SCL Manual for MSST-S Drives

SCL Commands for the MSST5-S and MSST10-S Step Drives

MOONS'

SHANGHAI AMP&MOONS' AUTOMATION CO., LTD.

Contents

Introduction

Thank you for purchasing an MOONS' 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 in several MOONS' drives. This manual focuses on using SCL with the MSST5-S and MSST10-S drives only.

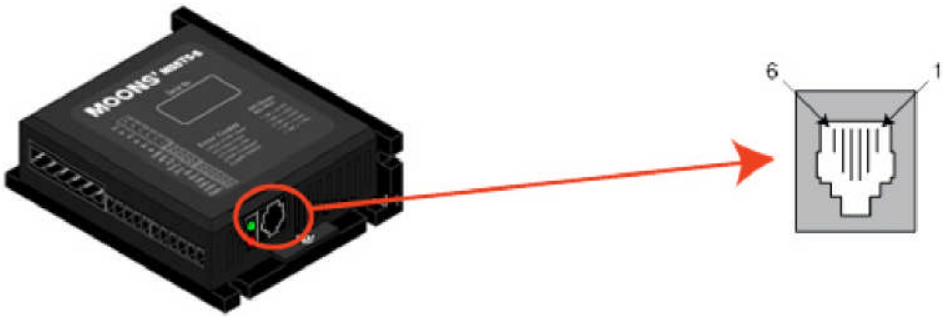
NOTE: Using SCL with other MOONS' drives is detailed in other manuals. Please visit our web site ***www.moons.com.cn t****o view and download these manuals.*

NOTE: This manual only covers details related to using SCL with the MSST-S drives. For all other aspects of applying your MSST-S drive, including hardware configuration, I/O, and software settings, view MSST5(10)-S User Manual and the Help file contained in the ST Configurator software. The manual and software can be downloaded for free from ***www.moons.com.cn****.*

What is SCL?

SCL was 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.

MSST-S 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.

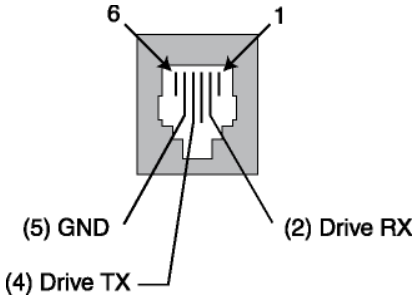
When in SCL mode, an MSST-S drive receives commands from the host into a command buffer, and then executes the received commands directly out of that buffer. One thing you cannot do with an MSST-S drive is to create a stored program that the drive can run stand-alone. For that you should consider the MSST-Q or MSST-Si drives, which are designed for stored program execution.

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 MSST-S drive are shown here.



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 MOONS' 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 running with your MSST-S drive and SCL as quickly as possible, follow the basic steps below.

Step 1: Install software

Your MSST-S stepper drive was shipped with *User Manual and CD-ROM* containing all of the software applications available from MOONS' drives. If you don't have a copy of this CD-ROM, you can also visit www.moons.com.cn to download software applications for free.

From the CD-ROM or from a download, install *ST Configurator* and *SCL Setup Utility* on your Windows-based PC. *ST Configurator* will be used to configure your drive and put it into SCL mode. *SCL Setup Utility* will be used to practice with SCL commands.

NOTE: For laptop computers without a serial port you will have to use a USB-Serial adapter or a PCMCIA -Serial adapter.

Step 2: Configure your MSST-S drive using ST Configurator

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

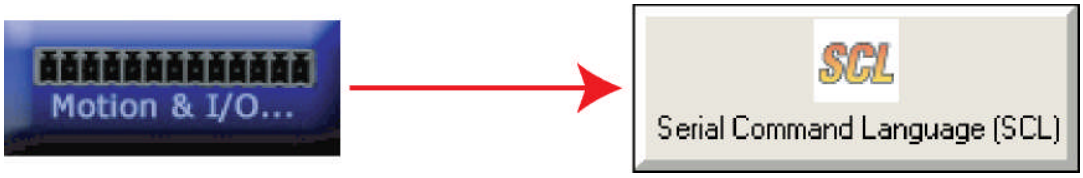
- An MSST5-S or MSST10-S stepper drive
- A 2-phase step motor. MOONS' offers a number of step motors for use with the MSST series drives. Of course you can use your own step motors.
- The programming cable supplied with your MSST-S drive (9-pin D-sub at one end, RJ-11 modular connector at the other).
- A small, flat-blade screwdriver (supplied with your MSST-S drive).
- A 24 or 48 VDC power supply.

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

Connect the 2-phase step motor to your MSST-S drive. Then connect your MSST-S drive to your PC using the programming cable. Launch *ST Configurator.* Power your drive ON. If power was ON to the drive when you launched *ST Configurator,* power the drive OFF, then back ON.

Configure your motor by clicking the "Motor" button on the main screen of *ST Configurator.* Use the Help file contained in *ST Configurator* for details on configuring your drive for the particular step motor you have.

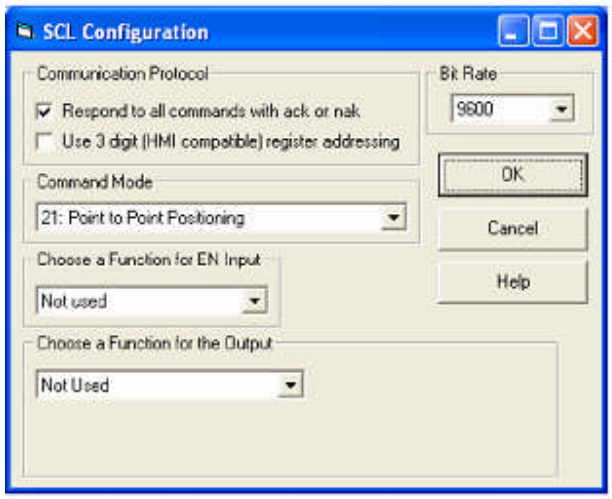
Each MSST-S drive can run in one of 4 Motion Control Modes: Pulse & Direction, Velocity (Oscillator), Multi-axis MisNet Hub, and SCL. Click the "Motion & I/O" button in *ST Conigurator*, then select SCL. This will bring up the SCL Configuration window.



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 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 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 *ST configurator* and have chosen SCL mode for the drive, click the "Download to Drive" button on the main screen and exit *ST Configurator.*

Step 3: Get familiar with SCL commands

We highly recommend the *SCL Setup Utility* software application for familiarizing yourself with SCL commands. *SCL Setup Utility* can be downloaded for free from www.moons.com.cn.

Launch *SCL Setup Utility* and connect your MSST-S drive to your PC (if not already connected from Step 2). To send commands to your drive simply type a command in the Command Line of *SCL Setup Utility* 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 in *SCL Setup Utility* 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 you see a steady, flashing green LED. You might also want to review your settings in *ST Configurator* 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 *SCL Setup Utility* 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. MOONS' offers some sample VisualBasic code on its web site to show how SCL commands can be sent from a windows-based PC application. You can visit www.moons.com.cn to download it.

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 Summary

The set of tables that follows lists all of the SCL commands available with your drive. In each table there are a number of columns that give information about each command.

- "Command" shows the command's two-letter Command Code.
- "Description" shows the name of each command.
- "NV" designates which commands are Non-volatile: that is, which commands are saved in non-volatile memory when the SA (Save) command is sent to the drive.
- "Write only" or "Read only" is checked when a command is not both Read/Write compatible.
- "Immediate" designates an immediate command (all other commands are buffered).
- "Units" shows a couple of different things. If a command has a parameter option it shows the units of that parameter. If the command requests information from the drive (status command) it shows the units of the response.
- "Range" shows the range of values the command can use in its parameter.
- "Default" shows the default parameter value stored in the drive.

Motion Commands

Com-mand	Description	NV	write only	read only	Imme-diate	units	range	default
AC	Acceleration Rate	•				rps/s	0.167 - 5461 .167	100
AM	Max Acceleration	•				rps/s	0.167 - 5461 .167	1000
CJ	Commence Jogging		•			-	-	-
CS	Change Jog Speed				•	rps	+/-133.3333	-
DC	Change Distance	•				steps	0 - 2,147,483,467	0
DE	Deceleration Rate	•				rps/s	0.167 - 5461 .167	100
DI	Distance / Position	•				steps	+/- 2,147,483,647	20000
EG	Electronic Gearing	•				steps/rev	200 - 51200	20000
FC	Feed to Length with Speed Change		•			-	-	-
FD	Feed to Double Sensor		•			-	-	-
FE	Follow Encoder		•			-	-	-
FL	Feed to Length		•			steps	+/- 2,147,483,647	-
FM	Feed to Sensor with Mask Dist		•			-	-	-
FO	Feed to Length and Set Output		•			-	-	-
FP	Feed to Position		•			steps	+/- 2,147,483,647	-
FS	Feed to Sensor		•			-	-	-
FY	Feed to Sensor with Safety Distance		•			-	-	-
HW	Hand Wheel		•			-	-	-
JA	Jog Acceleration Rate	•				rps/s	0.167 - 5461 .167	100
JC	Velocity (Oscillator) Mode Second Spe-ed	•				rps	0.0042 - 133.3333	5
JD	Jog Disable		•			-	-	-
JE	Jog Enable		•			-	-	-
JL	Jog Deceleration Rate	•				rps/s	0.167 - 5461 .167	100
JS	Jog Speed	•				rps	0.0042 - 133.3333	10
SH	Seek Home		•			-	-	-
SJ	Stop Jogging		•		•	-	-	-
SK	Stop & Kill Buffer		•		•	code	D or none	-
ST	Stop		•		•	-	-	-
VC	Change Velocity	•				rps	0.0042 - 133.3333	5
VE	Velocity	•				rps	0.0042 - 133.3333	10

Configuration Commands

Com-mand	Description	NV	write only	read only	Imme-diate	units	range	default
AI	Alarm Reset Input (EN input)	•				code	1, 2, 3	3
AO	Alarm Output	•				code	1, 2, 3	3
BD	Brake Disengage Delay time	•				seconds	0 - 32.767	0.2
BE	Brake Engage Delay time	•				seconds	0 - 32.767	0.2
BO	Brake Output	•				code	1, 2, 3	3
BR	Baud Rate	•				code	1 - 5	1
CC	Change Current	•				amps	0 - max of drive	-
CD	Idle Current Delay time	•				seconds	0 - 32.767	0.4
CE	Communication Error			•	•	hex code	0 - 7F	-
CF	Anti-resonance Filter Frequency	•				Hz	0 - 2000	241
CG	Anti-resonance Filter Gain	•				integer	0 - 32767	12000
CI	Change Idle Current	•				amps	0 - max of drive	-
CM	Command mode	•				code	7, 11-18, 21, 22	21
DA	Define Address	•				character	see DA command	1
DL	Define Limits	•				code	1, 2, 3	3
EG	Electronic Gearing	•				steps/rev	200 - 51200	20000
FI	Filter Input					input / value	1, 2, 3 / 0 - 32767	-
HG	4th Harmonic Filter Gain				•	integer	0 - 32767	-
HP	4th Harmonic Filter Phase				•	integer	+/-255	-
IA	Immediate Analog Request			•	•	input	1 or none	-
IC	Immediate Commanded Current			•	•	amps	-	-
ID	Immediate Distance			•	•	steps	-	-
IF	Immediate Format				•	code	H, D	H
IP	Immediate Position			•	•	steps	-	-
IT	Immediate Temperature			•	•	0.1 deg C	-	-
IU	Immediate DC Bus Voltage			•	•	0.1 VDC	-	-
IV	Immediate Velocity			•	•	rpm	-	-
MD	Motor Disable		•			-	-	-
ME	Motor Enable		•			-	-	-
MO	Motion Output	•				code	1, 2, 3, 4	3
PB	Power-up Baud Rate	•				code	1 - 5	1
PC	Power-up Current	•				amps	0 - max of drive	-
PI	Power-up Idle Current	•				amps	0 - max of drive	-
PM	Power-up Mode	•				code	0 - 7	-
PR	Protocol	•				decimal word	1 - 63	5
RE	Restart		•		•	-	-	-

Configuration Commands (continued)

SA	Save Parameters		•		•	-	-	-
SF	Step Filter Frequency	•				Hz	0 - 16000	2500
SI	Enable Input (EN input)	•				code	1, 2, 3	3
SP	Set Absolute Position	•				steps	+/- 2,147,483,64	-
TD	Transmit Delay	•				msec	0 - 32767	0

Buffer Commands

Com-mand	Description	NV	write only	read only	Imme-diate	Units	Range	Default
BS	Buffer Status			•	•	-	-	-
CT	Continue		•		•	-	-	-
PS	Pause		•			-	-	-
SK	Stop & Kill Buffer		•		•	code	D or none	-
SS	Send String		•			-	-	-
WI	Wait for Input		•			input / cond	1, 2, 3 / L, H, F, R	-
WT	Wait Time		•			seconds	0.00 - 320.00	-

Status Commands

Com-mand	Description	NV	write only	read only	Imme-diate	Units	Range	Default
AR	Alarm Reset (IMMEDIATE)		•		•	-	-	-
AX	Alarm Reset (BUFFERED)		•			-	-	-
BS	Buffer Status			•	•	-	-	-
IC	Immediate Current Request			•	•	amps	-	-
ID	Immediate Distance Request			•	•	steps	-	-
IF	Immediate Format				•	code	H, D	H
IO	Immediate Output Status Request				•	decimal word	0, 1	-
IP	Immediate Position Request			•	•	steps	-	-
IS	Immediate Input Status			•	•	-	-	-
IT	Immediate Temperature Request			•	•	0.1 deg C	-	-
IU	Immediate Voltage Request			•	•	0.1 VDC	-	-
IV	Immediate Velocity Request			•	•	rpm	-	-
MN	Model Number			•	•	code	D, E	-
RS	Request Status			•	•	code	see RS com-mand	-
RV	Revision Level Request			•	•	-	-	-
SC	Status Code			•	•	hex	0000 - FFFF	-

I/O Commands

Com-mand	Description	NV	write only	read only	Imme-diate	units	range	default
AD	Analog Deadband	•				mvolts	0 - 255	50
AF	Analog Filter	•				integer	0 - 32767	14418
AG	Analog Velocity Gain	•				integer	0 - 32767	2400
AO	Alarm Output	•				code	1, 2, 3	3
AP	Analog Position Gain	•				integer	0 - 32767	20000
AT	Analog Threshold	•				volts	+/-10.000	2.5
AV	Analog Offset	•				volts	+/-10.000	0
AZ	Analog Zero (Auto Zero)		•			-	-	-
BD	Brake Disengage Delay time	•				seconds	0 - 32.767	0.2
BE	Brake Engage Delay time	•				seconds	0 - 32.767	0.2
BO	Brake Output	•				code	1, 2, 3	3
MO	Motion Output	•				code	1, 2, 3, 4	3
FI	Filter Input					input / value	1, 2, 3 / 0 - 32767	-
IH	Immediate High Output		•		•	output	1	-
IL	Immediate Low Output		•		•	output	1	-
IO	Immediate Output Status Request			•	•	-	-	-
IS	Immediate Input Status Request			•	•	-	-	-
SI	Enable Input (EN input)	•				code	1, 2, 3	3
SO	Set Output		•			output / cond	1 / H, L	-
WI	Wait for Input		•			input / cond	1, 2, 3 / L, H, F, R	-

Register Commands

Com-mand	Description	NV	write only	read only	Imme-diate	Units	Range	Default
RL	Register Load (IMMEDIATE)				•	-	-	-
RU	Register Upload			•	•	-	-	-

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.

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, FD, FE, FL, FM, FS, FP, FY, SH Commands
See also: AM, DE, DI, DC, VE Commands

Command Structure:

AC{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"A" (017)
Parameter #1	Acceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)
- default	100

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 "zero". This zero point can be used as the zero velocity point in analog velocity mode, or as the zero position point in analog position mode. The deadband is an absolute value that in usage is applied to either side of zero volts.

Affects: Analog input
See also: CM command

Command Structure:

AD{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Analog deadband value
- units	millivolts
- range	0 - 255
- default	

Examples:

Command	Drive sends	Notes
AD100	-	Set analog dead band to 0.1 volts

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
Register Access	None
Parameter #1	Filter value
- units	integer (see formula above)
- range	0 - 32767* (0 disables the filter)
- default	14418 (500 Hz)

* 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 (oscillator) mode. 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 modes
See also: CM command

Command Structure:

AG{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
- units	0.25 rpm
- range	0 - 32767
- default	2400 (10 rps)

Examples:

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

AI- Alarm Reset Input (EN input)

Defines the EN input as an Alarm Reset Input.

The EN input can be assigned to only one function in an application. If you want to use the EN input as an Alarm Reset input you can define it as such in two ways, with the ST Configurator software, or with the AI command. AI takes no effect if the drive is set in Command Mode (CM) 13, 14, 17 or 18, because these modes use the EN input as a speed change input and take precedence over the AI command. Also, setting the SI command after setting the AI command reassigns the EN input to drive enable usage and turns off any alarm reset usage (AI3). In other words, the AI and SI commands, as well as Command Modes (CM) 13, 14, 17 and 18 each assign a usage to the EN input. Each of these must exclusively use the EN input. Command Modes are most dominant and will continually prevent AI and SI from using the input. AI and SI exclude each other by overwriting the usage of the EN input.

There are three Alarm Reset states that can be defined with the AI command:

AI1: Alarm reset occurs when the EN input is closed (energized). This is an edge-triggered event. If the switch is closed when an alarm is activated no reset will occur. The input must be opened (de-energized) and then closed to reset the alarm.

AI2: Alarm reset occurs when the input is open (de-energized). This is an edge-triggered event. If the switch is open when an alarm is activated no reset will occur. The input must be closed (energized) and then opened to reset the alarm.

AI3: The EN Input is not used for Alarm Reset and can be used as a general purpose input. AI will be automatically set to 3 if CM is set to 13, 14, 17, or 18, or if SI is set to 1 or 2 after the AI command is set.

Command Structure:

AI {Parameter #1 }

Details:

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

Examples:

Command	Drive sends	Notes
AI1	-	Closing EN input resets all possible alarms
AI	AI=1	

NOTE: When working with digital inputs and outputs in MSST-S 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.*

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

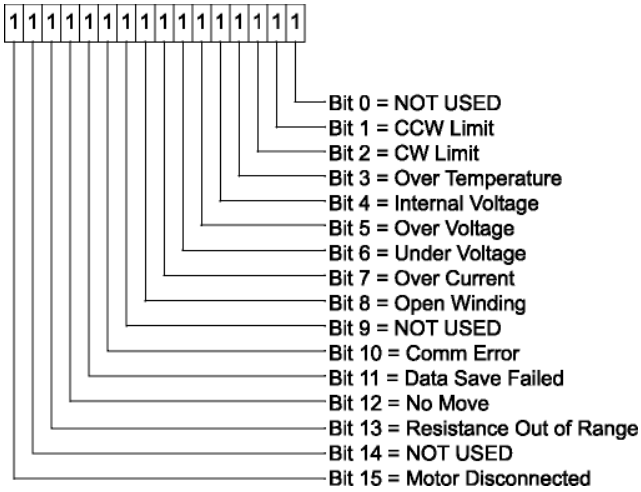
Command Structure:

AL

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	"f" (054)
Units	Hexadecimal value of 16-bit binary word (see below)

Alarm Description	Bit#	Hex
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)

AM - Max Acceleration

Sets or requests the maximum acceleration/deceleration allowed when using analog velocity (oscillator) mode. Also sets the deceleration used when an end-of-travel limit is activated during any of the "Feed" moves or when a Stop (ST) or Stop & Kill (SK) command is sent.

Affects: ST, SK commands. Analog velocity (oscillator) mode.
See also: VM command

Command Structure:

AM{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Maximum acceleration/deceleration
- units	rev/sec/sec (rps/s)
- range	0.167 - 5461 .167 (resolution is 0.167 rps/s)
- default	

Examples:

Command	Drive sends	Notes
AM2000	-	Set maximum acceleration/deceleration rates to 2000 rev/sec/sec.
AM	AM=2000	

AO - Alarm Output

Defines the drive's digital output as an Alarm Output.

The output of an MSST-S drive can be assigned to one of four functions: alarm output, brake output, motion output, or tach output. Each of these functions must exclusively use the output, so only one function is allowed. There are two ways to define the function of this output: via ST Configurator or via SCL commands. To set the output as an alarm output, use the AO command and one of the codes below.

NOTE: Setting the AO command to 1 or 2 overrides previous assignments of this output's function. Similarly, if you use the BO or MO command to set the function of the output after setting the AO command to 1 or 2, usage of the output will be reassigned and AO will be automatically set to 3.

There are three Alarm Output states that can be defined with the AO command:

AO1: Output is closed (energized) when an alarm is present.
AO2: Output is open (de-energized) when an alarm is present.
AO3: Output is not used as an Alarm Output and can be used for another automatic output function or as a general purpose output.

Affects: Function of digital output
See also: AI, SI, BO, and MO commands

Command Structure:

AO{Parameter #1 }

Details:

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

Examples:

Command	Drive sends	Notes
AO1	-	Output will be closed when an alarm or fault occurs
AO	AO=1	

NOTE: When working with digital inputs and outputs in MSST-S 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.*

AP - Analog Position Gain

Sets or requests the analog input gain that relates to motor position when the drive is in analog position command mode (see CM command). Gain value sets the commanded position when the analog input is at the configured full scale value. ST Configurator can be used to configure the analog inputs for the desired input type, scaling and offsetting.

Affects: CM22 (Analog Positioning Command Mode)
See also: AF, AZ, and CM commands

Examples:

Command	Drive sends	Notes
AP8000	-	Position range over full scale of analog input is 8000 steps
AP	AP=8000	

Command Structure:

AP{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"X" (040)
Parameter #1	Analog position gain value
- units	steps
- range	0 - 32767
- default	20000

Examples:

Command	Drive sends	Notes
AP8000	-	Position range over full scale of analog input is 8000 steps
AP	AP=8000	

AR - Alarm Reset (IMMEDIATE)

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
Register Access	None

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: AF, AZ, FS, FM, FY, and FD commands

Command Structure:

AT{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"Y" (041)
Parameter #1	Analog threshold value
- units	volts
- range	-10.000 to 10.000
- default	2.5

Examples:

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

AV - Analog Offset Value

Sets or returns the analog offset value of the analog input.

Affects: All Analog input functions
See also: AF, AP, AZ, CM and "Feed" commands

Command Structure:

AV{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"Z" (042)
Parameter #1	Analog offset value
- units	Volts
- range	-10.000 to 10.000
- default	0

Examples:

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

AX - Alarm Reset (BUFFERED)

Resets a drive fault and clears the alarm code. This command is the same as the AR command but is a buffered command rather than an immediate command.

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

Affects: Alarm Code
See also: ME, AR Commands

Command Structure:

AX

Details:

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

Examples:

Command	Drive sends	Notes
AX	-	Reset drive fault and clear alarm code

AZ - Analog Zero

Activates the analog "auto offset" algorithm. This algorithm can also be accessed in ST Configurator. It is useful in defining the current voltage present at the analog input as the zero point or offset.

Affects: All Analog input functions
See also: AF, AP, AV, CM and "Feed" commands

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

Examples: 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.

BD - Brake Disengage Delay

This command only takes effect if the BO command is set to 1 or 2. After a drive is enabled this is the time value that may delay a move waiting for the brake to disengage. When beginning a move the delay value must expire before a move can take place. The delay timer begins counting down immediately after the drive is enabled and the brake output is set. The BD command sets a time in milliseconds that a move may be delayed.

Affects: All "Feed" and Jog commands.
See also: BE and BO commands

Command Structure:

BD{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Delay time
- units	seconds
- range	0 - 32.767
- default	0.2

Examples:

Command	Drive sends	Notes
BD0.2	-	Sets brake disengage delay to 200 ms
BD	BD=0.2	

BE - Brake Engage Delay

This command only takes effect if the BO command is set to 1 or 2. After a drive is commanded to be disabled, this is the time value that delays the actual disabling of the driver output. When using the digital output as a brake output (see BO command) the output is activated immediately with the disable command, then the drive the waits the delay time before turning off the driver outputs.

Affects: All "Feed" and Jog commands
See also: BD and BO commands

Command Structure:

BE{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Delay time
- units	seconds
- range	0 - 32.767
- default	0.2

Examples:

Command	Drive sends	Notes
BE0.25	-	Sets brake engage delay to 250 ms
BE	BE=0.25	

BO - Brake Output

Defines the drive's digital output as a Brake Output.

The output of an MSST-S drive can be assigned to one of four functions: alarm output, brake output, motion output, or tach output. Each of these functions must exclusively use the output, so only one function is allowed. There are two ways to define the function of this output: via ST Configurator or via SCL commands. To set the output as a brake output, use the BO command and one of the codes below.

NOTE: Setting the BO command to 1 or 2 overrides previous assignments of this output's function. Similarly, if you use the AO or MO command to set the function of the output after setting the BO command to 1 or 2, usage of the output wil be reassigned and BO wil be automaticaly set to 3.

There are three Brake Output states that can be defined with the BO command:

BO1: Output is closed (energized) when the drive is enabled, and open when the drives is disabled.
BO2: Output is open(de-energized) when the drive is enabled, and closed when the drive is disabled.
BO3: Output is not used as an Brake Output and can be used for another automatic output function or as a general purpose output.

Affects: Function of digital output
See also: AI, AO, ME, MD, MO, SI commands

Command Structure:

BO{Parameter #1 }

Details:

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

Examples:

Command	Drive sends	Notes
BO1	-	Output will be closed when drive is enabled
BO	BO= 1	

NOTE: When working with digital inputs and outputs in MSST-S drives it is important to remember the designa*tions* **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.*

BR - Baud Rate

Sets or requests the bit rate (baud) for serial communications.

At power up the drive defaults to 9600 baud. If a host system is not detected after 1 second and the drive is configured for SCL mode the drive will set the baud rate according to the value stored in the baud rate NV parameter. A host system can set the baud rate at anytime using this command.

NOTE: Setting the value takes effect immediately.

Affects: Serial communications with the host
See also: TD, PR commands

Command Structure:

BR{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Baud rate (see above)
- units	integer code
- range	1 = 9600 2 = 19200 3 = 38400 4 = 57600 5 = 115200
- default	1

Examples:

Command	Drive sends	Notes
BR2	-	Baud rate is immediately set to 19200 bps
BR	BR=2	

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
Register Access	None
Units	Empty command spaces in buffer

Examples:

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

CC - Change Current

Sets or requests the current setting of drive.

Affects: All "Feed" commands, CJ, SH, WI (jogging) and Torque Mode
See also: PC command

Command Structure:

CC{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"N" (030)
Parameter #1	Motor current
- units	amps
- range	0 - 5.0 (MSST5-S) 0 - 10.0 (MMST10-S)

Examples:

Command	Drive sends	Notes
CC4.50	-	Set current to 4.5 amps
CC	CC=4.5	

CD - Idle Current Delay Time

Sets or requests the amount of time the drive will delay before transitioning from full current (CC) to idle cur-rent (CI). This transition is made after a step motor takes the final step of a move. Operating in any form of pulse & direction mode the drive will reset the idle current delay timer each time a step pulse is received by the drive.

Command Structure:

CD{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Delay time
- units	seconds
- range	0 - 32.767
- default	0.4

Examples:

Command	Drive sends	Notes
CD0.2	-	Idle current delay time set to 200 milliseconds
CD	CD=0.2	

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

CF - Anti-Resonance Filter Frequency

Sets or requests the anti-resonance filter frequency setting. This setting is in Hz and works in conjunction with the anti-resonance filter gain setting (CG) to cancel instabilities due to mid-band resonance.

NOTE: We strongly suggest using ST Configurator *to set this value by entering as accurate a load inertia value as possible in the motor settings window.*

Affects: Mid-range performance of step motors
See also: CG command

Command Structure:

CF{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Filter frequency
- units	Hz
- range	0 - 2000
- default	241

Examples:

Command	Drive sends	Notes
CF1400	-	Set anti-resonance filter frequency to 1400 Hz
CF	CF=1400	

CG - Anti-Resonance Filter Gain

Sets or requests the anti-resonance filter gain setting. This setting works in conjunction with the anti-resonance filter frequency setting (CF) to cancel instabilities due to mid-band resonance.

NOTE: We strongly suggest using ST Configurator to set this value by entering as accurate a load inertia value as possible in the motor settings window.

Affects: Mid-range performance of step motors
See also: CF command

Command Structure:

CG{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Filter gain
- units	integer number
- range	0 - 32767
- default	12000

Examples:

Command	Drive sends	Notes
CG800	-	Set anti-resonance filter gain to 800
CG	CG=800	

CI - Change Idle Current

Idle current is the level of current supplied to each motor phase when the motor is not moving. Using an idle current level lower than the running motor current level (see CC command) aids in motor cooling. A common level used for the idle current setting is 50% of the running current. After a motor move, there is a time delay after the motor takes its last step before the reduction to the idle current level takes place. This delay is set by the CD command.

Affects: Motor current at standstill
See also: CC, PI, CD

Command Structure:

CI{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	"O" (031)
Parameter #1	Current
- units	Amps
- range	0 - 5.0 (MSST5-S) 0 - 10.0 (MSST10-S)

Examples:

Command	Drive Sends	Notes
CI2	-	Set idle current to 2 amps
CI	CI=2	

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 be ware 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
Register Access	None

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. Feed commands and Jog command automatically set the proper control mode before execution. For more automated setup of command modes use ST Configurator software.

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
Non-Volatile	YES
Register Access	None
Parameter #1	Control mode
- units	integer code
- range	7 - Step & Direction 11 - Analog velocity 12 to 18 - (see below) 21 - Point-to-Point 22 - Analog Position
- default	21

Command Modes 12 to 18:

NOTE: It is recommended to use ST Configurator software for setting up velocity mode operation.

12 - Analog velocity mode with STEP input as run/stop input
13 - Analog velocity mode with EN input as speed change input
14 - Analog velocity mode with STEP input as run/stop input and EN input as speed change input
15 - Velocity mode (JS for speed)
16 - Velocity mode (JS for speed) with STEP input as run/stop input
17 - Velocity mode (JS for speed) with EN input as speed change input
18 - Velocity mode (JS for speed) with STEP input as run/stop input and EN input as speed change input

Examples:

Command	Drive sends	Notes
CM7	-	Set 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
Non-Volatile	NO
Register Access	"J" (026)
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, ST, and SK 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

DA - Define Address

Sets the drive address of your MSST-S drive. Since MSST-S drives only work in point-to-point RS-232 comunication schemes, the drive address does not normally need to be changed from the default of "1".

See also: PR command

Command Structure:

DA{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	RS-485 network address
- units	character
- range	Valid address character are: ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < > ?
- default	1

Examples:

Command	Drive sends	Notes
DA2	-	Set drive address to"2"
DA	DA=2	
SA	-	Saves new drive address in NV memory

Saves new drive address in NV memory

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

Command Structure:

DC{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
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, FD, FE, FL, FM, FS, FP, FY, SH Commands
See also: AC, AM, DE, DI, VE Commands

Command Structure:

DE{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"B" (018)
Parameter #1	Deceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)
- default	100

Examples:

Command	Drive sends	Notes
DE125	-	Set deceleration rate to 125 rev/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 "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	20000

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 ST Configurator software, or with the DL command. DL takes no effect if the drive is set in Command Mode (CM) 7, 11, 12, 13, 14, 15, 16, 17 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, 11, 12, 13, 14, 15, 16, 17 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, 11, 12, 13, 14, 15, 16, 17, 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 MSST-S 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. In most applications the step resolution will be set by the ST Configurator software and then left alone. However, some applications may require frequently changing this setting. For example, it is common to change the EG command when using the Follow Encoder (FE) command. In this case the EG command sets the following resolution of the motor to the master encoder. To change the following resolution EG should be set before executing the FE command. Also, it is possible to change the following resolution dynamically by changing the value of the "R" register. This is done with the RL command.

NOTE: The EG command is always twice the "R" register value. In other words, if you set EG to 10000, the value of the "R" register will be 5000.

NOTE: The values and ranges shown for the EG command and the "R" register assume 1.8 degree step motors are being used.

Affects: Control Mode 7, Follow Encoder (FE) and Hand Wheel (HW) commands
See also: "R" register, CM, FE, HW, and RL commands

Command Structure:

EG{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"R" (034)
Parameter #1	Step resolution
- units	steps/rev
- range	200 - 51200 (in increments of 2)
- default	20000

Examples:

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

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 wil result.

See also: VC and DC commands

Command Structure:

FC

Details:

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

Examples:

Command	Drive sends	Notes
D150000	-	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

FD - Feed to Double Sensor

Accelerates the motor at rate AC to speed VE. When the first sensor is reached (first input condition is made), the motor decelerates (at rate DE) to speed VC. When the second sensor is reached (second input condition is made), the motor decelerates to a stop at rate DE. The sign of the DI register is used to determine the direction. Both analog and digital inputs can be used in this command.

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

Command Structure:

FD(Parameter #1)(Parameter #2)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	1st Input number, 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
Parameter #2	2nd Input number, 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

Examples:

Command	Drive sends	Notes
AC50	-	Set accel rate to 50 rev/sec/sec
DE50	-	Set decel rate to 50 rev/sec/sec
DI-1	-	Set move direction to CCW
VE5	-	Set initial velocity to 5 rev/sec
VC1	-	Set change velocity to 1 rev/sec
FD1F2H	-	Launch Feed to Double Sensor move: decal from VE to VC when input 1 changes from high to low(falling), then decel to a stop when input 2 is high

NOTE: When working with digital inputs and outputs in MSST-S 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 MSST-S drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designates an analog value greater than the value set by the AT command

FE - Follow Encoder

Puts drive in encoder following mode until the given digital or analog input condition is met. The master encoder channels A and B must be wired to the STEP and DIR inputs. Use the EG command before the FE command to set the following resolution, or use the "R" register to dynamically adjust the following resolution while following. When the FE command is initiated, the acceleration rate AC is used to ramp the motor up to the following speed. Doing this prevents extreme accelerations when the master encoder signal is already at its target velocity. Furthermore, the motor will follow the master encoder pulses in both direction, CW and CCW. However, once the input condition to stop is met, the motor will only stop properly if moving in the direction set by the DI command. This command also works like the Feed to Sensor (FS) command in that it uses the DI register value to go the DI distance after the input condition triggers the stop. When done executing the drive returns to the mode it was in before executing the FE command.

NOTE: You must use ST Configurator to set up the STEP and DIR inputs for encoder following. Do this by choosing A/B Quadrature in the Pulse & Direction Motion mode.

NOTE: Take care when changing the "R" register while following because some move parameters wil be scaled as well and therefore the move may change unexpectedly.

See also: EG command and "R" register; see AT command for using AIN as sensor input

Command Structure:

FE(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: 3 = EN, 4 = AIN letter: L = low, H = high, F = falling edge, R = rising edge

Examples:

Command	Drive sends	Notes
AC500	-	Limit acceleration in encoder following to 500 rev/sec/sec
DI8000	-	Set the stopping offset distance to 8000 steps
FE3L	-	Run in encoder following mode until the EN input is low

NOTE: When working with digital inputs and outputs in MSST-S 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 MSST-S drive (AIN terminal), "L" designates an analog value lower than the value set by the AT command. Similarly "H" designates an analog value greater than the value set by the AT command.

FI- Filter Input

Applies a digital filter to a given input. The digital input must be at the same level for the time period specified by the FI command before the input state is updated. For example, if the time value is set to 100 the input must remain high for 100 processor cycles (one cycle = 250 usec) before high is updated as the input state. A filter value of 100 equals 25 msec. A filter value of "0" disables the filter. This command can be used to apply filters to inputs STEP, DIR, and EN

Affects: All commands using inputs
See also: WI, FE, FD, FM, FS, and FY commands

Command Structure:

FI(Parameter #1){Parameter #2}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	NO
Register Access	None
Parameter #1	Input
- units	integer
- range	1 = STEP, 2 = DIR, 3 = EN
Parameter #2	Filter value
- units	processor cycles
- range	0 - 32767 (0 disables the filter)

Examples:

Command	Drive sends	Notes
FI1100	-	Requires that STEP input maintain the same state(low or high) for 25 milliseconds before the drive registers that state
FI1	FI1=100	

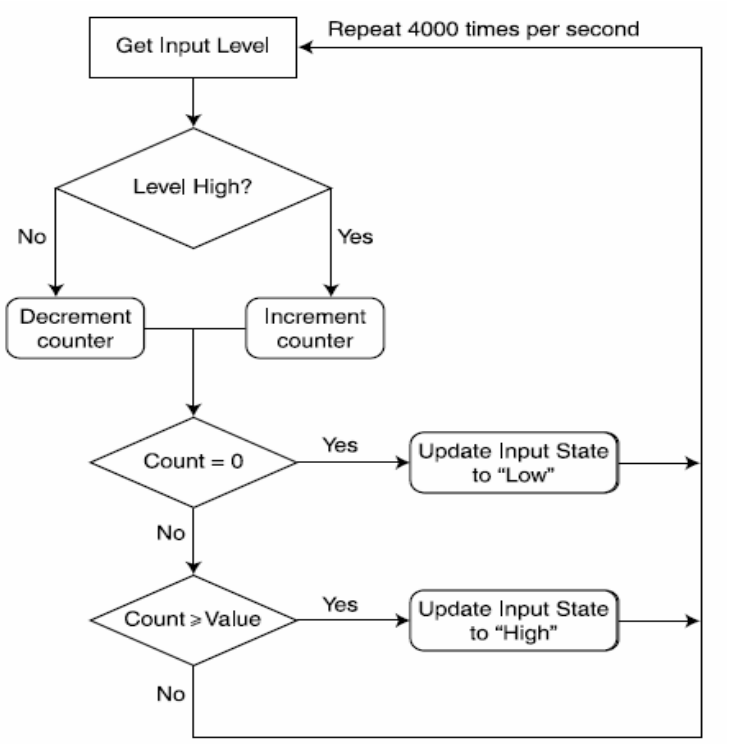
Digital Input Filters in Detail

The MSST-S drives have the capability to apply digital filters to selected digital inputs. With factory defaults, digital inputs are not filtered through any means other than the natural response time of the optical couplers used in the input circuits. Analog filtering has purposely not been implemented so as not to restrict the input circuit. However, digital filtering is available on select digital inputs to enhance the usage of those inputs.

On occasion, electrical noise at digital inputs may create a false trigger or even a double-trigger. This can often happen when using mechanical switches that "bounce" when activated or de-activated. For this reason there may be a need to filter an input to eliminate the effects of these noise conditions. Digital filtering gives the greatest flexibility by allowing the user to select the amount of filtering required to eliminate the effects of noise or bounce.

The digital filters implemented in MSST-S drives work by continuously monitoring the level of the inputs to which filters have been applied using the FI command. During each processor cycle (every

250 microseconds), internal counters associated with the filters are incremented or decremented depending on whether each input is high (open) or low (closed), respectively. When a command that accesses a digital input is executed, the state of the input requested by that command will be updated only after the internal counter for that input's filter reaches a threshold value. This threshold value is also known as the filter value, and is set by the FI command. The flow chart to the right shows how a digital filter works.



For example, if we apply a digital filter of 2 milliseconds to the EN input, it means we'd like the level of the EN input (low or high) to be true for 2 milliseconds before the processor updates the state of the EN input to the state requested by the command currently being executed. If the command being executed is a WI3L command, which literally means "wait for input 3 (EN input) low", it means the processor will wait until the level of the EN input has been low for 2 milliseconds before updating the state of the input as low and finishing the WI3L command. If by chance the EN input has been low for the prerequisite 2 milliseconds when the WI3L command is initiated, there will be no delay in executing the command. On the other hand, if the EN input is high when the WI3L command is initiated, there will be an additional minimum delay of 2 milliseconds after the input changes state from high to low. To turn filtering of the EN input on we need to use the FI command. The FI command works in processor cycles, so a value of 1 equals 250 microseconds. To filter the EN input for 2 milliseconds the value of the FI command would then be 2 msec divided by 250 usec, or 8. The correct syntax for the FI command would then be "FI38".

As can be seen from the example and flow chart above, the functioning of a digital input filter incorporates an averaging effect on the level of the input. This means that in the example above, if the level of the EN input were fluctuating between low and high over a range of processor cycles (maybe due to electrical noise), the drive would not update the input state until the internal counter value went to zero (for a low state) or the filter value (for a high state). Another example of this averaging effect is if the input were connected to a pulse train from a signal generator with a duty cycle of 51% high and 49% low. The input state would eventually be set to a high state, depending on the time value used in the pulse train. A side effect of the digital filter, which is true of any filter, is to cause a lag in the response to an input level. When an input changes state and is solid (no noise), the lag time will be the same as the filter value. When noise is present the lag may be longer.

On the MSST-S drives, each of the three digital inputs, STEP, DIR and EN, can be filtered using the FI command. Filter values are volatile, meaning that they are lost at power-down of a drive. Therefore filter values must be set each time the drive is powered on.

NOTE: When working with digital inputs and outputs in MSST-S 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.*

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 al-lows 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
Register Access	None
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 CW 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 MSST-S 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 MSST-S drive (AIN terminal), "L" designates an analog value *lower than the value set by the AT command. Similarly "H" designates 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 AO, BO, and MO commands.

See Also: DC, AO, BO, MO commands

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 MSST-S 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
Register Access	None
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 velocitv to 5 rev/sec
D180000	-	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.

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

See also: FD, 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
Register Access	None
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 MSST-S 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 MSST-S drive (AIN terminal),"L" designates an analog value lower than the value set by the AT command. Similarly "H" designates 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, but monitors a predefined safety distance. If sensor is not found before distance reaches the safety distance DC, the motor is stopped and the drive sends the host an exclamation point ("!"). 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 required 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, FD, 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/sec
DE50	-	Set decel rate to 100 rev/sec/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 MSST-S 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 MSST-S drive (AIN terminal),"L" designates an analog value *lower than the value set by the AT command. Similarly "H" designates an analog value greater than the value set by the AT command.*

HG - 4th Harmonic Filter Gain

Sets or requests the 4th harmonic filter gain setting. This setting works in conjunction with the 4th harmonic filter phase setting (HP) to reduce low-speed torque ripple in step motors.

NOTE: We strongly suggest you set this value in the ST Configurator software application only.

Affects: Low-speed performance of step motors
See also: HP command

Command Structure:

HG{Parameter #1 }

Details:

Command Type	IMMEDIATE
Usage	READ/WRITE
Non-Volatile	YES only when set in Configurator software, otherwise NO
Register Access	None
Parameter #1	Filter gain
- units	integer number
- range	0 - 32767

Example:

Command	Drive sends	Notes
HG8000	-	Set filter gain value to 8000
HG	HG=8000	

HP - 4th Harmonic Filter Phase

Sets or requests the 4th harmonic filter phase setting. This setting works in conjunction with the 4th harmonic filter gain setting (HG) to reduce low-speed torque ripple in step motors.

NOTE: We strongly suggest you set this value in the ST Configurator software application only.

Affects: Low-speed performance of step motors
See also: HG command

Command Structure:

HP{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES only when set in Configurator software, otherwise NO
Register Access	None
Parameter #1	Filter phase
- units	integer number
- range	-255 to +255

Examples:

Command	Drive sends	Notes
HG1 05	-	Set 4th harmonic filter gain to 105
HG	HG=105	

HW - Hand Wheel

Puts drive in "hand wheel" mode until the given digital or analog input condition is met. Hand wheel mode is a kind of low speed following mode, where the motor follows master encoder signals as a hand wheel is manually turned. This command differs from the FE command in that the AC, DE, and DI commands are not used in any way. In other words, the motor will attempt to follow the master encoder signals without injecting any ramps to smoothly approach high frequency target speeds or to come to a stop when the stop input condition is met. In this mode inputs STEP and DIR are used for connecting the A and B signals of the encoder-based hand wheel. The EG (Electronic Gearing) command defines the following resolution of the step motor.

See also: EG and FE commands; see AT command for using AIN as sensor input

Command Structure:

HW(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: 3 = EN letter: L = low, H = high, F = falling edge, R = rising edge

Examples:

Command	Drive sends	Notes
HW3L	-	Run in hand wheel mode until EN input is low

NOTE: When working with digital inputs and outputs in MSST-S 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 MSST-S drive (AIN terminal),"L" designates an analog value lower than the value set by the AT command. Similarly "H" designates an analog value greater than the value set by the AT command.

IA - Immediate Analog

Requests present analog input value. There are two different analog values that can be accessed. With no parameter the IA command returns the "analog command" value which is derived from the analog input with gain and offset values applied as set in *ST Configurator* or via the AD, AV and/or AZ commands. When a parameter is given the "raw" (unscaled) analog input value can be returned. Immediate Analog (IA) = Voltage at AIN - Analog Offset Value (AV, AZ).

See Also: AD, AV, and AZ commands

Command Structure:

IA{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	"a" (049) Analog command "j" (058) Analog input (raw AD counts)
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
IA1	IA=4.99	range 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.

IC - Immediate Current

Requests present commanded current.

See also: CC and CI commands

Command Structure:

IC

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	"c" (051)
Units	0.01 amps

Examples:

Command	Drive sends	Notes
With IF=H...		
IC	IC=015E	3.5 amps
IC	IC=FEA2	-3.5 amps
With IF=D...		
IC	IC=350	3.5 amps
IC	IC=-350	-3.5 amps

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=1 0000	10000 counts into CW move
ID	ID=-1 0000	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: Immediate Commands IA, IC, ID, IP, IT, IU and IV

Command Structure:

IF{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	READ/WRITE
Non-Volatile	NO
Register Access	None
Parameter #1	Return format
- units	letter
- range	H (hexadecimal) or D (decimal)
- default	H

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=1 0000	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
Register Access	None
Parameter #1	Output number
- units	integer
- range	1

Examples:

Command	Drives 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 ST-S 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 low (closed) 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
Register Access	None
Parameter #1	Output number
- units	integer
- range	1

Examples:

Command	Drive sends	Notes
I L1	-	Output set low immediately

NOTE: When working with digital inputs and outputs in MSST-S 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 MSST-S 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
Non-Volatile	NO
Register Access	None
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 MSST-S 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
Register Access	None
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=-1 0000	Absolute position is -10000 steps

IS - Input Status

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

Command Structure:

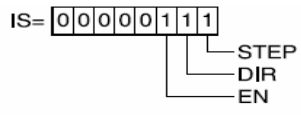
IS

Details:

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

Examples:

Command	Drive sends	Notes
IS	IS=00000000	All 3 inputs are closed
IS	IS=00000 111	All 3 inputs are open
IS	IS=00000001	STEP input is open, DIR and EN inputs are closed
IS	IS=00000 101	STEP and EN inputs are open, DIR input is closed



NOTE: When working with digital inputs and outputs in MSST-S 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.

IT - Immediate Temperature

Requests present value of the temperature sensor on the drive. The temperature reads out in 0.1 degrees Centigrade resolution. The drive will fault when the temperature reaches a specified maximum value. (See hardware manuals for details).

Command Structure:

IT

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	"t" (068)
Units	0.1 deg C

Examples:

Command	Drive sends	Notes
IT	IT=275	Drive temperature is 27.5 C。
IT	IT=310	Drive temperature is 31.0 C。

IU - Immediate Voltage

Requests present value of the DC bus voltage. The voltage reads out in 0.1 volts resolution. The drive will fault when the DC bus voltage reaches a specified maximum value. An Alarm will be set when the DC Bus voltage is less then a minimum value. (See user manuals for details).

Command Structure:

IU

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	"u" (069)
Units	0.1 Volts DC

Examples:

Command	Drive sends	Notes
With IF=H…		
IU	IU=01E2	DC supply voltage is 48.2 Volts
With IF=D…		
IU	IU=482	DC supply voltage is 48.2 Volts

IV - Immediate Velocity

Requests present velocity of the motor in rpm.

Command Structure:

IV(Parameter #1)

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	"w" (071)Target velocity
Parameter # 1	Velocity selector
-units	integer
-range	1 = target velocity

Examples:

Command	Drive sends	Notes
IV1	IV=1000	Motor is running at 1000 rpm

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: JL, JE, JD, JS, CS, CJ, SJ

Command Structure:

JA{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"K" (027)
Parameter #1	Jog acceleration value
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)
- default	100

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 Modes (CM) 13, 14, 17, and 18.

Affects: Velocity (oscillator) mode

See also: AD, AG, and CM commands

Command Structure:

JC{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
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
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

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, 11, 12, 13, 14, 15, 16, 17 or 18, because these modes predefine these inputs and take precedence over the JE command. Also, setting the DL command (to 1 or 2) after setting the JE command reassigns the STEP and DIR inputs as end-of-travel limit inputs and turns off jogging functionality. In other words, the JE and DL commands, as well as Command Modes (CM) 7, 11, 12, 13, 14, 15, 16, 17 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 and DL from using the inputs. JE and DL exclude each other by overwriting the usage of the STEP and DIR inputs.

To enable jogging with the STEP and DIR inputs simply execute the JE command with CM=21 or CM=22.

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

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: JA, JE, JS, CS, CM, and SJ commands

Command Structure:

JL{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Jog deceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 - 5461.167 rps/s (resolution is 0.167 rps/s)
- default	100

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, CM, and JE commands

Command Structure:

JS{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	"J" (026)
Parameter #1	Jog speed
- units	rev/sec (rps)
- range	0.0042 - 133.3333 (resolution is 0.0042 rps)
- default	10

Examples:

Command	Drive sends	Notes
JS10.35	-	Sets 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 Motion commands
See also: BD, BO, and ME commands

Command Structure:

MD

Details:

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

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. Enabling the motor also deactivates the output when set to function as a Brake Output (BO command). Also, enabling of the motor is delayed by the BE (Brake Engage) time delay when the output is set to function as a Brake Output.

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 motion commands

See also: BE, BO, and MD commands

Command Structure:

ME

Details:

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

Examples:

Command	Drive sends	Notes
ME	-	Motor current is restored
ME	&	Motor current is NOT restored: check Servo Enable input Proper state

MN - Model Number

Requests the drive's Model Number. Drive returns a single character that is a code for the model number.

NOTE: Unlike most other commands that request data back from the drive, where the drive will send the original Command Code with an "=" and then a value, the drive's response to the MN command is a single character code (see below).

Command Structure:

MN

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None
Units	character code
Range	D = MSST5-S E = MSST10-S

Examples:

Command	Drive sends	Notes
MN	MN=E	Connected drive is an MSST10-S

MO - Motion Output

Defines the drive's digital output as a Motion Output.

The output of an MSST-S drive can be assigned to one of four functions: alarm output, brake output, motion output, or tach output. Each of these functions must exclusively use the output, so only one function is allowed. There are two ways to define the function of this output: via *ST Configurator* or via SCL commands. To set the output as a motion output, use the MO command and one of the codes below.

NOTE: Setting the MO command to 1 or 2 overrides previous assignments of this output's function. Similarly, if you use the AO or BO command to set the function of the output after setting the MO command to 1 or 2, usage of the output will be reassigned and MO will be automatically set to 3.

There are four Motion Output states that can be defined with the MO command:

MO1: Output is closed (energized) when motor is not moving.
MO2: Output is open (de-energized) when motor is not moving.
MO3: Output is not used as a Motion Output and can be used for another automatic output function or as a general purpose output.
MO4: Output is used as a Tach Output. Use ST Configurator to set the resolution of the Tach Output function.

Affects: Function of digital output
See also: AO and BO commands

Command Structure:

MO{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	Yes
Register Access	None
Parameter #1	Condition code
- units	integer
- range	1, 2, 3, or 4 (see above)
- default	3

Examples:

Command	Drive sends	Notes
MO1	-	Output will be closed when motor is not moving
MO	MO=1	

NOTE: When working with digital inputs and outputs in MSST-S drives it is important to remember the designa - tions **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.*

PB - Power-up Baud Rate

Sets or requests the power-up baud rate for RS-232 serial communications. When executed, this command sets the baud rate and immediately saves it to non-volatile memory.

At power-up the drive defaults to 9600 baud. If a host system is not detected after 1 second and the drive is configured for host operation the drive will set the baud rate according to the value stored in the power-up baud rate non-volatile parameter. A host system can change the baud rate at any time.

NOTE: Setting the baud rate takes effect immediately.

See also: BR, PR, and TD commands

Command Structure:

PB{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Baud rate code
- units	integer code
- range	1 - 9600 2 - 19200 3 - 38400 4 - 57600 5 - 115200
- default	1

Examples:

Command	Drive sends	Notes
PB2	-	Power–up baud rate is set to 19200 and this value is saved to non-volatile memory
PB	PB=2	

PC - Power-up Current

Sets or requests the current setting of the drive. This command differs from the CC command in that the PC setting is saved to non-volatile memory as the command is executed.

Affects: Motor current, motor torque

See also: CC and PI commands

Command Structure:

PC{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Power-up current setting
- units	Amps (resolution is 0.01 Amps)
- range	0 - 5.0 (MSST5-S*) 0 - 10.0 (MSST1 0-S*)

*Current settings in MSST drives depend on the selected motor. Use *ST Configurator* software to select a motor and set the maximum and idle current settings

Examples:

Command	Drive sends	Notes
PC3.2	-	Set power-up current to 3.2 Amps
PC	PC3.2	

PI- Power-up Idle Current

Idle current is the level of current supplied to each motor phase when the motor is not moving. Using an idle current level lower than the running motor current (see CC and PC commands) aids in motor cooling. A common level used for the idle current setting is 50% of the running current. After a motor move, there is a time delay after the motor takes its last step before the reduction to the idle current takes place. This delay is set by the CD command. The PI command differs from the CI command in that when used, the level set by the PI command is immediately stored in non-volatile memory. For the level set by the CI command to be saved to non-volatile memory, an SA command must be issued after the CI command.

Affects: Motor current at standstill, holding torque
See also: CD, CI and PC commands

Command Structure:

PI{Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Idle current at power-up
- units	0.01 Amps
- range	0 - 5.0 (MSST5-S*) 0 - 10.0 (MSST10-S*)

*Current settings in MSST drives depend on the selected motor. Use *ST Configurator* software to select a motor and set the maximum and idle current settings.

Examples:

Command	Drive sends	Notes
PI.75	-	Set and save idle current at 0.75 amps
PI	PI=0.75	

PM - Power-up Mode

Sets or requests the power-up mode of the drive. PM determines how the drive is configured for serial communications at power-up. For SCL applications set PM=2 or PM=5.

Affects: Serial communications

See also: CM command

Command Structure:

PM {Parameter #1 }

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Power on mode
- units	integer code
- range	2 - SCL / Host command (drive enabled) 3 - ST Configurator only 4 - MisNet Hub 5 - SCL / Host command (drive disabled)

Examples:

Command	Drive sends	Notes
PM2	-	Drive will power up in SCL mode
PM	PM=2	

PR - Protocol

Sets or requests the serial communication protocol settings. There are a number of settings that can be turned on or off in the PR command. Each setting is assigned a bit in a 6-bit binary word. The parameter of the PR command is the decimal equivalent of this word. If you send the PR command without a parameter the drive will respond with the decimal equivalent of the word as well. The different protocol settings and their bit assignments are shown below.

Affects: RS-232 Serial Communications
See also: BR and PB commands

Command Structure:

PR {Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	None
Parameter #1	Protocol code
- units	decimal value of binary word
- range	1 - 63 (000001 - 111111) bit 0* - default ("Standard SCL") bit 1 - Always use Address Character bit 2 - Ack/Nack bit 3 - Checksum (RESERVED) bit 4 - RS-485 Adaptor (not available in MSST-S drives)
- default	5

*Bit 0 is only required when all other bits are set to 0. If any other bit in the word is set to 1, Bit 0 is ignored. In other words, PR4 and PR5 provide the same protocol settings.

Examples:

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

The PR Command in Detail

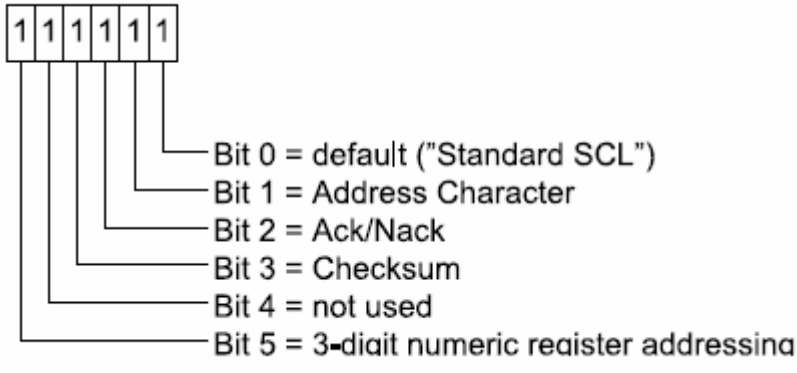
Because of the detailed nature of serial communications required in host mode applications, you are allowed to adjust a drive's serial communications protocol to best fit your application. Adjusting a drive's serial communications protocol is done using the PR command.

NOTE: We suggest turning Protocol settings ON or OFF using the SCL Configuration window of the ST

Configurator software application. This window offers the same options as the PR command.

Typically the PR command is used one time when configuring a drive and saved as part of the startup parameters (use SA command to save startup parameters). However, it can be changed at any time to dynamically alter the serial communications.

The PR command works by sending the decimal equivalent of a 6-bit binary "word". Each bit in the word represents a different setting of the serial communications protocol. These settings are additive, meaning when you set a bit to "1", or turn it ON, you are adding the functionality of that setting to the serial protocol. Think of this 6-bit word as a bank of 6 dip switches. You can turn each dip switch on or off, and in doing so add or subtract a particular setting from the overall protocol.



The diagram to the right shows the assignments of each of the 6 bits in the protocol word. Remember that when you use the PR command the parameter that you send along with the command code (PR) is the decimal equivalent of this binary word. Below are the details of each of the bits and the settings they are assigned to.

Bit 0 - default ("Standard SCL")

The PR command cannot equal 0 so if no other settings are to be turned ON Bit 0 must be set to "1". For this reason this bit is considered the default or "Standard SCL" bit. If any other settings in the protocol are turned ON this bit is ignored. In other words, PR4 (Ack/Nack turned ON) is the same as PR5 (Ack/Nack and Bit 0 turned ON). Below are some examples of command and response packets when PR=1. In this scenario, when commands that do not request returned data are received by the drive, no other response is sent from the drive. In other words, the drive will only send a response to commands that require a response.

Send data Examples:

Command	Drive Sends	Notes
DI8000	-	Set distance to 8000 steps
1DI8000	-	Drive with address "1" set distance to 8000 steps

Request data Examples:

Command	Drive Sends	Notes
DI	DI=8000	Distance request
1DI	1DI=8000	Distance request from drive with address "1"

Bit 1 - Address Character (always send address character)

With this option set (Bit 1=1, PR=2) a drive's address character will always be included in the response packet along with any requested data.

Send data Examples:

Command	Drive Sends	Notes
VE50	-	Set velocity to 50 rps
1VE50	-	Drive with address "1" set velocity to 50 rps

Request data Examples:

Command	Drive Sends	Notes
VE	1VE=50	Drive responds with address "1" and velocity to velocity request
1VE	1VE=50	Drive responds with address "1" and velocity to velocity request from drive at address "1"

Bit 2 - Ack/Nack (always send acknowledge character)

This option causes the drive to acknowledge every transmission from a host, whether the command is requesting data or not. If a host requests data (for example a DI command with no parameter), the response is considered the acknowledgement. However, if the host sends commands that do not request data from the drive, the drive will still respond with one of the following characters:

"%" - The "percent" character is a Normal Acknowledge (Ack) character that means the drive accepted the command and executed it.

"*" - The "asterisk" character is an Exception Acknowledge (Ack) character that means the drive accepted the command and buffered it into the queue. Depending on the status of the queue, execution of the exception acknowledged command(s) can occur at any time after the acknowledge.

"?" - The "question mark" character is a Negative Acknowledge (Nack) character that means a parsing error occurred while the drive was receiving the command. A second character may follow the question mark, which provides an error code describing the type of parsing error. Here is the list of error codes:

Negative Acknowledge Codes

1 = Command timed out
2 = Parameter is too long
3 = Too few parameters
4 = Too many parameters
5 = Parameter out of range
6 = Command buffer (queue) full
7 = Cannot process command
8 = Program running
9 = Bad password
10 = Comm port error
11 = Bad character

Acknowledge characters are always sent out of the RS-232 port. When operating on a 2-wire or 4-wire RS-485 network, the acknowledge characters are sent out under the following conditions:

1. An acknowledge character is sent when the received command has an address character at the beginning.
2. An acknowledge character is NOT sent when global commands (commands without addresses) that do not request data from the drive are used.
3. Global commands that request data will cause data to be returned from the drive(s). This can cause data collisions if there are more than one drive on a network. NOTE: Always use addresses with commands in multi-drop networks to avoid data collisions.

NOTE: When possible avoid using Acknowledge characters (%, *, ?) as drive addresses in multi-drop networks to prevent confusion.

Good command Examples:

Command	Drive sends	Notes
DI8000	%	Drive sends normal Ack (over RS-232 port only) in response to global set distance to 8000

1DI8000	1%	Drive at address "1" sends normal Ack (over both ports) in response to address-specific set distance to 8000

Bad command Examples:

Command	Drive sends	Notes
VE200	?5	Drive sends normal Nack (over RS-232 port only) in response to global set velocity to 200 rps; error code 5 is sent because parameter "200" is out of range
1VE200	1?5	Drive at address "1" sends Nack (over both ports) and error code in response to address-specific set velocity to 200 rps

Buffered command Examples:

Command	Drive sends	Notes
AC10	*	Drive sends Exception Ack(over RS-232 port only) in response to global set acceleration to 10 rps/s
1AC10	1*	Drive at address "1" sends Exception Ack and address (over both ports) in response to address-specific set acceleration

Bit 3 - Checksum (use 8-bit checksum)

Not implemented at this time. Call factory for schedule.

Bit 4- not used with MSST-S drives

Bit 5 - 3-digit numeric register addressing

Each data register in a drive is normally accessed using its single letter, number, or other ascii character. With Bit 5 set (Bit 5=1, PR=32), each of the data registers is instead accessed with a 3-digit number: 000 to 074. (See the Data Register section for character and 3-digit numerical assignments). The Bit 5 option implements this specific usage for the RL (Register Load IMMEDIATE) and RU (Register Upload) commands. This option was added to make the drives compatible with various HMIs.

NOTE: When data is returned from a drive (whether Bit 5 is set or not set), the data register is always represented by its single character designation.

RL Command Example:

Command	Drive sends	Notes
RL017100	-	Load register 017 ("A") with the value 100
RL017	RLA=100	Drive sends contents of acceleration register

RU Command Example:

Command	Drive sends	Notes
RU0174	RUA=100	Drive responds to register upload command by sending
	RUB=150	Contents of 4 sequential data registers, starting with
	RUC=140	register 017 ("A")
	RUD=210	

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, and 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

RE - Restart

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

See also: SA command for saving/changing non-volatile parameters

Command Structure:

RE

Details:

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

RL – Register Load (IMMEDIATE)

Sets or requests the contents of a data register. The data value is checked and stored as a Long word. When setting a Short-word register with a Long-word data value only the lower word of the Long value is used.
The RL commands is useful for dynamically changing certain drive and motion parameters. For example, while jogging the jog accel and decel rates can be changed using the "K" and "L" registers, respectively. This allows a more dynamic use of the drive's jogging functions because the JA and JL commands don't take effect if jogging has already commenced. Rather they are buffered until jogging stops, so they will take effect the next time jogging starts. Conversely, changing the "K" register during jogging takes effect immediately, and any subsequent increases in jog speed (CS for example) will use the new accel rate.

NOTE: When setting a register no pre-processing of the data value is performed. This means data sent using the RL command must be in the units used by the drive internally. In some cases the units used by the drive internally are different from the units used by the associated command. For example: jog accel rate can be changed by both the JA command and the "K" register. Units of the JA command are rev/sec/sec. Internal units of the "K" register are "dece-rpm/sec" (10 rpm/sec). In other words, JA 100 is the same as RLK600. See the Data Register section later in this manual for more details on data register assignments and units.

Affects: All data registers
See also: Section on Data Registers

Command Structure:

RL(Parameter #1){Parameter #2}

Details:

Command Type	IMMEDIATE
Usage	READ/WRITE
Non-Volatile	NO
Register Access	All data registers
Parameter #1	Data register assignment
- units	character
- range	All Read/Write and User-Defined data registers; Read-Only data registers can be read back when Parameter #2
Parameter #2	Data register value
- units	integer
- range	+/- 2147483647 (long data registers) +/- 32767 (short data registers)

Examples

Command	Drive sends	Notes
RLA150	-	Set acceleration register to 1500 rpm/sec (or 25
RLA	RLA=1 00	Return acceleration register value
JA100	-	Set jog accel rate to 100 rev/sec/sec

JS1	-	Set jog speed to 1 rev/sec
CJ	-	Commence jogging
CS2	-	Change jog speed to 2 rev/sec
RLK30	-	Set new jog accel rate to 300 rpm/sec or 5 rev/sec/sec
CS5	-	Change jog speed to 5 rev/sec
SJ	-	Stop jogging

With PR command Bit-5 turned on (PR32 or greater)…

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

Units Example:
AC10 means 10 rps/s
RLA10 means 10*10 rpm/s=1.667 rps/s
Multiply the desired rps/s value times 6 to convert to the internal acceleration register value

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
Register Access	None
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)

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=J R	Motor is jogging, drive is enabled

RU – Register Upload

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

Affects: All data registers

See also: PR and RL commands

Command Structure:

RU (Parameter #1)(Parameter #2)

Details:

Command Type	IMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	All data registers
Parameter #1	Data register assignment
- units	character
- range	all data registers
Parameter #2	Number of consecutive data registers to upload
- units	integer
- range	1 - 16

Examples:

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

With PR Command Bit-5 turned on (PR32 or greater)…

RU0175	RUA=400	"017" The Acceleration value
	RUB=400	"018" The Deceleration value
	RUC=16000	"019" The Distance Change value
	RUD=8000	"020" The Distance value
	RUE=0	"021" The Encoder value

NOTE: All data registers use internal drive units meaning, the data is not scaled to the units used by different commands. For example the velocity register ("V") will be returned as "quarter-rpm" (0.25 rpm) instead of rev/sec (like the VE command).

RV – Revision Level

Requests the drive's firmware version. Data is returned as a three digit value with no decimal point. See below for example.

Command Structure:

RV

Details:

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

Examples:

Command	Drive sends	Notes
RV	RV=150	Drive is running firmware version 1.50
RV	RV=222	Drive is running firmware version 2.22

SA – Save Parameters

Saves selected command parameters to non-volatile memory. All commands in this section 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. (See which commands are Non-Volatile in the Command Summary section earlier in this manual.)

See Also: RE command

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
Register Access	None
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 (Bit 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 (Bit 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. 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.

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 - 16000
- 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 is encountered before the home sensor condition is met, the move direction is reversed until the opposite limit is found. After the opposite limit is found the move then returns to the original direction and again attempts to find the home sensor. This always ensures that the motor is moving in the desired direction when the drive sees the home sensor.

NOTE: This command requires the use of three physical sensors or switches tied to three digital inputs of the stepper drive: a home sensor, a CW end-of travel limit, and a CCW end-of-travel limit. For this reason you should always wire the home sensor to the EN input.

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 –off travel limit switches)

NOTE: When working with digital inputs and outputs in MSST-S 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 MSST-S drive (AIN terminal),"L" designates an analog value lower than the value set by the AT command. Similarly "H" designates an analog value greater than the value set by the AT command.

SI – Enable Input (EN input)

Defines the EN input as an Enable Input.

The EN input can be assigned to only one function in an application. If you want to use the EN input as an Enable input you can define it as such in two ways, with the *ST Configurator* software, or with the SI command. SI takes no effect if the drive is set in Command Mode (CM) 13, 14, 17 or 18, because these modes use the EN input as a speed change input and take precedence over the SI command. Also, setting the AI command after setting the SI command reassigns the EN input to alarm reset usage and turns off any drive enable usage (SI3). In other words, the SI and AI commands, as well as Command Modes (CM) 13, 14, 17 and 18 each assign a usage to the EN input. Each of these must exclusively use the EN input. Command Modes are most dominant and will continually prevent SI and AI from using the input. SI and AI exclude each other by overwriting the usage of the EN input.

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

SI1: Drive is enabled when the EN input is open (de-energized).
SI2: Drive is enabled when the EN input is closed (energized).
SI3: The EN Input is not used for Enable and can be used as a general purpose input. SI will be automatically set to 3 if CM is set to 13, 14, 17, or 18, or if AI is set to 1 or 2 after the SI command is set.

See also: AI and CM commands

Command Structure:

SI{Parameter #1 }

Details:

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

Examples:

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

NOTE: When working with digital inputs and outputs in MSST-S 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.*

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, CJ, ST, SK, SM commands

Command Structure:

SJ

Details:

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

Examples:

Command	Drive sends	Notes
SJ	-	Stop 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: AM and ST commands

Command Structure:

SK{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
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: IL, IH, IO commands

Command Structure:

SO(Parameter #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Output number, Output state
- units	integer, letter
- range	integer: 1 = Output letter: L = Low, H = High

Examles:

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

NOTE: When working with digital inputs and outputs in MSST-S 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 commands

Command Structure:

SP{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	NO
Register Access	None
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 replaced 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(Parameters #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
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 decal rate to 100 rev/sec/sec
VE1	-	Set velocity to 1 rev/sec
EG10000	-	Set microstep resolution to 10000 steps
DI100000	-	Set move distance to 100000 steps
FL	-	Initiate Feed to Length move
SSdone	-	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 JA command (when jogging).

See Also: SK command

Command Structure:

ST{Parameter #1}

Details:

Command Type	IMMEDIATE
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
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
ST	-	Stop current command immediately and use the deceleration rate set by the AM command if motion is in process
STD	-	Stop current command immediately and use the deceleration rate set by the DE or JA command if motion is in process

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

See Also: BR, PB and PR commands

Command Structure:

TD{Parameter #1}

Details:

Command Type	BUFFERED
Usage	READ/WRITE
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 and FD moves.

Affects: FC, FD commands

Command Structure:

VC(Parameters #1)

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"V" (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 dccel 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 the speed for "Feed" move like FL, FP, FS, FD, SH, etc.

Affects: All "F" commands

Command Structure:

VE(Parameters #1)

Details:

Command Type	BUFFERED
Usage	READ/WRITE
Non-Volatile	YES
Register Access	"V" (038)
Parameter #1	Move velocity
- units	rev/sec (rps)
- range	0.0042 - 133.3333 (resolution is 0.0042 rev/sec)
- default	10

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 or 22, 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: FI, JE, and JD commands

Command Structure:

WI{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

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 MSST-S 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 MSST-S drive (AIN terminal),"L" designates an analog value *lower than the value set by the AT command. Similarly "H" designates an analog value greater than the value set by the AT command.*

WT – Wait Time

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

Command Structure:

WT (Parameters #1)

Details:

Command Type	BUFFERED
Usage	WRITE ONLY
Non-Volatile	NO
Register Access	None
Parameter #1	Time
- units	seconds
- range	0.00 - 320.00 (resolution is 0.01 seconds)

Examples:

Command	Drive sends	Notes
WT2.25	-	Cause 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

Data Registers

Many of the commands listed in this reference function by transferring data to a drive for later use. These values are stored in data registers within the drive and remain there until new commands change the values, or until power is removed from the drive. For example, if you send the Velocity command "VE1 0", a maximum move speed of 10 rev/sec is placed in the data register for velocity. You can then execute as many Feed to Length (FL), Feed to Position (FP) and Feed to Sensor (FS) commands as you'd like without sending another VE command: the move speed of 10 rev/sec will remain in the velocity data register until you change it or until power is removed from the drive.

In addition to the data register for velocity, there are registers for move acceleration (AC command, "A" register), deceleration (DE command, "B" register) and move distance (DI command, "D" register). There are also registers for limit sensors (DL command), motor current (CC command), motor resolution (EG command), and motor position (SP command). See the following section on Data Register Assignments for a complete listing of data registers available in your drive.

Not all commands function by transferring a data value into a register. Conversely, not all data registers are associated with a command. To access data registers that are not associated with a command, you can use a register's unique character assignment. See the Data Register Assignments on the following pages for a listing of data registers and their character assignments. When accessing a data register using its character assignment you use the RL (Register Load IMMEDIATE) or RX (Register Load BUFFERED) commands. These commands allow you to load data values into a register as well as read back the contents of a data register. For example, we set the move speed to 10 rev/sec by using the velocity command "VE1 0". You can accomplish the same thing by using the RL command and the character assignment for the velocity data register, "V". By sending "RLV2400" to the drive you set the move speed to 10 rev/sec. Wait, please read that again: send "RLV2400" to change the velocity to 10 rev/sec? Be careful of units when working directly with registers and the RL and RX commands. Data register units are often not the same as the units used by their associated commands. The VE command works in rev/sec, but the "V" register works in "deca-rpm/sec" (10 rpm/sec). This means you multiply the desired speed in rev/sec by 240 to get the same value in "deca-rpm/ sec".

There are two basic types of data registers available in MSST-S drives: Read-Only and Read/Write

Read-Only data registers

Read-Only data registers are predefined registers that contain information about drive parameters, settings, and states. These include registers for commanded current, analog input level, drive temperature, internal bus voltage, and more. You cannot transfer data values to a Read-Only data register; you can only read the contents of them (see RL and RX commands). Read-Only registers are assigned to lower-case letters.

Read/Write data registers

Read/Write data registers are predefined registers that contain drive and move parameters that can be set by the user. These parameters include acceleration rate, velocity, move distance, current setting, and more. Many of the Read/Write registers are associated with a particular command, so you can read their contents or load data into them with RL, RX, or that parameter's particular command. Read/Write registers are assigned to upper-case letters.

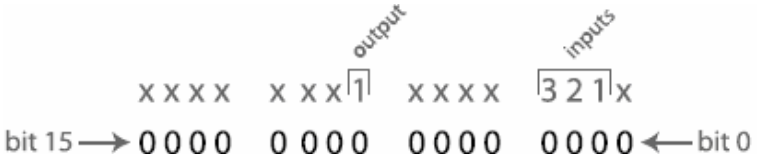
Data Registers Assignment

What follows is a listing of all the data registers available with your MSST-S drive. In the tables below,"Ch." denotes the data register's character assignment, and "Description" gives the name of the data register. The column "3-digit" denotes the register's 3-digit numeric assignment (see PR command); "Data Type" designates whether the data register is a 16-bit word (Short) or a 32-bit word (Long); "Units" shows how a data register's contents are used by the drive; and, "Default" shows the value loaded into the register at the factory. Also, some registers are followed by specific notes helpful for using them.

Read-Only data registers: a - z

Ch.	Description	3-digit	Data	Units	Default
a	Analog Command value	049	Short	32760 = +10V; -32767 = -10V	
c	Current Command	051	Short	0.01 Amps	
d	Relative Distance	052	Long	steps	
f	Alarm Code	054	Long	see Appendix B	
g	Sensor Position	055	Short	steps	
i	Driver Board Inputs	057	Short	decimal equivalent of binary bit pattern (see below)	

The "i" register contains the decimal equivalent of a 16-bit word that represents the status of the MSST-S drive's digital inputs and output. Because there are only 3 digital inputs and 1 digital output on each MSST-S drive, bits 0, 4-7, and 9-15 of the 16-bit word register are not used (will always be "0"). Only bits 1, 2, 3, and 8 are used. See the diagram below for more detail.



A closed (energized) state for an input is designated by a "0" in the "i" register, and a closed (energized) state for the output is designated by a "1" in the "i" register. In other words, if nothing is connected to the digital inputs and output of your MSST-S drive, the response to the command **RLi<cr>** will be "RLi=1 4" (0000 0000 0000 1110). As an example, if inputs 1 (STEP) and 3 (EN) are closed, input 2 (DIR) is open, and output 1 (OUT) is closed, the response of the drive to the command **RLi<cr>** will be "RLi=260".

j	Analog Input 1	058	Short	ADC counts	
l	Absolute Position	060	Short	bit pattern	
m	Control Mode	061	Short	Mode #	
n	Velocity Move State	062	Short	State # (see below)	

Drive response to **RLn**<cr> command:

WAITING	0	In Velocity mode waiting for a command
RUNNING	1	Velocity move in progress (jogging)
FAST STOPPING	2	Stopping a velocity move (SK or ST with no parameter)
STOPPING	3	Stopping a velocity move (SJ, SKD, or STD)
ENDING	4	Clean up at end of move (1 PWM cycle, 62 usec)

o	Analog Command value	063	Short	State #(see below)	

Drive response to the **RLo<cr>** command:

Description	Decimal Value	Comment
WAITING	0	In position mode waiting for command
WAITING ON BREAKE	1	Waiting for brake to release
CALCULATING	2	Doing the calculating for the move
ACCELERATING	3	Accelerating up to speed
CHANGE VELOCITY	4	Changing the speed (accel or dccel)
AT VELOCITY	5	At the desired speed
DECELERATIONG	6	Decelerating to a stop
FAST DECELERATION	7	Doing a fast deceleration (SK or ST)
POSITIONING	8	Clean up at end of move (1 PWM cycle, 62 usc)

s	Status Code	067	Short	see Appendix B	
t	Drive temperature	068	Short	0.1℃	
u	Bus Voltage	069	Short	0.1 Volts	
w	Target Velocity	071	Short	0.25 rpm	

Read/Write data registers: A - Z

Many of the Read/Write data registers are associated with a specific command. In the tables below, associated commands are shown in parentheses in the "Description" column.

***NOTE**: When using registers pay attention to units. In the case of some Read/Write registers, the units of the register when using the RL and RX command are different than when using the same register's associated command. For example, the "V" register uses units of 0.25 rpm, but its associated command, VE,uses revs/sec (rps). The reason for this difference is that all registers operate with integer math. On the other hand, when using commands it is often possible to include decimal places which allow for more user-friendly units.*

Ch.	Description	3-digit	Data Type	Units	Default
A	Acceleration (AC)	017	Short	10 rpm/sec	
B	Deceleration (DE)	018	Short	10 rpm/sec	
C	Change Distance (DC)	019	Long	steps	
D	Distance (DI)	020	Long	steps	

F	Other Flags	022	Long	bit pattern (see below)	

Drive response to **RLF<cr>** command:

Description	Hex Value	Decimal Value
DISTANCE LIMIT FLAG	0x0001	1
SENSOR FOUND FLAG	0x0002	2
HARDWARE OVERCURRENT	0x0004	4
SOFTWARE OVERCURRENT	0x0008	8
BAD CURRENT OFFSET – Ph. A	0x0010	16
BAD CURRENT OFFSET – Ph. A	0x0020	32
OPEN WINDING – Phase A	0x0040	64
OPEN WINDING – Phase B	0x0080	128

Note: Clear flags by sending **RLF0<cr>** command to the drive

H	RESERVED	024	Long		
J	Jog Velocity (JS)	026	Short	0.25 rpm	
K	Jog Acceleration (JA)	027	Short	10 rpm/sec	
L	Jog Deceleration (JL)	028	Short	10 rpm/sec	
N	Continuous Current/Change Current	030	Short	0.01 Amps	
O	Peak Current/Idle Current	031	Short	0.01 Amps	
P	Absolute Position Command	032	Long	Steps	
Q	RESERVED	033	Long		
R	Steps per Rev (EG)	034	Short	Steps/rev	
S	Actual Step Position	035	Long	Steps	
U	Change Velocity (VC)	037	Short	0.25 rpm	
V	Velocity (VE)	038	Short	0.25 rpm	
X	Analog Position Gain (AP)	040	Short	ADC counts/count	
Y	Analog threshold (AT)	041	Short	ADC counts	
Z	Analog Offset (AO)	042	Short	0.001 Volts	

Appendix A: Host Serial Communications

When an MSST-S stepper drive from MOONS' 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 MOONS' 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 MOONS' products MSST-S 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 MOONS' drive.
- COM Port Settings – UART settings and Bit Rate (Baud) settings.
- Communications Protocol
- Communication Details
- Communication Errors

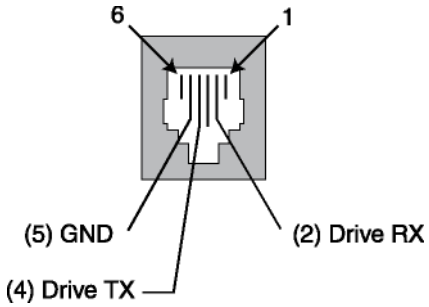
General structure of host serial communications

The MSST-S 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 MSST-S stepper drive ships with an RS-232 programming cable. This cable should be used for configuring your drive with the *ST Configurator* software, as well as for sending SCL commands from SCL Setup Utility. 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-1 1,6P4C) on MSST-S drives are shown in the diagram to the right. Pin 5 of the connector should be connected to your host's signal ground pin. Pin 4 of the connector should be connected to your host's Rx pin. And Pin 2 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 MOONS' 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. MSST-S 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. We recommend using MOONS' SCL Setup Utility instead. This utility sends out an entire command packet with the minimum delay between characters, and includes the packet's terminating character.

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 MSST-S 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 MOONS' 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 MOONS' software applications such as *Mis Programmer* and *ST Configurator.* The power-up packet is an exception to the ASCII character rule in that all the characters in the packet are binary value. 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 MSST-S 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 drive.

The power-up packet is always sent at 9600 baud, regardless of the bit rate set by the BR or PB command. If an MOONS' software application is present it will respond to the power-up packet and communications will continue at 9600 baud. If an MOONS' 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 MSST-S drive via the red and green LEDs on the drive, (see Appendix B), 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 communication errors using the AL, RS, and/or SC commands. See AL and SC commands for more details. Once the host has determined the presence of a hardware communication 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 servo system into your machine.

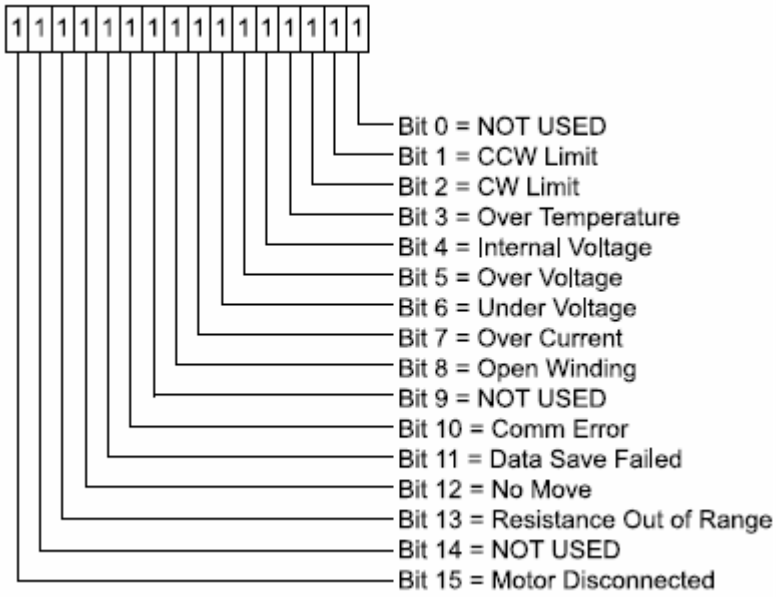
The Alarm and Status codes are hexadecimal equivalents of 16 bit binary "words". Each bit in each binary word is assigned a meaning, and therefore the responses to these two commands can actually show information about more than one alarm or status condition.

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
Motor Disconnected	15	8000



Example: The drive has hit the CW limit (Bit 2), there is an under voltage condition (Bit 6), and an encoder wiring connection has been lost resulting in an encoder fault (Bit 9). The resulting 16-bit word is 0000001001000100 - and the equivalent hexadecimal value is 0244. Therefore, when the host sends "AL", the drive will respond with "AL=244".

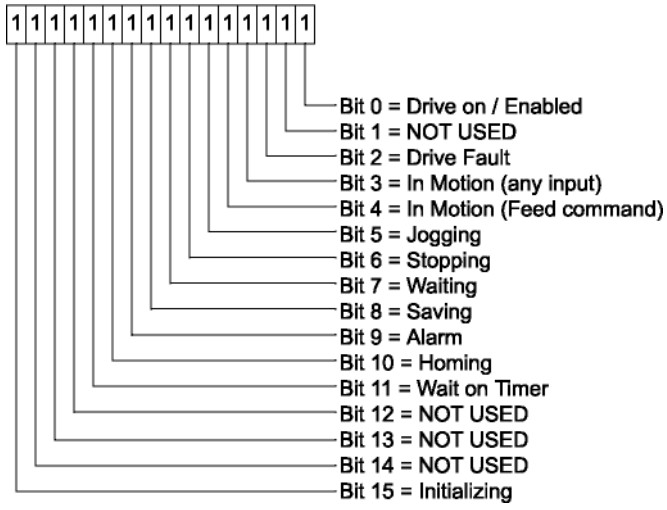
Status Code Definitions

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 MSST-S drive (which you'll definitely be doing if you're using any of the MOONS' 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 MSST-S 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 over-voltage
4	2	power supply under-voltage
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

Shanghai AMP&MOONS' Automation CO., Ltd.

NO.168 Mingjia Road, Shanghai 201107, P.R.China

Tel/86-21-52634688

Fax/86-21-52634098

E-mail/info@moons.com.cn

www.moons.com.cn

SCL Manual for MSST-S Drives