## SilverMax X-Series Breakout QCI-BO-X1 & QCI-BO-X1A

The QCI-BO-X1 is a simple breakout module for SilverMax X-Series integrated servo motors. The breakout module provides a conveniently way of connecting power and access to communication, and I/O lines from the SilverMax X-Series M16 19-pin connector. The breakout is intended to be mounted through the wall of the control cabinet to allow easy wiring inside the cabinet while also providing a sealed transition through the wall of the cabinet.

The QCI-BO-X1A adds an active filter that translates the SilverMax servo motor's 0 to 3.3v PWM output on I/O #2 into a 0-5V analog output. Besides the special circuitry on I/O #2, the QCI-BO-X1A is the same as the QCI-BO-X1. Refer to the last page of this document for examples of how to use the QCI-BO-X1A analog output feature.
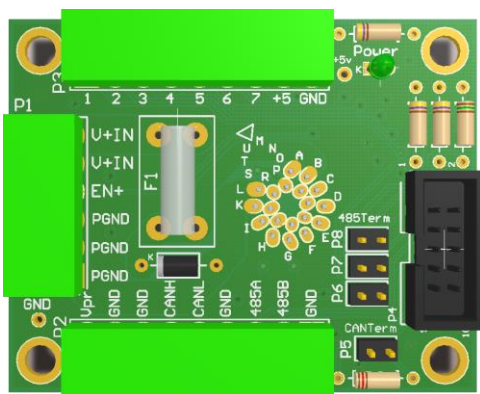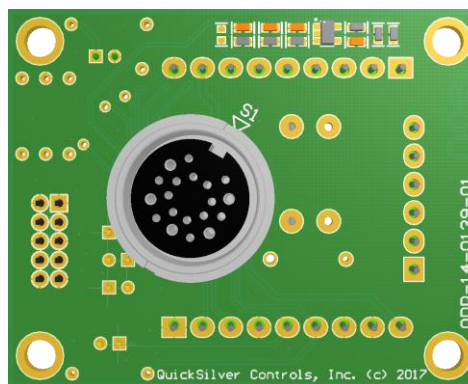
Top View   Bottom View

The input power is protected with an 8A fuse (F1):
- Manufacturer: Littelfuse
- Manufacturer Part Number: 0225008.HXUP

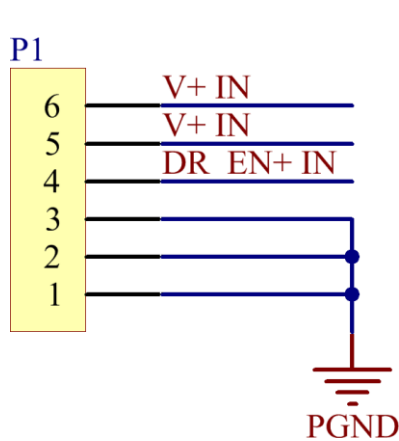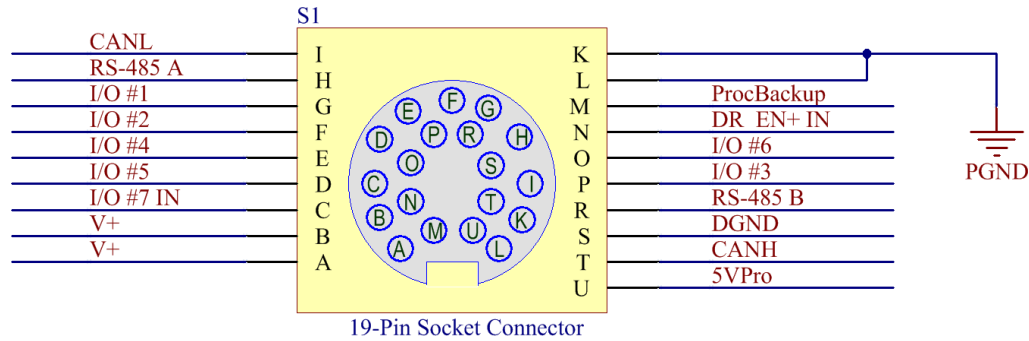The QCI-BO-X1 & QCI-BO-X1A breakout boards include the following items:
1. Qty. 3 – Pluggable connectors
    a. Qty. 1 - 6-pin (for P1)
    b. Qty. 2 - 9 pin (for P2 and P3)
2. Qty. 1 – Fuse (for F1)
3. Qty. 4 – 2-pin jumpers (for P5, P6, P7, and P8)

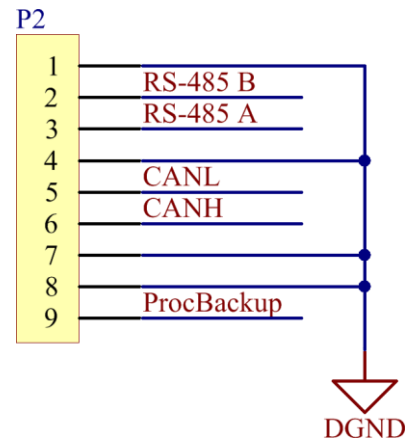The items listed above are available as a separate connector kit. Part number: QCI-CK-BX1.

Power LED lights up only when the breakout board is connected to a SilverMax X-Series motor and power is present on P1 terminal. Note: If power is present on P1 terminal and no SilverMax X-Series motor is connected, the power LED will not light up. The power LED should **not** be used to determine if power is present on the board.

The breakout board is designed to allow RS485 and CAN communications signals to be daisy-chained across multiple QCI-BO-X1 breakout boards via the P4 header using a standard 10-pin IDC flat ribbon cable. Contact QuickSilver Controls for 10-pin IDC flat ribbon cable options. The breakout board provides termination for RS-485 and CAN network via jumpers, P6, P7, P8, and P5, respectively. For the CAN bus, this termination is **not** optional.
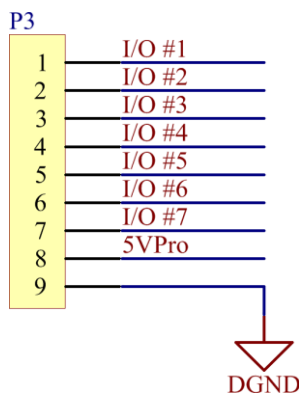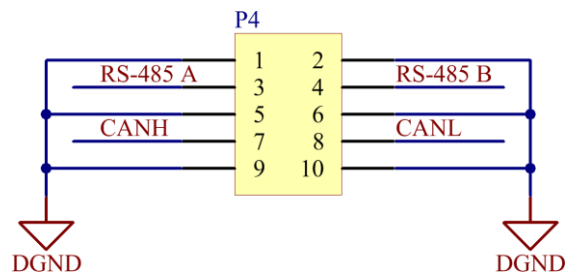
Connector Descriptions

S1

CANL
RS-485 A
I/O #1
I/O #2
I/O #4
I/O #5
I/O #7 IN
V+
V+

I H G F E D C B A
K L M N O P R S T U

ProcBackup
DR EN+ IN
I/O #6
I/O #3
RS-485 B
DGND
CANH
5VPro

PGND

19-Pin Socket Connector

P1

6
5
4
3
2
1

V+ IN
V+ IN
DR EN+ IN

PGND

P1 – Input Power and Drive Enable

P2

1
2
3
4
5
6
7
8
9

RS-485 B
RS-485 A

CANL
CANH

ProcBackup

DGND

P2 – Communications Lines

P3

1
2
3
4
5
6
7
8
9

I/O #1
I/O #2
I/O #3
I/O #4
I/O #5
I/O #6
I/O #7
5VPro

DGND

P3 – I/O Signals

P4

1 2
3 4
5 6
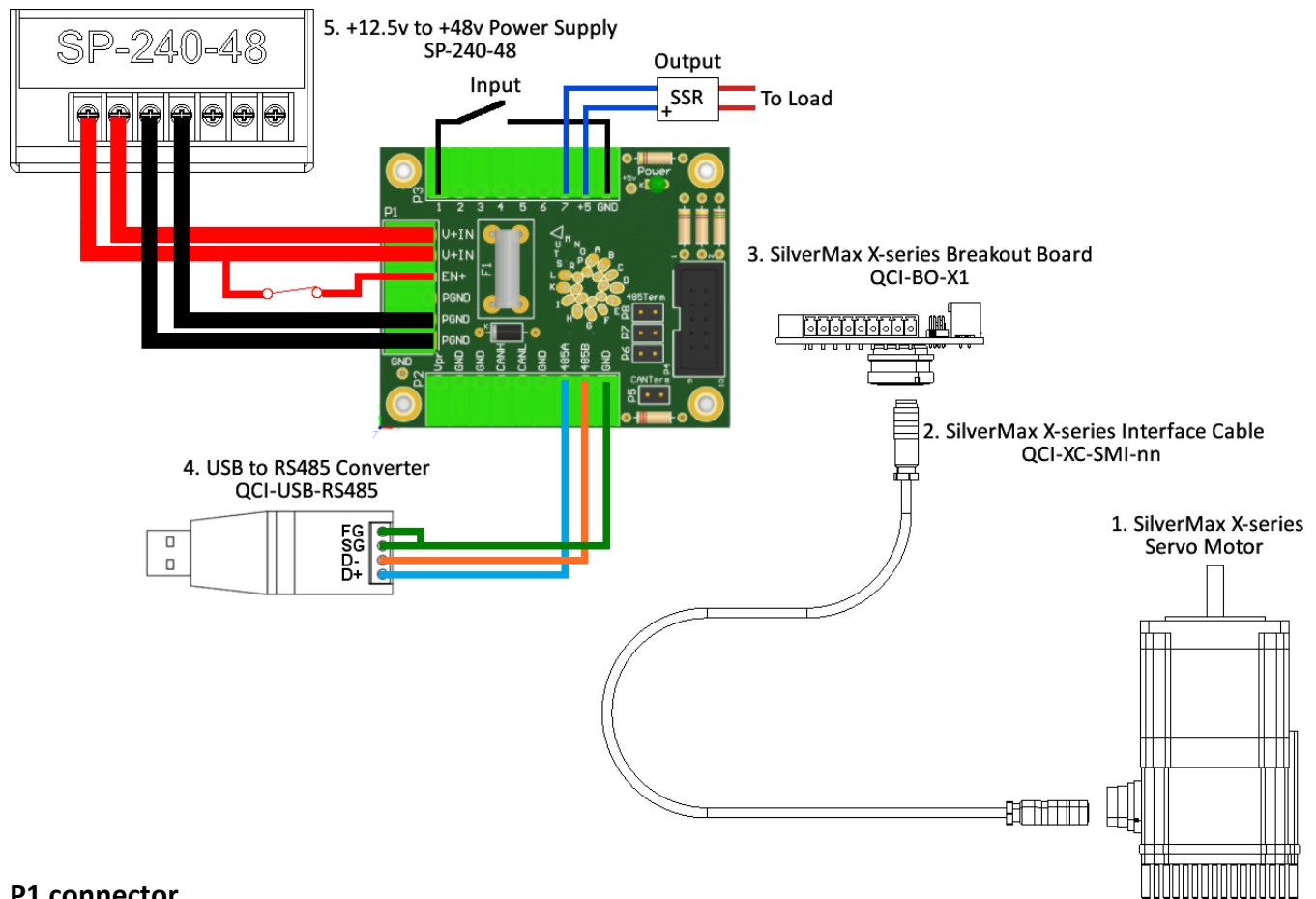7 8
9 10

RS-485 A
CANH

RS-485 B
CANL

DGND   DGND

P4 – Communications via 10-Pin IDC

Typical System Setup

P1 connector.

1. Connect the positive supply voltage to V+IN terminals. If using smaller than 20 AWG wire, run separate wires from the positive supply to both V+IN terminals.
2. Connect the negative supply voltage to PGND terminal. If using smaller than 20 AWG wire run separate wires from the negative supply to at least two of the PGND terminals.
3. To take advantage of the drive enable feature, wire a switch from EN+ to V+IN. An open, disables the motor driver. If drive enable is not required, connect EN+ to V+IN.

P2 connector

1. For a single SilverMax motor on an RS-485 network, connect the 2-pin supplied jumpers to P6, P7, and P8 to provide 485 termination. Internal to the QCI-USB-RS485 converter are biasing resistors for the RS-485 network.
   a. For multiple SilverMax motors on an RS-485 network, only connect the three jumpers on the motor farthest from the serial host.
2. Wire QCI-USB-RS485 converter to breakout board
   a. Connect 485A to D+ on the USB-RS485 converter.
   b. Connect 485B to D- on the USB-RS485 converter.
   c. Connect GND to SG on the USB-RS485 converter.
3. To keep the processor running while main input power is shut off, connect +8 VDC to +12 VDC to the Vpr (ProcBackup pin) terminal. Note: this connection is not needed for normal operation.

Mechanical Dimensions
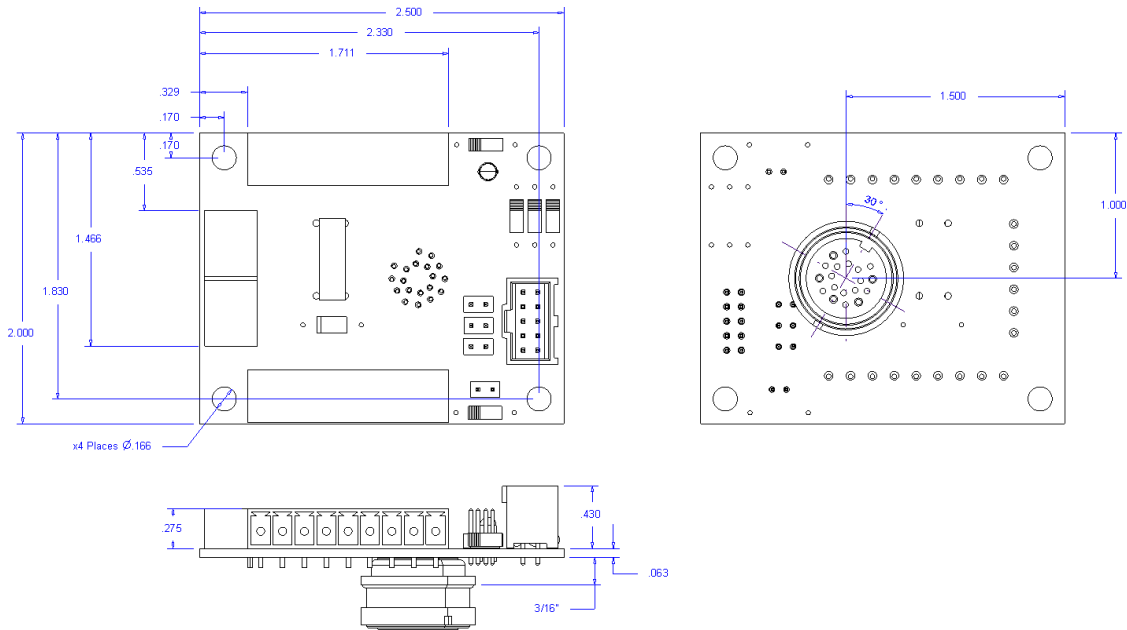

Panel Cutout Dimensions

The breakout board is designed to exit an enclosure (walls thicknesses 1mm MIN up to 3.5 mm MAX) with a single cutout for IP67 protection. The M16 19-pin connector includes a seal for IP67 protection.

Option 1 (Basic):
One .709" (18mm) hole with 4 holes for 3/16" tall standoff spacers to support board to panel. Must mount at least one standoff to prevent the breakout board from rotating when tightening 19-pin connector cable. User must seal spacer standoff holes to maintain IP67 rating. Standoffs holes on the breakout board allow for 6-32 and M3 size screws.
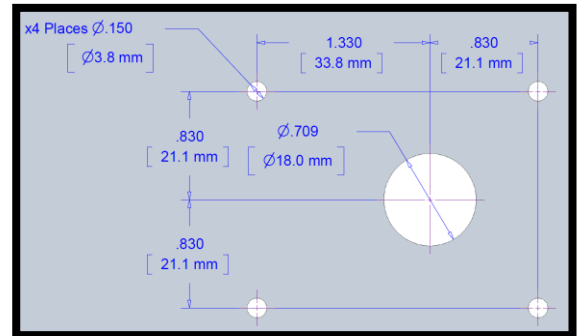

Option 1 (Basic) – Panel Cutout

Option 2 (Full IP67 Protection):
One .709" (18mm) hole with two .669" (17mm) flats to prevent the breakout board from rotating when tightening 19-pin connector cable. The R.079" (R2mm) notch is optional but ensures the M16 19-pin connector is aligned properly.
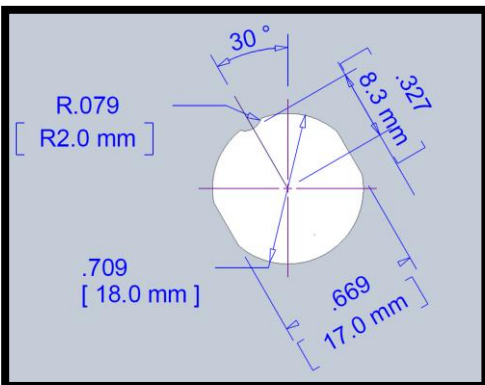
Option 2 (Full IP67 Protection) – Panel Cutout

Mounting Instructions

In wash-down environments, the breakout board should be mounted either vertically or horizontally, with the cable exiting downward, as shown in the image below. This helps prevent liquids from pooling around the connector, which can seep inside the cabinet.
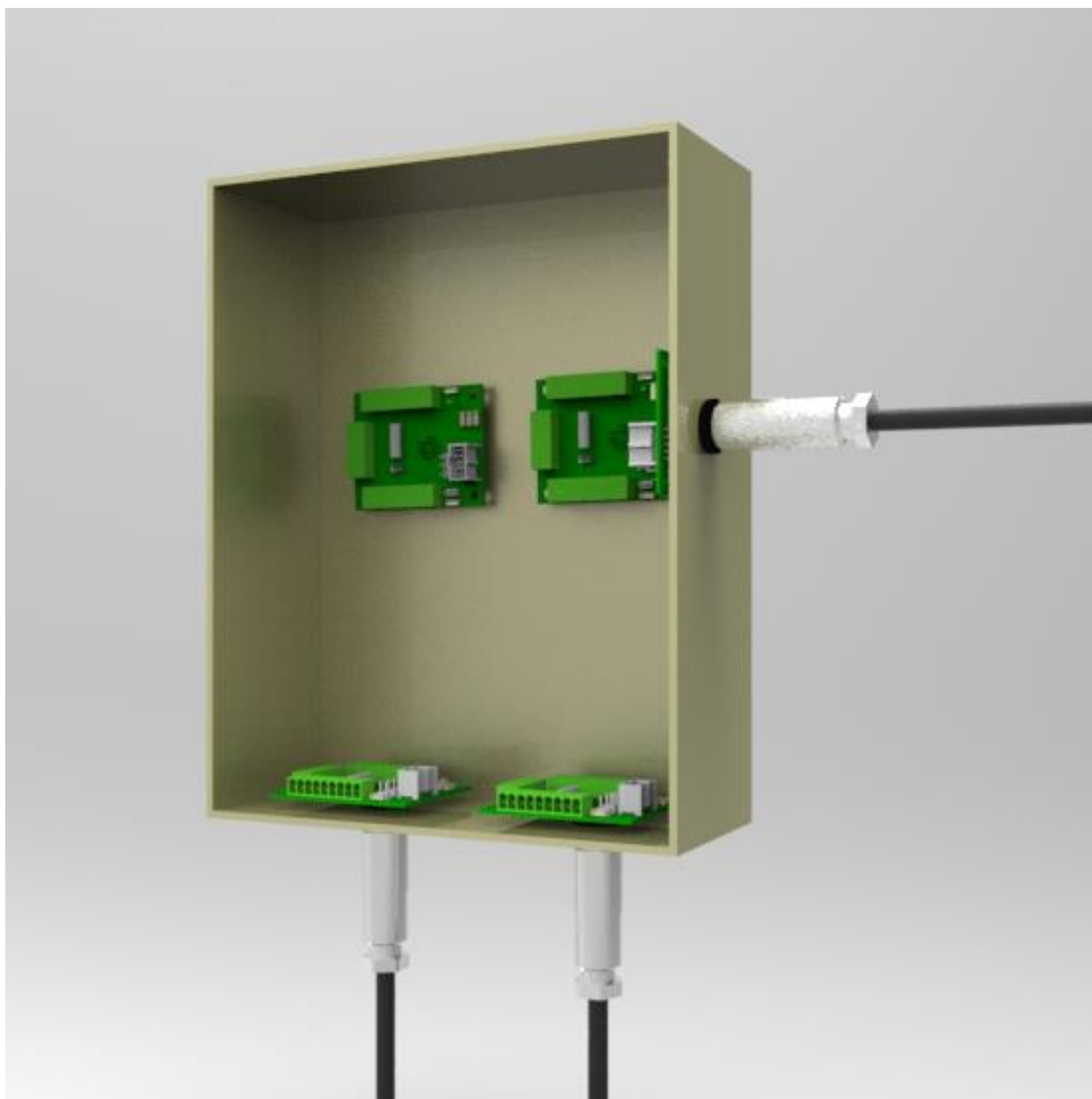
How to Use QCI-BO-X1A

Configure the PWO command to get duty cycle from lower or upper word of any register. As this word ranges from -32768 to 32767, the PWM output (I/O #2) duty cycle ranges from 0 to 100% at 3.3V. The B1A filters this PWM output and amplifies it to 0-5V.

　Note: PWO "Mode" parameter may have the following values:
　Disable, High Word, Low Word

Use the following equation to determine the Register Value (R) for the desired B1A output voltage (Vo):

$$R = [(Vo - 2.5)/2.5] * 32767$$
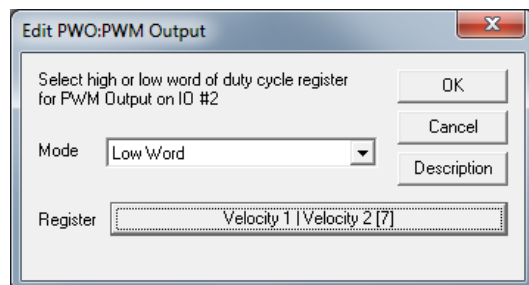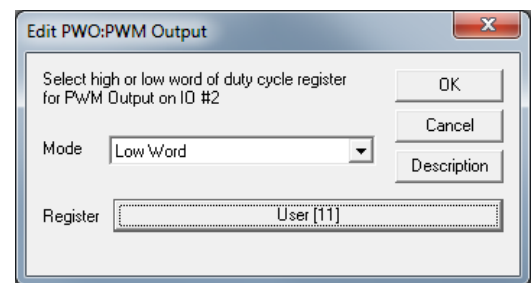
Example 1:
Desired analog output is 1.75 volts.
1) Configure PWO to get duty cycle from lower word of User Register 11.

2) Set Register 11 according to the following equation:
$$R = [(Vo - 2.5)/2.5] * 32767$$
$$R = [(1.75 - 2.5)/2.5] * 32767$$
$$R = -9830.1 \approx -9830$$

Example 2:
Output Analog Actual Velocity

All SilverLode servo systems store velocity in Register 7 [Velocity 1|Velocity 2]. Velocity 1 is the actual velocity filtered once. Velocity 2 is the actual velocity filtered twice. The above example uses Velocity 2. Velocity 2 is a signed 16-bit number where -32768 is –4000 RPM and +32767 is +4000 RPM. At zero speed, the output voltage will be 2.5 volts.

Example 3:
Using Analog Output for Torque

All SilverLode servo systems store torque in Register 9 [Control | Torque]. The lower word is the actual output torque on the motor shaft.   Torque values of –30000 is –150% torque and +30000 is +150% torque. The minus and plus represents clockwise and counter clockwise torque. A value of 0 is zero torque.