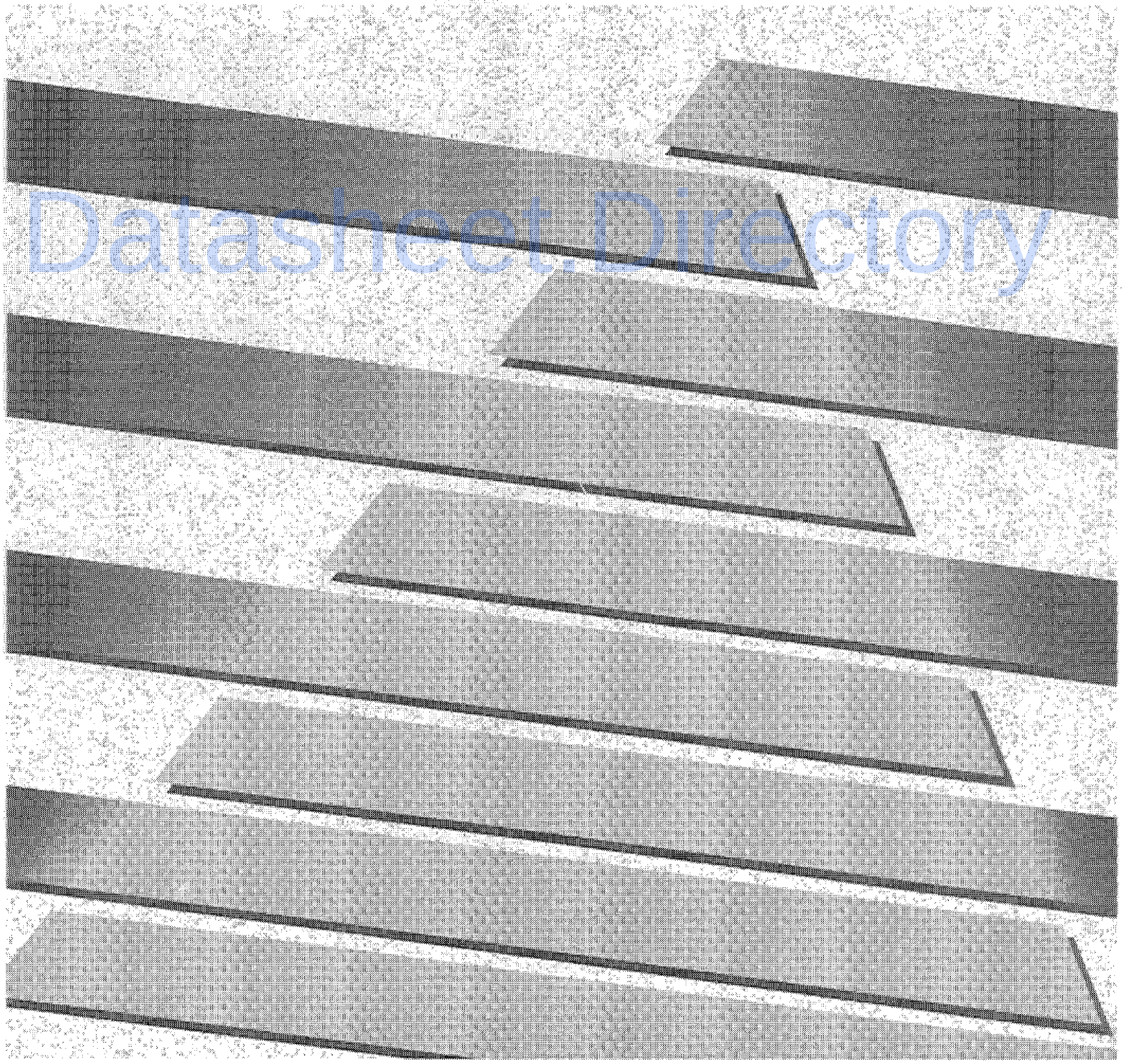
ALLEN-BRADLEY

Force Control Module

(Cat. No. 1771-QH)

User Manual



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 make notes to alert you to possible injury to people or damage to equipment under specific circumstances.

⚠ **WARNING:** Tells readers where people may be hurt if procedures are not followed properly.

⚠ **CAUTION:** Tells readers where machinery may be damaged or economic loss can occur if procedures are not followed properly.

Warnings and Cautions:

- identify a possible trouble spot
- tell what causes the trouble
- give the result of improper action
- tell the reader how to avoid trouble

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

Using This Manual

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 QH module to your 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
Understand how the QH module controls the axis using profiles to define the extend and retract motion of the hydraulic cylinder.	Chapter 1
Match the QH module to your hydraulic system with single-valve and 2-valve examples.	Chapter 2
Install the QH module by setting jumpers, keying the I/O chassis, and wiring I/O.	Chapter 3
Configure the QH module's I/O by selecting I/O ranges, configuring input sensors, and moving the axis.	Chapter 4
Overview the procedures you perform to load the QH module's memory with configuration values and setpoints.	Chapter 5
Jog your machine. This task requires that you determine jog setpoints and pressure alarm setpoints for axis motion.	Chapter 6
Program command-bit interaction to sequence the machine through its cycles. This task requires that you write ladder logic to communicate between PLC processor and QH module.	Chapter 7
Load initial configuration values. This task requires you to determine and enter values into configuration blocks that control the machine's hydraulics.	Chapter 8
Load initial motion profile values to the QH module. This task requires you to determine and enter setpoints that control axis motion	Chapter 9
Span your pressure and/or flow valves using set-output and open-loop modes.	Chapter 10
Tune the machine in closed-loop mode.	Chapter 11
Troubleshoot problems detected by the QH module and displayed with LEDs.	Chapter 12

Audience

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

- a professional system integrator
- an experienced PLC® programmer (especially with the Allen-Bradley PLC-5 family of processors)
- familiar with hydraulics

WARNINGS, CAUTIONS, and Important Information

We use the labels **WARNING, CAUTION,** and **Important** to identify the following types of information:

⚠ **WARNING:** Identifies circumstances that can lead to personal injury as well as equipment damage.

⚠ **CAUTION:** Identifies circumstances that can lead to equipment damage.

Important: Identifies information necessary for successful application of the QH module.

Use of Terms

We use an abbreviated name when referring to Allen-Bradley equipment:

Abbreviated Name:	Item:
QH module	1771-QH Force Control Module
PLC Processor	PLC-5 Programmable Controller
T45 T47 or T50 terminal	1784-T45 1784-T47 1784-T50 Industrial Terminal
PanelView™ Color display	PanelView Operator Interface Terminal (2711-KC1)

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

Term:	Definition:
Selected Valve	In multi-valve systems, depending on the configured profile, the QH module controls one valve and presets the setting of the remaining valves to produce motion profiles. We call the valve being controlled by the QH module's algorithms the selected valve.
Un-selected Valves	In multi-valve systems, depending on the configured profile, the QH module controls one valve and presets the remaining valves to produce motion profiles. We call the valves that are preset with an open loop percentage setpoint the un-selected valves.
Profile	A group of setpoints which define a given axis motion to the QH module.
Command Block	Configuration and/or profile blocks downloaded from the PLC data table to the QH module to make configuration changes or to initiate machine actions.
Status Block	Blocks used by the QH module to relay information to the PLC processor about the QH module's current operating status.
Profile Block	Command block containing motion 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. Command blocks are transferred from the PLC processor to the QH module by means of block transfer write (BTW) instructions in software ladder logic. Command block abbreviations are:

Acronym:	Description:
MCC	Module Configuration Block
JGC	Jog Configuration Block
E1C	1st Extend Configuration Block
E2C	2nd Extend Configuration Block
E3C	3rd Extend Configuration Block
E4C	4th Extend (pressure) Configuration Block
EP	Extend Profile Block
R1C	1st Retract Configuration Block
R2C	2nd Retract Configuration Block
R3C	3rd Retract Configuration Block
R4C	4th Retract (slow) Configuration Block
RP	Retract Profile Block
DYC	Dynamic Command Block

Status Blocks

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

Acronym:	Description:
SYS	System Status Block
ES	Axis-extend Profile Status Block
RS	Axis-retract Profile Status Block

Word and Bit Numbering

The QH 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, the QH module identifies word 09 of the Module Configuration Command Block (MCC) as MCC09.

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

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

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

Appendices

Word/bit descriptions and other information about the QH module are contained in appendices A-F. Familiarize yourself with this information.

For this information:	See appendix:
A summary of each data block used by the QH module (abbreviated command and status blocks)	A
Programming error codes returned by the QH module, and Recommended procedures to correct these errors	B
A description of each: command word and bit used by the QH module status word and bit returned by the QH module	C
Operational, mechanical, electrical, and environmental specifications	D
Blank worksheets for recording configuration setpoints	E
Application program for communication between QH module and PLC-5 processor	F
Calibration instructions	G

Related Publications

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

Use this documentation:	Publication #:	To:
PLC-5 Family Programmable Controller Installation Manual	1785-6.6.1	Install the PLC processor and I/O modules.
6200 PLC-5 Programming Software Documentation Set	6200-N8.001	Select instructions and organize memory when writing ladder logic to run your machine.

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Chapter 1

Overview of Axis Motion

Chapter Objectives

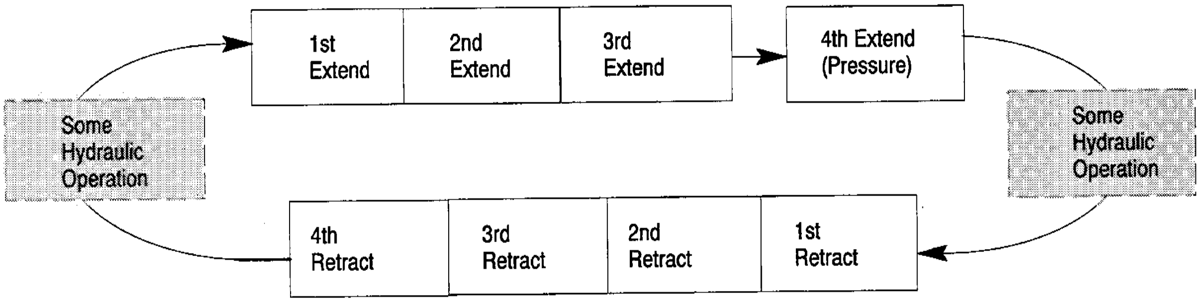
This chapter presents an overview of axis motion that you can program with the 1771-QH Force Control Module.

Control of Axis Motion

Using hydraulics, you can extend and retract an hydraulic cylinder in a reciprocating machine cycle by controlling axis motion with these phases:

- 1st, 2nd, and 3rd extend
- 4th extend (pressure)
- 1st, 2nd, 3rd, and 4th retract

Figure 1.1
Axis Motion in a Machine Cycle



Extend

Use extend profiles to maximize axis speed but stop at the same end point on each cycle by approaching the end point at low pressure so as not to damage the cylinder, the tooling, or a part being fabricated.

You may configure up to three separate profiles:

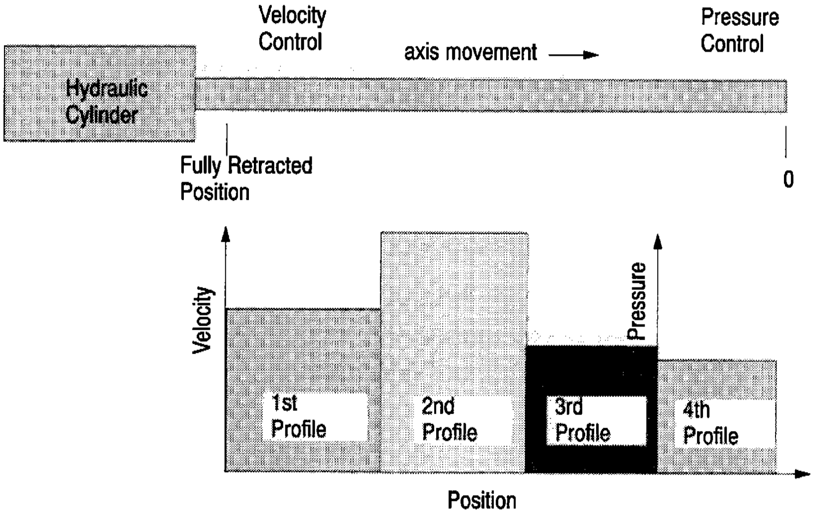
- 1st extend
- 2nd extend
- 3rd extend

with either of these control modes:

- velocity vs. position
- pressure vs. position

Important: Configure the 4th extend profile with pressure vs. position. This control mode can prohibit the cylinder from reaching its fully extended position if there is an obstruction.

Figure 1.2
Example Extend Profiles



Important: You could use pressure vs. position or velocity vs. position for the 1st, 2nd, and/or 3rd profiles. The fourth must be pressure vs. position.

With up to four different profiles, you can initiate the following operations between profiles:

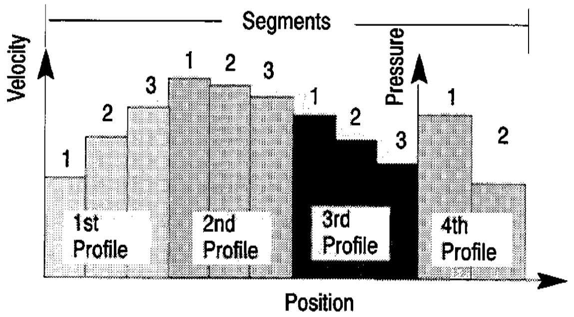
- pick up or drop out pumps to change axis speed or pressure
- program other events for your hydraulic valves
- either start the next profile automatically after the previous one (logical bridge between profiles) or let user programming decide when to begin the next profile

Each profile is subdivided into position segments so you can change the profile's velocity or pressure:

- up to three times in each of the 1st, 2nd, and 3rd profiles
- once or twice in the 4th profile

If needed, you can change velocity and pressure up to a total of 11 times over the entire movement as shown in Figure 1.3.

Figure 1.3
Example Segments for Axis-extend Motion



Important: You may use as many or as few profiles and/or segments within profiles as needed for axis motion. If using a single fast motion, use the first segment of the 1st profile. You must use the 4th profile.

Important: If you need only one segment in the 4th profile, you must configure the 1st segment of that profile.

After completing the last segment in each programmed profile, the QH module either:

- switches immediately to the next programmed segment of the next desired profile (automatic logical bridge), or
- waits for a command from your PLC program to continue.

At the end of the 4th profile, you can program the QH module to:

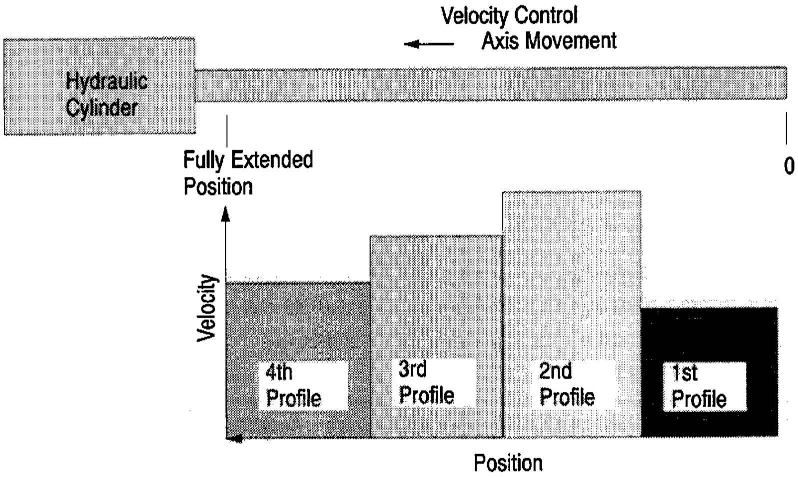
- notify your PLC program when the 4th profile is complete
- automatically apply end-of-profile set-output values to build tonnage

Retract

Important: Retract and extend profiles are identical with these exceptions:

- Retract moves in the opposite direction (Figure 1.4).
- You can use either control mode for all four retract profiles:
  - velocity vs. position
  - pressure vs. position

Figure 1.4
Example Retract Profiles



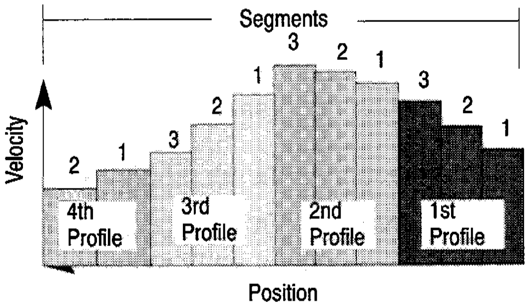
Important: You can use pressure vs. position or velocity vs. position for all four profiles with up to 11 segments (steps) during retract.

Each profile is subdivided into position segments so you can change the profile's velocity or pressure:

- up to three times in each of the 1st, 2nd, and 3rd profiles
- once or twice in the 4th profile

If needed, you can change velocity and pressure up to a total of 11 times over the entire movement as shown in Figure 1.5.

Figure 1.5
Example Segments for an Axis-retract Profile



Important: You may use as many or as few profiles and/or segments within profiles as needed for axis motion. If using a single fast motion, use the first segment of the 1st profile. You must use the 4th profile.

Important: If you need only one segment in the 4th profile, you must configure the 1st segment of that profile.

Table 1.A
Summary of Axis Motion

Phase of Motion:	**Description:**
Extend 1st Profile 2nd Profile 3rd Profile	You can program a single-step axis-extend profile and not use a second or third profile. Or, you can program up to three axis-extend profiles and insert the following actions at the end of each: • pick up or drop out pumps to change clamp speed or pressure • other motion-related functions
4th Profile	To guard against damaging the machine when the cylinder is fully extended, you extend the cylinder slowly with low pressure in closed-loop or open-loop control. You must use pressure vs. position profile for 4th extend profile.
Retract 1st Profile 2nd Profile 3rd Profile	You can program a single-step axis-retract profile and not use a second or third profile. Or, you can program up to three axis-retract profiles and insert the following actions at the end of each: • drop out or pick up pumps to change clamp speed or pressure • other motion-related functions
4th Profile	To decelerate the cylinder to accurately position it with high repeatability. You can use either control mode

Chapter 2

Match the QH Module to your Hydraulic System

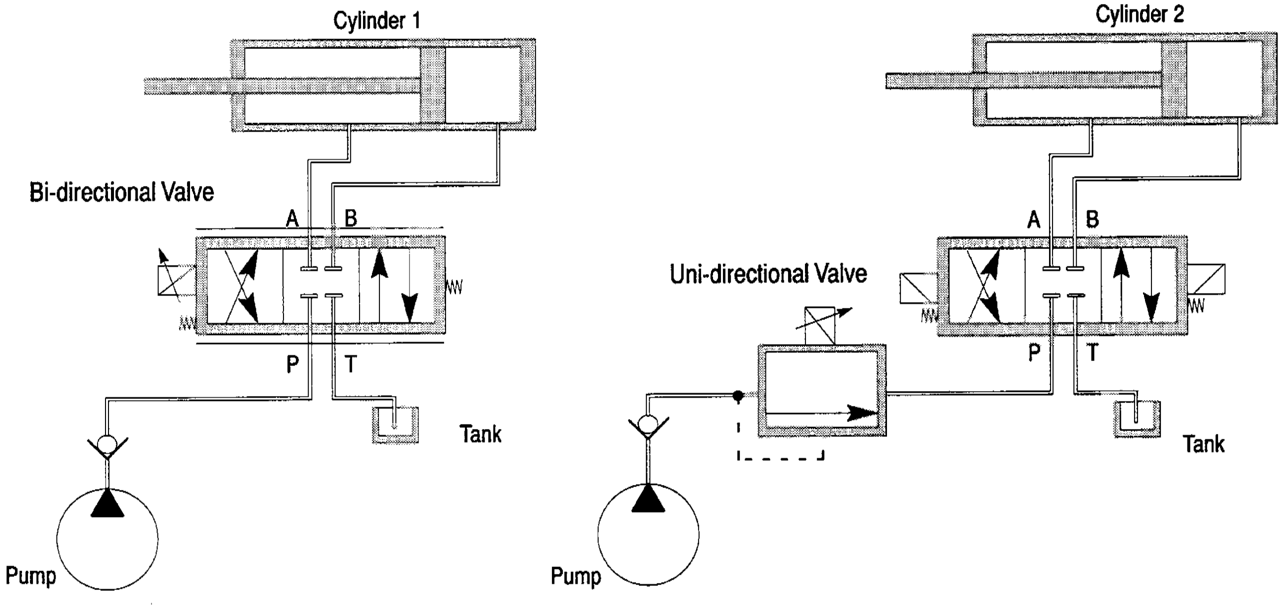
Chapter Objectives

This chapter acquaints you with QH module configurations for several different hydraulic control schemes.

We presents hydraulic sketches showing proportional valves controlled by QH modules. When necessary to convey the flow direction of a circuit, we also show directional solenoid valves.

This chapter gives configuration examples for bi-directional valve systems. Bi-directional valve configurations have an equivalent uni-directional valve solution (Figure 2.1). You can configure the QH module for operation with either uni- or bi-directional valve systems.

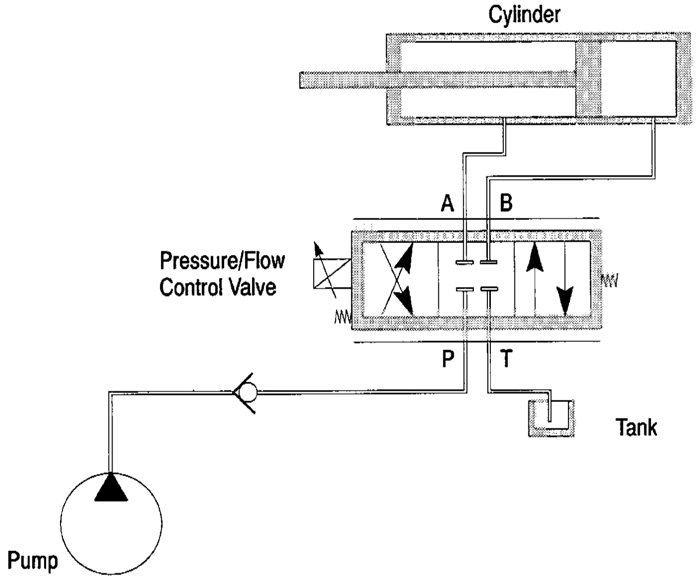
Figure 2.1
Example of Bi-directional vs. Uni-directional Proportional Valves



Single-valve System for Single-cylinder Control

If sized properly (particularly on smaller presses), you may use the same valve to control cylinder pressure and flow algorithms on certain machines. Figure 2.2 shows a single bi-directional valve used to control cylinder pressure and flow.

Figure 2.2
Example Single-valve System for Single-cylinder Control



This example requires a single QH module for this single-valve application (Table 2.A). In this configuration, the QH module controls axis pressure and flow.

You may use the remaining I/O as follows:

- inputs 1 and 2 to pass scaled analog input signals to the PLC processor
- outputs 2 - 4 to control some auxiliary fixed-level hydraulic functions

Table 2.A
I/O for Example Single-valve System

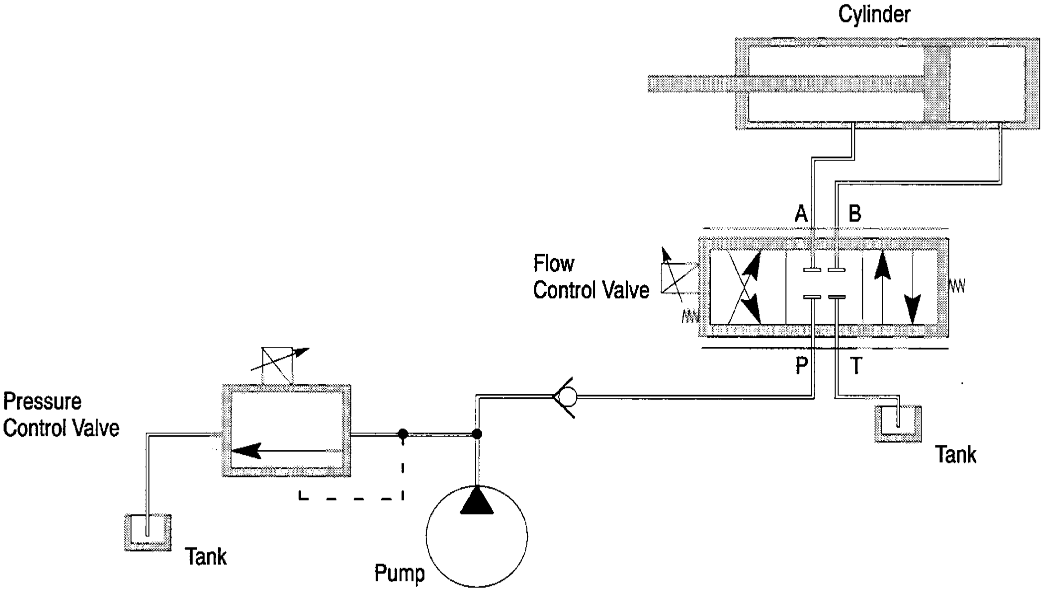
QH Module:	Application:
Input 1	Auxiliary Analog Input [1]
Input 2	Auxiliary Analog Input [1]
Input 3	Axis Position
Input 4	Axis Pressure
Output 1	Axis Pressure/Flow Control
Output 2	[2]
Output 3	[2]
Output 4	[2]

[1] May be used to send scaled analog input signals to the PLC processor.
[2] May be used to send fixed-level signals to other machine hydraulics.

2-Valve System for Single-cylinder Control

Separate valves are used for controlling pressure and flow in this 2-valve system. Figure 2.3 shows two valves used for single-cylinder control.

Figure 2.3
Example 2-valve System for Single-cylinder Control



This example requires a single QH module for this 2-valve application (Table 2.B). In this configuration, the QH module controls axis pressure and flow.

You may use the remaining I/O as follows:

- inputs 1 and 2 to pass scaled analog input signals to the PLC processor
- outputs 3 and 4 to control some auxiliary fixed-level functions

Table 2.B
I/O for Example 2-valve System

QH Module:	Application:
Input 1	Auxiliary Analog Input [1]
Input 2	Auxiliary Analog Input [1]
Input 3	Axis Position
Input 4	Axis Pressure
Output 1	Axis Flow
Output 2	Axis Pressure
Output 3	[2]
Output 4	[2]

[1] May be used to send scaled analog input signals to the PLC processor.
[2] May be used to send fixed-level signals to other machine hydraulics.

Chapter 3

Install the QH Module

Chapter Objectives

This chapter helps you install your QH module with these tasks:

- Record I/O ranges
- Set module jumpers
- Key the I/O chassis
- Install the QH module
- Wire I/O devices to the module
- Ground and shield your I/O devices
- Plan for E-STOPs and machine interlocks

Record I/O Ranges

To match your QH module to your I/O devices, record the I/O ranges of your I/O devices on Worksheet 3-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 your selections on Worksheet 3-A. Cross off I/O not used.

Worksheet 3-A
Select I/O Ranges

I/O Connection:	Voltage Range:	Voltage Range:	Current Range:
Input 1 Auxiliary Analog Input	0 to 10V dc	1 to 5V dc	4 to 20 mA
Input 2 Auxiliary Analog Input	0 to 10V dc	1 to 5V dc	4 to 20 mA
Input 3 Axis position	0 to 10V dc	1 to 5V dc	4 to 20 mA
Input 4 Axis pressure	0 to 10V dc	1 to 5V dc	4 to 20 mA
Output 1	-10 to +10V dc	0 to 10V dc	4 to 20 mA
Output 2	-10 to +10V dc	0 to 10V dc	4 to 20 mA
Output 3	-10 to +10V dc	0 to 10V dc	4 to 20 mA
Output 4	-10 to +10V dc	0 to 10V dc	4 to 20 mA

Important: Auxiliary analog inputs 1 and 2 are optional. Use them for any application where you need to pass a scaled analog input to the PLC processor. You can scale the raw input to any desired units. You can monitor auxiliary analog inputs and trigger any desired event by comparing these values to some limit(s) with your PLC ladder logic.

If you are configuring more than one QH module, you can find a duplicate of worksheet 3-A in appendix E.

Set Module Jumpers

Before installing the QH module, you must select with jumper plugs the I/O ranges that you recorded on Worksheet 3-A.

Access and Position the Jumpers

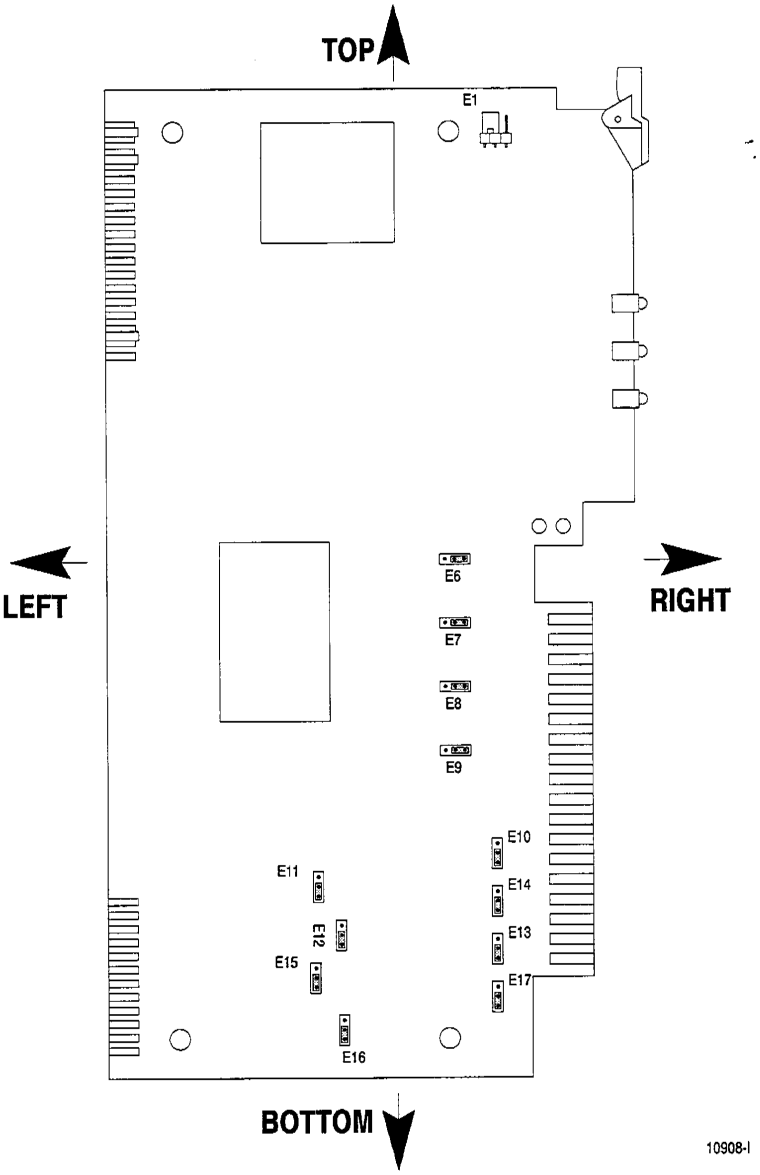
Access the jumper plugs and set them as follows:

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

---

1. Remove the label-side cover plate by removing the corner screws.
2. Remove the circuit board from the module housing. Do this by removing the two screws located center-front at the wiring arm catch.
3. Carefully turn over the circuit board so it is oriented as in figure 3.1. Handle it by its edges to avoid touching conductors or components.
4. Use figure 3.1 to locate the jumper plugs.
5. Set jumper plugs according to Table 3.A (next page) using:
   - your recorded I/O ranges from Worksheet 3-A
   - needle-nose pliers
6. After setting the jumper plugs, carefully re-assemble the QH module with steps 3, 2, and 1.

Figure 3.1
Jumper Locations on the QH Module's Circuit Board



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

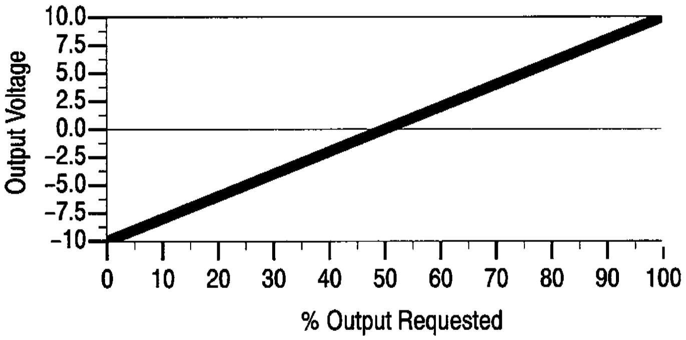
Table 3.A
Jumper Settings

Jumper:	Function:	Position:
E1	Run/Calibrate	Run = left[1] Calibrate = right
E6 E7 E8 E9	Input 1 Auxiliary Analog Input Input 2 Auxiliary Analog Input Input 3 Axis position Input 4 Axis pressure	Current = left Voltage = right[1]
E10 E14 E13 E17	Output 1 Valve 1 Output 2 Valve 2 Output 3 Valve 3 Output 4 Valve 4	Current = top Voltage = bottom[1]
E11 E12 E15 E16	Output Range 1 Valve 1 Output Range 2 Valve 2 Output Range 3 Valve 3 Output Range 4 Valve 4	-10 to +10V dc = top 0 to +10V dc or 4 to 20mA = bottom[1]

[1] Factory-set position

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

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



Key the I/O Chassis

Use plastic keying bands, shipped with each I/O chassis, for keying I/O slots to accept only this type of module.

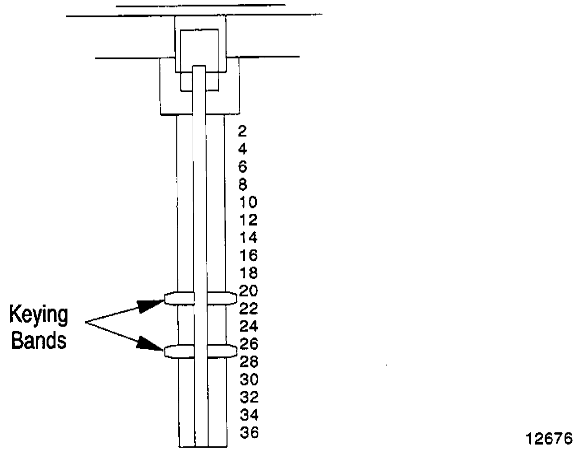
WARNING: This keying also accepts 1771-QD and -QDC Molding Modules. If installed by mistake and operated, either module could cause unexpected motion with possible personal injury or machine damage.

The QH 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 3.2):

- between 20 and 22
- between 26 and 28

Figure 3.2
Keying Positions



Important: Record the QH module's position in the I/O chassis to assure that you address it correctly in ladder logic. If using the PLC-5 application program that we provided, you must locate the QH module at this address:

- rack 0
- module group 0
- slot 0

Important: We provide a PLC-5 application program to assist you in developing your own application program for communication between PLC-5 processor and QH module. Download procedures and all PLC-5 addresses in this manual assume you are using it. For an overview of this program, refer to appendix F.

Install the QH Module

To install your QH module in an I/O chassis, complete these steps:

1. First, turn off power to the I/O chassis.

⚠ **WARNING:** Remove power from the 1771 I/O chassis backplane and wiring arm before removing or installing a QH 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 guides on the top and bottom of the slot that slides the module into position.
3. Do not force the module into its backplane connector. Apply firm, even pressure on the module to seat it properly.
4. Snap the chassis latch over the top of the module to secure it.
5. Connect the wiring arm to the module.

Wire I/O Devices

Use the wiring arm (1771-WF) supplied with the QH module to wire I/O devices (Figure 3.3). The wiring arm lets you install or remove the QH module from the I/O chassis without rewiring. Wiring arm terminals are numbered in descending order, from the top down, starting with terminal 18 (Table 3.B).

Figure 3.3
I/O Wiring and Grounding

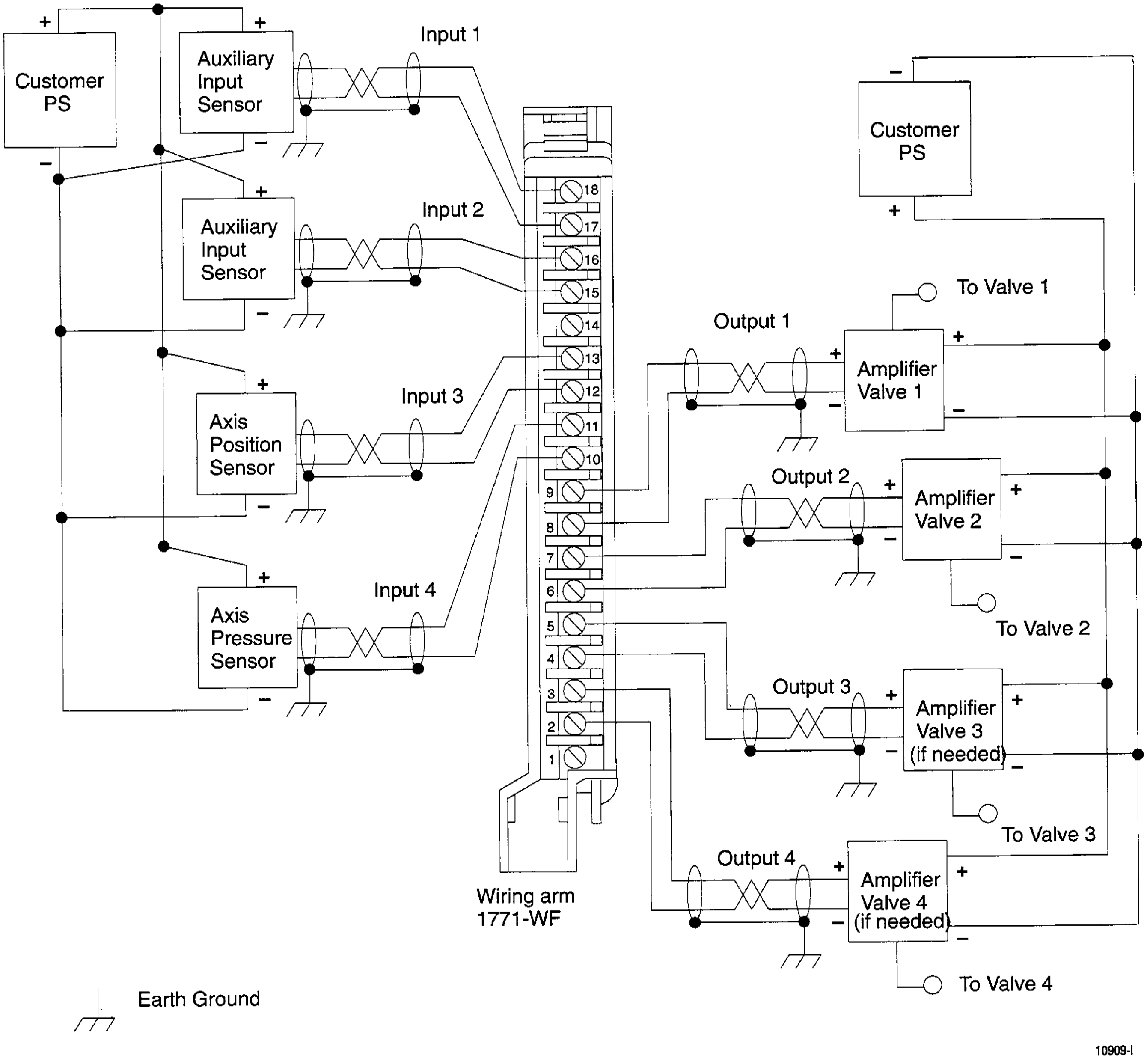

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Table 3.B
I/O Terminal Designations

Transducer:	**I/O Designation:**	**Terminal:**
Auxiliary analog input 1	Input 1 (+) (-)	18 17
Auxiliary analog input 2	Input 2 (+) (-)	16 15
	Input common	14
Axis position (see **Important** below)	Input 3 (+) (-)	13 12
Axis 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

Important: You must connect an axis position sensor to input 3 for the QH module to operate.

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

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

Ground and Shield Your I/O Devices

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

Grounding Guidelines

- Use 22-gage (or larger) twisted-pair cable, 100% shielded with drain wire, such as Belden 8761. For cable distances over 50 ft, use 18-gage cable such as Belden 8760.
- Ground the cable shield at one end only; generally at the sensor or amplifier end of the cable, not at the I/O chassis (see Figure 3.4 and Figure 3.5).

Figure 3.4
Shielding Differential Inputs

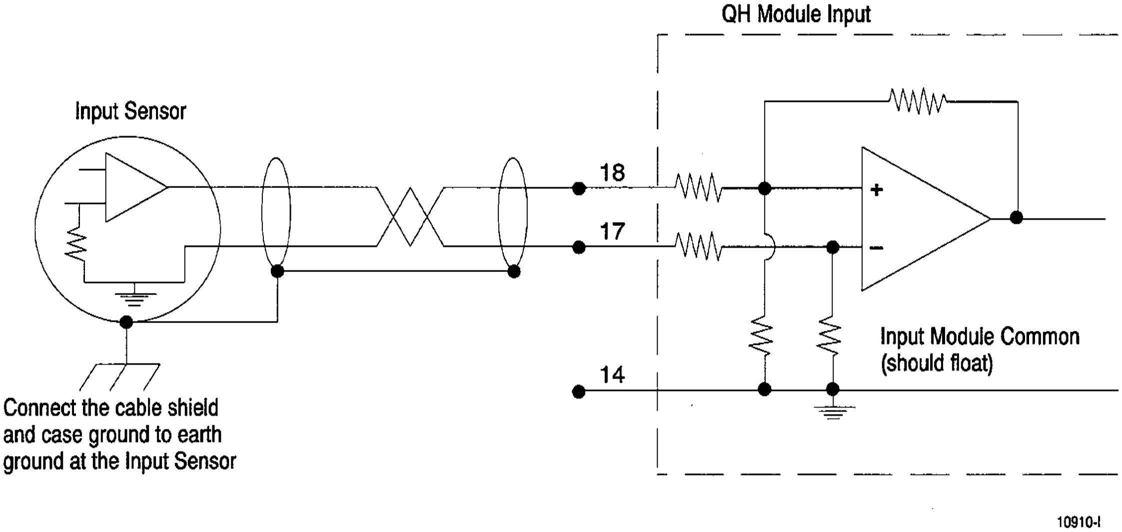
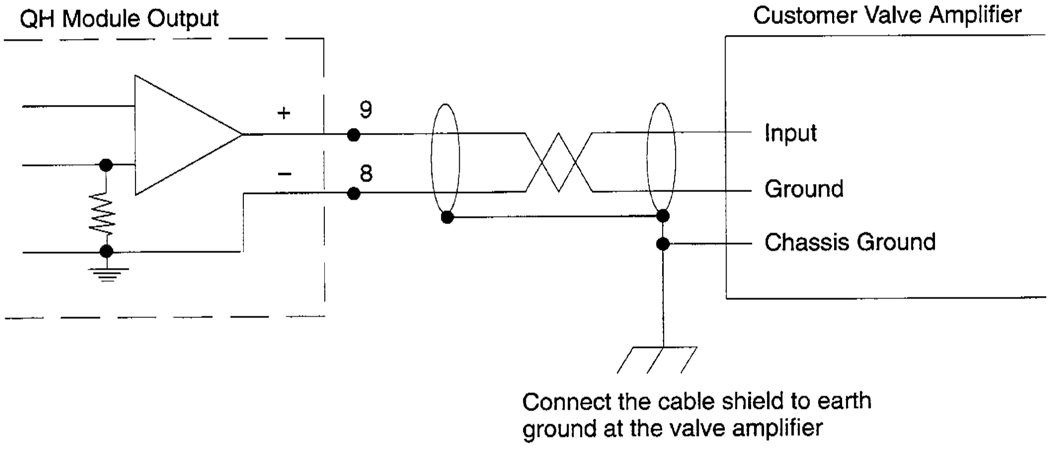


Figure 3.5
Shielding Single-ended Outputs



- ground cable shields to low-impedance earth ground of 1/8 ohm or less
- 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 (pub. no. 1770-4.1).

Exceptions

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

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

Plan for E-STOPs and Machine Interlocks

You must consider the installation of Emergency Stop switches and machine interlocks when performing the following system tasks:

- designing your system
- assembling mechanical/hydraulic components
- wiring system components
- developing system ladder logic

WARNING: 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. We recommend maintained-contact "Emergency Stop" push buttons.

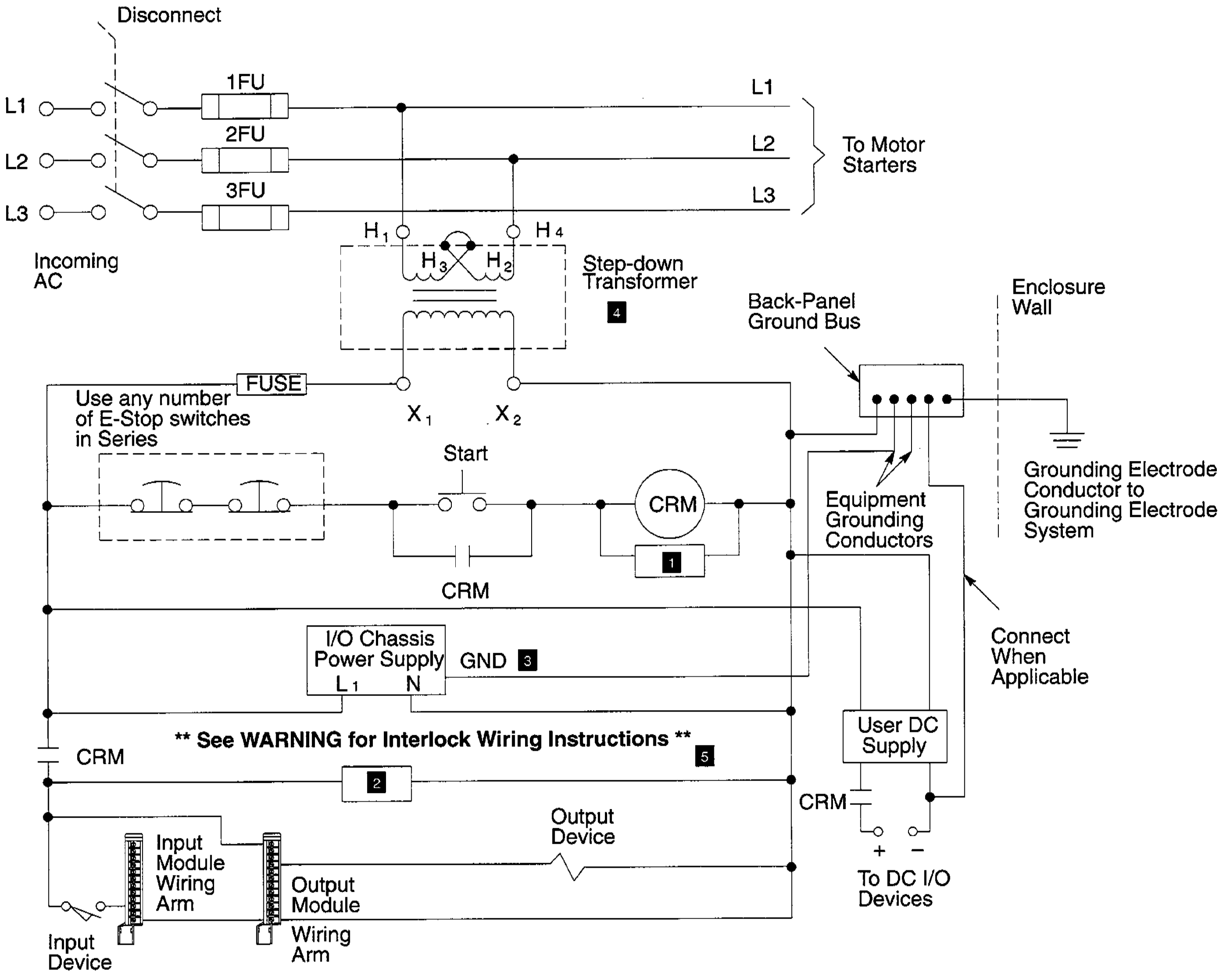
WARNING: Review the American National Standard for Machine Tools – Hydraulic Presses – Safety Requirements for Construction, Care, and Use (ANSI B11.2 - 1982) for safety requirements on hydraulics, mechanical, and electrical interlocks.

In addition, we strongly recommend that 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.

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

The next illustrates a typical grounded PLC power distribution circuit. For ungrounded systems or for more information on grounding and wiring guidelines, refer to Allen-Bradley Programmable Controller Wiring and Grounding Guidelines (pub. no. 1770-4.1) .

Figure 3.6
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 B11.2, NFPA for additional wiring guidelines.
- To minimize EMI generation, suppression networks should be connected across coils of electromagnetic devices.

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Chapter 4

Configure the QH Module's I/O

Chapter Objectives

Your QH module needs to know the characteristics of your axis sensors. In this chapter, we describe how to determine these characteristics and download them to the QH module. Topics include:

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

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

- Load Your PLC-5 Application Program
- Select I/O Ranges
- Determine Initial Sensor-configuration Values
- Download MCC Parameters to the QH Module
- Use Set-output Mode to Move the Axis
- Complete Your Sensor Configuration
- Select Optional Configurations

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

Load Your PLC-5 Application Program

We provide you with an application program for communication between the PLC-5 processor and the QH module. The PLC-5 addresses in this manual depend on using this program. Copy it into your 6200 Series Directory on your programming terminal's hard drive as follows:

1. At the DOS prompt, type: `C:[RETURN]`

2. Then type: `CD \IPDC\ARCH\PLC5[RETURN]`

3. At the new prompt, type this sequence:

```
C:\IPDS\ARCH\PLC5 > COPY A:\QHBASE.EXE[RETURN]

                  > QHBASE[RETURN]

                  > DEL QHBASE.EXE[RETURN]
```

Then load the application program into your PLC-5 processor using procedures in your 6200 Series software documentation.

Select I/O Ranges

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

Important: You must configure the QH module's I/O ranges to match the machine sensors and valves.

Refer to Worksheet 3-A from chapter 3 which you filled out when setting the QH module's jumpers. Apply this information to Worksheet 4-A for input ranges and Worksheet 4-B for output ranges as follows:

To Configure:	In Control Word:	Use this Worksheet:
Input Ranges	MCC03	Worksheet 4-A
Output Ranges	MCC04	Worksheet 4-B

Important: The Module Configuration Command block (MCC) stores configuration data used throughout the machine cycle. All configuration data described in this chapter is stored in the MCC block. For additional information on data blocks, refer to chapter 5.

Important: Software input/output selections that you are about to make in MCC03 and MCC04 must match the jumper settings for each respective input/output that you configured in Chapter 3.

Important: The QH module detects loss of sensor at input 3 (axis position) and input 4 (axis pressure) regardless of the input range you select. When the QH module detects loss of input, it:

- sets status bit SYS08-B02 (for input 3) or SYS08-B03 (for input 4)
- E-stops the profile in progress
- ignores any action execution command in DYC02

You must connect a position sensor to input 3 for the QH module to operate.

Worksheet 4-A
Selecting Input Ranges for your Sensors

Control Word MCC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address 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 Range, Axis Pressure, with bits 07, 06
Select Input 3 Range, Axis Position, with bits 05, 04
Select Input 2 Range, Auxiliary Input #2, with bits 03, 02
Select Input 1 Range, Auxiliary Input #1, with bits 01, 00

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

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

Worksheet 4-B
Selecting Output Ranges for your Valves

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

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

Output Range		
-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: If using ***metric*** units, set bit MCC02-B00 = 1. Do this in the same manner as you set bits in MCC03 and MCC04 above. Leave all other bits in MCC02 (B34:33) in their default state.

Example: If you select metric units: MCC02 = 00000000 00101001

Determine Initial Sensor-configuration Values

To determine initial sensor configuration values, refer to Table 4.A, and to the specifications that accompanied your sensors, valves, and cylinders. Write down applicable values on Worksheet 4-C.

Important: You must enter floating-point numbers and percentages as integers, so we recommend that you write them on Worksheet 4-C 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 - 010.00V dc	5.6V dc	00560
0 - 009.99 sec	0.47 sec	00047
0 - 09999 PSI	321 PSI	00321
0 - 0999.9 Bar	222 Bar	2220

Table 4.A
Determining Initial Sensor-configuration Values for Worksheet 4-C

For this Parameter:	If:	Then Use a Value Equal to:
Minimum Axis Position (MCC23)	N/A	zero
Maximum Axis Position (MCC24)	the axis is fully extended	full travel of the sensor
Analog Signal @ Min Position (MCC25)	your sensors are forward-acting	low end of your selected range
	your sensors are reverse-acting	high end of your selected range
Analog Signal @ Max Position (MCC26)	your sensors are forward-acting	high end of your selected range
	your sensors are reverse-acting	low end of your selected range
Minimum Axis Pressure (MCC31)	N/A	minimum range value specified by the manufacturer
Maximum Axis Pressure (MCC32)	N/A	maximum range value specified by the manufacturer
Analog Signal @ Min Pressure (MCC33)	your sensors are forward-acting	low end of your selected range
	your sensors are reverse-acting	high end of your selected range
Analog Signal @ Max Pressure (MCC34)	your sensors are forward-acting	high end of your selected range
	your sensors are reverse-acting	low end of your selected range

Worksheet 4-C
Determining Initial Sensor-configuration Values

Record Initial Values Here

Input	Control Word	Address	Value	Description (footnote = units)
1	MCC37	N40:33	0	Minimum Auxiliary Analog Input #1
	MCC38	N40:34		Maximum Auxiliary Analog Input #1
	MCC39	N40:35		Analog Signal @ Min Analog Input [2]
	MCC40	N40:36		Analog Signal @ Max Analog Input [2]
2	MCC45	N40:41	0	Minimum Auxiliary Analog Input #2
	MCC46	N40:42		Maximum Auxiliary Analog Input #2
	MCC47	N40:43		Analog Signal @ Min Analog Input [2]
	MCC48	N40:44		Analog Signal @ Max Analog Input [2]
3	MCC23	N40:19	0	Minimum Axis Position [1]
	MCC24	N40:20		Maximum Axis Position [1]
	MCC25	N40:21		Analog Signal @ Min Axis Position [2]
	MCC26	N40:22		Analog Signal @ Max Axis Position [2]
4	MCC31	N40:27	0	Minimum Axis Pressure [3]
	MCC32	N40:28		Maximum Axis Pressure [3]
	MCC33	N40:29		Analog Signal @ Min Axis Pressure [2]
	MCC34	N40:30		Analog Signal @ Max Axis Pressure [2]

[1] Axis Measured from Zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Input Signal Range
00.00 to 10.00V dc or
01.00 to 05.00V dc or
04.00 to 20.00mA dc

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

Important: Use auxiliary analog inputs for any application where you need to pass a scaled analog input to the PLC processor. You can scale the raw input to any desired units. You can monitor auxiliary analog inputs and trigger any desired event by comparing these values to some limit(s) with your PLC ladder logic.

Download MCC Parameters to the QH Module

The download operation requires you to complete the following procedures:

- enter configuration values into the PLC-5 data table
- download configuration values to the QH module (with PLC-5 processor in run mode)
- correct any programming errors

We tell you how, next.

Enter MCC Configuration Values into Your PLC-5 Data Table

With your programming terminal, enter values from Worksheets 4-A, 4-B and 4-C 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 table files for storing the MCC block as specified on the individual 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 Configuration Values to the QH Module

To download the MCC block to the QH module, switch the PLC-5 processor from PROGRAM to RUN mode. The diskette ladder logic that we provided downloads the MCC block to the QH module for you.

Important: If *not* using the PLC-5 application program that we provided on diskette, you must develop your own write ladder logic to:

- copy the binary and integer files of the MCC block into a single 64-word data block
- transfer the resulting MCC block to the QH module with a BTW instruction

Important: If using our PLC-5 application program, you can verify that the MCC block was successfully downloaded or that you made a programming error by evaluating the following words continuously returned to the PLC-5 processor.

If:	And:	Then:
SYS01-B08 (B34:0-B08) = 1	N/A	QH module accepted a valid MCC block.
SYS19-B00 (B34:18-B00)= 1	SYS61 (N40:213) = 1	You made a programming error in MCC block. Read the error code in SYS62 (N40:214)), and look up the error in Appendix B.

Correct Programming Errors in MCC

Upon receiving the MCC block, the QH module tests data for data-entry (programming) errors, such as a value out of range. The QH module halts operation until you correct the error(s). It must store a valid MCC block before it accepts additional data blocks.

Correct errors as follows:

1. Enter changed configuration values into your PLC-5 data table.
2. Download new values to the QH module by switching the PLC-5 processor from PROGRAM to RUN mode.

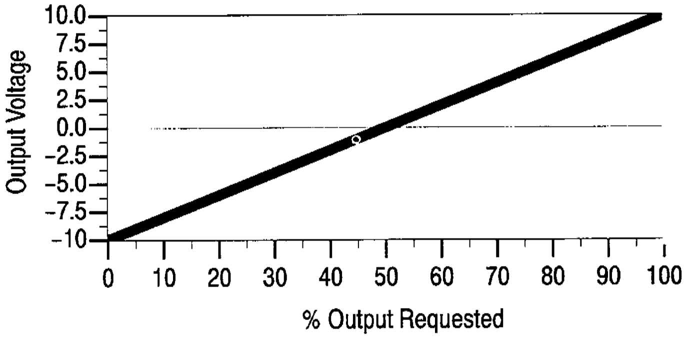
When the QH module no longer detects errors in the MCC block, it returns SYS01-B08 (B34:0-B08) = 1.

For a complete list of error codes that the QH module returns in SYS62 (N40:214) to help you correct programming errors, refer to Appendix B.

Use Set-output Mode to Move the Axis

To finish configuring the QH module, you move the axis with the QH module's set-output mode. Set-output applies a %-output signal to the valve or valve amplifier to move the axis in a controlled manner. You will determine the percentage output required to move the axis over its intended range. Later in chapter 10, you refine this value when you span the valves.

WARNING: A value of zero in set-output words DYC09-12 does not always correspond to zero pressure or flow. If you set jumper E11, E12, E15, or E16 for bi-directional valve operation an output of 0% gives –10V dc, 50% gives 0V dc (see graph). Amplifier electronics or spool-null offsets may also allow pressure or flow at zero volts signal input. Consult your valve and amplifier specifications for more details.



⚠ **WARNING:** As soon as you enable set-output operation, the QH module's outputs drive the connected valves according to the values you entered into DYC09-12. 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. Otherwise, unexpected machine motion could occur with possible personal injury or damage to the machine.

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

Use this procedure to move the axis.

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

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

2. Enable set-output operation by entering a 1 in DYC01-B08 (B34:24-B08). The QH module sets outputs 1 - 4 to percentage values that you entered in DYC09 -12 respectively.

Important: The DYC block is continuously transferred to the QH module, so changes you make to %-output values are immediately implemented.

3. With your programming terminal, slowly increase the %-output value of the output you have chosen to control your axis, as you observe the corresponding movement.

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

Complete Your Sensor Configuration

Next we complete the procedure for configuring the QH module to match its sensors by spanning the sensors over their intended range with the machine in operation. Here we describe how you determine values for the:

- axis position sensor
- axis pressure sensor

In the procedures that follow, measure and record:

- min/max positions and corresponding signal values
- min/max pressures and corresponding signal values

After determining these values, record them on Worksheet 4-D .

Worksheet 4-D
Final Sensor-configuration Values

Record Final Values Here

Input	Control Word	Address	Value	Description
1	MCC37	N40:33	0	Minimum Auxiliary Analog Input #1
	MCC38	N40:34		Maximum Auxiliary Analog Input #1
	MCC39	N40:35		Analog Signal @ Min Analog Input [2]
	MCC40	N40:36		Analog Signal @ Max Analog Input [2]
2	MCC45	N40:41	0	Minimum Auxiliary Analog Input #2
	MCC46	N40:42		Maximum Auxiliary Analog Input #2
	MCC47	N40:43		Analog Signal @ Min Analog Input [2]
	MCC48	N40:44		Analog Signal @ Max Analog Input [2]
3	MCC23	N40:19	0	Minimum Axis Position [1]
	MCC24	N40:20		Maximum Axis Position [1]
	MCC25	N40:21		Analog Signal @ Min Axis Position [2]
	MCC26	N40:22		Analog Signal @ Max Axis Position [2]
4	MCC31	N40:27	0	Minimum Axis Pressure [3]
	MCC32	N40:28		Maximum Axis Pressure [3]
	MCC33	N40:29		Analog Signal @ Min Axis Pressure [2]
	MCC34	N40:30		Analog Signal @ Max Axis Pressure [2]

[1] Axis Measured from Zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Input Signal Range
00.00 to 10.00V dc or
01.00 to 05.00V dc or
04.00 to 20.00mA dc

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

Important: The QH module detects loss of sensor for the axis position and pressure sensors. Upon detecting loss of sensor, the QH module:

- sets status bit SYS08-B02 (for position) or SYS08-B03 (for pressure)
- E-stops any profile in progress
- ignores any action execution commands in DYC02

Determine Values for the Axis Position Sensor

To complete the position sensor configuration, follow this procedure and record your values on Worksheet 4-D. Use words MCC23–26.

1. Move axis forward to its mechanical stop. This is the zero position.
2. Remove axis pressure and/or flow to stop movement.
3. Record this position value (usually 0000) for MCC23.
4. With your programming terminal, read the signal level returned in SYS35 (N40:187) from your position sensor.

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

5. Record the signal level for zero position for MCC25.
6. Move the axis backward to the mechanical stop.
7. Remove axis pressure and/or flow to stop movement.
8. Measure the distance travelled by the axis.
9. Record this distance for MCC24.
10. With your programming terminal, read the signal level returned in SYS35 (N40:187) from your position sensor.

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

11. Record this value for MCC26.

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

Determine Values for Pressure Sensor

To finish configuring your axis pressure sensor, record min/max pressures and corresponding signal levels from manufacturer specifications for words MCC31-34 on Worksheet 4-D. Most applications require no further spanning.

If greater accuracy is required, follow the procedure below. Record values for the axis pressure sensor in words MCC31–34 on Worksheet 4-D.

1. Release system pressure to obtain minimum pressure at the axis.
2. Read the pressure gauge at the axis.
3. Record this minimum value (usually 0000) for MCC31.
4. With your programming terminal, read the signal level returned in SYS36 (N40:188) from your pressure sensor.

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

5. Record this signal level for MCC33.

WARNING: 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 injury to personnel and/or damage to equipment.

6. Re-torque all hydraulic connections and joints before proceeding.
7. Boost system pressure to obtain maximum pressure at the axis. Do this by extending the axis against the mechanical stop, then fully opening its pressure valve.
8. Read the pressure gauge at the axis while the axis is mechanically bound from moving further.
9. Record maximum pressure for MCC32.
10. With your programming terminal, read the signal level returned in SYS36 (N40:188) from your pressure sensor.

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

11. Record this signal level for MCC34.
12. Release pressure.

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

Important: For auxiliary analog inputs, complete the configuration according to the sensor manufacturer's specifications. If more accurate values are required, use the above procedures as a guide for determining required values.

Select Optional Configurations

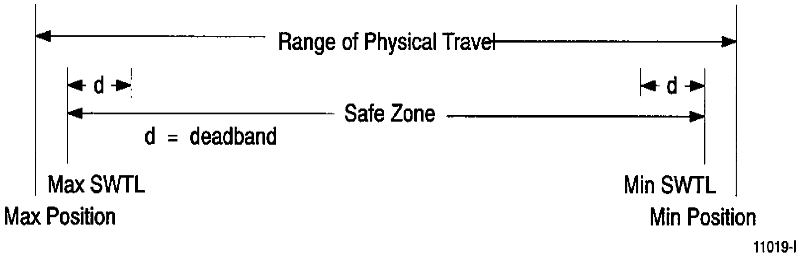
Your QH module provides the option of configuring the following features:

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

Configure Software Travel Limits

You may want to use software restrictions to stop the axis travel before reaching maximum limits configured earlier in this chapter.

Figure 4.7
Software Restrictions



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

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

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

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

Configure the QH module for SWTL as follows:

1. Determine these SWTL values for axis travel with respect to the range of physical travel:
   - SWTL deadband
   - Maximum SWTL
   - Minimum SWTL
2. Record non-zero SWTL values on Worksheet 4-E. Zero values disable the corresponding SWTLs.

WARNING: Leaving your SWTL settings at zero (MCC27, 28) disables this safety function.

Worksheet 4-E
SWTL Configuration Values

Record SWTL Values Here

Control Word	Address	Value	Description
MCC27	N40:23		Axis Minimum SWTL [1]
MCC28	N40:24		Axis Maximum SWTL [1]
MCC29	N40:25	10	Axis SWTL Deadband [2]

[1] Measured from Zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Incremental Distance
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

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

Set Up Maximum Pressure Alarms and Time Delays

The QH module continuously monitors its axis pressure input. When it detects that the pressure equals or exceeds a preset pressure alarm setpoint, the QH module sets alarm bit SYS05-B1 (B34/65).

A setpoint of zero disables the alarm.

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

Configure the QH module for the axis pressure alarm as follows:

1. Determine the axis pressure-alarm value.
   - pressure-alarm setpoint
   - time-delay setpoint
2. Record non-zero setpoints on Worksheet 4-F for the pressure alarm and time delay you want to use.
3. Download them to the QH module using the procedures presented earlier in this chapter.

Worksheet 4-F
Pressure-alarm and Time-delay Setpoints

Record Pressure-alarm and Time-delay Values Here ↓

Control Word	Address	Value	Description
MCC35	N40:31		Axis Pressure-alarm Setpoint [2]
MCC36	N40:32		Axis-pressure Time-delay Setpoint [1]

[1] Time
00.00 to 00.99 sec

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

Configure a Digital Filter for the Axis Position Input

You can enable an optional digital filter for your axis position input. Use this filter to reduce electrical noise from a potentiometer-type position sensor or picked up by your input circuit.

To determine if you need a digital filter, move the axis very slowly. Look for erratic position numbers reported in SYS27 with your programming terminal. If erratic signals are absent, omit the filter and skip this section.

If needed, we recommend a filter time constant under 00.10. For example, with an axis velocity of 20"/sec, a 00.01 time constant allows 0.20" of travel before the QH module can react to a travel limit. A time constant of 00.10 allows 2" of travel with an axis velocity of 20"/sec!

⚠ **WARNING:** Increasing the value of the time constant decreases the QH module's capability to respond quickly to travel limits and/or to accurately locate programmed positions. This could result in damaging the press and/or personal injury.

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

Determine the filter time constant (0 - 00.10 sec) by starting with a small value such as 00.01. A value of zero disables the filter. Record your value:

Worksheet 4-G
Time Constants for the Digital Filter

Record Filter Time Constant Here ↓

Control Word	Address	Value	Description
MCC30	N40:26		Time Constant for Axis Position Input [1]

[1] Time
00.00 to 00.99 sec

Download the time constant to the QH module using the procedures presented earlier in this chapter.

Chapter 5

Overview of Remaining Configuration Procedures

Chapter Objectives

This chapter gives you an overview of the remaining configuration procedures necessary to successfully configure your QH module. It is very important that you follow the procedures in the next several chapters in the correct order. Please use this chapter as a guide.

Configuration Concepts

The QH module communicates with your PLC-5 processor through data blocks. Data blocks are groups of 16-bit words stored in the PLC-5 data table. The QH module accesses these areas of PLC-5 data table through the 1771 backplane. There are two types of data blocks:

- **Command Blocks** - are downloaded from the PLC-5 data table to the QH module to make configuration changes or initiate machine actions
- **Status Blocks** - are used by the QH module to relay information to the PLC-5 processor about the QH module's current operating status

The configuration procedures presented in the next several chapters make extensive use of command and status blocks. In each chapter, you will enter important operating data into all applicable command blocks. You will use status blocks as a tool to read machine operating information to assist you in the configuration procedure.

Command Blocks

You configure the QH module with command blocks. They are located in an area of PLC-5 data table that you assign. They contain machine commands, set-up, and operating information for the QH module. On power-up, or when initiated by command, command blocks are downloaded from the PLC-5 data table to the QH module.

There are two types of command blocks, 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 1st extend profile
Profile Blocks	Actual process setpoints necessary to produce a desired part.	Operating setpoints for an axis-extend profile

Status Blocks

The QH module returns critical operating status and values to the PLC-5 data table through status blocks. They contain actual machine status as detected by the QH module and status of the QH module, itself.

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.

Name of Block:	**What it Contains:**	**Examples:**
Module Configuration Block (MCC)	Configuration information for QH module used in all phases of machine operation	Sensor spanning information and global alarm setpoints
Dynamic Command Block (DYC)	Commands the QH module to jog, run, and stop machine phases of operation.	Commands to jog the machine in manual mode, or start a profile
System Status Block (SYS)	Status of QH module and machine operation returned to PLC-5 processor	Actual voltages and engineering units read at QH module inputs

Overview of Procedures

The configuration procedures presented in the next several chapters are outlined below. These procedures are sequential in nature: configuration information that you determine initially is needed in later chapters.

Step:	Task:	Information that You Determine:	Refer to:
1	Jog Your Machine	machine jog pressure and flow setpoints into the Jog Configuration block (JGC) jog pressure alarm setpoints You will jog axis motion with commands in the Dynamic Command Block (DYC) to further refine your jog configuration.	Chapter 6
2	Write a PLC Program to Coordinate Phases	PLC ladder logic required to cycle the machine in the desired manner	Chapter 7
3	Enter Initial Configuration Values	output values to control pressure or flow, valve-spanning values, ramp rates (used in Chapters 9, 10)	Chapter 8
4	Enter Initial Profile Values	initial machine operation setpoints such as pressure, velocity, position, and time setpoints, other part-specific information (used in Chapters 9, 10)	Chapter 9
5	Span your Machine's Valves	modifications to configuration parameters so you can accurately span your axis control valves profile pressure alarms	Chapter 10
6	Tune Your Machine	topics to consider when tuning the machine	Chapter 11

Enter Data Table Values and Download Data Blocks

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

- enter data table values
- download data blocks.

Enter Values into Your PLC-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 data block as specified on individual worksheets.
4. Enter the value for each word and bit.

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

Download Data Blocks

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

Important: The exception to this procedure is the MCC command block that has its own download procedure outlined in chapter 4. The QH module must store a valid MCC block *before* you can use the following procedure.

We define the following data words and functions used in the procedure to download data blocks (other than the MCC command block).

This Word :	At Address:	Provides This Function:
DYC61	N40:173	Requests the QH module to return an error if it finds one in the designated data block. The QH module identifies the error in SYS61 and SYS62.
SYS61	N40:213	The QH 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 QH module reports the error code in this word. The error code relates to the data block whose ID is identified in SYS61.

Follow this download procedure:

1. For the block you want to download (*subject block*), get its ID number from Table 5.A and enter it into DYC61 (N40:173).

Table 5.A
Information Required to Download a Data Block

Subject Block:	Required Companion Block:	Block ID Number	Download Bit B21/
MCC		01	0
JGC		02	1
E1C	EP	03	2
E2C	EP	04	3
E3C	EP	05	4
E4C	EP	06	5
EP		07	6
R1C	RP	17	7
R2C	RP	18	8
R3C	RP	19	9
R4C	RP	20	10
RP		21	11

2. Confirm that the QH module returned the ID in SYS61 (N40:213).

Important: If the value returned in SYS61 is NOT the ID 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 4, Correct Programming Errors in MCC.
25	DYC	Go to steps 8 and 9 of this procedure.

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

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

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

4. Watch the bit you set in step 3 and wait for application ladder logic that we provided to reset it to zero. This indicates the PLC-5 processor has transferred the data block to the QH module.

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

a. If SYS62 (N40:214) equals 0, the QH module detected no errors. Go to step 6.

b. If SYS62 (N40:214) does not equal 0, the QH module detected an error. Go to step 8.

6. Since the QH module did not detect a programming error, check Table 5.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 to download the next block or the 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 QH module detected a programming error. Interpret the error code returned by the QH module in SYS62 (N40:214). The code identifies the first detected programming error in the subject block whose ID is reported in SYS61 (N40:213). Refer to Appendix B for how to interpret and correct the cause of programming errors.

9. Correct the error in 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 will report a value of zero.

Chapter 6

Jog Your Machine

Chapter Objectives

Jogging your machine is similar to operating it in set-output mode: you apply %-output values to QH module outputs to obtain desired axis motion. The jog configuration block (JGC) lets you set up jog parameters to jog the axis in the forward and reverse directions.

This chapter describes how to:

- configure initial jog block values
- test jog values and make changes if necessary

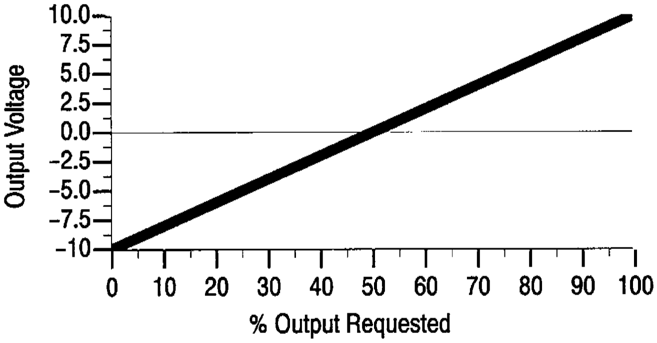
Command and Status Blocks Used

Block:	Type:	Is Used to Do This:
Dynamic (DYC)	Command	Execute jogs
Jog (JGC)	Command	Set jog set-output values and jog alarm setpoints
System (SYS)	Status	View jog alarms Check for command block programming errors

Determine Initial Jog Values

Obtain initial value(s) for minimal axis motion during jogs from chapter 4, section "Use Set-output to Move the Axis". Copy them on Worksheet 6-A for axis extend and retract jogs. Later in this chapter, you will increase initial values to the desired jog values.

WARNING: A value of 0 entered in your data table does not always correspond to zero pressure or flow. For a ± 10V dc range, 50% corresponds to zero volts signal output (see graph). Amplifier electronics or spool offsets may also allow an output for zero signal input. Consult valve and amplifier specifications.



Also record the jog pressure alarm setpoint on Worksheet 6-A. The QH module sets an alarm any time it detects that axis pressure equals or exceeds the alarm setpoint during a jog. A zero entry inhibits the alarm.

Important: The optional high pressure alarm that you set in chapter 4 is also active during jogging.

Worksheet 6-A
Initial Jog Set-output Values

Enter Initial Values Here

Word	Address	Value	Description (footnote = units)
Axis Extend Jog			
JGC33	N40:89		Output #1 %-output Value [2]
JGC34	N40:90		Output #2 %-output Value [2]
JGC35	N40:91		Output #3 %-output Value [2]
JGC36	N40:92		Output #4 %-output Value [2]
Axis Retract Jog			
JGC41	N40:97		Output #1 %-output Value [2]
JGC42	N40:98		Output #2 %-output Value [2]
JGC43	N40:99		Output #3 %-output Value [2]
JGC44	N40:100		Output #4 %-output Value [2]
Axis Jog Pressure Alarm			
JGC07	N40:63		Jog Pressure Alarm Setpoint [1]

Important: In addition to the extend and retract jog values for your axis, you may configure up to three alternate jog setups, such as:

- alternate speeds for your primary axis
- other axes or machine functions

Worksheet 6-A
Initial Jog Set-output Values (continued)

Enter Initial Values Here

Block Word	Address	Value	Description (footnote = units)
Alternate 1 Jog (unidirectional)			
JGC09	N40:65		Output #1 %-output Value [2]
JGC10	N40:66		Output #2 %-output Value
JGC11	N40:67		Output #3 %-output Value
JGC12	N40:68		Output #4 %-output Value
Alternate 2 Extend Jog			
JGC17	N40:73		Output #1 %-output Value [2]
JGC18	N40:74		Output #2 %-output Value
JGC19	N40:75		Output #3 %-output Value
JGC20	N40:76		Output #4 %-output Value
Alternate 2 Retract Jog			
JGC25	N40:81		Output #1 %-output Value [2]
JGC26	N40:82		Output #2 %-output Value
JGC27	N40:83		Output #3 %-output Value
JGC28	N40:84		Output #4 %-output Value
Alternate 3 Extend Jog			
JGC49	N40:105		Output #1 %-output Value [2]
JGC50	N40:106		Output #2 %-output Value
JGC51	N40:107		Output #3 %-output Value
JGC52	N40:108		Output #4 %-output Value
Alternate 3 Retract Jog			
JGC57	N40:113		Output #1 %-output Value [2]
JGC58	N40:114		Output #2 %-output Value
JGC59	N40;115		Output #3 %-output Value
JGC60	N40:116		Output #4 %-output Value

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

[2] % Signal Output
00.00 to 99.99 %

Enter and Download Initial Jog Values

Enter values into PLC-5 data table and download the JGC data block to the QH module with your programming terminal. Use procedures from chapter 5 "Enter Data Table Values and Download Data blocks".

Write Ladder Logic

When writing ladder logic to control jogging, use command and status bits in the following words:

- Dynamic Command block (DYC01) to enable and disable jogs
- System Status block (SYS01) to monitor jogs

The following tables identify jog command and status bits.

Important: Disregard command and status bits you do not need.

Table 6.A
Jog Enable Bits

Command Bit:	Description:	Address:
DYC01-B12	Execute Axis Extend Jog	B34:24-B12
DYC01-B13	Execute Axis Retract Jog	B34:24-B13
DYC01-B09	Execute Alternate 1 Jog	B34:24-B09
DYC01-B10	Execute Alternate 2 Extend Jog	B34:24-B10
DYC01-B11	Execute Alternate 2 Retract Jog	B34:24-B11
DYC01-B14	Execute Alternate 3 Extend Jog	B34:24-B14
DYC01-B15	Execute Alternate 3 Retract Jog	B34:24-B15

Table 6.B
Jog Status Bits

Status Bit:	Description:	Address:
SYS01-B12	Axis Extend Jog in Progress	B34:0-B12
SYS01-B13	Axis Retract Jog in Progress	B34:0-B13
SYS01-B09	Alternate 1 Jog in Progress	B34:0-B09
SYS01-B10	Alternate 2 Extend Jog in Progress	B34:0-B10
SYS01-B11	Alternate 2 Retract Jog in Progress	B34:0-B11
SYS01-B14	Alternate 3 Extend Jog in Progress	B34:0-B14
SYS01-B15	Alternate 3 Retract Jog in Progress	B34:0-B15

Develop ladder logic to control jogging so the PLC-5 processor can:

- monitor switches on your operator control panel
- transfer corresponding command bits to the QH module

We provide a programming example (Figure 6.1) for jog control for instructional purposes only. Your application-specific programming may vary significantly from this example.

Figure 6.1
Example Ladder Logic to Control Jogging

```
Rung 6:0
| EMERGENCY                                                        DYC02/15   |
|   STOP                                                           ********** |
| CONDITION                                                        SOFTWARE   |
|  EXISTS                                                           E-STOP    |
|     B3                                                             B35      |
+----] [--------------------------------------------------------------( )-----+
|       0                                                            415      |
Rung 6:1
|   CYCLE    |          |DIRECTION                                 DYC01/12   |
|  CONTROL   | MANUAL   |SOLENOIDS                                 ********** |
|  SELECTOR  | AXIS JOG |ALIGNED TO                                AXIS JOG   |
|  (A/S/M) IN| EXTEND   |MOVE AXIS                                  EXTEND    |
|  "MANUAL"  | ALLOWED  |FORWARD                                    COMMAND   |
|   I:003      B11        B11                                        B35      |
+----] [--------] [--------] [----------------------------------------( )-----+
|      05         5         11                                       396      |
Rung 6:2
|   CYCLE    |          |DIRECTION                                 DYC01/13   |
|  CONTROL   | MANUAL   |SOLENOIDS                                 ********** |
|  SELECTOR  | AXIS JOG |ALIGNED TO                                AXIS JOG   |
|  (A/S/M) IN| RETRACT  |MOVE AXIS                                  RETRACT   |
|  "MANUAL"  | ALLOWED  |IN REVERSE                                 COMMAND   |
|   I:003      B11        B11                                        B35      |
+----] [--------] [--------] [----------------------------------------( )-----+
|      05         6         12                                       397      |
Rung 6:3
|   CYCLE    | MANUAL   |DIRECTION                                 DYC01/14   |
|  CONTROL   | ALT #3   |SOLENOIDS                                 ********** |
|  SELECTOR  |  JOG     |ALIGNED TO                                ALT #3 JOG |
|  (A/S/M) IN| EXTEND   |ADVANCE                                    EXTEND    |
|  "MANUAL"  | ALLOWED  |ALT #3 JOG                                 COMMAND   |
|   I:003      B11        B11                                        B35      |
+----] [--------] [--------] [----------------------------------------( )-----+
|      05         7         13                                       398      |
Rung 6:4
|   CYCLE    | MANUAL   |DIRECTION                                 DYC01/15   |
|  CONTROL   | ALT #3   |SOLENOIDS                                 ********** |
|  SELECTOR  |  JOG     |ALIGNED TO                                ALT #3 JOG |
|  (A/S/M) IN| RETRACT  |RETRACT                                    RETRACT   |
|  "MANUAL"  | ALLOWED  |ALT #3 JOG                                 COMMAND   |
|   I:003      B11        B11                                        B35      |
+----] [--------] [--------] [----------------------------------------( )-----+
|      05         8         14                                       399      |
```

Important: If necessary, develop ladder logic that changes the direction of travel hydraulically when you command the QH module to jog in reverse.

Jog Your Machine

Jog your axis in both directions. Experiment with the %-output values that you entered in the Jog Configuration block (JGC) until you obtain the desired jog operation.

You must download the JGC block to the QH module each time you change a value so the new value can take effect. Refer to the download procedure outlined in chapter 5.

Adjust jog values as follows:

If You Observe This Condition:	Then Try This Adjustment:
Rough Jerky Acceleration/Deceleration (Hammering hydraulics)	1) Decrease %-output of you pressure valve 2) Decrease %-output of you flow valve
Sluggish Acceleration/Deceleration	1) Boost %-output of your pressure valve

Enter and Download Final Jog Values

Erase initial values and write final values on Worksheet 6-A.

Enter these values into the PLC-5 data table and download the Jog Configuration block (JGC) to the QH module. For the procedures, refer to chapter 5 "Enter Data Table Values and Download Data Blocks".

Chapter 7

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:

- monitor input devices on your Ready Panel or operator station
- step your QH module through machine cycles

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

Important: You must write your own ladder logic for machine sequencing because it depends on your machine's hydraulic configuration and your application. We cannot provide it in the PLC-5 application program that accompanied this manual.

Assess Your Logic Requirements

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

If you need to:	Then add ladder logic to:
Execute extend or retract without interruption	no additional ladder logic required
Stop between successive extend or retract profiles	start the next profile
Jog your machine	respond to jog commands (chapter 5)
Start a profile on command	start the profile

Important: We present command and status bits in this chapter. For your convenience, we provide cross-reference tables 6.F and 6.G for you to tally your data addresses and bit addresses for the QH module. If you need more description of these bits, refer Appendix C.

Use Command and Status Bit Tables

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

Table 7.A
Command and Status Bits for Manual Control

To Initiate this action:	Set this bit:	At Address in File B34/	The QH module sets this status bit during execution:	At Address in File B34/
Alternate #1 Jog	DYC01-B09	393	SYS01-B09	09
Alternate #2 Extend Jog	DYC01-B10	394	SYS01-B10	10
Alternate #3 Retract Jog	DYC01-B11	395	SYS01-B11	11
Axis Extend Jog	DYC01-B12	396	SYS01-B12	12
Axis Retract Jog	DYC01-B13	397	SYS01-B13	13
Alternate #3 Extend Jog	DYC01-B14	398	SYS01-B14	14
Alternate #3 Retract Jog	DYC01-B15	399	SYS01-B15	15
Direct Set-output	DYC01-B08	392	SYS01-B08	08
Stop	DYC02-B15	415	SYS02-B15	31

Table 7.B
Command Bits for Starting Profiles

To initiate this profile:	Toggle this bit DYC02-Bxx:	At Address in File B34/	If this bit is Reset:	At Address in File B37/	The profile in column 1 starts automatically after this profile:
E1	00	400	-		-
E2	01	401	EP03-B08	296	E1
E3	02	402	EP03-B09	297	E2
E4	03	403	EP03-B10	298	E3
R1	10	410	-		-
R2	11	411	RP03-B08	616	R1
R3	12	412	RP03-B09	617	R2
R4	13	413	RP03-B10	618	R3

Table 7.C
Status and Command Bit Interaction for Profile Execution

For this Profile:	During Execution, this bit is:		At Completion, this bit is:		At completion If this command bit is:	Then this status bit is:
	SET	RESET	SET	RESET	also SET	also SET
E1	SYS21-B00	SYS02-B00	SYS02-B00	SYS21-B00	EP03-B08	SYS22-B00
E2	SYS21-B01	SYS02-B01	SYS02-B01	SYS21-B01	EP03-B09	SYS22-B01
E3	SYS21-B02	SYS02-B02	SYS02-B02	SYS21-B02	EP03-B10	SYS22-B02
E4	SYS21-B03	SYS02-B03	SYS02-B03	SYS21-B03	---	SYS22-B03
R1	SYS21-B10	SYS02-B10	SYS02-B10	SYS21-B10	RP03-B08	SYS22-B10
R2	SYS21-B11	SYS02-B11	SYS02-B11	SYS21-B11	RP03-B09	SYS22-B11
R3	SYS21-B12	SYS02-B12	SYS02-B12	SYS21-B12	RP03-B10	SYS22-B12
R4	SYS21-B13	SYS02-B13	SYS02-B13	SYS21-B13	---	SYS22-B13

where:

These Bits	Report These Functions	or Command These Functions
SYS21-B00 thru B03, and B10 thru B13	profile in progress	
SYS02-B00 thru B03, and B10 thru B13	profile complete	
SYS22-B00 thru B03 and B10 thru B13	executing end-of-profile %-outputs	
EP03-B08, B09, B10 and RP03-B08, B09, B10		interrupt movement between profiles (see tables 7.B and 7.D)

Table 7.D
Command Bits to Interrupt Movement Between Profiles

To Perform this Function:	Use This Bit	at Address in File B37/
Start E2 profile @ end of E1 Stop and set-output @ end of E1	EP03-B08 = 0 = 1	296
Start E3 profile @ end of E2 Stop and set-output @ end of E2	EP03-B09 = 0 = 1	297
Start E4 profile @ end of E3 Stop and set-output @ end of E3	EP03-B10 = 0 = 1	298
Start R2 profile @ end of R1 Stop and set-output @ end of R1	RP03-B08 = 0 = 1	616
Start R3 profile @ end of R2 Stop and set-output @ end of R2	RP03-B09 = 0 = 1	617
Start R4 profile @ end of R3 Stop and set-output @ end of R3	RP03-B10 = 0 = 1	618

Table 7.E
Miscellaneous Status Bits That You Can Use to Trigger New Events

Reason for Using:	Bit Description:	QH Module Address	at Address in File B34/
To drop pump adders, or shift solenoids	Axis in protection zone	SYS03-B00	32
To add pump adders, or shift solenoids for tonnage	Axis at safe position	SYS03-B01	33
To begin retract movement	Tonnage complete	SYS03-B02	34
To drop pump adders, or shift solenoids	Axis in R4 zone	SYS03-B06	38
To idle the machine until starting next action	Axis fully retracted	SYS03-B07	39
To prevent starting next cycle when machine is in auto mode	Dwell timer is timing	SYS03-B09	41
To start next cycle with machine in auto mode	Cycle complete	SYS03-B11	43
To detect an axis obstruction during E4	E4 watchdog time-out	SYS04-B03	51

Important: Disregard bits not needed by your application.

Table 7.F
Status Bits

Category:	Bit Status (when = 1):	QH Block Address	at Address in File B34/
Jog Status	executing alternate # 1 jog	SYS01-B09	09
	executing alternate # 2 extend jog	SYS01-B10	10
	executing alternate # 2 retract jog	SYS01-B11	11
	executing axis extend jog	SYS01-B12	12
	executing axis retract jog	SYS01-B13	13
	executing alternate # 3 extend jog	SYS01-B14	14
	executing alternate # 3 retract jog	SYS01-B15	15
Profile Complete	E1 profile complete	SYS02-B00	16
	E2 profile complete	SYS02-B01	17
	E3 profile complete	SYS02-B02	18
	E4 profile complete	SYS02-B03	19
	R1 profile complete	SYS02-B10	26
	R2 profile complete	SYS02-B11	27
	R3 profile complete	SYS02-B12	28
	R4 profile complete	SYS02-B13	29
Busy Status	no action (outputs at zero)	SYS02-B15	31

Category:	Bit Status (when = 1):	QH Block Address	at Address in File B34/
Miscellaneous Status	axis in extend protection zone	SYS03-B00	32
	axis at fully extended position	SYS03-B01	33
	tonnage complete	SYS03-B02	34
	axis in retract protection zone	SYS03-B06	38
	axis fully retracted	SYS03-B07	39
	dwell timer is timing	SYS03-B09	41
	cycle complete	SYS03-B11	43
Watchdog Status	E1 watchdog timed out	SYS04-B00	48
	E2 watchdog timed out	SYS04-B01	49
	E3 watchdog timed out	SYS04-B02	50
	E4 watchdog timed out	SYS04-B03	51
	R1 watchdog timed out	SYS04-B10	58
	R2 watchdog timed out	SYS04-B11	59
	R3 watchdog timed out	SYS04-B12	60
	R4 watchdog timed out	SYS04-B13	61
	tonnage watchdog timed out	SYS04-B15	63
Profile Status	executing E1 profile	SYS21-B00	320
	executing E2 profile	SYS21-B01	321
	executing E3 profile	SYS21-B02	322
	executing E4 profile	SYS21-B03	323
	executing R1 profile	SYS21-B10	330
	executing R2 profile	SYS21-B11	331
	executing R3 profile	SYS21-B12	332
	executing R4 profile	SYS21-B13	333
End-of-profile Set-output Status	executing end-of-E1 set-output	SYS22-B00	336
	executing end-of-E2 set-output	SYS22-B01	337
	executing end-of-E3 set-output	SYS22-B02	338
	executing end-of-E4 set-output	SYS22-B03	339
	executing end-of-R1 set-output	SYS22-B10	346
	executing end-of-R2 set-output	SYS22-B11	347
	executing end-of-R3 set-output	SYS22-B12	348
	executing end-of-R4 set-output	SYS22-B13	349

Table 7.G
Command and Configuration Bits

Operation:	Function Enabled (when = 1):	QH Address	at Address in
Non-profiled Action Commands	execute set-output	DYC01-B08	B34/392
	execute alternate #1 jog	DYC01-B09	B34/393
	execute alternate #2 extend jog	DYC01-B10	B34/394
	execute alternate #2 retract jog	DYC01-B11	B34/395
	execute axis extend jog	DYC01-B12	B34/396
	execute axis retract jog	DYC01-B13	B34/397
	execute alternate #3 extend jog	DYC01-B14	B34/988
	execute alternate #3 retract jog	DYC01-B15	B34/399
Profile Action Commands	execute E1 profile	DYC02-B00	B34/400
	execute E2 profile	DYC02-B01	B34/401
	execute E3 profile	DYC02-B02	B34/402
	execute E4 profile	DYC02-B03	B34/403
	execute R1 profile	DYC02-B10	B34/410
	execute R2 profile	DYC02-B11	B34/411
	execute R3 profile	DYC02-B12	B34/412
	execute R4 profile	DYC02-B13	B34/413
Stop Command	execute all stop (outputs = zero)	DYC02-B15	B34/415
Miscellaneous Commands	reset tonnage watchdog timer	DYC03-B00	B34/416
	reset SYS01-B08	DYC03-B08	B34/424
	reset latched alarms	DYC03-B09	B34/425
	reset complete bits	DYC03-B10	B34/426
Logical Bridge	set-output @ end of E1 profile (0 = start E2 profile)	EP03-B08	B37/296
	set-output @ end of E2 profile (0 = start E3 profile)	EP03-B09	B37/297
	set-output @ end of E3 profile (0 = start E4 profile)	EP03-B10	B37/298
	set-output @ end of R1 profile (0 = start R2 profile)	RP03-B08	B37/616
	set-output @ end of R2 profile (0 = start R3 profile)	RP03-B09	B37/617
	set-output @ end of R3 profile (0 = start R4 profile)	RP03-B10	B37/618
Protection Zones	If an extend profile (E1, E2, or E3) enters the protection zone (EP61): 0 = start the E4 profile 1 = stop and zero outputs	EP03-B11	B37/299
	If a retract profile (R1, R2, or R3) enters the protection zone (RP61) 0 = start the 4R profile 1 = stop and zero outputs	RP03-B11	B37/619

Chapter

8

Load Initial Configuration Values

Chapter Objectives

In this chapter you load the QH module with machine-specific configuration values by performing four tasks:

- Determine initial configuration values from text
- Record them on worksheets
- Enter them into PLC-5 data table
- Download data blocks to the QH module

Initial values that you load include:

- configuration bits
- set-output values
- ramp rates
- velocity or pressure control limits
- velocity or pressure gain constants

Important: Complete all previous chapters before starting this chapter.

Use Configuration Block Worksheets

This chapter walks you through a configuration procedure that uses worksheets. You will fill in your best estimates of initial values, or zero for parameters not used. Obtain information for initial values from:

- this chapter
- word/bit descriptions in appendix C

Important: All initial values must be *zero* except for those:

- we already recorded on worksheets
- you estimate and record on worksheets

The majority of configuration parameters are similar from block to block, so we grouped similar data blocks on common worksheets as follows:

Grouped Data blocks	Worksheet
E1C, E2C, E3C	8A
E4C	8B
R1C, R2C, R3C, **R4C**	8C

Important: For minimum configuration, you must configure *at least* the following profile data blocks: E1C and E4C, R1C and R4C.

Each worksheet has bit entries followed by word entries.
We present all worksheets first, followed by procedures to complete them.

Worksheet 8-A
E1C, E2C, and E3C Configuration Blocks

Word **E1C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Word **E2C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0

Word **E3C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Block Identifier

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Word **E1C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			

Word **E2C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
Value	0	0	0	0	0	0	0	0	1				0			

Word **E3C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
Value	0	0	0	0	0	0	0	0	1				0			

Code:

▨	Address fields
☐	Your required value
0 or 1	Required default value loaded by software

Pressure Control Valve

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

Velocity Control Valve

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

Important: You must configure at least the E1C configuration block.

Worksheet 8-A (continued)
E1C, E2C, and E3C Configuration Blocks

Enter Your Values Here

For these Parameters (footnote = units)	Word	E1C N43:	E1C Value	E2C N43:	E2C Value	E3C N43:	E3C Value
Profile Watchdog Timer Preset [1]	08	04	0	64	0	124	0
Output #1 Selected Valve %-Output During Profile [4]	09	05	*	65	*	125	*
Output #2 Selected Valve %-Output During Profile [4]	10	06	*	66	*	126	*
Output #3 Selected Valve %-Output During Profile [4]	11	07	*	67	*	127	*
Output #4 Selected Valve %-Output During Profile [4]	12	08	*	68	*	128	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	13	0	73	0	133	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	14	0	74	0	134	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	15	0	75	0	135	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	16	0	76	0	136	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	21	0	81	0	141	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	22	0	82	0	142	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	23	0	83	0	143	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	24	0	84	0	144	0
Output #1 End-of-profile Set-output Value [4]	33	29	*	89	*	149	*
Output #2 End-of-profile Set-output Value [4]	34	30	*	90	*	150	*
Output #3 End-of-profile Set-output Value [4]	35	31	*	91	*	151	*
Output #4 End-of-profile Set-output Value [4]	36	32	*	92	*	152	*
Pressure Minimum Control Limit [3]	41	37	0	97	0	157	0
Pressure Maximum Control Limit [3]	42	38	Syst Press	98	Syst Press	158	Syst Press
Selected Pressure Valve Output for Minimum [4]	43	39	*	99	*	159	*
Selected Pressure Valve Output for Maximum [4]	44	40	*	100	*	160	*
Velocity Minimum Control Limit [2]	45	41	0	101	0	161	0
Velocity Maximum Control Limit [2]	46	42	per OEM *	102	per OEM *	162	per OEM *
Selected Velocity Valve Output for Minimum [4]	47	43	*	103	*	163	*
Selected Velocity Valve Output for Maximum [4]	48	44	*	104	*	164	*
Proportional Gain for Pressure Control (none)	49	45	100	105	100	165	100
Integral Gain for Pressure Control [6]	50	46	400	106	400	166	400
Derivative Gain for Pressure Control [7]	51	47	0	107	0	167	0
Proportional Gain for Velocity Control [6]	52	48	200	108	200	168	200
Feed Forward Gain for Velocity Control (none)	53	49	0	109	0	169	0
Profile High Pressure Alarm Setpoint [3]	57	53	0	113	0	173	0

[1] Time
00.00 to 99.99 Seconds

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

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

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

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

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

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

Worksheet 8-B
E4C Configuration Block

Word **E4C01** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0

Important:
Verify the block identifier.

Block Identifier

Word **E4C02** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

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

Code:

▨	Address field
☐	Your required value
0 or 1	Required default value loaded by software

Important: You must configure the E4C configuration block.

Worksheet 8-B (continued)
E4C Configuration Block

Enter Your Values Here

For these Parameters (footnote = units)	**Word**	**E4C N43:**	**E4C Value**
Tonnage Watchdog Timer Preset [1]	07	183	0
Profile Watchdog Timer Preset [1]	08	184	0
#1 Selected Valve Set-Output During Profile [4]	09	185	*
#2 Selected Valve Set-Output During Profile [4]	10	186	*
#3 Selected Valve Set-Output During Profile [4]	11	187	*
#4 Selected Valve Set-Output During Profile [4]	12	188	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	193	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	194	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	195	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	196	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	201	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	202	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	203	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	204	0
#1 End-of-profile Set-output Value [4]	33	209	*
#2 End-of-profile Set-output Value [4]	34	210	*
#3 End-of-profile Set-output Value [4]	35	211	*
#4 End-of-profile Set-output Value [4]	36	212	*
Pressure Minimum Control Limit [3]	41	217	0
Pressure Maximum Control Limit [3]	42	218	System Pressure
Selected Pressure Valve Output for Minimum [4]	43	219	*
Selected Pressure Valve Output for Maximum [4]	44	220	*
Proportional Gain for Pressure Control (none)	49	225	100
Integral Gain for Pressure Control [6]	50	226	400
Derivative Gain for Pressure Control [7]	51	227	0
Profile High Pressure Alarm Setpoint [3]	57	233	0

[1] Time
00.00 to 99.99 Sec

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

[3] Percent Signal Output
00.00 to 99.99

[4] Percent Signal Output per Sec
0000 to 9999

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

[6] Time (Algorithm)
00.00 to 99.99 Minutes

[7] Percent
00.00 to 99.99

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

Worksheet 8-C
R1C, R2C, R3C, and R4C Configuration Blocks

Word **R1C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	335	334	333	332	331	330	329	328	327	326	325	324	323	322	321	320
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Word **R2C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0

Word **R3C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	463	362	461	460	459	458	457	456	455	454	453	452	451	450	449	448
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1

Word **R4C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	527	526	525	524	523	522	521	520	519	518	517	516	515	514	513	512
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0

Block Identifier

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Word **R1C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336
Value	0	0	0	0	0	0	0	0	1				0			

Word **R2C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400
Value	0	0	0	0	0	0	0	0	1				0			

Word **R3C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	479	478	477	476	475	474	473	472	471	470	469	468	467	466	465	464
Value	0	0	0	0	0	0	0	0	1				0			

Word **R4C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528
Value	0	0	0	0	0	0	0	0	1				0			

Code:

▨ Address field
☐ Your required value
0 or 1 Required default value loaded by software

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

Velocity Control Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Important: You must configure at least the R1C and R4C configuration blocks.

Worksheet 8-C (continued)
R1C, R2C, R3C, and R4C Configuration Blocks

Enter Your Values Here

For these Parameters (footnote = units)	Word	R1C N43:	R1C Value	R2C N43:	R2C Value	R3C N43:	R3C Value	R4C N43:	R4C Value
Profile Watchdog Timer Preset [1]	08	304	0	364	0	424	0	484	0
#1 Selected Valve Set-Output During Profile [4]	09	305	*	365	*	425	*	485	*
#2 Selected Valve Set-Output During Profile [4]	10	306	*	366	*	426	*	486	*
#3 Selected Valve Set-Output During Profile [4]	11	307	*	367	*	427	*	487	*
#4 Selected Valve Set-Output During Profile [4]	12	308	*	368	*	428	*	488	*
Output #1 Accel Ramp Rate During Profile [5]	17	313	0	373	0	433	0	493	0
Output #2 Accel Ramp Rate During Profile [5]	18	314	0	374	0	434	0	494	0
Output #3 Accel Ramp Rate During Profile [5]	19	315	0	375	0	435	0	495	0
Output #4 Accel Ramp Rate During Profile [5]	20	316	0	376	0	436	0	496	0
Output #1 Decel Ramp Rate During Profile [5]	25	321	0	381	0	441	0	501	0
Output #2 Decel Ramp Rate During Profile [5]	26	322	0	382	0	442	0	502	0
Output #3 Decel Ramp Rate During Profile [5]	27	323	0	383	0	443	0	503	0
Output #4 Decel Ramp Rate During Profile [5]	28	324	0	384	0	444	0	504	0
#1 End-of-profile Set-output Value [4]	33	329	*	389	*	449	*	509	*
#2 End-of-profile Set-output Value [4]	34	330	*	390	*	450	*	510	*
#3 End-of-profile Set-output Value [4]	35	331	*	391	*	451	*	511	*
#4 End-of-profile Set-output Value [4]	36	332	*	392	*	452	*	512	*
Pressure Minimum Control Limit [3]	41	337	0	397	0	457	0	517	0
Pressure Maximum Control Limit [3]	42	338	Syst Press	398	Syst Press	458	Syst Press	518	Syst Press
Selected Pressure Valve Output for Min [4]	43	339	*	399	*	459	*	519	*
Selected Pressure Valve Output for Max [4]	44	340	*	400	*	460	*	520	*
Velocity Minimum Control Limit [2]	45	341	0	401	0	461	0	521	0
Velocity Maximum Control Limit [2]	46	342	per OEM *	402	per OEM *	462	per OEM *	522	per OEM *
Selected Velocity Valve Output for Min [4]	47	343	*	403	*	463	*	523	*
Selected Velocity Valve Output for Max [4]	48	344	*	404	*	464	*	524	*
Proportional Gain for Pressure Control (none)	49	345	100	405	100	465	100	525	100
Integral Gain for Pressure Control [6]	50	346	400	406	400	466	400	526	400
Derivative Gain for Pressure Control [7]	51	347	0	407	0	467	0	527	0
Proportional Gain for Velocity Control [6]	52	348	200	408	200	468	200	528	200
Feed Forward Gain for Velocity Control (none)	53	349	0	409	0	469	0	529	0
Profile High Pressure Alarm Setpoint [3]	57	353	0	413	0	473	0	533	0

[1] Time
00.00 to 99.99 Seconds

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

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

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

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

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

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

Procedure to Determine and Record Initial Values

Follow this procedure to complete each worksheet:

1. Decide which profiles to use from: E1, E2, E3, E4, R1, R2, R3, R4.
2. Read the text for the subject parameter.
3. Determine your initial value.

Important: If you need additional information to determine initial values, refer to the word/bit definitions in appendix C.

4. Locate each worksheet that requires the subject parameter.
5. Record the value on corresponding lines on the worksheets.

Important: Block identifier codes are already recorded for you.

Determine Bit Selections: Assign Module Outputs for Control Valves

Block Identifier
(E1C01, E2C01, E3C01, E4C01, R1C01, R2C01, R3C01, R4C01 Bits 07 thru 00)

Bits 07-00 of the first word in configuration data blocks identify the data block to the QH module. The PLC-5 application program that we provide sets these bits in PLC-5 data table to the same states as we recorded for you in Worksheets 8-A thru 8-C.

Selected Velocity Control Valve
(E1C02, E2C02, E3C02, R1C02, R2C02, R3C02, R4C02 Bits 02, 01, 00)

The QH module can control axis movement using a velocity vs. position algorithm. Since you can connect up to four valves to your QH module, you must tell it which one of its four valves to use for velocity control with this algorithm.

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

From the table, record the appropriate bit selections on the bit-select page of all three worksheets depending on your valve configuration.

Selected Pressure Control Valve

(E1C02, E2C02, E3C02, E4C02, R1C02, R2C02, R3C02, R4C02 Bits 06, 05, 04)

The QH module also controls axis movement with a pressure vs. position algorithm. The R4 profile must use this algorithm. Again, you must tell the QH module which valve to use for pressure control with this algorithm.

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

From the table, record the appropriate bit selections on the bit-select page of all three worksheets depending on your valve configuration.

Determine Word Values: Assign Set-output Values

Unselected Valve Set-output Values

(E1C09-12, E2C09-12, E3C09-12, E4C09-12, R1C09-12, R2C09-12, R3C09-12, R4C09-12)

With worksheet bit selections, you told the QH module which of its four outputs would control pressure and flow profiles. Your machine hydraulics may require that the remaining valves connected to your QH module assume a certain state during control.

Words 09-12 of the respective configuration blocks define these set-output values. The QH module sets its outputs for all unselected valves to the values in these words each time it starts the corresponding profile.

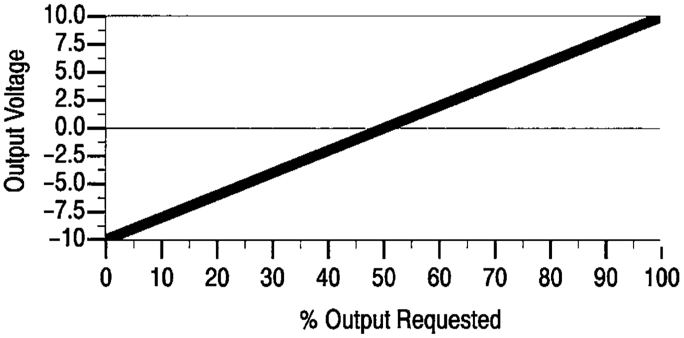
Table 8.A presents example setpoints for your unselected valves.

Table 8.A
Unselected Valve Setpoints

If the unselected valve controls:	And the unselected valve configuration is:	And during the profile the valve is:	And you require during the profile:	Then Record:
Pressure	Uni-directional	Direct acting	Maximum Pressure	9999
Pressure	Uni-directional	Direct acting	Medium Pressure	7500 to 5000
Pressure	Uni-directional	Direct acting	Low Pressure	5000 to 2500
Pressure	Uni-directional	Direct acting	Minimum Pressure	0
Pressure	Uni-directional	Reverse acting	Maximum Pressure	0
Pressure	Uni-directional	Reverse acting	Medium Pressure	2500 to 5000
Pressure	Uni-directional	Reverse acting	Low Pressure	5000 to 7500
Pressure	Uni-directional	Reverse acting	Minimum Pressure	9999

If the unselected valve controls:	And the unselected valve configuration is:	And during the profile the valve is:	And you require during the profile:	Then Record:
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

⚠ **WARNING:** A set-output value of 0% does not always correspond to zero pressure or flow. If you configured for bi-directional valve operation, an output of 0% gives –10V dc, 50% gives 0V dc (see graph). Amplifier electronics or spool-null offsets may also allow pressure or flow at zero signal input. Consult your valve and amplifier specifications.



Record %-output values for all set-outputs required to drive the unselected valves similar to how they are set during a normal production run. Record them for words 9-12 on the word-parameter page of all three worksheets.

Important: The QH module ignores the unselected valve set-output value associated with the "selected" profile valve. The selected valve output overrides the unselected valve set-output value.

End-of-profile Set-output Values
(E1C33-36, E2C33-36, E3C33-36, E4C33-36, R1C33-36, R2C33-36, R3C33-36, R4C33-36)

The QH module sets its outputs to these set-output values every time it completes the appropriate profile, when *not* configured to "bridge" to the next logical profile. These outputs remain in effect until the next logical profile begins or the module is stopped using DYC02-B15. Ramp rates (if used) control ramping to these set-output values.

Record values for all end-of-profile set-outputs that correspond to zero pressure or flow. Record them for words 33-36 on all three worksheets.

Set Pressure Control Limits

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

Important: If you have data on spanning the valve's working range from the manufacturer, record these values as instructed below.

Minimum Pressure Control Limit
(E1C41, E2C41, E3C41, E4C41, R1C41, R2C41, R3C41, R4C41)

The value in this word is the minimum controllable pressure during the respective profile. The QH module uses this word with word 43, Selected Pressure Valve, Output for Minimum, and expects this pressure when setting the selected pressure valve to the %-output entered in word 43.

We recorded 0 for word 41 on all three worksheets.

Maximum Pressure Control Limit
(E1C42, E2C42, E3C42, E4C42, R1C42, R2C42, R3C42, R4C42)

The value in this word is the maximum controllable pressure during the respective profile. The QH module uses this word with word 44, Selected Pressure Valve, Output for Maximum, and expects this pressure when setting the selected pressure valve to the %-output you enter in word 44.

Determine a value for word 42 equal to the maximum pressure available through the selected pressure control valve for each profile you are using. Record the value for word 42 for profiles used on all three worksheets.

Selected Pressure Valve, Output for Minimum

(E1C43, E2C43, E3C43, E4C43, R1C43, R2C43, R3C43, R4C43)

The QH module uses this word with word 41, Minimum Pressure Control Limit to drive the selected pressure valve to minimum pressure during any pressure vs. position profile. The QH module expects a pressure equal to word 41 when setting the selected pressure valve to this percentage output.

If your selected pressure valve is:	Then the value in word 43 should be:	And during the profile, the QH module never outputs a value:
Direct Acting	less than the value in word 44	less than word 43
Reverse Acting	greater than the value in word 44	greater than word 43

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

Determine the %-signal output for word 43 for each profile used. Record it for profiles used on all three worksheets.

Selected Pressure Valve Output for Maximum

(E1C44, E2C44, E3C44, E4C44, R1C44, R2C44, R3C44, R4C44)

The QH module uses this word with word 42, Maximum Pressure Control Limit to drive the selected pressure valve to maximum pressure during any pressure vs. position profile. The QH module expects a pressure equal to word 42 when setting the selected pressure valve to this percentage output.

If your selected pressure valve is:	Then the value in word 44 should be:	And during the profile, the QH module never outputs a value:
Direct Acting	greater than the value in word 43	greater than word 44
Reverse Acting	less than the value in word 43	less than word 44

Determine Output for Maximum values as follows:

- 9999 (100%) for uni-directional direct acting valves
- 0 (0%) or 9999 (100%) for bi-directional valves (dependant upon desired direction of motion)
- 0 (0%) for uni-directional reverse acting valves

Determine the %-signal output for word 44 for each profile used. Record it for profiles used on all three worksheets.

Set Velocity Control Limits

Use control limits to span your selected valve outputs for effective control.

Important: If you have data on spanning the valve's working range from the manufacturer, record these values as instructed below.

Minimum Velocity Control Limit
(E1C45, E2C45, E3C45, R4C45, R2C45, R3C45, R4C45)

The value in this word is the minimum controllable velocity during the respective profile. The QH module uses this word with word 47, Selected Velocity Valve, Output for Minimum. The QH module expects this velocity when setting the selected velocity valve to the %-output in word 47.

We recorded a value of zero for word 45 on Worksheets 8-A and 8-C.

Maximum Velocity Control Limit
(E1C46, E2C46, E3C46, R1C46, R2C46, R3C46, R4C46)

The value in this word is the maximum controllable velocity during the respective profile. The QH module uses it with word 48, Selected Velocity Valve, Output for Maximum. The QH module expects this velocity when setting the selected velocity valve to the %-output in word 48.

Record a value for word 46 equal to the maximum cylinder speed per your OEM specifications for each profile used on Worksheets 8-A and 8-C.

Selected Velocity Valve, Output for Minimum
(E1C47, E2C47, E3C47, R1C47, R2C47, R3C47, R4C47)

The QH module uses this word with word 45, Minimum Velocity Control Limit to drive the selected velocity valve to minimum velocity during any velocity vs. position profile. The QH module expects a velocity equal to word 45 when setting the selected velocity valve to this percentage output.

If your selected velocity valve is:	Then the value in word 47 should be:	And during the profile, the QH module never outputs a value:
Direct Acting	less than the value in word 48	less than word 47
Reverse Acting	greater than the value in word 48	greater than word 47

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

Determine the %-signal output for word 47 for each profile used. Record it for profiles used on all three worksheets.

Selected Velocity Valve, Output for Maximum

(E1C48, E2C48, E3C48, R1C48, R2C48, R3C48, R4C48)

The QH module uses this word with word 46, Maximum Velocity Control Limit, to drive the selected velocity valve to maximum velocity during any velocity vs. position profile. The QH module expects a velocity equal to word 46 when setting the selected velocity valve to this %-output.

If your selected velocity valve is:	Then the value in word 48 should be:	And during the profile, the QH module never outputs a value:
Direct Acting	greater than the value in word 47	greater than word 48
Reverse Acting	less than the value in word 47	less than word 48

Determine Output for Maximum values as follows:

- 9999 (100%) for uni-directional direct acting valves
- 0 (0%) or 9999 (100%) for bi-directional valves(dependant upon desired direction of motion)
- 0 (0%) for uni-directional reverse acting valves

Determine the %-signal output for word 48 for each profile used. Record it for profiles used on all three worksheets.

Profile Tuning Constants

(E1C49-53, E2C49-53, E3C49-53, E4C49-51, R1C49-53, R2C49-53, R3C49-53, R4C49-53)

The QH module's PID and velocity feedforward (VelFF) algorithms are different from classic PID and VelFF algorithms. The algorithm gain constants are typically lower than those used to control a traditional process that reacts to setpoints changes.

Use the default values we recorded on all three worksheets.

Enter and Download your Worksheet Values

Once you have recorded initial values on configuration worksheets, you are ready to proceed.

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

Important: Check that you entered each and every setpoint value exactly as it appeared on the worksheets.

2. Use the procedure in chapter 5 to download data blocks to the QH module. For your convenience, we repeat the table of download information from chapter 5.

Table 8.A
Information Required to Download a Data Block

Subject Block:	Block ID	Download Bit B21/Bit
E1C	03	02
E2C	04	03
E3C	05	04
E4C	06	05
EP	07	06
R1C	17	07
R2C	18	08
R3C	19	09
R4C	20	10
RP	21	11

Important: Do NOT download companion blocks at this time because the QH module will report errors when it detects they lack data. You will load companion blocks with initial setpoints in the next chapter.

Chapter 9

Load Initial Profile Setpoints

Chapter Objectives

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

- determine initial profile setpoints from text
- record them on worksheets
- enter them into PLC-5 data table
- download data blocks to the QH module

Initial profile setpoints that you load include:

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

Important: Complete all previous chapters before starting this chapter.

Use These Worksheets

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

To load the QH module with this profile block	See this Worksheet	On Page
Extend Profile (EP)	Worksheet 9-A	9-2
Retract Profile (RP)	Worksheet 9-B	9-9

Take a moment now to browse through the first worksheet. As in chapter 8, worksheets contain two parts:

- control words for setting bits
- data words for recording initial profile setpoints

Notice that many setpoints repeat within the profile block. For example, you can record up to 11 velocity setpoints on one worksheet.

We present each worksheet followed by text telling you how to determine initial values. For additional word/bit descriptions, refer to appendix C if necessary. Complete one worksheet before going to the next. This differs from the procedure in chapter 8.

Determine and Record Setpoints for the Extend Profile (EP)

The following two pages contain Worksheet 9-A for the extend profile (one page for bit entries and one page for word entries). The valve spanning procedures in chapter 10 require specific setpoints. We have already recorded many setpoints for you. You must complete the worksheet by recording setpoints for minimum profiles.

Important:

- You record setpoints for pressure vs. position and velocity vs. position profiles. We assist you in determining values.
- As a minimum, you must record setpoints for at least one segment in each profile.

Worksheet 9-A
Extend Profile Block (EP)

Word **EP01** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1

Block Identifier

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Word **EP03** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288
Value	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1

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

Protection Zone
0 = Start E4 on Reaching EP61
1 = Stop and Zero Outputs on Reaching EP61

E3 E2 E1

Logical Bridge
0 = Start Next Profile at End of Profile
1 = Stop and Set Output at End of Profile

E3 E2 E1

Algorithm
0 = Vel/Pos
1 = Press/Pos

Word **EP04** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304
Value	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1

Open/Closed-Loop
0 = Closed-Loop
1 = Open-Loop
bit 07 = Press/Pos E4
bit 05 = Press/Pos E3
bit 04 = Vel/Pos E3
bit 03 = Press/Pos E2
bit 02 = Vel/Pos E2
bit 01 = Press/Pos E1
bit 00 = Vel/Pos E1

Code:

▨ Address field

☐ Your required value

0 or 1 Required default value loaded by software

Worksheet 9-A (continued)
Extend Profile Block (EP)

Record Your Setpoints Here

For These Setpoints (footnote = units)	In Word	At Address N43:	Your Setpoints
E1 Segment 1 Velocity Setpoint [1, 2]	EP09	245	*
E1 Segment 1 Pressure Setpoint [3]	EP10	246	*
E1 End-of-segment 1 Position Setpoint [4]	EP11	247	*
E1 Segment 2 Velocity Setpoint [1, 2]	EP12	248	*
E1 Segment 2 Pressure Setpoint [3]	EP13	249	*
E1 End-of-segment 2 Position Setpoint [4]	EP14	250	*
E1 Segment 3 Velocity Setpoint [1, 2]	EP15	251	*
E1 Segment 3 Pressure Setpoint [3]	EP16	252	*
E1 End-of-segment 3 Position Setpoint [4]	EP17	253	*
E2 Segment 1 Velocity Setpoint [1, 2]	EP18	254	0
E2 Segment 1 Pressure Setpoint [3]	EP19	255	0
E2 End-of-segment 1 Position Setpoint [4]	EP20	256	0
E2 Segment 2 Velocity Setpoint [1, 2]	EP21	257	0
E2 Segment 2 Pressure Setpoint [3]	EP22	258	0
E2 End-of-segment 2 Position Setpoint [4]	EP23	259	0
E2 Segment 3 Velocity Setpoint [1, 2]	EP24	260	0
E2 Segment 3 Pressure Setpoint [3]	EP25	261	0
E2 End-of-segment 3 Position Setpoint [4]	EP26	262	0
E3 Segment 1 Velocity Setpoint [1, 2]	EP27	263	0
E3 Segment 1 Pressure Setpoint [3]	EP28	264	0
E3 End-of-segment 1 Position Setpoint [4]	EP29	265	0
E3 Segment 2 Velocity Setpoint [1, 2]	EP30	266	0
E3 Segment 2 Pressure Setpoint [3]	EP31	267	0
E3 End-of-segment 2 Position Setpoint [4]	EP32	268	0
E3 Segment 3 Velocity Setpoint [1, 2]	EP33	269	0
E3 Segment 3 Pressure Setpoint [3]	EP34	270	0
E3 End-of-segment 3 Position Setpoint [4]	EP35	271	0
E4 Segment 1 Pressure Setpoint [3]	EP37	273	*
E4 End-of-segment 1 Position Setpoint [4]	EP38	274	0
E4 Segment 2 Pressure Setpoint [3]	EP40	276	0
Start Extend Protection Zone Position Setpoint [4]	EP61	297	*
Fully Extended Position Setpoint [4]	EP62	298	*
Tonnage Complete Pressure Setpoint [3]	EP63	299	0

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 In per Sec
000.0 to 999.9 Mm per Sec

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

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

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

Determine Bit Selections for Worksheet 9-A

Block Identifier
(EP01-B07 thru 00)

Bits 07-00 of the first word in the extend profile block identify the profile to the QH module. The PLC-5 application program that we provide sets these bits in PLC-5 data table to the same states as we recorded for you in Worksheets 9-A. Verify that this value is 00000111.

Velocity Units
(EP03-B14)

The following bit determines units of measure for velocity setpoints.

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

  0 = Percent velocity
  1 = Inches or millimeters per second

  We set this bit to 1 for units per second on Worksheet 9-A.

Extend Protection Zone
(EP03-B11)

The following bit controls the QH module's reaction if it moves the axis into the protection zone while executing the E1, E2 or E3 profile.

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

  0 = Start executing E4 if the axis reaches EP61
  1 = Stop and zero outputs if the axis reaches EP61

  We set this bit to 0 for start executing E4 on Worksheet 9-A.

Logical Bridges
(EP03-B10 thru 08)

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

- **BIT 10** controls action at end of E3.
- **BIT 09** controls action at end of E2.
- **BIT 08** controls action at end of E1.

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

  We set these bits to 0 for start next profile on Worksheet 9-A.

Profile Algorithm
(EP03-B04, B02, B00)

The following bits determine the algorithm for each extend profile.

- **BIT 04** configures E3
- **BIT 02** configures E2
- **BIT 00** configures E1

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

We set these bits to 1 for pressure vs. position on Worksheet 9-A.

Important: All other bit selections in EP03 should be zero.

Open-loop or Closed-loop Control
(EP04-B07 and B05 thru B00)

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

0 = Closed loop
1 = Open loop

We set these bits to 1 for open-loop control on Worksheet 9-A.

Important: All other bit selections in EP04 should be zero.

The valve spanning procedures in chapter 10 require these initial bit settings. Where required, we help you select correct final bit settings for your application in chapter 11. For additional information, refer to Appendix C .

Determine Word Values for Worksheet 9-A

Velocity Setpoints
(EP09, 12, 15, 18, 21, 24, 27, 30, 33)

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

Select setpoints for E1 segments 1-3 that are typical of velocities you would run during normal machine operation.

Record these setpoints for EP09, 12, and 15 of Worksheet 9-A.
We recorded zero for the remaining velocity setpoints.

Pressure Setpoints
(EP10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40)

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

For EP10, 13, 16, and 37 (for E1, E2, E3, and E4), record pressure setpoints typical of machine operation.

We recorded zero for the remaining pressure setpoints in Worksheet 9-A.

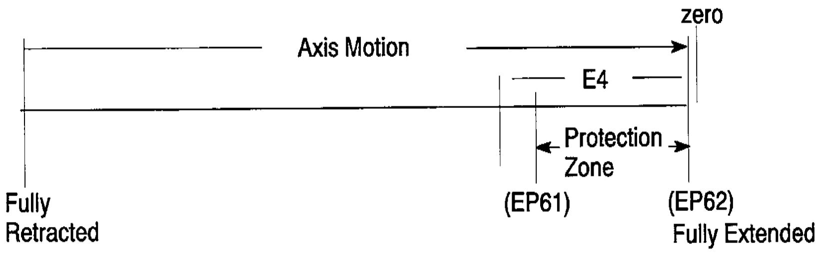
Fully Extended Position (End-of-E4)
(EP62)

The QH module uses the axis fully extended setpoint (EP62) as the end of E4 profile setpoint. When the axis reaches this position during the E4 profile, the QH module immediately terminates the profile and sets its outputs to the values you entered in E4C33-36 to apply tonnage.

To determine EP62, we recommend you jog your axis until the cylinder is fully extended and observe the value in SYS27.

Record this value for EP62 on Worksheet 9-A.

Figure 9.1
Example Setpoints for E4 and Protection Zone



Start Extend Protection Zone
(EP61)

The QH module uses this position to guard against extending the axis too far. If the axis reaches this position during the E1, E2, or E3 profile, the QH module immediately stops the ongoing profile and either:

- begins the E4 profile
- sets its outputs to zero (depending on EP03-B11, the protection zone bit)

Important: If the QH module detects that the axis entered the protection zone (starting at EP61) *after* starting the E4 profile, it disregards the function of this setpoint because its safety feature is no longer necessary.

We recommend an initial value larger than typically used for machine operation, and a safe distance from the fully extended position (EP62).

Record a value for EP61 on Worksheet 9-A .

End-of-segment Position Setpoint
(EP11, 14, 17, 20, 23, 26, 29, 32, 35, 38)

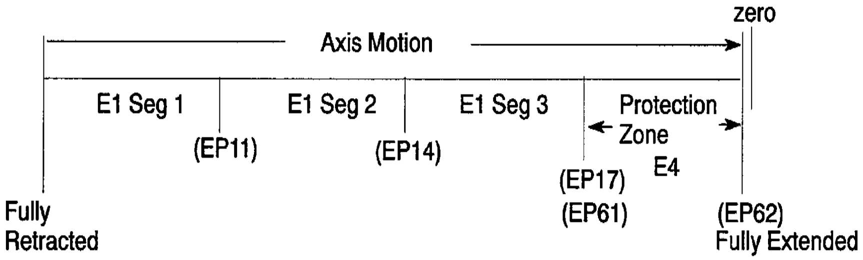
Configure only the first three segments.

Determine end-of-segment position setpoints, measured from zero, for E1 as follows:

1. Jog the axis to its full retracted position and read the value in SYS27.
2. Subtract the value you entered for start-E4 position setpoint (EP61) from SYS27.
3. Divide this difference into three equal segments. Record the dividing lines between segments as the end-of-segment position setpoints for segments 1, 2, and 3.

Important: If EP17 = EP61, then the protection zone and the E4 profile are the same.

Figure 9.2
Example Setpoints for an Extend Profile



4. Record your E1-end-of-segment position setpoints for EP11, EP14, and EP17 on Worksheet 9-A.

We recorded zero for the remaining position setpoints on Worksheet 9-A.

Enter and Download Your Worksheet Values

After you determine initial values and record them on Worksheet 9-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 in chapter 5 to download data blocks.
3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Determine and Record Setpoints for the Retract Profile (RP)

The following two pages contain Worksheet 9-B for the retract profile (one page for bit entries and one for word entries). The valve spanning procedure in chapter 10 requires specific setpoints. We have already recorded many setpoints for you. You must complete the worksheet by recording setpoints for minimum profiles.

Important:

- You record setpoints for pressure vs. position and velocity vs. position profiles. We assist you in determining values.
- As a minimum, you must record setpoints for at least one segment in each profile.

Worksheet 9-B
Retract Profile Block (RP)

Word **RP01** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	591	590	589	588	587	586	585	584	583	582	581	580	579	578	577	576
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1

Block Identifier

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Word **RP03** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	623	622	621	620	619	618	617	616	615	614	613	612	611	610	609	608
Value	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	1

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

R3 R2 R1

Logical Bridge
0 = Start Next Profile
1 = Stop and Set Output

Protection Zone
0 = Start R4 Profile on Reaching RP61
1 = Stop and Zero Outputs on Reaching RP61

R4 R3 R2 R1

Algorithm
0 = Vel/Pos
1 = Press/Pos

Word **RP04** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	639	638	637	636	635	634	633	632	621	630	629	628	627	626	625	624
Value	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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

bit 07 = Press/Pos R4
bit 06 = Vel/Pos R4
bit 05 = Press/Pos R3
bit 04 = Vel/Pos R3
bit 03 = Press/Pos R2
bit 02 = Vel/Pos R2
bit 01 = Press/Pos R1
bit 00 = Vel/Pos R1

Code:

▨	Address field
☐	Your required value
0 or 1	Required default value loaded by software

Worksheet 9-B (continued)
Retract Profile Block (RP)

Record Your Setpoints Here

Description	Word	At Address N43:	Your Setpoints
1R Segment 1 Velocity Setpoint	RP09	545	*
1R Segment 1 Pressure Setpoint	RP10	546	*
1R End-of-segment 1 Position Setpoint	RP11	547	*
1R Segment 2 Velocity Setpoint	RP12	548	*
1R Segment 2 Pressure Setpoint	RP13	549	*
1R End-of-segment 2 Position Setpoint	RP14	550	*
1R Segment 3 Velocity Setpoint	RP15	551	*
1R Segment 3 Pressure Setpoint	RP16	552	*
1R End-of-segment 3 Position Setpoint	RP17	553	*
2R Segment 1 Velocity Setpoint	RP18	554	0
2R Segment 1 Pressure Setpoint	RP19	555	0
2R End-of-segment 1 Position Setpoint	RP20	556	0
2R Segment 2 Velocity Setpoint	RP21	557	0
2R Segment 2 Pressure Setpoint	RP22	558	0
2R End-of-segment 2 Position Setpoint	RP23	559	0
2R Segment 3 Velocity Setpoint	RP24	560	0
2R Segment 3 Pressure Setpoint	RP25	561	0
2R End-of-segment 3 Position Setpoint	RP26	562	0
3R Segment 1 Velocity Setpoint	RP27	563	0
3R Segment 1 Pressure Setpoint	RP28	564	0
3R End-of-segment 1 Position Setpoint	RP29	565	0
3R Segment 2 Velocity Setpoint	RP30	566	0
3R Segment 2 Pressure Setpoint	RP31	567	0
3R End-of-segment 2 Position Setpoint	RP32	568	0
3R Segment 3 Velocity Setpoint	RP33	569	0
3R Segment 3 Pressure Setpoint	RP34	570	0
3R End-of-segment 3 Position Setpoint	RP35	571	0
4R Segment 1 Velocity Setpoint	RP36	572	*
4R Segment 1 Pressure Setpoint	RP37	573	*
4R End-of-segment 1 Position Setpoint	RP38	574	0
4R Segment 2 Velocity Setpoint	RP39	575	0
4R Segment 2 Pressure Setpoint	RP40	576	0
Start Retract Protection Zone Position Setpoint	RP61	597	*
Fully Retracted Position Setpoint	RP62	598	*
Dwell Timer Preset	RP63	599	0

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 in per sec
000.0 to 999.9 mm per sec

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

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

[5] Time
00.00 to 99.99 seconds

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

Determine Bit Selections for Worksheet 9-B

Block Identifier
(RP01-B07 thru 00)

Bits 07-00 of the first word in the retract profile block identify the profile to the QH module. The PLC-5 application program that we provide sets these bits in PLC-5 data table to the same states as we recorded for you in Worksheets 9-B. Verify that the value is 00010101.

Velocity Units
(RP03-B14)

The following bit determines units of measure for velocity setpoints.

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

0 = Percent Velocity
1 = Inches or Millimeters per second

We set this bit to 1 for units per second on Worksheet 9-B.

Retract Protection Zone
(RP03-B11)

The following bit controls the QH module's reaction if it moves the axis into the 4R zone while executing the R1, R2 or R3 profile.

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

0 = Start executing R4 if the axis reaches RP61
1 = Stop and zero outputs if the axis reaches RP61

We set this bit to 0 for start executing R4 on Worksheet 9-B.

Logical Bridges
(RP03-B10 thru 08)

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

- **BIT 10** controls action at end of R3
- **BIT 09** controls action at end of R2
- **BIT 08** controls action at end of R1

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

We set these bits to 0 for start next profile on Worksheet 9-B.

Profile Algorithm
(RP03-B06, 04, 02, 00)

The following bits determine the algorithm for each retract profile.

- **BIT 06** configures the R4 profile
- **BIT 04** configures the R3 profile
- **BIT 02** configures the R2 profile
- **BIT 00** configures the R1 profile

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

We set these bits to 1 for pressure vs. position on Worksheet 9-B.

Important: All other bit selections in RP03 should be zero.

Open-loop or Closed-loop Control
(RP04-B07, and 06 thru 00)

- **BITs 07, 06, 05, 04, 03, 02, 01, and 00** determine whether you use open- or closed-loop control of retract profiles. In open loop, a valve position moves the cylinder without sensor feedback. In closed loop, sensor feedback controls the valve regulating pressure or flow.

0 = Closed loop
1 = Open loop

We set these bits to 1 for open-loop control on Worksheet 9-B.

Important: All other bit selections in RP03 should be zero.

Determine Word Values for Worksheet 9-B

Velocity Setpoints
(RP09, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39)

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

Select setpoints for R1 segments 1-3 and R4 segment 1, typical of velocities you would run during normal machine operation.

Record these setpoints for RP09, 12, 15, and 36 on Worksheet 9-B.
We set the remaining velocity setpoints to zero.

Pressure Setpoints
(RP10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40)

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

For RP10, 13, 16 (R1 profile) and RP37 (R4 profile), record pressure setpoints typical of machine operation.

We recorded zero for the remaining pressure setpoints on Worksheet 9-B.

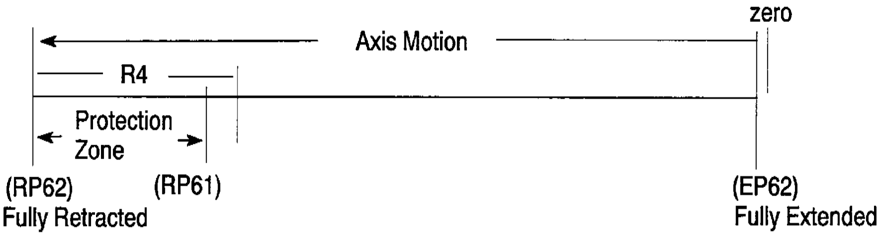
Fully Retracted Position (End-of-R4)
(RP62)

This setpoint defines the position when the axis is fully retracted. The QH module uses it as the end of R4 position setpoint. When the axis reaches this position during the R4 profile, the QH module immediately stops the profile and sets its outputs to values you stored in R4C33-36.

To determine RP62, we recommend you jog your axis to its fully retracted position and observe the value in SYS27.

Record this value for RP62 on Worksheet 9-B.

Figure 9.3
Example R4 Setpoints



Start Retract Protection Zone
(RP61)

The QH module uses this position to guard against retracting the axis too far. If the axis reaches the RP61 position during the R1, R2, or R3 profile, the QH module immediately stops the ongoing profile and either:

- begins the R4 profile
- sets its outputs to zero (depending on RP03-B11, protection zone bit)

Important: If the QH module detects that the axis entered the protection zone (starting at RP61) *after* starting the R4 profile, it disregards the function of this setpoint because its safety feature is no longer necessary.

We recommend an initial value that is a safe distance from the fully retracted position (RP62), and that gives ample distance for deceleration.

Record a value for RP61 on Worksheet 9-B.

End-of-segment Position Setpoint (RP11, 14, 17, 20, 23, 26, 29, 32, 35, 38)

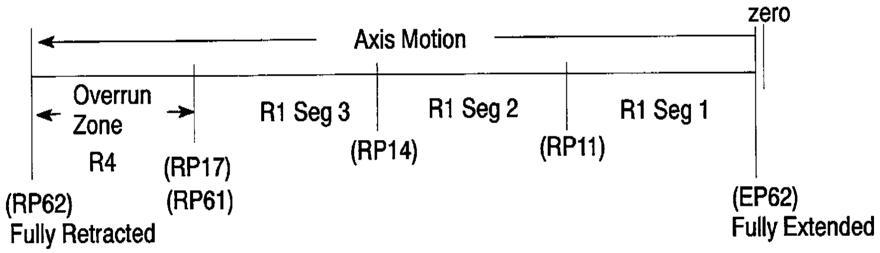
Configure only the first three profile segments.

Determine end-of-segment position setpoints, measured from zero, for the R1 profile as follows:

1. Subtract the fully-extended position setpoint (EP62) from the value you entered for start-R4 position setpoint (RP61).
2. Divide this difference into three equal segments. Record the dividing line between each segment as the end-of-segment position setpoints for segments 1, 2, and 3.

Important: If RP17 = RP61, then overrun zone and R4 profile are the same.

Figure 9.4
Example Setpoints for a Retract Profile



3. Record your R1 end-of-segment position setpoints for RP11, 14, and RP17 on Worksheet 9-B.

We recorded zero for the remaining position setpoints on Worksheet 9-B.

Enter and Download Your Worksheet Values

After you determine initial values and enter them on Worksheet 9-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 in chapter 5 to download data blocks to the QH module.
3. Check SYS61 and SYS62 for programming errors. Correct as needed.

Chapter 10

Span Your Valves

Chapter Objectives

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

The procedures in this chapter require the values and setpoints that you recorded on worksheets in chapters 8 and 9.

⚠ **WARNING:** Do not attempt this chapter unless you completed all previous chapters. The result could be unpredictable machine motion, with possible personal injury and/or equipment damage.

We describe how to span these selected valves:

- axis-extend low-pressure valve for the E4 profile
- axis-extend pressure valve for the E1, E2, and E3 profiles
- axis-extend velocity valve for the E1, E2, and E3 profiles
- axis-retract pressure valve for the R1, R2, R3, and R4 profiles
- axis-retract velocity valve for the R1, R2, R3, and R4 profiles

We also describe how to:

- test valve linearity
- set profile pressure alarms

Important: You may omit parts of this chapter.

- If you have the manufacturer's valve spanning data, you may omit the valve spanning procedure in corresponding sections of this chapter.
- You may omit whole sections of this chapter that do not apply to your machine application (see table).

For this Motion	If Using this Control	Then Skip the Section(s) Titled:
axis extend	velocity	E1, E2, E3 Profiles - Pressure Valves
	pressure: and your valve configuration is the same for all four profiles E1, E2, E3, E4	E4 Profile - Low Pressure Valve and E1, E2, E3 Profiles - Velocity Valve
axis retract	velocity	R1, R2, R3, R4 Profiles - Pressure Valve
	pressure	R1, R2, R3, R4 Profiles- Velocity Valve

Referenced Worksheets

The following table lists data blocks and corresponding worksheets from chapters 8 and 9 that contain initial values and setpoints used in this chapter.

Block:	Worksheet:
1st Extend Configuration Block (E1C)	8-A
2nd Extend Configuration Block (E2C)	8-B
3rd Extend Configuration Block (E3C)	8-C
4th Extend Configuration Block (E4C)	8-D
Extend Profile Block (EP)	9-A
1st Retract Configuration Block (R1C)	8-E
2nd Retract Configuration Block (R2C)	8-F
3rd Retract Configuration Block (R3C)	8-G
4th Retract Configuration Block (R4C)	8-H
Retract Profile Block (RP)	9-B

WARNING: Programming errors, configuration errors, or hydraulic problems could cause unexpected motion with possible personal injury or machine damage. As with any machine start-up, install a test jig.

WARNING: Make sure all machine guards and shields are in place before proceeding to guard against personal injury.

Important: Use the same initial values that you recorded in previous chapters except where noted in the text of this chapter.

E4 Profile - Low Pressure Valve

We recommend that you first span for optimum performance your low pressure valve used for the E4 profile. You do this in five parts:

- Confirm critical values
- Span your low pressure valve
- Test value linearity with an E4 profile
- Set up hydraulic tonnage
- Set the profile pressure alarm

Important: You may omit the procedure *Span your low pressure valve* in this section if you recorded valve spanning data from the manufacturer for pressure control limits E4C41-44 in chapter 8.

Confirm Critical Values

Important: Confirm that your configuration values (chapter 8) and profile values (chapter 9) for the E4 profile are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	At Address
8-D	QH module output to which you connected your selected pressure control valve	E4C02-B06, B05, B04 your selection	B37/214, 213, 212
	Your unselected set-output values for outputs 1-4	E4C09-12 = your values	N43:185-188
	All ramping is disabled with zero ramp rates	E4C17-20 = 0 E4C25-28 = 0	N43:193-196 N43:201-204
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Minimum Selected Pressure Valve, Output for Maximum	E4C41 = 0 E4C42 = your value E4C43 = your value E4C44 = your value	N43:217 N43:218 N43:219 N43:220
9-A	Start E4 on zone overrun	EP03-B11 = 0	B37/299
	Open-loop control	EP04-B07 = 1	B37/311
	Pressure setpoint	EP37 = your value	B37:273
	Start protection zone position	EP61 = your value	B37:297
	Fully extended position	EP62 = your value	B37:298

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 5.

Span Your Low Pressure Pressure Valve(s)

Span your selected low pressure valve(s) for smooth operation at the highest desired E4 profile pressure. Do this in the following procedure by finding the optimum values for these words:

- Minimum Pressure Control Limit E4C41
- Maximum Pressure Control Limit E4C42
- Selected Pressure Valve, Output for Minimum E4C43
- Selected Pressure Valve, Output for Maximum E4C44

Important: If PanelView is operational, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read the entire procedure before starting.

WARNING: Programming errors, configuration errors, or hydraulic problems could lead to personal injury and/or machine damage. As with any machine start-up, make sure you installed a test jig in the machine.

WARNING: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Jog your axis to the full extended position and block it.
2. Shut off your hydraulic pump motors. Align all other machine hydraulics to simulate low pressure movement. For example, shut off applicable pumps and align applicable valves.
3. Copy initial values from E4C09-12 (N43:185-188) into DYC09-12 (N40:121-124) with this exception:

Important: Enter a value corresponding to zero pressure into one word of DYC09-12 for output 1, 2, 3, or 4 that drives the selected valve.

WARNING: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

4. Enable set-output by changing DYC01-B08 (B34/392) to 1. This forces the QH 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 valve, and observe the pressure in SYS28 (N40:180).
   - **For a bi-directional valve with a spool offset:** If this pressure is greater than zero, adjust the set-output value to the selected 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 selected valve until the observed pressure just exceeds zero. Then re-adjust this value until you just observe zero again.
   - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.
6. Once you are satisfied that you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure in SYS28 (N40:180) into E4C41 (N43:217), the minimum control limit.
7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected valve. Copy this value into E4C43 (N43:219), the selected valve, output for minimum.
8. Change the set-output value in DYC09-12 (N40:121-124) that corresponds to the selected valve in 5% steps while observing the pressure in SYS28 (N40:180). Stop adjusting it when the pressure is equal to the maximum pressure for the E4 profile that you run on this machine. In most cases, this value is substantially less that the maximum obtainable system pressure.
9. Copy this observed maximum pressure from SYS28 (N40:180) into E4C42 (N43:218), the maximum control limit.
10. While maintaining this maximum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected valve. Copy this value into E4C44 (N43:220), the selected valve, output for maximum.
11. Lower the set-output value in DYC09-12 (N40:121-124) corresponding to the selected valve to a safe level.
12. Disable set-output operation. Toggle DYC01-B08 (B34/392) to 0.

13. Download your final values for E4C41-44 (N43:217-220) to the QH module by downloading the E4 block.

Important: If downloading from your programming terminal, you must download E4C followed by EP (chapter 5).

To download:	Set bit B21/
E4C	05
EP	06

Test Valve Linearity with a Low Pressure E4 Profile

1. Jog your axis to a position just inside the E4 start position (EP61).
2. Enable the E4 profile by setting DYC02-B03 (B34/403) = 1. The axis should move from its start position through the E4 profile. If no motion is observed, verify that:
    - no overtravel alarms are set. The QH module inhibits axis motion if alarm bits SYS07-B00 thru -B05 (B34/96-101) are set.
    - no programming error codes in SYS61 and 62 (N40:213 and 214).
3. At completion of the E4 profile, observe the pressure reported for E4 segment 1, ES37 (N43:689). If the observed pressure is not within 20% of the value you entered in EP37 (N43:273), then check:
    - Is your high-volume pump dropping out early enough?
    - Are any high-volume solenoids dropping out too early?

If the observed pressure ES37 (N43:689) is still not within 20% of EP37 (N43:273), your pressure valve is not linear over the desired range. Correct for a non-linear valve as follows:

If:	And Your Selected Valve is:	Then change E4C44 (N43:220) as follows:
ES37 was less than EP37	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
ES37 was more than EP37	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change E4C44 (N43:220), download the E4 block and repeat steps 1-3. Repeat as necessary.

Important: If downloading from your programming terminal, download E4 followed by EP with bits B21/05 and 06 respectively (chapter 5).

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during the E4 profile
- end-of-range maximum and minimum signal levels for linear control of the low pressure E4 valve in open-loop control

For this range limit	When trying to obtain the pressure in:	The QH module drives the selected pressure valve to % output signal in:
Minimum	E4C41	E4C43
Maximum	E4C42	E4C44

Now for the open-loop E4 profile, the QH module assumes a linear relationship between E4 axis pressure and signal output.

Set Hydraulic Tonnage

Once the axis has completed the E4 profile, use the E4 end-of-profile set-output values to build tonnage.

1. Jog your axis to the fully extended position.
2. Enter a value corresponding to minimum pressure into the set-output word DYC09-12 (N40:121-124) that corresponds to your tonnage pressure valve.
3. Copy the other three set-output values from E4C33-36 (N43:209-212) to DYC09-12, values that you would normally use during tonnage.

⚠ **WARNING:** A value of 0 entered in your data table does not necessarily correspond to zero pressure or flow. For example, a bi-directional valve would require a set-output value of 50% (5000) to obtain 0 PSI. Amplifier electronics or valve spools may also allow pressure or flow at 0 volts signal input.

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4. Align all other machine hydraulics to simulate tonnage. For example, enable required pumps and align required valves.
5. Enable set-output by transitioning DYC01-B08 (B34/392) to 1.

6. Change the set-output word in DYC09-12 (N40:121-124) that corresponds to your tonnage pressure valve in 5% increments while observing the pressure in SYS28 (N40:180). Stop changing it when observed pressure equals the desired tonnage pressure. If you cannot reach the desired pressure, verify that the other three set-output values are correct.

7. Copy the resultant set-output values from DYC09-12 (N40:121-124) into E4C33-36 (N43:209-212). The QH module will apply these values to the valves when the axis completes the E4 profile.

8. Disable set-output by transitioning DYC01-B08 (B34/392) to 0.

9. Enter the desired tonnage pressure for your machine (step 6) into the tonnage complete pressure setpoint EP63 (N43:299).

10. Download your changes in E4 and EP to the QH module.

Important: If downloading from your programming terminal, download E4 followed by EP (chapter 5).

Set the Profile Pressure Alarm

Set your maximum pressure alarm E4C57 (N43:233) to a pressure that should:

- not be exceeded during the E4 profile
- not exceed the maximum pressure control limit E4C42 (N43:218)

A value of zero disables this alarm.

Download the alarm setpoint to the QH by downloading the E4 block.

Important: If downloading from your programming terminal, download E4 followed by EP with download bits B21/05 and 06 (chapter 5).

E1, E2, E3 Profiles - Pressure Valve(s)

Span your axis-extend pressure valve(s) for optimum performance. Do this in four parts:

- Confirm critical values
- Span your axis-extend pressure valve(s)
- Test valve linearity
- Set pressure alarm setpoints

Important: You may omit the procedure *Span your axis-extend pressure valve(s)* in this section if you recorded valve spanning data from the manufacturer for pressure control limits E1C41-44, E2C41-44, and E3C41-44 in chapter 8.

Confirm Critical Values

Important: Confirm that your entries for configuration values (chapter 8) and profile values (chapter 9) for axis-extend profiles are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	At Address
8-A, 8-B, 8-C	QH module output to which you connect your selected pressure control valve	E1C02-B06,B05,B04 = your selection E2C02-B06,B05,B04 = your selection E3C02-B06,B05,B04 = your selection	B37/22, 21, 20 B37/86, 85, 84 B37/150, 149, 1489
	Your unselected set-output values for outputs 1-4	E1C09-12 = your values E2C09-12 = your values E3C09-12 = your values	N43:5-8 N43:65-68 N43:125-128
	All ramping is disabled with zero ramp rates	E1C17-20 = E1C25-28 = 0, E2C17-20 = E2C25-28 = 0 E3C17-20 = E3C25-28 = 0	N43:13-16 N43:21-24 N43:73-76 N43:81-84 N43:133-136 N43:141-144
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 E1C41=E2C41=E3C41=0 E1C42=E2C42=E3C42=your value E1C43=E2C43=E3C43=your value E1C44=E2C44=E3C44=your value	 N43:37, 97, 157 N43:38, 98, 158 N43:39, 99, 159 N43:40, 100, 160
9-A	Pressure vs. Position Control	EP03-B04 = B02 = B00 = 1	B37/292, 290, 288
	Logical bridge	EP03-B10, B09, B08 = 0	B37/298, 297, 296
	Protection Zone	EP03-B11 = 0	B37/299
	Open-loop control	EP04-B07 = B05-B00 = 1	B37/311, 309-304
	E1 pressure setpoints	EP10, 13, 16 = your value	N43:246, 249, 252
	E1 end-of-segment position setpoints	EP11, 14, 17 = your value	N43:247, 250, 253
	Start protection zone position	EP61 = your value	N43:297
	Fully extended position	EP62 = your value	N43:298

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 5.

Span Your Axis-extend Pressure Valve(s)

Span your axis-extend pressure valve(s) for smooth operation at highest desired profile pressure. Do this by finding optimum values for:

- Minimum Pressure Control Limit E1C41, E2C41, E3C41
- Maximum Pressure Control Limit E1C42, E2C42, E3C42
- Selected Pressure Valve, Output For Minimum E1C43, E2C43, E3C43
- Selected Pressure Valve, Output For Maximum E1C44, E2C44, E3C44

Important: If your hydraulics are identical for the E1, E2, and E3 profiles, complete the procedure for the E1 profile by finding values for E1C41-44 and enter the same four values for the E2 and E3 profiles in E2C41-44 and E3C41-44. If your hydraulics are different, repeat the procedure as needed.

Important: If PanelView is operational, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read the entire procedure before starting.

WARNING: Programming errors, configuration errors, or hydraulic problems could cause unexpected motion with possible personal injury and/or machine damage. As with any machine start-up, install a test jig.

WARNING: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Jog your axis to the fully extended position and block it.
2. Align all other machine hydraulics to simulate axis motion. For example, enable required pumps and align required valves.
3. Copy initial values from E1C09-12 (N43:5-8) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero pressure into one word of DYC09-12 for the output that drives the selected pressure valve.

WARNING: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

4. Enable set-output by changing DYC01-B08 (B34/392) from 0 to 1. This forces the QH 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 pressure valve, and observe the pressure reported in SYS28 (N40:180).

   - **For a bi-directional valve with a spool offset:** If this pressure is greater than zero, adjust the set-output value to the selected 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 selected pressure valve until the observed pressure just exceeds zero. Then re-adjust this value until you just observe zero again.

   - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.

6. Once you are satisfied that you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure in SYS28 (N40:180) into E1C41 (N43:37), E2C41 (N43:97) , and E3C41 (N43:157), the minimum pressure control limits.

7. While maintaining this minimum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected pressure valve. Copy this value into E1C43 (N43:39), E2C43 (N43:99), and E3C43 (N43:159), the selected pressure valve, output for minimum.

8. Change the set-output value in DYC09-12 that corresponds to the selected pressure valve by 50%, and then in 5% steps while observing the pressure in SYS28 (N40:180). Stop adjusting it when the pressure no longer increases with an increase in set-output value. The pressure in SYS28 is now the maximum attainable pressure.

9. Copy the pressure from SYS28 (N40:180) into E1C42 (N43:38), E2C42 (N43:98), and E3C42 (N43:158), the maximum pressure control limits.

10. While maintaining this maximum pressure, observe the actual set-output value in SYS41-44 (N40:193-196) that corresponds to your selected pressure valve. Copy this value into E1C44 (N43:40), E2C44 (N43:100), and E3C4 (N43:160), the selected pressure valve, output for maximum.

11. Lower the set-output value in DYC09-12 (N40:121-124) that corresponds to the selected pressure valve to a safe level.

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

13. Download your changes in E1C, E2C, and E3C to the QH module.

Important: If downloading from your programming terminal, download E1C, E2C, E3C, and EP in that order (chapter 5).

To download	Set bit B21/
E1C	02
E2C	03
E3C	04
EP	06

Test Valve Linearity with an E1 Pressure Profile

1. Jog your axis to the fully extended position.

2. Enable the E1 profile by setting DYC02-B00 (B34:400) to 1.
   The axis should move from its start position through the E1 and E4 profiles. If no motion, verify that:

   - no overtravel alarms are set. The QH module inhibits the profile if SYS07-B00 thru -B05 (B34/96-101) are set

   - no programming error codes in SYS61 and 62 (N40:213 and 214)

3. At completion of the profiles, observe the pressure reported for E1 segment 2, ES13 (N43:665). If it is not approximately equal to the setpoint you entered in EP13 (N43:249), then check:

   - was your valve and solenoid alignment the same for E1 profile execution and axis-extend action in set-output (chapter 6).

If the pressure in ES13 (N43:665) is still not within 20% of EP13 (N43:249), your pressure valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change E1C44 (N43:40) as follows:
ES13 was less than EP13	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
ES13 was more than EP13	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change E1C44 (N43:40), download the E1 block, and repeat steps 1-3. Repeat as necessary.

Important: If downloading from your programming terminal, download E1 followed by EP with download bits B21/02 and 06 (chapter 5).

4. Copy the final value of E1C44 (N43:40) into E2C44 (N43:100) and E3C44 (N43:160) and download these changes to the QH module.

Important: If downloading from your programming terminal, download E1, E2, E3, and EP with bits B21/02, 03, 04, 06 in that order (chapter 5).

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during the E1, E2, and E3 profiles
- end-of-range maximum and minimum signal levels for linear control of the selected pressure valve in open-loop control.

For this range limit	When trying to obtain the pressure in:	The QH module drives the selected pressure valve to % output signal in:
Minimum	E1C41, E2C41, E3C41	E1C43, E2C43, E3C43
Maximum	E1C42, E2C42, E3C42	E1C44, E2C44, E3C44

Now for all open-loop axis-extend pressure profiles, the QH module assumes a linear relationship between axis pressure and signal output.

Set Profile Pressure Alarms

For axis-extend profiles, set maximum pressure alarms E1C57 (N43:53), E2C57 (N43:113), and E3C57 (N43:173) to a pressure that should:

- not be exceeded during axis-extend profiles
- not exceed the maximum pressure control limit E1C42, E2C42, E3C42

A value of zero disables this alarm.

Send new values to QH module by downloading E1C, E2C, and E3C.

Important: If downloading from your programming terminal, download E1C, E2C, E3C, and EP with bits B21/02, 03, 04, 06 in that order.

E1, E2, E3 Profiles - Velocity (Flow) Valve(s)

Span your velocity (flow) valve(s) for optimum velocity performance. Do this in three parts:

- Confirm critical values
- Span your velocity (flow) valve(s)
- Test valve linearity with a velocity vs. position profile

Important: You may omit the procedure *Span your velocity (flow) valve* in this section if you recorded valve spanning data from the manufacturer for velocity control limits E1C45-48, E2C45-48, and E3C45-48 in chapter 8.

Confirm Critical Values

Important: Confirm that your entries for configuration values (chapter 8) and profile values (chapter 9) for axis-extend profiles are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	At Address
8-A, 8-B, 8-C	QH module output to which you connected your selected velocity control valve	E1C02-B02,B01,B00 = your selection E2C02-B02,B01,B00 = your selection E3C02-B02,B01,B00 = your selection	B37/22, 21, 20 B37/86, 85, 84 B37/150, 149, 148
	Your unselected set-output values for outputs 1-4	E1C09-12 = your value E2C09-12 = your value E3C09-12 = your value	N43:5-8 N43:65-68 N43:125-128
	All ramping is disabled with zero ramp rates	E1C17-20 = E1C25-28 = 0 E2C17-20 = E2C25-28 = 0 E3C17-20 = E3C25-28 = 0	N43:13-16 N43:21-24 N43:73-76 N43:81-84 N43:133-136 N43:141-144
	Velocity limits: Minimum Control Limit Maximum Control Limit Selected Velocity Valve, Output for Min Selected Velocity Valve, Output for Max	 E1C45=E2C45=E3C45=0 E1C46=E2C46=E3C46=sys vel E1C47=E2C47=E3C47=your value E1C48=E2C48=E3C48=your value	 N43:41, 101, 161 N43:42, 102, 162 N43:43, 103, 163 N43:44, 104, 164
9-A	Selected inches/second as velocity units	EP03-B14 = 1	B37/302
	Zone protection	EP03-B11 = 0	B37/299
	Logical bridge	EP03-B10 = B09 = B08 = 0	B37/298, 297, 296
	Open-loop control	EP04-B07 = B05-B00 = 1	B37/311, 309-304
	E1 segment velocities	EP09, 12, 15 = your values	N43:245, 248, 251
	End-of-segment position setpoints	EP11, 14, 17 = your values	N43:247, 250, 253
	Start protection zone position	EP61 = your value	N43:297
	Fully extended position	EP62 = your value	N43:298

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 5.

Span Your Axis-extend Velocity Valve(s)

Span your axis-extend velocity valve(s) for smooth operation at highest desired velocity. Do this in the following procedure by finding optimum values for:

- Minimum Velocity Control Limit E1C45, E2C45, E3C45
- Maximum Velocity Control Limit E1C46, E2C46, E3C46
- Selected Velocity Valve, Output For Minimum E1C47, E2C47, E3C47
- Selected Velocity Valve, Output For Maximum E1C48, E2C48, E3C48

Important: If your hydraulics are identical for the E1, E2, and E3 profiles, complete the procedure for the E1 profile by finding values for E1C45-48 and enter the same four values for the E2 and E3 profiles in E2C45-48 and E3C45-48. If your hydraulics are different, repeat the procedure as needed.

Important: If PanelView is operational, use it to:

- observe actuals
- change and download setpoints
- run profiles

Important: We suggest that you read the entire procedure before starting.

⚠ **WARNING:** Programming errors, configuration errors, or hydraulic problems could cause unexpected motion with possible personal injury and/or machine damage. As with any machine start-up, install a test jig.

⚠ **WARNING:** Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Obtain a copy of the flow rate curves provided by your flow valve manufacturer. The flow rate curves graphically illustrate the flow through a valve at different voltage or input current levels and at different pressure drops across the valve's spool.

2. From the above curves, determine the minimum and maximum flows available from your flow valve at the pressure you would normally run during axis-extend operation. Record these flows, along with the input voltages/current associated with them.

3. Convert the minimum and maximum flow obtained from your flow curve to cylinder velocity. This is done by:

$$\text{Cylinder Velocity (in/sec)} = \frac{\text{Flow (in}^3\text{/sec)}}{\text{Area (in}^2\text{)}}$$

   - where area is the inside diameter of the cylinder. This area may be different for the rod and piston ends of the cylinder:

$$\text{Area (no Rod)} = \pi \left(\frac{\text{I.D. of cylinder}}{2} \right)^2$$

$$\text{Area for Rod End} = \pi \left(\frac{\text{I.D. of cylinder}}{2} \right)^2 \quad \pi \left(\frac{\text{Rod diameter}}{2} \right)^2$$

   - The flow assumes no restrictions on the cylinder exhaust port.

4. Enter the minimum velocity (usually 0) from this calculation into E1C45, E2C45, and E3C45 (N43:41, 101, 161). Enter the maximum velocity into E1C46, E2C46, and E3C46 (N43:42, 102, and 162).
5. Divide the voltage/current corresponding to minimum velocity by the full range of the valve(s) input signal to determine the percent signal output for minimum. Enter this value into E1C47, E2C47, E3C47 (N43:43, 103, and 163).
6. Divide the voltage/current corresponding to maximum velocity by the full range of the valve(s) input signal to determine the percent signal output for maximum. Enter this value into E1C48, E2C48, E3C48.
7. Download changes in E1C, E2C, and E3C to the QH module.

Important: If downloading from your programming terminal, download E1C, E2C, E3C, and EP in that order (chapter 5).

To download:	**Set bit B21/**
E1C	02
E2C	03
E3C	04
EP	06

Test Valve Linearity with a Velocity Profile

1. Select velocity vs. position control for the entire axis-extend operation by resetting the following bits to zero:
   - EP03-B00 (B37/288)
   - EP03-B02 (B37/290)
   - EP03-B04 (B37/292)
2. Download the EP block to the QH module.

Important: If downloading from your programming terminal, download EP with download bit B21/06 (chapter 5).

3. Jog your axis to the fully retracted position.
4. Enable the E1 profile by setting DYC02-B00 (B34/400) to 1. The axis should move from its start position through the E1 and E4 profiles. If no motion, verify that:
   - no overtravel alarms are set. The QH module inhibits axis motion if SYS07-B00 thru -B05 (B34/96-101) are set
   - no programming error codes in SYS61 and 62 (N40:213 and 214)
5. Upon completion of the profiles, observe the velocity reported for E1 segment 2 in ES12 (N43:664). This velocity should be relatively close to the setpoint you entered in EP12 (N43:248). If the observed velocity is not within 25% of the setpoint, verify that:
   - the values from your flow rate curves are correct
   - your calculations are correct

If the observed velocity ES12 (N43:664) is still not within 25% of EP12 (N43248), your flow valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change E1C48 (N43:44) as follows:
ES12 was less than EP12	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
ES12 was more than EP12	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change E1C48 (N43:44), download the E1 block, and repeat steps 3-5. Repeat as necessary.

6. Copy the final value in E1C48 (N43:44) into E2C48 (N43:104) and E3C48 (N43:164), and download these changes to the QH module.

Important: If downloading from your programming terminal, download E1C, E2C, and E3C followed by EP (chapter 5).

To download:	Set bit B21/
E1C	02
E2C	03
E3C	04
EP	06

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of velocity available during any axis-extend profile
- end-of-range maximum and minimum signal levels for linear control of the velocity valve in open-loop control.

For this range limit	When trying to obtain the velocity in:	The QH module drives the selected velocity valve to % output signal in:
Minimum	E1C45, E2C45, E3C45	E1C47, E2C47, E3C47
Maximum	E1C46, E2C46, E3C46	E1C48, E2C48, E3C48

Now for all open-loop velocity profiles for axis-extend, the QH module assumes a linear relationship between axis velocity and signal output.

R1, R2, R3, R4 Profiles - Pressure Valve(s)

Span your axis-retract pressure valve(s) for optimum performance. Do this in four parts:

- Confirm critical values
- Span your selected pressure valve(s)
- Test valve linearity
- Set profile pressure alarms

Important: You may omit the procedure *Span your selected pressure valve* in this section if you recorded valve spanning data from the manufacturer for pressure control limits R1C41-44, R2C41-44, R3C41-44, and R4C41-44 in chapter 8.

Confirm Critical Values

Important: Confirm that your entries for configuration values (chapter 8) and profile values (chapter 9) for axis-retract profiles are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	At Your Address
8-E, 8-F, 8-G, 8-H	QH module output to which you connected your selected pressure control valve	R1C02-B06, B05, B04 = your selection R2C02-B06, B05, B04 = your selection R3C02-B06, B05, B04 = your selection R4C02-B06, B05, B04 = your selection	B37/342, 341, 340 B37/406, 405, 404 B37/470, 469, 468 B37/534, 533, 532
	Your unselected set-output values for outputs 1-4	R1C09-12 = your selection R2C09-12 = your selection R3C09-12 = your selection R4C09-12 = your selection	N43:305-308 N43:365-368 N43:425-428 N43:485-488
	All ramping is disabled with zero ramp rates	R1C17-20 = R1C25-28 = 0 R2C17-20 = R2C25-28 = 0 R3C17-20 = R3C25-28 = 0 R4C17-20 = R4C25-28 = 0	N43:313-316 N43:321-324 N43:373-376 N43:381-384 N43:433-436 N43:441-444 N43:493-496 N43:501-504
	Pressure limits: Minimum Control Limit Maximum Control Limit Selected Pressure Valve, Output for Min Selected Pressure Valve, Output for Max	 R1C41=R2C41=R3C41=R4C41=0 R1C42=R2C42=R3C42=R4C42=sys pres R1C43=R2C43=R3C43=R4C43=your value R1C44=R2C44=R3C44=R4C44=your value	 N43:337, 397, 457, 517 N43:338, 398, 458, 518 N43:339, 399, 459, 519 N43:340, 400, 460, 520
9-B	Protection Zone - start R4 profile on overrun	RP03-B11 = 0	B37/619
	Logical bridge - start next profile	RP03-B10 = B09 = B08 = 0	B37/618, 617, 616
	Pressure vs. Position control	RP03-B06 = 04 = 02 = 00 = 1	B37/614, 612, 610, 608
	Open-loop control	RP04-B07 - B00 = 1	B37/631-624
	R1 segment pressures	RP10, 13, 16 = your values	N43:546, 549, 552
	R1 end-of-segment position setpoints	RP11, 14, 17 = your values	N43:547, 550, 553
	Start protection zone position setpoint	RP61 = your value	N43:597
	Fully retracted position setpoint	RP62 = your value	N43:598

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 5.

Span Your Selected Pressure Valve(s)

Span your selected pressure valve for smooth operation at highest desired pressure. Do this in the following procedure by finding optimum values for:

- Minimum Pressure Control Limits R1C41, R2C41, R3C41, and R4C41
- Maximum Pressure Control Limits R1C42, R2C42, R3C42, and R4C42
- Selected Pressure Valve, Output For Minimum
  R1C43, R2C43, R3C43, and R4C43
- Selected Pressure Valve, Output For Maximum
  R1C44, R2C44, R3C44, and R4C44

Important: If your machine hydraulics are identical for all axis-retract profiles, complete the procedure for the R1 profile by finding values for R1C41-44, and copy them into the R2, R3, R4 profile words R2C41-44, R3C41-44, and R4C41-44. Otherwise, repeat the procedure as needed.

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.

⚠ **WARNING:** Programming errors, configuration errors, or hydraulic problems could cause unexpected motion with possible personal injury and/or machine damage. As with any machine start-up, install a test jig.

⚠ **WARNING:** Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

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1. Jog your axis to the fully retracted position.
2. Align all other machine hydraulics to simulate axis motion. For example, enable required pumps and align required valves.
3. Copy initial values from R1C09-12 (N43:305-308) into DYC09-12 (N40:121-124) of your PLC-5 data table with this exception:

Important: Enter a value corresponding to zero pressure into one word of DYC09-12 for output 1, 2, 3, or 4 that drives the selected pressure valve.

WARNING: A value of 0 does not always correspond to zero pressure or flow. For example, a bi-directional valve requires a set-output value of 50% (5000) to obtain 0 PSI. Valve spools or amplifier electronics may also allow pressure or flow at 0 volts.

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4. Enable set-output by transitioning DYC01-B08 (B34:392) to 1. This forces the QH 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 pressure valve, and observe the pressure reported in SYS28 (N40:180).
    - **For a bi-directional valve with a spool offset:** If this pressure is greater than zero, adjust the selected valve set-output value to obtain zero pressure. Stop adjusting it when you observe the smallest pressure attainable.
    - **For a uni-directional valve with no response at low signal level:** If this pressure is zero, adjust the selected valve set-output value until the observed pressure just exceeds zero. Then re-adjust it until you just observe zero again.
    - **For a uni-directional valve with a pressure actual greater than zero but with zero output to the valve:** This is lowest pressure.
6. Once you are satisfied you obtained the lowest possible pressure or the highest possible signal at zero pressure, copy the pressure observed in SYS28 (N40:180), (usually 0 PSI or Bar) into R1C41, R2C41, R3C41, and R4C41 (N43:337, 397, 457, and 517), the minimum pressure control limits.
7. While maintaining this minimum pressure, observe the actual pressure in SYS41-44 (N40:193-196) that corresponds to your selected pressure valve. Copy this value into R1C43, R2C43, R3C43, and R4C43 (N43:339, 399, 459, and 519), the selected pressure valve output for minimum.
8. Change the set-output value in DYC09-12 (N40:121-1124) that corresponds to the selected pressure valve by 50%, and then in 5% steps while observing the pressure in SYS28 (N40:180). Stop adjusting it when the observed pressure no longer increases with an increase in the set-output value. Now the pressure in SYS28 is the maximum obtainable axis-retract pressure.
9. Copy this observed maximum pressure from SYS28 (N40:180) into R1C42, R2C42, R3C42, and R4C42 (N43:338, 398, 458, and 518), the maximum pressure control limits.

10. While maintaining this maximum pressure, observe the actual set-output value in the SYS41-44 (N40:193-196) that corresponds to your selected pressure valve. Copy this value into R1C44, R2C44, R3C44, and R4C44 (N43:340, 400, 460, and 520), the selected pressure valve, output for maximum.

11. Lower the set-output value in DYC09-12 (N40:121-124) corresponding to the selected pressure valve to a safe level.

12. Disable set-output by transitioning DYC01-B08 (B34/392) to 0.

13. Download changes in R1C, R2C, R3C, and R4C to the QH module.

Important: If downloading from your programming terminal, you must download R1C, R2C, R3C, R4C, and RP in that order (chapter 5).

To download:	Set bit B21/
R1C	07
R2C	08
R3C	09
R4C	10
RP	11

Test Valve Linearity with a Pressure Profile

1. Jog your axis to the fully extended position.

2. Enable the R1 profile by setting DYC02-B10 (B34/410) = 1. The axis should move from its start position through the R1 and R4 profiles. If no motion, verify that:

   - no overtravel alarms are set. The QH module inhibits axis motion if SYS07-B00 thru -B05 (B34/96-101) are set
   - no programming error codes in SYS61 and 62 (N40:213 and 214)

3. Upon completion of the R4 profile, observe the pressure reported for R1 segment 2 in RS13 (N43:721). If the pressure is not about equal to the setpoint you entered in RP13 (N43:549), then check:

   - was your valve and solenoid alignment the same for the R1 profile and axis-retract action in set-output (chapter 6).

If pressure in RS13 (N43:721) is still not within 20% of RP13 (N43:549), your pressure is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change R1C44 as follows:
RS13 was less than RP13	Direct Acting	Increase in 5% steps
	Reverse Acting	Decrease in 5% steps
RS13 was more than RP13	Direct Acting	Decrease in 5% steps
	Reverse Acting	Increase in 5% steps

To do this: change R1C44 (N43:340), download the R1 block, and repeat steps 1-3. Do this as necessary.

Important: If downloading from your programming terminal, download R1 followed by RP with download bits B21/07 and 11 (chapter 5).

4. Copy final R1C44 (N43:340) into R2C44, R3C44 and R4C44 (N43:400, 460, and 520), and download these changes.

Important: If downloading from your programming terminal, download R1C, R2C, R3C and R4C followed by RP (chapter 5).

To download:	Set bit B21/
R1C	07
R2C	08
R3C	09
R4C	10
RP	11

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of pressure available during any axis-retract profile
- end-of-range maximum and minimum signal levels for linear control of the selected pressure valve in open-loop control.

For this range limit	When trying to obtain the pressure in:	The QH module drives the selected pressure valve to % output signal in:
Minimum	R1C41, R2C41, R3C41, R4C41	R1C43, R2C43, R3C43, and R4C43
Maximum	R1C42, R2C42, R3C42, R4C42	R1C44, R2C44, R3C44, and R4C44

Now, for all open-loop pressure profiles for clamp open, the QH module assumes a linear relationship between axis pressure and signal output.

Set Profile Pressure Alarms

For axis-retract profiles, set the maximum pressure alarm R1C57, R2C57, R3C57, R4C57 (N43:353, 413, 473, 533) to a pressure value that should:

- not be exceeded during R1, R2, R3, and R4 profiles
- not exceed the max pressure control limit
  R1C42, R2C42, R3C42, and R4C42 (N43:338, 398, 458, and 518)

A value of zero disables these alarms.

Download new values to the QH module.

Important: If downloading from your programming terminal, download R1C, R2C, R3C, R4C, and RP in that order (chapter 5):

To download	Set bit B21/
R1C	07
R2C	08
R3C	09
R4C	10
RP	11

R1, R2, R3, R4 Profiles - Velocity (Flow) Valve(s)

Span your selected velocity (flow) valve(s) for optimum velocity performance. Do this in three parts:

- Confirm critical values
- Span your selected velocity (flow) valve(s)
- Test valve linearity

Important: You may omit the procedure *Span your selected velocity (flow) valve* in this section if you recorded valve spanning data from the manufacturer for velocity control limits R1C45-48, R2C45-48, R3C45-48, and R4C45-48 in chapter 8.

Confirm Critical Values

Important: Confirm that your configuration values (chapter 8) and profile setpoints (chapter 9) are as follows:

On Worksheet:	Confirm Your Configuration:	With These Words or Bits:	At Address
8-E, 8-F, 8-G, 8-H	QH module output to which you connected your selected pressure control valve	R1C02-B06, B05, B04 = your selection R2C02-B06, B05, B04 = your selection R3C02-B06, B05, B04 = your selection R4C02-B06, B05, B04 = your selection	B37/342, 341, 340 B37/406, 405, 404 B37/470, 469, 468 B37/534, 533, 532
	Your unselected set-output values for outputs 1-4	R1C09-12 = your value R2C09-12 = your value R3C09-12 = your value R4C09-12 = your value	N43:305-308 N43:365-368 N43:425-428 N43:485-488
	All ramping is disabled with zero ramp rates	R1C17-20 = R1C25-28 = 0 R2C17-20 = R2C25-28 = 0 R3C17-20 = R3C25-28 = 0 R4C17-20 = R4C25-28 = 0	N43:313-316 N43:321-324 N43:373-376 N43:381-384 N43:433-436 N43:441-444 N43:493-496 N43:501-504
	Velocity limits: Minimum Control Limit Maximum Control Limit Selected Velocity Valve, Output for Min Selected Velocity Valve, Output for Max	R1C45=R2C45=R3C45=R4C45=0 R1C46=R2C46=R3C46=R4C46=sys vel R1C47=R2C47=R3C47=R4C47=your value R1C48=R2C48=R3C48=R4C48=your value	N43:341, 401, 461, 521 N43:342, 402, 462, 522 N43:343, 403, 463, 523 N43:344, 404, 464, 524
9-B	Select inches/second for velocity units	RP03-B14 = 1	B37/622
	Zone overrun - start R4 profile on overrun	RP03-B11 = 0	B37/619
	Logical bridge - start next profile	RP03-B10 = B09 = B08 = 0	B37/618, 617, 616
	Open-loop control	RP04-B07 - B00 = 1	B37/631-624
	R1 segment velocities	RP09, 12, 15 = your values	N43:545, 548, 551
	R1 end-of-segment position setpoints	RP11, 14, 17 = your values	N43:547, 550, 553
	Start protection zone position setpoint	RP61 = your value	N43:597
	Fully retracted position setpoint	RP62 = your value	N43:598

If these are not your current values, we suggest that you correct them now using the download procedure discussed in chapter 5.

Span Your Selected Velocity Valve(s)

Span your selected velocity valve(s) for smooth operation at highest velocity. Do this in the following procedure by finding optimum values for:

- Minimum Velocity Control Limits R1C45, R2C45, R3C45, R4C45
- Maximum Velocity Control Limits R1C46, R2C46, R3C46, R4C45
- Selected Velocity Valve, Output For Minimum
  R1C47, R2C47, R3C47, R4C45
- Selected Velocity Valve, Output For Maximum
  R1C48, R2C48, R3C48, R4C45

Important: If your machine hydraulics are identical for all axis-retract profiles, complete the procedure for the R1 profile by finding values for R1C45-48, and copy them into the R2, R3, R4 profile words R2C45-48, R3C45-48, and R4C45-48. Otherwise, repeat the procedure as needed.

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.

WARNING: Programming errors, configuration errors, or hydraulic problems cause unexpected motion with possible personal injury and/or machine damage. As with any machine start-up, install a test jig.

WARNING: Be sure all machine guards and shields are in place before proceeding to guard against personal injury.

1. Obtain a copy of the flow rate curves provided by your flow valve manufacturer. Flow rate curves graphically illustrate the flow through a valve at different voltage or input current levels and at different pressure drops across the valve's spool.

2. From these curves, determine the minimum and maximum flow available from your flow valve at the pressure you would normally run during axis-retract operation. Record these flows, along with the input voltage/current associated with them.

Important: If the flow rate during the R4 profile differs from that during the R1, R2, and R3 profiles, complete the calculations for both flow rates. Be sure to record your values in words with correct prefixes:

- slow retract values with the R4 prefix
- fast retract values with R1, R2 and R3 prefixes

3. Convert the minimum and maximum flow obtained from your flow curve to cylinder velocity. This is done by:

$$\text{Cylinder Velocity (in/sec)} = \frac{\text{Flow (in}^3\text{/sec)}}{\text{Area (in}^2\text{)}}$$

   - where area is the inside diameter of the cylinder. This area may be different for the rod and piston ends of the cylinder:

$$\text{Area (no Rod)} = \pi\left(\frac{\text{I.D. of cylinder}}{2}\right)^2$$

$$\text{Area for Rod End} = \pi\left(\frac{\text{I.D. of cylinder}}{2}\right)^2 \quad \pi\left(\frac{\text{Rod diameter}}{2}\right)^2$$

   - Flow assumes no restrictions on the exhaust port of the cylinder.

4. Enter the minimum velocity (usually 0) from these calculations into R1C45, R2C45, R3C45, and R4C45 (N43:341, 401, 461, and 521). Enter the maximum velocity into R1C46, R2C46, R3C46, and R4C46 (N43:342, 402, 462, and 522).

5. Divide the voltage/current corresponding to minimum velocity by the full range of valve input signal to determine the percent signal output for minimum. Enter this value into R1C47, R2C47, R3C47, R4C47 (N43:343, 403, 463, and 523).

6. Divide the voltage/current corresponding to maximum velocity by the full range of valve input signal to determine the percent signal output for maximum. Enter this value into R1C48, R2C48, R3C48, R4C48 (N43:344, 404, 464, and 524).

7. Download changes in R1C, R2C, R3C, and R4C to the QH module.

Important: If downloading from your programming terminal, download R1C, R2C, R3C, R4C, and RP with download bits B21/07, 08, 09, 10, and 11 in that order (chapter 5).

Test Valve Linearity with a Velocity vs. Position Profile

1. Select velocity vs. position control for the entire axis-extend operation by resetting the following bits to zero:
   - RP03-B00 (B37/608)
   - RP03-B02 (B37/610)
   - RP03-B04 (B37/612)
   - RP03-B06 (B37/614)
2. Download this change to the QH module.

Important: If downloading from your programming terminal, download RP with download bit B21/11 (chapter 5).

3. Jog your axis to the fully extended position.
4. Enable the R1 profile by setting DYC02-B10 (B34/410) to 1. The axis should move from its start position through the R1 and R4 profiles. If no motion is observed, verify that:
   - no overtravel alarms are set. The QH module inhibits axis motion if SYS07-B00 thru -B05 (B34/96-101) are set
   - no programming error codes in SYS61 and 62 (N40:213 and 214)
5. Upon completion of the profiles, observe the velocity reported for R1 segment 2 in RS12 (N43:720). This velocity should be relatively close to the setpoint you entered in RP12 (N43:548). If the observed velocity is not within 25% of the setpoint, verify that:
   - you choose the correct values from your flow rate curves
   - your calculations are correct

If the velocity in RS12 (N43:720) is still not within 20% of RP12 (N43:548), your pressure valve is not linear over the desired range. Correct as follows:

If:	And Your Selected Valve is:	Then change R1C48 (N43:344) as follows:
RS12 was less than RP12	Direct Acting	Increase by 5%
	Reverse Acting	Decrease by 5%
RS12 was more than RP12	Direct Acting	Decrease by 5%
	Reverse Acting	Increase by 5%

To do this: change R1C48 (N43:344), download the R1 block, and repeat steps 3-5. Repeat as necessary.

Important: If downloading from your programming terminal, download R1C followed by RP with download bits B21/07 and 11 (chapter 5).

6. Copy the final value in R1C48 (N43:344) into R2C48, R3C48 and R4C48 (N43:404, 464, and 524) and download these changes.

Important: If downloading from your programming terminal, download R1C, R2C, R3C and R4C followed by RP (chapter 5).

To download:	Set bit B21/
R1C	07
R2C	08
R3C	09
R4C	10
RP	11

What You Have Accomplished

The valve spanning procedure you just completed has defined the:

- range of velocity available during any axis-retract profile
- end-of-range maximum and minimum signal levels for linear control of the selected velocity valve in open-loop control:

For this range limit	When trying to obtain the velocity in:	The QH module drives the selected velocity valve to % output signal in:
Minimum	R1C45, R2C45, R3C45, R4C45	R1C47, R2C47, R3C47, and R4C47
Maximum	R1C46, R2C46, R3C46, R4C46	R1C48, R2C48, R3C48, and R4C48

Now, for all axis-retract velocity profiles, the QH module assumes a linear relationship between axis velocity and signal output in open loop.

Chapter 11

Tune Your Machine

Chapter Objectives

In chapter 10 you ran simple open-loop profiles to span your valves. This chapter presents guidelines to help you adjust parameters in configuration and profile blocks to optimize machine performance for production runs.

We present this chapter in two major sections:

- **Closed-loop Tuning** – We discuss the usage and effect of the QH module's PID gain constants, and procedures to determine proper gain settings. If your application does not require closed-loop operation, skip this section.
- **Tuning Considerations for Axis Motion** –
  We present the usage and effect of other QH module parameters for axis motion that require specific considerations, such as:
  - profile requirements
  - set-output values
  - ramp rates

Closed-loop Tuning

Closed-loop Control

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

- for spanning valves
- for troubleshooting machine performance
- when the machine has no pressure sensors for feedback

Important: You generally achieve more accurate positioning when the QH module operates in closed-loop control. With few exceptions, you should run machine production with closed-loop profiles.

In chapter 8 you entered our recommended values. They may give you desired machine performance.

Important: If you need to improve performance, continue with this section. If not, skip to Tuning Considerations for Axis Motion.

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:

- Axis-retract (R1, R2, R3, R4) – Pressure vs. Position
- Axis-extend (E1, E2, E3) – Pressure vs. Position
- Axis-extend (E4) – Pressure vs. Position

Important: Disable ramping when tuning closed-loop pressure profiles.

Important: The dynamics of loads being moved and different hydraulic characteristics may warrant different PID tuning constants for each profile.

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

- Use only proportional and integral control.

- Use the **lowest** possible P and I gain constants for repeatable performance.

- First tune your proportional gain. Then add integral gain.

- Typically, the integral term will be larger than the proportional term. The QH module's pressure algorithm differs from classic PID algorithms.

- Use an oscilloscope, if available. You can tune loops faster with one connected to the QH module's output driving the selected valve.

Important: If you have an oscilloscope, skip to the section "Tune Pressure Loops with an Oscilloscope".

Tune Pressure Loops Without An Oscilloscope

Repeat this procedure for each applicable pressure profile.

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

- selected the pressure vs. position algorithm
- selected closed-loop control
- disabled ramping

CAUTION: Verify that you have correctly set the following words and bits in EP and RP that control zone overrun to guard against damaging your machine.

- EP03-B11 (B37/317) = 0: execute the E4 profile if zone overrun occurs
- set EP61 (N43:297) larger than normal for a larger protection zone
- RP03-B11 (B37/619) = 0: execute the R4 profile if zone overrun occurs
- set RP61 (N43:597) smaller than normal for a larger R4 profile zone

---

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

2. Check that you zeroed the profile's integral and derivative terms. Leave the proportional term at the value you entered in chapter 8.

3. Downloaded all setpoint changes to the QH module (chapter 5).

4. Run several cycles of the profile while comparing profile actuals (returned in the corresponding status block) with profile setpoints. Also look for abnormal flexing or pulsing of hydraulic hoses leading to the controlled cylinder.

If:	Then:
Observed actuals are consistently well below profile setpoints	Increase the proportional term
Observed actuals are consistently well above profile setpoints	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QH module. Refer to the download procedure in chapter 5.

5. Re-run the profile after each change to the proportional term until actuals are close to setpoints, and there is no hammering and vibration in hydraulic lines to the controlled cylinder.

6. Slowly increase the integral term while running machine cycles until profile pressure actuals overshoot profile setpoints. Now decrease the integral term until overshoot disappear.

Important: If you cannot make pressures actuals match entered setpoints, verify your unselected valve set-output values are correct for your application (Refer to chapter 8 and the discussion later in this chapter).

Tune Pressure Loops With An Oscilloscope

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

- selected the pressure vs. position algorithm
- selected closed-loop control
- disabled ramping

⚠ **CAUTION:** Verify that you have correctly set the following words and bits in EP and RP that control zone overrun to guard against damaging your machine.

- EP03-B11 (B37/317) = 0: execute the E4 profile if zone overrun occurs
- set EP61 (N43:297) larger than normal for a larger protection zone
- RP03-B11 (B37/619) = 0: execute the R4 profile if zone overrun occurs
- set RP61 (N43: 597) smaller than normal for a larger R4 profile zone

---

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

2. Check that you zeroed the profile's integral and derivative terms. Leave the proportional term at the value you recorded in chapter 8.

3. Download all setpoint changes to the QH module (chapter 5).

4. Connect an oscilloscope to your selected pressure control valve

5. Run several profile cycles while observing the oscilloscope trace.

   Ideally for each step of a multi-step profile, the oscilloscope trace should rise or fall quickly to a controlled level and then flatten out. Bounce or chatter when rising or falling is undesirable.

If:	Then:
Your scope trace for any given profile step never levels off (it is either rising or falling for the entire step)	Increase the proportional term
Your scope trace for any given profile step rises (or falls) quickly and then "bounces" or "chatters" around a voltage/current	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QH module. Refer to download procedure in chapter 5.

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

7. Slowly increase the integral term while running machine cycles until you observe overshoots on the oscilloscope trace. Now decrease the integral term until overshoots disappear.

Important: If you cannot alter your proportional and integral terms so that oscilloscope traces quickly level off without bouncing or chattering, verify your unselected valve set-output values are correct for your application (Refer to chapter 8 and the discussion later in this chapter).

General Guidelines for Velocity Tuning

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

In this section we present two procedures:

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

Repeat either one of these procedures as needed for tuning closed-loop control of these velocity vs. position profiles:

- Axis retract (R1, R2, R3, R4)
- Axis extend (E1, E2, E3)

Important: Disable ramping when tuning closed-loop velocity profiles:

Important: The dynamics of loads being moved and different hydraulic characteristics may warrant separate PID tuning constants for each profile.

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

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

- Use the **lowest** possible P gain constant for repeatable performance.
- Use an oscilloscope, if available. You can tune loops faster and easier with it connected to QH 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 VelFF term
- disabled ramping

⚠ **CAUTION:** Verify that you have correctly set the following words and bits in EP and RP that control zone overrun to guard against damaging your machine.

- EP03-B11 (B37/317) = 0: execute the E4 profile if zone overrun occurs
- set EP61 (N43:297) larger than normal for a larger protection zone
- RP03-B11 (B37/619) = 0: execute the R4 profile if zone overrun occurs
- set RP61 (N43:597) smaller than normal for a larger R4 profile zone

---

1. Enter an operational profile representative of characteristics you desire for your production cycle.
2. Download all setpoint changes to the QH module (chapter 5).
3. Run several profile cycles while comparing profile actuals returned in the corresponding status block with profile setpoints. 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 QH module. Refer to download procedure in chapter 5.

4. Re-run the profile after each change to the proportional term until observed actuals are close to setpoints without hammering and vibration in hydraulic lines to the controlled cylinder.

Important: If you cannot make velocity actuals match entered setpoints, verify that your unselected valve set-output values are correct for your application (Refer to chapter 8 and the discussion later in this chapter).

5. If you are satisfied with your unselected valve set-output values and still cannot match velocity actuals to desired setpoints, your control may require a small feedforward gain.

6. If necessary, slowly increase the feedforward term while running machine cycles until velocity actuals satisfactorily match entered setpoints.

Tune Velocity Loops With An Oscilloscope

Before you begin tuning your velocity loop, confirm that you:

- selected the velocity vs. position algorithm
- selected closed-loop control
- zeroed the VelFF term
- disabled ramping

⚠ **CAUTION:** Verify that you have correctly set the following words and bits in EP and RP that control zone overrun to guard against damaging the machine.

- EP03-B11 (B37/317) = 0: Execute the E4 profile if zone overrun occurs
- set EP61 (N43:297) larger than normal for a larger protection zone
- RP03-B11 (B37/619) = 0: Execute R4 profile if zone overrun occurs
- set RP61 (N43:597) smaller than normal for a larger R4 profile zone

---

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

2. Check that you zeroed the profile's feedforward term. Leave the proportional term at the value you entered in chapter 8.

3. Download all setpoint changes to the QH module (chapter 5).

4. Connect an oscilloscope to your selected velocity control valve

5. Run several profile cycles while observing the oscilloscope trace.

   Ideally for each step of a multi-stepped profile, the oscilloscope trace should rise or fall quickly to a controlled level and then flatten out. Bounce or chatter when rising or falling is undesirable.

If:	Then:
Your scope trace for any given profile step never levels off (it is either rising or falling for the entire step)	Increase the proportional term
Your scope trace for any given profile step rises (or falls) quickly and then "bounces" or "chatters" around a voltage/current	Decrease the proportional term
Excessive hammering and vibration is observed in the cylinder's hydraulic lines	Decrease the proportional term

Important: Each time you change a gain constant, you must download the change to the QH module. Refer to the download procedure in chapter 5.

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

Important: If you cannot alter the proportional term so that oscilloscope traces quickly level off without bounce or chatter, verify that your unselected valve set-output values are correct for your application. (Refer to chapter 8 and the discussion later in this chapter).

7. If you are satisfied with the unselected valve set-output values and still cannot make the oscilloscope trace quickly level off without bounce or chatter, your control may require a small feedforward gain.

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

Tuning Considerations for Axis Motion

In this section, we discuss the usage and effect of the following items as they apply to axis motion:

- Profile Requirements
- Logical Bridges
- End-of-profile Set-output Values
- Unselected Valve Set-output Values
- Acceleration and Deceleration Ramp Rates
- Pressure Alarm Setpoints
- Watchdog Timer

Profile Requirements

A profile is a series of position and pressure (or velocity) setpoints which uniquely define a phase of axis motion. The complexity of the profile depends on your machine. Next we discuss required setpoints.

Velocity Setpoints
In general, choose velocity setpoints to move the axis quickly without damaging the machine. If moving a large dynamic load, be very careful if you configure fast motion, because once accelerated, the moving mass is extremely difficult to stop in a short period of time.

When configuring velocity profiles:

- Start with relatively low velocity setpoints.
- Increase them in small increments while observing axis motion and repeatability at critical positions in the cycle.

Because of the inertia and momentum of moving large masses, we suggest:

- Make the first profile segment relatively long in duration, to minimize the undershoot of actual velocities compared to setpoints. It takes time for the hydraulics to overcome inertia and build adequate pressure and flow to accelerate the load to the requested velocity.
- Make your second and/or third profile segments long enough in duration to avoid overshooting the setpoints. Overshoot increases with higher velocities. Once the moving load gains momentum, it is difficult to slow it to the requested velocity.

If Using Low Pressure for the E4 Profile
If necessary, you can use pressure setpoints low enough to let obstructions resist axis motion when approaching the fully extended (safe) position. You also can set a watchdog timer to signal the PLC-5 processor that a protection fault has occurred.

End-of-segment Position Setpoints
These setpoints depend on axis configurations of your machine. Generally, you are not required to enter any end-of-segment position setpoints. If not used, expect the following results:

For this profile	The QH module	Then the QH module:
E1	Uses any non-zero velocity setpoint (EP09) or pressure setpoint (EP10) until the axis reaches the protective start E4 position (EP61). The E2 and E3 profiles are not used.	• Either stops and zeros outputs (EP03-B11 = 1), or • runs the E4 profile (EP03-B11 = 0) until the axis reaches the fully extended position (EP62).
R1	Uses any non-zero velocity setpoint (RP09) or pressure setpoint (RP10 until the axis reaches the protective start R4 position (RP61). The R2 and R3 profiles are not used.	• Either stops and zeros outputs (RP03-B11 = 1), or • runs the R4 profile (RP03-B11 = 0) until the axis reaches the fully retracted position (RP62).

If you need additional profile segments, begin by adding:

- 1st segment of the E1 profile (EP11)
- 1st segment of the R1 profile (RP11)

Then add these profile segments:

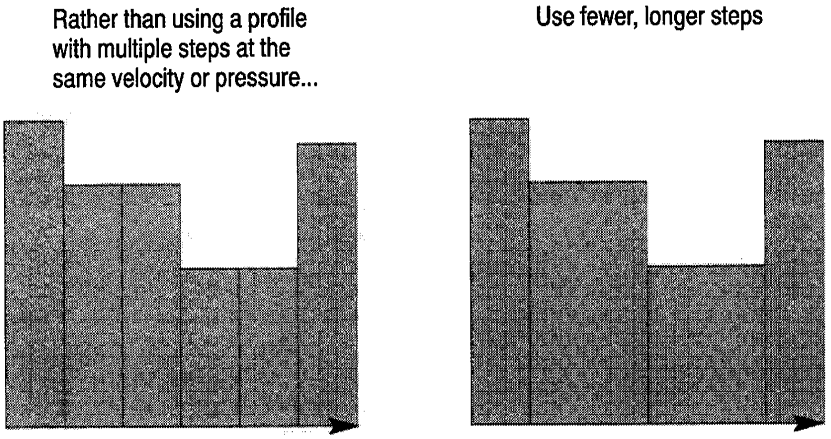
- 2nd segment of the E1 profile (EP14)
- 2nd segment of the R1 profile (RP14)

Use all available segments in the E1 and R1 profiles before using any in the E2 or R2 profiles unless you require different unselected valve set-output values for successive segments.

Important: Fast segment velocities or high segment pressures may cause the axis to overshoot the start E4 or start R4 position. If you increase a velocity or pressure setpoint in a fast axis-extend (or retract) movement, we recommend that you increase the protection zone with EP61 and the overrun zone with RP61 at least temporarily for safer axis movement.

Important: Avoid using the same velocity or pressure setpoint on sequential segments. For better control, use a single segment of longer length or duration (figure 10.2).

Figure 10.5
Better Control from Fewer and Longer Steps

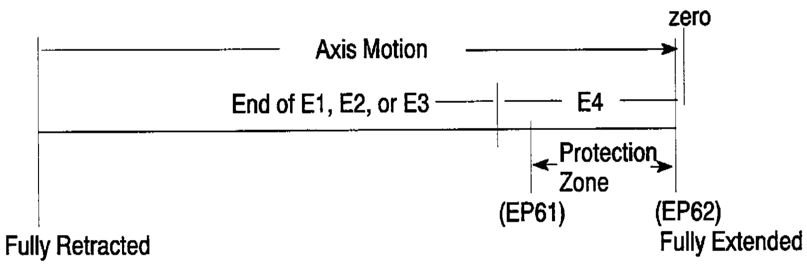


Axis-extend Profiles

Start Extend Protection Zone (EP61)

The QH module uses this axis position as protection against running an E1, E2, or E3 profile too far (into the protection zone). Although you can use it as an operational setpoint when EP03-B11 = 0 (see End-of-segment Position Setpoints above), its purpose is to guard against machine damage resulting from profile entry errors.

Figure 10.1
Example Setpoints for E4 and Protection Zone



Important: This position setpoint should be determined and set only by qualified personnel.

Calculate EP61 by determining the smallest distance required for the QH module to safely assume pressure control:

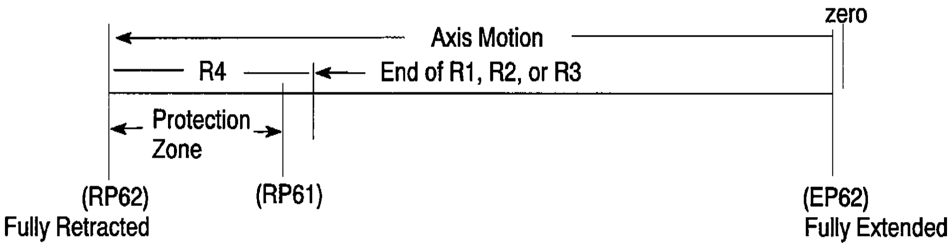
- prior to reaching the final extended position
- with the axis moving at maximum velocity and pressure

By setting EP61, you minimize the possibility of machine damage that could result from changing axis velocity, pressure, or position setpoints.

Start Retract Protection Zone (RP61)

The QH module uses this axis position to guard against running an R1, R2, or R3 profile too far (into the protection zone). Although you can use it as an operational setpoint when RP03-B11 = 0 (see End-of-segment Position Setpoints below), its purpose is to maintain precision axis positioning regardless of profile entry errors.

Figure 10.2
Example R4 Setpoints



Important: This position setpoint should be determined and set only by qualified personnel.

Calculate RP61 by determining the smallest distance required for the QH module to safely assume pressure control of the R4 profile:

- prior to the axis reaching fully retracted position
- with the axis moving at maximum velocity and pressure

By setting RP61, you minimize the possibility of machine damage that could result from changing axis velocity, pressure, or position setpoints.

Logic for Protection Zone (EP61 and RP61)

The following summarizes the choices of control action when the QH module detects that the axis passed position setpoints EP61 or RP61:

When the axis passes this position	The QH module	If you configured
RP61 start retract protection zone	changes to the R4 profile	EP03-B11 = 0
	stops and zeros outputs	EP03-B11 = 1
EP61 start extend protection zone	changes to the E4 profile	RP03-B11 = 0
	stops and zeros outputs	RP03-B11 = 1

End-of-profile Set-output Values

If required by your application, you may configure the QH module to stop at the completion of any profile and provide a constant signal to each of its four outputs while awaiting further commands from your PLC-5 processor. Disabling logical bridges (discussed later) and configuring end-of-profile set-output values let you do this. Recall in chapter 10 that we used set-output values at the end of the E4 profile to achieve hydraulic tonnage.

If your hydraulics and/or process require your PLC-5 processor to make changes between profiles, you may configure the QH module to stop at the completion of these profiles (with these control bits):

- E1 (EP03-B08 = 1)
- E2 (EP03-B09 = 1)
- E3 (EP03-B10 = 1)
- R1 (RP03-B08 = 1)
- R2 (RP03-B09 = 1)
- R3 (RP03-B10 = 1)

Then the QH module sends a fixed signal to each of its four outputs while awaiting further commands from the PLC-5 processor.

Important: The QH module always stops and sets outputs at completion of the E4 and R4 profiles.

Using end-of-profile set-output values between profiles for:

- adjusting flow with a variable pump between profiles
- initializing valves for the next profile
- re-aligning solenoid valves with your PLC-5 processor before the next profile

When configuring end-of-profile set-output values, remember:

- The QH module ignores these values on all profiles that are logically bridged to the next profile
- After the QH module sets these values, they remain set until the QH module is commanded to start another profile, or stop on command

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 8 prior to spanning your machine valves in chapter 10. The value in these words is the signal level sent to all outputs not selected for control by the QH module's algorithm during a profile.

In chapter 8, you determined the signal output percentages required to drive the unselected valves during respective profiles. These values should allow desired axis control. Although process considerations may require that you modify them during a particular profile, you should adjust them only if you are unable to obtain desired closed-loop control by modifying profile gain constants.

Important: When attempting to achieve desired closed-loop control, do NOT change unselected valve set-output values until after you have adjusted the profile gain constants.

Important: Large changes to unselected valve set-output values may require:

- re-spanning the selected valve for that profile (chapter 10)
- changing PID gain constants

If you think your unselected valve set-output values are adversely affecting your ability to obtain good closed-loop control, consider the following:

If your selected valve controls:	And you observe:	Then:
Pressure	Profile segment pressures substantially greater than setpoint	Decrease the flow available during the profile by appropriately modifying the set-output value driving the flow valve.
Pressure	Profile segment pressures substantially less than setpoint	Increase the flow available during the profile by appropriately modifying the set-output value driving the flow valve.
Velocity	Profile segment velocities substantially greater than setpoint	Decrease the pressure available during the profile by appropriately modifying the set-output value driving the pressure valve.
Velocity	Profile segment velocities substantially less than setpoint	Increase the flow available during the profile by appropriately modifying the set-output value driving the pressure valve.

Logical Bridges

In chapter 9, you configured your QH module to logically bridge all your profiles. This forced the QH module to start each successive profile at completion of the previous one in each direction of movement. If your hydraulics and/or process require NO changes between profiles controlling axis motion , you may configure the QH module to logically bridge the following profiles as integrated machine phases:

- E1 to E2 (EP03-B08 = 0)
- E2 to E3 (EP03-B09 = 0)
- E3 to E4 (EP03-B10 = 0)
- R1 to R2 (RP03-B08 = 0)
- R2 to R3 (RP03-B09 = 0)
- R3 to R4 (RP03-B10 = 0)

Bridging machine phases has benefits such as:

- reduced cycle time
- smoother control
- less chance of hydraulic pressure transients

Acceleration and Deceleration Ramp Rates

The zero ramp rates that you entered in chapter 8 disabled ramping. This forced the QH module to step from setpoint to setpoint during a profile.

If required by your application, you may configure your QH module to ramp its outputs during any profile. The QH module uses configured acceleration and deceleration ramp rates when moving all of its outputs from setpoint to setpoint during any profile (figures 10.3 and 10.4).

CAUTION: Because ramp rates are time based, using very slow (low value) ramp rates may inhibit effective closed-loop control and limit the QH module's control capability. Use ramp rates only if machine operation mandates them.

With caution, you can use ramp rates to smooth jerky motion resulting from large changes in axis pressure or flow.

Important: When enabled, the QH module applies ramp rates at the beginning of each profile or segment of a profile.

Figure 10.3
Example Velocity Profiles with Programmed Acc/Dec Ramps

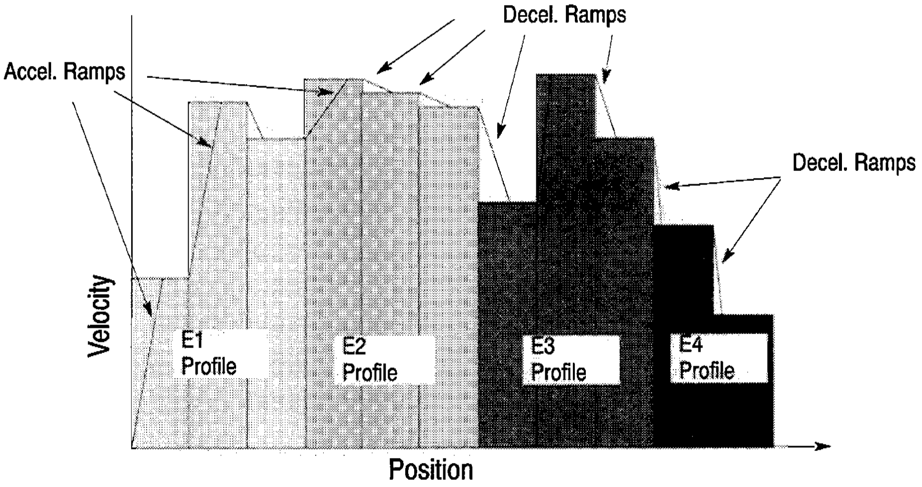
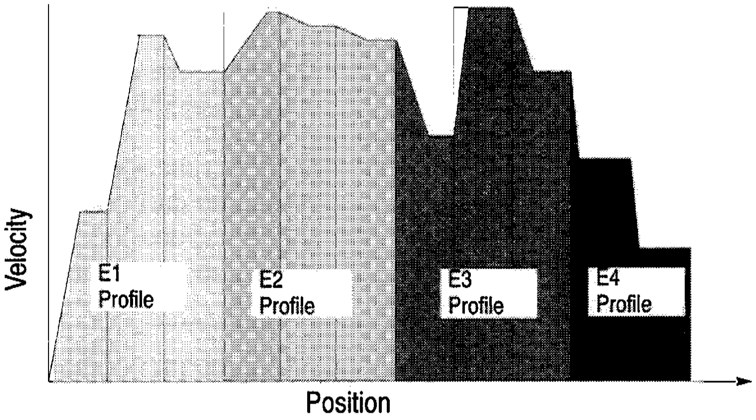


Figure 10.4
Example Velocity Profile When Ramps Are Used



You can configure ramp rates to decelerate the axis:

- At the beginning of the E4 profile. This may avoid possible damage to machinery when moving toward the protection zone at high velocities.
- At the beginning of the R4 profile. This may help achieve consistent repeatability of the fully retracted position when moving toward the R4 profile at high velocities.

If your application requires the use of ramp rates, remember:

- Never apply ramp rates until you tuned all applicable axis pressure and velocity loops.

- When applied, ramp rates affect both the selected and unselected valves. Therefore, even though you may be controlling velocity, you can ramp axis pressure during the E4 profile.
- Using slow ramp rates may force pressure and velocity actuals out of control because these actuals include the time spent ramping plus the time each segment is controlled.
- You enter ramp rates in units of 0 to 9999% signal output per second (note that there is no decimal point). A ramp rate entry of 9999 lets the output move full range in 10 milliseconds, while a ramp rate entry of 99 requires a full second to go full range. Lower values = slower ramps.

Pressure Alarm Setpoints

The QH module monitors high pressures and compares them with two types of alarm setpoints for:

- absolute pressure that you configure in the MCC block (chapter 5) The QH module monitors these continuously without regard to current machine mode or operational cycle.
- profile pressure that you configure in configuration blocks (chapter 8) The QH module monitors these only during the subject profile.

In general:

When using this alarm	to detect this condition	You set the alarm setpoint	and Program ladder logic to
Absolute pressure	Dangerously high pressure	• Well above normal operating level • Below the level that could result in machine damage or personal injury	• Stop the QH module • Place the machine in a safe condition
Profile pressure	Abnormally high pressure	• Just above the highest pressure expected for the profile of movement • Low enough to detect problems	• Stop the process • Signal the operator to take corrective action

Watchdog Timer Presets

Set the preset of profile and tonnage watchdog timers after your machine is running correctly. Set it just longer than the duration of the subject profile. We suggest that you use these timers:

- as an early alert that a process problem may be developing
- in your PLC ladder logic to automatically initiate a corrective action

Chapter 12

Troubleshoot with LEDs

Chapter Objectives

This chapter gives you information on how to troubleshoot your QH module using LED indicators.

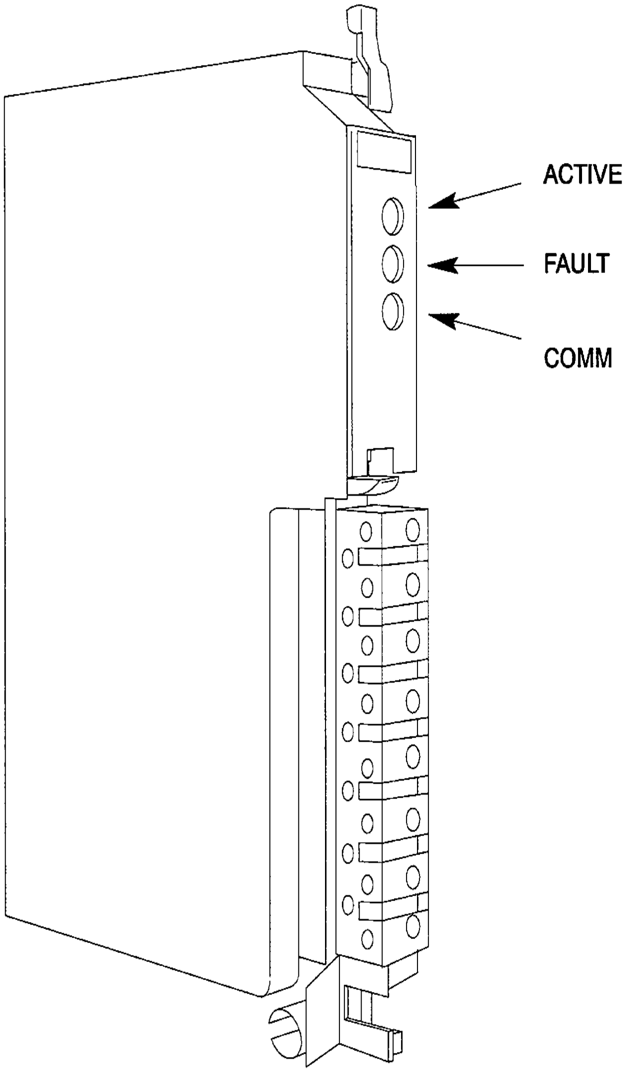
Use LEDs to Troubleshoot Your QH Module

The front panel of the QH module contains three Light Emitting Diodes (LEDs). These LEDs can be used to troubleshoot some basic problems that may occur during installation or operation of the QH module. Each LED is a different color for easy identification.

Color of LED:	Identified as:
Green	ACTIVE
Red	FAULT
Yellow	COMM

The QH module's three LEDs are located on the front panel of the module as shown on Figure 11.1.

Figure 11.1
QH Module LED's



The following table shows the meaning of the QH module's LEDs. The QH module monitors its own operation and reports detected conditions by illuminating its LEDs in the following combinations:

Table 11.A
LED Indicator Conditions

ACTIVE green	FAULT red	COMM yellow	Condition:	We recommend that you:
Flashing	Off	Off	Power-up. The QH module has completed its power-up diagnostics, the QH module hardware and firmware are OK, and the QH module is awaiting download of the MCC block.	Download the MCC block. Ladder logic on diskette downloads the MCC when you switch your PLC processor from program mode to run mode.
Flashing	On	On	Software Error. The QH hardware and firmware are OK, the last BTW received by the QH module had a recognizable Block ID, but the last MCC received by the QH module contained a programming error.	Use the MCC download procedure in chapter 6 to correct any MCC programming errors.
Flashing	On	Off	Software Error. The QH hardware and firmware are OK, but the last BTW received by the QH module did not have a recognizable Block ID, and the last MCC received by the QH module contained a programming error.	1) Use the MCC download procedure in chapter 6 to correct any MCC programming errors. 2) Verify Block ID's in your BTW data files.
On	Off	On	Normal operation. The QH hardware and firmware are OK, no programming errors exist, and the last command data block received by the QH module had a recognizable Block ID.	Nothing.
On	Off	Off	Software Error. The QH hardware and firmware are OK, no programming errors exist, but the last command data block received by the QH module did not have a recognizable Block ID.	Verify Block ID's in your BTW data files.
On	On	On	Limited operation. The QH hardware and firmware are OK, the last command data block received by the QH module had a recognizable Block ID, but a programming error(s) exists.	Use the download procedure in chapter 4 to determine and correct programming errors.
On	On	Off	Software Error. The QH hardware and firmware are OK, but a programming error(s) exists, and the last command data block received by the QH module did not have a recognizable Block ID.	1) Use the download procedure in chapter 4 to determine and correct programming errors. 2) Verify Block ID's in your BTW data files.
Off	Off	Flashing	Communications Error. The QH hardware and firmware are OK, but the module is not completing continuous transmission of status data blocks to the host PLC processor. The QH module is inoperable until continuous BTR communication is re-established with the host PLC processor.	1) Verify your PLC processor is in run mode. 2) Reseat your QH module in the I/O chassis. 3) Check for PLC ladder programming problems.
Off	On	On or Off	Hardware fault. The QH module is inoperable.	1) Cycle power to the QH module. 2) Replace the QH module and return it for factory repair.

Abbreviated Command & Status Blocks

Introduction

We present abbreviated data blocks used by the QH module for:

- receiving commands, configuration, and profile setpoints from the PLC-5 processor
- sending status to the PLC-5 processor

We abbreviated the titles with these codes:

- E = extend
- R = retract
- P = profile
- S = status
- # = profile number, 1-4

For example, the title code for 3rd axis-extend configuration block would be E3C. Blocks MCC, JGC, DYC, and SYS have unique title codes.

The table below lists the types of command and status blocks found in this appendix.

Command Block:	Page:
MCC	A-2
JGC	A-3
E1C	A-4
E2C	A-5
E3C	A-6
E4C	A-7
EP	A-8
R1C	A-9
R2C	A-10
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R4C	A-12
RP	A-13
DYC	A-14

Status Block:	Page:
SYS	A-15
ES	A-16
RS	A-17

For complete word and bit descriptions of these data blocks, refer to appendix C.

MODULE CONFIGURATION COMMAND BLOCK (MCC)

Word	Address	Description
Bit-mapped Control Words		
MCC01	B34:32	Block ID 00000000 00000001
MCC02	B34:33	Reserved for future use (RFU)
MCC03	B34:34	Input range selection
MCC04	B34:35	Output range selection
Axis Position Sensor Configuration		
MCC05-22	N40:1-18	RFU
MCC23	N40:19	Minimum position
MCC24	N40:20	Maximum position
MCC25	N40:21	Analog signal @ min position
MCC26	N40:22	Analog signal @ max position
MCC27	N40:23	Minimum SWTL
MCC28	N40:24	Maximum SWTL
MCC29	N40:25	SWTL alarm deadband
MCC30	N40:26	Digital filter
Axis Pressure Sensor Configuration		
MCC31	N40:27	Minimum pressure
MCC32	N40:28	Maximum pressure
MCC33	N40:29	Analog signal @ min pressure
MCC34	N40:30	Analog signal @ max pressure
MCC35	N40:31	High pressure alarm setpoint
MCC36	N40:32	Time delay for pressure alarms
Auxiliary Sensor Input #1 Configuration		
MCC37	N40:33	Minimum position
MCC38	N40:34	Maximum position
MCC39	N40:35	Analog signal @ min position
MCC40	N40:36	Analog signal @ max position
MCC41	N40:37	Minimum SWTL
MCC42	N40:38	Maximum SWTL
MCC43	N40:39	SWTL alarm deadband
MCC44	N40:40	Digital filter
Auxiliary Sensor Input #2 Configuration		
MCC45	N40:41	Minimum pressure
MCC46	N40:42	Maximum pressure
MCC47	N40:43	Analog signal @ min pressure
MCC48	N40:44	Analog signal @ max pressure
MCC49	N40:45	High pressure alarm setpoint
MCC50	N40:46	Time delay for pressure alarms

JOG CONFIGURATION COMMAND BLOCK (JGC)

Word	Address	Description
Bit-mapped Control Words		
JGC01	B34:36	Block ID 00000000 00000010
JGC02-04	B34:37-39	RFU
Jog Alarm Setpoints		
JGC05	N40:61	RFU
JGC06	N40:62	RFU
JGC07	N40:63	Axis jog pressure alarm
JGC08	N40:64	RFU
Alternate #1 Jog Set-output Values		
JGC09	N40:65	Output #1
JGC10	N40:66	Output #2
JGC11	N40:67	Output #3
JGC12	N40:68	Output #4
JGC13-16	N40:69-72	RFU
Alternate #2 Extend-jog Set-output Values		
JGC17	N40:73	Output #1
JGC18	N40:74	Output #2
JGC19	N40:75	Output #3
JGC20	N40:76	Output #4
JGC21-24	N40:77-80	RFU
Alternate #2 Retract-jog Set-output Values		
JGC25	N40:81	Output #1
JGC26	N40:82	Output #2
JGC27	N40:83	Output #3
JGC28	N40:84	Output #4
JGC29-32	N40:85-88	RFU
Axis Extend-jog Set-output Values		
JGC33	N40:89	Output #1
JGC34	N40:90	Output #2
JGC35	N40:91	Output #3
JGC36	N40:92	Output #4
JGC37-40	N40:93-96	RFU
Axis Retract-jog Set-output Values		
JGC41	N40:97	Output #1
JGC42	N40:98	Output #2
JGC43	N40:99	Output #3
JGC44	N40:100	Output #4
JGC45-48	N40:101-104	RFU
Alternate #3 Extend-jog Set-output Values		
JGC49	N40:105	Output #1
JGC50	N40:106	Output #2
JGC51	N40:107	Output #3
JGC52	N40:108	Output #4
JGC53-56	N40:109-112	RFU
Alternate #3 Retract-jog Set-output Values		
JGC57	N40:113	Output #1
JGC58	N40:114	Output #2
JGC59	N40:115	Output #3
JGC60	N40:116	Output #4
JGC61-64	N40:117-120	RFU

1st EXTEND CONFIGURATION BLOCK (E1C)

Word	Address	Description
Bit-mapped Control Words		
E1C01	B37:0	Block ID 00000000 00000011
E1C02	B37:1	Selected valve Configurations
E1C03-04	B37:2-3	RFU
Watchdog Timer		
E1C05-07	N43:1-3	RFU
E1C08	N43:4	Profile watchdog timer
Set-output Values for Unselected Valves (during profile)		
E1C09	N43:5	Output #1
E1C10	N43:6	Output #2
E1C11	N43:7	Output #3
E1C12	N43:8	Output #4
E1C13-16	N43:9-12	RFU
Acceleration Ramp Rates		
E1C17	N43:13	Output #1
E1C18	N43:14	Output #2
E1C19	N43:15	Output #3
E1C20	N43:16	Output #4
E1C21-24	N43:17-20	RFU
Deceleration Ramp Rates		
E1C25	N43:21	Output #1
E1C26	N43:22	Output #2
E1C27	N43:23	Output #3
E1C28	N43:24	Output #4
E1C29-32	N43:25-28	RFU
End-of Profile Set-output Values		
E1C33	N43:29	Output #1
E1C34	N43:30	Output #2
E1C35	N43:31	Output #3
E1C36	N43:32	Output #4
E1C37-40	N43:33-36	RFU
Pressure Control Limits		
E1C41	N43:37	Minimum limit
E1C42	N43:38	Maximum limit
E1C43	N43:39	% output for minimum
E1C44	N43:40	% output for maximum
Velocity Control Limits		
E1C45	N43:41	Minimum limit
E1C46	N43:42	Maximum limit
E1C47	N43:43	% output for minimum
E1C48	N43:44	% output for maximum
Profile Tuning Constants		
E1C49	N43:45	Proportional gain, pressure control
E1C50	N43:46	Integral gain, pressure control
E1C51	N43:47	Derivative gain, pressure control
E1C52	N43:48	Proportional gain, velocity control
E1C53	N43:49	Feedforward gain, velocity control
E1C54-56	N43:50-52	RFU
Setpoint for Profile Pressure Alarm		
E1C57	N43:53	High pressure alarm
E1C58-64	N43:54-60	RFU

2nd EXTEND CONFIGURATION BLOCK (E2C)

Word	Address	Description
Bit-mapped Control Words		
E2C01	B37:4	Block ID 00000000 00000100
E2C02	B37:5	Selected valve Configurations
E2C03-04	B37:6-7	RFU
Watchdog Timer		
E2C05-07	N43:61-63	RFU
E2C08	N43:64	Profile watchdog timer
Set-output Values for Unselected Valves (during profile)		
E2C09	N43:65	Output #1
E2C10	N43:66	Output #2
E2C11	N43:67	Output #3
E2C12	N43:68	Output #4
E2C13-16	N43:69-72	RFU
Acceleration Ramp Rates		
E2C17	N43:73	Output #1
E2C18	N43:74	Output #2
E2C19	N43:75	Output #3
E2C20	N43:76	Output #4
E2C21-24	N43:77-80	RFU
Deceleration Ramp Rates		
E2C25	N43:81	Output #1
E2C26	N43:82	Output #2
E2C27	N43:83	Output #3
E2C28	N43:84	Output #4
E2C29-32	N43:85-88	RFU
End-of Profile Set-output Values		
E2C33	N43:89	Output #1
E2C34	N43:90	Output #2
E2C35	N43:91	Output #3
E2C36	N43:92	Output #4
E2C37-40	N43:93-96	RFU
Pressure Control Limits		
E2C41	N43:97	Minimum limit
E2C42	N43:98	Maximum limit
E2C43	N43:99	% output for minimum
E2C44	N43:100	% output for maximum
Velocity Control Limits		
E2C45	N43:101	Minimum limit
E2C46	N43:102	Maximum limit
E2C47	N43:103	% output for minimum
E2C48	N43:104	% output for maximum
Profile Tuning Constants		
E2C49	N43:105	Proportional gain, pressure control
E2C50	N43:106	Integral gain, pressure control
E2C51	N43:107	Derivative gain, pressure control
E2C52	N43:108	Proportional gain, velocity control
E2C53	N43:109	Feedforward gain, velocity control
E2C54-56	N43:110-112	RFU
Setpoint for Profile Pressure Alarm		
E2C57	N43:113	High pressure alarm
E2C58-64	N43:114-120	RFU

3rd EXTEND CONFIGURATION BLOCK (E3C)

Word	Address	Description
Bit-mapped Control Words		
E3C01	B37:8	Block ID 00000000 00000101
E3C02	B37:9	Selected valve Configurations
E3C03-04	B37:10-11	RFU
Watchdog Timer		
E3C05-07	N43:121-123	RFU
E3C08	N43:124	Profile watchdog timer
Set-output Values for Unselected Valves (during profile)		
E3C09	N43:125	Output #1
E3C10	N43:126	Output #2
E3C11	N43:127	Output #3
E3C12	N43:128	Output #4
E3C13-16	N43:129-132	RFU
Acceleration Ramp Rates		
E3C17	N43:133	Output #1
E3C18	N43:134	Output #2
E3C19	N43:135	Output #3
E3C20	N43:136	Output #4
E3C21-24	N43:137-140	RFU
Deceleration Ramp Rates		
E3C25	N43:141	Output #1
E3C26	N43:142	Output #2
E3C27	N43:143	Output #3
E3C28	N43:144	Output #4
E3C29-32	N43:145-148	RFU
End-of Profile Set-output Values		
E3C33	N43:149	Output #1
E3C34	N43:150	Output #2
E3C35	N43:151	Output #3
E3C36	N43:152	Output #4
E3C37-40	N43:153156	RFU
Pressure Control Limits		
E3C41	N43:157	Minimum limit
E3C42	N43:158	Maximum limit
E3C43	N43:159	% output for minimum
E3C44	N43:160	% output for maximum
Velocity Control Limits		
E3C45	N43:161	Minimum limit
E3C46	N43:162	Maximum limit
E3C47	N43:163	% output for minimum
E3C48	N43:164	% output for maximum
Profile Tuning Constants		
E3C49	N43:165	Proportional gain, pressure control
E3C50	N43:166	Integral gain, pressure control
E3C51	N43:167	Derivative gain, pressure control
E3C52	N43:168	Proportional gain, velocity control
E3C53	N43:169	Feedforward gain, velocity control
E3C54-56	N43:170-172	RFU
Setpoint for Profile Pressure Alarm		
E3C57	N43:173	High pressure alarm
E3C58-64	N43:174-180	RFU

4th EXTEND CONFIGURATION BLOCK (E4C)

Word	Address	Description
Bit-mapped Control Words		
E4C01	B37:12	Block ID 00000000 00000110
E4C02	B37:13	Selected valve configurations
E4C03-04	B37:14-15	RFU
Watchdog Timer		
E4C05-06	N43:181-182	RFU
E4C07	N43:183	Tonnage timer preset
E4C08	N43:184	Profile timer preset
Set-output Values for Unselected Valves (during profile)		
E4C09	N43:185	Output #1
E4C10	N43:186	Output #2
E4C11	N43:187	Output #3
E4C12	N43:188	Output #4
E4C13-16	N43:189-192	RFU
Acceleration Ramp Rates		
E4C17	N43:193	Output #1
E4C18	N43:194	Output #2
E4C19	N43:195	Output #3
E4C20	N43:196	Output #4
E4C21-24	N43:197-200	RFU
Deceleration Ramp Rates		
E4C25	N43:201	Output #1
E4C26	N43:202	Output #2
E4C27	N43:203	Output #3
E4C28	N43:204	Output #4
E4C29-32	N43:205-108	RFU
End-of Profile Set-output values		
E4C33	N43:209	Output #1
E4C34	N43:210	Output #2
E4C35	N43:211	Output #3
E4C36	N43:212	Output #4
E4C37-40	N43:213-216	RFU
Pressure Control Limits		
E4C41	N43:217	Minimum limit
E4C42	N43:218	Maximum limit
E4C43	N43:219	% output for minimum
E4C44	N43:220	% output for maximum
E4C45-48	N43:221-224	RFU
Profile Tuning Constants		
E4C49	N43:225	Proportional gain, pressure control
E4C50	N43:226	Integral gain, pressure control
E4C51	N43:227	Derivative gain, pressure control
E4C52-56	N43:228-232	RFU
Setpoint for Profile Pressure Alarm		
E4C57	N43:233	High pressure alarm
E4C58-64	N43:234-240	RFU

EXTEND PROFILE BLOCK (EP)

Word	Address	Description
Bit-mapped Control Words		
EP01	B37:16	Block ID 00000000 00000111
EP02	B37:17	RFU
EP03	B37:18	Algorithm & logical bridging selections
EP04	B37:19	Open/closed loop
Setpoints for 1st Profile		
EP05-08	N43:241-244	RFU
EP09	N43:245	Segment 1 velocity
EP10	N43:246	Segment 1 pressure
EP11	N43:247	End-of Segment 1 position
EP12	N43:248	Segment 2 velocity
EP13	N43:249	Segment 2 pressure
EP14	N43:250	End-of Segment 2 position
EP15	N43:251	Segment 3 velocity
EP16	N43:252	Segment 3 pressure
EP17	N43:253	End-of Segment 3 position
Setpoints for 2nd Profile		
EP18	N43:254	Segment 4 velocity
EP19	N43:255	Segment 4 pressure
EP20	N43:256	End-of Segment 4 position
EP21	N43:257	Segment 5 velocity
EP22	N43:258	Segment 5 pressure
EP23	N43:259	End-of Segment 5 position
EP24	N43:260	Segment 6 velocity
EP25	N43:261	Segment 6 pressure
EP26	N43:262	End-of Segment 6 position
Setpoints for 3rd Profile		
EP27	N43:263	Segment 7 velocity
EP28	N43:264	Segment 7 pressure
EP29	N43:265	End-of Segment 7 position
EP30	N43:266	Segment 8 velocity
EP31	N43:267	Segment 8 pressure
EP32	N43:268	End-of Segment 8 position
EP33	N43:269	Segment 9 velocity
EP34	N43:270	Segment 9 pressure
EP35	N43:271	End-of Segment 9 position
Setpoints for 4th Profile		
EP36	N43:272	RFU
EP37	N43:273	Segment 1 pressure
EP38	N43:274	End-of Segment 1 position
EP39	N43:275	RFU
EP40	N43:276	Segment 2 pressure
EP41-60	N43:277-296	RFU
Critical Process Setpoints		
EP61	N43:297	Start extend protection zone position
EP62	N43:298	Fully extended position
EP63	N43:299	Full tonnage pressure
EP64	N43:300	RFU

1st RETRACT CONFIGURATION BLOCK (R1C)

Word	Address	Description
Bit-mapped Control Words		
R1C01	B37:20	Block ID 00000000 00010001
R1C02	B37:21	Selected valve configurations
R1C03-04	B37:22-23	RFU
Watchdog Timer		
R1C05-07	N43:301-303	RFU
R1C08	N43:304	Profile timer preset
Set-output Values for Unselected Valves (during profile)		
R1C09	N43:305	Output #1
R1C10	N43:306	Output #2
R1C11	N43:307	Output #3
R1C12	N43:308	Output #4
R1C13-16	N43:309-312	RFU
Acceleration Ramp Rates		
R1C17	N43:313	Output #1
R1C18	N43:314	Output #2
R1C19	N43:315	Output #3
R1C20	N43:316	Output #4
R1C21-24	N43:317-320	RFU
Deceleration Ramp Rates		
R1C25	N43:321	Output #1
R1C26	N43:322	Output #2
R1C27	N43:323	Output #3
R1C28	N43:324	Output #4
R1C29-32	N43:325-328	RFU
End-of Profile Set-output Values		
R1C33	N43:329	Output #1
R1C34	N43:330	Output #2
R1C35	N43:331	Output #3
R1C36	N43:332	Output #4
R1C37-40	N43:333-336	RFU
Pressure Control Limits		
R1C41	N43:337	Minimum limit
R1C42	N43:338	Maximum limit
R1C43	N43:339	% output for minimum
R1C44	N43:340	% output for maximum
Velocity Control Limits		
R1C45	N43:341	Minimum limit
R1C46	N43:342	Maximum limit
R1C47	N43:343	Minimum output for selected velocity valve
R1C48	N43:344	Maximum output for selected velocity valve
Profile Tuning Constants		
R1C49	N43:345	Proportional gain, pressure control
R1C50	N43:346	Integral gain, pressure control
R1C51	N43:347	Derivative gain, pressure control
R1C52	N43:348	Proportional gain, velocity control
R1C53	N43:349	Feedforward gain, velocity control
R1C54-56	N43:350-352	RFU
Setpoint for Profile Pressure Alarm		
R1C57	N43:353	High pressure alarm
R1C58-64	N43:354-360	RFU

2nd RETRACT CONFIGURATION BLOCK (R2C)

Word	Address	Description
Bit-mapped Control Words		
R2C01	B37:24	Block ID 00000000 00010010
R2C02	B37:25	Selected valve configurations
R2C03-04	B37:26-27	RFU
Watchdog Timer		
R2C05-07	N43:361-363	RFU
R2C08	N43:364	Profile timer preset
Set-output Values for Unselected Valves (during profile)		
R2C09	N43:365	Output #1
R2C10	N43:366	Output #2
R2C11	N43:367	Output #3
R2C12	N43:368	Output #4
R2C13-16	N43:369-372	RFU
Acceleration Ramp Rates		
R2C17	N43:373	Output #1
R2C18	N43:374	Output #2
R2C19	N43:375	Output #3
R2C20	N43:376	Output #4
R2C21-24	N43:377-380	RFU
Deceleration Ramp Rates		
R2C25	N43:381	Output #1
R2C26	N43:382	Output #2
R2C27	N43:383	Output #3
R2C28	N43:384	Output #4
R2C29-32	N43:385-388	RFU
End-of Profile Set-output Values		
R2C33	N43:389	Output #1
R2C34	N43:390	Output #2
R2C35	N43:391	Output #3
R2C36	N43:392	Output #4
R2C37-40	N43:393-396	RFU
Pressure Control Limits		
R2C41	N43:397	Minimum limit
R2C42	N43:398	Maximum limit
R2C43	N43:399	% output for minimum
R2C44	N43:400	% output for maximum
Velocity Control Limits		
R2C45	N43:401	Minimum limit
R2C46	N43:402	Maximum limit
R2C47	N43:403	% output for minimum
R2C48	N43:404	% output for maximum
Profile Tuning Constants		
R2C49	N43:405	Proportional gain, pressure control
R2C50	N43:406	Integral gain, pressure control
R2C51	N43:407	Derivative gain, pressure control
R2C52	N43:408	Proportional gain, velocity control
R2C53	N43:409	Feedforward gain, velocity control
R2C54-56	N43:410-412	RFU
Setpoint for Profile Pressure Alarm		
R2C57	N43:413	High pressure alarm
R2C58-64	N43:414-420	RFU

3rd RETRACT CONFIGURATION BLOCK (R3C)

Word	Address	Description
Bit-mapped Control Words		
R3C01	B37:28	Block ID 00000000 00010011
R3C02	B37:29	Selected valve configurations
R3C03-04	B37:30-31	RFU
Watchdog Timer		
R3C05-07	N43:421-423	RFU
R3C08	N43:424	Profile timer preset
Set-output Values for Unselected Valves (during profile)		
R3C09	N43:425	Output #1
R3C10	N43:426	Output #2
R3C11	N43:427	Output #3
R3C12	N43:428	Output #4
R3C13-16	N43:429-432	RFU
Acceleration Ramp Rates		
R3C17	N43:433	Output #1
R3C18	N43:434	Output #2
R3C19	N43:435	Output #3
R3C20	N43:436	Output #4
R3C21-24	N43:437-440	RFU
Deceleration Ramp Rates		
R3C25	N43:441	Output #1
R3C26	N43:442	Output #2
R3C27	N43:443	Output #3
R3C28	N43:444	Output #4
R3C29-32	N43:445-448	RFU
End-of Profile Set-output Values		
R3C33	N43:449	Output #1
R3C34	N43:450	Output #2
R3C35	N43:451	Output #3
R3C36	N43:452	Output #4
R3C37-40	N43:453-456	RFU
Pressure Control Limits		
R3C41	N43:457	Minimum limit
R3C42	N43:458	Maximum limit
R3C43	N43:459	% output for minimum
R3C44	N43:460	% output for maximum
Velocity Control Limits		
R3C45	N43:461	Minimum limit
R3C46	N43:462	Maximum limit
R3C47	N43:463	% output for minimum
R3C48	N43:464	% output for maximum
Profile Tuning Constants		
R3C49	N43:465	Proportional gain, pressure control
R3C50	N43:466	Integral gain, pressure control
R3C51	N43:467	Derivative gain, pressure control
R3C52	N43:468	Proportional gain, velocity control
R3C53	N43:469	Feedforward gain, velocity control
R3C54-56	N43:470-472	RFU
Setpoint for Profile Pressure Alarm		
R3C57	N43:473	High pressure alarm
R3C58-64	N43:474-480	RFU

4th RETRACT CONFIGURATION BLOCK (R4C)

Word	Address	Description
Bit-mapped Control Words		
R4C01	B37:32	Block ID 00000000 00010100
R4C02	B37:33	Selected valve configurations
R4C03-04	B37:34-35	RFU
Watchdog Timer		
R4C05-07	N43:481-483	RFU
R4C08	N43:484	Profile timer preset
Set-output Values for Unselected Valves (during profile)		
R4C09	N43:485	Output #1
R4C10	N43:486	Output #2
R4C11	N43:487	Output #3
R4C12	N43:488	Output #4
R4C13-16	N43:489-492	RFU
Acceleration Ramp Rates		
R4C17	N43:493	Output #1
R4C18	N43:494	Output #2
R4C19	N43:495	Output #3
R4C20	N43:496	Output #4
R4C21-24	N43:497-500	RFU
Deceleration Ramp Rates		
R4C25	N43:501	Output #1
R4C26	N43:502	Output #2
R4C27	N43:503	Output #3
R4C28	N43:504	Output #4
R4C29-32	N43:505-508	RFU
End-of Profile Set-output Values		
R4C33	N43:509	Output #1
R4C34	N43:510	Output #2
R4C35	N43:511	Output #3
R4C36	N43:512	Output #4
R4C37-40	N43:513-516	RFU
Pressure Control Limits		
R4C41	N43:517	Minimum limit
R4C42	N43:518	Maximum limit
R4C43	N43:519	% output for minimum
R4C44	N43:520	% output for maximum
Velocity Control Limits		
R4C45	N43:521	Minimum limit
R4C46	N43:522	Maximum limit
R4C47	N43:523	% output for minimum
R4C48	N43:524	% output for maximum
Profile Tuning Constants		
R4C49	N43:525	Proportional gain, pressure control
R4C50	N43:526	Integral gain, pressure control
R4C51	N43:527	Derivative gain, pressure control
R4C52	N43:528	Proportional gain, velocity control
R4C53	N43:529	Feedforward gain, velocity control
R4C54-56	N43:530-532	RFU
Setpoint for Profile Pressure Alarm		
R4C57	N43:533	High pressure alarm
R4C58-64	N43:534-540	RFU

RETRACT PROFILE BLOCK (RP)

Word	Address	Description
Bit-mapped Control Words		
RP01	B37:36	Block ID 00000000 00010101
RP02	B37:37	RFU
RP03	B37:38	Algorithm & logical bridging selections
RP04	B37:39	Open/closed loop
Setpoints for 1st Profile		
RP05-08	N43:541	RFU
RP09	N43:545	Segment 1 velocity
RP10	N43:546	Segment 1 pressure
RP11	N43:547	End-of Segment 1 position
RP12	N43:548	Segment 2 velocity
RP13	N43:549	Segment 2 pressure
RP14	N43:550	End-of Segment 2 position
RP15	N43:551	Segment 3 velocity
RP16	N43:552	Segment 3 pressure
RP17	N43:553	End-of Segment 3 position
Setpoints for 2nd Profile		
RP18	N43:554	Segment 4 velocity
RP19	N43:555	Segment 4 pressure
RP20	N43:556	End-of Segment 4 position
RP21	N43:557	Segment 5 velocity
RP22	N43:558	Segment 5 pressure
RP23	N43:559	End-of Segment 5 position
RP24	N43:560	Segment 6 velocity
RP25	N43:561	Segment 6 pressure
RP26	N43:562	End-of Segment 6 position
Setpoints for 3rd Profile		
RP27	N43:563	Segment 7 velocity
RP28	N43:564	Segment 7 pressure
RP29	N43:565	End-of Segment 7 position
RP30	N43:566	Segment 8 velocity
RP31	N43:567	Segment 8 pressure
RP32	N43:568	End-of Segment 8 position
RP33	N43:569	Segment 9 velocity
RP34	N43:570	Segment 9 pressure
RP35	N43:571	End-of Segment 9 position
Setpoints for 4th Profile		
RP36	N43:572	Segment 10 velocity
RP37	N43:573	Segment 10 pressure
RP38	N43:574	End-of Segment 10 position
RP39	N43:575	Segment 11 velocity
RP40	N43:576	Segment 11 pressure
RP41-60	N43:577-596	RFU
Critical Process Setpoints		
RP61	N43:597	Start retract protection zone position
RP62	N43:598	Fully retracted position
RP63	N43:599	Dwell timer preset
RP64	N43:600	RFU

DYNAMIC COMMAND BLOCK (DYC)

Word	Address	Description
Bit-mapped Control Words		
DYC01	B34:24	Block ID 00011001 & jog commands
DYC02	B34:25	Action-execution commands
DYC03	B34:26	Miscellaneous commands
DYC04	B34:27	Status request & status clear commands
DYC05-08	B34:28-31	RFU
Direct Set-output Values		
DYC09	N40:121	Output #1
DYC10	N40:122	Output #2
DYC11	N40:123	Output #3
DYC12	N40:124	Output #4
DYC13-16	N40:125-128	RFU
Acceleration Ramp Rates		
DYC17	N40:129	Output #1
DYC18	N40:130	Output #2
DYC19	N40:131	Output #3
DYC20	N40:132	Output #4
DYC21-124	N40:133-136	RFU
Deceleration Ramp Rates		
DYC25	N40:137	Output #1
DYC26	N40:138	Output #2
DYC27	N40:139	Output #3
DYC28	N40:140	Output #4
DYC29-60	N40:142-172	RFU
Request for Programming Error		
DYC61	N40:173	Fetch SYS61 and SYS62
DYC62-64	N40:174-176	RFU

SYSTEM STATUS BLOCK (SYS)

Word	Address	Description
Bit-mapped Status Words		
SYS01	B34:0	Block ID 00000001 (lower byte)
SYS01	B34:0	Jog status (upper byte)
SYS02	B34:1	Status of profile execution
SYS03	B34:2	Miscellaneous status
SYS04	B34:3	Status of watchdog timers
SYS05-08	B34:4-7	Status of real-time alarms
SYS09-12	B34:8-11	Status of latched alarms
SYS13-14	B34:12-13	Command errors
SYS15-16	B34:14-15	Status of transferred command blocks
SYS17-18	B34:16-17	Status of last block decoding
SYS19-20	B34:18-19	Programming error Alarms
SYS21	B34:20	Status of profile execution
SYS22	B34:21	Status of End-of Profile action
SYS23-24	B34:22-23	RFU
Input Level in Engineering Units		
SYS25	N40:177	Input #1
SYS26	N40:178	Input #2
SYS27	N40:179	Input #3
SYS28	N40:180	Input #4
SYS29-32	N40:181-184	RFU
Input Level, Raw Signal Level at A/D Converter		
SYS33	N40:185	Input #1
SYS34	N40:186	Input #2
SYS35	N40:187	Input #3
SYS36	N40:188	Input #4
SYS37-40	N40:189-192	RFU
Output Level in Percent		
SYS41	N40:193	Output #1
SYS42	N40:194	Output #2
SYS43	N40:195	Output #3
SYS44	N40:196	Output #4
SYS45-48	N40:197-200	RFU
Maximum Pressures of Each Cycle		
SYS49	N40:201	RFU
SYS50	N40:202	Maximum axis pressure, last cycle
SYS51-56	N40:203-208	RFU
Accumulated Process Times		
SYS57	N40:209	Tonnage
SYS58	N40:210	RFU
SYS59	N40:211	Retract dwell
SYS60	N40:212	Cycle
Programming Error Codes		
SYS61	N40:213	ID of data block with error
SYS62	N40:214	Programming error code
Firmware ID		
SYS63	N40:215	QH Series/Revision
Confirmation of New Status		
SYS64	N40:216	Counter accumulated value, each new SYS

EXTEND PROFILE STATUS BLOCK (ES)

Word	Address	Description
Bit-mapped Status Words		
ES01	B34:0	Block ID 00000010 (lower byte)
ES01	B34:0	Jog status (upper byte)
ES02	B34:1	Status of profile execution
ES03	B34:2	Miscellaneous status
ES04	B34:3	Status of watchdog timers
ES05-06	B37:40-41	RFU
ES07	B37:42	High limit alarms
ES08	B37:43	Low limit alarms
Actuals from 1st Profile		
ES09	N43:601	Segment 1 velocity
ES10	N43:602	Segment 1 pressure
ES11	N43:603	Segment 1 execution time
ES12	N43:604	Segment 2 velocity
ES13	N43:605	Segment 2 pressure
ES14	N43:606	Segment 2 execution time
ES15	N43:607	Segment 3 velocity
ES16	N43:608	Segment 3 pressure
ES17	N43:609	Segment 3 execution time
Actuals from 2nd Profile		
ES18	N43:610	Segment 4 velocity
ES19	N43:611	Segment 4 pressure
ES20	N43:612	Segment 4 execution time
ES21	N43:613	Segment 5 velocity
ES22	N43:614	Segment 5 pressure
ES23	N43:615	Segment 5 execution time
ES24	N43:616	Segment 6 velocity
ES25	N43:617	Segment 6 pressure
ES26	N43:618	Segment 6 execution time
Actuals from 3rd Profile		
ES27	N43:619	Segment 7 velocity
ES28	N43:620	Segment 7 pressure
ES29	N43:621	Segment 7 execution time
ES30	N43:622	Segment 8 velocity
ES31	N43:623	Segment 8 pressure
ES32	N43:624	Segment 8 execution time
ES33	N43:625	Segment 9 velocity
ES34	N43:626	Segment 9 pressure
ES35	N43:627	Segment 9 execution time
Actuals from 4th Profile		
ES36	N43:628	RFU
ES37	N43:629	Segment 1 pressure
ES38	N43:630	Segment 1 execution time
ES39	N43:631	RFU
ES40	N43:632	Segment 2 pressure
ES41	N43:633	Segment 2 execution time
ES42	N43:634	Starting velocity
ES43	N43:635	Starting pressure
ES44	N43:636	Starting position
ES45	N43:637	Ending velocity
ES46	N43:638	Ending pressure
ES47	N43:639	Ending position
ES48-52	N43:640-644	RFU

EXTEND PROFILE STATUS BLOCK (ES) (continued)

Maximum Pressures During Profiles

ES53	N43:645	During First profile
ES54	N43:646	During Second profile
ES55	N43:647	During Third profile
ES56	N43:648	During Fourth profile

Execution Times from Profiles

ES57	N43:649	First profile
ES58	N43:650	Second profile
ES59	N43:651	Third profile
ES60	N43:652	Fourth profile
ES61-64	N43:653-656	RFU

RETRACT PROFILE STATUS BLOCK (RS)

Word	Address	Description
Bit-mapped Status Words		
RS01	B34:0	Block ID 00000110 (lower byte)
RS01	B34:0	Jog status (upper byte)
RS02	B34:1	Status of profile execution
RS03	B34:2	Miscellaneous status
RS04	B34:3	Status of watchdog timers
RS05-06	B37:44-45	RFU
RS07	B37:46	High limit alarms
RS08	B37:47	Low limit alarms
Actuals from 1st Profile		
RS09	N43:657	Segment 1 velocity
RS10	N43:658	Segment 1 pressure
RS11	N43:659	Segment 1 execution time
RS12	N43:660	Segment 2 velocity
RS13	N43:661	Segment 2 pressure
RS14	N43:662	Segment 2 execution time
RS15	N43:663	Segment 3 velocity
RS16	N43:664	Segment 3 pressure
RS17	N43:665	Segment 3 execution time
Actuals from 2nd Profile		
RS18	N43:666	Segment 4 velocity
RS19	N43:667	Segment 4 pressure
RS20	N43:668	Segment 4 execution time
RS21	N43:669	Segment 5 velocity
RS22	N43:670	Segment 5 pressure
RS23	N43:671	Segment 5 execution time
RS24	N43:672	Segment 6 velocity
RS25	N43:673	Segment 6 pressure
RS26	N43:674	Segment 6 execution time
Actuals from 3rd Profile		
RS27	N43:675	Segment 7 velocity
RS28	N43:676	Segment 7 pressure
RS29	N43:677	Segment 7 execution time
RS30	N43:678	Segment 8 velocity
RS31	N43:679	Segment 8 pressure
RS32	N43:680	Segment 8 execution time

RETRACT PROFILE STATUS BLOCK (RS) (continued)

RS33	N43:681	Segment 9 velocity
RS34	N43:682	Segment 9 pressure
RS35	N43:683	Segment 9 execution time

Actuals from 4th Profile

RS36	N43:684	Segment 10 velocity
RS37	N43:685	Segment 10 pressure
RS38	N43:686	Segment 10 execution time
RS39	N43:687	Segment 11 velocity
RS40	N43:688	Segment 11 pressure
RS41	N43:689	Segment 11 execution time
RS42	N43:690	Starting velocity
RS43	N43:691	Starting pressure
RS44	N43:692	Starting position
RS45	N43:693	Ending velocity
RS46	N43:694	Ending pressure
RS47	N43:695	Ending position
RS48-52	N43:696-690	RFU

Maximum Pressures During Profile

RS53	N43:701	During first profile
RS54	N43:702	During second profile
RS55	N43:703	During third profile
RS56	N43:704	During fourth profile

Execution Times During Profile

RS57	N43:705	First profile
RS58	N43:706	Second profile
RS59	N43:707	Third profile
RS60	N43:708	Fourth profile
RS61-64	N43:709-712	RFU

Appendix **B**

Programming Error Codes

Programming Error Codes

Error codes in this section indicate that you entered invalid data when entering data in a data block. The balance of this appendix lists programming error codes for the following data blocks:

Acronym:	Block ID:	Page:	Description:
MCC	1	B-3	Module Configuration Block
JGC	2	B-4	Jog Configuration Block
E1C	3	B-5	1st Extend Configuration Block
E2C	4	B-6	2nd Extend Configuration Block
E3C	5	B-7	3rd Extend Configuration Block
E4C	6	2-11	4th Extend Configuration Block
EP	7	B-9	Extend Profile Block
R1C	17	B-14	1st Retract Configuration Block
R2C	18	B-15	2nd Retract Configuration Block
R3C	19	B-16	3rd Retract Configuration Block
R4C	20	2-21	4th Retract Configuration Block
RP	21	B-18	Retract Profile Block
DYC	25	B-23	Dynamic Command Block

Important: Error codes listed in this section are returned by the QH module in SYS62. Since the same error code can refer to different problems in different data blocks, you must refer to the block ID returned in SYS61 to determine the block to which the error code relates.

How to Read Error Codes

You read error codes on your 1784-T45 or 1784-T50 programming terminal by examining system status words in the PLC data table:

- SYS61 = block that contains the error
- SYS62 = error code

You can interpret most error codes by memorizing 10 basic types and knowing how the codes are organized.

The 4-digit code, xxyy, has two parts:

- xx = type description
- yy = word in the data block that contains the error

Next we list the type descriptions of example error codes.

Type Description/Example

02 Outside fixed limits

0236 Your entry for MCC36 is out-of-range. Make it 00000 ≤ MCC36 ≤ 00099

03 Cannot be equal

0325 Your entry for MCC25 is equal to MCC26. They must not be equal.

04 Outside range established by another entry

0427 Your entry for MCC27 is out-of-range.
If MCC28 is non-zero, MCC27 must be within MCC23 ≤ MCC27 ≤ MCC28
If MCC28 is zero, MCC27 must be within MCC23 ≤ MCC27 ≤ MCC24

05 Bit selection error

0502 Your bit pattern in E3C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.

06 Block-related configuration error

0609 Your EP09 must be zero because of invalid E1. (SYS15-B02(02)=0)

08 Entry must be zero

0816 Your entry for EP16 must be 00000 when EP14 = 00000.

09 Entry is too large

0929 Your entry for MCC29 is too large.
If MCC27 and MCC28 are both non-zero, MCC29 must be within
MCC27 + MCC29 < MCC28 - MCC29
If MCC27 is zero and MCC28 is non-zero, MCC29 must be within
MCC23 + MCC29 < MCC28 - MCC29
If MCC27 is non-zero and MCC28 is zero, MCC29 must be within
MCC27 + MCC29 < MCC24 - MCC29

10 Error in entry order

1017 Your entries for EP are not in decreasing positional order.
If non-zero, EP17 must be less than EP14.

Module Configuration Block (MCC) (ID = 1)

Error Code	Description
0225	Your entry for MCC25 is out-of-range. MCC25 must be within 00000 ≤ MCC25 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC25 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC25 ≤ 02000 (4 to 20 MADC sensor)
0226	Your entry for MCC26 is out-of-range. MCC26 must be within 00000 ≤ MCC26 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC26 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC26 ≤ 02000 (4 to 20 MADC sensor)
0229	Your entry for MCC29 is out-of-range. Make it 00000 ≤ MCC29 ≤ 00099
0230	Your entry for MCC30 is out-of-range. Make it 00000 ≤ MCC30 ≤ 00099
0233	Your entry for MCC33 is out-of-range. MCC33 must be within 00000 ≤ MCC33 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC33 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC33 ≤ 02000 (4 to 20 MADC sensor)
0234	Your entry for MCC34 is out-of-range. MCC34 must be within 00000 ≤ MCC34 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC34 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC34 ≤ 02000 (4 to 20 MADC sensor)
0236	Your entry for MCC36 is out-of-range. Make it 00000 ≤ MCC36 ≤ 00099
0239	Your entry for MCC39 is out-of-range. MCC39 must be within 00000 ≤ MCC39 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC39 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC39 ≤ 02000 (4 to 20 MADC sensor)
0240	Your entry for MCC40 is out-of-range. MCC40 must be within 00000 ≤ MCC40 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC40 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC40 ≤ 02000 (4 to 20 MADC sensor)
0247	Your entry for MCC47 is out-of-range. MCC47 must be within 00000 ≤ MCC47 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC47 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC47 ≤ 02000 (4 to 20 MADC sensor)
0248	Your entry for MCC48 is out-of-range. MCC48 must be within 00000 ≤ MCC48 ≤ 01000 (0 to 10 VDC sensor) 00100 ≤ MCC48 ≤ 00500 (1 to 5 VDC sensor) 00400 ≤ MCC48 ≤ 02000 (4 to 20 MADC sensor)
0325	Your entry for MCC25 is equal to MCC26. They must not be equal.
0333	Your entry for MCC33 is equal to MCC34. They must not be equal.
0339	Your entry for MCC39 is equal to MCC40. They must not be equal.
0347	Your entry for MCC47 is equal to MCC48. They must not be equal.
0423	Your entry for MCC23 is out-of-range. Make it 00000 ≤ MCC23 < MCC24
0424	Your entry for MCC24 is out-of-range. Make it MCC23 < MCC24 ≤ 09999
0427	Your non-zero entry for MCC27 is out-of-range. If MCC28 is non-zero, MCC27 must be within MCC23 ≤ MCC27 < MCC28 If MCC28 is zero, MCC27 must be within MCC23 ≤ MCC27 < MCC24
0428	Your non-zero entry for MCC28 is out-of-range. If MCC27 is non-zero, MCC28 must be within MCC27 < MCC28 ≤ MCC24 If MCC27 is zero, MCC28 must be within MCC23 < MCC28 ≤ MCC24
0431	Your entry for MCC31 is out-of-range. Make it 00000 ≤ MCC31 < MCC32
0432	Your entry for MCC32 is out-of-range. Make it MCC31 < MCC32 ≤ 09999

Module Configuration Block (MCC) (ID = 1) (continued)

0435	Your entry for MCC35 is out-of-range. If non-zero, MCC35 must be within MCC31 < MCC35 ≤ MCC32
0437	Your entry for MCC37 is out-of-range. Make it 00000 ≤ MCC37 < MCC38
0438	Your entry for MCC38 is out-of-range. Make it MCC37 < MCC38 ≤ 09999
0445	Your entry for MCC45 is out-of-range. Make it 00000 ≤ MCC45 < MCC46
0446	Your entry for MCC46 is out-of-range. Make it MCC45 < MCC46 ≤ 09999
0511	Your entry in MCC03 is invalid because your input range selection (MCC03-B04 = B05 = 1) defines an unconnected input #3. You must configure the QH module for a connected position sensor to input #3. (The sensor must be connected for the QH module to operate.)
0929	Your entry for MCC29 is too large. If MCC27 and MCC28 are both non-zero, MCC29 must be within MCC27 + MCC29 < MCC28 - MCC29 If MCC27 is zero and MCC28 is non-zero, MCC29 must be within MCC23 + MCC29 < MCC28 - MCC29 If MCC27 is non-zero and MCC28 is zero, MCC29 must be within MCC27 + MCC29 < MCC24 - MCC29

Jog Configuration Block (JGC) (ID = 2)

Error Code	Description
0209	Your entry for JGC09 is out-of-range. Make it 00000 ≤ JGC09 ≤ 09999
0210	Your entry for JGC10 is out-of-range. Make it 00000 ≤ JGC10 ≤ 09999
0211	Your entry for JGC11 is out-of-range. Make it 00000 ≤ JGC11 ≤ 09999
0212	Your entry for JGC12 is out-of-range. Make it 00000 ≤ JGC12 ≤ 09999
0213-0216	RFU
0217	Your entry for JGC17 is out-of-range. Make it 00000 ≤ JGC17 ≤ 09999
0218	Your entry for JGC18 is out-of-range. Make it 00000 ≤ JGC18 ≤ 09999
0219	Your entry for JGC19 is out-of-range. Make it 00000 ≤ JGC19 ≤ 09999
0220	Your entry for JGC20 is out-of-range. Make it 00000 ≤ JGC20 ≤ 09999
0221-0224	RFU
0225	Your entry for JGC25 is out-of-range. Make it 00000 ≤ JGC25 ≤ 09999
0226	Your entry for JGC26 is out-of-range. Make it 00000 ≤ JGC26 ≤ 09999
0227	Your entry for JGC27 is out-of-range. Make it 00000 ≤ JGC27 ≤ 09999
0228	Your entry for JGC28 is out-of-range. Make it 00000 ≤ JGC28 ≤ 09999
0229-0232	RFU
0233	Your entry for JGC33 is out-of-range. Make it 00000 ≤ JGC33 ≤ 09999
0234	Your entry for JGC34 is out-of-range. Make it 00000 ≤ JGC34 ≤ 09999
0235	Your entry for JGC35 is out-of-range. Make it 00000 ≤ JGC35 ≤ 09999
0236	Your entry for JGC36 is out-of-range. Make it 00000 ≤ JGC36 ≤ 09999
0237-02340	RFU
0241	Your entry for JGC41 is out-of-range. Make it 00000 ≤ JGC41 ≤ 09999
0242	Your entry for JGC42 is out-of-range. Make it 00000 ≤ JGC42 ≤ 09999
0243	Your entry for JGC43 is out-of-range. Make it 00000 ≤ JGC43 ≤ 09999
0244	Your entry for JGC44 is out-of-range. Make it 00000 ≤ JGC44 ≤ 09999
0245-0248	RFU
0249	Your entry for JGC49 is out-of-range. Make it 00000 ≤ JGC49 ≤ 09999
0250	Your entry for JGC50 is out-of-range. Make it 00000 ≤ JGC50 ≤ 09999
0251	Your entry for JGC51 is out-of-range. Make it 00000 ≤ JGC51 ≤ 09999
0252	Your entry for JGC52 is out-of-range. Make it 00000 ≤ JGC52 ≤ 09999
0253-0256	RFU
0257	Your entry for JGC57 is out-of-range. Make it 00000 ≤ JGC57 ≤ 09999
0258	Your entry for JGC58 is out-of-range. Make it 00000 ≤ JGC58 ≤ 09999

Jog Configuration Block (JGC) (ID = 2) (continued)

0259	Your entry for JGC59 is out-of-range. Make it 00000 ≤ JGC59 ≤ 09999
0260	Your entry for JGC60 is out-of-range. Make it 00000 ≤ JGC60 ≤ 09999
0261-0264	RFU
0405-0406	RFU
0407	Your entry for JGC07 is out-of-range. If non-zero, JGC07 must be within MCC31 < JGC07 ≤ MCC32

1st Extend Configuration Block (E1C) (ID = 3)

Error Code	**Description**
0205-0206	RFU
0208	Your entry for E1C08 is out-of-range. Make it 00000 ≤ E1C08 ≤ 09999
0209	Your entry for E1C09 is out-of-range. Make it 00000 ≤ E1C09 ≤ 09999
0210	Your entry for E1C10 is out-of-range. Make it 00000 ≤ E1C10 ≤ 09999
0211	Your entry for E1C11 is out-of-range. Make it 00000 ≤ E1C11 ≤ 09999
0212	Your entry for E1C12 is out-of-range. Make it 00000 ≤ E1C12 ≤ 09999
0213-0216	RFU
0217	Your entry for E1C17 is out-of-range. Make it 00000 ≤ E1C17 ≤ 09999
0218	Your entry for E1C18 is out-of-range. Make it 00000 ≤ E1C18 ≤ 09999
0219	Your entry for E1C19 is out-of-range. Make it 00000 ≤ E1C19 ≤ 09999
0220	Your entry for E1C20 is out-of-range. Make it 00000 ≤ E1C20 ≤ 09999
0221-0224	RFU
0225	Your entry for E1C25 is out-of-range. Make it 00000 ≤ E1C25 ≤ 09999
0226	Your entry for E1C26 is out-of-range. Make it 00000 ≤ E1C26 ≤ 09999
0227	Your entry for E1C27 is out-of-range. Make it 00000 ≤ E1C27 ≤ 09999
0228	Your entry for E1C28 is out-of-range. Make it 00000 ≤ E1C28 ≤ 09999
0229-0232	RFU
0233	Your entry for E1C33 is out-of-range. Make it 00000 ≤ E1C33 ≤ 09999
0234	Your entry for E1C34 is out-of-range. Make it 00000 ≤ E1C34 ≤ 09999
0235	Your entry for E1C35 is out-of-range. Make it 00000 ≤ E1C35 ≤ 09999
0236	Your entry for E1C36 is out-of-range. Make it 00000 ≤ E1C36 ≤ 09999
0237-0240	RFU
0243	Your entry for E1C43 is out-of-range. Make it 00000 ≤ E1C43 ≤ 09999
0244	Your entry for E1C44 is out-of-range. Make it 00000 ≤ E1C44 ≤ 09999
0247	Your entry for E1C47 is out-of-range. Make it 00000 ≤ E1C47 ≤ 09999
0248	Your entry for E1C48 is out-of-range. Make it 00000 ≤ E1C48 ≤ 09999
0249	Your entry for E1C49 is out-of-range. Make it 00000 ≤ E1C49 ≤ 09999
0250	Your entry for E1C50 is out-of-range. Make it 00000 ≤ E1C50 ≤ 09999
0251	Your entry for E1C51 is out-of-range. Make it 00000 ≤ E1C51 ≤ 09999
0252	Your entry for E1C52 is out-of-range. Make it 00000 ≤ E1C52 ≤ 09999
0253	Your entry for E1C53 is out-of-range. Make it 00000 ≤ E1C53 ≤ 09999
0343	Your entry for E1C43 is equal to E1C44. They must not be equal.
0347	Your entry for E1C47 is equal to E1C48. They must not be equal.
0441	Your entry for E1C41 is out-of-range. Make it 00000 ≤ E1C41 < E1C42
0442	Your entry for E1C42 is out-of-range. Make it E1C41 < E1C42 ≤ 09999
0445	Your entry for E1C45 is out-of-range. Make it 00000 ≤ E1C45 < E1C46
0446	Your entry for E1C46 is out-of-range. Make it E1C45 < E1C46 ≤ 09999
0457	Your entry for E1C57 is out-of-range. If non-zero, E1C57 must be within MCC31 < E1C57 ≤ MCC32
0502	Your bit pattern in E1C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.

1st Extend Configuration Block (E1C) (ID = 3)

0506	Your bit pattern in E1C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

2nd Extend Configuration Block (E2C) (ID = 4)

Error Code	Description
0205-0206	RFU
0208	Your entry for E2C08 is out-of-range. Make it 00000 ≤ E2C08 ≤ 09999
0209	Your entry for E2C09 is out-of-range. Make it 00000 ≤ E2C09 ≤ 09999
0210	Your entry for E2C10 is out-of-range. Make it 00000 ≤ E2C1C0 ≤ 09999
0211	Your entry for E2C11 is out-of-range. Make it 00000 ≤ E2C1C1 ≤ 09999
0212	Your entry for E2C12 is out-of-range. Make it 00000 ≤ E2C1C2 ≤ 09999
0213-0216	RFU
0217	Your entry for E2C17 is out-of-range. Make it 00000 ≤ E2C1C7 ≤ 09999
0218	Your entry for E2C18 is out-of-range. Make it 00000 ≤ E2C1C8 ≤ 09999
0219	Your entry for E2C19 is out-of-range. Make it 00000 ≤ E2C1C9 ≤ 09999
0220	Your entry for E2C20 is out-of-range. Make it 00000 ≤ E2C20 ≤ 09999
0221-0224	RFU
0225	Your entry for E2C25 is out-of-range. Make it 00000 ≤ E2C25 ≤ 09999
0226	Your entry for E2C26 is out-of-range. Make it 00000 ≤ E2C26 ≤ 09999
0227	Your entry for E2C27 is out-of-range. Make it 00000 ≤ E2C27 ≤ 09999
0228	Your entry for E2C28 is out-of-range. Make it 00000 ≤ E2C28 ≤ 09999
0229-0232	RFU
0233	Your entry for E2C33 is out-of-range. Make it 00000 ≤ E2C33 ≤ 09999
0234	Your entry for E2C34 is out-of-range. Make it 00000 ≤ E2C34 ≤ 09999
0235	Your entry for E2C35 is out-of-range. Make it 00000 ≤ E2C35 ≤ 09999
0236	Your entry for E2C36 is out-of-range. Make it 00000 ≤ E2C36 ≤ 09999
0237-0240	RFU
0243	Your entry for E2C43 is out-of-range. Make it 00000 ≤ E2C43 ≤ 09999
0244	Your entry for E2C44 is out-of-range. Make it 00000 ≤ E2C44 ≤ 09999
0247	Your entry for E2C47 is out-of-range. Make it 00000 ≤ E2C47 ≤ 09999
0248	Your entry for E2C48 is out-of-range. Make it 00000 ≤ E2C48 ≤ 09999
0249	Your entry for E2C49 is out-of-range. Make it 00000 ≤ E2C49 ≤ 09999
0250	Your entry for E2C50 is out-of-range. Make it 00000 ≤ E2C50 ≤ 09999
0251	Your entry for E2C51 is out-of-range. Make it 00000 ≤ E2C51 ≤ 09999
0252	Your entry for E2C52 is out-of-range. Make it 00000 ≤ E2C52 ≤ 09999
0253	Your entry for E2C53 is out-of-range. Make it 00000 ≤ E2C53 ≤ 09999
0343	Your entry for E2C43 is equal to E2C44. They must not be equal.
0347	Your entry for E2C47 is equal to E2C48. These must not be equal.
0441	Your entry for E2C41 is out-of-range. Make it 00000 ≤ E2C41 < E2C42
0442	Your entry for E2C42 is out-of-range. Make it E2C41 < E2C42 ≤ 09999
0445	Your entry for E2C45 is out-of-range. Make it 00000 ≤ E2C45 < E2C46
0446	Your entry for E2C46 is out-of-range. Make it E2C45 < E2C46 ≤ 09999
0457	Your entry for E2C57 is out-of-range. If non-zero, E2C57 must be within MCC31 < E2C57 ≤ MCC32
0502	Your bit pattern in E2C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.
0506	Your bit pattern in E2C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

3rd Extend Configuration Block (E3C) (ID = 5)

Error Code	Description
0205-0206	RFU
0208	Your entry for E3C08 is out-of-range. Make it 00000 ≤ E3C08 ≤ 09999
0209	Your entry for E3C09 is out-of-range. Make it 00000 ≤ E3C09 ≤ 09999
0210	Your entry for E3C10 is out-of-range. Make it 00000 ≤ E3C1C0 ≤ 09999
0211	Your entry for E3C11 is out-of-range. Make it 00000 ≤ E3C1C1 ≤ 09999
0212	Your entry for E3C12 is out-of-range. Make it 00000 ≤ E3C1C2 ≤ 09999
0213-0216	RFU
0217	Your entry for E3C17 is out-of-range. Make it 00000 ≤ E3C1C7 ≤ 09999
0218	Your entry for E3C18 is out-of-range. Make it 00000 ≤ E3C1C8 ≤ 09999
0219	Your entry for E3C19 is out-of-range. Make it 00000 ≤ E3C1C9 ≤ 09999
0220	Your entry for E3C20 is out-of-range. Make it 00000 ≤ E3C20 ≤ 09999
0221-224	RFU
0225	Your entry for E3C25 is out-of-range. Make it 00000 ≤ E3C25 ≤ 09999
0226	Your entry for E3C26 is out-of-range. Make it 00000 ≤ E3C26 ≤ 09999
0227	Your entry for E3C27 is out-of-range. Make it 00000 ≤ E3C27 ≤ 09999
0228	Your entry for E3C28 is out-of-range. Make it 00000 ≤ E3C28 ≤ 09999
0229-0232	RFU
0233	Your entry for E3C33 is out-of-range. Make it 00000 ≤ E3C33 ≤ 09999
0234	Your entry for E3C34 is out-of-range. Make it 00000 ≤ E3C34 ≤ 09999
0235	Your entry for E3C35 is out-of-range. Make it 00000 ≤ E3C35 ≤ 09999
0236	Your entry for E3C36 is out-of-range. Make it 00000 ≤ E3C36 ≤ 09999
0237-0240	RFU
0243	Your entry for E3C43 is out-of-range. Make it 00000 ≤ E3C43 ≤ 09999
0244	Your entry for E3C44 is out-of-range. Make it 00000 ≤ E3C44 ≤ 09999
0247	Your entry for E3C47 is out-of-range. Make it 00000 ≤ E3C47 ≤ 09999
0248	Your entry for E3C48 is out-of-range. Make it 00000 ≤ E3C48 ≤ 09999
0249	Your entry for E3C49 is out-of-range. Make it 00000 ≤ E3C49 ≤ 09999
0250	Your entry for E3C50 is out-of-range. Make it 00000 ≤ E3C50 ≤ 09999
0251	Your entry for E3C51 is out-of-range. Make it 00000 ≤ E3C51 ≤ 09999
0252	Your entry for E3C52 is out-of-range. Make it 00000 ≤ E3C52 ≤ 09999
0253	Your entry for E3C53 is out-of-range. Make it 00000 ≤ E3C53 ≤ 09999
0343	Your entry for E3C43 is equal to E3C44. They must not be equal.
0347	Your entry for E3C47 is equal to E3C48. They must not be equal.
0441	Your entry for E3C41 is out-of-range. Make it 00000 ≤ E3C41 < E3C42
0442	Your entry for E3C42 is out-of-range. Make it E3C41 < E3C42 ≤ 09999
0445	Your entry for E3C45 is out-of-range. Make it 00000 ≤ E3C45 < E3C46
0446	Your entry for E3C46 is out-of-range. Make it E3C45 < E3C46 ≤ 09999
0457	Your entry for E3C57 is out-of-range. If non-zero, E3C57 must be within MCC31 < E3C57 ≤ MCC32
0502	Your bit pattern in E3C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.
0506	Your bit pattern in E3C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

4th Extend Configuration Block (E4C) (ID = 6)

Error Code	Description
0205-0206	RFU
0207	
0208	Your entry for E4C08 is out-of-range. Make it 00000 ≤ E4C08 ≤ 09999
0209	Your entry for E4C09 is out-of-range. Make it 00000 ≤ E4C09 ≤ 09999
0210	Your entry for E4C10 is out-of-range. Make it 00000 ≤ E4C1C0 ≤ 09999
0211	Your entry for E4C11 is out-of-range. Make it 00000 ≤ E4C1C1 ≤ 09999
0212	Your entry for E4C12 is out-of-range. Make it 00000 ≤ E4C1C2 ≤ 09999
0213-0216	RFU
0217	Your entry for E4C17 is out-of-range. Make it 00000 ≤ E4C1C7 ≤ 09999
0218	Your entry for E4C18 is out-of-range. Make it 00000 ≤ E4C1C8 ≤ 09999
0219	Your entry for E4C19 is out-of-range. Make it 00000 ≤ E4C1C9 ≤ 09999
0220	Your entry for E4C20 is out-of-range. Make it 00000 ≤ E4C20 ≤ 09999
0221-0224	RFU
0225	Your entry for E4C25 is out-of-range. Make it 00000 ≤ E4C25 ≤ 09999
0226	Your entry for E4C26 is out-of-range. Make it 00000 ≤ E4C26 ≤ 09999
0227	Your entry for E4C27 is out-of-range. Make it 00000 ≤ E4C27 ≤ 09999
0228	Your entry for E4C28 is out-of-range. Make it 00000 ≤ E4C28 ≤ 09999
0229-0232	RFU
0233	Your entry for E4C33 is out-of-range. Make it 00000 ≤ E4C33 ≤ 09999
0234	Your entry for E4C34 is out-of-range. Make it 00000 ≤ E4C34 ≤ 09999
0235	Your entry for E4C35 is out-of-range. Make it 00000 ≤ E4C35 ≤ 09999
0236	Your entry for E4C36 is out-of-range. Make it 00000 ≤ E4C36 ≤ 09999
0237-0240	RFU
0243	Your entry for E4C43 is out-of-range. Make it 00000 ≤ E4C43 ≤ 09999
0244	Your entry for E4C44 is out-of-range. Make it 00000 ≤ E4C44 ≤ 09999
0249	Your entry for E4C49 is out-of-range. Make it 00000 ≤ E4C49 ≤ 09999
0250	Your entry for E4C50 is out-of-range. Make it 00000 ≤ E4C50 ≤ 09999
0251	Your entry for E4C51 is out-of-range. Make it 00000 ≤ E4C51 ≤ 09999
0343	Your entry for E4C43 is equal to E4C44. They must not be equal.
0441	Your entry for E4C41 is out-of-range. Make it 00000 ≤ E4C41 < E4C42
0442	Your entry for E4C42 is out-of-range. Make it E4C41 < E4C42 ≤ 09999
0457	Your entry for E4C57 is out-of-range. If non-zero, E4C57 must be within MCC31 < E4C57 ≤ MCC32
0506	Your bit pattern in E4C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

Extend Profile Block (EP) (ID = 7)

Error Code	Description
0209	Your entry for EP09 is out-of-range. When EP03-B14 = 0, EP09 must be within 00000 ≤ EP09 ≤ 09999
0212	Your entry for EP12 is out-of-range. When EP03-B14 = 0, EP12 must be within 00000 ≤ EP12 ≤ 09999
0215	Your entry for EP15 is out-of-range. When EP03-B14 = 0, EP15 must be within 00000 ≤ EP15 ≤ 09999
0218	Your entry for EP18 is out-of-range. When EP03-B14 = 0, EP18 must be within 00000 ≤ EP18 ≤ 09999
0221	Your entry for EP21 is out-of-range. When EP03-B14 = 0, EP21 must be within 00000 ≤ EP21 ≤ 09999
0224	Your entry for EP24 is out-of-range. When EP03-B14 = 0, EP24 must be within 00000 ≤ EP24 ≤ 09999
0227	Your entry for EP27 is out-of-range. When EP03-B14 = 0, EP27 must be within 00000 ≤ EP27 ≤ 09999
0230	Your entry for EP30 is out-of-range. When EP03-B14 = 0, EP30 must be within 00000 ≤ EP30 ≤ 09999
0233	Your entry for EP33 is out-of-range. When EP03-B14 = 0, EP33 must be within 00000 ≤ EP33 ≤ 09999
0409	Your entry for EP09 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP09 must be within E1C45 ≤ EP09 ≤ E1C46
0410	Your entry for EP10 is out-of-range. If non-zero, EP10 must be within E1C41 ≤ EP10 ≤ E1C42
0411	Your entry for EP11 is out-of-range. If MCC27 and MCC28 are both non-zero, EP11 must be within 00000 ≤ EP11 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP11 must be within 00000 ≤ EP11 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, EP11 must be within 00000 ≤ EP11 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP11 must be within 00000 ≤ EP11 < MCC24 - MCC23
0412	Your entry for EP12 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP12 must be within E1C45 ≤ EP12 ≤ E1C46
0413	Your entry for EP13 is out-of-range. If non-zero, EP13 must be within E1C41 ≤ EP13 ≤ E1C42
0414	Your entry for EP14 is out-of-range. If MCC27 and MCC28 are both non-zero, EP14 must be within 00000 ≤ EP14 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP14 must be within 00000 ≤ EP14 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, EP14 must be within 00000 ≤ EP14 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP14 must be within 00000 ≤ EP14 < MCC24 - MCC23
0415	Your entry for EP15 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP15 must be within E1C45 ≤ EP15 ≤ E1C46
0416	Your entry for EP16 is out-of-range. If non-zero, EP16 must be within E1C41 ≤ EP16 ≤ E1C42

Extend Profile Block (EP) (ID = 7) (continued)

0417	Your entry for EP17 is out-of-range. If MCC27 and MCC28 are both non-zero, EP17 must be within 00000 ≤ EP17 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP17 must be within 00000 ≤ EP17 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, EP17 must be within 00000 ≤ EP17 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP17 must be within 00000 ≤ EP17 < MCC24 - MCC23
0418	Your entry for EP18 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP18 must be within E2C45 ≤ EP18 ≤ E2C46
0419	Your entry for EP19 is out-of-range. If non-zero, EP19 must be within E2C41 ≤ EP19 ≤ E2C42
0420	Your entry for EP20 is out-of-range. If MCC27 and MCC28 are both non-zero, EP20 must be within 00000 ≤ EP20 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP20 must be within 00000 ≤ EP20 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, EP20 must be within 00000 ≤ EP20 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP20 must be within 00000 ≤ EP20 < MCC24 - MCC23
0421	Your entry for EP21 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP21 must be within E2C45 ≤ EP21 ≤ E2C46
0422	Your entry for EP22 is out-of-range. If non-zero, EP22 must be within E2C41 ≤ EP22 ≤ E2C42
0423	Your entry for EP23 is out-of-range. If MCC27 and MCC28 are both non-zero, EP23 must be within 00000 ≤ EP23 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP23 must be within 00000 ≤ EP23 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, EP23 must be within 00000 ≤ EP23 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP23 must be within 00000 ≤ EP23 < MCC24 - MCC23
0424	Your entry for EP24 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP24 must be within E2C45 ≤ EP24 ≤ E2C46
0425	Your entry for EP25 is out-of-range. If non-zero, EP25 must be within E2C41 ≤ EP25 ≤ E2C42
0426	Your entry for EP26 if out-of-range. If MCC27 and MCC28 are both non-zero, EP26 must be within 00000 ≤ EP26 ≤ MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP26 must be within 00000 ≤ EP26 ≤ MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero. EP26 must be within 00000 ≤ EP26 ≤ MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP26 must be within 00000 ≤ EP26 ≤ MCC24 - MCC23
0427	Your entry for EP27 is out-of-range. When EP03-B14 = 1, a non-zero entry for EP27 must be within E3C45 ≤ EP27 ≤ E3C46

Extend Profile Block (EP) (ID = 7) (continued)

0428 Your entry for EP28 is out-of-range.
If non-zero, EP28 must be within E3C41 ≤ EP28 ≤ E3C42

0429 Your entry for EP29 is out-of-range.
If MCC27 and MCC28 are both non-zero, EP29 must be within
00000 ≤ EP29 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, EP29 must be within
00000 ≤ EP29 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, EP29 must be within
00000 ≤ EP29 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, EP29 must be within
00000 ≤ EP29 < MCC24 - MCC23

0430 Your entry for EP30 is out-of-range.
When EP03-B14 = 1, a non-zero entry for EP30 must be within
E3C45 ≤ EP30 ≤ E3C46

0431 Your entry for EP31 is out-of-range.
If non-zero, EP31 must be within E3C41 ≤ EP31 ≤ E3C42

0432 Your entry for EP32 is out-of-range.
If MCC27 and MCC28 are both non-zero, EP32 must be within
00000 ≤ EP32 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, EP32 must be within
00000 ≤ EP32 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, EP32 must be within
00000 ≤ EP32 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, EP32 must be within
00000 ≤ EP32 < MCC24 - MCC23

0433 Your entry for EP33 is out-of-range.
When EP03-B14(16) = 1, a non-zero entry for EP33 must be within
E3C45 ≤ EP33 ≤ E3C46

0434 Your entry for EP34 is out-of-range.
If non-zero, EP34 must be within E3C41 ≤ EP34 ≤ E3C42

0435 Your entry for EP35 is out-of-range.
If MCC27 and MCC28 are both non-zero, EP35 must be within
00000 ≤ EP35 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, EP35 must be within
00000 ≤ EP35 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, EP35 must be within
00000 ≤ EP35 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, EP35 must be within
00000 ≤ EP35 < MCC24 - MCC23

0437 Your entry for EP37 is out-of-range.
If non-zero, EP37 must be within E4C41 ≤ EP37 ≤ E4C42

0438 Your entry for EP38 is out-of-range.
If MCC27 and MCC28 are both non-zero, EP38 must be within
00000 ≤ EP38 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, EP38 must be within
00000 ≤ EP38 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, EP38 must be within
00000 ≤ EP38 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, EP38 must be within
00000 ≤ EP38 < MCC24 - MCC23

0440 Your entry for EP40 is out-of-range.
If non-zero, EP40 must be within E4C41 ≤ EP40 ≤ E4C

Extend Profile Block (EP) (ID = 7) (continued)

0461	Your entry for EP61 is out-of-range. If MCC27 and MCC28 are both non-zero, EP61 must be within EP62 < EP61 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, EP61 must be within EP62 < EP61 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, EP61 must be within EP62 < EP61 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, EP61 must be within EP62 < EP61 < MCC24 - MCC23
0462	Your entry for EP62 is out-of-range. EP62 must be within 00000 ≤ EP62 < EP61
0463	Your entry for EP63 is out-of-range. If non-zero, EP63 must be within MCC31 < EP63 ≤ MCC32
0503	Your selection to bridge the E1 profile directly into the E2 profile, and set-output upon conclusion of the E2 profile (EP03-B08 = 0 and EP03-B09 = 1) is invalid because the QH module does not have a valid E2 on-board (SYS15-B03 = 0).
0504	You have selected closed-loop Press/Pos execution for the E1C profile by EP04-B01 = 0; however, your bit pattern in MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0507	Your selection to bridge the first two axis-extend profiles directly into the E3 profile, and set-output upon conclusion of the E3 profile (EP03-B08 = 0, EP03-B09 = 0, and EP03-B10 = 1) is invalid because the QH module does not have a valid E3 on-board (SYS15-B04 = 0).
0508	You have selected closed-loop Press/Pos execution for the E2 profile by EP04-B03 = 0; however, your bit pattern MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0511	Your selection to bridge the E2 profile directly into the E3 profile, and set-output upon conclusion of the E3 profile (EP03-B09 = 0, and EP03-B10 = 1) is invalid because the QH module does not have a valid E3 on-board (SYS15-B04 = 0).
0512	You have selected closed-loop Press/Pos execution for the E3 profile by EP04-B05 = 0; however, your bit pattern MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0516	You have selected closed-loop Press/Pos execution for the E4 profile by EP04-B07 = 0; however, your bit pattern in MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0600	Your entire EP profile block has been rejected because the QH module does not have a valid E4 configuration block on-board (SYS15-B05 = 0).
0609	Your EP09 must be zero because of invalid E1C. (SYS15-B02 = 0).
0610	Your EP10 must be zero because of invalid E1C. (SYS15-B02 = 0).
0611	Your EP11 must be zero because of invalid E1C. (SYS15-B02 = 0).
0612	Your EP12 must be zero because of invalid E1C. (SYS15-B02 = 0).
0613	Your EP13 must be zero because of invalid E1C. (SYS15-B02 = 0).
0614	Your EP14 must be zero because of invalid E1C. (SYS15-B02 = 0).
0615	Your EP15 must be zero because of invalid E1C. (SYS15-B02 = 0).
0616	Your EP16 must be zero because of invalid E1C. (SYS15-B02 = 0).
0617	Your EP17 must be zero because of invalid E1C. (SYS15-B02 = 0).
0618	Your EP18 must be zero because of invalid E2C. (SYS15-B03 = 0).
0619	Your EP19 must be zero because of invalid E2C. (SYS15-B03 = 0).
0620	Your EP20 must be zero because of invalid E2C. (SYS15-B03 = 0).
0621	Your EP21 must be zero because of invalid E2C. (SYS15-B03 = 0).
0622	Your EP22 must be zero because of invalid E2C. (SYS15-B03 = 0).
0623	Your EP23 must be zero because of invalid E2C. (SYS15-B03 = 0).
0624	Your EP24 must be zero because of invalid E2C. (SYS15-B03 = 0).
0625	Your EP25 must be zero because of invalid E2C. (SYS15-B03 = 0).
0626	Your EP26 must be zero because of invalid E2C. (SYS15-B03 = 0).
0627	Your EP27 must be zero because of invalid E3C. (SYS15-B04 = 0).
0628	Your EP28 must be zero because of invalid E3C. (SYS15-B04 = 0).
0629	Your EP29 must be zero because of invalid E3C. (SYS15-B04 = 0).

Extend Profile Block (EP) (ID = 7) (continued)

0630	Your EP30 must be zero because of invalid E3C. (SYS15-B04 = 0).
0631	Your EP31 must be zero because of invalid E3C. (SYS15-B04 = 0).
0632	Your EP32 must be zero because of invalid E3C. (SYS15-B04 = 0).
0633	Your EP33 must be zero because of invalid E3C. (SYS15-B04 = 0).
0634	Your EP34 must be zero because of invalid E3C. (SYS15-B04 = 0).
0635	Your EP35 must be zero because of invalid E3C. (SYS15-B04 = 0).
0812	Your entry for EP12 must be 00000 when EP11 = 00000.
0813	Your entry for EP13 must be 00000 when EP11 = 00000.
0814	Your entry for EP14 must be 00000 when EP11 = 00000.
0815	Your entry for EP15 must be 00000 when EP14 = 00000.
0816	Your entry for EP16 must be 00000 when EP14 = 00000.
0817	Your entry for EP17 must be 00000 when EP14 = 00000.
0821	Your entry for EP21 must be 00000 when EP20 = 00000.
0822	Your entry for EP22 must be 00000 when EP20 = 00000.
0823	Your entry for EP23 must be 00000 when EP20 = 00000.
0824	Your entry for EP24 must be 00000 when EP23 = 00000.
0825	Your entry for EP25 must be 00000 when EP23 = 00000.
0826	Your entry for EP26 must be 00000 when EP23 = 00000.
0830	Your entry for EP30 must be 00000 when EP29 = 00000.
0831	Your entry for EP31 must be 00000 when EP29 = 00000.
0832	Your entry for EP32 must be 00000 when EP29 = 00000.
0833	Your entry for EP33 must be 00000 when EP32 = 00000.
0834	Your entry for EP34 must be 00000 when EP32 = 00000.
0835	Your entry for EP35 must be 00000 when EP32 = 00000.
0840	Your entry for EP40 must be 00000 when EP38 = 00000.
1014	Your entry for EP14 is not in decreasing positional order. If non-zero, EP14 must be less than EP11.
1017	Your entry for EP17 is not in decreasing positional order. If non-zero, EP17 must be less than EP14.
1020	Your entry for EP20 is not in decreasing positional order. If non-zero, EP20 must be less than all non-zero entries in EP11,EP14, and EP17.
1023	Your entry for EP23 is not in decreasing positional order. If non-zero, EP23 must be less than EP20.
1026	Your entry for EP26 is not in decreasing positional order. If non-zero, EP26 must be less than EP23.
1029	Your entry for EP29 is not in decreasing positional order. If non-zero, EP29 must be less than all non-zero entries in EP11, EP14, EP17, EP20, EP23, and EP26.
1032	Your entry for EP32 is not in decreasing positional order. If non-zero, EP32 must be less than EP29.
1035	Your entry for EP35 is not in decreasing positional order. If non-zero, EP35 must be less than EP32.
1038	Your entry for EP38 is not in decreasing positional order. If non-zero, EP38 must be less than all non-zero entries in EP11, EP14, EP17, EP20, EP23, EP26, EP29, EP32, and EP35.

1st Retract Configuration Block (R1C) (ID = 17)

Error Code	Description
0205-0206	RFU
0208	Your entry for R1C08 is out-of-range. Make it 00000 ≤ R1C08 ≤ 09999
0209	Your entry for R1C09 is out-of-range. Make it 00000 ≤ R1C09 ≤ 09999
0210	Your entry for R1C10 is out-of-range. Make it 00000 ≤ R1C10 ≤ 09999
0211	Your entry for R1C11 is out-of-range. Make it 00000 ≤ R1C11 ≤ 09999
0212	Your entry for R1C12 is out-of-range. Make it 00000 ≤ R1C12 ≤ 09999
0213-0216	RFU
0217	Your entry for R1C17 is out-of-range. Make it 00000 ≤ R1C17 ≤ 09999
0218	Your entry for R1C18 is out-of-range. Make it 00000 ≤ R1C18 ≤ 09999
0219	Your entry for R1C19 is out-of-range. Make it 00000 ≤ R1C19 ≤ 09999
0220	Your entry for R1C20 is out-of-range. Make it 00000 ≤ R1C20 ≤ 09999
0221-0224	RFU
0225	Your entry for R1C25 is out-of-range. Make it 00000 ≤ R1C25 ≤ 09999
0226	Your entry for R1C26 is out-of-range. Make it 00000 ≤ R1C26 ≤ 09999
0227	Your entry for R1C27 is out-of-range. Make it 00000 ≤ R1C27 ≤ 09999
0228	Your entry for R1C28 is out-of-range. Make it 00000 ≤ R1C28 ≤ 09999
0229-0232	RFU
0233	Your entry for R1C33 is out-of-range. Make it 00000 ≤ R1C33 ≤ 09999
0234	Your entry for R1C34 is out-of-range. Make it 00000 ≤ R1C34 ≤ 09999
0235	Your entry for R1C35 is out-of-range. Make it 00000 ≤ R1C35 ≤ 09999
0236	Your entry for R1C36 is out-of-range. Make it 00000 ≤ R1C36 ≤ 09999
0237-0240	RFU
0243	Your entry for R1C43 is out-of-range. Make it 00000 ≤ R1C43 ≤ 09999
0244	Your entry for R1C44 is out-of-range. Make it 00000 ≤ R1C44 ≤ 09999
0247	Your entry for R1C47 is out-of-range. Make it 00000 ≤ R1C47 ≤ 09999
0248	Your entry for R1C48 is out-of-range. Make it 00000 ≤ R1C48 ≤ 09999
0249	Your entry for R1C49 is out-of-range. Make it 00000 ≤ R1C49 ≤ 09999
0250	Your entry for R1C50 is out-of-range. Make it 00000 ≤ R1C50 ≤ 09999
0251	Your entry for R1C51 is out-of-range. Make it 00000 ≤ R1C51 ≤ 09999
0252	Your entry for R1C52 is out-of-range. Make it 00000 ≤ R1C52 ≤ 09999
0253	Your entry for R1C53 is out-of-range. Make it 00000 ≤ R1C53 ≤ 09999
0343	Your entry for R1C43 is equal to R1C44. They must not be equal.
0347	Your entry for R1C47 is equal to R1C48. They must not be equal.
0441	Your entry for R1C41 is out-of-range. Make it 00000 ≤ R1C41 < R1C42
0442	Your entry for R1C42 is out-of-range. Make it 13R41 < R1C42 ≤ 09999
0445	Your entry for R1C45 is out-of-range. Make it 00000 ≤ R1C45 < R1C46
0446	Your entry for R1C46 is out-of-range. Make it R1C45 < R1C46 ≤ 09999
0457	Your entry for R1C57 is out-of-range. If non-zero, R1C57 must be within MCC31 < R1C57 ≤ MCC32
0502	Your bit pattern in R1C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.
0506	Your bit pattern in R1C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

2nd Retract Configuration Block (R2C) (ID = 18)

Error Code	Description
0205-0206	RFU
0208	Your entry for R2C08 is out-of-range. Make it 00000 ≤ R2C08 ≤ 09999
0209	Your entry for R2C09 is out-of-range. Make it 00000 ≤ R2C09 ≤ 09999
0210	Your entry for R2C10 is out-of-range. Make it 00000 ≤ R2C10 ≤ 09999
0211	Your entry for R2C11 is out-of-range. Make it 00000 ≤ R2C11 ≤ 09999
0212	Your entry for R2C12 is out-of-range. Make it 00000 ≤ R2C12 ≤ 09999
0213-0216	RFU
0217	Your entry for R2C17 is out-of-range. Make it 00000 ≤ R2C17 ≤ 09999
0218	Your entry for R2C18 is out-of-range. Make it 00000 ≤ R2C18 ≤ 09999
0219	Your entry for R2C19 is out-of-range. Make it 00000 ≤ R2C19 ≤ 09999
0220	Your entry for R2C20 is out-of-range. Make it 00000 ≤ R2C20 ≤ 09999
0221-0224	RFU
0225	Your entry for R2C25 is out-of-range. Make it 00000 ≤ R2C25 ≤ 09999
0226	Your entry for R2C26 is out-of-range. Make it 00000 ≤ R2C26 ≤ 09999
0227	Your entry for R2C27 is out-of-range. Make it 00000 ≤ R2C27 ≤ 09999
0228	Your entry for R2C28 is out-of-range. Make it 00000 ≤ R2C28 ≤ 09999
0229-0232	RFU
0233	Your entry for R2C33 is out-of-range. Make it 00000 ≤ R2C33 ≤ 09999
0234	Your entry for R2C34 is out-of-range. Make it 00000 ≤ R2C34 ≤ 09999
0235	Your entry for R2C35 is out-of-range. Make it 00000 ≤ R2C35 ≤ 09999
0236	Your entry for R2C36 is out-of-range. Make it 00000 ≤ R2C36 ≤ 09999
0237-0240	RFU
0243	Your entry for R2C43 is out-of-range. Make it 00000 ≤ R2C43 ≤ 09999
0244	Your entry for R2C44 is out-of-range. Make it 00000 ≤ R2C44 ≤ 09999
0247	Your entry for R2C47 is out-of-range. Make it 00000 ≤ R2C47 ≤ 09999
0248	Your entry for R2C48 is out-of-range. Make it 00000 ≤ R2C48 ≤ 09999
0249	Your entry for R2C49 is out-of-range. Make it 00000 ≤ R2C49 ≤ 09999
0250	Your entry for R2C50 is out-of-range. Make it 00000 ≤ R2C50 ≤ 09999
0251	Your entry for R2C51 is out-of-range. Make it 00000 ≤ R2C51 ≤ 09999
0252	Your entry for R2C52 is out-of-range. Make it 00000 ≤ R2C52 ≤ 09999
0253	Your entry for R2C53 is out-of-range. Make it 00000 ≤ R2C53 ≤ 09999
0343	Your entry for R2C43 is equal to R2C44. They must not be equal.
0347	Your entry for R2C47 is equal to R2C48. They must not be equal.
0441	Your entry for R2C41 is out-of-range. Make it 00000 ≤ R2C41 < R2C42
0442	Your entry for R2C42 is out-of-range. Make it R2C41 < R2C42 ≤ 09999
0445	Your entry for R2C45 is out-of-range. Make it 00000 ≤ R2C45 < R2C46
0446	Your entry for R2C46 is out-of-range. Make it R2C45 < R2C46 ≤ 09999
0457	Your entry for R2C57 is out-of-range. If non-zero, R2C57 must be within MCC31 < R2C57 ≤ MCC32
0502	Your bit pattern in R2C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.
0506	Your bit pattern in R2C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

3rd Retract Configuration Block (R3C) (ID = 19)

Error Code	Description
0205-0206	RFU
0208	Your entry for R3C08 is out-of-range. Make it 00000 ≤ R3C08 ≤ 09999
0209	Your entry for R3C09 is out-of-range. Make it 00000 ≤ R3C09 ≤ 09999
0210	Your entry for R3C10 is out-of-range. Make it 00000 ≤ R3C10 ≤ 09999
0211	Your entry for R3C11 is out-of-range. Make it 00000 ≤ R3C11 ≤ 09999
0212	Your entry for R3C12 is out-of-range. Make it 00000 ≤ R3C12 ≤ 09999
0213-0216	RFU
0217	Your entry for R3C17 is out-of-range. Make it 00000 ≤ R3C17 ≤ 09999
0218	Your entry for R3C18 is out-of-range. Make it 00000 ≤ R3C18 ≤ 09999
0219	Your entry for R3C19 is out-of-range. Make it 00000 ≤ R3C19 ≤ 09999
0220	Your entry for R3C20 is out-of-range. Make it 00000 ≤ R3C20 ≤ 09999
0221-0224	RFU
0225	Your entry for R3C25 is out-of-range. Make it 00000 ≤ R3C25 ≤ 09999
0226	Your entry for R3C26 is out-of-range. Make it 00000 ≤ R3C26 ≤ 09999
0227	Your entry for R3C27 is out-of-range. Make it 00000 ≤ R3C27 ≤ 09999
0228	Your entry for R3C28 is out-of-range. Make it 00000 ≤ R3C28 ≤ 09999
0229-0232	RFU
0233	Your entry for R3C33 is out-of-range. Make it 00000 ≤ R3C33 ≤ 09999
0234	Your entry for R3C34 is out-of-range. Make it 00000 ≤ R3C34 ≤ 09999
0235	Your entry for R3C35 is out-of-range. Make it 00000 ≤ R3C35 ≤ 09999
0236	Your entry for R3C36 is out-of-range. Make it 00000 ≤ R3C36 ≤ 09999
0237-0240	RFU
0243	Your entry for R3C43 is out-of-range. Make it 00000 ≤ R3C43 ≤ 09999
0244	Your entry for R3C44 is out-of-range. Make it 00000 ≤ R3C44 ≤ 09999
0247	Your entry for R3C47 is out-of-range. Make it 00000 ≤ R3C47 ≤ 09999
0248	Your entry for R3C48 is out-of-range. Make it 00000 ≤ R3C48 ≤ 09999
0249	Your entry for R3C49 is out-of-range. Make it 00000 ≤ R3C49 ≤ 09999
0250	Your entry for R3C50 is out-of-range. Make it 00000 ≤ R3C50 ≤ 09999
0251	Your entry for R3C51 is out-of-range. Make it 00000 ≤ R3C51 ≤ 09999
0252	Your entry for R3C52 is out-of-range. Make it 00000 ≤ R3C52 ≤ 09999
0253	Your entry for R3C53 is out-of-range. Make it 00000 ≤ R3C53 ≤ 09999
0343	Your entry for R3C43 is equal to R3C44. They must not be equal.
0347	Your entry for R3C47 is equal to R3C48. They must not be equal.
0441	Your entry for R3C41 is out-of-range. Make it 00000 ≤ R3C41 < R3C42
0442	Your entry for R3C42 is out-of-range. Make it R3C41 < R3C42 ≤ 09999
0445	Your entry for R3C45 is out-of-range. Make it 00000 ≤ R3C45 < R3C46
0446	Your entry for R3C46 is out-of-range. Make it R3C45 < R3C46 ≤ 09999
0457	Your entry for R3C57 is out-of-range. If non-zero, R3C57 must be within MCC31 < R3C57 ≤ MCC32
0502	Your bit pattern in R3C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.
0506	Your bit pattern in R3C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

4th Retract Configuration Block (R4C) (ID = 20)

Error Code	Description
0205-0206	RFU
0208	Your entry for R4C08 is out-of-range. Make it 00000 ≤ R4C08 ≤ 09999
0209	Your entry for R4C09 is out-of-range. Make it 00000 ≤ R4C09 ≤ 09999
0210	Your entry for R4C10 is out-of-range. Make it 00000 ≤ R4C10 ≤ 09999
0211	Your entry for R4C11 is out-of-range. Make it 00000 ≤ R4C11 ≤ 09999
0212	Your entry for R4C12 is out-of-range. Make it 00000 ≤ R4C12 ≤ 09999
0213-0216	RFU
0217	Your entry for R4C17 is out-of-range. Make it 00000 ≤ R4C17 ≤ 09999
0218	Your entry for R4C18 is out-of-range. Make it 00000 ≤ R4C18 ≤ 09999
0219	Your entry for R4C19 is out-of-range. Make it 00000 ≤ R4C19 ≤ 09999
0220	Your entry for R4C20 is out-of-range. Make it 00000 ≤ R4C20 ≤ 09999
0221-0224	RFU
0225	Your entry for R4C25 is out-of-range. Make it 00000 ≤ R4C25 ≤ 09999
0226	Your entry for R4C26 is out-of-range. Make it 00000 ≤ R4C26 ≤ 09999
0227	Your entry for R4C27 is out-of-range. Make it 00000 ≤ R4C27 ≤ 09999
0228	Your entry for R4C28 is out-of-range. Make it 00000 ≤ R4C28 ≤ 09999
0229-0232	RFU
0233	Your entry for R4C33 is out-of-range. Make it 00000 ≤ R4C33 ≤ 09999
0234	Your entry for R4C34 is out-of-range. Make it 00000 ≤ R4C34 ≤ 09999
0235	Your entry for R4C35 is out-of-range. Make it 00000 ≤ R4C35 ≤ 09999
0236	Your entry for R4C36 is out-of-range. Make it 00000 ≤ R4C36 ≤ 09999
0237-0240	RFU
0243	Your entry for R4C43 is out-of-range. Make it 00000 ≤ R4C43 ≤ 09999
0244	Your entry for R4C44 is out-of-range. Make it 00000 ≤ R4C44 ≤ 09999
0247	Your entry for R4C47 is out-of-range. Make it 00000 ≤ R4C47 ≤ 09999
0248	Your entry for R4C48 is out-of-range. Make it 00000 ≤ R4C48 ≤ 09999
0249	Your entry for R4C49 is out-of-range. Make it 00000 ≤ R4C49 ≤ 09999
0250	Your entry for R4C50 is out-of-range. Make it R4C50 ≤ R4C50 ≤ 09999
0251	Your entry for R4C51 is out-of-range. Make it 00000 ≤ R4C51 ≤ 09999
0252	Your entry for R4C52 is out-of-range. Make it 00000 ≤ R4C52 ≤ 09999
0253	Your entry for R4C53 is out-of-range. Make it 00000 ≤ R4C53 ≤ 09999
0343	Your entry for R4C43 is equal to R4C44. They must not be equal.
0347	Your entry for R4C47 is equal to R4C48. They must not be equal.
0441	Your entry for R4C41 is out-of-range. Make it 00000 ≤ R4C41 < R4C42
0442	Your entry for R4C42 is out-of-range. Make it R4C41 < R4C42 ≤ 09999
0445	Your entry for R4C45 is out-of-range. Make it 00000 ≤ R4C45 < R4C46
0446	Your entry for R4C46 is out-of-range. Make it R4C45 < R4C46 ≤ 09999
0457	Your entry for R4C57 is out-of-range. If non-zero, R4C57 must be within MCC31 < R4C57 ≤ MCC32
0502	Your bit pattern in R4C02-B02, -B01, and -B00 indicates a selected axis velocity control valve that is unconnected according to your entries in MCC04.
0506	Your bit pattern in R4C02-B06, -B05, and -B04 indicates a selected axis pressure control valve that is unconnected according to your entries in MCC04.

Retract Profile Block (RP) (ID = 21)

Error Code	Description
0209	Your entry for RP09 is out-of-range. When RP03-B14 = 0, RP09 must be within 00000 ≤ RP09 ≤ 09999
0212	Your entry for RP12 is out-of-range. When RP03-B14 = 0, RP12 must be within 00000 ≤ RP12 ≤ 09999
0215	Your entry for RP15 is out-of-range. When RP03-B14 = 0, RP15 must be within 00000 ≤ RP15 ≤ 09999
0218	Your entry for RP18 is out-of-range. When RP03-B14 = 0, RP18 must be within 00000 ≤ RP18 ≤ 09999
0221	Your entry for RP21 is out-of-range. When RP03-B14 = 0, RP21 must be within 00000 ≤ RP21 ≤ 09999
0224	Your entry for RP24 is out-of-range. When RP03-B14 = 0, RP24 must be within 00000 ≤ RP24 ≤ 09999
0227	Your entry for RP27 is out-of-range. When RP03-B14 = 0, RP27 must be within 00000 ≤ RP27 ≤ 09999
0230	Your entry for RP30 is out-of-range. When RP03-B14 = 0, RP30 must be within 00000 ≤ RP30 ≤ 09999
0233	Your entry for RP33 is out-of-range. When RP03-B14 = 0, RP33 must be within 00000 ≤ RP33 ≤ 09999
0236	Your entry for RP36 is out-of-range. When RP03-B14 = 0, RP36 must be within 00000 ≤ RP36 ≤ 09999
0239	Your entry for RP39 is out-of-range. When RP03-B14 = 0, RP39 must be within 00000 ≤ RP39 ≤ 09999
0263	Your entry for RP63 is out-of-range. Make it 00000 ≤ RP63 ≤ 09999
0409	Your entry for RP09 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP09 must be within R1C45 ≤ RP09 ≤ R1C46
0410	Your entry for RP10 is out-of-range. If non-zero, RP10 must be within R1C41 ≤ RP10 ≤ R1C42
0411	Your entry for RP11 is out-of-range. If MCC27 and MCC28 are both non-zero, RP11 must be within 00000 ≤ RP11 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, RP11 must be within 00000 ≤ RP11 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, RP11 must be within 00000 ≤ RP11 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, RP11 must be within 00000 ≤ RP11 < MCC24 - MCC23
0412	Your entry for RP12 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP12 must be within R1C45 ≤ RP12 ≤ R1C46
0413	Your entry for RP13 is out-of-range. If non-zero, RP13 must be within R1C41 ≤ RP13 ≤ R1C42
0414	Your entry for RP14 is out-of-range. If MCC27 and MCC28 are both non-zero, RP14 must be within 00000 ≤ RP14 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, RP14 must be within 00000 ≤ RP14 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, RP14 must be within 00000 ≤ RP14 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, RP14 must be within 00000 ≤ RP14 < MCC24 - MCC2

Retract Profile Block (RP) (ID = 21) (continued)

0415	Your entry for RP15 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP15 must be within R1C45 ≤ RP15 ≤ R1C46
0416	Your entry for RP16 is out-of-range. If non-zero, RP16 must be within R1C41 ≤ RP16 ≤ R1C42
0417	Your entry for RP17 is out-of-range. If MCC27 and MCC28 are both non-zero, RP17 must be within 00000 ≤ RP17 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, RP17 must be within 00000 ≤ RP17 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, RP17 must be within 00000 ≤ RP17 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, RP17 must be within 00000 ≤ RP17 < MCC24 - MCC23
0418	Your entry for RP18 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP18 must be within R2C45 ≤ RP18 ≤ R2C46
0419	Your entry for RP19 is out-of-range. If non-zero, RP19 must be within R2C41 ≤ RP19 ≤ R2C42
0420	Your entry for RP20 is out-of-range. If MCC27 and MCC28 are both non-zero, RP20 must be within 00000 ≤ RP20 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, RP20 must be within 00000 ≤ RP20 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, RP20 must be within 00000 ≤ RP20 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, RP20 must be within 00000 ≤ RP20 < MCC24 - MCC23
0421	Your entry for RP21 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP21 must be within R2C45 ≤ RP21 ≤ R2C46
0422	Your entry for RP22 is out-of-range. If non-zero, RP22 must be within R2C41 ≤ RP22 ≤ R2C42
0423	Your entry for RP23 is out-of-range. If MCC27 and MCC28 are both non-zero, RP23 must be within 00000 ≤ RP23 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, RP23 must be within 00000 ≤ RP23 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, RP23 must be within 00000 ≤ RP23 < MCC28 - MCC23 If MCC27 and MCC28 are both zero, RP23 must be within 00000 ≤ RP23 < MCC24 - MCC23
0424	Your entry for RP24 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP24 must be within R2C45 ≤ RP24 ≤ R2C46
0425	Your entry for RP25 is out-of-range. If non-zero, RP25 must be within R2C41 ≤ RP25 ≤ R2C42
0426	Your entry for RP26 is out-of-range. If MCC27 and MCC28 are both non-zero, RP26 must be within 00000 ≤ RP26 < MCC28 - MCC27 If MCC27 is non-zero and MCC28 is zero, RP26 must be within 00000 ≤ RP26 < MCC24 - MCC27 If MCC27 is zero and MCC28 is non-zero, RP26 must be within 00000 ≤ RP26 < MCC28 - MCC2

Retract Profile Block (RP) (ID = 21) (continued)

If MCC27 and MCC28 are both zero, RP26 must be within
00000 ≤ RP26 < MCC24 - MCC23

0427 Your entry for RP27 is out-of-range.
When RP03-B14 = 1, a non-zero entry for RP27 must be within
R3C45 ≤ RP27 ≤ R3C46

0428 Your entry for RP28 is out-of-range.
If non-zero, RP28 must be within R3C41 ≤ RP28 ≤ R3C42

0429 Your entry for RP29 is out-of-range.
If MCC27 and MCC28 are both non-zero, RP29 must be within
00000 ≤ RP29 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, RP29 must be within
00000 ≤ RP29 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, RP29 must be within
00000 ≤ RP29 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, RP29 must be within
00000 ≤ RP29 < MCC24 - MCC23

0430 Your entry for RP30 is out-of-range.
When RP03-B14 = 1, a non-zero entry for RP30 must be within
R3C45 ≤ RP30 ≤ R3C46

0431 Your entry for RP31 is out-of-range.
If non-zero, RP31 must be within R3C41 ≤ RP31 ≤ R3C42

0432 Your entry for RP32 is out-of-range.
If MCC27 and MCC28 are both non-zero, RP32 must be within
00000 ≤ RP32 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, RP32 must be within
00000 ≤ RP32 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, RP32 must be within
00000 ≤ RP32 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, RP32 must be within
00000 ≤ RP32 < MCC24 - MCC23

0433 Your entry for RP33 is out-of-range.
When RP03-B14 = 1, a non-zero entry for RP33 must be within
R3C45 ≤ RP33 ≤ R3C46

0434 Your entry for RP34 is out-of-range.
If non-zero, RP34 must be within R3C41 ≤ RP34 ≤ R3C42

0435 Your entry for RP35 is out-of-range.
If MCC27 and MCC28 are both non-zero, RP35 must be within
00000 ≤ RP35 < MCC28 - MCC27
If MCC27 is non-zero and MCC28 is zero, RP35 must be within
00000 ≤ RP35 < MCC24 - MCC27
If MCC27 is zero and MCC28 is non-zero, RP35 must be within
00000 ≤ RP35 < MCC28 - MCC23
If MCC27 and MCC28 are both zero, RP35 must be within
00000 ≤ RP35 < MCC24 - MCC23

0436 Your entry for RP36 is out-of-range.
When RP03-B14 = 1, a non-zero entry for RP36 must be within
R4C45 ≤ RP36 ≤ R4C46

0437 Your entry for RP37 is out-of-range.
If non-zero, RP37 must be within R4C41 ≤ RP37 ≤ R4C

Retract Profile Block (RP) (ID = 21) (continued)

0438	Your entry for RP38 is out-of-range. If MCC27 and MCC28 are both non-zero, RP38 must be within $00000 \le RP38 < MCC28 - MCC27$ If MCC27 is non-zero and MCC28 is zero, RP38 must be within $00000 \le RP38 < MCC24 - MCC27$ If MCC27 is zero and MCC28 is non-zero, RP38 must be within $00000 \le RP38 < MCC28 - MCC23$ If MCC27 and MCC28 are both zero, RP38 must be within $00000 \le RP38 < MCC24 - MCC23$
0439	Your entry for RP39 is out-of-range. When RP03-B14 = 1, a non-zero entry for RP39 must be within $R4C45 \le RP39 \le R4C46$
0440	Your entry for RP40 is out-of-range. If non-zero, RP40 must be within $R4C41 \le RP40 \le R4C42$
0461	Your entry for RP61 is out-of-range. Make it $00000 \le RP61 < RP62$
0462	Your entry for RP62 is out-of-range. If MCC27 and MCC28 are both non-zero, RP62 must be within $RP61 < RP62 < MCC28 - MCC27$ If MCC27 is non-zero and MCC28 is zero, RP62 must be within $RP61 < RP62 < MCC24 - MCC27$ If MCC27 is zero and MCC28 is non-zero, RP62 must be within $RP61 < RP62 < MCC28 - MCC23$ If MCC27 and MCC28 are both zero, RP62 must be within $RP61 < RP62 < MCC24 - MCC23$
0503	Your selection to bridge the R1 Profile directly into the R2 profile, and set-output upon conclusion of the R2C profile (RP03-B08 = 0 and RP03-B09 = 1) is invalid because the QH module does not have a valid R2C (SYS16-B01 = 0).
0504	You have selected closed-loop Press/Pos execution for the R1 profile by RP04-B01 = 0; however, your bit pattern in MCC02 indicates that the QH module does not have access to a connected axis pressure transducer.
0507	Your selection to bridge the R1 and R2 profiles directly into the R3 profile, and set-output upon conclusion of the R3 profile. (RP03-B08 = 0, RP03-B09 = 0, and RP03-B10 = 1) is invalid because the QH module does not have a valid R3C configuration block on-board (SYS16-B02 = 0).
0508	You have selected closed-loop Press/Pos execution for the R2 profile by RP04-B03 = 0; however, your bit pattern in MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0511	Your selection to bridge the R2 profile directly into the R3 profile, and set-output upon conclusion of the R3 profile. (RP03-B09 = 0, and RP03-B10 = 1) is invalid because the QH module does not have a valid R3 block on-board (SYS16-B02 = 0).
0512	You have selected closed-loop Press/Pos execution for the R3 profile by RP04-B05 = 0; however, your bit pattern in MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0516	You have selected closed-loop Press/Pos execution for the R4 profile by RP04-B07 = 0; however, your bit pattern in MCC03 indicates that the QH module does not have access to a connected axis pressure transducer.
0600	Your entire RP profile block has been rejected because the QH module does not have a valid R4 configuration block on-board (SYS16-B03 = 0).
0609	Your RP09 must be zero because R1C is invalid (SYS16-B00 = 0).
0610	Your RP10 must be zero because R1C is invalid (SYS16-B00 = 0).
0611	Your RP11 must be zero because R1C is invalid (SYS16-B00 = 0).
0612	Your RP12 must be zero because R1C is invalid (SYS16-B00 = 0).
0613	Your RP13 must be zero because R1C is invalid (SYS16-B00 = 0).
0614	Your RP14 must be zero because R1C is invalid (SYS16-B00 = 0).
0615	Your RP15 must be zero because R1C is invalid (SYS16-B00 = 0).
0616	Your RP16 must be zero because R1C is invalid (SYS16-B00 = 0).
0617	Your RP17 must be zero because R1C is invalid (SYS16-B00 = 0).

Retract Profile Block (RP) (ID = 21) (continued)

0618	Your RP18 must be zero because R2C is invalid (SYS16-B01 = 0).
0619	Your RP19 must be zero because R2C is invalid (SYS16-B01 = 0).
0620	Your RP20 must be zero because R2C is invalid (SYS16-B01 = 0).
0621	Your RP21 must be zero because R2C is invalid (SYS16-B01 = 0).
0622	Your RP22 must be zero because R2C is invalid (SYS16-B01 = 0).
0623	Your RP23 must be zero because R2C is invalid (SYS16-B01 = 0).
0624	Your RP24 must be zero because R2C is invalid (SYS16-B01 = 0).
0625	Your RP25 must be zero because R2C is invalid (SYS16-B01 = 0).
0626	Your RP26 must be zero because R2C is invalid (SYS16-B01 = 0).
0627	Your RP27 must be zero because R3C is invalid (SYS16-B02 = 0).
0628	Your RP28 must be zero because R3C is invalid (SYS16-B02 = 0).
0629	Your RP29 must be zero because R3C is invalid (SYS16-B02 = 0).
0630	Your RP30 must be zero because R3C is invalid (SYS16-B02 = 0).
0631	Your RP31 must be zero because R3C is invalid (SYS16-B02 = 0).
0632	Your RP32 must be zero because R3C is invalid (SYS16-B02 = 0).
0633	Your RP33 must be zero because R3C is invalid (SYS16-B02 = 0).
0634	Your RP34 must be zero because R3C is invalid (SYS16-B02 = 0).
0635	Your RP35 must be zero because R3C is invalid (SYS16-B02 = 0).
0812	Your entry for RP12 must be 00000 when RP11 = 00000.
0813	Your entry for RP13 must be 00000 when RP11 = 00000.
0814	Your entry for RP14 must be 00000 when RP11 = 00000.
0815	Your entry for RP15 must be 00000 when RP14 = 00000.
0816	Your entry for RP16 must be 00000 when RP14 = 00000.
0817	Your entry for RP17 must be 00000 when RP14 = 00000.
0821	Your entry for RP21 must be 00000 when RP20 = 00000.
0822	Your entry for RP22 must be 00000 when RP20 = 00000.
0823	Your entry for RP23 must be 00000 when RP20 = 00000.
0824	Your entry for RP24 must be 00000 when RP23 = 00000.
0825	Your entry for RP25 must be 00000 when RP23 = 00000.
0826	Your entry for RP26 must be 00000 when RP23 = 00000.
0830	Your entry for RP30 must be 00000 when RP29 = 00000.
0831	Your entry for RP31 must be 00000 when RP29 = 00000.
0832	Your entry for RP32 must be 00000 when RP29 = 00000.
0833	Your entry for RP33 must be 00000 when RP32 = 00000.
0834	Your entry for RP34 must be 00000 when RP32 = 00000.
0835	Your entry for RP35 must be 00000 when RP32 = 00000.
0839	Your entry for RP39 must be 00000 when RP38 = 00000.
0840	Your entry for RP40 must be 00000 when RP38 = 00000.
1014	Your entry for RP14 is not in increasing positional order. If non-zero, RP14 must be greater than RP11.
1017	Your entry for RP17 is not in increasing positional order. If non-zero, RP17 must be greater than RP14.
1020	Your entry for RP20 is not in increasing positional order. If non-zero, RP20 must be greater than RP11, RP14, and RP17.
1023	Your entry for RP23 is not in increasing positional order. If non-zero, RP23 must be greater than RP20.
1026	Your entry for RP26 is not in increasing positional order. If non-zero, RP26 must be greater than RP23.
1029	Your entry for RP29 is not in increasing positional order. If non-zero, RP29 must be greater than RP11, RP14, RP17, RP20, RP23, and RP26.
1032	Your entry for RP32 is not in increasing positional order. If non-zero, RP32 must be greater than RP29.
1035	Your entry for RP35 is not in increasing positional order. If non-zero, RP35 must be greater than RP32.
1038	Your entry for RP38 is not in increasing positional order. If non-zero, RP38 must be greater than RP11, RP14, RP17, RP20, RP23, RP26, RP29, RP32, and RP35.

Dynamic Command Block (DYC) (ID = 25)

Error Code	Description
0209	Your entry for DYC09 is out-of-range. Make it 00000 ≤ DYC09 ≤ 09999
0210	Your entry for DYC10 is out-of-range. Make it 00000 ≤ DYC10 ≤ 09999
0211	Your entry for DYC11 is out-of-range. Make it 00000 ≤ DYC11 ≤ 09999
0212	Your entry for DYC12 is out-of-range. Make it 00000 ≤ DYC12 ≤ 09999
0213-0216	RFU
0217	Your entry for DYC17 is out-of-range. Make it 00000 ≤ DYC17 ≤ 09999
0218	Your entry for DYC18 is out-of-range. Make it 00000 ≤ DYC18 ≤ 09999
0219	Your entry for DYC19 is out-of-range. Make it 00000 ≤ DYC19 ≤ 09999
0220	Your entry for DYC20 is out-of-range. Make it 00000 ≤ DYC20 ≤ 09999
0221-0224	RFU
0225	Your entry for DYC25 is out-of-range. Make it 00000 ≤ DYC25 ≤ 09999
0226	Your entry for DYC26 is out-of-range. Make it 00000 ≤ DYC26 ≤ 09999
0227	Your entry for DYC27 is out-of-range. Make it 00000 ≤ DYC27 ≤ 09999
0228	Your entry for DYC28 is out-of-range. Make it 00000 ≤ DYC28 ≤ 09999
0229-0132	RFU
0261	Your entry for DYC61 is out-of-range. Make it 00000 ≤ DYC61 ≤ 00027

Word/Bit Descriptions

List of Data Blocks and Block ID Codes

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

Acronym:	Block ID:	Page:	Description:
MCC	00000001	C-6	Module Configuration Block
JGC	00000010	C-9	Jog Configuration Block
E1C	00000011	C-11	1st Extend Configuration Block
E2C	00000100	C-14	2nd Extend Configuration Block
E3C	00000101	C-17	3rd Extend Configuration Block
E4C	00000110	C-21	4th Extend Configuration Block
EP	00000111	C-24	Extend Profile Block
R1C	00010001	C-29	1st Retract Configuration Block
R2C	00010010	C-32	2nd Retract Configuration Block
R3C	00010011	C-36	3rd Retract Configuration Block
R4C	00010100	C-39	4th Retract Configuration Block
RP	00010101	C-42	Retract Profile Block
DYC	00011001	C-48	Dynamic Block

List of Status Blocks and ID Codes

Status blocks report current status of machine operation. They are returned from the QH module to the PLC processor by block transfer read (BTR) instructions in software ladder logic.

Acronym:	Block ID:	Page:	Description:
SYS	00000001	C-60	System Status Block
ES	00000010	C-80	Extend Profile Status Block
RS	00000110	C-85	Retract Profile Status Block

List of Data Words

The listings of data and status blocks use five types of data words:

- Block ID
- Bit-mapped
- Stored-value
- Open
- Reserved

Block ID Word

The first word in each data and status block contains a binary number code in the low byte that identifies the block. The QH module uses block IDs to identify data blocks sent from the PLC processor, while the PLC processor uses them to identify status blocks received from the QH module.

The high byte of all status block ID words is identical to the high byte of system status word SYS01. It reports jog-execution and power-up status.

Bit-mapped Words

The first several words in any data block are bit–mapped.

For bit-mapped words, you must set/reset or latch/unlatch bits to set QH module operating configurations.

For bit-mapped status words, as the QH module monitors and detects changes in events of machine cycles, it sets/resets or latches/unlatches status bits to inform the PLC-5 processor that these events have occurred.

Stored-value Words

These words establish configuration values and profile setpoints such as:

- velocity, pressure, and position setpoints for extend and retract profiles
- output values for certain conditions
- minimum and maximum pressures, positions, velocities,
- alarm setpoints

For status blocks, the QH module reports actual values of machine operation obtained from sensors that you connect to its input terminals. The values are transferred to the PLC processor for data processing and alarm purposes. These values include positions, pressures, and velocities.

Reserved and Open Words

Reserved words are for future enhancements. Do not use them.
Open words are not used by the QH module. Use them only if lack of memory requires their use.

Engineering Units

In the listings of data and status blocks, each stored-value word is followed by a bracketed 2-digit number code denoting the engineering units and range associated with the value as shown in the following table:

# Code:	Reference:	Units and Range:
02		Pressure (0000. to 9999. PSI or 000.0 to 999.9 Bar)
07		Percent of Maximum Velocity (00.00 to 99.99%)
08		Velocity along Axis (00.00 to 99.99 in. per Sec. or 000.0 to 999.9 mm. per Sec.)
13	Axis Measured from zero	Incremental Distance (00.00 to 99.99 in. or 000.0 to 999.9 mm.)
14	Axis Measured from MCC27	Incremental Distance (00.00 to 99.99 in. or 000.0 to 999.9 mm.)
17	Measured as noted	Incremental Distance (00.00 to 99.99 in. or 000.0 to 999.9 mm.)
19		Percent Signal Output (00.00 to 99.99%)
20		Percent Signal Output per Second (0000. to 9999.)
21		Time Measured in Seconds (00.00 to 99.99)
22		Time Measured in Seconds (000.0 to 999.9)
23		Time Measured in Seconds (00.00 to 00.99)
24		Input Signal Range (00.00 to 10.00V dc or 01.00 to 05.00V dc or 04.00 to 20.00 mA)
26		Time (algorithm) (00.00 to 9.99 minutes)
27		Inverse Time (algorithm) (00.00 to 99.99 inverse minutes)
28		Inverse Time (algorithm) (00.00 to 99.99 inverse seconds)
29		Input Signal Range (00.00 to 10.00V dc or 01.00 to 05.00V dc or 04.00 to 20.00 mA)
31		Percent (00.00 to 99.99%)

Required Input Sensor

You must connect a position sensor to input #3 for the QH module to operate correctly, because the QH module decodes its own I/O configuration based on parameters that you provide in the Module Configuration Block (MCC).

If you do not connect a position sensor to input #3, the QH module will reject defined data blocks and inhibit defined status blocks because the QH module cannot use or generate block parameters without data from this input.

Also, if you attempt to download an unusable data block from the host processor, the QH module treats it as "unrecognizable" and discards the data. It does so in the same manner as if it had received a data block containing an undefined Block ID

Data Blocks for System Control

Data blocks for system–level control are:

- MCC – Module Configuration Block
- JGC – Jog Configuration Block
- DYC – Dynamic Command Block

The QH module always accepts a valid Module Configuration Block (MCC). After configuring the QH module with a valid MCC, the QH module always accepts and processes (considers "recognizable") the JGC and DYC blocks.

The QH module returns system status with this block:

- SYS – System Status Block

The QH module always returns the System Status Block after each block transfer read (BTR) request from the host processor with this exception: it returns the status block requested by a valid DYC written (by BTR) to the QH module.

Data Blocks for Controlling Position and Pressure

The host processor can write any of these data blocks to the QH module to control the position and pressure of the axis:

- E1C – 1st Extend Configuration Block
- E2C – 2nd Extend Configuration Block
- E3C – 3rd Extend Configuration Block
- E4C – 4th Extend Configuration Block
- EP – Extend Profile Block
- R1C – 1st Retract Configuration Block
- R2C – 2nd Retract Configuration Block
- R3C – 3rd Retract Configuration Block
- R4C – 4th Retract Configuration Block
- RP – Retract Profile Block

The QH module can return any of these status blocks:

- ES – Extend Profile Status Block
- RS – Retract Profile Status Block

After you configure the QH module with a valid MCC block, the QH module determines if it has access to axis position data from the axis position sensor. The QH module recognizes data blocks and returns status blocks if you configured the QH module for the axis position sensor and physically connected the sensor to the QH module.

Notation Conventions

We use the following word and bit designations:

Word

All references to 16-bit words will be in this format: **WWWxx**

Where: **WWW** = the 2- or 3-letter acronym designating the data block or status block containing the bit
xx = the 2-digit number designating the word within the block containing the bit

Bit

All references to discrete bits will be in this format: **WWWxx-Byy**

Where: **WWW** = the 2- or 3--letter acronym designating the data block or status block containing the bit
xx = the 2-digit number designating the word within the block containing the bit
yy = the 2-digit DECIMAL number designating the bit location within the word

MODULE CONFIGURATION BLOCK (MCC)

BIT-MAPPED CONTROL WORDS

MCC01 – Block ID
B00 – B07 00000001
B08 – B15 Reserved for Module. Do Not Use.

MCC02 – Configuration Selections

English/metric Selection
B00 = 0 English Units (Inches and PSI)
= 1 Metric Units (Millimeters and Bar)
B01-B07 – Open
B08-B015 – Reserved for Module. Do Not Use.

MCC03 – Input Range Selection
Use these bit pairs to select the input range from below:
B01 B00 Input #1
B03 B02 Input #2
B05 B04 Input #3
B07 B06 Input #4

Byy	**Bxx**	**Range**
0	0	0 to 10 VDC
0	1	1 to 5 VDC
1	0	4 to 20 MADC
1	1	Not Connected

B08–B15 – Reserved for Module. Do Not Use.

MCC04 – Output Range Selection
Use these bit pairs to select the output range from below:
B01 B00 Output #1
B03 B02 Output #2
B05 B04 Output #3
B07 B06 Output #4

Byy	**Bxx**	**Range**
0	0	–10 to +10 VDC
0	1	0 to +10 VDC
1	0	4 to 20 MADC
1	1	Not Connected

B08–B15 – Reserved for Module. Do Not Use.

MCC05 – MCC22 – Reserved for Module. Do Not Use.

MCC (continued)

POSITION TRANSDUCER CONFIGURATION

MCC23 – Minimum Axis Position [13]
MCC24 – Maximum Axis Position [13]
MCC25 – Analog Signal at Minimum Position [29]
MCC26 – Analog Signal at Maximum Position [29]

MCC27 – Axis Position Minimum Software Travel Limit [13]

The QH module continuously compares real–time axis position against this entry. The QH module sets alarm status bit SYS07–B02 and forces all of its outputs to zero when executing an axis-extend (EP) profile and axis position is less than or equals this entry. A zero entry inhibits SYS07–B02.

MCC28 – Axis Position Maximum Software Travel Limit [13]

The QH module continuously compares real–time axis position against this entry. The QH module sets alarm status bit SYS07–B03 and forces all of its outputs to zero when executing an axis-retract (RP) profile and the axis position equals or exceeds this entry. A zero entry inhibits SYS07–B03.

MCC29 – Software Travel Limit Alarm Deadband [17]

After flagging an axis overtravel by latching alarm status bit SYS07–B02 or SYS07–B03, the QH module will not unlatch the bit until real–time axis position is “inside” the overtravel setpoint by an incremental length equal to this entry. This incremental position will be added to MCC27 in order to determine the axis position required to unlatch SYS07–B02. This incremental position will be subtracted from MCC28 in order to determine the axis position required to unlatch SYS07–B03.

MCC30 – Position Transducer Digital Filter [23]

A non–zero entry forces the QH module to filter the input before using the result for all axis position calculations. Use this parameter to “soften” the input signal from a linear potentiometer.

PRESSURE TRANSDUCER CONFIGURATION

The QH module accesses data in MCC31–MCC36 if the bit pattern in MCC02 indicates that the QH module is configured for connection of an axis pressure sensor.

MCC31 – Minimum axis Pressure [02]
MCC32 – Maximum axis Pressure [02]
MCC33 – Analog Signal at Minimum axis Pressure [29]
MCC34 – Analog Signal at Maximum axis Pressure [29]

MCC35 – High-pressure Alarm Setpoint [02]

The QH module continuously compares real–time axis pressure against this entry. The QH module sets alarm status bit SYS05–B01 when axis pressure equals or exceeds this entry. A zero entry inhibits SYS05–B01.

MCC (continued)

MCC36 – Pressure Alarm Time Delay [23]

Total time the QH module must monitor a continuous axis pressure in excess of the non–zero entry in all axis pressure alarm setpoints before setting the associated alarm status bit. Setpoint/bit pairs affected are:

SETPOINT	ALARM STATUS BIT
MCC35	SYS05–B01
JGC07	SYS05–B10
E1C57	SYS05–B12
E2C57	SYS05–B13
E3C57	SYS05–B14
E4C57	SYS05–B15
R1C57	SYS06–B09
R2C57	SYS06–B10
R3C57	SYS06–B11
R4C57	SYS06–B12

Use a non–zero entry in this word to "filter out" axis pressure spikes of short enough duration to avoid nuisance alarms.

CONFIGURATION OF AUXILIARY ANALOG INPUTS

MCC37 – Minimum Span Position of Auxiliary Input #1
MCC38 – Maximum Span Position of Auxiliary Input #1
MCC39 – Analog Signal at Minimum Span [29]
MCC40 – Analog Signal at Maximum Span [29]

MCC41 – 44 – Reserved for Module. Do Not Use.

MCC45 – Minimum Span Position of Auxiliary Input #2
MCC46 – Maximum Span Position of Auxiliary Input #2
MCC47 – Analog Signal at Minimum Span [29]
MCC48 – Analog Signal at Maximum Span [29]

MCC49 – 64 – Reserved for Module. Do Not Use.

JOG CONFIGURATION BLOCK (JGC)

THE QH MODULE WILL NOT ACCEPT OR PROCESS THE JOG CONFIGURATION BLOCK UNLESS IS HAS A VALID MCC ON-BOARD.

BIT–MAPPED CONTROL WORDS

JGC01 – Block ID
  low byte 00000010
  high byte Reserved for Module. Do Not Use.
JGC02 – JGC06 – Reserved for module. Do not use.

JOG ALARM SETPOINTS

JGC07 – Jog Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when responding to command bit DYC01–B12 = 1 or DYC01–B13 = 1. The QH module sets alarm status bit SYS05–B10 when axis pressure equals or exceeds this entry during an axis jog. A zero entry inhibits SYS05–B10.

JOG08 – Reserved for Module. Do Not Use.

ALTERNATE 1, JOG SET-OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B09 = 1.

JGC09 – Output #1 Set–Output Value for Alternate 1 Jog [19]
JGC10 – Output #2 Set–Output Value for Alternate 1 Jog [19]
JGC11 – Output #3 Set–Output Value for Alternate 1 Jog [19]
JGC12 – Output #4 Set–Output Value for Alternate 1 Jog [19]

JGC13 – JGC16 – Reserved for Module. Do Not Use.

ALTERNATE 2, EXTEND-JOG SET-OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B10 = 1.

JGC17 – Output #1 Set–Output Value for Alternate 2 Extend Jog [19]
JGC18 – Output #2 Set–Output Value for Alternate 2 Extend Jog [19]
JGC19 – Output #3 Set–Output Value for Alternate 2 Extend Jog [19]
JGC20 – Output #4 Set–Output Value for Alternate 2 Extend Jog [19]

JGC21 – JGC24 – Reserved for Module. Do Not Use.

ALTERNATE 2, RETRACT-JOG SET-OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B11 = 1.

JGC25 – Output #1 Set–Output Value for Alternate 2 Retract Jog [19]
JGC26 – Output #2 Set–Output Value for Alternate 2 Retract Jog [19]
JGC27 – Output #3 Set–Output Value for Alternate 2 Retract Jog [19]
JGC28 – Output #4 Set–Output Value for Alternate 2 Retract Jog [19]

JGC29 – JGC30 – Reserved for Module. Do Not Use.

JGC (continued)

AXIS EXTEND-JOG SET–OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B12 = 1.

JGC33 – Output #1 Set–Output Value for Axis Extend Jogs [19]
JGC34 – Output #2 Set–Output Value for Axis Extend Jogs [19]
JGC35 – Output #3 Set–Output Value for Axis Extend Jogs [19]
JGC36 – Output #4 Set–Output Value for Axis Extend Jogs [19]

JGC37 – JGC40 – Reserved for Module. Do Not Use.

AXIS RETRACT-JOG SET–OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B13 = 1.

JGC41 – Output #1 Set–Output Value for Axis Retract Jogs [19]
JGC42 – Output #2 Set–Output Value for Axis Retract Jogs [19]
JGC43 – Output #3 Set–Output Value for Axis Retract Jogs [19]
JGC44 – Output #4 Set–Output Value for Axis Retract Jogs [19]

JGC45 – JGC48 – Reserved for Module. Do Not Use.

ALTERNATE 3, EXTEND-JOG SET-OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B14 = 1.

JGC49 – Output #1 Set–Output Value for Alternate 3 Extend Jog [19]
JGC50 – Output #2 Set–Output Value for Alternate 3 Extend Jog [19]
JGC51 – Output #3 Set–Output Value for Alternate 3 Extend Jog [19]
JGC52 – Output #4 Set–Output Value for Alternate 3 Extend Jog [19]

JGC53 – JGC56 – Reserved for Module. Do Not Use.

ALTERNATE 3, RETRACT-JOG SET-OUTPUT VALUES

The QH module sets its outputs to these values in response to command bit DYC01–B15 = 1.

JGC57 – Output #1 Set–Output Value for Alternate 3 Retract Jog [19]
JGC58 – Output #2 Set–Output Value for Alternate 3 Retract Jog [19]
JGC59 – Output #3 Set–Output Value for Alternate 3 Retract Jog [19]
JGC60 – Output #4 Set–Output Value for Alternate 3 Retract Jog [19]

JGC61 – JGC64 – Reserved for Module. Do Not Use.

1ST EXTEND CONFIGURATION BLOCK (E1C)

BIT–MAPPED CONTROL WORDS

E1C01 – Block ID

low byte	00000011
high byte	Reserved for Module. Do Not Use.

E1C02 – Configuration Selections

Selected Velocity Control Valve

B00–B02 The QH module uses its algorithm to drive the following output during any Vel/Pos E1 profile.

B02	B01	B00	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

B03 – Open

Selected Pressure Control Valve

B04–B06 The QH module drives the following output during any Press/Pos E1 Profile.

B06	B05	B04	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08 – B15 – Open

E1C03 – E1C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

E1C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the E1 profile, it

1) starts an internal "Profile Watchdog" timer
2) stops this timer and resets its accumulated value to zero (after reporting total execution time in ES57) when it completes the profile
3) sets master status bit SYS04–B00 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B00

E1C (continued)

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the E1 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates E1C17–20 and E1C25–28 to ramp "unselected" outputs

E1C09 – Output #1 Set–Output Value during Profile [19]
E1C10 – Output #2 Set–Output Value during Profile [19]
E1C11 – Output #3 Set–Output Value during Profile [19]
E1C12 – Output #4 Set–Output Value during Profile [19]
E1C13 – 16 – Reserved for Module. Do Not Use.

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the E1 profile. The QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION (RAMP DISABLE).

E1C17 – Output #1 Acceleration Ramp Rate during Profile [20]
E1C18 – Output #2 Acceleration Ramp Rate during Profile [20]
E1C19 – Output #3 Acceleration Ramp Rate during Profile [20]
E1C20 – Output #4 Acceleration Ramp Rate during Profile [20]

E1C21 – E1C24 – Reserved for module. Do not use.

E1C25 – Output #1 Deceleration Ramp Rate during Profile [20]
E1C26 – Output #2 Deceleration Ramp Rate during Profile [20]
E1C27 – Output #3 Deceleration Ramp Rate during Profile [20]
E1C28 – Output #4 Deceleration Ramp Rate during Profile [20]

E1C29 – E1C32 – Reserved for module. Do not use.

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the first extend profile and EP03–B08 is SET, it:

1) sets its outputs to the following values
2) sets status bit SYS22–B00
3) uses ramp rates E1C17–20 and E1C25–28 when changing outputs to these values

E1C33 – Output #1 Set–Output Value at End-of Profile [19]
E1C34 – Output #2 Set–Output Value at End-of Profile [19]
E1C35 – Output #3 Set–Output Value at End-of Profile [19]
E1C36 – Output #4 Set–Output Value at End-of Profile [19]

E1C37 – E1C40 – Reserved for Module. Do Not Use.

E1C (continued)

PRESSURE CONTROL LIMITS

E1C41 – Pressure Minimum Control Limit [02]

Minimum "controllable" axis pressure attainable during any Press/Pos E1 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in E1C43.

E1C42 – Pressure Maximum Control Limit [02]

Maximum "controllable" axis pressure attainable during any Press/Pos E1 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in E1C44.

E1C43 – Selected Pressure Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos E1 profile. The QH module expects a pressure equal to E1C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos E1 profile will be executed as a reverse-acting algorithm if this entry is greater than E1C44.

E1C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos E1 profile. The QH module expects a pressure equal to E1C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos E1 profile will be executed as a reverse-acting algorithm if this entry is less than E1C43.

VELOCITY CONTROL LIMITS

E1C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos E1 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in E1C47.

E1C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos E1 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in E1C48.

E1C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos E1 profile. The QH module expects a velocity equal to E1C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos E1 profile will be executed as a reverse-acting algorithm if this entry is greater than E1C48.

E1C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos E1 profile. The QH module expects a velocity equal to E1C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos E1 profile will be executed as a reverse-acting algorithm if this entry is less than E1C47.

E1C (continued)

PROFILE TUNING CONSTANTS

E1C49 – Proportional Gain for Pressure Control [30]
E1C50 – Integral Gain for Pressure Control [27]or[28]
E1C51 – Derivative Gain for Pressure Control [26]or[21]
E1C52 – Proportional Gain for Velocity Control [28]
E1C53 – Feed Forward Gain for Velocity Control [30]

E1C54 - E1C56 – Open

PROFILE PRESSURE ALARM SETPOINT

E1C57 – Profile High Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the E1 profile. The QH module sets alarm status bit SYS05–B12 when profile pressure equals or exceeds this entry during the E1 profile. A zero entry inhibits SYS05–B12.

E1C58 - E1C64 – Open

2nd EXTEND CONFIGURATION BLOCK (E2C)

BIT–MAPPED CONTROL WORDS

E2C01 – Block ID
low byte 00000100
high byte Reserved for Module. Do Not Use.

E2C02 – Configuration Selections

Selected Velocity Control Valve

B00–B02 The QH module uses its algorithm to drive the following output during any Vel/Pos E2 profile.

B02	B01	B00	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

B03 – Open

Selected Pressure Control Valve

B04–B06 The QH module uses its algorithm to drive the following output during any Press/Pos E2 profile

B06	B05	B04	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

E2C (continued)

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08 – B15 – Open

E2C03 – E2C04 – Open
E2C05 – E2C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

E2C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the E2 profile, it

1) starts an internal "Profile Watchdog" timer
2) stops this timer and resets its accumulated value to zero (after reporting total execution time in ES58) when it completes the profile
3) sets master status bit SYS04–B01 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B01.

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the E2 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates E2C17–20 and E2C25–28 to ramp "unselected" outputs

E2C09 – Output #1 Set–Output Value during Profile [19]
E2C10 – Output #2 Set–Output Value during Profile [19]
E2C11 – Output #3 Set–Output Value during Profile [19]
E2C12 – Output #4 Set–Output Value during Profile [19]
E2C13 – E2C16 – Reserved for Module. Do Not Use.

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the E2 profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

E2C17 – Output #1 Acceleration Ramp Rate during Profile [20]
E2C18 – Output #2 Acceleration Ramp Rate during Profile [20]
E2C19 – Output #3 Acceleration Ramp Rate during Profile [20]
E2C20 – Output #4 Acceleration Ramp Rate during Profile [20]
E2C21 – E2C24 – Reserved for Module. Do Not Use.

E2C25 – Output #1 Deceleration Ramp Rate during Profile [20]
E2C26 – Output #2 Deceleration Ramp Rate during Profile [20]
E2C27 – Output #3 Deceleration Ramp Rate during Profile [20]
E2C28 – Output #4 Deceleration Ramp Rate during Profile [20]
E2C29 – E2C32 – Reserved for Module. Do Not Use.

E2C (continued)

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the E2 profile and EP03–B09 is SET, it:

1) sets its outputs to the following values
2) sets status bit SYS22–B01
3) uses ramp rates E2C17–20 and E2C25–28 when changing outputs to these values

E2C33 – Output #1 Set–Output Value at End-of Profile [19]
E2C34 – Output #2 Set–Output Value at End-of Profile [19]
E2C35 – Output #3 Set–Output Value at End-of Profile [19]
E2C36 – Output #4 Set–Output Value at End-of Profile [19]
E2C37 – E2C40 – Reserved for Module. Do Not Use.

PRESSURE CONTROL LIMITS

E2C41 – Pressure Minimum Control Limit [02]

Minimum "controllable" axis pressure attainable during any Press/Pos E2 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in E2C43.

E2C42 – Pressure Maximum Control Limit [02]

Maximum "controllable" axis pressure attainable during any Press/Pos E2 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in E2C44.

E2C43 – Selected Pressure Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos E2 profile. The QH module expects a pressure equal to E2C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos E2 profile will be executed as a reverse-acting algorithm if this entry is greater than E2C44.

E2C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos E2 profile. The QH module expects a pressure equal to E2C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos E2 profile will be executed as a reverse-acting algorithm if this entry is less than E2C43.

VELOCITY CONTROL LIMITS

E2C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos E2 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in E2C47.

E2C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos E2 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in E2C48.

E2C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos E2 profile. The QH module expects a velocity equal to E2C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos E2 profile will be executed as a reverse-acting algorithm if this entry is greater than E2C48.

E2C (continued)

E2C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos E2 profile. The QH module expects a velocity equal to E2C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos E2 profile will be executed as a reverse-acting algorithm if this entry is less than E2C47.

PROFILE TUNING CONSTANTS

E2C49 – Proportional Gain for Pressure Control [30]
E2C50 – Integral Gain for Pressure Control [27]or[28]
E2C51 – Derivative Gain for Pressure Control [26]or[21]
E2C52 – Proportional Gain for Velocity Control [28]
E2C53 – Feed Forward Gain for Velocity Control [30]
E2C54 – E2C56 – Open

PROFILE PRESSURE ALARM SETPOINT

E2C57 – Profile High Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the E2 profile. The QH module sets alarm status bit SYS05–B13 when profile pressure equals or exceeds this entry during the E2 profile. A zero entry inhibits SYS05–B13.

E2C58 – E2C64 – Open

3rd EXTEND CONFIGURATION BLOCK (E3C)

BIT–MAPPED CONTROL WORDS

E3C01 – Block ID

low byte	00000101
high byte	Reserved for Module. Do Not Use.

E3C02 – Configuration Selections

Selected Velocity Control Valve

B00–B02 The QH module uses its algorithm to drive the following output during any Vel/Pos E3 Profile.

B02	B01	B00	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

B03 – Open

E3C (continued)

Selected Pressure Control Valve

B04–B06 QH module uses its algorithm to drive the following output during any Press/Pos E3 profile.

B06	B05	B04	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)
B08 – B15 Open

E3C03 – E3C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

E3C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the E3 profile, it:

1) starts an internal "Profile Watchdog" timer
2) starts this timer and resets its accumulated value to zero (after reporting total execution time in ES59) when it completes the profile
3) sets master status bit SYS04–B02 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B02.

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the E3 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates E3C17–20 and E3C25–28 to ramp "unselected" outputs

E3C09 – Output #1 Set–Output Value during Profile [19]
E3C10 – Output #2 Set–Output Value during Profile [19]
E3C11 – Output #3 Set–Output Value during Profile [19]
E3C12 – Output #4 Set–Output Value during Profile [19]
E3C13 – E3C16 – Reserved for module. Do not use.

E3C (continued)

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the E3 profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

E3C17 – Output #1 Acceleration Ramp Rate during Profile [20]
E3C18 – Output #2 Acceleration Ramp Rate during Profile [20]
E3C19 – Output #3 Acceleration Ramp Rate during Profile [20]
E3C20 – Output #4 Acceleration Ramp Rate during Profile [20]
E3C21 – E2C24 – Reserved for Module. Do Not Use.

E3C25 – Output #1 Deceleration Ramp Rate during Profile [20]
E3C26 – Output #2 Deceleration Ramp Rate during Profile [20]
E3C27 – Output #3 Deceleration Ramp Rate during Profile [20]
E3C28 – Output #4 Deceleration Ramp Rate during Profile [20]
E3C29 – E2C32 – Reserved for Module. Do Not Use.

END-OF PROFILE SET–OUTPUT VALUES

When the QH module completes the E3 profile and EP03–B10 is SET, it:

1) sets its outputs to the following values
2) sets status bit SYS22–B02
3) uses ramp rates E3C17–20 and E3C25–28 when changing outputs to these values

E3C33 – Output #1 Set–Output Value at End-of Profile [19]
E3C34 – Output #2 Set–Output Value at End-of Profile [19]
E3C35 – Output #3 Set–Output Value at End-of Profile [19]
E3C36 – Output #4 Set–Output Value at End-of Profile [19]
E3C37 – E3C40 – Reserved for module. Do not use.

PRESSURE CONTROL LIMITS

E3C41 – Pressure Minimum Control Limit [02]

Minimum “controllable” axis pressure attainable during any Press/Pos E3 profile. The QH module expects this pressure when setting its “selected” pressure valve to the %–output in E3C43.

E3C42 – Pressure Maximum Control Limit [02]

Maximum “controllable” axis pressure attainable during any Press/Pos E3 profile. The QH module expects this pressure when setting its “selected” pressure valve to the %–output in E3C44.

E3C43 – Selected Pressure Valve Output for Minimum [19]

“0% CV” output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos E3 profile. The QH module expects a pressure equal to E3C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos E3 profile will be executed as a reverse-acting algorithm if this entry is greater than E3C44.

E3C (continued)

E3C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos E3 profile. The QH module expects a pressure equal to E3C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos E3 profile will be executed as a reverse-acting algorithm if this entry is less than E3C43.

VELOCITY CONTROL LIMITS

E3C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos E3 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in E3C47.

E3C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos E3 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in E3C48.

E3C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos E3 profile. The QH module expects a velocity equal to E3C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos E3 profile will be executed as a reverse-acting algorithm if this entry is greater than E3C48.

E3C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos E3 profile. The QH module expects a velocity equal to E3C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos E3 profile will be executed as a reverse-acting algorithm if this entry is less than E3C47.

PROFILE TUNING CONSTANTS

E3C49 – Proportional Gain for Pressure Control [30]
E3C50 – Integral Gain for Pressure Control [27]or[28]
E3C51 – Derivative Gain for Pressure Control [26]or[21]
E3C52 – Proportional Gain for Velocity Control [28]
E3C53 – Feed Forward Gain for Velocity Control [30]

E3C54 – E3C56 – Open

PROFILE PRESSURE ALARM SETPOINT

E3C57 – Profile High-pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the E3 profile. The QH module sets alarm status bit SYS05–B14 when profile pressure equals or exceeds this entry during the E3 profile. A zero entry inhibits SYS05–B14.

E3C58 – E3C64 – Open

4th PROFILE, EXTEND, CONFIGURATION BLOCK (E4C)

BIT-MAPPED CONTROL WORDS

E4C01 – Block ID

low byte 00000110

high byte Reserved for Module. Do Not Use.

E4C02 – Configuration Selections

B00–B03 – Open

Selected Pressure Control Valve

B04–B06 The QH module uses its algorithm to drive the following output during any E4 profile.

B06	B05	B04	
0	0	0	Output #1
0	0	1	Output #2
0	1	0	Output #3
0	1	1	Output #4

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08–B15 – Open

E4C03 – E4C06 – Open

WATCHDOG TIMERS

E4C07 – Tonnage Watchdog Timer Preset [21]

When the QH module completes the E4 profile and sets its outputs to E4C33 – E4C36, it:

1) starts an internal “Tonnage Watchdog” timer
2) starts this timer when it sets master status bit SYS03–B02 and reports the accumulated value of the timer in SYS57
3) resets SYS57 to zero when it detects a F–to–T transition of DYC03–B00
4) sets master status bit SYS04–B15 when SYS57 equals or exceeds this entry. A zero entry inhibits SYS04–B15.

E4C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the E4 profile, it:

1) starts an internal “Profile Watchdog” timer
2) starts this timer and resets its accumulated value to zero (after reporting total execution time in ES60) when it completes the profile
3) sets master status bit SYS04–B03 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B03

E4C (continued)

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the E4 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates E4C17–20 and E4C25–28 to ramp "unselected" outputs

E4C09 – Output #1 Set–Output Value during Profile [19]
E4C10 – Output #2 Set–Output Value during Profile [19]
E4C11 – Output #3 Set–Output Value during Profile [19]
E4C12 – Output #4 Set–Output Value during Profile [19]
E4C13 – E4C16 – Reserved for module. Do not use.

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the E4 profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

E4C17 – Output #1 Acceleration Ramp Rate during Profile [20]
E4C18 – Output #2 Acceleration Ramp Rate during Profile [20]
E4C19 – Output #3 Acceleration Ramp Rate during Profile [20]
E4C20 – Output #4 Acceleration Ramp Rate during Profile [20]
E4C21 – E4C24 – Reserved for module. Do not use.

E4C25 – Output #1 Deceleration Ramp Rate during Profile [20]
E4C26 – Output #2 Deceleration Ramp Rate during Profile [20]
E4C27 – Output #3 Deceleration Ramp Rate during Profile [20]
E4C28 – Output #4 Deceleration Ramp Rate during Profile [20]
E4C29 – E4C32 – Reserved for module. Do not use.

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the E4 profile, it:

1) sets its outputs to the following values
2) sets status bit SYS22–B03
3) uses ramp rates E4C17–20 and E4C25–28 when changing outputs to these values

E4C33 – Output #1 Set–Output Value at End-of Profile [19]
E4C34 – Output #2 Set–Output Value at End-of Profile [19]
E4C35 – Output #3 Set–Output Value at End-of Profile [19]
E4C36 – Output #4 Set–Output Value at End-of Profile [19]
E4C37 – E4C40 – Reserved for module. Do not use.

PRESSURE CONTROL LIMITS

E4C41 – Pressure Minimum Control Limit [02]

Minimum "controllable" axis pressure attainable during any E4 profile. The QH module expects this pressure when setting its "selected" valve to the %–output in E4C43.

E4C42 – Pressure Maximum Control Limit [02]

Maximum "controllable" axis pressure attainable during any E4 profile. The QH module expects this pressure when setting its "selected" valve to the %–output in E4C44.

E4C (continued)

E4C43 – Selected Pressure Valve Output of Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected pressure valve during any E4 profile. The QH module expects a pressure equal to E4C41 when setting the selected pressure valve to this %–output during profile execution. The E4 profile will be executed as a reverse-acting algorithm if this entry is greater than E4C44.

E4C44 – Selected Pressure Valve Output of Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any E4 profile. The QH module expects a pressure equal to E4C42 when setting the selected pressure valve to this %–output during profile execution. The E4 profile will be executed as a reverse-acting algorithm if this entry is less than E4C43.

E4C45 – E4C48 – Open

PROFILE TUNING CONSTANTS

E4C49 – Proportional Gain for Pressure Control [30]
E4C50 – Integral Gain for Pressure Control [27]or[28]
E4C51 – Derivative Gain for Pressure Control [26]or[21]
E4C52 – E4C56 – Open

PROFILE PRESSURE ALARM SETPOINT

E4C57 – Profile High-pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the E4 profile. The QH module sets alarm status bit SYS05–B15 when profile pressure equals or exceeds this entry during the E4 profile. A zero entry inhibits SYS05–B15.

E4C58 – E4C64 – Open

EXTEND PROFILE BLOCK (EP)

BIT–MAPPED CONTROL WORDS

EP01 – Block ID
low byte 00000111
high byte Reserved for Module. Do Not Use.

EP02 – Open

EP03 – Configuration Selections

Profile Algorithm Selections

B00 = 0 Vel/Pos selected for the E1 profile
= 1 Press/Pos selected for the E1 profile

B01 – Open

B02 = 0 Vel/Pos selected for the E2 profile
= 1 Press/Pos selected for the E2 profile

B03 – Open

B04 = 0 Vel/Pos selected for the E3 profile
= 1 Press/Pos selected for the E3 profile

B05–B07 – Open

E1/E2 Logical Bridge Selection

B08 = 0 Start the E2 profile at end of E1 profile
= 1 Stop and Set–output at end of E1 profile

The QH module checks the state of this bit at completion of the E1 profile to determine what further action to take:

If this "pause" bit is SET, the QH module sets its outputs to E1C33 – E1C36.

If this "pause" bit is RESET and EP20 > 00000, the QH module immediately begins the E2 profile.

If this "pause" bit is RESET and EP20 = 00000, the QH module reacts as if it had just completed the E2 profile, and continues operation based upon the state of EP03–B09.

E2/E3 Logical Bridge Selection

B09 = 0 Start the E3 profile at end of E2 profile
= 1 Stop and Set–output at end of E2 profile

The QH module checks the state of this bit at completion of the E2 profile to determine what further action to take:

If this "pause" bit is SET, the QH module sets its outputs to E2C33 – E2C36.

If this "pause" bit is RESET and EP29 > 00000, the QH module immediately begins the E3 profile.

If this "pause" bit is RESET and EP29 = 00000, the QH module reacts as if it had just completed the E3 profile, and continues operation based upon the state of EP03–B10.

EP (continued)

E3/E4 Logical Bridge Selection

B10 = 0 Start the E4 profile at end of E3 profile
= 1 Stop and Set–output at end of E3 profile

The QH module checks the state of this bit at completion of the E3 profile to determine what further action to take:

If this "pause" bit is SET, the QH module sets its outputs to E3C33 – E3C36.

If this "pause" bit is RESET, the QH module immediately begins the E4 profile.

Selection of Extend Protection Zone Overrun

B11 = 0 Start E4 profile on overrun of protection zone
= 1 Stop and zero outputs on overrun of extend protection zone

If the axis position reaches a value less than or equal to EP61 while the QH module is executing any of the first three axis-extend profiles, the QH module immediately terminates the ongoing axis-extend profile and checks the state of this bit. If RESET, the QH module immediately begins the E4 profile. If SET, the QH module sets its outputs to zero.

B12–B13 – Open

Velocity Units Selection

B14 = 0 Velocity parameters in "Percent Velocity"
= 1 Velocity parameters in Inches(mm)/Second

If RESET, the QH module returns all segment velocity actuals (and assumes all velocity setpoints) in units of "percent velocity" where E1C46, E2C46, and E3C46 represent 100% velocity.

If SET, the QH module returns all velocity actuals (and assumes all velocity setpoints) in units of inches(mm)/second.

B15 – Open

EP04 – Configuration Selections

Open/Closed Loop Selection

B00 = 0 Vel/Pos E1 Profile Closed Loop
= 1 Vel/Pos E1 Profile Open Loop

B01 = 0 Press/Pos E1 Profile Closed Loop
= 1 Press/Pos E1 Profile Open Loop

B02 = 0 Vel/Pos E2 Profile Closed Loop
= 1 Vel/Pos E2 Profile Open Loop

B03 = 0 Press/Pos E2 Profile Closed Loop
= 1 Press/Pos E2 Profile Open Loop

B04 = 0 Vel/Pos E3 Profile Closed Loop
= 1 Vel/Pos E3 Profile Open Loop

EP (continued)

B05 = 0 Press/Pos E3 Profile Closed Loop
= 1 Press/Pos E3 Profile Open Loop

B06 – Open

B07 = 0 E4 Profile Closed Loop
= 1 E4 Profile Open Loop

B08 – B15 – Reserved for Module. Do Not Use.

EP05 – EP08 – Open

E1 PROFILE SETPOINTS

EP09 – Segment 1 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the E1 profile until axis position reaches the larger of EP11 or EP61. If EP03–B14 is RESET, the QH module reads this parameter in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP10 – Segment 1 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the E1 profile until axis position reaches the larger of EP11 or EP61.

EP11 – End-of Segment 1 Position Setpoint [14]

EP12 – Segment 2 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position EP11 until the position reaches the larger of EP14 or EP61. If EP03–B14 is RESET, the QH module reads this value in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP13 – Segment 2 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from the axis position EP11 until the position reaches the larger of EP14 or EP61.

EP14 – End-of Segment 2 Position Setpoint [14]

EP15 – Segment 3 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position EP14 until the position reaches the larger of EP17 or EP61. If EP03–B14 is RESET, the QH module reads this value in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP16 – Segment 3 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position EP14 until the position reaches the larger of EP17 or EP61.

EP17 – End-of Segment 3 Position Setpoint [14]

EP (continued)

E2 PROFILE SETPOINTS

EP18 – Segment 4 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the E2 profile until the position reaches the larger of EP20 or EP61. If EP03–B14 is RESET, the QH module reads this parameter in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP19 – Segment 4 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the E2 profile until the position reaches the larger of EP20 or EP61.

EP20 – End-of Segment 4 Position Setpoint [14]

EP21 – Segment 5 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position EP20 until the position reaches the larger of EP23 or EP61. If EP03–B14 is RESET, the QH module reads this value in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP22 – Segment 5 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position EP20 until the position reaches the larger of EP23 or EP61.

EP23 – End-of Segment 5 Position Setpoint [14]

EP24 – Segment 6 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position EP23 until the position reaches the larger of EP26 or EP61. If EP03–B14 is RESET, the QH module reads this value in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP25 – Segment 6 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position EP23 until the position reaches the larger of EP26 or EP61.

EP26 – End-of Segment 6 Position Setpoint [14]

E3 PROFILE SETPOINTS

EP27 – Segment 7 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the E3 profile until the position reaches the larger of EP29 or EP61. If EP03–B14 is RESET, the QH module reads this parameter in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP28 – Segment 7 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the E3 profile until the position reaches the larger of EP29 or EP61.

EP29 – End-of Segment 7 Position Setpoint [14]

EP (continued)

EP30 – Segment 8 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position EP29 until the position reaches the larger of EP32 or EP61. If EP03–B14 is RESET, the QH module reads this value in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP31 – Segment 8 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position EP29 until the position reaches the larger of EP32 or EP61.

EP32 – End-of Segment 8 Position Setpoint [14]

EP33 – Segment 9 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position EP32 until the position reaches the larger of EP35 or EP61. If EP03–B14 is RESET, the QH module reads this value in percent velocity. If EP03–B14 is SET, reads it in inches(mm)/second.

EP34 – Segment 9 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position EP32 until the position reaches the larger of EP35 or EP61.

EP35 – End-of Segment 9 Position Setpoint [14]

E4 PROFILE SETPOINTS

EP36 – Reserved

EP37 – Segment 1 Pressure Setpoint [02]

The QH module controls axis pressure to this setpoint after starting the E4 profile until the position reaches the larger of EP38 or EP62.

EP38 – End-of Segment 1 Position Setpoint [14]

EP39 – Reserved

EP40 – Segment 2 Pressure Setpoint [02]

The QH module controls axis pressure to this setpoint from axis position EP38 until the position reaches EP62.

EP41 – EP60 – Open

CRITICAL PROCESS SETPOINTS

EP61 – Start Protection Zone Position Setpoint [14]

The QH module uses this position as protection against running an E1, E2, or E3 profile into the extend protection zone. If this position is reached while the QH module is executing any of the first three axis-extend profiles, the QH module immediately terminates the ongoing profile and checks the state of EP03–B11.

If this "overrun" bit is RESET, the QH module immediately begins the E4 profile.
If SET, the QH module sets its outputs to zero.

EP (continued)

The QH module sets master status bit SYS03–B00 when axis position is less than or equal to this entry. The QH module also sets alarm status bit SYS07–B06 if it reaches the protection zone while executing one of the first three axis-extend profiles.

EP62 – Fully Extended Position Setpoint [14]
THIS ENTRY IS THE FULLY EXTENDED POSITION

The QH module uses this position as the end of E4 profile position setpoint. If this position is reached while the QH module is executing the E4 profile, the QH module immediately terminates the E4 profile and sets its outputs to E4C33 – E4C36 to apply tonnage.

The QH module sets master status bit SYS03–B01 when position is less than or equal to this entry.

EP63 – Tonnage Complete Pressure Setpoint [02]
The QH module compares real–time axis pressure against this entry when the position is less than or equal to EP62. The QH module sets master status bit SYS03–B02 when pressure equals or exceeds this entry when the position is less than or equal to EP62.

EP64 – Open

1st RETRACT CONFIGURATION BLOCK (R1C)

BIT–MAPPED CONTROL WORDS

R1C01 – Block ID
low byte 00010001
high byte Reserved for Module. Do Not Use.
R1C02 – Configuration Selections

Selected Velocity Control Valve

The QH module uses its algorithm to drive the following output during any Vel/Pos R1 Profile.

	B02	B01	B00	
B00 -B02	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

B03 – Open

Selected Pressure Control Valve

The QH module uses its algorithm to drive the following output during any Press/Pos R1 Profile.

	B06	B05	B04	
B04–B06	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

R1C (continued)

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08–B15 – Open

R1C03 – R1C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

R1C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the R1 profile, it:

1) starts an internal "Profile Watchdog" timer
2) stops this timer and resets its accumulated value to zero (after reporting total execution time in RS57) when it completes the profile
3) sets master status bit SYS04–B10 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B10.

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the R1 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates R1C17–20 and R1C25–28 to ramp "unselected" outputs

R1C09 – Output #1 Set–Output Value during Profile [19]
R1C10 – Output #2 Set–Output Value during Profile [19]
R1C11 – Output #3 Set–Output Value during Profile [19]
R1C12 – Output #4 Set–Output Value during Profile [19]
R1C13 – R1C16 – Reserved for Module. Do Not Use.

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the R1 Profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

R1C17 – Output #1 Acceleration Ramp Rate during Profile [20]
R1C18 – Output #2 Acceleration Ramp Rate during Profile [20]
R1C19 – Output #3 Acceleration Ramp Rate during Profile [20]
R1C20 – Output #4 Acceleration Ramp Rate during Profile [20]
R1C21 – R1C24 – Reserved for module. Do not use.

R1C25 – Output #1 Deceleration Ramp Rate during Profile [20]
R1C26 – Output #2 Deceleration Ramp Rate during Profile [20]
R1C27 – Output #3 Deceleration Ramp Rate during Profile [20]
R1C28 – Output #4 Deceleration Ramp Rate during Profile [20]
R1C29 – R1C32 – Reserved for Module. Do Not Use.

R1C (continued)

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the R1 profile and R1C03–B08 is SET and SYS21–B14 is RESET, it:

1) sets its outputs to the following values
2) sets status bit SYS22–B10
3) uses ramp rates R1C17–20 and R1C25–28 when changing outputs to these values

R1C33 – Output #1 Set–Output Value at End-of Profile [19]
R1C34 – Output #2 Set–Output Value at End-of Profile [19]
R1C35 – Output #3 Set–Output Value at End-of Profile [19]
R1C36 – Output #4 Set–Output Value at End-of Profile [19]
R1C37 – R1C40 – Reserved for Module. Do Not Use.

PRESSURE CONTROL LIMITS

R1C41 – Pressure Minimum Control Limit [02]

Minimum "controllable" axis pressure attainable during any Press/Pos R1 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in R1C43.

R1C42 – Pressure Maximum Control Limit [02]

Maximum "controllable" axis pressure attainable during any Press/Pos R1 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in R1C44.

R1C43 – Selected Pressure Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R1 profile. The QH module expects a pressure equal to R1C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R1 profile will be executed as a reverse-acting algorithm if this entry is greater than R1C44.

R1C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R1 profile. The QH module expects a pressure equal to R1C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R1 profile will be executed as a reverse-acting algorithm if this entry is less than R1C43.

VELOCITY CONTROL LIMITS

R1C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos R1 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R1C47.

R1C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos R1 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R1C48.

R1C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R1 profile. The QH module expects a velocity equal to R1C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R1 profile will be executed as a reverse-acting algorithm if this entry is greater than R1C48.

R1C (continued)

R1C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R1 profile. The QH module expects a velocity equal to R1C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R1 profile will be executed as a reverse-acting algorithm if this entry is less than R1C47.

PROFILE TUNING CONSTANTS

R1C49 – Proportional Gain for Pressure Control [30]
R1C50 – Integral Gain for Pressure Control [27]or[28]
R1C51 – Derivative Gain for Pressure Control [26]or[21]
R1C52 – Proportional Gain for Velocity Control [28]
R1C53 – Feed Forward Gain for Velocity Control [30]

R1C54 – R1C56 – Open

PROFILE PRESSURE ALARM SETPOINT

R1C57 – Profile High Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the R1 profile. The QH module sets alarm status bit SYS06–B09 when profile pressure equals or exceeds this entry during the R1 profile. A zero entry inhibits SYS06–B09.

R1C58 – R1C64 – Open

2nd RETRACT CONFIGURATION BLOCK (R2C)

BIT–MAPPED CONTROL WORDS

R2C01 – Block ID
low byte 00010010
high byte Reserved for Module. Do Not Use.
R2C02 – Configuration Selections

Selected Velocity Control Valve

The QH module uses its algorithm to drive the following output during any Vel/Pos R2 profile.

B00–B02	B02	B01	B00	
	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

B03 – Open

R2C (continued)

Selected Pressure Control Valve

The QH module uses its algorithm to drive the following output during any Press/Pos R2 profile.

	B06	**B05**	**B04**	
B04–B06				
	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08–B15 – Open

R2C03 – R2C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

R2C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the R2 profile, it:

1) starts an internal "Profile Watchdog" timer
2) starts this timer and reset its accumulated value to zero (after reporting total execution time in RS58) when it completes the profile
3) sets master status bit SYS04–B11 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B11.

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the R2 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates R2C17–20 and R2C25–28 to ramp "unselected" outputs

R2C09 – Output #1 Set–Output Value during Profile [19]
R2C10 – Output #2 Set–Output Value during Profile [19]
R2C11 – Output #3 Set–Output Value during Profile [19]
R2C12 – Output #4 Set–Output Value during Profile [19]
R2C13 – R2C16 – Reserved for Module. Do Not Use.

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the R2 profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

R2C17 – Output #1 Acceleration Ramp Rate during Profile [20]
R2C18 – Output #2 Acceleration Ramp Rate during Profile [20]
R2C19 – Output #3 Acceleration Ramp Rate during Profile [20]
R2C20 – Output #4 Acceleration Ramp Rate during Profile [20]
R2C21 – R2C24 – Reserved for Module. Do Not Use.

R2C (continued)

R2C25 – Output #1 Deceleration Ramp Rate during Profile [20]
R2C26 – Output #2 Deceleration Ramp Rate during Profile [20]
R2C27 – Output #3 Deceleration Ramp Rate during Profile [20]
R2C28 – Output #4 Deceleration Ramp Rate during Profile [20]
R2C29 – R2C32 – Reserved for Module. Do Not Use.

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the R2 profile and RP03–B09 is SET, it:

1) sets its outputs to the values listed below
2) sets status bit SYS22–B11
3) ignores SYS22 and the values below, and relinquishes output control to the E2 profile if SYS21–B14 is SET
4) uses ramp rates R2C17–20 and R2C25–28 when changing outputs to these values

R2C33 – Output #1 Set–Output Value at End-of Profile [19]
R2C34 – Output #2 Set–Output Value at End-of Profile [19]
R2C35 – Output #3 Set–Output Value at End-of Profile [19]
R2C36 – Output #4 Set–Output Value at End-of Profile [19]
R2C37 –R2C40 – Reserved for Module. Do Not Use.

PRESSURE CONTROL LIMITS

R2C41 – Pressure Minimum Control Limit [02]

Minimum "controllable" axis pressure attainable during any Press/Pos R2 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in R2C43.

R2C42 – Pressure Maximum Control Limit [02]

Maximum "controllable" axis pressure attainable during any Press/Pos R2 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in R2C44.

R2C43 – Selected Pressure Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R2 profile. The QH module expects a pressure equal to R2C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R2 profile will be executed as a reverse-acting algorithm if this entry is greater than R2C44.

R2C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R2 profile. The QH module expects a pressure equal to R2C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R2 profile will be executed as a reverse-acting algorithm if this entry is less than R2C43.

VELOCITY CONTROL LIMITS

R2C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos R2 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R2C47.

R2C (continued)

R2C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos R2 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R2C48.

R2C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R2 profile. The QH module expects a velocity equal to R2C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R2 profile will be executed as a reverse-acting algorithm if this entry is greater than R2C48.

R2C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R2 profile. The QH module expects a velocity equal to R2C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R2 profile will be executed as a reverse-acting algorithm if this entry is less than R2C47.

PROFILE TUNING CONSTANTS

R2C49 – Proportional Gain for Pressure Control [30]
R2C50 – Integral Gain for Pressure Control [27]or[28]
R2C51 – Derivative Gain for Pressure Control [26]or[21]
R2C52 – Proportional Gain for Velocity Control [28]
R2C53 – Feed Forward Gain for Velocity Control [30]

R2C54 – R2C56 – Open

PROFILE PRESSURE ALARM SETPOINT

R2C57 – Profile High Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the R2 profile. The QH module sets alarm status bit SYS06–B10 when profile pressure equals or exceeds this entry during the R2 profile. A zero entry inhibits SYS06–B10.

R2C58 – R2C64 – Open

3rd RETRACT CONFIGURATION BLOCK (R3C)

BIT–MAPPED CONTROL WORDS

R3C01 – Block ID
low byte 00010011
high byte Reserved for Module. Do Not Use.
R3C02 – Configuration Selections

Selected Velocity Control Valve

The QH module uses its algorithm to drive the following output during any Vel/Pos R3 Profile.

	B02	**B01**	**B00**	
B00–B02	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

B03 Open

Selected Pressure Control Valve

QH module uses its algorithm to drive the following output during any Press/Pos R3 profile.

	B06	**B05**	**B04**	
B04–B06	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08–B15 – Open

R3C03 – R3C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

R3C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the R3 profile, it:

1) starts an internal "Profile Watchdog" timer
2) stops this timer and reset its accumulated value to zero (after reporting total execution time in RS59) when it completes the profile
3) sets master status bit SYS04–B12 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B12.

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the R3 profile, it:

1) sets its "unselected" outputs to the values listed below
2) ignores the "unselected" value of the "selected" output
3) uses ramp rates R3C17–20 and R3C25–28 to ramp "unselected" outputs

R3C (continued)

R3C09 – Output #1 Set–Output Value during Profile [19]
R3C10 – Output #2 Set–Output Value during Profile [19]
R3C11 – Output #3 Set–Output Value during Profile [19]
R3C12 – Output #4 Set–Output Value during Profile [19]
R3C13 – R3C16 – Reserved for Module. Do Not Use.

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the R3 Profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

R3C17 – Output #1 Acceleration Ramp Rate during Profile [20]
R3C18 – Output #2 Acceleration Ramp Rate during Profile [20]
R3C19 – Output #3 Acceleration Ramp Rate during Profile [20]
R3C20 – Output #4 Acceleration Ramp Rate during Profile [20]
R3C21 – R3C24 – Reserved for Module. Do Not Use.

R3C25 – Output #1 Deceleration Ramp Rate during Profile [20]
R3C26 – Output #2 Deceleration Ramp Rate during Profile [20]
R3C27 – Output #3 Deceleration Ramp Rate during Profile [20]
R3C28 – Output #4 Deceleration Ramp Rate during Profile [20]
R3C29 – R3C32 – Reserved for Module. Do Not Use.

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the R3 profile and RP03–B10 is SET, it:

1) sets its outputs to the values listed below
2) sets status bit SYS22–B12
3) uses ramp rates R3C17–20 and R3C25–28 when changing outputs to these values

R3C33 – Output #1 Set–Output Value at End-of Profile [19]
R3C34 – Output #2 Set–Output Value at End-of Profile [19]
R3C35 – Output #3 Set–Output Value at End-of Profile [19]
R3C36 – Output #4 Set–Output Value at End-of Profile [19]
R3C37 – R3C40 – Reserved for Module. Do Not Use.

PRESSURE CONTROL LIMITS

R3C41 – Pressure Minimum Control Limit [02]

Minimum "controllable" axis pressure attainable during any Press/Pos R3 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in R3C43.

R3C42 – Pressure Maximum Control Limit [02]

Maximum "controllable" axis pressure attainable during any Press/Pos R3 profile. The QH module expects this pressure when setting its "selected" pressure valve to the %–output in R3C44.

R3C43 – Selected Pressure Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R3 profile. The QH module expects a pressure equal to R3C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R3 profile will be executed as a reverse-acting algorithm if this entry is greater than R3C44.

R3C (continued)

R3C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R3 profile. The QH module expects a pressure equal to R3C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R3 profile will be executed as a reverse-acting algorithm if this entry is less than R3C43.

VELOCITY CONTROL LIMITS

R3C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos R3 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R3C47.

R3C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos R3 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R3C48.

R3C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R3 profile. The QH module expects a velocity equal to R3C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R3 profile will be executed as a reverse-acting algorithm if this entry is greater than R3C48.

R3C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R3 profile. The QH module expects a velocity equal to R3C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R3 profile will be executed as a reverse-acting algorithm if this entry is less than R3C47.

PROFILE TUNING CONSTANTS

R3C49 – Proportional Gain for Pressure Control [30]
R3C50 – Integral Gain for Pressure Control [27]or[28]
R3C51 – Derivative Gain for Pressure Control [26]or[21]
R3C52 – Proportional Gain for Velocity Control [28]
R3C53 – Feed Forward Gain for Velocity Control [30]

R3C54 – R3C56 – Open

PROFILE PRESSURE ALARM SETPOINT

R3C57 – Profile High Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the R3 profile. The QH module sets alarm status bit SYS06–B11 when profile pressure equals or exceeds this entry during the R3 profile. A zero entry inhibits SYS06–B11.

R3C58 – R3C64 – Open

4th RETRACT CONFIGURATION BLOCK (R4C)

BIT–MAPPED CONTROL WORDS

R4C01 – Block ID
low byte 0010100
high byte Reserved for Module. Do Not Use.
R4C02 – Configuration Selections

Selected Velocity Control Valve

The QH module uses its algorithm to drive the following output during any Vel/Pos R4 Profile.

	B02	B01	B00	
B00–B02	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

B03 – Open

Selected Pressure Control Valve

The QH module uses its algorithm to drive the following output during any Press/Pos R4 profile.

	B06	B05	B04	
B04–B06	0	0	0	Output #1
	0	0	1	Output #2
	0	1	0	Output #3
	0	1	1	Output #4

Pressure Algorithm Selection

B07 = 0 Dependent Gains (ISA)
= 1 Independent Gains (AB)

B08–B15 – Open

R4C03 – R4C07 – Reserved for Module. Do Not Use.

WATCHDOG TIMER

R4C08 – Profile Watchdog Timer Preset [21]

When the QH module starts the R4 profile, it:

1) starts an internal “Profile Watchdog” timer
2) stops this timer and reset its accumulated value to zero (after reporting total execution time in RS60) when it completes the profile
3) sets master status bit SYS04–B13 when the accumulated value of this timer equals or exceeds this entry. A zero entry inhibits SYS04–B13.

UNSELECTED VALVE SET–OUTPUT VALUES

When the QH module starts the R4 profile, it:

1) sets its “unselected” outputs to the values listed below
2) ignores the “unselected” value of the “selected” output
3) uses ramp rates R4C17–20 and R4C25–28 to ramp “unselected” outputs

R4C (continued)

R4C09 – Output #1 Set–Output Value during Profile [19]
R4C10 – Output #2 Set–Output Value during Profile [19]
R4C11 – Output #3 Set–Output Value during Profile [19]
R4C12 – Output #4 Set–Output Value during Profile [19]
R4C13 – R4C16 – Reserved for Module. Do Not Use

OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs from setpoint to setpoint during the R4 Profile. THE QH MODULE INTERPRETS A RAMP RATE ENTRY OF ZERO AS A STEP FUNCTION RAMP (RAMP DISABLE).

R4C17 – Output #1 Acceleration Ramp Rate during Profile [20]
R4C18 – Output #2 Acceleration Ramp Rate during Profile [20]
R4C19 – Output #3 Acceleration Ramp Rate during Profile [20]
R4C20 – Output #4 Acceleration Ramp Rate during Profile [20]
R4C21 – R4C24 – Reserved for Module. Do Not Use

R4C25 – Output #1 Deceleration Ramp Rate during Profile [20]
R4C26 – Output #2 Deceleration Ramp Rate during Profile [20]
R4C27 – Output #3 Deceleration Ramp Rate during Profile [20]
R4C28 – Output #4 Deceleration Ramp Rate during Profile [20]
R4C29 – R4C32 – Reserved for Module. Do Not Use.

END-OF-PROFILE SET–OUTPUT VALUES

When the QH module completes the R4 profile and SYS21–B14 is RESET, it:

1) sets its outputs to the values listed below
2) sets status bit SYS22–B13
3) uses ramp rates R4C17–20 and R4C25–28 when changing outputs to these values

R4C33 – Output #1 Set–Output Value at End-of Profile [19]
R4C34 – Output #2 Set–Output Value at End-of Profile [19]
R4C35 – Output #3 Set–Output Value at End-of Profile [19]
R4C36 – Output #4 Set–Output Value at End-of Profile [19]
R4C37 – R4C40 – Reserved for Module. Do Not Use.

PRESSURE CONTROL LIMITS

R4C41 – Pressure Minimum Control Limit [02]

Minimum “controllable” axis pressure attainable during any Press/Pos R4 profile. The QH module expects this pressure when setting its “selected” pressure valve to the %–output in R4C43.

R4C42 – Pressure Maximum Control Limit [02]

Maximum “controllable” axis pressure attainable during any Press/Pos R4 profile. The QH module expects this pressure when setting its “selected” pressure valve to the %–output in R4C44.

R4C43 – Selected Pressure Valve Output for Minimum [19]

“0% CV” output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R4 profile. The QH module expects a pressure equal to R4C41 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R4 profile will be executed as a reverse-acting algorithm if this entry is greater than R4C44.

R4C (continued)

R4C44 – Selected Pressure Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected pressure valve during any Press/Pos R4 profile. The QH module expects a pressure equal to R4C42 when setting the selected pressure valve to this %–output during profile execution. The Press/Pos R4 profile will be executed as a reverse-acting algorithm if this entry is less than R4C43.

VELOCITY CONTROL LIMITS

R4C45 – Velocity Minimum Control Limit [08]

Minimum "controllable" axis velocity attainable during any Vel/Pos R4 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R4C47.

R4C46 – Velocity Maximum Control Limit [08]

Maximum "controllable" axis velocity attainable during any Vel/Pos R4 profile. The QH module expects this velocity when setting its "selected" velocity valve to the %–output in R4C48.

R4C47 – Selected Velocity Valve Output for Minimum [19]

"0% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R4 profile. The QH module expects a velocity equal to R4C45 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R4 profile will be executed as a reverse-acting algorithm if this entry is greater than R4C48.

R4C48 – Selected Velocity Valve Output for Maximum [19]

"100% CV" output percentage that the QH module uses to drive the selected velocity valve during any Vel/Pos R4 profile. The QH module expects a velocity equal to R4C46 when setting the selected velocity valve to this %–output during profile execution. The Vel/Pos R4 profile will be executed as a reverse-acting algorithm if this entry is less than R4C47.

PROFILE TUNING CONSTANTS

R4C49 – Proportional Gain for Pressure Control [30]
R4C50 – Integral Gain for Pressure Control [27]or[28]
R4C51 – Derivative Gain for Pressure Control [26]or[21]
R4C52 – Proportional Gain for Velocity Control [28]
R4C53 – Feed Forward Gain for Velocity Control [30]

R4C54 – R4C57 – Open

PROFILE PRESSURE ALARM SETPOINT

R4C57 – Profile High Pressure Alarm Setpoint [02]

The QH module compares real–time axis pressure against this entry when executing the R4 profile. The QH module sets alarm status bit SYS06–B12 when profile pressure equals or exceeds this entry during the R4 profile. A zero entry inhibits SYS06–B12.

R4C58 – R4C64 – Open

RETRACT PROFILE BLOCK (RP)

BIT–MAPPED CONTROL WORDS

RP01 – Block ID
low byte 00010101
high byte Reserved for Module. Do Not Use.
RP02 – Open

RP03 – Configuration Selections

Profile Algorithm Selections

B00 = 0 Vel/Pos selected for the R1 profile
= 1 Press/Pos selected for the R1 profile

B01 – Open

B02 = 0 Vel/Pos selected for the R2 profile
= 1 Press/Pos selected for R2 profile

B03 – Open

B04 = 0 Vel/Pos selected for the R3 profile
= 1 Press/Pos selected for the R3 profile
B05 – Open

B06 = 0 Vel/Pos selected for the R4 profile
= 1 Press/Pos selected for R4 profile

B07 – Open

R1/R2 Logical Bridge Selection

B08 = 0 Start R2 profile at end of R1 profile
= 1 Stop and Set–output at end of R1 profile

The QH module checks the state of this bit at completion of the R1 profile to determine what further action to take:

If this “pause” bit is SET, the QH module sets its outputs to R1C33 – R1C36.

If this “pause” bit is RESET and RP20 > 00000, the QH module immediately begins the R2 profile.

If this “pause” bit is RESET and RP20 = 00000, the QH module reacts as if it just completed the R2 profile, and continues operation based upon the state of RP03–B09.

R2/R3 Logical Bridge Selection

B09 = 0 Start the R3 profile at end of R2 profile
= 1 Stop and Set–output at end of R2 profile

The QH module checks the state of this bit at completion of the R2 profile to determine what further action to take:

If this “pause” bit is SET, the QH module sets its outputs to R2C33 – R2C36.

If this “pause” bit is RESET and RP29 > 00000, the QH module immediately begins the R3 profile.

RP (continued)

If this "pause" bit is RESET and RP29 = 00000, the QH module reacts as if it had just completed the R3 profile, and continues operation based upon the state of RP03–B10.

R3/R4 Logical Bridge Selection

B10 = 0 Start R4 profile at end of R3 profile
= 1 Stop and Set–output at end of R3 profile

The QH module checks the state of this bit at completion of the R3 profile to determine what further action to take:

If this "pause" bit is SET, the QH module sets its outputs to R3C33 – R3C36.

If this "pause" bit is RESET, the QH module immediately begins the R4 profile.

Selection of Retract Protection Zone Overrun

B11 = 0 Start R4 profile on overrun of retract protection zone.
= 1 Stop and zero outputs on overrun of retract protection zone.

If the axis position equals or exceeds RP61 while the QH module is executing any of the first three axis-retract profiles (R1, R2, or R3), the QH module immediately terminates the ongoing axis-retract profile and checks the state of this bit.

If RESET, the QH module immediately begins the R4 profile.

If SET, the QH module sets its outputs to zero.

B12–B13 – Open

Velocity Units Selection

B14 = 0 Velocity parameters in "Percent Velocity"
= 1 Velocity parameters in Inches(mm)/Second

If RESET, the QH module returns all segment velocity actuals (and assumes all velocity setpoints) in "percent velocity" where R1C46, R2C46, R3C46, and R4C46 represent 100% velocity.

If SET, the QH module returns all velocity actuals (and assume all velocity setpoints) in inches(mm)/second.

B15 – Open

RP04 – Configuration Selections

Open/Closed Loop Selection

B00 = 0 Vel/Pos R1 profile in closed loop
= 1 Vel/Pos R1 profile in open loop

B01 = 0 Press/Pos R1 profile in closed loop
= 1 Press/Pos R1 profile in open Loop

B02 = 0 Vel/Pos R2 profile in closed loop
= 1 Vel/Pos R2 profile in open loop

RP (continued)

B03 = 0 Press/Pos R2 profile in closed loop
= 1 Press/Pos R2 profile in open loop

B04 = 0 Vel/Pos R3 profile in closed loop
= 1 Vel/Pos R3 profile in open loop

B05 = 0 Press/Pos R3 profile in closed loop
= 1 Press/Pos R3 profile in open loop

B06 = 0 Vel/Pos R4 profile in closed loop
= 1 Vel/Pos R4 profile in open loop

B07 = 0 Press/Pos R4 profile in closed loop
= 1 Press/Pos R4 profile in open loop
B08 – B15 – Reserved for module. Do not use.

RP05 – RP08 – Open

R1 PROFILE SETPOINTS

RP09 – Segment 1 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the R1 profile until axis position reaches the smaller of non–zero RP11 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP10 – Segment 1 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the R1 profile until axis position reaches the smaller of non–zero RP11 or RP61.

RP11 – End-of Segment 1 Position Setpoint [14]

RP12 – Segment 2 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP11 until the position reaches the smaller of non–zero RP14 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP13 – Segment 2 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position RP11 until axis position reaches the smaller of non–zero RP14 or RP61.

RP14 – End-of Segment 2 Position Setpoint [14]

RP15 – Segment 3 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP14 until axis position reaches the smaller of non–zero RP17 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP (continued)

RP16 – Segment 3 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position RP14 until axis position reaches the smaller of non–zero RP17 or RP61.

RP17 – End-of Segment 3 Position Setpoint [14]

R2 PROFILE SETPOINTS

RP18 – Segment 4 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the R2 profile until axis position reaches the smaller of non–zero RP20 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP19 – Segment 4 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the R2 profile until axis position reaches the smaller of non–zero RP20 or RP61.

RP20 – End-of Segment 4 Position Setpoint [14]

RP21 – Segment 5 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP20 until axis position reaches the smaller of non–zero RP23 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP22 – Segment 5 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position RP20 until axis position reaches the smaller of non–zero RP23 or RP61.

RP23 – End-of Segment 5 Position Setpoint [14]

RP24 – Segment 6 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP23 until axis position reaches the smaller of non–zero RP26 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP25 – Segment 6 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis open pressure to this setpoint from the axis position RP23 until axis position reaches the smaller of non–zero RP26 or RP61.

RP26 – End-of Segment 6 Position Setpoint [14]

R3 PROFILE SETPOINTS

RP27 – Segment 7 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the R3 profile until axis position reaches the smaller of non–zero RP29 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP (continued)

RP28 – Segment 7 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the R3 profile until axis position reaches the smaller of non–zero RP29 or RP61.

RP29 – End-of Segment 7 Position Setpoint [14]

RP30 – Segment 8 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP29 until axis position reaches the smaller of non–zero RP32 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP31 – Segment 8 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position RP29 until axis position reaches the smaller of non–zero RP32 or RP61.

RP32 – End-of Segment 8 Position Setpoint [14]

RP33 – Segment 9 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP32 until axis position reaches the smaller of non–zero RP35 or RP61. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP34 – Segment 9 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position RP32 until axis position reaches the smaller of non–zero RP35 or RP61.

RP35 – End-of Segment 9 Position Setpoint [14]

R4 PROFILE SETPOINTS

RP36 – Segment 10 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint after starting the R4 profile until axis position reaches the smaller of non–zero RP38 or RP62. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP37 – Segment 10 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint after starting the R4 profile until axis position reaches the smaller of non–zero RP38 or RP62.

RP38 – End-of Segment 10 Position Setpoint [14]

RP39 – Segment 11 Velocity Setpoint [07]or[08]

If you select Vel/Pos profile execution, the QH module controls axis speed to this setpoint from axis position RP38 until axis position reaches RP62. If RP03–B14 is RESET, the QH module reads this parameter in percent velocity. If RP03–B14 is SET, reads it in inches(mm)/second.

RP40 – Segment 11 Pressure Setpoint [02]

If you select Press/Pos profile execution, the QH module controls axis pressure to this setpoint from axis position RP38 until axis position reaches RP62.

RP41 – RP60 – Open

CRITICAL PROCESS SETPOINTS

RP61 – Start Protection Zone Position Setpoint [14]

The QH module uses this axis position as protection against running an axis-retract profile (R1, R2, or R3) into the retract protection zone. If this position is reached while the QH module is executing any of the first three axis-retract profiles, the QH module immediately terminates the ongoing profile and checks the state of RP03–B11.

If this "overrun" bit is RESET, the QH module immediately begins the R4 profile.

If this "overrun" bit is SET, the QH module sets its outputs to zero.

The QH module sets master status bit SYS03–B06 when axis position equals or exceeds this entry, and sets alarm status bit SYS07–B07 if it reaches the R4 profile while executing one of the first three axis-retract profiles (R1, R2, or R3).

RP62 – Fully Retracted Position Setpoint [14]

THIS ENTRY IS THE FULLY RETRACTED POSITION

The QH module uses this axis position as the end of R4 profile position setpoint. If this position is reached while the QH module is executing the R4 profile, the QH module immediately terminates the R4 profile and sets outputs to values R4C33–R4C36.

The QH module sets master status bit SYS03–B07 when axis position equals or exceeds this entry.

RP63 – Retract-dwell Timer Preset [21]

When the QH module starts its internal retract-dwell timer at completion of the R4 profile, it:

1) sets master status bit SYS03–B09
2) reports the accumulated value of the timer in SYS59

When the timer accumulated value in SYS59 equals this entry, the QH module:

1) resets master status bit SYS03–B09
2) stops accumulating time in SYS59

If it receives a F-to-T transition of any new "action execution" command, the QH module:

1) resets master status bit SYS03-B09
2) resets SYS59 to zero

RP64 – Open

DYNAMIC COMMAND BLOCK (DYC)

THE QH MODULE WILL NOT ACCEPT OR PROCESS THIS BLOCK UNLESS IT HAS A VALID MCC ON-BOARD.

BIT–MAPPED CONTROL WORDS

DYC01 – Block ID and Commands
low byte 00011001

Action Execution Commands

Bits DYC01–B08 thru –B15, DYC02–B00 thru B03, and DYC02–B10 thru B13 are the 16 "action execution" commands to control the QH module. Because the QH module cannot respond to more than one "action execution" command at a time.

THE QH MODULE CEASES ALL "ACTION EXECUTION" AND SET ITS OUTPUTS TO ZERO WHEN IT DECODES A VALID DYNAMIC COMMAND BLOCK WITH MORE THAN ONE OF THESE BITS SET.

The QH module flags this invalid request by latching alarm status bit SYS14–B00, and unlatches SYS14–B00 when it decodes a valid Dynamic Command Block with one or none of the "action execution" bits SET.

Set–output Command

B08 = 0 Normal
= 1 Execute Set–output
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to DYC09–12. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

Jog Commands

B09 = 0 Normal
= 1 Execute Alternate 1 Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC09–12. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

B10 = 0 Normal
= 1 Execute Alternate 2 Extend Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC17–20. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

B11 = 0 Normal
= 1 Execute Alternate 2 Retract Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC25–28. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

B12 = 0 Normal
= 1 Execute Axis Extend Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC33–36. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

DYC (continued)

B13 = 0 Normal
= 1 Execute Axis Retract Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC41–44. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

B14 = 0 Normal
= 1 Execute Alternate 3 Extend Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC49–52. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

B15 = 0 Normal
= 1 Execute Alternate 3 Retract Jog
When the QH module decodes a valid DYC having this bit SET, the QH module sets its outputs to JGC57–60. The outputs remain at these values as long as this bit is SET, and return to zero when this bit RESET.

DYC02 – Action Execution Commands

Bits DYC01–B08 thru B15, DYC02–B00 thru B03, and DYC02–B10 thru B13 are the 16 "action execution" commands to control the QH module. Because the QH module cannot respond to more than one "action execution" command at a time.

THE QH MODULE CEASES ALL "ACTION EXECUTION" AND SET ITS OUTPUTS TO ZERO WHEN IT DECODES A VALID DYC BLOCK WITH MORE THAN ONE OF THESE BITS SET.

The QH module flags this invalid request by latching alarm status bit SYS14–B00, and unlatches SYS14–B00 when it decodes a valid Dynamic Command Block having one or none of the "action execution" bits SET.

Profile Execution Commands for E1, E2, E3, and E4 Profiles

Bits DYC02–B00, –B01, –B02, –B03 are the four "action execution" commands available to initiate all profiled axis-extend movements. The four axis-extend profiles may be logically linked as a single integrated machine movement if all three of the Logical Bridge Bits are RESET. The Logical Bridge Bits are as follows:

EP03–B08 – Link the E1 profile to the E2 profile
EP03–B09 – Link the E2 profile to the E3 profile
EP03–B10 – Link the E3 profile to the E4 profile

IF ALL THREE OF THESE BITS ARE RESET, TRANSFER ONLY DYC02–B00 TO THE QH MODULE TO EXECUTE THE ENTIRE AXIS-EXTEND PORTION OF AN AUTOMATIC MACHINE CYCLE.

B00 = 0 Normal
= 1 Execute the E1 Profile
A false-to-true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in the order listed:

DYC (continued)

A) Nothing if any of the following bits are SET.
   1) SYS07–B02
   2) SYS07–B03

B) Latch SYS13–B01 if either of the following are true:
   1) EP03–B08 is SET and SYS15–B02 is RESET
   2) SYS15–B06 is RESET

C) Terminate action in progress and start the E1 profile if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is not zero
   3) axis position exceeds a non–zero entry in EP11, EP14, or EP17

D) Terminate action in progress and set outputs to E1C33–36 if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is zero; or is not zero when axis position is less than all non–zero entries in EP11, EP14, and EP17
   3) EP03–B08 is SET

E) Terminate action in progress and start the E2 profile if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is zero; or is not zero when axis position is less than all non–zero entries in EP11, EP14, and EP17
   3) EP03–B08 is RESET
   4) EP20 is not zero
   5) axis position exceeds a non–zero entry in EP20, EP23, or EP26

F) Terminate action in progress and set outputs to E2C33–36 if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is zero; or is not zero when axis position is less than all non–zero entries in EP11, EP14, and EP17
   3) EP03–B08 is RESET
   4) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
   5) EP03–B09 is SET

G) Terminate action in progress and start the E3 profile if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is zero; or is not zero when axis position is less than all non–zero entries in EP11, EP14, and EP17
   3) EP03–B08 is RESET
   4) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
   5) EP03–B09 is RESET
   6) EP29 is not zero
   7) axis position exceeds a non–zero entry in EP29, EP32, or EP35

H) Terminate action in progress and set outputs to E3C33–36 if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is zero; or is not zero when axis position is less than all non–zero entries in EP11, EP14, and EP17

DYC (continued)

   3) EP03–B08 is RESET
   4) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
   5) EP03–B09 is RESET
   6) EP29 is zero; or is not zero when axis position is less than all non–zero entries in EP29, EP32, and EP35
   7) EP03–B10 is SET

I) Terminate action in progress and start the E4 profile if all of the following are true:
   1) axis position exceeds EP61
   2) EP11 is zero; or is not zero when axis position is less than all non–zero entries in EP11, EP14, and EP17
   3) EP03–B08 is RESET
   4) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
   5) EP03–B09 is RESET
   6) EP29 is zero; or is not zero when axis position is less than all non–zero entries in EP29, EP32, and EP35
   7) EP03–B10 is RESET

   This also occurs if axis position exceeds EP62 but not exceeds EP61.

J) Terminate action in progress and set outputs to E4C33–36 if axis position equals or is less than EP62.

B01 = 0 Normal
= 1 Execute E2 Profile

A false–to–true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in the order listed.

A) Nothing if any of the following bits are SET.
   1) SYS07–B02
   2) SYS07–B03

B) Latch SYS13–B02 if either of the following are true:
   1) EP03–B09 is SET and SYS15–B03 is RESET
   2) SYS15–B06 is RESET.

C) Terminate action in progress and start the E2 profile if all of the following are true:
   1) axis position exceeds EP61
   2) EP20 is not zero
   3) axis position exceeds a non–zero entry in EP20, EP23, or EP26

D) Terminate action in progress and set outputs to E2C33–36 if all of the following are true:
   1) axis position exceeds EP61
   2) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
   3) EP03–B09 is SET

DYC (continued)

E) Terminate action in progress and start the E3 profile if all of the following are true:
  1) axis position exceeds EP61
  2) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
  3) EP03–B09 is RESET
  4) EP29 is not zero
  5) axis position exceeds a non–zero entry in EP29, EP32, or EP35

F) Terminate action in progress and set outputs to E3C33–36 if all of the following are true:
  1) axis position exceeds EP61
  2) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
  3) EP03–B09 is RESET
  4) EP29 is zero; or is not zero when axis position is less than all non–zero entries in EP29, EP32, and EP35
  5) EP03–B10 is SET

G) Terminate action in progress and start the E4 profile if all of the following are true:
  1) axis position exceeds EP61
  2) EP20 is zero; or is not zero when axis position is less than all non–zero entries in EP20, EP23, and EP26
  3) EP03–B09 is RESET
  4) EP29 is zero; or is not zero when axis position is less than all non–zero entries in EP29, EP32, and EP35
  5) EP03–B10 is RESET

  This also occurs if axis position exceeds EP62 but not exceeds EP61.

H) Terminate action in progress and set outputs to E4C33–36 if axis position equals or is less than EP62.

B02 = 0 Normal
= 1 Execute E3 Profile

A false–to–true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in order listed.

A) Nothing if any of the following bits are SET.
  1) SYS07–B02
  2) SYS07–B03

B) Latch SYS13–B03 if either of the following are true:
  1) EP03–B10 is SET and SYS15–B04 is RESET
  2) SYS15–B06 is RESET.

C) Terminate any action in progress and start the E3 profile if all of the following are true:
  1) axis position exceeds EP61
  2) EP29 is not zero
  3) axis position exceeds a non–zero entry in EP29, EP32, or EP35

DYC (continued)

D) Terminate any action in progress and set outputs to E3C33–36 if all the following are true:
  1) axis position exceeds EP61
  2) EP29 is zero; or is not zero when axis position is less than all non–zero entries in EP29, EP32, and EP35
  3) EP03–B10 is SET

E) Terminate any action in progress and start the E4 profile if all of the following are true:
  1) axis position exceeds EP61
  2) EP29 is zero; or is not zero when axis position is less than all non–zero entries in EP29, EP32, and EP35
  3) EP03–B10 is RESET

  This also occurs if axis position exceeds EP62 but not exceeds EP61.

F) Terminate action in progress and set outputs to E4C33–36 if axis position equals or is less than EP62.

B03 = 0 Normal
= 1 Execute E4 Profile

A false–to–true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in the order listed.

A) Nothing if any of the following bits are SET.
  1) SYS07–B02
  2) SYS07–B03
B) Latch SYS13–B04 if SYS15–B06 is RESET.
C) Terminate action in progress and start the E4 profile if both of the following are true:
  1) EP38 is not zero
  2) axis position exceeds EP38

  This also occurs if axis position exceeds EP62 but not exceeds EP61.

D) Terminate action in progress and set outputs to E4C33–36 if axis position equals or is less than EP62.

B04-09 – Reserved for Module. Do Not Use.

Profile Execution Commands for R1, R2, R3, and R4 Profiles

Bits DYC02–B10 thru B13 are the four "action execution" commands available to initiate all profiled axis-retract movements. The four axis-retract profiles may be logically linked as a single integrated machine movement if all three of the following Logical Bridge Bits are RESET:
RP03–B08 – Link the R1 profile to the R2 profile
RP03–B09 – Link the R2 profile to the R3 profile
RP03–B10 – Link the R3 profile to the R4 profile

IF ALL THREE BITS ARE RESET, TRANSMIT ONLY DYC02–B10 TO THE QH MODULE TO FORCE THE ENTIRE AXIS-RETRACT OF AN AUTOMATIC MACHINE CYCLE.

B10 = 0 Normal
= 1 Execute R1 Profile

DYC (continued)

A false–to–true transition of this bit forces the QH module to do one of the following, attempted in the order listed.

- A) Nothing if any of the following bits are SET.
  - 1) SYS07–B02
  - 2) SYS07–B03
- B) Latch SYS13–B11 if either of the following are true:
  - 1) RP03–B08 is SET and SYS16–B00 is RESET
  - 2) SYS16–B04 is RESET
- C) Terminate action in progress and start the R1 profile if all of the following are true:
  - 1) axis position is less than RP61
  - 2) RP11 is not zero
  - 3) axis position less than a non–zero entry in RP11, RP14, or RP17
- D) Terminate action in progress and set outputs to R1C33–36 if all of the following are true:
  - 1) axis position is less than RP61
  - 2) RP11 is zero, or is not zero when axis position exceeds all non–zero entries in RP11, RP14, and RP17
  - 3) RP03–B08 is SET
- E) Terminate action in progress and start the R2 profile if all of the following are true:
  - 1) axis position is less than RP61
  - 2) RP11 is zero, or is not zero when axis position exceeds all non–zero entries in RP11, RP14, and RP17
  - 3) RP03–B08 is RESET
  - 4) RP20 is not zero
  - 5) axis position less than a non–zero entry in RP20, RP23, or RP26
- F) Terminate action in progress and set outputs to R2C33–36 if all of the following are true:
  - 1) axis position is less than RP61
  - 2) RP11 is zero, or is not zero when axis position exceeds all non–zero entries in RP11, RP14, and RP17
  - 3) RP03–B08 is RESET
  - 4) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
  - 5) RP03–B09 is SET
- G) Terminate action in progress and start the R3 profile if all of the following are true:
  - 1) axis position is less than RP61
  - 2) RP11 is zero, or is not zero when axis position exceeds all non–zero entries in RP11, RP14, and RP17
  - 3) RP03–B08 is RESET
  - 4) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
  - 5) RP03–B09 is RESET
  - 6) RP29 is not zero
  - 7) axis position less than a non–zero entry in RP29, RP32, or RP35

DYC (continued)

H) Terminate action in progress and set outputs to R3C33–36 if all of the following are true:
  1) axis position is less than RP61
  2) RP11 is zero, or is not zero when axis position exceeds all non–zero entries in RP11, RP14, and RP17
  3) RP03–B08 is RESET
  4) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
  5) RP03–B09 is RESET
  6) RP29 is zero, or is not zero when axis position exceeds all non–zero entries in RP29, RP32, and RP35
  7) RP03–B10 is SET

I) Terminate action in progress and start the R4 profile if all of these are true:
  1) axis position is less than RP61
  2) RP11 is zero, or is not zero when axis position exceeds all non–zero entries in RP11, RP14, and RP17
  3) RP03–B08 is RESET
  4) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
  5) RP03–B09 is RESET
  6) RP29 is zero, or is not zero when axis position exceeds all non–zero entries in RP29, RP32, and RP35
  7) RP03–B10 is RESET

  Also occurs if axis position is less than RP62 but not less than RP61.

J) Terminate action in progress and set outputs to R4C33–36 if axis position equals or exceeds RP62.

B11 = 0 Normal
= 1 Execute R2 Profile

A false–to–true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in the order listed.

A) Nothing if any of the following bits are SET.
  1) SYS07–B02
  2) SYS07–B03

B) Latch SYS13–B12 if either of the following are true:
  1) RP03–B09 is SET and SYS16–B01 is RESET
  2) SYS16–B04 is RESET

C) Terminate action in progress and start the R2 profile if all of these are true:
  1) axis position is less than RP61
  2) RP20 is not zero
  3) axis position less than a non–zero entry in RP20, RP23, or RP26

DYC (continued)

D) Terminate action in progress and set outputs to R2C33–36 if all of the following are true:
   1) axis position is less than RP61
   2) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
   3) RP03–B09 is SET

E) Terminate action in progress and start the R3 profile if all of the following are true:
   1) axis position is less than RP61
   2) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
   3) RP03–B09 is RESET
   4) RP29 is not zero
   5) axis position less than a non–zero entry in RP29, RP32, or RP35

F) Terminate action in progress and set outputs to R3C33–36 if all of the following are true:
   1) axis position is less than RP61
   2) RP20 is zero; or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
   3) RP03–B09 is RESET
   4) RP29 is zero, or is not zero when axis position exceeds all non–zero entries in RP29, RP32, and RP35
   5) RP03–B10 is SET

G) Terminate action in progress and start the R4 profile if all of these are true:
   1) axis position is less than RP61
   2) RP20 is zero, or is not zero when axis position exceeds all non–zero entries in RP20, RP23, and RP26
   3) RP03–B09 is RESET
   4) RP29 is zero, or is not zero when axis position exceeds all non–zero entries in RP29, RP32, and RP35
   5) RP03–B10 is RESET

   Also occurs if axis position is less than RP62 but not less than RP61.

H) Terminate action in progress and set outputs to R4C33–36 if axis position equals or exceeds RP62.

B12 = 0 Normal
= 1 Execute R3 Profile

A false–to–true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in the order listed.

A) Nothing if any of the following bits are SET.
   1) SYS07–B02
   2) SYS07–B03

B) Latch SYS13–B13 if either of the following are true:
   1) RP03–B10 is SET and SYS16–B02 is RESET
   2) SYS16–B04 is RESET

DYC (continued)

C) Terminate action in progress and start the R3 profile if all of the following are true:
   1) axis position is less than RP61
   2) RP29 is not zero
   3) axis position less than a non–zero entry in RP29, RP32, or RP35

D) Terminate action in progress and set outputs to R3C33–36 if all of the following are true:
   1) axis position is less than RP61
   2) RP29 is zero, or is not zero when axis position exceeds all non–zero entries in RP29, RP32, and RP35
   3) RP03–B10 is SET

E) Terminate action in progress and start the R4 profile if all of these are true:
   1) axis position is less than RP61
   2) RP29 is zero, or is not zero when axis position exceeds all non–zero entries in RP29, RP32, and RP35
   3) RP03–B10 is RESET

   Also occurs if axis position is less than RP62 but not less than RP61.

F) Terminate action in progress and set outputs to R4C33–36 if axis position equals or exceeds RP62.

B13 = 0 Normal
= 1 Execute R4 Profile

A false–to–true transition of this bit forces the QH module to do <u>one</u> of the following, attempted in the order listed.

A) Nothing if any of the following bits are SET.
   1) SYS07–B00
   2) SYS07–B01
   3) SYS07–B02
   4) SYS07–B03
   5) SYS07–B04
   6) SYS07–B05

B) Latch SYS13–B14 if SYS16–B04 is RESET.

C) Terminate action in progress and start the R4 profile if all of these are true:
   1) RP38 is not zero
   2) axis position is less than RP38

   Also occurs if axis position is less than RP62 but not less than RP61.

D) Terminate action in progress and set outputs to R4C33–36 if axis position equals or exceeds RP62.

B14 – Reserved for Module. Do Not Use.

DYC (continued)

Stop

B15 = 0 Outputs Enabled
= 1 Outputs Disabled

When the QH module decodes a valid DYC having this bit SET, the QH module halts any ongoing profile or jog movement and set its outputs to zero. The QH module will not respond to any new jog or profile execution commands as long as this bit remains SET. This bit may be latched by the end user to serve as a module E– Stop command, or may be momentarily asserted to force the QH module to terminate an ongoing profile.

DYC03 – Commands

Timer Reset Commands

B00 = 0 Normal
= 1 Reset Tonnage Watchdog Timer

A false–to–true transition of this bit forces the QH module to zero the accumulated value of the Tonnage Watchdog Timer in SYS57.

B01 – Reserved for Module. Do Not Use.
B02–B07 – Open

Power–up Reset

B08 = 0 Normal
= 1 Reset Power–up Bit

A false–to–true transition of this bit forces QH module to unlatch SYS01–B08.

Alarm Reset

B09 = 0 Normal
= 1 Reset Latched Alarms

A false–to–true transition of this bit forces the QH module to unlatch all bits in SYS09, SYS10, SYS11, and SYS12.

Profile Status Bits Reset

B10 = 0 Normal
= 1 Reset Profile Status Bits

A false–to–true transition of this bit forces the QH module to unlatch the eight "profile complete" status bits, SYS02–B00 thru B03 and SYS02–B10 thru B13.

B11–B14 – Open
B15 Reserved for module. Do not use.

DYC04 – Commands

Status Request Commands

Bits DYC04–B00 and B04 are the two command bits available to request the Status Blocks that the QH module returns with the next BTR to the PLC-5 processor.

The QH module defaults to returning System Status Block (SYS) if:

1) neither of these bits are set
2) the last BTW received at the module was not the Dynamic Command Block (DYC).

DYC (continued)

If both of these bits are set, the QH module prioritizes BTR service by responding to the lowest-numbered bit.

B00 = 0 Normal
= 1 Return ES with next BTR

B01 – B03 Reserved for module. Do not use.

B04 = 0 Normal
= 1 Return RS with next BTR

B05 – B07 reserved for module. DO not use.

Commands to Clear Profile Status Blocks

B08 = 0 Normal
= 1 Clear ES
A false–to–true transition of this bit forces the QH module to clear (zero) all words in its ES buffer (except Master Status Words ES01 – ES04).

B09 – B11 Reserved for module. Do not use.

B12 = 0 Normal
= 1 Clear RS
A false–to–true transition of this bit forces the QH module to clear (zero) all words in its RS buffer (except Master Status Words RS01 – RS04).

B13–B15 – Open

DYC05 – Reserved for module. Do not use.
DYC06 – DYC08 – Open

DIRECT SET–OUTPUT VALUES

The QH module sets its outputs to the following values when responding to command bit DYC01–B08 = 1. The QH module uses ramp rates DYC17–20 and DYC25–28 when moving the outputs to these values after DYC01–B08 is SET, and will also use the ramps when one of DYC09–12 is changed while DYC01–B08 is SET.

DYC09 – Output #1 Direct Set–Output Value [19]
DYC10 – Output #2 Direct Set–Output Value [19]
DYC11 – Output #3 Direct Set–Output Value [19]
DYC12 – Output #4 Direct Set–Output Value [19]
DYC13 – DYC16 – Reserved for Module. Do Not Use.

DIRECT SET–OUTPUT RAMP RATES

The QH module uses the following ramp rates when moving its outputs to DYC09–12 upon monitoring a F–to–T transition of DYC01–B08. The QH module also uses these ramp rates when moving its outputs to any modified entry in DYC09–12 if DYC01–B08 is SET. THE QH MODULE INTERPRETS A ZERO RAMP RATE AS A STEP FUNCTION RAMP (RAMP DISABLE).

DYC17 – Output #1 Accel Ramp Rate for Direct Set–output Moves [20]
DYC18 – Output #2 Accel Ramp Rate for Direct Set–output Moves [20]
DYC19 – Output #3 Accel Ramp Rate for Direct Set–output Moves [20]
DYC20 – Output #4 Accel Ramp Rate for Direct Set–output Moves [20]
DYC21 – DYC24 – Reserved for Module. Do Not Use.

DYC (continued)

DYC25 – Output #1 Decel Ramp Rate for Direct Set–output Moves [20]
DYC26 – Output #2 Decel Ramp Rate for Direct Set–output Moves [20]
DYC27 – Output #3 Decel Ramp Rate for Direct Set–output Moves [20]
DYC28 – Output #4 Decel Ramp Rate for Direct Set–output Moves [20]
DYC29 – DYC32 – Reserved for Module. Do Not Use.
DYC33 – DYC60 – Open

DYC61 – Programming Error Return Request [29]

When the QH module has a valid MCC and DYC on–board, responding to any non–zero command block ID to the lower byte of this word by returning the identical command block ID in SYS61, and by returning the existing programming error code associated with the command block in SYS62.

If the QH module does not have a current programming error as associated with the requested command block, or if this entry is zero, the QH module reports values in SYS61 and SYS62 in the order that programming errors were received.

DYC62 – DYC64 – Open

SYSTEM STATUS BLOCK (SYS)

BIT–MAPPED STATUS WORDS

SYS01 – Block ID and Jog Status

Block ID Byte
B00–B07 00000001

Power–up Status
B08 = 0 QH Wants Complete Download
= 1 Valid MCC on Board

Jog Execution Status
B09 = 0 Normal
= 1 Executing Alternate 1 Jog

The QH module sets this bit when responding to command bit DYC01–B09 = 1 and sets its outputs to JGC09–12.

B10 = 0 Normal
= 1 Executing Alternate 2 Jog Extend

The QH module sets this bit when responding to command bit DYC01–B10 = 1 and sets its outputs to JGC17–20.

B11 = 0 Normal
= 1 Executing Alternate 2 Jog Retract

The QH module sets this bit when responding to command bit DYC01–B11 = 1 and sets its outputs to JGC25–28.

SYS (continued)

B12 = 0 Normal
= 1 Executing Axis Jog Extend

The QH module sets this bit when responding to command bit DYC01–B12 = 1 and sets its outputs to JGC33–36.

B13 = 0 Normal
= 1 Executing Axis Jog Retract

The QH module sets this bit when responding to command bit DYC01–B13 = 1 and sets its outputs to JGC41–44.

B14 = 0 Normal
= 1 Executing Alternate 3 Jog Extend

The QH module sets this bit when responding to command bit DYC01–B14 = 1 and sets its outputs to JGC49–52.

B15 = 0 Normal
= 1 Executing Alternate 3 Jog Retract

The QH module sets this bit when responding to command bit DYC01–B15 = 1 and sets its outputs to JGC57–60.

SYS02 – Profile Execution Status

B00 = 0 Normal
= 1 E1 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B01 = 0 Normal
= 1 E2 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B02 = 0 Normal
= 1 E3 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B03 = 0 Normal
= 1 E4 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or

SYS (continued)

2) it receives a new “action execution” command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B04 – B09 Reserved for module. Do not use.

B10 = 0 Normal
= 1 R1 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new “action execution” command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B11 = 0 Normal
= 1 R2 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new “action execution” command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B12 = 0 Normal
= 1 R3 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new “action execution” command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B13 = 0 Normal
= 1 R4 Profile Complete

The QH module sets this bit when:
1) it completes the profile, or
2) it receives a new “action execution” command that terminates the profile.

The QH module resets this bit when:
1) it starts the profile, or
2) it receives a valid DYC with DYC03–B10 SET.

B14 Reserved for Module. Do Not Use.

SYS (continued)

Module Busy Status

B15 = 0 Normal
= 1 No Action in Progress

The QH module resets this bit when it is performing one of the following:

1) executing a profile
2) holding its outputs at any end-of-phase values
3) executing any jog movement

SYS03 – Miscellaneous Status

B00 = 0 Normal
= 1 Axis in Extend Protection Zone

The QH module sets this bit when axis position is equal to or less than EP61 (start of the extend protection zone.

B01 = 0 Normal
= 1 Fully Extended Position

The QH module sets this bit when axis position is equal to or less than EP62 (fully extended position).

B02 = 0 Normal
= 1 Tonnage Complete

If the bit pattern in MCC03 indicates that the QH module is configured for a connected axis pressure transducer, the QH module:

Latches this bit when both of the following are true:

1) axis pressure equals or exceeds the Tonnage Pressure (EP63).
2) axis position equals or is less than the Safe position (EP62).

Unlatches this bit when either of the following are true:

1) axis pressure is less than the Tonnage Pressure (EP63).
2) axis position exceeds the Safe position (EP62).

B03 – B05 Reserved for Module. Do Not Use.

B06 = 0 Normal
= 1 Axis in Retract Protection Zone

The QH module sets this bit when axis position equals or exceeds RP61 (start of the retract protection zone).

B07 = 0 Normal
= 1 Fully Retracted Position

The QH module sets this bit when axis position equals or exceeds RP62 (fully retracted position).

B08 Reserved for Module. Do Not Use.

SYS (continued)

B09 = 0 Normal
= 1 Dwell Timer Timing

The QH module sets this bit when the internal Dwell Timer is timing and the accumulated Dwell Time (SYS59) is less than its preset (RP63).

B10 Reserved for Module. Do Not Use.

B11 = 0 Normal
= 1 Cycle Complete

The QH module:

1) Latches this bit on each F-toT transition of SYS02–B13 if RP63 is zero.
2) Latches this bit on each T-to-F transition of SYS03-B09.
3) Unlatches this bit upon receipt of any new "action execution" command.

B12 – B15 Reserved for Module. Do Not Use.

SYS04 – Watchdog Time–Out Status

B00 = 0 Normal
= 1 E1 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (E1C08).

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to E1C33–36 at completion of this profile.

B01 = 0 Normal
= 1 E2 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (E2C08).

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to E2C33–36 at completion of this profile.

B02 = 0 Normal
= 1 E3 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (E3C08).

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to E3C33–36 at completion of this profile.

SYS (continued)

B03 = 0 Normal
= 1 E4 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (E4C08).

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to E4C33–36 at completion of this profile.

B04–B06 – Open
B07–B09 – Reserved for Module. Do Not Use.

B10 = 0 Normal
= 1 R1 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (R1C08).

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to R1C33–36 at completion of this profile.

B11 = 0 Normal
= 1 R2 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (R2C08).

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to R2C33–36 at completion of this profile.

B12 = 0 Normal
= 1 R3 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (R3C08).

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs toR3C33–36 at completion of this profile.

B13 = 0 Normal
= 1 R4 Profile Watchdog Time–Out

The QH module sets this bit when the time required for the profile equals or exceeds the Watchdog Timer preset (R4C08).

SYS (continued)

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile

The QH module does not leave this bit set when holding its outputs to R4C33–36 at completion of this profile.

B14 Reserved for Module. Do Not Use.

B15 = 0 Normal
= 1 Tonnage Watchdog Time–Out

The QH module sets this bit when it has completed the E4 profile and the time required for tonnage build–up equals or exceeds the Watchdog Timer preset (E4C07).

The QH module resets this bit when:

1) it sets SYS03–B02, or
2) a new "execution" bit forces termination of tonnage build–up

SYS05 – High-pressure Alarm Status (Real Time)

The QH module sets alarm bits on a real–time basis. THESE BITS ARE NOT LATCHED. You can inhibit each bit by setting its associated alarm setpoint to zero.

B00 – Reserved for Module. Do Not Use.

B01 = 0 Normal
= 1 Axis High Pressure

QH module sets this bit when real–time axis pressure equals or exceeds MCC35.

B02–B04 Reserved for Module. Do Not Use.
B05–B07 – Open
B08–B09 Reserved for Module. Do Not Use.

B10 = 0 Normal
= 1 Axis High Jog Pressure

The QH module sets this bit when responding to command DYC01–B12 = 1 or DYC01–B13 = 1 and real–time axis pressure equals or exceeds JGC07.

B11 Reserved for Module. Do Not Use.

B12 = 0 Normal
= 1 E1 Profile High Axis Pressure

The QH module sets this bit when real–time axis pressure equals or exceeds E1C57.

B13 = 0 Normal
= 1 E2 Profile High Axis Pressure

The QH module sets this bit when real–time axis pressure equals or exceeds E2C57.

B14 = 0 Normal
= 1 E3 Profile High Axis Pressure

The QH module sets this bit when real–time axis pressure equals or exceeds E3C57.

SYS (continued)

B15 = 0 Normal
= 1 E4 Profile High Axis Pressure
The QH module sets this bit when real–time axis pressure equals or exceeds E4C57.

SYS06 – High-pressure Alarm Status (Real Time)

The QH module sets alarm bits on a real–time basis. THESE BITS ARE NOT LATCHED. You can inhibit each bit by setting its associated alarm setpoint to zero.

B00–B08 Reserved for module. Do not use.

B09 = 0 Normal
= 1 R1 Profile High Axis Pressure
The QH module sets this bit when real–time axis pressure equals or exceeds R1C57.

B10 = 0 Normal
= 1 R2 Profile High Axis Pressure
The QH module sets this bit when real–time axis pressure equals or exceeds R2C57.

B11 = 0 Normal
= 1 R3 Profile High Axis Pressure
The QH module sets this bit when real–time axis pressure equals or exceeds R3C57.

B12 = 0 Normal
= 1 R4 Profile High Axis Pressure
The QH module sets this bit when real–time axis pressure equals or exceeds R4C57.

B13 Reserved for Module. Do Not Use.

B14 – B15 – Open

SYS07 – Overtravel Alarm Status (Real Time)

The QH module sets alarm bits in real time. THESE BITS ARE NOT LATCHED. You can inhibit each bit by setting its associated alarm setpoint to zero.

B00–B01 Reserved for Module. Do Not Use.

B02 = 0 Normal
= 1 Axis Overtravel on Extend
The QH module sets this bit when real–time axis position is less than or equal to MCC27. The QH module resets this bit when real–time axis position equals or exceeds the position defined by MCC27 + MCC29.

WHEN SET, THE QH MODULE IGNORES ANY COMMAND IN DYC02.

B03 = 0 Normal
= 1 Axis Overtravel on Retract
The QH module sets this bit when real–time axis position equals or exceeds MCC28. The QH module resets this bit when real–time axis position is less than or equal to the position defined by MCC28 – MCC29.

WHEN SET, THE QH MODULE IGNORES ANY COMMAND IN DYC02.

SYS (continued)

B04–B05 Reserved for Module. Do Not Use.

B06 = 0 Normal

= 1 Profile Overtravel into Extend Protection Zone

The QH module sets this bit during one of the first three axis-extend profiles when real–time axis position is less than or equal to EP61. The QH module resets this bit on the next false–to–true transition of an action execution bit in DYC01 or DYC02.

B07 = 0 Normal

= 1 Profile Overtravel into Retract Protection Zone

The QH module sets this bit during one of the first three Axis-retract profiles when real–time axis position equals or exceeds RP61. The QH module resets this bit on the next false–to–true transition of an action execution bit in DYC01 or DYC02.

B08–B15 – Reserved for Module. Do Not use.

SYS08 – Alarm Status for Loss of Input Sensor (Real Time).

The QH module sets alarm bits in real time. THESE BITS ARE NOT LATCHED.

B00–B01 Reserved for module. Do not use.

B02 = 0 Normal

= 1 Loss of Axis Position Sensor

The QH module sets this bit when it detects a loss of signal input from the transducer.

WHEN THIS BIT IS SET, THE QH MODULE E-STOPS ANY PROFILE IN PROGRESS AND IGNORES ANY ACTION EXECUTION COMMAND IN DYC02 .

B03 = 0 Normal

= 1 Loss of Axis Pressure Sensor

If the bit pattern in MCC03 indicates that the QH module is configured for a connected axis pressure transducer, the QH module sets this bit when it detects a loss of signal input from the transducer.

WHEN THIS BIT IS SET, THE QH MODULE E-STOPS ANY PROFILE IN PROGRESS AND IGNORES ANY ACTION EXECUTION COMMAND IN DYC02.

B04–B07 Reserved for module. Do not use.

B08–B15 Open

SYS09 – High-pressure Alarm Status (Latched)

The QH module latches alarm bits on each false–to–true transition of the corresponding real–time alarm bit in SYS05. The QH module unlatches all 16 bits when it receives a false– to–true transition of DYC03–B09. You can inhibit each bit by setting its associated alarm setpoint to zero.

SYS (continued)

When this bit is latched ON	QH module detected this alarm
B01	Axis High Pressure
B10	Axis High Jog Pressure
B12	E1 Profile High Pressure
B13	E2 Profile High Pressure
B14	E3 Profile High Pressure
B15	E4 Profile High Pressure
B00, B02, B03, B04	Reserved for Module. Do Not Use.
B05- B07	Open
B08, B09, B11	Reserved for Module. Do Not Use.

SYS10 – High-pressure Alarm Status (Latched)

The QH module latches alarm bits on each false–to–true transition of the corresponding real–time alarm bit in SYS06. The QH module unlatches all 16 bits when it receives a false–to–true transition of DYC03–B09. You can inhibit each bit by setting its associated alarm setpoint to zero.

When this bit is latched ON	QH module detected this alarm
B09	R1 Profile High Pressure
B10	R2 Profile High Pressure
B11	R3 Profile High Pressure
B12	R4 Profile High Pressure
B14–B15	Open
B00–B08, B13	Reserved for Module. Do Not Use.

SYS11 – Overtravel Alarm Status (Latched)

The QH module latches alarm bits on each false–to–true transition of the corresponding real–time alarm bit in SYS07. The QH module unlatches all 16 bits when it receives a false–to–true transition of DYC03–B09. You can inhibit each bit by setting its associated alarm setpoint to zero.

When this bit is latched ON	QH module detected this alarm
B02	Axis Overtravel on Extend
B03	Axis Overtravel on Retract
B06	Profile Overtravel into Extend Protection Zone
B07	Profile Overtravel into Retract Protection Zone
B00, B01, B04, B05, B08–B15	Reserved for Module. Do Not Use.

SYS12 – Alarm Status for Loss of Input Sensor (Latched)

The QH module latches alarm bits on each false–to–true transition of the corresponding real–time alarm bit in SYS08. The QH module unlatches all 16 bits when it receives a false–to–true transition of DYC03–B09.

SYS (continued)

When this bit is latched ON	**QH module detected this alarm**
B02	Loss of Axis Position Sensor
B03	Loss of Axis Pressure Sensor
B09-B15	Open
B00, B01, B04–B08	Reserved for Module. Do Not Use.

SYS13 – Action–execution Command Errors

B00 = 0 Normal
= 1 Jog Command Error

The QH module latches this bit when SYS15–B01 is RESET and one of the following is true:

1) DYC01–B09 is SET.
2) DYC01–B10 is SET.
3) DYC01–B11 is SET.
4) DYC01–B12 is SET.
5) DYC01–B13 is SET.
6) DYC01–B14 is SET.
7) DYC01–B15 is SET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET “action execution” bit other than the ones listed above.

B01 = 0 Normal
= 1 E1 Profile Command Error

The QH module latches this bit when all of the following are true:

1) DYC02–B00 is SET.
2) EP03–B08 is SET.
3) SYS15–B02 is RESET.

The QH module also latches this bit when both of the following are true:

1) DYC02–B00 is SET.
2) SYS15–B06 is RESET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET “action execution” bit other than DYC02–B00.

B02 = 0 Normal
= 1 E2 Profile Command Error

The QH module latches this bit when both of the following are true:

1) DYC02–B01 is SET.
2) SYS15–B06 is RESET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET “action execution” bit other than DYC02–B01.

B03 = 0 Normal
= 1 E3 Profile Command Error

The QH module latches this bit when both of the following are true:

1) DYC02–B02 is SET.
2) SYS15–B06 is RESET.

SYS (continued)

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET "action execution" bit other than DYC02–B02.

B04 = 0 Normal
= 1 E4 Profile Command Error

The QH module latches this bit when both of the following are true:
1) DYC02–B03 is SET.
2) SYS15–B06 is RESET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET "action execution" bit other than DYC02–B03.

B05–B10 Reserved for Module. Do Not Use.

B11 = 0 Normal
= 1 R1 Profile Command Error

The QH module latches this bit when all of the following are true:
1) DYC02–B10 is SET.
2) RP03–B08 is SET.
3) SYS16–B00 is RESET.

The QH module also latches this bit when both of the following are true:
1) DYC02–B10 is SET.
2) SYS16–B04 is RESET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET "action execution" bit other than DYC02–B10.

B12 = 0 Normal
= 1 R2 Profile Command Error

The QH module latches this bit when both of the following are true:
1) DYC02–B11 is SET.
2) SYS16–B04 is RESET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET "action execution" bit other than DYC02–B11.

B13 = 0 Normal
= 1 R3 Profile Command Error

The QH module latches this bit when both of the following are true:
1) DYC02–B12 is SET.
2) SYS16–B04 is RESET.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET "action execution" bit other than DYC02–B12.

B14 = 0 Normal
= 1 R4 Profile Command Error

The QH module latches this bit when both of the following are true:
1) DYC02–B13 is SET.
2) SYS16–B04 is RESET.

SYS (continued)

The QH module unlatches this bit when it decodes a valid Dynamic Command Block with any SET "action execution" bit other than DYC02–B13.

B15 Reserved for module. Do not use.

SYS14 – Miscellaneous

B00 = 0 Normal
= 1 Dual–Command Error

The QH module latches this bit when it decodes a valid Dynamic Command Block having more than one of the twenty–four "action execution" command bits SET. Bits DYC01–B08 thru B15, DYC02–B00 thru B03, and DYC02–B10 thru B13 are the 16 "action execution" commands available to the end user for control of the QH module.

The QH module unlatches this bit when it decodes a valid Dynamic Command Block having one or none of the "action execution" bits SET.

B01 – Open

Block Rejection Errors

The QH module discards and does not attempt to decode any command block associated with a profiled movement in progress.

B02 = 0 Normal
= 1 Axis-extend Command Block Rejected

The QH module latches this bit when it receives an E1, E2, E3, E4, or EP for decode and any one of SYS21–B00 – SYS21–B03 is SET.

The QH module unlatches this bit when it receives an E1, E2, E3, E4, or EP for decode and all of SYS21–B00 – SYS21–B03 are RESET.

B03–B05 Reserved for module. Do not use.

B06 = 0 Normal
= 1 Axis-retract Command Block Rejected

The QH module latches this bit when it receives an R1, R2, R3, R4, or RP for decode and any one of SYS21–B10 – SYS21–B13 is SET.

The QH module unlatches this bit when it receives an R1, R2, R3, R4, or RP for decode and all of SYS21–B10 – SYS21–B13 are RESET.

B07–B09 Reserved for Module. Do Not Use.
B10–B15 – Open

SYS15 – Status of On-board Command Blocks

The QH module latches bits individually when it successfully decodes the referenced command block and places new data into operational memory. The QH module does not latch any bit associated with an "unrecognizable" command block.

The QH module unlatches all bits in this word:
1) on power–up, or
2) it receives a new MCC for decode

SYS (continued)

When this bit is latched ON	This on-board block is valid	
B00	MCC	
B01	JGC	
B02	E1C	
B03	E2C	
B04	E3C	
B05	E4C	
B06	EP	The QH module also unlatches this bit when it successfully decodes a new E1C, E2C, E3C, or E4C
B07–B15	Reserved for Module. Do Not Use.	

SYS16 – Status of On-board Command Block

The QH module latches bits individually when it successfully decodes the referenced block and places new data into operational memory. The QH module does not latch any bit associated with an "unrecognizable" command block.

The QH module unlatches all bits in this word:
1) on power-up, or
2) when it receives a new MCC for decoding.

When this bit is latched ON	This on-board block is valid	
B00	R1C	
B01	R2C	
B02	R3C	
B03	R4C	
B04	RP	QH module also unlatches this bit when it successfully decodes a new R1C, R2C, R3C, or RP.
B08	DYC	
B05-B07, B09 and B10	Reserved for Module. Do Not Use.	
B11–B15	Open	

SYS17 – Status of Last Successful Decode

The QH module latches one of the bits in SYS17 and SYS18 (while unlatching all others) when it successfully decodes the referenced command block and places the new data into operational memory. The QH module does not latch any bit associated with an "unrecognizable" command block. Set no more than one bit at a time in SYS17 and SYS18.

When this bit is latched ON	Last successful decode was
B00	MCC
B01	JCC
B02	E1C
B03	E2C

SYS (continued)

B04	E3C
B05	E4C
B06	EP
B07–B15	Reserved for Module. Do Not Use.

SYS18 – Status of Last Successful Decode

The QH module latches one of the bits in SYS17 and SYS18 (while unlatching all others) when it successfully decodes the referenced command block and places the new data into operational memory. The QH module does not latch any bit associated with an "unrecognizable" command block. Set no more than one bit at a time in SYS17 and SYS18.

When this bit is latched ON	**Last successful decode was**
B00	R1
B01	R2
B02	R3
B03	R4
B04	RP
B05–B07	Reserved for Module. Do Not Use.
B08	DYC
B09–B10	Reserved for Module. Do Not Use.
B11–B15	Open

SYS19 – Programming–error Alarms

The QH module latches bits when it attempts to decode a newly received copy of the subject command block and is forced to discard the data due to the presence of a programming error in the newly received block. The QH module does not latch any bit associated with an "unrecognizable" command block. the QH module unlatches each bit when it successfully decodes the referenced block and places the new data into operational memory.

When this bit is latched ON	**QH module detected programming error in**
B00	MCC The QH module ceases all "action execution" and sets its outputs to zero when forced to set this bit. The QH module does not respond to any "action execution" commands as long as this bit remains SET.
B01	JGC
B02	E1C
B03	E2C
B04	E3C
B05	E4C
B06	EP
B07–B15	Reserved for Module. Do Not Use.

SYS (continued)

SYS20 – Programming–error Alarms

The QH module latches bits when it attempts to decode a newly received copy of the subject command block and is forced to discard the data due to the presence of a programming error in the newly received block. The QH module does not latch any bit associated with an "unrecognizable" command block. The QH module unlatches each bit when it successfully decodes the referenced block and places the new data into operational memory.

When this bit is latched ON	**QH module detected a programming error in**	
B00	R1C	
B01	R2C	
B02	R3C	
B03	R4C	
B04	RP	
B08	DYC	The QH module ceases all "action execution" and sets its outputs to zero when forced to set this bit. The QH module does not respond to any "action execution" commands as long as this bit remains SET.
B05-B07, B09–B10	Reserved for Module. Do Not Use.	
B11–B15	Open	

SYS21 – Status of Profile Execution

B00 = 0 Normal
= 1 E1 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to E1C33–36 at completion of the first axis close profile.

B01 = 0 Normal
= 1 E2 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:

1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to E2C33–36 at completion of the second axis close profile.

B02 = 0 Normal
= 1 E3 Profile in Progress

The QH module sets this bit when it starts the profile.

SYS (continued)

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to E3C33–36 at completion of the third axis close profile.

B03 = 0 Normal
= 1 E4 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to E4C33–36 at completion of the axis low pressure close profile.

B04–B09 Reserved for Module. Do Not Use.

B10 = 0 Normal
= 1 R1 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to R1C33–36 at completion of the first axis open profile.

B11 = 0 Normal
= 1 R2 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to R2C33–36 at completion of the second axis open profile.

B12 = 0 Normal
= 1 R3 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to R3C33–36 at completion of the third axis open profile.

SYS (continued)

B13 = 0 Normal
= 1 R4 Profile in Progress

The QH module sets this bit when it starts the profile.

The QH module resets this bit when:
1) it completes the profile, or
2) it receives a new "action execution" command that terminates the profile.

The QH module does not leave this bit set when holding outputs to R4C33–36 at completion of the axis open slow profile.

B14 Reserved for Module. Do Not Use.

B15 – Open

SYS22 – Status of End-of-Profile Set-Output Execution

B00 = 0 Normal
= 1 End-of–E1 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to E1C33–36 after completion the profile.

The QH module resets this bit when it receives any new action execution command bit.

B01 = 0 Normal
= 1 End-of-E2 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to E2C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

B02 = 0 Normal
= 1 End-of-E3 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to E3C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

B03 = 0 Normal
= 1 End-of-E4 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to E4C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

B04–B05 Open

B06–B09 Reserved for Module. Do Not Use

B10 = 0 Normal
= 1 End-of-R1 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to R1C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

SYS (continued)

B11 = 0 Normal
= 1 End-of-R2 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to R2C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

B12 = 0 Normal
= 1 End-of-R3 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to R3C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

B13 = 0 Normal
= 1 End-of-R4 Profile Set-Output in Progress

The QH module sets this bit when holding its outputs to R4C33–36 after completion of the profile.

The QH module resets this bit when it receives any new action execution command bit.

B14–B15 Reserved for Module. Do Not Use.

SYS23 – SYS24 – Open

INPUT LEVEL IN ENGINEERING UNITS

The QH module reports real–time input levels scaled to engineering units.

SYS25 – Input #1 [11] or [15]
SYS26 – Input #2 [01] or [03]
SYS27 – Input #3 [13] or [25]
SYS28 – Input #4 [02] or [04]
SYS29 – SYS32 – Reserved for Module. Do Not Use.

INPUT LEVEL, RAW SIGNAL

The QH module reports real–time signal levels at the input to each A/D input converter.

SYS33 – Input #1 [24]
SYS34 – Input #2 [24]
SYS35 – Input #3 [24]
SYS36 – Input #4 [24]
SYS37 – SYS40 – Reserved for Module. Do Not Use.

OUTPUT LEVEL IN PERCENTAGE

The QH module reports real–time output percentage it sends to each D/A output converter.

SYS41 – Output #1 [19]
SYS42 – Output #2 [19]
SYS43 – Output #3 [19]
SYS44 – Output #4 [19]

SYS (continued)

CYCLE MAXIMUM PRESSURES

SYS49 – Reserved for module. Do not use.

SYS50 – Maximum axis Pressure During Last Cycle [02]

If the bit pattern in MCC03 indicates that the QH module is configured for a connected axis pressure transducer, the QH module reports the highest axis pressure it detected since last F–to–T transition of DYC02–B00.

SYS51 – SYS52 – Reserved for Module. Do Not Use.

SYS53 – SYS56 – Open

PROCESS TIMES

SYS57 – Accumulated Tonnage Time [21]

If the bit pattern in MCC03 indicates that the QH module is configured for a connected axis pressure transducer, the QH module:

1) resets this word to zero and starts an internal tonnage watchdog timer when it completes the E4 profile and sets its outputs to E4C33 – E4C40
2) stops this timer when it sets master status bit SYS03–B02 and reports the accumulated value of the timer (maximum of 99.99 seconds) in this word
3) sets master status bit SYS04–B15 when this value equals or exceeds E4C07. A zero entry in E4C07 inhibits SYS04–B15.

The QH module also resets this word to zero when it detects a F-to-T transition of DYC03–B00.

SYS58 – Reserved for Module. Do Not Use.

SYS59 – Accumulated Retract Dwell Time [21]

The QH module:

1) reports the accumulated value of its internal dwell timer (maximum 99.99 seconds) in this word.
2) sets master status bit SYS03–B09 when the timer is timing.
3) stops the timer, resets SYS03–B09, and resets this word to zero upon receipt of any action execution command bit.

SYS60 – Accumulated Cycle Time [22]

The QH module:

1) resets this word to zero and starts an internal cycle timer when it detects a F–to–T transition of DYC02–B00
2) stops this timer when it sets master status bit SYS03–B11 and reports the accumulated value of the timer (maximum of 999.9 seconds) in this word

DIAGNOSTICS

SYS61 – Programming Error Block

The QH module reports in the lower byte of this word a bit pattern copy of the block id associated with the command block that contained the error referred to in SYS62. The priority order to be used by the QH module module when reporting programming error codes will be as follows:

1) any MCC programming error
2) any DYC programming error
3) any programming error associated with DYC61
4) any other current programming error

SYS (continued)

SYS62 – Programming Error Code

SYS63 – QH module Series/Revision

Upper byte – QH module reports its firmware series in ASCII.

Lower byte – QH module reports its firmware revision in ASCII.

NEW STATUS CONFIRMATION

SYS64 – New data counter

The QH module sets this counter to zero on power–up or above 9999, and increments this counter when it sends a new SYS to its internal TIC chip.

Use this value to indicate that a most recent BTR of SYS is "old data" (last SYS64 equals new SYS64) or "new data" (last SYS64 is less than new SYS64). You may also monitor the value to determine if "missing" any data (last SYS + 1 is less than new SYS64).

AXIS-EXTEND PROFILE STATUS BLOCK (ES)

BIT–MAPPED STATUS WORDS

ES01 – Block ID

low byte 00000010

high byte identical to SYS01

ES02 – See SYS02

ES03 – See SYS03

ES04 – See SYS04

ES05 – Open

ES06 – Open

ES07 – CV High Limit Alarms

The QH module latches each bit when executing the subject profile segment in closed loop, and drives its algorithm CV to maximum (100%) in an attempt to control the profile setpoint.
The QH module unlatches each bit when it completes execution of the subject profile segment in open loop, or in closed loop without driving its algorithm CV to maximum (100%).

When this bit is latched ON	Algorithm CV is maximum during
B00	Segment 1 (E1)
B01	Segment 2 (E1)
B02	Segment 3 (E1)
B03	Segment 4 (E2)
B04	Segment 5 (E2)
B05	Segment 6 (E2)
B06	Segment 7 (E3)
B07	Segment 8 (E3)
B08	Segment 9 (E3)
B09	Segment 1 (E4)
B10	Segment 2 (E4)
B11–B15	Open

ES (continued)

ES08 – CV Low Limit Alarms

The QH module latches each bit when executing the subject profile segment in closed loop, and drives its algorithm CV to minimum (0%) in an attempt to control the profile setpoint.

The QH module unlatches each bit when it completes execution of the subject profile segment in open loop, or in closed loop without driving its algorithm CV to minimum (0%).

When this bit is latched ON	Algorithm CV is minimum during
B00	Segment 1 (E1)
B01	Segment 2 (E1)
B02	Segment 3 (E1)
B03	Segment 4 (E2)
B04	Segment 5 (E2)
B05	Segment 6 (E2)
B06	Segment 7 (E3)
B07	Segment 8 (E3)
B08	Segment 9 (E3)
B09	Segment 1 (E4)
B10	Segment 2 (E4)
B11–B15	Open

E1 PROFILE ACTUALS

ES09 – Actual Segment 1 Velocity [07]or[08]

Average axis velocity during last Segment 1.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES10 – Actual Segment 1 Pressure [02]

Average axis pressure during last Segment 1.

ES11 – Actual Segment 1 Execution Time [21]

Time required for last Segment 1.

ES12 – Actual Segment 2 Velocity [07]or[08]

Average axis velocity during last Segment 2.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES13 – Actual Segment 2 Pressure [02]

Average axis pressure during last Segment 2.

ES14 – Actual Segment 2 Execution Time [21]

Time required for last Segment 2.

ES15 – Actual Segment 3 Velocity [07]or[08]

Average axis velocity during last Segment 3.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES (continued)

ES16 – Actual Segment 3 Pressure [02]
Average axis pressure during last Segment 3.

ES17 – Actual Segment 3 Execution Time [21]
Time required for last Segment 3.

E2 PROFILE ACTUALS

ES18 – Actual Segment 4 Velocity [07]or[08]
Average axis velocity during last Segment 4.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES19 – Actual Segment 4 Pressure [02]
Average axis pressure during last Segment 4.

ES20 – Actual Segment 4 Execution Time [21]
Time required for last Segment 4.

ES21 – Actual Segment 5 Velocity [07]or[08]
Average axis velocity during last Segment 5.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES22 – Actual Segment 5 Pressure [02]
Average axis pressure during last Segment 5.

ES23 – Actual Segment 5 Execution Time [21]
Time required for last Segment 5.

ES24 – Actual Segment 6 Velocity [07]or[08]
Average axis velocity during last Segment 6.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES25 – Actual Segment 6 Pressure [02]
Average axis pressure during last Segment 6.

ES26 – Actual Segment 6 Execution Time [21]
Time required for last Segment 6.

E3 PROFILE ACTUALS

ES27 – Actual Segment 7 Velocity [07]or[08]
Average axis velocity during last Segment 7.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES28 – Actual Segment 7 Pressure [02]
Average axis pressure during last Segment 7.

ES (continued)

ES29 – Actual Segment 7 Execution Time [21]
Time required for last Segment 7.

ES30 – Actual Segment 8 Velocity [07]or[08]
Average axis velocity during last Segment 8.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES31 – Actual Segment 8 Pressure [02]
Average axis pressure during last Segment 8.

ES32 – Actual Segment 8 Execution Time [21]
Time required for last Segment 8.

ES33 – Actual Segment 9 Velocity [07]or[08]
Average axis velocity during last Segment 9.
If EP03–B14 is RESET, the QH module reports this average in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES34 – Actual Segment 9 Pressure [02]
Average axis pressure during last Segment 9.

ES35 – Actual Segment 9 Execution Time [21]
Time required for last Segment 9.

E4 PROFILE ACTUALS

ES36 – Reserved

ES37 – Actual Segment 1 Pressure [02]
Average axis pressure during last Segment 1.

ES38 – Actual Segment 1 Execution Time [21]
Time required for last Segment 1.

ES39 – Reserved
ES40 – Actual Segment 2 Pressure [02]
Average axis pressure during last Segment 2.

ES41 – Actual Segment 2 Execution Time [21]
Time required for last Segment 2.

ES42 – Velocity at Start-of-E4 Profile [07]or[08]
Instantaneous axis velocity at start of last profile.
If EP03–B14 is RESET, the QH module reports this value in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES43 – Pressure at Start-of-E4 Profile [02]
Instantaneous axis pressure at start of last profile.

ES44 – Position at Start-of-E4 Profile [14]
Instantaneous axis position at start of last profile.

ES (continued)

ES45 – Velocity at End-of-E4 Profile [07]or[08]
Instantaneous axis velocity at completion of last profile.
If EP03–B14 is RESET, the QH module reports this value in percent velocity.
If EP03–B14 is SET, reports it in inches(mm)/second.

ES46 – Pressure at End-of-E4 Profile [02]
Instantaneous axis pressure at completion of last profile.

ES47 – Position at End-of-E4 Profile [14]
Instantaneous axis position at completion of last profile.

ES48 – ES52 – Open

EXTEND-PROFILE MAXIMUM PRESSURES

ES53 – Maximum Pressure During E1 Profile [02]
Maximum instantaneous axis pressure during last profile.

ES54 – Maximum Pressure During E2 Profile [02]
Maximum instantaneous axis pressure during last profile.

ES55 – Maximum Pressure During E3 Profile [02]
Maximum instantaneous axis pressure during last profile.

ES56 – Maximum Pressure During E4 Profile [02]
Maximum instantaneous axis pressure during last profile.

EXTEND-PROFILE EXECUTION TIMES

ES57 – E1 Profile Execution Time [21]
Total time required for last profile.

ES58 – E2 Profile Execution Time [21]
Total time required for last profile.

ES59 – E3 Profile Execution Time [21]
Total time required for last profile.

ES60 – E4 Profile Execution Time [21]
Total time required for last profile.

ES61 – ES64 – Open

AXIS-RETRACT PROFILE STATUS BLOCK (RS)

BIT–MAPPED STATUS WORDS

RS01 – Block ID

low byte 00000110

high byte identical to SYS01

RS02, 03, 04 – See SYS02, 03, 04

RS05, 06 – Open

RS07 – CV High Limit Alarms

The QH module latches each bit when executing the subject profile segment in closed loop, and drives its algorithm CV to maximum (100%) in an attempt to control the profile setpoint. The QH module unlatches each bit when it completes execution of the subject profile segment in open loop, or in closed loop without driving its algorithm CV to maximum (100%).

When this bit is latched ON	Algorithm CV is maximum during
B00	Segment 1 (R1)
B01	Segment 2 (R1)
B02	Segment 3 (R1)
B03	Segment 4 (R2)
B04	Segment 5 (R2)
B05	Segment 6 (R2)
B06	Segment 7 (R3)
B07	Segment 8 (R3)
B08	Segment 9 (R3)
B09	Segment 10 (R4)
B10	Segment 11 (R4)
B11–B15	Open

RS08 – CV Low Limit Alarms

The QH module latches each bit when executing the subject profile segment in closed loop, and drives its algorithm CV to minimum (0%) in an attempt to control the profile setpoint. The QH module unlatches each bit when it completes execution of the subject profile segment in open loop, or in closed loop without driving its algorithm CV to minimum (0%).

When this bit is latched ON	Algorithm CV is minimum during
B00	Segment 1 (R1)
B01	Segment 2 (R1)
B02	Segment 3 (R1)
B03	Segment 4 (R2)
B04	Segment 5 (R2)
B05	Segment 6 (R2)
B06	Segment 7 (R3)
B07	Segment 8 (R3)
B08	Segment 9 (R3)
B09	Segment 10 (R4)
B10	Segment 11 (R4)
B11–B15	Open

RS (continued)

R1 PROFILE ACTUALS

RS09 – Actual Segment 1 Velocity [07]or[08]

Average axis velocity during last Segment 1.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS10 – Actual Segment 1 Pressure [02]

Average axis pressure during last Segment 1.

RS11 – Actual Segment 1 Execution Time [21]

Time required for last Segment 1.

RS12 – Actual Segment 2 Velocity [07]or[08]

Average axis velocity during last Segment 2.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS13 – Actual Segment 2 Pressure [02]

Average axis pressure during last Segment 2.

RS14 – Actual Segment 2 Execution Time [21]

Time required for last Segment 2.

RS15 – Actual Segment 3 Velocity [07]or[08]

Average axis velocity during last Segment 3.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS16 – Actual Segment 3 Pressure [02]

Average axis pressure during last Segment 3.

RS17 – Actual Segment 3 Execution Time [21]

Time required for last Segment 3.

R2 PROFILE ACTUALS

RS18 – Actual Segment 4 Velocity [07]or[08]

Average axis velocity during last Segment 4.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS19 – Actual Segment 4 Pressure [02]

Average axis pressure during last Segment 4.

RS20 – Actual Segment 4 Execution Time [21]

Time required for last Segment 4.

RS21 – Actual Segment 5 Velocity [07]or[08]

Average axis velocity during last Segment 5.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS (continued)

RS22 – Actual Segment 5 Pressure [02]
Average axis pressure during last Segment 5.

RS23 – Actual Segment 5 Execution Time [21]
Time required for last Segment 5.

RS24 – Actual Segment 6 Velocity [07]or[08]
Average axis velocity during last Segment 6.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS25 – Actual Segment 6 Pressure [02]
Average axis pressure during last Segment 6.

RS26 – Actual Segment 6 Execution Time [21]
Time required for last Segment 6.

R3 PROFILE ACTUALS

RS27 – Actual Segment 7 Velocity [07]or[08]
Average axis velocity during last Segment 7.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS28 – Actual Segment 7 Pressure [02]
Average axis pressure during last Segment 7.

RS29 – Actual Segment 7 Execution Time [21]
Time required for last Segment 7.

RS30 – Actual Segment 8 Velocity [07]or[08]
Average axis velocity during last Segment 8.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS31 – Actual Segment 8 Pressure [02]
Average axis pressure during last Segment 8.

RS32 – Actual Segment 8 Execution Time [21]
Time required for last Segment 8.

RS33 – Actual Segment 9 Velocity [07]or[08]
Average axis velocity during last Segment 9.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS34 – Actual Segment 9 Pressure [02]
Average axis pressure during last Segment 9.

RS35 – Actual Segment 9 Execution Time [21]
Time required for last Segment 9.

RS (continued)

R4 PROFILE ACTUALS

RS36 – Actual Segment 10 Velocity [07]or[08]
Average axis velocity during last Segment 1.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS37 – Actual Segment 10 Pressure [02]
Average axis pressure during last Segment 1.

RS38 – Actual Segment 10 Execution Time [21]
Time required for last Segment 1.

RS39 – Actual Segment 11 Velocity [07]or[08]
Average axis velocity during last Segment 2.
If RP03–B14 is RESET, the QH module reports this average in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS40 – Actual Segment 11 Pressure [02]
Average axis pressure during last Segment 2.

RS41 – Actual Segment 11 Execution Time [21]
Time required for last Segment 2.

RS42 – Velocity at Start-of-R4 Profile [07]or[08]
Instantaneous axis velocity at start of last profile.
If RP03–B14 is RESET, the QH module reports this value in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS43 – Pressure at Start-of-R4 Profile [02]
Instantaneous axis pressure at start of last profile.

RS44 – Position at Start-of-R4 Profile [14]
Instantaneous axis position at start of last profile.

RS45 – Velocity at End-of-R4 Profile [07]or[08]
Instantaneous axis velocity at completion of last profile.
If RP03–B14 is RESET, the QH module reports this value in percent velocity.
If RP03–B14 is SET, reports it in inches(mm)/second.

RS46 – Pressure at End-of-R4 Profile [02]
Instantaneous axis pressure at completion of last profile.

RS47 – Position at End-of-R4 Profile [14]
Instantaneous axis position at completion of last profile.

RS48 – RS52 – Open

RETRACT-PROFILE MAXIMUM PRESSURES

RS53 – Maximum Pressure During R1 Profile [02]
Maximum instantaneous axis pressure during last profile.

RS54 – Maximum Pressure During R2 Profile [02]
Maximum instantaneous axis pressure during last profile.

RS (continued)

RS55 – Maximum Pressure During R3 Profile [02]
Maximum instantaneous axis pressure during last profile.

RS56 – Maximum Pressure During R4 Profile [02]
Maximum instantaneous axis pressure during last profile.

RETRACT-PROFILE EXECUTION TIMES

RS57 – R1 Profile Execution Time [21]
Total time required for last profile.

RS58 – R2 Profile Execution Time [21]
Total time required for last profile.

RS59 – R3 Profile Execution Time [21]
Total time required for last profile.

RS60 – R4 Profile Execution Time [21]
Total time required for last profile.

RS61 – RS64 – Open

QH Module Specifications

Objectives

This section gives 1771-QH module specifications including:

- QH module's I/O specifications
- environmental conditions
- hardware requirements
- process control options

1771-QH Module I/O Specifications

Table A

Inputs	4 analog (4-20 mA, 1 to +5V dc, 0 to +10V dc selectable)
Outputs	4 analog (4-20 mA, 0 to +10V dc, -10 to +10V dc selectable)
I/O Resolution	12-bit binary
I/O Isolation	100% tested at 2100V dc for 1 second between: * chassis and wiring arm terminals * input and output terminals
I/O Accuracy (linearity, gain, and offset)	0.1% full scale @ 25°C, and ±50ppm/°C of full scale range
Input Impedance	Voltage Input * 50K ohms, differential mode * 25K ohms, common mode Current Input * 250 ohms
Loss-of-sensor Detection	Detects loss of position and/or pressure input sensors for any selected input range
Output Loading	Voltage: 5 mA max for any range Current: 15V dc compliance (supports a max current-loop impedance of 750 ohm)
Output Overload Protection	Protects against short circuit for one minute, max

Environmental Conditions

Table B

Operational Temperature	0 to 60°C (32 to 140°F)
Thermal Dissipation	21 BTU/hr (outputs full ON)
Storage Temperature	−40 to +85°C (−40 to +140°F)
Relative Humidity	5 to 95% (without condensation)

Hardware Requirements

Table C

Compatible I/O Chassis	Allen-Bradley Series B
Slot Size	Any single I/O slot in 1771-I/O chassis
Power Requirements (Backplane)	1.2 amps at 5V dc
Wiring Arm Style	1771-WF
Keying Band Locations in I/O Chassis	Between: 20-22 and 26-28

Process Control Options

Table D

Phase:	Type:	Mode:
Axis extend phase: three 3-step profiles (for a total of 9 steps)	velocity vs. position profile or pressure vs. position profile	open or closed loop
Low pressure extend with re-try: (2-step profile)	pressure vs. position profile	open or closed
Axis retract phase: three 3-step profiles, and one 2-step profile (for a total of 11 steps)	velocity vs. position profile or pressure vs. position profile	open or closed
Alarms	Process and Programming	N/A
Control Options	P, I, PI, PD, PID, and FF Open- or Closed-loop	N/A

Application Program

Overview

The following describes the application program that accompanies your user manual. The program is on a 3.5" diskette, and provides you with:

- Dedicated PLC-5 data table areas for all command and status blocks
- STI*-based (50-ms) ladder logic for status data from the QH module
- Continuous data table update-on-change for status from the QH module
- Automatic sequential downloads for all command blocks, and an initialization file to restore all command block header IDs:
  - at power up
  - when the PLC-5 processor is switched from PROGRAM to RUN
- Automatic BTW retry if the QH module rejects a command block
- Automatic BTW of the DYC when the application program modifies any DYC value
- BTW-on-bit-command of all command blocks for use in the end-user application program

* Selectable-timed-interrupt subroutines are a PLC-5 processor feature.

Data Table Assignments

The application program uses the following PLC-5 addresses for command and status data:

QH Module Block Address	PLC-5 Data Table Bit Address	PLC-5 Data Table Word Address
MCC01-04	B34:32-35	none
MCC05-64	none	N40:1-60
JGC01-04	B34:36-39	none
JGC05-64	none	N40:61-120
E1C01-04	B37:0-3	none
E1C05-64	none	N43:1-60
E2C01-04	B37:4-7	none
E2C05-64	none	N43:61-120
E3C01-04	B37:8-11	none
E3C05-64	none	N43:121-180
E4C01-04	B37:12-15	none
E4C05-64	none	N43:181-240
EP01-04	B37:16-19	none
EP05-64	none	N43:241-300

QH Module Block Address	PLC-5 Data Table Bit Address	PLC-5 Data Table Word Address
R1C01-04	B37:20-23	none
R1C05-64	none	N43:301-360
R2C01-04	B37:24-27	none
R2C05-64	none	N43:361-420
R3C01-04	B37:28-31	none
R3C05-64	none	N43:421-480
R4C01-04	B37:32-35	none
R4C05-64	none	N43:481-540
RP01-04	B37:36-39	none
RP05-64	none	N43:541-600
DYC01-08	B34:24-31	none
DYC09-64	none	N40:121-176
SYS01-24	B34:0-23	none
SYS25-64	none	N40:177-216
ES01-04	B34:0-3	none
ES05-08	B37:40-43	none
ES08-64	none	N43:601-656
RS01-04	B34:4-7	none
RS05-08	B37:44-47	none
RS08-64	none	N43:657-712

Bit-commanded Downloads

You download data blocks with the procedure in chapter 5 by using the corresponding block ID, download bit, and companion block if needed.

Subject Block:	Required Companion Block:	Block ID Number	Download Bit B21/
MCC		01	0
JGC		02	1
E1C	EP	03	2
E2C	EP	04	3
E3C	EP	05	4
E4C	EP	06	5
EP		07	6
R1C	RP	17	7
R2C	RP	18	8
R3C	RP	19	9
R4C	RP	20	10
RP		21	11

Appendix F

Blank Worksheets

Worksheet 4-A
Selecting Input Ranges for your Sensors

Control Word MCC03-Bxx	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address 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 Range, Axis Pressure, with bits 07, 06
Select Input 3 Range, Axis Position, with bits 05, 04
Select Input 2 Range, Auxiliary Input #2, with bits 03, 02
Select Input 1 Range, Auxiliary Input #1, with bits 01, 00

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

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

Worksheet 4-B
Selecting Output Ranges for your Valves

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

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

Output Range		
-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: If using ***metric*** units, set bit MCC02-B00 = 1. Do this in the same manner as you set bits in MCC03 and MCC04 above. Leave all other bits in MCC02 (B34:33) in their default state.

Example: If you select metric units: MCC02 = 00000000 00101001

Worksheet 4-C
Determining Initial Sensor-configuration Values

Record Initial Values Here

Input	Control Word	Address	Value	Description (footnote = units)
1	MCC37	N40:33	0	Minimum Auxiliary Analog Input #1
	MCC38	N40:34		Maximum Auxiliary Analog Input #1
	MCC39	N40:35		Analog Signal @ Min Analog Input [2]
	MCC40	N40:36		Analog Signal @ Max Analog Input [2]
2	MCC45	N40:41	0	Minimum Auxiliary Analog Input #2
	MCC46	N40:42		Maximum Auxiliary Analog Input #2
	MCC47	N40:43		Analog Signal @ Min Analog Input [2]
	MCC48	N40:44		Analog Signal @ Max Analog Input [2]
3	MCC23	N40:19	0	Minimum Axis Position [1]
	MCC24	N40:20		Maximum Axis Position [1]
	MCC25	N40:21		Analog Signal @ Min Axis Position [2]
	MCC26	N40:22		Analog Signal @ Max Axis Position [2]
4	MCC31	N40:27	0	Minimum Axis Pressure [3]
	MCC32	N40:28		Maximum Axis Pressure [3]
	MCC33	N40:29		Analog Signal @ Min Axis Pressure [2]
	MCC34	N40:30		Analog Signal @ Max Axis Pressure [2]

[1] Axis Measured from Zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Input Signal Range
00.00 to 10.00V dc or
01.00 to 05.00V dc or
04.00 to 20.00mA dc

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

Worksheet 4-D
Final Sensor-configuration Values

Record Final Values Here

Input	Control Word	Address	Value	Description
1	MCC37	N40:33	0	Minimum Auxiliary Analog Input #1
	MCC38	N40:34		Maximum Auxiliary Analog Input #1
	MCC39	N40:35		Analog Signal @ Min Analog Input [2]
	MCC40	N40:36		Analog Signal @ Max Analog Input [2]
2	MCC45	N40:41	0	Minimum Auxiliary Analog Input #2
	MCC46	N40:42		Maximum Auxiliary Analog Input #2
	MCC47	N40:43		Analog Signal @ Min Analog Input [2]
	MCC48	N40:44		Analog Signal @ Max Analog Input [2]
3	MCC23	N40:19	0	Minimum Axis Position [1]
	MCC24	N40:20		Maximum Axis Position [1]
	MCC25	N40:21		Analog Signal @ Min Axis Position [2]
	MCC26	N40:22		Analog Signal @ Max Axis Position [2]
4	MCC31	N40:27	0	Minimum Axis Pressure [3]
	MCC32	N40:28		Maximum Axis Pressure [3]
	MCC33	N40:29		Analog Signal @ Min Axis Pressure [2]
	MCC34	N40:30		Analog Signal @ Max Axis Pressure [2]

[1] Axis Measured from Zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Input Signal Range
00.00 to 10.00V dc or
01.00 to 05.00V dc or
04.00 to 20.00mA dc

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

Worksheet 4-E
SWTL Configuration Values

Record SWTL Values Here

Control Word	Address	Value	Description
MCC27	N40:23		Axis Minimum SWTL [1]
MCC28	N40:24		Axis Maximum SWTL [1]
MCC29	N40:25	10	Axis SWTL Deadband [2]

[1] Measured from Zero
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

[2] Incremental Distance
00.00 to 99.99 Inches
000.0 to 999.9 Millimeters

Worksheet 4-F
Pressure-alarm and Time-delay Setpoints

Record Pressure-alarm and Time-delay Values Here →

Control Word	Address	Value	Description
MCC35	N40:31		Axis Pressure-alarm Setpoint [2]
MCC36	N40:32		Axis-pressure Time-delay Setpoint [1]

[1] Time
00.00 to 00.99 sec

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

Worksheet 4-G
Time Constants for the Digital Filter

Record Filter Time Constant Here →

Control Word	Address	Value	Description
MCC30	N40:26		Time Constant for Axis Position Input [1]

[1] Time
00.00 to 00.99 sec

Worksheet 6-A
Initial Jog Set-output Values

Enter Initial Values Here

Word	Address	Value	Description (footnote = units)
Axis Extend Jog			
JGC33	N40:89		Output #1 %-output Value [2]
JGC34	N40:90		Output #2 %-output Value [2]
JGC35	N40:91		Output #3 %-output Value [2]
JGC36	N40:92		Output #4 %-output Value [2]
Axis Retract Jog			
JGC41	N40:97		Output #1 %-output Value [2]
JGC42	N40:98		Output #2 %-output Value [2]
JGC43	N40:99		Output #3 %-output Value [2]
JGC44	N40:100		Output #4 %-output Value [2]
Axis Jog Pressure Alarm			
JGC07	N40:63		Jog Pressure Alarm Setpoint [1]
Alternate 1 Jog (unidirectional)			
JGC09	N40:65		Output #1 %-output Value [2]
JGC10	N40:66		Output #2 %-output Value
JGC11	N40:67		Output #3 %-output Value
JGC12	N40:68		Output #4 %-output Value
Alternate 2 Extend Jog			
JGC17	N40:73		Output #1 %-output Value [2]
JGC18	N40:74		Output #2 %-output Value
JGC19	N40:75		Output #3 %-output Value
JGC20	N40:76		Output #4 %-output Value
Alternate 2 Retract Jog			
JGC25	N40:81		Output #1 %-output Value [2]
JGC26	N40:82		Output #2 %-output Value
JGC27	N40:83		Output #3 %-output Value
JGC28	N40:84		Output #4 %-output Value
Alternate 3 Extend Jog			
JGC49	N40:105		Output #1 %-output Value [2]
JGC50	N40:106		Output #2 %-output Value
JGC51	N40:107		Output #3 %-output Value
JGC52	N40:108		Output #4 %-output Value
Alternate 3 Retract Jog			
JGC57	N40:113		Output #1 %-output Value [2]
JGC58	N40:114		Output #2 %-output Value
JGC59	N40;115		Output #3 %-output Value
JGC60	N40:116		Output #4 %-output Value

[1] Pressure
0000 to 9999 PSI

[2] % Signal Output
00.00 to 99.99 %
000.0 to 999.9 Bar

Worksheet 8-A
E1C, E2C, and E3C Configuration Blocks

Word **E1C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Word **E2C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Word **E3C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Block Identifier

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Word **E1C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Value	0	0	0	0	0	0	0	0	1				0			
Word **E2C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
Value	0	0	0	0	0	0	0	0	1				0			
Word **E3C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
Value	0	0	0	0	0	0	0	0	1				0			

Code:

▨	Address fields
☐	Your required value
0 or 1	Required default value loaded by software

Pressure Control Valve

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

Velocity Control Valve

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

Important: You must configure at least the E1C configuration block.

Worksheet 8-A (continued)
E1C, E2C, and E3C Configuration Blocks

Enter Your Values Here

For these Parameters (footnote = units)	Word	E1C N43:	E1C Value	E2C N43:	E2C Value	E3C N43:	E3C Value
Profile Watchdog Timer Preset [1]	08	04	0	64	0	124	0
Output #1 Selected Valve %-Output During Profile [4]	09	05	*	65	*	125	*
Output #2 Selected Valve %-Output During Profile [4]	10	06	*	66	*	126	*
Output #3 Selected Valve %-Output During Profile [4]	11	07	*	67	*	127	*
Output #4 Selected Valve %-Output During Profile [4]	12	08	*	68	*	128	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	13	0	73	0	133	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	14	0	74	0	134	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	15	0	75	0	135	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	16	0	76	0	136	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	21	0	81	0	141	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	22	0	82	0	142	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	23	0	83	0	143	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	24	0	84	0	144	0
Output #1 End-of-profile Set-output Value [4]	33	29	*	89	*	149	*
Output #2 End-of-profile Set-output Value [4]	34	30	*	90	*	150	*
Output #3 End-of-profile Set-output Value [4]	35	31	*	91	*	151	*
Output #4 End-of-profile Set-output Value [4]	36	32	*	92	*	152	*
Pressure Minimum Control Limit [3]	41	37	0	97	0	157	0
Pressure Maximum Control Limit [3]	42	38	Syst Press	98	Syst Press	158	Syst Press
Selected Pressure Valve Output for Minimum [4]	43	39	*	99	*	159	*
Selected Pressure Valve Output for Maximum [4]	44	40	*	100	*	160	*
Velocity Minimum Control Limit [2]	45	41	0	101	0	161	0
Velocity Maximum Control Limit [2]	46	42	per OEM *	102	per OEM *	162	per OEM *
Selected Velocity Valve Output for Minimum [4]	47	43	*	103	*	163	*
Selected Velocity Valve Output for Maximum [4]	48	44	*	104	*	164	*
Proportional Gain for Pressure Control (none)	49	45	100	105	100	165	100
Integral Gain for Pressure Control [6]	50	46	400	106	400	166	400
Derivative Gain for Pressure Control [7]	51	47	0	107	0	167	0
Proportional Gain for Velocity Control [6]	52	48	200	108	200	168	200
Feed Forward Gain for Velocity Control (none)	53	49	0	109	0	169	0
Profile High Pressure Alarm Setpoint [3]	57	53	0	113	0	173	0

[1] Time
00.00 to 99.99 Seconds

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

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

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

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

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

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

Worksheet 8-B
E4C Configuration Block

Word **E4C01** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0

Important:
Verify the block identifier.

Block Identifier

Word **E4C02** Bits 15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Addresses B37/Bxxx	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
Value	0	0	0	0	0	0	0	0	1				0	0	0	0

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

Code:

▨	Address field
☐	Your required value
0 or 1	Required default value loaded by software

Important: You must configure the E4C configuration block.

Worksheet 8-B (continued)
E4C Configuration Block

Enter Your Values Here

For these Parameters (footnote = units)	Word	E4C N43:	E4 C Value
Tonnage Watchdog Timer Preset [1]	07	183	0
Profile Watchdog Timer Preset [1]	08	184	0
#1 Selected Valve Set-Output During Profile [4]	09	185	*
#2 Selected Valve Set-Output During Profile [4]	10	186	*
#3 Selected Valve Set-Output During Profile [4]	11	187	*
#4 Selected Valve Set-Output During Profile [4]	12	188	*
Output #1 Acceleration Ramp Rate During Profile [5]	17	193	0
Output #2 Acceleration Ramp Rate During Profile [5]	18	194	0
Output #3 Acceleration Ramp Rate During Profile [5]	19	195	0
Output #4 Acceleration Ramp Rate During Profile [5]	20	196	0
Output #1 Deceleration Ramp Rate During Profile [5]	25	201	0
Output #2 Deceleration Ramp Rate During Profile [5]	26	202	0
Output #3 Deceleration Ramp Rate During Profile [5]	27	203	0
Output #4 Deceleration Ramp Rate During Profile [5]	28	204	0
#1 End-of-profile Set-output Value [4]	33	209	*
#2 End-of-profile Set-output Value [4]	34	210	*
#3 End-of-profile Set-output Value [4]	35	211	*
#4 End-of-profile Set-output Value [4]	36	212	*
Pressure Minimum Control Limit [3]	41	217	0
Pressure Maximum Control Limit [3]	42	218	System Pressure
Selected Pressure Valve Output for Minimum [4]	43	219	*
Selected Pressure Valve Output for Maximum [4]	44	220	*
Proportional Gain for Pressure Control (none)	49	225	100
Integral Gain for Pressure Control [6]	50	226	400
Derivative Gain for Pressure Control [7]	51	227	0
Profile High Pressure Alarm Setpoint [3]	57	233	0

[1] Time
00.00 to 99.99 Sec

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

[3] Percent Signal Output
00.00 to 99.99

[4] Percent Signal Output per Sec
0000 to 9999

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

[6] Time (Algorithm)
00.00 to 99.99 Minutes

[7] Percent
00.00 to 99.99

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

Worksheet 8-C
R1C, R2C, R3C, and R4C Configuration Blocks

Word **R1C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	335	334	333	332	331	330	329	328	327	326	325	324	323	322	321	320
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

Word **R2C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0

Word **R3C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	463	362	461	460	459	458	457	456	455	454	453	452	451	450	449	448
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1

Word **R4C01** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	527	526	525	524	523	522	521	520	519	518	517	516	515	514	513	512
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Block Identifier

Word **R1C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336
Value	0	0	0	0	0	0	0	0	1				0			

Word **R2C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400
Value	0	0	0	0	0	0	0	0	1				0			

Word **R3C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	479	478	477	476	475	474	473	472	471	470	469	468	467	466	465	464
Value	0	0	0	0	0	0	0	0	1				0			

Word **R4C02** B15 thru 00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528
Value	0	0	0	0	0	0	0	0	1				0			

Code:

▨ Address field

☐ Your required value

0 or 1 Required default value loaded by software

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

Velocity Control Valve
000 = Output 1
001 = Output 2
010 = Output 3
011 = Output 4

Important: You must configure at least the R1C and R4C configuration blocks.

Worksheet 8-C (continued)
R1C, R2C, R3C, and R4C Configuration Blocks

Enter Your Values Here

For these Parameters (footnote = units)	Word	R1C N43:	R1C Value	R2C N43:	R2C Value	R3C N43:	R3C Value	R4C N43:	R4C Value
Profile Watchdog Timer Preset [1]	08	304	0	364	0	424	0	484	0
#1 Selected Valve Set-Output During Profile [4]	09	305	*	365	*	425	*	485	*
#2 Selected Valve Set-Output During Profile [4]	10	306	*	366	*	426	*	486	*
#3 Selected Valve Set-Output During Profile [4]	11	307	*	367	*	427	*	487	*
#4 Selected Valve Set-Output During Profile [4]	12	308	*	368	*	428	*	488	*
Output #1 Accel Ramp Rate During Profile [5]	17	313	0	373	0	433	0	493	0
Output #2 Accel Ramp Rate During Profile [5]	18	314	0	374	0	434	0	494	0
Output #3 Accel Ramp Rate During Profile [5]	19	315	0	375	0	435	0	495	0
Output #4 Accel Ramp Rate During Profile [5]	20	316	0	376	0	436	0	496	0
Output #1 Decel Ramp Rate During Profile [5]	25	321	0	381	0	441	0	501	0
Output #2 Decel Ramp Rate During Profile [5]	26	322	0	382	0	442	0	502	0
Output #3 Decel Ramp Rate During Profile [5]	27	323	0	383	0	443	0	503	0
Output #4 Decel Ramp Rate During Profile [5]	28	324	0	384	0	444	0	504	0
#1 End-of-profile Set-output Value [4]	33	329	*	389	*	449	*	509	*
#2 End-of-profile Set-output Value [4]	34	330	*	390	*	450	*	510	*
#3 End-of-profile Set-output Value [4]	35	331	*	391	*	451	*	511	*
#4 End-of-profile Set-output Value [4]	36	332	*	392	*	452	*	512	*
Pressure Minimum Control Limit [3]	41	337	0	397	0	457	0	517	0
Pressure Maximum Control Limit [3]	42	338	Syst Press	398	Syst Press	458	Syst Press	518	Syst Press
Selected Pressure Valve Output for Min [4]	43	339	*	399	*	459	*	519	*
Selected Pressure Valve Output for Max [4]	44	340	*	400	*	460	*	520	*
Velocity Minimum Control Limit [2]	45	341	0	401	0	461	0	521	0
Velocity Maximum Control Limit [2]	46	342	per OEM *	402	per OEM *	462	per OEM *	522	per OEM *
Selected Velocity Valve Output for Min [4]	47	343	*	403	*	463	*	523	*
Selected Velocity Valve Output for Max [4]	48	344	*	404	*	464	*	524	*
Proportional Gain for Pressure Control (none)	49	345	100	405	100	465	100	525	100
Integral Gain for Pressure Control [6]	50	346	400	406	400	466	400	526	400
Derivative Gain for Pressure Control [7]	51	347	0	407	0	467	0	527	0
Proportional Gain for Velocity Control [6]	52	348	200	408	200	468	200	528	200
Feed Forward Gain for Velocity Control (none)	53	349	0	409	0	469	0	529	0
Profile High Pressure Alarm Setpoint [3]	57	353	0	413	0	473	0	533	0

[1] Time
00.00 to 99.99 Seconds

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

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

[4] Percent Signal Output
00.00 to 99.99

[5] Percent Signal Output per Second
0000 to 9999

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

[7] Time (Algorithm)
00.00 to 99.99 Minutes

[8] Percent
00.00 to 99.99

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

Worksheet 9-A
Extend Profile Block (EP)

Word **EP01** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Block Identifier

Word **EP03** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288
Value	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1

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

E3 E2 E1

E3 E2 E1

Protection Zone
0 = Start E4 on Reaching EP61
1 = Stop and Zero Outputs on Reaching EP61

Algorithm
0 = Vel/Pos
1 = Press/Pos

Logical Bridge
0 = Start Next Profile at End of Profile
1 = Stop and Set Output at End of Profile

Word **EP04** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304
Value	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1

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

bit 07 = Press/Pos E4
bit 05 = Press/Pos E3
bit 04 = Vel/Pos E3
bit 03 = Press/Pos E2
bit 02 = Vel/Pos E2
bit 01 = Press/Pos E1
bit 00 = Vel/Pos E1

Code:

▨ Address field

☐ Your required value

0 or 1 Required default value loaded by software

Worksheet 9-A (continued)
Extend Profile Block (EP)

Record Your Setpoints Here

For These Setpoints (footnote = units)	In Word	At Address N43:	Your Setpoints
E1 Segment 1 Velocity Setpoint [1, 2]	EP09	245	*
E1 Segment 1 Pressure Setpoint [3]	EP10	246	*
E1 End-of-segment 1 Position Setpoint [4]	EP11	247	*
E1 Segment 2 Velocity Setpoint [1, 2]	EP12	248	*
E1 Segment 2 Pressure Setpoint [3]	EP13	249	*
E1 End-of-segment 2 Position Setpoint [4]	EP14	250	*
E1 Segment 3 Velocity Setpoint [1, 2]	EP15	251	*
E1 Segment 3 Pressure Setpoint [3]	EP16	252	*
E1 End-of-segment 3 Position Setpoint [4]	EP17	253	*
E2 Segment 1 Velocity Setpoint [1, 2]	EP18	254	0
E2 Segment 1 Pressure Setpoint [3]	EP19	255	0
E2 End-of-segment 1 Position Setpoint [4]	EP20	256	0
E2 Segment 2 Velocity Setpoint [1, 2]	EP21	257	0
E2 Segment 2 Pressure Setpoint [3]	EP22	258	0
E2 End-of-segment 2 Position Setpoint [4]	EP23	259	0
E2 Segment 3 Velocity Setpoint [1, 2]	EP24	260	0
E2 Segment 3 Pressure Setpoint [3]	EP25	261	0
E2 End-of-segment 3 Position Setpoint [4]	EP26	262	0
E3 Segment 1 Velocity Setpoint [1, 2]	EP27	263	0
E3 Segment 1 Pressure Setpoint [3]	EP28	264	0
E3 End-of-segment 1 Position Setpoint [4]	EP29	265	0
E3 Segment 2 Velocity Setpoint [1, 2]	EP30	266	0
E3 Segment 2 Pressure Setpoint [3]	EP31	267	0
E3 End-of-segment 2 Position Setpoint [4]	EP32	268	0
E3 Segment 3 Velocity Setpoint [1, 2]	EP33	269	0
E3 Segment 3 Pressure Setpoint [3]	EP34	270	0
E3 End-of-segment 3 Position Setpoint [4]	EP35	271	0
E4 Segment 1 Pressure Setpoint [3]	EP37	273	*
E4 End-of-segment 1 Position Setpoint [4]	EP38	274	0
E4 Segment 2 Pressure Setpoint [3]	EP40	276	0
Start Extend Protection Zone Position Setpoint [4]	EP61	297	*
Fully Extended Position Setpoint [4]	EP62	298	*
Tonnage Complete Pressure Setpoint [3]	EP63	299	0

[1] Percent of Maximum Velocity
00.00 to 99.99

[2] Velocity along Axis
00.00 to 99.99 In per Sec
000.0 to 999.9 Mm per Sec

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

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

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

Worksheet 9-B
Retract Profile Block (RP)

Word **RP01** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	591	590	589	588	587	586	585	584	583	582	581	580	579	578	577	576
Value	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1

Bits 07-00: Block Identifier

Important: Verify block identifiers used.
Record values only in words used.
Record zeros in words not used.

Word **RP03** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	623	622	621	620	619	618	617	616	615	614	613	612	611	610	609	608
Value	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	1

Bit 14: Velocity Units
0 = Percent Velocity
1 = Inches (mm)/Second

Bit 11: Protection Zone
0 = Start R4 Profile on Reaching RP61
1 = Stop and Zero Outputs on Reaching RP61

Bits 10, 09, 08: R3 R2 R1
Logical Bridge
0 = Start Next Profile
1 = Stop and Set Output

Bits 06, 04, 02, 00: R4 R3 R2 R1
Algorithm
0 = Vel/Pos
1 = Press/Pos

Word **RP04** Bits 15-00	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Bit Address B37/Bit	639	638	637	636	635	634	633	632	621	630	629	628	627	626	625	624
Value	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Bits 07-00: Open/Closed-Loop
0 = Closed-Loop
1 = Open-Loop

bit 07 = Press/Pos R4
bit 06 = Vel/Pos R4
bit 05 = Press/Pos R3
bit 04 = Vel/Pos R3
bit 03 = Press/Pos R2
bit 02 = Vel/Pos R2
bit 01 = Press/Pos R1
bit 00 = Vel/Pos R1

Code:

▨	Address field
☐	Your required value
0 or 1	Required default value loaded by software

Worksheet 9-B (continued)
Retract Profile Block (RP)

Record Your Setpoints Here

Description	Word	At Address N43:	Your Setpoints
1R Segment 1 Velocity Setpoint	RP09	545	*
1R Segment 1 Pressure Setpoint	RP10	546	*
1R End-of-segment 1 Position Setpoint	RP11	547	*
1R Segment 2 Velocity Setpoint	RP12	548	*
1R Segment 2 Pressure Setpoint	RP13	549	*
1R End-of-segment 2 Position Setpoint	RP14	550	*
1R Segment 3 Velocity Setpoint	RP15	551	*
1R Segment 3 Pressure Setpoint	RP16	552	*
1R End-of-segment 3 Position Setpoint	RP17	553	*
2R Segment 1 Velocity Setpoint	RP18	554	0
2R Segment 1 Pressure Setpoint	RP19	555	0
2R End-of-segment 1 Position Setpoint	RP20	556	0
2R Segment 2 Velocity Setpoint	RP21	557	0
2R Segment 2 Pressure Setpoint	RP22	558	0
2R End-of-segment 2 Position Setpoint	RP23	559	0
2R Segment 3 Velocity Setpoint	RP24	560	0
2R Segment 3 Pressure Setpoint	RP25	561	0
2R End-of-segment 3 Position Setpoint	RP26	562	0
3R Segment 1 Velocity Setpoint	RP27	563	0
3R Segment 1 Pressure Setpoint	RP28	564	0
3R End-of-segment 1 Position Setpoint	RP29	565	0
3R Segment 2 Velocity Setpoint	RP30	566	0
3R Segment 2 Pressure Setpoint	RP31	567	0
3R End-of-segment 2 Position Setpoint	RP32	568	0
3R Segment 3 Velocity Setpoint	RP33	569	0
3R Segment 3 Pressure Setpoint	RP34	570	0
3R End-of-segment 3 Position Setpoint	RP35	571	0
4R Segment 1 Velocity Setpoint	RP36	572	*
4R Segment 1 Pressure Setpoint	RP37	573	*
4R End-of-segment 1 Position Setpoint	RP38	574	0
4R Segment 2 Velocity Setpoint	RP39	575	0
4R Segment 2 Pressure Setpoint	RP40	576	0
Start Retract Protection Zone Position Setpoint	RP61	597	*
Fully Retracted Position Setpoint	RP62	598	*
Dwell Timer Preset	RP63	599	0

[1] Percent of Maximum Velocity
00.00 to 99.99

[5] Time
00.00 to 99.99 seconds

[2] Velocity along Axis
00.00 to 99.99 in per sec
000.0 to 999.9 mm per sec

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

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

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

Calibration Instructions

Objective

Use this document to calibrate your 1771-QH module.
You should calibrate it once a year.

Calibration Equipment

To calibrate the QH module, you must have the following equipment:

- digital DC voltage source (1 mv accuracy)
- Allen-Bradley 1784-T45 or -T50 (or equivalent) programming terminal
- digital DC voltmeter (1 mv accuracy)

To calibrate the QH module quickly and conveniently away from your control application, we recommend this addition equipment:

- spare PLC-5 processor
- spare I/O chassis
- extender card (1771-EX)
- two spare wiring arms (1771-WF)

If you do not have the optional equipment to calibrate the QH module in a laboratory away from your control application, then proceed as follows:

If you do NOT have this optional equipment:	**Then you must:**
PLC-5 processor	• inhibit your application program with jump/label instructions (Jump prior to the first rung to a label after the last rung)
I/O chassis	• remove all I/O modules from the application i/O chassis
two wiring arms (1771-WF)	• disconnect application wiring, then rewire after calibration • rewire for input calibration, then rewire for output calibration
extender card (1771-EX)	• install the QH module (without covers) in the right-most I/O slot, so you can access the jumper plugs from inside the I/O chassis (removing the module invalidates the procedure)
digital DC voltmeter	• omit verifying calibration accuracy

Overview of the Calibration Procedures

The QH module has no potentiometers to adjust. Instead, you apply precision input voltages and corresponding reference values to the QH module so it can calibrate itself. First, you must:

- map two data blocks: one for BTW, and one for BTR
- write your calibration ladder logic
- set internal jumpers beforehand and afterwards
- follow the calibration procedures without error

Important: If the QH module detects an error during calibration, it reports it in the BTR status byte. Then you must re-start the procedure.

Map Your BTW and BTR Data Blocks

Create BTR and BTW calibration data blocks in your PLC-5 data table:

Word	BTW File		Description
1	---	1C	ID that you enter
2	Command Word		Command codes that you enter
3	Output 1		Codes that you enter during the calibration procedure.
4	Output 2		
5	Output 3		
6	Output 4		

Word	BTR File		Description
1	Status	0A	Status and ID that you observe
2	---	Min Input	Values that you observe during the calibration procedure.
3	---	Max Input	
4	---	Min Output	
5	---	Max Output	
6	actual input 1		Raw data from DAC (useful by not required during calibration procedure).
7	actual input 2		
8	actual input 3		
9	actual input 4		
10	calibrated input 1		Values that you observe during the calibration procedure.
11	calibrated input 2		
12	calibrated input 3		
13	calibrated input 4		
15	echo of your command		Indicates the transfer of data blocks

Record BTR and BTW file addresses for use in your calibration logic.

Write Your Calibration Logic

Write your calibration logic as follows:

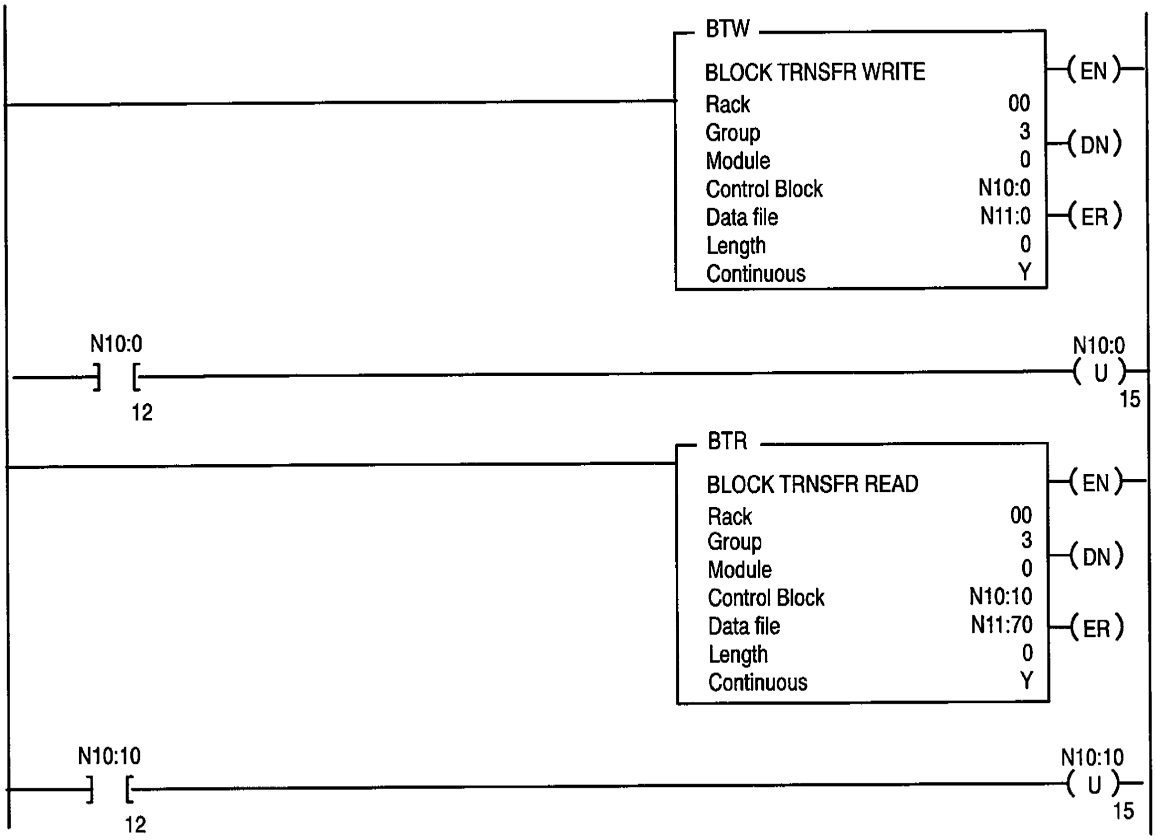
9. Write unconditional BTW and BTR instructions (use a block length of 0 for processor-controlled length).

10. Unlatch BTW and BTR enable bits with BTW and BTR done bits.

11. Assign the module address and data table addresses.

Important: The module address of your BTR and BTW instructions depends on the location of the QH module in the I/O chassis. If you do NOT have an extender card that lets you access jumpers on the QH module circuit board, it in the right-most slot and access the jumpers from inside the I/O chassis.

We present example calibration logic for instructional purposes, only.



Set Internal Jumpers

Set jumpers on the circuit board inside the QH module as follows:

Important: To avoid elector-static damage to internal electronic circuits, rid your self of electric charge by touching a grounded object before opening the module. Avoid touching circuit components or conductor surfaces. We recommend that you use a static-free workstation.

1. Remove the label-side cover by removing the corner screws.
2. Remove the circuit board by removing the two screws located front-center. Then place it on a table, component-side down.
3. Record operational jumper settings on figure G.1 before changing them.

⚠ **WARNING:** The QH module cannot read its jumpers. If you reset them improperly after calibration, unexpected operation could occur with possible personal injury or equipment damage. Record them accurately on figure G.1 in the table at the left.

---

4. Set all jumpers within each group the same way:
   (E6-E9) to voltage
   (E10, E14, E13, E17) to voltage
   (E11, E12, E15, E16) to –10 to +10V

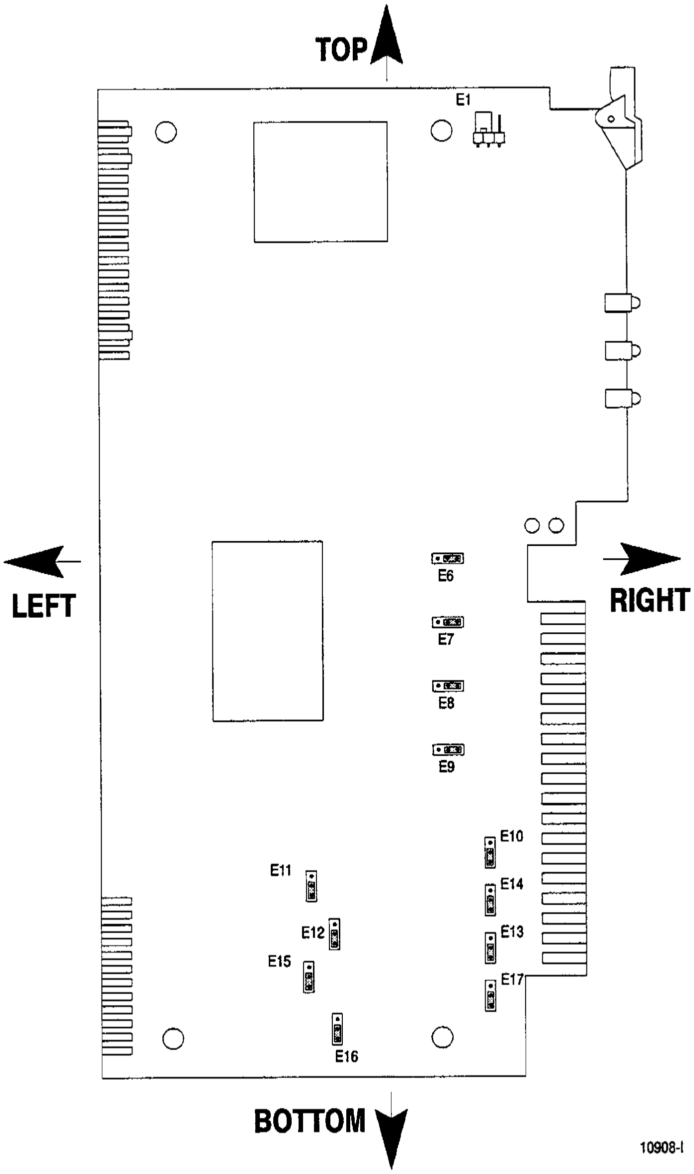
Important: Jumper settings of left, right, top, or bottom represent the position of the jumper on the 3–pin connector as referenced in figure G.1.

Figure G.1
Jumper Settings and Locations on the QH Module's Circuit Board

Record Jumper Settings Here

	Operational Setting		Calibration	
Jumper	**Left**	**Right**	**Left**	**Right**
E1				X
E6			Current	Voltage
E7			↓	↓
E8				
E9				

Jumper	Top	Bottom	Top	Bottom
E10			Current	Voltage
E14			↓	↓
E13				
E17				
E11			-10 to	0 to 10V
E12			+10 V	or
E15				4-20mA
E16				



5. Install the circuit board on an extender card.

6. Install the extender card and circuit board in the I/O chassis using the module slot that corresponds to the address you assigned to the module in your calibration ladder logic. If you do not have an extender card, install the circuit board in the right-most module slot so you can access the jumper plugs by reaching inside the I/O chassis. The module address must match the slot location in the I/O chassis.

Wire the Wiring Arms

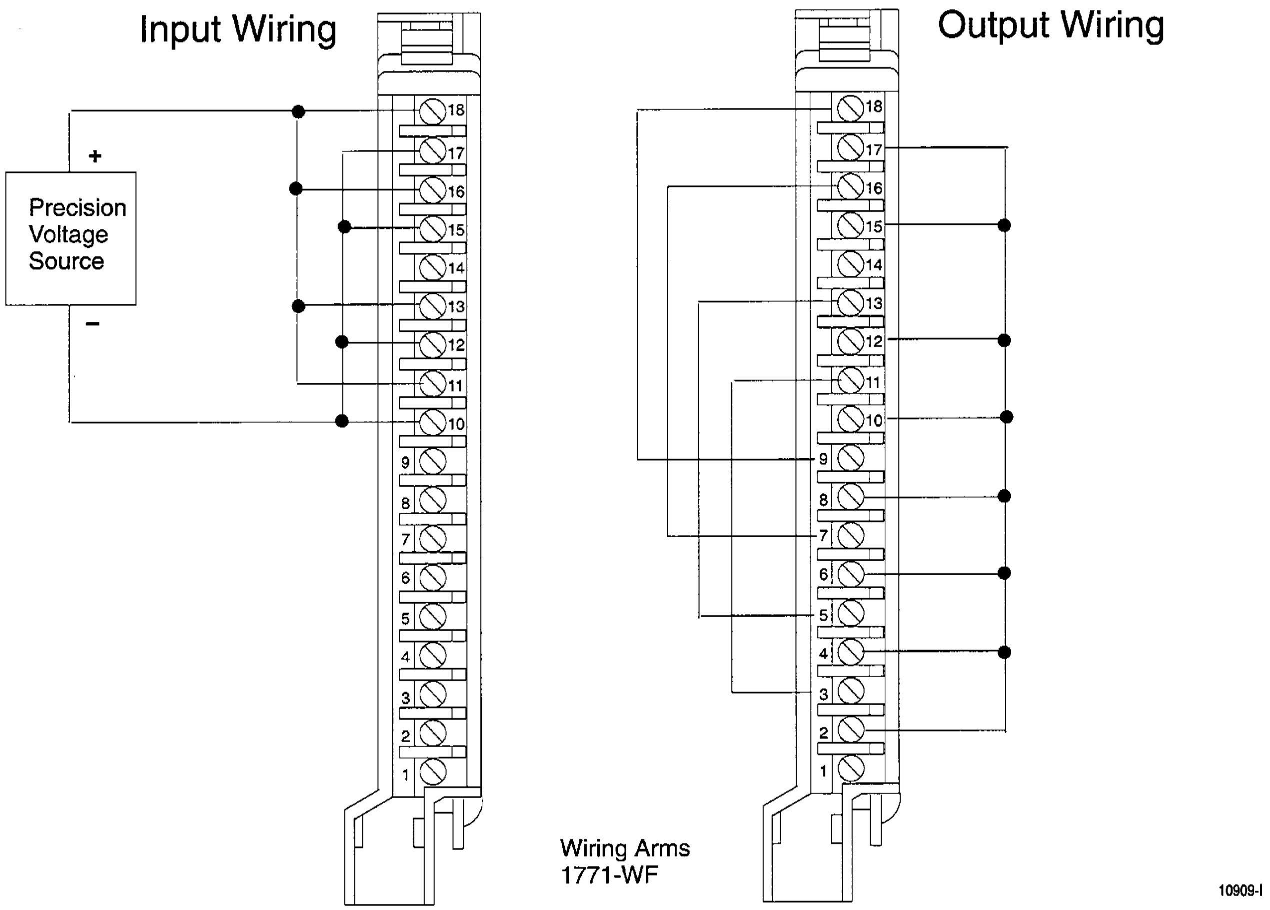
If you have extra wiring arms, wire them in advance to save time. Otherwise, remove system wiring and rewire as required in the procedure.

Input Wiring

1. Connect all four (+) input terminals (18, 16, 13, 11) to the (+) terminal of the precision voltage source.
2. Connect all four (–) input terminals (17, 15, 12, 10) to the (–) terminal of the precision voltage source.

Output Wiring

1. Wrap all four (+) output terminals (9, 7, 5, 3) back to their corresponding (+) input terminals (18, 16, 13, 11), respectively.
2. Connect all input and output commons together: (17, 15, 12, 10, 8, 6, 4, 2).



Calibration Setup Using Optional Equipment

Set up your calibration equipment at a remote location as follows:

1. Install the PLC-5 processor in the I/O chassis.
2. Verify that you set all the QH module's jumpers to initial calibration settings (see *Set Internal Jumpers*, above).
3. Install the QH module circuit board with extender card in the I/O chassis slot location corresponding to the module address of your BTR and BTW instructions.

   If you do not have an extender card, place the module circuit board in the right-most slot so you can access the jumpers by reaching inside the I/O chassis.
4. Connect the pre-wired input wiring arm to the module circuit board.
5. Connect other wiring as needed for the calibration setup.
6. Apply power.
7. Switch the PLC-5 processor to program mode and enter your calibration ladder logic.

Calibration Setup at the Machine Location

Set up your calibration equipment at your machine location as follows:

1. Remove all I/O modules from the I/O chassis.
2. Verify that you set all the QH module's jumpers to initial calibration settings (see *Set Internal Jumpers*, above).
3. Install the QH module circuit board in the right-most slot so you can access the jumpers by reaching inside the I/O chassis. Be sure the module address of your BTR and BTW instructions matches the module's slot location in the I/O chassis.
4. Wire the wiring arm and connect it to the QH module circuit board (see *Wire the Wiring Arms*).
5. Connect other wiring as needed for the calibration setup.
6. Apply power.
7. Switch the PLC-5 processor to program mode and disable your entire ladder logic program by inserting a jump to label around the application program.
8. Enter your calibration ladder logic.

Calibration Procedure for Inputs

Follow this procedure for:

- calibrating the QH module's inputs
- verifying the calibration

For each calibration below, you will:

- apply precise voltages using the input wiring arm
- enter command codes in BTW word 2 with your programming terminal

For each verification below, you will:

- apply precise voltages using the input wiring arm
- read verification codes in BTR words 10-13 with programming terminal

1. To calibrate the 0 to +10V dc range:

Step	Enter Command Code (BTW 2):	With Applied Voltage	and Read in BTR:
1	0000H	000.0	word 2 = 000F
2	8000H		
3	0008H		
4	8008H		
5	0008H	10.000	word 3 = 000F
6	8008H		

2. To verify 0 to +10V range, enter command codes 0100H and 8100H. Then apply the following voltages:

Step	Apply this Voltage	and Read Verification Code (BTR 10-13):
1	000.0	000H
2	5.000	800H
3	9.997	FFFH

3. To calibrate the 1 to 5V dc range:

Step	Enter Command Code (BTW 2):	With Applied Voltage	and Read in BTR
1	0010H	1.000	word 2 = 00FF
2	8010H		
3	0010H	5.000	word 3 = 00FF
4	8010H		

4. To verify 1 to 5V range, enter command codes 0400H and 8400H. Then apply the following voltages:

Step	Apply this Voltage	and Read Verification Code (BTR 10-13):
1	1.000	000H
2	3.000	800H
3	5.000	FFFH

Calibration Procedure for Outputs

Important: Calibrate inputs before outputs.

For each output calibration below, you will:

- change jumpers as required (with power ON)
- enter command codes in BTW word 2
- enter voltage codes in BTW words 3, 4, 5, and 6
- read verification codes in BTR words 10, 11, 12, and 13

Important: Do not remove module. Loss of power voids the procedure.

Follow this procedure for calibrating the QH module's outputs.

1. With the power remaining ON, connect the output wiring arm.

2. To calibrate the –10 to +10V dc output range, follow these steps:

Step	Enter Command Code (BTW 2):	and Read in BTR:
1	0020H	word 4 = 000F
2	8020H	word 5 = 000F

3. To verify –10 to +10V range, enter command codes 0100H and 8100H. Then enter voltage codes:

Step	Enter Voltage Code (BTW 3-6):	and Read Verification Code (BTR 10-13):
1	000H (for 0 volts)	000H
2	0400H (for +5 volts)	0800H
3	7FFH (for +10 volts)	FFFH

4. To calibrate the 0 to +10V dc range, first change these jumpers with power ON: E11, E12, E15, E16 to the 0 to +10V dc position (bottom)

Step	Enter Command Code (BTW 2):	and Read in BTR:
1	0040H	word 4 = 00FF
2	8040H	word 5 = 00FF

5. To verify 0 to +10V range, enter command codes 0400H and 8400H. Then enter voltage codes:

Step	Enter Voltage Code (BTW 3-6):	and Read Verification Code (BTR 10-13):
1	000H (for 0 volts)	000H
2	0800H (for +5 volts)	0800H
3	FFFH (for +10 volts)	FFFH

6. To calibrate the 4-20mA output range, first change the following jumpers with power ON, then calibrate:
   - E6-E9 to the current position (left)
   - E10, E14, E13, E17 to the current position (top)

Step	Enter Command Code (BTW 2):	and Read in BTR:
1	0080H	word 4 = 0FFF
2	8080H	word 5 = 0FFF

7. To verify 4-20mA range, enter command codes 0400H and 8400H. Then apply these codes for current:

Step	Apply Code for Current (BTW 3-6):	and Read Verification Code (BTR 10-13):
1	000H (4mA)	000H
2	0800H (12mA)	0800H
3	FFFH (20mA)	FFFH

8. To store the calibration data in EEPROM, follow these steps:

Step	Enter this Command Code (BTW 2):
1	0800H
2	8800H
3	0000H

If there is no error in the BTR status byte, you completed the procedure.

WARNING: To avoid possible injury or machine damage when you return the QH module to its application, reset the jumpers to the *application settings* before re-assembling the module.

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If you need additional assistance on using your software, Allen-Bradley offers telephone and on-site product support at Customer Support Centers worldwide.

For technical assistance on the telephone, first contact your local sales office, distributor, or system integrator. If additional assistance is needed, then contact your local Customer Support Center or contact System Support Services.

In the United States and Canada

If you have a SupportPlus agreement or your software is under warranty, you can contact System Support Services at: 1-800-289-2279. Have your support contract or software registration number available.

For assistance that requires on-site support, contact your local sales office, distributor, or system integrator. During non-office hours, contact the Allen-Bradley 24-hour Hot Line at 1-800-422-4913.

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