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**Getting Started**

Thank you for purchasing an MOONS’ product. We hope you will find that the performance, price and ease of use make our products the best value for your application.

The Serial Command Language (SCL) can be used to command a MOONS’ drive in real time from host such as a PC or PLC. This manual focuses on using SCL with Mis drives (MS1240MI, MS3540MI and MS7080MI) only. Using SCL with other MOONS’ drives, please visit our website www.moons.com.cn to view and download these manuals.

If your application calls for a program to be stored in the drive and executed without a host computer, then you will want to use the Mis Programmer software. There is a separate manual for that.

For information regarding your specific hardware, such as wiring and mounting, please read the hardware manual that came with that product. Of course, you can download for free from website www.moons.com.cn.

Using the SCL requires three steps:
1. You must get the drive into SCL mode (see Power Up Signature, page 6).
2. You must learn to use the SCL commands. We highly recommend using the SCL Setup Utility software (can be downloaded from website www.moons.com.cn) for steps 1 and 2.
3. Develop an application program on your host computer.

**Connecting to your PC**

- Locate your computer within 6 feet of your drive.
- Your Mis product was shipped with a black adapter plug. It has a telephone style jack at one end and a larger 9 pin connector at the other. Plug the large end into the COM1 serial port of your PC. Secure the adapter with the screws on the sides. If the COM1 port on your PC is already used by something else, you may use the COM2 port. On some PCs, COM2 will have a 25 pin connector that does not fit the black adapter plug. If this is the case, and you must use COM2, you will have to purchase a 25 to 9 pin serial adapter at your local computer store. For laptop computers without a serial port you will have to use a USB-Serial adapter.

*Never connect the Mis drives to a telephone circuit. It uses the same connectors and cords as telephones and modems, but the voltages are not compatible.*

You may also need to set the COM port in the Windows software. When the software is loaded, it looks for the first available COM port, but doesn’t always find the one you’ve plugged into.

You can choose the port yourself by clicking on one of the “COM port” option buttons. If the port exists and is not already in use, the programming software will use it to communicate with the Mis drive.

Always apply power to Mis drive after the SCL Setup Utility software is running on your PC.

**Introduction**

SCL provides a means to control Mis drives from a host PC or PLC. SCL allows the host to command the drive to perform a variety of motion and I/O tasks, and to provide the host with status information.

Individual drives can be directly connected to the serial port of a PC or PLC, or up to 8 drives can be connected to single port using the MisNetHub-8. Up to 30 drives with the Multi-drop RS485 option can be connected to one RS485 or RS422 port.

The SCL mode firmware coexists in the drive with the Mis Programmer firmware. The drive determines the proper mode of operation by detecting a host signature at power up. The Windows-based Mis Programmer software automatically supplies the necessary signature, invoking Mis Programmer mode. Please see the section “Power Up Signature” for details.
SCL requires previous programming experience and custom application software. It is intended for systems developers who have the tools and knowledge to put together an application program that sends commands over a serial port.

One thing you cannot do with SCL is writing a program to be stored in the drive. If you want to do that, use the Mis Programmer software. However, SCL provides a 128 character command buffer that allows the host to send commands ahead of time, while other commands are running.

SCL for Mis drives provides more than 30 instructions. All commands begin with two upper-case ASCII characters. 9 of the commands are the same as our Windows-based Mis language:

- Feed to Length (FL)
- Feed to Sensor (FS)
- Feed to Position (FP)
- Set Position (SP)
- Seek Home (SH)
- Wait for Input (WI)
- Wait Time (WT)
- Set Output (SO)
- Change Current (CC)

Two additional instructions implement options of the Mis Change Current instruction:

- Motor Enable (ME)
- Motor Disable (MD)

Another 4 commands are used to set up move parameters

- Accel (AC)
- Decel (DE)
- Velocity (VE)
- Distance (DI)

7 commands configure the global parameters seen on the left-hand side of the Mis Programmer screen:

- power up current (PC)
- microstep resolution (MR)
- define limits (DL)
- jog accel (JA)
- jog speed (JS)
- jog enable (JE)
- jog disable (JD)

7 commands ask the drive for status information:

- buffer status (BS)
- input status (IS)
- request status (RS)
- revision level (RV)
- immediate distance (ID)
- immediate position (IP).

Power up mode (PM) sets the drive to power up in SCL mode, or in the factory default “auto detect mode.”

Send string (SS) tells the drive to send a text string back to the host. This is useful for detecting when a prior buffered command, typically a move, has completed.

Pause (PS) suspends execution of buffered commands until the continue (CT) command is received.

Stop (ST) stops a command in mid-execution. This is useful for killing an errant move, wait time or wait input instruction, especially during the debug phase of a program.

Stop and Kill Buffer (SK) stops any buffered command and removes all other commands from the buffer.

RS485 compatible drives are equipped with a Define Address (DA) command so that each drive can be assigned a unique address.

Drives with the encoder feedback option provide four commands for defining the encoder characteristics and functionality.

### Communication Protocol

Communication between drive and host is 9600 baud, 8 data bits, one stop bit, no parity. Each command must be terminated with a carriage return (ascii 13). Drive does not echo received characters to the host. No handshaking is required. Newer firmware includes a bit rate (BR) command that allows the host to increase the communication speed.

RS232 connection is a three wire type: transmit, receive and ground. Use the cable supplied with your Mis drives.

RS485 connection is a five wire type: transmit+, transmit-, receive+, receive- and ground.

You must provide your own cabling (Category 5 style recommended). Refer to your drive’s Hardware Manual for more detail.
Power Up Signature

To invoke SCL mode, the user’s program must detect power up of the drive and supply the signature “00” within two seconds, but not sooner than 2 milliseconds. If this is inconvenient, the drive can be set to automatically wake up in SCL mode using the PM2 command. The SCL Setup Utility provides an easy way to configure the power up mode of the drives and/or hub. It also and gives the user a convenient way to try out commands and gain familiarity with SCL.

When a Mis drive is set for “auto-detect” mode, it sends three characters to the host when power is first applied. The first character is ascii(255). The second character identifies the firmware revision. The third character of the power up packet tells the host which model Mis product is connected.

Note: Before installation into a multi-drop network, RS485 drives should be powered-up individually so that individual, non-conflicting addresses can be set using the “DA” command. The power up mode should be set to “2” at that time.

Using SCL with the MisNet Hub

The MisNet Hub-8 can be used to connect up to eight Mis drives to one PC/PLC serial port. The Hub444 can connect four drives. The hub acts a “router” sending your commands to the appropriate drive and returning information that you request from each drive. The addressing scheme is simple. If you want to route a Feed to Length command to the drive on Hub Port 4, simply send the string “4FL” followed by a carriage return.

If you request the input status of the drive on port 2, send the command “2IS”. The drive will respond and the hub will add an address character so that you know which drive the response came from. A typical response might be “2IS=00000000”.

To send a command to all the drives that are connected to the hub, just omit the address (for example: FL).

The following SCL commands can also be used to control or query the hub itself. Address “0” is always used for commands that affect the hub.

0BR - This sets the bit rate of all the serial ports in the hub. 0BR1 specifies 9600 bits/second. 0BR2 indicates 19200 bps. The power up bit rate is 9600. You must do this in the correct sequence or communication will be lost. Think of your system as a pyramid: the PC is at the top. The next layer is the hub and the base of the pyramid consists of the drives that are connected to the hub. Always start at the bottom. For example:

a) Make sure that all the drives in your system have firmware version 2.10 or later. The “RV” command will report the firmware of all drives connected to the hub.
b) Send the command 1BR2. This asks drive 1 to change to 19200 bps.
c) Repeat step (b) for each drive (2BR2, 3BR2, etc)
d) Change the bit rate of the hub by sending 0BR2
e) Change the bit rate of the PC. If you are trying this with the SCL Setup Utility, which we highly recommend, there is a drop down list for setting the PC bit rate.

Don’t forget: at power down, the drive and hub change back to 9600 bps. If you send the hub the command “0BR” with no parameter, the hub will report its present bit rate, for example “0BR=1”.

Requires Hub firmware version 1.14 or later, and drive firmware 2.10 or later.

0IH (Hub444 only) - Sets one of the Hub’s four on-board outputs high (open) immediately. Your must specify which of the four outputs you want to use: 0IH1, 0IH2, 0IH3 or 0IH4.

0IL (Hub444 only) - Sets one of the Hub’s four on-board outputs low (closed) immediately. Your must specify which of the four outputs you want to use: 0IL1, 0IL2, 0IL3 or 0IL4.

0IS (Hub444 only) - requests the input status of the hub’s four inputs. Responds in the same format as a drive IS command. This is an immediate command.
0PM - sets the hub’s power up mode. 0PM1 sets the hub for auto detect mode, where it can be used as an SCL Router or with the MisNet Hub Programmer software. A command button in the SCL Setup Utility can also be used to set the power up mode.

0RV - makes the hub report its firmware version.

0SO (Hub444 only) - sets one of the hub’s four on-board outputs to a specified state (high or low). To set output 3 low, use the command “0SO3L”.

Buffered or Immediate?
There are two basic types of SCL commands: buffered and immediate. Buffered commands execute one at a time. If you send two buffered commands to the drive at the same time, like an FL and an SS, the SS command sits in a buffer and doesn’t execute until the FL is completed. Other commands, indicated as immediate in the Command Summary, are executed right away, running in parallel with a buffered command if necessary. That allows you to check the buffer status (BS), or input status (IS) while the motor is moving.

Registers
Many SCL commands transfer information to a drive for later use. This information is stored in “registers” and remains there until a new command changes it or power is removed. For example, if you send the command “VE10”, the VE register is set for a maximum move speed of 10 rev/sec. You can execute as many FL, FP or FS moves as you like without sending another VE command - the speed will remain at 10 until you change it.

In addition to the VE register, there are registers for move acceleration and deceleration (AC and DE), move distance (DI), and jog acceleration and speed (JA and JS). Besides the move parameters, there are registers for limit sensors (DL), motor current (CC), motor and encoder resolution (MR, ER), motor and encoder position (SP, EP).

Two special registers are PC (power on current) and PM (power on mode). Unlike the other registers, PC and PM retain their value even when power is removed from the drive. All other registers are “volatile”, losing their information at power down, and reverting to default values at power on.

Idle Current Reduction
Any Mis drive operating in SCL mode automatically reduces the motor current by 50% when the motor is not moving. If you need an idle current value other than 50%, you will need to use CC command before and after each move to “manually” set the current. To completely power down the motor, use the MD command.
# Command Summary

<table>
<thead>
<tr>
<th>command</th>
<th>description</th>
<th>write only</th>
<th>read only</th>
<th>immediate</th>
<th>units</th>
<th>range</th>
<th>default</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>accel rate</td>
<td></td>
<td></td>
<td></td>
<td>rev/s/s</td>
<td>1 - 3000</td>
<td>25</td>
</tr>
<tr>
<td>AM</td>
<td>accel max (quick decel)</td>
<td></td>
<td></td>
<td></td>
<td>rev/s/s</td>
<td>1 - 3000</td>
<td>500</td>
</tr>
<tr>
<td>BR</td>
<td>bit rate</td>
<td></td>
<td></td>
<td></td>
<td>rate code</td>
<td>1 - 3</td>
<td></td>
</tr>
<tr>
<td>BS</td>
<td>buffer status</td>
<td></td>
<td></td>
<td></td>
<td>chars</td>
<td>0 - 128</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>change current</td>
<td>current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CJ</td>
<td>commence jogging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>change jog speed</td>
<td>speed</td>
<td></td>
<td></td>
<td>rev/sec</td>
<td>0 - 50</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>continue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DA</td>
<td>define address</td>
<td>address</td>
<td></td>
<td></td>
<td></td>
<td>1 - @</td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td>distance for FC, FM, FO, FY</td>
<td>distance</td>
<td></td>
<td></td>
<td>steps</td>
<td>16,000,000</td>
<td>20,000</td>
</tr>
<tr>
<td>DE</td>
<td>decel rate</td>
<td>decel</td>
<td></td>
<td></td>
<td>rev/s/s</td>
<td>1 - 3000</td>
<td>25</td>
</tr>
<tr>
<td>DI</td>
<td>distance or position</td>
<td>distance</td>
<td></td>
<td></td>
<td>steps</td>
<td>±16,000,000</td>
<td>20000</td>
</tr>
<tr>
<td>DL</td>
<td>define limits</td>
<td>limitstate</td>
<td></td>
<td></td>
<td></td>
<td>1 - 3</td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>encoder deadband</td>
<td>deadband</td>
<td></td>
<td></td>
<td>counts</td>
<td>1 - 255</td>
<td>10</td>
</tr>
<tr>
<td>EF</td>
<td>encoder function</td>
<td>function</td>
<td></td>
<td></td>
<td>function</td>
<td>0 - 3</td>
<td>0</td>
</tr>
<tr>
<td>EP</td>
<td>encoder position</td>
<td>position</td>
<td></td>
<td></td>
<td>counts</td>
<td>±16,000,000</td>
<td></td>
</tr>
<tr>
<td>ER</td>
<td>encoder ratio</td>
<td>ratio</td>
<td></td>
<td></td>
<td></td>
<td>1 - 255</td>
<td>5</td>
</tr>
<tr>
<td>FC</td>
<td>Feed to Length with Speed Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>feed to length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FM</td>
<td>Feed to Sensor with Mask Dist</td>
<td>inputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-8, H/L/R/F</td>
<td></td>
</tr>
<tr>
<td>FO</td>
<td>Feed to Length &amp; Set Output</td>
<td>outputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-3, H or L</td>
<td></td>
</tr>
<tr>
<td>FP</td>
<td>feed to position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS</td>
<td>feed to sensor</td>
<td>inputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-8, H/L/R/F</td>
<td></td>
</tr>
<tr>
<td>FY</td>
<td>Feed to Sensor with Safety Dist</td>
<td>inputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-8, H/L/R/F</td>
<td></td>
</tr>
<tr>
<td>HW</td>
<td>follow hand wheel</td>
<td>in,condition,steps/count</td>
<td></td>
<td></td>
<td></td>
<td>steps 1-8, H/L/R/F, 1-255</td>
<td></td>
</tr>
<tr>
<td>IA</td>
<td>immediate analog input, in hex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>immediate distance request, in hex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IE</td>
<td>immediate encoder request, in hex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IH</td>
<td>Immediate High output</td>
<td>outputnum</td>
<td></td>
<td></td>
<td></td>
<td>1 - 8</td>
<td></td>
</tr>
<tr>
<td>IL</td>
<td>Immediate Low output</td>
<td>outputnum</td>
<td></td>
<td></td>
<td></td>
<td>1 - 8</td>
<td></td>
</tr>
<tr>
<td>IP</td>
<td>immediate position request, in hex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>input status request</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JA</td>
<td>jog accel/decel rate</td>
<td>accel</td>
<td></td>
<td></td>
<td></td>
<td>1 - 3000</td>
<td>25</td>
</tr>
<tr>
<td>JD</td>
<td>jog disable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JE</td>
<td>jog enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JS</td>
<td>jog speed</td>
<td>speed</td>
<td></td>
<td></td>
<td>.025 - 50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MD</td>
<td>motor disable</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ME</td>
<td>motor enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MR</td>
<td>microstep resolution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 - 16</td>
<td>8</td>
</tr>
<tr>
<td>PC</td>
<td>power up current</td>
<td>current</td>
<td></td>
<td></td>
<td></td>
<td>A 0 - imax</td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td>power up mode</td>
<td>mode (1=auto ,2=SCL)</td>
<td></td>
<td></td>
<td></td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>pause</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RA</td>
<td>read analog input</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>volts 0 - 5</td>
<td></td>
</tr>
<tr>
<td>RS</td>
<td>request status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>revision level request</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SH</td>
<td>seek home</td>
<td>inputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-8, H/L/R/F</td>
<td></td>
</tr>
<tr>
<td>SJ</td>
<td>stop jogging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SK</td>
<td>stop &amp; kill buffer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO</td>
<td>set output</td>
<td>outputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-3, H or L</td>
<td></td>
</tr>
<tr>
<td>SP</td>
<td>set abs position</td>
<td>position</td>
<td></td>
<td></td>
<td></td>
<td>±16,000,000</td>
<td></td>
</tr>
<tr>
<td>SS</td>
<td>send string</td>
<td>text string</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>stop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC</td>
<td>velocity for speed change (FC)</td>
<td>speed</td>
<td></td>
<td></td>
<td>rev/sec</td>
<td>.025 - 50</td>
<td>1</td>
</tr>
<tr>
<td>VE</td>
<td>velocity setting</td>
<td>speed</td>
<td></td>
<td></td>
<td>rev/sec</td>
<td>.025 - 50</td>
<td>1</td>
</tr>
<tr>
<td>WI</td>
<td>wait for input</td>
<td>inputnum,condition</td>
<td></td>
<td></td>
<td></td>
<td>1-8, H/L/R/F</td>
<td></td>
</tr>
<tr>
<td>WT</td>
<td>wait time</td>
<td>time</td>
<td></td>
<td></td>
<td>sec</td>
<td>.01 - 300</td>
<td></td>
</tr>
</tbody>
</table>
Command Descriptions

AC – Acceleration
Sets accel rate in rev/sec/sec. Sending AC with no number causes drive to respond with present accel rate. Range is 1 – 3000.

Affects: FL, FS, FP, SH
See also: DE

Example:
You send Drive sends
AC100 nothing
AC AC=100

AM – Acceleration Maximum
Sets maximum accel rate in rev/sec/sec. This value is used if a move encounters an end of travel limit. It is also used by the ST and SK commands if they interrupt a move. Sending AM with no number causes drive to respond with present accel rate. Range is 1 – 3000.

Affects: FL, FS, FP, SH
See also: AC, DE

Not available with older firmware.

Example:
You send Drive sends
AM500 nothing
AM AC=500

BR – Bit Rate
Changes the serial port bit rate. This can be used to increase the communication speed between the host controller and the Mis drive. You must change the bit rate of the host controller after sending this command or subsequent command will not be understood by the drive. Version 1.31 of the SCL Setup Utility has adjustable bit rates and is a useful tool for experimenting with bit rates. Drive powers up to 9600 bits/second.

Not available with older firmware. Some drives do not support BR3 (38400 bps).

Bit Rate Codes
1 = 9600 (about 1000 characters per second)
2 = 19200 (2000 chars/sec)
3 = 38400 (4000 chars/sec)

BS – Buffer Status
Drive tells you how much space is available in the command buffer.

Example:
You send Drive sends note
BS BS=128 there is room for 128 additional characters
CC – Change Current
Changes current setting of drive. Also allows you to request present current setting. When you set the current with the CC, the idle current is automatically set to 50%.

Affects: FL, FS, FP, SH, WI (jogging)
See also: PC, CI

Example:
You send | Drive sends | note
CC5.1    | nothing     | run current set to 5.1 amps, idle current to 2.55 amps
CC       | CC=5.1      | current settings unchanged

CI – Change Idle Current
Changes idle current setting of drive. Also allows you to request present idle current setting. Note: this command will overridden by any subsequent CC commands, which set the idle current to 50%. For best results, use the CI command after CC.

Affects: FL, FS, FP, SH, WI (jogging)
See also: PC, CC

Example:
You send | Drive sends | note
CI3.0    | nothing     | idle current set to 3 amps, run current unchanged
CI       | CC=3.0      | current settings unchanged

CJ – Commence Jogging
If jogging is enabled (JE command), the motor accelerates at rate set by JA command, then runs continuously at speed set by JS command. To stop jogging, use the SJ command if you want a controlled decel rate. For a faster stop, use the ST command, but beware that if the speed or load inertia is high, the motor may coast to a stop. The jogging direction is set by the sign of the last DI command. You can change the jog speed “on the fly” using the CS command.

CS – Change Jog Speed
Changes the software jog speed “on the fly”. If the new speed is faster than the old one, the drive accelerates to the new speed using the rate set by JA. If the new speed is slower, the motor is decelerated using JA. CS requires a speed in rev/sec.

Example:
CS11.2

CT – Continue
Resume execution of buffered commands.

Example:
Send | Drive sends | note
CT   | nothing     | 

DA – Define Address
Sets individual drive address character for multi-drop RS485 communication. This command should only be used with drives that have optional RS485 communications. Valid address characters are: ! ” # $ % & ’ ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < > ? @
DC - Distance till Change
Sets or requests the “change” distance, in steps. The “change distance” is used by certain moves to change their behavior after this distance has been traveled. For example, FM is a Feed to Sensor move, but the sensor is ignored until the motor has moved DC steps. This is useful for “debouncing” a switch or sensor. Since DC is a relative distance, it is not necessary to provide a sign. Range is 1 – 16,000,000.
Affects: FC, FY, FO, FM  See also: FC, FY, FO, FM

DE – Deceleration
Changes decel setting of drive. Also allows you to request present decel setting. Range is 1 – 3000.
Affects: FL, FS, FP, SH
See also: AC

Example:
You send  Drive sends  Notes
DE125    nothing
DE        DE=125

DI – Distance/Position
Sets or requests move distance, in steps. The sign of DI indicates move direction. Affects: FL, FS, FP, SH, CJ
See also: AC, DE, VE

Example:
You send  Drive sends  Notes
DI20000   nothing   cw direction
DI-20000  nothing  ccw direction
DI        DI=-20000

DL – Define Limits
Sets limits to normally open (1), normally closed (2) or not used (3).
Affects: FL, FS, FP, SH, WI (jogging)

Example:
You send  Drive sends  Notes
DL1       nothing   limits are normally open
DL3       nothing   limits are not used

ED – Encoder Dead Band
On drives that have the encoder feedback option, this defines the size of the “in position” region. If static position maintenance is enabled and a motor at rest deviates from this zone, automatic correction occurs. If “end of move correction” is turned on, and the motor is outside the dead band at the end of a feed to length or feed to position move, automatic error correction occurs. The size is in encoder counts.

Example:
You send  Drive sends  Notes
ED50      nothing   dead band is 50 encoder counts
ED        ED=50
EF – Encoder Function

On drives supporting encoder feedback, the EF command tells the drive what kind of position maintenance you want. Static position maintenance watches the encoder while the motor is at rest. If an external force moves the motor out of position, the drive tries to return it to within the dead band. “End of move correction” checks the encoder position after a feed to length or feed to position move.

If the motor is not within the dead band, corrective action is taken. For both static position maintenance and end of move correction, the corrective move length is half the distance to the ideal position. Additional corrections are made until the encoder position is within the dead band.

Example:
You send | Drive sends | Notes
--- | --- | ---
EF0 | nothing | all automatic encoder functions are off (but the encoder still tracks position and can be read via the EP or IE commands.)
EF1 | nothing | Turns on end of move correction
EF2 | nothing | Turns on static position maintenance
EF3 | nothing | Enables static position maintenance and end of move correction

EP – Encoder Position

On drives supporting encoder feedback, the EP command allows the host to define the present encoder position. For example, if the encoder is at 4500 counts, and you would like to refer to this position as 0, send “EP0”. Sending EP with no position parameter requests the present encoder position from the drive.

ER – Encoder Ratio

On drives supporting encoder feedback, the ER command defines the encoder ratio. This number is the motor resolution, in steps/rev, divided by the encoder resolution, in counts/rev.

For example, if you are using a 4000 count encoder and the motor resolution is set to 20000 steps/rev (MR8), then you should set ER5. (Because 20000 / 4000 = 5. The motor will take 5 steps per encoder count.) If your motor resolution is not evenly divisible by the encoder count, try a different motor resolution (using the MR command.) Encoders with binary resolutions, such as 512 and 1024, are unacceptable.

Note: the Mis drive electronics use “X4” decoding, so a 1000 line encoder produces 4000 counts/revolution.

FC – Feed to Length with Speed Change

Executes Feed to Length (relative move) command. 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 had moved DC steps, the speed is reduced to VC. **DC must not exceed DI.**

Example: You’re drilling holes. You want to rapidly approach the work piece, then slow down for drilling. Total move distance is 50000 steps, but after 45000 steps, you want to reduce the speed from 8 rev/sec to 0.5 rev/sec.

You send | Notes
--- | ---
VE8 | initial speed is 8 rev/sec
VC0.5 | change speed is 0.5 rev/sec
DI50000 | total move distance is 50,000 steps
DC45000 | change distance is 45,000 steps
FC | launch move
**FD - Feed to Double Sensor**

Accelerates the motor at rate AC to speed VE. When the first sensor "trips", the motor decelerates (at rate DE) to speed VC. When the second sensor is reached, the motor decelerates to a stop at rate DE. The sign of the DI register is used to determine the direction.

Example:
You send
DI1
move direction will be cw
VE5
speed will be 5 rev/sec until first sensor is reached
VC.2
speed will be 0.2 rev/sec after first sensor is reached
FD2F4H
move until falling edge on input 2, then decel to VC.
Decel to stop when input 4 goes high.

**FD Command: Speed vs Time**

**FL – Feed to Length**

Executes 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.

**FM – Feed to Sensor with Mask Distance**

Executes Feed to Sensor command, but sensor is ignored for the first DC steps of the move. Useful for “debouncing” a switch or clearing a part before sensing the next one.

Example: You’re feeding parts on a conveyor. A sensor detects the leading edge of the part and stops. But if the part has a hole in it, which many objects do, then when you attempt to feed the next part into position you may in fact stop after feeding the previous part only a short distance. The solution is the use FM instead of FS and to set the DC for the size of the part.

Example: The parts are 6 inches long. Your mechanical linkage provides 20000 steps/inch. You want the part to stop moving 1 inch past the sensor. 5 inches of the part will not have gone past the sensor yet.

You send
DI20000
stop 20000 steps (1 inch) past sensor
DC102000
ignore sensor for next 5.1 inches, allowing old part to completely clear sensor
FM1F
launch move. Sensor is connected to input 1 and goes low when it sees a part

**FO – Feed to Length and Set Output**

Same as Feed to Length (FL) but changes the state of an output during the move.
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.

You send
DI20000  feed 20000 steps
DC15000  set output at 15000 steps
FO1L     close output 1 at 15000 steps

**FP – Feed to Position**

Executes Feed to Position (absolute move) command. Move position comes from the last DI command. Speed, accel and decel are from VE, AC and DE commands.

**FS – Feed to Sensor**

Executes Feed to Sensor command. Requires input number (1-8) and condition (H=high, L=low, R=rising, F=falling) The motor moves until the sensor state change is detected, then stops a precise distance beyond the sensor. That distance is specified by the DI command. The direction of rotation is determined by the sign of the DI command (positive is clockwise). Speed, accel and decel are from the most recent VE, AC and DE commands.

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 become confused and greatly 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.). \( R = \text{steps/rev} \).

\[
DI_{\text{min}} = \frac{R V^2}{2D}
\]

Example: \( DI_{\text{min}} = (20000) \frac{(1)^2}{(2)(25)} = 400 \text{ steps} \)

The Help screen of the **SCL Setup utility** contains a special calculator that computes the distance for you.

Example:
You send
FS1L     nothing  Feed to Sensor 1 low
FS3R     nothing  Feed to Sensor 3 rising edge

**FY – Feed to Sensor with Safety Distance**

Executes Feed to Sensor command, but monitors total distance traveled. If sensor is not found before distance exceeds DC, the motor is stopped and the drive sends the host and exclamation point (“!”).

This is useful for detecting machine jams or the end of a roll of labels. For example: you are feeding labels. 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.

You send
DI2000  stop 2000 steps beyond sensor
DC60000  stop after 60000 steps if no sensor detected
FY2L     feed to sensor 2 low
HW – Hand Wheel
Commands the drive to follow the position of a low speed quadrature encoder. This instruction is intended to allow the drive to be manually positioned using a CNC hand wheel. The HW command terminates when a condition on an input is met. You must include the input and condition in the command. You must also provide a move increment in motor steps per encoder (hand wheel) count.

Example:
You send Drive sends Notes
HW4L10 nothing drive follows hand wheel until input 4 is low, 10 steps/count

IA - Immediate Analog
Requests a reading from the analog to digital converter connected to input pin AIN. Value is provided in hexadecimal. 0 represents 0 volts at the AIN input and 3FF represents 5 volts DC. To convert the hex value to a voltage, use the formula \( v = IA \times 5 / 1023 \). For example, if the drive responds with “IA=2C0”, which converts to 704, the voltage is \( v = 704 \times 5 / 1023 = 3.441 \) volts.

The IA command is immediate, so it will respond even during moves, WT and WI commands. See also: RA.

ID – Immediate Distance
Requests present distance, in hex. (Distance is in hex because conversion to ascii of another format would tax the CPU enough to interfere with a move in progress. Application programs can easily convert a hex value to integer.)

Example:
You send Drive sends Notes
ID ID=0000271 0 +10000 (10,000 steps into cw move)
ID ID=FFFFD8F0 -10000 (10,000 steps into ccw move)

IE – Immediate Encoder
Requests present encoder position, in hex. (Distance is in hex because conversion to ascii of another format would tax the CPU enough to interfere with a move in progress. Application programs can easily convert a hex value to integer.)

Example:
You send Drive sends Notes
IE IE=0000271 0 encoder position is +10000 counts
IE IE=FFFFD8F0 encoder position is -10000 counts

IH – Immediate High Output
Sets output high (open) immediately. Use SO instead if you don’t want the output to change until a buffered command (like a move) is complete.

You send Drive sends
IH1 output 1 goes high immediately
IH2 output 2 goes high immediately

See also: IL, SO

IL – Immediate Low Output
Sets output low (closed) immediately. Use SO instead if you don’t want the output to change until a buffered command (like a move) is complete.
Example:
You send | Driver sends
---|---
IL1 | output 1 goes low immediately
IL2 | output 2 goes low immediately

See also: IH, SO

**IP – Immediate Position**

Requests present absolute position, in hex. (Value is in hex because converts format would tax the CPU enough to interfere with a move in program. Application easily convert a hex value to integer.)

Example:
You send | Drive sends | Notes
---|---|---
IP | IP=00002710 | abs position is 10,000 steps

**IS – Input Status**

Requests immediate status of all 8 inputs.

Example:
You send | Drive sends | Notes
---|---|---
IS | IS=00000000 | all 8 inputs are low(closed)
IS | IS=11111111 | all 8 inputs are high(open)
IS | IS=00000001 | input 1 is high
IS | IS=1 0000000 | input 1 is low

**JA – Jog Acceleration**

Sets 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. Range is 1 – 3000.

Affects: WI (jogging)
See also: JS

Example:
You send | Drive sends
---|---
JA100 | nothing
JA | JA=100

**JD – Jog Disable**

Disables jog inputs (normally active during WI instructions)

**JE – Jog Enable**

Enables jog inputs (active during WI instructions)

**JS – Jog Speed**

Sets speed for jog moves in rev/sec. Sending JS with no number causes drive to respond with present jog speed. Range is .025 – 50.

Affects: WI (jogging)
See also: JA

Example:
You send | Drive sends
---|---
JS10.35 | nothing
JS
JS=1 0.35

MD – Motor Disable
Disables motor (cuts current to zero).

ME – Motor Enable
Restores previous motor current.

MR – Microstep Resolution
Sets, or requests microstep resolution. The MR command should be used before setting the accel and decel rates and speed, because a change in motor resolution will corrupt these settings. The MR command also resets the step table, which moves the motor to the nearest pole position. The absolute position register is not changed.

Example:
You send Drive sends Notes
MR8 nothing sets drive to 20,000 steps/rev
MR MR=8

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<td>18000</td>
<td>12</td>
<td>25600</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PC – Power on Current
Sets power on current in amps. Also changes present current.

Example:
You send Drive sends
PC3.2 nothing

PM – Power on Mode
Sets or requests power on mode. 1=auto detect. 2=SCL mode only. Set to 1 if you plan to use the drive with the Mis Programmer.

Note: RS485 drives do not work with the Mis Programmer software.

Example:
You send Drive sends Notes
PM1 nothing drive is set to auto detect host at power on
PM2 nothing drive is set for SCL mode at power on
PM PM=2

PS – Pause
Suspends execution of buffered commands until the next CT command. Useful for coordinating motion among axes by sending commands to each, while paused, then resuming all drives at once. Also can be used to suspend the operation of a machine.
RA - Read Analog
Requests the voltage on the AIN (analog input) pin. Range is 0 to 5 volts. Resolution is 10 bits. This is a buffered command, so it will wait for other buffered commands such as moves to be completed before responding. For an immediate reading, use IA.

RS – Request Status
Asks the drive to tell you what it is doing. Responses are:
M = motion in progress
W = wait input command executing
T = wait time command executing
R = ready (none of the above happening)

RV – Revision Level
Asks the drive what firmware it has in it.

Example:
You send | Drive sends | Notes
---------|-------------|-------
RV       | RV=150      | drive has firmware version 1.50

SH – Seek Home
Executes seek home command. Requires input number (1-8) and condition (H=high, L=low, R=rising, F=falling) 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 clockwise, - is ccw).

Example:
You send | Drive sends | Notes
---------|-------------|-------
SH1L     | nothing     | Seek home 1 low
SH3R     | nothing     | Seek home 3 rising edge

SJ – Stop Jogging
Stops the motor when jogging (CJ starts it). Decel rate is defined by JA command.

SK – Stop & Kill
Halts any buffered command in progress. Removes any other commands from buffer.

SO – Set Output

SP – Set Position
Set or request absolute position.

Affects: FP

Example:
You send | Drive sends
---------|-------------
SP100    | nothing
SP       | SP=100

SS – Send String
Drive sends a text string to the host when this buffered command is executed. The maximum string length is determined by the available space in the command buffer (the BS command can tell you what's available).
Example:
You send Drive sends
SSMove complete move complete

ST – Stop
Terminates any buffered command in progress.

VC – Velocity Change
Sets or requests the “change speed”, in rev/sec, for FC moves. Range is .025 - 50. Affects: FC.

VE – Velocity
Sets or requests move speed in rev/sec. Range is .025 - 50. Affects: FL, FS, FP, SH.

Example:
You send Drive sends
VE2.525 nothing
VE VE=2.525

WI – Wait for Input
Waits for an input to match a condition. Inputs: 1-8. Allows very precise triggering of moves if a WI command precedes a move command in the buffer. Conditions: H=high, L=low, R= rising edge, F=falling edge. Jogging is active during this instruction, unless disabled by JD.

Example:
You send Drive
WI3R waits for rising edge on input 3 before proceeding to next buffered command.

WT – Wait Time
Causes a time delay, in seconds. Range is .01 – 300.