

Host Command Reference

Q and SCL commands for servo and stepper drives

*Includes RS-232, RS-485,
Ethernet UDP, Ethernet TCP/IP, EtherNet/IP,
Modbus RTU and Modbus TCP/IP*



APPLIED MOTION PRODUCTS

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Getting Started

The basic procedures for integrating an Applied Motion drive into your application are the same for every drive offered. The first step is to configure and/or tune the drive using either *ST Configurator* (stepper) or *Quick Tuner* (servo). Depending on the specific drive, the user may now use *SCL Utility*, *Q Programmer* or *Si Programmer* software for testing and advanced programming.

Servo Drives

- This series includes all SV7, SVAC3, SV200, BLuAC5, BLuDC9, and BLuDC4 drives.
- For Ethernet-enabled drives, see Appendix G of this document and your drive's Hardware Manual for information regarding Ethernet communications.
- Use SVX Servo Suite to tune, configure (and program) SV200 series servo drives.
- Use *Quick Tuner* software to tune and configure SV7, SVAC3, BLu series drives. See the appropriate Software Manual for details on tuning servo drives.
- For SCL applications choose the SCL Operating Mode; for Q applications choose either the SCL or Q Program Operating Mode.
- For SCL applications, the *SCL Setup Utility* is a useful tool to gain familiarity with the SCL command syntax and to test commands that will be used in the final product.
- For Q applications use *Q Programmer* both for creating stored programs and for sending commands to your drive. Note that SVX Servo Suite, used for SV200 series drives has Q Programmer built in.
- For Si applications use Si Programmer for creating stored programs.
- Note: SV7-Si and BLu-Si drives are not recommended for multi-drop communications over the RS-485 port.

StepSERVO

- This series includes all SSM, TSM, SS, SSAC and TXM drives.
- For Ethernet-enabled drives, see Appendix G of this document and your drive's Hardware Manual for information regarding Ethernet communications.
- Use StepSERVO Quick Tuner software to tune and configure your drive. See the StepSERVO Quick Tuner Software Manual for details on tuning StepSERVO drives.
- For SCL applications choose the SCL Operating Mode; for Q applications choose either the SCL or Q Program Operating Mode.
- For SCL applications, the SCL Setup Utility is a useful tool to gain familiarity with the SCL command syntax and to test commands that will be used in the final product.
- For Q applications use Q Programmer both for creating stored programs and for sending commands to your drive.

Stepper Drives

- This series includes all ST5/10, STF, STM, SWM, STAC5 and STAC6 drives.
- For Ethernet-enabled drives, see Appendix G of this document and your drive's Hardware Manual for information regarding Ethernet communications.
- Use *ST Configurator* software to define your motor, configure the operating mode and encoder (if applicable), as well as any application-specific I/O requirements. For STF products, use *STF Configurator*.

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- For SCL applications choose the SCL Operating Mode; for Q applications choose either the SCL or Q Program Operating Mode.
- For SCL applications, the *SCL Setup Utility* is a useful tool to gain familiarity with the SCL command syntax and to test commands that will be used in the final product.
- For Q applications use *Q Programmer* both for creating stored programs and for sending commands to your drive. *Q Programmer* is built into *ST Configurator* and *STF Configurator*.
- For Si applications use Si Programmer for creating stored programs.
- Note: ST5/10-Si and STAC6-Si drives are not recommended for multi-drop communications over the RS-485 port.
- STAC5-Q, STAC6-Q, STAC6-QE, and STAC6-Si drives can be used in Q applications.

Commands

There are two types of host commands available: buffered and immediate. Buffered commands are loaded into and executed out of the drive's volatile command buffer, also known as the *queue*. Immediate commands are not buffered: when received by the drive they are executed immediately.

Buffered Commands

After being loaded into the command buffer of a drive, buffered commands are executed one at a time. (See "Multi-tasking in Q Drives" below for an exception to this rule). If you send two buffered commands to the drive in succession, like an FL (Feed to Length) command followed by an SS (Send String) 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 PS (Pause) and CT (Continue), enable the buffer to be loaded and to pause execution until the desired time.

Stored Programs in Q Drives

Stored Q Programs, created with the *Q Programmer* application software, are created by using only buffered commands. Q Programmer is built in to the configuration software for SV200 servo drives and StepSERVO products.

Multi-tasking in Q Drives

Multi-tasking allows for an exception to the "one at a time" rule of buffered commands. The multi-tasking feature of a Q drive allows you to initiate a move command (FL, FP, CJ, FS, etc.) and proceed to execute other commands without waiting for the move command to finish. See MT command for additional details.

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 BS (Buffer Status) command, or the immediate status of digital inputs using the IS (Input Status) command, while the drive is processing other commands. Immediate commands are designed to access the drive at any time.

Applied Motion recommends waiting for an appropriate Ack/Nack response from the drive before sending subsequent commands. This adds limited overhead but ensures that the drive has received and executed the current command, preventing many common communication errors. If the Ack/Nack functionality cannot be used in the application for any reason, the user should allow a 10ms delay between commands to allow the drive sufficient time to receive and act on the last command sent.

This approach allows a host controller to get information from the drive at a high rate, most often for checking drive status or motor position.

Using Commands

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.

YXXAB<cr>

In the syntax above, "Y" symbolizes the drive's RS-485 address, and is only required when using RS-485 networking. "XX" symbolizes the command itself, which is always composed of two capital letters. "A" symbolizes the first of two possible parameters, and "B" symbolizes the second. Parameters 1 and 2 vary in length, can be letters or numbers, and are often optional. The "<cr>" symbolizes the carriage return which terminates the command string. How the carriage return is generated in your application will depend on your host software.

Once a drive receives the <cr> it will determine whether or not it understood the preceding characters as a valid command. If it did understand the command the drive will either execute or buffer the command. If Ack/Nack

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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).

It is always recommended that the user program wait for an ACK/NACK character before subsequent commands are sent. If the ACK/NACK functionality cannot be used in the application, a 10ms delay is recommended between non-motion commands.

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 details in Appendix D.

Responses from the drive will be sent with a similar syntax to the associated SCL command.

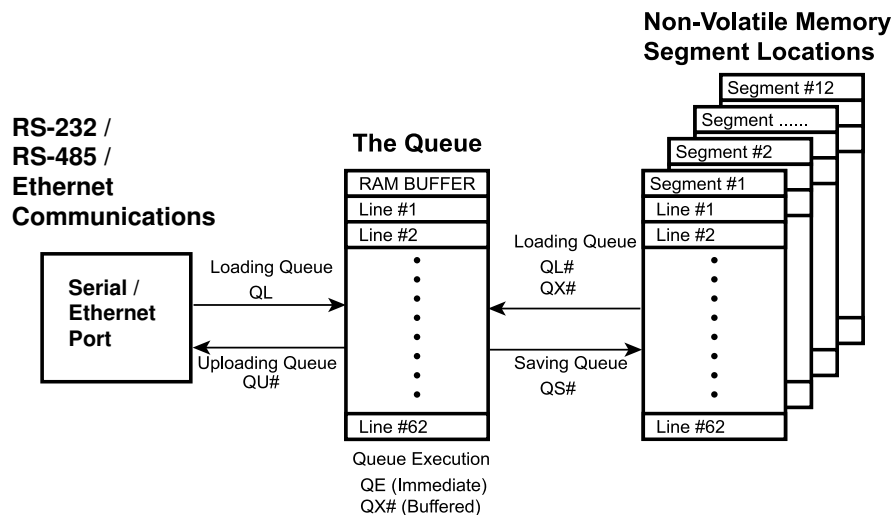
YXX=A<cr>

In the syntax above, “Y” symbolizes the drive’s RS-485 address, and is only present when using RS-485 networking. “XX” symbolizes the command itself, which is always composed of two capital letters. “A” symbolizes the requested data, and may be presented in either Decimal or Hexadecimal format (see the IF command). The “<cr>” symbolizes the carriage return which terminates the response string.

Commands in Q drives

Q drives have additional functionality because commands can also be composed into a stored program that the Q drive can run stand-alone. The syntax for commands stored in a Q program is the same as if the commands were being sent directly from the host, or “XXAB”. *Q Programmer* software is used to create stored Q programs and can be downloaded for free from www.applied-motion.com/support/software.php.

The diagram below shows how commands sent from the host’s serial port interact with the volatile command buffer (AKA the Queue), and the drive’s non-volatile program memory storage. Loading and Uploading the Queue contents via the serial port are done with the QL and QU commands, respectively. Similarly, the Queue’s contents can be Loaded from NV memory using the QL and QX commands, and can be saved to NV memory with the QS command. Finally, commands currently in the Queue can be executed with the QE or QX command.



The *Q Programmer* software automates many of the functions shown in the diagram above.

SCL Utility software

The *SCL Utility* software is an excellent application for familiarizing yourself with host commands. *SCL Utility* can be downloaded for free from www.applied-motion.com.

To send commands to your drive from *SCL Utility* simply type a command in the Command Line and press the ENTER key to send it. (Remember that all commands are capital letters so pressing the Caps Lock key first is a good tip). Pressing the ENTER key while in *SCL Utility* does two things: it terminates the command with a carriage return 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 carriage return.

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 |
| FL20000<ENTER> | Move the motor 20000 steps in the CW direction. |

If your motor didn't move after sending the FL20000 check the LEDs on your drive to see if there is an error present. If so send the AR command (AR<ENTER>) to clear the alarm. If after clearing the alarm you see a solid green LED it means the drive is disabled. Enable the drive by sending the ME command (ME<ENTER>) and verify that the you see a steady, flashing green LED. 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.

Command Summary

This section contains a set of tables that list all of the Host 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. Note that certain commands (PA, PB, PC, PI, and PM) save their parameter data to non-volatile memory immediately upon execution, and need not be followed by an SA command.
- “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).
- “Compatibility” shows which drives use each of the commands.

The different categories for these tables - Motion, Servo, Configuration, I/O, Communications, Q Program, Register - are set up to aid you in finding particular commands quickly.

- “Motion” commands have to do with the actual shaft rotation of the step or servo motor.
- “Servo” commands cover servo tuning parameters, enabling / disabling the motor, and filter setup.
- “Configuration” commands pertain to setting up the drive and motor for your application, including tuning parameters for your servo drive, step resolution and anti-resonance parameters for your step motor drive, etc.
- “I/O” commands are used to control and configure the inputs and outputs of the drive.
- “Communications” commands have to do with the configuration of the drive’s serial ports.
- “Q Program” commands deal with programming functions when creating stored programs for your Q drive.
- “Register” commands deal with data registers. Many of these commands are only compatible with Q drives.

Motion Commands

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|----------------------------------|----|------------|-----------|-----------|---|
| AC | Accel Rate | • | | | | All drives |
| AM | Accel Max | • | | | | All drives |
| CJ | Commence Jogging | | • | | | All drives |
| CS | Change Speed | | • | | • | All drives |
| DC | Distance for FC, FM, FO, FY | • | | | | All drives |
| DE | Decel Rate | • | | | | All drives |
| DI | Distance or Position | • | | | | All drives |
| ED | Encoder Direction | • | | | | Servos and steppers with encoder feedback |
| EF | Encoder Function | • | | | | Steppers with encoder feedback |
| EG | Electronic Gearing | • | | | | All drives |
| EH | Extended Homing | | • | | | StepSERVO and SV200 series only |
| EI | Input Noise Filter | • | | | | All drives |
| EP | Encoder Position | | | | | Servos and steppers with encoder feedback |
| FC | Feed to Length with Speed Change | | • | | | All drives |
| FD | Feed to Double Sensor | | • | | | All drives |
| FE | Follow Encoder | | • | | | All drives |
| FH | Find Home | | • | | | StepSERVO and SV200 series only |
| FL | Feed to Length | | • | | | All drives |
| FM | Feed to Sensor with Mask Dist | | • | | | All drives |
| FO | Feed to Length & Set Output | | • | | | All drives |
| FP | Feed to Position | | • | | | All drives |
| FS | Feed to Sensor | | • | | | All drives |
| FY | Feed to Sensor with Safety Dist | | • | | | All drives |
| HA | Homing Acceleration | • | | | | StepSERVO and SV200 series only |
| HL | Homing Deceleration | • | | | | StepSERVO and SV200 series only |
| HO | Homing Offset | • | | | | StepSERVO and SV200 series only |
| HS | Hard Stop Homing | | • | | | StepSERVO and SV200 series only |
| HV | Homing Velocity | • | | | | StepSERVO and SV200 series only |
| HW | Hand Wheel | | • | | | All drives |
| JA | Jog Accel/Decel rate | • | | | | All drives |
| JC | Velocity mode second speed | • | | | | All drives |
| JD | Jog Disable | | • | | | All drives |
| JE | Jog Enable | | • | | | All drives |
| JL | Jog Decel rate | • | | | | All drives |
| JM | Jog Mode | • | | | | All drives (see JM command) |
| JS | Jog Speed | • | | | | All drives |
| MD | Motor Disable | | • | | | All drives |
| ME | Motor Enable | | • | | | All drives |

Motion Commands (continued)

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|--------------------------------------|----|------------|-----------|-----------|---------------------------------------|
| MR | Microstep Resolution | • | | | | Stepper drives only |
| PA | Power-up Accel Current | • | | | | STM stepper drives only |
| SD | Set Direction | • | | | | STM stepper drives with Flex I/O only |
| SH | Seek Home | | • | | | All drives |
| SJ | Stop Jogging | | • | | • | All drives |
| SM | Stop the Move | | • | | | Q drives only |
| SP | Set Absolute Position | | | | | All drives |
| ST | Stop Motion | | • | | • | All drives |
| VC | Velocity for Speed Change (FC) | • | | | | All drives |
| VE | Velocity Setting (For Feed Commands) | • | | | | All drives |
| VM | Velocity Max | • | | | | All drives |
| WM | Wait on Move | | • | | | Q drives only |
| WP | Wait on Position | | • | | | Q drives only |

Servo Commands

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|-------------------------------------|----|------------|-----------|-----------|--|
| CP | Change Peak Current | • | | | | Servo drives only |
| EP | Encoder Position | | | | | Servo drives only |
| GC | Current Command | • | | | • | Servo drives only |
| IC | Immediate Current Command | | | • | • | Servo drives only |
| IE | Immediate Encoder Position | | | • | • | Servo drives only |
| IQ | Immediate Actual Current | | | • | • | Servo drives only |
| IX | Immediate Position Error | | | • | • | Servo drives only |
| KC | Overall Servo Filter | • | | | | Servo drives only |
| KD | Differential Constant | • | | | | Servo drives only |
| KE | Differential Filter | • | | | | Servo drives only |
| KF | Velocity Feedforward Constant | • | | | | Servo drives only |
| KG | Global Gain 1 | • | | | | SV200 series only |
| KI | Integrator Constant | • | | | | Servo drives only |
| KJ | Jerk Filter Frequency | • | | | | SV7 Servo drives only |
| KK | Inertia Feedforward Constant | • | | | | Servo drives only |
| KP | Proportional Constant | • | | | | Servo drives only |
| KV | Velocity Feedback Constant | • | | | | Servo drives only |
| PF | Position Fault | • | | | | Servo drives, drives with encoder feedback |
| PL | Position Limit | • | | | | Servo drives only |
| PP | Power-Up Peak Current | • | | | | Servo drives only |
| VI | Velocity Integrator Constant | • | | | | Servo drives only |
| VP | Velocity Mode Proportional Constant | • | | | | Servo drives only |

Configuration Commands

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|---|----|------------|-----------|-----------|---|
| AL | Alarm Code | | | • | • | All drives |
| AR | Alarm Reset | | • | | • | All drives |
| BD | Brake Disengage Delay time | • | | | | All drives |
| BE | Brake Engage Delay time | • | | | | All drives |
| BS | Buffer Status | | | • | • | All drives |
| CA | Change Acceleration Current | • | | | | STM stepper drives only |
| CC | Change Current | • | | | | All drives |
| CB | CANopen baud rate | • | | | | SV200 series only |
| CD | Idle Current Delay | • | | | | Stepper drives only |
| CF | Anti-resonance Filter Frequency | • | | | | Stepper drives only |
| CG | Anti-resonance Filter Gain | • | | | | Stepper drives only |
| CI | Change Idle Current | • | | | | Stepper drives only |
| CM | Control mode | • | | | | All drives |
| CO | CANopen Node ID / IP Address Index Number | • | | | | SV200 series only |
| CP | Change peak current | • | | | | Servo drives only |
| DA | Define Address | • | | | | All drives |
| DD | Default Display for Front Panel | • | | | • | SV200 series only |
| DL | Define Limits | • | | | | All drives |
| DR | Data Register for Capture | | • | | | Q servo drives only |
| DW | Dumping voltage setting | • | | | | SV2D series drive |
| ED | Encoder Direction | • | | | | Servo drives, drives with encoder feedback |
| EN | Electronic Gearing Ratio Numerator | • | | | | SV200 series only |
| ER | Encoder or Resolution | • | | | | Servo drives, drives with encoder feedback |
| ES | Single-Ended Encoder Usage | • | | | | Servo and stepper drives with encoder feedback (except STM) |
| ES | Absolute Encoder Mode | • | | | | TSM23X, TXM24X, TXM34X |
| EU | Electronic Gearing Ratio Denominator | • | | | | SV200 series only |
| HC | Hard Stop Current | • | | | | StepSERVO and SV200 series only |
| HG | 4th Harmonic Filter Gain | • | | | | Stepper drives only |
| HP | 4th Harmonic Filter Phase | • | | | | Stepper drives only |
| IA | Immediate Analog | | | • | • | All drives |
| ID | immediate Distance | | | • | • | All drives |
| IE | Immediate Encoder | | | • | • | Servo drives, drives with encoder feedback |
| IF | Immediate Format | • | | | • | All drives |
| IQ | Immediate Current | | | • | • | Servo drives only |
| IP | Immediate Position | | | • | • | All drives |
| IT | Immediate Temperature | | | • | • | All drives |

Configuration Commands (continued)

| IU | Immediate Voltage | | | • | • | All drives |
|---------|-------------------------------|----|------------|-----------|-----------|--|
| IV | Immediate Velocity | | | • | • | All drives |
| LM | Software Travel Limit CCW | | | | | StepSERVO and SV200 series only |
| Command | Description | NV | write only | read only | Immediate | Compatibility |
| LP | Software Travel Limit CW | | | | | StepSERVO and SV200 series only |
| LV | Low Voltage Threshold | • | | | | All drives |
| MD | Motor Disable | | | | • | All drives |
| ME | Motor Enable | | | | • | All drives |
| MN | Model Number | | | • | • | All drives |
| MO | Motion Output | • | | | | All drives |
| MR | Microstep Resolution | • | | | | All drives (deprecated - see EG command) |
| MS | Control Mode Select | • | | | | SV200 series only |
| MV | Model & Revision | | | • | • | All drives except Blu servos |
| OF | On Fault | | • | | | Q drives only |
| OI | On Input | | • | | | Q drives only |
| OP | Option Board | • | | • | • | All drives |
| PA | Power-up Acceleration Current | • | | | | |
| PC | Power up Current | • | | | | All drives |
| PD | In Position Counts | • | | | | StepSERVO and SV200 series only |
| PE | In Position Timing | • | | | | StepSERVO and SV200 series only |
| PF | Position Fault | • | | | | Servo drives, drives with encoder feedback |
| PI | Power up Idle Current | • | | | | Stepper drives only |
| PK | Parameter Lock | • | | | | SV200 series only |
| PL | In Position Limit | • | | | | Servo drives only |
| PM | Power up Mode | • | | | | All drives |
| PP | Power up peak current | • | | | | Servo drives only |
| PT | Pulse Type | • | | | | All drives |
| PW | Pass Word | | • | | | Q drives only |
| RE | Restart / Reset | | • | | • | All drives |
| RL | Register Load | | | | • | All drives |
| RS | Request Status | | | • | • | All drives |
| RV | Revision Level | | | • | • | All drives |
| SA | Save all NV Parameters | | • | | | All drives |
| SC | Status Code | | | • | • | |
| SD | Set Direction | • | | | | STM stepper drives with Flex I/O only |
| SF | Step Filter Frequency | • | | | | Stepper drives only |

Configuration Commands (continued)

| SI | Enable Input usage | • | | | | All drives |
|---------|--|----|------------|-----------|-----------|--|
| SK | Stop & Kill | | • | | • | All drives |
| TT | Pulse Complete Timing | • | | | | StepSERVO and SV200 series only |
| Command | Description | NV | write only | read only | Immediate | Compatibility |
| TV | Torque Value | • | | | | SV200 series only |
| VR | Velocity Ripple Value | • | | | | SV200 series only |
| WC | Legal Pressor for Continuous Waveage | • | | | | BLuAC5 and STAC6 drives only |
| Command | Description | NV | write only | read only | Immediate | Compatibility |
| BR | Baud Rate | • | | | | All drives |
| BS | Buffer Status | | | | • | All drives |
| CE | Communications Error | | | | • | All drives |
| IF | Immediate Format | • | | | • | All drives |
| PB | Power up Baud Rate | • | | | | All drives |
| PR | Protocol | • | | | | All drives |
| TD | Transmit Delay | • | | | | All drives |
| ZA | Network Communication Time-out (Watchdog) Action | | | | | MDX, SSDC, STF, STM23X, TSM14POE, TSM23X, TSM34, TXM24X, TXM34, TXM34X |
| ZE | Network Communication Time-Out (Watchdog) Enable | • | | | | MDX, SSDC, STF, STM23X, TSM14POE, TSM23X, TSM34, TXM24X, TXM34, TXM34X |
| ZS | Network Communication Time-out (Watchdog) Delay | | | | | MDX, SSDC, STF, STM23X, TSM14POE, TSM23X, TSM34, TXM24X, TXM34, TXM34X |

Register Commands

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|---------------------------|----|------------|-----------|-----------|---------------|
| CR | Compare Register | | • | | | Q drives only |
| DR | Data Register for Capture | | • | | | Q drives only |
| RC | Register Counter | | • | | | Q drives only |
| RD | Register Decrement | | • | | | Q drives only |
| RI | Register Increment | | • | | | Q drives only |
| RL | Register Load | | | | • | Q drives only |
| RM | Register Move | | • | | | Q drives only |
| RR | Register Read | | • | | | Q drives only |
| RU | Register Upload | | • | | • | |
| RW | Register Write | | • | | | Q drives only |
| RX | Register Load | | | | | Q drives only |
| R+ | Register Addition | | • | | | Q drives only |
| R- | Register Subtraction | | • | | | Q drives only |
| R* | Register Multiplication | | • | | | Q drives only |
| R/ | Register Division | | • | | | Q drives only |
| R& | Register Logical AND | | • | | | Q drives only |
| RI | Register Logical OR | | • | | | Q drives only |
| TR | Test Register | | • | | | Q drives only |
| TS | Time Stamp read | | • | | | Q drives only |

I/O Commands

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|-----------------------------------|----|------------|-----------|-----------|---|
| AD | Analog Deadband | • | | | | All stepper drives and SV servo drives |
| AF | Analog Filter | • | | | | All drives |
| AG | Analog Velocity Gain | • | | | | All stepper drives and SV servo drives |
| AI | Alarm Input usage | • | | | | All drives |
| AN | Analog Torque Gain | • | | | | StepSERVO and SV200 series only |
| AO | Alarm Output usage | • | | | | All drives |
| AP | Analog Position Gain | • | | | | All drives |
| AS | Analog Scaling | • | | | | All stepper drives and SV servo drives |
| AT | Analog Threshold | • | | | | All drives |
| AV | Analog Offset | • | | | | All drives |
| AZ | Analog Zero (Auto Zero) | | • | | | All drives |
| BD | Brake Disengage Delay time | • | | | | All drives |
| BE | Brake Engage Delay time | • | | | | All drives |
| BO | Brake Output usage | • | | | | All drives |
| CN | Second Control Mode | • | | | | SV200 series only |
| DL | Define Limits | • | | | | All drives |
| DS | Dividing Select | • | | | | SV200 series only |
| EI | Input Noise Filter | • | | | | All drives |
| FI | Filter Input | • | | | | All drives (Note: not NV on Blu servos) |
| FX | Filter Selected Inputs | | | | | Blu, STAC5, STAC6, SVAC3 |
| GG | Gain Select | • | | | | SV200 series only |
| IH | Immediate High Output | | • | | • | All drives |
| IL | Immediate Low Output | | • | | • | All drives |
| IO | Output Status | | | | • | All drives |
| IS | Input Status request | | | • | • | All drives |
| MO | Motion Output | • | | | | All drives |
| OI | On Input | | • | | | Q drives only |
| PH | Pulse Command Inhibit | • | | | | SV200 series only |
| PV | Second Electronic Gearing Setting | • | | | | SV200 series only |
| SI | Enable Input usage | • | | | | All drives |
| SO | Set Output | | • | | | All drives |
| TI | Test Input | | • | | | Q drives only |
| TO | Tach Output Setting | • | | | | SV200 series and TSM series only |
| WI | Wait on Input | | • | | | All drives |

Q Program Commands

| Command | Description | NV | write only | read only | Immediate | Compatibility |
|---------|-----------------------------------|----|---------------|--------------|-----------|---------------|
| AX | Alarm Reset | | • | | | All drives |
| CT | Continue | | • | | • | All drives |
| MT | Multi-Tasking | | | | | Q drives only |
| NO | No Operation | | • | | | Q drives only |
| OF | On Fault | | • | | | Q drives only |
| OI | On Input | | • | | | Q drives only |
| PS | Pause | | • | | | All drives |
| QC | Queue Call | | • | | | Q drives only |
| QD | Queue Delete | | • | | | Q drives only |
| QE | Queue Execute | | • | | • | Q drives only |
| QG | Queue Goto | | • | | | Q drives only |
| QJ | Queue Jump | | • | | | Q drives only |
| QK | Queue Kill | | • | | | Q drives only |
| QL | Queue Load | | • | | • | Q drives only |
| QR | Queue Repeat | | • | | | Q drives only |
| QS | Queue Save | | • | | • | Q drives only |
| QU | Queue Upload | | | • | • | Q drives only |
| QX | Queue Load & Execute | | • | | | Q drives only |
| SM | Stop Move | | • | | | Q drives only |
| SS | Send String | | • | | | All drives |
| TI | Test Input | | • | | | Q drives only |
| WD | Wait Delay using Data Register | | • | | | Q drives only |
| WI | Wait for Input | | • | | | All drives |
| WM | Wait for Move to complete | | • | | | Q drives only |
| WP | Wait for Position in complex move | | • | | | Q drives only |
| WT | Wait Time | | • | | | All drives |

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.

DI - Distance/Position

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

Sets or requests the move distance in encoder counts (servo) or steps (stepper). The sign of DI indicates move direction: no sign means CW and "-" means CCW. DI sets both the distance for relative moves, like FL, and the position for absolute moves, like FP. DI also sets the direction of rotation for jogging (CJ).

Command Details:

| | |
|-----------------|------------------|
| Structure | DI(Parameter #1) |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | "D" (020) |

Parameter Details:

| | |
|--------------|---|
| Parameter #1 | distance |
| - units | encoder counts (servo) or steps (stepper) |
| - range | -2,147,483,647 to 2,147,483,647 sign determines direction: "-" for CCW, no sign for CW |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|--|
| DI20000 | - | Set distance to 20000 counts in the CW direction |
| DI | DI=20000 | |
| DI-8000 | - | Set distance to 8000 counts in the CCW direction |
| FL | - | Initiate FL move |

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

Compatibility - shows which drives use this command.

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

See Also - related commands

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

Command Details - shows the command's Structure, Type, Usage, Non-Volatile status, and Register Access. Structure always shows 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 (). Type can be BUFFERED or IMMEDIATE. Usage can be Read Only, Read/Write, or Write Only. Non-Volatile will show if the command can be saved (YES) or not (NO). Saving Non-Volatile commands to memory requires the SA (Save) command. Register Access shows any data registers associated with the command. If the command transfers data to a register that is accessible via the RL and RX commands, that register will be shown here.

Parameter Details - shows a description, the units, and the range of the parameter(s) available with a given command. Some commands will also have a **Response Details** section which shows how the drive's response to the given command is formatted.

Examples - shows what to expect when you use this command. Under "Command" are the command strings you would send from a host controller or write into a stored program. Under "Drive Sends" are the responses from the drive: no response from the drive is denoted by "-". "Notes" give additional information about the results of the command string.

AC - Acceleration Rate

Compatibility: All drives
 Affects: FC, FD, FE, FL, FM, FS, FP, FY, SH commands
 See also: AM, DE, DI, DC, VE commands

Sets or requests the acceleration rate used in point-to-point move commands in rev/sec/sec.

Command Details:

| | |
|-----------------|---|
| Structure | AC{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | "A" (017) Note: Units of AC command and "A" register are different. See Data Registers section for details of "A" register. |

Parameter Details:

| | |
|--------------|---|
| Parameter #1 | Acceleration rate |
| - units | rev/sec/sec (rps/s) |
| - range | 0.167 to 5461.167 (resolution is 0.167 rps/s) |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|--|
| AC100 | - | Set Acceleration to 100 rev/sec/sec |
| AC | AC=100 | |
| AC25 | - | Set acceleration rate to 25 rev/sec/sec |
| DE25 | - | Set deceleration rate to 25 rev/sec/sec |
| VE1.5 | - | Set velocity to 1.5 rev/sec |
| FL20000 | - | Execute Feed to Length move of 20000 steps |

AD - Analog Deadband

Compatibility: All stepper drives and SV servo drives
Affects: Analog input
See also: CM command

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 (see CM command). The deadband is an absolute value that in usage is applied to either side of the zero point.

Note that in Analog Positioning mode (CM22), the AD setting is used as a hysteresis value rather than a standard deadband setting. As such, it will work over the entire analog range, not just at zero volts.

Command Details:

| | |
|-----------------|--|
| Structure | AD{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | Setting the AD command will affect the contents of the “a” (Analog Command) register |

Parameter Details:

| | |
|--------------|-----------------------|
| Parameter #1 | Analog deadband value |
| - units | millivolts |
| - range | 0 - 255 |

Examples:

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

AD - Analog Deadband (SV200 Drives)

Compatibility: SV200 drives
 Affects: Analog input
 See also: AV, AF, AS commands

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

The command has two parameters: the first parameter selects the analog channel (Range: 1~3); the second parameter set the dead band value of the selected analog channel (Range:0~255).

- 1 – select analog channel 1
- 2 – select analog channel 2
- 3 – select differential analog

Command Details:

| | |
|-----------------|--------------------------------|
| Structure | AD{Parameter #1}{Parameter #2} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | NONE |

Parameter Details:

| | |
|---------------|------------------------|
| Parameter #1 | Analog channel |
| - units | None |
| - range | 1~3 |
| Parameter #2 | Analog dead band value |
| - units | millivolts |
| - range | 0~255 |
| Default value | 0 |

Examples:

| | | |
|---------|-------------|------------------------------------|
| Command | Drive sends | Notes |
| AD110 | % | Set the dead band of Ain1 to 10 mV |
| AD1 | AD1=10 | The dead band of Ain1 is 10 mV |

AF - Analog Filter

Compatibility: All drives
 Affects: All commands using the analog inputs
 See also: IA, CM commands

Applies a digital filter to the analog input(s). 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:

$$\text{Filter value} = 72090 / [(1400 / x) + 2.2]$$

where x = desired value of the analog filter in Hz

Command Details:

| | |
|-----------------|---|
| Structure | AF{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | Setting the AF command will affect the responsiveness of the "a", "j", and "k" registers to changes in analog voltage |

Parameter Details:

| | |
|--------------|------------------------------------|
| Parameter #1 | Filter value |
| - units | integer (see formula above) |
| - range | 0 - 32767* (0 disables the filter) |

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

Examples:

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

AG - Analog Velocity Gain

Compatibility: All stepper drives and SV servo drives
 Affects: Analog velocity modes
 See also: CM command

Sets or requests the gain value used in analog velocity / oscillator modes. 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 analog input is scaled to 0 - 5 volt input and 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.

Command Details:

| | |
|-----------------|------------------|
| Structure | AG{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|--------------|----------------------------|
| Parameter #1 | Analog velocity gain value |
| - units | 0.25 rpm |
| - range | -32767 to 32767 |

Examples:

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

AI - Alarm Reset Input

Compatibility: All drives, see below
 Affects: Alarm Reset input usage
 See also: AL, CM, DL, SI, SD commands

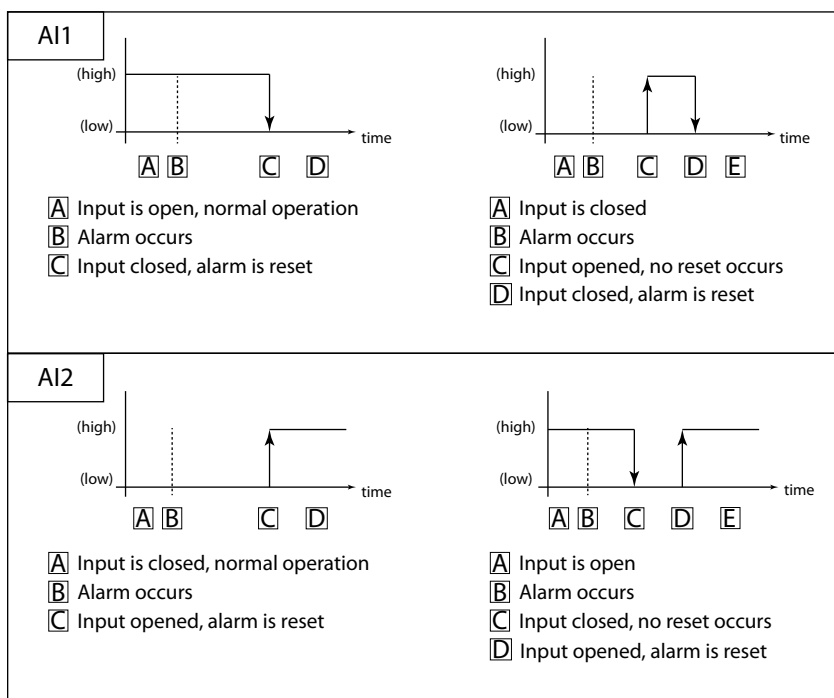
BLu, SV, STAC6, ST-Q/Si

Defines the function of the X4 input. This input can be used to clear a drive fault and reset the Alarm Code (see AL command). When the Alarm Reset function is not needed at input X4, such as when operating with a host controller where faults and alarms can be cleared via serial commands, it may be useful to reconfigure X4 as a general purpose input, which allows it to be used by other types of input commands.

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

AI1: For normal operation the X4 input must be open (inactive, high). Alarm reset occurs when the input is closed (active, low). 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 (inactive, high) and then closed to reset the alarm.

AI2: For normal operation the X4 input must be closed (active, low). Alarm reset occurs when the input is opened (inactive, high). 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 and then opened to reset the alarm.



AI3: Input is not used for Alarm Reset and can be used as a general purpose input.

ST-S, STM17, STM23

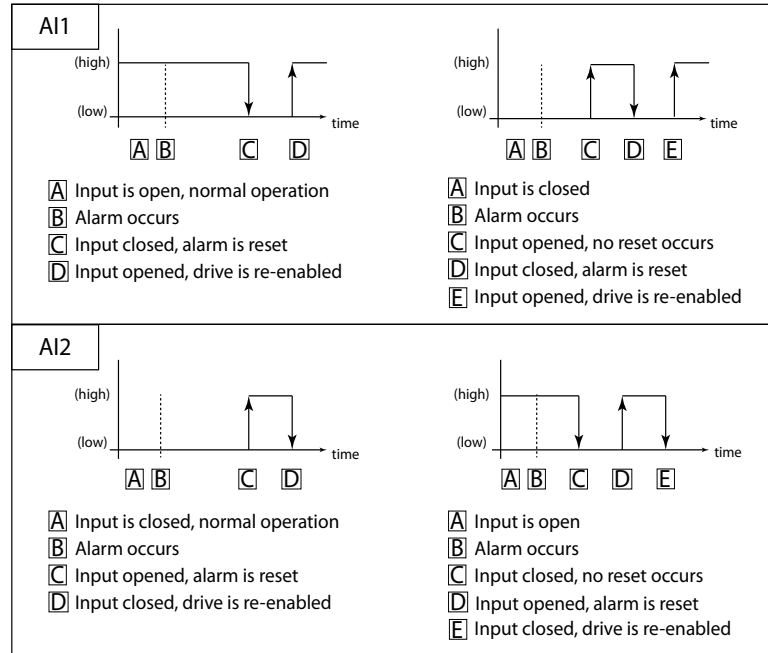
Defines the EN input as an Alarm Reset Input. If you want to use the EN input as an Alarm Reset input you can define it as such in two ways, with the *ST Configurator* software, or with the AI command. AI takes no effect if the drive is set in Command Mode (CM) 13, 14, 17 or 18, because these modes use 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.

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

AI1: For normal operation the EN input must be open (inactive, high). Alarm reset occurs when the EN input is closed (active, low). 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 and then closed to reset the alarm. After the alarm is cleared, the drive will be enabled when the input is opened again.

AI2 : For normal operation the EN input must be closed (active, low). Alarm reset occurs when the input is opened (inactive, high). 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 and then opened to reset the alarm. After the alarm is cleared, the drive will be enabled when the input is closed again.

AI3: The EN Input is not used for Alarm Reset and may 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 either 1 or 2 after the AI command is set.

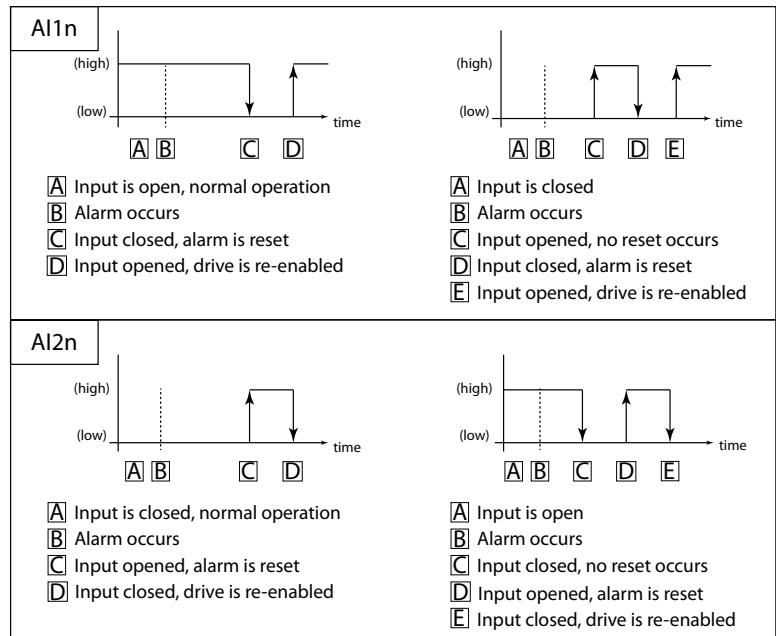


STM24

Drives with Flex I/O allow a second parameter which allows the user to specify the I/O point used as the Alarm Reset input. Before an I/O point can be used as an Alarm Reset input it must first be configured as an input with the SD command. See the STM24 Hardware Manual for details of which inputs may be used as the Alarm Reset input.

Possible uses for the AI command on the STM24 are as follows ('n' denotes the I/O point to be used):

AI1n: For normal operation the designated input 'n' must be open (inactive, high). Alarm reset occurs when the input is closed (active, low). 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 (inactive, high) and then closed to reset the alarm. The drive will be enabled when the input is returned to the opened state (inactive, high), unless the SI command has been used to configure hardware enable functionality.



AI2n: For normal operation the designated input 'n' input must be closed (active, low). Alarm reset occurs when the designated input is opened (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. The drive will be enabled when the input is returned to the closed state

Host Command Reference

(active, low), unless the SI command has been used to configure hardware enable functionality.

AI3n: The designated input 'n' is not used for Alarm Reset and may be used as a general purpose input.

NOTE: A rule of thumb when using the Alarm Reset function is to toggle the designated input twice whenever an alarm occurs. That is, if the input is normally open (inactive, high), it should be closed and then opened again. If the input is normally closed (active, low), it should be opened and then closed again.

Command Details:

| | |
|-----------------|--|
| Structure | AI{Parameter #1}{Parameter #2 (Flex I/O only)} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|------------------------------|--|
| Parameter #1 | Input Usage |
| - units | integer code |
| - range | 1, 2, or 3 |
| Parameter #2 (Flex I/O only) | I/O Point (if applicable, see note below) |
| - units | Integer Code |
| - range | 2 or 4 (See STM24 Hardware Manual for details) |

NOTES:

- For drives equipped with Flex I/O, the SD command must be executed to set an I/O point as an input before it can be used as the Alarm Reset Input.
- Parameter #2 only applies to drives equipped with Flex I/O. Parameter #2 is not defined for drives equipped with standard I/O.

Examples:

All drives with standard I/O:

| Command | Drive sends | Notes |
|---------|-------------|--|
| AI1 | - | Enables input to reset alarm when closed (active, low) |
| AI | AI=1 | |

Drives with Flex I/O:

| Command | Drive sends | Notes |
|---------|-------------|--|
| SD4I | - | Configures I/O 4 as input (see SD command for details) |
| AI14 | - | Assigns input 4 to reset the alarm when closed (active, low) |
| AI | AI=14 | |

*NOTE: When working with digital inputs and outputs 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 low", and SO1L means "set output 1 low". A high state is represented by the "H" character.*

AL - Alarm Code

Compatibility: All drives

See also: AI, AR, AX commands, Appendix E

Reads back an equivalent hexadecimal value of the Alarm Code's 16-bit binary word.

Command Details:

| | |
|-----------------|---|
| Structure | AL |
| Command Type | IMMEDIATE |
| Usage | READ ONLY |
| Non-Volatile | NO |
| Register Access | "f" (054) Note: response to AL command is a different format than the response to the RLf command. See Appendix E for details. |
| Units | Hexadecimal value of 16-bit binary word (see below) |

Response Details:

| Hex Value | BLu | SV, MDX | STAC6 | ST, STF | STM |
|-----------|------------------------|-------------------------|-------------------------------|-------------------------|-------------------------|
| 0001 | <i>Position Limit</i> | | | | |
| 0002 | CCW Limit | | | | |
| 0004 | CW Limit | | | | |
| 0008 | <i>Over Temp</i> | | | | |
| 0010 | <i>Excess Regen*</i> | <i>Internal Voltage</i> | <i>Excess Regen</i> | <i>Internal Voltage</i> | <i>Internal Voltage</i> |
| 0020 | <i>Over Voltage</i> | | | | |
| 0040 | <i>Under Voltage*</i> | Under Voltage | <i>Under Voltage</i> | Under Voltage | Under Voltage |
| 0080 | <i>Over Current</i> | | | | |
| 0100 | <i>Bad Hall Sensor</i> | | <i>Open Motor Winding</i> | | |
| 0200 | <i>Bad Encoder</i> | | | | (not used) |
| 0400 | Comm Error | | | | |
| 0800 | Bad Flash | | | | |
| 1000 | Wizard Failed | | No Move | | |
| 2000 | Current Foldback | | Motor Resistance Out of Range | (not used) | (not used) |
| 4000 | Blank Q Segment | | | | |
| 8000 | No Move | | (not used) | | |

* BLuAC drives only

NOTE: Items in *bold italic* represent Drive Faults, which automatically disable the motor. Use the OF command in a Q Program to branch on a Drive Fault.

NOTE: See Appendix E for more detailed information on Alarm Codes.

Host Command Reference

Examples:

| Command | Drive sends | Notes |
|---------|-------------|--|
| AL | AL=0000 | No alarms |
| AL | AL=0001 | Position limit alarm |
| AL | AL=0201 | Position limit and bad encoder signal alarms |

Response Details:

| Hex Value | SSM/TSM/TXM | SS | SV200 Series |
|-----------|---------------------------|---------------------------|----------------------|
| 0001 | <i>Position Limit</i> | | |
| 0002 | CCW Limit | | |
| 0004 | CW Limit | | |
| 0008 | <i>Over Temp</i> | | |
| 0010 | <i>Internal Voltage</i> | | |
| 0020 | <i>Over Voltage</i> | | |
| 0040 | Under Voltage | Under Voltage | <i>Under Voltage</i> |
| 0080 | <i>Over Current</i> | | |
| 0100 | <i>Open Motor Winding</i> | <i>Open Motor Winding</i> | <i>Bad Hall</i> |
| 0200 | <i>Bad Encoder</i> | | |
| 0400 | Comm Error | | |
| 0800 | Bad Flash | | |
| 1000 | No Move | No Move | <i>Excess Regen</i> |
| 2000 | Current Foldback | | |
| 4000 | Blank Q Segment | | |
| 8000 | NV Memory Double Error | NV Memory Double Error | No Move |

NOTE: Items in *bold italic* represent Drive Faults, which automatically disable the motor. Use the OF command in a Q Program to branch on a Drive Fault.

NOTE: See Appendix E for more detailed information on Alarm Codes.

For SS and SV200 drives, AL command has a optional parameter 1 to read back the higher 16 bit of alarm code.

Response Details:

| Hex Value | SS | SV200 |
|-----------|---------------------|----------------------------|
| 0001 | <i>Excess Regen</i> | <i>AC Power Phase Lost</i> |
| 0002 | Reserved | <i>Safe Torque Off</i> |
| 0004 | Reserved | Reserved |
| 0008 | Reserved | <i>Velocity Limit</i> |
| 0010 | Reserved | Voltage Warning |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|-----------------------|
| AL1 | AL1=0000 | No alarms |
| AL1 | AL1=0001 | Excess Regen (For SS) |

Additional Alarm Description Details:

Position Limit: Commonly referred to as “Motor Stall” or “Following Error”, this alarm condition, which will fault the motor, occurs when the actual motor position (as measured by the feedback) is off from the target position by a value equal to or greater than the Position Fault (PF) setting for servos. For stepper systems with encoder feedback and stall prevention enabled, this value is fixed at approximately 1.8 mechanical degrees.

Internal Voltage Out of Range: This alarm occurs when one or more board-level voltage supplies are outside the range specified in firmware. This can be caused by a short-circuit condition at the I/O connector or a failing gate driver in the power output section.

Current Foldback: This alarm occurs on servo and StepSERVO products when the current output to the motor exceeds the continuous current setting for more time that allowed by the drive (typically 1 sec. max). This is common during acceleration and deceleration, so decreasing the accel/decel rate will help to eliminate the alarm.

AM - Max Acceleration

Compatibility: All drives
Affects: ST, SK , SM, QK commands; analog velocity and oscillator modes
See also: VM command

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

Command Details:

| | |
|-----------------|------------------|
| Structure | AM{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|--------------|--|
| Parameter #1 | Maximum acceleration/deceleration |
| - units | rev/sec/sec (rps/s) |
| - range | 0.167 - 5461.167 (resolution is 0.167 rps/s) |

Examples:

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

AN - Analog Torque Gain

Compatibility: SV200 servo drives and StepSERVO models (including SSM, TSM, and TXM)
 Affects: CM2, 3, and 4 (Analog Torque Command Modes)
 See also: AD, AF, AZ, CM, CC, SF commands

Sets or requests the gain value used in analog torque mode. This is used to set the analog input gain that relates voltage to motor current when the drive is in analog torque mode. The analog torque gain value represents the commanded current in units of 0.01A when the analog input is at the configured full scale value. See specific analog input ranges in hardware manual for the StepSERVO or SV200 product being used.

Command Details:

| | |
|-----------------|------------------|
| Structure | AN{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|--------------|-----------------------------|
| Parameter #1 | Current (A rms) |
| - units | Amps (resolution is 0.01 A) |
| - range | Related to CC command range |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|---|
| AN1 | % | Current range over full scale of analog input is 1A |
| AN | AN=1 | |

AO - Alarm Output

Compatibility: All drives
 Affects: Alarm Output usage
 See also: AI, BO, MO, SD, SI commands

BLu, SV, STAC6, ST-Q/Si, SVAC3-Q/S/IP, STAC5-Q/S/IP

Defines usage of digital output Y3 for BLu, SV7, STAC6 and ST-Q/Si. STAC5 and SVAC3 use Y1. Normally this output is used to indicate an Alarm caused by a Drive Fault. This output can be reconfigured as a general purpose output for use with other types of output commands. There are three states that can be defined:

- AO1: Output is closed (active, low) when a Drive Fault is present.
- AO2: Output is open (inactive, high) when a Drive Fault is present.
- AO3: Output is not used as an Alarm Output and can be used as a general purpose output.

ST-S, STM17, STM23, STM24-C

Defines the drive's digital output as an Alarm Output. The output of a drive can be assigned to one of five functions: Alarm Output, Brake Output, Motion Output, Tach Output or General Purpose 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 the *ST Configurator* or via SCL commands. To set the output as an Alarm Output, use the AO command and one of the codes below. There are three Alarm Output states that can be defined with the AO command:

- AO1: Output is closed (active, low) when a Drive Fault is present.
- AO2: Output is open (inactive, high) when a Drive Fault 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.

STM24-SF/QF

Drives with Flex I/O allow a second parameter which allows the user to specify the I/O point used. Before an I/O point can be used as an Alarm Output it must first be configured as an output with the SD command.

Possible uses for the AO command on the STM24 are as follows ('n' denotes the I/O point to be used):

- AO1n: Designated output 'n' is closed (active, low) when a Drive Fault is present.
- AO2n: Designated output 'n' is open (inactive, high) when a Drive Fault is present.
- AO3n: Designated output 'n' is not used as an Alarm Output and can be used for another automatic output function or as a general purpose output.

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.

Command Details:

| | |
|-----------------|--|
| Structure | AO{Parameter #1}{Parameter #2 (Flex I/O only)} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|------------------------------|---|
| Parameter #1 | Output Usage (see above) |
| - units | integer code |
| - range | 1, 2 or 3 |
| Parameter #2 (Flex I/O only) | I/O Point (if applicable, see note below) |
| - units | integer code |
| - range | 1 - 4 |

NOTES:

- For drives with Flex I/O, the SD command must be executed to set an I/O point as an input or output before that output can be designated as the Alarm Output.
- Parameter #2 only applies to drives equipped with Flex I/O. This includes the STM24SF and STM24QF. Parameter #2 is not defined for drives equipped with standard I/O.

Examples:

All drives with standard I/O:

| Command | Drive sends | Notes |
|---------|-------------|---|
| AO1 | - | Alarm Output will close when a Drive Fault occurs |
| AO | AO=1 | |

Drives with Flex I/O only:

| Command | Drive sends | Notes |
|---------|-------------|--|
| SD4O | - | Configures I/O 4 as output (see SD command for details) |
| AO14 | - | Alarm Output is mapped to output #4, and will close when a Drive Fault occurs. |
| AO | AO=14 | |

NOTE: When working with digital inputs and outputs 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, W13L means "wait for input 3 low", and SO1L means "set output 1 low". A high state is represented by the "H" character.

AP - Analog Position Gain

Compatibility: All drives
 Affects: CM22 (Analog Positioning Command Mode)
 See also: AD, AF, AZ, CM, SF commands

Sets or requests the analog Input gain that relates to motor position when the drive is in analog position command mode (see CM command, parameter value 22). Gain value sets the commanded position when the analog input is at the configured full scale value. *Quick Tuner* (BLu, SV), *STAC6 Configurator* (STAC6), or *ST Configurator* (ST, STM) can be used to configure the analog inputs for the desired input type, scaling and offsetting.

Command Details:

| | |
|-----------------|------------------|
| Structure | AP{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | "X" (040) |

Parameter Details:

| | |
|--------------|----------------------------|
| Parameter #1 | Analog position gain value |
| - units | encoder counts |
| - range | 0 - 32767 |

Examples:

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

AR - Alarm Reset (Immediate)

Compatibility: All drives
Affects: Alarm Code
See also: AL, ME, MD commands

Clears Alarms and Drive Faults. If an Alarm or Drive Fault condition persists after sending the AR command the Alarm is not cleared.

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

Command Details:

| | |
|-----------------|------------|
| Structure | AR |
| Type | IMMEDIATE |
| Usage | WRITE ONLY |
| Non-Volatile | NO |
| Register Access | None |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|--|
| AR | - | Reset Drive Fault and clear Alarm Code (if possible) |

AS - Analog Scaling

Compatibility: All stepper drives and SV servo drives
 Affects: Analog input
 See also: CM command

Sets or requests the analog input scaling setting. This is a code that determines what type of analog input scaling is desired. The codes for selecting the various settings are in the Details table below.

Command Details:

| | |
|-----------------|------------------|
| Structure | AS{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| Parameter #1 | Code |
|------------------------|--|
| - units | integer number |
| - range | 0 = single-ended +/- 10 volts 1 = single-ended 0 - 10 volts 2 = single-ended +/- 5 volts 3 = single-ended 0 - 5 volts 4 = differential +/- 10 volts 5 = differential 0 - 10 volts 6 = differential +/- 5 volts 7 = differential 0 - 5 volts |
| - range (SV200 series) | 0 = single-ended +/- 10 volts 1 = single-ended 0 - 10 volts |

Examples:

| | | |
|---------|-------------|--|
| Command | Drive sends | Notes |
| AS2 | - | Analog input scaling set to single-ended +/- 5 volts |
| AS | AS=2 | |

AT - Analog Threshold

Compatibility: All drives
 Affects: All "Feed to Sensor" type commands
 See also: AF, AZ, FS, FY, FD commands

Sets or requests the Analog Input Threshold that is used by the "Feed to Sensor" command. The threshold value sets the Analog voltage that determines a sensor state or a trigger value.

Command Details:

| | |
|-----------------|------------------|
| Structure | AT{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | "Y" (041) |

Parameter Details:

| | |
|--------------|---|
| Parameter #1 | Analog threshold value |
| - units | volts |
| - range | BLu, SV, STAC6, ST-Q/Si, STAC5, SVAC3: -10.000 to 10.000 ST-S, STM: 0.000 to 5.000 |

Examples:

| | | |
|---------|-------------|---|
| Command | Drive sends | Notes |
| AT4.5 | - | Analog input threshold set to 4.5 volts |
| AT | AT=4.5 | |

AV - Analog Offset Value

Compatibility: All drives (except SV200 series)
 Affects: All Analog input functions
 See also: AF, AP, AZ, CM & Feed commands

Sets or requests the analog offset value in volts.

Command Details:

| | |
|-----------------|--|
| Structure | AV{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | “Z” (042) Note: Units of AV command are different than units of “Z” register; see Data Registers section for more details |

Parameter Details:

| | |
|--------------|--|
| Parameter #1 | Analog offset value |
| - units | Volts |
| - range | BLu, SV, STAC6, ST-Q/Si, STAC5, SVAC3: -10.000 to 10.000 ST-S, STM: -5.000 to 5.000 |

Examples:

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

AV - Analog Offset Value - SV200

Compatibility: SV200 drives
 Affects: Analog inputs
 See also: AD, AF, AS commands

Sets or requests the offset value of the analog input in volts.

The command has two parameters: the first parameter selects the analog channel (Range: 1~3); the second parameter set the offset value of the selected analog channel (Range: -10~10).

- 1 – select analog channel 1
- 2 – select analog channel 2
- 3 – select differential analog

Command Details:

| | |
|-----------------|--------------------------------|
| Structure | AV{Parameter #1}{Parameter #2} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|---------------|---------------------|
| Parameter #1 | Analog channel |
| - units | None |
| - range | 1~3 |
| Parameter #2 | Analog offset value |
| - units | volts |
| - range | 0~255 |
| Default value | 0 |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|------------------------------|
| AV11 | % | set the offset of Ain1 to 1V |
| AV1 | AV1=1 | the offset of Ain1 is 1V |

AX - Alarm Reset (Buffered)

Compatibility: All drives
 Affects: Alarm Code
 See also: AR, ME, OF, WT Commands

Clears Alarms and Drive Faults. This command functions the same as AR (Alarm Reset) but is a Buffered type command.

Typically used in conjunction with OF within a Q program. Please note that while immediately executing AX will clear the alarm code, it does not guarantee that the condition that caused the alarm has been resolved. Therefore it is recommended to include a short delay or wait for user input before clearing the alarm and resuming normal operation.

In addition to clearing alarms and faults, the AX command resets the LED blink timer. As such, if the AX command is used within a tight loop in a Q program, the LED may actually appear to be solid green.

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

Command Details:

| | |
|-----------------|------------|
| Structure | AX |
| Type | BUFFERED |
| Usage | WRITE ONLY |
| Non-Volatile | NO |
| Register Access | None |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|-------|
|---------|-------------|-------|

In segment 1 of a Q program...

| | | |
|-----|---|--|
| OF9 | - | When a drive fault occurs load and execute program segment 9 |
|-----|---|--|

In segment 9 of the same Q program...

| | | |
|-------|---|--|
| WT0.1 | - | Short delay to allow the system to settle |
| AX | - | Alarm reset |
| ME | - | Motor enable |
| QX1 | - | Load and execute segment 1, which will also reset the OF function. |

AZ - Analog Zero

Compatibility: All drives
Affects: All Analog input functions
See also: AF, AP, AV, CM & Feed commands

Activates the analog “auto offset” algorithm. It is useful in defining the current voltage present at the analog input as the zero reference point, or offset.

Command Details:

| | |
|-----------------|------------|
| Structure | AZ |
| Type | BUFFERED |
| Usage | WRITE ONLY |
| Non-Volatile | NO |
| Register Access | None |

Examples:

| Command | Drive sends | Notes |
|---------|-------------|-------------------------------|
| AZ | - | Start analog offset algorithm |

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

BD - Brake Disengage Delay

Compatibility: All drives
Affects: All "F" (Feed) and Jog commands.
See also: BE command

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.

Command Details:

| | |
|-----------------|------------------|
| Structure | BD{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|--------------|------------|
| Parameter #1 | Delay time |
| - units | seconds |
| - range | 0 - 32.767 |

Examples:

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

BE - Brake Engage Delay

Compatibility: All drives
 Affects: All "F" (Feed) and Jog commands.
 See also: BD command

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 dedicated brake output (see BO command) the output is activated immediately with the disable command, then the drive waits the delay time before turning off the motor current.

Command Details:

| | |
|-----------------|------------------|
| Structure | BE{Parameter #1} |
| Type | BUFFERED |
| Usage | READ/WRITE |
| Non-Volatile | YES |
| Register Access | None |

Parameter Details:

| | |
|--------------|------------|
| Parameter #1 | Delay time |
| - units | seconds |
| - range | 0 - 32.767 |

Examples:

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

BO - Brake Output

Compatibility: All drives
Affects: Function of digital output
See also: AI, AO, BD, ME, MD, MO, SD, SI commands

NOTE: The digital output circuits available on Applied Motion drives are not sized for directly driving a typical holding brake. An external relay must be wired in circuit between the digital output of the drive and the holding brake. See the appropriate drive hardware manual for an example wiring diagram.

BLu, SV, STAC6, ST-Q/Si

Defines usage of digital output Y1 as the Brake Output, which can be used to automatically activate and deactivate a holding brake. Output Y1 can also be configured as a general purpose output for use with other types of output commands. There are three states that can be defined:

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

ST-S, STM17, STM23, STM24-C

Defines the drive's digital output as a Brake Output. The output of a drive can be assigned to one of five functions: Alarm Output, Brake Output, Motion Output, Tach Output, or General Purpose 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.

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

STM24-SF/QF

Drives with Flex I/O allow a second parameter which allows the user to specify the I/O point used. Before an I/O point can be used as a Brake Output it must first be configured as an output with the SD command. Possible uses for the BO command on the STM24 are as follows ('n' denotes the I/O point to be used):

- BO1n: Designated output 'n' is closed (active, low) when the drive is enabled and open when the drive is disabled.
- BO2n: Designated output 'n' is open (inactive, high) when the drive is enabled and closed when the drive is disabled.
- BO3n: Designated output 'n' is not used as a Brake Output and can be used for another automatic output function or as a general purpose output.

STAC5-S, SVAC3-S

Defines usage of digital output Y2 as the Brake Output, which can be used to automatically activate and deactivate a holding brake. Output Y2 can also be configured as a Motion Output, a Tach Output, or a General Purpose output for use with other types of output commands. There are three states that can be defined:

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