

# **Gold Solo Hawk Digital Servo Drive Installation Guide EtherCAT and CAN**



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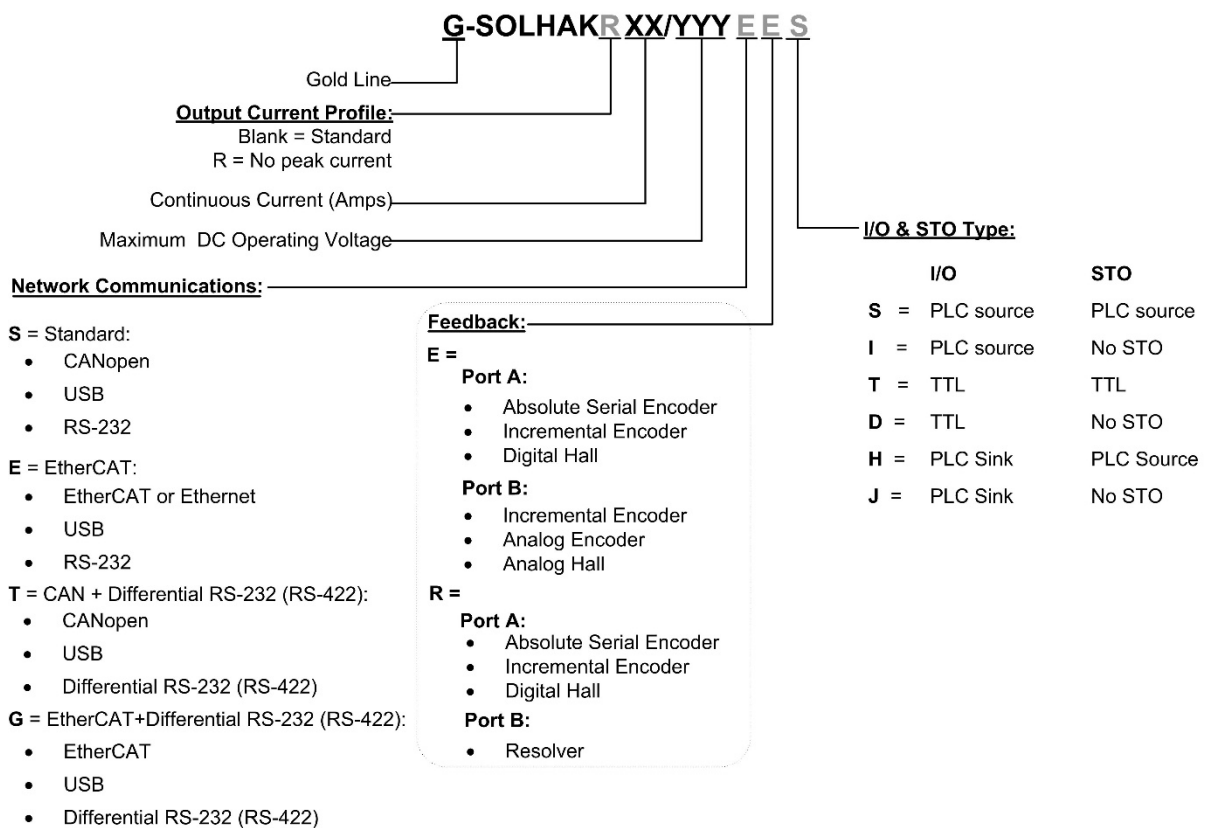
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## Catalog Number



**Note:** There are two models of the Gold Solo Hawk: connectors only for currents of 50 A or less, and wires only, for currents of more than 50 A.

## Cable Kit

Catalog number: CBL-GSOLHAKKIT01 (can be ordered separately).



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## Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Solo Hawk. For a comprehensive detailed description of the functions refer to the MAN-G-Panel Mounted Drives Hardware manual which describes Panel Mounted products.

## Chapter 2: Safety Information

In order to achieve the optimum, safe operation of the Gold Solo Hawk, 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 Hawk 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 Hawk 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.**



**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 Hawk 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 Hawk to an approved isolated Control power 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 Hawk, 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. CE Marking Conformance

The Gold Solo Hawk is intended for incorporation in a machine or end product. The actual end product must comply with all safety aspects of the relevant requirements of the European Safety of Machinery Directive 2006/42/EC as amended, and with those of the most recent versions of standards EN 60204-1 and EN ISO 12100 at the least, and in accordance with 2006/95/EC.

Concerning electrical equipment designed for use within certain voltage limits, the Gold Solo Hawk meets the provisions outlined in 2006/95/EC. The party responsible for ensuring that the equipment meets the limits required by EMC regulations is the manufacturer of the end product.

## 2.4. 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 Hawk is an integrated solution delivering up to **3.3 kW of continuous power** or **6.6 kW of peak power** in a compact package (51.8 (H) x 80 (L) x 61 (W) mm (2.04" x 3.15" x 2.40")), and designed to be simply and efficiently connected directly to the application. The solution consists of the Gold Solo Hawk together with a convenient connection interface which either eliminates or reduces development time and resources when designing an application's PCB board.

This advanced, high power density servo drive provides top performance, advanced networking and built-in safety, as well as a fully featured motion controller and local intelligence. The Gold Solo Hawk is powered by a single 14 V – 195 V isolated DC power source (not included) and a "smart" control-supply algorithm enables the drive to operate with only one power supply with no need for a Control power supply for the logic.

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 Hawk drive is easily set up and tuned using Elmo Application Studio (EAS) software tools. As part of the Gold product line, it is fully programmable with the Elmo motion control language. For more about software tools refer to the Elmo Application Studio Software Manual.

The Gold Solo Hawk is available in a variety of options. There are multiple power rating options, four different communications options:

Option	Suffix in the part number
Standard	S
CANopen & RS-422	T
EtherCAT	E
EtherCAT & RS-422	G

In addition the Gold Solo Hawk offers a variety of feedback selections and I/O configuration possibilities.

### 3.1.1. Accessories

Cable Kit, catalog number: CBL-GSOLHAKKIT01 (can be ordered separately)



## Chapter 4: Technical Information

### 4.1. Physical Specification

Feature	Units	All Types
Weight	g (oz)	239.3 (8.44)
Dimension	mm (in)	51.8 (H) x 80 (L) x 61 (W) mm (2.04" x 3.15" x 2.40")
Mounting method		Panel Mounted

### 4.2. Technical Data

Feature	Units						
		20/100	35/100	50/100	10/200	17/200	20/200
Minimum supply voltage	VDC	14			23		
Nominal supply voltage	VDC	85			170		
Maximum supply voltage	VDC	96			195		
Maximum continuous power output	W	1600	2800	4000	1650	2800	3300
Efficiency at rated power (at nominal conditions)	%	> 98					
Maximum output voltage	VDC	14 V to 96 V			23 V to 195 V		
Continuous current limit (Ic) amplitude of sinusoidal current, or DC trapezoidal commutation	A	20	35	50	10	17	20
Sinusoidal continuous RMS current limit (Ic)	A	14.2	24.7	35.4	7.07	12	14.3
Peak current limit	A	2 x Ic					
Digital out		4 digital outputs					

**Table 1: Power Rating**

**Note on current ratings:** The current ratings of the Gold Solo Hawk are given in units of DC amperes (ratings that are used for trapezoidal commutation or DC motors). The RMS (sinusoidal commutation) value is the DC value divided by 1.41.



### 4.2.1. Control Supply

Feature	Details
Control power supply	<i>Isolated DC source only</i>
Control supply input voltage	14 to 96 VDC (100 V models) 23 to 195 (200 V models)
Control supply input power	≤ 5 VA without external loading ≤ 8 VA with full external loading

### 4.2.2. Product Features

Main Feature	Details	Presence / No.
<b>STO</b>	TTL <i>or</i>	√
	PLC Source	√
<b>Digital Input Option</b>	TTL <i>or</i>	6
	PLC Source <i>or</i>	6
	PLC Sink	6
<b>Digital Output Option</b>	TTL <i>or</i>	4
	PLC Source <i>or</i>	4
	PLC Sink	4
<b>Analog Input</b>	Differential ±10V	1
<b>Feedback</b>	Standard Port A, B, & C	√
<b>Communication Option</b>	USB	√
	EtherCAT <i>or</i>	√
	CAN	√
	EIA RS-232 <i>or</i>	√
	Differential RS-232 (RS-422)	√



### 4.3. Environmental Conditions

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



**Caution:**

The Gold Solo Hawk dissipates its heat by convection. The maximum ambient operating temperature of 70 °C (160 °F) must not be exceeded.

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

Feature	Operation Conditions	Range
<b>Ambient Temperature Range</b>	Non-operating conditions	-50 °C to +100 °C (-58 °F to 212 °F)
	Operating conditions	-40 °C to +70 °C (-40 °F to 160 °F)
<b>Temperature Shock</b>	Non-operating conditions	-40 °C to +70 °C (-40 °F to 160 °F) within 3 min
<b>Altitude</b>	Non-operating conditions	Unlimited
	Operating conditions	-400 m to 12,000 m (-1312 to 39370 feet)
<b>Maximum Humidity</b>	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)
<b>Vibration</b>	Operating conditions	20 Hz to 2,000 Hz, 14.6 g
<b>Mechanical Shock</b>	Non-operating conditions	±40g; Half sine, 11 msec
	Operating conditions	±20g; Half sine, 11 msec
<b>Atmosphere</b>	Operating area atmosphere	No flammable gases or vapors permitted in area



## 4.4. Gold Line Standards

The following table describes the Main Standards of the Gold Solo Hawk servo drive. For further details refer to the MAN-G-Panel Mounted Drives Hardware manual.

Main Standards	Item
	The related standards below apply to the performance of the servo drives as stated in the environmental conditions in section 4.3 Environmental Conditions above.
<b>STO IEC 61800-5-2:2007 SIL 3</b>	Adjustable speed electrical power drive systems – Safety requirements – Functional
<b>EN ISO 13849-1:2008 PL e, Cat 3</b>	Safety of machinery — Safety-related parts of control systems.
<b>Approved IEC/EN 61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>Recognized UL61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>Recognized UL 508C</b>	Power Conversion Equipment
<b>In compliance with UL 840</b>	Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment
<b>Conformity with CE 2006/95/EC</b>	Low-voltage directive 2006/95/EC
<b>Recognized CSA C22.2 NO. 14-13</b>	Industrial Control Equipment





## Chapter 5: Installation

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

### 5.1. Unpacking the Drive Components

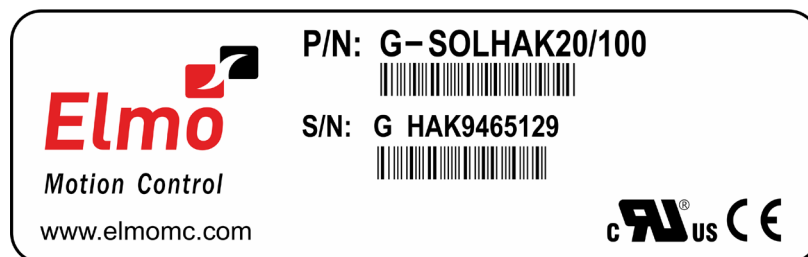
Before you begin working with the Gold Solo Hawk, verify that you have all of its components, as follows:

- The Gold Solo Hawk servo drive
- The Elmo Application Studio software and software manual

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

#### To unpack the Gold Solo Hawk:

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



4. Verify that the Gold Solo Hawk 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.



## 5.2. Connectors and Indicators

The Gold Solo Hawk has 4 connectors (connectors' version).

### 5.2.1. Connector Types

Port	No. Pins	Type	Function
<p style="text-align: center;">G-SOLHAK053D-A</p>			
J4	1x5	CONEC D-SUB 5W5 PLUG 40A STR 5-Pin Connector	Power & Phase
J1	2x15	NICOMATIC 221Y30F21 T.H CMM220 30 Pin Connector	VL, PORT A, PORT B, PORT C
J2	2x12	NICOMATIC 221Y24F21 T.H CMM220 24 Pin connector	STO, IO, Analog
J3	2x10	NICOMATIC 221Y20F21 T.H CMM220 20 Pin Connector	Communication

**Table 2: Connector Types**

### 5.2.2. Mating Connector Types

Port	Drive Connector Type	Mating Connector Type
J4	CONEC D-SUB 5W5 PLUG 40A STR	Mating JCW-221005G, Contacts JCW-221005CF
J1	NICOMATIC 221Y30F21 T.H CMM220	Mating +contacts JCW-220230FG
J2	NICOMATIC 221Y24F21 T.H CMM220	Mating +contacts JCW-220224FG
J3	NICOMATIC 221Y20F21 T.H CMM220	Mating + contacts JCW-220220MG

**Table 3: Mating Connector Types**

The pinouts in Chapter 6: Wiring describe the function of each pin in the Gold Solo Hawk connectors that are listed in Table 2.



### 5.3. Mounting the Gold Solo Hawk

The Gold Solo Hawk was designed for mounting on a surface. When integrating the Gold Solo Hawk into a device, be sure to leave about 1 cm (0.4") outward from the heat-sink to enable free air convection around the drive. If the Gold Solo Hawk is enclosed in a metal chassis, we recommend that the Gold Solo Hawk be screw-mounted to it to help with heat dissipation. The Gold Solo Hawk has screw-mount holes on each corner of the heat-sink for this purpose. Use four 3.5 mm screws to secure the Gold Solo Hawk.

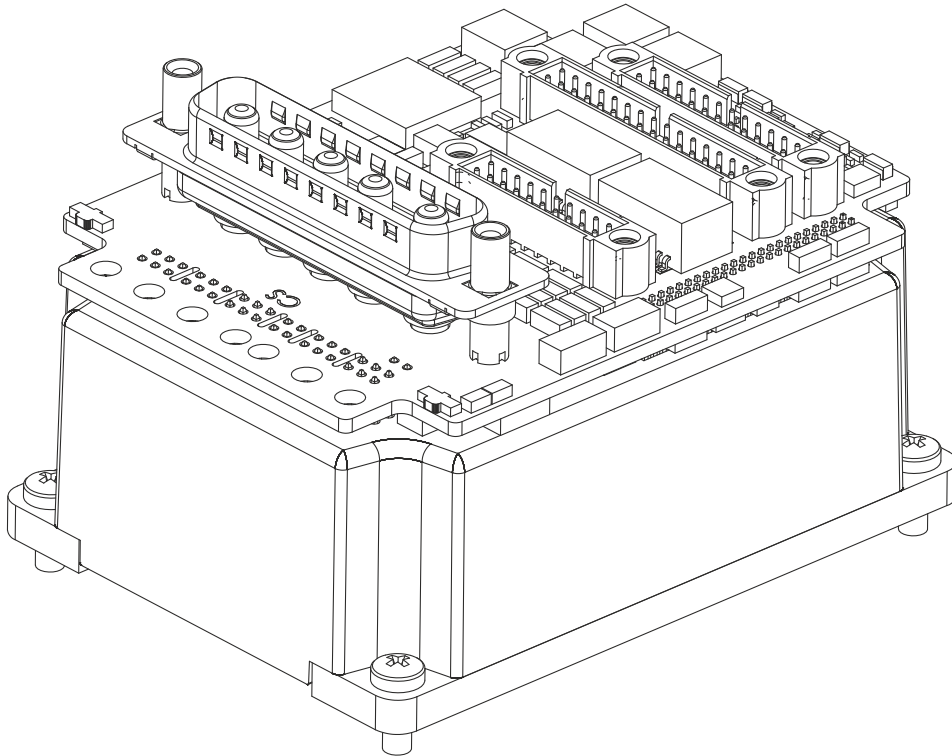
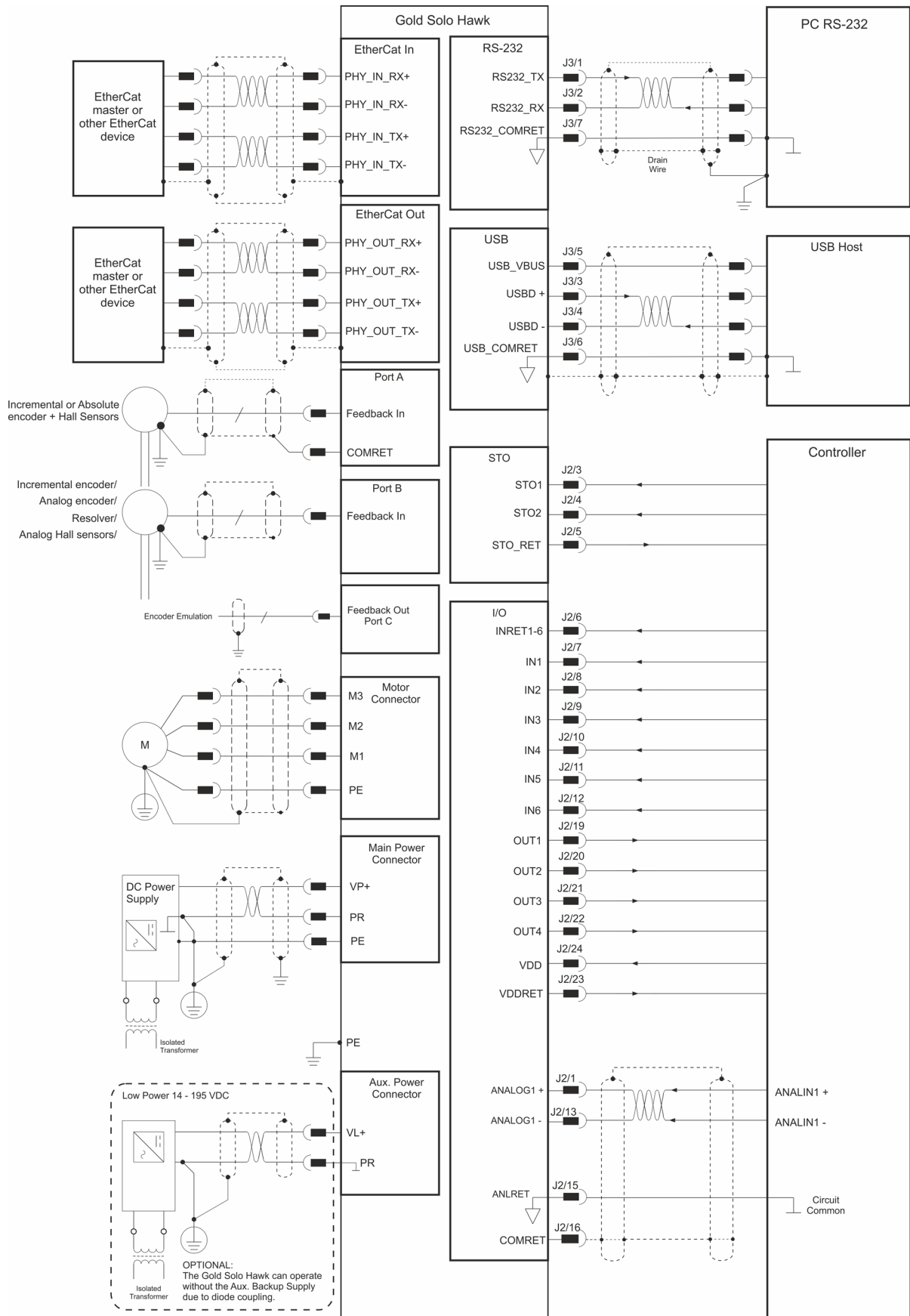


Figure 1: Mounting the Gold Solo Hawk

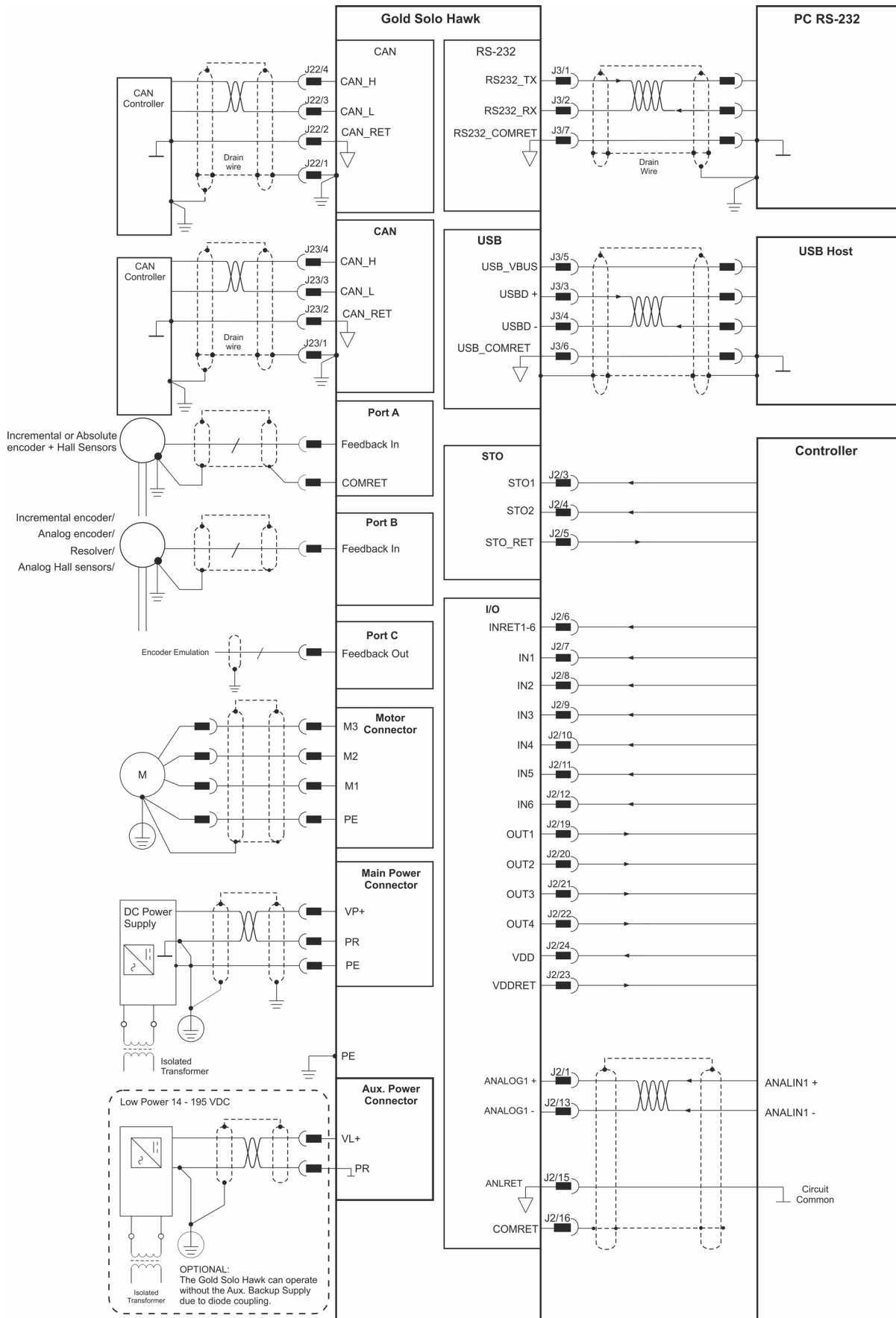


## 5.4. The Gold Solo Hawk Connection Diagrams



G-SOLHAK032B

Figure 2: The Gold Solo Hawk Connection Diagram - EtherCAT



G-SOLHAK033C


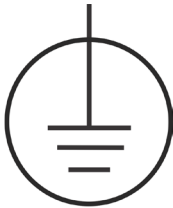
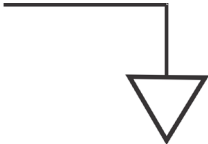
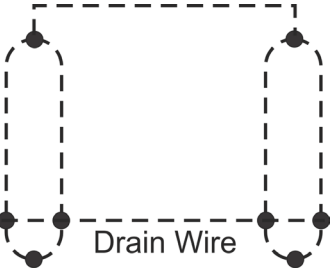
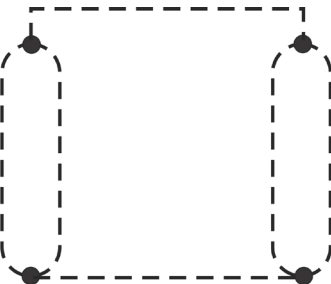
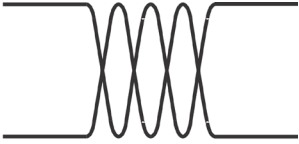
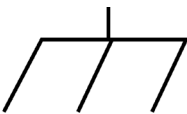
Figure 3: The Gold Solo Hawk Connection Diagram – CAN



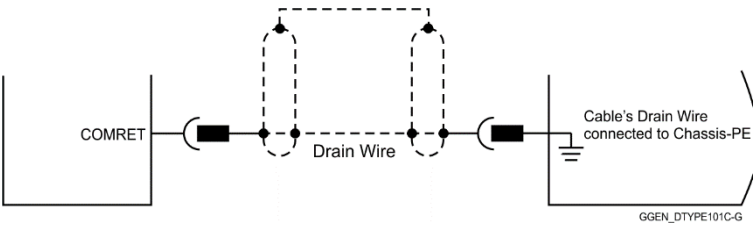
## Chapter 6: Wiring

Once the product is mounted, you are ready to wire the device. Proper wiring, grounding and shielding are essential for ensuring safe, immune and optimal servo performance of the drive.

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_101D-K	Analog Ground



Wiring Symbol	Description
	<p>Encoder Earthing.</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>





## 6.1. Basic Recommendations

### 6.1.1. General

1. Use shielded cables. For best results, the cable should have an aluminum foil shield covered by copper braid, and should contain a drain wire.  
Use 24, 26 or 28 AWG twisted-pair shielded with drain wire cables.
2. Keep the cable as short as possible.  
Do not mount the power cables of the motor and power bus in the proximity of the control and feedback cables.
3. Ensure that in normal operating conditions, the “earth connection” wires and shield of the control cables *carry no current*. The only time these conductors carry current is under abnormal conditions, when electrical equipment has become a potential shock or fire hazard while conducting external EMI interferences directly to ground, in order to prevent them from affecting the drive. Failing to meet this requirement might result in drive/controller/host failure.
4. The PE (Earth connection) is connected internally in the drive to the Gold Solo Hawk’s chassis (heat-sink) which serves as an EMI common plane.

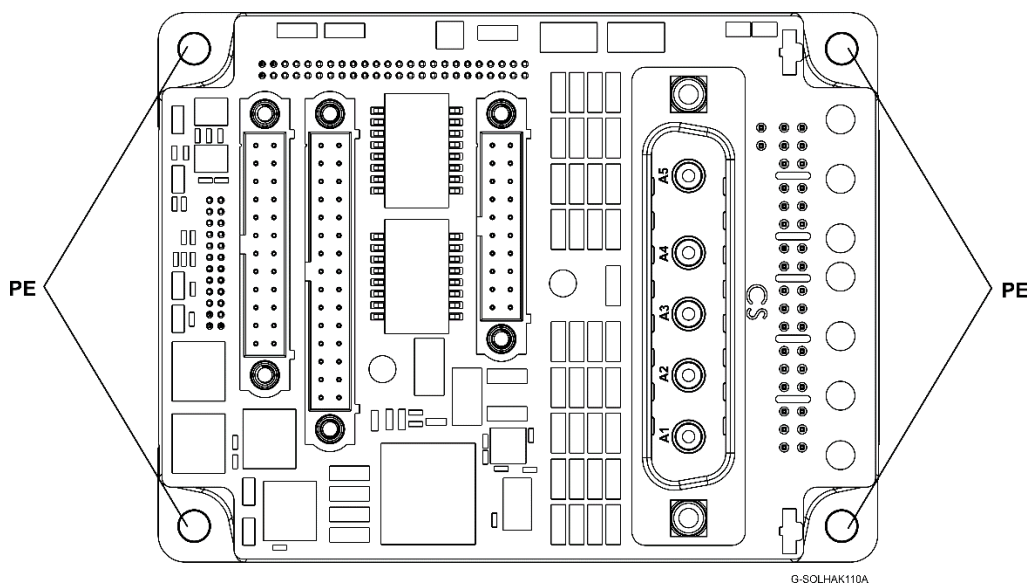


Figure 4: Protective Earth on the Gold Solo Hawk

**Note:** The Heat sink is used as the PE junction.

5. After completing the wiring, carefully inspect all wires to ensure tightness, good solder of joints and general safety.
6. Where there is only one COMRET pin (Common Return) in the connector, which MUST be connected to the DRAIN WIRE and also to COMRET signal of the cable, it is necessary to connect the drain wire and COMRET signal to the same pin.



### 6.1.2. Feedback Cable Port A and Port B Connector

1. On the motor side connections, ground the shield to the motor chassis.
2. At least One COMRET (Common Return) must be connected to the PE.

Implement the following steps to connect the COMRET to the PE:

- a. At the drive, connect the feedback drain wire to one of the COMRET terminals in the shrouded feedback connector (Figure 5).
- b. At the motor, connect the feedback cable drain wire to the GND motor chassis terminal of the feedback connector.

The drawings below display two earth connections.

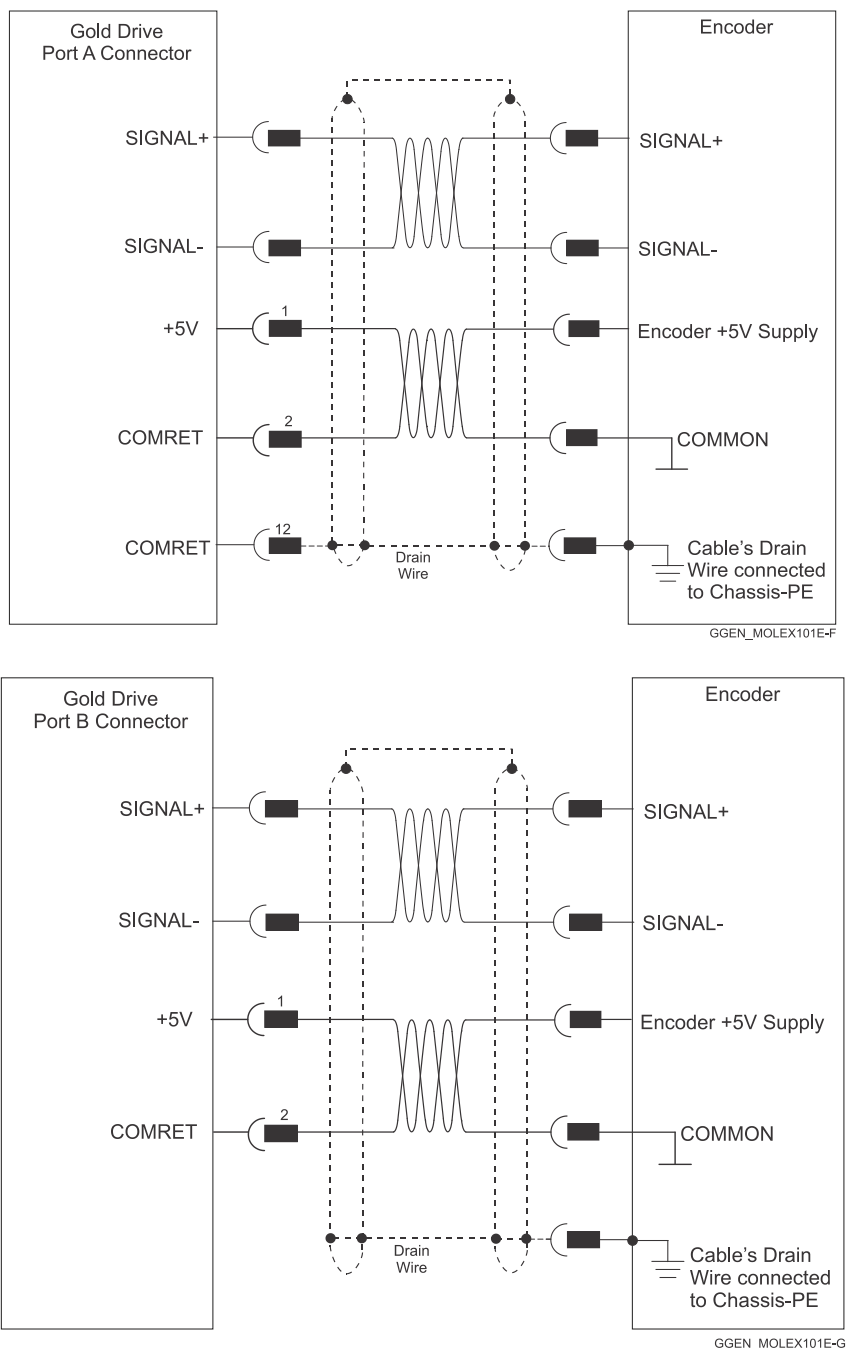


Figure 5: Feedback Port A and B Cable Assemblies



### 6.1.3. Feedback Cable Port C Connector

1. At the controller side connections, follow the controller manufacturer's recommendations concerning the shield.
2. The connection of the Drain wire to the Port C is not mandatory.

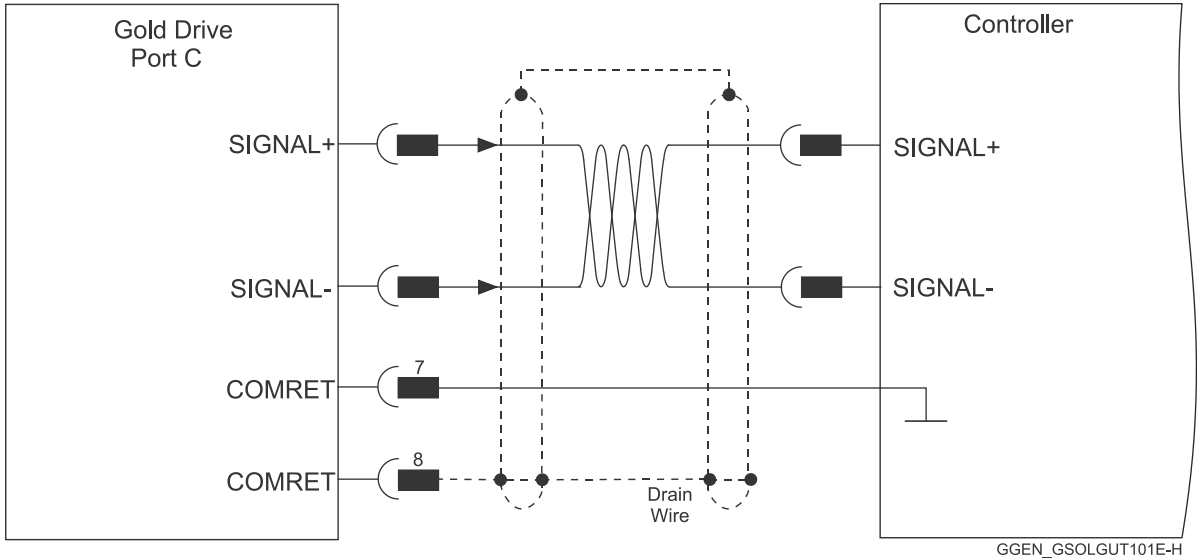


Figure 6: Feedback Port C Cable Assemblies

### 6.1.4. IO Cable Connector

It is recommended to use shielded cable, but is not mandatory.

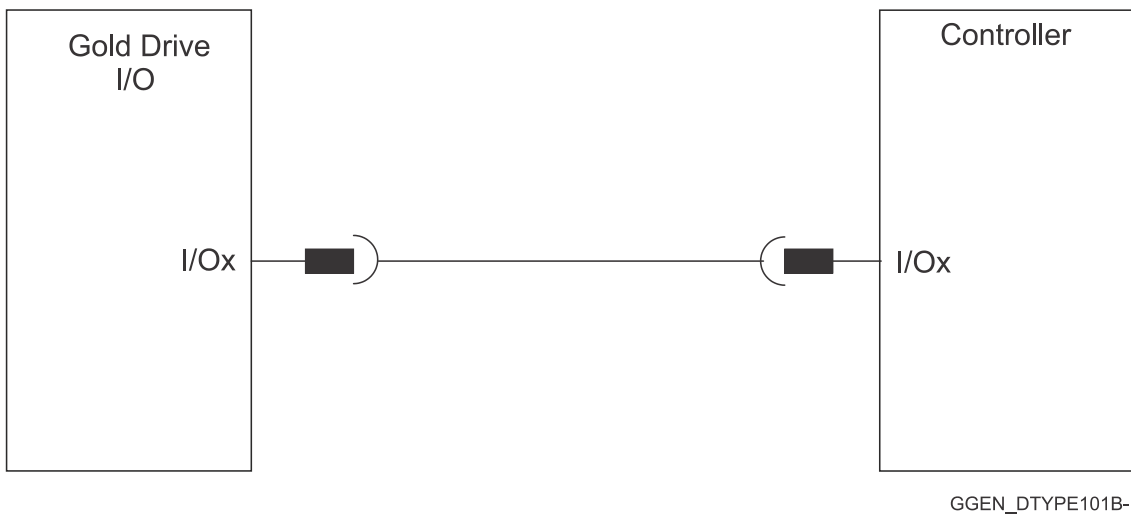


Figure 7: Feedback IO Cable Assemblies



### 6.1.5. STO (Port C) Cable Connector

It is recommended to use shielded cable, but is not mandatory.

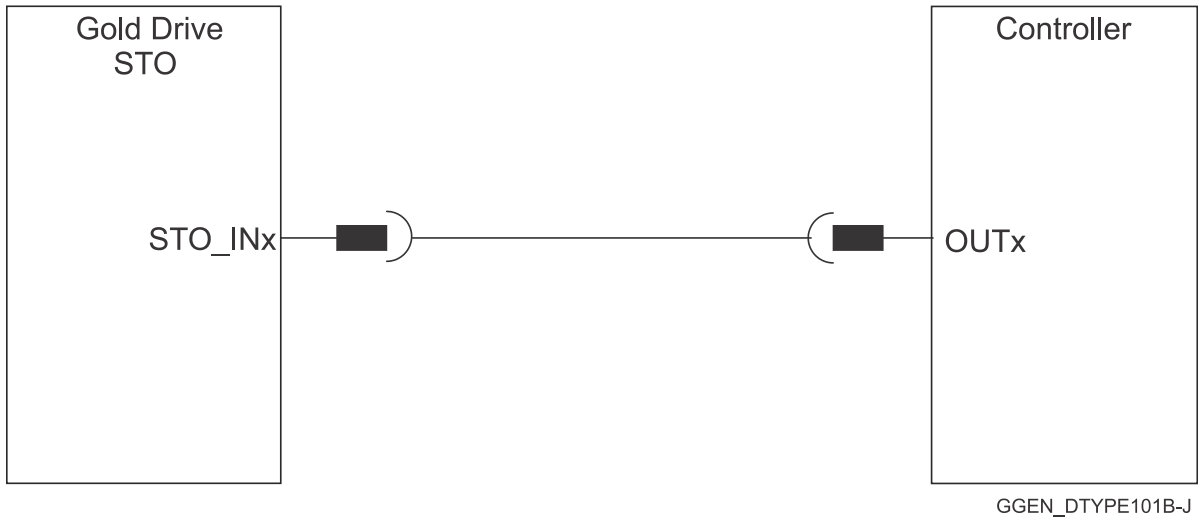


Figure 8: STO Cable Assemblies



## 6.2. Motor Power Connector Pinouts (J4)

See Chapter 8 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Pin (J4)	Signal	Function	Cable - Wires	
			Brushless Motor	Brushed DC Motor
A1	M3	Motor Phase 3	Motor	Motor
A2	M2	Motor Phase 2	Motor	Motor
A3	M1	Motor Phase 1	Motor	N/C
	PE	Earthing connections	PE wire	

### Pin Positions

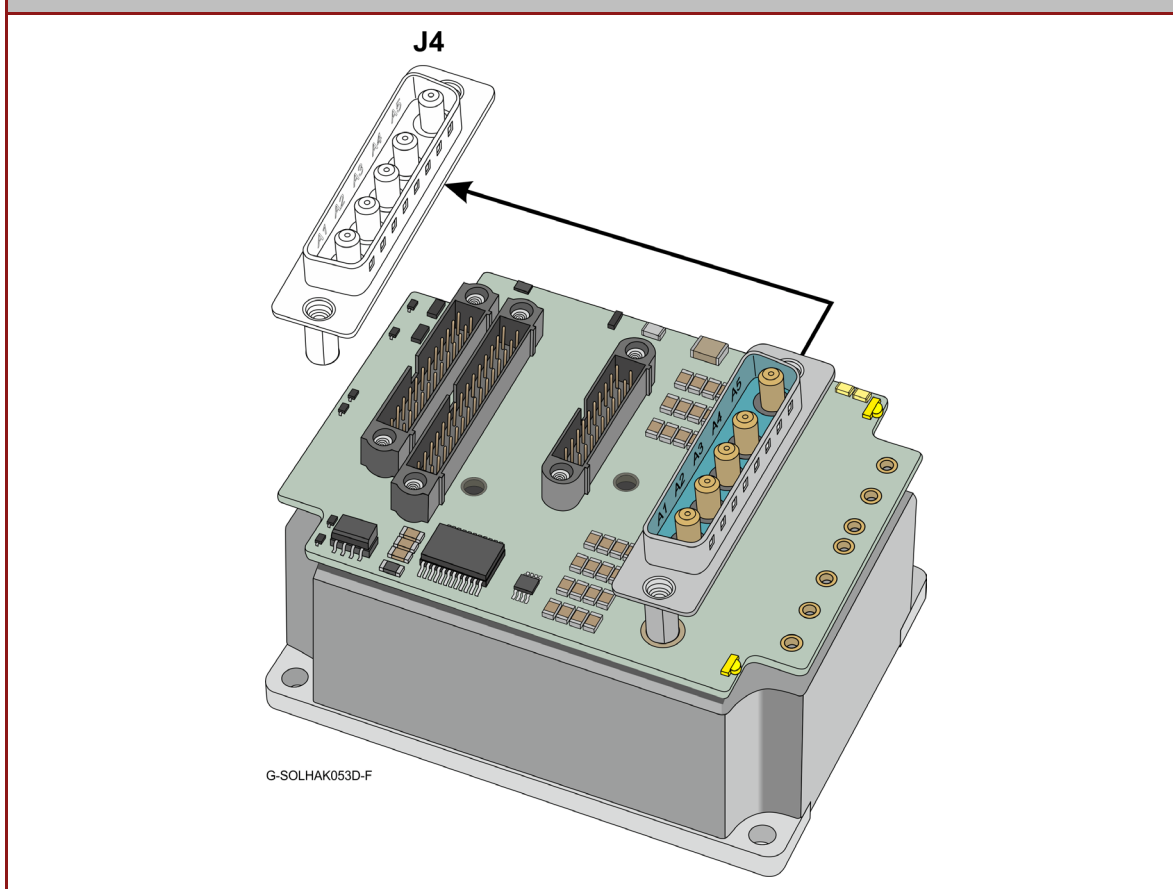


Table 4: Main Power and Motor Connections

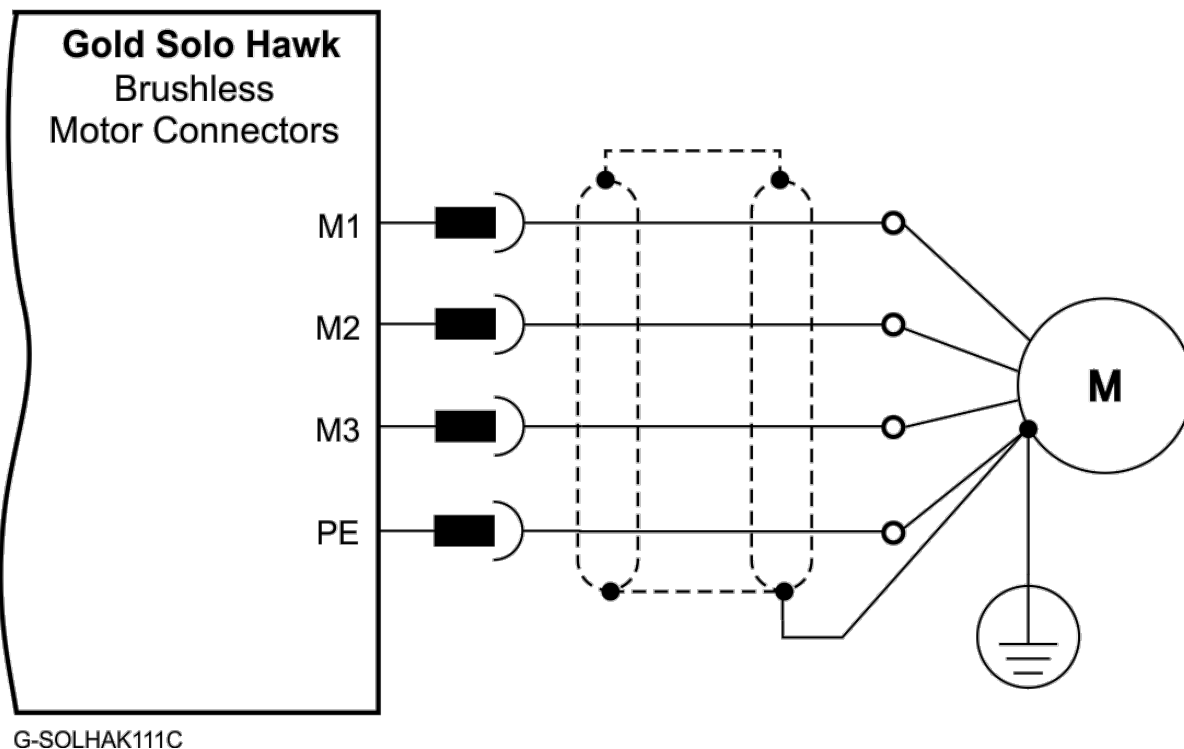


Figure 9: Brushless Motor Power Connection Diagram

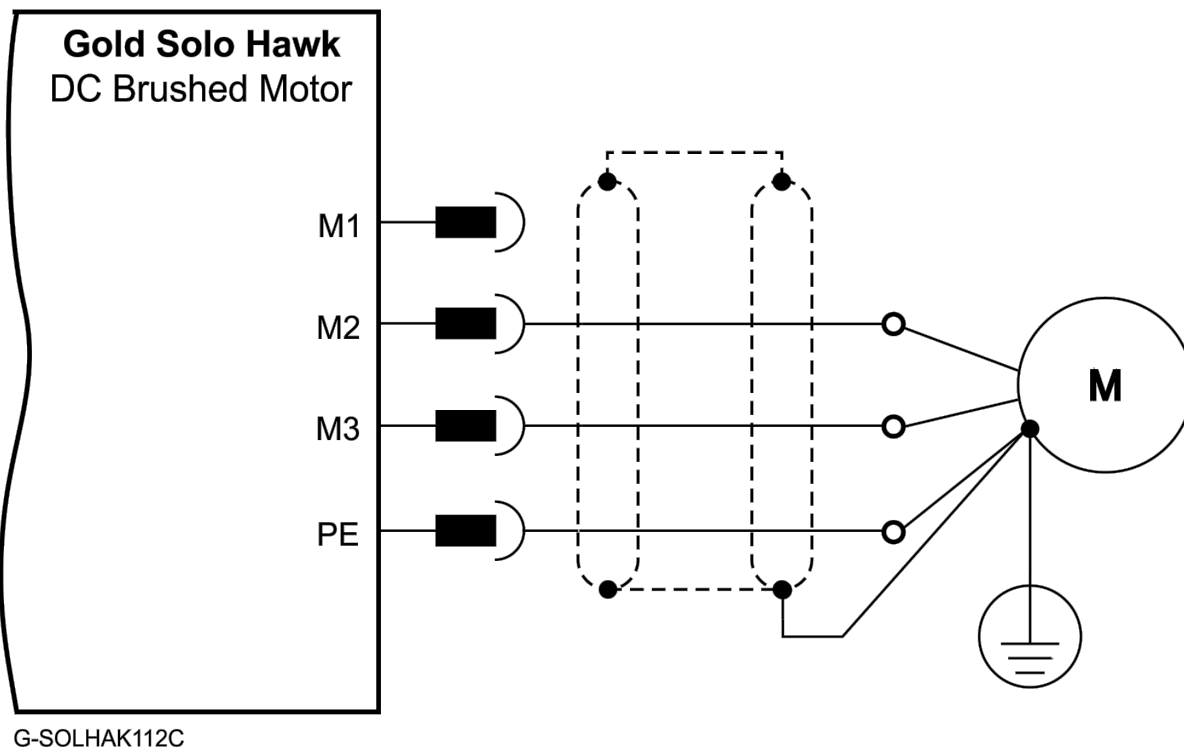


Figure 10: DC Brushed Motor Power Connection Diagram



## 6.3. Main Power, Control Power (J4)

### 6.3.1. Main Power

- Single DC Power Supply - Power to the Gold Solo Hawk is provided by a 14 to 195 VDC single isolated DC power source (not included with the Gold Solo Hawk). A “smart” control-supply algorithm enables the Gold Solo Hawk to operate with only one power supply with no need for a control power supply for the logic.
- Optional Backup Supply - If backup functionality is required in case of power loss, e.g., to keep the original position, a 14 to 195 VDC external isolated supply should be connected (via the Gold Solo Hawk’s VL+ terminal). This is more flexible than the requirement for 24 VDC supply. If backup is not needed, a single power supply is used for both the power and logic circuits.

There are multiple voltage ratings of the Gold Solo Hawk (14 V to 195 V), so you must use the correct power supply according to the maximum operating voltage of the Gold Solo Hawk. Refer to the Section 4.2 Technical Data.

Pin	Signal	Function	Cable
A4	PR	Power Return	Power
A5	VP+	Positive Power Input	Power
	PE	Earth connections	PE wire

#### Pin Positions

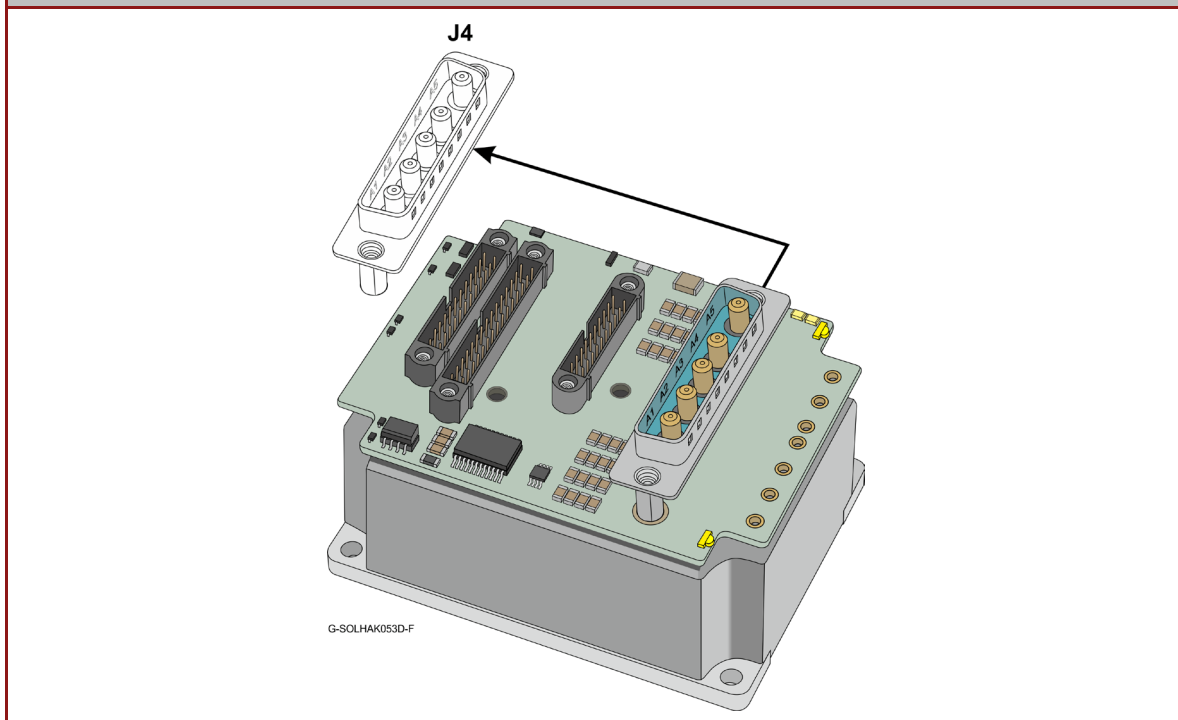


Table 5: Main Power and Motor Connections

Power to the Gold Solo Hawk is provided by a 14 to 195 VDC source. A smart control-supply algorithm enables the Solo Guitar to operate with the power supply only, with no need for a control supply.

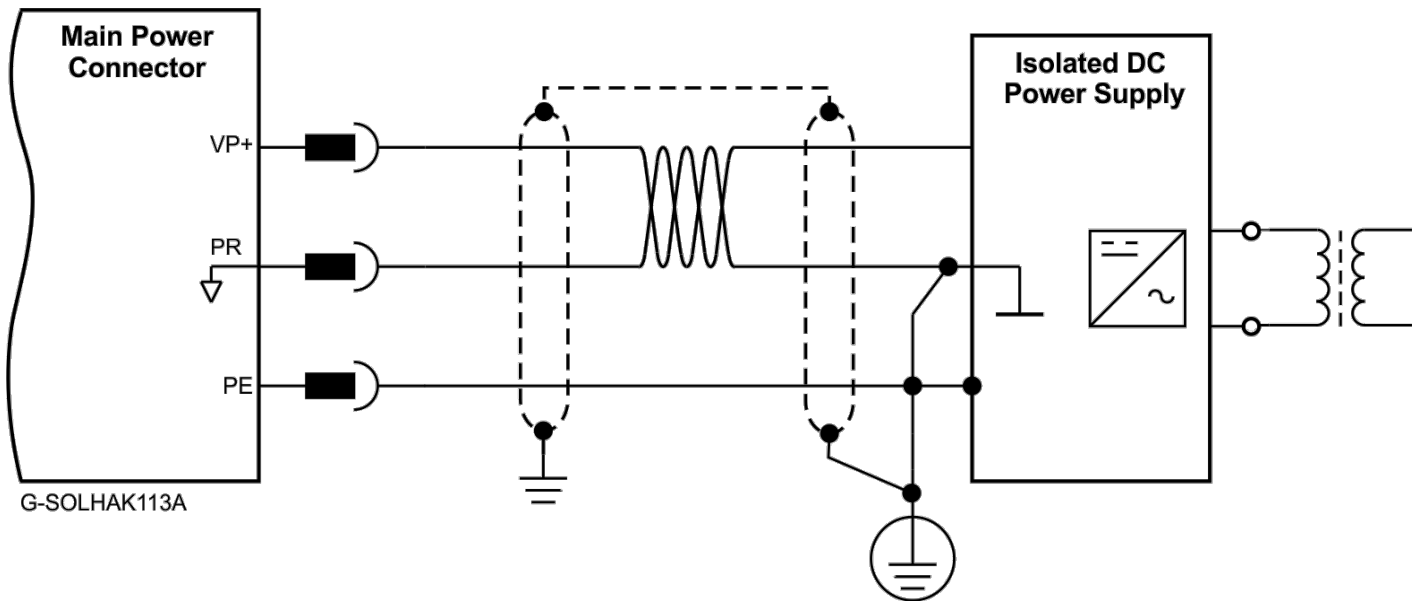
Connect the DC power cable to the VP+ and PR terminals on the Main Power Connector.





**To connect the DC power supply:**

1. The source of the 14 to 195 VDC power supply must be isolated.
2. For best immunity, it is highly recommended to use twisted and shielded cables for the DC power supply. A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the motor.
3. Connect the cable shield to the closest ground connection near the power supply.
4. Connect the PE to the closest ground connection near the power supply.
5. Connect the PR to the closest ground connection near the power supply.
6. Before applying power, first verify the polarity of the connection.



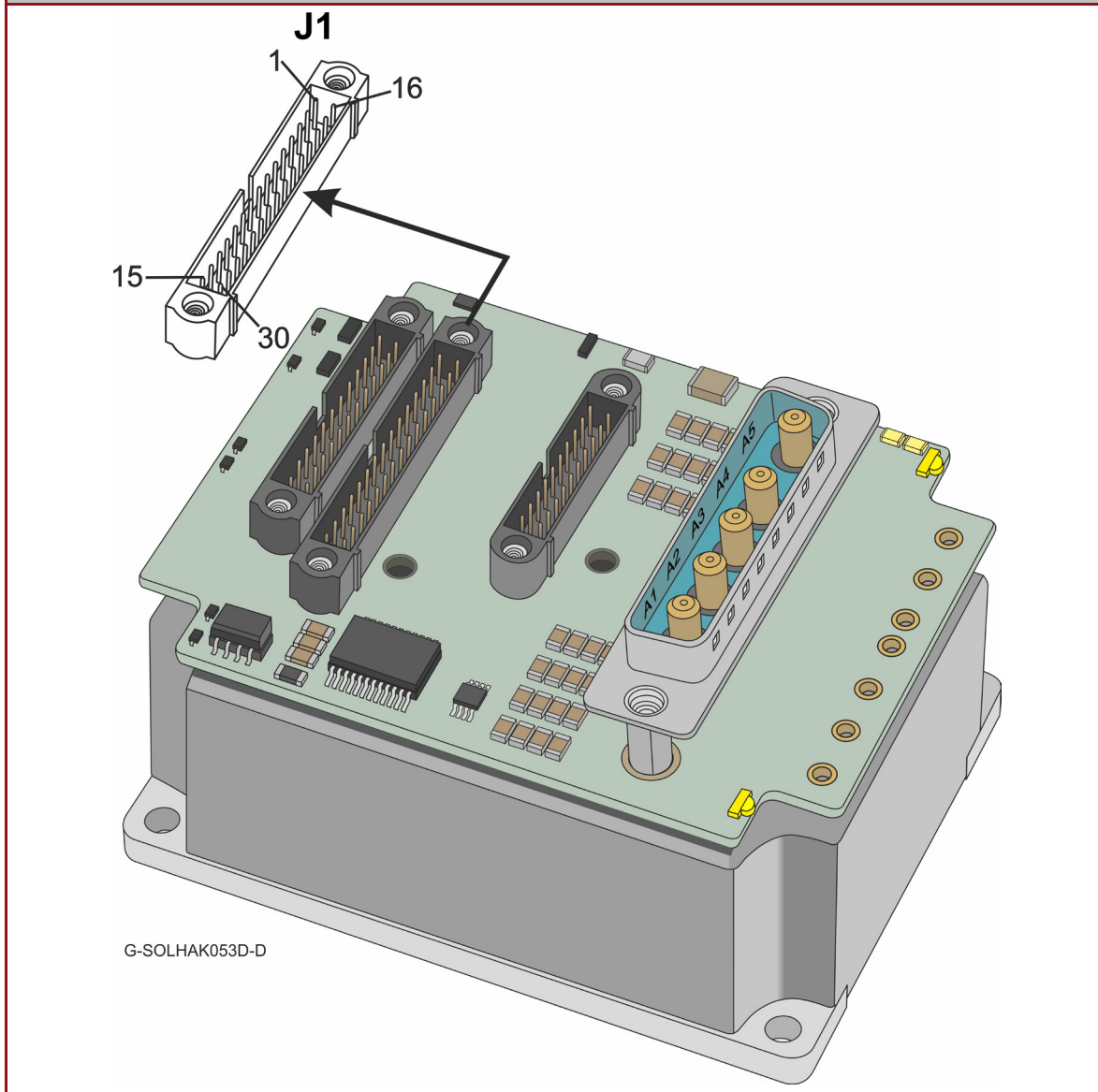
**Figure 11: Main Power Supply Connection Diagram (no Control Supply)**



### 6.3.2. Control Power Supply (J1) - (Optional)

Pin	Signal	Function
J1/1	PR	Control Supply Return
J1/16	VL+	Control Supply Input

#### Pin Positions



**Table 6: Control Supply Pins**

**Note:** The source of the Control Supply must be isolated.

Connect the VL+ and PR pins on the Gold Solo Hawk in the manner described on page 28.



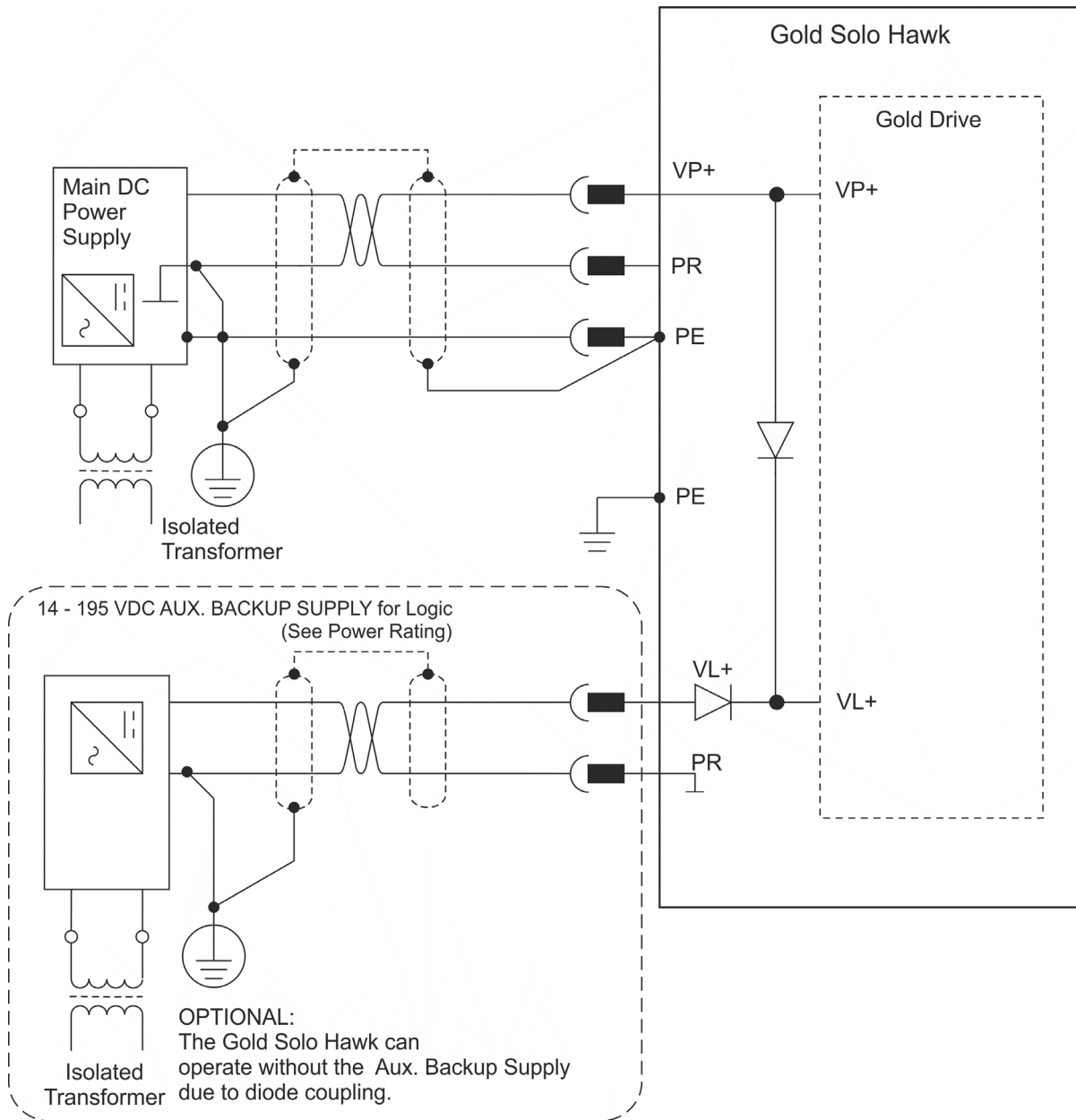
**Caution:** Power from the Gold Solo Hawk to the motor must come from the Main Supply and **not** from the Control Supply.

Power to the Control Supply can be provided by a separate Control Supply.



**To connect the Control supply:**

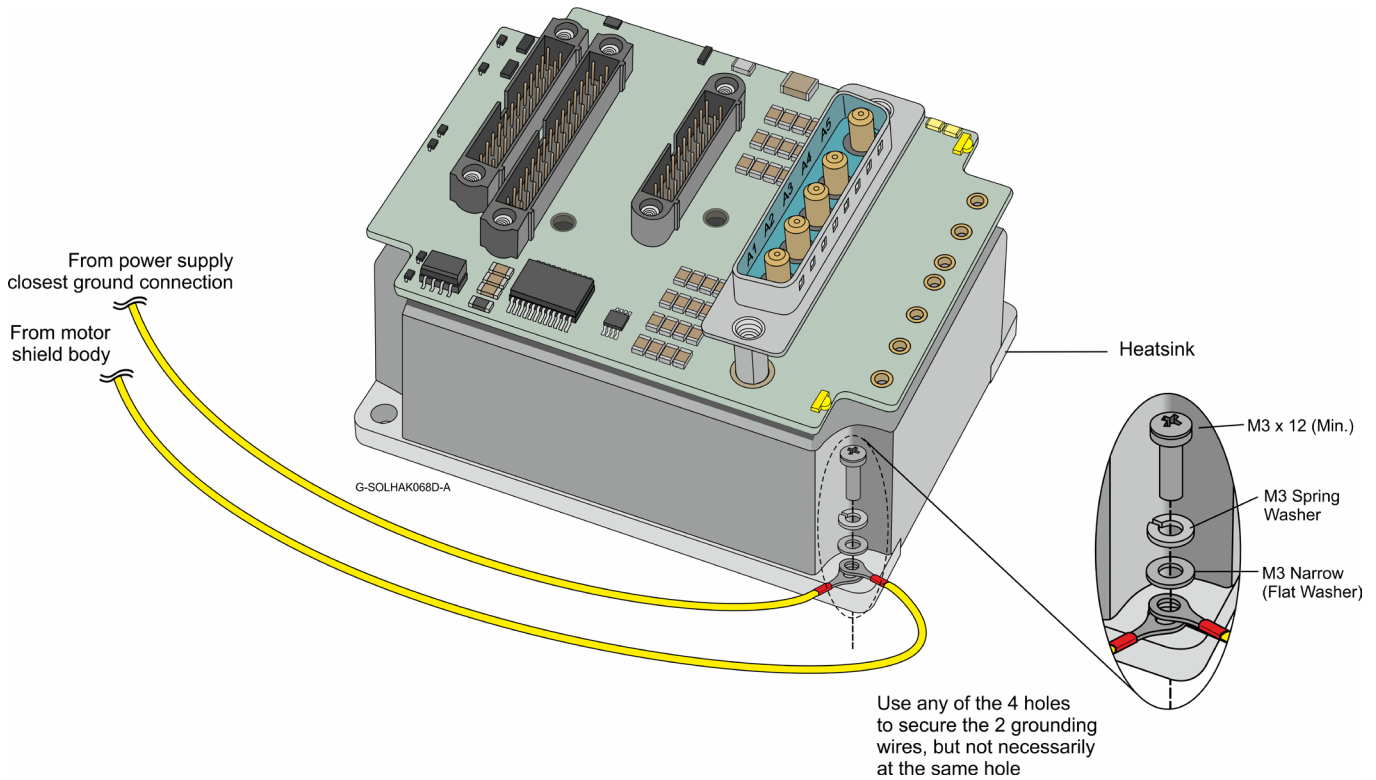
1. The source of the Control supply must be isolated.
2. For safety reasons, connect the return (common) of the Control supply source to the closest ground near the Control supply source.
3. Connect the cable shield to the closest ground near the Control supply source.
4. Before applying power, first verify the polarity of the connection.



**Figure 12: Separate Control Supply Connection Diagram**



### 6.3.3. Connecting Groundings (PEs)



**Figure 13: Connecting Groundings to the Heatsink**

When connecting to the groundings (corner PEs heatsink in Figure 13) from the Power Supply and Motor to the Gold Solo Hawk heat-sink at any of its four securing screw holes, make sure of the following:

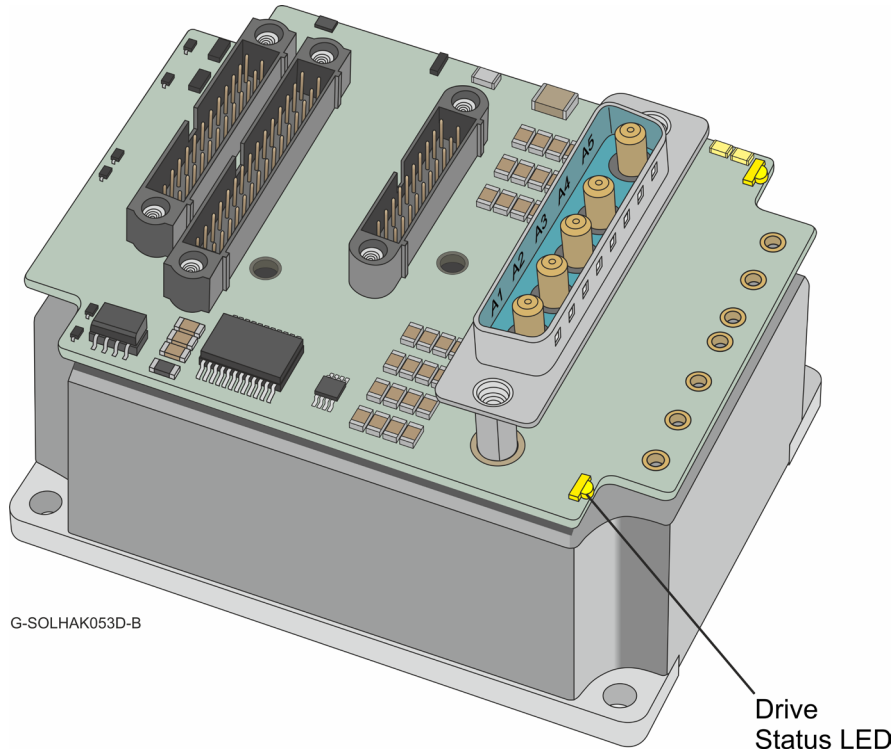
- Secure the terminal rings of the grounding wires to the servo drive heatsink securing holes using M3 Screw(s), M3 Spring washer(s), and M3 Flat washer(s).
- Connect the open side of the grounding wires to:
  - First wire - Closest ground connection near the power supply.
  - Second wire - Motor shield body.

**NOTE:** It is not required to secure both wires to the same heat-sink screw-hole.



## 6.4. Drive Status Indicator

Figure 14 shows the position of the 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.



**Figure 14: Drive Status LED**

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).



## 6.5. Port A, Port B, Port C, and VL Connector (J1)

Connector J1 is a 30 pin connector which includes the functions of Ports A, B, C, and the VL Control power. See Sections 10.3, 10.4 and 10.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

VL	Signal	Function
Pin (J1)	Signal	Function
1	PR	Control Supply Return
16	VL+	Control Power Input

Port A	Incremental Encoder		Absolute Serial Encoder	
Pin (J1)	Signal	Function	Signal	Function
2	PortA_ENC_A+	Channel A +	ABS_CLK+	Absolute encoder clock+
3	PortA_ENC_A-	Channel A -	ABS_CLK-	Absolute encoder clock-
4	PortA_ENC_B+	Channel B+	ABS_DATA+	Absolute encoder data+
5	PortA_ENC_B-	Channel B -	ABS_DATA-	Absolute encoder data -
6	PortA_ENC_INDEX+	Index+	Reserved	Reserved
7	PortA_ENC_INDEX-	Index -	Reserved	Reserved
8	+5V	Encoder +5V supply	+5V	Encoder +5V supply
9	COMRET	Common Return	COMRET	Common Return
26	PORTA_SHIELD	In case of Port A shielding connect drain wire to this pin	PORTA_SHIELD	In case of Port A shielding connect drain wire to this pin
27	HA	Hall sensor A	HA	Hall sensor A
28	HB	Hall sensor B	HB	Hall sensor B
29	HC	Hall sensor C	HC	Hall sensor C



Port B	Incremental or Interpolated Analog Encoder		Resolver	
Pin (J1)	Signal	Function	Signal	Function
17	PortB_ENC_A+/SIN+	Channel A+/Sine+	SIN+	Sine+
18	PortB_ENC_A-/SIN-	Channel A-/Sine-	SIN-	Sine-
19	PortB_ENC_B+/COS+	Channel B+/Cosine+	COS+	Cosine+
20	PortB_ENC_B-/COS-	Channel B-/Cosine-	COS-	Cosine-
21	PortB_ENC_INDEX+/Analog_Index+	Channel_Index+/Analog_Index+	RESOLVER_OUT+	Vref f=1/TS, 50 mA Max.
22	PortB_ENC_INDEX-/Analog_Index-	Channel_Index-/Analog_Index-	RESOLVER_OUT-	Vref complement f= 1/TS, 50 mA Max.
23	+5V	Encoder +5V supply	NC	
24	COMRET	Common Return	COMRET	Common Return
25	PORTB_SHIELD	In case of Port B shielding connect drain wire to this pin	PORTB_SHIELD	In case of Port B shielding connect drain wire to this pin





Port C		Encoder Output
Pin (J1)	Signal	Function
10	PORTC_ENCO_A+	Buffered Channel A Output
11	PORTC_ENCO_A-	Buffered Channel A Complement Output
12	PORTC_ENCO_B+	Buffered Channel B Output
13	PORTC_ENCO_B-	Buffered Channel B Complement Output
14	PORTC_ENCO_INDEX+	Buffered INDEX Output
15	PORTC_ENCO_INDEX-	Buffered INDEX Complement Output
30	PORTC_SHIELD	In case of Port C shielding connect drain wire to this pin

Pin Positions	Cable Connector
<p>G-SOLHAK053D-D</p>	<p><b>30-Pin Connector</b></p>

Table 7: Connector J1 – Port A, Port B, Port C, VL Pin Assignments



### 6.5.1. Incremental Encoder

The following figure describes the connections at Port A for the Incremental encoder.

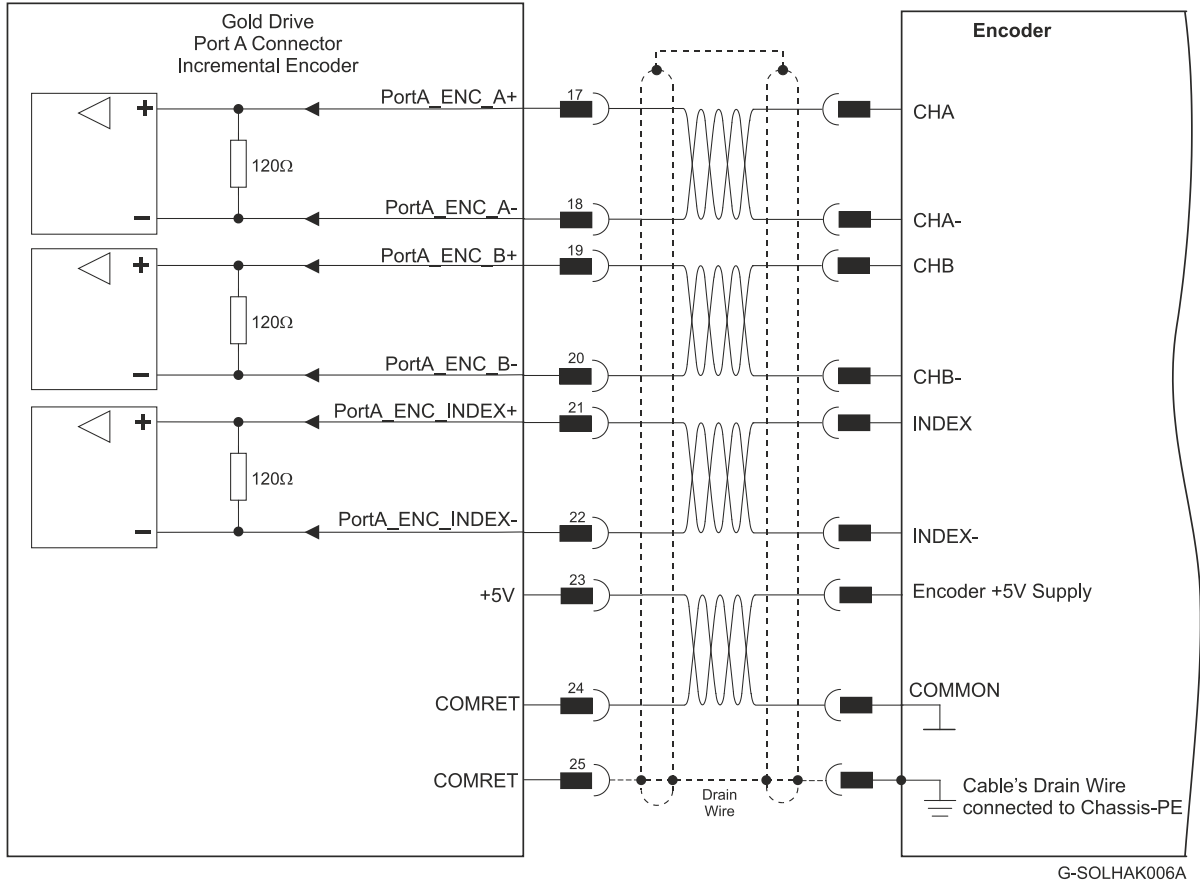


Figure 15: Port A Incremental Encoder Input – Recommended Connection Diagram

### 6.5.2. Hall Sensor

The following figure describes the connections at Port A for the Hall Sensor.

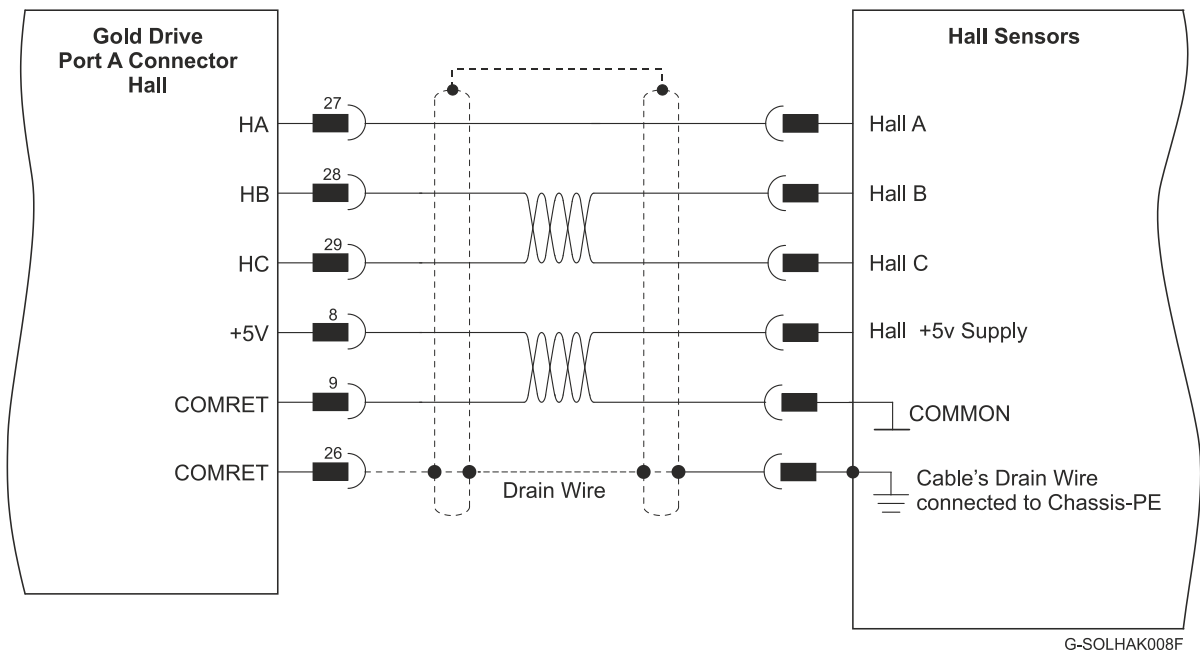


Figure 16: Hall Sensor Connection Diagram



### 6.5.3. Absolute Serial Type Encoder

The following figures describe the connections at Port A for the Absolute Serial type encoders.

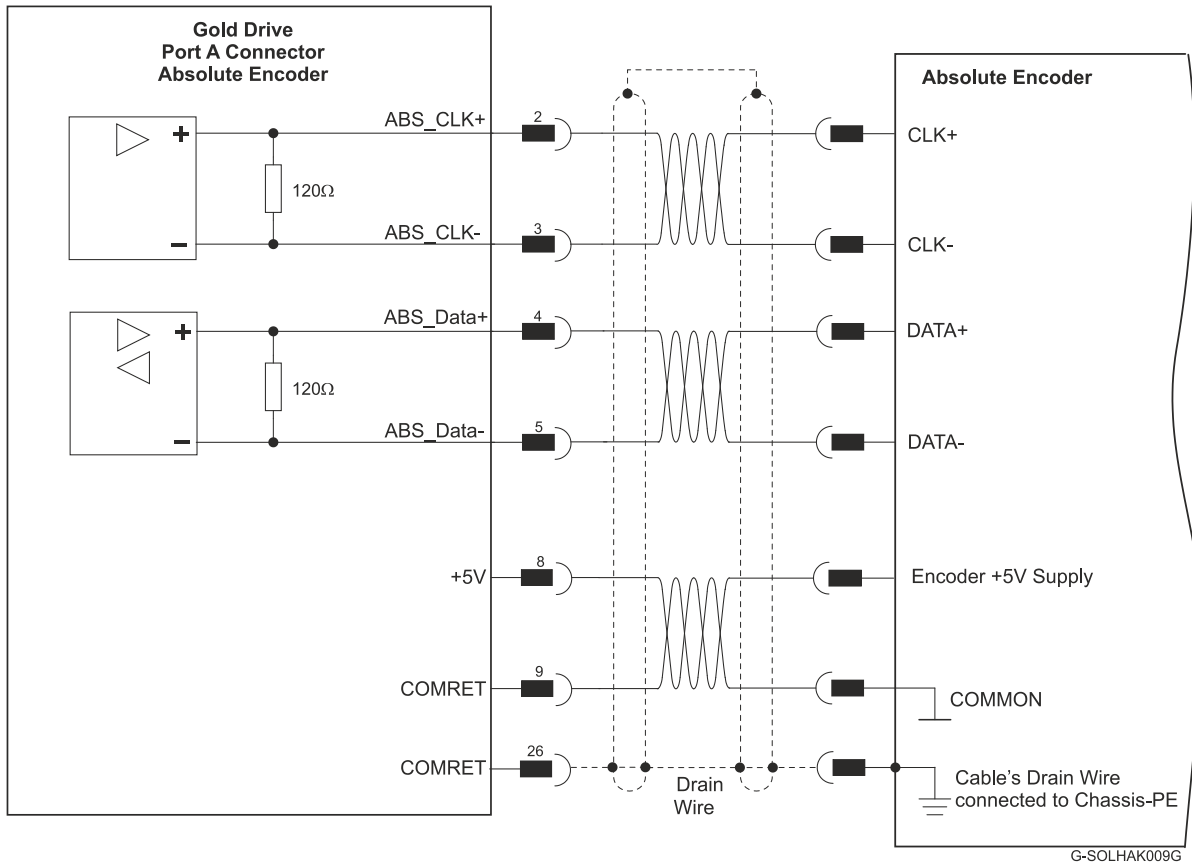


Figure 17: Absolute Serial Encoder – Recommended Connection Diagram for EnDAT, Biss, and SSI

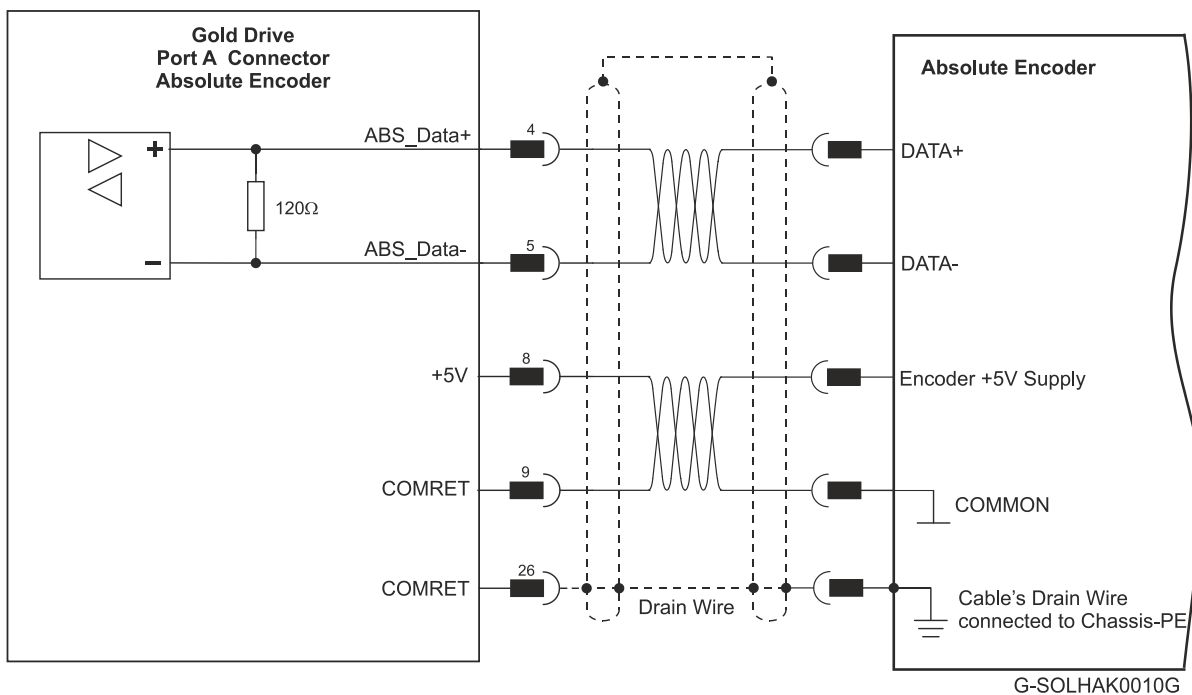


Figure 18: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)



### 6.5.3.1. Hiperface

The following figure describes the connection diagram.

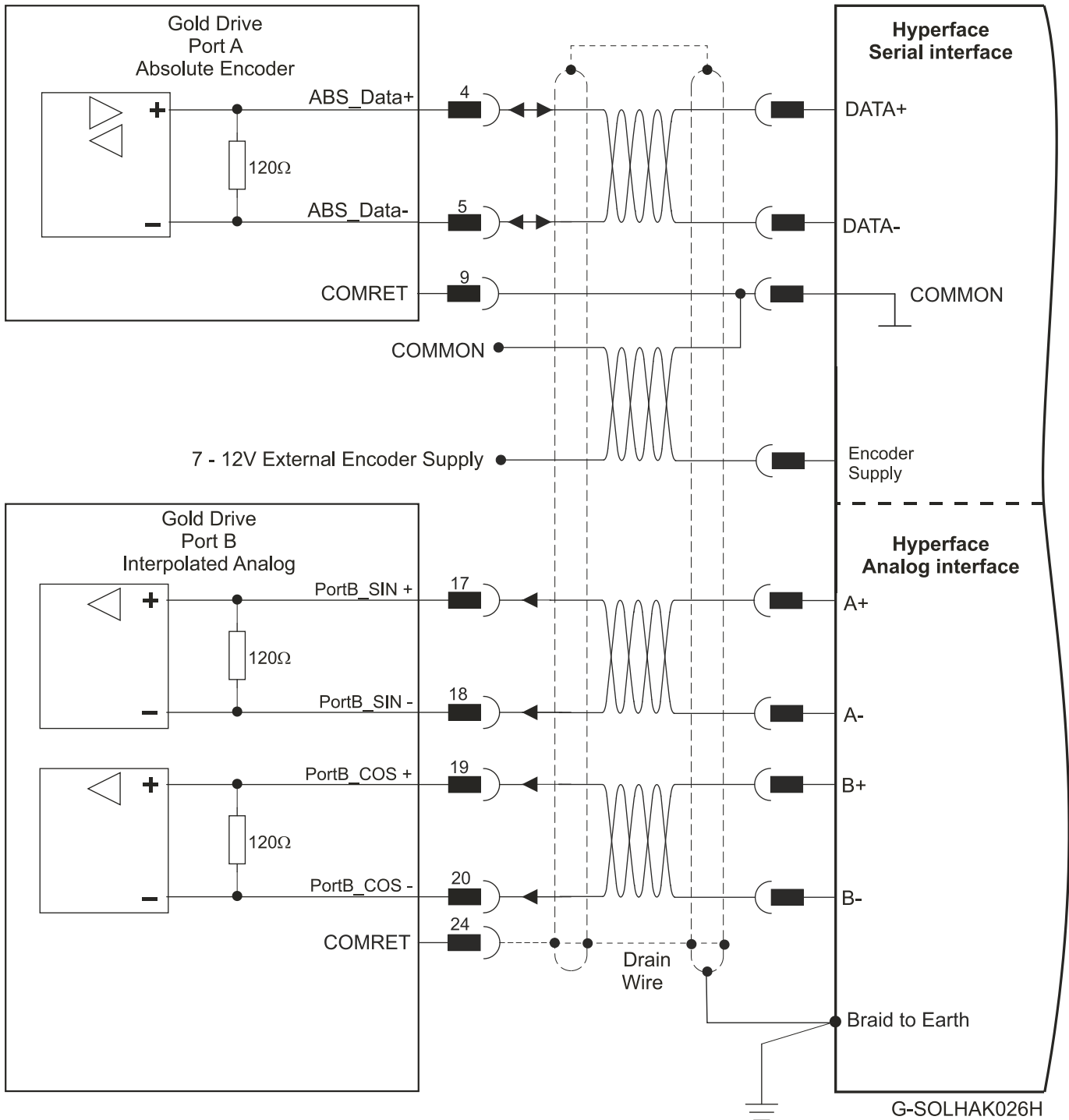


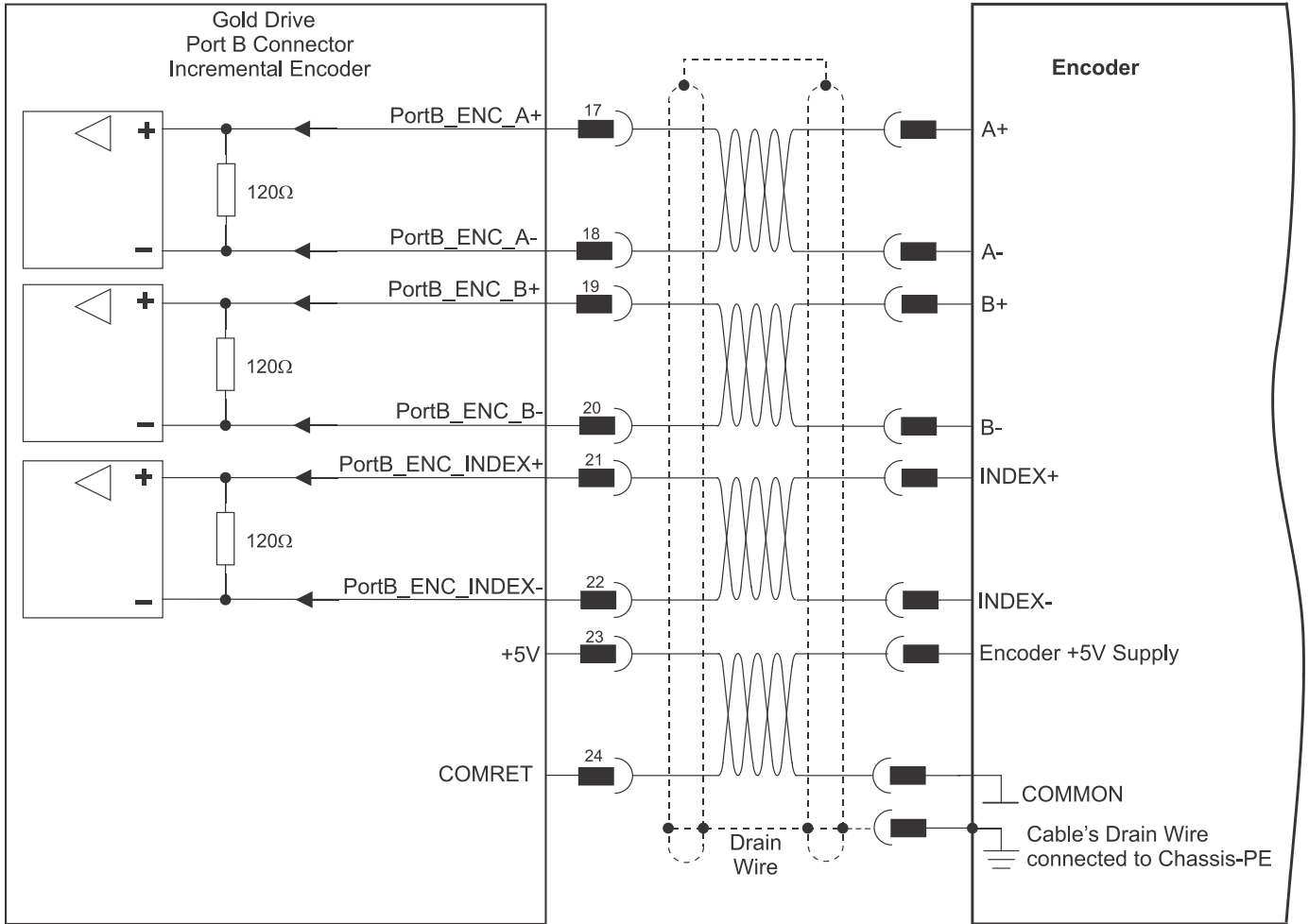
Figure 19: Absolute Serial Encoder – Recommended Connection Diagram for Stegmann Hiperface

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



### 6.5.4. Incremental Encoder

The following figure describes the connections at Port B for the Incremental encoder.



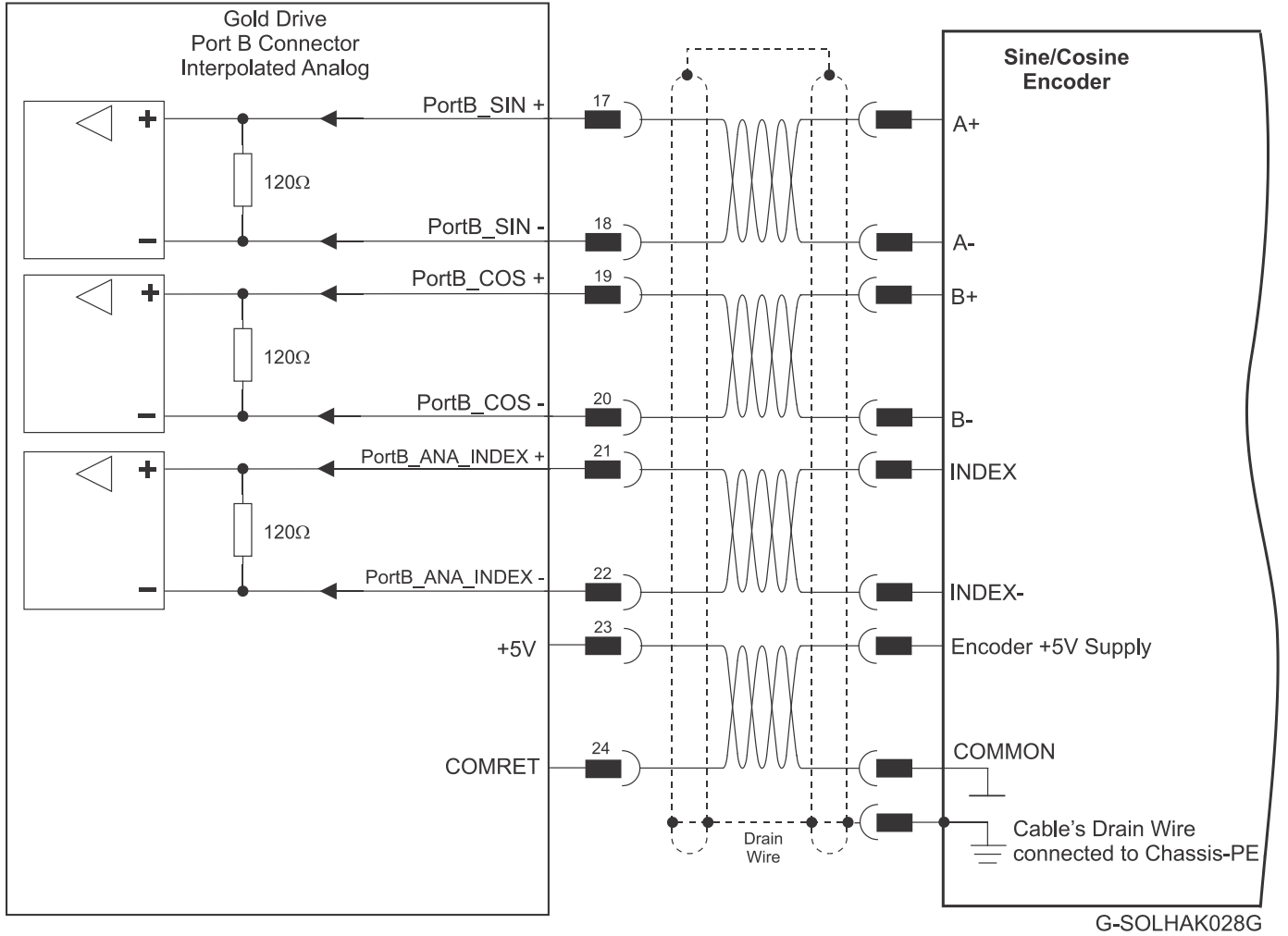
G-SOLHAK027G

Figure 20: Port B Incremental Encoder Input – Recommended Connection Diagram



### 6.5.5. Interpolated Analog Encoder

The following figure describes the connections at Port B for the Interpolated Analog encoder.



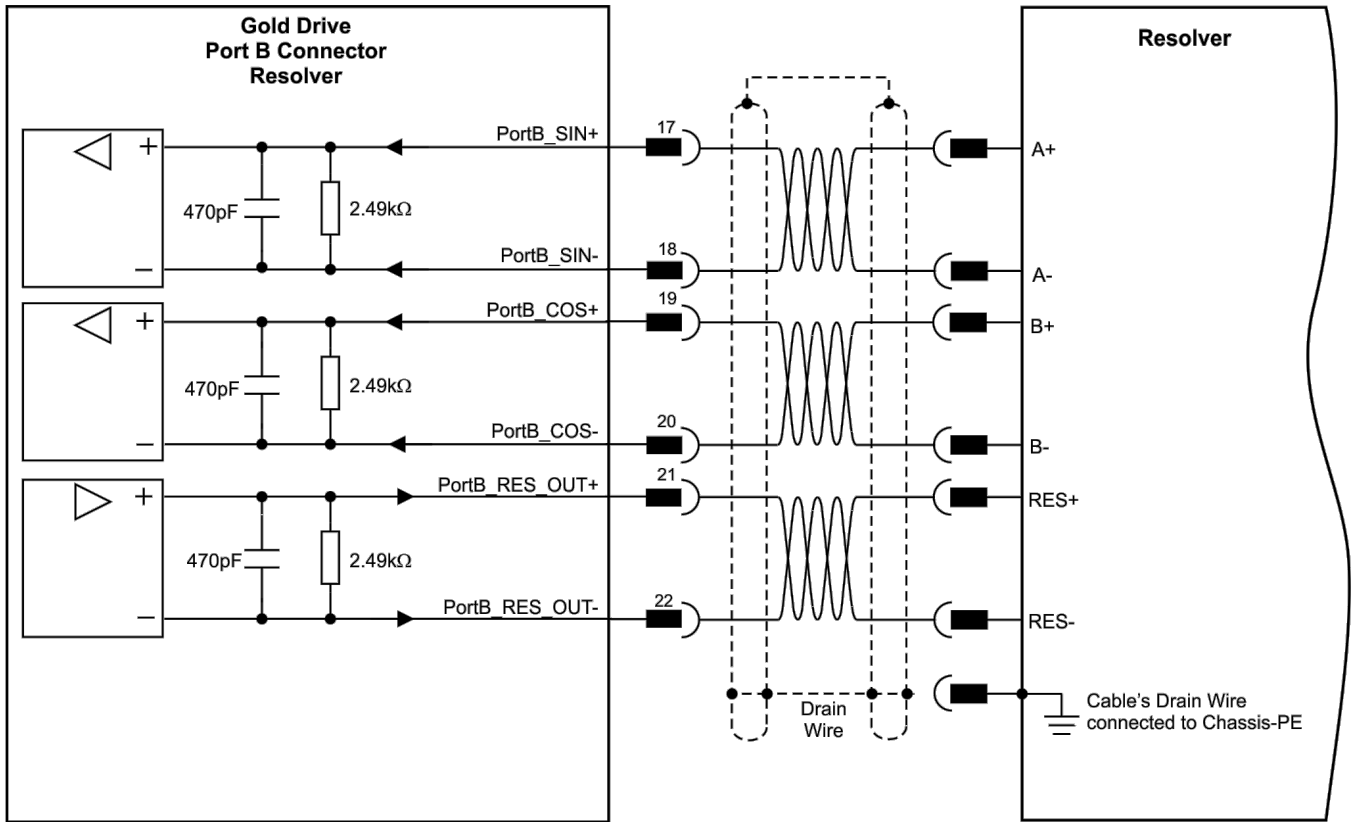
G-SOLHAK028G

Figure 21: Port B - Interpolated Analog Encoder Connection Diagram



### 6.5.6. Resolver

The following figure describes the connections at Port B for the Resolver encoder.



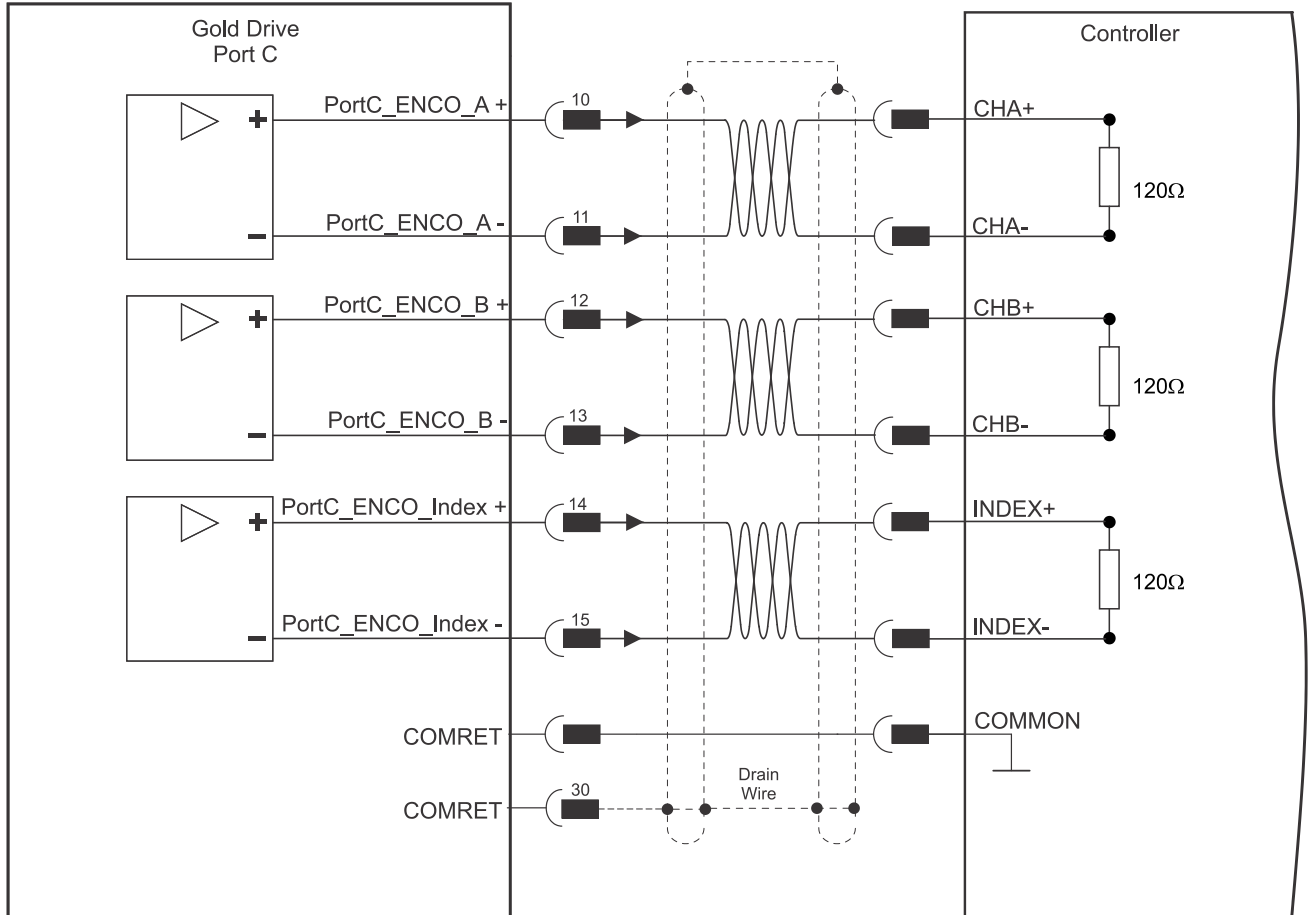
G-SOLHAK029H

Figure 22: Port B – Resolver Connection Diagram



### 6.5.7. Port C – Encoder Output

The following figure describes the connections at Port C for the Encoder Differential.



G-SOLHAK030J

Figure 23: Encoder Differential Output – Recommended Connection Diagram





## 6.6. Digital I/Os, Analog Inputs, and STO (J2)

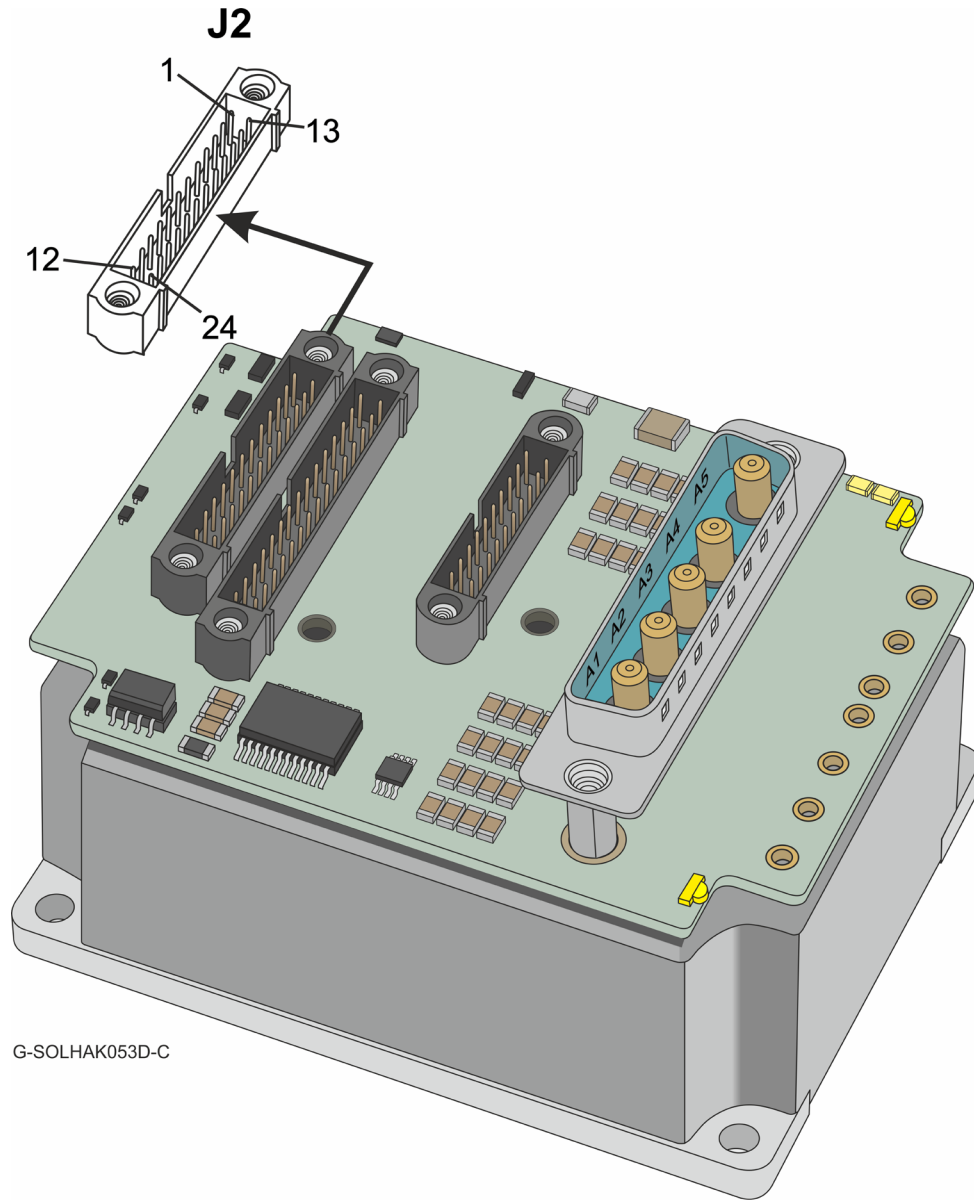
The J2 connector is a 24 pin connector which includes the following functions:

- I/O: Refer to Chapter 11 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.
- Analog input: See Section 11.2 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.
- STO: See Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

I/Os, Analog Inputs, and STO		
Pin (J2)	Signal	Function
1	ANALOG1+	Analog Input1
2	ANALOG2+	Analog Input2
3	STO1	STO1 Input (Default 24 V)
4	STO2	STO2 Input (Default 24 V)
5	STO_RET	STO signal return
6	INRET1_6	Programmable Input 1-6 Return
7	IN1	Programmable Input 1
8	IN2	Programmable Input 2
9	IN3	Programmable Input 3
10	IN4	Programmable Input 4
11	IN5	Programmable Input 5
12	IN6	Programmable Input 6
13	ANALOG1-	Analog Input1 Complement
14	ANALOG2-	Analog Input2 Complement
15	ANARET	Analog Return
16	SHIELD	Connect Analog drain wire to this pin
17	Not Connected	Not in use
18	COMRET	Common Return
19	OUT1	Programmable Output 1
20	OUT2	Programmable Output 2
21	OUT3	Programmable Output 3
22	OUT4	Programmable Output 4
23	VDDRET	VDD supply return
24	VDD	VDD supply (5V up to 30V)



### Pin Positions and Cable Connector



G-SOLHAK053D-C

**Table 8: Connector J2 – Digital I/Os, Analog Inputs, and STO Pin Assignments**



### 6.6.1. Analog Input

The following circuit describes the internal interface of the Analog input.

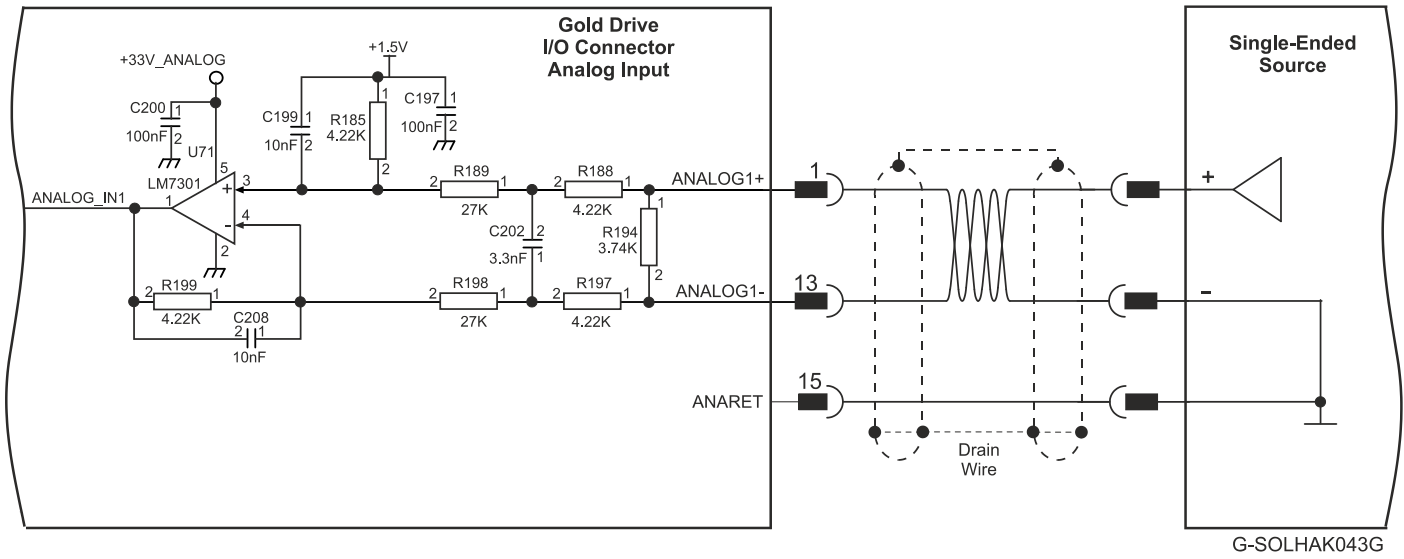
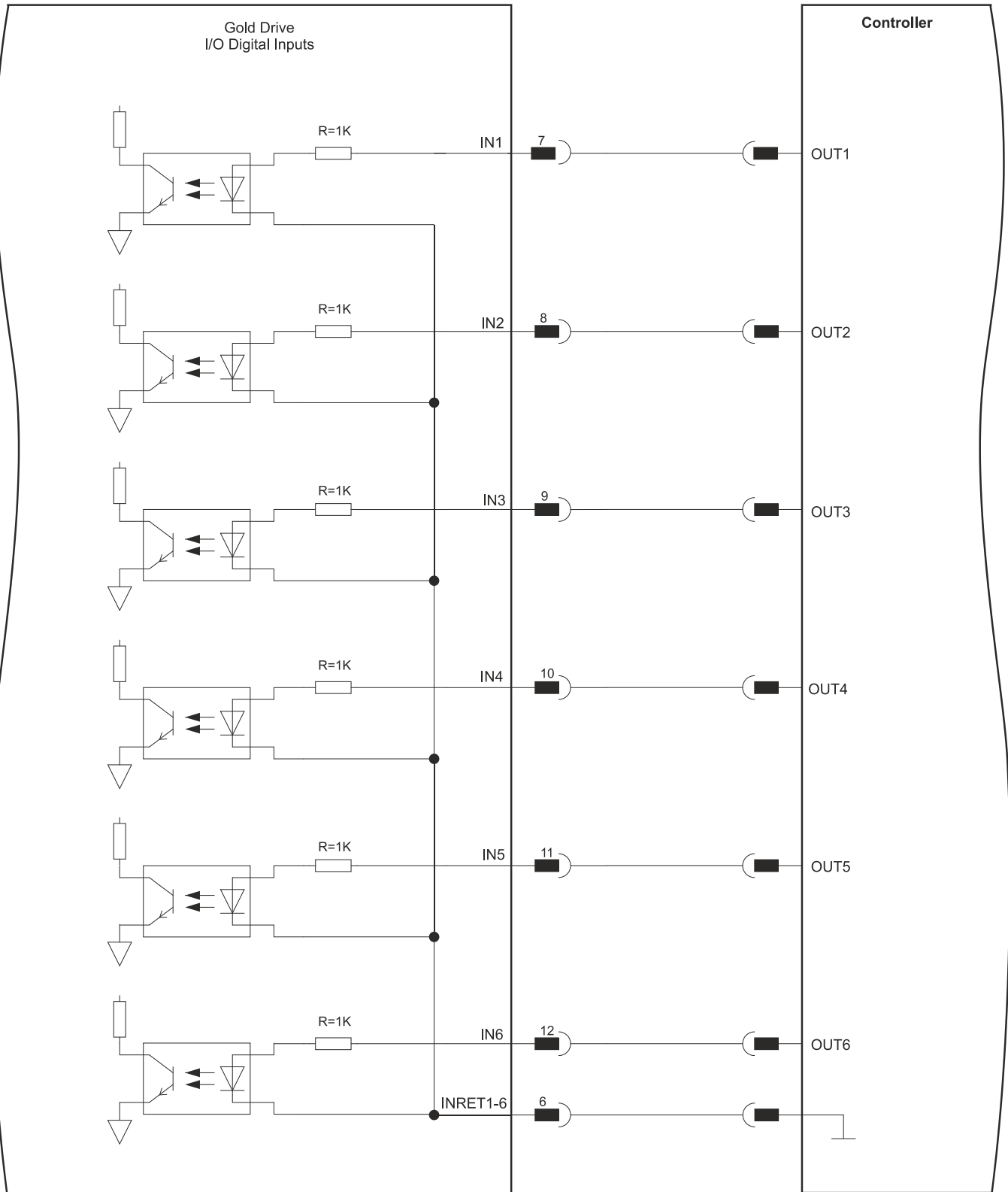


Figure 24: Differential Analog Input



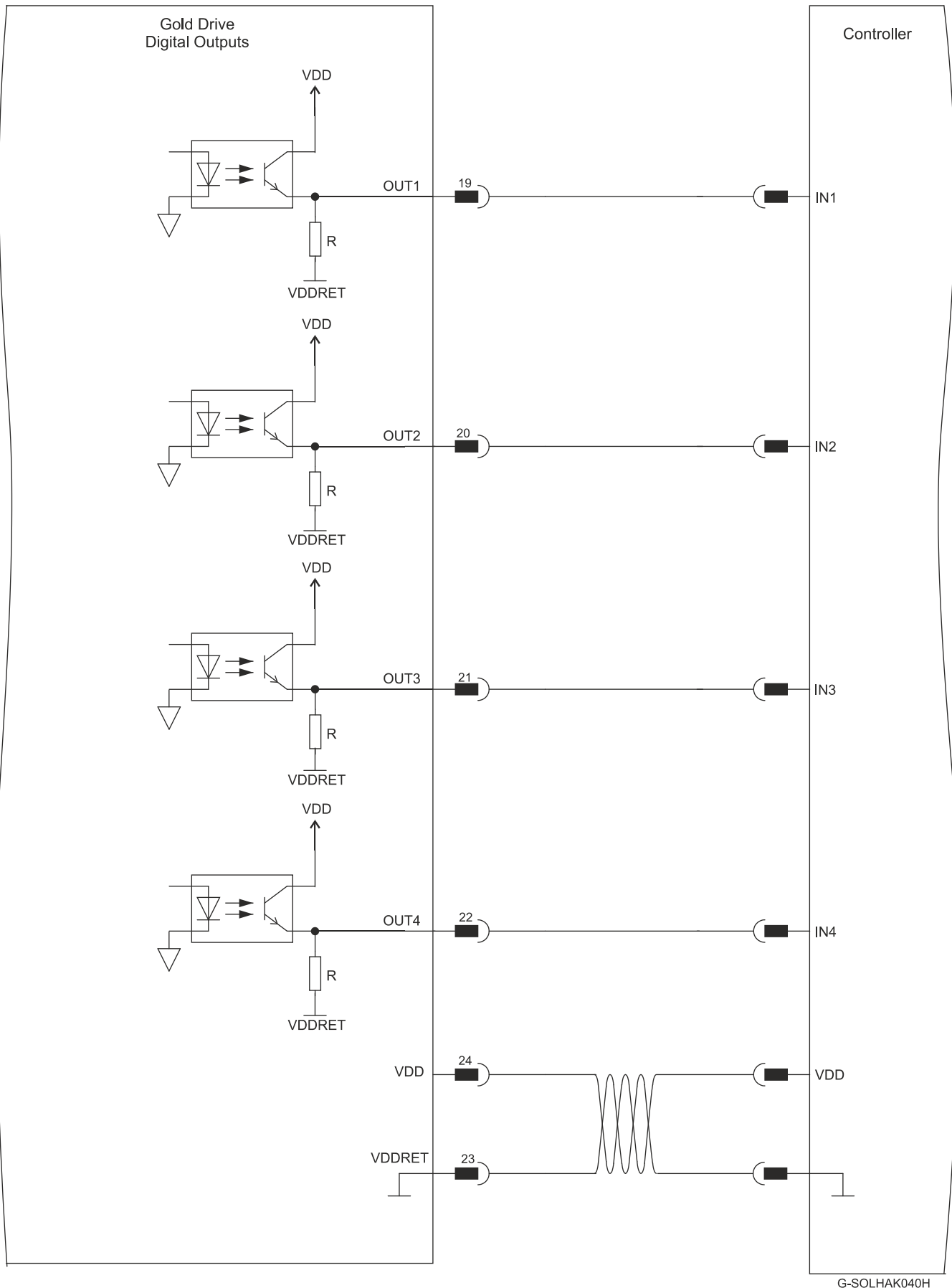
### 6.6.2. Digital Input and Output TTL Mode

The following figure describes the connections at the I/O Port for the Digital Input and Output TTL Mode.



G-SOLHAK037I

Figure 25: Digital Input TTL Mode Connection Diagram



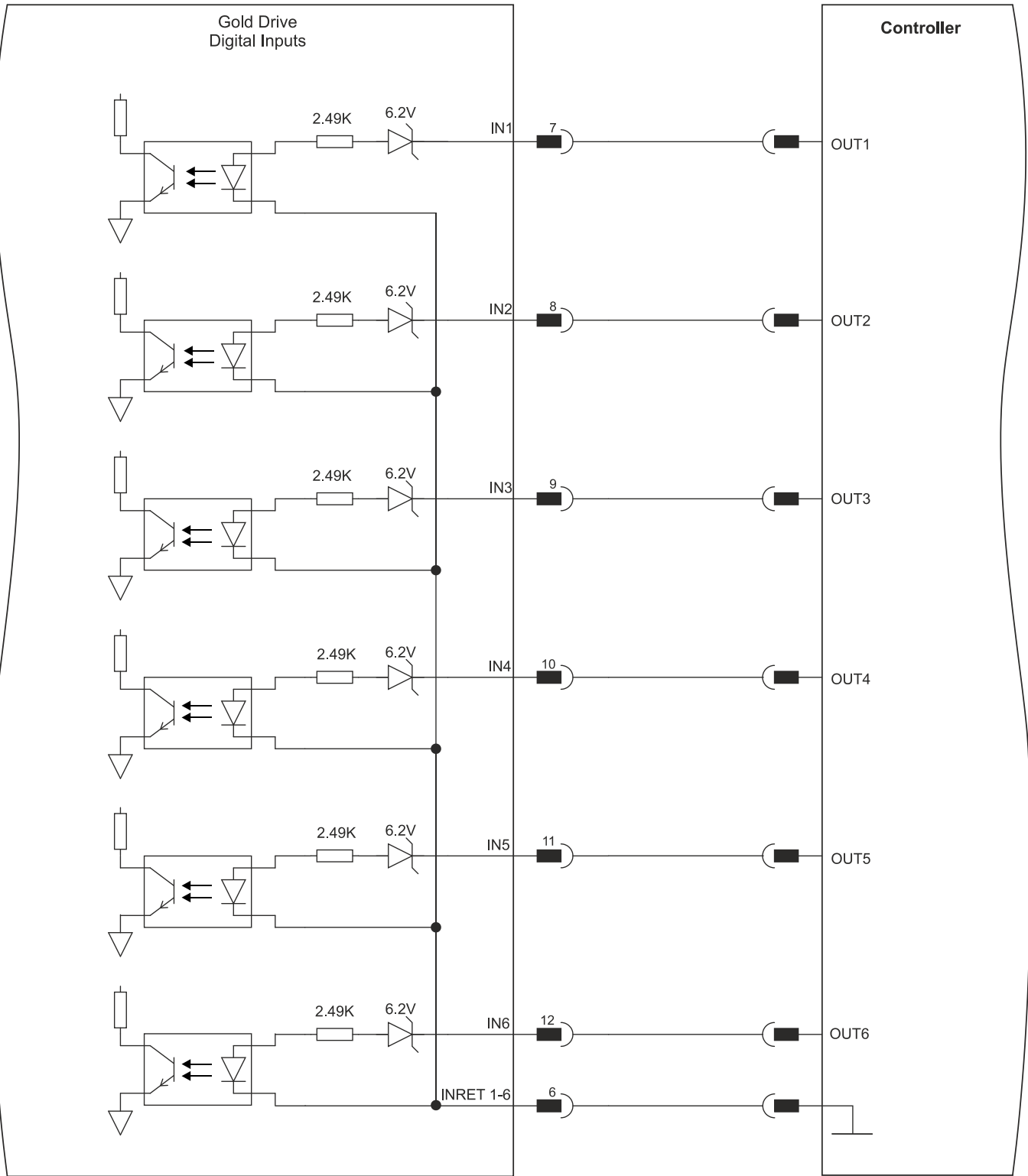
G-SOLHAK040H

Figure 26: Digital Output Connection Diagram – TTL Option



### 6.6.3. Digital Input and Output PLC Source Mode

The following figure describes the connections at the I/O Port for the Digital Input and Output PLC Mode.



G-SOLHAK038I

Figure 27: Digital Input Connection Diagram – Source PLC Option

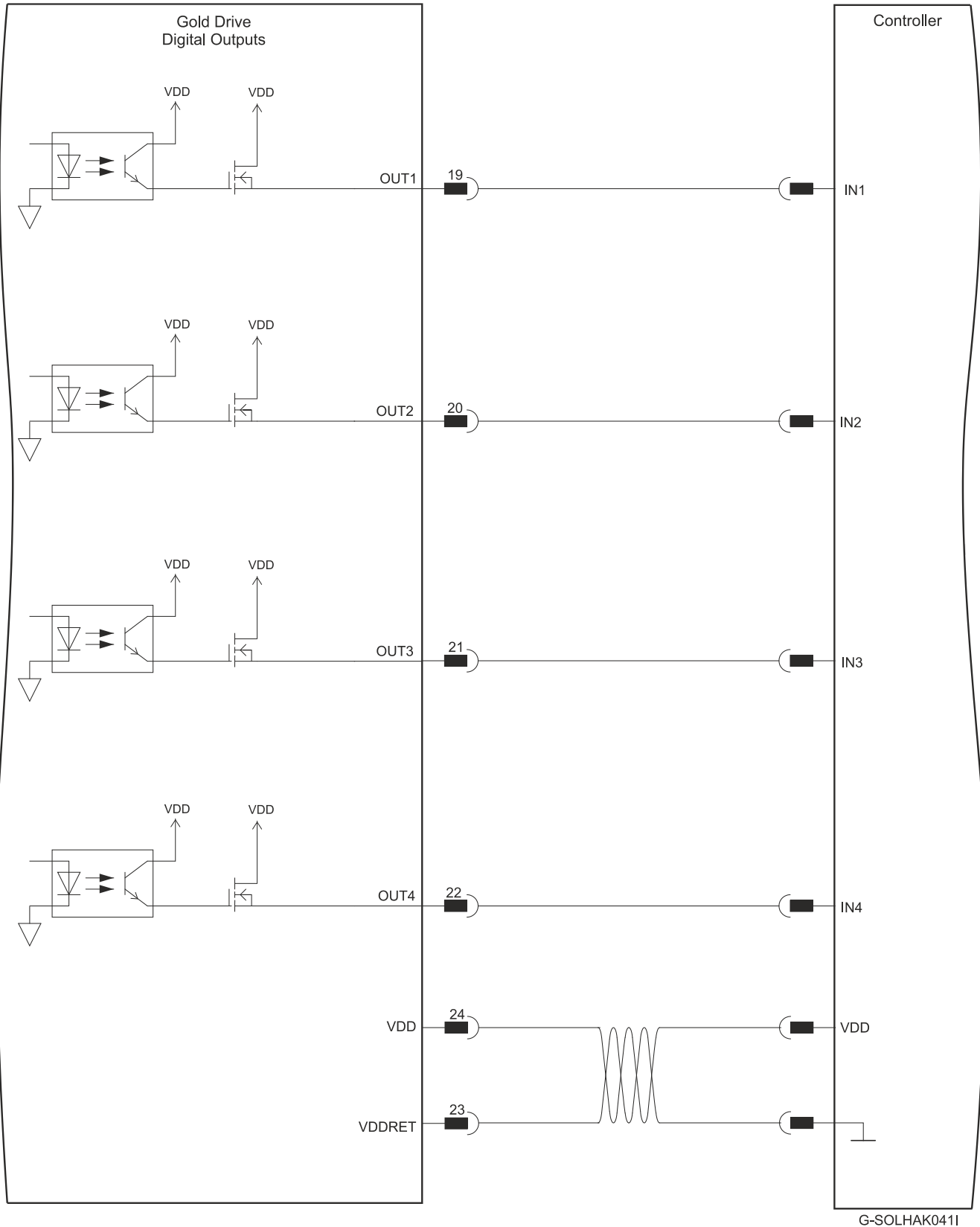
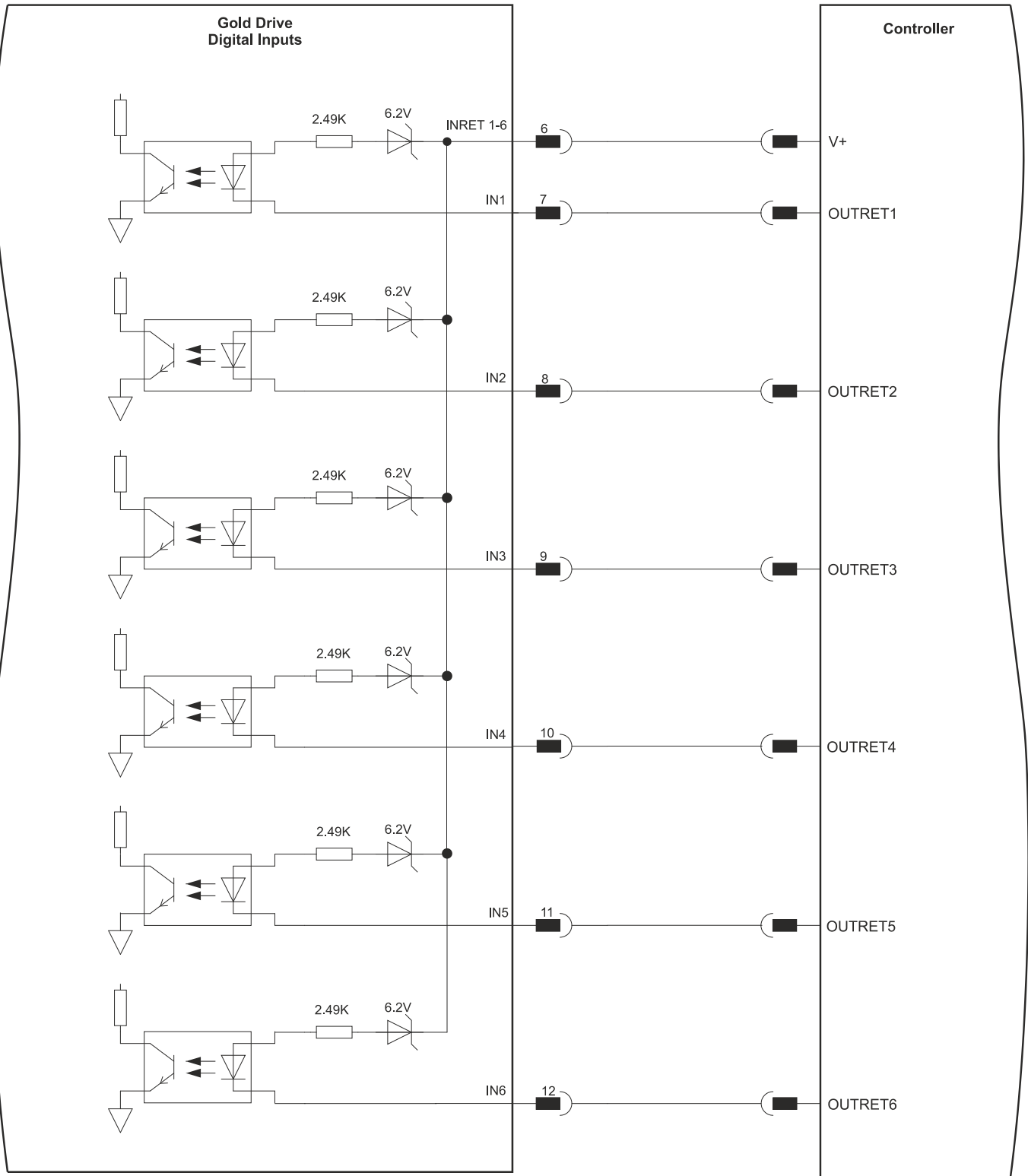


Figure 28: Digital Output Connection Diagram – Source PLC Option



### 6.6.4. Digital Input and Output Sink Mode

The following figure describes the connections at the I/O Port for the Digital Input and Output Sink Mode.



G-SOLHAK039H

Figure 29: Digital Input Sink Mode – PLC voltage level Connection Diagram



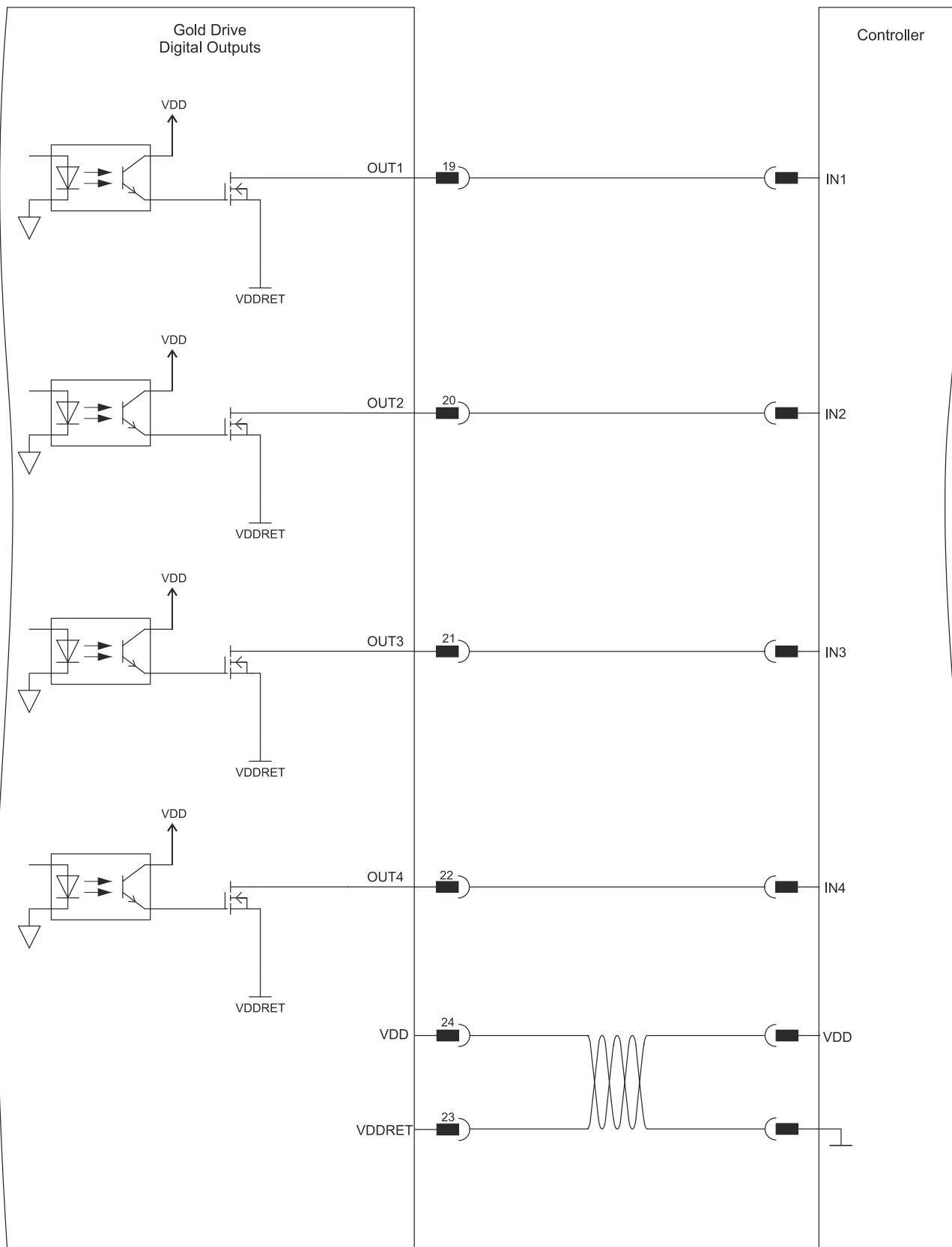


Figure 30: Digital Output as Sink Configuration Connection Diagram



### 6.6.5. STO

The following circuits describe the STO wiring options.

#### 6.6.5.1. Source Mode PLC Voltage Level

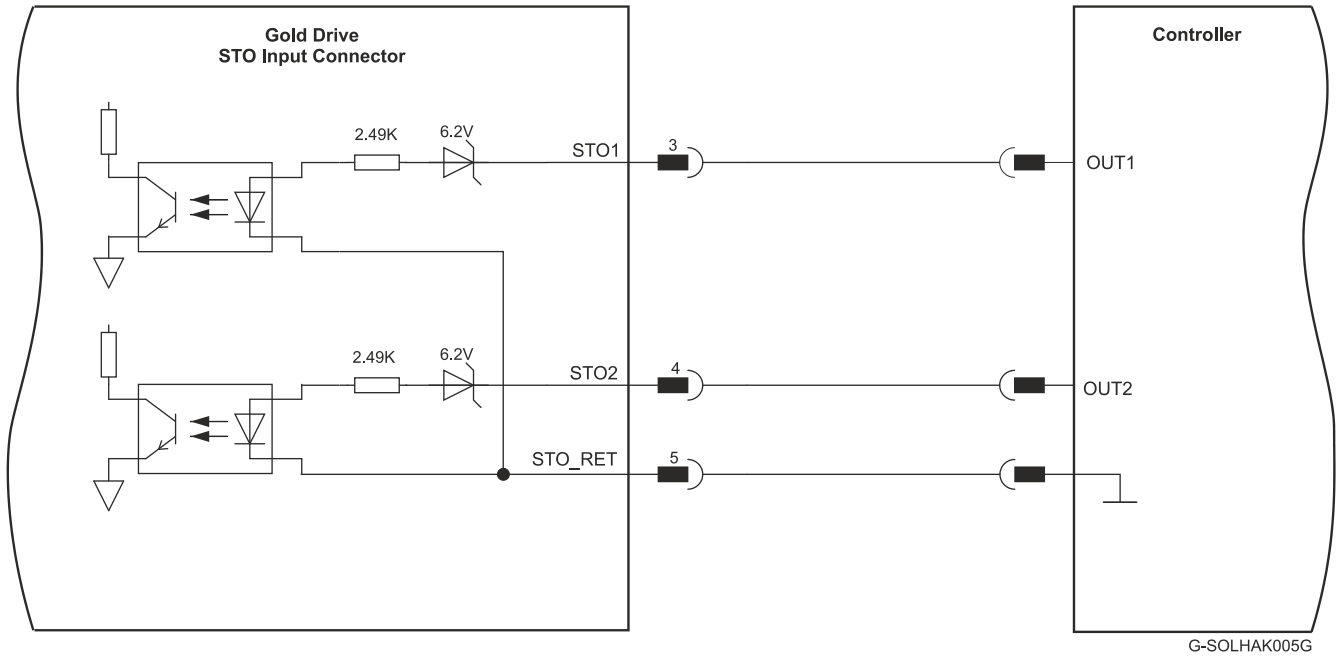


Figure 31: STO Input Connection – PLC Source Option

#### 6.6.5.2. TTL Mode TTL Voltage Level

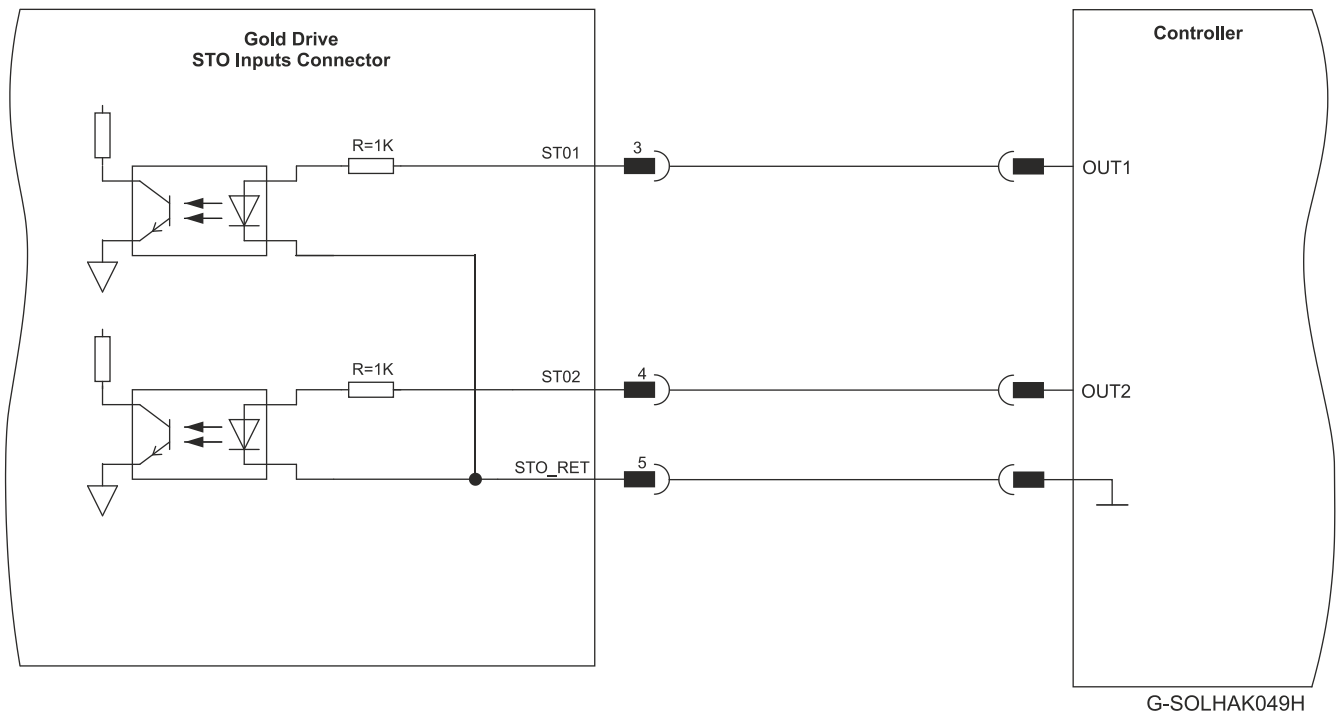


Figure 32: STO Input Connection – TTL Option



## 6.7. Communication (J3)

The J3 connector is a 20 pin connector which includes the following communication functions:

For **RS-232**: See section 12.4 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

For **RS-422**: See section 12.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

For **USB**: See Section 12.1 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives.

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

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

COMRET		
Pin (J3)	Signal	Function
7	COMRET	Common Return
13	COMRET	Common Return
18	COMRET	Common Return
19	ECAT_SHIELD	Connect EtherCAT drain wire to this pin

RS-232		
Pin (J3)	Signal	Function
1	RS-232_Tx	RS-232 transmit
2	RS-232_Rx	RS-232 receive

Differential RS-232 (RS-422)		
Pin (J3)	Signal	Function
1	RS422_RX+	Differential RS-232 (RS-422) Receive
2	RS422_RX-	Differential RS-232 (RS-422) Receive Complement
10	RS-422 TX+	Differential RS-232 (RS-422) Transmit
20	RS-422_TX-	Differential RS-232 (RS-422) Transmit Complement



USB 2.0		
Pin (J3)	Signal	Function
3	USBD+	USB _P line USB Data
4	USBD-	USB _N line USB Data Complement
5	USB_VBUS	USB VBUS 5 V
6	USB_COMRET	USB Common Return

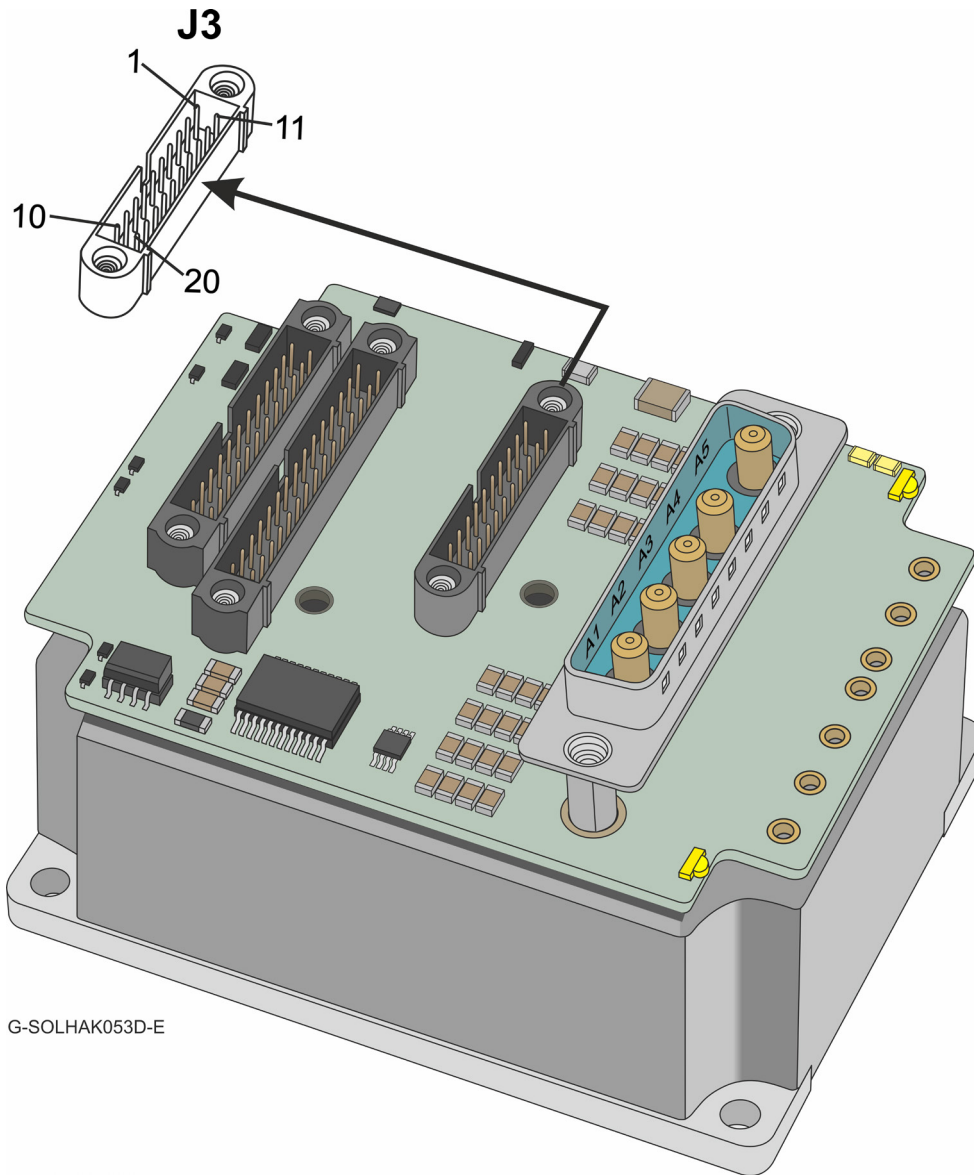
EtherCAT IN/Ethernet		
Pin (J3)	Signal	Function
8	EtherCAT_IN_TX+/Ethernet_TX+	EtherCAT in/Ethernet transmit +
9	EtherCAT_IN_TX-/Ethernet_TX-	EtherCAT in/Ethernet transmit -
11	EtherCAT_IN_RX+/Ethernet_RX+	EtherCAT in/Ethernet receive +
12	EtherCAT_IN_RX-/Ethernet_RX-	EtherCAT in/Ethernet receive -

EtherCAT OUT		
Pin (J3)	Signal	Function
14	EtherCAT_OUT_TX+	EtherCAT out transmit +
15	EtherCAT_OUT_TX-	EtherCAT out transmit -
16	EtherCAT_OUT_RX+	EtherCAT out receive +
17	EtherCAT_OUT_RX-	EtherCAT out receive -

CAN		
Pin (J3)	Signal	Function
14	CAN_H	CAN_H bus line (dominant high)
15	CAN_L	CAN_L bus line (dominant low)
16	CAN_H	CAN_H bus line (dominant high)
17	CAN_L	CAN_L bus line (dominant low)



### Pin Positions and Cable Connector



G-SOLHAK053D-E

**Table 9: Connector J3 – Communication Assignments**



### 6.7.1. RS-232

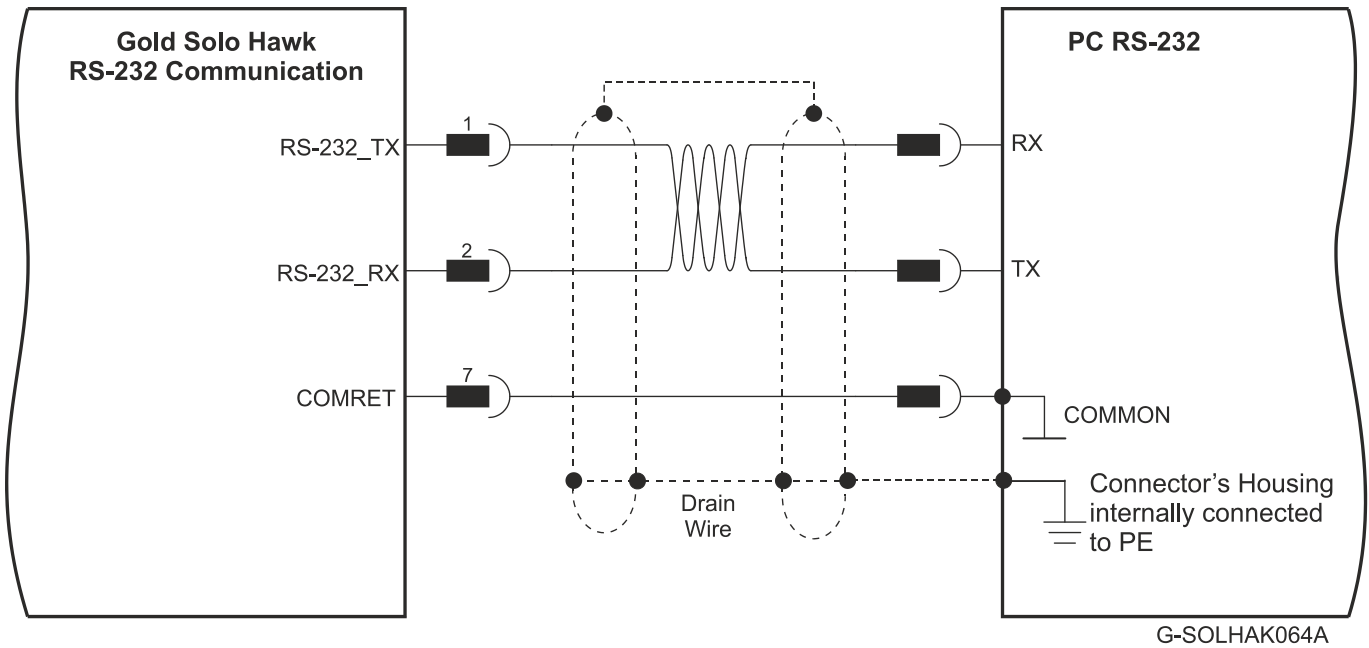


Figure 33: RS-232 Connection Diagram

### 6.7.2. Differential RS-232 (RS-422)

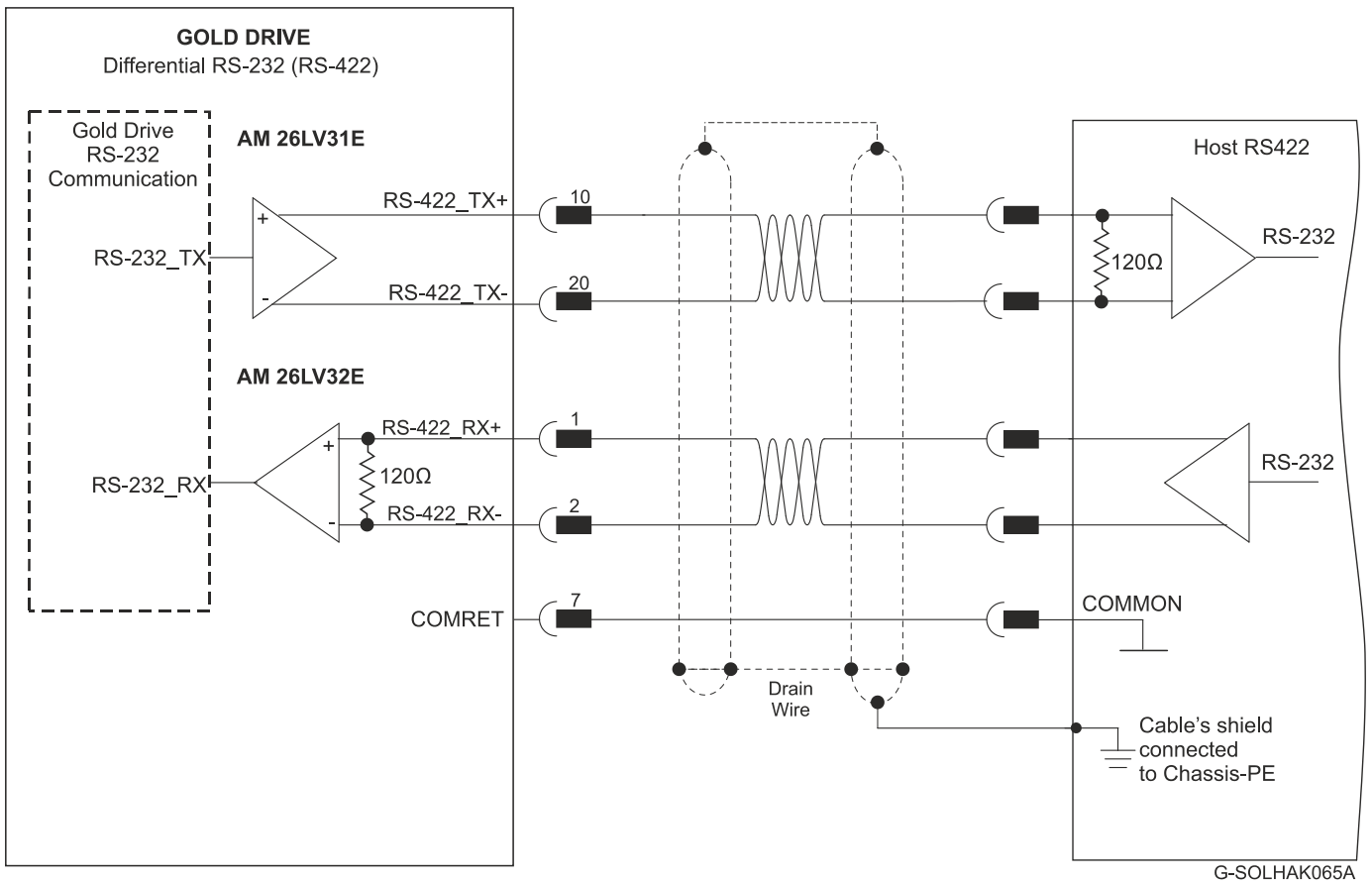


Figure 34: RS-422 Connection Diagram



### 6.7.3. USB 2.0

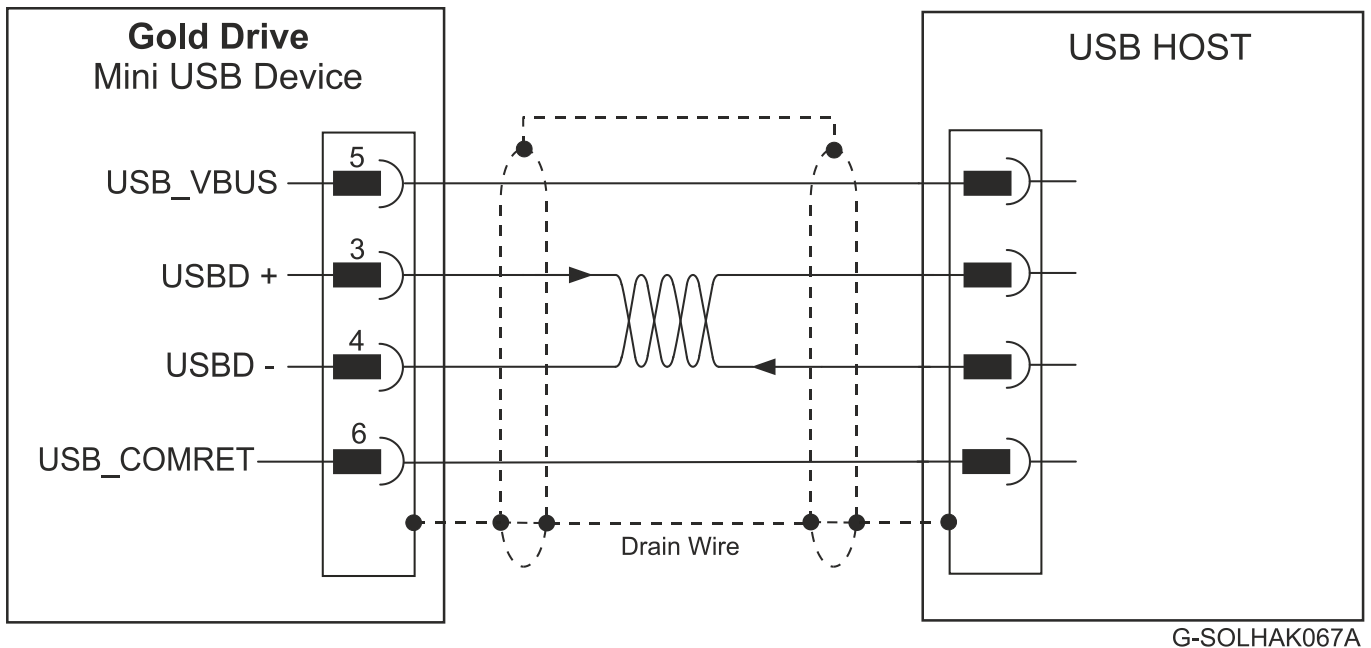


Figure 35: USB Network Diagram

### 6.7.4. EtherCAT Wiring

Figure 36 describes the wiring diagram for the EtherCAT connections.

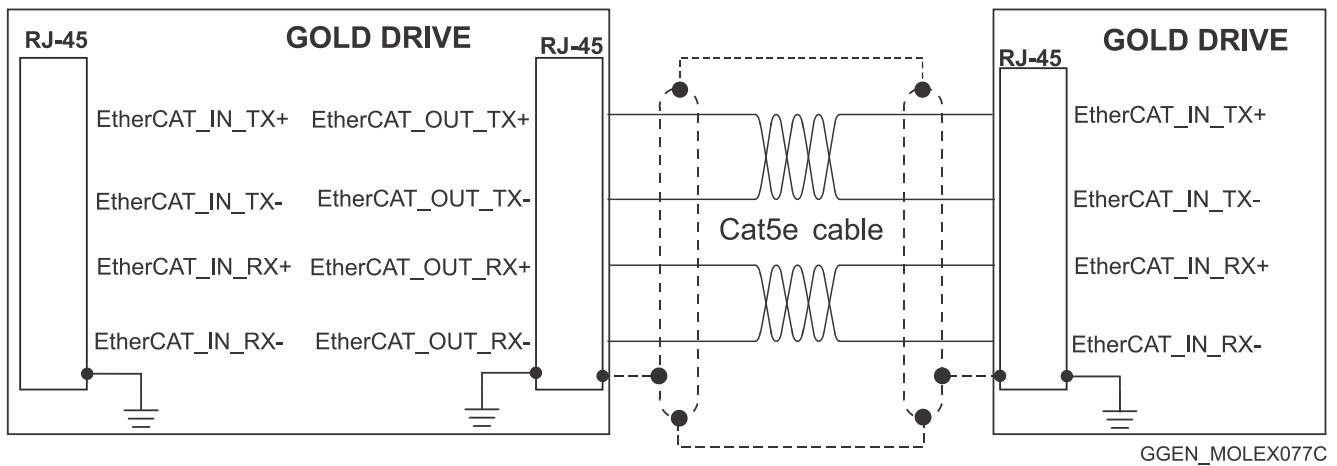
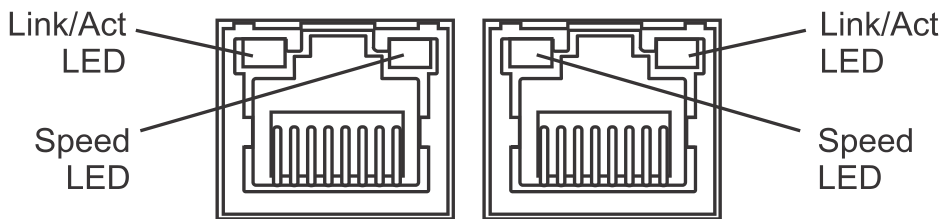


Figure 36: EtherCAT RJ-45 Connections



### 6.7.5. EtherCAT Link Indicators

The Gold Solo Hawk can serve as an EtherCAT slave device. For this purpose it has two RJ-45 connectors, which are designated as EtherCAT In and EtherCAT Out. Each of these RJ-45 connectors has two status LEDs, which are shown in Figure 37.



**Figure 37: Ethernet Connector LEDs**

The green LED is the link/activity indicator. It shows the state of the applicable physical link and the activity on that link. The amber LED is the speed indicator. It shows the speed of the connection on the Ethernet line. Refer to the section 12.2.1.2 in the document; MAN-G-Panel Mounted Drives Hardware manual.





### 6.7.6. CAN Wiring

Figure 38 describes the CAN wiring diagram below.

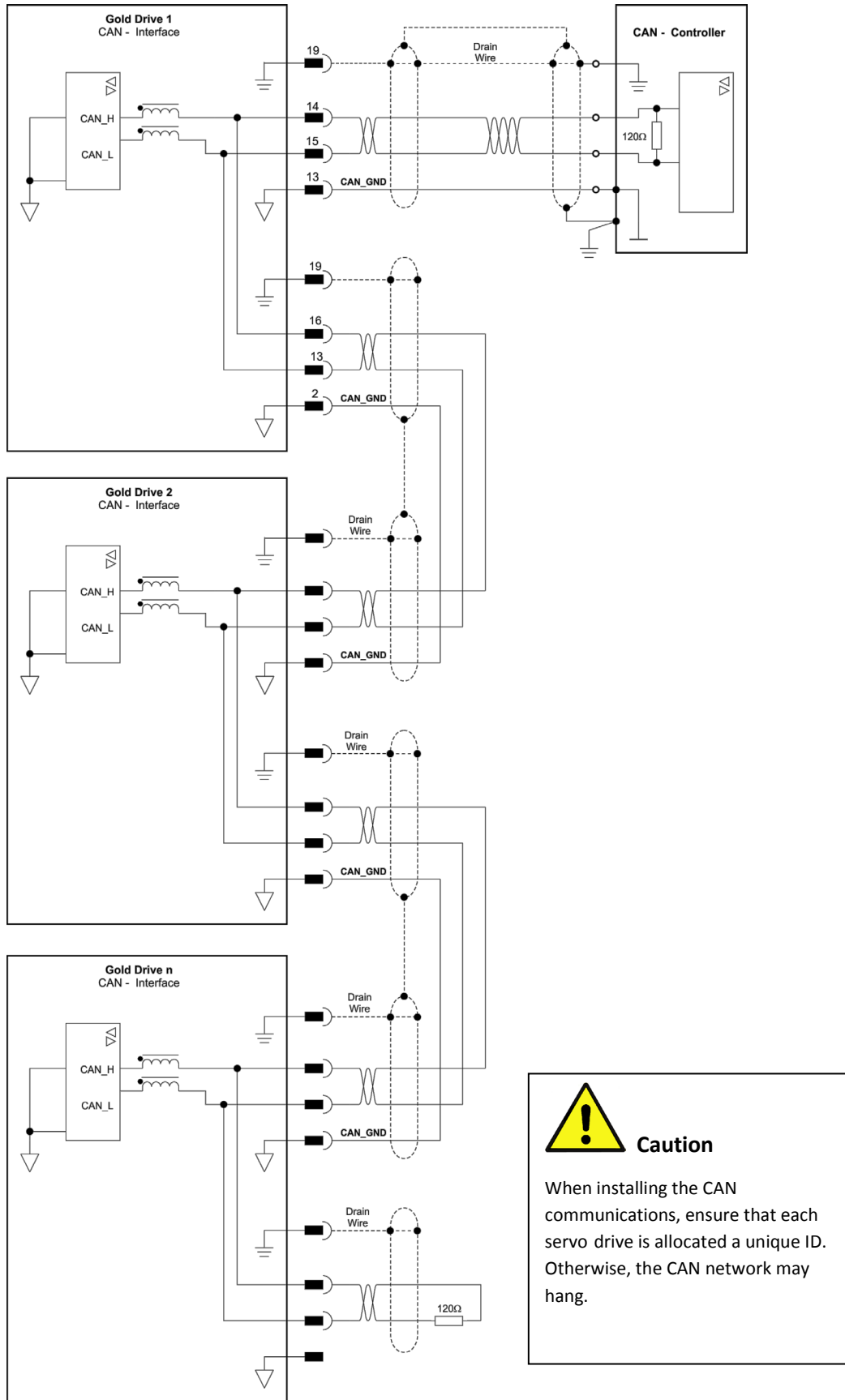


Figure 38: Gold Solo Hawk Connection Diagram – CAN



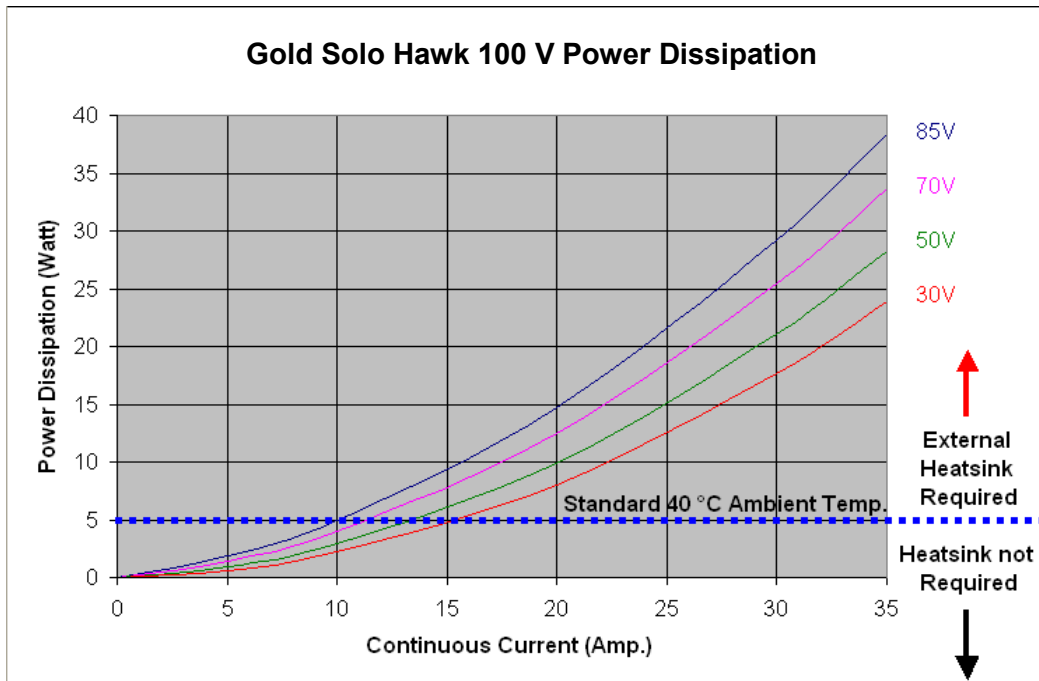
## 6.8. Heat Dissipation

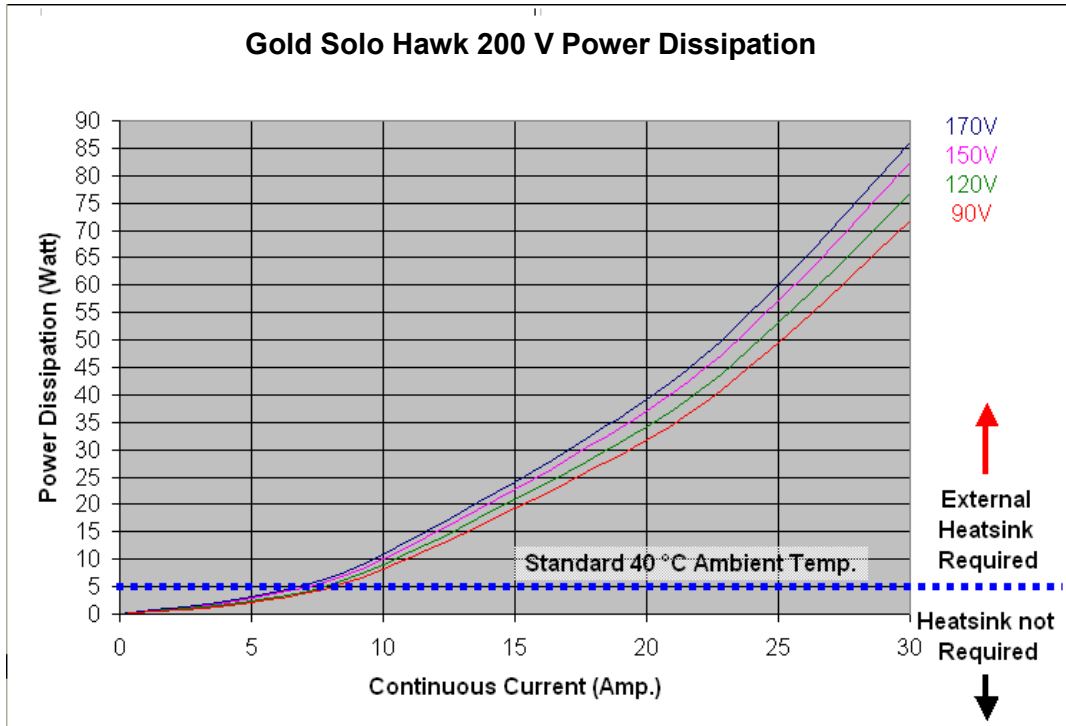
The best way to dissipate heat from the Gold Solo Hawk is to mount it so that its heat-sink faces up. For best results leave approximately 10 mm of space between the Gold Solo Hawk's heat-sink and any other assembly.

### 6.8.1. Gold Solo Hawk Thermal Data

- Heat dissipation capability ( $\theta$ ): Approximately 8 °C/W
- Thermal time constant: Approximately 360 seconds (thermal time constant means that the Guitar will reach two thirds of its final temperature after 6 minutes)
- Shut-off temperature: 86 °C to 88 °C (measured on the heat-sink)

### 6.8.2. Heat Dissipation Data





### 6.8.3. How to Use the Charts

The charts above are based upon theoretical worst-case conditions. Actual test results show 30% to 50% better power dissipation.

To determine if your application needs a heat-sink:

1. Allow maximum heat-sink temperature to be 80 °C or less.
2. Determine the ambient operating temperature of the Gold Solo Hawk.
3. Calculate the allowable temperature increase as follows:
  - for an ambient temperature of 40 °C ,  $\Delta T = 80\text{ °C} - 40\text{ °C} = 40\text{ °C}$
4. Use the chart to find the actual dissipation power of the drive. Follow the voltage curve to the desired output current and then find the dissipated power.
5. If the dissipated power is below 5 W the Gold Solo Hawk will need no additional cooling.

**Note:** The chart above shows that no heat-sink is needed when the heat-sink temperature is 80 °C, ambient temperature is 40 °C and heat dissipated is 5 W.



## 6.9. Powering Up

After the Gold Solo Hawk 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.

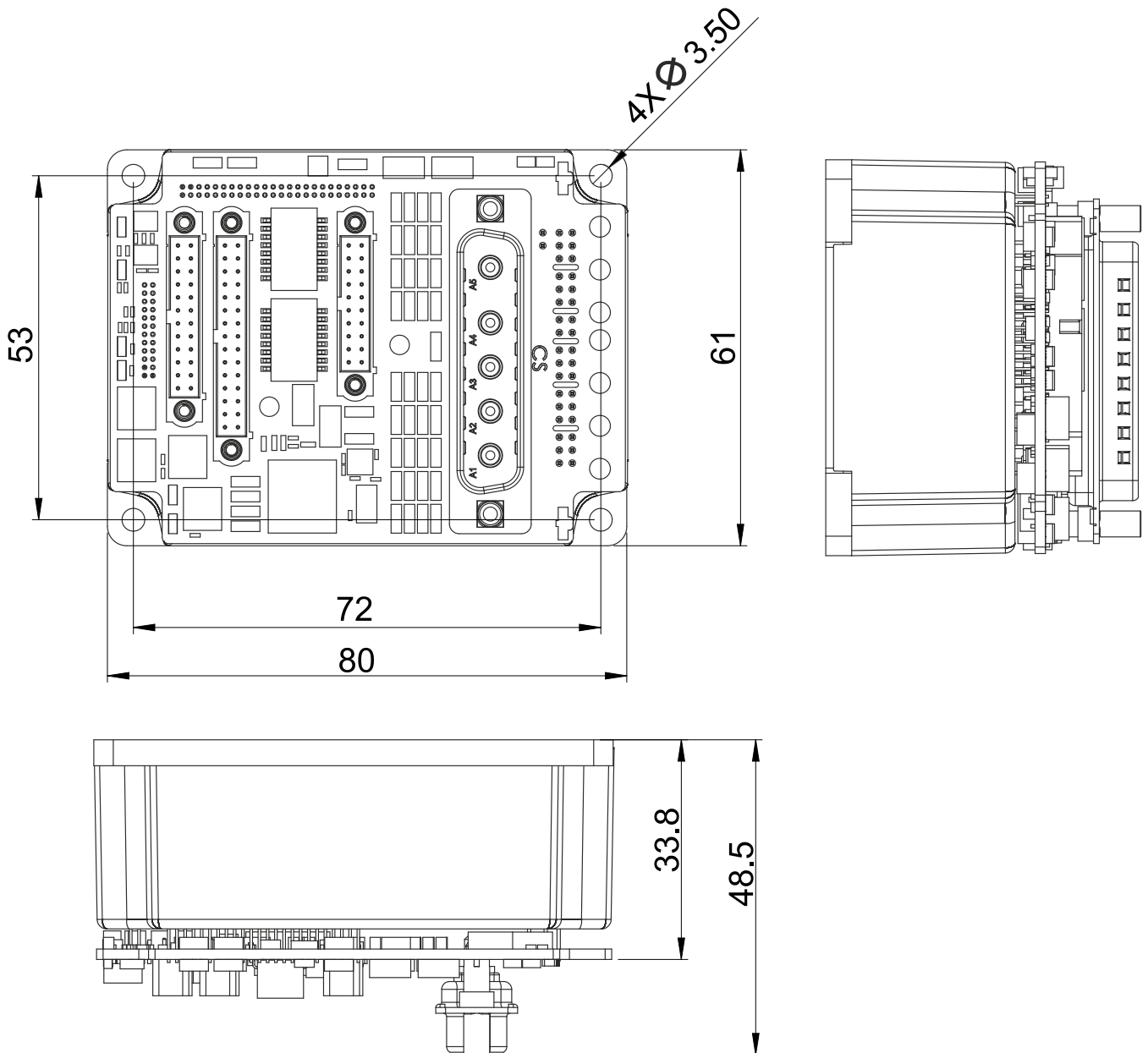
## 6.10. Initializing the System

After the Gold Solo Hawk 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*.



## Chapter 7: Dimensions

This chapter provides detailed technical information regarding the Gold Solo Hawk.



# Inspiring Motion

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