SCL Manual for STP-DRV Drives

SCL Commands for the STP-DRV-4850 and STP-DRV-80100 Step Motor Drives

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Contents

Introduction

Thank you for purchasing an Automation Direct stepper drive. We hope you will find that performance, price, and ease of use make our products the best value for your application.

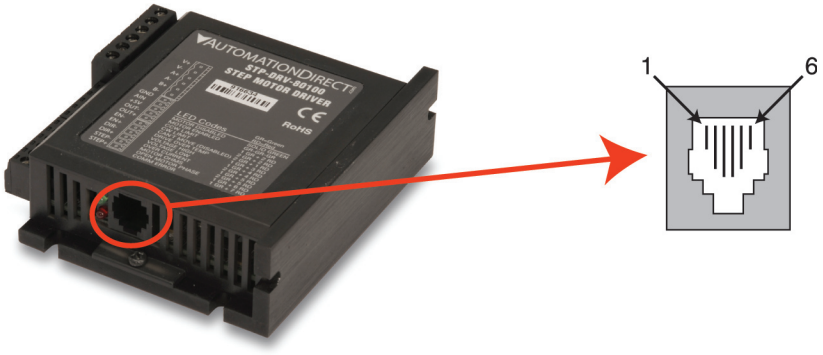
The Serial Command Language (SCL) can be used with Automation Direct STP-DRV-4850 and STP-DRV-80100 stepper drives and this manual focuses on using SCL with these drives only.

NOTE: This manual only covers details related to using SCL with the STP-DRV drives. For all other aspects of applying your STP-DRV drive, including hardware configuration, I/O, and software settings, view the Help file contained in the SureStep Pro software. This software can be downloaded for free from www.automationdirect.com.

What is SCL?

SCL was developed to give users a simple way to control a motor drive via a serial port. This eliminates the need for separate motion controllers or indexers to supply Pulse & Direction signals to your stepper drive. It also provides an easy way to interface to a variety of other industrial devices like PLCs and HMIs, which most often have standard or optional serial ports for communicating to other devices.

STP-DRV drives come with one RS-232 serial port. This port is an RJ-11 jack (6P4C) as shown in the picture below.



To use SCL in an application means you will have a host device, such as a PC, a PLC, or an HMI, connected to the drive's serial port and using that connection to send commands to the drive. The set of commands defined by SCL includes commands for motion of the step motor, commands for using the three digital inputs, one analog input, and one digital output of the drive, as well as commands for configuring different aspects of the drive like motor current and microstep resolution.

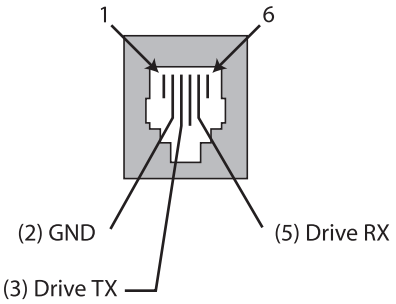
When in SCL mode, an STP-DRV drive receives commands from the host into a command buffer, and then executes the received commands directly out of that buffer. One thing you cannot do with an STP-DRV drive is create a stored program that the drive can run stand-alone.

SCL Details

There are two basic parts to the serial communications used in SCL: the physical connection between the drive and the host, and the communications protocol.

The physical connection between the drive and the host is based on standard RS-232 connections. With PCs this is one of the COM ports on your computer. With PLCs and HMIs look for connections labeled RS-232, PLC port, AUX port, ASCII, or something similar that would indicate a serial RS-232 connection. There are only three connections to be made between the drive and the host: transmit (Tx), receive (Rx), and signal ground (GND).

The pin assignments of these connections on an STP-DRV drive are shown in the following diagram.



To configure your host to properly communicate with the drive you'll need to configure your host's serial port as follows: 9600 bps, 8 data bits, 1 stop bit, no parity. Not coincidentally, these are the default COM port settings for a Windows-based PC.

The communications protocol of SCL is simple in that all communications are initiated by the host. The only communication the drive will ever initiate is at power-up of the drive. At power-up the drive sends what we call the "power-up packet", which is simply an identifier that is used by Automation Direct software applications. This identifier tells our software which drive is connected and what its firmware version is. Other than that, all communications are initiated by the host.

The basic structure of a command packet from the host to the drive is always a text string followed by a carriage return (no line feed required). The text string is always composed of the command itself, followed by any parameters used by the command. The carriage return denotes the end of transmission to the drive. Here is the basic syntax.

XXAB<cr>

In the syntax above, "XX" designates the SCL command, which is always composed of two capital letters. "A" designates the first of two possible parameters, and "B" designates the second. Parameters 1 and 2 vary in length, can be letters or numbers, and are often optional.

Once a drive receives the <cr> it will determine whether or not it understood the command. If it did understand the command the drive will either execute or buffer the command. If Ack/Nack is turned on (see PR command), the drive will also send an Acknowledge character (Ack) back to the host. The Ack for an executed command is % (percent sign), and for a buffered command is * (asterisk). If the drive did not understand the command it will do nothing. If Ack/Nack is turned on a Nack will be sent, which is signified by a ? (question mark). The Nack is usually accompanied by a numerical code that indicates a particular error. To see a list of these errors see the PR command.

Getting Started

To get up an running with your STP-DRV drive and SCL as quickly as possible, follow the basic steps below.

Step 1: Install software

Your STP-DRV stepper drive was shipped with a *Software, Manuals and More CD-ROM* containing all of the software applications available from Automation Direct. If you don't have a copy of this CD-ROM, you can also visit www.automationdirect.com to download software applications for free.

From the CD-ROM or from a download, install *SureStep Pro* on your Windows-based PC. *SureStep Pro* will be used to configure your drive and put it into SCL mode.

NOTE: Laptop computers without a serial port will require a USB-Serial adapter or PCMCIA-Serial adapter. Automation Direct offers a USB to serial adapter (part number USB-RS232) that is suitable for use in these applications.

Step 2: Configure your STP-DRV drive using *SureStep Pro*

If you haven't already done so, unpack your STP-DRV drive and step motor and collect them together near your PC. You're going to need the following items to begin developing your application.

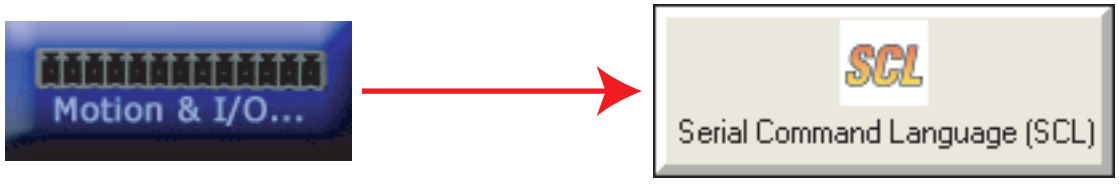
- An STP-DRV-4850 or STP-DRV-80100 stepper drive
- A 2-phase step motor. Automation Direct offers a number of step motors specifically chosen for use with the ST series drives. A drop-down list of these motors is contained in the Motor window of *SureStep Pro.* If you have a different step motor view the Help file in *SureStep Pro* for details on setting up a custom motor.
- The programming cable supplied with your STP-DRV drive (9-pin D-sub at one end, RJ-11 modular connector at the other).
- A small, flat-blade screwdriver.
- A correctly sized DC power supply.

IMPORTANT: Never connect a step motor to your STP-DRV drive with power applied to the drive. Always make sure your DC power supply is either off or disconnected from the STP-DRV drive when connecting or disconnecting your step motor.

Connect the 2-phase step motor to your STP-DRV drive. Then connect your STP-DRV drive to your PC using the programming cable. Launch *SureStep Pro*. Power your drive ON. If power was ON to the drive when you launched *SureStep Pro* power the drive OFF, then back ON.

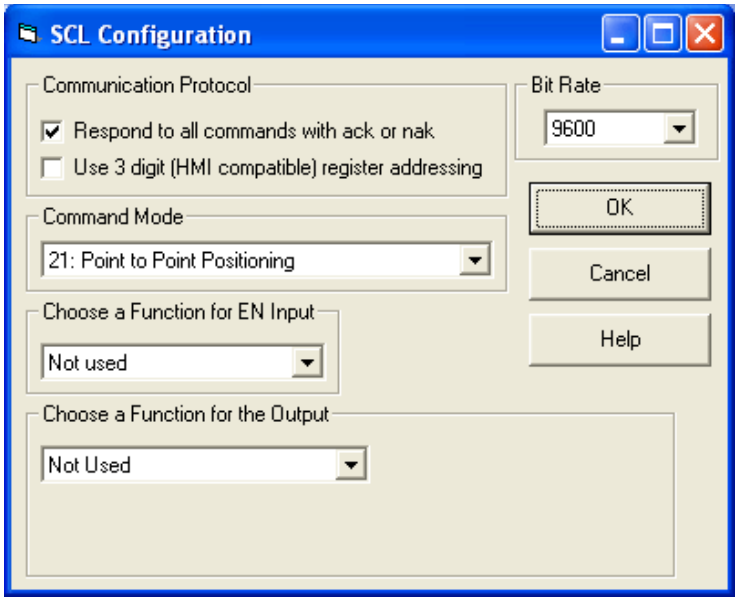
Configure your motor by clicking the "Motor" button on the main screen of *SureStep Pro*. Use the Help file contained in *SureStep Pro* for details on configuring your drive for the particular step motor you have. If you have a recommended Automation Direct step motor you may simply find that part number in the drop-down menu of the Motor window.

Each STP-DRV drive can run in one of four Motion Control Modes: Pulse & Direction, Analog Velocity, Fixed Velocity, or Point to Point (SCL). Click the "Motion & I/O" button in *SureStep Pro*, then select SCL. This will bring up the SCL Configuration window.



In the SCL Configuration window there are a number of settings you can make that affect how the drive operates while in SCL mode. View the graphic below to understand these settings.

Communication Protocol contains settings to turn on Ack/Nack and to turn on 3-digit numeric register addressing. Ack/Nack is a useful setting because the drive will respond to each command it receives with an Ack (% or * sign) or Nack (? sign). 3-digit numeric register addressing is a common setting for HMI hosts because many HMIs work with numerical register addresses rather than alphabetical register addresses.



Power Up Command Mode sets which mode the drive will power up in. There are a number of different modes the drive can operate in and still communicate with SCL commands. Most applications will at least start out in Command Mode 21: Point-to-point Positioning. See details on the Command Mode (CM) command for more information.

Choose a Function for EN Input allows you to define how the digital EN input will be used in your application. The options available here are to use EN as a drive enable input, an alarm reset input, or a general purpose input ("not used").

Choose a Function for the Output allows you to define how the drive's single digital Output will be used. The options available here are fault output, brake output, motion output, tach output, or general purpose output ("not used").

Once you've set up the motor in *SureStep Pro* and have chosen SCL mode for the drive, click the Download to Drive button on the main screen.

Step 3: Get familiar with SCL commands

After downloading, click the Drive menu, then SCL Terminal... This opens the Host Terminal window. To send commands to your drive simply type a command in the Command Line of the Host Terminal and press the ENTER key to send it. (Remember that all commands are capital letters so pressing the Caps Lock key first is a good tip). Pressing the ENTER key while in the Host Terminal does two things: it terminates the command with a <cr> and automatically sends the entire string. Try the example sequence below. In this example, note that <ENTER> means press the ENTER key on your keyboard, which is the same as terminating the command with a <cr>.

IMPORTANT: We recommend practicing with SCL commands with no load attached to the motor shaft. You want the motor shaft to spin freely during startup to avoid damaging mechanical components in your system.

AC25<ENTER>	Set accel rate to 25 rev/sec/sec.
DE25<ENTER>	Set decel rate to 25 rev/sec/sec
VE5<ENTER>	Set velocity to 5 rev/sec/sec
FL20000<ENTER>	Move the motor 20000 steps in the CW direction.

If your motor didn't move after sending the FL20000 check the LEDs on your drive to see if there is an error present. If so send the AR command (AR<ENTER>) to clear the alarm. If after clearing the alarm you see a solid green LED it means the drive is disabled. Enable the drive by sending the ME command (ME<ENTER>) and verify that the you see a steady, flashing green LED. You might also want to review your settings in *SureStep Pro* to make sure the motor current is set properly. Then try the above sequence again.

Here is another sample sequence you can try.

JA10<ENTER>	Set jog accel rate to 10 rev/sec/sec
JL10<ENTER>	Set jog decel rate to 10 rev/sec/sec
JS1<ENTER>	Set jog speed to 1 rev/sec
CJ<ENTER>	Commence jogging
CS-1<ENTER>	Change jog speed to 1 rev/sec in CCW direction
SJ<ENTER>	Stop jogging

In the above sequence notice that the motor ramps to the new speed set by CS. This ramp is affected by the JA and JL commands. Try the same sequence above with different JA, JL, JS, and CS values to see how the motion of the motor shaft is affected.

Step 4: Develop your application

This step will involve different things for different users. You'll probably want to spend sufficient time getting familiar with SCL commands using the Host Terminal window before getting to this step, but once you have consider the following.

If your host is a PC you've already done a lot of the hardware configuration necessary for your application. The rest of your application will involve developing your PC applications to properly send SCL commands to your drive. Which application or language you use, whether it be VisualBasic, C+, LabView, a proprietary vision system application, or something else, is up to you.

If your host is a PLC you'll have to connect and configure the ASCII module, RS-232 port or Aux serial port on your PLC according to the pin assignments and COM port settings listed in the Introduction section. From there you'll have to be able to send text strings followed by carriage returns from the PLC.

If your host is an HMI you'll have to connect and configure the serial port of the HMI in the same way as with a PLC, as well as be able to send commands in the proper syntax to the drive.

Commands

There are two basic types of SCL commands: buffered and immediate. Buffered commands are loaded into and executed out of your drive's command buffer. Immediate commands are not buffered: when received by the drive they are executed immediately.

Buffered Commands

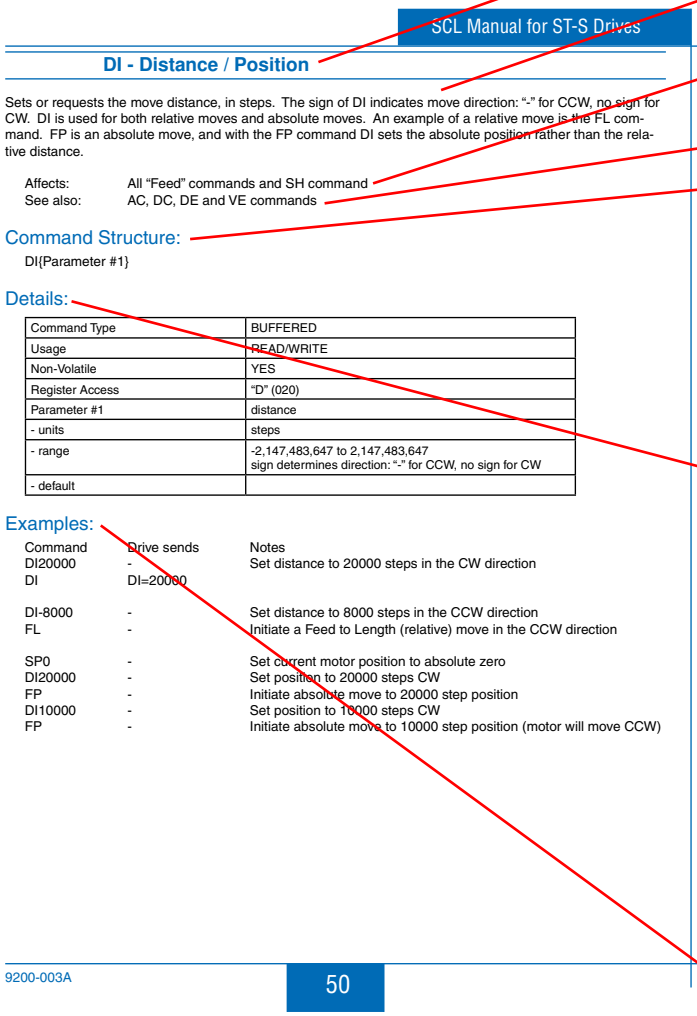
After being loaded into the command buffer, buffered commands are executed one at a time. If you send two buffered commands to the drive in succession, like a Feed to Length (FL) command followed by a Send String (SS) command, the SS command sits in the command buffer and waits to execute until the FL command is completed. The command buffer can be filled up with commands for sequential execution without the host controller needing to wait for a specific command to execute before sending the next command. Special buffer commands, like Pause (PS) and Continue (CT), enable the buffer to be loaded and to pause execution until the desired time.

Immediate Commands

Immediate commands are executed right away, running in parallel with a buffered command if necessary. For example, this allows you to check the remaining space in the buffer using the Buffer Status (BS) command, or the immediate status of digital inputs using the Input Status (IS) command, while the drive is processing other commands. Immediate commands are designed to access the drive at any time and can be sent as often as needed. This allows a host controller to get information from the drive at a high rate, most often for checking drive status or motor position.

Command Listing

This section is an alphabetical listing of all the commands available with your drive. Each page in this section contains the details of one available command. Below is a sample of what these pages look like, with an explanation of the information you will find on each page.



SCL Manual for ST-S Drives

DI - Distance / Position

Sets or requests the move distance, in steps. The sign of DI indicates move direction: "-" for CCW, no sign for CW. DI is used for both relative moves and absolute moves. An example of a relative move is the FL command. FP is an absolute move, and with the FP command DI sets the absolute position rather than the relative distance.

Affects: All "Feed" commands and SH command
See also: AC, DC, DE and VE commands

Command Structure:

DI{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"D" (020)
Parameter #1	distance
- units	steps
- range	-2,147,483,647 to 2,147,483,647 sign determines direction: "-" for CCW, no sign for CW
- default	

Examples:

Command	Drive sends	Notes
DI20000	-	Set distance to 20000 steps in the CW direction
DI	DI=20000	
DI-8000	-	Set distance to 8000 steps in the CCW direction
FL	-	Initiate a Feed to Length (relative) move in the CCW direction
SP0	-	Set current motor position to absolute zero
DI20000	-	Set position to 20000 steps CW
FP	-	Initiate absolute move to 20000 step position
DI10000	-	Set position to 10000 steps CW
FP	-	Initiate absolute move to 10000 step position (motor will move CCW)

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50

Title - shows the command's two-letter command code followed by the command's name.

Description - an explanation of what the command does and how it works.

Affects - a summary of parameters or other commands the command affects.

See Also - related commands

Command Structure - shows the command's syntax. The format for this line is always the two-letter command code, followed by the number of parameters it uses. Not all commands have parameters, some commands have optional parameters, and other commands always have a parameter. Optional parameters are designated by { }, and required parameters are designated by ( ).

Details - shows the "Command Type" (buffered or immediate), the command's "Usage" (Read Only, Read/Write, or Write Only), and whether the command is "Non-Volatile" or not. Non-Volatile commands are saved when the Save (SA) command is sent. If the command transfers data to a register that is accessible via the RL command, that register will be shown in "Register Access". Also, the details of the command's parameter(s) are shown. Parameter #1 or #2 gives a brief description of the parameter, "- units" shows how the parameter is interpreted by the drive, "- range" gives the acceptable range of values for the parameter, and "- default" shows the default value of the parameter.

Examples - shows what to expect when you use this command. Under "Command" are the command strings you would send from a host controller. Note that <cr> is not shown after each command string in these examples but is still necessary to terminate the string. Under "Drive Sends" are the responses from the drive: no response from the drive is denoted by "-", although if Ack/Nack is turned on there will always be a response to every command sent. "Comments" gives additional information about the results of the command string.

AC - Acceleration Rate

Sets or requests the acceleration rate used in all “F” (point-to-point) moves in rev/sec/sec.

Affects: FC, FL, FM, FP, FS, FY, SH Commands
See also: DE, DI, DC, VE Commands

Command Structure:

AC{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Acceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)

Examples:

Command	Drive sends	Notes
AC100	-	Set Acceleration rate to 100 rev/sec/sec
AC	AC=100	
AC25	-	Set Acceleration rate to 25 rev/sec/sec
DE25	-	Set Acceleration rate to 25 rev/sec/sec
VE1.5	-	Set Velocity to 1.5 rev/sec
FL20000	-	Execute Feed to Length move of 20000 steps in CW direction

AD - Analog Deadband

Sets or requests the analog deadband value in millivolts. The deadband value is the zone around the “zeroed” value of the analog input. This deadband defines the area of the analog input range that the drive should interpret as the zero velocity point in analog velocity mode (CM14). The deadband is an absolute value that in usage is applied to either side of the zero point.

Affects: Analog input
See also: CM command

Command Structure:

AD{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Parameter #1	Analog deadband value
- units	millivolts
- range	0 - 255

Examples:

Command	Drive sends	Notes
AD100	-	Set analog deadband to 0.1 volts
AD	AD=100	

AF - Analog Filter

Applies a digital filter to the analog input. This is a simple single pole filter that rolls off the analog input. The filter value of the AF command is related to the desired value of the analog filter in Hz by the following equation:

Filter value = 72090 / [(1400 / x) + 2.2]
where x = desired value of the analog filter in Hz

Affects: Analog input
See also: IA, CM commands

Command Structure

AF{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Parameter #1	Filter value
- units	integer (see formula above)
- range	0 - 32767* (0 disables the filter)

* An AF value of 28271 equates to 4000.425 Hz. Setting the AF command to anything higher than 28271 has a negligible effect on the analog filter. In other words, the maximum value of the filter is approximately 4000 Hz.

Examples:

Command	Drive sends	Notes
AF5000	-	Make the analog input bandwidth 114.585 Hz
AF	AF=5000	

AG - Analog Velocity Gain

Sets or requests the gain value used in analog velocity mode (CM14). The gain value is used to establish the relationship between the analog input and the motor speed. The units are 0.25 rpm. For example, if the gain is set to 2400, when 5 Volts is read at the analog input the motor will spin at 10 rps. TIP: To set the analog velocity gain to the desired value, multiply the desired motor speed in rps by 240, or the desired motor speed in rpm by 4.

Affects: Analog velocity mode
See also: CM command

Command Structure:

AG{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Parameter #1	Analog velocity gain value
- units	0.25 rpm
- range	-32767 to 32767

Examples:

Command	Drive sends	Notes
AG3000	-	Set top speed of analog velocity mode to 12.5 rps
AG	AG=3000	

AL - Alarm Code

Reads back an equivalent hexadecimal value of the Alarm Code's 16-bit binary word. This command is useful for viewing over the serial port any alarms present at the drive.

See also: AR command, Appendix B

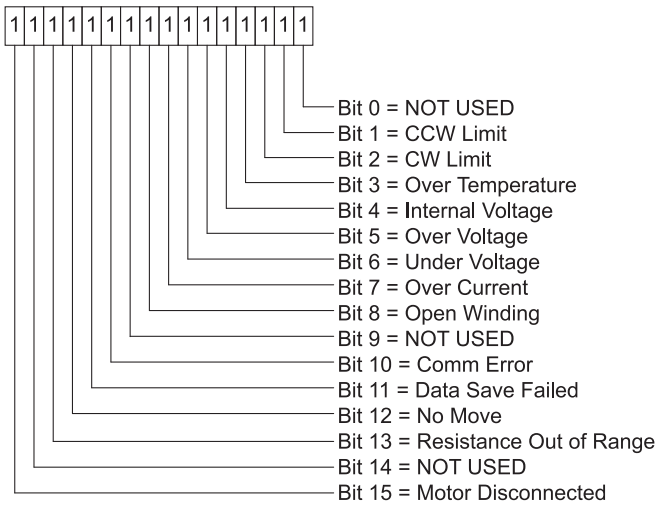
Command Structure:

AL

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Units	Hexadecimal value of 16-bit binary word (see below)

Alarm Description	Bit #	Hex Value
NOT USED	0	0001
CCW Limit	1	0002
CW Limit	2	0004
Over Temperature	3	0008
Internal Voltage	4	0010
Over Voltage	5	0020
Under Voltage	6	0040
Over Current	7	0080
Open Winding	8	0100
NOT USED	9	0200
Comm Error	10	0400
Data Save Failed	11	0800
No Move	12	1000
Resistance Out of Range	13	2000
NOT USED	14	4000
Motor Disconnected	15	8000



Examples:

Command	Drive sends	Notes
AL	AL=0000	No alarms (0000000000000000)
AL	AL=0002	CCW end-of-travel limit alarm (0000000000000001)
AL	AL=2001	CCW end-of-travel limit and current limit (0010000000000001)

AR - Alarm Reset

Resets the alarm and clears the fault (if faulted). If fault or alarm condition still persists the alarm is not cleared.

Affects: Alarm Code
See also: AL, ME, and MD commands

NOTE: Does not re-enable the drive. Use Motor Enable (ME) command to re-enable drive.

Command Structure:

AR

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
AR	-	Alarm code is cleared (if possible)

AT - Analog Threshold

Sets or requests the analog input threshold at the AIN input that is used by the Feed to Sensor (FS) command. The threshold value sets the analog voltage that determines a sensor state or a trigger value.

Affects: All “Feed to Sensor” type commands
See also: FM, FS, and FY commands

Command Structure:

AT{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Analog threshold value
- units	volts
- range	-5.000 to 5.000

Examples:

Command	Drive sends	Notes
AT5	-	Analog input threshold set to 5 volts
AT	AT=5	

AV - Analog Offset Value

Sets or requests the analog offset value of the analog input. The analog offset value can be set manually using the AV command, or automatically using the AZ command, which automatically sets the offset value to the current analog input value.

Affects: Analog input
See also: AZ, CM commands

Command Structure:

AV{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Parameter #1	Analog offset value
- units	volts
- range	-5.000 to 5.000

Examples:

Command	Drive sends	Notes
AV0.25	-	Set analog offset to 0.25 Volts
AV	AV=0.25	

AZ - Analog Zero

Activates the analog input auto offset algorithm. This algorithm can also be accessed in *SureStep Pro*, in the Advanced Settings button of the Velocity Control Mode dialog. It is useful in defining the current voltage present at the analog input as the zero point, or offset. AZ directly affects the AV command, which can be used to manually adjust the analog input offset value.

Affects: Analog input
See also: AV command

Command Structure:

AZ

Details:

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

Examples:

Command	Drive sends	Notes
AZ	-	Start analog auto offset algorithm

Example: Apply 1 VDC across the AIN (+) and GND (-) terminals of the drive. Then send the AZ command to the drive. Next apply 4 VDC across the AIN and GND terminals. Send the IA command and the response should be very close to IA=3.00.

BS - Buffer Status

Requests from the drive the number of available command locations in the command buffer. This technique simplifies sending commands by eliminating the need to calculate if there is enough space in the buffer for additional commands. If the drive responds with at least a “1”, a command can be sent.

If a drive responds to the BS command with “63”, the buffer is empty. If a “0” is returned the buffer is full and no more buffered commands can be accepted.

Command Structure:

BS

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Units	Empty command spaces in buffer

Examples:

Command	Drive sends	Notes
BS	BS=20	There is room in the buffer for 20 more commands

CE - Communication Error

Reads back the communication error code. This can be read back when the status code indicates a communication error is present. The value sent from the drive is the hexadecimal equivalent of the binary code. Bit assignments are shown in the Details table below.

Command Structure:

CE

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Communication error code
- units	hex code
- range	bit 0 = parity error (not used) bit 1 = framing error bit 2 = noise error bit 3 = overrun error bit 4 = Rx buffer full bit 5 = Tx buffer full bit 6 = bad SPI op-code

Examples:

Command	Drive sends	Notes
CE	CE=10	Rx buffer full

CJ - Commence Jogging

Starts the motor jogging. The motor accelerates up to the jog speed (JS) at a rate defined by the jog accel (JA) command, then runs continuously until stopped. To stop jogging, use the Stop Jogging (SJ) command for a controlled decel rate (decel rate set by JL command). For a faster stop, use the ST command (decel rate set by AM command), but beware that if the speed or load inertia is high, the drive may miss steps or fault. The jogging direction is set by the last DI command. Use the CS command to change jog speed and direction while jogging. CS does not affect JS.

See also: CS, DI, JA, JL, JS, SJ, and ST commands.

Command Structure:

CJ

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
JS5	-	Set jog speed to 5 rps
CJ	-	Initiate jogging at 5 rps
CS10	-	Change jog speed to 10 rps
SJ	-	Stop jogging

CM - Command Mode

Sets or requests the Command Mode that the drive operates in. For more automated setup of command modes use *SureStep Pro* software. The most common command mode is Point-to-Point (21), in which all move commands can be executed. Move commands (like FL, FP, FS, and CJ) can still be executed when the command mode is set to Step & Direction (7), because the drive will temporarily switch to command mode 21 to execute the move, then revert back to command mode 7. However move commands are either ignored or do not function properly when the command mode is set to a velocity mode (14 or 18).

WARNING: Changing the Command Mode without proper care may cause the motor to spin at a high rate of speed or give other unexpected results.

Command Structure:

CM{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Control mode
- units	integer code
- range	7 - Step & Direction 14 - Analog velocity (oscillator) mode with STEP input as run/stop input 18 - Fixed velocity (oscillator) mode with STEP input as run/stop input, EN input as speed change input, and JS for base speed setting 21 - Point-to-Point

Examples:

Command	Drive sends	Notes
CM7	-	Sets the drive to Pulse & Direction mode
CM	CM=7	

CS - Change Speed

Sets or requests the jog speed in rev/sec while jogging. When Jogging using the CJ command the jog speed can be changed dynamically by using this command. The value of CS can be positive or negative allowing the direction of jogging to be changed also. Ramping between speeds while jogging is controlled by the JA and JL commands. Changing CS does not change either JS or DI.

Affects: Jog speed while jogging
See also: CJ and JS commands

Command Structure:

CS{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	NO
Parameter #1	Jog Speed
- units	rev/sec
- range	-133.3333 to 133.3333 sign determines direction: "-" for CCW, no sign for CW

Examples:

Command	Drive sends	Notes
CS2.5	-	Set jog speed to CW at 2.5 rev/sec
CS	CS=2.5	Displays current Jog speed
CS-5	-	Set jog speed to CCW at 5 rev/sec

CT - Continue

Resume execution of buffered commands after a PS command has been sent. The Pause (PS) command allows you to pause execution of commands in the command buffer. After sending the PS command, subsequent commands are buffered in the command buffer until either a CT command is sent, at which time the buffered commands will execute in the order they were received, or until the command buffer is full.

See also: PS, SK, and ST commands

Command Structure:

CT

Details:

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

Examples:

Command	Drive sends	Notes
CT	-	Resumes execution of a paused command buffer

DC - Change Distance

Sets or requests the “change distance” or offset distance in steps. The change distance is used by various move commands to define more than one distance parameter. All move commands use the DI command at some level, and many require DC as well. Examples are FC, FM, FO, and FY. The moves executed by these commands change their behavior after the change distance (DC) has been traveled. For example, FM is similar to FS, but in an FM move the sensor input is ignored until the motor has moved the number of steps set by DC. This is useful for masking unwanted switch or sensor triggers. Since DI sets move direction (CW or CCW), the sign of DC is ignored.

Affects: FC, FM, FO, and FY commands
See also: VC command

Command Structure:

DC{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Register Access	“C” (019)
Parameter #1	distance
- units	steps
- range	0 to 2,147,483,647
- default	0

Examples:

Command	Drive sends	Notes
DC80000	-	Set change distance to 80000 counts
DC	DC=80000	
DI-100000	-	Set overall distance to 100000 counts in CCW direction
DC50000	-	Set change distance to 50000 counts
VE5	-	Set velocity to 5 rev/sec
VC2	-	Set change velocity to 2 rev/sec
FC	-	Initiate FC command

DE - Deceleration Rate

Sets or requests the deceleration rate used in all “F” (point-to-point) moves in rev/sec/sec.

Affects: FC, FL, FM, FP, FS, FY, SH commands
See also: AC, DE, DI, VE commands

Command Structure:

DE{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Deceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)

Examples:

Command	Drive sends	Notes
DE125	-	Set deceleration rate to 125 rev/sec/sec
DE	DE=125	
AC25	-	Set Acceleration rate to 25 rev/sec/sec
DE10	-	Set Acceleration rate to 10 rev/sec/sec
VE5	-	Set Velocity to 5 rev/sec
FL200000	-	Execute Feed to Length move of 200000 steps in CW direction

DI - Distance / Position

Sets or requests the move distance, in steps. The sign of DI indicates move direction: "-" for CCW, no sign for CW. DI is used for both relative moves and absolute moves. An example of a relative move is the FL command. FP is an absolute move, and with the FP command DI sets the absolute position rather than the relative distance.

Affects: All move commands
See also: AC, DC, DE and VE commands

Command Structure:

DI{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	distance
- units	steps
- range	-2,147,483,647 to 2,147,483,647 sign determines direction: "-" for CCW, no sign for CW

Examples:

Command	Drive sends	Notes
DI20000	-	Set distance to 20000 steps in the CW direction
DI	DI=20000	
DI-8000	-	Set distance to 8000 steps in the CCW direction
FL	-	Initiate a Feed to Length (relative) move in the CCW direction
SP0	-	Set current motor position to absolute zero
DI20000	-	Set position to 20000 steps CW
FP	-	Initiate absolute move to 20000 step position
DI10000	-	Set position to 10000 steps CW
FP	-	Initiate absolute move to 10000 step position (motor will move CCW)

DL - Define Limits

Defines the STEP and DIR inputs as CW end-of-travel and CCW end-of-travel limit inputs, respectively. Both inputs are assigned together as end-of-travel limits, and for the same connection type (see definition of states below). If one of these inputs is activated while defined as an end-of-travel limit, motor rotation will stop in that direction, and an alarm code will show at the drive's status LEDs. The alarm code will be 2 Green + 2 Red for a CW end-of-travel, and 1 Green + 2 Red for a CCW end-of-travel.

The STEP and DIR inputs can each be assigned to only one function in an application. If you want to use the STEP and DIR inputs as end-of-travel limit inputs you can define them as such in two ways, with the *SureStep Pro* software, or with the DL command. DL takes no effect if the drive is set in Command Mode (CM) 7, 14, or 18, because these modes predefine these inputs and take precedence over the DL command. Also, setting the JE command after setting the DL command reassigns the STEP and DIR inputs as jog inputs and turns off any limit input usage (DL3). In other words, the DL and JE commands, as well as Command Modes (CM) 7, 14, and 18 each assign a usage to the STEP and DIR inputs. Each of these must exclusively use the STEP and DIR inputs. Command Modes are most dominant and will continually prevent DL and JE from using the inputs. DL and JE exclude each other by overwriting the usage of the STEP and DIR inputs.

There are three end-of-travel limit input states that can be defined with the DL command:

DL1: End-of-travel limit occurs when an input is closed (energized). Motor automatically decelerates using the AM command.
DL1: End-of-travel limit occurs when an input is open (de-energized). Motor automatically decelerates using the AM command.
DL3: The STEP and DIR inputs are not used as end-of-travel limit inputs and can be used as a general purpose inputs. DL will be automatically set to 3 if CM is set to 7, 14, or 18, or if JE is executed after the DL command is set.

Affects: All "F" commands, CJ, SH, WI (when jogging) commands
See also: AM command

Command Structure:

DL{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Limit input state (see above)
- units	integer number
- range	1, 2 or 3
- default	3

Examples:

Command	Drive sends	Notes
DL1	-	Set limit inputs to act as normally open
DL	DL=1	
DL3	-	Set limit inputs to act as general purpose inputs

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

EG - Electronic Gearing

Sets or requests the desired step resolution of the step motor. Units of the EG command, steps/rev, are based on 2-phase, 1.8 degree step motors, which provide 200 full steps per revolution.

Note: Step resolution is always set in SureStep Pro during startup and configuration of the drive. If no further adjustment to the step resolution is required the EG command is not needed.

Affects: Command Mode 7
See also: CM command

Command Structure:

EG{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Step resolution
- units	steps/rev
- range	200 - 51200 (in increments of 2)

Examples:

Command	Drive sends	Notes
EG20000	-	Set step resolution to 20000 steps/rev
EG	EG=20000	

FC - Feed to Length with Speed Change

Executes a Feed to Length (relative move) with a speed change. Overall move distance and direction come from the last DI command. Accel and decel are from AC and DE commands. Initial speed is VE. After the motor has moved DC counts, the speed is reduced to VC.

NOTE: If DC is greater than DI minus the distance required to decelerate the motor (affected by DE and VE), no speed change will result.

See also: DC and VC commands

Command Structure:

FC

Details:

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

Examples:

Command	Drive sends	Notes
DI50000	-	Set overall distance to 50000 steps
VE5	-	Set initial velocity to 5 rev/sec
DC40000	-	Set change distance to 40000 steps
VC0.5	-	Set change velocity to 0.5 rev/sec
FC	-	Initiate move

FL - Feed to Length

Executes a Feed to Length (relative move) command. Move distance and direction come from the last DI command. Speed, accel and decel are from VE, AC and DE commands respectively. Optional parameter allows using a local distance for the FL command rather than the last DI value.

NOTE: The last DI command can be ignored/unaltered if a parameter is used with the FL command.

See also: AC, DE, DI, VE commands

Command Structure:

FL{Parameter #1}

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1*	Relative distance
- units	steps
- range	-2,147,483,647 to 2,147,483,647 sign determines direction: "-" for CCW, no sign for CW

Examples:

Command	Drive sends	Notes
AC100	-	Set accel rate to 100 rev/sec/sec
DE150	-	Set decel rate to 150 rev/sec/sec
VE8	-	Set velocity to 8 rev/sec
DI20000	-	Set distance to 20000 steps in the CW direction
FL	-	Initiate Feed to Length move
FL10000	-	Initiate Feed to Length move of 10000 steps in the CW direction without affecting the last DI command
FL-400	-	Initiate Feed to Length move of 400 steps in the CCW direction without affecting the last DI command

FM - Feed to Sensor with Mask Distance

Executes a Feed to Sensor command, but sensor is ignored for the first DC counts of the move. Useful for masking a switch or clearing a part before sensing the correct stop input. DI sets the distance to move after the stop input is triggered. AC sets accel rate, VE sets velocity, and DE sets decel rate.

See also: DC and FS commands; see AT command for using AIN as sensor input

Command Structure:

FM(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Input, Input condition
- units	integer, letter
- range	integer: 1 = STEP, 2 = DIR, 3 = EN, 4 = AIN letter: L = low, H = high, F = falling edge, R = rising edge

Examples:

Example: Parts are feeding on a conveyor which is being driven by the step motor. A sensor detects the leading edge of the part and stops. If the part has a hole in it, which is common, when you attempt to feed the next part into position you may in fact stop after feeding the previous part only a short distance because the sensor will register the hole in the part rather than the leading edge of the next part. The solution is to use the FM command instead of the FS command, and to set the DC command for the size of the part (or greater).

Example continued: The parts on the conveyor are 6 inches long. Your mechanical linkage provides 2000 steps per inch. You want the leading edge of the part to stop moving 1 inch past the sensor, and therefore 5 inches of the part will not have gone past the sensor yet. To avoid holes in the part and see the next part properly, we need to mask 5 inches or more of the move. Here are the commands you could use.

Command	Drive sends	Notes
DI2000	-	Set distance to stop past sensor at 1 inch (2000 steps)
DC10200	-	Set distance over which to ignore (mask) the sensor at 5.1 inches, enough to allow the previous part to completely clear the sensor
FM1F	-	Initiate FM move. Sensor is connected to input 1 and will close when it sees a part

NOTE: When working with inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

NOTE: When working with the analog input of an STP-DRV drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designtates an analog value greater than the value set by the AT command.

FO - Feed to Length and Set Output

Same as Feed to Length (FL) but changes the state of an output during the move. Overall move distance is defined by the DI command. Accel rate, decel rate, and velocity are set by the AC, DE and VE commands, respectively. Distance within overall move at which output condition should be set is defined by the DC command.

NOTE: Dedicated output functions - alarm output, brake output, motion output - must be configured as general purpose before the FO command can be used with the drive's output.

See Also: DC command

Command Structure:

FO(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Output, Output condition
- units	integer, letter
- range	integer: 1 letter: L = low (closed), H = high (open)

Examples:

Example: You're feeding parts to be cut to length. For maximum throughput, you want to trigger the cut-off knife as the part is nearing the final position.

Command	Drive sends	Notes
AC100	-	Set accel rate to 100 rev/sec/sec
DE100	-	Set decel rate to 100 rev/sec/sec
VE2.5	-	Set velocity to 2.5 rev/sec
DI20000	-	Overall move distance set to 20000 steps
DC15000	-	Set output distance set to 15000 steps
FO1L	-	Initiate move and set output low at 15000 steps

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

FP - Feed to Position

Executes a Feed to Position (absolute) move. Move position comes from the last DI command. Speed, accel and decel are from VE, AC and DE commands, respectively. Optional parameter allows using a local absolute position for the FP command rather than the last DI value.

NOTE: The last DI command can be ignored/unaltered if a parameter is used with the FP command.

See also: AC, DE, DI, VE commands

Command Structure:

FP{Parameter #1}

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1*	Absolute position
- units	steps
- range	-2,147,483,647 to 2,147,483,647

Examples:

Example: After homing the motor you want to zero the home position and move to an absolute position 80000 steps from the new home position.

Command	Drive sends	Notes
SP0	-	Set current motor position as absolute zero
VE5	-	Set velocity to 5 rev/sec
DI80000	-	Set move position to 80000 steps
FP	-	Initiate Feed to Position move
FP40000	-	Initiate Feed to Position move to 40000 steps without affecting the the last DI command

FS - Feed to Sensor

Executes a Feed to Sensor command. Requires input number and condition. The motor moves until a sensor triggers the stop input, then stops a precise distance beyond the sensor. The stop distance is defined by the DI command. The direction of rotation is defined by the sign of the DI command ("-" for CCW, no sign for CW). Speed, accel and decel are from the last VE, AC and DE commands, respectively.

A motor moving at a given speed, with a given decel rate, needs a certain distance to stop. If you specify too short a distance, the drive may overshoot the target. Use the following formula to compute the minimum decel distance, given a velocity V (in rev/sec) and decel rate D (in rev/sec/sec.). R = steps/rev, which in this equation equals the value set by the EG command in steps/rev.

$$\text{minimum decel distance} = \frac{(V)^2(R)}{2(D)}$$

See also: FM and FY commands; see AT command for using AIN as sensor input

Command structure:

FS(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Input number, Input condition
- units	integer, letter
- range	integer: 1 = STEP, 2 = DIR, 3 = EN, 4 = AIN condition: L (low), H (high), F (falling edge), R (rising edge)

Examples:

Command	Drive sends	Notes
AC100	-	Set accel rate to 100 rev/sec/sec
DE100	-	Set decel rate to 100 rev/sec/sec
DI1000	-	Set stop distance to 1000 steps
VE0.5	-	Set velocity to 0.5 rev/sec
FS1L	-	Initiate move and decel to stop when sensor tied to input 1 is low

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

NOTE: When working with the analog input of an STP-DRV drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designtates an analog value greater than the value set by the AT command.

FY - Feed to Sensor with Safety Distance

Executes a Feed to Sensor move while monitoring a predefined safety distance DC. If sensor is not found before DC is reached the motor is stopped and the drive sends the host an exclamation point ("!") and adds a value of 1 to the Other Flags register ("F"). DI defines the direction of rotation and the stop distance to move after the sensor triggers the stop input. Accel rate, decel rate, and velocity are set by the AC, DE, and VE commands, respectively. Note that the final motor position if the sensor is not found will be the safety distance plus the distance requied to decelerate the load, which is dependent on the decel rate DE. This command is useful for avoiding machine jams or detecting the end of a roll of labels. For example, you are feeding labels and you want to stop each label 2000 steps after the sensor detects the leading edge. The labels are 60,000 steps apart. Therefore, if you move the roll more than 60,000 steps without detecting a new label, you must be at the end of the roll.

See also: DC, DE, FM and FS commands; see AT command for using AIN as sensor input

Command Structure:

FY(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Input number, Input condition
- units	integer, letter
- range	integer: 1 = STEP, 2 = DIR, 3 = EN condition: L (low), H (high), F (falling edge), R (rising edge)

Examples:

Command	Drive sends	Notes
AC50	-	Set accel rate to 50 rev/sec
DE50	-	Set decel rate to 50 rev/sec
VE2.5	-	Set velocity to 2.5 rev/sec
DI2000	-	Set distance to stop beyond sensor to 2000 steps, and set move direction to CW
DC60000	-	Set safety distance to 60000 steps
FY2L	-	Launch Feed to Sensor: motor will stop when input 2 is low or when 60000 steps are reached: whichever event comes first

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations ***low*** *and* ***high****. If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* ***low*** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* ***high*** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

NOTE: When working with the analog input of an STP-DRV drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designtates an analog value greater than the value set by the AT command.

IA - Immediate Analog

Requests present analog input value. The IA command returns the “analog command” value which is derived from the analog input with gain and offset applied in *SureStep Pro*.

Command Structure:

IA{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Parameter #1	Analog input
- units	integer
- range	No parameter or 0 = Analog command 1 = Analog input (raw AD counts)

Examples:

Command	Drive sends	Notes
IA	IA=2.5	Analog command value is at mid range
IA1	IA=4.99	Analog input is near 5 volts

Example: Send the command AV1 to the drive to set the Analog Offset Value to 1 VDC. Then apply 4 VDC across the AIN (+) and GND (-) terminals of the drive. The response to the IA command will then be very close to IA=3.00.

ID - Immediate Distance

Requests present relative distance from the beginning of the last move.

Command Structure:

ID

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	“d” (052)
Units	steps

Examples:

Command	Drive sends	Notes
With IF=H...		
ID	ID=00002710	10000 (10000 counts into CW move)
ID	ID=FFFFD8F0	-10000 (10000 counts into CCW move)
With IF=D...		
ID	ID=10000	10000 counts into CW move
ID	ID=-10000	10000 counts into CCW move

IF - Immediate Format

Sets the data format, hexadecimal or decimal, for data returned using all “I” commands (except IH, IL, IO and IS).

Data can be requested from the drive in two formats: hexadecimal or decimal. By default data is returned in hexadecimal because of its speed and efficiency. Conversion to ascii in the decimal format is slower and causes a slight delay that varies in length. Hexadecimal minimizes the overhead required to convert the internal binary data to ascii form. This speeds up the process of sending out the requested data thus giving the most recent value. Typically, applications written on more powerful host computers can easily convert a hexadecimal value into a decimal value.

All “I” commands can be used at any time and at the fastest rate possible limited only by the given baud rate (see BR and PB commands). Immediate commands are executed as they are received, regardless of what is in the drive’s command buffer. Regardless of format (hex or dec) there will be a slight delay in processing the response to an “I” command. “Real time” usage of the data must be carefully analyzed.

Affects: IA, ID, and IP commands

Command Structure:

IF{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	NO
Parameter #1	Return format
- units	letter
- range	H (hexadecimal) or D (decimal)

Examples:

Command	Drive sends	Notes
IFH	-	Sets format to Hexadecimal
ID	ID=00002710	Distance is 10000 counts
IF	IF=H	
IFD	-	Sets format to Decimal
ID	ID=10000	Distance is 10000 counts
IF	IF=D	

IH - Immediate High Output

Sets the output high (open) immediately. Use SO if you don't want the output to change until a buffered command (like a move) is complete.

See also: IL, SO commands

Command Structure:

IH(Parameter #1)

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Output number
- units	integer
- range	1

Examples:

Command	Drive sends	Notes
IH1	-	Output set high immediately, regardless of what commands are in the command buffer

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

IL - Immediate Low Output

Sets the output high (open) immediately. Use SO if you don't want the output to change until a buffered command (like a move) is complete.

See also: IH, SO commands

Command Structure:

IL(Parameter #1)

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Output number
- units	integer
- range	1

Examples:

Command	Drive sends	Notes
IL1	-	Output set low immediately

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

IO - Output Status

With no parameter this command requests the immediate status of the designated outputs. The status is displayed as an 8-bit binary number with input 1 in the far right position (bit 0). With a parameter this command sets the outputs high or low using the decimal equivalent of the same binary pattern. Logic zero ("0") turns an output on by closing it.

NOTE: Since the STP-DRV drives only have one digital output this command will only return values of 0 or 1.

See also: IS command

Command Structure:

IO{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	NO
Parameter #1	Decimal equivalent of binary output pattern
- units	integer
- range	0, 1

Examples:

Command	Drive sends	Notes
IO	IO=00000000	Output is low (closed)
IO	IO=00000001	Output is high (open)
IO0	-	Set output low (closed)
IO1	-	Set output high (open)

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

IP - Immediate Position

Requests present absolute position. The position data is assigned a 32-bit value. When sent out in Hexadecimal it will be 8 characters long. When sent out in decimal it will range from 2147483647 to -2147483648.

Command Structure:

IP

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Units	steps

Examples:

Command	Drive sends	Notes
With IF=H...		
IP	IP=00002710	Absolute position is 10,000 steps
IP	IP=FFFFD8F0	Absolute position is -10,000 steps
With IF=D...		
IP	IP=10000	Absolute position is 10000 steps
IP	IP=-10000	Absolute position is -10000 steps

IS - Input Status

Requests immediate status of all three digital inputs, STEP, DIR, and EN.

Command Structure:

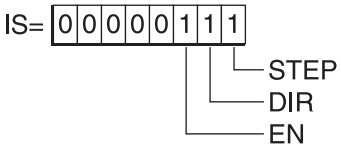
IS

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
IS	IS=00000000	All 3 inputs are closed
IS	IS=00000111	All 3 inputs are open
IS	IS=00000001	STEP input is open, DIR and EN inputs are closed
IS	IS=00000101	STEP and EN inputs are open, DIR input is closed



NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

JA - Jog Acceleration

Sets or requests the accel/decel rate for Jog moves in rev/sec/sec. Sending JA with no number causes drive to respond with present jog accel/decel rate. Setting JA overwrites the both the last JA and JL values. This means that to have different jog accel and jog decel values, you should first send JA to set the jog accel and then send JL to set the jog decel. The JA value cannot be changed while jogging. To change jog speed while jogging use the CS command.

Affects: CJ, WI (jogging) commands
See also: CS, JD, JE, JL, JS, and SJ commands

Command Structure:

JA{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Jog acceleration value
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)

Examples:

Command	Drive sends	Notes
JA10	-	Set jog acceleration to 10 rev/sec/sec
JA	JA=10	

JC - Velocity (Oscillator) Mode Second Speed

Sets or requests the second speed used in velocity (oscillator) mode. The EN input is used to select the speed set by the JC command. This only applies to Command Mode (CM) 18.

Affects: Velocity (oscillator) mode
See also: CM command

Command Structure:

JC{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Register Access	None
Parameter #1	Analog velocity mode second speed
- units	rev/sec (rps)
- range	0.0042 - 133.0 rps
- default	5

Examples:

Command	Drive sends	Notes
JC11	-	Set second jog speed in velocity mode to 11 rps
JC	JC=11	

JD - Jog Disable

Disables the STEP and DIR inputs as jog inputs during a WI instruction.

Affects: Jogging during WI command
See also: JE and WI commands

Command Structure:

JD

Details:

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

Examples:

Command	Drive sends	Notes
JD	-	Disable jogging while executing a WI command

JE - Jog Enable

Enables the STEP and DIR inputs as jog inputs during a WI instruction. Jog accel, decel and velocity are set using the JA, JL, and JS commands, respectively.

The STEP and DIR inputs can each be assigned to only one function in an application. If you want to use the STEP and DIR inputs as jog inputs you can define them as such with the JE command. JE takes no effect if the drive is set in Command Mode (CM) 7, 14 or 18, because these modes predefine these inputs and take precedence over the JE command. In other words, the JE command, as well as Command Modes (CM) 7, 14 and 18 each assign a usage to the STEP and DIR inputs. Each of these must exclusively use the STEP and DIR inputs. Command Modes are most dominant and will continually prevent JE from using the inputs.

To enable jogging with the STEP and DIR inputs simply execute the JE command with CM=21.

Affects: Jogging during WI command
See also: JD and WI commands

Command Structure:

JE

Details:

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

Examples:

Command	Drive sends	Notes
JE	-	Enable jogging while executing the WI command

JL - Jog Decel

Sets or requests the decel rate for Jog moves and velocity (oscillator) mode in rev/sec/sec. The JL value cannot be changed while jogging. To maintain compatibility with legacy products, JA sets both the JA and JL values, so when a different JL value is required set JA first, then set JL.

Affects: Jogging during WI command, velocity (oscillator) mode, and CJ command
See also: CS, JA, JE, JS, and SJ commands

Command Structure:

JL{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Jog deceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 - 5461.167 rps/s (resolution is 0.167 rps/s)

Examples:

Command	Drive sends	Notes
JL25	-	Sets jog deceleration rate to 25 rps/s
JL	JL=25	

JS - Jog Speed

Sets or requests the speed for Jog moves in rev/sec. Sending JS with no number causes drive to respond with present jog speed.

Affects: Jogging during WI command, oscillator (velocity) mode, and CJ command
See also: CJ, CS, and JE commands

Command Structure:

JS{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	Yes
Parameter #1	Jog speed
- units	rev/sec (rps)
- range	0.0042 - 133.3333 (resolution is 0.0042 rps)

Examples:

Command	Drive sends	Notes
JS10.35	-	Set jog speed to 10.35 rps
JS	JS=10.35	

MD - Motor Disable

Disables motor outputs (reduces motor current to zero). Disabling the motor also activates the output when set to function as a Brake Output (BO command).

Affects: All move commands
See also: ME command

Command Structure:

MD

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	No

Examples:

Command	Drive sends	Notes
MD	-	Drive turns off current to the motor

ME - Motor Enable

Restores drive current to motor. If the drive cannot be enabled due to the Enable Input (SI) state, the drive will respond with a "&" which indicates that the drive could not be enabled.

IMPORTANT: This command restores the previous mode of operation. If for example the drive is operating in velocity (oscillator) mode the motor may immediately start moving after sending the ME command. External inputs to the drive must be sequenced properly to avoid unpredicted operation.

Affects: All move commands
See also: MD commands

Command Structure:

ME

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
ME	-	Motor current is restored
ME	&	Motor current is NOT restored: check Servo Enable input (SI) for proper state

PS - Pause

Suspends execution of buffered commands until the next Continue (CT) command is executed. This can be useful for holding a sequence of commands in the drive's command buffer to time with an external event. Use the PS command to pause the command buffer, then send each (buffered type) command in the desired sequence to the drive. When the timing with the external event occurs, simply send the CT command which will trigger the execution of the already buffered sequence of commands.

See also: CT command

Command Structure:

PS

Details:

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

Examples:

Command	Drive sends	Notes
PS	-	Pause execution of commands in the command buffer

RS - Request Status

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

See also: SC command

Command Structure:

RS

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Units	Character Code
Range	A = Alarm Code is present (use AL command to view alarm code) D = Drive Disabled E = Drive Faulted (use AR command to clear fault) H = Homing (SH in progress) J = Jogging (CJ in progress) F = Motion in progress (Feed & Jog commands) M = Motion in progress (from any kind of input) R = Ready (drive is enabled and ready) S = Stopping a motion (ST or SK command executing) T = Wait Time (WT command executing) W = Wait Input (WI command executing)

Examples:

Command	Drive sends	Notes
RS	RS=R	Drive is enabled and ready
RS	RS=ADE	Alarm code is present, drive is faulted and disabled
RS	RS=JR	Motor is jogging, drive is enabled

SA - Save Parameters

Saves selected command parameters to non-volatile memory. All commands in this manual that show "Non-Volatile = YES" are saved when the SA command is sent. This command is useful for saving the desired defaults for subsequent power-ups.

Command Structure:

SA

Details:

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

Examples:

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

SC - Status Code

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

See also: RS command

Command Structure:

SC

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Units	Hexadecimal equivalent of the binary status code word (see bit assignments below)

Examples:

Command	Drive sends	Notes
SC	SC=0009	Drive is in motion and enabled (Bits 3 and 0)
SC	SC=0004	Drive is faulted and disabled (Bit 2)
SC	SC=0209	Drive has an alarm, is in motion, and is enabled (Bits 9, 3 and 0)

Status Code bit assignments:
Bit 0 = Drive On / Enabled (drive is Off / disabled if this bit = 0)
Bit 1 = NOT USED
Bit 2 = Drive Fault (check Alarm Code, AL)
Bit 3 = In Motion (from any kind of input)
Bit 4 = In Motion (using Feed command)
Bit 5 = Jogging (currently in Jog mode)
Bit 6 = Stopping (stop command in progress, SK or ST)
Bit 7 = Waiting (for an Input, WI)
Bit 8 = Saving (parameter data is being saved, SA)
Bit 9 = Alarm (Alarm Code is present, AL)
Bit 10 = Homing (SH command in progress, SH)
Bit 11 = Wait on Timer (Wait time is in progress, WT)
Bit 12 = NOT USED
Bit 13 = NOT USED
Bit 14 = NOT USED
Bit 15 = Initializing (happens at power up)

SF - Step Filter Frequency

Sets or requests the step filter frequency which affects motor smoothness in Step & Direction mode (CM7). The primary use of this filter is to introduce microstep emulation into the motion of the step motor, which smooths motion when the drive's microstep resolution (EG command) is set to a low value. This command is exceptionally useful when using a low-resolution indexer or encoder to send pulses to the stepper drive and smooth motor shaft rotation is required.

Note: The step filter frequency is labeled Step Smoothing Filter in the Pulse & Direction Control dialog of SureStep Pro.

Command Structure:

SF{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Step filter frequency
- units	Hz
- range	0 - 2500
- default	2500

Examples:

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

SH - Seek Home

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

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

This command is designed to use three physical sensors or switches tied to three digital inputs of the stepper drive: a home sensor, a CW end-of-travel limit switch, and a CCW end-of-travel limit switch. With STP-DRV drives tie the home sensor to the EN input, the CW end-of-travel limit switch to the STEP input, and the CCW end-of-travel limit switch to the DIR input. Use the DL command to define the usage of STEP and DIR as end-of-travel limits.

If end-of-travel limits are not used in the application, tie the home sensor to any one of the three digital inputs and use the DL command to define the STEP and DIR inputs as general purpose inputs (DL3).

See also: DL command

Command Structure:

SH(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Input number, Input condition
- units	integer, letter
- range	integer: 1 = STEP, 2 = DIR, 3 = EN letter: L = low, H = high, F = falling edge, R = rising edge

Examples:

Command	Drive sends	Notes
SH3L	-	Seek home to EN input low (STEP and DIR inputs wired to end-of-travel limit switches)

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-ener-*

gized, or the input/output is not connected, the logic state is **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

NOTE: When working with the analog input of an STP-DRV drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designtates an analog value greater than the value set by the AT command.

SJ - Stop Jogging

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

Affects: CJ command
See Also: JA, JL, SK, and ST commands

Command Structure:

SJ

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

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

SK - Stop & Kill Buffer

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

Affects: Motion and command buffer contents
See Also: ST command

Command Structure:

SK{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Deceleration rate
- units	letter
- range	D = deceleration rate set by DE or JA command no parameter = deceleration rate set by AM command

Examples:

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

SO - Set Output

Sets drive's digital output to the given condition, low or high. This can only be done if the digital output is not being used for a dedicated function such as Alarm Output (AO), Brake Output (BO) or Motion Output (MO).

See Also: IH, IL, IO commands

Command Structure:

SO(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Output number, Output state
- units	integer, letter
- range	integer: 1 = Output letter: L = Low, H = High

Examples:

Command	Drive sends	Notes
SO1L	-	Set Output low (closed)
SO1H	-	Set Output high (open)

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

SP - Set Position

Sets or requests the motor's absolute position in steps.

See Also: FP command

Command Structure:

SP{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	NO
Parameter #1	Absolute position
- units	steps
- range	+/- 2,147,483,647

Examples:

Command	Drive sends	Notes
SP100	-	Set absolute position offset to 100 steps
SP	SP=100	

SS - Send String

Instructs drive to respond with the desired character string (up to 4 characters). This command is useful for letting the host system know via the serial port when a sequence of commands has finished executing. Multiple SS commands can be placed into the command buffer at any time, though care should be taken when using this command to avoid serial data collisions. For example, the host system should avoid sending commands to the drive while expecting a character string (from a previously buffered SS command).

Command Structure:

SS(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	String of characters
- units	any printable characters
- range	up to 4 characters

Examples:

Command	Drive sends	Notes
AC100	-	Set accel rate to 100 rev/sec/sec
DE100	-	Set decel rate to 100 rev/sec/sec
VE1	-	Set velocity to 1 rev/sec
EG10000	-	Set microstep resolution to 10000 steps/rev
DI100000	-	Set move distance to 100000 steps
FL	-	Initiate Feed to Length move
SSdone	done	String “done” sent to host after FL command is completed

ST - Stop

Halts the current buffered command being executed, but does not affect other buffered commands in the command buffer. When used to stop a move deceleration rate is controlled by the AM (Max Acceleration) command. If a “D” parameter is used deceleration rate is controlled by either the DE command (with “Feed” moves like FL, FP, and SH) or the JL* command (when jogging).

*Note that setting the JA command also sets the JL command. If distinct JA and JL values are required always set JL after setting JA.

See Also: SK command

Command Structure:

ST{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Deceleration rate
- units	letter
- range	D = deceleration rate set by DE or JL command no parameter = deceleration rate set by AM command

Examples:

Command	Drive sends	Notes
ST	-	Stop current command immediately and use the deceleration rate set by the AM command if motion is in progress
STD	-	Stop current command immediately and use the deceleration rate set by the DE or JL command if motion is in progress

TD - Transmit Delay

Sets or requests the time delay used by the drive when responding to a command that requests a response. Most RS-232 hosts will not require a non-zero TD value because separate Rx and Tx lines are used.

Affects: RS-232 Serial Communications

Command Structure:

TD{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Register Access	None
Parameter #1	Time value
- units	milliseconds
- range	0 - 32767
- default	0

Examples:

Command	Drive sends	Notes
TD10	-	Set drive Tx time delay to 10 milliseconds
TD	TD=10	

VC - Change Velocity

Sets or requests the “change speed” for FC moves.

Affects: FC command

Command Structure:

VC{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Register Access	“U” (037)
Parameter #1	Change speed value
- units	rev/sec (rps)
- range	0.0042 - 133.3333 (resolution is 0.0042 rev/sec)
- default	5

Examples:

Command	Drive sends	Notes
VC5	-	Set change velocity to 5 rev/sec
VC	VC=5	
AC100	-	Set accel rate to 100 rev/sec/sec
DE100	-	Set decel rate to 100 rev/sec/sec
DI100000	-	Set overall move distance to 100000 steps
DC75000	-	Set change distance to 75000 steps
VE5	-	Set initial velocity to 5 rev/sec
VC1	-	Set change velocity to 1 rev/sec
FC	-	Initiate Feed to Length with Speed Change command

VE - Velocity

Sets or requests move speed for moves like FL, FP, FS, FD, SH, etc.

Affects: All move commands except jogging

Command Structure:

VE{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE* *Direct Logic PLCs are write only!
Non-Volatile	YES
Parameter #1	Move velocity
- units	rev/sec (rps)
- range	0.0042 - 133.3333 (resolution is 0.0042 rev/sec)

Examples:

Command	Drive sends	Notes
VE2.525	-	Set move velocity to 2.525 rev/sec
VE	VE=2.525	
DI-20000	-	Set move distance to 20000 steps in CCW direction
VE2.5	-	Set move velocity to 2.5 rev/sec
FL	-	Initiate Feed to Length command

WI - Wait for Input

Waits for an input to reach the given condition. Allows very precise triggering of moves if a WI command is followed by a move command. When JE (Jog Enable) has been executed and the drive is in CM21, the STEP and DIR inputs act as jog inputs during WI commands. JD (Jog Disable) disables jogging using these inputs during WI commands.

Affects: Use of STEP and DIR inputs as jog inputs
See Also: JD, and JE commands

Command Structure:

WI(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Input number, Input condition
- units	integer, letter
- range	integer: 1 = STEP, 2 = DIR, 3 = EN letter: L = low, H = high, F = falling edge, R = rising edge

Examples:

Command	Drive sends	Notes
WI3R	-	Wait for EN input to go high (rising edge) before proceeding to the next command in the command buffer

NOTE: When working with digital inputs and outputs in STP-DRV drives it is important to remember the designations **low** *and* **high**. *If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as* **low** *or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is* **high** *or open. A low state is represented by the "L" character in parameters of commands that affect inputs/outputs. For example, WI3L means "wait for input 3 (EN input) low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

NOTE: When working with the analog input of an STP-DRV drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designtates an analog value greater than the value set by the AT command.

WT - Wait Time

Causes a time delay in seconds. The resolution is 0.01 seconds with the largest value being 320.00 seconds.

Command Structure:

WT(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Parameter #1	Time
- units	seconds
- range	0.00 - 320.00 (resolution is 0.01 seconds)

Examples:

Command	Drive sends	Notes
WT2.25	-	Causes time delay of 2.25 seconds
PS	-	Pause command buffer
WT1	-	Time delay 1 second
FL	-	Initiate Feed to Length instruction
CT	-	Continue execution of commands in command buffer

Appendix A: Host Serial Communications

When an STP-DRV stepper drive from Automation Direct is operating in host mode (AKA SCL mode), it means that a host device sends commands to the drive (or drives) over a serial connection and the drive executes the incoming commands. Here are some examples of typical host devices:

- A Windows-based PC running Automation Direct software
- An industrial PC running a custom-built or other proprietary software application
- A PLC with an ASCII module/serial port for sending text strings
- An HMI with a serial connection for sending text strings

The aim of this appendix is to describe the following aspects of operating an Automation Direct STP-DRV drive in **host mode**.

- General structure of host serial communications (host mode).
- Hardware – wiring and connecting a host device to the serial ports of an Automation Direct drive.
- COM Port Settings – UART settings and Bit Rate (Baud) settings.
- Communications Protocol
- Communication Details
- Communication Errors

General structure of host serial communications

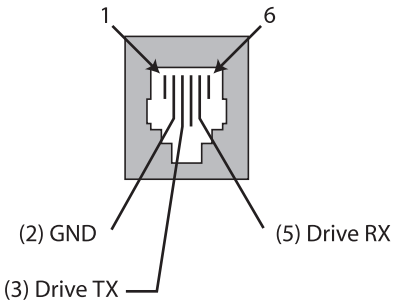
The STP-DRV host serial communications are based on the common ASCII character set transmitted using standard UARTs over an RS-232 hardware interface.

The ASCII character set is used because it is common and well-understood, as well as easy to read. UART (Universal Asynchronous Receiver Transmitter) serial transceivers are available on many types of equipment, including most PCs, and provide a common form of serial communications interface. RS-232 hardware connections are commonly used with UARTs and also provide the easiest and most common form of connectivity.

Hardware

Each STP-DRV stepper drive ships with an RS-232 programming cable. This cable should be used for configuring your drive with the *SureStep Pro* software. Furthermore, if the host device in your application is a PC, you can consider using this cable as well.

For applications where the host device is a PLC or HMI, you will need to make your own communications cable. The pinouts of the RS-232 connector (RJ-11, 6P4C) on STP-DRV drives are shown in the diagram to the right. Pin 2 of the connector should be connected to your host's signal ground pin. Pin 3 of the connector should be connected to your host's Rx pin. And Pin 5 of the connector should be connected to your host's Tx pin.



COM Port Settings

UART Settings: We operate our UARTs with the following settings: 1 start bit, 8 data bits, 0 (no) parity bits, and 1 stop bit.

Bit rate (baud) settings: (BR and PB commands): All STP-DRV drives default to 9600 baud from the factory. In most cases this speed is adequate for setup, configuring, programming, as well as host mode communications. If higher baud rates are required the drives can be configured to operate with a different rate using the BR (Baud Rate) or PB (Power-up Baud Rate) command. In all cases the drive starts up at the factory

rate, 9600, and will remain there if the “power-up packet” is acknowledged by the host (see “Drive Startup” below). When the power-up cycle is complete and if the drive has not received the power-up packet, the drive will activate the new baud rate.

Selecting a baud rate higher than the default 9600 is dependent on the application. If there is a host device operating a number of drives on a network, a higher speed may be required in order to process all the communication needs.

Communications Protocol

In general, the protocol for communications between a host device and a drive is quite simple. STP-DRV drives do not initiate communications on their own, so drives are normally in a state to receive packets from the host. A communications packet, or packet for short, includes all the characters required to complete a command (host to drive) or response (drive to host) transmission. In other words, a host initiates communication by sending a command packet, and the drive responds to that command by sending a response packet back to the host.

Command Transmission (host to drive): The philosophy of sending characters to the drive requires the host to send all the required characters that form a packet in a limited time frame. At the start of receiving a packet, the drive begins timing the space between characters. Each time a character is received an internal timer is reset to 200 milliseconds. If the timer reaches zero before the next character in the packet is received the drive will terminate its packet parsing (characters will still go into the receive buffer) and may send out an error response packet depending on the protocol setting. The purpose of the timeout feature is to allow the drive to purge its buffers automatically when a bad transmission occurs.

NOTE: This timeout feature limits the usage of host devices such as the Windows application HyperTerminal, in which characters are sent as soon as they are typed. For this reason HyperTerminal is not recommended for use with these drives.

Response Transmission (drive to host): In response to a command packet from the host a drive will usually send a response packet. The drive sends out its entire response packet with very limited space between characters. At 9600 baud rate the space between characters is less then 1 bit space (0.0001 seconds). The host system must be able to handle this speed. The space between characters can vary depending on the settings of the PR command (see below).

Protocol Settings (PR Command): The PR (Protocol) command offers users the ability to add various features to the overall communications protocol, i.e. tailor the structure of command and response packets to best fit the needs of their application. In general, when a host device sends a command packet to a drive, the drive will either understand the command or not. If the drive understands the command the drive executes the command. If the drive doesn’t understand the command it cannot execute the command. In most cases the host device will want to know whether the drive has understood the command or not, and so the drive can be set to automatically send an Acknowledge (understood) or Negative Acknowledge (not understand) response packet to the host.

Along with Acknowledge/Negative Acknowledge (Ack/Nack), the PR command controls a number of other protocol settings (see PR command). Also, the PR command controls whether or not the drive will respond with error codes in the response packet when communications errors occur.

Communication Details

Transmit Delay: (TD Command): The TD command allows users to define a dwell time in a drive, which is used by the drive to delay the start of transmission of a response packet after the end of reception of a command packet.

NOTE: The Transmit Delay (TD) command is intended for use in 2-wire RS-485 serial communication networks. Because the STP-DRV drives only have RS-232 ports for serial communications, setting the TD command to a non-zero value is unnecessary.

Communications Packet: A Communications Packet, or **packet** for short, includes all the characters required to complete a command or response transmission. This can vary depending on the settings of the

PR command. See the PR command for more details.

Drive Startup: At power-up, all Automation Direct drives send out what is called the "power-up packet". This packet notifies a host of the drive's presence. After sending the power-up packet the drive waits for a response from the host. This is one of the rare instances in which a drive will initiate communications with the host. This process is necessary for a number of Automation Direct software applications such as *Si Programmer™* and *SureStep Pro™*. The power-up packet is an exception to the ASCII character rule in that all the characters in the packet are binary value. Even if the character is printable its binary value is what is important. The power-up packet consists of three binary characters with the first character being a binary 255 (255 is not a printable ASCII character). This character designates to the software application that the packet is a power-up packet. The following two characters are the firmware version number and the model number of the drive, respectively.

Power-Up Packet = (255)(F/W Version)(Model No.)

As an example, an STP-DRV drive with f/w version 1.53 will send out a power-up packet that looks like this: (255)(53)(38). To an ASCII terminal this packet may look like "ÿ5&". The (255) is the power-up packet designator, the (53) actually stands for f/w version 1.53 (the "1" is implied), and the (38) is an internal model number for the "BLuAC5-Si".

The power-up packet is always sent at 9600 baud, regardless of the bit rate set by the BR or PB command. If an Automation Direct software application is present it will respond to the power-up packet and communications will continue at 9600 baud. If an Automation Direct software application is not present, the drive's request made by the power-up packet will time-out and the drive will begin communicating at the saved bit rate (BR or PB command), 9600 or otherwise.

Communication Errors

During the process of sending communication packets between the host and drive(s), two different types of communication errors can occur.

Hardware errors: Hardware errors are displayed physically by an STP-DRV drive via the red and green LEDs on the drive, (see Appendix F), but no response packet is automatically generated from the drive to the host. Therefore it is the responsibility of the host to check for hardware comm errors using the AL, RS, and/or SC commands. See Appendix B for more details on the AL and SC commands. Once the host has determined the presence of a hardware comm error, the nature of the error can be retrieved using the CE command.

Parsing errors: Parsing errors happen when a drive receives a command packet but cannot properly interpret (parse) the command. Parsing errors can automatically generate a response packet from the drive to the host, depending on the settings of the PR command (see PR command, Bit 2).

Appendix B: Alarm and Status Codes

One of a drive's diagnostic tools is its ability to send alarm and status codes back to a host. The AL (Alarm Code) and SC (Status Code) commands can be used by a host to query a drive at any time. If a drive faults or sets an alarm, the AL command allows the host to find out what alarm, or alarms, has been set. Similarly, the SC command allows a host to find out what the status code of a drive is at any time during drive operation. A status code provides information as to whether the drive is running, in position, disabled, homing, and other conditions. Both alarm and status codes can be very useful when initially setting up and integrating a drive into your application.

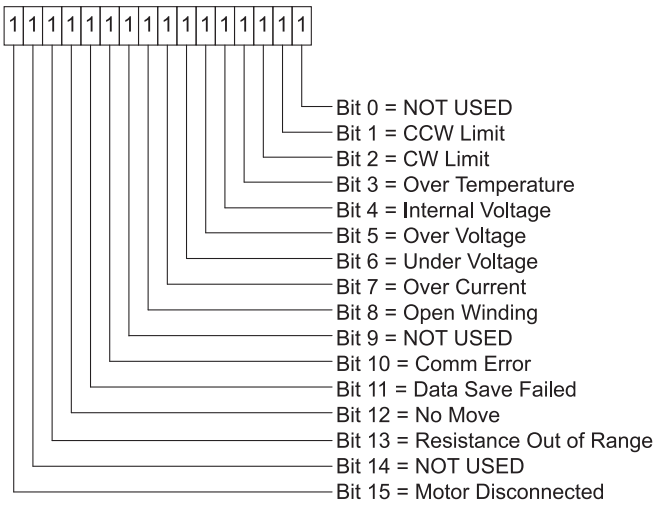
The Alarm and Status codes are hexadecimal equivalents of 16 bit binary "words". Each bit in each binary word is assigned a meaning, and therefore the responses to these two commands can actually show information about more than one alarm or status condition.

Alarm Code Definitions

Here is a diagram showing the meaning assigned to each of the 16 bits in the Alarm Code's binary word. For example, if Bit 5 = 1, there is an Over Voltage condition at the drive. A drive will set any and all bits that pertain to its immediate alarm/fault status at the moment of receiving the AL command from the host.

When a host sends the AL command, the response from the drive will be the Hexadecimal equivalent of this 16-bit word. This hexadecimal value is considered the Alarm Code, and the equivalent hexadecimal value for each of the bits is given below.

Alarm Description	Bit #	Hex Value
NOT USED	0	0001
CCW Limit	1	0002
CW Limit	2	0004
Over Temperature	3	0008
Internal Voltage	4	0010
Over Voltage	5	0020
Under Voltage	6	0040
Over Current	7	0080
Open Winding	8	0100
NOT USED	9	0200
Comm Error	10	0400
Data Save Failed	11	0800
No Move	12	1000
Resistance Out of Range	13	2000
NOT USED	14	4000
NOT USED	15	8000



Example: The drive has hit the CW limit (Bit 2) and there is an under voltage condition (Bit 6). The resulting 16-bit word is - 0000 0000 0100 0100 - and the equivalent hexadecimal value is 0044. Therefore, when the host sends "AL", the drive will respond with "AL=44".

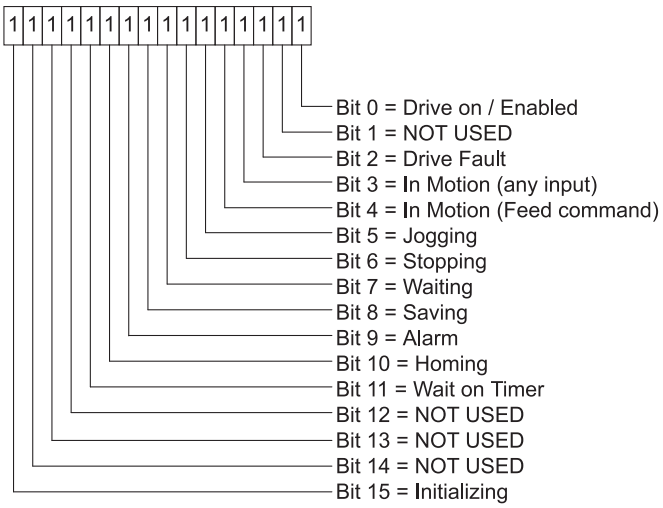
Status Code Definitions

Below is a diagram showing the meaning assigned to each of the 16 bits in the Status Code's binary word. For example, when Bit 1 = 1, the drive is disabled. Similarly, when Bit 10 = 1, the drive is seeking the home sensor (defined by the SH command). A drive will set any and all bits that pertain to its immediate status condition at the moment of receiving the SC command from the host.

When a host sends the SC command, the response from the drive will be the Hexadecimal equivalent of this 16-bit word. This hexadecimal value is considered the Status Code, and the equivalent hexadecimal value for each of the bits is given below.

Bit Assignment	Hex Value	Bit #
Drive On/ Enabled (drive is Off / disabled if this bit = 0)	0001	0
NOT USED	0002	1
Drive Fault (check Alarm code, AL)	0004	2
In Motion (from any kind of input)	0008	3
In Motion (using a Feed command)	0010	4
Jogging (currently in Jog mode)	0020	5
Stopping (stop command in progress, SK or ST)	0040	6
Waiting (for an Input, WI)	0080	7
Saving (parameter data is being saved, SA)	0100	8
Alarm (Alarm Code is present, AL)	0200	9
Homing (SH command in progress, SH)	0400	10
Wait on Timer (Wait time is in progress, WT)	0800	11
NOT USED	1000	12
NOT USED	2000	13
NOT USED	4000	14
Initializing (happens at power up)	8000	15

Example: The drive is executing an FL command (Bit 4), and it's waiting for the input specified by the WI command (Bit 7). The 16-bit word for this condition is - 0000 0000 1001 0000 - and the hexadecimal equivalent is 90. Therefore, when the host sends "SC", the drive will respond with "SC=90".



A useful tool for converting alarm and status codes to binary

If you're using a Windows-based PC as a host with your STP-DRV drive (which you'll definitely be doing if you're using any of the Automation Direct software supplied with your drive), you can use the Calculator utility that comes with Windows to convert hexadecimal values into binary values or "words". This utility is usually found in the Accessories folder of the Programs Folder in the Start menu. Once open, make sure the Scientific view is set by choosing it from the View menu of Calculator. This view provides some radio buttons for switching between Hex and Bin (as well as Dec and Oct).

To figure out what your Alarm or Status Code is telling you, check the Hex radio button and enter the hexadecimal code sent by the drive. Then check the Bin radio button and your code will automatically be converted to a binary word. Note that Calculator does not allow leading zeros in entries, so you may see less than 16 bits. That's OK, just start counting from the right with Bit 0, and you will be able to determine the conditions set in the codes.

LED Display codes

In addition to the AL and SC commands, some alarm and status codes are physically displayed at the red and green LEDs of STP-DRV drives.

		DESCRIPTION
1	1	NOT USED
1	2	no move (attempted move while drive disabled)
2	1	CCW limit
2	2	CW limit
3	1	drive overheating
3	2	NOT USED
4	1	power supply overvoltage
4	2	power supply undervoltage
5	1	over current / short circuit
5	2	motor resistance out of range
6	1	open motor winding
6	2	NOT USED
7	1	serial communication error
7	2	NOT USED

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