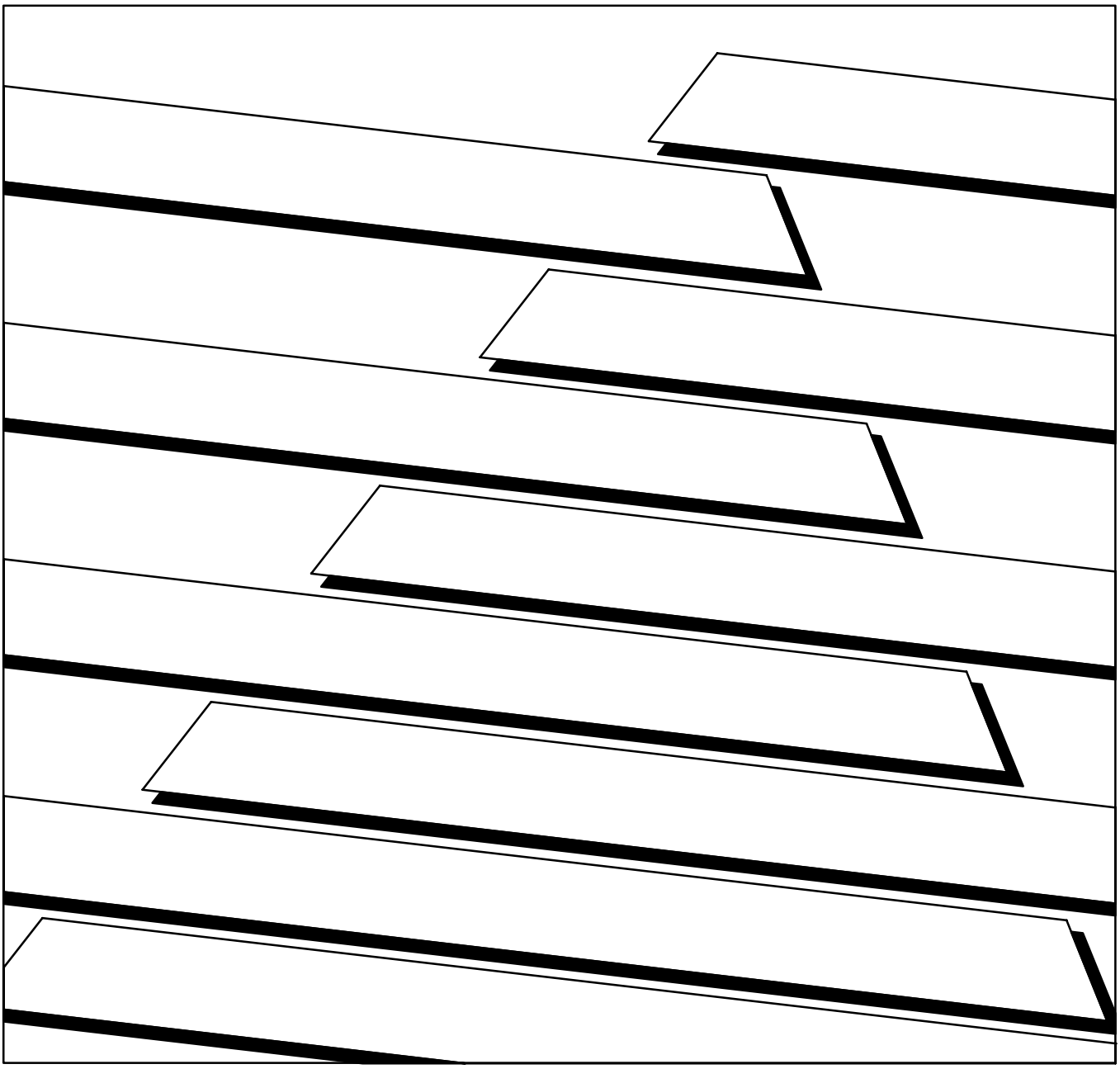
ALLEN-BRADLEY

Plastic Molding Module

(Cat. No. 1771-QDC)

Inject, Clamp, and Eject Mode



Important User Information

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

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

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

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ATTENTION: Tells readers where people may be hurt, machinery may be damaged, or economic loss may occur, if procedures are not followed properly.

ATTENTION helps 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.

Important: We recommend that you frequently back up your application programs on an appropriate storage medium to avoid possible data loss.

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Important Information

Manual Objectives

Use this preface to familiarize yourself with this manual so you can use it effectively. This manual shows you how to apply the QDC module to your molding machine in a reasonable length of time.

Since this manual is task oriented, we recommend that you perform these tasks in the following order:

Perform this task:	As discussed in this chapter:
Browse through the entire manual to become familiar with its contents.	All chapters
Learn about the inject, clamp, and eject process. This describes how the QDC module controls your injection molding system.	Chapter 1
Install the QDC module. This includes such tasks as wiring and setting jumpers.	Chapter 2
Learn about the configuration process. This describes procedures you perform using this manual.	Chapter 3
Configure the QDC module mode of operation to match your specific application, and its communication with its inputs and outputs.	Chapter 4
Jog the ram (screw), clamp, and ejector. This task requires that you configure jog setpoints and pressure alarm setpoints.	Chapter 5
Set up communications between your PLC-5 processor and the QDC module. You write ladder logic to handle command bit interaction between the two devices.	Chapter 6
Prepare to run your machine in open loop. This task requires that you determine and enter initial values into the ram (screw), clamp, and ejector configuration blocks.	Chapter 7
Prepare to run and tune your machine in open loop. This task requires that you determine and enter initial values into ram (screw), clamp, and ejector profile blocks.	Chapter 8
Span your ram (screw), clamp, and ejector valves. This is done using set-output and open-loop control.	Chapter 9
Tune the machine for parts production.	Chapter 10
Troubleshoot problems that may occur with QDC module.	Chapter 11
Refer to this appendix for a blank copy of each worksheet contained in this manual.	Appendix A

Audience

Before attempting to apply the QDC module to a molding machine we assume that you are:

- an injection molding professional
- an experienced PLC® programmer
  (especially with the Allen-Bradley PLC-5 family of processors)
- an hydraulics designer or technician

Use of Terms

We use abbreviated catalog numbers when referring to Allen-Bradley equipment:

Abbreviated Name:	Title:
QDC module	1771-QDC Plastic Molding Module
PLC-5 processor	PLC-5 Programmable Controller
T45 or T47 T50 oe T53 terminal	1784-T45 or -47 Portable Programming Terminal 1784-T50 or -53 Industrial Terminal
Pro-Set™ 600 Software	6500-PS600 Pro-Set 600 Injection Molding Operator Interface Software
PanelView™ Color display	2711-KC1 PanelView Operator Interface Terminal
ERC™	Expert Response Compensation™

The next table presents other terms we commonly use in this manual:

Term:	Definition:
Selected Valve	In multi-valve systems, depending on the configured profile, the QDC module controls one valve and presets the setting of the remaining valves to produce molding-machine profiles. We call the valve being controlled by the QDC modules algorithms the selected valve.
Unselected Valves	In multi-valve systems, depending on the configured profile, the QDC module controls one valve and presets the setting of the remaining valves to produce molding-machine profiles. We call the valves that are preset with an open-loop percentage setpoint the unselected valves.
Profile	A group of mold/part setpoints which define a given machine operation to the QDC module.
Command Block	Data blocks downloaded from the PLC-5 data table to the QDC module to make configuration changes or to initiate machine actions.
Status Block	Data blocks used by the QDC module to relay information to the PLC-5 processor about the QDC module's current operating status.
Profile Block	Command block containing mold/part setpoints.
Configuration Block	Command block containing machine setpoints.
Direct Acting Valve	An analog control valve that delivers increasing velocity or pressure with increasing signal input.
Reverse Acting Valve	An analog control valve that delivers increasing velocity or pressure with decreasing signal input.

Command Blocks

Command blocks provide the parameters that control machine operation. They are transferred from the PLC-5 processor to the QDC module by means of block transfer write (BTW) instructions in software ladder logic. Command block abbreviations are:

Acronym:	Description:
MCC	Module Configuration Command Block
JGC	Jog Configuration Command Block
FCC	First Clamp Close Configuration Command Block
SCC	Second Clamp Close Configuration Command Block
TCC	Third Clamp Close Configuration Command Block
LPC	Clamp Low Pressure Close Configuration Command Block
CFC	Clamp Close Profile Command Block
INC	Injection Configuration Command Block
IPC	Injection Profile Command Block
PKC	Pack Configuration Command Block
HDC	Hold Configuration Command Block
HPC	Pack/Hold Profile Command Block
PRC	Pre-decompression Configuration Command Block
PLC	Plastication Configuration Command Block
PPC	Plastication Profile Command Block
PSC	Post-decompression Configuration Command Block
FOC	First Clamp Open Configuration Command Block
SOC	Second Clamp Open Configuration Command Block
TOC	Third Clamp Open Configuration Command Block
OSC	Clamp Open Slow Configuration Command Block
OPC	Clamp Open Profile Command Block
EAC	Ejector Advance Command Block
ERC	Ejector Retract Command Block
EPC	Ejector Profile Command Block
DYC	Dynamic Command Block
RLC	Inject ERC Values Command Block
CLC	Clamp and Eject ERC Values Command Block

Status Blocks

Status blocks report current status of molding-machine operation. They are returned from the QDC module to the PLC-5 processor by means of block transfer read (BTR) instructions in software ladder logic. Status block abbreviations are:

Acronym:	Description:
SYS	System Status Block
CPS	Clamp Close Profile Status Block
IPS	Injection Profile Status Block
HPS	Pack/Hold Profile Status Block
PPS	Plastication Profile Status Block
OPS	Clamp Open Profile Status Block
EPS	Ejector Profile Status block
RLS	Inject ERC Values Status Block
CLS	Clamp and Eject ERC Values Status Block

Word and bit Numbering

The QDC module stores data in command and status blocks. Each word location in a command or status block is identified by an alphanumeric code containing the block acronym and word number. For example, word 09 of the Module Configuration Command Block (MCC) is identified as MCC09.

Identify bits in a word location by adding bit numbering to the abbreviated word location. For example:

Specific: MCC09-B15 **General:** MCCxx-Byy

where:

- MCC = Module Configuration Command Block
- xx=word number (01-64)
- B = bit identifier
- yy = bit number (00-15)

Related Publications

The following table lists documentation necessary for the successful application of the QDC Module:

Publication	Use this documentation:	To:
1785-6.6.1	PLC-5 Family Programmable Controller Installation Manual	Install the PLC-5 processor and I/O modules.
6200-N8.001	6200 PLC-5 Programming Software Documentation Set	Select instructions and organize memory when writing ladder logic to run your machine.
1771-4.10	Plastic Molding Module Application Guide	Help select the module mode and match your QDC module to your hydraulic layout.
1771-6.5.85 1771-6.5.86 1771-6.5.87	Plastic Molding Module User Manuals for other modes.	Configure, program, install, and operate your QDC module to control molding operations.
1771-6.5.88	Plastic Molding Module Reference Manual	Program block transfers between PLC-5 processor and QDC module. Also, information on PLC-5 data transfer logic.

Take time now to familiarize yourself with the Reference Manual (publication 1771-6.5.88). The four sections include:

- a summary of each data block used by the QDC module (abbreviated command and status blocks)
- programming error codes returned by the QDC module for each data block, and recommended procedures to correct these errors
- detailed listing and explanation of each command word and bit used by, and each status word and bit returned from, the QDC module
- operational, electrical, and environmental specifications of your module

If you purchased the Pro-Set 600 software, you also need the following:

Publication	Use this documentation:	To:
6500-6.5.11	Pro-Set 600 Software Designers Guide	Select the Pro-Set 600 software that matches the requirements of your molding machine.
6500-6.5.12	Pro-Set 600 Software Assembly Manual	Transfer your Pro-Set 600 software from a floppy disk to your hard drive. Add Overlays into your PLC-5 and PanelView application files.
6500-6.5.13	Pro-Set 600 Software Overlay Installation Manual	Install Pro-Set 600 overlays into your application files.
6500-6.5.14	Pro-Set 600 Software Customization Manual	Customize your Pro-Set 600 build for your machine control requirements.
6500-6.5.15	Pro-Set 600 Software Reference Manual	Support customizing your software control system.

Chapter 1

Overview of Inject, Clamp, and Eject Mode

Chapter Objectives

This chapter presents an overview of the 1771-QDC Plastic Molding Module in the inject, clamp, and eject mode. We present a summary of operating features followed by sample applications.

Important: This chapter assumes you have already read your Plastic Molding Module Application Guide (publication 1771-4.10) and have chosen inject, clamp, and eject as your QDC module's mode of operation.

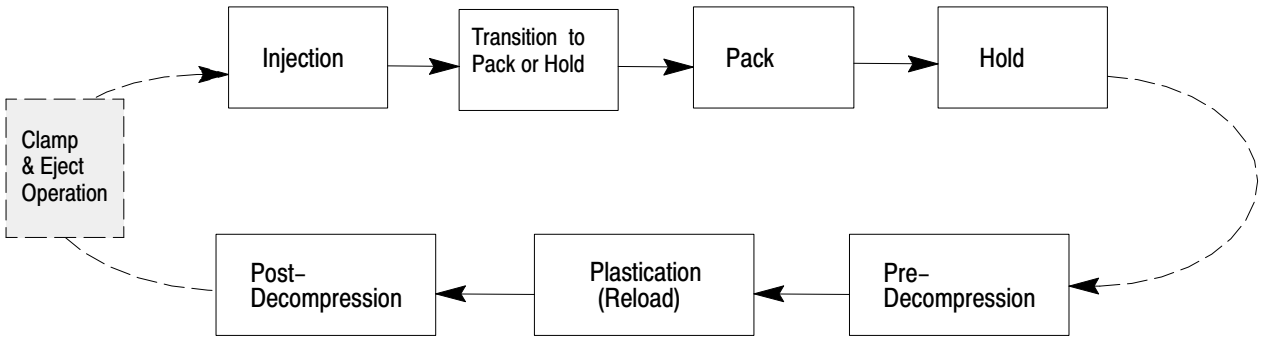
Next we describe the control operations of this mode.

Inject Control

You can control the inject operation with these phases:

- injection
- transition
- pack
- hold
- pre-decompression
- plastication
- post-decompression

Figure 1.1
Inject Operation of a Typical Machine Cycle

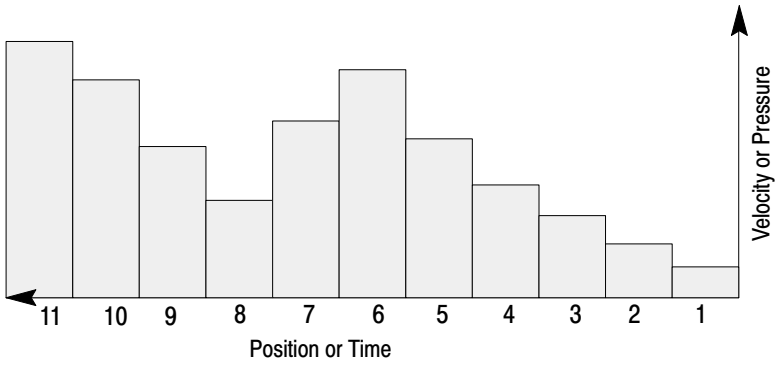


Injection Phase

You can vary the velocity of the ram (screw), or the pressure driving it, so the leading edge of the melt moves through the mold cavity at the desired speed. The pattern of velocity or pressure variation during injection is called the injection profile. The QDC module lets you chose from four different injection profiles:

- velocity vs. position
- pressure-limited velocity vs. position
- pressure vs. position
- pressure vs. time

Figure 1.2
Example Injection Profile



You enter setpoints to create a profile. You can select from 1 to 11 segments of position or time. Segment numbers represent the order of operation. By convention the ram (screw) injects plastic by moving from right to left.

With this Profile:	You Control Injection:	With up to 11 Segments Distributed over the:
Velocity vs. Position	Speed	Length of the shot
Pressure-limited[1] Velocity vs. position	Speed with a maximum pressure	Length of the shot
Pressure vs. Position	Pressure	Length of the shot
Pressure vs. Time	Pressure	Time for a shot

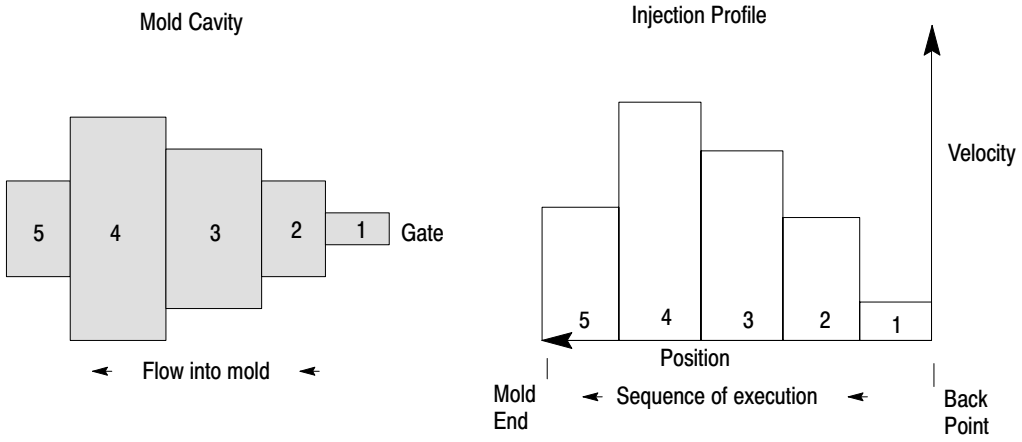
[1] Pressure-limited velocity vs. position profile differs from the velocity vs. position profile as follows: During any segment, if the pressure exceeds a preset limit, the module switches to PID pressure control with the pressure limit as the setpoint. Then if velocity exceeds the velocity setpoint, the module returns to velocity control.

Example Benefits of Profiling an Injection Phase

The injection phase should force the melt through the mold as fast as possible without flashing the mold or burning the melt at a mold gate. Here are two examples of how you can achieve this by profiling the injection phase:

Velocity Example - As the leading edge of the melt enters different mold cavities, the flow of plastic through the gate should increase or decrease accordingly to keep the melt front at maximum desired speed without flashing the mold. This reduces injection time and minimizes surface stress due to surface cooling. You achieve this by shaping the injection profile to suit the mold cavity (Figure 1.3).

Figure 1.3
Velocity Example

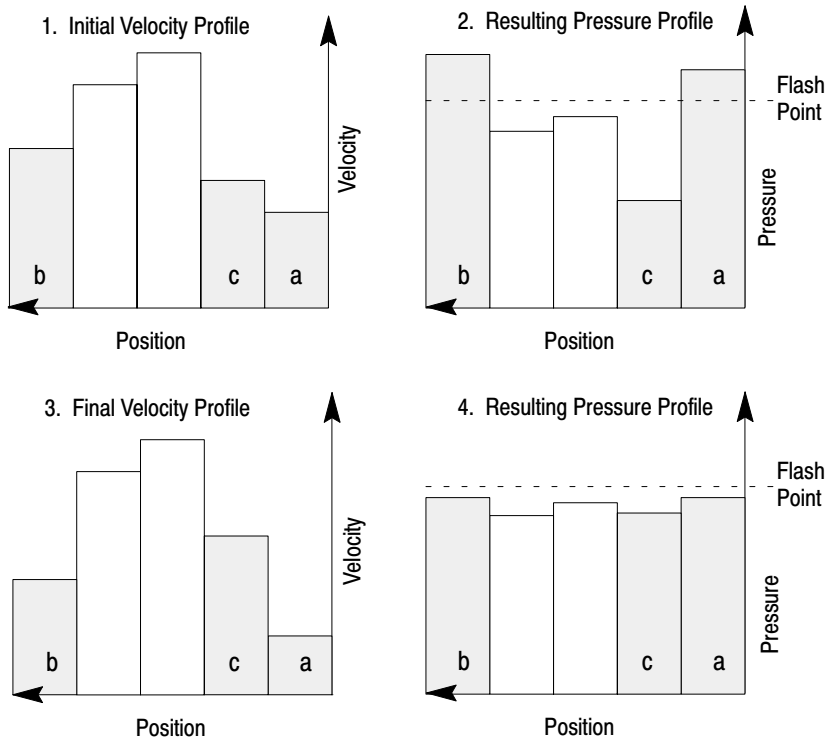


Flash Prevention Example - With a velocity profile (Figure 1.4 part 1), the pressure may reach a peak and flash the mold at ram (screw) position segments that correspond to events such as:

- the initial surge (2.a)
- when the melt front enters a constriction in the mold cavity (2.b)

You can remedy this (part 3) by decreasing the ram (screw) velocity at segments (3.a) and (3.b) that correspond to flash points. Conversely, you can boost velocity at segment (3.c) where the resulting pressure is well below the flash point.

Figure 1.4
Flash Prevention Example



Optionally, you may select pressure limited velocity versus position as your method of injection control. With your pressure limit setpoint just below the flash point, the module switches over to pressure control prior to flashing the mold.

Injection-to-pack Transition

The QDC module ends the injection phase and automatically starts the pack or hold phase when it detects the first of up to three events occurred:

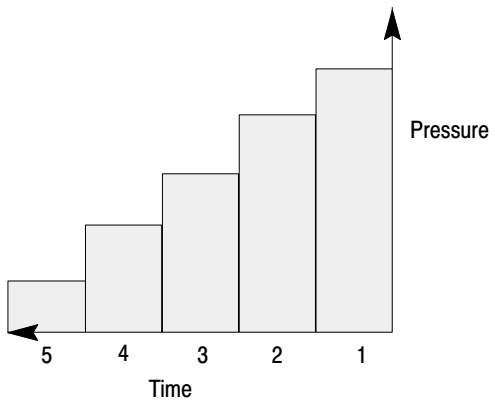
- Ram (screw) position exceeds a preset limit
- Ram (screw) pressure exceeds a preset limit
- Injection phase elapsed time exceeds a preset limit

You select which of these events you want monitored for transition by entering the appropriate setpoint, or zero for ignoring the event. You also may specify the zone of ram (screw) travel over which the QDC module inhibits or allows a pressure transition.

Pack Phase

The QDC module controls the pack phase with a pressure vs. time profile. You create the profile based on controlling the hydraulic pressure against the ram (screw). You can control pressure with up to five segments. By convention, events occur from right to left on the time axis (Figure 1.5). You determine the pressure setpoints and time durations for the pack profile based on molding requirements. The pack phase is optional.

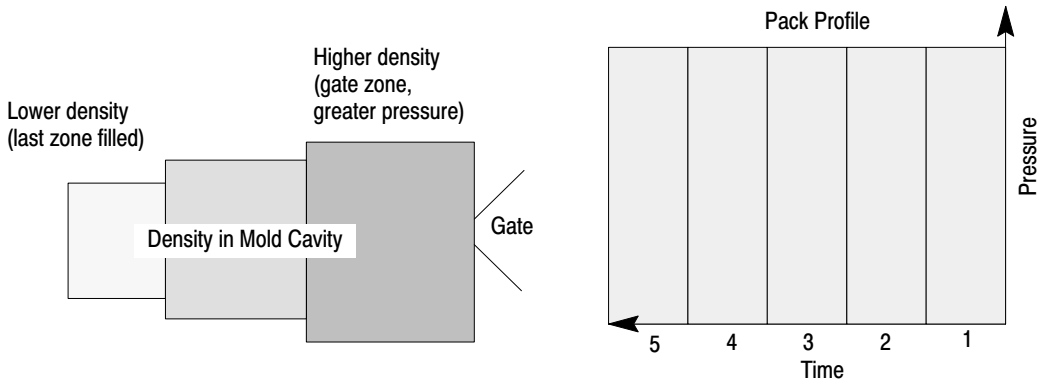
Figure 1.5
Pack Phase Example



Example Benefit of Profiling the Pack Phase

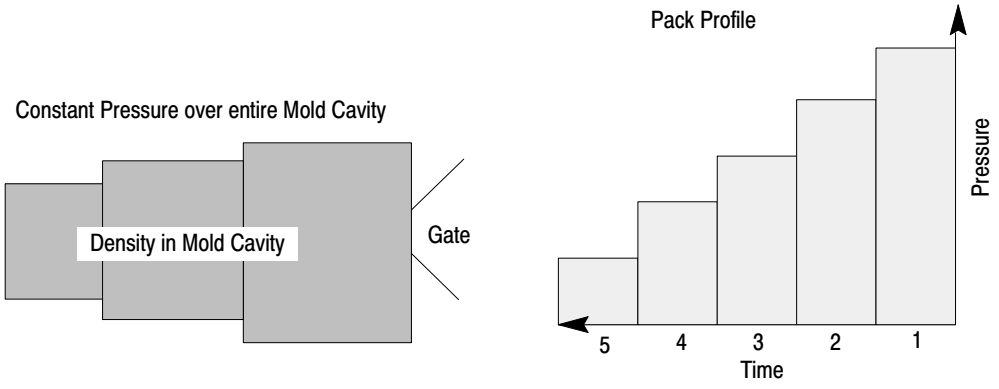
Molten plastic may cool unevenly in the mold causing variations in density with the end result of warpage and distortion as shown in Figure 1.6.

Figure 1.6
Uneven Cooling in Pack Phase



You can remedy this by decreasing the pack pressure with time so plastic can back out of the mold as shown in Figure 1.7. This is to alleviate gradations in density as the plastic cools from the low-density end of the mold (last zone filled) to the high-density end of the mold cavity (gate zone where pressure is greater).

Figure 1.7
Even Cooling in Pack Phase



After completing the last segment of the pack phase, the QDC module automatically starts the hold phase.

Hold Phase

The QDC module controls the hold phase with a pressure vs. time profile. You create the profile based on controlling the hydraulic pressure against the ram (screw). The pressure can be controlled using up to five segments. You determine the pressure setpoints and time durations for the hold profile based on molding requirements.

After completing the last segment of the hold phase, the QDC module either immediately starts the optional pre-decompression movement, skips the pre-decompression movement if none is required and immediately starts the plastication phase, or waits for a command from your PLC-5 program to continue.

Pre-decompression Movement

You select a length of pullback for the ram (screw) prior to the plastication phase to separate plastic solidifying in the sprue from molten cushion remaining in the barrel.

After completing the pre-decompression movement, the QDC module either immediately starts the plastication phase or waits for a command from your PLC-5 program to continue.

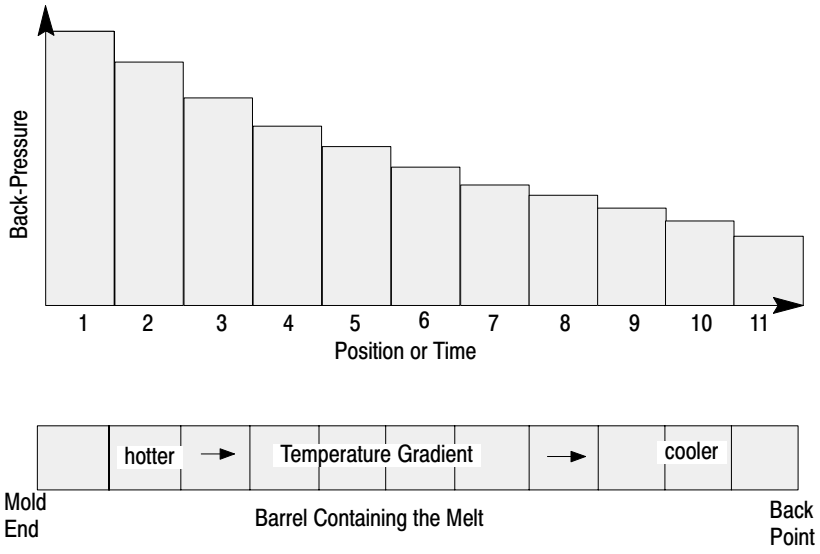
Plastication Phase

The plastication phase lets you achieve a melt temperature gradient in the barrel containing the ram (screw). To program the desired temperatures, you consult backup rate (backpressure) vs. temperature tables. You can create the profile with up to 11 segments of position or time (figure 1.8).

You chose from two plastication profiles:

- Backpressure vs. position
- Backpressure vs. time

Figure 1.8
Plastication Phase Example



Example Benefits of Profiling a Plastication Phase
The higher the backpressure during plastication, the slower the backup rate and higher the resultant temperature of the melt. You can achieve the desired temperature gradient by lowering ram (screw) backpressure to accelerate the backup rate and decrease the temperature of the melt along the length of the barrel.

After completing the last segment of the plastication phase, the QDC module either immediately starts the post-decompression movement or waits for a command from your PLC-5 program to continue.

Post-decompression Movement

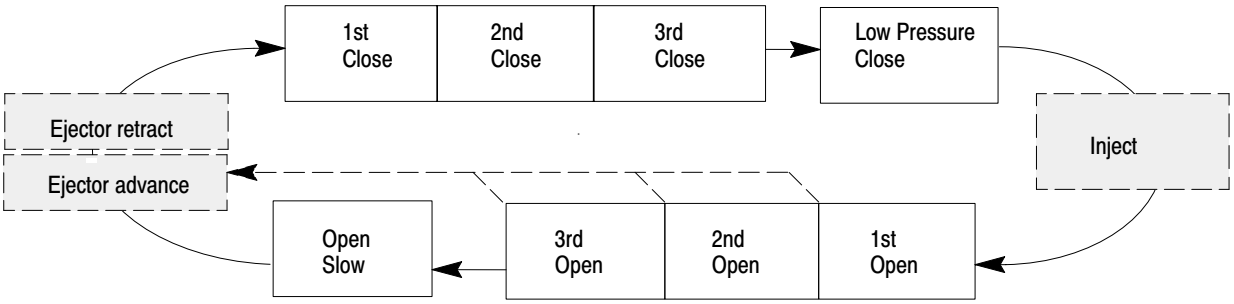
You select a length of pullback of the ram (screw) after the plastication phase to guard against drooling molten plastic into the open mold during ejection. The QDC module notifies your PLC-5 program when the post-decompression movement is complete.

Clamp Control

You control clamp operation with these phases:

- clamp close
- low pressure close
- clamp open
- open slow

Figure 1.9
Clamp Portion of a Typical Machine Cycle



Clamp Close

You may configure three separate clamp close profiles:

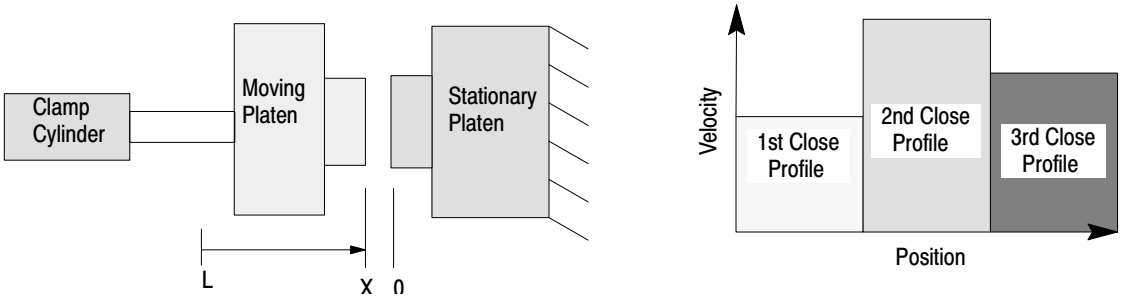
- first close
- second close
- third close

You may select from these control modes:

- velocity vs. position
- pressure vs. position

Use clamp close to move the platen from the fully open position (L) to some position X at a relatively high velocity or pressure. X is a position relatively close to the stationary platen yet far enough away to allow deceleration into low pressure close. This prevents the platens from coming together at a high velocity (Figure 1.10).

Figure 1.10
Example Clamp Close

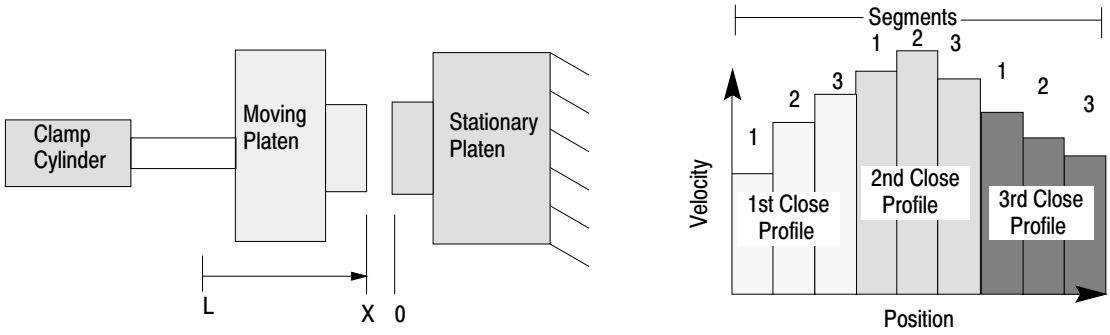


You may start these operations between the three clamp close profiles:

- pick up the 3rd plate of a mold (on a floating 3-plate mold) or set cores
- program other events for all valves
- automatically bridge between profiles, or let ladder logic decide when to begin the next profile

You can subdivide each clamp close profile into three position segments (Figure 1.11). You can change clamp velocity or pressure up to three times in each profile, or up to nine times for the entire clamp close phase.

Figure 1.11
Example Clamp Close Position Segments



Important: You may use as many or as few profiles and/or segments within profiles as needed for your molding application. If using a single close fast motion, use the first segment of the 1st close profile. The low pressure close profile must follow.

After completing the last segment in each profile, the QDC module either switches immediately to the next programmed segment of the next programmed profile or waits for a command from your PLC-5 program to continue.

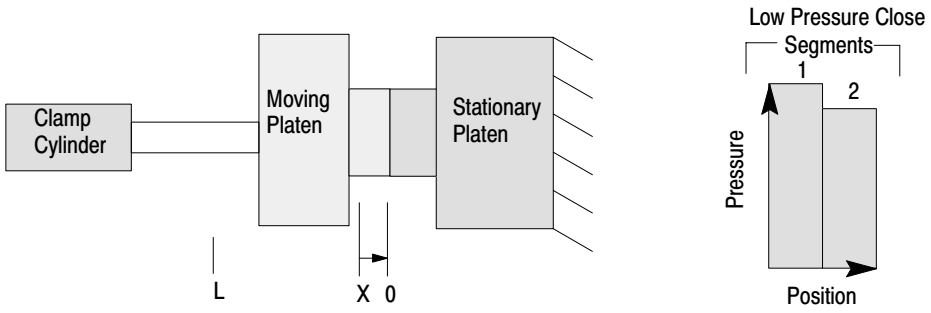
After completing the last configured close profile, the QDC module either switches immediately to the first programmed segment of low pressure close, or waits for a command from your PLC-5 program to continue.

Low Pressure Close

Use the low pressure close profile to decelerate closing motion to guard against damaging the mold halves and detect for part obstructions. The pressure setpoint(s) that you select to control low pressure close should prohibit the mold from fully closing if there is an obstruction. You may use one or two low pressure close profile segments (Figure 1.12).

You must use pressure vs. position for low pressure close.

Figure 1.12
Example Low Pressure Close



Important: If you need only one low pressure close segment, configure the 1st segment of the low pressure close profile.

The QDC module notifies your PLC-5 program when this profile is complete and automatically uses set-output values at the end of low pressure close to build tonnage (hydraulic machine) or lockup your toggle (toggle machine).

Clamp Open

You can open the mold fast with three profiles of the clamp open phase:

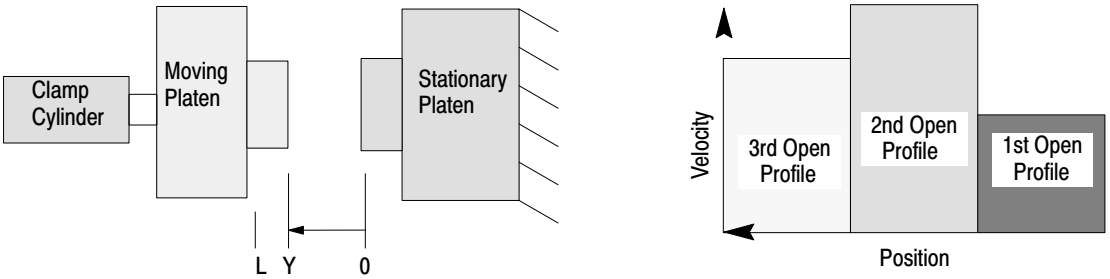
- first open
- second open
- third open

You may select from these control modes:

- velocity vs. position
- pressure vs. position

Use clamp open to move the platen from the fully closed position (0) to some position Y at relatively high velocity or pressure (Figure 1.13). Y is close to your fully open position (L), yet far enough away for deceleration into the open slow profile. This aids positioning accuracy at position (L).

Figure 1.13
Example Clamp Open

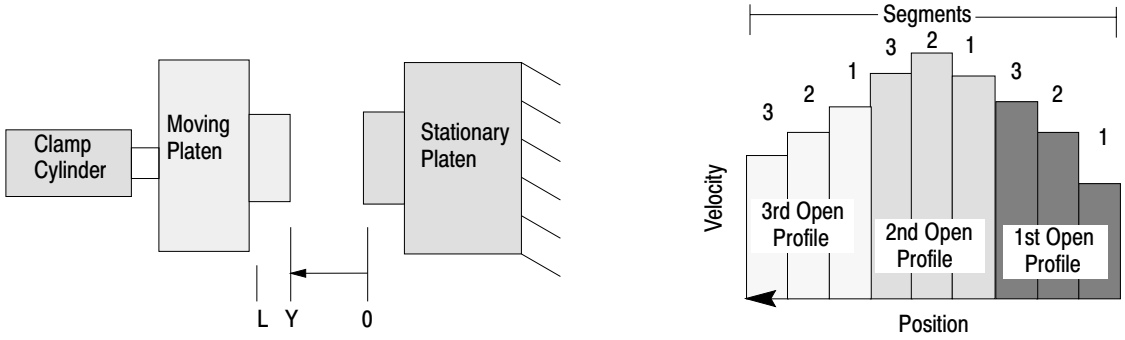


You may start these operations between the three clamp open profiles:

- drop the third plate of a mold (on a floating 3-plate mold) or pull cores
- program other events for all valves
- automatically bridge between profiles, or let ladder logic decide when to begin the next profile.

Each clamp open profile can be subdivided into three position segments (Figure 1.14). You can change clamp velocity or pressure up to three times in each profile, or up to nine times for the entire clamp open phase.

Figure 1.14
Example Clamp Open Position Segments



Important: You may use as many or as few profiles and/or segments within profiles as needed. If using a single open motion, use the first segment of the 1st open profile. The open slow profile must follow.

After completing the last segment in each profile, the QDC module either switches immediately to the next programmed segment of the next programmed profile or waits for a command from your PLC-5 program to continue.

After completing the last configured open profile, the QDC module either switches immediately to the first programmed segment of the open slow profile, or waits for a command from your PLC-5 program to continue.

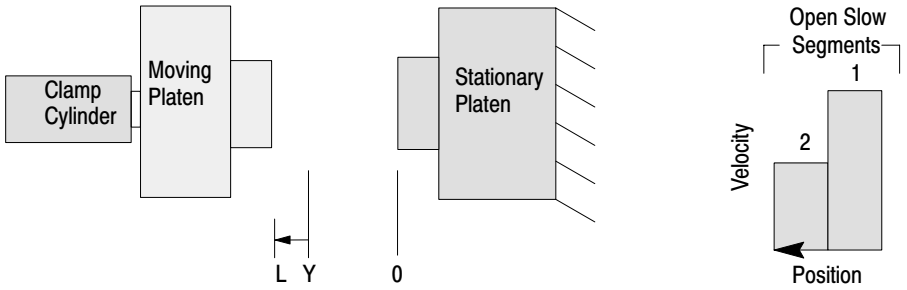
Open Slow

Use the open slow profile to accurately position the clamp for ejecting the part(s). You may decelerate clamp motion twice with this profile using up to two profile segments (Figure 1.15).

You may select from these control modes:

- velocity vs. position
- pressure vs. position

Figure 1.15
Example Open Slow



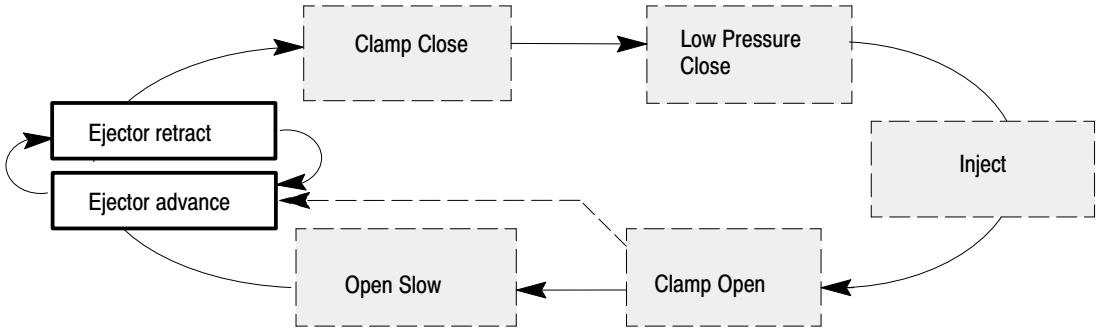
Important: If you need only one open slow motion, configure only the 1st segment of the open slow profile.

Ejector Control

In this section, we describe the eject operation for expelling molded parts. The operation consists of:

- ejector advance
- ejector retract

Figure 1.16
Clamp and Eject Portion of a Typical Machine Cycle



Ejector Advance

The QDC module starts advancing the ejector after detecting either one of these events that you configure/program:

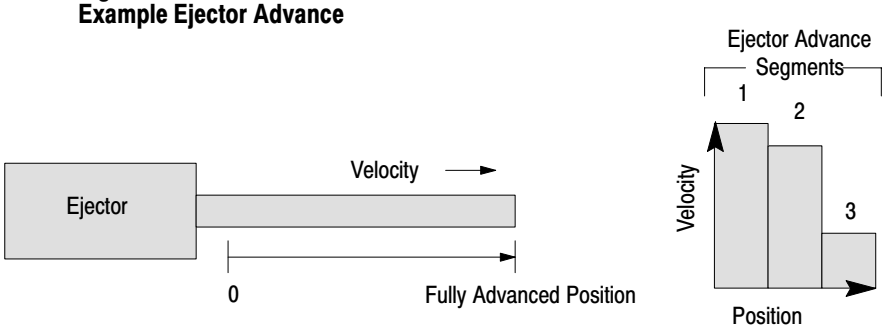
- clamp position reaching a pre-determined setpoint
- command from your PLC program

You may advance the ejector while the clamp is still opening the mold, or wait until the mold is fully open.

You may use up to three ejector-advance profile segments, and select from these control modes:

- velocity vs. position
- pressure vs. position

Figure 1.17
Example Ejector Advance



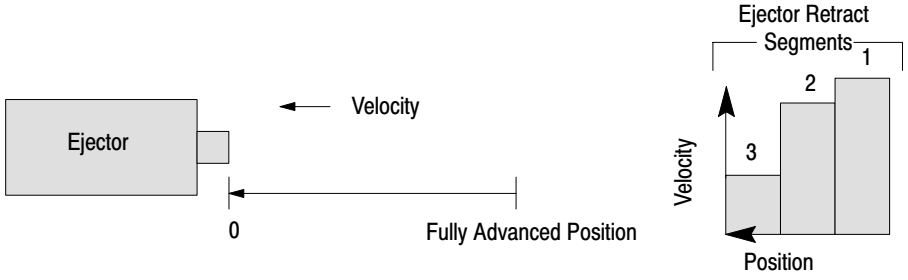
Important: If you need only one ejector-advance motion, configure only the 1st advance segment.

Ejector Retract

After ejector advance is completed, the QDC module executes ejector retract. Similar to ejector advance, you retract the ejector with up to three profile segments. You may select from these control modes:

- velocity vs. position
- pressure vs. position

Figure 1.18
Example Ejector Retract

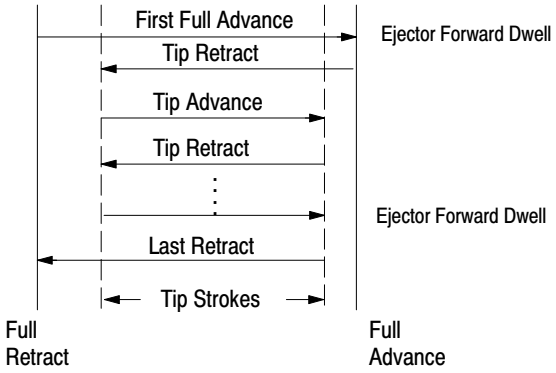


Other Eject Features

The QDC module gives you the following additional features:

- **Multiple Cycles** – the ability to repeat the ejector cycle a number of times, changing from advance to retract determined either automatically or by command from your PLC program
- Ejector Forward Dwell - the ability to pause after completing the first or last advance stroke. Use this feature so a robot can pick off a part when ejectors are fully extended
- Ejector "Tip" Strokes - the ability to shake the part off the ejector. You may program interim single-segment advance and retract tip strokes that occur after the first advance stroke and before the last retract stroke

Figure 1.19
Advance, Retract and Tip Strokes



System Pressure

We define system pressure for the Inject, Clamp, and Eject mode as the pressure continuously detected by the single pressure sensor connected to the QDC module at input 2. Depending on machine hydraulics, a single pressure valve may control inject, clamp, and/or eject mode profiles.

ATTENTION: Your control system may not work as expected with possibly machine damage if you attempt to control a pressure profile of a phase (inject, clamp, or eject) not hydraulically plumbed for pressure control.

Because system pressure may change from one phase to the next, we recommend that you:

- assign pressure control to phases that *require* pressure profiles (and are hydraulically plumbed to support it)
- place the system pressure sensor accordingly in the hydraulic circuit
- configure the remaining phases with velocity profiles

We define open-loop pressure control as when the QDC module controls phase pressure without input from the system pressure sensor. For example: when the system pressure sensor monitors the clamp for closed-loop pressure control, the QDC module can control:

- ram (screw) pressure for pack, hold, and plastication in open loop
- ejector velocity in closed- or open-loop using a position sensor

For example:

For this Phase	The QDC Module Can Control it With
clamp close and open	closed-loop pressure
injection	open-loop pressure-limited velocity
pack/hold	open-loop pressure
plastication	open-loop pressure
ejector advance and retract	velocity

In general:

If your system pressure sensor reads pressure for only ONE of these modes:	Then you must control the other modes by either of: 1. closed- or open-loop velocity 2. open-loop pressure
inject	clamp, eject
clamp	inject , eject
eject	inject, clamp

Example Hydraulic Circuits for the Inject, Clamp, and Eject Mode

We illustrate three examples of hydraulic circuits compatible with the QDC module in the inject, clamp, and eject mode:

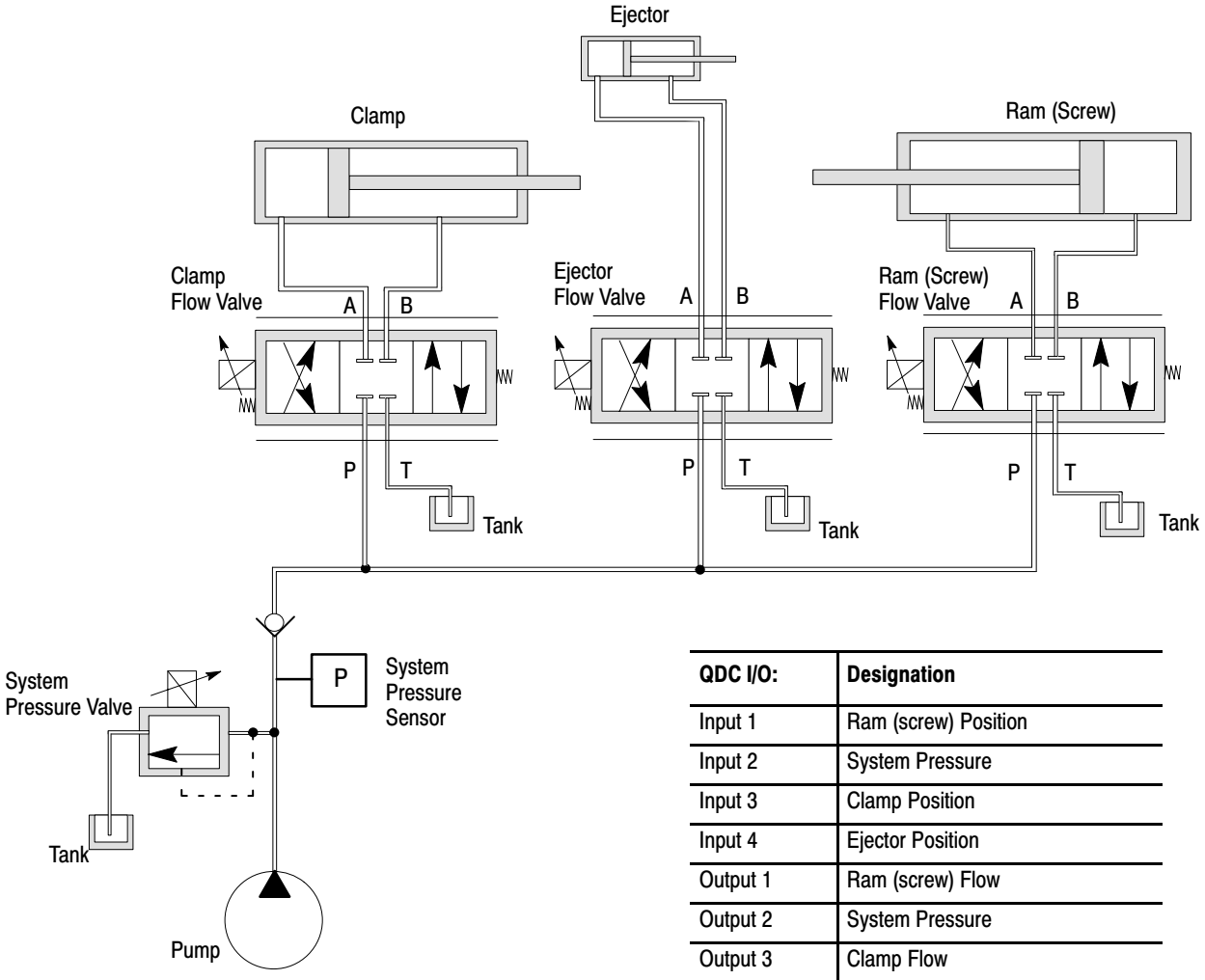
- 4-valve system with system pressure sensor
- 3-valve system with ram (screw) pressure sensor
- 2-valve system for inject phase with clamp and ejector position inputs (clamp and ejector direction solenoid valves controlled by ladder logic)

Example 4-valve System with System Pressure Sensor

With this hydraulic system, a QDC module in the Inject, Clamp, and Eject mode, has maximum control flexibility. It can control all profiles with:

- pressure or velocity
- open or closed loop

Figure 1.20
Example 4-valve System for Inject/Clamp/Eject Control



QDC I/O:	Designation
Input 1	Ram (screw) Position
Input 2	System Pressure
Input 3	Clamp Position
Input 4	Ejector Position
Output 1	Ram (screw) Flow
Output 2	System Pressure
Output 3	Clamp Flow
Output 4	Ejector Flow

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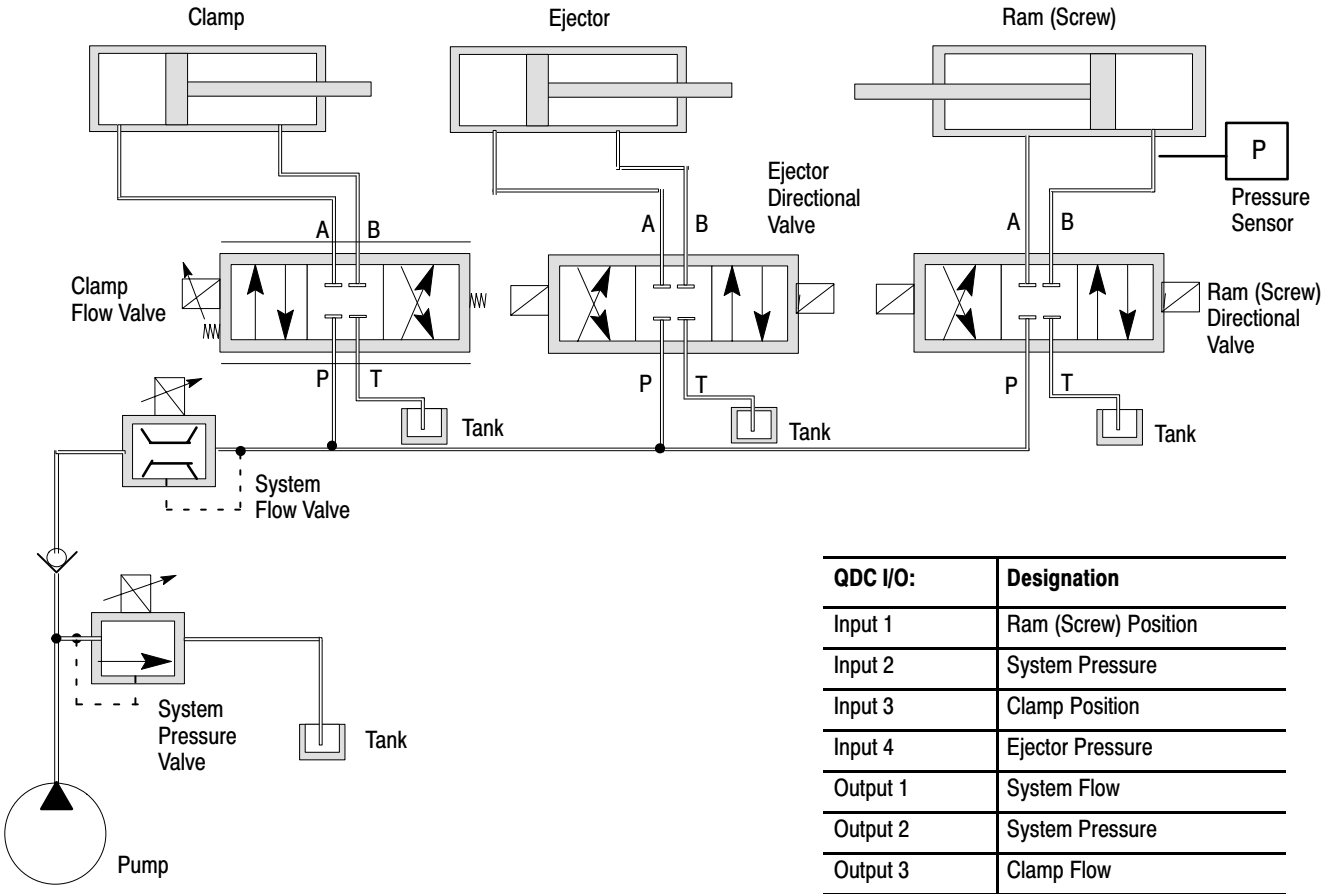
Example 3-valve System with Ram (Screw) Pressure Sensor

With this hydraulic system, one QDC module in the Inject, Clamp, and Eject mode, can control the following:

- closed-loop pressure for injection, pack, hold, and plastication profiles
- closed-loop velocity for injection profiles
- open-loop pressure for clamp and ejector profiles
- closed-loop velocity for clamp and ejector profiles

Figure 1.21
3-Valve System for Inject and Clamp Control Example



QDC I/O:	Designation
Input 1	Ram (Screw) Position
Input 2	System Pressure
Input 3	Clamp Position
Input 4	Ejector Pressure
Output 1	System Flow
Output 2	System Pressure
Output 3	Clamp Flow
Output 4	Not Used

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Example 2-valve System for Injection Control with Clamp and Ejector Position Inputs

With this hydraulic system, the QDC module in the Inject, Clamp, and Eject mode sends clamp and ejector position data to the PLC-5 processor.

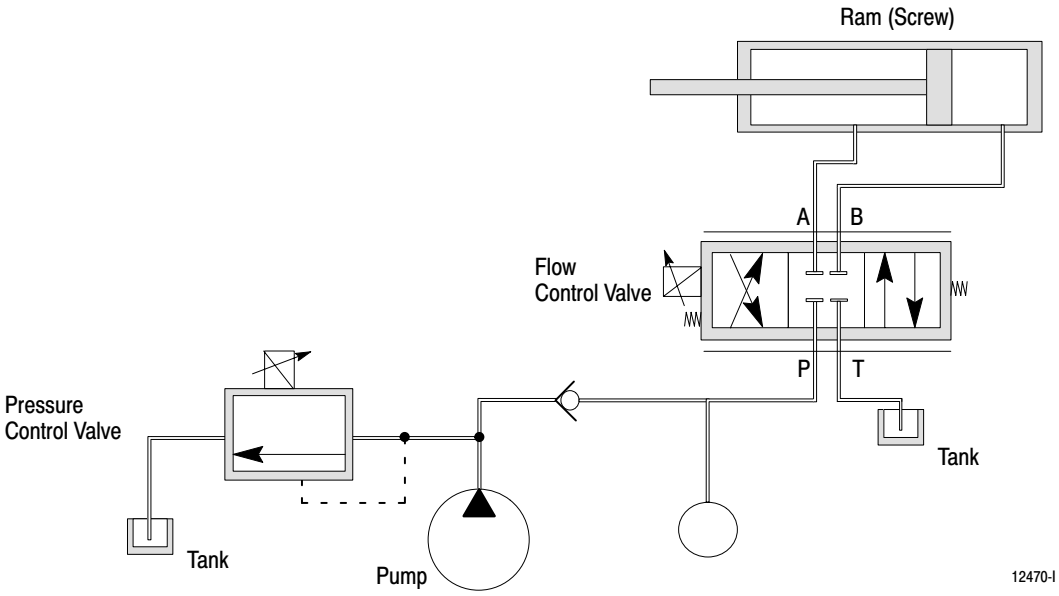
The QDC module can control the following:

- closed-loop pressure for injection, pack, hold, and plastication profiles
- closed-loop velocity for injection profiles

The PLC-5 processor can control:

- clamp and ejector hydraulic directional valves
- other hydraulic and machine sequencing

Figure 1.22
2-Valve System: Injection Control
(Clamp and Ejector Valves Controlled by Ladder Logic)



QDC I/O:	Designations
Input 1	Ram (Screw) Position
Input 2	System Pressure
Input 3	Clamp Position
Input 4	Ejector Position
Output 1	Injection Flow Control
Output 2	Injection Pressure Control
Output 3	Not Used
Output 4	Not Used

Summary of Inject, Clamp, and Eject Mode of Operation

When you select this mode, you can use the following phases of operation:

Inject Phase:	Description:
Injection	The ram (screw) injects plastic into the mold. You can vary the velocity of the ram (screw), or the pressure driving it, to fill areas of the mold cavity at different rates to achieve uniform quality of the molded part. This phase can be critical to part quality. The pattern of velocity or pressure variation during injection is called the injection profile.
Transition	Detects when injection is complete.
Pack (optional)	Packing pressurizes the plastic to a specified density which determines the flexibility of the molded part. To achieve uniform density, you can release or increase pressure in steps according to cooling gradients across the mold. Thus, as the plastic cools unevenly, the pack profile can compress the plastic uniformly.
Hold	Holding lets the plastic cool and shrink slightly from the mold cavity in preparation for ejection. The effect is similar to packing. You can hold at predetermined pressures for predetermined lengths of time throughout the hold phase.
Pre-decompression (optional)	This single, backward movement of the ram (screw) separates plastic solidifying in the mold from molten cushion remaining in the barrel prior to plastication. This phase is also called sprue break or suckback.
Plastication Phase	The machine reloads by drawing plastic beads into the barrel containing the ram (screw). The mechanical action of the rotating ram (screw) grinds and melts the beads. The longer it grinds, the hotter it melts. You can vary the backpressure on the ram (screw) causing it to remain longer in an area. Thus, you can induce any desired temperature gradient along the length of the shot by controlling ram (screw) backpressure.
Post-decompression (optional)	This single, backward movement of the ram (screw) guards against drooling molten plastic into the open mold during ejection prior to clamp close. This phase is also called melt pullback or suckback.
1st Close 2nd Close 3rd Close	You can program a single-step clamp-close profile and not use a second or third profile. Or, you can program up to three clamp-close profiles that let you do the following at up to three different points in the clamp-close phase: • pick up a third mold plate • set cores • pick up or drop out pumps to change clamp speed or pressure
Low Pressure Close	To guard against damaging the mold when the two mold surfaces make contact and to detect obstructions to mold closure, you close the mold slowly with low pressure and closed-loop or open-loop control. Low Pressure Close can only be controlled through a pressure vs. position profile.
1st Open 2nd Open 3rd Open	You can program a single-step clamp-open profile and not use a second or third profile. Or, you can program up to three clamp-open profiles that let you do the following at up to three different points in the clamp-open phase: • drop out a third mold plate • pull cores • drop out or pick up pumps to change clamp speed or pressure
Open Slow	To decelerate the moving platen to accurately position it before ejecting the part.
Ejector Advance Ejector Retract	You can advance and retract the ejector in a single stroke or in multiple strokes using closed- or open-loop control.
Tip Strokes	You can shake the part off the ejector tip by programming rapid single-stroke interim ejector cycles starting after the first advance stroke and ending before the last retract stroke.
Forward Dwell	You can pause after the first advance stroke or before the last retract stroke to let a robot remove the part when the ejectors are extended.

Chapter 2

Install the QDC Module

Chapter Objectives

This chapter helps you install the QDC module with these procedures:

- record I/O ranges
- set module jumpers
- key the I/O chassis
- install the QDC module
- wire I/O devices to the QDC module
- ground and shield I/O devices
- plan for E-STOPs and machine interlocks

Record I/O Ranges

To match your QDC module to your I/O devices, record the I/O ranges of your I/O devices on Worksheet 2-A. You will use this information in this chapter for hardware configuration (setting jumper plugs) and in chapter 4 to configure the module's inputs and outputs with software.

Circle or check the I/O ranges on Worksheet 2-A. Cross off I/O not used.

Worksheet 2-A
Record I/O Ranges

I/O Connection:	Voltage 1:	Voltage 2:	Current:
Input 1 (Screw position)	0 to 10V dc	1 to 5V dc	4 to 20 mA
Input 2 (System pressure)	0 to 10V dc	1 to 5V dc	4 to 20 mA
Input 3 (Clamp position)	0 to 10V dc	1 to 5V dc	4 to 20 mA
Input 4 (Ejector position)	0 to 10V dc	1 to 5V dc	4 to 20 mA
Output 1	-10 to 10V dc	0 to 10V dc	4 to 20 mA
Output 2	-10 to 10V dc	0 to 10V dc	4 to 20 mA
Output 3	-10 to 10V dc	0 to 10V dc	4 to 20 mA
Output 4	-10 to 10V dc	0 to 10V dc	4 to 20 mA

Set Module Jumpers

Before installing the QDC module, you must select with jumper plugs the I/O ranges that you recorded on Worksheet 2-A

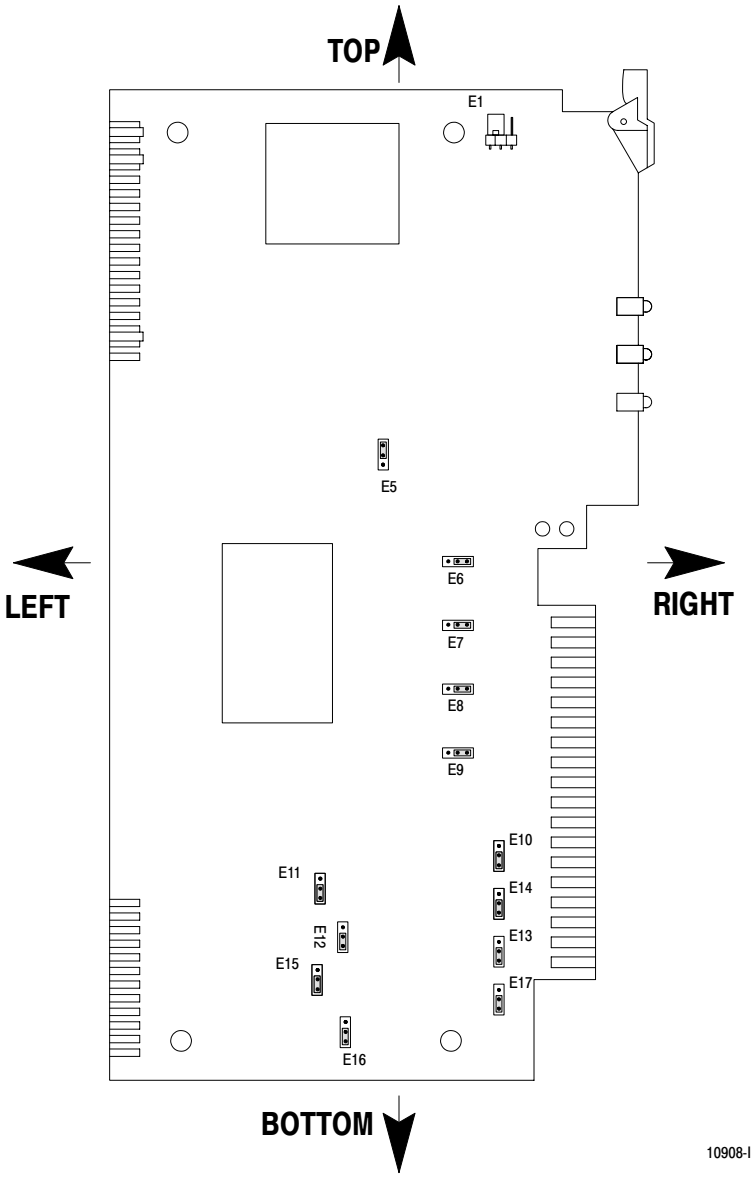
Access and Position the Jumpers

Access the jumper plugs and set them as follows:

ATTENTION: To avoid damage to internal circuits, observe handling precautions and rid yourself of any electrostatic charge. Use an anti-static work station when setting jumpers.

1. Remove the label-side cover plate by removing the four screws.
2. Remove the circuit board from the module housing by removing the two screws located center-front at the swingarm catch.
3. Carefully turn over the circuit board so it is oriented as in figure 2.1. Handle it by the edges to avoid touching conductors or components.
4. Use figure 2.1 to locate the jumpers.
5. Set the jumpers according to Table 2.A (next page) using
   - your I/O ranges from Worksheet 2-A
   - needle-nose pliers.
6. After setting the jumpers, carefully re-assemble the module with steps 3, 2, and 1.

Figure 2.1
Jumper Locations on the QDC Module's Circuit Board



Important: We define jumper positions as left, right, top, and bottom. This represents the position of the jumper on the 3-pin connector relative to the orientation of the circuit board shown above.

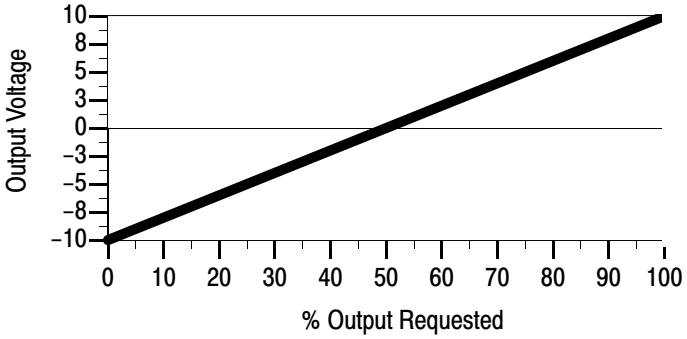
Table 2.A
Jumper Settings

Jumper:	Function:	Setting:
E1	Run/Calibrate	Run = left[1] Calibrate = right
E5	I/O Density	Standard = top[1] Do not use bottom position
E6 E7 E8 E9	Input 1 (Screw position) Input 2 (System pressure) Input 3 (Clamp position) Input 4 (Ejector position)	Current = left Voltage = right[1]
E10 E14 E13 E17	Output 1 (Valve 1) Output 2 (Valve 2) Output 3 (Valve 3) Output 4 (Valve 4)	Current = top Voltage = bottom[1]
E11 E12 E15 E16	Output 1 (Valve 1) Output 2 (Valve 2) Output 3 (Valve 3) Output 4 (Valve 4)	–10 to +10V dc = top 0 to +10V dc or 4 to 20mA = bottom[1]

[1] Factory Defaults

Important: If you select current output with jumpers E10, E14, E13, E17, then you must select 4 to 20mA with jumpers E11, E12, E15, E16.

ATTENTION: If an output is not used, set its jumper (E11, E12, E15, or E16) to 0 - 10V dc (bottom position). Otherwise, setting the jumper for –10 to +10V dc could cause the QH module to output –10V dc on that channel (a hazard): because when the system is stopped or when a system reset occurs, all outputs are forced to 0% but 0% output = –10V dc in this example (see graph).



Key the I/O Chassis

Use plastic keying bands, shipped with each I/O chassis, for keying the backplane connector to accept only one type of module. Do this to prevent inadvertent installation of the wrong module into the designated slot location.

Important: You must use the following slot location in the I/O chassis for the QDC module because this is the address used by your Pro-Set 600 software to communicate with the QDC module.

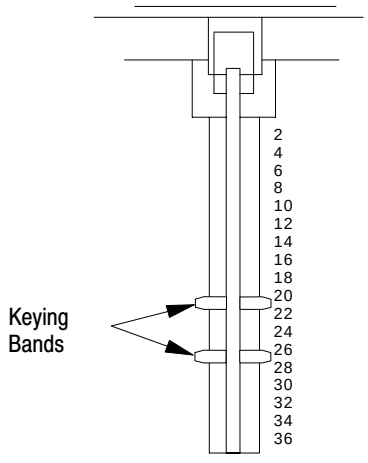
- rack 0
- module group 0
- slot 0

The QDC module is slotted in two places on the rear edge of the circuit board. The position of the keying bands on the backplane connector must correspond to these slots to allow insertion of the module.

Place keying bands between the following terminal numbers labeled on the backplane connector of your I/O chassis (see Figure 2.2):

- between 20 and 22
- between 26 and 28

Figure 2.2
Keying Positions



Install the QDC Module

To install your QDC module in an I/O chassis, complete the following:

1. Turn off power to the I/O chassis.

ATTENTION: Remove power from the 1771 I/O chassis backplane and wiring arm before removing or installing a module.

Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.

Failure to remove power from the backplane or wiring arm could cause injury, module damage, and/or degradation of module performance.

---

2. Place the module in the plastic guides on the top and bottom of the slot that slides the module into position.

Important: Pro-Set 600 software expects your QDC module (configured for inject, clamp, and eject mode) to be placed in rack 0, module group 0, slot 0. If you choose to install it in some other slot, you must modify your PLC-5 application program accordingly (refer to your Pro-Set 600 documentation for details).

3. Do not force the module into its backplane connector. Apply firm, even pressure on the module to seat it properly.

4. Snap the chassis latch over the top of the module to secure it.

5. Connect the wiring arm to the module.

Wire I/O Devices

Use the wiring arm (1771-WF) supplied with the QDC module to wire I/O devices (Figure 2.3). The wiring arm lets you install or remove the QDC module from the I/O chassis without rewiring. Wiring arm terminals are numbered in descending order, from the top down, starting with terminal 18 (Table 2.B).

Figure 2.3
I/O Wiring and Grounding

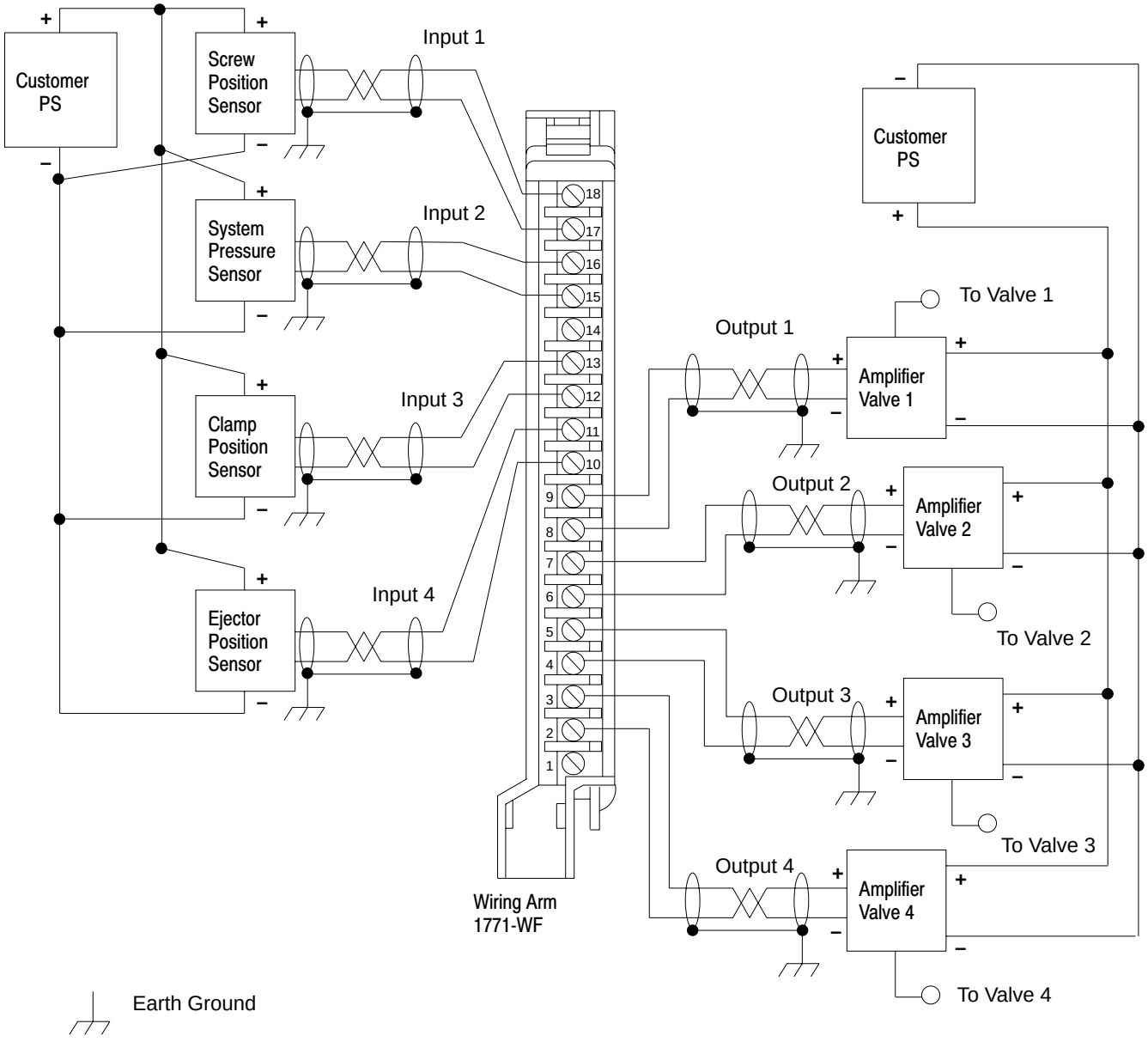


Table 2.B
I/O Terminal Designations

Transducer:	I/O Designation:	Terminal:
Screw position (see **Important** below)	Input 1 (+) (–)	18 17
System pressure (see **ATTENTION** below)	Input 2 (+) (–)	16 15
N/A	Input common	14
Clamp position (see **Important** below)	Input 3 (+) (–)	13 12
Ejector position (see **Important** below)	Input 4 (+) (–)	11 10
Valve 1	Output 1 (+) Output common	09 08
Valve 2	Output 2 (+) Output common	07 06
Valve 3	Output 3 (+) Output common	05 04
Valve 4	Output 4 (+) Output common	03 02
Not used		01

Important: For the QDC module to operate in the inject, clamp, and eject mode, you must connect position sensors to these two inputs:

- input 1 (screw position)
- input 3 (clamp position)

ATTENTION: Your control system may not work as expected with possibly machine damage if you attempt to control a pressure profile of a phase (inject, clamp, or eject) not hydraulically plumbed for pressure control.

Because system pressure may change from one phase to the next, we recommend that you:

- assign pressure control to phases that *require* pressure profiles (and are hydraulically plumbed to support it)
- place the system pressure sensor accordingly in the hydraulic circuit
- configure the remaining phases with velocity profiles

ATTENTION: The QDC module has ESD protection to 20kV, but you can damage the module by accidental application of the wrong voltage to the I/O terminals. Do not exceed:

This voltage:	On these terminals:	When in:
+12V dc	input (18 thru 10)	any mode
±12V dc	output (09 thru 02)	voltage mode
+24V dc	output (09 thru 02)	current mode

Ground and Shield Your I/O Devices

Analog inputs and outputs are sensitive to electrical noise interference. Take care to ground and shield them properly.

Guidelines:

- Use 22-gage (or larger) twisted-pair cable, 100% shielded with drain wire, such as Belden 8761. For cable distances over 50 ft, use 18-gage cable such as Belden 8760.
- Ground the cable shield at one end only; generally at the sensor or amplifier end, not at the I/O chassis (see Figure 2.4 and Figure 2.5).

Figure 2.4
Shielding Differential Inputs

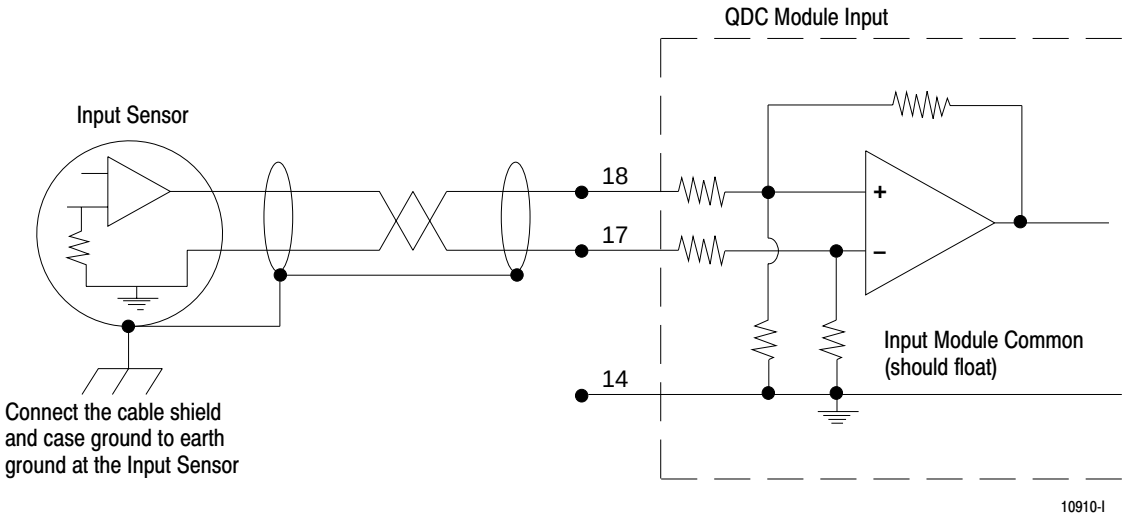
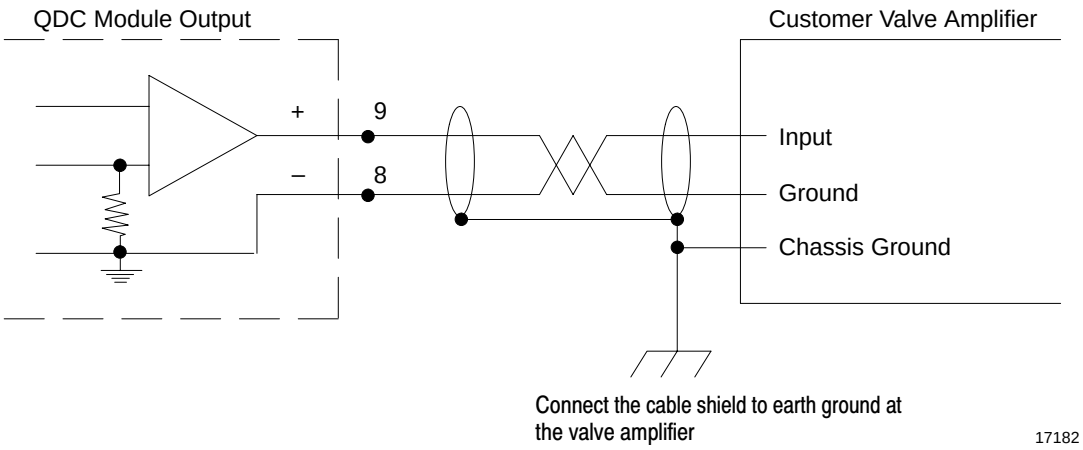


Figure 2.5
Shielding Single-ended Outputs



- Ground the cable shields to a low-impedance earth ground of less than 1/8 ohm
- Do not connect any ground to input common (terminal 14) except as specified in the Exceptions section, below.
- Place high-voltage class A wiring and low-voltage class B wiring in separate grounded conduits
- In parallel runs, separate the class A and B conduit by at least 1 foot
- Where conduit runs must cross, cross them at right angles

For additional grounding recommendations, refer to the Allen-Bradley Programmable Controller Wiring and Grounding Guidelines (publication 1770-4.1).

Exceptions

If you experience unacceptable electrical noise interference, then try one or both of the following alternative grounding connections:

- connect the input cable shield to input common (terminal 14) after disconnecting the shield from the transducer
- connect the output cable shield to output common (terminal 8, 6, 4, and/or 2) after disconnecting it from the valve amplifier

Plan for E-STOPs and Machine Interlocks

You must consider the installation of Emergency Stop switches and machine interlocks when you:

- design your system
- assemble mechanical/hydraulic components
- wire system components
- develop system ladder logic

ATTENTION: The Electrical Standard for Industrial Machinery (NFPA 79-1987) requires an emergency stop that, when actuated, de-energizes all electrical power circuits which provide electrical energy to sustain machine motion. Maintained contact “Emergency Stop” push buttons are recommended.

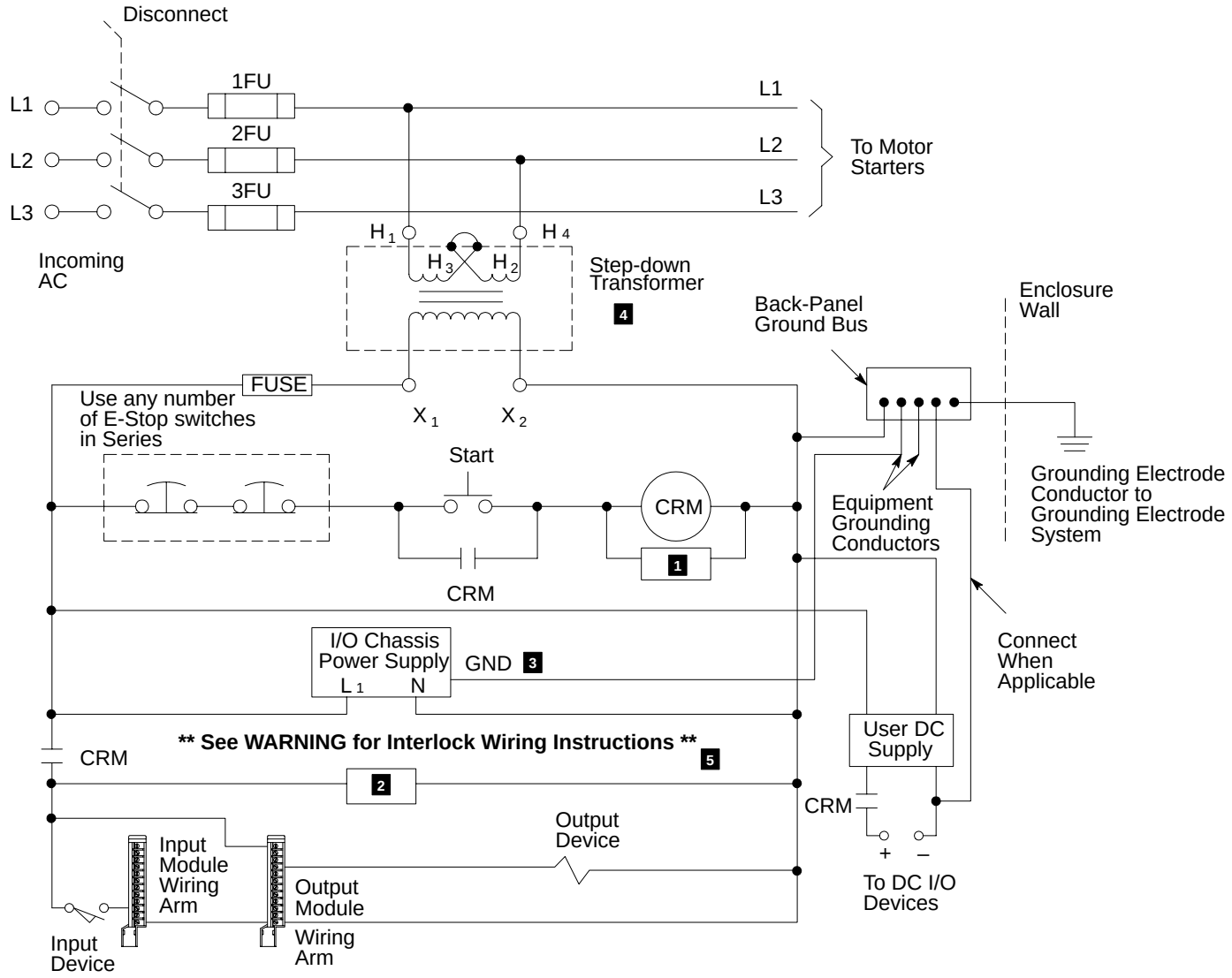
ATTENTION: The American National Standard for Plastics Machinery — Horizontal Injection Molding Machines — for Construction, Care, and Use (ANSI B151.1-1984) requires hydraulic, mechanical, and electrical interlocks to prevent inadvertent clamp closing with a safety gate in an open position.

In addition, we strongly recommend that the electrical interlocks consist of redundant devices and that the control circuit be so arranged that malfunction or improper sequencing of either redundant device prevents further operation of the machine.

ATTENTION: NEMA Standards Publication ICS1.1, Safety guidelines for the Application, Installation, and Maintenance of Solid State Control recommends that the emergency stop and safety gate electrical interlocks should directly control their appropriate functions through an electromechanical device independent of the solid state logic.

The next page shows an illustration of a typical grounded PLC-5 power distribution circuit. For ungrounded systems or for more information on grounding and wiring guidelines, refer to Allen-Bradley Programmable Controller Wiring and Grounding Guidelines (publication 1770-4.1).

Figure 2.6
Typical PLC-5 Power Distribution with Interlocks



1 To minimize EMI generation, you should connect a suppression network: for 120V AC, use Allen-Bradley cat. no. 700-N24; for 220/240V AC, use cat. no. 599-KA04.

2 To minimize EMI generation, you should connect a suppression network: for 120V AC, use Allen-Bradley cat. no. 599-K04; for 220/240V AC, use cat. no. 599-KA04.

3 For a power supply with a groundable chassis, this represents connection to the chassis only. For a power supply without a groundable chassis, this represents connection to both the chassis and the GND terminal.

4 In many applications, a second transformer provides power to the input circuits and power supplies for isolation from the output circuits.

5
- Reference the current NEC code and ANSI B151.1 for additional wiring guidelines.
- To minimize EMI generation, suppression networks should be connected across coils of electromagnetic devices.

10907-I

Chapter 3

Configure the QDC Module's I/O

Chapter Objectives

Your QDC module needs to know the characteristics of your **ram (screw), clamp, and ejector sensors.** In this chapter, we describe how to determine these characteristics and download them to the QDC module for the following:

- signal ranges from pressure and position sensors
- minimum and maximum sensor signals corresponding to minimum and maximum pressures and positions
- alarm values and travel limits

We describe how to configure the QDC module in these sections:

- Select Module Parameters and I/O Ranges
- Determine Initial Sensor-configuration Values
- Download MCC Parameters to the QDC module
- Use Set-output Mode to Move the **Ram (screw), Clamp, and Ejector**
- Complete Your Sensor Configuration
- Select Optional Configurations

Important: You must properly configure the QDC module using procedures in this chapter before attempting further configurations.

Important: If you have not already done so, install Pro-Set 600 software. The procedures in this and the next several chapters assume that you have done so.

Select Module Parameters and I/O Ranges

You select module parameters and I/O ranges by setting configuration bits in control words.

To Configure:	In Control Word:	Starting At Pro-Set 600 Address:	Use this Worksheet:
Module Parameters	MCC02	B34/528	Worksheet 3-A
Input Range	MCC03	B34/544	Worksheet 3-B
Output Range	MCC04	B34/560	Worksheet 3-C

Select module parameters with Worksheet 3-A:

- Operating mode of the QDC module to inject, clamp, and eject
- Units of measure to English or metric

Select I/O ranges with Worksheets 3-B and 3-C.

Refer to Worksheet 2-A from chapter 2 which you filled out when setting the QDC module's jumper plugs. Apply this information to Worksheet 3-B for input ranges and Worksheet 3-C for output ranges.

Important: Software input/output selections that you are about to make in MCC03 and MCC04 must match the jumper plug settings for each respective input and output that you configured in chapter 2.

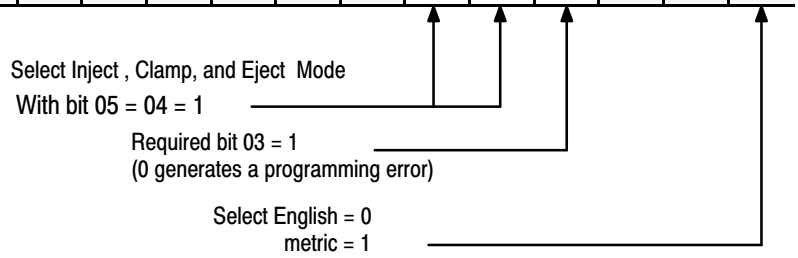
Important: The QDC module detects loss of sensor at all four inputs regardless of the input range you select. When detected, the QDC module:

- sets status bits SYS08-B00, 01, 02, and 03 for inputs 1, 2, 3, and 4
- E-stops the profile in progress
- ignores any action execution commands in DYC02

Worksheet 3-A
Select Module Parameters

.

Control Word MCC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B34/bit	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528
Value	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	



Example: If you select Inject, Clamp, and Eject mode with English units:
MCC02 = 00000000 00111000

Worksheet 3-B
Select Input Ranges for your Sensors

Control Word MCC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B34/bit	559	558	557	556	555	554	553	552	551	550	549	548	547	546	545	544
Value	1	1	1	1	1	1	1	1								

Select Input 4 (Ejector Position) Range with bits 07, 06
Select Input 3 (Clamp Position) Range with bits 05, 04
Select Input 2 (System Pressure) Range with bits 03, 02
Select Input 1 (Ram Screw Position) Range with bits 01, 00

Input Range		
0 – 10V dc	0	0
1 – 5V dc	0	1
4 – 20 mA	1	0
Not connected	1	1

Example: If you select an input range of 4-20 mA for all four inputs:
MCC03 = 11111111 10101010.

Important: Software input selections must match the jumper settings for each respective input.

Worksheet 3-C
Select Output Ranges for your Valves

Control Word MCC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B34/bit	575	574	573	572	571	570	569	568	567	566	565	564	563	562	561	560
Value	1	1	1	1	1	1	1	1								

Select Output 4 Range with bits 07, 06
Select Output 3 Range with bits 05, 04
Select Output 2 Range with bits 03, 02
Select Output 1 Range with bits 01, 00

Output Range		
to +10V dc0	0	
0 to +10V dc	0	1
4 to 20 mA	1	0
Not connected	1	1

-10

Example: If you select 0-10V dc for all four output ranges:
MCC04 = 11111111 01010101.

Important: Software output selections must match the jumper settings for each respective output.

Determine Initial Sensor-configuration Values

To determine initial sensor configuration values, refer to Table 3.A, and specifications that accompanied your sensors, valves, and cylinders. Write down applicable values on Worksheet 3-D.

Important: You must enter floating-point numbers and percentages as integers, so we recommend that you write them in Worksheet 3-D in the following format: Use an assumed decimal point position that depends on the range value. For example:

If the Range is:	And You Want to Enter this Value:	Use this Format:
0 - 099.99%	75%	07500
0 - 99.99 inch	7.32 inch	00732
0 - 0999.9 mm	432.6 mm	4326
4.00 - 020.00 mA	16 mA	01600
0 - 010.00V dc	5.6V dc	00560
0 - 009.99 sec	0.47 sec	00047
0 - 09999 psi	321 psi	00321
0 - 0999.9 Bar	222 Bar	2220

Table 3.A
Determine Initial Sensor-configuration Values for Worksheet 3-D

Category:	If your:	Then Use a Value Equal to:
Minimum Position (Lines 1, 9, and 13)	N/A	zero
Maximum Position (Lines 2, 10, and 14)	Actuator is fully extended	full travel of the sensor
Analog Signal @ Min Position (Lines 3, 11, and 15)	sensor is forward-acting	low end of your selected range
	sensor is reverse-acting	high end of your selected range
Analog Signal @ Max Position (Lines 4, 12, and 16)	sensor is forward-acting	high end of your selected range
	sensor is reverse-acting	low end of your selected range
Minimum System Pressure (Line 5)	N/A	min range value specified by manufacturer
Maximum System Pressure (Lines 6)	N/A	max range value specified by manufacturer
Analog Signal @ Min System Pressure (Line 7)	sensors are forward-acting	low end of your selected range
	sensors are reverse-acting	high end of your selected range
Analog Signal @ Max System Pressure (Line 8)	sensors are forward-acting	high end of your selected range
	sensors are reverse-acting	low end of your selected range

Worksheet 3-D
Determine Initial Sensor-configuration Values

Record Your Initial Values Here

Input	Line	Control Word	Pro-Set 600 Addr.	Value	Description
1	1	MCC09	N40:5	0	Minimum Screw Position [1]
	2	MCC10	N40:6		Maximum Screw Position [1]
	3	MCC11	N40:7		Analog Signal @ Min Screw Position [2]
	4	MCC12	N40:8		Analog Signal @ Max Screw Position [2]
2	5	MCC57	N40:53	0	Minimum System Pressure [3]
	6	MCC58	N40:54		Maximum System Pressure [3]
	7	MCC59	N40:55		Analog Signal @ Min System Pressure [2]
	8	MCC60	N40:56		Analog Signal @ Max System Pressure [2]
3	9	MCC23	N40:19	0	Minimum Clamp Position [1]
	10	MCC24	N40:20		Maximum Clamp Position [1]
	11	MCC25	N40:21		Analog Signal @ Min Clamp Position [2]
	12	MCC26	N40.22		Analog Signal @ Max Clamp Position [2]
4	13	MCC31	N40:27	0	Minimum Ejector Position [1]
	14	MCC32	N40:28		Maximum Ejector Position [1]
	15	MCC33	N40:29		Analog Signal @ Min Ejector Position [2]
	16	MCC34	N40:30		Analog Signal @ Max Ejector Position [2]

[1] Incremental Distance
00.00 to 99.99in
000.0 to 999.9mm

[2] Input Signal Range
00.00 to 10.00VDC or
01.00 to 05.00VDC or
04.00 to 20.00MADC

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Download MCC Parameters to the QDC Module

Use this download procedure now and later in this chapter. The procedure requires you to complete the following general steps:

- enter MCC parameters into the PLC-5 data table
- download them to the QDC module (with PLC-5 processor in run mode)
- correct any programming errors

Next, we describe the general steps.

Enter MCC Parameters into Your PLC-5 Data Table

With your programming terminal, enter values from Worksheet 3-A thru 4-D into your PLC-5 data table as follows:

1. Switch the PLC-5 processor to PROGRAM mode.

2. Display your PLC-5 data table.

3. Locate the data file for storing the MCC block. PLC-5 data table word addresses are listed on the worksheets.

4. Enter the value for each word and bit.

When you enter bit selections in words prefixed with file identifier B (example: B34), the PLC-5 processor automatically switches the radix to binary format so you can conveniently enter binary data.

Download MCC Parameters

To download the MCC block to the QDC module, switch the PLC-5 processor from PROGRAM mode to RUN mode. Pro-Set 600 software downloads the MCC to the QDC module for you.

Important: You can verify that the MCC block was successfully downloaded or you made a programming error by evaluating the following words that Pro-Set 600 software continuously reports to the PLC-5 processor.

If:	And:	Then:
SYS01-B08 = 1 (B34/8)	N/A	QDC module accepted a valid MCC.
SYS19-B00 = 1 (B34/288)	SYS61 = 1 (ID code for MCC block stored in N40:213)	You made a programming error in MCC. Read the error code in SYS62 (N40:214), and look up the error in Section 2 of the Plastic Molding Module Reference Manual (pub. no. 1771-6.5.88).

Important: Pro-Set 600 software downloads all command blocks when your PLC-5 processor enters run mode and after a valid MCC is accepted. All programming errors reported in SYS62 (N40:214) are referenced to the MCC until SYS01-B08 (B34/08) equals zero.

Correct Any Data-entry Errors

Upon receipt of MCC block, the QDC module tests data for data-entry errors, such as a value out of range. When it detects an error, The QDC module halts operation until you correct the error. For a complete list of error codes to help you correct errors, refer to Section 2 of the Plastic Molding Module Reference Manual, publication 1771-6.5.88.

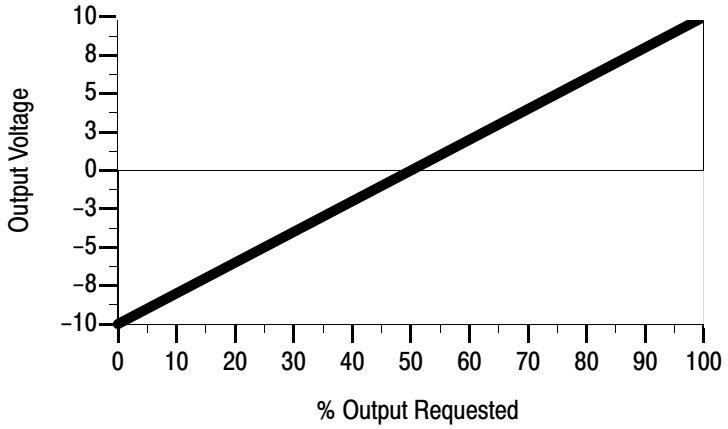
You must correct errors by entering the changed configuration values into your PLC-5 data table and downloading the new values to the QDC module as outlined above. Pro-Set 600 software continues to attempt to download the MCC block to the QDC module until an MCC is accepted and the QDC module returns SYS01-B08 (B34/08) equal to 1.

Use Set-output Operation to Move the Ram (screw), Clamp, and Ejector

To finish configuring the QDC module, you actuate the ram (screw), clamp, and ejector axes with the QDC module's set-output operation that applies percentage values to your QDC module's outputs to move the actuator in a controllable fashion. To do this, you apply a %-output signal to a module output so you can move the actuator over its intended range.

ATTENTION: Do not rely on pressure valves connected to the QDC module for pressure relief. Use them only for pressure control below the setting of the system pressure-relief valve.

ATTENTION: A value of zero in set-output words N40:121-124 does not necessarily correspond to zero pressure or flow. If you configured jumpers E11, E12, E15, or E16 for bi-directional valve operation, an output of 0% gives –10V dc, 50% gives 0V dc (see chart). Amplifier electronics or spool-null offsets may also allow pressure or flow at zero volts signal input. Consult your valve and amplifier specifications.



ATTENTION: As soon as you enable set-output operation, the QDC module's outputs drive the connected valves according to the values you entered into DYC09-12 (N40:121-124). Be sure these values RESULT IN NO MOVEMENT until you adjust them one-at-a-time with your programming terminal in the procedures that follow.

Follow this procedure to actuate the ram (screw), clamp, and ejector:

1. Enter values in words DYC09-12 that result in *no motion*.

Output:	In Data Word:	At Pro-Set 600 Address:
1	DYC09	N40:121
2	DYC10	N40:122
3	DYC11	N40:123
4	DYC12	N40:124

2. Enable set-output operation by entering a 1 in DYC01-B08 (B34/392). The QDC module sets outputs 1-4 to percentage values that you entered in DYC09-12 respectively.

Important: The DYC is constantly transferred to the QDC module by Pro-Set 600 software, so changes you make to %-output values are immediately implemented.

3. With your programming terminal, slowly change the %-output value of **each output, one at a time,** as you observe the corresponding **actuator** movement.

4. Increase the %-output value until you reach a safe actuator speed to use in the next procedure.

Complete your Sensor Configuration

Complete the procedure for configuring the QDC module to match its sensors by spanning them over their intended range with the machine in operation. Here we describe how you determine:

- **ram (screw) position sensor values**
- **system pressure sensor values**
- **clamp position sensor values**
- **ejector position sensor values**

In the procedures that follow, measure and record:

- min/max positions and corresponding signal values
- **min/max system pressure and** corresponding signal values

After determining these values from the procedures, write them down on Worksheet 3-E.

Important: You must complete this configuration before proceeding to any other chapters on module configuration.

Worksheet 3-E
Final Sensor-configuration Values

Record Your Final Values Here

Input	Line	Control Word	Pro-Set 600 Addr.	Value	Description
1	1	MCC09	N40:5	0	Minimum Screw Position [1]
	2	MCC10	N40:6		Maximum Screw Position [1]
	3	MCC11	N40:7		Analog Signal @ Min Screw Position [2]
	4	MCC12	N40:8		Analog Signal @ Max Screw Position[2]
2	5	MCC57	N40:53	0	Minimum System Pressure [3]
	6	MCC58	N40:54		Maximum System Pressure [3]
	7	MCC59	N40:55		Analog Signal @ Min System Pressure [2]
	8	MCC60	N40:56		Analog Signal @ Max System Pressure [2]
3	9	MCC23	N40:19	0	Minimum Clamp Position [1]
	10	MCC24	N40:20		Maximum Clamp Position [1]
	11	MCC25	N40:21		Analog Signal @ Min Clamp Position [2]
	12	MCC26	N40:22		Analog Signal @ Max Clamp Position [2]
4	13	MCC31	N40:27	0	Minimum Ejector Position [1]
	14	MCC32	N40:28		Maximum Ejector Position [1]
	15	MCC33	N40:29		Analog Signal @ Min Ejector Position [2]
	16	MCC34	N40:30		Analog Signal @ Max Ejector Position [2]

[1] Incremental Distance
00.00 to 99.99in
000.0 to 999.9mm

[2] Input Signal Range
00.00 to 10.00VDC or
01.00 to 05.00VDC or
04.00 to 20.00MADC

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Determine Values for Ram (Screw) Position Sensor

ATTENTION: Incorrect values entered in DYC09-12 may result in rapid ram (screw) motion and potential damage to your barrel and seals of your injection cylinder.

To complete the configuration for your ram (screw) position sensor, do the following and enter the results on Worksheet 3-E:

1. Move the ram (screw) forward until it reaches its mechanical stop at the nozzle end. This is the zero position.

2. Remove ram (screw) pressure and/or flow to stop movement.

3. Record this position value (normally 0000) on line 1 for MCC09 on Worksheet 3-E.

4. With your programming terminal, read the signal level returned in SYS33 (N40:185) from your position sensor.

Important: If your position sensor has a potentiometer for setting the zero reference, do so now.

5. Record this value on line 3 for MCC11 (should be at minimum signal if you zeroed your position sensor in step 4).

6. Move the ram (screw) backward to the backpoint mechanical stop.

7. Remove ram (screw) pressure and/or flow to stop movement.

8. Measure the distance travelled.

9. Record this distance on line 2 for MCC10.

10. With your programming terminal, read the signal level returned in SYS33 (N40:185) from your positioning sensor.

Important: If your position sensor has a potentiometer to set the span (linear resolution), do so now.

11. Record this value on line 4 for MCC12.

You may now download your adjusted values to the QDC module using the MCC download procedure presented earlier in this chapter.

Determine Values for the Clamp Position Sensor

Important: Use the following procedure and subsequent set-up information for each different mold used on a hydraulic machine. On a toggle clamp (with die height adjust), complete it only once.

ATTENTION: Incorrect values entered in DYC09-12 may result in rapid clamp motion and potential damage to your mold or cylinder seals. We strongly recommend using a "dummy" mold on hydraulic machines and no mold on toggle machines.

1. Move the clamp forward until it reaches its mechanical close stop. This is the zero position.

2. Remove clamp pressure and/or flow to stop clamp movement.

3. Record this position value (usually 0000) on line 9 for MCC23 on Worksheet 3-E.

4. With your programming terminal, read the signal level returned in SYS35 (N40:187) from your position sensor.

Important: If your position sensor has a potentiometer to set the zero reference, do so now.

5. Record this value on line 11 for MCC25 (should be at minimum signal if you zeroed your position sensor in step 4).

6. Move the clamp backward to the mechanical open stop.

7. Remove clamp pressure and/or flow to stop clamp movement.

8. Measure the distance travelled.

9. Record this distance on line 10 for MCC24.

10. With your programming terminal, read the signal level returned in SYS35 (N40:187) from your positioning sensor.

Important: If your position sensor has a potentiometer to set the span (linear resolution), do so now.

11. Record this value on line 12 for MCC26.

You may now download your adjusted values to the QDC module using the MCC download procedure presented earlier in this chapter.

Determine Values for Ejector Position Sensor

ATTENTION: Be sure to open the clamp sufficiently to allow full ejector travel before proceeding. Otherwise, you could damage the ejectors and/or the mold.

To complete the configuration for your ejector position sensor, do the following and enter the results on Worksheet 3-E:

1. Move the ejector backward until it reaches its mechanical retract stop. This is the zero position.

2. Remove ejector pressure and/or flow to stop movement.

3. Record this position value (normally 0000) on line 13 for MCC31 on Worksheet 3-E.

4. With your programming terminal, read the signal level returned in SYS33 (N40:185) from your position sensor.

Important: If your position sensor has a potentiometer for setting the zero reference, do so now

5. Record this value on line 15 for MCC33 (should be at minimum signal if you zeroed your position sensor in step 4).

6. Move the ejector forward to the mechanical advance stop.

7. Remove ejector pressure and/or flow to stop movement.

8. Measure the distance travelled by the ejector.

9. Record this distance on line 14 for MCC32.

10. With your programming terminal, read the signal level returned in SYS33 (N40:185) from your positioning sensor.

Important: If your position sensor has a potentiometer to set the span (linear resolution), do so now.

11. Record this value on line 16 for MCC34.

You may now download your adjusted values to the QDC module using the MCC download procedure presented earlier in this chapter.

Determine Values for the System Pressure Sensor

To complete the sensor configuration procedure, record minimum and maximum system pressures and corresponding signal levels from the sensor manufacturer's specifications onto Worksheet 3-E, words MCC57-60. Most applications require no further spanning. If your application requires greater accuracy, follow the procedure below:

1. Release system pressure to a minimum.

2. Read the system pressure gauge.

3. Record minimum pressure (normally 0000) on line 5 for MCC57 on Worksheet 4-E.

4. With your programming terminal, read the signal level returned in SYS34 (N40:186) from your pressure sensor.

Important: If your pressure sensor has a potentiometer for setting the zero reference, do so now

5. Record this signal level on line 7 for MCC59. It should be at minimum signal if you zeroed your pressure sensor in step 4.

ATTENTION: Use extreme caution during the next steps because you stress the hydraulic system to its maximum rated pressure. Loose fittings or faulty components could fail, causing possible damage to equipment and/or injury to personnel.

ATTENTION: If the ram (screw), clamp, and/or ejectors are not disconnected from the hydraulic circuit, be sure that they are fully retracted with their hydraulics aligned in the retract position. This forces the cylinders to press against the mechanical limits of travel and builds max system pressure. Otherwise, they could suddenly move, causing possible damage to equipment and/or injury to personnel.

6. Re-torque all hydraulic connections and joints before proceeding.

7. Boost system pressure to maximum.

8. Read the system pressure gauge. Do this while the ram (screw) is mechanically bound from moving.

9. Record this maximum pressure on line 6 for MCC58.

10. With your programming terminal, read the signal level returned in SYS34 (N40:186) from your pressure sensor.

Important: If your pressure sensor has a potentiometer to set the span (linear resolution), do so now.

11. Record this signal level on line 8 for MCC60.

12. Release pressure.

You may now download your adjusted values to the QDC module using the MCC download procedure presented earlier in this chapter.

Select Optional Configurations

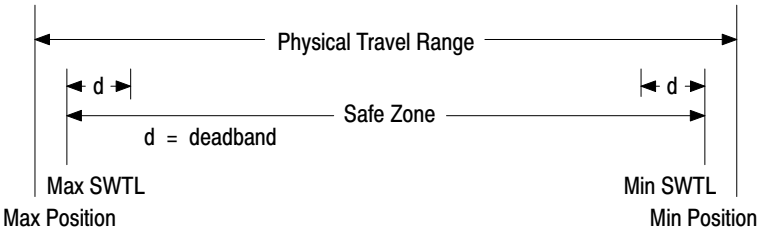
You have the option of configuring the following QDC module features:

Use this Option:	For this Benefit:
Software Travel Limits	to guard against damaging the **nozzle, mold, or ejectors**
Pressure Alarm Time Delay	to warn of excessive pressure without nuisance alarms
Digital Filter	to compensate for electrical noise on position inputs

Configure Software Travel Limits

You may want to use software restrictions to stop the travel of your ram (screw), clamp, and/or ejector before either reaches its maximum limits (configured earlier in this chapter).

Figure 3.1
Software Restrictions



Important: With the orientation shown, clamp movement is from left to right. By convention, ram (screw) and ejector movement is reversed.

During normal machine operation and whenever your cylinder travels outside the safe zone (outside the specified software travel limits, SWTL), the QDC module:

- sets an alarm status bit
- forces its outputs to zero
- ignores all profile commands (except set-output and jogs) until you jog the cylinder back through the deadband into the safe zone at either end

The deadband guards against sensor noise flickering the SWTL alarms and requires that the operator jog the cylinder a set distance away from the software overtravel limit. We recommend a value of 00.10 inch as a starting deadband. Your sensor may require a greater deadband.

ATTENTION: When jogging or when performing a set-output operation, the QDC module ignores SWTLs. In these modes, it will not zero its outputs so equipment damage could occur.

Configure the QDC module for SWTL alarms as follows:

1. Determine these SWTL values for ram (screw), clamp, and/or ejector travel with respect to the range of physical travel.

- SWTL deadband
- Maximum SWTL
- Minimum SWTL

2. Record non-zero SWTL values on Worksheet 3-F. Zero values disable the corresponding SWTLs.

ATTENTION: Leaving your SWTL settings at zero (MCC13, 14, 27, 28, 41, 42) inhibits the QDC module from performing this safety function.

Worksheet 3-F
SWTL Configuration Values

Record Your SWTL Configuration Values Here

Control Word	Pro-Set 600 Addr.	Value	Description
MCC13	N40:9		Screw Minimum SWTL [1]
MCC14	N40:10		Screw Maximum SWTL [1]
MCC15	N40:11	10	Screw SWTL Deadband [2]
MCC27	N40:23		Clamp Minimum SWTL [1]
MCC28	N40:24		Clamp Maximum SWTL [1]
MCC29	N40:25	10	Clamp SWTL Deadband [2]
MCC41	N40:37		Ejector Minimum SWTL [1]
MCC42	N40:38		Ejector Maximum SWTL [1]
MCC43	N40:39	10	Ejector SWTL Deadband [2]

[1] Incremental distance measured from zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Incremental distance measured as noted
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

You may now download your adjusted values to the QDC module using the MCC download procedure presented earlier in this chapter.

Set Up Maximum Pressure Alarms and Time Delays

The QDC module continuously monitors the system pressure input. When it detects that the process input equals or exceeds a preset alarm setpoint, the QDC module sets an alarm bit. A setpoint of zero disables the associated alarm.

To guard against nuisance alarms caused by noise spikes or pressure transients, you can set a time delay so the QDC module must monitor continuous excessive pressure for an amount of time before setting the high pressure alarm. A setpoint of zero disables this delay.

Configure the QDC module for the system pressure alarm as follows:

1. Determine these values:
   - pressure-alarm setpoint
   - time-delay setpoint
2. Record non-zero setpoints on Worksheet 3-G for the pressure alarm and time delay.
3. Download them to the QDC module using the procedures presented earlier in this chapter.

Worksheet 3-G
Pressure-alarm and Time-delay Setpoints

Enter Your Pressure-alarm and Time-delay Values Here

Control Word	Pro-Set 600 Addr.	Value	Description
MCC61	N40:57		System Pressure-alarm Setpoint [2]
MCC62	N40:58		System Pressure Time-delay Setpoint [1]

[1] Time Measured in Seconds
00.00 to 00.99

[2] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Configure Digital Filters for Position Inputs

You may enable an optional digital filter on position inputs to reduce electrical noise from a potentiometer-type position sensors or picked up by your input circuits.

To determine if you need a digital filter, move the ram (screw), clamp, and/or ejector very slowly. With your programming terminal, look for erratic position numbers reported for ram (screw), clamp, and/or ejector position by examining these words:

For this Input:	In Word:	Look at this Pro-Set 600 Address:
Ram (Screw)	SYS25	N40:177
Clamp	SYS27	N40:179
Ejector	SYS28	N40:180

To determine the time constant (00.10 sec max), start with a small value such as 00.01. A value of zero disables the filter.

To Filter this Input:	In Word:	Enter a Filter Time Constant in:
Ram (Screw)	MCC16	N40:12
Clamp	MCC30	N40:26
Ejector	MCC44	N40:40

ATTENTION: Increasing the value of the time constant decreases the QDC module's capability to respond quickly to travel limits and/or to accurately locate programmed positions. We recommend that you keep the time constant under 00.10.

For example, with a clamp velocity of 2 inches/sec, a 00.01 time constant allows a 0.20 inch travel before the QDC module can react to a travel limit.

Important: If you have a noisy potentiometer-type position sensor and digital filtering slows the QDC module's response time too much, consider replacing the sensor with a non-contact, linear-displacement type.

Download time constants to the QDC module using the procedures presented earlier in this chapter.

Chapter 4

Overview of Remaining Configuration Procedures

Chapter Objectives

This chapter gives you and overview of the remaining configuration procedures necessary to successfully configure your QDC module for the inject, clamp, and eject mode

Important: You must follow the configuration procedures presented in chapters 5-10 in given order. Please use this chapter as a guide.

Configuration Concepts

The QDC module communicates with your PLC-5 processor through data "blocks". These blocks are made up of several 16-bit words stored in the PLC-5 data table. The QDC module accesses these areas of data table through the 1771 backplane. There are two types of data blocks:

- Command Blocks - these blocks are downloaded from the PLC-5 data table to the QDC module to make configuration changes or initiate machine actions
- Status Blocks - the QDC module uses these blocks to send information to the PLC-5 processor about current operating status

The configuration procedure detailed over the next several chapters makes extensive use of command and status blocks. You will:

- enter important operating data into all applicable command blocks
- read machine operating data in status blocks to assist you in the configuration procedure

Command Blocks

You configure the QDC module with a series of command blocks. Command blocks are an area of the PLC-5 data table containing machine commands, set-up, and operating information for the QDC module. On power-up, or when you initiate a download, command blocks are downloaded from the PLC-5 data table to the QDC module.

There are two types of command blocks, presented in the following table:

Type of Command Block:	Which Contains:	Examples:
Configuration	Information necessary to configure your module to run a certain portion of a profile.	Valve spanning information for the 1st clamp close profile.
Profile	Actual process setpoints necessary to produce a desired part.	1st clamp close profile operating setpoints.

Status Blocks

The QDC module returns critical operating status and values to the PLC-5 data table through status blocks. Like configuration blocks, status blocks are areas of PLC-5 data table. Status blocks, however, contain actual machine operation information rather than machine setpoints and action commands.

Type of Block:	Which Contains:	Examples:
Status	Information about machine operation and QDC module operating status.	The molding machine is currently performing an injection operation.

System Command and Status Blocks

The Module Configuration Block (MCC), Dynamic Command Block DYC), and the System Status Block (SYS) are system data blocks because of functions they perform:

Type of Block:	Description:	Examples:
Module Configuration (MCC)	Contains configuration information used throughout all phases of machine operation.	Sensor spanning information and global alarm setpoints.
Dynamic Command (DYC)	Includes all commands necessary to jog, run, and stop any applicable machine phase or operation.	Command to start the injection phase.
System Status (SYS)	Returns to the PLC-5 processor information relevant to common module parameters.	Actual voltages and engineering units read at the four QDC module inputs.

Overview of Procedures

Configuration procedures described in the next several chapters are outlined below. They are sequential in nature: configuration information determined in initial chapters is needed in later chapters.

Step:	Procedure:	Description:	Refer to:
1	Jog Your Machine	You enter machine jog pressure and flow setpoints into the Jog Configuration (JGC) block. **You jog your ram (screw), clamp, and ejector** with commands in the DYC block to further refine your jog configuration. You enter jog pressure alarm setpoints into the JGC block.	Chapter 5
2	Select Command and Status Bits to Sequence Machine Operation	You write PLC-5 ladder logic required to cycle the machine in the desired manner.	Chapter 6
3	Load Initial Configuration Values	You load initial values for controlling pressure or flow, ramp rates, pressure alarms.	Chapter 7 (Used in Chapters 9 & 10)
4	Load Initial Profile Setpoints	You load Initial setpoints for process control, such as pressure, velocity, position, and time setpoints.	Chapter 8 (Used in Chapters 9 & 10)
5	Span your Valves	You span your **inject, clamp, and ejector valves.** and set profile pressure alarms.	Chapter 9
6	Tune your Machine for Producing Parts	We discuss topics to consider when tuning your machine.	Chapter 10
7	Troubleshoot the QDC Module with LEDs	We present a troubleshooting table based on LED indicator conditions	Chapter 11

Important: Throughout the rest of this manual, we refer to system pressure during profile or axis movement as corresponding to:

- inject pressure, or
- clamp pressure, or
- ejector pressure

All three are the pressure measured at input 2 of the QDC module.

For additional information, refer to *System Pressure* in chapter 1.

Enter Data Table Values and Download Data Blocks

We refer to these procedures throughout this manual whenever you must:

- enter data table values
- download data blocks

Enter Values into Your PLC- Data Table

With your programming terminal, enter worksheet values into your PLC-5 data table as follows:

1. Switch the PLC-5 processor to PROGRAM mode.

2. Display your PLC-5 data table

3. Locate the data files for storing the subject block as specified on individual worksheets.

4. Enter the value for each word and bit.

When you set bits in words prefixed with file identifier B (example: B34), the PLC-5 processor automatically switches the radix to binary format.

Download Data Blocks

We define the following data words and functions used in the procedure to download data blocks.

This Word:	At Address:	Provides this Function:
DYC61	N40:173	Requests that the QDC module return an error if it finds one in the designated data block. The QDC module reports the error in SYS61 and SYS62.
SYS61	N40:213	The QDC module reports the ID of the data block containing the error (identified in SYS62). This word will match a non-zero DYC61.
SYS62	N40:214	The QDC module reports the error code in this word. This error code relates to the data block whose ID is reported in SYS61.

The following steps outline the procedure to download data blocks from the PLC-5 data table to the QDC module.

Important: The exception to this procedure is the MCC block that has its own download procedure already outlined in chapter 3. The QDC module must store a valid MCC block before you can use the following procedure.

1. For the block you want to download (subject block), get its ID number from Table 4.A and enter it into DYC61.

Table 4.A
Information Required to Download a Block

Block to Download:	Pro-Set 600 Block ID.:	Pro-Set 600 Download Bit B21/	Companion Block:
JGC	02	1	
FCC	03	2	CPC
SCC	04	3	CPC
TCC	05	4	CPC
LPC	06	5	CPC
CPC	07	6	
INC	08	7	IPC
IPC	09	8	
PKC	10	9	HPC
HDC	11	10	HPC
HPC	12	11	
PRC	13	12	
PLC	14	13	PPC
PPC	15	14	
PSC	16	15	
FOC	17	16	OPC
SOC	18	17	OPC
TOC	19	18	OPC
OSC	20	19	OPC
OPC	21	20	
EAC	22	21	EPC
ERC	23	22	EPC
EPC	24	23	

2. Confirm that the QDC module returns the ID in SYS61.

Important: If the value returned in SYS61 is NOT the ID number you entered, you have an error in the MCC or DYC block:

If SYS61 has this value:	This block has errors:	Fix them as follows:
1	MCC	Refer to chapter 3 “Correct Programming Errors in MCC”
25	DYC	Go to steps 8 and 9 of this procedure.

- Fix MCC and DYC errors before starting the download procedure
- MCC and DYC errors are corrected when SYS61≠ 1 or 25, but when SYS61=DYC61=ID number of the subject block

When you have done all three:	Then:
1. Corrected all errors in MCC and DYC blocks 2. Entered the ID of the subject block in DYC61 3. Downloaded the subject block	The QDC module immediately reports any programming errors it detected in the subject block

3. Start the download procedure by setting the corresponding download bit (Table 4.A) in your PLC-5 data table.

4. Watch the bit you set in step 3 and wait for Pro-Set 600 software to reset it to zero. This indicates the PLC-5 processor has transferred the block to the QDC module.

5. Observe the value of SYS62 (N40:214) in your PLC-5 data table:

- If SYS62 = 0, the QDC module detected no errors. Go to step 6.
- If SYS62 ≠ 0, the QDC module detected an error. Go to step 8.

6. Since the QDC module did not detect a programming error, check Table 4.A to see if the subject block has a required companion block.

Important: When downloading multiple subject blocks that share the same companion block, you may download the companion block:

- after each subject block
- once after the last subject block

To simplify troubleshooting your data entry (programming) errors during initial configuration procedures, we recommend that you download the companion block after each subject block. Otherwise, the procedure to correct multiple errors becomes too complex.

7. Complete the procedure as follows:

a. If the subject block has a required companion block, return to step 2 and repeat the procedure for the next block or companion block.

b. If the subject block is the companion block, download it. Return to step 2 to download additional blocks if required.

8. The QDC module detected a programming error. Interpret the error code returned by the QDC module in SYS62. The code identifies the first detected programming error in the subject block whose ID is reported in SYS61 (N40:213). Refer to Section 2 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88) for how to interpret and correct the cause of programming errors.

9. Correct the error in the PLC-5 data table corresponding to the subject block. Since you may have more than one programming error in the subject block, return to step 4 and repeat the download procedure until you have corrected all errors in this block. Then SYS62 = 0.

Important: Pro-Set 600 software forces the PLC-5 processor to download all command blocks to the QDC module when you switch the processor from PROGRAM to RUN or power it up.

Chapter 5

Jog Your Machine

Chapter Objectives

This chapter describes how to:

- configure jog block values necessary to jog the ram (screw), clamp, and ejector
- test jog values and make changes, if necessary
- configure values which indirectly affect screw-rotate jogs

About Jogging

Jogging your machine is similar to operating in set-output mode: You apply percentage values to your QDC module's outputs to obtain the desired motion. The jog configuration block (JGC) lets you set up jog parameters to control QDC module outputs to jog the:

- ram (screw) forward and backward
- clamp open and closed
- ejector advance and retract

Although the QDC module (in the inject, clamp, and eject mode) may not directly control your machine's screw-rotate jogs, your hydraulics may require that valves connected to QDC module outputs assume a certain position to assure proper screw-rotate jog functions. The QDC jog configuration block allows you to set up these indirect jog values.

Use These Worksheets

The following table lists the worksheets for recording initial values in the JGC block to configure the QDC module for jogging the ram (screw), clamp, and ejector.

To configure the QDC module for jogging the:	Use this Worksheet	On Page
ram (screw), clamp, and ejector	5-A	5-3
screw-rotate (indirect control)	5-B	5-8

Determine Initial Jog Values

Worksheet 5-A lists all words in which you must enter values to successfully configure your QDC module for jogging the ram (screw), clamp, and ejector in both directions. Use it to record:

- initial values

  Enter initial values just sufficient to jog in the desired direction. Keep this information in mind:

  - The numbers you enter are %-signal output.
  - For a range of –10 to +10V dc, zero output occurs @ 50% (See Warning on next page.)

  Later in this chapter you modify these values to obtain desired results.

- pressure alarm setpoints for ram (screw), clamp, and/or ejector jogs

  The QDC module sets an alarm any time system pressure equals or exceeds the corresponding alarm setpoints during a jog. A zero entry inhibits alarm actuation.

  Important: The system high pressure alarm that you set in chapter 4 is also active during jog functions.

Worksheet 5. A
Ram (screw), Clamp, and Ejector Jog Configuration Values

Record Your Initial Values Here

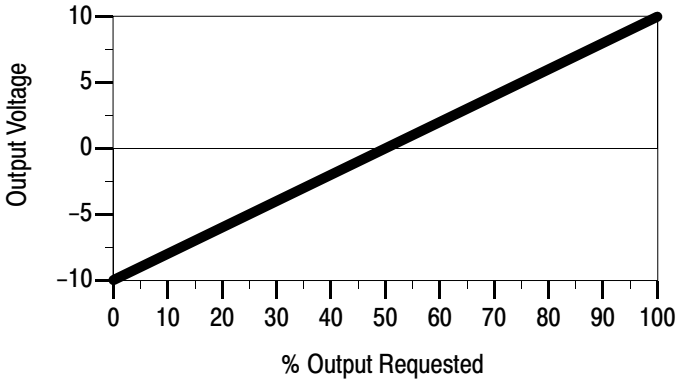
Block Word	Pro-Set 600 Addr.	Value	Description
Inject, Forward Jog			
JGC17	N40:73		Set-output Values Output #1 [1]
JGC18	N40:74		Output #2 [1]
JGC19	N40:75		Output #3 [1]
JGC20	N40:76		Output #4 [1]
Inject, Reverse Jog			
JGC25	N40:81		Set-output Values Output #1 [1]
JGC26	N40:82		Output #2 [1]
JGC27	N40:83		Output #3 [1]
JGC28	N40:84		Output #4 [1]
Clamp, Forward Jog			
JGC33	N40:89		Set-output Values Output #1 [1]
JGC34	N40:90		Output #2 [1]
JGC35	N40:91		Output #3 [1]
JGC36	N40:92		Output #4 [1]
Clamp, Reverse Jog			
JGC41	N40:97		Set-output Values Output #1 [1]
JGC42	N40:98		Output #2 [1]
JGC43	N40:99		Output #3 [1]
JGC44	N40:100		Output #4 [1]
Ejector, Advance Jog			
JGC49	N40:105		Set Output Values Output #1 [1]
JGC50	N40:106		Output #2 [1]
JGC51	N40:107		Output #3 [1]
JGC52	N40:108		Output #4 [1]
Ejector, Retract Jog			
JGC57	N40:113		Set Output Values Output #1 [1]
JGC58	N40:114		Output #2 [1]
JGC59	N40:115		Output #3 [1]
JGC60	N40:116		Output #4 [1]
Jog Pressure Alarms			
JGC06	N40:62		Ram Jog Pressure, Alarm Setpoint [2]
JGC07	N40:63		Clamp Jog Pressure, Alarm Setpoint [2]
JGC08	N40:64		Ejector Jog Pressure, Alarm Setpoint [2]

[1] % Signal Output
00.00 to 99.99 %

[2] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

ATTENTION: You can connect up to four different valves to your QDC module. Although all four may not directly jog the ram (screw), clamp, and/or ejector, consider their indirect effect when setting jog set-output values. Indirectly, they could cause unexpected machine motion with possible damage to equipment or injury to personnel.

ATTENTION: A value of 0 entered in your data table does not necessarily correspond to zero pressure or flow. For an output configured ± 10V dc, an output of 50% corresponds to zero volts signal output (see graph). Amplifier electronics or spool offsets may also be designed such that zero volts signal input does not result in no flow or pressure. Please consult your valve and amplifier specifications for more details.



Enter and Download Initial Jog Values

Enter values from Worksheet 5-A into PLC-5 data table and download the JGC block to the QDC module with your programming terminal. Use the procedures from chapter 4, *Enter Data Table Values and Download Data Blocks*. We repeat the JGC block download data.

To download	Set B21/
JGC	1

Write Ladder Logic

Take time now to develop ladder logic (independent of Pro-Set 600 software) to jog the ram (screw), clamp, and ejector. You may need to monitor switches on your operator control panel, and set corresponding command bits.

Use word 1 in the dynamic command block (DYC01) to enable and disable individual jogs. Use word 1 in the system status block (SYS01) to monitor the QDC module's reaction to jog commands. Tables 5.A and 5.B identify command and status bits for jogging the ram (screw), clamp, and ejector.

Table 5.A
Enable Bits for Ram (Screw), Clamp, and Ejector Jogs

Control Block Word:	Pro-Set 600 Address:	Description:
DYC01-B10	B34/394	Execute Ram (Screw) Jog Forward
DYC01-B11	B34/395	Execute Ram (Screw) Jog Reverse
DYC01-B12	B34/396	Execute Clamp Jog Forward
DYC01-B13	B34/397	Execute Clamp Jog Reverse
DYC01-B14	B34/398	Execute Ejector Jog Advance
DYC01-B15	B34/399	Execute Ejector Jog Retract

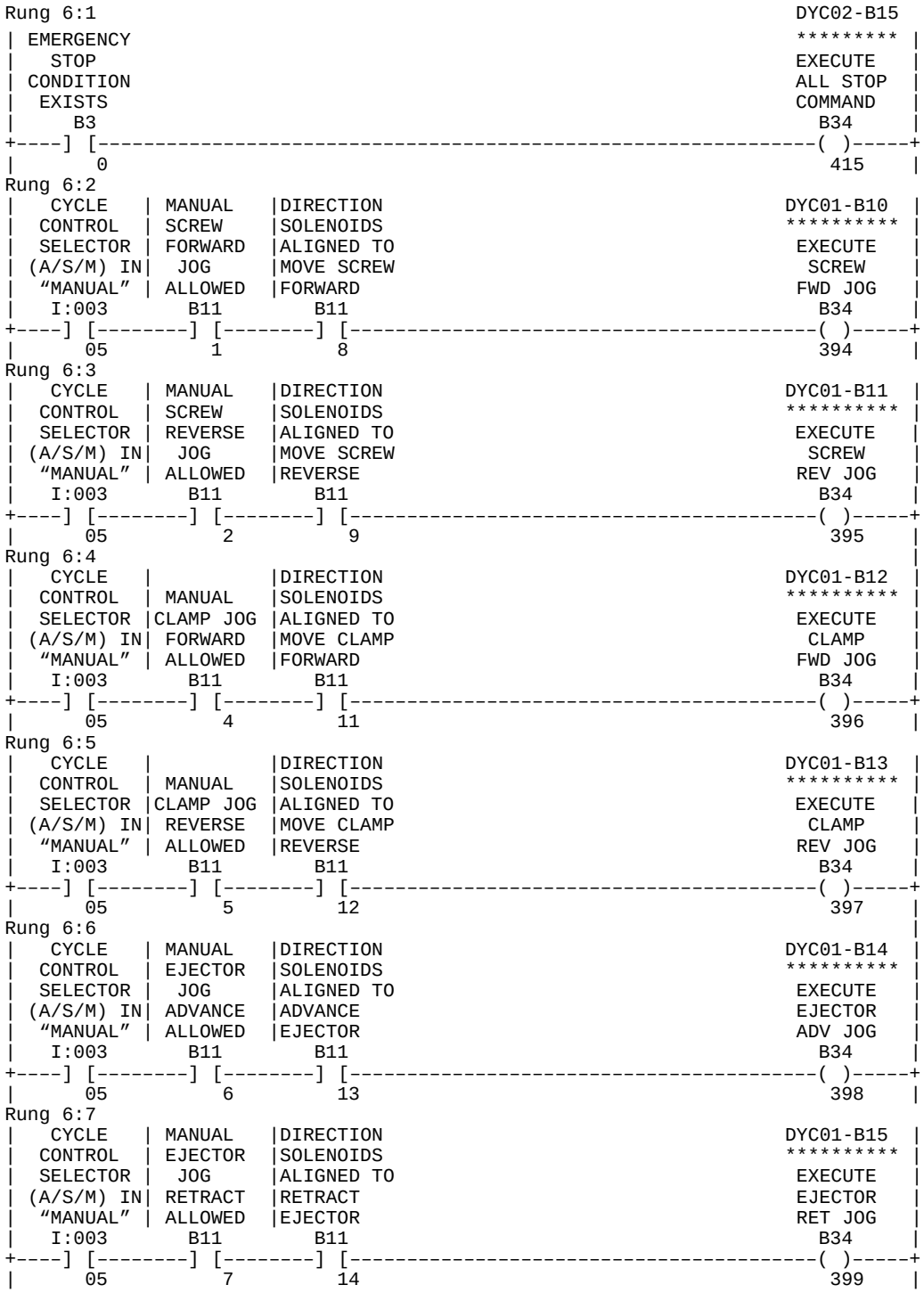
Table 5.B
Status Bits for Ram (Screw), Clamp, and Ejector Jogs

Status Block Word:	Pro-Set 600 Address:	Description:
SYS01-B10	B34/10	Ram (Screw) Jog Forward in Progress
SYS01-B11	B34/11	Ram (Screw) Jog Reverse in Progress
SYS01-B12	B34/12	Clamp Jog Forward in Progress
SYS01-B13	B34/13	Clamp Jog Reverse in Progress
SYS01-B14	B34/14	Ejector Jog Advance in Progress
SYS01-B15	B34/15	Ejector Jog Retract in Progress

We provide a programming example (Figure 5.1) of jog control for instructional purposes only. Your application-specific programming may vary significantly from this example.

Important: You may also need to develop ladder logic that changes the direction of ram (screw), clamp, and/or ejector travel hydraulically when you command the QDC module to jog in reverse.

Figure 5.1
Example Programming for Ram (Screw), Clamp, and Ejector Jogs



Jog Your Ram (Screw), Clamp, and Ejector

Jog your ram (screw), clamp, and ejector, one at a time, in forward and reverse directions. Experiment with values you entered in the jog configuration block (JGC) until you obtain the desired jog operation.

If You Observe This Condition:	Then Make This Adjustment:
Rough jerky acceleration or deceleration (hammering hydraulics)	1) Decrease jog pressure 2) Decrease jog flow
Sluggish acceleration or deceleration	1) Boost jog pressure

You must download the JGC block to the QDC module each time you change one or more of its values to implement the new value(s). Use the procedures in chapter 4 to change values in the JGC block and download it to the QDC module. We repeat the JGC block download data.

To download	Set B21/
JGC	1

Configure Screw-rotate Jogs for Indirect Control

Although the QDC module may not directly control your machine's screw-rotate jog, your hydraulics may require valves connected to this QDC module's outputs to go to a certain position to assure proper screw-rotate jog functions. The jog configuration block lets you set up these indirect jog values.

If your hydraulics require it, take time now to set your valves connected to the QDC module to assist with the screw-rotate jog. Otherwise, omit the rest of this chapter.

Whenever the appropriate screw-rotate jog bit is set in dynamic command block DYC01, the jog configuration block (JGC) values corresponding to the respective jog are applied to QDC module outputs.

1. In Worksheet 5-B, enter values which must be applied to the QDC module to successfully execute the screw-rotate jog.

Important: Jog-specific high pressure alarms are NOT activated during the screw-rotate jog.

2. Download the jog configuration block (JGC) with download bit B21/1 using the download procedure outlined in chapter 4.

Worksheet 5. B
Screw-rotate Jog Configuration Values for Indirect Control

Enter Your Initial Values Here

Block Word	Pro-Set 600 Addr.	Value	Description
Screw Rotate Jog			
JGC09	N40:65		Set Output Values Output #1 [1]
JGC10	N40:66		Output #2 [1]
JGC11	N40:67		Output #3 [1]
JGC12	N40:68		Output #4 [1]

[1] % Signal Output
00.00 to 99.99 %

Write Ladder Logic to Assist with Screw-rotate Jogs

If your hydraulics require it, take time now to develop ladder logic (independent of Pro-Set 600 software) so the QDC module can assist in screw-rotate jogs. Otherwise, omit the rest of this chapter.

Use word 1 in the dynamic command block (DYC01) to enable and disable individual jogs. Use word 1 in the system status block (SYS01) to monitor the QDC module's reaction to jog commands. Tables 5.C and 5.D identify command and status bits for jogging screw rotation.

Table 5.C
Enable Bits for Screw-rotate Jogs

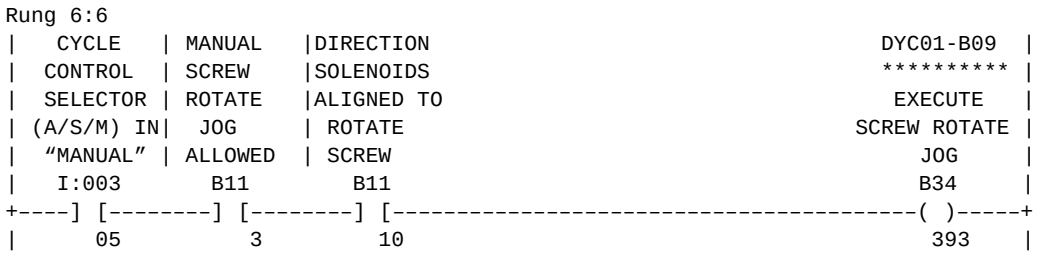
Command Block Word:	Pro-Set 600 Address:	Description:
DYC01-B09	B34/393	Execute Screw-rotate Jog

Table 5.D
Status Bits for Screw-rotate Jogs

Status Block Word:	Pro-Set 600 Address:	Description:
SYS01-B09	B34/9	Screw-rotate Jog in Progress

We provide a programming example (Figure 5.2) of assisted jog control for instructional purposes only. Your application-specific programming may vary significantly from this example.

Figure 5.2
Example Programming for Assisting Screw-rotate Jogs



Rotate the Screw

Do this only after writing all direct and assisted ladder logic for controlling screw-rotate jogs**.**

Rotate the ram (screw) by jogging. Experiment with values you entered in the jog configuration block (JGC) until you obtain the desired jog operation.

If You Observe This Condition:	Then Make This Adjustment:
Rough jerky acceleration or deceleration (hammering hydraulics)	1) Decrease jog pressure 2) Decrease jog flow
Sluggish acceleration or deceleration	1) Boost jog pressure

You must download the JGC block to the QDC module each time you change one or more of its values to implement the new value(s). Use download bit B21/1. If necessary, refer to the download procedure in chapter 4.

Chapter 6

Select Command and Status Bits to Sequence Machine Operation

Chapter Objectives

In this chapter, we provide you with tables of command and status bits that you use to write ladder logic to:

- implement manual functions such as jog, set outputs, and stop
- step your QDC module through machine cycles

We suggest how to assess your logic requirements and based on those requirements how to use bit tables to write your machine's sequential ladder logic.

Important: You must write your own ladder logic for machine sequencing because it depends on your machine's hydraulic configuration and your application. It is not included in Pro-Set 600 software.

Assess Your Logic Requirements

Assess your logic requirements according to how your machine must be sequenced.

If you need to	Refer to this table for required command and/or status bits
Execute phases of the inject, clamp, and eject mode without interruption	no additional ladder logic required
Jog your machine in manual mode, set outputs, or stop	6.A
Start the next profile or movement	6.B and 6.C
Interrupt movement between profiles	6.D
Trigger new events	6.E
Review all available status bits	6.F
Review all available command and configuration bits	6.G

Important: For a more thorough description of all command and status bits presented in this chapter, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Use Command and Status Bit Tables

Use the following tables to select command and status bits when writing ladder logic to control manual functions and machine sequencing.

Table 6.A
Command and Status Bits for Manual Control

To Initiate this action:	Set this bit:	Pro-Set B34/xx:	The QDC sets this bit during execution:	Pro-Set B34/xx:
Direct Set-output	DYC01-B08	392	SYS01-B08	08
Unassigned #1 Jog	DYC01-B09	393	SYS01-B09	09
Ram (screw) Forward Jog	DYC01-B10	394	SYS01-B10	10
Ram (screw) Reverse Jog	DYC01-B11	395	SYS01-B11	11
Clamp Forward Jog	DYC01-B12	396	SYS01-B12	12
Clamp Reverse Jog	DYC01-B13	397	SYS01-B13	13
Ejector Advance Jog	DYC01-B14	398	SYS01-B14	14
Ejector Retract Jog	DYC01-B15	399	SYS01-B15	15
Stop	DYC02-B15	415	SYS02-B15	31

Table 6.B
Command Bits for Starting Profiles

To initiate this Profile/Movement:	Toggle this bit in DYC02:	Pro-Set B34/xx:	If this bit is Reset:	Pro-Set Address:	The Profile/Movement in column 1 starts automatically after:
1st Clamp Close	00	400	---	---	---
2nd Clamp Close	01	401	CPC03-B08	B37/296	1st Clamp Close
3rd Clamp Close	02	402	CPC03-B09	B37/297	2nd Clamp Close
Low Pressure Close	03	403	CPC03-B10	B37/298	3rd Clamp Close
Injection	04	404	[1] ---	---	---
Pack	05	405	[1] ---	---	Injection
Hold	06	406	[1] ---	---	Pack
Pre-decompression	07	407	HPC03-B08	B38/296	Hold
Plastication	08	408	HPC03-B09	B38/297	Pre-decompression
Post-decompression	09	409	PPC03-B08	B38/488	Plastication
1st Clamp Open	10	410	---	---	---
2nd Clamp Open	11	411	OPC03-B08	B37/616	1st Clamp Open
3rd Clamp Open	12	412	OPC03-B09	B37/617	2nd Clamp Open
Clamp Open Slow	13	413	OPC03-B10	B37/618	3rd Clamp Open
1st Ejector Advance	14	414	EPC03-B08	B39/168	On Clamp Position During Open
Ejector Continue	15	415	EPC03-B12	B39/172	Previous Ejector Stroke

[1] Injection, Pack, and Hold are always linked as one profile.

Table 6.C
Status and Command Bit Interaction for Profile Execution

For this Profile/Movement:	During Execution this bit in B34 is:		At Completion this bit in B34 is:		At completion If this command bit is:	Then this status bit is:
	SET	RESET	SET	RESET	also SET	also SET
1st Clamp Close	SYS21-B00	SYS02-B00	SYS02-B00	SYS21-B00	CPC03-B08	SYS22-B00
2nd Clamp Close	SYS21-B01	SYS02-B01	SYS02-B01	SYS21-B01	CPC03-B09	SYS22-B01
3rd Clamp Close	SYS21-B02	SYS02-B02	SYS02-B02	SYS21-B02	CPC03-B10	SYS22-B02
Low Pressure Close	SYS21-B03	SYS02-B03	SYS02-B03	SYS21-B03	---	SYS22-B03
Injection	SYS21-B04	SYS02-B04	SYS02-B04	SYS21-B04	---	---
Pack	SYS21-B05	SYS02-B05	SYS02-B05	SYS21-B05	---	---
Hold	SYS21-B06	SYS02-B06	SYS02-B06	SYS21-B06	HPC03-B08	SYS22-B06
Pre-decompression	SYS21-B07	SYS02-B07	SYS02-B07	SYS21-B07	HPC03-B09	SYS22-B07
Plastication	SYS21-B08	SYS02-B08	SYS02-B08	SYS21-B08	PPC03-B08	SYS22-B08
Post-decompression	SYS21-B09	SYS02-B09	SYS02-B09	SYS21-B09	---	SYS22-B09
1st Clamp Open	SYS21-B10	SYS02-B10	SYS02-B10	SYS21-B10	OPC03-B08	SYS22-B10
2nd Clamp Open	SYS21-B11	SYS02-B11	SYS02-B11	SYS21-B11	OPC03-B09	SYS22-B11
3rd Clamp Open	SYS21-B12	SYS02-B12	SYS02-B12	SYS21-B12	OPC03-B10	SYS22-B12
Clamp Open Slow	SYS21-B13	SYS02-B13	SYS02-B13	SYS21-B13	---	SYS22-B13
Ejector Advance	SYS21-B14	SYS02-B14	SYS21-B14	SYS02-B14	EPC03-B12	SYS22-B14
Ejector Retract (tip strokes)	SYS21-B14	SYS02-B14	SYS21-B14	SYS02-B14	EPC03-B12	SYS22-B15
Final Ejector Retract	SYS21-B14	SYS02-B14	SYS02-B14	SYS21-B14	---	SYS22-B15

where:

These Bits:	Report These Functions:	or Command These Functions:
SYS21-B00 thru B14	profile in progress	
SYS02-B00 thru B14	profile complete	
SYS22-B00 thru B03 and B06 thru B15	executing end-of-profile %-outputs	
CPC03/HPC03/PPC03/OPC03/EPC03 Bits B08, 09, 10, 12		interrupt movement between profiles (see tables 6.B and 6.D)

Table 6.D
Command Bits To Interrupt Movement Between Profiles

To Perform T his Function	Use This Bit	Pro-Set Address:
Start 2nd clamp close profile @ end-of 1st Stop and set-output @ end-of 1st	CPC03-B08 = 0 = 1	B37/296
Start 3rd clamp close profile @ end-of 2nd Stop and set-output @ end-of 2nd	CPC03-B09 = 0 = 1	B37/297
Start LP close profile @ end-of 3rd Stop and set-output @ end-of 3rd	CPC03-B10 = 0 = 1	B37/298
Start 2nd clamp open profile @ end-of 1st Stop and set-output @ end-of 1st	OPC03-B08 = 0 = 1	B37/616
Start 3rd clamp open profile @ end-of 2nd Stop and set-output @ end-of 2nd	OPC03-B09 = 0 = 1	B37/617
Start clamp open slow profile @ end-of 3rd Stop and set-output @ end-of 3rd	OPC03-B10 = 0 = 1	B37/618
Start ejector profile on clamp position Start ejector profile on command	EPC03-B08 = 0 = 1	B39/168
Enable ejector profile Disable ejector profile	EPC03-B09 = 0 = 1	B39/169
Run ejector profile without interruption Stop and notify @ end of ejector stroke	EPC03-B12 = 0 = 1	B39/172
Start pre-decompression movement @ end-of hold Stop and set output @ end-of hold	HPC03-B08 = 0 = 1	B38/296
Start plastication profile @ end-of pre-decompression Stop and set output @ end-of pre-decompression	HPC03-B09 = 0 = 1	B38/297
Start post-decompression movement @ end-of plastication Stop and set output @ end-of plastication	PPC03-B08 = 0 = 1	B38/488

Important: In any of these bit tables, disregard bits not needed by your application.

Table 6.E
Miscellaneous Status Bits To Trigger New Action

Reason for Using:	Bit Description:	QDC Block Address:	Pro-Set B34/xx:
To drop pump adders, or shift solenoids before starting pack/hold profile	Injection complete	SYS02-B04	
To drop pump adders, or shift solenoids	Clamp in mold-protect zone	SYS03-B00	32
To add pump adders, or shift solenoids for tonnage build or lock-up	Mold safe	SYS03-B01	33
To start inject cycle	Tonnage complete	SYS03-B02	34
To inhibit clamp from opening in auto mode	Cure timer timing	SYS03-B03	35
To start clamp-open phase	Ram (screw) retracted, and Cure time complete	SYS03-B04, and -B05	36, 37
To drop pump adders, or shift solenoids	Clamp in open-slow zone	SYS03-B06	38
To idle the machine until starting next action	Mold fully open	SYS03-B07	39
To shift solenoids before starting next ejector stroke after the 1st advance strode	Ejector profile stopped at end of stroke	SYS03-B08	40
To prevent starting next cycle with machine in auto mode	Open-dwell timer is timing	SYS03-B09	41
To prevent starting ejector retract until valves have shifted	Ejector forward dwell timer is timing	SYS03-B10	42
To start next cycle with machine in auto mode	Cycle complete	SYS03-B11	43
To start ejector retract	Ejector fully advanced	SYS03-B12	44
To start ejector retract when tip stroking is ON	Ejector is beyond tip advance position	SYS03-B13	45
To start ejector advance when tip stroking is ON	Ejector is within tip retract position	SYS03-B14	46
To start ejector advance	Ejector fully retracted	SYS03-B15	47
To re-open the clamp when the part is stuck	LP close watchdog time-out	SYS04-B03	51
To idle the machine and activate an alarm because the hopper is running out of plastic	Watchdog for plastication phase	SYS04-B08	56
To shift solenoids for pre-decompression	Set-output in progress @ end of hold	SYS22-B06	342
To shift solenoids for plastication	Set-output in progress @ end of pre-decompression	SYS22-B07	343
To shift solenoids for post-decompression	Set-output in progress @ end of plastication	SYS22-B08	344
To idle the machine until starting next action	Set-output in progress @ end of post-decompression	SYS22-B09	345

Table 6.F
Status Bits

Category:	Bit Status (when = 1):	QDC Block Address	Pro-Set B34/xx:
Jog Status	executing unassigned #1 jog	SYS01-B09	09
	executing ram (screw) forward jog	SYS01-B10	10
	executing ram (screw) reverse jog	SYS01-B11	11
	executing clamp forward jog	SYS01-B12	12
	executing clamp reverse jog	SYS01-B13	13
	executing ejector advance jog	SYS01-B14	14
	executing ejector retract jog	SYS01-B15	15
Profile Complete	1st clamp close profile complete	SYS02-B00	16
	2nd clamp close profile complete	SYS02-B01	17
	3rd clamp close profile complete	SYS02-B02	18
	LP close profile complete	SYS02-B03	19
	injection profile complete	SYS02-B04	20
	pack profile complete	SYS02-B05	21
	hold profile complete	SYS02-B06	22
	pre-decompress movement complete	SYS02-B07	23
	plastication profile complete	SYS02-B08	24
	post-decompress movement complete	SYS02-B09	25
	1st clamp open profile complete	SYS02-B10	26
	2nd clamp open profile complete	SYS02-B11	27
	3rd clamp open profile complete	SYS02-B12	28
	clamp open slow profile complete	SYS02-B13	29
	ejector profile complete	SYS02-B14	30
Busy Status	no action (outputs at zero)	SYS02-B15	31
Miscellaneous Status	clamp in mold protection zone	SYS03-B00	32
	mold safe	SYS03-B01	33
	tonnage complete	SYS03-B02	34
	cure timer timing	SYS03-B03	35
	ram (screw) retracted	SYS03-B04	36
	cure time complete	SYS03-B05	37
	clamp in open-slow zone	SYS03-B06	38
	mold open	SYS03-B07	39
	ejector stopped at end of stroke	SYS03-B08	40
	mold open-dwell timer is timing	SYS03-B09	41

Table 6.F
Status Bits (continued)

Category:	Bit Status (when = 1):	QDC Block Address	Pro-Set B34/xx:
	ejector forward dwell timer is timing	SYS03-B10	42
	cycle complete	SYS03-B11	43
	ejector fully advanced	SYS03-B12	44
	ejector is beyond tip advance position	SYS03-B13	45
	ejector is within tip retract position	SYS03-B14	46
	ejector fully retracted	SYS03-B15	47
Watchdog Status	1st clamp close watchdog timed out	SYS04-B00	48
	2nd clamp close watchdog timed out	SYS04-B01	49
	3rd clamp close watchdog timed out	SYS04-B02	50
	LP close watchdog timed out	SYS04-B03	51
	pre-decompress watchdog timed out	SYS04-B07	55
	plastication watchdog timed out	SYS04-B08	56
	post-decompress watchdog timed out	SYS04-B09	57
	1st clamp open watchdog timed out	SYS04-B10	58
	2nd clamp open watchdog timed out	SYS04-B11	59
	3rd clamp open watchdog timed out	SYS04-B12	60
	clamp open slow watchdog timed out	SYS04-B13	61
	ejector watchdog timed out	SYS04-B14	62
	tonnage watchdog timed out	SYS04-B15	63
Profile Status	executing 1st close profile	SYS21-B00	320
	executing 2nd close profile	SYS21-B01	321
	executing 3rd close profile	SYS21-B02	322
	executing LP close profile	SYS21-B03	323
	executing injection profile	SYS21-B04	324
	executing pack profile	SYS21-B05	325
	executing hold profile	SYS21-B06	326
	executing pre-decompress movement	SYS21-B07	327
	executing plastication profile	SYS21-B08	328
	executing post-decompress movement	SYS21-B09	329
	executing 1st clamp open profile	SYS21-B10	330
	executing 2nd clamp open profile	SYS21-B11	331
	executing 3rd clamp open profile	SYS21-B12	332

Table 6.F
Status Bits (continued)

Category:	Bit Status (when = 1):	QDC Block Address:	Pro-Set B34/xx:
	executing clamp open slow profile	SYS21-B13	333
	executing ejector profile	SYS21-B14	334
End-of Profile Set-output Status	executing end-of 1st clamp close set-output	SYS22-B00	336
	executing end-of 2nd clamp close set-output	SYS22-B01	337
	executing end-of 3rd clamp close set-output	SYS22-B02	338
	executing end-of LP close set-output	SYS22-B03	339
	executing end of hold set-output	SYS22-B06	342
	executing end of pre-decompression set-output	SYS22-B07	343
	executing end of plastication set-output	SYS22-B08	344
	executing end of post-decompression set-output	SYS22-B09	345
	executing end-of 1st clamp open set-output	SYS22-B10	346
	executing end-of 2nd clamp open set-output	SYS22-B11	347
	executing end-of 3rd clamp open set-output	SYS22-B12	348
	executing end-of clamp open slow set-output	SYS22-B13	349
	executing end-of ejector advance set-output	SYS22-B14	350
	executing end-of ejector retract set-output	SYS22-B15	351

Table 6.G
Command and Configuration Bits

Operation:	Function Enabled (when = 1):	QDC Block Address:	Pro-Set B34/xx:
Non-profiled	execute set-output	DYC01-B08	392
Action Commands	execute unassigned # 1 jog	DYC01-B09	393
	execute ram (screw) forward jog	DYC01-B10	394
	execute ram (screw) reverse jog	DYC01-B11	395
	execute clamp forward jog	DYC01-B12	396
	execute clamp reverse jog	DYC01-B13	397
	execute ejector advance jog	DYC01-B14	398
	execute ejector retract jog	DYC01-B15	399
Profile Action	execute 1st clamp close profile	DYC02-B00	400
Commands	execute 2nd clamp close profile	DYC02-B01	401
	execute 3rd clamp close profile	DYC02-B02	402
	execute LP clamp close profile	DYC02-B03	403
	execute injection profile	DYC02-B04	404
	execute pack profile	DYC02-B05	405
	execute hold profile	DYC02-B06	406
	execute pre-decompression movement	DYC02-B07	407
	execute plastication profile	DYC02-B08	408
	execute post-decompression movement	DYC02-B09	409
	execute 1st clamp open profile	DYC02-B10	410
	execute 2nd clamp open profile	DYC02-B11	411
	execute 3rd clamp open profile	DYC02-B12	412
	execute clamp open slow profile	DYC02-B13	413
	execute ejector profile	DYC02-B14	414
Stop Command	execute all stop (outputs = zero)	DYC02-B15	415
Miscellaneous	reset tonnage watchdog timer	DYC03-B00	416
Commands	reset cure timer	DYC03-B01	417
	reset SYS01-B08	DYC03-B08	424
	reset latched alarms	DYC03-B09	425
	reset complete bits	DYC03-B10	426
	continue ejector profile	DYC03-B15	431

Table 6.G (continued)
Command and Configuration Bits

Operation:	Function Enabled (when = 1):	QDC Block Address:	Pro-Set Address:
Logical Bridge	set output @ end of 1st clamp close profile (0 = start 2nd clamp close profile)	CPC03-B08	B37/296
	set output @ end of 2nd clamp close profile (0 = start 3rd clamp close profile)	CPC03-B09	B37/297
	set output @ end of 3rd clamp close profile (0 = start clamp LP close profile)	CPC03-B10	B37/298
	set output @ end of hold profile (0 = start pre-decompress movement @ end of hold)	HPC03-B08	B38/296
	set output @ end of pre-decompress movement (0 = start plastication profile @ end of pre-decompress)	HPC03-B09	B38/297
	set output at end of plastication profile (0 = start post-decompression at end of plastication)	PPC03-B08	B38/488
	set output @ end of 1st clamp open profile (0 = start 2nd clamp open profile)	OPC03-B08	B37/616
	set output @ end of 2nd clamp open profile (0 = start 3rd clamp open profile)	OPC03-B09	B37/617
	set output @ end of 3rd clamp open profile (0 = start clamp open slow profile)	OPC03-B10	B37/618
	set output @ end of all ejector strokes (0 = start each new stroke at end of previous)	EPC03-B12	B39/172
Configured Protection from Clamp-zone Overrun	If a clamp close profile overruns the mold protection zone: 0 = start LP-close profile 1 = stop and zero outputs	CPC03-B11	B37/299
	If a clamp open profile overruns the clamp open slow zone 0 = start open slow profile 1 = stop and zero outputs	OPC03-B11	B37/619
Additional Ejector Configuration	start ejector profile on command from PLC processor (0 = start ejector profile on position during clamp open)	EPC03-B08	B39/168
	disable ejector profile (0 = enable ejector profile)	EPC03-B09	B39/169
	change intermediate strokes to tip strokes (0 = all ejector strokes are full strokes)	EPC03-B13	B39/173
	execute forward dwell after 1st advance stroke (0 = execute forward dwell after last advance stroke)	EPC03-B15	B39/175

Chapter 7

Load Initial Configuration Values

Chapter Objectives

This chapter helps you load the QDC module with machine-specific configuration values by performing four tasks:

- Determine initial configuration values
- Record them on worksheets
- Enter them in PLC-5 data table
- Download them to the QDC module

Initial values that you load include:

- configuration bits
- set-output values
- acceleration and deceleration ramp rates
- pressure or velocity control limits
- pressure or velocity gain constants
- pressure alarm setpoints

We already recorded many initial values on worksheets for you.

Important: Do not start this chapter until you have:

- spanned your sensors, and moved hydraulic cylinders (chapter 3)
- jogged the ram (screw), clamp, and ejector (chapter 5)

Use These Worksheets

The following table lists configuration blocks and corresponding worksheets for recording your initial values to configure the QDC module.

To configure the QDC module with these configuration blocks:	Use worksheet:	On page:
Clamp Close Configuration Blocks (FCC, SCC, and TCC)	7-A	7-3
Low Pressure Close Configuration Block (LPC)	7-B	7-5
Injection Configuration Block (INC)	7-C	7-7
Pack Configuration Block (PKC)	7-D	7-9
Hold Configuration Block (HDC)	7-E	7-11
Plastication Configuration Block (PLC)	7-F	7-13
Clamp Open Configuration Blocks (FOC, SOC, TOC, and OSC)	7-G	7-15
Ejector Configuration Blocks (EAC and ERC)	7-H	7-17

Important: We omitted pre- and post-decompression blocks because you do not use them when spanning valves in chapter 9. We discuss their application in chapter 10.

Take a moment now to browse through the worksheets. Notice that we grouped clamp close configuration blocks onto one worksheet, and clamp open configuration blocks onto another because they are similar. Otherwise, each configuration block has its own worksheet.

Each configuration block has two types of storage words:

- control words for selecting parameters by setting bits
- data words for recording initial values

Many parameters repeat from one configuration block to the next. Because of this, we describe how you determine an initial value once for all configuration blocks that require it. Then you enter that parameter in all applicable configuration blocks. That is why we placed worksheets together, followed by the text to describe how to determine initial values.

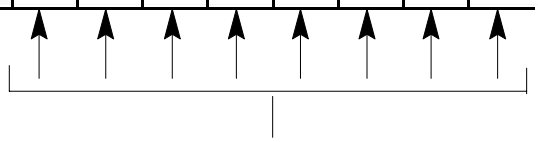
We give you the procedure immediately following the worksheets.

Worksheet 7-A
Clamp Close Configuration Blocks (FCC, SCC, and TCC)

Word **FCC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Word **SCC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Word **TCC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1



Block Identifier

Important: Record values only in words used.
Record zeros in words not used.
You must configure at least FCC02

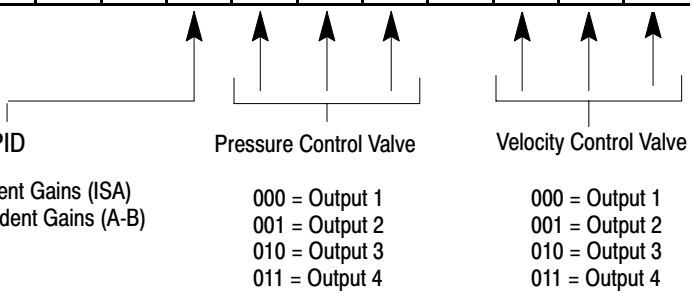
Word **FCC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Word **SCC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
Value	0	0	0	0	0	0	0	0	1				0			

Word **TCC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used



Important: You must configure at least the FCC configuration block.

Worksheet 7-A (continued)
Clamp Close Configuration Blocks (FCC, SCC, and TCC)

Enter Your Values Here

For these Parameters (footnote = units)	Word	FCC N43:	FCC Value	SCC N43:	SCC Value	TCC N43:	TCC Value
Minimum ERC Percentage – Velocity [8]	05	1	1000	61	1000	121	1000
Minimum ERC Percentage – Pressure [8]	06	2	1000	62	1000	122	1000
Profile Watchdog Timer Preset [1]	08	4	0	64	0	124	0
Output #1 Selected Valve %-Output During Profile [4]	09	5	*	65	*	125	*
Output #2 Selected Valve %-Output During Profile [4]	10	6	*	66	*	126	*
Output #3 Selected Valve %-Output During Profile [4]	11	7	*	67	*	127	*
Output #4 Selected Valve %-Output During Profile [4]	12	8	*	68	*	128	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	13	0	73	0	133	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	14	0	74	0	134	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	15	0	75	0	135	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	16	0	76	0	136	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	21	0	81	0	141	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	22	0	82	0	142	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	23	0	83	0	143	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	24	0	84	0	144	0
Output #1 End-of-profile Set-output Value [4]	33	29	*	89	*	149	*
Output #2 End-of-profile Set-output Value [4]	34	30	*	90	*	150	*
Output #3 End-of-profile Set-output Value [4]	35	31	*	91	*	151	*
Output #4 End-of-profile Set-output Value [4]	36	32	*	92	*	152	*
Pressure Minimum Control Limit [3]	41	37	0	97	0	157	0
Pressure Maximum Control Limit [3]	42	38	Syst Press	98	Syst Press	158	Syst Press
Selected Pressure Valve Output for Minimum [4]	43	39	*	99	*	159	*
Selected Pressure Valve Output for Maximum [4]	44	40	*	100	*	160	*
Velocity Minimum Control Limit [2]	45	41	0	101	0	161	0
Velocity Maximum Control Limit [2]	46	42	per OEM *	102	per OEM *	162	per OEM *
Selected Velocity Valve Output for Minimum [4]	47	43	*	103	*	163	*
Selected Velocity Valve Output for Maximum [4]	48	44	*	104	*	164	*
Proportional Gain for Pressure Control (none)	49	45	100	105	100	165	100
Integral Gain for Pressure Control [6]	50	46	400	106	400	166	400
Derivative Gain for Pressure Control [7]	51	47	0	107	0	167	0
Proportional Gain for Velocity Control [6]	52	48	200	108	200	168	200
Feed Forward Gain for Velocity Control (none)	53	49	0	109	0	169	0
Profile High Pressure Alarm Setpoint [3]	57	53	0	113	0	173	0

[1] Time
00.00 to 99.99 Seconds

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Seconds

[7] Time (Algorithm)
00.00 to 99.99 Minutes

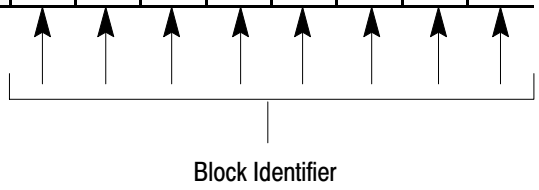
[8] Percent
00.00 to 99.99

***Important**: Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-B
Low Pressure Close Configuration Block (LPC)

Word **LPC01** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0

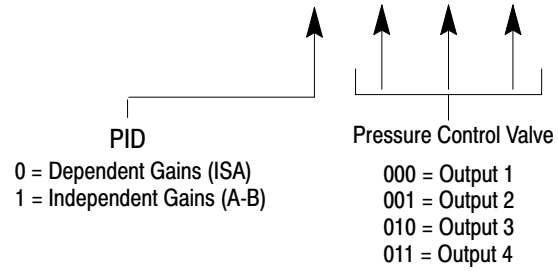
Important:
Verify block identifier.



Word **LPC02** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used



Important: You must configure the LPC configuration block.

Worksheet 7-B (continued)
Low Pressure Close Configuration Block (LPC)

Enter Your Values Here

For these Parameters (footnote = units)	Word	LPC N43:	LPC Value
Minimum ERC Percentage [8]	06	182	1000
Tonnage Watchdog Timer Preset [1]	07	183	0
Profile Watchdog Timer Preset [1]	08	184	0
#1 Selected Valve Set-Output During Profile [4]	09	185	*
#2 Selected Valve Set-Output During Profile [4]	10	186	*
#3 Selected Valve Set-Output During Profile [4]	11	187	*
#4 Selected Valve Set-Output During Profile [4]	12	188	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	193	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	194	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	195	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	196	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	201	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	202	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	203	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	204	0
#1 End-of-profile Set-output Value [4]	33	209	*
#2 End-of-profile Set-output Value [4]	34	210	*
#3 End-of-profile Set-output Value [4]	35	211	*
#4 End-of-profile Set-output Value [4]	36	212	*
Pressure Minimum Control Limit [3]	41	217	0
Pressure Maximum Control Limit [3]	42	218	System Pressure
Selected Pressure Valve Output for Minimum [4]	43	219	*
Selected Pressure Valve Output for Maximum [4]	44	220	*
Proportional Gain for Pressure Control (none)	49	225	100
Integral Gain for Pressure Control [6]	50	226	400
Derivative Gain for Pressure Control [7]	51	227	0
Profile High Pressure Alarm Setpoint [3]	57	233	0

[1] Time
00.00 to 99.99 Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Sec
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Sec

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

*** Important**: Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-C
Injection Configuration Block (INC)

Control Word INC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

INC Block Identifier

Control Word INC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Selected Pressure Valve

000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Selected Velocity Valve

000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Worksheet 7-C (continued)
Injection Configuration Block (INC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description
INC05	N44:1	1000	Minimum ERC Percentage--Velocity [8]
INC06	N44:2	1000	Minimum ERC Percentage--Pressure [8]
INC09	N44:5	*	Output #1 Set-output Value During Profile [4]
INC10	N44:6	*	Output #2 Set-output Value During Profile [4]
INC11	N44:7	*	Output #3 Set-output Value During Profile [4]
INC12	N44:8	*	Output #4 Set-output Value During Profile [4]
INC17	N44:13	0	Output #1 Acceleration Ramp Rate During Profile [5]
INC18	N44:14	0	Output #2 Acceleration Ramp Rate During Profile [5]
INC19	N44:15	0	Output #3 Acceleration Ramp Rate During Profile [5]
INC20	N44:16	0	Output #4 Acceleration Ramp Rate During Profile [5]
INC25	N44:21	0	Output #1 Deceleration Ramp Rate During Profile [5]
INC26	N44:22	0	Output #2 Deceleration Ramp Rate During Profile [5]
INC27	N44:23	0	Output #3 Deceleration Ramp Rate During Profile [5]
INC28	N44:24	0	Output #4 Deceleration Ramp Rate During Profile [5]
INC41	N44:37	0	Pressure Minimum Control Limit [3]
INC42	N44:38	*	Pressure Maximum Control Limit [3]
INC43	N44:39	*	Selected Pressure Valve, Output for Minimum [4]
INC44	N44:40	*	Selected Pressure Valve, Output for Maximum [4]
INC45	N44:41	0	Velocity Minimum Control Limit [2]
INC46	N44:42	*	Velocity Maximum Control Limit [2]
INC47	N44:43	*	Selected Velocity Valve, Output for Minimum [4]
INC48	N44:44	*	Selected Velocity Valve, Output for Maximum [4]
INC49	N44:45	100	Proportional Gain for Pressure Control [none]
INC50	N44:46	400	Integral Gain for Pressure Control [6]
INC51	N44:47	0	Derivative Gain for Pressure Control [7]
INC52	N44:48	200	Proportional Gain for Velocity Control [6]
INC53	N44:49	0	Feed Forward Gain for Velocity Control [none]
INC57	N44:53	0	Profile High Pressure Alarm Setpoint [3]

[2] Velocity along Axis
00.00 to 99.99 inches per second
000.0 to 999.9 millimeters per second

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-D
Pack Configuration Block (PKC)

Control Word PKC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0

PKC Block Identifier

Control Word PKC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Selected
Pressure Valve

000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Worksheet 7-D (continued)
Pack Configuration Block (PKC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PKC06	N44:122	1000	Minimum ERC Percentage--Pressure	Percent [8]
PKC09	N44:125	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
PKC10	N44:126	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
PKC11	N44:127	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
PKC12	N44:128	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
PKC17	N44:133	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC18	N44:134	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC19	N44:135	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC20	N44:136	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC25	N44:141	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC26	N44:142	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC27	N44:143	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC28	N44:144	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC41	N44:157	0	Pressure Minimum Control Limit	Pressure [3]
PKC42	N44:158	*	Pressure Maximum Control Limit	Pressure [3]
PKC43	N44:159	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
PKC44	N44:160	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
PKC49	N44:165	100	Proportional Gain for Pressure Control	None
PKC50	N44:166	400	Integral Gain for Pressure Control	Inverse Time (Algorithm) [6]
PKC51	N44:167	0	Derivative Gain for Ram Pressure Control	Time (Algorithm) [7]
PKC57	N44:173	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-E
Hold Configuration Block (HDC)

Control Word HDC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1

HDC Block Identifier

Control Word HDC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Selected
Pressure Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Worksheet 7-E (continued)
Hold Configuration Block (HDC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HDC06	N44:182	1000	Minimum ERC Percentage--Pressure	Percent [8]
HDC09	N44:185	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
HDC10	N44:186	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
HDC11	N44:187	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
HDC12	N44:188	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
HDC17	N44:193	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC18	N44:194	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC19	N44:195	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC20	N44:196	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC25	N44:201	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC26	N44:202	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC27	N44:203	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC28	N44:204	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC33	N44:209	*	Output #1 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC34	N44:210	*	Output #2 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC35	N44:211	*	Output #3 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC36	N44:212	*	Output #4 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC41	N44:217	0	Pressure Minimum Control Limit	Pressure [3]
HDC42	N44:218	*	Pressure Maximum Control Limit	Pressure [3]
HDC43	N44:219	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
HDC44	N44:220	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
HDC49	N44:225	100	Proportional Gain for Pressure Control	None
HDC50	N44:226	400	Integral Gain for Pressure Control	Inverse Time (algorithm) [6]
HDC51	N44:227	0	Derivative Gain for Pressure Control	Time (algorithm) [7]
HDC57	N44:233	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-F
Plastication Configuration Block (PLC)

Control Word PLC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0

PLC Block Identifier

Control Word PLC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Selected
Pressure Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Worksheet 7-F (continued)
Plastication Configuration Block (PLC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PLC06	N44:362	1000	Minimum ERC Percentage--Pressure	Percent [8]
PLC08	N44:364	0	Profile Watchdog Timer Preset	Time [1]
PLC09	N44:365	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
PLC10	N44:366	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
PLC11	N44:367	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
PLC12	N44:368	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
PLC17	N44:373	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC18	N44:374	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC19	N44:375	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC20	N44:376	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC25	N44:381	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC26	N44:382	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC27	N44:383	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC28	N44:384	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC33	N44:389	*	Output #1 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC34	N44:390	*	Output #2 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC35	N44:391	*	Output #3 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC36	N44:392	*	Output #4 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC41	N44:397	0	Pressure Minimum Control Limit	Pressure [3]
PLC42	N44:398	*	Pressure Maximum Control Limit	Pressure [3]
PLC43	N44:399	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
PLC44	N44:400	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
PLC49	N44:405	100	Proportional Gain for Pressure Control	None
PLC50	N44:406	400	Integral Gain for Pressure Control	Inverse Time (Algorithm) [6]
PLC51	N44:407	0	Derivative Gain for Pressure Control	Time (Algorithm) [7]
PLC57	N44:413	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[1] Time
00.00 to 99.99 seconds

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-G
Clamp Open Configuration Blocks (FOC, SOC, TOC, and OSC)

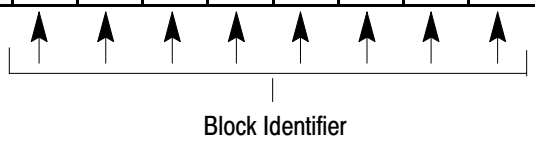
Word **FOC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	335	334	333	332	331	330	329	328	327	326	325	324	323	322	321	320
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Word **SOC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0

Word **TOC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	463	362	461	460	459	458	457	456	455	454	453	452	451	450	449	448
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1

Word **OSC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	527	526	525	524	523	522	521	520	519	518	517	516	515	514	513	512
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0

Important: Record values only in words used.
Record zeros in words not used.
You must configure at least FOC02



Word **FOC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336
Value	0	0	0	0	0	0	0	0	1				0			

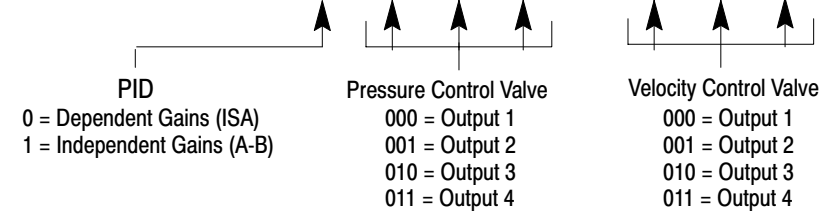
Word **SOC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400
Value	0	0	0	0	0	0	0	0	1				0			

Word **TOC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	479	478	477	476	475	474	473	472	471	470	469	468	467	466	465	464
Value	0	0	0	0	0	0	0	0	1				0			

Word **OSC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used



Important: You must configure at least the FOC and OSC configuration blocks.

Worksheet 7-G (continued)
Clamp Open Configuration Blocks (FOC, SOC, TOC, and OSC)

Enter Your Values Here

For these Parameters (footnote = units)	Word	FOC N43	FOC Value	SOC N43	SOC Value	TOC N43	TOC Value	OSC N43	OSC Value
Minimum ERC Percentage – Velocity [8]	05	301	1000	361	1000	421	1000	481	1000
Minimum ERC Percentage – Pressure [8]	06	302	1000	362	1000	422	1000	482	1000
Profile Watchdog Timer Preset [1]	08	304	0	364	0	424	0	484	0
#1 Selected Valve Set-Output During Profile [4]	09	305	*	365	*	425	*	485	*
#2 Selected Valve Set-Output During Profile [4]	10	306	*	366	*	426	*	486	*
#3 Selected Valve Set-Output During Profile [4]	11	307	*	367	*	427	*	487	*
#4 Selected Valve Set-Output During Profile [4]	12	308	*	368	*	428	*	488	*
Output #1 Accel Ramp Rate During Profile [5]	17	313	0	373	0	433	0	493	0
Output #2 Accel Ramp Rate During Profile [5]	18	314	0	374	0	434	0	494	0
Output #3 Accel Ramp Rate During Profile [5]	19	315	0	375	0	435	0	495	0
Output #4 Accel Ramp Rate During Profile [5]	20	316	0	376	0	436	0	496	0
Output #1 Decel Ramp Rate During Profile [5]	25	321	0	381	0	441	0	501	0
Output #2 Decel Ramp Rate During Profile [5]	26	322	0	382	0	442	0	502	0
Output #3 Decel Ramp Rate During Profile [5]	27	323	0	383	0	443	0	503	0
Output #4 Decel Ramp Rate During Profile [5]	28	324	0	384	0	444	0	504	0
#1 End-of-profile Set-output Value [4]	33	329	*	389	*	449	*	509	*
#2 End-of-profile Set-output Value [4]	34	330	*	390	*	450	*	510	*
#3 End-of-profile Set-output Value [4]	35	331	*	391	*	451	*	511	*
#4 End-of-profile Set-output Value [4]	36	332	*	392	*	452	*	512	*
Pressure Minimum Control Limit [3]	41	337	0	397	0	457	0	517	0
Pressure Maximum Control Limit [3]	42	338	Syst Press	398	Syst Press	458	Syst Press	518	Syst Press
Selected Pressure Valve Output for Min [4]	43	339	*	399	*	459	*	519	*
Selected Pressure Valve Output for Max [4]	44	340	*	400	*	460	*	520	*
Velocity Minimum Control Limit [2]	45	341	0	401	0	461	0	521	0
Velocity Maximum Control Limit [2]	46	342	per OEM *	402	per OEM *	462	per OEM *	522	per OEM *
Selected Velocity Valve Output for Min [4]	47	343	*	403	*	463	*	523	*
Selected Velocity Valve Output for Max [4]	48	344	*	404	*	464	*	524	*
Proportional Gain for Pressure Control (none)	49	345	100	405	100	465	100	525	100
Integral Gain for Pressure Control [6]	50	346	400	406	400	466	400	526	400
Derivative Gain for Pressure Control [7]	51	347	0	407	0	467	0	527	0
Proportional Gain for Velocity Control [6]	52	348	200	408	200	468	200	528	200
Feed Forward Gain for Velocity Control (none)	53	349	0	409	0	469	0	529	0
Profile High Pressure Alarm Setpoint [3]	57	353	0	413	0	473	0	533	0

[1] Time
00.00 to 99.99 Seconds

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Seconds

[7] Time (Algorithm)
00.00 to 99.99 Minutes

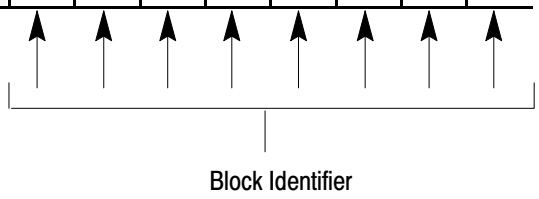
[8] Percent
00.00 to 99.99

*** Important:** Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-H
Ejector Configuration Blocks (EAC and ERC)

Control Word EAC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0

Control Word ERC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1

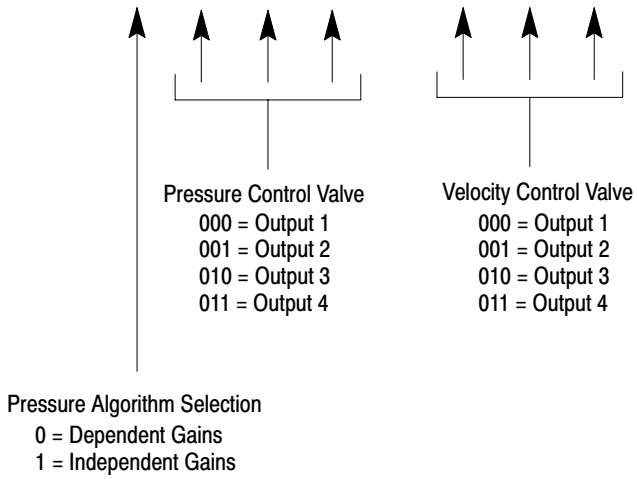


Control Word EAC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Control Word ERC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used



Worksheet 7-H (continued)
Ejector Configuration Blocks (EAC and ERC)

Enter Your Values Here

Description	Word	EAC @ N45:	EAC Value	ERC @ N45:	ERC Value
Minimum ERC™ Percentage--Velocity [8]	05	N45:1	1000	N45:61	1000
Minimum ERC™ Percentage--Pressure [8]	06	N45:2	1000	N45:62	1000
Profile Watchdog Timer Preset [1]	08	N45:4	0	N/A	N/A
Output #1 Set-Output Value during Advance [4]	09	N45:5	*	N45:65	*
Output #2 Set-Output Value during Advance [4]	10	N45:6	*	N45:66	*
Output #3 Set-Output Value during Advance [4]	11	N45:7	*	N45:67	*
Output #4 Set-Output Value during Advance [4]	12	N45:8	*	N45:68	*
Output #1 Acceleration Ramp Rate during Advance [5]	17	N45:13	0	N45:73	0
Output #2 Acceleration Ramp Rate during Advance [5]	18	N45:14	0	N45:74	0
Output #3 Acceleration Ramp Rate during Advance [5]	19	N45:15	0	N45:75	0
Output #4 Acceleration Ramp Rate during Advance [5]	20	N45:16	0	N45:76	0
Output #1 Deceleration Ramp Rate during Advance [5]	25	N45:21	0	N45:81	0
Output #2 Deceleration Ramp Rate during Advance [5]	26	N45:22	0	N45:82	0
Output #3 Deceleration Ramp Rate during Advance [5]	27	N45:23	0	N45:83	0
Output #4 Deceleration Ramp Rate during Advance [5]	28	N45:24	0	N45:84	0
Output #1 Set-Output Value at End-of Advance [4]	33	N45:29	*	N45:89	*
Output #2 Set-Output Value at End-of Advance [4]	34	N45:30	*	N45:90	*
Output #3 Set-Output Value at End-of Advance [4]	35	N45:31	*	N45:91	*
Output #4 Set-Output Value at End-of Advance [4]	36	N45:32	*	N45:92	*
Pressure Minimum Control Limit [3]	41	N45:37	0	N45:97	0
Pressure Maximum Control Limit [3]	42	N45:38	System Pressure	N45:98	System Pressure
Selected Pressure Valve Output for Minimum [4]	43	N45:39	*	N45:99	*
Selected Pressure Valve Output for Maximum [4]	44	N45:40	*	N45:100	*
Velocity Minimum Control Limit [2]	45	N45:41	0	N45:101	0
Velocity Maximum Control Limit [2]	46	N45:42	Max Velocity per OEM specs*	N45:102	Max Velocity per OEM specs*
Selected Velocity Valve Output for Minimum [4]	47	N45:43	*	N45:103	*
Selected Velocity Valve Output for Maximum [4]	48	N45:44	*	N45:104	*
Proportional Gain for Pressure Control None	49	N45:45	100	N45:105	100
Integral Gain for Pressure Control [6]	50	N45:46	400	N45:106	400
Derivative Gain for Pressure Control [1, 7]	51	N45:47	0	N45:107	0
Proportional Gain for Velocity Control [6]	52	N45:48	200	N45:108	200
Feed Forward Gain for Velocity Control None	53	N45:49	0	N45:109	0
Profile High Pressure Alarm Setpoint [3]	57	N45:53	0	N/A	N/A

[1] Time
00.00 to 99.99 Seconds

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Seconds

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

*Refer to the appropriate section later in this chapter for information on this parameter

Procedure to Determine and Record Initial Values

Follow this procedure to complete each worksheet:

1. Decide which profiles you will and will not use.
2. Read the text for the subject parameter.
3. Determine your initial value for that parameter.

Important: If you need additional information when determining your initial values, refer to the same configuration blocks in Section 3 of the Plastic Molding Module Reference Manual, publication 1771-6.5.88.

Important: In the text that follows the worksheets, configuration words that require the subject parameter are listed under the title of each subject parameter. The address codes identify the configuration blocks that uses it.

4. Locate each worksheet that requires the subject parameter.
5. Record the value on the corresponding line(s) in the worksheet.

Important: Block identifier codes are already recorded for you.

Determine Bit Selections: Assign Module Outputs for Your Control Valves

Selected Valve for Velocity Control
(FCC02, SCC02, TCC02, INC02, FOC02, SOC02, TOC02, OSC02, EAC02, ERC02)

The QDC module can control ram (screw), clamp, and ejector movement using a velocity vs. position algorithm. Since you can connect up to four valves to your QDC module, you must tell it which valve to use for velocity (flow) control.

B02	B01	B00	Selects:
0	0	0	Output #1 Used for Velocity Control
0	0	1	Output #2 Used for Velocity Control
0	1	0	Output #3 Used for Velocity Control
0	1	1	Output #4 Used for Velocity Control

Record the appropriate bit selections for your valve configurations in the control word of applicable worksheets.

Selected Valve for Pressure Control

(FCC02, SCC02, TCC02, LPC02, INC02, PKC02, HDC02, PLC02, FOC02, SOC02, TOC02, OSC02, EAC02, ERC02)

Important: We define system pressure for the Inject, Clamp, and Eject mode as the pressure continuously detected by the single pressure sensor connected to the QDC module at input 2. Depending on machine hydraulics, a single pressure valve may control inject, clamp, and/or eject mode profiles.

ATTENTION: Your control system may not work as expected with possibly machine damage if you attempt to control a pressure profile of a phase (inject, clamp, or eject) not hydraulically plumbed for pressure control.

Because system pressure may change between the inject, clamp, and eject phases, we recommend that you:

- assign pressure control to phases that *require* pressure profiles (and are hydraulically plumbed to support it)
- place the system pressure sensor accordingly in the hydraulic circuit
- configure the remaining phases with velocity profiles

The QDC module can control ram (screw), clamp, and ejector movement using pressure vs. position (or time) algorithms. For the plastication algorithm, the pressure component is backpressure. You must inform the QDC module which valve to use for controlling pressure with these algorithms.

B06	B05	B04	Selects:
0	0	0	Output #1 Used for Pressure Control
0	0	1	Output #2 Used for Pressure Control
0	1	0	Output #3 Used for Pressure Control
0	1	1	Output #4 Used for Pressure Control

Record the appropriate bit selections for your valve configurations in the control word of applicable worksheets.

Select the Type of PID Algorithm

Type of PID Pressure Algorithm
(FCC02, SCC02, TCC02, LPC02, INC02, PKC02, HDC02, PLC02, FOC02, SOC02, TOC02, OSC02, EAC02, ERC02)

When executing pressure versus position or time profiles, the QDC module can use one of two types of PID algorithms: dependent gains (ISA) or independent gains (Allen-Bradley).

If B07 = :	Then it uses:
0	Dependent Gains (ISA)
1	Independent Gains (A-B)

Dependent gains (ISA):
Output = $Kc[(E) + 1/Ti \int_{o}^{t} (E)dt + Td*d(E)/dt]$

Independent gains (AB):
Output = $Kp(E) + Ki \int_{o}^{t} (E)dt + Kd*d(E)/dt$

Comparison of Gain Constants

Compare dependent and independent gains constants as follows:

Dependent Gains Constants:	Independent Gains Constants:
Controller Gain K_c (dimensionless)	Proportional Gain K_p (dimensionless)
Reset Term $1/T_i$ (minutes per repeat)	Integral Gain K_i (inverse seconds)
Rate Term T_d (minutes)	Derivative Term K_d (seconds)

Other variables used in any algorithm choice include:

Output = Percentage of full scale
E = Error (scaled) SP-PV (Setpoint-Process Variable)
PV = Process Variable (scaled)

Convert from dependent to independent gains constants by substituting controller gain (K_c), reset ($1/T_i$), and rate (T_d) values in these formulas:

$$K_p = K_c \text{ unitless}$$

$$K_i = \frac{K_c}{60\ T_i} \text{ inverse seconds}$$

$$K_d = K_c(T_d)60 \text{ seconds}$$

We recorded bit B07 = 1 for A-B independent gains on all corresponding worksheets.

Important: PID gain constants that we entered on worksheets and used in closed-loop tuning procedures in chapter 10 were independent (A-B) gains. If, after attempting to tune your pressure loops in chapter 10, you must use dependent (ISA) gain constants, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88) for more information.

Determine Word Values: Select Values for Expert Response Compensation (ERC)

Expert Response Compensation Minimum Percentages

(FCC05-06, SCC05-06, TCC05-06, LPC06, INC05-06, PKC06, HDC06, PLC06, FOC05-06, SOC05-06, TOC05-06, OSC05-06, EAC05-06, ERC05-06)

The QDC module uses a proprietary control scheme called Expert Response Compensation. It accounts for changes in your machine, machine hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long term deviations to your process.

We already recorded initial values of 10% (1000) on all worksheets.

We help you select final values required by your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine Unselected Valve Set-output Values

Unselected Valve Set-output Values

(FCC09-12, SCC09-12, TCC09-12, LPC09-12, INC09-12, PKC09-12, HDC09-12, PLC09-12, FOC09-12, SOC09-12, TOC09-12, OSC09-12, EAC09-12, ERC09-12)

Earlier in this chapter, you told the QDC module which of its four outputs was being used to control pressure and flow profiles. Your machine hydraulics probably require that the remaining unselected valves connected to your QDC module assume a set-output condition during the profile.

Words 09 through 12 define set-output values for your unselected valves. The QDC module sets its four outputs to the values in these words each time it starts the appropriate profile with this exception:

Important: The QDC module ignores the set-output value associated with the selected valve, and drives that output independently.

To assist you when determining unselected valve set-output values, refer to Table 7.A. We present this table for reference, only. Your application will dictate your setpoints.

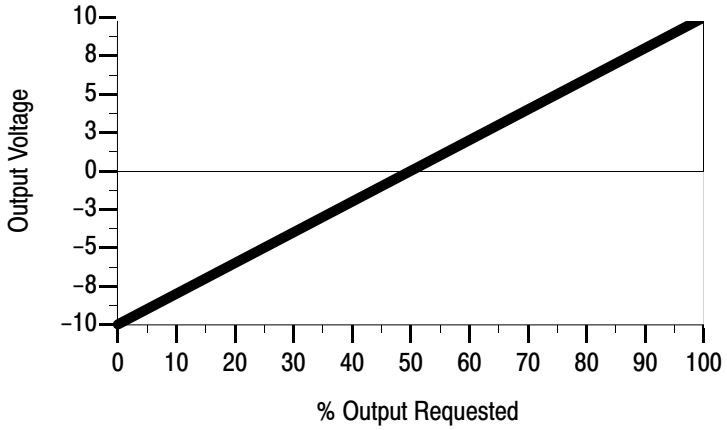
Table 7.A
Set-output Values for Unselected Valves

If the unselected valve controls:	and the unselected valve type is:	and during profile, valve action is:	and during profile, you require:	Then Enter:
Pressure	Uni-directional	Direct acting	Maximum Pressure	9999
Pressure	Uni-directional	Direct acting	Medium Pressure	7500 to 5000
Pressure	Uni-directional	Direct acting	Low Pressure	5000 to 2500
Pressure	Uni-directional	Direct acting	Minimum Pressure	0
Pressure	Uni-directional	Reverse acting	Maximum Pressure	0
Pressure	Uni-directional	Reverse acting	Medium Pressure	2500 to 5000
Pressure	Uni-directional	Reverse acting	Low Pressure	5000 to 7500
Pressure	Uni-directional	Reverse acting	Minimum Pressure	9999
Flow	Uni-directional	Direct acting	Maximum Flow	9999
Flow	Uni-directional	Direct acting	Medium Flow	7500 to 5000
Flow	Uni-directional	Direct acting	Low Flow	5000 to 2500
Flow	Uni-directional	Direct acting	Minimum Flow	0
Flow	Uni-directional	Reverse acting	Maximum Flow	0
Flow	Uni-directional	Reverse acting	Medium Flow	2500 to 5000
Flow	Uni-directional	Reverse acting	Low Flow	5000 to 7500
Flow	Uni-directional	Reverse acting	Minimum Flow	9999
Flow	Bi-directional	Direct acting	Maximum Flow	9999
Flow	Bi-directional	Direct acting	Medium Flow	8750 to 7500
Flow	Bi-directional	Direct acting	Low Flow	7500 to 6250
Flow	Bi-directional	Direct acting	Minimum Flow	5000
Flow	Bi-directional	Reverse acting	Maximum Flow	0
Flow	Bi-directional	Reverse acting	Medium Flow	1250 to 2500
Flow	Bi-directional	Reverse acting	Low Flow	2500 to 3750
Flow	Bi-directional	Reverse acting	Minimum Flow	5000

Record all set-output values for unselected valves on your worksheets.

Important: Valve spanning procedures in chapter 9 require unselected valves be driven at signal levels representative of a normal production run. We discuss process considerations that impend changing these values in chapter 10. Changing these values may require you to re-span your valves.

ATTENTION: A value of zero entered in your set-output words does not necessarily correspond to zero pressure or flow. If you configured for bi-directional valve operation (–10 to +10V dc), a set-output value of 50% gives zero volts signal output (see graph) while a set-output value of 0% or 100% gives maximum signal output. Amplifier electronics or spool-null offsets may also allow pressure or flow at zero signal input. Consult your valve and amplifier specifications for more details.



For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Set Your Acceleration/Deceleration Ramp Rates

You may need ramp rates for smooth actuator motion. The QDC module gives you multi-stepped profiles to reduce the need for ramp rates, so we recommend starting with zero ramp rates. If you observe rough, jerky motion during profile tuning in chapter 10, enter other values at that time.

ATTENTION: Using ramp rates may degrade closed-loop control, ERC calculations, and QDC control capability. Use ramp rates only if machine operation mandates them.

Acceleration Ramp Rates

(FCC17-20, SCC17-20, TCC17-20, LPC17-20, INC17-20, PKC17-20, HDC17-20, PLC17-20, FOC17-20, SOC17-20, TOC17-20, OSC17-20, EAC17-20, ERC17-20)

The QDC module uses acceleration ramp rates when moving its outputs to a higher setpoint during execution of a profile. They affect both selected and unselected valves. A ramp rate of zero disables ramping, and the QDC module steps directly from setpoint to setpoint.

We recorded zero on corresponding worksheets.

Deceleration Ramp Rates

(FCC25-28, SCC25-28, TCC25-28, LPC25-28, INC25-28, PKC25-28, HDC25-28, PLC25-28, FOC25-28, SOC25-28, TOC25-28, OSC25-28, EAC25-28, ERC25-28)

The QDC module uses deceleration ramp rates when moving its outputs to a lower setpoint during execution of a profile. They affect selected and unselected valves alike. A ramp rate of zero disables ramping, and the QDC module steps directly from setpoint to setpoint.

We recorded zero on corresponding worksheets.

Important: The valve spanning procedures in chapter 9 require **zero** acceleration and deceleration ramp rates. We help you select the correct final values required by your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine Set-output Values for End of Profiles

End-of-Profile Set-output Values

(FCC33-36, SCC33-36, TCC33-36, LPC33-36, HDC33-36, PLC33-36, FOC33-36, SOC33-36, TOC33-36, OSC33-36, EAC33-36, ERC33-36)

The QDC module sets its outputs to these values every time it completes the appropriate profile when commanded NOT to “bridge” to the next profile or movement. Set-outputs remain in effect until the QDC module is commanded to start the next programmed profile (or movement) or is stopped using stop command DYC02-B15.

Record values that correspond to zero pressure or zero flow on worksheets. For assistance in determining your set-output values, refer to Table 7-A.

Important: Valve spanning procedures in chapter 9 require **no** flow or pressure after profile execution. We help you select the correct final values required by your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Set Pressure Control Limits

Control limits let you span your selected valve outputs for effective control with either direct-acting or reverse-acting valves. Your machine manufacturer typically provides you with values to configure these limits.

Important: We refer to system pressure during profile or axis movement as:

- inject pressure
- clamp pressure
- ejector pressure

All three are the pressure measured at input 2 of the QDC module.

Minimum Pressure Control Limit
(FCC41, SCC41, TCC41, LPC41, INC41, PKC41, HDC41, PLC41, FOC41, SOC41, TOC41, OSC41, EAC41, ERC41)

The value in this word corresponds to the minimum controllable pressure during the respective profile. The QDC module uses this word with the Selected Pressure Valve, Output for Minimum (word 43) below. The QDC module expects this pressure when setting the selected pressure valve to the percentage output you enter in word 43.

We recorded zero on corresponding worksheets.

Maximum Pressure Control Limit
(FCC42, SCC42, TCC42, LPC42, INC42, PKC42, HDC42, PLC42, FOC42, SOC42, TOC42, OSC42, EAC42, ERC42)

The value in this word corresponds to the maximum controllable pressure during the respective profile. The QDC module uses this word with the Selected Pressure Valve, Output for Maximum (word 44) below. The QDC module expects this pressure when setting the selected pressure valve to the percentage output you enter in word 44.

Record an initial control limit equal to the maximum pressure available through the selected pressure valve during the profile.

Selected Pressure Valve, Output for Minimum
(FCC43, SCC43, TCC43, LPC43, INC43, PKC43, HDC43, PLC43, FOC43, SOC43, TOC43, OSC43, EAC43, ERC43)

The QDC module uses this word with the Minimum Pressure Control Limit (word 41) above. Enter the %-signal output that the QDC module uses to drive the selected pressure valve for minimum profile pressure. The QDC module expects a pressure equal to word 41 when setting the selected pressure valve to this percentage output.

Determine Output for Minimum values as follows:

- 0 (0%) for uni-directional direct acting valves
- 5000 (50%) for bi-directional valves
- 9999 (100%) for uni-directional reverse acting valves

If your selected pressure valve is:	Then the value in word 43 should be:	And during the profile, the QDC module does NOT drive the valve with a % output:
Direct Acting	less than the value in word 44	less than the value in word 43
Reverse Acting	greater than the value in word 44	greater than the value in word 43

Record initial Output for Minimum values on corresponding worksheets.

Selected Pressure Valve, Output for Maximum

(FCC44, SCC44, TCC44, LPC44, INC44, PKC44, HDC44, PLC44, FOC44, SOC44, TOC44, OSC44, EAC44, ERC44)

The QDC module uses this word with the Maximum Pressure Control Limit (word 42) above. Enter the %-signal output that the QDC module uses to drive the selected pressure valve for maximum profile pressure. The QDC expects a pressure equal to word 42 when setting the selected pressure valve to this percentage output.

Determine Output for Maximum values as follows:

- 9999 (100%) for uni-directional direct acting valves
- 0 (0%) or 9999 (100%) for bi-directional valves depending on direction
- 0 (0%) for uni-directional reverse acting valves

If your selected pressure valve is:	Then the value in word 44 should be:	And during the profile, the QDC module does NOT drive the valve with a % output:
Direct Acting	greater than the value in word 43	greater than the value in word 44
Reverse Acting	less than the value in word 43	less than the value in word 44

Record initial Output for Maximum values on corresponding worksheets.

Set Velocity Control Limits

Minimum Velocity Control Limit
(FCC45, SCC45, TCC45, INC45, FOC45, SOC45, TOC45, OSC45, EAC45, ERC45)

The value in this word corresponds to the minimum controllable velocity during the respective profile. The QDC module uses this word with the Selected Velocity Valve, Output for Minimum (word 47) below. The QDC module expects this velocity when setting the selected velocity valve to the percentage output you enter in word 47.

We recorded zero on corresponding worksheets.

Maximum Velocity Control Limit
(FCC46, SCC46, TCC46, INC46, FOC46, SOC46, TOC46, OSC46, EAC46, ERC46)

The value in this word corresponds to the maximum controllable velocity during the respective profile. The QDC module uses this word with the Selected Velocity Valve, Output for Maximum (word 48) below. The QDC module expects this velocity when setting the selected velocity valve to the percentage output you enter in word 48.

Record the maximum ram (screw), clamp, and/or ejector speed per your OEM specifications on corresponding worksheets.

Selected Velocity Valve, Output for Minimum
(FCC47, SCC47, TCC47, INC47, FOC47, SOC47, TOC47, OSC47, EAC47, ERC47)

The QDC module uses this word with the Minimum Velocity Control Limit (word 45) above. Enter the %-signal output that the QDC module uses to drive the selected velocity valve for minimum profile velocity. The QDC expects a velocity equal to word 45 when setting the selected velocity valve to this percentage output.

The QDC module uses this setpoint to drive the selected velocity valve to attain zero ram (screw), clamp, or ejector velocity. It should drive the selected velocity valve to a spool position that prohibits hydraulic flow.

Determine Output for Minimum values as follows:

- 0 (0%) for uni-directional direct acting valves
- 5000 (50%) for bi-directional valves
- 9999 (100%) for uni-directional reverse acting valves

If your selected velocity valve is:	Then the value in word 47 should be:	And during the profile or stroke, the QDC module does NOT drive the valve with a % output:
Direct Acting	less than the value in word 48	less than word 47
Reverse Acting	greater than the value in word 48	greater than word 47

Record initial Output for Minimum values on corresponding worksheets.

Selected Velocity Valve, Output for Maximum
(FCC48, SCC48, TCC48, INC48, FOC48, SOC48, TOC48, OSC48, EAC48, ERC48)

The QDC module uses this word with the Maximum Velocity Control Limit (word 46) above. Enter the %-signal output that the QDC module uses to drive the selected velocity valve for maximum profile velocity. The QDC module expects a velocity equal to word 46 above when setting the selected velocity valve to this percentage output.

The QDC module uses this setpoint to drive the selected velocity valve when attempting to attain maximum ram (screw), clamp, or ejector velocity. It should drive the selected velocity valve to a spool position that provides full hydraulic flow.

Determine Output for Maximum values as follows:

- 9999 (100%) for uni-directional direct acting valves
- 0 (0%) or 9999 (100%) for bi-directional valves depending on direction
- 0 (0%) for uni-directional reverse acting valves

If your selected velocity valve is:	Then the value in word 48 should be:	And during the profile, the QDC module does NOT drive the valve with a % output:
Direct Acting	greater than the value in word 47	greater than word 48
Reverse Acting	less than the value in word 47	less than word 48

Record initial Output for Maximum values on corresponding worksheets.

Important: Valve spanning procedures in chapter 9 require these initial velocity control limits. For additional information, refer to section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Set Profile Gain Constants, Pressure-Alarm Setpoints, and Watchdog Timer Presets

Profile Gain Constants
(FCC49-53, SCC49-53, TCC49-53, LPC49-51, INC49-53, PKC49-51, HDC49-51, PLC49-51, FOC49-53, SOC49-53, TOC49-53, OSC49-53, EAC49-53, ERC49-53)

The QDC module's PID and velocity feedforward (VelFF) algorithms are different from classic PID and VelFF algorithms. QDC module algorithms are sensitive to changes in load (not changes in setpoint) because the QDC module must respond to a system that is undergoing constant load changes when hydraulic fluid is introduced into or relieved from the hydraulic circuit. The algorithm gain constants are typically lower than those used to control a process that reacts to setpoints changes.

We recorded all profile gain constants on corresponding worksheets.

Profile Pressure-Alarm Setpoints

(FCC57, SCC57, TCC57, LPC57, INC57, PKC57, HDC57, PLC57, FOC57, SOC57, TOC57, OSC57, EAC57)

The QDC module compares real-time clamp pressure against these entries when executing the appropriate profile. The QDC module sets a corresponding alarm bit any time pressure equals or exceeds these entries during the respective profile. A zero entry inhibits each respective alarm.

We recorded zero for each alarm setpoint on corresponding worksheets.

Watchdog Timer Presets

(FCC08, SCC08, TCC08, LPC07-08, PLC08, FOC08, SOC08, TOC08, OSC08, EAC08)

Use the watchdog timer to signal an alarm if the associated profile takes longer than expected. To inhibit each timer, enter a preset of zero.

When the QDC module starts a profile, it:

- starts the associated internal timer
- stops the timer, reports execution time, and resets the accumulated value to zero when it completes the profile
- sets an alarm bit if the accumulated value exceeds this preset

We recorded zero on corresponding worksheets to inhibit all watchdog timers.

The closed-loop tuning procedures in chapter 10 require these initial values. In that chapter, we help you select the correct final values required by your application. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Enter and Download your Worksheet Values

After you determine your initial values and record them on configuration worksheets, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheets.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. For your convenience, we repeat the table of download information (Table 7.B) from chapter 4.

Important: Do NOT download companion blocks at this time.

Table 7.B
Information Required to Download a Block

Block to Download:	Pro-Set 600 Block ID.:	Pro-Set 600 Download Command Bit *in B21:*
FCC	03	2
SCC	04	3
TCC	05	4
LPC	06	5
INC	08	7
PKC	10	9
HDC	11	10
PLC	14	13
FOC	17	16
SOC	18	17
TOC	19	18
OSC	20	19
EAC	22	21
ERC	23	22

Chapter 8

Load Initial Profile Setpoints

Chapter Objectives

In this chapter you load the QDC module with profile setpoints by performing four tasks:

- Determine initial profile setpoints from text
- Record them on worksheets
- Enter them into PLC-5 data table
- Download profile blocks to the QDC module

Initial profile setpoints that you load include:

- control bits
- velocity setpoints
- pressure setpoints
- position setpoints
- timer presets

Important Complete all previous chapters before starting this chapter.

Use These Worksheets

The following table lists profile blocks and corresponding worksheets for recording initial profile setpoints that you download to the QDC module.

To configure the QDC module with this profile block	See this Worksheet	On Page
Clamp Close Profile Block (CPC)	Worksheet 8-A	8-3
Injection Profile Command Block (IPC)	Worksheet 8-B	8-11
Pack/Hold Profile Command Block (HPC)	Worksheet 8-C	8-19
Plastication Profile Command Block (PPC)	Worksheet 8-D	8-25
Clamp Open Profile Block (OPC)	Worksheet 8-E	8-32
Ejector Profile Command Block (EPC)	Worksheet 8-F	8-39

Take a moment to browse through a worksheet. It contains two parts:

- control words for selecting parameters by setting bits
- data words for recording initial profile setpoints

We present each worksheet followed by text telling you how to determine initial setpoints. Complete one worksheet before going to the next. If you need additional word/bit descriptions, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine and Record Setpoints for the Clamp Close Profile (CPC)

The following two pages contain Worksheet 8-A for the clamp close profile (one page for bit entries and one for word entries). The valve spanning procedures in chapter 9 require specific values. We have already recorded many setpoints for you on the worksheet. You must determine the remaining setpoints based on your specific machine.

Important: You record setpoints for pressure vs. position and velocity vs. position profiles on Worksheet 8-A. We assist you in determining values.

Worksheet 8-A
Clamp Close Profile Block (CPC)

Control Word CPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/ bit	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1

CPC Block Identifier

Control Word CPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288
Value	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1

Velocity Units
0 = Percent Velocity
1 = Inches (mm)/Second

Mold Protection Zone
0 = Start LPC when clamp reaches CPC61
1 = Stop and zero outputs when clamp reaches CPC61

TCC SCC FCC

Logical Bridge
0 = Start next profile at end of profile
1 = Stop and set output at end of profile

TCC SCC FCC

Algorithm
0 = Vel/Pos
1 = Press/Pos

Control Word CPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304
Value	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

ERC
0 = ON
1 = OFF

bit 15 = Press/Pos LPC
bit 13 = Press/Pos TCC
bit 12 = Vel/Pos TCC
bit 11 = Press/Pos SCC
bit 10 = Vel/Pos SCC
bit 09 = Press/Pos FCC
bit 08 = Vel/Pos FCC

Open/Closed-Loop
0 = Closed-Loop
1 = Open-Loop

bit 07 = Press/Pos LPC
bit 05 = Press/Pos TCC
bit 04 = Vel/Pos TCC
bit 03 = Press/Pos SCC
bit 02 = Vel/Pos SCC
bit 01 = Press/Pos FCC
bit 00 = Vel/Pos FCC

Worksheet 8-A (continued)
Clamp Close Profile Block (CPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
CPC09	N43:245	*	FCC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC10	N43:246	*	FCC Segment 1 Pressure Setpoint	Pressure [3]
CPC11	N43:247	*	FCC End-of Segment 1 Position Setpoint	Incremental Distance [4]
CPC12	N43:248	*	FCC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC13	N43:249	*	FCC Segment 2 Pressure Setpoint	Pressure [3]
CPC14	N43:250	*	FCC End-of Segment 2 Position Setpoint	Incremental Distance [4]
CPC15	N43:251	*	FCC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC16	N43:252	*	FCC Segment 3 Pressure Setpoint	Pressure [3]
CPC17	N43:253	*	FCC End-of Segment 3 Position Setpoint	Incremental Distance [4]
CPC18	N43:254	0	SCC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC19	N43:255	0	SCC Segment 1 Pressure Setpoint	Pressure [3]
CPC20	N43:256	0	SCC End-of Segment 1 Position Setpoint	Incremental Distance [4]
CPC21	N43:257	0	SCC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC22	N43:258	0	SCC Segment 2 Pressure Setpoint	Pressure [3]
CPC23	N43:259	0	SCC End-of Segment 2 Position Setpoint	Incremental Distance [4]
CPC24	N43:260	0	SCC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC25	N43:261	0	SCC Segment 3 Pressure Setpoint	Pressure [3]
CPC26	N43:262	0	SCC End-of Segment 3 Position Setpoint	Incremental Distance [4]
CPC27	N43:263	0	TCC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC28	N43:264	0	TCC Segment 1 Pressure Setpoint	Pressure [3]
CPC29	N43:265	0	TCC End-of Segment 1 Position Setpoint	Incremental Distance [4]
CPC30	N43:266	0	TCC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC31	N43:267	0	TCC Segment 2 Pressure Setpoint	Pressure [3]
CPC32	N43:268	0	TCC End-of Segment 2 Position Setpoint	Incremental Distance [4]
CPC33	N43:269	0	TCC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC34	N43:270	0	TCC Segment 3 Pressure Setpoint	Pressure [3]
CPC35	N43:271	0	TCC End-of Segment 3 Position Setpoint	Incremental Distance [4]
CPC37	N43:273	*	LPC Segment 1 Pressure Setpoint	Pressure [3]
CPC38	N43:274	0	LPC End-of-Segment 1 Position Setpoint	Incremental Distance [4]
CPC40	N43:276	0	LPC Segment 2 Pressure Setpoint	Pressure [3]
CPC61	N43:297	*	Start LPC Position Setpoint	Incremental Distance [4]
CPC62	N43:298	*	Mold Safe Position Setpoint	Incremental Distance [4]
CPC63	N43:299	0	Tonnage Complete Pressure Setpoint	Pressure [3]

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Second

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Axis Measured from MCC27 (if non-zero) or MCC23
00.00 to 99.99 Inches
00.00 to 999.9 Millimeters

* Refer to the appropriate section later in this chapter for information on this parameter

Determine Bit Selections for Worksheet 8-A

Block Identifier (CPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the clamp close profile. Pro-Set 600 sets these bits to 00000111.

We recorded this value on Worksheet 8-A.

Velocity Units (CPC03)

The following bit determines units of measure for velocity values.

- **BIT 14** selects units of measure.

  0 = Percent velocity
  1 = Inches or millimeters per second

  We recorded a value of 1 for units per second on Worksheet 8-A.

Mold Protection (CPC03)

The following bit controls QDC module reaction if it moves the clamp into the mold protection zone while executing the 1st or 2nd or 3rd clamp close profile.

- **BIT 11** determines QDC module response to the protection zone.

  0 = Start executing low pressure close if clamp reaches CPC61
  1 = Stop and zero outputs if clamp reaches CPC61

  We recorded a value of 0 for start executing LPC on Worksheet 8-A.

Logical Bridges (CPC03)

Logical bridges control the action taken by the QDC module when it completes a profile.

- **BIT 10** controls action at end of third clamp close.
- **BIT 09** controls action at end of second clamp close.
- **BIT 08** controls action at end of first clamp close.

  0 = Start next profile when this profile is complete
  1 = Stop and set output when this profile is complete

  We recorded a value of 0 for start next profile on Worksheet 8-A.

Profile Algorithm (CPC03)

The following bits determine the algorithm for each clamp close profile.

- **BIT 04** configures third clamp close profile
- **BIT 02** configures second clamp close profile
- **BIT 00** configures first clamp close profile

0 = Velocity vs. position algorithm
1 = Pressure vs. position algorithm

We recorded a value of 1 for pressure vs. position on Worksheet 8-A.

Important: All other bit selections in CPC03 should be zero.

Expert Response Compensation (CPC04)

- **BITs 15, 13, 12, 11, 10, 09, and 08** determine whether you apply Expert Response Compensation (ERC) to clamp close profiles. ERC is an exclusive algorithm that adjusts for changes in your machine, hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long term deviations.

0 = Expert Response Compensation ON
1 = Expert Response Compensation OFF

We recorded a value of 1 (ERC = Off) on Worksheet 8-A.

Open-loop or Closed-loop Control (CPC04)

- **BITs 07, 05, 04, 03, 02, 01, and 00** determine whether you use open- or closed-loop control of clamp close profiles. In open loop, a valve position moves the cylinder without sensor feedback. In closed loop, sensor feedback controls the valve regulating the pressure or velocity.

0 = Closed loop
1 = Open loop

We recorded a value of 1 for open-loop control on Worksheet 8-A.

Important: All other bit selections in CPC04 should be zero.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select correct final bit settings for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Determine Word Values for Worksheet 8-A

Velocity Setpoints
(CPC09, 12, 15, 18, 21, 24, 27, 30, 33)

Use these words to configure velocity vs. position profiles in units per second. Each setpoint controls the velocity of its corresponding segment.

Select setpoints for first clamp close segments 1-3 that are typical of velocities you would run during normal machine operation.

Record these setpoints into CPC09, 12, and 15 of Worksheet 8-A.
We recorded zero for the remaining velocity setpoints.

Pressure Setpoints
(CPC10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40)

Use these words to configure pressure vs. position profiles in PSI or Bar. Each pressure setpoint controls the pressure of its corresponding segment.

For CPC10, 13,16, and 37, record pressure setpoints typical of machine operation.

We recorded zero for the remaining pressure setpoints in Worksheet 8-A.

The valve spanning procedures in chapter 9 require these initial values. We help you select the correct final values required by your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Mold Safe Position Setpoint
(CPC62)

This setpoint defines the clamp position when the mold halves mate. The QDC module uses it as the end of low pressure close (LPC) setpoint. If the clamp reaches this position during the low pressure close profile, the QDC module immediately terminates the profile and sets its outputs to zero.

To determine CPC62, we recommend you jog your clamp closed until the two mold halves mate and observe the value in SYS27 (N40:179).

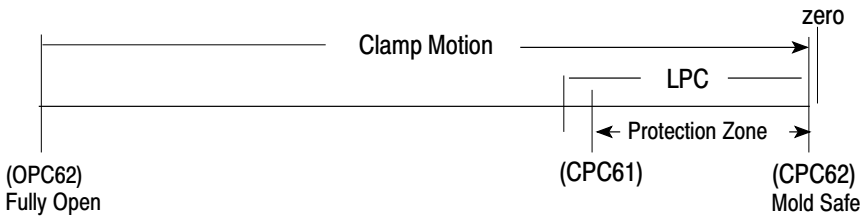
Record this value for CPC62 on Worksheet 8-A.

Start Mold Protection Zone Setpoint
(CPC61)

This QDC module uses this position as protection against running the clamp into the mold. If the clamp reaches this position during any of the first three clamp close profiles, the QDC module immediately terminates the ongoing profile and either:

- begins low pressure close (LPC)
- sets its outputs to zero
  (depending on the state of CPC03-B11, the mold protection bit)

Figure 1.1
Example Setpoints for Mold Safe (CPC62) and Start Protection Zone (CPC61)



We recommend an initial value larger than the start LPC position you would typically use during normal machine operation.

Record a value for CPC61 that is a safe distance from mold safe (CPC62) on Worksheet 8-A.

The valve spanning procedures in chapter 9 require this initial value. We help you select the correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

End-of-segment Position Setpoint
(CPC11, 14, 17, 20, 23, 26, 29, 32, 35, 38)

Configure only the first clamp close profile segments.

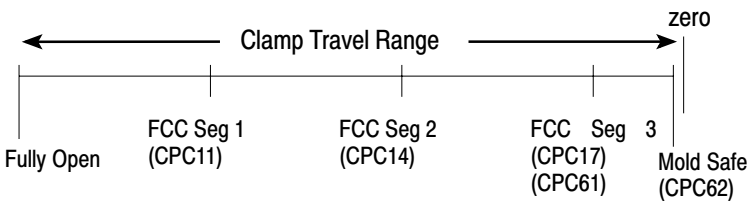
Determine end-of-segment position setpoints for first clamp close as follows:

1. Jog the mold to its full open position and observe the value in SYS27 (N40:179).

2. Subtract the value you recorded for Start LPC Position Setpoint (CPC61) from SYS27.

3. Divide this difference into three equal sections. The dividing line of each section should be recorded for the end-of-segment position setpoints for segments 1, 2, and 3.

Important: Measure end-of-segment positions from zero (mold safe).



4. Record your FCC end-of-segment position setpoints for CPC11, 14, and 17 on Worksheet 8-A.

We recorded zero for the remaining position setpoints on Worksheet 8-A.

The valve spanning procedures in chapter 9 require these initial values. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Tonnage-complete Pressure Setpoint (CPC63)

The QDC module compares clamp pressure with this value, and sets status bit SYS03-B02 when clamp pressure equals or exceeds this value.

We recorded zero for the tonnage watchdog timer preset.

The valve spanning procedures in chapter 9 require this initial value. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Enter and Download Your Worksheet Values

After you determine initial values and record them on Worksheet 8-A, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheet.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. We repeat the CPC block download data.

Block to Download:	Pro-Set 600 Block ID:	Download Command Bit:	Companion Block:
CPC	07	B21/6	none

3. Check SYS61 and SYS62 for programming error. Correct as needed.

Determine and Record Setpoints for the Injection Profile (IPC)

The following two pages contain Worksheet 8-B for the injection profile (one page for bit entries and one for word entries). The valve spanning procedures in chapter 9 require specific values. We have already recorded many values for you on the worksheet. You must determine the remaining setpoints based on your specific machine.

Important: You record setpoints for a pressure vs. time and a velocity vs. position profile on Worksheet 8-B. We assist you in determining them.

Worksheet 8-B
Injection Profile Block (IPC)

Control Word IPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

IPC Block Identifier

Control Word IPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
Value	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Velocity Units
0 = Parameters in "Percent Velocity"
1 = Parameters in Inches (mm)/Sec

Sign of Pressure Offset
0 = Positive
1 = Negative

Sign of Velocity Offset
0 = Positive
1 = Negative

Algorithm Selection
00 = Vel/Pos
01 = Vel/Pos (pressure limited)
10 = Press/Pos
11 = Press/Time

Control Word IPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
Value	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

0 = ERC On for Press/Time
1 = ERC Off

0 = ERC On for Press/Pos
1 = ERC Off

0 = ERC On for Vel/Pos (limited)
1 = ERC Off

0 = ERC On for Vel/Pos
1 = ERC Off

0 = Press/Time Closed Loop
1 = Open Loop

0 = Press/Pos Closed Loop
1 = Open Loop

0 = Vel/Pos (limited) Closed Loop
1 = Open Loop

0 = Vel/Pos Closed Loop
1 = Open Loop

0 Value not used

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
IPC09	N44:65	*	Segment 1 Velocity Setpoint	Velocity [4]
IPC10	N44:66	*	Segment 1 Pressure Setpoint	Pressure [3]
IPC11	N44:67	*	End-of Segment 1 Position Setpoint	Distance from Mold-end [2]
IPC12	N44:68	100	Segment 1 Time Setpoint	Time [1]
IPC13	N44:69	*	Segment 2 Velocity Setpoint	Velocity [4]
IPC14	N44:70	*	Segment 2 Pressure Setpoint	Pressure [3]

IPC15	N44:71	*	End-of Segment 2 Position Setpoint	Distance from Mold-end [2]
IPC16	N44:72	100	Segment 2 Time Setpoint	Time [1]
IPC17	N44:73	*	Segment 3 Velocity Setpoint	Velocity [4]
IPC18	N44:74	*	Segment 3 Pressure Setpoint	Pressure [3]
IPC19	N44:75	*	End-of Segment 3 Position Setpoint	Distance from Mold-end [2]
IPC20	N44:76	100	Segment 3 Time Setpoint	Time [1]
IPC21	N44:77	*	Segment 4 Velocity Setpoint	Velocity [4]
IPC22	N44:78	*	Segment 4 Pressure Setpoint	Pressure [3]
IPC23	N44:79	*	End-of Segment 4 Position Setpoint	Distance from Mold-end [2]
IPC24	N44:80	100	Segment 4 Time Setpoint	Time [1]
IPC25	N44:81	*	Segment 5 Velocity Setpoint	Velocity [4]
IPC26	N44:82	*	Segment 5 Pressure Setpoint	Pressure [3]
IPC27	N44:83	*	End-of Segment 5 Position Setpoint	Distance from Mold-end [2]
IPC28	N44:84	100	Segment 5 Time Setpoint	Time [1]
IPC29	N44:85	*	Segment 6 Velocity Setpoint	Velocity [4]
IPC30	N44:86	*	Segment 6 Pressure Setpoint	Pressure [3]
IPC31	N44:87	*	End-of Segment 6 Position Setpoint	Distance from Mold-end [2]
IPC32	N44:88	100	Segment 6 Time Setpoint	Time [1]
IPC33	N44:89	*	Segment 7 Velocity Setpoint	Velocity [4]
IPC34	N44:90	*	Segment 7 Pressure Setpoint	Pressure [3]
IPC35	N44:91	*	End-of Segment 7 Position Setpoint	Distance from Mold-end [2]
IPC36	N44:92	100	Segment 7 Time Setpoint	Time [1]
IPC37	N44:93	*	Segment 8 Velocity Setpoint	Velocity [4]
IPC38	N44:94	*	Segment 8 Pressure Setpoint	Pressure [3]
IPC39	N44:95	*	End-of Segment 8 Position Setpoint	Distance from Mold-end [2]
IPC40	N44:96	100	Segment 8 Time Setpoint	Time [1]
IPC41	N44:97	*	Segment 9 Velocity Setpoint	Velocity [4]
IPC42	N44:98	*	Segment 9 Pressure Setpoint	Pressure [3]
IPC43	N44:99	*	End-of Segment 9 Position Setpoint	Distance from Mold-end [2]
IPC44	N44:100	100	Segment 9 Time Setpoint	Time [1]
IPC45	N44:101	*	Segment 10 Velocity Setpoint	Velocity [4]
IPC46	N44:102	*	Segment 10 Pressure Setpoint	Pressure [3]
IPC47	N44:103	*	End-of Segment 10 Position Setpoint	Distance from Mold-end [2]
IPC48	N44:104	100	Segment 10 Time Setpoint	Time [1]
IPC49	N44:105	*	Segment 11 Velocity Setpoint	Velocity [4]
IPC50	N44:106	*	Segment 11 Pressure Setpoint	Pressure [3]
IPC51	N44:107	0	Profile Velocity Offset	Velocity [4]
IPC52	N44:108	0	Profile Pressure Offset	Pressure [3]
IPC57	N44:113	0	Ram Pressure Limit for Pressure-limit Velocity Control	Pressure [3]
IPC58	N44:114	0	Start of Zone for Pressure-limit Velocity Control	Distance from Mold-end [2]
IPC59	N44:115	0	Time Delay for Pressure-limit Velocity Control	Time [6]
IPC60	N44:116	1000	Time Limit for Transition	Time[1]
IPC61	N44:117	0	Ram (screw) Position for Transition	Distance from Mold-end [2]
IPC62	N44:118	0	Ram (screw) Pressure for Transition	Pressure [3]
IPC64	N44:120	0	Start of Zone for Pressure Transition	Distance from Mold-end [2]

[1] Time
00.00 to 99.99 seconds

[2] Distance from MCC13 (if not zero) or MCC09
00.00 to 99.99 inches
000.0 to 999.9 millimeters

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Velocity
00.00 to 99.99 in/sec
000.0 to 999.9 mm/sec

[6] Time
00.00 to 00.99 seconds

* Refer to the appropriate section later in this chapter for information on this parameter

Determine Bit Selections for Worksheet 8-B

Block Identifier (IPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the injection profile. Pro-Set 600 sets these bits to 00001001.

We recorded this value on Worksheet 8-B.

Velocity Units (IPC03)

The following bit determines units of measure for velocity values.

- **BIT 14** selects units of measure.
  0 = Percent velocity
  1 = Inches or millimeters per second

  We recorded a value of 1 for units per second on Worksheet 8-B.

Profile Offset Sign (IPC03)

Profile offsets let you shift the amplitude of entire profiles up or down, if necessary. The offset sign determines the direction of shift.

- **BIT 13** controls the direction of pressure profile offset.
  0 = Pressure offset is positive (more pressure)
  1 = Pressure offset is negative (less pressure)

  We set this bit to 0 for positive offset on Worksheet 8-B.

- **BIT 12** controls the direction of velocity profile offset.
  0 = Velocity offset is positive (more velocity)
  1 = Velocity offset is negative (less velocity)

  We recorded a value of 0 for positive offset on Worksheet 8-B.

Profile Algorithm (IPC03)

The following bits determine the type of injection profile.

- **BITS 01 and 00** select the algorithm for the injection profile.
  00 = Velocity vs. Position
  01 = Velocity vs. Position (pressure-limited)
  10 = Pressure vs. Position
  11 = Pressure vs. Time

  We recorded a value of 11 for pressure vs. time on Worksheet 8-B.

Important: All other bit selections in IPC03 should be zero.

Expert Response Compensation (IPC04)

- **BITS 11, 10, 09, and 08** determine whether you apply Expert Response Compensation (ERC) to injection profiles. ERC is an exclusive algorithm that adjusts for changes in your machine, hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long term deviations.

  0 = Expert Response Compensation ON
  1 = Expert Response Compensation OFF

  We recorded a value of 1 (ERC = Off) on Worksheet 8-B.

Open-loop or Closed-loop Control (IPC04)

- **BITS 03, 02, 01, and 00** determine whether you use open- or closed-loop control of injection profiles. In open loop, a valve position moves the cylinder without sensor feedback . In closed loop, sensor feedback controls the valve regulating pressure or velocity.

  0 = Closed loop
  1 = Open loop

  We recorded a value of 1 for open-loop control on Worksheet 8-B.

Important: All other bit selections in IPC04 should be zero.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select correct final bit settings for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine Word Values for Worksheet 8B

Velocity Setpoints (IPC09, 13, 17, 21, 25, 29, 33, 37, 41, 45, and 49)

Use these words when configuring velocity vs. position profiles. This velocity is used between the last completed profile segment and the end-of-segment position setpoint. You may use from 1 to 11 segments in your profile. The procedures in chapter 9 require all eleven.

We recommend that you use initial velocity setpoints equal to the maximum velocity your ram (screw) is capable of traveling. Get this value from your OEM specs for your specific machine.

Record this initial value for all 11 velocity setpoints on Worksheet 8-B.

Pressure Setpoints
(IPC10, 14, 18, 22, 26, 30, 34, 38, 42, 46, and 50)

Use these words when configuring pressure vs. position or time profiles in PSI or Bar. Each pressure setpoint controls the pressure of its corresponding segment. You may use from 1 to 11 segments in your profile. The procedures in chapter 9 require all eleven.

Record the initial value of one-half system pressure for all 11 pressure setpoints on Worksheet 8-B.

The valve spanning procedures in chapter 9 require these initial velocity and pressure values. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

End-of-Segment Position Setpoints
(IPC11, 15, 19, 23, 27, 31, 35, 39, 43, and 47)

Use these words to configure velocity or pressure vs. position profiles. The procedures in chapter 9 require that you use all 10 position setpoints.

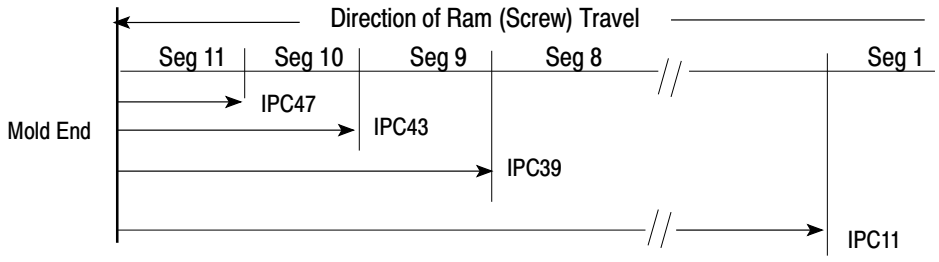
Determine end-of-segment position setpoints for your velocity vs. position injection profile for use in chapter 9 as follows:

1. Back up the ram (screw) from the mold end to its maximum position and read this length in SYS25 (N40:177).

2. Divide this length by 11 to use all segments of this profile. The dividing line for each segment is a multiple of this division.

For example, if the ram travel distance in step 1 was 11”, the 11-segment profile has dividing lines at 1” intervals. That is, end-of-segment positions are 1”, 2”, 3”, ... 9” and 10”.

Important: Measure end-of-segment positions from mold end.



3. Record end-of-segment position setpoints on Worksheet 8-B.

The valve spanning procedures in chapter 9 require these initial values. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Time Setpoints
(IPC12, 16, 20, 24, 28, 32, 36, 40, 44, and 48)

Use these words when configuring pressure vs.time profiles in seconds (1 second as 100). Each setpoint controls the time of its own segment. You must use one less time setpoint than pressure setpoints.

We recorded 1 second (100) for these time setpoints on Worksheet 8-B.

The valve spanning procedures in chapter 9 require these initial values. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Profile Offsets
(IPC51 and 52)

Profile offset let you shift the amplitude of the entire injection profile up or down, if necessary.

- **IPC51** determines the offset for velocity profiles in inches (or mm)/sec.

  We recorded zero (no offset) on Worksheet 8-B.

- **IPC52** determines the offset for pressure profiles in PSI or Bar.

  We recorded zero (no offset) on Worksheet 8-B.

Pressure Limiting Setpoints
(IPC57, 58, and 59)

Use these words in a pressure-limited velocity vs. position profile.

- **IPC57** determines the ram (screw) pressure limit for the pressure-limited velocity vs. position profile in PSI or Bar.
- **IPC58** determines the position at which the QDC module begins pressure-limited control. A non-zero value measured from mold end forces the QDC module NOT to apply pressure-limiting control until the ram (screw) reaches this point. A zero entry forces the QDC module to apply pressure limiting over the entire shot length.
- **IPC59** determines the time delay in a pressure-limited velocity vs. position profile that has exceeded the pressure limit during:
  - over-pressure before QDC module returns to a pressure-limit PID algorithm
  - over-velocity before QDC module returns to its VelFF algorithm

  A non-zero value filters pressure spikes to avoid nuisance pressure limiting during pressure-limited velocity vs. position profiles.

We recorded zero for these three setpoints on Worksheet 8-B.

The valve spanning procedures in chapter 9 require these initial values. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Transition Setpoints
(IPC60, 61, 62, and 64)

Use these words when configuring the type of transition from injection to the pack (or hold) profile. The QDC module starts the transition when it detects the first of the following conditions that you enable with a non-zero setpoint. You may enable one or more of the following:

- **IPC60** determines the transition time limit. The QDC module immediately terminates the injection profile and begins the pack (or hold) profile if total injection-profile execution time equals or exceeds the non-zero entry in this word.

  We recorded 10 seconds (1000) for this setpoint on Worksheet 8-B.

- **IPC61** determines the ram (screw) position for transition. The QDC module immediately terminates the injection profile and begins the pack (or hold) profile if the ram (screw) position is less than or equal to the non-zero entry in this word. Use a position equal to or just beyond top-of-cushion position PPC61 measured from the mold end.

  We recorded zero on Worksheet 8-B to inhibit a position transition.

- **IPC62** determines the ram (screw) pressure for transition. The QDC module immediately terminates the injection profile and begins the pack (or hold) profile if both occur:

  - ram (screw) position is less than or equal to any non-zero entry in INC64, start of zone for pressure transition
  - ram (screw) pressure equals or exceeds the non-zero entry in this word. Typically, you use a setpoint below mold-flash pressure.

    We recorded zero on Worksheet 8-B to inhibit pressure transition.

- **IPC6**4 determines the start of zone in which the QDC module allows pressure transitions. A non-zero value measured from the mold end forces the QDC module NOT to transition on pressure until the ram (screw) reaches this position. A zero setpoint forces the QDC module to use any non-zero pressure setpoint in IPC62 over the entire injection profile.

  We recorded zero on Worksheet 8-B to inhibit this function.

The valve spanning procedures in chapter 9 require these initial values. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Enter and Download your Worksheet Values

After you determine initial values and record them on Worksheet 8-B, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheet.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. We repeat the IPC block download data.

Block to Download	Pro-Set 600 Block ID	Download Command Bit	Companion Block
IPC	09	B21/8	none

3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Determine and Record Setpoints for the Pack/Hold Profile (HPC)

The following two pages contain Worksheet 8-C for the pack/hold profile (one page for bit entries and one for word entries). The valve spanning procedures in chapter 9 require specific values. We have already recorded many values for you on the worksheet. You must determine the remaining setpoints based on your specific machine.

Important: You record setpoints for a pressure vs. time profile on Worksheet 8-C. We assist you in determining these values.

Worksheet 8-C
Pack/Hold Profile Block (HPC)

Control Word HPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0

HPC Block Identifier

Control Word HPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288
Value	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Profile Offset Sign
1=Negative 0=Positive

13=Pack
15=Hold

Hold/Pre-decompression
Logical Bridging
0=Start Movement
1=Stop and set outputs

Pre-decompression/Plastication
Logical Bridging
0=Start Plastication
1=Stop and set outputs

Control Word HPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304
Value	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Enable/Disable ERC
1=Off 0=On

08=Pack
10=Hold

Open/Closed Loop
1=Open 0=Closed

00=Pack
02=Hold

Worksheet 8-C (continued)
Pack/Hold Profile Block (HPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HPC10	N44:246	*	Pack Segment 1 Pressure Setpoint	Pressure [3]
HPC11	N44:247	100	Pack Segment 1 Time Setpoint	Time [1]
HPC13	N44:249	*	Pack Segment 2 Pressure Setpoint	Pressure [3]
HPC14	N44:250	100	Pack Segment 2 Time Setpoint	Time [1]
HPC16	N44:252	*	Pack Segment 3 Pressure Setpoint	Pressure [3]
HPC17	N44:253	100	Pack Segment 3 Time Setpoint	Time [1]
HPC19	N44:255	*	Pack Segment 4 Pressure Setpoint	Pressure [3]
HPC20	N44:256	100	Pack Segment 4 Time Setpoint	Time [1]
HPC22	N44:258	*	Pack Segment 5 Pressure Setpoint	Pressure [3]
HPC23	N44:259	100	Pack Segment 5 Time Setpoint	Time [1]
HPC25	N44:261	0	Pack Profile Pressure Offset	Pressure [3]
HPC27	N44:263	*	Hold Segment 1 Pressure Setpoint	Pressure [3]
HPC28	N44:264	100	Hold Segment 1 Time Setpoint	Time [1]
HPC30	N44:266	*	Hold Segment 2 Pressure Setpoint	Pressure [3]
HPC31	N44:267	100	Hold Segment 2 Time Setpoint	Time [1]
HPC33	N44:269	*	Hold Segment 3 Pressure Setpoint	Pressure [3]
HPC34	N44:270	100	Hold Segment 3 Time Setpoint	Time [1]
HPC36	N44:272	*	Hold Segment 4 Pressure Setpoint	Pressure [3]
HPC37	N44:273	100	Hold Segment 4 Time Setpoint	Time [1]
HPC39	N44:275	*	Hold Segment 5 Pressure Setpoint	Pressure [3]
HPC40	N44:276	100	Hold Segment 5 Time Setpoint	Time [1]
HPC42	N44:278	0	Hold Profile Pressure Offset	Pressure [3]
HPC61	N44:297	0	Cure Timer Preset	Time [4]

[1] Time
00.00 to 99.99 seconds

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Time
000.0 to 999.9 seconds

* Refer to the appropriate section later in this chapter for information on this parameter

Determine Bit Selections for Worksheet 8-C

Block Identifier (HPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the pack/hold profile. Pro-Set 600 sets these bits to 00001100.

We recorded this value on Worksheet 8-C.

Profile Offset Sign (HPC03)

Profile offsets let you shift the amplitude of entire profiles up or down, if necessary. The offset sign determines the direction of shift.

- **BIT 15** selects the profile offset sign for the hold profile.
- **BIT 13** selects the profile offset sign for the pack profile.

We recorded the value of 0 for positive offset on Worksheet 8-C.

Logical Bridges (HPC03)

Logical bridges control the action taken by the QDC module when it completes a profile or movement.

The following bits of HPC03 determine whether the QDC module stops or continues when entering and/or leaving the pre-decompression movement.

- **BIT 09** determines if the QDC continues to the plastication profile after the pre-decompression movement, or stops and sets outputs.
- **BIT 08** determines if the QDC continues to the pre-decompression movement after the hold profile, or stops and sets outputs.

0 = continues to next phase
1 = stops and sets outputs

We recorded a value of 1 to stop and set outputs on Worksheet 8-C.

Important: All other bit selections in HPC03 should be zero.

Expert Response Compensation (HPC04)

- **BITS 10 and 08** determine whether you apply Expert Response Compensation (ERC) to pack and hold profiles. ERC is an exclusive algorithm that adjusts for changes in your machine, hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long term deviations.

0 = Expert Response Compensation ON
1 = Expert Response Compensation OFF

We recorded a value of 1 (ERC = Off) on Worksheet 8-C.

Open-loop or Closed-loop Control (HPC04)

- **BITS 03 and 01** determine whether you use open- or closed-loop control of pack and hold profiles. In open loop, a valve position moves the cylinder without sensor feedback . In closed loop, sensor feedback controls the valve regulating pressure.

  0 = Closed loop
  1 = Open loop

  We recorded a value of 1 for open-loop control on Worksheet 8-C.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select correct final bit settings for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine Word Values for Worksheet 8-C

Time Setpoints
(for pack profile: HPC11, 14, 17, 20, and 23)
(for hold profile: HPC28, 31, 34, 37, and 40)

Use these words when configuring pack or hold profiles in seconds. Each setpoint controls the time of its corresponding segment. You must use the same number of time setpoints as pressure setpoints. The procedures in chapter 9 require all five.

We recorded a value of 1 second (100) on Worksheet 8-C for each of the 10 time setpoints listed above.

The valve spanning procedures in chapter 9 require these initial values. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Profile Offsets
(for Pack profile: HPC25)
(for Hold profile: HPC42)

Profile offsets let you shift the amplitude of the entire pack or hold profile up or down, if necessary. You record these setpoints in PSI or Bar.

We recorded zeros for no pressure offsets on Worksheet 8-C.

Cure Timer Preset (HPC61)

Use this word to set the length of cure time that starts at completion of the hold profile. You record this preset in seconds (000.0 to 999.9). After the QDC module starts the internal cure timer, it:

- reports the accumulated value of the timer in SYS58
- sets bit SYS03-B03 when the timer is timing
- sets the done bit SYS03-B05 when SYS58 equals or exceeds HPC61
- stops this timer when:
  - SYS58 = 999.9 seconds, or when
  - it sees a true-to-false transition of DYC03-B01
- resets SYS58 to zero on a false-to-true transition of DYC03-B01

We recorded zero for this preset on Worksheet 8-C.

The valve spanning procedures in chapter 9 require these initial values. We help you select correct final values for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Enter and Download your Worksheet Values

After you determine initial values and record them on Worksheet 8-C, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheet.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. We repeat the HPC block download data:

Block	Block ID	Command Bit	Companion
HPC	12	B21/11	none

3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Determine and Record Setpoints for the Plastication Profile (PPC)

The following two pages contain Worksheet 8-D for the plastication profile (one page for bit entries and one for word entries). The valve spanning procedures in chapter 9 require specific values. We have already recorded many setpoints for you on the worksheet. You must determine the remaining setpoints based on your specific machine.

Important: You enter setpoints for a backpressure vs. position profile on Worksheet 8-D. We assist you in determining them.

Worksheet 8-D
Plastication Profile Block (PPC)

Control Word PPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	463	462	461	460	459	458	457	456	455	454	453	452	421	450	449	448
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

PPC Block Identifier

Control Word PPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	495	494	493	492	491	490	489	488	487	486	485	484	483	482	481	480
Value	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

Sign of Profile Offset
0 = Positive 1 = Negative

Plastication/Post-decompression
Logical Bridging
0 = Start Post-decomp Movement
1 = Stop and set outputs

Profile Algorithm
0 = Pressure/Position
1 = Pressure/Time

Control Word PPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	511	510	509	508	507	506	505	504	503	502	501	500	499	498	497	496
Value	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Enable/Disable ERC
0 = On 1 = Off

08 = Pressure/ Position
09 = Pressure/Time

Open/Closed Loop
0 = Closed 1 = Open

00 = Pressure/Position
01 = Pressure/Time

Worksheet 8-D (continued)
Plastication Profile Block (PPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PPC10	N44:426	*	Segment 1 Pressure Setpoint	Pressure [3]
PPC11	N44:427	*	End-of Segment 1 Position Setpoint	Distance from Mold-end [2]
PPC12	N44:428	0	Segment 1 Time Setpoint	Time [1]
PPC14	N44:430	*	Segment 2 Pressure Setpoint	Pressure [3]
PPC15	N44:431	*	End-of Segment 2 Position Setpoint	Distance from Mold-end [2]
PPC16	N44:432	0	Segment 2 Time Setpoint	Time [1]
PPC18	N44:434	*	Segment 3 Pressure Setpoint	Pressure [3]
PPC19	N44:435	*	End-of Segment 3 Position Setpoint	Distance from Mold-end [2]
PPC20	N44:436	0	Segment 3 Time Setpoint	Time [1]
PPC22	N44:438	*	Segment 4 Pressure Setpoint	Pressure [3]
PPC23	N44:439	*	End-of Segment 4 Position Setpoint	Distance from Mold-end [2]
PPC24	N44:440	0	Segment 4 Time Setpoint	Time [1]
PPC26	N44:442	*	Segment 5 Pressure Setpoint	Pressure [3]
PPC27	N44:443	*	End-of Segment 5 Position Setpoint	Distance from Mold-end [2]
PPC28	N44:444	0	Segment 5 Time Setpoint	Time [1]
PPC30	N44:446	*	Segment 6 Pressure Setpoint	Pressure [3]
PPC31	N44:447	*	End-of Segment 6 Position Setpoint	Distance from Mold-end [2]
PPC32	N44:448	0	Segment 6 Time Setpoint	Time [1]
PPC34	N44:450	*	Segment 7 Pressure Setpoint	Pressure [3]
PPC35	N44:451	*	End-of Segment 7 Position Setpoint	Distance from Mold-end [2]
PPC36	N44:452	0	Segment 7 Time Setpoint	Time [1]
PPC38	N44:454	*	Segment 8 Pressure Setpoint	Pressure [3]
PPC39	N44:455	*	End-of Segment 8 Position Setpoint	Distance from Mold-end [2]
PPC40	N44:456	0	Segment 8 Time Setpoint	Time [1]
PPC42	N44:458	*	Segment 9 Pressure Setpoint	Pressure [3]
PPC43	N44:459	*	End-of Segment 9 Position Setpoint	Distance from Mold-end [2]
PPC44	N44:460	0	Segment 9 Time Setpoint	Time [1]
PPC46	N44:462	*	Segment 10 Pressure Setpoint	Pressure [3]
PPC47	N44:463	*	End-of Segment 10 Position Setpoint	Distance from Mold-end [2]
PPC48	N44:464	0	Segment 10 Time Setpoint	Time [1]
PPC50	N44:466	*	Segment 11 Pressure Setpoint	Pressure [3]
PPC52	N44:468	*	Profile Pressure Offset	Pressure [3]
PPC61	N44:477	0	Cushion Size	Distance from Mold-end [2]
PPC62	N44:478	*	Shot Size	Incremental Distance [4]

[1] Time
00.00 to 99.99 Seconds

[2] Distance from MCC13 (if not zero) or MCC09
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Distance from PPC61
00.00 to 99.99 Inches
000.0 to 999.9 Millimeter

* Refer to the appropriate section later in this chapter for information on this parameter

Determine Bit Selections for Worksheet 8-D

Block Identifier (PPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the plastication profile. Pro-Set 600 sets these bits to 00001111.

We recorded this value on Worksheet 8-D.

Profile Offset Sign (PPC03)

The profile offset lets you shift the amplitude of the entire profile up or down, if necessary. The offset sign determines the direction of shift.

- **BIT 13** selects the profile offset sign for the plastication profile.
  0 = positive offset (more pressure)
  1 = negative offset (less pressure)

  We recorded a value of 0 for positive offset on Worksheet 8-D.

Logical Bridge (PPC03)

The logical bridge controls the action taken by the QDC module when it completes the plastication profile.

- **BIT 08** determines if the QDC continues to the post-decompression movement after the plastication profile, or stops and sets outputs.
  0 = continues to post-decompression
  1 = stops and sets outputs

  We recorded a value of 1 to stop and set outputs on Worksheet 8-D.

Profile Algorithm (PPC03)

The following bit determines the type of plastication profile.

- **BIT 00** selects the algorithm for the plastication profile.
  0 = Ram (screw) backpressure vs. position
  1 = Ram (screw) backpressure vs. time

  We recorded a value of 0 for backpressure vs. position on Worksheet 8-D.

Important: All other bit selections in PPC03 should be zero.

Expert Response Compensation (PPC04)

- **BITS 09 and 08** determine whether you apply Expert Response Compensation (ERC) to plastication profiles. ERC is an exclusive algorithm that adjusts for changes in your machine, hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long term deviations.

  0 = Expert Response Compensation ON
  1 = Expert Response Compensation OFF

  We recorded a value of 1 (ERC = Off) on Worksheet 8-D.

Open-loop or Closed-loop Control (PPC04)

- **BITS 01 and 00** determine whether you use open- or closed-loop control of plastication profiles. In open loop, a valve position moves the cylinder without sensor feedback. In closed loop, sensor feedback controls the valve regulating pressure.

  0 = Closed loop
  1 = Open loop

  We recorded a value of 1 for open-loop control on Worksheet 8-D.

Important: All other bit selections in PPC04 should be zero.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select correct final bit settings for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine Word Values for Worksheet 8-D

Backpressure Setpoints (PPC10, 14, 18, 22, 26, 30, 34, 38, 42, 46, and 50)

Use these words when configuring backpressure vs. position or time profiles in PSI or Bar. Each setpoint controls the pressure of its corresponding segment. You may use from 1 to 11 segments in your profile. The procedures in chapter 9 require all eleven.

Record backpressure setpoints on Worksheet 8-D equal to the maximum plastication backpressure you would ever expect in the backpressure vs. position profile for each of the 11 backpressure setpoints listed above.

The valve spanning procedures in chapter 9 require these initial values. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

End-of-Segment Position Setpoints

(PPC11, 15, 19, 23, 27, 31, 35, 39, 43, and 47)

Use these words to configure the backpressure vs. position profile. The procedures in chapter 9 require that you use all 10 position setpoints.

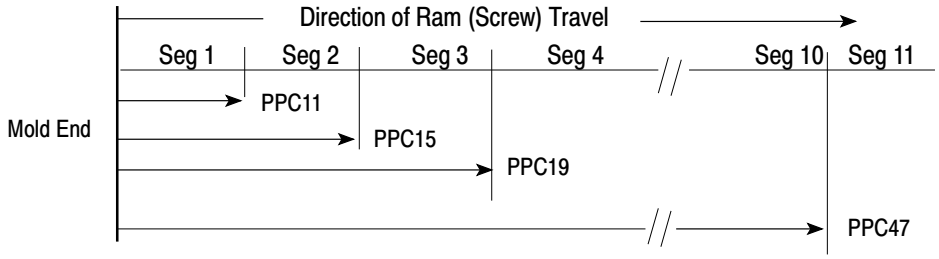
Determine end-of-segment position setpoints for your backpressure vs. position profile for use in chapter 9 as follows:

1. Back up the ram (screw) from the mold end to the shot size position as read in SYS25 (N40:177). Refer to PPC62 for this value.

2. Divide this length by 11, the maximum number of segments for this profile. The dividing line for each segment is a multiple of this division.

For example, if the ram travel distance in step 1 was 11", the 11-segment profile has dividing lines at 1" intervals. That is, end-of-segment positions of 1", 2", 3", ... 9" and 10".

Important: Measure end-of-segment positions from the mold end.



3. Record your end-of-segment position setpoints on Worksheet 8-D.

The valve spanning procedures in chapter 9 require these initial values. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Time Setpoints

(PPC12, 16, 20, 24, 28, 32, 36, 40, 44, and 48)

Use these words when configuring backpressure vs time profiles in seconds. Each setpoint controls the time of its corresponding segment. You must use one less time setpoint than pressure setpoints.

We recorded zero for all 10 time setpoints on Worksheet 8-D.

Profile Offset
(PPC52)

The profile offset lets you shift the amplitude of the backpressure profile up or down, if necessary. You record this setpoint in PSI or Bar.

We recorded zero (no offset) on Worksheet 8-D.

Cushion Size
(PPC61)

This word determines the length of molten plastic that should remain in the barrel at the conclusion of the hold profile. The QDC uses this length in computing the 100% shot size. Units are inches or millimeters.

We recorded zero (no cushion) on Worksheet 8-D.

Shot Size
(PPC62)

This word determines the length of molten plastic drawn during the plastication profile. Use this value to determine segment length in End-of-segment Positions, above. Units are inches or millimeters. The QDC uses this length for computing the end-of-plastication position (100% shot size).

100% shot size = shot size + cushion
= PPC62 + PPC61

Record a typical shot size for your machine on Worksheet 8-D.

The valve spanning procedures in chapter 9 require these initial cushion and shot size values. Where required, we help you select correct final values for your application in chapter 10. For additional information, refer to Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Enter and Download your Worksheet Values

After you determine initial values and record them on Worksheet 8-D, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheet.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. We repeat the PPC block download data.

Block	Block ID	Command Bit	Companion
PPC	15	B21/**14**	none

3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Determine and Record Setpoints for the Clamp Open Profile (OPC)

The following two pages contain Worksheet 8-E for the clamp open profile (one worksheet for bit entries and one for word entries). The valve spanning procedures in chapter 9 require specific values. We have already recorded many values for you on the worksheet. You must determine the remaining setpoints based on your specific machine.

Important: You enter setpoints for pressure vs. position and velocity vs. position profiles on Worksheet 8-E. We assist you in determining them.

Worksheet 8-E
Clamp Open Profile Block (OPC)

Control Word OPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	591	590	589	588	587	586	585	584	583	582	581	580	579	578	577	576
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1

OPC Block Identifier

Control Word OPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	623	622	621	620	619	618	617	616	615	614	613	612	611	610	609	608
Value	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	1

Velocity Units
0 = Percent Velocity
1 = Inches (mm)/Second

TOC SOC FOC

Logical Bridge
0 = Start Next Profile at end
1 = Stop and Set Output at end

Zone Overrun
0 = Start Clamp Open Slow on Zone Overrun
1 = Stop and Zero Outputs on Zone Overrun

OSC TOC SOC FOC

Algorithm
0 = Vel/Pos
1 = Press/Pos

Control Word OPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	639	638	637	636	635	634	633	632	631	630	629	628	627	626	625	624
Value	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ERC Enable/Disable Selection
0 = ON
1 = OFF

bit 15 = Press/Pos OSC
bit 14 = Vel/Pos OSC
bit 13 = Press/Pos TOC
bit 12 = Vel/Pos TCC
bit 11 = Press/Pos SOC
bit 10 = Vel/Pos SOC
bit 09 = Press/Pos FOC
bit 08 = Vel/Pos FOC

Open/Closed-Loop Selection
0 = Closed-Loop
1 = Open-Loop

bit 07 = Press/Pos OSC
bit 06 = Vel/Pos OSC
bit 05 = Press/Pos TOC
bit 04 = Vel/Pos TOC
bit 03 = Press/Pos SOC
bit 02 = Vel/Pos SOC
bit 01 = Press/Pos FOC
bit 00 = Vel/Pos FOC

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Worksheet 8-E (continued)
Clamp Open Profile Block (OPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
OPC09	N43:545	*	FOC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC10	N43:546	*	FOC Segment 1 Pressure Setpoint	Pressure [3]
OPC11	N43:547	*	FOC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC12	N43:548	*	FOC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC13	N43:549	*	FOC Segment 2 Pressure Setpoint	Pressure [3]
OPC14	N43:550	*	FOC End-of Segment 2 Position Setpoint	Incremental Distance [4]
OPC15	N43:551	*	FOC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC16	N43:552	*	FOC Segment 3 Pressure Setpoint	Pressure [3]
OPC17	N43:553	*	FOC End-of Segment 3 Position Setpoint	Incremental Distance [4]
OPC18	N43:554	0	SOC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC19	N43:555	0	SOC Segment 1 Pressure Setpoint	Pressure [3]
OPC20	N43:556	0	SOC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC21	N43:557	0	SOC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC22	N43:558	0	SOC Segment 2 Pressure Setpoint	Pressure [3]
OPC23	N43:559	0	SOC End-of Segment 2 Position Setpoint	Incremental Distance [4]
OPC24	N43:560	0	SOC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC25	N43:561	0	SOC Segment 3 Pressure Setpoint	Pressure [3]
OPC26	N43:562	0	SOC End-of Segment 3 Position Setpoint	Incremental Distance [4]
OPC27	N43:563	0	TOC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC28	N43:564	0	TOC Segment 1 Pressure Setpoint	Pressure [3]
OPC29	N43:565	0	TOC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC30	N43:566	0	TOC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC31	N43:567	0	TOC Segment 2 Pressure Setpoint	Pressure [3]
OPC32	N43:568	0	TOC End-of Segment 2 Position Setpoint	Incremental Distance [4]
OPC33	N43:569	0	TOC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC34	N43:570	0	TOC Segment 3 Pressure Setpoint	Pressure [3]
OPC35	N43:571	0	TOC End-of Segment 3 Position Setpoint	Incremental Distance [4]
OPC36	N43:572	*	OSC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC37	N43:573	*	OSC Segment 1 Pressure Setpoint	Pressure [3]
OPC38	N43:574	0	OSC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC39	N43:575	0	OSC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC40	N43:576	0	OSC Segment 2 Pressure Setpoint	Pressure [3]
OPC61	N43:597	*	Start OSC Position Setpoint	Incremental Distance [4]
OPC62	N43:598	*	Mold Open Position Setpoint	Incremental Distance [4]
OPC63	N43:599	0	Mold Open Dwell Timer Preset	Time [5]

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 inches per second
000.0 to 999.9 millimeters per second

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Axis Measured from MCC27 (if non-zero) or MCC23
00.00 to 99.99 inches
00.00 to 999.9 millimeters

[5] Time
00.00 to 99.99 seconds

* Refer to the appropriate section later in this chapter for information on this parameter

Determine Bit Selections for Worksheet 8-E

Block Identifier (OPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the clamp open profile. Pro-Set 600 sets these bits to 00010101.

We recorded this value on Worksheet 8-E.

Velocity Units (OPC03)

The following bit determines units of measure for velocity values.

- **BIT 14** selects units of measure.

  0 = Percent Velocity
  1 = Inches or Millimeters per second

  We recorded the value of 1 for units per second on Worksheet 8-E.

Overrun Zone (OPC03)

The following bit controls QDC module reaction if it moves the clamp into the overrun zone while executing the 1st, 2nd, or 3rd clamp open profile.

- **BIT 11** determines the QDC modules response to the overrun zone.

  0 = Start executing open slow (OSC) if clamp reaches OPC61
  1 = Stop and zero outputs if clamp reaches OPC61

  We recorded the value of 0 for start executing open slow on Worksheet 8-E.

Logical Bridges (OPC03)

Logical bridges control the action taken by the QDC module when it completes a profile.

- **BIT 10** controls action at end of third clamp open
- **BIT 09** controls action at end of second clamp open
- **BIT 08** controls action at end of on first clamp open

  0 = Start next Profile when this profile is complete
  1 = Stop and set output when this profile is complete

  We recorded the value of 0 for start next profile on Worksheet 8-E.

Profile Algorithm (OPC03)

The following bits determine the algorithm for each clamp open profile.

- **BIT 06** configures the open slow profile
- **BIT 04** configures the third clamp open profile
- **BIT 02** configures the second clamp open profile
- **BIT 00** configures the first clamp open profile

0 = Velocity vs. Position algorithm
1 = Pressure vs. Position algorithm

We recorded the value of 1 for pressure vs. position on Worksheet 8-E.

Important: All other bit selections in OPC03 should be zero.

Expert Response Compensation (OPC04)

- **BITs 15, 14, 13, 12, 11, 10, 09, and 08** determine whether you apply Expert Response Compensation (ERC) to clamp open profiles. ERC is an exclusive algorithm that adjusts for changes in your machine, hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long run term deviations.

  0 = Expert Response Compensation ON
  1 = Expert Response Compensation OFF

  We recorded the value of 1 (ERC = Off) on Worksheet 8-E.

Open-loop or Closed-loop Control (OPC04)

- **BITs 07, 06, 05, 04, 03, 02, 01, and 00** determine whether you use open- or closed-loop control of clamp open profiles. In open loop, a valve position moves the cylinder without sensor feedback. In closed loop, sensor feedback controls the valve regulating pressure or flow.

  0 = Closed loop
  1 = Open loop

  We recorded the value of 1 for open-loop control on Worksheet 8-E.

Important: All other bit selections in OPC03 should be zero.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select correct final values for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Determine Word Values for Worksheet 8-E

Velocity Setpoints
(OPC09, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39)

Use these words to configure velocity vs. position profiles in units per second. Each velocity setpoint controls the velocity of its corresponding segment.

Select setpoints for first clamp open segments 1-3 and open slow segment 1, typical of velocities you would run during normal machine operation.

Record these setpoints into OPC09, 12, 15, and 36 on Worksheet 8-E. We recorded zero for the remaining velocity setpoints.

Pressure Setpoints
(OPC10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40)

Use these words to configure pressure vs. position profiles in PSI or Bar. Each pressure setpoint controls the pressure of its corresponding segment.

For OPC10, 13, 16, and 37, record pressure setpoints typical of machine operation.

We recorded zero for the remaining pressure setpoints on Worksheet 8-E.

The valve spanning procedures in chapter 9 require these initial velocity and pressure values. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Fully Open Position Setpoint
(OPC62)

This setpoint defines the position when the clamp is fully open. The QDC module uses it as the end of open slow position setpoint. If the clamp reaches this position during the open slow profile, the QDC module immediately terminates the profile and sets its outputs to zero.

To determine OPC62, we recommend you jog your clamp to its maximum open position and observe the value in SYS27 (N40:179).

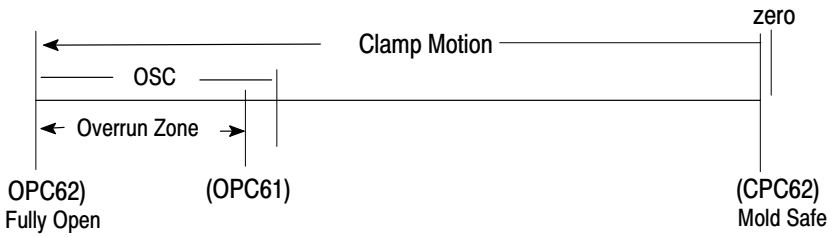
Record this value for OPC62 on Worksheet 8-E.

Start Overrun Zone Setpoint (OPC61)

The QDC module uses this position as protection against opening the clamp too far. If the clamp reaches this position during any of the first three clamp open profiles (FOC, SOC, or TOC), the QDC module immediately terminates the ongoing profile and either:

- begins the open slow profile (OSC)
- sets its outputs to zero
  (depending on the state of OPC03-B11, the overrun zone bit)

Figure 1.2
Example R4 Setpoints



We recommend an initial value larger than the start OSC position you would typically use during normal machine operation.

Record a value for OPC61 that is a safe distance from fully open (OPC62).

The valve spanning procedures in chapter 9 require these initial OPC61 and OPC62 values. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

End-of-segment Position Setpoint (OPC11, 14, 17, 20, 23, 26, 29, 32, 35, 38)

Configure only the first clamp open profile segments.

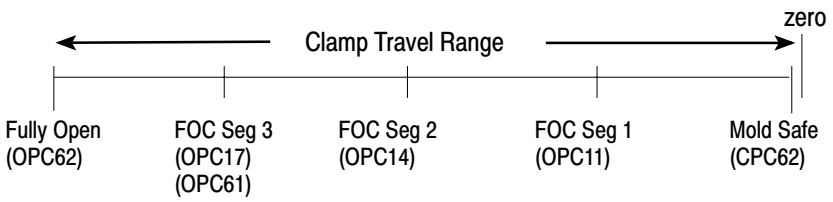
Determine end-of-segment position setpoints for the first clamp open profile as follows:

1. Jog the mold fully closed and observe the value in SYS27 (N40:179).

2. Subtract the mold safe position setpoint (CPC62) from the value you recorded for start overrun zone setpoint (OPC61).

3. Divide this difference into three equal sections. The dividing line of each section should be recorded for the end-of-segment position setpoints for segments 1, 2, and 3.

Important: Measure end-of-segment positions from zero (mold safe).



4. Record your FOC end-of-segment position setpoints for OPC11, 14, and 17 on Worksheet 8-E.

We recorded zero for the remaining position setpoints on Worksheet 8-E.

The valve spanning procedures in chapter 9 require these initial values. We help you select correct final values for your application in chapter 10. for additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Mold Open Dwell Timer Preset (OPC63)

The QDC module starts its internal mold open dwell timer according to how you set OPC03-B15.

We recorded zero for the mold open dwell timer preset.

The valve spanning procedures in chapter 9 require this initial value. We help you select correct final values for your application in chapter 10. For additional information, refer to Section 3 of the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Enter and Download Your Worksheet Values

After you determine initial values and record them on Worksheet 8-E, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheet.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. We repeat the OPC block download data.

Block to Download:	Pro-Set 600 Block ID:	Download Command Bit:	Companion Block:
OPC	21	B21/20	none

3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Determine and Record Setpoints for the Ejector Profile (EPC)

The following two pages contain Worksheet 8-F for the ejector profile (one worksheet for bit entries and one for word entries). The valve spanning procedure in chapter 9 requires specific values. We have already entered those values for you on the worksheet. You must determine the remaining setpoints based on your specific machine.

Important: You enter setpoints for a pressure vs. position profile on Worksheet 8-F. We assist you in determining them.

Worksheet 8-F
Ejector Profile Block (EPC)

Control Word EPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0

EPC Block Identifier

Control Word EPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
Value	0	1	0	*	0	0	0	1	0	0	0	0	0	0	0	1

Forward Dwell
0=Apply Forward Dwell on Final Stroke
1=Apply Forward Dwell on Initial Stroke

Velocity Units
0 = Percent Velocity
1 = Inches (mm)/Second

Ejector Tip Strokes
0 = All Strokes to be Full Strokes
1 = Intermediate Strokes to be Tip Strokes

Stop and Notify
0 = Ejector Profile to Run without Interruption
1 = QDC to “Stop-and-Notify” at end of Stroke

Ejector Profile
0 = Ejector profile enabled
1 = Ejector profile disabled

Logical Bridge
0 = Start Profile on Clamp Position During Open
1 = Start Profile on Command

Algorithm
0 = Vel/Pos
1 = Press/Pos

Control Word EPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
Value	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Expert Response Compensation
0 = ON
1 = OFF

bit 09 = Press/Pos
bit 08 = Vel/Pos

Open/Closed Loop Selection
0 = Closed Loop
1 = Open Loop

bit 01 = Press/Pos
bit 00 = Vel/Pos

Worksheet 8-F (continued)
Ejector Profile Block (EPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
EPC09	N45:125	0	Full Advance Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC10	N45:126	*	Full Advance Segment 1 Pressure Setpoint	Pressure [3]
EPC11	N45:127	0	End of Full Advance Segment 1 Position Setpoint	Incremental Distance [4]
EPC12	N45:128	0	Full Advance Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC13	N45:129	0	Full Advance Segment 2 Pressure Setpoint	Pressure [3]
EPC14	N45:130	0	End of Full Advance Segment 2 Position Setpoint	Incremental Distance [4]
EPC15	N45:131	0	Full Advance Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC16	N45:132	0	Full Advance Segment 3 Pressure Setpoint	Pressure [3]
EPC21	N45:137	0	Tip Retract Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC22	N45:138	0	Tip Retract Pressure Setpoint	Pressure [3]
EPC23	N45:139	0	End of Tip Retract Position Setpoint	Incremental Distance [4]
EPC27	N45:143	0	Tip Advance Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC28	N45:144	0	Tip Advance Pressure Setpoint	Pressure [3]
EPC29	N45:145	0	End of Tip Advance Position Setpoint	Incremental Distance [4]
EPC33	N45:149	0	Full Retract Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC34	N45:150	*	Full Retract Segment 1 Pressure Setpoint	Pressure [3]
EPC35	N45:151	0	End of Full Retract Segment 1 Position Setpoint	Incremental Distance [4]
EPC36	N45:152	0	Full Retract Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC37	N45:153	0	Full Retract Segment 2 Pressure Setpoint	Pressure [3]
EPC38	N45:154	0	End of Full Retract Segment 2 Position Setpoint	Incremental Distance [4]
EPC39	N45:155	0	Full Retract Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
EPC40	N45:156	0	Full Retract Segment 3 Pressure Setpoint	Pressure [3]
EPC57	N45:173	0	Ejector Forward Dwell timer Preset	Time [5]
EPC59	N45:175	*	Ejector Fully Advanced Position Setpoint	Incremental Distance [4]
EPC60	N45:176	*	Ejector Fully Retracted Position Setpoint	Incremental Distance [4]
EPC61	N45:177	*	Clamp Position for Start of Eject Profile	Incremental Distance [6]
EPC62	N45:178	*	Clamp Position for Ejector Inhibit	Incremental Distance [6]
EPC63	N45:179	*	Ejector Position for Clamp Close Enable	Incremental Distance [4]
EPC64	N45:180	1	Ejector Strokes Required	Number of Strokes

[1] Ejector Percent of Maximum Velocity
00.00 to 99.99

[2] Ejector Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Second

[3] Ejector Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Ejector Axis Measured from MCC41 (if non-zero) or MCC37
00.00 to 99.99 Inches
00.00 to 999.9 Millimeters

[5] Time
00.00 to 99.99 Seconds

[6] Clamp Axis Measured from MCC27 (if non-zero) or MCC23
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

* Refer to the appropriate section later in this chapter for information on this parameter

Determine Bit Selections for Worksheet 8-F

Block Identifier (EPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the ejector profile. Pro-set 600 sets these bits to 00011000.

We recorded this value on Worksheet 8-F.

Ejector Forward Dwell (EPC03)

Forward dwell stops the ejector in its full advance position to let a robot remove a part when ejectors are fully extended.

- **BIT 15** selects when the QDC module starts its internal ejector forward dwell timer:
  0 = after final advance stroke
  1 = after initial advance stroke

  We recorded the value of 0 to start forward dwell on final advance stroke.

Velocity Units (EPC03)

- **BIT 14** selects units of measure for velocity values.
  0 = Percent velocity
  1 = Inches or millimeters per second

  We recorded the value of 1 for units per second on Worksheet 8-F.

Type of Ejector Strokes (EPC03)

- **BIT 13** selects the type of intermediate ejector strokes, if you select multiple strokes (EPC64 greater than one).
  0 = All ejector strokes are full strokes
  1 = Intermediate ejector strokes are tip strokes

  We recorded the value of 0 for full strokes on Worksheet 8-F.

Continue Stroking or Stop and Notify (EPC03)

Set this bit only if you your QDC module does NOT have control of all valves required to change direction of ejector travel after each stroke.

- **BIT 12** controls QDC module reaction when it completes any advance or retract stroke during the ejector profile. The QDC module:
  - 0 = Runs the ejector profile without interruption
  - 1 = At end of stroke:
    - * stops the ejector profile
    - * sets outputs
    - * notifies the PLC processor

  Select this bit as follows, based on how you configured your ejector hydraulic circuit.

Does the QDC module have control of all valves required to change direction of ejector travel?	Then set Bit 12 to	Then the QDC module;	And Your Ladder Logic Must:
Yes	0	Initiates each subsequent retract/advance stroke upon completion of the preceding one.	Toggle DYC02-B14 (B35/414) to command the QDC module to execute the entire ejector profile.
For example: Direction of ejector travel is determined by a bi-directional flow valve connected to the QDC module.			
No	1	* Stops the ejector profile * Sets outputs to end-of-profile set-output values * Notifies the PLC processor	Control directional valves NOT connected to the QDC module to assist executing the ejector profile.
For example: Direction of ejector travel is determined by uni-directional flow valves connected to outputs controlled by the PLC processor.			

We provide the following partial list of the interactive command and status bits to help you program a stop-and-notify ejector profile in your PLC ladder logic (for use when EPC03-B12 = 1).

Control Word:	Pro-Set 600 address:	Performs this action:
DYC02-B14	B35/414	Execute Ejector Profile
DYC03-B15	B35/431	Continue Ejector Profile
SYS03-B08	B35/40	Ejector Profile Stopped at End-of Stroke
SYS03-B10	B35/42	Ejector Forward Dwell Timer timing
SYS21-B14	B35/334	Ejector Profile in Progress
SYS22-B14	B35/350	Ejector End-of Advance set-output in Progress
SYS22-B15	B35/351	Ejector End-of Retract set-output in Progress

For additional ladder logic programming, refer to chapter 6.

Record a value for bit 12 accordingly on Worksheet 8-F.

Enable/Disable Ejectors
(EPC03)

- **BIT 09** controls whether the QDC module performs any profiled ejector movement. The QDC module:
  0 = Executes profiled ejector movement
  1 = Inhibits any profiled ejector movement

  We recorded zero to enable ejector movement on Worksheet 8-F.

Logical Bridge
(EPC03)

- **BIT 08** controls how the QDC module starts the ejector profile:
  0 = upon clamp position during clamp open profiles
  1 = on command from the PLC processor

  We recorded a 1 to start on PLC command on Worksheet 8-F.

Profile Algorithm
(EPC03)

- **BIT 00** selects which algorithm the QDC module uses for the ejector profile.
  0 = Velocity vs. position algorithm
  1 = Pressure vs. position algorithm

  We recorded a value of 1 for a pressure vs. position algorithm.

Important: All other bit selections in EPC03 should be zero.

Expert Response Compensation
(EPC04)

- **BITs 09 and 08** determine whether you apply Expert Response Compensation (ERC) to ejector profiles. ERC is an exclusive algorithm that adjusts for changes in your machine, hydraulics, raw materials, and other process variables. It compensates for abrupt upsets and long term deviations.

  0 = Expert Response Compensation ON
  1 = Expert Response Compensation OFF

  We recorded a value of 1 (ERC = Off) on Worksheet 8-F.

Open-loop or Closed-loop Control (EPC04)

- **BITs 01 and 00** determine whether you use open- or closed-loop control of ejector profiles. In open loop, a valve position moves the cylinder without sensor feedback. In closed loop, sensor feedback controls the valve regulating the pressure or velocity.

  0 = Closed loop
  1 = Open loop

  We recorded a value of 1 for open-loop control on Worksheet 8-A.

Important: All other bit selections in EPC04 should be zero.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select correct final bit settings for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Determine Word Values for Worksheet 8-F

Velocity Setpoints (EPC09, 12, 15, 21, 27, 33, 36, 39)

Use these words to configure velocity vs. position profiles in units per second. Each velocity setpoint controls the velocity of its corresponding segment.

We recorded zero for these setpoints on Worksheet 8-F.

Pressure Setpoints (EPC10 and 34) (EPC13, 16, 22, 28, 37, and 40)

Use these words to configure pressure vs. position profiles in PSI or Bar. Each pressure setpoint controls the pressure of its segment.

Configure only the 1st full advance and the 1st full retract segments for a pressure vs. position profile for machine tuning in chapter 9. Do this by recording typical pressure setpoints for normal machine operation into:

- EPC10 full advance, segment 1, pressure setpoint
- EPC34 full retract, segment 1, pressure setpoint

We recorded zero for the other pressure setpoints on Worksheet 8-F.

End-of-segment Position Setpoints
(EPC11, 14, 23, 29, 35, 38)

Use these words to configure pressure vs. position or velocity vs. position ejector profiles. Record positions in inches or millimeters. Measure each position setpoint from the ejector minimum software travel limit.

We recorded zero for EPC11, 14, 23, 29, 35, and 38 end-of-segment position setpoints on Worksheet 8-F.

The valve spanning procedures in chapter 9 require these initial values for velocity, pressure, and end-of-segment setpoints. We help you select correct final values for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Ejector Forward Dwell Timer Preset
(EPC57)

The QDC module starts an internal ejector forward dwell timer dependent of EPC03-B15 (dwell on initial or final stroke).

We recorded zero for the forward dwell preset on Worksheet 8-F.

The valve spanning procedures in chapter 9 require this initial value. For additional information to help you select a correct final value, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Ejector Fully Advanced Position Setpoint
(EPC59)

This setpoint defines the ejector position when fully extended. The QDC module uses this position as the end-of-full-advance position setpoint. If reached while the QDC module is executing a full advance ejector stroke, the QDC module immediately terminates the advance stroke and checks EPC03-B12 (continue or stop/notify) to determine its next action.

To determine this position setpoint, we recommend that you jog the ejector to its fully advanced position and observe the value in SYS28 (N40:180). Record this initial value for EPC59.

The valve spanning procedures in chapter 9 require this initial value. For additional information to help you select a correct final value, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Ejector Fully Retracted Position Setpoint (EPC60)

This setpoint defines the ejector position when fully retracted. The QDC module uses this position as the end-of-full-retract position setpoint. If reached while the QDC module is executing a full retract ejector stroke, the QDC module immediately terminates the retract stroke and checks EPC03-B12 (continue or stop/notify) to determine its next action.

To determine this position setpoint, we recommend that you jog the ejector to its fully retracted position and observe the value in SYS28 (N40:180). Record this initial value for EPC60.

The valve spanning procedures in chapter 9 require this initial value. For additional information to help you select a correct final value, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88).

Clamp Position for Start of Ejector Profile (EPC61)

The QDC module uses this setpoint as the clamp position at which it starts ejector movement during any clamp open profile if you configured the QDC module to start the profile on clamp position (EPC03-B08 = 0).

Record a value for EPC61 equal to the mold open position (OPC62).

The valve spanning procedures in chapter 9 require this initial value. We help you select a correct final value for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Clamp Position for Ejector Inhibit (EPC62)

The QDC module uses this clamp position as protection against starting or continuing any ejector profile when clamp clearance is not adequate for full ejector travel.

- If the clamp position is equal to or less than this setpoint when the QDC module is commanded to start (or continues) an ejector profile, the QDC module ignores the command and sets alarm bit SYS14-B09 (B34/217).
- If the clamp attains a position equal to or less than this setpoint during execution of an ejector profile, the QDC module sets its outputs to zero and sets alarm bit SYS14-B09 (B34/217).

To determine this clamp position, jog the clamp open and measure the gap between the two mold halves. When the gap equals the ejector-fully-advanced position setpoint (EPC 59), observe the position reported in SYS27 (N40:179). Record this observed position (N40:179) as your initial setpoint for EPC62.

The valve spanning procedures in chapter 9 require this initial value. We help you select a correct final value for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Ejector Position for Clamp Close Enable (EPC63)

The QDC module uses this ejector position as protection against starting or continuing any clamp close profile when the ejector is not safe.

- If the ejector position is greater than this setpoint when the QDC module is commanded to start a clamp close profile, the QDC module ignores the command and sets alarm bit SYS14/B08 (B34/216).
- If the ejector attains a position greater than this setpoint during execution of a clamp close profile, the QDC module sets its outputs to zero and sets alarm bit SYS14-B08 (B34/216).

ATTENTION: Verify that your ejector jog pressure and flow values are set low enough to guard against damaging ejector pins when advancing them against the closed clamp, next.

To determine this position (EPC63), we recommend that you jog the clamp closed until the two mold halves mate. Then jog the ejector toward its fully advanced position while constrained by the closed mold and observe the value in SYS28 (N40:180). Record this as your initial value for EPC63.

The valve spanning procedures in chapter 9 require this initial value. We help you select a correct final value for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Ejector Strokes Required (EPC64)

The QDC module uses this counter preset to determine how many times the ejector must attain one of its advanced positions (EPC59 or EPC29) during the ejector profile before the QDC module starts the final full-retract portion of the ejector profile.

Important: A zero entry inhibits the entire ejector profile.

Record 1 for one ejector stroke.

The valve spanning procedures in chapter 9 require this initial value. We help you select a correct final value for your application in chapter 10. For additional information, refer to the Plastic Molding Module Reference Manual (publication 1771-6.5.88)

Enter and Download Your Worksheet Values

After you determine initial values and record them on Worksheet 8-F, you are ready to proceed. Refer to procedures in chapter 4 if necessary.

Important: Be sure that you do not alter any setpoints, and that you enter each and every setpoint exactly as on the worksheet.

1. Enter all worksheet values into your PLC-5 data table.

2. Download command blocks to the QDC module. We repeat EPC download data.

Block to Download:	Pro-Set 600 Block ID:	Download Bit, B21/:	Companion Block:
EPC	24	23	none

3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Chapter 9

Span Your Valves

Chapter Objectives

This chapter describes how to span your valves using set-output operation, and verify valve linearity by running simple open-loop profiles.

The procedures in this chapter require the values and setpoints that you recorded on worksheets in chapters 7 and 8.

ATTENTION: Do not attempt this chapter unless you completed all previous chapters. The results could be unpredictable machine motion, with possible personal injury and/or equipment damage.

We describe how to span these selected valves:

- low pressure close valve
- clamp close pressure valve
- clamp close velocity valve
- injection pressure valve
- injection velocity valve
- pack/hold pressure valve
- plastication pressure valve
- clamp open pressure valve
- clamp open velocity valve
- ejector pressure valve
- ejector velocity valve

We also describe how to:

- test valve linearity
- set profile pressure alarms

Choose Only Applicable Valve-Spanning Procedures

You may omit parts of this chapter if either of the following applies:

- If you have the manufacturer's valve spanning data, you may omit the valve spanning procedure in corresponding sections of this chapter.
- You may omit whole sections of this chapter that do not apply to your machine application (see next table).

For this Phase	If Using Only this Control	Then Skip the Section(s) Titled:
clamp close	velocity	FCC, SCC, TCC Profiles – Pressure Valves
	pressure: and your valve configuration is the same for all four profiles FCC, SCC, TCC, LPC	LPC Profile – Low Pressure Valve and FCC, SCC, TCC Profiles – Velocity Valve
injection	velocity	INC Profile – Pressure Valve
	pressure	INC Profile – Velocity Valve
clamp open	velocity	FOC, SOC, TOC, OSC Profiles – Pressure Valve
	pressure	FOC, SOC, TOC, OSC Profiles – Velocity Valve
ejection	velocity	EAC, ERC Profiles – Pressure Valves
	pressure	EAC, ERC Profiles – Velocity Valves

For each of the available profiles, decide which ones you will:

- span for pressure control
- span for velocity control
- operate in closed loop
- operate in open loop
- not use

To assist you, we provide worksheet 9.A. Use it to select only the valve-spanning procedures required for your particular application.

Table 9.A
Profiles Required for Valve Spanning

Check the boxes that apply to your application.

Profile	Pressure	Velocity	Closed Loop	Open Loop	Not Used
LPC					
FCC					
SCC					
TCC					
INC					
PKC					
HDC					
PLC					
FOC					

Profile	Pressure	Velocity	Closed Loop	Open Loop	Not Used
SOC					
TOC					
OSC					
EAC					
ERC					

If necessary, review system pressure, hydraulic circuits and corresponding control options presented in chapter 2 under the sections *System Pressure* and *Example Hydraulic Circuits*, to verify that your application is hydraulically correct.

Referenced Worksheets

The following table lists worksheets containing initial values from chapters 7 and 8 that you will use in this chapter.

Data Block:	Worksheet:
Clamp Low Pressure Close Configuration Block (LPC)	7-B
Clamp Close Configuration Blocks (FCC, SCC, TCC)	7-A
Clamp Close Profile Block (CPC)	8-A
Injection Configuration Block (INC)	7-C
Injection Profile Block (IPC)	8-B
Pack Configuration Block (PKC)	7-D
Hold Configuration Block (HDC)	7-E
Pack/Hold Profile Block (HPC)	8-C
Plastication Configuration Block (PLC)	7-F
Plastication Profile Block (PPC)	8-D
Clamp Open and Open Slow Configuration Blocks (FOC, SOC, TOC, OSC)	7-G
Clamp Open Profile Block (OPC)	8-E
Ejector Configuratiion Blocks (EAC, ERC)	7-H
Ejector Profile Block (EPC)	8-F

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Make sure all machine guards and shields are in place before proceeding to guard against personal injury.

LPC Profile – Low Pressure Valve

We recommend that you first span for optimum performance your low pressure valve used for the LPC profile. You do this in five parts:

- Confirm critical values
- Span your low pressure valve
- Test value linearity with a LPC profile
- Set up tonnage (hydraulic clamp) or hold pressure (toggle clamp)
- Set the profile pressure alarm

Important: You may omit the procedure *Span your low pressure valve* in this section if the recorded valve spanning data from the manufacturer for pressure control limits LPC41-44 (chapter 7) are adequate for your application.

Confirm Critical Values

Important: Confirm that your configuration values (chapter 7) and profile values (chapter 8) for the low pressure close profile are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-Set Addr.
7-D	QDC module output to which you connected your selected pressure control valve	LPC02-B06, B05, B04 your selection	B37/214, 213, 212
	Your unselected set-output values for outputs 1-4	LPC09-LPC12 = your values	N43:185-188
	All ramping is disabled with zero ramp rates	LPC17-LPC20 = 0 LPC25-LPC28 = 0	N43:193-196 N43:201-204
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Minimum Selected Pressure Valve, Output for Maximum	 LPC41 = 0 LPC42 = your value LPC43 = your value LPC44 = your value	 N43:217 N41:218 N41:219 N41:220
8-A	Start LPC at overrun zone	CPC03-B11 = 0	B37/299
	Expert Response Compensation (ERC) is disabled	CPC04-B15 = 1	B37/319
	Open-loop control	CPC04-B07 = 1	B37/311
	Pressure setpoint	CPC37 = your value	N43:273
	Start LPC position	CPC61 = your value	N43:297
	Mold safe position	CPC62 = your value	N43:298

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Low Pressure Close Pressure Valve(s)

Span your clamp pressure valve for smooth operation at the highest desired LPC pressure. Do this in the following procedure by finding the optimum values for these words:

- Minimum Pressure Control Limit LPC41
- Maximum Pressure Control Limit LPC42
- Selected Pressure Valve, Output for Minimum LPC43
- Selected Pressure Valve, Output for Maximum LPC44

Important: If PanelView is operational for clamp profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, make sure you installed a test mold in the machine. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Jog your clamp to the full close position (mold halves mated).
2. Align all other machine hydraulics to simulate low pressure close. For example, shut off applicable pumps and align applicable valves.
3. Copy initial values from LPC09-12 into DYC09-12 (N40:121-124 of your PLC-5 data table) with this exception:

Important: Enter a value corresponding to zero pressure into the word DYC09-12 (N40:121-124) for output 1, 2, 3, or 4 that drives the selected clamp LPC valve.

ATTENTION: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

4. Enable set-output by changing DYC01-B08 (B34/392) to 1. This forces the QDC module to apply the values in DYC09-12 directly to its outputs 1-4, respectively.

5. Adjust the set-output value DYC09-12 (N40:121-124) that corresponds to the selected clamp LPC valve, and observe the pressure reported in SYS26 (N40:178).

   - **For a bi-directional valve with a spool offset:**
     If this pressure is greater than zero, adjust the set-output value to the clamp LPC valve to obtain zero pressure. Stop the adjustments when you observe the smallest pressure attainable.

   - **For a uni-directional valve with no response at low signal level:**
     If this pressure is zero, adjust the set-output value to the clamp pressure valve until the observed pressure just exceeds zero. Then re-adjust this value until you just observe zero again.

   - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once you are satisfied that you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure observed in SYS26 (N40:178) into LPC41 (N43:217), the LPC minimum control limit.

7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your clamp LPC valve. Copy this value into LPC43 (N43:219), the selected LPC valve, output for minimum.

8. Change the set-output value in DYC09-12 (N40:121-124) that corresponds to the clamp LPC valve in 5% steps while observing the pressure in SYS26 (N40:178). Stop adjusting it when the observed pressure is equal to the maximum LPC pressure that you run on this machine. In most cases, this value is substantially less that the maximum obtainable system pressure.

9. Copy this observed maximum LPC pressure from SYS26 (N40:178) into LPC42 (N43:218), the maximum LPC control limit.

10. While maintaining this maximum LPC pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected clamp LPC valve. Copy this value into LPC44 (N43:220), the selected LPC valve, output for maximum.

11. Lower the set-output value in DYC09-12 corresponding to the selected clamp LPC valve to a safe level.

12. Disable set-output operation. Toggle DYC01-B08 (B34/392) to 0.

13. Download your final values for LPC41-44 to the QDC module by downloading the LPC block.

Important: If downloading from your programming terminal, you must download LPC followed by CPC (chapter 4).

To download:	Set: B21/
LPC	5
CPC	6

Test Valve Linearity with a Low Pressure Close (LPC) Profile

1. Jog your clamp to a position just inside LPC start position (CPC61).

2. Enable the LPC profile by setting DYC02-B03 (B34/403) = 1. The clamp should move from its start position through the LPC profile. If no motion is observed, verify that:

- no overtravel alarms are set. The QDC module inhibits clamp low pressure close if alarm bits SYS07-B00 through -B05 are set.
- no programming error codes exist in SYS61 and SYS62.

3. At completion of the LPC profile, observe the pressure reported for LPC segment 1, CPS37 (N43:689). If the observed pressure is not within 20% of the value you entered in CPC37, then check:

- Is your high-volume pump dropping out early enough?
- Are any high-volume solenoids dropping out too early?

If the observed pressure CPS37 is still not within 20% of CPC37, your pressure valve is not linear over the desired range. Correct for a non-linear valve as follows:

If:	And Your Selected Valve is:	Then change LPC44 (N43:220) as follows:
CPS37 was less than CPC37	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
CPS37 was more than CPC37	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change LPC44, download the LPC block, repeat steps 1-3. Repeat as necessary.

Important: If downloading from your programming terminal, download LPC followed by CPC with bits B21/5 and 6 respectively (chapter 4).

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during low pressure close
- end-of-range maximum and minimum signal levels for linear control of the clamp LPC valve in open-loop control

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	LPC41	LPC43
Maximum	LPC42	LPC44

Now for the open-loop LPC profile, the QDC module assumes a linear relationship between LPC clamp pressure and signal output.

Set Tonnage on Hydraulic Clamps or Hold Pressure on Toggle Clamps

Once the clamp has completed low pressure close, use the LPC end-of-profile set-output values to:

- build tonnage on your hydraulic clamp
- lock up your toggle clamp

1. Jog your clamp to the full close position (mold halves mated).

2. Enter a value corresponding to minimum pressure into the set-output word DYC09-12 (N40:121-124) that corresponds to your clamp-tonnage or lock-up pressure valve.

3. Copy the other three set-output values from LPC33-36 (N43:209-212) to DYC09-12 (N40:121-124), values that you would normally use during tonnage (or lock up).

ATTENTION: A value of 0 entered in your data table does not necessarily correspond to zero pressure or flow. For example, a bi-directional valve would require a set-output value of 50% (5000) to obtain 0 PSI. Amplifier electronics or valve spools may also allow pressure or flow at 0 volts signal input.

4. Align all other machine hydraulics to simulate clamp tonnage or lock-up for a toggle clamp. For example, enable required pumps and align required valves.

5. Enable set-output by transitioning DYC01-B08 (B34/392) to 1.

6. Change the set-output word DYC09-12 (N40:121-124) corresponding to your clamp tonnage (lock-up) pressure valve in 5% increments while observing clamp pressure in SYS26 (N40:178). Stop changing it when the observed clamp pressure equals the desired tonnage pressure. If you cannot reach the desired pressure, verify that the other three set-output values are correct.

7. Copy the resultant set-output values from DYC09-12 (N40:121-124) into LPC33-36 (N43:209-212). The QDC module will apply these values to the valves when the clamp completes low pressure close.

8. Disable set-output by transitioning DYC01-B08 (B34/392) to 0.

9. Enter the desired tonnage pressure for your machine (step 6) into the tonnage complete pressure setpoint CPC63 (N43:299).

10. Download your changes in LPC and CPC to the QDC module.

Important: If downloading from your programming terminal, download LPC followed by CPC with download bits B21/5 and 6 (chapter 4).

Set the Profile Pressure Alarm

Set your clamp LPC maximum pressure alarm LPC57 (N43:233) to a pressure that should:

- not be exceeded during the clamp close profile
- not exceed the maximum pressure control limit LPC42 (N43:218)

Entering a value of zero disables this alarm.

Download the alarm setpoint to the QDC by downloading the LPC block.

Important: If downloading from your programming terminal, download LPC followed by CPC with download bits B21/5 and 6 (chapter 4).

FCC, SCC, TCC Profiles – Pressure Valve(s)

Span your clamp close pressure valve(s) for optimum performance. Do this in four parts:

- Confirm critical values
- Span your clamp close pressure valve(s)
- Test valve linearity
- Set pressure alarm setpoints

Important: You may omit the procedure *Span your clamp close pressure valve(s)* in this section if the recorded valve spanning data from the manufacturer for pressure control limits FCC41-44, SCC41-44, and TCC41-44 (chapter 7) are adequate for your application.

Confirm Critical Values

Important: Confirm that your entries for configuration values (chapter 7) and profile values (chapter 8) for clamp close profiles are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-Set Addr.:
7-A, 7-B, 7-C	QDC module output to which you connect your selected pressure control valve	FCC02-B06,B05,B04 = your selection SCC02-B06,B05,B04 = your selection TCC02-B06,B05,B04 = your selection	B37/22, 21, 20 B37/86, 85, 84 B37/150,149,148
	Your unselected set-output values for outputs 1-4	FCC09-12 = your values SCC09-12 = your values TCC09-12 = your values	N43:5-8 N43:65-68 N43:125-128
	All ramping is disabled with zero ramp rates	FCC17-20 = FCC25-28 = 0, SCC17-20 = SCC25-28 = 0 TCC17-20 = TCC25-28 = 0	N43:13-16 N43:21-24 N43:73-76 N43:81-84 N43:133-136 N43:141-144
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 FCC41=SCC41=TCC41=0 FCC42=SCC42=TCC42=your value FCC43=SCC43=TCC43=your value FCC44=SCC44=TCC44=your value	 N43:37, 97, 157 N43:38, 98, 158 N43:39, 99, 159 N43:40, 100, 160
8-A	Pressure vs. Position Control	CPC03-B04 = B02 = B00 = 1	B37/292, 290, 288
	Logical bridge	CPC03-B10, B09, B08 = 0	B37/298, 297, 296
	Mold Protection	CPC03-B11 = 0	B37/299
	Open-loop control	CPC04-B07 = B05-B00 = 1	B37/311, 309-304
	Expert Response Compensation (ERC) = Off	CPC04-B15 = B13-B08 = 1	B37/319, 317-312
	FCC pressure setpoints	CPC10, 13, 16 = your value	N43:246, 249, 252
	FCC end-of-segment position setpoints	CPC11, 14, 17 = your value	N43:247,250,253
	Start LPC position	CPC61 = your value	N43:297
	Mold Safe Position	CPC62 = your value	N43:298

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Clamp Close Pressure Valve(s)

Span your clamp close pressure valve(s) for smooth operation at highest desired clamp pressure. Do this by finding optimum values for:

- Minimum Pressure Control Limit FCC41, SCC41, TCC41
- Maximum Pressure Control Limit FCC42, SCC42, TCC42
- Selected Pressure Valve, Output For Minimum FCC43, SCC43, TCC43
- Selected Pressure Valve, Output For Maximum FCC44, SCC44, TCC44

Important: If your hydraulics are identical for first, second, and third clamp close, complete the procedure for first clamp close by finding values for FCC41-44 and enter the same four values for second and third clamp close. If your hydraulics are different, repeat the procedure as needed.

Important: If PanelView is operational for clamp profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Jog your clamp to the full close position (mold halves mated).
2. Align all other machine hydraulics to simulate clamp close. For example, enable required pumps and align required valves.
3. Copy initial values from FCC09-12 (N43:5-8) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero pressure into the word DYC09-12 for the output that drives the selected clamp pressure valve.

ATTENTION: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

4. Enable set-output by changing DYC01-B08 (B34/392) from 0 to 1. This forces the QDC module to apply the values in DYC09-12 directly to its outputs 1-4, respectively.

5. Adjust the set-output value DYC09-12 (N40:121-124) that corresponds to the selected clamp close pressure valve, and observe the pressure reported in SYS26 (N40:178).

   - **For a bi-directional valve with a spool offset:**
     If this pressure is greater than zero, adjust the set-output value to the clamp close pressure valve to obtain zero pressure. Stop the adjustments when you observe the smallest pressure attainable.

   - **For a uni-directional valve with no response at low signal level:**
     If this pressure is zero, adjust the set-output value to the clamp close pressure valve until the observed pressure just exceeds zero. Then re-adjust this value until you just observe zero again.

   - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once you are satisfied that you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure observed in SYS26 (N40:178) into FCC41, SCC41, and TCC41 (N43:37, N43:97, and N43:157), the clamp close minimum pressure control limit.

7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your clamp close pressure valve. Copy this value into FCC43, SCC43, and TCC43 (N43:39, 99, and 159), the selected clamp close pressure valve output for minimum.

8. Change the set-output value in DYC09-12 (N40:121-124) that corresponds to the clamp close pressure valve by 50%, and then in 5% steps while observing the clamp pressure in SYS26 (N40:178). Stop adjusting it when the observed pressure no longer increases with an increase in set-output value. The pressure in SYS26 (N40:178) is now the maximum attainable clamp close pressure.

9. Copy this observed pressure from SYS26 (N40:178) into FCC42, SCC42, and TCC42 (N43:38, 98, and 158), the maximum clamp close pressure control limits.

10. While maintaining this maximum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected clamp close pressure valve. Copy this value into FCC44, SCC44, and TCC44 (N43:40, 100, and 160), the selected clamp close pressure valve, output for maximum.

11. Lower the set-output value in DYC09-12 corresponding to the selected clamp close pressure valve to a safe level.

12. Disable set-output operation. Toggle DYC01-B08 (B34:392) to 0.

13. Download your changes in FCC, SCC, and TCC to the QDC module.

Important: If downloading from your programming terminal, download FCC, SCC, TCC, and CPC in that order (chapter 4).

To download	Set B21/
FCC	2
SCC	3
TCC	4
CPC	6

Test Valve Linearity with a Clamp Close Pressure Profile

1. Jog your clamp to the full open position.

2. Enable the first clamp close profile by setting DYC02-B00 (B34/400) to 1. The clamp should move from its start position through clamp close and low pressure close profiles. If no motion, verify that:

- no clamp overtravel alarms are set. The QDC module inhibits clamp close if SYS07-B00 through -B05 are set
- no programming error codes exist in SYS61 and SYS62

3. At completion of clamp close, observe the pressure reported for first clamp close segment 2 CPS13 (N43:665). If it is not approximately equal to the setpoint you entered in CPC13, then check:

- was your valve and solenoid alignment the same for clamp close profile execution and clamp close action in set-output?

If the observed pressure CPS13 is still not within 20% of CPC13, your pressure valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change FCC44 (N43:40) as follows:
CPS13 was less than CPC13	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
CPS13 was more than CPC13	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change FCC44, download the FCC block, and repeat steps 1-3. Repeat as necessary.

Important: If downloading from your programming terminal, download FCC followed by CPC with download bits B21/2 and 6 (chapter 4).

4. Copy final FCC44 (N43:40) into SCC44 and TCC44 (N43:100 and 160) and download these changes to the QDC module.

Important: If downloading from your programming terminal, download FCC, SCC, TCC, and CPC in that order with download bits B21/2, 3, 4, and 6 respectively (chapter 4).

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during first, second and third clamp close
- end-of-range maximum and minimum signal levels for linear control of the clamp close pressure valve in open-loop control.

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	FCC41, SCC41, TCC41	FCC43, SCC43, TCC43
Maximum	FCC42, SCC42, TCC42	FCC44, SCC44, TCC44

Now for all open-loop clamp close pressure profiles, the QDC module assumes a linear relationship between clamp pressure and signal output.

Set Profile Pressure Alarms

For clamp close profiles, set your maximum pressure alarms FCC57, SCC57, and TCC57 (N43:53, 113, and 173) to a pressure that should:

- not be exceeded during the clamp close profile
- not exceed the maximum pressure control limit FCC42, SCC42, TCC42

Entering a value of zero disables this alarm.

Send new values to QDC module by downloading FCC, SCC, and TCC.

Important: If downloading from your programming terminal, download FCC, SCC, TCC, and CPC in that order with download bits B21/2, 3, 4, and 6 respectively (chapter 4).

FCC, SCC, TCC Profiles – Velocity (Flow) Valve(s)

Span your clamp close velocity (flow) valve(s) for optimum velocity performance. Do this in three parts:

- Confirm critical values
- Span your clamp close velocity (flow) valve(s)
- Test valve linearity with a velocity vs. position profile

Important: You may omit the procedure *Span your clamp close velocity (flow) valve(s)* if the recorded valve spanning data from the manufacturer for velocity control limits FCC45-48, SCC45-48, and TCC45-45 (chapter 7) are adequate for your application.

Confirm Critical Values

Important: Confirm that your entries for configuration values (chapter 7) and profile values (chapter 8) for clamp close profiles are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-Set Addr.
7-A, 7-B, 7-C	QDC module output to which you connected your selected velocity control valve	FCC02-B02,B01,B00 = your selection SCC02-B02,B01,B00 = your selection TCC02-B02,B01,B00 = your selection	B37/18, 17, 16 B37/82, 81, 80 B37/146,145,144
	Your unselected set-output values for outputs 1-4	FCC09-12 = your value SCC09-12 = your value TCC09-12 = your value	N43:5-8 N43:65-68 N43:125-128
	All ramping is disabled with zero ramp rates	FCC17-20 = FCC25-28 = 0 SCC17-20 = SCC25-28 = 0 TCC17-20 = TCC25-28 = 0	N43:13-16 N43:21-24 N43:73-76 N43:81-84 N43:133-136 N43:141-144
	Velocity limits: Minimum Control Limit Maximum Control Limit Selected Velocity Valve, Output for Min Selected Velocity Valve, Output for Max	 FCC45=SCC45=TCC45=0 FCC46=SCC46=TCC46=sys vel FCC47=SCC47=TCC47=your value FCC48=SCC48=TCC48=your value	 N43:41, 101, 161 N43:42, 102, 162 N43:43, 103, 163 N43:44, 104, 164
8-A	Selected inches/second as velocity units	CPC03-B14 = 1	B37/302
	Mold protection	CPC03-B11 = 0	B37/299
	Logical bridge	CPC03-B10 = B09 = B08 = 0	B37/298, 297, 296
	Expert Response Compensation (ERC) = Off	CPC04-B15 = B13-B08 = 1	B37/319, 317-312
	Open-loop control	CPC04-B07 = B05-B00 = 1	B37/311, 309-304
	End-of Segment position setpoints	CPC11,14,17	N43:247, 250, 253
	Start LPC position	CPC61	N43:297
	Mold Safe Position	CPC62	N43:298

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Clamp Close Velocity Valve(s)

Span your clamp close velocity valve(s) for smooth operation at highest desired clamp velocity. Do this in the following procedure by finding optimum values for:

- Minimum Pressure Control Limit FCC45, SCC45, TCC45
- Maximum Pressure Control Limit FCC46, SCC46, TCC46
- Selected Pressure Valve, Output For Minimum FCC47, SCC47, TCC47
- Selected Pressure Valve, Output For Maximum FCC48, SCC48, TCC48

Important: If your hydraulics are identical for first, second, and third clamp close, complete the procedure for first clamp close by finding values for FCC45-48 and enter the same four values for second and third clamp close, SSC45-48 and TCC45-48. If your hydraulics are different, repeat the procedure as needed.

Important: If PanelView is operational for clamp profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Obtain a copy of the flow rate curves provided by your flow valve manufacturer. The flow rate curves graphically illustrate the flow through a valve at different voltage or input current levels and at different pressure drops across the valve's spool.

2. From the above curves, determine the minimum and maximum clamp close flows available from your flow valve at the pressure you would normally run during clamp close operation. Record these flows, along with the input voltages/current associated with them.

3. Convert the minimum and maximum flow obtained from your flow curve to clamp cylinder velocity. This is done by:

$$\text{Clamp Cylinder Velocity (in/sec)} = \frac{\text{Flow (in}^3\text{/sec)}}{\text{Area (in}^2\text{)}}$$

- where area is the inside diameter of the cylinder. This area may be different for the rod and piston ends of the cylinder:

$$\text{Area (no Rod)} = \pi \left(\frac{\text{I.D. of cylinder}}{2} \right)^2$$

$$\text{Area for Rod End} = \pi \left(\frac{\text{I.D. of cylinder}}{2} \right)^2 \quad \pi \left(\frac{\text{Rod diameter}}{2} \right)^2$$

- The flow assumes no restrictions on the cylinder exhaust port.

4. Enter the minimum velocity (usually 0) from this calculation into FCC45, SCC45, and TCC45. Enter the maximum velocity into FCC46, SCC46, and TCC46.

5. Divide the voltage/current corresponding to minimum velocity by the full range of the valve(s) input signal to determine the percent signal output for minimum. Enter this value into FCC47, SCC47, TCC47.

6. Divide the voltage/current corresponding to maximum velocity by the full range of the valve(s) input signal to determine the percent signal output for maximum. Enter this value into FCC48, SCC48, TCC48.

7. Download changes in FCC, SCC, and TCC to the QDC module.

Important: If downloading from your programming terminal, download FCC, SCC, TCC, and CPC in that order (chapter 4).

To download:	Set B21/
FCC	2
SCC	3
TCC	4
CPC	6

Test Valve Linearity with a Velocity Profile

1. Select velocity vs. position control for the entire clamp close operation by resetting the following bits to zero:

- CPC03-B00 (B37/288)
- CPC03-B02 (B37/290)
- CPC03-B04 (B37/292)

2. Download the CPC block to the QDC module.

Important: If downloading from your programming terminal, download CPC by setting B21/6 (chapter 4).

3. Jog your clamp to the full open position.

4. Enable first clamp close by setting DYC02-B00 (B34/400) to 1. The clamp should move from its start position through the first clamp close and low pressure close profiles. If no motion, verify that:

- no overtravel alarms are set. The QDC module inhibits clamp close if SYS07-B00 through -B05 are set
- no programming error codes exist in SYS61 and SYS62

5. Upon completion of clamp close, observe the velocity reported for 1st clamp close segment 2 CPS12 (N43:664). This velocity should be relatively close to the setpoint you entered in CPC12 (N43:248). If the observed velocity is not within 25% of the setpoint, verify that:

- the values from your flow rate curves are correct
- your calculations are correct

If the observed velocity CPS12 is still not within 25% of CPC12, your flow valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change FCC48 (N43:44) as follows:
CPS12 was less than CPC12	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
CPS12 was more than CPC12	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change FCC48, download the FCC block, and repeat steps 3-5. Repeat as necessary.

6. Copy final FCC48 (N43:44) into SCC48 and TCC48 (N43:104 and 164), and download these changes to the QDC module.

Important: If downloading from your programming terminal, download FCC, SCC, and/or TCC followed by CPC (chapter 4).

To download:	Set B21/
FCC	2
SCC	3
TCC	4
CPC	6

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of velocity available during any clamp close profile
- end-of-range maximum and minimum signal levels for linear control of the clamp velocity valve in open-loop control.

For this range limit	When trying to obtain the velocity in:	The QDC module drives the selected velocity valve to % output signal in:
Minimum	FCC45, SCC45, TCC45	FCC47, SCC47, TCC47
Maximum	FCC46, SCC46, TCC46	FCC48, SCC48, TCC48

Now for all open-loop velocity profiles for clamp close, the QDC module assumes a linear relationship between clamp velocity and signal output.

INC Profile – Pressure Valve

Span your injection pressure valve for optimum pressure performance. You do this in four parts:

- Confirm critical values
- Span your injection pressure valve(s)
- Test valve linearity with a pressure vs. time injection profile
- Set profile pressure alarms

Important: You may omit the procedure *Span your injection pressure valve(s)* in this section if the recorded valve spanning data from the manufacturer in pressure control limits INC41-44 (chapter 7) is adequate for your application.

Confirm Critical Values

Important: Confirm that all entries you made for configuration values (chapter 7) and profile values (chapter 8) are as follows:

On Worksheet	Confirm Your Configuration	With These Words or Bits	Pro-Set Addr.
7-E, 7-G	QDC module output to which you connected your pressure control valve	INC02-B06, B05, B04	B38/20, 21, 22
	Set-output values for unselected valves	INC09-12 = your values	N44:5, 6, 7, 8
	All ramping is disabled with zero ramp rates	INC17-20 = 0 INC25-28 = 0	N44:13-16 N44:21-24
	Pressure limits: Minimum Pressure Control Limit Maximum Pressure Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 INC41 = 0 INC42 = system pressure INC43 = your value INC44 = your value	 N44:37 N44:38 N44:39 N44:40
	End-of-profile set-output values	HDC33-36 for zero output	N44:209-212
8-B, 8-C	Pressure vs Time algorithm	IPC03-B01 = B00 = 1	B38/96-97
	Open-loop control	IPC04-B03 = B02 = B01 = B00 = 1	B38/112-115
	Expert Response Compensation (ERC) = Off	IPC04-B11 = B10 = B09 = B08 = 1	B38/120-123
	Pressure setpoints	IPC10,14,18,22,26,30,34,38,42,46,50 all equal to one-half system pressure	start @ N44:66 end @ N44:106
	Time setpoints	IPC12,16,20,24,28,32,36,40,44,48 all equal to 1 second (100)	start @ N44:68 end @ N44:104
	Transition setpoints Time limit Ram (screw) position Ram (screw) pressure Cavity pressure Minimum position for pressure transition	 IPC60 = 10 seconds (1000) IPC61 = zero to inhibit IPC62 = zero to inhibit IPC63 = zero to inhibit IPC64 = zero to inhibit	 N44:116 N44:117 N44:118 N44:119 N44:120
	Logical bridge to stop and set outputs	HPC03-B08 = 1	B38/296

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Injection Pressure Valve

Span your injection valve for smooth operation at highest desired pressure. Do this in the following procedure by finding the optimum values for:

- Minimum Pressure Control Limit INC41 (N44:37)
- Maximum Pressure Control Limit INC42 (N44:38)
- Selected Pressure Valve, Output for Minimum INC43 (N44:39)
- Selected Pressure Valve, Output for Maximum INC44 (N44:40)

Important: If PanelView is operational for injection profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Manually jog your ram (screw) to the mold-end position so you can exert maximum pressure against the nozzle tip.
2. Align all other machine hydraulics to simulate injection: enable pumps and align valves to their normal injection state.
3. Copy initial values INC09-12 (N44:5-8) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero pressure into the word DYC09-12 (N40:121-124) for output 1, 2, 3, or 4 that drives the selected clamp pressure valve.

ATTENTION: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

4. Enable set-output by changing DYC01-B08 (B34/392) from 0 to 1. This forces the QDC module to apply the values in DYC09-12 directly to its outputs 1-4, respectively.

5. Adjust the set-output value DYC09-12 (N40:121-124) that corresponds to the selected ram (screw) pressure valve, and observe actual pressure reported in SYS26 (N40:178).

   - **For a bi-directional valve with a spool offset:**
     If this pressure is greater than zero, adjust the set-output value to the ram (screw) pressure valve to obtain zero pressure. Stop the adjustments when you observe the smallest pressure attainable.

   - **For a uni-directional valve with no response at low signal level:**
     If this pressure is zero, adjust the set-output value to the ram (screw) pressure valve until the observed pressure just exceeds zero. Then re-adjust this value until you just observe zero again.

   - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once satisfied that you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure observed in SYS26 into INC41 (N44:37), the minimum pressure control limit.

7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-44, (N40:193-196) that corresponds to your ram (screw) pressure valve. Copy this value into INC43 (N44:39), the selected pressure valve output for minimum.

8. Modify the value in DYC09-12 (N40:121-124) that corresponds to the ram (screw) pressure valve in 5% steps while observing rising pressure in SYS26 (N40:178). Stop adjusting it when the observed pressure no longer increases with a change in the set-output value. Now the pressure in SYS26 is the maximum obtainable pressure.

9. Copy the pressure observed in SYS26 (N40:178) into INC42 (N44:38), the maximum pressure control limit.

10. While maintaining this maximum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your ram (screw) pressure valve. Copy this value into INC44 (N44:40), the selected pressure valve output for maximum.

11. Disable set-output operation. Toggle DYC01-B08 (B34/392) to 0.

12. Download your final values for INC41-44 to the QDC module.

Important: If downloading from your programming terminal, download INC followed by IPC with download bits B21/7 and 8 (chapter 4).

Test Valve Linearity with a Pressure vs. Time Injection Profile

1. Confirm that your pressure setpoints are equal to one-half system pressure in IPC10, 14, 18, 22, 26, 30, 34, 38, 42, 46, and 50 (N44:66, 70, 74, 78, 82, 86, 90, 94, 98, 102, 106).

If not, correct them and download them to the QDC module. For instructions, refer to chapter 4.

2. Check that the ram (screw) is still at the mold-end position.

3. Run a pressure vs. time injection profile by toggling DYC02-B04 (B34/404) from 0 to 1 to 0. The ram (screw) remains fixed so it can exert pressure against the nozzle tip. If no pressure, verify that:

- no overtravel alarms are set. The QDC module inhibits injection profiles if alarm bits SYS07-B00 through -B05 are set.
- no programming error codes exist in SYS61 and SYS62.

4. The QDC module automatically runs injection, pack, and hold profiles in succession. At completion, observe the pressures reported for the middle segments in IPS22, 26, 30, and 34 (N44:614, 618, 622, and 626). If the observed pressures are not within 20% of the setpoints entered in IPC22, 26, 30, and 34, then check:

- Was your valve and solenoid alignment for the injection profile the same as for set-output ram (screw) action in the previous section? If not the same, correct and repeat steps 3 and 4.

5. If the observed actual pressures IPS22, 26, 30, and 34 are still not within 20% of IPC22, 26, 30, and 34, your pressure valve is not linear over the desired range. Correct for a non-linear valve as follows:

If actuals are at least 20%:	And Your Selected Valve is:	Then change INC44 (N44:40) as follows:
Less than setpoints	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
Greater than setpoints	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change INC44, download INC, and repeat steps 3-5. Repeat as necessary.

Important: If downloading from your programming terminal, download INC followed by IPC with download bits B21/7 and 8 (chapter 4).

What You Have Accomplished

The open-loop tuning procedure you just completed has defined the:

- range of pressure during injection
- end-of-range maximum and minimum signal levels for linear control of the injection pressure valve in open-loop control

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	INC41	INC43
Maximum	INC42	INC44

Now, for all open-loop injection pressure profiles, the QDC module assumes a linear relationship between ram pressure and signal outputs.

Set the Profile Pressure Alarm

Set the profile pressure alarm INC57 (N44:53) for the ram (screw) to a pressure that should:

- not be exceeded during the injection profile
- not exceed the maximum pressure control limit INC42 (N44:38)

Entering a value of zero disables this alarm.

Download new value to the QDC module by downloading the INC block.

Important: If downloading from your programming terminal, download INC followed by IPC with download bits B21/7 and 8 (chapter 4).

INC Profile – Velocity Valve

Span your flow valve for optimum velocity performance in three parts:

- Confirm critical values
- Span your injection flow valve
- Test valve linearity with a velocity vs. position profile

Important: You may omit the procedure *Span your injection flow valve* in this section if the recorded valve spanning data from the manufacturer in velocity control limits INC45-48 (chapter 7) are adequate for your application.

Confirm Critical Values

Confirm that all entries you made for configuration values (chapter 7) and profile values (chapter 8) are correct for the velocity vs. position profile.

Important: Use the following configuration and profile values:

On Worksheet	Confirm Your Configuration	With These Words or Bits	Pro-Set Addr.
7-E, 7-G	QDC module output to which you connected your flow control valve	INC02-B02, B01, B00 your selection	B38/16, 17, 18
	Set-output values for outputs to unselected valves	INC09-12 = your values	N44:5, 6, 7, 8
	All ramping is disabled with zero ramp rates	INC17-20 = 0 INC25-28 = 0	N44:13-16 N44:21-24
	Velocity limits: Minimum Velocity Control Limit Maximum Velocity Control Limit Selected Velocity Valve, Output for Min Selected Velocity Valve, Output for Max	 INC45 = 0 INC46 = max velocity per valve specs INC47 = your value INC48 = your value	 N44:41 N44:42 N44:43 N44:44
	End-of-profile set-output values	HDC33-36 for zero output	N44:209-212
8-B, 8-C	Velocity units are inches (mm)/sec	IPC03-B14 = 1	B38/110
	Open-loop control	IPC04-B03 = B02 = B01 = B00 = 1	B38/112-115
	Expert Response Compensation (ERC) = Off	IPC04-B11 = B10 = B09 = B08 = 1	B38/120-123
	Velocity setpoints	IPC09,13,17,21,25,29,33,37,41,45,49 all equal to max velocity per valve specs	start @ N44:65 end @ N44:105
	End-of segment position setpoints	IPC11, 15, 19, 23, 27, 31, 35, 39, 43, 47, equal segments over length of travel	start @ N44:67 end @ N44:103
	Logical bridge to stop and set outputs	HPC03-B08 = 1	B38/296

Set New Values for the Velocity vs. Position Profile

If necessary, refer to chapter 8 for when you determine the following:

8-B	Velocity vs. position algorithm	IPC03-B01 = B00 = 0	B38/96, 97
	Transition setpoints:		
	Time limit	IPC60 = above typical	N44:116
	Ram (screw) position	IPC61 = estimated top of cushion	N44:117
	Ram (screw) pressure	IPC62 = below mold flash pressure	N44:118
	Cavity pressure	IPC63 = zero to inhibit	N44:119
	Minimum position for pressure transition	IPC64 = zero to inhibit	N44:120

Download new values to the QDC module by downloading INC.

Important: If downloading from your programming terminal, download INC followed by IPC (chapter 4).

To download:	Set: B21/
INC	7
IPC	8

Span Your Injection Velocity Valve

Span your injection valve for smooth operation at the highest desired velocity. Do this by finding optimum values for these words:

- Minimum Velocity Control Limit INC45 (N44:41)
- Maximum Velocity Control Limit INC46 (N44:42)
- Selected Velocity Valve, Output for Minimum INC47 (N44:43)
- Selected Velocity Valve, output for maximum INC48 (N44:44)

Important: If PanelView is operational for injection profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

Find optimum values for INC46, 48

1. Jog the ram (screw) all the way to the backpoint position.

2. Set machine hydraulics to simulate injection. Enable pumps and align valves to their normal state during injection.

3. Run an open-loop velocity vs. position injection profile by toggling DYC02-B04 (B34/404) from 0 to 1 to 0.

4. The QDC module automatically runs the injection, pack, and hold profiles in succession. At completion, observe the maximum segment velocity reported by the QDC module in IPS09, 13, 17, 21, 25. . . (N44:601, 605, 609, 613, 617, 621, 625, 629, 632, 637, or 641) for all segments of the profile. Record the highest reported velocity.

5. With your programming terminal, enter the highest velocity from step 4 into INC46 (N44:42) the maximum velocity control limit.

6. Change all profile velocity setpoints to the value in INC46. Do this in IPC09, 13, 17, 21, 25, 29, 33, 37, 41, 45, and 49 (N44:65, 69, 73, 77, 81, 85, 89, 93, 97, 101, and 105).

7. Download these values to the QDC module.

Important: If downloading from your programming terminal, download INC first, followed by IPC (chapter 4).

To download :	Set: B21/
INC	7
IPC	8

8. Re-run the profile and verify that segment velocity actuals are about equal to segment setpoints.

9. Modify (in the proper direction for flow reduction) the value in INC48 (N44:44) in 5% increments until you observe the highest velocity referred to in step 4. To do this, enter a new value in INC48 and repeat steps 7, 3, 4, and 9 as needed. INC48 is the selected velocity valve, output for maximum.

10. After reaching the point where the maximum velocity starts to decrease, change the signal in INC48 just enough to restore the highest velocity referred to in step 4. Enter a new INC48 and repeat steps 7, 3, and 4 one last time.

Determine the Optimum Value for INC47

11. Enter new velocity setpoints equal to 1/10 maximum velocity (0.10 times the velocity in INC48) in these words:
IPC09, 13, 17, 21, 25, 29, 33, 37, 41, 44, and 49
(N44:65, 69, 73, 77, 81, 85, 89, 93, 97, 101, and 105)

12. Download the INC and IPC blocks to the QDC module.

Important: If downloading from your programming terminal, download INC followed by IPC (chapter 4).

To download	Set B21/
INC	7
IPC	8

13. Run another open-loop velocity vs. position profile. Do this by toggling DYC02-B04 (B34/404) from 0 to 1 to 0.

14. The QDC module automatically runs the injection, pack, and hold profiles in succession. At completion, observe the actual segment velocities reported by the QDC module in IPS09, 13, 17, 21, 25 . . . (N44:601, 605, 609, 613, 617, 621, 625, 629, 633, 637, and 641) for all segments of the profile. Expect about 10% of maximum.

If observed velocities are at least 20%:	Then change INC47 (N44:43) as follows:
Greater than or equal to setpoints in step 1	Make no further adjustments at this time.
Below setpoints in step 1	Modify the signal in 5% steps until actual velocities equal setpoints in step 1. To do this, enter a new value in INC47 and repeat steps 12-14 as needed.

15. After reaching the point where minimum velocities start to exceed setpoints in step 11, change the signal in INC47 just enough so actual velocities equal setpoints in step 11. To do this, enter a final INC47 and repeat steps 12-14 one last time.

Test Valve Linearity with a Velocity vs. Position Profile

1. Change your velocity setpoints to one-half maximum velocity (0.5 times the velocity in INC48) in these words:
IPC09, 13, 17, 21, 25, 29, 33, 37, 41, 45, and 49
(N44:65, 69, 73, 77, 81, 85, 89, 93, 97, 101, 105).

Important: Be sure the correct pump adders are set for this velocity.

2. Download the INC and IPC data blocks to the QDC module.

Important: If downloading from your programming terminal, download INC followed by IPC (chapter 4).

To download	Set B21/
INC	7
IPC	8

3. Run an open-loop velocity vs. position profile. Do this by toggling DYC02-B04 (B34/404) from 0 to 1 to 0.

4. The QDC module automatically runs the injection, pack, and hold profiles in succession. At completion, observe the actual segment velocities reported by the QDC module in mid-profile segments 5, 6, and 7 in IPS25, 29, and 33 (N44:617, 621, and 625).

If they are not within 20% of mid-profile velocity setpoints IPC25, 29, and 33, your flow valve is not linear over the desired range of operation. Correct for a non-linear valve by adjusting as follows:

If observed velocity is 20% or more:	And Your Selected Valve is:	Then change INC47 (N44:43) as follows:
Below setpoints	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
Above setpoints	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change INC47, download INC and IPC blocks, and repeat steps 2-4. Repeat as necessary.

What You Have Accomplished

The valve-spanning procedure you just completed has defined the:

- range of ram (screw) velocity during any injection profile
- end-of-range maximum and minimum signal levels for linear control of the injection velocity valve in open-loop control

For this range limit	When trying to obtain the velocity in:	The QDC module drives the selected velocity valve to % output signal in:
Minimum	INC45	INC47
Maximum	INC46	INC48

Now for all open-loop injection velocity profiles, the QDC module assumes a liner relationship between ram velocity and signal output.

Note that there are no velocity profile alarms.

PKC and HDC Profiles – Pressure Valves

We recommend that you span your pack and hold pressure valves for optimum pressure performance in four parts:

- Confirm critical values
- Span your pack and hold pressure valves
- Test valve linearity with a pressure vs. time profile
- Set profile pressure alarms

Important: You may omit the procedure *Span your pack and hold pressure valves* in this section if the recorded valve spanning data from the manufacturer in pressure control limits PKC41-44 and HDC41-44 (chapter 7) are adequate for your application.

Important: If your machine hydraulics for pack and hold are identical to those for injection, you may use your injection pressure valve spanning parameters for pack and hold. If so, enter your values for INC41-44 into PKC41-44 and into HDC41-44, and skip to Set Profile Pressure Alarms.

Confirm Critical Values

Important: Confirm that all entries you made for configuration values (chapter 7) and profile values (chapter 8) are as follows:

On Worksheet	Confirm Your Configuration	With These Words or Bits for Pack Pressure	Pro-Set Addr
7-F	QDC module output to which you connected your pressure control valve	PKC02-B06, B05, B04	B38/148-150
	Set-output values for unselected valves	PKC09-12 = your values	N44:125-128
	All ramping is disabled with zero ramp rates	PKC17-20 = 0 PKC25-28 = 0	N44:133-136 N44:141-144
	Pressure limits: Minimum Pressure Control Limit Maximum Pressure Control Limit Selected Pressure Valve, Output for Minimum Selected Pressure Valve, Output for Maximum	 PKC41 = 0 PKC42 = system pressure PKC43 = your value PKC44 = your value	 N44:157 N44:158 N44:159 N44:160
7-G	QDC module output to which you connected your pressure control valve	HDC02-B06, B05, B04	B38/212-214
	Set-output values for unselected valves	HDC09-12 = your values	N44:185-188
	All ramping is disabled with zero ramp rates	HDC17-20 = 0 HDC25-28 = 0	N44:193-196 N44:201-204
	End-of-profile set-output values	HDC33-36 for zero output	N44:209-212
	Pressure limits: Minimum Pressure Control Limit Maximum Pressure Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 HDC41 = 0 HDC42 = system pressure HDC43 = your value HDC44 = your value	 N44:217 N44:218 N44:219 N44:220

On Worksheet	Confirm Your Configuration	With These Words or Bits for Hold Pressure	Pro-Set Addr
8-C	Pressure vs Time algorithm for Pack and Hold	HPC03-B02 = B00 = 0	B38/288, 290
	Logical bridge to stop and set outputs before: pre-decompression plastication	 HPC03-B08 = 1 HPC03-B09 = 1	 B38/296 B38/297
	Open-loop control	HPC04-B03, B02, B01, B00 = 1	B38/304-307
	Expert Response Compensation (ERC) = Off	HPC04-B11, B10, B09, B08 = 1	B38/312-315
	Pressure setpoints	HPC10,13,16,19,22,27,30,33,36, 39 all equal full injection pressure	start @ N44:246 end @ N44:275
	Time setpoints	HPC11,14,17,20,23,28,31,34,37 40 all equal to 1 second (100)	start @ N44:247 end @ N44:276

If these are not your current values, we suggest that you correct them now and download them using the download procedure discussed in chapter 4.

Before proceeding, observe these warnings:

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

Span Your Pack and Hold Pressure Valves

Span your pack valve for smooth operation at the highest desired pressure. Do this in the following procedure by finding optimum values for words:

Title of Word	Pack Word (Address)	Hold Word (Address)
Minimum Pressure Control Limit	PKC41 (N44:157)	HDC41 (N44:217)
Maximum Pressure Control Limit	PKC42 (N44:158)	HDC42 (N44:218)
Selected Pressure Valve, Output for Minimum	PKC43 (N44:159)	HDC43 (N44:219)
Selected Pressure Valve, Output for Maximum	PKC44 (N44:160)	HDC44 (N44:210)

Important: If using the same valve for pack and hold with similar values in PKC and HDC, span this valve for pack and hold at the same time. When you enable the pack profile, the QDC module automatically runs the pack and hold profiles in succession. If using different valves for pack and hold or substantially different hydraulic circuit during the profiles, span the pack valve first. Then repeat the procedure for the hold valve.

Important: If PanelView is available for pack and hold profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

1. Manually jog your ram (screw) to the mold-end position so you can exert maximum pressure against the nozzle tip.
2. Align all other machine hydraulics to simulate pack and hold: enable pumps and align valves to their normal state for pack or hold.
3. Copy initial values PKC09-12 (N44:125-128) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero pressure into the word DYC09-12 (N40:121-124) for output 1, 2, 3, or 4 that drives the selected ram (screw) pressure valve.

ATTENTION: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may allow pressure or flow at 0 volts.

4. Enable set-output by changing DYC01-B08 (B34/392) from 0 to 1. This forces the QDC module to apply the values in DYC09-12 directly to its outputs 1-4, respectively.

5. Adjust the value of DYC09-12 (N40:121-124) that corresponds to the selected pressure valve, and observe actual pressure reported in SYS26 (N40:178).

   - **For a bi-directional valve with a spool offset**:
     If this pressure is greater than zero, adjust the set-output value to the pressure valve to obtain zero pressure. Stop adjusting when you observe the smallest pressure attainable.

   - **For a uni-directional valve with no response at low signal level**:
     If this pressure is zero, adjust the set-output value to the pressure valve until the observed pressure just exceeds zero. Then re-adjust this value until you just observe zero again.

   - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once satisfied that you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the actual pressure observed in SYS26 into the minimum pressure control limit: PKC41 (N44:157) for pack, HDC41 (N44: 217) for hold.

7. While maintaining this minimum pressure, observe the actual set-output value SYS41-44 (N40:193-196) that corresponds to your pressure valve. Copy this value into the selected pressure valve, output for minimum: PKC43 (N44:159) for pack, HDC43 (N44:219) for hold.

8. Modify the value in DYC09-12 (N40:121-124) that corresponds to the pressure valve in 5% steps while observing rising pressure in SYS26 (N40:178). Stop adjusting it when the observed pressure no longer increases with a change in the set-output value. Now the pressure in SYS26 is the maximum obtainable pressure.

9. Copy the pressure in SYS26 (N44:178) into the maximum pressure control limit: PKC42 (N44:158) for pack, HDC42 (N44:218) for hold

10. While maintaining this maximum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected pressure valve. Copy this value into the selected pressure valve, output for maximum: PKC44 (N44:160) for pack, HDC44 (N44:220) for hold.

11. Disable set-output operation. Toggle DYC01-B08 (B34/392) to 0.

12. Download your final values for PKC41-44 and HDC41-44 to the QDC module by downloading the PKC block.

Important: If downloading from your programming terminal, download PKC and HDC, followed by HPC (chapter 4).

To download	Set B21/
PKC	9
HDC	10
HPC	11

Test Valve Linearity with a Pressure vs. Time Profile

After you span the pressure valve for ram (screw) pack and hold, test linearity for pack and hold profiles with this procedure:

1. Confirm that pressure setpoints equal full injection pressure:
for pack: HPC10, 13, 16, 19, 22 (N44:246, 249, 252, 255, 258)
for hold: HPC27, 30, 33, 36, 39 (N44:263, 266, 269, 272, 275)

If not, correct them and download them to the QDC module. For instructions, refer to chapter 4.

2. Check that the ram (screw) is still at the mold-end position.

3. Run the pressure vs. time pack profile by toggling DYC02-B05 (B34/405) from 0 to 1 to 0. The ram (screw) remains fixed so it can exert pressure against the nozzle tip. If no pressure, verify that:

- no ram (screw) overtravel alarms are set. The QDC module inhibits injection profiles if alarm bits SYS07-B00 through SYS07-B05 are set.
- no programming error codes exist in SYS61 and SYS62.

4. The QDC module automatically runs pack and hold profiles in succession. At completion, observe the pressures reported for the middle segment pressure in HPS16 (N44:664) for pack and HPS33 (N44:681) for hold.

5. If observed pressures are not within 20% of entered setpoints, check that valve and solenoid alignment for the profile is the same as for set-output (previous procedure). If not, correct. Repeat steps 3 and 4.

6. If the observed pressure HPS16 for pack and HPS33 for hold are still not within 20% of setpoints HPC16 and HPC33, your pressure valve is not linear over the desired range. Correct by adjusting the selected pressure valve, output for minimum PKC43 and HDC43 as follows:

If actuals are at least 20%:	And Your Selected Valve is:	Then change PKC43, HDC43 (N44:159, N44:219) as follows
Less than setpoints	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
Greater than setpoints	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change PKC43 and HDC43, download PKC and HDC, and repeat steps 3 and 4. Repeat as needed.

Important: If downloading from your programming terminal, download PKC, HDC, and HPC in that order with bits B21/9, 10, and 11 (chapter 4).

What You Have Accomplished

The open-loop tuning procedure you just completed has defined the:

- range of pressure during pack and hold
- end-of-range maximum and minimum signal levels for linear control of the pack and hold pressure valve in open-loop control

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	PKC41 or HDC41	PKC43 or HDC43
Maximum	PKC42 or HDC42	PKC44 or HDC44

Now for all open-loop pack or hold pressure profiles, the QDC module assumes a linear relationship between ram pressure and signal outputs.

Set Profile Pressure Alarms

Set profile maximum pressure alarm setpoints PKC57 (N44:173) for pack and HDC57 (N44:233) for hold to a pressure that should:

- not be exceeded during either profile
- not be greater than maximum pressure control limits PKC42, HDC42

Entering a value of zero disables these alarms.

Download new values to the QDC module by downloading PKC, HDC.

Important: If downloading from your programming terminal, download PKC, HDC, and HPC in that order with bits B21/9, 10, and 11 (chapter 4).

PLC Profile – Pressure Valve

We recommend that you span your plastication pressure valve for optimum plastication performance in four parts:

- Confirm critical values
- Span your plastication pressure valve
- Test valve linearity with a plastication backpressure vs. position profile
- Set the profile pressure alarm

Important: You may omit the procedure *Span your plastication pressure valve* in this section if the recorded valve spanning data from the manufacturer in pressure control limits PLC41-44 (chapter 7) are adequate for your application.

Confirm Critical Values

Important: Confirm that all entries you made for configuration values (chapter 7) and profile values (chapter 8) are as follows:

On Worksheet	Confirm Your Configuration	With These Words or Bits	Pro-Set Addr
7-H	QDC module output to which you connected your plastication pressure control valve	PLC02-B06, B05, B04	B38/404-406
	Set-output values for unselected valves	PLC09-12 = your values	N44:365-368
	All ramping is disabled with zero ramp rates	PLC17-20 = 0 PLC25-28 = 0	N44:373-376 N44:381-384
	End-of-profile Set-output values	PLC33-36 for zero output	N44:389-392
	Pressure limits: Minimum Pressure Control Limit Maximum Pressure Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 PLC41 = 0 PLC42 = max attainable backpressure PLC43 = your value PLC44 = your value	 N44:397 N44:398 N44:399 N44:400
8-D	Backpressure vs Position algorithm	PPC03-B00 = 0	B38/480
	Logical bridge to stop and set outputs before post-decompression	PPC03-B08 = 1	B38/488
	Open-loop control	PPC04-B01 = B00 = 1	B38/496, 497
	Expert Response Compensation (ERC) = Off	PPC04-B09 = B08 = 1	B38/504, 505
	Backpressure setpoints	PPC10,14, 18, 22, 26, 30, 34, 38, 42, 46, 50 all equal to max desired backpressure	start @ N44:426 end @ N44:466
	Position setpoints	PPC11,15,19,23,27,31,35,39,43,47 equal segments over shot size	start @ N44:427 end @ N44:463
	Shot size	PPC62 = typical for your machine	N44:478

If these are not your current values, we suggest that you correct them now and download them using the download procedure discussed in chapter 4.

Before proceeding, observe these warnings:

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

ATTENTION: Load the hopper with plastic before starting this procedure. Absence of plastic during plastication:

- nullifies this procedure
- may cause excessive wear to the barrel and ram (screw)

Span Your Plastication Backpressure Valve

Span your plastication valve for smooth operation at the highest desired backpressure. Do this by finding the optimum values for these words:

- Minimum Pressure Control Limit PLC41 (N44:397)
- Maximum Pressure Control Limit PLC42 (N44:398)
- Selected Pressure Valve, Output for Minimum PLC43 (N44:399)
- Selected Pressure Valve, Output for Maximum PLC44 (N44:400)

Important: If PanelView is operational for injection profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

1. Jog your ram (screw) to the mold-end position.

2. Set machine hydraulics to simulate ram (screw) backpressure: enable pumps and align valves to normal state during plastication.

Important: Move injection carriage up to mold block to build pressure.

3. While observing actual pressure in SYS26 (N40:178) and the output in SYS41-44 (N40:193-196) that corresponds to the selected plastication valve, run a plastication backpressure vs. position profile. Do this by toggling DYC04-B08 (B34/408) from 0 to 1 to 0.

4. With your programming terminal, record:

- maximum profile backpressure displayed in SYS26 (N40:178)
  Record here a) _____
- %-output signal in SYS41-44 (N40:193-196) corresponding to the ram (screw) plastication valve
  Record here b)_____

5. Compute the signal level required for the Selected Pressure Valve, Output for Maximum PLC44 as follows:

$$PLC44 = \frac{(\text{Max desired backpressure}) \times (\text{Observed \%-signal output in SYS41-44 that corresponds to the ram plastication valve})}{(\text{Observed Pressure in SYS26})}$$

Important: If your valve is reverse acting, apply the algebraic sign (–) of value b correctly when computing PLC44.

$$PLC44 = \frac{(\text{PPC10}) \times (\text{Your recorded value b})}{(\text{Your recorded value a})}$$

PLC44 = _____ For example, 1000 for 10%

6. Enter new values into the PLC data table:

- value from step 5 into PLC44 (N44:400)
- maximum desired backpressure PPC10 from step 5 into PLC42 (N44:398)

7. Download the PLC block to the QDC module.

Important: If downloading from your programming terminal, download PLC followed by PPC with download bits B21/13 and 14 (chapter 4).

8. Run an open-loop backpressure vs. position profile. Do this by toggling DYC02-B08 (B34/408) from 0 to 1 to 0.

9. Observe and record actual backpressures reported by the QDC module for all profile segments in PPS10, 14, 18, 22, 26, 30, 34 etc. (N44:714, 718, 722, 726, 730, 734, 738, 742, 746, 750, 754).

10. Compare actual backpressures with your setpoints in PPC10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50 as follows:

If	Then
Actuals are greater than setpoints by 20% or more	1. Decrease PLC44 by 10%. 2. Enter this new value into PLC data table. 3. Repeat the profile with steps 7-9. 4. Repeat these adjustments until actuals just drop below setpoints.
Actuals are less than setpoints by 20% or more	1. Increase PLC44 by 10%. 2. Enter this new value into PLC data table. 3. Repeat the profile with steps 7-9. 4. Repeat these adjustments until actuals are equal to or greater than setpoints.
Actuals are less than setpoints by 20% **and** PLC44 = 100%	1. Decrease PLC42 by 10%. 2. Enter this new value into PLC data table. 3. Repeat the profile with steps 7-9. 4. Repeat these adjustments until actuals are equal to or greater than setpoints.

Test Valve Linearity with a Plastication Backpressure Profile

1. Change backpressure setpoints to 1/2 PLC44 (1/2 Max Control Limit) in PPC10, 14, 18, 22, 26, 30, 34, 38, 42, 46, and 50 (in N44:426, 430, 434, 438, 442, 446, 450, 454, 458, 462, 466).

2. Download the PLC block to the QDC module.

Important: If downloading from your programming terminal, download PLC followed by PPC with download bits B21/13 and 14 (chapter 4).

3. Run an open-loop backpressure vs. position profile. Do this by toggling DYC02-B08 (B34/408) from 0 to 1 to 0.

4. Compare backpressures reported in middle segments 5, 6, and 7 in PPS26, 30, 34 (N44:730, 734, 738) with setpoints PLC26, 30, and 34. Adjust PLC41 or PLC43 as follows:

If actual backpressures are:	And Your Selected Valve is:	Then change PLC41 or 43 (N44:397 or 399) as follows:
Greater than or equal to setpoints	Either one	Increase PLC41 in 5% steps
Less than setpoints	Direct Acting	Increase PLC43 n 5% steps
	Reverse Acting	Decrease PLC43 in 5% steps

To do this: change PLC41 and/or PLC43, download the block, and repeat steps 2-4. Repeat as necessary.

Important: If downloading from your programming terminal, download PLC followed by PPC with download bits B21/13 and 14 (chapter 4).

What You Have Accomplished

The open-loop tuning procedure you just completed has defined the:

- range of ram (screw) backpressure during plastication
- end-of-range maximum and minimum signal levels for linear control of the plastication pressure valve in open-loop control

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	PLC41	PLC43
Maximum	PLC42	PLC44

Now for open-loop plastication profiles, the QDC module assumes a liner relationship between backpressure and signal output.

Set the Profile Pressure Alarm

Set the maximum pressure alarm PLC57 (N44:413) equal to a back-pressure that should:

- not be exceeded during the plastication profile
- not be greater than PLC42 (N44:398) maximum pressure control limit

Entering zero disables this alarm.

Download the PLC block to the QDC module.

Important: If downloading from your programming terminal, download PLC followed by PPC with download bits B21/13 and 14 (chapter 4).

FOC, SOC, TOC, OSC Profiles – Pressure Valve(s)

Span your clamp open pressure valve(s) for optimum performance. Do this in four parts:

- Confirm critical values
- Span your clamp open pressure valve(s)
- Test valve linearity
- Set profile pressure alarms

Important: You may omit the procedure *Span your clamp open pressure valve(s)* in this section if the recorded valve spanning data from the manufacturer for pressure control limits FOC41-44, SOC41-44, TOC41-44, and OSC41-44 (chapter 7) are adequate for your application.

Confirm Critical Values

Important: Confirm that your entries for configuration values (chapter 7) and profile values (chapter 8) for clamp open profiles are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-set Addr:
7-I, 7-J, 7-K, 7-L	QDC module output to which you connected your selected pressure control valve	FOC02-B06, B05, B04 = your selection SOC02-B06, B05, B04 = your selection TOC02-B06, B05, B04 = your selection OSC02-B06, B05, B04 = your selection	B37/342, 341, 340 B37/406, 405, 404 B37/470, 469, 468 B37/534, 533, 532
	Your unselected set-output values for outputs 1-4	FOC09-12 = your selection SOC09-12 = your selection TOC09-12 = your selection OSC09-12 = your selection	N43:305-308 N43:365-368 N43:425-428 N43:485-488
	All ramping is disabled with zero ramp rates	FOC17-20 = FOC25-28 = 0 SOC17-20 = SOC25-28 = 0 TOC17-20 = TOC25-28 = 0 OSC17-20 = OSC25-28 = 0	N43:313-316 N43:321-324 N43:373-376 N43:381-384 N43:433-436 N43:441-444 N43:493-496 N43:501-504
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 FOC41=SOC41=TOC41=OSC41=0 FOC42=SOC42=TOC42=OSC42=sys press FOC43=SOC43=TOC43=OSC43=your value FOC44=SOC44=TOC44=OSC44=your value	 N43:337, 397, 457, 517 N43:338, 398, 458, 518 N43:339, 399, 459, 519 N43:340, 400, 460, 520
8-E	Mold Protection – start open slow on overrun	OPC03-B11 = 0	B37/619
	Logical bridge – start next profile	OPC03-B10 = B09 = B08 = 0	B37/618, 617, 616
	Pressure vs. Position control	OPC03-B06 = 04 = 02 = 00 = 1	B37/614, 612, 610, 608
	Expert Response Compensation (ERC) = Off	OPC04-B15 – B08 = 1	B37/639-632
	Open-loop control	OPC04-B07 – B00 = 1	B37/631-624
	FOC segment pressures	OPC10, 13, 16 = your values	N43:546, 549, 552
	FOC end-of-segment position setpoints	OPC11, 14, 17 = your values	N43:547, 550, 553
	Start OSC position setpoint	OPC61 = your value	N43:597
	Mold full open position setpoint	OPC62 = your value	N43:598

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Clamp Open Pressure Valve(s)

Span your clamp pressure valve for smooth operation at highest desired clamp open pressure. Do this in the following procedure by finding optimum values for:

- Minimum Pressure Control Limit FOC41, SOC41, TOC41, and OSC41
- Maximum Pressure Control Limit FOC42, SOC42, TOC42, and OSC42
- Selected Pressure Valve, Output For Minimum
  FOC43, SOC43, TOC43, and OSC43
- Selected Pressure Valve, Output For Maximum
  FOC44, SOC44, TOC44, and OSC44

Important: If your machine hydraulics are identical for all clamp open and open slow profiles, complete the procedure for first clamp open by finding values for FOC41-44, and copy them into the other clamp open profile words SOC41-44, TOC41-44, and OSC41-44 when told. Otherwise, repeat the procedure as needed.

Important: If PanelView is operational for clamp profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Jog your clamp to the full open position.
2. Align all other machine hydraulics to simulate clamp open motion. For example, enable required pumps and align required valves.
3. Copy initial values from FOC09-12 (N43:305-308) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero pressure into the word DYC09-12 for output 1, 2, 3, or 4 that drives the selected clamp pressure valve.

ATTENTION: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

4. Enable set-output by transitioning DYC01-B08 (B34/392) to 1. This forces the QDC module to apply the values in DYC09-12 directly to its outputs 1-4, respectively.

5. Adjust the set-output value DYC09-12 (N40:121-124) that corresponds to the selected clamp open pressure valve, and observe the pressure reported in SYS26 (N40:178).

- **For a bi-directional valve with a spool offset:**
  If this pressure is greater than zero, adjust the selected valve set-output value to obtain zero pressure. Stop adjusting it when you observe the smallest pressure attainable.

- **For a uni-directional valve with no response at low signal level:**
  If this pressure is zero, adjust the selected valve set-output value until the observed pressure just exceeds zero. Then re-adjust it until you just observe zero again.

- **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once you are satisfied you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure observed in SYS26 (N40:178), (usually 0 PSI or Bar) into FOC41, SOC41, TOC41, and OSC41 (N43:337, 397, 457, and 517), the minimum pressure control limits.

7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected clamp open pressure valve. Copy this value into FOC43, SOC43, TOC43, and OSC43 (N43:339, 399, 459, and 519), the selected pressure valve output for minimum.

8. Change the set-output value in DYC09-12 (N40:121-124) that corresponds to the clamp open pressure valve by 50%, and then in 5% steps while observing the clamp pressure in SYS26 (N40:178). Stop adjusting it when the observed pressure no longer increases with an increase in the set-output value. Now the pressure in SYS26 (N40:178) is the maximum obtainable clamp open pressure.

9. Copy this observed maximum pressure from SYS26 (N40:178) into FOC42, SOC42, TOC42, and OSC42 (N43:338, 398, 458, and 518), the maximum pressure control limits.

10. While maintaining this maximum pressure, observe the actual set-output value in the SYS41-44 (N40:193-196) that corresponds to your selected clamp open pressure valve. Copy this value into FOC44, SOC44, TOC44, and OSC44 (N43:340, 400, 460, and 520), the selected pressure valve, output for maximum.

11. Lower the set-output value in DYC09-12 corresponding to the selected clamp open pressure valve to a safe level.

12. Disable set-output by transitioning DYC01-B08 (B34/392) to 0.

13. Download the changes FOC, SOC, TOC, OSC to the QDC module.

Important: If downloading from your programming terminal, you must download FOC, SOC, TOC, OSC, and OPC in that order (chapter 4).

To download:	Set: B21/
FOC	16
SOC	17
TOC	18
OSC	19
OPC	20

Test Valve Linearity with a Clamp Open Pressure Profile

1. Jog your clamp to the fully open position.

2. Enable first clamp open by setting DYC02-B10 (B34/410) = 1. The clamp should move from its start position through the first clamp open and open slow profiles. If no motion, verify that:

- no overtravel alarms are set. The QDC module inhibits clamp open if SYS07-B00 through SYS07-B05 are set
- no programming error codes exist in SYS61 and SYS62

3. Upon completion of clamp open, observe the pressure reported for 1st clamp open segment 2 (OPS13, N43:721). If the observed pressure is not about equal to the setpoint you entered in OPC13, then check:

- was your valve and solenoid alignment the same for clamp open profile execution and clamp open action in set-output?

If the observed pressure OPS13 is still not within 20% of OPC13, your pressure is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change FOC44 (N43:340) as follows:
OPS13 was less than OPC13	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
OPS13 was more than OPC13	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change FOC44, download the FOC block, and repeat steps 1-3. Do this as necessary.

Important: If downloading from your programming terminal, download FOC followed by OPC with download bits B21/16 and 20 (chapter 4).

4. Copy final FOC44 (N43:340) into SOC44, TOC44 and OSC44 (N43:400, 460, and 520), and download these changes.

Important: If downloading from your programming terminal, download FOC, SOC, TOC and/or OSC followed by OPC (chapter 4).

To download:	Set B21/
FOC	16
SOC	17
TOC	18
OSC	19
OPC	20

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during any clamp open profile
- end-of-range maximum and minimum signal levels for linear control of the clamp open pressure valve in open-loop control.

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	FOC41,SOC41,TOC41,OSC41	FOC43, SOC43, TOC43, and OSC43
Maximum	FOC42,SOC42,TOC42,OSC42	FOC44, SOC44, TOC44, and OSC44

Now, for all open-loop pressure profiles for clamp open, the QDC module assumes a linear relationship between clamp pressure and signal output.

Set Profile Pressure Alarms

For clamp open profiles, set the maximum pressure alarm (FOC57, SOC57, TOC57, OSC57) to a pressure value that should:

- not be exceeded during the clamp profile
- not exceed the max pressure control limit
  FOC42, SOC42, TOC42, and OSC42

Entering a value of zero disables these alarms.

Download new values to the QDC module.

Important: If downloading from your programming terminal, download FOC, SOC, TOC, OSC, and OPC in that order (chapter 4):

To download	Set B21/
FOC	16
SOC	17
TOC	18
OSC	19
OPC	20

FOC, SOC, TOC, OSC Profiles – Velocity (Flow) Valve(s)

Span your clamp open velocity (flow) valve(s) for optimum velocity performance. Do this in three parts:

- Confirm critical values
- Span your clamp open velocity (flow) valve(s)
- Test valve linearity

Important: You may omit the procedure *Span your clamp open velocity (flow) valve(s)* in this section if the recorded valve spanning data from the manufacturer for velocity control limits FCC45-48, SCC45-48, TCC45-48, and OSC45-48 (chapter 7) are adequate for your application.

Confirm Critical Values

Important: Confirm that your entries you configuration values (chapter 7) and profile values (chapter 8) are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-set Addr:
7-I, 7-J, 7-K, 7-L	QDC module output to which you connected your selected velocity control valve	FOC02-B02, B01, B00 = your selection SOC02-B02, B01, B00 = your selection TOC02-B02, B01, B00 = your selection OSC02-B02, B01, B00 = your selection	B37/338, 337, 336 B37/402, 401, 400 B37/466, 465, 464 B37/530, 529, 528
	Your unselected set-output values for outputs 1-4	FOC09-12 = your value SOC09-12 = your value TOC09-12 = your value OSC09-12 = your value	N43:305-308 N43:365-368 N43:425-428 N43:485-488
	All ramping is disabled with zero ramp rates	FOC17-20 = FOC25-28 = 0 SOC17-20 = SOC25-28 = 0 TOC17-20 = TOC25-28 = 0 OSC17-20 = OSC25-28 = 0	N43:313-316 N43:321-324 N43:373-376 N43:381-384 N43:433-436 N43:441-444 N43:493-496 N43:501-504
	Velocity limits: Minimum Control Limit Maximum Control Limit Selected Velocity Valve, Output for Min Selected Velocity Valve, Output for Max	 FOC45=SOC45=TOC45=OSC45=0 FOC46=SOC46=TOC46=OSC46=sys vel FOC47=SOC47=TOC47=OSC47=your value FOC48=SOC48=TOC48=OSC48=your value	 N43:341, 401, 461, 521 N43:342, 402, 462, 522 N43:343, 403, 463, 523 N43:344, 404, 464, 524
8-E	Select inches/second for velocity units	OPC03-B14 = 1	B37/622
	Zone overrun – start open slow on overrun	OPC03-B11 = 0	B37/619
	Logical bridge – start next profile	OPC03-B10 = B09 = B08 = 0	B37/618, 617, 616
	Expert Response Compensation (ERC) = Off	OPC04-B15 – B08 = 1	B37/639-632
	Open-loop control	OPC04-B07 – B00 = 1	B37/631-624
	FOC segment velocities	OPC09, 12, 15 = your values	N43:545, 548, 551
	FOC end-of-segment position setpoints	OPC11, 14, 17 = your values	N43:547, 550, 553
	Start OSC position setpoint	OPC61 = your value	N43:597
	Mold open position setpoint	OPC62 = your value	N43:598

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Clamp Open Velocity Valve(s)

Span your clamp open velocity valve(s) for smooth operation at highest velocity. Do this in the following procedure by finding optimum values for:

- Minimum Velocity Control Limit FOC45, SOC45, TOC45, OSC45
- Maximum Velocity Control Limit FOC46, SOC46, TOC46, OSC45
- Selected Velocity Valve, Output For Minimum
  FOC47, SOC47, TOC47, OSC45
- Selected Velocity Valve, Output For Maximum
  FOC48, SOC48, TOC48, OSC45

Important: If your machine hydraulics are identical for all clamp open and open slow profiles, complete the procedure for first clamp open by finding values for FOC45-48, and copy them into the other clamp open profile words SOC45-48, TOC45-48, and OSC45-48 when told. Otherwise, repeat the procedure as needed.

Important: If PanelView is operational for clamp profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Obtain a copy of the flow rate curves provided by your flow valve manufacturer. Flow rate curves graphically illustrate the flow through a valve at different voltage or input current levels and at different pressure drops across the valve's spool.

2. From these curves, determine the minimum and maximum clamp open flow available from your flow valve at the pressure you would normally run during clamp open operation. Record these flows, along with the input voltage/current associated with them.

Important: If the pressure during clamp open slow differs from that during clamp open fast, complete the calculations for both pressures. Be sure to record words with correct prefixes:

- open slow values with the OSC prefix
- clamp open fast values with FOC, SOC and TOC prefixes

3. Convert the minimum and maximum flow obtained from your flow curve to clamp cylinder velocity. This is done by:

$$\text{Clamp Cylinder Velocity (in/sec)} = \frac{\text{Flow (in}^3\text{/sec)}}{\text{Area (in}^2\text{)}}$$

- where area is the inside diameter of the cylinder. This area may be different for the rod and piston ends of the cylinder:

$$\text{Area (no Rod)} = \pi\left(\frac{\text{I.D. of cylinder}}{2}\right)^2$$

$$\text{Area for Rod End} = \pi\left(\frac{\text{I.D. of cylinder}}{2}\right)^2 \quad \pi\left(\frac{\text{Rod diameter}}{2}\right)^2$$

- Flow assumes no restrictions on the exhaust port of the cylinder.

4. Enter the minimum velocity (usually 0) from these calculations into FOC45, SOC45, TOC45, and OSC45. Enter the maximum velocity into FOC46, SOC46, TOC46, and OSC46.

5. Divide the voltage/current corresponding to minimum velocity by the full range of valve input signal to determine the percent signal output for minimum. Enter this value into FOC47, SOC47, TOC47, OSC47.

6. Divide the voltage/current corresponding to maximum velocity by the full range of valve input signal to determine the percent signal output for maximum. Enter this value into FOC48, SOC48, TOC48, OSC48.

7. Download changes to the QDC module.

Important: If downloading from your programming terminal, download FOC, SOC, TOC, OSC, and OPC in that order (chapter 4).

To download	Set B21/
FOC	16
SOC	17
TOC	18
OSC	19
OPC	20

Test Valve Linearity with a Velocity vs. Position Profile

1. Select velocity vs. position control for the entire clamp open operation by resetting the following bits to zero:

- OPC03-B00 (B37/608)
- OPC03-B02 (B37/610)
- OPC03-B04 (B37/612)
- OPC03-B06 (B37/614)

2. Download this change to the QDC module.

Important: If downloading from your programming terminal, download OPC by setting download bit B21/20 (chapter 4).

3. Jog your clamp to the full close position (mold halves mated).

4. Enable first clamp open by setting DYC02-B10 (B34/410) to 1. The clamp should move from its start position through the first clamp open profile, and then execute open slow. If no motion is observed, verify that:

- no overtravel alarms are set. The QDC module inhibits clamp open if SYS07-B00 through -B05 are set
- no programming error codes exist in SYS61 and SYS62

5. Upon completion of clamp open, observe the velocity reported for 1st clamp open segment 2 in OPS12 (N43:720). This velocity should be relatively close to the setpoint you entered in OPC12 (N43:548). If the observed velocity is not within 25% of the setpoint, verify that:

- you choose the correct values from your flow rate curves
- your calculations are correct

If the observed velocity OPS12 is still not within 20% of OPC12, your pressure valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change FOC48 (N43:344) as follows:
OPS12 was less than OPC12	Direct Acting	Increase by 5%
	Reverse Acting	Decrease by 5%
OPS12 was more than OPC12	Direct Acting	Decrease by 5%
	Reverse Acting	Increase by 5%

To do this: change FOC48, download the FOC block, and repeat steps 3-5. Repeat as necessary.

Important: If downloading from your programming terminal, download FOC followed by OPC with download bits B21/16 and 20 (chapter 4).

6. Copy final FOC48 (N43:344) into SOC48, TOC48 and OSC48 (N43:404, 464, and 524), and download these changes.

Important: If downloading from your programming terminal, download FOC, SOC, TOC and/or OSC followed by OPC (chapter 4).

To download:	Set B21/
FOC	16
SOC	17
TOC	18
OSC	19
OPC	20

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of velocity available during any clamp open profile
- end-of-range maximum and minimum signal levels for linear control of the clamp velocity valve in open-loop control:

For this range limit	When trying to obtain the velocity in:	The QDC module drives the selected velocity valve to % output signal in:
Minimum	FOC45,SOC45,TOC45,OSC45	FOC47, SOC47, TOC47, and OSC47
Maximum	FOC46,SOC46,TOC46,OSC46	FOC48, SOC48, TOC48, and OSC48

Now, for all clamp-open velocity profiles, the QDC module assumes a linear relationship between clamp velocity and signal output in open loop.

EAC, ERC Profiles – Pressure Valve(s)

Span your ejector pressure valve(s) for optimum pressure performance. Do this in four parts:

- Confirm critical values
- Span your ejector pressure valve(s)
- Test valve linearity with an ejector pressure profile
- Set pressure alarm setpoints

Important: Omit the procedure *Span your ejector pressure valve(s)* in this section if the recorded manufacturer's valve spanning data for pressure control limits EAC41-44 and ERC41-44 are adequate for your application.

Confirm Critical Values

Important: Confirm that all entries you made for configuration values (chapter 7) and profile values (chapter 8) are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-set Addr:
7-M, 7-N	QDC module output to which you connected your selected pressure control valve	EAC02-B06, B05, B04 = your selection ERC02-B06, B05, B04 = your selection	B39/22, 21, 20 B37/86, 85, 84
	Unselected set-output values for outputs 1-4	EAC09-12 = ERC09-12 = your value	N45:05-08, N45:65-68
	All ramping is disabled with zero ramp rates	EAC17-20,25-28 = ERC17-20,25-28 = 0	N45:13-16,21-24, N45:73-76,81-84
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 EAC41 = ERC41 = 0 EAC42 = ERC42 = system pressure EAC43 = ERC43 = your value EAC44 = ERC44 = your value	 N45:37, 97 N45:38, 98 N45:39, 99 N45:40, 100
8-F	Forward dwell – apply after final stroke	EPC03-B15 = 0	B39/175
	Type of stroke – all full strokes	EPC03-B13 = 0	B39/173
	Continue or stop/notify – your selection	EPC03-B12	B39/172
	Ejector profile On/Off – profile On	EPC03-B09 = 0	B39/169
	Logical bridge – start on command from PLC	EPC03-B08 = 1	B39/168
	Profile algorithm – pressure vs. position	EPC03-B00 = 1	B39/160
	Expert Response Compensation (ERC) = Off	EPC04-B09 = B08 = 1	B39/185-184
	Open-loop control	EPC04-B01 = B00 = 1	B39/177-176
	EPC velocity setpoints	EPC09, 12, 15, 21, 27, 33, 36, 39 = zero	N45:125,128,131,137,143,149,152,155
	EPC pressure setpoints	EPC10, 34 = your value EPC13, 16, 22, 28, 37, 40 = zero	N45:126, 150 N45:129,132,138,144,153,156
	EPC end-of-segment position setpoints	EPC11, 14, 23, 29, 35, 38 = zero	N45:127,130,139,145,151,154
	Ejector forward dwell timer preset	EPC57 = zero	N45:173
	Ejector full advance position setpoint	EPC59 = your value	N45:175
	Ejector full retract position setpoint	EPC60 = your value	N45:176
	Clamp position for start ejector profile	EPC61 = value in OPC62	N45:177
	Clamp position for ejector inhibit	EPC62 = your value	N45:178
	Ejector position for clamp close enable	EPC63 = your value	N45:179
	Ejector strokes required	EPC64 = one	N45:180

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Ejector Pressure Valve(s)

Span your ejector valve(s) for smooth operation at highest desired pressure. Do this in the following procedure by finding the optimum values for:

- Minimum Pressure Control Limit EAC41, ERC41
- Maximum Pressure Control Limit EAC42, ERC42
- Selected Pressure Valve, Output for Minimum EAC43, ERC43
- Selected Pressure Valve, Output for Maximum EAC44, ERC44

Important: This procedure must be done twice, because cylinder dynamics are different for the rod side and piston side.

Important: If PanelView is operational for ejector profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Jog your ejectors to the full advanced position.
2. Align all other machine hydraulics to simulate ejector advance. For example, enable required pumps and align required valves.
3. Copy initial values from EAC09-12 (N45:05-08) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value that gives zero pressure into the word for output 1, 2, 3, or 4 (DYC09-12) that drives the selected ejector pressure valve.

ATTENTION: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI.

4. Enable set-output by setting DYC01-B08 (B34/392) to 1. The QDC module applies the values in DYC09-12 directly to its outputs 1-4.

5. Observe the pressure reported in SYS26 (N40:178).

- **For a bi-directional valve with a spool offset:**
  If this pressure is greater than zero, adjust the selected valve set-output value to obtain zero pressure. Stop adjusting it when you observe the smallest pressure attainable.

- **For a uni-directional valve with no response at low signal level:**
  If this pressure is zero, adjust the selected valve set-output value until the observed pressure just exceeds zero. Then re-adjust it until you just observe zero again.

- **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once you are satisfied you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure observed in SYS26 (N40:178), (usually 0 PSI or Bar) into EAC41 (N45:37), the minimum pressure control limit.

7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-SYS44 (N40:193-196) that corresponds to your selected ejector advance pressure valve. Copy this value into EAC43 (N45:39), the selected pressure valve, output for minimum.

8. Change the set-output value in DYC09-12 (N40:121-124) that corresponds to the selected ejector pressure valve by 50%, and then in 5% increments while observing the ejector pressure in SYS26. Stop adjusting it when the observed pressure no longer increases with an increase in the set-output value. The pressure now observed in SYS26 is the maximum obtainable ejector pressure.

9. Copy this observed maximum pressure from SYS26 (N40:178) into EAC42 (N45:38), the maximum pressure control limit.

10. While maintaining this maximum pressure, observe the actual valve set-output value in SYS41-SYS44 (N40:193-196) that corresponds to your selected pressure valve. Copy this value into EAC44 (N45:40), the selected pressure valve, output for maximum.

11. Lower the set-output value in DYC09-12 corresponding to the selected ejector pressure valve to a safe level.

12. Disable set-output by transitioning DYC01-B08 (B34/392) to 0.

13. Download your changes in EAC to the QDC module.

Important: If downloading from your programming terminal, download EAC followed by EPC with download bits B21/21 and 23 (chapter 4).

Test Valve Linearity with an Ejector Pressure Profile

1. Jog your ejector to the fully retracted position.

2. Enable the ejector profile by setting DYC02-B14 (B34/414) to 1. The ejector should move through its advance and retract stroke. If no motion, verify that:

- no overtravel alarms are set. The QDC module inhibits ejector profiles if SYS07-B00 through SYS07-B05 are set
- there are no programming error codes in SYS61 and SYS62

3. Upon completion of the ejector profile, observe the pressures reported for ejector advance and ejector retract segment 1 in EPS10 (N45:182) and EPS34 (N45:206). If observed pressures are not approximately equal to the setpoints entered in EPC10 and EPC34, then check:

- was your valve and solenoid alignment the same for ejector profile execution and ejector action in set-output?

If the observed pressures in EPS10 and EPS34 (N45:182 and 206) are still not within 20% of setpoints EPC10 and EPC34 (N45:126 and 150), your pressure valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change EAC44 (N45:40) or ERC44 (N45:100) as follows:
EPS10 was less than EPC10	Direct Acting	Increase EAC44 by 5%
	Reverse Acting	Decrease EAC44 by 5%
EPS10 was more than EPC10	Direct Acting	Decrease EAC44 by 5%
	Reverse Acting	Increase EAC44 by 5%
EPS34 was less than EPC34	Direct Acting	Increase ERC44 by 5%
	Reverse Acting	Decrease ERC44 5%
EPS34 was more than EPC34	Direct Acting	Decrease ERC44 5%
	Reverse Acting	Increase ERC44 by 5%

To do this: change EAC44 or ERC44, download the EAC or ERC block, and repeat steps 1-3. Do this as necessary.

Important: If downloading from your programming terminal, download EAC or ERC followed by EPC with download bits B21/21 or 22, and 23.

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during any ejector profile
- end-of-range minimum and maximum signal levels for linear control of the ejector pressure valve in open-loop control.

For this range limit	When trying to obtain the pressure in:	The QDC module drives the selected pressure valve to % output signal in:
Minimum	EAC41, ERC41	EAC43,. ERC43
Maximum	EAC42, ERC42	EAC44, ERC44

Now for open-loop ejector profiles, the QDC module assumes a liner relationship between ejector pressure and signal output.

Set the Profile Pressure Alarm

Set the maximum pressure alarm EAC57 (N45:53) equal to an ejector pressure that should:

- not be exceeded during the ejector profile
- not be greater than EAC42 (N45:38) or ERC42 (N45:98) maximum pressure control limits

Entering zero disables this alarm.

Download the EAC block to the QDC module.

Important: If downloading from your programming terminal, download EAC followed by EPC, with download bits B21/21 and 23 (chapter 4).

EAC, ERC Profiles – Velocity (Flow) Valve(s)

Span your ejector velocity (flow) valve(s) for optimum velocity performance. Do this in three parts:

- Confirm critical values
- Span your ejector velocity (flow) valve(s)
- Test valve linearity with an ejector velocity profile

Important: Omit the procedure *Span your ejector velocity (flow) valve(s)* in this section if the recorded manufacturer's valve spanning data for pressure control limits EAC45-48 and ERC45-48 are adequate.

Confirm Critical Values

Important: Confirm that all your entries for configuration values (chapter 7) and profile values (chapter 8) are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	Pro-set Addr:
7-M, 7-N	QDC module output to which you connected your selected velocity control valve	EAC02-B02, B01, B00 = your selection ERC02-B02, B01, B00 = your selection	B39/18, 17, 16 B39/82, 81, 80
	Unselected set-output values for outputs 1-4	EAC09-12 = ERC09-12 = your value	N45:05-08, 65-68
	All ramping is disabled with zero ramp rates	EAC17-20, 25-28 = ERC17-20, 25-28 = 0	N45:13-16, 21-24, 73-76, 81-84
	Velocity limits: Minimum Control Limit Maximum Control Limit Selected Velocity Valve, Output for Min Selected Velocity Valve, Output for Max	 EAC45 = ERC45 = 0 EAC46 = ERC46 = max velocity spec. EAC47 = ERC47 = your value EAC48 = ERC48 = your value	 N45:41, 101 N45:42, 102 N45:43, 103 N45:44, 104
8-F	Forward Dwell – apply after final stroke	EPC03-B15 = 0	B39/175
	Velocity Units – inches/second	EPC03-B14 = 1	B39/174
	Type of stroke – all full strokes	EPC03-B13 = 0	B39/173
	Continue or stop/notify – your selection	EPC03-B12	B39/172
	Ejector profile On/Off – profile On	EPC03-B09 = 0	B39/169
	Logical bridge – start on command from PLC	EPC03-B08 = 1	B39/168
	Expert Response Compensation (ERC) = Off	EPC04-B09 = B08 = 1	B39/185-184
	Open-loop control	EPC04-B01 = B00 = 1	B39/177-176
	EPC end-of-segment position setpoints	EPC11, 14, 23, 29, 35, 38 = zero	N45:127,130,139,145,151,154
	Ejector forward dwell timer preset	EPC57 = zero	N45:173
	Ejector full advance position setpoint	EPC59 = your value	N45:175
	Ejector full retract position setpoint	EPC60 = your value	N45:176
	Clamp position for start ejector profile	EPC61 = value in OPC62	N45:177
	Clamp position for ejector inhibit	EPC62 = your value	N45:178
	Ejector position for clamp close enable	EPC63 = your value	N45:179
	Ejector strokes required	EPC64 = one	N45:180

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 4.

Span Your Ejector Velocity Valve(s)

Span your ejector valve(s) for smooth operation at highest desired velocity. Do this in the following procedure by finding the optimum values for:

- Minimum Velocity Control Limit EAC45, ERC45
- Maximum Velocity Control Limit EAC46, ERC46
- Selected Velocity Valve, Output for Minimum EAC47, ERC47
- Selected Velocity Valve, Output for Maximum EAC48, ERC48

Important: This procedure must be done twice, because cylinder dynamics are different for the rod side and piston side.

Important: If PanelView is operational for ejector profiles, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this procedure before starting.

ATTENTION: As with any machine start-up, install a test mold. Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage.

ATTENTION: Be sure all machine guards and shields are in place before proceeding to guard against personal, injury.

1. Obtain a copy of the flow rate curves provided by your flow valve manufacturer. The flow rate curves graphically illustrate the flow through a valve at different input voltage or current levels and at different pressure drops across the valve's spool.

2. From these curves, determine the minimum and maximum ejector advance and retract flows available from your flow valve at the pressure you would normally run during ejector operation. Record the flows, along with the input voltages/current associated with them.

3. Convert the min and max flows obtained from your flow curve to ejector cylinder velocities. This is done by:

$$\text{Ejector Cylinder Velocity (in/sec)} = \frac{\text{Flow (in}^3\text{/sec)}}{\text{Area (in}^2\text{)}}$$

- where area is the inside diameter of the cylinder. This area may be different for the rod and piston ends of the cylinder:

$$\text{Area (no Rod)} = \pi \left(\frac{\text{I.D. of cylinder}}{2} \right)^2$$

$$\text{Area for Rod End} = \pi \left(\frac{\text{I.D. of cylinder}}{2} \right)^2 - \pi \left(\frac{\text{Rod diameter}}{2} \right)^2$$

- The flow assumes no restrictions on the cylinder exhaust port .

4. Enter minimum velocities (usually 0) from the calculation into EAC45, ERC45. Enter maximum velocities into EAC46, ERC46.

5. Divide the voltage/current corresponding to minimum velocities by the full range of valve input signal to determine the percent signal output for minimum. Enter these values into EAC47 and ERC47.

6. Divide the voltage/current corresponding to maximum velocities by the full range of valve input signal to determine the percent signal output for maximum. Enter these values into EAC48 and ERC48.

7. Download changes to the QDC module.

Important: If downloading from your programming terminal, download EAC, ERC, and EPC in that order, with download bits B21/21, 22, and 23.

Test Valve Linearity with an Ejector Velocity Profile

1. Select velocity vs. position control for the ejector profile by setting EPC03-B00 (B39/160) = 0.

2. Select velocity setpoints for ejector advance and ejector retract that are typical of velocities you would run during normal machine operation. Enter these setpoints into EPC09 and EPC33 (N45:125 and N45:149).

3. Download changes to the QDC module.

Important: If downloading from your programming terminal, download EPC with download bit B21/23 (chapter 4).

4. Jog your ejector to the fully retracted position.

5. Enable the ejector profile by setting DYC02-B14 (B34/414) to 1. The ejector should move through its advance and retract stroke. If no motion, verify that::

- none of your overtravel alarms are set. The QDC module inhibits ejector profiles if SYS07-B00 through SYS07-B05 are set
- there are no programming error codes in SYS61 and SYS62

6. Upon completion of the ejector profile, observe the velocities reported for ejector advance and ejector retract segment 1 in EPS09 (N45:181) and EPS33 (N45:205). These velocities should be relatively close to the setpoints you entered in EPC09 and EPC33 (N45:125, N45:149). If observed velocities are not within 25% of the setpoints, verify that:

- you chose the correct values from your flow rate curves
- your calculations are correct

If the actual velocities are still not representative of your setpoints, your flow valve is not linear over the range of your setpoints. Correct as follows:

If:	And Your Selected Valve is:	Then:
EPS09 was less than EPC09	Direct Acting	Increase EAC48 by 5%
	Reverse Acting	Decrease EAC48 5%
EPS09 was more than EPC09	Direct Acting	Decrease EAC48 5%
	Reverse Acting	Increase EAC48 by 5%
EPS33 was less than EPC33	Direct Acting	Increase ERC48 by 5%
	Reverse Acting	Decrease ERC48 5%
EPS33 was more than EPC33	Direct Acting	Decrease ERC48 5%
	Reverse Acting	Increase ERC48 by 5%

To do this: change EAC48 or ERC48, download the EAC or ERC block, and repeat steps 4-6. Do this as necessary.

Important: If downloading from your programming terminal, download EAC or ERC followed by EPC with download bits B21/21 or 22, and 23.

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of velocity available during any ejector profile
- end-of-range minimum and maximum signal levels for linear control of the ejector velocity valve in open-loop control.

For this range limit	When trying to obtain the velocity in:	The QDC module drives the selected velocity valve to % output signal in:
Minimum	EAC45, ERC45	EAC47, ERC47
Maximum	EAC46, ERC46	EAC48, ERC48

Now for open-loop ejector profiles, the QDC module assumes a liner relationship between ejector velocity and signal output.

Chapter 10

Tune Your Machine

Chapter Objectives

In chapter 9 you ran simple open-loop profiles to span your valves. This chapter presents guidelines to help you adjust parameters in configuration and profile blocks to optimize machine performance for production runs.

We present this chapter in three major sections:

- **Closed-loop Tuning** – We discuss the usage and effect of the QDC module's PID gain constants, and procedures to determine proper gain settings for inject, clamp, and eject operations of your plastic molding process. If your application does not require closed-loop operation, skip this section and proceed to the section entitled Injection Tuning Considerations for Producing Parts.
- **Injection Tuning Considerations for Producing Parts** – We present the usage and effect of QDC module injection parameters that require specific considerations. We assume you are familiar with conventions, terminology, and procedures used in the injection molding industry, this manual, and the Plastic Molding Module Reference Manual, publication 1771-6.5.88.
- **Tuning Considerations for Clamp and Eject Operations** – We present the usage and effect of other QDC module parameters for clamp and eject operations that require specific considerations. As with the previous section, we assume you are familiar with conventions, terminology, and procedures used in the injection molding industry, this manual, and the Plastic Molding Module Reference Manual, publication 1771-6.5.88.

Closed-loop Tuning

Closed-loop Control

So far, you have run open-loop profiles with the QDC module's PID and VelFF algorithms disabled. We suggest that you use open-loop control:

- for spanning valves
- for troubleshooting machine performance
- when the machine has no pressure sensors for feedback

Important: You can achieve considerably better consistency of finished parts when the QDC module operates in closed-loop control. With few exceptions, you should run machine production with closed-loop profiles.

Correctly tuned closed-loop profiles are essential for precise, repeatable operation. In chapter 7 you entered our recommended values. They may give you desired machine performance.

Important: If you need to improve performance, continue with this section. If not, skip to Injection Tuning Considerations for Producing Parts.

General Guidelines for Pressure Tuning

In this section we present two procedures:

- Tune Pressure Loops without an Oscilloscope
- Tune Pressure Loops with an Oscilloscope

Repeat either one of these procedures as needed for tuning the pressure-control loop of these profiles:

- Injection – Pressure vs. Position or Time
- Pack and Hold – Pressure vs. Time
- Plastication – Backpressure vs. Position
- Clamp Open (3) – Pressure vs. Position
- Clamp Open Slow – Pressure vs. Position
- Clamp Close (3) – Pressure vs. Position
- Low Pressure Close – Pressure vs. Position
- Ejector – Pressure vs. Position

Follow these general guidelines when tuning closed-loop pressure profiles:

- Disable ramping
- Disable Expert Response Compensation (ERC)
- Reset ERC values to zero by setting DYC05-B15 (B34/463) = 1. (Pro-Set 600 resets this bit to zero after resetting ERC values.)

Important: Gain constants differ between pressure profiles. The dynamics of loads being moved and different hydraulic characteristics warrant separate PID tuning considerations for each profile.

Important: In most cases, adding a derivative term to pressure control algorithms makes it too sensitive and does not enhance loop stability.

- Use only proportional and integral control.
- Use the *highest* possible P and I gain constants for *inject-mode* profiles for precise performance without hammering your hydraulics, but use the *lowest* possible P and I gain constants for *clamp and eject* profiles for repeatable performance.
- First tune your proportional gain. Then add integral gain.
- Typically, the integral term will be larger than the proportional term. The QDC module's pressure algorithm differs from classic PID algorithms.
- Use an oscilloscope, if available. You can tune loops faster and easier with it connected to QDC module's output driving the selected valve.

Important: If you have an oscilloscope, skip to the section Tune Pressure Loops with an Oscilloscope.

Tune Pressure Loops Without An Oscilloscope
Repeat this procedure for each applicable pressure profile.

Before you begin tuning PID pressure loops, confirm that you:

- selected the pressure vs. position algorithm
- selected closed-loop control
- disabled ERC
- reset ERC values
- disabled ramping

ATTENTION: Verify that you have correctly set the following words and bits in CPC and OPC that control zone overrun to guard against damaging the clamp or mold.

- CPC03-B11 = 0: execute low pressure close if zone overrun occurs
- set CPC61 to a value larger than normal for a larger mold-protect zone
- OPC03-B11 = 0: execute open slow if zone overrun occurs
- set OPC61 to a value smaller than normal for a larger open-slow zone

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1. Enter an operational profile representative of the characteristics you desire for your production cycle.
2. Check that you zeroed the profile's integral and derivative terms. Leave the proportional term at the value you entered in chapter 7.

3. Downloaded all setpoint changes to the QDC module.

4. Run several cycles of the profile while comparing profile actuals (returned in the corresponding status block) with profile setpoints. Also look for abnormal flexing or pulsing of hydraulic hoses leading to the controlled cylinder.

If:	Then:
Observed actuals are consistently well below profile setpoints	Increase the proportional term
Observed actuals are consistently well above profile setpoints	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QDC module. Refer to download procedure in chapter 4.

5. Re-run the profile after each change to the proportional term until actuals are close to setpoints, and there is no hammering and vibration in hydraulic lines to the controlled cylinder.

6. Slowly increase the integral term while running machine cycles until profile pressure actuals overshoot profile setpoints. Now decrease the integral term until overshoot disappear.

Important: If you cannot make pressures actuals match entered setpoints, verify your unselected valve set-output values are correct for your application (Refer to chapter 7 and the discussion later in this chapter).

Tune Pressure Loops With An Oscilloscope

Before you begin tuning your pressure loops, confirm that you:

- selected the pressure vs. position algorithm
- selected closed-loop control
- disabled ERC
- reset ERC values
- disabled ramping

ATTENTION: Verify that you have correctly set the following words and bits in CPC and OPC that control zone overrun to guard against damaging the clamp or mold.

- CPC03-B11 = 0: execute low pressure close if zone overrun occurs
- set CPC61 to a value larger than normal for a larger mold-protect zone
- OPC03-B11 = 0: execute open slow if zone overrun occurs
- set OPC61 to a value smaller than normal for a larger open-slow zone

1. Enter an operational profile representative of the characteristics you desire for your production cycle.

2. Check that you zeroed the profile's integral and derivative terms. Leave the proportional term at the value you recorded in chapter 7.

3. Downloaded all setpoint changes to the QDC module.

4. Connect an oscilloscope to your selected pressure control valve

5. Run several profile cycles while observing the oscilloscope trace.

Ideally for each step of a multi-step profile, the oscilloscope trace should rise or fall quickly to a controlled level and then flatten out. Bounce or chatter when rising or falling is undesirable.

If:	Then:
Your scope trace for any given profile step never levels off (it is either rising or falling for the entire step)	Increase the proportional term
Your scope trace for any given profile step rises (or falls) quickly and then "bounces" or "chatters" around a voltage/current	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QDC module. Refer to download procedure in chapter 4.

6. Re-run the profile after each change to the proportional term until oscilloscope traces quickly level off without bounce or chatter.

7. Slowly increase the integral term while running machine cycles until you observe overshoots on the oscilloscope trace. Now decrease the integral term until overshoots disappear.

Important: If you cannot alter your proportional and integral terms so that oscilloscope traces quickly level off without bouncing or chattering, verify your unselected valve set-output values are correct for your application (Refer to chapter 7 and the discussion later in this chapter).

General Guidelines for Velocity Tuning

If your machine will never run velocity profiles, skip this section.

In this section we present two procedures:

- Tune Pressure Loops without an Oscilloscope
- Tune Pressure Loops with an Oscilloscope

Repeat either one of these procedures as needed for tuning closed-loop control of these velocity vs. position profiles:

- Injection
- Clamp Open (3 movements)
- Clamp Open Slow
- Clamp Close (3 movements)
- Ejector (2 movements)

Follow these general guidelines when tuning closed-loop velocity profiles:

- Disable ramping
- Disable Expert Response Compensation (ERC)
- Reset ERC values to zero by setting DYC05-B15 (B35/463) = 1. (Pro-Set 600 resets this bit to zero after resetting ERC values.)

Important: Gain constants differ between velocity profiles. The dynamics of loads being moved and different hydraulic characteristics warrant separate VelFF tuning considerations for each profile.

Important: Never use feedforward gain and ERC in the same velocity profile.

Important: In most cases, adding a feedforward term to the VelFF algorithm makes it too sensitive and does not enhance loop stability.

- Use proportional control with a zero feedforward term. (Add feedforward only if required)
- Use the *highest* possible P gain constant for *injection* profiles for precise performance without hammering your hydraulics, but use the *lowest* possible P gain constant for *clamp and ejector* profiles for repeatable performance.
- Use an oscilloscope, if available. You can tune loops faster and easier with it connected to QDC module's output driving the selected valve.

Important: If you have an oscilloscope, skip to Tune Velocity Loops with an Oscilloscope.

Tune Velocity Loops Without An Oscilloscope
Before you begin tuning your velocity loop, confirm that you:

- selected the velocity vs. position algorithm
- selected closed-loop control
- zeroed the VelFF term
- disabled ERC
- reset ERC values
- disabled ramping

ATTENTION: Verify that you have correctly set the following words and bits in CPC and OPC that control zone overrun to guard against damaging the clamp or mold.

- CPC03-B11 = 0: execute low pressure close if zone overrun occurs
- set CPC61 to a value larger than normal for a larger mold-protect zone
- OPC03-B11 = 0: execute open slow if zone overrun occurs
- set OPC61 to a value smaller than normal for a larger open-slow zone

1. Enter an operational profile representative of characteristics you desire for your production cycle.

2. Downloaded all setpoint changes to the QDC module.

3. Run several profile cycles while comparing profile actuals with profile setpoints. Also observe hydraulic hoses leading to the cylinder as follows:

If:	Then:
Observed actuals are consistently well below profile setpoints	Increase the proportional term
Observed actuals are consistently well above profile setpoints	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QDC module. Refer to download procedure in chapter 4.

4. Re-run the profile after each change to the proportional term until observed actuals are close to setpoints without hammering and vibration in hydraulic lines to the controlled cylinder.

Important: If you cannot make velocity actuals match entered setpoints, verify that your unselected valve set-output values are correct for your application (Refer to chapter 7 and the discussion later in this chapter).

5. If you are satisfied with your unselected valve set-output values and still cannot match velocity actuals to desired setpoints, your control may require a small feedforward gain.

6. If necessary, slowly increase the feedforward term while running machine cycles until velocity actuals satisfactorily match entered setpoints.

Important: If you must use feedforward gain to adequately tune your velocity profile, do NOT enable ERC for this profile.

Tune Velocity Loops With An Oscilloscope

Before you begin tuning your velocity loop, confirm that you:

- selected the velocity vs. position algorithm
- selected closed-loop control
- zeroed the VelFF term
- disabled ERC
- reset ERC values
- disabled ramping

ATTENTION: Verify that you have correctly set the following words and bits in CPC and OPC that control zone overrun to guard against damaging the clamp or mold.

- CPC03-B11 = 0: Execute low pressure close if zone overrun occurs
- set CPC61 to a value larger than normal for a larger mold-protect zone
- OPC03-B11 = 0: Execute open slow if zone overrun occurs
- set OPC61 to a value smaller than normal for a larger open-slow zone

1. Enter an operational profile representative of characteristics you desire for your production cycle.

2. Check that you zeroed the profile's feedforward term. Leave the proportional term at the value you entered in chapter 7.

3. Downloaded all setpoint changes to the QDC module.

4. Connect an oscilloscope to your selected velocity control valve

5. Run several profile cycles while observing the oscilloscope trace.

   Ideally for each step of a multi-stepped profile, the oscilloscope trace should rise or fall quickly to a controlled level and then flatten out. Bounce or chatter when rising or falling is undesirable.

If:	Then:
Your scope trace for any given profile step never levels off (it is either rising or falling for the entire step)	Increase the proportional term
Your scope trace for any given profile step rises (or falls) quickly and then "bounces" or "chatters" around a voltage/current	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QDC module. Refer to the download procedure in chapter 4.

6. Re-run the profile after each change to the proportional term until oscilloscope traces quickly level off without bounce or chatter.

Important: If you cannot alter the proportional term so that oscilloscope traces quickly level off without bounce or chatter, verify that your unselected valve set-output values are correct for your application. (Refer to chapter 7 and the discussion later in this chapter).

7. If you are satisfied with the unselected valve set-output values and still cannot make the oscilloscope trace quickly level off without bounce or chatter, your control may require a small feedforward gain.

8. If necessary, slowly increase the feedforward term while running machine cycles until the oscilloscope trace levels off without bounce or chatter.

Important: If you must use feedforward gain to adequately tune your velocity profile, do NOT enable ERC for this profile.

Injection Tuning Considerations for Producing Parts

In this section, we discuss the usage and effect of the following items as they apply to the inject operation:

- Profile Requirements
- Cushion, Shot Size, and Transition Setpoints
- Unselected Valve Set-output Values
- Logical Bridges
- End-of-profile Set-output Values
- Pre- and Post-decompression Pullback
- Acceleration and Deceleration Ramp Rates
- Watchdog Timer and Profile Offsets
- Pressure Alarm Setpoints
- Pressure-limited Velocity vs. Position Injection
- Expert Response Compensation

We assume you are familiar with conventions, terminology, and procedures used in the Injection Molding Industry, in this manual, and in the Plastic Molding Module Reference Manual.

Profile Requirements

A profile is a series of position (or time) and pressure (or velocity) setpoints which uniquely define a phase of the injection molding process for a given part. The complexity of the profile depends on your machine and the part you want to mold. Next we discuss required setpoints.

Velocity Setpoints
Use velocity setpoints for the injection velocity vs. position profile to control the fill rate of various mold cavities with repeatability.

Do not be concerned if the reported velocity in the first segment of your velocity vs. position profile does not match its setpoint. For example, the velocity of the first segment could:

- Undershoot if you programmed a short length or time. It takes time for the hydraulics to overcome the inertia of the injection cylinder and accelerate the ram (screw) to desired velocity.

  Do NOT increase velocity gain constants to compensate. Excessive gain may de-stabilize the velocity loop during the rest of the profile.

- Overshoot if you configured a large post-decompression pullback after plastication. The ram (screw) sees little resistance pushing plastic over the post-decompression distance until the plastic reaches the mold gate.

  Do NOT decrease velocity gain constants to compensate. Too little gain may cause the velocity loop to be sluggish during the rest of the profile.

Important: The injection velocity profile requires one additional velocity setpoint beyond the last non-zero end-of position setpoint, so you must program one more velocity setpoint than position setpoint, such that

total velocity setpoints = total position setpoints + 1

If not, the ram (screw) stops at the final end-of-position setpoint (if it does not see a pressure transition beforehand).

Pressure Setpoints
You may use pressure setpoints in all phases of the inject mode:

- For injection, use pressure setpoints to fill the mold cavity. Make them:
  - high enough to give sufficient pressure to fill the mold
  - low enough to avoid flashing the mold
- For pack and hold, use pressure setpoints to relax the pressure applied to the molten plastic as it cools in the mold.
- For plastication, use backpressure setpoints to control heating the plastic due to shearing as the rotating ram (screw) backs up the length of the shot against a backpressure determined by your setpoints.

Important: The injection and plastication pressure profiles require one additional pressure setpoint beyond the last non-zero end-of position setpoint (or last non-zero segment time setpoint), so you must program one more pressure setpoint than position (or time) setpoint, such that

total pressure setpoints = total position (or time) setpoints + 1

If not,

- for the injection pressure profile, the ram (screw) **stops** at the final end-of-position (or time) setpoint, unless it sees a transition before:
  - reaching the last end-of position setpoint
  - the final time setpoint has expired
- for the plastication pressure profile, the final backpressure becomes zero unless the ram (screw) reaches 100% shot size before:
  - reaching the final end-of-segment position
  - the final time setpoint has expired

End-of-segment Position Setpoints
Shot size is subdivided into profile segments, the lengths of which are determined by your end-of-segment position setpoints. Each segment has its velocity or pressure setpoint for controlling the ram (screw).

Important: Avoid multiple adjacent segments having the same velocity or pressure setpoint. For better control, use a constant velocity or pressure over a single equivalent length segment.

For injection velocity or pressure profiles, you must always program one final velocity or pressure setpoint without an associated end-of-position setpoint that the QDC module uses until it reaches transition (for injection) or 100% shot size (for plastication).

Time Setpoints
Time setpoints define the duration of each profile segment that applies pressure to the ram (screw).

Important: Avoid multiple adjacent segments having the same pressure setpoint. For better control, use a constant pressure over a single equivalent time segment.

For injection or plastication pressure profiles, you must always program one final pressure setpoint without an associated time setpoint that the QDC module uses until it reaches transition (for injection) or 100% shot size (for plastication).

Minimum Profile Requirements
We present minimum requirements for inject-mode profiles. Use this as a starting point for developing your own part-specific profiles.

Profile	End-of-Segment Position Setpts	Time Setpoints	Velocity Setpoints	Pressure Setpoints	Other
Injection					
Velocity vs. Position	None required	N/A	IPC09	N/A	one of IPC60, 61, or 62
Pressure-limited Velocity vs. Position	None required	N/A	IPC09	N/A	one of IPC60, 61, or 62 IPC57, 58, and 59
Pressure vs. Position	None required	N/A	N/A	IPC10	one of IPC60, 61, or 62
Pressure vs. Time	N/A	None required	N/A	IPC10	one of IPC60, 61, or 62
Pack Pressure vs. Time	N/A	HPC11	N/A	HPC10	----
Hold Pressure vs. Time	N/A	HPC28	N/A	HPC27	----
Plastication					
Pressure vs. Position	None required	N/A	N/A	PPC10	PPC61 and 62
Pressure vs. Time	N/A	None required	N/A	PPC10	PPC61 and 62

Cushion, Shot Size, and Transition Setpoints

Shot Size is the amount of molten plastic injected into the mold. Cushion is the amount of molten plastic that remains in the barrel after injection.The sum of shot size (PPC61) plus cushion (PPC62) tells the QDC module where to terminate the Plastication profile.

During injection, the QDC module does NOT terminate the shot at cushion, but continues injecting until one of the three injection transition conditions occurs. These three conditions during the injection profile are:

- elapsed time exceeds a preset limit
- ram (screw) pressure exceeds a preset limit
- ram (screw) position exceeds a preset limit

Shot Size
(PPC61)
Shot size (measured from cushion) is the amount of molten plastic needed to fill the mold (figure 10.3). Determine it with these general steps:

1. Start with a shot size you know will NOT fill the mold.

2. Enter a ram(screw) transition position about 1/2” from ram bottom.

3. Run a shot with transition on position.

The end-of-hold position will be at ram bottom, because mold cavities continue to fill during pack and hold.

4. While continuing to transition on position, slowly increase the shot size until the end-of-hold position is

- above ram bottom
- approximately equal to cushion

5. The shot size is correct for the mold/part you are tuning when:

- the end-of-hold position is approximately equal to cushion
- all cavities on the mold are being fully filled

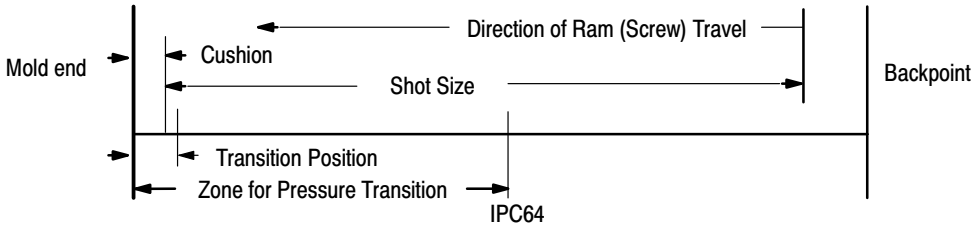
Cushion
(PPC62)
Cushion (measured from mold end) is the length of molten plastic you want remaining in the barrel after filling mold cavities (figure 10.3). The QDC module adds this length to shot size length to determine where to terminate plastication.

Ram (Screw) Position for Transition
(IPC61)
This position setpoint (measured from mold end) determines where injection ends and pack (or hold) begins (figure 10.3). Enter a position value equal to or slightly greater than the top-of-cushion position, depending on whether your part requires additional plastic compressed into the mold during pack and hold.

Ram (Screw) Pressure for Transition
(IPC62)
If actual ram (screw) pressure during injection exceeds this setpoint, the QDC module transitions to the pack phase. Typically you enter a value less than mold flash pressure.

Start of Zone for Pressure Transition
(IPC64)
A non-zero value (measured from mold end) forces the QDC module NOT to transition on pressure until the ram (screw) reaches this position (figure 10.3). Use this setpoint to prevent nuisance pressure transitions due to pressure spikes during the early phases of the injection profile. Typically, you can inhibit pressure transitions over 50% of shot size without flashing the mold.

Figure 10.3
Static Setpoints for the Injection Profile



Time Limit for Transition
(IPC60)
The QDC module transitions from injection to pack (or hold) if the total injection profile time equals or exceeds this setpoint. Use this value as a safety watchdog if some condition prevents the injection profile from completing in a timely fashion.

Unselected Valve Set-output Values

We presented guidelines to assist you in determining unselected valve set-output values (words 09 through 12 in configuration command blocks) in chapter 7 prior to spanning your machine valves in chapter 9. The value in these words is the signal level sent to all outputs not selected for control by the QDC module's algorithm during a profile.

In chapter 7, you determined the signal output percentages required to drive the unselected valves during respective profiles. These values should allow desired ram (screw) control. Although different part set-ups and other process considerations may require that you modify them during a particular profile, you should adjust them only if you are unable to obtain desired closed-loop control by modifying profile gain constants.

Important: When attempting to achieve desired closed-loop control, do NOT change unselected valve set-output values until after you have adjusted the profile gain constants.

Important: Large changes to your unselected valve set-output values may require re-spanning the selected valve for that profile. Refer to chapter 9 for valve spanning procedures.

If you believe your unselected valve set-output values are adversely affecting your ability to obtain quality closed-loop control, consider the following:

If your Selected valve controls:	And you observe:	Then:
Pressure	Profile segment pressures substantially greater than setpoint	Decrease the flow available during the profile by appropriately modifying the set-output value driving the flow valve.
Pressure	Profile segment pressures substantially less than setpoint	Increase the flow available during the profile by appropriately modifying the set-output value driving the flow valve.
Velocity	Profile segment velocities substantially greater than setpoint	Decrease the pressure available during the profile by appropriately modifying the set-output value driving the pressure valve.
Velocity	Profile segment velocities substantially less than setpoint	Increase the flow available during the profile by appropriately modifying the set-output value driving the pressure valve.

Logical Bridges

In chapter 8, you configured your hold and plastication profiles to stop and set outputs for no flow or pressure at completion. If your hydraulics and/or process require NO changes controlled by your PLC-5 processor before continuing a molding cycle, you may configure the QDC module to logically bridge the following profile/movement pairs as integrated machine phases:

- hold/pre-decompression (HPC03-B08 = 0)
- pre-decompression/plastication (HPC03-B09 = 0)
- plastication/post-decompression (PPC03-B08 = 0)

Important: The QDC module always logically bridges the injection, pack and hold phases as a single integrated machine movement.

Bridging machine phases has benefits such as:

- reduced cycle time
- smoother QDC control
- less chance of hydraulic pressure transients

If your hydraulics and/or process require changes controlled by your PLC-5 processor before continuing a molding cycle, you may configure the QDC module to stop at completion of:

- hold (HPC03-B08 = 1)
- pre-decompression (HPC03-B09 = 1)
- plastication (PPC03-B08 = 1)

Then the QDC module sends a fixed signal to each of its four outputs while awaiting further commands from the PLC-5 processor.

Important: The QDC module always stops and sets outputs at completion of the post-decompression movement.

End-of-profile Set-output Values

End-of-profile set-output values have uses including:

- adjusting flow through a variable pump between profiles
- initializing valves for the next profile or movement
- re-aligning solenoid valves by PLC-5 processor before starting the next profile or movement

When configuring end-of-profile set-output values, remember:

- The QDC module ignores these values on all profiles that are logically bridged to the next profile or movement

- After the QDC module sets them, they remain set until the QDC module is commanded to start another movement or profile, or until the stop command is asserted

Pre- and Post-decompression Pullback (for pre-decompression PRC05) (for post-decompression PSC05)

Pre-decompression separates plastic solidifying in the sprue from the molten cushion remaining in the barrel. The QDC module applies pre-decompression pullback to the ram (screw) after hold, before plastication.

Post-decompression guards against drooling molten plastic into the open mold when the clamp is opening. The QDC module applies post-decompression pullback to the ram (screw) after plastication.

When configuring pre- and post-decompression:

- Enter values into PRC05 and PSC05 only after you have tested shot size and cushion (PPC61 and PPC62).
- Enter set-output values into PRC09-12 and PSC09-12 for the pre-and post-decompression movements equal to the ram (screw) reverse jog set-output values (JGC25-28) from chapter 5.
- Enter end-of-movement set-output values into PRC33-36 and PSC33-36 as required by your application.

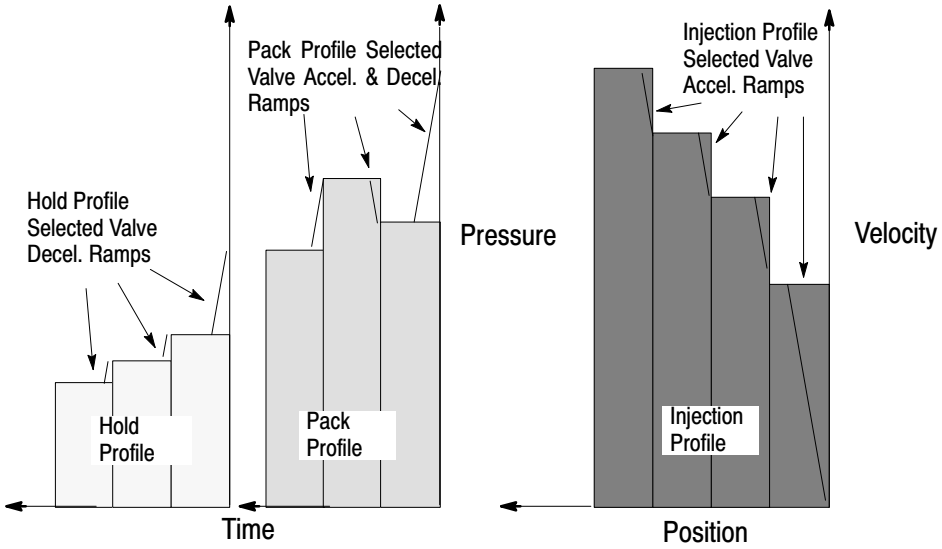
Acceleration and Deceleration Ramp Rates

The zero ramp rate values entered in chapter 7 disabled ramping. This forces the QDC module to step from setpoint to setpoint during a profile.

If required by your application, you may configure your QDC module to ramp its outputs during a profile. The QDC module uses configured acceleration and deceleration ramp rates to move all outputs from setpoint to setpoint during execution of any profile (figure 10.1).

ATTENTION: Ramp rates are not applied until the QDC module is actually executing the profile. Because ramp rates are time based, using excessively slow (low value) ramp rates may inhibit effective closed-loop control, reduce ERC calculation accuracy, and limit QDC control capability. Use ramps only if machine operation mandates them.

Figure 10.1
Example Injection, Pack, and Hold Profiles with Ramps



Important: When enabled, the QDC module applies ramp rates at the beginning of each profile segment.

With caution, you can use ramp rates to smooth out jerky motion present during large increases or decreases in pressure or flow.

If your application requires the use of ramp rates:

- Never apply ramp rates until you have already tuned all applicable pressure and velocity loops.
- Ramp rates control selected and unselected valves. Therefore, even though you may be controlling velocity, you can ramp ram (screw) pressure during an injection profile prior to pack.
- Ramp rates and ERC may not function properly together. Be very careful if applying ERC and ramp rates on the same profile.
- Using slow ramp rates may force pressure and velocity actuals out of control because these actuals include the time spent ramping as well as the time for each segment.
- The QDC module uses ramp rates when beginning a profile or movement, or when stepping from segment to segment within a profile.
- You enter ramp rates in units of 0 to 9999 percent signal output per second (note that there is no decimal point). A ramp rate of 9999 lets the output move full range in 10 milliseconds, while a ramp rate of 99 requires a full second to go full range. Lower values = slower ramps.

Profile Watchdog Timer and Profile Offsets

Profile Watchdog Timer
(PLC08)
Set your plastication profile watchdog timer preset after your machine is running repeatable, quality parts. Set it just longer than the repetitive duration of the profile to warn that a process problem may be developing. For example, warn of a low feed level from the hopper.

Profile Offsets
(for velocity – IPC51)
(for pressure – IPC52, HPC25 and 42, PPC52)
The offset shifts the amplitude of all pressure or velocity setpoints (y-axis) of a profile by a single value. Use it during set-up after you have obtained the desired profile shape to boost or reduce the overall effect of the profile.

Pressure Alarm Setpoints

The QDC monitors process pressure and compares it against two different types of high pressure alarm setpoints. Pressure is compared to the absolute pressure alarm setpoint (configured in the MCC - refer to chapter 4) on a continuous basis and without regard to current machine mode or operational cycle. Pressure is compared to profile pressure alarm setpoints (configured in the respective configuration blocks - refer to chapter 7) only during the execution of the subject profile. In general:

- Use the absolute pressure alarm to detect dangerously high pressure conditions. We recommend that you set this alarm setpoint well above normal operating levels while still below levels that could result in machinery damage or danger to personnel. Program your PLC-5 ladder logic to stop the QDC module and place the machine in a safe condition if this alarm is triggered.

- Use profile pressure alarms to detect abnormally high pressure conditions. We recommend these alarm setpoints be set only marginally above the highest pressure expected during any acceptable iteration of the subject profile while still low enough to be indicative of process problems. Program your PLC-5 ladder logic to interrupt the process or signal the machine operator to determine corrective action if one of these alarms is triggered.

Pressure-limited Velocity vs. Position Injection

Pressure-limited velocity vs. position differs from both velocity and pressure injection control. During normal operation, pressure-limited velocity control acts the same as velocity vs. position control. However, when ram (screw) pressure exceeds a preset, the QDC module changes from velocity to pressure control to guard against flashing the mold.

Use pressure-limited velocity vs. position control during:

- Set-up – It lets you enter a pressure-limiting preset just below the mold flash point to guard against flashing the mold.
- Normal operation – It lets you run high speed velocity vs. position profiles while guarding against flashing the mold.

In general, pressure-limited injection velocity works as follows starting with velocity control:

When the QDC module	And	And	Then the QDC module
Controls ram velocity	Ram pressure exceeds IPC57	Ram position is within pressure-limit zone defined by IPC58	1) Freezes its outputs at current levels. 2) Starts time delay in IPC59.
Freezes its outputs after ram pressure exceeds IPC57 during velocity control	Time delay IPC59 expires	Ram pressure exceeds IPC57	1) Switches to PID control of the selected pressure valve using IPC57 as the PID setpoint.. 2) Resets the selected velocity valve (if different from the selected pressure valve) to its set-output value from INC09-12.
		Ram pressure is less than IPC57	Resumes velocity control.
Controls ram pressure	Ram velocity exceeds a segment setpoint	---	1) Freezes its out puts as current levels. 2) Starts time delay IPC59.
Freezes its outputs after ram velocity exceeds a segment setpoint during pressure control	Time delay IPC59 expires	Velocity exceeds the segment setpoint	1) Returns to VelFF control of the selected velocity valve using current setpoint. 2) Resets the selected pressure valve (if different from the selected velocity valve) to its set-output value from INC09-12.
		Velocity is less than the segment setpoint	Resumes pressure control

You control the maximum pressure of the pressure-limited velocity vs. position profile with setpoint IPC57.

IPC57 – Ram Pressure Limit for Pressure-limited Velocity Control.
When ram (screw) pressure reaches this limit and IPC58 and 59 allow it, the QDC module switches control from velocity to pressure control. Consider the following when determining this setpoint. Use a value:

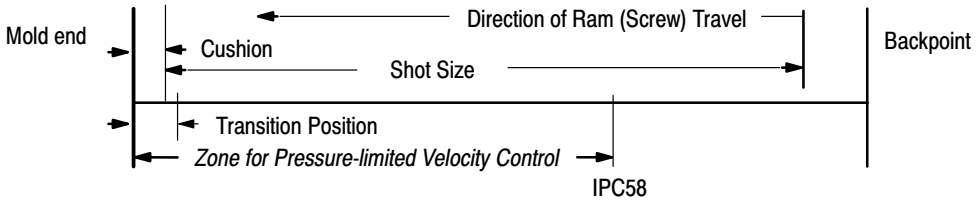
- considerably below the mold flash point to let the QDC module gain pressure control before flashing the mold
- less than the injection transition pressure in IPC62

The QDC module may switch back and forth between velocity and pressure control excessively. To guard against this condition, you can use setpoints IPC58 and IPC59.

IPC58 – Start of Zone for Pressure-limited Velocity Control.
This position defines the zone measured from mold end in which the QDC module allows a change from velocity to pressure control (figure 10.2). Pressure limiting can occur after the ram (screw) passes this position. We recommend a distance of about 50% of shot size. Smaller distances increase the possibility of flashing the mold.

IPC59 – Time Delay for Pressure-limited Velocity Control.
This delay starts at change of control. Use it to avoid changing control to frequently due to nuisance pressure or velocity spikes. We recommend an initial delay of 8 to 12 ms. Too small a delay induces oscillation between pressure and velocity control resulting in poor control and excessive hydraulic wear. Too large a delay results in poor control and mold flashing.

Figure 10.2
Zone for Pressure-limited Velocity Control



Expert Response Compensation

The QDC module uses a proprietary, enhanced control scheme called Expert Response Compensation (ERC). It compensates for changes in your machine dynamics, machine hydraulics, raw materials, and other process variables. It also adjusts the open-loop and closed-loop control algorithms to compensate for abrupt upsets and long term deviations to your process. In previous chapters, you ran profiles with the QDC module's ERC algorithm disabled.

Use ERC:

- for normal operation when strict adherence to velocity or pressure (not position) setpoints is required.

Do NOT use ERC:

- when spanning your valves
- if using velocity feedforward Vel/FF gain
- if using acceleration or deceleration ramp rates
- until you have properly tuned the control loop

ATTENTION: Jerky, abrupt ram (screw) motion may result if you apply ERC to a control loop that has not been properly tuned.

ERC Minimum Percentage Values

If using ERC, adjust values recommended in chapter 7 as follows:

If ERC is enabled (on) and:	Then:
The actual velocity or pressure swings wildly around the setpoint from cycle to cycle	Decrease the ERC minimum % value
The actual velocity or pressure takes several cycles to achieve the desired setpoint	Increase the ERC minimum % value

Tuning Considerations for Clamp and Ejector Operations

In this section, we discuss the usage and effect of the following items as they apply to clamp operation:

- Control Objectives for Clamp and Ejector Operations
- Profile Requirements
- Logical Bridges
- End-of-profile (-stroke) Set-output Values
- Unselected Valve Set-output Values
- Acceleration and Deceleration Ramp Rates
- Pressure Alarm Setpoints
- Watchdog Timer
- Expert Response Compensation

We assume you are familiar with conventions, terminology, and procedures used in the Injection Molding Industry, in this manual, and in the Plastic Molding Module Reference Manual.

Control Objectives for Clamp and Ejector Operations

Most molders share the following objectives when tuning their clamp and ejector operations and setting up molds to produce parts. These objectives apply to both toggle and hydraulic machines.

- **Repeatable mold full open position**. Automated removal of parts from mold cavities makes repeatable mold full open positioning a necessity.
- **Precise pressure control during low pressure close**. This is necessary to detect obstructions to mold closure and prevent mold damage. Recent advances in control technology let you do this with closed-loop algorithms, not relying on hydraulic components and circuit design.
- **High speed clamp operation**. This lets you achieve minimum machine cycle time with repeatable mold positioning and precise low pressure close control.
- **Smooth clamp operation**. Abrupt clamp movements can cause damage to clamp mechanisms and accelerate wear on machine hydraulics.
- **High certainty of parts ejection**. Parts not automatically or completely ejected can cause machine downtime and equipment damage.
- **Part quality protection**. Care must be taken not to damage the parts when ejecting them from the mold cavities.
- **Repeatable ejection position**. The advent of automated part removal from mold cavities has made repeatable ejector advance positioning a process necessity.

- **High speed ejector operation while meeting the above objectives**. Molders want to achieve minimal machine cycle time while insuring part quality, achieving repeatable ejector advance positioning, and positive part ejection.

Profile Requirements

A profile is a series of position and pressure (or velocity) setpoints which uniquely define a phase of **clamp or ejector** motion. The complexity of the profile depends on your **mold, clamp, and ejector mechanism**. Next we discuss required setpoints.

Velocity Setpoints for Clamp and Ejector Profiles
In general, choose velocity setpoints to move the clamp and ejector quickly without damaging the machine, mold, or parts. Because of the clamp's large dynamic load, be very careful if you configure the clamp to operate at high speeds because once accelerated, the moving platen/mold combination is extremely difficult to stop in a short period of time.

When configuring velocity profiles:

- Start with relatively low velocity setpoints.
- Increase them in small increments while observing clamp motion and repeatability at critical positions in the cycle.

Because of the inertia and momentum of moving large masses, remember:

- Unless the first clamp close/open profile segment is of long duration, actual velocities generally will undershoot setpoints. It takes time for the hydraulics to overcome the clamp's inertia and build adequate pressure and flow to accelerate the clamp to the requested velocity.
- Actual velocities of your second and/or third clamp close/open profile segments generally will overshoot setpoints. Overshoot increases with higher velocities. Once the platen/mold combination gains momentum, it is difficult to slow it to the requested velocity.

Low Pressure Close (LPC) Pressure Setpoints
In general, use LPC pressure setpoints low enough to let obstructions (such as sprues or un-ejected parts) resist mold closure and halt clamp movement before the clamp reaches the mold-safe position. Use the low pressure close watchdog timer to signal the PLC-5 processor that a mold-protection fault has occurred.

End-of-segment Position Setpoints for Clamp and Ejector
These setpoints depend on the mold, clamp, and ejector configurations of your molding machine. In general, you are not required to enter any end-of-segment position setpoints for the clamp or ejector. If you DO NOT use them, expect the following results in these movements:

For this movement	The QDC module	Then the QDC module:
First Clamp Close	Uses any non-zero velocity setpoint (CPC09) or pressure setpoint (CPC10) until the clamp reaches the protective start LPC position (CPC61). The 2nd and 3rd clamp close movements are not used.	• Either stops and zeros outputs (CPC03-B11 = 1) • or begins LPC movement (CPC03-B11 = 0) until the clamp reaches the configured mold-safe position (CPC62).
First Clamp Open	Uses any non-zero velocity setpoint (OPC09) or pressure setpoint (OPC10 until the clamp reaches the protective start open slow position (OPC61). The 2nd and 3rd clamp open movements are not used.	• Either stops and zeros outputs (OPC03-B11 = 1) • or begins Open-Slow movement (OPC03-B11 = 0) until the clamp reaches the configured mold fully open position (OPC62).
Ejector	Uses velocity setpoint (EPC09) or pressure setpoint (EPC10) until the ejector reaches its fully advanced position (EPC59).	• Either stops and sets outputs (EPC03-B12 = 1) • or begins retract movement (EPC03-B12 = 0) with velocity setpoint (EPC33) or pressure setpoint (EPC34) until the ejector reaches the configured fully retract position (EPC60).

During normal operation, the only required end-of-segment position setpoints are for:

- first clamp close (CPC11) to identify the operational start LPC position
- first clamp open (OPC11) to identify the operational start open-slow position

If you need additional profile segments (with the same unselected valve set-output values), begin with:

- 2nd segment of first clamp close for clamp close profiles
- 2nd segment of first clamp open for open profiles

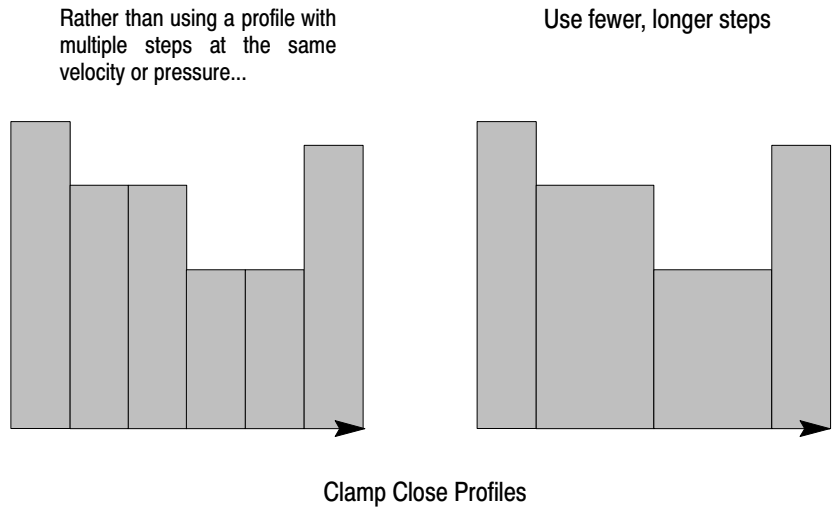
Use all available segments in first clamp close and first clamp open before using any in second and third clamp close/open (unless you require different unselected valve set-output values for successive segments).

If using ejectors, start with the first advance and retract setpoints. If additional profiled setpoints are required, add the second, then the third advance and retract setpoints.

Important: Fast segment velocities or high segment pressures may cause the clamp to overshoot the start low pressure close or start open-slow position. If you increase a velocity or pressure setpoint in a fast clamp close (or open) movement, we recommend that you increase the distance to the start LPC position (or decrease the distance to the open-slow position) at least temporarily to assure a successful low pressure close (or open slow) movement and mold closure (or opening).

Important: Avoid using the same velocity or pressure setpoint on sequential segments. For better control, use a single segment of longer length or duration (figure 10.3).

Figure 10.3
Better Control from Fewer and Longer Steps



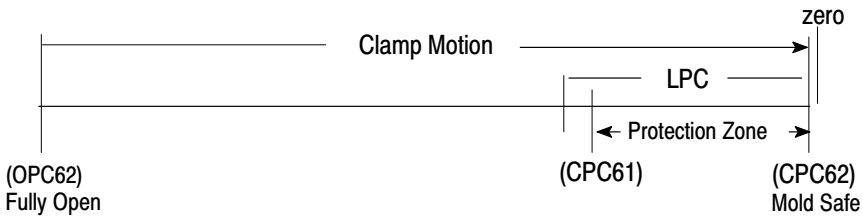
Start Clamp LPC Position Setpoint (CPC61)
The QDC module uses this clamp position as protection against running a clamp close profile into the mold protection zone. Although you can use it as an operational setpoint when CPC03-B11 = 0 (see discussion of End-of-Segment Position Setpoints above), its purpose is to guard against mold damage resulting from profile entry errors.

Important: This position setpoint should be determined and set only by qualified personnel, so we do not present it on any Pro-Set 600 screen.

Calculate CPC61 by determining the smallest distance required for the QDC module to safely assume pressure control:

- prior to mating the two mold halves
- with the clamp closing at maximum velocity and pressure

Figure 10.1
Example Setpoints for Mold Safe (CPC62) and Start Protection Zone (CPC61)



By setting this clamp position as stated, you minimize the possibility of mold damage that could result from changing clamp-close velocity, pressure, or position setpoints.

ATTENTION: On hydraulic (non-toggle) clamp mechanisms, re-adjust this parameter to account for mold thickness each time you install a different mold to guard against damage to the machine and personal injury.

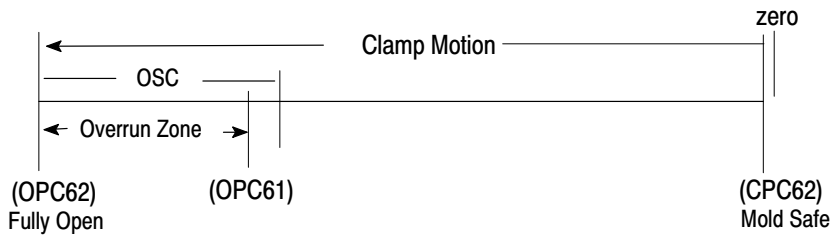
Start Clamp Open Slow Position Setpoint (OPC61)
The QDC module uses this clamp position to guard against running a clamp-open profile into the open-slow zone. Although you can use it as an operational setpoint OPC03-B11 = 0 (see discussion of End-of Segment Position Setpoints above), its purpose is to maintain precision clamp positioning regardless of profile entry errors.

Important: This position setpoint should be determined and set only by qualified personnel, so we do not present it on any Pro-Set 600 screen.

Calculate OPC61 by determining the smallest distance required for the QDC module to safely assume pressure control:

- prior to the mold reaching full open position
- with the clamp opening at maximum velocity and pressure

Figure 10.2
Example R4 Setpoints



By setting this clamp position as stated, you guard against the possibility of damaging your clamp mechanism that could result from changing clamp-open velocity, pressure, or position setpoints.

Important: Re-adjust this value each time you install a new mold.

Zone Overrun for CPC61 and OPC61
The following summarizes the choices of control action when the QDC module detects that the clamp passed these positions:

- start open slow position (OPC61)
- start LPC position (CPC61)

When the clamp passes this position	The QDC module	If you configured
CPC61	changes to low pressure close	CPC03-B11 = 0
start LPC position	stops and zeros outputs	CPC03-B11 = 1
OPC61	changes to clamp open slow	OPC03-B11 = 0
start open-slow position	stops and zeros outputs	OPC03-B11 = 1

Ejector Position for Clamp Close Enable (EPC63)
The QDC module uses this position as protection against starting (or continuing) any clamp close profile when the ejector is not safely retracted. This includes possible extension of ejectors after full retraction due to:

- bi-directional proportional flow valves which cannot be centered
- delays in the shifting directional solenoid valves

The QDC module requires this parameter to guard against starting a close operation by operator error or faulty logic when the ejector is advanced.

In chapter 8, you determined the maximum safe ejector position for EPC63 by jogging the ejectors against a fully closed mold.

Important: If you change ejector tooling or the mold on your machine, repeat the procedure in chapter 8 and recalculate this value to guard against damaging ejectors when closing the mold.

Clamp Position for Ejector Inhibit (EPC62)
The QDC module uses this clamp position as protection against starting (or continuing) any ejector profile when the clamp opening is not adequate for full ejector action. Nominally, this clamp position is equal to the sum of:

mold safe position + ejector full stroke length
(CPC62) + (EPC59–EPC60)

Important: If you change tooling or set-up which results in changing either of these two distances, you must recalculate clamp position EPC62.

Clamp Position for Start of Ejector Profile (EPC61)
If you select to start the ejector profile on position (EPC03-B08 = 0) rather than on command (EPC03-B08 = 1), the QDC module immediately begins executing the ejector profile once the clamp reaches this position during any clamp open profile.

Any position greater than EPC62 is satisfactory for this clamp position. Starting ejector movement before the clamp is fully open has industry acceptance as a legitimate method to reduce overall machine cycle time.

If your machine shares hydraulic flow between clamp and ejector manifolds, operating the two cylinders in tandem decreases the accuracy of

- valve spanning parameters determined in chapter 9
- tuning constants determined earlier in this chapter

In closed-loop mode, the QDC module attempts to fully open both the ejector and clamp flow valves to maintain velocity setpoints. When the clamp reaches the full open position and full flow is again made available to the ejector, closed-loop ejector operation may become unstable.

ATTENTION: Use extreme caution when operating the clamp and ejector in tandem on machines that share fluid between the two cylinders in closed-loop, especially with ERC enabled. Unstable operation could result in unpredictable operation with possible equipment damage and injury to personnel.

Logical Bridges

In chapter 8, you configured your QDC module to logically bridge all your clamp profiles. This forced the QDC module to start each successive profile at completion of the previous one in each direction of movement. If your hydraulics and/or process require NO changes between profiles controlling clamp motion, you may configure the QDC module to logically bridge the clamp open and close profiles as integrated machine phases:

- first clamp close to second clamp close (CPC03-B08 = 0)
- second clamp close to third clamp close (CPC03-B09 = 0)
- third clamp close to low pressure close (CPC03-B10 = 0)
- first clamp open to second clamp open (OPC03-B08 = 0)
- second clamp open to third clamp open (OPC03-B09 = 0)
- third clamp open to open slow (OPC03-B10 = 0)

Bridging machine phases has benefits such as:

- reduced cycle time
- smoother control
- less chance of hydraulic pressure transients

End-of-profile (-stroke) Set-output Values

If required by your application, you may configure the QDC module to stop at the completion of any profile (or stoke) and provide a constant signal to each of its four outputs while awaiting further commands from your PLC-5 processor. Disabling logical bridges and configuring end-of-profile (-stroke) set-output values let you do this. Recall in chapter 9 that we used set-output values at the end of the low pressure close profile to achieve tonnage on hydraulic clamps and hold pressure on toggle clamps.

If your hydraulics and/or process require changes controlled by your PLC-5 processor between profiles controlling clamp or ejector motion, you may configure the QDC module to stop at the completion of:

- first clamp close (CPC03-B08 = 1)
- second clamp close (CPC03-B09 = 1)
- third clamp close (CPC03-B10 = 1)
- first clamp open (OPC03-B08 = 1)
- second clamp open (OPC03-B09 = 1)
- third clamp open (OPC03-B10 = 1)
- end-of-stroke position (EPC03-B12 = 1)

Then the QDC module sends a fixed signal to each of its four outputs while awaiting further commands from the PLC-5 processor.

Important: The QDC module always stops and sets outputs at completion of the low pressure close and open slow profiles.

End-of-profile set-output values have uses including:

- setting cores between clamp close profiles
- pulling cores between clamp open profiles
- third plate drop-off and pick-up
- building tonnage/holding pressure on the clamp prior to injection
- adjusting flow with a variable pump after clamping or between profiles
- initializing valves for the next profile or movement
- re-aligning solenoid valves by PLC-5 processor before starting the next profile or movement
- decreasing ejector hydraulic circuit volume after the clamp is fully open
- resting your hydraulics before switching directional valves by PLC processor and retracting the ejector

When configuring end-of-profile (-stroke) set-output values, remember:

- The QDC module ignores these values on all profiles (or strokes) that are logically bridged to the next profile or movement
- After the QDC module sets them, they remain in set until the QDC module is commanded to start another movement or profile, or until the stop command is asserted

Unselected Valve Set-output Values

Refer to this title in Injection Tuning Considerations for Producing Parts.

Acceleration and Deceleration Ramp Rates

The zero ramp rates that you entered in chapter 7 disabled ramping. This forced the QDC module to step from setpoint to setpoint during a profile.

If required by your application, you may configure your QDC module to ramp its outputs during any profile. The QDC module uses configured acceleration and deceleration ramp rates when moving all of its outputs from setpoint to setpoint during any profile (figures 10.4 and 10.5).

ATTENTION: Because ramp rates are time based, using very slow (low value) ramp rates may inhibit effective closed-loop control, reduce ERC calculation accuracy, and limit the QDC module's control capability. Use ramp rates only if machine operation mandates them.

Important: When enabled, the QDC module applies ramp rates at the beginning of each profile segment.

With caution, you can use ramp rates to smooth jerky motion resulting from large changes in clamp pressure or flow.

Figure 10.3
Example Clamp Close Profiles with Accel/Decel Ramps

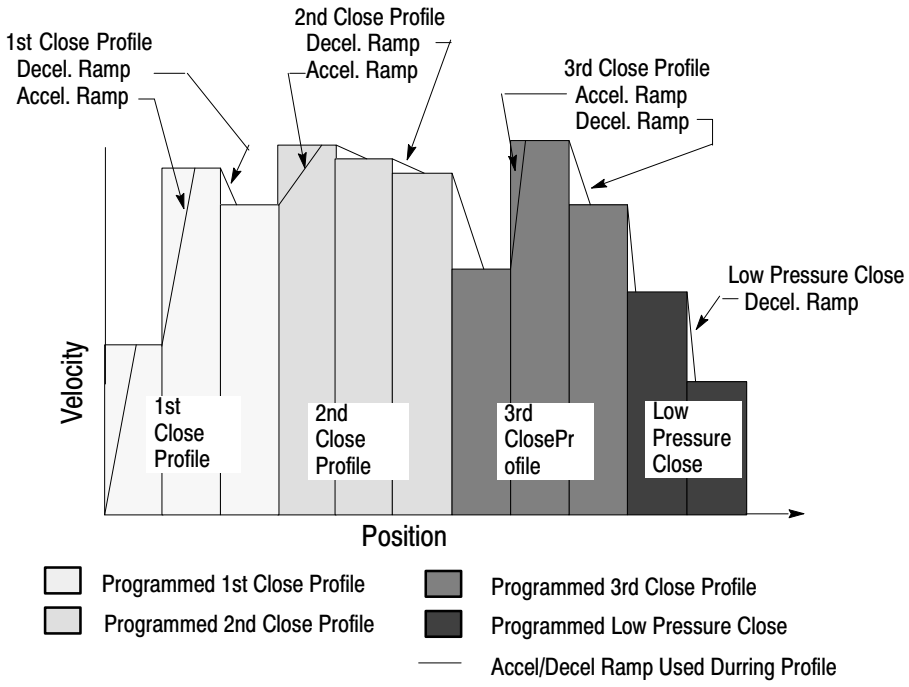
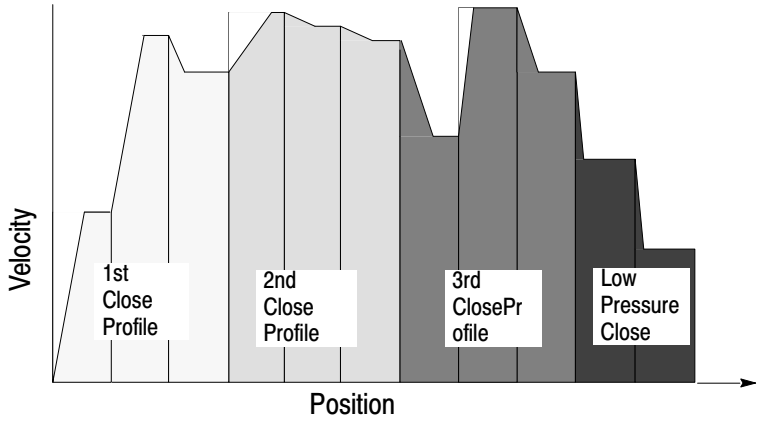


Figure 10.4
Actual Velocity Setpoint Profile When Above Ramps Are Used



You can configure ramp rates to decelerate the clamp:

- at the beginning of low pressure close. This may avoid possible damage to mold or machinery when moving toward the mold protection zone at high velocities during the clamp close operation.
- at the beginning of open slow. This may help achieve consistent repeatability of the full open position when moving toward the open slow zone at high velocities during the clamp open operation.

If your application requires the use of ramp rates, remember:

- Never apply ramp rates until you tuned all applicable clamp pressure and velocity loops.
- You can apply ramp rates to selected and unselected valves. Therefore, even though you may be controlling velocity, you can ramp clamp pressure during low pressure close.
- Ramp rates and ERC may not function properly together. Be very careful if applying ERC and ramp rates in the same profile.
- Using slow ramp rates may force pressure and velocity actuals out of control because these actuals include the time spent ramping plus the time each segment is controlled.
- The QDC module uses ramp rates upon entry into a profile and when stepping between segments in that profile. See figures 10.4 and 10.5.
- You enter ramp rates in units of 0 to 9999% signal output per second (note that there is no decimal point). A ramp rate entry of 9999 lets the output move full range in 10 milliseconds, while a ramp rate entry of 99 requires a full second to go full range. Lower values = slower ramps.

Pressure Alarm Setpoints

The QDC module monitors high pressure and compares it with two types of alarm setpoints for:

- absolute pressure that you configure in the MCC block (chapter 4) The QDC module monitors this continuously without regard to current machine mode or operational cycle.
- profile pressure that you configure in configuration blocks (chapter 7) The QDC module monitors these only during the subject profile.

In general:

When using this alarm	to detect this condition	You set the alarm setpoint	and Program ladder logic to
Absolute pressure	Dangerously high pressure	• Well above normal operating level • Below the level that could result in machine damage or personal injury	• Stop the QDC module • Place the machine in a safe condition
Profile pressure	Abnormally high pressure	• Just above the highest pressure expected for the profile of movement • Low enough to detect problems	• Stop the process • Signal the operator to take corrective action

Profile Watchdog Timer

Set the preset of profile watchdog timers after your machine is running repeatable quality parts. Set it just longer than the repetitive duration of the subject profile. Use these timers:

- as an early alert to operators that a process problem may be developing
- in PLC ladder logic to automatically initiate need for corrective action

For example, your PLC-5 processor could monitor the watchdog of the low pressure close profile and initiate a clamp-action re-try if the watchdog times out during the profile.

Expert Response Compensation

The QDC module uses a proprietary, enhanced control scheme called Expert Response Compensation (ERC). It compensates for changes in your machine dynamics, machine hydraulics, raw materials, and other process variables. It also adjusts the open-loop and closed-loop control algorithms to compensate for abrupt upsets and long term deviations to your process. In previous chapters, you ran profiles with the QDC module's ERC algorithm disabled.

Use ERC to strictly adhere to velocity or pressure (not position) setpoints. For example, ERC may be of great value during closed-loop LPC control when actual pressure must not exceed pressure setpoints.

Important: We recommend using ERC for clamp or ejector control *only* when adherence to velocity or pressure setpoints is absolutely required. Otherwise, we do *not* recommend it.

ERC is *not* required for repeatable clamp or ejector positioning. Without ERC, the QDC module will still force the clamp or ejector to overshoot by a constant repeatable amount (relative to cylinder speed and QDC module's 2 ms scan time).

Do NOT use ERC when:

- spanning your valves
- using velocity feedforward gain
- using profile ramp rates to smooth the operation.
- you have NOT tuned the machine in closed-loop control

ATTENTION: Jerky, abrupt clamp motion may result if you apply ERC to a control loop that has not been properly tuned.

ERC Minimum Percentage Values
If using ERC, adjust values recommended in chapter 7 as follows:

If ERC is enabled (on) and:	Then:
The actual velocity or pressure swings wildly around the setpoint from cycle to cycle	Decrease the ERC minimum % value
The actual velocity or pressure takes several cycles to achieve the desired setpoint	Increase the ERC minimum % value

Chapter 11

Troubleshoot with LEDs

Chapter Objectives

This chapter tells you how to troubleshoot your QDC module using LED indicators.

Use LEDs to Troubleshoot Your QDC Module

The front panel of the QDC module contains three Light Emitting Diodes (LEDs). Use them to troubleshoot problems that may occur during integration or operation of the QDC module. Each LED is a different color for easy identification.

Color of LED:	Identified as:
Green	ACTIVE
Red	FAULT
Yellow	COMM

The LEDs are located on the front panel of the module (Figure 11.1).

Figure 11.1
QDC Module LEDs

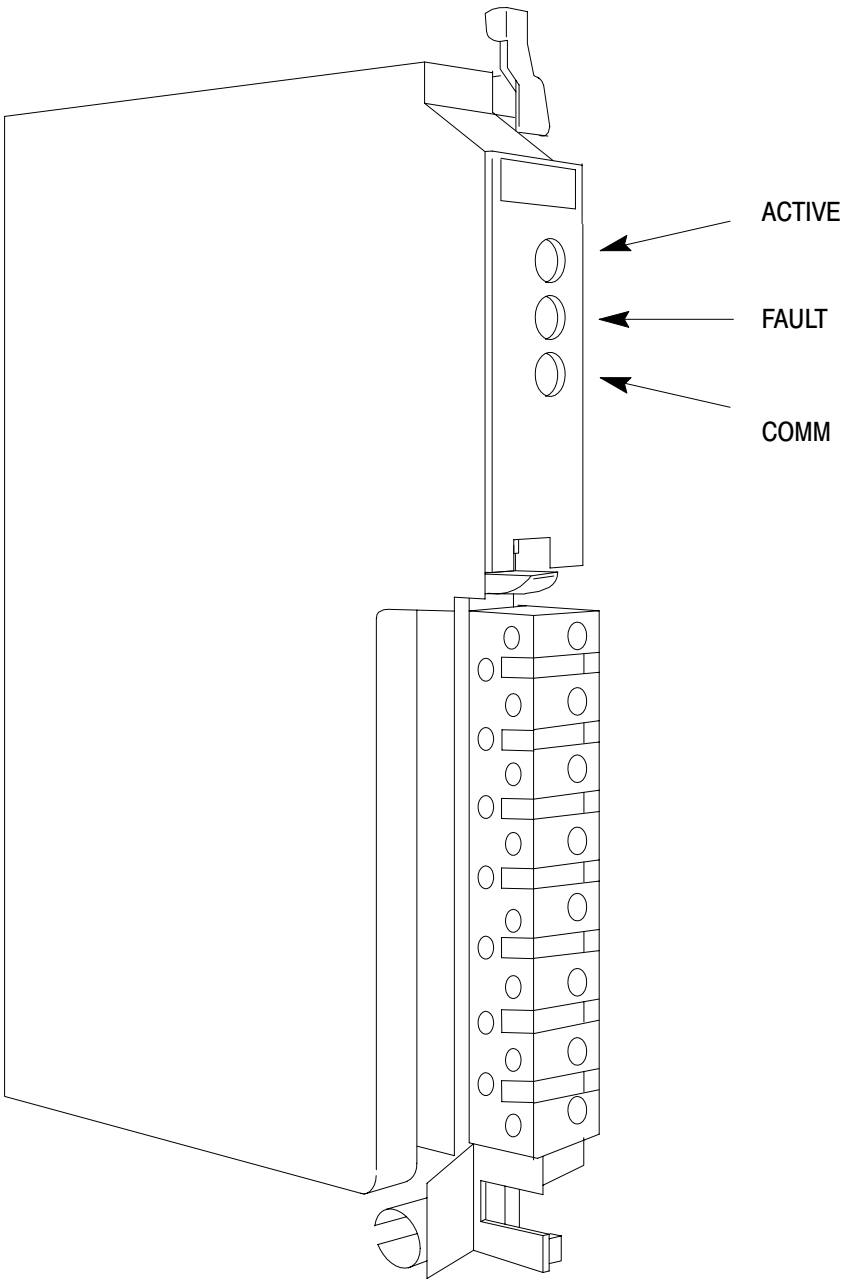


Table 11.A shows how to interpret QDC module LEDs. The QDC module monitors its own operation and reports detected conditions by illuminating its LEDs in the following combinations:

Table 11.A
LED Indicator Conditions

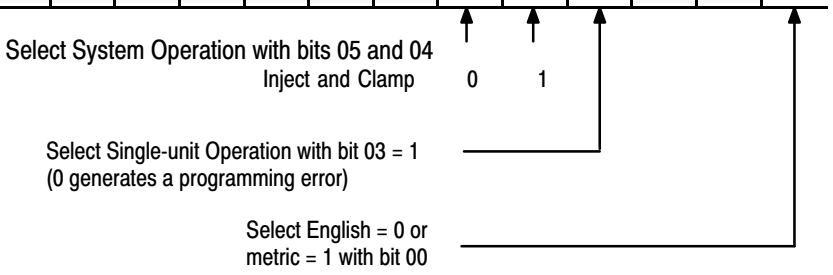
ACTIVE	FAULT	COMM	Condition:	We recommend that you:
Flashing	Off	Off	Power-up. The QDC module has completed its power-up diagnostics, the QDC module hardware and firmware are OK, and the QDC module is awaiting download of the MCC block.	Download the MCC block. Pro-Set 600 downloads the MCC when you switch your PLC-5 processor from program mode to run mode.
Flashing	Red	Yellow	Software Error. The QDC hardware and firmware are OK, the last BTW received by the QDC module had a recognizable block ID, but the last MCC received by the QDC module contained a programming error.	**1.** Fine and correct the MCC programming error. **2.** Use the MCC download procedure in chapter 4 to download corrected data to the QDC module.
Flashing	Red	Off	Software Error. The QDC hardware and firmware are OK, but the last BTW received by the QDC module did not have a recognizable block ID, and the last MCC received by the QDC module contained a programming error.	**1.** Find and correct the MCC programming error. **2.** Use the MCC download procedure in chapter 4 to download corrected data to the QDC module. **3.** Verify block IDs in your BTW data files.
Green	Off	Yellow	Normal operation. The QDC hardware and firmware are OK, no programming errors exist, and the last command block received by the QDC module had a recognizable block ID.	Do nothing.
Green	Off	Off	Software Error. The QDC hardware and firmware are OK, no programming errors exist, but the last command block received by the QDC module did not have a recognizable block ID.	Verify block IDs in your BTW data files.
Green	Red	Yellow	Limited operation. The QDC hardware and firmware are OK, the last command block received by the QDC module had a recognizable block ID, but a programming error(s) exists.	**1.** Find and correct the programming error. **2.** Use the download procedure in chapter 3 to download corrected data to the QDC module.
Green	Red	Off	Software Error. The QDC hardware and firmware are OK, but a programming error(s) exists, and the last command block received by the QDC module did not have a recognizable block ID.	**1.** Find and correct the programming error. **2.** Use the download procedure in chapter 3 to download corrected data to the QDC module. **3.** Verify block IDs in your BTW data files.
Off	Off	Flashing	Communications Error. The QDC hardware and firmware are OK, but the module is not completing continuous transmission of status data blocks to the host PLC processor. The QDC module is inoperable until continuous BTR communication is re-established with the host PLC processor.	**1.** Verify your PLC is in run mode. **2.** Reseat your QDC module in the I/O chassis. **3.** Check for PLC ladder programming problems.
Off	Red	Yellow or Off	Hardware fault. The QDC module is inoperable.	**1.** Cycle power to the QDC module. **2.** Replace the QDC module **3.** Return it for factory repair.

Appendix **A**

Blank Worksheets

Worksheet 4-A
Selecting Module Parameters

Control Word MCC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B34/bit	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528
Value	0	0	0	0	0	0	0	0	0	0				0	0	

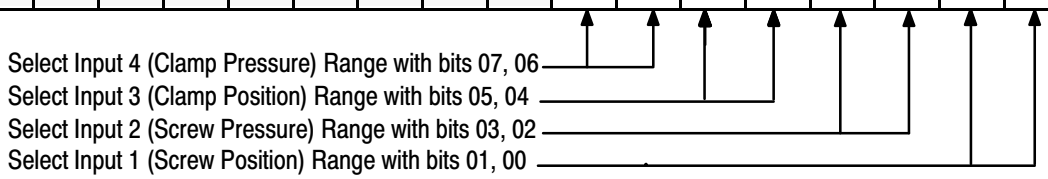


Example: If you select Inject and Clamp operation with English units:
MCC02 = 00000000 00011000

Worksheet 4-B

Selecting Input Ranges for your Sensors

Control Word MCC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B34/bit	559	558	557	556	555	554	553	552	551	550	549	548	547	546	545	544
Value	1	1	1	1	1	1	1	1								



Input Range		
0 – 10V dc	0	0
1 – 5V dc	0	1
4 – 20 mA	1	0
Not connected	1	1

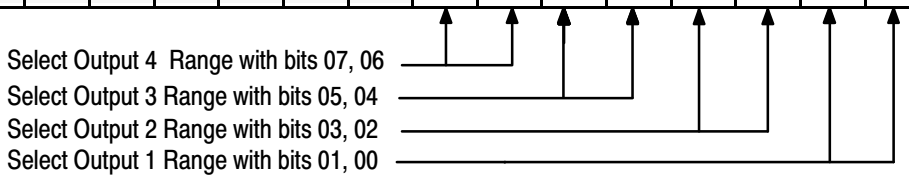
Example: If you select an input range of 4-20 mA for all four inputs:
MCC03 = 11111111 10101010.

Important: Software input selections must match the jumper settings for each respective input.

Worksheet 4-C

Selecting Output Ranges for your Valves

Control Word MCC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B34/bit	575	574	573	572	571	570	569	568	567	566	565	564	563	562	561	560
Value	1	1	1	1	1	1	1	1								



Output Range		
–10 to +10V dc	0	0
0 to +10V dc	0	1
4 to 20 mA	1	0
Not connected	1	1

Example: If you select 0-10V dc for all four output ranges:
MCC04 = 11111111 01010101.

Important: Software output selections must match the jumper settings for each respective output.

Worksheet 4-D
Determining Initial Sensor-configuration Values

Enter Your Initial Values Here

Input	Line	Control Word	Pro-Set 600 Addr.	Value	Description	Units
1	1	MCC09	N40:5		Minimum Screw Position	Screw Axis Measured from zero [1]
	2	MCC10	N40:6		Maximum Screw Position	Screw Axis Measured from zero [1]
	3	MCC11	N40:7		Analog Signal @ Min Screw Position	Input Signal Range [2]
	4	MCC12	N40:8		Analog Signal @ Max Screw Position	Input Signal Range [2]
2	5	MCC17	N40:13		Minimum Screw Pressure	Screw Pressure [3]
	6	MCC18	N40:14		Maximum Screw Pressure	Screw Pressure [3]
	7	MCC19	N40:15		Analog Signal @ Min Screw Pressure	Input Signal Range [2]
	8	MCC20	N40:16		Analog Signal @ Max Screw Pressure	Input Signal Range [2]
3	9	MCC23	N40:19		Minimum Clamp Position	Clamp Axis Measured from zero [1]
	10	MCC24	N40:20		Maximum Clamp Position	Clamp Axis Measured from zero [1]
	11	MCC25	N40:21		Analog Signal @ Min Clamp Position	Input Signal Range [2]
	12	MCC26	N40.22		Analog Signal @ Max Clamp Position	Input Signal Range [2]
4	13	MCC31	N40:27		Minimum Clamp Pressure	Clamp Pressure [3]
	14	MCC32	N40:28		Maximum Clamp Pressure	Clamp Pressure [3]
	15	MCC33	N40:29		Analog Signal @ Min Clamp Pressure	Input Signal Range [2]
	16	MCC34	N40:30		Analog Signal @ Max Clamp Pressure	Input Signal Range [2]

[1] Incremental Distance
00.00 to 99.99in
000.0 to 999.9mm

[2] Input Signal Range
00.00 to 10.00VDC or
01.00 to 05.00VDC or
04.00 to 20.00MADC

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Worksheet 4-E
Final Sensor-configuration Values

Enter Your Final Values Here

Input	Line	Control Word	Pro-Set 600 Addr.	Value	Description	Units
1	1	MCC09	N40:5		Minimum Screw Position	Screw Axis Measured from zero [1]
	2	MCC10	N40:6		Maximum Screw Position	Screw Axis Measured from zero [1]
	3	MCC11	N40:7		Analog Signal @ Min Screw Position	Input Signal Range [2]
	4	MCC12	N40:8		Analog Signal @ Max Screw Position	Input Signal Range [2]
2	5	MCC17	N40:13		Minimum Screw Pressure	Screw Pressure [3]
	6	MCC18	N40:14		Maximum Screw Pressure	Screw Pressure [3]
	7	MCC19	N40:15		Analog Signal @ Min Screw Pressure	Input Signal Range [2]
	8	MCC20	N40:16		Analog Signal @ Max Screw Pressure	Input Signal Range [2]
3	9	MCC23	N40:19		Minimum Clamp Position	Clamp Axis Measured from zero [1]
	10	MCC24	N40:20		Maximum Clamp Position	Clamp Axis Measured from zero [1]
	11	MCC25	N40:21		Analog Signal @ Min Clamp Position	Input Signal Range [2]
	12	MCC26	N40:22		Analog Signal @ Max Clamp Position	Input Signal Range [2]
4	13	MCC31	N40:27		Minimum Clamp Pressure	Clamp Pressure [3]
	14	MCC32	N40:28		Maximum Clamp Pressure	Clamp Pressure [3]
	15	MCC33	N40:29		Analog Signal @ Min Clamp Pressure	Input Signal Range [2]
	16	MCC34	N40:30		Analog Signal @ Max Clamp Pressure	Input Signal Range [2]

[1] Incremental Distance
00.00 to 99.99in
000.0 to 999.9mm

[2] Input Signal Range
00.00 to 10.00VDC or
01.00 to 05.00VDC or
04.00 to 20.00MADC

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Worksheet 4-F
SWTL Configuration Values

Enter Your SWTL Configuration Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
MCC13	N40:9		Screw Minimum SWTL	Screw Axis Measured from zero [1]
MCC14	N40:10		Screw Maximum SWTL	Screw Axis Measured from zero [1]
MCC15	N40:11		Screw SWTL Deadband	As noted [1]
MCC27	N40:23		Clamp Minimum SWTL	Clamp Axis Measured from zero [1]
MCC28	N40:24		Clamp Maximum SWTL	Clamp Axis Measured from zero [1]
MCC29	N40:25		Clamp SWTL Deadband	As noted [1]

[1] Incremental Distance
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

Worksheet 4-G
Pressure-alarm and Time-delay Setpoints

Enter Your Pressure-alarm and Time-delay Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
MCC21	N40:17		Screw Pressure-alarm Setpoint	Ram (screw) Pressure [2]
MCC22	N40:18		Screw-pressure Time-delay Setpoint	Time Measured in Seconds [1]
MCC35	N40:31		Clamp Pressure-alarm Setpoint	Clamp Pressure [2]
MCC36	N40:32		Clamp-pressure Time-delay Setpoint	Time Measured in Seconds [1]

[1] Time Measured in Seconds
00.00 to 00.99

[2] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Worksheet 5-A
Ram (screw) and Clamp Jog Configuration Values

Enter Your Initial Values Here

Control Block Word	Pro-Set 600 Addr.	Value	Description	Units
Inject, Forward Jog				
JGC17	N40:73		Set Output Values Output #1	% Signal Output [1]
JGC18	N40:74		Output #2	% Signal Output [1]
JGC19	N40:75		Output #3	% Signal Output [1]
JGC20	N40:76		Output #4	% Signal Output [1]
Inject, Reverse Jog				
JGC25	N40:81		Set Output Values Output #1	% Signal Output [1]
JGC26	N40:82		Output #2	% Signal Output [1]
JGC27	N40:83		Output #3	% Signal Output [1]
JGC28	N40:84		Output #4	% Signal Output [1]
Clamp, Forward Jog				
JGC33	N40:89		Set Output Values Output #1	% Signal Output [1]
JGC34	N40:90		Output #2	% Signal Output [1]
JGC35	N40:91		Output #3	% Signal Output [1]
JGC36	N40:92		Output #4	% Signal Output [1]
Clamp, Reverse Jog				
JGC41	N40:97		Set Output Values Output #1	% Signal Output [1]
JGC42	N40:98		Output #2	% Signal Output [1]
JGC43	N40:99		Output #3	% Signal Output [1]
JGC44	N40:100		Output #4	% Signal Output [1]
Jog Pressure Alarms				
JGC06	N40:62		Ram Jog Pressure, Alarm Setpoint	Ram (screw) Pressure [2]
JGC07	N40:63		Clamp Jog Pressure Alarm Setpoint	Clamp Pressure [2]

[1] % Signal Output
00.00 to 99.99 %

[2] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

Worksheet 5-B

Screw-rotate & Eject Jog Configuration Values for Indirect Control

Enter Your Initial Values Here

Control Block Word	Pro-Set 600 Addr.	Value	Description	Units
Screw Rotate Jog				
JGC09	N40:65		Set Output Values Output #1	% Signal Output [1]
JGC10	N40:66		Output #2	% Signal Output [1]
JGC11	N40:67		Output #3	% Signal Output [1]
JGC12	N40:68		Output #4	% Signal Output [1]
Ejector, Advance Jog				
JGC49	N40:105		Set Output Values Output #1	% Signal Output [1]
JGC50	N40:106		Output #2	% Signal Output [1]
JGC51	N40:107		Output #3	% Signal Output [1]
JGC52	N40:108		Output #4	% Signal Output [1]
Ejector, Retract Jog				
JGC57	N40:113		Set Output Values Output #1	% Signal Output [1]
JGC58	N40:114		Output #2	% Signal Output [1]
JGC59	N40:115		Output #3	% Signal Output [1]
JGC60	N40:116		Output #4	% Signal Output [1]

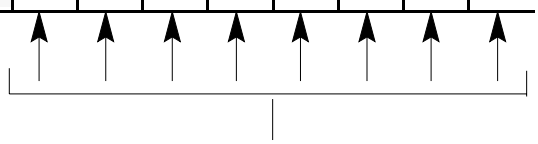
[1] % Signal Output
00.00 to 99.99 %

Worksheet 7-A
Clamp Close Configuration Blocks (FCC, SCC, and TCC)

Word **FCC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Word **SCC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Word **TCC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1



Important: Record values only in words used.
Record zeros in words not used.
You must configure at least FCC02

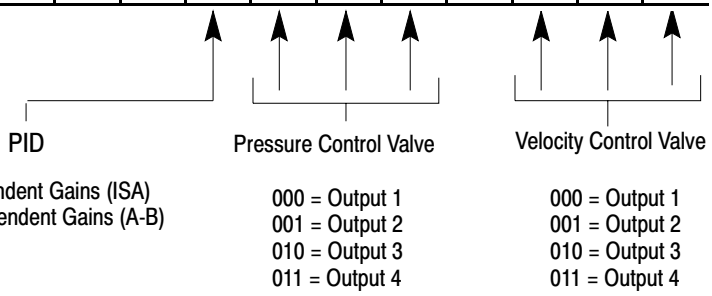
Word **FCC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Word **SCC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
Value	0	0	0	0	0	0	0	0	1				0			

Word **TCC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used



Important: You must configure at least the FCC configuration block.

Worksheet 7-A (continued)
Clamp Close Configuration Blocks (FCC, SCC, and TCC)

Enter Your Values Here

For these Parameters (footnote = units)	Word	FCC N43:	FCC Value	SCC N43:	SCC Value	TCC N43:	TCC Value
Minimum ERC Percentage – Velocity [8]	05	1	1000	61	1000	121	1000
Minimum ERC Percentage – Pressure [8]	06	2	1000	62	1000	122	1000
Profile Watchdog Timer Preset [1]	08	4	0	64	0	124	0
Output #1 Selected Valve %-Output During Profile [4]	09	5	*	65	*	125	*
Output #2 Selected Valve %-Output During Profile [4]	10	6	*	66	*	126	*
Output #3 Selected Valve %-Output During Profile [4]	11	7	*	67	*	127	*
Output #4 Selected Valve %-Output During Profile [4]	12	8	*	68	*	128	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	13	0	73	0	133	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	14	0	74	0	134	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	15	0	75	0	135	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	16	0	76	0	136	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	21	0	81	0	141	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	22	0	82	0	142	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	23	0	83	0	143	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	24	0	84	0	144	0
Output #1 End-of-profile Set-output Value [4]	33	29	*	89	*	149	*
Output #2 End-of-profile Set-output Value [4]	34	30	*	90	*	150	*
Output #3 End-of-profile Set-output Value [4]	35	31	*	91	*	151	*
Output #4 End-of-profile Set-output Value [4]	36	32	*	92	*	152	*
Pressure Minimum Control Limit [3]	41	37	0	97	0	157	0
Pressure Maximum Control Limit [3]	42	38	Syst Press	98	Syst Press	158	Syst Press
Selected Pressure Valve Output for Minimum [4]	43	39	*	99	*	159	*
Selected Pressure Valve Output for Maximum [4]	44	40	*	100	*	160	*
Velocity Minimum Control Limit [2]	45	41	0	101	0	161	0
Velocity Maximum Control Limit [2]	46	42	per OEM *	102	per OEM *	162	per OEM *
Selected Velocity Valve Output for Minimum [4]	47	43	*	103	*	163	*
Selected Velocity Valve Output for Maximum [4]	48	44	*	104	*	164	*
Proportional Gain for Pressure Control (none)	49	45	100	105	100	165	100
Integral Gain for Pressure Control [6]	50	46	400	106	400	166	400
Derivative Gain for Pressure Control [7]	51	47	0	107	0	167	0
Proportional Gain for Velocity Control [6]	52	48	200	108	200	168	200
Feed Forward Gain for Velocity Control (none)	53	49	0	109	0	169	0
Profile High Pressure Alarm Setpoint [3]	57	53	0	113	0	173	0

[1] Time
00.00 to 99.99 Seconds

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Seconds

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

***Important**: Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-B
Low Pressure Close Configuration Block (LPC)

Word **LPC01** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0

Block Identifier

Word **LPC02** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

PID
0 = Dependent Gains (ISA)
1 = Independent Gains (A-B)

Pressure Control Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Important: You must configure the LPC configuration block.

Worksheet 7-B (continued)
Low Pressure Close Configuration Block (LPC)

Enter Your Values Here

For these Parameters (footnote = units)	Word	LPC N43:	LPC Value
Tonnage Watchdog Timer Preset [1]	07	183	0
Profile Watchdog Timer Preset [1]	08	184	0
#1 Selected Valve Set-Output During Profile [4]	09	185	*
#2 Selected Valve Set-Output During Profile [4]	10	186	*
#3 Selected Valve Set-Output During Profile [4]	11	187	*
#4 Selected Valve Set-Output During Profile [4]	12	188	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	193	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	194	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	195	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	196	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	201	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	202	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	203	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	204	0
#1 End-of-profile Set-output Value [4]	33	209	*
#2 End-of-profile Set-output Value [4]	34	210	*
#3 End-of-profile Set-output Value [4]	35	211	*
#4 End-of-profile Set-output Value [4]	36	212	*
Pressure Minimum Control Limit [3]	41	217	0
Pressure Maximum Control Limit [3]	42	218	System Pressure
Selected Pressure Valve Output for Minimum [4]	43	219	*
Selected Pressure Valve Output for Maximum [4]	44	220	*
Proportional Gain for Pressure Control (none)	49	225	100
Integral Gain for Pressure Control [6]	50	226	400
Derivative Gain for Pressure Control [7]	51	227	0
Profile High Pressure Alarm Setpoint [3]	57	233	0

[1] Time
00.00 to 99.99 Sec

[2] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[3] Percent Signal Output
00.00 to 99.99

[4] Percent Signal Output per Sec
0000 to 9999

[5] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Sec

[6] Time (Algorithm)
00.00 to 99.99 Minutes

[7] Percent
00.00 to 99.99

*** Important**: Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-C
Injection Configuration Block (INC)

Control Word INC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

INC Block Identifier

Control Word INC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Selected Pressure Valve

000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Selected Velocity Valve

000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Worksheet 7-C (continued)
Injection Configuration Block (INC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description
INC05	N44:1	1000	Minimum ERC Percentage--Velocity [8]
INC06	N44:2	1000	Minimum ERC Percentage--Pressure [8]
INC09	N44:5	*	Output #1 Set-output Value During Profile [4]
INC10	N44:6	*	Output #2 Set-output Value During Profile [4]
INC11	N44:7	*	Output #3 Set-output Value During Profile [4]
INC12	N44:8	*	Output #4 Set-output Value During Profile [4]
INC17	N44:13	0	Output #1 Acceleration Ramp Rate During Profile [5]
INC18	N44:14	0	Output #2 Acceleration Ramp Rate During Profile [5]
INC19	N44:15	0	Output #3 Acceleration Ramp Rate During Profile [5]
INC20	N44:16	0	Output #4 Acceleration Ramp Rate During Profile [5]
INC25	N44:21	0	Output #1 Deceleration Ramp Rate During Profile [5]
INC26	N44:22	0	Output #2 Deceleration Ramp Rate During Profile [5]
INC27	N44:23	0	Output #3 Deceleration Ramp Rate During Profile [5]
INC28	N44:24	0	Output #4 Deceleration Ramp Rate During Profile [5]
INC41	N44:37	0	Pressure Minimum Control Limit [3]
INC42	N44:38	*	Pressure Maximum Control Limit [3]
INC43	N44:39	*	Selected Pressure Valve, Output for Minimum [4]
INC44	N44:40	*	Selected Pressure Valve, Output for Maximum [4]
INC45	N44:41	0	Velocity Minimum Control Limit [2]
INC46	N44:42	*	Velocity Maximum Control Limit [2]
INC47	N44:43	*	Selected Velocity Valve, Output for Minimum [4]
INC48	N44:44	*	Selected Velocity Valve, Output for Maximum [4]
INC49	N44:45	100	Proportional Gain for Pressure Control
INC50	N44:46	400	Integral Gain for Pressure Control [6]
INC51	N44:47	0	Derivative Gain for Pressure Control [7]
INC52	N44:48	200	Proportional Gain for Velocity Control [6]
INC53	N44:49	0	Feed Forward Gain for Velocity Control
INC57	N44:53	0	Profile High Pressure Alarm Setpoint [3]

[2] Velocity along Axis
00.00 to 99.99 inches per second
000.0 to 999.9 millimeters per second

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-D
Pack Configuration Block (PKC)

Control Word PKC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0

PKC Block Identifier

Control Word PKC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Selected
Pressure Valve

000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Worksheet 7-D (continued)
Pack Configuration Block (PKC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PKC06	N44:122	1000	Minimum ERC Percentage--Pressure	Percent [8]
PKC09	N44:125	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
PKC10	N44:126	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
PKC11	N44:127	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
PKC12	N44:128	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
PKC17	N44:133	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC18	N44:134	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC19	N44:135	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC20	N44:136	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC25	N44:141	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC26	N44:142	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC27	N44:143	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC28	N44:144	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC41	N44:157	0	Pressure Minimum Control Limit	Pressure [3]
PKC42	N44:158	*	Pressure Maximum Control Limit	Pressure [3]
PKC43	N44:159	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
PKC44	N44:160	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
PKC49	N44:165	100	Proportional Gain for Pressure Control	None
PKC50	N44:166	400	Integral Gain for Pressure Control	Inverse Time (Algorithm) [6]
PKC51	N44:167	0	Derivative Gain for Ram Pressure Control	Time (Algorithm) [7]
PKC57	N44:173	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-E
Hold Configuration Block (HDC)

Control Word HDC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1

HDC Block Identifier

Control Word HDC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Selected Pressure Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

Worksheet 7-E (continued)
Hold Configuration Block (HDC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HDC06	N44:182	1000	Minimum ERC Percentage--Pressure	Percent [8]
HDC09	N44:185	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
HDC10	N44:186	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
HDC11	N44:187	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
HDC12	N44:188	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
HDC17	N44:193	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC18	N44:194	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC19	N44:195	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC20	N44:196	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC25	N44:201	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC26	N44:202	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC27	N44:203	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC28	N44:204	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC33	N44:209	*	Output #1 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC34	N44:210	*	Output #2 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC35	N44:211	*	Output #3 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC36	N44:212	*	Output #4 Set-output Value at End-of Profile	Percent Signal Output [4]
HDC41	N44:217	0	Pressure Minimum Control Limit	Pressure [3]
HDC42	N44:218	*	Pressure Maximum Control Limit	Pressure [3]
HDC43	N44:219	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
HDC44	N44:220	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
HDC49	N44:225	100	Proportional Gain for Pressure Control	None
HDC50	N44:226	400	Integral Gain for Pressure Control	Inverse Time (algorithm) [6]
HDC51	N44:227	0	Derivative Gain for Pressure Control	Time (algorithm) [7]
HDC57	N44:233	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-F
Plastication Configuration Block (PLC)

Control Word PLC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384
Value	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0

PLC Block Identifier

Control Word PLC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Selected
Pressure Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

PID Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

Worksheet 7-F (continued)
Plastication Configuration Block (PLC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PLC06	N44:362	1000	Minimum ERC Percentage--Pressure	Percent [8]
PLC08	N44:364	0	Profile Watchdog Timer Preset	Time [1]
PLC09	N44:365	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
PLC10	N44:366	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
PLC11	N44:367	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
PLC12	N44:368	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
PLC17	N44:373	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC18	N44:374	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC19	N44:375	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC20	N44:376	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC25	N44:381	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC26	N44:382	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC27	N44:383	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC28	N44:384	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
PLC33	N44:389	*	Output #1 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC34	N44:390	*	Output #2 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC35	N44:391	*	Output #3 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC36	N44:392	*	Output #4 Set-output Value at End-of Profile	Percent Signal Output [4]
PLC41	N44:397	0	Pressure Minimum Control Limit	Pressure [3]
PLC42	N44:398	*	Pressure Maximum Control Limit	Pressure [3]
PLC43	N44:399	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
PLC44	N44:400	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
PLC49	N44:405	100	Proportional Gain for Pressure Control	None
PLC50	N44:406	400	Integral Gain for Pressure Control	Inverse Time (Algorithm) [6]
PLC51	N44:407	0	Derivative Gain for Pressure Control	Time (Algorithm) [7]
PLC57	N44:413	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[1] Time
00.00 to 99.99 seconds

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[7] Time (Algorithm)
00.00 to 99.99 Minutes (ISA)
00.00 to 99.99 Seconds (A-B)

[8] Percent
00.00 to 99.99

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 4-G
Clamp Open Configuration Blocks (FOC, SOC, TOC, and OSC)

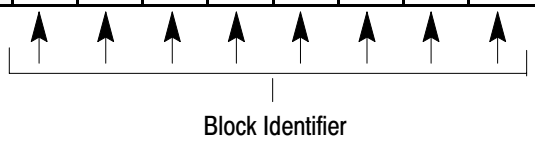
Word **FOC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	335	334	333	332	331	330	329	328	327	326	325	324	323	322	321	320
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Word **SOC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0

Word **TOC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	463	362	461	460	459	458	457	456	455	454	453	452	451	450	449	448
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1

Word **OSC01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	527	526	525	524	523	522	521	520	519	518	517	516	515	514	513	512
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0

Important: Record values only in words used.
Record zeros in words not used.
You must configure at least FOC02



Word **FOC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336
Value	0	0	0	0	0	0	0	0	1				0			

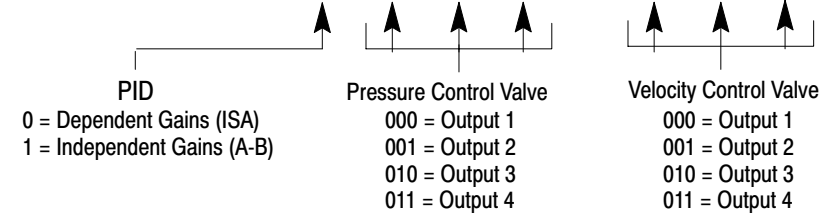
Word **SOC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400
Value	0	0	0	0	0	0	0	0	1				0			

Word **TOC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	479	478	477	476	475	474	473	472	471	470	469	468	467	466	465	464
Value	0	0	0	0	0	0	0	0	1				0			

Word **OSC02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used



Important: You must configure at least the FOC and OSC configuration blocks.

Worksheet 7-G (continued)
Clamp Open Configuration Blocks (FOC, SOC, TOC, and OSC)

Enter Your Values Here

For these Parameters (footnote = units)	Word	FOC N43	FOC Value	SOC N43	SOC Value	TOC N43	TOC Value	OSC N43	OSC Value
Minimum ERC Percentage – Velocity [8]	05	301	1000	361	1000	421	1000	481	1000
Minimum ERC Percentage – Pressure [8]	06	302	1000	362	1000	422	1000	482	1000
Profile Watchdog Timer Preset [1]	08	304	0	364	0	424	0	484	0
#1 Selected Valve Set-Output During Profile [4]	09	305	*	365	*	425	*	485	*
#2 Selected Valve Set-Output During Profile [4]	10	306	*	366	*	426	*	486	*
#3 Selected Valve Set-Output During Profile [4]	11	307	*	367	*	427	*	487	*
#4 Selected Valve Set-Output During Profile [4]	12	308	*	368	*	428	*	488	*
Output #1 Accel Ramp Rate During Profile [5]	17	313	0	373	0	433	0	493	0
Output #2 Accel Ramp Rate During Profile [5]	18	314	0	374	0	434	0	494	0
Output #3 Accel Ramp Rate During Profile [5]	19	315	0	375	0	435	0	495	0
Output #4 Accel Ramp Rate During Profile [5]	20	316	0	376	0	436	0	496	0
Output #1 Decel Ramp Rate During Profile [5]	25	321	0	381	0	441	0	501	0
Output #2 Decel Ramp Rate During Profile [5]	26	322	0	382	0	442	0	502	0
Output #3 Decel Ramp Rate During Profile [5]	27	323	0	383	0	443	0	503	0
Output #4 Decel Ramp Rate During Profile [5]	28	324	0	384	0	444	0	504	0
#1 End-of-profile Set-output Value [4]	33	329	*	389	*	449	*	509	*
#2 End-of-profile Set-output Value [4]	34	330	*	390	*	450	*	510	*
#3 End-of-profile Set-output Value [4]	35	331	*	391	*	451	*	511	*
#4 End-of-profile Set-output Value [4]	36	332	*	392	*	452	*	512	*
Pressure Minimum Control Limit [3]	41	337	0	397	0	457	0	517	0
Pressure Maximum Control Limit [3]	42	338	Syst Press	398	Syst Press	458	Syst Press	518	Syst Press
Selected Pressure Valve Output for Min [4]	43	339	*	399	*	459	*	519	*
Selected Pressure Valve Output for Max [4]	44	340	*	400	*	460	*	520	*
Velocity Minimum Control Limit [2]	45	341	0	401	0	461	0	521	0
Velocity Maximum Control Limit [2]	46	342	per OEM *	402	per OEM *	462	per OEM *	522	per OEM *
Selected Velocity Valve Output for Min [4]	47	343	*	403	*	463	*	523	*
Selected Velocity Valve Output for Max [4]	48	344	*	404	*	464	*	524	*
Proportional Gain for Pressure Control (none)	49	345	100	405	100	465	100	525	100
Integral Gain for Pressure Control [6]	50	346	400	406	400	466	400	526	400
Derivative Gain for Pressure Control [7]	51	347	0	407	0	467	0	527	0
Proportional Gain for Velocity Control [6]	52	348	200	408	200	468	200	528	200
Feed Forward Gain for Velocity Control (none)	53	349	0	409	0	469	0	529	0
Profile High Pressure Alarm Setpoint [3]	57	353	0	413	0	473	0	533	0

[1] Time
00.00 to 99.99 Seconds

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Seconds

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

*** Important:** Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-H
Ejector Configuration Blocks (EAC and ERC)

Control Word EAC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0

Control Word ERC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1

Block Identifier

Control Word EAC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Control Word ERC02-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B39/bit	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
Value	0	0	0	0	0	0	0	0	1				0			

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Pressure Control Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Velocity Control Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Pressure Algorithm Selection
0 = Dependent Gains
1 = Independent Gains

Worksheet 7-H (continued)
Ejector Configuration Blocks (EAC and ERC)

Enter Your Values Here

Description	Word	EAC @ N45:	EAC Value	ERC @ N45:	ERC Value
Minimum ERC™ Percentage--Velocity [8]	05	N45:1	1000	N45:61	1000
Minimum ERC™ Percentage--Pressure [8]	06	N45:2	1000	N45:62	1000
Profile Watchdog Timer Preset [1]	08	N45:4	0	N/A	N/A
Output #1 Set-Output Value during Advance [4]	09	N45:5	*	N45:65	*
Output #2 Set-Output Value during Advance [4]	10	N45:6	*	N45:66	*
Output #3 Set-Output Value during Advance [4]	11	N45:7	*	N45:67	*
Output #4 Set-Output Value during Advance [4]	12	N45:8	*	N45:68	*
Output #1 Acceleration Ramp Rate during Advance [5]	17	N45:13	0	N45:73	0
Output #2 Acceleration Ramp Rate during Advance [5]	18	N45:14	0	N45:74	0
Output #3 Acceleration Ramp Rate during Advance [5]	19	N45:15	0	N45:75	0
Output #4 Acceleration Ramp Rate during Advance [5]	20	N45:16	0	N45:76	0
Output #1 Deceleration Ramp Rate during Advance [5]	25	N45:21	0	N45:81	0
Output #2 Deceleration Ramp Rate during Advance [5]	26	N45:22	0	N45:82	0
Output #3 Deceleration Ramp Rate during Advance [5]	27	N45:23	0	N45:83	0
Output #4 Deceleration Ramp Rate during Advance [5]	28	N45:24	0	N45:84	0
Output #1 Set-Output Value at End-of Advance [4]	33	N45:29	*	N45:89	*
Output #2 Set-Output Value at End-of Advance [4]	34	N45:30	*	N45:90	*
Output #3 Set-Output Value at End-of Advance [4]	35	N45:31	*	N45:91	*
Output #4 Set-Output Value at End-of Advance [4]	36	N45:32	*	N45:92	*
Pressure Minimum Control Limit [3]	41	N45:37	0	N45:97	0
Pressure Maximum Control Limit [3]	42	N45:38	System Pressure	N45:98	System Pressure
Selected Pressure Valve Output for Minimum [4]	43	N45:39	*	N45:99	*
Selected Pressure Valve Output for Maximum [4]	44	N45:40	*	N45:100	*
Velocity Minimum Control Limit [2]	45	N45:41	0	N45:101	0
Velocity Maximum Control Limit [2]	46	N45:42	Max Velocity per OEM specs*	N45:102	Max Velocity per OEM specs*
Selected Velocity Valve Output for Minimum [4]	47	N45:43	*	N45:103	*
Selected Velocity Valve Output for Maximum [4]	48	N45:44	*	N45:104	*
Proportional Gain for Pressure Control None	49	N45:45	100	N45:105	100
Integral Gain for Pressure Control [6]	50	N45:46	400	N45:106	400
Derivative Gain for Pressure Control [1, 7]	51	N45:47	0	N45:107	0
Proportional Gain for Velocity Control [6]	52	N45:48	200	N45:108	200
Feed Forward Gain for Velocity Control None	53	N45:49	0	N45:109	0
Profile High Pressure Alarm Setpoint [3]	57	N45:53	0	N/A	N/A

[1] Time
00.00 to 99.99 Seconds

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Sec

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

[6] Inverse Time (Algorithm)
00.00 to 99.99 Minutes
00.00 to 99.99 Seconds

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

*Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 8-A
Clamp Close Profile Command Block (CPC)

Control Word CPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/ bit	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256
Value	0	0	0	0	0	0	0	0								

CPC Block Identifier

Control Word CPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288
Value	0		0	0					0	0	0		0		0	

Velocity Units
0 = Percent Velocity
1 = Inches (mm)/Second

Mold Protection
0 = Start LPC on Zone Overrun
1 = Stop and Zero Outputs on Zone Overrun

TCC SCC FCC

Logical Bridge
0 = Start Next Profile at end
1 = Stop and Set Output at end

TCC SCC FCC

Algorithm
0 = Vel/Pos
1 = Press/Pos

Control Word CPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304
Value		0								0						

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

ERC Enable/Disable Selection
0 = ON
1 = OFF

bit 15 = Press/Pos LPC
bit 13 = Press/Pos TCC
bit 12 = Vel/Pos TCC
bit 11 = Press/Pos SCC
bit 10 = Vel/Pos SCC
bit 09 = Press/Pos FCC
bit 08 = Vel/Pos FCC

Open/Closed-Loop Selection
0 = Closed-Loop
1 = Open-Loop

bit 07 = Press/Pos LPC
bit 05 = Press/Pos TCC
bit 04 = Vel/Pos TCC
bit 03 = Press/Pos SCC
bit 02 = Vel/Pos SCC
bit 01 = Press/Pos FCC
bit 00 = Vel/Pos FCC

Worksheet 8-A (continued)
Clamp Close Profile Command Block (CPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
CPC09	N43:245		FCC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC10	N43:246		FCC Segment 1 Pressure Setpoint	Pressure [3]
CPC11	N43:247		FCC End-of Segment 1 Position Setpoint	Incremental Distance [4]
CPC12	N43:248		FCC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC13	N43:249		FCC Segment 2 Pressure Setpoint	Pressure [3]
CPC14	N43:250		FCC End-of Segment 2 Position Setpoint	Incremental Distance [4]
CPC15	N43:251		FCC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC16	N43:252		FCC Segment 3 Pressure Setpoint	Pressure [3]
CPC17	N43:253		FCC End-of Segment 3 Position Setpoint	Incremental Distance [4]
CPC18	N43:254		SCC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC19	N43:255		SCC Segment 1 Pressure Setpoint	Pressure [3]
CPC20	N43:256		SCC End-of Segment 1 Position Setpoint	Incremental Distance [4]
CPC21	N43:257		SCC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC22	N43:258		SCC Segment 2 Pressure Setpoint	Pressure [3]
CPC23	N43:259		SCC End-of Segment 2 Position Setpoint	Incremental Distance [4]
CPC24	N43:260		SCC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC25	N43:261		SCC Segment 3 Pressure Setpoint	Pressure [3]
CPC26	N43:262		SCC End-of Segment 3 Position Setpoint	Incremental Distance [4]
CPC27	N43:263		TCC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC28	N43:264		TCC Segment 1 Pressure Setpoint	Pressure [3]
CPC29	N43:265		TCC End-of Segment 1 Position Setpoint	Incremental Distance [4]
CPC30	N43:266		TCC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC31	N43:267		TCC Segment 2 Pressure Setpoint	Pressure [3]
CPC32	N43:268		TCC End-of Segment 2 Position Setpoint	Incremental Distance [4]
CPC33	N43:269		TCC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
CPC34	N43:270		TCC Segment 3 Pressure Setpoint	Pressure [3]
CPC35	N43:271		TCC End-of Segment 3 Position Setpoint	Incremental Distance [4]
CPC37	N43:273		LPC Segment 1 Pressure Setpoint	Pressure [3]
CPC38	N43:274		LPC End-of-Segment 1 Position Setpoint	Incremental Distance [4]
CPC40	N43:276		LPC Segment 2 Pressure Setpoint	Pressure [3]
CPC61	N43:297		Start LPC Position Setpoint	Incremental Distance [4]
CPC62	N43:298		Mold Safe Position Setpoint	Incremental Distance [4]
CPC63	N43:299		Tonnage Complete Pressure Setpoint	Pressure [3]

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 Inches per Second
000.0 to 999.9 Millimeters per Second

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Axis Measured from MCC27 (if non-zero) or MCC23
00.00 to 99.99 Inches
00.00 to 999.9 Millimeters

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 8-B
Injection Profile Command Block (IPC)

Control Word IPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0								

IPC Block Identifier

Control Word IPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
Value	0				0	0	0	0	0	0	0	0	0	0		

Velocity Units
0 = Parameters in "Percent Velocity"
1 = Parameters in Inches (mm)/Sec

Sign of Pressure Offset
0 = Positive
1 = Negative

Sign of Velocity Offset
0 = Positive
1 = Negative

Algorithm Selection
00 = Vel/Pos
01 = Vel/Pos (pressure limited)
10 = Press/Pos
11 = Press/Time

Control Word IPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
Value	0	0	0	0					0	0	0	0				

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

0 = ERC On for Press/Time
1 = ERC Off

0 = ERC On for Press/Pos
1 = ERC Off

0 = ERC On for Vel/Pos (limited)
1 = ERC Off

0 = ERC On for Vel/Pos
1 = ERC Off

0 = Press/Time Closed Loop
1 = Open Loop

0 = Press/Pos Closed Loop
1 = Open Loop

0 = Vel/Pos (limited) Closed Loop
1 = Open Loop

0 = Vel/Pos Closed Loop
1 = Open Loop

Worksheet 8-B (continued)
Injection Profile Command Block (IPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
IPC09	N44:65		Segment 1 Velocity Setpoint	Velocity [4]
IPC10	N44:66		Segment 1 Pressure Setpoint	Pressure [3]
IPC11	N44:67		End-of Segment 1 Position Setpoint	Distance from Mold-end [2]
IPC12	N44:68		Segment 1 Time Setpoint	Time [1]
IPC13	N44:69		Segment 2 Velocity Setpoint	Velocity [4]
IPC14	N44:70		Segment 2 Pressure Setpoint	Pressure [3]

Enter Your Values Here

IPC17	N44:73		Segment 3 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC18	N44:74		Segment 3 Pressure Setpoint	Pressure [3]
IPC19	N44:75		End-of Segment 3 Position Setpoint	Incremental Distance [2]
IPC20	N44:76		Segment 3 Time Setpoint	Time [1]
IPC21	N44:77		Segment 4 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC22	N44:78		Segment 4 Pressure Setpoint	Pressure [3]
IPC23	N44:79		End-of Segment 4 Position Setpoint	Incremental Distance [2]
IPC24	N44:80		Segment 4 Time Setpoint	Time [1]
IPC25	N44:81		Segment 5 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC26	N44:82		Segment 5 Pressure Setpoint	Pressure [3]
IPC27	N44:83		End-of Segment 5 Position Setpoint	Incremental Distance [2]
IPC28	N44:84		Segment 5 Time Setpoint	Time [1]
IPC29	N44:85		Segment 6 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC30	N44:86		Segment 6 Pressure Setpoint	Pressure [3]
IPC31	N44:87		End-of Segment 6 Position Setpoint	Incremental Distance [2]
IPC32	N44:88		Segment 6 Time Setpoint	Time [1]
IPC33	N44:89		Segment 7 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC34	N44:90		Segment 7 Pressure Setpoint	Pressure [3]
IPC35	N44:91		End-of Segment 7 Position Setpoint	Incremental Distance [2]
IPC36	N44:92		Segment 7 Time Setpoint	Time [1]
IPC37	N44:93		Segment 8 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC38	N44:94		Segment 8 Pressure Setpoint	Pressure [3]
IPC39	N44:95		End-of Segment 8 Position Setpoint	Incremental Distance [2]
IPC40	N44:96		Segment 8 Time Setpoint	Time [1]
IPC41	N44:97		Segment 9 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC42	N44:98		Segment 9 Pressure Setpoint	Pressure [3]
IPC43	N44:99		End-of Segment 9 Position Setpoint	Incremental Distance [2]
IPC44	N44:100		Segment 9 Time Setpoint	Time [1]
IPC45	N44:101		Segment 10 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC46	N44:102		Segment 10 Pressure Setpoint	Pressure [3]
IPC47	N44:103		End-of Segment 10 Position Setpoint	Incremental Distance [2]
IPC48	N44:104		Segment 10 Time Setpoint	Time [1]
IPC49	N44:105		Segment 11 Velocity Setpoint	Percent of Maximum Velocity [4]
IPC50	N44:106		Segment 11 Pressure Setpoint	Pressure [3]
IPC51	N44:107		Profile Velocity Offset	Percent of Maximum Velocity [4]
IPC52	N44:108		Profile Pressure Offset	Pressure [3]
IPC57	N44:113		Ram Pressure Limit for Pressure-limit Velocity Control	Pressure [3]
IPC58	N44:114		Min Ram Position for Pressure-limit Velocity Control	Incremental Distance [2]
IPC59	N44:115		Time Delay for Pressure-limit Velocity Control	Time [1]
IPC60	N44:116		Time Limit for Transition	Time [1]
IPC61	N44:117		Ram (screw) Position for Transition	Incremental Distance [2]
IPC62	N44:118		Ram (screw) Pressure for Transition	Pressure [3]
IPC63	N44:119		Cavity Pressure for Transition	Pressure [3]
IPC64	N44:120		Ram (screw) Position for Pressure Transition Inhibit	Incremental Distance [2]

[1] Time
00.00 to 99.99 Seconds

[2] Axis Measured from MCC27 (is non-zero) or MCC23
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[3] Pressure
0000. to 9999. PSI
000.0 to 999.9 Bar

[4] Percent Signal Output
00.00 to 99.99%

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 8-C
Pack/Hold Profile Command Block (HPC)

Control Word HPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256
Value	0	0	0	0	0	0	0	0								

HPC Block Identifier

Control Word HPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288
Value					0	0			0	0	0	0	0	0	0	0

Profile Offset Sign
1=Negative 0=Positive

13=Pack
15=Hold

Hold/Pre-decompression
Logical Bridging
0=Start Movement
1=Stop and set outputs

Pre-decompression/Plastication
Logical Bridging
0=Start Plastication
1=Stop and set outputs

Control Word HPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304
Value	0	0	0	0					0	0	0	0				

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Enable/Disable ERC
1=Off 0=On

08=Pack
10=Hold

Open/Closed Loop
1=Open 0=Closed

00=Pack
02=Hold

Worksheet 8-C (continued)
Pack/Hold Profile Command Block (HPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HPC10	N44:246		Pack Segment 1 Ram Pressure Setpoint	Pressure [3]
HPC11	N44:247		Pack Segment 1 Time Setpoint	Time [1]
HPC13	N44:249		Pack Segment 2 Pressure Setpoint	Pressure [3]
HPC14	N44:250		Pack Segment 2 Time Setpoint	Time [1]
HPC16	N44:252		Pack Segment 3 Pressure Setpoint	Pressure [3]
HPC17	N44:253		Pack Segment 3 Time Setpoint	Time [1]
HPC19	N44:255		Pack Segment 4 Pressure Setpoint	Pressure [3]
HPC20	N44:256		Pack Segment 4 Time Setpoint	Time [1]
HPC22	N44:258		Pack Segment 5 Pressure Setpoint	Pressure [3]
HPC23	N44:259		Pack Segment 5 Time Setpoint	Time [1]
HPC25	N44:261		Pack Profile Ram Pressure Offset	Pressure [3]
HPC27	N44:263		Hold Segment 1 Ram Pressure Setpoint	Pressure [3]
HPC28	N44:264		Hold Segment 1 Time Setpoint	Time [1]
HPC30	N44:266		Hold Segment 2 Ram Pressure Setpoint	Pressure [3]
HPC31	N44:267		Hold Segment 2 Time Setpoint	Time [1]
HPC33	N44:269		Hold Segment 3 Pressure Setpoint	Pressure [3]
HPC34	N44:270		Hold Segment 3 Time Setpoint	Time [1]
HPC36	N44:272		Hold Segment 4 Ram Pressure Setpoint	Pressure [3]
HPC37	N44:273		Hold Segment 4 Time Setpoint	Time [1]
HPC39	N44:275		Hold Segment 5 Ram Pressure Setpoint	Pressure [3]
HPC40	N44:276		Hold Segment 5 Time Setpoint	Time [1]
HPC42	N44:278		Hold Profile Pressure Offset	Pressure [3]
HPC61	N44:297		Cure Timer Preset	Time [4]

[1] Time
00.00 to 99.99 seconds

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Time
000.0 to 999.9 seconds

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 8-D
Plastication Profile Command Block (PPC)

Control Word PPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	463	462	461	460	459	458	457	456	455	454	453	452	421	450	449	448
Value	0	0	0	0	0	0	0	0								

PPC Block Identifier

Control Word PPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	495	494	493	492	491	490	489	488	487	486	485	484	483	482	481	480
Value	0	0		0	0	0	0		0	0	0	0	0	0	0	

Sign of Profile Offset
0 = Positive 1 = Negative

Plastication/Post-decompression
Logical Bridging
0 = Start Post-decomp Movement
1 = Stop and set outputs

Profile Algorithm
0 = Pressure/Position
1 = Pressure/Time

Control Word PPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/bit	511	510	509	508	507	506	505	504	503	502	501	500	499	498	497	496
Value	0	0	0	0	0	0			0	0	0	0	0	0		

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Enable/Disable ERC
0 = On 1 = Off

08 = Pressure/ Position
09 = Pressure/Time

Open/Closed Loop
0 = Closed 1 = Open

01 = Pressure/Position
00 = Pressure/Time

Worksheet 8-D (continued)
Plastication Profile Command Block (PPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PPC10	N44:426		Segment 1 Pressure Setpoint	Pressure [3]
PPC11	N44:427		End-of Segment 1 Position Setpoint	Distance from Mold-end [2]
PPC12	N44:428		Segment 1 Time Setpoint	Time [1]
PPC14	N44:430		Segment 2 Pressure Setpoint	Pressure [3]
PPC15	N44:431		End-of Segment 2 Position Setpoint	Distance from Mold-end [2]
PPC16	N44:432		Segment 2 Time Setpoint	Time [1]
PPC18	N44:434		Segment 3 Pressure Setpoint	Pressure [3]
PPC19	N44:435		End-of Segment 3 Position Setpoint	Distance from Mold-end [2]
PPC20	N44:436		Segment 3 Time Setpoint	Time [1]
PPC22	N44:438		Segment 4 Pressure Setpoint	Pressure [3]
PPC23	N44:439		End-of Segment 4 Position Setpoint	Distance from Mold-end [2]
PPC24	N44:440		Segment 4 Time Setpoint	Time [1]
PPC26	N44:442		Segment 5 Pressure Setpoint	Pressure [3]
PPC27	N44:443		End-of Segment 5 Position Setpoint	Distance from Mold-end [2]
PPC28	N44:444		Segment 5 Time Setpoint	Time [1]
PPC30	N44:446		Segment 6 Pressure Setpoint	Pressure [3]
PPC31	N44:447		End-of Segment 6 Position Setpoint	Distance from Mold-end [2]
PPC32	N44:448		Segment 6 Time Setpoint	Time [1]
PPC34	N44:450		Segment 7 Pressure Setpoint	Pressure [3]
PPC35	N44:451		End-of Segment 7 Position Setpoint	Distance from Mold-end [2]
PPC36	N44:452		Segment 7 Time Setpoint	Time [1]
PPC38	N44:454		Segment 8 Pressure Setpoint	Pressure [3]
PPC39	N44:455		End-of Segment 8 Position Setpoint	Distance from Mold-end [2]
PPC40	N44:456		Segment 8 Time Setpoint	Time [1]
PPC42	N44:458		Segment 9 Pressure Setpoint	Pressure [3]
PPC43	N44:459		End-of Segment 9 Position Setpoint	Distance from Mold-end [2]
PPC44	N44:460		Segment 9 Time Setpoint	Time [1]
PPC46	N44:462		Segment 10 Pressure Setpoint	Pressure [3]
PPC47	N44:463		End-of Segment 10 Position Setpoint	Distance from Mold-end [2]
PPC48	N44:464		Segment 10 Time Setpoint	Time [1]
PPC50	N44:466		Segment 11 Pressure Setpoint	Pressure [3]
PPC52	N44:468		Profile Pressure Offset	Pressure [3]
PPC61	N44:477		Cushion Size	Distance from Mold-end [2]
PPC62	N44:478		Shot Size	Incremental Distance [4]

[1] Time
00.00 to 99.99 Seconds

[2] Distance from MCC13 (if not zero) or MCc09
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Distance from PPC61
00.00 to 99.99 Inches
000.0 to 999.9 Millimeter

* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 8-E
Clamp Open Profile Command Block (OPC)

Control Word OPC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	591	590	589	588	587	586	585	584	583	582	581	580	579	578	577	576
Value	0	0	0	0	0	0	0	0								

OPC Block Identifier

Control Word OPC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	623	622	621	620	619	618	617	616	615	614	613	612	611	610	609	608
Value			0	0					0		0		0		0	

Velocity Units
0 = Percent Velocity
1 = Inches (mm)/Second

TOC SOC FOC

Logical Bridge
0 = Start Next Profile at end
1 = Stop and Set Output at end

Zone Overrun
0 = Start Clamp Open Slow on Zone Overrun
1 = Stop and Zero Outputs on Zone Overrun

OSC TOC SOC FOC

Algorithm
0 = Vel/Pos
1 = Press/Pos

Control Word OPC04-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B37/bit	639	638	637	636	635	634	633	632	631	630	629	628	627	626	625	624
Value																

ERC Enable/Disable Selection
0 = ON
1 = OFF

bit 15 = Press/Pos OSC
bit 14 = Vel/Pos OSC
bit 13 = Press/Pos TOC
bit 12 = Vel/Pos TCC
bit 11 = Press/Pos SOC
bit 10 = Vel/Pos SOC
bit 09 = Press/Pos FOC
bit 08 = Vel/Pos FOC

Open/Closed-Loop Selection
0 = Closed-Loop
1 = Open-Loop

bit 07 = Press/Pos OSC
bit 06 = Vel/Pos OSC
bit 05 = Press/Pos TOC
bit 04 = Vel/Pos TOC
bit 03 = Press/Pos SOC
bit 02 = Vel/Pos SOC
bit 01 = Press/Pos FOC
bit 00 = Vel/Pos FOC

Code:

	Your value
0 or 1	Required initial value loaded by Pro-Set 600
0	Value not used

Worksheet 8-E (continued)
Clamp Open Profile Command Block (OPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
OPC09	N43:545		FOC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC10	N43:546		FOC Segment 1 Pressure Setpoint	Pressure [3]
OPC11	N43:547		FOC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC12	N43:548		FOC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC13	N43:549		FOC Segment 2 Pressure Setpoint	Pressure [3]
OPC14	N43:550		FOC End-of Segment 2 Position Setpoint	Incremental Distance [4]
OPC15	N43:551		FOC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC16	N43:552		FOC Segment 3 Pressure Setpoint	Pressure [3]
OPC17	N43:553		FOC End-of Segment 3 Position Setpoint	Incremental Distance [4]
OPC18	N43:554		SOC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC19	N43:555		SOC Segment 1 Pressure Setpoint	Pressure [3]
OPC20	N43:556		SOC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC21	N43:557		SOC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC22	N43:558		SOC Segment 2 Pressure Setpoint	Pressure [3]
OPC23	N43:559		SOC End-of Segment 2 Position Setpoint	Incremental Distance [4]
OPC24	N43:560		SOC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC25	N43:561		SOC Segment 3 Pressure Setpoint	Pressure [3]
OPC26	N43:562		SOC End-of Segment 3 Position Setpoint	Incremental Distance [4]
OPC27	N43:563		TOC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC28	N43:564		TOC Segment 1 Pressure Setpoint	Pressure [3]
OPC29	N43:565		TOC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC30	N43:566		TOC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC31	N43:567		TOC Segment 2 Pressure Setpoint	Pressure [3]
OPC32	N43:568		TOC End-of Segment 2 Position Setpoint	Incremental Distance [4]
OPC33	N43:569		TOC Segment 3 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC34	N43:570		TOC Segment 3 Pressure Setpoint	Pressure [3]
OPC35	N43:571		TOC End-of Segment 3 Position Setpoint	Incremental Distance [4]
OPC36	N43:572		OSC Segment 1 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC37	N43:573		OSC Segment 1 Pressure Setpoint	Pressure [3]
OPC38	N43:574		OSC End-of Segment 1 Position Setpoint	Incremental Distance [4]
OPC39	N43:575		OSC Segment 2 Velocity Setpoint	Percent of Maximum Velocity [1] or Velocity along Axis [2]
OPC40	N43:576		OSC Segment 2 Pressure Setpoint	Pressure [3]
OPC61	N43:597		Start OSC Position Setpoint	Incremental Distance [4]
OPC62	N43:598		Mold Open Position Setpoint	Incremental Distance [4]
OPC63	N43:599		Mold Open Dwell Timer Preset	Time [5]

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 inches per second
000.0 to 999.9 millimeters per second

[3] Pressure
0000 to 9999 PSI
000.0 to 999.9 Bar

[4] Axis Measured from MCC27 (if non-zero) or MCC23
00.00 to 99.99 iInches
00.00 to 999.9 millimeters

[5] Time
00.00 to 99.99 seconds

* Refer to the appropriate section later in this chapter for information on this parameter

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