Danaher Motion

Dual-Axis Drive

VarCom

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Firmware Version 0.5.6
M-SS-014-2064

Record of Revisions

Issue No	Date	Brief Description of Revision
01	10/31/01	Initial release
02	11/21/01	Added new instructions (GPI, GPISATIN, GPISATOUT, COMPFILT, VF2, DIR)
03	12/31/01	Added description for VD
04	02/05/02	Added description for PGEAR, UVIGNORE
05	March 25, 2002	Update upper limit of KV Correct units of MKT
06	April 28, 2002	Changes to PFB and PFBOFF descriptions Improved description of VF and VF2

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Therefore, information contained in this manual may be updated from time-to-time due to product improvements, etc., and may not conform in every respect to former issues.

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Variable and Command Syntax

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.

Syntax
Description
Firmware
Type
Limitations

Syntax: Shows how the command must be written

Description: Describes how to use the command

Firmware: Provides the earliest version of firmware in which the command existed. To check your drive's firmware version, use the VER command.

Type: Indicates that the instruction is a command

Limitations: Describes any limitations that there may be to executing the command.

VARIABLE

This is the format that a variable description will take.

Syntax
Description
Firmware
Type
Units
Range:
Default:
Non-Volatile
Write Access
Limitations

Syntax: Shows how the command must be written

Description: Describes how to use the command

Firmware: Provides the earliest version of firmware in which the command existed. To check your drive's firmware version, use the VER command.

Type: Indicates the type of variable (switch variable, switch mode variable, (standard) variable, or vector 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.

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

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.

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

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

Limitations: Describes any limitations that there may be to executing the instruction, specifically the Enable and DISable status of the drive, and the opmodes in which the instruction is valid

Variable and Command Set

ACTIVE

Syntax	**ACTIVE**
Description	Displays if the drive is enabled and power is applied to the motor. This flag is the overall readiness indicator of the drive. The values are: 0 = drive is inactive 1 = drive is active and ready to operate
Firmware	All versions
Type	Switch
Units	N/A
Range	0, 1
Default:	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

ANDB

Syntax	**ANDB=<*expression*>**
Description	Sets the dead band of the analog input signal. If the absolute value of the analog input signal is less than this value, no analog command signal is generated.
Firmware	All versions
Type	Variable
Units	Millivolts
Range:	0 to 10,000
Default:	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

ANIN1

Syntax	**ANIN1**
Description	Displays the analog input value after being filtered by ANOFF1 and ANDB.
Firmware	All versions
Type	Variable
Units	Millivolts
Range	-10,000 to +10,000
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

ANLPFHZ

Syntax	**ANLPFHZ=<*expression*>**
Description	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	All versions
Type	Variable
Units	Hz
Range	1 to 10,000
Default	10,000
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

ANOFF1

Syntax	**ANOFF1=<*expression*>**
Description	Sets the analog offset that is added to the analog input command to the drive. This is used to compensate for the analog input signal (ANIN1) offset or drift.
Firmware	All versions
Type	Variable
Units	Millivolts
Range	-10,000 to 10,000
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

ANZERO

Syntax	**ANZERO**
Description	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 the value of ANOFF1 will probably be modified.
Firmware	All versions
Type	Command
Limitations	Controller Status : EN/DIS Op. Modes : All

AXISOFF

Syntax	**AXISOFF=<value>**
Description	When set to 1, this variable causes an axis to be disabled so that it will not affect the state of the Alarm and the Ready signals of the Dual-Axis Drive.
Firmware	All versions
Type	Switch
Units	**N/A**
Range	0, 1
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

CLREEPROM

Syntax **CLREEPROM**

Description 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 then has to be initiated before resuming drive operation. This command is the only method of resetting the run time clock.

Firmware All versions

Type Command

Limitations Controller Status : DIS
Op. Modes : All

COMPFILT

Syntax	**COMPFILT=<value>**
Description	This is a switch variable that enables and disables a 400 Hz low pass filter in the velocity feedback loop.
Firmware	0.4.8
Type	Switch
Units	**N/A**
Range	0 (Off), 1 (On)
Default	1
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

CONFIG

Syntax **CONFIG**

Description Configures the current and velocity control loops after motor data has been entered. Executing this command tells the drive that the motor data parameters have all 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 cause the drive to enter a non-compensated (no-comp) state. The LED display will flash an alternating minus sign and the digit “1”. In this case, a CONFIG command is required. This also occurs when CLREEPROM is executed.

Firmware All versions

Type Command

Limitations Controller Status : DIS
Op. Modes : All

DICONT

Syntax **DICONT**

Description 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.
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 All versions

Type Variable

Units **A**mps RMS * 0.1

Range 10 to 11000*0.1

Default 60

Non-Volatile Yes

Write Access Read

Limitations Controller Status : EN/DIS
Op. Modes : All

DIPEAK

Syntax	**DIPEAK**
Description	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 * 3 on the 3- or 6-Amp units and to the value of DICONT *2 on the 10-Amp unit. DIPEAK sets the 100% reference for many other current variables.
Firmware	All versions
Type	Variable
Units	**A**mps RMS * 0.1
Range	20 to 2200 amperes*0.1
Default	**180**
Non-Volatile	Yes
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

DIR

Syntax **DIR=<value>**

Description When set to 1, this variable inverts the sign of the reference command (±10Vdc for Torque and Velocity modes, and Direction signal for Pulse & Direction Position mode).

The following table describes the effect of DIR in Torque and Velocity modes:

DIR Value	**Reference Command**	**Direction of Motor Rotation**	**Equivalent Encoder Output**
0	Positive	CW	A lead B
0	Negative	CCW	B lead A
1	Positive	CCW	B lead A
1	Negative	CW	A lead B

The following table describes the effect of DIR in Position mode:

DIR Value	**Direction Signal**	**Direction of Motor Rotation**	**Equivalent Encoder Output**
0	5V	CW	A lead B
0	0V	CCW	B lead A
1	5V	CCW	B lead A
1	0V	CW	A lead B

Firmware All versions
Type Switch
Units **N/A**
Range 0, 1
Default 0
Non-Volatile Yes
Write Access Read/Write
Limitations Controller Status : EN/DIS
Op. Modes : All

DIS

Syntax **DIS**

Description 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 All versions
Type Command
Units N/A
Range N/A
Default N/A
Limitations Controller Status : DIS
Op. Modes : All

DRIVEOK

Syntax	**DRIVEOK**
Description	Displays the status of the drive faults. 0 = faults exist 1 = no faults exist
Firmware	All versions
Type	Switch
Units	N/A
Range	0, 1
Default	N/A
Limitations	Controller Status : EN/DIS Op. Modes : All

DUMP

Syntax	**DUMP**
Description	Transmits all variables and their settings to the serial port terminal. The variables can then be reviewed or saved to a variable file (*.SSV). The PFBOFF parameter is NOT returned by the DUMP instruction.
Firmware	All versions
Type	Command
Units	N/A
Range	0, 1
Default	N/A
Limitations	Controller Status : EN/DIS Op. Modes : All

EN

Syntax	**EN**
Description	Initiates a software enable of the drive, then sets SWEN to 1. If READY and REMOTE, 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	All versions
Type	Command
Limitations	Controller Status : EN Op. Modes : All

FLTCLR

Syntax **FLTCLR**

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

Firmware All versions

Type Command

Limitations Controller Status : EN/DIS
Op. Modes : All

FLTHIST

Syntax **FLTHIST**

Description Causes 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.

Firmware All versions

Type Command

Limitations Controller Status : EN/DIS
Op. Modes : All

FOLD

Syntax **FOLD**

Description 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.
0 = drive foldback OFF
1 = drive foldback ON

Firmware All versions

Type Switch

Units N/A

Range 0, 1

Default 0

Non-Volatile No

Write Access Read

Limitations Controller Status : EN/DIS
Op. Modes : All

FOLDD

Syntax	**FOLDD=<*expression*>**
Description	Sets the delay time for drive foldback. This is the amount of time that the system current can exceed ICONT before the drive will enter the motor foldback state. The time units assume a worst-case scenario where the drive is applying DIPEAK current. A current level of less than DIPEAK can be allowed for a longer time.
Firmware	All versions
Type	Variable
Units	Seconds at DIPEAK
Range:	1 to 32767
Default:	1000
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

FOLDMODE

Syntax	**FOLDMODE=<*expression*>**
Description	Sets the mode for drive current foldback and motor current foldback operation. 0 = normal foldback from ILIM to ICONT 1 = foldback to ICONT and issue fault after FOLDTIME 2 = issue fault immediately upon detection
Firmware	All versions
Type	Variable
Units	N/A
Range	0, 1, 2
Default	0
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

FOLDR

Syntax	**FOLDR=<*expression*>**
Description	Sets the recovery time for drive foldback. After the drive enters the foldback state (FOLD=1), and the current folds back to ICONT, this is the amount of time that the current will be held at ICONT or below before it is allowed to exceed ICONT again. See also FOLD, FOLDMODE, FOLDD, and FOLDT.
Firmware	All versions
Type	Variable
Units	Seconds
Range	1 to 32767
Default	17000
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

FOLDT

Syntax	**FOLDT=<*expression*>**
Description	Sets the time constant for drive foldback. After the drive enters the foldback state (FOLD=1), this variable defines how long it will take the drive to reduce the system current level to ICONT.
Firmware	All versions
Type	Variable
Units	Seconds
Range:	1 to 32767
Default:	1450
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

FOLDTIME

Syntax	**FOLDTIME=<*expression*>**
Description	Sets the time since foldback detection to foldback fault latch for FOLDMODE=1 only. 0 = normal foldback from ILIM to ICONT.
Firmware	All versions
Type	Variable
Units	Seconds
Range	1 to 300
Default	30
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

GP

Syntax	**GP=<*expression*>**
Description	Sets the proportional gain for the position loop.
Firmware	All versions
Type	Variable
Units	0.01 kRPM/rev
Range	1 to 7000
Default	30
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

GPI

Syntax	**GPI=<*expression*>**
Description	sets the integral gain for the Proportional-Integral (PI) compensator in the position loop. Setting this value = 10,000 means that GPI=GP (expressed mathematically, the internal PI gain used by the drive processor equals GP*GPI/10000).
Firmware	All versions
Type	Variable
Units	N/A
Range	0 to 10000
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

GPISATIN

Syntax	**GPISATIN=<*expression*>**
Description	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	All versions
Type	Variable
Units	feedback counts
Range	0 to 1,000,000
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

GPISATOUT

Syntax	**GPISATOUT=<*expression*>**
Description	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	All versions
Type	Variable
Units	feedback counts
Range	0 to 1,000,000
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

GPVFR

Syntax	**GPVFR=<*expression*>**
Description	This 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	All versions
Type	Variable
Units	0.1%
Range	1 to 2000
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

I

Syntax	**I**
Description	Displays the equivalent motor current. The value is calculated from the individual phase currents as follows: $I = \sqrt{Ia^2 + Ib^2 + Ic^2}$ Only Ia and Ic are actually measured. Using Kirchoff's law, Ib is calculated from $Ib = -(Ia + Ic)$
Firmware	All versions
Type	Variable
Units	% of DIPEAK * 0.1
Range	0 to 2000
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

IA

Syntax	**IA**
Description	Displays the motor's A phase current.
Firmware	All versions
Type	Variable
Units	% of DIPEAK * 0.1
Range	-1000 to 1000
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

IC

Syntax	**IC**
Description	Displays the motor’s C phase current.
Firmware	All versions
Type	Variable
Units	% of DIPEAK * 0.1
Range	-1000 to 1000
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

ICONT

Syntax	**ICONT=<*expression*>**
Description	Sets the system continuous current. This variable is used in the foldback algorithm. 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 is set equal to IMAX. This variable is reset to its default whenever DICONT or MICONT is changed. The user can override the default.
Firmware	All versions
Type	Variable
Units	% of DIPEAK * 0.1
Range	0 to IMAX
Default	Minimum of DICONT and MICONT
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

ILIM

Syntax **ILIM=<*expression*>**

Description Sets the application current limit, allowing the user to limit the drive's peak current. This variable limits the current command issued by the control loops (in Opmodes 1 and 3). 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 Opmode 1) and can be used to protect delicate load equipment.

Firmware All versions

Type Variable

Units % of DIPEAK * 0.1

Range 0 to IMAX

Default IMAX

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : All

IMAX

Syntax **IMAX**

Description 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 All versions

Type Variable

Units % of DIPEAK *0.1

Range: 0 to 1000

Default: Minimum of DIPEAK & MIPEAK

Non-Volatile No

Write Access Read

Limitations Controller Status : EN/DIS
Op. Modes : All

INPOS

Syntax	**INPOS**
Description	Indicates if the actual position (PFB) is following the commanded position (PCMD) within the following error set by PEINPOS. 0 – not in position 1 **–** in position
Firmware	All versions
Type	Switch
Units	% of DIPEAK *0.1
Range:	0 to 1000
Default:	Minimum of DIPEAK & MIPEAK
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : 8

ISCALE

Syntax	**ISCALE=<*expression*>**
Description	An analog current scale factor that scales the analog input ANIN1 for OPMODE 3 (analog torque mode). The value entered is the motor current per 10 volts of analog input. For example, a value of 123 means that 10V on the input will result in a current command that is 12.3% of DIPEAK. 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	All versions
Type	Variable
Units	(%DIPEAK*0.1)/10V
Range	100 to 10,000
Default	833
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 3

K

Syntax	**K**
Description	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	All versions
Type	Command
Units	N/A
Range	N/A
Default	N/A
Non-Volatile	Yes
Write Access	N/A
Limitations	Controller Status : EN/DIS Op. Modes : All

KV

Syntax	**KV=<*expression*>**
Description	KV sets the proportional gain for the Pseudo Derivative Feedback with Feed-Forward Velocity Control Loop. This variable is set manually by the user.
Firmware	All versions
Type	Variable
Units	N/A
Range	0 to 1,000,000,000
Default	1000
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 1, 8

KVFR

Syntax	**KVFR=<*expression*>**
Description	KVFR sets the feed-forward to feedback gain ratio for the Pseudo Derivative Feedback with Feed-Forward Velocity Control Loop. This variable is set manually by the user.
Firmware	All versions
Type	Variable
Units	percent *0.1
Range	0 to 1,000
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 1, 8

KVI

Syntax	**KVI=<*expression*>**
Description	KVI sets the integral gain for the Pseudo Derivative Feedback with Feed-Forward Velocity Control Loop. This variable is set manually by the user.
Firmware	All versions
Type	Variable
Units	N/A
Range	0 to 65,535
Default	1000
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 1, 8

LIST

Syntax	**LIST**
Description	Dumps a list of valid instructions to the serial port.
Firmware	All versions
Type	Command
Limitations	Controller Status : EN/DIS Op. Modes : All

LOAD

Syntax	**LOAD**
Description	Loads all variables saved in the EEPROM into system RAM. This command is automatically executed on power-up.
Firmware	All versions
Type	Command
Limitations	Controller Status : DIS Op. Modes : All

MBEMFCOMP

Syntax	**MBEMFCOMP=<*expression*>**
Description	Sets a back EMF compensation percentage value. This variable affects the amount of back EMF compensation that is applied to the motor command.
Firmware	All versions
Type	Variable
Units	Percent
Range	1 to 130
Default	50, or motor data
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

MENCRES

Syntax	**MENCRES=<*expression*>**
Description	Displays the resolution of the motor encoder in number of equivalent lines per revolution of the motor. The encoder used is a sine encoder with 2048 sine cycles per revolution. The sine signals are interpolated to a level of 256, giving 524288 equivalent lines per revolution. Note that the number of encoder counts per revolution is obtained by multiplying MENCRES by 4. **This value is fixed at 524288.**
Firmware	All versions
Type	Variable
Units	Rotary: Lines/Motor Rev
Range	**N/A: Value set to 524288**
Write Access	Read Only
Limitations	Controller Status : EN/DIS Op. Modes : All

MICONT

Syntax	**MICONT=<*expression*>**
Description	Defines the motor's continuous rated current. The value of this parameter is fixed at 4.2 Amps.
Firmware	All versions
Type	Variable
Units	Amperes RMS*0.1
Range	N/A: value fixed at **42**
Write Access	Read Only
Limitations	Controller Status : DIS
	Op. Modes : All

MIPEAK

Syntax	**MIPEAK=<*expression*>**
Description	Defines the motor's peak rated current. The value of this parameter is fixed at 18.6 Amps.
Firmware	All versions
Type	Variable
Units	Amperes RMS*0.1
Range:	N/A: value fixed at **186**
Write Access	Read Only
Limitations	Controller Status : DIS
	Op. Modes : All

MKT

Syntax	**MKT <*expression*>**
Description	Sets the motor's torque constant.
Firmware	All versions
Type	Variable
Units	N.m per 1000 Amps (Nm/Amp * 10e-3)
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS
	Op. Modes : All

MLGAINC

Syntax	**MLGAINC <*expression*>**
Description	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.
Firmware	All versions
Type	Variable
Units	% *10
Range	1 to 100
Default	8
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

MLGAINP

Syntax	**MLGAINP=<*expression*>** **?MLGAINP**
Description	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 currents within 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.
Firmware	All versions
Type	Variable
Units	% *10
Range	1 to 100
Default	4
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

MLIST

Syntax	**MLIST**
Description	Dumps all motor variables and their values to the serial port.
Firmware	All versions
Type	Command
Limitations	Controller Status : DIS Op. Modes : All

MLMIN

Syntax	**MLMIN=<*expression*>** **?MLMIN**
Description	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.
Firmware	All versions
Type	Variable
Units	Millihenries *10 –2
Range	1 to 32767
Default	Motor data
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

MPHASE

Syntax	**MPHASE=<*expression*>** **?MPHASE**
Description	Allows the encoder alignment for adjusting commutation angle. This variable is set to 0. Note that changing MPHASE will ***not*** create a physical change in the position of the motor shaft - it merely shifts the internal commutation angle.
Firmware	All versions
Type	Variable
Range	0 to 359
Units	Electrical degrees
Default	Motor data
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

MPOLES

Syntax	**MPOLES**
Description	Defines the number of motor poles. This parameter is used for commutation control and represents the number of individual magnetic poles of the motor (not pole pairs). **The value is fixed at 18**.
Firmware	All versions
Type	Switch
Range	18
Units	Poles
Write Access	Read Only
Limitations	Controller Status : EN/DIS Op. Modes : All

MSPEED

Syntax	**MSPEED**
Description	Defines the maximum recommended velocity of the motor. **The value is fixed at 600 RPM**.
Firmware	All versions
Type	Variable
Range	**600**
Units	Rotary: RPM
Write Access	Read Only
Limitations	Controller Status : EN/DIS Op. Modes : All

MTANGLC

Syntax	**MTANGLC=<*expression*>**
Description	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	All versions
Type	Variable
Range	0 to 45
Units	Electrical degrees
Default	10
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

MTANGLP

Syntax **MTANGLP=<*expression*>**

Description 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 All versions

Type Variable

Range 0 to 45

Units Electrical degrees

Default 10

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : All

MVANGLF

Syntax **MVANGLF=<*expression*>**

Description 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 a value for MVANGLF, it keeps that value and is not changed if a CONFIG is executed.

Firmware All versions

Type Variable

Range 0 to 90

Units Electrical degrees

Default Motor data

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : All

MVANGLH

Syntax	**MVANGLH=<*expression*>**
Description	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 a value for MVANGLH, it keeps that value and is not changed if a CONFIG is executed.
Firmware	All versions
Type	Variable
Range	0 to 90
Units	Electrical degrees
Default	Motor data
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

OPMODE

Syntax	**OPMODE=<*expression*>**
Description	Sets the operational mode for the drive. The OPMODES are: 1 = Analog Velocity 3 = Analog Torque 8 = Position
Firmware	All versions
Type	Switch
Range	1, 3, 8
Units	N/A
Default	1
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

PE

Syntax	**PE**
Description	Displays the position following error. If this value is greater than PEMAX, then the drive will be disabled.
Firmware	All versions
Type	Variable
Range	-2,147,483,647 to +2,147,483,647
Units	Counts
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : 8

PEMAX

Syntax	**PEMAX <value>**
Description	Sets the maximum allowable position following error (OPMODE 8). If the position following error (PE) exceeds this value, the drive is disabled on fault.
Firmware	All versions
Type	Variable
Range	-2,147,483,647 to +2,147,483,647
Units	Counts
Default	N/A
Non-Volatile	No
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

PEINPOS

Syntax	**PEINPOS**
Description	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	All versions
Type	Variable
Range	-2,147,483,647 to +2,147,483,647
Units	Counts
Default	100
Non-Volatile	No
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 8

PFB

Syntax	**PFB**
Description	PFB displays the position feedback. The position feedback is given in units of encoder counts, where there are 2, 097, 152 counts per motor revolution. The value is always positive, and in the range 0 .. 2,097,151. That is, the value is always within one revolution. The value displayed is modified relative to the value read from the encoder by the PFBOFF variable. The value of PFBOFF is added to the value read from the encoder before PFB is presented to the user.
Firmware	All versions
Type	Variable
Range	0 to 2,097,151
Units	Counts
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

PFBOFF

Syntax **PFBOFF=<value>**

Description Sets a value for zero position offset. The value of PFB that is reported by the drive is modified by PFBOFF in the following way:

$$PFB_{User} = PFB_{Internal} + PFBOFF$$

PFBOFF can be used to set the position of the machine zero point. In order to do this, do the following steps:

- Set PFBOFF to 0
- Read PFB
- Set PFBOFF to the negative value of the PFB

The value of PFBOFF is stored in the non-volatile memory of the EnDat encoder. It is NOT returned by the drive in response to the DUMP instruction.

Firmware All versions

Type Variable

Range -2,147,483,647 to +2,147,483,647

Units Counts

Default N/A

Non-Volatile Yes (in encoder)

Write Access Read/Write

Limitations Controller Status : DIS
Op. Modes : All

PGEAR

Syntax **PGEAR=<*expression*>**
?PGEAR

Description Allows increasing of motor speed by a factor of 2 or 4. It is used in Position mode (OPMODE 8) to multiply the input pulse frequency relative to the feedback resolution. The motor will turn by PGEAR counts for every commanded pulse. The equivalent encoder output is also scaled by PGEAR, such that the pulse input resolution (pulses per revolution) is equal to the encoder output resolution (counts per revolution).

Firmware A.0.5.4

Type Switch Mode

Range 1, 2, 4

Units N/A

Default 1

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : 8

READY

Syntax	**READY**
Description	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) is still required to enable the drive (ACTIVE = 1). The flag values are: 0 = faults exist or SWEN = 0 1 = no faults exist and SWEN = 1
Firmware	All versions
Type	Switch
Range	0, 1
Units	N/A
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

REMOTE

Syntax	**REMOTE**
Description	Indicates the state of the external hardware enable input line. If the drive is READY, then the drive will be enbaled when this signal is on. The RMTMODE instruction can be used to tell the drive to ignore this signal. 0 = remote enable input off 1 = remote enable input on
Firmware	All versions
Type	Switch
Range	0, 1
Units	N/A
Default	Hardware defined
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

RMTMODE

Syntax	**RMTMODE < value>**
Description	A software switch that is used to tell the drive whether or not to ignore the Remote Enable signal. 0 = Drive does *not* ignore the Remote Enable signal 1 = Drive ignores the Remote Enable
Firmware	All versions
Type	Switch
Range	0, 1
Units	N/A
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

RSTVAR

Syntax	**RSTVAR**
Description	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	All versions
Type	Command
Limitations	Controller Status : DIS Op. Modes : All

SAVE

Syntax	**SAVE**
Description	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 0.5 seconds to execute.
Firmware	All versions
Type	Command
Limitations	Controller Status : EN/DIS Op. Modes : All

SWEN

Syntax **SWEN**

Description 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 READY = 1.

0 = software disabled (DIS, K, or S command has been issued)
1 = software enabled (EN command has been issued)

Firmware All versions

Type Switch

Range 0, 1

Units N/A

Default The SWEN state on power-up is determined according to the SWENMODE value. Its value will be 1 if SWENMODE is set to 1, otherwise 0.

Non-Volatile No

Write Access Read

Limitations Controller Status : EN/DIS
Op. Modes : All

SWENMODE

Syntax **SWENMODE < value>**

Description A software switch that is used to tell the drive whether to power up with the software enable (SWEN) signal set to 1 or to 0.

0 = Power up with SWEN set to 0
1 = Power up with SWEN set to 1

Firmware All versions

Type Switch

Range 0, 1

Units N/A

Default 0

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : All

TRUN

Syntax	**TRUN**
Description	Provides a relative incremental run time counter. Fault log stamps include the value of this counter at the time of the error. This clock has a resolution of 1 second and is reset when power is cycled and when CLREEPROM is issued.
Firmware	All versions
Type	Variable
Range	0:0:0 to 99:59:59
Units	Hours: Minutes:Seconds
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

UVIGNORE

Syntax	**UVIGNORE=<*expression*>**
Description	Defines how the drive will respond to an under-voltage (UV) fault: 0 = latch fault immediately, display flashing “u”. 1 = UV fault is ignored
Firmware	A.0.5.4
Type	Switch
Range	0, 1
Units	N/A
Default	0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : All

V

Syntax	**V**
Description	Displays the actual motor speed.
Firmware	All versions
Type	Variable
Range	-15000 to 15000
Units	Rotary: RPM Linear: mm/sec
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

VBUS

Syntax	**VBUS=<*expression*>**
Description	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.
Firmware	All versions
Type	Variable
Range	10 to 850
Units	Volts
Default	325
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : DIS Op. Modes : All

VCMD

Syntax **VCMD=<*expression*>**

Description Displays the Velocity command to the velocity controller. This value is equivalent to the Analog Input (ANIN1) in OPMODE 1.

Firmware All versions

Type Variable

Range -VLIM to +VLIM

Units Rotary: RPM
Linear: mm/sec

Default N/A

Non-Volatile No

Write Access Read

Limitations Controller Status : EN/DIS
Op. Modes : 1

VD

Syntax **VD [d1] [d2] [dshift]**

Description Set the forward path filter of the velocity controller. The vector defined by this variable includes two integers that represent the polynomial coefficients, and one shift parameters, that scales the polynomial.
The filter structure is:

$$1 + (d1/2^{dshift}) * z^{-1} + (d2/2^{dshift}) * z^{-2}$$

Firmware All versions

Type Vector Variable

Range d1, d2: -32768 to 32767
dshift: 0 to 32767

Units N/A

Default 0 0 0

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : 1, 8

VE

Syntax	**VE**
Description	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	All versions
Type	Variable
Range	-32,768 to +32,767
Units	Rotary: RPM Linear: mm/sec
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : 1

VER

Syntax	**VER <*parameter*>**
Description	Indicates the version of the drive firmware in use. This variable also displays other pertinent information such as the drive name, current ratings and TRUN. The VER variable has two optional parameters: requesting VER 1 returns feedback type (encoder or resolver), and VER 2 returns the firmware version.
Firmware	All versions
Type	String Variable
Range	1, 2
Units	N/A
Default	N/A
Non-Volatile	No
Write Access	Read
Limitations	Controller Status : EN/DIS Op. Modes : All

VF

Syntax	**VF [b0] [b1] [b2] [bshift] [a1] [a2] [ashift]**
Description	A vector variable that defines the filter at the output of the velocity controller. The vector defined by this variable includes five integers that represent the polynomial coefficients, and two shift parameters, one that scales each polynomial. The filter structure is: $(b0 + b1*z^{-1} + b2*z^{-2}) / (1 + a1*z^{-1} +a2*z^{-2})$ Using this parameter, one of the following filters can be implanted: • First order low-pass filter • Second order low-pass filter • Notch filter • Resonance compensation filter Please refer to additional documentation on how to use this parameter to program the filter: • *pdff_filters.pdf*: Detailed description of the filters • *res_comp.xls*: EXCEL file utility to be used to find the coefficients of the filter with respect to the filter's characteristics
Firmware	All versions
Type	Vector Variable
Range	aN, bN = 32767 to -32768 ashift, bshift = 0 to 255
Units	N/A
Default	1 0 0 0 0 0 0
Non-Volatile	Yes
Write Access	Read/Write
Limitations	Controller Status : EN/DIS Op. Modes : 1, 8
Example	VF 100 200 300 4 500 600 7

VF2

Syntax **VF2 [b0] [b1] [b2] [bshift] [a1] [a2] [ashift]**

Description A second vector variable that defines the filter at the output of the velocity controller. The vector defined by this variable includes five integers that represent the polynomial coefficients, and two shift parameters, one that scales each polynomial.

The filter structure is:

$$(b0 + b1*z^{-1} + b2*z^{-2}) / (1 + a1*z^{-1} +a2*z^{-2})$$

Using this parameter, one of the following filters can be implanted:

- First order low-pass filter
- Second order low-pass filter
- Notch filter
- Resonance compensation filter

Please refer to additional documentation on how to use this parameter to program the filter:

- *pdff_filters.pdf*: Detailed description of the filters
- *res_comp.xls*: EXCEL file utility to be used to find the coefficients of the filter with respect to the filter's characteristics

Firmware All versions

Type Vector Variable

Range aN, bN = 32767 to -32768
ashift, bshift = 0 to 255

Units N/A

Default 1 0 0 0 0 0 0

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : 1, 8

Example VF2 100 200 300 4 500 600 7

VLIM

Syntax **VLIM=<*expression*>**

Description Sets the application velocity limit, allowing the user to limit the motor's peak velocity. VLIM limits the velocity command issued by the control loops. 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 and can be used to protect delicate load equipment.

Firmware All versions

Type Variable

Range 10 to VMAX

Units Rotary: RPM
Linear: mm/sec

Default VMAX

Non-Volatile Yes

Scope Configuration, Task, Terminal

Write Access Read/Write

Limitations Controller Status : DIS
Op. Modes : 1

VMAX

Syntax **VMAX=<*expression*>**

Description 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 following values:

1.) MSPEED
2.) VBUS / MKT * 11703
3.) 24,000
4.) 393,216,000 / MENCRES

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

Firmware All versions

Type Variable

Range 10 to 24,000

Units Rotary: RPM
Linear: mm/sec

Default See Description

Non-Volatile Yes

Write Access Read

Limitations Controller Status : DIS
Op. Modes : 1

VOSPD

Syntax **VOSPD=<*expression*>**

Description Sets the overspeed trip limit for the motor. The drive is disabled with an error condition when the drive velocity exceeds this limit. The 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 All versions

Type Variable

Range 10 to (1.2 * VMAX)

Units Rotary: RPM
Linear: mm/sec

Default VMAX * 1.2

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : DIS
Op. Modes : All

VSCALE

Syntax **VSCALE <value>**

Description An analog velocity scale factor that scales the analog input ANIN for OPMODE 1 (analog velocity mode). The value entered is the motor velocity per 10 volts of analog input or output. For example, if the value entered is 500, then 10V on the input results in a velocity command of 500RPM. This variable may be either higher or lower than the application velocity limit (VLIM), but the actual speed will always be limited by VLIM.

Firmware All versions

Type Variable

Range 10 to 32,767

Units Rotary: RPM/10V
Linear: mm/sec/10V

Default VLIM/0.8

Non-Volatile Yes

Write Access Read/Write

Limitations Controller Status : EN/DIS
Op. Modes : 1