Inspiring Motion
Since 1988

Gold Solo Twitter
Digital Servo Drive
Installation Guide

April 2019 (Ver. 4.002)

www.elmomc.com

Elmo
Motion Control

Notice

This guide is delivered subject to the following conditions and restrictions:

- This guide contains proprietary information belonging to Elmo Motion Control Ltd. Such information is supplied solely for the purpose of assisting users of the Gold Solo Twitter servo drive in its installation.
- The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice.
- Information in this document is subject to change without notice.

Document no. MAN-G-SOLTWI (Ver. 4.002)
Copyright © 2019
Elmo Motion Control Ltd.
All rights reserved.

Catalog Number

G-SOLTWI R XX/YYY EE1S

Gold Line

Output Current Profile:

*Blank = Standard
R = No peak current

Continuous Current (Amps)

Maximum DC Operating Voltage

Network Communications:

S = Standard:
- CANopen
- RS-232

E = EtherCAT:
- EtherCAT or Ethernet
- USB
- RS-232

Feedback:

E =

Port A:
- Absolute Serial Encoder
- Incremental Encoder
- Digital Hall

Port B:
- Incremental Encoder
- Analog Encoder
- Analog Hall

R =

Port A:
- Absolute Serial Encoder
- Incremental Encoder
- Digital Hall

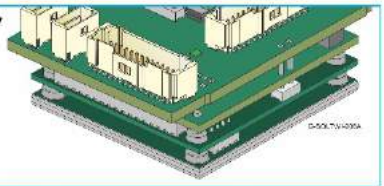
Port B:
- Resolver

***Note: Blank refers to the default option.**
It is not shown as a space.

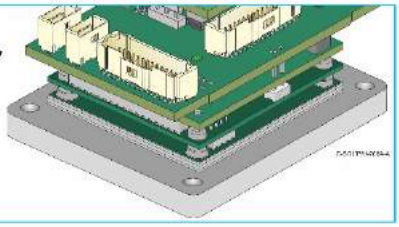
Power Supply & Heatsink Options:

S = Control Supply (VL) 11V – 95V

***Blank** = VL <40V



H = Control Supply (VL) 11V – 95V with Flat Heatsink



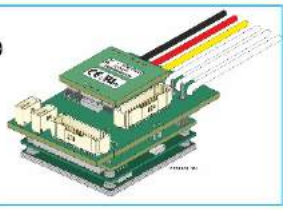
Options:

Wires power connection

1 = • 24 V I/O & STO – High side logic (Source)

2 = • 5 V I/O & STO – High side logic (Source)

3 = • 24 V I/O – Low side logic (Sink)
- 24 V STO – High Side Logic (Source)

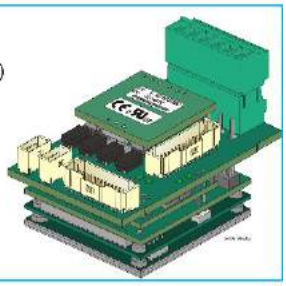


Pluggable vertically positioned power connector for drives rated current XX ≤ 10A

4 = • 24 V I/O & STO – High side logic (Source)

5 = • 5 V I/O & STO – High side logic (Source)

6 = • 24 V I/O – Low side logic (Sink)
- 24 V STO – High Side Logic (Source)

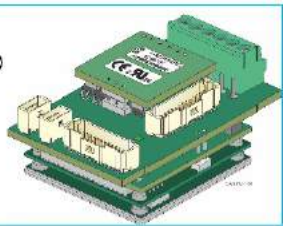


Horizontally positioned power connector for drives rated current XX ≤ 25A

7 = • 24 V I/O & STO – High side logic (Source)

8 = • 5 V I/O & STO – High side logic (Source)

9 = • 24 V I/O – Low side logic (Sink)
- 24 V STO – High Side Logic (Source)



To order the accessories refer to the Chapter 11: Accessories.

Revision History

Version	Date
Ver. 1.000	Apr 2016
Ver. 1.001	Sep 2016
Ver. 1.002	Oct 2016
Ver. 2.000	Dec 2016
Ver. 2.001	Feb 2017
Ver. 2.002	Feb 2017
Ver. 2.003	Mar 2017
Ver. 2.004	Apr 2017
Ver. 2.005	Apr 2017
Ver. 2.006	Oct 2017
Ver. 2.007	May 2018
Ver. 2.008	Oct 2018
Ver. 3.000	May 2018
Ver. 4.000	Nov 2018
Ver. 4.001	Dec 2018
Ver. 4.002	April 2019

Chapter 1: This Installation Guide 8

Chapter 2: Safety Information 8

2.1. Warnings 9

2.2. Cautions 9

2.3. Warranty Information 9

Chapter 3: Product Description 10

Chapter 4: Technical Information 11

4.1. 60V and 100V Models Technical Data 11

4.2. 200V Models Technical Data 12

4.3. R Type Technical Data 12

4.4. Control Supply Input Voltage (VL) 13

4.5. Product Features 14

4.6. Environmental Conditions 15

Chapter 5: Standards 16

5.1. CE Declaration 16

Chapter 6: Installation 17

6.1. Unpacking the Drive Components 17

6.2. Mounting the Optional Accessories Heat Sinks 18

6.3. Mounting Gold Solo Twitter to an External Heatsink 20

6.4. The Gold Solo Twitter Connection Diagrams 21

6.4.1. EtherCAT Connection Diagram 21

6.4.2. CAN Connection Diagram 22

Chapter 7: Wiring 23

7.1. Wiring Legend 23

7.2. Connectors Types 25

7.3. Mating Connectors 25

7.4. Logic and Control Cabling and Wiring 26

7.4.1. J10 and J11 (Feedback ports, VL, RS232, USB, Analog Input) 26

7.4.2. J11 (Digital Inputs/Outputs, STO) 26

7.4.3. J17, J18 EtherCAT or CAN Communication 26

7.4.4. COMRET to PE Connection 26

7.5. Wiring the Female Connectors 27

Chapter 8: Connections 28

8.1. Main, Control, and Motor Power 28
8.1.1. Motor Power 28
8.1.1.1. Motor Power Connections 29
8.1.2. Main Power Wires & Connector 31
8.1.2.1. Main Power 31
8.1.2.2. Wiring Technical Details 32
8.1.3. Control Supply (J10) 33
8.1.4. Control Supply Connections for Power Supply & Heatsink Option: (Blank) 35
8.1.4.1. Dual Power Supply 35
8.1.4.2. Single Power Supply (VP+ < 40VDC) 37
8.1.5. Control Supply Connections for Power Supply & Heatsink Option: S or H 38
8.1.5.1. Dual Power Supply 38
8.1.5.2. Single Power Supply (VP+ < 95VDC) 40
8.2. Drive Status Indicator 41
8.3. J10 VL and Feedback Connector 42
8.3.1. Port A 45
8.3.1.1. Incremental Encoder 45
8.3.1.2. Absolute Serial Encoder 46
8.3.1.3. Hiperface 47
8.3.1.4. Hall Sensors 48
8.3.2. Port B 49
8.3.2.1. Incremental Encoder 49
8.3.2.2. Interpolated Analog Encoder 50
8.3.2.3. Resolver 51
8.3.3. Port C – Emulated Encoder Output (J10) 52
8.4. J11 I/O and Communication Connector 53
8.4.1. Digital Inputs 56
8.4.1.1. Source PLC Voltage Level Digital Input 56
8.4.1.2. Sink PLC Voltage Level Digital Input 58
8.4.1.3. Source 5V Logic Level Digital Input 60
8.4.2. Digital Outputs 62
8.4.2.1. Source PLC Voltage Level Digital Output 62
8.4.2.2. Sink PLC Voltage Level Digital Output 64
8.4.2.3. Digital Outputs Source 5V Logic Mode 66
8.4.3. STO (Safe Torque Off) 68
8.4.4. Analog Input 69
8.4.5. Standard RS-232 70

8.4.6. USB 2.0 Communication (Only for EtherCAT version)....71
8.5. EtherCAT Communications Version....72
8.5.1. EtherCAT IN/Ethernet Connector (J17)....72
8.5.2. EtherCAT OUT Connector (J18)....73
8.5.3. EtherCAT Schematic Connections....74
8.5.3.1. EtherCAT Communication....74
8.5.3.2. EtherCAT Status Indicator (D2)....75
8.5.3.3. EtherCAT Link Indicators (D3, D4)....76
8.6. CAN Communications Version....77
8.6.1. CAN IN Connector (J17)....77
8.6.2. CAN OUT Connector (J18)....78
8.6.3. CAN Schematic Connections....79
8.6.3.1. Interface....79
8.6.3.2. CAN Network Topology....80

Chapter 9: Powering Up....81
9.1. Initializing the System....81
9.2. Heat Dissipation....82
9.2.1. Heat Dissipation Data....82
9.2.2. How to Use the Chart....85

Chapter 10: Dimensions, Physical Specifications....86
10.1. EtherCAT without Heatsink....86
10.2. EtherCAT with Heatsink....89
10.3. CAN without Heatsink....92
10.4. CAN with Heatsink....95

Chapter 11: Accessories....98
11.1. Accessories Heat Sink Dimensions....100

Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Solo Twitter. For a comprehensive detailed description of the functions and connections of the drive, refer to the Gold Board Level Module Hardware Manual.

Chapter 2: Safety Information

In order to achieve the optimum, safe operation of the Gold Solo Twitter, it is imperative that you implement the safety procedures included in this installation guide. This information is provided to protect you and to keep your work area safe when operating the Gold Solo Twitter and accompanying equipment.

Please read this chapter carefully before you begin the installation process.

Before you start, ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

Only qualified personnel may install, adjust, maintain and repair the servo drive. A qualified person has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating motors.

The Gold Solo Twitter contains electrostatic-sensitive components that can be damaged if handled incorrectly. To prevent any electrostatic damage, avoid contact with highly insulating materials, such as plastic film and synthetic fabrics. Place the product on a conductive surface and ground yourself in order to discharge any possible static electricity build-up.

To avoid any potential hazards that may cause severe personal injury or damage to the product during operation, keep all covers and cabinet doors shut.

The following safety symbols are used in this and all Elmo Motion Control manuals:

Warning:
This information is needed to avoid a safety hazard, which might cause bodily injury or death as a result of incorrect operation.

Hot Surface Warning:
To alert against surfaces that may reach high temperatures. The heatsink and wires may reach high temperatures.

Caution:
This information is necessary to prevent bodily injury, damage to the product or to other equipment.

Important:
Identifies information that is critical for successful application and understanding of the product.

2.1. Warnings

- To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the servo drive while the power source is on.
- Power cables can carry a high voltage, even when the motor is not in motion. Disconnect the Gold Solo Twitter from all voltage sources before servicing.
- The high voltage products within the Gold Line range contain grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- After shutting off the power and removing the power source from your equipment, wait at least 1 minute before touching or disconnecting parts of the equipment that are normally loaded with electrical charges (such as capacitors or contacts). Measuring the electrical contact points with a meter, before touching the equipment, is recommended.

2.2. Cautions

- The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- When connecting the Gold Solo Twitter to an approved control supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Gold Solo Twitter, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.
- Make sure that the Safe Torque Off is operational.

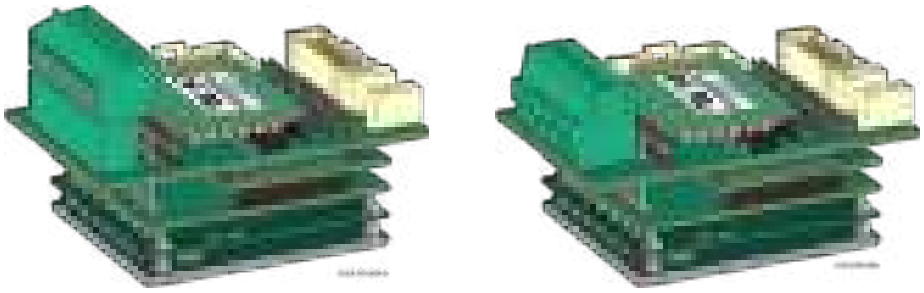
2.3. Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All Elmo drives are warranted for a period of 12 months from the date of shipment. No other warranties, expressed or implied — and including a warranty of merchantability and fitness for a particular purpose — extend beyond this warranty.

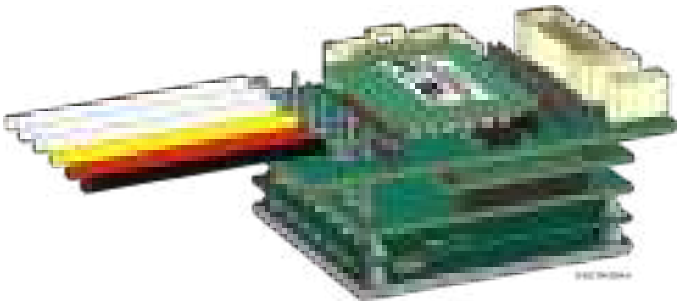
Chapter 3: Product Description

The Gold Solo Twitter is a "ready to use Gold Twitter", advanced high power density, highly intelligent servo drive operational within a few minutes, delivering up to **5.6 kW power** in an average 30.59 cm^3 (1.87 in^3) compact package (refer to Chapter 10: Dimensions, Physical Specifications for details). A cable kit and optional heat sinks are available for easy and fast operation of the Gold Solo Twitter.

The Gold Solo Twitter which is provided in the optional forms shown in Figure 1, provides top performance, advanced networking and built-in certified safety, as well as a fully featured motion controller and local intelligence.



Vertical (≤ 10A) or Horizontal (≤ 25A) Power Connector for Output Current



Wired Power Connection (recommended for >25A Output Current, but optional for ≤ 25A)

Figure 1: Gold Solo Twitter with Power Connectors Options

Power to the Gold Solo Twitter is provided by a DC power source which is isolated from the Mains. The Gold Solo Twitter can operate with single or dual power supplies. If separation between the main DC power source and a control supply is required, then a control supply (also isolated from the Mains) is required.

The drive can operate as a stand-alone device or as part of a multi-axis system in a distributed configuration on a real-time network.

The Gold Solo Twitter drive is easily set up and tuned using the Elmo Application Studio (EASII) software tools. As part of the Gold product line, it is fully programmable with the Elmo motion control languages. For more information about software tools refer to the Elmo Application Studio (EASII) User Guide.

Optionally, where necessary, Elmo offers two external heat sinks (Catalog number: G-TWIHSFINS01, and G-TWIHSFLAT01) which should be ordered separately. Refer to the section 6.2 Mounting the Optional Accessories Heat Sinks for details of installing the heatsinks.

Chapter 4: Technical Information

Note: **It should be noted that for all models, the Max Output current is guaranteed for $T_{Heat-Sink}$ <85°C**

General Mounting method	Panel mount

4.1. 60V and 100V Models Technical Data

Feature	Units	30/60	1/100	3/100	6/100	10/100	15/100	25/100
Minimum supply voltage	VDC	8	10					
Nominal supply voltage	VDC	48	85					
Maximum supply voltage	VDC	55	95					
Maximum continuous power output	W	1370	80	235	470	800	1125	2000
Efficiency at rated power (at nominal conditions)	%	> 99						
Maximum output voltage		Up to 96% of DC bus voltage						
Ic, Amplitude sinusoidal/DC continuous current	A	30	1	3	6	10	15	25
Sinusoidal continuous RMS current limit (Ic)	A	21	0.7	2.1	4.2	7.1	10	17.7
Peak current limit	A	2 x Ic						

Table 1: 60V and 100V Models Technical Data

4.2. 200V Models Technical Data

Feature	Units	3/200	6/200	10/200
Minimum supply voltage	VDC	20		
Nominal supply voltage	VDC	170		
Maximum supply voltage	VDC	195		
Maximum continuous power output	W	485	975	1650
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		Up to 96% of DC bus voltage		
Ic, Amplitude sinusoidal/DC continuous current	A	3	6	10
Sinusoidal continuous RMS current limit (Ic)	A	2.1	4.2	7.1
Peak current limit	A	2 x Ic		

Table 2: 200V Models Technical Data

4.3. R Type Technical Data

Feature	Units	R50/60	R80/80	R50/100	R70/100	R45/150	R15/200
Minimum supply voltage	VDC	8	10	10	10	12	20
Nominal supply voltage	VDC	48	65	85	85	115	170
Maximum supply voltage	VDC	55	75	95	95	135	195
Maximum continuous Electrical power output	kW	2.3	5	4.0	5.6	5	2.5
Efficiency at rated power (at nominal conditions)	%	> 99					
Maximum output voltage		Up to 96% of DC bus voltage					
Amplitude sinusoidal/DC continuous current	A	50	80	50	70	45	15
Sinusoidal continuous RMS current limit (Ic)	A	35.3	56.5	35.3	49.5	32	10.6

Table 3: R Type Models Technical Data

4.4. Control Supply Input Voltage (VL)

Feature	Unit	Details
Standard CAN		
Input range for Power Supply & Heatsink Option: **(Blank)**	V	12V – 40V
Input range for Power Supply & Heatsink Option: **S** or **H**	V	11V – 95V
Power consumption (including 5 V/200 mA for encoder)	W	<2.5W
ETHERCAT		
Input range for Power Supply & Heatsink Option: **(Blank)**	V	14V – 40V
Input range for Power Supply & Heatsink Option: **S** or **H**	V	11V – 95V
Power consumption (including 5 V/200 mA for encoder)	W	<4W

4.5. Product Features

Main Feature	Details	Presence / No.
STO	+5V Logic, Opto isolated from the Control section, *or*	**√**
	PLC Source, Opto isolated from the Control section	**√**
Digital Input	+5V Logic, Opto isolated from the Control section *or*	**6**
	PLC Source, Opto isolated from the Control section *or*	**6**
	PLC Sink Opto isolated from the Control section	**6**
Digital Output	+5V Logic, Opto isolated from the Control section *or*	**4**
	PLC Source, Opto isolated from the Control section *or*	**4**
	PLC Sink, Opto isolated from the Control section	**4**
Analog Input	Differential ±10V or Single Ended	**1**
Feedback	Standard Port A, B, & C	**√**
Communication Option	USB (only for EtherCAT version)	**√**
	EtherCAT *or*	**√**
	CAN	**√**
	Standard RS232	**√**

4.6. Environmental Conditions

You can guarantee the safe operation of the Gold Solo Twitter by ensuring that it is installed in an appropriate environment.

Warning: During operation the Gold Solo Twitter becomes hot to the touch (the heatsink and wires may heat up to 92 °C). Care should be taken when handling it.

Caution:
The Gold Solo Twitter dissipates its heat by convection or by conduction. The maximum ambient operating temperature of 50 °C (122°F) must not be exceeded.

Feature	Details
Operating ambient temperature in compliance with STO standards	0 °C to 40 °C (32 °F to 104 °F)
Operating ambient temperature according to IEC60068-2-2	0 °C to 50 °C (32 °F to 122 °F) in compliance with UL standards
Storage temperature	-20 °C to +85 °C (-4 °F to +185 °F)
Maximum non-condensing humidity according to IEC60068-2-78	95%
Maximum Operating Altitude	2,000 m (6562 feet) It should be noted that servo drives capable of higher operating altitudes are available on request.
Mechanical Shock according to IEC60068-2-27	15g / 11ms Half Sine
Vibration according to IEC60068-2-6	5 Hz ≤ f ≤ 10 Hz: ±10mm 10 Hz ≤ f ≤ 57 Hz: 4G 57 Hz ≤ f ≤ 500 Hz:5G

Chapter 5: Standards

Refer to the complete Standards list detailed and available on the internet at:

https://www.elmomc.com/capabilities/standards-compliance/gold-family/

5.1. CE Declaration

Refer to the complete EC Declaration of Conformity available on the internet at:

https://www.elmomc.com/wp-content/uploads/dlm_uploads/2018/05/Gold-Line-CE-Declaration-of-Conformity.pdf.

Chapter 6: Installation

The Gold Solo Twitter must be installed in a suitable environment and properly connected to its voltage supplies and the motor.

6.1. Unpacking the Drive Components

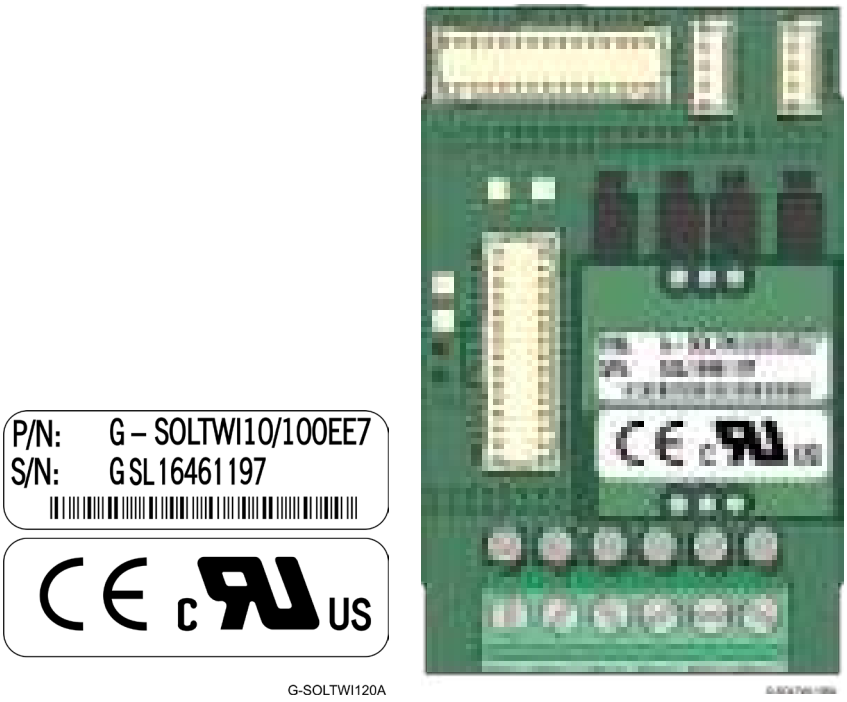
Before you begin working with the Gold Solo Twitter, verify that you have all of its components, as follows:

- The Gold Solo Twitter servo drive
- The Elmo Application Studio (EASII) software and software manual

The Gold Solo Twitter is shipped in a cardboard box with Styrofoam protection.

To unpack the Gold Solo Twitter:

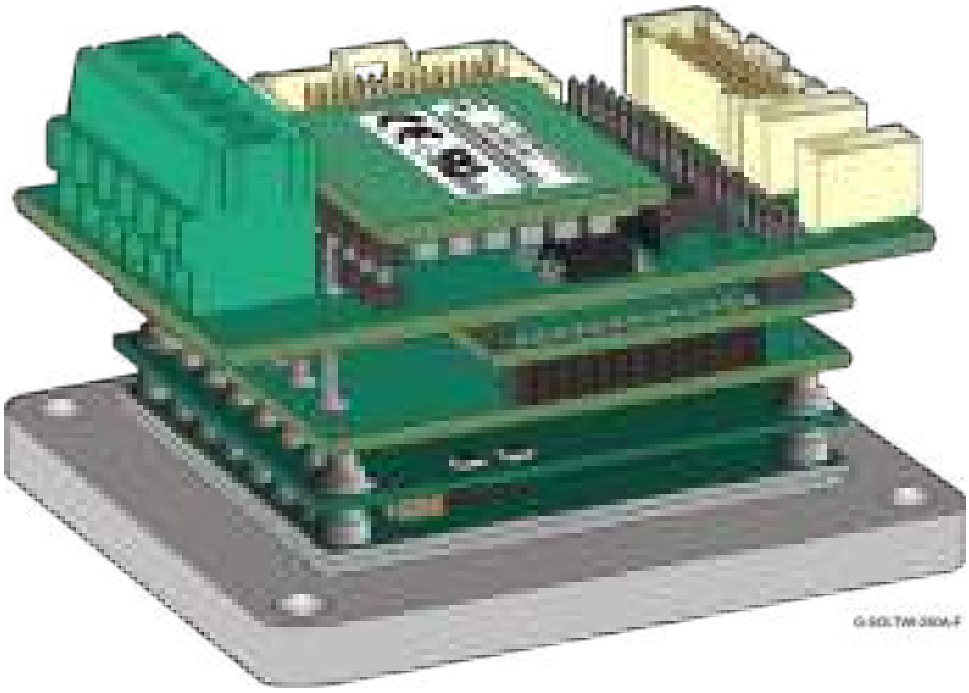
1. Carefully remove the servo drive from the box and the Styrofoam.
2. Check the drive to ensure that there is no visible damage to the instrument. If any damage has occurred, report it immediately to the carrier that delivered your drive.
3. To ensure that the Gold Solo Twitter you have unpacked is the appropriate type for your requirements, locate the part number sticker on the top of the Gold Solo Twitter. It looks like this:



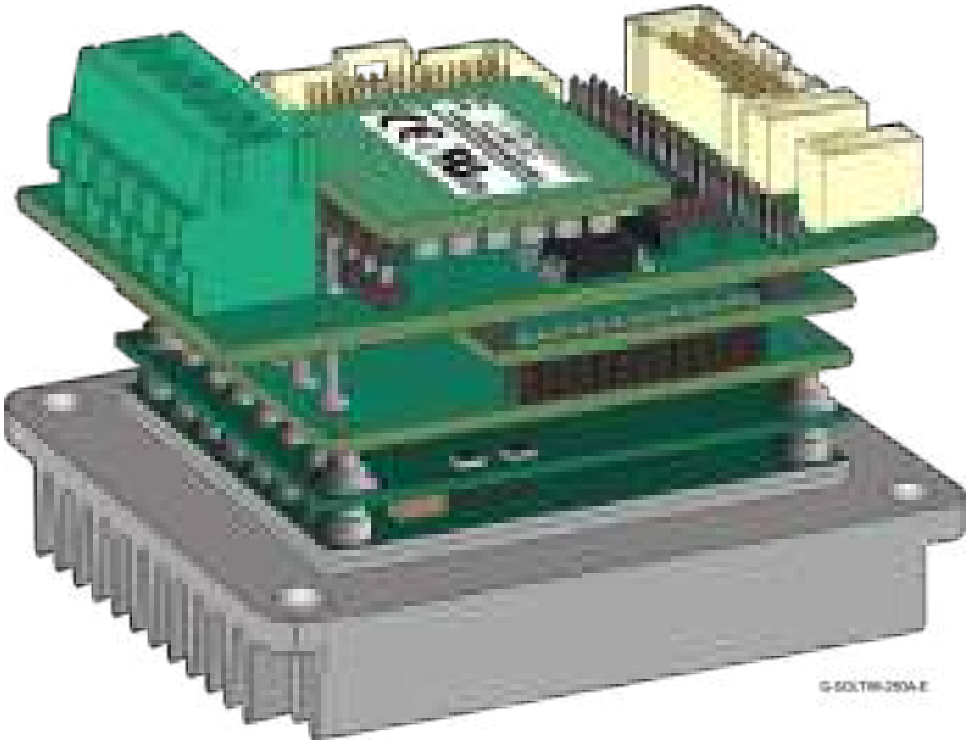
4. Verify that the Gold Solo Twitter type is the one that you ordered, and ensure that the voltage meets your specific requirements.
   The part number at the top provides the type designation. Refer to the appropriate part number in the section Catalog Number at the beginning of the installation guide.

6.2. Mounting the Optional Accessories Heat Sinks

There are two optional heat sinks, available as accessory kits (the model Power Supply & Heatsink Option: **H** is integrated with the Flat Heatsink P/N G-TWIHSFLAT01):



Flat Heat Sink (P/N G-TWIHSFLAT01)



Fins Heat Sink (P/N G-TWIHSFINS01)

The optional heat sink must be screwed to the lower surface of the Gold Solo Twitter.

To mount the accessory heatsink (Not available for the option Power Supply & Heatsink Option: H):

1. Mount the heat sink under the base of the Gold Solo Twitter.
2. Place the Thermal foil (enclosed in the heat sink accessories kit) between the lower surface of the servo drive, and the upper surface of the heatsink.
3. Use four M2 screws (enclosed in the heat sink accessories kit) to secure the heatsink under the servo drive.
4. Tighten the screws to the relevant torque force applicable to an M2 stainless steel A2 screw.

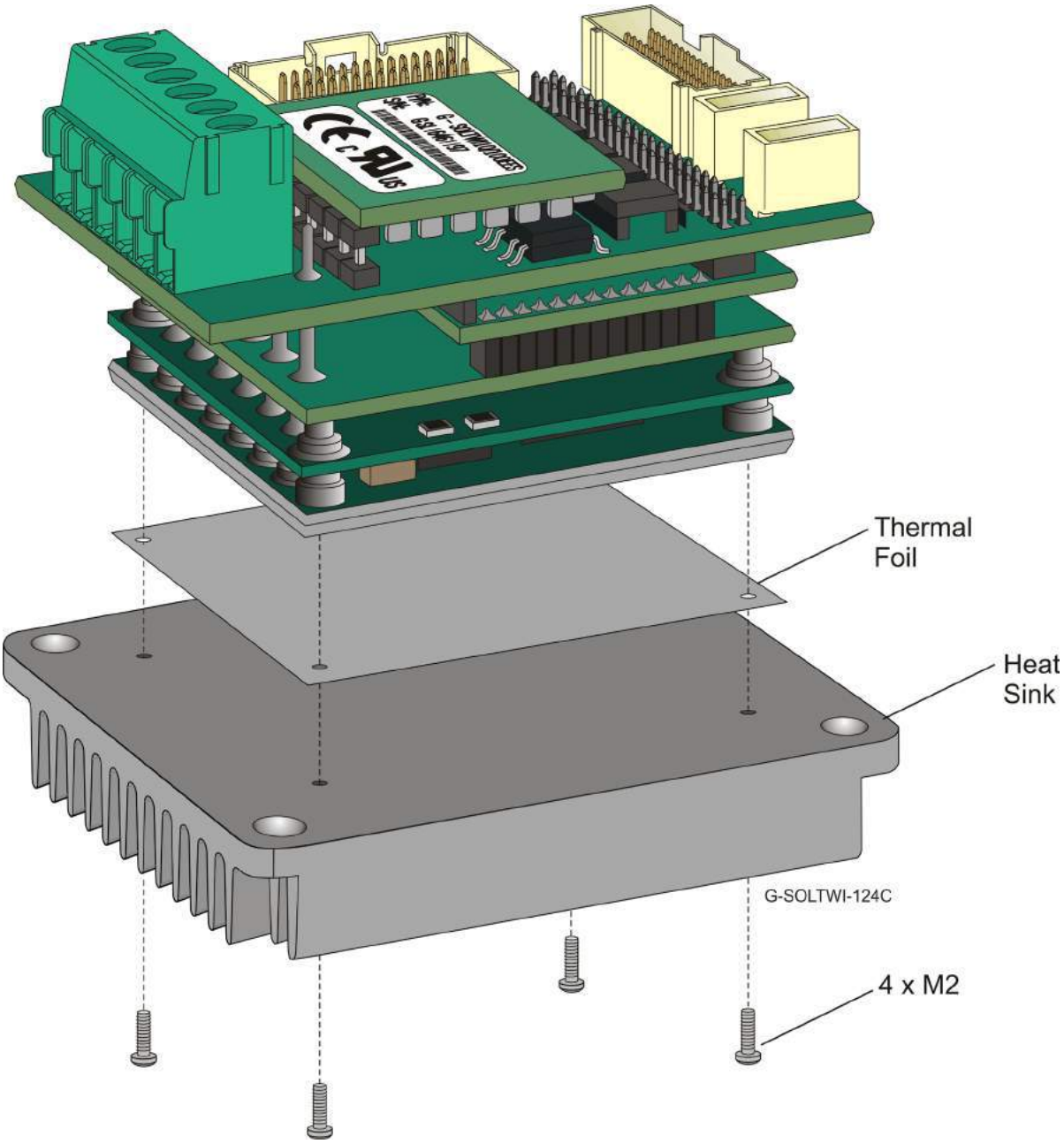


Figure 2: Mount the Heat Sink and Thermal Foil to the Gold Solo Twitter

6.3. Mounting Gold Solo Twitter to an External Heatsink

This option is only available for Power Supply & Heatsink Option: **H**.

The selected heat sink must be screwed to the lower surface of the Gold Solo Twitter.

To mount the Gold Solo Twitter to an external heat sink:

1. Mount the heat sink under the base of the Gold Solo Twitter.
2. Place the Thermal foil (PN IMT-GTWIALHFLAT purchased from Elmo) between the lower surface of the servo drive, and the upper surface of the heatsink.
3. Use four M2.5 head cup Allen screws to secure the heat sink under the servo drive.
4. Tighten the screws to the relevant torque force applicable to an M2.5 stainless steel A2 screw.

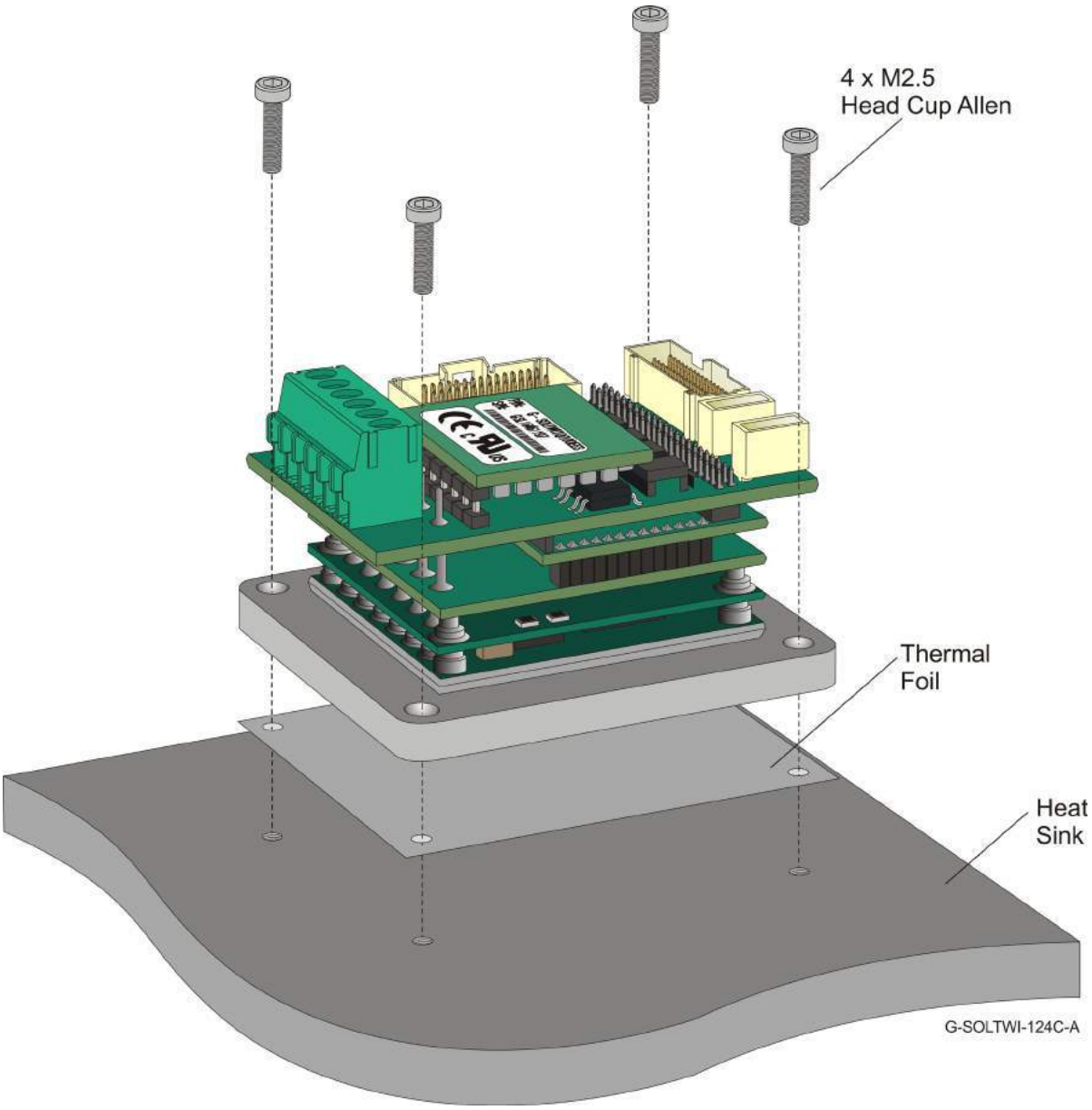


Figure 3: Mounting the Heat Sink and Thermal Foil to the Gold Solo Twitter

6.4. The Gold Solo Twitter Connection Diagrams

6.4.1. EtherCAT Connection Diagram

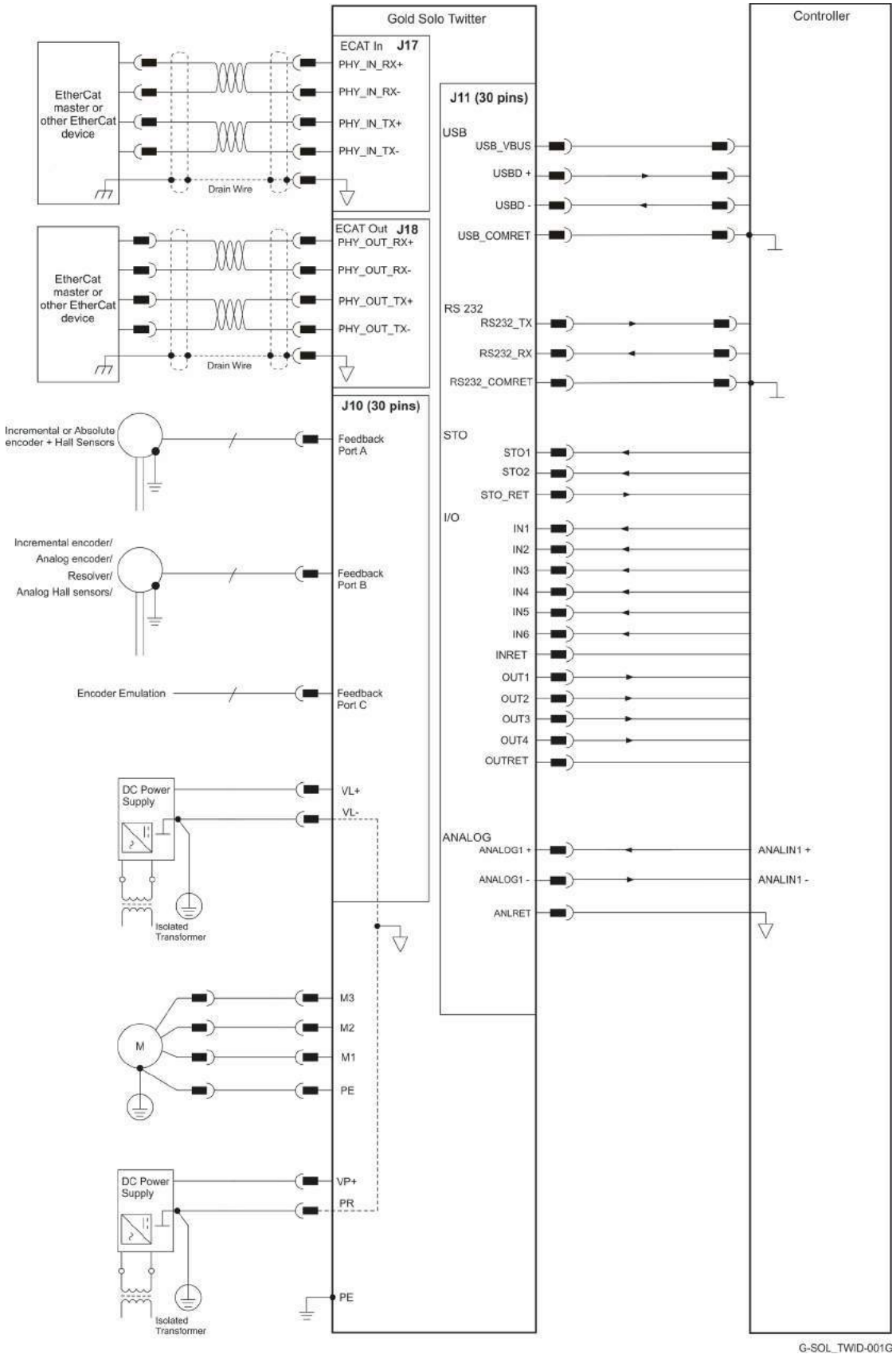


Figure 4: The Gold Solo Twitter EtherCAT Connection Diagram

6.4.2. CAN Connection Diagram

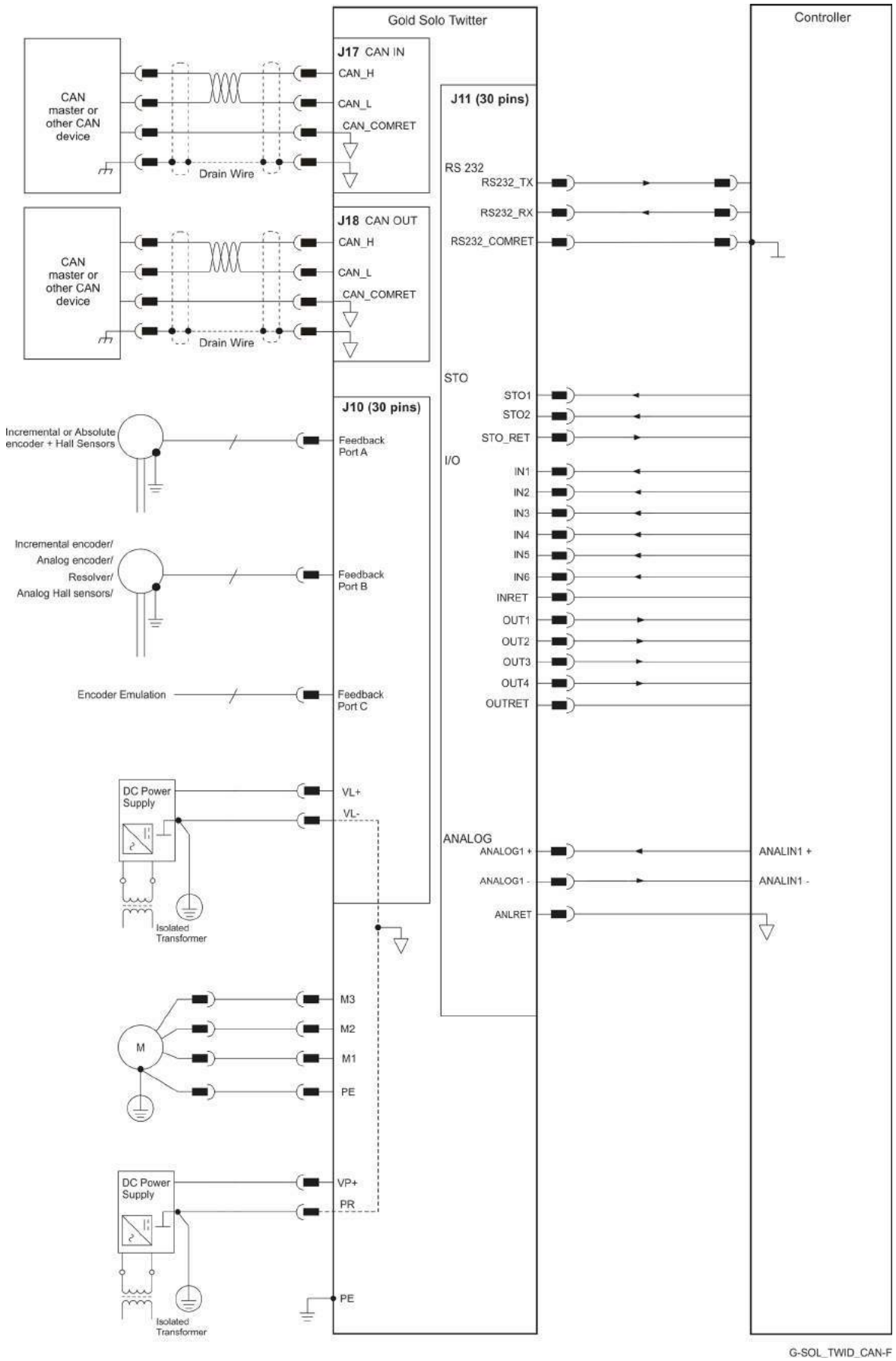
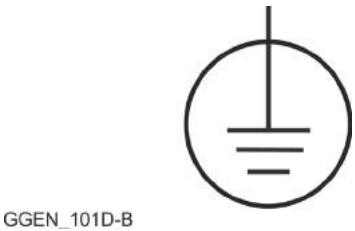
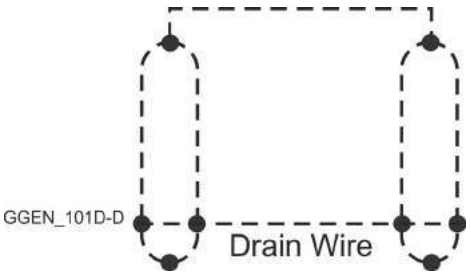
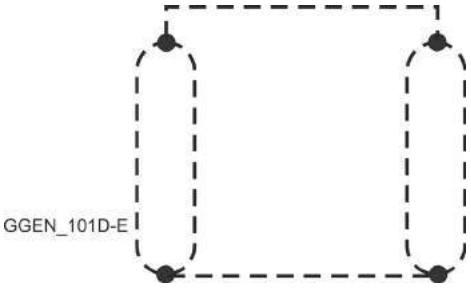
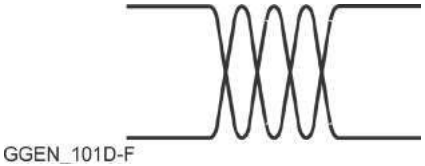


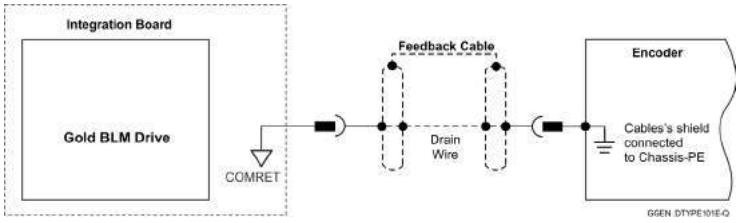
Figure 5: The Gold Solo Twitter CAN Connection Diagram

Chapter 7: Wiring

7.1. Wiring Legend

The following table legend describes the wiring symbols detailed in all installation guides.

Wiring Symbol	Description
GGEN_101D-A	Earth connection (PE)
 GGEN_101D-B	Earth Connection
GGEN_101D-C	Common at the Controller
 GGEN_101D-D	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
 GGEN_101D-E	Shielded cable braid only, without drain wire.
 GGEN_101D-F	Twisted-pair wires

Wiring Symbol	Description
	Encoder Earthing. The cable`s shield is connected to the chassis (PE) in the connector. Earthing the Encoder and connecting the Earth (PE) to the drive COMRET is mandatory to insure reliable operation, high noise immunity and rejection of voltage common mode interferences.

7.2. Connectors Types

The Gold Solo Twitter has five connectors:

Connector	Connector Type
Power	Wires, Horizontal or Pluggable Vertical Pheonix connector
J10, J11	J10 - VL & Feedback Ports Connector (2 rows x 15 Pins) J11 - IO and Communication Connector (2 rows x 15 Pins)
J17, 18	J17 - CAN/EtherCAT IN Communication J18 - CAN/EtherCAT OUT Communication

7.3. Mating Connectors

Connector	Mating Connector Type	Mating Crimping Pins
Power(Vertical model)	PHEONIX 3.5 mm pitch terminal 6-pin plug straight 1840405	N/A
J10, J11 **VL & Feedback Ports** **IO and Communication**	MOLEX 1.00mm "Pico-Clasp" 501189-3010	MOLEX 1.00mm crimp terminal 501193-3000
J17, 18 **IN/OUT CAN/EtherCAT** **Communication**	MOLEX 1.00mm "Pico-Clasp" 501330-0500	MOLEX 1.00mm crimp terminal 501334-0100
Connectors Location		

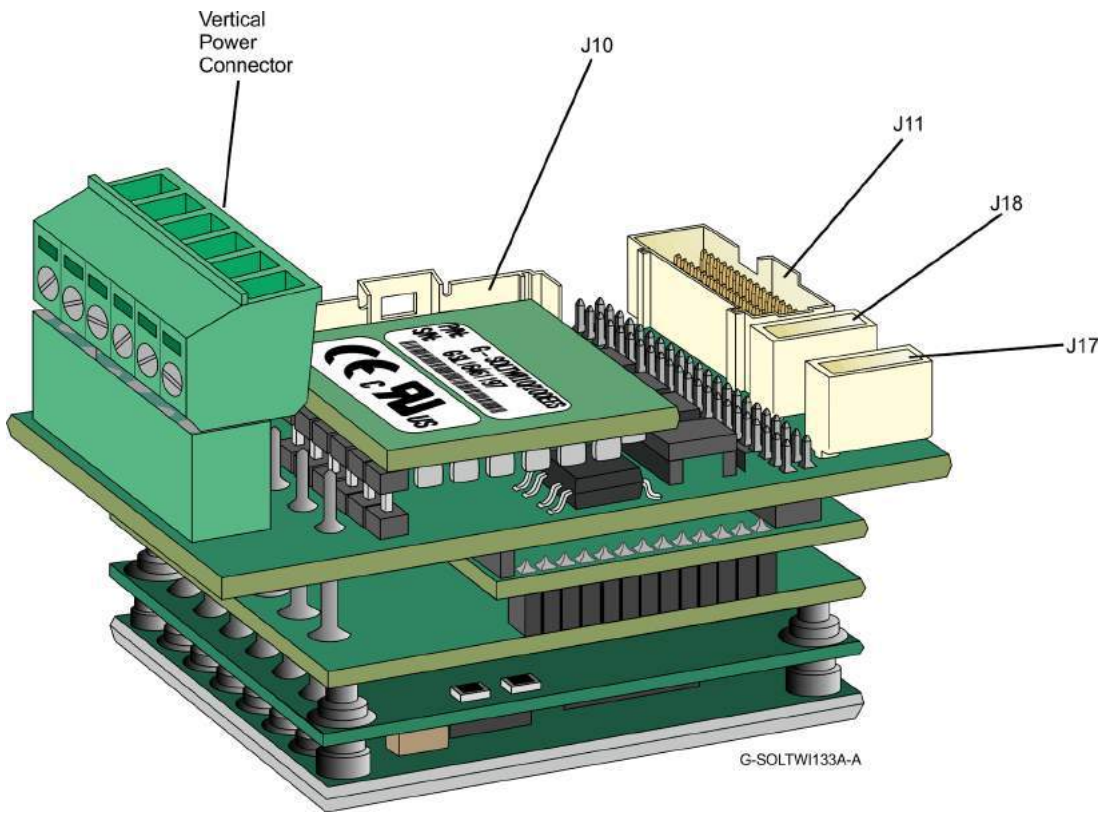


Table 4: Connector Types

7.4. Logic and Control Cabling and Wiring

7.4.1. J10 and J11 (Feedback ports, VL, RS232, USB, Analog Input)

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

7.4.2. J11 (Digital Inputs/Outputs, STO)

Wires can always be used, no need for twisting, no need for shielding.

7.4.3. J17, J18 EtherCAT or CAN Communication

Always use CAT5e cables (see Elmo's Gold Solo Twitter Cable Kit (MAN-G-SOLTWI-CBLKIT)).

7.4.4. COMRET to PE Connection

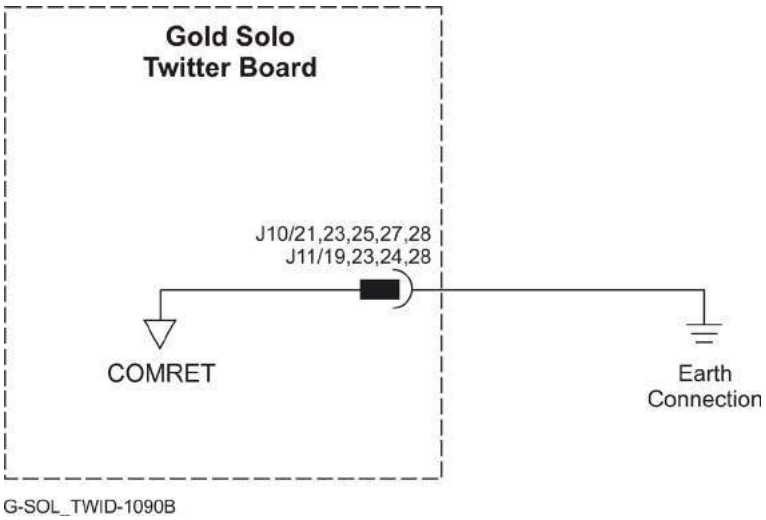


Figure 6: COMRET Connection to the PE

At least one COMRET pin (Figure 6) must be connected to the Protective Earth (PE).
Earthing the COMRET by connecting the Earth (PE) to the drive COMRET is mandatory to insure reliable operation, high noise immunity and rejection of voltage common mode interferences.

7.5. Wiring the Female Connectors

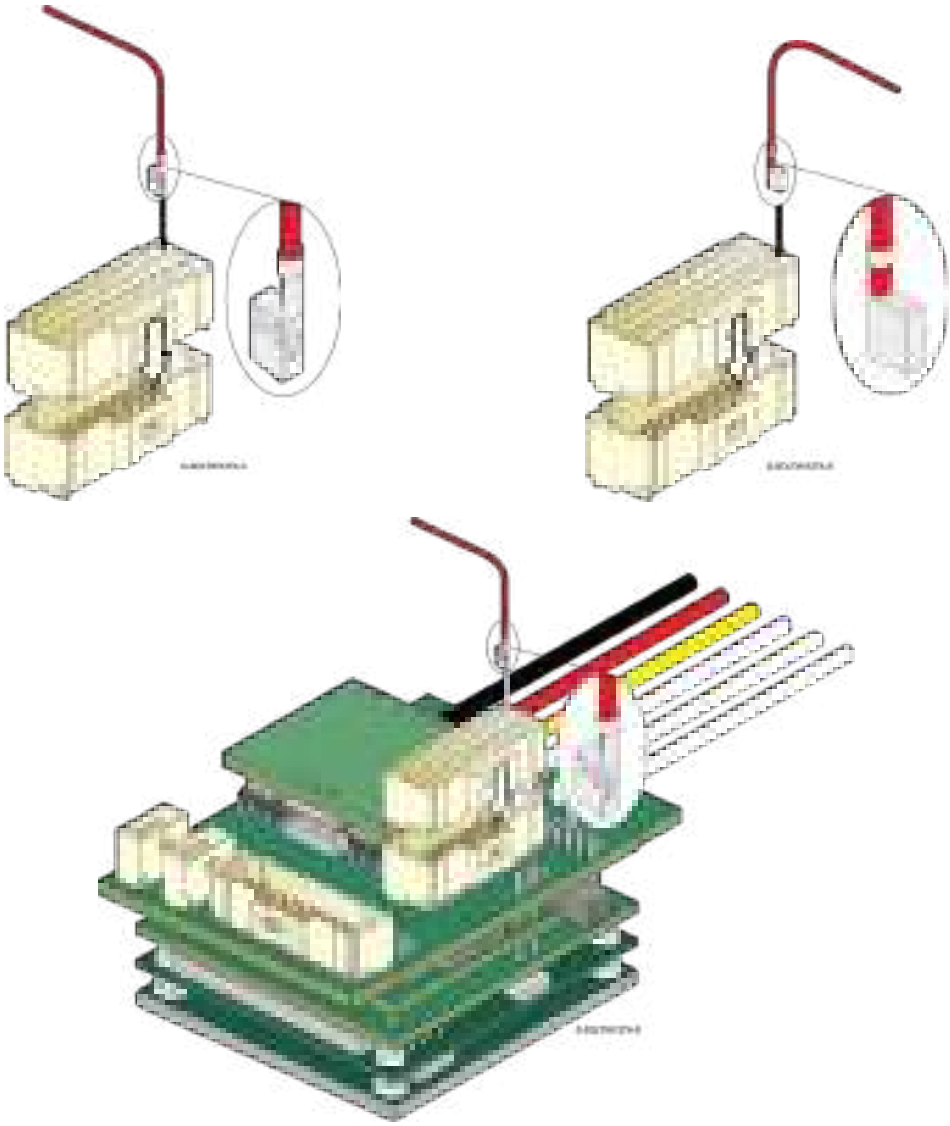


Figure 7: Inserting a wire/pin to the Female Connector

To insert a wire/pin to the female connectors of J10, J11, J17, and J18 do the following:

1. Select the relevantly colored wire to insert to a specific rectangular compartment on the female connector.
2. Use the appropriate Molex crimping plier (Molex P/N 63819-1500) to fasten a pin connector to the end of the wire.
3. Place the connector on a flat surface, in the orientation as shown in Figure 7.
   Notice that the rectangular slot has a niche at the bottom of the slot.
4. Insert the wire connector to the slot as shown in Figure 7. Make sure that the connector protrusion is inserted to the bottom of the rectangular slot.
   When inserting the wire connector to a slot in the second row, make sure to rotate the connector in the opposite orientation.
5. Repeat the same procedure for any other wire connections.

Chapter 8: Connections

8.1. Main, Control, and Motor Power

This section describes the Main and Control supplies, and Motor Power connections.

There are three optional Motor and Main Power interfaces:

- The current carrying capacity of the Solo board wires is up to 80A (57A RMS)
- Pheonix horizontal connector on models have an output current of 25A (17.7A RMS) or less
- Pheonix pluggable vertical connector on models have an output current of 10A (7.1A RMS) or less

8.1.1. Motor Power

For full details see Section 7.3 in the manual: MAN-G-Board Level Modules Hardware manual.

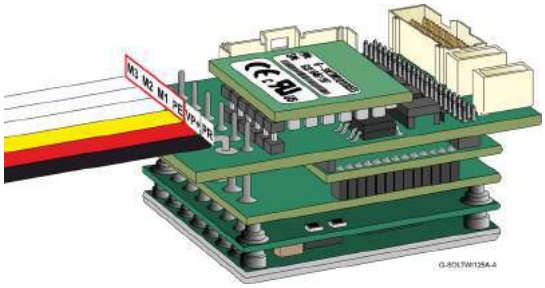
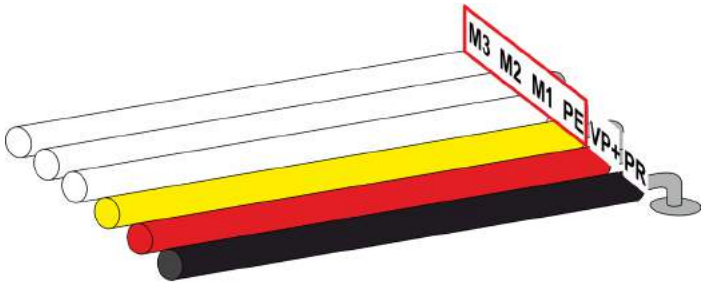
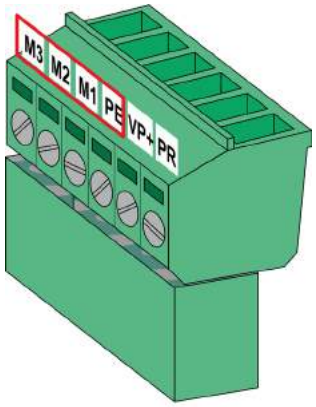
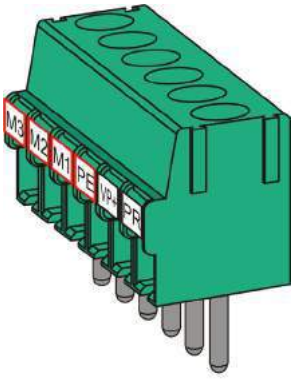
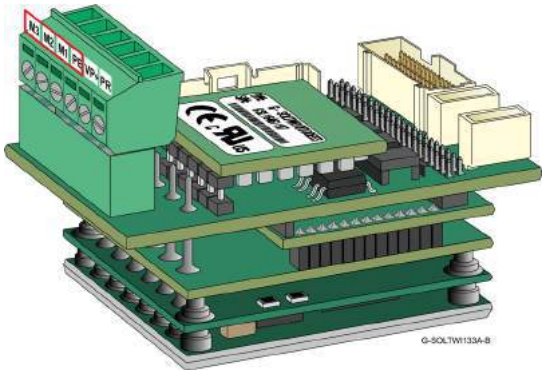
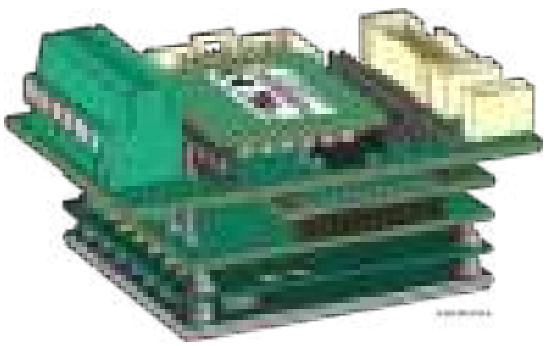
Pin	Wire Color	Function	Cable		Pin Positions
			Brushless Motor	Brushed DC Motor	
PE	Yellow	Connection earth	Motor	Motor	
M1	White	Motor phase	Motor	N/C	
M2	White	Motor phase	Motor	Motor	
M3	White	Motor phase	Motor	Motor	
 G-SOLTWI125A-C  G-SOLTWI133A-D  G-SOLTWI-209A-B				 

Table 5: Motor Wires or Connector

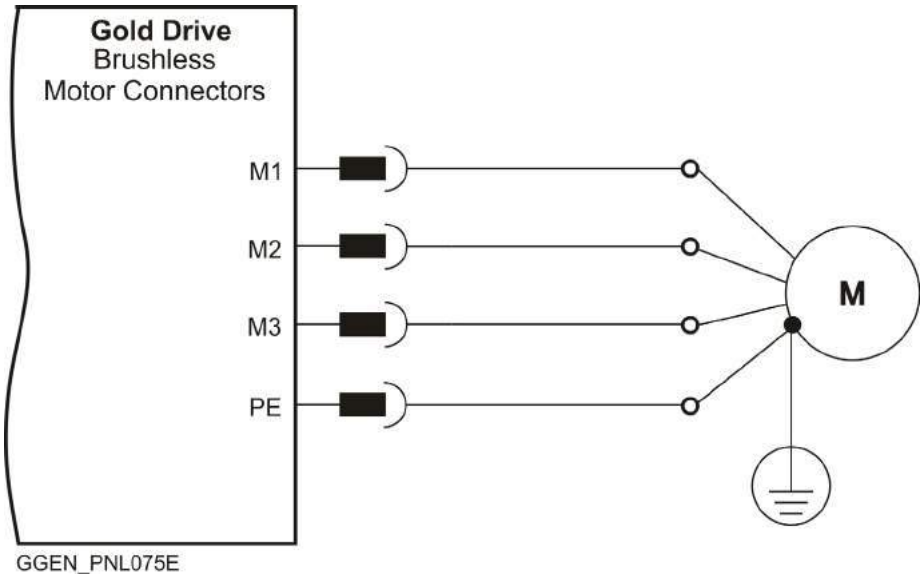


Figure 8: Brushless Motor Power Connection Diagram

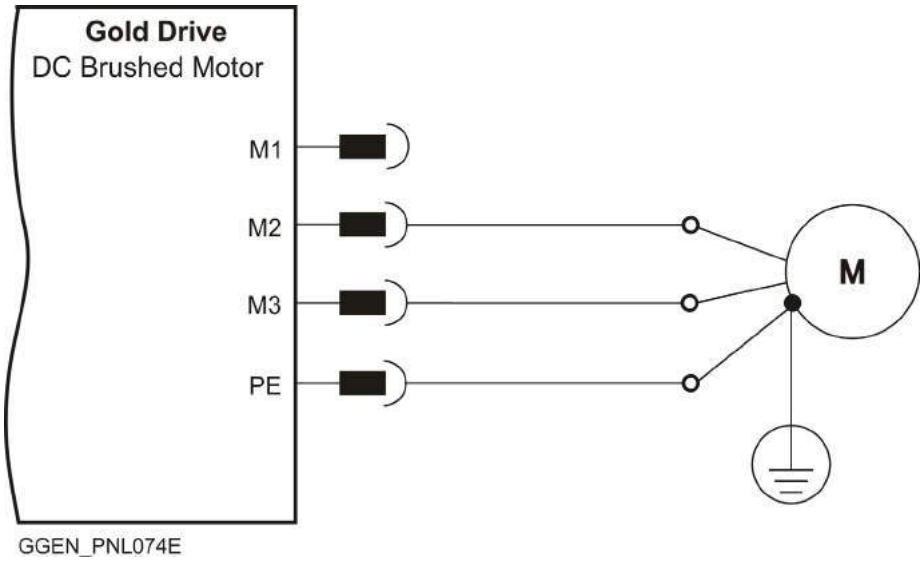


Figure 9: Brushed Motor Power Connection Diagram

8.1.1.1. Motor Power Connections

1. Ensure that the motor chassis is properly earthed.
2. Connect the appropriate wire from the Motor Power cables to the M1, M2, M3, and PE terminals on the Gold Solo Twitter.

   The phase connection is arbitrary as Elmo Application Studio (EAS II) will establish the proper commutation automatically during setup. When tuning a number of drives, you can copy the setup file to the other drives and thus avoid tuning each drive separately. In this case the motor-phase order must be the same as on the first drive.

3. For high EMI environment, it is highly recommended to use a 4-wire shielded (not twisted) cable for the motor connection. The gauge is determined by the actual RMS current consumption of the motor.
   Connect the cable shield to the closest ground connection at the motor end.
   For better EMI performance, the shield should be connected to Earth Connection (heat sink mounting holes).
4. Connect the motor power wires as shown in Figure 10. The Yellow wire is the Grounding wire.
   Make sure not to bundle the wires.

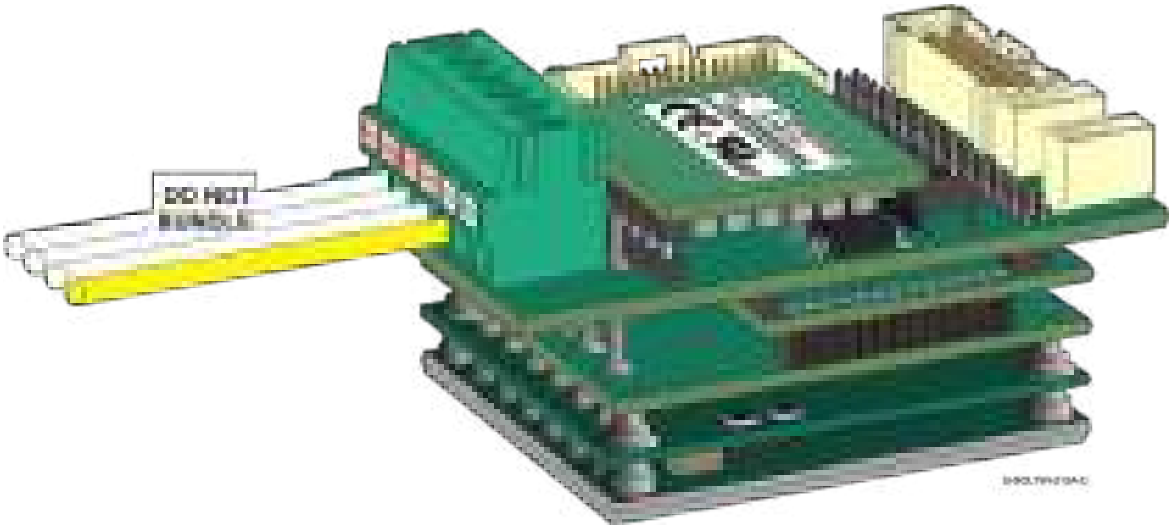


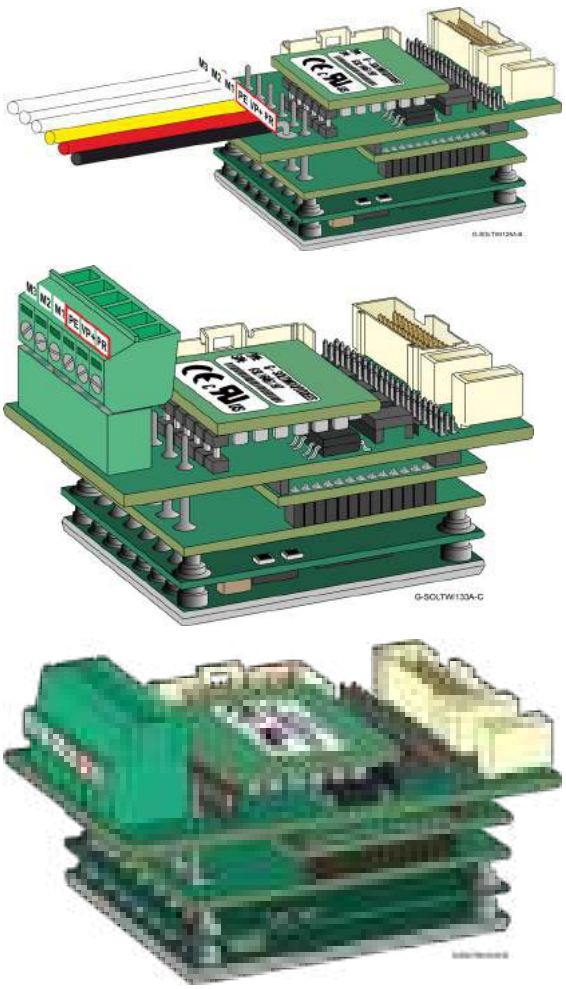
Figure 10: Connecting the Motor Power Wires

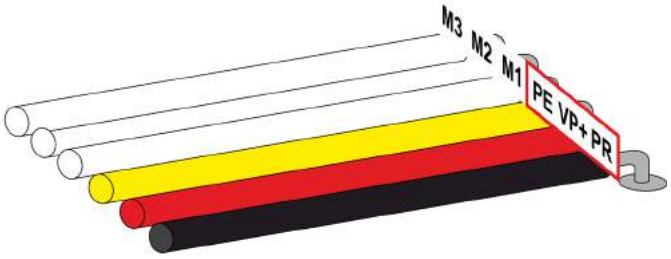
8.1.2. Main Power Wires & Connector

This section describes the Main Power and the Control supply connector.

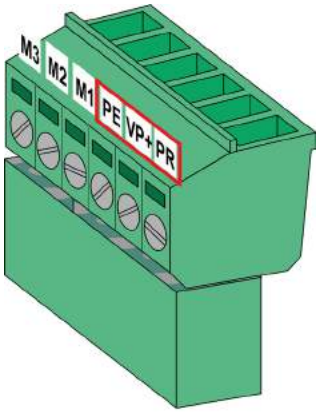
8.1.2.1. Main Power

The isolated DC power source is not included with the Gold Solo Twitter.

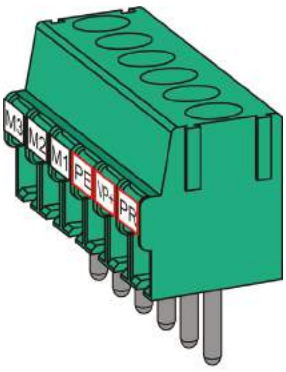
Pin	Wire Color	Function	Cable	Pin Positions
VP+	Red	DC Pos. Power input	Power	
PR	Black	Power return	Power	
PE	Yellow	Connection earth	Power	



G-SOLTWI125A-D



G-SOLTWI133A-E



G-SOLTWI-209A-C

Table 6: Connector or Wires for Main Power

Connect the DC power cable to the VP+ and PR terminals on the main power connector.

To connect the Gold Solo Twitter to the DC power source:

1. The source of the VDC power supply must be isolated from the Mains.
2. Verify that the rectified VDC is indeed within the range of the drive.

3. Connect the VP+ and PR wires to the terminals on the servo-drive as shown in Figure 11.
   It is highly recommended to twist the two DC main power cables at intervals of 10 cm.

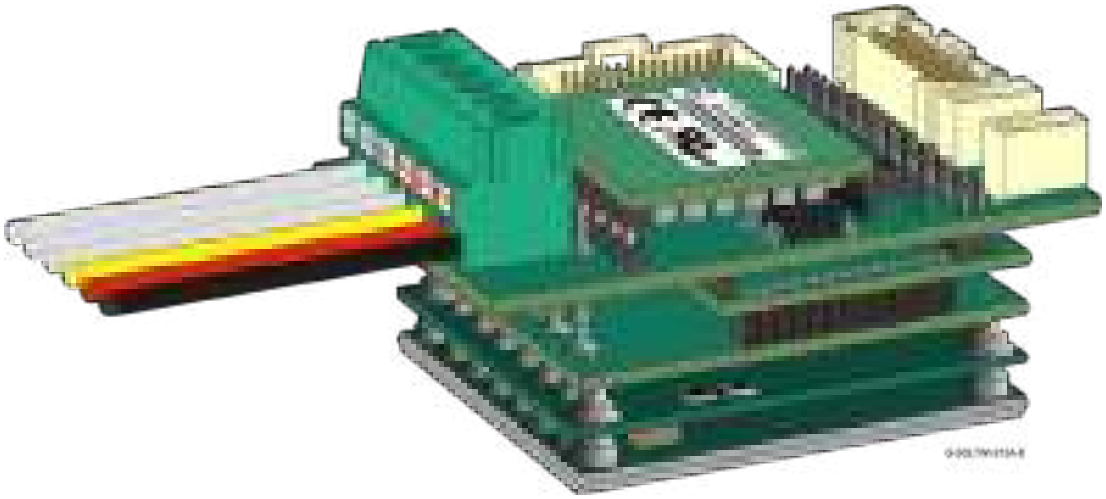


Figure 11: Connecting the Main Power Wires

4. Connect the PE to the closest earth connection near the power supply.
5. Connect the PR to the closest earth connection near the power supply.
6. Before applying power, first verify the polarity of the connection.

8.1.2.2. Wiring Technical Details

The following Wired Power Connections are rated to operate up to 200°C:

- For up to 30A consist of six 14-AWG colored high quality wires
- For 45A and higher consist of six 12-AWG colored high quality wires

The Gold Solo Twitter wire connection conforms to UL standards for operation up to 105°C (on the wires). Under extensive load conditions the wires temperature gradient is ≈50 °C above ambient.

8.1.3. Control Supply (J10)

Connect the VL+ and VL- pins on the Gold Solo Twitter in the manner described in the table and drawing below.

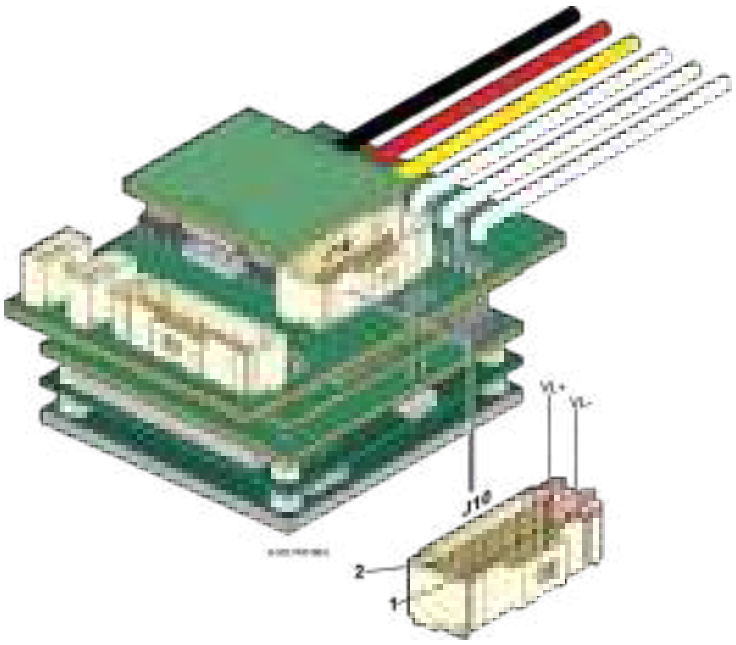
Pin	Signal	Function	Pin Positions
30	VL+	Control Supply Input	
29	VL-	Control Supply Return	
1. Standard CAN (Power Supply & Heatsink Option: **(Blank)**) Input range: 12VDC – 40VDC Power consumption: <2.5W (including 5 V/200 mA for encoder) 2. EtherCAT (Power Supply & Heatsink Option: **(Blank)**) Input range: 14VDC – 40VDC Power consumption: <4W (including 5 V/200 mA for encoder) 3. Standard CAN (Power Supply & Heatsink Option: **S** or **H**) Input range: 11VDC – 95VDC Power consumption: <2.5W (including 5 V/200 mA for encoder) 4. EtherCAT (Power Supply & Heatsink Option: **S** or **H**) Input range: 11VDC – 95VDC Power consumption: <4W (including 5 V/200 mA for encoder)			

Table 7: Control Supply Pins

Connect the VL+ and VL- terminals to the power supply Control Connector.

To connect the VL+ and VL- to the control supply:

1. The source of the control supply must be isolated from the Mains.
2. Connect the return (common) of the control supply source to the closest earth connection near the control supply source.

3. Connect the VL+ and VL- wires to the terminals on the servo-drive as shown in Figure 12.

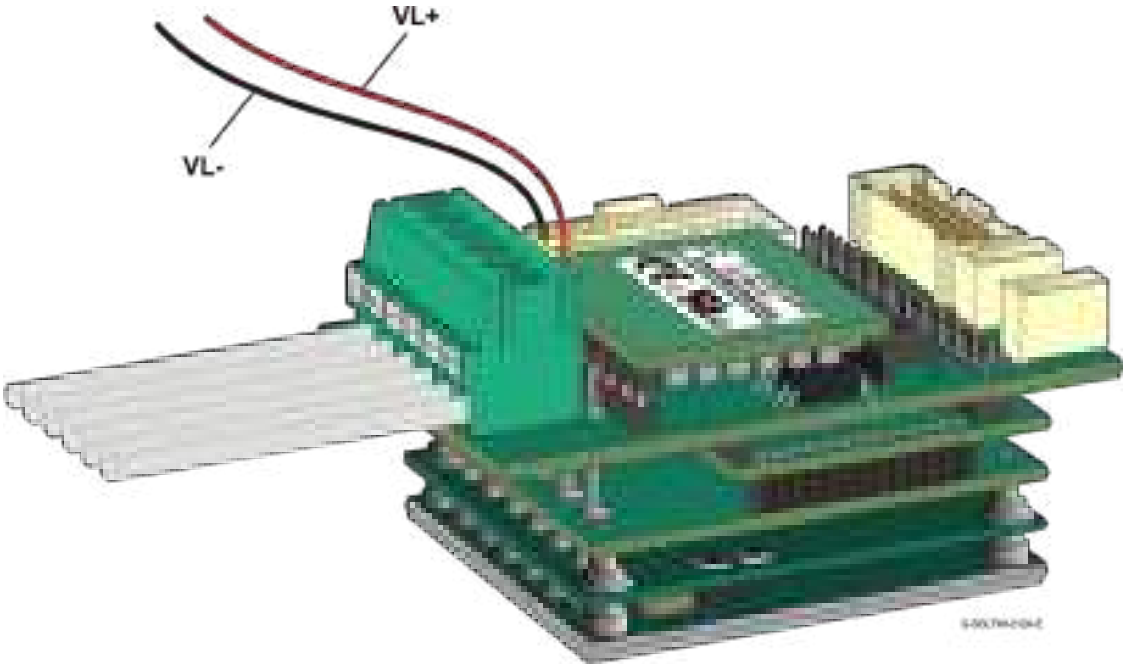


Figure 12: Connecting the Control Supply Wires

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

4. Before applying power, first verify the polarity of the connection.

Note: **For VL 12VDC to 40VDC (Power Supply & Heatsink Option: (Blank)) refer to section 8.1.4.**

For VL 11VDC to 95VDC (Power Supply & Heatsink Option: S or H) refer to section 8.1.5.

8.1.4. Control Supply Connections for Power Supply & Heatsink Option: (Blank)

Note: **This section is for VL 12VDC to 40VDC.**
For VL 11VDC to 95VDC (Power Supply & Heatsink Option: S or H) refer to section 8.1.5.

8.1.4.1. Dual Power Supply

Whenever the VP+ is >40VDC, a separate supply for the Logic is required. Both the Power and Logic supplies are required to be isolated-from-the-mains:

- A battery or main DC power source rectified from the Mains, according to specification
- A control supply for the logic (VL+, VL-)

The following figure describes an ordinary power supply for Servo drives with sufficient internal capacitance and shunt regulator to manage power flow in both directions to-and-from the motor.

Note: **The PR, COMRET, and VL- are connected internally in the Gold Solo Twitter.**

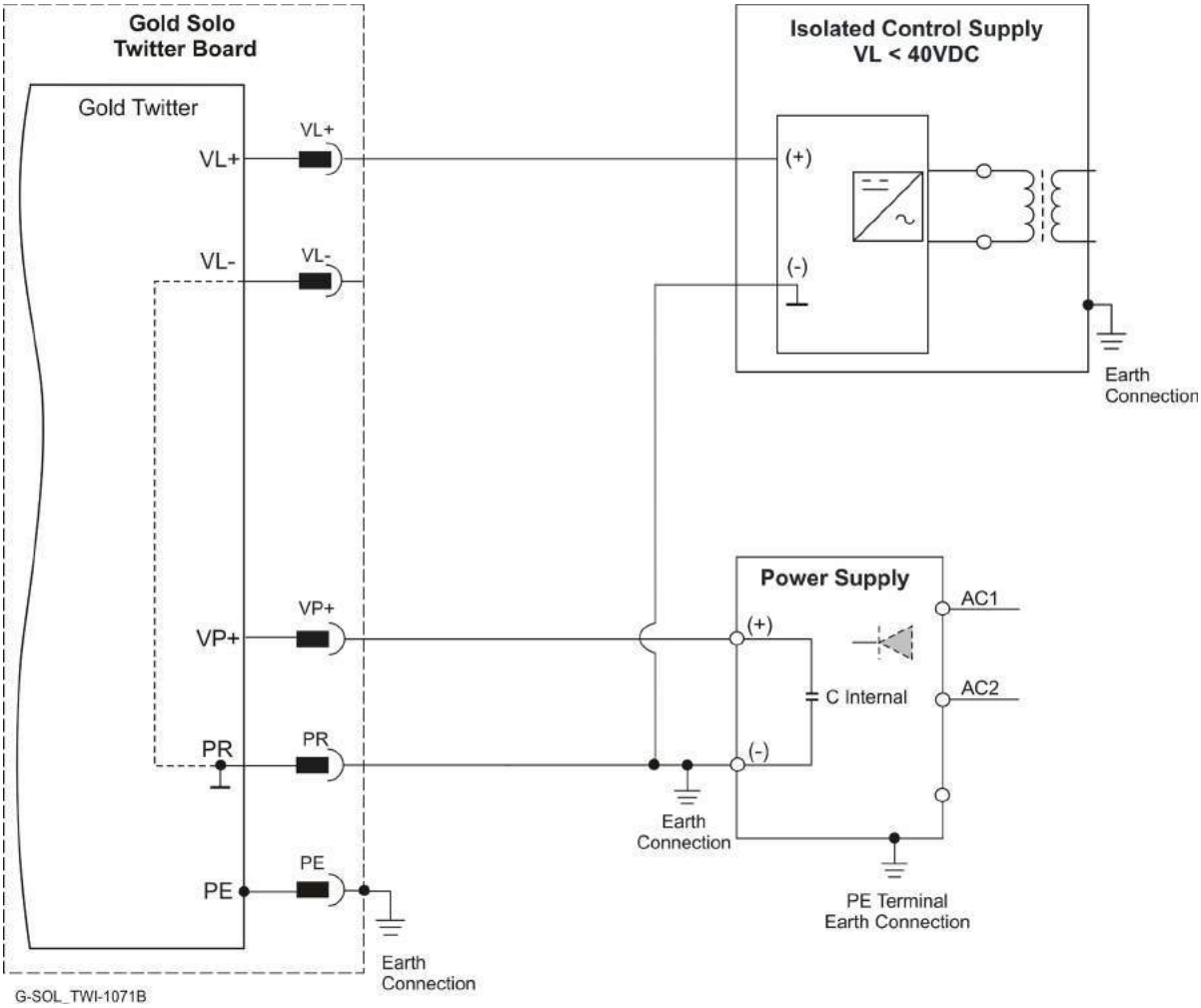


Figure 13: Separate VP and VL Power Supplies Connection Diagram –Highly Recommended

The (+) of the control power supply is connected to the VL+ terminal, while the (-) of the control power supply is connected directly to the (-) of the DC bus power supply. This connection avoids high current ground loops due to poor wiring (Figure 13).

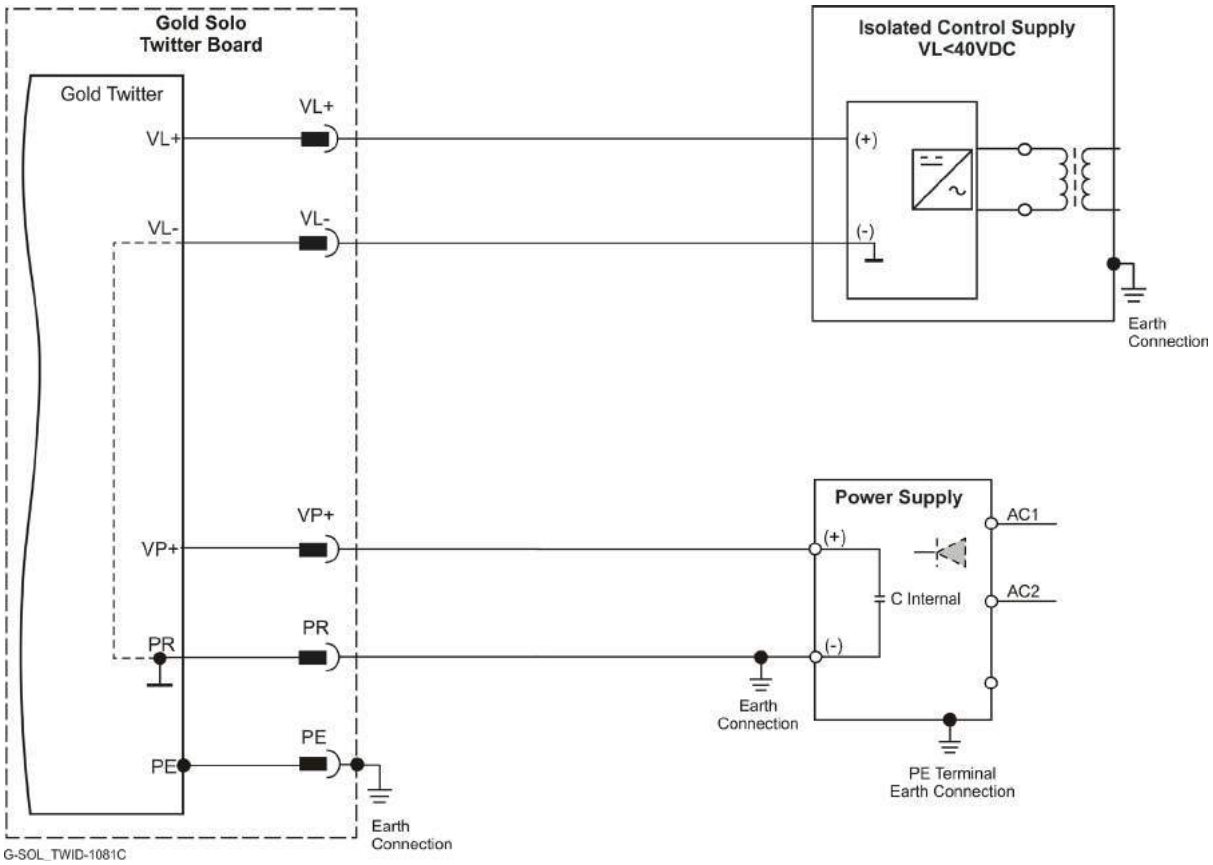


Figure 14: Separate VP and VL Power Supplies Connection Diagram - Alternative

The (-) of the control power supply is connected to the VL- of the Gold Solo Twitter (Figure 14).

8.1.4.2. Single Power Supply (VP+ < 40VDC)

Where a single power supply is used (VL+ connected to VP+), the absolute maximum VP+ and VL+ voltage must be < 40VDC, under all conditions, to prevent VL+ supply failure.

When regeneration or braking occurs, the DC bus may increase and may exceed the VL limit of over 40VDC, possibly causing the VL to fail. Under these conditions, you must install the Dual Power Supply described above in section 8.1.4.1.

Note: **For the EtherCAT (E option), the minimum VL is 14 VDC.**

For the CAN version power rating of 12VDC to 40VDC, or 14VDC to 40VDC for the EtherCAT version, a single power supply can be used for the main and control power.

The following figure describes a single connection of main power and control.

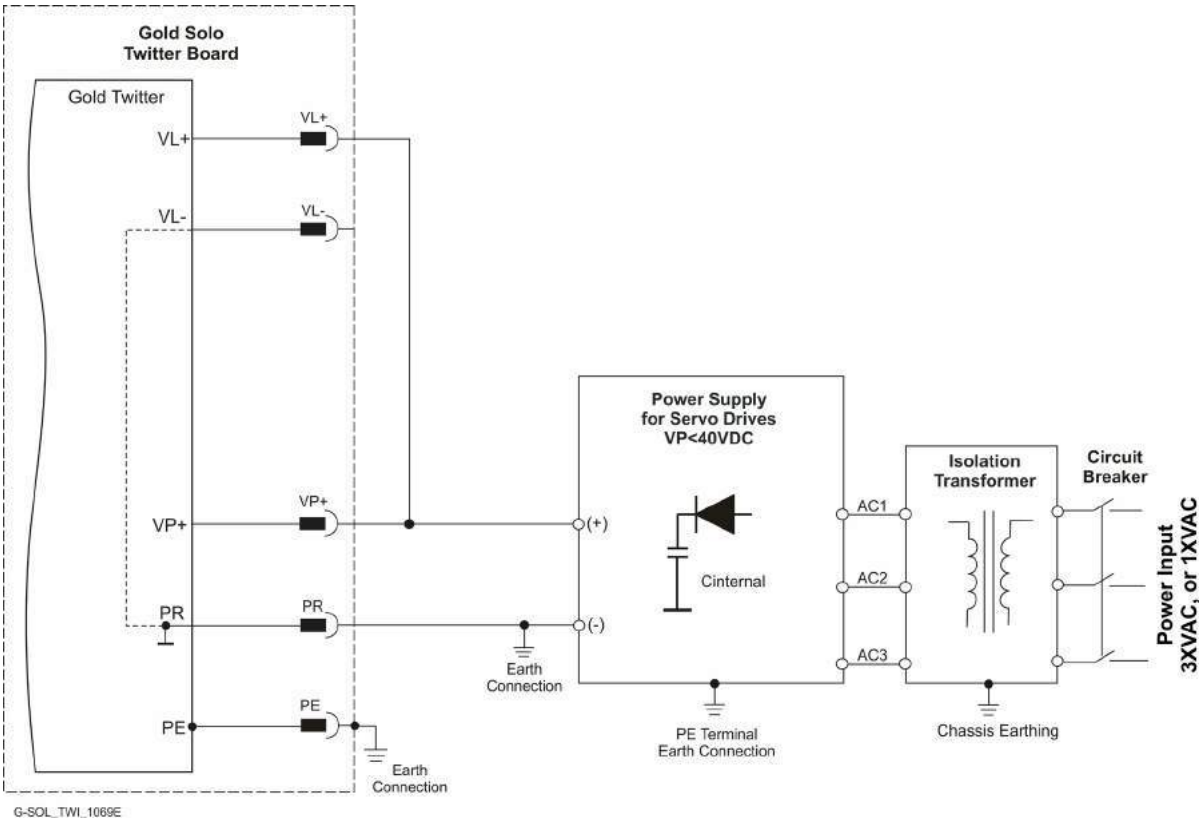


Figure 15: Single Power Supply (VP+ <40V) Connection Diagram

Note: **This option is available for power supply up to 40VDC.**

8.1.5. Control Supply Connections for Power Supply & Heatsink Option: S or H

Note: **This section is for VL 11VDC to 95VDC.**
For VL 12VDC to 40VDC (Power Supply & Heatsink Option: (Blank)) refer to section 8.1.4.

8.1.5.1. Dual Power Supply

Whenever the VP+ is >95VDC, a separate supply for the Logic is required. Both the Power and Logic supplies are required to be isolated-from-the-mains:

- A battery or main DC power source rectified from the Mains, according to specification
- A control supply for the logic (VL+, VL-)

The following figure describes an ordinary power supply for Servo drives with sufficient internal capacitance and shunt regulator to manage power flow in both directions to-and-from the motor.

Note: **The PR, COMRET, and VL- are connected internally in the Gold Solo Twitter.**

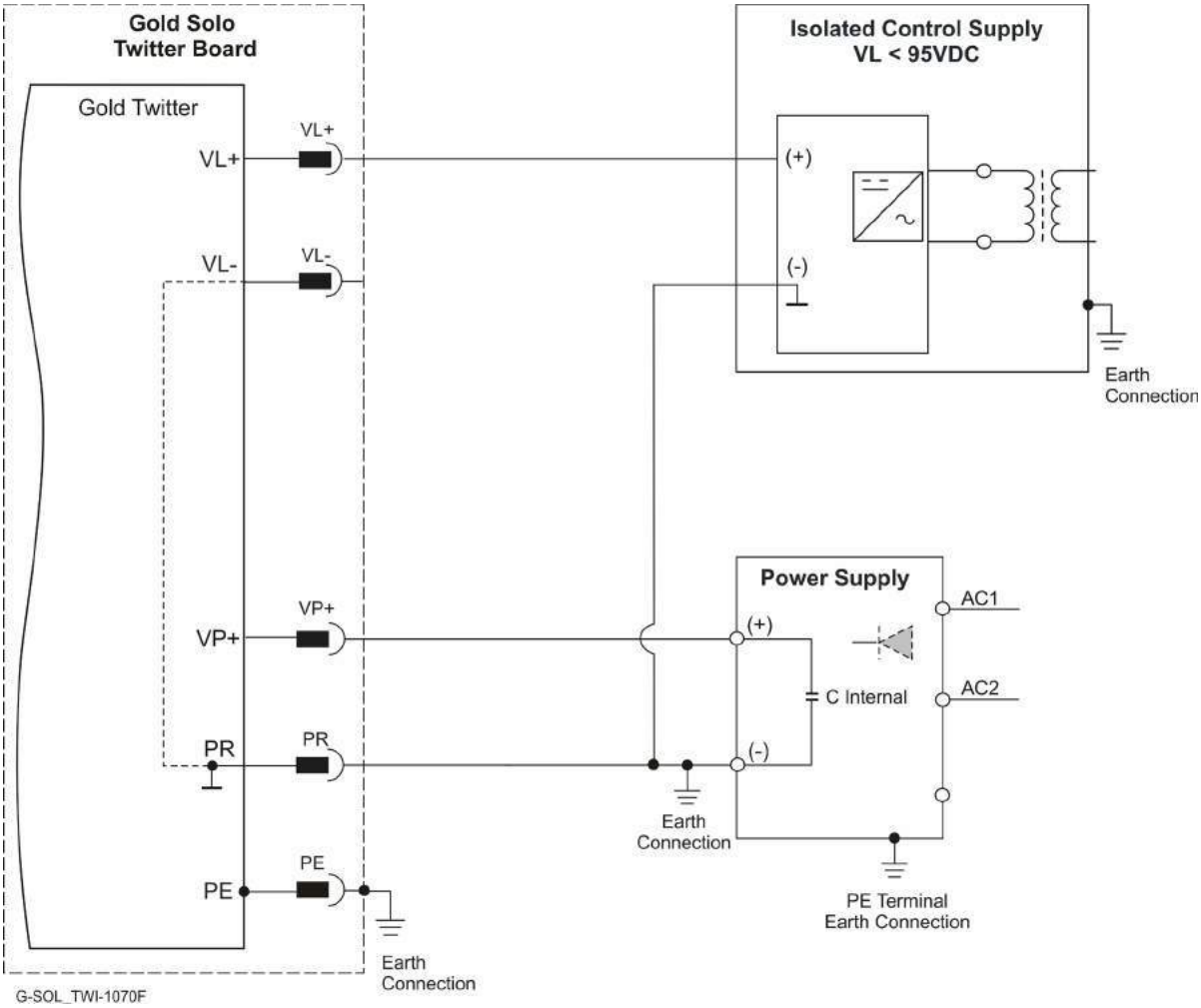


Figure 16: Separate VP and VL Power Supplies Connection Diagram –Highly Recommended

The (+) of the control power supply is connected to the VL+ terminal, while the (-) of the control power supply is connected directly to the (-) of the DC bus power supply. This connection avoids high current ground loops due to poor wiring (Figure 16).

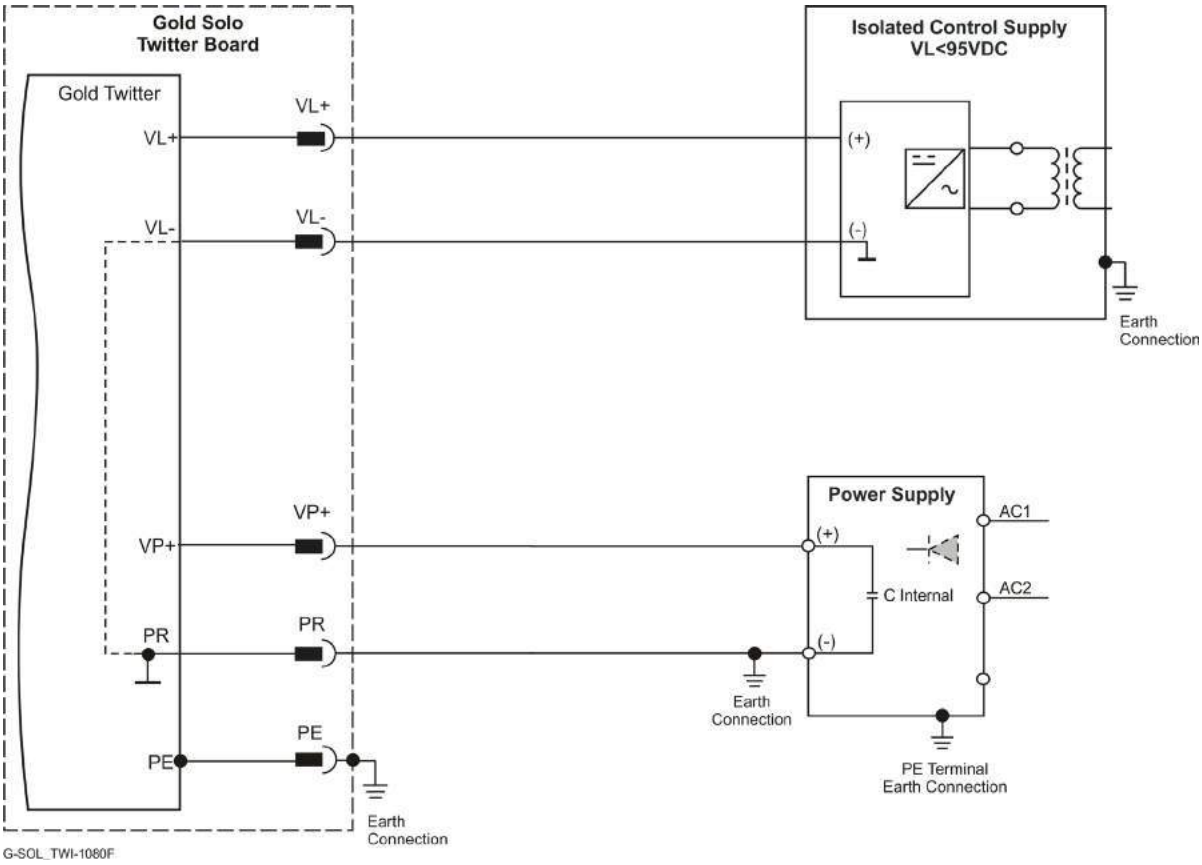


Figure 17: Separate VP and VL Power Supplies Connection Diagram - Alternative

The (-) of the control power supply is connected to the VL- of the Gold Solo Twitter (Figure 17).

8.1.5.2. Single Power Supply (VP+ < 95VDC)

Where a single power supply is used (VL+ connected to VP+), the absolute maximum VP+ and VL+ voltage must be < 95VDC, under all conditions, to prevent VL+ supply failure.

A single power supply can be used for the main and control power in the range of 11VDC to 95VDC.

The following figure describes a single connection of main power and control.

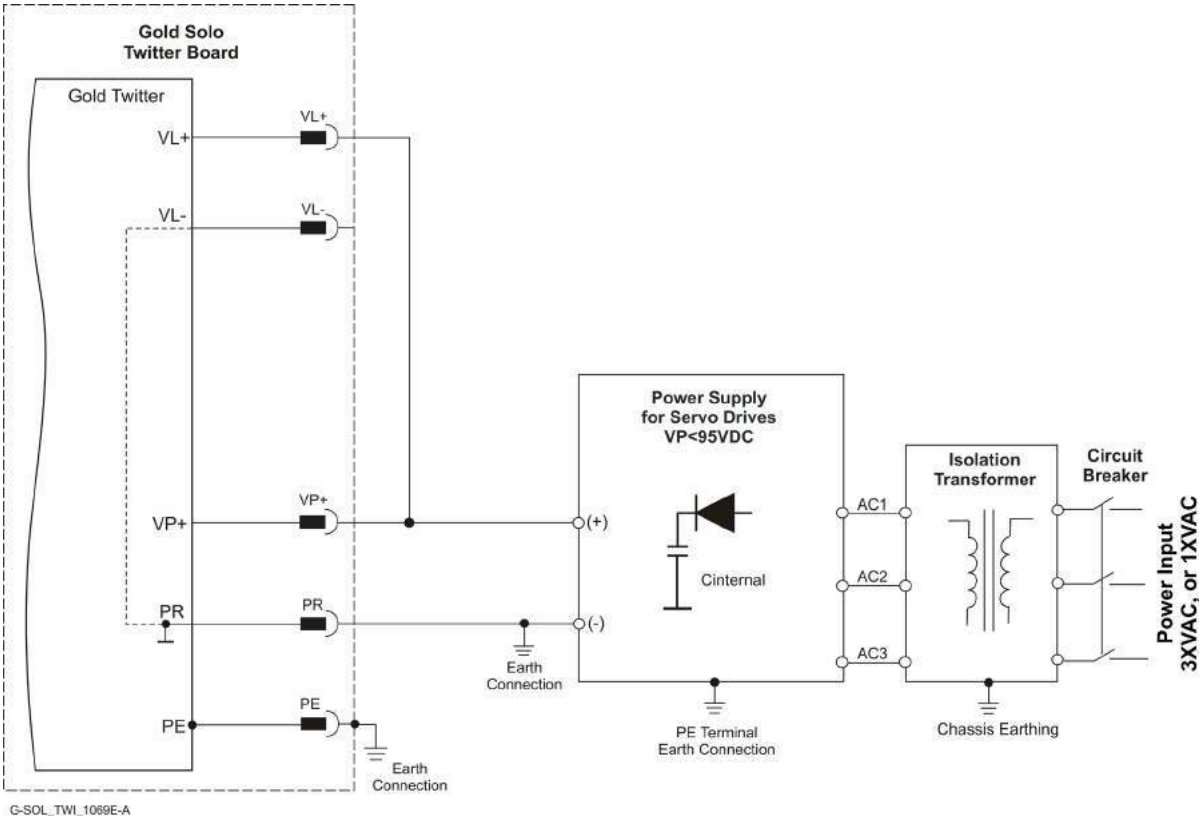
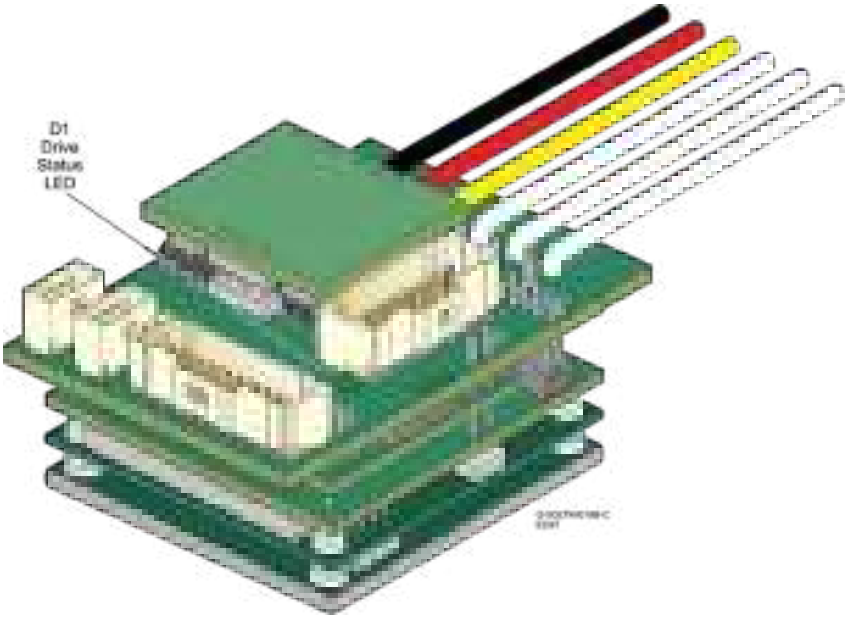


Figure 18: Single Power Supply (VP+ <95V) Connection Diagram

Note: **This option is available for power supply up to 95VDC.**

8.2. Drive Status Indicator

Figure 19 shows the position of the D1 red/green dual LED, which is used for immediate indication of the Initiation and Working states. For details refer to Chapter 7 Drive Status Indicator, in the MAN-G-Panel Mounted Drives Hardware manual.



Drive Status Indicator - EtherCAT

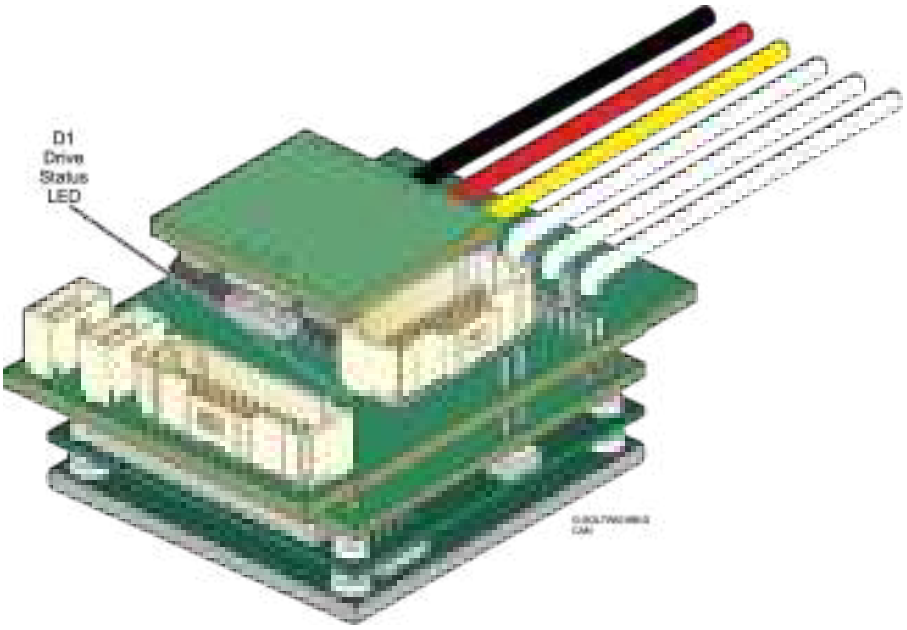
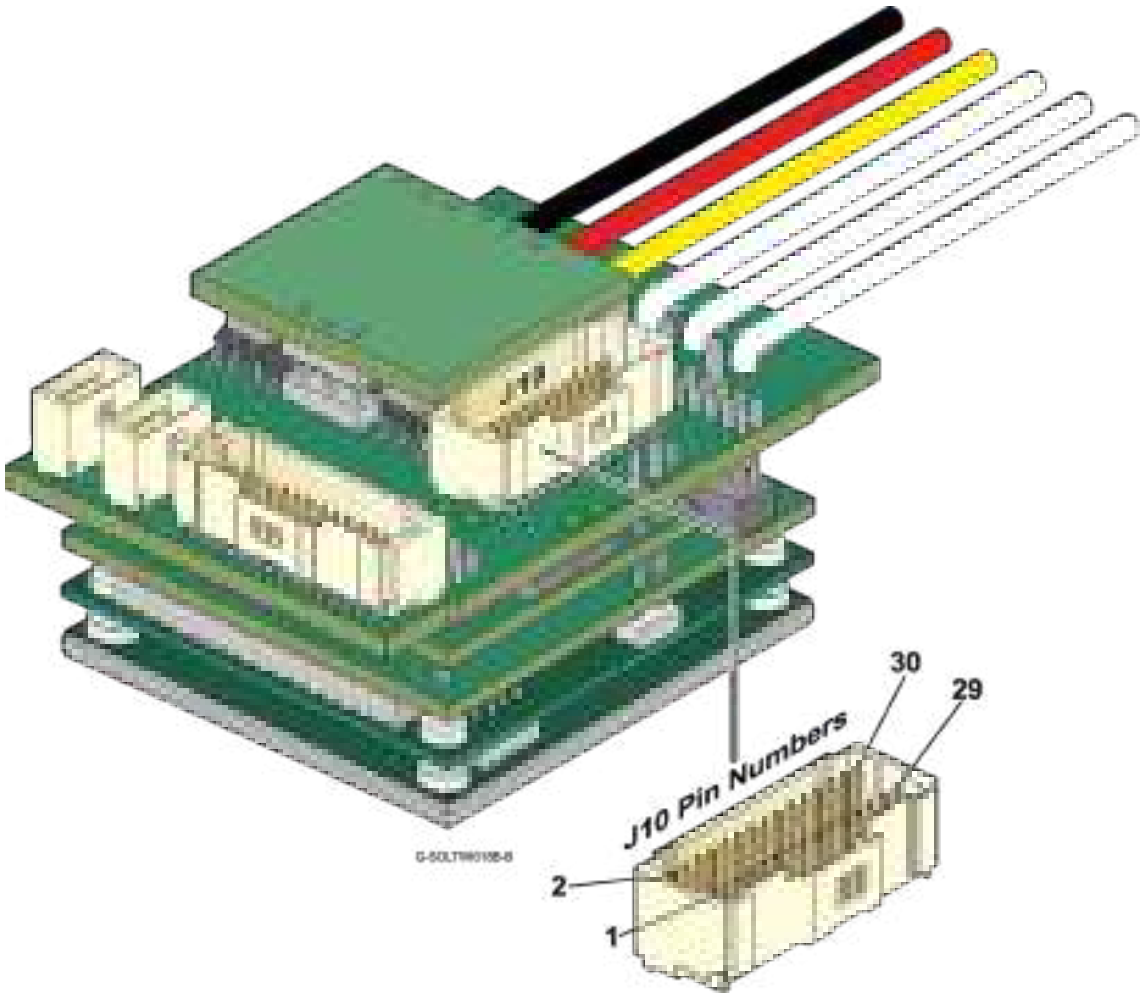


Figure 19: Drive Status Indicator - CAN

The red/green dual LED is used for immediate indication of the following states:

- **Initiation state:** In this state the LED indicates whether the drive is in the boot state (blinking red) or in the operational state (steady red).
- **Working state:** In this state the LED indicates whether the drive is in an amplifier failure state (red) or is ready to enable the motor (green).

8.3. J10 VL and Feedback Connector



J10 VL & Feedback Connector

Feedback A/B/C, Digital Halls – see Section 9.2 in the manual: MAN-G-Board Level Modules Hardware Manual.

The following table describes the J10 VL and Feedback connections to the 2 x 15 pins female connector.

Pin J10	Signal	Function
1	PortA_ENC_A+ / ABS_CLK+	Channel A+ / Abs encoder clock +
2	PortB_ENC_A-	Port B Channel A-
3	PortA_ENC_A- / ABS_CLK-	Channel A- / Abs encoder clock -
4	PortB_ENC_A+	Port B Channel A+
5	PortA_ENC_B+ / ABS_DATA+	Channel B+ / Abs encoder data +
6	PortB_ENC_B-	Port B Channel B-
7	PortA_ENC_B- / ABS_DATA-	Channel B- / Abs encoder data -

Pin J10	Signal	Function
8	PortB_ENC_B+	Port B Channel B+
9	PortA_ENC_INDEX+	Index+
10	PortB_ENC_INDEX-	Port B Index-
11	PortA_ENC_INDEX-	Index-
12	PortB_ENC_INDEX+	Port B Index+
13	HA	Hall sensor A
14	PortC_ENCO_A-	Buffered Channel A- output / Pulse- / PWM-
15	HB	Hall sensor B
16	PortC_ENCO_A+	Buffered Channel A+ output/Pulse+/PWM+
17	HC	Hall sensor C
18	PortC_ENCO_B-	Buffered Channel B- output / Dir-
19	+5V	Encoder +5V supply with a total allowable maximum consumption of 200mA using Pins 19 or 26.
20	PortC_ENCO_B+	Buffered Channel B+ output / Dir+
21	COMRET	Common return
22	PortC_ENCO_Index-	Buffered Channel INDEX- output
23	COMRET	Common return
24	PortC_ENCO_Index+	Buffered Channel INDEX+ output
25	COMRET	Common return
26	+5V	Encoder +5V supply with a total allowable maximum consumption of 200mA using Pins 19 or 26.
27	COMRET	Common return
28	COMRET	Common return
29	VL-	Control 24V supply return
30	VL+	Control 24V supply

Table 8: Connector J10 – VL & Feedback

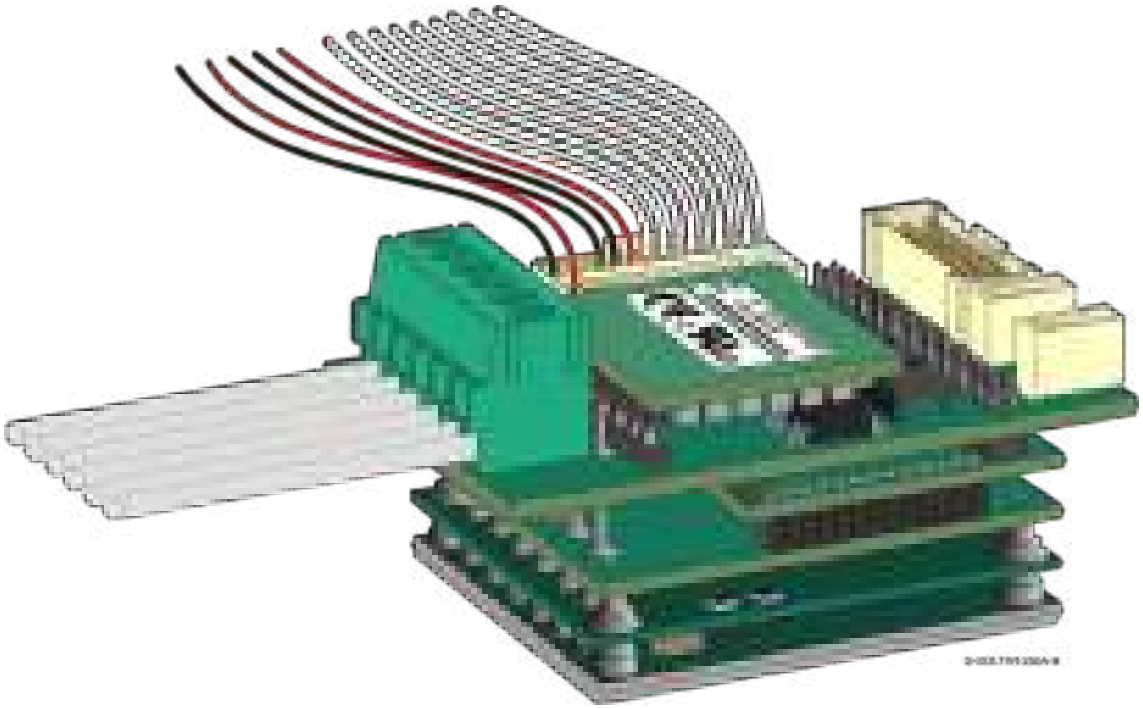


Figure 20: Connecting the Feedback Wires

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.1. Port A

Refer to section 10.3 in the MAN-G-Board Level Modules Hardware Manual for further details of the Port A connections.

8.3.1.1. Incremental Encoder

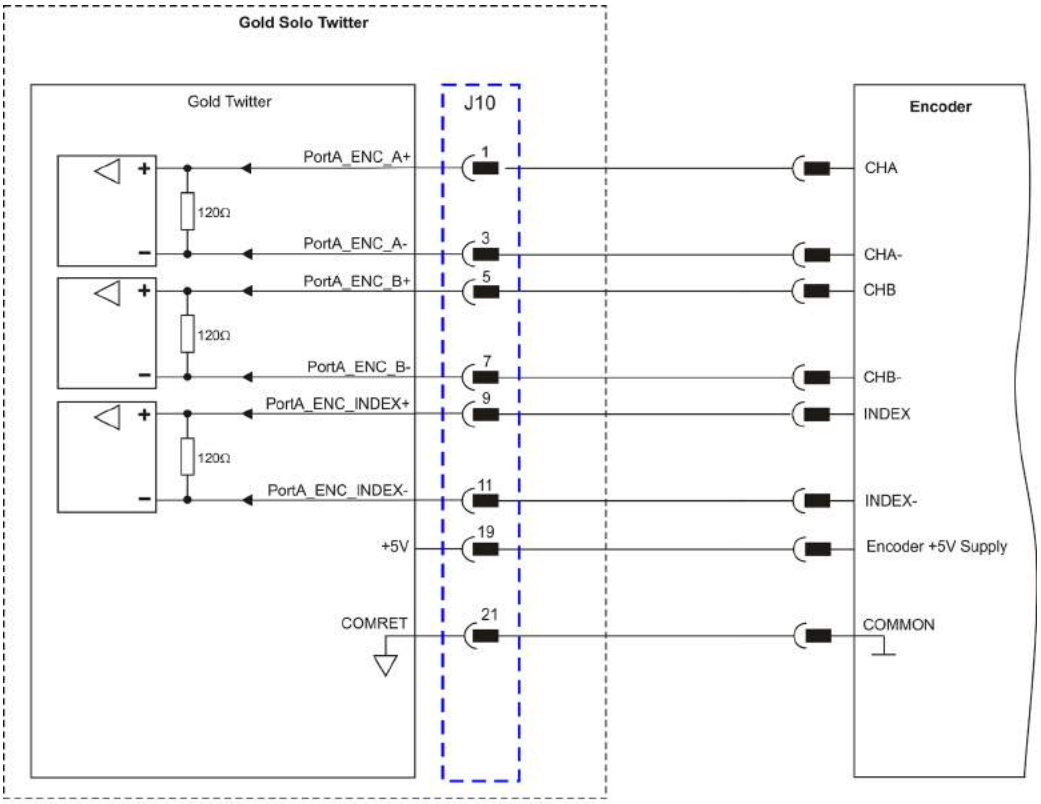


Figure 21: Port A Incremental Encoder Input – Recommended Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.1.2. Absolute Serial Encoder

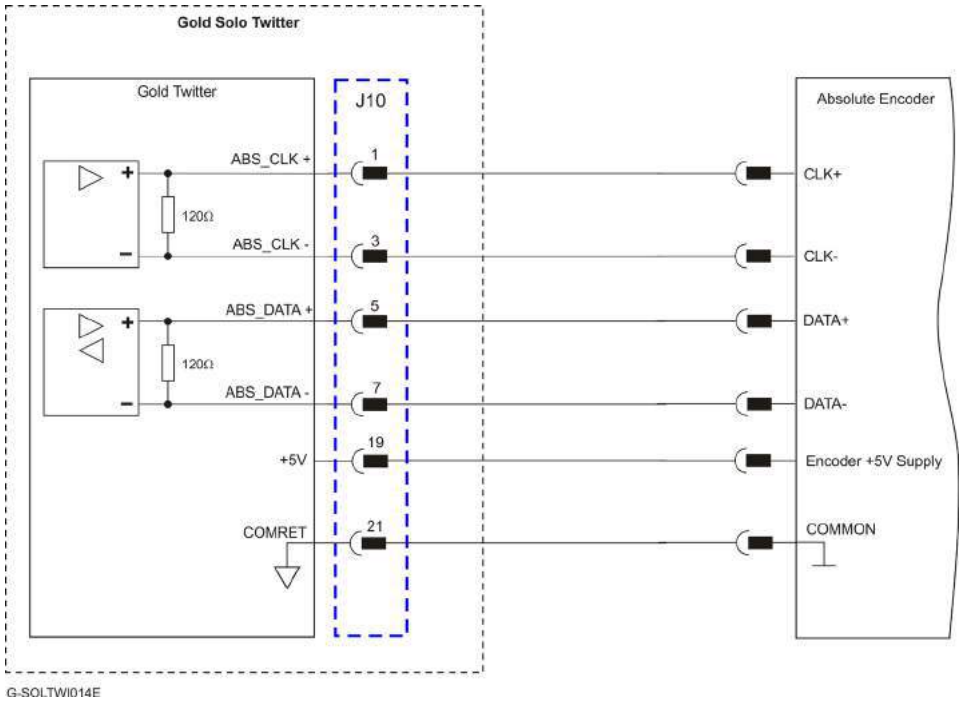


Figure 22: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data/Clock (e.g., Biss / SSI / EnDAT, etc.)

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

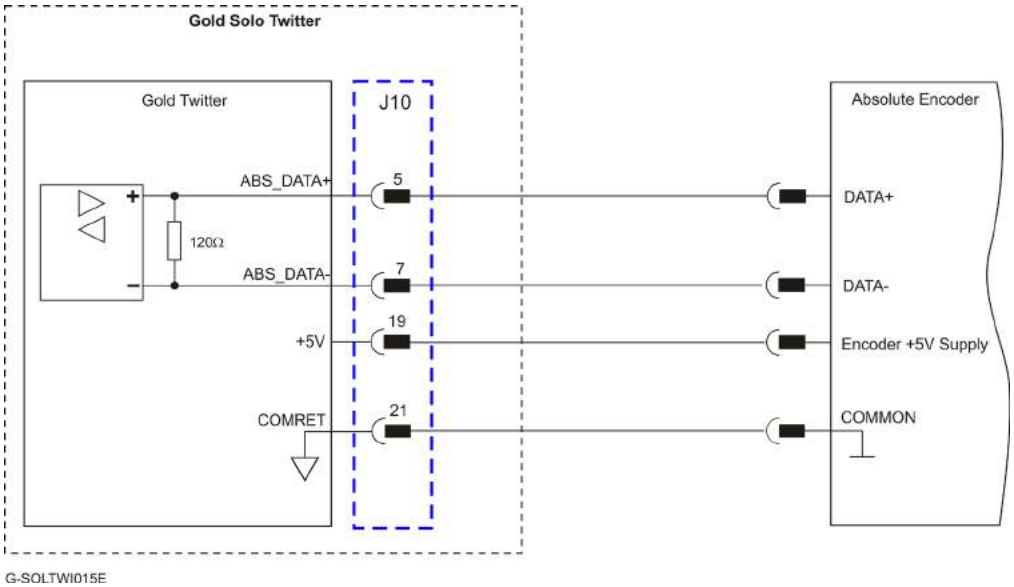


Figure 23: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / etc.)

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.1.3. Hiperface

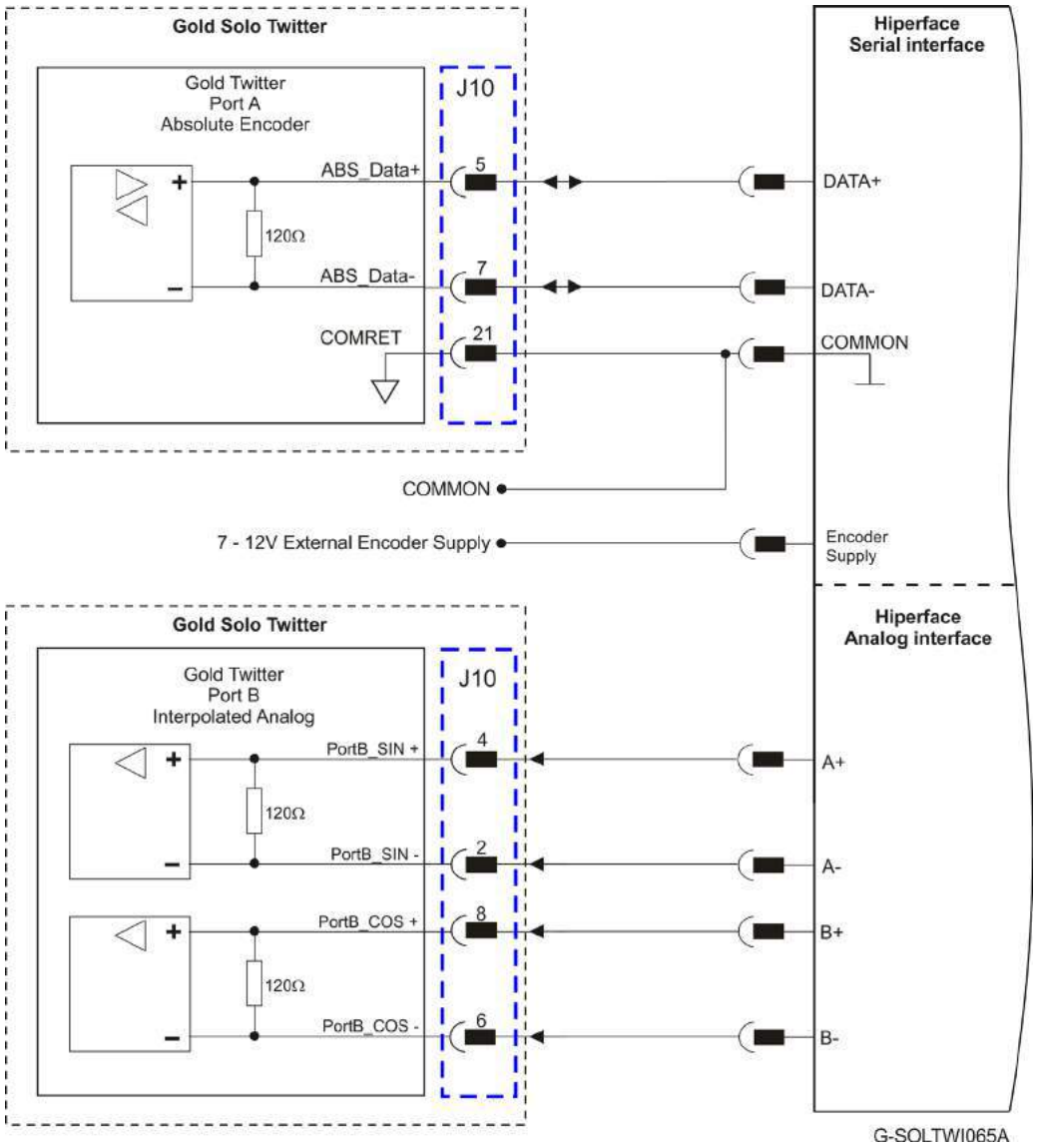


Figure 24: Absolute Serial Encoder – Recommended Connection Diagram for Stegmann Hiperface

Note: When the Hiperface protocol is used, the RS-232 connection is not available.

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.1.4. Hall Sensors

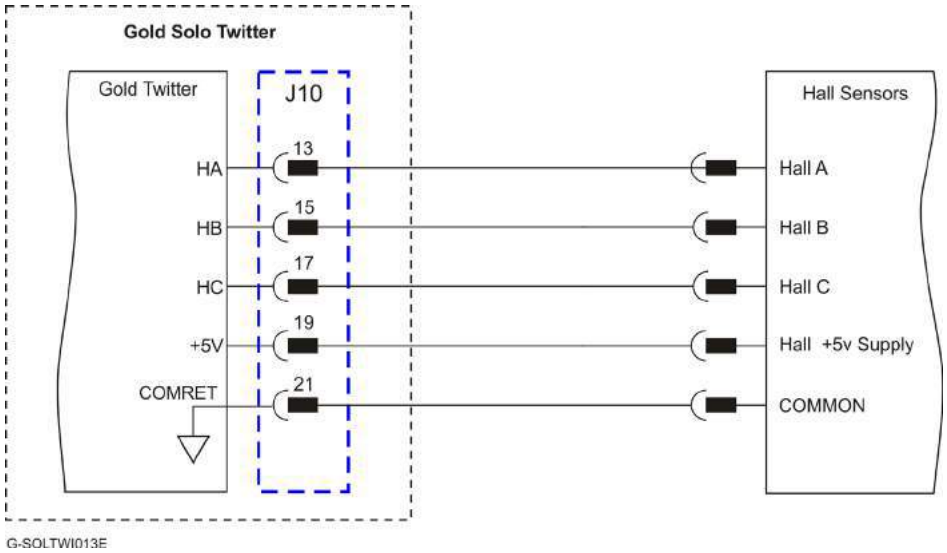


Figure 25: Hall Sensors Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.2. Port B

Refer to section 10.4 in the MAN-G-Board Level Modules Hardware Manual for further details of the Port B connections.

8.3.2.1. Incremental Encoder

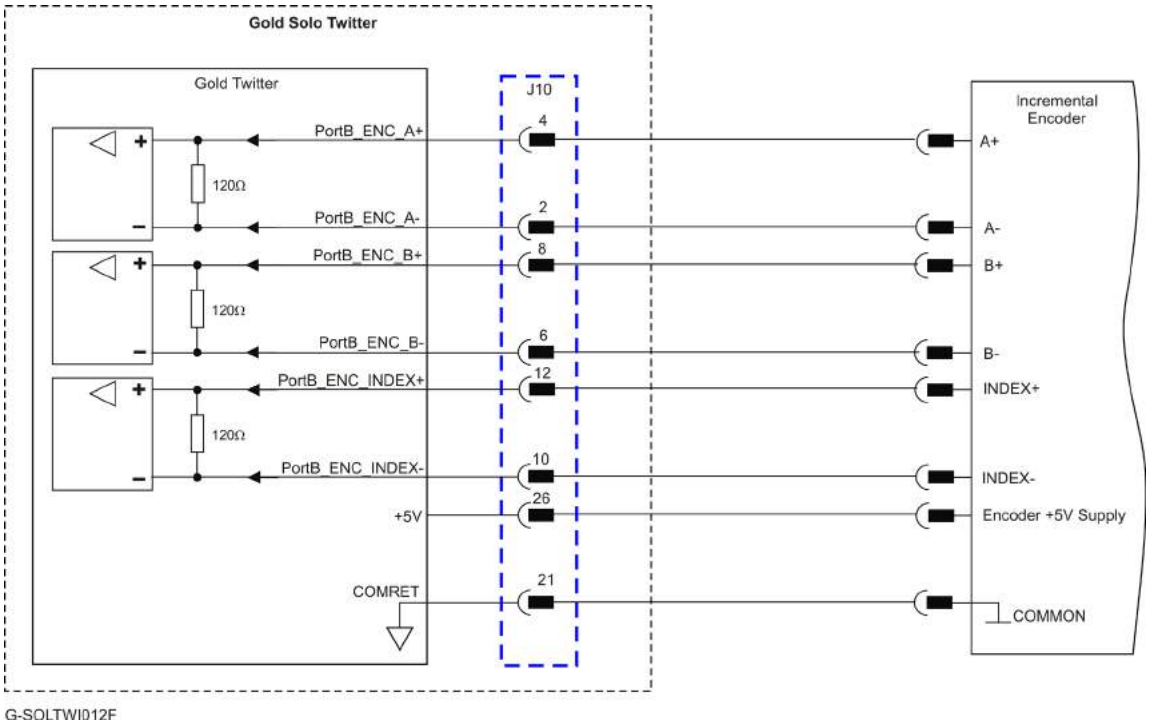


Figure 26: Port B Incremental Encoder Input – Recommended Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.2.2. Interpolated Analog Encoder

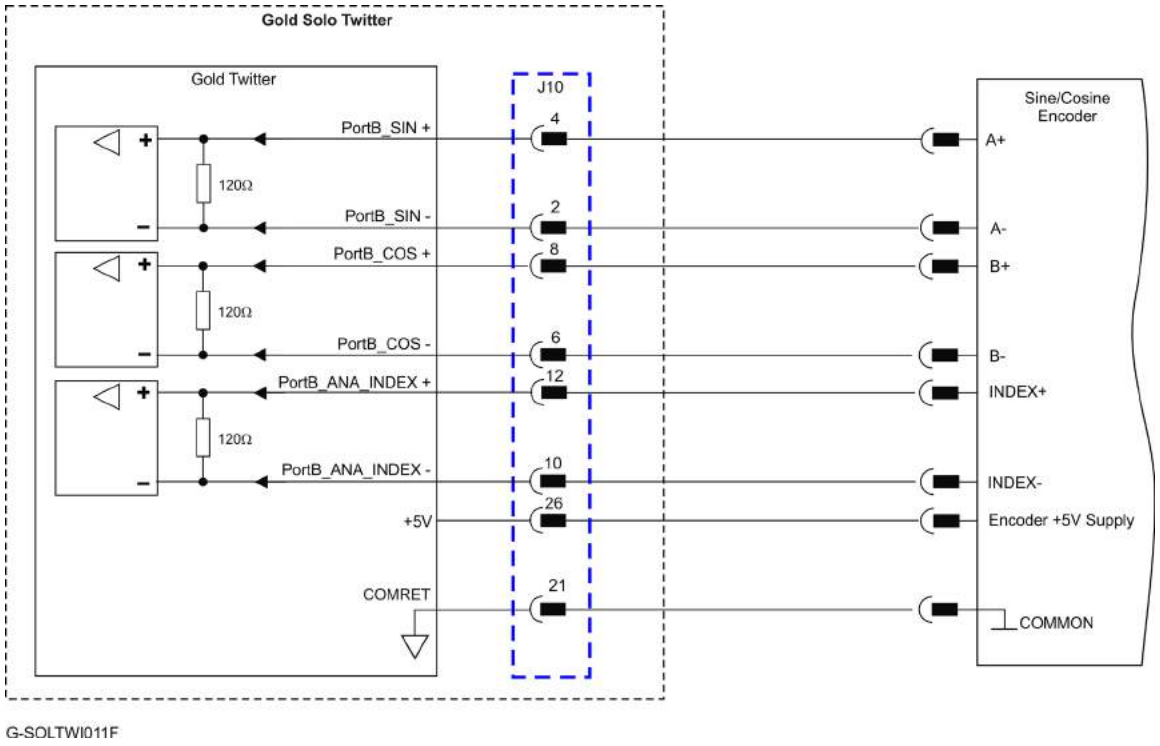


Figure 27: Port B - Interpolated Analog Encoder Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.2.3. Resolver

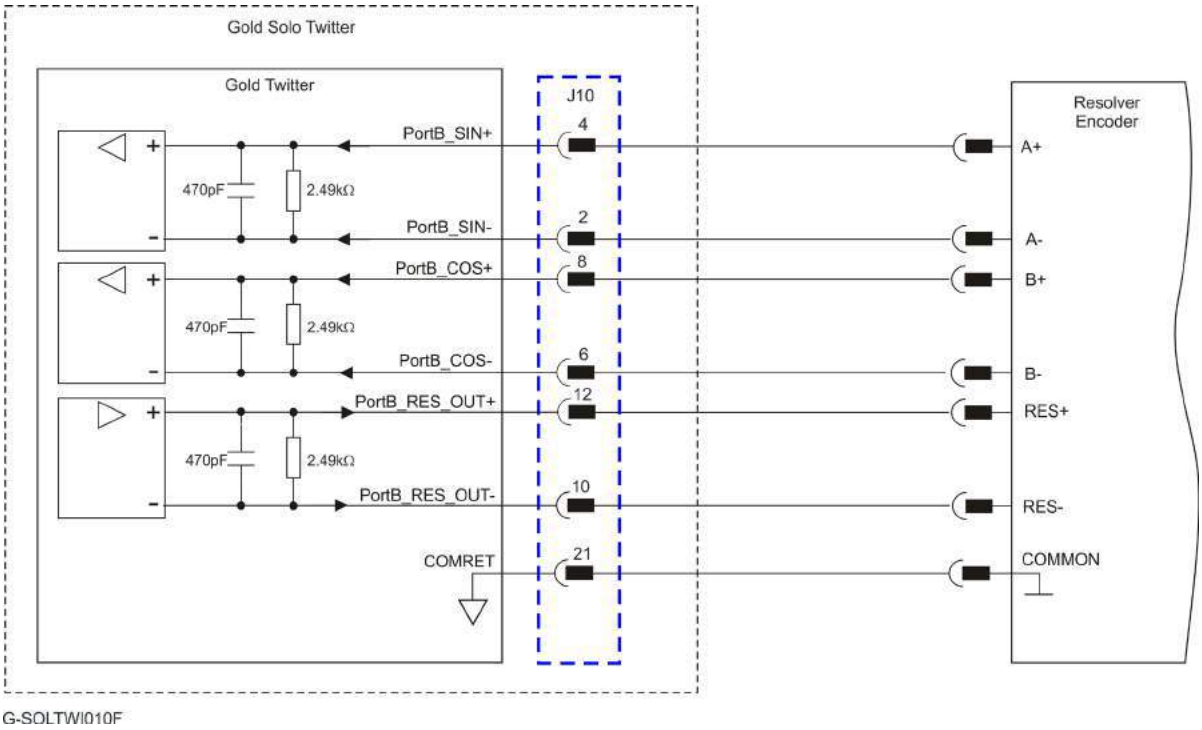


Figure 28: Port B – Resolver Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.3.3. Port C – Emulated Encoder Output (J10)

See Section 10.5 in the manual: MAN-G-Board Level Modules Hardware Manual for further details of Port C.

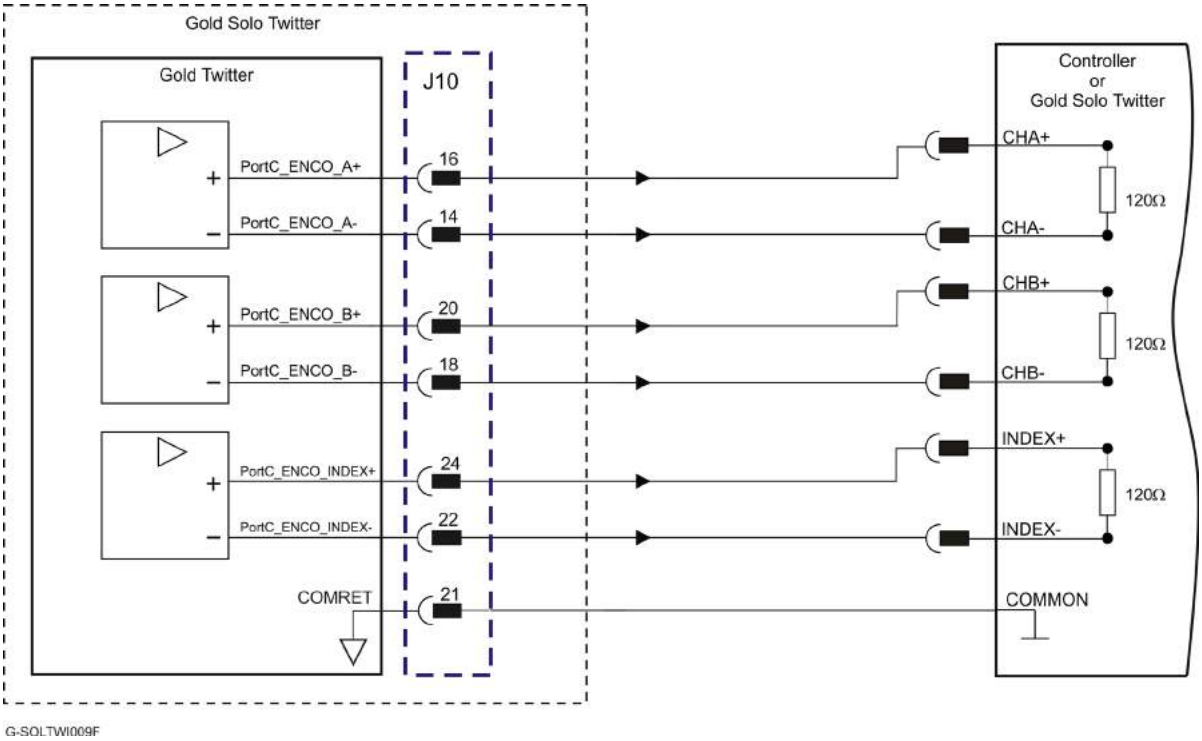
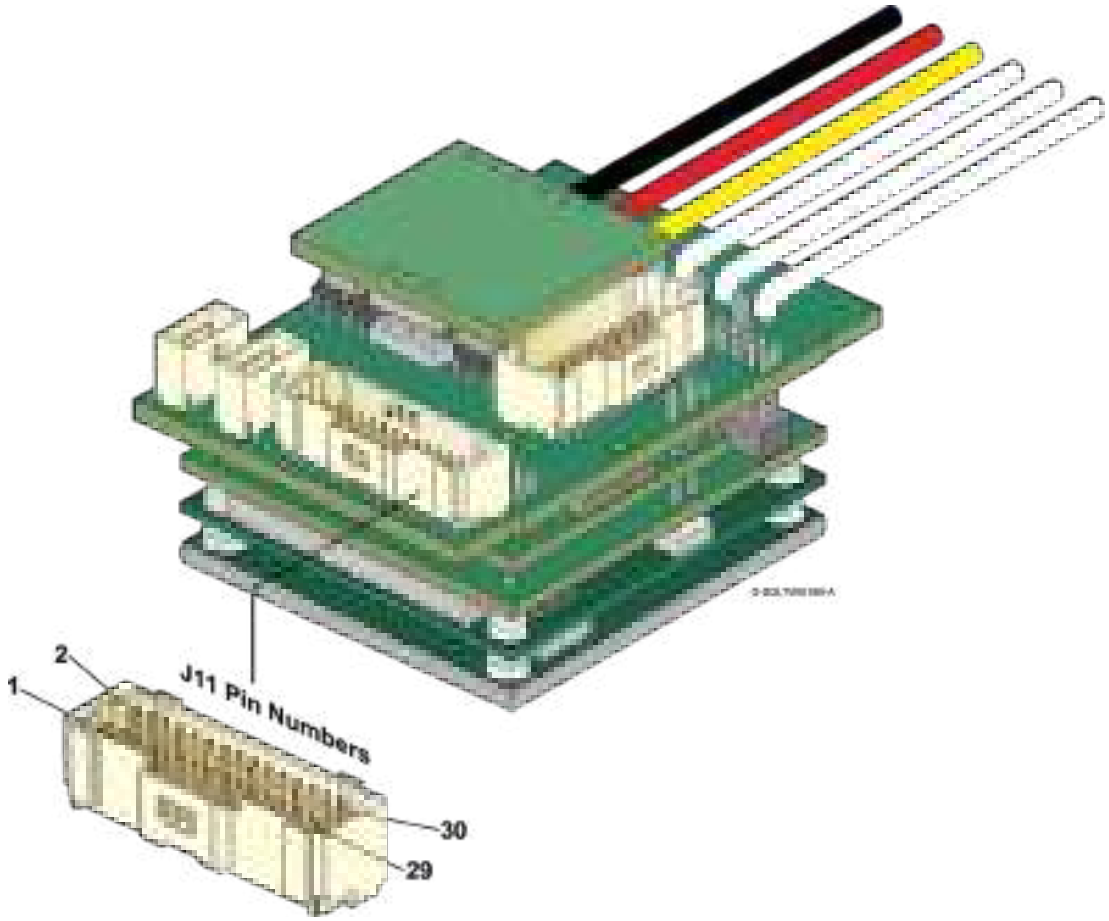


Figure 29: Emulated Encoder Differential Output – Recommended Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.4. J11 I/O and Communication Connector



J11 I/O and Communication Connector

Pin J11	Signal	Function
1	IN1	High speed programmable digital input 1 (opto isolated from control COMRET)
2	IN2	High speed programmable digital input 2 (opto isolated from control COMRET)
3	IN3	High speed programmable digital input 3 (opto isolated from control COMRET)
4	IN4	High speed programmable digital input 4 (opto isolated from control COMRET)
5	IN5	High speed programmable digital input 5 (opto isolated from control COMRET)
6	IN6	High speed programmable digital input 6 (opto isolated from control COMRET)
7	INRET	Din return

Pin J11	Signal	Function
8	INRET	Din return
9	OUT1	Programmable output 1 (opto isolated from control COMRET)
10	OUT2	Programmable output 2 (opto isolated from control COMRET)
11	OUT3	Programmable output 3 (opto isolated from control COMRET)
12	OUT4	Programmable output 4 (opto isolated from control COMRET)
13	OUTRET	D_{out} return
14	OUTRET	D_{out} return
15	STO1	STO 1 input opto isolated from control COMRET
16	STO2	STO 2 input opto isolated from control COMRET
17	STO_RET	STO signal return. The two digital STO inputs are optically isolated from the other parts of the drive, and share one return line.
18	STO_RET	STO signal return. The two digital STO inputs are optically isolated from the other parts of the drive, and share one return line.
19	COMRET	Common return
20	GPIO5 ANALOG IN	GPIO5 Analog input
21	ANALOG1+	Analog input 1
22	ANALOG1-	Analog input 1 complement
23	COMRET	Common return
24	COMRET	Common return
25	RS-232_TX	RS-232 Transmit
26	RS-232_RX	RS-232 Receive
27	USB_VBUS	USB VBUS detector (Only for EtherCAT version)
28	COMRET	Common return
29	USB D+	USB _P line (Only for EtherCAT version)
30	USB D-	USB _N line (Only for EtherCAT version)

Table 9: I/O, STO, Analog, RS-232, and USB Connector

STO (safety): For full details on STO, see Chapter 9 in the in the MAN-G-Board Level Modules Hardware manual for full details.

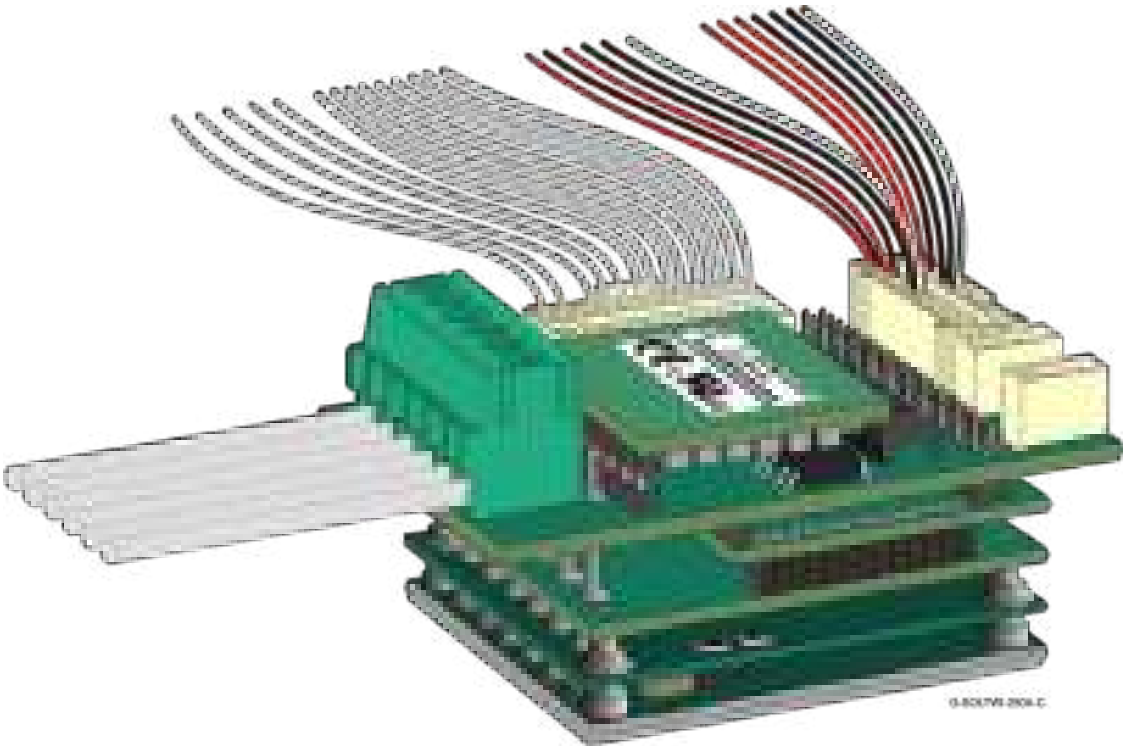


Figure 30: Connecting the USB, RS232, and Analog Input Wires

For USB, RS232, and Analog Input Wires

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

For Digital Inputs/Outputs, STO

Wires can be always used, no need for twisting, no need for shielding.

8.4.1. Digital Inputs

8.4.1.1. Source PLC Voltage Level Digital Input

Feature	Details
Standard	Isolated PLC source Conforming to IEC 61131-2
Input current	I_{in} = (Vin-7.4)/4.99 Kohm I_{in} = 920 uA @ Vin = 12 V I_{in} = 4.5 mA @ V_{in} = 30 V
High-level input voltage	12 V < Vin < 30 V
Low-level input voltage	0 V < Vin < 7 V
Minimum pulse width	>250 µsec
Execution time (all inputs): the time from application of voltage on input until execution is complete	0 < T < 250 µsec
High-speed inputs – 1–6 minimum pulse width, in high-speed mode	T > 5 µsec if the input functionality is set to latch/capture (index/strobe). **Notes:** • Home mode is high-speed mode and can be used for fast capture and precise homing. • Highest speed is achieved when turning on optocouplers.
Capture with differential input Port A, Port B Index	T > 0.1 µsec if the differential input functionality is set to touch probe/capture (index/strobe).

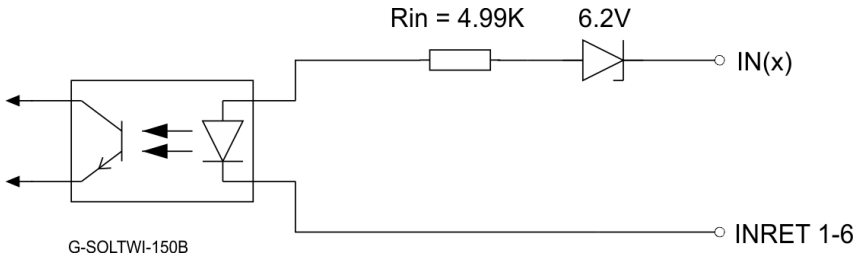


Figure 31: Digital Input PLC Source Schematic

The following are the connection diagram of Digital inputs:

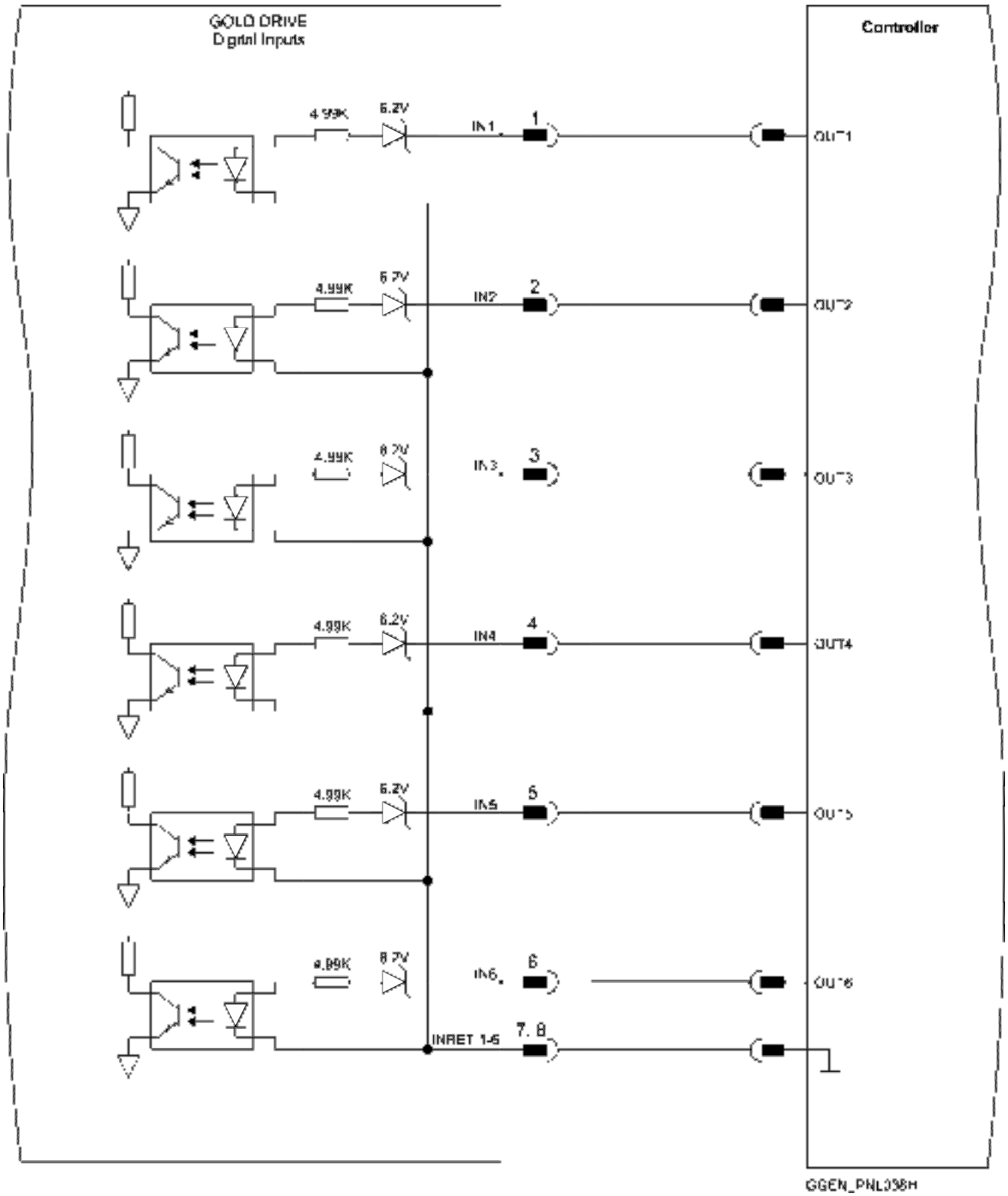


Figure 32: Digital Input Connection Diagram Example – Source PLC Option

8.4.1.2. Sink PLC Voltage Level Digital Input

Feature	Details
Type of input	Isolated PLC Sink
Input current	$I_{in}=(V_{in}-7.4)/4.99Kohm$ I_{in} = 920 uA @ V_{in} = 12 V I_{in} = 4.5 mA @ V_{in} = 30 V
High-level input voltage	12 V < V_{in} < 30 V
Low-level input voltage	0 V < V_{in} < 7 V
Minimum pulse width	>250 µsec
Execution time (all inputs): the time from application of voltage on input until execution is complete	0 < T < 250 µsec
High-speed inputs – 1–6 minimum pulse width, in high-speed mode	T > 5 µsec if the input functionality is set to latch/capture (index/strobe). **Notes:** • Home mode is high-speed mode and can be used for fast capture and precise homing. • Highest speed is achieved when turning on optocouplers.
Capture with differential input Port A, Port B Index	T > 0.1 µsec if the differential input functionality is set to touch probe/capture (index/strobe).

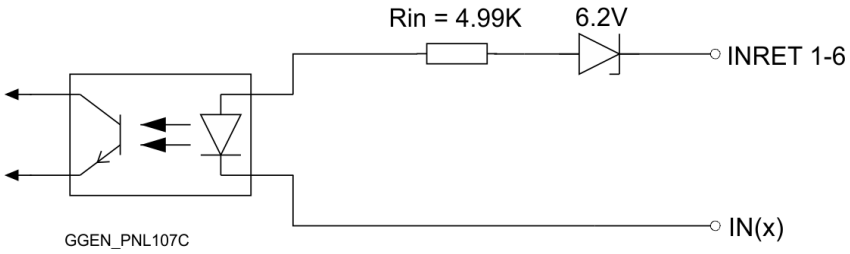


Figure 33: Digital Input Sink PLC Schematic

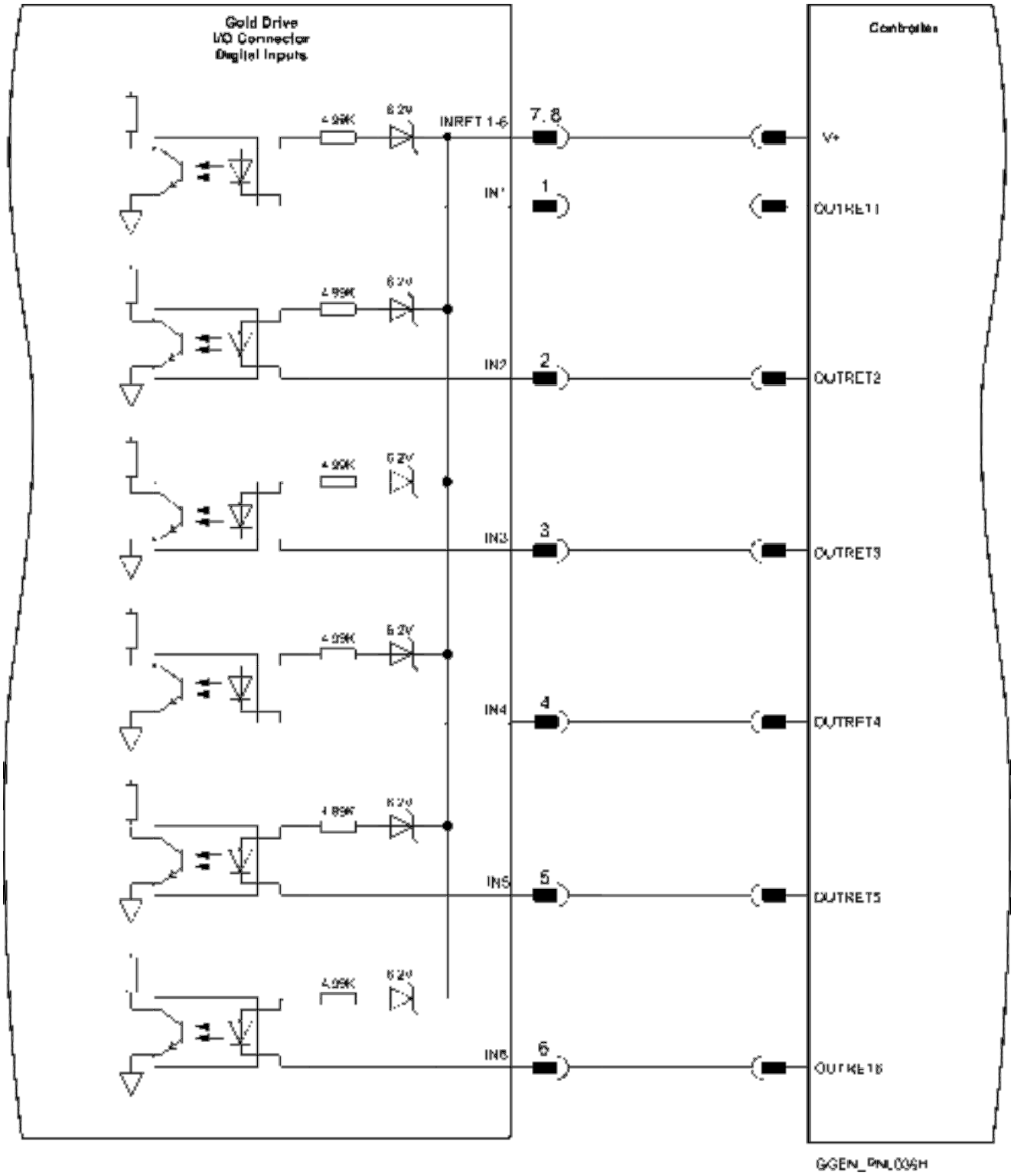


Figure 34: Digital Input Sink Mode Example – PLC voltage level Connection Diagram

8.4.1.3. Source 5V Logic Level Digital Input

Feature	Details
Type of input	Optically isolated
Input current for all inputs	I_{in} = 3.8 mA @ V_{in} = 5 V
High-level input voltage	3.0 V < V_{in} < 10 V, 5 V typical
Low-level input voltage	0 V < V_{in} < 0.8 V
Minimum pulse width	> 250 µsec
Execution time (all inputs): the time from application of voltage on input until execution is complete	0 < T < 250 µsec
High-speed inputs – 1–6 minimum pulse width, in high-speed mode	T > 5 µsec if the input functionality is set to latch/capture (index/strobe). **Notes:** Home mode is high-speed mode and can be used for fast capture and precise homing. Highest speed is achieved when turning on optocouplers.

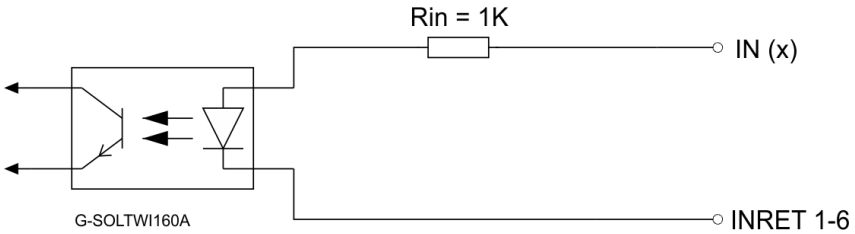


Figure 35: Digital Input 5V Logic Schematic

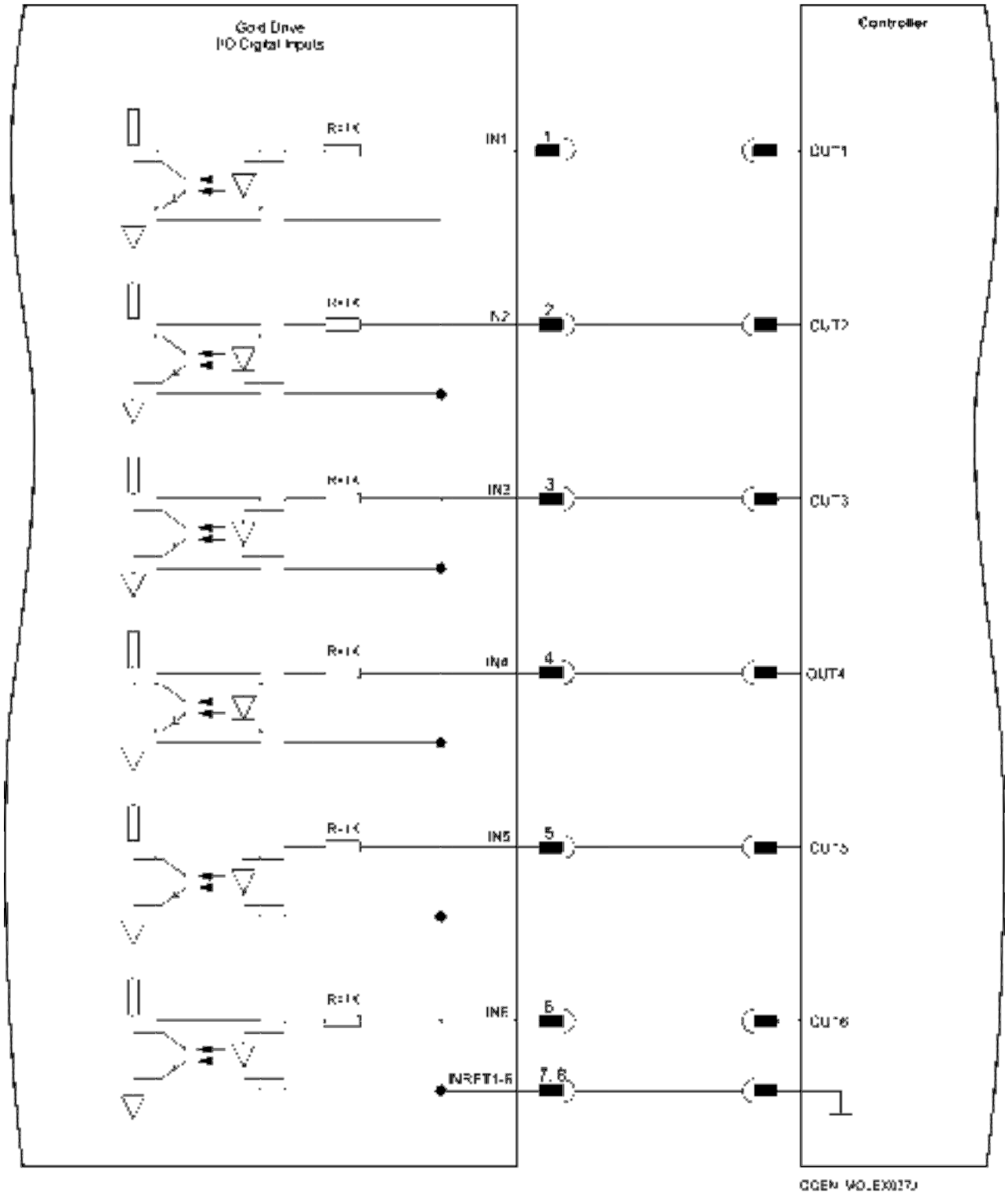


Figure 36: Digital Input Source 5V Logic Mode Connection Diagram

8.4.2. Digital Outputs

8.4.2.1. Source PLC Voltage Level Digital Output

Feature	Details
Type of output	Optically isolated PLC source
Supply output (VDD)	12V to 30V (typically 24V)
Max. output current I_{out} (max) (V_{out} = High)	I_{out} (max) ≤ 30 mA
Collector Emitter saturation voltage	1V
T_{on} (Time from low to high) If V_{dd}= 24V	< 15usec
T_{off} (Time from high to Low)	< 250usec
R_L	The external R_L must be selected to limit output current to no more than 30 mA. $$R_L = \frac{VDD-1}{I_{out}\,(\max)}$$
Executable time	0 < T < 250 µsec

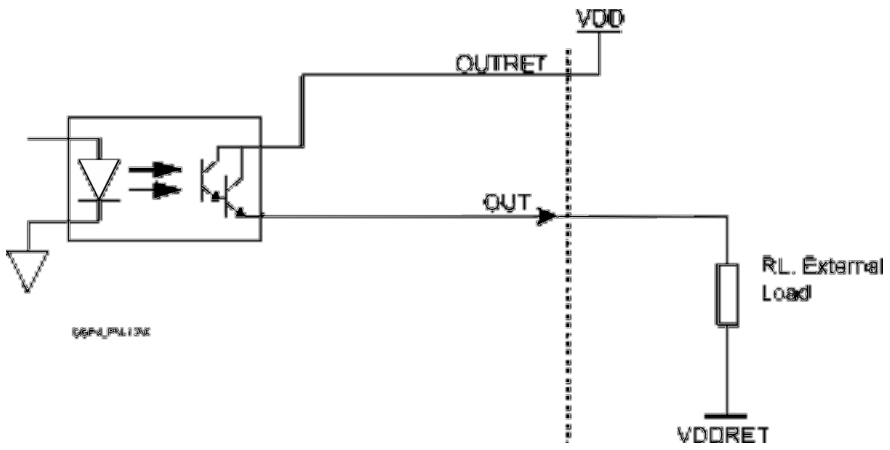


Figure 37: Digital Photodarlington Output Schematic – Source Mode PLC Level

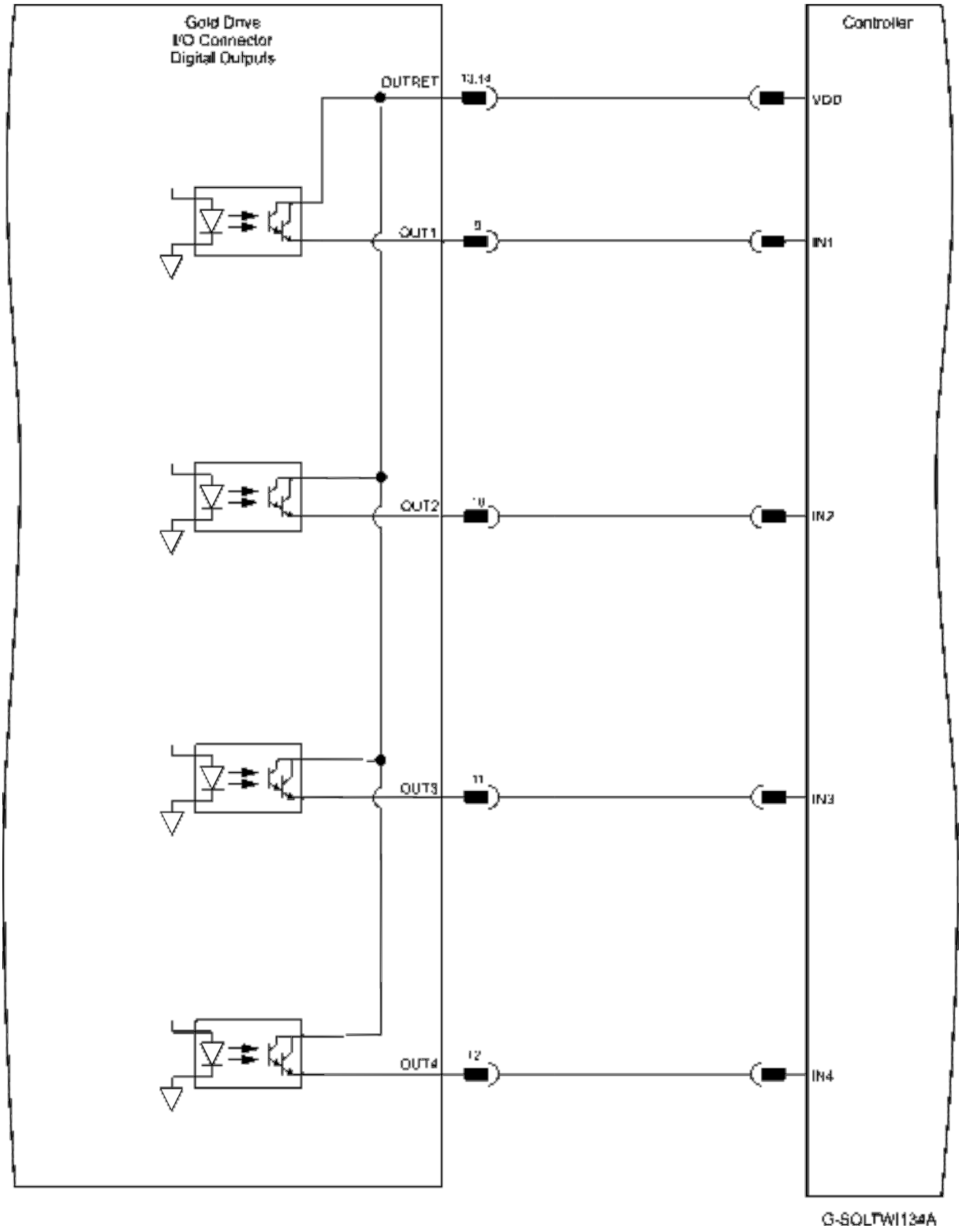


Figure 38: Digital Output Connection Diagram Example – Source PLC Option

8.4.2.2. Sink PLC Voltage Level Digital Output

Feature	Details
Type of output	Optically isolated PLC Sink
Supply output (VDD)	12V to 30V (Typically 24V)
Max. output current I_{out} (max) (V_{out} = Low)	I_{out} (max) ≤ 30 mA
Collector Emitter saturation voltage	1V
T_{on} (Time from low to high) If V_{dd}= 24V	< 15usec
T_{off} (Time from high to Low)	< 300usec
R_L	The external R_L must be selected to limit output current to no more than 30 mA. $$R_L = \frac{VDD-1}{I_{out}\,(\max)}$$
Executable time	0 < T < 250 µsec

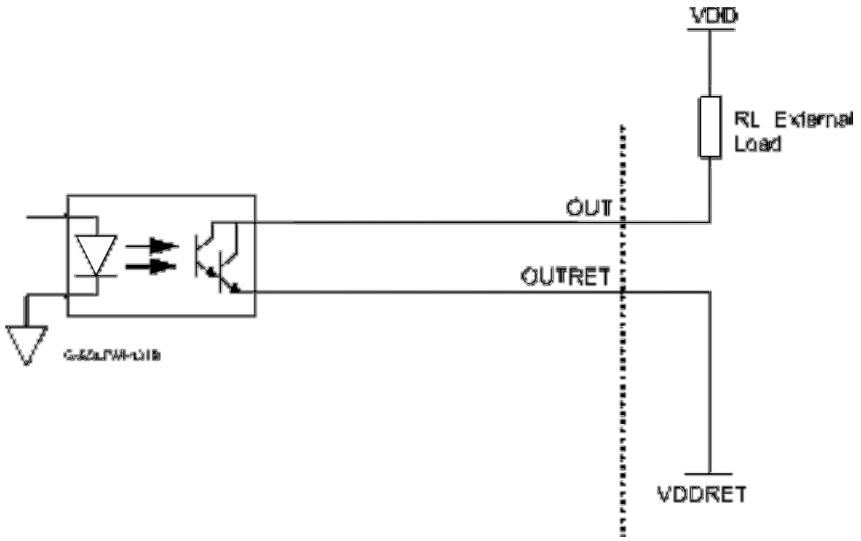


Figure 39: Digital Photodarlington Output Schematic for Sink – PLC level

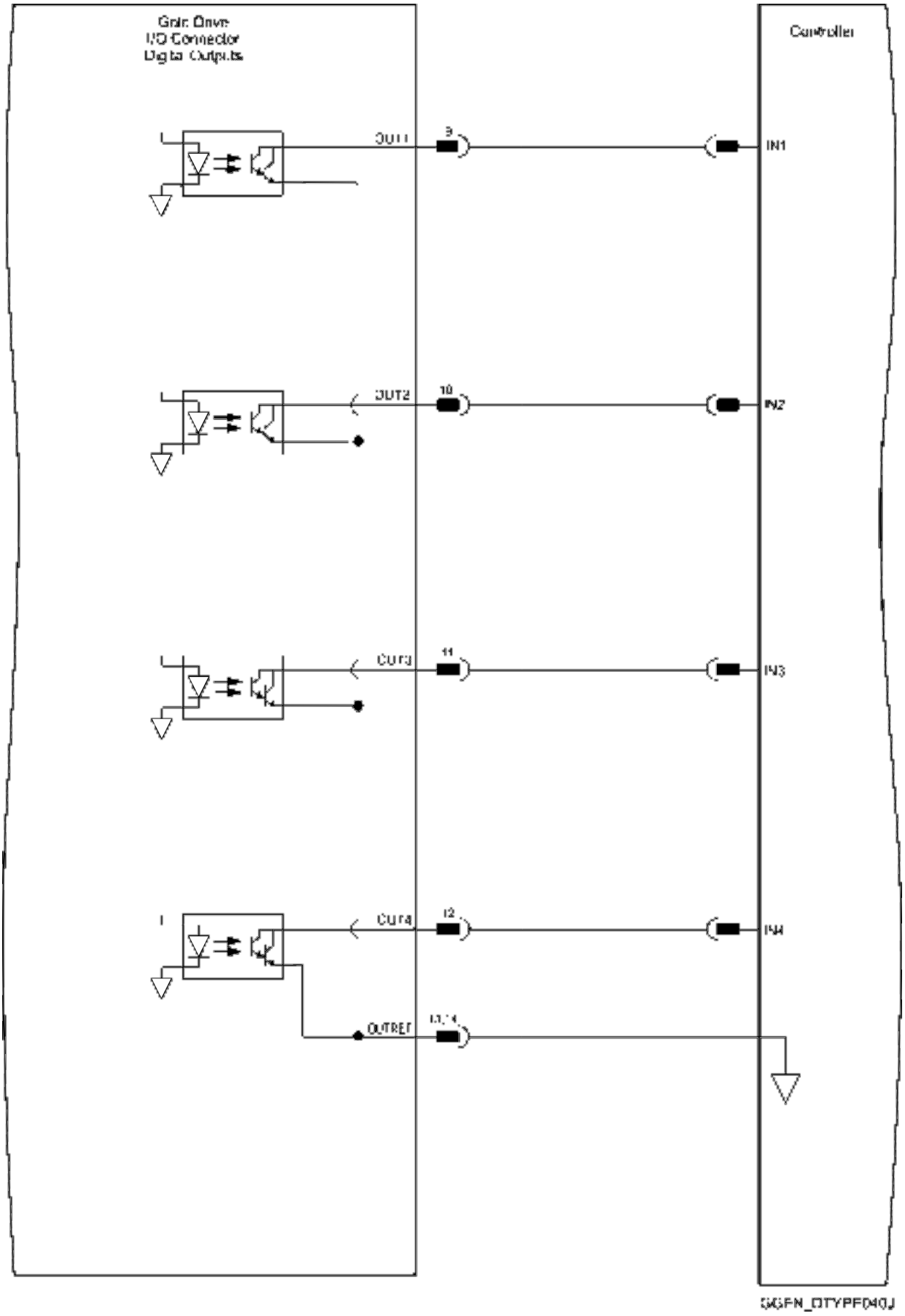


Figure 40: Digital Output Connection Diagram Example – Sink PLC Option

8.4.2.3. Digital Outputs Source 5V Logic Mode

Feature	Details
Type of output	Optically isolated 5V Logic source
Supply output (VDD)	< 30 V (Typically 5 V)
Max. output current I_{out} (max) (V_{out} = High)	I_{out} (max) ≤ 30 mA
Collector Emitter saturation voltage	1V
T_{on} (Time from low to high) If V_{dd}= 5V	< 10usec
T_{off} (Time from high to Low)	< 100usec
R_L	The external R_L must be selected to limit output current to no more than 30 mA. $$R_L = \frac{VDD-1}{I_{out}\,(\max)}$$
Executable time	0 < T < 250 µsec

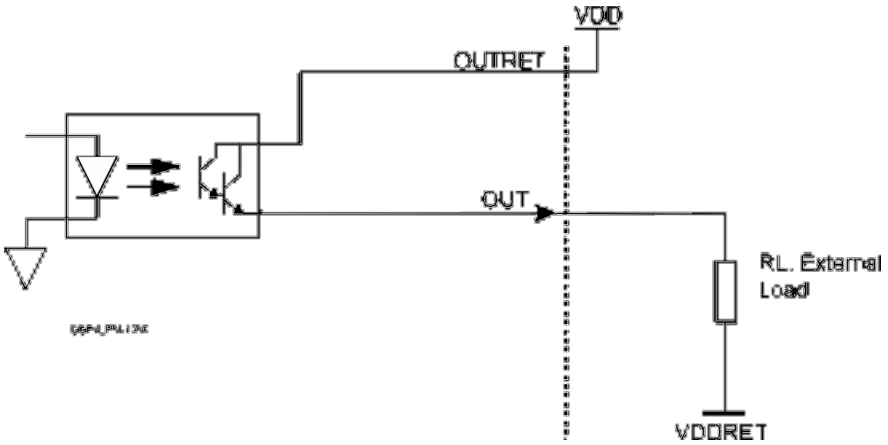


Figure 41: Digital Photodarlington Output Schematic – Source Mode 5V Logic Level

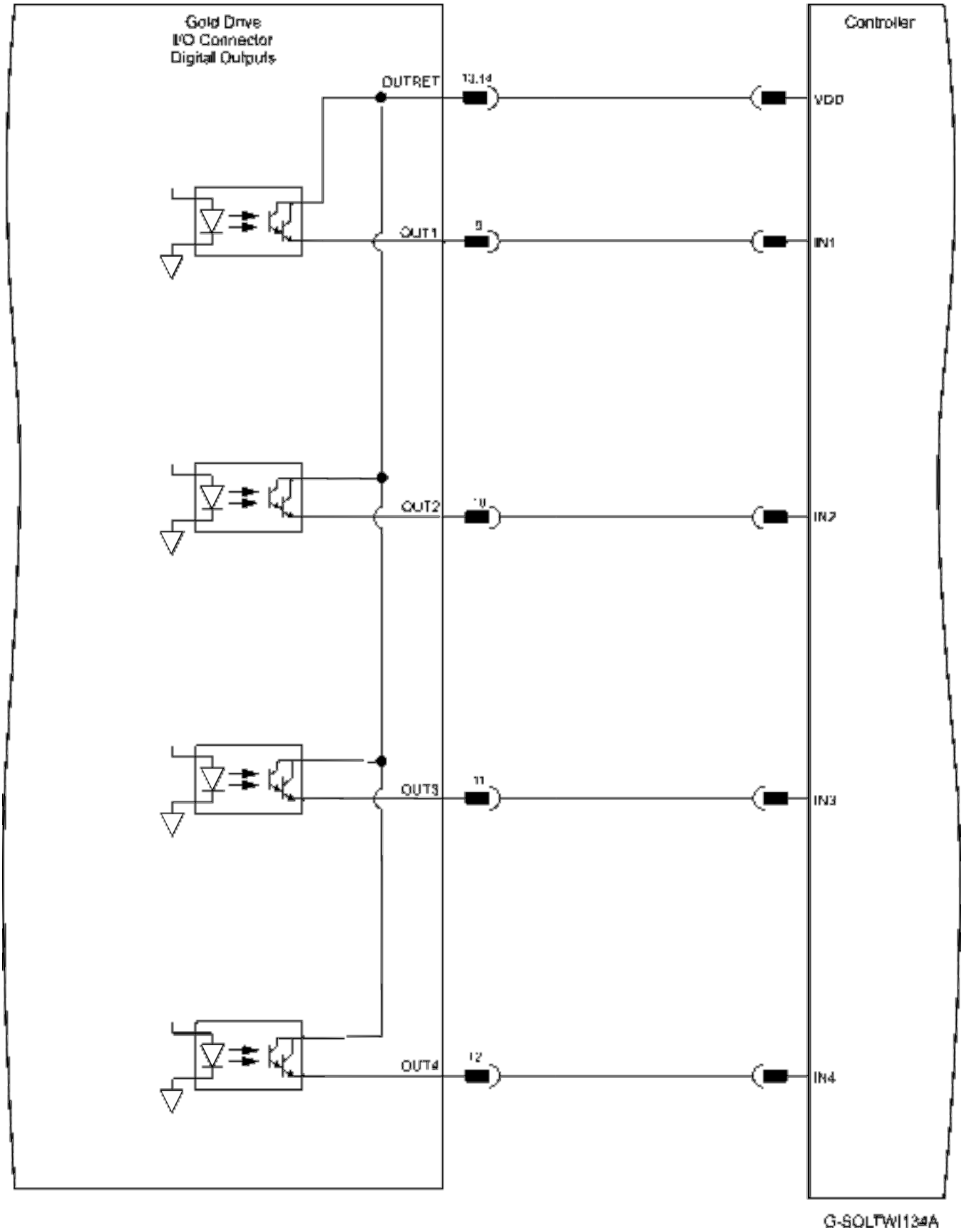


Figure 42: Digital Output Connection Diagram Example – Source 5V Logic Option

8.4.3. STO (Safe Torque Off)

For full details on STO, see Chapter 9 in the MAN-G-Board Level Modules Hardware manual.

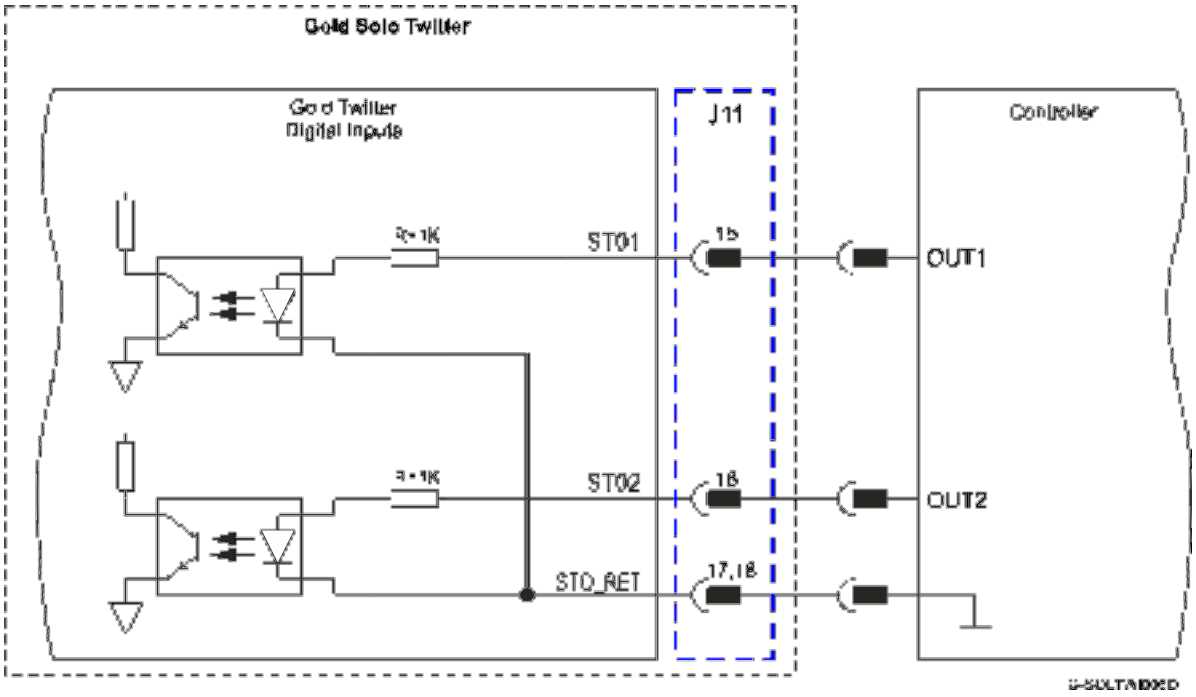


Figure 43: STO Input Connection – 5V Logic

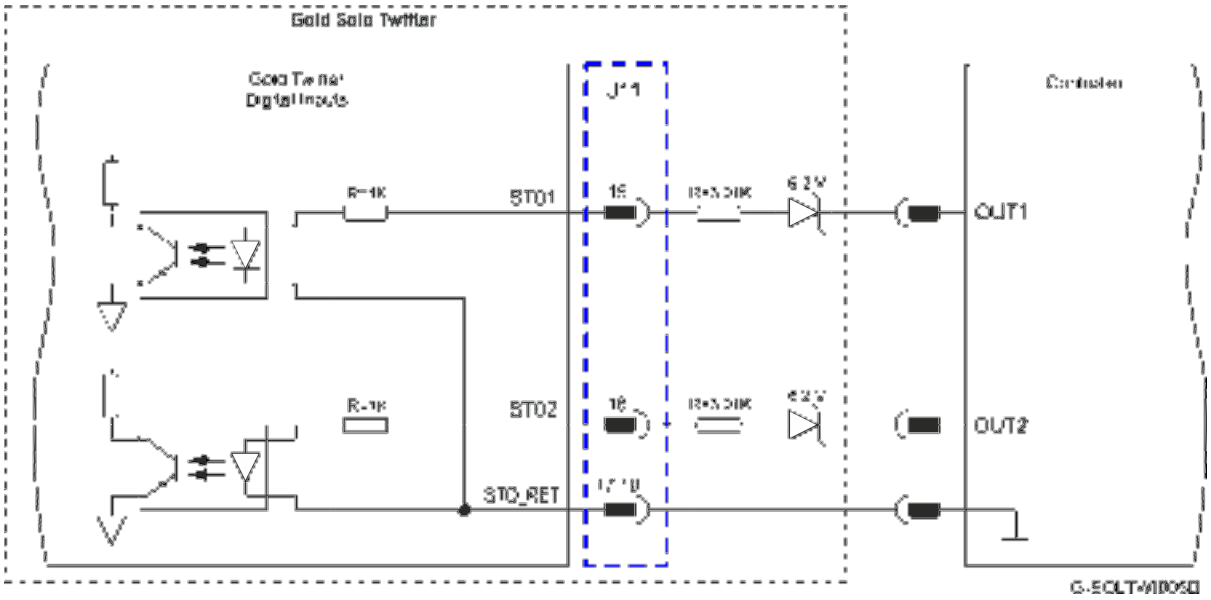


Figure 44: STO Input Connection – PLC (24V Logic)

8.4.4. Analog Input

For full details on Analog Inputs, see section 11.3 in the MAN-G-Board Level Modules Hardware manual.

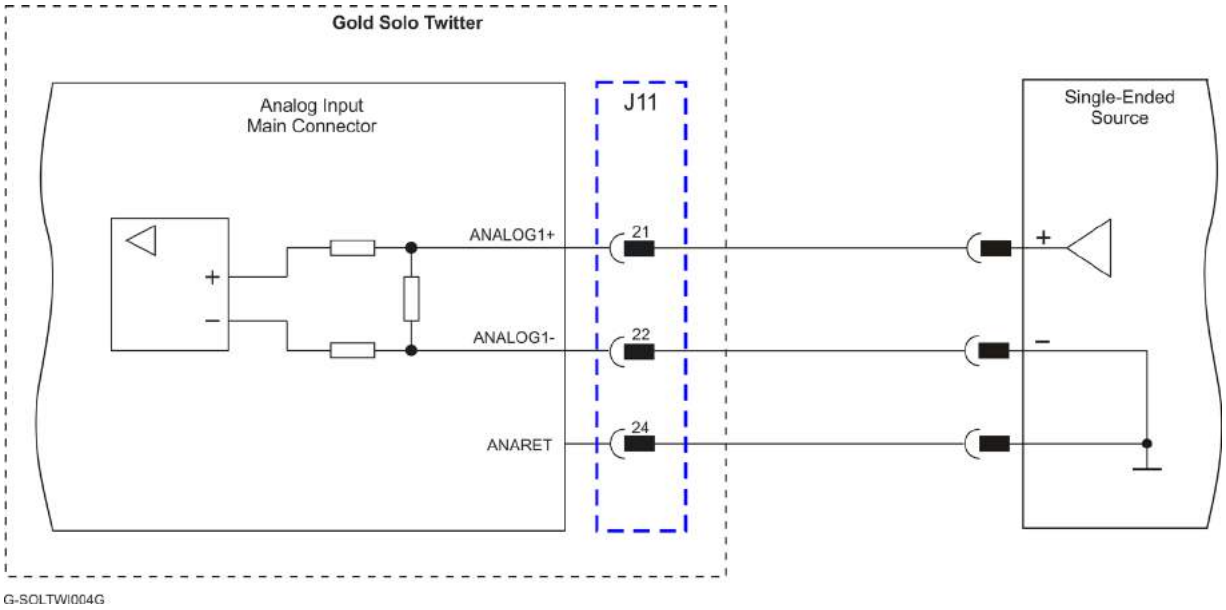


Figure 45: Analog Input

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.4.5. Standard RS-232

Figure 46 describes the Standard RS-232 connection diagram.

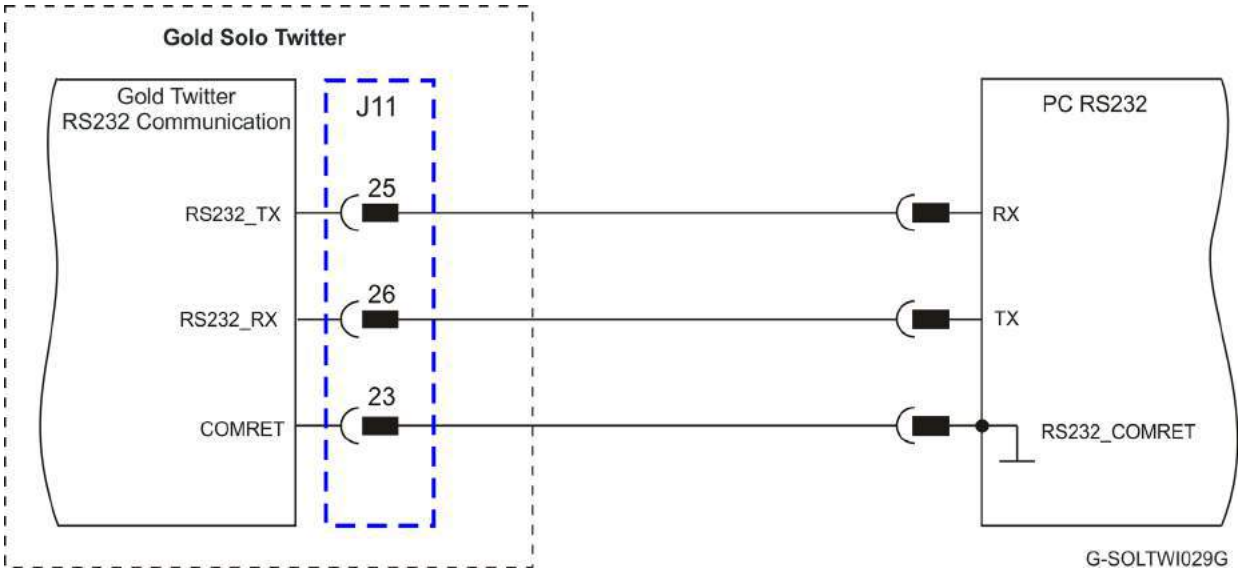


Figure 46: Standard RS-232 Connection Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.4.6. USB 2.0 Communication (Only for EtherCAT version)

For full details on USB communication, see section 12.1 in the MAN-G-Board Level Modules Hardware manual.

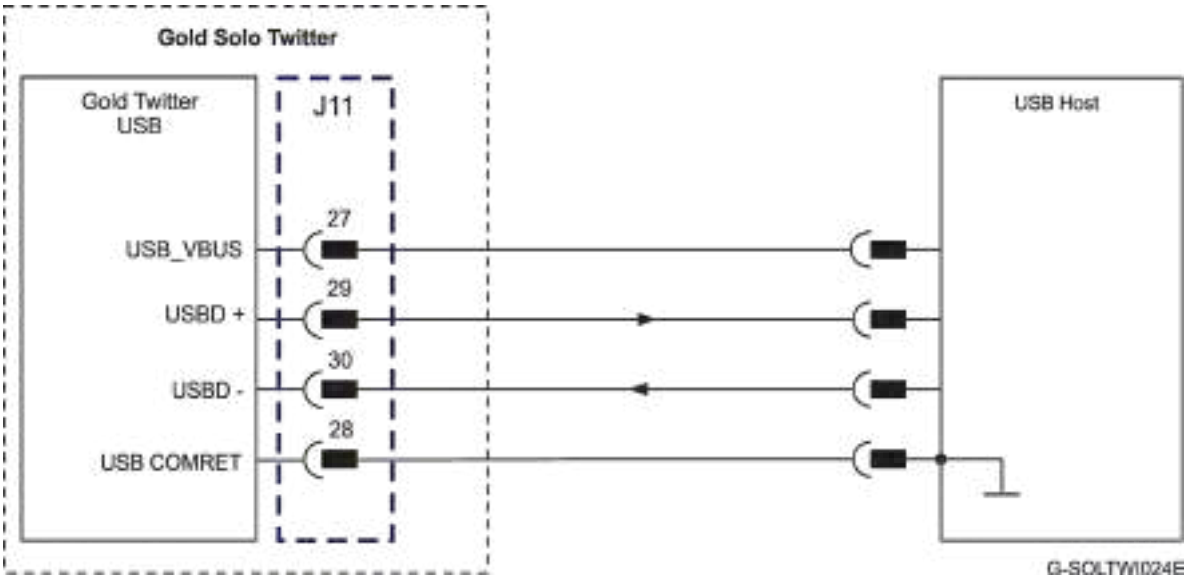


Figure 47: USB Network Diagram

For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.

8.5. EtherCAT Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Gold Solo Twitter supports the following EtherCAT fieldbus type industrial network protocol:

Fieldbus Type	Product Number
EtherCAT	G-SOLTWIXX/YYY**E**XXX

8.5.1. EtherCAT IN/Ethernet Connector (J17)

Refer to section 12.2 in the MAN-G-Panel Mounted Drives Hardware manual for more details.

Pin (J17)	Signal	Function
1	EtherCAT_IN_TX+/Ethernet_TX+	EtherCAT in/Ethernet transmit +
2	EtherCAT_IN_TX-/Ethernet_TX-	EtherCAT in/Ethernet transmit -
3	EtherCAT_IN_RX+/Ethernet_RX+	EtherCAT in/Ethernet receive +
4	EtherCAT_IN_RX-/Ethernet_RX-	EtherCAT in/Ethernet receive -
5	COMRET	Shield drain wire

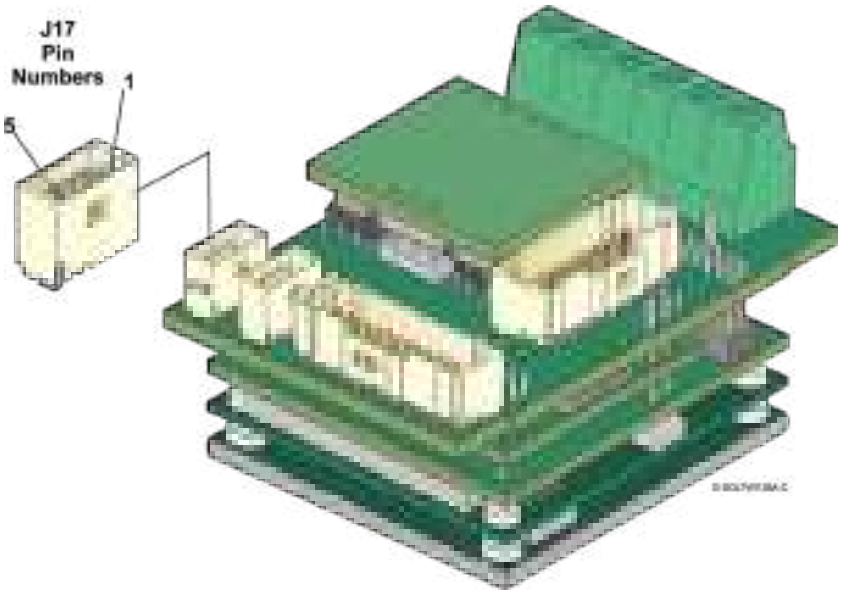
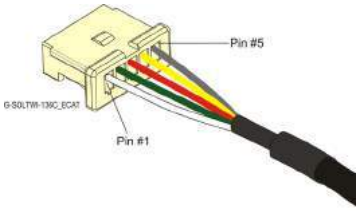
Pin Positions	Cable Connector
	 Ethernet Cable Connector

Table 10: EtherCAT IN / Ethernet Pin Assignments

Note: Always use CAT5e cables.

8.5.2. EtherCAT OUT Connector (J18)

See Section 12.2 in the MAN-G-Panel Mounted Drives Hardware manual for the electrical diagram.

Pin (J18)	Signal	Function
1	EtherCAT_OUT_TX+	EtherCAT out transmit +
2	EtherCAT_OUT_TX-	EtherCAT out transmit -
3	EtherCAT_OUT_RX+	EtherCAT out receive +
4	EtherCAT_OUT_RX-	EtherCAT out receive -
5	COMRET	Shield drain wire

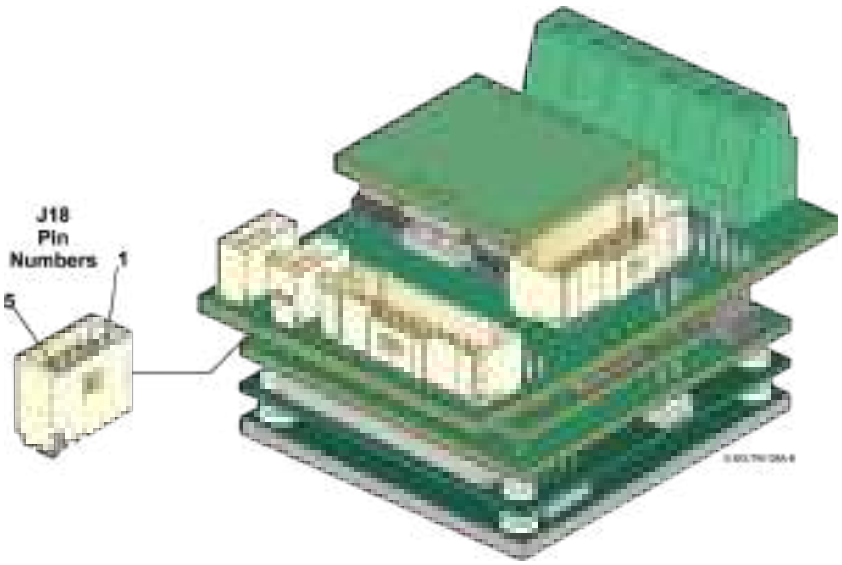
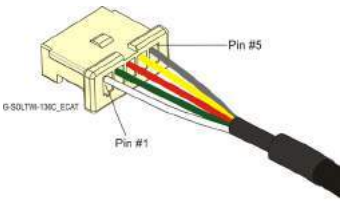
Pin Positions	Cable Connector
	 Ethernet Cable Connector

Table 11: EtherCAT OUT Pin Assignments

Note: Always use CAT5e cables.

8.5.3. EtherCAT Schematic Connections

For full details on EtherCAT communication, see Section 12.2 in the in the MAN-G-Board Level Modules Hardware manual.

Note: **The EtherCAT IN port can be configured to an Ethernet Port.**

8.5.3.1. EtherCAT Communication

This section only describes the EtherCAT communication, and the pinout drawing of the connector.

When the EtherCAT is connected and the FoE is in operation, the USB cable connection must be disconnected.

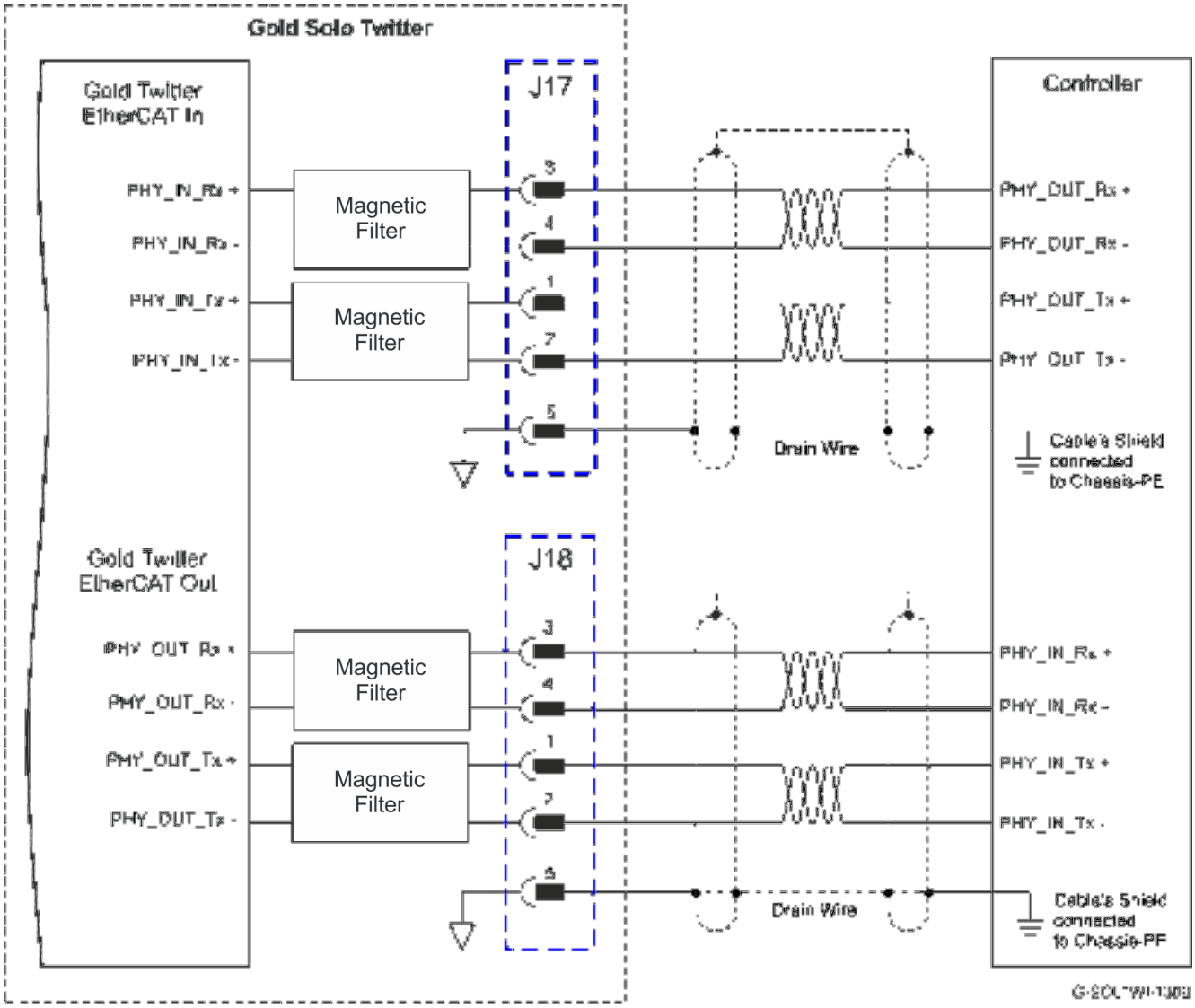


Figure 48: EtherCAT Connection Schematic Diagram

Note: Always use CAT5e cables.

8.5.3.2. EtherCAT Status Indicator (D2)

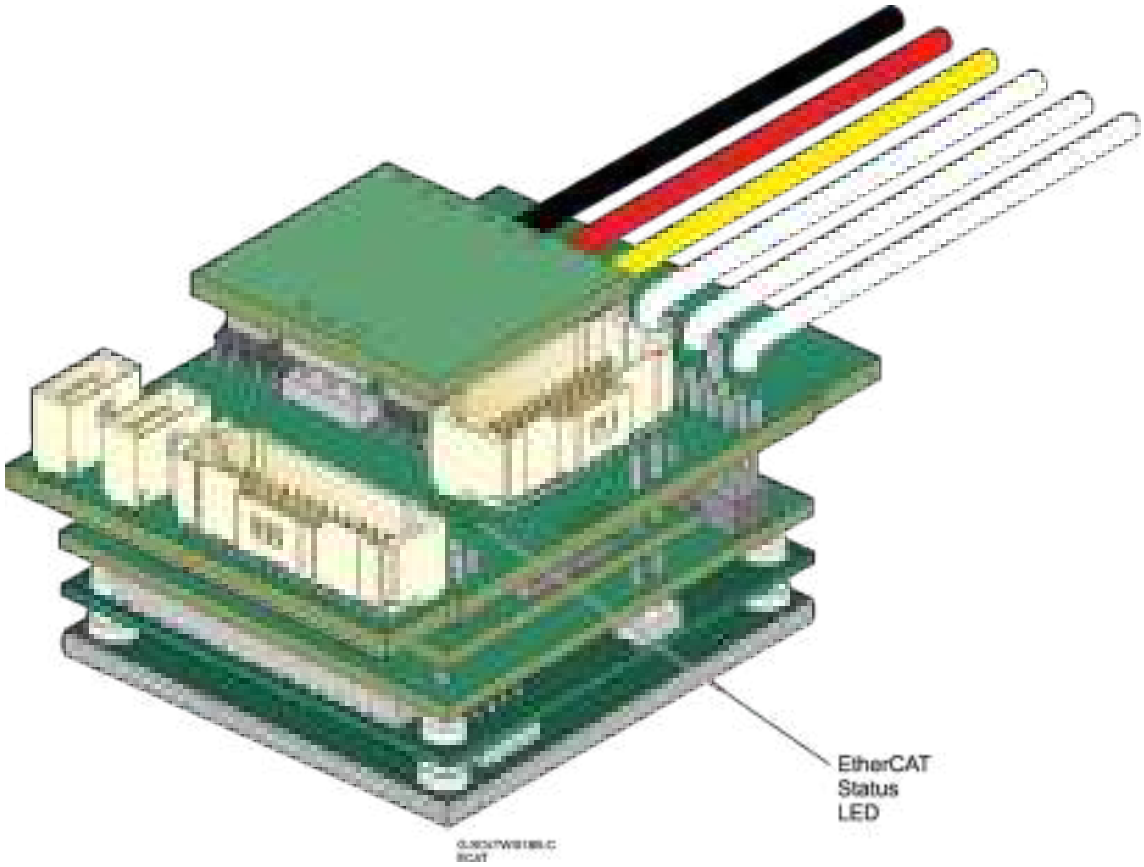


Figure 49: EtherCAT Status LED

The EtherCAT status indicator D2 is a single red/green dual bi-colored LED that combines the green RUN indicator and the red ERROR indicator of the EtherCAT state machine. For further details, see the EtherCAT Application Manual.

8.5.3.3. EtherCAT Link Indicators (D3, D4)

The Gold Solo Twitter can serve as an EtherCAT slave device. For this purpose it has two Ports J17 and J18, which are designated as EtherCAT In and EtherCAT Out. Each of these Ports has a status LED; D3 EtherCAT In and D4 EtherCAT Out, which are shown in Figure 50.

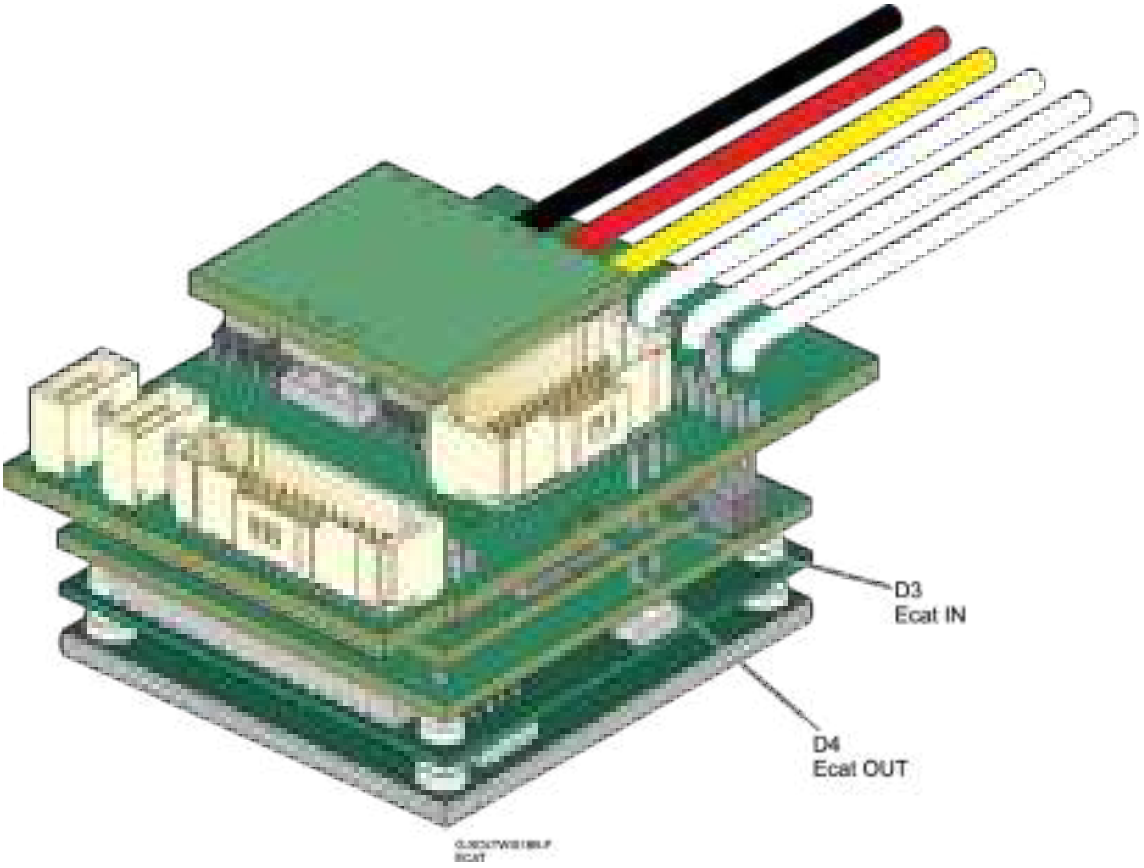


Figure 50: Ethernet Connector LEDs

The green LEDs D3 and D4 are the link/activity indicators. They show the state of the applicable physical link and the activity on that link; blinking green, D3 for the Link Act IN, and D4 for the Link Act OUT.

8.6. CAN Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Gold Solo Twitter supports the following CAN fieldbus type industrial network protocol:

Fieldbus Type	Product Number
CAN	G-SOLTWIXX/YYY**S**XXX

See Section 12.4 in the MAN-G-Panel Mounted Drives Hardware manual for the electrical diagram.

8.6.1. CAN IN Connector (J17)

Pin (J17)	Signal	Function
1	NC	NC
2	CAN_RET	CAN Return
3	CAN_H	CAN_H bus line (dominant high)
4	CAN_L	CAN_L bus line (dominant low)
5	COMRET	Shield drain wire

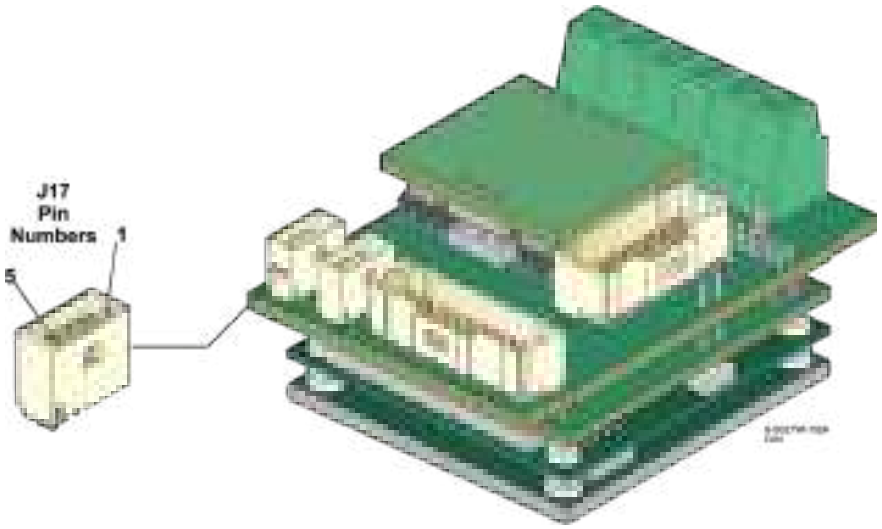
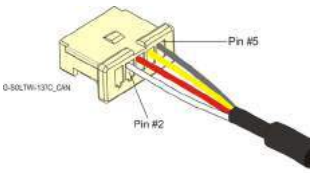
Pin Positions	Cable Connector
	 **CAN Cable Connector**

Table 12: CAN IN Connector Pin Assignments

Note: Always use CAT5e cables.

8.6.2. CAN OUT Connector (J18)

Pin (J18)	Signal	Function
1	NC	NC
2	CAN_RET	CAN Return
3	CAN_H	CAN_H bus line (dominant high)
4	CAN_L	CAN_L bus line (dominant low)
5	COMRET	Shield drain wire

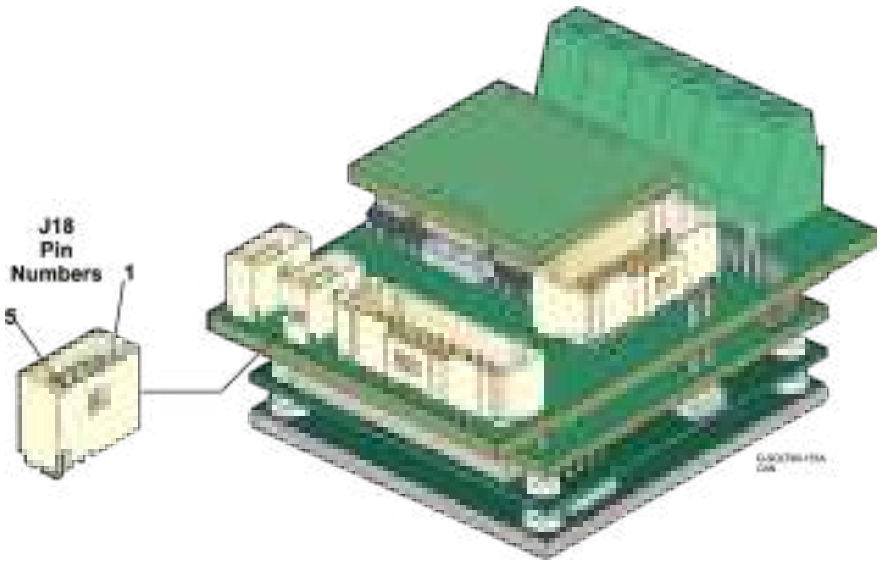
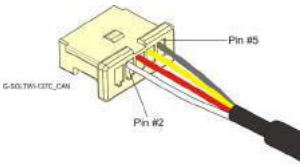
Pin Positions	Cable Connector
	 CAN Cable Connector

Table 13: CAN OUT Connectors Pin Assignments

Note: Always use CAT5e cables.

8.6.3. CAN Schematic Connections

For full details on CANopen communication, see section 14.3 in the MAN-G-Board Level Modules Hardware manual.

8.6.3.1. Interface

The Gold Solo Twitter includes the CAN transceiver, common mode choke, and a CAN Bus Protector against ESD and other harmful transient voltage events.

The following signals describe how to connect CAN to the external connector.

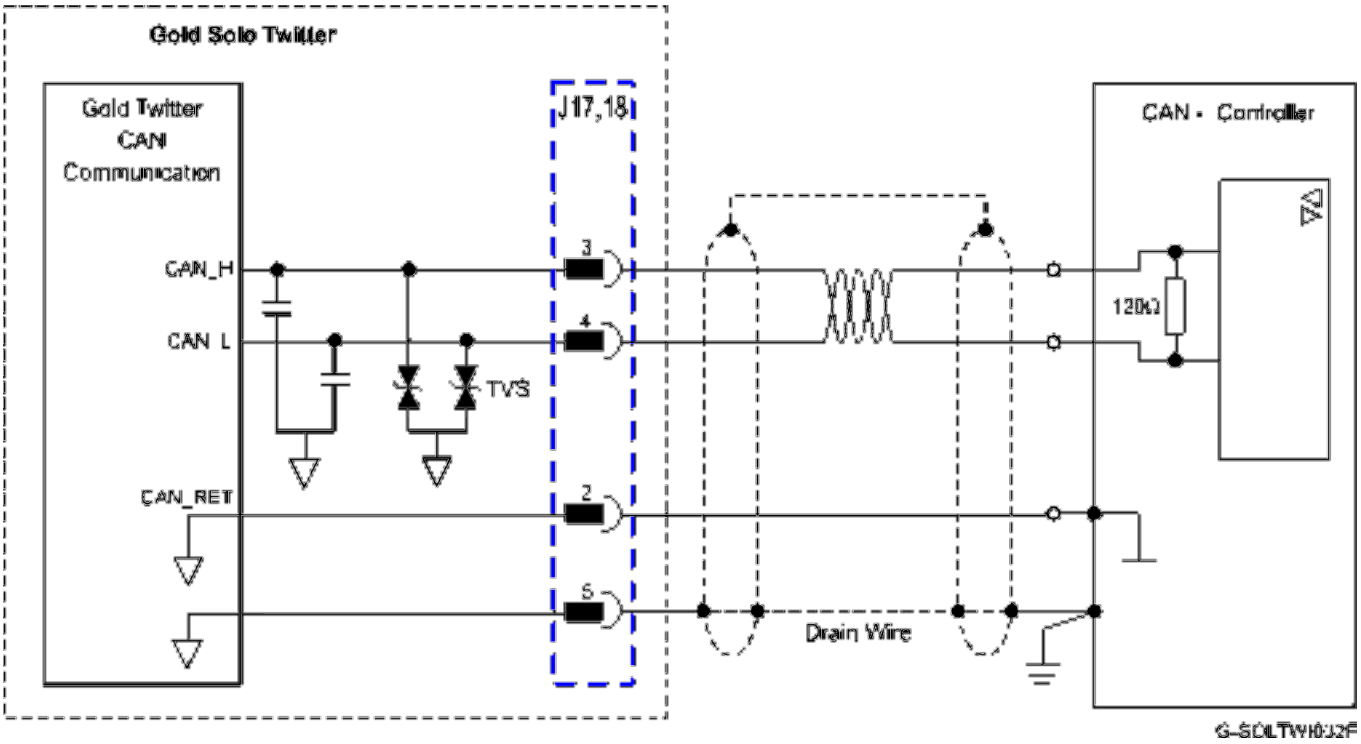


Figure 51: CAN Interface

8.6.3.2. CAN Network Topology

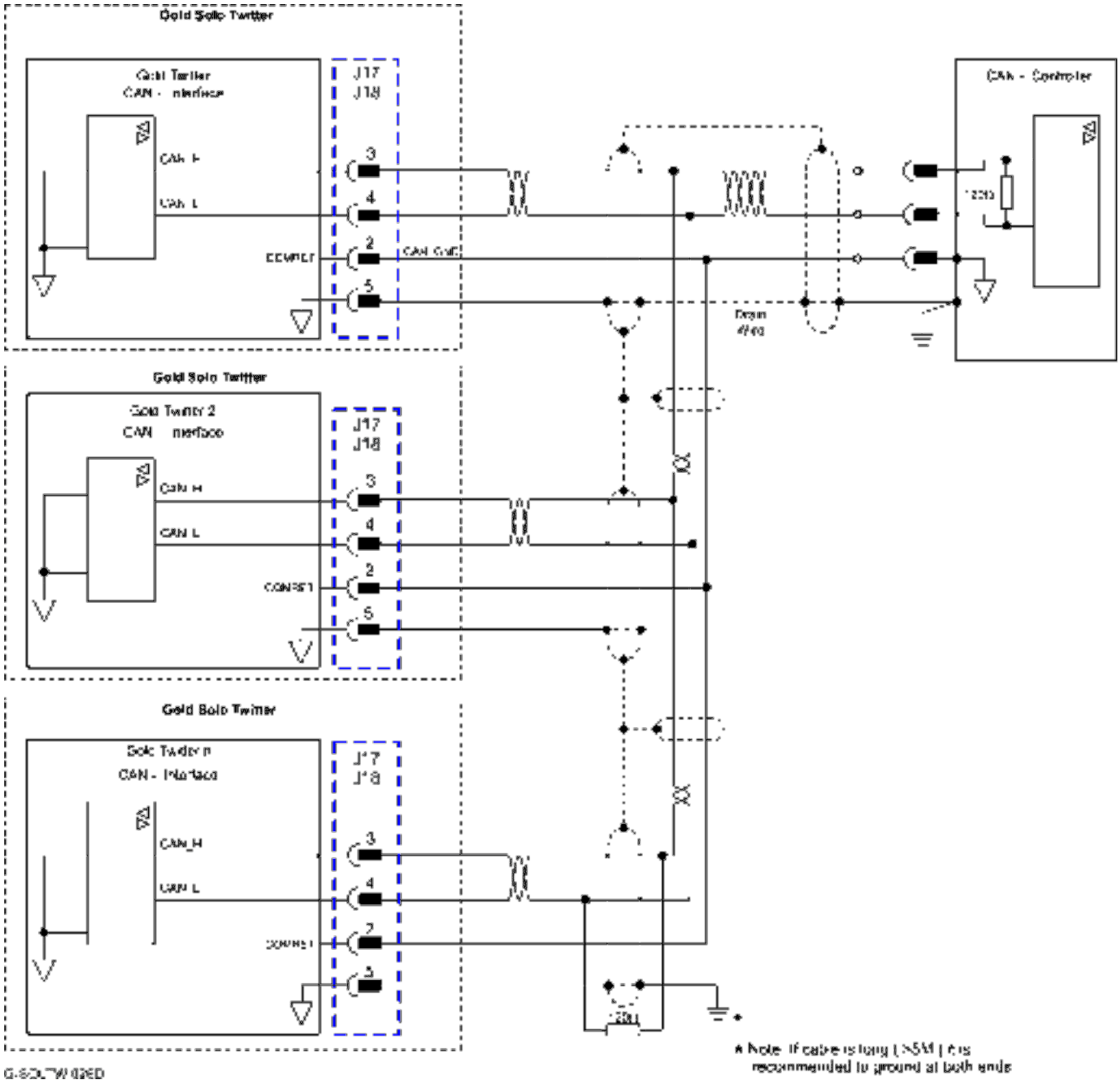


Figure 52: CAN Network Diagram – Drop Off Topology

Caution: When installing CAN communication, ensure that each servo drive is allocated a unique ID. Otherwise, the CAN network may "hang".

Note: Daisy chain topology can also be accomplished using J18.

Note: Always use CAT5e cables.

Chapter 9: Powering Up

After the Gold Solo Twitter is connected to its device, it is ready to be powered up.

Caution:
Before applying power, ensure that the DC supply is within the specified range and that the proper plus-minus connections are in order.

9.1. Initializing the System

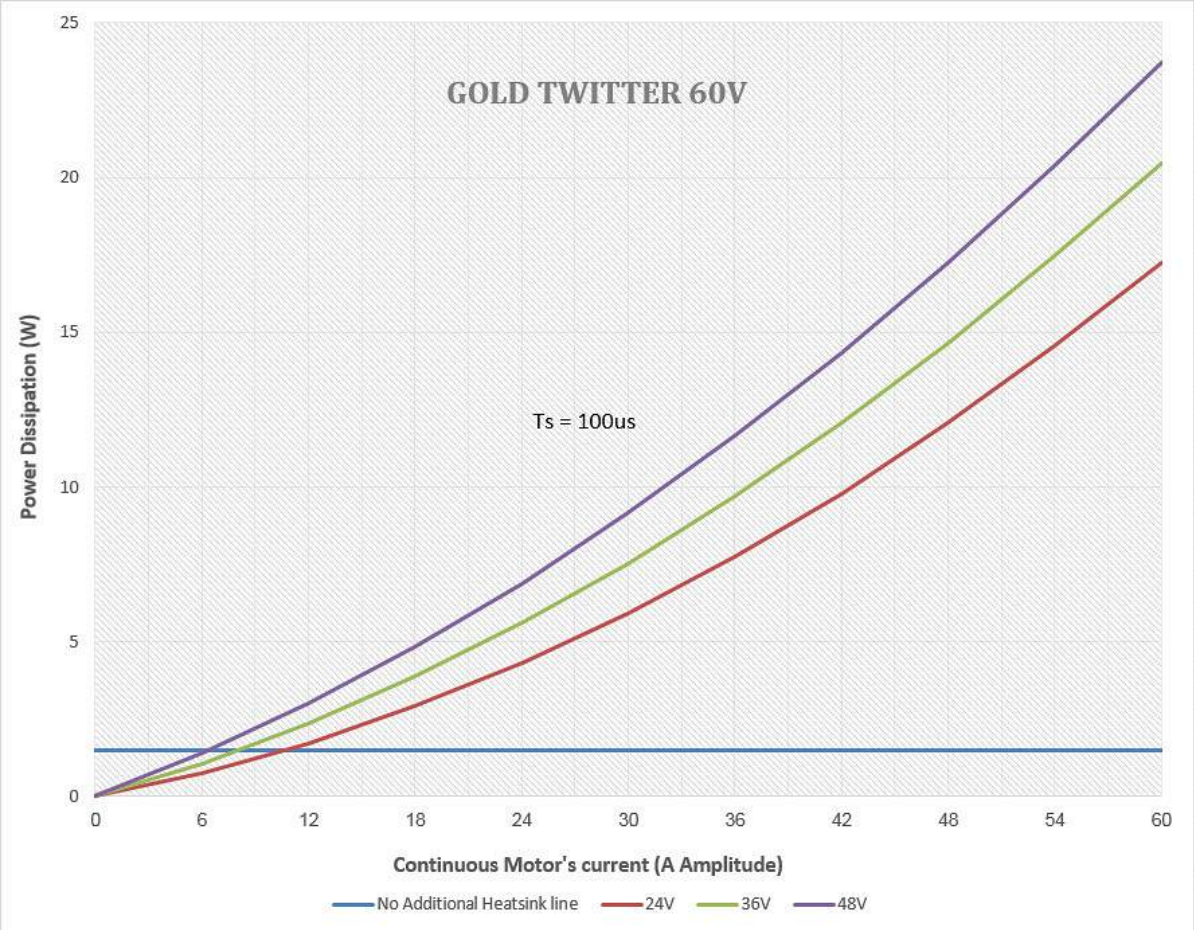
After the Gold Solo Twitter has been connected and mounted, the system must be set up and initialized. This is accomplished using the *EASII*, Elmo's Windows-based software application. Install the application and then perform setup and initialization according to the directions in the *EASII User Manual*.

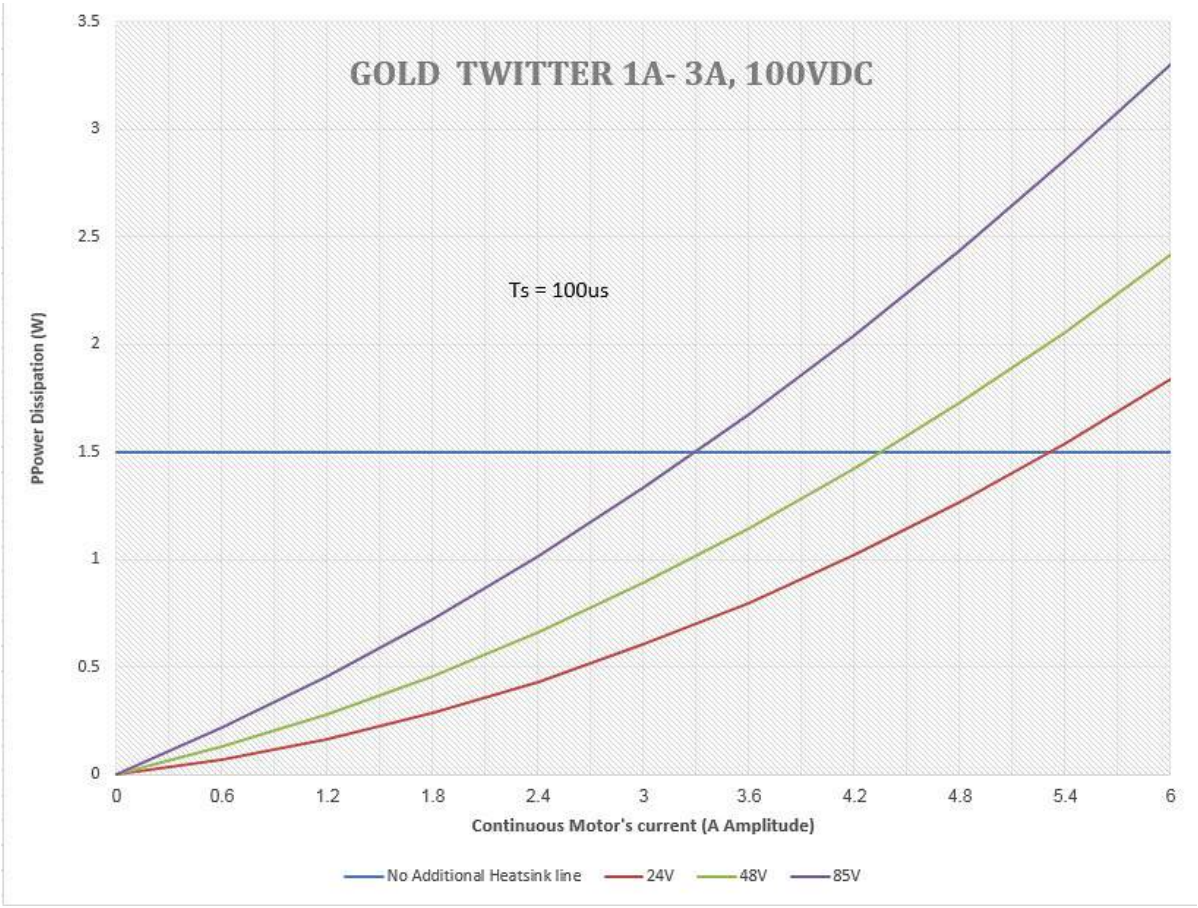
9.2. Heat Dissipation

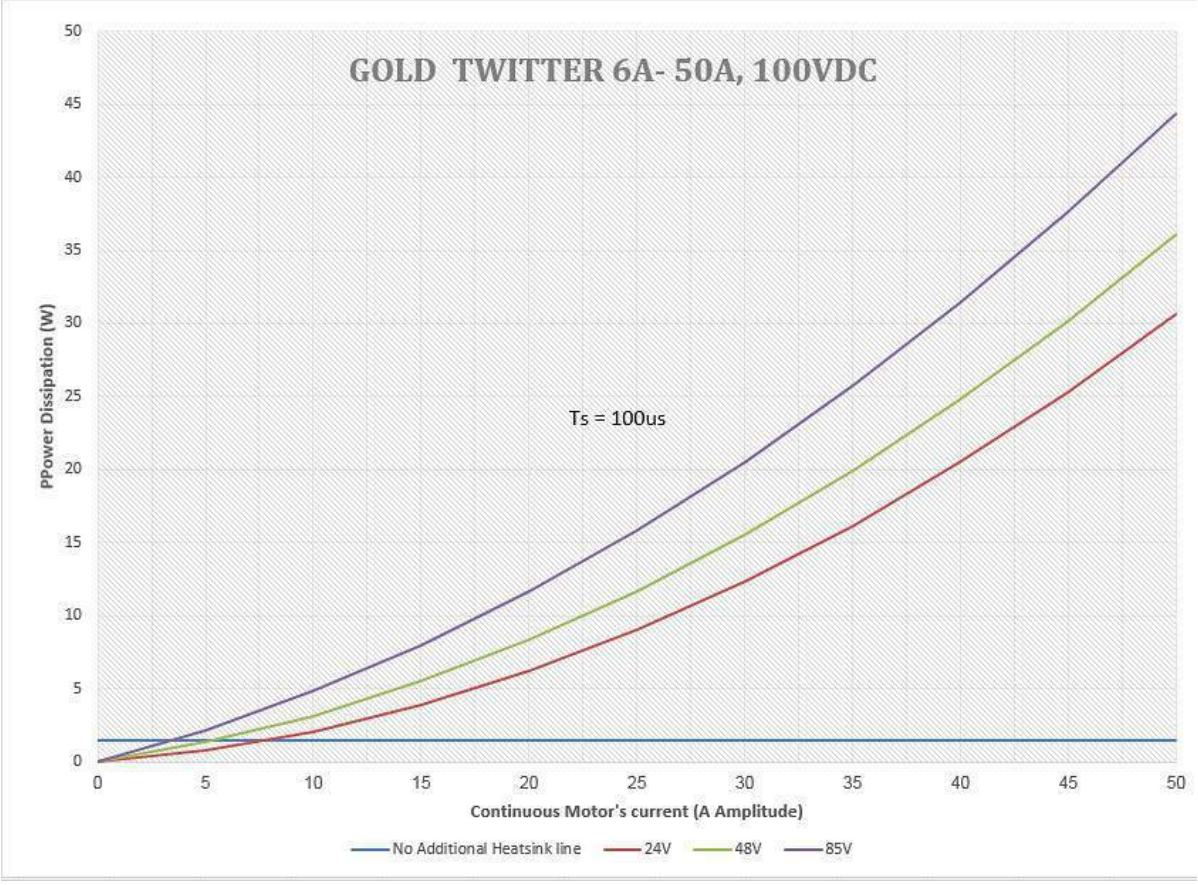
The best way to dissipate heat from the Gold Solo Twitter is to mount it so that its heat-sink is attached to the machine chassis. If mounted with its heat-sink suspended, then for best results mount the servo drive faced upwards and leave approximately 10 mm of space between the Gold Solo Twitter's heat-sink and any other assembly.

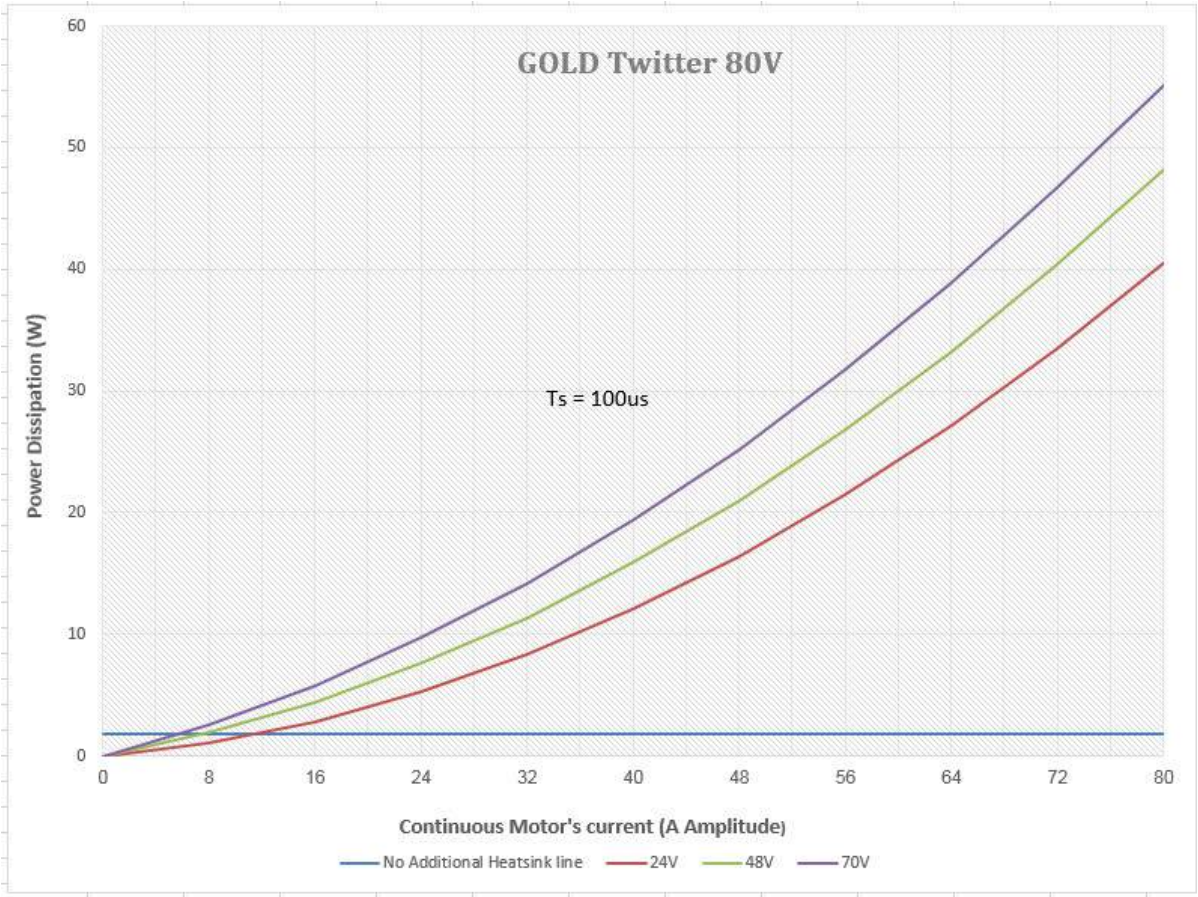
9.2.1. Heat Dissipation Data

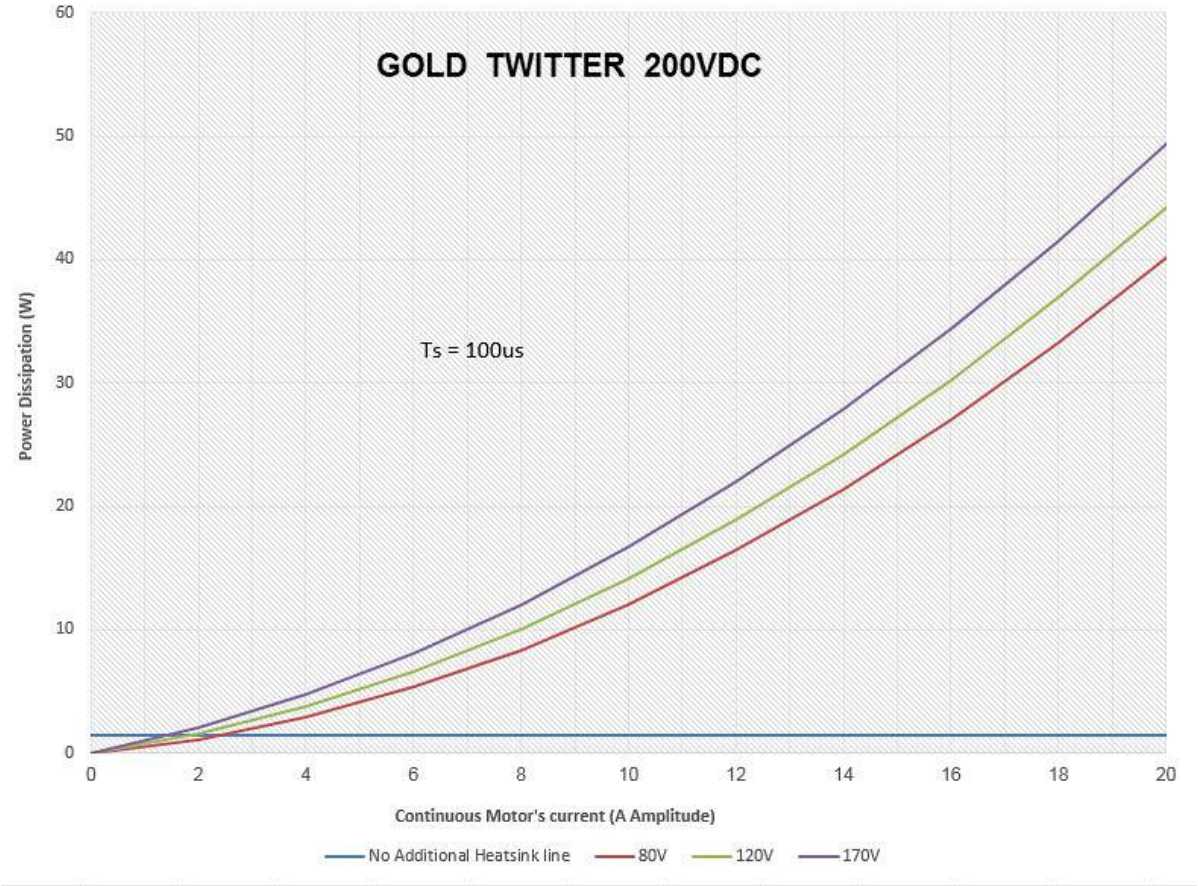
Heat Dissipation is shown graphically below. **It should be noted in the graphs below that the Flat Heat Sink and Fins Heat Sink can dissipate up to 5.5W and 7.0W respectively**:




GOLD TWITTER 1A- 3A, 100VDC
Ts = 100us
PPower Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
24V
48V
85V


GOLD TWITTER 6A- 50A, 100VDC
Ts = 100us
PPower Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
24V
48V
85V


GOLD Twitter 80V
Ts = 100us
Power Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
24V
48V
70V


GOLD TWITTER 200VDC
Ts = 100us
Power Dissipation (W)
Continuous Motor's current (A Amplitude)
No Additional Heatsink line
80V
120V
170V

9.2.2. How to Use the Chart

The charts above are based upon the theoretical worst-case scenario. The actual test results display a 20% -30% lower power dissipation.

The above charts indicate the net power conversion losses and exclude the control losses.

To determine if your application heat dissipation requires a heat sink:

1. Determine the power dissipation according to the "continuous current" and the DC bus voltage curve.
   If the DC bus is not one of the three curves above, estimate the dissipation by interpolation. The estimation error is not critical.
2. The chart is calculated for continuous current operation, if the actual operation is pulsed current, add 25% to 30% to the power dissipation of the average (RMS) current.
3. When the Heat-Sink temperature reaches ≈ 85 °C, the Gold Solo Twitter will shut down. Design the system for continuous operation so that the maximum Heat Sink temperature should be no higher than between 80°C to 82°C.
4. **For models Power Supply & Heatsink Option: (Blank) or S**
   If the average heat dissipation is less than ≈1.5W (Average operating power of 100W to 200W) there will be no requirement for an external heat sink.
   If the average Heat dissipation is higher than 1.5W then an additional heat dissipation means is required, usually by connecting to an external heat-sink.
   For model Power Supply & Heatsink Option: H
   If the average heat dissipation is less than ≈4W to 5W (Average operating power of 300W to 600W) there will be no requirement for an additional external heat sink.
   If the average Heat dissipation is higher than 4W then an additional heat dissipation means is required, usually by connecting to an additional external heat-sink.
5. When an external Heat-Sink is required, calculate the thermal resistance of the heat sink according to:

$$Ø_{°C/W} = \frac{80°C - T_{Ambient}}{Heat\ Dissipation}$$

Chapter 10: Dimensions, Physical Specifications

This chapter provides detailed technical dimensions regarding the Gold Solo Twitter.

10.1. EtherCAT without Heatsink

Weights (g (oz))	Dimensions (mm (in))
60.5 (2.13)	47.2 x 30 x 22.2 mm (1.86" x 1.18" x 0.87")

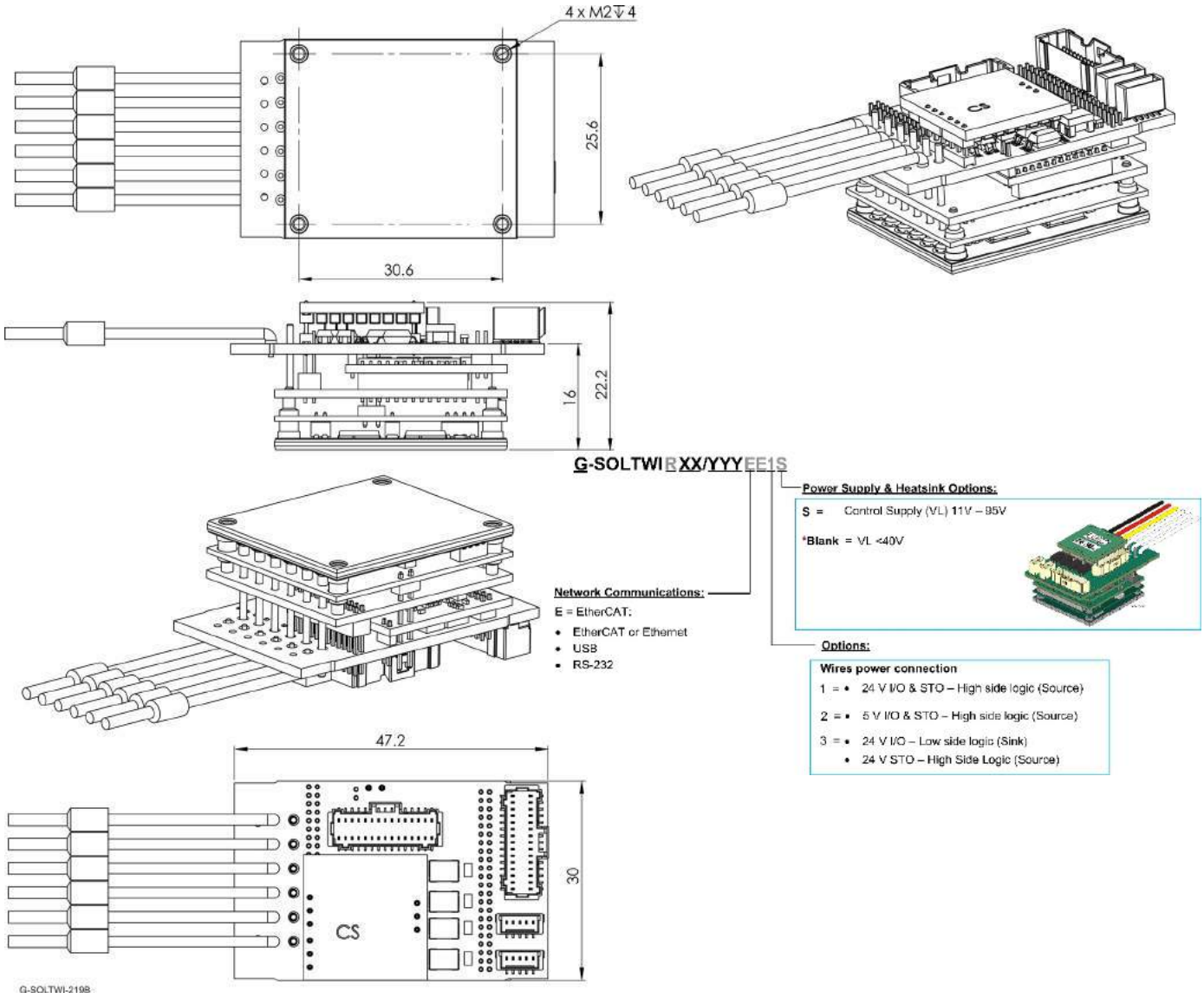


Figure 53: G-Solo Twitter –EtherCAT version with wires to power supply and motor

Weights (g (oz))	Dimensions (mm (in))
36.5 (1.29)	48.1 x 30 x 25.0 mm (1.89" x 1.18" x 0.98")

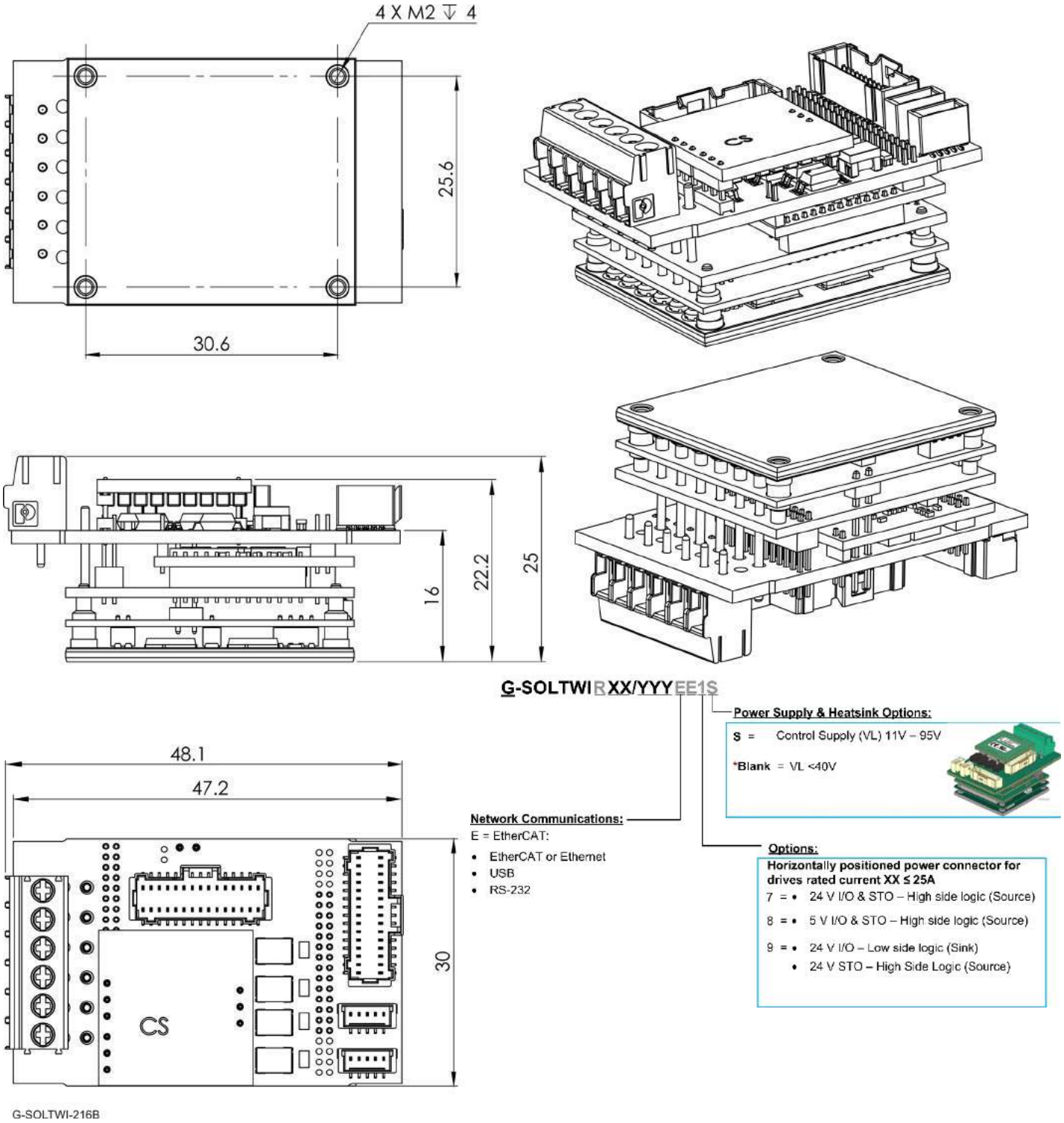


Figure 54: G-Solo Twitter –EtherCAT version with horizontal power connector

Weights (g (oz))	Dimensions (mm (in))
39.0 (1.38)	48.3 x 30 x 34.7 mm (1.90" x 1.18" x 1.37")

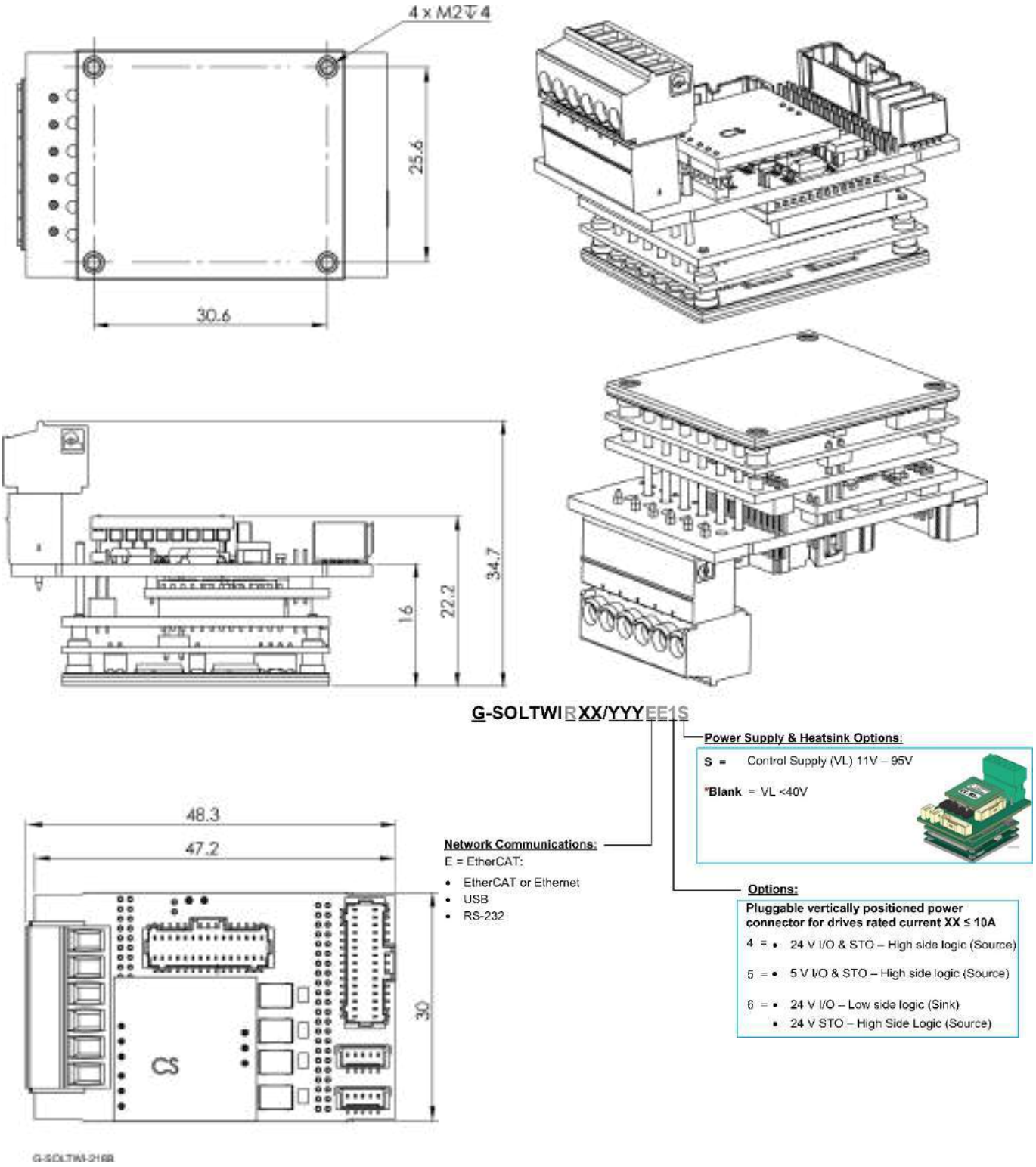


Figure 55: G-Solo Twitter –EtherCAT version with vertical power connector

10.2. EtherCAT with Heatsink

Weights (g (oz))	Dimensions (mm (in))
270.5 (9.54)	47.6 x 41.3 x 26.2 mm (1.87" x 1.63" x 1.03")

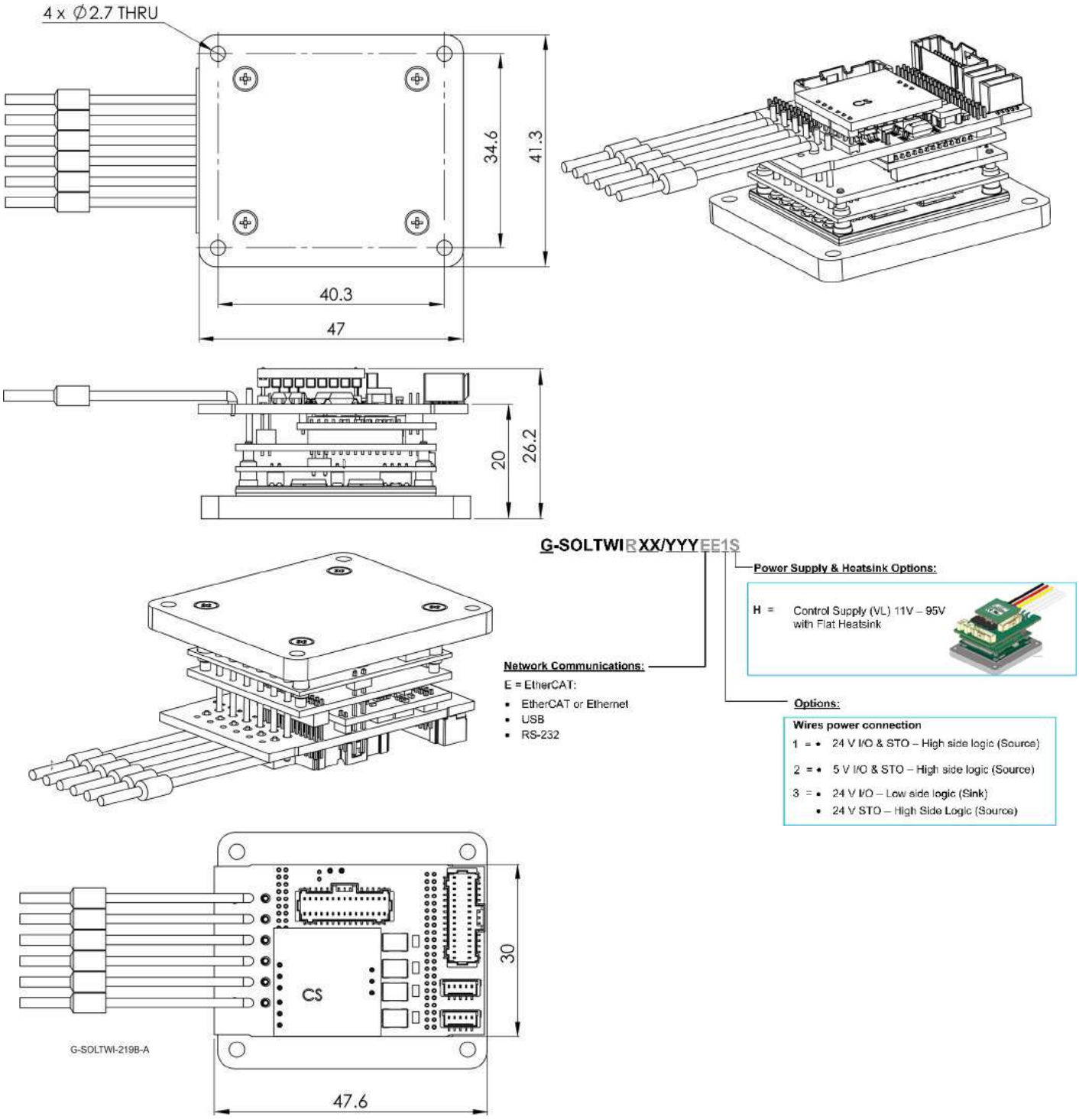


Figure 56: G-Solo Twitter –EtherCAT version with wires to power supply and motor

Weights (g (oz))	Dimensions (mm (in))
246.5 (8.69)	48.5 x 41.3 x 29.0 mm (1.91" x 1.63" x 1.14")

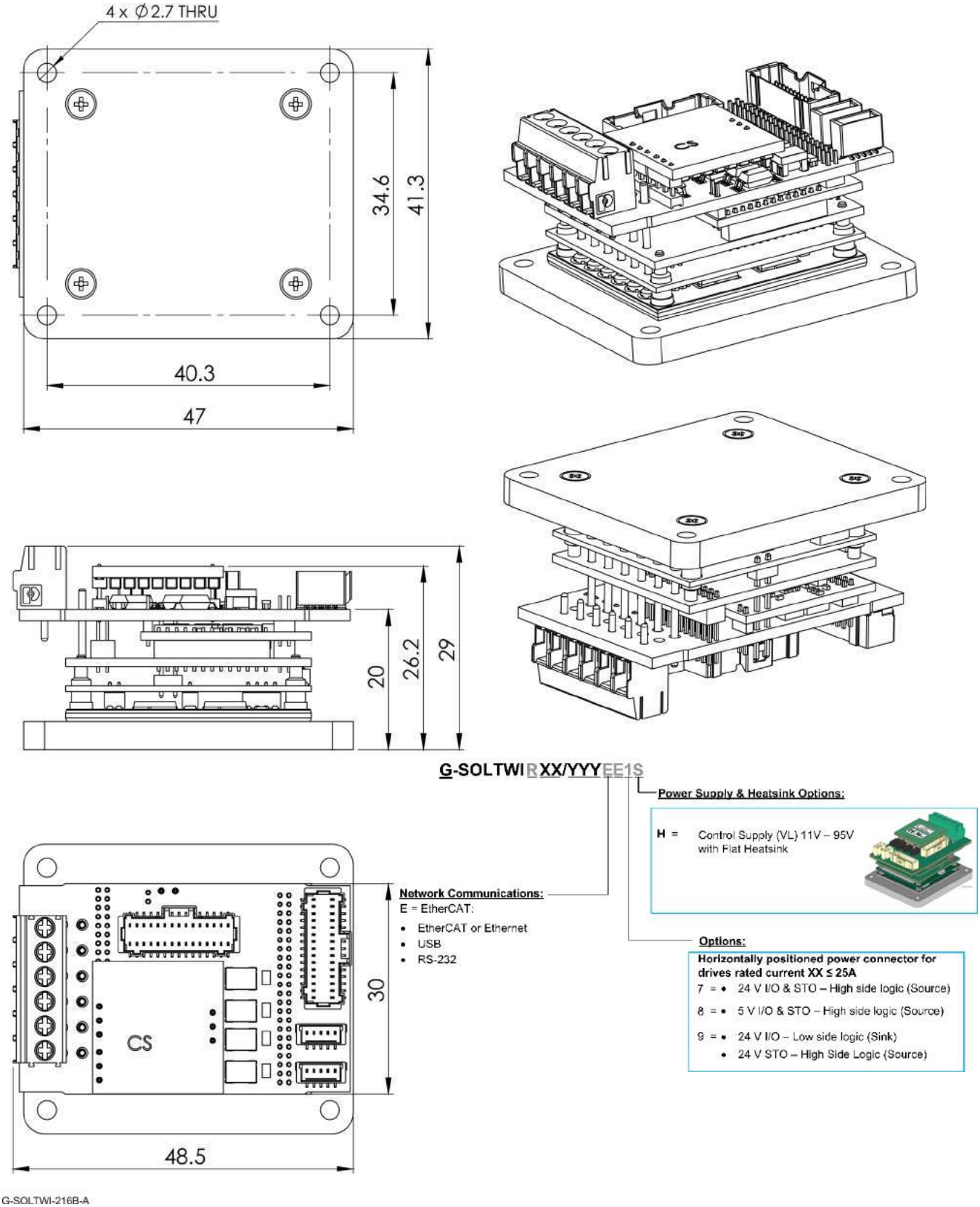


Figure 57: G-Solo Twitter –EtherCAT version with horizontal power connector

Weights (g (oz))	Dimensions (mm (in))
249.0 (8.78)	48.7 x 41.3 x 38.7 mm (1.92" x 1.63" x 1.52")

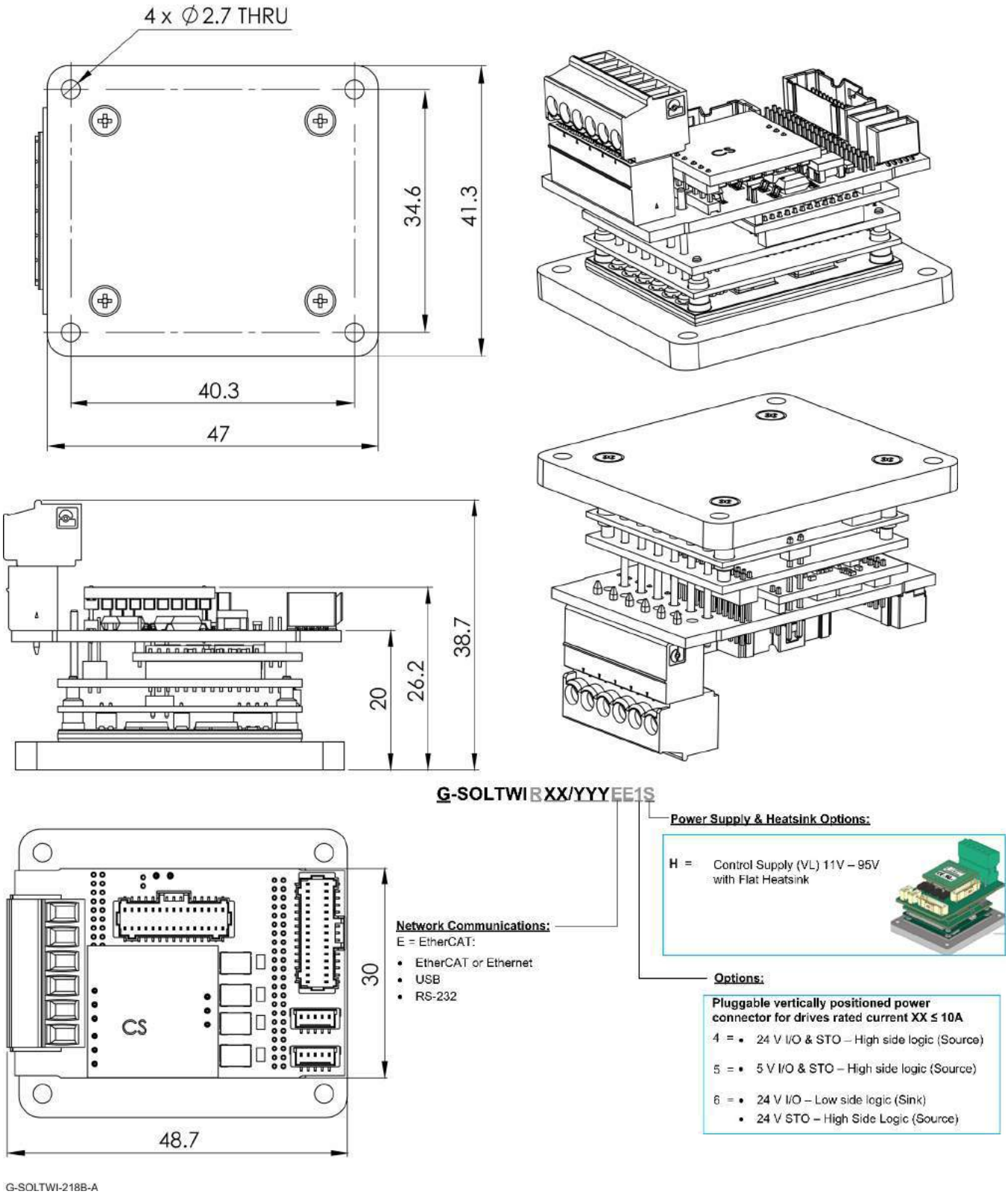


Figure 58: G-Solo Twitter –EtherCAT version with vertical power connector

10.3. CAN without Heatsink

Weights (g (oz))	Dimensions (mm (in))
56.0 (1.97)	47.2 x 30 x 19.3 mm (1.86" x 1.18" x 0.76")

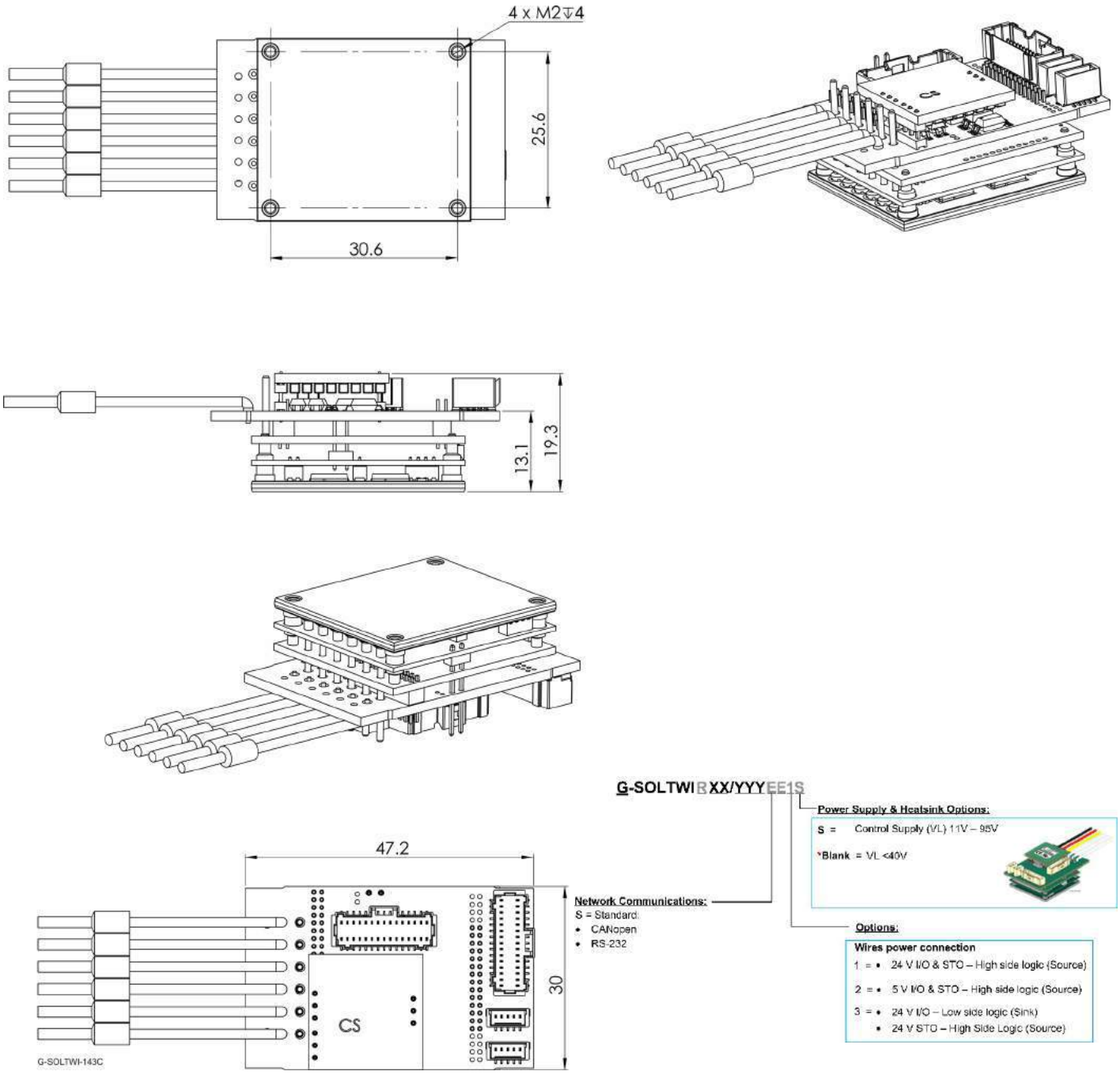


Figure 59: G-Solo Twitter –CAN version with wires to power supply and motor

Weights (g (oz))	Dimensions (mm (in))
32.5 (1.14)	48.1 x 30 x 22.1 mm (1.89" x 1.18" x 0.87")

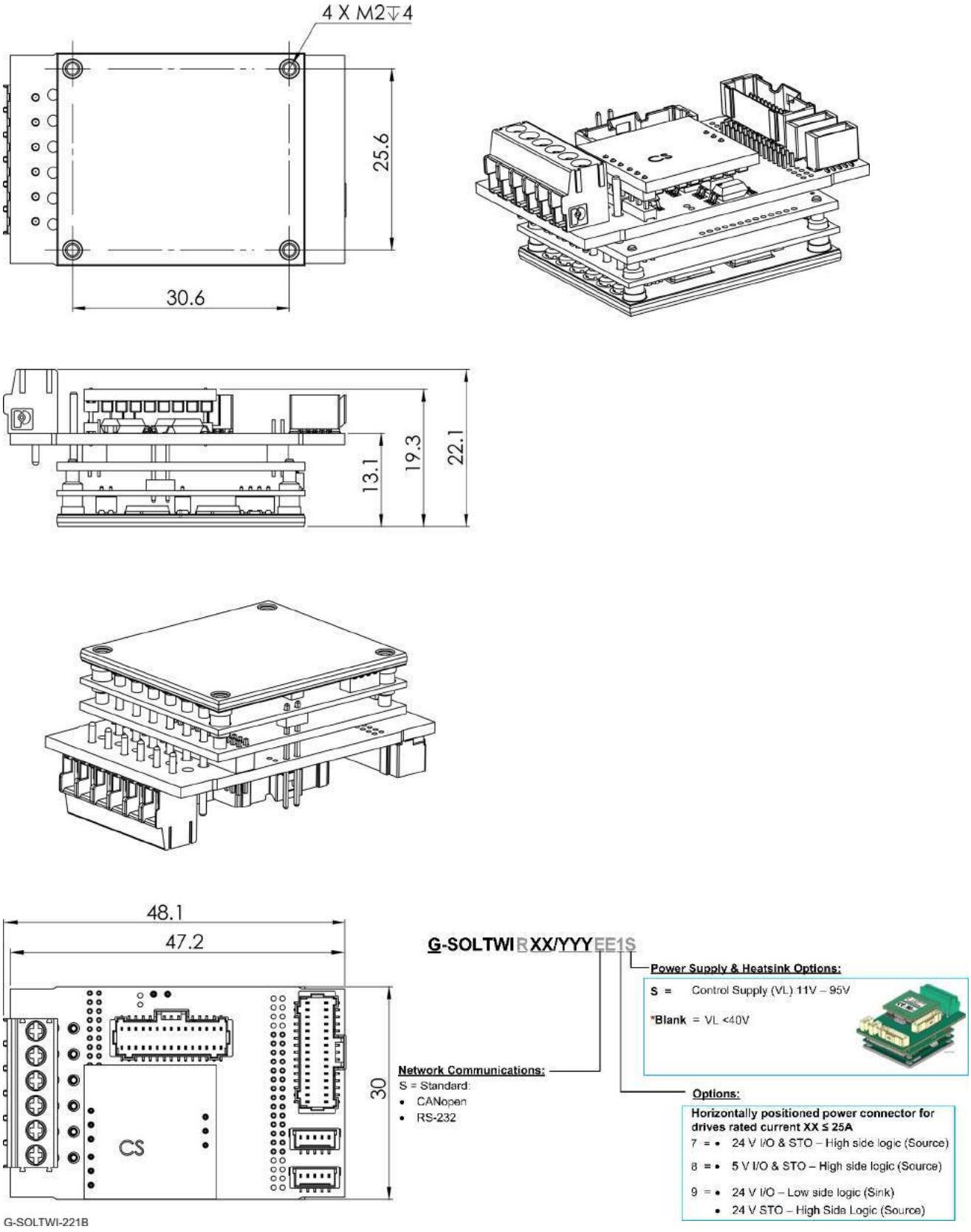


Figure 60: G-Solo Twitter –CAN version with horizontal power connector

Weights (g (oz))	Dimensions (mm (in))
35.0 (1.23)	48.3 x 30 x 31.8 mm (1.9" x 1.18" x 1.25")

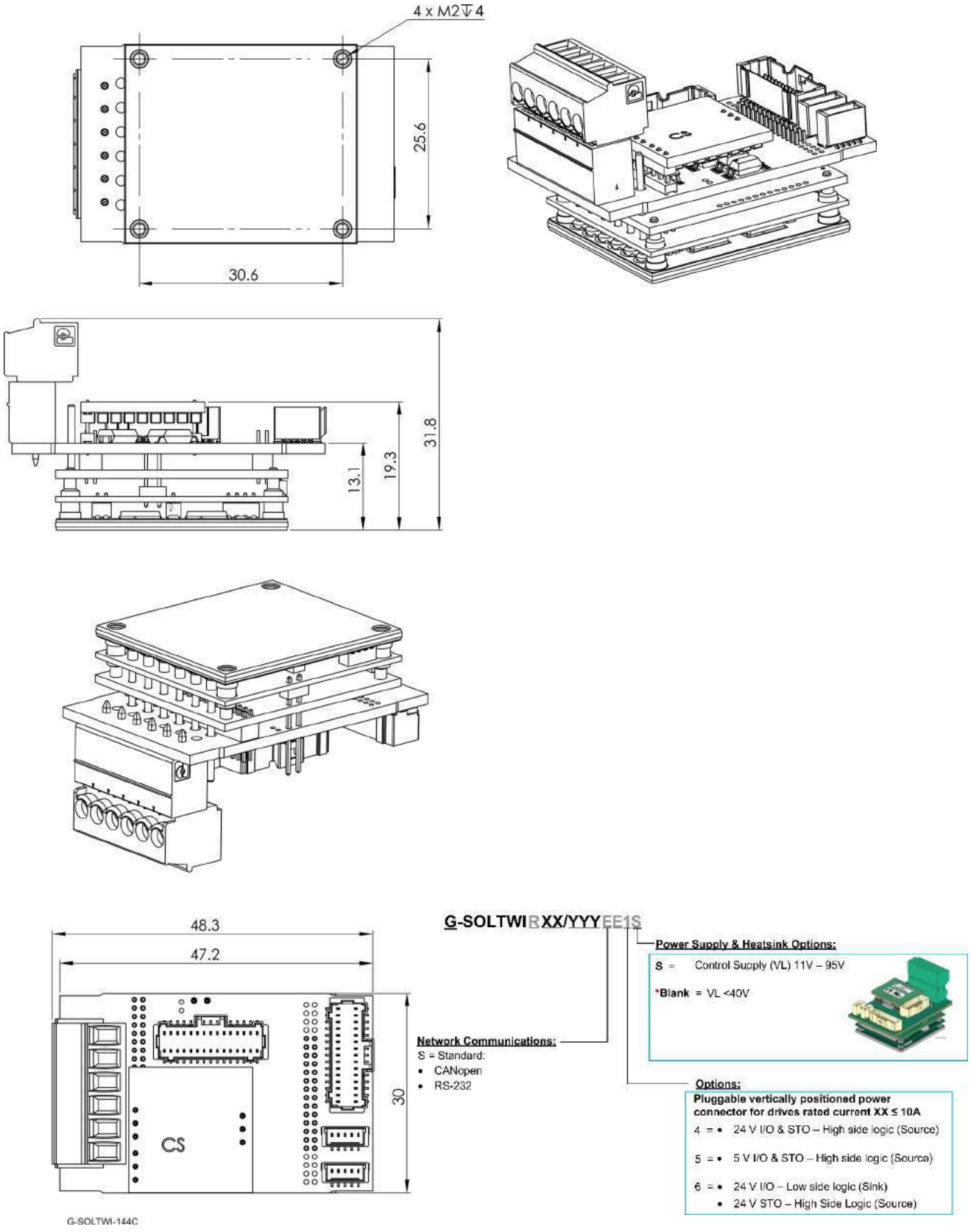


Figure 61: G-Solo Twitter –CAN version with vertical power connector

10.4. CAN with Heatsink

Weights (g (oz))	Dimensions (mm (in))
266.0 (9.38)	47.6 x 41.3 x 23.3 mm (1.87" x 1.63" x 0.92")

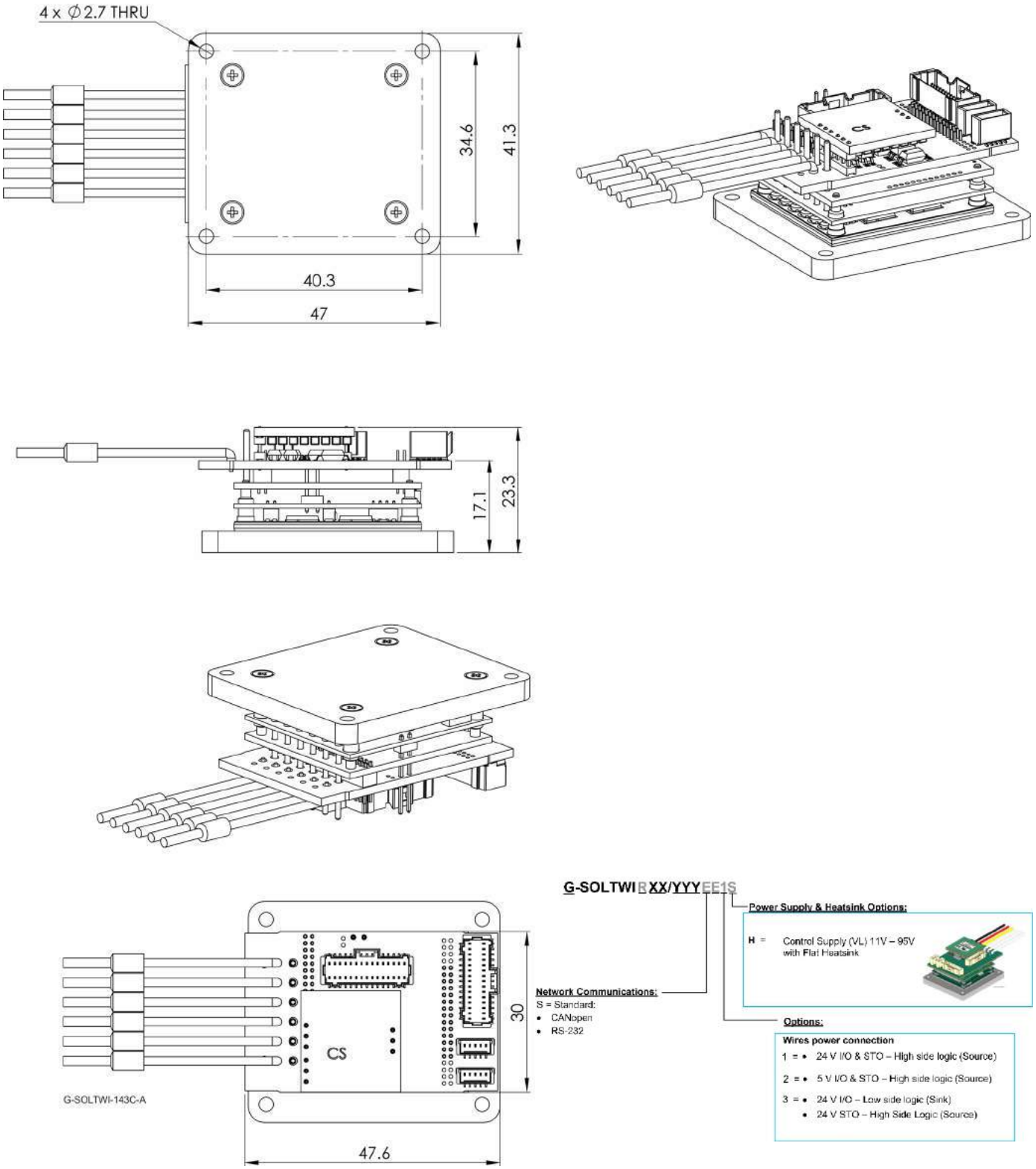


Figure 62: G-Solo Twitter –CAN version with wires to power supply and motor

Weights (g (oz))	Dimensions (mm (in))
242.5 (8.55)	48.5 x 41.3 x 26.1 mm (1.91" x 1.63" x 1.03")

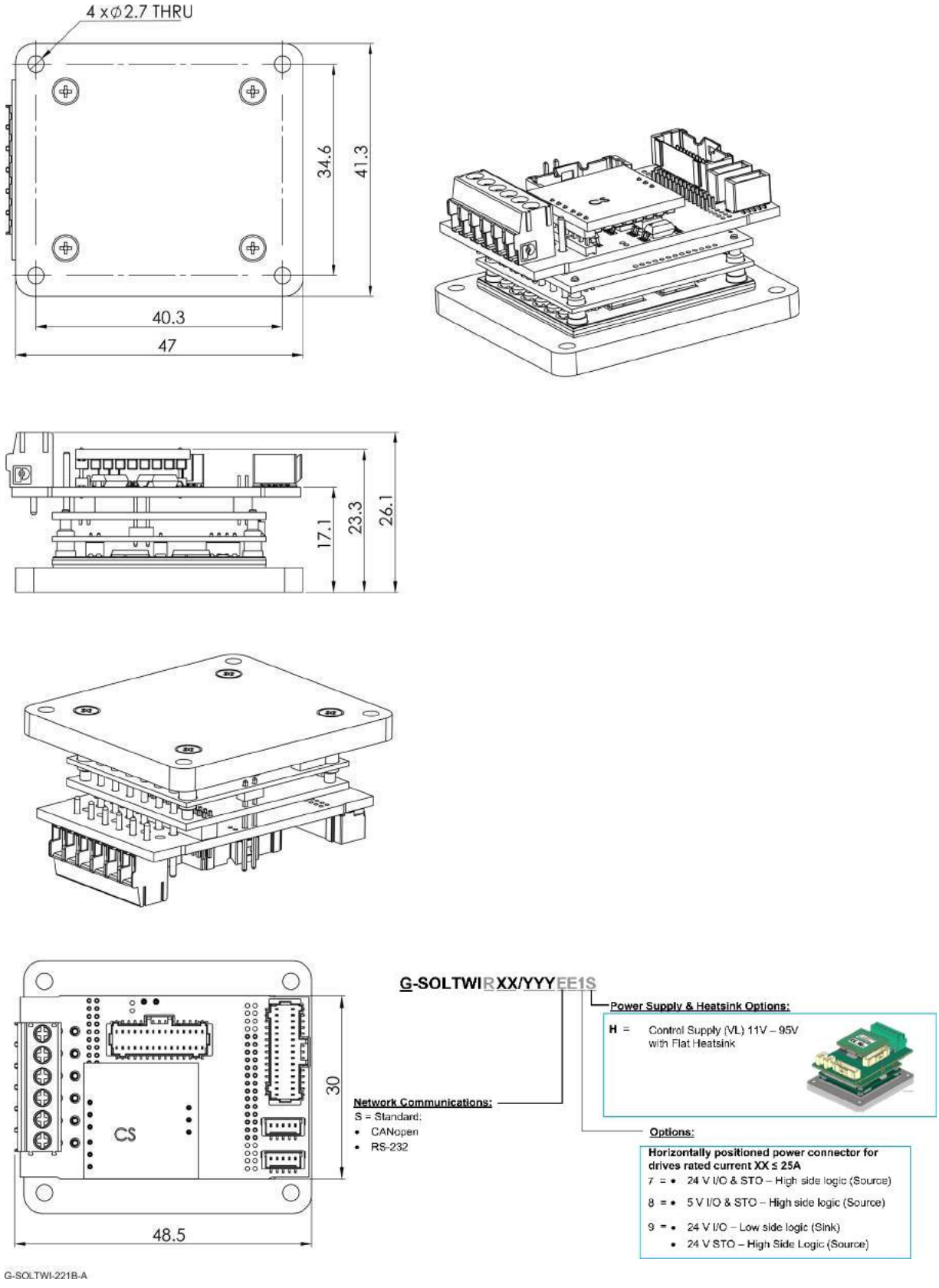


Figure 63: G-Solo Twitter –CAN version with horizontal power connector

Weights (g (oz))	Dimensions (mm (in))
245.0 (8.64)	48.7 x 41.3 x 35.8 mm (1.92" x 1.63" x 1.41")

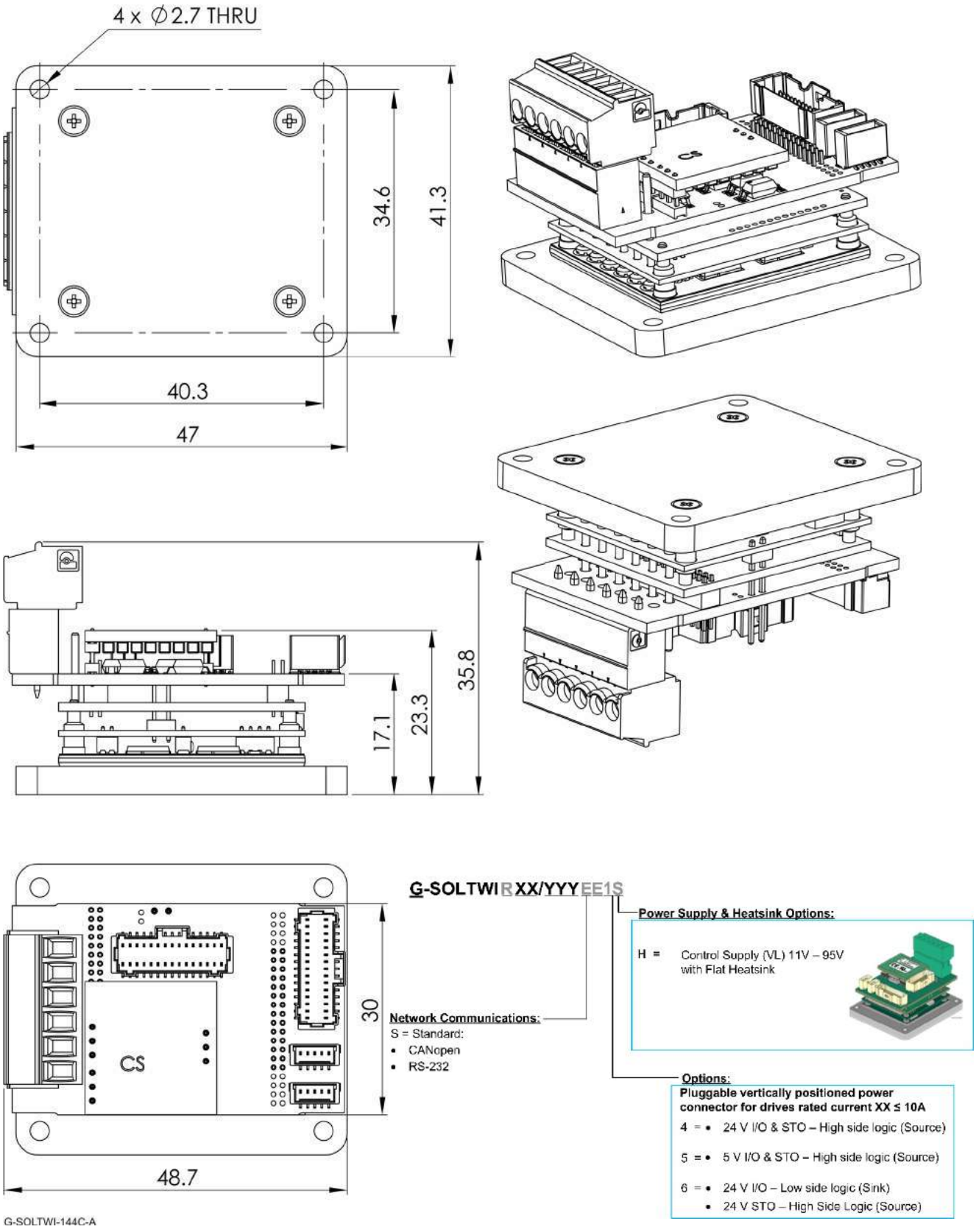


Figure 64: G-Solo Twitter –CAN version with vertical power connector

Chapter 11: Accessories

The model Power Supply & Heatsink Option: **H** is integrated with the Flat Heatsink P/N G-TWIHSFLAT01.

The following describes the accessory kits available for the Gold Solo Twitter.

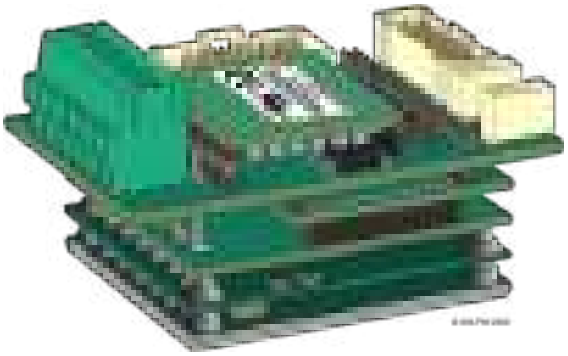
Part Number	Description
CBL-GSOLTWIKIT03	Kit cable for EtherCAT model
CBL-GSOLTWIKIT04	Kit cable for CAN model
CBL-GSOLTWIKIT05	CONNECTORS AND PINS KIT
G-TWIHSFLAT01	Flat Heat-Sink Kit
G-TWIHSFINS01	FINs Heat-Sink Kit

A specific Crimping Tool (available for purchase from Elmo) is required to mount extra connecting pins on the wires. A number of wires are provided in the kit as pre-crimped for convenience:

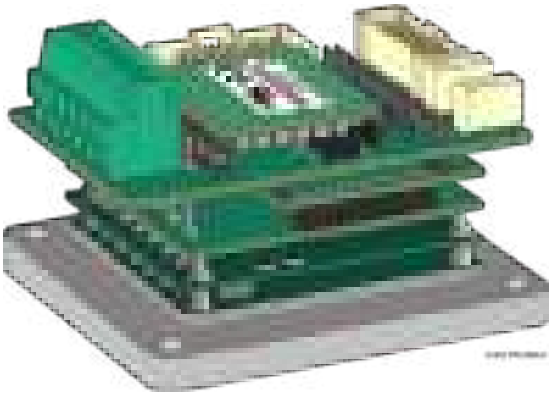
Crimping Tool
Molex P/N 63819-1500
Elmo P/N TOOL-P000040

Pins for Single Row Connector
MOLEX P/N 501334-0100
Pins for Dual Row Connector
MOLEX P/N 501193-3000

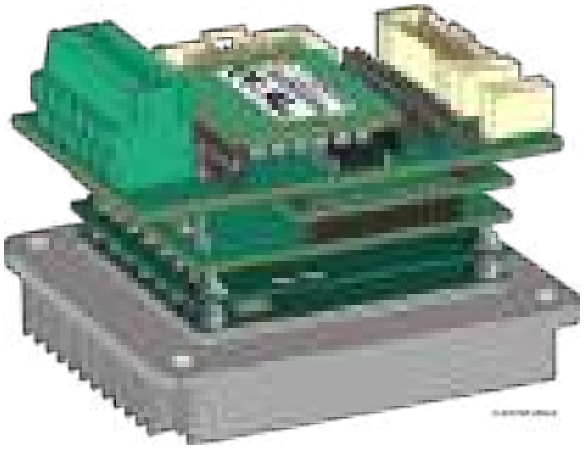
Optionally, the Gold Solo Twitter has two standard heat-sink configurations which are obtainable separately as kit accessories from Elmo:



Default Heat Sink



Flat Heat Sink (P/N G-TWIHSFLAT01)



Fins Heat Sink (P/N G-TWIHSFINS01)

11.1. Accessories Heat Sink Dimensions

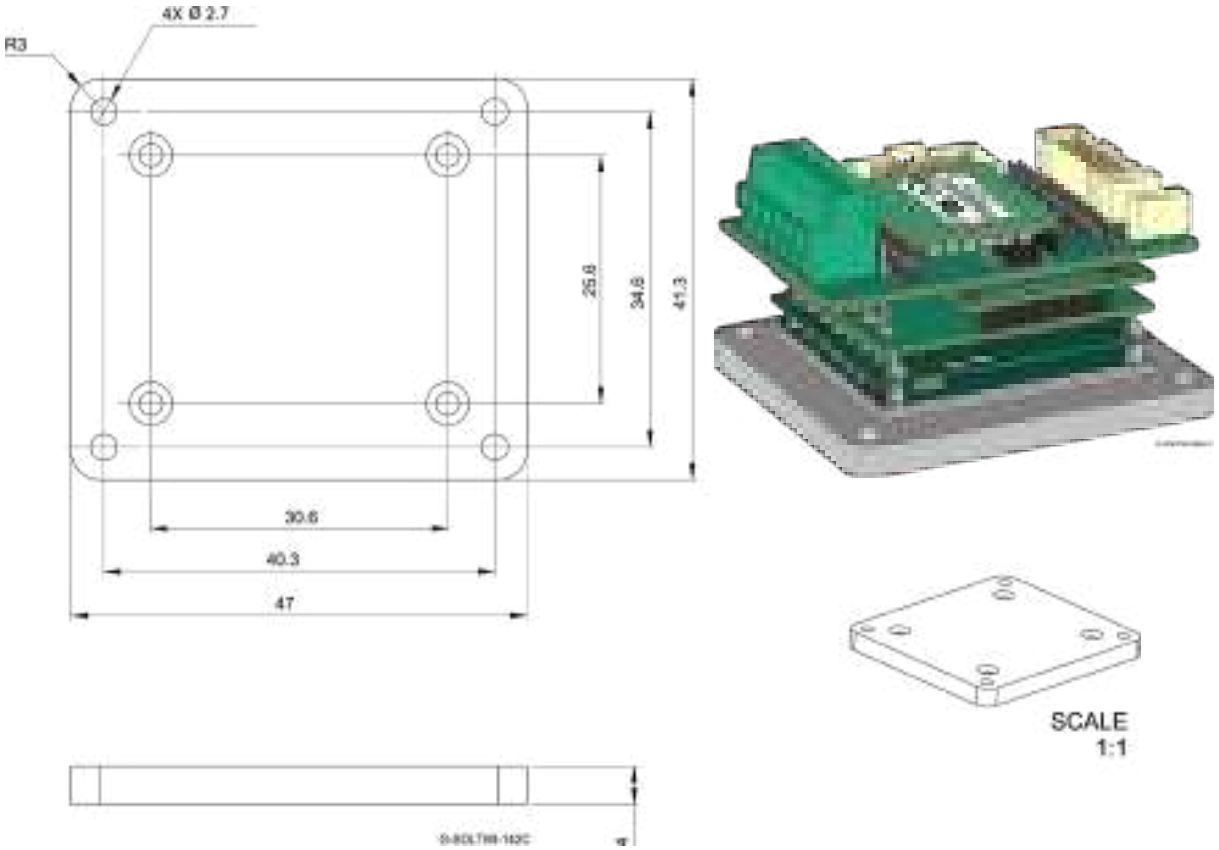


Figure 65: G-Solo Twitter – Flat Heat Sink (P/N G-TWIHSFLAT01) Dimensions

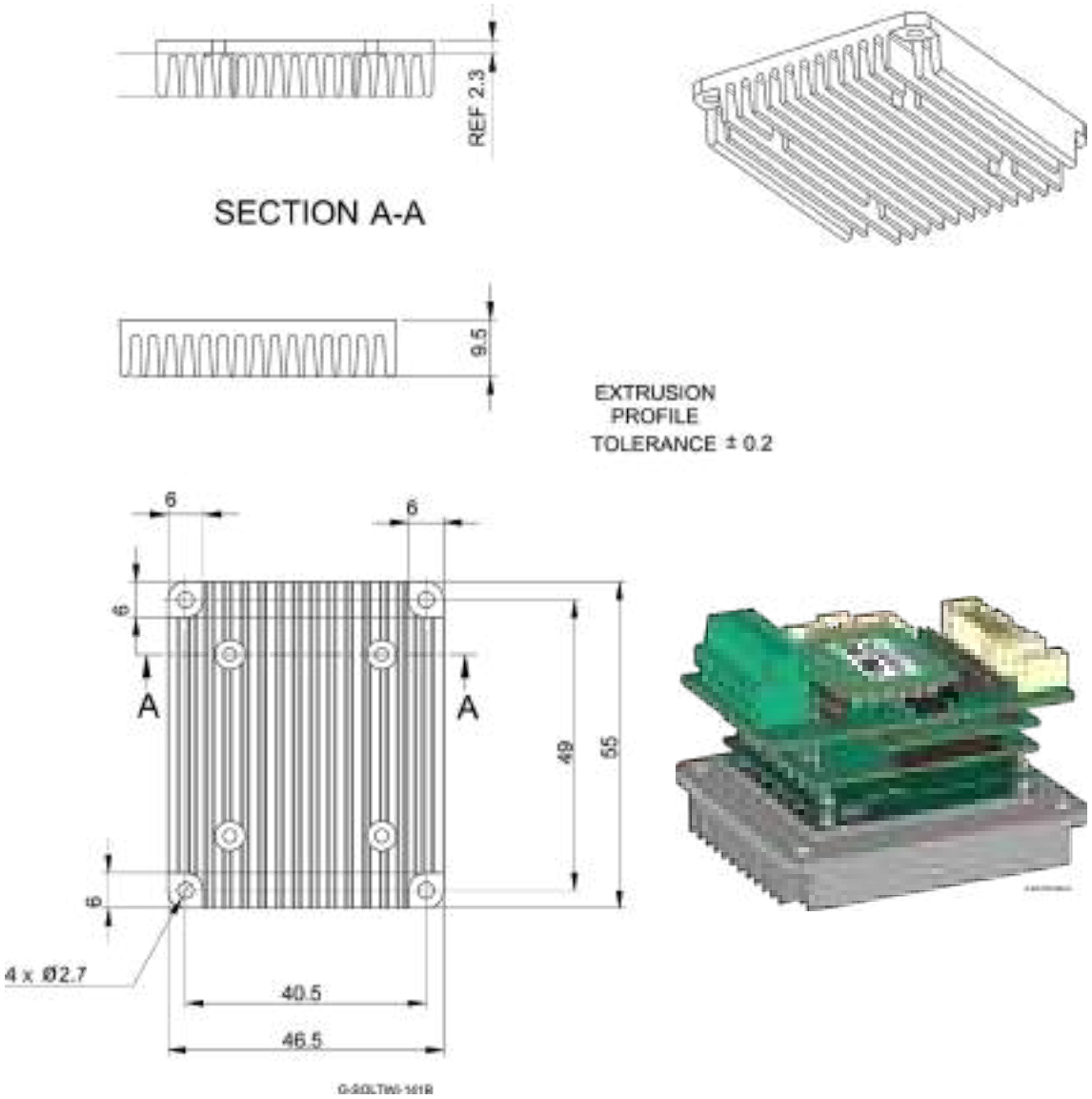
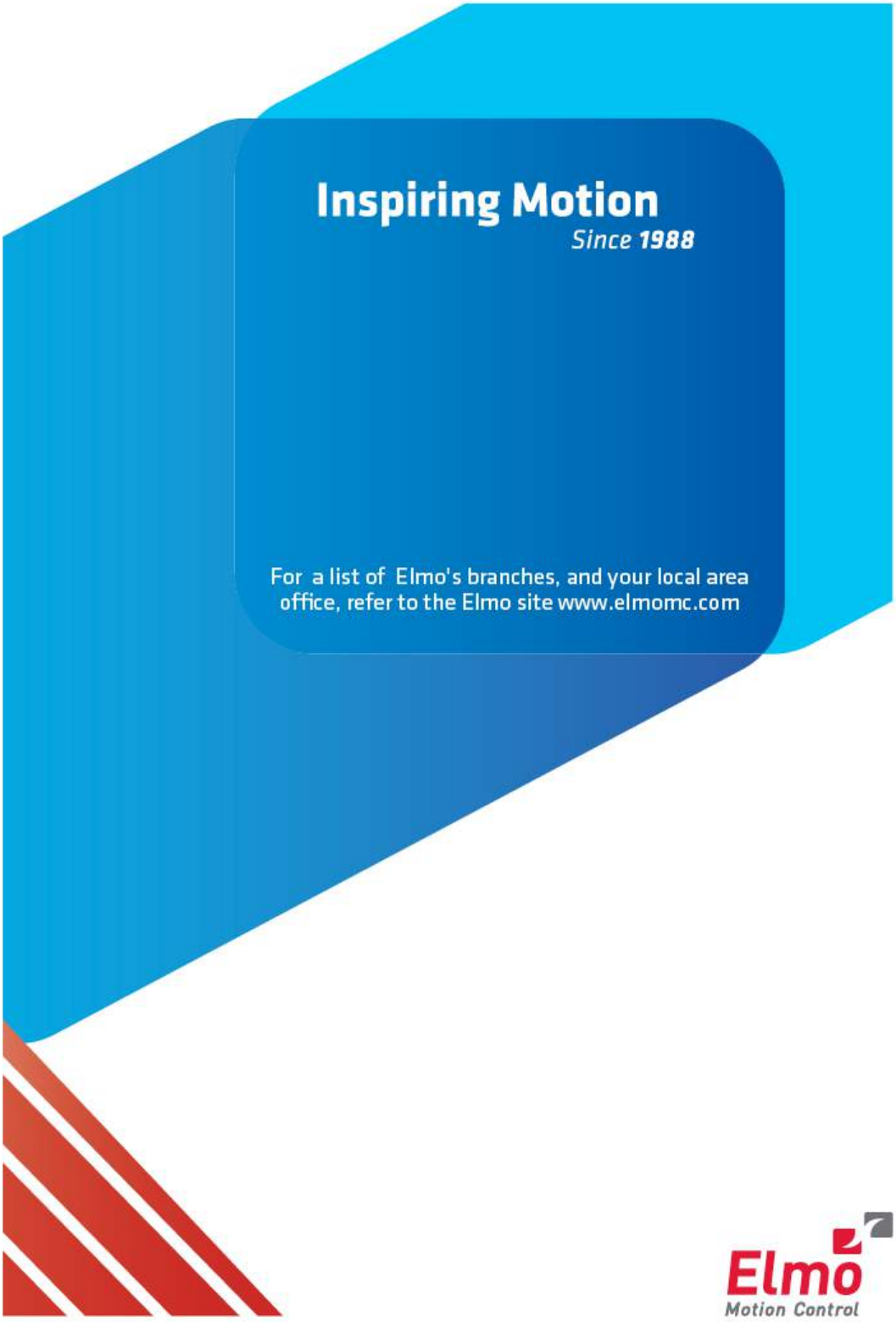


Figure 66: G-Solo Twitter – Fins Heat Sink (P/N G-TWIHSFINS01)


Inspiring Motion
Since 1988
For a list of Elmo's branches, and your local area office, refer to the Elmo site www.elmomc.com
Elmo
Motion Control