SERVO**STAR**® **CD**

VarCom Reference Guide

SERVO**STAR**® **CD Product Series**
VarCom Reference Guide
Firmware Version 3.3 and before

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Copyright Information

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NOTICE:

Section 1

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Section 2

General Information

USE AS DIRECTED

Use the MotionLink® Terminal Mode (or any other "dumb" host) to directly monitor or modify the variable set and command the SERVO**STAR**® CD drive.
The characteristic nature of a PC mean that these functions are not functionally safe without further measures. A PC-program might be unexpectedly disturbed or stopped, so that in the event of a malfunction any movements that have already been initiated cannot be stopped from the PC.
The manufacturer of the machine must carry out a hazard analysis for the machine, and is responsible for the functional, mechanical and personnel safety aspects of the machine. This applies especially to the initiation of movements with the aid of ASCII commands.

The online parameter setting of a drive that is running may always result in dangerous situations. Therefore you must follow the safety, installation and commissioning instructions in the installation manual for the servo amplifier that is used.

The servo amplifiers are components that are built into electrical equipment or machines, and can only be operated as integral components of such equipment.
The BTB/RTO contact must be wired into the safety loop of the system. The safety loop, and the Stop and Emergency Stop functions must fulfill the requirements of EN60204, EN292 and VDI2853.

Knowledge of the WINDOWS operating system and the use of a personal computer is assumed.

Only personnel who have extensive knowledge in the fields of drive technology and control technology are permitted to carry out online parameter setting of a drive that is running.

Sets of data that are stored on data media are not safe from undesirable alteration by third parties. So after you have loaded a set of data, you must check all the parameters before enabling the servo amplifier.

Section 3

Commands/Variables by Function

DRIVE PARAMETERS

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DRIVE CONFIGURATION / MODES

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DIPEAK	IC	ILIM2	MFOLDDIS
DICONT	ICMD	IMAX	MFOLDR
FOLD	ICONT	ISCALE	MFOLDT
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IA	ILIM	MFOLDD	***T***

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FILTMODE	GVI	MTANGLC	VH
GP	KV	MTANGLP	VR
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GPAFR2	KVFR	NOTCHHZ	***REFRESH***
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GPI	LPFHZ1	MVANGLF	

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HOMESTATE	MIDIST0-3	PEMAX	PSCALE
HOMETYPE	MISPEED0-3	PFB	STOPPED
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MENCTYPE	MKTI*	MPITCH	MTANGLP
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* These variables are not documented and are no longer used. They are listed here because they are included in MLIST.

Section 4

Variable / Command List

VARIABLE / COMMAND FORMAT

The command and variable descriptions presented here are in alphabetical order. Command and variable descriptions utilize different formats, as described below.

COMMAND

This is the format of a command description.

Firmware Versions:
Command Syntax:
Opmodes: **Drive Status:**

- Firmware Versions: tells what firmware versions the command is implemented in. To check your drive's firmware version, use the VER command.
- Command Syntax: gives the exact syntax of the command. Any optional or required parameters are also listed. If parameters are used with the command, the units and ranges of those parameters are given.
- Opmodes: (0-4, 8) indicates in which operational modes (opmodes) the command can be used (see the description for the variable OPMODE).
- Drive Status: (en, dis, or en/dis) indicates the drive state in which the command can be used (en = enabled; dis = disabled; en/dis = either).

VARIABLE

this is the format that a variable description will take. The variable name font is Arial, 16-pt, bold.

Firmware Versions:
Type: **Range:**
Units: **Default:**
Opmodes: **Drive Status:** **EEPROM:**

The operator can set variable values by typing in the name of the variable followed by a new value for the variable, separated by an equals sign or one or more spaces. Just typing in the name of a variable without a new value will cause the ServoStar to output the current value of that variable to the serial port.

- Firmware Versions: tells what firmware versions the variable is implemented in. To check your drive's firmware version, use the VER command.

- Type: switch variable, switch mode variable, (standard) variable, or vector variable. Switch variables can be toggled between two different states (0/1, on/off, etc.). Switch mode variables are state variables used to select one of more than two states (for example, opmode is a switch mode variable that selects one of 6 opmodes - 0-4, 8). Standard variables are set to an integer value within a given range.

  Vector variables are special variables that are used for the Advanced Pole Placement compensator (see COMPMODE 3) and require the use of the REFRESH command when changed.

  All variables are classified as read-only (R) or read/write (R/W).

- Range: defines the range of valid values for the variable.

- Units: defines the units of the variable. Note that to get the final value of the variable, including its units, you multiply its value by its units. Example: the units of MICONT are "amperes * 0.1." If MICONT = 200, then its value is 200 * amperes * 0.1 = 20 amperes.

- Default: defines the default value of the variable. If this field says "motor data," then the default value is entered from a motor data file (using MotionLink's Motor Configuration Screen) or a motor data sheet. Most variables are reset to their defaults by using the RSTVAR command.

- Opmodes: (0-4, 8) indicates in which operational modes (opmodes) the variable is used (see the description for the variable OPMODE). Most variables can be set in any opmode, but they only have an effect in the opmodes listed here.

- Drive Status: (en, dis, or en/dis) indicates the drive state in which the command can be used (en = enabled; dis = disabled; en/dis = either).

- EEPROM: (yes or no) specifies whether or not a variable can be stored in non-volatile memory (EEPROM). If a variable is stored in EEPROM, it is "remembered" by the ServoStar when the drive is powered down and back up. Refer to the SAVE command and section 5 for more information.

VARIABLE / COMMAND SET

ACC

Sets the drive acceleration rate. This variable is only asserted when linear ramp control is selected (PROFMODE = 1 and OPMODE = 0, 1, 4, or 8). For firmware versions (VER) prior to 3.1.0, the range of this variable was 1 to 399,987.

Firmware Versions: all
Type: variable (R/W) Range: 10 to 400,000
Units: rotary: RPM / sec Default: 400,000
linear: mm/sec/sec
Opmodes: 0, 1, 4, 8 Drive Status: en/dis EEPROM: yes

ACKMODE

Sets the communication safety level of the drive. The range of values is 0, 1, or 2.

0 = No safety procedures or error messages
1 = Drive responds with ACK or NAK after every message
2 = Same as 1 with an added Block Check Character (BCC or checksum) attached to the end of every message

Note that ACKMODE must be set to 0 for MotionLink to function properly.

Firmware Versions: all
Type: switch mode (R/W) Range: 0 - 2
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

ACONFIG

enables/disables the Auto-Config process.

0 = disable the Auto-Config process
1 = enable the Auto-Config process

The Auto-Config process tests motor and feedback wiring connections using a series of 6 tests for resolver-based systems and 8 tests for encoder based systems. To execute the Auto-Config process, the user must first disable the drive, then set ACONFIG=1, and then enable the drive. The process will then execute. The steps of the process are as follows:

Phase 1: Forced commutation - this phase rotates the motor.
Phase 2: No movement test - if the motor doesn't move, there might be a problem with the motor leads.
Phase 3: Phase current test - checks to see if the motor leads are connected properly.
Phase 4: Counts per cycle test- checks MENCRES / MPOLES (in encoder based systems) or 65536 * MRESPOLES / MPOLES in resolver based systems to make sure its accurate.
Phase 5: Direction test - may fail if two motor lead wires are switched. User can change the value of MFBDIR to compensate for failure. See MFBDIR for more details on correcting a failure in this phase.
Phase 6: Resolution accuracy test - moves the motor 4 revolutions. This phase may change the value of MPHASE.
Phase 7: Hall switch test (encoders with halls only) - may fail if hall switches are improperly connected. This phase may change the value of MPHASE or MHINVA / B / C to compensate for incorrect results.
Phase 8: Find index test (encoders only) - moves the motor one revolution and searches for index pulse.

For more details, see ACONFIGST and MFBDIR.

Firmware Versions: 3.3.0 and later

Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: no

ACONFIGST

gives the status for the Auto-Config process. This variable includes four values: the current phase that is being run, a bit array that includes a status of the process phases (0 - not done yet or failed, 1 - succeeded) and two result variables for phases 4 and 6, one is the expected MENCRES / MPOLES (encoder systems) or 65536 * MRESPOLES / MPOLES (resolver systems), and the second is the measured MENCRES / MPOLES (encoder systems) or 65536 * MRESPOLES / MPOLES (resolver systems) during the process. For more information, see ACONFIG and MFBDIR.

Syntax: ACONFIGST <bit array> <phase> <expected> <measured>

Here is a list of the bits in the <bit array> variable:

Bit number	Description
0	Phase 1 (Forced commutation) success/failure (always successful)
1	Phase 2 (No movement) success/ failure
2	Phase 3 (Phase currents) success/ failure
3	Phase 4 (Counts per cycle) success/ failure
4	Phase 5 (direction) success/ failure
5	Phase 6 (Accurate resolution) success/ failure
6	Phase 6 (Accurate resolution) MPHASE change/ no change
7	Phase 7 (Hall switches) success/ failure
8	Phase 7 (Hall switches) MPHASE, MHINVx change/ no change
9	Phase 8 (Find index) success/ failure
10	Phase 8 (Find index) MENCOFF change/ no change
15	Process is running/ process is not running

- In the success/ failure bits: ‘1’ is success, ‘0’ is failure or not done yet.
- In the change/ no change bits: ‘1’ means there was a change, ‘0’ means there was no change.
- In bit no. 15, ‘1’ means that the process is running, ‘0’ means the process isn’t running.

Firmware Versions: 3.3.0 and later
Type: variable (R)
Range:
<bit array> : see table below.
<phase> : 0 to 8
<expected> : long
<measured> : long
Units: n/a Default: 0, 0, 0, 0
Opmodes: all Drive Status: en/dis EEPROM: n/a

ACTFAULT

Defines how to handle the DISABLE procedure when a fault occurs.
0 = disable the drive immediately
1 = follow an Active Disable procedure (similar to the “S” cmd - see also DECSTOP, DISSPEED, DISTIME, and O1MODE=5)

Note: the drive will always be disabled immediately in the event of a feedback loss fault to prevent the drive from “running away.”

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

ACTIVE

Displays if the drive is enabled and power is applied to the motor. This flag is the overall readiness indicator of the drive.

0 = drive is inactive
1 = drive is active and ready to operate

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

ADDR

Displays the position of the drive address switches (switches 1-4 or 1-5, depending upon firmware version, of the DIP switch) located on the top of the drive.

Firmware Versions: all
Type: variable (R) Range: 0 to 15 (firmware versions prior to 2.0.0)
0 to 31 (firmware versions 2.0.0 and later)
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

ANDB

Sets the dead band of the analog input signal. If the absolute value of the analog input signal is less than this value, then no analog command signal is generated.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 10,000
Units: milliVolts Default: 0
Opmodes: 1,3,8 Drive Status: en/dis EEPROM: yes

ANDG

Enables the drive's dual gain algorithm. The dual gain algorithm effectively increases the resolution of the command input from 14 to 15 bits under 4v of input.

0 - No dual gain
1 - Dual gain hysteresis algorithm
2 - Dual gain linear combination algorithm

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to 2
Units: n/a Default: 0
Opmodes: 1,3,8 Drive Status: en/dis EEPROM: yes

ANIN

displays the analog input value after being filtered by ANOFF and ANDB. The AVGTIME variable effects the time-averaging of this variable.

Firmware Versions: all
Type: variable (R) Range: -22,500 to 22,500
Units: millivolts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

ANLPFHZ

sets a filter rate (corner frequency) for the analog input filter. This is a simple single pole filter which is always present. The filter rate adjusts automatically as the analog input sampling rate changes for different operational modes. A value of 10,000 = unity gain (no filter).

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 1 to 10,000
Units: Hz Default: 10,000
Opmodes: 1,3,8 Drive Status: en/dis EEPROM: yes

ANOFF

sets the analog offset which is added to the analog input command to the drive. This is used to compensate for the analog input signal (ANIN) offset or drift.

Firmware Versions: all
Type: variable (R/W) Range: -10,000 to 10,000
Units: millivolts Default: 0
Opmodes: 1,3,8 Drive Status: en/dis EEPROM: yes

ANOUT

sets the source for the analog output feature at user connector C3 pin 13.

0 - Tachometer (vel. feedback V) scaled identical to VSCALE.
1 - I monitor (equivalent current) scaled identical to ISCALE.
2 - Velocity Error, VE, scaled identical to VSCALE.
3 - Torque Command Output Scaled to ISCALE.
4 - Reserved.
5 - Position following error, PE, scaled to PSCALE.
6 - not used
7 - not used.
8 - Position feedback, PFB, scaled to PSCALE.

Firmware Versions: 2.1.0 and later
Type: switch mode (R/W) Range: 0 to 5
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

ANZERO

Causes the drive to zero the analog offset. A sample of the motor analog input command is averaged over 64 samples, and the value of ANOFF is set to zero out the analog input command. This command may need to be executed more than once to achieve zero offset, and ANOFF will probably be modified.

Firmware Versions: all
Command Syntax: ANZERO
Opmodes: all Drive Status: en/dis

AVGTIME

Sets the variable averaging time period. This variable is expressed as multiples of the servo update period (Ts), which is 500 microseconds. A value of 0 for AVGTIME causes requested variable values to be returned as instantaneous values. Note that AVGTIME has no effect on variables that are sampled using the Record command and MotionLink's PC Scope Screen. AVGTIME affects the time averaging of ANIN, I, ICMD, V, VCMD.

Firmware Versions: all
Type: switch mode (R/W) Range: 0, 2, 4, 8, 16, 32, or 64
Units: Ts (500 microseconds) Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

BW

Sets the desired velocity control loop bandwidth. This variable only affects the system when using the Standard Pole-Placement controller in velocity mode (COMPMODE = 2 or 4 and OPMODE = 0 or 1). With COMPMODE=2, BW is limited to 200 Hz; with COMPMODE=4, BW can extend to 400 Hz. Note that COMPMODE=4 is only available in firmware versions 2.1.0 and later.

Firmware Versions: all
Type: variable (R/W)
Range: 10 to 200 (COMPMODE=2)
10 to 400 (COMPMODE=4)
Units: Hz Default: 20
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

CCWLIM

displays the state of the external counter clockwise (CCW) limit switch input (see also CWLIM, IN1-IN3, IN1MODE-IN3MODE).

0 = switch closed, CCW limit not reached
1 = switch open, CCW limit reached

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

CLREEPROM

clears the non-volatile memory (EEPROM) in the drive. The drive null's the EEPROM and recovers from a NVRAM error and assumes a no-comp state. A complete drive configuration procedure (see section 5) then has to be initiated before resuming drive operation. This command is the only method of resetting the run time clock (see TRUN).

Firmware Versions: all
Command Syntax: CLREEPROM
Opmodes: all Drive Status: dis

COMPFILT

is a switch variable that enables and disables a 400 Hz low pass filter in the velocity feedback loop. The filter will automatically be disabled if COMPMODE is set equal to 4. COMPFILT will retain its value regardless of whether the COMPMODE setting is enabling and disabling the filter.

Firmware Versions: 2.1.0 and later
Type: switch (R/W) Range: 0 (OFF), 1 (ON)
Units: n/a Default: 1
Opmodes: 0,1,4,8 Drive Status: dis EEPROM: no

COMPMODE

sets the velocity controller type for OPMODE 0 or 1 according to the following table.

COMPMODE	Controller Type	Loop Variables
0	PI	GV, GVI
1	PDFF	KV, KVI, KVFR
2	Standard Pole Placement (low-frequency)	BW, MJ, LMJR, TF
3	Advanced Pole Placement	VD, VF, VH, VR
4	Standard Pole Placement (high-frequency)	BW, MJ, LMJR, TF

Note: COMPMODE 3 is not available in version 1 firmware. COMPMODE 4 is available in firmware versions 2.1.0 and later.

Firmware Versions: see Note
Type: switch mode (R/W) Range: 0 - 4
Units: n/a Default: 2
Opmodes: 0,1,4,8 Drive Status: dis EEPROM: yes

CONFIG

configures the current control loops after motor data has been entered. Executing this command tells the drive that all motor data parameters have been entered and that it is time for the drive to configure its control loops using the motor data.

When certain drive or motor variables are entered, they will cause the drive to enter a non-compensated (no-comp) state. The LED display will flash a minus sign. In this case, a CONFIG command is required. This also occurs when CLREEPROM is executed.

Firmware Versions: all
Command Syntax: CONFIG
Opmodes: all Drive Status: dis

CWLIM

displays the state of the external clockwise (CW) limit switch input (see also CCWLIM, IN1-IN3, IN1MODE-IN3MODE).

0 = switch closed, CW limit not reached
1 = switch open, CW limit reached

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

DEC

sets the deceleration rate of the drive. This variable only affects the drive when linear ramp control and velocity mode are selected (PROFMODE = 1 and OPMODE = 0, 1, 4, or 8). For firmware versions (VER) prior to 3.1.0, the range of this variable was 1 to 399,987.

Firmware Versions: all
Type: variable (R/W) Range: 10 to 400,000
Units: rotary: RPM / sec Default: 400,000
linear: mm/sec/sec
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

DECSTOP

is a deceleration that is used by drive commands that require a faster than usual stop. This DECSTOP value is used instead of DEC in the following instances: end-travel limits, HOLD, S, and a fault occurrence with ACTFAULT = 1. See also DISSPEED and DISTIME.

Firmware Versions: all
Type: variable (R/W) Range: 1 to 32767
Units: rotary: RPM * 1000/sec Default: 5000
linear: m/sec/sec
Opmodes: all Drive Status: en/dis EEPROM: yes

DICONT

defines the continuous rated current for the drive (sinusoidal RMS). This is a hardware-defined read-only variable that is detected automatically by the drive.

DICONT is usually 50% of DIPEAK, the peak current of the drive (this will not be true in many cases with the ServoStar CD). In a given application, the drive may be configured to a lower rating than DICONT by setting the value of ICONT to the desired rating.

Firmware Versions: all
Type: variable (R) Range: 10 to 1100
Units: amperes * 0.1 Default: hardware/user defined
Opmodes: all Drive Status: en/dis EEPROM: yes

DIP

displays the settings of the DIP switches located on top of the drive. This variable returns a series of 1's and 0's for each of the switches, with a comma inserted in the middle for clarity. Switch 10 is the leftmost digit, and switch 1 is the rightmost.

Note: in firmware versions prior to V2.0.0, there were only 8 DIP switches, and no comma was printed out.

Firmware Versions: all
Type: switch mode (R)
Range: 00000000-11111111 (firmware versions prior to 2.0.0)
00000,00000-11111,11111 (firmware 2.0.0 and later)
Units: 1=on, 0=off Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

DIPEAK

defines the peak rated current of the drive (sinusoidal RMS). This is a hardware-defined read-only variable that will be set to a value of (DICONT * 2), except in the ServoStar CD, where it may be different. DIPEAK sets the 100% reference for many other current variables.

Firmware Versions: all
Type: variable (R) Range: 20 to 2200
Units: amperes * 0.1 Default: DICONT * 2
Opmodes: all Drive Status: en/dis EEPROM: yes

DIPEN

displays the state of the Dip Switch Enable status (switch number 8 of the DIP switches on top of the drive). This variable has to be set=1 (switch set OFF) to allow the drive to be enabled.

Firmware Versions: all
Type: switch (R) Range: 0 (disabled), 1 (enabled)
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

DIR

sets the direction defined as positive rotation for the motor as seen when looking at the motor shaft end.
0 = positive motion is counter-clockwise (CCW)
1 = positive motion is clockwise (CW)

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 1
Opmodes: all Drive Status: en/dis EEPROM: yes

DIS

disables the drive. Software servo loops are halted and power is disconnected from the motor. The function is immediate, and the motor may coast.

Firmware Versions: all
Command Syntax: DIS
Opmodes: all Drive Status: en/dis

DISSPEED

sets the speed window for the Active Disable function. The Active Disable function ramps the motor to zero speed using DECSTOP. DISSPEED is compared to the actual motor speed, and if the speed is less than this value, the active disable timer (DISTIME) will begin timing. Once the timer times out, the drive disables. See also ACTFAULT, DECSTOP, DISTIME, and O1MODE=5.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to 14,999
Units: rotary: RPM Default: 50 RPM
linear: mm/sec
Opmodes: all Drive Status: en/dis EEPROM: yes

DISTIME

sets the amount of time to wait after motor speed goes below DISSPEED before the drive is disabled in the Active Disable process. Once motor speed goes below DISSPEED, the drive will wait for the time period specified by DISTIME, and will then disable the drive. See also ACTFAULT, DECSTOP, DISSPEED, and O1MODE=5.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to 65535
Units: millisecond * 0.1 Default: 100
Opmodes: all Drive Status: en/dis EEPROM: yes

DRIVEOK

displays the status of the drive faults.
0 = faults exist
1 = no faults exist

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

DUMP

transmits all variables and their settings to the serial port terminal. This command actually outputs the EEPROM contents of the drive to the serial port, where the variables can then be reviewed or saved to a variable file (*.SSV).

Firmware Versions: all
Command Syntax: DUMP
Opmodes: all Drive Status: en/dis

DUALFB

Enables/disables the reading of an external feedback signal through the C8 connector.
0 = no dual loop
1 = dual loop without checking for external feedback fault
2 = dual loop with checking for external feedback fault
Note: the fault options above can relate to a line break; however, the motor must be in motion for this detection to occur. It can also indicate a wrong XENDIR parameter.

Firmware Versions: 3.3 and later
Type: switch (R/W) Range: 0, 1, 2
Units: n/a Default: 0
Opmodes: 8 Drive Status: dis EEPROM: yes

ECHO

enables/disables serial port character echo. If echo is enabled, characters received via the serial port are echoed back to the serial port and displayed on the MotionLink monitor or terminal.
0 = serial port echo disabled
1 = serial port echo enabled
Note that ECHO = 1 is needed for proper operation of MotionLink.

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 1
Opmodes: all Drive Status: en/dis EEPROM: yes

EN

initiates a software enable of the drive. This command first attempts to reset any existing fault conditions, then sets SWEN to 1. If READY, REMOTE, and DIPEN are equal to one, then the drive becomes ACTIVE. Checking the value of ACTIVE will inform the user whether or not an EN command successfully enabled the drive.

Firmware Versions: all
Command Syntax: EN
Opmodes: all Drive Status: en/dis

ENCINIT

triggers the encoder initialization process for type 0-2 and type 7 encoders (see MENCTYPE). The initialization process requires rotating the motor until the encoder index is found, whereupon the drive will set the value of MENCOFF.

If the drive is enabled and in Opmode 0, the jog command can be used to rotate the motor. When the encoder index is encountered, the drive will set the value of MENCOFF. In this case, the status of the ENCINIT function is observed using the switch variable ENCINITST.

Firmware Versions: all
Command Syntax: ENCINIT
Opmodes: all Drive Status: dis

ENCINITST

displays the status of the encoder initialization function (see ENCINIT). This variable is reset to 0 when the user manually sets the index position (see MENCOFF).

0 = initialization process has not begun
1 = encoder initialization is in progress
2 = encoder initialization has been completed

Firmware Versions: all
Type: switch mode (R) Range: 0, 1, 2
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

ENCOUT

sets the resolution (number of lines) of the encoder equivalent output channel for resolver based systems only. For encoder-based systems, this variable is read-only and is set equal to MENCRES (for firmware versions prior to 3.3.0) or MENCRES / ENCOUTO (for firmware versions 3.3.0 and later). For sine encoder-based systems, this variable is read-only and is set equal to MENCRES * SININTOUT / ENCOUTO.

Note that ENCOUT values of 2048 and 4096 are available only when VLIM < 6100 RPM (RDRES = 14 or 16). ENCOUT values of 8192 and 16384 are available only when VLIM <=1500 RPM (RDRES = 16). In the majority of resolvers, one electrical revolution = one mechanical revolution.

Firmware Versions: all
Type: switch mode (R/W) Range: 512, 1024, 2048, 4096, 8192, or 16384
Units: lines per electrical rev. of the resolver Default: 1024
Opmodes: all Drive Status: dis EEPROM: yes

ENCOUTO

sets the value of a scale-down factor for the encoder equivalent output channel (ENCOUT) for encoder- and sine encoder-based systems only. For encoder-based systems with firmware versions 3.3.0 or later, ENCOUT = MENCRES / ENCOUTO. For sine encoder-based systems, ENCOUT = MENCRES * SININTOUT / ENCOUTO.

Firmware Versions: all
Type: switch mode (R/W) Range: 1, 2, 4, 8, 16
Units: none Default: 1
Opmodes: all Drive Status: dis EEPROM: yes

ENCSTART

triggers the encoder initialization process for encoder types 1-4 and 6 (see MENCTYPE). In the initialization process, the drive rotates the motor to a known electrical position by placing IENCSTART current from the motor B terminal to the motor C terminal. If the encoder index is encountered (for type 1 and 2 encoders), the process terminates immediately. The ENCSTART process is initiated by doing the following:

1. With the drive disabled, type the command "ENCSTART".
2. Enable the drive. The current will be placed on the motor terminals and the initialization process will be completed after the drive enable occurs.

Enable is inhibited until this command is executed (for encoder types 1 and 3). The Status Display will flash the current OPMODE at 3 Hz as a visual indicator that the encoder is not initialized yet.

Firmware Versions: all
Command Syntax: ENCSTART
Opmodes: all Drive Status: dis

ERR

displays the last error detected by the drive. A numeric code and a short explanatory string are output to the serial port (if MSG = 1). The error buffer is cleared when the drive undergoes a transition from disabled (dis) to enabled (en).

Firmware Versions: all
Command Syntax: ERR
Opmodes: all Drive Status: en/dis

FILTMODE

sets the velocity loop filter mode.
0 = no LPF.
1 = a single first order filter. Cutoff frequency is LPFHZ1.
2 = two first order filters. Cutoff frequencies are LPFHZ1 and LPFHZ2.
3 = notch filter. Frequency NOTCHHZ, bandwidth NOTCHBW. Available only if firmware version (VER)

is 3.1.0 or greater.
The filters affect the PI, PDFF, and standard pole placement controllers (COMPMODES 0-2 and 4), and are ignored in the advanced pole placement controller (COMPMODE=3).

Firmware Versions: all
Type: switch mode (R/W) Range: 0, 1, 2
Units: n/a Default: 0
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

FLTCLR

clears the fault history buffer, which contains up to 10 faults.

Firmware Versions: all
Command Syntax: FLTCLR
Opmodes: all Drive Status: en/dis

FLTHIST

will cause the drive to transmit the fault history buffer to the serial port. The most recent fault is sent first. Up to 10 fault messages will be output by the drive, with each fault message followed by a CR-LF. A time stamp in the format of hours:minutes is displayed along with each fault, indicating the time at which the fault occurred (refer to TRUN for more time stamp info).

Firmware Versions: all
Command Syntax: FLTHIST
Opmodes: all Drive Status: en/dis

FOLD

displays the status of the drive foldback circuit. When the system current level exceeds ICONT for too long, the drive enters foldback mode, FOLD changes from 0 to 1, and the drive current is limited gradually (in exponential fashion) to the value of ICONT. See also FOLDMODE, MFOLD, MFOLDD, MFOLDDIS, MFOLDR, and MFOLDT.

0 = drive foldback OFF
1 = drive foldback ON

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: no

FOLDMODE

sets the mode for drive current foldback and motor current foldback operation. See also FOLD, MFOLD, MFOLDD, MFOLDDIS, MFOLDR, and MFOLDT.

0 = normal foldback from ILIM to ICONT
1 = foldback to ICONT and issue fault after FOLDTIME
2 = issue fault immediately upon detection

Firmware Versions: all
Type: switch mode (R/W) Range: 0, 1, 2
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

FOLDTIME

sets the time since foldback detection to foldback fault latch (for FOLDMODE=1 only).
0 = normal foldback from ILIM to ICONT.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 1-300
Units: seconds Default: 30
Opmodes: all Drive Status: en/dis EEPROM: yes

GEAR

enables/disables electronic gearing. The GEAR command is an immediate command (causes immediate gearing) unless INxMODE is selected to allow hardware control. If INxMODE is selected to control this function, this serial command must be 1 and the INx input must be on to enable the gear function. The GEAR function is a velocity-lock function so any bits lost during unlock time or ramp-to-speed are lost.

Firmware Versions: 2.1.0 and later
Type: switch (R/W) Range: 0 (off), 1 (on)
Units: n/a Default: 1
Opmodes: 4 Drive Status: en/dis EEPROM: yes

GEARI

specifies the number of teeth on the input "gear" for the Gearing mode.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: -32767 to + 32767
Units: teeth Default: 1
Opmodes: 4 Drive Status: en/dis EEPROM: yes

GEARMODE

is a switch mode variable that specifies the operation of electronic gearing for OPMODE 4:

- **GEARMODE = 0 - Encoder Follower, Flex I/O (Connector C3) Inputs:** The encoder input channel is decoded as a quadrature input, scaled through GEARI / GEARO, and becomes the position command for the motor. The digital I/O ("Flex I/O") inputs serve as the encoder input channel (see Note below for clarification).
- **GEARMODE = 1 - Pulse and Direction, Flex I/O (Connector C3) Inputs:** The encoder input channel A counts positive edges and becomes the position command. The encoder input channel B level dictates if the counter will count up or down. Channel B low drives motor in CW direction. The digital I/O ("Flex I/O") inputs serve as the encoder input channel (see Note below for clarification).
- **GEARMODE = 2 - Up/Down Mode, Flex I/O (Connector C3) Inputs:** The encoder input channel is configured as a counter to command the motor's position. Positive edges on the A channel increments the counter (motor CW) while positive edges on the encoder input channel B decrements the counter (motor CCW). The digital I/O ("Flex I/O") inputs serve as the encoder input channel (see Note below for clarification).
- **GEARMODE = 3 - Encoder Follower, Remote Encoder (Connector C8) Inputs:** The encoder input channel is decoded as a quadrature input, scaled through GEARI / GEARO, and becomes the position command for the motor. The remote encoder ("handwheel") inputs serve as the encoder input channel (see Note below for clarification).
- **GEARMODE = 4 - Pulse and Direction, Remote Encoder (Connector C8) Inputs:** The encoder input channel A counts positive edges and becomes the position command. The encoder input channel B level dictates if the counter will count up or down. Channel B low drives motor in CW direction. The remote encoder ("handwheel") inputs serve as the encoder input channel (see Note below for clarification).
- **GEARMODE = 5 - Up/Down Mode, Remote Encoder (Connector C8) Inputs:** The encoder input channel is configured as a counter to command the motor's position. Positive edges on the A channel increments the

counter (motor CW) while positive edges on the encoder input channel B decrements the counter (motor CCW). The remote encoder ("handwheel") inputs serve as the encoder input channel (see Note below for clarification).

Note: if GEARMODE = 0-2, encoder A/B inputs are received via the digital "Flex I/O" inputs on connector C3 (see INx and INxMODE descriptions); if GEARMODE = 3-5, encoder A/B inputs are received via the remote encoder (sometimes called "handwheel") inputs on connector C8.

Note that each of these modes are subject to: GEARI, GEARO, GEAR, and DIR.

Firmware Versions: 2.1.0 and later
Type: switch mode (R/W) Range: 0 to 5
Units: n/a Default: 3
Opmodes: 4 Drive Status: dis EEPROM: yes

GEARO

specifies the number of teeth on the output "gear" for the Gearing mode.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 1 to 32767
Units: teeth Default: 1
Opmodes: 4 Drive Status: en/dis EEPROM: yes

GET

causes all recorded variables to be transmitted to the serial port for use with PC Scope. The data format is defined by the variable GETMODE. See also RECORD.

Firmware Versions: all
Command Syntax: GET
Opmodes: all Drive Status: en/dis

GETMODE

sets the mode of data transfer from the drive to the host when using the GET command.
0 = ASCII data transfer format
1 = ASCII-HEX data transfer format
2 = BINARY data transfer format (fastest)
Note that GETMODE=0 is needed for operation of MotionLink.

Firmware Versions: all
Type: switch mode (R/W) Range: 0, 1, 2
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

GP

sets the proportional gain for the position loop. Executing the TUNE command successfully may change the value of this parameter.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 1 to 7000
Units: rotary: 0.01 kRPM/rev Default: calculated
linear: 0.01 m/min/mm
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPAFR

is a position loop feedforward acceleration gain term (see also GPAFR2). This term is applied in the position loop and is used to create an acceleration feedforward input to the current loop.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to 2000
Units: 0.1% Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPAFR2

is a second position loop feedforward acceleration gain term (see also GPAFR). This term is applied in the position loop and is used to create an acceleration feedforward input to the velocity loop. Note that prior to firmware version 3.2.0, the range was 0 to 2000.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: -10,000 to +10,000
Units: 0.1% Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPD

sets the derivative gain for the Proportional-Integral-Derivative (PID) compensator in the position loop.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to 32767
Units: n/a (1000=unity gain) Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPI

sets the integral gain for the Proportional-Integral-Derivative (PID) compensator in the position loop. Setting this value = 10,000 means that GPI=GP (expressed mathematically, the internal PID gain used by the drive processor equals GP*GPI/10000).

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to 10000
Units: n/a Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPISATIN

limits the input of the position loop integrator by setting the input saturation. When used in concert with GPISATOUT, this variable enables the operator to make the position loop integrator effective near the target position, whereas far from the target position, the integrator is not dominant in the loop dynamics.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to 1,000,000
Units: feedback counts Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPISATOUT

limits the output of the position loop integrator by setting the output saturation. When used in concert with GPISATIN, this variable enables the operator to make the position loop integrator effective near the target position, whereas far from the target position, the integrator is not dominant in the loop dynamics.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to 1,000,000
Units: feedback counts Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GPVFR

is a position loop feedforward velocity gain term. This term is applied in the position loop and is used to create a feedforward input to the velocity loop.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to 2000
Units: 0.1% Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

GV

sets the proportional gain for the Proportional Integral Velocity Control Loop (PI loop; COMPMODE = 0). Executing the TUNE command successfully may change the value of this parameter. Note that in firmware versions

Firmware Versions: all
Type: variable (R/W) Range: 0 to 1,000,000,000 (firmware versions 3.3.0 and later)
0 to 65,535 (firmware versions 2.2.0 to 3.2.1)
0 to 32,767 (firmware versions up to and including 2.1.0)
Units: n/a Default: 500
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

GVI

sets the velocity integral gain for the Proportional Integral Velocity Control Loop (PI loop; COMPMODE = 0). Executing the TUNE command successfully may change the value of this parameter.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 65535
Units: n/a Default: 20
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

HALLS

returns the hall switch values (encoder feedback option only). The switch values are displayed as a three-bit code in the sequence C-B-A.

Firmware Versions: all
Type: switch mode (R) Range: 000-111
Units: bits Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

HOLD

sets a flag indicating whether or not the drive should enter the position-hold mode. When activated, the motor will decelerate to zero speed at the DECSTOP rate and switch modes to hold the motor shaft at its present position. This variable may be set either by serial communication, by asserting both limit switches (CWLIM and CCWLIM), or by setting DIP switch number 7, or during active disable. The Status Display will flash the current OPMODE as a visual indicator that the drive is in the HOLD mode.

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: no

HOMESPD

sets the homing speed and direction (first time initialize) for INxMODE 10-12 and the MH command. A positive speed is CW.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: -VMAX to VMAX
Units: rotary: RPM Default: 100
linear: mm/sec
Opmodes: 8 Drive Status: en/dis EEPROM: yes

HOMESTATE

returns the status of the homing function. This variable can be polled during homing to track the homing status. A homing process may not go through all of the steps listed below, which are a chronological listing of the steps taken during a full homing procedure that begins when homing is initiated with a home switch that is already pressed. See also MH, HOMESPD, HOMETYPE, and IN1MODE-IN3MODE.

0 = no drive controlled homing has been initiated.
1 = homing started; moving away from pressed home switch.
2 = waiting for home switch to clear; drive will stop when it does.
3 = home switch has cleared; check if drive is stopped.
4 = home search; move towards home switch.
5 = waiting for home switch to be pressed; drive will stop.
6 = home switch detected; check if motor is stopped.
7 = after motion stops, motor will go home.
8 = check if motor is at home.
10 = homing is complete.
11 = homing process was interrupted during execution.

Firmware Versions: 3.1.0 and later
Type: switch mode (R) Range: 0-11
Units: n/a Default: n/a
Opmodes: 8 Drive Status: en/dis EEPROM: n/a

HOMETYPE

defines the type of homing function performed. This variable takes on a different meaning depending on the type of positioning selected (using PCMDMODE). In the following descriptions, “Home switch” refers to a digital input (IN1-IN3) that has been configured as a home switch by setting INxMODE = 10. “Marker” refers to an encoder’s index pulse or a resolver zero point:

In Serial Position Mode (PCMDMODE = 0; also see MH; PFB is normalized to zero after the home search):

0 = homing with home switch and marker (PFB = 0).
1 = homing with home switch only (PFB = 0).
2 = homing with marker only (PFB = 0).
3 = present position is home on the rising edge of IN1, IN2, or IN3 with the corresponding INxMODE value set to 12 (PFB = 0).
4 = homing on marker with every drive enable, MH command, or on the rising edge of IN1-IN3 with the corresponding INxMODE set equal to 12 (PFB = 0).
5 = homing on marker with every MH command, or on the rising edge of IN1-IN3 with the corresponding INxMODE set equal to 12 (PFB = 0).
6 = homing with home switch and marker (PFB = 0) on every MH command (firmware versions 3.3.0 and later).
7 = homing with home switch only (PFB = 0) on every MH command (firmware versions 3.3.0 and later).

Note that for HOMETYPE 0-3, the initial homing will search for home, and successive homing commands will go back to home. For HOMETYPE 4-7, the drive will search for home on every home command, whether home has previously been detected or not.

In Analog Position Mode (PCMDMODE = 1):

HOMETYPES 0-7: same as for Serial Position Mode. When homing is complete, PFB is normalized (set equal to 0) at the current value of the analog input (ANIN). Example: when homing is complete, if 2 volts are present at the analog input, then PFB will be set equal to 0 at 2 volts of input.

HOMETYPES 50-57: same as 0-7, except that when homing is complete, PFB is NOT normalized at the current value of ANIN. Instead, PFB is normalized at 0 volts input. * **Caution!** If there is a voltage on the analog input other than 0v and the drive is enabled, the motor will see this as a "command to move" and move to the position specified by the analog input voltage.

Firmware revision information: prior to firmware version 3.3.0, only Analog Position Mode HOMETYPES 0 and 3 were available.

Firmware Versions: 3.1.0 and later
Type: switch mode (R/W) Range: 0 to 7 (analog and serial position modes), 50-57 (analog position mode only)
Units: n/a Default: 0
Opmodes: 8 Drive Status: en/dis EEPROM: yes

HWPOS

displays the position feedback directly from the feedback hardware counter. For resolver-based systems, HWPOS will range from 0 to 65,535 per electrical revolution of the resolver (the number of electrical resolver revolutions per each mechanical revolution is calculated by dividing the number of resolver poles by 2 - see MRESPOLES). The resolution of HWPOS is based on RDRES:

RDRES = 12, resolution of HWPOS = 16
RDRES = 14, resolution of HWPOS = 4
RDRES = 16, resolution of HWPOS = 1

For encoder-based systems, HWPOS will return the encoder counter content, which is based on quadrature pulse input and will range from 0 to 65535, with a resolution of 32.

Firmware Versions: 2.0.0 and later
Type: variable (R) Range: 0 to 65,535
Units: counts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

I

displays the motor current. The AVGTIME variable determines the averaging of this variable, except when recorded for graphical display by MotionLink, in which case it is not averaged.

Firmware Versions: all
Type: variable (R) Range: 0 to 2000
Units: % of DIPEAK * 0.1 Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

IA

displays the motor's A phase current. AVGTIME does not affect this variable.

Firmware Versions: all
Type: variable (R) Range: -1000 to 1000
Units: % of DIPEAK * 0.1 Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

IC

displays the motor's C phase current. AVGTIME does not affect this variable.

Firmware Versions: all
Type: variable (R) Range: -1000 to 1000
Units: % of DIPEAK * 0.1 Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

ICMD

displays the Current (Torque) command to the current controller. This variable is equivalent to the Analog Input (ANIN) in OPMODE 3, to the Torque Command (T) in OPMODE 2, and to the output of the velocity controller in OPMODE 0 or 1. The AVGTIME variable affects averaging of this variable, except when recorded for graphical display by MotionLink, in which case it is not averaged.

Firmware Versions: all
Type: variable (R) Range: -1000 to 1000
Units: % of DIPEAK * 0.1 Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

ICONT

sets the system continuous current. This variable is used in the foldback algorithm (see FOLD and FOLDMODE). The default value of this variable is the minimum of DICONT (Drive Continuous Current) and MICONT (Motor Continuous Current), unless that value exceeds IMAX, in which case ICONT will be set equal to IMAX. This variable will be reset to its default whenever DICONT or MICONT is changed. The user can override the default.

Firmware Versions: all
Type: variable (R/W) Range: 0 to IMAX
Units: % of DIPEAK *0.1 Default: min of DICONT and MICONT
Opmodes: all Drive Status: en/dis EEPROM: yes

IENCSTART

sets the B-C phase current for the ENCSTART encoder initialization process.

Firmware Versions: all
Type: variable (R/W) Range: 1 to 100
Units: % of MICONT Default: 25
Opmodes: all Drive Status: en/dis EEPROM: yes

IFRIC

is the Coulomb Friction constant for the current loop.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to 500
Units: 0.1% of DIPEAK Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

IGRAV

is the Gravity constant for the current loop.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: -500 to 500
Units: 0.1% of DIPEAK Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

ILIM

sets the application current limit, allowing the user to limit the drive's peak current. This variable limits the current command that will be accepted from the user (using the T command in Opmode 2) or issued by the control loops (in Opmodes 0, 1, 3, and 4). This variable is an independent variable that is not calculated from hardware parameters and is not tied to any other variables. ILIM is similar to VLIM (which is used in Opmodes 0 and 1) and can be used to protect delicate load equipment.

Firmware Versions: all
Type: variable (R/W) Range: 0 to IMAX
Units: % of DIPEAK * 0.1 Default: IMAX
Opmodes: all Drive Status: en/dis EEPROM: yes

ILIM2

is a variable used to define a new current limit value for INxMODE 8. This variable functions in similar fashion to ILIM if INxMODE = 8 and the corresponding INx input = 1.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 0 to IMAX
Units: % of DIPEAK * 0.1 Default: 0.1 * IMAX
Opmodes: all Drive Status: en/dis EEPROM: yes

ILSBMODE

(relevant for resolver feedback only) sets the mode of operation of the inter-LSB algorithm, which interpolates feedback between least significant bits (LSB's) of the resolver. Enabling this algorithm will improve performance when the RDRES resolution is low (12 bits), BW is high, and the commanded velocity is low.

ILSBMODE = 0; algorithm disabled
ILSBMODE = 1; enabled for velocity feedback.

ILSBMODE = 2; enabled for velocity and position feedback

Firmware Versions: 2.1.0 and later
Type: switch mode (R/W) Range: 0, 1, 2
Units: n/a Default: 2
Opmodes: 0,1,4,8 Drive Status: dis EEPROM: yes

IMAX

displays the system current maximum for a drive and motor combination. This variable is actually the minimum of the drive Peak Current (DIPEAK) and the Motor Peak Current (MIPEAK).

Firmware Versions: all
Type: variable (R) Range: 0 to 1000
Units: % of DIPEAK *0.1 Default: min of DIPEAK & MIPEAK
Opmodes: all Drive Status: en/dis EEPROM: no

IN

returns the state of the three digital inputs (IN1/2/3) in a three-character string. The leftmost bit represents IN1 and the rightmost bit represents IN3.

Firmware Versions: V3.1.0 and later
Type: switch mode (R) Range: 000 - 111 (0=off, 1=on)
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: n/a

IN1

is used to read the state of the hardware input on user connector C3 Pin 9.

Firmware Versions: V2.1.0 and later
Type: switch (R) Range: 0 (off), 1 (on)
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: n/a

IN1MODE

IN1MODE, IN2MODE, and IN3MODE set the functionality of the IN1, IN2, and IN3 inputs, respectively. The function list is:

INxMODE=0: No function*
INxMODE=1: CW limit switch*
INxMODE=2: CCW limit switch*
INxMODE=3: Gear disable input (all GEARMODE values)*
INxMODE=4: Gear mask input (all GEARMODE values)*
INxMODE=5: Gear A input (GEARMODE = 0-2)*
INxMODE=6: Gear B input (GEARMODE = 0-2)*
INxMODE=7: Trigger incremental move / jog (see Notes below)**
INxMODE=8: Use second current limit (ILIM2)**
INxMODE=9: Switch OPMODE from 1 to 3** (see Notes below)
INxMODE=10: Home switch**
INxMODE=11: Reserved
INxMODE=12: Search for home switch / Move to home switch**
INxMODE=13: Trigger absolute move (MAPOS at MASPEED)**

INxMODE=14: Binary MIDIST / MISPEED selection code MSB**
INxMODE=15: Binary MIDIST / MISPEED selection code LSB**
INxMODE=16: Reserved
INxMODE=17: Trigger active disable (see DISSPEED)*
INxMODE=18: Control fault relay** (see Notes below)
INxMODE=19: Hold position*

* available in firmware versions 2.1.0 and later
** available in firmware versions 3.1.0 and later

Notes:

- **INxMODE = 7** operation: If the drive is in OPMODE 8 (positioning), an input with INxMODE=7 can be used to trigger an incremental move (MI), using the variables MIDIST0-3, MISPEED0-3. Refer to the descriptions for those variables, as well as the description of MH, for more information. If the drive is in OPMODE 1 (analog velocity), an input with INxMODE =7 can be used to trigger a jog at a speed entered in MISPEED0-3. See the description of MISPEED0 for more details.
- **INxMODE = 9** operation: If the drive is in OPMODE 1 (serial velocity) and INxMODE is 9, then switching the related INx input to '1' will cause the drive to switch to OPMODE 3 (serial current). Switching the INx input back to '0' will cause the drive to switch back to OPMODE 1 (serial velocity). The LED display of OPMODE will change according to the user input, but the serial response to a prompt for OPMODE will return 1.

  Attention !
  The OPMODE change can happen when the drive is enabled, therefore the user must make the switch with zero command.
- **INxMODE = 12** operation: the first time this mode is triggered, the drive will search for home. Subsequent triggers will cause a move to home. Moves are performed at velocity equal to HOMESPD.
- **INxMODE = 18**: if input = 0, the fault relay will open. If input = 1, the fault relay operates as normal.

Firmware Versions: see * and **
Type: switch mode (R/W) Range: 0 to 19
Units: n/a Default: 1 for IN1MODE, 2 for IN2MODE, 3 for IN3MODE
Opmodes: dependent Drive Status: en/dis EEPROM: yes

IN2

is used to read the state of the hardware input on user connector C3 Pin 10.

Firmware Versions: V2.1.0 and later
Type: switch (R) Range: 0 (off), 1 (on)
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: n/a

IN2MODE

See the description for IN1MODE.

IN3

is used to read the state of the hardware input on user connector C3 Pin 11.

Firmware Versions: V2.1.0 and later
Type: switch (R) Range: 0 (off), 1 (on)
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: n/a

IN3MODE

See the description for IN1MODE.

INPOS

indicates if the actual position (PFB) is following the commanded position (PCMD) within the following error set by PEINPOS.

Firmware Versions: 2.1.0 and later
Type: switch (R) Range: 0 (not in posn), 1 (in posn)
Units: n/a Default: n/a
Opmodes: 4 Drive Status: en/dis EEPROM: n/a

ISCALE

Is an analog current scale factor that scales (1) the analog input ANIN for OPMODE 3 (analog torque mode), and (2) the analog output for ANOUT=1 or 3. The value entered is the motor current per 10 volts of analog input or output. This variable may be either higher or lower than 100%, but the actual analog I/O will be limited by the application current limit (ILIM).

Firmware Versions: all
Type: variable (R/W) Range: 100 to 10,000
Units: (% DIPEAK*0.1) /10V Default: 1250 (default is 833 for the ServoStar CD)
Opmodes: 3 Drive Status: en/dis EEPROM: yes

ISTOP

sets the current command for the braking function. See also STOPMODE.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to IMAX
Units: % of DIPEAK *0.1 Default: DICONT
Opmodes: all Drive Status: en/dis EEPROM: yes

IZERO

sets the C-B phase current for ZERO Mode (A=0). See also ZERO.

Firmware Versions: all
Type: variable (R/W) Range: 1 to 100
Units: % of MICONT Default: 25
Opmodes: all Drive Status: en/dis EEPROM: yes

J

sets the continuous jog speed and initiates motion at that speed if the motor is currently enabled (see EN and REMOTE) in OPMODE 0. J is set to 0 whenever the drive is disabled or enabled, or the operational mode is changed to prevent the motor from moving when enabled. The J command has an optional parameter of 'for-time', in milliseconds. Not available when the drive is in Hold mode.

Firmware Versions: all
Command Syntax: J [speed] {time}
speed (required) = -VLIM to +VLIM in RPM (rotary) or mm/sec (linear)
time (optional) = 0 to 32767 in milliseconds
Opmodes: 0 Drive Status: en

K

is the same as the disable command (DIS) and provides a one-key hot-button. The drive is disabled and the motor may coast when this command is issued.

Firmware Versions: all
Command Syntax: K
Opmodes: all Drive Status: en/dis

KV

is a tuning variable which sets the proportional gain for the Pseudo Derivative Feedback with Feed-Forward Velocity Control Loop (PDFF loop; COMPMODE = 1). This variable is set manually by the user. Executing the TUNE command successfully may change the value of this parameter.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 1,000,000,000 (firmware versions 3.3.0 and later)
0 to 65,535 (firmware versions 2.2.0 to 3.2.1)
0 to 32,767 (firmware versions up to and including 2.1.0)
Units: n/a Default: 1000
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

KVFR

is a tuning variable which sets the feed-forward to feedback gain ratio for the Pseudo Derivative Feedback with Feed-Forward Velocity Control Loop (PDFF loop; COMPMODE = 1). This variable is set manually by the user. Executing the TUNE command successfully may change the value of this parameter.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 1000
Units: percent *0.1 Default: 0
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

KVI

is a tuning variable which sets the integral gain for the Pseudo Derivative Feedback with Feed-Forward Velocity Control Loop (PDFF loop; COMPMODE = 1). This variable is set manually by the user. Executing the TUNE command successfully may change the value of this parameter.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 65535
Units: n/a Default: 1000
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

LIMDIS

enables/disables the End Travel Limit function. This function only pertains to units with the limit switch option.
0 = limit switch function enabled
1 = limit switch function disabled; LED decimal point flashes

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

LIST

dumps a list of valid commands and variables to the serial port. Only the names of variables are transmitted, not values. Note that some factory variables and commands, not intended for use by the user, may be printed.
Do not use commands and variables that are not described in this guide.

Firmware Versions: all
Command Syntax: LIST
Opmodes: all Drive Status: en/dis

LMJR

sets the ratio of the estimated Load Moment of Inertia (LMJ) relative to the Motor Moment of Inertia (MJ). The variables LMJR and MJ and the required closed loop bandwidth (BW) are used for the Velocity Control Loop design in the Standard Pole-Placement controller (COMPMODE = 2 or 4). Executing the TUNE command successfully may change the value of this parameter.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 10,000
Units: percent of MJ Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

LOAD

loads all variables saved in the EEPROM into system RAM. This command is automatically executed on power-up.

Firmware Versions: all
Command Syntax: LOAD
Opmodes: all Drive Status: dis

LPFHZ1

sets the cutoff frequency of the first Low Pass Filter (LPF) used in the velocity loop. This variable only affects the system when FILTMODE = 1 or 2.

Firmware Versions: all
Type: variable (R/W) Range: 20 to 800, steps of 20 (20, 40, ..., 800)
Units: Hz Default: 500
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

LPFHZ2

sets the cutoff frequency of the second Low Pass Filter (LPF) used in the velocity loop. This variable only affects the system when FILTMODE = 2.

Firmware Versions: all
Type: variable (R/W) Range: 20 to 800, steps of 20 (20, 40, ..., 800)
Units: Hz Default: 500
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

MA

Serial Move Absolute: this command will move to the specified position at the specified speed. Motion could occur in either direction, depending upon the relationship between the starting position and the commanded position. The current position of the motor can be read using PFB.

The optional flag [in pos ack] enables the operator to direct the drive to indicate when the commanded move is completed. When this flag is set to 1, the drive, upon completion of the commanded move, will output an exclamation point (!) over the serial port. The exclamation point is tied to the STOPPED flag and will be issued when STOPPED transitions from 0 to 1.

Position is in feedback counts. Issuing an MA command while the motor is not stopped will cause the command to be ignored.

See also INPOS, MI, PCMD, PEINPOS, PFB, STOPPED.

Syntax/Range: MA <position> <velocity> [in pos ack]
<position> -LONG to LONG (feedback counts)
<velocity> 1 to VMAX (rpm or mm/sec)
[in pos ack] 0 or 1 (optional)
in pos ack = 0: do not indicate when move is complete
in pos ack = 1: indicate when move is complete

Firmware Versions: 3.1.0 and later
Command Syntax: see above
Opmodes: 8 Drive Status: en

Example:

MA 10000 1000 (Move to absolute position 10,000 at a speed of 1,000 RPM)
MA -5000 100 1 (Move to absolute position -5000 at a speed of 100 RPM; transmit a (!) to the serial port when the move is completed)

MAPOS

sets the absolute position for INxMODE 13. Position is in counts, where 65536 counts represent one motor revolution for resolver systems, and 4*MENCRES counts represents on motor revolution for encoder systems.

When IN1MODE, IN2MODE, or IN3MODE is set equal to 13, and the associated digital input (IN1, IN2, or IN3) goes high, the drive will move to MAPOS at a speed of MASPEED.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: +/- 2,147,483,647
Units: counts Default: 0
Opmodes: 8 Drive Status: en/dis EEPROM: yes

MASPEED

sets the move speed (unsigned) for INxMODE 13.

When IN1MODE, IN2MODE, or IN3MODE is set equal to 13, and the associated digital input (IN1, IN2, or IN3) goes high, the drive will move to MAPOS at a speed of MASPEED.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 1 to VMAX
Units: rotary: RPM Default: 0
linear: mm/sec
Opmodes: 8 Drive Status: en/dis EEPROM: yes

MBEMF

displays the motor's back EMF constant. This value is used for current loop controller design. This variable requires a CONFIG command when changed.

Firmware Versions: all
Type: variable (R/W) Range: 1 to 3900
Units: rotary: (V_{RMS}) / kRPM Default: motor data
linear: (V_{Peak}) / (m/sec)
Opmodes: all Drive Status: dis EEPROM: yes

MBEMFCOMP

sets a back EMF compensation percentage value. This variable affects the amount of back EMF compensation that is applied to the motor command. Note that for firmware version, 2.0.0, this variable was called BEMFCOMP.

Firmware Versions: V2.0.1 and later
Type: variable (R/W) Range: 1 to 130
Units: percent Default: 50, or motor data
Opmodes: all Drive Status: en/dis EEPROM: yes

MENCOFF

sets the encoder index position (encoder feedback systems only). This variable is expressed in units of encoder counts after quadrature, and the range is from 0 to (4 * encoder resolution - 1), or (4 * MENCRES - 1). This variable can be set automatically using ENCINIT.

Firmware Versions: all
Type: variable (R/W) Range: 0 to (4*MENCRES) - 1
Units: encoder counts / mechanical motor revolution Default: motor data (120 degrees if undefined)
Opmodes: all Drive Status: en/dis EEPROM: yes

MENCRES

displays the resolution of the motor encoder (encoder feedback systems only) in number of lines per revolution of the motor. Note that the number of encoder counts per revolution is obtained by multiplying MENCRES by 4. This variable requires a CONFIG command when changed. Note that prior to firmware version 3.2.0, the lowest valid value for MENCRES was 100.

Firmware Versions: all
Type: variable (R/W) Range: 1 to 10,000,000
Units: rotary: lines/motor rev Default: motor data
linear: lines/pitch
Opmodes: all Drive Status: dis EEPROM: yes

MENCTYPE

sets the motor encoder type. When this variable is changed on an encoder-based system, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG). In version 1 firmware prior to 1.2.0, MENCTYPE = 0 is assumed. This variable may take value from 0 to 6.

ENCODER CHARACTERISTICS				
MENCTYPE	**A/BQuad**	**Marker Pulse**	**Hall Effects**	**Firmware Versions**
0	√	√	√	all
1	√	√		all

2	√	√		all
3	√			all
4	√			all
5			√	reserved
6	√		√	2.1.0 and later

INITIALIZATION METHODS	
MENCTYPE	**Method of Initialization**
0	Initialization is optional; may be performed using the ENCINIT command to locate the marker.
1	Initialization is required and is triggered by the ENCSTART command. This may optionally be followed by marker pulse location using the ENCINIT command.
2	Initialization is required and is triggered on power up (when the drive is enabled) or by using ENCSTART. This may optionally be followed by marker pulse location using the ENCINIT command.
3	Initialization is required and is triggered by the ENCSTART command.
4	Initialization is required and is triggered on power up (when the drive is enabled) or by using the ENCSTART command.
5	Reserved for later introduction
6	Initialization is required and is triggered by the ENCSTART command.

For MENCTYPE 0-2, ENCINIT should be performed where MENCOFF is unknown.

Firmware Versions: all
Type: switch mode (R/W) Range: 0 to 6 (5 is reserved for future)
Units: n/a Default: motor data (0 if undefined)
Opmodes: all Drive Status: dis EEPROM: yes

MFBDIR

sets the motor feedback direction. This switch is used during the Auto-Config process (see ACONFIG). If Phase 5 of Auto-Config (Direction test) fails, MFBDIR can be used to switch the motor feedback direction. The range is 0 to 3:

MFBDIR = 0: normal commutation direction, normal velocity direction.
MFBDIR = 1: inverted commutation direction, normal velocity direction.
MFBDIR = 2: normal commutation direction, inverted velocity direction.
MFBDIR = 3: inverted commutation direction, inverted velocity direction.

If the motor leads/motor stator are phased incorrectly, then setting MFBDIR=1 will solve the problem. If the feedback device is connected/phased incorrectly, you have to set MFBDIR=3, which changes both the commutation and velocity loop directions.

Firmware Versions: 3.3.0 and later
Type: switch mode (R/W) Range: 0-3
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: yes

MFOLD

displays the status of the motor foldback circuit. When the system current level exceeds MICONT for too long, the drive enters motor foldback mode, MFOLD changes from 0 to 1, and the drive current is limited gradually (in exponential fashion) to the value of MICONT. See also FOLD, FOLDMODE, MFOLDD, MFOLDDIS, MFOLDR, and MFOLDT.

0 = motor foldback OFF (inactive)

1 = motor foldback ON (drive is limiting output current)

Firmware Versions: 3.2.0 and later
Type: switch (R) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: no

MFOLDD

sets the delay time for motor foldback. This is the amount of time that the system current can exceed MICONT before the drive will enter the motor foldback state. The time units assume a worst-case scenario where the drive is applying MIPEAK current. A current level of less than MIPEAK can be allowed for a longer time. See also FOLD, FOLDMODE, MFOLD, MFOLDDIS, MFOLDR, and MFOLDT.

Firmware Versions: 3.2.0 and later
Type: variable (R/W) Range: 1 to 2400
Units: seconds at MIPEAK Default: 1200
Opmodes: all Drive Status: en/dis EEPROM: yes

MFOLDDIS

enables/disables the motor current foldback function. See also FOLD, FOLDMODE, MFOLD, MFOLDD, MFOLDR, and MFOLDT.

0 = enable motor foldback function
1 = disable motor foldback function

Firmware Versions: 3.2.0 and later
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 1 (disabled)
Opmodes: all Drive Status: en/dis EEPROM: yes

MFOLDR

sets the recovery time for motor foldback. After the drive enters the motor foldback state (MFOLD=1), and the current folds back to MICONT, this is the amount of time that the current will be held at MICONT or below before it is allowed to exceed MICONT again. See also FOLD, FOLDMODE, MFOLD, MFOLDD, MFOLDDIS, and MFOLDT.

Firmware Versions: 3.2.0 and later
Type: variable (R/W) Range: 900 to 3600
Units: seconds Default: 1800
Opmodes: all Drive Status: en/dis EEPROM: yes

MFOLDT

sets the time constant for motor foldback. After the drive enters the motor foldback state (MFOLD=1), this variable defines how long it will take the drive to reduce the system current level to MICONT. See also FOLD, FOLDMODE, MFOLD, MFOLDD, MFOLDDIS, and MFOLDR.

Firmware Versions: 3.2.0 and later
Type: variable (R/W) Range: 1 to 1200
Units: seconds Default: 600
Opmodes: all Drive Status: en/dis EEPROM: yes

MH

Move Home: this command will cause the motor to move to the home position. HOMESPD controls the speed. HOMETYPE defines the type of homing sequence, while HOMESTATE gives the homing status and describes the homing process further.

After power up, or after a feedback loss fault, the first issue of this command causes a search for home. Further issues of this command will cause a move to home position (equivalent to MA 0 command). HOMESPD controls the speed and direction of the search. PFB is normalized to 0 after completion.

The optional flag [in pos ack] enables the operator to direct the drive to indicate when the commanded move is completed. When this flag is set to 1, the drive, upon completion of the commanded move, will output an exclamation point (!) over the serial port. The exclamation point is tied to the STOPPED flag and will be issued when STOPPED transitions from 0 to 1.

Homing Process Using MH command:

- issue MH command via serial port
- if home switch is already pressed (see IN1MODE = 10), the drive will move in the opposite homing direction, until home switch is released.
- if home switch is not already pressed, the drive will move in the homing direction, until home switch is pressed.
- drive will capture position of first index (or resolver 0) past switch.
- drive will decelerate to stop using DEC.
- drive will go back to home position using ACC, DEC, and HOMESPD (in firmware versions 3.3.0 and later, the speed is MISPEED0). Drive will reset the absolute position (PFB) to 0.

Homing Process using digital I/O (see descriptions for INx and INxMODE 10 and 12):

When Home Input is activated for the first time after power-up:

- if home switch is already pressed (see INxMODE = 10), the drive will move in the opposite homing direction, until home switch is released.
- if home switch is not already pressed, drive will move in the homing direction, until home switch is pressed.
- drive will capture position of first index (or resolver 0) past switch.
- drive will decelerate at DEC to stop.
- drive will go back to home position using ACC, DEC, and HOMESPD (in firmware versions 3.3.0 and later, the speed is MISPEED0).
- drive will reset the absolute position (PFB) to 0

Otherwise:

- drive will move to absolute 0 at HOMESPD.

Syntax/Range: MH [in pos ack]
[in pos ack] 0 or 1 (optional)
in pos ack = 0: do not indicate when move is complete
in pos ack = 1: indicate when move is complete

Firmware Versions: 3.1.0 and later
Command Syntax: see above
Opmodes: 8 Drive Status: end

MHINVA

is a variable which applies to encoder-based systems which use hall switches to commutate. This variable inverts the hall sensor A feedback, causing the system to read the 'A' hall channel as inverted data.

MHINVA = 0: do not invert hall A
MHINVA = 1: invert hall A

Firmware Versions: all

Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: yes

MHINVB

is a variable which applies to encoder-based systems which use hall switches to commutate. This variable inverts the hall sensor B feedback, causing the system to read the 'B' hall channel as inverted data.

MHINVB = 0: do not invert hall B
MHINVB = 1: invert hall B

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: yes

MHINVC

is a variable which applies to encoder-based systems which use hall switches to commutate. This variable inverts the hall sensor C feedback, causing the system to read the 'C' hall channel as inverted data.

MHINVC = 0: do not invert hall C
MHINVC = 1: invert hall C

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: yes

MI

Serial Move Incremental: this command will incrementally move the specified distance at the specified speed. A positive incremental move will occur in the direction determined by the variable DIR, and a negative incremental move will occur in the opposite direction.

The optional flag [in pos ack] enables the operator to direct the drive to indicate when the commanded move is completed. When this flag is set to 1, the drive, upon completion of the commanded move, will output an exclamation point (!) over the serial port. The exclamation point is tied to the STOPPED flag and will be issued when STOPPED transitions from 0 to 1.

Position is in feedback counts. Issuing an MI command while the motor is not stopped will cause the command to be buffered for later execution. However, more than one command will not be buffered.

See also INPOS, MA, PCMD, PEINPOS, PFB, STOPPED.

SYNTAX/RANGE: MI <pos> <vel> [in pos ack]
<pos> -LONG to LONG (feedback counts)
<vel> 1 to VMAX (rpm or mm/sec)
[in pos ack] 0 or 1 (optional)
in pos ack = 0: do not indicate when move is complete
in pos ack = 1: indicate when move is complete

Firmware Versions: 3.1.0 and later
Command Syntax: see above
Opmodes: 8 Drive Status: en

EXAMPLES:
MI 10000 1000 (move 10,000 counts in the positive direction at a speed of 1,000 RPM)
MI -10000 100 1 (move 10,000 counts in the negative direction at a speed of 100 RPM; transmit a (!) to the serial port when the move is completed)

MICONT

sets the motor's continuous rated current. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 10 to 1750
Units: amperes RMS*0.1 Default: motor data
Opmodes: all Drive Status: dis EEPROM: yes

MIDIST0

MIDIST0, MIDIST1, MIDIST2, and MIDIST3 set four possible index distances for triggering via a digital input (IN1, IN2, or IN3) set to INxMODE 7. The other two inputs must be configured to INxMODE 14 and 15.

The user selects an MIDISTx / MISPEEDx pair using two digital inputs that are configured to INxMODEs 14 and 15. An incremental move (MI) is then triggered for the selected distance and speed by configuring the third digital input to INxMODE=7 and transitioning that input from low to high. When the INxMODE input goes high, the move will be initiated.

Position is in counts, where 65536 counts represent one motor revolution for resolver systems, and 4*MENCRES counts represents on motor revolution for encoder systems. See also MISPEED0.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: +/- 2,147,483,647
Units: counts Default: 0
Opmodes: 8 Drive Status: en/dis EEPROM: yes

MIDIST1

See the description for MIDIST0

MIDIST2

See the description for MIDIST0

MIDIST3

See the description for MIDIST0

MIPEAK

sets the motor's peak rated current. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 10 to 3500
Units: amperes RMS*0.1 Default: motor data
Opmodes: all Drive Status: dis EEPROM: yes

MISPEED0

MISPEED0, MISPEED1, MISPEED2, and MISPEED3 set four possible index speeds for triggering via a digital input (IN1, IN2, or IN3) set to INxMODE 7. The other two inputs must be configured to INxMODE 14 and 15.

Opmode 8 operation: The user selects an MIDISTx / MISPEEDx pair using two digital inputs that are configured to INxMODEs 14 and 15. An incremental move (MI) is then triggered for the selected distance and speed by configuring the third digital input to INxMODE=7 and setting that input high. When the INxMODE input goes high, the move will be initiated.

Opmode 1 operation: The user selects an MISPEEDx velocity using two digital inputs that are configured to INxMODEs 14 and 15. A jog is then triggered for the selected speed by configuring the third digital input to INxMODE=7 and setting that input high. When the INxMODE input is high, the jog command will be issued, and when the INxMODE input is low, the jog will not be performed. Note that PROFMODE affects the jog command issued in this scenario. If the user selects MISPEED0 and then sets MISPEED0=0, an analog input jog command can be given, as is normal for OPMODE 1 operation.

Note: in firmware versions 3.3.0 and later, when homing is performed (see MH, HOMESPD, HOMESTATE, and HOMETYPE), MISPEED0 sets the velocity at which the drive will return to home after finding home.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: +/- VLIM
Units: rotary: RPM Default: 100
linear: mm/sec
Opmodes: 1,8 Drive Status: en/dis EEPROM: yes

MISPEED1

See the description for MISPEED0

MISPEED2

See the description for MISPEED0

MISPEED3

See the description for MISPEED0

MJ

sets the motor's rotor inertia (rotary motors) or motor coil mass (linear motors, MOTORTYPE=2). The Motor rotor inertia (MJ) and the Load moment of inertia ratio (LMJR) define the total system moment of inertia. The variables LMJR and MJ and the required closed loop bandwidth (BW) are used for the Velocity Control Loop design in the Standard Pole-Placement controller (COMPMODE = 2 or 4).

Firmware Versions: all
Type: variable (R/W) Range: 1 to 2,000,000,000
Units: rotary: Kg $*m^2 *10^{-6}$ Default: motor data
linear: grams
Opmodes: all Drive Status: dis EEPROM: yes

MLGAINC

sets the current loop adaptive gain value at continuous motor current (MICONT). MLGAINC, MLGAINP, and MLGAINZ define the adaptive gain algorithm that is based on motor current.

The current-based adaptive gain algorithm is a gain calculation method that increases current loop stability by reducing the current loop gain as the motor current increases. The current-based adaptive gain algorithm is set up by defining the gains at peak motor current (MLGAINP), at continuous motor current (MLGAINC), and at zero motor current (MLGAINZ). All other gains between zero, continuous, and peak current are interpolated linearly.

This variable should typically be set to the midpoint of MLGAINZ and MLGAINP. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 1 to 100
Units: % * 10 Default: 8
Opmodes: all Drive Status: dis EEPROM: yes

MLGAINP

sets the current loop adaptive gain value at peak motor current (MIPEAK). MLGAINC, MLGAINP, and MLGAINZ define the adaptive gain algorithm that is based on motor current.

The current-based adaptive gain algorithm is a gain calculation method that increases current loop stability by reducing the current loop gain as the motor current increases. The current-based adaptive gain algorithm is set up by defining the gains at peak motor current (MLGAINP), at continuous motor current (MLGAINC), and at zero motor current (MLGAINZ). All other gains between zero, continuous, and peak current are interpolated linearly.

This variable is typically set to 4 for motors that don't have a lot of iron in their construction and peak currentswithin the boundaries of the drive. If the motor is rated for much more than what the drive can deliver, and/or if there is a lot of iron in the motor, saturation has less of an effect, and there may be an opportunity to increase this variable. The range for this variable is typically 4 to 7. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 1 to 100
Units: % * 10 Default: 4
Opmodes: all Drive Status: dis EEPROM: yes

MLGAINZ

sets the current loop adaptive gain value at zero motor current. MLGAINC, MLGAINP, and MLGAINZ define the adaptive gain algorithm that is based on motor current.

The current-based adaptive gain algorithm is a gain calculation method that increases current loop stability by reducing the current loop gain as the motor current increases. The current-based adaptive gain algorithm is set up by defining the gains at peak motor current (MLGAINP), at continuous motor current (MLGAINC), and at zero motor current (MLGAINZ). All other gains between zero, continuous, and peak current are interpolated linearly.

This variable is typically set to 10, resulting in 100% gain. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 1 to 100
Units: % * 10 Default: 10
Opmodes: all Drive Status: dis EEPROM: yes

MLIST

dumps all motor variables and their values to the serial port.

Firmware Versions: all
Command Syntax: MLIST
Opmodes: all Drive Status: en/dis

MLMIN

sets the motor's minimum line-to-line inductance. This variable is used for current loop controller design and as an input to the Torque Angle Control algorithms. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 1 to 32767
Units: millihenries $*10^{-2}$ Default: motor data
Opmodes: all Drive Status: dis EEPROM: yes

MOTOR

is the name of the motor connected to the drive. The motor string variable MUST BE PRECEDED BY DOUBLE QUOTES (") when entered.

Firmware Versions: all
Type: string variable (R/W) Range: 10 characters
Units: n/a Default: motor data
Opmodes: all Drive Status: en/dis EEPROM: yes

MOTORTYPE

sets the drive control algorithms to different motor types as follows:
MOTORTYPE=0: permanent magnet rotary motor
MOTORTYPE=1: reserved; do not use
MOTORTYPE=2: permanent magnet linear motor

Firmware Versions: 2.1.0 and later
Type: switch mode (R/W) Range: 0, 2
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: yes

MPHASE

defines the resolver/encoder phase relative to the "standard" commutation table. This variable can be used to compensate for resolver offset and should be set to 0 if there is no resolver offset. Note that changing MPHASE will ***not*** change the value of PRD or HWPOS, nor will it create a physical change in the position of the motor shaft - it merely shifts the internal commutation table.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 359
Units: electrical degrees Default: motor data
Opmodes: all Drive Status: dis EEPROM: yes

MPITCH

is a variable for use with linear motors (MOTORTYPE = 2). It defines the pole-pitch (length in millimeters of one electrical cycle - 360 electrical degrees) of the motor and allows the drive to be able to calculate other variables such as velocity. The drive assumes a 'no-comp' state after an entry of this parameter and requires the CONFIG command.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 1 to 500
Units: mm per 360º elec. Default: 16
Opmodes: all Drive Status: dis EEPROM: yes

MPOLES

sets the number of motor poles. This variable is used for commutation control and represents the number of individual magnetic poles of the motor (not pole pairs). When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG). When MOTORTYPE=2, this variable will be forced to a value of 2.

Firmware Versions: all
Type: switch mode (R/W) Range: 2, 4, 6, 8, ... , 78,80
Units: poles Default: motor data
Opmodes: all Drive Status: dis EEPROM: yes

MRESPOLES

sets the number of individual poles in the feedback device. This variable is used for the commutation function, as well as for velocity feedback scaling, and represents the number of individual poles, not pole pairs. When this variable is changed on a resolver system, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: switch mode (R/W)
Range: 2, 4, 6, 8, 12, 14, 16, …. 60 (resolver-based)
0, 2, 4, 6, 8, 12, 14, 16, …. 60 (encoder-based)
Units: poles Default: motor data
Opmodes: all Drive Status: dis EEPROM: yes
[END]
[BEGIN]

MSG

will enable/disable the sending of error messages from the drive to the serial port.
0 = disable messages
1 = enable messages
Note that MSG = 1 is needed for proper operation of MotionLink.

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 1
Opmodes: all Drive Status: en/dis EEPROM: yes

MSININT

is used with the sine encoder option and sets the interpolation level of the drive. A CONFIG Command is required after entering this variable.

Firmware Versions: 3.2.0 and 3.2.1 only (This variable is automatically set to 256 in later firmware versions)
Type: switch mode (R/W) Range: 1,2,4,8,16,32,64
Units: n/a Default: 1
Opmodes: all Drive Status: dis EEPROM: yes

MSINFRQ

is used with the sine encoder option and sets the maximum frequency limit of the encoder equivalent output. If the encoder equivalent output exceeds the value set by this variable, it becomes inaccurate, and a burst overflow fault is generated.

0 = ignore burst overflow fault
1 = 2.5 MHz
2 = 1.25 MHz
3 = 625 KHz
4 = 312 KHz

Firmware Versions: 3.3.0
Type: switch mode (R/W) Range: 0-4
Units: n/a Default: 1
Opmodes: all Drive Status: dis EEPROM: yes

MSPEED

defines the maximum recommended velocity of the Motor. When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 10 to 32767
Units: rotary: RPM Default: motor data
linear: mm/sec
Opmodes: all Drive Status: dis EEPROM: yes

MTANGLC

sets the value of the torque-related commutation angle advance at the motor's continuous current rating (MICONT). This variable helps increase reluctance torque. For surface magnet motors, a typical value is 5. For motors with embedded magnets, a typical value is 8 to 10.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 45
Units: electrical degrees Default: 10
Opmodes: all Drive Status: en/dis EEPROM: yes

MTANGLP

sets the value of the torque-related commutation angle advance at the motor's peak current (MIPEAK). This variable helps increase reluctance torque. For surface magnet motors, a typical value is 10. For motors with embedded magnets, a typical value is 23 to 25.

Firmware Versions: all

Type: variable (R/W) Range: 0 to 45
Units: electrical degrees Default: 23
Opmodes: all Drive Status: en/dis EEPROM: yes

MVANGLF

sets the value of the velocity-related commutation angle advance to be used when the motor is operating at motor max speed (MSPEED). Between MSPEED/2 RPM and MSPEED, the angle advance will be linearly interpolated based on MVANGLH and MVANGLF.

When a CLREEPROM command is issued, MVANGLF is set to a value of 10. If a CONFIG command is then issued, MVANGLF is set to a default value based on MSPEED and MPOLES. Once the user enters their own value for MVANGLF, however, MVANGLF will keep that value and will not be changed if a CONFIG is executed

Firmware Versions: all
Type: variable (R/W) Range: 0 to 90
Units: electrical degrees Default: calculated fr motor data
Opmodes: all Drive Status: en/dis EEPROM: yes

MVANGLH

sets the value of the velocity-related commutation angle advance to be used when the motor is operating at half of the motor max speed (MSPEED). Between 0 RPM and half of MSPEED, the angle advance will be linearly interpolated based on MVANGLH.

When a CLREEPROM command is issued, MVANGLH is set to a value of 5. If a CONFIG command is then issued, MVANGLH is set to a default value based on MSPEED and MPOLES. Once the user enters their own value for MVANGLH, however, MVANGLH will keep that value and will not be changed if a CONFIG is executed

Firmware Versions: all
Type: variable (R/W) Range: 0 to 90
Units: electrical degrees Default: calculated fr motor data
Opmodes: all Drive Status: en/dis EEPROM: yes

NOTCHBW

sets the bandwidth of the notch filter used in the velocity loop. Affects the system only when FILTMODE=3.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 1 to 100
Units: Hz Default: 1
Opmodes: all Drive Status: en/dis EEPROM: yes

NOTCHHZ

sets the center frequency of the notch filter used in the velocity loop. Affects the system only when FILTMODE=3.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 30 to 1000
Units: Hz Default: 500
Opmodes: all Drive Status: en/dis EEPROM: yes

O1

is used to read or write the state of the hardware output on user connector C3 Pin 12. Note that writing O1 in certain O1MODE conditions does not stop the drive from resetting the output according to drive conditions. See also O1MODE.

Firmware Versions: 2.1.0 and later
Type: switch (R/W) Range: 0 to 1
Units: 0, 1 (Off / On) Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: n/a

O1MODE

is a switch mode variable used to define the function of O1:

0 - Disabled
1 - O1 goes on when absolute motor speed is above 01TRIG speed.
2 - O1goes on when the absolute actual output current is above O1TRIG current.
3 - O1 goes on when drive is in FOLDBACK.
4 - O1 goes on when absolute motor speed is above O1TRIG but less than O1RST.
5 - Brake Mode: O1 is OFF only when (1) drive is disabled or (2) during an active disable sequence, when actual motor speed has dropped below DISSPEED, but DISTIME timer has not timed out yet. O1 is ON when the drive is enabled.
6 - Motion Complete Output: O1 is tied to STOPPED switch.
7 - In Position Output: O1 is tied to INPOS.
8 - Zero Speed Detect: O1 on if absolute motor speed < O1TRIG.
9 - Programmable Limit Switch: O1 goes on if O1TRIG < PFB < O1RST (firmware versions 3.2.0 and later).
10 - Active: O1 goes on if drive is active (firmware versions 3.1.0 and later).

Firmware Versions: 2.1.0 and later
Type: switch mode (R/W) Range: 0 to 10
Units: n/a Default: 6
Opmodes: all Drive Status: en/dis EEPROM: yes

O1RST

is a variable used to define the reset level for O1MODE. Range is dependent on O1MODE: 0 through 3 - n/a

4 - Absolute: 0 - 15000 RPM (0 - 250*MPITCH mm/sec for linear)
5 - Absolute: 0 - 15000 RPM (0 - 250*MPITCH mm/sec for linear)
6 through 8 - n/a
9 - (-2,147,483,647) to 2,147,483,647 counts
10 - n/a

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: see above
Units: RPM or mm/sec Default: VOSPD
Opmodes: all Drive Status: en/dis EEPROM: yes

O1TRIG

is a variable used to define the trip level for O1MODE. Range is dependent on O1MODE:

0 - n/a
1 - Absolute: 0 to 15000 RPM (mm/sec for linear motors)
2 - Absolute: 0 to 1000 (0.1 percent of DIPEAK)
3 - n/a
4 - Absolute: 0 to 15000 RPM (mm/sec for linear motors)

5 through 7 - n/a
8 - Absolute: 0 to 15000 RPM (mm/sec for linear motors)
9 - (-2,147,483,647) to 2,147,483,647 counts
10 - n/a

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: see above
Units: see above Default: 1000
Opmodes: all Drive Status: en/dis EEPROM: yes

OPMODE

sets the operational mode for the drive. The drive can be configured as a velocity, torque loop, pulse following (gearing), or position controller.

Opmode	Description	See Also
0	Serial Velocity	J, COMPMODE, PROFMODE, S, STOP
1	Analog Velocity	VSCALE, COMPMODE, S, PROFMODE
2	Serial Torque	T, S, STOP
3	Analog Torque	ISCALE, S
4	Gearing	GEAR, GEARI, PEXT, GEARMODE, XENCRES
8	Positioning	PCMDMODE, MA, MI, MH, PROFMODE, S

Notes:
Opmode 4 available only in firmware versions 2.1.0 and later.
Opmode 8 available only in firmware versions 3.1.0 and later.

Firmware Versions: all (see notes above)
Type: switch mode (R/W) Range: 0, 1, 2, 3, 4, 8
Units: n/a Default: 1
Opmodes: all Drive Status: dis EEPROM: yes

PCMD

returns the position command as output by the profile generator. PCMD is expressed in counts.

Firmware Versions: 3.1.0 and later
Type: variable (R) Range: +/- 2,147,483,647
Units: counts Default: n/a
Opmodes: 4, 8 Drive Status: en/dis EEPROM: n/a

PCMDMODE

is a switch mode variable which can change the flow of data in the position loop according to the following arguments:

0.) Normal operation: Command comes from profile generator, feedback comes from motor. PCMDMODE must be set to 0 to generate move commands via the serial port.
1.) Analog Position Mode: Absolute position command comes from the analog input port, feedback from the motor.

Firmware Versions: 3.2.0 and later
Type: switch (R/W) Range: 0-1
Units: n/a Default: 0
Opmodes: 8 Drive Status: dis EEPROM: yes

PE

displays the position following error. If this value is greater than PEMAX, then the drive will be disabled. Position is in counts.

Firmware Versions: 2.1.0 and later
Type: variable (R) Range: +/- 2,147,483,647
Units: counts Default: n/a
Opmodes: 4,8 Drive Status: en/dis EEPROM: n/a

PEINPOS

sets the threshold position error for the INPOS flag. If PE is less than PEINPOS, the INPOS switch is set, indicating that the drive is in position (see INPOS). If PE is greater than PEINPOS, the INPOS switch is not set. Position is in counts.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to 32767
Units: Counts Default: 100
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

PEMAX

sets the maximum allowable following error (OPMODE's 4 and 8). If the error exceeds this value, then the drive is disabled on fault. PEMAX = 0 disables this function. Position is in counts.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0 to 2,147,483,647
Units: counts Default: 0
Opmodes: 4,8 Drive Status: en/dis EEPROM: yes

PEXT

displays the accumulated position feedback from the external encoder. This variable is similar to PFB for the resolver feedback.

Firmware Versions: 2.1.0 and later
Type: variable (R) Range: +/- 2,147,483,647
Units: counts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: n/a

PEXTOFF

is an offset that is added to the internal accumulated position feedback from the external encoder to give the value of PEXT.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: +/- 2,147,483,647
Units: counts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

PFB

displays the cumulative position feedback from the feedback device. Prior to firmware version 2.0.0, PFB had the same definition as HWPOS. For firmware versions 2.0.0 and later, PFB was extended into a cumulative counter.

Firmware Versions: all
Type: variable (R) Range: +/- 2,147,483,647
Units: counts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

PFBOFF

is a feedback offset that is added to the internal cumulative position counter to give the value of PFB.

Firmware Versions: 2.0.0 and later
Type: variable (R/W) Range: +/- 2,147,483,647
Units: counts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

PLIM

is a switch mode variable that controls operation of the software position limits PMAX and PMIN:
0 = software position limits disabled
1 = drive will disable when a soft position limit is exceeded (Caution! Motor may coast)
2 = drive will decelerate to a stop at DECSTOP deceleration when a soft position limit is exceeded; drive will remain enabled and will only allow motion in opposite direction only

Firmware Versions: 3.1.0 and later.
Type: switch (R/W) Range: 0 - 2
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

PMAX

sets the maximum allowable position for the motor shaft. Position is expressed in counts and can be read using PFB. If position exceeds PMAX (PFB > PMAX), an overtravel fault is generated. A fault will be generated only if PLIM is set to a nonzero value.

Firmware Versions: 3.1.0 and later.
Type: variable (R/W) Range: +/- 2,000,000,000
Units: counts Default: 2,000,000,000
Opmodes: all Drive Status: en/dis EEPROM: yes

PMIN

sets the minimum allowable position for the motor shaft. Position is expressed in counts and can be read using PFB. If position goes below PMIN (PFB < PMIN), an overtravel fault is generated. A fault will be generated only if PLIM is set to a nonzero value.

Firmware Versions: 3.1.0 and later.
Type: variable (R/W) Range: +/- 2,000,000,000
Units: counts Default: -2,000,000,000
Opmodes: all Drive Status: en/dis EEPROM: yes

PRD

displays the absolute position feedback of the hardware feedback device (for both resolver and encoder based systems). PRD will increment from 0 to 65,535 throughout the course of one mechanical motor shaft revolution

(360 degrees). The range of PRD will not change. Its resolution for resolver feedback systems is dependent upon the value of RDRES:

RDRES = 12, resolution of PRD = 16.
RDRES = 14, resolution of PRD = 4.
RDRES = 16, resolution of PRD = 1.

For encoder-based systems, until the encoder has been initialized, PRD will be uninitialized and its value will not be useful or meaningful. For information on encoder initialization requirements according to the type of encoder, see MENCTYPE, ENCINIT, and ENCINITST.

Firmware Versions: all
Type: variable (R) Range: 0 to 65,535
Units: counts Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

PROFMODE

selects the acceleration and deceleration algorithm used by the drive (profile mode). Note that PROFMODE is associated with ACC and DEC but may not affect ramping depending upon the values of ACTFAULT, STOP, and DECSTOP.

0 = no acceleration and deceleration ramp limits
1 = linear acceleration and deceleration ramp limits
2 = S-curve accel/decel in Positioning Opmode 8 only (firmware versions 3.3.0 and later - see PROFSCRV).

Firmware Versions: all
Type: switch mode (R/W) Range: 0-2
Units: n/a Default: 0
Opmodes: 0,1,4,8 Drive Status: dis EEPROM: yes

PROFSCRV

defines the S-curve acceleration time (used when PROFMODE=2) relative to the trapezoidal, or linear, acceleration time of PROFMODE=1. Setting PROFMODE=2 and setting the value of PROFSCRV to a non-zero value introduces S-curve acceleration, which is a smoothing of the acceleration that occurs when a positional move is initiated. The tradeoff is that peak accelerations and horsepower requirements are higher when using S-curving than when linear profiling (PROFMODE=1) is used.

0 = S-curve acceleration time is equal to the trapezoidal acceleration time (ACC applies to both acceleration and deceleration).
100 = S-curve acceleration time is equal to twice the trapezoidal acceleration time.

Firmware Versions: 3.3.0 and later
Type: variable (R/W) Range: 0-100
Units: percent Default: 50
Opmodes: 8 Drive Status: dis EEPROM: yes

PROMPT

enables/disables the serial port prompt (-->) output by the drive after each message.

0 = disable the prompt
1 = enable the prompt

Note that PROMPT = 1 is needed for proper operation of MotionLink.

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 1
Opmodes: all Drive Status: en/dis EEPROM: yes

PSCALE

is an position scale factor that scales the analog output, ANOUT=5 or 8, to PE or PFB. The value entered is the motor position movement in counts per 10 volts of output.

Firmware Versions: 3.2.0 and later
Type: variable (R/W) Range: 10 to 2,147,483,647
Units: counts per 10 volts Default: 2048
Opmodes: 1 Drive Status: en/dis EEPROM: yes

RDRES

displays the resolver resolution on resolver-based systems. RDRES is a read-only variable which is automatically calculated in order to achieve maximum resolution. The setting is based on VLIM, which is the maximum application velocity. The relationship between VLIM and RDRES is given below:

if (VLIM ≥ 6101) then RDRES = 12
if (1501 ≤ VLIM ≤ 6100) then RDRES = 14
if (VLIM ≤ 1500) then RDRES = 16

Firmware Versions: all
Type: switch mode (R) Range: 12, 14, or 16
Units: bits Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

READY

is a flag indicating the status of the software enable. READY = 1 means that there are no faults (DRIVEOK = 1) and a communication enable request has been commanded (SWEN = 1). An external Remote Enable (REMOTE = 1) and a Dip Switch Enable (DIPEN = 1) are still required to enable the drive (ACTIVE = 1).

0 = faults exist or SWEN = 0
1 = no faults exist and SWEN = 1

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

RECDONE

indicates whether or not the Record command is done and data is available.

0 = recording not finished
1 = recording done; data available

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: no

RECING

indicates if data recording is in progress.

0 = recording not in progress
1 = recording in progress

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: no

RECOFF

is used to cancel/reset a recording process that has been armed but has not triggered.
State before RECOFF: RECRDY=0, RECING=1, RECDONE=0.
State after RECOFF: RECRDY=1, RECING=0, RECDONE=0.

Firmware Versions: all
Command Syntax: RECOFF
Opmodes: all Drive Status: en/dis

RECORD

captures real-time variables to memory for retrieval / display using the GET command or the MotionLink PC Scope function. RECORD must be set up before the RECTRIG command is used. Note that variables that are recorded using this method are NOT averaged using AVGTIME.
1024 four-word buffers are available for use by the RECORD command, where one "word" is defined as 16 bits. Most variables in the ServoStar are one word in size, but some are two words. You can record up to three variables, as long as the total size of the three variables does not exceed 4 words. The following variables can be recorded by the ServoStar:

Variable	(Size)	Variable	(Size)
ANIN*	(1 word)	PCMD*	(2 words)
I	(2 words)	PE*	(2 words)
IA	(1 word)	PEXT*	(2 words)
IC	(1 word)	PFB*	(2 words)
ICMD	(1 word)	PRD	(1 word)
IN1*	(1 word)	STOPPED*	(1 word)
IN2*	(1 word)	V	(1 word)
IN3*	(1 word)	VCMD	(1 word)
INPOS*	(1 word)	VEXT*	(1 word)
O1*	(1 word)		

* Added in firmware version 3.2.0

For example, a combination of V, VCMD, and VEXT is valid for recording, because it only takes up 3 words of memory. However, a combination of PCMD, PE, and PEXT (6 words total) cannot be recorded, because it exceeds 4 words of memory.

The RECORD command also defines the time period between each consecutive recorded data point and the variable names (up to three) being recorded. An additional parameter defines the number of recorded data points for each variable (up to 1024). Once they are recorded, variables are retrieved with the GET command. See also RECTRIG, RECDONE, RECING, and RECRDY Switch Variables.

Firmware Versions: all
Command Syntax:
RECORD [sample time] [num points] [VAR1] {VAR2} {VAR3}

Range/Units: sample time = 1 to 10,000 (* 0.5 milliseconds)
num points = 1 to 1024 (1, 2, 4, 8, … 512, 1024)
VARn = a system variable, by ASCII (text) name

Example: RECORD 10 100 "VCMD "V "PRD
(record 100 points for VCMD, V, and PRD every 5 milliseconds)

Note: system variables must be preceded by a double-quote (")

Opmodes: all Drive Status: en/dis

RECRDY

indicates the ready status of the RECORD function. This variable can be polled after a RECORD command is issued to determine if the system is waiting for RECTRIG.
0 = RECTRIG has been received and record function is armed
1 = record function is waiting to be armed by RECTRIG command

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: 1
Opmodes: all Drive Status: en/dis EEPROM: no

RECTRIG

sets up the trigger mechanism for the RECORD function. RECORD must be set up before a RECTRIG command is issued. Four parameters are required to set up RECTRIG: Mode, Level, Location, and Direction.

1. MODE is a string variable that specifies the parameter that will be used to trigger recording. Mode can be a variable name or a triggering condition. Mode determines what other parameters must be entered in order to completely set up the trigger. Mode must be preceded by a double-quote when entered, as shown in the following table, which tells what other parameters are required (LEVel, LOCation, and DIRection) depending upon the selected Mode.

2. LEVEL specifies the value that the variable defined by Mode must reach for recording to begin.

3. LOCATION specifies how many data points to save before the trigger in the Recording buffer (see the RECORD command for a description of the 1024 data points that are available). When recorded data is retrieved and displayed, the trigger point's location in the 1024-point buffer will be at the place specified by Location.

4. DIRECTION has two meanings depending upon the type of Mode parameter that is used. For Mode variables (PRD, IA, IC, etc. - see below), it defines the direction the variable value must be changing when it crosses Level in order to trigger recording (1 = increasing, 0 = decreasing). For Mode switch inputs (CW, CCW, etc. - see below) it defines the logic level the input must achieve in order to trigger recording (1 = HI, 0 = LOW).

Required RECTRIG Parameters Based on MODE Parameter				
MODE	**DESCRIPTION**	**LEV**	**LOC**	**DIR**
"IA	Trigger on Phase A Current	√	√	√
"IC	Trigger on Phase C Current	√	√	√
"ICMD	Trigger on Current Cmd	√	√	√
"PCMD*	Trigger on Position Cmd	√	√	√

"PFB*	Trigger on Position Fdback	√	√	√
"PRD	Trigger on PRD	√	√	√
"V	Trigger on Velocity	√	√	√
"VCMD	Trigger on Velocity Cmd	√	√	√
"CCW	Trigger on CCWLIM Sw	X	√	√
"CW	Trigger on CWLIM Sw	X	√	√
"IN1*	Trigger on IN1 Input	X	√	√
"IN2*	Trigger on IN1 Input	X	√	√
"IN3*	Trigger on IN1 Input	X	√	√
"O1*	Trigger on O1 Output	X	√	√
"RMT	Trigger on REMOTE Input	X	√	√
"CMD	Trigger on Next Command	X	√	X
"IMM	Trigger Immediately	X	X	X

* = firmware versions 3.2.0 and later
√ = Required Parameter
X = Don't care; something must be entered to make the command work, but it doesn't matter what is entered.

Syntax: RECTRIG [mode] [level] [location] [direction]

Range: Mode = see table above
Level = depends upon the mode variable (range of PRD levels is 0-65535, all others are -32768 to 32767)
Location = 0 - 1023
Direction = 0 or 1

Firmware Versions: all
Type: variable (R/W) Range: see above
Units: see above Default: dir=1, loc=0, level=0
Opmodes: all Drive Status: en/dis EEPROM: no

REFRESH

is a command that is used when tuning the drive for COMPMODE 3. With the Advanced Pole Placement algorithm utilized in the drive, the interaction of the variables is too dramatic to allow variables to be changed one by one. Therefore, as pole placement algorithm vector variables (VD, VF, VH, and VR) are entered, the new values are buffered without changing the actual values used by the control loops.

Once all desired new values have been entered, the operator enters a REFRESH command, and all vector variables are written to the control loops simultaneously.

Firmware Versions: all
Command Syntax: REFRESH
Opmodes: 0,1 Drive Status: en/dis

RELAY

indicates the status of the Fault / Drive Up Relay.
0 = relay open
1 = relay closed

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

RELAYMODE

sets the operation of the Drive Up / Drive Ready Relay.
0 = relay will be closed when no faults exist
1 = relay will be closed when ACTIVE equals 1
2 = during Active Disable, relay will open when the fault occurs (it will not wait until DISTIME times out).

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

REMOTE

indicates the state of the external hardware enable input line. When REMOTE is set to 1, the software is ready (READY = 1), and Dip Switch 8 is set to OFF (DIPEN = 1), the drive is Enabled (ACTIVE = 1).
0 = remote enable input off
1 = remote enable input on

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

RSTVAR

sets all variables, switch variables, and switch mode variables to their factory default settings. These settings are stated within this document under the variable DEFAULT category. The default values of variables loaded from a motor data file cannot be predicted and are denoted “motor data” in the DEFAULT category.

Firmware Versions: all
Command Syntax: RSTVAR
Opmodes: all Drive Status: dis

S

will stop motor motion in all OPMODES. Deceleration ramp control is always used, using the rate specified by DECSTOP. After the profile generator reaches 0 speed, the drive will wait for the time period specified by DISTIME and will then disable the drive.

This command is a one-key hot button, similar to the K command, but with an active stop function controlled by the drive (no coasting of the motor will occur, as is possible with the K command).

Firmware Versions: all
Command Syntax: S
Opmodes: all Drive Status: en/dis

SAVE

copies all system configuration variables from working RAM to non-volatile memory (EEPROM). This command must be executed in order to retain setting changes during power cycling. The SAVE command takes about 2 seconds to execute.

Firmware Versions: all
Command Syntax: SAVE
Opmodes: all Drive Status: en/dis

SERIALNO

indicates the serial number of the drive in which the firmware is installed. This variable is password protected. This variable is included in the VER string.

Firmware Versions: all
Type: string variable (R) Range: 10 ASCII characters
Units: n/a Default: blanks
Opmodes: all Drive Status: en/dis EEPROM: yes

SININTOUT

sets an interpolation factor of the sine encoder board for the equivalent encoder output. For sine encoder systems, the encoder output value (ENCOUT) = MENCRES * SININTOUT / ENCOUTO.

Firmware Versions: 3.3.0 and later
Type: switch mode (R/W) Range: 1, 2, 4, 8, 16, 32, 64, 128
Units: n/a Default: 1
Opmodes: all Drive Status: dis EEPROM: yes

STAT

will output a drive status summary word to the serial port. The summary word is in ASCII-hex format, prefixed by the letter 'H.'. See STATUS for information on how to obtain more detailed drive status information. The format of the STAT word is described in the following table.

Bit #	Function	Convention
0 (LSB)	Disable Status	1 = drive is DISabled 0 = drive is ENabled
1	Fault Status	1 = fault exists 0 = no fault exists
2	Safety Status	1 = safety feature triggered/inactive* 0 = drive is safe
3	Special Mode Status	1 = Step, Burnin, or Zero is active 0 = normal
4**	Hold Mode Status**	1 = drive is in Hold mode, In Position, or Stopped 0 = drive is not in Hold mode
5-15	not used	

*CWLIM=1, CCWLIM=1, LIMDIS=1, THERMODE=1 or 2, or FOLD=1, or (PLIM>0 and PFB>PMAX), or (PLIM>0 and PFB<PMIN).

** Prior to firmware version 2.0.0, Bit 4 was undefined.

Firmware Versions: all
Type: variable (R) Range: see above
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

STATUS

will output the drive status detail words to the serial port. Five words are transferred in ASCII-HEX format, with each word preceded by the letter 'H.' The words are separated by a space.

The following tables break the status words down bit by bit (bit 15 = MSB; bit 0 = LSB; n/u = not used). For all bits, 0=false and 1=true.

STATUS Word 1: Disable Status Word	
If the drive is disabled (Bit 0 of the STAT word = 1), the process(es) which have caused that disable condition will have their bits set to 1 in this word.	
Bit #	**Description**
0 (LSB)	Remote disable (REMOTE = 0)
1	Software disable (SWEN = 0)
2	DIP switch disable (DIPEN = 0)
3	Fault disable
4	Velocity loop design failure
5	Encoder not initialized
6-15	not used

STATUS Word 2: Fault Status Word	
If a fault exists (Bit 1 of the STAT word = 1), the fault(s) which exist(s) will have the corresponding bits set to 1 in this word.	
Bit #	**Description**
0 (LSB)	Drive over temperature
1	Over voltage condition
2	Over current condition
3	Feedback loss
4	Under voltage condition
5	Motor over temperature
6	Analog supply fault
7	Over speed condition
8	EEPROM fault
9	EEPROM checksum fault
10	No comp (compensation) for the motor
11	Foldback condition
12	not used
13	Overtravel fault
14	Position deviation fault
15	not used

STATUS Word 3: Safety Status Word	
If safety of the drive is compromised (Bit 2 of the STAT word = 1), the condition which is causing that state has its corresponding bit set to 1 in this word.	
Bit #	**Description**
0 (LSB)	CWLIM = 1 (motor has reached CW travel limit)
1	CCWLIM = 1 (motor has reached CCW travel limit)
2	LIMDIS = 1 (limit switch function disabled by user)
3	THERMODE = 1, 2, 3 (set to non-zero by the user)
4	FOLD = 1 (drive current foldback mode)
5*	LIMDIS=0 & CW switch not routed (INxMODE 1)
6*	LIMDIS=0 & CCW switch not routed (INxMODE 2)

7***	Positive Overtravel (PFB > PMAX) with PLIM > 0
8***	Negative Overtravel (PFB < PMIN) with PLIM > 0
9****	MFOLD = 1 (motor current foldback mode)
10-15	not used

STATUS Word 4: Special Mode Status Word	
If the drive is in a special operating mode (Bit 3 of the STAT word = 1), the special mode that the drive is in has its corresponding bit set to 1 in this word.	
Bit #	**Description**
0 (LSB)	Drive is in Step mode (see STEP)
1	Drive is in Burnin mode (factory function)
2	Drive is in Zeroing mode (see ZERO)
3-15	not used

STATUS Word 5: Hold Mode Status Word	
If the drive is in Hold mode (Bit 4 of the STAT word = 1), the condition which caused the drive to enter Hold mode has its corresponding bit set to 1 in this word).	
Bit #	**Description**
0 (LSB)	User request (user set HOLD = 1)
1	DIP switch setting (DIP switch 7 = 1)
2	Drive is in Active disable state
3	Limit switch(es) tripped: 1. velocity command is in direction of tripped switch in opmode 0 or 1 with drive enabled; or 2. both limit switches are activated
4**	User input switch hold (INxMODE=19)
5**	Internal hold request during homing process.
6-10	not used
11++	Analog position hold before homing
12-15	not used

Firmware Versions: all, with exceptions:
*-versions 2.1.0 and later
**-versions 3.0.0 and later
*** - versions 3.1.0 and later
**** - versions 3.2.0 and later
++ - versions 3.3.0 and later
Type: variable (R) Range: see above
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

STATUS2

will output drive status detail words to the serial port. Four words are transferred in ASCII-HEX format, with each word preceded by the letter 'H.'

The following tables break the status words down bit by bit (bit 15 = MSB; bit 0 = LSB; n/u = not used). For all bits, 0=false and 1=true.

STATUS2 Word 1: Feedback Loss Status Word	
If the drive has experienced a feedback loss fault (Bit 3 of STATUS Word 2 = 1), the condition which caused that fault will have its bit set to 1 in this word.	
Bit #	**Description**
0 (LSB)	Resolver line break
1	Resolver/Digital Converter Error bit (following err)
2	Sine encoder initialization failed
3	Line break of encoder A/B input
4	Line break of encoder index input
5	Illegal halls state
6	Line break of encoder C/D input (sine encoder)
7	A/B lines out of range (sine encoder)
8	Burst overflow (sine encoder)
9*	External feedback line break
10-15	not used

STATUS2 Word 2: Analog Supply Fault Status Word	
If the drive has experienced an analog supply fault (Bit 6 of STATUS Word 2 = 1), the condition which caused that fault will have its bit set to 1 in this word.	
Bit #	**Description**
0 (LSB)	Positive analog supply fault
1	Negative analog supply fault
2-15	not used

STATUS2 Word 3: Position Deviation and Over Travel Fault Status Word	
Bit #	**Description**
0	Internal Numerical Position Deviation
1	Pos. Error (PE) exceeded max PE limit (PEMAX)
2	Positive Overtravel (PFB > PMAX) with PLIM=1
3	Negative Overtravel (PFB < PMIN) with PLIM=1
4-15	Reserved

STATUS2 Word 4: Limit Switches Status Word	
If the drive has experienced a limit switch fault (Bit 3 of STATUS Word 5 = 1), the condition which caused that fault will have its bit set to 1 in this word.	
Bit #	**Description**
0 (LSB)	CW Limit Switch tripped (CWLIM=1)
1	CCW Limit Switch tripped (CCWLIM=1)
2-15	not used

STATUS2 Word 5: Encoder Initialization Status Word (added in firmware version 3.3.0)	
If the drive has experienced a fault during encoder initiali-zation (Bit 5 of STATUS Word 1 = 1), the condition which caused that fault will have its bit set to 1 in this word.	
Bit #	**Description**
0 (LSB)	MENCRES, MPOLES or low IENCSTART failure
1	Phase A current mismatch
2	Phase C current mismatch
3	Limit switch tripped
4-15	not used

STATUS2 Word 6: Over speed Status Word (added in firmware version 3.3.0)	
This status word details the cause of over speed fault.s.	
Bit #	**Description**
0 (LSB)	velocity feedback > VOSPD
1	velocity feedback > 1.8*VLIM
2-15	not used

* - firmware version 3.3.0 and later

Firmware Versions: 2.1.0 and later
Type: variable (R) Range: see above
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

STEP

generates a step or square wave velocity command. This command is intended to be used to record the drive response after the RECTRIG has been set up to define the trigger as occurring after the next command. This command takes 2, 3, or 4 parameters.

- When 2 parameters are used, the drive is issued a STEP command with a specified duration (“duration1”) and velocity (“velocity1”).
- When 3 parameters are used, the command becomes a repeating square wave which includes a zero velocity cycle whose duration is specified by the third parameter (“duration2”).
- When 4 parameters are used, the square wave command will run for the time specified by “duration1” at the speed specified by “velocity1,” then will run for the time specified by “duration2” at the speed specified by “velocity2.” This motion then repeats.

The user can terminate the command by entering S, K, DIS, or a Jog (J) command. This command is prohibited while in Hold mode.

Firmware Versions: all
Command Syntax: STEP [duration1] [velocity1] {<duration2> <velocity2>}
Units/Range: durationN = milliseconds (0 to 32767)
velocityN = rotary: RPM (-VLIM to +VLIM)
linear: mm/sec (-VLIM to +VLIM)
Opmodes: 0 Drive Status: en

STOP

will stop motion in OPMODE 0 (J and STEP commands) or 2 (T command). Unlike the S and K commands, the drive is not disabled using the STOP command. Deceleration ramp control is used in OPMODE 0, if PROFMODE

is set to 1. The deceleration rate is stored in the variable DEC. If this command is invoked in Opmode 1 or 3, it is ignored.

Firmware Versions: all
Command Syntax: STOP
Opmodes: 0, 2 Drive Status: en

STOPMODE

sets the mode of dynamic braking operation. See also ISTOP.
0 = no braking operation (default).
1 = brake on fault only.
2 = brake on fault and/or drive disable.
Note: Faults do not include Over Voltage or Power Stage Faults!

Firmware Versions: 2.1.0 and later
Type: switch mode (R/W) Range: 0, 1, 2
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

STOPPED

is a read-only switch that indicates the status of a move command (MA, MI, or MH) issued by the profile generator in Opmode 8. This bit will read 1 when a move is complete and the next move command can be issued. It will read 0 when a move is in progress.
0 = move in progress.
1 = move complete; next move command can be issued.

Firmware Versions: 3.1.0 and later
Type: switch (R) Range: 0, 1
Units: n/a Default: n/a
Opmodes: 8 Drive Status: en/dis EEPROM: n/a

SWEN

is a software enable switch that defines the status of the serial port Enable (EN) request. If SWEN is set to 1, and there are no faults (DRIVEOK = 1), then switch variable READY is set = 1.
0 = software disabled (DIS, K, or S command has been issued)
1 = software enabled (EN command has been issued)

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: 1 (analog drives), 0 (SERCOS)
Opmodes: all Drive Status: en/dis EEPROM: no

T

is used to set commanded current in OPMODE 2 (Serial Torque Mode). This command is subject to current limits, clamps, and digital filtering, and it is set to zero whenever the drive is enabled or disabled. The range of this value is -1000 to 1000, but the value entered by the user cannot exceed ILIM. An S, STOP, DIS, or K command, or change of operating mode, zeros the value of T.

Firmware Versions: all
Command Syntax: T [current] (where -1000 ≤ current ≤ 1000)
Range: -ILIM to +ILIM Units: % of DIPEAK*0.1

Opmodes: 2 Drive Status: en

TESTLED

is used to put the drive into a Status LED test mode. In this test mode, all of the segments of the LED will illuminate for approximately half a second and then return to normal.

Firmware Versions: all Command Syntax: TESTLED
Opmodes: all Drive Status: dis

TF

sets the damping factor for the velocity loop when using COMPMODE 2 or COMPMODE 4 (Standard Pole Placement). A value of 100 is backward compatible to all previous firmware. As TF approaches zero, overshoot is diminished while sacrificing some tracking ability. As TF approaches 200, the system may overshoot more but will have excellent steady-state tracking ability. Successful execution of the TUNE command may result in this parameter being changed.

Firmware Versions: all
Type: variable (R/W) Range: 0 to 200
Units: n/a Default: 100
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

THERM

indicates the state of the motor thermostat input.
0 = thermostat input closed (normal)
1 = thermostat input open (overheat condition)

Firmware Versions: all
Type: switch (R) Range: 0, 1
Units: n/a Default: hardware defined
Opmodes: all Drive Status: en/dis EEPROM: no

THERMODE

determines the operation of the drive when the Motor Thermostat Input (THERM) opens.
0 = disable drive and open fault relay immediately
1 = disable drive after 2 minutes; open fault relay immediately
2 = do not disable drive; open fault relay immediately
3 = ignore thermostat input
4 = issue warning; no other action*
5 = issue warning, open fault relay after THERMTIME elapses*
Note: opening the fault relay sets RELAY=0.
* Firmware versions 3.1.0 and later

Firmware Versions: all
Type: switch mode (R/W) Range: 0 - 5
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

THERMTIME

sets the number of seconds the drive will wait after motor overtemperature detection before it opens the fault relay (THERMODE = 5 only).

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 1-300
Units: seconds Default: 30
Opmodes: all Drive Status: en/dis EEPROM: yes

THERMTYPE

sets the motor temperature sensor type:
0 = PTC (Positive Temperature Coefficient)
1 = NTC (Negative Temperature Coefficient)

Firmware Versions: 3.1.0 and later
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

TRUN

provides a relative incremental run time counter. Error log stamps include the value of this counter at the time of the error. The clock is a very coarse counter and is incremented every 15 minutes. It is intended for use by factory Quality Assurance Program personnel. This clock has a resolution of 15 minutes and is reset only when the CLREEPROM command is used.

Firmware Versions: all
Type: variable (R) Range: 0000:00 to 9999:45
Units: hours: minutes Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: yes

TUNE

tunes the system for the given drive and load conditions. Velocity steps are performed in closed loop while maintaining position and velocity constraints in order to capture the system dynamics and set tuning constants accordingly.

Motor rotations are performed in OPMODE 0, with a bandwidth of 10 Hz. Successful termination of this command will set the value of LMJR (COMPMODE = 2 or 4) and will change the control variables of the PI (COMPMODE = 0) and PDFF (COMPMODE = 1) controllers accordingly. Successful termination of this command may change BW, LMJR, GP, GV, GVI, KV, KVI, KVFR, FILTMODE, and TF.

The command may take a few seconds to execute. This command may not always be successful, in which case the tuning variables must be set manually. Unsuccessful termination may result due to current saturation, a motor that cannot rotate, or an unsuccessful controller design. For successful termination, it is required that VLIM is greater than or equal to 500 RPM, and VMAX is greater than or equal to 1160 RPM.

This command takes three optional parameters: bandwidth, direction, and speed. Bandwidth can range from 10 to 100 Hz (the default is the current bandwidth BW). Direction is equal to 0, 1, or 2 (0 = bi-directional rotation, which is the default, 1 = CW rotation only, 2 = CCW rotation only). Speed must be greater than 350 RPM, and its default is the minimum of 500, (0.7 * VLIM), and (0.3 * VMAX).

Recommendations: (1) use low bandwidth for tuning and increase the bandwidth (using BW), if desired, after tuning is successful; (2) execute a SAVE after the TUNE command has executed successfully in order to write new gain parameters to EEPROM; (3) the higher the TUNE speed, the more accurate the process is.

NOTE: this command not available in version 1.0.0 & 1.0.1 firmware.

Firmware Versions: all
Command Syntax: TUNE [bw] [dir] [speed]
bw = bandwidth in Hz (10 to 100)
dir = 0, 1, 2 (0=bidir, 1=CW, 2=CCW)
speed = speed used during TUNE in RPM (rotary) or mm/sec (linear) (350 to 0.7 * VLIM)
Opmodes: all Drive Status: en/dis

UNITS

defines whether physical units or internal bits are used. This variable is relevant mainly for Current, Velocity, Acceleration and Analog Input variables, in order to allow more precise definitions while using the internal bits of the Integer variables. It is recommended that most users use the physical units.

0 = use physical units
1 = use internal units

The descriptions in this guide use the physical units. Variables that may be defined using internal units are listed in the following table, along with their internal unit ranges and units.

INTERNAL VARIABLE UNITS		
Variable	**Range**	**Internal Units**
ANDB	0 to 16383 bits	1 bit = 10V / 16384
ANIN	-16383 to 16383 bits	1 bit = 10V / 16384
ANOFF	-16383 to 16383 bits	1 bit = 10V / 16384
I	0 to 65535 bits	32768 bits = DIPEAK * (√2/0.8)
IA	-32767 to 32767 bits	32768 bits = DIPEAK * (√2 / 0.8)
IC	-32767 to 32767 bits	32768 bits = DIPEAK * (√2 / 0.8)
ICMD	-32767 to 32767 bits	32768 bits = DIPEAK * (√2 / 0.8)
ICONT	0 to IMAX bits	32768 bits = DIPEAK * (√2 / 0.8)
ILIM	0 to IMAX bits	32768 bits = DIPEAK * (√2 / 0.8)
IMAX	0 to 32767 bits	32768 bits = DIPEAK * (√2 / 0.8)
J <vel> <time>	vel:-16383 to 16383 time:0 to 32767	vel:1 bit = VLIM / 16384 time:1 bit = 0.5 ms
STEP<period> <speed>	Period :0 to 32767 Speed :-16363 to +16383	period: milliseconds speed: VLIM / 16384
T	-ILIM to ILIM	32768 bits = DIPEAK * (√2 / 0.8)
V	-32767 to 32767	1 bit = VLIM / 16384
VCMD	-VLIM to VLIM	1 bit = VLIM / 16384
VE	-16383 to 16383	1 bit = VLIM / 16384

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

UVMODE

defines how the drive will respond to an undervoltage (UV) fault:

0 = latch fault immediately, display flashing “u”.
1 = display steady “u”. Warning only, with no fault latch.
2 = display steady “u” - after UVTIME elapses, latch fault relay.

If UVMODE= 1 or 2, and the drive is disabled, the UV fault is ignored.

Firmware Versions: 3.1.0
Type: switch mode (R/W) Range: 0, 1, 2
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

UVRECOVER

defines how the drive will recover from an undervoltage (UV) fault:
0 = recover by toggling drive from disable to enable condition after the UV condition clears
1 = automatically recover when the UV condition clears

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: yes

UVTIME

sets the amount of time an undervoltage warning will be displayed ("u") before it is latched when UVMODE = 2.

Firmware Versions: 3.1.0 and later
Type: variable (R/W) Range: 1 to 300
Units: seconds Default: 30
Opmodes: all Drive Status: en/dis EEPROM: yes

V

displays the velocity as calculated from the hardware feedback (resolver or encoder). The velocity that is displayed is subject to averaging by the variable AVGTIME, except when it is recorded for graphical display by MotionLink, in which case it is not averaged.

Firmware Versions: all
Type: variable (R) Range: -15000 to 15000
Units: rotary: RPM Default: n/a
linear: mm/sec
Opmodes: all Drive Status: en/dis EEPROM: no

VBUS

sets the drive bus voltage. This variable is used for current controller design. VBUS also affects the value of VMAX (see VMAX). When this variable is changed, the drive will enter a no-comp state, requiring a CONFIG command (see CONFIG).

Firmware Versions: all
Type: variable (R/W) Range: 10 to 850
Units: volts Default: 325
Opmodes: all Drive Status: dis EEPROM: yes

VCMD

displays the Velocity command to the velocity controller. This value is equivalent to the Analog Input (ANIN) in OPMODE 1, to the Jog Command (J) in OPMODE 0, and the output of the position controller gearing (OPMODE

4), positioning (OPMODE 8), and Hold Position mode (HOLD=1). This variable is averaged, based on the AVGTIME, when it is requested via the serial port. It is not averaged when it is recorded for graphical display.

Firmware Versions: all
Type: variable (R) Range: -VLIM to +VLIM
Units: rotary: RPM Default: n/a
linear: mm/sec
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: no

VD

is a vector variable that sets the D (forward path) polynomial of the Advanced Pole-Placement velocity controller (COMPMODE = 3). The vector defined by this variable includes five integers that represent the polynomial coefficients and a shift parameter that scales the polynomial. If this variable is changed, a REFRESH command is required.

NOTE: prior to firmware version 2.1.0, this command mnemonic was “D”.

SYNTAX: VD [vector1] [vector2] [vector3] ... [vector5] [scale]
EXAMPLE: VD 100 200 300 400 500 1

RANGES: vectorN = -32768 to 32767
scale = 0 to 15

Firmware Versions: 2.1.0 and later (previously D)
Type: vector variable (R/W) Range: see above
Units: n/a Default: 0 (all parameters)
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

VE

displays the velocity error, which is the difference between the commanded motor velocity (VCMD) and the actual motor velocity (V). This value is an instantaneous reading.

Firmware Versions: all
Type: variable (R) Range: -32768 to 32767
Units: rotary: RPM Default: n/a
linear: mm/sec
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: no

VER

indicates the version of the drive firmware in use. This variable also displays other pertinent information such as the drive name, current ratings, TRUN, etc. The VER variable has two optional parameters: requesting VER 1 will return feedback type (encoder or resolver), and VER 2 will return firmware version.

Firmware Versions: all
Type: string variable (R) Range: VER {1 or 2}
Units: n/a Default: n/a
Opmodes: all Drive Status: en/dis EEPROM: no

VEXT

displays the instantaneous velocity feedback as calculated from the external encoder input channel. The command uses XENCRES to calculate velocity. This variable is similar to V for the motor feedback. This variable is subject to AVGTIME

Firmware Versions: 2.1.0 and later
Type: variable (R) Range: -32767 to +32767
Units: rotary: RPM Default: n/a
linear: mm/sec
Opmodes: all Drive Status: en/dis EEPROM: n/a

VF

is a vector variable that defines the filter at the output of the Advanced Pole-Placement velocity controller (COMPMODE = 3). The vector defined by this variable includes five integers that represent the polynomial coefficients, and two shift parameters, one that scales each polynomial. If this variable is changed, a REFRESH command is required.

SYNTAX: VF [b0] [b1] [b2] [bshift] [a1] [a2] [ashift]
EXAMPLE: VF 100 200 300 4 500 600 7

RANGE: aN, bN = 0 to -32768
ashift, bshift = 0 to 15

Firmware Versions: 3.1.0 and later
Type: vector variable (R/W) Range: see above
Units: n/a Default: 1 0 0 0 0 0 0
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

VH

is a vector variable that defines the H (feedback path) polynomial of the Advanced Pole-Placement velocity controller (COMPMODE = 3). The vector defined by this variable includes four integers that represent the polynomial coefficients, and four shift parameters, one that scales each polynomial. If this variable is changed, a REFRESH command is required.

NOTE: prior to firmware version 2.1.0, this command mnemonic was “H”.

SYNTAX: VH [h0] [h0shift] [h1] [h1shift] ... [h3] [h3shift]
EXAMPLE: VH 10000 2 30000 4 50000 6 70000 8
RANGE: hN = -2,147,483,647 to 2,147,483,647
hNshift = 0 to 32767

Firmware Versions: 2.1.0 and later (previously H)
Type: vector variable (R/W) Range: see above
Units: n/a Default: 0 (all parameters)
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

VLIM

sets the application velocity limit, allowing the user to limit the motor’s peak velocity. VLIM limits the velocity command that will be accepted from the user (using the J command in Opmode 0) or issued by the control loops (in Opmode 1). VLIM is an independent variable that is not calculated from hardware parameters and is not tied to any other variables. VLIM is similar to ILIM (used in Opmodes 2 & 3) and can be used to protect delicate load equipment. For rotary motors, VLIM > 6100 only if ENCOUT ≤ 1024, and VLIM > 1500 only if ENCOUT ≤ 4096.

Firmware Versions: all
Type: variable (R/W) Range: 10 to VMAX

Units: rotary: RPM Default: VMAX
linear: mm/sec
Opmodes: 0,1,4,8 Drive Status: dis EEPROM: yes

VMAX

displays the system velocity maximum for a drive and motor combination. This variable is based on drive and motor hardware parameters and is set equal to the MINIMUM of the five following values:

1.) MSPEED
2.) (VBUS * 0.707 / MBEMF) * 1000
3.) 24,000
4.) 180,000,000 / MENCRES (encoder-feedback systems only)
5.) 192,000 / MRESPOLES (resolver system, MRESPOLES>8)

Note that 24,000 is the highest value VMAX can take. VMAX is used to limit VLIM and VOSPD.

Firmware Versions: all
Type: variable (R) Range: 10 to 24,000
Units: rotary: RPM Default: see above
linear: mm/sec
Opmodes: 0,1,4,8 Drive Status: dis EEPROM: yes

VOSPD

sets the over-speed trip limit for the motor. The drive is disabled with an error condition when the drive velocity exceeds this limit. This default value of this variable is 20% above the system velocity maximum (VMAX) but can be reduced by the user during regular motor operation for protection.

Firmware Versions: all
Type: variable (R/W) Range: 10 to (1.2 * VMAX)
Units: rotary: RPM Default: VMAX * 1.2
linear: mm/sec
Opmodes: all Drive Status: dis EEPROM: yes

VR

is a vector variable that defines the R (feed-forward path) polynomial of the Advanced Pole-Placement velocity controller (COMPMODE = 3). This vector includes three integers that represent the polynomial coefficients and three shift parameters, one that scales each polynomial. If this variable is changed, a REFRESH command is required.

NOTE: prior to firmware version 2.1.0, this command mnemonic was “R”.

SYNTAX: VR [r0] [r0shift] [r1] [r1shift] [r2] [r2shift]
EXAMPLE: VR 10000 2 30000 4 50000 6

RANGES: rNvector = -2,147,483,647 to 2,147,483,647
rNshift = 0 to 32767

Firmware Versions: 2.1.0 and later (previously R)
Type: vector variable (R/W) Range: see above
Units: n/a Default: all 0’s
Opmodes: 0,1,4,8 Drive Status: en/dis EEPROM: yes

VSCALE

is an analog velocity scale factor that scales (1) the analog input ANIN for OPMODE 1 (analog torque mode), and (2) the analog output for ANOUT=0 or 2. The value entered is the motor velocity per 10 volts of analog input or output. This variable may be either higher or lower than the application velocity limit (VLIM), but the actual analog I/O will be limited by VLIM.

Firmware Versions: all
Type: variable (R/W) Range: 10 to 32767
Units: rotary: RPM / 10V Default: VLIM / 0.8
linear: mm/sec / 10V
Opmodes: 1 Drive Status: en/dis EEPROM: yes

XENCDIR

sets the direction defined as positive rotation for the external encoder input.
0 = normal
1 = inverted

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 0,1
Units: n/a Default: 0
Opmodes: all Drive Status: dis EEPROM: yes

XENCRES

sets the resolution of the external encoder input channel and is used to calculate VEXT.

Firmware Versions: 2.1.0 and later
Type: variable (R/W) Range: 100 to 10,000,000
Units: Lines per revolution Default: 1024
Opmodes: all Drive Status: dis EEPROM: yes

ZERO

enables/disables Resolver/Encoder Zeroing Mode. If Zeroing Mode is enabled, the drive rotates the motor to an electrical null by placing IZERO current from the motor C terminal to the B terminal.
0 = zeroing mode disabled
1 = zeroing mode enabled (puts the drive in OPMODE 2)

Firmware Versions: all
Type: switch (R/W) Range: 0, 1
Units: n/a Default: 0
Opmodes: all Drive Status: en/dis EEPROM: no

Section 5

VARIABLES BY TYPE

READ/WRITE SWITCH VARIABLES

ACONFIG	GEAR	MSG	RELAYMODE
ACTFAULT	HOLD	O1	THERMTYPE
COMPFILT	LIMDIS	PCMDMODE	UNITS
DIR	MFOLDDIS	PLIM	UVRECOVER
ECHO	MHINVA/B/C	PROMPT	ZERO

READ-ONLY SWITCH VARIABLES

ACTIVE	FOLD	RECING	SWEN
CCWLIM	IN1, IN2, IN3	RECRDY	THERM
CWLIM	MFOLD	RELAY	
DIPEN	READY	REMOTE	
DRIVEOK	RECDONE	STOPPED	

R/W SWITCH MODE VARIABLES

ACKMODE	FOLDMODE	MOTORTYPE	PROFMODE
ANOUT	GEARMODE	MPOLES	SININTOUT
AVGTIME	GETMODE	MRESPOLES	STOPMODE
COMPMODE	HOMETYPE	MSINFRQ	THERMODE
ENCOUT	IN1MODE-IN3MODE	O1MODE	UVMODE
ENCOUTO	MENCTYPE	OPMODE	
FILTMODE	MFBDIR	PCMDMODE	

R-ONLY SWITCH MODE VARIABLES

DIP	HALLS	ILSBMODE	RDRES
ENCINITST	HOMESTATE	IN	

READ/WRITE VARIABLES

ACC	HOMESPD	MENCOFF	O1RST
ANDB	ICONT	MENCRES	O1TRIG
ANDG	IENCSTART	MFOLDD	PEINPOS
ANOFF	IFRIC	MFOLDR	PEMAX
BW	IGRAV	MFOLDT	PEXTOFF
DEC	ILIM	MICONT	PFBOFF
DECSTOP	ILIM2	MIPEAK	PMAX
DISSPEED	IN	MJ	PMIN
DISTIME	ISCALE	MLGAINP	PROFSCRV
FOLDTIME	ISTOP	MLGAINZ	PSCALE
GEAR	IZERO	MLMAX	RECTRIG
GEARI	KV	MLMIN	TF
GEARO	KVFR	MOTOR	THERMTIME
GP	KVI	MPHASE	UVTIME
GPAFR	LMJR	MPITCH	VBUS
GPAFR2	LPFHZ1	MSININT	VD
GPD	LPFHZ2	MSPEED	VF
GPI	MAPOS	MTANGLC	VH
GPISATIN	MASPEED	MTANGLP	VLIM
GPISATOUT	MBEMF	MVANGLF	VOSPD
GPVFR	MBEMFCOMP	MVANGLH	VR
GV	MIDIST0-3	NOTCHBW	VSCALE
GVI	MISPEED0-3	NOTCHHZ	XENCRES

READ-ONLY VARIABLES

ACONFIGST	IA	PFB	VE
ADDR	IC	PRD	VER
ANIN	ICMD	STAT	VEXT
DICONT	IMAX	STATUS	VMAX
DIPEAK	PCMD	TRUN	
HWPOS	PE	V	
I	PEXT	VCMD	

"RSTVAR" DEFAULT VALUES

ACC = 400,000	HOMESPD = 100	MPHASE = 0
ACKMODE = 0	HOMETYPE = 0	MSG = 1
ACTFAULT = 0	IENCSTART = 25	MSINFRQ = 1
ANDB = 0	IFRIC = 0	NOTCHBW = 1
ANDG = 0	IGRAV = 0	NOTCHHZ = 500
ANOFF = 0	ILIM = IMAX	O1MODE = 6
ANOUT = 0	ILIM2 = 100	O1RST = VOSPD
AVGTIME = 0	ILSBMODE = 2	O1TRIG = 1000
BW = 20	IN1MODE = 1	OPMODE = 1
COMPFILT=1	IN2MODE = 2	PCMDMODE = 0
COMPMODE = 2	IN3MODE = 3	PEMAX = 0
DEC = 400,000	ISCALE = 1250	PLIM = 0
DECSTOP = 5000	ISTOP = DICONT	PMAX=2,000,000,000
DIR = 1	IZERO = 25	PMIN=-2,000,000,000
DISSPEED = 50	KV = 1000	PROFMODE = 0
DISTIME = 100	KVI = 1000	PROFSCRV=50
ECHO = 1	KVFR = 0	PROMPT = 1
ENCOUT = 1024	LIMDIS = 0	RELAYMODE = 0
ENCOUTO = 1	LMJR = 0	SININTOUT = 1
FILTMODE = 0	LPFHZ1 = 500	STOPPED = 0
FOLDMODE = 0	LPFHZ2 = 500	TF=100
FOLDTIME=30	MAPOS = 0	THERMODE = 0
GEAR = 1	MASPEED = 0	THERMTIME = 30
GEARI = 1	MFBDIR = 0	THERMTYPE = 0
GEARMODE = 3	MFOLDD = 1200	UNITS = 0
GEARO = 1	MFOLDDIS = 0	UVMODE = 0
GETMODE = 0	MFOLDR = 1800	UVTIME = 30
GPAFR = 0	MFOLDT = 600	UVRECOVER = 0
GPAFR2 = 0	MIDIST0 = 0	VD, VH, VR = all 0's
GPD = 0	MIDIST1 = 0	VF = 1 0 0 0 0 0 0
GPI = 0	MIDIST2 = 0	VLIM = VMAX
GPISATIN = 0	MIDIST3 = 0	VOSPD = 1.2*VLIM
GPISATOUT = 0	MISPEED0 = 100	VSCALE = 1.25*VLIM
GPVFR = 0	MISPEED1 = 100	XENCDIR = 0
GV = 500	MISPEED2 = 100	XENCRES = 1024
GVI = 20	MISPEED3 = 100	

Section 6

Revision Notes

INTRODUCTION STATEMENT

Due to the continual improvements and enhancements that Kollmorgen makes to its products, the information that is supplied with the product will sometimes become out of date. For your convenience, Kollmorgen provides the most up-to-date copy of this document on our website.

Revisions to this document since the last hard copy printing (version 3.3.0):

ENHANCEMENTS / CHANGES

V2.0.0	1. Added BEMFCOMP.
V2.0.1	2. Renamed BEMFCOMP to MBEMFCOMP.
V2.1.0	3. Added Gearing opmode (OPMODE=4), GEAR, GEARI, GEARO, GEARMODE, and supporting variables PEXT, PEXTOFF, XENCRES, XENCDIR, GP, INPOS, PE, PEINPOS, and PEMAX, and VEXT. 4. Added linear motor support (MOTORTYPE=2 and MPITCH). 5. Added Flex I/O (also called Drive I/O): IN1, IN2, IN3, IN1MODE, IN2MODE, IN3MODE, O1, O1MODE, O1RST, O1TRIG, ANOUT. 6. Added COMPMODE 4 and COMPFILT. 7. Added MENCTYPE 5. 8. Implemented ISTOP and STOPMODE. 9. Changed D, H, and R variables to VD, VH, VR. 10.Added IFRIC, IGRAV, ILSBMODE.
V2.1.1	11.Modified ANLPFHZ so 10,000 HZ is unity gain. 12.Corrected the calculation of power-up values for VSCALE, ACC, DEC on encoder systems.
V3.1.0	13.Added positioning opmode (OPMODE=8) and associated commands, gains, etc.: GPAFR, GPAFR2, GPD, GPI, GPISATIN, GPISATOUT, GPVFR, HOMESPD, HOMESTATE, HOMETYPE, MA, MAPOS, MASPEED, MH, MI, MIDIST0-3, MISPEED0-3, PCMD, PLIM, PMAX, PMIN, and STOPPED. 14.Added second current limit ILIM2. 15.Added sine encoder support: MSININT. 16.Expanded thermostat function: THERMODE's 4 and 5, THERMTIME, THERMTYPE. 17.Expanded Undervoltage capability: UVMODE, UVTIME. 18.Added new COMPMODE 3 filter: VF. 19.Added FILTMODE=3, NOTCHBW, NOTCHHZ. 20.Added INxMODE's 7-16, 18, and IN variable. 21.Added O1MODE 10. 22.New range for ACC and DEC: 10 to 400,000. 23.Added error codes 85, 92-96, and LED fault displays 4.3 and 4.7-4.9.
V3.2.0	24.Added analog positioning (PCMDMODE, PSCALE). 25.Expanded CONFIG failed error messages (37.01 through 37.14). 26.Expanded RECORD and RECTRIG. 27.Added HOMETYPE 3-5. 28.Added O1MODE=9. 29.Added motor foldback: MFOLD, MFOLDD, MFOLDDIS, MFOLDR, MFOLDT. 30.Expanded STATUS Word 3. 31.Added ANOUT=8. 32.Changed units of MENCRES to lines per pitch for MOTORTYPE=2 (linear motor).
V3.3.0	33.Added new PROFMODE=2 and PROFSCRV. 34.Added velocity buffering feature for use in OPMODE 1 (see INxMODE = 7). 35.Improved the encoder initialization process. 36.Implemented new return-to-home velocity (see MISPEED0 and MH). 37.Added a fifth word and a sixth word to STATUS2 variable. 38.Upper limit if GV and KV was increased to 1,000,000,000 from 65,535. 39.Added a second overspeed fault of 1.8 * VLIM. 40.Added SININTOUT and MSINFRQ for encoder equivalent output with sine encoders. 41.Added ENCOUTO for scaling down encoder equivalent output. 42.Added HOMETYPES 6, 7, 50-57. 43.Added Auto-Config function (ACONFIG, ACONFIGST, and MFBDIR). 44.Changed definition of ENCOUT to accommodate new SININTOUT and ENCOUTO variables.