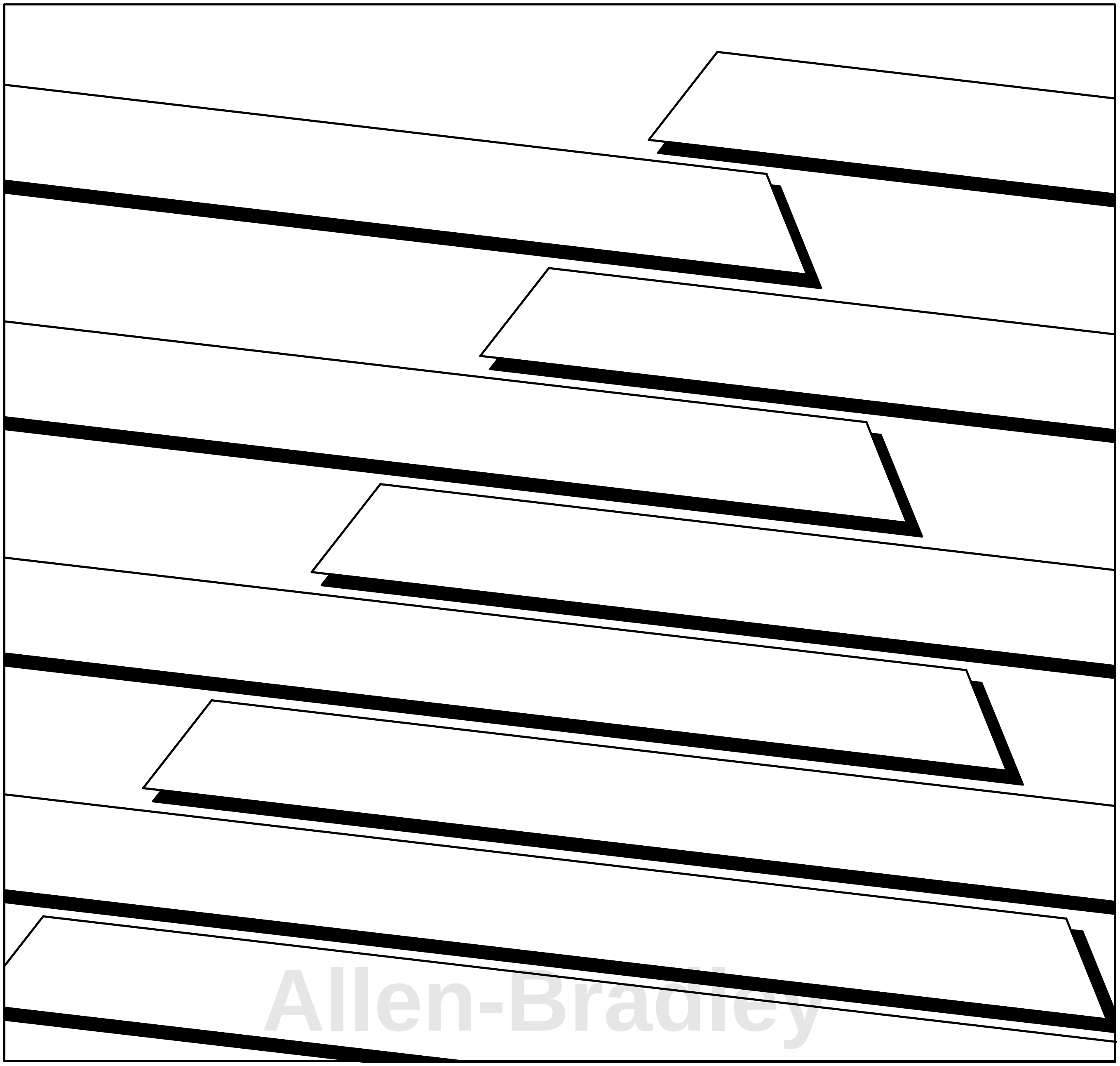
ALLEN-BRADLEY

Plastic Molding Module

(Cat. No. 1771-QDC)

Inject 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.

Throughout this manual we use **ATTENTION** and **Important** to alert you to the following:

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.

Summary of Changes

Summary of Changes

We revised this publication to include changes due to upgrading the 1771-QDC/B module to a 1771-QDC/C.

For These Changes	Refer to Page(s)
Loss-of-sensor detection input range changed back to 0.00 to 10V dc	3-5, 3-10 A-3, A-4
Added the section, Record I/O Ranges. Added the title Ground and Shield Your I/O Devices to better describe the task.	2-1 2-9
Reversed the order of chapters 3 and 4 to present the download procedure for the MCC block before the download procedure for the other data blocks. Revised the download procedure for the MCC block (chapter 3) and for other command blocks (chapter 4).	Chapters 3 and 4
Added data codes to Profile Block worksheets.	Chapter 8 and Appendix A
Placed 2-page worksheets on facing pages	Chapters 7 and 8
Minor corrections	as found

To Help You Find Changes

To help you find these changes, we added change bars as shown to the left.

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Load Initial Profile Values 8-1

Use This Preface

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 the minimum 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
Overview the inject process. This presents an overview on how the QDC module controls the inject phase of your injection molding system.	Chapter 1
Install the QDC module. This includes such tasks as wiring and setting jumpers.	Chapter 2
Configure the QDC module mode to match your specific application, and to communicate with inputs and outputs.	Chapter 3
Overview of remaining configuration procedures that you will perform throughout the remainder of this manual.	Chapter 4
Jog the ram (screw). This task requires jog setpoints to be configured along with jog pressure alarm setpoints.	Chapter 5
Set up communications between your PLC-5 processor and the QDC module. Select command and status bits that you will use when writing your ladder logic.	Chapter 6
Load your initial configuration values to the QDC module. This task requires you to determine and enter values into configuration blocks in preparation for chapter 9.	Chapter 7
Load your initial machine profile setpoints to the QDC module. This is performed in preparation for chapter 9.	Chapter 8
Span your machine's valves for inject mode. This is done using set-output and open-loop control.	Chapter 9
Tune your machine for producing parts.	Chapter 10
Troubleshoot problems that may occur with the QDC module.	Chapter 11
Refer to this appendix for a blank copy of each worksheet contained in this manual.	Appendix A

Audience

In order to apply the QDC module to a molding machine, we assume that you are an:

- injection molding professional
- experienced programmer with Allen-Bradley PLC-5 processors
- hydraulics designer or technician

Use of Terms

We use these abbreviations:

Abbreviated Name:	Item
QDC module	1771-QDC Plastic Molding Module
PLC® processor	PLC-5 Processor
T45 or T47 T50 or T53 terminal	1784-T45 or -T47 1784-T50 or -T53 Industrial Terminal
Pro-Set™ 600 Software	6500-PS600 Pro-Set 600 Injection Molding Operator Interface Software
PanelView™ Terminal	2711-KC1 PanelView Operator Interface Terminal

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 module's algorithms the selected valve.
Unselected Valves	In multi-valve systems, depending on the configured profile, the QDC module controls one valve and presets 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 Blocks	Data blocks downloaded from the PLC-5 data table to the QDC module to make configuration changes or to initiate machine actions.
Status Blocks	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 processor to the QDC module by means of block transfer write (BTW) instructions in software ladder logic. Their abbreviations are:

Acronym:	Description:
MCC	Module Configuration Block
JGC	Jog Configuration Block
INC	Injection Configuration Block
IPC	Injection Profile Block
PKC	Pack Configuration Block
HDC	Hold Configuration Block
HPC	Pack/Hold Profile Block
PRC	Pre-decompression Configuration Block
PLC	Plastication Configuration Block
PPC	Plastication Profile Block
PSC	Post-decompression Configuration Block
DYC	Dynamic Command Block
RLC	Inject 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 processor by means of block transfer read (BTR) instructions in software ladder logic. Their abbreviations are:

Acronym:	Description:
SYS	System Status Block
IPS	Injection Profile Status Block
HPS	Pack/Hold Profile Status Block
PPS	Plastication Profile Status Block
RLS	Inject 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 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	Application guide	Select QDC module's mode of operation and match it to your machine's hydraulics
1771-6.5.86 1771-6.5.87 1771-6.5.93	Plastic Molding Module, 1771-QDC, User Manuals	Configure, program, install, and operate your QDC module in other QDC modes of operation
1771-6.5.88	Plastic Molding Module 1771-QDC, Reference Manual	Program block transfers between PLC processor and QDC. Also, information on PLC-5 data transfer logic.

Take time now to familiarize yourself with the Reference Manual, publication 1771-6.5.88. The five sections, in brief, include:

- 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, mechanical, electrical, and environmental specifications about your module
- instructions to help you calibrate your QDC module

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

Publication #:	**Use this documentation**:	**To:**
6500-6.5.11	Pro-Set 600 Software Designer's 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 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 to obtain desired features.
6500-6.5.14	Pro-Set 600 Software Customization Manual	Customize your Pro-Set 600 application to 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 Mode

Chapter Objectives

This chapter presents an overview of the 1771-QDC Plastic Molding Module in the Inject mode. We present a summary of Inject features followed by sample applications.

Important: This manual assumes you have already read your Plastic Molding Module Application Guide, publication 1771-4.10, and have chosen Inject as your QDC module's mode of operation.

Inject Mode Operation

The Inject mode controls the following actions of your molding machine:

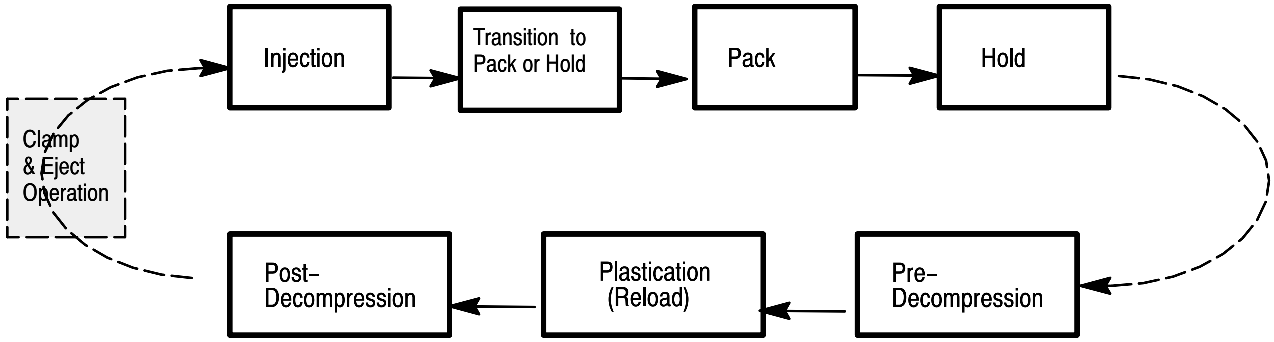
- Shoots hot plastic into the mold
- Packs and holds the plastic until cured
- Reloads for the next shot

When you select the Inject mode, you can use the following phases:

Table 1.A
Phases of Inject Mode

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 affect 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 referred to as sprue break.
Plastication	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 screw RPM or 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.
Post-decompression (optional)	This single, backward movement of the ram (screw) guards against drooling molten plastic into the open mold during ejection prior to the next injection. This phase is also called melt pullback or suckback.

Figure 1.1
Inject Operation of a Typical Machine Cycle

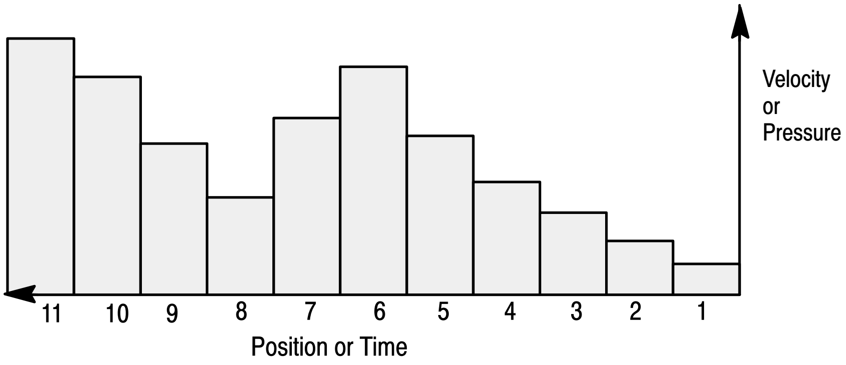


Injection Phase

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

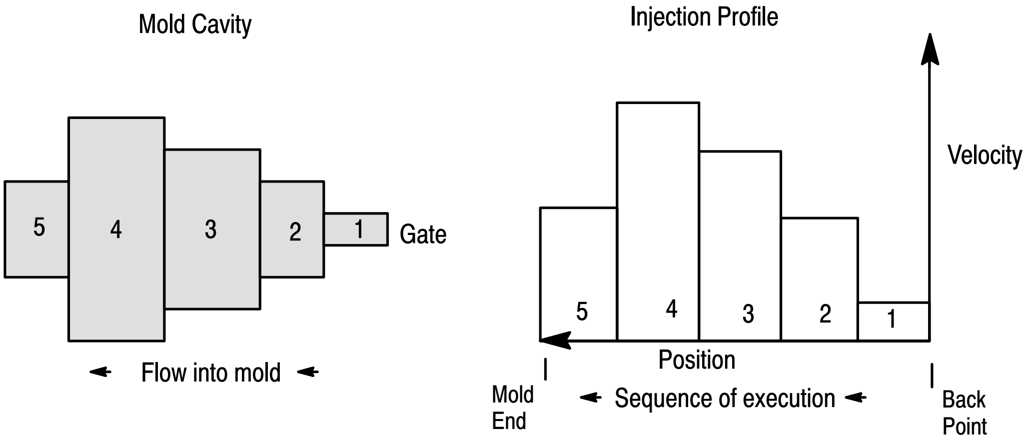
[1] Pressure-limited velocity vs. position profile differs from the velocity vs. position profile as follows: During any segment of a pressure-limited profile if the pressure exceeds a preset limit, the module switches to PID pressure control with the pressure limit as the setpoint. Then if velocity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

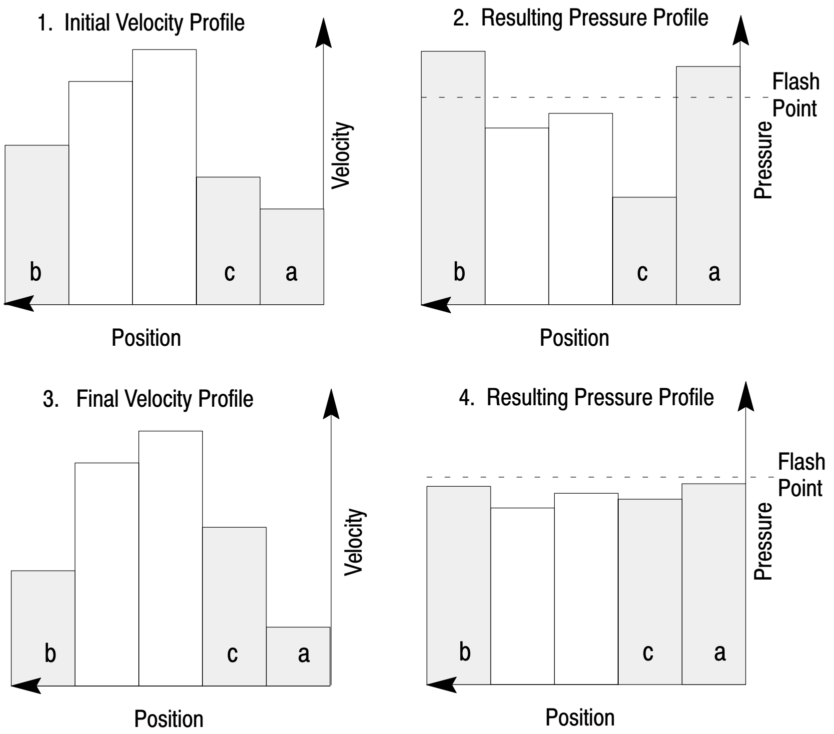


Flash Prevention Example – With a velocity profile (figure 1.4 part 1), the pressure may reach a peak and flash the mold at ram (screw) position segments (part 2) that correspond to events such as:

- 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. Segment pressures in part 4 are optimum for the velocity vs. position profile in part 3.

Figure 1.4
Flash Prevention Example



As an option, you may select pressure-limited velocity vs. position injection control. With your pressure-limit setpoint below the flash point, the module switches 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 four events occurred:

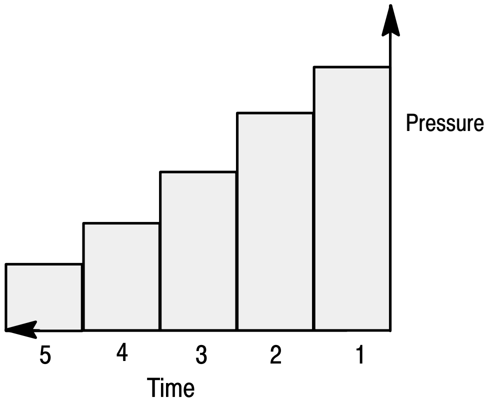
- Ram (screw) position exceeds a preset limit
- Ram (screw) pressure exceeds a preset limit
- Cavity pressure exceeds a preset limit
- Injection phase elapsed time exceeds a preset limit

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 pressure transitions may or may not occur.

Pack Phase

The QDC module controls the pack phase with a pressure vs. time profile. You create the profile based on controlling hydraulic pressure against the ram (screw), or by controlling pressure within the mold cavity resulting from hydraulic pressure against the ram (screw). You can control either pressure with up to five time 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.

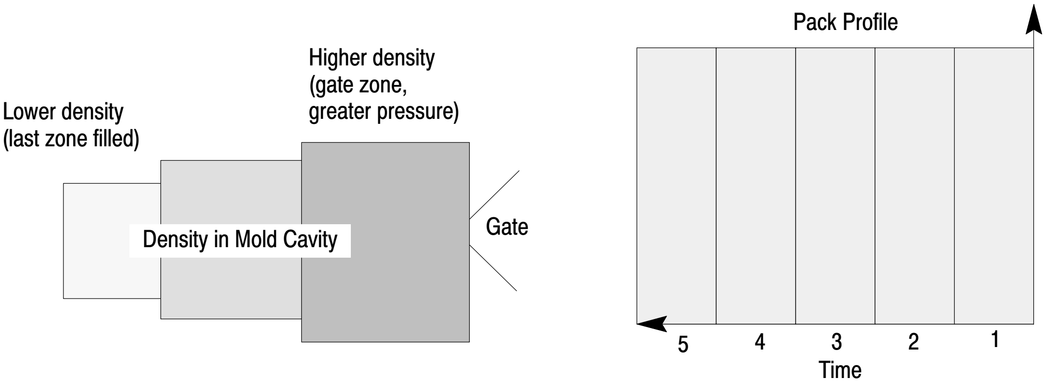
Figure 1.5
Pack Phase Example



Example Benefits of Profiling the Pack Phase

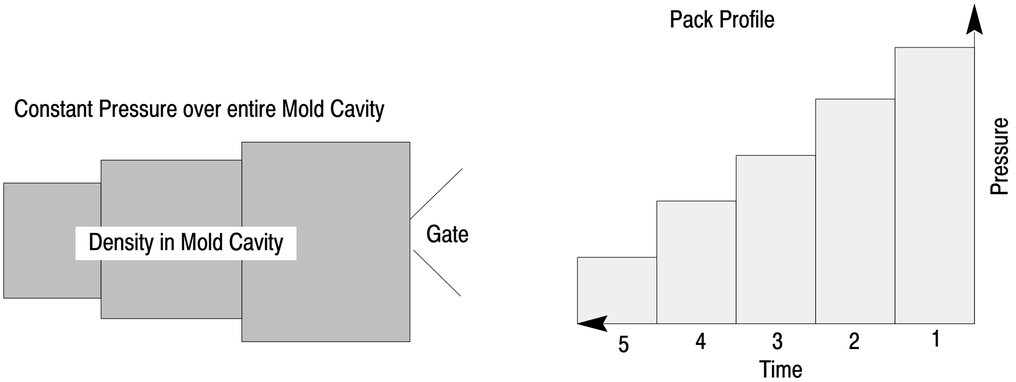
Molten plastic may cool unevenly in the mold causing variations in density with the end result of warpage and distortion as shown in Figure 1.6.

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 hydraulic pressure against the ram (screw), or by controlling pressure within the mold cavity resulting from hydraulic pressure against the ram (screw). You can control either pressure with up to five time segments. You determine the pressure setpoints and time durations for the hold profile based on your 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 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 program to continue.

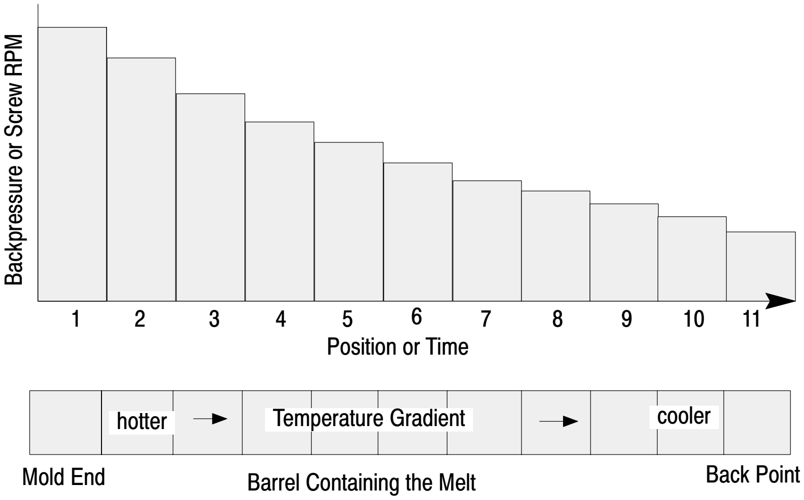
Plastication Phase

The plastication phase lets you achieve a melt temperature gradient in the barrel containing the ram (screw). To do this, you can create the plastication profile with up to 11 segments of position or time (figure 1.8).

You chose from four plastication profiles:

- Backpressure vs. position
- Backpressure vs. time
- Screw RPM vs. position
- Screw RPM vs. time

Figure 1.8
Plastication Phase Example



Affects of Profiling a Plastication Phase
Backpressure and/or screw RPM have these affects on plastication:

- The higher the backpressure (or screw RPM) during plastication, the higher the resultant temperature of the melt.
- You can accelerate the backup rate by reducing backpressure (or increasing screw RPM).
- You can increase resultant melt temperature by increasing backpressure (or increasing screw RPM).

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 Post-decompression pull-back 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.

Screw Speed

Beginning with the 1771-QDC/C revision of the module, you can control and monitor screw RPM only when you have configured the QDC module for the singular Inject mode. None of the other mode combinations allow for connecting a screw RPM sensor to the QDC module.

Chapter 2

Install the QDC Module

Chapter Objectives

This chapter guides you through the following installation procedures:

- record I/O ranges
- set module jumpers
- key your I/O chassis
- install your QDC module
- wire I/O devices to your QDC module
- ground your system
- 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 10 Vdc	1 to 5 Vdc	4 to 20 mA
Input 2 (Screw pressure)	0 to 10 Vdc	1 to 5 Vdc	4 to 20 mA
Input 3 (Screw RPM)	0 to 10 Vdc	1 to 5 Vdc	4 to 20 mA
Input 4 (Cavity pressure)	0 to 10 Vdc	1 to 5 Vdc	4 to 20 mA
Output 1	-10 to 10 Vdc	0 to 10 Vdc	4 to 20 mA
Output 2	-10 to 10 Vdc	0 to 10 Vdc	4 to 20 mA
Output 3	-10 to 10 Vdc	0 to 10 Vdc	4 to 20 mA
Output 4	-10 to 10 Vdc	0 to 10 Vdc	4 to 20 mA

Set Module Jumper Plugs

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 jumpers 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 jumper plugs.

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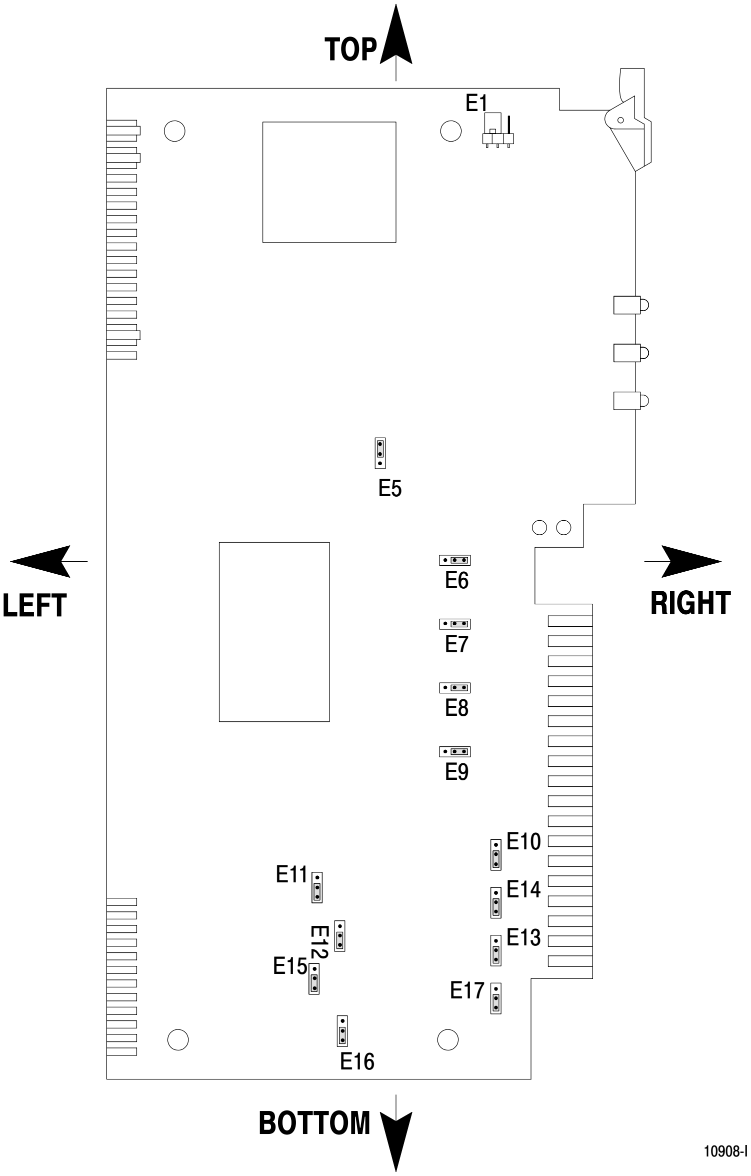
1. Remove the label-side cover plate by removing the four screws.
2. Remove the circuit board from the module housing by removing the two screws located center-front at the swingarm catch.
3. Carefully turn over the circuit board so it is oriented as in figure 2.1. Handle it by the edges to avoid touching conductors or components.
4. Use figure 2.1 to locate the jumper plugs.
5. Set the jumper plugs (Table 2.A) using a small needle-nose pliers.
6. After setting the jumper plugs, re-assemble the module.

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



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

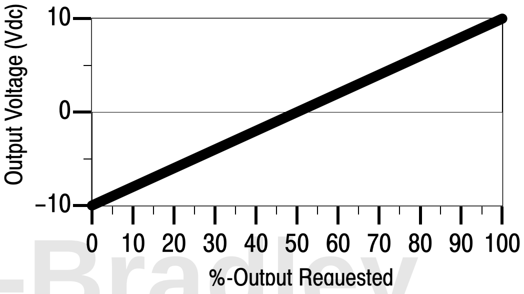
Table 2.A
Jumper Settings

Jumper	Function	Setting
E1	Run/Calibrate (Appendix G)	Calibrate = right Run = left [1]
E5	I/O Density	Standard = top [1] Do not use bottom position
E6 E7 E8 E9	Input 1 (Screw position) Input 2 (Screw pressure) Input 3 (Screw RPM) Input 4 (Cavity pressure)	Voltage = right [1] Current = left
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 +10VDC = top 0 to +10VDC or 4 to 20mA = bottom [1]
[1] factory-set defaults		

Important: If you select current output with jumper plugs E10, E14, E13, and/or E17, then you must select the 4 to 20mA jumper position with E11, E12, E15, and/or E16.

ATTENTION: If an output is unconnected, set the jumper (E11, E12, E15, and/or E16) that corresponds to that output to 0 to 10 Vdc (bottom position). Setting the jumpers for –10 to +10 Vdc and later configuring the output as "unconnected" causes the QDC module to output –10 Vdc on that channel when stopped or when a system reset occurs and all outputs are forced to 0% (i.e. 0% output equals –10Vdc).

Important: Selecting –10 to +10 VDC with jumper E11, E12, E15, and/or E16 sets the QDC module for bi-directional valve operation. The relationship to percentage output is as follows:



Key Your I/O Chassis

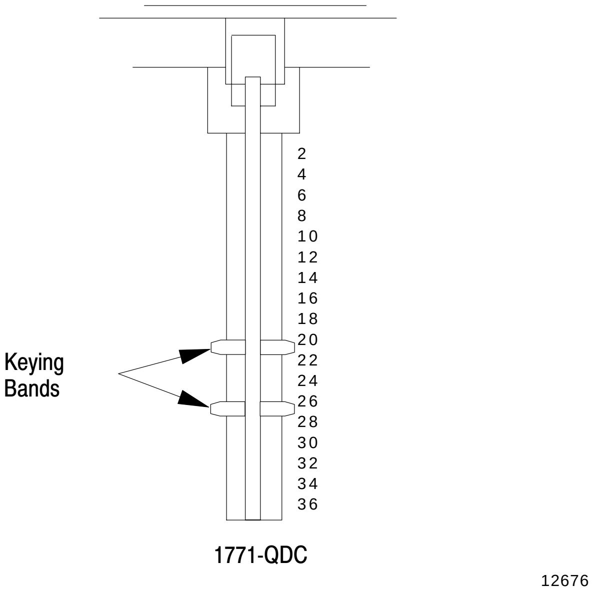
Use the plastic keying bands, shipped with each I/O chassis, for keying I/O slots to accept only one type of module. This is done to prevent the inadvertent installation of the wrong module into the wrong slot.

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

Install your QDC module in an I/O chassis with these steps:

1. First, 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 QDC 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 module damage, degradation of performance, or injury.

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

Important: Be aware that Pro-Set 600 expects your QDC module to be placed in slot 0 of I/O rack 0 when operating in inject mode. If you choose to install your QDC module in some other slot, some modifications to your PLC-5 application program will be necessary (refer to your Pro-Set 600 documentation for details).

3. Do not force the module into its backplane connector. Apply a firm and 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 the QDC Module

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 (Figure 2.3 and Table 2.B).

Figure 2.3
I/O Wiring and Grounding

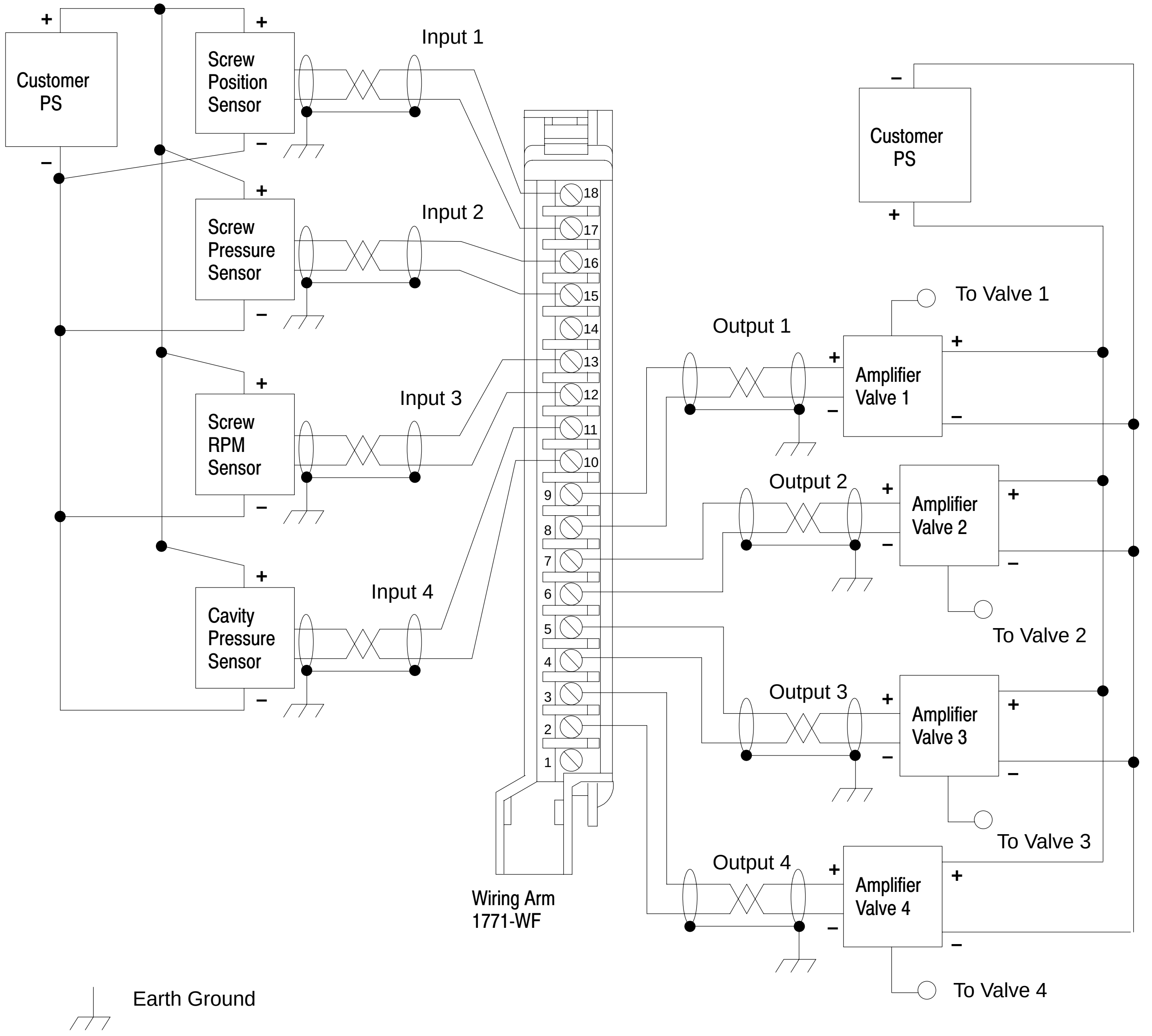


Table 2.B
I/O Terminal Designations

Transducer	I/O Designation	Terminal
Screw position	Input 1 (+) (–)	18 17
Screw pressure	Input 2 (+) (–)	16 15
	Input common	14
Screw RPM	Input 3 (+) (–)	13 12
Cavity pressure	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

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
+12vdc	input (18 thru 10)	any mode
±12vdc	output (09 thru 02)	voltage mode
+24vdc	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 shield them properly.

Guidelines:

- Use 22-gage (or larger) twisted-pair cable, 100% shielded with drain wire, such as Belden 8761 (or equivalent). For cable distances over 50 ft, use 18-gage cable such as Belden 8760 (or equivalent)
- 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

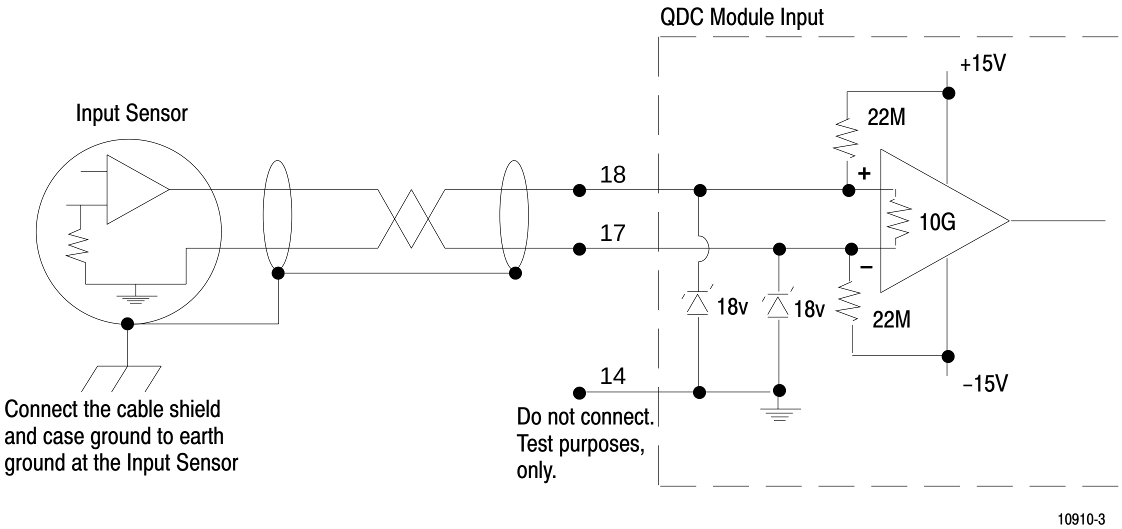
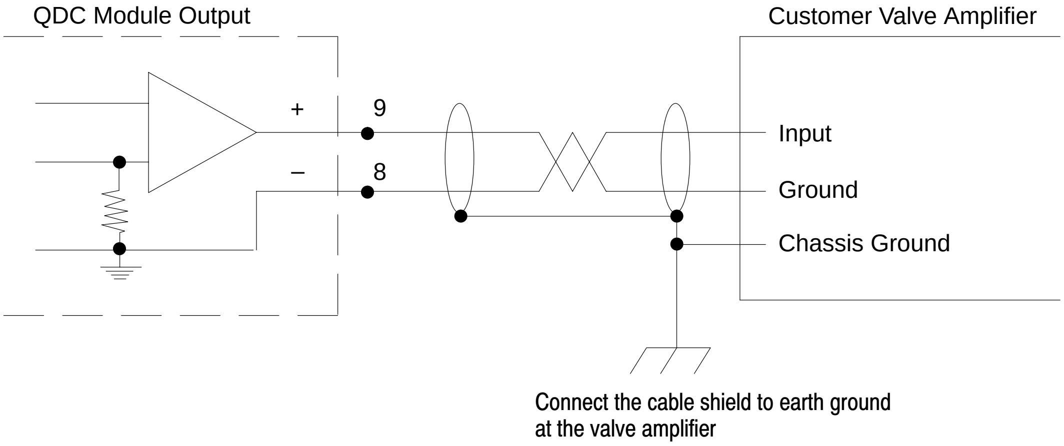


Figure 2.5
Shielding Single-ended Outputs



Connect the cable shield to earth ground at the valve amplifier

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- 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 below under Grounding Exceptions
- 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 (terminals 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 (E-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, shall de-energize all electrical power circuits which provide electrical energy to sustain machine motion. Maintained contact “Emergency Stop” push buttons are recommended.

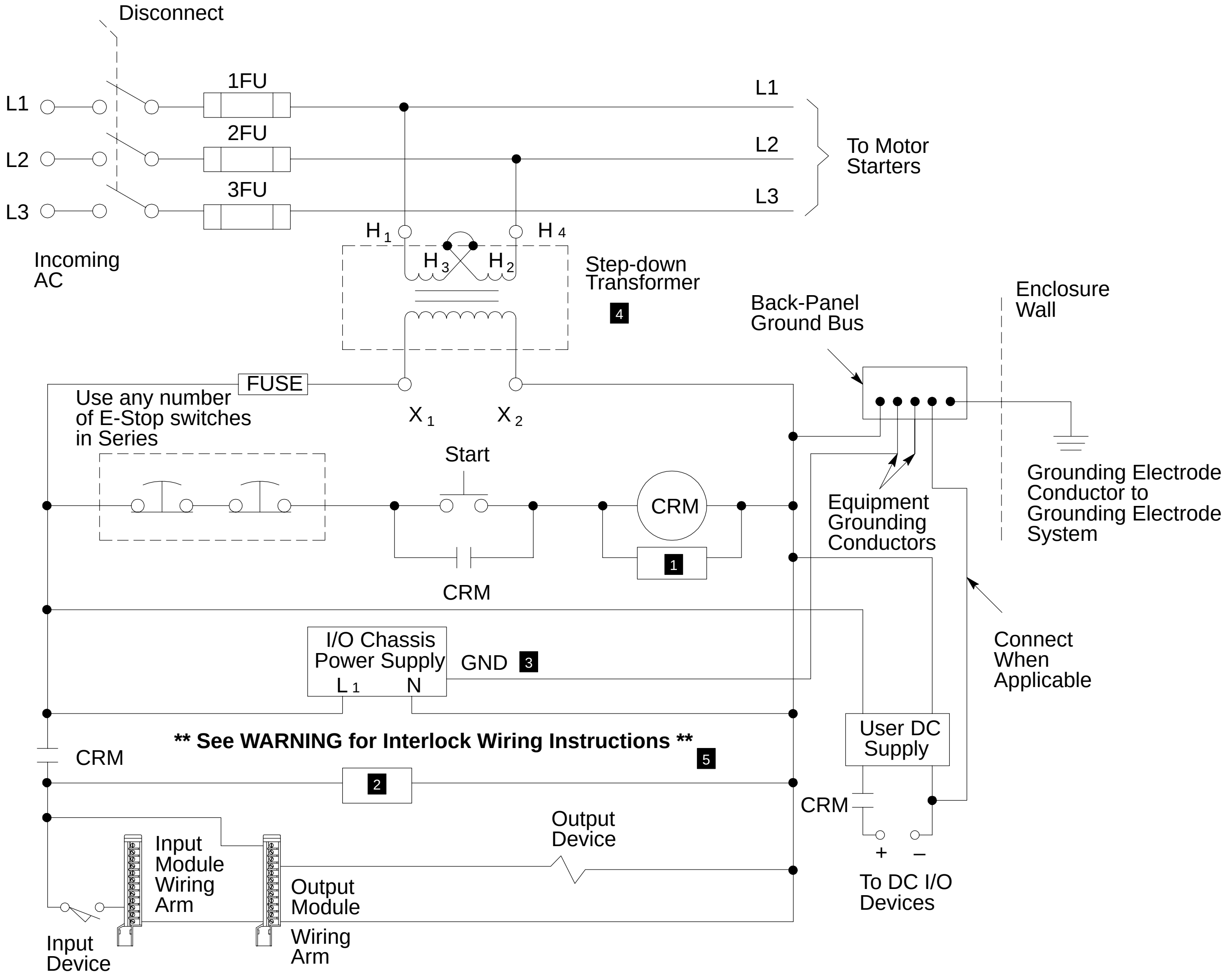
ATTENTION: The American National Standard for Plastics Machinery -- Horizontal Injection Molding Machines -- for Construction, Care, and Use (ANSI B151.1-1984) requires hydraulic, mechanical, and electrical interlocks to prevent inadvertent clamp closing with a safety gate in an open position.

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 power distribution circuit. For ungrounded systems or for more information on grounding and wiring guidelines, refer to Allen-Bradley publication 1770-4.1, Programmable Controller Wiring and Grounding Guidelines.

Figure 2.6
Typical PLC 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 B151.1-1984 for wiring guidelines.
- To minimize EMI generation, suppression network should be connected across coils of electromagnetic devices.

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Chapter 3

Configure the QDC Module's I/O

Chapter Objectives

Your QDC module needs to know the characteristics of your ram (screw) sensors. In this chapter, we describe how you determine these characteristics and download them to the QDC module. Topics include:

- signal ranges from pressure, position, and RPM sensors
- minimum and maximum sensor signals corresponding to minimum and maximum pressures, positions, and RPM
- 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 configuration values to the QDC module
- use the set-output operation to move the ram (screw)
- complete your sensor configuration
- use optional sensor 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.

Use Worksheets to Select Module Parameters and I/O Ranges

You select module parameters and I/O ranges by setting configuration bits in control words. First, determine and write down correct settings using Worksheet 3-A through Worksheet 3-C as follows:

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

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	0	0	1	0	0	

Code:

☐ Your value

0 or 1 Required initial value loaded by Pro-Set 600

System Operation:
Inject Mode 0 0

Select Units
0 = English
1 = metric

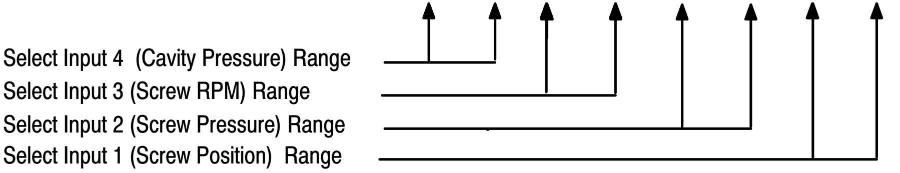
Example: If you select Inject operation with English units:
MCC02 = 00000000 00001000

Select I/O Ranges for your Sensors

Next, configure the QDC module's I/O ranges to match the machine sensors and valves. Refer to Worksheet 2-A from chapter 2 which you filled out when setting the QDC module's jumpers. Apply this information to Worksheet 3-B for input ranges and Worksheet 3-C for output ranges.

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								



Code:

☐ Your value

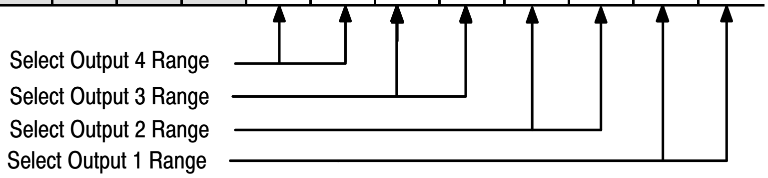
0 or 1 Required initial value loaded by Pro-Set 600

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

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

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 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								



Code:

☐ Your value

0 or 1 Required initial value loaded by Pro-Set 600

Output Range		
–10 to +10 vdc	0	0
0 to +10 vdc	0	1
4 to 20 mA	1	0
Not connected	1	1

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

Important: Software input/output selections must match the jumper settings for each respective input/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	16mA	01600
0 - 010.00 vdc	5.6 vdc	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 (Line 1)	N/A	zero
Maximum Position (Line 2)	ram (screw) is fully extended to the mold end (ram bottom)	full travel of the sensor
Analog Signal @ Min Position (Line 3)	sensor is forward-acting	low end of your selected range
	sensor is reverse-acting	high end of your selected range
Analog Signal @ Max Position (Line 4)	sensor is forward-acting	high end of your selected range
	sensor is reverse-acting	low end of your selected range
Minimum Pressure (Lines 5 and 13)	N/A	minimum range value specified by the manufacturer
Maximum Pressure (Lines 6 and 14)	N/A	maximum range value specified by the manufacturer

Category:	If your:	Then Use a Value Equal to:
Analog Signal @ Min Pressure	sensors are forward-acting	low end of your selected range
(Lines 7 and 15)	sensors are reverse-acting	high end of your selected range
Analog Signal @ Max Pressure	sensors are forward-acting	high end of your selected range
(Lines 8 and 16)	sensors are reverse-acting	low end of your selected range
Minimum Screw RPM (Line 9)	N/A	zero
Maximum Screw RPM (Line 10)	N/A	max range value specified by the manufacturer
Analog Signal @ Min RPM	sensors are forward-acting	low end of of your selected range
(Line 11)	sensors are reverse-acting	high end of your selected range
Analog Signal @ Max RPM	sensors are forward-acting	high end of your selected range
(Line 12)	sensors are reverse-acting	low end of your selected range

Worksheet 3-D
Determine Initial Sensor-configuration Values

Enter Your Initial Values Here

Input	Line	Control Word	Pro-Set 600 Address	Value	Description	Units
1	1	MCC09	N40:5	0	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	0	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	MCC51	N40:47	0	Minimum Screw RPM	Rotational Speed [4]
	10	MCC52	N40:48		Maximum Screw RPM	Rotational Speed [4]
	11	MCC53	N40:49		Analog Signal @ Min Screw RPM	Input Signal Range [2]
	12	MCC54	N40.50		Analog Signal @ Max Screw RPM	Input Signal Range [2]
4	13	MCC57	N40:53	0	Minimum Cavity Pressure	Cavity Pressure [5]
	14	MCC58	N40:54		Maximum Cavity Pressure	Cavity Pressure [5]
	15	MCC59	N40:55		Analog Signal @ Min Cavity Pressure	Input Signal Range [2]
	16	MCC60	N40:56		Analog Signal @ Max Cavity 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

[4] Rotational Speed
000.0 to 999.9 RPM

[5] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

Download MCC Values 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 values into the PLC-5 data table
- download them to the QDC module (PLC-5 processor in run mode)
- correct any data entry (programming) errors

Next we describe the general steps:

Enter MCC Values into Your PLC-5 Data Table

With your programming terminal, enter values from Worksheet 3-A thru Worksheet 3-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 Values to the QDC Module

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

Important: You can verify that the MCC block was successfully downloaded or that you made a data entry (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 QDC Module Reference Manual, publication 1771-6.5.88.

Important: Pro-Set 600 software downloads all command blocks when your PLC-5 processor enters run mode after a valid MCC block is accepted. All programming errors reported in SYS62 (N40:214) are referenced to the MCC block until SYS01-B08 = 1.

Correct Any Data-entry (Programming) Errors in MCC

Upon receipt of the 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 a programming error, 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 block is accepted and the QDC module returns SYS01-B08 = 1.

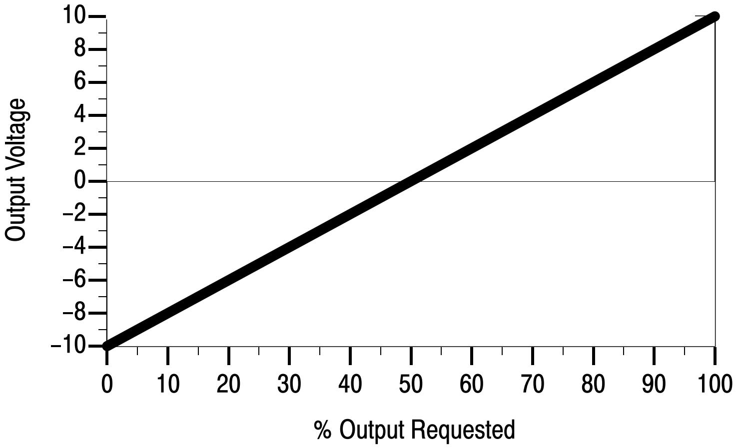
Important: The QDC module must receive a valid MCC block before you can download additional blocks.

Use Set-Output Operation to Move the Ram (Screw)

To finish configuring the QDC module, you actuate the ram (screw) with the QDC module's set-output operation that applies percentage values to your QDC module's outputs to move the ram (screw) in a controllable fashion. To do this, you apply %-output signals to all module outputs so you can move the actuator over its intended range. Sensor spanning values can then be refined per the actual values monitored by the QDC module.

⚠ **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 - N40:124 does not necessarily correspond to zero pressure or flow. If you configured jumper E11, E12, E15, and/or E16 for bi-directional valve operation, an output of 0% gives –10vdc, 50% gives 0vdc (see chart). Amplifier electronics or spool-null offsets may also allow pressure or flow at zero 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 - DYC12 (Pro-Set 600 words N40:121 - N40:124). 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.

Actuate the Ram (screw) with Set-output Operation

1. Enter values that result in no motion in these DYC words

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 (Pro-Set 600 address B34/392). The QDC module sets outputs 1 - 4 to percentage values that you entered in DYC09 - DYC12 respectively.

3. With your programming terminal, slowly change the %-output value of one output as you observe the corresponding movement.

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.

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:

- screw position sensor values
- screw pressure sensor values
- cavity pressure sensor values
- screw RPM sensor values

In the procedures that follow, measure and record:

- minimum and maximum positions
- corresponding signal values
- minimum and maximum pressures
- corresponding signal values
- minimum and maximum RPM
- corresponding signal values

After determining these values from the procedures, write them down on Worksheet 4-E.

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

Worksheet 3-E
Final Sensor-configuration Values

Enter Your Final Values Here

Input	Line	Control Word	Pro-Set 600 Address	Value	Description	Units
1	1	MCC09	N40:5	0	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	0	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	MCC51	N40:47	0	Minimum Screw RPM	Rotational Speed [4]
	10	MCC52	N40:48		Maximum Screw RPM	Rotational Speed [4]
	11	MCC53	N40:49		Analog Signal @ Min Screw RPM	Input Signal Range [2]
	12	MCC54	N40.50		Analog Signal @ Max Screw RPM	Input Signal Range [2]
4	13	MCC57	N40:53	0	Minimum Cavity Pressure	Cavity Pressure [5]
	14	MCC58	N40:54		Maximum Cavity Pressure	Cavity Pressure [5]
	15	MCC59	N40:55		Analog Signal @ Min Cavity Pressure	Input Signal Range [2]
	16	MCC60	N40:56		Analog Signal @ Max Cavity 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

[4] Rotational Speed
000.0 to 999.9 RPM

[5] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

Determine Values for the Ram (Screw) Position Sensor

ATTENTION: Incorrect values entered in DYC09 through DYC12 may result in rapid ram (screw) motion and potential damage to your barrel or seals of your injection cylinder.

To complete the configuration for your ram (screw) position sensor, do the following and enter the results on Worksheet 4-E:

Important: If your position sensor has zero and span potentiometers for setting the zero reference and linear resolution, do so during this procedure.

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 4-E.
4. With your programming terminal, read the signal level returned in SYS33 (N40:185) from your position sensor. You may wish to zero your position sensor at this time.
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 position sensor. You may wish to span your position sensor at this time.
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 Ram (Screw) Pressure Sensor

To complete the configuration for your ram (screw) pressure sensor, enter on Worksheet 4-E minimum and maximum pressures and corresponding signal levels from manufacturer's specifications in MCC17-20. Most applications require no further spanning. If your application requires greater accuracy, follow the procedure below:

1. Release system pressure to obtain minimum ram (screw) pressure.

2. Read the pressure gauge at the ram (screw).

3. Record minimum pressure (normally 0000) on line 5 for MCC17 on Worksheet 4-E.

4. With your programming terminal, read the signal level returned in SYS34 (N40:186) from your pressure sensor. You may wish to zero your pressure sensor at this time.

5. Record this signal level on line 7 for MCC19. 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.

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

7. Boost system pressure to obtain maximum ram (screw) pressure.

Obtain maximum system pressure by positioning the ram (screw) at its fully forward (nozzle end) or fully retracted (backpoint) position while keeping its pressure valve in the maximum open position. This forces the cylinder to press against the mechanical limits of its travel and builds max system pressure.

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

9. Record this maximum pressure on line 6 for MCC18.

10. With your programming terminal, read the signal level returned in SYS34 (N40:186) from your pressure sensor. You may wish to span your pressure sensor at this time.

11. Record this signal level on line 8 for MCC20.

12. Release pressure.

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 Cavity Pressure Sensor (if used)

To complete the configuration for your cavity pressure sensor, enter in Worksheet 4-E minimum and maximum pressures and corresponding signal levels from manufacturer's specifications in MCC57-60. Most applications require no further spanning.

Determine Values for the Screw RPM Sensor

To complete the configuration for your screw RPM sensor, enter in Worksheet 4-E on lines 9-12 (MCC51-54) minimum and maximum RPM and corresponding signal levels from manufacturer's specifications. Most applications require no further spanning.

If your application requires greater accuracy, follow the this procedure:

1. Confirm that the screw is at rest (not rotating).

2. Record 0000 as the minimum RPM on line 9 for MCC51 of Worksheet 4-E.

3. With your programming terminal, read signal level returned in SYS35 (N40:187) from your RPM sensor. You may wish to zero your RPM sensor at this time.

4. Record this signal level on line 11 for MCC53.

⚠ **ATTENTION:** Be sure that any residual plastic in your barrel is hot enough to be liquified before proceeding to step 5. Attempting to rotate the screw at maximum RPM with cool plastic in the barrel could damage your barrel/screw set.

5. Allow full hydraulic flow to your screw motor at rated hydraulic pressure to obtain maximum RPM.

6. Determine the actual RPM using a calibrated, hand-held touch tachometer (or similar device).

7. Record the observed maximum RPM on line 10 for MCC52.

8. With your programming terminal, read the signal level returned in SYS35 (N40:187) from your RPM sensor. You may wish to span your RPM sensor at this time.

9. Record this signal level on line 12 for MCC54.

10. Release all flow and pressure from your screw motor and allow the screw to return to rest.

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

Select Optional Configurations

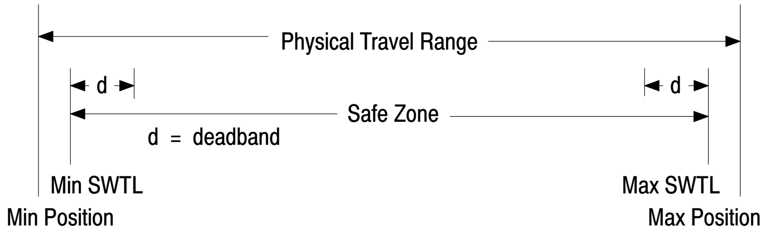
You also have the option of configuring the following QDC features:

Use this Option:	For this Benefit:
Software Travel Limits	to guard against damaging the nozzle assembly or seals
Pressure Alarm Time Delay	to warn of excessive pressure without nuisance alarms
Digital Filter	to compensate for noise on position inputs
RPM Alarm Time Delay	to warn of excessive screw RPM without nuisance alarms

Configure Software Travel Limits

You may want to use the software restrictions to stop the travel of your ram (screw) before it reaches its maximum limits (configured earlier in this chapter).

Figure 4.1
Software Restrictions



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-outputs 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 the operator to jog the cylinder a set distance away from the software overtravel. We recommend a value of 00.10 inch as a starting deadband. Your sensor may require a greater deadband.

ATTENTION: The QDC module ignores SWTL alarms when jogging or when performing a set-output operation.

Configure the QDC module for SWTL as follows:

1. Determine these SWTL values for ram (screw) 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 and 14), inhibits the QDC module from performing this safety function.

Worksheet 3-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	10	Screw SWTL Deadband	As noted [1]

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

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

Set Up Maximum RPM and Pressure Alarms, and Time Delays

The QDC module continuously monitors screw RPM, ram (screw) pressure, and cavity pressure inputs. 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 or RPM for an amount of time before setting the high alarm. A setpoint of zero disables this delay.

Configure the QDC module for pressure and RPM alarms as follows:

1. Determine these values for ram (screw) and/ or cavity pressure alarms:
   - pressure-alarm setpoint
   - time-delay setpoint

2. Determine these values for screw RPM alarms:
   - RPM-alarm setpoint
   - time-delay setpoint

3. Record non-zero setpoints on Worksheet 3-G for the pressure alarms, RPM alarm, and time delays you want to use.

4. Download them to the QDC module using the procedures presented earlier in this chapter:

Worksheet 3-G
Alarm and Time-delay Setpoints

Enter Your 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]
MCC55	N40:51		High-RPM Alarm Setpoint	Rotational Speed [3]
MCC56	N40:52		Screw RPM Time-delay Setpoint	Time Measured in Seconds [1]
MCC61	N40:57		Cavity Pressure-alarm Setpoint	Cavity Pressure [4]
MCC62	N40:58		Cavity-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

[3] Rotational Speed
000.0 to 999.9 RPM

[4] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

Configure a Digital Filter for the Position Input from the Ram (Screw)

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

To determine if you need a digital filter, move the ram (screw) very slowly. With your programming terminal, look for erratic position numbers reported for ram (screw) position by examining SYS25 (N40:177).

Configure the QDC Module for a Digital Input Filter as Follows:

To determine the time constant (0 - 00.10 sec), start with a small value such as 00.01 and enter it into MCC16 (N40:12). A value of zero disables the filter.

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 ram (screw) linear velocity of 10”/sec, a 00.01 time constant allows 0.10” of 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 introduces you to the remaining procedure necessary to successfully configure your QDC module. You must follow the procedures in the order given. 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 - you download these blocks 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 in 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 PLC-5 data table containing machine commands, set-up, and operating information for the QDC module. You download command blocks from PLC-5 data table to the QDC module manually on command or automatically at power up.

There are two types of command blocks. They are presented in the following table.

Type	Which Contain	Examples
Configuration Blocks	Information necessary to configure your module to run a certain portion of a profile	Valve spanning information for the injection profile
Profile Blocks	Actual process setpoints necessary to produce a desired part.	Plastication 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	Which Contain	Examples
Status Blocks	Information about machine operation and operating status of the QDC module.	The molding machine is currently performing a pre-decompression movement.

Special Command and Status Blocks

A few special command and status blocks are the Module Configuration Block, Dynamic Command Block, and the System Status Block.

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

Overview of Remaining Configuration Procedures

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

Step	Procedure	Information that you enter:	Refer to:
1	Jog Your Machine	Machine jog pressure and flow setpoints are entered into the Jog Configuration block (JGC). You jog your ram (screw) with commands in the Dynamic Command block (DYC) to further refine your jog configuration. Jog-pressure and screw-RPM alarm setpoints that you determine.	Chapter 5
2	Write a PLC Program to Coordinate Phases	The QDC module offers many machine operation options to meet nearly any injection molding machine's requirements. You must write PLC ladder logic to cycle the machine in the desired manner.	Chapter 6
3	Enter Initial Configuration Values	Output values to valves controlling pressure or flow, ramp rates, and valve span.	Chapter 7 (Used in Chapters 9 & 10)
4	Enter Initial Profile Values	Initial machine operation setpoints (pressure, velocity, position, time, and other part-specific information)	Chapter 8 (Used in Chapters 9 & 10)
5	Span Your Valves	Configuration parameters necessary to accurately span your hydraulic valves in open loop. You also set profile pressure alarms.	Chapter 9
6	Tune Your Machine for Producing Parts	Closed-loop tuning parameters. We also discuss other setpoints for part tuning and machine tuning.	Chapter 10

Enter Data Table Values and Download Command Blocks

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

- enter data table values
- download command blocks

Enter Values into Your PLC-5 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 Command Blocks

Use this procedure to send one or more command blocks from PLC-5 data table to QDC module while leaving the PLC-5 processor in Run mode. (As an alternative, 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.)

Important: The following procedure does NOT apply to the MCC block. It has its own download procedure described in chapter 3.

Important: Before you can use the following procedure, you must first have successfully downloaded a valid MCC block to the QDC module.

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

Learn the following procedure because you will use it often.

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 Command Block

Subject Block	Pro-Set 600 Block ID Number	Pro-Set 600 Command Bit *in B21*	Required Companion Block
JGC	02	1	
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	

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 Any Data-entry 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.

Chapter
5

Jog Your Machine

Chapter Objectives

This chapter describes how to:

- configure all jog block values necessary to jog your ram (screw)
- test jog values and make changes, if necessary
- configure values which may indirectly affect clamp and eject jogs

About Jogging

Jogging your machine is similar to operating it in set-output operation: 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:

- rotate the ram (screw)
- jog it forward and backward

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

Use These Worksheets

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

To configure the QDC module for jogging the:	With this block:	Use this Worksheet	On Page
ram (screw)	JGC	5-A	5-3
clamp and ejector	JGC	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). 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 +10vdc, zero output occurs @ 50% (See Warning on next page.)

  Later in this chapter you modify them to obtain desired jog results.

- setpoints for jog-RPM and jog-pressure alarms

  The QDC module sets an alarm any time ram (screw) RPM and/or pressure equals or exceeds the respective value during jogs. A zero entry inhibits alarm actuation.

  Important:

  - High RPM and/or high pressure alarms that you set in chapter 3 are also active during jog functions.

  - Jog-specific high pressure alarms for clamp and eject jogs are NOT activated in a QDC module configured for inject mode.

Worksheet 5. A
Ram (screw) Jog Configuration Values

Enter Your Initial Values Here

Control Block Word	Pro-Set 600 Address	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]
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]
Jog RPM and Pressure Alarms				
JGC05	N40:61		Screw-rotate Jog RPM, Alarm Setpoint	Rotational Speed [3]
JGC06	N40:62		Screw Jog Pressure, Alarm Setpoint	Ram (screw) Pressure [2]

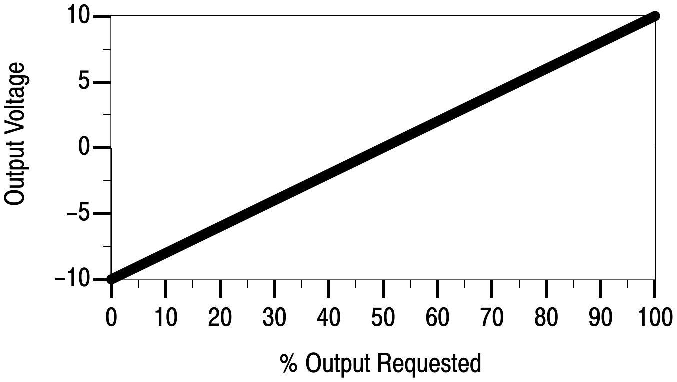
[1] % Signal Output
00.00 to 99.99 %

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

[3] Rotational Speed
000.0 to 999.9 RPM

ATTENTION: You can connect up to four different valves to your QDC module. Although all four may not directly jog the ram (screw), 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 ± 10VDC, 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

Using the same procedure outlined in chapter 3, enter your initial jog values in Worksheet 5-A. To download the jog configuration block (JGC), refer to the download procedure outlined in chapter 4.

Write Ladder Logic

Take time now to develop ladder logic (independent of Pro-Set 600 software) to jog the ram (screw) with the QDC module. You 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).

Table 5.A
Ram (Screw) Jog Enable Bits

Control Block Word:	Pro-Set 600 Address:	Description:
DYC01-B09	B34/393	Execute Screw Rotate Jog
DYC01-B10	B34/394	Execute Inject Cylinder Jog Forward
DYC01-B11	B34/395	Execute Inject Cylinder Jog Reverse

Table 5.B
Ram (Screw) Jog Status Bits

Status Block Word:	Pro-Set 600 Address:	Description:
SYS01-B09	B34/9	Screw Rotate Jog in Progress
SYS01-B10	B34/10	Inject Cylinder Jog Forward in Progress
SYS01-B11	B34/11	Inject Cylinder Jog Reverse 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) travel hydraulically when you command the QDC module to jog the ram (screw) in reverse.

Figure 5.1
Example Jog Programming

```
Rung 6:1                                                             DYC02-B15
| EMERGENCY                                                          ********* |
|   STOP                                                             EXECUTE   |
| CONDITION                                                          ALL STOP  |
|  EXISTS                                                            COMMAND   |
|     B3                                                               B34     |
+----] [---------------------------------------------------------------( )-----+
|       0                                                               415    |
Rung 6:2
|   CYCLE   | MANUAL   |DIRECTION                                   DYC01-B10  |
|  CONTROL  | SCREW    |SOLENOIDS                                   ********** |
|  SELECTOR | FORWARD  |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN|  JOG     |MOVE SCREW                                    SCREW    |
|  “MANUAL” | ALLOWED  |FORWARD                                      FWD JOG   |
|   I:003       B11        B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05         1          8                                         394     |
Rung 6:3
|   CYCLE   | MANUAL   |DIRECTION                                   DYC01-B11  |
|  CONTROL  | SCREW    |SOLENOIDS                                   ********** |
|  SELECTOR | REVERSE  |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN|  JOG     |MOVE SCREW                                    SCREW    |
|  “MANUAL” | ALLOWED  |REVERSE                                      REV JOG   |
|   I:003       B11        B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05          2         9                                          395    |
Rung 6:4
|   CYCLE   | MANUAL   |DIRECTION                                   DYC01-B09  |
|  CONTROL  | SCREW    |SOLENOIDS                                   ********** |
|  SELECTOR | ROTATE   |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN|  JOG     | ROTATE                                       SCREW    |
|  “MANUAL” | ALLOWED  | SCREW                                      ROTATE JOG |
|   I:003       B11        B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05          3        10                                          393    |
```

Jog Your Ram (Screw)

Jog your ram (screw) in forward and reverse directions. Experiment with values you entered in the jog configuration block (JGC) until you obtain the desired jog operation.

You must download the JGC to the QDC module each time you change a value in the command block to implement the new value. Refer to the download procedure outlined in chapter 4.

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

Configure Jogs for the Clamp and Ejector

Although the QDC module (in inject mode) may not be directly controlling your machine's clamp and ejector jogs, your hydraulics may require valves connected to this QDC module's outputs to go to a certain position to assure proper clamp and/or ejector 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 (in inject mode) to assist with clamp and/or eject jogs. Otherwise, omit the rest of this chapter.

Whenever the appropriate clamp or ejector 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 (in inject mode) to successfully execute clamp and ejector jogs.

Important: Jog-specific high pressure alarms are NOT activated in an inject-mode QDC module during clamp and ejector jogs.

2. Download the jog configuration block (JGC) using the download procedure outlined in chapter 4.

Worksheet 5. B
Clamp & Eject Jog Configuration Values for QDC Module in Inject Mode

Enter Your Initial Values Here

Control Block Word	Pro-Set 600 Addr.	Value	Description	Units
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]
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 %

Write Ladder Logic to Assist with Clamp & Eject Jogs

If your hydraulics require it, take time now to develop ladder logic (independent of Pro-Set 600 software) so the QDC module (in inject mode) can assist jogging the clamp and ejector. 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 the clamp and/or ejector.

Table 5.C
Clamp and Eject Jog Enable Bits

Command Block Word:	Pro-Set 600 Address:	Description:
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.D
Clamp and Eject Jog Status Bits

Status Block Word:	Pro-Set 600 Address:	Description:
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 5.2) of assisted 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 clamp and/or ejector travel hydraulically when you command the QDC module to retract the clamp and/or ejector.

Figure 5.2
Example Programming for Assisting Clamp and/or Ejector Jogs

```
Rung 6:5
|   CYCLE   |          |DIRECTION                                   DYC01-B12  |
|  CONTROL  | MANUAL   |SOLENOIDS                                   ********** |
|  SELECTOR |CLAMP JOG |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN| FORWARD  |MOVE CLAMP                                  UNASSIGNED |
|  “MANUAL” | ALLOWED  |FORWARD                                      #4 JOG    |
|   I:003       B11       B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05          4        11                                         396    |
Rung 6:6
|   CYCLE   |          |DIRECTION                                   DYC01-B13  |
|  CONTROL  | MANUAL   |SOLENOIDS                                   ********** |
|  SELECTOR |CLAMP JOG |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN| REVERSE  |MOVE CLAMP                                  UNASSIGNED |
|  “MANUAL” | ALLOWED  |REVERSE                                      #5 JOG    |
|   I:003       B11       B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05          5        12                                         397    |
Rung 6:7
|   CYCLE   | MANUAL   |DIRECTION                                   DYC01-B14  |
|  CONTROL  | EJECTOR  |SOLENOIDS                                   ********** |
|  SELECTOR |  JOG     |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN| ADVANCE  |ADVANCE                                     UNASSIGNED |
|  “MANUAL” | ALLOWED  |EJECTOR                                      #6 JOG    |
|   I:003       B11       B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05          6        13                                         398    |
Rung 6:8
|   CYCLE   | MANUAL   |DIRECTION                                   DYC01-B15  |
|  CONTROL  | EJECTOR  |SOLENOIDS                                   ********** |
|  SELECTOR |  JOG     |ALIGNED TO                                   EXECUTE   |
| (A/S/M) IN| RETRACT  |RETRACT                                     UNASSIGNED |
|  “MANUAL” | ALLOWED  |EJECTOR                                      #7 JOG    |
|   I:003       B11       B11                                         B34     |
+----] [--------] [--------] [-----------------------------------------( )-----+
|      05          7        14                                         399    |
```

Jog Your Clamp and Ejector

Do this only after writing all direct and assisted ladder logic for controlling clamp and eject jogs.

Jog your clamp and/or ejector in forward and retract directions. Experiment with values you entered in the jog configuration block (JGC) until you obtain the desired jog operation.

You must download the JGC block to the QDC module each time you change a value in the command block to implement the new value. Refer to the download procedure outlined in chapter 4.

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

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 that depends on your machine's hydraulic configuration.

Assess Your Logic Requirements

You must add your own ladder logic according to your machine's sequencing requirements.

If you need to	Refer to this table for required command and/or status bits
Execute phases of the Inject 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 ram (screw) 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	The QDC sets this bit during execution
Direct Set-output	DYC01-B08	SYS01-B08
Screw Rotate Jog	DYC01-B09	SYS01-B09
Ram (screw) Forward Jog	DYC01-B10	SYS01-B10
Ram (screw) Reverse Jog	DYC01-B11	SYS01-B11
Unassigned # 4 Jog	DYC01-B12	SYS01-B12
Unassigned # 5 Jog	DYC01-B13	SYS01-B13
Unassigned # 6 Jog	DYC01-B14	SYS01-B14
Unassigned # 7 Jog	DYC01-B15	SYS01-B15
Stop	DYC02-B15	SYS02-B15

Table 6.B
Command Bits for Automatic Functions

To initiate this profile/movement	Toggle this bit	Or the profile/movement starts automatically after	If this bit is Reset
Injection	DYC02-B04	–	–
Pack	DYC02-B05	Injection	Note 1
Hold	DYC02-B06	Pack	Note 1
Pre-decompression	DYC02-B07	Hold	HPC03-B08
Plastication	DYC02-B08	Pre-decompression	HPC03-B09
Post-decompression	DYC02-B09	Plastication	PPC03-B08
Note 1 Injection, Pack, and Hold are always linked as one profile.			

Table 6.C
Status and Command Bit Interaction for Automatic Functions

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	This status bit is
	SET	**RESET**	**SET**	**RESET**	**also SET**	**also SET**
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

Table 6.D
Command Bits To Interrupt Ram (screw) Movement Between Profiles

Bit Description	QDC Block Address
0 = start pre-decompression movement @ end of hold profile 1 = stop and set output @ end of hold profile	HPC03-B08
0 = start plastication profile @ end of pre-decompression movement 1 = stop and set output @ end of pre-decompression movement	HPC03-B09
0 = start post-decompression movement @ end of plastication profile 1 = stop and set output @ end of plastication profile	PPC03-B08

Table 6.E
Miscellaneous Status Bits To Trigger New Events in Inject Mode

Reason for Using	Bit Description	QDC Block Address
To drop pump adders, or shift solenoids before starting pack/hold profile	Injection complete	SYS02-B04
To inhibit clamp from opening in auto mode	Cure timer timing	SYS03-B03
To start clamp-open phase	Ram (screw) retracted, and Cure time complete	SYS03-B04, and SYS03-B05
To idle the machine and activate an alarm because the hopper is running out of plastic	Watchdog for plastication phase	SYS04-B08
To shift solenoids for pre-decompression	Set-output in progress @ end of hold	SYS22-B06
To shift solenoids for plastication	Set-output in progress @ end of pre-decompression	SYS22-B07
To shift solenoids for post-decompression	Set-output in progress @ end of plastication	SYS22-B08
To idle the machine until starting next action	Set-output in progress @ end of post-decompression	SYS22-B09

Table 6.F
Status Bits

Category	Bit Status (when = 1)	Pro-Set B34/___	QDC Block Address
Jog Status	executing screw rotate jog	9	SYS01-B09
	executing inject cylinder forward jog	10	SYS01-B10
	executing inject cylinder reverse jog	11	SYS01-B11
	executing unassigned #4 jog	12	SYS01-B12
	executing unassigned #5 jog	13	SYS01-B13
	executing unassigned #6 jog	14	SYS01-B14
	executing unassigned #7 jog	15	SYS01-B15
Profile Complete	injection profile complete	20	SYS02-B04
	pack profile complete	21	SYS02-B05
	hold profile complete	22	SYS02-B06
	pre-decompression movement complete	23	SYS02-B07
	plastication profile complete	24	SYS02-B08
	post-decompression movement complete	25	SYS02-B09
Busy Status	no action (outputs at zero)	31	SYS02-B15
Miscellaneous Status	cure timer timing	35	SYS03-B03
	ram (screw) retracted	36	SYS03-B04
	cure time complete	37	SYS03-B05
Watchdog Status	pre-decompression watchdog timed out	55	SYS04-B07
	plastication watchdog timed out	56	SYS04-B08
	post-decompression watchdog timed out	57	SYS04-B09
Profile Status	executing injection profile	324	SYS21-B04
	executing pack profile	325	SYS21-B05
	executing hold profile	326	SYS21-B06
	executing pre-decompression movement	327	SYS21-B07
	executing plastication profile	328	SYS21-B08
	executing post-decompression movement	329	SYS21-B09
End of Profile Set-output Status	executing end of hold set-output	342	SYS22-B06
	executing end of pre-decompression set-output	343	SYS22-B07
	executing end of plastication set-output	344	SYS22-B08
	executing end of post-decompression set-output	345	SYS22-B09

Table 6.G
Command and Configuration Bits

Category	**Function Enabled (when = 1)**	**Pro-Set B34/___**	**QDC Block Address**
Non-profiled Action Commands	execute set-output	392	DYC01-B08
	execute screw rotate jog	393	DYC01-B09
	execute inject cylinder forward jog	394	DYC01-B10
	execute inject cylinder reverse jog	395	DYC01-B11
	execute unassigned #4 jog	396	DYC01-B12
	execute unassigned #5 jog	397	DYC01-B13
	execute unassigned #6 jog	398	DYC01-B14
	execute unassigned #7 jog	399	DYC01-B15
Profiled Action Commands	execute injection profile	404	DYC02-B04
	execute pack profile	405	DYC02-B05
	execute hold profile	406	DYC02-B06
	execute pre-decompression movement	407	DYC02-B07
	execute plastication profile	408	DYC02-B08
	execute post-decompression movement	409	DYC02-B09
Stop Command	execute all stop (outputs = zero)	415	DYC02-B15
Miscellaneous Commands	reset cure timer	417	DYC03-B01
	reset SYS01-B08	424	DYC03-B08
	reset latched alarms	425	DYC03-B09
	reset complete bits (SYS02)	426	DYC03-B10
Logical Bridge Configuration	set output at end of hold profile (0 = start pre-decompression movement at end of hold)	B38/296	HPC03-B08
	set output at end of pre-decompression movement (0 = start plastication profile at end of pre-decompression)	B38/297	HPC03-B09
	set output at end of plastication profile (0 = start post-decompression movement at end of plastication)	B38/488	PPC03-B08

Chapter 7

Load Initial Configuration Values

Chapter Objectives

This chapter helps you determine, enter, and download configuration setpoints required to tune the QDC module. You will refer to this chapter frequently when tuning the QDC module in chapter 9.

We give you information to:

- assign outputs for control valves
- select the type of PID algorithm
- set values for Expert Response Compensation™
- determine set-output values for profiles
- set accel/decel ramp rates
- determine set-output values for end of profiles
- set pressure control limits
- set velocity control limits
- set screw RPM control limits
- set profile tuning constants and pressure-alarm setpoints

Then you:

- determine initial values
- record values on worksheets
- enter them in your PLC-5 data table
- download them to the QDC module

Important: We already entered on the worksheets most initial values required for chapter 9. Your objective is to become familiar with how to:

- determine setpoint values as described in text
- enter and download values in preparation for tuning the machine in chapter 9.

Important: Before starting this chapter, you should have previously:

- spanned your sensors and moved the ram (screw) in chapter 3
- jogged the ram (screw) in chapter 5

Use These Worksheets

The following table lists command blocks and corresponding worksheets for recording your initial values that you use to configure the QDC module.

To configure the QDC module with this configuration block	Use this Worksheet	On Page
Injection Configuration Command Block (INC)	7-A	7-3
Pack Configuration Command Block (PKC)	7-B	7-5
Hold Configuration Command Block (HDC)	7-C	7-7
Plastication Configuration Command Block (PLC)	7-D	7-9

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 each worksheet contains two parts:

- control words for selecting parameters by setting bits
- a configuration block of data words for recording initial values

Also notice that many parameters repeat from one block to the next.
For example:

- control bits for selecting an output
- block parameters such as decel ramp rate during profile

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 grouped all worksheets together, followed by all text.

This page is purposely blank so that the following 2-page worksheets will be on facing pages.

Worksheet 7- A
Injection Configuration Command 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

Ram PID
Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Selected Ram
Pressure Valve

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

Selected Ram
Velocity Valve

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

Worksheet 7-A (continued)
Injection Configuration Command Block (INC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
INC05	N44:1	1000	Minimum ERC Percentage--Velocity	Percent [8]
INC06	N44:2	1000	Minimum ERC Percentage--Pressure	Percent [8]
INC09	N44:5	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
INC10	N44:6	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
INC11	N44:7	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
INC12	N44:8	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
INC17	N44:13	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC18	N44:14	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC19	N44:15	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC20	N44:16	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC25	N44:21	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC26	N44:22	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC27	N44:23	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC28	N44:24	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC41	N44:37	0	Pressure Minimum Control Limit	Pressure [3]
INC42	N44:38	*	Pressure Maximum Control Limit	Pressure [3]
INC43	N44:39	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
INC44	N44:40	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
INC45	N44:41	0	Velocity Minimum Control Limit	Velocity along Axis [2]
INC46	N44:42	*	Velocity Maximum Control Limit	Velocity along Axis [2]
INC47	N44:43	*	Selected Velocity Valve, Output for Minimum	Percent Signal Output [4]
INC48	N44:44	*	Selected Velocity Valve, Output for Maximum	Percent Signal Output [4]
INC49	N44:45	100	Proportional Gain for Pressure Control	None
INC50	N44:46	400	Integral Gain for Pressure Control	Inverse Time (Algorithm) [6]
INC51	N44:47	0	Derivative Gain for Pressure Control	Time (Algorithm) [7]
INC52	N44:48	200	Proportional Gain for Velocity Control	Inverse Time (Algorithm) [6]
INC53	N44:49	0	Feed Forward Gain for Velocity Control	None
INC57	N44:53	0	Profile High Ram (screw) Pressure Alarm Setpoint	Pressure [3]
INC58	N44:54	0	Profile High Cavity Pressure Alarm Setpoint	Pressure [1]

[1] Pressure
00000 to 20000 PSI
0000.0 to 2000.0 Bar

[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- B
Pack Configuration Command 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

Bits 07–00: 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				1			

Bits 06–04: Selected Ram Pressure Valve

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

Bits 02–00: Selected Cavity Pressure Valve

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

Bit 07: Ram PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Bit 03: Cavity PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

Worksheet 7-B (continued)
Pack Configuration Command Block (PKC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PKC05	N44:121	1000	Minimum ERC Percentage--Cavity Pressure	Percent [8]
PKC06	N44:122	1000	Minimum ERC Percentage--Ram (Screw) 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 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC18	N44:134	0	Output #2 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC19	N44:135	0	Output #3 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC20	N44:136	0	Output #4 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC25	N44:141	0	Output #1 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC26	N44:142	0	Output #2 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC27	N44:143	0	Output #3 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC28	N44:144	0	Output #4 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC41	N44:157	0	Ram (screw) Pressure Minimum Control Limit	Pressure [3]
PKC42	N44:158	*	Ram (screw) Pressure Maximum Control Limit	Pressure [3]
PKC43	N44:159	*	Selected Ram (screw) Pressure Valve, Output for Minimum	Percent Signal Output [4]
PKC44	N44:160	*	Selected Ram (screw) Pressure Valve, Output for Maximum	Percent Signal Output [4]
PKC45	N44:161	0	Cavity Pressure Minimum Control Limit	Pressure [1]
PKC46	N44:162	*	Cavity Pressure Maximum Control Limit	Pressure [1]
PKC47	N44:163	*	Selected Cavity Pressure Valve, Output for Minimum	Percent Signal Output [4]
PKC48	N44:164	*	Selected Cavity Pressure Valve, Output for Maximum	Percent Signal Output [4]
PKC49	N44:165	100	Proportional Gain for Ram (screw) Pressure Control	None
PKC50	N44:166	400	Integral Gain for Ram (screw) Pressure Control	Inverse Time (Algorithm) [6]
PKC51	N44:167	0	Derivative Gain for Ram (screw) Pressure Control	Time (Algorithm) [7]
PKC52	N44:168	100	Proportional Gain for Cavity Pressure Control	None
PKC53	N44:169	400	Integral Gain for Cavity Pressure Control	Inverse Time (Algorithm) [6]
PKC54	N44:170	0	Derivative Gain for Cavity Pressure Control	Time (Algorithm) [7]
PKC57	N44:173	0	Profile High Ram (screw) Pressure Alarm Setpoint	Pressure [3]
PKC58	N44:174	0	Profile High Cavity Pressure Alarm Setpoint	Pressure [1]

[1] Pressure
00000 to 20000 PSI
0000.0 to 2000.0 Bar

[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- C
Hold Configuration Command 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				1			

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

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

Ram PID
Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

Cavity PID
Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

Code:

☐ Your value

▨ 0 or 1 Required initial value loaded by Pro-Set 600

Worksheet 7-C (continued)
Hold Configuration Command Block (HDC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HDC05	N44:181	1000	Minimum ERC Percentage--Cavity Pressure	Percent [8]
HDC06	N44:182	1000	Minimum ERC Percentage--Ram (Screw) 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 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC18	N44:194	0	Output #2 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC19	N44:195	0	Output #3 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC20	N44:196	0	Output #4 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC25	N44:201	0	Output #1 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC26	N44:202	0	Output #2 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC27	N44:203	0	Output #3 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC28	N44:204	0	Output #4 Decel 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	Ram (screw) Pressure Minimum Control Limit	Pressure [3]
HDC42	N44:218	*	Ram (screw) Pressure Maximum Control Limit	Pressure [3]
HDC43	N44:219	*	Selected Ram (screw) Pressure Valve, Output for Minimum	Percent Signal Output [4]
HDC44	N44:220	*	Selected Ram (screw) Pressure Valve, Output for Maximum	Percent Signal Output [4]
HDC45	N44:221	0	Cavity Pressure Minimum Control Limit	Pressure [1]
HDC46	N44:222	*	Cavity Pressure Maximum Control Limit	Pressure [1]
HDC47	N44:223	*	Selected Cavity Pressure Valve, Output for Minimum	Percent Signal Output [4]
HDC48	N44:224	*	Selected Cavity Pressure Valve, Output for Maximum	Percent Signal Output [4]
HDC49	N44:225	100	Proportional Gain for Ram (screw) Pressure Control	None
HDC50	N44:226	400	Integral Gain for Ram (screw) Pressure Control	Inverse Time (algorithm) [6]
HDC51	N44:227	0	Derivative Gain for Ram (screw) Pressure Control	Time (algorithm) [7]
HDC52	N44:228	100	Proportional Gain for Cavity Pressure Control	None
HDC53	N44:229	400	Integral Gain for Cavity Pressure Control	Inverse Time (algorithm) [6]
HDC54	N44:230	0	Derivative Gain for Cavity Pressure Control	Time (algorithm) [7]
HDC57	N44:233	0	Profile High Ram (screw) Pressure Alarm Setpoint	Pressure [3]
HDC58	N44:234	0	Profile High Cavity Pressure Alarm Setpoint	Pressure [1]

[1] Pressure
00000 to 20000 PSI
0000.0 to 2000.0 Bar

[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
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				1			

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

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

PID Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

PID RPM Algorithm
0 = Dependent Gains
1 = Independent Gains

Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

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

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PLC05	N44:361	1000	Minimum RPM Control ERC Percentage	Percent [8]
PLC06	N44:362	1000	Minimum Pressure Control ERC Percentage	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]
PLC45	N44:401	0	RPM Minimum Control Limit	RPM [2]
PLC46	N44:402	*	RPM Maximum Control Limit	RPM [2]
PLC47	N44:403	*	Selected RPM Valve, Output for Minimum	Percent Signal Output [4]
PLC48	N44:404	*	Selected RPM 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]
PLC52	N44:405	100	Proportional Gain for RPM Control	None
PLC53	N44:406	400	Integral Gain for RPM Control	Inverse Time (Algorithm) [6]
PLC54	N44:407	0	Derivative Gain for RPM Control	Time (Algorithm) [7]
PLC57	N44:413	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[1] Time
00.00 to 99.99 seconds

[2] Screw Speed
000.0 to 999.9 RPM

[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

Procedure to Determine and Enter Initial Values

Follow this procedure to complete each worksheet:

1. Read the text for the subject parameter.

2. Determine your initial value.

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.

3. Observe the list of configuration words that require the subject parameter. The list is located under the title of each subject parameter.

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 Control Valve for Injection Velocity
(INC02)

The QDC module can control ram (screw) 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 configuration in the control word of worksheet 7-A.

Selected Control Valve for Screw RPM
(PLC02)

The QDC module can control screw RPM using an RPM vs. position or time algorithm. Since you can connect up to four valves to your QDC module, you must tell it which valve to use for RPM control.

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

Record the appropriate bit selections for your valve configurations in the control word of worksheet 7-D.

Selected Control Valve for Ram (Screw) Pressure
(INC02, PKC02, HDC02, and PLC02)

The QDC module can control ram (screw) movement using pressure vs. position or time algorithms. For the plastication algorithm, the pressure component is backpressure. You must tell 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.

Selected Control Valve for Cavity Pressure
(PKC02 and HDC02)

The QDC module can control cavity pressure using a pressure vs. time algorithm during pack and hold. You must tell the QDC module which valve to use for controlling pressure with this algorithm.

B02	B01	B00	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 Algorithm
(INC02, PKC02, HDC02, and PLC02)

When executing pressure or screw RPM 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(B03) = :	Then it uses:
0	Dependent Gains (ISA)
1	Independent Gains (A-B)

Dependent gains (ISA):
$\text{Output} = Kc[(E) + 1/Ti \ {}_0\int^t (E)dt + Td*d(E)/dt]$

Independent gains (AB):
$\text{Output} = Kp(E) + Ki \ {}_0\int^t (E)dt + Kd*d(E)/dt$

Comparison of Gain Constants

Compare dependent and independent gains constants as follows:

Dependent Gains Constants:	Independent Gains Constants:
Controller Gain Kc (dimensionless)	Proportional Gain Kp (dimensionless)
Reset Term 1/Ti (minutes per repeat)	Integral Gain Ki (inverse seconds)
Rate Term Td (minutes)	Derivative Term Kd (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 gain constants by substituting controller gain (Kc), reset (1/Ti), and rate (Td) values in these formulas:

$$Kp = Kc \text{ unitless}$$

$$Ki = \frac{Kc}{60\ Ti} \text{ inverse seconds}$$

$$Kd = Kc(Td)60 \text{ seconds}$$

We recorded bit B07 (B03) = 1 for A-B independent gains on all corresponding worksheets.

Important: These recorded PID gain constants and closed-loop tuning procedures in chapter 10 assume the selection of independent (A-B) gains. If, after attempting to tune your pressure loops in chapter 10, you believe you must use dependent (ISA) gain constants, refer to section 3 of the Reference Manual (1771-6.5.88) for information on this option.

Set Values for Expert Response Compensation™ (ERC)

Expert Response Compensation Minimum Percentages (INC05-06, PKC05-06, HDC05-06, PLC05-06)

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 an initial value of 10% (1000) on all worksheets.

We help you select final values required 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).

Determine Unselected Valve Set-output Values

Unselected Valve Set-output Values (INC09-12, PKC09-12, HDC09-12, and PLC09-12)

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.

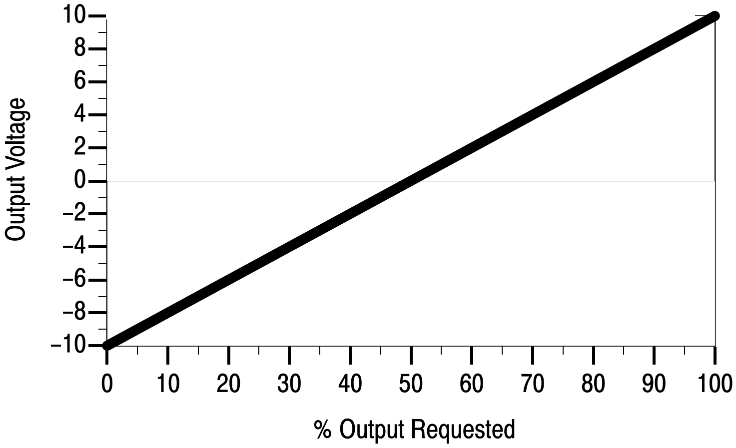
Table 7.A
Set-output Setpoints for Unselected Valves

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
Flow	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

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.

Record all set-output values for unselected valves in worksheets 7.A – 7.D.

ATTENTION: A value of 0 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 + 10VDC), an output value of 50% gives a zero volts signal output (see graph) while an output value of 0% or 100% gives a maximum signal output . Amplifier electronics or spool offsets may also allow pressure or flow at zero volts 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
(INC17-20, PKC17-20, HDC17-20, and PLC17-20)

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
(INC25-28, PKC25-28, HDC25-28, and PLC25-28)

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
(HDC33-36 and PLC33-36)

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: The 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

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

Minimum Ram (Screw) Pressure Control Limit (INC41, PKC41, HDC41, and PLC41)

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

We recorded zero on corresponding worksheets.

Maximum Ram (Screw) Pressure Control Limit (INC42, PKC42, HDC42, and PLC42)

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

Selected Ram (Screw) Pressure Valve, Output for Minimum (INC43, PKC43, HDC43, and PLC43)

The QDC module uses this word with Minimum Pressure Control Limit (word 41) above. Enter the %-signal output that the QDC module uses to drive the selected ram (screw) pressure valve for minimum profile pressure. The QDC module expects a pressure equal to word 41 when setting the selected ram (screw) 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 value in word 44	less than value in word 43
Reverse acting	greater than value in word 44	greater than value in word 43

Record initial Output for Minimum values on corresponding worksheets.

Selected Ram (Screw) Pressure Valve, Output for Maximum (INC44, PKC44, HDC44, and PLC44)

The QDC module uses this word with Maximum Ram (Screw) Pressure Control Limit (word 42) above. Enter the %-signal output that the QDC module uses to drive the selected ram (screw) pressure valve for maximum profile pressure. The QDC expects a pressure equal to word 42 when setting the selected ram (screw) 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 value in word 43	greater than value in word 44
Reverse acting	less than value in word 43	less than value in word 44

Record initial Output for Maximum values on corresponding worksheets.

Minimum Cavity Pressure Control Limit (PKC45 and HDC45)

The value in this word corresponds to the minimum controllable cavity pressure during pack and hold profiles. The QDC module uses this word with Selected Cavity Pressure Valve, Output for Minimum (word 47) below. The QDC module expects this pressure when setting the selected cavity pressure valve to the percentage output you enter in word 47.

We recorded zero on corresponding worksheets.

Maximum Cavity Pressure Control Limit (PKC46 and HDC46)

The value in this word corresponds to the maximum controllable cavity pressure during pack and hold profiles. The QDC module uses this word with Selected Cavity Pressure Valve, Output for Maximum (word 48) below. The QDC expects this pressure when setting the selected cavity pressure valve to the percentage output you enter in word 48.

Record on corresponding worksheets a maximum control limit equal to the maximum obtainable cavity pressure based on valve settings during respective profiles.

Selected Cavity Pressure Valve, Output for Minimum (PKC47and HDC47)

The QDC module uses this word with Minimum Cavity Pressure Control Limit (word 45) above. Enter the %-signal output that the QDC module uses to drive the selected cavity pressure valve for minimum profile pressure. The QDC module expects a pressure equal to word 45 when setting the selected cavity pressure valve to this %-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 47 should be	And during the profile, the QDC module does NOT drive the valve with a % output
Direct acting	less than value in word 48	less than value in word 47
Reverse acting	greater than value in word 48	greater than value in word 47

Record initial Output for Minimum values on corresponding worksheets.

Selected Cavity Pressure Valve, Output for Maximum (PKC48 and HDC48)

The QDC module uses this word with Maximum Cavity Pressure Control Limit (word 46) above. Enter the %-signal output that the QDC module uses to drive the selected cavity pressure valve for maximum profile pressure. The QDC module expects a pressure equal to word 46 when setting the selected cavity pressure valve to this %-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 48 should be	And during the profile, the QDC module does NOT drive the valve with a % output
Direct acting	greater than value in word 47	greater than value in word 48
Reverse acting	less than value in word 47	less than value in word 48

Record initial Output for Maximum values on corresponding worksheets.

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

Set Velocity Control Limits

Minimum Velocity Control Limit
(INC45)

The value in this word corresponds to the minimum controllable ram (screw) velocity during the injection profile. The QDC module uses this word with Selected Velocity Valve, Output for Minimum (INC47) below. The QDC module expects this velocity when setting its selected velocity valve to the percentage output you enter in INC47.

We recorded zero on Worksheet 7-A.

Maximum Velocity Control Limit
(INC46)

The value in this word corresponds to the maximum controllable ram (screw) velocity during the injection profile. The QDC module uses this word with Selected Velocity Valve, Output for Maximum (INC48) below. The QDC module expects this velocity when setting its selected velocity valve to the percentage output you enter in INC48.

Record the maximum ram (screw) speed per your OEM specifications on Worksheet 7-A.

Selected Velocity Valve, Output for Minimum
(INC47)

The QDC module uses this word with Minimum Velocity Control Limit (INC45) 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 INC45 when setting the selected velocity valve to this %-output.

The QDC module uses this setpoint to drive the selected velocity valve when attempting to attain zero ram (screw) velocity. It should drive the selected velocity valve to a spool position that prohibits any hydraulic flow into the hydraulic cylinder during injection.

Determine the Output for Minimum value 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 INC47 should be	And during the profile, the QDC module does NOT drive the valve with a % output
Direct acting	less than value in INC48	less than value in INC47
Reverse acting	greater than value in INC48	greater than value in INC47

Record the initial Output for Minimum value on Worksheet 7-A.

Selected Velocity Valve, Output for Maximum
(INC48)

The QDC module uses this word with Maximum Velocity Control Limit (INC46) 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 INC46 when setting the selected velocity valve to this %-output.

The QDC module uses this setpoint to drive the selected velocity valve when attempting to attain maximum ram (screw) velocity. It should drive the selected velocity valve to a spool position that provides full hydraulic flow into the hydraulic cylinder during injection.

Determine the Output for Maximum value 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 INC48 should be	And during the profile, the QDC module does NOT drive the valve with a % output
Direct acting	greater than value in INC47	greater than value in INC48
Reverse acting	less than value in INC47	less than value in INC48

Record the initial Output for Maximum value on Worksheet 7-A.

Important: The 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 RPM Control Limits

Minimum RPM Control Limit
(PLC45)

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

We recorded zero on Worksheet 7-D.

Maximum RPM Control Limit
(PLC46)

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

Record the maximum screw RPM per your OEM specifications on Worksheet 7-D.

Selected RPM Valve, Output for Minimum
(PLC47)

The QDC module uses this word with the Minimum RPM Control Limit (word 45) above. Enter the %-signal output that the QDC module uses to drive the selected RPM valve for minimum profile RPM. The QDC module expects an RPM equal to word 45 when setting the selected RPM 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 47 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 48	less than the value in word 47
Reverse Acting	greater than the value in word 48	greater than the value in word 47

Record your initial Output for Minimum value on worksheet 7-D.

Selected RPM Valve, Output for Maximum
(PLC48)

The QDC module uses this word with the Maximum RPM Control Limit (word 48) above. Enter the %-signal output that the QDC module uses to drive the selected RPM valve for maximum profile RPM. The QDC expects an RPM equal to word 46 when setting the selected RPM 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 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 the value in word 48
Reverse Acting	less than the value in word 47	less than the value in word 48

Record your initial Output for Maximum value on Worksheet 7-D.

Set Profile Tuning Constants, Pressure-Alarm Setpoints, and Watchdog Timer Preset

Profile Tuning Constants

(INC49-53, PKC49-54, HDC49-54, and PLC49-54)

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 entered all profile tuning constants on corresponding worksheets.

Profile Pressure Alarm Setpoints

(INC57-58, PKC57-58, HDC57-58, and PLC57)

The QDC module compares the ram (screw) or cavity pressure against these entries when executing the appropriate profile. The QDC module sets a corresponding alarm bit any time ram (screw) or cavity 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 Preset
(PLC08)

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

When the QDC module starts the plastication profile, it:

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

We recorded zero on Worksheet 7-D to inhibit the timer.

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 initial values and enter them on configuration worksheets, you are ready to proceed.

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

Important: Be sure that you have not altered any setpoints, and that you have entered each and every setpoint exactly as on the worksheets.

2. Use the procedure described in chapter 4 to download command blocks to the QDC module. For your convenience, we repeat download information from chapter 4 (Table 7.B).

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:
INC	08	7
PKC	10	9
HDC	11	10
PLC	14	13

Chapter 8

Load Initial Profile Values

Chapter Objectives

This chapter describes how to load setpoints for inject-mode profiles. You determine initial values and enter setpoints into PLC-5 data table for the following profiles:

- Injection Profile (IPC)
- Pack/Hold Profile (HPC)
- Plastication Profile (PPC)

Then, you download them to the QDC module.

Important: This chapter continues the procedure for loading information into the QDC module. Complete chapter 7 before starting this chapter.

Use These Worksheets

The following table lists command blocks and corresponding worksheets for recording your initial values that you download to the QDC module.

To configure the QDC module with this profile block	See this Worksheet	On Page
Injection Profile Command Block (IPC)	8-A	8-3
Pack/Hold Profile Command Block (HPC)	8-B	8-10
Plastication Profile Command Block (PPC)	8-C	8-17

Take a moment now to browse through the first worksheet.

Notice that it contains two parts:

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

Also notice that many parameters repeat within the profile block.
For example: segments 1-11 for velocity setpoints

Because many parameters repeat within a worksheet, we present each worksheet followed by text telling you how to determine initial values. Complete one worksheet before going to the next. This differs from the procedure in chapter 7.

Determine and Record Setpoints for the Injection Profile (IPC)

Use Worksheet 8-A to enter setpoints for pressure vs. time and velocity vs. position injection profiles. The valve spanning procedures in chapter 9 require specific values. We have already entered many values for you, and help you determine other values in the text that follows.

Worksheet 8-A
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	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

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

Code:

☐ Your value

0 or 1 Required initial value loaded by Pro-Set 600

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]
IPC63	N44:119	0	Cavity Pressure for Transition	Pressure [5]
IPC64	N44:120	0	Start of Zone for Pressure Transition	Distance from Mold-end [2]

[1] Time
00.00 to 99.99 seconds

[6] Time
00.00 to 00.99 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

[5] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

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

Determine Bit Selections for Worksheet 8-A

Injection Profile Block Identifier
(IPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the injection profile. These bits must be set to 00001001.

We recorded these bits on Worksheet 8-A.

Velocity Units
(IPC03)

The following bit determines units of measure for injection velocity values.

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

We recorded B14 = 1 for units per second on Worksheet 8-A.

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 recorded B13 = 0 for positive offset on Worksheet 8-A.

-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 B12 = 0 for positive offset on Worksheet 8-A.

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 B01 = B00 = 1 for pressure vs. time on Worksheet 8-A.

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 these bits = 1 (ERC = Off) on worksheet 8-A

Open- 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, you set a valve position to move the cylinder without sensor feedback . In closed loop, you use sensor feedback to control the valve regulating pressure or velocity.

0 = Closed loop
1 = Open loop

We recorded these bits = 1 for open-loop control on worksheet 8-A.

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 8-A

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

Use these words when configuring velocity vs. position profiles. Each velocity setpoint 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-A.

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).

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. Enter pressure 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-A.

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

(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.

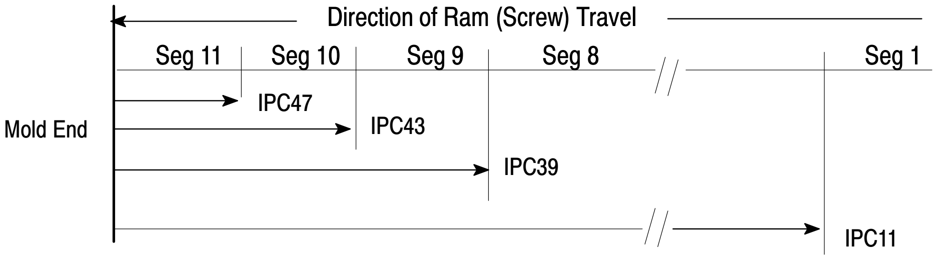
Determine end-of-segment position setpoints for your velocity vs. position injection profile for use in chapter 9 as follows:

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-A.

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. Enter time 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-A.

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 offsets 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.

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

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

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. You enter this limit 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-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. If needed, see Plastic Molding Module Reference Manual (pub 1771-6.5.88).

Transition Setpoints
(IPC60, 61, 62, 63, 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-A.

-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-A 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 enter a setpoint below mold-flash pressure.

We recorded zero on Worksheet 8-A to inhibit pressure transition.

-IPC63 determines the cavity 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
- cavity pressure equals or exceeds the non-zero entry in this word. Typically, you enter a setpoint below mold-flash pressure.

We recorded zero on Worksheet 8-A to inhibit pressure transition.

-IPC64 determines the position at which the QDC module begins to allow 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 setpoint in IPC62 or IPC63 over the entire injection profile.

We recorded zero on Worksheet 8-A to inhibit this function.

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 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.

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

Important: Be sure that you have not altered any setpoints, and that you have entered each and every setpoint exactly as on the worksheet.

2. Use the procedure described in chapter 4 to 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)

Use Worksheet 8-B to enter setpoints for a ram (screw) pressure vs. time pack/hold profile. The valve spanning procedures in chapter 9 require specific values. We have already entered many values for you, and help you determine other values in the text that follows.

Worksheet 8-B
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	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

12=Pack Cav/Press
13=Pack Ram/Press
14=Hold Cav/Press
15=Hold Ram/Press

Pre-decompression/Plastication
Logical Bridging
0=Start Plastication
1=Stop and set outputs

Hold/Pre-decompression
Logical Bridging
0=Start Movement
1=Stop and set outputs

Profile Algorithm
02=Hold 00=Pack
0=Ram Press vs Time
1=Cav Press vs Time

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	1	1	1	1	0	0	0	0	1	1	1	1

Enable/Disable ERC
1=Off 0=On

08=Pack Ram Press vs Time
09=Pack Cav Press vs Time
10=Hold Ram Press vs Time
11=Hold Cav Press vs Time

Open/Closed Loop
1=Open 0=Closed

00=Pack Ram Press vs Time
01=Pack Cav Press vs Time
02=Hold Ram Press vs Time
03=Hold Cav Press vs Time

Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

Worksheet 8-B (continued)
Pack/Hold Profile Command Block (HPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HPC09	N44:245	0	Pack Segment 1 Cavity Pressure Setpoint	Pressure [2]
HPC10	N44:246	*	Pack Segment 1 Ram (screw) Pressure Setpoint	Pressure [3]
HPC11	N44:247	100	Pack Segment 1 Time Setpoint	Time [1]
HPC12	N44:248	0	Pack Segment 2 Cavity Pressure Setpoint	Pressure [2]
HPC13	N44:249	*	Pack Segment 2 Ram (screw) Pressure Setpoint	Pressure [3]
HPC14	N44:250	100	Pack Segment 2 Time Setpoint	Time [1]
HPC15	N44:251	0	Pack Segment 3 Cavity Pressure Setpoint	Pressure [2]
HPC16	N44:252	*	Pack Segment 3 Ram (screw) Pressure Setpoint	Pressure [3]
HPC17	N44:253	100	Pack Segment 3 Time Setpoint	Time [1]
HPC18	N44:254	0	Pack Segment 4 Cavity Pressure Setpoint	Pressure [2]
HPC19	N44:255	*	Pack Segment 4 Ram (screw) Pressure Setpoint	Pressure [3]
HPC20	N44:256	100	Pack Segment 4 Time Setpoint	Time [1]
HPC21	N44:257	0	Pack Segment 5 Cavity Pressure Setpoint	Pressure [2]
HPC22	N44:258	*	Pack Segment 5 Ram (screw) Pressure Setpoint	Pressure [3]
HPC23	N44:259	100	Pack Segment 5 Time Setpoint	Time [1]
HPC24	N44:260	0	Pack Profile Cavity Pressure Offset	Pressure [2]
HPC25	N44:261	0	Pack Profile Ram (screw) Pressure Offset	Pressure [3]
HPC26	N44:262	0	Hold Segment 1 Cavity Pressure Setpoint	Pressure [2]
HPC27	N44:263	*	Hold Segment 1 Ram (screw) Pressure Setpoint	Pressure [3]
HPC28	N44:264	100	Hold Segment 1 Time Setpoint	Time [1]
HPC29	N44:265	0	Hold Segment 2 Cavity Pressure Setpoint	Pressure [2]
HPC30	N44:266	*	Hold Segment 2 Ram (screw) Pressure Setpoint	Pressure [3]
HPC31	N44:267	100	Hold Segment 2 Time Setpoint	Time [1]
HPC32	N44:268	0	Hold Segment 3 Cavity Pressure Setpoint	Pressure [2]
HPC33	N44:269	*	Hold Segment 3 Ram (screw) Pressure Setpoint	Pressure [3]
HPC34	N44:270	100	Hold Segment 3 Time Setpoint	Time [1]
HPC35	N44:271	0	Hold Segment 4 Cavity Pressure Setpoint	Pressure [2]
HPC36	N44:272	*	Hold Segment 4 Ram (screw) Pressure Setpoint	Pressure [3]
HPC37	N44:273	100	Hold Segment 4 Time Setpoint	Time [1]
HPC38	N44:274	0	Hold Segment 5 Cavity Pressure Setpoint	Pressure [2]
HPC39	N44:275	*	Hold Segment 5 Ram (screw) Pressure Setpoint	Pressure [3]
HPC40	N44:276	100	Hold Segment 5 Time Setpoint	Time [1]
HPC41	N44:277	0	Hold Profile Cavity Pressure Offset	Pressure [2]
HPC42	N44:278	0	Hold Profile Ram (screw) Pressure Offset	Pressure [3]
HPC61	N44:297	0	Cure Timer Preset	Time [4]

[1] Time
00.00 to 99.99 seconds

[2] Pressure
00000 to 20,000 PSI
000.0 to2000.0 Bar

[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-B

Pack/Hold Profile 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. These bits must be set to 00001100.

We recorded these bits on Worksheet 8-B.

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 hold ram (screw) pressure.

-BIT 14 selects the profile offset sign for hold cavity pressure.

-BIT 13 selects the profile offset sign for pack ram (screw) pressure.

-BIT 12 selects the profile offset sign for pack cavity pressure.

0 = positive offset (more pressure)
1 = negative offset (less pressure)

We recorded these bits = 0 for positive offset on Worksheet 8-B.

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 these bits = 1 on Worksheet 8-B to stop and set outputs.

Profile Algorithm
(HPC03)

The following bits of HPC03 determine whether the pack and/or hold profiles use the ram (screw) or cavity pressure algorithm.

-BIT 02 selects the algorithm for the hold profile.

-BIT 00 selects the algorithm for the pack profile.

0 = Ram (screw) pressure vs. time
1 = Cavity pressure vs. time

We recorded these bits = 0 for ram pressure vs. time on Worksheet 8-B.

Important: All other bit selections in HPC03 should be zero.

Expert Response Compensation
(HPC04)

-BITS 11, 10, 09, 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 these bits = 1 (ERC = Off) on worksheet 8-B

Open-or Closed-loop Control
(HPC04)

-BITS 03, 02, 01, and 00 determine open- or closed-loop control of pack and hold profiles. In open loop, you set a valve position to move the cylinder without sensor feedback . In closed loop you use sensor feedback to control the valve regulating pressure.
0 = Closed loop
1 = Open loop

We recorded these bits = 1 for open-loop control on worksheet 8-B.

Important: All other bit selections in HPC04 should be zero.

The valve spanning procedures in chapter 9 require these initial bit settings. Where required, we help you select the 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-B

Cavity Pressure Setpoints

(for pack profile: HPC09, 12, 15, 18, and 21)
(for hold profile: HPC26, 29, 32, 35, and 38)
Use these words when configuring cavity pressure vs. time pack or hold profiles. You enter pressure in PSI or Bar. Each setpoint controls the pressure of its corresponding segment.

We recorded zero for all pack and hold cavity pressure setpoints on Worksheet 8-B because you will use a ram (screw) pressure profile in chapter 9.

Ram (Screw) Pressure Setpoints

(for pack profile: HPC10, 13, 16, 19, and 22)
(for hold profile: HPC27, 30, 33, 36, and 39)
Use these words when configuring ram (screw) pressure vs. time pack or hold profiles. You enter pressure in PSI or Bar. Each setpoint controls the pressure of its corresponding segment. You may use from one to five segments in your profile. The procedures in chapter 9 require all five.

Record maximum injection pressure (a value less than maximum system pressure) on Worksheet 8-B for each of the 10 ram (screw) pressure 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).

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. You enter time 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-B 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: HPC24 and 25)
(for Hold profile: HPC41 and 42)

Profile offsets let you shift the amplitude of the entire pack or hold profile up or down, if necessary. You enter these setpoints in PSI or Bar.

-HPC24 and 41 determine the offset for cavity pressure profiles.

-HPC25 and 42 determine the offset for ram pressure profiles.

We recorded zeros for no pressure offsets on Worksheet 8-B.

Cure Timer Preset
(HPC61)

Use this word to set the length of cure time that starts at completion of the hold profile. You enter 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 false-to-true 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-B.

The valve spanning procedures in chapter 9 require these initial values. We help you select correct final values required by 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-B, you are ready to proceed.

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

Important: Be sure that you have not altered any setpoints, and that you have entered each and every setpoint exactly as on the worksheet.

2. Use the procedure described in chapter 4 to 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 Plastication Profile (PPC)

Use Worksheet 8-C to enter setpoints for a backpressure vs. position plastication profile. The valve spanning procedures in chapter 9 require specific values. We have already entered many values for you, and help you determine other values in the text that follows.

Worksheet 8-C
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

Bit 12 for RPM Profile
Bit 13 for Pressure Profile

Plastication/Post-decompression
Logical Bridging
0 = Start Post-decomp Movement
1 = Stop and set outputs

Profile Algorithm
00 = Ram (screw) Pressure/Position
01 = Ram (screw) Pressure/Time
10 = Screw RPM/Position
11 = Screw RPM/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	1	1	1	1	0	0	0	0	1	1	1	1

Enable/Disable ERC
0 = On 1 = Off

Bit 08 for Pressure/ Position
Bit 09 for Pressure/Time
Bit 10 for RPM/Position
Bit 11 for RPM/Time

Open/Closed Loop
0 = Closed 1 = Open

Bit 00 for Pressure/Position
Bit 01 for Pressure/Time
Bit 02 for RPM/Position
Bit 03 for RPM/Time

Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PPC09	N44:425	*	Segment 1 RPM Setpoint	RPM [5]
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	100	Segment 1 Time Setpoint	Time [1]
PPC13	N44:429	*	Segment 2 RPM Setpoint	RPM [5]
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	100	Segment 2 Time Setpoint	Time [1]
PPC17	N44:433	*	Segment 3 RPM Setpoint	RPM [5]
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	100	Segment 3 Time Setpoint	Time [1]
PPC21	N44:437	*	Segment 4 RPM Setpoint	RPM [5]
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	100	Segment 4 Time Setpoint	Time [1]
PPC25	N44:441	*	Segment 5 RPM Setpoint	RPM [5]
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	100	Segment 5 Time Setpoint	Time [1]
PPC29	N44:445	*	Segment 6 RPM Setpoint	RPM [5]
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	100	Segment 6 Time Setpoint	Time [1]
PPC33	N44:449	*	Segment 7 RPM Setpoint	RPM [5]
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	100	Segment 7 Time Setpoint	Time [1]
PPC37	N44:453	*	Segment 8 RPM Setpoint	RPM [5]
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	100	Segment 8 Time Setpoint	Time [1]
PPC41	N44:457	*	Segment 9 RPM Setpoint	RPM [5]
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	100	Segment 9 Time Setpoint	Time [1]
PPC45	N44:461	*	Segment 10 RPM Setpoint	RPM [5]
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	100	Segment 10 Time Setpoint	Time [1]
PPC49	N44:465	*	Segment 11 RPM Setpoint	RPM [5]
PPC50	N44:466	*	Segment 11 Pressure Setpoint	Pressure [3]
PPC51	N44:467	*	RPM Profile Offset	RPM [5]
PPC52	N44:468	*	Pressure Profile 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

[5] Screw Speed
000.0 to 999.9 RPM

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

Determine Bit Selections for Worksheet 8-C

Plastication Profile Block Identifier
(PPC01)

Bits 07-00 of this word identify it as the first word in a series used to define the plastication profile. These bits must be set to 00001111.

We recorded these bits on Worksheet 8-C.

Profile Offset Sign
(PPC03)

Profile offset lets 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 = positive offset (more pressure)
1 = negative offset (less pressure)

-BIT 12 controls the direction of RPM profile offset.
0 = positive offset (higher RPMs)
1 = negative offset (lower RPMs)

We recorded B13 = B12 = 0 for positive offset on Worksheet 8-C.

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 this bit = 1 to stop and set outputs on Worksheet 8-C.

Profile Algorithm
(PPC03)

The following bits determine the type of plastication profile.

-BITS 01 and 00 select the algorithm for the plastication profile.
00 = Ram (screw) backpressure vs. position
01 = Ram (screw) backpressure vs. time
10 = Screw RPM vs. position
11 = Screw RPM vs. time

We recorded B01 = B00 = 0 for backpressure vs. position on Worksheet 8-C.

Important: All other bit selections in PPC03 should be zero.

Expert Response Compensation (PPC04)

-BITS 11, 10, 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 these bits = 1 (ERC = Off) on worksheet 8-C.

Open- or Closed-Loop Control (PPC04)

-BITS 03, 02, 01, and 00 determine whether you use open-loop 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 or screw RPM.

0 = Closed loop
1 = Open loop

We recorded these bits = 1 for open-loop control on Worksheet 8-C.

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-C

RPM Setpoints (PPC09, 13, 17, 21, 25, 29, 33, 37, 41, 45, and 49)

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

Record the initial value of one-half maximum attainable screw RPM per your OEM specifications on Worksheet 8-C for each of the 11 RPM 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).

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. You enter pressure 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-C 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 either one of the following profiles:

- backpressure vs. position
- RPM vs. position

The procedures in chapter 9 require that you use all 10 position setpoints.

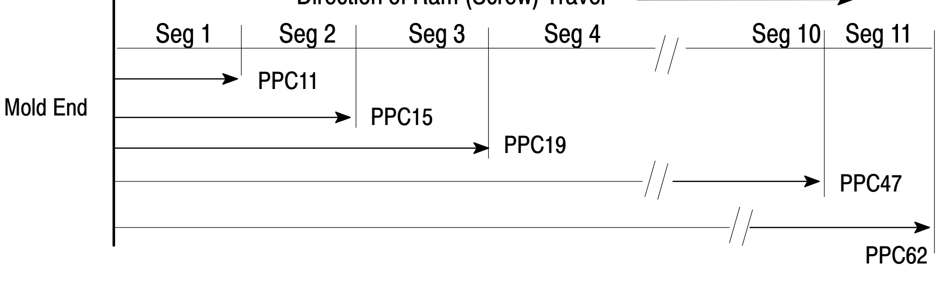
Determine end-of-segment position setpoints for your profile as follows:

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-C.

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 either one of the following profiles:

- backpressure vs time
- RPM vs time

Each setpoint controls the time (in seconds) of its corresponding segment.

Important: Use one less time setpoint than pressure or RPM setpoints.

We recorded one second (100) for these time setpoints on Worksheet 8-C.

Profile Offsets
(PPC51, 52)

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

-PPC51 determines the offset for RPM profiles in rotations per minute

-PPC52 determines the offset for backpressure profiles in PSI or Bar

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

Cushion Size
(PPC61)

This word determines the nominal 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-C.

Shot Size
(PPC62)

This word determines the nominal length of molten plastic that should be drawn during the plastication profile. The QDC uses this length when computing the end-of-plastication position (100% shot size). Units are inches or millimeters.

100% shot size = shot size + cushion
= PPC62 + PPC61

Record a typical shot size for your machine on Worksheet 8-C. Use this value to determine segment length in End-of-segment Positions, above.

The valve spanning procedures in chapter 9 require these initial values. Where required, we help you select correct final values required by 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.

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

Important: Be sure that you have not altered any setpoints, and that you have entered each and every setpoint exactly as on the worksheet.

2. Use the procedure described in chapter 4 to 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.

Chapter 9

Span Your Valves

Chapter Objectives

This chapter describes how to span your valves using direct-output operation, and verify by running simple open-loop profiles.

ATTENTION: Before proceeding, be sure you completed all previous chapters. Failure to do so could result in unpredictable machine motion, with possible equipment damage and/or injury.

We show you how to span these valves:

- injection pressure valve
- injection velocity valve
- pack/hold pressure valve
- plastication pressure valve
- plastication screw RPM valve

We also describe how to:

- test valve linearity
- set profile pressure alarms

Referenced Worksheets

The following table lists command blocks used in this chapter and corresponding worksheets from chapters 7 and 8 that contain initial values.

Block:	Worksheet
Injection Configuration Block (INC)	7-A
Injection Profile Block (IPC)	8-A
Pack Configuration Block (PKC)	7-B
Hold Configuration Block (HDC)	7-C
Pack/Hold Profile Block (HPC)	8-B
Plastication Configuration Block (PLC)	7-D
Plastication Profile Block (PPC)	8-C

Span Your Injection Pressure Valve

We recommend that you first span your injection pressure valve for optimum pressure performance. You do this in four parts:

- Confirm critical values
- Span your injection pressure valves
- Test valve linearity with a pressure vs. time injection profile
- Set profile pressure alarms

Important: You may omit the subsection *Span Your Injection Pressure Valve* below if you have information from molding machine OEMs or hydraulic valve manufacturers on spanning the working range of valves. If available for your machine's injection pressure valve(s), enter valve spanning values into pressure control limits INC41-44 and proceed to *Test Valve Linearity.* First confirm your critical values.

Confirm Critical Values

Important: Confirm that all values you recorded for configuration (chapter 7) and profiles (chapter 8) are as follows:

On Worksheet	Confirm Your Configuration	With These Words or Bits	Pro-Set Addr.
7-A (chapter 7)	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 Minimum Selected Pressure Valve, Output for Maximum	 INC41 = 0 INC42 = system pressure INC43 = your value INC44 = your value	 N44:37 N44:38 N44:39 N44:40
7-C	End-of-profile set-output values	HDC33-36 for zero output	N44:209-212
8-A (chapter 8)	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) is disabled	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
8-B	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 the highest desired injection pressure. Do this in the following procedure by finding the optimum values for these words:

- 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, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this entire 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 machine damage or injury to personnel.

ATTENTION: Be sure all machine guards and shields are in place before proceeding.

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 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 necessarily correspond to zero pressure. For example, a bi-directional valve would require a set-output value of 50% (5000) to obtain 0 PSI.

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 back 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 by downloading the INC and IPC blocks.

Important: If downloading from your programming terminal, you must download INC first, followed by IPC (chapter 4).

To download:	Set:
INC	B21/7
IPC	B21/8

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 (B35/404) from 0 to 1 to 0. The ram (screw) remains fixed so it can exert pressure against the nozzle tip. If you observe 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 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 direct-output ram (screw) action in the previous section? If not the same, correct and repeat steps 3 and 4.

5. If the observed 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 followed by IPC with bits B21/7, 8, and repeat steps 3 and 4 as necessary.

What You Have Accomplished

The open-loop tuning procedure you just completed has defined the:

- range of ram (screw) 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 Profile Pressure Alarms

For Ram (Screw) Pressure - After spanning your injection pressure valve, set the maximum ram (screw) pressure alarm setpoint INC57 (N44:53) for the injection profile. Set it equal to a pressure value that should not be exceeded during the injection profile. This value should not exceed the Maximum Pressure Control Limit, INC42 (N44:38). Entering a value of zero disables this alarm.

For Cavity Pressure - If using a cavity pressure sensor, set the maximum cavity pressure alarm setpoint INC58 (N44:54) for the injection profile. Set it to a cavity pressure that should not be exceeded during the injection profile. Entering a value of zero disables this alarm.

Download new values to the QDC module by downloading INC and IPC.

Important: If downloading from your programming terminal, you must download INC first, followed by IPC (chapter 4).

To download:	Set:
INC	B21/7
IPC	B21/8

Span Your Injection 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 subsection *Span Your Injection Flow Valve* below if you have information from molding machine OEMs or hydraulic valve manufacturers on spanning the working range of valves. If available for your machine's injection flow valve, enter valve spanning values into velocity control limits INC45-48 and proceed to *Test Valve Linearity.* First, confirm your critical values.

Confirm Critical Values

Confirm that your recorded 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-A (chapter 7)	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 Minimum Selected Velocity Valve, Output for Maximum	 INC45 = 0 INC46 = max velocity per valve specs INC47 = your value INC48 = your value	 N44:41 N44:42 N44:43 N44:44
7-C	End-of-profile set-output values	HDC33-36 for zero output	N44:209-212
8-A (chapter 8)	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) is disabled	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
8-B	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-A	Velocity vs. position algorithm	IPC03-B01 = B00 = 0	B38/96, 97
(chapter 8)	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 and IPC.

Important: If downloading from your programming terminal, you must download INC first, followed by IPC (chapter 4).

To download:	**Set:**
INC	B21/7
IPC	B21/8

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, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this entire 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 machine damage or injury to personnel.

ATTENTION: Be sure all machine guards and shields are in place before proceeding.

Start by testing for maximum velocity and finding optimum values for INC46 and INC48 .

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, you must download INC first, followed by IPC (chapter 4).

To download :	Set:
INC	B21/7
IPC	B21/8

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.

Next, determine INC47, Selected Velocity Valve, Output for Minimum.

1. 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)

2. Download the INC and IPC blocks to the QDC module.

Important: If downloading from your programming terminal, you must download INC first, followed by IPC (chapter 4).

To download	Set
INC	B21/7
IPC	B21/8

3. Run another 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 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 2-4 as needed.

5. After reaching the point where minimum velocities start to exceed setpoints in step 1, change the signal in INC47 just enough so actual velocities equal setpoints in step 1. To do this, enter a final INC47 and repeat steps 2-4 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, you must download INC first, followed by IPC (chapter 4).

To download	Set
INC	B21/7
IPC	B21/8

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 and repeat steps 2-4 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.

Span Your Pack and Hold 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 subsection *Span Your Pack and Hold Pressure Valve* below if you have information from molding machine OEMs or hydraulic valve manufacturers on spanning the working range of valves. If available for your machine's pack and hold pressure valve, enter valve spanning values into pressure control limits PKC41-44 for Pack and HDC41-44 for Hold, and proceed to *Test Valve Linearity.*

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 *Test Valve Linearity.*

Important: If your machine controls cavity pressure during pack and hold, follow the procedure for ram (screw) pressure and transfer the values to PKC45-48 and HDC45-48 for cavity pressure. First confirm critical values.

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-B (chapter 7)	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

On Worksheet	Confirm Your Configuration	With These Words or Bits for Hold Pressure	Pro-Set Addr
7-C (chapter 7)	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 Minimum Selected Pressure Valve, Output for Maximum	HDC41 = 0 HDC42 = system pressure HDC43 = your value HDC44 = your value	N44:217 N44:218 N44:219 N44:220
8-B (chapter 8)	Pressure vs Time algorithm for Pack and Hold	HPC03-B02 = B00 = 0 for ram (screw) pressure	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) is disabled	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, make sure you installed a test mold in the machine. Programming errors, configuration errors, or hydraulic problems could lead to machine damage or injury to personnel.

ATTENTION: Be sure all machine guards and shields are in place before proceeding.

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, 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 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 zero does not necessarily correspond to zero pressure. For example, a bi-directional valve would require a set-output value of 50% (5000) to obtain 0 PSI.

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 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 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 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 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 ram (screw) 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 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 (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 ram (screw) 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, HDC, and HPC blocks.

Important: If downloading from your programming terminal, you must first download PKC and HDC, followed by HPC (chapter 4).

To download	Set
PKC	B21/9
HDC	B21/10
HPC	B21/11

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 (B35/405) 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 of operation. Correct for a non-linear valve by adjusting the Selected Pressure Valve, Output for Minimum: PKC43 for pack or HDC43 for hold as follows:

If actuals are at least 20%:	And Your Selected Valve is:	Then change PKC43 or HDC43 (N44:159 or 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/or HDC43, download PKC and HDC followed by HPC with bits B21/9, 10, 11, and repeat steps 3 and 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	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

For Ram (Screw) Pressure – After spanning your pack and hold pressure valve, set profile maximum pressure alarm setpoints PKC57 (N44:173) for pack and HDC57 (N44:233) for hold equal to a ram (screw) pressure that should not be exceeded during either profile. Make sure these values are not greater than the Maximum Pressure Control Limits: PKC42 and HDC42. Entering a value of zero disables these alarms.

For Cavity Pressure – If using a cavity pressure sensor, set the maximum cavity pressure alarm setpoints PKC58 (N44:174) for pack and HDC58 (N44:234) for hold to a cavity pressure that should not be exceeded during these profiles. Entering zero disables these alarms.

Download new values to the QDC module by downloading PKC, HDC and HPC.

Important: If downloading from your programming terminal, you must download PKC and HDC, followed by HPC (chapter 4).

To download:	Set:
PKC	B21/9
HDC	B21/10
HPC	B21/11

Span Your Plastication 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 subsection *Span Your Plastication Pressure Valve* below if you have information from molding machine OEMs or hydraulic valve manufacturers on spanning the working range of valves. If available for your machine's plastication pressure valve(s), enter valve spanning values into pressure control limits PLC41-44 and proceed to *Test Valve Linearity.* First confirm your critical values.

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-D (chapter 7)	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 Minimum Selected Pressure Valve, Output for Maximum	PLC41 = 0 PLC42 = max attainable backpressure PLC43 = your value PLC44 = your value	N44:397 N44:398 N44:399 N44:400
8-C	Backpressure vs Position algorithm	PPC03-B01 = B00 = 0	B38/480-481
(chapter 8)	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) is disabled	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, make sure you installed a test mold in the machine. Programming errors, configuration errors, or hydraulic problems could lead to machine damage or injury to personnel.

ATTENTION: Be sure all machine guards and shields are in place before proceeding.

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, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read this entire 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:

$$\text{PLC44} = \frac{\text{Max desired backpressure} \times \text{Observed \%-signal output in SYS41-44 that corresponds to the ram plastication valve}}{\text{Observed Pressure in SYS26}}$$

Important: If your valve is reverse acting, apply the algebraic sign (–) of value b correctly when computing PLC44 in the equation above.

PLC44 = _______________ For example, 1000 for 10%

6. Enter new values into the PLC data table:
   - value from step 5 into PLC44 (N44:400)
   - max desired backpressure PPC10 from step 5 into PLC42 (N44:398)
7. Download the PLC and PPC blocks to the QDC module.

Important: If downloading from your programming terminal, you must download PLC first, followed by PPC (chapter 4).

To download	Set
PLC	B21/13
PPC	B21/14

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 and PPC blocks to the QDC module.

Important: If downloading from your programming terminal, you must download PLC first, followed by PPC (chapter 4).

To download	Set
PLC	B21/13
PPC	B21/14

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 Selected Pressure Valve, Output for Minimum 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 or PLC43 and repeat steps 2-4 as necessary.

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

After spanning your plastication pressure valve, set the maximum pressure alarm setpoint PLC57 (N44:413) equal to a ram (screw) backpressure that should not be exceeded during the plastication profile. Make sure this value is not greater than PLC42 (N44:398) Maximum Pressure Control Limit. Entering zero disables this alarm.

Download the PLC and PPC blocks to the QDC module.

Important: If downloading from your programming terminal, you must download PLC first, followed by PPC.

To download	Set
PLC	B21/13
PPC	B21/14

Span Your Plastication RPM Valve

We recommend that you span your plastication RPM valve for optimum plastication performance in three parts:

- Confirm critical values
- Span your plastication RPM control valve
- Test valve linearity with a plastication RPM vs. time profile

Important: You may omit the subsection *Span Your Plastication RPM Control Valve* below if you have information from molding machine OEMs or hydraulic valve manufacturers on spanning the working range of valves. If available for your machine's plastication RPM valve, enter valve spanning values into RPM control limits PLC45-48 and proceed to *Test Valve Linearity.* First confirm your critical values.

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-D (chapter 7)	QDC module output to which you connected your plastication RPM control valve	PLC02-B02, B01, B00	B38/402-400
	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
	RPM limits: Minimum RPM Control Limit Maximum RPM Control Limit Selected RPM Valve, Output for Min Selected RPM Valve, Output for Max	 PLC45 = 0 PLC46 = max attainable screw RPM PLC47 = your value PLC48 = your value	 N44:401 N44:402 N44:403 N44:404
8-C (chapter 8)	Logical bridge to stop and set outputs before post-decompression	PPC03-B08 = 1	B38/488
	Open-loop control	PPC04-B03 = B02 = 1	B38/499, 498
	Expert Response Compensation (ERC) = Off	PPC04-B11 = B10 = 1	B38/507, 506
	RPM setpoints	PPC09,13, 17, 21, 25, 29, 33, 37, 41, 45, 49 all equal to 1/2 max screw RPM	start @ N44:425 end @ N44:465
	Time setpoints	PPC12,16,20,24,28,32,36,40,44,48 all equal to one second (100)	start @ N44:428 end @ N44:464
	Shot size	PPC62 = typical for your machine	N44:478

Set New Values for the RPM vs. Time Profile

On Worksheet	Set this Configuration	With These Words or Bits	Pro-Set Addr
8-C	RPM vs Time algorithm	PPC03-B01 = B00 = 1	B38/480-481

Download the PPC block using the download procedure from 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.

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 RPM Valve

Span your plastication RPM valve for smooth operation at the highest desired RPM. Do this by finding the optimum values for these words:

- Minimum RPM Control Limit PLC45 (N44:401)
- Maximum RPM Control Limit PLC46 (N44:402)
- Selected RPM Valve, Output for Minimum PLC47 (N44:403)
- Selected RPM Valve, Output for Maximum PLC48 (N44:404)

Important: If PanelView is operational, 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 a point near the mold-end position.

2. Align all other machine hydraulics to simulate plastication: enable pumps and align valves to their normal plastication state.

3. Copy initial values PLC09-12 into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero RPM into the word DYC09-12 (N40:121-124) for output 1, 2, 3, or 4 that drives the selected screw RPM valve.

⚠ **ATTENTION:** A value of zero does not necessarily correspond to zero RPM. For example, a bi-directional valve would require a set-output of 50% (5000) to obtain zero RPM.

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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 in DYC09-12 (N40:121-124) that corresponds to the selected RPM valve, and observe the actual screw RPM reported in SYS27 (N40:179).

- **For a bi-directional valve with a spool offset:**
  If this RPM is greater than zero, adjust the set-output value to the screw RPM valve until the screw stops.
- **For a uni-directional valve with no response at low signal level:**
  If this screw RPM is zero, adjust the set-output value to the screw RPM valve until the screw begins rotating. Then re-adjust this value until the screw just stops.
- **For a uni-directional valve with a screw RPM greater than zero but with zero output to the valve:** This is lowest RPM.

6. Once satisfied that you obtained the lowest possible RPM or the highest possible signal at zero RPM, copy the RPM observed in SYS27 into PLC45 (N44:401), the Minimum RPM Control Limit.

7. While maintaining this minimum RPM, observe the actual set-output value in SYS41-44, (N40:193-196) that corresponds to your screw RPM valve. Copy this value into PLC47 (N44:403), the Selected RPM Valve, Output for Minimum.

8. Modify the value in DYC09-12 (N40:121-124) that corresponds to the screw RPM valve in 5% steps while observing rising RPM in SYS27 (N40:179). Stop adjusting it when the observed RPM no longer increases with a change in the set-output value. Now the RPM in SYS27 is the maximum obtainable RPM.

9. Copy the RPM observed in SYS27 (N40:179) into PLC46 (N44:402), the Maximum RPM Control Limit.

10. While maintaining this maximum RPM, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your screw RPM valve. Copy this value into PLC48 (N44:404), the Selected RPM Valve, Output for Maximum.

11. Disable set-output operation. Toggle DYC01-B08 (B34/392) to 0.

12. Download your final values for PLC45-48 to the QDC module by downloading the PLC and PPC blocks.

Important: If downloading from your programming terminal, download PLC followed by PPC with download bits B21/13 and 14 (chapter 4).

Test Valve Linearity with an RPM vs. Time Plastication Profile

1. Confirm that your RPM setpoints are equal to 1/2 the maximum attainable RPM in PPC09, 13, 17, 21, 25, 29, 33, 37, 41, 45, and 49 (in N44:425, 429, 433, 437, 441, 445, 449, 453, 457, 461, 465).

If not, correct them and download them to the QDC module.
For instructions, refer to chapter 4.

2. Manually jog your ram (screw) to a point near the mold-end position.

3. Run an RPM vs. time injection profile by toggling DYC02-B08 (B35/408) from 0 to 1 to 0. If you observe no screw rotation, verify that:

- no ram (screw) overtravel alarms are set. The QDC module inhibits plastication profiles if alarm bits SYS07-B00 through SYS07-B05 are set.
- no programming error codes exist in SYS61 and SYS62.

The QDC module automatically runs the plastication profile until the ram (screw) backs up to the 100% shot size position (PPC61 + 62).

4. At completion of the profile, observe the RPM actuals reported for the middle segments in PPS25, 29, and 33 (N44:729, 733, and 737). If the observed RPMs are not within 20% of the setpoints entered in PPC25, 29, and 33, then your RPM 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 PLC48 (N44:404) 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 PLC48, download PLC followed by PPC with bits B21/13 and 14, and repeat steps 3 and 4 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 screw RPM during plastication
- end-of-range maximum and minimum signal levels for linear control of the plastication RPM valve in open-loop control

For this range limit	When trying to obtain the RPM in:	The QDC module drives the selected RPM valve to % output signal in:
Minimum	PLC45	PLC47
Maximum	PLC46	PLC48

Now, for all open-loop plastication RPM profiles, the QDC module assumes a liner relationship between screw RPM and signal output.

Chapter

10

Tune Your Machine for Producing Parts

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.

In this chapter, we consider the following items not covered previously.

- closed-loop tuning
- part tuning parameters that require specific considerations

We present this chapter in two 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 your plastic molding process. If your application does not require closed-loop operation, skip this section and proceed to the section entitled Part Tuning Considerations.

- Tuning Considerations for Production Parts – We discuss the usage and effect of other QDC module parameters. We present this section in a discussion rather than a procedural format. The discussions 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 Control

So far, you ran open-loop profiles with the QDC module's PID and VelFF control algorithms disabled. We suggest that you use open-loop control for:

- spanning valves
- 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 injection profiles are essential for precise, repeatable operation. In chapter 7 you entered our recommended values. They may give you desired machine performance. If you need to improve performance, continue with this section.

Tune Closed-loop Pressure Control

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 (or Time)

Follow these general guidelines when tuning closed-loop pressure profiles:

- Disable ramping
- Disable Expert Response Compensation (ERC)
  Set IPC04-B11 = B10 = B09 = B08 = 1
  Set HPC04-B11 = B10 = B09 = B08 = 1
  Set PPC04-B09 = B08 = 1
  Set PPC04-B11 = B10 = B09 = B08 = 1
- Reset ERC values to zero. Set DYC05-B15 (B34/463) = 1.
  The QDC module resets this bit to zero after resetting ERC values.

Important: Tuning constants differ between pressure profiles. The dynamics of loads being moved and different hydraulic characteristics warrant separate PID tuning considerations for each profile.

- Use only proportional and integral control.

Important: In most cases, adding a derivative term to pressure control algorithms makes it too sensitive and does not enhance loop stability.

- Use the highest possible P and I gain constants for repeatable performance without hammering your hydraulics
- 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

Before you begin tuning PID pressure loops, confirm that you:

- selected the pressure vs. position (or time) algorithm
- selected closed-loop control
- zeroed the integral and derivative terms
- did not change the proportional term that you entered in chapter 7
- disabled ERC
- reset ERC values
- disabled ramping
- downloaded all setpoint changes to the QDC module

1. Enter an operational profile representative of the characteristics you desire for your production cycle.

2. 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 the download procedure in chapter 4.

3. 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.

4. 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
- zeroed the integral and derivative terms
- did not change the proportional term that you entered in chapter 7
- disabled ERC
- reset ERC values
- disabled ramping
- downloaded all setpoint changes to the QDC module

1. Connect the oscilloscope to your selected pressure control valve.

2. Enter the desired operational profile for a production cycle.

3. 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 and then flatten without bouncing.

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.

4. Re-run the profile after each change to the proportional term until oscilloscope traces quickly level off without bounce or chatter.

5. 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 oscilloscope traces quickly level without bouncing, verify your Unselected Valve Set-output Values are correct. Refer to this topic later in this chapter or in chapter 7.

Tune Closed-loop Velocity Control

General Guidelines for Velocity Tuning

If your machine will never run velocity profiles, skip this section.

In this section we present two procedures:

- Tune Velocity Loops without an Oscilloscope
- Tune Velocity Loops with an Oscilloscope

Use either one of these procedures for tuning closed-loop control of the injection velocity vs. position profile. Tuning constants are the same for velocity and pressure-limited velocity profiles.

Follow these general guidelines when tuning a closed-loop velocity profile:

- Disable ramping
- Disable Expert Response Compensation (ERC)
  Set IPC04-B11 = B10 = B09 = B08 = 1
- Reset ERC values to zero. Set DYC05-B15 (B34/463) = 1.
  The QDC module resets this bit to zero after resetting ERC values.

Important: Tuning constants differ between velocity profiles. The dynamics of loads being moved and different hydraulic characteristics warrant separate tuning considerations for each profile.

- Use proportional control with a zero feedforward term.
  (Add feedforward only if required.)

Important: In most cases, adding a feedforward term to the VelFF algorithm makes it too sensitive and does not enhance loop stability.

Important: Never use feedforward gain and ERC in the same velocity profile.

- Use the highest possible P gain constant for repeatable performance without hammering your hydraulics.
- 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 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 velocity feedforward term
- did not change the proportional term that you entered in chapter 7
- disabled ERC
- reset ERC values
- disabled ramping
- downloaded all setpoint changes to the QDC module

1. Enter the desired operational profile for a production cycle.

2. Run several profile cycles while comparing profile actuals returned in status block IPS with profile setpoints in command block IPC. Also observe hydraulic hoses leading to the injection 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 the download procedure in chapter 4.

3. 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 injection cylinder.

Important: If you cannot make velocity actuals match entered setpoints, verify that your Unselected Valve Set-output Values are correct. Refer to this topic later in this chapter or in chapter 7.

4. 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.

5. 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 loops, confirm that you:

- selected the velocity vs. position algorithm
- selected closed-loop control
- zeroed the feedforward term
- did not change the proportional term entered in chapter 7
- disabled ERC
- reset ERC values
- disabled ramping
- downloaded all setpoint changes to the QDC module

1. Connect the oscilloscope to your selected pressure control valve.

2. Enter the desired operational profile for a production cycle.

3. 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 and then flatten without bouncing.

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.

4. 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 without bounce, verify that your Unselected Valve Set-output Values are OK. (See same topic later in this chapter or in chapter 7).

5. If you are satisfied with the Unselected Valve Set-output Values and still cannot make the oscilloscope trace quickly level off without bouncing, your control may require a small feedforward gain.

6. If necessary, slowly increase the feedforward term while running machine cycles until the oscilloscope trace levels off without bounce.

Important: If you must use feedforward gain to adequately tune your velocity profile, do NOT enable ERC for this profile.

Tuning Considerations for Production Parts

In this section, we discuss the usage and effect of the following items:

- Profile Requirements
- Cushion, Shot Size, and Transition Setpoints
- Unselected Valve Set-output Values
- Logical Bridges and End-of-profile Set-output Values
- Decompression Pullback
- Acceleration and Deceleration Ramp Rates
- Watchdog Timer and Profile Offsets
- Pressure Alarm Setpoints
- Pressure-limited Velocity vs. Position Profile
- Expert Response Compensation

We assume you are familiar with conventions, terminology, and procedures used in the Injection Molding Industry and in this 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.

Velocity Setpoints

Use velocity setpoints only 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 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

RPM Setpoints

Use RPM setpoints only for the plastication RPM vs. position (or time) profile to control screw rotational speed and the temperature gradient of the melt. The resulting shear rate produces a barrel re-fill suited to the requirements of the next injection phase.

Important: Plastication RPM profiles require one additional RPM setpoint beyond the last non-zero end-of-position setpoint (or last non-zero segment time setpoint), so you must program one more RPM setpoint than position (or time) setpoint, such that

total RPM setpoints = total position (or time) setpoints + 1

If not, screw rotation will stop 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, pressure, or RPM setpoint for controlling the ram (screw).

Important: Avoid multiple adjacent segments having the same velocity, pressure, or RPM setpoint. For better control, use a constant velocity, pressure, or screw RPM over a single equivalent length (or time) segment.

For injection and plastication profiles, you must always program one final velocity, pressure, or RPM 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 and plastication profiles, you must always program one final pressure or RPM 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	RPM Setpoints	Other
Injection Velocity vs. Position	None required	N/A	IPC09	N/A	N/A	one of IPC60, 61, 62, or 63
Pressure-limited Vel/Pos	None required	N/A	IPC09	N/A	N/A	one of IPC60, 61, 62, or 63. IPC57, 58, and 59
Pressure vs. Position	None required	N/A	N/A	IPC10	N/A	one of IPC60, 61, 62, or 63
Pressure vs. Time	N/A	None required	N/A	IPC10	N/A	one of IPC60, 61, 62, or 63
Pack Pressure vs. Time	N/A	HPC11	N/A	HPC09 or HPC10	N/A	––––
Hold Pressure vs. Time	N/A	HPC28	N/A	HPC26 or HPC27	N/A	––––
Plastication Pressure vs. Position	None required	N/A	N/A	PPC10	N/A	PPC61 and 62
Pressure vs. Time	N/A	None required	N/A	PPC10	N/A	PPC61 and 62
RPM vs. Position	None required	N/A	N/A	N/A	PPC09	PPC61 and 62
RPM vs. Time	N/A	None required	N/A	N/A	PPC09	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 four injection transition conditions occurs. These four conditions during the injection profile are:

- elapsed time exceeds a preset limit
- ram (screw) pressure exceeds a preset limit
- cavity pressure exceeds a preset limit
- ram (screw) position becomes less than 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.

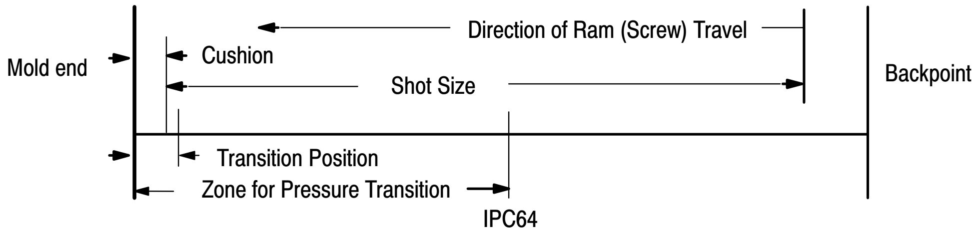
Ram (Screw) Pressure for Transition (IPC62)

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 zone (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



Cavity Pressure for Transition (IPC63)

If using a cavity pressure sensor, the QDC module monitors this pressure setpoint (along with the others you programmed) to determine transition from injection to pack. Choose a setpoint under the mold flash point. The Minimum Position for Pressure Transition IPC64 also applies to this pressure transition setpoint.

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 tuning 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 tuning 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 this:

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.
RPM	Backup rate substantially faster than desired	Increase profile backpressure by modifying the set-output value driving the backpressure valve.
RPM	Backup rate substantially slower than desired	Decrease profile backpressure by modifying the set-output value driving the backpressure valve.

Logical Bridges and End-of-profile Set-output Values

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 as 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 have uses including:

- adjusting flow through a variable pump between profiles
- initializing values 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 in set until the QDC module is commanded to start another movement or profile, or until the stop command is asserted

Decompression Pullback

Lengths for 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.

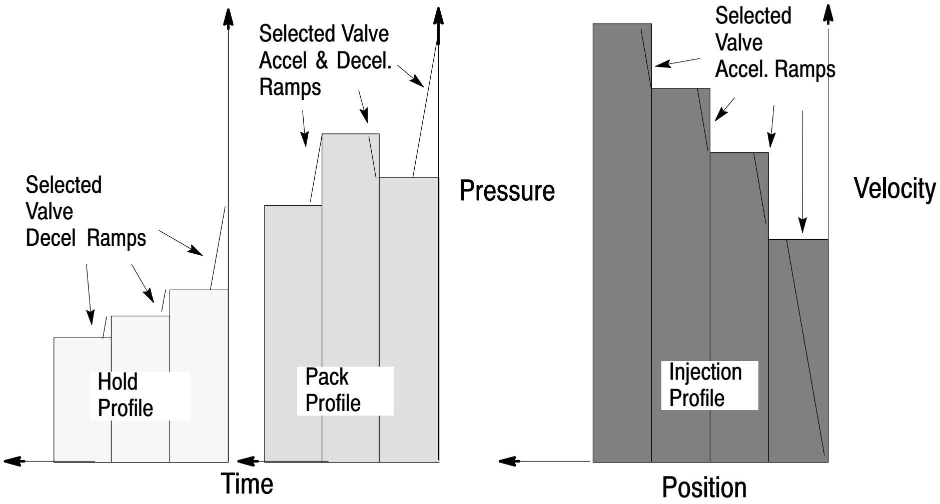
Acceleration and Deceleration Ramp Rates

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 (not prior to) execution of any profile.

⚠ **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 Accl/Decel Ramps



Important: When enabled, the QDC module applies ramp rates at the beginning of each profile segment. When moving from one profile to the next, the QDC module never applies ramps until it begins the next profile.

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.

Watchdog Timer and Profile Offsets

Profile Watchdog Timer Preset (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, HPC24, 25, 41 and 42, PPC52)
(for screw RPM – PPC51)

The offset shifts the amplitude of all pressure, velocity, or RPM 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 pressures and compare them against two different types of high pressure alarm setpoints. Pressures are compared to absolute pressure alarm setpoints (configured in the MCC - refer to chapter 3) on a continuous basis and without regard to current machine mode or operational cycle. Pressures are 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 absolute pressure alarms to detect dangerously high pressure conditions. We recommend these alarm setpoints be set 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 one of these alarms 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 Injection Velocity vs. Position

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 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 outputs 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

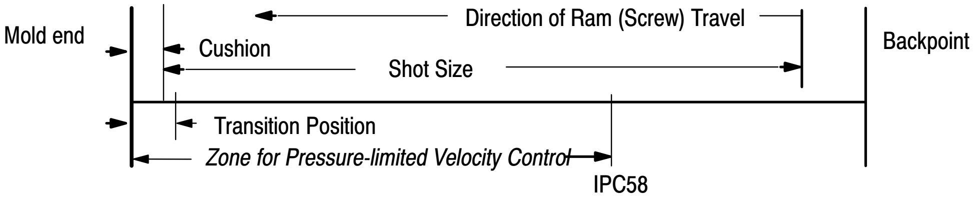
You control the maximum pressure of the pressure-limited velocity vs. position profile with this setpoint:

- **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 set:

- **IPC58** – Start 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 10.4). 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 slow (low value) acceleration or deceleration ramp rates
- until you have properly tuned the control loop

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, use minimum percentage values recommended in chapter 7, except for the following:

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 %
The actual velocity or pressure takes several cycles to achieve the desired setpoint	Increase the ERC minimum %

Chapter 11

Troubleshoot with LEDs

Chapter Objectives

This chapter helpes you 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 for troubleshooting 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

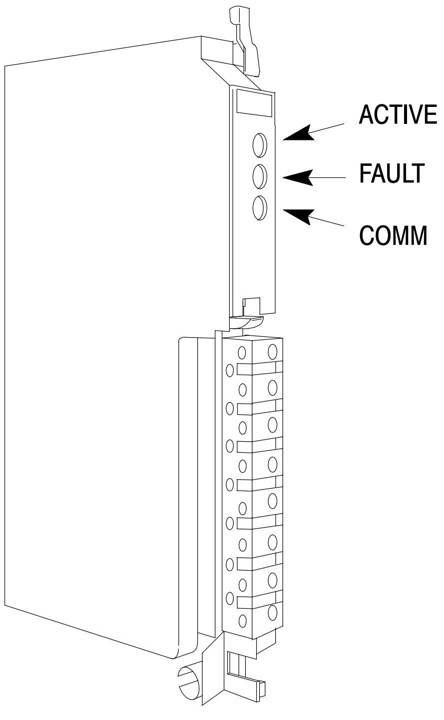


Table 11.A shows how to interpret QDC module LEDs. The QDC module monitors its own operation and reports detected conditions by illuminating its LEDs in the following combinations:

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 3 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 3 to download corrected data to the QDC module. **3.** Verify block IDs in your BTW data files.
Flashing	Flashing	Flashing	You put the Run/Calibrate jumper (E1) in the Calibrate position.	Put the E1 jumper in the Run position (chapter 2).
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 4 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 4 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.

Module Calibration

We recommend that you re-calibrate your QDC module every two years. To calibrate it yourself, refer to the Reference Manual, 1771-6.5.88 (dated November 1992), for calibration instructions. Otherwise, return it to the factory with this order number: 1771-QDC/(Rev Letter) – CAL.

Appendix A

Blank Worksheets

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	0	0	1	0	0	

System Operation:
Inject Mode 0 0

Select Units
0 = English
1 = metric

Code:

☐ Your value

0 or 1 Required initial value loaded by Pro-Set 600

Example: If you select Inject operation with English units:
MCC02 = 00000000 00001000

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 (Cavity Pressure) Range
Select Input 3 (Screw RPM) Range
Select Input 2 (Screw Pressure) Range
Select Input 1 (Screw Position) Range

Code:

☐ Your value

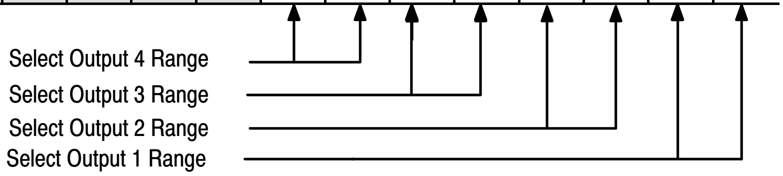
0 or 1 Required initial value loaded by Pro-Set 600

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

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

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 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								



Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

Output Range		
−10 to +10 vdc	0	0
0 to +10 vdc	0	1
4 to 20 mA	1	0
Not connected	1	1

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

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

Worksheet 3-D
Determine Initial Sensor-configuration Values

Enter Your Initial Values Here

Input	Line	Control Word	Pro-Set 600 Address	Value	Description	Units
1	1	MCC09	N40:5	0	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	0	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	MCC51	N40:47	0	Minimum Screw RPM	Rotational Speed [4]
	10	MCC52	N40:48		Maximum Screw RPM	Rotational Speed [4]
	11	MCC53	N40:49		Analog Signal @ Min Screw RPM	Input Signal Range [2]
	12	MCC54	N40.50		Analog Signal @ Max Screw RPM	Input Signal Range [2]
4	13	MCC57	N40:53	0	Minimum Cavity Pressure	Cavity Pressure [5]
	14	MCC58	N40:54		Maximum Cavity Pressure	Cavity Pressure [5]
	15	MCC59	N40:55		Analog Signal @ Min Cavity Pressure	Input Signal Range [2]
	16	MCC60	N40:56		Analog Signal @ Max Cavity 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

[4] Rotational Speed
000.0 to 999.9 RPM

[5] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

Worksheet 3-E
Final Sensor-configuration Values

Enter Your Final Values Here

Input	Line	Control Word	Pro-Set 600 Address	Value	Description	Units
1	1	MCC09	N40:5	0	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	0	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	MCC51	N40:47	0	Minimum Screw RPM	Rotational Speed [4]
	10	MCC52	N40:48		Maximum Screw RPM	Rotational Speed [4]
	11	MCC53	N40:49		Analog Signal @ Min Screw RPM	Input Signal Range [2]
	12	MCC54	N40.50		Analog Signal @ Max Screw RPM	Input Signal Range [2]
4	13	MCC57	N40:53	0	Minimum Cavity Pressure	Cavity Pressure [5]
	14	MCC58	N40:54		Maximum Cavity Pressure	Cavity Pressure [5]
	15	MCC59	N40:55		Analog Signal @ Min Cavity Pressure	Input Signal Range [2]
	16	MCC60	N40:56		Analog Signal @ Max Cavity 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

[4] Rotational Speed
000.0 to 999.9 RPM

[5] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

Worksheet 3-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	10	Screw SWTL Deadband	As noted [1]

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

Worksheet 3-G
Alarm and Time-delay Setpoints

Enter Your 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]
MCC55	N40:51		High-RPM Alarm Setpoint	Rotational Speed [3]
MCC56	N40:52		Screw RPM Time-delay Setpoint	Time Measured in Seconds [1]
MCC61	N40:57		Cavity Pressure-alarm Setpoint	Cavity Pressure [4]
MCC62	N40:58		Cavity-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

[3] Rotational Speed
000.0 to 999.9 RPM

[4] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

Worksheet 5-A
Ram (screw) 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]
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]
Jog RPM and Pressure Alarms				
JGC05	N40:61		Screw-rotate Jog RPM, Alarm Setpoint	Rotational Speed [3]
JGC06	N40:62		Screw Jog Pressure, Alarm Setpoint	Ram (screw) Pressure [2]

[1] % Signal Output
00.00 to 99.99 %

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

[3] Rotational Speed
000.0 to 999.9 RPM

Worksheet 5-B
Clamp & Eject Jog Configuration Values for QDC Module in Inject Mode

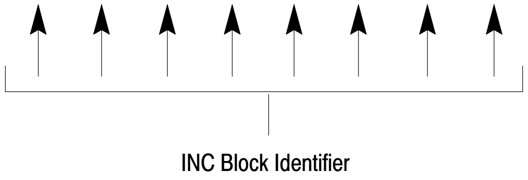
Enter Your Initial Values Here

Control Block Word	Pro-Set 600 Addr.	Value	Description	Units
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]
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]

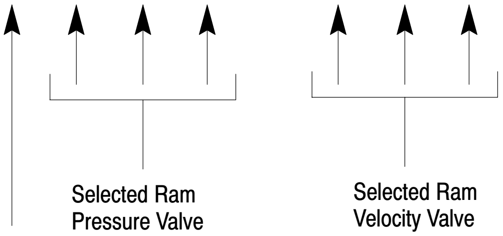
[1] % Signal Output
00.00 to 99.99 %

Worksheet 7-A
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



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

Ram PID Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Selected Ram Pressure Valve

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

Selected Ram Velocity Valve

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

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

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
INC05	N44:1	1000	Minimum ERC Percentage--Velocity	Percent [8]
INC06	N44:2	1000	Minimum ERC Percentage--Pressure	Percent [8]
INC09	N44:5	*	Output #1 Set-output Value During Profile	Percent Signal Output [4]
INC10	N44:6	*	Output #2 Set-output Value During Profile	Percent Signal Output [4]
INC11	N44:7	*	Output #3 Set-output Value During Profile	Percent Signal Output [4]
INC12	N44:8	*	Output #4 Set-output Value During Profile	Percent Signal Output [4]
INC17	N44:13	0	Output #1 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC18	N44:14	0	Output #2 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC19	N44:15	0	Output #3 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC20	N44:16	0	Output #4 Acceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC25	N44:21	0	Output #1 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC26	N44:22	0	Output #2 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC27	N44:23	0	Output #3 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC28	N44:24	0	Output #4 Deceleration Ramp Rate During Profile	Percent Signal Output per Second [5]
INC41	N44:37	0	Pressure Minimum Control Limit	Pressure [3]
INC42	N44:38	*	Pressure Maximum Control Limit	Pressure [3]
INC43	N44:39	*	Selected Pressure Valve, Output for Minimum	Percent Signal Output [4]
INC44	N44:40	*	Selected Pressure Valve, Output for Maximum	Percent Signal Output [4]
INC45	N44:41	0	Velocity Minimum Control Limit	Velocity along Axis [2]
INC46	N44:42	*	Velocity Maximum Control Limit	Velocity along Axis [2]
INC47	N44:43	*	Selected Velocity Valve, Output for Minimum	Percent Signal Output [4]
INC48	N44:44	*	Selected Velocity Valve, Output for Maximum	Percent Signal Output [4]
INC49	N44:45	100	Proportional Gain for Pressure Control	None
INC50	N44:46	400	Integral Gain for Pressure Control	Inverse Time (Algorithm) [6]
INC51	N44:47	0	Derivative Gain for Pressure Control	Time (Algorithm) [7]
INC52	N44:48	200	Proportional Gain for Velocity Control	Inverse Time (Algorithm) [6]
INC53	N44:49	0	Feed Forward Gain for Velocity Control	None
INC57	N44:53	0	Profile High Ram (screw) Pressure Alarm Setpoint	Pressure [3]
INC58	N44:54	0	Profile High Cavity Pressure Alarm Setpoint	Pressure [1]

[1] Pressure
00000 to 20000 PSI
0000.0 to 2000.0 Bar

[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-B
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				1			

Selected Ram
Pressure Valve

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

Selected Cavity
Pressure Valve

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

Ram PID
Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Cavity PID
Pressure Algorithm

0 = Dependent Gains
1 = Independent Gains

Code:

☐ Your value

▨ 0 or 1 Required initial value loaded by Pro-Set 600

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

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PKC05	N44:121	1000	Minimum ERC Percentage--Cavity Pressure	Percent [8]
PKC06	N44:122	1000	Minimum ERC Percentage--Ram (Screw) 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 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC18	N44:134	0	Output #2 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC19	N44:135	0	Output #3 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC20	N44:136	0	Output #4 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC25	N44:141	0	Output #1 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC26	N44:142	0	Output #2 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC27	N44:143	0	Output #3 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC28	N44:144	0	Output #4 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
PKC41	N44:157	0	Ram (screw) Pressure Minimum Control Limit	Pressure [3]
PKC42	N44:158	*	Ram (screw) Pressure Maximum Control Limit	Pressure [3]
PKC43	N44:159	*	Selected Ram (screw) Pressure Valve, Output for Minimum	Percent Signal Output [4]
PKC44	N44:160	*	Selected Ram (screw) Pressure Valve, Output for Maximum	Percent Signal Output [4]
PKC45	N44:161	0	Cavity Pressure Minimum Control Limit	Pressure [1]
PKC46	N44:162	*	Cavity Pressure Maximum Control Limit	Pressure [1]
PKC47	N44:163	*	Selected Cavity Pressure Valve, Output for Minimum	Percent Signal Output [4]
PKC48	N44:164	*	Selected Cavity Pressure Valve, Output for Maximum	Percent Signal Output [4]
PKC49	N44:165	100	Proportional Gain for Ram (screw) Pressure Control	None
PKC50	N44:166	400	Integral Gain for Ram (screw) Pressure Control	Inverse Time (Algorithm) [6]
PKC51	N44:167	0	Derivative Gain for Ram (screw) Pressure Control	Time (Algorithm) [7]
PKC52	N44:168	100	Proportional Gain for Cavity Pressure Control	None
PKC53	N44:169	400	Integral Gain for Cavity Pressure Control	Inverse Time (Algorithm) [6]
PKC54	N44:170	0	Derivative Gain for Cavity Pressure Control	Time (Algorithm) [7]
PKC57	N44:173	0	Profile High Ram (screw) Pressure Alarm Setpoint	Pressure [3]
PKC58	N44:174	0	Profile High Cavity Pressure Alarm Setpoint	Pressure [1]

[1] Pressure
00000 to 20000 PSI
0000.0 to 2000.0 Bar

[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)

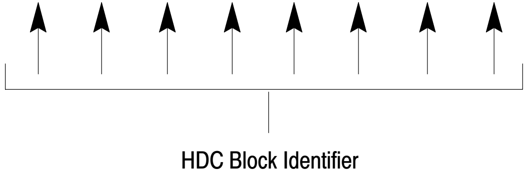
[7] Time (Algorithm)
00.00 to 99.99 minutes (ISA)
00.00 to 99.99 seconds (A-B)

[8] Percent
00.00 to 99.99

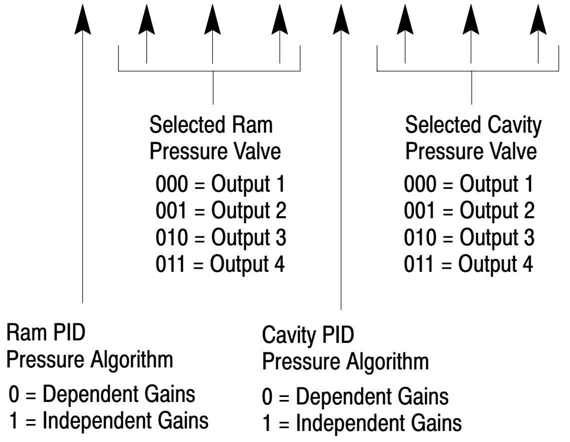
* Refer to the appropriate section later in this chapter for information on this parameter

Worksheet 7-C
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



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				1			



Code:

☐ Your value

▨ 0 or 1 Required initial value loaded by Pro-Set 600

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

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HDC05	N44:181	1000	Minimum ERC Percentage--Cavity Pressure	Percent [8]
HDC06	N44:182	1000	Minimum ERC Percentage--Ram (Screw) 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 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC18	N44:194	0	Output #2 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC19	N44:195	0	Output #3 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC20	N44:196	0	Output #4 Accel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC25	N44:201	0	Output #1 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC26	N44:202	0	Output #2 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC27	N44:203	0	Output #3 Decel Ramp Rate During Profile	Percent Signal Output per Second [5]
HDC28	N44:204	0	Output #4 Decel 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	Ram (screw) Pressure Minimum Control Limit	Pressure [3]
HDC42	N44:218	*	Ram (screw) Pressure Maximum Control Limit	Pressure [3]
HDC43	N44:219	*	Selected Ram (screw) Pressure Valve, Output for Minimum	Percent Signal Output [4]
HDC44	N44:220	*	Selected Ram (screw) Pressure Valve, Output for Maximum	Percent Signal Output [4]
HDC45	N44:221	0	Cavity Pressure Minimum Control Limit	Pressure [1]
HDC46	N44:222	*	Cavity Pressure Maximum Control Limit	Pressure [1]
HDC47	N44:223	*	Selected Cavity Pressure Valve, Output for Minimum	Percent Signal Output [4]
HDC48	N44:224	*	Selected Cavity Pressure Valve, Output for Maximum	Percent Signal Output [4]
HDC49	N44:225	100	Proportional Gain for Ram (screw) Pressure Control	None
HDC50	N44:226	400	Integral Gain for Ram (screw) Pressure Control	Inverse Time (algorithm) [6]
HDC51	N44:227	0	Derivative Gain for Ram (screw) Pressure Control	Time (algorithm) [7]
HDC52	N44:228	100	Proportional Gain for Cavity Pressure Control	None
HDC53	N44:229	400	Integral Gain for Cavity Pressure Control	Inverse Time (algorithm) [6]
HDC54	N44:230	0	Derivative Gain for Cavity Pressure Control	Time (algorithm) [7]
HDC57	N44:233	0	Profile High Ram (screw) Pressure Alarm Setpoint	Pressure [3]
HDC58	N44:234	0	Profile High Cavity Pressure Alarm Setpoint	Pressure [1]

[1] Pressure
00000 to 20000 PSI
0000.0 to 2000.0 Bar

[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
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				1			

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

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

PID Pressure Algorithm
0 = Dependent Gains
1 = Independent Gains

PID RPM Algorithm
0 = Dependent Gains
1 = Independent Gains

Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

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

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PLC05	N44:361	1000	Minimum RPM Control ERC Percentage	Percent [8]
PLC06	N44:362	1000	Minimum Pressure Control ERC Percentage	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]
PLC45	N44:401	0	RPM Minimum Control Limit	RPM [2]
PLC46	N44:402	*	RPM Maximum Control Limit	RPM [2]
PLC47	N44:403	*	Selected RPM Valve, Output for Minimum	Percent Signal Output [4]
PLC48	N44:404	*	Selected RPM 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]
PLC52	N44:405	100	Proportional Gain for RPM Control	None
PLC53	N44:406	400	Integral Gain for RPM Control	Inverse Time (Algorithm) [6]
PLC54	N44:407	0	Derivative Gain for RPM Control	Time (Algorithm) [7]
PLC57	N44:413	0	Profile High Pressure Alarm Setpoint	Pressure [3]

[1] Time
00.00 to 99.99 seconds

[2] Screw Speed
000.0 to 999.9 RPM

[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
Pre-decompression Configuration Block (PRC)

Control Word PRC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/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	0	1	1	0	1

PRC Block Identifier

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PRC05	N44:301		Incremental Movement Length	Incremental Distance [2]
PRC08	N44:304		Movement Watchdog Timer Preset	Time [1]
PRC09	N44:305		Output #1 Set-output Value during Movement	Percent Signal Ouput [4]
PRC10	N44:306		Output #2 Set-output Value during Movement	Percent Signal Ouput [4]
PRC11	N44:307		Output #3 Set-output Value during Movement	Percent Signal Ouput [4]
PRC12	N44:308		Output #4 Set-output Value during Movement	Percent Signal Ouput [4]
PRC17	N44:313		Output #1 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC18	N44:314		Output #2 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC19	N44:315		Output #3 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC20	N44:316		Output #4 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC25	N44:321		Output #1 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC26	N44:322		Output #2 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC27	N44:323		Output #3 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC28	N44:324		Output #4 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PRC33	N44:329		Output #1 Set-output Value at end of Movement	Percent Signal Ouput [4]
PRC34	N44:330		Output #2 Set-output Value at end of Movement	Percent Signal Ouput [4]
PRC35	N44:331		Output #3 Set-output Value at end of Movement	Percent Signal Ouput [4]
PRC36	N44:332		Output #4 Set-output Value at end of Movement	Percent Signal Ouput [4]
PRC57	N44:353		Movement High Pressure Alarm Setpoint	Pressure [3]

[1] Time
00.00 to 99.99 Seconds

[2] Measured as Noted
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%

[5] Percent Signal Output per Second
00.00 to 99.99

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

Worksheet 7-F
Post-decompression Configuration Block (PSC)

Control Word PSC01-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Pro-Set 600 Addr. B38/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	0	0	0

PSC Block Identifier

Enter Your Values Here

Control Word	**Pro-Set 600 Addr.**	**Value**	**Description**	**Units**
PSC05	N44:481		Incremental Movement Length	Incremental Distance [2]
PSC08	N44:484		Movement Watchdog Timer Preset	Time [1]
PSC09	N44:485		Output #1 Set-output Value during Movement	Percent Signal Output [4]
PSC10	N44:486		Output #2 Set-output Value during Movement	Percent Signal Output [4]
PSC11	N44:487		Output #3 Set-output Value during Movement	Percent Signal Output [4]
PSC12	N44:488		Output #4 Set-output Value during Movement	Percent Signal Output [4]
PSC17	N44:493		Output #1 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC18	N44:494		Output #2 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC19	N44:495		Output #3 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC20	N44:496		Output #4 Accel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC25	N44:501		Output #1 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC26	N44:502		Output #2 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC27	N44:503		Output #3 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC28	N44:504		Output #4 Decel Ramp Rate during Movement	Percent Signal Output per Second [5]
PSC33	N44:509		Output #1 Set-output Value at End-of Movement	Percent Signal Output [4]
PSC34	N44:510		Output #2 Set-output Value at End-of Movement	Percent Signal Output [4]
PSC35	N44:511		Output #3 Set-output Value at End-of Movement	Percent Signal Output [4]
PSC36	N44:512		Output #4 Set-output Value at End-of Movement	Percent Signal Output [4]
PSC57	N44:533		Movement High Pressure Alarm Setpoint	Pressure [3]

[1] Time
00.00 to 99.99 seconds

[2] Velocity along Axis
00.00 to 99.99 inches per sec
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 (ISA)
00.00 to 99.99 seconds (A-B)

[7] Time (Algorithm)
00. to 99.99

[8] Percent
00.00 to 99.99

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

Worksheet 8-A
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 = 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

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]
IPC63	N44:119	0	Cavity Pressure for Transition	Pressure [5]
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

[5] Pressure
00000 to 20,000 PSI
0000.0 to 2000.0 Bar

[6] Time
00.00 to 00.99 seconds

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

Worksheet 8-B
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

12=Pack Cav/Press
13=Pack Ram/Press
14=Hold Cav/Press
15=Hold Ram/Press

Pre-decompression/Plastication
Logical Bridging
0=Start Plastication
1=Stop and set outputs

Hold/Pre-decompression
Logical Bridging
0=Start Movement
1=Stop and set outputs

Profile Algorithm
02=Hold 00=Pack
0=Ram Press vs Time
1=Cav Press vs Time

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	1	1	1	1	0	0	0	0	1	1	1	1

Enable/Disable ERC
1=Off 0=On

08=Pack Ram Press vs Time
09=Pack Cav Press vs Time
10=Hold Ram Press vs Time
11=Hold Cav Press vs Time

Open/Closed Loop
1=Open 0=Closed

00=Pack Ram Press vs Time
01=Pack Cav Press vs Time
02=Hold Ram Press vs Time
03=Hold Cav Press vs Time

Code:

☐ Your value

▨ 0 or 1 Required initial value loaded by Pro-Set 600

Worksheet 8-B (continued)
Pack/Hold Profile Block (HPC)

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
HPC09	N44:245	0	Pack Segment 1 Cavity Pressure Setpoint	Pressure [2]
HPC10	N44:246	*	Pack Segment 1 Ram (screw) Pressure Setpoint	Pressure [3]
HPC11	N44:247	100	Pack Segment 1 Time Setpoint	Time [1]
HPC12	N44:248	0	Pack Segment 2 Cavity Pressure Setpoint	Pressure [2]
HPC13	N44:249	*	Pack Segment 2 Ram (screw) Pressure Setpoint	Pressure [3]
HPC14	N44:250	100	Pack Segment 2 Time Setpoint	Time [1]
HPC15	N44:251	0	Pack Segment 3 Cavity Pressure Setpoint	Pressure [2]
HPC16	N44:252	*	Pack Segment 3 Ram (screw) Pressure Setpoint	Pressure [3]
HPC17	N44:253	100	Pack Segment 3 Time Setpoint	Time [1]
HPC18	N44:254	0	Pack Segment 4 Cavity Pressure Setpoint	Pressure [2]
HPC19	N44:255	*	Pack Segment 4 Ram (screw) Pressure Setpoint	Pressure [3]
HPC20	N44:256	100	Pack Segment 4 Time Setpoint	Time [1]
HPC21	N44:257	0	Pack Segment 5 Cavity Pressure Setpoint	Pressure [2]
HPC22	N44:258	*	Pack Segment 5 Ram (screw) Pressure Setpoint	Pressure [3]
HPC23	N44:259	100	Pack Segment 5 Time Setpoint	Time [1]
HPC24	N44:260	0	Pack Profile Cavity Pressure Offset	Pressure [2]
HPC25	N44:261	0	Pack Profile Ram (screw) Pressure Offset	Pressure [3]
HPC26	N44:262	0	Hold Segment 1 Cavity Pressure Setpoint	Pressure [2]
HPC27	N44:263	*	Hold Segment 1 Ram (screw) Pressure Setpoint	Pressure [3]
HPC28	N44:264	100	Hold Segment 1 Time Setpoint	Time [1]
HPC29	N44:265	0	Hold Segment 2 Cavity Pressure Setpoint	Pressure [2]
HPC30	N44:266	*	Hold Segment 2 Ram (screw) Pressure Setpoint	Pressure [3]
HPC31	N44:267	100	Hold Segment 2 Time Setpoint	Time [1]
HPC32	N44:268	0	Hold Segment 3 Cavity Pressure Setpoint	Pressure [2]
HPC33	N44:269	*	Hold Segment 3 Ram (screw) Pressure Setpoint	Pressure [3]
HPC34	N44:270	100	Hold Segment 3 Time Setpoint	Time [1]
HPC35	N44:271	0	Hold Segment 4 Cavity Pressure Setpoint	Pressure [2]
HPC36	N44:272	*	Hold Segment 4 Ram (screw) Pressure Setpoint	Pressure [3]
HPC37	N44:273	100	Hold Segment 4 Time Setpoint	Time [1]
HPC38	N44:274	0	Hold Segment 5 Cavity Pressure Setpoint	Pressure [2]
HPC39	N44:275	*	Hold Segment 5 Ram (screw) Pressure Setpoint	Pressure [3]
HPC40	N44:276	100	Hold Segment 5 Time Setpoint	Time [1]
HPC41	N44:277	0	Hold Profile Cavity Pressure Offset	Pressure [2]
HPC42	N44:278	0	Hold Profile Ram (screw) Pressure Offset	Pressure [3]
HPC61	N44:297	0	Cure Timer Preset	Time [4]

[1] Time
00.00 to 99.99 seconds

[2] Pressure
00000 to 20,000 PSI
000.0 to2000.0 Bar

[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-C
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

Bit 12 for RPM Profile
Bit 13 for Pressure Profile

Plastication/Post-decompression
Logical Bridging
0 = Start Post-decomp Movement
1 = Stop and set outputs

Profile Algorithm
00 = Ram (screw) Pressure/Position
01 = Ram (screw) Pressure/Time
10 = Screw RPM/Position
11 = Screw RPM/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	1	1	1	1	0	0	0	0	1	1	1	1

Enable/Disable ERC
0 = On 1 = Off

Bit 08 for Pressure/ Position
Bit 09 for Pressure/Time
Bit 10 for RPM/Position
Bit 11 for RPM/Time

Open/Closed Loop
0 = Closed 1 = Open

Bit 00 for Pressure/Position
Bit 01 for Pressure/Time
Bit 02 for RPM/Position
Bit 03 for RPM/Time

Code:

☐	Your value
0 or 1	Required initial value loaded by Pro-Set 600

Enter Your Values Here

Control Word	Pro-Set 600 Addr.	Value	Description	Units
PPC09	N44:425	*	Segment 1 RPM Setpoint	RPM [5]
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	100	Segment 1 Time Setpoint	Time [1]
PPC13	N44:429	*	Segment 2 RPM Setpoint	RPM [5]
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	100	Segment 2 Time Setpoint	Time [1]
PPC17	N44:433	*	Segment 3 RPM Setpoint	RPM [5]
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	100	Segment 3 Time Setpoint	Time [1]
PPC21	N44:437	*	Segment 4 RPM Setpoint	RPM [5]
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	100	Segment 4 Time Setpoint	Time [1]
PPC25	N44:441	*	Segment 5 RPM Setpoint	RPM [5]
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	100	Segment 5 Time Setpoint	Time [1]
PPC29	N44:445	*	Segment 6 RPM Setpoint	RPM [5]
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	100	Segment 6 Time Setpoint	Time [1]
PPC33	N44:449	*	Segment 7 RPM Setpoint	RPM [5]
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	100	Segment 7 Time Setpoint	Time [1]
PPC37	N44:453	*	Segment 8 RPM Setpoint	RPM [5]
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	100	Segment 8 Time Setpoint	Time [1]
PPC41	N44:457	*	Segment 9 RPM Setpoint	RPM [5]
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	100	Segment 9 Time Setpoint	Time [1]
PPC45	N44:461	*	Segment 10 RPM Setpoint	RPM [5]
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	100	Segment 10 Time Setpoint	Time [1]
PPC49	N44:465	*	Segment 11 RPM Setpoint	RPM [5]
PPC50	N44:466	*	Segment 11 Pressure Setpoint	Pressure [3]
PPC51	N44:467	*	RPM Profile Offset	RPM [5]
PPC52	N44:468	*	Pressure Profile 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

[5] Screw Speed
000.0 to 999.9 RPM

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

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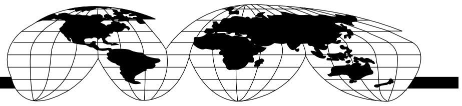

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