

ACE-SXC

Single Axis Step Motor Controller with USB 2.0 Communication



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Revision History:

- 1.01 – First revision
- 1.02 – Added dimensions
- 1.03 – Added ASCII command set
- 1.3 – Added new graphics
- 1.4 – Added firmware and software compatibility
- 1.5 – New hardware, outputs changed, removed loopwhile/repeat
- 1.6 – Delay resolution updated
- 1.7 – Updated introduction, updated alarm input schematic, added connector information, moved GUI section up to section 5, added active/low high for inputs and outputs, updated GUI section, updated stand-alone command spec, updated ASCII command spec
- 1.8 – Removed differential output spec, added pull-down resistor to circuit overview, updated B/C/D/F/J sections of GUI, already in motion situations, enable as GPIO, updated cable accessory names (male side)

Firmware Compatibility:

V410

Software Compatibility:

V413

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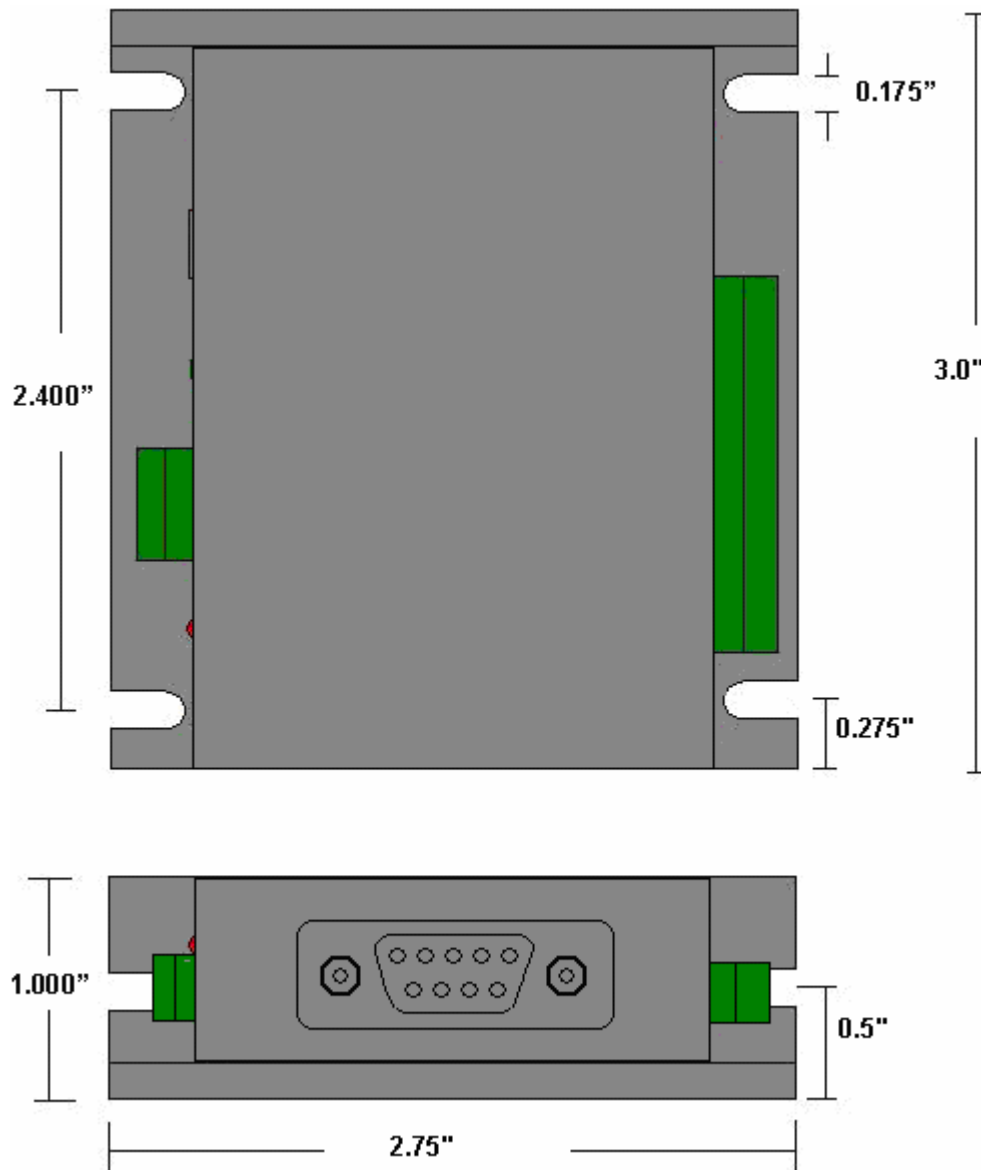
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1. Introduction

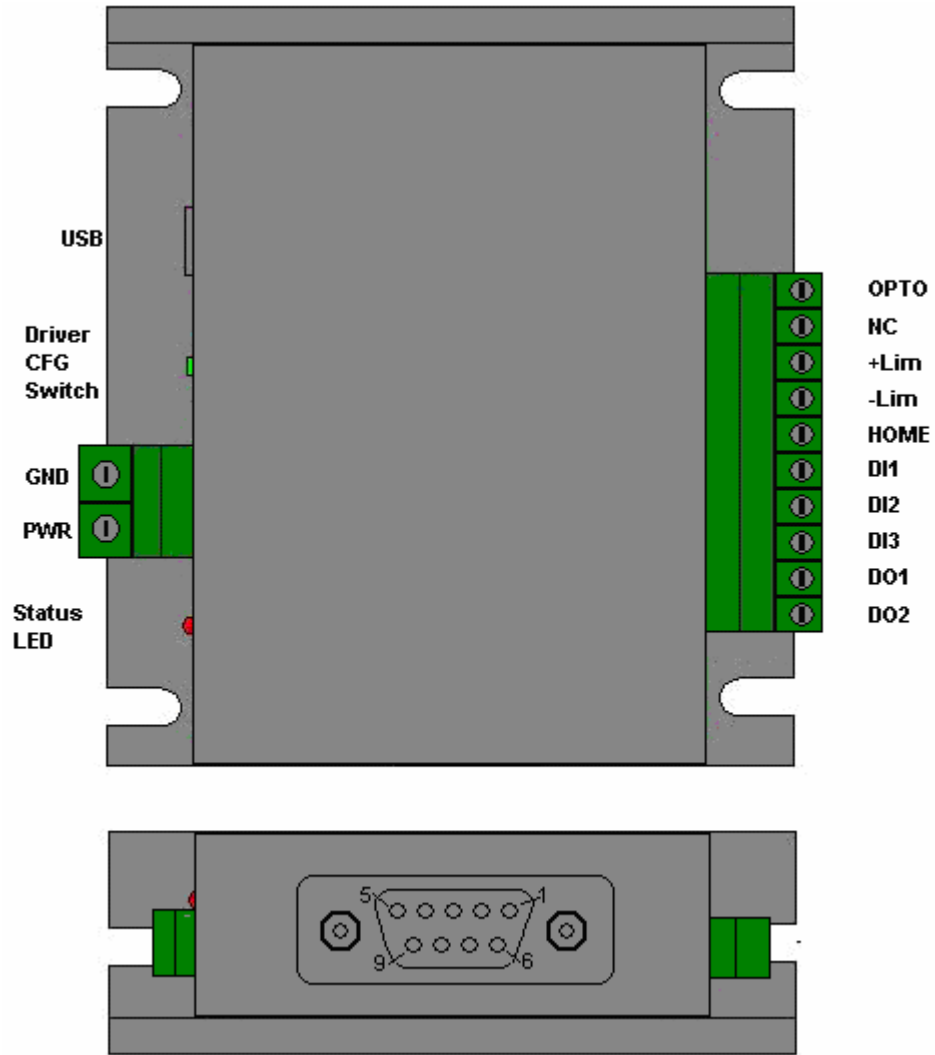
ACE-SXC is a single axis step motor controller with following features:

- USB 2.0 Communication
- PC based control through USB 2.0
- Standalone Control with BASIC-like programming language
- 12-48VDC voltage input
- Pulse/Dir open-collector signal output
- 400K maximum pulse rate output
- Open-collector Enable output
- TTL Alarm input
- Opto-isolated +Limit, -Limit, and Home inputs
- Three Opto-isolated Digital inputs
- Two Opto-isolated Digital outputs
- DMX-K-DRV, DMX-A2-DRV and ACE-SDX driver configuration

2. Dimensions



3. Connectors



DB9 Connector Information

Pin#	Name	Type
1	PWR	OUT
2	PUL	OUT
3	ENA	OUT
4	ALM	IN
5	5V+	OUT
6	GND	OUT
7	DIR	OUT
8	NC	OUT
9	5V+	OUT

2 pin Connector Information

Pin #	Name	Description
1	G	Ground
2	V+	Power Input +12 to +48VDC

Mating Connector Description: 2 pin 0.2" (5.08mm) connector

Mating Connector Manufacturer: On-Shore

Mating Connector Manufacturer Part: EDZ950/2

Note: Other 5.08mm compatible connector can be used.

10 pin Connector Information

Pin #	Name	Description
1	DO2	Digital Output 1
2	DO1	Digital Output 2
3	DI3	Digital Input 3
4	DI2	Digital Input 2
5	DI1	Digital Input 1
6	HOME	Home Input 1
7	-LIM	Minus Limit Input
8	+LIM	Plus Limit input
9	NC	No Connection
10	OPTO-IN	Opto-supply in (12-24VDC)

Mating Connector Description: 10 pin 0.15" (3.81mm) connector

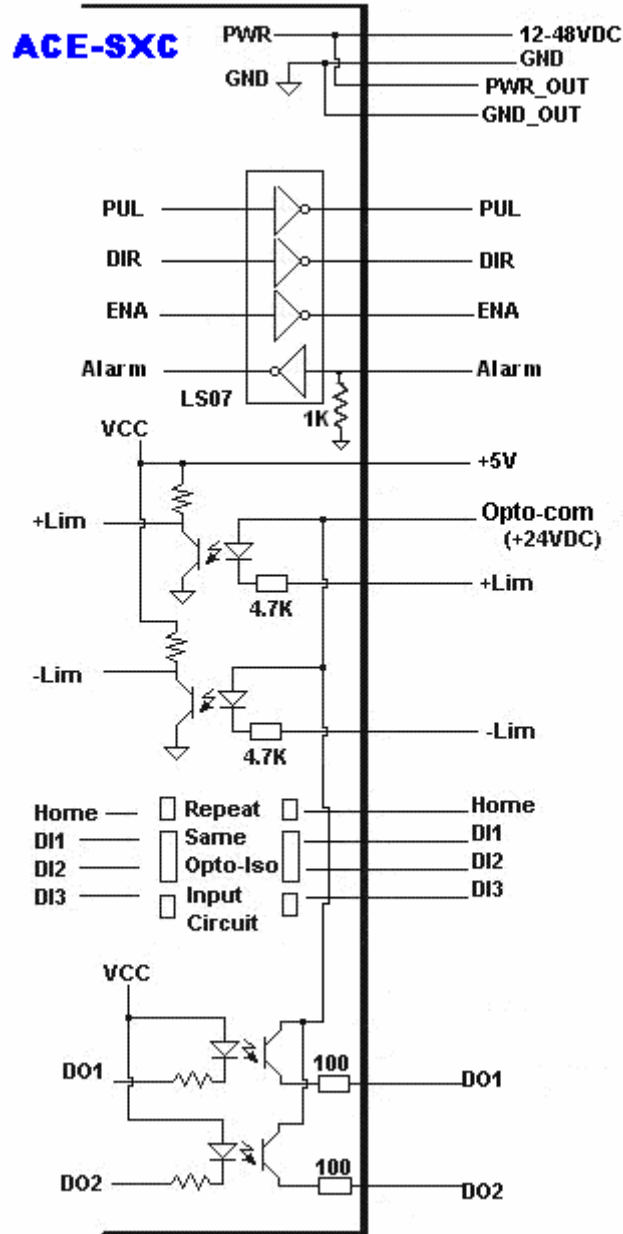
Mating Connector Manufacturer: On-Shore

Mating Connector Manufacturer Part: EDZ1550/10

Note: Other 3.81mm compatible connector can be used.

4. Electrical Specifications

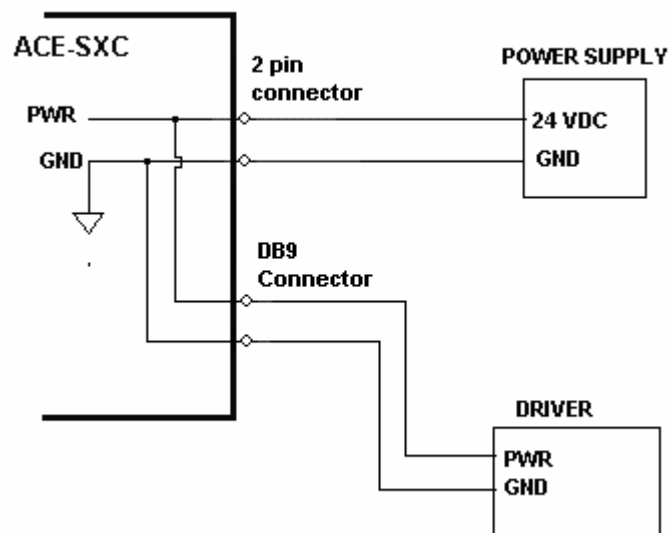
Internal Interface Circuit Overview



Power Input

Regulated Supply Voltage Range: **+12 to 48 VDC**
 Recommended Current for power supply: **200 mA**
 (Current required for powering the ACE-SXC. If driver is powered through the DB-9, additional current is required to power the driver.)

Power and ground signals that are supplied to ACE-SXC through the 2 pin connector are also available through the DB9 pin connector.



Important Note: *If the driver is powered through the DB9 connector, make sure that the voltage of the power supply does not go over the maximum rated power supply voltage of the driver. For example, DMX-K-DRV maximum allowed voltage is +24VDC. If ACE-SXC is powered by +48VDC, powering the DMX-K-DRV through the DB9 connector will damage the driver.*

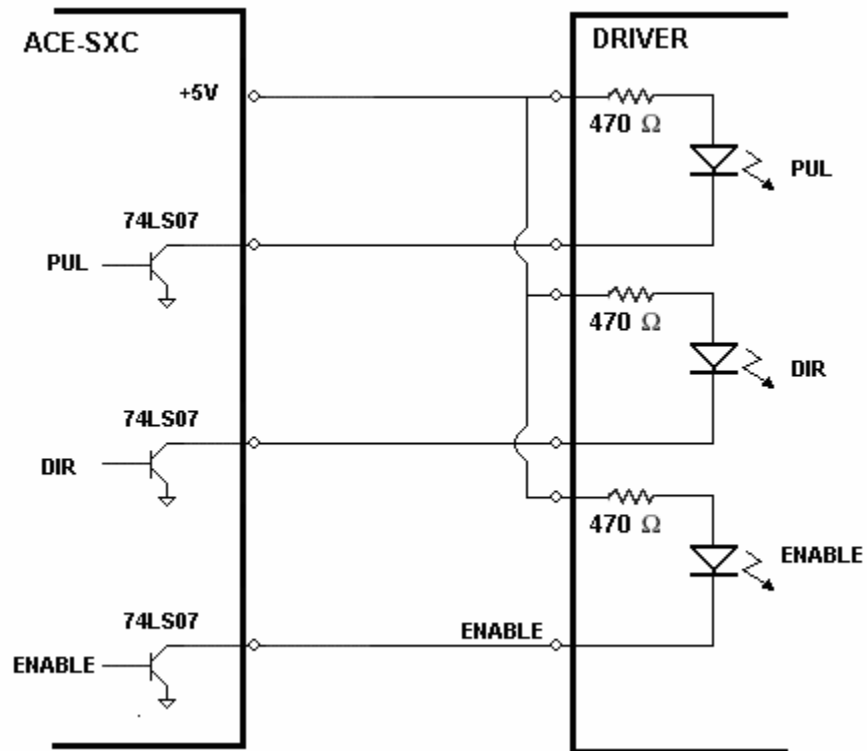
Communication:

Communication: **USB 2.0**
 Connector: **Mini-B to A**

Pulse, Direction and Enable Outputs

Enable Output is an open collector output using 74LS07.

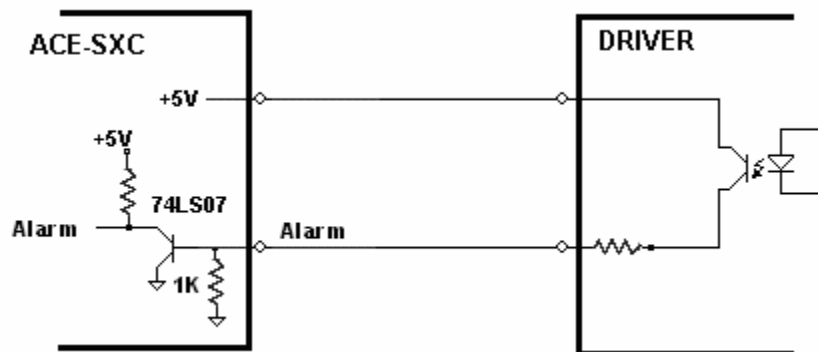
An example of a pulse, direction and enable circuit connection to a driver is shown below.



Alarm Input

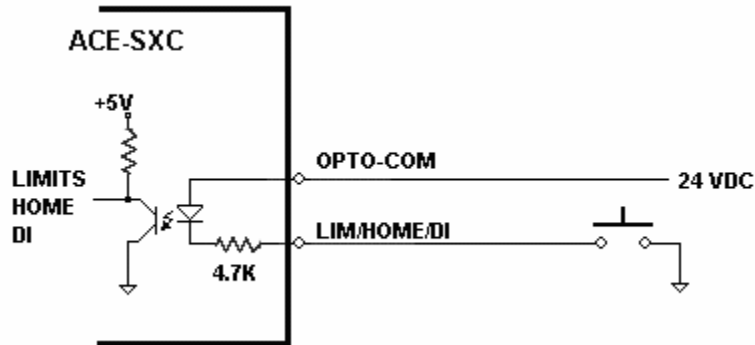
Alarm input is a TTL compatible input using the 74LS07.

An example of Alarm circuit is shown below.



Limits, Home and Digital Inputs:

Type:	Opto-isolated inputs
Opto voltage supply input:	+24 VDC
Maximum diode forward current:	50mA

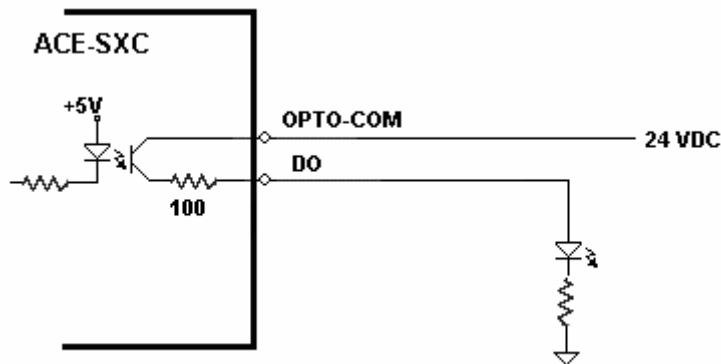


4.7K resistor is built in to the limit, home and digital inputs to limit the current across the diode of the opto-isolator.

Digital inputs are active high.

Digital Outputs:

Type:	Opto-isolated open-emitter transistor output
Maximum emitter current:	50 mA



Digital outputs are active low.

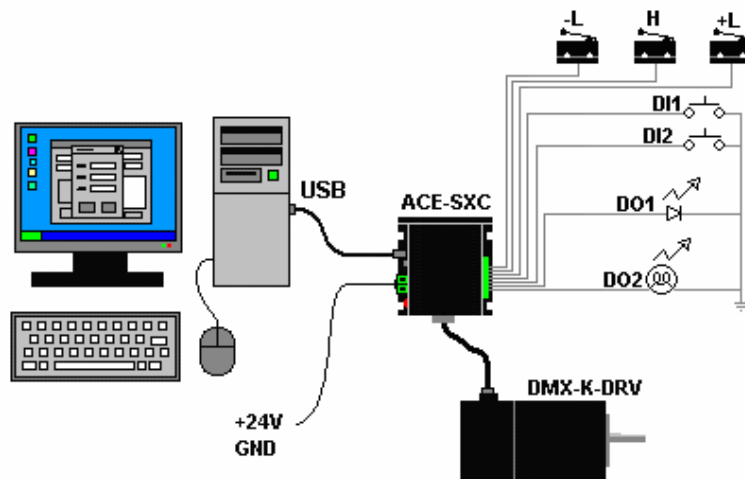
Operating Temperature

Electronic components used in ACE-SXC have maximum ambient operating temperature of **85 degree Celsius**.

5. Getting Started

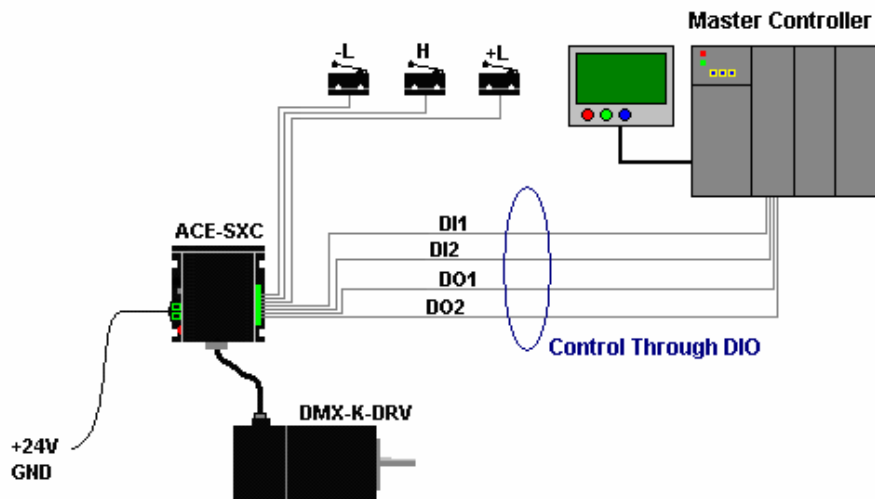
Typical Setup

PC-Controlled



OR

Stand-Alone Operation



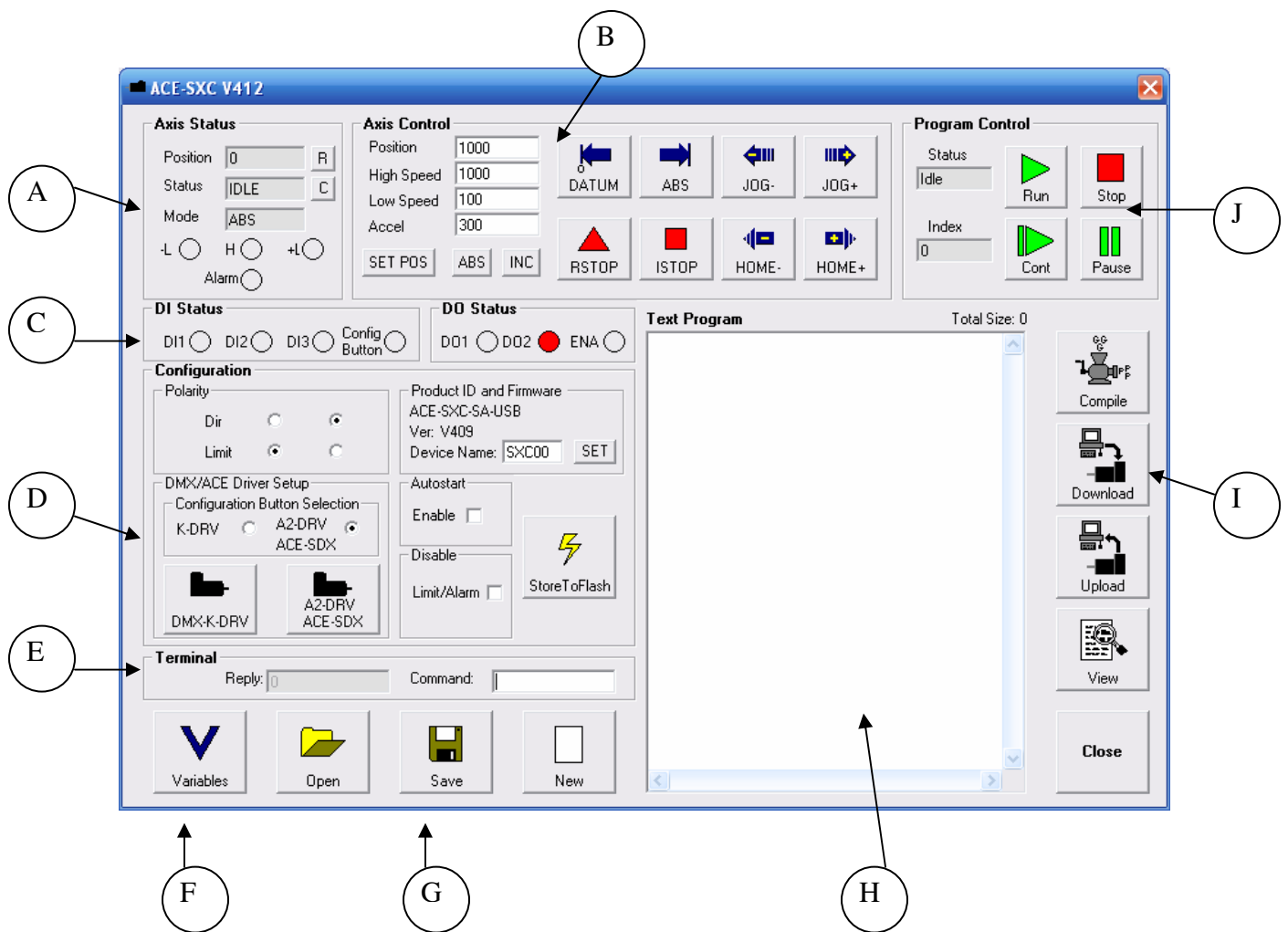
Windows GUI

ACE-SXC comes with Windows GUI program to test, program, compile, download, and debug the controller. GUI program can also be used to configure driver settings of DMX-K-DRV, DMX-A2-DRV, and ACE-SDX.

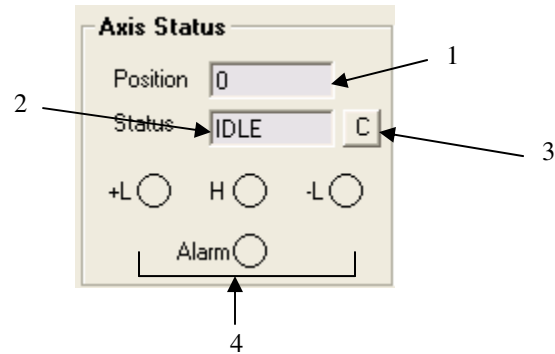
Make sure that the USB driver is installed properly before running the controller.

Startup the ACE-SXC GUI program and you will see following screen:

Main Control Screen

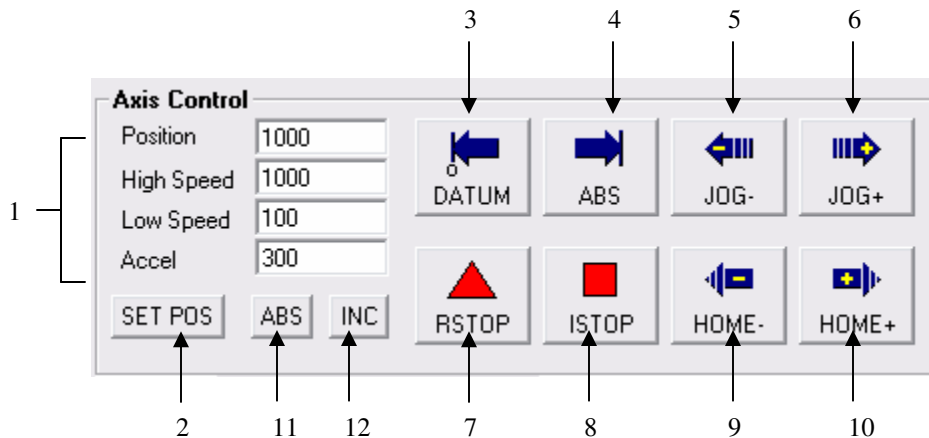


A. Status



- 1. Position** – Display of current motor position counter value
- 2. Status** – Display of current motor status. Possible values are
ACCEL – acceleration in progress
CONST – constant speed in progress
DECEL – deceleration in progress
-LIM ERROR – minus limit error occurred
+LIM ERROR – plus limit error occurred
- 3. Clear Error** – Clear Error button is used to clear the Limit error status.
- 4. Limit and Home and Alarm Input Status** – Display of limits and home and alarm input status.

B. Axis Control



1. Target Position/Speed/Accel

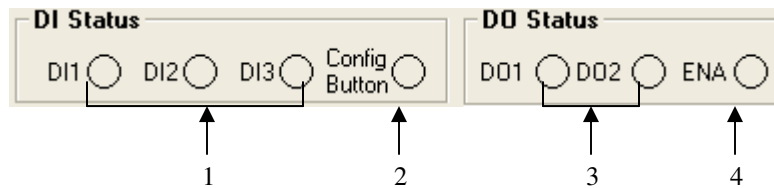
Target Position – use this to set the target position. This position is the pulse position.

High/Low Speed – use this to set the speed of the move. This value is in pulses/second.

Accel – acceleration value in milliseconds

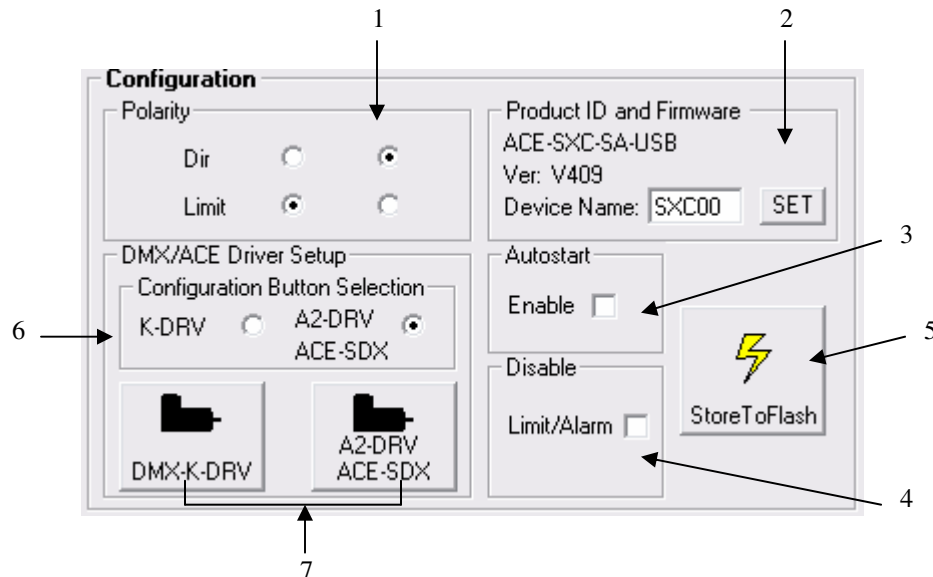
2. **Set Position** – Set Position button
3. **DATUM** – Absolute move to zero position. Maximum delta from current position to target is 262,143. If greater, then move will not perform.
4. **ABS** – Absolute move to target position. Maximum delta from current position to target is 262,143. If greater, then the move will not perform.
5. **JOG-** - Jog to minus direction
6. **JOG+** - Jog to plus direction
7. **RSTOP** – Stop with deceleration
8. **ISTOP** – Immediate stop without deceleration
9. **HOME-** - Homing in minus direction
10. **HOME+** - Homing in plus direction
11. **ABS Mode** – Set to absolute move mode. In ABS mode, all position moves go directly to the target position.
12. **INC Mode** – Set to incremental move mode. In INC mode, all moves increment/decrement from the current position.

C. DI Status/DO Status/Enable



1. **Digital Input Status** – Display of the three digital input bits. If the digital input pin is grounded, the digital input is turned on.
2. **Configuration Button Input Status** – Display of the driver configuration button.
3. **Digital Output Status** – Display of the two digital output status. Digital output can be toggled by clicking on the circle.
4. **Enable Output Status** – Enable output status. Enable output can be toggled by clicking on the circle.

D. Configuration



1. Polarity – Direction polarity can be configured to change the rotational direction. Limit switch input can be configured. Limit switch polarity setting is valid only when the limit switch function is enabled.

2. Product ID and Firmware – Product ID and firmware is shown to confirm the ACE-SXC product. Firmware version loaded on the ACE-SXC is shown. Device name can be changed so that multiple ACE-SXC can be connected on the USB. When entering the new Device Name, make sure to enter in the format of SXCXX where XX ranges from 00 to 99. To change the device name, click “SET”, then store the parameter to flash. After a power cycle, the new device name will take effect.

3. Autostart – Autostart is for automatic startup of the standalone program. If this is checked, the standalone program startup up automatically when the unit is powered.

4. Limit and Alarm Disable – Limit and alarm switch function can be disabled and the inputs can be used as general purpose inputs.

5. Store To Flash – Parameters on the ACE can be permanently stored on the flash memory. The unit is powered, the parameter values stored on the flash is loaded and used. Following are parameters that are stored on the flash.

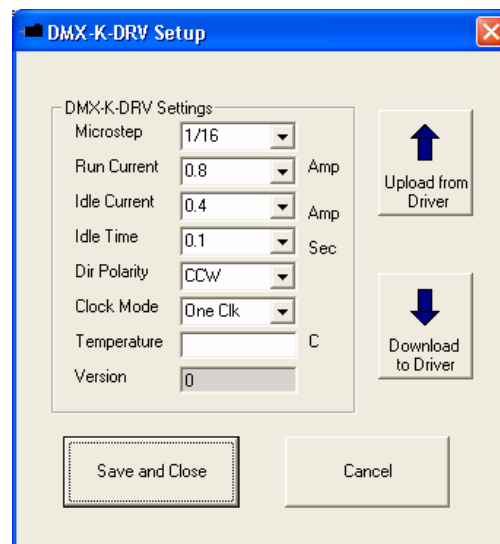
- Direction Polarity
- Limit Polarity
- Autostart Enable
- Disable Limit and Alarm switch function
- Device Name

- Driver settings
- Configuration Button Selection
- Variables V26 – V50

6. Configuration Button Selection – Configuration button is used to download the driver parameters without the use of the Windows PC. With the controller powered and connected to DMX-K-DRV, DMX-A2-DRV, or ACE-SDX, the driver configurations on the controller can be downloaded to the driver by using the configuration button. A2-DRV and ACE-SDX use the same driver parameter settings and grouped together as one type. Select the driver type that will be used with the configuration button and once selected, store to the flash memory so that the driver type and driver parameters to be used will be stored to the controller.

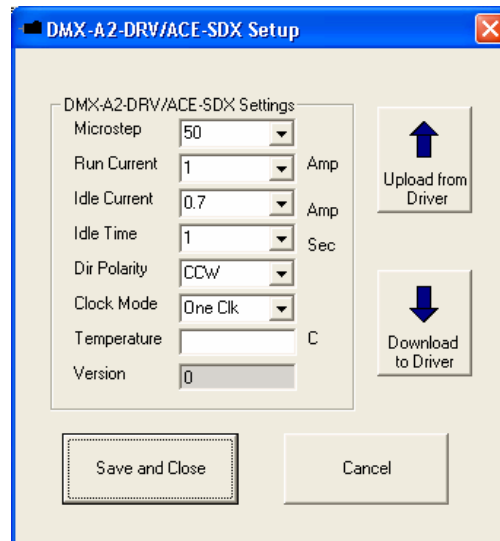
7. DMX-K-DRV and DMX-A2-DRV/ACE-SDX Configuration using Windows GUI – DMX-K-DRV and DMX-A2-DRV/ACE-SDX can be configured from the GUI by selecting one of the buttons.

1. When DMX-K-DRV button is selected DMX-K-DRV configuration dialog box is opened. From this dialog box, settings for DMX-K-DRV can be uploaded or downloaded. Note that Temperature (showing the current driver temperature as detected) and Version can only be uploaded.



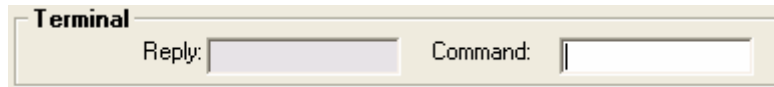
The driver settings can be stored on ACE-SXC so that the parameter values can be used by the configuration button. To save to ACE-SXC, select **Save and Close** button which will download the parameters to the ACE-SXC. To store the downloaded parameters permanently on the ACE-SXC controller, make sure to store to flash before powering down the controller. To close without downloading the parameters to ACE-SXC, select **Cancel** button.

2. When DMX-A2-DRV/ACE-SDX button is selected DMX-A2-DRV/ACE-SDX configuration dialog box is opened. From this dialog box, settings for DMX-A2-DRV/ACE-SDX can be uploaded or downloaded. Note that Temperature (showing the current driver temperature as detected) and Version can only be uploaded.



The driver settings can be stored on ACE-SXC so that the parameter values can be used by the configuration button. To save to ACE-SXC, select **Save and Close** button which will download the parameters to the ACE-SXC. To store the downloaded parameters permanently on the ACE-SXC controller, make sure to store to flash before powering down the controller. To close without downloading the parameters to ACE-SXC, select **Cancel** button.

E. Terminal



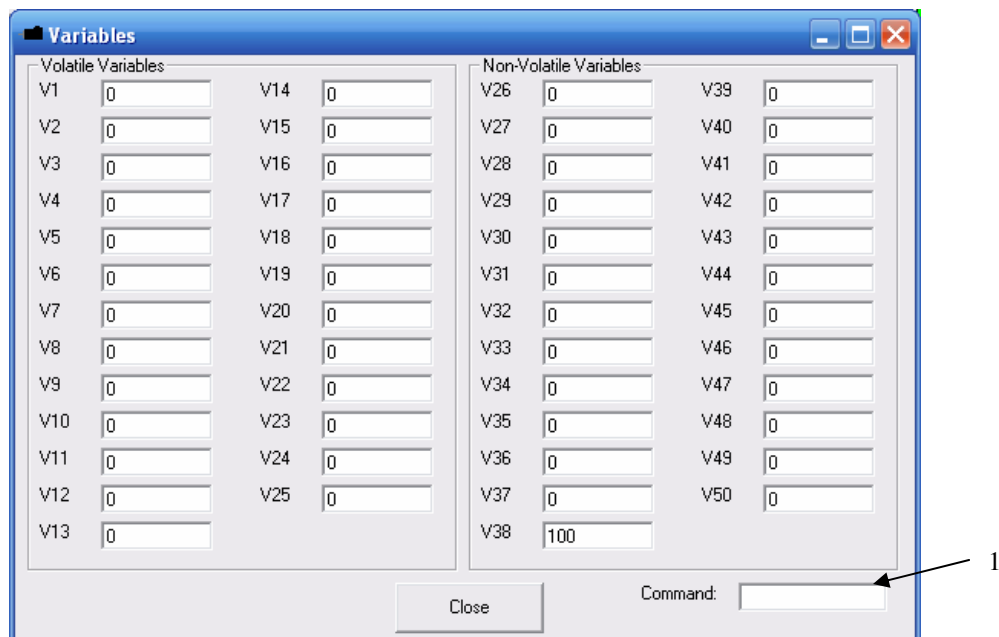
Terminal

Reply: Command:

Interactive terminal commands can be sent and replies can be received. See interactive commands for details of the interactive commands.

F. Variable Status

View the status of variables 1-50. Note that this window is read-only.



Variables

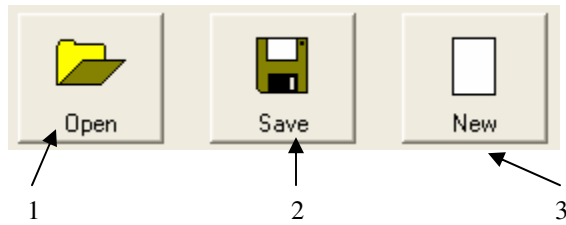
Volatile Variables		Non-Volatile Variables	
V1	0	V26	0
V2	0	V27	0
V3	0	V28	0
V4	0	V29	0
V5	0	V30	0
V6	0	V31	0
V7	0	V32	0
V8	0	V33	0
V9	0	V34	0
V10	0	V35	0
V11	0	V36	0
V12	0	V37	0
V13	0	V38	100
V14	0	V39	0
V15	0	V40	0
V16	0	V41	0
V17	0	V42	0
V18	0	V43	0
V19	0	V44	0
V20	0	V45	0
V21	0	V46	0
V22	0	V47	0
V23	0	V48	0
V24	0	V49	0
V25	0	V50	0

Close Command:

1

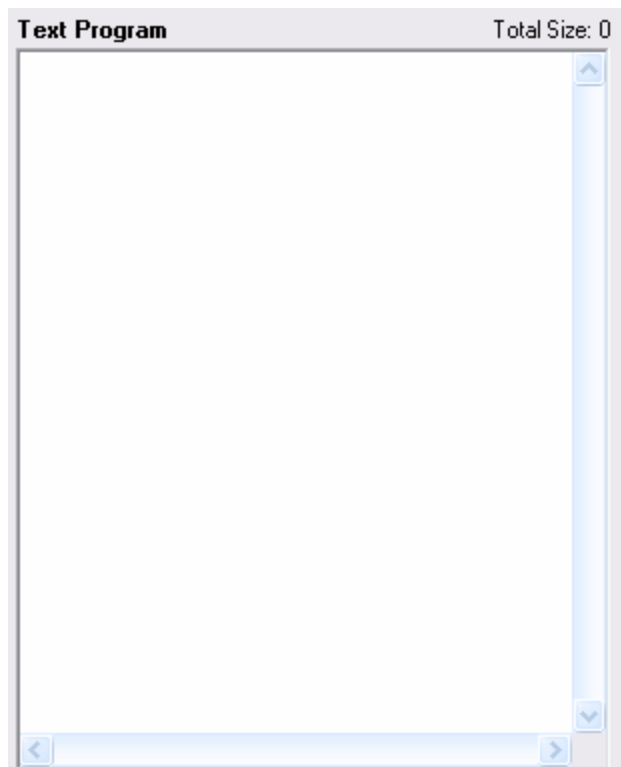
1. Command line – To write to variable, use V[1-50] = [value] syntax.

G. Standalone Program File Management

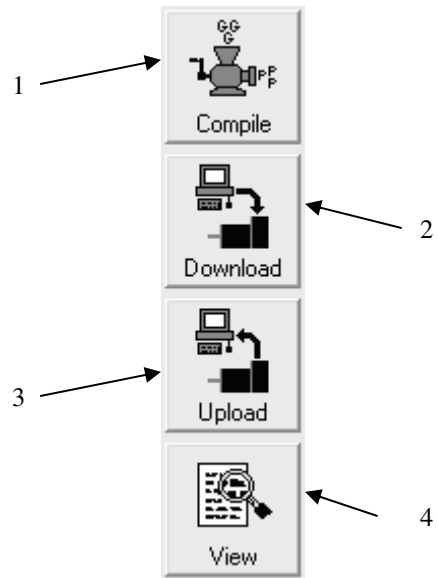


1. **Open** – Open standalone program
2. **Save** – Save standalone program
3. **New** – Clear the standalone program editor

H. Standalone Program Editor

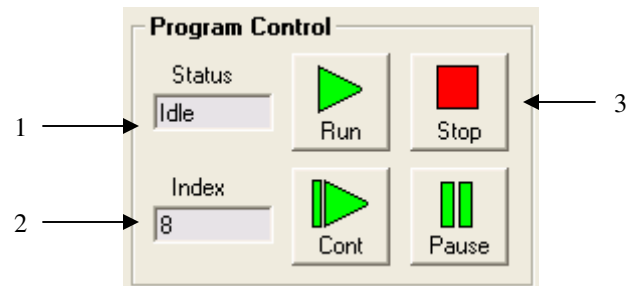


I. Standalone Program Compile/Download/Upload/View



1. **Compile** – Compile the standalone program
2. **Download** – Download the compiled program
3. **Upload** – Upload the standalone program from the controller
4. **View** – View the low level compiled program

J. Program Control



1. Program Status – display of program status. Possible statuses are

Idle – program is not running

Running – program is running

Paused – program is paused

Errored – program is in error status

2. Program Index – display of low level program index. This is the index of the low level program index.

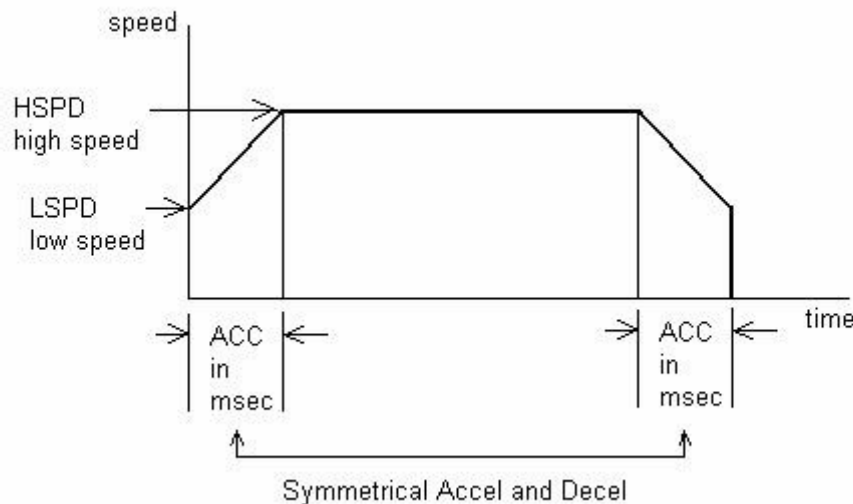
3. Program Control – Program can be RUN, STOP, PAUSED, and CONTINUED.

6. Motion Control Overview

All the commands described in this section are all interactive commands and do not transfer over directly to standalone commands. Please refer to the “Standalone Language Specification” section for details.

Motion Profile and Speed

ACE-SXC incorporates trapezoidal velocity profile as shown below.



High speed and low speed are in pps (pulses/second). Use **HSPD** and **LSPD** commands to set/get the high speed and low speed settings. Pulse output rate supported is from 100 to 400K pulses/second.

Acceleration and deceleration time is in milliseconds and are symmetrical (same value is used for acceleration as deceleration). Use the **ACC** command to set/get the acceleration/deceleration value. Acceleration range is from 10 msec to 1000 msec.

Position Counter

ACE-SXC has 32 bit signed position counter. Range of the position counter is from -2,147,483,648 to 2,147,483,647. Get the current position by using the **PX** command.

Note on motion commands: If a motion command is sent while the controller is already moving, the command is not processed. Instead, an error response is returned.

Target Move

Target move, also known as absolute move, is used to move the motor to the desired position from the current position.

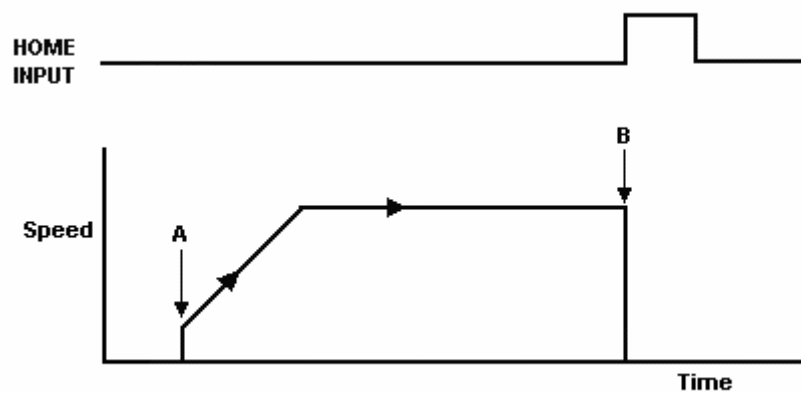
Maximum allowable difference to target position from current position is 262,143. Maximum difference between current position and the target position has to be less than

or equal to 262,143. For example, if the current position counter is 1000, target position allowed will be between -261,143 (1,000-262,143) and 263,143 (1,000+262,143).

ACE-SXC can operate in either incremental or absolute move modes. Use **X** command to make moves. Use the **INC** and **ABS** commands to set the move mode. Use the **MODE** command to read the current move mode.

Home Move

Home search sequence involves moving the motor towards the home switch and then stopping when the home input is detected. Use the **H+ / H-** command. Following sequence shows the homing routine.



- A. Issuing home command starts the motor from low speed and accelerates to high speed.
- B. As soon as the home input is triggered, the position counter is reset to zero and the motor stops immediately. If the home switch is triggered in the middle of the acceleration, the motor stops immediately.

To trigger the home input switch, supply the opto-supply voltage with 24VDC and connect the home input signal to opto-supply ground.

If home switch is not used, home input can also be used as general purpose input. Digital input assignment for the home input switch is **DI6**.

Digital inputs are active high.

Jog Move

Jog move is used to continuously move the motor without stopping. Use **J+ / J-** commands.

Stopping Motor

When motor is moving, jogging, or homing, motion can be stopped abruptly or with deceleration. It is recommended to use decelerate and stop command so that there is less

impact to the system. To stop abruptly, use the **ABORT** command. To stop with deceleration, use the **STOP** command.

Limit Switch Function

With limit switch function enabled, triggering of the limit switch in motion will stop the motion immediately depending on the direction of the motion. If positive limit switch is triggered while moving in positive direction, motor will immediately stop and the motor status bit for positive limit error is set. Same is for negative limit while moving in negative direction. Once limit error is set, status must be cleared (using the **CLR** command) in order to move again. Once the error is cleared, move the motor out of the limit switch.

Limit switch function can also be disabled by using the **DL** command. By disabling the limit switch function, the limits switches can be used as general purpose inputs. When limit function is disabled, digital input assignments are: **DI5** for –Limit and **DI7** for +Limit.

Digital inputs are active high.

Alarm Switch Function

Alarm switch when triggered will immediately stop the motor if in motion regardless of the direction of the motor. Once alarm error is set, status must be cleared (using the **CLR** command) in order to move again. Alarm switch function can be disabled using the **DL** command and alarm input can be used as general purpose input as **DI8**.

Digital inputs are active high.

Configuration Button Function

Configuration button is used to configure the DMX-K-DRV, DMX-A2-DRV, and ACE-SDX. Configuration button can also be used as general purpose digital input in the standalone program. Digital input assignment of configuration button is **DI4**.

Digital inputs are active high.

Motor Status

Motor status can be read anytime using the **MST** command. The following are bit representation of motor status.

Bit	Description
0	Motor running at constant speed
1	Motor in acceleration
2	Motor in deceleration
3	Home input switch status
4	Minus limit input switch status
5	Plus limit input switch status

6	Minus limit error. This bit is latched when minus limit is hit during negative direction motion. This error must be cleared before issuing any subsequent move commands (CLR command).
7	Plus limit error. This bit is latched when plus limit is hit during positive direction motion. This error must be cleared before issuing any subsequent move commands (CLR command).
8	Alarm error. This bit is latched when the alarm input is triggered while motion is in progress. This error must be cleared before issuing any subsequent move commands (CLR command).

Digital Inputs

ACE-SXC module comes with 3 digital inputs. If limit/alarm function is disabled, up to 8 inputs can be used as general purpose inputs

Read digital input status using the **DI** command. See description below:

Bit	Description
0	Digital Input 1
1	Digital Input 2
2	Digital Input 3
3	Configuration Button
4	Minus Limit
5	Home
6	Plus Limit
7	Alarm

Digital input values can also be referenced one bit at a time by the **DI[1-8]** commands. Note that the indexes are 1-based for the bit references (i.e. DI1 refers to bit 0, not bit 1)

Digital inputs are active high.

Digital Outputs

ACE-SXC module comes with 2 digital outputs.

Read/set digital output status using the **DO** command. See description below:

Bit	Description
0	Digital Output 1
1	Digital Output 2

Digital output values can also be referenced one bit at a time by the **DO[1-2]** commands. Note that the indexes are 1-based for the bit references (i.e. DO1 refers to bit 0, not bit 1)

Digital outputs are active low.

Motor Power

Using the **EO** command, the motor power can be enabled or disabled. If the enable function is not used, the enable output can be used as a general purpose output. The enable output does not effect the move command.

Polarity

Using **POL** command, polarity of following signals can be configured:

Bit	Description
0	Direction
1	Limit

Device Number

ACE-SXC module provides the user with the ability to set the device number of a specific device. In order to make these changes, first store the desired number using the **DN** command. Please note that this value must be within the range [SXC01,SXC99].

To write the values to the device's flash memory, use the **STORE** command. After a complete power cycle, the new device number will be written to memory. Note that before a power cycle is completed, the settings will not take effect.

By default: Device name is set to: **SXC00**

Standalone Programming

Standalone Program Specification:

Memory size: 1275 assembly lines ~ 7.5 KB.

Note: Each line of pre-compiled code equates to 1-4 lines of assembly lines.

Stand-alone execution while in Step-N-Loop:

While a stand-alone program is running in closed-loop operation, before executing an absolute move command, the controller first verifies that it is NOT correcting or moving to a previous absolute position.

Error Handling:

If an error occurs during standalone execution (i.e. limit error), the program automatically jumps to SUB 31. If SUB 31 is NOT defined, the program will cease execution and go to error state. If SUB 31 is defined by the user, the code within SUB 31 is first executed, and then standalone execution continues.

Calling subroutines over communication: Once a subroutine is written into the flash, they can be called via USB communication using the **GS** command. The subroutines are

referenced by their subroutine number [0-31]. If a subroutine number is not defined, the ACE-SXC will return with an error.

Storing to Flash

The following items are stored to flash:

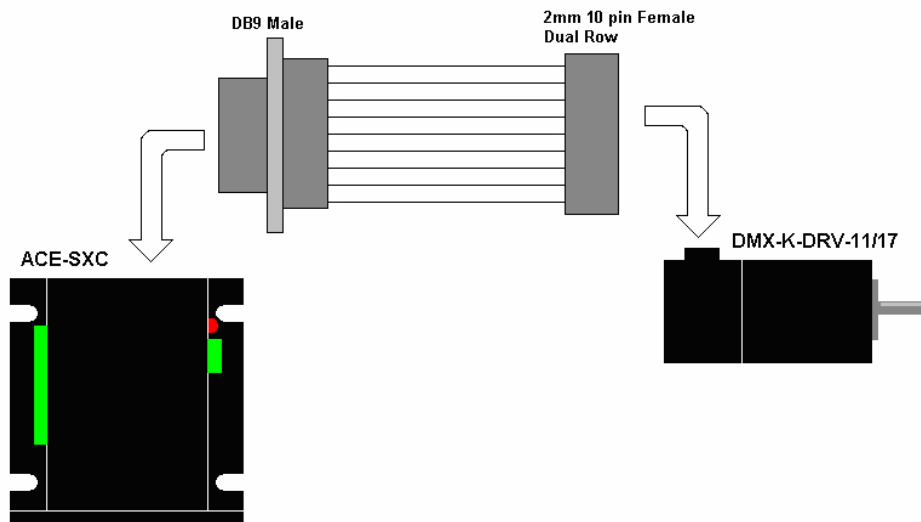
- Device Name
- Polarity settings
- Standalone program run on boot up parameter
- Stepper driver configuration type
- Stepper driver parameters
- Variables V26-V50 (Note that on boot-up, V1-V25 are reset to value 0)

Note: When standalone program is downloaded, the program is immediately written on the flash memory.

7. Connecting to DMX-K-DRV, DMX-A2-DRV, and ACE-SDX

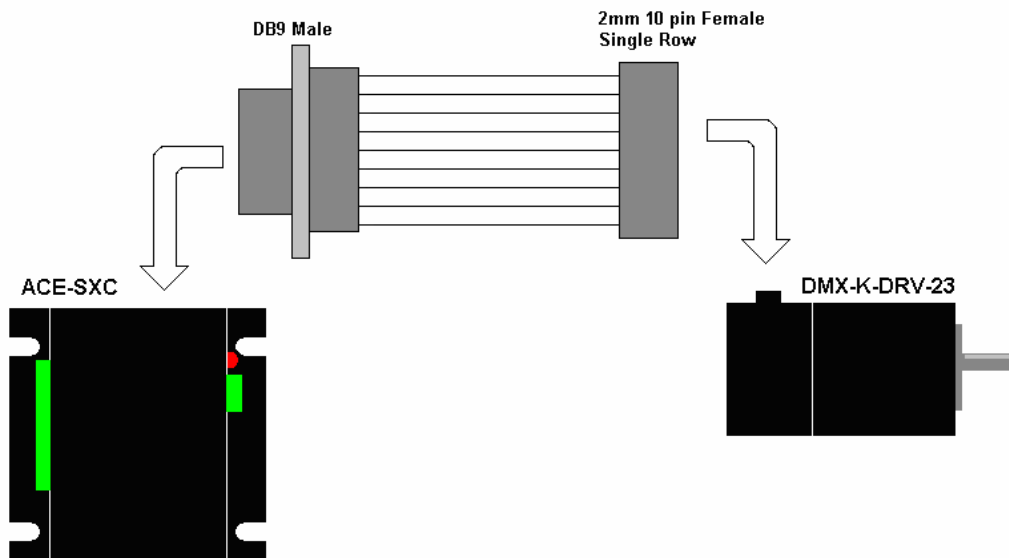
Connecting ACE-SXC to DMX-K-DRV-11/17

Cable Accessory: CBL-DB_9M-DF11_10F-L1-G24-V1



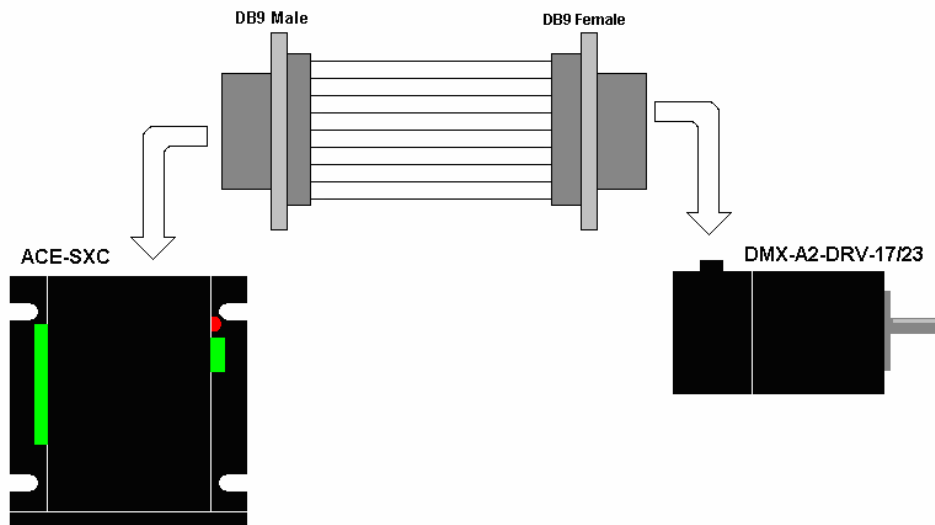
Connecting ACE-SXC to DMX-K-DRV-23

Cable Accessory: CBL-DB_9M-DF3_10-L1-G24-V1



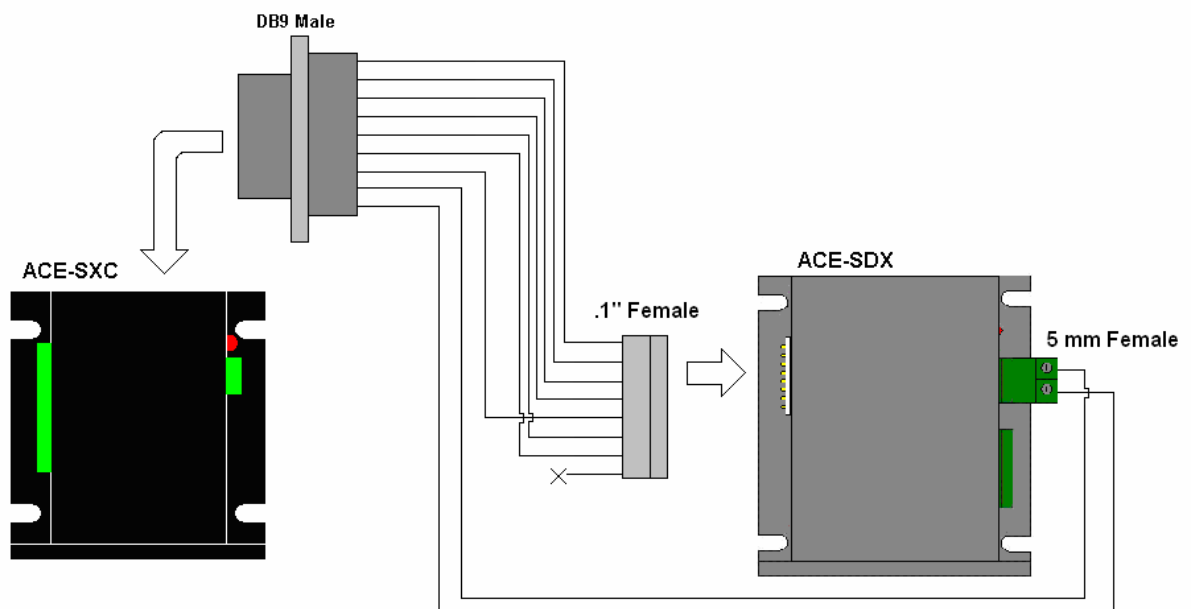
Connecting ACE-SXC to DMX-A2-DRV-17/23

Cable Accessory: CBL-DB_9M-DB_9F-L1-G24-V1



Connecting ACE-SXC to ACE-SDX

Cable Accessory: CBL-DB_9M-I_8F-L1-G24-V1



8. DriveMax Configuration

ACE-SXC can be used to configure the driver settings for the following products.

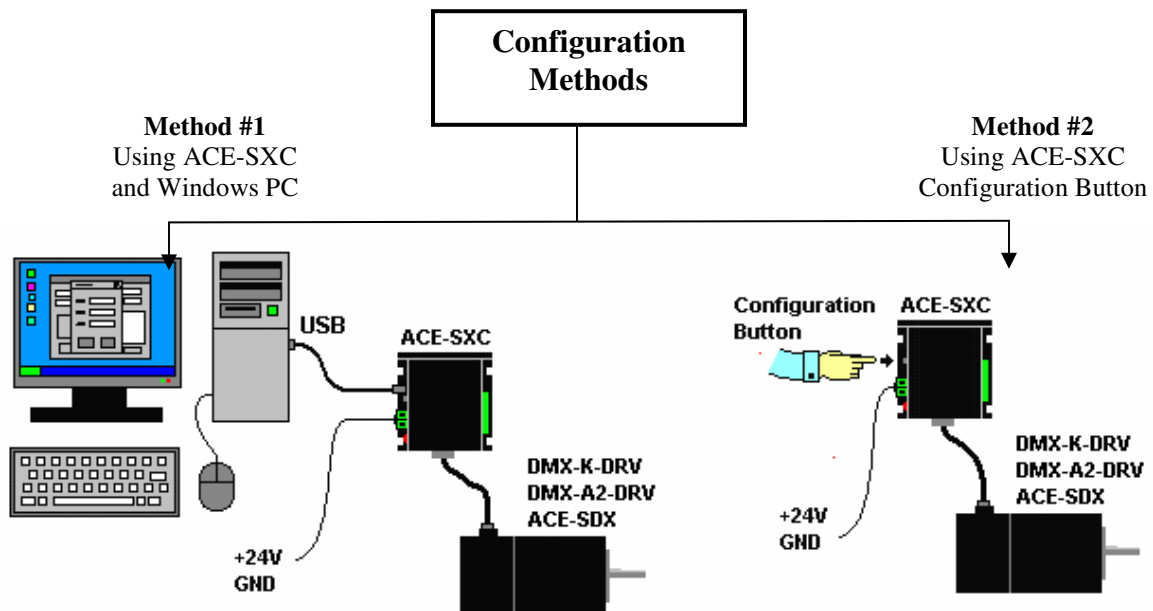
DMX-K-DRV-11/17/23

DMX-A2-DRV-17/23

ACE-SDX

ACE-SXC uses patent pending Dynamic Configuration method of reading and writing of the driver setting through control lines: PULSE/DIR/ENABLE/ALARM.

There are two ways to configure the DMX-K/DMX-A2/ACE-SDX using ACE-SXC.



Configuration Method #1 – Using Windows PC

Method #1 uses the Windows PC using the ACE-SXC GUI program to upload and download the driver parameters. For detailed description, refer to the ACE-SXC GUI section on driver configuration.

Configuration Method #2 – Using the Configuration Button

Method #2 uses the configuration button on the ACE-SXC controller to download the driver parameters. Note that configuration button is used only for downloading the driver parameters that have been stored on the ACE-SXC controller.

On the ACE-SXC controller, driver type needs to be stored on the flash so that when the button configuration is used, correct driver configuration is done. There are two types of driver type for button configuration: 1) K-DRV and 2) A2-DRV/ACE-SDX.

Once the correct driver type is selected and the driver parameter values are stored on the flash memory of ACE-SXC controller, driver parameters can be downloaded from ACE-SXC to DMX-K-DRV without the use of Windows PC using the configuration button on the ACE-SXC. To configure the driver through the configuration button follow the steps below.

- 1) Power the ACE-SXC controller using 24VDC power supply.
- 2) Connect the control cable between ACE-SXC and DMX-K-DRV/A2-DRV/ACE-SDX. All the control signals (Pulse/Dir/Enable/Alarm) must be connected to work properly.
- 3) Press and hold down the configuration button for 3 seconds. LED on ACE-SXC controller will start blinking quickly indicating that the configuration is ready to start.
- 4) While the LED is blinking quickly, release the button and press the button again to start the configuration of the connected driver. While the configuration is done, LED is turned off. Configuration takes about 3 seconds. If button is not pressed again within 3 seconds during quick blinking state, LED will stop blinking and configuration will be aborted.
- 5) If the configuration is done properly, the LED will blink quickly for 3 seconds. If the configuration is not done properly, LED will blink slowly for 3 seconds.

9. Communication – USB

ACE-SXC USB communication is USB 2.0 compliant.

Communication between the PC and ACE-SXC is done using Windows compatible DLL API function calls as shown below. Windows programming language such as Visual BASIC, Visual C++, LABView, or any other programming language that can use DLL can be used to communicate with the Performax module.

Typical communication transaction time between PC and ACE-SXC for sending a command from a PC and getting a reply from ACE-SXC using the **fnPerformaxComSendRecv()** API function is in single digit milliseconds. This value will vary with CPU speed of PC and the type of command.

Important Note: PerformaxCom.dll only supports single-threaded programming. Calling PerformaxCom.dll functions from different threads will lead to unexpected behavior even if the functions are not being used by different threads simultaneously.

USB Communication API Functions

For USB communication, following DLL API functions are provided.

BOOL fnPerformaxComGetNumDevices(OUT LPDWORD lpNumDevices);

- This function is used to get total number of all types of Performax and Performax USB modules connected to the PC.

**BOOL fnPerformaxComGetProductString(IN DWORD dwNumDevices,
OUT LPVOID lpDeviceString,
IN DWORD dwOptions);**

- This function is used to get the Performax or Performax product string. This function is used to find out Performax USB module product string and its associated index number. Index number starts from 0.

**BOOL fnPerformaxComOpen(IN DWORD dwDeviceNum,
OUT HANDLE* pHandle);**

- This function is used to open communication with the Performax USB module and to get communication handle. dwDeviceNum starts from 0.

BOOL fnPerformaxComClose(IN HANDLE pHandle);

- This function is used to close communication with the Performax USB module.

**BOOL fnPerformaxComSetTimeouts(IN DWORD dwReadTimeout,
DWORD dwWriteTimeout);**

- This function is used to set the communication read and write timeout. Values are in milliseconds. This must be set for the communication to work. Typical value of 1000 msec is recommended.

BOOL fnPerformaxComSendRecv(IN HANDLE pHandle,
 IN LPVOID wBuffer,
 IN DWORD dwNumBytesToWrite,
 IN DWORD dwNumBytesToRead,
 OUT LPVOID rBuffer);

- This function is used to send command and get reply. Number of bytes to read and write must be 64 characters.

USB Communication Issues

A common problem that users may have with USB communication is that after sending a command from the PC to the device, the response is not received by the PC until another command is sent. In this case, the data buffers between the PC and the USB device are out of sync. Below are some suggestions to help alleviate this issue.

- 1) **Multi-threading:** Be sure that your application does not employ multi-thread processing. See “important note” in the beginning of this section.
- 2) **Buffer Flushing:** If USB communication begins from an unstable state (i.e. your application has closed unexpectedly, it is recommended to first flush the USB buffers of the PC and the USB device. See the following function prototype below:

BOOL fnPerformaxComFlush(IN HANDLE pHandle)

Note: fnPerformaxComFlush is only available in the most recent PerformaxCom.dll which is not registered by the standard USB driver installer. A sample of how to use this function along with this newest DLL is available for download on the website

- 3) **USB Cable:** Another source of USB communication issues may come from the USB cable. Confirm that the USB cable being used has a noise suppression choke. See photo below:



10. ASCII Language Specification

All the commands described in this section are all interactive commands and do not transfer over directly to standalone commands. Please refer to the “Standalone Language Specification” section for details.

ACE-SXC language is case sensitive. All command should be in capital letters. Invalid command is returned “?”. Always check for proper reply when command is sent.

Command	Description	Return
ABORT	Immediately stops the motor if in motion. For decelerate stop, use STOP command. This command can also be used to clear a StepNLoop error	OK
ABS	Set move mode to absolute	OK
ACC	Returns current acceleration value in milliseconds. (10-1000)	Milli-seconds
ACC=[Value]	Sets acceleration value in milliseconds. (10-1000) Example: ACC=300	OK
BDT	Get driver configuration type	1 – DMX-K-DRV 2 – DMX-A2-DRV / ACE-SDX
BDT=[0,1]	Set driver configuration type	OK
CLR	Clears limit error as well as StepNLoop error	OK
DI	Return status of digital inputs	Bit 0 – Digital Input 1 Bit 1 – Digital Input 2 Bit 2 – Digital Input 3 Bit 3 – Configuration Button Bit 4 – Minus Limit Input Bit 5 – Home Bit 6 – Plus Limit Input Bit 7 – Alarm Input
DI[1-8]	Return individual status of inputs	DI1, DI2, DI3 – Digital inputs 1, 2, and 3 DI4 – Configuration Button DI5 – Minus Limit DI6 – Home DI7 – Plus Limit DI8 – Alarm
DO	Return status of digital outputs	2-bit number
DO=[Value]	Set digital output 2 bit number. Digital output is writable only if DIO is disabled.	OK
DO[1-2]	Get status if individual output	DO1 – Digital Output 1 DO2 – Digital Output 2
DO[1-2]=[Value]	Set individual output	OK
DL	Get disable limit/alarm function 0 – limit/alarm function is enabled 1 – limit/alarm function is disabled	[0,1]
DL=[Value]	Set disable limit/alarm function 0 – limit/alarm function is enabled 1 – limit/alarm function is disabled	OK
DN	Get device number	[SXC00-SXC99]
DN=[value]	Set device number	OK
EO	Returns driver power enable.	1 – Motor power enabled 0 – Motor power disabled

EO=[0 or 1]	Enables (1) or disable (0) motor power.	OK
GS[0-31]	Call a subroutine that has been previously stored to flash memory	OK
HSPD	Returns High Speed Setting	PPS
HSPD=[Value]	Sets High Speed.	OK
H+	Homes the motor in positive direction	OK
H-	Homes the motor in negative direction	OK
ID	Returns product ID	ACE-SXC-SA-USB
INC	Set move mode to incremental	OK
J+	Jogs the motor in positive direction	OK
J-	Jogs the motor in negative direction	OK
LSPD	Returns Low Speed Setting	PPS
LSPD=[Value]	Sets Low Speed	OK
MODE	Get move mode status	0 – Absolute move mode 1 – Incremental move mode
MST	Returns motor status	Bit 0 – constant speed Bit 1 – accelerating Bit 2 – decelerating Bit 3 – home input Bit 4 – minus limit input Bit 5 – plus limit input Bit 6 – minus limit error Bit 7 – plus limit error Bit 8 – alarm error
POL	Returns current polarity	Bit 0 – Dir Bit 1 – Limit
POL=[value]	Sets polarity.	OK
PX	Returns current position value	32-bit number
PX=[value]	Sets the current position value	OK
SASTAT	Get standalone program status 0 – Stopped 1 – Running 2 – Paused 4 – In Error	0-4
SA[LineNumber]	Get standalone line LineNumber: [0,1274]	
SA[LineNumber]=[Value]	Set standalone line LineNumber: [0,1274]	
SLOAD	Returns RunOnBoot parameter	0,1
SLOAD=[0 or 1]	0 – Do NOT run standalone program on boot up 1 – Run standalone program on boot up	OK
SR=[Value]	Control standalone program: 0 – Stop standalone program 1 – Run standalone program 2 – Pause standalone program 3 – Continue standalone program	OK
SPC	Get program counter for standalone program	[0-1274]
STORE	Store settings to flash	OK
V[1-50]	Read variables 1-50	32-bit number
V[1-50]=[value]	Set variables 1-50	OK
VER	Get firmware version	VXXX
X[value]	Moves the motor to absolute position value using the HSPD, LSPD, and ACC values. Maximum allowed incremental move amount is 262143. For example, if current position is	OK

	100000, target move must be between 362143 and -162143	
--	--	--

11. Standalone Language Specification

;

Description:

Comment notation. In programming, comment must be in its own line.

Syntax:

; [Comment Text]

Examples:

```

; ***This is a comment
JOGX+           ; ***Jogs axis to positive direction
DELAY=1000      ; ***Wait 1 second
ABORT           ; ***Stop immediately all axes including X axis

```

ABORTX

Description:

Motion: Immediately stop motion without deceleration.

Syntax:

ABORTX

Examples:

```

JOGX+           ; ***Jogs axis to positive direction
DELAY=1000      ; ***Wait 1 second
ABORTX          ; ***Stop axis immediately

```

ABS

Description:

Command: Changes all move commands to absolute mode.

Syntax:

ABS

Examples:

```

ABS          ;***Change to absolute mode
PX=0        ;***Change position to 0
X1000       ;***Move X axis to position 1000
X3000       ;***Move X axis to position 3000
  
```

ACC

Description:

Read: Get acceleration value

Write: Set acceleration value.

Value is in milliseconds.

Syntax:

Read: [variable] = ACC

Write: ACC = [value]

ACC = [variable]

Examples:

```

ACC=300     ;***Sets the acceleration to 300 milliseconds
V3=500     ;***Sets the variable 3 to 500
ACC=V3     ;***Sets the acceleration to variable 3 value of 500
  
```

DELAY

Description:

Set a delay (1 ms units)

Syntax:

Delay=[Number] (1 ms units)

Examples:

```
JOGX+           ;***Jogs axis to positive direction
DELAY=10000     ;***Wait 10 second
ABORTX          ;***Stop axis
```

DI

Description:

Read: Gets the digital input value. ACE-SXC has 8 digital inputs.

Digital inputs are active high

Syntax:

Read: [variable] = DI

Conditional: IF DI=[variable]
ENDIF

IF DI=[value]
ENDIF

Examples:

```
IF DI=0
    DO=1           ;***If all digital inputs are triggered, set DO=1
ENDIF
```

DI[1-8]

Description:

Read: Gets the digital input value. ACE-SXC has 8 digital inputs.

Digital inputs are active high

Syntax:

Read: [variable] = DI[1-8]

Conditional: IF DI[1-8]=[variable]
ENDIF

IF DI[1-8]=[0 or 1]
ENDIF

Examples:

```
IF DI1=0
    DO=1      ;***If digital input 1 is triggered, set DO=1
ENDIF
```

DO

Description:

Read: Gets the digital output value

Write: Sets the digital output value

ACE-SXC has 2 digital outputs.

Digital outputs are active low.

Syntax:

Read: [variable] = DO

Write: DO = [value]

DO = [variable]

Conditional: IF DO=[variable]
ENDIF

IF DO=[value]
ENDIF

Examples:

```
DO=3      ;***Turn on both bits
```

DO[1-2]

Description:

Read: Gets the individual digital output value

Write: Sets the individual digital output value

ACE-SXC has 2 digital outputs.

Digital outputs are active low.

Syntax:

Read: [variable] = DO[1-2]

Write: DO[1-2] = [0 or 1]

DO[1-2] = [variable]

Conditional: IF DO[1-2]=[variable]
ENDIF

IF DO[1-2]=[0 or 1]
ENDIF

Examples:

DO1=1 ;***Turn DO1 on

DO2=1 ;***Turn DO2 on

ECLEARX

Description:

Write: Clears motor error status.

Syntax:

Write: ECLEARX

Examples:

```
ECLEARX                ;***Clears motor error
```

ELSE

Description:

Perform ELSE condition check as a part of IF statement

Syntax:

ELSE

Examples:

```
IF V1=1
    X1000                ;***If V1 is 1, then move to 1000
ELSE
    X-1000              ;***If V1 is not 1, then move to -1000
ENDIF
```

ELSEIF

Description:

Perform ELSEIF condition check as a part of the IF statement

Syntax:

ELSEIF [Argument 1] [Comparison] [Argument 2]

[Argument] can be any of the following:

- Numerical value
- Pulse or Encoder Position
- Digital Output
- Digital Input
- Enable Output
- Motor Status

[Comparison] can be any of the following

- = Equal to
- > Greater than
- < Less than
- >= Greater than or equal to
- <= Less than or equal to
- != Not Equal to

Examples:

```

IF V1=1
    X1000
ELSEIF V1=2
    X2000
ELSEIF V1=3
    X3000
ELSE
    X0
ENDIF

```

END

Description:

Indicate end of program.
Program status changes to idle when END is reached.

Note: Subroutine definitions should be written AFTER the END statement

Syntax:

END

Examples:

```
X0  
WAITX  
X1000  
END
```

ENDIF

Description:

Indicates end of IF operation

Syntax:

ENDIF

Examples:

```
IF V1=1  
    X1000  
ENDIF
```

ENDSUB

Description:

Indicates end of subroutine

When ENDSUB is reached, the program returns to the previously called subroutine.

Syntax:

ENDSUB

Examples:

```
GOSUB 1
END
```

```
SUB 1
    X0
    WAITX
    X1000
    WAITX
ENDSUB
```

ENDWHILE

Description:

Indicate end of WHILE loop

Syntax:

ENDWHILE

Examples:

```
WHILE V1=1          ;***While V1 is 1 continue to loop
    X0
    WAITX
    X1000
    WAITX
ENDWHILE           ;***End of while loop so go back to WHILE
```

EO

Description:

Read: Gets the enable output value

Write: Sets the enable output value

Syntax:

Read: [variable] = EO

Write: EO = [value]

EO = [variable]

Conditional: IF EO=[variable]
ENDIF

IF EO=[value]
ENDIF

Examples:

EO=1 ;***Energize motor

GOSUB

Description:

Perform go to subroutine operation

Subroutine range is from 0 to 31.

Note: Subroutine definitions should be written AFTER the END statement.
Subroutine 31 is reserved for error handling.

Syntax:

GOSUB [subroutine number]

[Subroutine Number] range is 0 to 31

Examples:

```
GOSUB 0
END
```

```
SUB 0
  X0
  WAITX
  X1000
  WAITX
ENDSUB
```

HOMEX[+ or -]

Description:

Command: Perform homing using current high speed, low speed, and acceleration.

Syntax:

HOMEX[+ or -]

Examples:

HOMEX+ ;***Homes axis in positive direction

HSPD

Description:

Read: Gets high speed. Value is in pulses/second

Write: Sets high speed. Value is in pulses/second.

Range is from 1 to 400,000.

Syntax:

Read: [variable] = HSPD

Write: HSPD = [value]

HSPD = [variable]

Examples:

HSPD=10000 ;***Sets the high speed to 10,000 pulses/sec

V1=2500 ;***Sets the variable 1 to 2,500

HSPD=V1 ;***Sets the high speed to variable 1 value of 2500

IF

Description:

Perform IF condition check

Syntax:

IF [Argument 1] [Comparison] [Argument 2]

[Argument] can be any of the following:

- Numerical value
- Pulse or Encoder Position
- Digital Output
- Digital Input
- Enable Output
- Motor Status

[Comparison] can be any of the following

- = Equal to
- > Greater than
- < Less than
- >= Greater than or equal to
- <= Less than or equal to
- != Not Equal to

Examples:

```
IF V1=1
    X1000
ENDIF
```

INC

Description:

Command: Changes all move commands to incremental mode.

Syntax:

INC

Examples:

```

INC           ;***Change to incremental mode
PX=0         ;***Change position to 0
X1000        ;***Move axis to position 1000 (0+1000)
X2000        ;***Move axis to position 3000 (1000+2000)

```

JOGX[+ or -]

Description:

Command: Perform jogging using current high speed, low speed, and acceleration.

Syntax:

JOGX[+ or -]

Examples:

```

JOGX+       ;***Jogs axis in positive direction
JOGX-       ;***Jogs axis in negative direction

```

LSPD

Description:

Read: Get low speed. Value is in pulses/second.

Write: Set low speed. Value is in pulses/second.

Range is from 1 to 400,000.

Syntax:

Read: [variable]=LSPD

Write: LSPD=[long value]

LSPD=[variable]

Examples:

LSPD=1000 ;***Sets the start low speed to 1,000 pulses/sec

V1=500 ;***Sets the variable 1 to 500

LSPD=V1 ;***Sets the start low speed to variable 1 value of 500

MSTX

Description:

Read: Get motor status

Syntax:

Read: [variable]=MSTX

Conditional: IF MSTX=[variable]
ENDIF

IF MSTX=[value]
ENDIF

Examples:

```
IF MSTX=0
    DO=3
ELSE
    DO=0
ENDIF
```

PX

Description:

Read: Gets the current pulse position

Write: Sets the current pulse position

Syntax:

Read: Variable = PX

Write: PX = [value]

PX = [variable]

Conditional: IF PX=[variable]
ENDIF

IF PX=[value]
ENDIF

Examples:

```
JOGX+           ;***Jogs axis to positive direction
DELAY=1000      ;***Wait 1 second
ABORTX          ;***Stop with deceleration all axes including X axis
PX=0            ;***Sets the current pulse position to 0
```

STOPX

Description:

Command: Stop all axes if in motion with deceleration.

Previous acceleration value is used for deceleration.

Syntax:

STOPX

Examples:

```
JOGX+           ;***Jogs axis to positive direction
DELAY=1000      ;***Wait 1 second
STOPX           ;***Stop with deceleration
```

STORE

Description:

Command: Store all values to flash

Syntax:

STORE

Examples:

```
V40=PX           ;***Put position value in V40
DELAY=1000       ;***Wait 1 second
STORE            ;***Store V40 to non-volatile flash
```

SUB

Description:

Indicates start of subroutine

Syntax:

SUB [subroutine number]

[Subroutine Number] range is 0 to 31

Examples:

```
GOSUB 1
END
SUB 1
    X0
    WAITX
    X1000
    WAITX
ENDSUB
```

V[1-50]

Description:

Assign to variable.
ACE-SXC has 100 variables [V1-V50]

Syntax:

V[Variable Number] = [Argument]
V[Variable Number] = [Argument1][Operation][Argument2]

Special case for BIT NOT:

V[Variable Number] = ~[Argument]

[Argument] can be any of the following:

- Numerical value
- Pulse or Encoder Position
- Digital Output
- Digital Input
- Enable Output
- Motor Status

[Operation] can be any of the following

- + Addition
- Subtraction
- * Multiplication
- / Division
- % Modulus
- >> Bit Shift Right
- << Bit Shift Left
- & Bit AND
- | Bit OR
- ~ Bit NOT

Examples:

V1=12345	;	***Set Variable 1 to 123
V2=V1+1	;	***Set Variable 2 to V1 plus 1
V3=DI	;	***Set Variable 3 to digital input value
V4=DO	;	***Sets Variable 4 to digital output value
V5=~EO	;	***Sets Variable 5 to bit NOT of enable output value

WAITX

Description:

Command: Tell program to wait until move on the certain axis is finished before executing next line.

Syntax:

WAITX

Examples:

```
X10000      ;***Move axis to position 10000
WAITX       ;***Wait until axis move is done
DO=3        ;***Set digital output
X3000       ;***Move axis to 3000
WAITX       ;***Wait until axis move is done
```

WHILE

Description:

Perform WHILE loop

Syntax:

WHILE [Argument 1] [Comparison] [Argument 2]

[Argument] can be any of the following:

- Numerical value
- Pulse or Encoder Position
- Digital Output
- Digital Input
- Enable Output
- Motor Status

[Comparison] can be any of the following

- = Equal to
- > Greater than
- < Less than
- >= Greater than or equal to
- <= Less than or equal to
- != Not Equal to

Examples:

```

WHILE V1=1      ;***While V1 is 1 continue to loop
  X0
  WAITX
  X1000
  WAITX
ENDWHILE
  
```

X

Description:

Command: Perform X axis move to target location

Syntax:

X[value]
X[variable]

Examples:

```
ABS      ;***Absolute move mode
X10000   ;***Move to position 10000
V10 = 1200 ;***Set variable 10 value to 1200
XV10     ;***Move axis to variable 10 value
```

Standalone Example Program 1

Task: Set the high speed and low speed and move the motor to 1000 and back to 0.

```

HSPD=20000      ;* Set the high speed to 20000 pulses/sec
LSPD=1000       ;* Set the low speed to 1000 pulses/sec
ACC=300         ;* Set the acceleration to 300 msec
EO=1            ;* Enable the motor power
X1000           ;* Move to 1000
X0              ;* Move to 1000
END             ;* End of the program

```

Standalone Example Program 2

Task: Move the motor back and forth indefinitely between position 1000 and 0.

```

HSPD=20000      ;* Set the high speed to 20000 pulses/sec
LSPD=1000       ;* Set the low speed to 1000 pulses/sec
ACC=300         ;* Set the acceleration to 300 msec
EO=1            ;* Enable the motor power
WHILE 1=1       ;* Forever loop
    X1000       ;* Move to zero
    X0          ;* Move to 1000
ENDWHILE        ;* Go back to WHILE statement
END

```

Standalone Example Program 3

Task: Move the motor back and forth 10 times between position 1000 and 0.

```

HSPD=20000      ;* Set the high speed to 20000 pulses/sec
LSPD=1000       ;* Set the low speed to 1000 pulses/sec
ACC=300         ;* Set the acceleration to 300 msec
EO=1            ;* Enable the motor power
V1=0            ;* Set variable 1 to value 0
WHILE V1<10    ;* Loop while variable 1 is less than 10
    X1000       ;* Move to zero
    X0          ;* Move to 1000
    V1=V1+1     ;* Increment variable 1
ENDWHILE        ;* Go back to WHILE statement
END

```

Standalone Example Program 4

Task: Move the motor back and forth between position 1000 and 0 only if the digital input 1 is turned on.

```

HSPD=20000          ;* Set the high speed to 20000 pulses/sec
LSPD=1000           ;* Set the low speed to 1000 pulses/sec
ACC=300             ;* Set the acceleration to 300 msec
EO=1                ;* Enable the motor power
WHILE 1=1           ;* Forever loop
    IF DI1=1        ;* If digital input 1 is on, execute the statements
        X1000       ;* Move to zero
        X0          ;* Move to 1000
    ENDIF
ENDWHILE            ;* Go back to WHILE statement
END

```

Standalone Example Program 5

Task: Using a subroutine, increment the motor by 1000 whenever the DI1 rising edge is detected.

```

HSPD=20000          ;* Set the high speed to 20000 pulses/sec
LSPD=1000           ;* Set the low speed to 1000 pulses/sec
ACC=300             ;* Set the acceleration to 300 msec
EO=1                ;* Enable the motor power
V1=0                ;* Set variable 1 to zero
WHILE 1=1           ;* Forever loop
    IF DI1=1        ;* If digital input 1 is on, execute the statements
        GOSUB 1     ;* Move to zero
    ENDIF
ENDWHILE            ;* Go back to WHILE statement
END

SUB 1
    XV1              ;* Move to V1 target position
    V1=V1+1000      ;* Increment V1 by 1000
    WHILE DI1=1     ;* Wait until the DI1 is turned off so that
    ENDWHILE        ;* 1000 increment is not continuously done
ENDSUB

```

Standalone Example Program 6

Task: If digital input 1 is on, move to position 1000. If digital input 2 is on, move to position 2000. If digital input 3 is on, move to 3000. If digital input 5 is on, home the motor in negative direction. Use digital output 1 to indicate that the motor is moving or not moving. **Note that in order to have digital input 3 and 5 working as digital input instead of limit switches, disable the limit switch function.**

```

HSPD=20000          ;* Set the high speed to 20000 pulses/sec
LSPD=1000           ;* Set the low speed to 1000 pulses/sec
ACC=300             ;* Set the acceleration to 300 msec
EO=1                ;* Enable the motor power
WHILE 1=1           ;* Forever loop
    IF DI1=1        ;* If digital input 1 is on
        X1000       ;* Move to 1000
    ELSEIF DI2=1    ;* If digital input 2 is on
        X2000       ;* Move to 2000
    ELSEIF DI3=1    ;* If digital input 3 is on
        X3000       ;* Move to 3000
    ELSEIF DI5=1    ;* If digital input 5 is on
        HOMEX-      ;* Home the motor in negative direction
    ENDIF
    V1=MSTX         ;* Store the motor status to variable 1
    V2=V1&7         ;* Get first 3 bits
    IF V2!=0
        DO1=1
    ELSE
        DO1=0
    ENDIF
ENDWHILE           ;* Go back to WHILE statement
END

```

Contact Information

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