

# ***Host Command Reference***

*Q and SCL commands for servo and stepper drives*

*Includes RS-232, RS-485,  
Ethernet UDP, Ethernet TCP/IP, EtherNet/IP,  
Modbus RTU and Modbus TCP/IP*



APPLIED MOTION PRODUCTS

## Contents

Getting Started.....	11
Servo Drives .....	11
StepSERVO .....	11
Stepper Drives .....	11
Commands.....	13
Buffered Commands .....	13
Stored Programs in Q Drives.....	13
Multi-tasking in Q Drives .....	13
Immediate Commands.....	13
<b>Using Commands.....</b>	<b>13</b>
Commands in Q drives .....	14
<i>SCL Utility</i> software.....	15
<b>Command Summary .....</b>	<b>16</b>
Motion Commands.....	17
Servo Commands .....	18
Configuration Commands .....	19
Communications Commands.....	21
Register Commands .....	21
I/O Commands.....	22
Q Program Commands .....	23
<b>Command Listing.....</b>	<b>24</b>
AC - Acceleration Rate .....	25
AD - Analog Deadband.....	26
AD - Analog Deadband (SV200 Drives).....	27
AF - Analog Filter .....	28
AG - Analog Velocity Gain.....	29
AI - Alarm Reset Input .....	30
AL - Alarm Code .....	33
AM - Max Acceleration.....	36
AN - Analog Torque Gain .....	37
AO - Alarm Output .....	38
AP - Analog Position Gain .....	40
AR - Alarm Reset (Immediate).....	41
AS - Analog Scaling.....	42
AT - Analog Threshold.....	43
AV - Analog Offset Value.....	44
AV - Analog Offset Value - SV200.....	45
AX - Alarm Reset (Buffered) .....	46
AZ - Analog Zero.....	47

BD - Brake Disengage Delay .....	48
BE - Brake Engage Delay .....	49
BO - Brake Output .....	50
BR - Baud Rate .....	52
BS - Buffer Status .....	53
CA - Change Acceleration Current .....	54
CB - CANopen Baudrate.....	55
CC - Change Current.....	56
CD - Idle Current Delay Time.....	58
CE - Communication Error.....	59
CF - Anti-resonance Filter Frequency .....	60
CG - Anti-resonance Filter Gain.....	61
CI - Change Idle Current.....	62
CJ - Commence Jogging .....	64
CM - Command Mode (AKA Control Mode) .....	65
CN - Secondary Control Mode.....	67
CO - Node ID/ IP address .....	68
CP - Change Peak Current.....	69
CR - Compare Registers .....	70
CS - Change Speed.....	71
CT - Continue.....	72
DA - Define Address .....	73
DC - Change Distance.....	74
DD - Default Display Item of LEDs.....	75
DE - Deceleration.....	76
DI - Distance/Position .....	77
DL - Define Limits .....	78
DL - Define Limits (StepSERVO and SV200 drives) .....	80
DR - Data Register for Capture.....	81
DS - Switching Electronic Gearing.....	82
DW - Dumping Voltage Setting.....	83
ED - Encoder Direction .....	84
EF - Encoder Function.....	85
EG - Electronic Gearing.....	87
EH - Extended Homing .....	88
EI - Input Noise Filter .....	90
EN - Numerator of Electronic Gearing Ratio.....	91
EP - Encoder Position.....	92
ER - Encoder Resolution .....	93

## Host Command Reference

ES - Single-Ended Encoder Usage.....	94
ES - Absolute Encoder Mode .....	95
EU - Denominator of Electronic Gearing Ratio .....	96
FA - Function of the Single-ended Analog Input .....	97
FC - Feed to Length with Speed Change .....	98
FD - Feed to Double Sensor .....	100
FE - Follow Encoder .....	101
FH - Find Home .....	102
FI - Filter Input.....	105
FL - Feed to Length .....	109
FM - Feed to Sensor with Mask Distance .....	110
FO - Feed to Length and Set Output .....	111
FP - Feed to Position .....	112
FS - Feed to Sensor.....	113
FX - Filter select inputs .....	114
FY - Feed to Sensor with Safety Distance .....	115
GC - Current Command.....	116
GG - Controller Global Gain Selection.....	117
HA - Homing Acceleration.....	118
HC – Hard Stop Current.....	119
HD - Hard Stop Fault Delay .....	120
HG - 4th Harmonic Filter Gain .....	121
HL - Homing Deceleration.....	122
HO – Home Offset .....	123
HP - 4th Harmonic Filter Phase .....	124
HS - Hard Stop Homing .....	125
HV - Homing Velocity .....	127
HW - Hand Wheel .....	128
Immediate Status Commands.....	129
IA - Immediate Analog .....	130
IC - Immediate Current (Commanded) .....	132
ID - Immediate Distance .....	133
IE - Immediate Encoder .....	134
IF - Immediate Format .....	135
IH - Immediate High Output .....	136
IL - Immediate Low Output.....	137
IO - Output Status.....	138
IP - Immediate Position .....	140
IQ - Immediate Current (Actual).....	141

IS - Input Status .....	142
IT - Immediate Temperature .....	145
IU - Immediate Voltage.....	147
IV - Immediate Velocity .....	148
IX - Immediate Position Error .....	149
JA - Jog Acceleration .....	150
JC - Velocity (Oscillator) mode second speed .....	151
JC - 8 Jog Velocities (SV200 drives) .....	152
JD - Jog Disable.....	153
JE - Jog Enable.....	154
JL - Jog Decel .....	155
JM - Jog Mode .....	156
JS - Jog Speed .....	157
KC - Overall Servo Filter .....	158
KD - Differential Constant .....	159
KE - Differential Filter .....	160
KF - Velocity Feedforward Constant.....	161
KG – Secondary Global Gain .....	162
KI - Integrator Constant.....	163
KJ - Jerk Filter Frequency .....	164
KK - Inertia Feedforward Constant .....	165
KP - Proportional Constant.....	166
KV - Velocity Feedback Constant.....	167
LA - Lead Angle Max Value.....	168
LM - Software Limit CCW .....	170
LP - Software Limit CW.....	171
LS - Lead Angle Speed.....	172
LV - Low Voltage threshold.....	173
MC - Motor Current, Rated .....	174
MD - Motor Disable .....	175
ME - Motor Enable .....	176
MN - Model Number.....	177
MO - Motion Output .....	178
MR - Microstep Resolution.....	181
MS - Control Mode Selection .....	182
MT - Multi-Tasking.....	183
MV - Model & Revision .....	184
NO - No Operation .....	187
OF - On Fault .....	188

## Host Command Reference

OI - On Input .....	189
OP - Option board.....	190
PA - Power-up Acceleration Current .....	191
PB - Power-up Baud Rate .....	193
PC - Power-up Current.....	194
PD - In-Position Counts .....	195
PE - In-Position Timing .....	196
PF - Position Fault.....	197
PH - Inhibit Pulse Command .....	198
PI - Power-up Idle Current .....	199
PK - Parameter Lock.....	200
PL - Position Limit .....	201
PM - Power-up Mode .....	202
PN - Probe On Demand.....	203
PP - Power-up Peak current.....	204
PR - Protocol.....	205
PS - Pause.....	206
PT - Pulse Type.....	207
PV - Secondary Electronic Gearing .....	208
PW - Password .....	209
QC - Queue Call .....	210
QD - Queue Delete .....	211
QE - Queue Execute.....	212
QG - Queue Goto.....	213
QJ - Queue Jump.....	214
QK - Queue Kill .....	215
QL - Queue Load .....	216
QR - Queue Repeat.....	217
QS - Queue Save.....	218
QU - Queue Upload .....	219
QX - Queue Load & Execute .....	220
RC - Register Counter .....	221
RD - Register Decrement.....	223
RE - Restart or Reset .....	224
RI - Register Increment.....	225
RL - Register Load - immediate .....	226
RM - Register Move .....	227
RO - Anti-Resonance ON .....	228
RR - Register Read.....	229
RS - Request Status .....	230

RU - Register Upload .....	231
RV - Revision Level .....	232
RW - Register Write .....	233
RX - Register Load - buffered .....	234
R+ - Register Add .....	235
R- - Register Subtract .....	236
R* - Register Multiply .....	237
R/ - Register Divide .....	238
R& - Register AND .....	239
R  - Register OR .....	240
SA - Save Parameters .....	241
SC - Status Code .....	242
SD - Set Direction .....	243
SF - Step Filter Frequency .....	244
SH - Seek Home .....	245
SI - Enable Input Usage .....	246
SJ - Stop Jogging .....	248
SK - Stop & Kill .....	249
SM - Stop Move .....	250
SO - Set Output .....	251
SP - Set Position .....	252
SS - Send String .....	253
ST - Stop .....	254
TD - Transmit Delay .....	255
TI - Test Input .....	256
TO - Tach Output .....	257
TR - Test Register .....	259
TS - Time Stamp .....	260
TT - Pulse Complete Timing .....	261
TV - Torque Ripple .....	262
VC - Velocity Change .....	263
VE - Velocity .....	264
VI - Velocity Integrator Constant .....	265
VL - Voltage Limit .....	266
VM - Maximum Velocity .....	267
VP - Velocity Mode Proportional Constant .....	268
VR - Velocity Ripple .....	269
WD - Wait Delay .....	270
WI - Wait for Input .....	271

WM - Wait on Move .....	272
WP - Wait Position .....	273
WT - Wait Time .....	274
ZA – Network Communication Time-out (Watchdog) Action.....	274
ZC - Regen Resistor Continuous Wattage.....	275
ZE - Network Communication Time-Out (Watchdog) Enable.....	276
ZR - Regen Resistor Value .....	277
ZS- Network Communication Time-out (Watchdog) Delay .....	278
ZT - Regen Resistor Peak Time.....	279
Data Registers .....	280
Read-Only data registers .....	280
Read/Write data registers .....	280
User-Defined data registers .....	280
Storage data registers.....	280
<b>Using Data Registers .....</b>	<b>281</b>
Loading (RL, RX) .....	281
Uploading (RL, RU).....	281
Writing Storage registers (RW) ( <i>Q drives only</i> ).....	282
Reading Storage registers (RR) ( <i>Q drives only</i> ) .....	282
Moving data registers (RM) ( <i>Q drives only</i> ) .....	282
Incrementing/Decrementing (RI, RD) ( <i>Q drives only</i> ) .....	282
Counting (RC, “I” register) ( <i>Q drives only</i> ).....	282
Math & Logic (R+, R-, R*, R/, R&, RI) ( <i>Q drives only</i> ).....	282
Conditional Testing (CR, TR) ( <i>Q drives only</i> ) .....	283
Data Register Assignments .....	283
Read-Only data registers: a - z .....	283
Read/Write data registers: A - Z .....	288
User-Defined data registers: 0 - 9, other characters .....	292
Appendices .....	293
<b>Appendix A: Non-Volatile Memory in Q drives .....</b>	<b>294</b>
<b>Appendix B: Host Serial Communications .....</b>	<b>295</b>
<b>Appendix C: Host Serial Connections.....</b>	<b>299</b>
<b>Appendix D: The PR Command.....</b>	<b>303</b>
<b>Appendix E: Alarm and Status Codes .....</b>	<b>312</b>
<b>Appendix F: Working with Inputs and Outputs.....</b>	<b>320</b>
<b>Appendix G: eSCL (SCL over Ethernet) Reference.....</b>	<b>328</b>
<b>Appendix H: EtherNet/IP .....</b>	<b>342</b>
Input Assembly (0x64) .....	344
Input Assembly (0x65) .....	346



Input Status Details .....	346
Output Assembly (0x70) .....	347
Explicit Messaging .....	354
Type 2 Message Format .....	360
Table 1: Message Type 1 Command List .....	364
Table 2: Message Type 2 Commands .....	369
Table 3: Parameter read/write operands .....	370
IO Encoding Table.....	373
Register Encoding Table .....	374
EtherNet/IP And Q Programs.....	376
EtherNet/IP on large networks .....	378
<b>Appendix I: Troubleshooting .....</b>	<b>379</b>
<b>Appendix J: List of Supported Drives .....</b>	<b>381</b>
<b>Appendix K: Modbus appendix.....</b>	<b>388</b>
What is Modbus? .....	390
Wiring.....	390
Drive Behavior .....	391
Monitoring .....	391
Sending Commands .....	391
Examples .....	392
SCL Command Mode Table .....	393
IO Encoding Table.....	394
Register Encoding Table .....	395
Modbus Register Table for Step Drives .....	398
Modbus Register Table for Servo Drives .....	406
Modbus Register Table for StepSERVO Drives.....	416

## PL - Position Limit

Compatibility: Servo drives only  
 Affects: Motion Output function  
 See also: MO command

Sets or requests the count value used by the servo to determine if the motor is in position. This is used by the servo for determining the state of Motion Output (see MO command). When performing a move the Motion Output will be set to the designated condition until the servo is in position at the end of a move. The "In Position" status is set in the same way.

### Command Details:

Structure	PL{Parameter #1}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	None

### Parameter Details:

Parameter #1	Positioning limit
- units	encoder counts
- range	0 - 32767

### Examples:

Command	Drive sends	Notes
PL20	-	Set position limit to 20 counts
PL	PL=20	

## PM - Power-up Mode

Compatibility: All drives  
See also: CM command

Sets or requests the power-up mode of the drive. PM determines how the drive is configured for serial communications at power-up. For example, for SCL applications set PM=2 or PM=5. The power-up mode is also set when configuring the drive with *Quick Tuner* or *Configurator*. PM2 (Q / SCL) is the same as PM7 (Q Program Mode), except the program is not automatically executed at power up.

### Q drives

When creating Q Programs for your Q drive, checking the “Execute “Q” at Power-up” box on the main screen of the Q Programmer software will change the power-up mode of the drive to 7 (PM7) with the next download. This will cause the drive to run its stored Q Program at power-up. You must download the program after checking this box for the change to take effect.

### Si drives

An Si drive is set to PM1 automatically when an Si program is downloaded to the drive. If the drive is currently set to PM7 for operation in Q mode, simply uploading and executing a stored Si program will not change the power-up mode of the drive to PM1. The program may be uploaded and executed, but the drive will not power up and execute the Si program until after a download through the *Si Programmer* software.

*NOTE: If the drive is configured for power-up modes 1 or 3, it will not respond to SCL commands issued by a host device. If SCL communications are required in this scenario, the host device must recognize the drive's power-up packet and issue the response “00” (double-zero, no carriage return) within two seconds to force the drive into SCL mode without altering the PM setting. See Appendix B for further information.*

### Command Details:

Structure	PM {Parameter #1}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes (see note below)
Register Access	None

### Parameter Details:

Parameter #1	Power on mode
- units	integer code
- range	1 = Si Program (Si versions only) 2 = Q / SCL (drive enabled) 3 = Quick Tuner (servos) or Configurator (steppers) 4 = SiNet Hub 5 = Q / SCL (drive disabled) 6 = not used 7 = Q Program, Auto-execute (Q drives only) 8 = Modbus (drive enabled) 9 = Modbus, auto-execute Q program 10 = Modbus (drive disabled)

*NOTE: This data is saved to non-volatile memory immediately upon execution. It is not required to execute the SA command to save to non-volatile memory.*

### Examples:

Command	Drive sends	Notes
PM2	-	Drive will power up in Q / SCL mode (drive enabled)
PM	PM=2	

## PN - Probe On Demand

Compatibility: Stepper drives  
 See also: EF, MC commands

Perform a full-current probe of the motor. The motor's maximum rated current is used as defined by the MC command. This allows the drive to dynamically measure electrical parameters such as inductance and resistance, which are used to optimize the drive's control over the motor.

This probe is automatically done on power-up and after an EF command is issued, but may be performed at any time using the PN command.

*NOTE: This operation will briefly energize the motor with full current. Use caution when executing the PN command as this may cause slight movement of the motor shaft.*

### Command Details:

Structure	PN
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
PN	-	Perform a full-current probe of the motor.

## PP - Power-up Peak current

Compatibility: Servo drives only  
 Affects: Motor current, especially during acceleration and deceleration  
 See also: CC, CP, PC commands

Sets or requests the power-up peak (RMS) current setting of the servo drive. This command differs from the CP command in that in addition to setting the peak current of the drive, PP also immediately saves the setting to NV memory. In other words, PP = CP + SA.

### Command Details:

Structure	PP{Parameter #1}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None

### Parameter Details:

Parameter #1	Power-up peak current limit
- units	amps RMS (resolution is 0.01 amps)
- range	BLuDC4: 0 - 13.5 BLuDC9: 0 - 18.0 BLuAC5: 0 - 15.0 SV7: 0 - 7.0 SVAC3 (120V): 0 - 7.5 SVAC3 (220V): 0 - 3.75

### Examples:

Command	Drive sends	Notes
PP6	-	Set power-up peak current to 6.0 amps RMS
PP	PP=6	

## PR - Protocol

Compatibility: All drives  
 Affects: RS-232 & RS-485 Serial Communications  
 See also: BR and PB commands

Sets or requests the serial communication protocol settings. Sets or requests the serial communication protocol settings. There are a number of settings that can be turned on or off in the PR command. Each setting is assigned a bit in a 9 - bit binary word. The parameter of the PR command is the decimal equivalent of this word. If you send the PR command without a parameter the drive will respond with the decimal equivalent of the word as well. The different protocol settings and their bit assignments are shown below.

### Command Details:

Structure	PR{Parameter #1}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	None

### Parameter Details:

Parameter #1	Protocol code
- units	decimal (integer) value of binary word
- range	1 - 511 (000000001 - 111111111)  bit 0 = Default ("Standard SCL") bit 1 = Always use Address Character bit 2 = Ack/Nack bit 3 = Checksum bit 4 = (reserved) bit 5 = 3-digit numeric register addressing bit 6 = Checksum Type (step-servo and SV200 only) bit 7 = Little/Big Endian in Modbus Mode bit 8 = Full Duplex in RS-422

\*Bit 0 is only required when all other bits are set to 0. If any other bit in the word is set to 1, Bit 0 is ignored.

For example, PR4 and PR5 provide the same protocol settings.

Bit3 = 1: has checksum / 0: No checksum

Bit6 = 1: STM type checksum / 0: SSM type checksum

\*For more details about STM type checksum and SSM type checksum, please refer to Appendix D.

Bit7 = 1: Little Endian / 0: Big Endian

Bit8 = 1: Full Duplex / 0: Half Duplex

### Examples:

Command	Drive sends	Notes
PR1	-	Set to standard SCL protocol
PR4	-	Turn Ack/Nack on
PR	PR=4	

---

### PS - Pause

---

Compatibility: All drives  
See also: BS, CT command

Suspends execution of buffered commands until the next CT (Continue) command is executed. This can be useful for coordinating motion among axes by first pausing (PS) the drives, then loading the drives' command buffers with commands, and then resuming command execution (CT) in all drives at once. PS can also be useful for holding a sequence of commands in the drive's command buffer to time with an external event. Use the PS command to pause the command buffer, then send each (buffered type) command in the desired sequence to the drive. When the timing with the external event occurs, simply send the CT command which will trigger the execution of the already buffered sequence of commands.

*NOTE: It is possible to overflow the command buffer. Use the BS (Buffer Status) command to view how many command spaces are vacant in the buffer at any given time.*

#### Command Details:

Structure	PS
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

#### Examples:

Command	Drive sends	Notes
PS	-	Pause execution of buffered commands

## PT - Pulse Type

Compatibility: All drives  
 See also: CM, EG commands

Sets or requests the type of incoming pulse used in CM7 (Pulse and Direction mode).

The possible input signals are as follows:

- 0 = Step / Direction
- 1 = CW / CCW Pulse
- 2 = AB Quadrature (master encoder)
- 4 = Step / ~Direction (direction input is reversed from PT0)
- 6 = BA Quadrature (count direction is reverse of PT2)

### Command Details:

Structure	PT{Parameter #1}
Type	BUFFERED
Usage	READ / WRITE
Non-Volatile	YES
Register Access	None

### Parameter Details:

Parameter #1	Pulse Type
- units	integer
- range	0, 1, 2, 4, or 6

### Examples:

Command	Drive sends	Notes
PT0	-	Instruct the drive to follow step/direction pulses from a master controller.
PT	PT=0	
PT2	-	Instruct the drive to follow AB quadrature encoder pulses, typically from a master encoder.
PT	PT=2	



### PV - Secondary Electronic Gearing

Compatibility: SV200 series servo drives only  
Affects: Control mode 7  
See also: EG, DS Commands

This parameter determines the second electronic gearing of SV200 drives. This secondary electronic gearing can be selected with the X9 digital input. See DS command or **SVX Servo Suite** for configuration of X9 input.

#### Command Details:

Structure	PV{Parameter #1}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None

#### Parameter Details:

Parameter #1	See above
- units	Integer(counts/rev)
- range	10~51200
-default	20000

#### Examples:

Command	Drive sends	Notes
PV20000	%	set the second electronic gearing to 20000 counts/rev
PV	PV=20000	the second electronic gearing is 20000 counts/rev

## PW - Password

Compatibility: Q drives only

Normally the stored program of a Q drive can be uploaded and downloaded at will. This allows basically any user to access the stored program of a Q drive. To password-protect the stored program of a Q drive the PW command can be issued with a customized key code.

The factory default key code is “1234”, which allows uploading and downloading programs freely. To password-protect a stored program the user should enter the PW command with a new key code. This new key code can be any 4 character alpha-numeric code (characters A-Z, a-z, and 0-9 are acceptable). After entering the new key code the user must enter the SA (Save) command for the new key code to be saved in the drive. Then, the next time the drive is powered up password-protection will take effect, which means the user must first “unlock” the drive by sending the PW command with the customized key code before being able to upload (QU), save (QS), or delete (QD) any part of the Q drive’s stored program. (All other immediate commands function even if the drive is not “unlocked”). Furthermore, every subsequent power-up of the drive will require the same key code to be entered before uploading. To change the key code, enter the present key code at power up and then use the PW command to enter a new key code followed by the SA command. To return the drive to the default state of no-password protection, unlock the drive first by using the present key code, then enter the default key code of “1234” followed by the SA command.

*NOTE: If the key code is forgotten or lost, re-entering the default code of “1234” will unlock the drive and ERASE THE CONTENTS OF THE DRIVE’S NON-VOLATILE MEMORY AT THE SAME TIME.*

### Command Details:

Structure	PW(Parameter #1)
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	Yes
Register Access	None

### Parameter Details:

Parameter #1	4-digit alphanumeric key code
- units	upper and lower-case letters and numbers
- range	A-Z, a-z, 0-9
- default	Default key code is “1234”

### Examples:

Command	Drive sends	Notes
PWak99	-	Password key code set to “ak99”
SA	-	New key code saved in drive
PWak99	-	Access to stored program unlocked at next power-up of drive

### QC - Queue Call

Compatibility: Q drives only

See also: QX, QE, QL commands

Loads a program segment from non-volatile memory into the queue and begins executing at line #1. Loads the “calling” segment location and the line where the call occurred into a call “stack”. When a QC command without a parameter is encountered in the segment a “return” to the calling segment is activated. The “calling” segment is loaded from non-volatile memory back into the queue and begins executing at the line immediately following the line number of the original “calling” QC command.

The call stack can go 5 calls deep which means you can nest up to 5 calls. If the number of calls before a “return” (QC with no parameter) is encountered exceeds 5 the “calling” QC command (with parameter) is ignored. If a “return” is encountered without a previous call, the return is ignored.

#### Command Details:

Structure	QC{Parameter #1}
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

#### Parameter Details:

Parameter #1	Program segment, no parameter means return to calling segment
- units	integer
- range	1 - 12 = segment 1 - 12 no parameter = return to calling segment

#### Examples:

Command	Drive sends	Notes
QC4	-	Call segment 4
QC	-	Return to calling segment

---

## QD - Queue Delete

---

Compatibility: Q drives only  
See also: QL, QS, PW commands

Deletes the contents of the non-volatile memory location associated with a particular program segment.

### Command Details:

Structure	QD(Parameter #1)
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Segment number
- units	integer number
- range	1 - 12

### Examples:

Command	Drive sends	Notes
QD5	-	Delete program segment 5 from the drive's non-volatile memory

---

## QE - Queue Execute

---

Compatibility: Q drives only  
See also: QL, QX

Begins executing a program segment previously loaded into the queue. Starts executing at line #1. A segment must have previously been loaded using the “QL” or “QX” commands.

### Command Details:

Structure	QE
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
QE	-	Begin execution of loaded segment

---

## QG - Queue Goto

---

Compatibility: Q drives only  
See also: QJ, QR

Causes program segment execution to jump to the given line number in the queue. Gotos directed to the same line number as the QG command or past the end of the queue are ignored.

### Command Details:

Structure	QG(Parameter #1)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Segment line number
- units	integer
- range	1 - 62

### Examples:

Command	Drive sends	Notes
QG10	-	Cause a jump to line 10 in the segment

## QJ - Queue Jump

Compatibility: Q drives only  
 Affects: Program flow  
 See also: QG, TI, TR, CR and all Math commands ("R" commands)

Causes program segment execution to jump to the given line number in the queue based on a "condition code". Jumps directed to the same line number as the QJ command or past the end of the queue are ignored. If the condition code is met the jump occurs, if not the program proceeds to the next line. Condition codes are set by previous commands such as the TI (Test Input) or TR (Test Register) commands. When using math commands ("R" commands) the condition code is set based on the result of the math operation.

### Command Details:

Structure	QJ(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Condition code
- units	letter
- range	T = True F = False P = Positive G = Greater than L = Less than E = Equals U = Unequal Z = Zero
Parameter #2	Segment line number
- units	integer
- range	1 - 62

### Examples:

Command	Drive sends	Notes
TI4L	-	Test input 4 to see if it's low (active)
QJT15	-	Jump to line 15 if condition code is "True" (i.e. input 4 is low)

---

## QK - Queue Kill

---

Compatibility: Q drives only  
Affects: Queue execution and program flow  
See also: SK

Halts execution of the queue. The queue contents are not affected and can be executed again using the “QE” command.

### Command Details:

Structure	QK
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
QK	-	Stop execution of the queue/program



### QL - Queue Load

Compatibility: Q drives only  
Affects: Contents of command buffer  
See also: QE, QS, QX commands

Initiates the loading of a command sequence into the queue. Loading can come from the serial port (host controller) or from non-volatile memory (stored program). When no parameter is sent with the command loading is done from the serial port. Loading is finished when a QS (Queue Save) or QE (Queue Execute) command is sent. When a parameter is sent with the command the parameter designates the non-volatile memory location of the desired program segment to be loaded into the queue. QL will cause an overwrite of any commands in the queue starting at line #1.

#### Command Details:

Structure	QL{Parameter #1}
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

#### Parameter Details:

Parameter #1	Program segment number
- units	integer
- range	1 - 12

#### Examples:

Command	Drive sends	Notes
QL	-	Initiates loading queue from serial port
QL3	-	Loads segment from non-volatile memory into the queue

## QR - Queue Repeat

Compatibility: Q drives only  
 Affects: Selected data register  
 See also: QJ, QG, RL, RX commands

Causes program segment execution to jump to a previous line number in the queue for a given number of repeat counts. The repeat count is acquired from a selected Read/Write or User-Defined data register. Jumps past the end of the queue are ignored. Jumps to subsequent line numbers in the queue will not be repeated. If repeat count is set to "1" no Jump is performed. The data register selected for the repeat count must be set with the number of repeat counts prior to using the QR command: use the RX (Register Load - buffered) command to load the data register with the repeat count. The data register contents are affected by this command and must be re-loaded before each usage with the QR command.

*NOTE: Although data registers A - Z can be used with the QR command it is not recommended. The QR command eventually destructs the data in a register by decrementing its value each time a jump is made in the repeat loop and could therefore lead to unexpected results in other parts of the program that make use of data registers A - Z.*

### Command Details:

Structure	QR(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Data register
- units	register character
- range	A - Z and all user-defined registers (listed in the Data Registers section)
Parameter #2	Segment line number
- units	integer
- range	1 - 62

### Sample Program:

Segment 1					
Line	Label	Cmd	Param1	Param2	Comment
1		RX	2	4	set up loop counter
2	LABEL1	DI	2000		set move distance
3		FL			do a point to point move
4		QR	2	#LABEL1	loop
5					
6					

---

## QS - Queue Save

---

Compatibility: Q drives only  
Affects: None  
See also: QE, QL, QX, PW commands

Saves a segment currently in the queue to a non-volatile memory location. Ends a QL (Queue Load) if one is in progress. See Appendix B for more details on this command, including its limitations.

### Command Details:

Structure	QS(Parameter #1)
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Program segment location
- units	integer
- range	1 - 12

### Examples:

Command	Drive sends	Notes
QS2	-	Save contents of queue to non-volatile memory location #2

## QU - Queue Upload

Compatibility: Q drives only  
 See also: QL, QE, QS, QX, PW commands

Uploads a stored program segment from the drive's non-volatile memory to the serial port. This command is used to retrieve stored program segments from the drive. When using this command the drive responds with either a "positive" or a "negative" response. A "positive" response consists of a normal acknowledge ("ack") followed by the contents of the requested program segment with each line number separated by a carriage return. Program segments 1 to 12 can be uploaded, as well as the contents of the queue. A "negative" response from the drive consists of a normal acknowledge ("ack") followed by one of four error codes: 0, -1, -2, or -3. A *negative acknowledge ("nack" / "?") will be sent from the drive if the command is not understood by the drive. See Appendix D for more information on acknowledge and negative acknowledge responses.*

Positive response format:

"ack" ("%")  
 First line = "QU##" where "##" = the number of lines in the segment + 1  
 Second line = command at line 1 of the segment  
 Next line = command at line 2 of the segment  
 ...  
 Last line = command at last line of segment

Negative Responses:

"ack" ("%")  
 QU0 = No segment at specified location  
 QU-1 = Program Running (Cannot upload at this time)  
 QU-2 = Upload currently in process  
 QU-3 = Password Protected (Protection must be unlocked using PW command)

### Command Details:

Structure	QU(Parameter #1)
Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Program segment location
- units	integer
- range	1 - 12, or 0 to upload queue

### Examples:

Command	Drive sends	Notes
QU0	(queue contents)	Uploads contents of queue to the serial port
QU3	(segment #3 contents)	Uploads contents of segment from non-volatile memory location #3

---

## QX - Queue Load & Execute

---

Compatibility: Q drives only  
Affects: Stored program flow  
See also: QE, QL

Loads a program segment from non-volatile memory into the queue. Begins executing the segment at line #1. This is similar to the combination of a QL (Queue Load) and a QE (Queue Execute) command with the difference being the QX command can be written into a stored program segment. Use this command to “jump” from segment to segment.

### Command Details:

Structure	QX(Parameter #1)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Program segment location
- units	integer
- range	1 - 12

### Examples:

Command	Drive sends	Notes
QX2	-	Loads segment #2 and begins execution

## RC - Register Counter

Compatibility: Q drives only  
 Affects: Data Register "I" (025)  
 See also: RL, RX , RI, RD, TS commands

This command enables a function that increments the "I" data register when the given input condition (determined by the RC command) is met. Typically the "R" or "F" input condition (see Details below) is used to trigger an increment. If however the "L" or "H" input condition is used the register will be incremented at a rate of 8000 times per second. In other words the "R" and "F" input conditions are used for true input counting while the "L" and "H" conditions act as input timers. Use the RL (Register Load - immediate) or RX (Register Load - buffered) commands to preset or set the "I" data register to a predetermined value. Sending the RC command without a parameter disables the function.

This command is also used in conjunction with the TS (Time Stamp) command. See the TS command for more details.

### Command Details:

Structure	RC{Parameter #1}
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	"I" (025)

### Parameter Details:

(See Appendix F: Working With Inputs and Outputs)

### Examples:

Command	Drive sends	Notes
RC4F	-	Increment data register "I" each time input 4 changes from high to low (falling edge)

The sample Q program on the following page illustrates the interaction of the RC and TS commands. After initialization, the program waits for a falling edge event on input X3, at which point a 5 second timer begins counting down. During this delay, the user may trigger X3 an arbitrary number of times. After 5 seconds, the motor will execute a series of 5000-step moves, with the delay between each corresponding to the delay between switch closures on X3. That is, if the user trips X3 four times waiting 1 second between each event, the motor will execute four 5000-step moves with a 1 second dwell between each.

## Host Command Reference

Sample Q program for illustrating RC and TS interaction

	MT	1		Multi-tasking ON
	EG	20000		20,000 steps/rev
	AC	250		
	DE	250		
	VE	5		
	FI	3	200	Filter input 3 for 200 processor ticks
	RX	I	0	Zero the "I" register
	RC	X3F		Setup the "I" register for input X3
	WI	X3F		Wait for input X3
	WT	5.00		Wait 5 seconds >>> trigger inpuxt X3 a few times
	TS			Throw away first time stamp
LABEL2	RD	I		Decrement "I" register
	FL	5000		Feed 5000 steps
	TR	I	1	Test "I" against 1
	QJ	L	#LABEL1	Jump to end if "I" less than 1
	TS			Time stamp
	RM	W	1	Move "W" into "1"
	WD	1		Delay for "1" milliseconds
	QG	#LABEL2		Go to Label 2
LABEL1	NO			Stop program

## RD - Register Decrement

Compatibility: Q drives only  
 Affects: All data registers  
 See also: RI, RM

Decrements by 1 the value of the designated data register.

### Command Details:

Structure	RD(Parameter #1)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	All Read/Write and User-Defined data registers

### Parameter Details:

Parameter #1	Data register assignment
- units	character
- range	all Read/Write and User-Defined data registers

### Examples:

Command	Drive sends	Notes
RDV	-	Decrements the value of the velocity data register "V"



---

## RE - Restart or Reset

---

Compatibility: All drives

Restarts the drive by resetting fault conditions and re-initializing the drive with the startup parameters. Leaves the drive in a disabled state to prevent any movement after the restart is complete.

### Command Details:

Structure	RE
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
RE	-	Resets drive condition and parameters

## RI - Register Increment

Compatibility: Q drives only  
 Affects: All data registers  
 See also: RD, RM commands

Increments by 1 the value of the designated data register.

### Command Details:

Structure	RI(Parameter #1)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	All Read/Write and User-Defined data registers

### Parameter Details:

Parameter #1	Data register assignment
- units	character
- range	all Read/Write and User-Defined data registers

### Examples:

Command	Drive sends	Notes
RIV	-	Increments the value of the velocity data register "V"

## RL - Register Load - immediate

Compatibility: All drives  
 Affects: All data registers  
 See also: RX, RI, RD, RM commands

Sets a data register to the given immediate data value. The data value is checked and stored as a Long word. When setting a Short-word register with the given Long-word data value only the lower word of the Long value is used.

### Command Details:

Structure	RL(Parameter #1){Parameter #2}
Type	IMMEDIATE
Usage	READ/WRITE
Non-Volatile	NO
Register Access	All data registers

### Parameter Details:

Parameter #1	Data register assignment
- units	character
- range	All Read/Write and User-Defined data registers; Read-Only data registers can be read back when Parameter #2 is not included
Parameter #2	Data register value
- units	integer
- range	+/- 2147483647 (long data registers) +/- 32767 (short data registers)

### Examples:

Command	Drive sends	Notes
RLA100	-	Set acceleration register to 1000 rpm/s
RLA	RLA=100	Return acceleration register value

When PR command Bit 5 is set

RL017100	-	Set Acceleration register to 1000 rpm/s
RL017	RLA=100	Return acceleration register value

NOTE: When setting a register no pre-processing of the data value is performed. Data is set to the internal raw value. For example, the internal raw acceleration value is in tens of rpm/s. See the "Data Register" section at the beginning of this manual for more details on data register assignments and units.

Units Example:

AC10 means 10 rps/s

RLA10 means  $10 * 10 \text{ rpm/s} = 1.667 \text{ rps/s}$

Multiply the desired rps/s value times 6 to convert to the "raw" acceleration value

## RM - Register Move

Compatibility: Q drives only  
 Affects: All data registers  
 See also: RI, RD, RL, TR, RX commands

Move the contents of a first data register into a second data register.

### Command Details:

Structure	RM(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	All Read/Write and User-Defined data registers

### Parameter Details:

Parameter #1	Source data register
- units	character
- range	all data register assignments
Parameter #2	Destination data register
- units	character
- range	all Read/Write and User-Defined data registers

### Examples:

Command	Drive sends	Notes
RMAB	-	Move contents of acceleration register "A" into the deceleration register "B"

---

## RO - Anti-Resonance ON

---

Compatibility: Stepper drives

Enables or disables the Anti-Resonance algorithm. This command has the same effect as the “Anti-Resonance off” check box in ST Configurator’s motor configuration dialog.

### Command Details:

Structure	RO{Parameter #1}
Type	BUFFERED
Usage	READ / WRITE
Non-Volatile	YES
Register Access	None

### Parameter Details:

Parameter #1	Anti-Resonance Algorithm Status
- units	integer
- range	0 (Anti-Resonance OFF) 1 (Anti-Resonance ON)

### Examples:

Command	Drive sends	Notes
RO1	-	Enable Anti-Resonance algorithm
RO	RO=1	
RO0	-	Disable Anti-Resonance algorithm
RO	RO=0	

## RR - Register Read

Compatibility: Q drives only  
 Affects: All data registers  
 See also: RI, RD, RL, RM, RW commands

Reads a data value from a non-volatile memory location into a data register. The data value is read as a Long word. If the value being read is too large for the destination data register, the value is truncated.

### Command Details:

Structure	RR(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	All Read/Write and User-Defined data registers

### Parameter Details:

Parameter #1	Data register
- units	character
- range	all Read/Write and User-Defined data registers
Parameter #2	Non-volatile memory location
- units	integer
- range	1 - 100

### Examples:

Command	Drive sends	Notes
RRV10	-	Read data from non-volatile memory location #10 and place it in data register "V"

---

## RS - Request Status

---

Compatibility: All drives  
See also: SC command

Asks the drive to respond with what it's doing. The drive has a number of different states of operation that are represented by character codes. The drive can send more than one code at a time to define its current status.

### Command Details:

Structure	RS
Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
RS	RS=PR	Motor is in position, drive is enabled
RS	RS=AED	Alarm code is present, drive is faulted and disabled
RS	RS=JR	Motor is jogging, drive is enabled

Status character codes:

A = An Alarm code is present (use AL command to see code, AR command to clear code)

D = Disabled (the drive is disabled)

E = Drive Fault (drive must be reset by AR command to clear this fault)

F = Motor moving

H = Homing (SH in progress)

J = Jogging (CJ in progress)

M = Motion in progress (Feed & Jog Commands)

P = In position

R = Ready (Drive is enabled and ready)

S = Stopping a motion (ST or SK command executing)

T = Wait Time (WT command executing)

W = Wait Input (WI command executing)

## RU - Register Upload

Compatibility: Q drives only  
 Affects: All data registers  
 See also: PR, RL, RX commands

Upload the contents of an array of data registers. Up to 16 registers can be read back with one RU command. Each reading is terminated with a carriage return.

### Command Details:

Structure	RU(Parameter #1)(Parameter #2)
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	All data registers

### Parameter Details:

Parameter #1	Data register assignment
- units	character
- range	all data registers
Parameter #2	Number of consecutive data registers to upload
- units	integer
- range	1 - 16

### Examples:

Command	Drive sends	Notes
RUA5	RUA=400	"A" The Acceleration value RUB=400      "B" The Deceleration value RUC=16000    "C" The Distance Change value RUD=8000     "D" The Distance value RUE=0        "E" The Encoder value

When PR command Bit 5 is set		
RU0175	RUA=400	"017" The Acceleration value RUB=400      "018" The Deceleration value RUC=16000    "019" The Distance Change value RUD=8000     "020" The Distance value RUE=0        "021" The Encoder value

NOTE: All Data values are "raw" meaning the data is not scaled to the drive user units. For example the velocity value ("V") will be returned as 0.25 rpm instead of rps: raw value of 2400 = 10 rps.



---

## RV - Revision Level

---

Compatibility: All drives  
See also: MV command

Requests the drive's firmware version. Data is returned as a three digit value. To see the firmware version's sub-letter as well (if applicable) use the MV command.

### Command Details:

Structure	RV
Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None
Units	Drive firmware version

### Examples:

Command	Drive sends	Notes
RV	RV=150	Drive is running firmware version 1.50

## RW - Register Write

Compatibility: Q drives only  
 Affects: All data registers  
 See also: RI, RD, RL, RM, RW commands

Writes the data value of a given data register into non-volatile memory. The data value is written as a Long word. See Appendix A for more details on this command, including its limitations.

*NOTE: The RW function writes information to flash memory, which has a useful life of 10,000 write cycles.*

### Command Details:

Structure	RW(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	All Read/Write and User-Defined data registers

### Parameter Details:

Parameter #1	Data register assignment
- units	character
- range	all Read/Write and User-Defined data registers
Parameter #2	Non-volatile memory location
- units	integer
- range	1 - 100

### Examples:

Command	Drive sends	Notes
RWV10	-	Write data from data register "V" into non-volatile memory location #10

## RX - Register Load - buffered

Compatibility: Q drives only  
 Affects: All data registers  
 See also: RL, RU, RM, QR commands

Sets a data register to the given immediate data value. The data value is checked and stored as a Long word. When loading a Short-word data register with the given Long-word data value only the lower word of the Long value is used. This command is the same as the RL command except it is a buffered command and therefore can be placed in a stored program.

### Command Details:

Structure	RX(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	NO
Register Access	All data registers

### Parameter Details:

Parameter #1	Data register assignment
- units	character
- range	All Read/Write and User-Defined data registers; Read-Only data registers can be used when Parameter #2 is not included (i.e. for reading back the contents of a Read-Only data register)
Parameter #2	Data register value
- units	integer
- range	+/- 2147483647 (long data registers) +/- 32767 (short data registers)

### Examples:

Command	Drive sends	Notes
RXA100	-	Set acceleration register "A" to 1000 rpm/s
RXA	RXA=100	

## R+ - Register Add

Compatibility: Q drives only  
 Affects: All data registers  
 See also: R-, R\*, R/, R&, RD, RI, QJ commands

Adds the contents of a first data register to a second data register and places the result in the accumulator data register, User-Defined register "0". This is a 32-bit operation: adding two Long word values can cause an overflow.

All math operations affect the "condition code" used by the QJ (Queue Jump) command. R+ can set condition codes T, F, N, P, and Z

### Command Details:

Structure	R+(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	"0" (000), Accumulator

### Parameter Details:

Parameter #1	First data register assignment
- units	character
- range	all data registers
Parameter #2	Second data register assignment
- units	character
- range	all data registers

### Examples:

Command	Drive sends	Notes
R+D1	-	Add contents of distance register "D" to user-defined register "1" and place the result in the accumulator register "0"

## R- - Register Subtract

Compatibility: Q drives only  
 Affects: All data registers  
 See also: R+, R\*, R/, R&, RD, RI, QJ commands

Subtracts the contents of the second data register from the first data register and places the result in the accumulator data register, User-Defined register "0". This is a 32-bit operation: subtracting two Long word values can cause an underflow.

All math operations affect the "condition code" used by the QJ (Queue Jump) command. Can set condition codes T, F, N, P, and Z.

### Command Details:

Structure	R-(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	"0" (000), Accumulator

### Parameter Details:

Parameter #1	First data register assignment
- units	character
- range	all data registers
Parameter #2	Second data register assignment
- units	character
- range	all data registers

### Examples:

Command	Drive sends	Notes
R-D1	-	Subtract the contents of user-defined register "1" from the distance register "D" and place the result in the accumulator register "0"

## R\* - Register Multiply

Compatibility: Q drives only  
 Affects: All data registers  
 See also: R+, R-, R/, R&, RD, RI, QJ commands

Multiply the contents of the first data register by the second data register and place the result in the accumulator data register, User-Defined register "0". This is a 32-bit operation: multiplying two Long word values can cause an overflow.

All math operations affect the "condition code" used by the QJ (Queue Jump) command. Can set condition codes T, F, N, P, and Z.

### Command Details:

Structure	R*(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	"0" (000), Accumulator

### Parameter Details:

Parameter #1	First data register assignment
- units	character
- range	all data registers
Parameter #2	Second data register assignment
- units	character
- range	all data registers

### Examples:

Command	Drive sends	Notes
R*D1	-	Multiply contents of distance register "D" by contents of user-defined register "1" and place result in accumulator register "0"

## R/ - Register Divide

Compatibility: Q drives only  
 Affects: All data registers  
 See also: R+, R-, R\*, R&, RD, RI, QJ commands

Divide the contents of the first data register by the second data register and place the result in the accumulator data register, User-Defined register "0". This is a 32-bit operation. A value of "zero" in the second data register will cause an illegal "divide by zero", in which case the divide operation is ignored.

All math operations affect the "condition code" used by the QJ (Queue Jump) command. Can set condition codes T, F, N, P, and Z.

### Command Details:

Structure	R/(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	"0" (000), Accumulator

### Parameter Details:

Parameter #1	First data register
- units	data register assignment
- range	All data registers
Parameter #2	Second data register
- units	data register assignment
- range	All data registers

### Examples:

Command	Drive sends	Notes
R/D1	-	Divide contents of distance register "D" by user-defined register "1" and place result in accumulator register "0"

## R& - Register AND

Compatibility: Q drives only  
 Affects: All data registers  
 See also: R+, R-, R\*, R/, RD, RI, QJ commands

Do a “bit-wise” AND of the contents of the first data register with the contents of the second data register and place the result in the accumulator data register, User-Defined register “0”. This is a 32-bit operation. This operation affects the “condition code” use by the QJ (Queue Jump) command.

All math operations affect the “condition code” used by the QJ (Queue Jump) command. Can set condition codes T, F, N, P, and Z.

### Command Details:

Structure	R&(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	“0” (000), Accumulator

### Parameter Details:

Parameter #1	First data register
- units	data register assignment
- range	All data registers
Parameter #2	Second data register
- units	data register assignment
- range	All data registers

### Examples:

Command	Drive sends	Notes
R&s1	-	AND the contents of status register “s” and user-defined register “1” and place the result in accumulator register “0”



## RI - Register OR

Compatibility: Q drives only  
 Affects: All data registers  
 See also: R+, R-, R\*, R/, R&, RD, RI, QJ commands

Do a “bit-wise” OR of the contents of the first data register with the contents of the second data register and place the result in the accumulator data register, User-Defined register “0”. This is a 32-bit operation.

All math operations affect the “condition code” used by the QJ (Queue Jump) command. Can set condition codes T, F, N, P, and Z.

### Command Details:

Structure	RI(Parameter #1)(Parameter #2)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	“0” (000), Accumulator

### Parameter Details:

Parameter #1	First data register
- units	data register assignment
- range	All data registers
Parameter #2	Second data register
- units	data register assignment
- range	All data registers

### Examples:

Command	Drive sends	Notes
Rli1	-	OR the contents of inputs register “i” with user-defined register “1” and place the results in accumulator register “0”

---

## SA - Save Parameters

---

Compatibility: All drives  
See Also: RE command

Saves selected command parameters to non-volatile memory. This command is useful for setting up the drive configuration with the desired defaults at power-up. (See which commands are non-volatile in the Command Summary section.)

NOTE: Excessive use of this command will wear out the NV memory. Use of this command within a Q program is not advised for this reason.

### Command Details:

Structure	SA
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
SA	-	Save all Non-Volatile-designated data registers

## SC - Status Code

Compatibility: All drives  
See also: RS command

Requests the current drive status as the Hexadecimal equivalent of a binary word. Each bit in the binary word relates to a status condition (see assignments below). The representation of this binary word as a hexadecimal value is called the Status Code. Drives can have multiple status conditions at one time, and host systems can typically interpret a Hexadecimal code very quickly. See Appendix E for more details on the Status Code.

### Command Details:

Structure	SC
Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None
Units	Hexadecimal equivalent of the binary status code word (see bit assignments below)

### Response Details:

Hex Value	Status Code bit definition
0001	Motor Enabled and in position (Motor Disabled if this bit = 0)
0002	Sampling (for Quick Tuner)
0004	Drive Fault (check Alarm Code)
0008	In Position (motor is in position), only valid on servo and StepSERVO drives
0010	Moving (motor is moving)
0020	Jogging (currently in jog mode)
0040	Stopping (in the process of stopping from a stop command)
0080	Waiting (for an input; executing a WI command)
0100	Saving (parameter data is being saved)
0200	Alarm present (check Alarm Code)
0400	Homing (executing an SH command)
0800	Waiting (for time; executing a WD or WT command)
1000	Wizard running (Timing Wizard is running)
2000	Checking encoder (Timing Wizard is running)
4000	Q Program is running
8000	Initializing (happens at power up) ; Servo Ready (for SV200 drives only)

### Examples:

Command	Drive sends	Notes
SC	SC=0009	Drive is in position and enabled (hex values 0001 and 0008)
SC	SC=0004	Drive is faulted and disabled (hex value 0004)
SC	SC=0209	Drive has an alarm, is in position and enabled (hex values 0001, 0008, and 0200)

## SD - Set Direction

Compatibility: Integrated Steppers with Flex I/O  
 Affects: All input and output commands  
 See Also: AI, AO, BO, DL, MO and SI

The Flex I/O feature allows the user to specify the direction of each I/O point. That is, to configure each as either an input or output. SD may be used as a query if issued without a parameter. The drive will then report the direction of each I/O point.

**WARNING:** The SD command allows dynamic changes to I/O behavior of the drive, and may cause unintended interactions with other machine components if not implemented properly. Extreme caution should be used. The SD command is documented here only for completeness; Applied Motion Products strongly recommends that the Configurator software be used to make changes to drive I/O behavior.

### Command Details:

Structure	SD{Parameter #1}{Parameter #2}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	None

### Parameter Details:

Parameter #1	I/O point to configure
- units	Integer
- range	1 - 4
Parameter #2	Direction (input or output)
- units	Single character
- range	'I' or 'O' (letter 'O', not zero)

**NOTE:** This command requires either the letter 'I' (input) or 'O' (output) as Parameter #2. The drive's response however, is composed of the numbers 1 (one = input) or 0 (zero = output).

### Examples:

Command	Drive sends	Notes
SD2O	-	Set I/O point 2 as an Output
SD4I	-	Set I/O point 4 as an Input
SD	SD=00000111	Drive reports that I/O points 1, 2 and 3 are inputs, 4 is an output. (Note: on the STM24, I/O points 5-8 are unused)

---

## SF - Step Filter Frequency

---

Compatibility: Stepper drives only

Sets or requests the step filter frequency. The primary use of this filter is to introduce “microstep emulation” effects, which smooth out low resolution step pulses when the drive’s microstep/gearing resolution (EG command) is set to a low value. This command is exceptionally useful when using a low-resolution indexer and smooth motor shaft rotation is required.

### Command Details:

Structure	SF{Parameter #1}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	None

### Parameter Details:

Parameter #1	Step filter frequency
- units	Hz
- range	0 - 2500

### Examples:

Command	Drive sends	Notes
SF500	-	Set step filter frequency to 500 Hz
SF	SF=500	

## SH - Seek Home

Compatibility: All drives  
 See Also: DL, FD, FS, FY, MT commands

Executes the seek home command. Requires input number and condition for the home sensor. Speed is set by the last VE command. Accel and decel are set by AC and DE. Direction comes from the sign of the last DI command ("- is CCW, no sign is CW).

It should be noted that the SH command is not affected by multitasking. It will execute as shown here regardless of the current MT setting. Please see the MT command for details.

The SH command performs a number of operations all combined into one command. The basic operation acts like a combination of the FS (Feed to Sensor) and FP (Feed to Position) commands. First, an FS-like move is made that runs the motor until the drive "sees" the home sensor. When the drive sees this home sensor it does two things: it records the absolute position of the home sensor and it immediately starts decelerating the motor to a stop. After the motor has come to a stop the drive then does an FP-like move to move the motor back to the absolute position recorded for the home sensor. Another function of the SH command is that if an end-of-travel limit switch is encountered before the home sensor condition is met, the move direction is reversed until the opposite limit is found. After the opposite limit is found the move then returns to the original direction and again attempts to find the home sensor. This always ensures that the motor is moving in the desired direction when the drive sees the home sensor.

*NOTE: This command is designed for use with three physical sensors or switches tied to three separate digital inputs of the drive: a home sensor, a CW end-of travel limit, and a CCW end-of-travel limit.*

### Command Details:

Structure	SH{Parameter #1}
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

(See Appendix F: Working With Inputs and Outputs)

### Examples:

Command	Drive sends	Notes
SH1L	-	Seek home to input 1 low
SH3R	-	Seek home to input 3 rising edge
SHX5L	-	Seek home to input X5 low (main driver board input)

*NOTE: It may be necessary to add an 'X' in front of the input number '0' when using the Seek Home command with the encoder index (X0) as Param1. This is necessary on BLu servo drives.*

---

## SI - Enable Input Usage

---

Compatibility: All drives  
Affects: Enable input usage  
See also: AI, CM, SD commands

### BLu, SV, STAC6, ST-Q/Si

Sets or requests the usage of the Enable input. Input X3 is the default Enable input on all drives, however IN3 on SE, QE and Si drives may also be designated as the Enable input (see below). If an external Enable function is not needed input X3 and/or IN3 can be defined solely as a general purpose input. In this scenario only the ME and MD commands will enable and disable the drive, respectively. When using the brake output (see BO, BD and BE commands) the disabling of the drive is delayed by the time value set using the BD command.

There are five possible usage states for the Enable function:

SI1: Drive is enabled when X3 is open (inactive, high).

SI2: Drive is enabled when X3 is closed (active, low).

SI3: Neither X3 nor IN3 is used for enabling/disabling the drive, but as general purpose inputs.

SI4: Drive is enabled when IN3 is open (inactive, high). (SE, QE, and Si drives only).

SI5: Drive is enabled when IN3 is closed (active, low). (SE, QE, and Si drives only).

### ST-S, STM17, STM23-Q/C, STM24-C

Defines the EN input as an Enable Input. If you want to use the EN input as an Enable input you can define it as such in two ways, with the *ST Configurator* software, or with the SI command. SI takes no effect if the drive is set in Command Mode (CM) 13, 14, 17 or 18, because these modes use the EN input as a speed change input and take precedence over the SI command. Also, setting the AI command after setting the SI command reassigns the EN input to Alarm Reset usage and turns off any drive enable usage (SI3). In other words, the AI and SI commands, as well as Command Modes (CM) 13, 14, 17 and 18 each assign a usage to the EN input. Each of these must exclusively use the EN input. Note: The STM24-C drive uses IN3 for the Enable Input.

There are three Enable input states that can be defined with the SI command:

SI1: Drive is enabled when the EN input is open (inactive, high).

SI2: Drive is enabled when the EN input is closed (active, low).

SI3: The EN input is not used for Enable and can be used as a general purpose input. SI will be automatically set to 3 if CM is set to 13, 14, 17, or 18, or if AI is set to 1 or 2 after the SI command is set.

### STM24-SF/QF

Drives with Flex I/O allow a second parameter which allows the user to specify the I/O point used. Before an I/O point can be used as the Drive Enable input it must first be configured as an input with the SD command. See the STM24 Hardware Manual for details of which inputs may be used as the Drive Enable input.

Possible uses for the SI command on the STM24 are as follows ('n' denotes the I/O point to be used):

SI1n: Drive is enabled when the designated input is open (inactive, high).

SI2n: Drive is enabled when the designated input is closed (active, low).

SI3n: The specified input ('n') is not used for Drive Enable and may be used as a general purpose input.

**STAC5-S, SVAC3-S**

Defines the X3 input as an Enable Input. If you want to use the X3 input as an Enable input you can define it as such in two ways, with the ST Configurator software, or with the SI command. SI takes no effect if the drive is set in Command Mode (CM) 13, 14, 17 or 18, because these modes use the X3 input as a speed change input and take precedence over the SI command. Also, setting the AI command after setting the SI command reassigns the X3 input to Alarm Reset usage and turns off any drive enable usage (SI3). In other words, the AI and SI commands, as well as Command Modes (CM) 13, 14, 17 and 18 each assign a usage to the X3 input. Each of these must exclusively use the X3 input.

There are three Enable input states that can be defined with the SI command:

SI1: Drive is enabled when the X3 input is open (inactive, high).

SI2: Drive is enabled when the X3 input is closed (active, low).

SI3: The X3 input is not used for Enable and can be used as a general purpose input. SI will be automatically set to 3 if CM is set to 13, 14, 17, or 18, or if AI is set to 1 or 2 after the SI command is set.

**Command Details:**

Structure	SI{Parameter #1} {Parameter #2 (Flex I/O only)}
Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	None

**Parameter Details:**

Parameter #1	Input Usage
- units	integer code
- range	1 - 3 or 1 - 5 (see above)
Parameter #2 (Flex I/O only)	I/O Point (if applicable, see note below)
- units	Integer Code
- range	1 or 3 (See STM24 Hardware Manual for details)

**NOTES:**

- For drives with Flex I/O, the SD command must be executed to set an I/O point as an input or output before it can have a dedicated function assigned to it.
- Parameter #2 only applies to drives equipped with Flex I/O. This includes the STM24SF and STM24QF. Parameter #2 is not defined for drives equipped with standard I/O.

**Examples:****All drives with standard I/O:**

Command	Drive sends	Notes
SI1	-	Cause drive to be enabled when X3 / EN input is open
SI	SI=1	

**Drives with Flex I/O:**

Command	Drive sends	Notes
SD3I	-	Configures I/O 3 as input (see SD command for details)
SI13	-	Cause drive to be enabled when Input 3 is open
SI	SI=13	



---

## SJ - Stop Jogging

---

Compatibility: All drives  
Affects: CJ command  
See Also: JA, CJ, ST, SK, SM commands

Stops the motor when jogging (CJ starts jogging). Jog decel rate is defined by the JA command.

### Command Details:

Structure	SJ
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Examples:

Command	Drive sends	Notes
SJ	-	Stops jogging immediately using the deceleration rate set by the JA command

## SK - Stop & Kill

Compatibility: All drives

See Also: AM, DE, JA, ST, SM commands

Halts any buffered command in progress and removes any other buffered commands from the queue. When used to stop a move deceleration rate is controlled by the AM (Max Acceleration) parameter. If the “D” parameter is used deceleration rate is controlled by either DE (with “Feed” moves like FL, FP, SH) or JA (when jogging).

### Command Details:

Structure	SK{Parameter #1}
Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Deceleration rate
- units	letter
- range	D = deceleration rate set by DE or JA command no parameter = deceleration rate set by AM command

### Examples:

Command	Drive sends	Notes
SK	-	Stop motion immediately using the deceleration rate set by the AM command and erase the contents of the queue
SKD	-	Stop motion immediately using the deceleration rate set by the DE command (or JA if jogging) and erase the contents of the queue

## SM - Stop Move

Compatibility: Q drives only

See also: AM, DE, JL, SK, ST, QK commands

Stops any type of move in progress\* such as FL or CJ. This command acts like the ST (Stop) command except it will not stop a wait operation (like WD, WI, WP, or WT) and it can be part of a stored Q program. The contents of the queue are not affected by the SM command

\* = Exception: SH

*NOTE: Requires Multi-Tasking to be enabled (MT1). By default Motion-Tasking is disabled, which means the current move must complete before any subsequent buffered command (such as SM) can execute. With Multi-Tasking enabled, subsequent commands may be processed while a move is in progress and the SM command will execute properly.*

### Command Details:

Structure	SM(Parameter #1)
Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None

### Parameter Details:

Parameter #1	Deceleration rate
- units	letter
- range	D = deceleration rate set by DE command or JL command (if jogging) M = deceleration rate set by AM command

### Examples:

Command	Drive sends	Notes
SMD	-	Stop motion immediately using the deceleration rate set by the DE command or the JL command (if jogging)
SMM	-	Stop motion immediately using the deceleration rate set by the AM command