 32767
8	Enter the clamp velocity large deviation CV in a range from 0 to 32767
9	Enter the clamp velocity small deviation CV in a range from 0 to 32767
10	Enter the injection velocity small deviation CV in a range from 0 to 32767
11	Enter the injection velocity large deviation CV in a range from 0 to 32767
12	Enter the ejection velocity small deviation CV in a range from 0 to 32767
13	Enter the clamp psi small deviation PV in a range from 0 to 3000
14	Enter the clamp psi large deviation PV in a range from 0 to 3000
15	Enter the injection psi small deviation PV in a range from 0 to 3000
16	Enter the injection psi large deviation PV in a range from 0 to 3000
17	Enter the ejection psi small deviation PV in a range from 0 to 3000
18	Enter the ejection psi large deviation PV in a range from 0 to 3000
19	Enter the clamp psi small deviation CV in a range from 0 to 32767
20	Enter the clamp psi large deviation CV in a range from 0 to 32767
21	Enter the injection psi small deviation CV in a range from 0 to 32767
22	Enter the injection psi large deviation CV in a range from 0 to 32767

In this field:	Do this:
23	Enter the ejection psi small deviation CV in a range from 0 to 32767
24	Enter the ejection psi large deviation CV in a range from 0 to 32767

What’s Next?

In the next chapter, we discuss BTMs.

Using Barrel Temperature Modules (BTM)

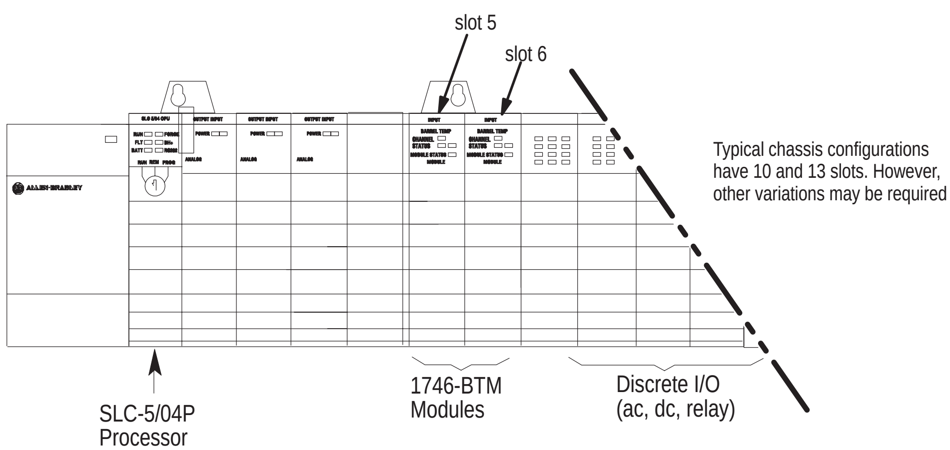
What's in This Chapter?

This chapter explains the Barrel Temperature module (1746-BTM). You use the Barrel Temperature module to control the temperature of the barrel of the injection molding machine.

For more information about the1746-BTM module, see the Barrel Temperature Control Module user manual, publication number 1746-6.10.

Placing the BTM in the I/O Chassis

The following shows the Barrel Temperature modules located in slots 5 and 6 in a Pro-Set 200 system.



The above figure also shows a discrete output module, which is used in conjunction with the BTM. The discrete output module is used to drive the heater contactors. You need up to eight outputs from a discrete output module for each BTM, which depends on if you have heat only, or heat/cool zones. Heat only will require four outputs, and heat/cool will require eight outputs. You can use any type of discrete output module and can place the discrete output module in any slot in the range of 7-30.

If your Pro-Set 200 system uses more than 30 slots of I/O and you need to add BTM, put the BTM in another rack with its own processor. We show an example of this configuration in the following two figures:

Figure 9.1 Communicating over DH485 Link

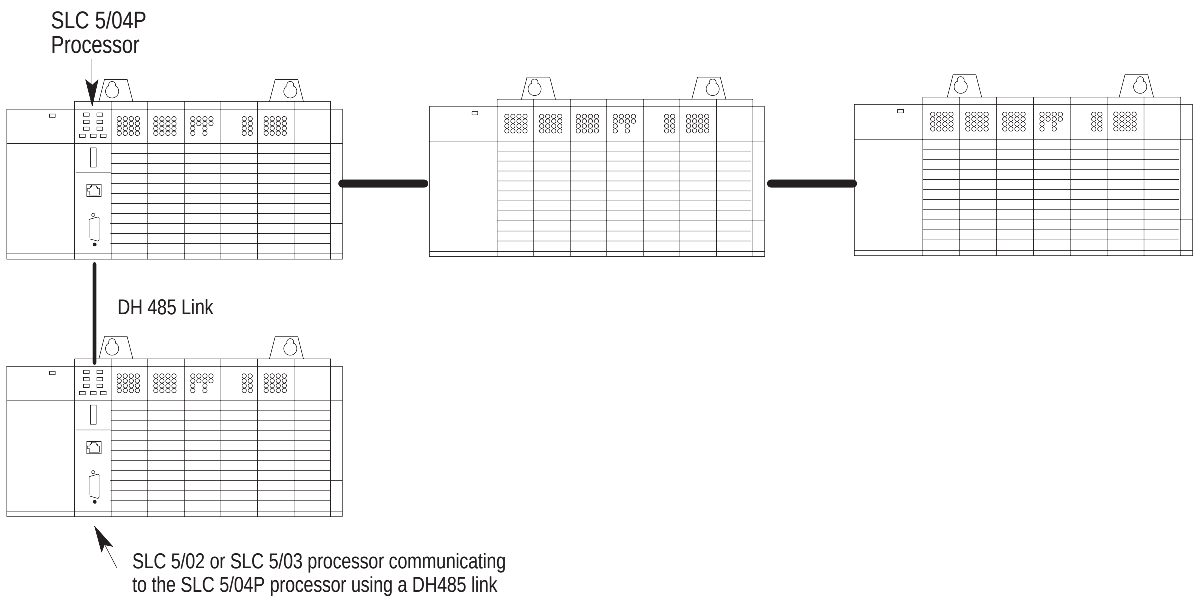
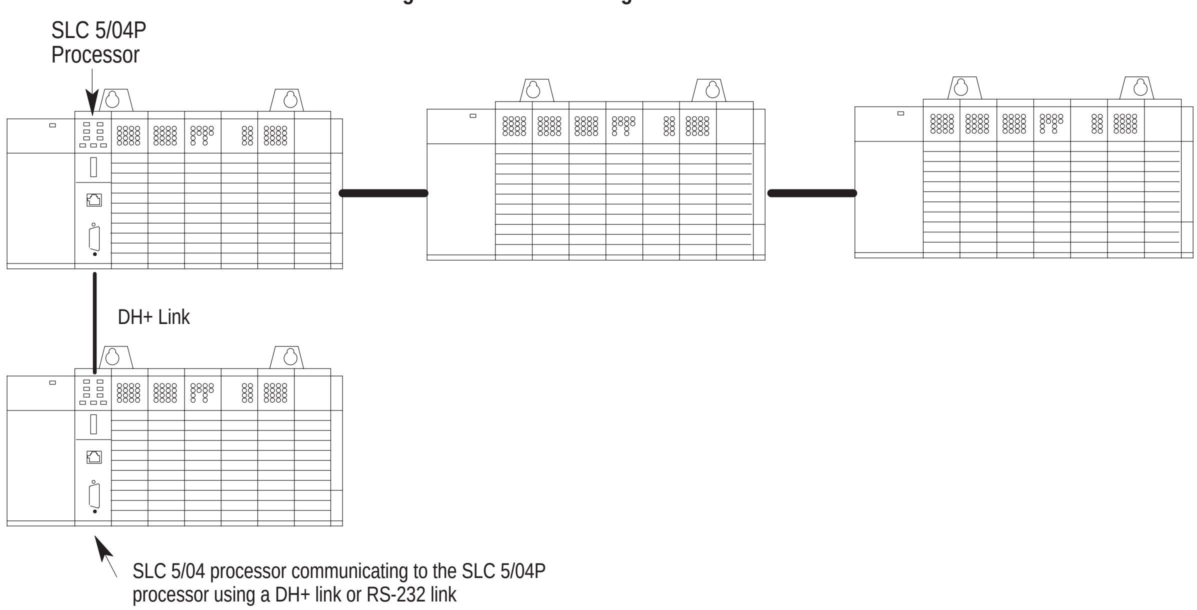


Figure 9.2 Communicating over DH+™ Link



ATTENTION: Do ***not*** put the BTM in a remote rack with a 1747-ASB adapter. The 1747-ASB adapter will not support the large M file transfers required by the BTM.

Wiring Considerations

Thermocouple inputs are highly susceptible to electrical noise due to the small signal amplitudes (microvolt/°C). Most applications require that the processor and I/O chassis be installed in an industrial enclosure to reduce the effects of electrical interference. Consider the following conditions when selecting a slot location for the module. Position the module away from other modules that:

- connect to sources of electrical noise such as relays, and AC motor drives
- generate significant heat, such as 32-point I/O modules

Follow these guidelines to wire your input signal cables:

- To limit the pickup of electrical noise, keep thermocouple and millivolt signal wires as far as from power and load lines as possible.
- For high immunity to electrical noise, use Alpha 5121 (shielded, twisted pair) or equivalent wire for millivolt sensors; or use shielded, twisted pair thermocouple extension lead wire specified by the thermocouple manufacturer. Using the incorrect type of thermocouple extension wire or not following the correct polarity may cause invalid readings.
- Ground the shield drain wire at only one end of the cable. The preferred location is at the I/O chassis ground. (Refer to IEEE Std. 518, Section 6.4.2.7 or contact your sensor manufacturer for additional details.)
- Keep all unshielded wires as short as possible.
- Tighten screw terminals with care. Excessive tightening can strip a screw.
- The open-circuit detector generates approximately 20 nano-amperes into the thermocouple cable. A total lead resistance of 25 ohms (12.5 one-way) will produce 0.5µV of error.
- Follow system grounding and wiring guidelines found in your SLC 500 Installation and Operation Manual

Changing BTM Module Locations in the I/O Chassis

The ladder logic supplied with Pro-Set 200 is designed to accommodate BTM, refer to chapter 6, "Customizing Your System."

BTM Ladder Logic and Data Tables

The ladder logic which controls the BTM is located in files 94, 95, 96, 97, 98, and 99. You can remove files 95 and 98 and update files 96 and 99 if you have only one BTM. If you have more than 8 temperature loops, you will need to expand the ladder logic to support the new BTMs. You will also need to modify the mold part storage logic contained in file 92 to accommodate the additional BTM recipe storage requirements.

Configuring the BTM for Use

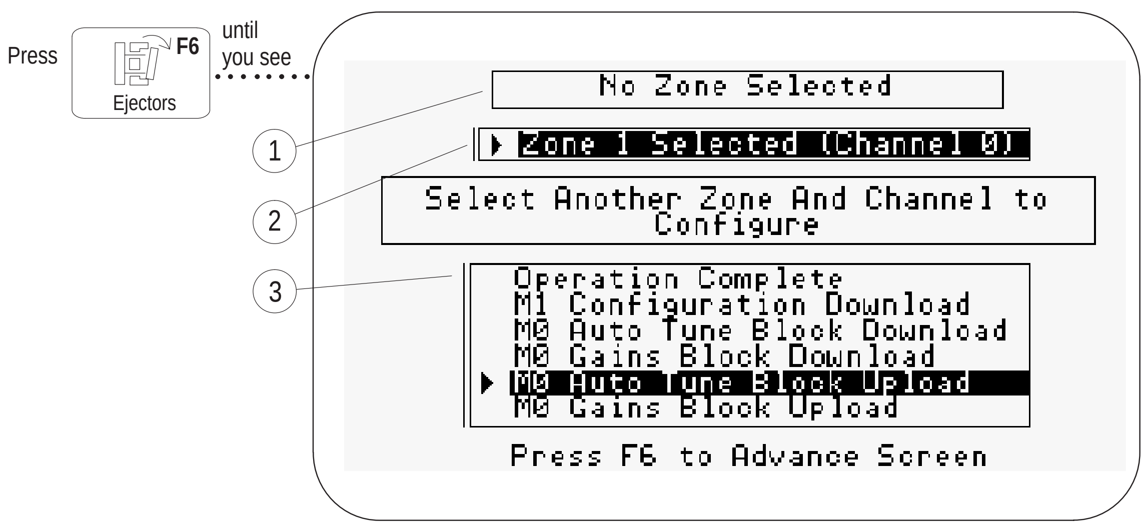
Follow this procedure to configure the BTM to control temperature loops.

Creating a New Mold Recipe

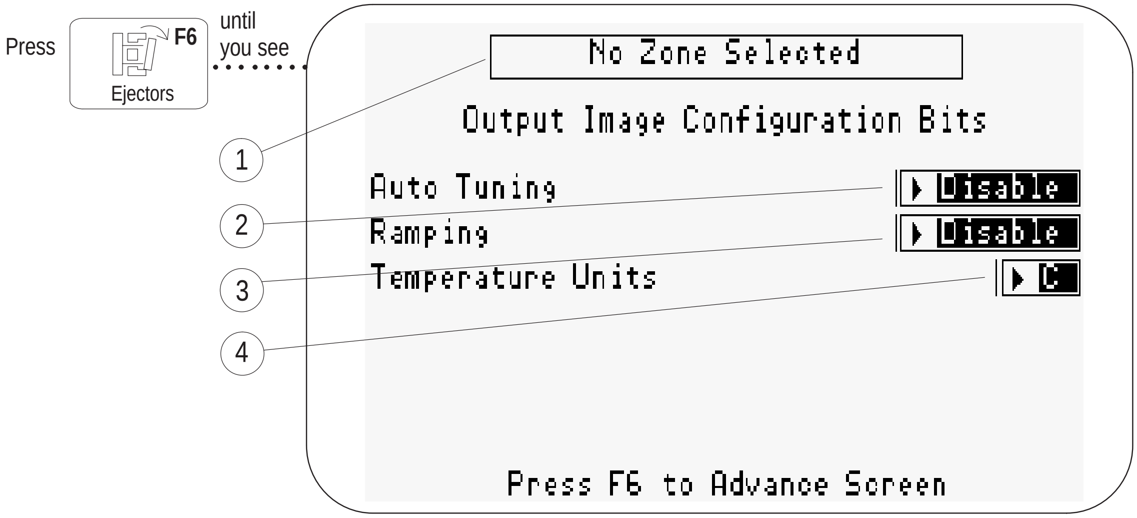
If you are not restoring a previously run mold, you need to configure all temperature zones.

Follow the steps outlined in the following tables to configure temperature zones.

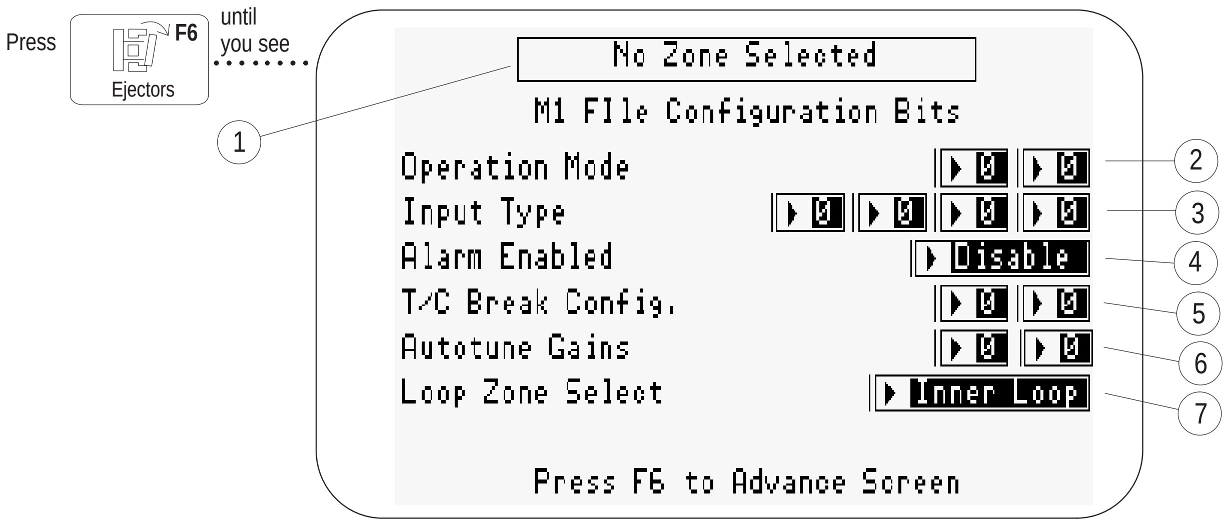
If at any time you do not understand a configuration parameter, refer to the 1746 BTM User Manual.



Use this field:	To:
1	View the zone number you have selected.
2	Select the zone that you want to configure. For one BTM you can choose zones 1 through 4 (1 through 8 for two BTM modules). No Zone Selected is the default. **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **3.** Select a number by pressing the up and down arrow keys: △ ▽ **4.** Press the enter key ⏎ when you reach the correct number. **5.** Press [F6] to go to the remaining configuration screens.
3	Select the appropriate download or upload. Choose from the following: M1 Configuration Download M0 Auto Tune Block Download M0 Gains Block Download M0 Auto Tune Block Upload M0 Gains Block Upload **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **3.** Select a number by pressing the up and down arrow keys: △ ▽ **4.** Press the enter key ⏎ when you reach the correct selection. When an operation upload or download is complete, “Operation Complete” is highlighted.

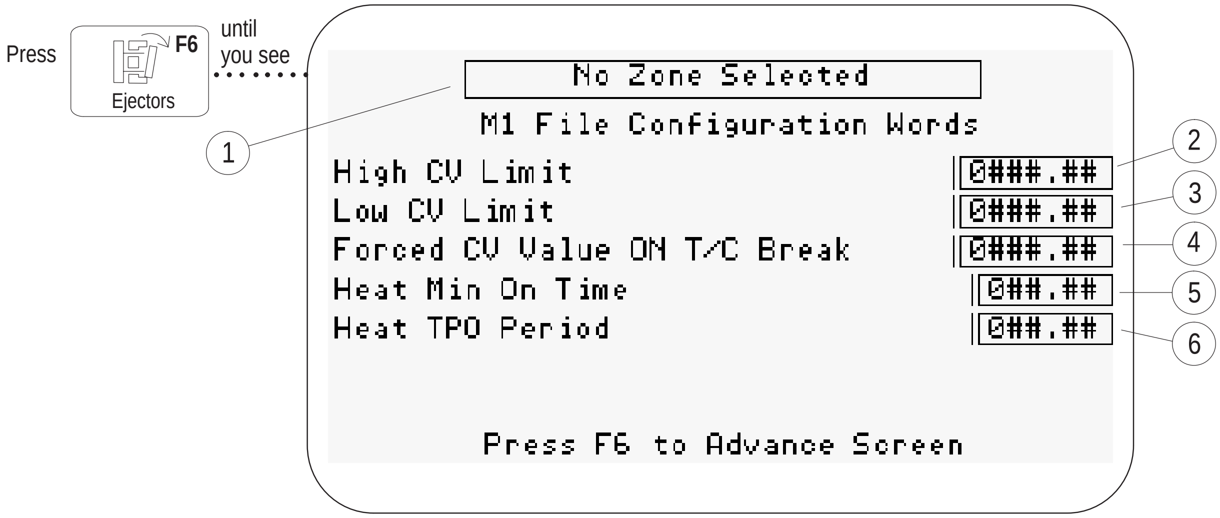


Use this field:	To:
1	View the currently selected zone.
2	Select enable or disable auto tuning. **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection.
3	Select enable or disable ramping. **1.** Cursor to this field by using the left and right arrow keys: **2.** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection.
4	Select degrees Fahrenheit (°F) or Celsius (°C). **1.** Cursor to this field by using the left and right arrow keys: **2.** Select a position by pressing the up and down arrow keys: 3. Press the enter key when you reach the correct selection.



Use this field:	To:
1	View the currently selected zone.
2	Select the operating mode. Choose from: 00 monitor only 01 PID loop control (no control action, no alarms set) 10 disable (loop is off, no temperature reported, no alarms set) **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection.
3	Select the thermocouple type. Choose from: 0000 type J 0001 type K **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection.
4	Enable or disable alarming for this zone.. **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys. **3.** Press the enter key when you reach the correct selection.
5	Select the action to take on thermocouple break. Choose from: 00 disable loop control and set CV to zero 01 set the output to the forced CV value on thermocouple break 10 set output to the manual mode CV value **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection.

Use this field:	To:
6	Select the auto tune gains you want to use. Choose from: 00 low gains 01 medium gains 10 high gains 11 very high gains We recommend that you first select low gains, test, then change gain settings if necessary. **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **2** Make your selection by pressing the up and down arrow keys: △ ▽ **3.** Press the enter key ↵ when you reach the correct selection.
7	Select inner or outer zones. **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **2** Make your selection by pressing the up and down arrow keys: △ ▽ **3.** Press the enter key ↵ when you reach the correct selection.

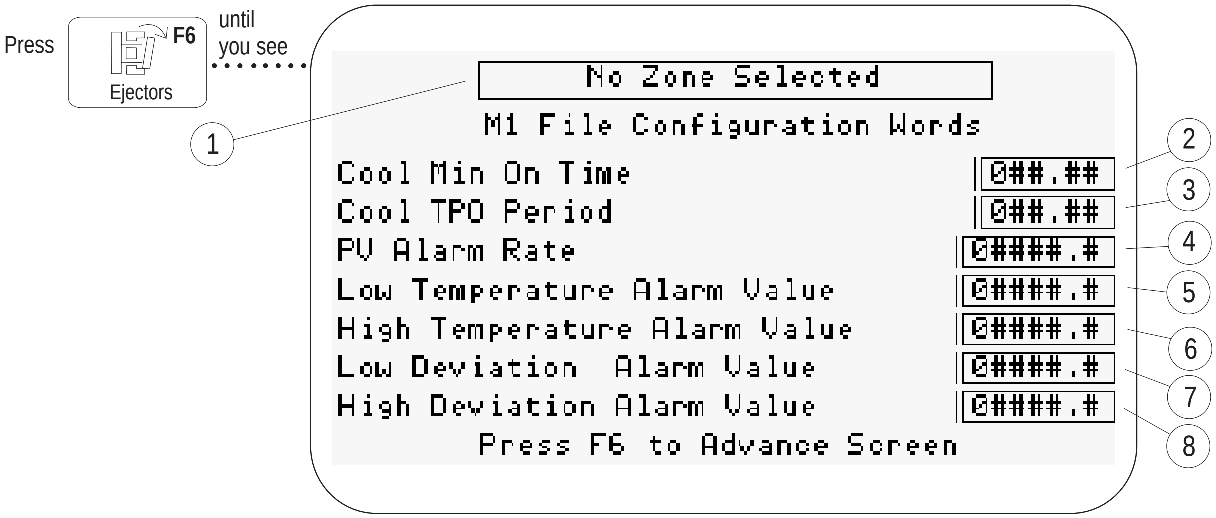


Use this field:	To:
1	View the currently selected zone.
2	View and modify the high CV limit in a range of –100.00 to 100.00. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: `Enter value (–100.00 to 100.00)` XXX.XX **3.** Enter a value between –100.00 and 100.00.
3	View and modify the low CV limit in a range of –100.00 to 100.00. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: `Enter value (–100.00 to 100.00)` XXX.XX **3.** Enter a value between –100.00 and 100.00.
4	View and modify the forced CV on thermocouple break in a range of –100.00 to 100.00. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: `Enter value (–100.00 to 100.00)` XXX.XX **3.** Enter a value between –100.00 and 100.00

Use this field:	To:

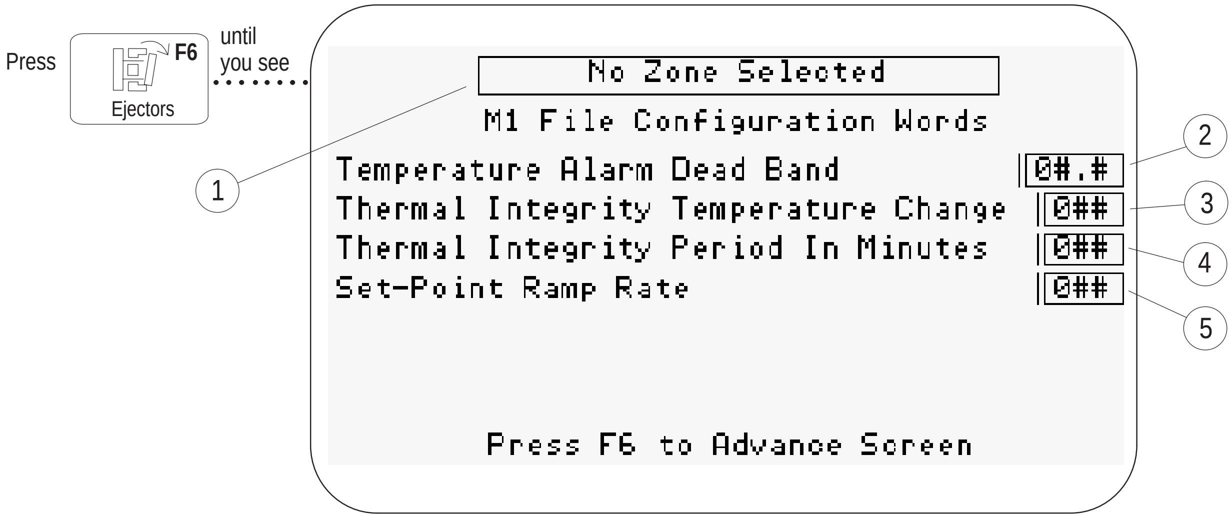
5	View and modify the minimum heat TPO on time in a range of 0 – 100 seconds..
	1. Cursor to this field by using the left and right arrow keys: ◁ ▷
	2. Press the enter key:
	The scratch pad appears:
	`Enter value XXX`
	`(0 to 100)`
	3. Enter a value in a range of 0 to 100 seconds.

6	View and modify the total heat TPO on time in a range of 0 – 100 seconds.
	1. Cursor to this field by using the left and right arrow keys: ◁ ▷
	2. Press the enter key:
	The scratch pad appears:
	`Enter value XXX`
	`(0 to 100)`
	3. Enter a value in a range of of 0 to 100 seconds.



Use this field:	To:
1	View the currently selected zone.
2	View and modify the minimum cool TPO on time in a range of 0 – 100 seconds.. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XXX (0 to 100) **3.** Enter a value in a range of 0 to 100 seconds.
3	View and modify the total cool TPO on time in a range of 0 – 100 seconds. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XXX (0 to 100) **3.** Enter a value in a range of of 0 to 100 seconds.
4	View and modify the value of the PV rate alarm in a range from –3276.8 to 3276.7° This alarm is set if the PV deviates from the value specified here. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XXXX.X (–3276.8 to 3276.7) **3.** Enter a value in a range of –3276.8 to 3276.7 °.

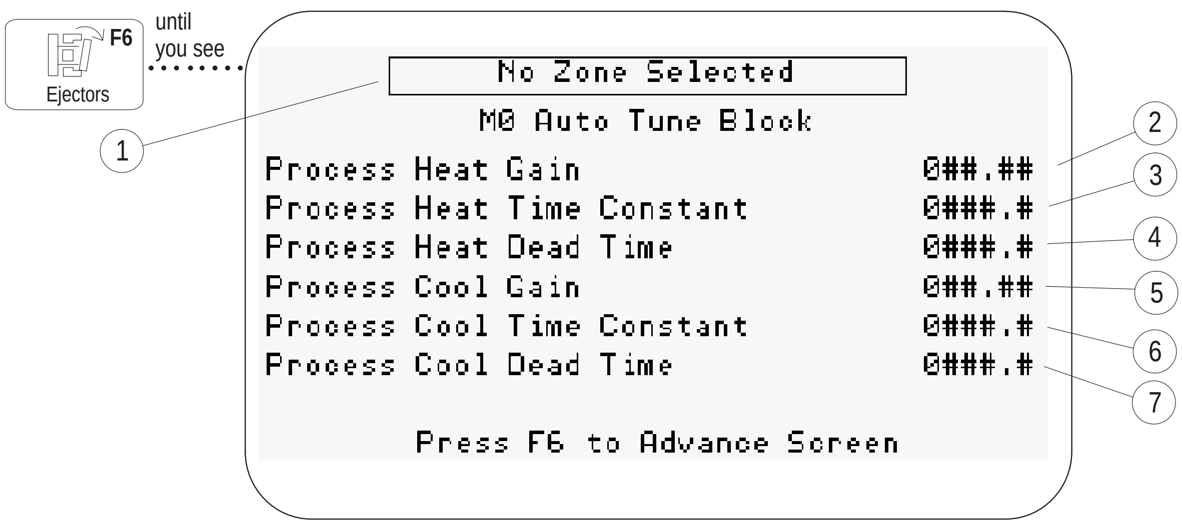
<table>
<tr><th>Use this field:</th><th>To:</th></tr>
<tr><td>5</td><td>View and modify the low temperature alarm value.
If: / Then:
the PV falls below this value — an alarm is set in the discrete output table, and an alarm banner appears
this alarm condition is present, and injection unit is turned on — you cannot select semi-automatic or automatic mode
the unit is on and in manual mode — you cannot select injection forward, retract, or screw rotate
1. Cursor to this field by using the left and right arrow keys: ◁ ▷
2. Press the enter key: ◁—┘
The scratch pad appears:
<code>Enter value [XXXX.X]
(–3276.8 to
 2376.7)</code>
3. Enter a value in a range of –3276.8 to 3276.7.</td></tr>
<tr><td>6</td><td>View and modify the high temperature alarm value. If the PV exceeds this value, the loop is disabled and turned off.
1. Cursor to this field by using the left and right arrow keys: ◁ ▷
2. Press the enter key: ◁—┘
The scratch pad appears:
<code>Enter value [XXXX.X]
(–3276.8 to
 2376.7)</code>
3. Enter a value in a range of –3276.8 to 3276.7.</td></tr>
<tr><td>7</td><td>View and modify the low deviation alarm value.
1. Cursor to this field by using the left and right arrow keys: ◁ ▷
2. Press the enter key: ◁—┘
The scratch pad appears:
<code>Enter value [XXXX.X]
(–3276.8 to
 2376.7)</code>
3. Enter a value in a range of –3276.8 to 3276.7.</td></tr>
<tr><td>8</td><td>View and modify the high deviation alarm value.
1. Cursor to this field by using the left and right arrow keys: ◁ ▷
2. Press the enter key: ◁—┘
The scratch pad appears:
<code>Enter value [XXXX.X]
(–3276.8 to
 2376.7)</code>
3. Enter a value in a range of –3276.8 to 3276.7 .</td></tr>
</table>



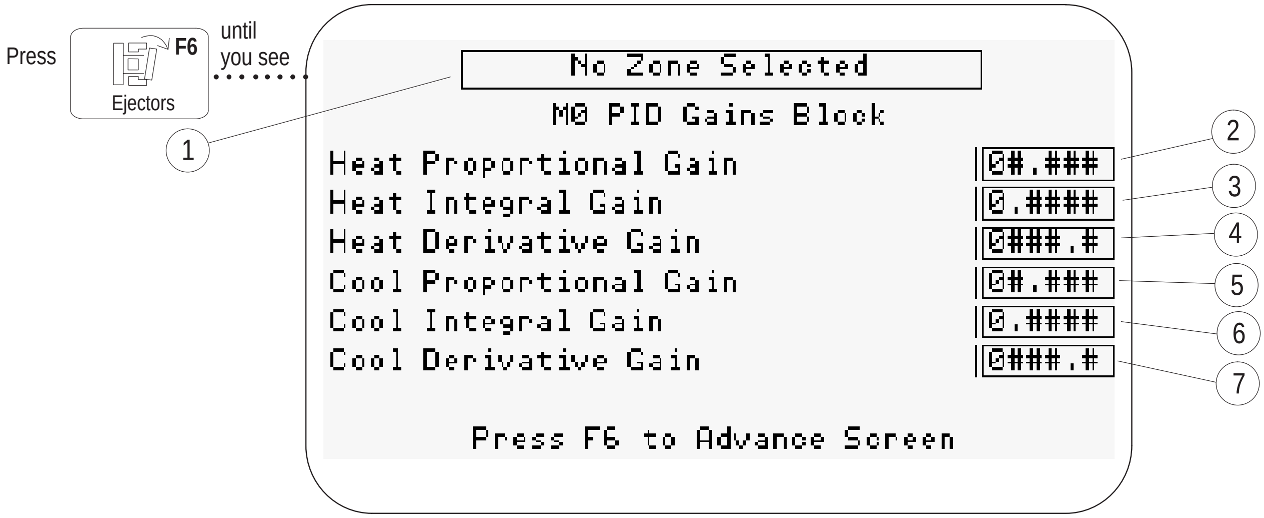
Use this field:	To:
1	View the currently selected zone.
2	View and modify the temperature alarm deadband. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XX.X (1 to 10.0) **3.** Enter a value in a range of 1 to 10.0.
3	View and modify the thermal integrity temperature change value . The thermal integrity measures the change in temperature over a specified period (this period is called the thermal integrity period, which is when the loop is in auto mode at 100% output). If this condition exists, an alarm banner appears. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XXX (1 to 100) **3.** Enter a value in a range of 1to 100.

Use this field:	To:
4	View the thermal integrity period in minutes. The thermal integrity period is the time you specify to measure temperature change (described in item 7). **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **2.** Press the enter key: The scratch pad appears: `Enter value (1 to 100)` XXX **3.** Enter a value in a range of 1 to 100.
5	View the rate at which temperatures are ramped in °/minute. **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **2.** Press the enter key: The scratch pad appears: `Enter value (1 to 100)` XXX **3.** Enter a value in a range of 1 to 100.

Press until you see



Use this field:	To:
1	View the currently selected zone.
2–7	View the values returned by the auto tune/gain block after a successful auto tune was performed.



Use this field:	To:
1	View the currently selected zone.
2	View and modify the proportional gain value for the heat loop. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XX.XXX (0 to 32.767) **3.** Enter a value in a range of 0 to 32.767.
3	View and modify the integral gain value for the heat loop. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value X.XXXX (0 to 3.2767) **3.** Enter a value in a range of 0 to 3.2767.
4	View and modify the derivative gain value for the heat loop. **1.** Cursor to this field by using the left and right arrow keys: **2.** Press the enter key: The scratch pad appears: Enter value XXXX.X (0 to 3276.7) **3.** Enter a value in a range of 0 to 3276.7.

Use this field:	To:

5	View and modify the proportional gain value for the cool loop.
	1. Cursor to this field by using the left and right arrow keys:
	2. Press the enter key:
	The scratch pad appears:
	`Enter value XX.XXX`
	`(0 to 32.767)`
	3. Enter a value in a range of 0 to 32.767.

6	View and modify the integral gain value for the cool loop.
	1. Cursor to this field by using the left and right arrow keys:
	2. Press the enter key:
	The scratch pad appears:
	`Enter value X.XXXX`
	`(0 to 3.2767)`
	3. Enter a value in a range of 0 to 3.2767.

7	View and modify the derivative gain value for the cool loop.
	1. Cursor to this field by using the left and right arrow keys:
	2. Press the enter key:
	The scratch pad appears:
	`Enter value XXXX.X`
	`(0 to 3276.7)`
	3. Enter a value in a range of 0 to 3276.7.

When you press F6 from this screen you will return to the screen on page 9– 6. Press F5 to save the zone you just configured, and then select another to configure. Repeat this process until all zones are configured.

Once all zones have been configured, select M1 Configuration download and press enter. This sends the configuration data to the BTM modules.

If at any time you change any configuration data you must re–download the M1 Configuration file for the changes to take effect.

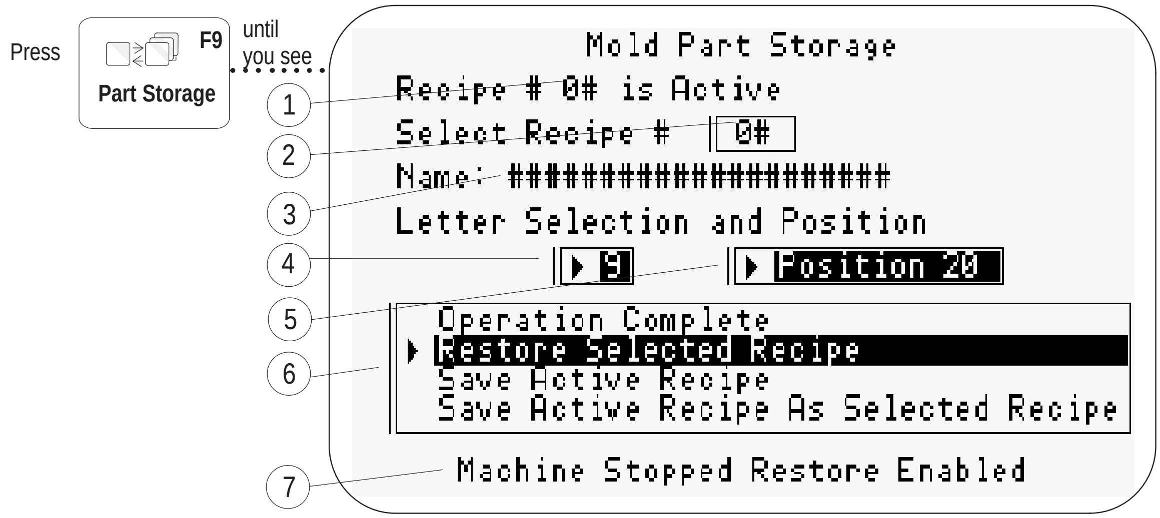
Creating a New Mold Recipe Based on an Existing Recipe

You can create a new mold recipe by using a previously created recipe as a template. First you must restore the mold recipe you want to modify. Then you need only to change the recipe parameters that you need modified. Finally, you must save the active recipe as an recipe number other than the original restored recipe.

Restoring a Previously Run Mold Recipe

In order for the previously run recipe to become active, you must first restore it.

Press the [F9] function key to access the mold/part storage screen.



Use this field:	To:
1	View which recipe number Pro-Set 200 is currently using.
2	Select a recipe for which you want to configure the BTM.. **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **2.** Press the enter key: The scratch pad appears: Enter value (1 to 5) X **3.** Enter a recipe number between 1 -5 (Pro-Set 200 lets you use up to 5 recipes).
3	View the recipe name of the selected recipe. This field is a display only field; you cannot enter a new name in this field. Use fields 4 and 5 to enter a new name.
4	Change the letter selection. **1.** Select the letter. **2.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **3.** Select a letter by pressing the up and down arrow keys: △ ▽ **4.** Press the enter key when you reach the correct letter.

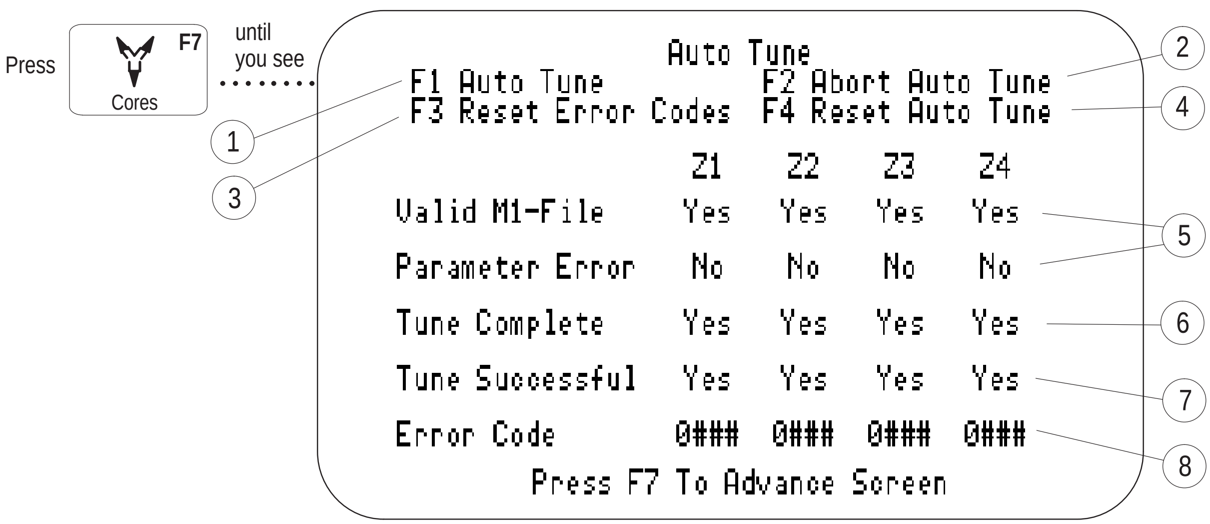
Use this field:	To:
5	Select the position of a letter in the name field. **1.** Cursor to this field by using the left and right arrow keys: **2.** Select a position by pressing the up and down arrow keys: 3. Press the enter key when you reach the correct position number. This field relates to the following positions on the name display (③): Name: 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 position 1 position 20
6	Save a mold recipe that you configured **or** retrieve a previously stored recipe.
7	Determine whether a restore can be performed. • disabled means the machine is currently running and a restore cannot be performed • enabled means the machine is not currently running and a restore can be performed.

Auto Tune the BTMs

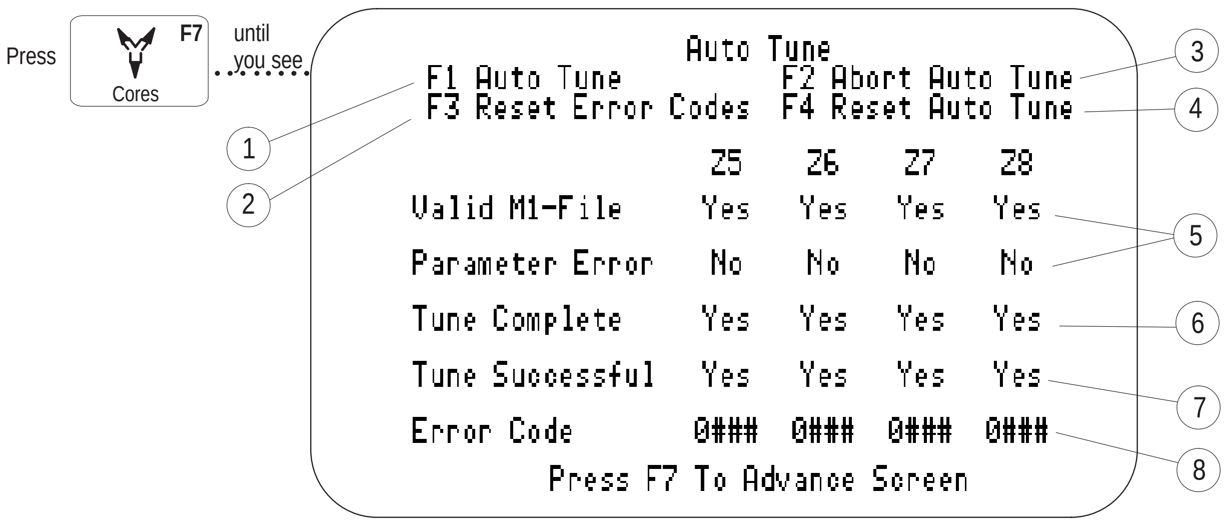
Once you have configured all the zones and have downloaded the M1 configuration files to the BTM you are ready to Auto Tune.

Before you Auto Tune, check and ensure that M1 configuration files you downloaded are valid and free of error. This is accomplish by using the following screens. If all zones have valid M1 files without parameter error, you can Auto Tune. If not, refer to the error code in the BTM manual for corrective action.

When all zones are configured error–free, begin the Auto Tune process by pressing F1. When the Auto Tune is complete, the Tune Complete and Tune Successful will report Yes. If Auto Tune is not successful, refer to the error codes in the BTM manual for corrective action.



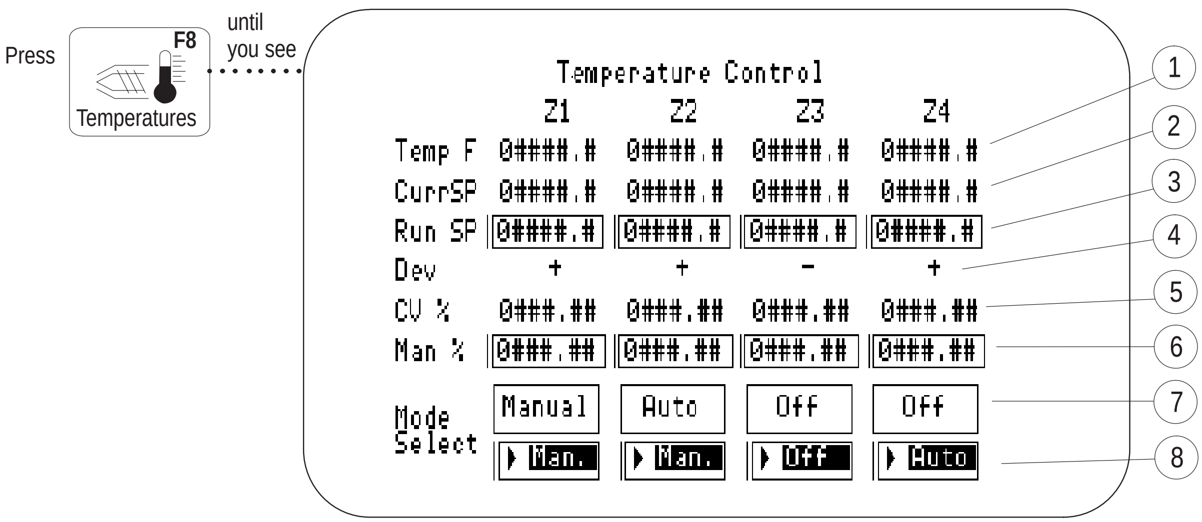
Use this field:	To:
1	Use the [F1] key to auto tune all loops simultaneously (when auto tuning is enabled). The ladder logic driving the BTM auto tune routine requires that you enable all zones on a module.
2	Use the [F2] key to abort autotuning for all loops that have auto tuning enabled.
3	Use the [F3] key to reset all error codes to zero
4	Use the [F4] key to reset the ladder logic controlling auto tuning (first abort auto tuning with the [F2] key).
5	Determine whether: • the M1 file is valid • parameter errors are present You must have a valid M1 file and no errors present to start auto tuning.
6	Determine that auto tuning is complete for each zone.
7	Determine that auto tuning was successful for each zone.
8	View error codes for each zone. When you have fixed an error, clear the error code by pressing [F3], then download the M1 file. There must be no errors to start auto tuning.



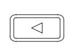
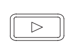
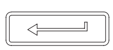
Use this field:	To:
1	Use the [F1] key to auto tune all loops simultaneously (when auto tuning is enabled). The ladder logic driving the BTM auto tune routine requires that you enable all zones on a module.
2	Use the [F2] key to abort autotuning for all loops that have auto tuning enabled.
3	Use the [F3] key to reset all error codes to zero
4	Use the [F4] key to reset the ladder logic controlling auto tuning (first abort auto tuning with the [F2] key).
	Use the [F5] key to save configured zones.
	Use the [F6] key to return to the zone and channel configuration screen.
5	Determine whether: • the M1 file is valid • parameter errors are present You must have a valid M1 file and no errors present to start auto tuning.
6	Determine that auto tuning is complete for each zone.

Use this field:	To:
7	Determine that auto tuning was successful for each zone.
8	View error codes for each zone. When you have fixed an error, clear the error code by pressing [F3], then download the M1 file. There must be no errors to start auto tuning.

Temperature Zone Control and Monitoring



Use this field:	To:
1	View the actual temperature for zones 1 – 4.
2	View the current run time or stand by setpoint.

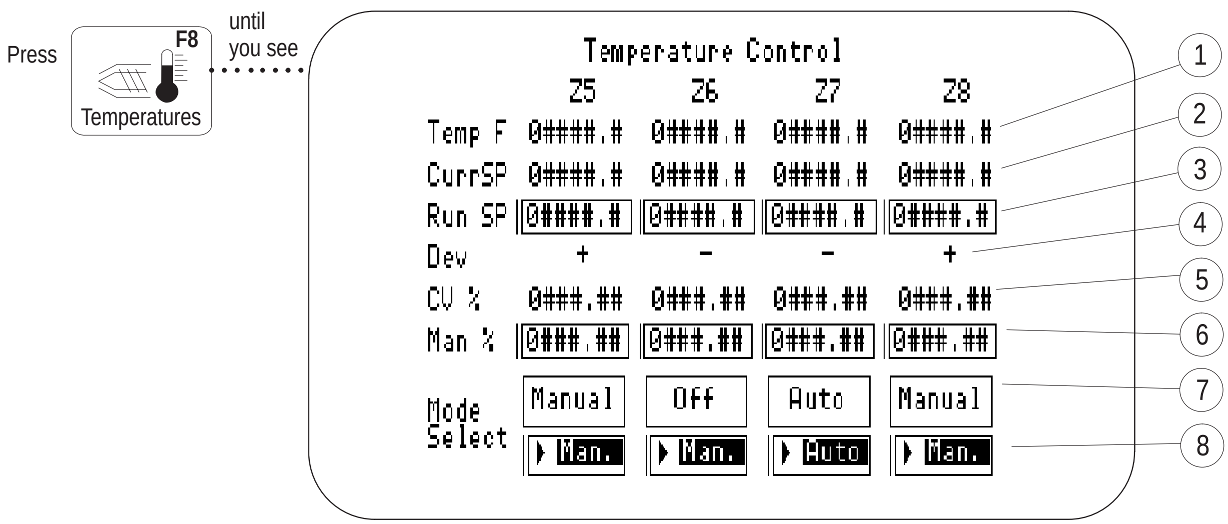
3	View or modify the run setpoint..
	1. Cursor to this field by using the left and right arrow keys:  
	2. Press the enter key: 
	The scratch pad appears:
	`Enter value  XXX.X`
	`(0 to 999.9)`
	3. Enter a value in a range of 0 to 999.9°.

4	View the temperature deviation for each zone. **If:** / **Then:** the field shows a plus sign (+) for the zone / the temperature is above the deviation you have established the field shows a minus sign (–) for the zone / the temperature is below the deviation you have established
5	View the % CV output for each zone.

Use this field:	To:

6	View or modify the manual % CV output for each zone.
	1. Cursor to this field by using the left and right arrow keys:
	2. Press the enter key:
	The scratch pad appears:
	`Enter value XXX.XX`
	`(–100.00 to 100.00)`
	3. Enter a value in a range of –100.00 to 100.00%.

7	View the mode selection for each zone (manual, auto, or off).
8	Enter a mode selection. Choose from manual, auto, or off. **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you have entered the correct selection.



Use this field:	To:
1	View the actual temperature for zones 5 – 8.
2	View the current run time or stand by setpoint.

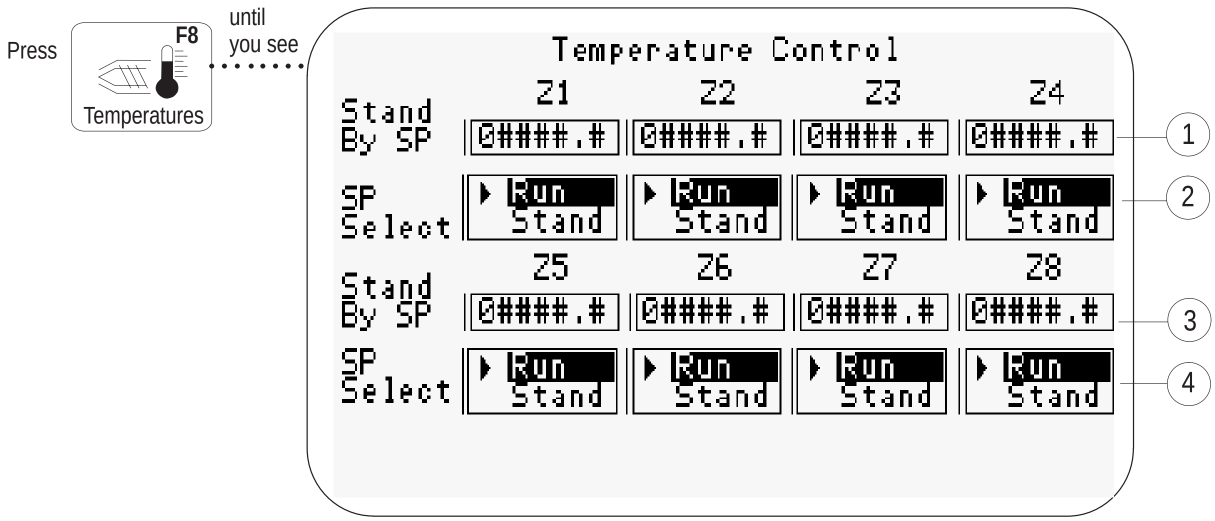
3	View or modify the run setpoint..
	1. Cursor to this field by using the left and right arrow keys:
	2. Press the enter key:
	The scratch pad appears:
	`Enter value XXXX.X`
	`(0 to 3276.7)`
	3. Enter a value in a range of 0 to 3276.7 °.

4	View the temperature deviation for each zone. **If:** / **Then:** the field shows a plus sign (+) for the zone — the temperature is above the deviation you have established the field shows a minus sign (–) for the zone — the temperature is below the deviation you have established

Use this field:	To:
5	View the % CV output for each zone.

6	View or modify the manual % CV output for each zone.
	1. Cursor to this field by using the left and right arrow keys: ◁ ▷
	2. Press the enter key: ⟵┘
	The scratch pad appears:
	`Enter value XXX.XX`
	`(–100.00 to 100.00)`
	3. Enter a value in a range of –100.00 to 100.00%.

7	View the mode selection for each zone (manual, auto, or off).
8	Enter a mode selection. Choose from manual, auto, or off. **1.** Cursor to this field by using the left and right arrow keys: ◁ ▷ **2** Make your selection by pressing the up and down arrow keys: △ ▽ **3.** Press the enter key ⟵┘ when you have entered the correct selection.



Use this field:	To:
1	View the setpoint selections for zones 1 – 4.
2	Select setpoint for zones 1 – 4. Choose run time or stand by. **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection. **If you change a standby setpoint you must re-download the M1 configuration file for the changes to take place**.
3	View the setpoint selections for zones 5 – 8.
4	Select setpoint zones for zones 5 – 8. Choose run time or stand by. **1.** Cursor to this field by using the left and right arrow keys: **2** Make your selection by pressing the up and down arrow keys: **3.** Press the enter key when you reach the correct selection. **If you change a standby setpoint you must re-download the M1 configuration file for the changes to take place**.

What's Next?

In the next chapter, we explain how to start up the machine.

Starting Up the Machine

What's in This Chapter?

This chapter explains how to:

- access the setup screens
- enter values to verify hydraulics
- save and restore machine setup data
- verify correct hydraulic operation

To move all machine axes so that you can properly calibrate the valves to the control, we suggest that you start up your machine by following these steps:

1. Enter values that will let you verify correct hydraulic operation.
2. Verify correct hydraulic operation.

Important: For safety considerations, complete all previous chapters.

Accessing the Setup Screens

Access the Pro-Set 200 setup screens by loading the setup file:

```
ps2s102.pva
```

In the procedure, you will use this pair of screens:

- Input/Output Device Setup
  (only the output values for each phase)
- Velocity Spanning Values (for each phase)

Use these screens:	To:
Input Sensor Nameplate and Output Nameplate Values	Enter min/max pressure output values from the nameplate; omit entering sensor values at this time
Velocity Spanning Values	Enter min/max values for the corresponding valve
Machine Setup Storage	Save entered values

► In the procedures that follow, we suggest that you enter values on screens associated with one phase of operation. Then repeat the procedure for each of the other phases.

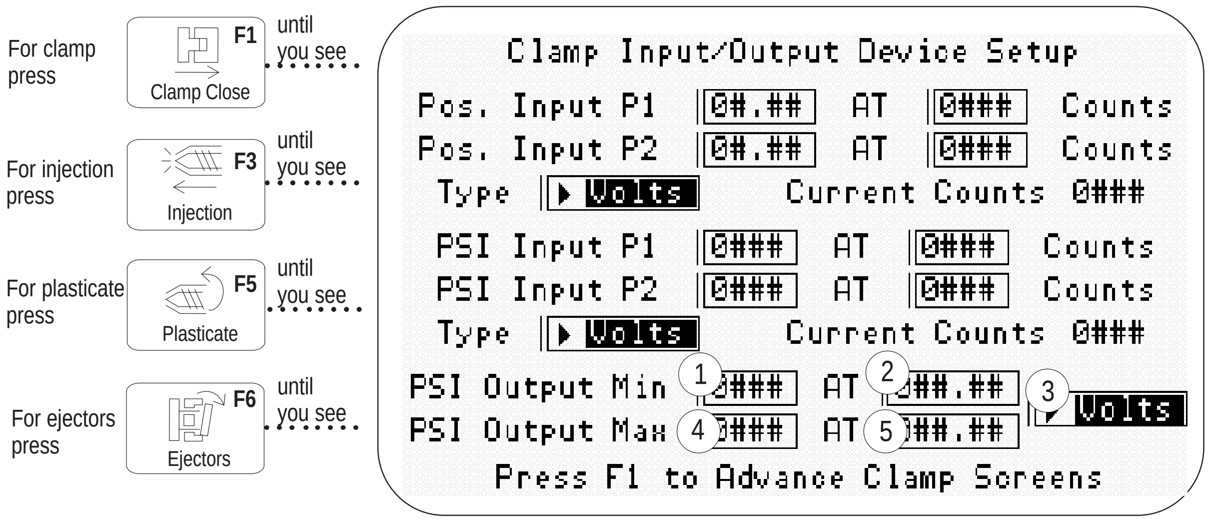
Entering Values to Verify Hydraulics

Starting with the clamp phase, go to the setup screens and enter values that tell the SLC processor the following valve parameters:

- pressure nameplate (max) values for the valves
- whether the output signal is in volts dc or mA
- maximum velocity values for outputs to each valve (second screen)

Do this as follows:

1. Go to the first clamp setup screen.



2. In the output nameplate values (lower) part of the screen, enter:

In this field:	Enter:
1	psi output min (enter 0)
2	psi output min voltage or current from the valve specifications
3	whether the output signal is volts or milliamps
4	psi output max from the valve specifications (or maximum pressure allowed for maximum
5	psi output max from the valve specifications(or maximum pressure allowed for maximum)

For example, your valve could have these parameters:

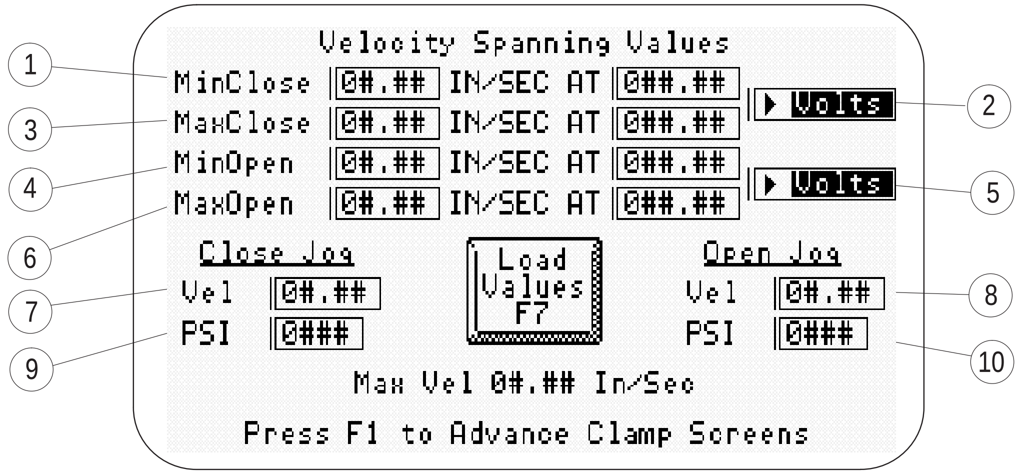
- psi output max from the valve specifications—3000 psi
- psi output min (a value of zero)—zero
- psi max volts or amps—10 volts or 20 milliamps
- psi min volts or amps—0 volts or 4 milliamps

This example spans the valve for full scale. If you do not want to span to full scale, refer to page 11–6.

▶ When entering values, first press the enter key to display the scratch pad. Then enter your value.

When selecting volts or amps, go to the selector, make your selection, then press enter.

3. Press [F1] to advance to the second clamp setup screen.



4. In the upper half of the screen, enter spanning values as shown in the following table.

When selecting volts or amps, go to the selector, make your selection, then press enter.

In this step, you entered limits to allow your machine to move. These limits define the minimum and maximum volts/milliamps that will be sent to the valve(s). You will span valves in later chapters.

In this field:	Enter these min/max valve spanning values:
1	min close (zero) in/sec at the corresponding voltage or milliamperage
2	units in volts or mA
3	max close (99.99) in/sec at the corresponding voltage or milliamperage
4	min open (zero) in/sec at the corresponding voltage or milliamperage
5	units in volts or mA
6	max open (99.99) in/sec at the corresponding voltage or milliamperage

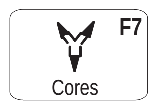
5. In the lower half of the screen, enter values as shown in the following table.

▶ The velocity spanning values that you have entered cause the jog values for velocity to read as a percent value (%). In the next chapter the jog values will be scaled into inches per second.

The jog values you enter here will be written to the analog output card(s) for initial machine movements.

ATTENTION: Unexpected machine movement could result in personal injury or property damage. When entering jog values, use low enough percentages so that unexpected machine motion does not occur.

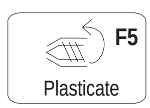
In this field:	Enter jog values that move the phase at slow to moderate speed:
7	Close Jog Vel (in/sec)
8	Open Jog Vel (in/sec)
9	Close Jog psi (psi)
10	Open Jog psi (psi)

6. To apply the entered values, press 

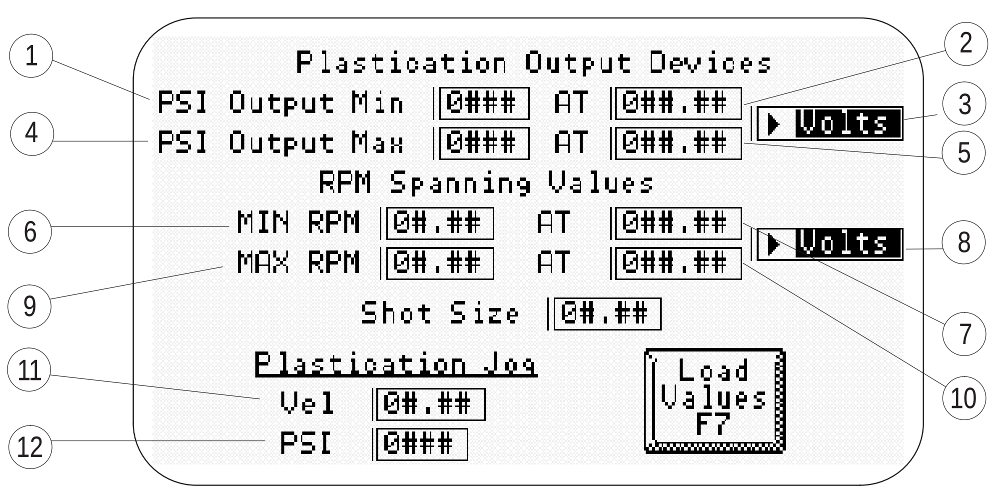
. It is important to remember that anytime you change a pressure or velocity output entry, you must press F7 for changes to take effect.

7. Repeat this procedure for each of the other phases.

▶ The setup for the plasticate phase has only one screen.

8. Press 

to go to the plasticate screen.

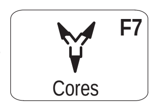


9. For the plasticate screen, enter these values as shown in the following table.

▶ Min/max RPM velocity units are in percent (%). For this step in the machine setup, enter a max RPM velocity of 99.99%.

▶ When selecting volts or amps, go to the selector, make your selection, then press Enter.

In this field:	Enter:
1	psi Output Min (enter zero)
2	psi Output Min or current or voltage from valve specifications
3	whether the output signal is volts or milliamps
4	psi Output Max from the valve specifications
5	psi Output Max or current or voltage from valve specifications
6	Min RPM (zero) % at corresponding voltage or milliamperage
7	Min voltage/current for maximum RPM %
8	whether the output signal is volts or milliamps
9	Max RPM (99.99) % at corresponding voltage or milliamperage
10	Max voltage/current for maximum RPM %
11	Jog Vel (%)
12	Jog psi (psi)

10. To apply the entered values, press 

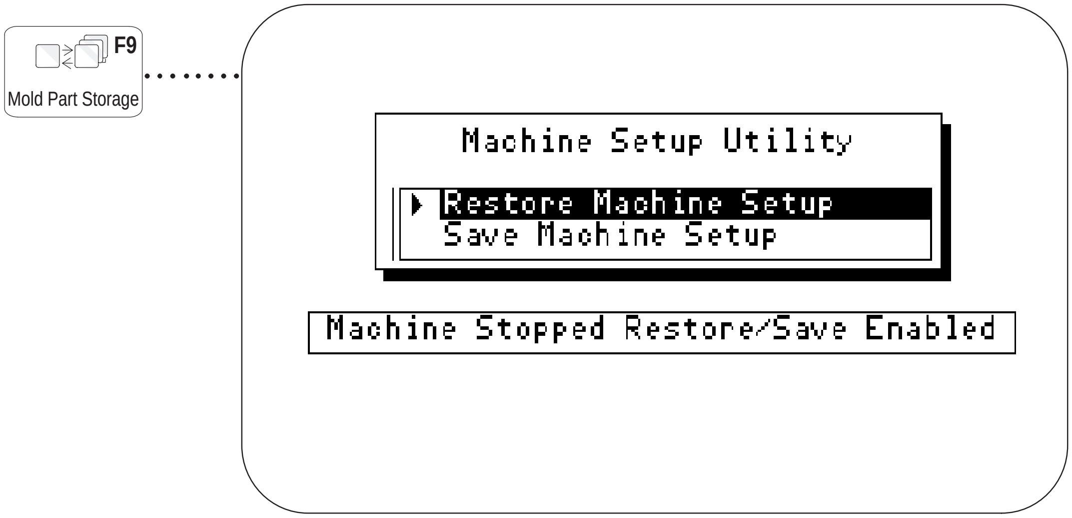
. It is important to remember that anytime you change a pressure or velocity output entry, you must press F7 for changes to take effect.

11. **Important:** Save your machine setup data. See the next section.

Saving and Restoring Machine Setup Data

You can save machine setup data or restore the original configuration.

Press



To :	Do this:
save machine setup data	1. Select Restore Machine Setup ▶ **Save Machine Setup** 2. Press enter
restore machine setup data	1. Select **Restore Machine Setup** ▶ Save Machine Setup 2. Press enter

Verifying Correct Hydraulic Operation

This section helps you verify correct hydraulic operation, and helps you ensure that the jog setpoints that you just loaded are in control of your machine.

▶ At this point, you have ***not*** scaled the sensors. You have entered values to enable your machine to move.

ATTENTION: Unexpected machine movement could result in personal injury or property damage. Ensure all machine safety guards are in place. Use care when activating each phase

To verify hydraulic operation:

1. Switch your machine to setup mode.
2. Using switches on the machine control panel, activate each axis of machine motion in the forward and reverse directions. For example:
   - clamp open and close
   - ejectors forward and reverse
   - injection ram forward and reverse
   - screw rotation
3. Use your own troubleshooting techniques to correct problems such as no motion or reverse motion when forward motion is commanded.

Important: Complete this part of setting up machine operation before starting to the next chapter. For safety reasons, you should verify correct hydraulic operation and know that your setpoints are in control of the machine before proceeding further.

What's Next?

In the next chapter, we explain how to span your sensors and valves.

Determining Sensor and Valve Operation

What's in This Chapter?

For proper system operation, you must determine the range of your input sensors for position and pressure. You must also adjust your machine's pressure and velocity output valves to match the analog output module linear signal range. This is called *spanning*. This chapter tells you how to:

- span inputs
- span outputs
- span to remove upper and lower deadbands
- test valve linearity

Important: Do not span valves until you have completed all previous chapters.

Accessing the Setup Screens

Access the Pro-Set 200 setup screens by loading this setup file:

```
ps2s102.pva
```

You use these setup screens for this procedure:

- input/output screens
- velocity spanning/jog screens

Use this type of screen:	To:
input/output screens	• enter setpoints for position sensors and pressure transducers • enter nameplate or min/max values for the corresponding valve
velocity spanning/jog screen	• enter % velocity and pressure setpoints for the corresponding phase • span velocity valves
machine setup storage screen	save all the values that you have configured in the input, output, and jog screens

Remember that the spanning parameters, found on the calibration screens for each applicable machine phase, are the following:

- maximum limit in/sec or psi (pressure or velocity)
- maximum output volts/milliamps (to obtain the maximum limit)
- minimum limit in/sec or psi (pressure or velocity)
- minimum output volts/milliamps (to obtain the minimum limit)

Spanning Inputs

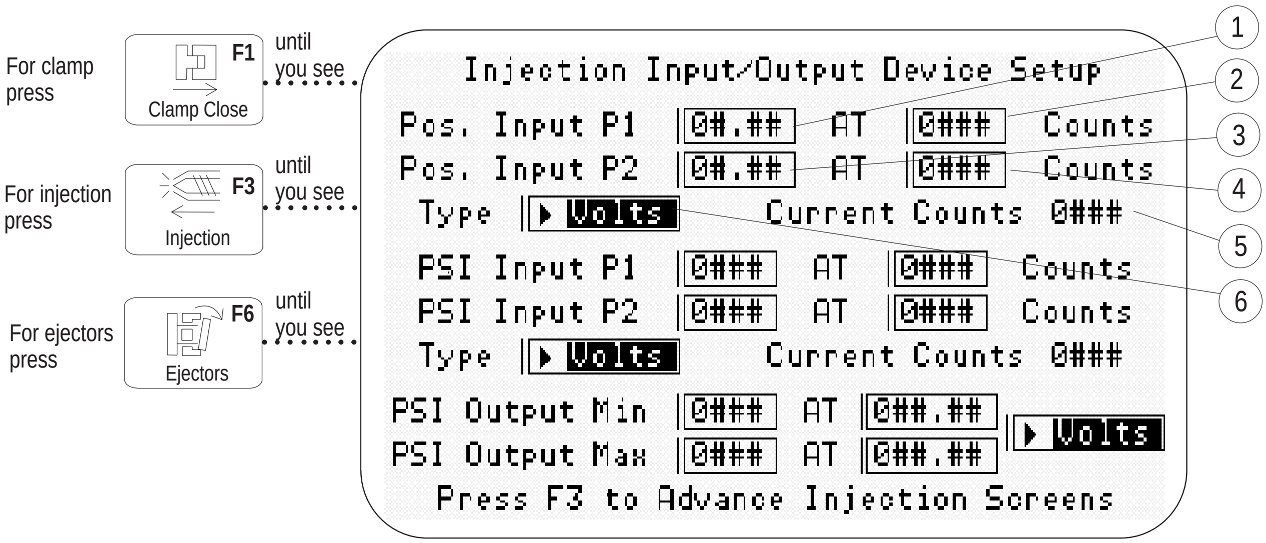
This section explains how to span linear position and pressure inputs. Span inputs for each phase: clamp, injection, and ejector.

In the examples we show injection phase screens; if you are spanning the clamp or ejectors phases, substitute those screens.

Spanning Linear Position Inputs

To span linear position inputs, do the following:

1. Go to the injection, clamp, or ejector input scaling screen



2. Enter configuration values.

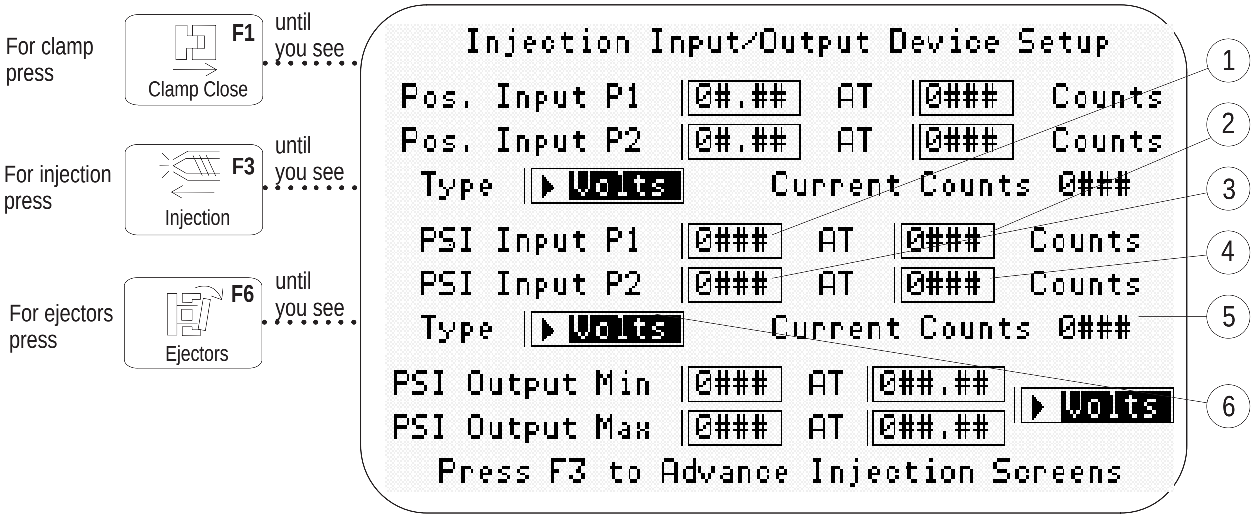
When selecting volts or amps, go to the selector, make your selection, then press enter.

For this phase:	Do the following:
injection (press F3)	1. Bottom the injection ram (P1). 2. Enter 0 into field 1. 3. Enter the counts that the fast analog module is returning from the current counts field 5 into field 2. 4. Move the injection ram to its full back position (P2). 5. Measure the distance travelled from P1 to P2. 6. Enter this measurement (in inches) into field 3. 7. Enter the counts that the fast analog module is returning from the current counts field 5 into field 4. 8. Select the appropriate voltage or amperage for your input module in field 6.
clamp (press F1)	1. Close or nearly close the clamp. 2. Measure the distance from the stationary platen to the moving platen (P1). 3. Enter the measurement into field 1. 4. Enter the counts that the fast analog module is returning from the current counts field 5 into field 2. 5. Open the clamp to its near full open position. 6. Measure the distance from the stationary platen to the moving platen. 7. Enter this measurement (in inches) into field 3. 8. Enter the counts that the fast analog module is returning from the current counts field 5 into field 4. 9. Select the appropriate voltage or amperage for your input module in field 6.
ejectors (press F6)	1. Place the ejectors in the fully retracted position (P1). 2. Enter 0 into field 1. 3. Enter the counts that the fast analog module is returning from the current counts field 5 into field 2. 4. Move the ejectors to their full forward position (P2). 5. Measure the distance travelled from P1 to P2. 6. Enter this measurement (in inches) into field 3. 7. Enter the counts that the fast analog module is returning from the current counts field 5 into field 4. 8. Select the appropriate voltage or amperage for your input module in field 6.

Spanning Pressure Inputs

To span pressure inputs, do the following:

1. Go to the injection, clamp, or ejector input scaling screen.



2. Enter configuration values.

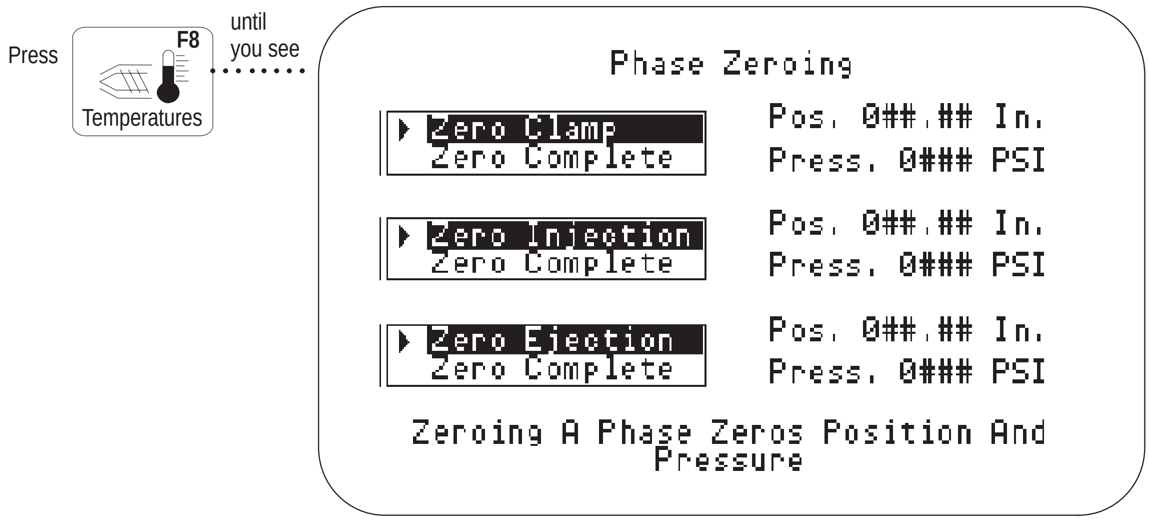
When selecting volts or amps, go to the selector, make your selection, then press enter.

In this field:	Do the following:
1	Enter 0 for the psi input P1 when the machine pumps are off.
2	1. Enter the counts that the analog module returns for P1 read from the current counts field 5.
3,4	There are two ways to determine pressure and counts: **Method 1:** 1. Apply pressure to the transducer, then read with a pressure gauge. 2. Enter this value into field 3. 3. Enter the counts that the fast analog module is returning from the current counts field 5 into field 4 when pressure is applied. **Method 2:** 1. Enter nameplate values into field 3. 2. If you have a maximum pressure value at: 10 v dc, enter 4095 into field 4. 5 v dc, enter 2047 into field 4. 20 mA, enter 2047 into field 4.

3. Repeat steps 1–2 to span the clamp and ejector inputs.

Zeroing Position and Pressure Inputs

Once you have spanned all of your position and pressure inputs you will need to zero them. The following steps explain how to zero position and pressure inputs (in this example we describe clamp zeroing; if you are zeroing injection or ejectors, substitute those phase zeroing menu components.)



1. For clamp zeroing, begin by completely closing the clamp. If you are using a toggle machine, lock the toggle over. For injection zeroing, bottom out the screw, and for ejector zeroing, fully retract ejector pins into mold.
2. From the PanelView screen, use the left and right arrow keys select 

.
3. Using the up and down arrow keys select zero clamp.
4. Press the enter key .
5. Repeat the above steps substituting injection and ejection for clamp.

▶ The zeroing function zeros position and pressure. If you want zero pressure to be true, shut pumps off before performing the zeroing process. If you want idle pressure to be the zero pressure, perform the zeroing process with the pumps running, but without motion.

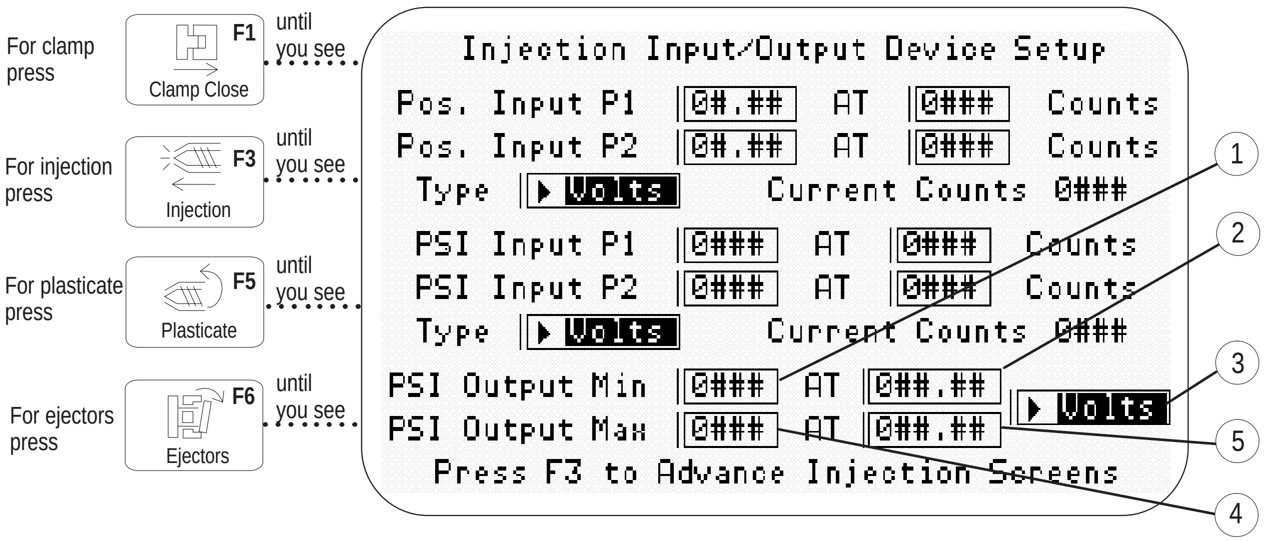
Spanning Outputs

This section explains how to span pressure and velocity valve outputs. Span outputs for each phase: injection, clamp, and ejector. (We show injection phase screens; if you are spanning the clamp or ejectors phase or the plasticate profile, substitute those screens.)

Spanning Pressure Valve Outputs

To span pressure valve outputs, do the following:

1. Go to the injection, clamp, or ejector output scaling screen.



2. Enter these configuration values.

▶ When selecting volts or amps, go to the selector, make your selection, then press enter.

In this field:	Do this:
1	Enter the minimum pressure rating of the valve. In most cases the minimum is 0 psi.
2	Enter the corresponding voltage or amperage command signal to achieve the rated pressure. In most cases, this is 0 volts or 4 milliamps.
3	Select voltage or milliamps for the corresponding sensor. This tells the SLC 5/04P processor which analog output card has been placed in the system: FIO4V or FIO4I.
4	Enter the maximum pressure rating of the valve.
5	Enter the corresponding voltage or amperage command signal to achieve the rated pressure. Most pressure valve manufactures give the rating of the valve and the command signal to achieve the rated pressure.

Example: Spanning a Pressure Valve to Less Than its Rated Output

Suppose the maximum range of a pressure valve is 0 - 3000 psi and you want to use it over a range of 0 - 2000 psi. To span the Pro-Set 200 system's output to a maximum limit of 2000 psi, the %-output should be very near 67%. Realize that your initial output of 67% will produce a psi that is near 2000, but probably not exact due to system variations.

Table 11.A Pressure vs %-output for an Example 3000 psi Valve (Max Rating)

psi	%-output	V dc output	Range Used
3000	100 %	10.0	
2500	83 %	8.3	
2000	67 %	6.7	2000
1500	50 %	5.0	1500
1000	33 %	3.3	1000
500	17 %	1.7	500
0	0 %	0	0

To produce a precise 2000 psi, you must adjust the control output voltage and/or adjust the valve's min and max potentiometer so that the valve delivers 2000 psi at an output of 67% (high end) and 500 psi (low end) at an output of 17%.

Adjust Pro-Set 200 outputs with the jog screens by entering the jog values for the output. You need to adjust the upper and lower end of the valve to span correctly

For each upper and lower output, alternately adjust the maximum then minimum %–output value until the valve delivers the desired pressure range.

Spanning Velocity Valve Outputs

You can span the velocity valve outputs by running the injection, clamp, or ejector phase at the minimum and maximum speeds to record the values. Enter starting values into the min/max fields so the SLC 5/04P processor can establish the performance limits of your machine.

Defining Minimum and Maximum Spanning Values for Forward Direction

Establish the maximum speed of the phase you are trying to control.

ATTENTION: Use caution when running the injection, clamp, or ejector phase at the maximum speed.

This section helps to determine the maximum operating speed of the phase that is used as the SLC 5/04P processor limit. To record the maximum speed, move the injection, clamp, or ejector phase at full flow and pressure.

To move the injection, clamp, or ejector phase at maximum flow and pressure, check that:

- all the pumps available from the hydraulic system are energized to insure that maximum pump volume is being sent to the cylinder.
- the correct maximum signal is being sent to your pressure relief valve to insure that all the flow is going to the cylinder. This insures that the oil is not diverting across the system pressure relief valve while the cylinder is in motion.
- the correct maximum signal is being sent to your flow control valve. You should also check:
  - if you are using a bidirectional valve. Ensure that the proper command signal to the valve gives you the expected motion.

    Most valve manufacturers list the command signal input to the valve and the corresponding flow path (such as 0 to +10 VDC may give a flow path from the pressure port to the “A” port while another valve manufacturer may tell you that a 0 to + 10 VDC may give you a path from the pressure port to the “B” port). The hydraulic plumbing dictates if flow from port “A” or port “B” extends or retracts a cylinder.
  - if your flow control valve has a feedback mechanism such as a valve position transducer. Check to see that the spool/cartridge has fully shifted during cylinder motion.

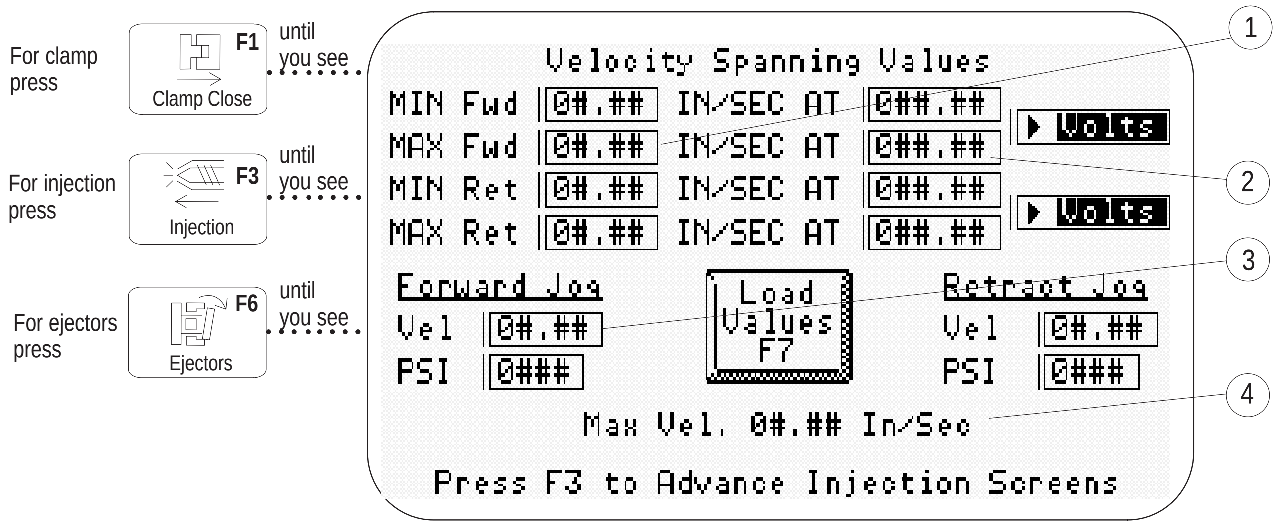
Jogging the Phase

So far, you have done the following:

- defined the linear position spanning values.
- defined the pressure transducer spanning values.
- defined the pressure valve output limits
- set minimum forward and retract velocity to zero in/sec.
- set the maximum forward and retract velocity to 99.99 inches/second in order to record the actual maximum velocities.

Now we explain how to jog the injection, clamp, ejector phases to record the maximum velocity. Use the jog screens included in the Pro-Set 200 setup screens. (We show injection phase screens; if you are jogging the clamp or ejectors phase, substitute those screens.)

1. Go to the injection phase jog screen.



2. Make sure the max fwd (field 1) is 99.99 in/sec.
3. Enter 1.00 in field 3.
4. Jog the injection ram forward and watch field 4.
5. Increase the jog velocity (field 3), typically by 1.00 in/sec, until field 4 does not increase (i.e., you have reached maximum velocity).
6. Read the value in field 4 and record it here_________________.

   For example, assume the following:

   - you enter max fwd 99.99 in/sec at 10.00 volts (field 1)
   - and you increase the jog value to 50.00 vel fwd (field 3)
   - you record 10.00 in/sec recorded during jog (field 4) as the maximum velocity

7. Place the max recorded velocity (field 4) into the max fwd (field 1) field.

   In the example, enter 10.00 in/sec in the max fwd (field 1) field.

8. Enter the maximum voltage required to achieve maximum velocity.

   ```
   Maximum Voltage * Maximum Jog %
   ```

   In the example:

   ```
   10.00 volts * 50.00%
   10.00 volts * .50 = 5.00 volts to achieve 10 in/sec
   ```

9. Enter the calculated value in the max fwd (field 1) field.

   In the example, enter 5.00 volts.

▶ When selecting volts or amps, go to the selector, make your selection, then press enter.

10. Press `[F7] Load Values`.

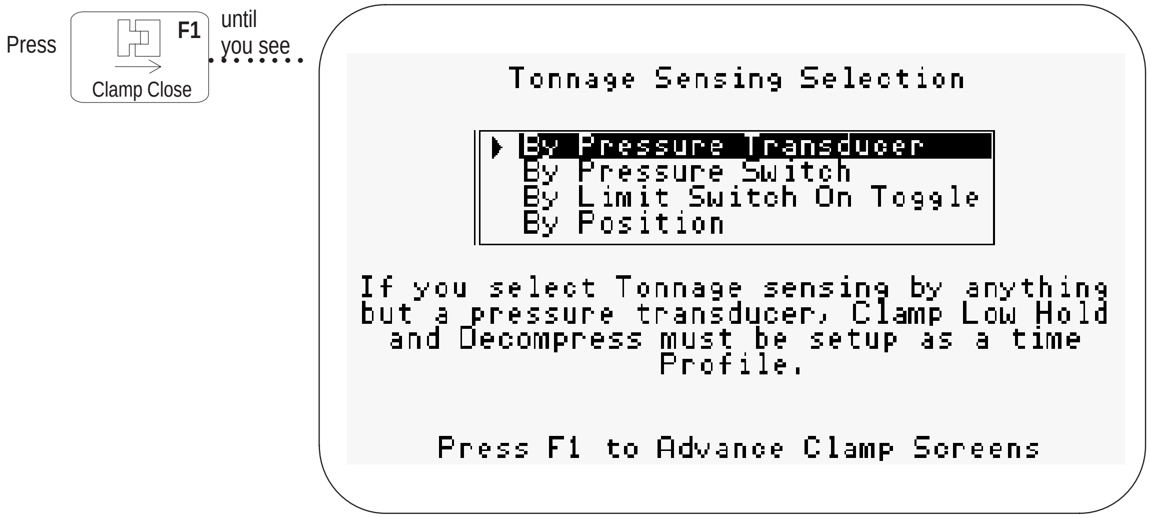
11. Repeat steps 3 through 10 for injection retract, clamp forward, clamp retract, ejector forward, and ejector retract.

The process above will convert the units of velocity jog values to in./sec. From this point forward you must remember to enter your velocity jog values as in./sec.

Selecting How Tonnage is Sensed

To select how tonnage is sensed, do the following:

1. Go to the tonnage sensing screen. (This is the third clamp setup screen).

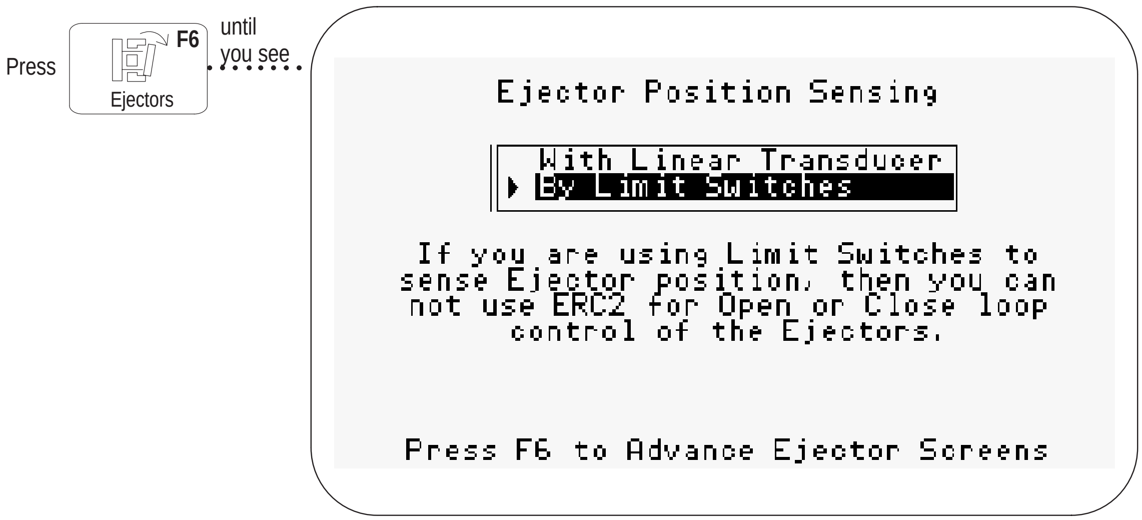


2. Using the up and down arrow keys select how the machine senses tonnage.
3. Press the enter key .

Selecting How Ejector Position is Sensed

To select how ejector position sensed, do the following:

1. Go to the ejector position sensing screen. (This is the third ejector setup screen.)

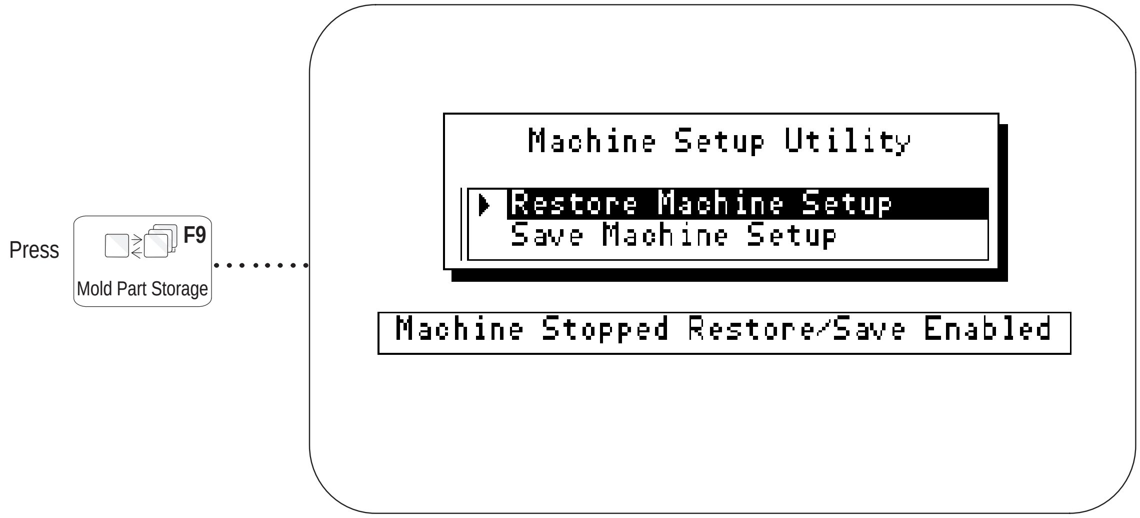


2. Using the up and down arrow keys select how the machine senses ejector position.
3. Press the enter key .

Saving and Restoring Machine Setup Data

You can save your machine's setup data or restore the original configuration.

1. Press the F9 function key to access this screen:



2.

To :	Do this:
save machine setup data	1. Select Restore Machine Setup ▶ **Save Machine Setup** 2. Press enter
restore machine setup data	1. Select **Restore Machine Setup** ▶ Save Machine Setup 2. Press enter

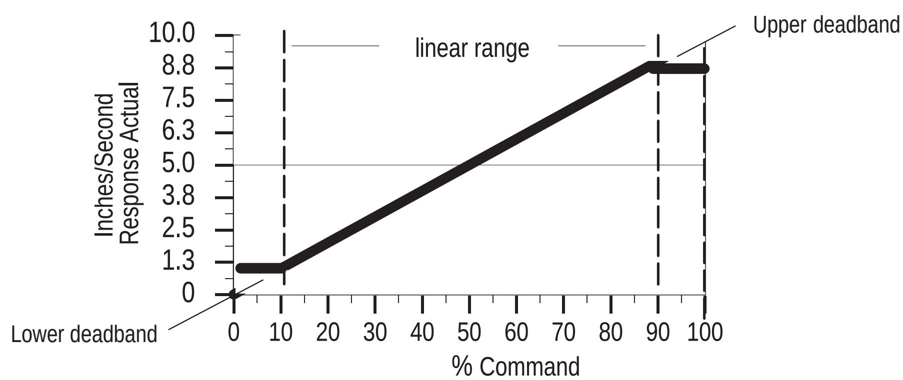
Spanning to Remove Upper and Lower Deadbands

When your control valve has a deadband at the upper and/or lower end of the valve curve, you must span the output to control the valve over the linear range between the deadband(s).

The objective of spanning is to:

- determine the location of the upper and lower points in the valve curve at which flow rate levels off
- span the output to the valve so that the valve operates only in the linear range

Here is an example flow valve curve showing an upper and lower deadband.



▶ To remove deadbands from a valve, you should jog the appropriate phase.

To span to remove upper and lower deadbands, follow these steps for the upper and lower ends of the valve curve.

1. On the output scaling screen, set the jog rate to zero, and raise the minimum volts/milliamps by .01 volts/ milliamps until the axis begins to move.
2. Once the axis begins to move, lower the value back to the value that did not move the cylinder.
3. If you have not determined the maximum velocity of the phase, set jog to the maximum velocity. Then start incrementing the max volt/amp by .01 increments until the cylinder speeds do not increase.
4. Once the cylinder speed no longer increases with an increase in volts/amps, return the value back to the amount that caused the maximum speed.

Quick Tune Procedure

What's in This Chapter?

Once you can cycle the machine in the automatic or semi–automatic mode, you are ready to run the quick tune procedure. The quick tune procedure:

- captures your machine's response characteristics
- automatically tunes the control system.

Run the procedure during initial machine setup or during the installation of a new mold. The quick tune procedure is comprised of two steps:

- coarse tune
- fine tune

Important: Do not run the quick tune procedure unless you are certain that you can cycle the machine in automatic and semi-automatic mode.

Before You Begin

Before you perform the quick tune procedure, be certain that you:

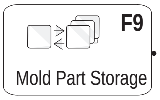
- Load the machine with plastic
- Use the actual profile that you'll be running with the mold (it is alright to run a short shot if you're concerned about the mold)

Quick Tune Procedure

Start the quick tune procedure by displaying the quick tune screen on your PanelView terminal.

How to get to the Quick Tune Screen

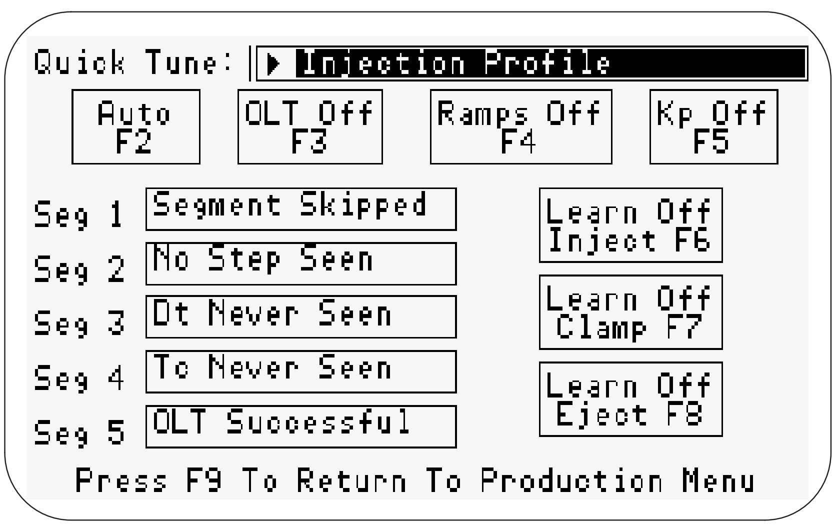
From the PanelView terminal display:

Press 

until you see

1. Using the up and down arrow keys select quick tune from the production menu.
2. Press the enter key .

The next screen you see will be the quick tune screen:



Once you have reached the quick tune screen, you must choose a profile to tune.

3. Using the up and down arrow keys △ ▽ select a profile.

4. Press the enter key ⏎.

► When you first enter the quick tune screen, no profile is selected. You must select a profile.

The Coarse Tune Step

Do the following to complete the coarse tune of the selected profile:

Step	Description	Function Key
1	Make certain that Kp is off	F5
2	Make certain that each profile being tuned is set to the Manual Mode	F2
3	Set Ramps OFF	F4
4	Set OLT (Open Loop Test) ON	F3
5	Run a complete cycle and check to see if all active segments OLT successfully. If not, refer to page 12–5 for corrective actions. **All profile being used must have successful OLTs before continuing to the next step**.	
6	Set OLT OFF	F3
7	Set Ramps ON	F4
8	Turn learning on	F6, F7 or F8
9	Set the profile in Auto Mode	F2
10	Run 4 cycles	

At the completion of the coarse tune step, speeds and pressures should be roughly close to the desired setpoints.

Fine Tune Step

Complete the fine tune step after you've completed the coarse tune step or after making big changes to the primary or secondary setpoints. From the quick tune screen:

Step	Description	Function Key
1	Set the profile in Auto Mode	F2
2	Set Kp OFF	F5
3	Turn Ramps OFF	F4
4	Set OLT ON	F3
5	Run a complete cycle and check to see if all active segments OLT successfully. If not, refer to page 12–5 for corrective actions. **All profile being used must have successful OLTs before continuing to the next step**.	
6	Set OLT OFF	F3
7	Turn Ramps ON	F4
8	Turn Kp ON	F5
9	Turn learning on (if learning is still on from coarse tune you can leave it on)	F6, F7, or F8

Automatic Mode (ERC2) Open Loop Test Status Word

Built into the quick tune screen are status areas that report tuning success. The engineering actual word blocks are 1,17,33,49, and 65

Engineering Actual Word Values	Segment Status on PanelView Screen	Extended Description
0	Segment Skipped	Segment Skipped
1	No Step Seen	Segment didn't progress through dead time threshold
2	Dt Never Seen	Segment didn't progress through dead time
3	Tc Never Seen	Segment didn't progress through Time Constant
4	OLT Successful	Segment reached steady state. Open Loop Test successful.

▶ You will also see a status of Segment Not Used. Segment Not Used is displayed when a profile being tuned does not have five segments, for example, Pack and Hold. This is determined by ladder logic and not by ERC2.

Corrective Actions Based on Open Loop Status

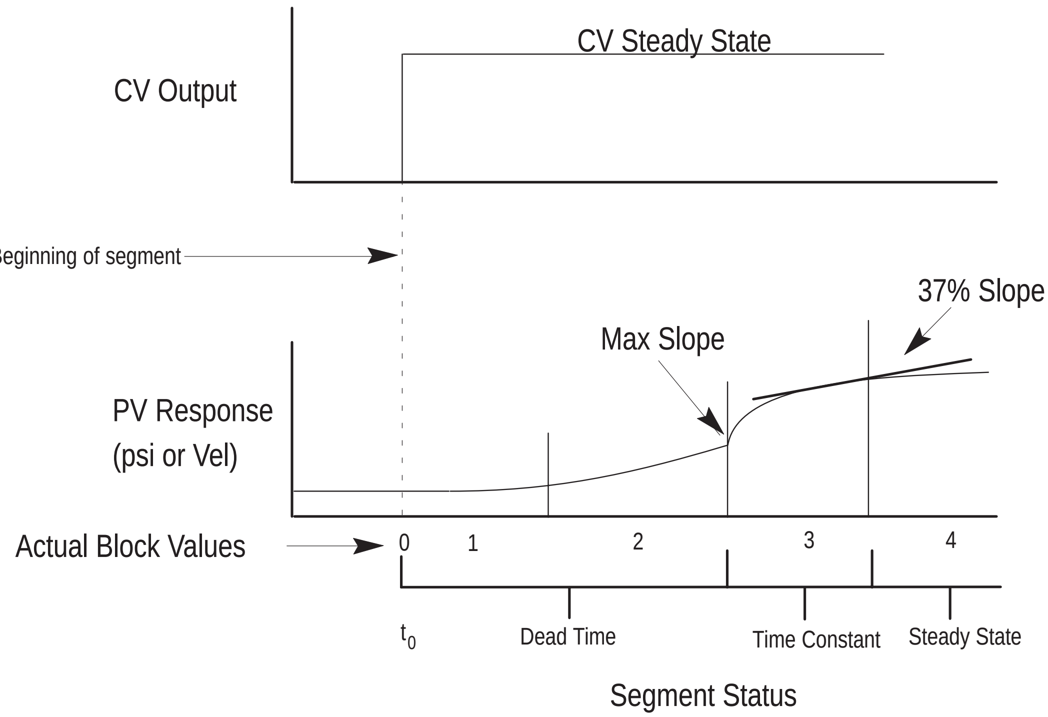
Depending on the Open Loop Status (OLT), corrective action may be needed before the quick tune procedure can be completed with successful results. Based on the segment (Seg) information from the quick tune screen, the following corrective actions should be taken. Perform corrective action and run another complete cycle (i.e. repeat step 4 of coarse tune and fine tune) until OLT is successful.

Segment Status on PanelView Screen	Corrective Action Required
Segment Skipped	Check time and position setpoints (make certain time is not 0) Check trigger settings (it is possible to trigger and never get to a segment)
No Step Seen	Lengthen segment by changing position, slowing velocity, or increasing time. Turn Ramps OFF Reduce dead time thresholds in Phase Setpoint table (N104:8, N104:9) Increase step size
Dt Never Seen	Lengthen segment Increase step size (make segment have different setpoint than previous segment)
Tc Never Seen	Lengthen segment Check N104:10 and N104:11 (value should be 370) Check N104:12 and N104:13 (value should be 3)
OLT Successful	Good Job. No Action Required.
Segment Not Used	No action required. This is to inform you that the profile does not exist for the selected profile.

If you are running a small shot size or a short clamp stroke, it may not be possible to use all of the segments provided in Pro-Set 200. The OLT status will inform you if you are trying to run a segment that will not reach steady state. This is a valuable diagnostics tool that informs you of unobtainable segments in your profile. If you cannot get all of your segments to reach a successful OLT, try using fewer segments.

Quick Tune Response And Understanding ERC2 OLT Status Words

The graphic below displays the relationship between CV output and the PV response. Note that the numbers correlate with the open loop test status word



Learning During Production

With learning turned on, ERC2 will continuously adapt as it works to make your process meet your setpoints. At this point, you may or may not want to turn learning off.

If the combined variables of your process gives you good repeatability, leaving learning turned on will not harm anything – as long as your process is relatively consistent. However, if your machine encounters a major problem, such as a clogged sprue, ERC2 will try to compensate for the problem, thereby learning incorrect information. After you discover and fix the problem, ERC2 will operate with the values learned during the problem period and will have to relearn the original, correct information. The total time necessary for ERC2 to learn depends greatly on the on the cycle time of your product.

To avoid the previous scenario, you can turn learning off once ERC2 yields desirable results. However, by turning learning off, Pro–Set 200's ability to adjust to minor variations in process variables will be disabled. The decision to leave learning on or off is highly dependent on your individual application, and the inherent repeatability of your product and machine.

Another alternative method is to only turn learning on when you believe it would be beneficial – possibly when you have introduced some new variable and you want ERC2 to compensate. In this case, to get your actuals closer to the setpoints while you are running the machine in production mode, follow the procedures below.

Conditions (these settings should already be in use)	**Perform These Actions**
Velocity Profiles only: **Set Kp ON** (F5)	1. Run a complete cycle 2. Press the Learn button (turn on) 3. Repeat steps 1 and 2 until setpoints reached 4. Press the Learn button (turn off)
Pressure Profiles only: **Set Kp OFF** (F5)	1. Run a complete cycle 2. Press the Learn button (turn on) 3. Repeat steps 1 and 2 until setpoints reached 4. Press the Learn button (turn off)

What's Next?

In the next chapter, we explain how to use mold part recipes.

Using Mold Part Recipes

What's in This Chapter?

This chapter explains:

- mold part recipe storage
- how to name mold part recipes
- how to save and restore mold part recipes
- how to increase the number of mold part recipes

Understanding Mold Part Recipe Storage in Pro-Set 200

Each mold part recipe contains nine files, called vaults (one floating point and eight integer files). The vaults contain setpoint information for each phase, calibration constants for ERC2, and temperature module information. File space is also provided in vault nine for your information. In total, approximately 2000 words are used in the nine files to store a mold part recipe (before customer additions).

Pro-Set 200 ladder logic supports storage of 5 mold part recipes. It stores these recipes in the file range: N205 – N249. The layout of these recipe files is as follows:

File:	Mold Part Recipe:
N203	Machine setup parameters
N204	Recipe name storage
F205	Mold Part 1, Vault 1 (ERC2 Memory)
N206	Mold Part 1, Vault 2 (Injection and Pack)
N207	Mold Part 1, Vault 3 (Hold, Pre, Plast, Post)
N208	Mold Part 1, Vault 4 (Clamp Close, LPMP, Tonnage)
N209	Mold Part 1, Vault 5 (Clamp Low Hold, Dec, Open)
N210	Mold Part 1, Vault 6 (Eject, File N92, Customer Additions)
N211	Mold Part 1, Vault 7 (BTM setpoints/calibration for Zones 1–4)
N212	Mold Part 1, Vault 8 (BTM setpoints/calibration for Zones 5–8)
N213	Spare
F214	Mold Part 2, Vault 1 (ERC2 Memory)
N215	Mold Part 2, Vault 2 (Injection and Pack)
N216	Mold Part 2, Vault 3 (Hold, Pre, Plast, Post)
N217	Mold Part 2, Vault 4 (Clamp Close, LPMP, Tonnage)
N218	Mold Part 2, Vault 5 (Clamp Low Hold, Dec, Open)
N219	Mold Part 2, Vault 6 (Eject, File N92, Customer Additions)
N220	Mold Part 2, Vault 7 (BTM setpoints/calibration for Zones 1–4)
N221	Mold Part 2, Vault 8 (BTM setpoints/calibration for Zones 5–8)
N222	Spare
F223	Mold Part 3, Vault 1 (ERC2 Memory)
N224	Mold Part 3, Vault 2 (Injection and Pack)
N225	Mold Part 3, Vault 3 (Hold, Pre, Plast, Post)
N226	Mold Part 3, Vault 4 (Clamp Close, LPMP, Tonnage)
N227	Mold Part 3, Vault 5 (Clamp Low Hold, Dec, Open)
N228	Mold Part 3, Vault 6 (Eject, File N92, Customer Additions)
N229	Mold Part 3, Vault 7 (BTM setpoints/calibration for Zones 1–4)
N230	Mold Part 3, Vault 8 (BTM setpoints/calibration for Zones 5–8)
N231	Spare
F232	Mold Part 4, Vault 1 (ERC2 Memory)
N233	Mold Part 4, Vault 2 (Injection and Pack)

File:	Mold Part Recipe:
N234	Mold Part 4, Vault 3 (Hold, Pre, Plast, Post)
N235	Mold Part 4, Vault 4 (Clamp Close, LPMP, Tonnage)
N236	Mold Part 4, Vault 5 (Clamp Low Hold, Dec, Open)
N237	Mold Part 4, Vault 6 (Eject, File N92, Customer Additions)
N238	Mold Part 4, Vault 7 (BTM setpoints/calibration for Zones 1–4)
N239	Mold Part 4, Vault 8 (BTM setpoints/calibration for Zones 5–8)
N240	Spare
F241	Mold Part 5, Vault 1 (ERC2 Memory)
N242	Mold Part 5, Vault 2 (Injection and Pack)
N243	Mold Part 5, Vault 3 (Hold, Pre, Plast, Post)
N244	Mold Part 5, Vault 4 (Clamp Close, LPMP, Tonnage)
N245	Mold Part 5, Vault 5 (Clamp Low Hold, Dec, Open)
N246	Mold Part 5, Vault 6 (Eject, File N92, Customer Additions)
N247	Mold Part 5, Vault 7 (BTM setpoints/calibration for Zones 1–4)
N248	Mold Part 5, Vault 8 (BTM setpoints/calibration for Zones 5–8)
N249	Spare

What's in Each Recipe File?

Each recipe is laid out according to the following table. This formula is used to determine storage area:

{[(current recipe number – 1) x 9] + 205} = starting file for recipe

File:	Word:	Size in Words:	Data Table Location (between words):
205, 214, 223, 232, 241	F108	2	0 and 1
	F112	31	2 and 32
	F116	13	33 and 45
	F120	13	46 and 58
	F124	7	59 and 65
	F128	31	66 and 96
	F132	7	97 and 103
	F148	2	104 and 105
	F152	19	106 and 124
	F156	7	125 and 131
	F160	7	132 and 138
	F164	7	139 and 145
	F168	7	146 and 152
	F172	25	153 and 177
	F188	2	178 and 179
	F192	13	180 and 192
	F196	7	193 and 199
	F200	7	200 and 206
206, 215, 224, 233, and 242	N104	28	0 and 27

File:	Word:	Size in Words:	Data Table Location (between words):
	N109	70	28 and 97
	N113	46	98 and 143
207, 216, 225, 234, and 243	N117	46	0 and 45
	N121	38	46 and 83
	N125	70	84 and 153
	N129	38	154 and 191
208, 217, 226, 235, and 244	N144	28	0 and 27
	N149	54	28 and 81
	N153	38	82 and 119
	N157	38	120 and 157
209, 218, 227, 236, and 245	N161	38	0 and 37
	N165	38	38 and 75
	N169	62	76 and 137
210, 219, 228, 237, and 246	N184	28	0 and 27
	N189	46	28 and 73
	N193	38	74 and 111
	N197	38	112 and 149
	N92	12	150 and 162
	T4.PREs	25	163 and 187
	C5.PREs	10	188 and 198
211, 220, 229, 238, and 247	N93	196	0 and 204
212, 221, 230, 239, and 248	N94	196	0 and 204
213, 222, 231, 240, and 249	Reserved	Reserved	Reserved

Naming Mold Part Recipes

Each mold part recipe can have a file name with a maximum of 20 alpha-numeric characters (A – Z, 0 – 9). The mold part recipe names are stored sequentially in file N204. The following table shows a breakdown of mold part file names.

Data Table Location (N204):	Recipe Number:	Character	Character
:0	1	1	2
:1		3	4
:2		5	6
:3		7	8
:4		9	10
:5		11	12
:6		13	14
:7		15	16
:8		17	18
:9		19	20
:10	Null Character		
:11	2	1	2
:12		3	4
:13		5	6
:14		7	8
:15		9	10
:16		11	12
:17		13	14
:18		15	16
:19		17	18
:20		19	20
:21	Null Character		
:22	3	1	2
:23		3	4
:24		5	6
:25		7	8
:26		9	10
:27		11	12
:28		13	14
:29		15	16
:30		17	18
:31		19	20
:32	Null Character		
:33	4	1	
:34		3	
:35		5	
:36		7	
:37		9	
:38		11	
:39		13	
:40		15	
:41		17	

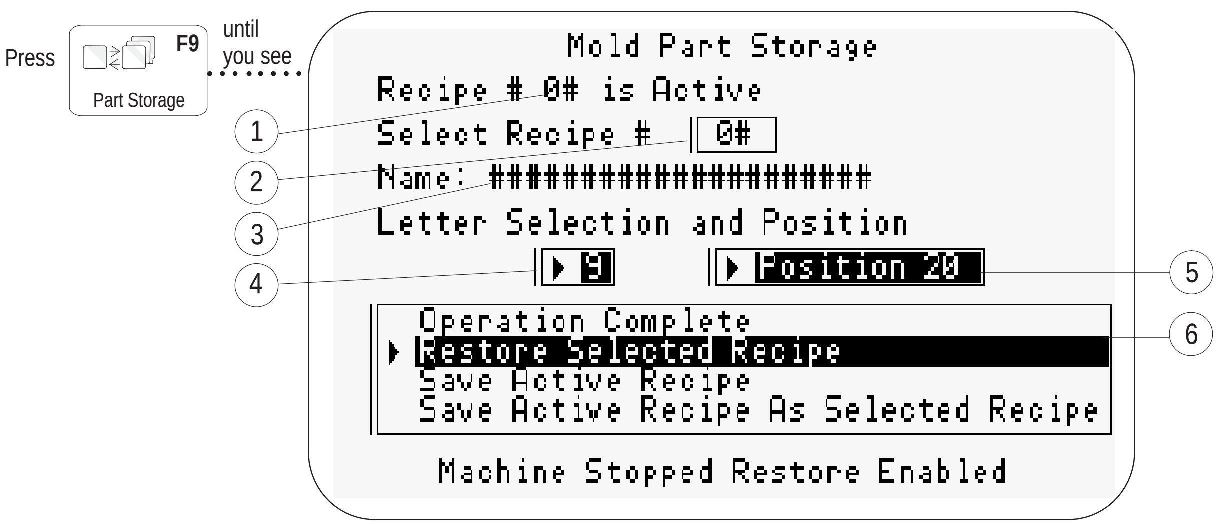
Data Table Location (N204):	Recipe Number:	Character	Character
:42	4	19	20
:43	Null Character		
:44	5	1	2
:45		3	4
:46		5	6
:47		7	8
:48		9	10
:49		11	12
:50		13	14
:51		15	16
:52		17	18
:53		19	20
:54	Null Character		

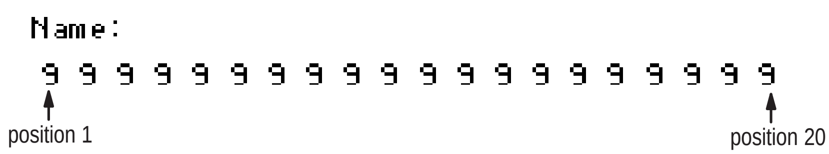
Saving and Restoring Mold Part Recipes

You can save or restore a recipe by using the Pro-Set 200 mold part storage screen. Access this screen by loading the following files:

- `ps2o102.pva`
- `ps2b102.pva`
- `ps2c102.pva`

Press the [F9] function key to access the mold part storage screen.



<table>
<tr><th>Use this field:</th><th>To:</th></tr>
<tr><td>1</td><td>View which recipe number Pro-Set 200 is currently using.</td></tr>
<tr><td>2</td><td>Select a recipe number.
1. Cursor to this field by using the left and right arrow keys:
2. Press the enter key:
The scratch pad appears:
<pre>
Enter value   0
(1 to 5)
</pre>
3. Enter a recipe number between 1 –5 (Pro-Set 200 lets you use up to 5 recipes).</td></tr>
<tr><td>3</td><td>View the recipe name of the selected recipe. This field is a display only field; you cannot enter a new name in this field. Use fields 4 and 5 to enter a new name.</td></tr>
<tr><td>4</td><td>Change the letter selection.
1. Select the letter.
2. Cursor to this field by using the left and right arrow keys:
3. Select a letter by pressing the up and down arrow keys:
4. Press the enter key when you reach the correct letter.</td></tr>
<tr><td>5</td><td>Select the position of a letter in the name field.
1. Cursor to this field by using the left and right arrow keys:
2. Select a position by pressing the up and down arrow keys:
3. Press the enter key when you reach the correct position number.
This field relates to the following positions on the name display (③):

</td></tr>
<tr><td>6</td><td>Save a mold recipe that you configured or retrieve a previously stored recipe.</td></tr>
</table>

Increasing the Number of Mold Part Recipes

The number of mold part recipe files that can be stored in Pro-Set 200 depends on the available memory and unused data table file space. Use the following method for calculating the number of recipes you can store:

1. Calculate the number of data table files available for mold recipe storage as follows:

   256 data table files (maximum of files in a SLC 5/04P processor)
   – data table files used by your application
   = total of data table files available for mold part storage

2. Calculate the number of recipes you can store as follows:

   number of recipes you can store = total of data table files available / 9 data table files per recipe

   The number of recipes you can store cannot exceed the available memory in the processor. See item 3 below.

3. Determine how much memory is available in the SLC 5/04P processor after you add all your ladder code and miscellaneous memory storage requirements. You can check this number with your ladder logic programming software.

   number of recipes you can store = available memory **/ 2000** words per recipe

   Important: This number is the amount of memory each recipe requires ***before*** customer additions. If you are adding data to be stored, add that amount to 2000.

4. After calculating steps 2 and 3, determine which number is the smaller of the two. This number represents the number of recipes you can store.

► Each controlled phase in Pro-Set 200 requires 29 files. If you are not using Pro-Set 200 to control a particular phase, you can reuse its file space for mold part storage.

► If you increase the number of mold part recipes, modify the mold part storage screens and ladder file 92.

What's Next?

The following chapter provides information for using production monitor screens.

Using Production Monitor Screens

What's in This Chapter?

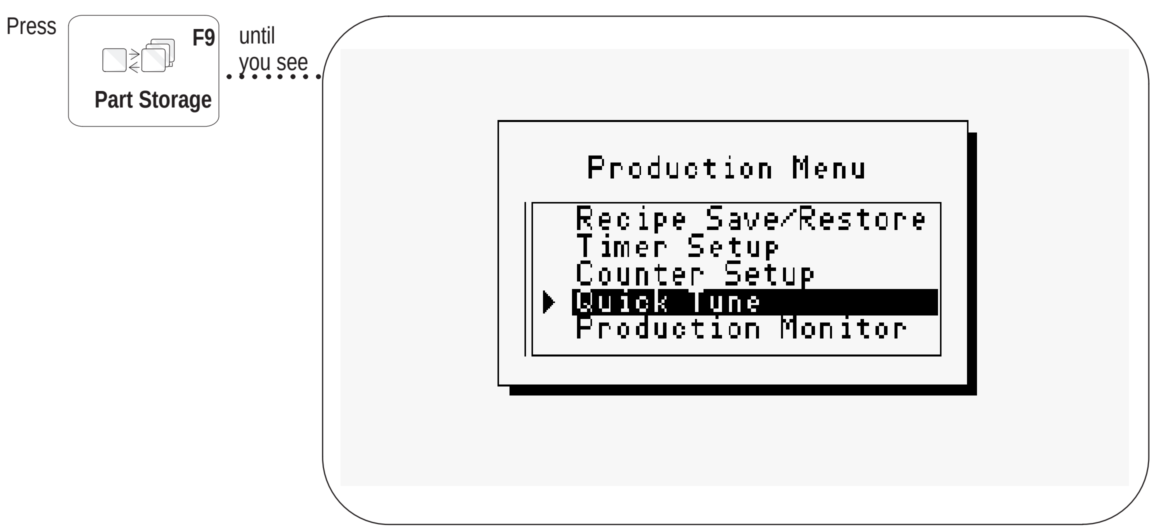
This chapter explains how to use the Production Monitor Screens to:

- Monitor cycle times, fill times, cure times, overall clamp time, idle time and cycle counts
- Examine temperatures and monitor pressure and velocity values from ERC2
- determine which profile is being executed by ERC2 for the Injection, Clamp, and Ejector phases

You can access the Pro-Set 200 Production Monitor Screens by loading this file:

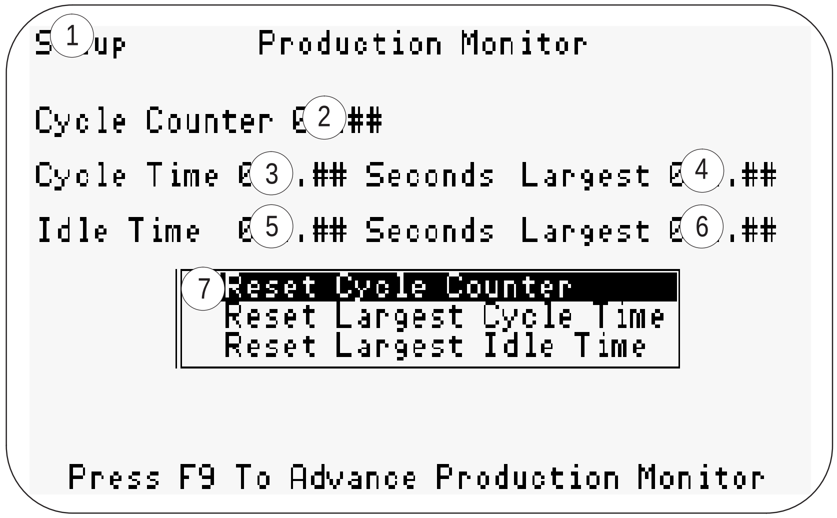
```
ps2o102.pva
```

Accessing Production Monitor Screens



1. Using the up and down arrow keys on the PanelView screen, highlight Production Monitor from the Production Menu
2. Press the Enter key:

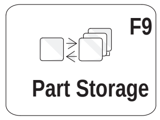
Using Production Monitor Screen 1



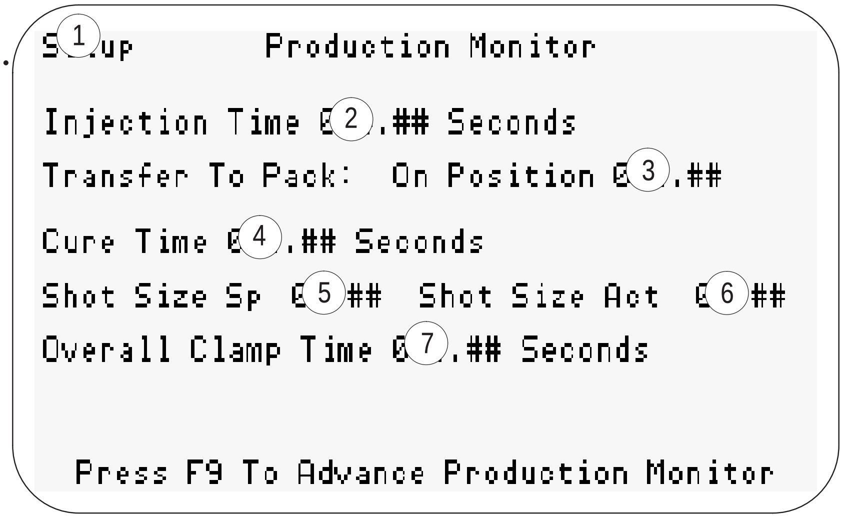
This field:	Monitors this:
1	The mode of the machine: setup, manual, semi–auto, or full–auto
2	Cycle Counter. Indicates the number of cycles which have occurred during the production run. Reset by pressing F1 (the largest count is 32767).
3	Cycle Time. Cycle Time range is from 0 to 327.67 seconds, and is measured from the moment that the time Permit Clamp Closed Bit (Bit B101:4/0) is set until the Cycle Complete Bit (B3:12/3) is set.
4	Longest Cycle. Range: 0 to 327.67 seconds.
5	Idle Time. Idle time is used in the semi–automatic mode to measure the elapsed time between the start of 2 successive cycles. With a range of 0 to 327.67 seconds, the Idle time is measured from the moment the Cycle Complete Bit (B3:12/3) is set until the gate is cycled (B3:1/0).
6	Longest Idle Time. Displays the longest idle time which has occurred during the production run (range: 0 to 327.67 seconds).
7	Resets the cycle counter, largest cycle time or largest idle time. To reset counter and times:

Using Production Monitor Screen 2

Press



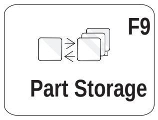
until you see



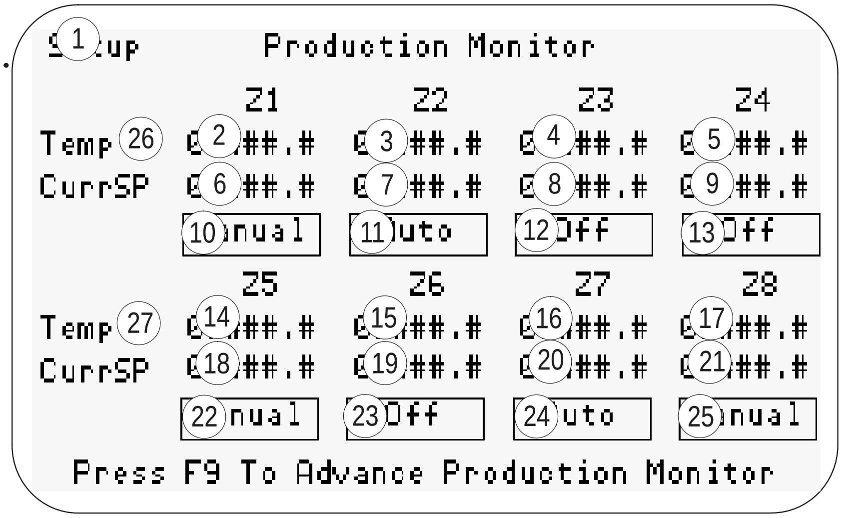
This field:	Monitors this::
1	The mode of the machine: setup, manual, semi–auto, or full–auto.
2	Overall Injection Time. Includes the time required for injection, pack and hold, and delay injection timers for the most recent shot. Range: 0 to 327.67 seconds.
3	Transfer to pack. Displays what condition caused the transition from injection to pack. It can display 4 transitions: 1. Did Not Occur 2. On Position① 3. On Pressure① 4. On Time① ① will show the value at which transition occurred
4	Cure Time. Includes the time from the end of the hold profile until the clamp opens. Range: 0 to 327.67 seconds.
5	Displays the shot size setpoint being used.
6	Displays the actual shot size from the most recent shot.
7	Overall Clamp Time. Includes the time required for Clamp Close, LPMP, Tonnage, Low Hold, Decompress and Clamp Open and delay timers. Range:0 to 327.67 seconds.

Using Production Monitor Screen 3

Press



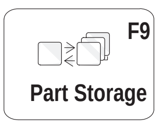
until you see

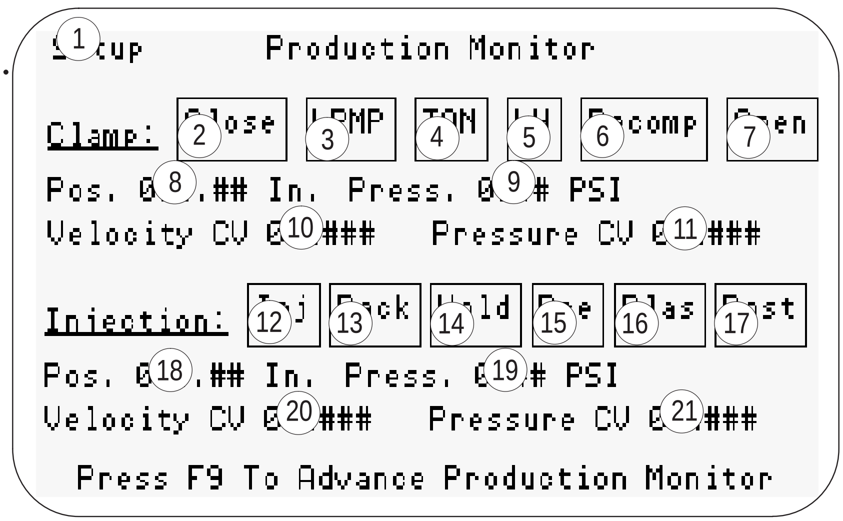


This field:	Monitors this:
1	The mode of the machine: setup, manual, semi–auto, or full–auto
2	Displays the current temperature for zone 1
3	Displays the current temperature for zone 2
4	Displays the current temperature for zone 3
5	Displays the current temperature for zone 4
6	Displays the current temperature setpoint for zone 1
7	Displays the current temperature setpoint for zone 2
8	Displays the current temperature setpoint for zone 3
9	Displays the current temperature setpoint for zone 4
10	Displays the current mode for zone 1
11	Displays the current mode for zone 2
12	Displays the current mode for zone 3
13	Displays the current mode for zone 4
14	Displays the current temperature for zone 5
15	Displays the current temperature for zone 6
16	Displays the current temperature for zone 7
17	Displays the current temperature for zone 8
18	Displays the current temperature setpoint for zone 5
19	Displays the current temperature setpoint for zone 6
20	Displays the current temperature setpoint for zone 7

This field:	Monitors this:
21	Displays the current temperature setpoint for zone 8
22	Displays the current mode for zone 5
23	Displays the current mode for zone 6
24	Displays the current mode for zone 7
25	Displays the current mode for zone 8
26	Shows the temperature units in Degrees Celsius or Fahrenheit for zones 1–4
27	Shows the temperature units in Degrees Celsius or Fahrenheit for zones 5–8

Using Production Monitor Screen 4

Press


until you see


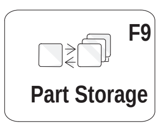
This field:	Monitors this:
1	The mode of the machine: setup, manual, semi–auto, or full–auto.
2	Shows the status of the clamp close profile①
3	Shows the status of the clamp LPMP profile①
4	Shows the status of the clamp tonnage profile①
5	Shows the status of the clamp low hold①
6	Shows the status of the clamp decompress①
7	Shows the status of the clamp open①
8	Shows the current position of the clamp phase
9	Shows the current pressure of the clamp phase
10	Shows the current velocity CV for clamp (in counts)
11	Shows the current pressure CV for clamp (in counts)

This field:	Monitors this:
12	Shows the status of the injection profile[①]
13	Shows the status of the pack profile[①]
14	Shows the status of the hold profile[①]
15	Shows the status of the pre–decompress profile[①]
16	Shows the status of the plastication profile[①]
17	Shows the status of the post decompress profile[①]
18	Shows the current position of injection phase
19	Shows the current pressure of injection phase
20	Shows the current velocity CV for injection (in counts)
21	Shows the current pressure CV for injection (in counts)

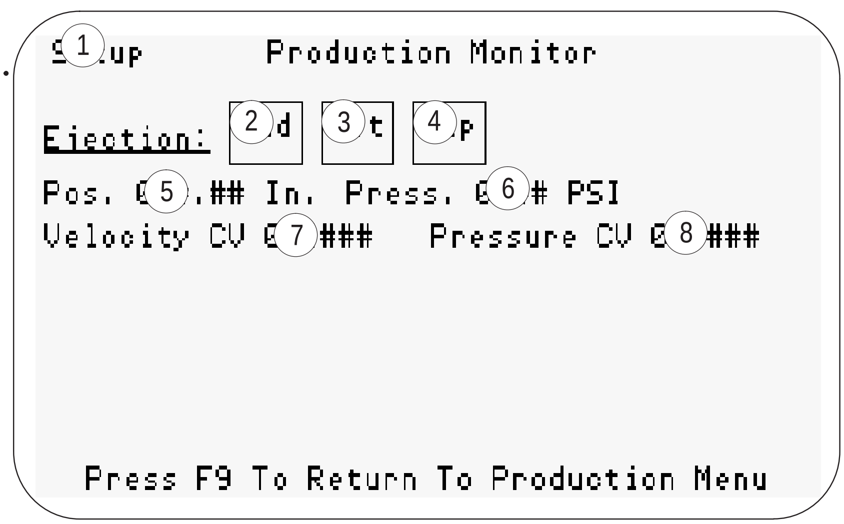
① There are seven status indicators. Depending on the state of the profile, the indicator will appear differently. See following status indicator descriptions at the end of this chapter.

Using Production Monitor Screen 5

Press



until you see



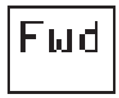
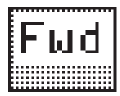
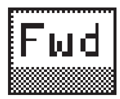
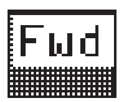
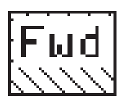
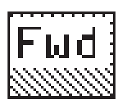
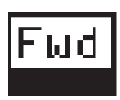
This field:	Monitors this:
1	The mode of the machine: setup, manual, semi–auto, or full–auto
2	Shows the status of the eject forward profile[①]
3	Shows the status of the eject retract profile[①]
4	Shows the status of the eject tip–stroke profile[①]
5	Shows current position of ejection phase
6	Shows current pressure of ejection phase
7	Shows current velocity CV for ejection (in counts)

This field:	Monitors this:
8	Shows current pressure CV for ejection (in counts)

① There are seven state indicators. Depending on the state of the profile, the indicator will appear differently. See previous status indicator descriptions below.

Status Indicators

The state indicators noted in Production Monitor Screens 4 and 5 are as follows:

Status Indicator	Description
	Status indicator 1 is non–blinking (profile is not active).
	Status indicator 2 is blinking (profile active and not suspend active).
	Status indicator 3 is blinking (profile active and suspend active).
	Status indicator 4 is blinking (profile active and suspend done).
	Status indicator 5 is non–blinking (profile complete with no internal trigger).
	Status indicator 6 is non–blinking (profile complete due to internal trigger).
	Status indicator 7 is non–blinking (profile not on).

What's Next?

In the following appendix, we explain about using alarms to troubleshoot your system.

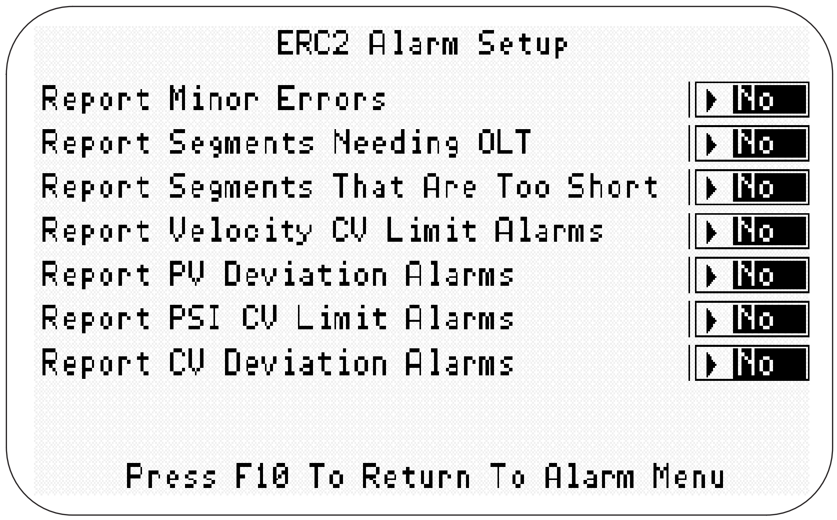
Using Alarms to Troubleshoot Your System

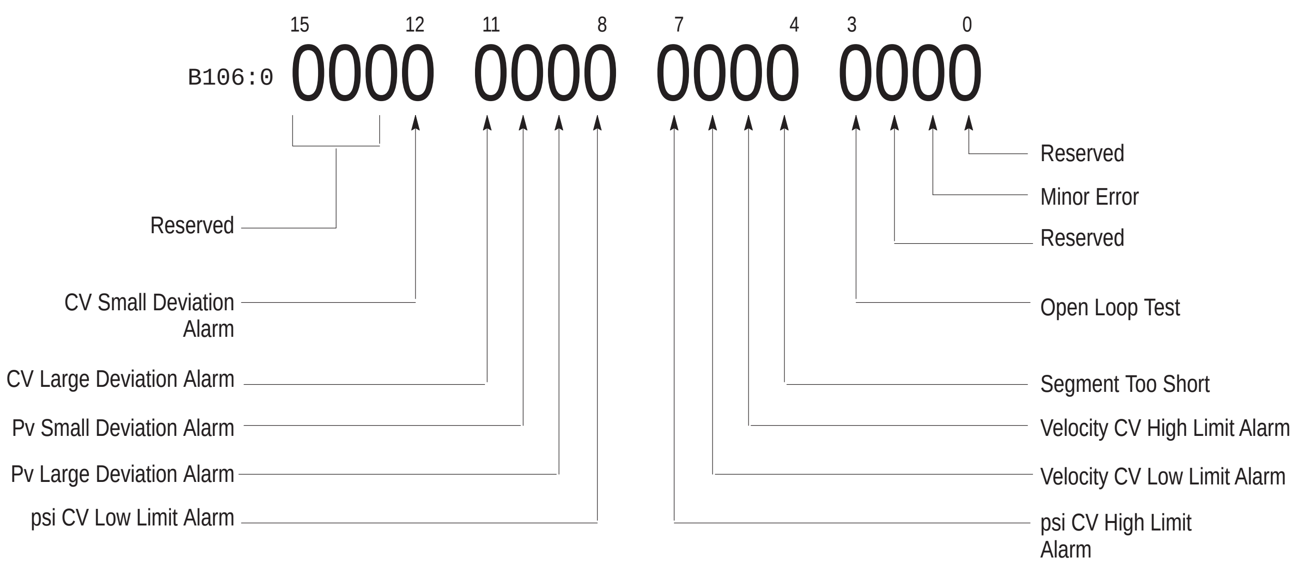
What's in This Appendix?

Use this appendix to read and interpret alarm codes to identify system problems.

Alarm Bits

The following screen shows the alarm bits that you can disable during setup until you get the machine up and running. You can use this screen for phase-wide alarms.





Processor Faults

The following table lists the SLC 5/04P processor's major faults. These faults are reported via the SLC user-defined fault. When any of these faults occur, the fault light blinks and the processor halts. These faults are in addition to the standard SLC 5/04 processor (cat. no. 1747-L542) faults listed in SLC 500™ and MicroLogix 1000™ Instruction Set Reference Manual, publication number 1747-6.15.

Description	Fault Codes Found in File S:6	Probable Cause	Corrective Action
Internal Software Error	0xa0	Internal software error	Call Customer Support
Machine File Bad	0xa1	N100 bad	Call Customer Support
Machine CV Output File Bad	0xa2	N102 not found or too short	**1.** Check N102 length. **2.** Check N100:6.
Machine Status File Bad	0xa3	N103 not found or too short	**1.** Check N103 length. **2.** Check N100:6.
Machine Command (Permit) File Bad	0xa4	B101 not found or too short	**1.** Check B101 length. **2.** Check N100:6.
Phase SetPoint File Bad	0xa5	N104, N144, or N184 not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Create file of correct length. **3.** Check N100:7, N100:9, N100:11 for correct number of profiles.
Phase Actuals File Bad	0xa6	N105, N145, or N185 not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Create file of correct length. **3.** Check N100:7, N100:9, N100:11 for correct number of profiles.
Phase Engineering Actuals File Bad	0xa7	F107, F147, or F187 not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Create file of correct length. **3.** Check N100:7, N100:9, N100:11 for correct number of profiles.
Phase ERC2 Memory File Bad	0xa8	F108, F148, or F188 not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Create file of correct length. **3.** Check N100:7, N100:9, N100:11 for correct number of profiles.
Phase Status File Bad	0xa9	B106, B146, or B186 not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Create file of correct length. **3.** Check N100:7, N100:9, N100:11 for correct number of profiles.
Profile SetPoint File Bad	0xaa	N109, N113, N117... Profile Setpoint files not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Use N103:16, N103:29, or N103:42 to find the offending profile.
Profile Actuals File Bad	0xab	N110, N114, N118... profile actuals file not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Use N103:16, N103:29, or N103:42 to find the offending profile.

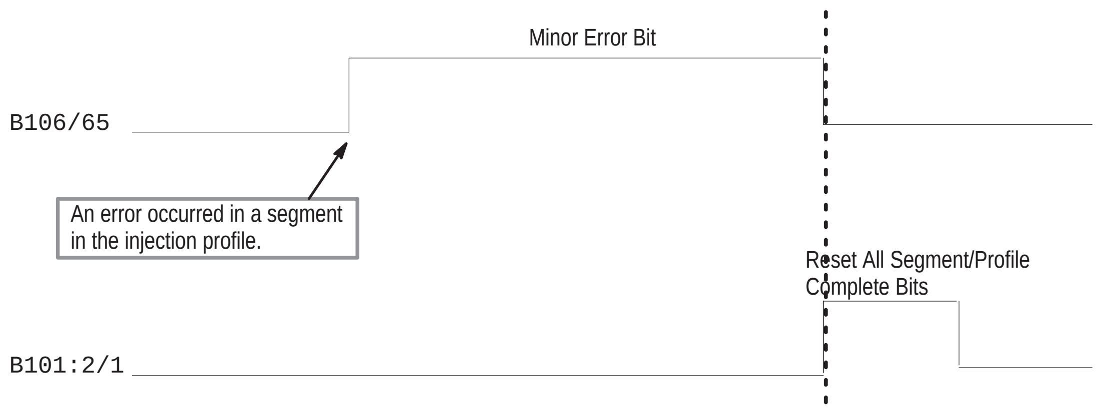
Description	Fault Codes Found in File S:6	Probable Cause	Corrective Action
Profile Engineering Actuals Bad	0xac	N111, N115, N119... profile engineering actuals file not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Use N103:16, N103:29, or N103:42 to find the offending profile.
Profile ERC2 Memory File Bad	0xad	F112, F116, F120... profile ERC2 memory file not found or too short	**1.** Look in N103 to determine if problem is on inject, clamp, or eject. **2.** Use N103:16, N103:29, or N103:42 to find the offending profile.
Wrong Processor Type	0xae	Processor is not an L54xP	You might have a normal L54x processor. Pro-Set 200 requires a L542P processor.
Invalid Profile Count	0xaf;	N100:1, N100:3, or N100:5 contains an invalid value	Look in N103 to determine if problem is on inject, clamp, or eject.
Invalid JSR to ERC Subroutine	0xb0	ERC2 update subroutine (JSR254) has been called again before completing the first time	**1.** Remove JSR 255 from any DII or Main scan ladder files. **2.** Call this subroutine only from the STI.
Wrong OS Firmware	0xC0	Pro-Set 200 operating system is not installed in SLC 5/04P processor	Obtain an SLC 5/04P processor with Pro-Set 200 firmware extensions.

0000 0000 0000 0010

bit 1

Minor Error Bit

The minor error bit indicates a segment in one of the phase profiles has a minor error condition. For example, the following diagram shows how the minor error bit works on the injection profile.



The following minor error conditions are reported through file N103.

Description	N103:18, N103:31, or N103:44 Detail Value	Probable Cause	Corrective Action
Invalid Profile Number	1	N103:19, 32, 45 contain invalid values	Remove any writes to N103:19, 32, or 45. Do not alter these values from ladder program or Data Highway.
Zero Gain	2	F107:4,10, F147:4,10, or F187:4,10 are zero	Remove any writes to these locations from the ladder program.
Not Deadhead Segment	3	N104:3,4, N144:3,4, or N184:3,4 refer to a segment that appears not to be a deadheaded pressure segment	Change ladder program to place the identifiers for a deadheaded pressure segment in these fields. The profile ID field (N104:3) uses the same bit pattern as the permit bit for that profile. For example, the hold profile is binary 00000100 or Decimal 4.
Invalid Deadhead Segment	4	N104:4, N144:4, or N184:4 contain a segment number larger than the number of segments in the profile	Change ladder program to place the correct segment number in this field. The first segment of a profile is segment 1.
Invalid Segment State	5	N103:21, 34, or 47 are invalid	Remove any ladder program or Data Highway writes to these locations.
Invalid Segment Number	6	N103:21, 33, or 46 are invalid	Remove any ladder program or Data Highway writes to these locations.
Invalid Profile Link	7	Profiles are linked in a a circle	**1.** Examine link ID words. **2.** Remove links to any earlier profile. For example, remove any link from hold to inject.
Improper call to ERC SUBR 253	8	Invalid call to ERC subroutine 253	Remove calls to JSR 253
Improper Data File configuration	1000 — 1256	ERC data table file not found or too short	Subtract 1000 from error detail value. This value yields the offending file number. For example, if the error detail value is 1109, the inject profile setpoint file N109 is not configured properly.

0000 0000 0000 **1**000

bit 3

Segment Needs OLT Bit

This bit, when set, indicates that you need to run an open loop test so that ERC2 can identify the system dynamics.

Profile setpoint word 0, bit 12 enables the open loop test. If this alarm remains set after an open loop test is performed, check the phase setpoint file (N104, N144, and N184).

This bit is:	When:
set (ON)	process dynamics are not identified during an open loop test
reset (OFF)	the reset all segment done bits are pulsed, or valid open loop test performed This bit remains reset (OFF) until you run an open loop test.

0000 0000 0001 0000

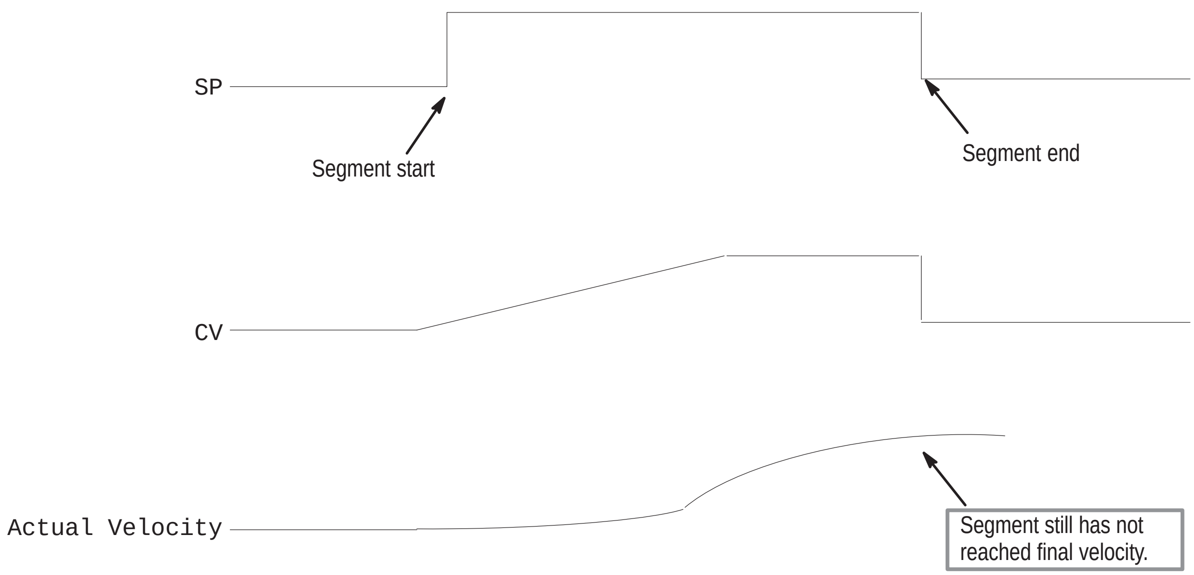
bit 4

Segment Too Short Bit

This bit, when set, indicates that the segment was not long enough for the machine to achieve the segment setpoint. Pro-Set 200 does not learn optimal CV values for segments that are too short to reach a steady state.

To correct a segment too short condition, do the following:

- ensure the segment has a valid open loop test
- reduce velocity and/or pressure setpoints
- lengthen segment time or position



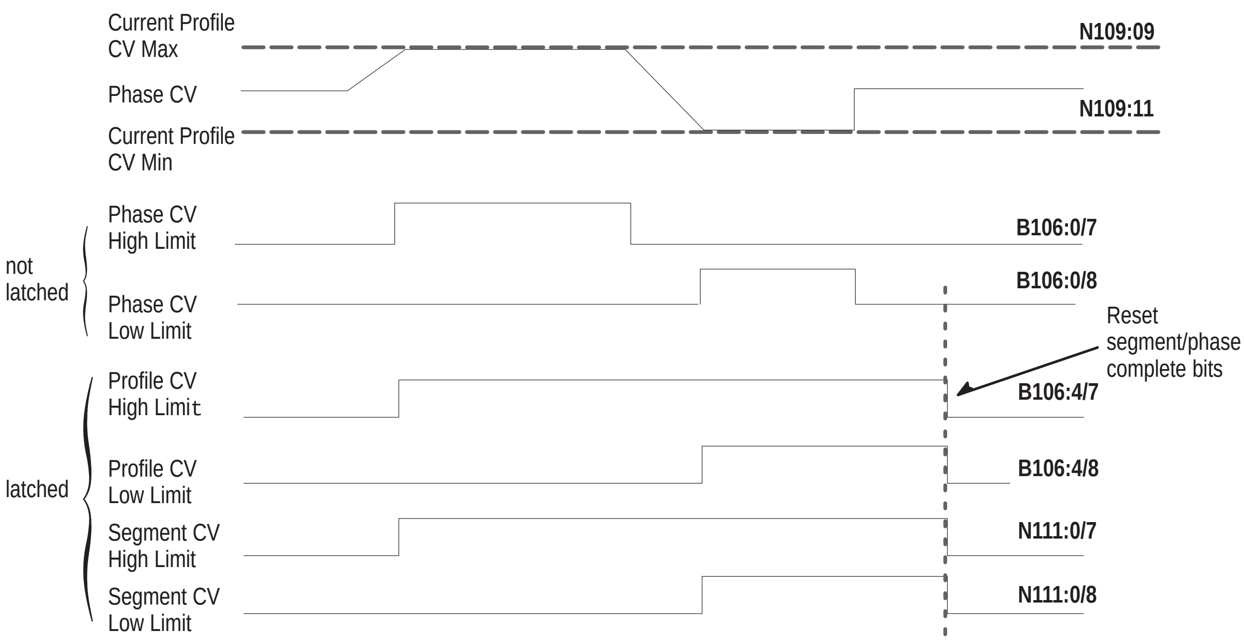
This bit is:	When:
set (ON)	a segment is unable to reach its final velocity in the allotted time
reset (OFF)	you use the reset all segment/phase complete bit

0000 0001 1110 0000

bits 5, 6, 7 and 8

High and Low psi and Velocity CV Alarms

These bits indicate that the ERC2 algorithm has calculated a control output that exceeds a CV minimum or CV maximum limit setpoint. The control output has been restricted to the CV limits (e.g., N109:8 and N109:10).

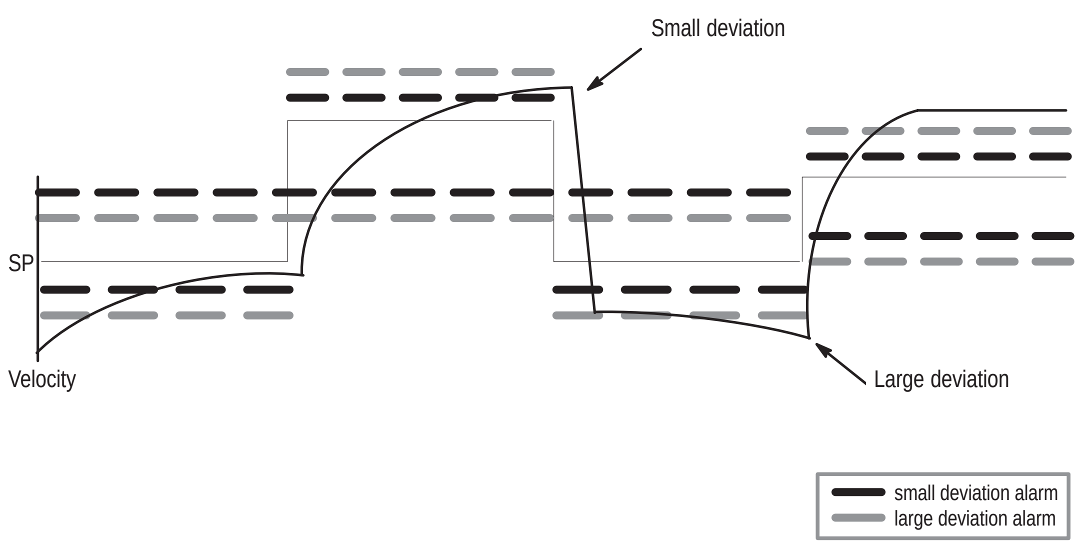


0000 0110 0000 0000

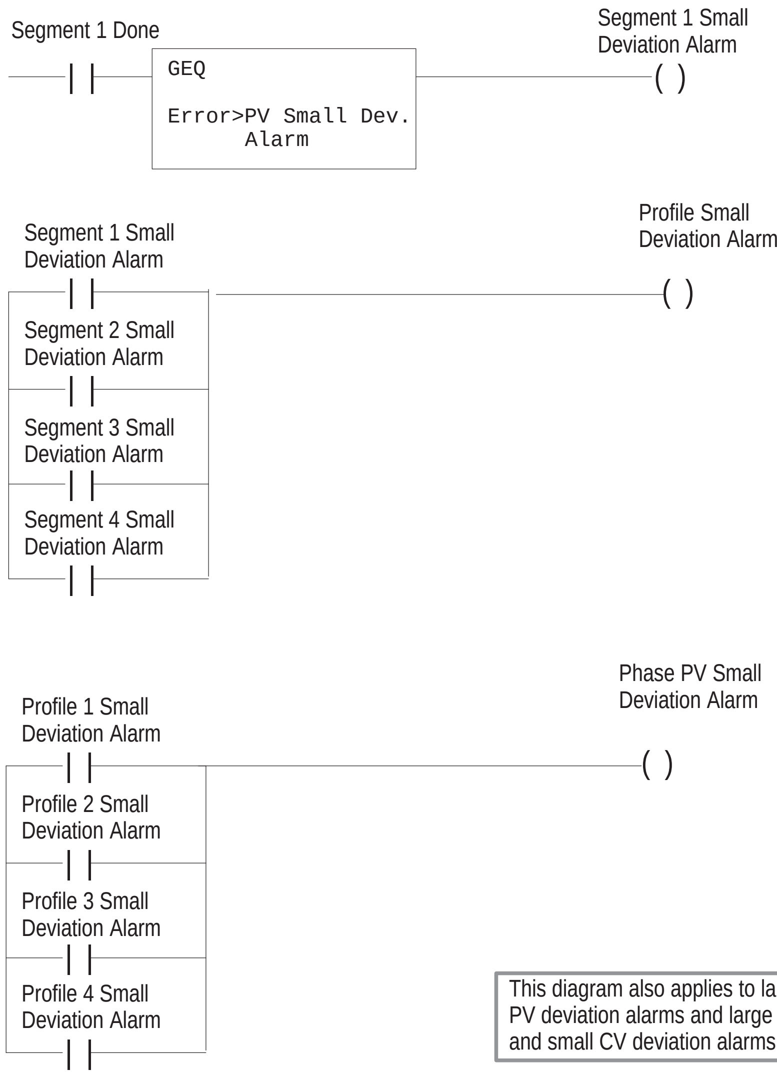
bits 9 and 10

PV Small and Large Deviation Alarms

These bits indicate that the actual velocity or pressure differs from the setpoint. PV deviations are specified in the phase-wide setpoint tables (N104:16–19, N144:16–19, N184:16–19).



The following diagram shows the ladder equivalent of small PV deviation alarms.



This diagram also applies to large PV deviation alarms and large and small CV deviation alarms.

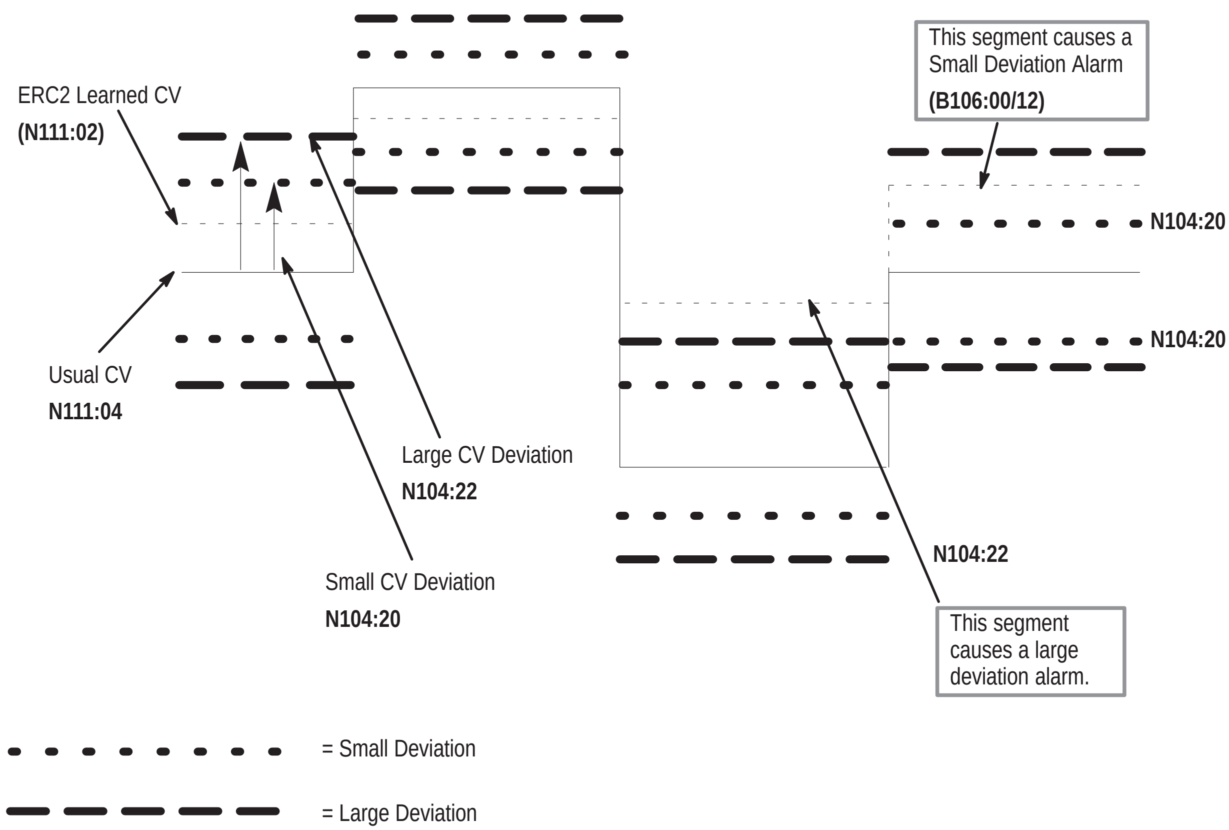
0001 1000 0000 0000

bits 11 and 12

CV Small and Large Deviation Alarms

These bits indicate that the valve setting required to obtain the profile setpoint have changed from the usually required values. This may be due to wear, temperature, or viscosity changes. The CV deviation band is set in the phase-wide setpoint table (N104:20–24, N144:20–24, N184:20–24).

To set the usual CV, when the process is running well, set B101:2/4 for injection (CV deviation band) for at least one STI period.



Understanding SLC 5/04P Processor Addresses

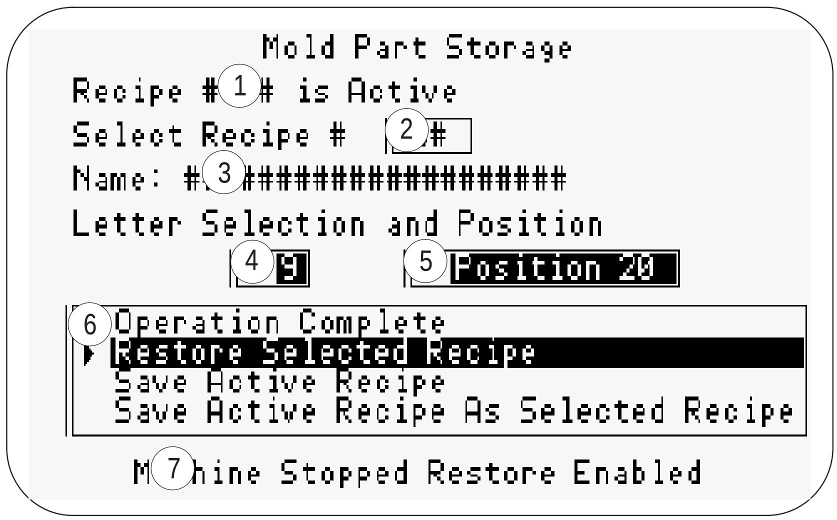
What's in This Appendix?

Use this appendix to become familiar with SLC 5/04P processor addresses for all Pro-Set 200 screens.

Operator Screens

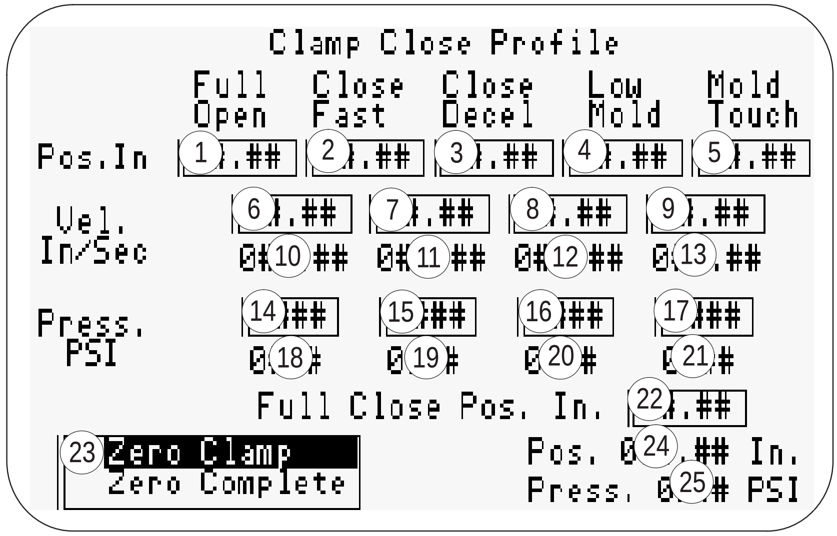
Mold Part Storage Screen

This field:	Is located in:
1	N88:16
2	N88:17
3	N88:20/00
4	N88:15
5	N88:14
6	N88:13
7	N88:18



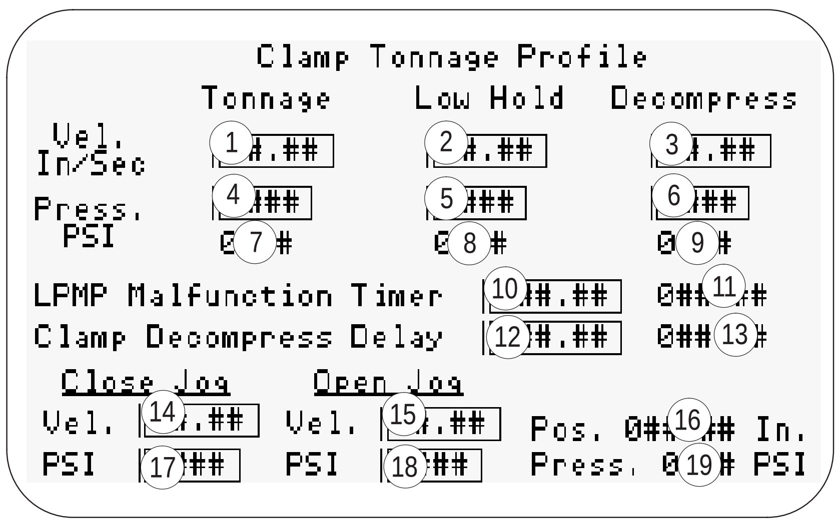
Clamp Close Profile Screen

This field:	Is located in:	This field:	Is located in:
1	N169:56	14	N149:31
2	N149:32	15	N149:39
3	N149:40	16	N149:47
4	N149:48	17	N153:31
5	N153:32	18	N150:07
6	N149:30	19	N150:11
7	N149:38	20	N150:15
8	N149:46	21	N154:07
9	N153:30	22	N92:07
10	N150:06	23	N83:13/14
11	N150:10	24	N145:00
12	N150:14	25	N92:07
13	N154:06		



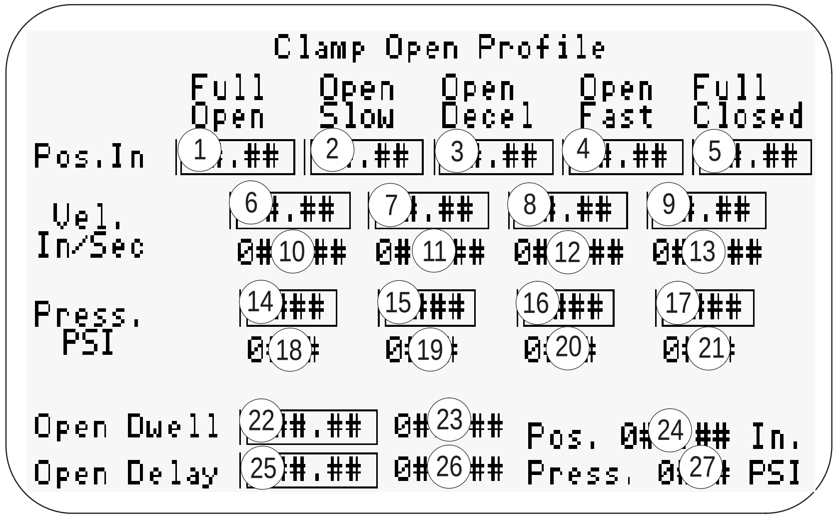
Clamp Tonnage Screen

This field:	Is located in:	This field:	Is located in:
1	N157:30	11	T4:05.ACC
2	N161:30	12	T4:14.PRE
3	N165:30	13	T4:14.ACC
4	N157:31	14	N149:06
5	N161:31	15	N169:06
6	N165:31	16	N145:00
7	N158:07	17	N145:07
8	N162:07	18	N169:07
9	N166:07	19	N145:01
10	T4:05.PRE		



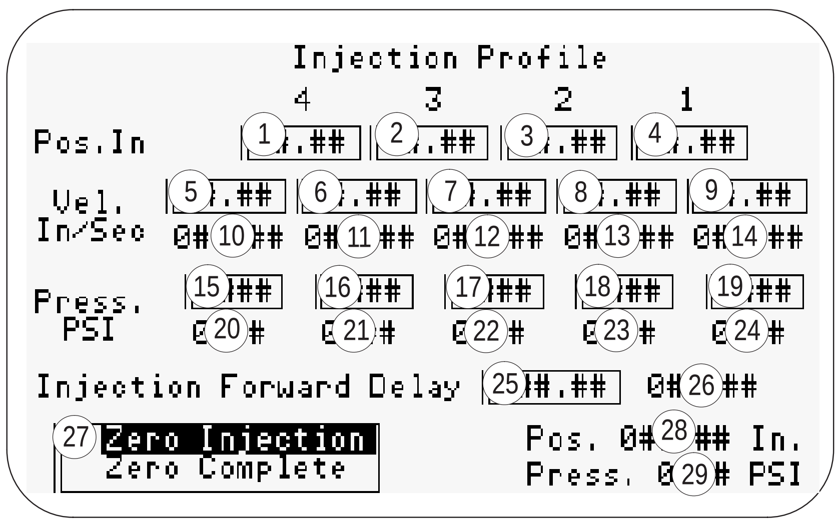
Clamp Open Profile Screen

This field:	Is located in:	This field:	Is located in:
1	N169:56	15	N169:47
2	N169:48	16	N169:39
3	N169:40	17	N169:31
4	N169:32	18	N170:19
5	N92:07	19	N170:15
6	N169:54	20	N170:11
7	N169:46	21	N170:07
8	N169:38	22	T4:01.PRE
9	N169:30	23	T4:01.ACC
10	N170:18	24	N145:00
11	N170:14	25	T4:16.PRE
12	N170:10	26	T4:16.ACC
13	N170:06	27	N145:01
14	N169:55		



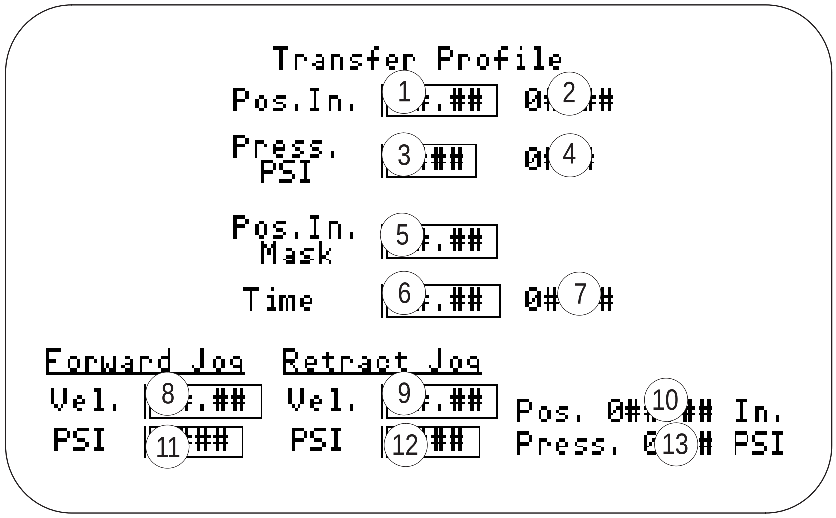
Injection Profile Screen

This field:	Is located in:	This field:	Is located in:
1	N109:56	16	N109:55
2	N109:48	17	N109:47
3	N109:40	18	N109:39
4	N109:32	19	N109:31
5	N109:62	20	N110:23
6	N109:54	21	N110:19
7	N109:46	22	N110:15
8	N109:38	23	N110:11
9	N109:30	24	N110:07
10	N110:22	25	T4:15.PRE
11	N110:18	26	T4:15.ACC
12	N110:14	27	N82:13/14
13	N110:10	28	N105:00
14	N110:06	29	N105:01
15	N109:63		



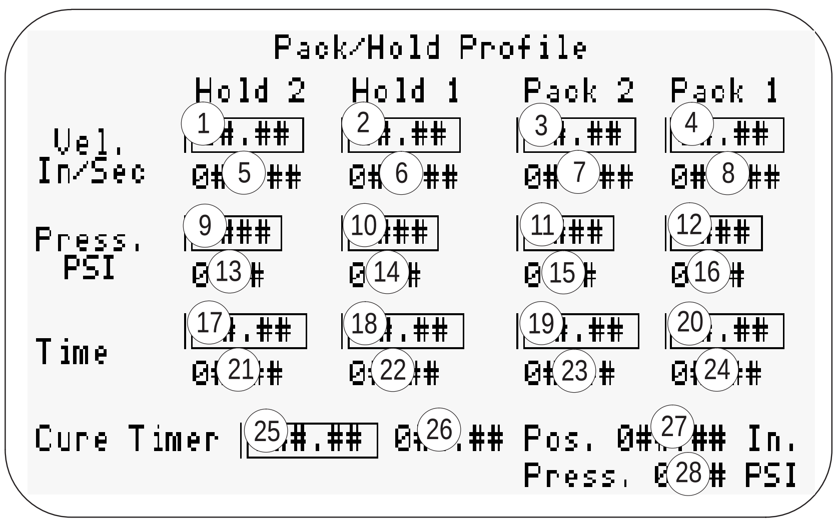
Transfer Profile Screen

This field:	Is located in:
1	N109:18
2	N110:00
3	N109:19
4	N110:01
5	N109:21
6	N109:20
7	N110:02
8	N109:06
9	N129:06
10	N105:00
11	N109:07
12	N129:07
13	N105:01



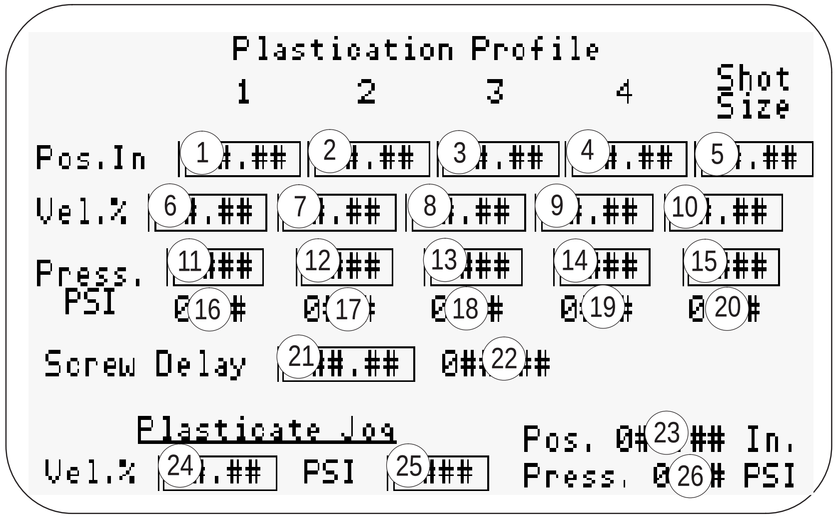
Pack/Hold Profile Screen

This field:	Is located in:	This field:	Is located in:
1	N117:38	15	N114:11
2	N117:30	16	N114:07
3	N113:38	17	N117:41
4	N113:30	18	N114:33
5	N118:10	19	N117:41
6	N118:06	20	N113:33
7	N114:10	21	N118:13
8	N114:06	22	N118:09
9	N117:39	23	N114:13
10	N117:31	24	N114:09
11	N113:39	25	T4:2.PRE
12	N113:31	26	T4:2.ACC
13	N118:11	27	N105:00
14	N118:07	28	N105:01



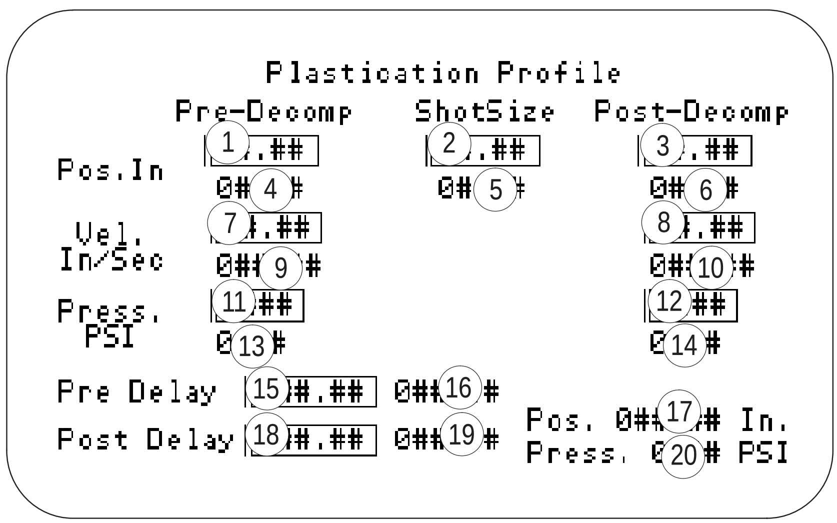
Plastication Profile Screen 1

This field:	Is located in:	This field:	Is located in:
1	N125:32	14	N125:55
2	N125:40	15	N126:63
3	N125:48	16	N126:07
4	N125:56	17	N126:11
5	N125:28	18	N126:15
6	N125:30	19	N126:19
7	N125:38	20	N126:23
8	N125:46	21	T4:11.PRE
9	N125:54	22	T4:11.ACC
10	N125:62	23	N105:00
11	N125:31	24	N125:06
12	N125:39	25	N125:07
13	N125:49	26	N105:01



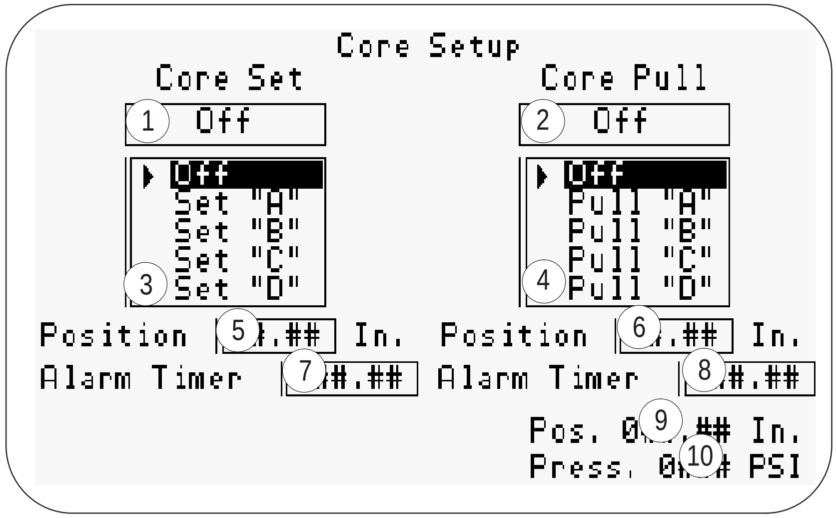
Plastication Profile Screen 2

This field:	Is located in:	This field:	Is located in:
1	N121:32	11	N121:31
2	N125:32	12	N121:31
3	N182:17	13	N122:07
4	N122:08	14	N130:07
5	N126:00	15	T4:9.PRE
6	N130:08	16	T4:9.ACC
7	N121:30	17	N105:00
8	N129:30	18	T4:10.ACC
9	N122:06	19	T4:10:ACC
10	N130:06	20	N105:01



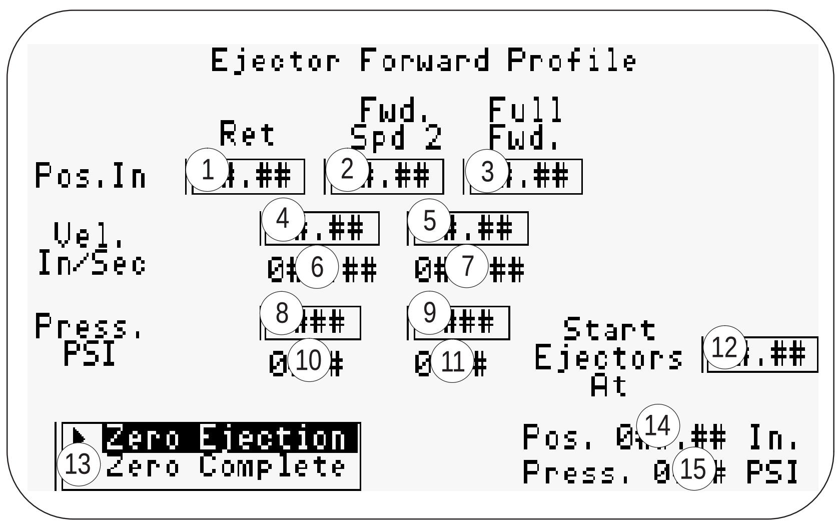
Core Selections Screen

This field:	Is located in:
1	B3:18
2	B3:19
3	B3:18
4	B3:19
5	N92:04
6	N92:03
7	T4:17:PRE
8	T4:18:PRE
9	N145:00
10	N145:01



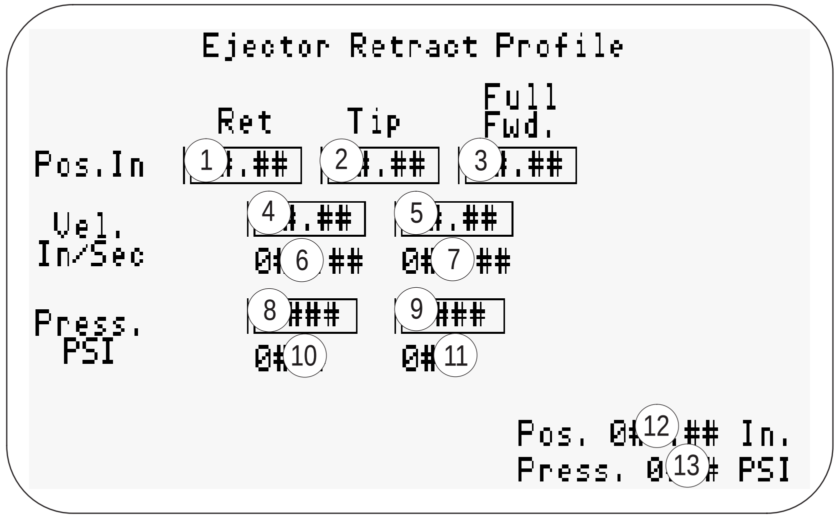
Ejector Forward Screen

This field:	Is located in:	This field:	Is located in:
1	N193:32	9	N189:39
2	N189:32	10	N190:07
3	N189:40	11	N190:11
4	N189:30	12	N92:05
5	N193:38	13	N84:13/14
6	N190:06	14	N185:00
7	N190:10	15	N185:01
8	N189:31		



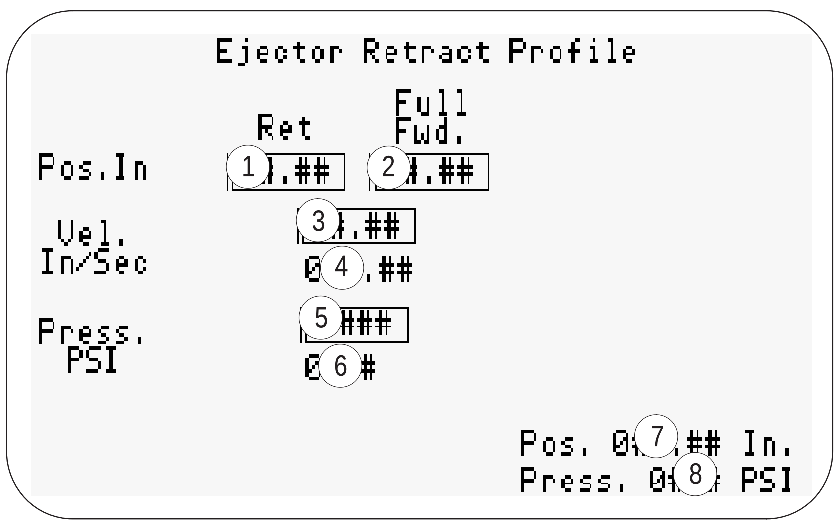
Ejector Retract Screen 1

This field:	Is located in:
1	N193:32
2	N197:32
3	N189:40
4	N193:30
5	N197:30
6	N194:06
7	N198:06
8	N193:31
9	N197:31
10	N194:07
11	N198:07
12	N185:00
13	N185:01



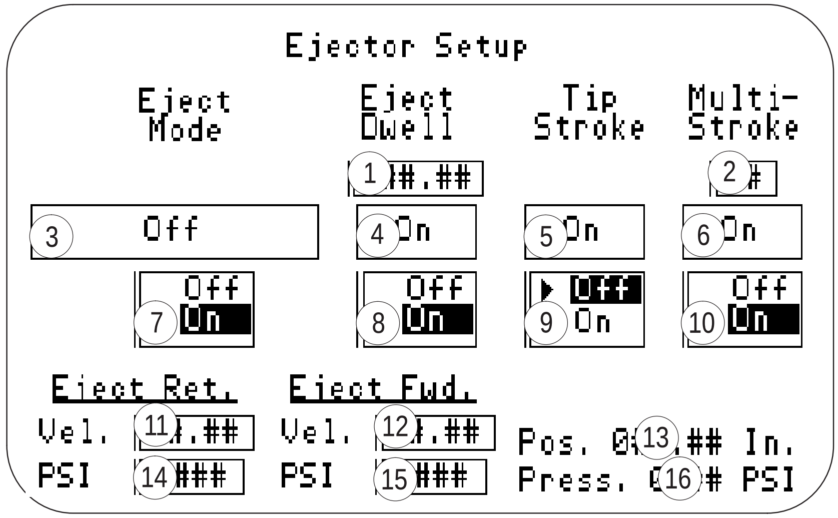
Ejector Retract Screen 2

This field:	Is located in:
1	N193:32
2	N189:40
3	N193:30
4	N194:06
5	N193:31
6	N194:07
7	N185:00
8	N185:01



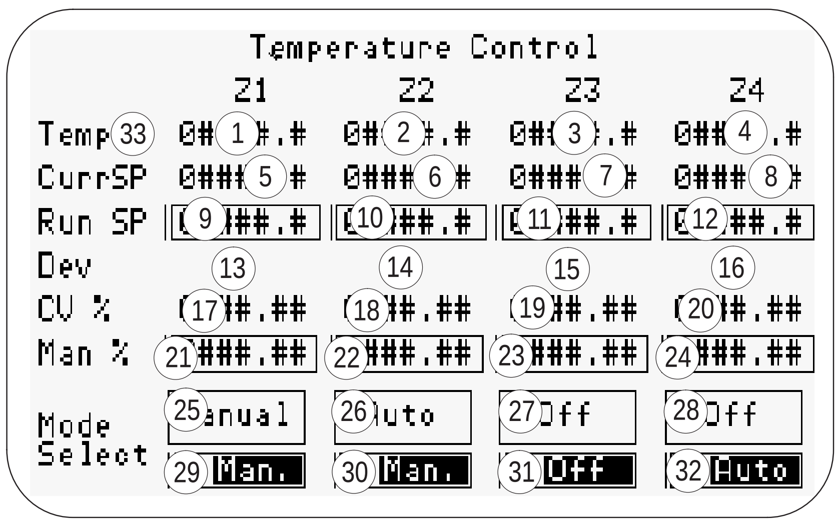
Ejector Selections Screen

This field:	Is located in:	This field:	Is located in:
1	T4:3.PRE	9	N92:01/05
2	N92:02	10	N92:01/04
3	N92:06	11	N193:06
4	N92:01/00	12	N189:06
5	N92:01/02	13	N189:07
6	N92:01/01	14	N193:07
7	N92:00	15	N189:07
8	N92:01/03	16	N185:01



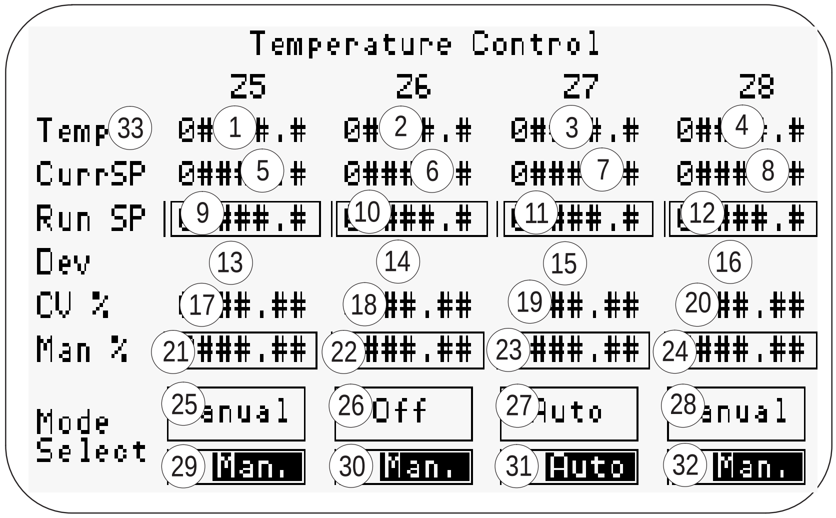
Temperature Control Screen 1

This field:	Is located in:	This field:	Is located in:
1	N95:24	17	N95:08
2	N95:25	18	N95:09
3	N95:26	19	N95:10
4	N95:27	20	N95:11
5	N95:00	21	N95:36
6	N95:01	22	N95:37
7	N95:02	23	N95:38
8	N95:03	24	N95:39
9	N95:28	25	N95:40
10	N95:29	26	N95:41
11	N95:30	27	N95:42
12	N95:31	28	N95:43
13	N95:32	29	N95:44
14	N95:33	30	N95:45
15	N95:34	31	N95:46
16	N95:35	32	N95:47
		33	N95:48/14



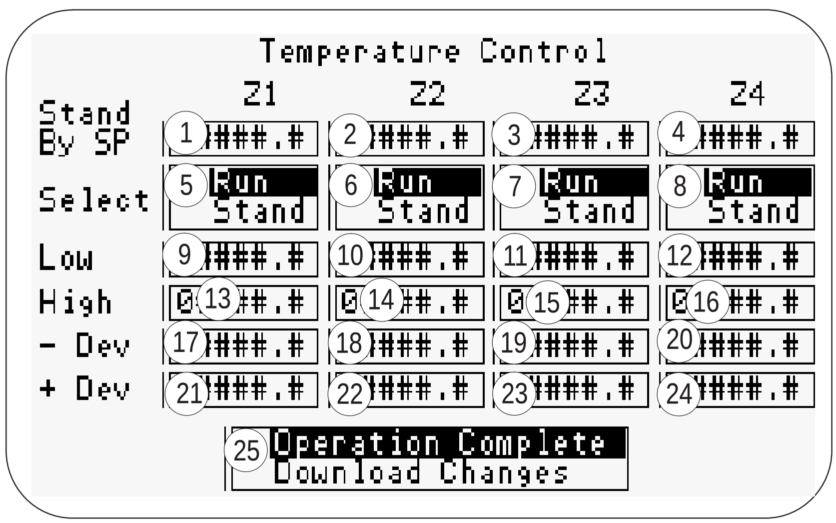
Temperature Control Screen 2

This field:	Is located in:	This field:	Is located in:
1	N96:24	17	N96:08
2	N96:25	18	N96:09
3	N96:26	19	N96:10
4	N96:27	20	N96:11
5	N96:00	21	N96:36
6	N96:01	22	N96:37
7	N96:02	23	N96:38
8	N96:03	24	N96:39
9	N96:04	25	N96:40
10	N96:29	26	N96:41
11	N96:30	27	N96:42
12	N96:31	28	N96:43
13	N96:32	29	N96:44
14	N96:33	30	N96:45
15	N96:34	31	N96:46
16	N96:35	32	N96:47
		33	N96:48/14



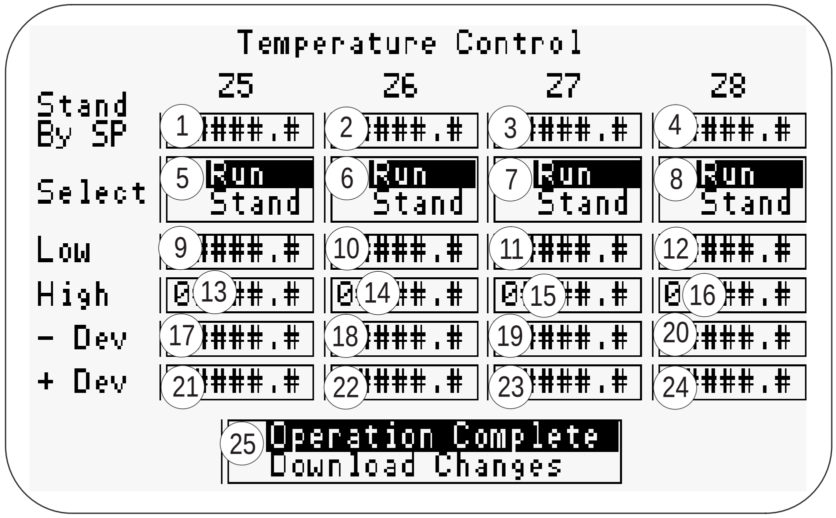
Temperature Control Screen 3

This field:	Is located in:	This field:	Is located in:
1	N93:05	14	N93:37
2	N93:30	15	N93:62
3	N93:55	16	N93:87
4	N93:80	17	N93:13
5	N95:48/01	18	N93:38
6	N95:48/02	19	N93:63
7	N95:48/03	20	N93:88
8	N95:48/04	21	N93:14
9	N93:11	22	N93:39
10	N93:36	23	N93:64
11	N93:61	24	N93:89
12	N93:86	25	N97:50
13	N93:12		



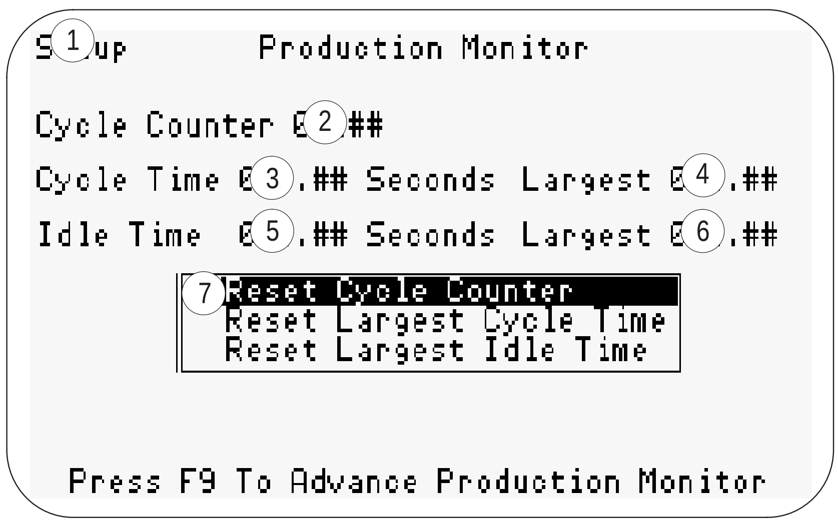
Temperature Control Screen 4

This field:	Is located in:	This field:	Is located in:
1	N94:05	14	N94:37
2	N94:30	15	N94:62
3	N94:55	16	N94:87
4	N94:80	17	N94:13
5	N96:48/01	18	N94:38
6	N96:48/02	19	N94:63
7	N96:48/03	20	N94:88
8	N96:48/04	21	N94:14
9	N94:11	22	N94:39
10	N94:36	23	N94:64
11	N94:61	24	N94:89
12	N94:86	25	N97:50
13	N94:12		



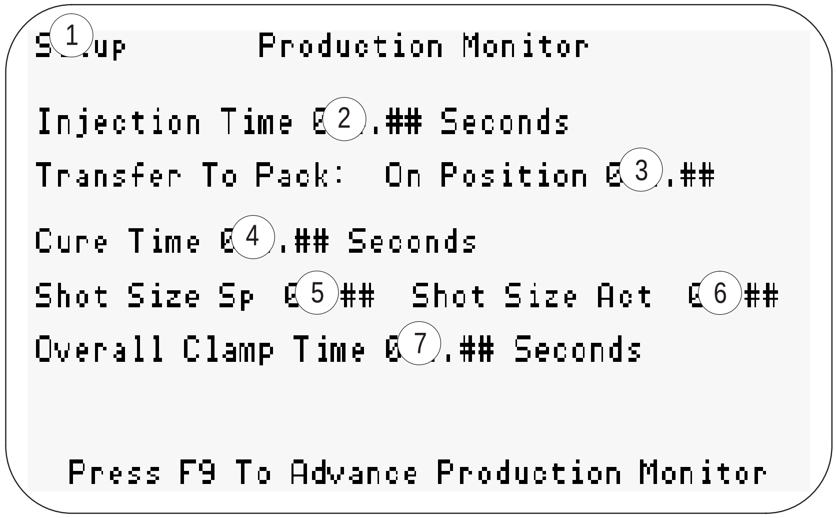
Production Monitor Screen 1

This field:	Is located in:
1	N80:00
2	N80:05
3	N80:00
4	N80:10
5	N80:07
6	N80:11
7	N80:06



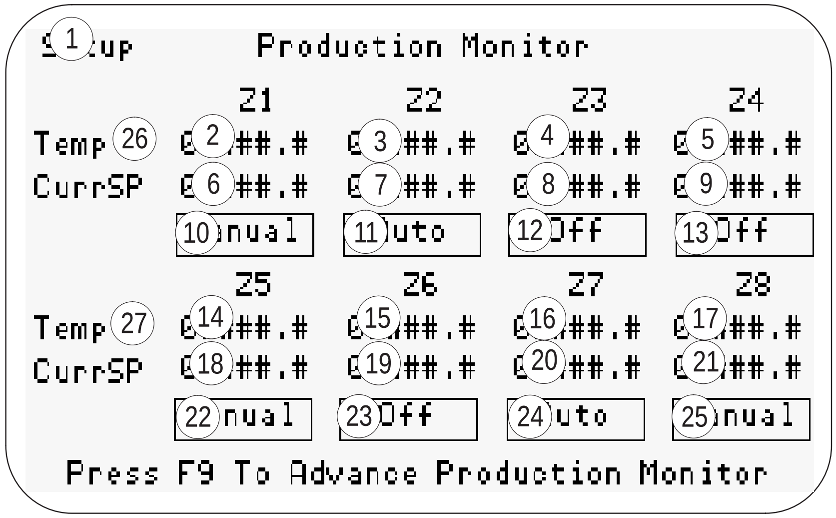
Production Monitor Screen 2

This field:	Is located in:
1	N80:09
2	N80:01
3	N80:08
4	N80:03
5	N125:18
6	N126:00
7	N80:04



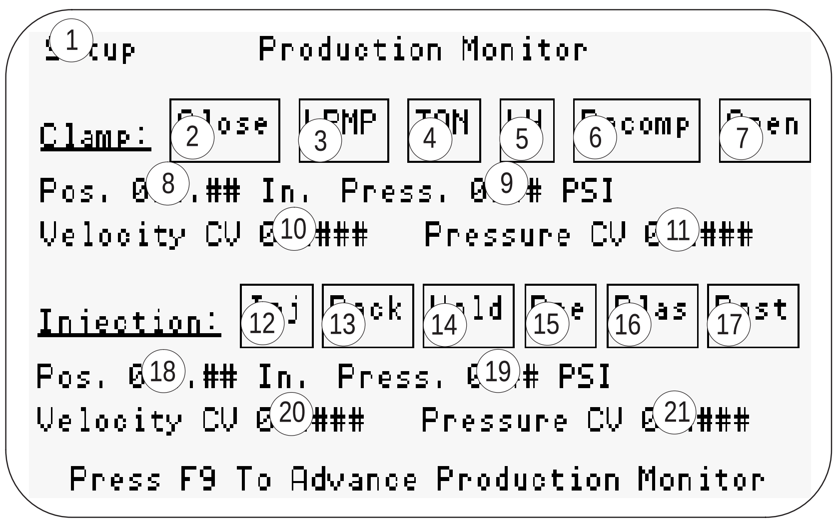
Production Monitor Screen 3

This field:	Is located in:	This field:	Is located in:
1	N80:09	14	N96:24
2	N95:24	15	N96:25
3	N95:25	16	N96:26
4	N95:26	17	N96:27
5	N95:27	18	N96:00
6	N95:00	19	N96:01
7	N95:01	20	N96:02
8	N95:02	21	N96:03
9	N95:03	22	N96:40
10	N95:40	23	N96:41
11	N95:41	24	N96:42
12	N95:42	25	N96:43
13	N95:43	26	N95:48/14
		27	N96:48:14



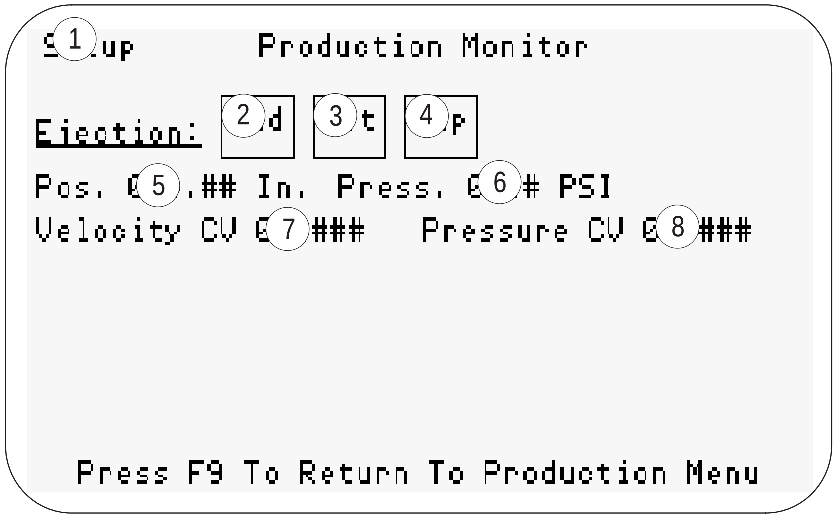
Production Monitor Screen 4

This field:	Is located in:
1	N80:09
2	N80:22
3	N80:23
4	N80:24
5	N80:25
6	N80:26
7	N80:27
8	N145:00
9	N145:01
10	N102:01
11	N102:04
12	N80:16
13	N80:17
14	N80:18
15	N80:19
16	N80:20
17	N80:21
18	N105:00
19	N105:01
20	N102:01
21	N102:02



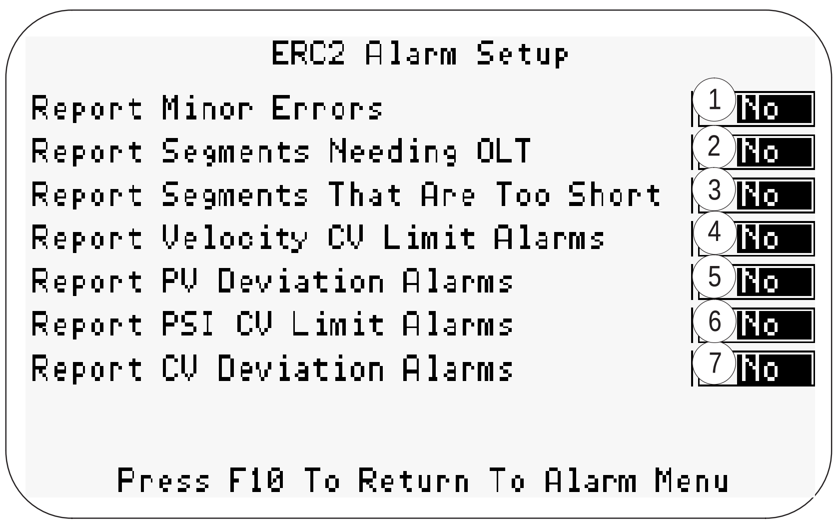
Production Monitor Screen 5

This field:	Is located in:
1	N80:09
2	N80:28
3	N80:29
4	N80:30
5	N185:00
6	N185:01
7	N102:05
8	N102:06



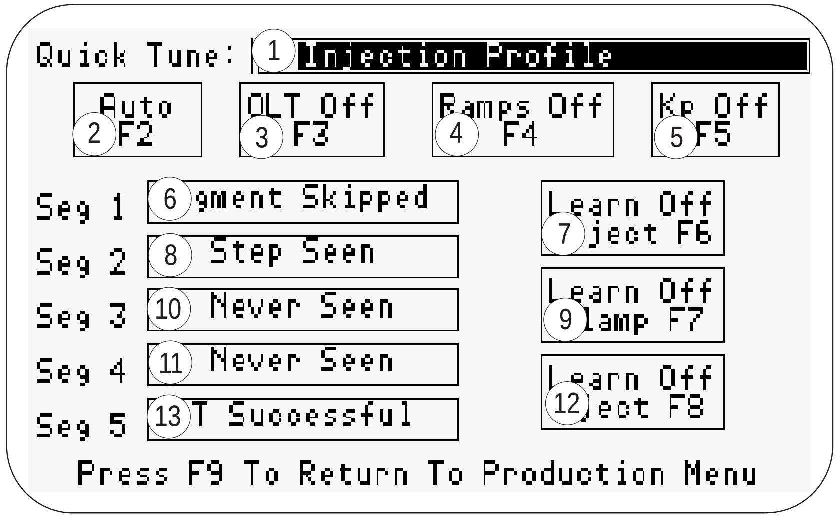
ERC2 Alarm Setup Screen

This field:	Is located in:
1	B14:0/01
2	B14:0/03
3	B14:0/04
4	B14:0/05
5	B14:0/06
6	B14:0/07
7	B14:0/08



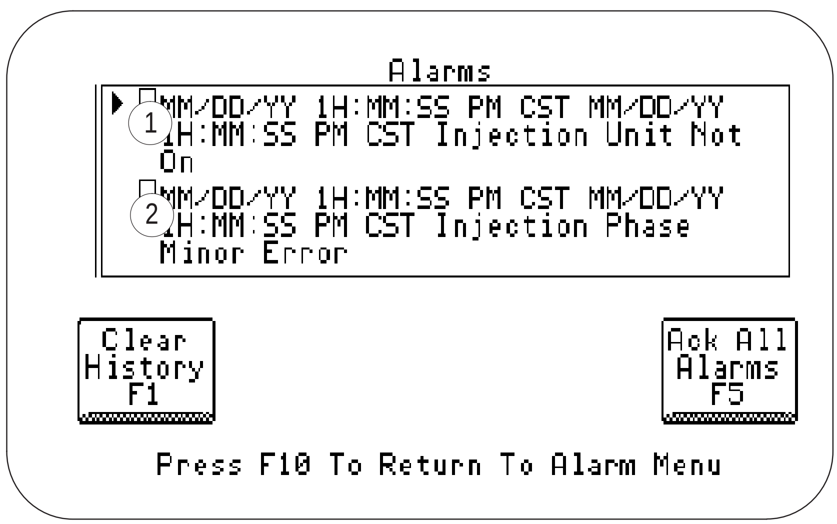
Quick Tune Screen

This field:	Is located in:
1	N81:00
2	N81:01/00
3	N81:01/01
4	N81:01/02
5	N81:01/03
6	N81:02
7	N81:01/13
8	N81:03
9	N81:01/14
10	N81:04
11	N81:05
12	N81:01/14
13	N81:06



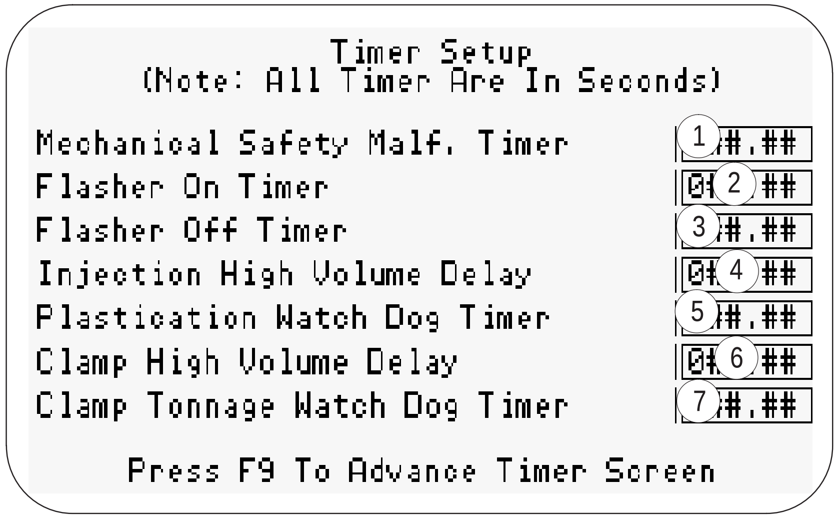
Alarm History Screen

This field:	Is located in:
1	Refer to files B11 and B12 in the Pro-Set 200 Data Table Reference Manual, publication 6500-6.4.4
2	



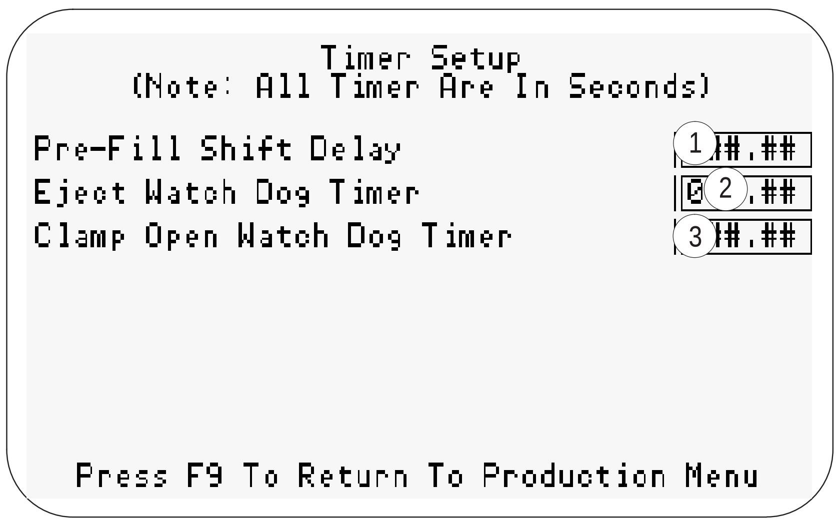
Timer Setup Screen 1

This field:	Is located in:
1	T4:4.PRE
2	T4:6.PRE
3	T4:7.PRE
4	T4:8.PRE
5	T4:12.PRE
6	T4:13.PRE
7	T4:0.PRE



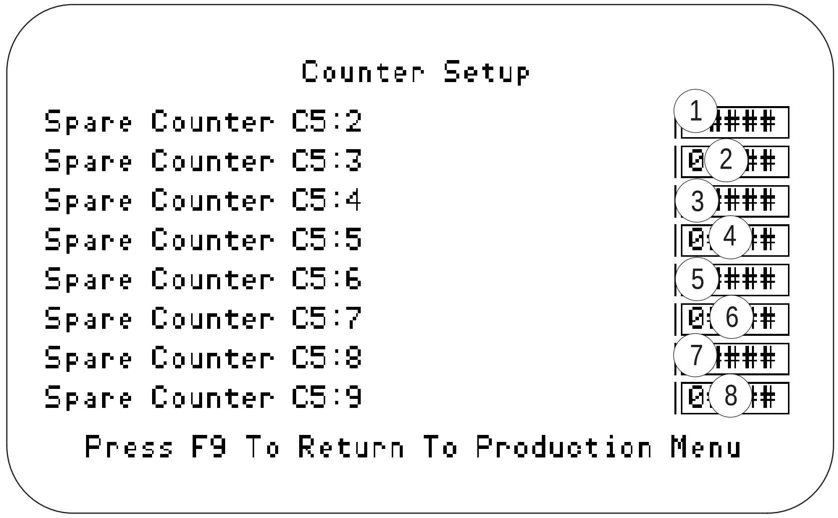
Timer Setup Screen 2

This field:	Is located in:
1	T4:21.PRE
2	T4:23.PRE
3	T4:24.PRE



Counter Setup Screen

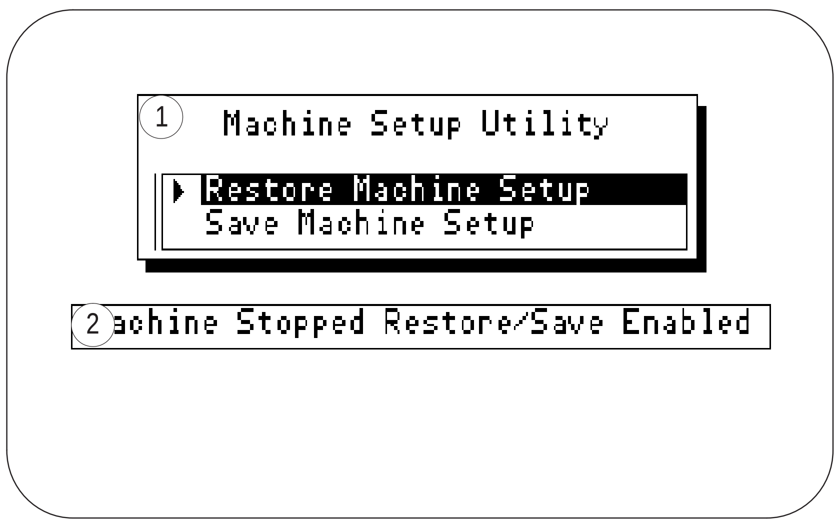
This field:	Is located in:
1	C5:02.PRE
2	C5:03.PRE
3	C5:04.PRE
4	C5:05.PRE
5	C5:06.PRE
6	C5:07.PRE
7	C5:08.PRE
8	C5:09.PRE



Setup Screens

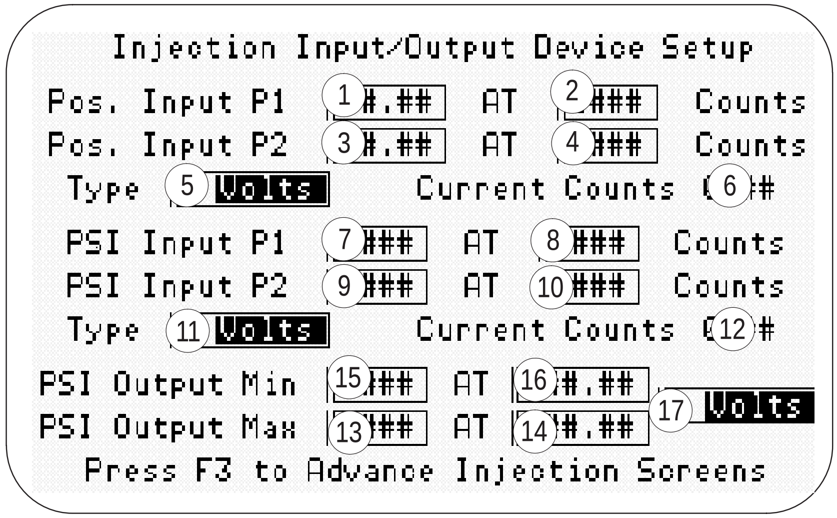
Machine Setup Utility Screen

This field:	Is located in:
1	N90:09
2	N90:00



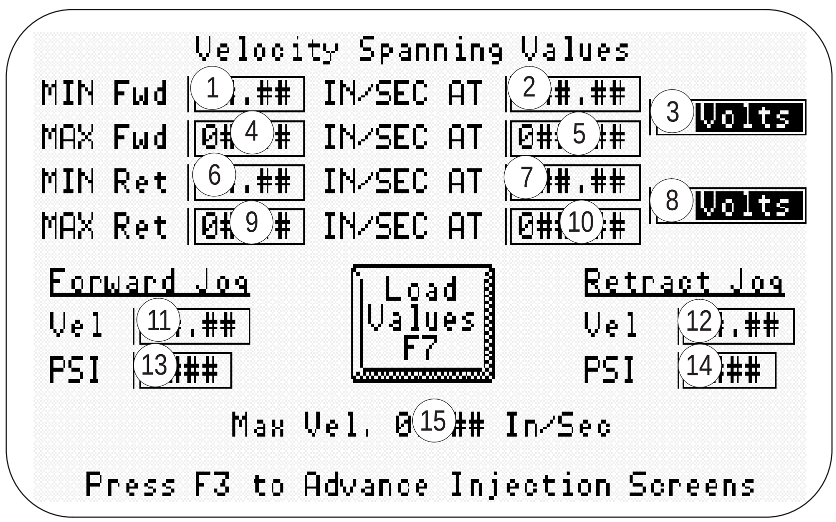
Injection Input/Output Device Setup Screen

This field:	Is located in:	This field:	Is located in:
1	N82:00	10	N82:08
2	N82:01	11	N82:13/01
3	N82:02	12	N82:09
4	N82:03	13	N82:18
5	N82:13/01	14	N82:19
6	N82:04	15	N82:13/02
7	N82:05	16	N82:20
8	N82:06	17	N82:21
9	N82:07		



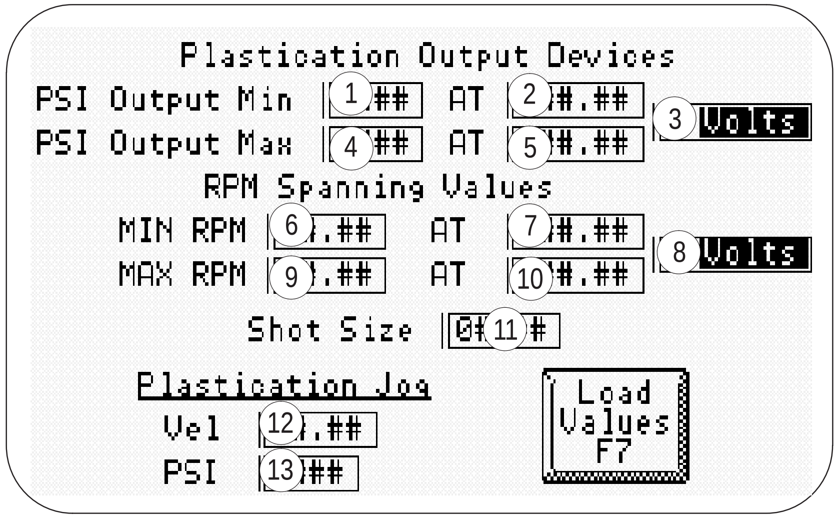
Velocity Spanning Values Screen 1

This field:	Is located in:	This field:	Is located in:
1	N82:22	9	N82:28
2	N82:23	10	N82:29
3	N82:13/03	11	N109:06
4	N82:24	12	N129:06
5	N82:25	13	N109:07
6	N82:26	14	N129:07
7	N82:27	15	N82:30
8	N82:13/04		



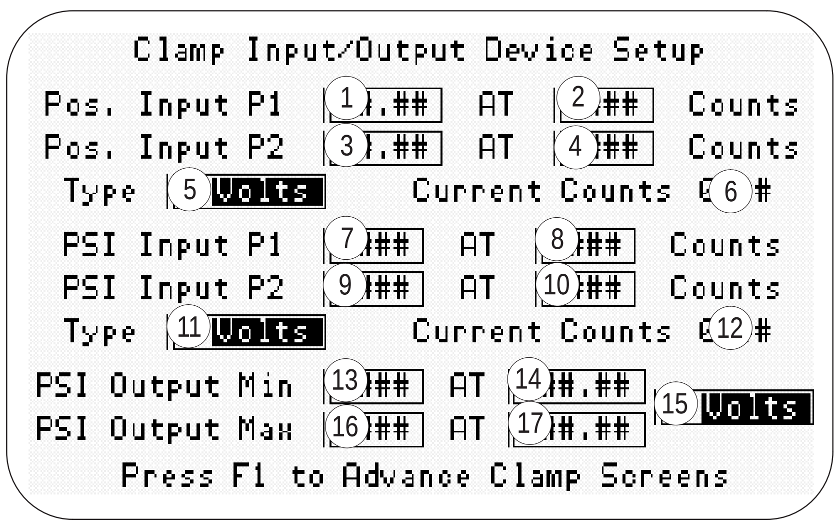
Plastication Sensor Nameplate Values Screen

This field:	Is located in:	This field:	Is located in:
1	N82:34	8	N82:13/06
2	N82:35	9	N82:36
3	N82:13/05	10	N82:37
4	N82:32	11	N125:08
5	N82:33	12	N125:06
6	N82:28	13	N125:07
7	N82:39		



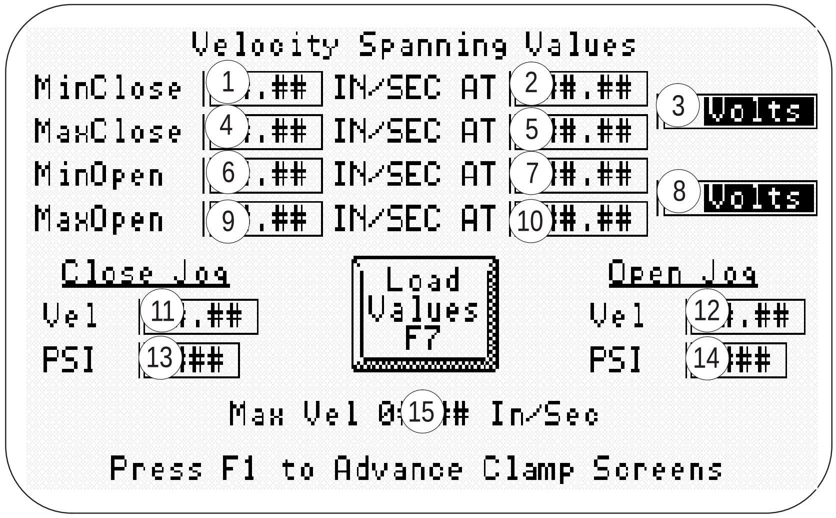
Clamp Input/Output Device Setup Screen

This field:	Is located in:	This field:	Is located in:
1	N83:00	10	N83:08
2	N83:01	11	N83:13/01
3	N83:02	12	N83:09
4	N83:03	13	N83:20
5	N83:13/00	14	N83:21
6	N83:04	15	N83:13/02
7	N83:05	16	N83:18
8	N83:06	17	N83:19
9	N83:07		



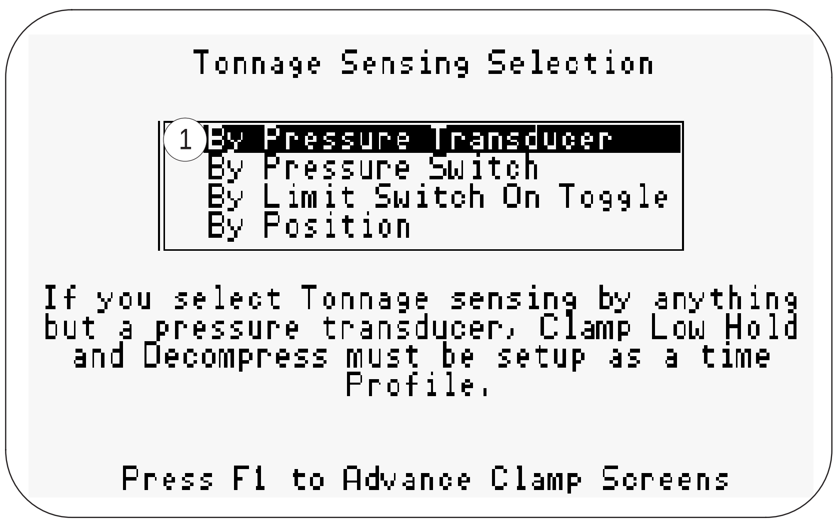
Velocity Spanning Values Screen 2

This field:	Is located in:	This field:	Is located in:
1	N83:22	9	N83:28
2	N83:23	10	N83:29
3	N83:13/03	11	N149:06
4	N83:24	12	N169:06
5	N83:25	13	N149:07
6	N83:26	14	N169:07
7	N83:27	15	N83:30
8	N83:13/04		



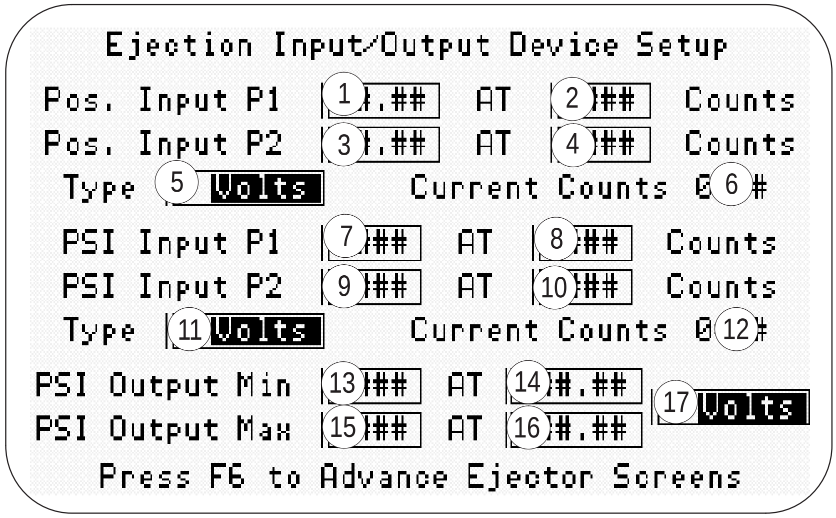
Tonnage Sensing Selection Screen

This field:	Is located in:
1	N83:17



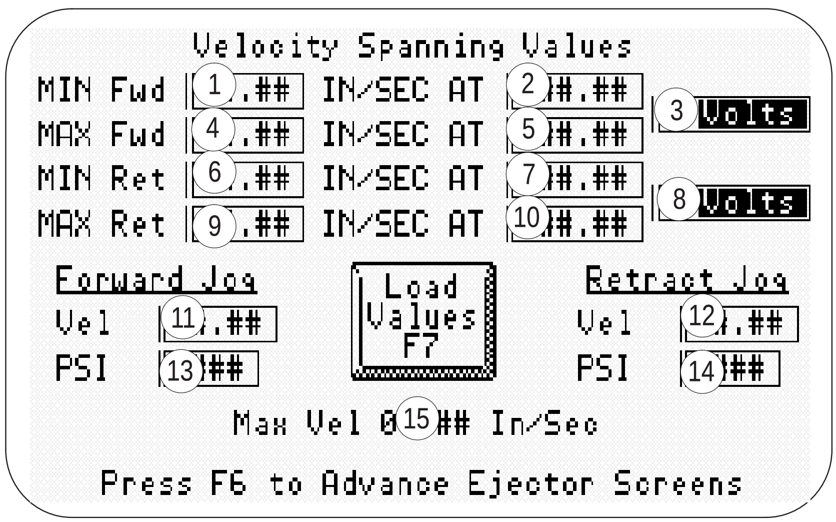
Ejection Input/Output Device Setup Screen

This field:	Is located in:	This field:	Is located in:
1	N84:00	10	N84:08
2	N84:01	11	N84:13/01
3	N84:02	12	N84:09
4	N84:03	13	N84:20
5	N84:13/00	14	N84:21
6	N84:04	15	N84:13/02
7	N84:05	16	N84:18
8	N84:06	17	N84:19
9	N84:07		



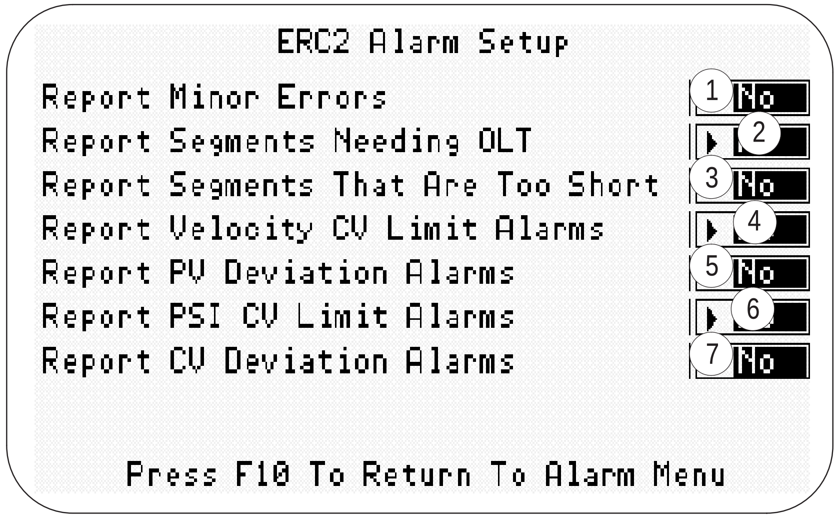
Velocity Spanning Values Screen 3

This field:	Is located in:	This field:	Is located in:
1	N84:22	9	N84:28
2	N84:23	10	N84:29
3	N84:13/03	11	N189:06
4	N84:24	12	N193:06
5	N84:25	13	N189:07
6	N84:26	14	N193:07
7	N84:27	15	N84:30
8	N84:13/04		



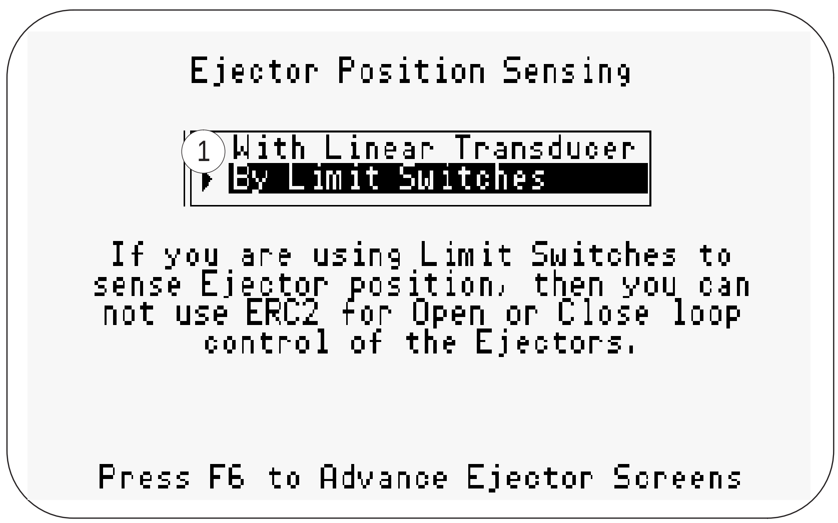
ERC2 Alarm Setup Screen

This field:	Is located in:
1	B14:00/01
2	B14:00/03
3	B14:00/04
4	B14:00/05
5	B14:00/07
6	B14:00/06
7	B14:00/08



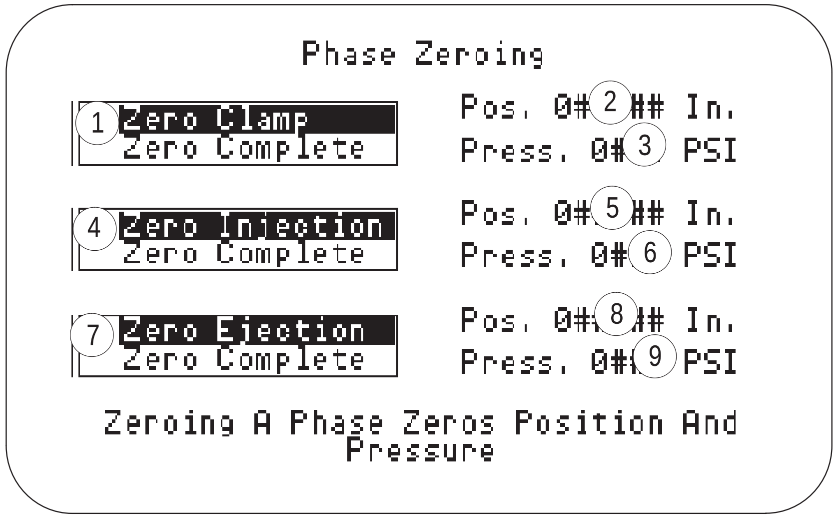
Ejector Position Sensing Screen

This field:	Is located in:
1	N84:13/11



Phase Zeroing Screen

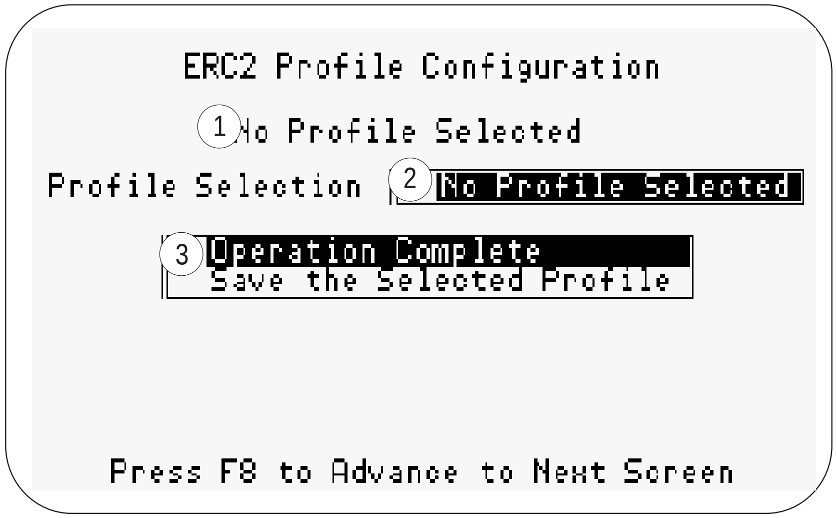
This field:	Is located in:
1	N83:13/14
2	N145:00
3	N145:01
4	N82:13/24
5	N105:00
6	N105:01
7	N84:13/14
8	N185:00
9	N185:01



Configuration Screens

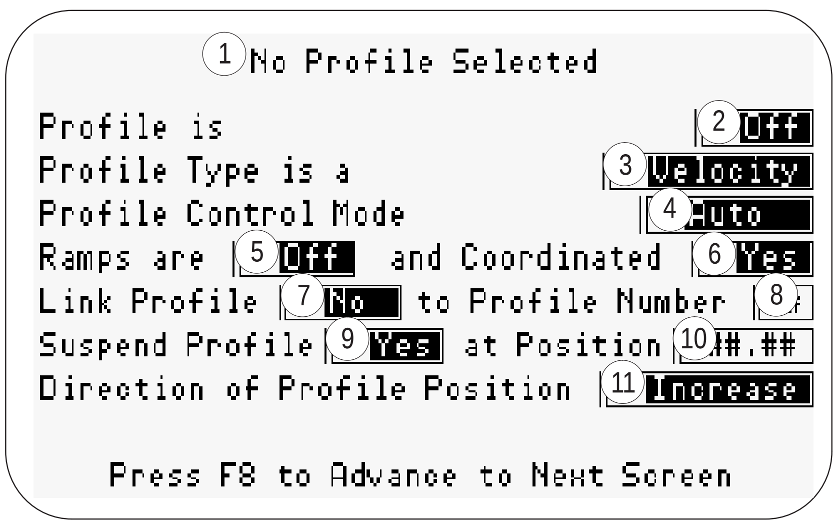
ERC2 Profile Configuration Screen

This field:	Is located in:
1	N90:07
2	N90:07
3	N90:06/01



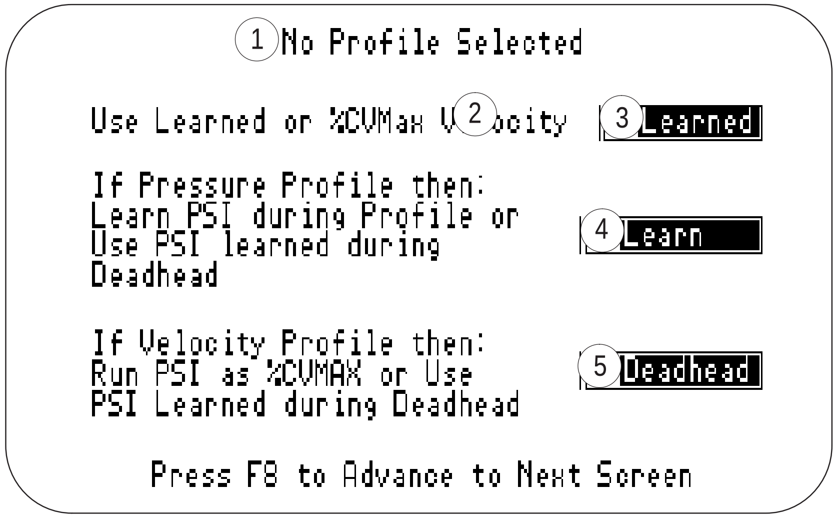
Profile Selection Screen

This field:	Is located in:
1	N90:07
2	N90:01/00
3	N90:01/01
4	N90:01/03
5	N90:01/07
6	N90:01/13
7	N90:01/08
8	N90:03
9	N90:01/09
10	N90:04
11	N90:01/10



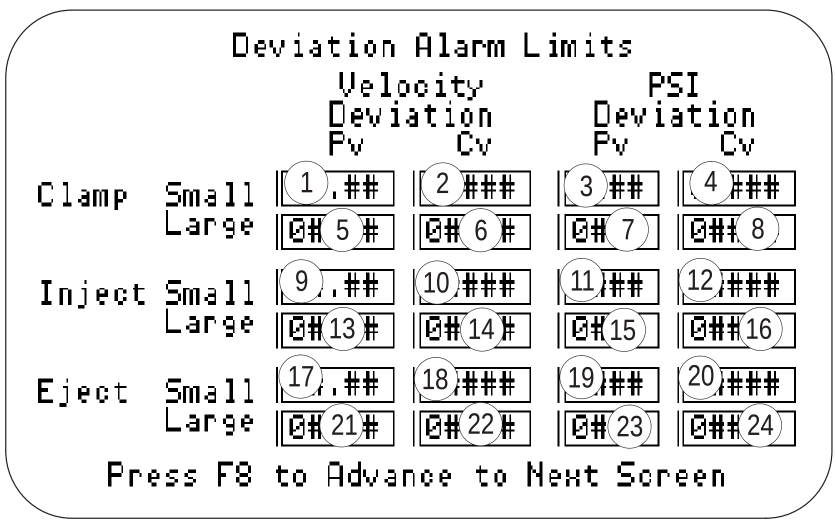
Profile Selected Screen 1

This field:	Is located in:
1	N90:07
2	N90:01/01
3	N:90:01/04
4	N90:01/05
5	N90:01/06



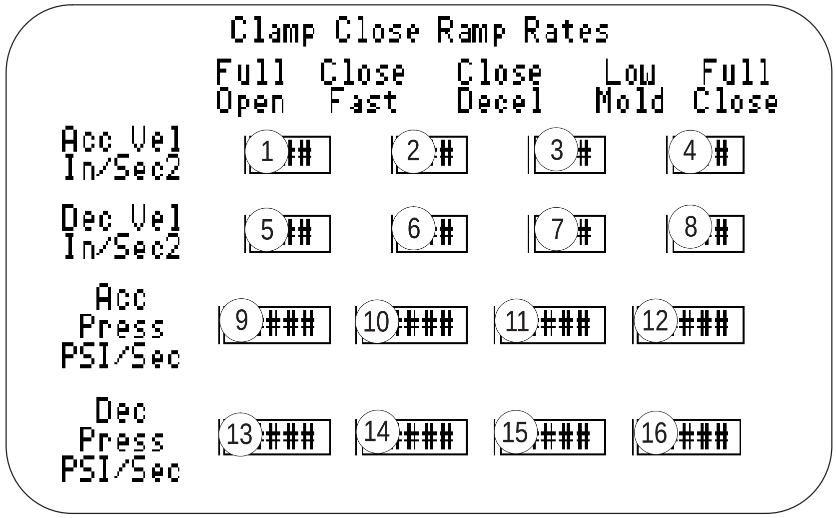
Profile Selected Screen 2

This field:	Is located in:	This field:	Is located in:
1	N144:16	13	N104:18
2	N144:20	14	N104:22
3	N144:17	15	N104:19
4	N144:21	16	N104:23
5	N144:18	17	N184:16
6	N144:22	18	N184:20
7	N144:19	19	N184:17
8	N144:23	20	N184:21
9	N104:16	21	N184:18
10	N104:20	22	N184:22
11	N104:17	23	N184:19
12	N104:21	24	N184:23



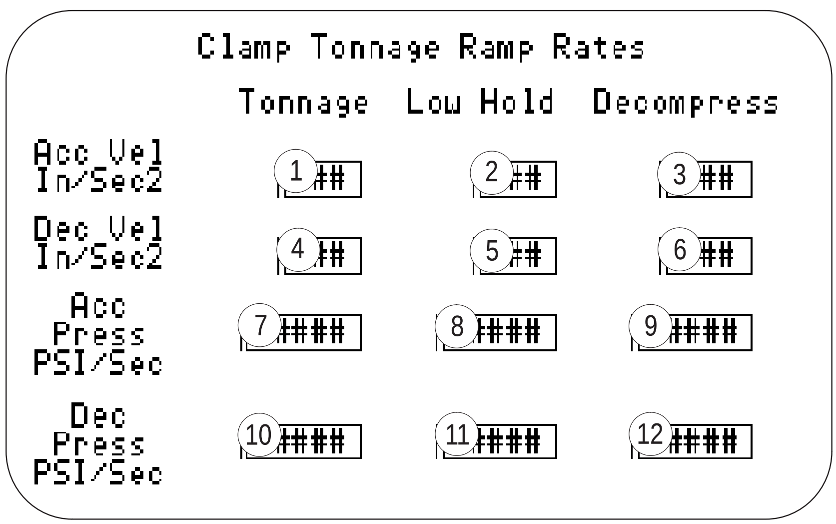
Clamp Close Ramp Rates Screen

This field:	Is located in:	This field:	Is located in:
1	N149:34	9	N149:36
2	N149:42	10	N149:44
3	N149:50	11	N149:52
4	N153:34	12	N153:36
5	N149:35	13	N149:37
6	N149:43	14	N149:45
7	N149:51	15	N149:53
8	N153:35	16	N153:37



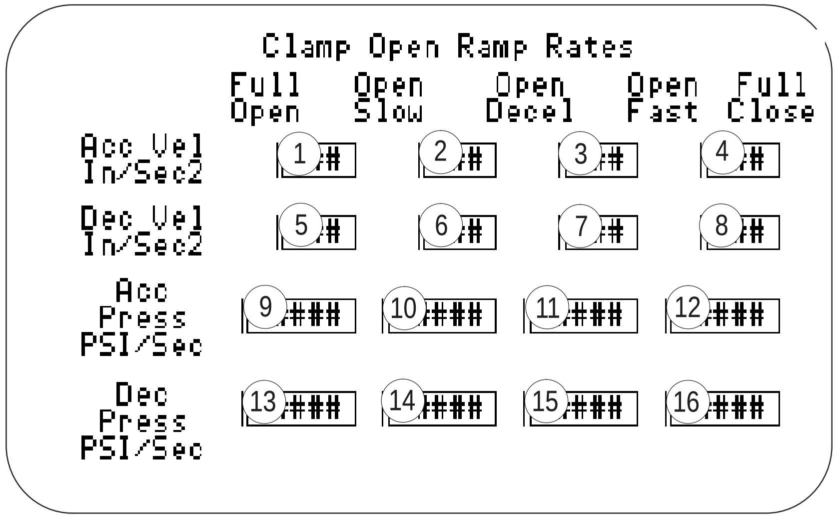
Clamp Tonnage Ramp Rates Screen

This field:	Is located in:
1	N157:34
2	N161:34
3	N165:34
4	N157:35
5	N161:35
6	N165:35
7	N157:36
8	N161:36
9	N165:36
10	N157:37
11	N161:37
12	N165:37



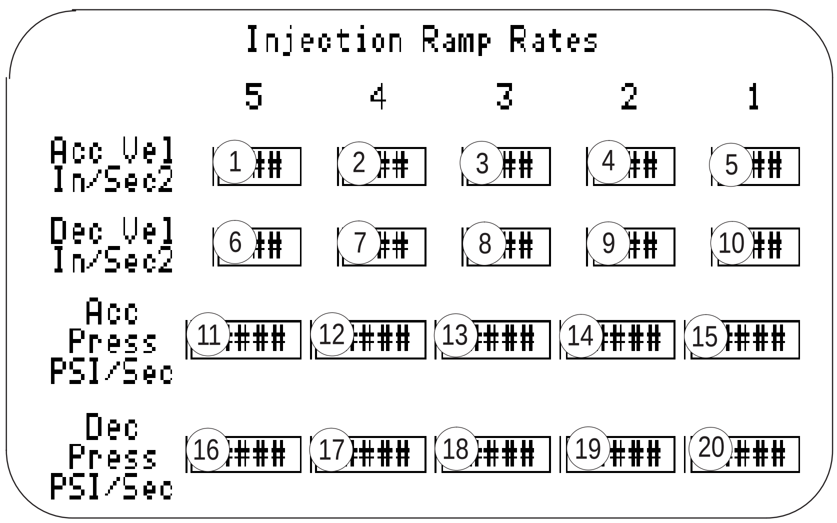
Clamp Open Ramp Rates Screen

This field:	Is located in:	This field:	Is located in:
1	N169:58	9	N169:60
2	N169:50	10	N169:52
3	N169:42	11	N169:44
4	N169:34	12	N169:36
5	N169:59	13	N169:61
6	N169:51	14	N169:53
7	N169:43	15	N169:45
8	N169:35	16	N169:37



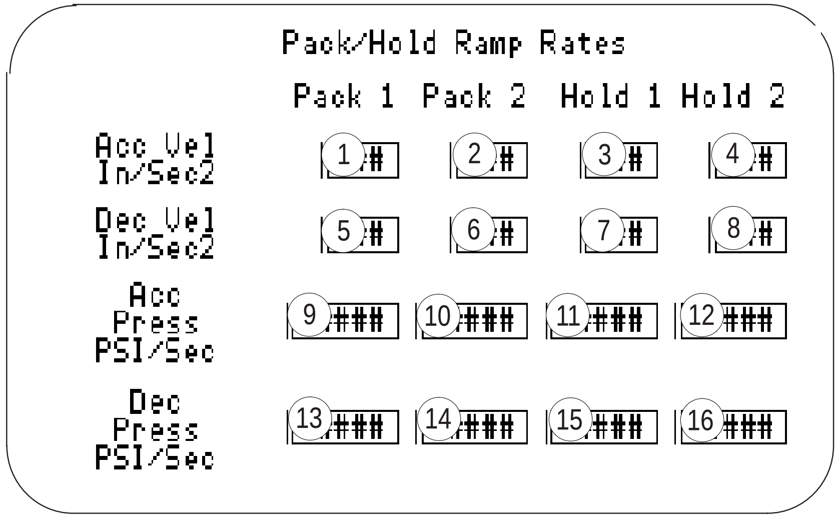
Injection Ramp Rates Screen

This field:	Is located in:	This field:	Is located in:
1	N109:66	11	N109:68
2	N109:58	12	N109:60
3	N109:50	13	N109:52
4	N109:42	14	N109:44
5	N109:34	15	N109:36
6	N109:67	16	N109:69
7	N109:59	17	N109:61
8	N109:51	18	N109:53
9	N109:43	19	N109:45
10	N109:35	20	N109:37



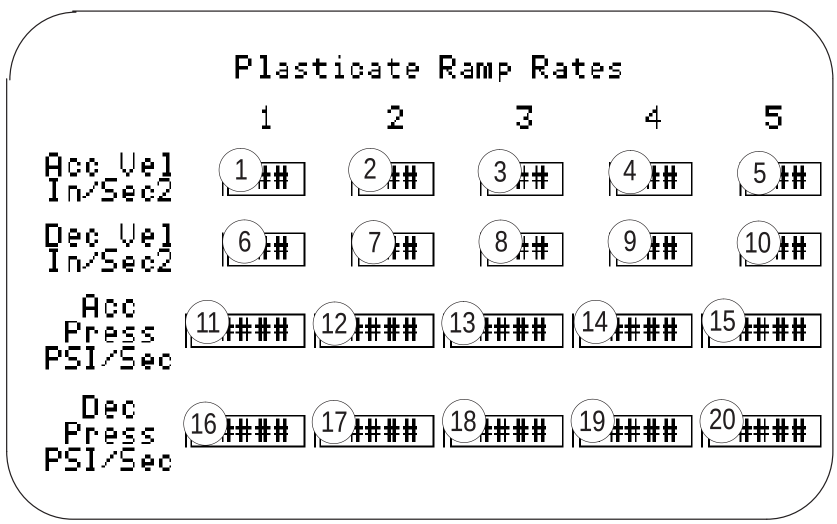
Pack/hold Ramp Rates Screen

This field:	Is located in:	This field:	Is located in:
1	N113:34	9	N113:36
2	N113:42	10	N113:44
3	N117:34	11	N117:36
4	N117:42	12	N117:44
5	N113:35	13	N113:37
6	N113:43	14	N113:45
7	N117:35	15	N113:37
8	N117:43	16	N117:45



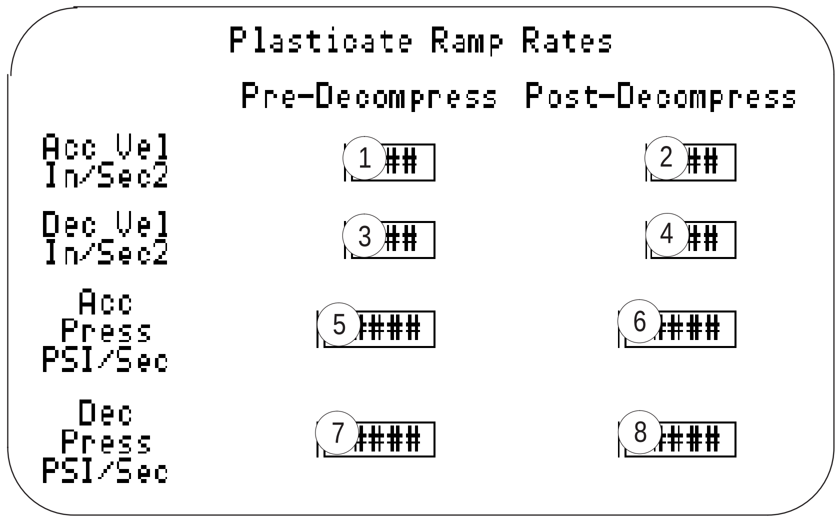
Plasticate Ramp Rates Screen 1

This field:	Is located in:	This field:	Is located in:
1	N125:34	11	N125:36
2	N125:42	12	N125:44
3	N125:50	13	N125:52
4	N125:58	14	N125:60
5	N125:66	15	N125:68
6	N125:35	16	N125:37
7	N125:43	17	N125:45
8	N125:51	18	N125:53
9	N125:59	19	N125:61
10	N125:67	20	N125:69



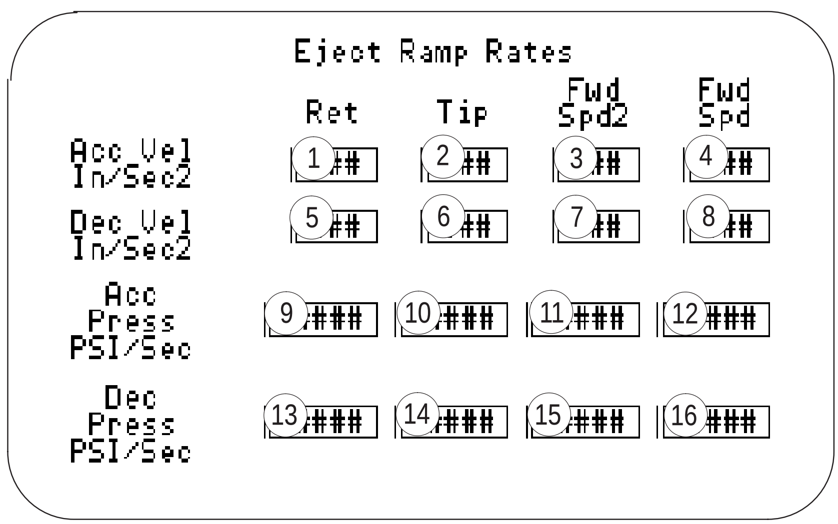
Plasticate Ramp Rates Screen 2

This field:	Is located in:
1	N121:34
2	N129:34
3	N121:35
4	N129:35
5	N121:36
6	N129:36
7	N121:37
8	N129:37



Eject Ramp Rates Screen

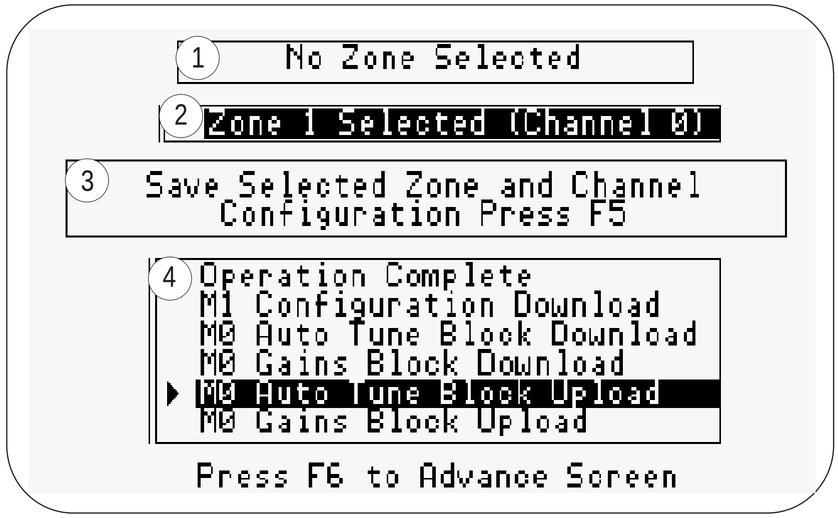
This field:	Is located in:	This field:	Is located in:
1	N193:34	9	N193:36
2	N197:34	10	N197:36
3	N189:42	11	N189:44
4	N189:34	12	N189:36
5	N193:35	13	N193:37
6	N197:35	14	N197:37
7	N189:43	15	N189:45
8	N189:35	16	N189:37



BTM Configuration Screens

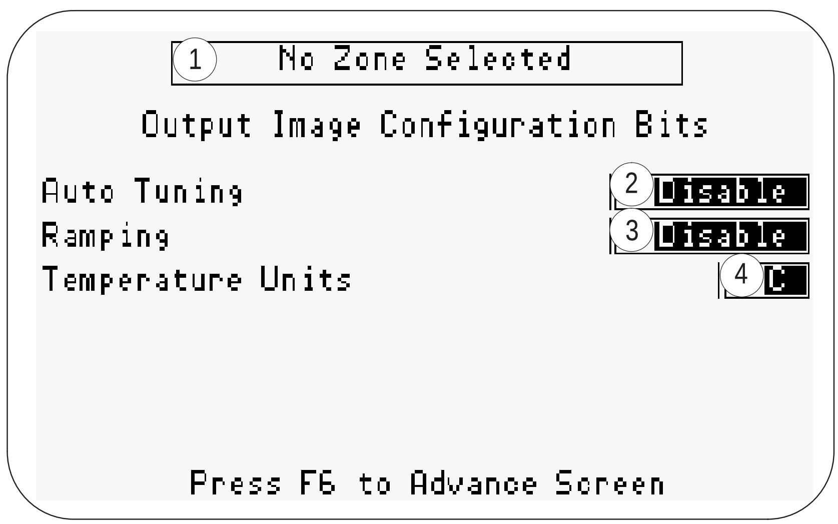
Zone Selection Screen 1

This field:	Is located in:
1	N97:40
2	N97:39
3	N97:41/04
4	N97:50
F10 (Save) *[not shown]*	N97:41/03



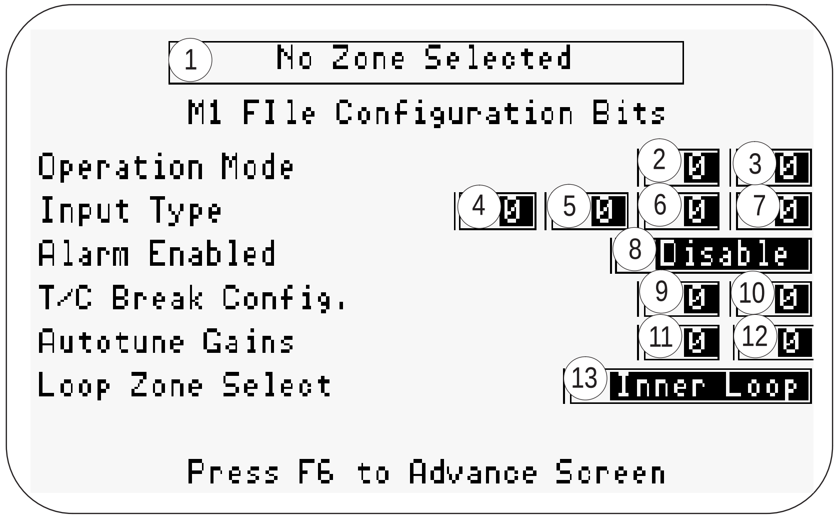
Zone Selection Screen 2

This field:	Is located in:
1	N97:40
2	N97:38/03
3	N97:38/05
4	N97:00/00



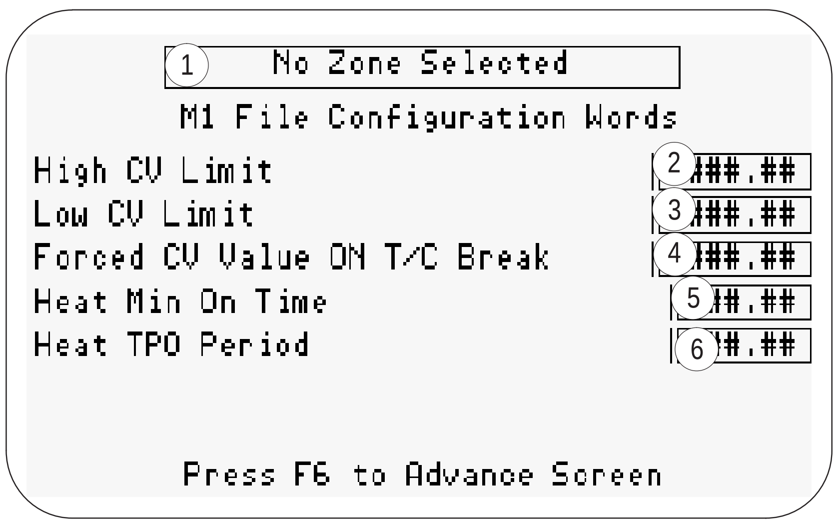
Zone Selection Screen 3

This field:	Is located in:	This field:	Is located in:
1	N97:40	8	N97:01/06
2	N97:01/01	9	N87:01/08
3	N97:01/00	10	N97:01/07
4	N97:01/05	11	N97:01/11
5	N97:01/04	12	N97:01/10
6	N97:01/03	13	N97:01/13
7	N97:01/02		



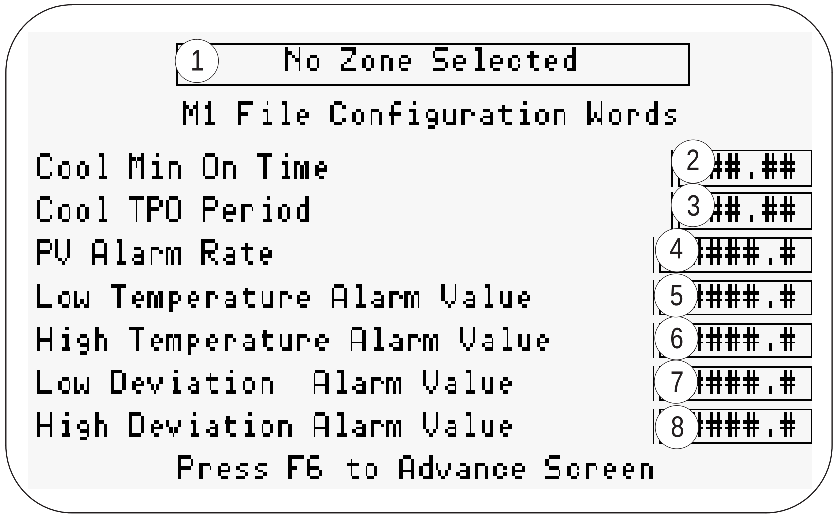
Zone Selection Screen 4

This field:	Is located in:
1	N97:40
2	N97:02
3	N97:03
4	N97:04
5	N97:06
6	N97:07



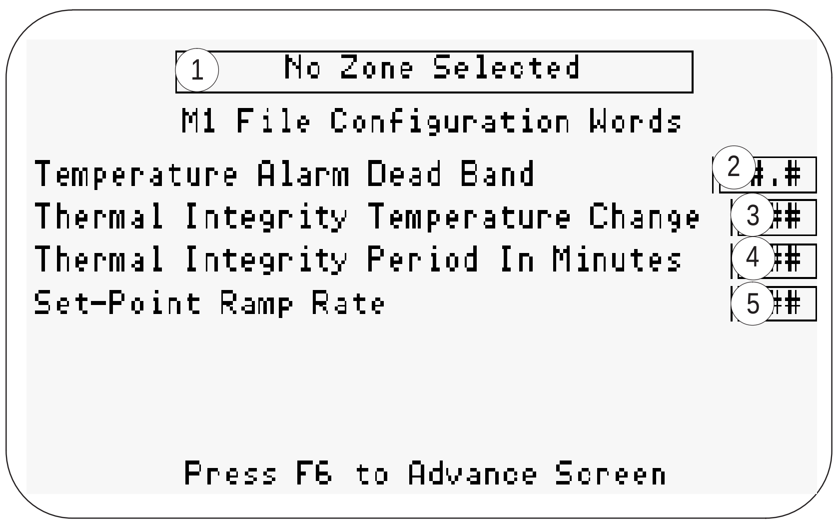
Zone Selection Screen 5

This field:	Is located in:
1	N97:40
2	N97:08
3	N97:09
4	N97:10
5	N97:11
6	N97:12
7	N97:13
8	N97:14



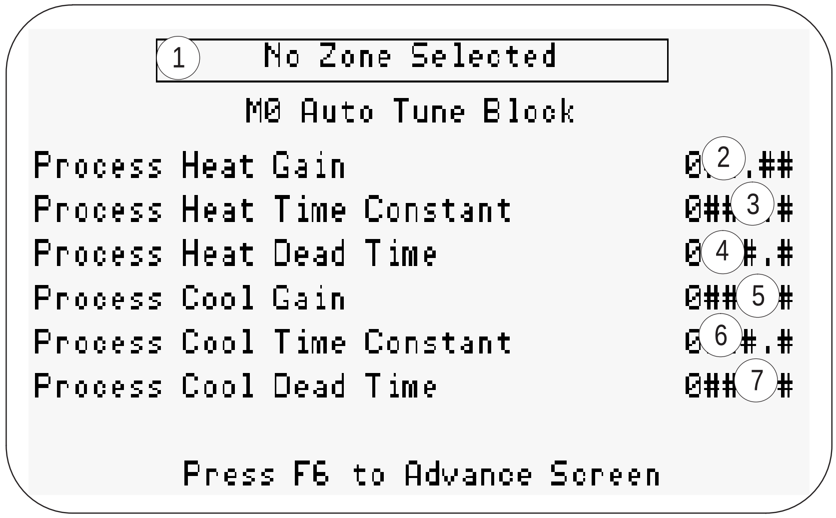
Zone Selection Screen 6

This field:	Is located in:
1	N97:40
2	N97:15
3	N97:16
4	N97:17
5	N97:18



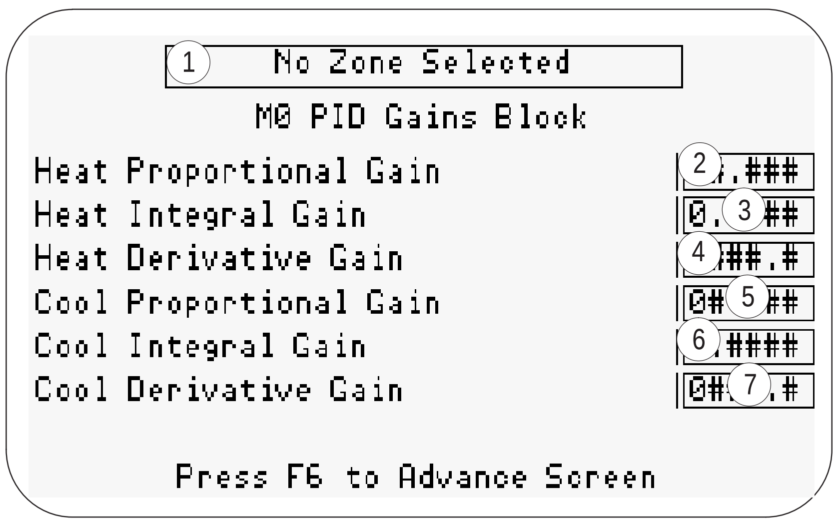
Zone Selection Screen 7

This field:	Is located in:
1	N97:40
2	N97:26
3	N97:27
4	N97:28
5	N97:29
6	N97:30
7	N97:31



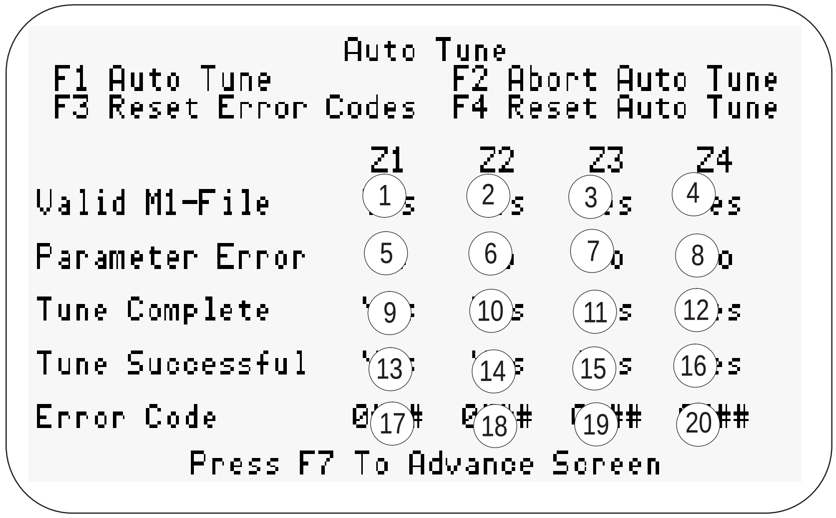
Zone Selection Screen 8

This field:	Is located in:
1	N97:40
2	N97:32
3	N97:33
4	N97:34
5	N97:35
6	N97:36
7	N97:37



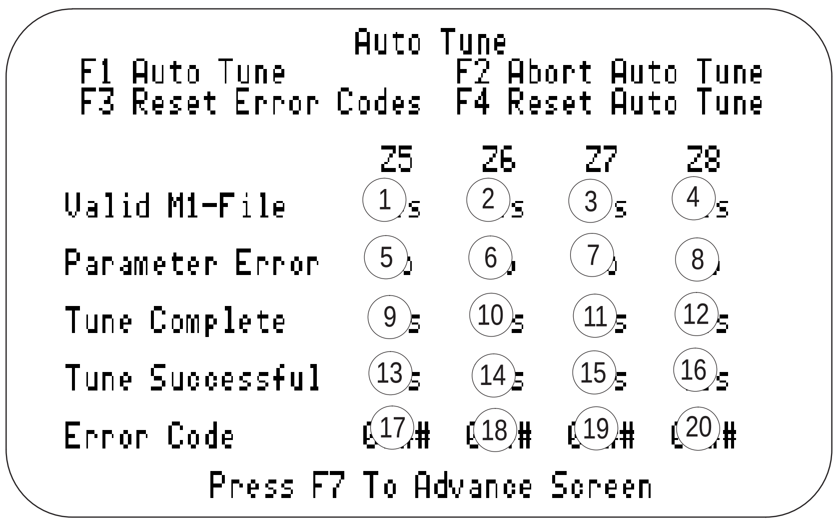
Auto Tune Screen 1

This field:	Is located in:	This field:	Is located in:
1	N93:164/03	11	N93:170/03
2	N93:165/03	12	N93:171/03
3	N93:166/03	13	N93:168/04
4	N93:167/03	14	N93:169/04
5	N93:164/04	15	N93:170/04
6	N93:165/04	16	N93:171/04
7	N93:166/04	17	N95:12
8	N93:167/04	18	N95:13
9	N93:168/03	19	N95:14
10	N93:169/03	20	N95:15



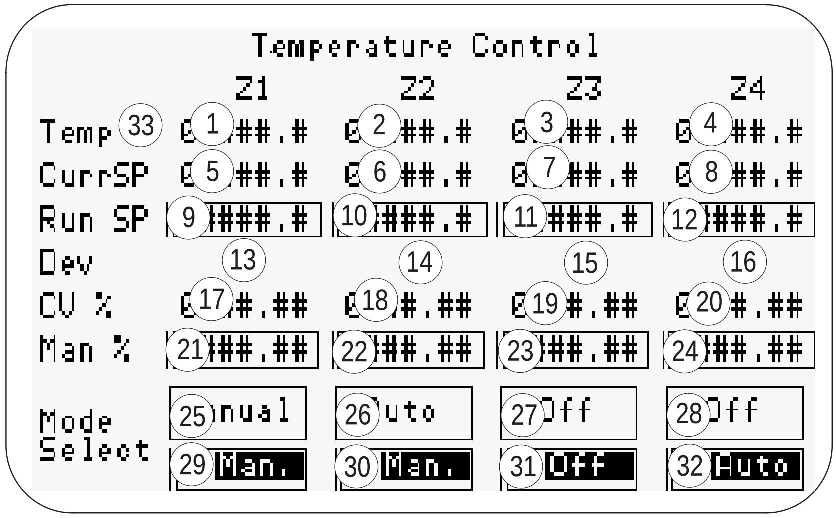
Auto Tune Screen 2

This field:	Is located in:	This field:	Is located in:
1	N94:164/03	11	N94:170/03
2	N94:165/03	12	N94:171/03
3	N94:166/03	13	N94:168/04
4	N94:167/03	14	N94:169/04
5	N94:164/04	15	N94:170/04
6	N94:165/04	16	N94:171/04
7	N94:166/04	17	N96:12
8	N94:167/04	18	N96:13
9	N94:168/03	19	N96:14
10	N94:169/03	20	N96:15



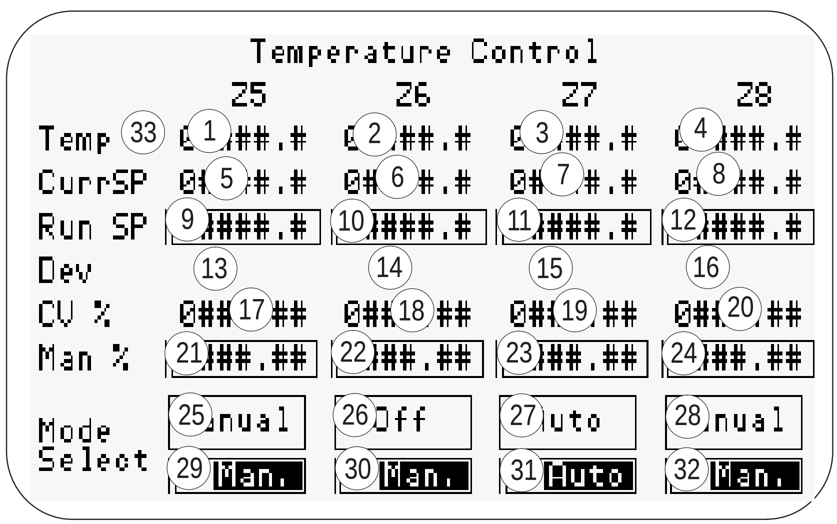
Temperature Setpoints 1–4 Screen

This field:	Is located in:	This field:	Is located in:
1	N95:24	17	N95:08
2	N95:25	18	N95:09
3	N95:26	19	N95:10
4	N95:27	20	N95:11
5	N95:00	21	N95:36
6	N95:01	22	N95:37
7	N95:02	23	N95:38
8	N95:03	24	N95:39
9	N95:28	25	N95:40
10	N95:29	26	N95:41
11	N95:30	27	N95:42
12	N95:31	28	N95:43
13	N95:32	29	N95:44
14	N95:33	30	N95:45
15	N95:34	31	N95:46
16	N95:35	32	N95:47



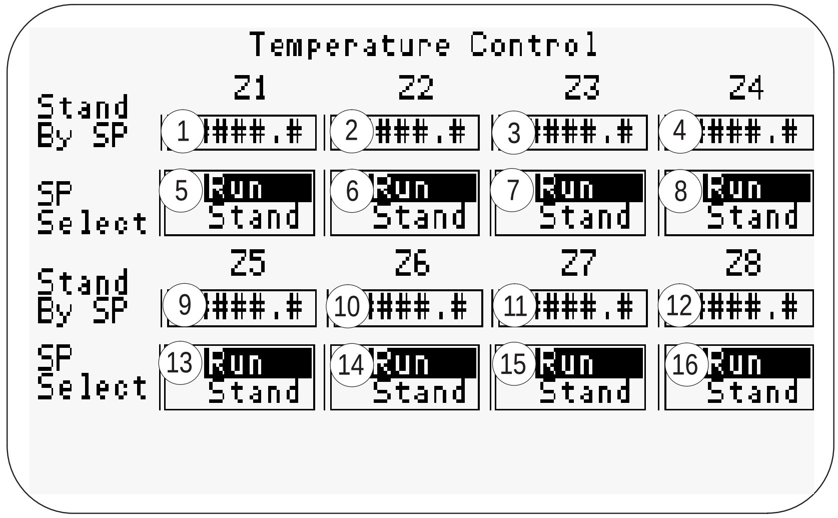
Temperature Setpoints 5–8 Screen

This field:	Is located in:	This field:	Is located in:
1	N96:24	18	N96:09
2	N96:25	19	N96:10
3	N96:26	20	N96:11
4	N96:27	21	N96:36
5	N96:00	22	N96:37
6	N96:01	23	N96:38
7	N96:02	24	N96:39
8	N96:03	25	N96:40
9	N96:28	26	N96:41
10	N96:29	27	N96:42
11	N96:30	28	N96:43
12	N96:31	29	N96:44
13	N96:32	30	N96:45
14	N96:33	31	N96:46
15	N96:34	32	N96:47
16	N96:35	33	N96:48/14
17	N96:08		



Zone Selection Screen 11

This field:	Is located in:
1	N93:05
2	N93:30
3	N93:55
4	N93:80
5	N95:48/01
6	N95:48/02
7	N95:48/03
8	N95:48/04
9	N94:05
10	N94:30
11	N94:55
12	N94:80
13	N96:48:01
14	N96:48:02
15	N96:48:03
16	N96:48:04



Notes

Processor Specifications

What's in This Appendix?

This appendix describes the SLC 5/04P processor specifications.

SLC 5/04P Processor (Catalog Number 1747-L542P)

The SLC 5/04P processor provides:

- program memory size 32K
- high-speed performance – 0.90 ms/K typical
- control of up to 960 local I/O
- online programming (includes runtime editing)
- built-in DH+ channel, supporting:
  - high-speed SLC 5/04P to SLC 5/04P communication
  - messaging capability between PLCs® and SLCs
- built-in RS-232 channel, supporting:
  - DF1 Full-Duplex for remote or point-to-point communication, or direct connection to IBM compatible programming devices
  - DF1 Half-Duplex Master/Slave for SCADA type communication
  - DH-485 (serves as a second DH-485 channel using a 1747-PIC or direct connection to IBM compatible programming devices)
  - ASCII for connection to other ASCII devices, such as bar code readers, printers, and weigh scales
- passthru capability to PanelView 550 and PanelView 900
- remote I/O passthru
- built-in real-time clock/calendar
- 1 ms Selectable Timed Interrupt (STI)
- 0.50 ms Discrete Input Interrupt (DII)
- advanced math features – trigonometric, PID, exponential, floating point, and the compute instruction
- indirect addressing
- flash PROM provides firmware upgrades without physically changing EPROMS
- keyswitch – RUN, REMote, PROGram (clear faults)

General Specifications

The following table summarizes the general specifications for the SLC 5/04P processor:

Description:	Specification:
Power Supply Loading at 5V dc	1.0A for the SLC 5/04P processor
Power Supply Loading at 24V dc	200 mA for the SLC 5/04P processor
Program Scan Hold-up Time after Loss of Power	20 ms to 3 s (dependent on power supply loading)
Clock/Calendar Accuracy	+ or – 54 sec/month @ 25° C (77° F) + or – 81 sec/month @ 60° C (140° F)
Noise Immunity	NEMA Standard ICS 2–230
Vibration	Displacement: 0.015 inch, peak-to-peak at 5–57 Hz
	Acceleration: 2.5Gs at 57–2000 Hz
Shock (operating)	30Gs
Ambient Temperature Rating	Operating: 0 to + 60° C (32° F to 140° F) Storage: –40°C to 85° C (–40° F to 185° F)
Humidity	5 to 95% without condensation
Certification (when product or packaging is marked)	UL listed CSA approved Class 1, Groups A, B, C or D, Division 2 CE marked for all applicable directives

The following table summarizes the available memory back up options for the SLC 500 processors. EEPROM and UVPROM memory modules provide non-volatile memory back-up. Flash EPROMs (Flash Erasable Programmable Read Only Memory) combine the versatility of EEPROMs with the security of UVPROMs.

Memory Backup Option:	SLC 5/04P (1747-L542P):
Flash	1747-M11 1747-M12 (OS401 only)

Communication Options

The SLC 5/04P processor supports different types of communication options. The following sections describe the available physical connections used by the SLC 5/04P processor.

Data Highway Plus (DH+) channel offers:

- communication rates of 57.6K, 115.2K, and 230K baud
- maximum network length of 3,048 m (10,000 ft.)
- Belden 9463 (blue hose) cable connection between nodes (daisy chain connection)
- built-in isolation

DH-485 channel offers:

- communication configure rates up to 19.2K baud
- electrical isolation via the 1746-AIC
- maximum network length of 1219 m (4,000 ft.)
- RS-485 electrical specifications
- Belden 9842 cable connection between nodes (daisy chain connection)

RS-232 channel offers:

- communication rates up to 19.2K baud
- maximum distance between devices is 15.24 m (50 ft.)
- RS-232C electrical specifications
- modem support
- built-in isolation

The following table summarizes the SLC 5/04P processor channel connections.

Processor	Physical Communication Channel		
	DH-485	RS-232	DH+
SLC 5/04P Channel 0	NA	DH-485,[1] DF1 Full-Duplex, DF1 Half-Duplex Master/Slave, and ASCII protocols	NA
Channel 1	NA	NA	DH+ protocol

[1] A 1747-PIC is required when connecting to a DH-485 channel.

Programming Instructions

The following programming instructions are used with the SLC 5/04P processor. Included are instruction execution times (µs) for the processor when the instruction is true and instruction execution times (µs) when floating point math is used.

For more information about programming instructions, see SLC 500™ and MicroLogix™ 1000 Instruction Set Reference Manual, publication number 1747-6.15.

Basic Instructions

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Output Instructions Input or Output:
XIC	Examine if Closed	0.37	Conditional instruction. True when bit is on (1).
XIO	Examine if Open	0.37	Conditional instruction. True when bit is off (0).
OTE	Output Energize	0.56	Output instruction. True (1) when conditions preceding it are true. False when conditions preceding it go false.
OTL	Output Latch	0.56	Output instruction. Addressed bit goes true (1) when conditions preceding the OTL instruction are true. When conditions go false, OTL remains true until the rung containing an OTU instruction with the same address goes true.
OTU	Output Unlatch	0.56	Output instruction. Addressed bit goes false (0) when conditions preceding the OTU instruction are true. Remains false until the rung containing an OTL instruction with the same address goes true.
OSR	One-Shot Rising	9.10	Conditional instruction. Makes rung true for one scan upon each false-to-true transition of conditions preceding it in the rung.
TON	Timer On-Delay	1.31	Counts time intervals when conditions preceding it in the rung are true. Produces an output when accumulated value (count) reaches the preset value.
TOF	Timer Off-Delay	1.31	Counts time intervals when conditions preceding it in the rung are false. Produces an output when accumulated value (count) reaches the preset value.
RTO	Retentive Timer	1.31	This is an On-Delay timer that retains its accumulated value when: – Rung conditions go false. – The mode changes to program from run or test. – The processor loses power. – A fault occurs.
CTU	Count Up	1.31	Counts up for each false-to-true transition of conditions preceding it in the rung. Produces an output when accumulated value (count) reaches the preset value.
CTD	Count Down	1.31	Counts down for each false-to-true transition of conditions preceding it in the rung. Produces an output when accumulated value (count) reaches the preset value.
RES	Reset	1.31	Used with timers and counters. When conditions preceding it in the rung are true, the RES instruction resets the accumulated value and control bits of the timer or counter.

Comparison Instructions

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Output Instructions:
EQU	Equal	1.12/12.5	Instruction is true when source A = source B.
NEQ	Not Equal	1.12/12.18	Instruction is true when source A ≠ source B.
LES	Less Than	1.12/13.94	Instruction is true when source A < source B.
LEQ	Less Than or Equal	1.12/13.93	Instruction is true when source A ≤ source B.
GRT	Greater Than	1.12/12.62	Instruction is true when source A > source B.
GEQ	Greater Than or Equal	1.12/14.31	Instruction is true when source A ≥ source B.
MEQ	Masked Comparison for Equal	22.75/NA	Compares 16-bit data of a source address to 16-bit data at a reference address through a mask. If the values match, the instruction is true.
LIM	Limit Test	1.68/20.19	True/false status of the instruction depends on how a test value compares to specified low and high limits.

Math Instructions

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Output Instructions:
ADD	Add	1.50/18.22	When rung conditions are true, the ADD instruction adds source A to source B and stores the result in the destination.
SUB	Subtract	1.50/19.50	When rung conditions are true, the SUB instruction subtracts source B from source A and stores the result in the destination.
MUL	Multiply	17.75/ 21.94	When rung conditions are true, the MUL instruction multiplies source A by source B and stores the result in the destination.
DIV	Divide	25.9/23.27	When rung conditions are true, the DIV instruction divides source A by source B and stores the result in the destination and the math register.
DDV	Double Divide	29.6/NA	When rung conditions are true, the DDV instruction divides the contents of the math register by the source and stores the result in the destination and the math register.
NEG	Negate	1.5/11.87	When rung conditions are true, the NEG instruction changes the sign of the source and places it in the destination.
CLR	Clear	1.5/5.94	When rung conditions are true, the CLR instruction clears the destination to zero.
SQR	Square Root	28.8/18.87	When rung conditions are true, the SQR instruction calculates the square root of the source and places the result in the destination.

Math Instructions continued

Instruction Mnemonic and Name:		Execution Times (μs)/ Floating Point (μs):	Function – Output Instructions:
SCL	Scale	33.06/NA	When rung conditions are true, the SCL instruction multiplies the source by a specified rate. The result is added to an offset value and placed in the destination.
SCP	Scale with Parameters	29.85/ 94.15	Produces a scaled output value that has a linear relationship between the input and scaled values.
CPT	Compute	7.7/NA①	Evaluates an expression and stores the result in the destination.
SWP	Swap	22.6 + 12.13 per word	Swaps the low and high bytes of a specified number of words in a bit integer, ASCII, or string file.
ABS	Absolute Value	8.60/ 4.35	Calculates the absolute value of the source and places the result in the destination.
XPY	X to the Power of Y Register/Data	335.10/NA	Raises a value to a power and stores the result in the destination.
LOG	Log to the Base 10	54.55/NA	Takes the log base 10 of the value in the source and stores the result in the destination.
LN	Natural Log	51.35/NA	Takes the natural log of the value in the source and stores it in the destination.
SIN	Sine	38.05/NA	Takes the sine of a number and stores the result in the destination.
COS	Cosine	37.20/NA	Takes the cosine of a number and stores the result in the destination.
TAN	Tangent	43.00/NA	Takes the tangent of a number and stores the result in the destination.
ASN	Arc Sine	41.45/NA	Takes the arc sine of a number and stores the result (in radians) in the destination.
ACS	Arc Cosine	51.90/NA	Takes the arc cosine of a number and stores the result (in radians) in the destination.
ATN	Arc Tangent	40.15/NA	Takes the arc tangent of a number and stores the result (in radians) in the destination.

① To get the total execution time for a CPT instruction, take the CPT execution time plus each additional math instruction execution time, plus the number of math instructions times 3.01. For example if a CPT instruction calls one ADD and one SUB instruction the calculation is:
8.8 + 1.70 + 1.70 + 2(3.01) = 18.22

Data Handling Instructions

Instruction Mnemonic and Name:		Execution Times (μs)/ Floating Point (μs):	Function – Output Instructions:
TOD	Convert to BCD	34.06/NA	When rung conditions are true, the TOD instruction converts the source value to BCD and stores it in the math register or the destination.
FRD	Convert from BCD	23.88/NA	When rung conditions are true, the FRD instruction converts a BCD value in the math register or the source to an integer and stores it in the destination.
RAD	Degrees to Radians	24.65/NA	When rung conditions are true, RAD converts degrees (source) to radians and stores the result in the destination.
DEG	Radians to Degrees	24.70/NA	When rung conditions are true, DEG converts radians (source) to degrees and stores the result in the destination.
DCD	Decode	8.88/NA	When rung conditions are true, the DCD instruction decodes 4-bit value (0 to 16), turning on the corresponding bit in 16-bit destination.
COP	File Copy	20.2 + 2.0 per word/NA	When rung conditions are true, the COP instruction copies a user-defined source file to the destination file.
FLL	File Fill	21.9 + 2.5 per word/NA	When rung conditions are true, the FLL instruction loads a source value into a specified number of elements in a user-defined file.
MOV	Move	1.12/11.44	When rung conditions are true, the MOV instruction moves a copy of the source to the destination.
MVM	Masked Move	17.40/NA	When rung conditions are true, the MVM instruction moves a copy of the source through a mask to the destination.
AND	And	1.5/NA	When rung conditions are true, sources A and B of the AND instruction are ANDed bit by bit and stored in the destination.
OR	Inclusive Or	1.5/NA	When rung conditions are true, sources A and B of the OR instruction are ORed bit by bit and stored in the destination.
XOR	Exclusive Or	1.5/NA	When rung conditions are true, sources A and B of the XOR instruction are Exclusive ORed bit by bit and stored in the destination.
NOT	Not	1.5/NA	When rung conditions are true, the source of the NOT instruction is NOTed bit by bit and stored in the destination.
	First In First Out (FIFO)		The FFL instruction loads a word into a FIFO stack on successive false-to-true transitions. The FFU unloads a word from the stack on successive false-to-true transitions. The first word loaded is the first to be unloaded.
FFL	Load (FFL)	40.75/NA	
FFU	Unload (FFU)	60 + 2 per word/ NA	
	Last In First Out (LIFO)		The LFL instruction loads a word into a LIFO stack on successive false-to-true transitions. The LFU unloads a word from the stack on successive false-to-true transitions. The last word loaded is the first to be unloaded.
LFL	Load (LFL)	40.70/NA	
LFU	Unload (LFU)	34.70/NA	

Program Flow Instructions

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Conditional or Output Instructions:
JMP	Jump to Label	37.44	Output instruction. When rung conditions are true, the JMP instruction causes the program scan to jump forward or backward to the corresponding LBL instruction.
LBL	Label	0.18	This is the target of the correspondingly numbered JMP instruction.
JSR	Jump to Subroutine	112.0	Output instruction. When rung conditions are true, the JSR instruction causes the processor to jump to the targeted subroutine file.
SBR	Subroutine	0.18	Placed as first instruction in a subroutine file. Identifies the subroutine file.
RET	Return from Subroutine	20.0	Output instruction, placed in subroutine. When rung conditions are true, the RET instruction causes the processor to resume program execution in the main program file or the previous subroutine file.
MCR	Master Control Reset	3.0	Output instruction. Used in pairs to inhibit or enable a zone within a ladder program.
TND	Temporary End	13.05	Output instruction. When rung conditions are true, the TND instruction stops the program scan, updates I/O, and resumes scanning at rung 0 of the main program file.
SUS	Suspend	10.31	Output instruction, used for troubleshooting. When rung conditions are true, the SUS instruction places the controller in the Suspend Idle mode. The suspend ID number is placed in word S:7 and the program file number is placed in S:8.
IIM	Immediate Input with Mask	51.0	When conditions preceding it in the rung are true, the IIM instruction is enabled and interrupts the program scan to write a word of masked external input data to the input data file.
IOM	Immediate Output with Mask	75.74	When conditions preceding it in the rung are true, the IOM instruction is enabled and interrupts the program scan to read a word of data from the output data file and transfer the data through a mask to the corresponding external outputs.

Application Specific Instructions

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Output Instructions:
BSL **BSR**	Bit Shift Left Bit Shift Right	31.5 + 2.31 per word	On each false-to-true transition, these instructions load a bit of data into a bit array, shift the pattern of data through the array, and unload the end bit of data. The BSL shifts data to the left and the BSR shifts data to the right.
SQO	Sequencer Output	44.1	On successive false-to-true transitions, the SQO moves a step through the programmed sequencer file, transferring step data through a mask to a destination word.
SQC	Sequencer Compare	33.2	On successive false-to-true transitions, the SQC moves a step through the programmed sequencer file, comparing the data through a mask to a source word or file for equality.
SQL	Sequencer Load	33.2	On successive false-to-true transitions, the SQL moves a step through the sequencer file, loading a word of source data into the current element of the sequencer file.

Communication Instructions

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Output Instructions:
MSG	Message Read/Write	183	This instruction transfers data from one node to another on the communication network. When the instruction is enabled, message transfer is pending. Actual data transfer takes place at the end of the scan.
SVC	Service Communications	200	When conditions preceding it in the rung are true, the SVC instruction interrupts the program scan to execute the service communication portion of the operating cycle.

Proportional Integral Derivative Instruction

Instruction Mnemonic and Name:		Execution Times (µs)/ Floating Point (µs):	Function – Output Instructions:
PID	Proportional Integral Derivative	169.82	This instruction is used to control physical properties such as temperature, pressure, liquid level, or flow rate of process loops.

ASCII Instructions

Instruction Mnemonic and Name:		Execution Times (µs):	Function – Output Instructions:
ABL	Test Buffer for Line	156.0	Determines the number of characters in the buffer, up to and including the end-of-line characters (termination).
ACB	Number of Characters in Buffer	131.0	Determines the total characters in the buffer.
ACI	String to Integer	56.0	Converts an ASCII string to an integer value.
ACL	ASCII Clear Receive and/or Send Buffer	332.8	Clears the ASCII buffer.
ACN	String Concatenate	56 + 2.5 per character	Combines two strings using ASCII strings as operands.
AEX	String Extract	43.4 + 4.0 per character	Creates a new string by taking a portion of an existing string and linking it to a new string.
AHL	ASCII Handshake Lines	115.1	Sets or resets the RS-232 Data Terminal Ready and Request to Sender handshake control lines for the modem.
AIC	Integer to String	110.0	Converts an integer value to an ASCII string.
ARD	ASCII Read Characters	151.0	Reads characters from the buffer and stores them in a string.
ARL	ASCII Read Line	156.0	Reads characters from the buffer up to and including the end–of–line characters and stores them in a string.
ASC	String Search	43.5 + 2.5 per character	Searches an existing string for an occurrence of the source string.
ASR	ASCII String Compare	43.5	Compares two ASCII strings.
AWA	ASCII Write with Append	307.8	Adds the two appended characters set from the ASCII configuration menu.
AWT	ASCII Write	217.3	Writes characters from a source string to a display device.

Notes

Specialized Hydraulic Configurations Supported by Pro-Set 200

What's in This Appendix?

This appendix shows three specialized hydraulic configurations that Pro-Set 200 can support. Certain components in the hydraulic circuit require that you:

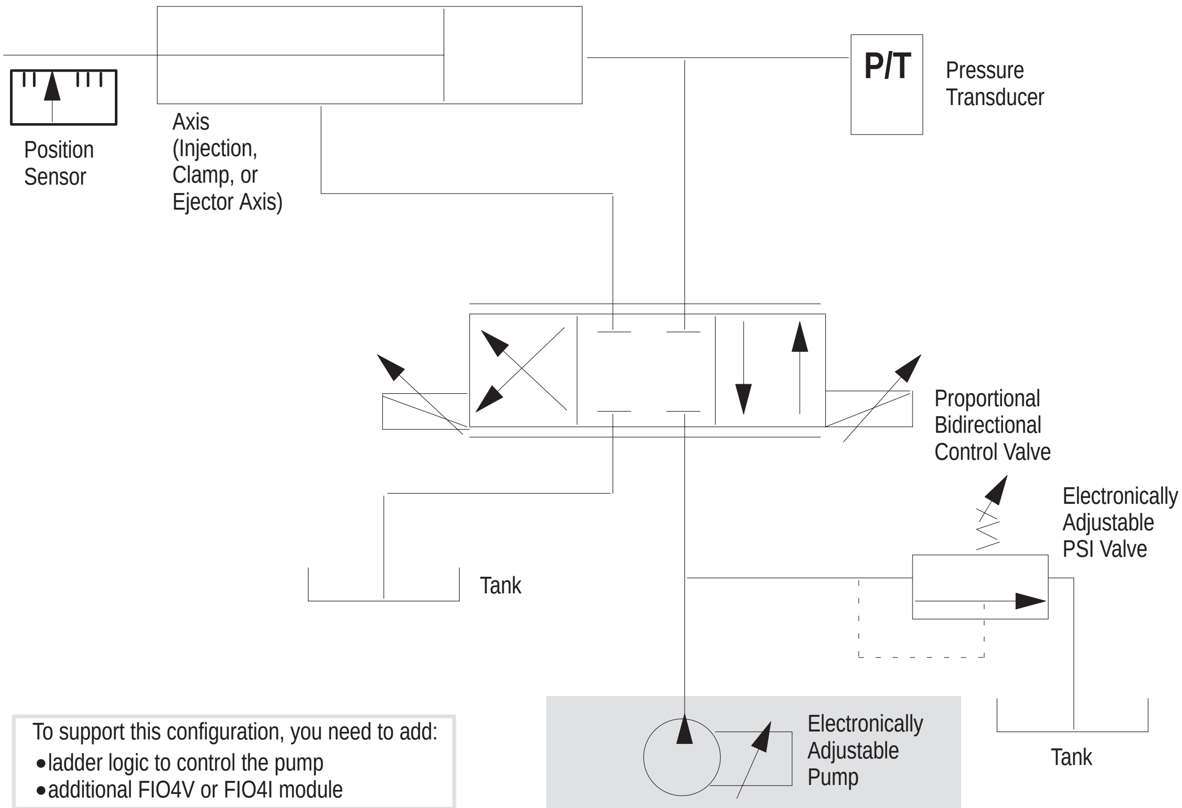
- write special ladder logic
- include an additional output module (0–10 volts or 4–20 milliamps)

Figures D.1, D.2, and D.3 show common hydraulic configurations.

Specialized Hydraulic Diagrams

In the following circuit diagrams the specialized feature is highlighted with a gray box.

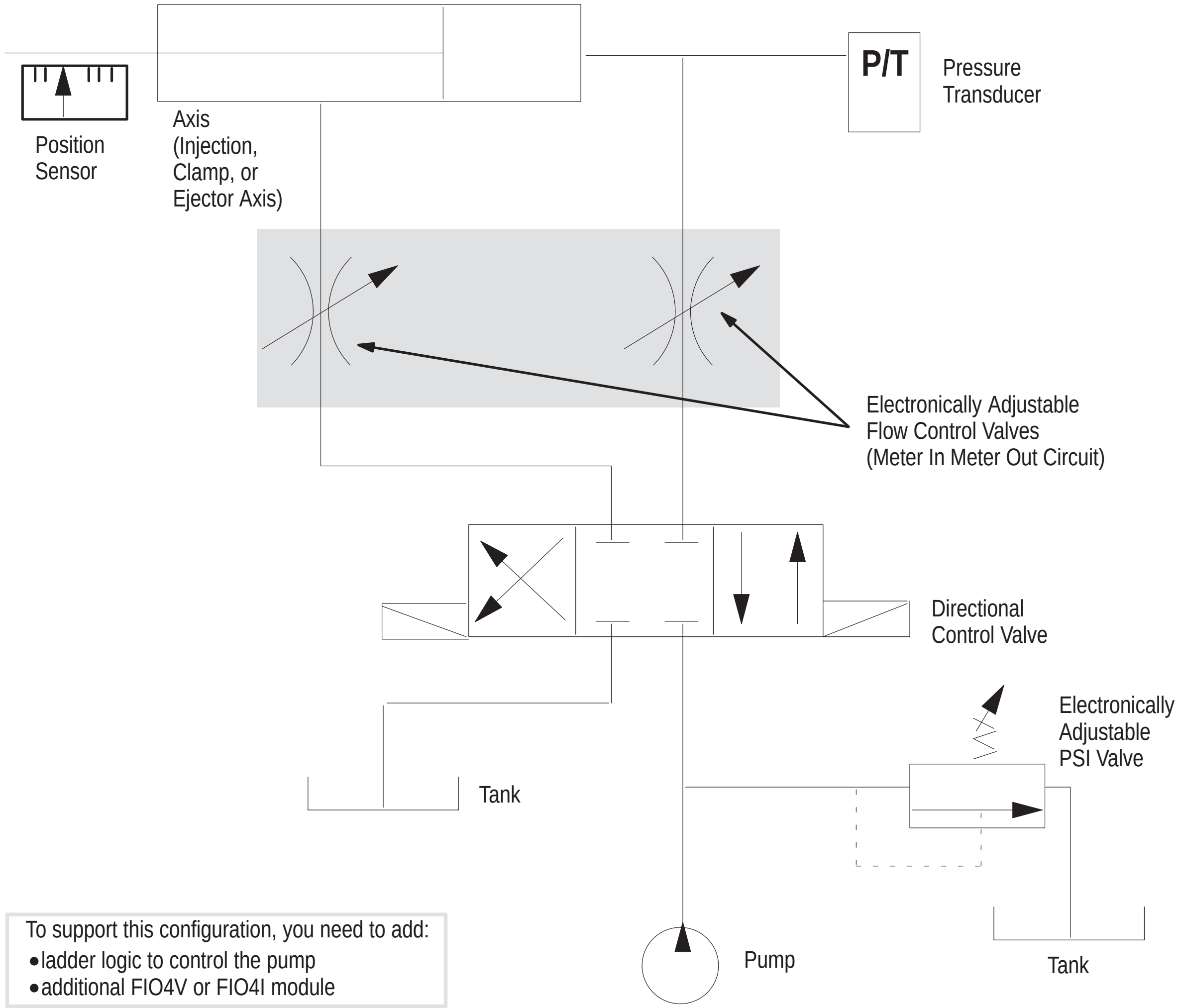
Figure D.1 Pro-Set 200 Specialized Hydraulic Configuration with an Electronically Adjustable Pump



To support this configuration, you need to add:
- ladder logic to control the pump
- additional FIO4V or FIO4I module

This:	Does this:
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–10 volts or 4–20 milliamps proportional to the pressure
Proportional Bidirectional Control Valve	• controls the flow (speed) • switches cylinder direction
Electronically Adjustable Pump	controls flow and/or pressure to the cylinder
Electronically Adjustable psi Valve	controls the pressure in the circuit

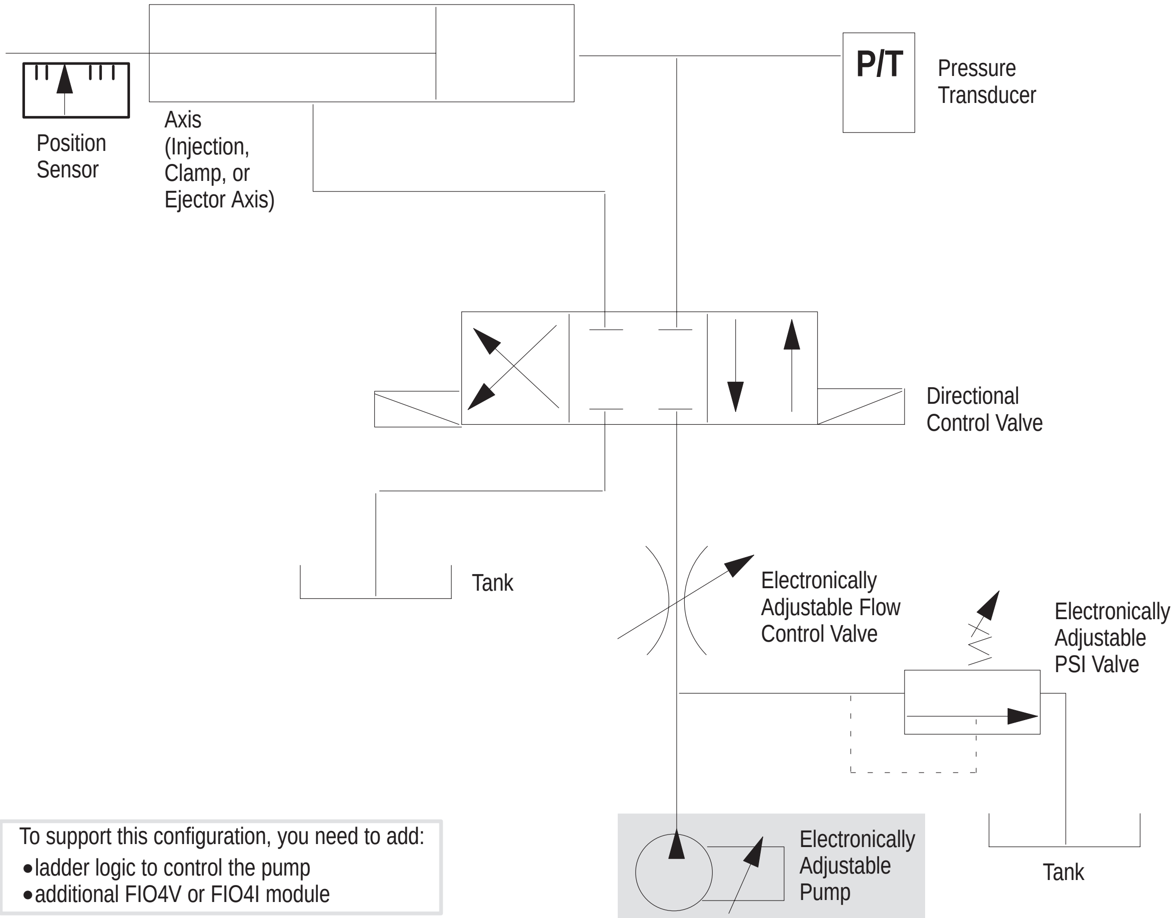
Figure D.2 Pro-Set 200 Specialized Hydraulic Configuration with Electronically Adjustable Flow Control Valves



To support this configuration, you need to add:
- ladder logic to control the pump
- additional FIO4V or FIO4I module

This:	Does this:
Electronically Adjustable Flow Control Valves	controls speed of flow in and out of the cylinder
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–10 volts or 4–20 milliamps proportional to the pressure
Directional Control Valve	switches the cylinder direction
Electronically Adjustable psi Valve	controls the pressure in the circuit

Figure D.3 Pro-Set 200 Specialized Hydraulic Configuration with an Electronically Adjustable Pump



To support this configuration, you need to add:
- ladder logic to control the pump
- additional FIO4V or FIO4I module

This:	Does this:
Position Sensor	measures cylinder position
Pressure Transducer	• senses hydraulic pressure in the cylinder • sends back 0–10 volts or 4–20 milliamps proportional to the pressure in that signal
Directional Control Valve	switches the cylinder from a forward to reverse position
Electronically Adjustable Flow Control Valve	controls the flow (speed)
Electronically Adjustable Pump	controls flow and/pr pressure to the cylinder
Electronically Adjustable psi Valve	controls the pressure in the circuit

Using Internal and External Trigger Setpoints

What's in This Appendix?

This appendix explains how to:

- use internal trigger setpoints
- use external trigger setpoints

Using Internal Trigger Setpoints

Trigger cause the machine to go into the next profile as defined by the Link Profile Word (word 2 of the setpoint block). Trigger setpoints are available for all profiles of the clamp, inject, and eject phases and may be position, pressure, or time triggers. There are two types of trigger setpoints:

Type of trigger setpoint:	Definition:
internal	The position, pressure, or time supplied by a sensor. This sensor is physically located on or attached to the axis which is being controlled (for example, inject position)
external	The position, pressure, or time supplied by an external sensor. This sensor is not directly attached or connected to the axis. For example, a mold cavity pressure transducer physically located inside the mold is an external triggering device.

If several trigger setpoints are enabled at the same time, whichever trigger setpoint is reached **first** causes the machine to go to the next profile.

Trigger setpoints are commonly used to transfer from the injection profile to the pack profile or from the pack profile to the hold profile. Other applications include those that use external sensors such as mold cavity pressure transducers.

There are three types of internal trigger setpoints. They are:

- position
- pressure
- time

When an internal trigger is reached, it forces the current profile to go to the next linked profile.

The internal trigger setpoints are located in words 18 – 20 of the profile setpoint block:

Address:	Description:	Range:
Nxxx:18	position trigger setpoint	± 327.67 in. ①
Nxxx:19	pressure trigger setpoint	0 – 9999 psi
Nxxx:20	time trigger setpoint	327.67 sec. ①

① Decimal place is implied

Example: Internal Trigger Setpoints

Configuration Word 1 of the profile setpoint block contains the following bits to enable or disable internal trigger conditions:

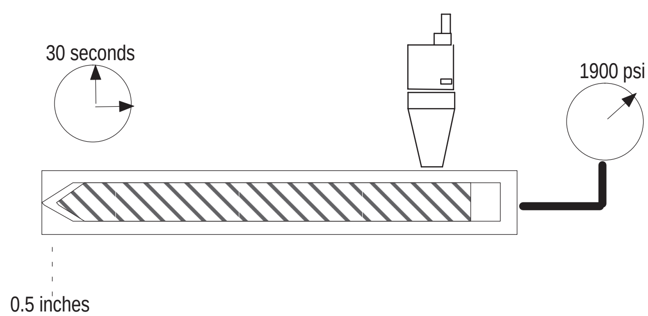
This address:	Contains:
Nxxx:1/0	internal position trigger enable
Nxxx:1/1	internal pressure trigger enable
Nxxx:1/2	internal time trigger enable

For example, suppose you want to transfer from the injection profile to the pack profile using one of these triggers:

- ram position = 0.5 inch
- hydraulic pressure = 1900 PSI
- **or** time = 30 seconds

Injection Setpoint Block

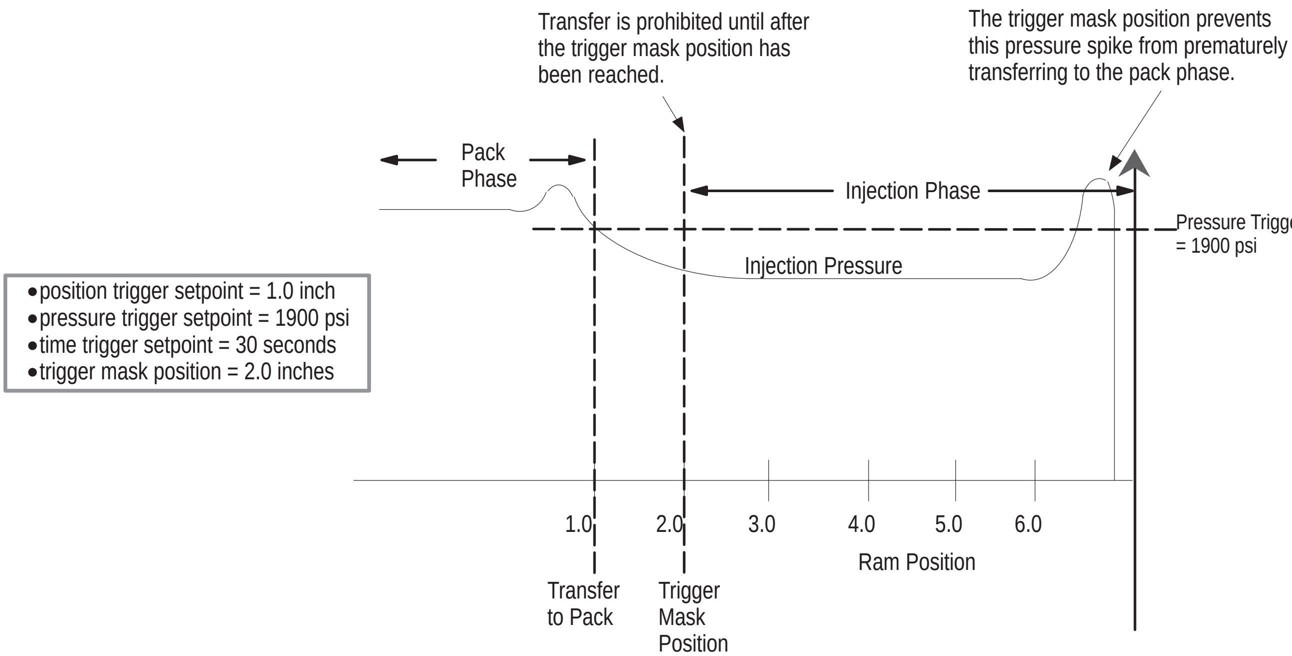
N109:1	Enable position, pressure, timer triggers = xxxx xxxx xxxx x111
N109:2	Link profile word = 0000 0000 0000 0010 (pack)
	• • • • • •
N109:18	Position trigger setpoint = 00050
N109:19	Pressure trigger = 1900
N109:20	Time trigger = 03000



Whichever trigger is reached first causes the machine to transfer into the next linked profile (in this case, the pack profile).

Using the Internal Position Mask

Use the trigger mask position setpoint to prevent an internal pressure trigger setpoint from being executed until a certain position has been reached. The Pro-Set 200 trigger mask position setpoint applies only to internal pressure triggers. The internal trigger mask position setpoint is often used to prevent the injection profile from prematurely transferring into the pack profile due to pressure spikes. The following picture shows how this works:



The internal mask position setpoints are located in word 21 of the profile setpoint block.

Address:	Description:	Range:
Nxx:21	trigger mask position	± 32767.7 in [1]
Nxx:1/3	internal pressure trigger position mask enable	

[1] Decimal point is implied.

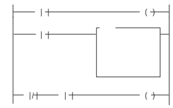
Internal trigger mask positions only apply to pressure trigger setpoints. Time and position trigger setpoints are not affected by the trigger mask position.

Setting the Internal Trigger Mask Position Setpoint

Word 1 of the Setpoint Block

0000 0000 0000 **1**000

bit 3

To:	
enable the internal trigger mask position setpoint	set bit 3 = 1
disable the internal trigger mask position setpoint	set bit 3 = 0

Setting the Internal Pressure Over/Under Bit

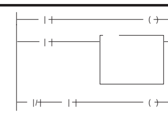
When using internal or external pressure trigger setpoints, you must indicate whether you want the actual pressure to be an:

- **under operation** – current pressure less than (or under) the trigger pressure to trigger to the next profile
- or **over operation** – current pressure greater than (or over) the trigger pressure to trigger to the next profile

Word 1 of the Setpoint Block

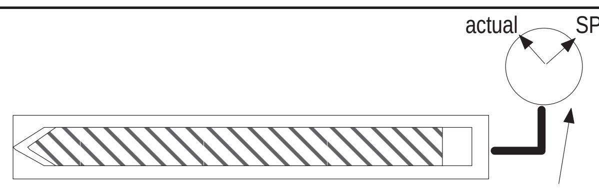
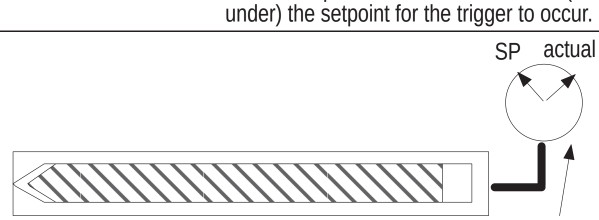
0000 0000 000**1** 0000

bit 4

If you want the actual pressure to be:	
=< the current pressure (under)	set bit 4 = 1
>= the current pressure (over)	set bit 4 = 0

Example: Internal Pressure Over/Under

When setting the internal pressure trigger over/under bit:

If bit 4 equals:	**Then:**
1	 The actual pressure must be less than (or under) the setpoint for the trigger to occur.
0	 The actual pressure must be greater than (or over) the setpoint for the trigger to occur.

Using External Trigger Setpoints

External triggers are sent from devices that are not directly attached to the axis which is being controlled. For example, external timers, mold cavity pressure transducers, etc. are triggering devices.

The units of measure for external trigger setpoints are user-defined. Depending on the type of ladder logic you write to handle the external trigger setpoints, you can use raw counts or traditional units of measure such as psi, inches, seconds, etc. External trigger are compared to external actual values in phase-wide screen actuals (e.g., N105).

Address:	Description:	Range:
Nxx:22	external position trigger setpoint	user-defined
Nxx:23	external pressure trigger setpoint	user-defined
Nxx:24	external time trigger setpoint	user-defined

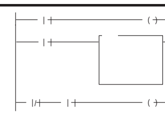
Setting External Velocity Trigger Setpoints

Use this field to enable or disable the external velocity trigger setpoint.

Word 1 of the Setpoint Block

0000 0000 0010 0000

bit 5

To:	
enable the external velocity trigger setpoint	set bit 5 = 1
disable the external velocity trigger setpoint	set bit 5 = 0

Setting the External Velocity Over/Under Bit

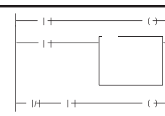
When using external velocity trigger setpoints, you must specify whether you want the actual velocity to be an:

- **under operation** – external velocity less than (or under) or equal to the external trigger velocity to trigger to the next profile
- or **over operation** – external velocity greater than (or over) or equal to the external trigger velocity to trigger to the next profile

Word 1 of the Setpoint Block

0000 0010 0000 0000

bit 9

To set the external velocity trigger to:	
< = (under)	set bit 9 = 1
> = (over)	set bit 9 = 0

Setting External Pressure Trigger Setpoints

Use this field to enable or disable the external pressure trigger setpoint.

Word 1 of the Setpoint Block

0000 0000 0100 0000

bit 6

To:	
enable the external pressure trigger setpoint	set bit 6 = 1
disable the external pressure trigger setpoint	set bit 6 = 0

Setting the External Pressure Over/Under Bit

When using external pressure trigger setpoints, you must indicate whether you want the actual pressure to be an:

- **under operation** – external pressure less than (or under) the external trigger pressure to trigger to the next profile
- or **over operation** – external pressure greater than (or over) the external trigger pressure to trigger to the next profile

The internal pressure over/under example on page E–4 illustrates this concept as well.

Word 1 of the Setpoint Block

0000 0100 0000 0000

bit 10

To set the external pressure trigger to:	
< = (under)	set bit 10 = 1
> = (over)	set bit 10 = 0

Setting External Time Trigger Setpoints

Time triggers transfer to the next profile when the external time is greater or equal to the external time trigger. The time range is 0 to 65535. Use this field to enable or disable the external time trigger setpoint.

Word 1 of the Setpoint Block

0000 0000 1000 0000

bit 7

To:	
enable the external time trigger setpoint	set bit 7 = 1
disable the external time trigger setpoint	set bit 7 = 0

Using Profile Status and Complete Bits

What's in This Appendix?

This appendix provides bar charts which show you the operation of the following:

- segment active bits
- segment complete bits
- profile active bits
- Profile Done bits
- emergency stop bits
- reset bits

A bit contained in a shaded area B186/30 indicates that the bit is ON or set. All non-shaded areas indicate that bits are turned OFF, or reset.

At the bottom of each bar chart, we show data table addresses for velocity, pressure, position and time. These addresses are taken from the setpoint block for the affected phase. The values are the velocity, pressure, position, or time which when reached, cause a transition into the next active segment or phase

How Do Segment Active, Segment Complete, Profile Active, and Profile Done Bits Work?

Pro-Set 200 contains bits in the phase wide status blocks which can be used by your ladder logic to tell when a profile or segment is being executed or has completed execution. There are 3 phase wide status blocks in Pro-Set 200, one for each phase of control. These blocks are shown in the following table:

Phase-Wide Status Blocks:	Data Table Location:
Injection Phase Permit Status Block	B106
Clamp Phase Permit Status Block	B146
Ejector Phase Permit Status Block	B186

The operation of these bits is as follows:

Bits:	Operation:
Segment Active Bits	These bits are turned ON when the segment is being executed by the ERC2 engine. They turn OFF after the segment has been executed. Examples of segment active bits are injection segment active bits (B106/16 thru B106/20).
Segment Complete Bits	These bits remain OFF until a segment has been completed. When the ERC2 engine finishes executing a particular segment, it signals that it is done by setting the segment complete bit. The complete bit will remain on until one of the following conditions resets it: 1. The reset all segment and profile done bit is set. When this bit is set for a particular phase, it automatically resets all of the segment and Profile Done bits. (Note: There are 3 Reset all segment and phase done bits. They are located in the dynamic phase permit block: • Injection Phase B101:2/1 • Clamp Phase B101:5/1 • Ejector Phase B101:8/1 2. The profile is re-executed. This occurs when the machine completes a cycle and starts a new one. As the new cycle is started, the segment and profile done bits are reset to zero. The segment complete bit is not set if the profile permissive bit is turned off prior to segment completion.
Profile Active Bits	These bits are ON when any segment in the profile is ON. For example, B106/31, the injection profile active bit is ON when any of the injection segment active bits are ON (i.e. when any of B106/16, B106/17, B106/18, B106/19 or B106/20 is ON). See the bar charts for the injection phase for further details.
Profile Done Bit	This bit becomes enabled (ON) when the last segment complete bit in the profile becomes true. For example, the Profile Done bit for the injection profile , B106/57 is set when B106/36 is set. See the bar charts for the injection phase for further details.

Segment Complete Bits

The segment complete bit indicates that a velocity or pressure segment has been executed when set to one (ON).

Figure F.1 Segment Complete Bits for Injection Phase Example

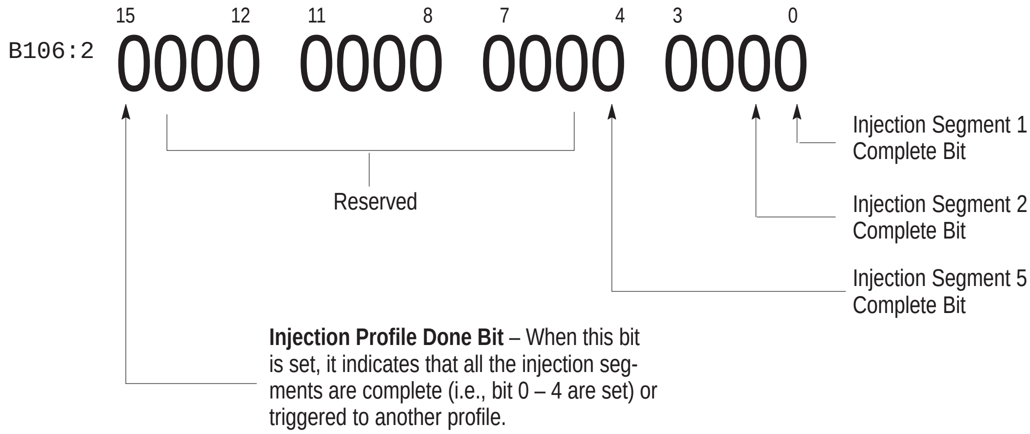
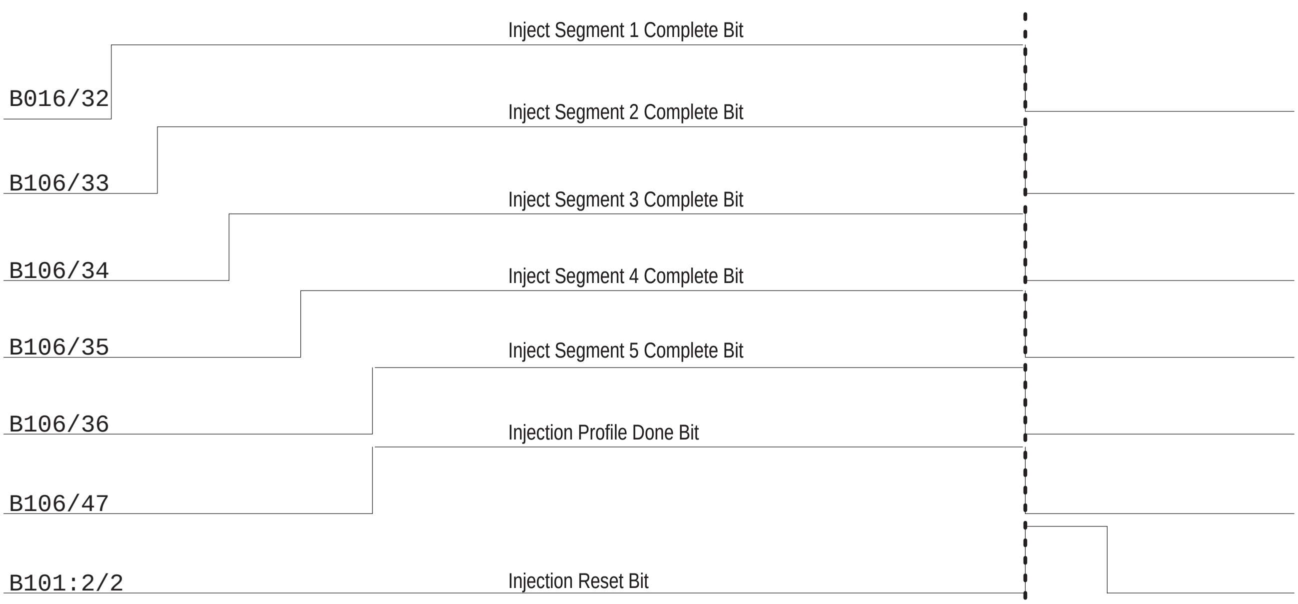


Figure F.2 Using Reset Segment/Segment Done Bits Example



Injection, Pack, Hold Bar Chart

The following bar chart describes the operation of the output coils in the injection, pack, and hold profiles.

	Injection Segment 1 Active Bit	Injection Segment 1 Comp. Bit	Injection Segment 2 Active Bit	Injection Segment 2 Comp. Bit	Injection Segment 3 Active Bit	Injection Segment 3 Comp. Bit	Injection Segment 4 Active Bit	Injection Segment 4 Comp. Bit	Injection Segment 5 Active Bit	Injection Segment 5 Comp. Bit
	B106/16									
		B106/32								
			B106/17							
				B106/33						
					B106/18					
						B106/34				
							B106/19			
								B106/35		
									B106/20	
										B106/36
	B106/31 Injection Profile Active Bit									
										B106/47
Velocity Setpoint	N109:30		N109:38		N109:46		N109:54		N109:62	
Pressure Setpoint	N109:31		N109:39		N109:47		N109:55		N109:63	
Position Setpoint	N109:32		N109:40		N109:48		N109:56		N109:64	
Time Setpoint	N109:33		N109:41		N109:49		N109:57		N109:65	

Pack Segment 1 Active Bit	Pack Segment 1 Comp. Bit	Pack Segment 2 Active Bit	Pack Segment 2 Comp. Bit	Hold Segment 1 Active Bit	Hold Segment 1 Comp. Bit	Hold Segment 2 Active Bit	Hold Segment 2 Comp. Bit
B106/80							
	B106/96						
		B106/81					
			B106/97				
				B106/144			
					B106/160		
						B106/145	
							B106/161

Injection Profile Done Bit							
B106/95 Pack Profile Active							
			B106/111 Pack Profile Done Bit				
				B106/159 Hold Profile Active			
							B106/175 Hold Profile Done Bit
N113:30		N113:38		N117:30		N117:38	
N113:31		N113:39		N117:31		N117:39	
N113:32		N113:40		N117:32		N117:40	
N113:33		N113:41		N117:33		N117:41	

Pre-Decompress, Plasticate, and Post-Decompress Bar Chart

The following bar chart describes the operation of the output coils in the pre-decompress, plasticate, and post-decompress profiles.

	Pre–Decomp Segment 1 Active Bit	Pre–Decomp Segment 1 Comp. Bit	Plasticate Segment 1 Active Bit	Plasticate Segment 1 Comp. Bit	Plasticate Segment 2 Active Bit	Plasticate Segment 2 Comp. Bit	Plasticate Segment 3 Active Bit	Plasticate Segment 3 Comp. Bit
	B106/208							
	B106:13/00	B106/224						
		B106:14/00	B106/272					
			B106:17/00	B106/288				
				B106:18/00	B106/273			
					B106:17/01	B106/289		
						B106:18/01	B106/274	
							B106:17/02	B106/289
								B106:18/02
	Pre-Decompress Phase Active Bit							
	B106/223							
	B106:13/15	B106/239 Pre–Decompress Profile Done						
		B106:14/15	B106/287 Plastication Profile Active					
			B106:17/15					

Velocity Setpoint	N121:30	N125:30	N125:38	N125:46
Pressure Setpoint	N121:31	N125:31	N125:39	N125:47
Position Setpoint	N121:32	N125:32	N125:40	N125:48
Time Setpoint	N121:33	N125:33	N125:41	N125:49

Plasticate Segment 4 Active Bit	Plasticate Segment 4 Comp. Bit	Plasticate Segment 5 Active Bit	Plasticate Segment 5 Comp. Bit	Post–Decomp Segment 1 Active Bit	Post–Decomp Segment 1 Comp. Bit
B106/275					
B106:17/03	B106/290				
	B106:18/03	B106/276			
		B106/17:04	B106/291		
			B106:18/04	B106/336	
				B106:21/00	B106/292
					B106:22/00
			B106/303 Plastication Profile Done		
			B106:18/15	*Post Decompress Profile Active*	
				B106/351	
				B106:21/15	B106/367 Post Decomp Profile Done
					B106:22/25
N125:54		N125:62		N129:30	
N125:55		N125:63		N129:31	
N125:56		N125:64		N129:32	
N125:57		N125:65		N129:33	

Clamp Bar Chart

The following bar chart describes the operation of the output coils in the clamp profiles.

	Clamp Close Initial Active Bit	Clamp Close Initial Comp. Bit	Clamp Close Fast Active Bit	Clamp Close Fast Comp. Bit	Clamp Close Decel Active Bit	Clamp Close Decel Comp. Bit	Clamp LPMP Active Bit	Clamp LPMP Comp. Bit	Tonnage Active Bit	Tonnage Comp. Bit
	B146/16									
	B146:01/00	B146/32								
		B146:02/00	B146/17							
			B146:01/01	B146/33						
				B146:02/01	B146/18					
					B146:01/02	B146/34				
						B146:02/02				
							B146/80			
							B146:05/00	B146/96		
								B146:06/00	B146/144	
									B146:09/00	B146/160
										B146:10/00
	B146/31 Clamp Close Profile Active Bit									
	B146:01/15									
							Clamp LPMP Profile Active			
							B146/95			
							B146:05/25	B146/111 Clamp LPMP Profile		
								B146:06/15	*Tonnage Profile Active Bit*	
									B146/159	
									B146:09/15	B146/175
										B146:10/15

Velocity Setpoint	N149:30	B149:38	N149:46	N153:30	N157:30
Pressure Setpoint	N149:31	N149:39	N149:47	N153:31	N157:31
Position Setpoint	N149:32	N149:40	N149:48	N153:32	N157:32
Time Setpoint	N149:33	n149:41	N149:49	N153:33	N157:33

Clamp **Low Hold Decel Active Bit**	**Clamp** **Low Hold Comp. Bit**	**Clamp Decomp Active Bit**	**Clamp** **Decomp Comp. Bit**	**Clamp** **Open Breakaway Active Bit**	**Clamp** **Open Breakaway Comp Bit**	**Clamp Open Fast Active Bit**	**Clamp Open Fast Comp Bit**	**Clamp** **Open Decel Active Bit**	**Clamp** **Open Decel Comp Bit**	**Clamp** **Open Slow Active Bit**	**Clamp** **Open Slow Comp. Bit**
B146/208											
B146:13/00	B146/224										
	B146:14/00	B146/272									
		B146:17/00	B146/288								
			B146:18/00	B146/336							
				B146:21/00	B146/352						
					B146:22/00	B146/337					
						B146:21/01	B146/353				
							B146:22/01	B146/338			
								B146:21/02	B146/354		
									B146:22/02	B146/339	
										B146:21/03	B146/355
											B146:22/03
Complete Bit											
Tonnage Profile Done Bit											
Clamp Low Hold Profile Active											
B146/223											
B146:13/15	B146/239 Clamp Low Hold Profile Done										
	B146:14/15	*Clamp Decompress Profile Active*									
		B146/287									
		B146:17/15	B146/303 Clamp Decompress Profile Done								
			B146:18/15	B146/351 Clamp Open Profile Active							
				B146:21/15							*Clamp Open Profile Done Bit*
											B146/367
N161:30		N165:30		N169:30		N169:38		N169:46		N169:54	B146:22/15
N161:31		N165:31		N169:31		N169:39		N169:47		N169:55	
N161:32		N165:32		N169:32		N169:40		N169:48		N169:56	
N161:33		N165:33		N169:33		N169:41		N169:49		N169:57	

Eject Forward and Retract Bar Chart

The following bar chart describes the operation of the output coils in the eject forward and retract profiles.

	Ejector Forward Segment 1 Active Bit	**Ejector Forward Segment 1 Comp Bit**	**Ejector Forward Segment 2 Active Bit**	**Ejector Forward Segment 2 Comp Bit**	**Ejector Retract Segment 1 Active Bit**	**Ejector Forward Segment 1 Comp Bit**
	B186/16					
	B186:01/00	B186/32				
		B186:02/00	B186/17			
			B186:01/01	B186/33		
				B186:02/01	B186/80	
					B186:05/00	B186/96
	B186/31 Eject Forward Profile Active					B186:16/00
	B186:01/15			Eject Forward Profile Done		
				B186:02/15	*Eject Retract Profile Active*	
					B186/95	
					B186:05/15	B186/111 Eject Ret. Profile Complete
						B186:06/15
Velocity Setpoint	N189:30		N189:38		N193:30	
Pressure Setpoint	N189:31		N189:39		N193:31	
Position Setpoint	N189:32		N189:40		N193:32	
Time Setpoint	N189:33		N189:41		N193:33	

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X

Y

Z

Glossary

A

Actual – The current status of a machine parameter (such as current velocity, acceleration, pressure change rate, etc.) showing how the machine responded to the setpoint.

Axis – A major moveable part of the machine. A typical injection molding machine has 3 axes: injection, clamp, and ejectors

B

Barrel – The chamber in which plastication takes place; houses the injection screw.

C

Clamp Phase – The axis of motion which controls clamp. It is typically comprised of 6 profiles: close profile, Low Pressure Mold Protect (LPMP) profiltonnage profile, low hold profile, decompress profile, and open profile.

Control Output – The output from the ERC2 algorithm. Typically these control values (CV) are pressure or velocity signals which are sent to drive the appropriate value driver cards.

Cycle Time – Average time taken by the machine to complete the operation.

D

Deadband – The range through which an input can be varied without initiating an observable response.

Deadheaded – The pressure that is measured when the cylinder has stopped moving.

Dead Time – The interval of time between initiation of an input change or stimulus and the start of the resulting observable response.

Display Area – The touch screen on the front of the operator interface, where video displays appear during operation.

E

Ejector Cycle – Machine phase when parts are extracted from the mold. Same as ejector phase

Ejector Phase – The axis of motion which controls the ejectors.It is usually comprised of 3 profiles; forward profile, retract profile, tip–stroke profile.

F

Flash – Melted plastic forced out of mold halves due to excessive pressure.

H

Hold – Machine profile when pressure is applied to melted plastic in the mold to cure the part.

I

Injection – Machine profile when the plastic is forced into the mold.

Injection phase – The axis controlling injection. The injection phase is typically made up of 6 profiles: injection profile, pack profile, hold profile, pre–decompress profile, plasticate profile and post–decompress profile.

Injection Ram/Injection Screw – The plastication device; typically a threaded, screw-like device which heats and liquifies plastic pellets.

J

Jog – Constant speed and pressure setting used to move the machine while setting a mold or configuring the machine. While jogging in manual mode, the same command value is sent to the valves regardless of position or pressure feedback values. The profile's velocity and pressure segment setpoints are not used. Trigger setpoints are ignored. Segment and profile active and done bits are set according to the profile segment position and time setpoints.

K

Kp – Roughly equivalent to a proportional term. Provides in–shot correction (i.e. makes changes to the valve in response to error).

L

Low Pressure Mold Protect – Last clamp close operation to protect the mold if a plastic part is stuck in it.

M

Manual (Machine Control) – Control of the machine by an operator.

Manual (Temperature) – Temperature control of a loop with fixed %-output setpoints (no feedback).

Mode (Machine) – Select from manual, semi-auto (one cycle), or automatic (production).

O

Open Slow – Last clamp open operation when clamp decelerates to fully open position.

Open Loop Test (OLT) – Used by ERC2 to determine System Gains, Dead Times and Time Constants for profiles.

Operator Panel – Device where machine status is displayed and the operator enters setpoints; also called *operator interface (OI)*.

P

Pack – Machine profile when the melt is pressured to complete filling mold cavity.

Phase – An axis of control. In injection molding there are typically three phases: injection, clamp, and eject. Phases are often referred specifically as injection phase, ejector phase, and clamp phase.

Plastication – Machine profile when the screw rotates and backs up to load plastic for another shot; the process of melting and liquifying plastic pellets.

Post-decompression – Length of ram (screw) pullback after plastication to avoid drooling melt during ejection.

Pre-decompression – Length of injection screw pullback before plastication to isolate cushion melt left in barrel.

Pressure-limited Velocity – A type of velocity vs. position profile in which control changes to pressure vs position when injection pressure exceeds a preset limit.

Process Variable – measured value from a process, such as velocity, pressure, or temperature.

Profile – Setpoints to control a portion of the machine cycle. Select from clamp close, inject, pack, hold, pre-decompress, plastication, post-decompress, clamp open, eject, clamp low hold, clamp low pressure mold protect, tonnage, ejector forward, ejector reverse, ejector tip storage. For example:

- velocity and position setpoints for velocity vs position profile to open clamp
- pressure and position setpoints for a pressure vs. position LPC profile to close clamp
- pressure and time setpoints for pressure vs time profile to pack the melt

R

Rise Time – The time required for the output of a system to change from a small specified percentage (typical 5 – 10%) of the steady state increment to a large specified percentage (typical 90 to 95%).

S

Setpoint – A preset, targeted machine parameter (such as velocity, acceleration, pressure change rate, etc.) that serves as the benchmark for ERC2.

Setting Time – The time required, following the detection of a specified stimulus to a system, for the output to enter and remain within a specified narrow band centered about its steady state value.

Shot Size – Length the injection screw travels to load the next shot of plastic (cushion NOT included).

Shot Size (100%) – Length *including cushion* that the injection screw travels to load the next shot of plastic.

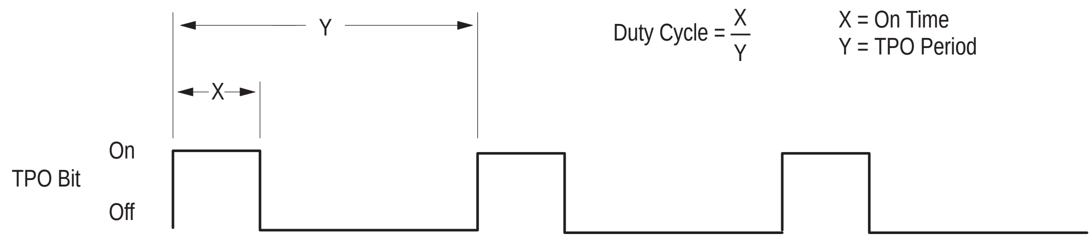
Segment – A pair of velocity and pressure setpoints which comprise an increment. Multiple segments make up a profile.

T

Time Constant – The time required to complete 63% of the total rise or decay at any step of the process.

Tip Strokes – Optional ejector strokes to dislodge a part after first ejector advance and before last retract.

Timed Proportional Output TPO – The control-variable output of each loops is sent from the 1746–BTM module to the SLC data table as the duty cycle of a bit that is cycled at a regular period. We call this bit a time-proportioned output (TPO) bit. The ladder logic can send this signal to a digital output module to generate the control variable output signal to the temperature control actuator.



Transition – Pressure, position, or time when machine changes from one phase, profile, or segment to another, such as injection to pack; same as **Trigger**.

Trigger – A position, pressure, or time which, when needed, permits the transfer from one phase, profile, or segment to the next; same as **Transition**.

U

V

W

X

Y

Z

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