

SilverSterling Backplane – QCI-BO-BP8, QCI-BO-BP4 and QCI-BO-BP2

The SilverSterling™ QCI-S2-IGH and QCI-S3-IGH SilverSterling controller/drivers are designed to be mounted in a rack/cage to minimize space and wiring.

The QCI-BO-BP8 is an eight-slot backplane that may be used with either or both controllers. The QCI-BO-BP4 is a four-slot backplane that may be used with either or both controllers. The QCI-BO-BP2 is a two-slot backplane that may be used with either or both controllers.

The QCI-S2-IGH and QCI-S3-IGH fit into configurable backplanes having a range of slots. These provide fusing, power, communications, and motor/feedback connections in a compact format. Each slot in the backplane has an auxiliary memory associated with it to hold slot ID information as well as axis specific information, allowing for easy swapping of controllers.



Note: Card Cage concept in upper photo is shown with eight QCI-S2-IGH, sold separately. Card Cage Metal work and fan are user supplied. The QCI-S3-IGH configuration in the lower photo shows the backplane and eight QCI-S3-IGH controllers, sold separately. See backplane information on the next page for actual backplane information.

Specifications subject to change without notice. See www.QuickSilverControls.com for current information.

Using SilverSterling Backplane w/ QCI-S2-IGH and the QCI-S3-IGH

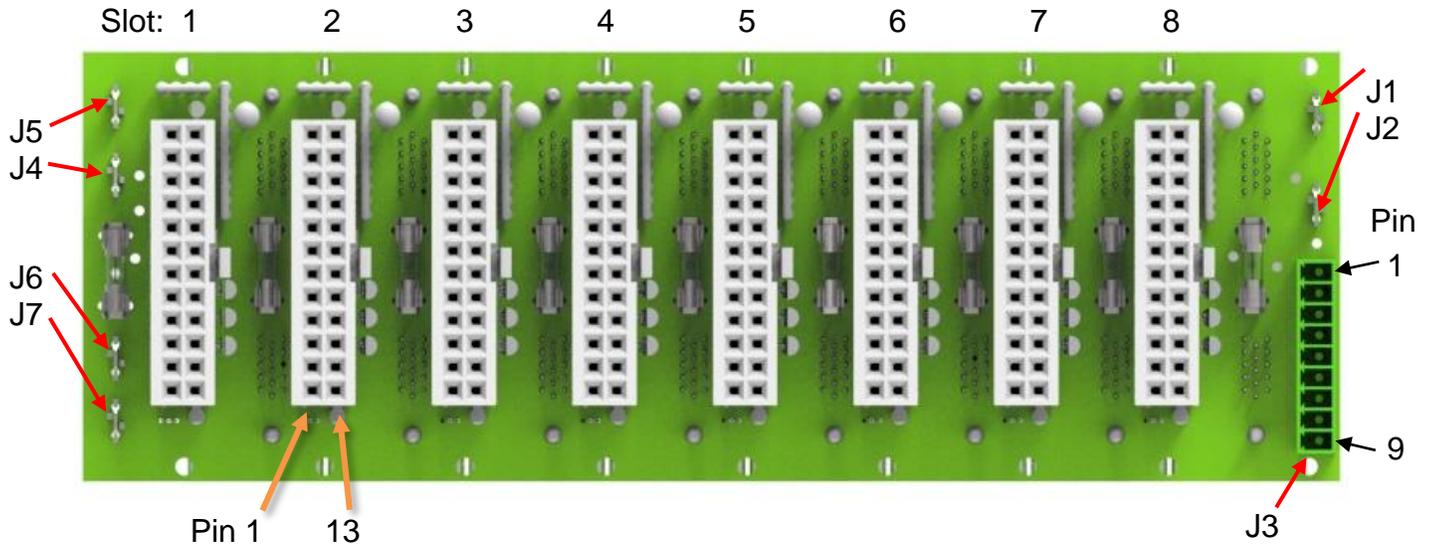
The SilverSterling QCI-S2-IGH and QCI-S3-IGH Controller/Drivers are designed to be mounted into the backplane. The outer two mounting holes of the D-sub connectors on the QCI-S2-IGH and QCI-S3-IGH are provided with guide pins to allow “blind” plugging of these connectors into mating connectors on the backplane. The backplane has matching clearance holes for these pins. 4-40 screws through the top and bottom edges of the controller heatsink hold the individual controllers into the rack. A rack could alternatively use clips from the front to hold the controllers in their respective slots.

Backplane Features

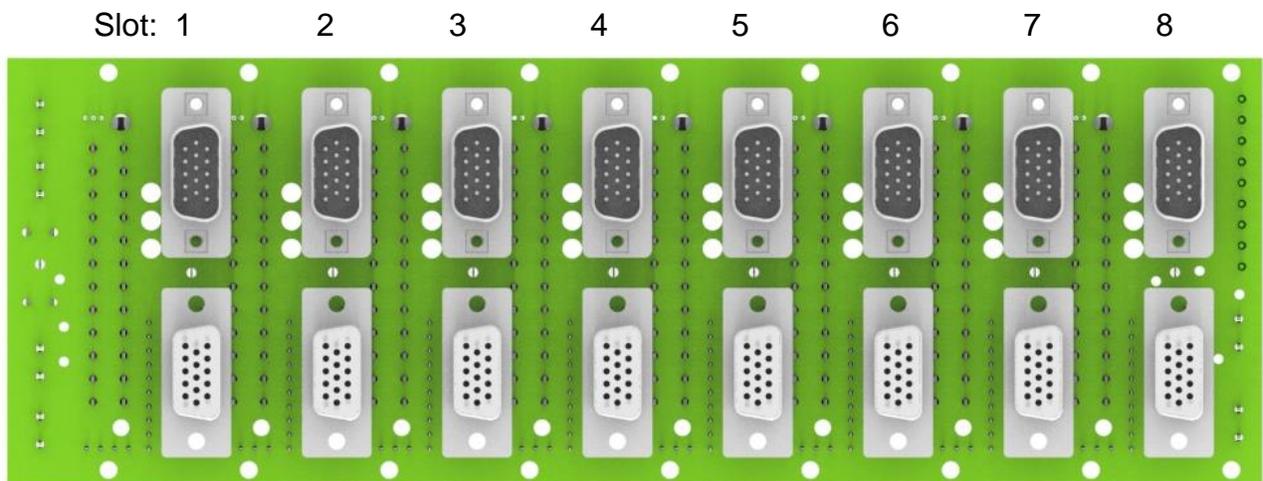
- Each slot has its own fuse as well as a motor/sensor plug that brings out the motor and feedback signals from the D-sub connectors on the QCI-S2-IGH. Note: for the QCI-S3-IGH, driver power and motor connections are brought in on separate connectors (see below) due to the higher power requirements. These separate driver power inputs need to be individually fused externally.)
- The backplane has connections for adding terminations for the RS-485 and CANopen signals.
- An auxiliary memory is provided for each slot to store communications channel information as well as storing axis specific information such that swapping of controllers is simplified. This holds up to 64 pages of 64 bits (double word) accessed via the MAA command.
- The backplane provides pull-ups for the encoder signals, allowing longer runs using conventional single-ended encoder signals. Pullups are also provided for the hall signals, and connections are included allowing for either single-ended or differential encoders.
- The 24-pin motor interface connector provides a place to connect an optional homing sensor.
- The 24-pin motor interface connector provides a place to connect a 1-wire temperature sensor which can be used to monitor motor temperature.
- The backplane includes a separately fused connection to power an external device, such as a fan, PLC, HMI, etc.

Connector Data

QCI-BO-BP8

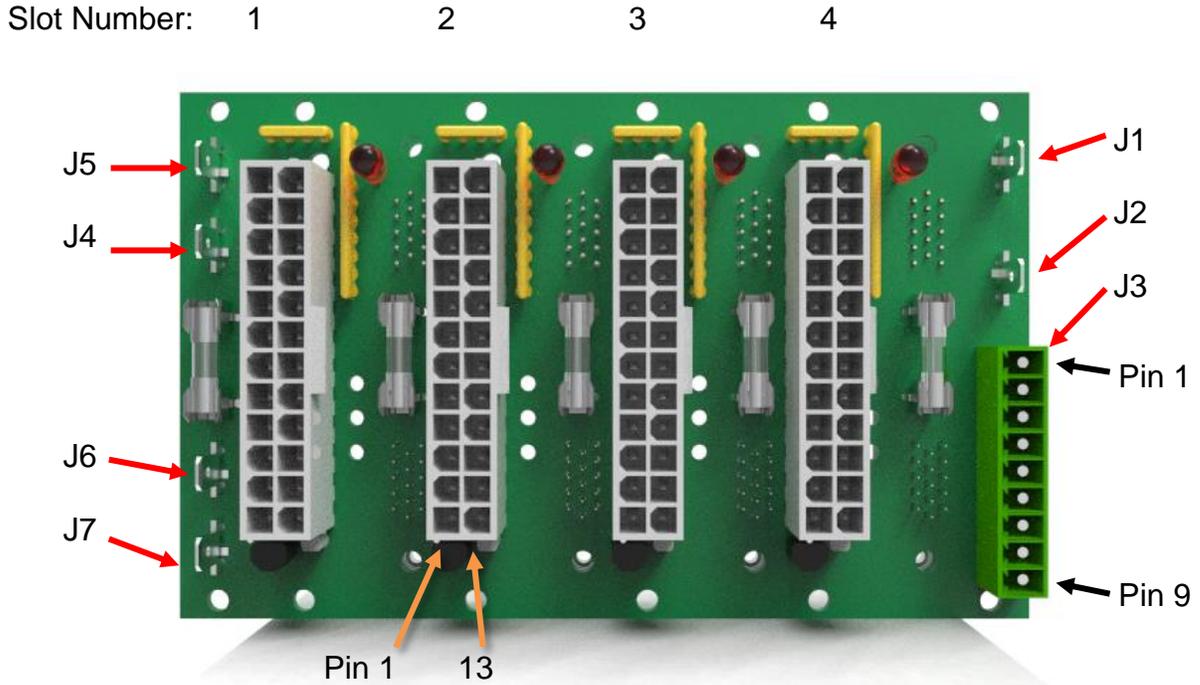


Back side view showing motor interface connectors, fuses, power and communication

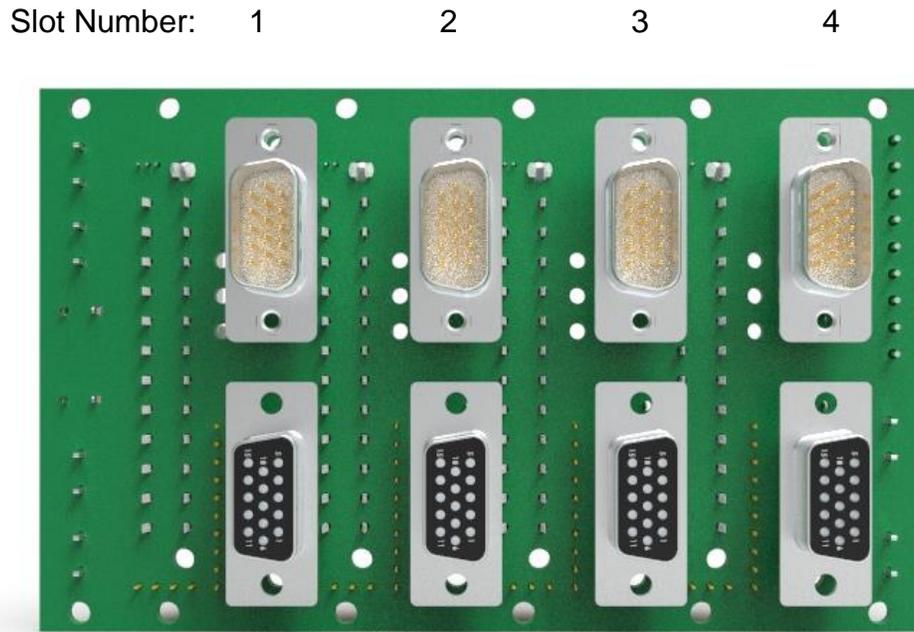


Front side view of backplane showing SIP and Motor DB 15 connectors

QCI-BO-BP4

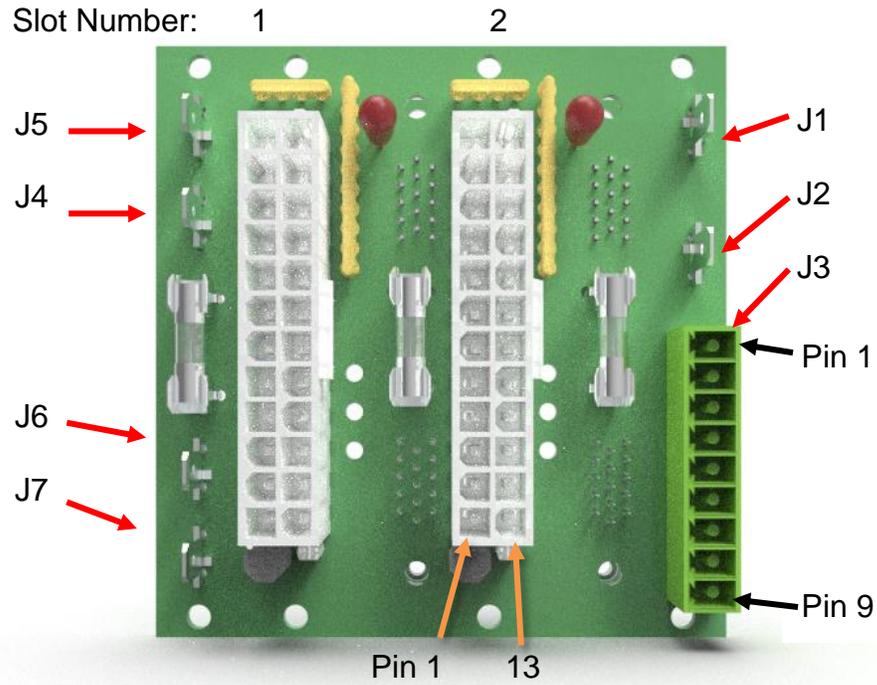


Back side view showing motor interface connectors, fuses, power and communications.

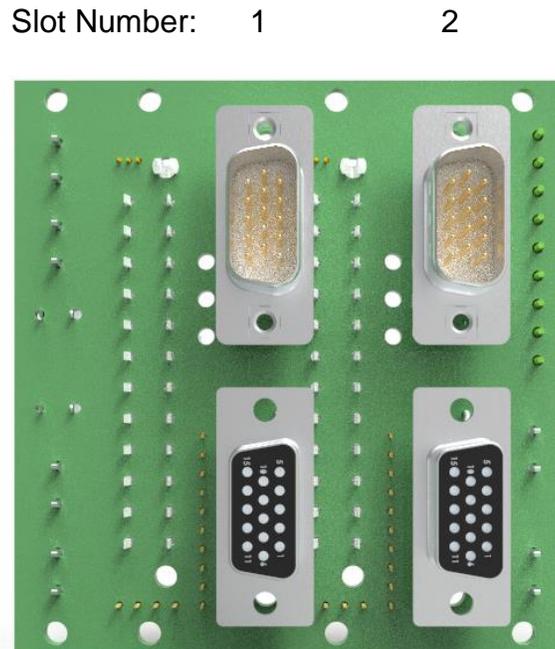


Front side view of backplane showing SIP and Motor DB 15 connectors.

QCI-BO-BP2



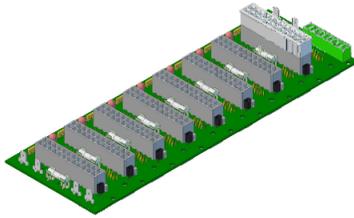
Back side view showing motor interface connectors, fuses, power and communications.



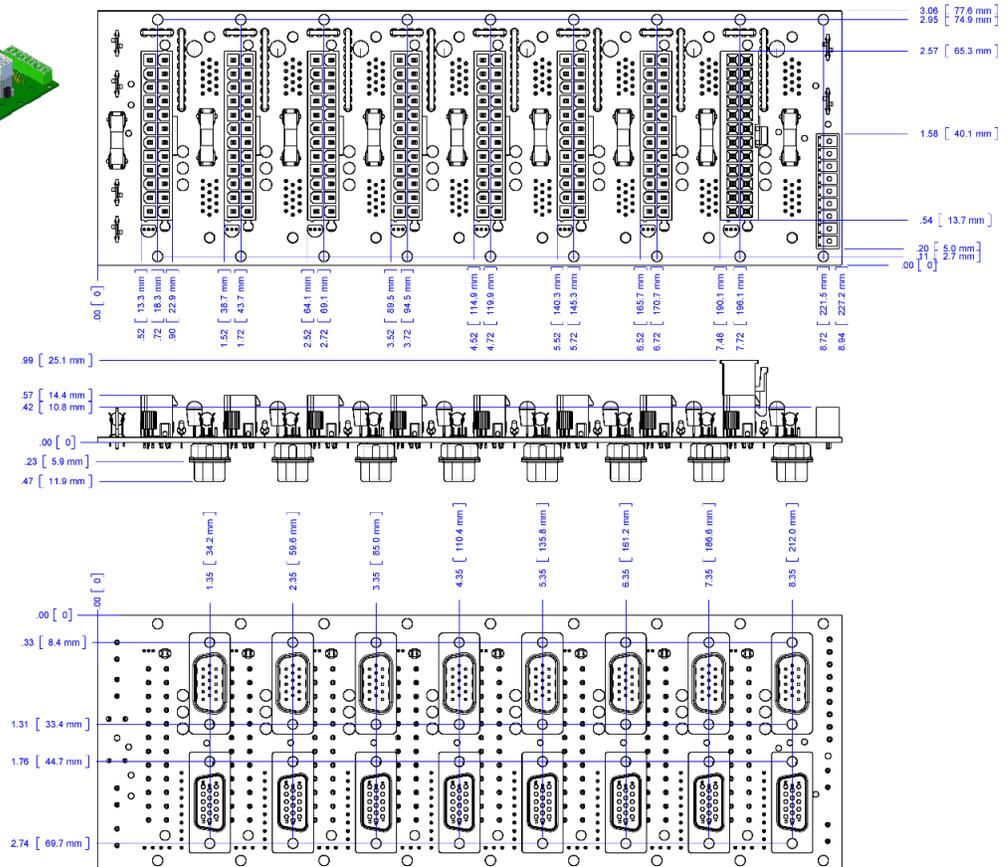
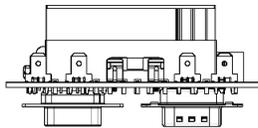
Front side view of backplane showing SIP and Motor DB 15 connectors.

Mechanical Dimensions

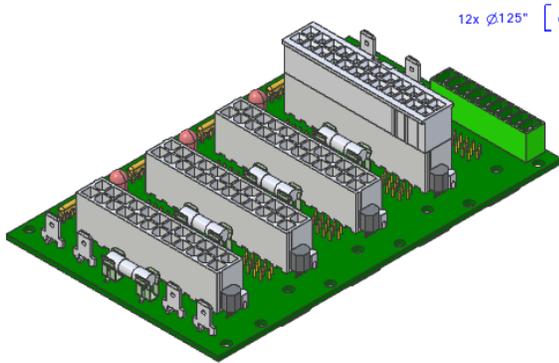
QCI-BO-BP8



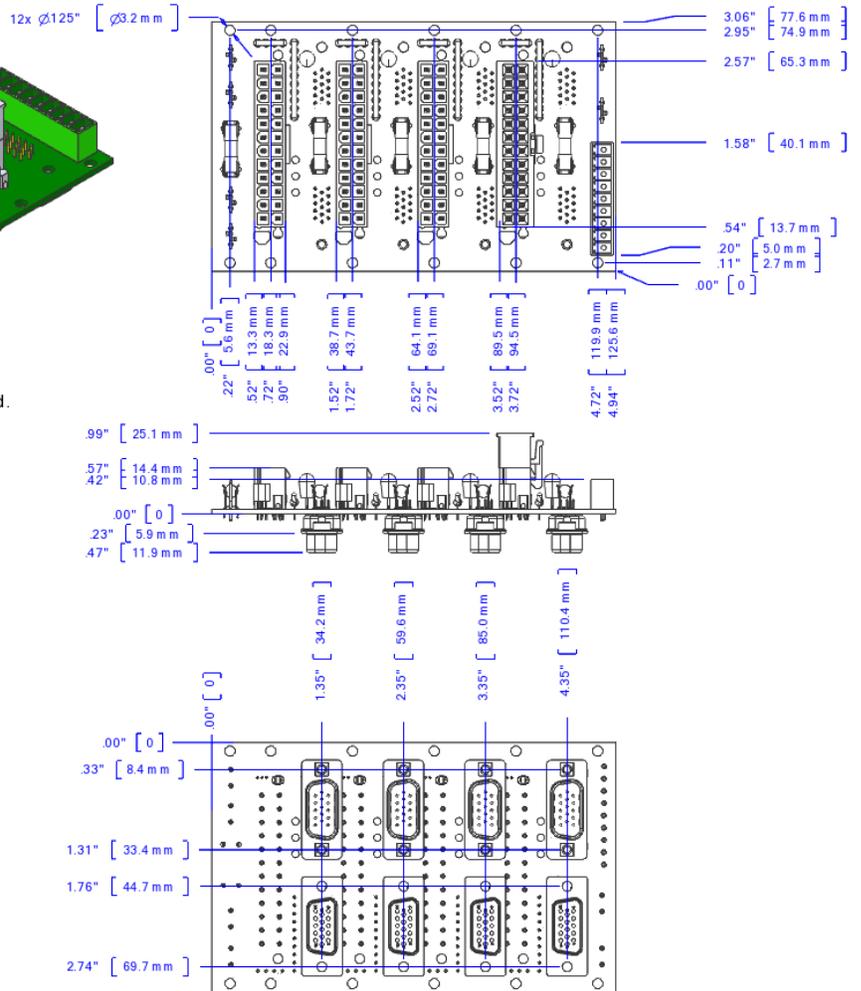
Shown with one mating connector, not included.



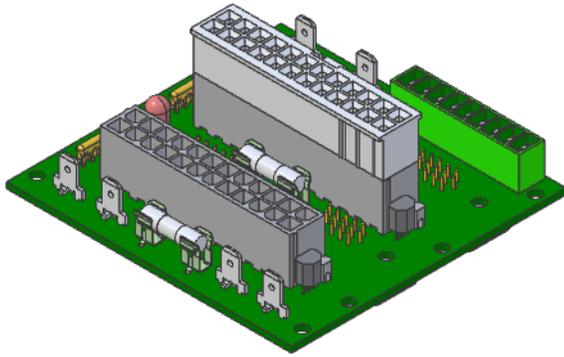
QCI-BO-BP4



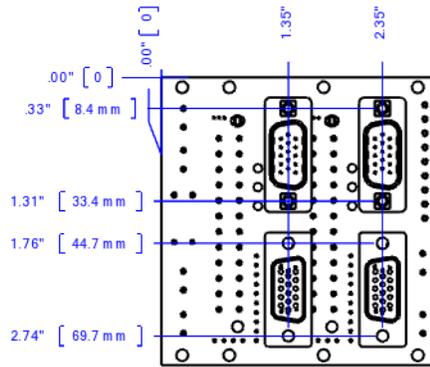
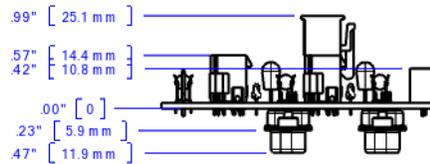
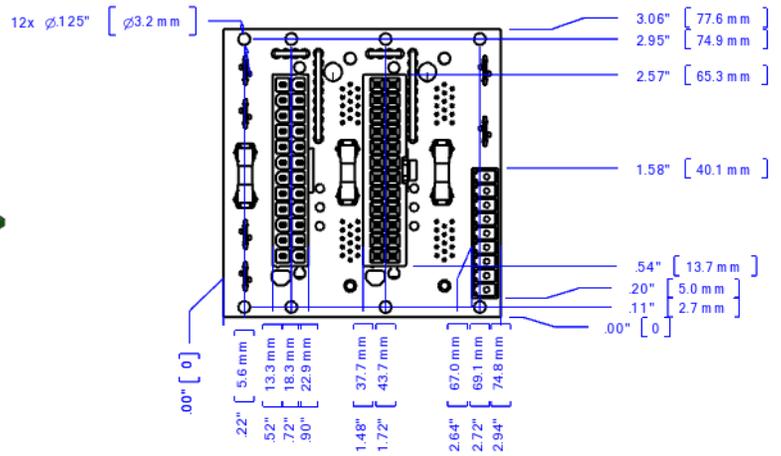
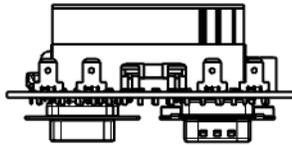
Shown with one mating connector, not included.



QCI-BO-BP2



Shown with one mating connector, not included.



Note: See our website for 2D drawings and 3D models.

QCI-S2-IGH wiring information

Power Wiring (J1 & J2)

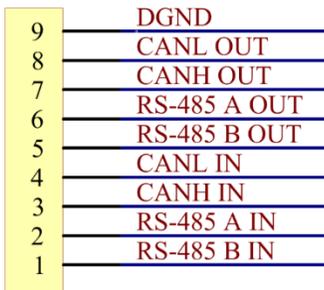
Designator	Signal Name	Description
J1, J5	V-	Power supply ground
J2, J4	V+	Input power supply, +12v to +48v (internally connected. Both connections should share a common fuse between them and the power supply - do not fuse separately).
J6	Fan V+	Fan power from V+ through a separate fuse
J7	Fan V-	Fan return power

Note: Fan must be supplied for the selected voltage being used.

J1, J2, J4, J5, J6, and J7 are quick connect terminal tabs (Faston series) manufactured by TE Connectivity. Manufacturer part number is 1217133-1. Refer to manufacturer for connector mating options.

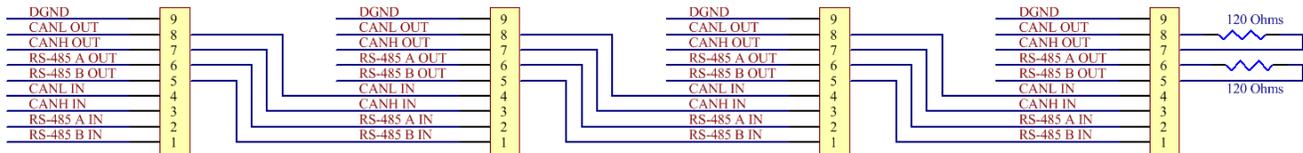
Communications Wiring (J3)

J3



The communication bus consists of an RS-485 network and CANopen network combined in a 9-pin terminal block connector (J3).

Connect incoming communications signals to xxxIN terminals. Connect outgoing communications signals, xxxOUT, to the next backplane's incoming communications signals. If J3 is the last backplane in the communication bus, terminate RS-485 and CAN networks. See below for communication bus wiring diagram.

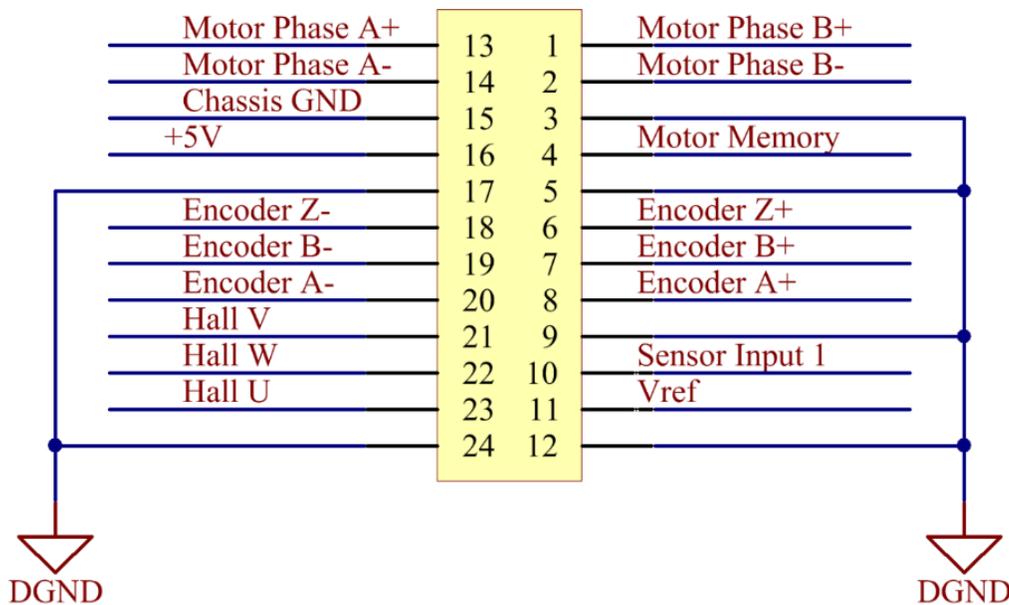


Note: user must terminate both RS-485 and CAN networks on both ends of the communication bus with 120 ohms resistors (¼ watt, 5%).

Motor & Feedback 24-pin Pinout

24-pin connector combines motor power, motor feedback, and one I/O. The 24-pin connector is mapped to interface with various motor types supporting a variety of motor feedback signals. The backplane allows for quadrature encoder signals, either differential or single-ended, hall-effect signals, and QuickSilver Controls’ Mosolver feedback signals. For single-ended encoder signals, the 24-pin connector provides a 2v reference (Vref) for the complementary encoder signals, A-, B- and Z-. Complementary hall-effect signals are no connect.

An I/O (“Sensor Input 1”) is available on pin 10. This input should be driven with a totem-pole sensor. Only a light ~100k pullup is provided. The input is LVTTTL, but may be driven up to 5v. This is provided for use as a homing sensor, or as desired.



The 24-pin connector is manufactured by Molex. The manufacturer part number is 044206-0007 and belong to the Mini-Fit Jr series (5557). Refer to manufacturer for connector mating options.

***If Encoder A leads Encoder B for motor shaft CW, swap pins 20 and 8. Refer to following page to more details. Otherwise, if Encoder B leads Encoders A, wire as shown above. Note: a standard encoder mounted on the back of the motor has B leading A for a clockwise rotation of the front shaft of the motor (CCW at back).**

2-phase Motor with Differential-Ended Encoder Signals

QCI's I-Grade Motors, Encoder A leads Encoder B for motor shaft CW. Therefore, pins 20 and 8 need to be swapped. See below.

*Wire Encoder A+ (Grey) to Pin 20

*Wire Encoder A- (Yellow) to Pin 8

MOT A+ (Yellow-Wh)	13	1	MOT B+ (Red-Wh)
MOT A- (White)	14	2	MOTB- (Blue-Wh)
MOT GND (P1/P2 Drains)	15	3	
+5V (Red)	16	4	MEM (Orange-Wh)
GND (Black-Wh)	17	5	
Z- (Brown)	18	6	Z+ (Orange)
B- (Blue)	19	7	B+ (Green)
A+ (Grey)*	20	8	A- (Yellow)*
	21	9	
	22	10	
	23	11	
	24	12	

Color codes correspond to QCI's motor cable.

*NOTE: Mating options for Molex connector 044206-0007 limit wire sizes from 16 to 28 AWG wire.

3-phase Motor with Differential Encoder and Hall-Effect Signals

FHA-11C-50-US200-E* Note: use Set Mode (SMD) 26,1 for the below wiring.
 Harmonic Drive Motors, Encoder B leads Encoder A for motor shaft CW. Complementary hall-effects signals are No Connect.

Motor Signals	24-pin Connector Pin Number	24-pin Connector Pin Name	FHA-11C-50-US200-E Motor Cable (AWG #24)
Motor Phase U	13	Motor Phase A+	Red
Motor Phase V	1	Motor Phase B+	White
Motor Phase W	14	Motor Phase A-	Black
Motor Chassis	15	Chassis GND	Green/Yellow

Encoder Signals	24-pin Connector Pin Number	24-pin Connector Pin Name	FHA-11C-50-US200-E Encoder Cable (AWG#30)
A	8	Encoder A+	Light Green
B	7	Encoder B+	Grey
Z (Index)	6	Encoder Z+	Yellow
A-	20	Encoder A-	Dark Green
B-	19	Encoder B-	White
Z- (Index-)	18	Encoder Z-	Clear
U	23	Hall U	Brown
V	21	Hall V	Dark Blue
W	22	Hall W	Orange
+5	16	+5	Red
Ground	17	DGND	Black
Encoder Shield	15	Chassis GND	Shield

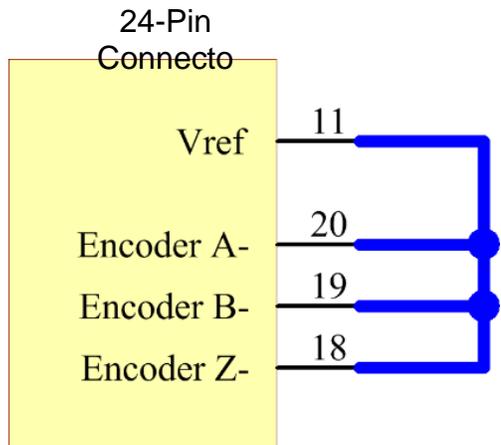
*Purple, Light Blue, Pink are No Connect



3-phase Motor with Single-Ended Encoder and Hall-Effect Signals

Motor Signals	24-pin Connector Pin Number	24-pin Connector Pin Name
Motor Phase U	13	Motor Phase A+
Motor Phase V	1	Motor Phase B+
Motor Phase W	14	Motor Phase A-
Motor Chassis	15	Chassis GND

Encoder Signals	24-pin Connector Pin Number	24-pin Connector Pin Name
A	8	Encoder A+
B	7	Encoder B+
Z (Index)	6	Encoder Z+
U	23	Hall U
V	21	Hall V
W	22	Hall W
+5	16	+5
Ground	17	DGND



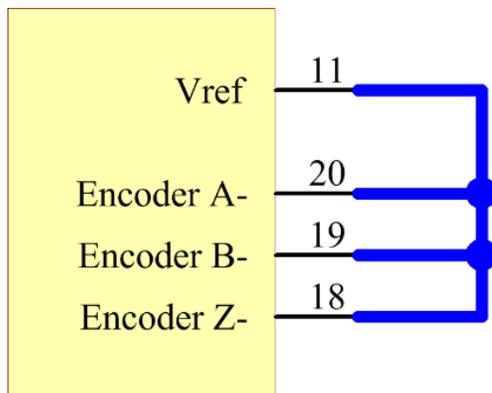
Note: For singled-ended encoders, user must externally connect complementary encoder signals, A-, B-, and Z- to Vref. This provides a known voltage (~2v) to allow differential encoder receiver to function properly. This connection will also light the RED LED for the associated slot. *Complementary hall-effects signals are No Connect.*

DC Motor with Single-Ended Encoder

Motor Signals	24-pin Connector Pin Number	24-pin Connector Pin Name
DC Motor +	13	Motor Phase A+
DC Motor +	1	Motor Phase B+
DC Motor -	14	Motor Phase A-
DC Motor-	2	Motor Phase B-
Motor Chassis	15	Chassis GND

Encoder Signals	24-pin Connector Pin Number	24-pin Connector Pin Name
A	8	Encoder A+
B	7	Encoder B+
Z (Index)	6	Encoder Z+
+5	16	+5
Ground	17	DGND

24-Pin Connector



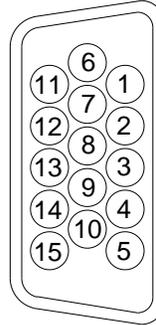
Note: For singled-ended encoders, user must externally connect complementary encoder signals, A-, B-, and Z- to Vref. This provides a known voltage (~2v) to allow differential encoder receiver to function properly. This connection will also light the RED LED for the associated slot. *Complementary hall-effects signals are No Connect.*

Low current motors (<3A) can connect the motor windings to just pins 13 and 14. Connecting + to both 13 and 1, and - to both 14 and 2 uses a bridged configuration to supply higher current ratings for S2 controller. The DC motor connections: normal convention is a clockwise motion with Motor+ connected to a positive voltage with respect to the Motor-; this should also give a positive encoder count sequence. If the physical direction of the motor is not visible, view the encoder signals to verify the direction of the motor. The case of the motor should be connected to Motor Chassis (15) to minimize switching noise being coupled to sensor inputs.

S2-IGH Interface Connector Data

SilverSterling Interface Port (SIP)

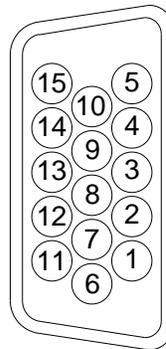
This port provides Power, RS-485 serial communications, CAN communications, and four IO. The IO is nominally 0-3.3v and should be limited to no more than 5v to avoid damage. The CAN and RS485 have extended input voltage range to improve robustness. Power ground and logic ground are internally connected.



1	V+ (12-48 VDC)
2	RS-485A
3	+5V OUTPUT 100mA
4	I/O #3
5	CAN_H
6	POWER GROUND
7	V+ (12-48 VDC)
8	LOGIC GROUND
9	I/O #2
10	LOGIC GND (CAN GND)
11	POWER GROUND
12	RS-485B
13	I/O #1
14	I/O #4
15	CAN_L

Motor Interface

This connector normally interfaces to the Backplane of the Card-cage. The signals are then routed to the motor via a dedicated connector. See backplane wiring for more details.



1	Motor B+
2	Chassis Ground
3	+ 5V Encoder Power
4	Encoder A -
5	Encoder B -
6	Motor A +
7	Motor B -
8	Encoder Z +
9	Encoder A +
10	Encoder Z -
11	Motor A -
12	Chassis Ground
13	Encoder B+
14	Encoder Ground
15	Motor Memory Access

QCI-S3-IGH Wiring Information

Power Wiring (J1 & J2)

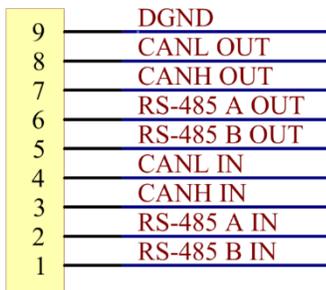
Designator	Signal Name	Description
J1, J5	V-	Power supply ground
J2, J4	V+	Input power supply, +12v to +48v (internally connected. Both connections should share the same up-line fuse. If only QCI-S3-IGH are used, a single connection is sufficient, as these inputs only power the drive enable and the fan.
J6	Fan V+	Fan power from V+ through a separate fuse
J7	Fan V-	Fan return power

Note: Fan must be supplied for the selected voltage being used. Drive Power for the QCI-S3-IGH must be connected via the Red (V+) and Black (V-) two pin connector. This power **MUST** be externally fused or current limited. The mating connectors are called out in the QCI-DS042 document.

J1, J2, J4, J5, J6, and J7 are quick connect terminal tabs (Faston series) manufactured by TE Connectivity. Manufacturer part number is 1217133-1. Refer to manufacturer for connector mating options.

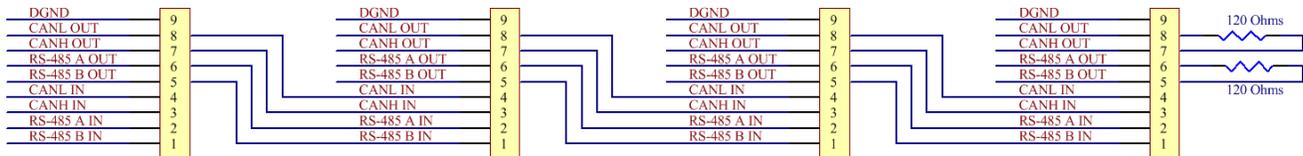
Communications Wiring (J3)

J3



The communication bus consists of an RS-485 network and CANopen network combined in a 9-pin terminal block connector (J3).

Connect incoming communications signals to xxxIN terminals. Connect outgoing communications signals, xxxOUT, to the next backplane's incoming communications signals. If J3 is the last backplane in the communication bus, terminate RS-485 and CAN networks. See below for communication bus wiring diagram.

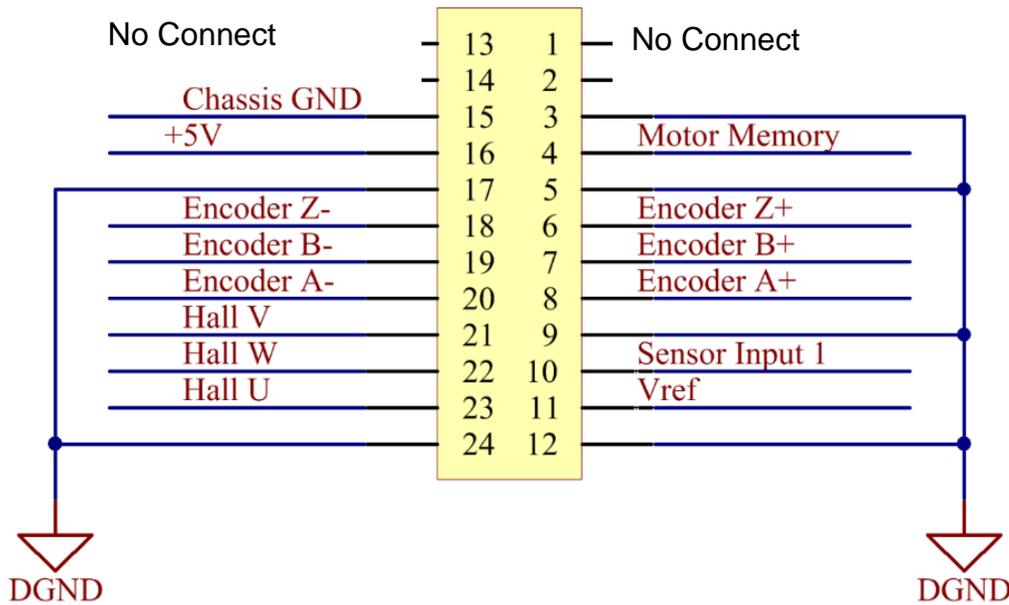


Note: user must terminate both RS-485 and CAN networks on both ends of the communication bus with 120 ohms resistors (¼ watt, 5%).

Motor & Feedback 24-pin Pinout

24-pin connector combines motor power, motor feedback, and one I/O. The 24-pin connector is mapped to interface with various motor types supporting a variety of motor feedback signals. The backplane allows for quadrature encoder signals, either differential or single-ended, hall-effect signals, and QuickSilver Controls’ Mosolver feedback signals. For single-ended encoder signals, the 24-pin connector provides a 2v reference (Vref) for the complementary encoder signals, A-, B- and Z-. Complementary hall-effect signals are no connect. Connect Chassis Ground to encoder cable shield.

An I/O (“Sensor Input 1”) is available on pin 10. This input should be driven with a totem-pole sensor. Only a light ~100k pullup is provided. The input is LVTTTL, but may be driven up to 5v. This is provided as a homing sensor. SET MODE (SMD) command 26 option 2 should be used to select the hall sensors as shown below with the motor phases (U= RED, V=WHITE, W=BLACK) connected as shown below. The W drive signal is repeated on the BLUE connector to allow the motor and ground to be connected as a set without needing a blank plug to hold the motor drive connector together.



Color	Signal	Color	Signal
		Green	Motor Ground
Red	U Phase = Motor A+	Blue	(Alt W Phase) = Motor B-
Black	W Phase = Motor A-	White	V Phase = Motor B+
Red	Power V+	Black	Power V-

Motor Ground should connect to the shield of the cable and to the Motor frame. A ferrite bead is suggested over the shielded motor cable to minimize electrical noise.

The 24-pin connector is manufactured by Molex. The manufacturer part number is 044206-0007 and belong to the Mini-Fit Jr series (5557). Refer to manufacturer for connector mating options.

***If Encoder A leads Encoder B for motor shaft CW, swap pins 20 and 8. Refer to following page to more details. Otherwise, if Encoder B leads Encoders A, wire as**

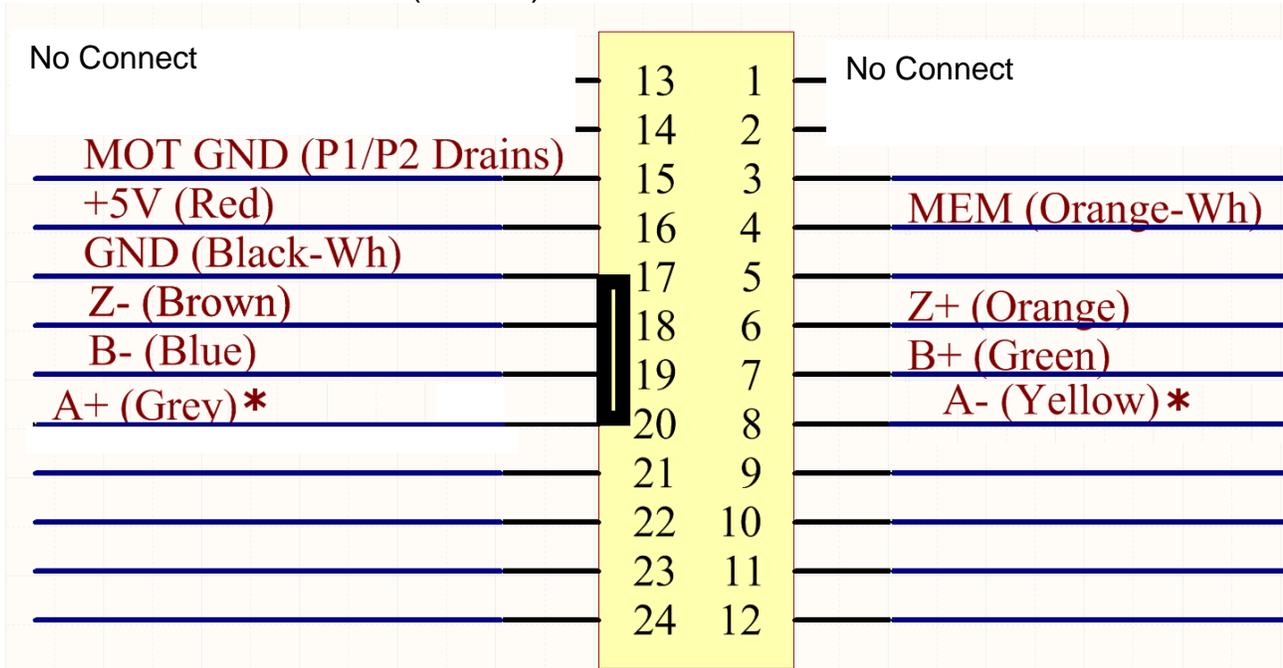
shown above. Note: a standard encoder mounted on the back of the motor has B leading A for a clockwise rotation of the front shaft of the motor (CCW at back).

2-phase Motor with Differential-Ended Encoder Signals

QCI's I-Grade Motors, Encoder A leads Encoder B for motor shaft CW. Therefore, pins 20 and 8 need to be swapped. See below.

*Wire Encoder A+ (Grey) to Pin 20

*Wire Encoder A- (Yellow) to Pin 8



Color codes correspond to QCI's D5P-D5S motor cable.

Color	Signal	Color	Signal
		Green	Motor Ground
Red	Motor A+ (RED)	Blue	Motor B- (Orange)
Black	Motor A- (Yellow)	White	Motor B+ (Black)
Red	Power V+	Black	Power V-

3-phase Motor with Differential Encoder and Hall-Effect Signals

FHA-17C-xx-US200-E*

Harmonic Drive Motors, Encoder B leads Encoder A for motor shaft CW. Complementary hall-effects signals are No Connect.

Motor Signals	5 Pin Connector Pin Color	5-pin Connector Pin Name	FHA-14C/17C-XX-US200-E Motor Cable
Motor Phase U	RED	Motor Phase A+	Red
Motor Phase V	WHITE	Motor Phase B+	White
Motor Phase W	BLACK	Motor Phase A-	Black
Motor Chassis	Green	Chassis GND	Green-Yellow

Encoder Signals	24-pin Connector Pin Number	24-pin Connector Pin Name	FHA-14C/17C-XX-US200-E Encoder Cable
A	8	Encoder A+	Light Green / Green
B	7	Encoder B+	Grey
Z (Index)	6	Encoder Z+	Yellow
A-	20	Encoder A-	Dark Green / Green-Wh
B-	19	Encoder B-	White or Grey-Wh
Z- (Index-)	18	Encoder Z-	Clear or Yellow-Wh
U	23	Hall U	Brown
V	21	Hall V	Blue
W	22	Hall W	Orange
+5	16	+5	Red
Ground	17	DGND	Black
Encoder Shield	15	Chassis GND	Shield

*Purple, Light Blue, Pink are No Connect



*Mating options for Molex connector 044206-0007 limit wire sizes from 16 to 28 AWG wire. For Harmonic Drive encoder cable (30 AWG), it's suggested user extends encoder wires by soldering 16 to 28 AWG wires that are compatible with Molex crimp terminal selected.

Color	Signal	Color	Signal
		Green	Motor Ground
Red	Motor A+ (RED = U)	Blue	Alternate for W **
Black	Motor A- (BLACK = W)	White	Motor B+ (WHITE = V)
Red	Power V+	Black	Power V-

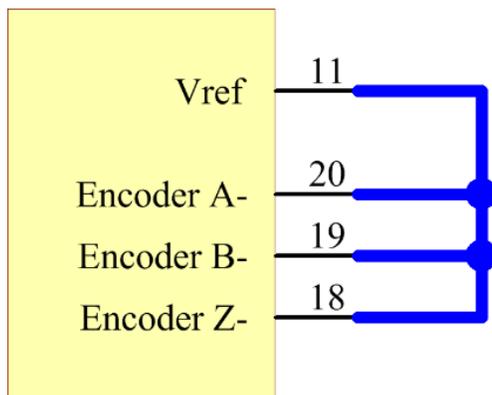
3-phase Motor with Single-Ended Encoder and Hall-Effect Signals

Motor Signals	5 Pin Connector Pin Color	5-pin Connector Pin Name
Motor Phase U	RED	Motor Phase A+
Motor Phase V	WHITE	Motor Phase B+
Motor Phase W	BLACK (or BLUE)	Motor Phase A-
Motor Chassis	Green	Chassis GND

Encoder Signals	24-pin Connector Pin Number	24-pin Connector Pin Name
A	8	Encoder A+
B	7	Encoder B+
Z (Index)	6	Encoder Z+
U	23	Hall U
V	21	Hall V
W	22	Hall W
+5	16	+5
Ground	17	DGND

Connect encoder cable shield to SHIELD pin15 on the 24pin connector. No connection at motor end of cable. Connect the Motor cable shield to **both** the Green pin on the controller and to the motor chassis. Place a ferrite bead over the motor cable near the controller to minimize electrical noise.

** The W phase may be connected either to BLACK or BLUE for 3 phase operation (Revision 37 and higher). These wiring connections are using SMD 26 option 2.



Note: For singled-ended encoders, user must externally connect complementary encoder signals, A-, B-, and Z- to Vref. This provides a known voltage (~2v) to allow differential encoder receiver to function properly. *Complementary hall-effects signals are No Connect.*

S3-IGH Interface Connector Data

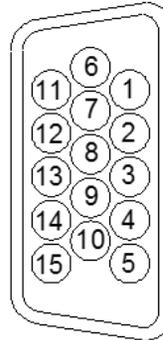
SilverSterling Interface Port (SIP)

This port provides Power, RS-485 serial communications, CAN communications, and four IO. The IO is nominally 0-3.3v and should be limited to no more than 5v to avoid damage. The CAN and RS485 have extended input voltage range to improve robustness. Power ground and logic ground are internally connected.

Drive Enable:

Connecting pins 1 to 7, and 6 to 11 connects an internal current limited source to power the drive enable input.

Alternately connect DR_ENA+ to 12-48v above DR_ENA- to enable the drive (optically coupled drive enable input). The backplane connects Drive Enable to the backplane power input so that all drives are enabled automatically.

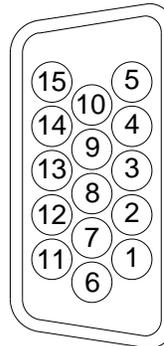


1	DR_ENA+
2	RS-485A
3	+5V OUTPUT 100mA
4	I/O #3
5	CAN_H
6	DR_ENA-
7	DR_ENA_SOURCE
8	LOGIC GROUND
9	I/O #2
10	LOGIC GND (CAN GND)
11	POWER GROUND
12	RS-485B
13	I/O #1
14	I/O #4
15	CAN_L

Motor Interface

This connector normally interfaces to the Backplane of the Card-cage. The signals are then routed to the motor via a dedicated connector. See backplane wiring for more details.

NOTE: * The S3 supports two alternate Hall sensor inputs, either using IO2, 3, 4, as are used for the S2 configuration, which is the preferred configuration or using Motor connector pins 1,6,7 (which frees up IO2, 3, 4. On the S2 pins 1,6,7,11 are used for motor driver signals, so it is advised against using these connections for hall signals to prevent damage to the hall sensors if the cable wired in this non-preferred option were to be inadvertently plugged into an S2 backplane. The use of preferred IO2, 3, 4 is thus documented in the wiring charts above.



1	Hall V *
2	Chassis Ground
3	+5v Encoder Power
4	Encoder A-
5	Encoder B-
6	Hall W*
7	Hall U*
8	Encoder Z+
9	Encoder A+
10	Encoder Z-
11	Spare Hall*
12	Chassis Ground
13	Encoder B+
14	Encoder Ground
15	Motor Memory

Color	Signal	Color	Signal
		Green	Motor Ground
Red	Motor A+ (U)	Blue	Motor B- (Alternatre W)**
Black	Motor A- (W)	White	Motor B+ (V)
Red	Power V+	Black	Power V-

** The W phase may be connected either to BLACK or BLUE for 3 phase operation (Revision 37 and higher). These wiring connections are using SMD 26 option 2.

Part Numbers

silverSterling™ Card Cage	
Backplane	Controllers Supported
QCI-BO-BP8	Eight – QCI-S2-IGH or Eight QCI-S3-IGH
QCI-BO-BP4	Four – QCI-S2-IGH or Four QCI-S3-IGH
QCI-BO-BP2	Two – QCI-S2-IGH or Two QCI-S3-IGH

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