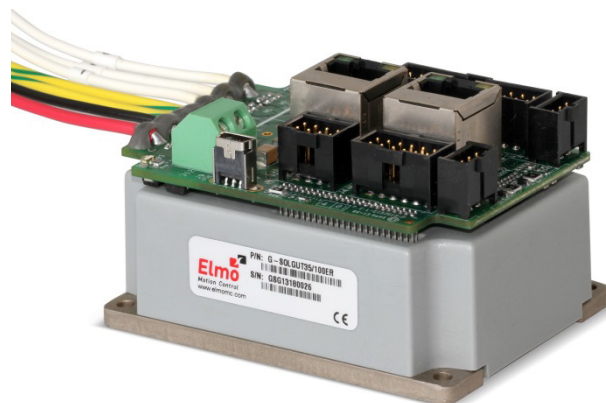


# Gold Solo Guitar Digital Servo Drive Installation Guide EtherCAT and CAN



## 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 Guitar 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.

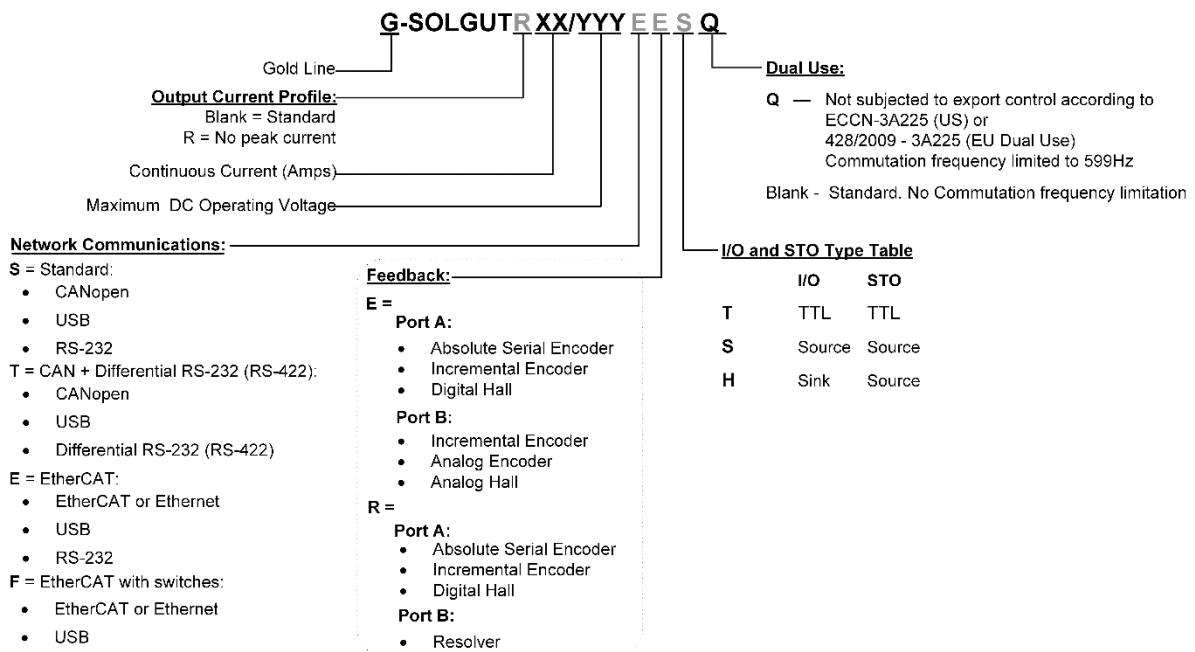
Document no. MAN-G-SOLGUTIG-EC (Ver. 1.108)

Copyright © 2021

Elmo Motion Control Ltd.

All rights reserved.

## Catalog Number



**Note:** There are two models of the Gold Solo Guitar: connectors only for currents of 30 A or less, and wires only for currents of 35 A or more.

## Cable Kit

Catalog number: CBL-GSOLGUIT01 (can be ordered separately). For further details, see the documentation for this cable kit MAN-G-SOLOGUT-CBLKIT.



- Chapter 1: This Installation Guide .....5**
  
- Chapter 2: Safety Information .....5**
  - 2.1. Warnings ..... 6
  - 2.2. Cautions..... 6
  - 2.3. CE Marking Conformance..... 6
  - 2.4. Warranty Information ..... 6
  
- Chapter 3: Product Description.....7**
  - 3.1.1. Accessories ..... 7
  
- Chapter 4: Technical Information.....8**
  - 4.1. Physical Specification ..... 8
  - 4.2. Technical Data ..... 8
    - 4.2.1. Auxiliary Supply ..... 9
    - 4.2.2. Product Features ..... 9
  - 4.3. Environmental Conditions..... 10
    - 4.3.1. Gold Line..... 10
  - 4.4. Gold Line Standards and Certifications ..... 11
    - 4.4.1. Dual Use..... 11
  
- Chapter 5: Installation..... 12**
  - 5.1. Unpacking the Drive Components ..... 12
  - 5.2. Connectors and Indicators ..... 13
    - 5.2.1. Connector Types..... 13
  - 5.3. Mounting the Gold Solo Guitar ..... 16
  - 5.4. The Gold Solo Guitar Connection Diagrams..... 17
  
- Chapter 6: Wiring..... 19**
  - 6.1. Basic Recommendations ..... 20
    - 6.1.1. General ..... 20
    - 6.1.2. Feedback Cable Port A and Port B Connector ..... 21
    - 6.1.3. Feedback Cable Port C Connector ..... 22
    - 6.1.4. IO Cable Connector..... 22
    - 6.1.5. STO (Port C) Cable Connector..... 22
  - 6.2. Motor Power Connector Pinouts ..... 23
  - 6.3. Main Power, Auxiliary Power ..... 25
    - 6.3.1. Main Power ..... 25
    - 6.3.2. Auxiliary Power Supply (J12) - (Optional) ..... 27
  - 6.4. Drive Status Indicator ..... 29
  - 6.5. Port A Connector (J4) ..... 30
    - 6.5.1. Incremental Encoder ..... 32

## Table of Contents

MAN-G-SOLGUTIG-EC (Ver. 1.108)

6.5.2.	Hall Sensor .....	32
6.5.3.	Absolute Serial Type Encoder .....	33
6.5.3.1.	Hiperface .....	34
6.6.	Port B Connector (J5) .....	35
6.6.1.	Incremental Encoder .....	36
6.6.2.	Interpolated Analog Encoder .....	37
6.6.3.	Resolver .....	38
6.7.	Port C, Digital I/Os, and Analog Inputs (J6) .....	39
6.7.1.	Port C – Encoder Output.....	40
6.7.2.	Analog Input .....	41
6.7.3.	Digital Input and Output TTL Mode.....	42
6.7.4.	Digital Input and Output PLC Source Mode .....	44
6.7.5.	Digital Input and Output Sink Mode.....	46
6.8.	STO Connector (J26) .....	48
6.8.1.1.	Source Mode PLC Voltage Level .....	48
6.8.1.2.	TTL Mode TTL Voltage Level .....	49
6.8.1.3.	STO Output (J6).....	50
6.9.	RS-232/RS-422 Connector (J21) .....	51
6.9.1.	RS-232.....	52
6.9.2.	Differential RS-232 (RS-422) .....	53
6.10.	USB 2.0 (J9).....	54
6.11.	EtherCAT Communications Version .....	55
6.11.1.	EtherCAT IN/Ethernet Pin Assignments (J7).....	55
6.11.2.	EtherCAT OUT Connector (J8) .....	56
6.11.3.	EtherCAT Wiring .....	56
6.11.4.	EtherCAT Address Switches.....	57
6.11.5.	EtherCAT Link Indicators .....	58
6.12.	CAN Communications Version .....	59
6.12.1.	CAN Wiring .....	61
6.13.	Heat Dissipation .....	62
6.13.1.	Gold Solo Guitar Thermal Data.....	62
6.13.2.	Heat Dissipation Data .....	62
6.13.3.	How to Use the Charts.....	63
6.14.	Powering Up .....	64
6.15.	Initializing the System .....	64
<b>Chapter 7:</b>	<b>Dimensions .....</b>	<b>65</b>



## Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Solo Guitar. 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 Guitar, 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 Guitar 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 Guitar 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 Guitar 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 Guitar to an approved isolated auxiliary 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 Guitar, 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 Guitar 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 Guitar 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 Guitar 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 (2.039" x 3.15" x 2.402")), and designed to be simply and efficiently connected directly to the application. The solution consists of the Gold Solo Guitar 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 Guitar 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 an auxiliary 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 Guitar 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 Guitar 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 with switches	F

and a variety of feedback selections and I/O configuration possibilities.

### 3.1.1. Accessories

Cable Kit, catalog number: CBL-GSOLGUITKIT01 (can be ordered separately)

For further details, see the MAN-G-SOLOGUT-CBLKIT documentation for this cable kit.



## 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 (2.039" x 3.15" x 2.402")
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 or 3 digital outputs + STO chaining					

**Table 1: Power Rating**

**Note on current ratings:** The current ratings of the Gold Solo Guitar 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. Auxiliary Supply

Feature	Details
Auxiliary power supply	<i>Isolated DC source only</i>
Auxiliary supply input voltage	14 to 96 VDC (100 V models) 23 to 195 (200 V models)
Auxiliary 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>	√
	EtherCAT with Switches	√
	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 Guitar by ensuring that it is installed in an appropriate environment.

#### 4.3.1. Gold Line

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



## 4.4. Gold Line Standards and Certifications

The following table describes the Main Standards of the Gold Solo Guitar 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 4.3.1 Gold Line 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

### 4.4.1. 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 5: Installation

The Gold Solo Guitar 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 Guitar, verify that you have all of its components, as follows:

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

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

#### To unpack the Gold Solo Guitar:

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



G-SOLGUT\_GCON-070A

4. Verify that the Gold Solo Guitar 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.

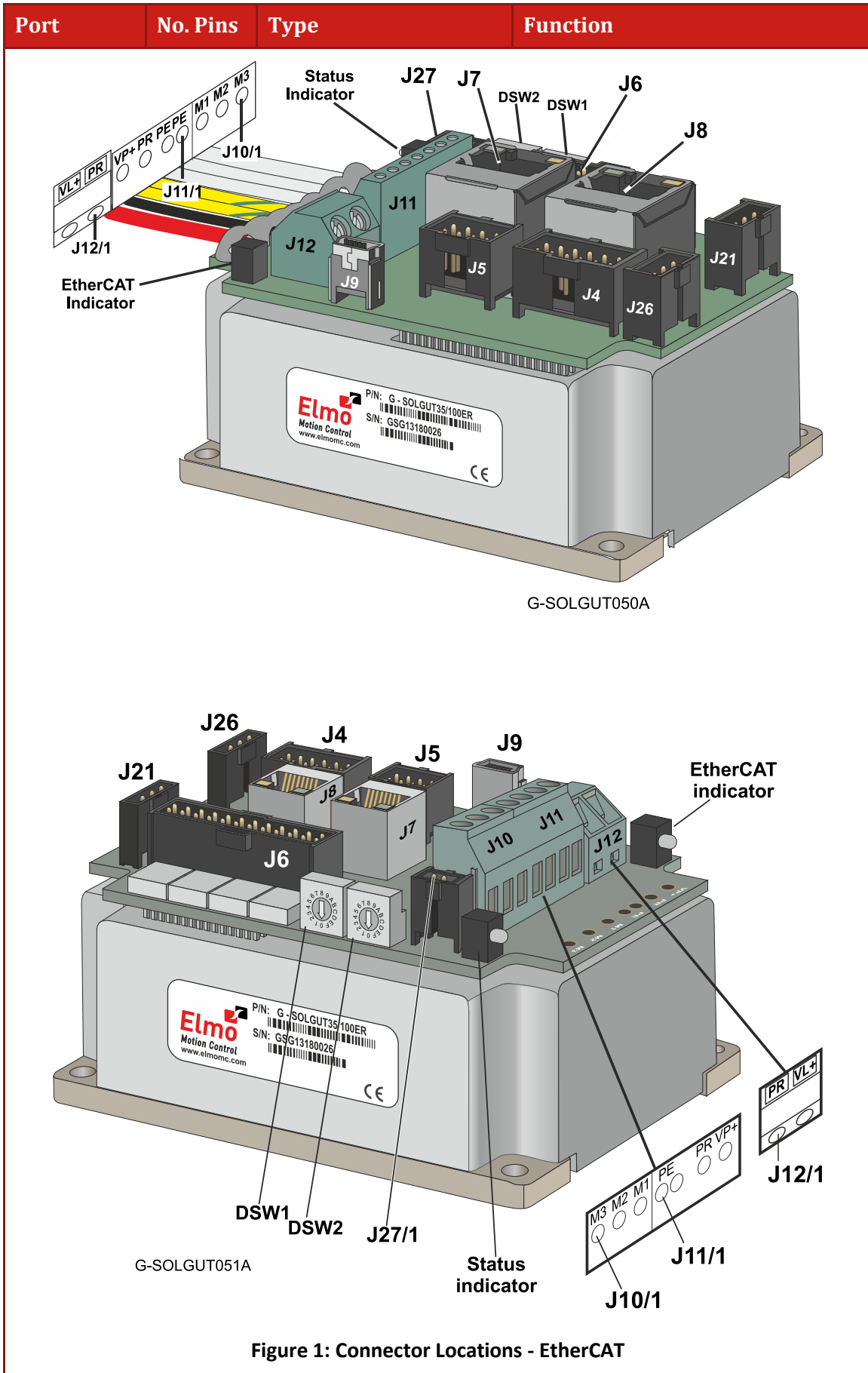


## 5.2. Connectors and Indicators

The Gold Solo Guitar has 14 connectors (connectors' version).

### 5.2.1. Connector Types

Port	No. Pins	Type	Function
Wires	7	Variable AWG (M1,M2,M3,PR,VP+,PE) Dependant on current	Main Power and Motor Power (Wires version)
J4	2x6	2.54 mm pitch	Feedback Port A
J5	2x4	2.54 mm pitch	Feedback Port B
J6	2x12	2.54 mm pitch	I/O and Port C
J9	5	Mini-USB type B	Mini-USB type B
J10	3	5.08 mm pitch	Motor phases (Connectors version)
J11	4	5.08 mm pitch	Positive power input (VP+)
J12	2	5.08 mm pitch	Auxiliary supply input (VL+)
J21	3	2.54 mm pitch	RS-232 communication or
	5	2.54 mm pitch	RS-422 communication
J26	3	2.54 mm pitch	STO
J27	2	2.54 mm pitch	PTC - External Temperature Sensor
<b>EtherCAT Version</b>			
J7	8	RJ-45	EtherCAT in
J8	8	RJ-45	EtherCAT out
<b>CAN Version</b>			
J22	4	2.54 mm pitch	CAN
J23	4	2.54 mm pitch	CAN



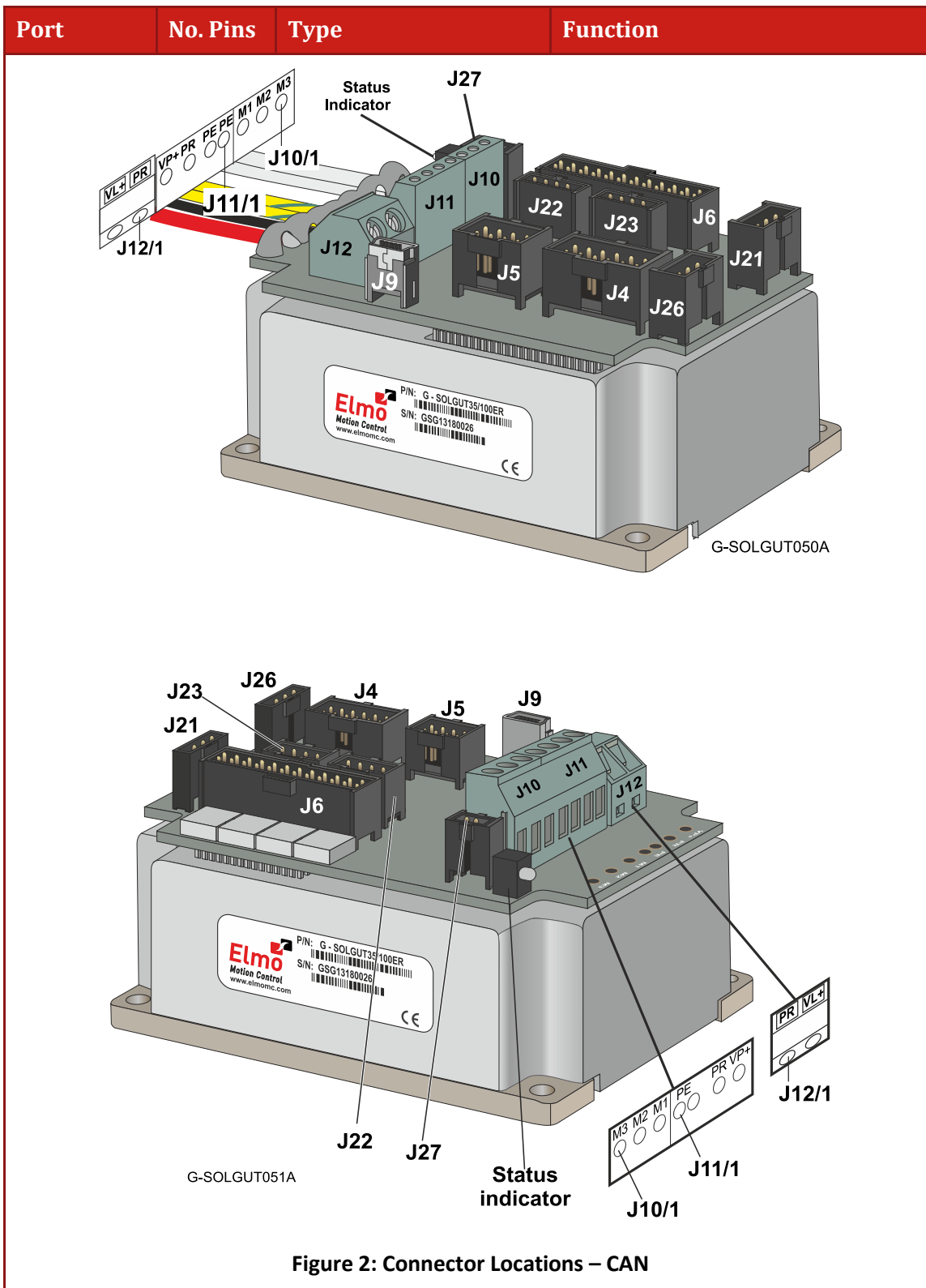


Table 2: Connector Types



### 5.3. Mounting the Gold Solo Guitar

The Gold Solo Guitar was designed for mounting on a surface. When integrating the Gold Solo Guitar 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 Guitar is enclosed in a metal chassis, we recommend that the Gold Solo Guitar be screw-mounted to it to help with heat dissipation. The Gold Solo Guitar has screw-mount holes on each corner of the heat-sink for this purpose – see below.

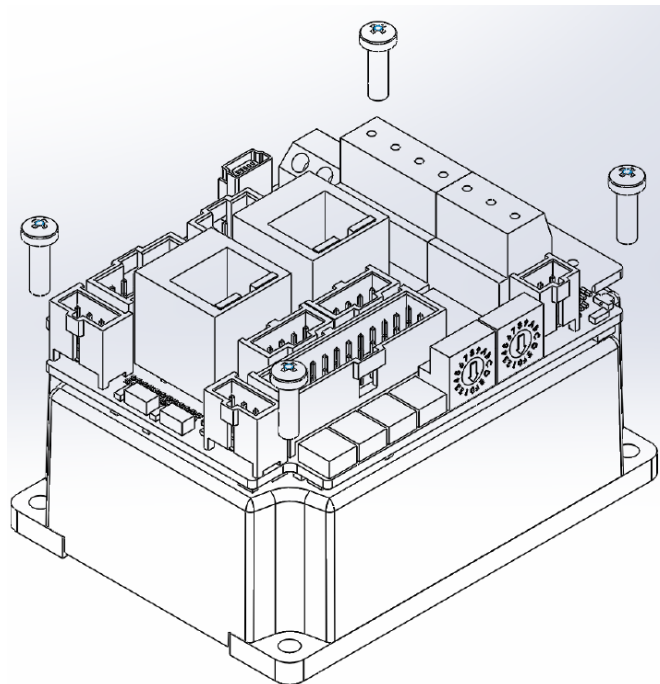
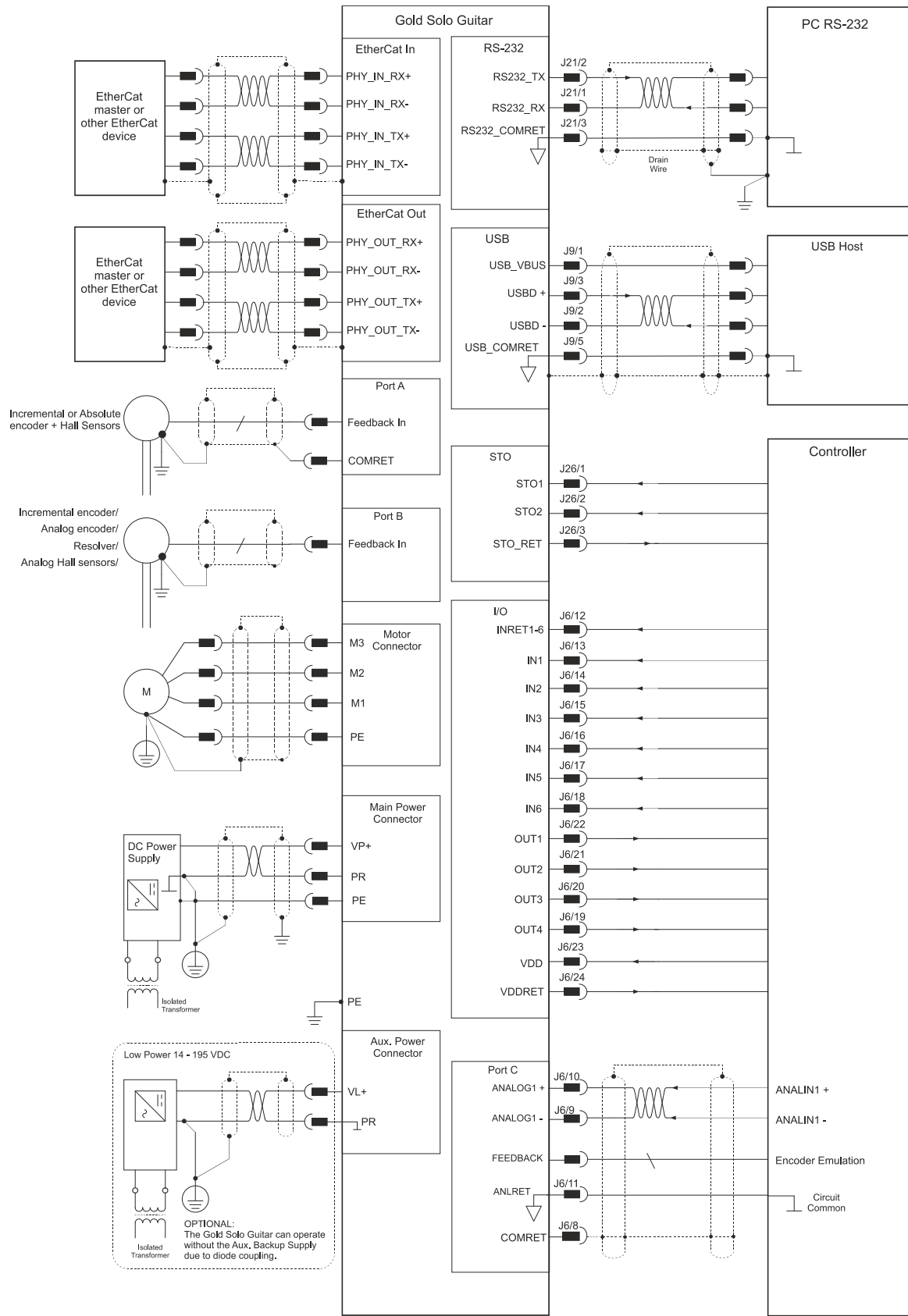


Figure 3: Mounting the Gold Solo Guitar



## 5.4. The Gold Solo Guitar Connection Diagrams



G-SOLGUT032B

Figure 4: The Gold Solo Guitar Connection Diagram - EtherCAT

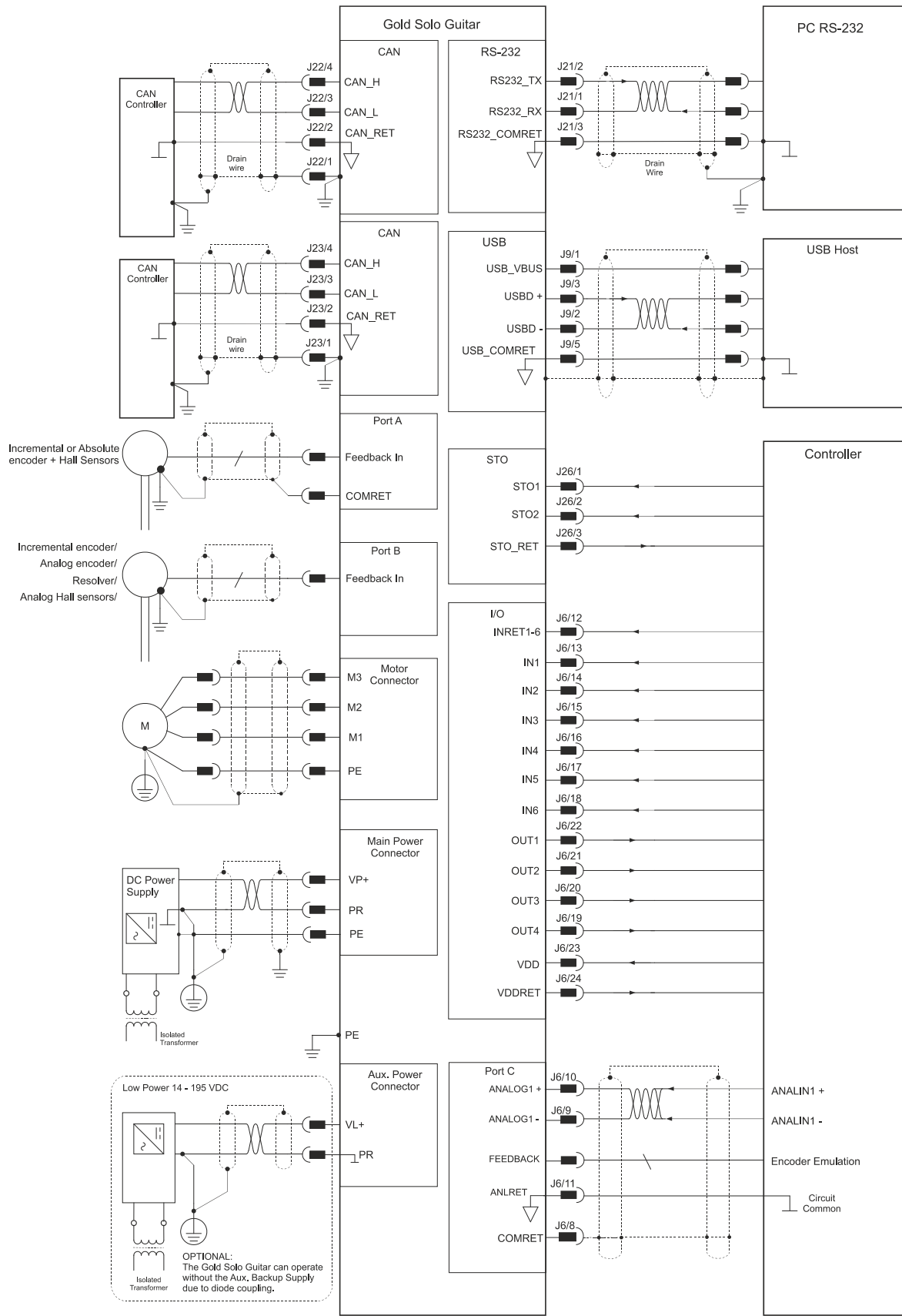




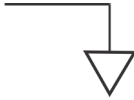
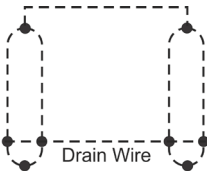
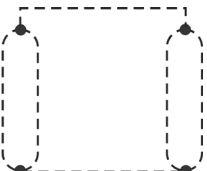
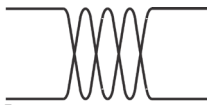
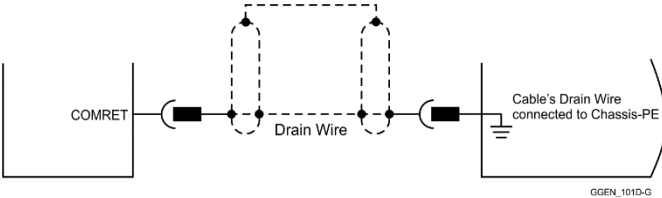
Figure 5: The Gold Solo Guitar Connection Diagram – CAN



## 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
 <p>GGEN_101D-A</p>	Earth connection (PE)
 <p>GGEN_101D-B</p>	Protective Earth Connection
 <p>GGEN_101D-C</p>	Common at the Controller
 <p>GGEN_101D-D</p>	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.
 <p>GGEN_101D-E</p>	Shielded cable braid only, without drain wire.
 <p>GGEN_101D-F</p>	Twisted-pair wires
 <p>GGEN_101D-G</p>	Encoder Earthing. The cable's shield is connected to the chassis (PE) in the connector. Earthing the Encoder and connecting the Earth (PE) to the drive COMRET is mandatory to insure reliable operation, high noise immunity and rejection of voltage common mode interferences.



## 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. After completing the wiring, carefully inspect all wires to ensure tightness, good solder of joints and general safety.

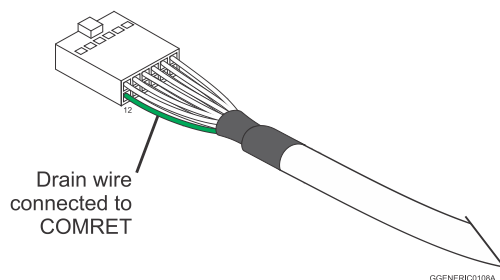


Figure 6: Feedback and Molex Control Cable Assemblies

**Note:** Please pay attention to the location of PIN 1 in the above connector diagram.

It should be noted that in all Elmo manuals the pinouts are shown differently to Molex’s technical sheets. Molex shows pin 1 at the bottom-left when looking at the face of the cable-side connector, tab down (Figure 7).

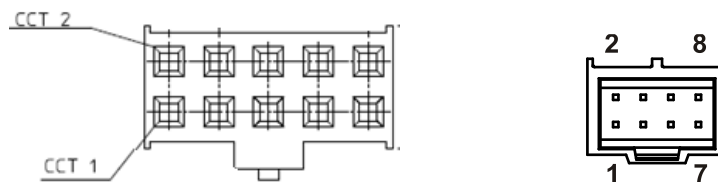


Figure 7: Molex vs Elmo Technical Diagram Examples Showing Pinout Numbers

However, Elmo specifies pin 1 as the bottom-left of drive-side connector. The result is that Elmo’s pin designations are mirrored relative to the pinouts as labeled by Molex.

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 8).
- 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.

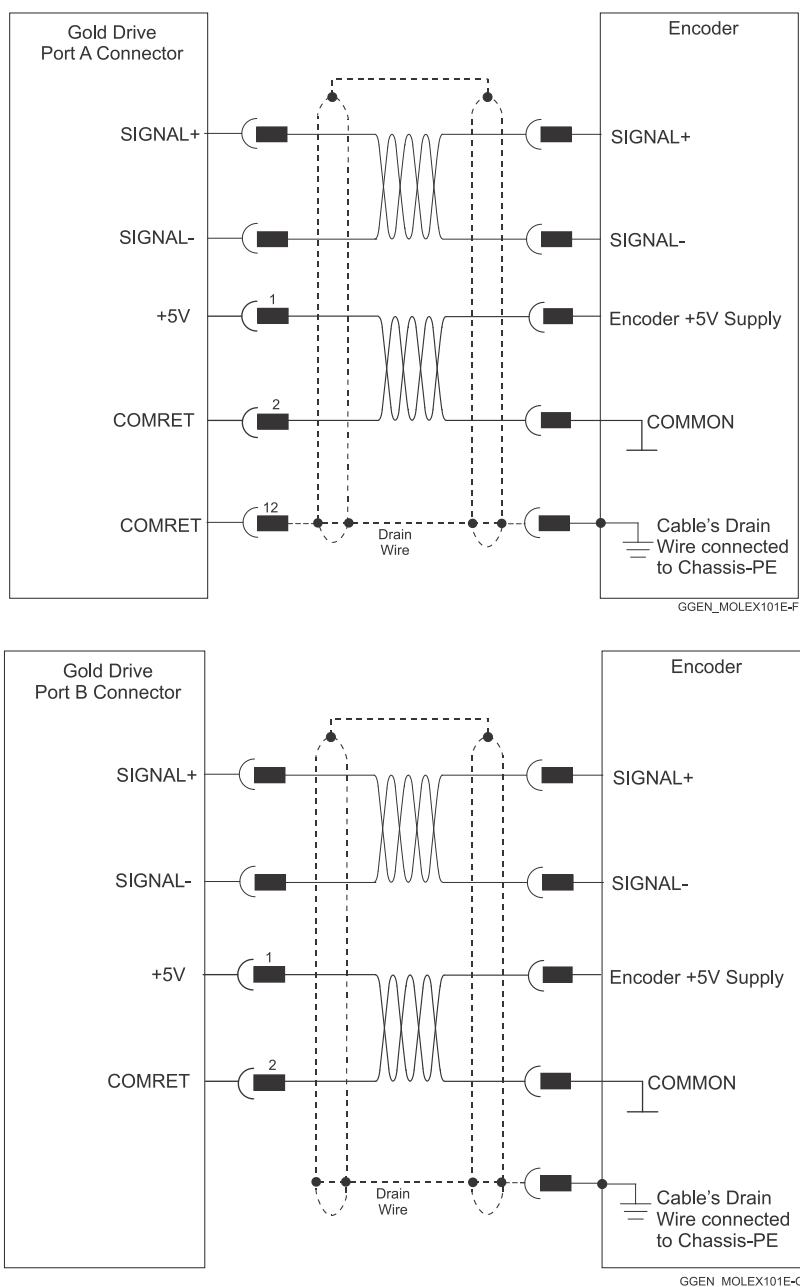


Figure 8: Feedback Port A and B Cable Assemblies



### 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.

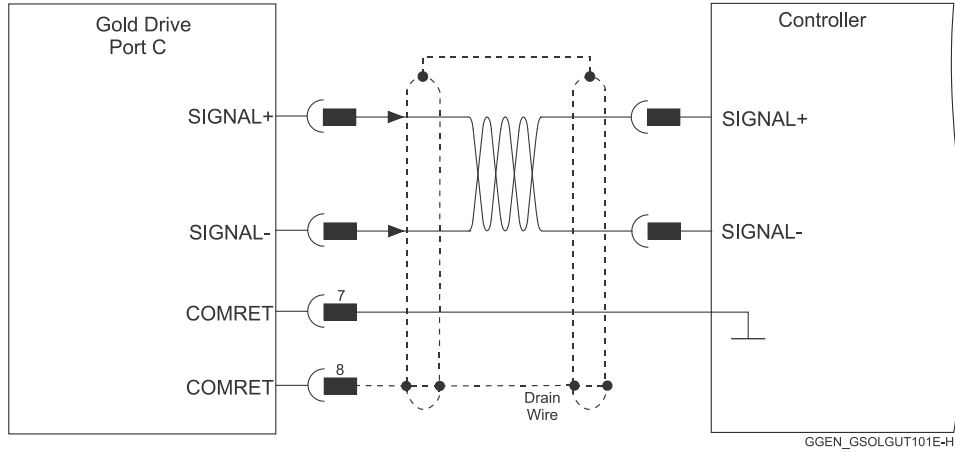


Figure 9: Feedback Port C Cable Assemblies

### 6.1.4. IO Cable Connector

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

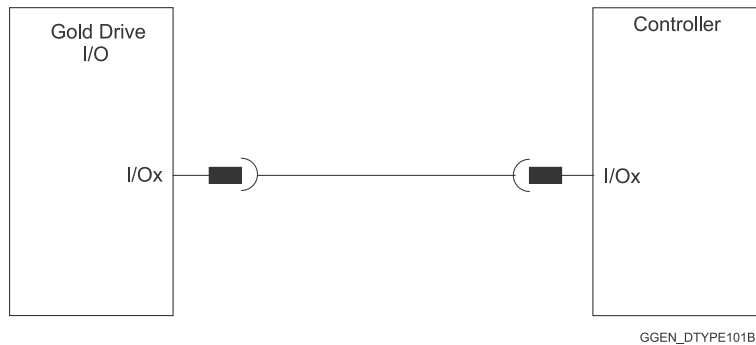


Figure 10: Feedback IO Cable Assemblies

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

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

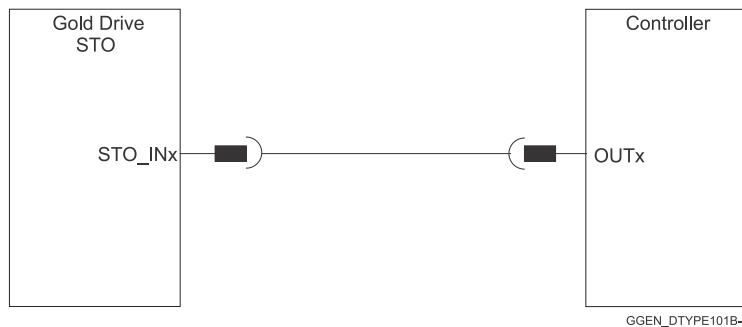


Figure 11: STO Cable Assemblies



## 6.2. Motor Power Connector Pinouts

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

Pin	Signal	Function	Cable - Wires	
			Brushless Motor	Brushed DC Motor
J11/1	PE	Protective Earth	Motor	Motor
J10/3	M1	Motor Phase 1	Motor	N/C
J10/2	M2	Motor Phase 2	Motor	Motor
J10/1	M3	Motor Phase 3	Motor	Motor

Pin Positions	
<p>G-SOLGUT051B-B</p> <p>Status indicator</p> <p>J10/1</p> <p>J11/1</p> <p>J12/1</p>	

Table 3: Main Power and Motor Connections

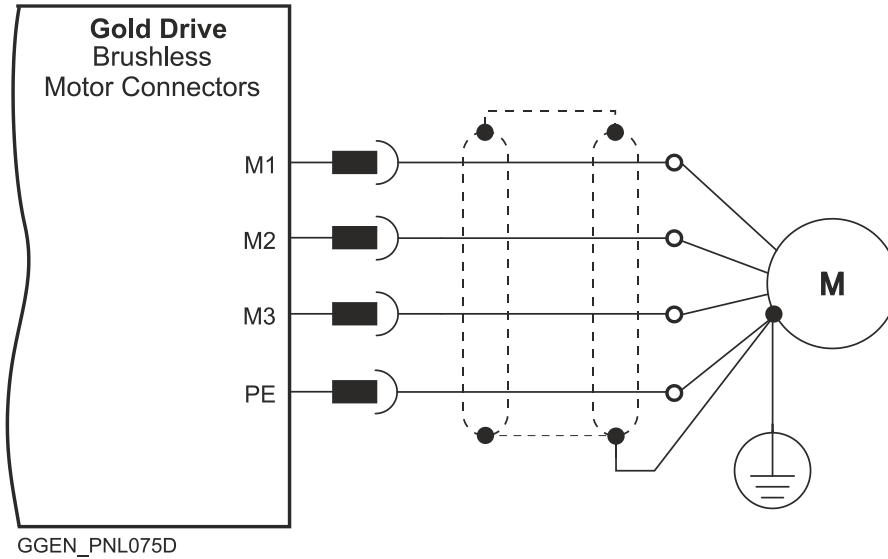


Figure 12: Brushless Motor Power Connection Diagram

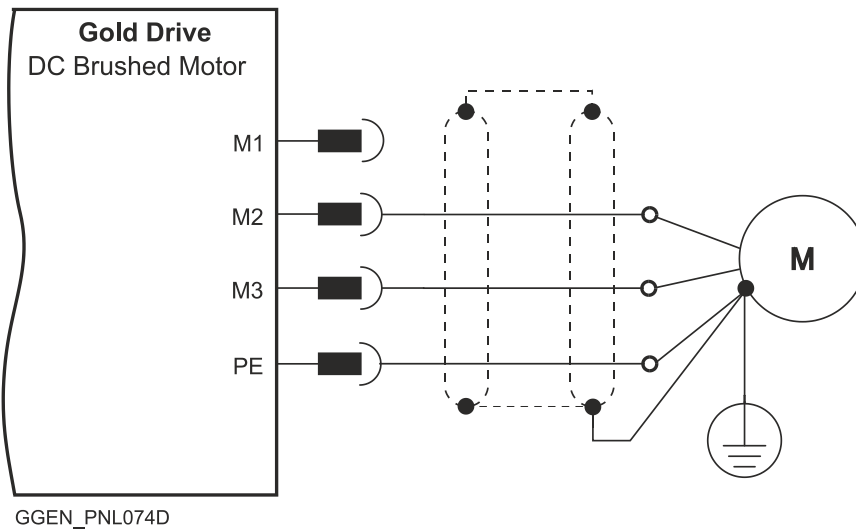


Figure 13: DC Brushed Motor Power Connection Diagram



## 6.3. Main Power, Auxiliary Power

### 6.3.1. Main Power

- Single DC Power Supply - Power to the Gold Solo Guitar is provided by a 14 to 195 VDC single isolated DC power source (not included with the Gold Solo Guitar). A “smart” control-supply algorithm enables the Gold Solo Guitar to operate with only one power supply with no need for an auxiliary 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 Guitar’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 Guitar (14 V to 195 V), so you must use the correct power supply according to the maximum operating voltage of the Gold Solo Guitar. Refer to the Section 4.2 Technical Data.

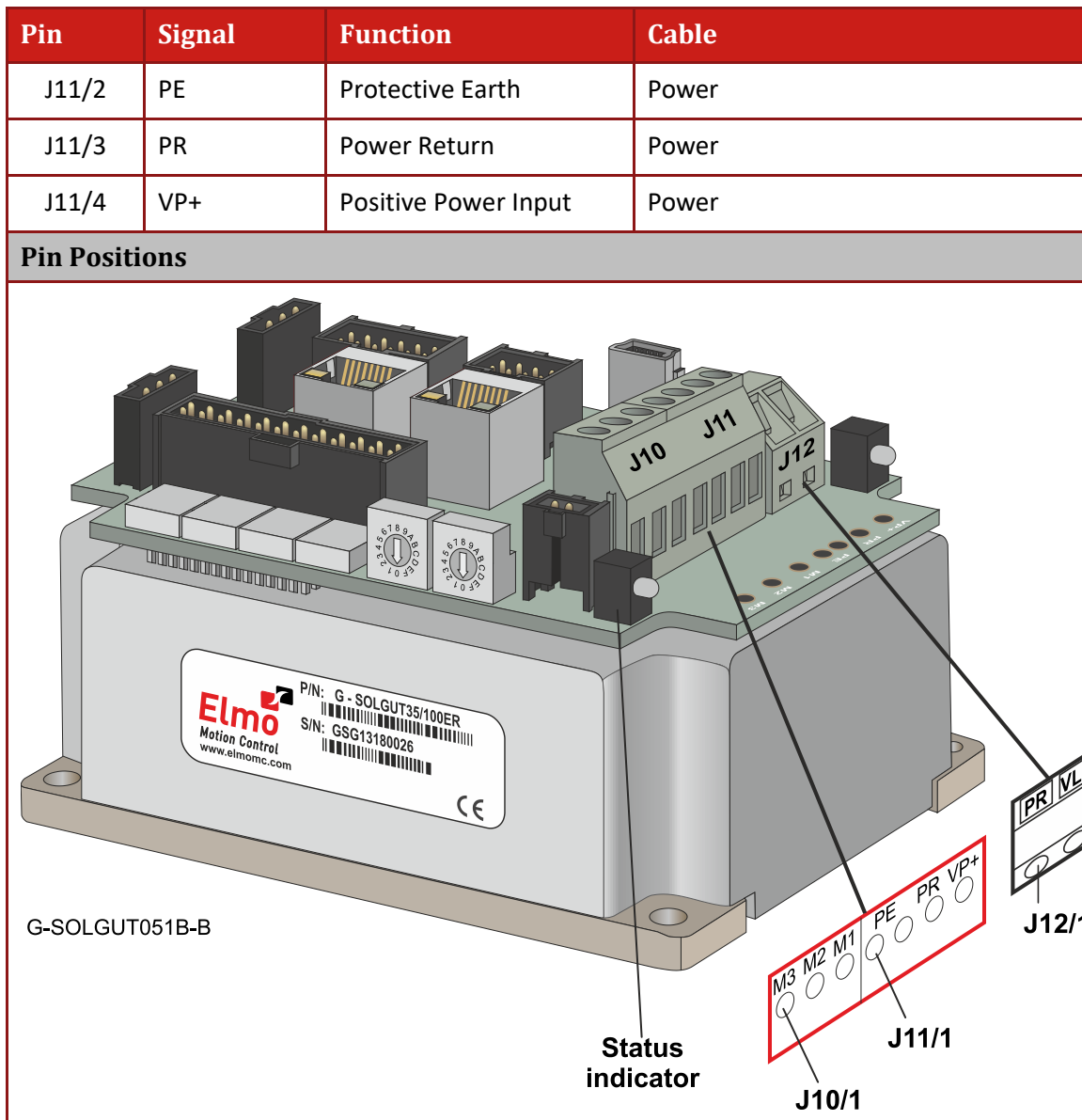


Table 4: Main Power and Motor Connections

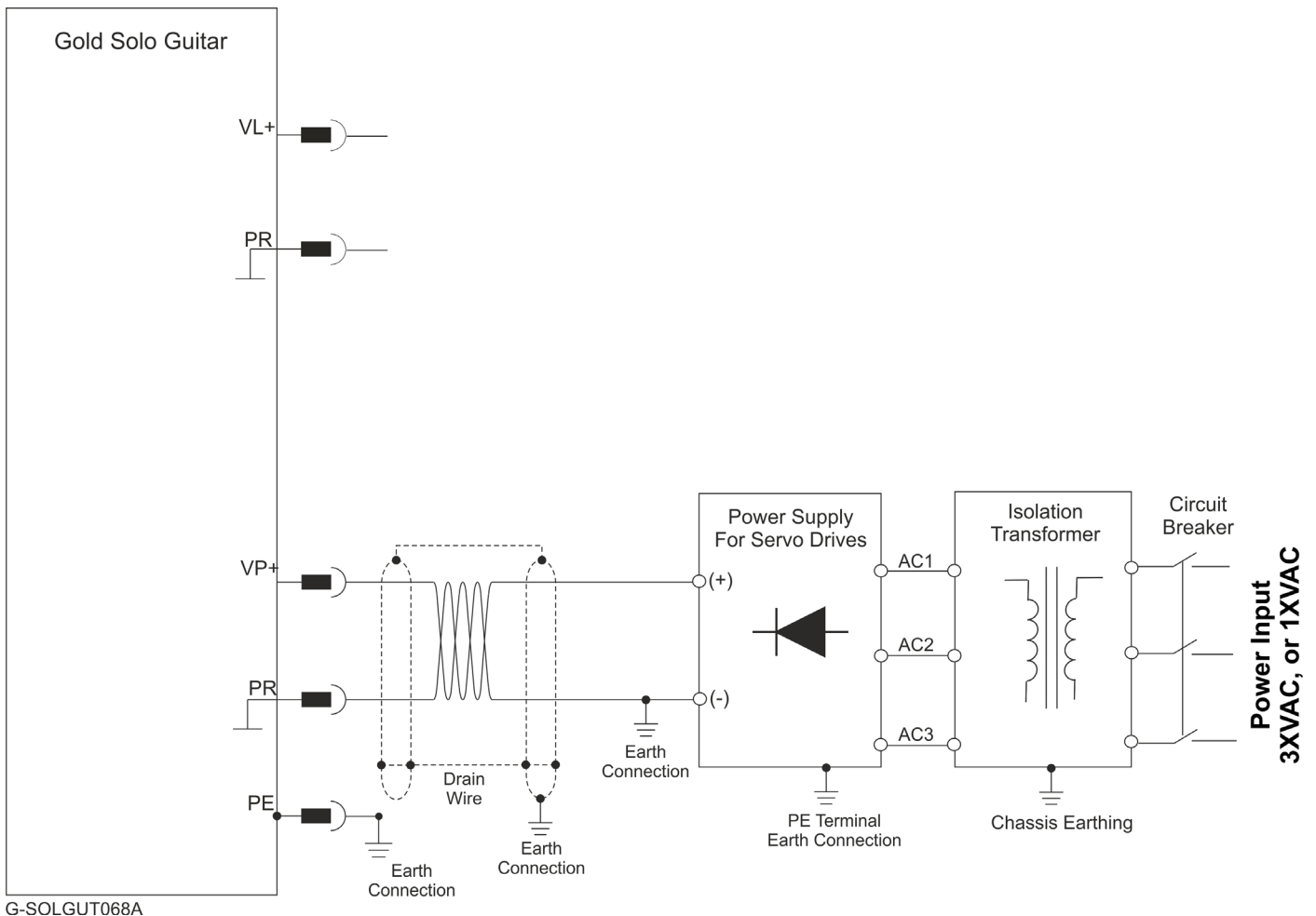


**Power to the Gold Solo Guitar is provided by a 14 to 195 VDC source. A smart control-supply algorithm enables the Solo Guitar to operate with the power supply only, with no need for an auxiliary supply.**

*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 14: Main Power Supply Connection Diagram (no Auxiliary Supply)**



### 6.3.2. Auxiliary Power Supply (J12) - (Optional)

Pin	Signal	Function
J12/1	PR	Auxiliary Supply Return
J12/2	VL+	Auxiliary Supply Input
<b>Pin Positions</b>		<b>Cable Connector</b>

Table 5: Auxiliary Supply Pins

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

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



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

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





## 6.4. Drive Status Indicator

Figure 16 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.

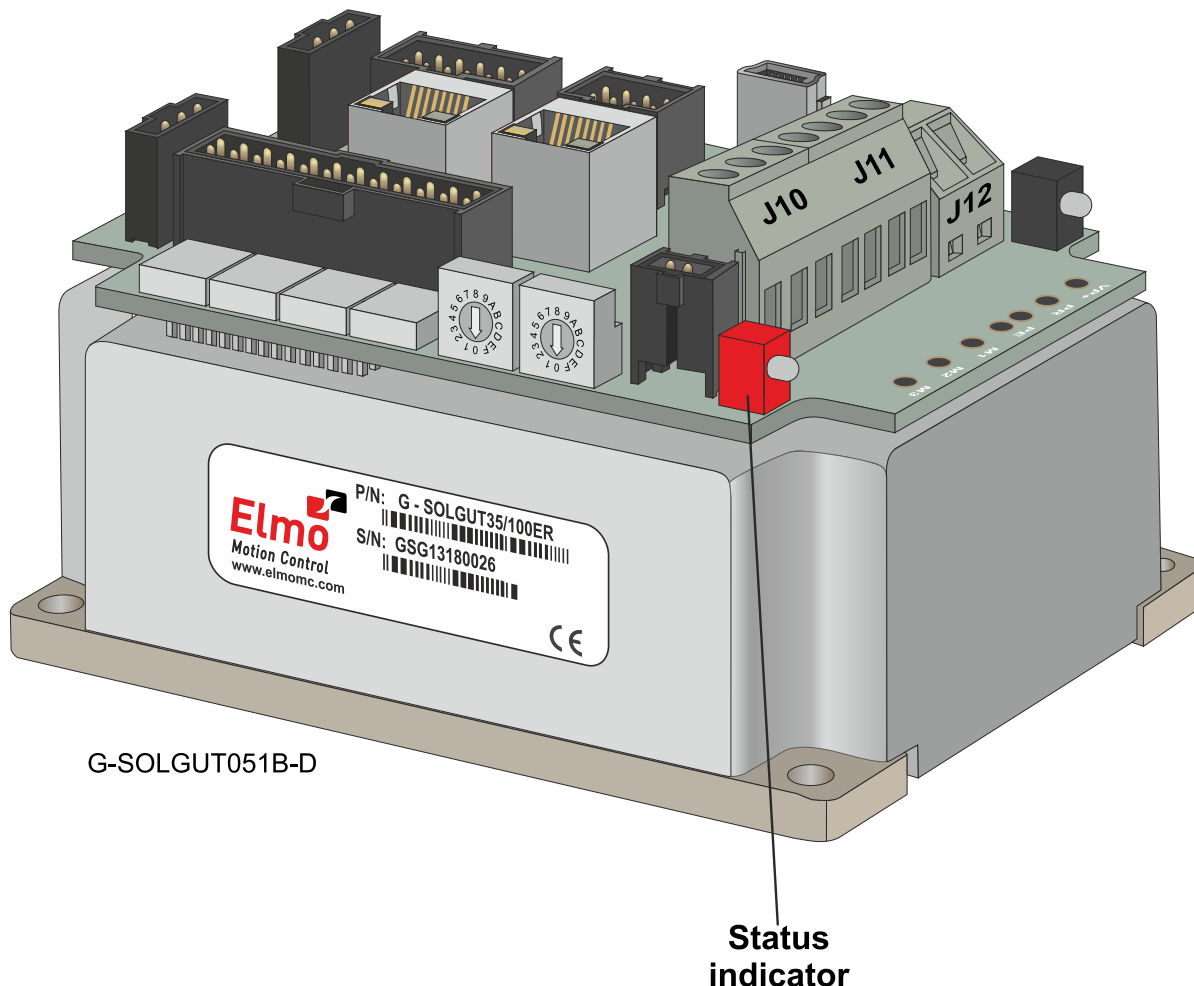


Figure 16: Drive Status LED

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 Connector (J4)

See Section 10.3 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Pin (J4)	Incremental Encoder		Absolute Serial Encoder	
	Signal	Function	Signal	Function
1	+5V	Encoder +5V supply	+5V	Encoder +5V supply
2	COMRET	Common Return	COMRET	Common Return
3	PortA_ENC_A+	Channel A +	ABS_CLK+	Absolute encoder clock+
4	PortA_ENC_A-	Channel A -	ABS_CLK-	Absolute encoder clock-
5	PortA_ENC_B+	Channel B+	ABS_DATA+	Absolute encoder data+
6	PortA_ENC_B-	Channel B -	ABS_DATA-	Absolute encoder data -
7	PortA_ENC_INDEX+	Index+	Reserved	Reserved
8	PortA_ENC_INDEX-	Index -	Reserved	Reserved
9	HA	Hall sensor A	HA	Hall sensor A
10	HB	Hall sensor B	HB	Hall sensor B
11	HC	Hall sensor C	HC	Hall sensor C
12	COMRET	Common Return	COMRET	Common Return



Incremental Encoder		Absolute Serial Encoder
Pin Positions		Cable Connector
		<p><b>12-Pin Molex Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.1</p>

Table 6: Port A Pin Assignments



### 6.5.1. Incremental Encoder

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

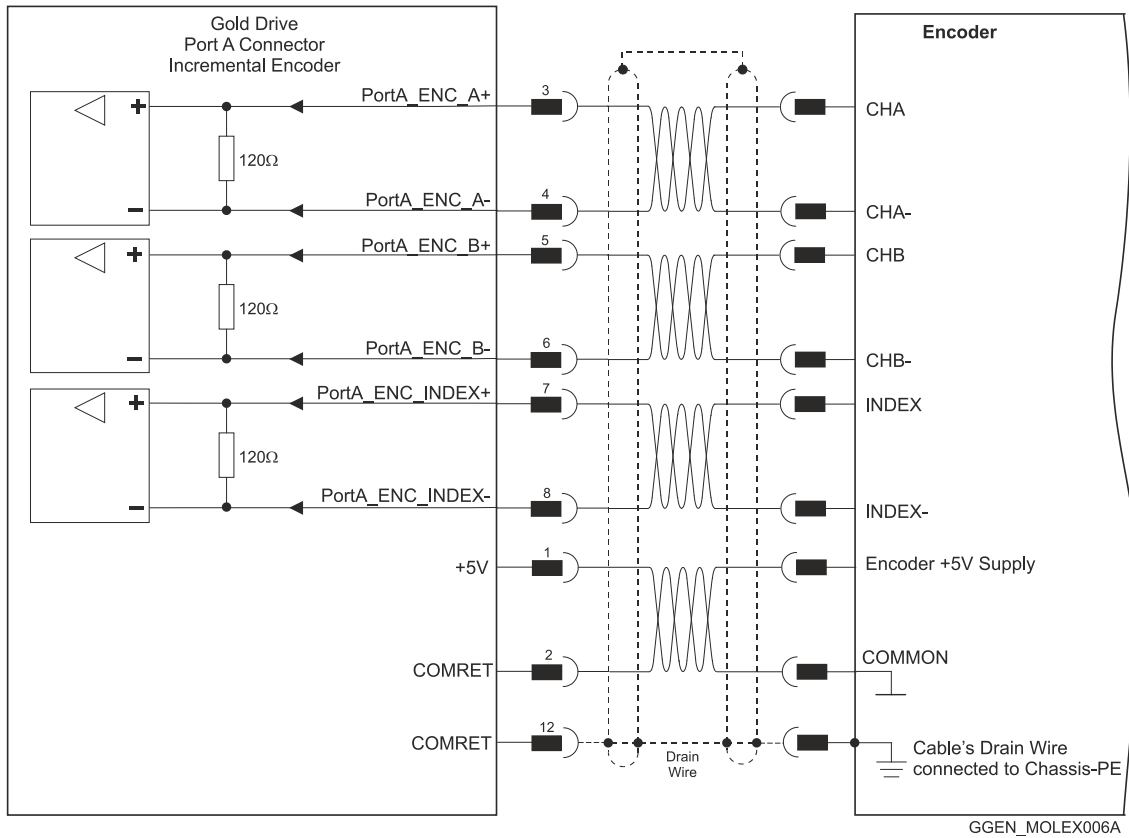


Figure 17: Port A Incremental Encoder Input – Recommended Connection Diagram

### 6.5.2. Hall Sensor

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

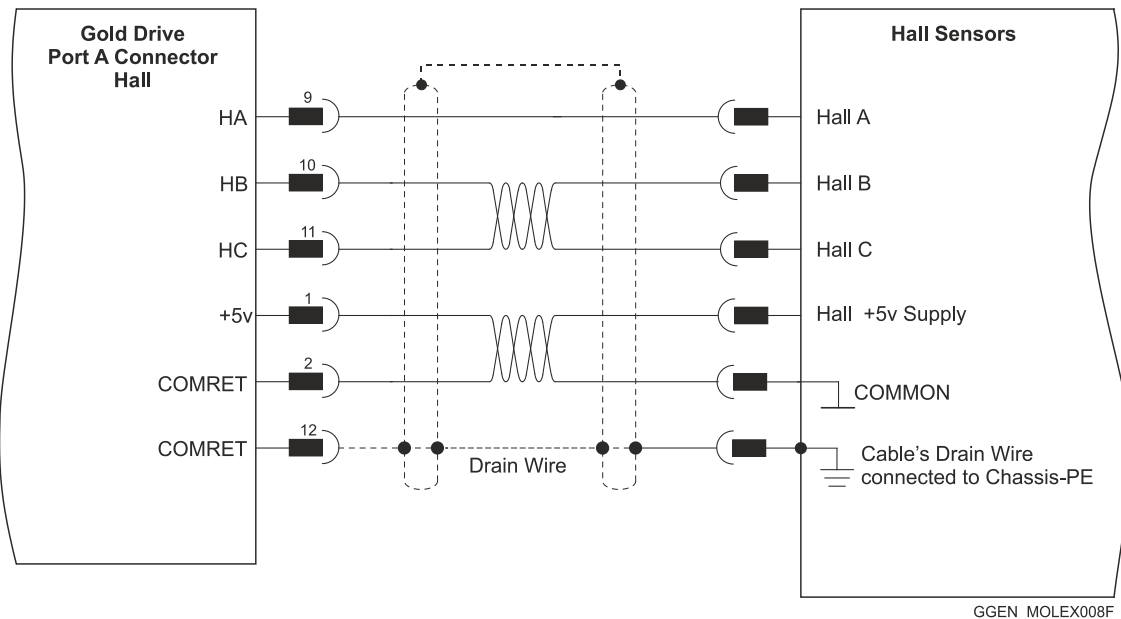


Figure 18: Hall Sensor Connection Diagram



### 6.5.3. Absolute Serial Type Encoder

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

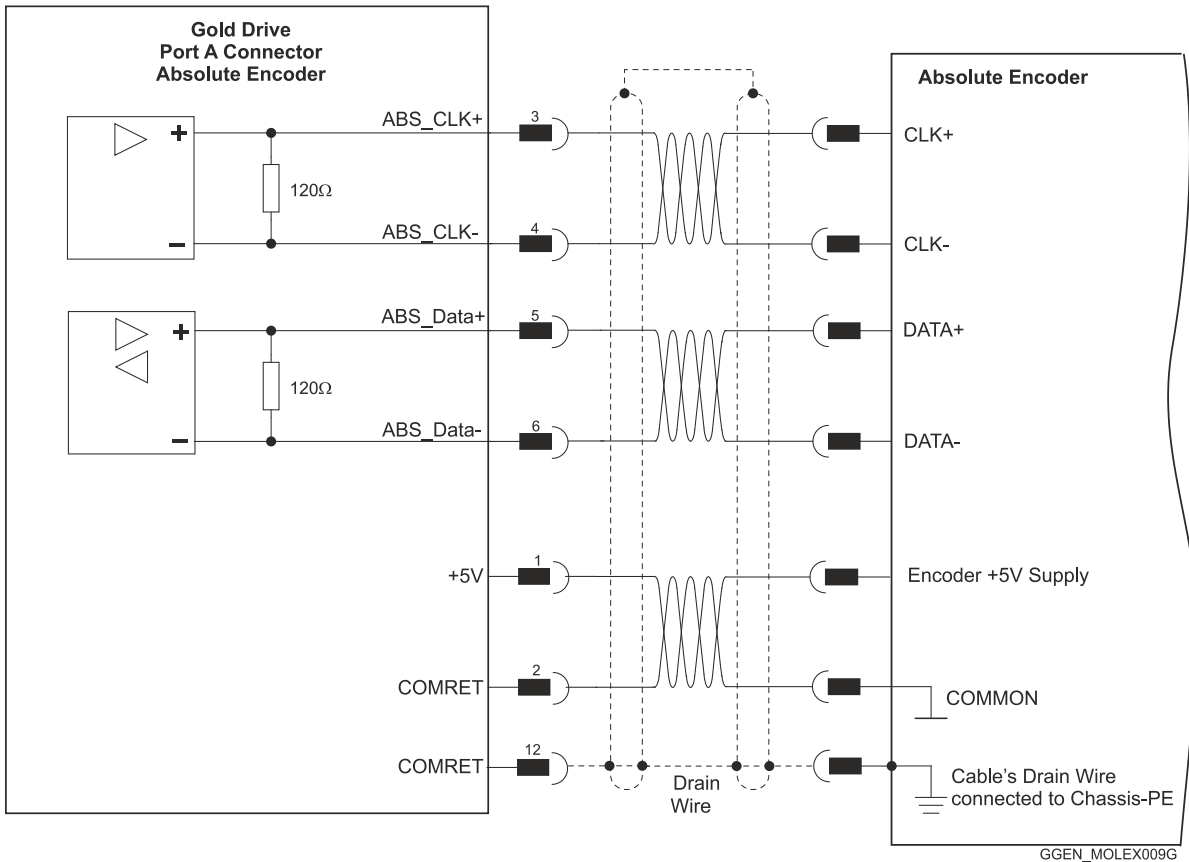


Figure 19: Absolute Serial Encoder – Recommended Connection Diagram for EnDAT, Biss, and SSI

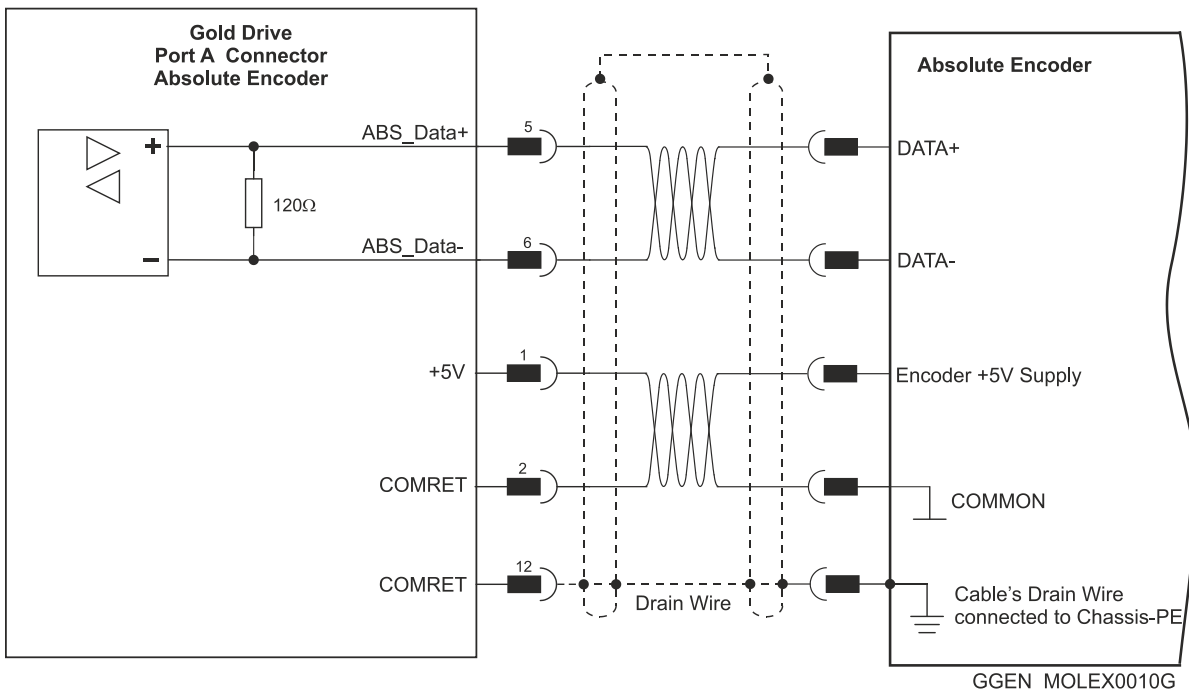


Figure 20: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)



### 6.5.3.1. Hiperface

The following figure describes the connection diagram.

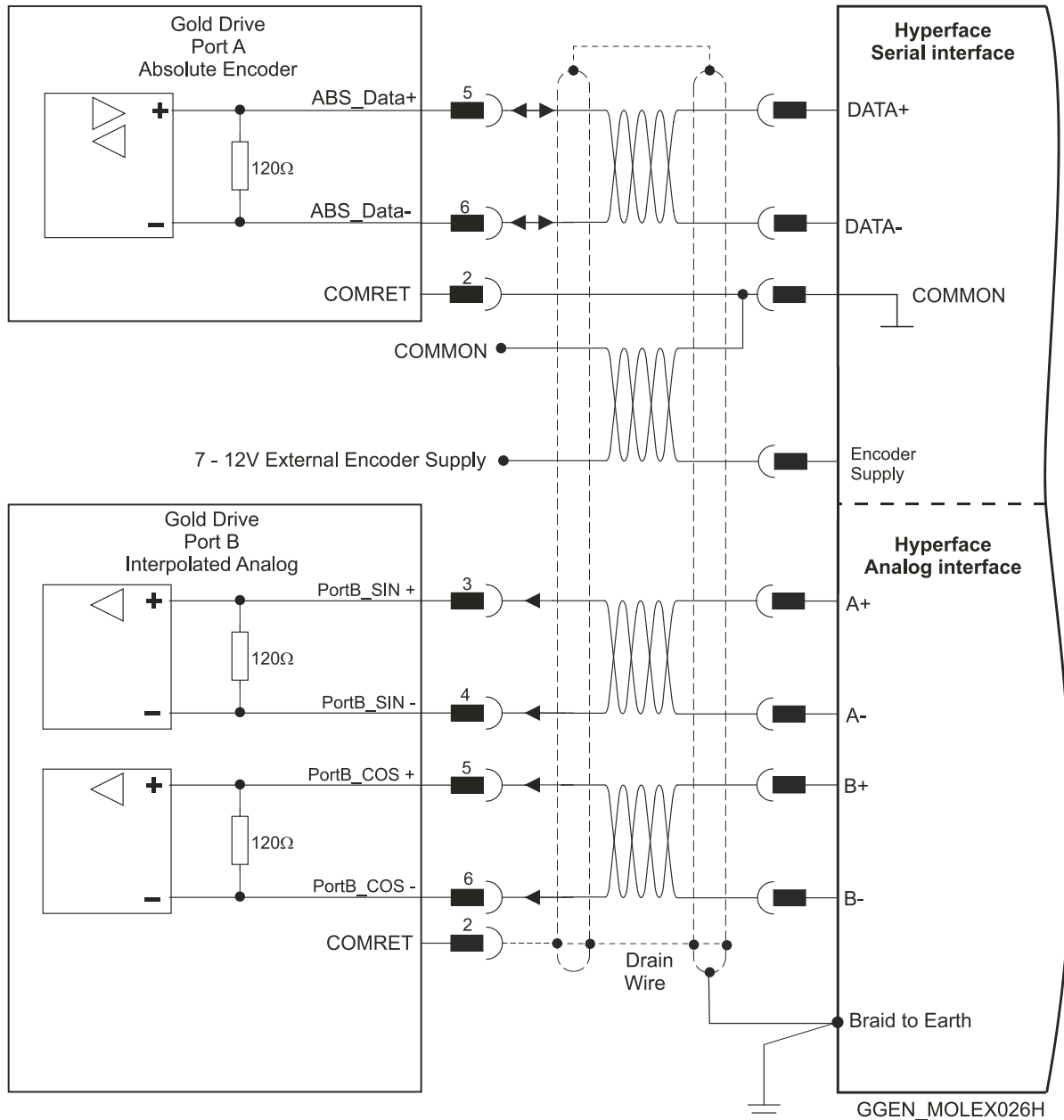


Figure 21: Absolute Serial Encoder – Recommended Connection Diagram for Stegmann Hiperface

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



## 6.6. Port B Connector (J5)

See Section 10.4 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

		Incremental or Interpolated Analog Encoder		Resolver	
		G-SOLGUT	E	G-SOLGUT	R
Pin (J5)	Signal	Function		Signal	Function
1	+5V	Encoder +5V supply		NC	
2	COMRET	Common Return		COMRET	Common Return
3	PortB_ENC_A+/SIN+	Channel A+/Sine+		SIN+	Sine+
4	PortB_ENC_A-/SIN-	Channel A-/Sine-		SIN-	Sine-
5	PortB_ENC_B+/COS+	Channel B+/Cosine+		COS+	Cosine+
6	PortB_ENC_B-/COS-	Channel B-/Cosine-		COS-	Cosine-
7	PortB_ENC_INDEX+/ Analog_Index+	Channel_Index+/ Analog_Index+		RESOLVER_OUT+	Vref f=1/TS, 50 mA Max.
8	PortB_ENC_INDEX-/ Analog_Index-	Channel_Index- / Analog_Index-		RESOLVER_OUT-	Vref complement f= 1/TS, 50 mA Max.

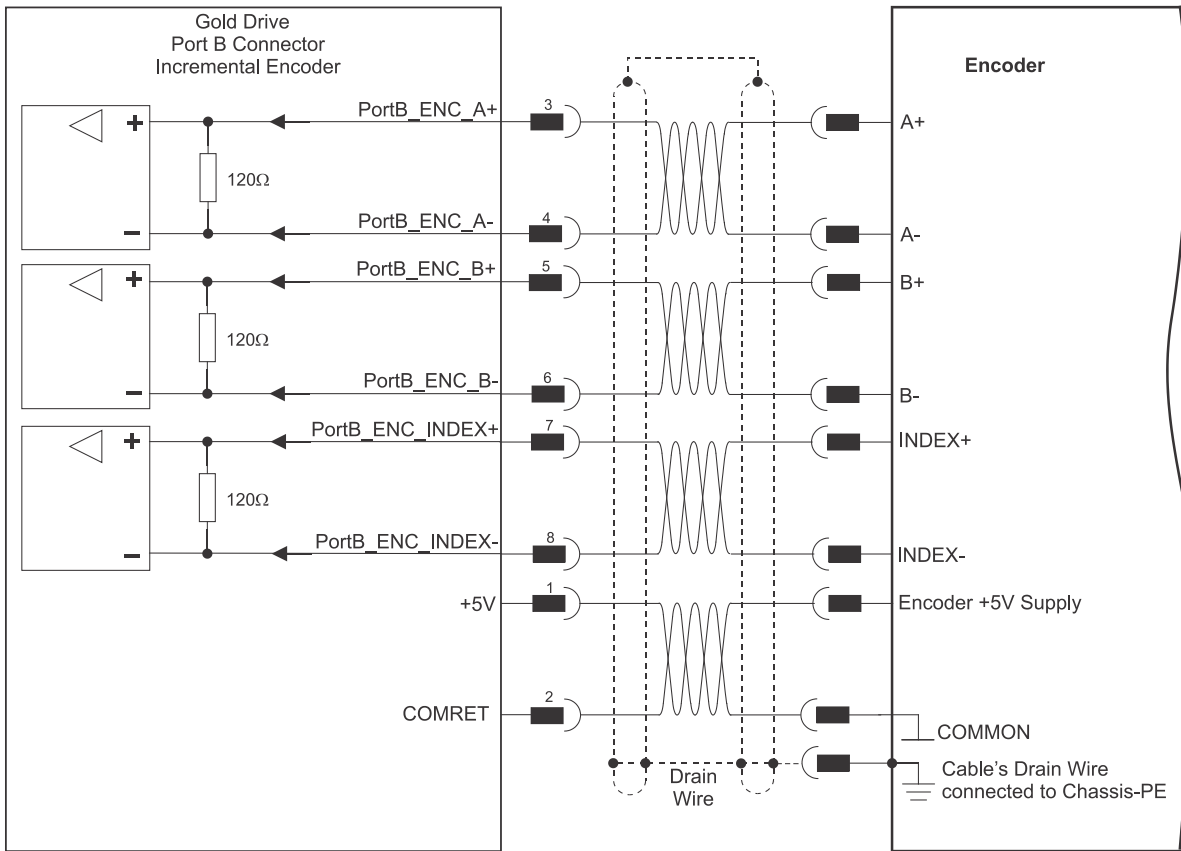
Pin Positions	Cable Connector
	<p><b>8-Pin Molex Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.1.</p>

Table 7: Port B Pin Assignments



### 6.6.1. Incremental Encoder

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



GGEN\_MOLEX027G

Figure 22: Port B Incremental Encoder Input – Recommended Connection Diagram



### 6.6.2. Interpolated Analog Encoder

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

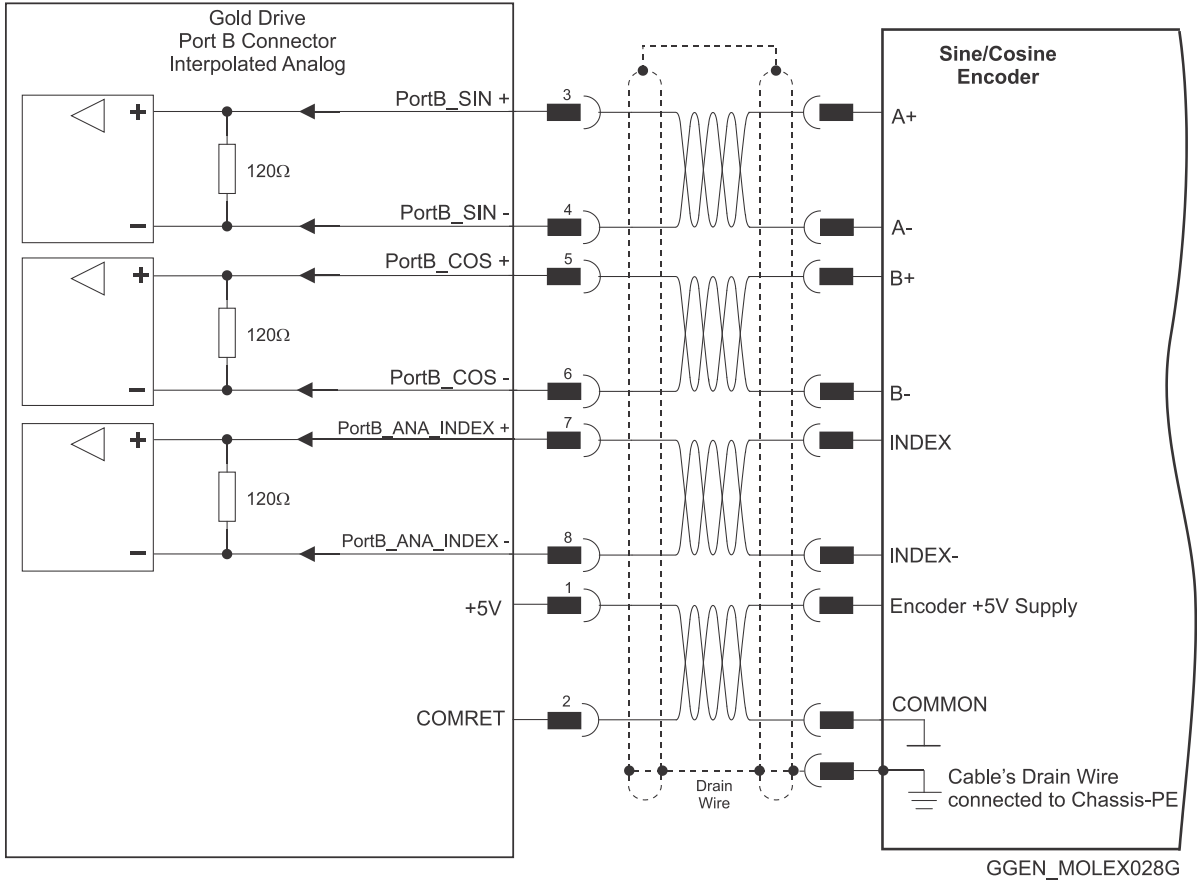


Figure 23: Port B - Interpolated Analog Encoder Connection Diagram



### 6.6.3. Resolver

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

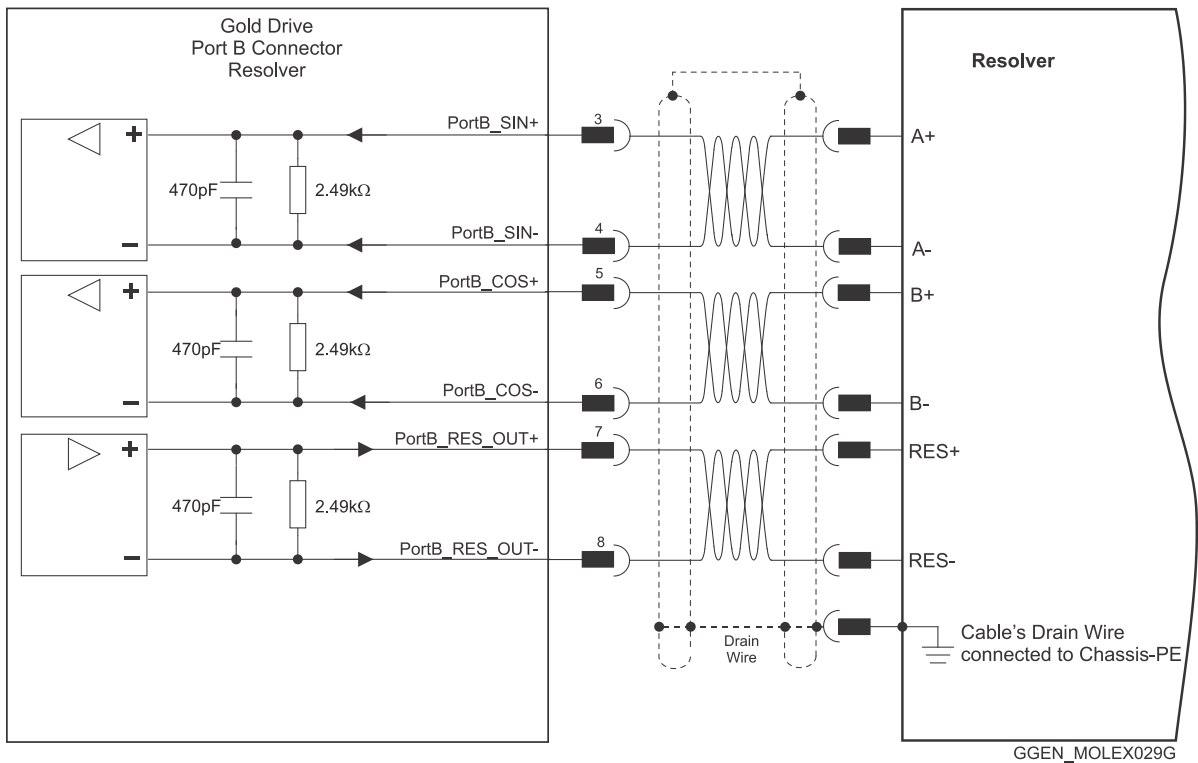


Figure 24: Port B – Resolver Connection Diagram



## 6.7. Port C, Digital I/Os, and Analog Inputs (J6)

The Port C connector includes the following functions:

- Port C: Refer to Sections 10.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details
- 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.

Pin (J6)	Signal	Function
1	PortC_ENCO_A+	Buffered Channel A output
2	PortC_ENCO_A-	Buffered Channel A complement output
3	PortC_ENCO_B+	Buffered Channel B output
4	PortC_ENCO_B-	Buffered Channel B complement output
5	PortC_ENCO_Index+	Buffered INDEX output
6	PortC_ENCO_Index-	Buffered INDEX complement output
7	COMRET	Common return
8	COMRET	Common return
9	ANALOG1-	Analog input complement
10	ANALOG1+	Analog input
11	ANARET	Analog return
12	INRET1_6	Programmable input 1 – 6 return
13	IN1	Programmable input 1 (High speed)
14	IN2	Programmable input 2 (High speed)
15	IN3	Programmable input 3 (High speed)
16	IN4	Programmable input 4 (High speed)
17	IN5	Programmable input 5 (High speed)
18	IN6 or STO OUT chaining	Programmable input 6 (High speed)
19	OUT4	Programmable output 4
20	OUT3	Programmable output 3
21	OUT2	Programmable output 2
22	OUT1	Programmable output 1
23	VDD	VDD supply. Refer to <a href="#">MAN-G-Panel Mounted Drives Hardware Manual</a> for VDD specification
24	VDDRET	VDD supply return



Pin (J6)	Signal	Function
Pin Positions		Cable Connector
		<p><b>24-Pin Molex Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.1.</p>

Table 8: Connector J6 – Port C and I/O Pin Assignments

### 6.7.1. Port C – Encoder Output

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

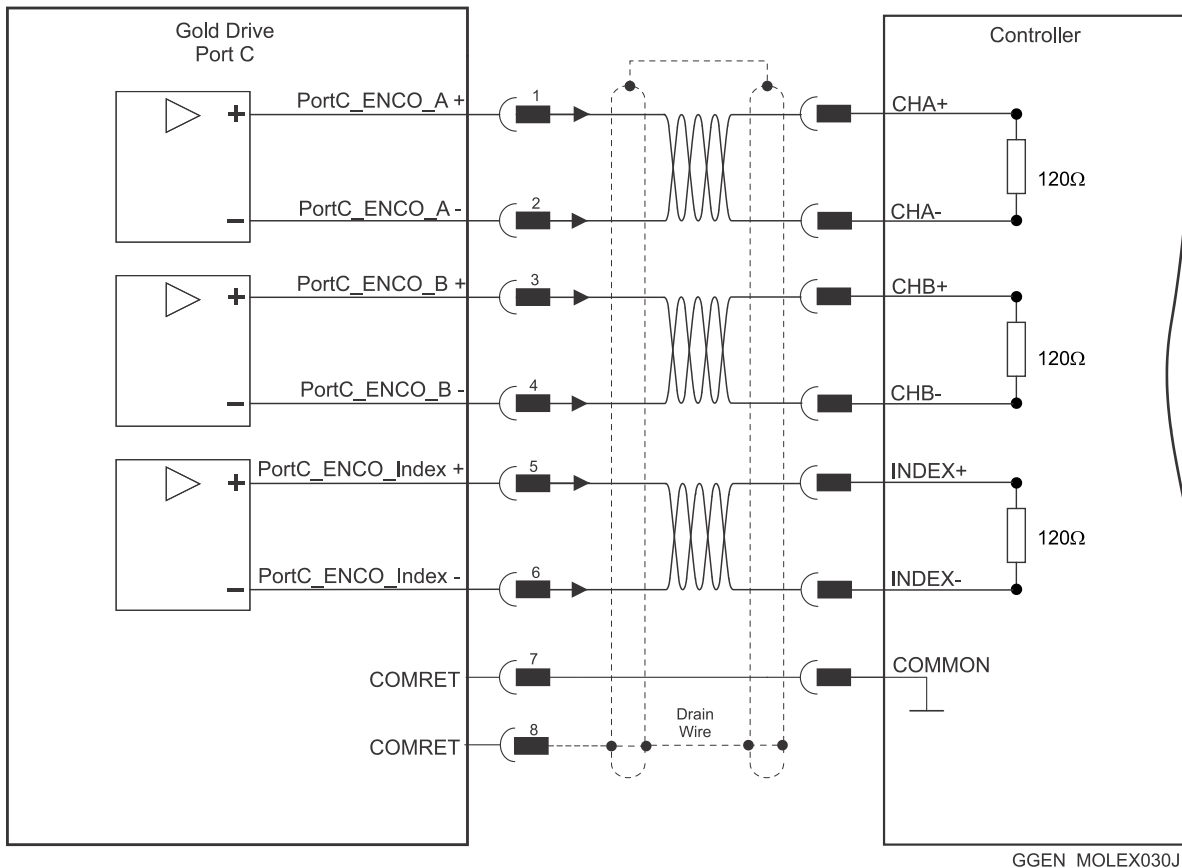


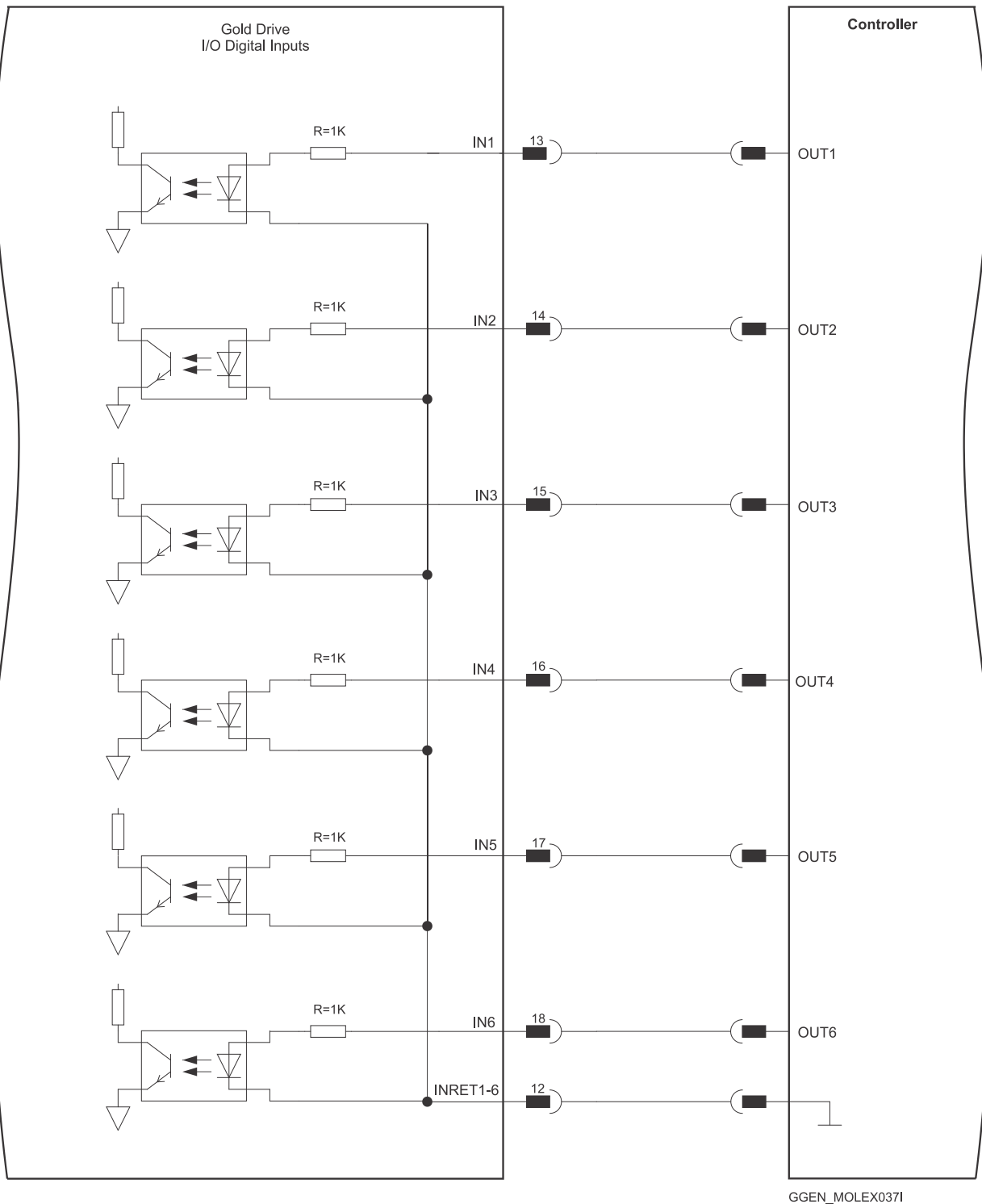
Figure 25: Encoder Differential Output – Recommended Connection Diagram





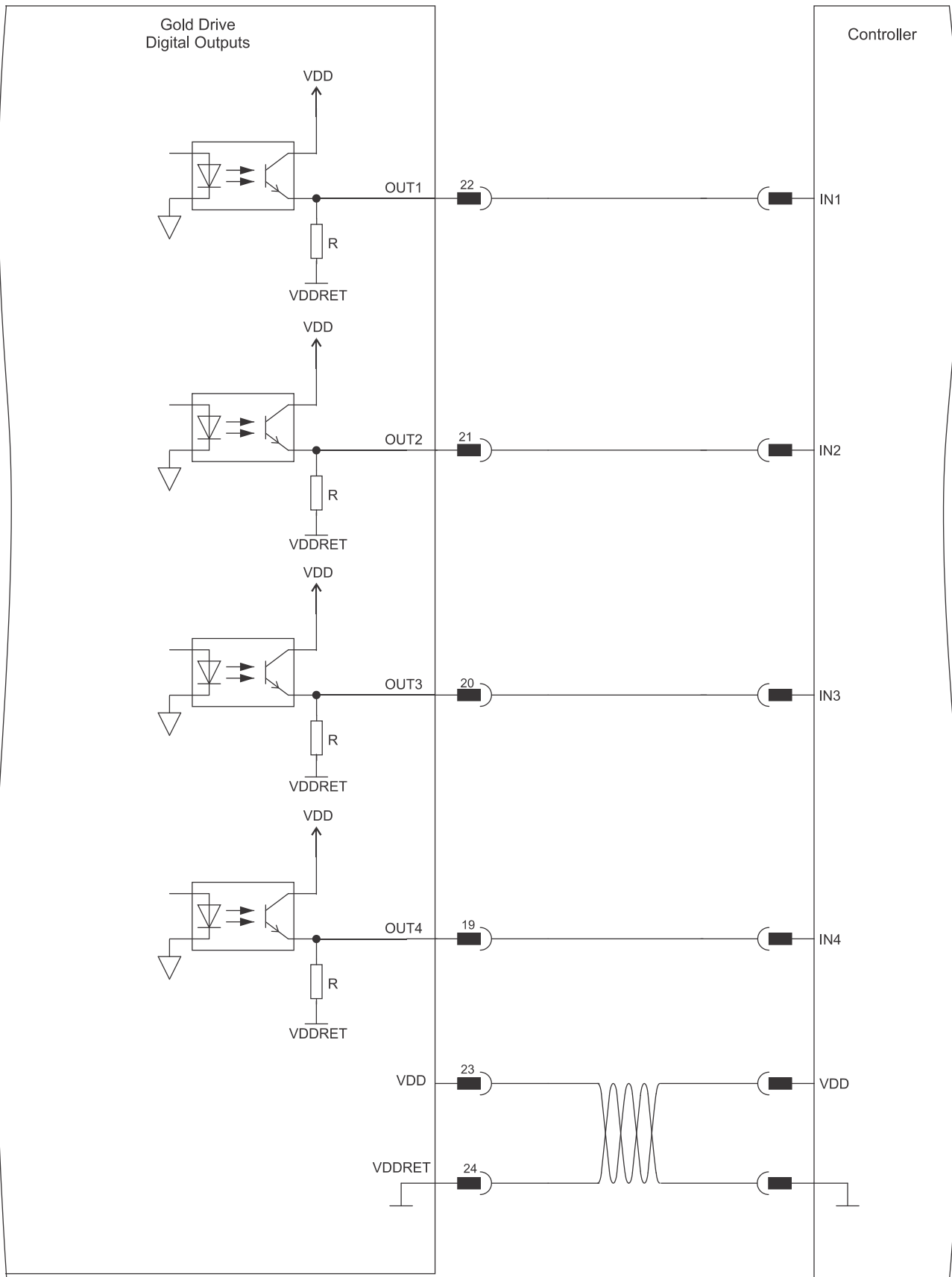
### 6.7.3. Digital Input and Output TTL Mode

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



GGEN\_MOLEX0371

Figure 27: Digital Input TTL Mode Connection Diagram



GGEN\_MOLEX040H

Figure 28: Digital Output Connection Diagram – TTL Option



### 6.7.4. 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.

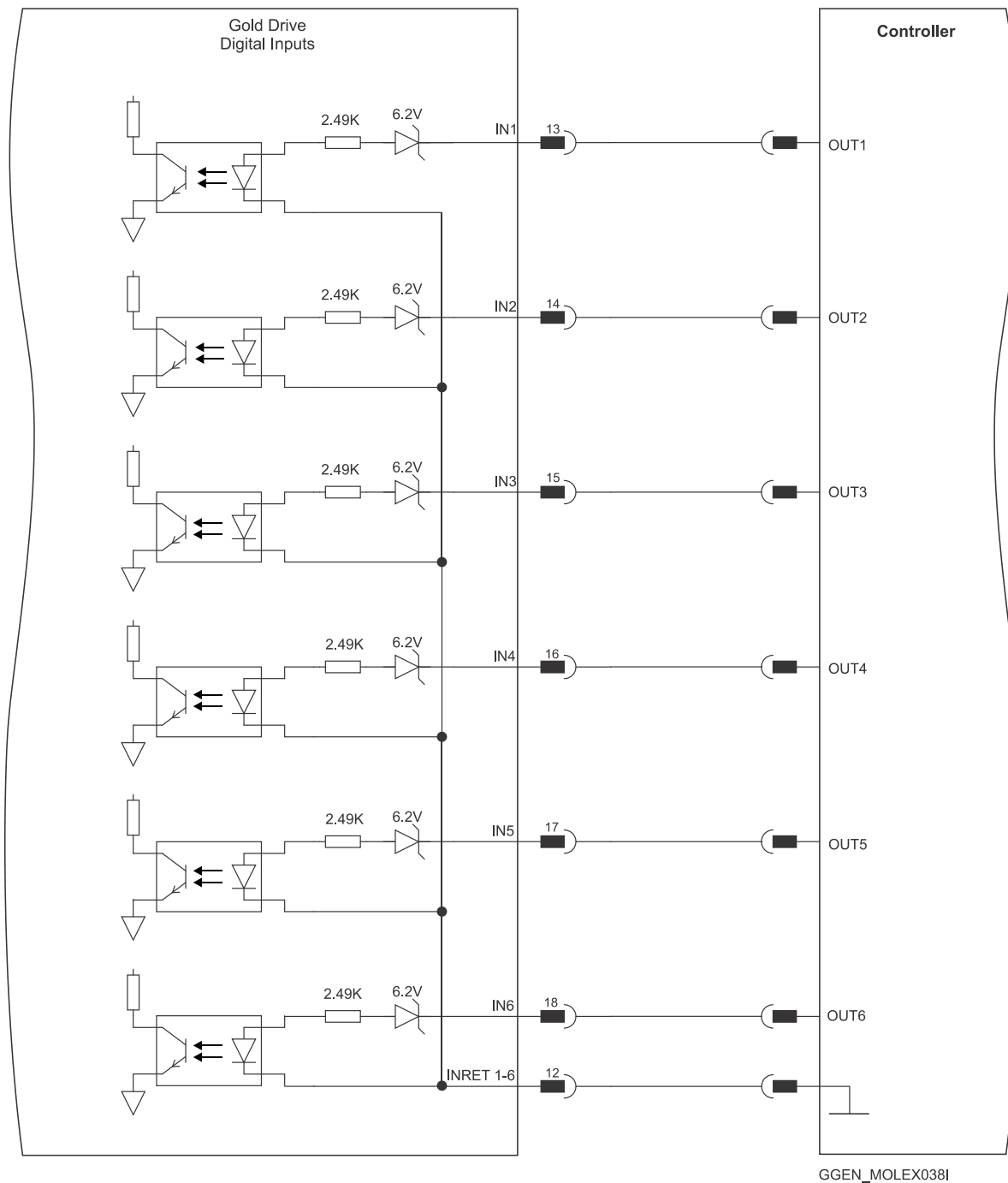


Figure 29: Digital Input Connection Diagram – Source PLC Option

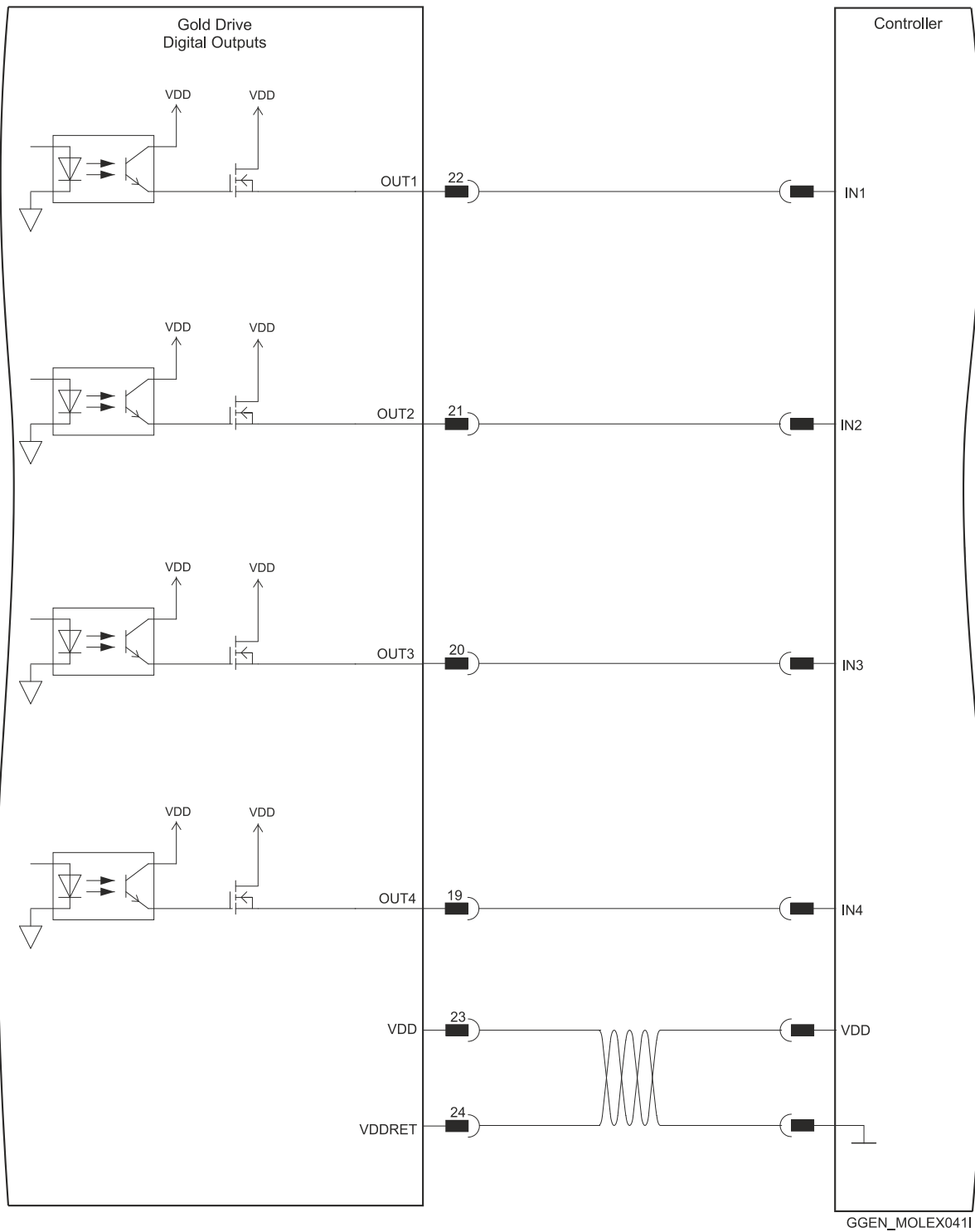


Figure 30: Digital Output Connection Diagram – Source PLC Option



### 6.7.5. 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.

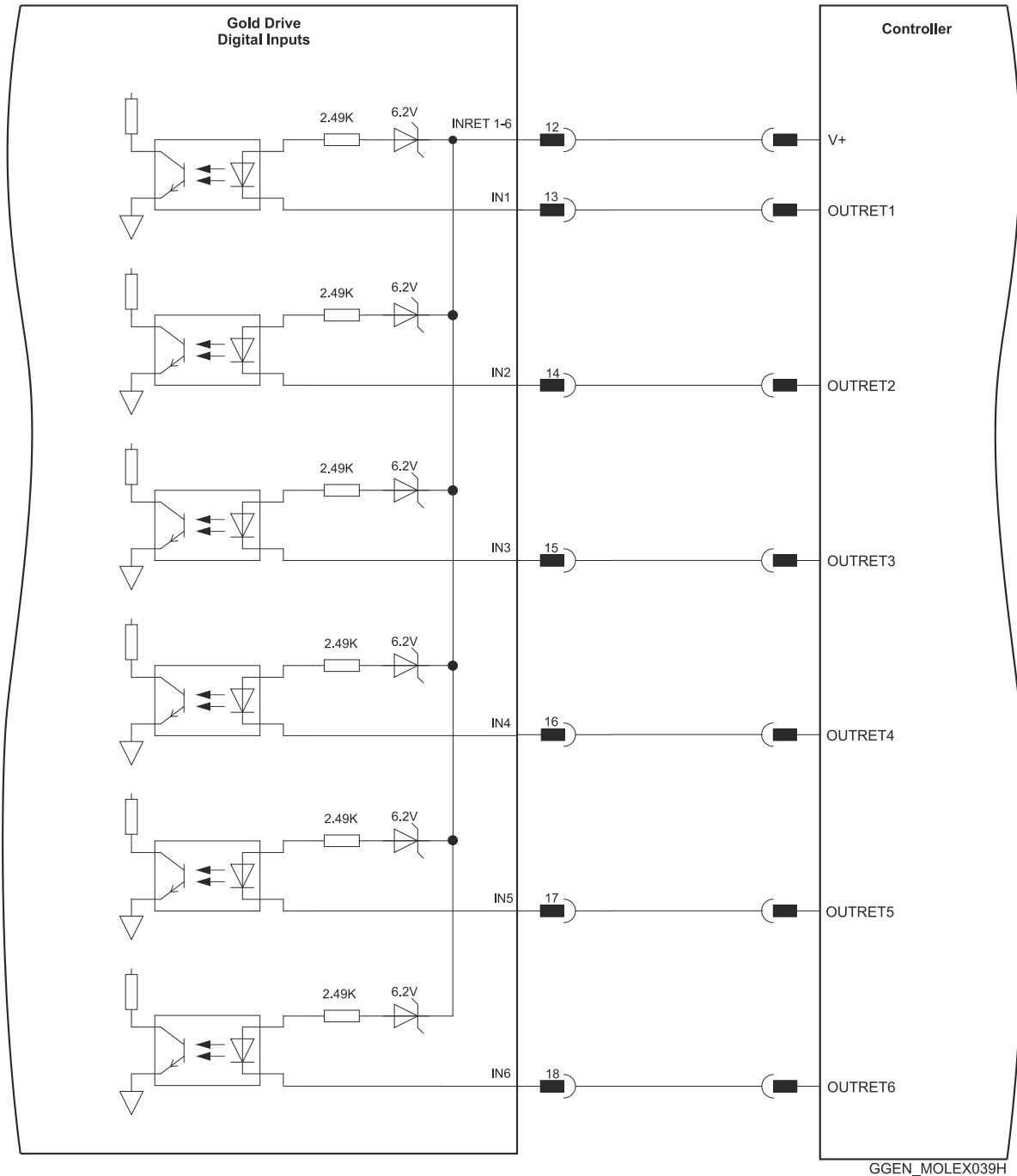


Figure 31: Digital Input Sink Mode – PLC voltage level Connection Diagram





## 6.8. STO Connector (J26)

See Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

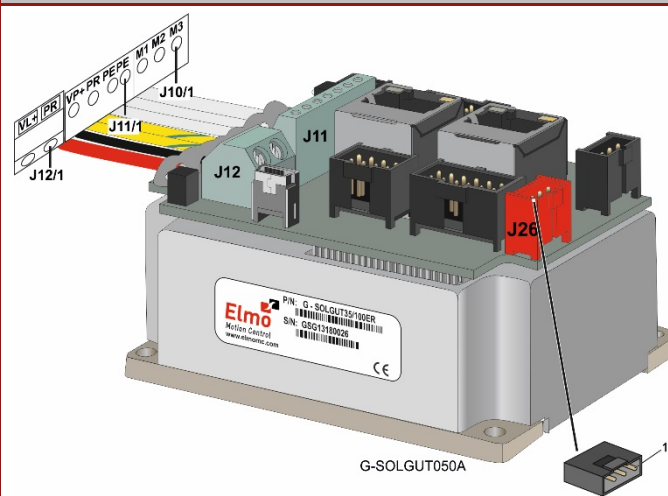
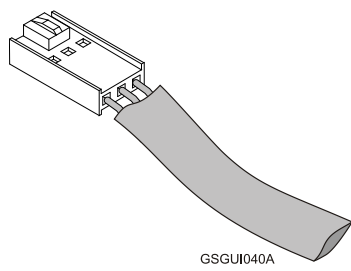
Pin (J26)	Signal	Function
1	STO1	STO 1 input (5V for TTL, 24V for PLC voltages)
2	STO2	STO 2 input (5V for TTL, 24V for PLC voltages)
3	STO_RET	STO signal return
Pin Positions		Cable Connector
		 GSGUI040A <b>3-Pin Molex Plug</b> This cable is included in the cable kit described in Section 3.1.1

Table 9: STO Input Pin Assignments

The following circuits describe the STO wiring options.

### 6.8.1.1. Source Mode PLC Voltage Level

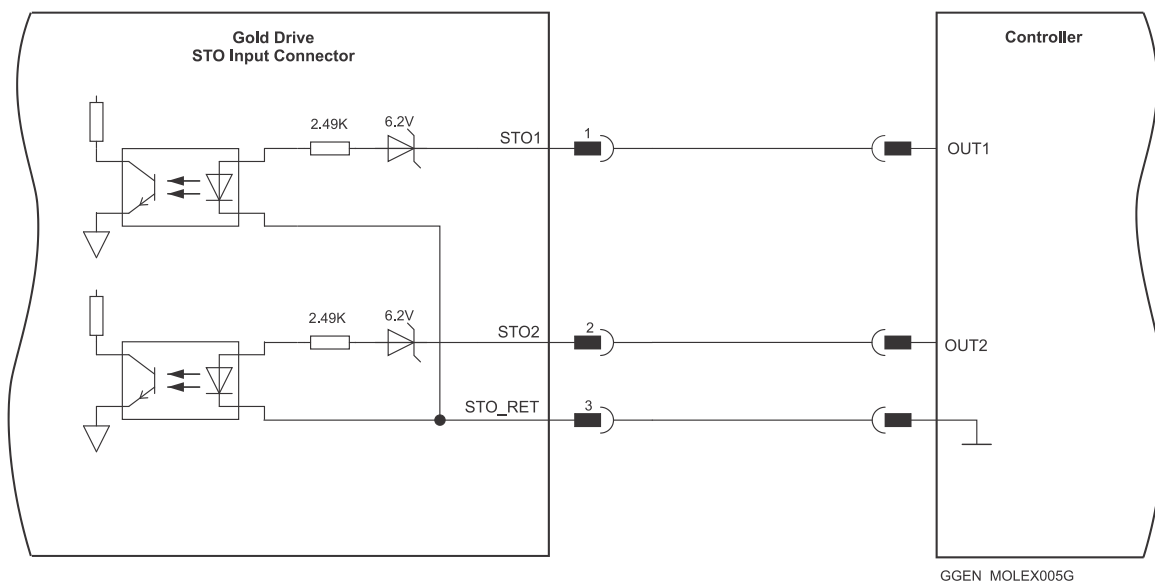


Figure 33: STO Input Connection – PLC Source Option



### 6.8.1.2. TTL Mode TTL Voltage Level

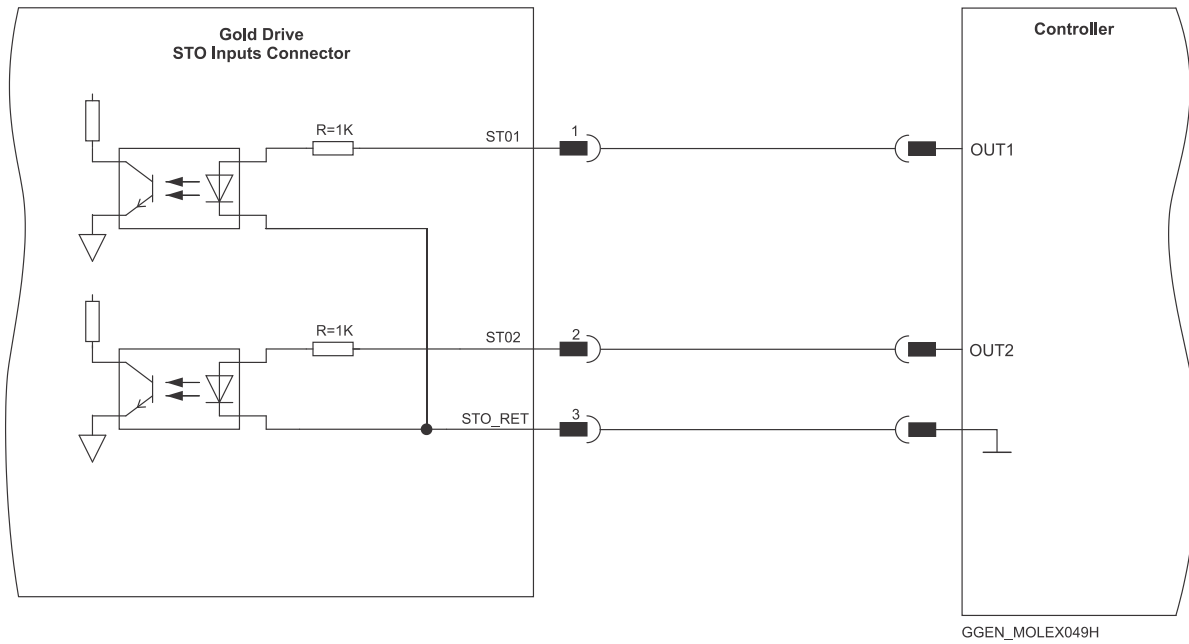


Figure 34: STO Input Connection – TTL Option



### 6.8.1.3. STO Output (J6)

There are two available options:

- I/O and STO type without STO
- I/O and STO type with STO

If the STO STATUS OUT is configured, then IN6 and OUT4 pins of the J6 connector will not be available. Refer to Figure 35 below for details of the connections. Refer to Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

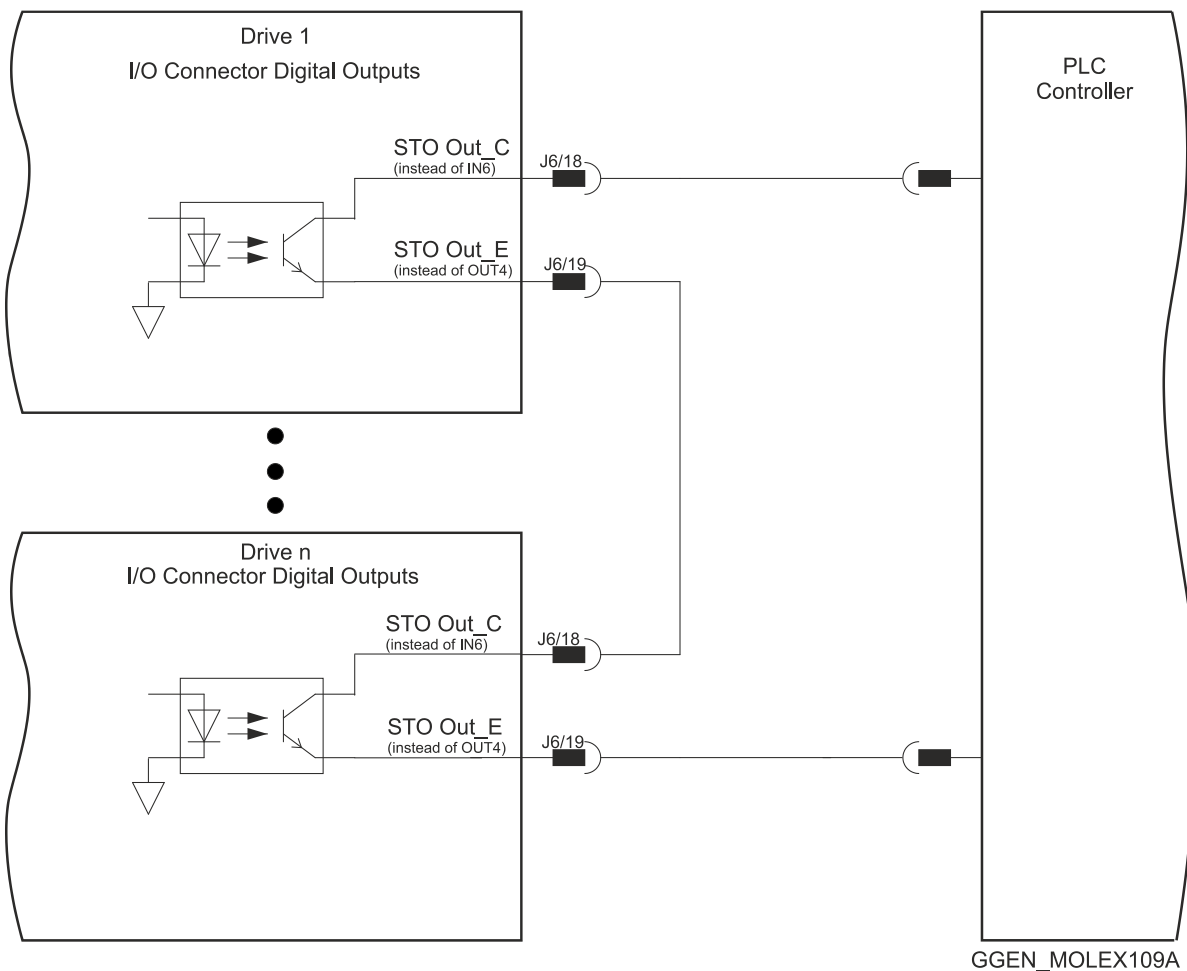


Figure 35: STO Output



## 6.9. RS-232/RS-422 Connector (J21)

There are two configurations available for this connector; RS-232 or RS-422.

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.



### 6.9.1. RS-232

Pin (J21)	Signal	Function
1	RS-232_Rx	RS-232 receive
2	RS-232_Tx	RS-232 transmit
3	COMRET	Common return

Pin Positions	Cable Connector
<p style="text-align: center;">G-SOLGUT050A</p>	<p style="text-align: center;"><b>3-Pin Molex Plug</b></p>

Table 10: RS-232 Pin Assignments

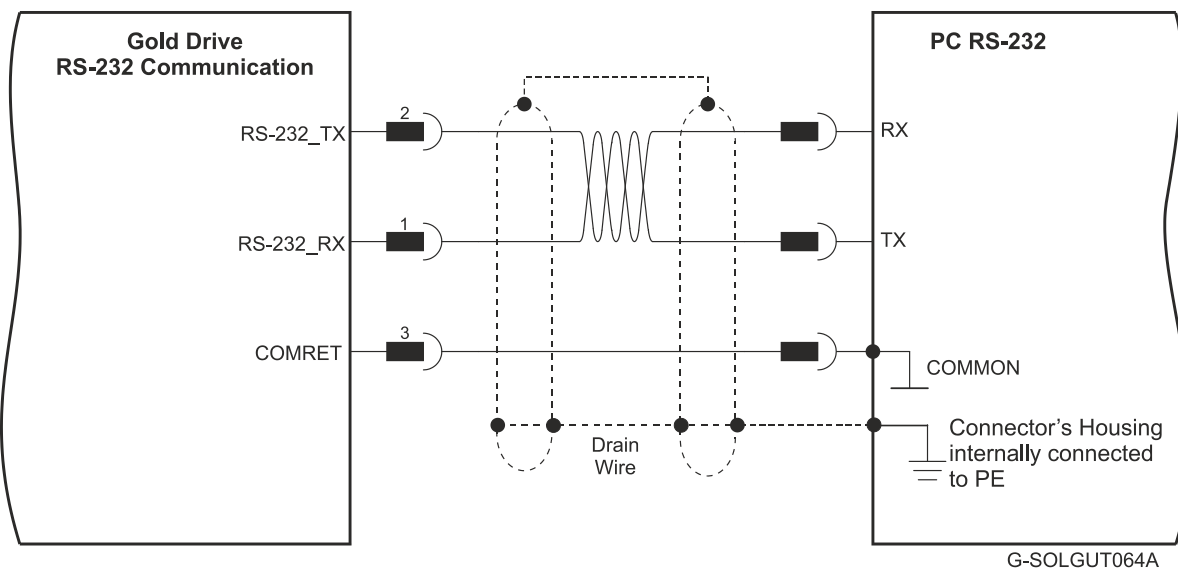


Figure 36: RS-232 Connection Diagram



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

Pin (J21)	Signal	Function
1	RS-422_Tx-	RS-422 complement transmit
2	RS-422_Tx+	RS-422 transmit
3	COMRET	Common return
4	RS-422_Rx-	RS-422 complement receive
5	RS-422_Rx+	RS-422 receive

Pin Positions	Cable Connector
<p>G-SOLGUT050A</p>	<p>G-SOLGUT065A</p> <p><b>5-Pin Molex Plug</b></p>

Table 11: RS-422 Pin Assignments

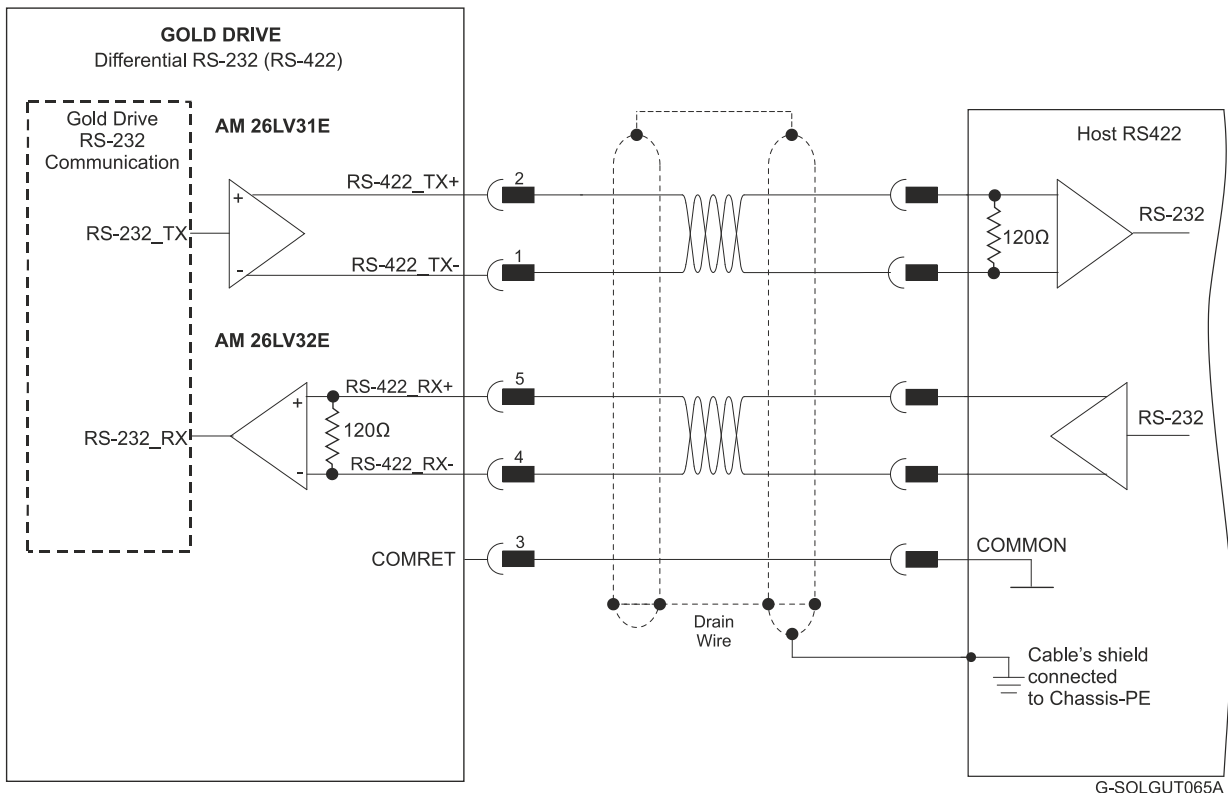


Figure 37: RS-422 Connection Diagram



## 6.10. USB 2.0 (J9)

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

Pin (J9)	Signal	Function
1	USB VBUS	USB VBUS 5 V
2	USBD-	USB _N line
3	USBD+	USB _P line
4	Not Connected	N/A
5	USB_COMRET	USB communication return
Pin Positions		Cable Connector
		<p>GDCWH1026A</p> <p><b>USB Device Mini-B Plug</b></p>

Table 12: USB Device Mini-B - Pin Assignments

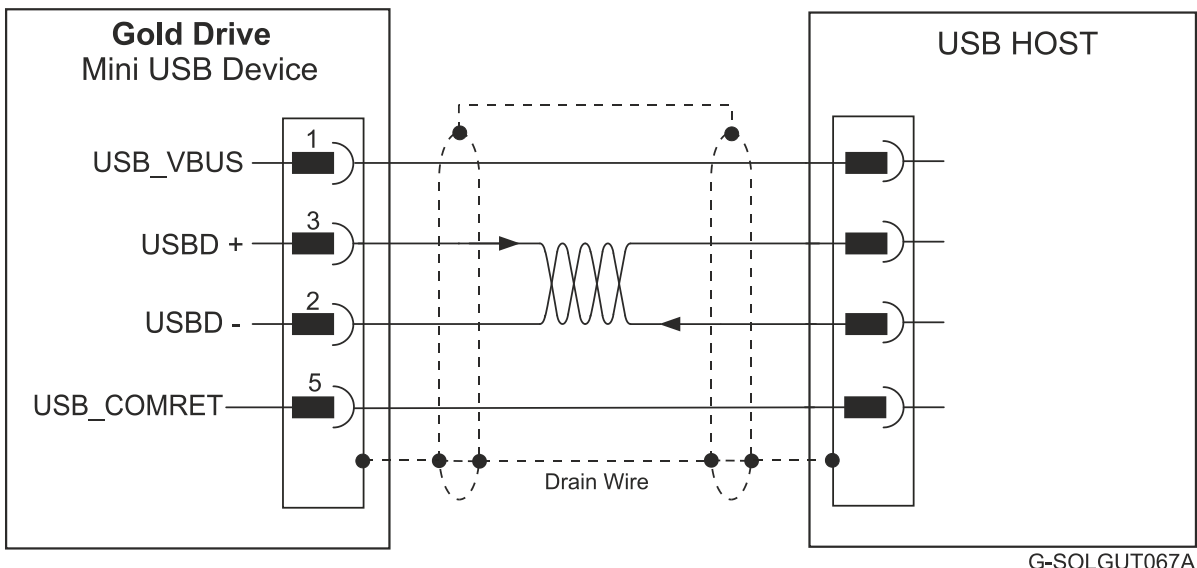


Figure 38: USB Network Diagram



## 6.11. EtherCAT Communications Version

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

### 6.11.1. EtherCAT IN/Ethernet Pin Assignments (J7)

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

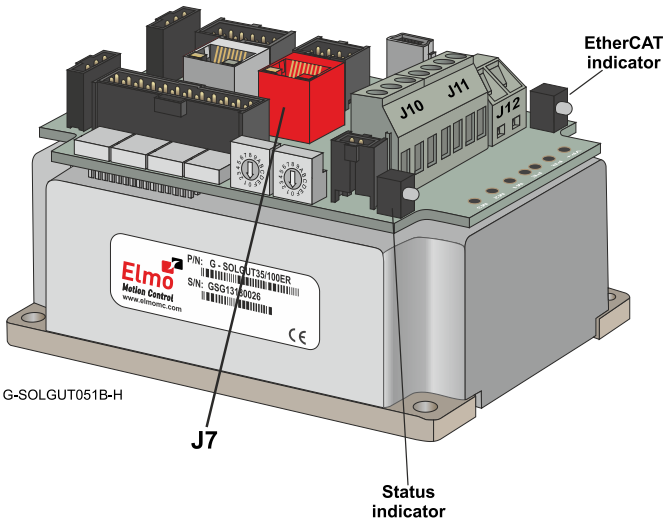
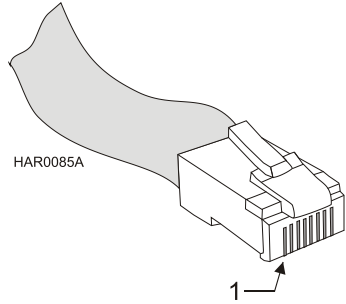
Pin (J7)	Signal	Function
1	EtherCAT_IN_TX+/Ethernet_TX+	EtherCAT in/Ethernet transmit +
2	EtherCAT_IN_TX-/Ethernet_TX-	EtherCAT in/Ethernet transmit -
3	EtherCAT_IN_RX+/Ethernet_RX+	EtherCAT in/Ethernet receive +
4, 5	N/A	
6	EtherCAT_IN_RX-/Ethernet_RX-	EtherCAT in/Ethernet receive -
7, 8	N/A	
Pin Positions		Cable Connector
 <p>The diagram shows a servo drive with a red Ethernet connector labeled J7. Other connectors J10, J11, and J12 are also visible. An EtherCAT indicator and a Status indicator are also shown. The model number G-SOLGUT051B-H is printed on the drive.</p>		 <p>The diagram shows a Standard CAT5e Ethernet Cable connector with the label HAR0085A and a pin 1 indicator.</p> <p><b>Standard CAT5e Ethernet Cable</b></p>

Table 13: EtherCAT IN - Pin Assignments



### 6.11.2. EtherCAT OUT Connector (J8)

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

Pin (J8)	Signal	Function
1	EtherCAT_OUT_TX+	EtherCAT out transmit +
2	EtherCAT_OUT_TX-	EtherCAT out transmit -
3	EtherCAT_OUT_RX+	EtherCAT out receive +
4, 5	N/A	
6	EtherCAT_OUT_RX-	EtherCAT out receive -
7, 8	N/A	
Pin Positions		Cable Connector
		<p><b>Standard CAT5e Ethernet Cable</b></p>

Table 14: EtherCAT OUT - Pin Assignments

### 6.11.3. EtherCAT Wiring

Figure 39 describes the wiring diagram for the EtherCAT connections.

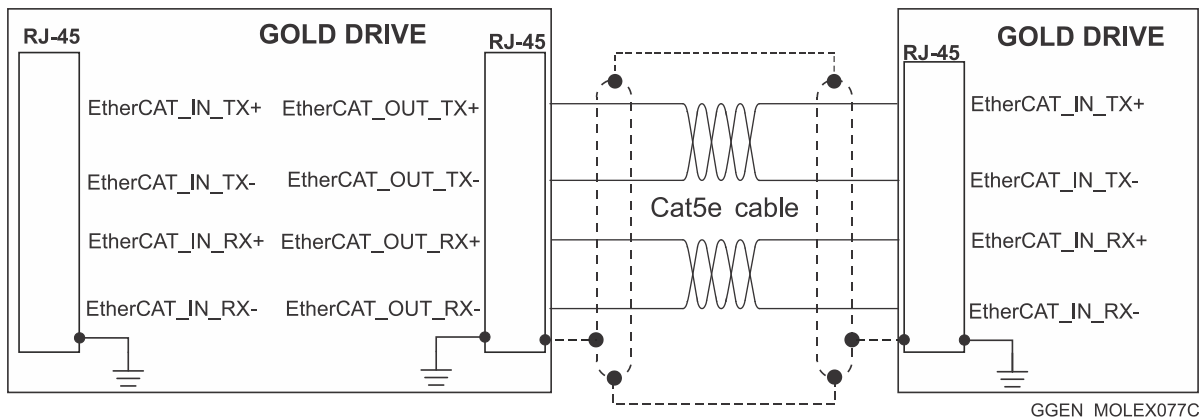


Figure 39: EtherCAT RJ-45 Connections



### 6.11.4. EtherCAT Address Switches

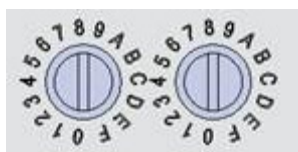


Figure 40: EtherCAT Address Switches

- DSW1 sets the ECAT High address.
- DSW2 sets the ECAT Low address.

EtherCAT slave drives with rotary switches shown in Figure 40 above, allow the user to define a unique node ID to a slave. The two rotary switches offer up to 255 addresses, with the 0 setting referring to No alias address.

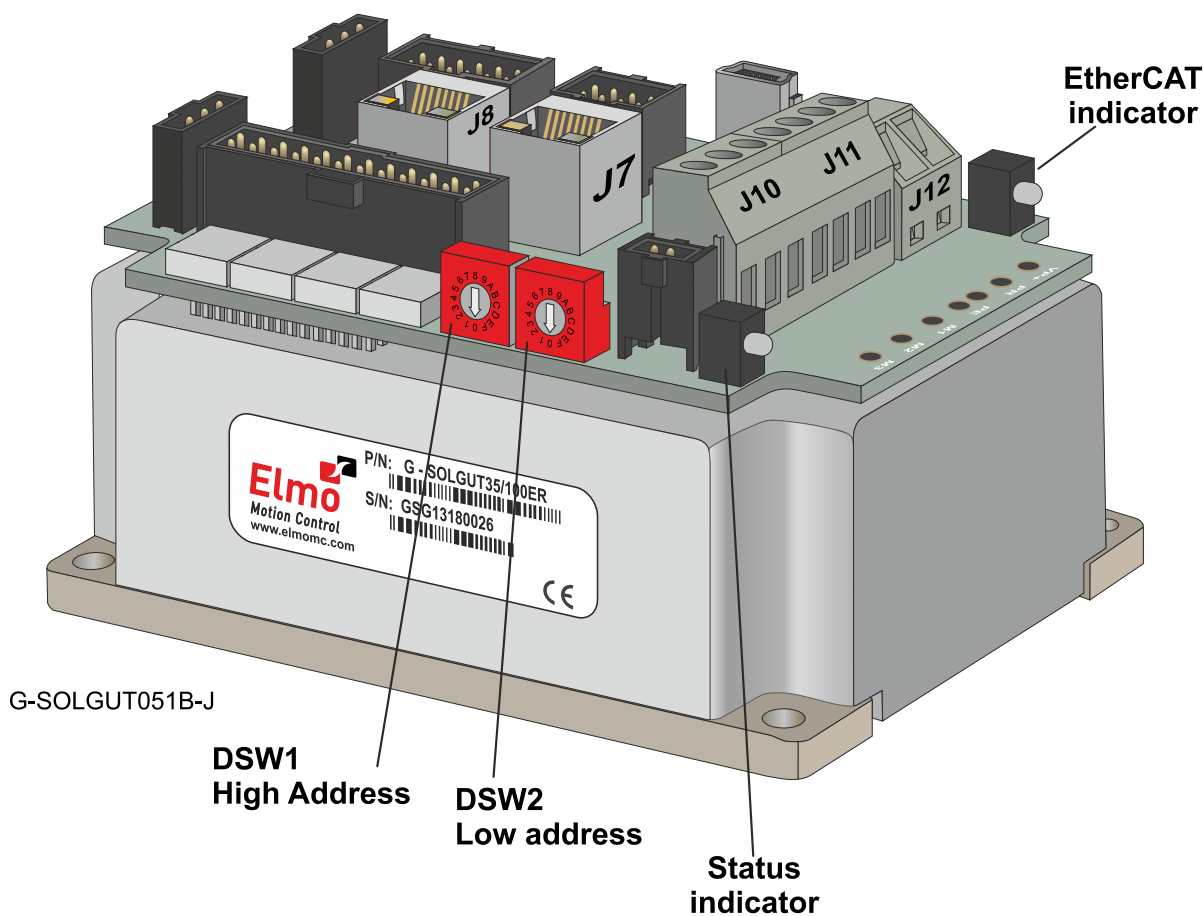


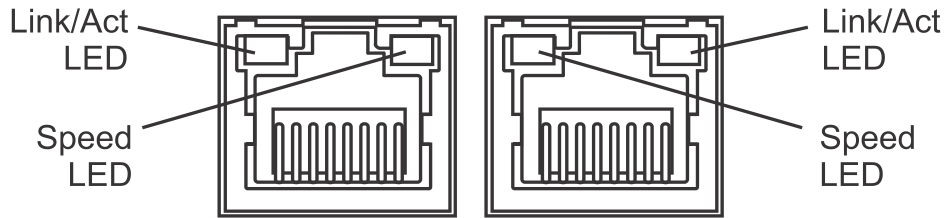
Figure 41: Position of EtherCAT Address Switches on the Gold Solo Guitar

The positions of the switches on the drive are shown in Figure 40. Use a screwdriver to set the low and high bytes values of the drive EtherCAT address. This address is only retrieved after power-up.



### 6.11.5. EtherCAT Link Indicators

The Gold Solo Guitar 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 42.



**Figure 42: 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.



## 6.12. CAN Communications Version

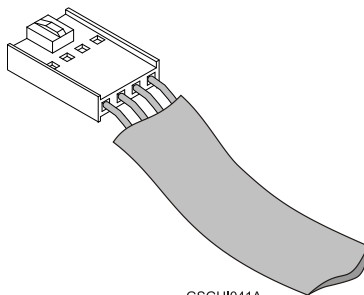
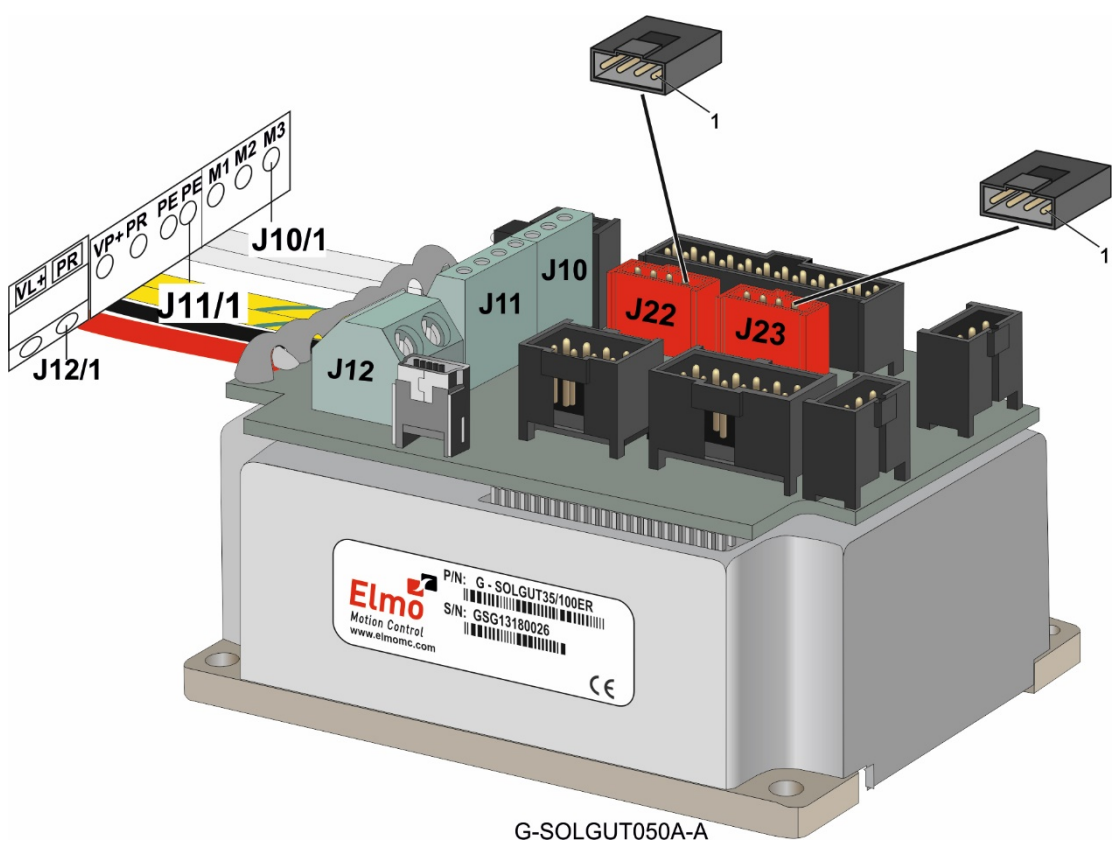
Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives.

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

Pin (J22, J23)	Signal	Function
1	PE	Protective Earth
2	COMRET (CAN_RET)	CAN Return
3	CAN_L	CAN_L bus line (dominant low)
4	CAN_H	CAN_H bus line (dominant high)



### Pin Positions



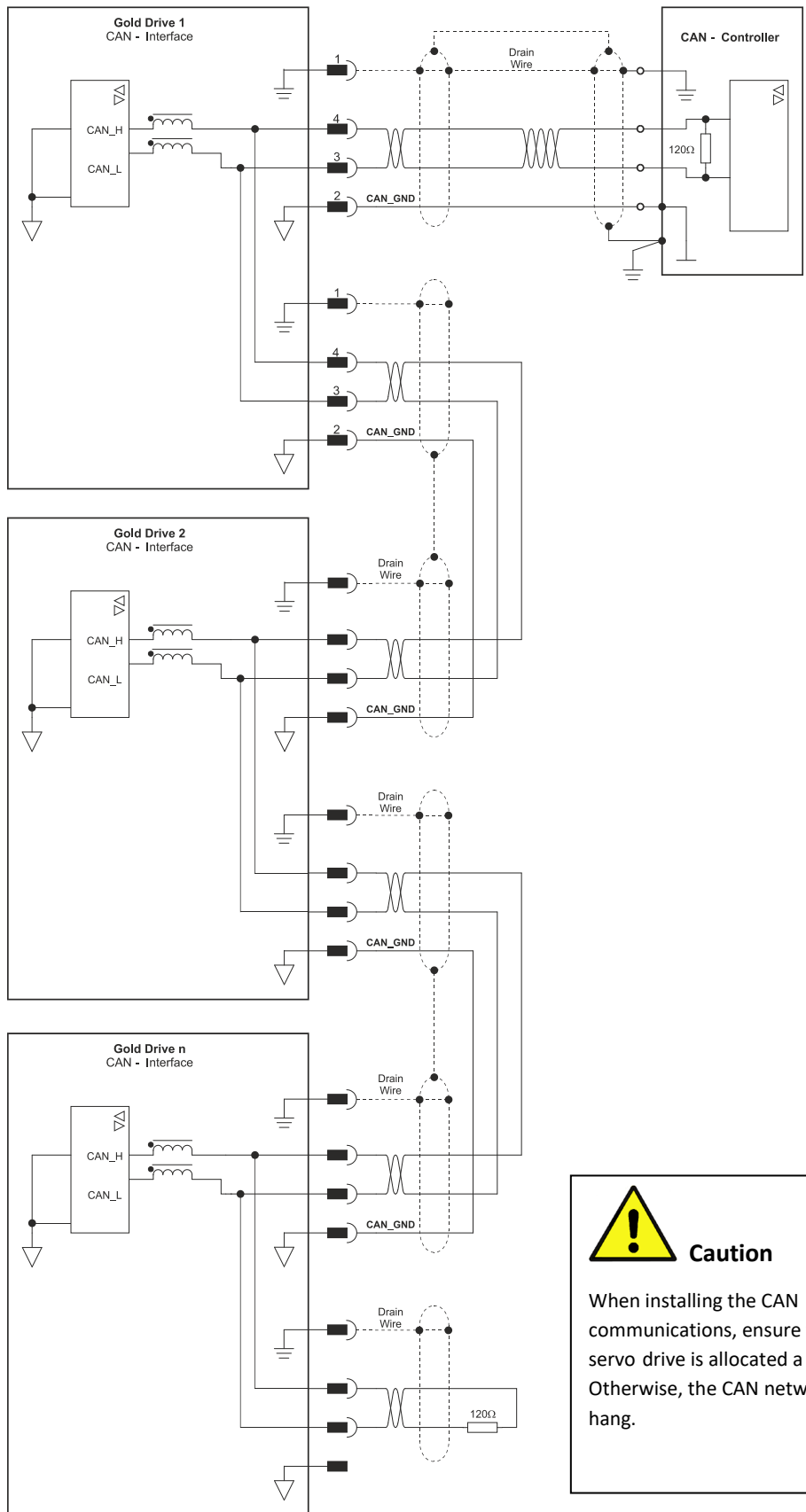
**4-Pin Molex Plug**


**Table 15: CAN Connectors Pin Assignments**



### 6.12.1. CAN Wiring

Figure 43 describes the CAN wiring diagram below.



 **Caution**

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

G-SOLGUT066A CAN

Figure 43: Gold Solo Guitar Connection Diagram – CAN



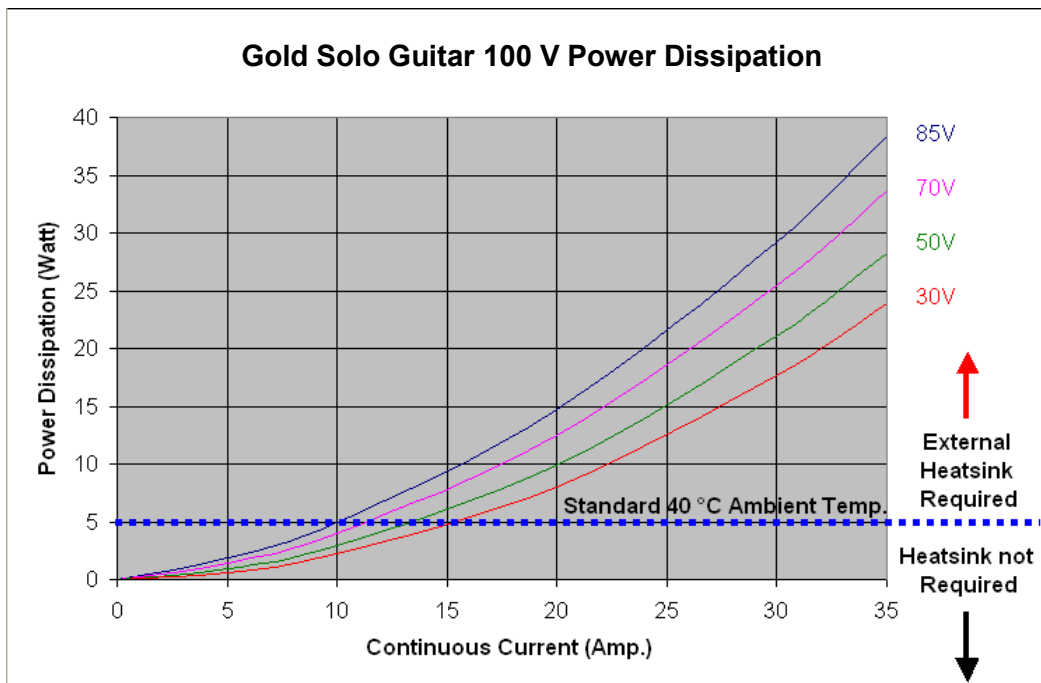
## 6.13. Heat Dissipation

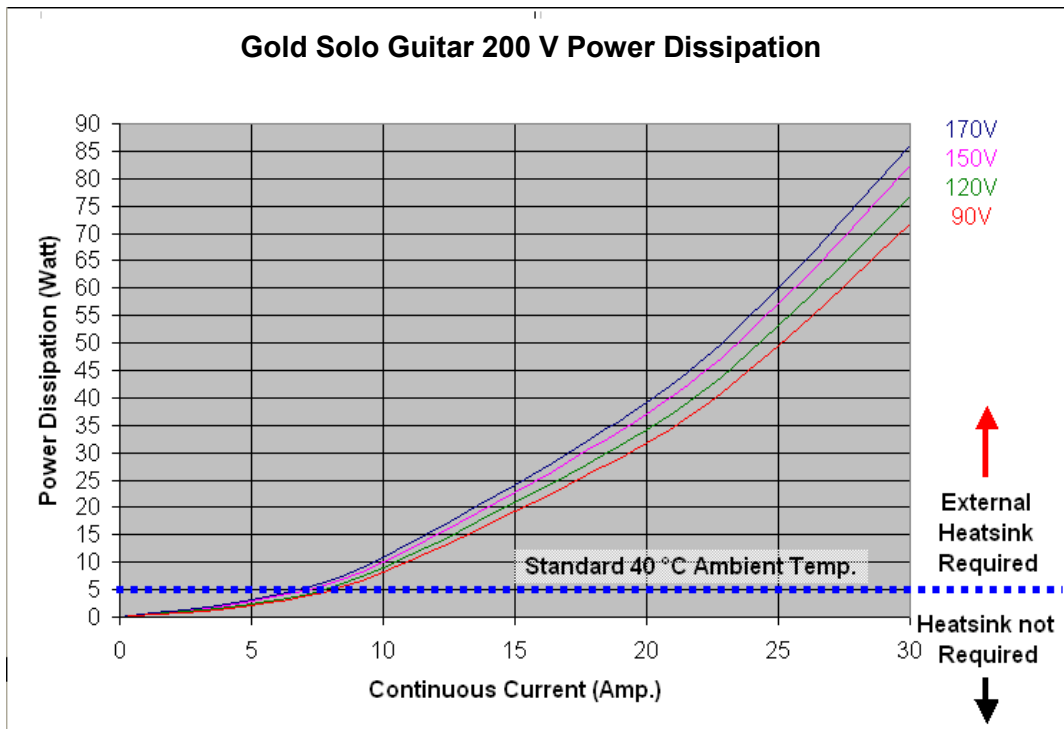
The best way to dissipate heat from the Gold Solo Guitar is to mount it so that its heat-sink faces up. For best results leave approximately 10 mm of space between the Gold Solo Guitar's heat-sink and any other assembly.

### 6.13.1. Gold Solo Guitar 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)

### 6.13.2. Heat Dissipation Data





### 6.13.3. 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 Guitar.
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 Guitar 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.



## 6.14. Powering Up

After the Gold Solo Guitar 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.

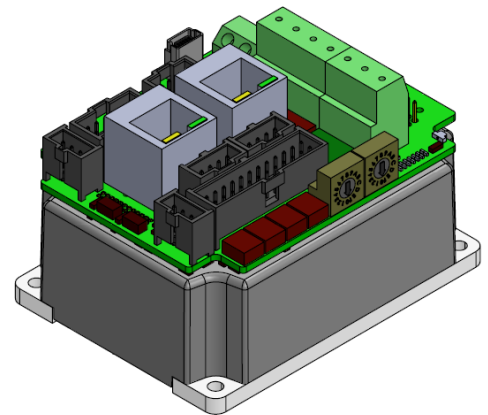
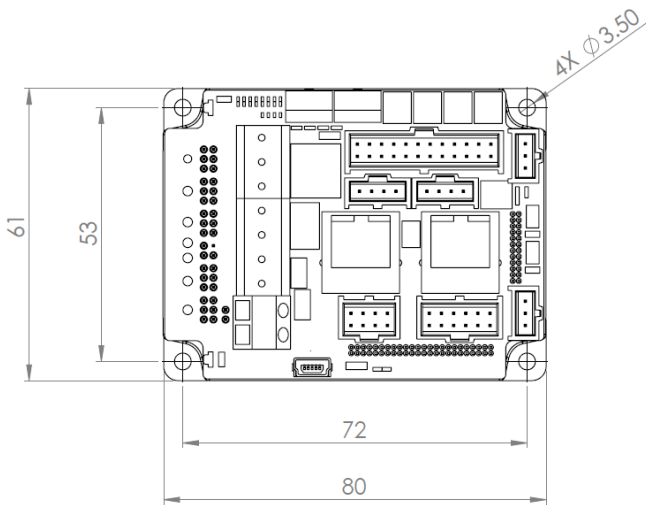
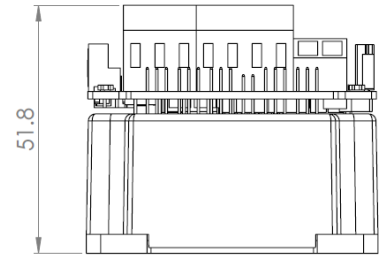
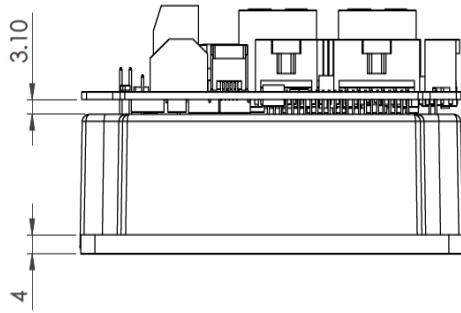
## 6.15. Initializing the System

After the Gold Solo Guitar 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 Guitar.



# Inspiring Motion

*Since 1988*

For a list of Elmo's branches, and your local area office, refer to the Elmo site [www.elmomc.com](http://www.elmomc.com)

