

Gold Solo Bee Digital Servo Drive Installation Guide



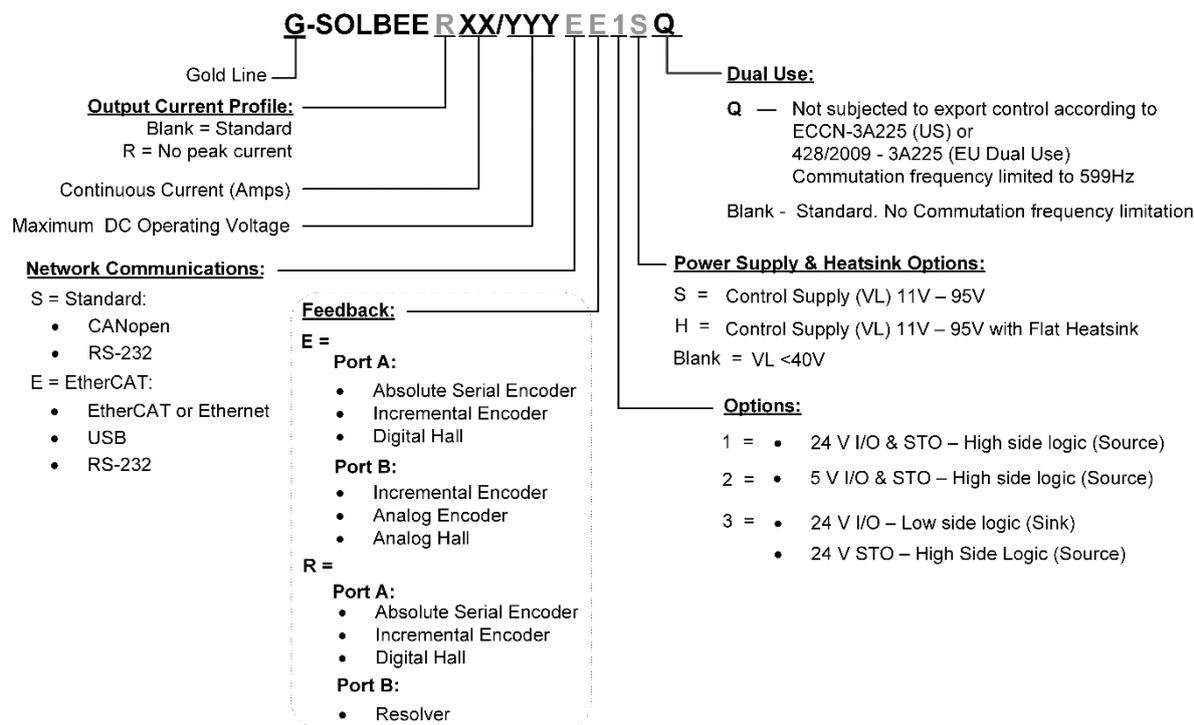
Notice

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 Bee 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-SOLBEE (Ver. 2.007)
 Copyright © 2023
 Elmo Motion Control Ltd.
 All rights reserved.

Catalog Number



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

Revision History

Version	Date
Ver. 1.000	June 2017
Ver. 1.001	May 2018
Ver. 1.002	Oct 2018
Ver. 2.000	Mar 2019
Ver. 2.001	June 2019
Ver. 2.002	June 2019
Ver. 2.003	Jan 2020
Ver. 2.004	Sept 2021
Ver. 2.005	Dec 2021
Ver. 2.006	Nov 2022
Ver. 2.007	Jan 2023

Chapter 1: This Installation Guide	7
Chapter 2: Safety Information	7
2.1. Warnings	8
2.2. Cautions.....	8
2.3. Warranty Information	8
Chapter 3: Product Description	9
Chapter 4: Technical Information.....	10
4.1. 60V and 100V Models Technical Data.....	10
4.2. 200V Models Technical Data	11
4.3. R Type Technical Data	11
4.4. Control Supply Input Voltage (VL).....	12
4.5. Product Features.....	13
4.6. Environmental Conditions.....	14
4.6.1. ExtriQ Conditions.....	14
4.6.2. ExtriQ Series Environmental Conditions for STO	15
Chapter 5: Standards and Certifications	16
5.1. Functional Safety.....	16
5.2. Electrical Safety	16
5.3. Electromagnetic Compatibility.....	16
5.4. Environmental	17
5.5. Other Compliant Standards.....	17
5.6. CE Declaration	17
5.7. Dual Use	17
Chapter 6: Installation.....	18
6.1. Unpacking the Drive Components	18
6.2. Mounting the Optional Accessories Heat Sinks	19
6.3. Mounting Gold Solo Bee to an External Heatsink.....	21
6.4. The Gold Solo Bee Connection Diagram.....	22
6.4.1. EtherCAT Connection Diagram.....	22
6.4.2. CAN Connection Diagram.....	23
Chapter 7: Wiring.....	24
7.1. Wiring Legend	24
7.2. Connector 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.....	30
8.1.2.1.	Main Power	30
8.1.2.2.	Wiring Technical Details	30
8.1.3.	Control Supply (J10)	31
8.1.4.	Control Supply Connections for Power Supply & Heatsink Option: (Blank)33	
8.1.4.1.	Dual Power Supply.....	33
8.1.4.2.	Single Power Supply (VP+ < 40VDC).....	35
8.1.5.	Control Supply Connections for Power Supply & Heatsink Option: S or H36	
8.1.5.1.	Dual Power Supply.....	36
8.1.5.2.	Single Power Supply (VP+ < 95VDC).....	38
8.2.	Drive Status Indicator.....	39
8.3.	J10 VL and Feedback Connector.....	40
8.3.1.	Port A.....	43
8.3.1.1.	Incremental Encoder	43
8.3.1.2.	Absolute Serial Encoder	44
8.3.1.3.	Hall Sensors	45
8.3.2.	Port B.....	46
8.3.2.1.	Incremental Encoder	46
8.3.2.2.	Interpolated Analog Encoder	46
8.3.2.3.	Resolver	47
8.3.3.	Port C – Emulated Encoder Output (J10)	48
8.4.	J11 I/O and Communication Connector.....	49
8.4.1.	Digital Inputs	52
8.4.1.1.	Source PLC Voltage Level Digital Input.....	52
8.4.1.2.	Sink PLC Voltage Level Digital Input	54

8.4.1.3.	Source 5V Logic Level Digital Input	56
8.4.2.	Digital Outputs.....	58
8.4.2.1.	Source PLC Voltage Level Digital Output.....	58
8.4.2.2.	Sink PLC Voltage Level Digital Output	60
8.4.2.3.	Digital Outputs Source 5V Logic Mode.....	62
8.4.3.	STO (Safe Torque Off).....	64
8.4.4.	Analog Input	64
8.4.5.	Standard RS-232	65
8.4.6.	USB 2.0 Communication (Only for EtherCAT version).....	65
8.5.	EtherCAT Communications Version	66
8.5.1.	EtherCAT IN/Ethernet Connector (J17)	66
8.5.2.	EtherCAT OUT Connector (J18)	67
8.5.3.	EtherCAT Schematic Connections	68
8.5.3.1.	EtherCAT Communication	68
8.5.3.2.	EtherCAT Status Indicator (D2).....	69
8.5.3.3.	EtherCAT Link Indicators (D3, D4)	69
8.6.	CAN Communications Version	70
8.6.1.	CAN IN Connector (J17)	70
8.6.2.	CAN OUT Connector (J18)	71
8.6.3.	CAN Schematic Connections	72
8.6.3.1.	Interface	72
8.6.3.2.	CAN Network Topology	73
Chapter 9: Powering Up.....		74
9.1.	Initializing the System	74
9.2.	Heat Dissipation	74
9.2.1.	Heat Dissipation Data.....	74
9.2.2.	How to Use the Chart	76
Chapter 10: Dimensions, Physical Specifications.....		77
10.1.	EtherCAT without Heatsink.....	77
10.2.	EtherCAT with Heatsink.....	78
10.3.	CAN without Heatsink	79
10.4.	CAN with Heatsink.....	80
Chapter 11: Accessories.....		81
11.1.	Accessories Heat Sink Dimensions	83



Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Solo Bee. 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 Bee, 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 Bee 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 Bee 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 Bee 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 Bee 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 Bee, 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 Bee is a “ready to use Gold Bee”, 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 cc (1.87 in³) 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 Bee.

The Gold Solo Bee, 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.

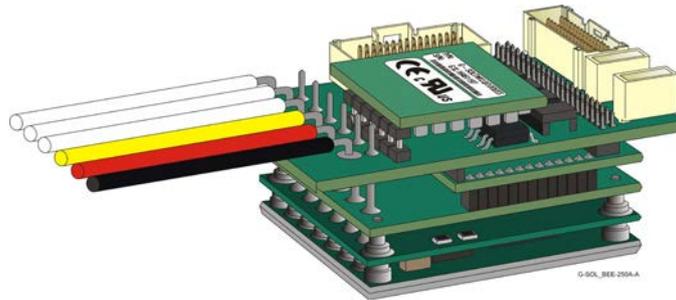


Figure 1: Gold Solo Bee with Wired Power Connection

Power to the Gold Solo Bee is provided by a DC power source which is isolated from the Mains. The Gold Solo Bee 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 Bee 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 heat sinks.



Chapter 4: Technical Information

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

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						
I _c , Amplitude sinusoidal/DC continuous current	A	30	1	3	6	10	15	25
Sinusoidal continuous RMS current limit (I _c)	A	21	0.7	2.1	4.2	7.1	10	17.7
Peak current limit	A	2 x I _c						

Table 1: 60V and 100V Models Technical Data



4.2. 200V Models Technical Data

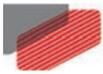
Feature	Units	3/200	6/200	10/200
Minimum supply voltage	VDC	20		
Nominal supply voltage	VDC	170		
Maximum supply voltage	VDC	195		
Maximum continuous power output	W	485	975	1650
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		Up to 96% of DC bus voltage		
I _c , Amplitude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

Table 2: 200V Models Technical Data

4.3. R Type Technical Data

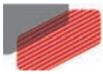
Feature	Units	R50/60	R80/80	R50/100	R70/100	R45/150	R15/200	R35/200
Minimum supply voltage	VDC	8	10	10	10	12	20	20
Nominal supply voltage	VDC	48	65	85	85	115	170	170
Maximum supply voltage	VDC	55	75	95	95	135	195	195
Maximum continuous Electrical power output	kW	2.3	5	4.0	5.6	5	2.5	5.6
Efficiency at 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	35
Sinusoidal continuous RMS current limit (I _c)	A	35.3	56.5	35.3	49.5	32	10.6	24.7

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	12 – 40
Input range for Power Supply & Heatsink Option: S or H	V	12 – 95
24V Control supply input power consumption with encoder up to 200mA@5V	W	<2.5
ETHERCAT		
Input range for Power Supply & Heatsink Option: (Blank)	V	14 – 40
Input range for Power Supply & Heatsink Option: S or H	V	12 – 95
24V Control supply input power consumption with encoder up to 200mA@5V	W	<4



4.5. Product Features

Main Feature	Details	Presence / No.
STO	+5V Logic, Opto isolated from the Control section, <i>or</i>	√
	PLC Source, Opto isolated from the Control section	√
Digital Input	+5V Logic, Opto isolated from the Control section <i>or</i>	6
	PLC Source, Opto isolated from the Control section <i>or</i>	6
	PLC Sink Opto isolated from the Control section	6
Digital Output	+5V Logic, Opto isolated from the Control section <i>or</i>	4
	PLC Source, Opto isolated from the Control section <i>or</i>	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 <i>or</i>	√
	CAN	√
	Standard RS232	√



4.6. Environmental Conditions

You can guarantee the safe operation of the Gold Solo Bee by ensuring that it is installed in an appropriate environment. Section 4.6.1 describes the extended environmental conditions. However, the Functional Safety of the ExtriQ series servo drives is certified according to the environmental conditions in section 4.6.2.



Warning: During operation the Gold Solo Bee 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 Bee dissipates its heat by convection or by conduction. The maximum ambient operating temperature of 70 °C (158 °F) must not be exceeded.

4.6.1. ExtriQ Conditions

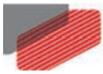
Feature	Operation Conditions	Range
Ambient Temperature Range		-40 °C to +70 °C (-40 °F to +158 °F)
Storage temperature		-40 °C to +85 °C (-40 °F to +185 °F)
Altitude	Non-operating conditions	Unlimited
	Operating conditions	-400 m to 12,000 m (-1312 to 39370 feet)
Maximum Humidity	Non-operating conditions	Up to 95% relative humidity non-condensing at 35 °C (95 °F)
	Operating conditions	Up to 95% relative humidity non-condensing at 25 °C (77 °F), up to 90% relative humidity non-condensing at 42 °C (108 °F)
Vibration	Operating conditions	20 Hz to 2,000 Hz, 14.6 g
Mechanical Shock	Non-operating conditions	±40g; Half sine, 11 msec
	Operating conditions	±20g; Half sine, 11 msec
Protection level		IP00



4.6.2. ExtriQ Series Environmental Conditions for STO

The ExtriQ series of drives with STO support the following extended environmental conditions.

Feature	Details
Operating ambient temperature	0 °C to +50 °C (32 °F to +122 °F)
Storage temperature	-40 °C to +85 °C (-40 °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 and Certifications

5.1. Functional Safety

Standard	Item
IEC 61800-5-2:2017	Adjustable speed electrical power drive systems – Safety requirements – Functional
EN ISO 13849-1:2015	Safety of machinery — Safety-related parts of control systems.
EN 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems

5.2. Electrical Safety

Specification	Details
Recognized UL 61800-5-1	Adjustable speed electrical power drive systems: Safety requirements – Electrical, thermal and energy
CSA C22.2 NO. 274-17	Adjustable speed drives

5.3. Electromagnetic Compatibility

Specification	Details
EN 61800-3:2004/A1:2011	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
EN 61800-5-2: 2017 Annex E	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional



5.4. Environmental

Specification	Details
IEC60068-2-78	Damp heat, steady state
IEC60068-2-6	Vibration (sinusoidal)
IEC60068-2-2	Dry heat
IEC60068-2-27	Shock

5.5. Other Compliant Standards

For other compliant standards refer to the

[MAN-G-Board Level Modules Hardware Manual section 17.7](#) or refer to the Elmo website:

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

5.6. 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.

5.7. Dual Use

No export license is required for the Gold Line products signified with the suffix Q in the Part Number.

The operating frequency of the Gold Line products is “factory limited” to ≤ 599 Hz, and therefore complies with the EU Dual Use Regulation 428/2009, 3A225, and the US Dual Use regulation EAR ECCN# 3A225.

This statement applies to all identical specimens and will become invalid if a change is made in the firmware.



Chapter 6: Installation

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

6.1. Unpacking the Drive Components

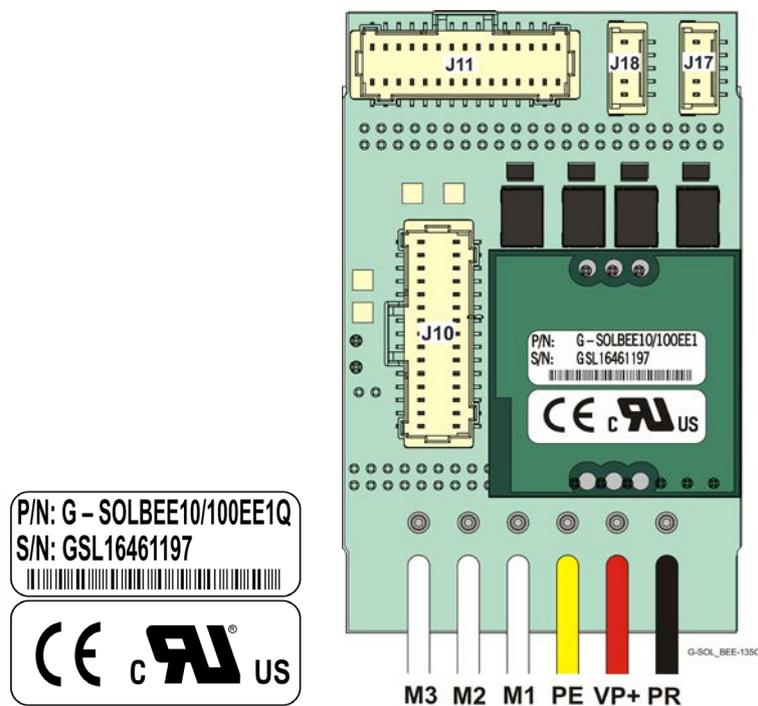
Before you begin working with the Gold Solo Bee, verify that you have all of its components, as follows:

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

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

To unpack the Gold Solo Bee:

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 Bee you have unpacked is the appropriate type for your requirements, locate the part number sticker on the top of the Gold Solo Bee. It looks like this:



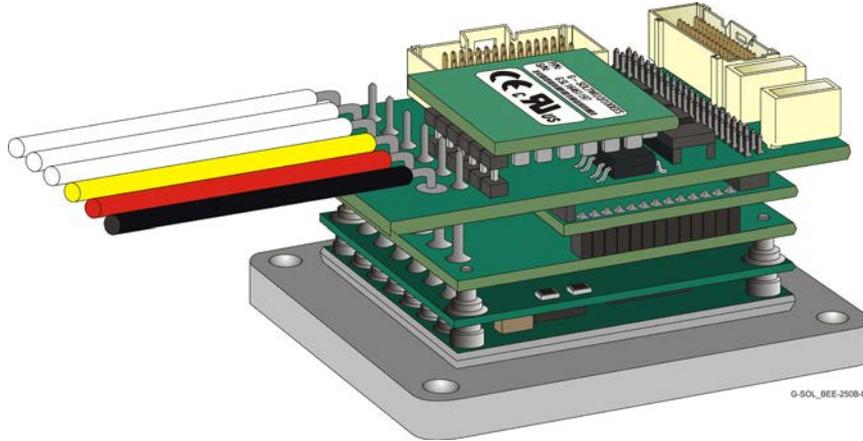
4. Verify that the Gold Solo Bee type is the one that you ordered, and ensure that the voltage meets your specific requirements.

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.

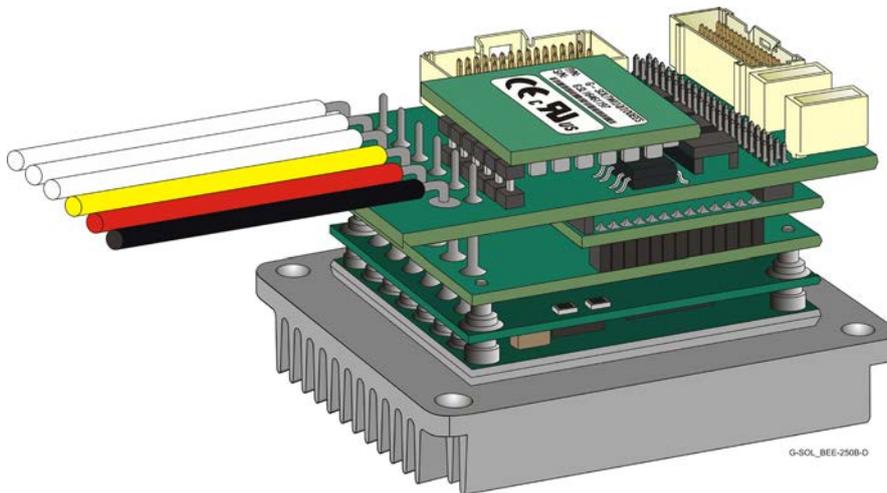


6.2. Mounting the Optional Accessories Heat Sinks

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 Bee.

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 Bee.
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.

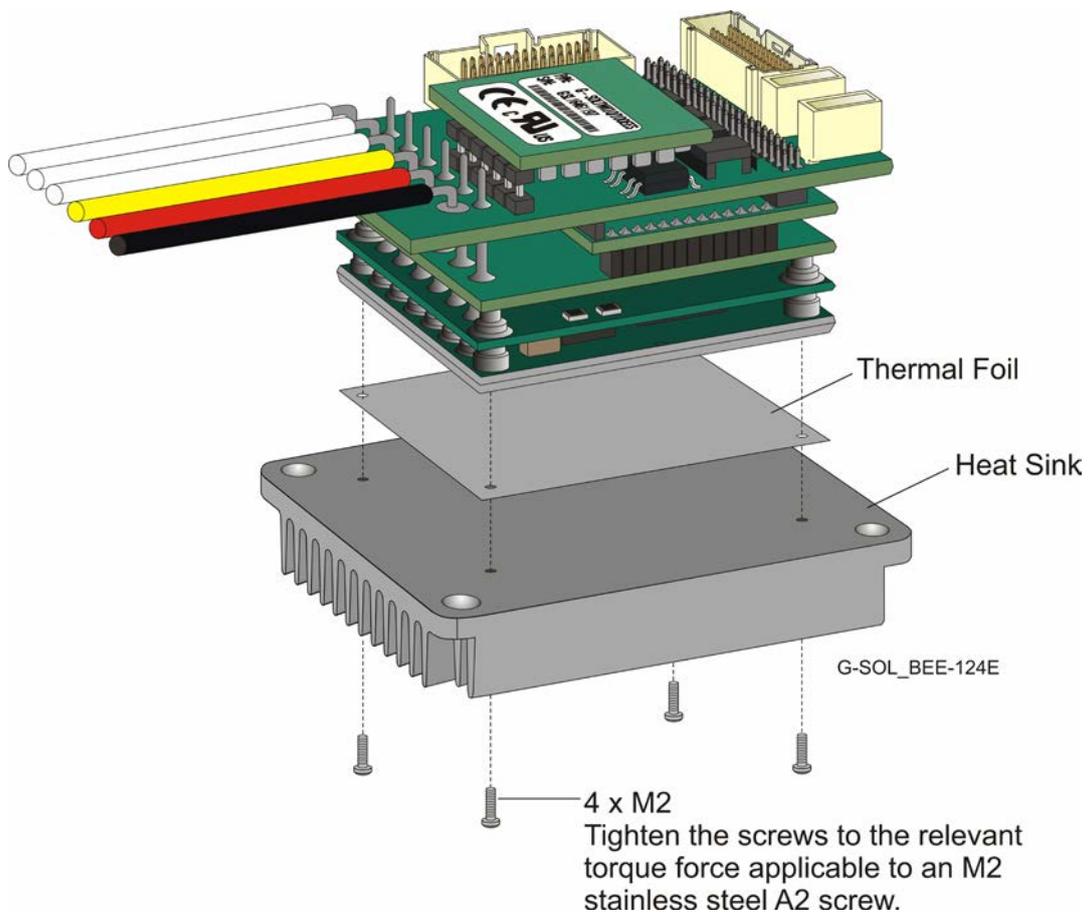


Figure 2: Mount the Heat Sink and Thermal Foil to the Gold Solo Bee



6.3. Mounting Gold Solo Bee 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 Bee.

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

1. Mount the heat sink under the base of the Gold Solo Bee.
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.

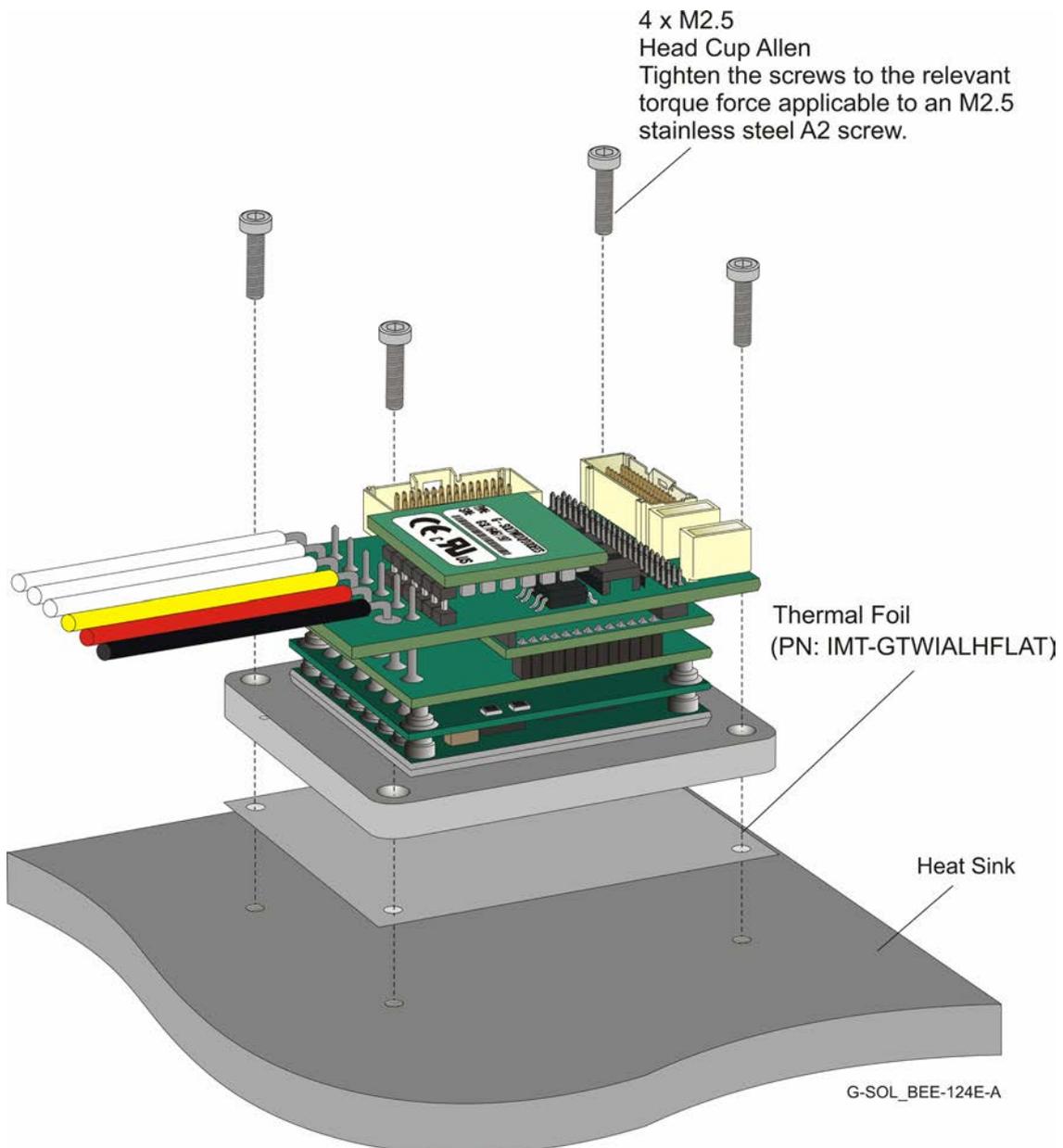
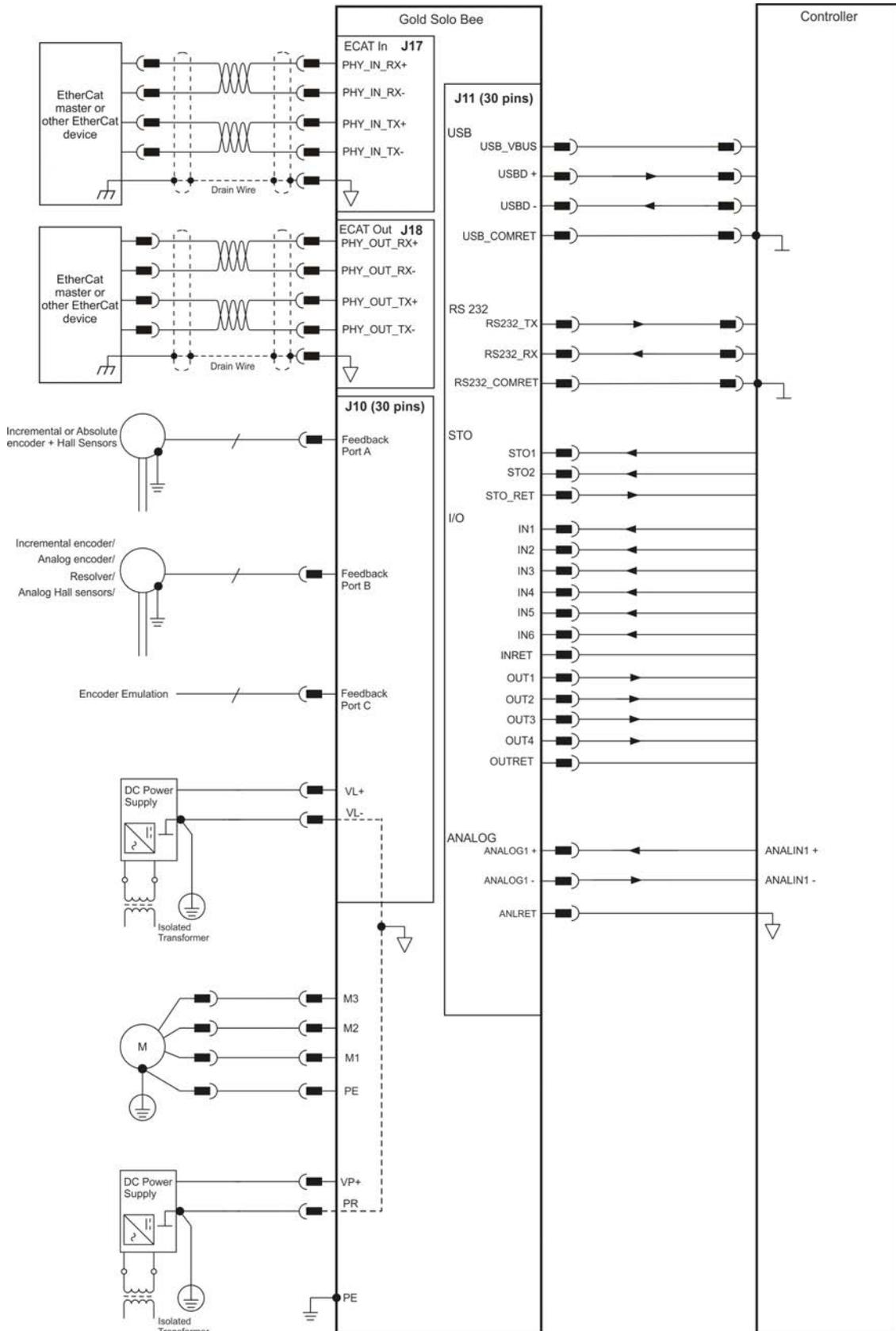


Figure 3: Mounting the Heat Sink and Thermal Foil to the Gold Solo Bee



6.4. The Gold Solo Bee Connection Diagrams

6.4.1. EtherCAT Connection Diagram

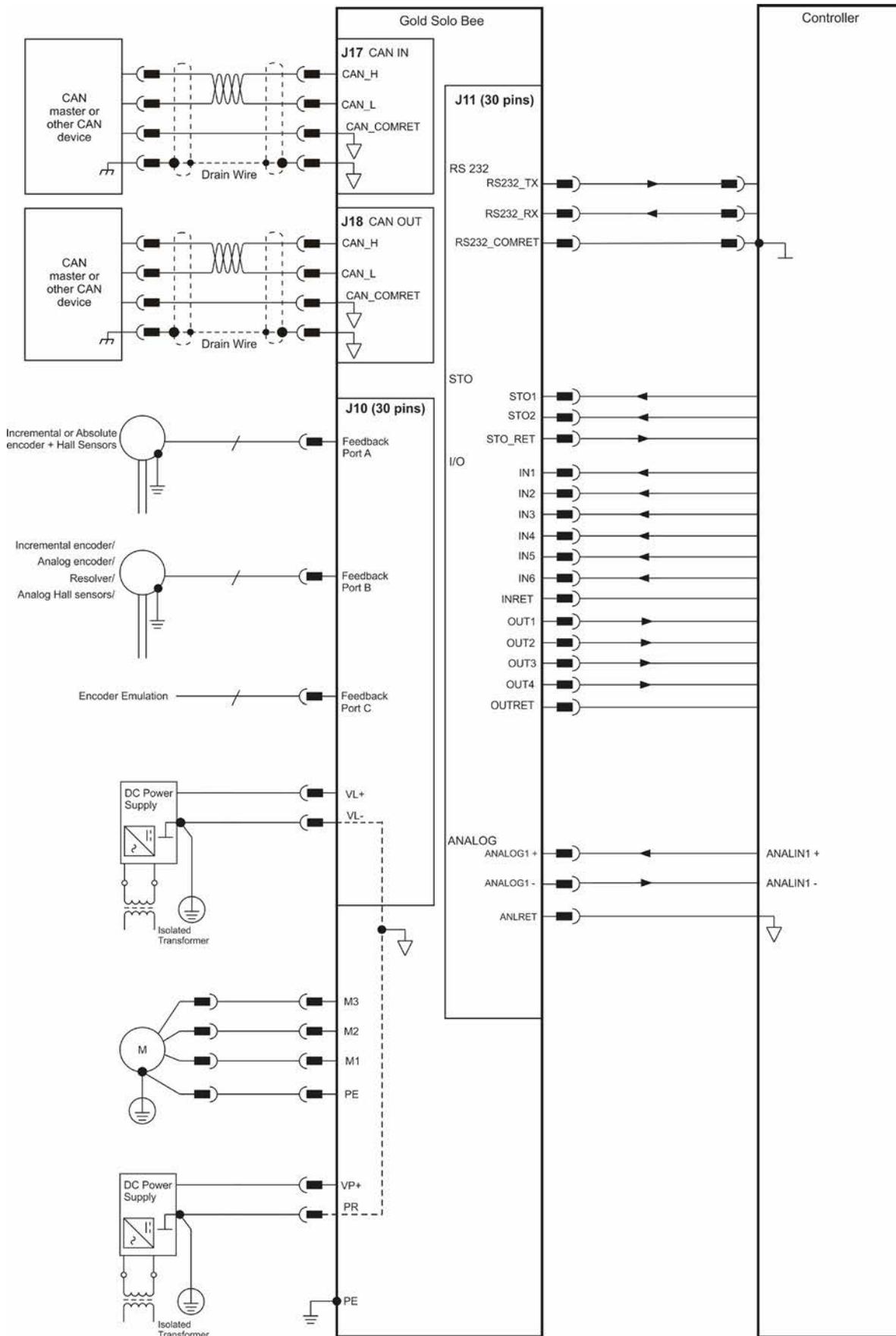


G-SOL_BEE-001G

Figure 4: The Gold Solo Bee EtherCAT Connection Diagram



6.4.2. CAN Connection Diagram



G-SOL_BEE_CAN-F

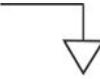
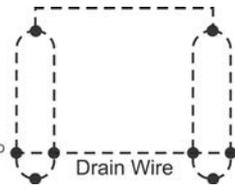
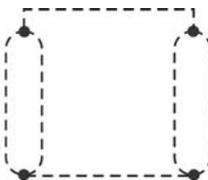
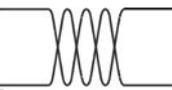
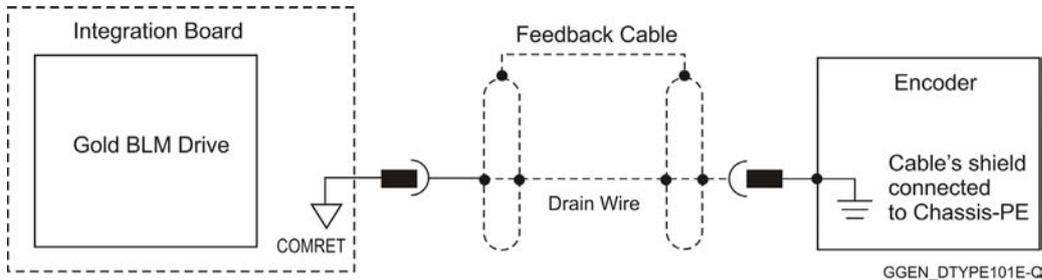
Figure 5: The Gold Solo Bee CAN Connection Diagram



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	Protective 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
 GGEN_DTYPE101E-G	
<p>Encoder Earthing.</p> <p>The cable's shield is connected to the chassis (PE) in the connector.</p> <p>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.</p>	



7.2. Connector Types

The Gold Solo Bee has five connectors:

Connector	Connector Type
Power	Wires
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
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

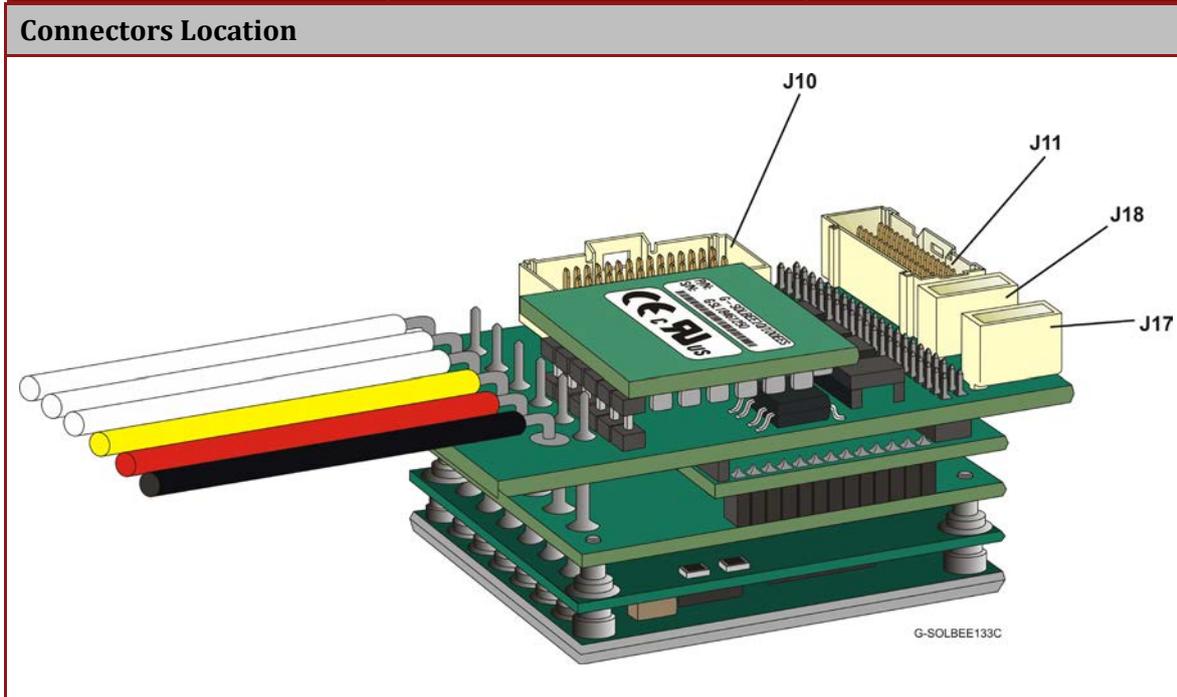


Table 4: Connector Types



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/Bee Cable Kit (MAN-G-SOLTWI-CBLKIT)).

7.4.4. COMRET to PE Connection

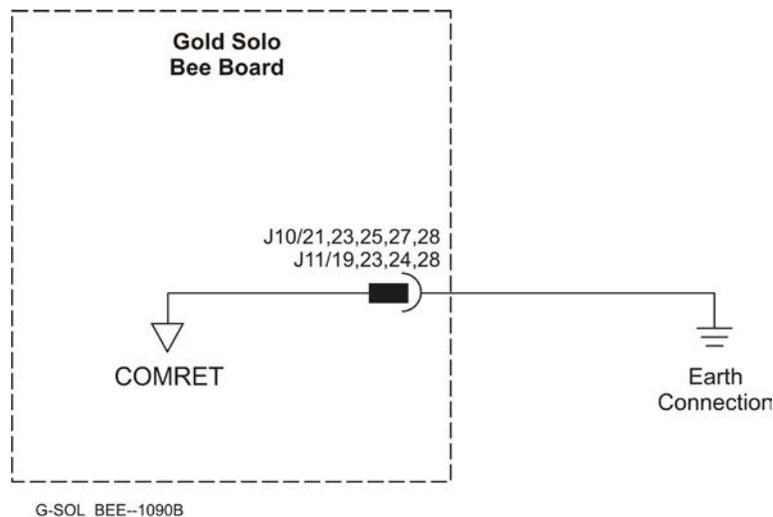


Figure 6: COMRET Connection to the PE

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

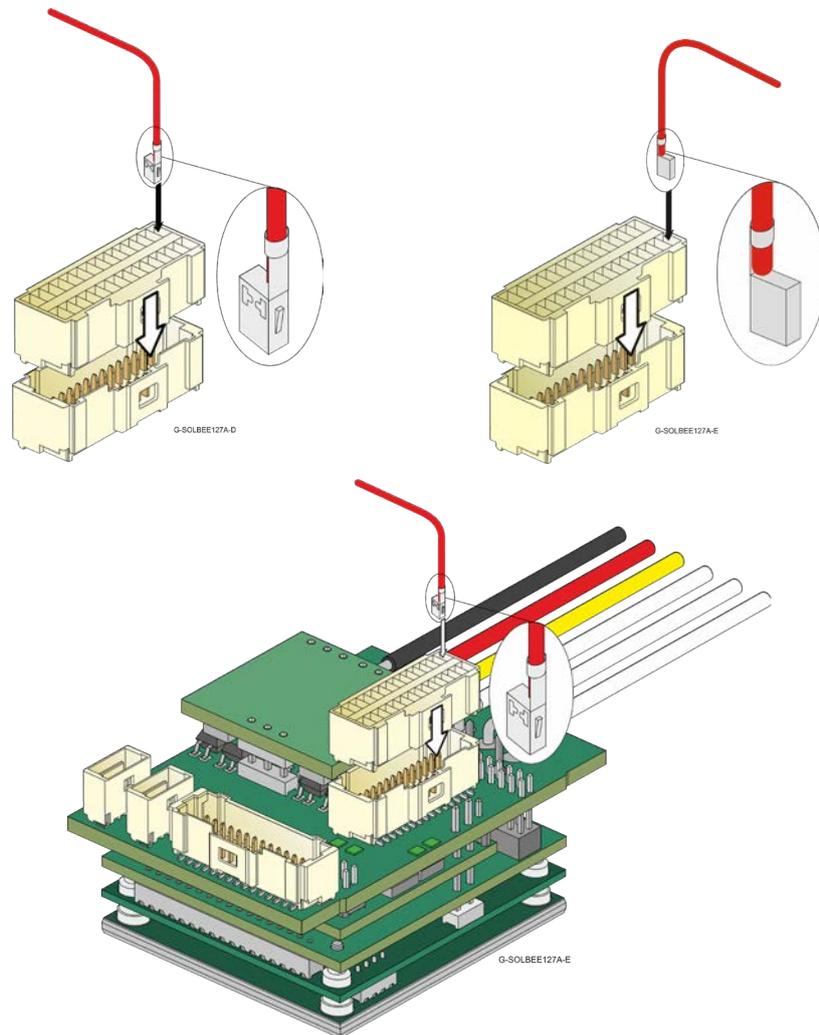


Figure 7: Inserting a wire/pin to the Female Connector

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, Motor and Main Power interface, and Motor Power connections.

The current carrying capacity of the Solo board wires is up to 80A (57A RMS).

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-SOL_BEE-125A-C

Table 5: Motor Wires or Connector

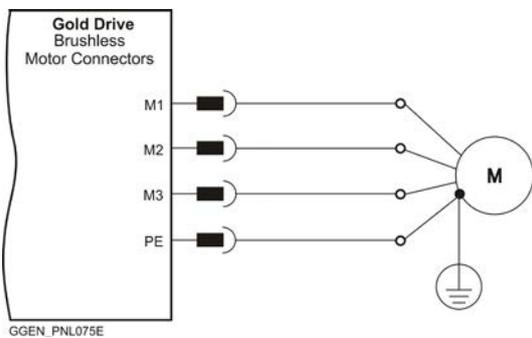


Figure 8: Brushless Motor Power Connection Diagram

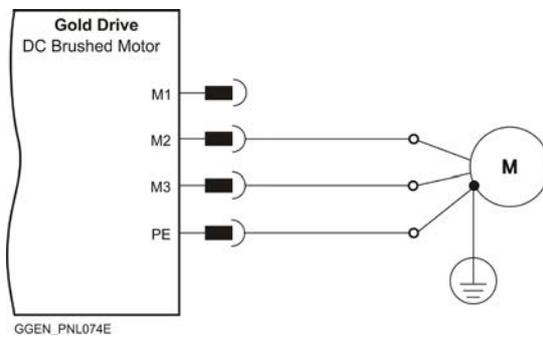


Figure 9: Brushed Motor Power Connection Diagram



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 Bee.

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.

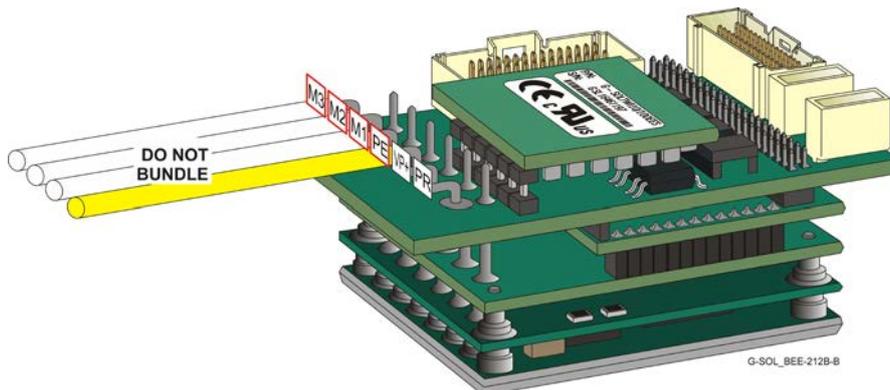


Figure 10: Connecting the Motor Power Wires

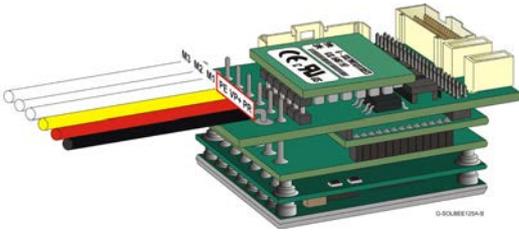


8.1.2. Main Power Wires

This section describes the Main Power.

8.1.2.1. Main Power

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

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

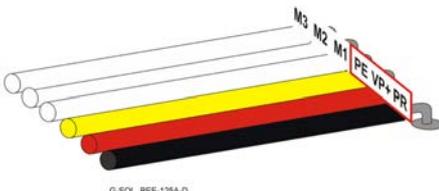


Table 6: Connector or Wires for Main Power

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

To connect the Gold Solo Bee 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.

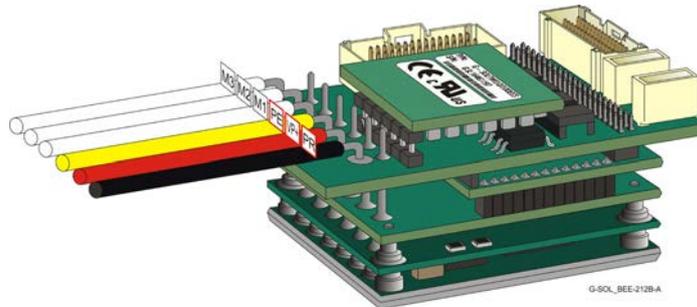


Figure 11: Connecting the Main Power Wires

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 six 14-AWG, silicon insulated, 300mm length colored high quality, power connection wires are rated to operate up to 200°C:

The Gold Solo Bee 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 Bee 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	
<p>1. Standard CAN (Power Supply & Heatsink Option: (Blank)) Input range: 12 – 40VDC Power consumption: <2.5W (including up to 200mA@5V for encoder)</p> <p>2. EtherCAT (Power Supply & Heatsink Option: (Blank)) Input range: 14 – 40VDC Power consumption: <4W (including up to 200mA@5V for encoder)</p> <p>3. Standard CAN (Power Supply & Heatsink Option: S or H) Input range: 12 – 95VDC Power consumption: <2.5W (including up to 200mA@5V for encoder)</p> <p>4. EtherCAT (Power Supply & Heatsink Option: S or H) Input range: 12 – 95VDC Power consumption: <4W (including up to 200mA@5V for encoder)</p>			

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.

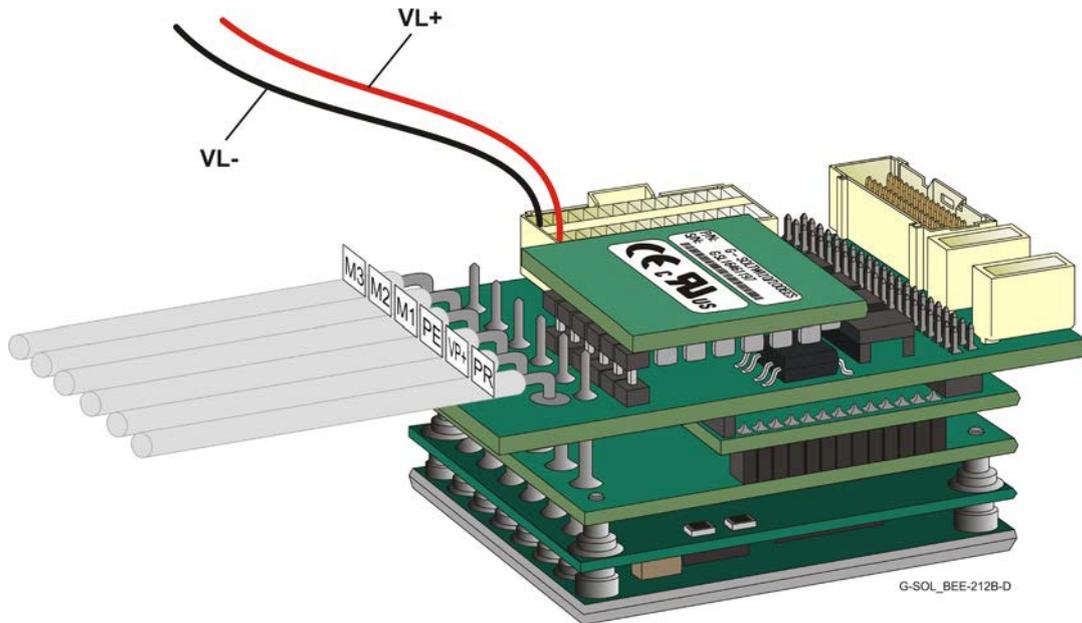


Figure 12: Connecting the Control Supply Wires

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

For VL 12 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 12 to 40VDC

For VL 12 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 Bee.

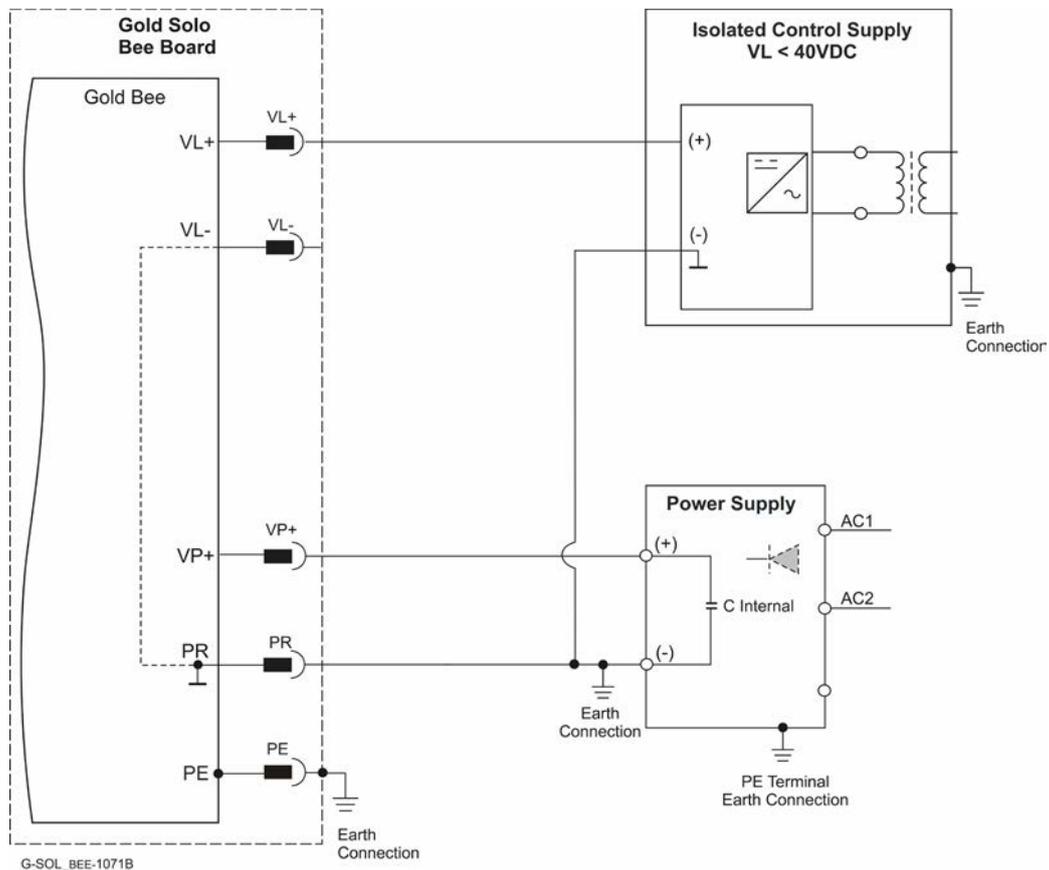


Figure 13: Separate VP and VL Power Supplies Connection Diagram –Highly Recommended

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).

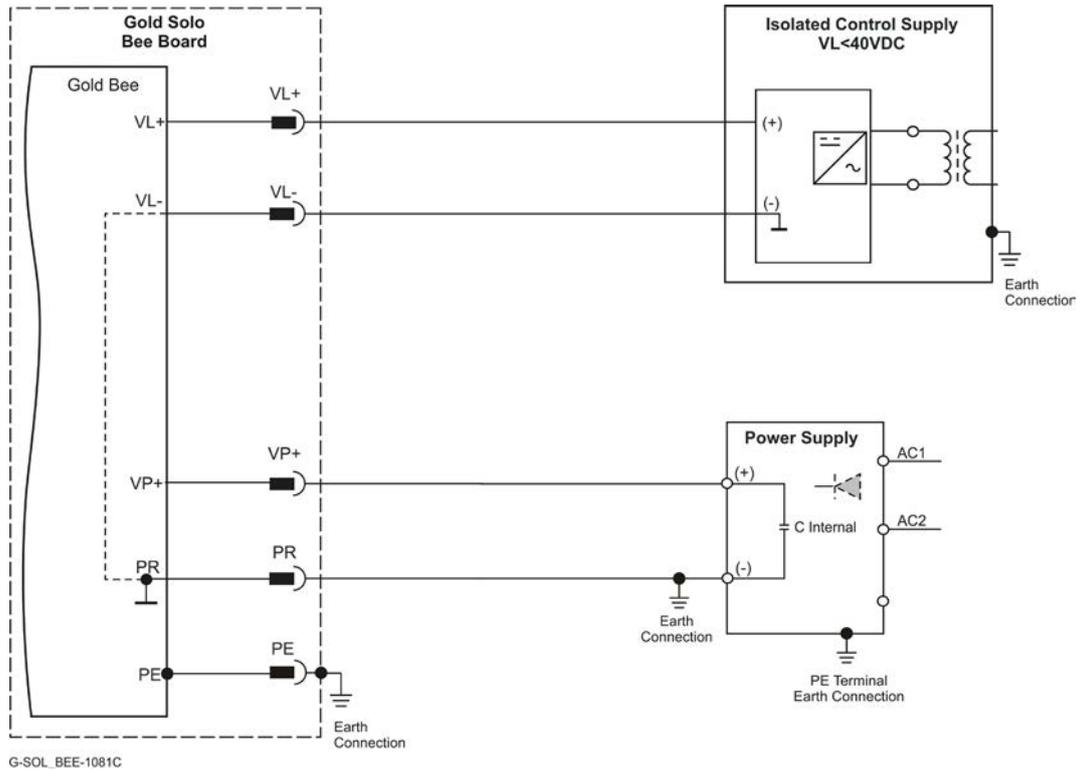


Figure 14: Separate VP and VL Power Supplies Connection Diagram - Alternative

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

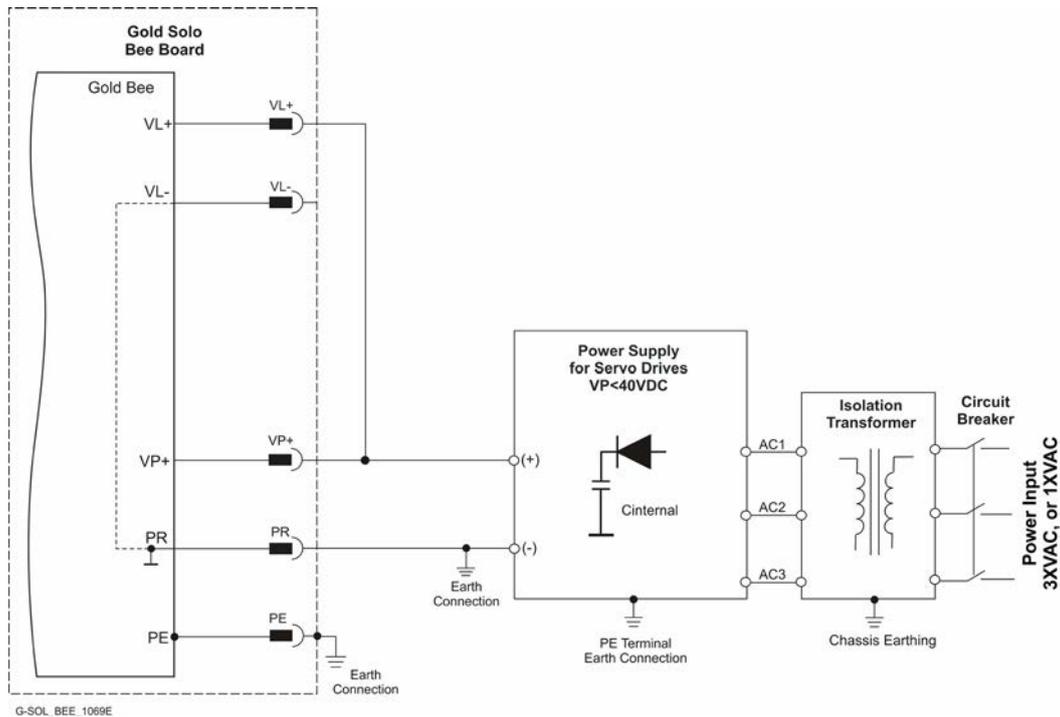


Figure 15: Single Power Supply (VP+ <40V) Connection Diagram

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 12 to 95VDC.

For VL 12 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 Bee.

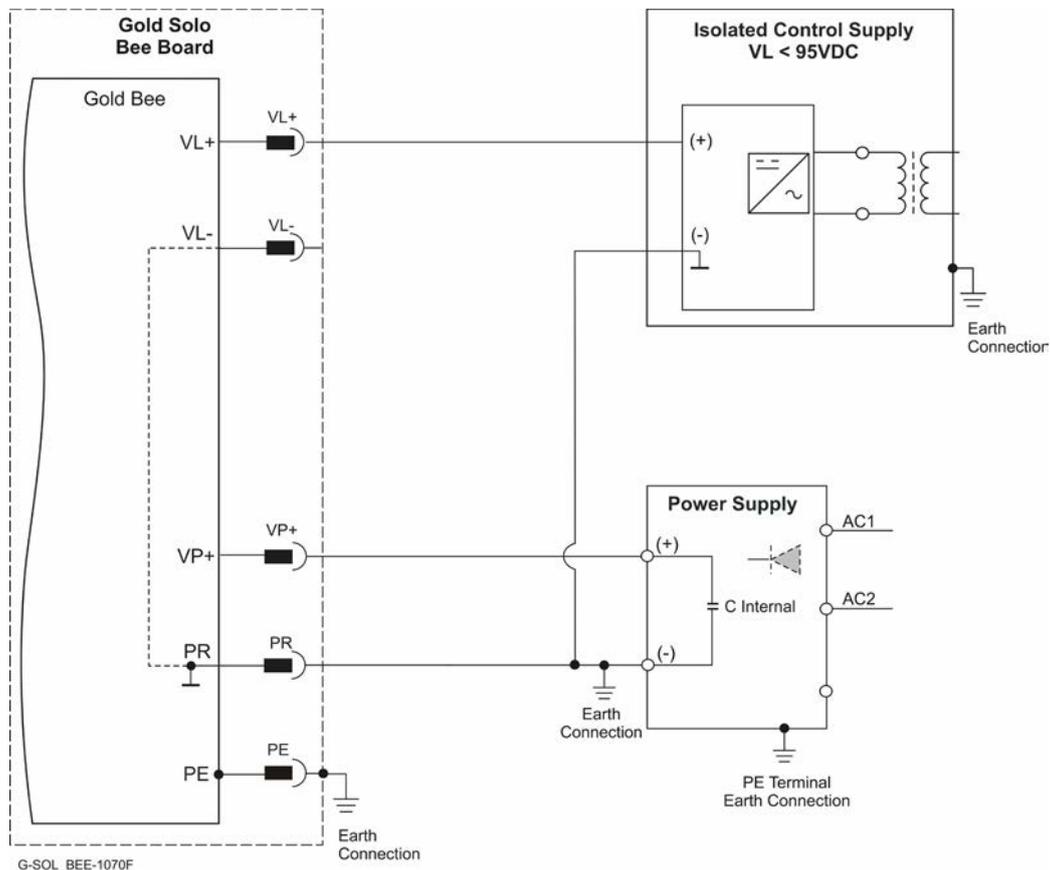


Figure 16: Separate VP and VL Power Supplies Connection Diagram –Highly Recommended

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).

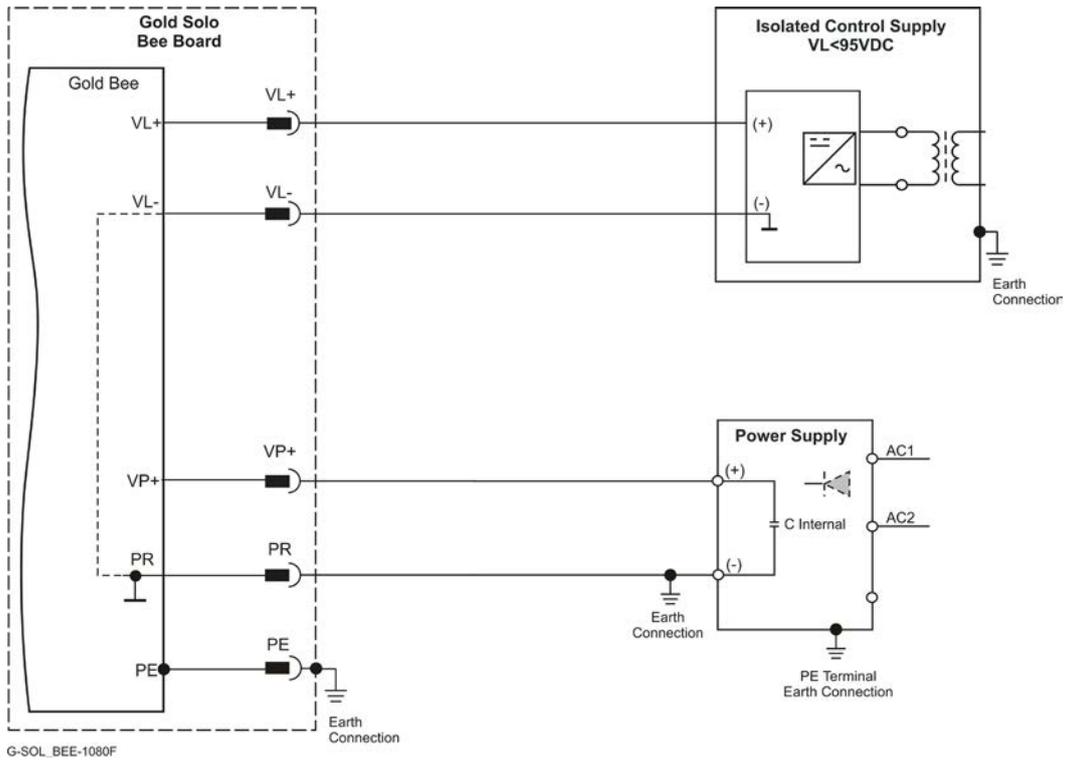


Figure 17: Separate VP and VL Power Supplies Connection Diagram - Alternative

The (-) of the control power supply is connected to the VL- of the Gold Solo Bee (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 12 to 95VDC.

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

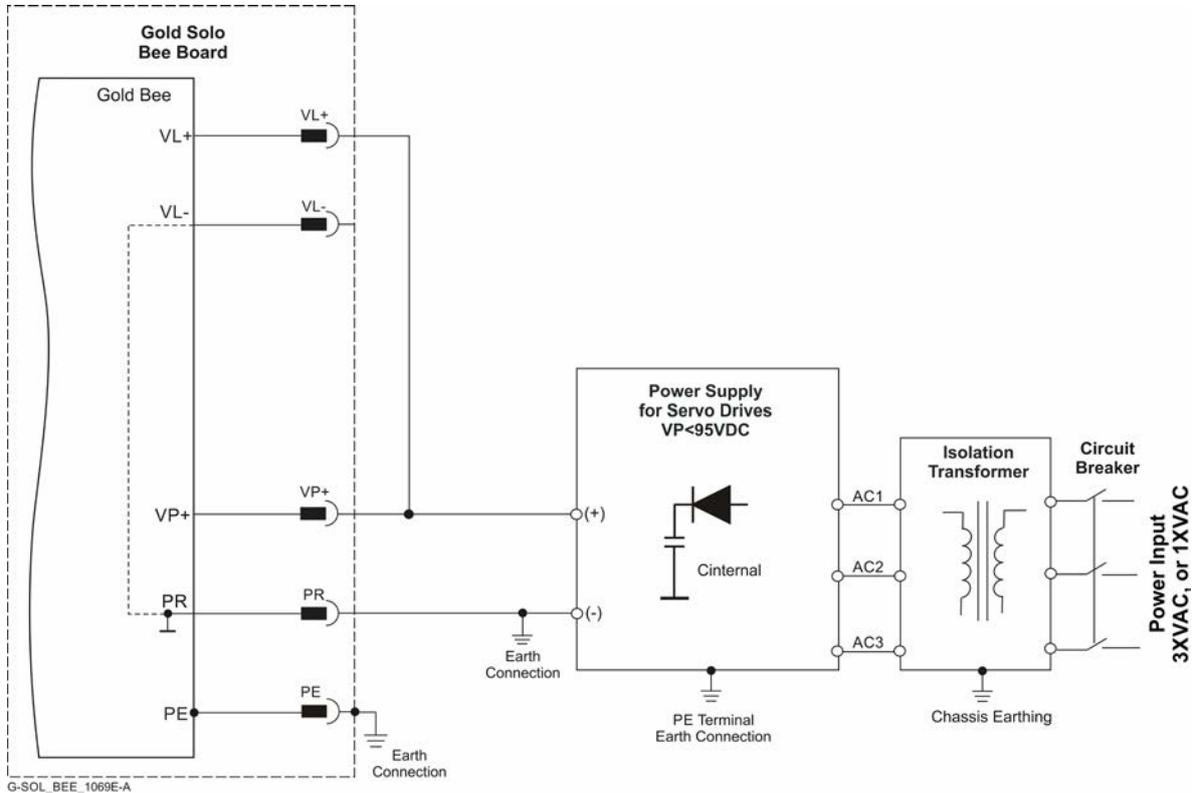


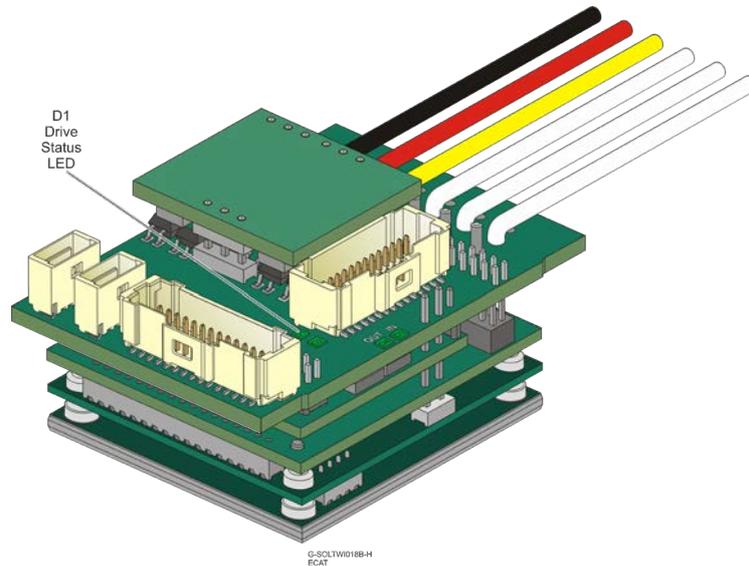
Figure 18: Single Power Supply (VP+ <95V) Connection Diagram

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

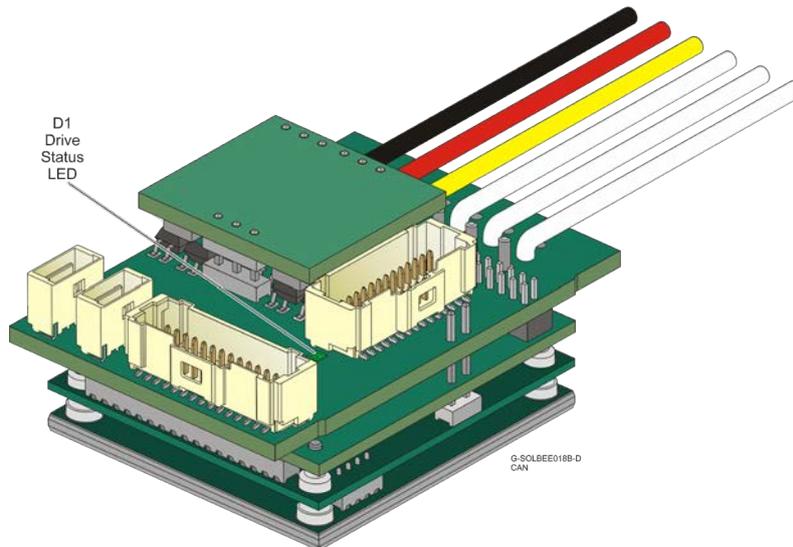


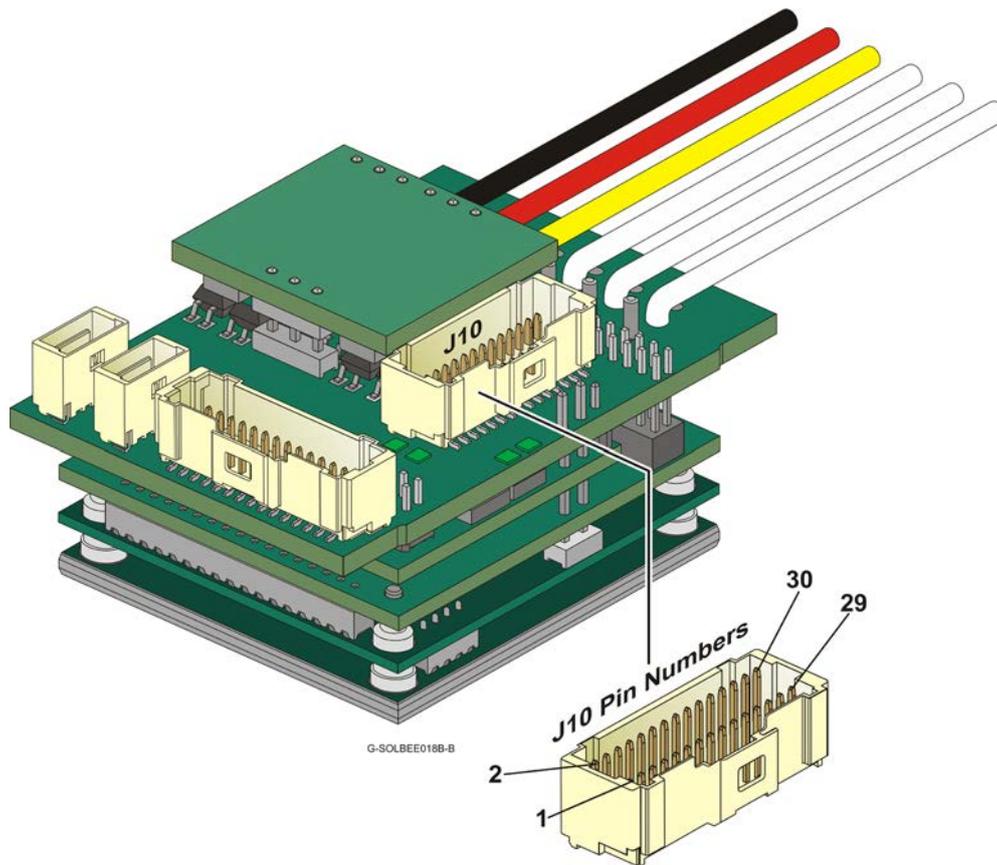
Figure 19: Drive Status Indicator - CAN

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 -
8	PortB_ENC_B+	Port B Channel B+
9	PortA_ENC_INDEX+	Index+



Pin J10	Signal	Function
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 and 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 and 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

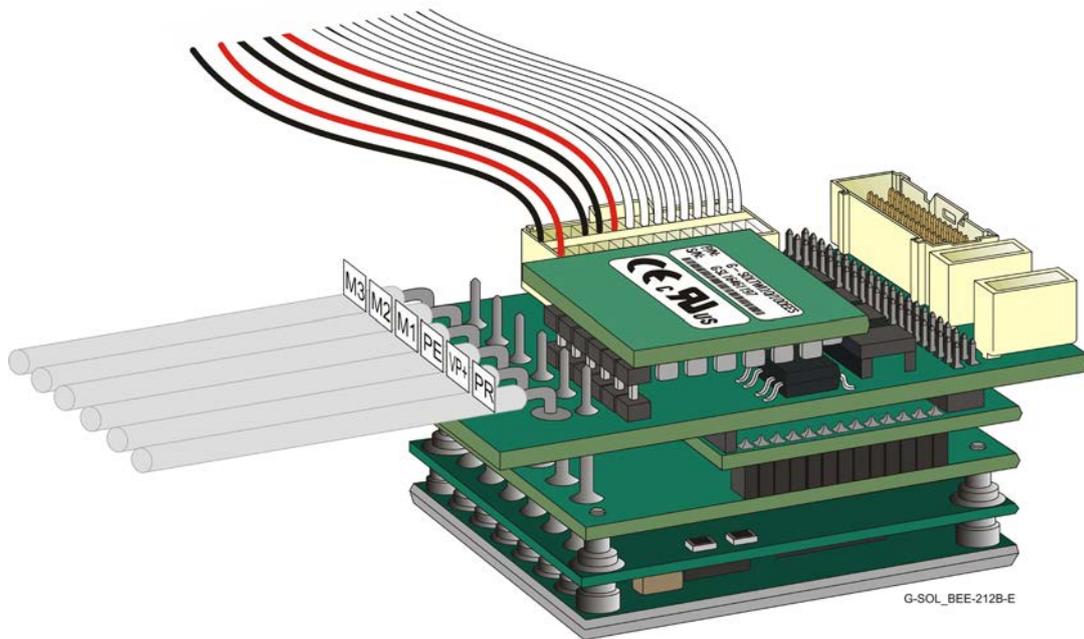


Figure 20: Connecting the Feedback Wires

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

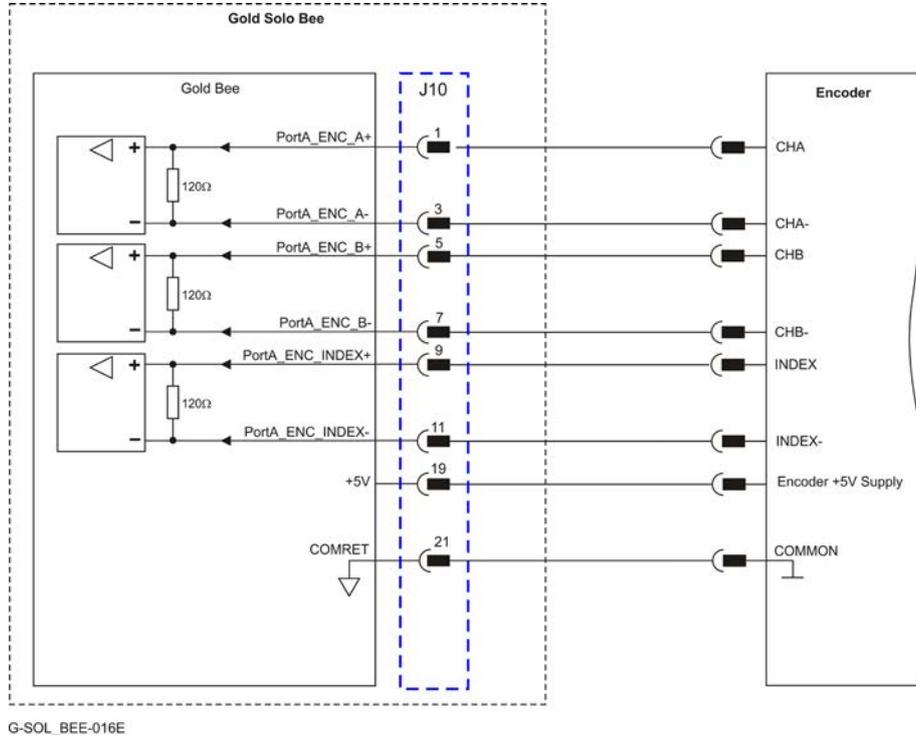


Figure 21: Port A Incremental Encoder Input – Recommended Connection Diagram

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

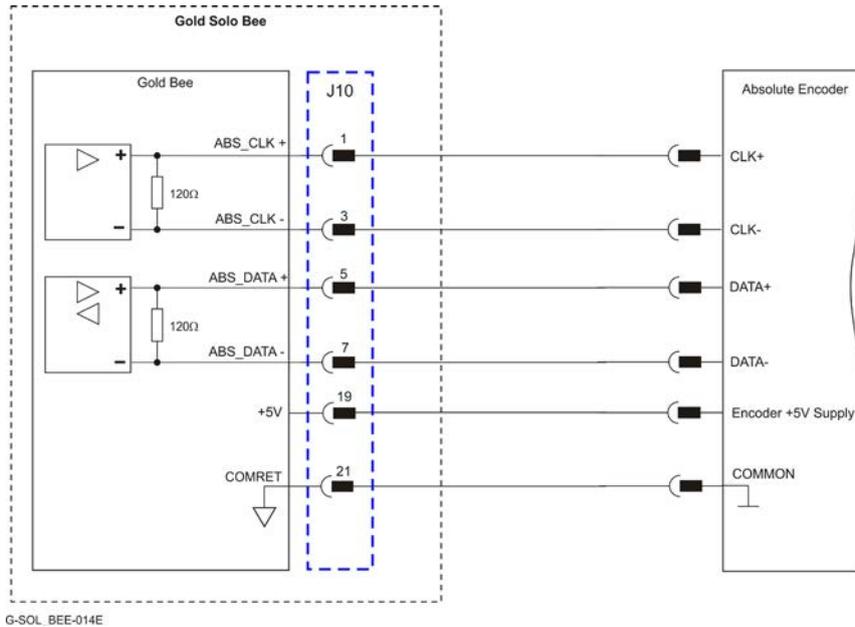


Figure 22: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data/Clock (e.g., Biss / SSI / EnDAT, etc.)

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.

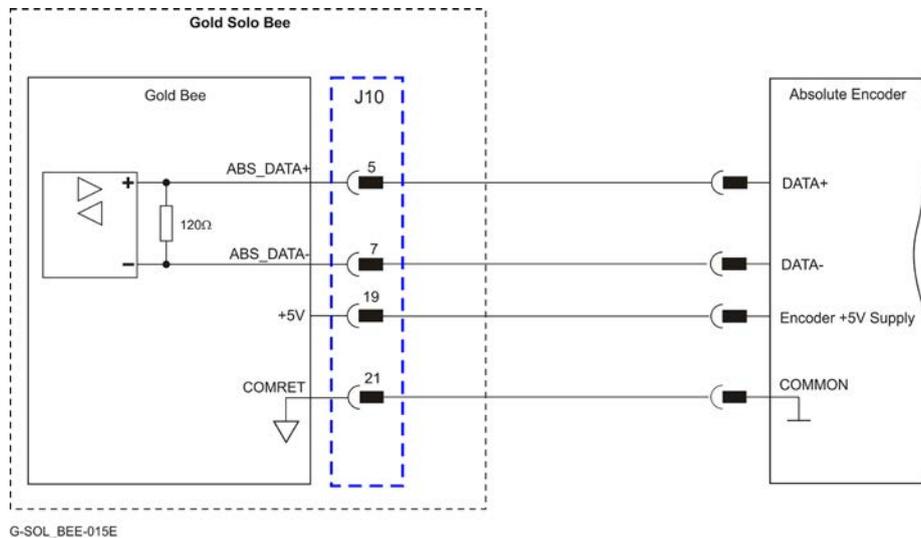


Figure 23: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / etc.)

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. Hall Sensors

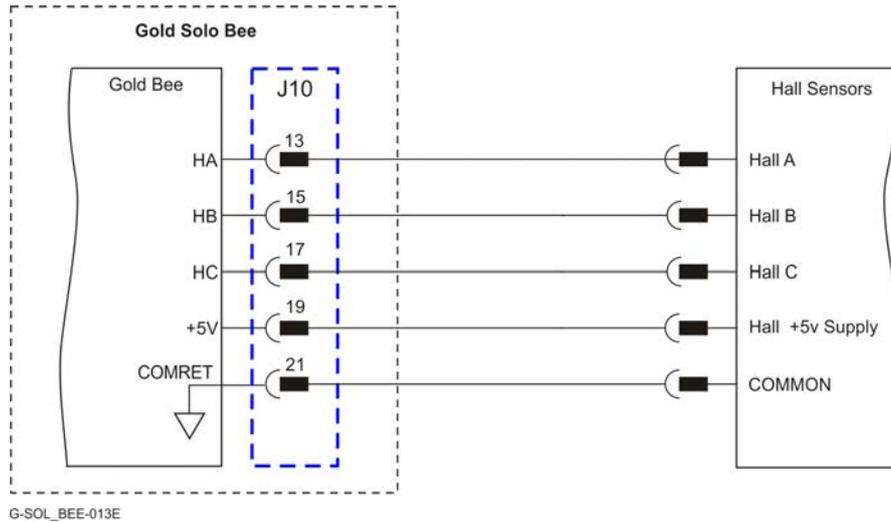


Figure 24: Hall Sensors Connection Diagram

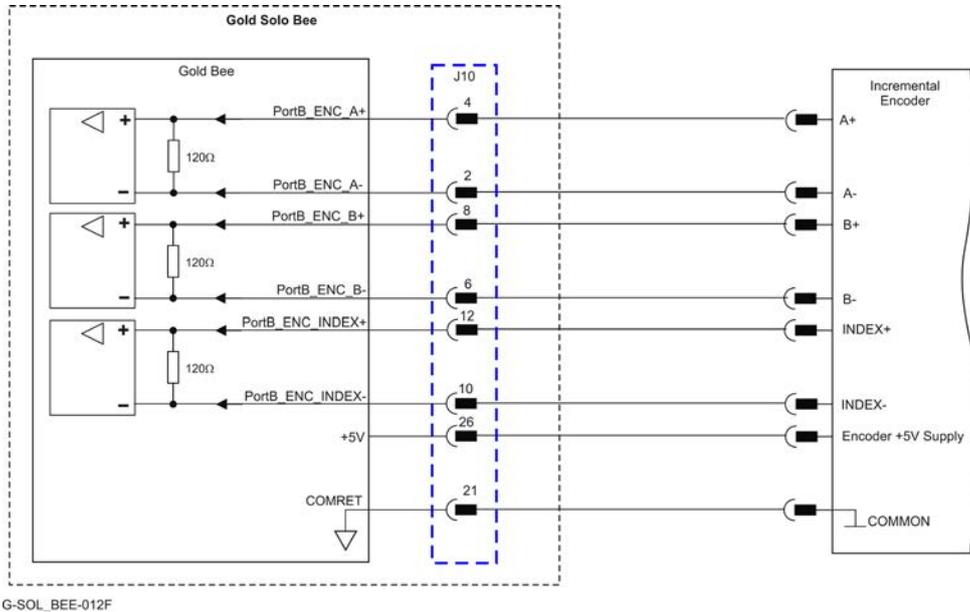
For short distances between the drive and control, 0.5 to 1.0 m wires can be used and shielding is not required. For longer distances than 1.0 m and/or high EMI environment, shielded and twisted wires should be used. Drain wires should be connected to Elmo COMRET.



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

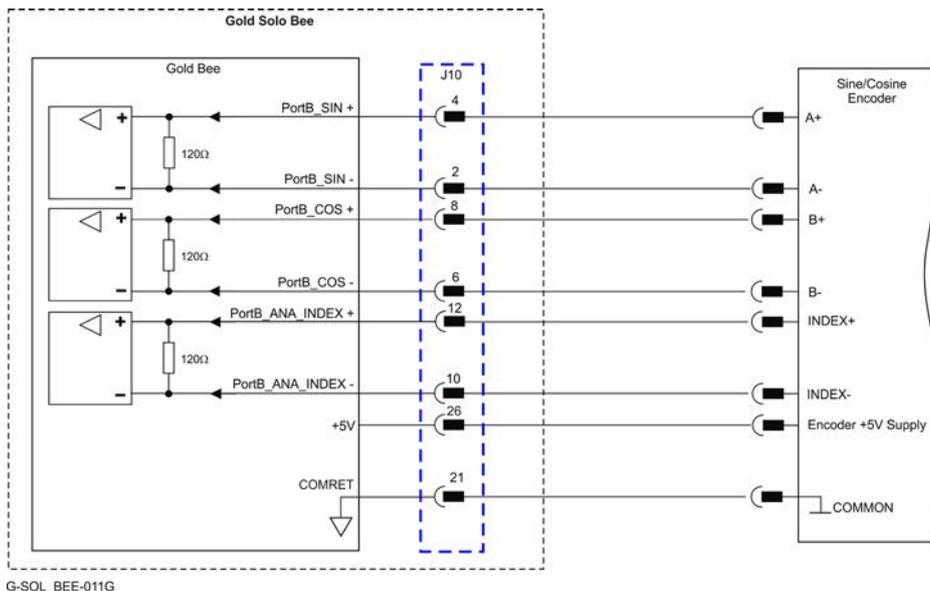


G-SOL_BEE-012F

Figure 25: 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



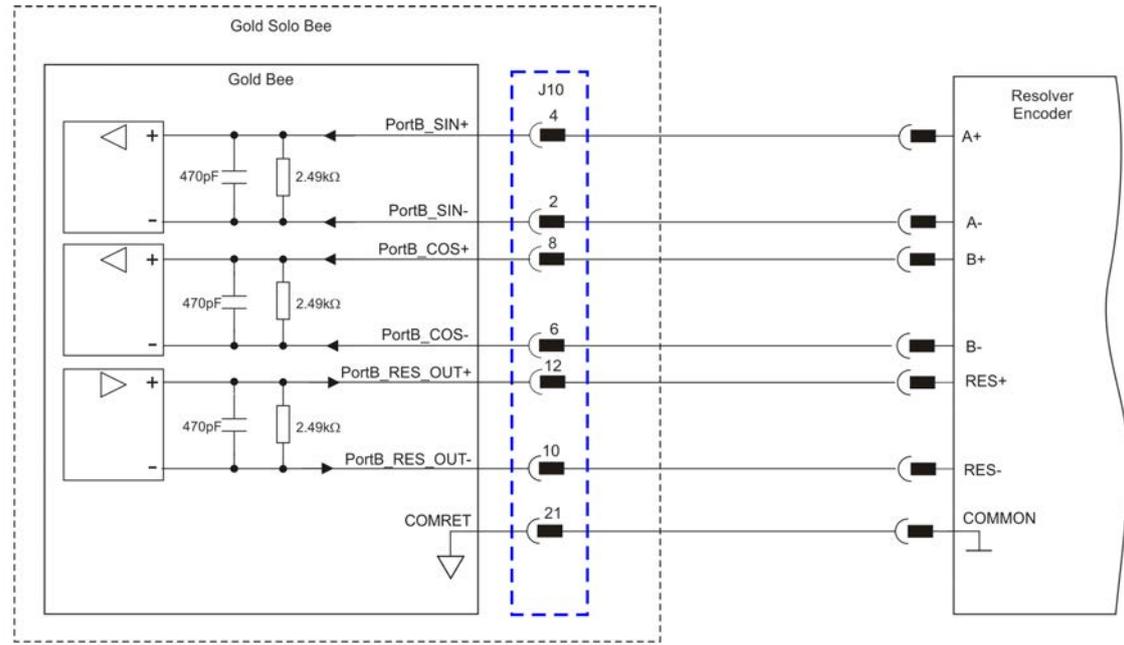
G-SOL_BEE-011G

Figure 26: 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



G-SOL_BEE-010F

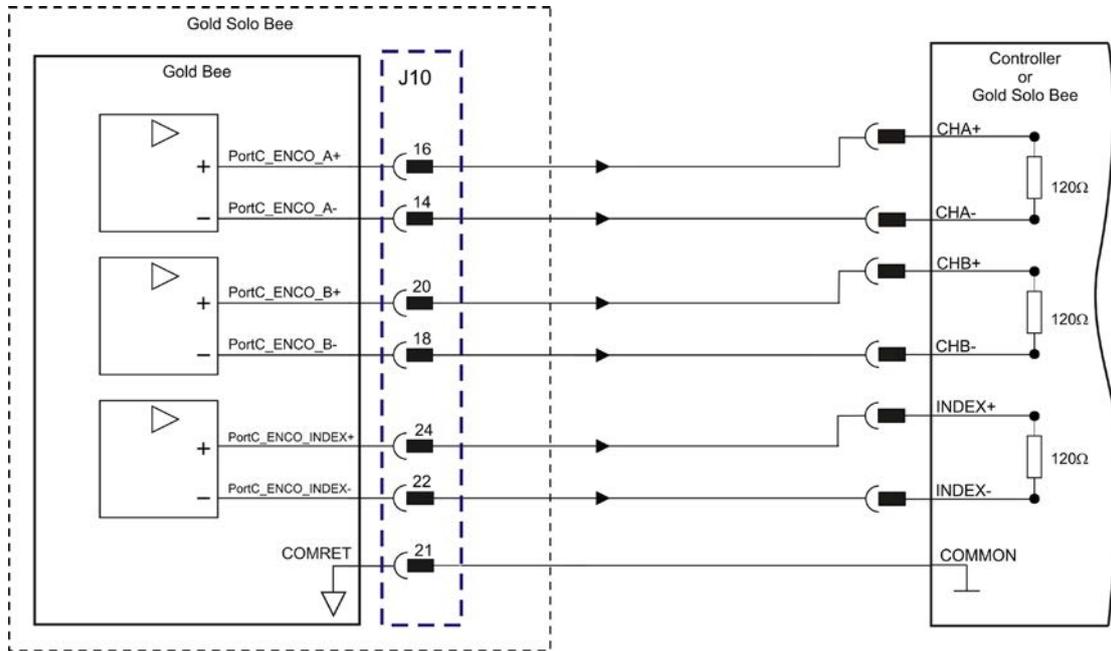
Figure 27: Port B – Resolver Connection Diagram

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.



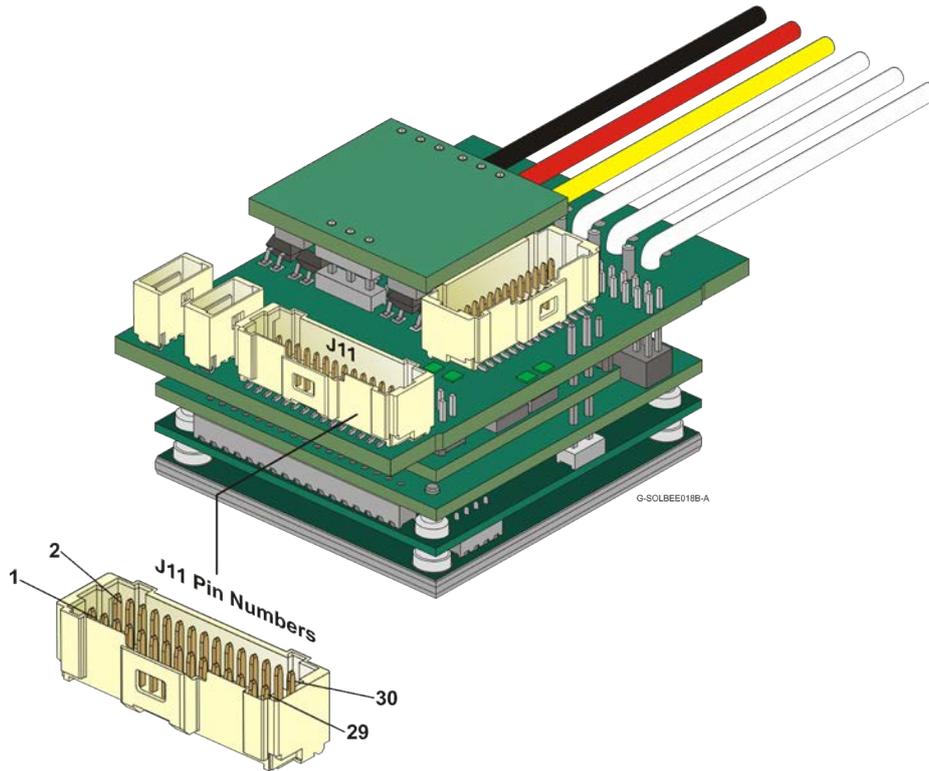
G-SOL BEE-009G

Figure 28: 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	D _{in} return
8	INRET	D _{in} return
9	OUT1	Programmable output 1 (opto isolated from control COMRET)



Pin J11	Signal	Function
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.

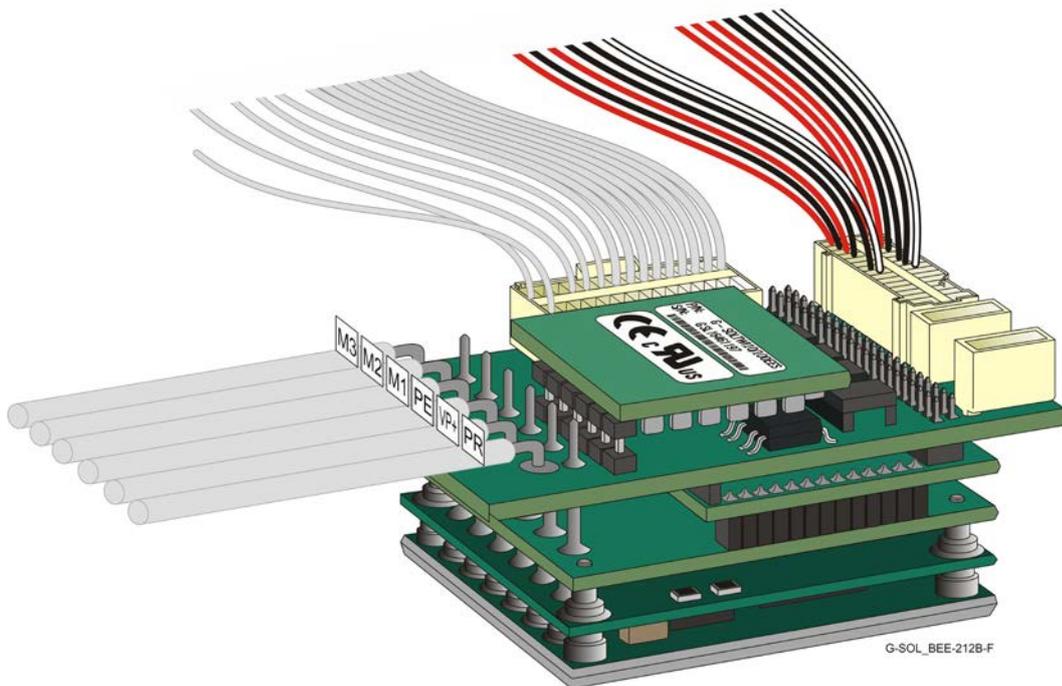


Figure 29: Connecting the USB, RS232, and Analog Input Wires

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 always be 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	$I_{in} = (V_{in} - 7.4) / 4.99 \text{ Kohm}$ $I_{in} = 920 \text{ uA @ } V_{in} = 12 \text{ V}$ $I_{in} = 4.5 \text{ mA @ } V_{in} = 30 \text{ V}$
High-level input voltage	$12 \text{ V} < V_{in} < 30 \text{ V}$
Low-level input voltage	$0 \text{ V} < V_{in} < 7 \text{ V}$
Minimum pulse width	$> 250 \text{ } \mu\text{sec}$
Execution time (all inputs): the time from application of voltage on input until execution is complete	$0 < T < 250 \text{ } \mu\text{sec}$
High-speed inputs – 1–6 minimum pulse width, in high-speed mode	$T > 5 \text{ } \mu\text{sec}$ if the input functionality is set to latch/capture (index/strobe). Notes: <ul style="list-style-type: none"> 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	$T > 0.1 \text{ } \mu\text{sec}$ if the differential input functionality is set to touch probe/capture (index/strobe).

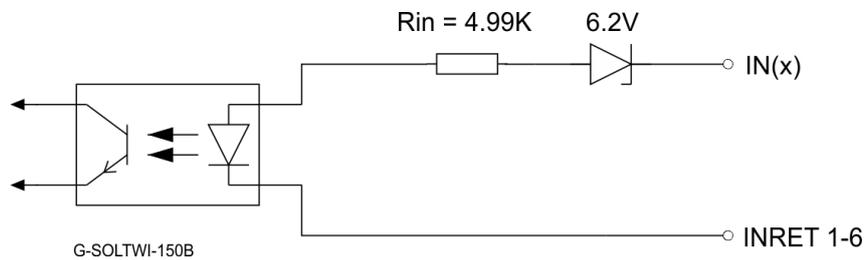


Figure 30: Digital Input PLC Source Schematic

NOTE: In the default state, when there is no current in the optocoupler diode of the Gold Solo Bee OPTO, the digital input is "1". It is possible to change the default state by the IL[] command.



The following are the connection diagram of Digital inputs:

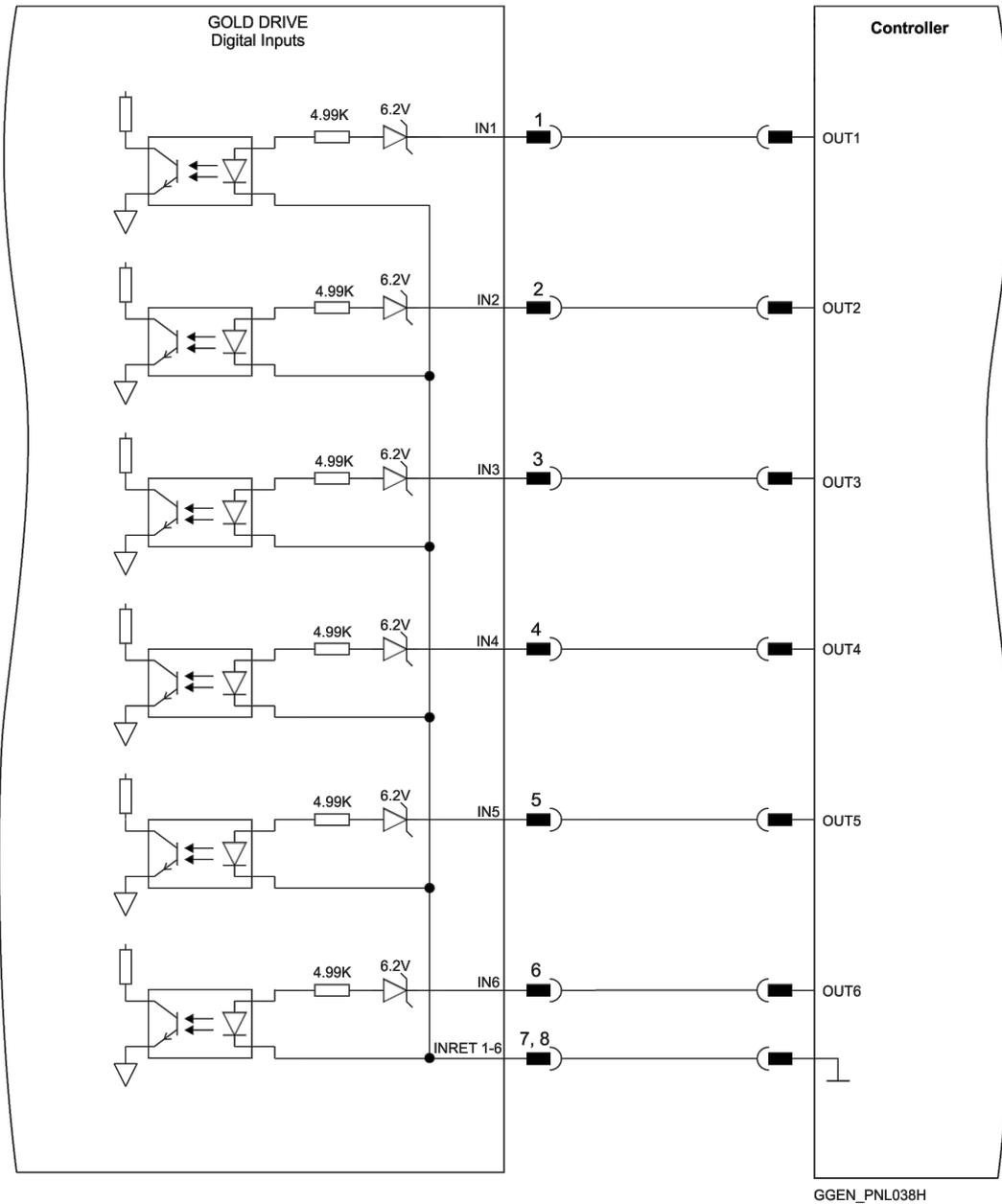


Figure 31: Digital Input Connection Diagram Example – Source PLC Option



8.4.1.2. Sink PLC Voltage Level Digital Input

Feature	Details
Type of input	Isolated PLC Sink
Input current	$I_{in} = (V_{in} - 7.4) / 4.99 \text{ Kohm}$ $I_{in} = 920 \text{ uA @ } V_{in} = 12 \text{ V}$ $I_{in} = 4.5 \text{ mA @ } V_{in} = 30 \text{ V}$
High-level input voltage	$12 \text{ V} < V_{in} < 30 \text{ V}$
Low-level input voltage	$0 \text{ V} < V_{in} < 7 \text{ V}$
Minimum pulse width	$> 250 \text{ } \mu\text{sec}$
Execution time (all inputs): the time from application of voltage on input until execution is complete	$0 < T < 250 \text{ } \mu\text{sec}$
High-speed inputs – 1–6 minimum pulse width, in high-speed mode	$T > 5 \text{ } \mu\text{sec}$ if the input functionality is set to latch/capture (index/strobe). Notes: <ul style="list-style-type: none"> 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	$T > 0.1 \text{ } \mu\text{sec}$ if the differential input functionality is set to touch probe/capture (index/strobe).

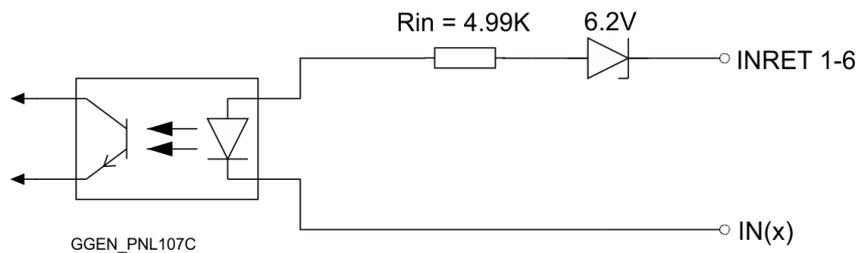


Figure 32: Digital Input Sink PLC Schematic

NOTE: In the default state, when there is no current in the optocoupler diode of the Gold Solo Bee OPTO, the digital input is "1". It is possible to change the default state by the IL[] command.

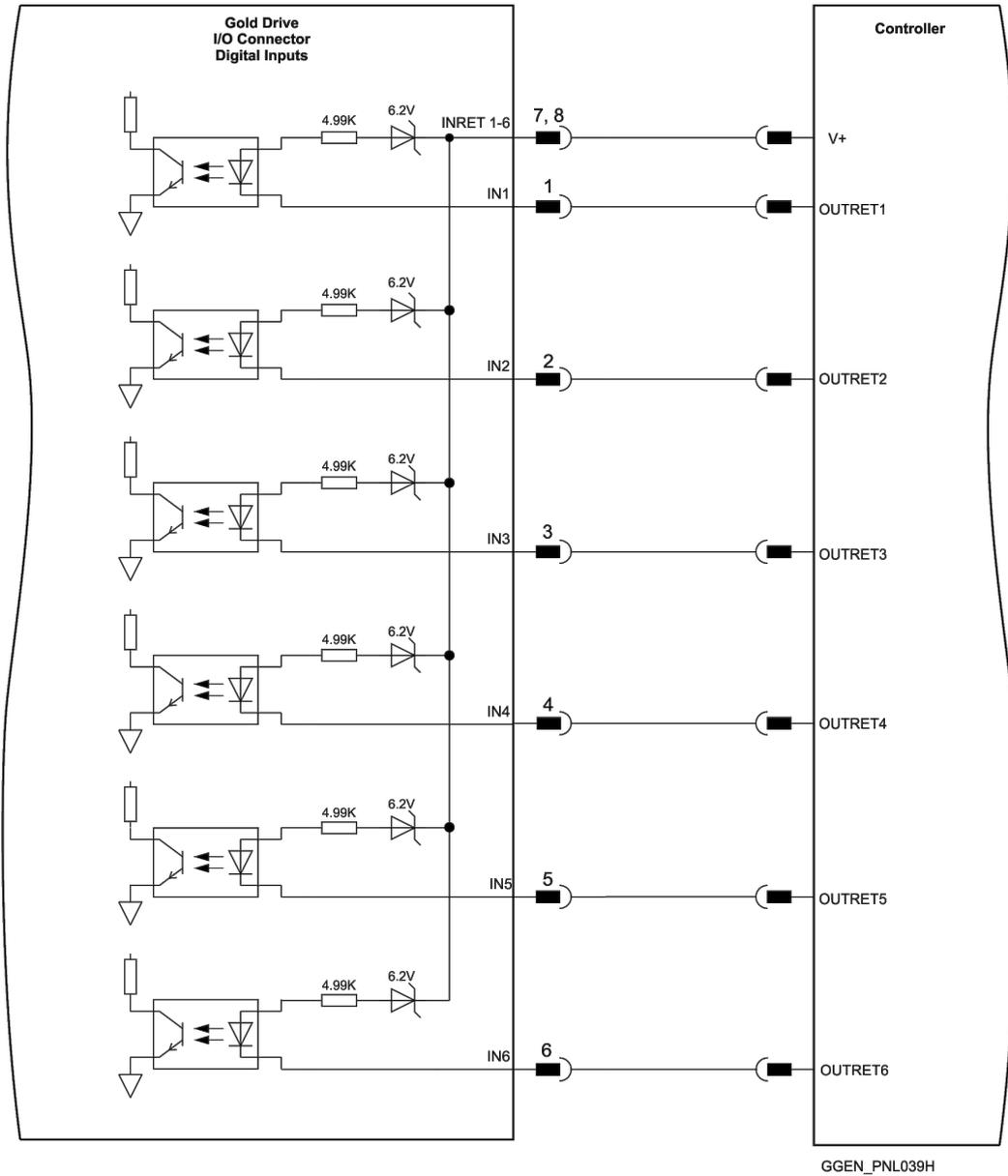


Figure 33: Digital Input Sink Mode Example – PLC voltage level Connection Diagram



8.4.1.3. Source 5V Logic Level Digital Input

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

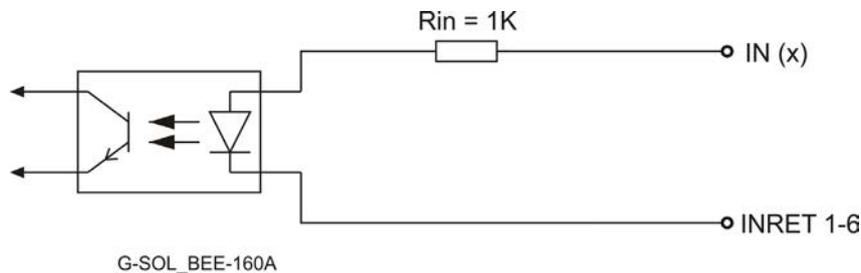


Figure 34: Digital Input 5V Logic Schematic

NOTE: In the default state, when there is no current in the optocoupler diode of the Gold Solo Bee OPTO, the digital input is "1". It is possible to change the default state by the IL[] command.

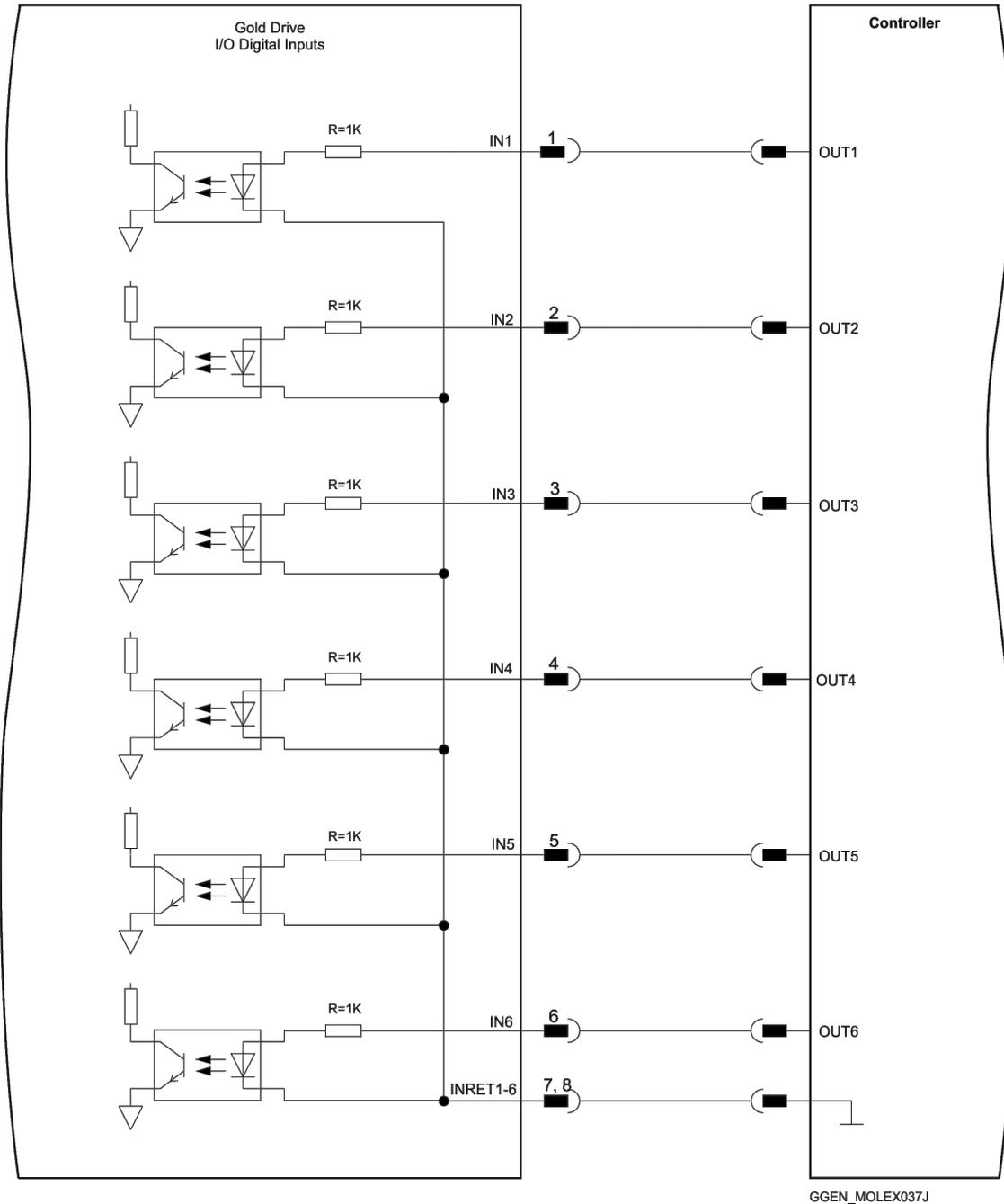


Figure 35: Digital Input Source 5V Logic Mode Connection Diagram



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)	12 V to 30 V (typically 24 V)
Max. output current $I_{out (max)} (V_{out} = High)$	$I_{out (max)} \leq 30 \text{ mA}$
Collector Emitter saturation voltage	1 V
T_{on} (Time from low to high) If $V_{dd} = 24V$	$< 15 \mu\text{sec}$
T_{off} (Time from high to Low)	$< 250 \mu\text{sec}$
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	$0 < T < 250 \mu\text{sec}$

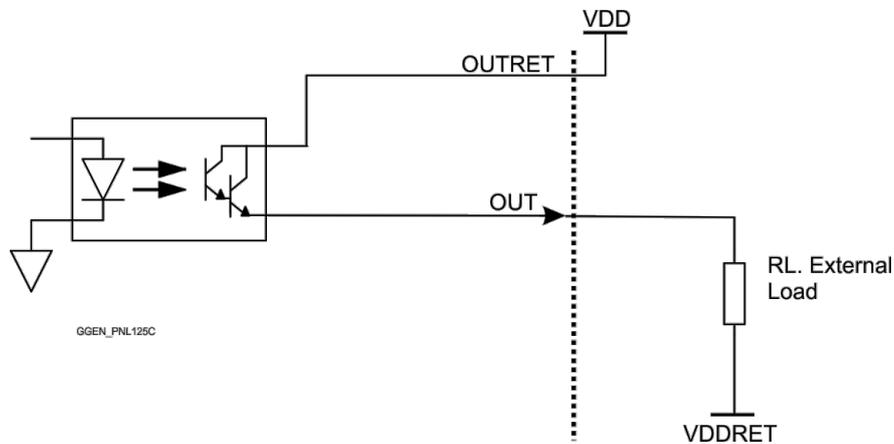
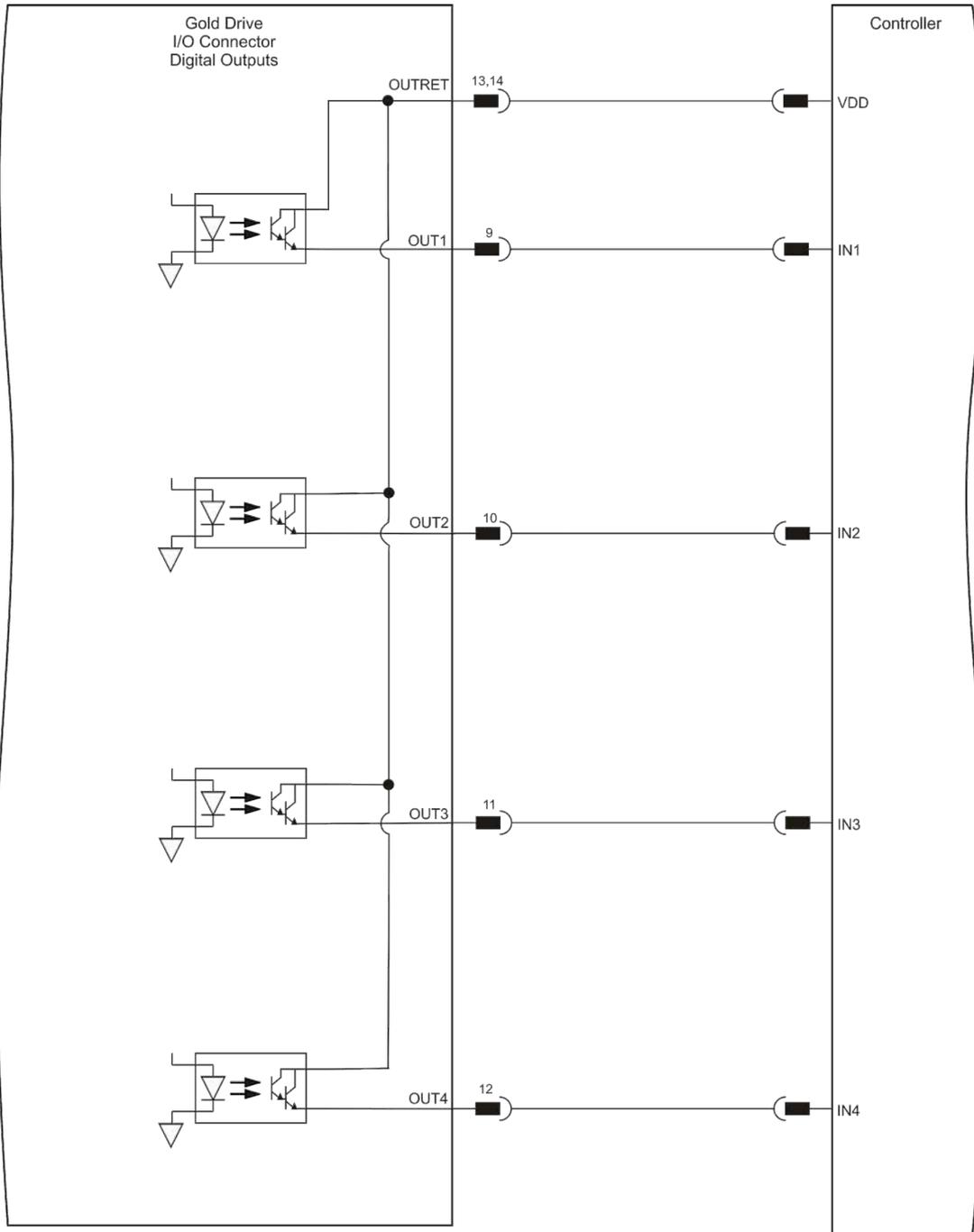


Figure 36: Digital Photodarlington Output Schematic – Source Mode PLC Level



G-SOL_BEE-134A

Figure 37: 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)	12 V to 30 V (Typically 24 V)
Max. output current $I_{out (max)} (V_{out} = Low)$	$I_{out (max)} \leq 30 \text{ mA}$
Collector Emitter saturation voltage	1 V
T_{on} (Time from low to high) If $V_{dd} = 24 \text{ V}$	$< 15 \mu\text{sec}$
T_{off} (Time from high to Low)	$< 300 \mu\text{sec}$
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	$0 < T < 250 \mu\text{sec}$

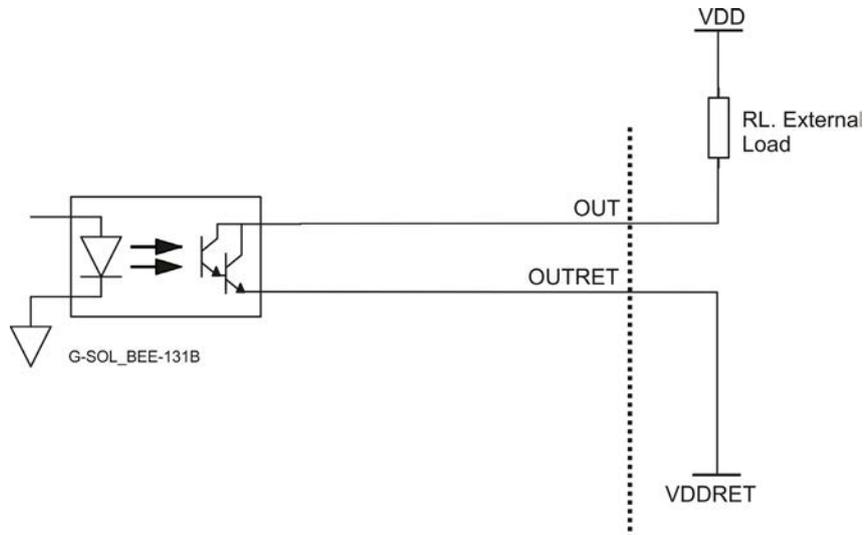


Figure 38: Digital Photodarlington Output Schematic for Sink – PLC level

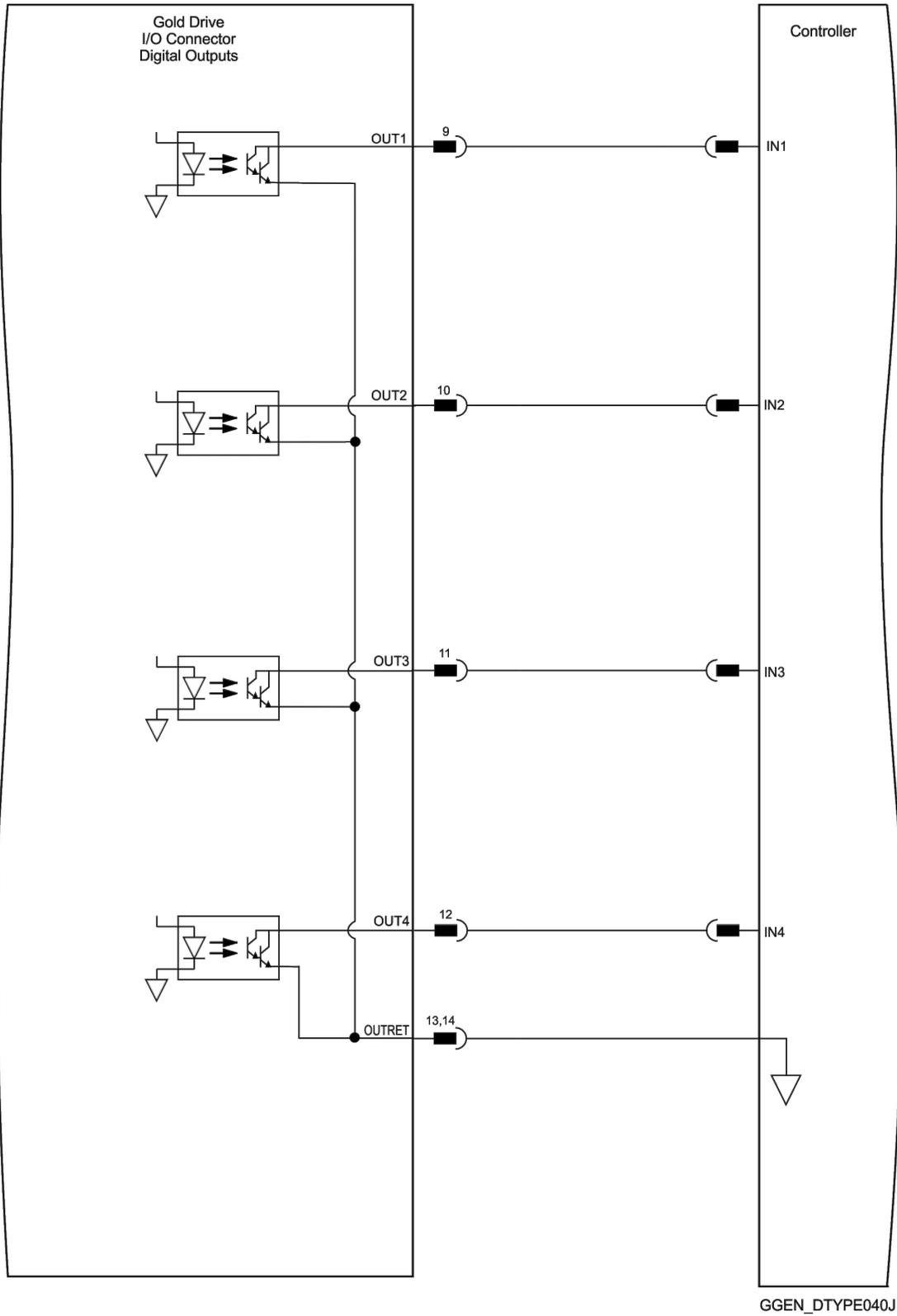


Figure 39: Digital Output Connection Diagram Example – Sink PLC Option



8.4.2.3. Digital Outputs Source 5V Logic Mode

Feature	Details
Type of output	Optically isolated 5 V Logic source
Supply output (VDD)	< 30 V (Typically 5 V)
Max. output current $I_{out (max)} (V_{out} = High)$	$I_{out (max)} \leq 30 \text{ mA}$
Collector Emitter saturation voltage	1 V
T_{on} (Time from low to high) If $V_{dd} = 5 \text{ V}$	< 10 μsec
T_{off} (Time from high to Low)	< 100 μsec
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	$0 < T < 250 \mu\text{sec}$

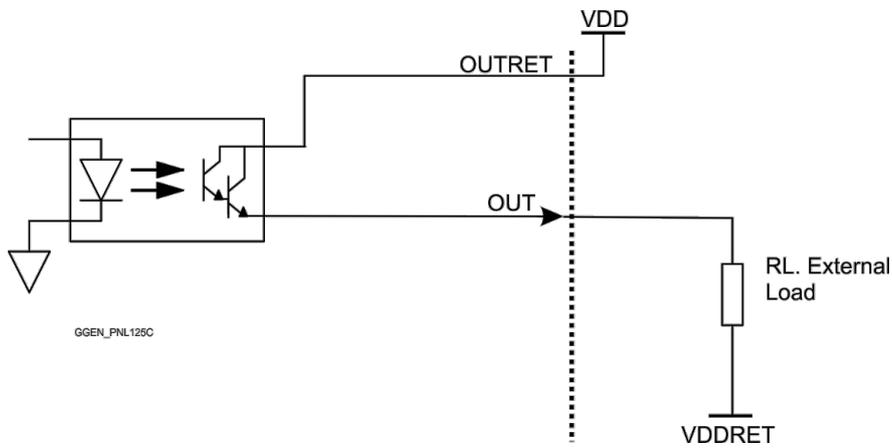
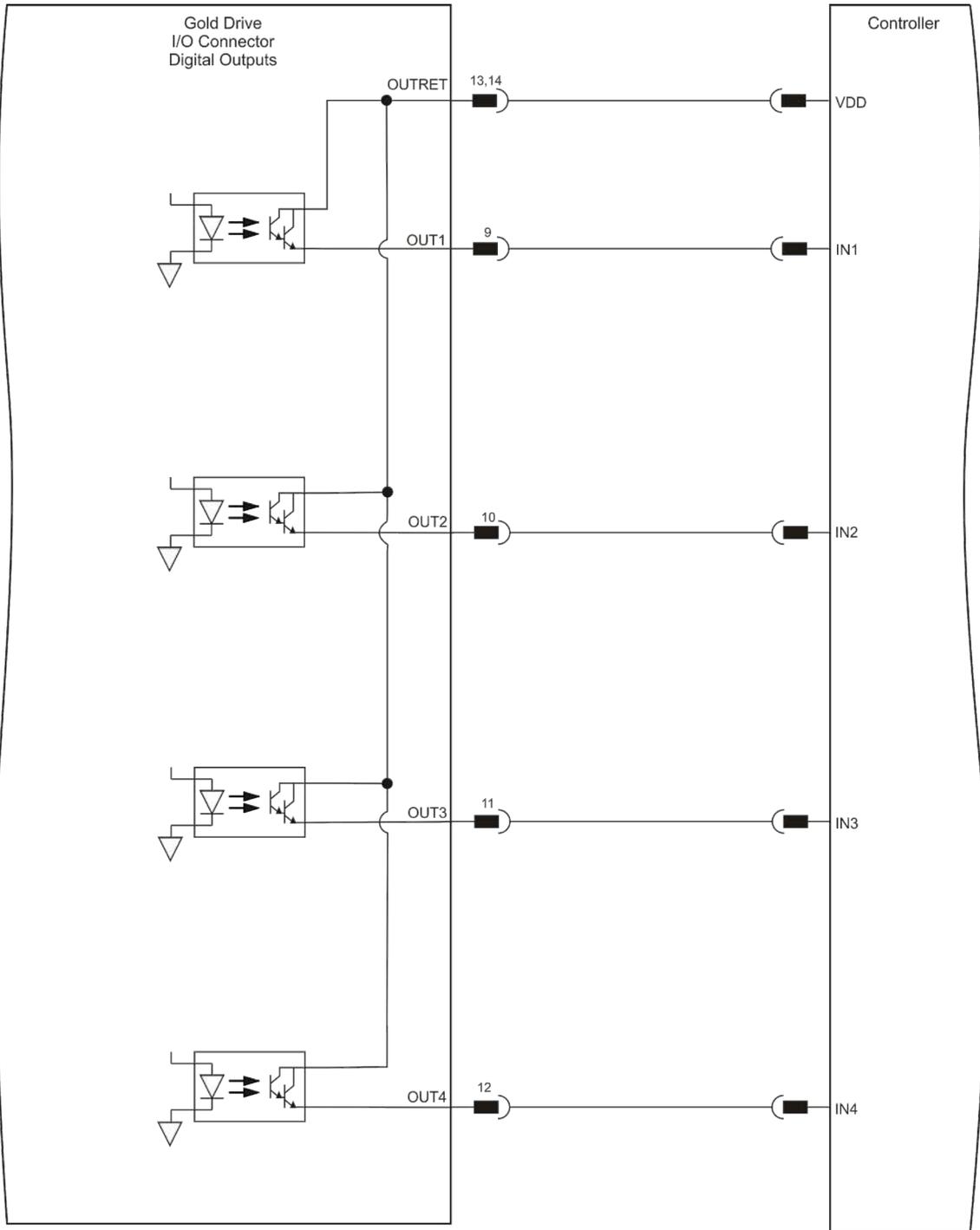


Figure 40: Digital Photodarlington Output Schematic – Source Mode 5 V Logic Level



G-SOL_BEE-134A

Figure 41: Digital Output Connection Diagram Example – Source 5 V 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.

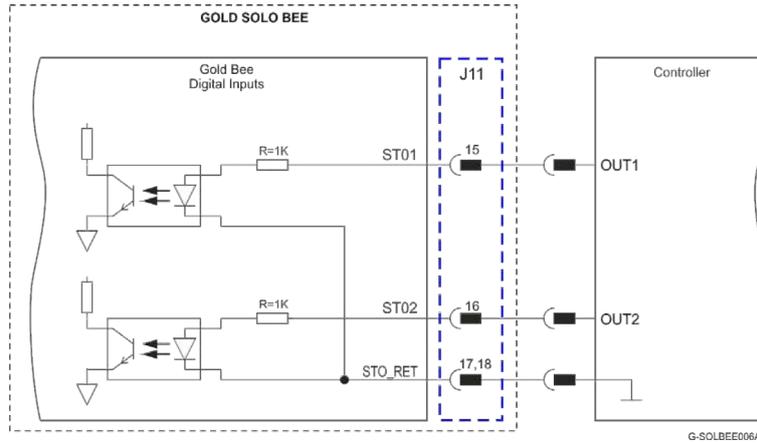


Figure 42: STO Input Connection – 5 V Logic

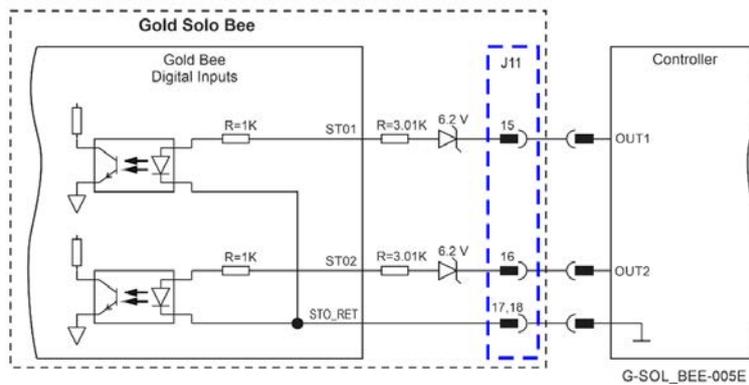


Figure 43: STO Input Connection – PLC (24 V Logic)

8.4.4. Analog Input

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

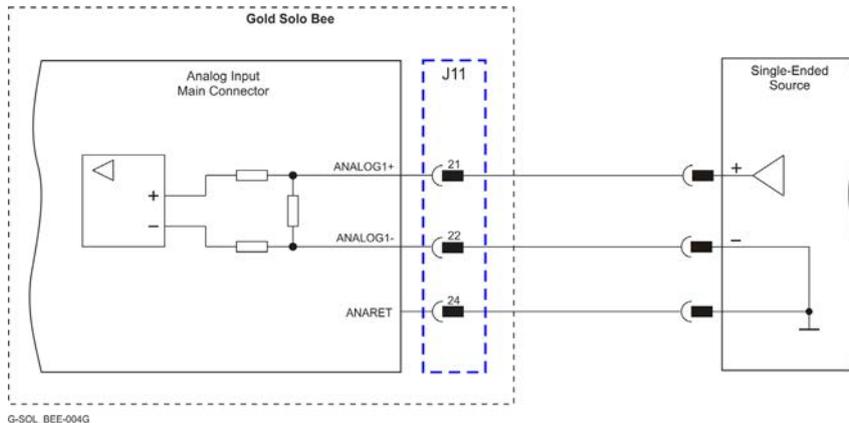


Figure 44: Analog Input

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 45 describes the Standard RS-232 connection diagram.

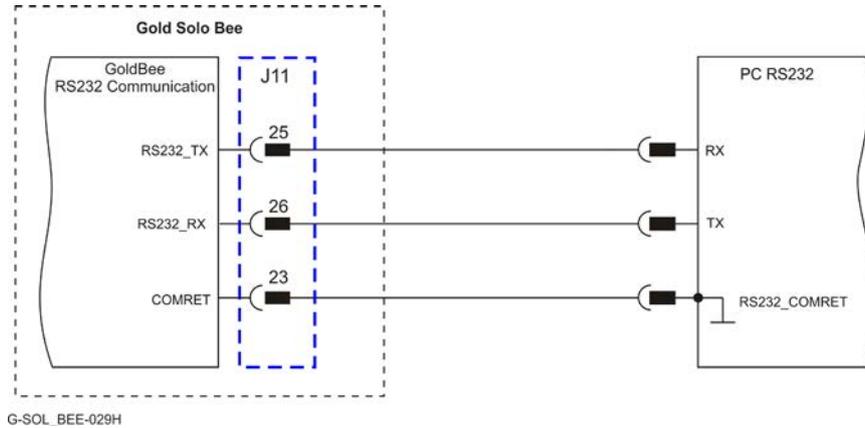


Figure 45: Standard RS-232 Connection Diagram

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.

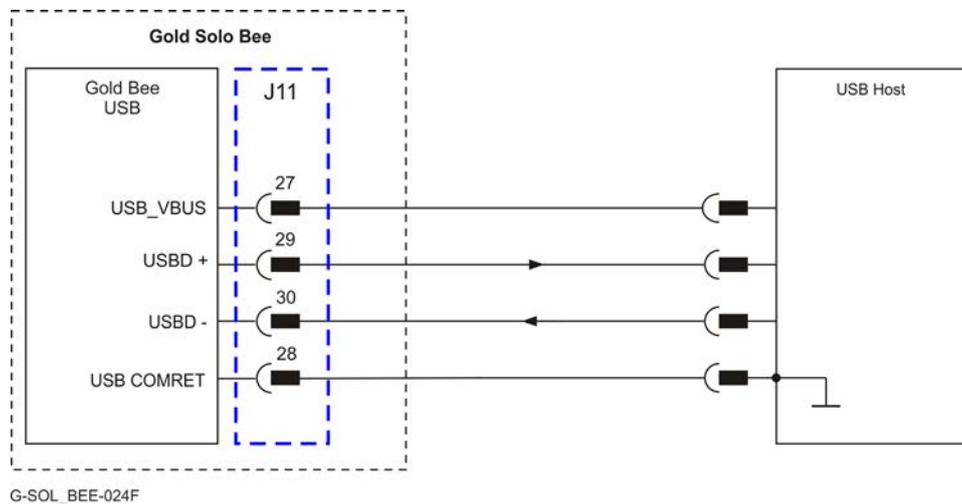


Figure 46: USB Network Diagram

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 Bee supports the following EtherCAT fieldbus type industrial network protocol:

Fieldbus Type	Product Number
EtherCAT	G-SOLBEEXX/YYYE 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
	<p>Ethernet Cable Connector</p>

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
<p>J18 Pin Numbers 1 5</p>	<p>Ethernet Cable Connector</p>

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.

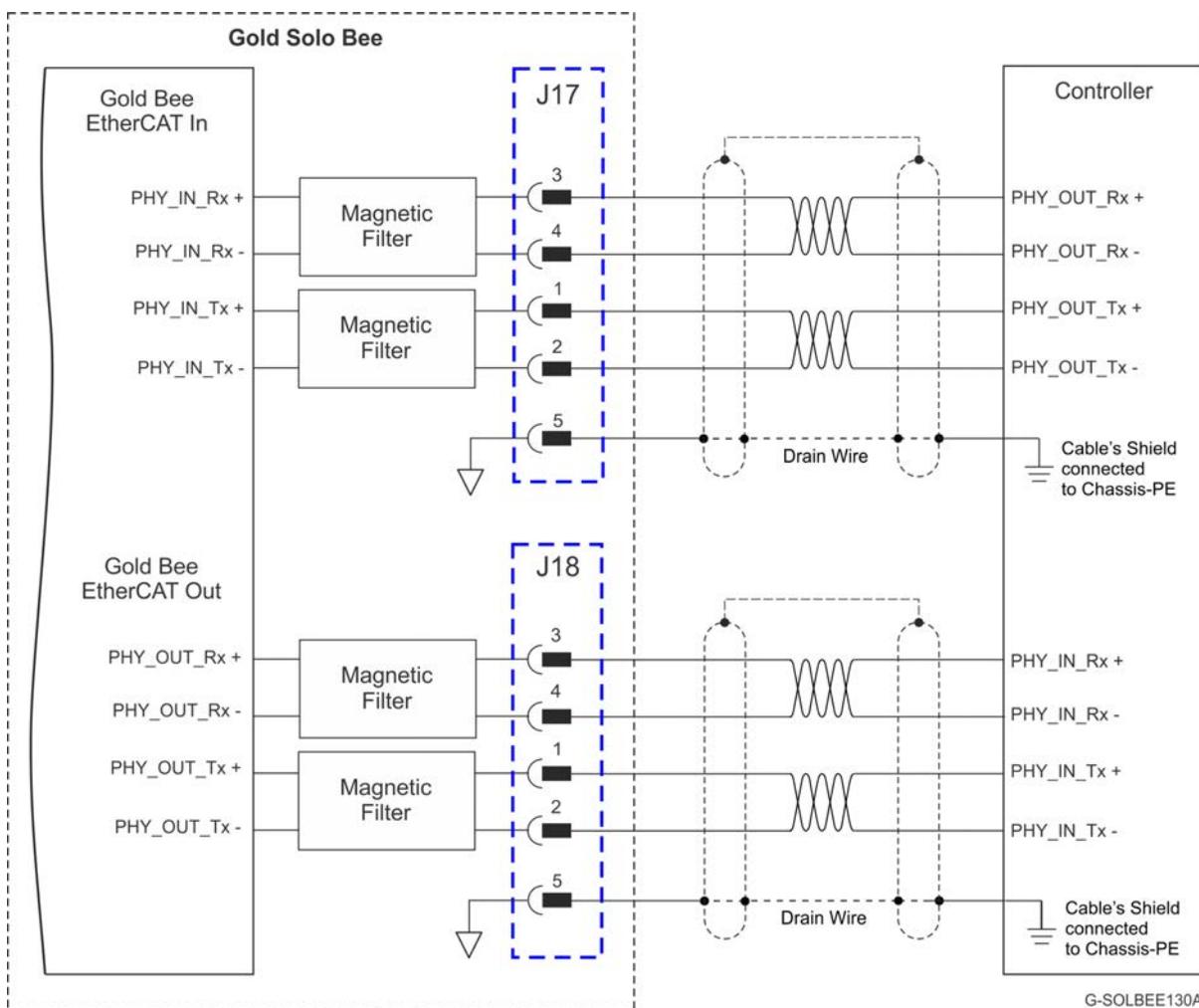


Figure 47: EtherCAT Connection Schematic Diagram

Note: Always use CAT5e cables.



8.5.3.2. EtherCAT Status Indicator (D2)

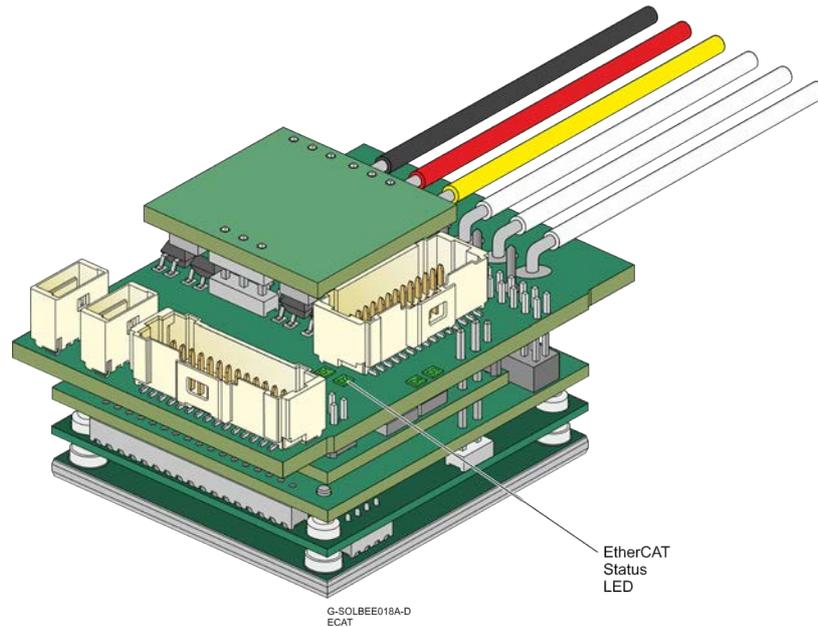


Figure 48: EtherCAT Status LED

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 Bee 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 49.

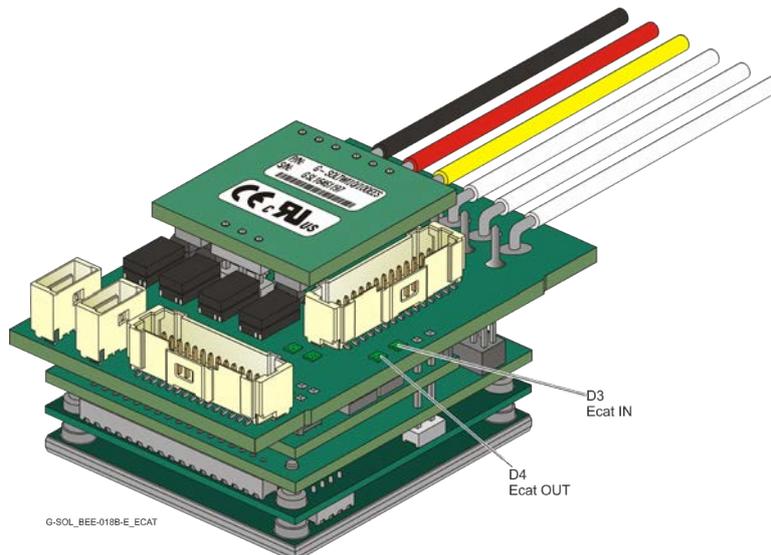


Figure 49: Ethernet Connector LEDs

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 Bee supports the following CAN fieldbus type industrial network protocol:

Fieldbus Type	Product Number
CAN	G-SOLBEEXX/YYYYSXXX

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
	<p>CAN Cable Connector</p>

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

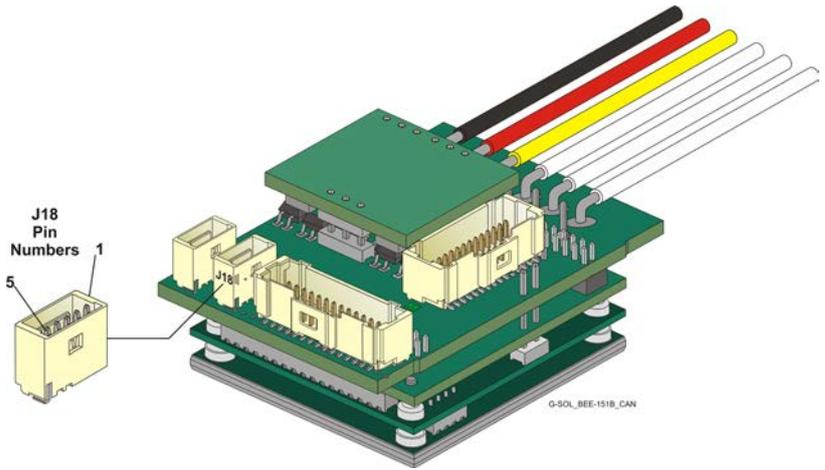
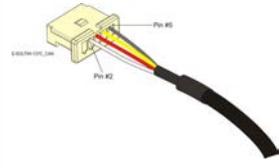
Pin Positions	Cable Connector
	 <p>CAN Cable Connector</p>

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 Bee 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.

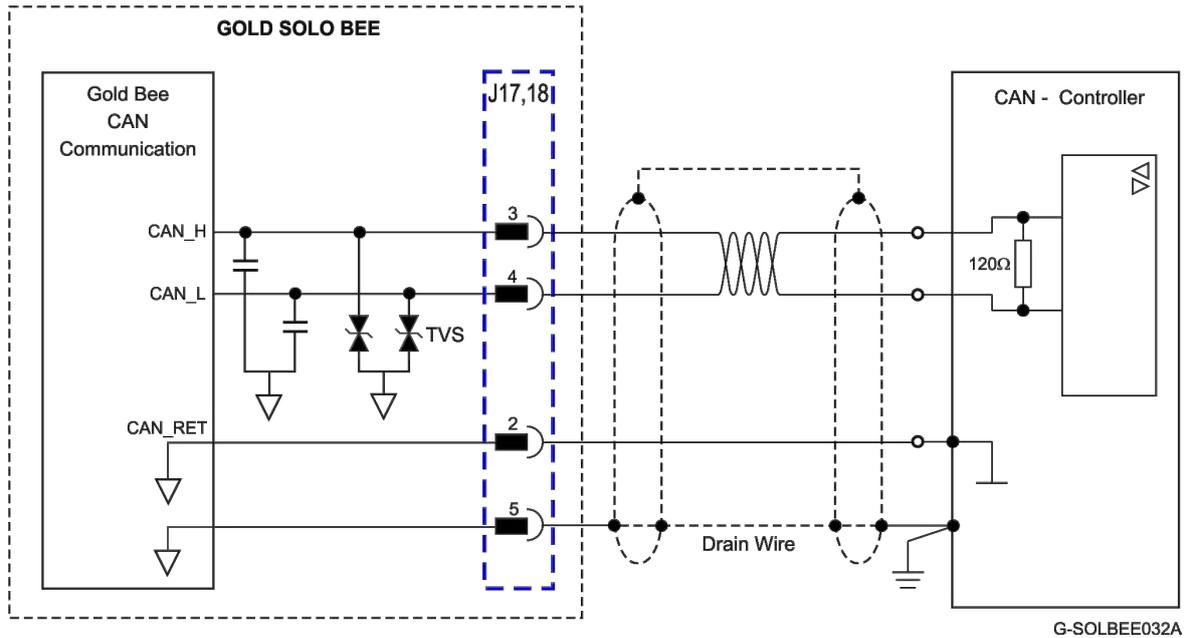


Figure 50: CAN Interface



8.6.3.2. CAN Network Topology

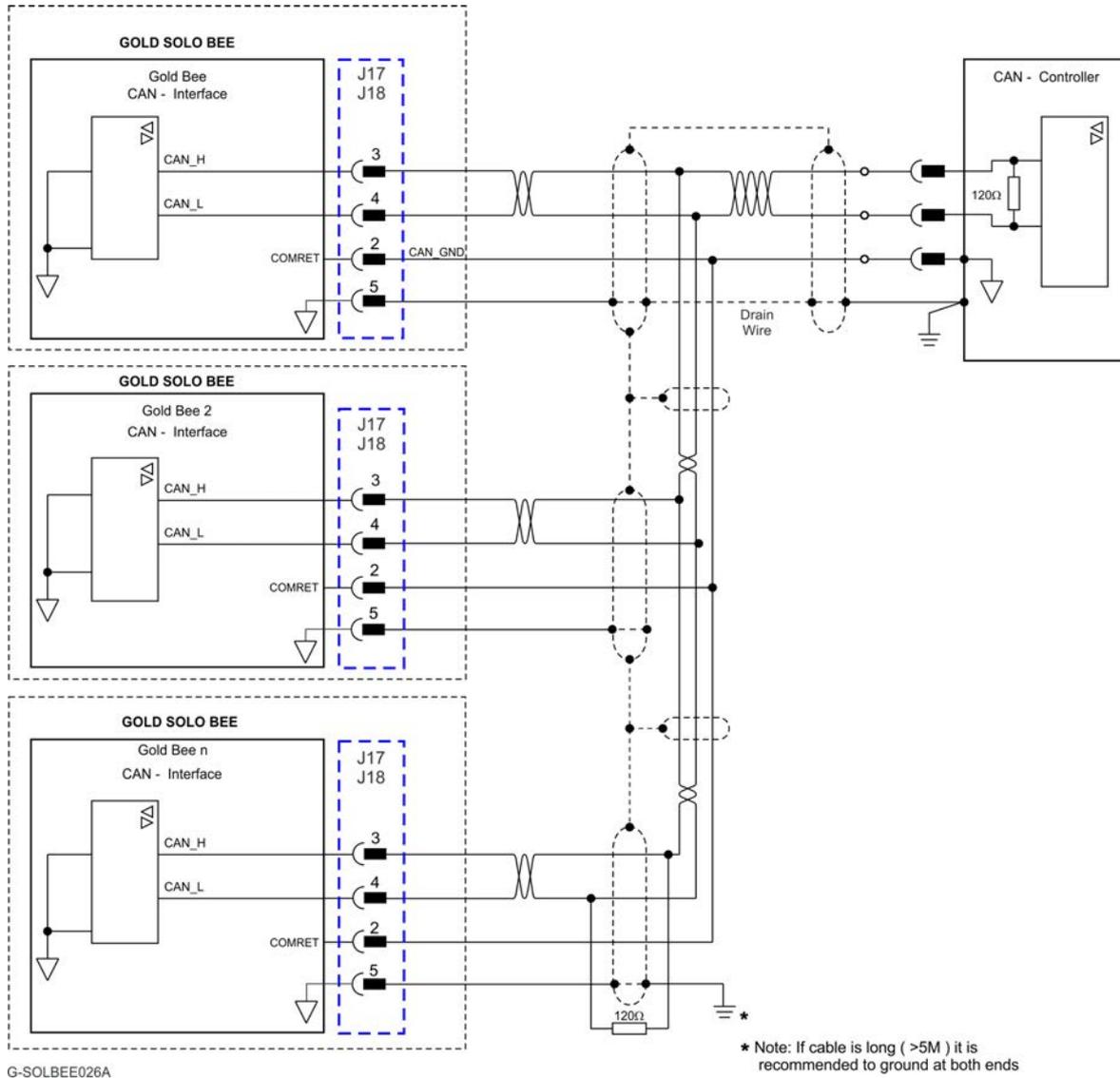


Figure 51: CAN Network Diagram – Drop Off Topology



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 Bee 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

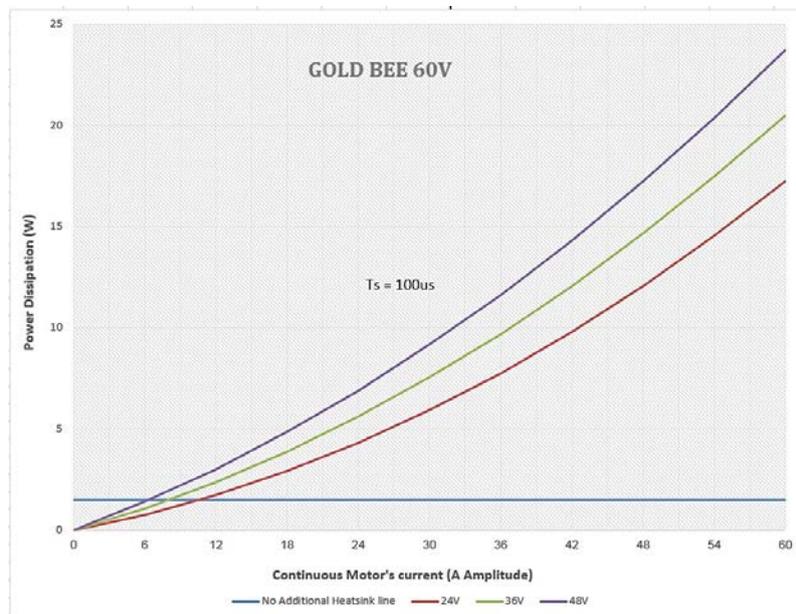
After the Gold Solo Bee has been connected and mounted, the system must be set up and initialized. This is accomplished using the *EASII*, Elmo's Windows-based software application. Install the application and then perform setup and initialization according to the directions in the *EASII User Manual*.

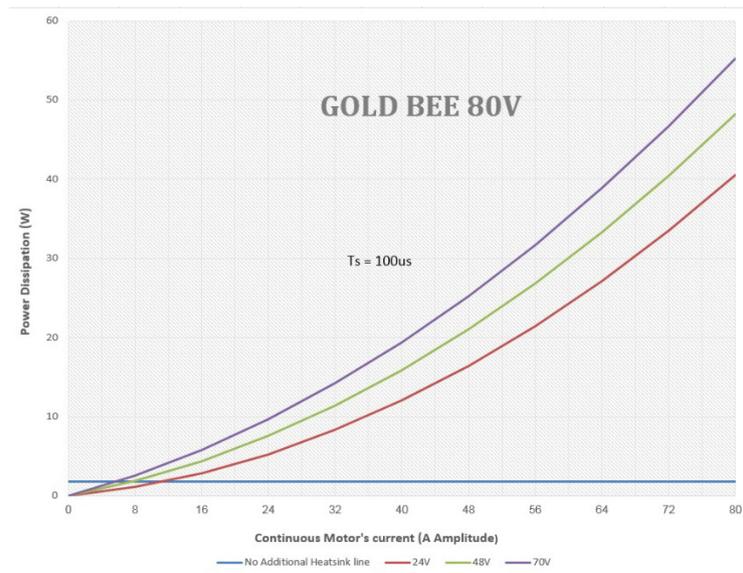
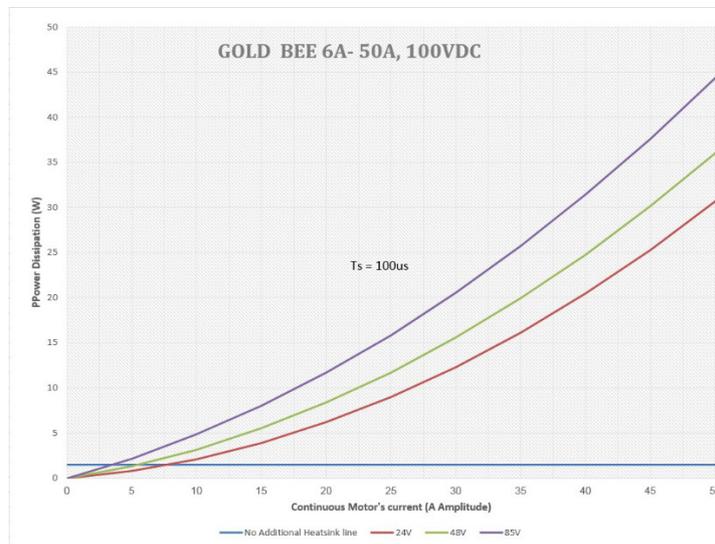
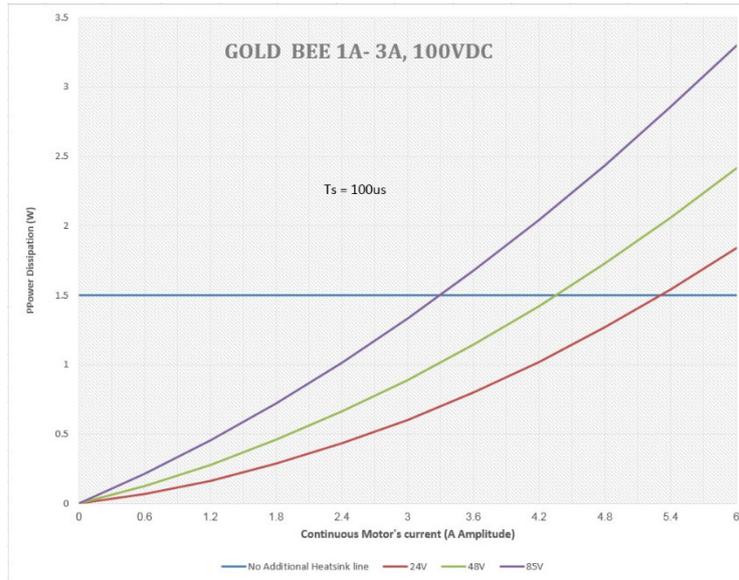
9.2. Heat Dissipation

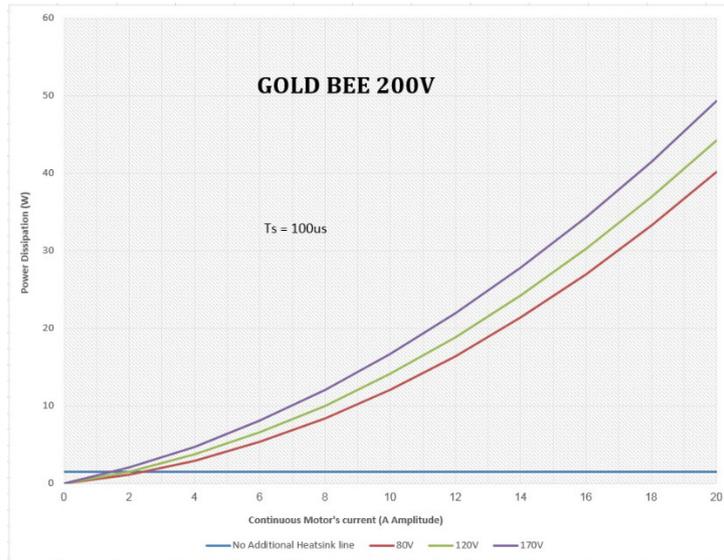
The best way to dissipate heat from the Gold Solo Bee is to mount it so that its heat-sink is attached to the machine chassis. If mounted with its heat-sink suspended, then for best results mount the servo drive faced upwards and leave approximately 10 mm of space between the Gold Solo Bee's heat-sink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







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:

- 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.
- 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.
- When the Heat-Sink temperature reaches $\approx 85^{\circ}\text{C}$, the Gold Solo Bee 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 .
- For models Power Supply & Heatsink Option: (Blank) or S**
If the average heat dissipation is less than $\approx 1.5\text{W}$ (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 $\approx 4\text{W}$ 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.
- When an external Heat-Sink is required, calculate the thermal resistance of the heat sink according to:

$$\theta_{C/W} = \frac{80^{\circ}\text{C} - T_{Ambient}}{Heat\ Dissipation}$$



Chapter 10: Dimensions, Physical Specifications

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

10.1. EtherCAT without Heatsink

Weight (g (oz))	Dimensions (mm (in))
60.5 (2.13)	47.2 x 30 x 22.8 mm (1.86" x 1.18" x 0.9")

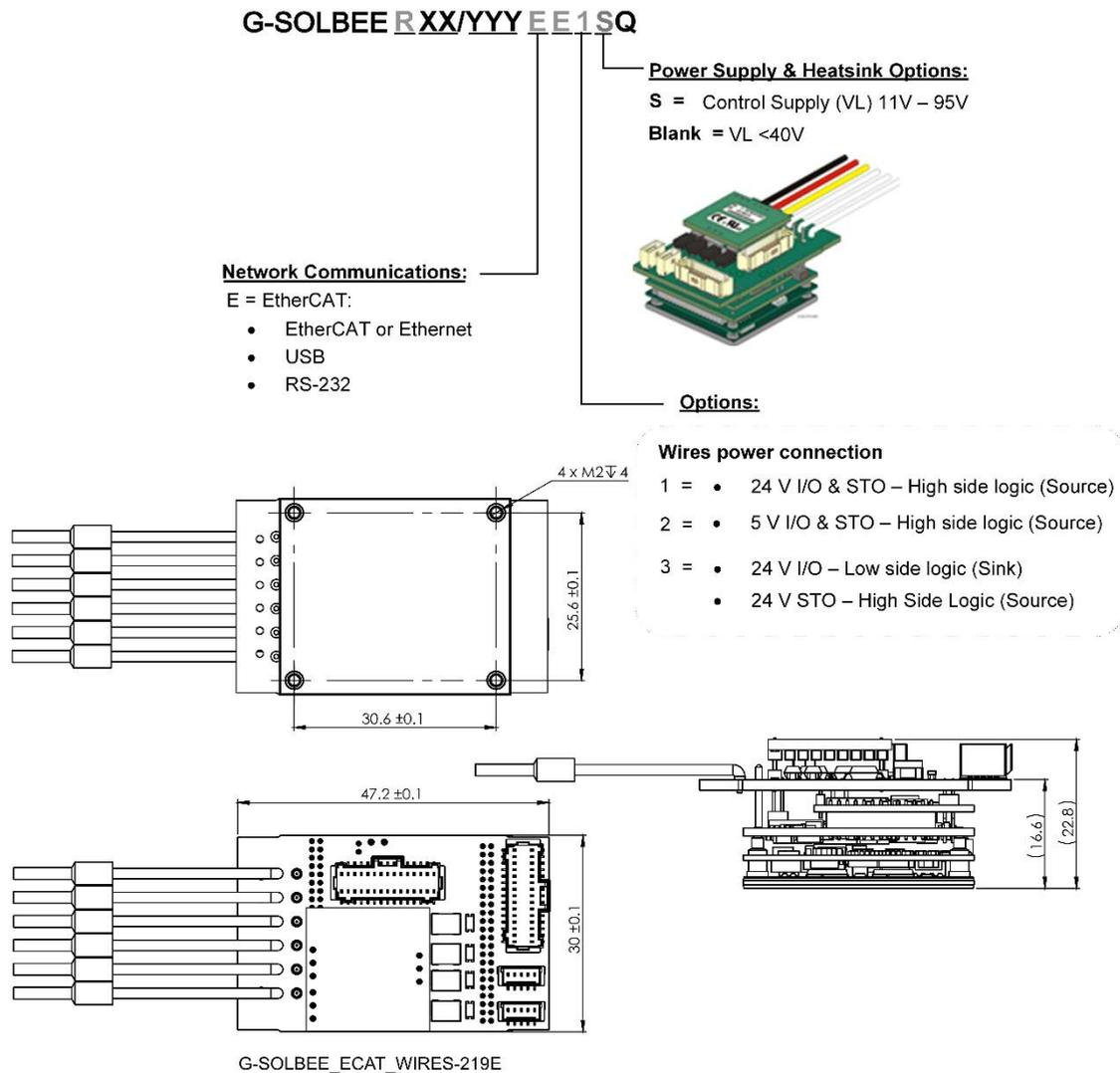


Figure 52: Gold Solo Bee –EtherCAT version with wires to power supply and motor



10.2. EtherCAT with Heatsink

Weight (g (oz))	Dimensions (mm (in))
81.5 (2.88)	47.6 x 41.3 x 26.8 mm (1.87" x 1.63" x 1.06")

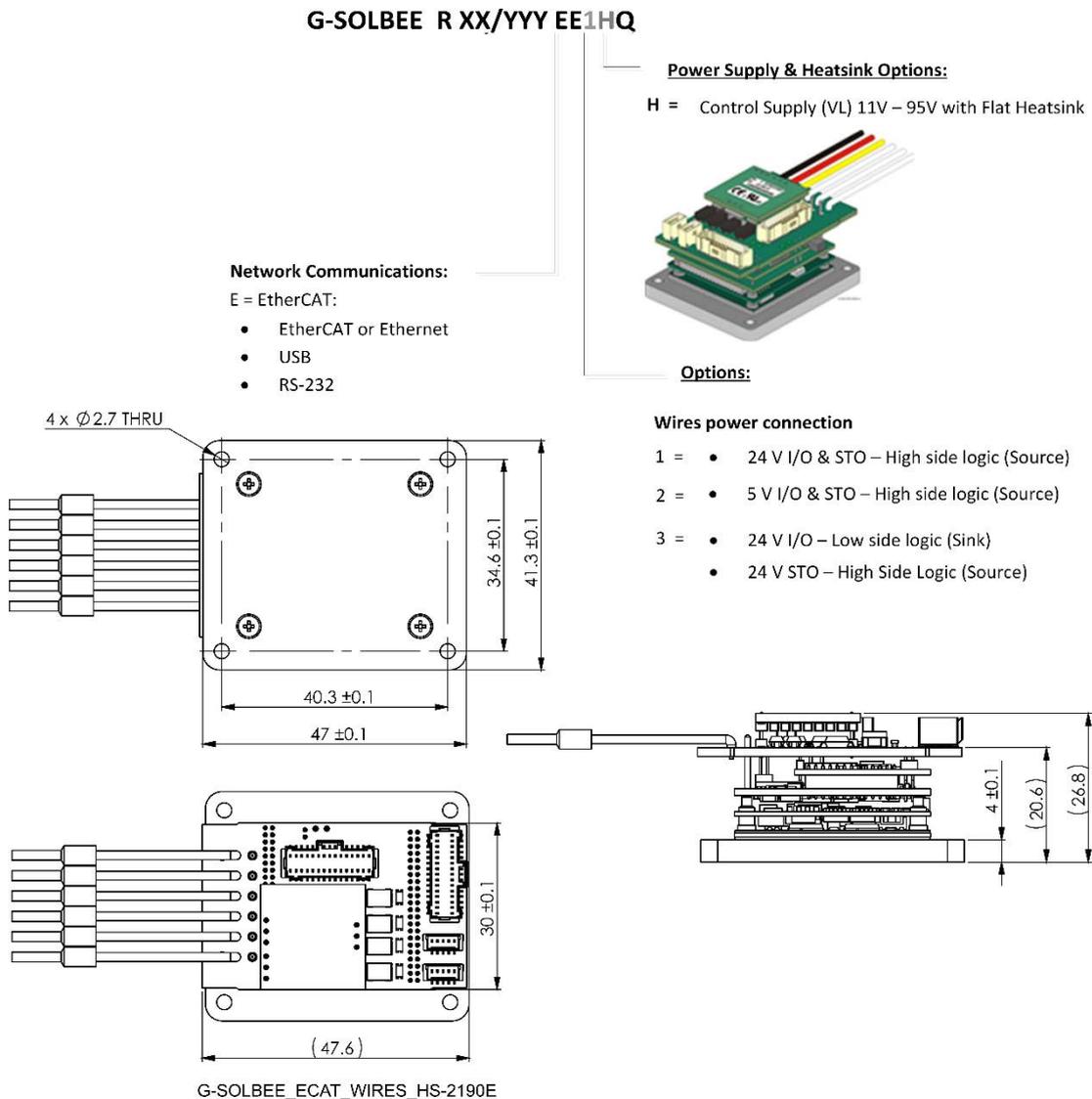
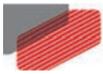


Figure 53: Gold Solo Bee –EtherCAT version with wires to power supply and motor



10.3. CAN without Heatsink

Weight (g (oz))	Dimensions (mm (in))
56.0 (1.97)	47.2 x 30 x 19.2 mm (1.86" x 1.18" x 0.76")

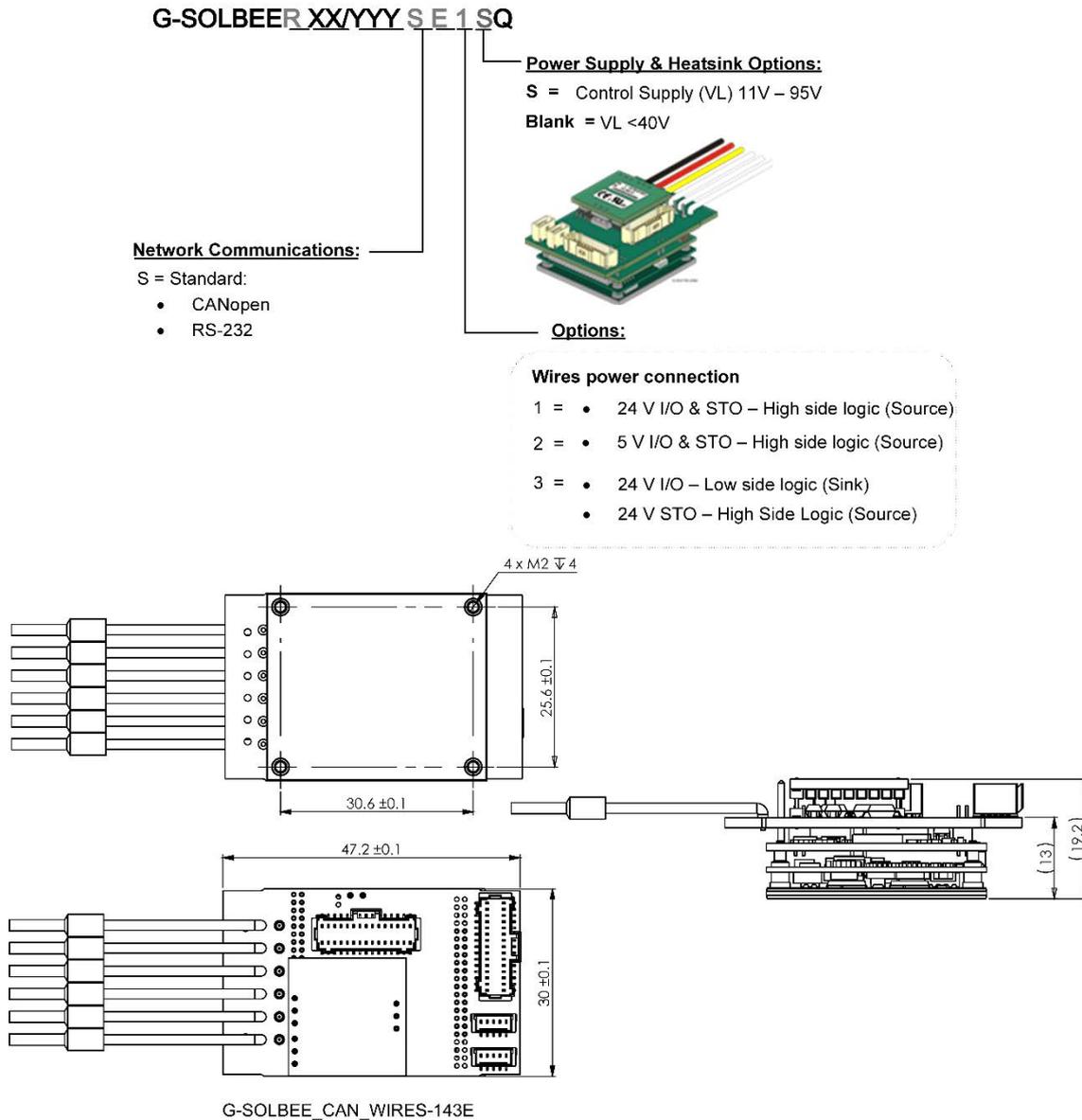


Figure 54: Gold Solo Bee –CAN version with wires to power supply and motor



10.4. CAN with Heatsink

Weight (g (oz))	Dimensions (mm (in))
77.0 (2.72)	47.6 x 41.3 x 23.2 mm (1.87" x 1.63" x 0.91")

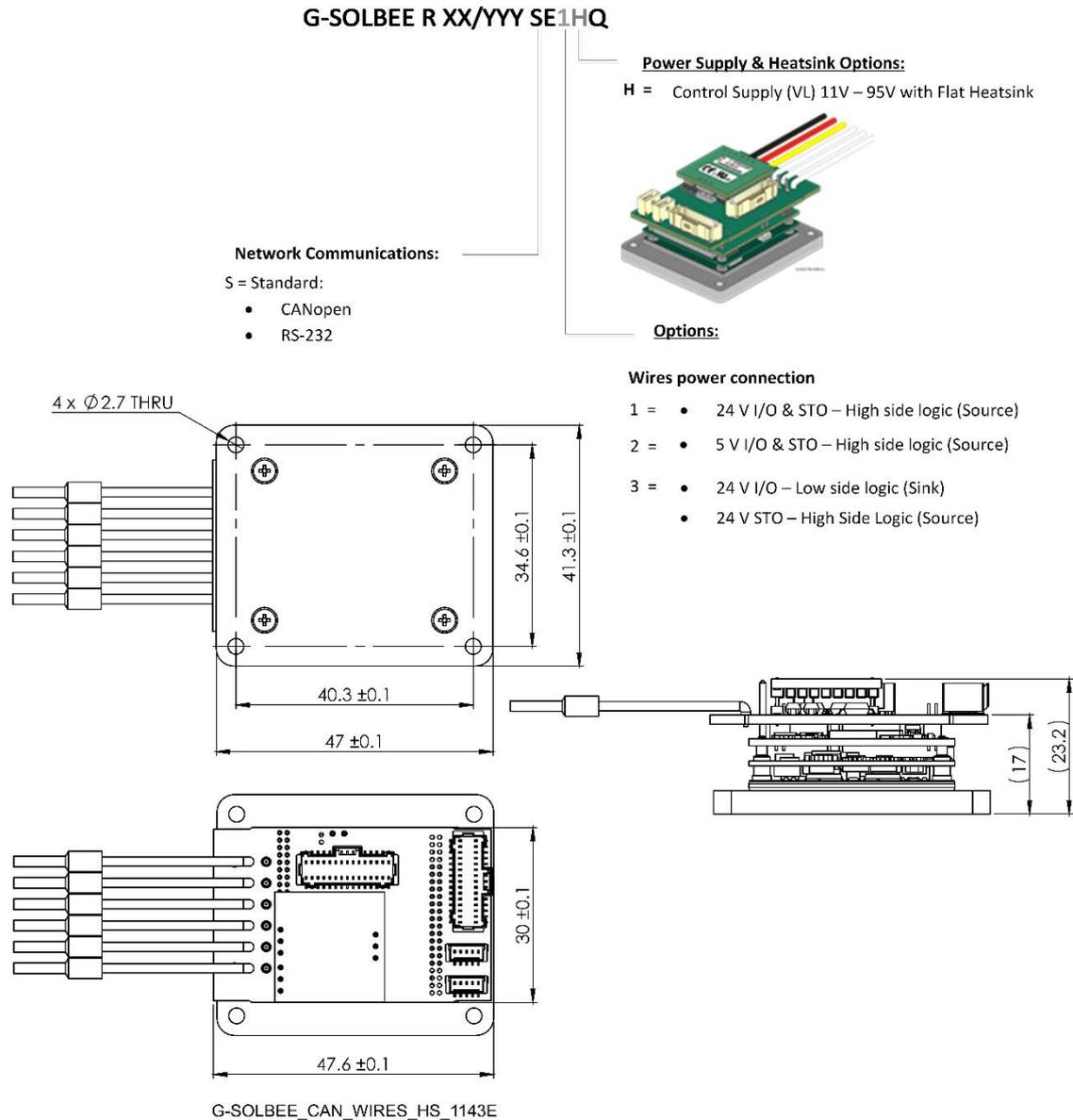


Figure 55: Gold Solo Bee –CAN version with wires to power supply and motor



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 Bee.

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:



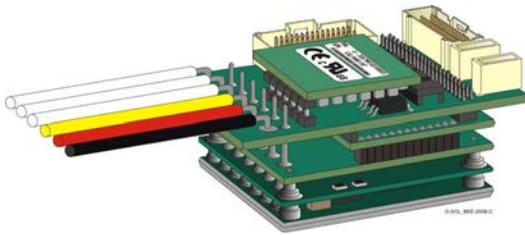
Crimping Tool
Molex P/N 63819-1500
Elmo P/N TOOL-P000040



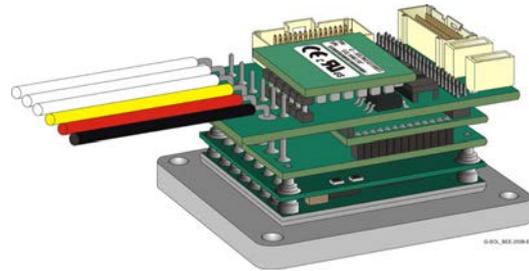
Pins for Single Row Connector
MOLEX P/N 501334-0100
Pins for Dual Row Connector
MOLEX P/N 501193-3000



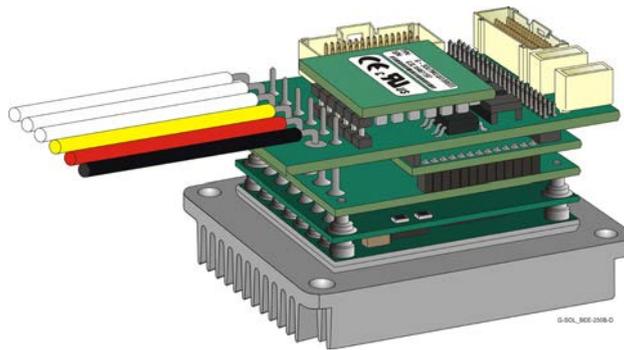
Optionally, the Gold Solo Bee has two standard heat-sink configurations which are obtainable separately as kit accessories from Elmo:



Default Heat Sink



Flat Heat Sink (P/N G-TWIHSFLAT01)



Fins Heat Sink (P/N G-TWIHSFINS01)



11.1. Accessories Heat Sink Dimensions

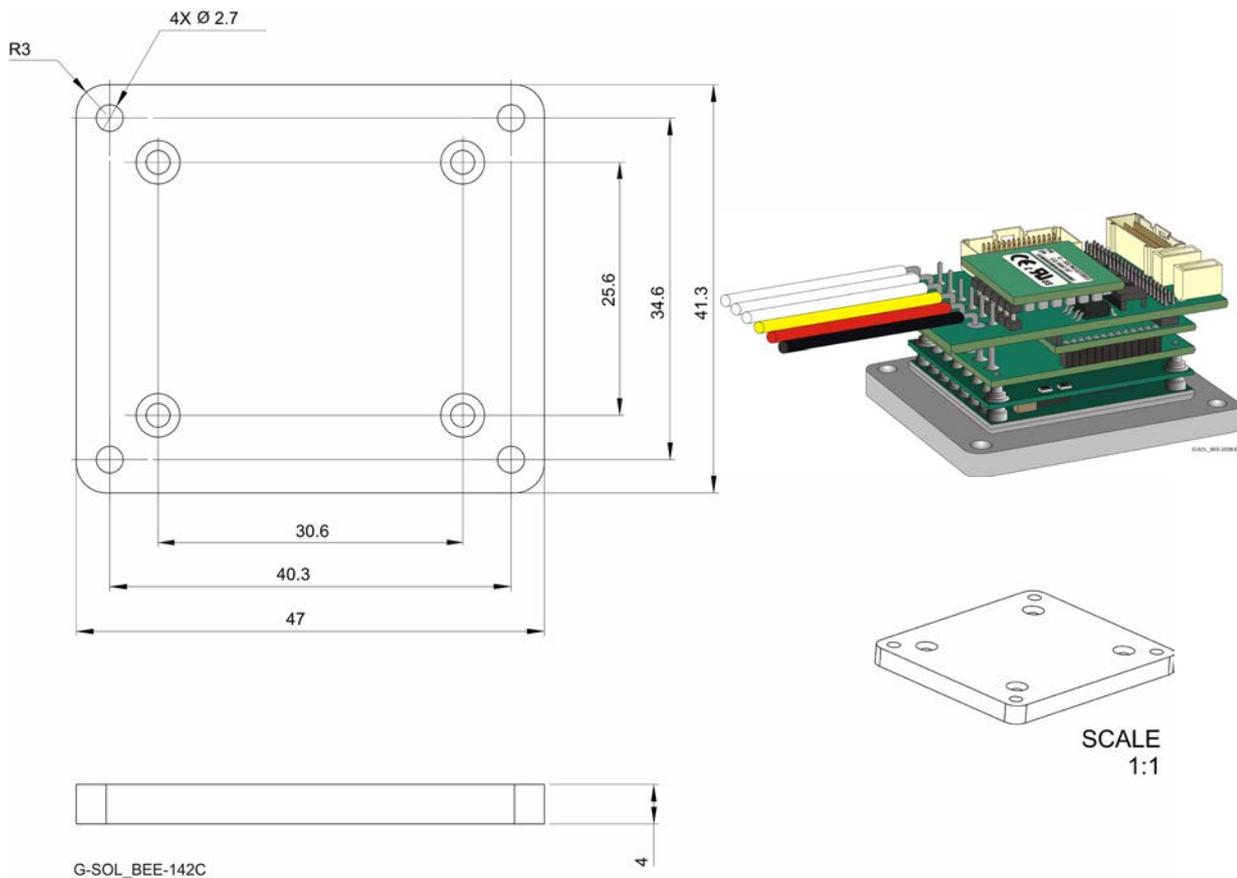
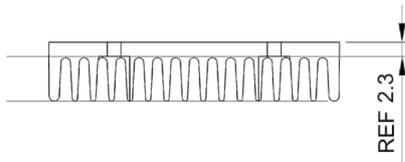
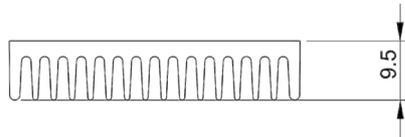
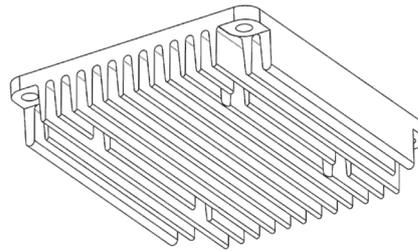


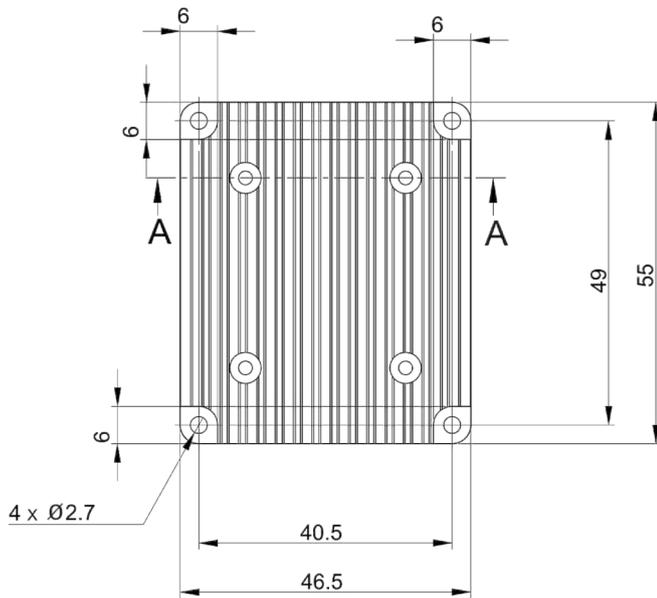
Figure 56: Gold Solo Bee – Flat Heat Sink (P/N G-TWIHSFLAT01) Dimensions



SECTION A-A



EXTRUSION
PROFILE
TOLERANCE ± 0.2



G-SOLBEE-141B

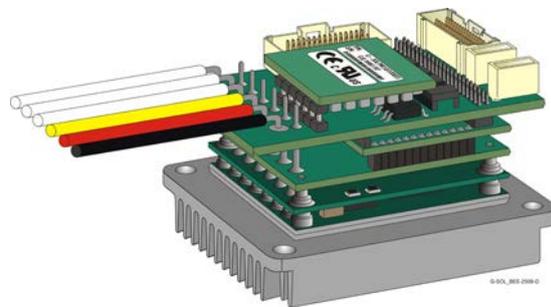


Figure 57: Gold Solo Bee – Fins Heat Sink (P/N G-TWIHSFINS01)

Inspiring Motion

Since 1988

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

