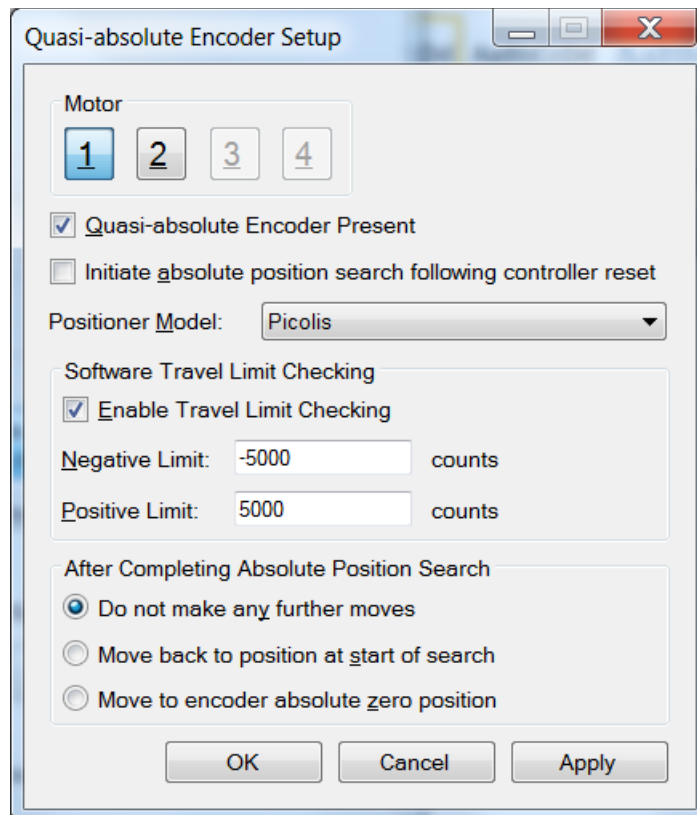


1 Computer Interfacing

1.1 Picomotor Controller Software Application

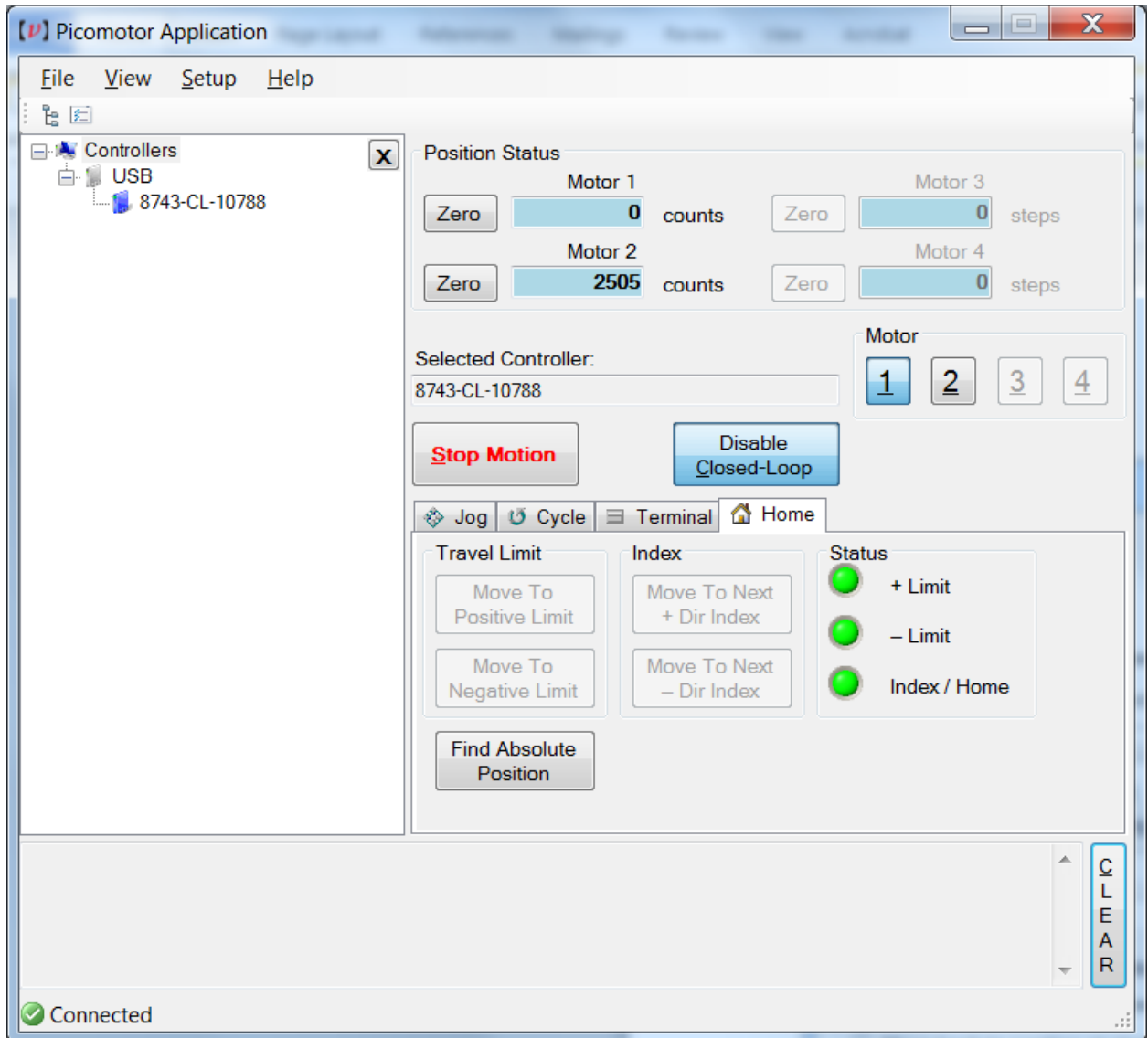
1.1.1 Quasi-absolute Encoder Setup

To setup the controller for use with a positioner that has Quasi-absolute Encoder, select “Quasi-absolute Encoder” under Setup menu. The application will open a dialog box as shown in picture below. Make desired changes for the motor and click on OK button.



1.1.2 Find Absolute Position

If the controller detects that a positioner with Quasi-absolute encoder is present, the “Home” tab will be modified as shown in picture below. The move to travel limit and index buttons are disabled. Users can click on the “Find Absolute Position” button to initiate absolute position search process.



2 Remote Command Set

2.1 Command List

The controller understands many commands. The following table lists all of them in alphabetical order. It also shows whether the command can be issued while motion of any Picomotor is in progress or otherwise.

PICOLIS STAGE RELATED COMMANDS

Command	Description	Command executed when motion is in progress
*RCL	Recall parameters	
AD	Set absolute position search mode	
AD?	Get absolute position search mode	◆
AE	Set absolute encoder parameters	
AE?	Get absolute encoder parameters	◆
AF	Start absolute position search	
AF?	Get absolute position search state	◆
OF?	Query if absolute position determined after controller reset	◆
SL	Set negative software travel limit	
SL?	Get negative software travel limit	◆
SR	Set positive software travel limit	
SR?	Get positive software travel limit	◆
ZH	Set hardware configuration	◆
ZH?	Get hardware configuration	◆
ZZ	Set system configuration	◆

ZZ?	Get system configuration	◆
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*RCL

Description Recall command.

Syntax *RCL *Bin*

Remarks This command restores the controller working parameters from values saved in its non-volatile memory. It is useful when, for example, the user has been exploring and changing parameters (e.g., velocity) but then chooses to reload from previously stored, qualified settings. Note that “*RCL 0” command just restores the working parameters to factory default settings. It does not change the settings saved in EEPROM.

The parameters that can be restored are:

1. Hostname (see HOSTNAME command)
2. IP Mode (see IPMODE command)
3. IP Address (see IPADDRESS command)
4. Subnet mask address (see NETMASK command)
5. Gateway address (see GATEWAY command)
6. Configuration register (see ZZ command)
7. Motor type (see QM command)
8. Desired Velocity (see VA command)
9. Desired Acceleration (see AC command)
10. Units (see SU command)
11. Deadband (see DB command)
12. Following error (see FE command)
13. Closed-loop update interval (see CL command)
14. Hardware configuration register (see ZH command)
15. Quasi-absolute encoder parameters (see AE command)
16. Absolute position search mode (see AD command)
17. Negative software travel limit (see SL command)
18. Positive software travel limit (see SR command)

Argument	Value	Description
<i>Bin</i>	0	Restores factory default settings
	1	Restores last saved settings

Example *RCL1 (Restore from last saved settings)

See Also SM, XX

AD

Description Absolute position search mode set.

Syntax xxADnn

Remarks This command is used to set the absolute position search mode for an axis. It is used to specify the final move the controller should make after determining the absolute position of the stage/positioner. If this command is issued when an axis' absolute position search is in progress, the controller will generate "COMMAND NOT ALLOWED DURING HOMING" error message.

Argument	Value	Description
xx	1 to 2	Axis number
nn	0 (Default)	Do not make any further moves after finding absolute position
	1	Move to the position at the start of absolute position search
	2	Move to absolute zero position

Example

1ZH12	(Tells controller that a stage/positioner with quasi-absolute encoder is present on axis 1 and software travel limit checking should be enabled)
1SN1	(Sets the displacement units to encoder counts)
1AD1	(Sets absolute position search mode to 1)
1AF	(Start absolute position search)

See Also AD?, AE, AE?, AF, AF?, ZH, ZH?

AD?

Description Absolute position search mode query.

Syntax xxAD?

Remarks This command is used to query the absolute position search mode for an axis.

Argument	Value	Description
xx	1 to 2	Axis number

Response	Value	Description
Value	0 (Default)	Do not make any further moves after finding absolute position
	1	Move to the position at the start of absolute position search
	2	Move to absolute zero position

Example

1AD?	(get absolute position search mode setting)
1	(reply; 1)

See Also AD, AE, AE?, AF, AF?, ZH, ZH?

AE

Description Quasi-absolute encoder parameters set.

Syntax xxAE $nn1,nn2,nn3,nn4$

Remarks This command is used to set the quasi-absolute encoder parameters for an axis. Since these values are stage/positioner-specific, please consult the stage's user's manual for guidance on correct parameter values. If this command is issued when an axis' absolute position search is in progress, the controller will generate "COMMAND NOT ALLOWED DURING HOMING" error message.

Argument	Value	Description
<i>xx</i>	1 to 2	Axis number
<i>nn1</i>	570 (Default)	Start index increment
<i>nn2</i>	8190 (Default)	Start absolute position
<i>nn3</i>	10 (Default)	Index increment
<i>nn4</i>	25 (Default)	Maximum number of index marks

Example 1ZH12 (Tells controller that a stage/positioner with quasi-absolute encoder is present on axis 1 and software travel limit checking should be enabled)
 1SN1 (Sets the displacement units to encoder counts)
 1AE570,8190,10,25 (Sets quasi-absolute encoder parameters)
 SM (Save settings to non-volatile flash memory in the controller)

See Also AD, AD?, AE?, AF, AF?, ZH, ZH?

AE?

Description Quasi-absolute encoder parameters query.

Syntax xxAE?

Remarks This command is used to query the quasi-absolute encoder parameters for an axis.

Argument	Value	Description
<i>xx</i>	1 to 2	Axis number

Response	Value	Description
<i>Value</i>	$nn1,nn2,nn3,nn4$	Response string with four (4) parameters comma-delimited

Example 1AE? (get absolute encoder parameters)
 570, 8190, 10, 25 (reply; four parameters that are comma-delimited)

See Also AD, AD?, AE, AF, AF?, ZH, ZH?

AF

Description Start absolute position search.

Syntax xxAF

Remarks This command is used to start the absolute position search process for an axis. If this command is issued when an axis' motion is in progress, the controller will generate "MOTION IN PROGRESS" error message. If this command is issued before telling the controller that a quasi-absolute encoder is connected and the displacement units are encoder counts, the controller will generate "QUASI-ABSOLUTE ENCODER NOT CONNECTED" error message.

Argument	Value	Description
xx	1 to 2	Axis number

Example

1ZH12	(Tells controller that a stage/positioner with quasi-absolute encoder is connected on axis 1 and software travel limit checking should be enabled)
1SN1	(Sets the displacement units to encoder counts)
1AD1	(Sets absolute position search mode to 1)
1AF	(Start absolute position search)

See Also AD, AD?, AE, AE?, AF?, ZH, ZH?

AF?

Description Absolute position search state query.

Syntax xxAF?

Remarks This command is used to query the state of absolute position search process for an axis.

Argument	Value	Description
xx	1 to 2	Axis number

Response	Value	Description
Value	0	Motion in progress (Absolute position search in progress)
	1	Motion done (Absolute position search completed)

Example

1AF?	(get absolute position search state)
1	(reply; 1)

See Also AD, AD?, AE, AE?, AF?, ZH, ZH?

OF?

Description Query absolute position found following a reset.

Syntax xxOF?

Remarks This command is used to query if an axis' absolute position was found following a reset.

Argument	Value	Description
xx	1 to 2	Axis number

Response	Value	Description
Value	0	Absolute position not found after controller reset
	1	Absolute position found after controller reset

Example 1OF? (Query if absolute position was found following a reset)
1 (reply; 1)

See Also AD, AD?, AE, AE?, AF?, ZH, ZH?

SL

Description Negative software travel limit set.

Syntax xxSLnn

Remarks This command is used to set the negative software travel limit for an axis. If this command is issued when an axis' absolute position search is in progress, the controller will generate "COMMAND NOT ALLOWED DURING HOMING" error message. The controller will generate "PARAMETER OUT OF RANGE" error message if the value specified is greater than the positive software travel limit. This value can be saved in controller's non-volatile memory by issuing "SM" command. If define home (DH) command is issued after this command is issued, the controller will adjust the software travel limits and temporarily override the value specified using this command. The temporarily modified software limits are not saved in controller's non-volatile memory. This allows the controller to preserve user-specified software limits. Bit #3 in hardware configuration register (refer ZH command) must be set to 1 in order for the controller to check for any software travel limit violations.

Argument	Value	Description
xx	1 to 2	Axis number
nn	Integer	Negative software travel limit (encoder counts)

Example 1SL-8250 (set axis 1 negative travel limit to -8250 encoder counts)
1SR8190 (set axis 1 positive travel limit to 8190 encoder counts)
SM (save to non-volatile memory)

See Also SL?, SR, SR?, SM

SL?

Description Negative software travel limit query.

Syntax xxSL?

Remarks This command is used to query the negative software travel limit for an axis. The response to this command can be different from the value specified using “SL” command if define home (DH) command is issued after “SL” command is issued.

Argument	Value	Description
xx	1 to 2	Axis number

Response	Value	Description
Value	Integer	Negative software travel limit

Example 1SL? (get negative software travel limit)
-8250 (reply; -8250 encoder counts)

See Also AD, AE, AE?, AF, AF?, ZH, ZH?

SR

Description Positive software travel limit set.

Syntax xxSRnn

Remarks This command is used to set the positive software travel limit for an axis. If this command is issued when an axis’ absolute position search is in progress, the controller will generate “COMMAND NOT ALLOWED DURING HOMING” error message. The controller will generate “PARAMETER OUT OF RANGE” error message if the value specified is lower than the negative software travel limit. This value can be saved in controller’s non-volatile memory by issuing “SM” command. If define home (DH) command is issued after this command is issued, the controller will adjust the software travel limits and temporarily override the value specified using this command. The temporarily modified software limits are not saved in controller’s non-volatile memory. This allows the controller to preserve user-specified software limits. Bit #3 in hardware configuration register (refer ZH command) must be set to 1 in order for the controller to check for any software travel limit violations.

Argument	Value	Description
xx	1 to 2	Axis number
nn	Integer	Positive software travel limit (encoder counts)

Example 1SL-8250 (set axis 1 negative travel limit to -8250 encoder counts)

1SR8190 (set axis 1 positive travel limit to 8190 encoder counts)
 SM (save to non-volatile memory)

See Also SL, SL?, SR?, SM

SR?

Description Positive software travel limit query.

Syntax xxSR?

Remarks This command is used to query the positive software travel limit for an axis. The response to this command can be different from the value specified using “SR” command if define home (DH) command is issued after “SR” command is issued.

Argument	Value	Description
xx	1 to 2	Axis number

Response	Value	Description
Value	Integer	Positive software travel limit

Example 1SR? (get positive software travel limit)
 8190 (reply; 8190 encoder counts)

See Also AD, AE, AE?, AF, AF?, ZH, ZH?

ZH

Description Hardware configuration set.

Syntax xxZHnn

Remarks This command is used to set the hardware configuration of an axis.

The real-time status of hardware travel limit signals can be monitored using the PH command.

If hardware travel limit checking is disabled then MT (Find Limit) command is NOT allowed.

If the following error checking is disabled then the FE command setting is effectively ignored.

NOTE: When controlling a standard open-loop Picomotor positioner (1) set ‘Units’ option to ‘Steps’ and (2) disable ‘Travel Limit Checking.’

NOTE: The Travel Limit Checking feature should be disabled when controlling the 8410 rotary positioner.

Argument	Value	Description
<i>xx</i>	1 to 2	Axis number
<i>nn</i>	see table below	

Bit	Value	Definition
0	0	Enable hardware travel limit checking
	1	Disable hardware travel limit checking
1	0	Enable following error checking
	1	Disable following error checking
2	0	Stage/positioner with quasi-absolute encoder not present
	1	Stage/positioner with quasi-absolute encoder present
3	0	Disable software travel limit checking for stage/positioner with quasi-absolute encoder
	1	Enable software travel limit checking for stage/positioner with quasi-absolute encoder

Example 1ZH12 (Stage/positioner with quasi-absolute encoder present and enable software travel limit checking)

See Also ZH?, CL, FE, MT, DB, PH

ZH?

Description Hardware configuration query.

Syntax xx**ZH?**

Remarks This command is used to query the hardware configuration for an axis.

Argument	Value	Description
xx	1 to 2	Axis number

Response	Value	Description
Value	see table below	

Bit	Value	Definition
0	0	Enable hardware travel limit checking
	1	Disable hardware travel limit checking
1	0	Enable following error checking
	1	Disable following error checking
2	0	Stage/positioner with quasi-absolute encoder not present
	1	Stage/positioner with quasi-absolute encoder present
3	0	Disable software travel limit checking for stage/positioner with quasi-absolute encoder
	1	Enable software travel limit checking for stage/positioner with quasi-absolute encoder

Example 1ZH? (get hardware configuration for axis 2)
 12 (reply; 12 decimal is equal to 1100 in binary. This means bits 2 and 3 are set and bits 0 and 1 are cleared. This implies that the controller is informed that a stage/positioner with quasi-absolute encoder is present and it must check for software travel limits, hardware travel limits, and following error violations.)

See Also **ZH, CL, FE, MT, DB, PH**

ZZ**Description** Configuration register set**Syntax** *ZZnn***Remarks** This command is used to configure the default behavior of some of the controller's features. It is typically followed with an SM (Save to Memory) command.

Bit	Value	Definition
0	0*	Perform auto motor detection. Check and set motor type automatically when commanded to move.
	1	Do not perform auto motor detection on move
1	0*	Do not scan for motors connected to controllers upon reboot (Performs 'MC' command upon power-up, reset or reboot)
	1	Scan for motors connected to controller upon power-up or reset
2	0*	Do not initiate absolute position search following controller reset
	1	Initiate absolute position search following controller reset

Example: *ZZ 1; SM* (Disable automatic motor check and save to memory)
ZZ 3; SM (Disable motor check on move, check motors on system reset)

See Also *RCL, MC

ZZ?**Description** Configuration register query.**Syntax** *ZZ?***Remarks** This command is used to query the configuration register setting.

Response	Value	Description
<i>nn</i>	Integer	Configuration register.

Example: *ZZ ?* (Get configuration register settings)
 1 (Returns 1; bit-0=1 & bit-1=0; means auto motor detection on move is disabled)

See Also *ZZ*

3 Appendix

3.1 Non Axis-Specific Error Messages

0, NO ERROR DETECTED

There are no error messages in the error buffer

3, OVER TEMPERATURE SHUTDOWN

The temperature inside the controller has exceeded 85°C. Under this condition, the controller automatically stops any motion that is in progress and changes the status LED color to solid RED. When the temperature goes below 75°C, the controller changes the status LED color to solid GREEN. Motion related commands can once again be issued in this state.

6, COMMAND DOES NOT EXIST

The command sent to the controller is invalid. Please check the command syntax.

7, PARAMETER OUT OF RANGE

The parameter sent along with a command is out of range.

9, AXIS NUMBER OUT OF RANGE

The axis number specified is out of range.

10, EEPROM WRITE FAILED

Unable to save the controller's settings in its non-volatile memory.

11, EEPROM READ FAILED

Unable to restore the controller's settings from its non-volatile memory.

37, AXIS NUMBER MISSING

The command sent to the controller requires an axis number prefix. Please check the command syntax.

38, COMMAND PARAMETER MISSING

The command sent to the controller requires a valid parameter. Please check the command syntax.

46, RS-485 ETX FAULT DETECTED

A slave controller can generate this error message if the command received by it is incomplete; the number of bytes transmitted by a master controller do not match the number of bytes received by the slave controller.

A master controller can generate this error message if the response received by it is incomplete; the number of bytes transmitted by a slave controller do not match the number of bytes received by the master controller.

NOTE: Check for (a) improper RS-485 cable connection, (b) controller address conflict, or (c) prohibited multiple master configuration.

47, RS-485 CRC FAULT DETECTED

A slave controller can generate this cyclical redundancy check (CRC) error message if a checksum verification of the command received by it does not match the checksum computed by master controller.

A master controller can generate this cyclical redundancy check (CRC) error message if a checksum verification of the response received by it does not match the checksum computed by slave controller.

NOTE: Check for (a) improper RS-485 cable connection, (b) controller address conflict, or (c) prohibited multiple master configuration.

48, CONTROLLER NUMBER OUT OF RANGE

The controller number prefix is out of range.

49, SCAN IN PROGRESS

This error message is generated if “SC” or “SC?” commands are received by a controller while a scan is already in progress.

51, HOMING STARTED AFTER RESET

This message is generated if absolute position search was initiated following a controller reset.

3.2 Axis-Specific Error Messages

Where (“x” = 1 to 2)

x00, MOTOR TYPE NOT DEFINED

A motion command has been issued to the controller before specifying a motor type. Enable auto motor detection by setting bit# 0 in configuration register to 0 (refer ZZ command) or set valid motor type (refer QM command).

x01, PARAMETER OUT OF RANGE

The parameter sent along with a command is out of range.

x03, FOLLOWING ERROR THRESHOLD EXCEEDED

According to the encoder count monitor, the following error exceeds the maximum following (tracking) error threshold setting.

x04, POSITIVE HARDWARE LIMIT DETECTED

The motion in progress has been stopped because the controller detected positive direction hardware travel limit crossing.

NOTE: When controlling a standard open-loop Picomotor positioner (1) set ‘Units’ option to ‘Steps’ and (2) disable ‘Travel Limit Checking.’

NOTE: The Travel Limit Checking feature should be disabled when controlling the 8410 rotary positioner.

x05, NEGATIVE HARDWARE LIMIT DETECTED

The motion in progress has been stopped because the controller detected negative direction hardware travel limit crossing.

NOTE: When controlling a standard open-loop Picomotor positioner (1) set ‘Units’ option to ‘Steps’ and (2) disable ‘Travel Limit Checking.’

NOTE: The Travel Limit Checking feature should be disabled when controlling the 8410 rotary positioner.

x06, POSITIVE SOFTWARE LIMIT DETECTED

The motion in progress has been stopped because the controller detected positive direction software travel limit crossing.

x07, NEGATIVE SOFTWARE LIMIT DETECTED

The motion in progress has been stopped because the controller detected negative direction software travel limit crossing.

x08, MOTOR NOT CONNECTED

The controller has detected that there is no motor connected to the axis that is either being commanded to move or is already in motion.

x10, MAXIMUM VELOCITY EXCEEDED

The velocity parameter specified exceeds the maximum velocity rating for the connected motor.

x11, MAXIMUM ACCELERATION EXCEEDED

The acceleration parameter specified exceeds the maximum acceleration rating for the connected motor.

x14, MOTION IN PROGRESS

A new move is commanded while an axis is already moving.

x20, HOMING ABORTED

Homing process has been aborted. This is likely caused by either Abort (AB) or Stop (ST) command received or hardware travel limit detected.

x30, COMMAND NOT ALLOWED DURING HOMING

The command received cannot be processed while absolute position search is in progress.

x33, MAX CLOSED LOOP ATTEMPTS EXCEEDED

The controller has made more than 100 unsuccessful consecutive attempts to correct the position of the motion device, and was unable to bring the following error to within specified deadband setting.

x34, FEEDBACK CONNECTOR REMOVED

The feedback connector has been removed while a move is in progress. Properly fasten feedback connector to controller.

x35, TRAVEL LIMIT CHECKING DISABLED

The controller received “MT” command when hardware travel limit checking was disabled. Travel limit checking must be enabled (see ZH command) in order to perform Move to Limit (MT) command.

x36, QUASI-ABSOLUTE ENCODER NOT CONNECTED

The controller received “AF” command before being told that a quasi-absolute encoder is connected and the displacement units are encoder counts. Set bit #2 in hardware configuration register (see ZH command) to tell the controller that a quasi-absolute encoder is connected to that axis. Also set the displacement units to encoder counts (see SN command).

x37, INVALID CMD FOR QUASI-ABSOLUTE ENCODERS

The controller received a command to home on a switch (OR command) or a travel limit (MT command) or an index (MZ command) after being told that a quasi-absolute encoder is connected. If there is no quasi-absolute encoder connected to the controller, clear bit #2 in hardware configuration register (see ZH command) to tell the controller that a quasi-absolute encoder is not connected to that axis