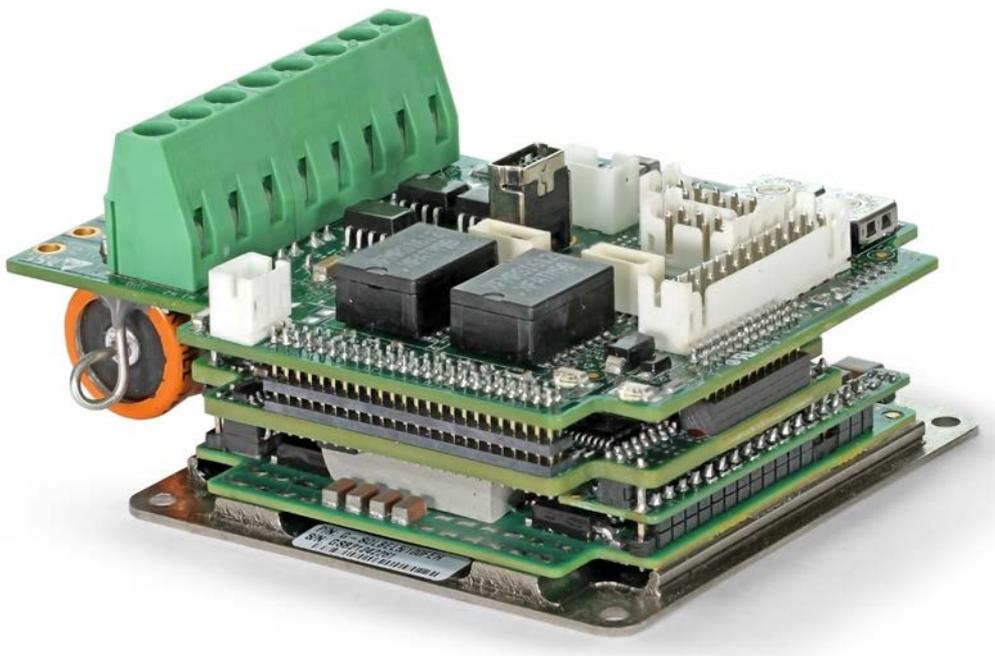


# **Gold Solo Bell Digital Servo Drive Installation Guide**

With EtherCAT/CAN 1mm Pitch Connectors  
**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 Bell (1 mm pitch E/C Conn.) 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.
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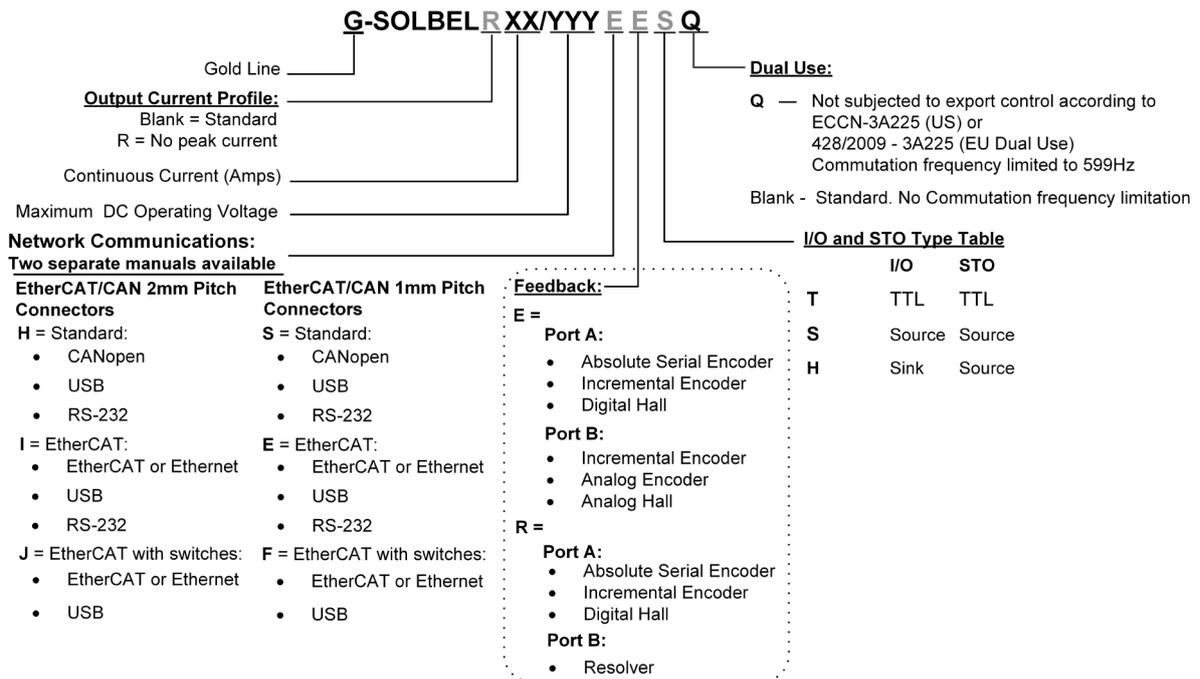
Document no. MAN-G-SOLBELIG-EC (Ver. 2.002)

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## Catalog Number



### Notes

- Two separate manuals are available for the Gold Solo Bell (1 mm pitch E/C Conn.) depending on the Network Communications selected. These are:
  - Gold Solo Bell with EtherCAT/CAN 1mm Pitch Connectors Installation Guide
  - Gold Solo Bell with EtherCAT/CAN 2mm Pitch Connectors Installation Guide

Make sure to select the appropriate installation guide to your Gold Solo Bell (1 mm pitch E/C Conn.).

- The part number of the Gold Solo Bell (1 mm pitch E/C Conn.) (EtherCAT version) has an E, for example, G-SOLBEL1/100E whereas the CAN version has an S, for example G-SOLBEL1/100S.
- There are two models of the Gold Solo Bell (1 mm pitch E/C Conn.): connectors only for currents of 10 A or less, and wires only for currents of 15 A or more. On request, the wires model may be ordered for currents of 10 A or less.

## Cable Kit

Cable kits catalog numbers are as follows:

- CBL-GSOLBELKIT01 for the EtherCAT Cable kit
- CBL-GSOLBELKIT02 for the CAN Cable kit

These kits can be ordered separately. For further details, see the documentation for this cable kit ([MAN-CBLKIT-GSOLBEL.pdf](#)).

## Revision History

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Ver. 1.000	May 2017
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## Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Solo Bell (1 mm pitch E/C Conn.). 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 Bell (1 mm pitch E/C Conn.), 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 Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.), 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 Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) 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 time of installation, or 12 months from time of shipment, whichever comes first. 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 Bell (1 mm pitch E/C Conn.) is an advanced high power density servo drive, delivering up to **1.6 kW of continuous power** or **3.2 kW of peak power** in a compact 139.60 cc (8.52 in<sup>3</sup>) package (73.2 x 58.5 x 32.6 mm (2.88" x 2.30" x 1.28")), and designed to simply and efficiently connect Elmo's Gold Bell servo drive directly to the application. The solution consists of the Gold Bell 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 Bell (1 mm pitch E/C Conn.) is powered by a single 12 V – 195 V isolated DC power source (not included) and a "smart" control-supply algorithm enables the drive to operate up to 95V with only one power supply with no need for an control power supply for the logic.

The Gold Solo Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) is available in a variety of options. There are multiple power rating options, two different communications options – Standard (S suffix in the part number) or EtherCAT (E suffix in the part number), a variety of feedback selections and I/O configuration possibilities.

### 3.1. Accessories

Cable kits catalog numbers are as follows:

CBL-GSOLBELKIT01 for the EtherCAT Cable kit

CBL-GSOLBELKIT02 for the CAN Cable kit

These kits can be ordered separately. For further details, see the documentation for this cable kit ([MAN-CBLKIT-GSOLBEL.pdf](#)).



## Chapter 4: Technical Information

### 4.1. Physical Specification

Feature	Units	All Types
Weight	g (oz)	estimated 122g (to be update) (4.30 oz)
Dimension	mm (in)	73.2 x 58.5 x 32.6 mm (2.88" x 2.30" x 1.28")
Mounting method		Panel Mounted

### 4.2. Technical Data for 100V Models

Feature	Units	1/100	2.5/100	5/100	10/100	15/100	20/100
Minimum supply voltage	VDC	12					
Nominal supply voltage	VDC	85					
Maximum supply voltage	VDC	95					
Maximum continuous power output	W	80	200	400	800	1200	1600
Efficiency at rated power (at nominal conditions)	%	> 99					
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz					
Control supply	VDC	12 to 95 VDC (up to 6 VA inc. 5 V/2 x 200 mA for encoder)					
Amplitude sinusoidal/DC continuous current	A	1.0	2.5	5	10	15	20
Sinusoidal continuous RMS current limit (Ic)	A	0.7	1.8	3.5	7	10.6	14.1
Peak current limit	A	2 x Ic					

**Table 1: Power Rating**

**Note on current ratings:** The current ratings of the Gold Solo Bell (1 mm pitch E/C Conn.) 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.



### 4.3. Technical Data for 200V Models

Elmo now offers a 200 VDC maximum output rating selection of Gold Solo Bell (1 mm pitch E/C Conn.), according to the following technical data:

Feature	Units	3/200	6/200	9/200
Minimum supply voltage	VDC	12		
Nominal supply voltage	VDC	170		
Maximum supply voltage	VDC	195		
Maximum continuous power output	W	480	960	1450
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz		
Control power supply	VDC	12 to 95 VDC (up to 6 VA inc. 5 V/2 x 200 mA for encoder)		
Control sinusoidal/DC continuous current	A	3	6	9
Sinusoidal continuous RMS current limit (Ic)	A	2.1	4.2	6.3
Peak current limit	A	2 x Ic		

**Note on current ratings:** The current ratings of the Gold Solo Bell (1 mm pitch E/C Conn.) 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.

### 4.4. Control Supply

Feature	Unit	Details
Control supply input voltage	V	<b>Isolated DC source:</b> 12 to 95
24V Control supply input power consumption	Without Encoder	≤ 4
	With Encoder up to 400mA@5V	≤ 6



## 4.5. Product Features

Main Feature	Details	Presence and No.
<b>STO</b>	TTL, or	√
	PLC Source	√
<b>Digital Input</b>	TTL, or	6
	PLC Source <i>or</i>	6
	PLC Sink	6
<b>Digital Output</b>	TTL, or	2
	PLC Source <i>or</i>	2
	PLC Sink	2
<b>Analog Input</b>	Differential ±10V	1
<b>Feedback</b>	Standard Port A, B, & C	√
<b>Communication Option</b>	USB	√
	EtherCAT	√
	CAN	√
	RS-232	√



## 4.6. Environmental Conditions

You can guarantee the safe operation of the Gold Solo Bell (1 mm pitch E/C Conn.) by ensuring that it is installed in an appropriate environment. The following table describes the certified environmental conditions for STO of the Gold series servo drives.

Feature	Details
<b>Operating ambient temperature</b>	0 °C to +40 °C (32 °F to +104 °F)
<b>Storage temperature</b>	-40 °C to +85 °C ( -40 °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



## Chapter 5: Standards and Certifications

### 5.1. Functional Safety

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

### 5.2. Electrical Safety

Specification	Details
IEC/EN 61800-5-1:2007	Adjustable speed electrical power drive systems Part 5-1: Safety requirements – Electrical, thermal and energy
Recognized UL 61800-5-1	Adjustable speed electrical power drive systems: Safety requirements – Electrical, thermal and energy
CSA C22.2 NO. 274-17	Adjustable speed drives

### 5.3. Electromagnetic Compatibility

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



## 5.4. Environmental

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

## 5.5. Other Compliant Standards

For other compliant standards refer to the

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

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

## 5.6. CE Declaration

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

[https://www.elmomc.com/wp-content/uploads/dlm\\_uploads/2018/05/Gold-Line-CE-Declaration-of-Conformity.pdf](https://www.elmomc.com/wp-content/uploads/dlm_uploads/2018/05/Gold-Line-CE-Declaration-of-Conformity.pdf).

## 5.7. Dual Use

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

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

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



## Chapter 6: Installation

The Gold Solo Bell (1 mm pitch E/C Conn.) must be installed in a suitable environment and properly connected to its voltage supplies and the motor.

### 6.1. Unpacking the Drive Components

Before you begin working with the Gold Solo Bell (1 mm pitch E/C Conn.), verify that you have all of its components, as follows:

- The Gold Solo Bell (1 mm pitch E/C Conn.) servo drive
- The Elmo Application Studio software and software manual

The Gold Solo Bell (1 mm pitch E/C Conn.) is shipped in a cardboard box with Styrofoam protection.

#### To unpack the Gold Solo Bell (1 mm pitch E/C Conn.):

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 Bell (1 mm pitch E/C Conn.) you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Gold Solo Bell (1 mm pitch E/C Conn.). It looks like this:



G-SOLBEL-065C

4. Verify that the Gold Solo Bell (1 mm pitch E/C Conn.) 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.

The part number of the Gold Solo Bell (1 mm pitch E/C Conn.) (EtherCAT version) has an E, for example, G-SOLBEL10/100E whereas the CAN version has an S, for example G- SOLBEL10/100S.

There are two models of the Gold Solo Bell (1 mm pitch E/C Conn.): connectors only (for currents of 10 A or less) and wires only (for currents of 15 A or more). On request, the wires model may be ordered for currents of 10 A or less.



## 6.2. Connector Types

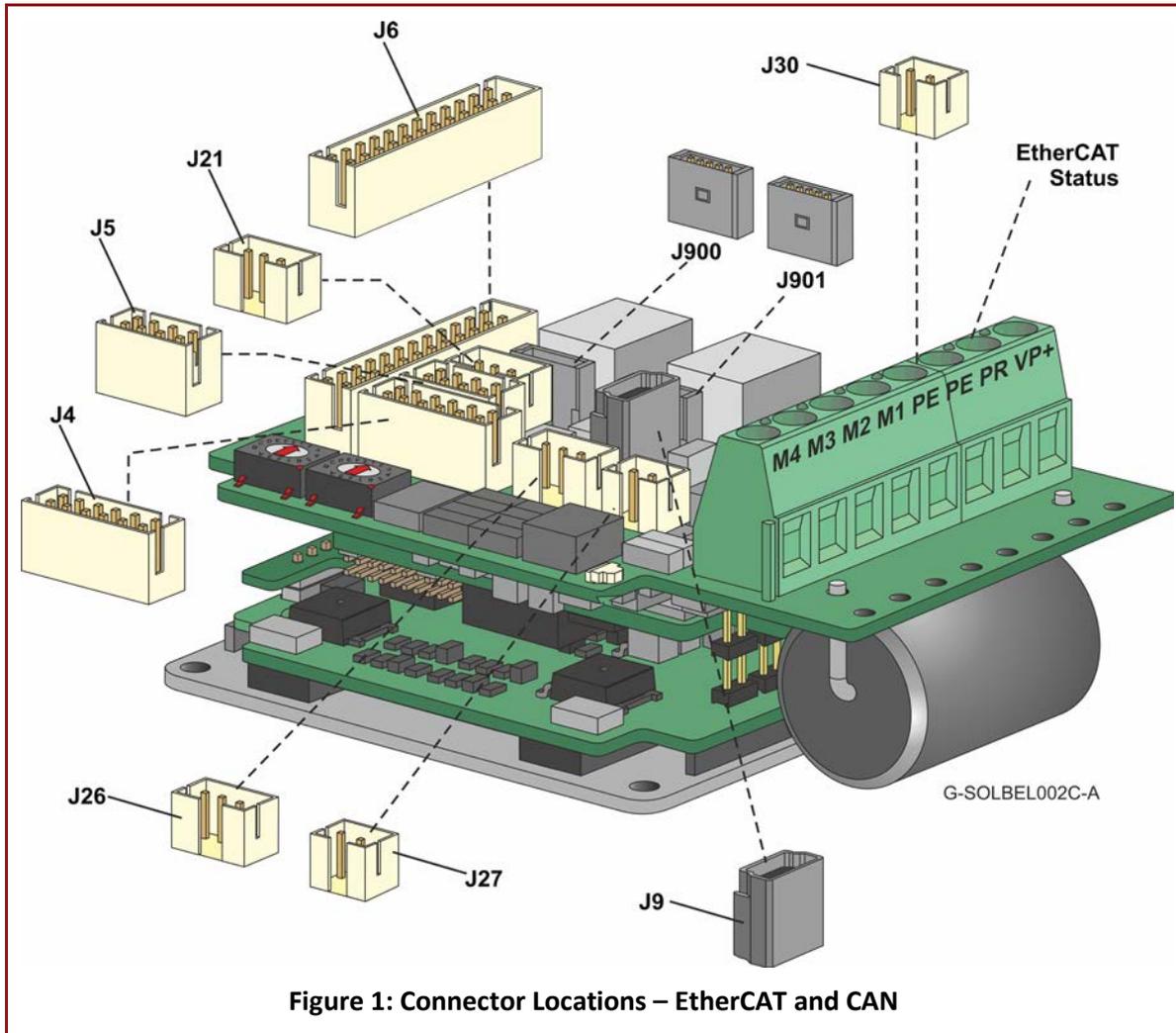
The Gold Solo Bell (1 mm pitch E/C Conn.) has twelve connectors (connectors' version).

### 6.2.1. Connector Types

Port	No. Pins	Type	Function
M1, M2, M3, M4, PE	5	5.08 mm pitch	Motor phases <i>(Connectors version)</i>
VP+, PR, PE	3	5.08 mm pitch	Power <i>(Connectors version)</i>
Wires	7	14 AWG (M1, M2, M3, M4, PR, VP+) 16 AWG (PE)	Main Power and Motor Power <i>(Wires version)</i>
J4	2x6	2.0 mm pitch	Feedback port A
J5	2x4	2.0 mm pitch	Feedback port B
J6	2x12	2.0 mm pitch	I/O and port C
J9	5	USB Device Mini-B	Mini-USB type B
J21	3	2.0 mm pitch	RS-232 communication
J26	3	2.0 mm pitch	STO
J27	2	2.0 mm pitch	Reserved
J30 (PR, VL)	2	2.0 mm pitch	Control supply input
<b>EtherCAT/CAN Version</b>			
J900	5	MOLEX 1.00mm "Pico-Clasp" 501331-0507	EtherCAT/CAN in
J901	5	MOLEX 1.00mm "Pico-Clasp" 501331-0507	EtherCAT/CAN out

### 6.2.2. Mating Connector

Connector	Mating Connector Type	Mating Crimping Pins
<b>J900, J901 IN/OUT CAN/EtherCAT Communication</b>	MOLEX 1.00mm "Pico-Clasp" 501330-0500	MOLEX 1.00mm crimp terminal 501334-0100



**Figure 1: Connector Locations – EtherCAT and CAN**

**Table 2: Connector Types**

The pinouts in Chapter 7: Wiring describe the function of each pin in the Gold Solo Bell (1 mm pitch E/C Conn.) connectors that are listed in Table 2.



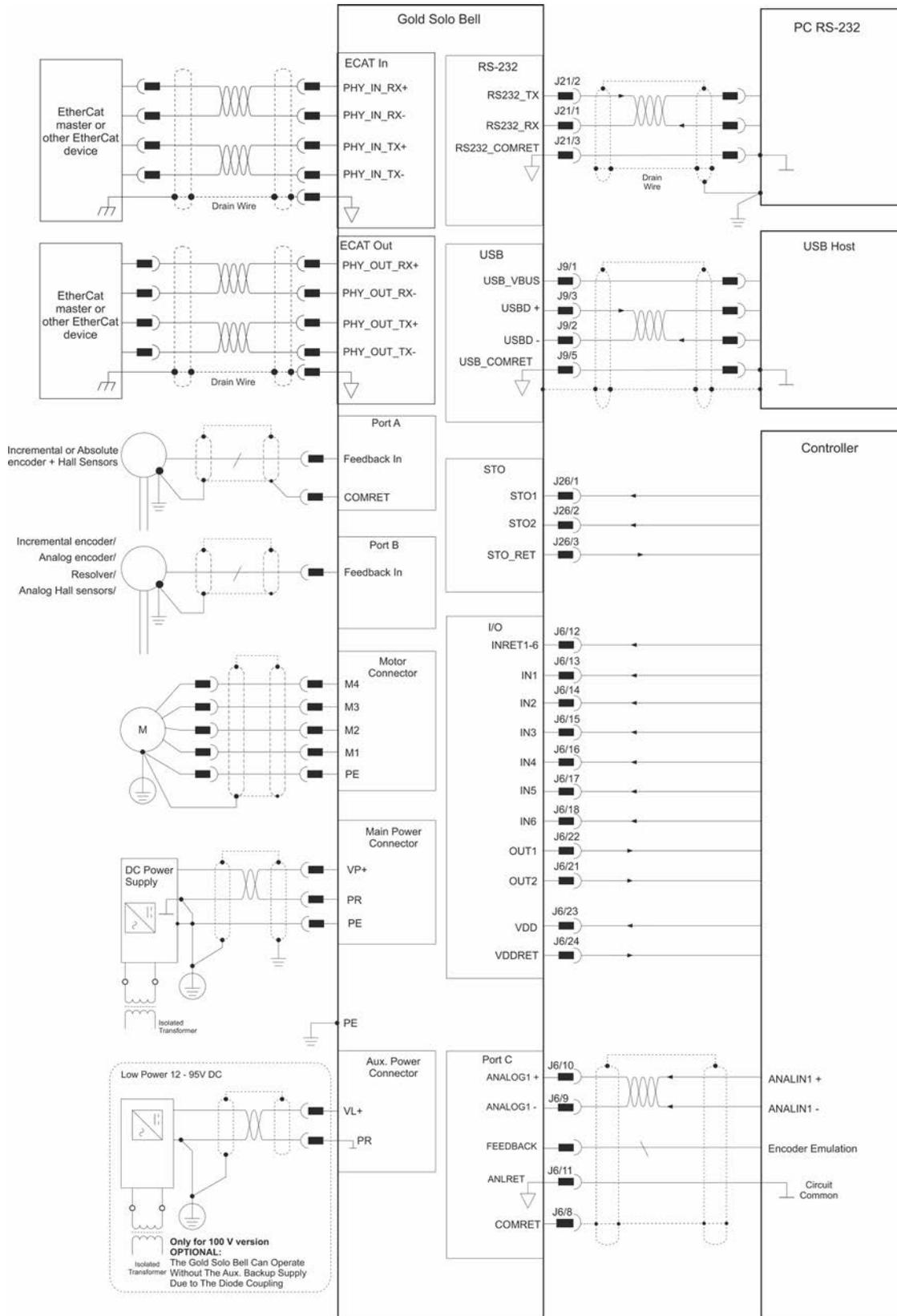
### 6.3. Mounting the Gold Solo Bell (1 mm pitch E/C Conn.)

The Gold Solo Bell (1 mm pitch E/C Conn.) was designed for mounting on a surface. When integrating the Gold Solo Bell (1 mm pitch E/C Conn.) 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 Bell (1 mm pitch E/C Conn.) is enclosed in a metal chassis, we recommend that the Gold Solo Bell (1 mm pitch E/C Conn.) be screw-mounted to it to help with heat dissipation.

When the Gold Solo Bell (1 mm pitch E/C Conn.) is not connected to a metal chassis, the application's thermal profile may require a solution for heat dissipation due to insufficient air convection. In this case, we recommend that you connect an external heat-sink.



## 6.4. The Gold Solo Bell (1 mm pitch E/C Conn.) Connection Diagrams



G-SOLBEL028A

Figure 2: The Gold Solo Bell (1 mm pitch E/C Conn.) Connection Diagram - EtherCAT

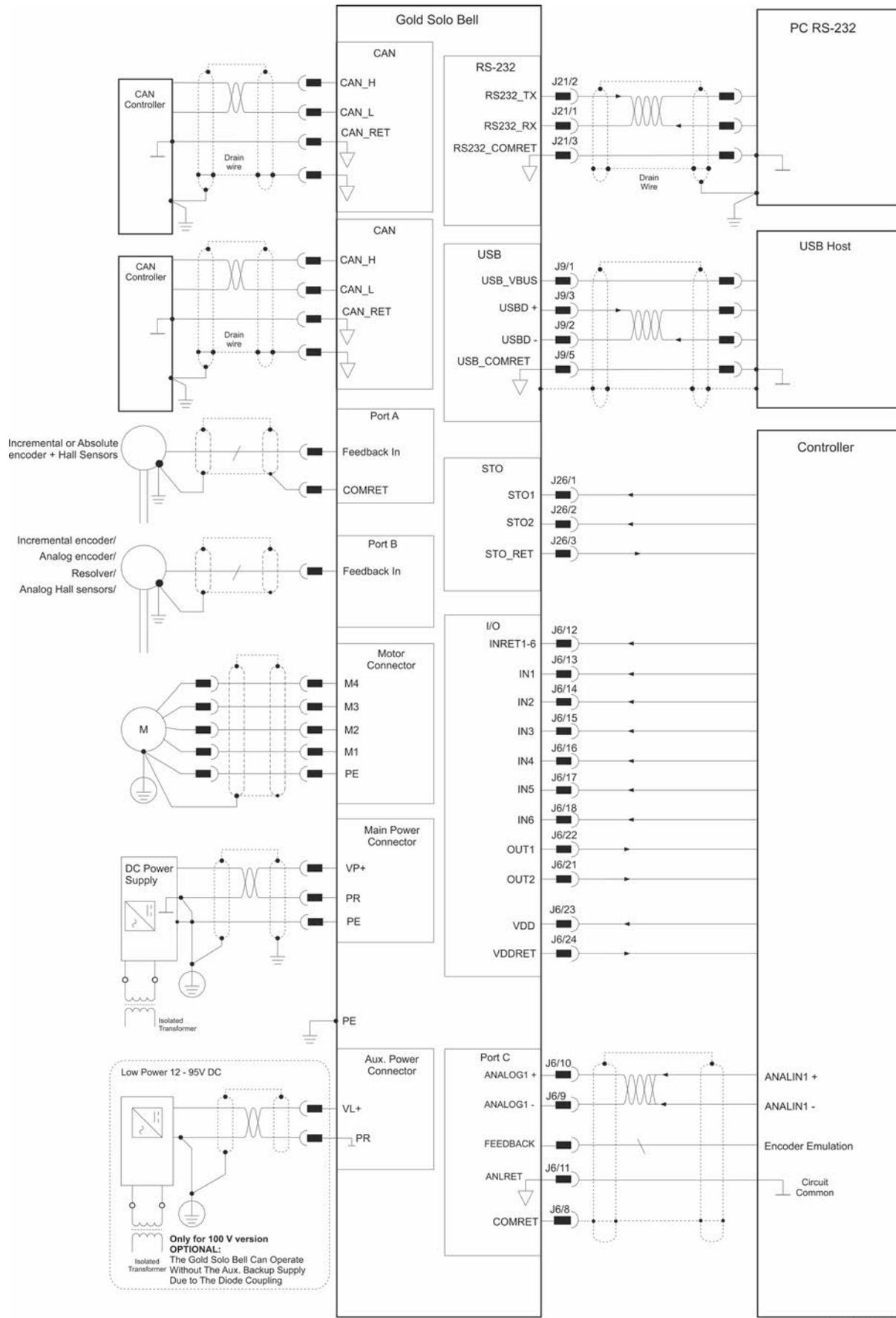
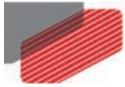


Figure 3: The Gold Solo Bell (1 mm pitch E/C Conn.) Connection Diagram – CAN

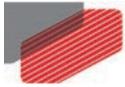


## Chapter 7: Wiring

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.

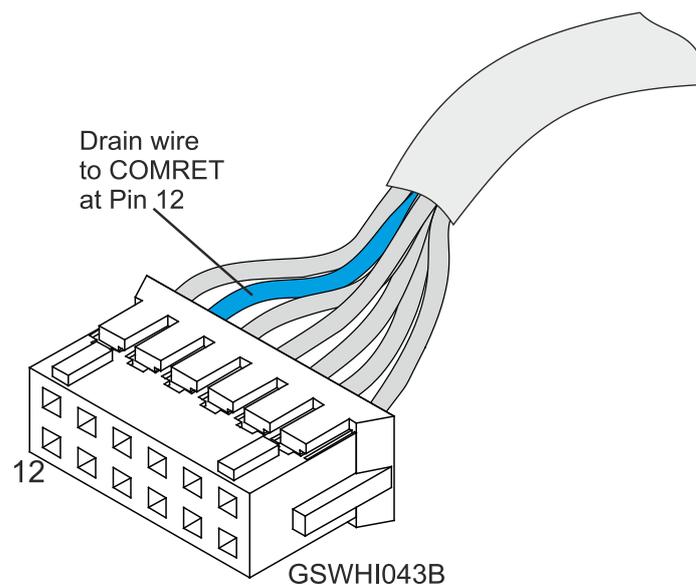
Wiring Symbol	Description
	Earth connection (PE)
	Protective Earth Connection
	Common at the Controller
	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
	Shielded cable braid only, without drain wire.
	Twisted-pair wires
	Encoder Earthing. The cable's shield is connected to the chassis (PE) in the connector. Earthing the Encoder and connecting the Earth (PE) to the drive COMRET is mandatory to insure reliable operation, high noise immunity and rejection of voltage common mode interferences.



## 7.1. Basic Recommendations

### 7.1.1. 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 4: Feedback and Shrouded Control Cable Assemblies – Example**

5. 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.



### 7.1.2. 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 (Figure 5).

The drawing displays two earth connections.

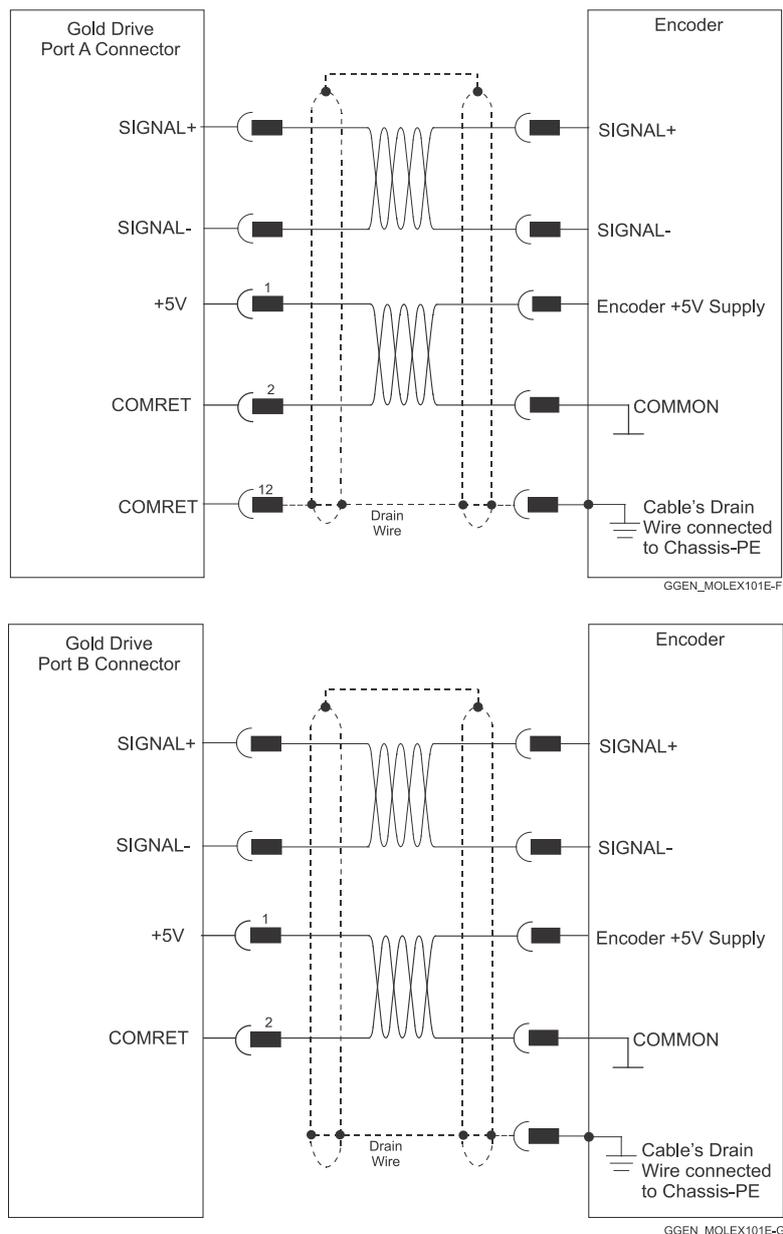


Figure 5: Feedback Port A and B Cable Assemblies



### 7.1.3. 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.

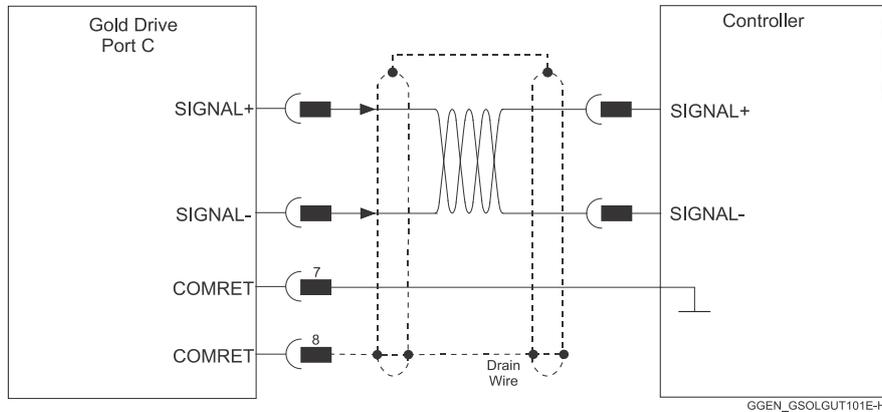


Figure 6: Feedback Port C Cable Assemblies

### 7.1.4. IO Cable Connector

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

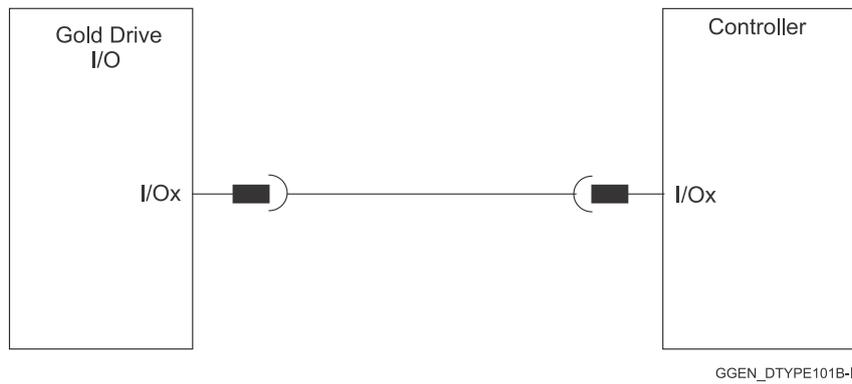


Figure 7: Feedback IO Cable Assemblies

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

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

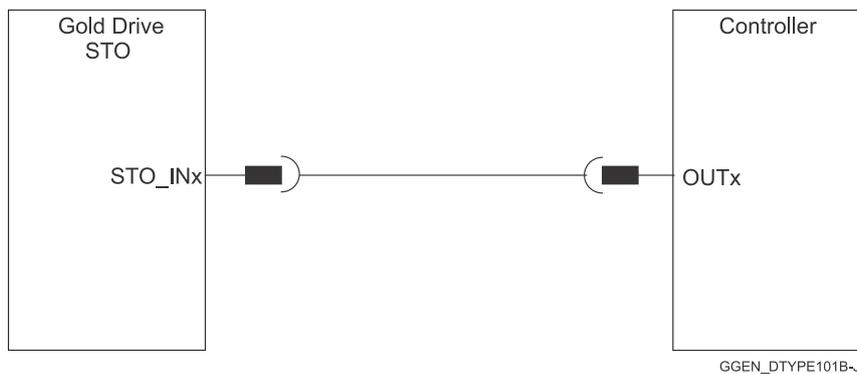


Figure 8: STO Cable Assemblies

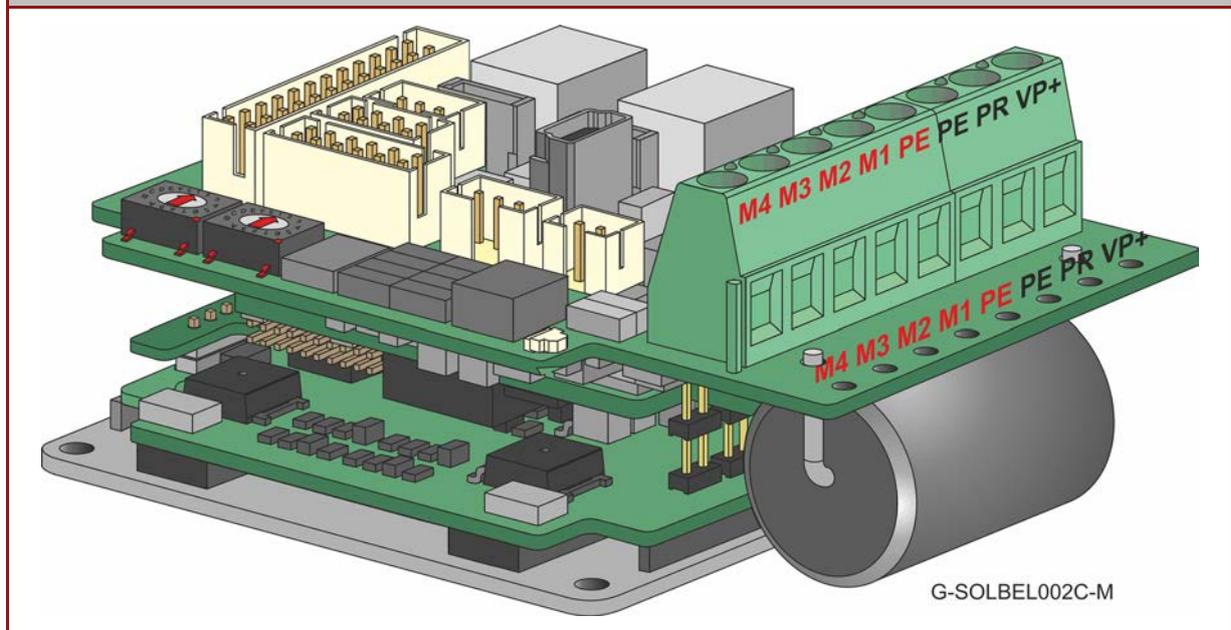


## 7.2. Motor Power Connector Pinouts (J28)

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

Pin (J28)	Signal	Function	Cable - Wires		
			Brushless Motor	Brushed DC Motor	Stepper Motor
5	PE	Protective earth	Motor	Motor	Motor
4	M1	Motor phase	Motor	No Connection	Motor Phase 1+
3	M2	Motor phase	Motor	Motor	Motor Phase 1-
2	M3	Motor phase	Motor	Motor	Motor Phase 2+
1	M4	Motor phase	No Connection	No Connection	Motor Phase 2-

### Pin Positions



**Table 3: Main Power and Motor Connections**

When connecting several drives to several similar motors, all should be wired in an identical manner. This will enable the same settings to run on all drives.

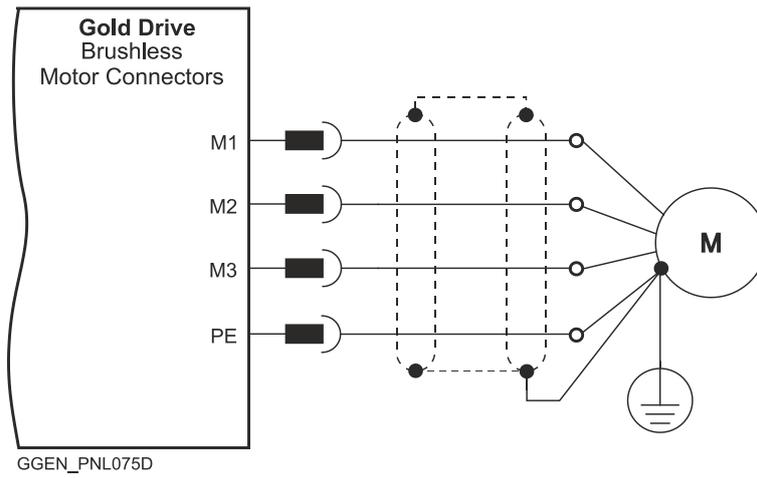
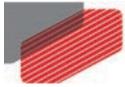


Figure 9: Brushless Motor Power Connection Diagram

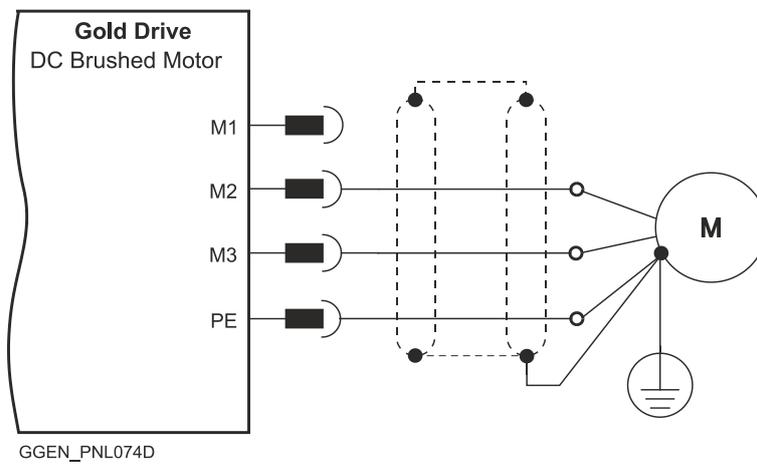


Figure 10: DC Brushed Motor Power Connection Diagram

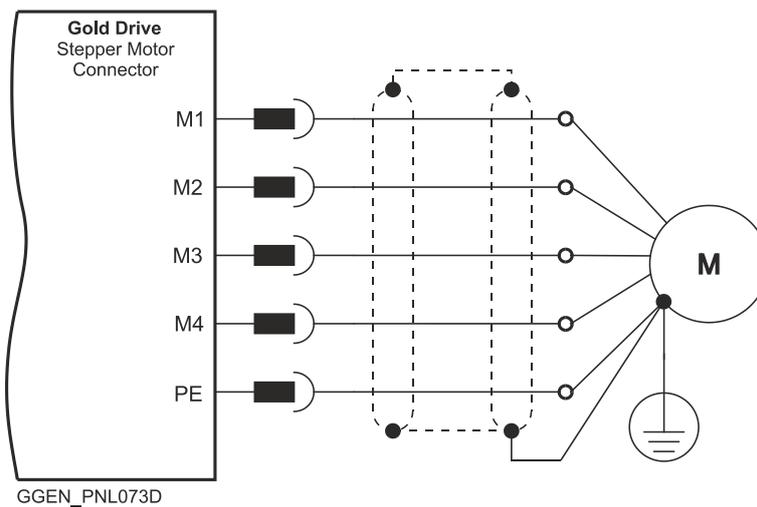


Figure 11: Stepper Motor Power Connection Diagram



## 7.3. Main and Control Power

The Gold Solo Bell (1 mm pitch E/C Conn.) receives power from main and control supplies and delivers power to the motor.

### 7.3.1. Description

This section describes the Main and Control Power for power ratings 200V and 100V, and provides details for the optional Backup (Control) Supply.

- The Gold Solo Bell (1 mm pitch E/C Conn.) Power rating is 12 to 195 VDC
- There are Two power ratings for Gold Solo Bell (1 mm pitch E/C Conn.); 100V and 200V:

#### **For power rating 200V**

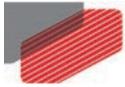
Two power isolated DC power sources are required, main power 12 - 195V and Control Power 12-95V for the logic.

#### **For power rating of 100V**

Single DC Power Supply - Power to the Gold Solo Bell (1 mm pitch E/C Conn.) is provided by a 12–95 VDC single isolated DC power source (not included with the Gold Solo Bell (1 mm pitch E/C Conn.)). A “smart” control-supply algorithm enables the Gold Solo Bell (1 mm pitch E/C Conn.) to operate with only one power supply with no need for a control power supply for the logic.

#### **Optional Backup (Control) Supply**

If backup functionality is required in case of power loss, e.g., to keep the original position, a 12–95 VDC external isolated supply should be connected (via the Gold Solo Bell (1 mm pitch E/C Conn.)’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 two voltage ratings of the Gold Solo Bell (1 mm pitch E/C Conn.), therefore the correct power supply must be used, according to the maximum operating voltage of the Gold Solo Bell (1 mm pitch E/C Conn.). Refer to section 4.2 Technical Data.



### 7.3.2. Main Power (J29)

Pin (J29)	Signal	Function	Cable
1	PE	Protective Earth	DC Power
2	PR	Power Return	DC Power
3	VP+	Positive Power Input	DC Power

#### Pin Positions

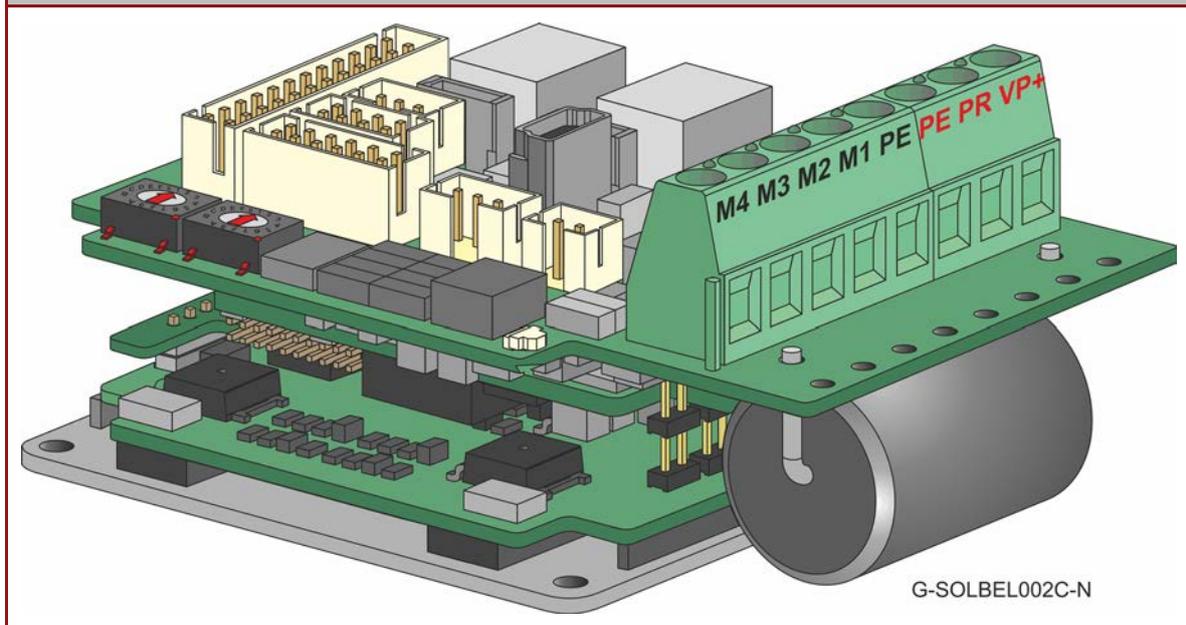


Table 4: Main Power and Motor Connections

Power to the Gold Solo Bell (1 mm pitch E/C Conn.) is provided by a 12 to 195 VDC source.

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 12 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.



### 7.3.3. Control Power Supply (J30)

Pin (J30)	Signal	Function
1	PR	Control Supply Return
2	VL+	Control Supply Input

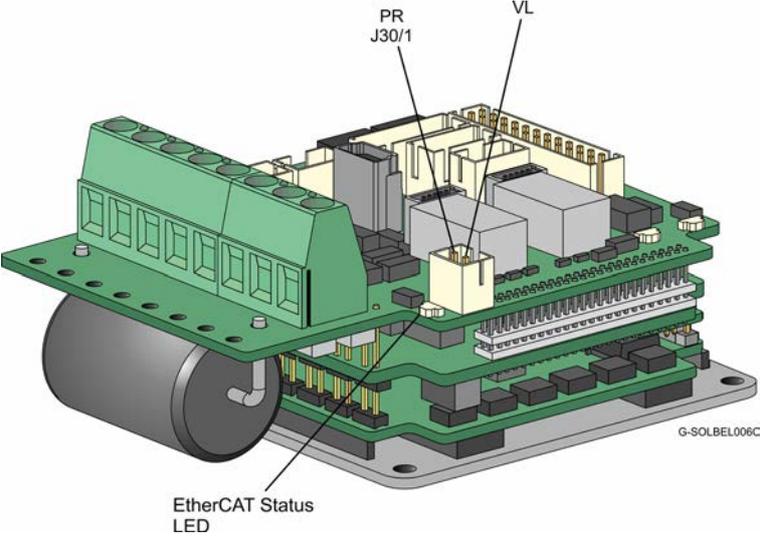
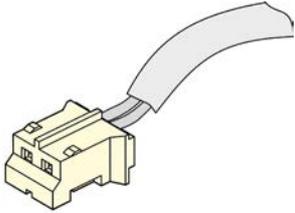
Pin Positions	Cable Connector
	 <p>G-SOLBEL-509A</p> <p><b>2-Pin Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 5: Control Supply Pins



**Caution:** Power from the Gold Solo Bell (1 mm pitch E/C Conn.) to the motor must come from the Main Supply and **NOT** from the Control Supply.

The backup functionality can be used for storing control parameters in case of power-outs, providing maximum flexibility and backup capability when needed.

Connect the VL+ and PR terminal to the **Control** Connector.

**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.  
A cable kit containing a cable that connects to the control supply connector (J30) is available. See Section 3.1.
4. Before applying power, first verify the polarity of the connection.



### 7.3.4. Connectivity

#### 7.3.4.1. Power Rating 200 V

For Power Rating 200 V, two power isolated DC power sources are required, main power **12 - 195V** and control Power **12-95V** for the logic.

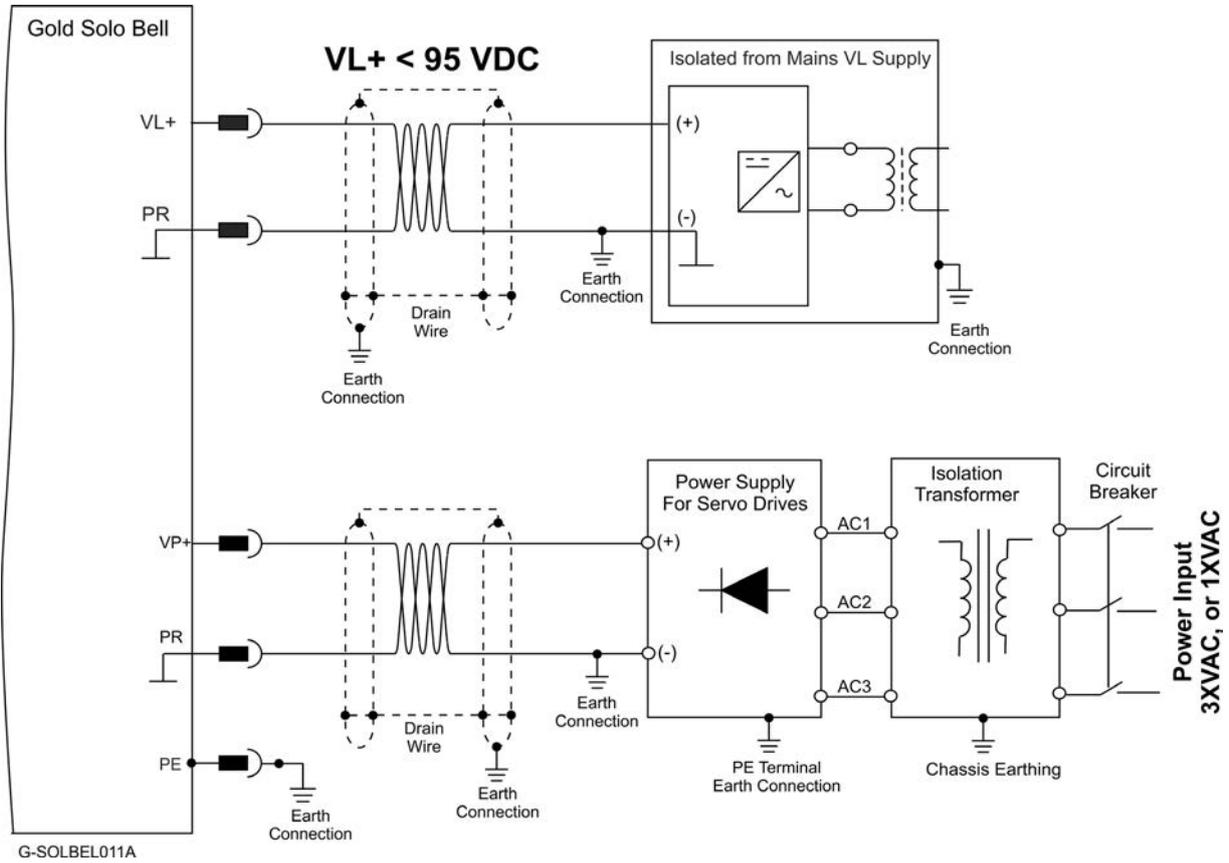
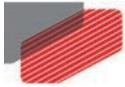


Figure 12: 200 VDC Power Source Connection Diagram



### 7.3.4.2. Power Rating 100 V

#### 7.3.4.2.a Single Power Supply

For power rating 100 V , a single Power Supply is required which contains a “smart” control-supply algorithm, enabling the Gold Solo Bell (1 mm pitch E/C Conn.) to operate with only one power supply with no need for a control power supply for the logic.

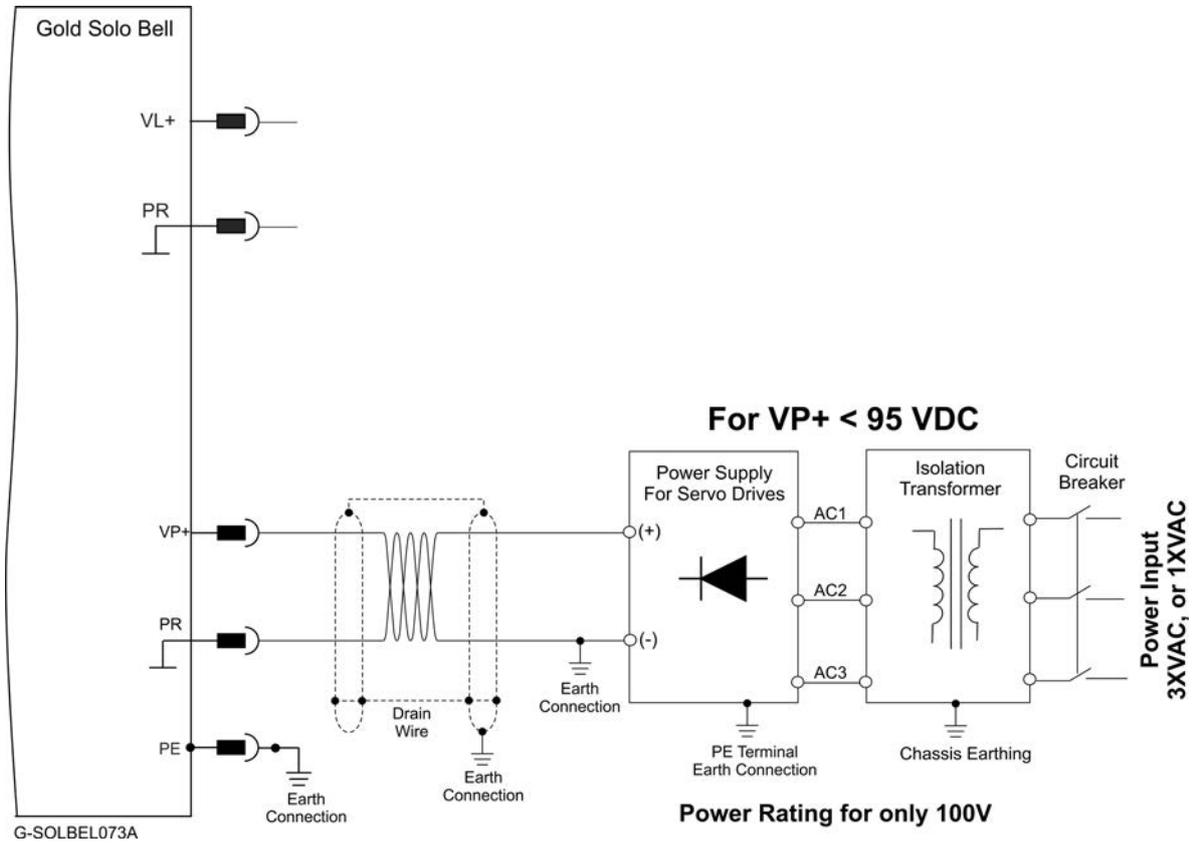
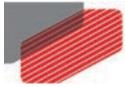


Figure 13: Main Power Supply Connection Diagram (No Control Supply)



### 7.3.4.2.b Optional Backup Supply

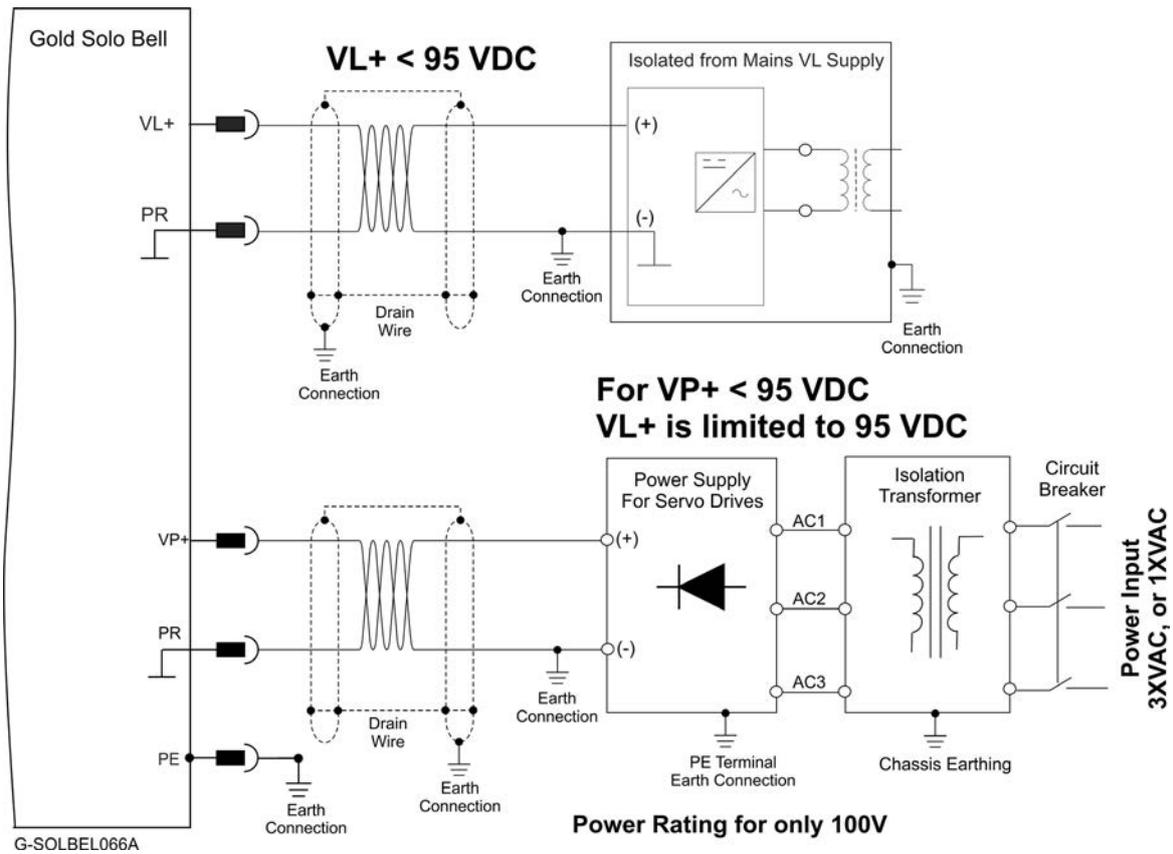
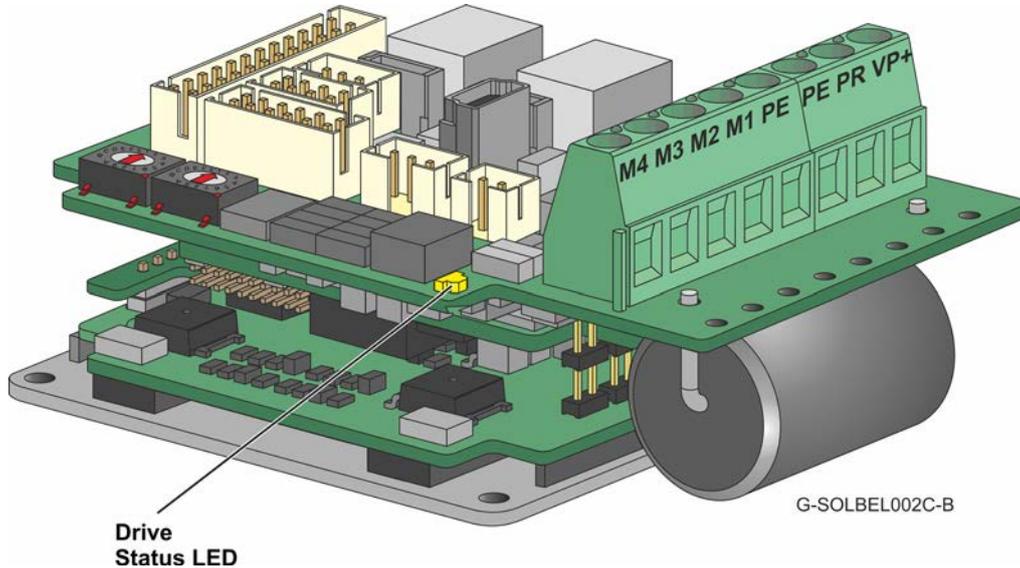


Figure 14: Control Supply Connection Diagram



## 7.4. Drive Status Indicator

Figure 15 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 15: Drive Status Indicator**

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).



## 7.5. STO (Safe Torque Off) (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

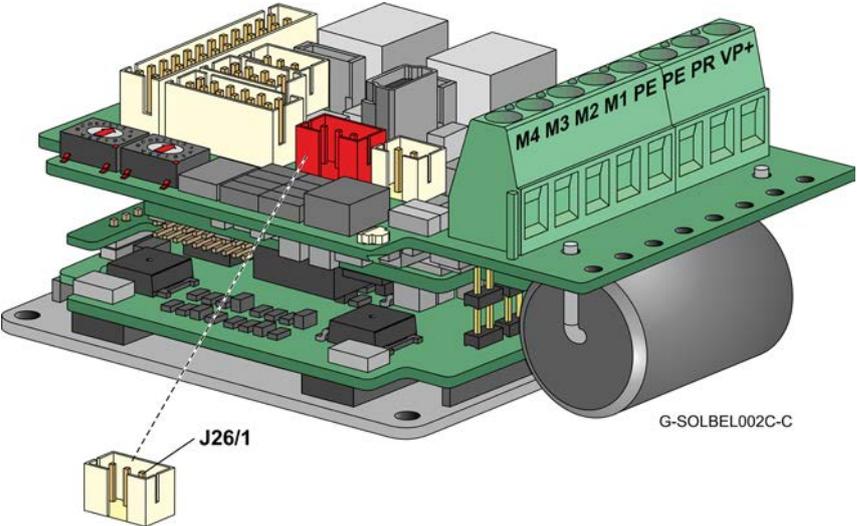
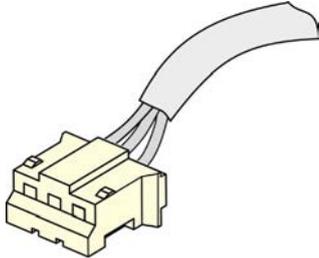
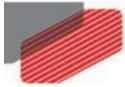
Pin Positions	Cable Connector
	 <p><b>3-Pin Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 6: STO Input Pin Assignments



### 7.5.1. Source Mode – PLC Voltage Level

Refer to the diagrams below for the PLC Source option connection.

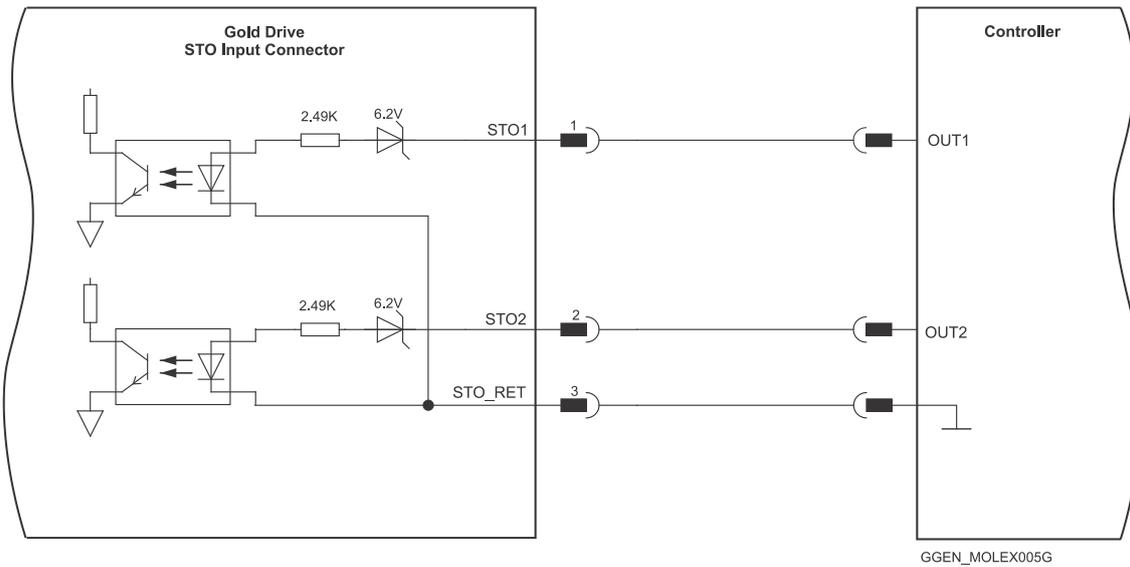


Figure 16: STO Shrouded Type Input Connection – PLC Source Option

### 7.5.2. TTL Mode – TTL Voltage Level

Refer to the diagrams below for TTL option connection.

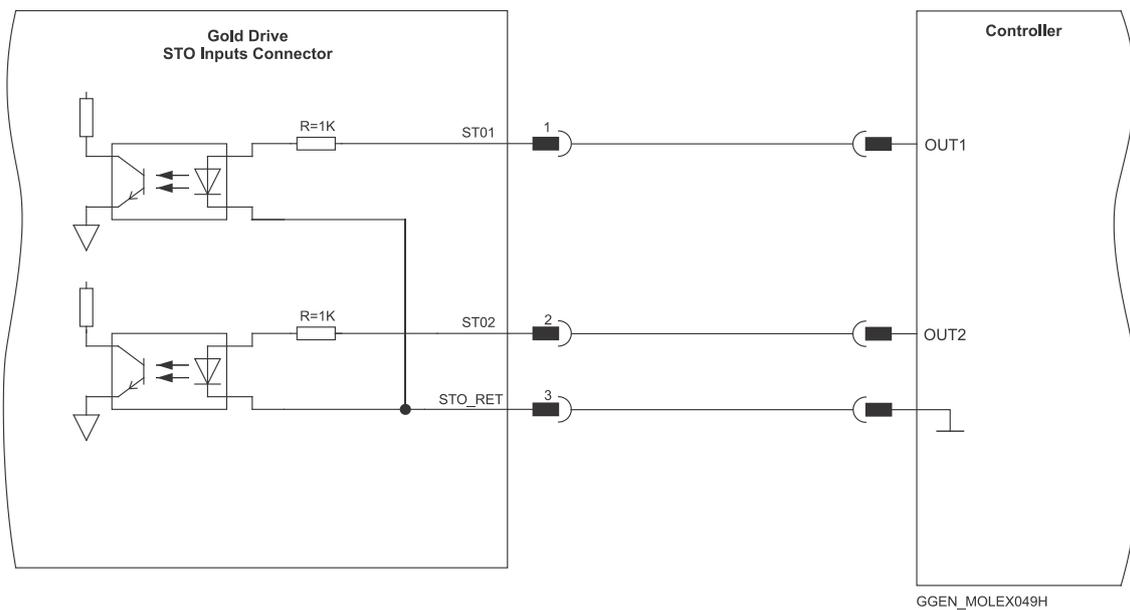
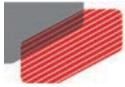


Figure 17: STO Input Connection – TTL Option



## 7.6. Port A Connector (J4)

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

		Incremental Encoder		Absolute Serial Encoder	
Pin (J4)	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	

Pin Positions	Cable Connector
	<p><b>12-Pin (2x6) Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 7: Port A Pin Assignments



### 7.6.1. Incremental Encoder

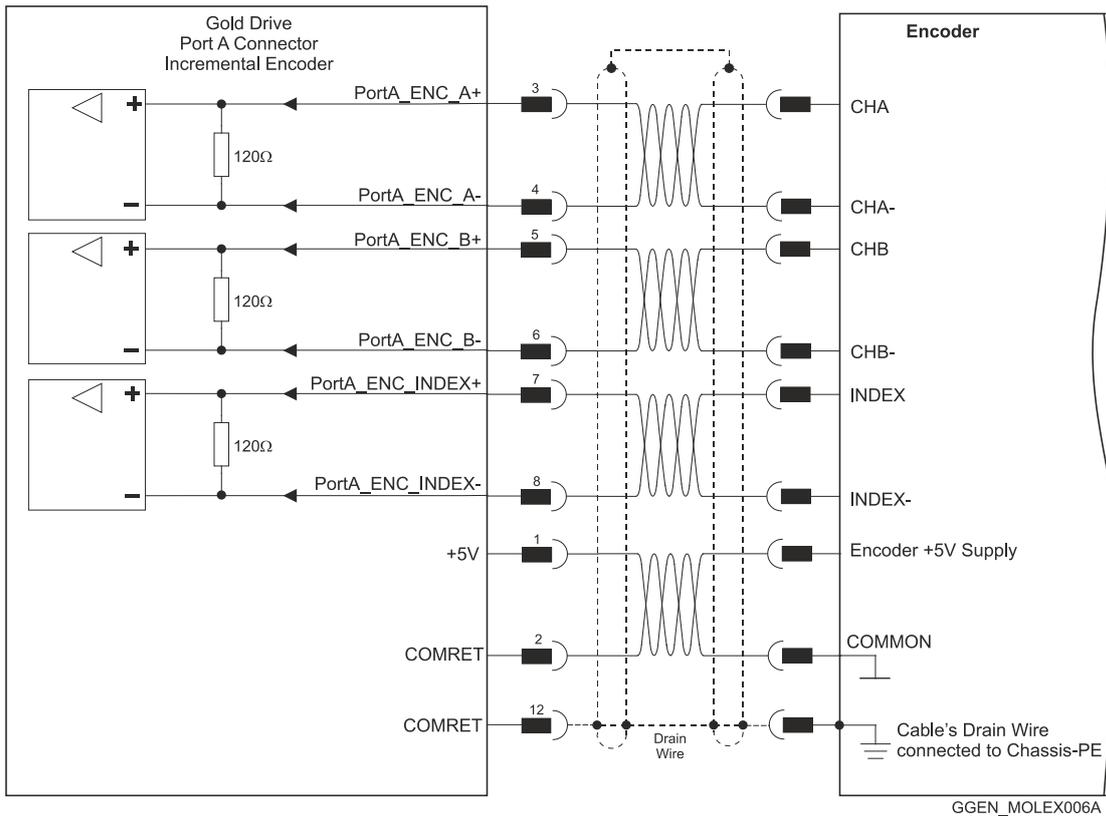


Figure 18: Port A Shrouded Type Incremental Encoder Input – Recommended Connection Diagram

### 7.6.2. Halls Sensor

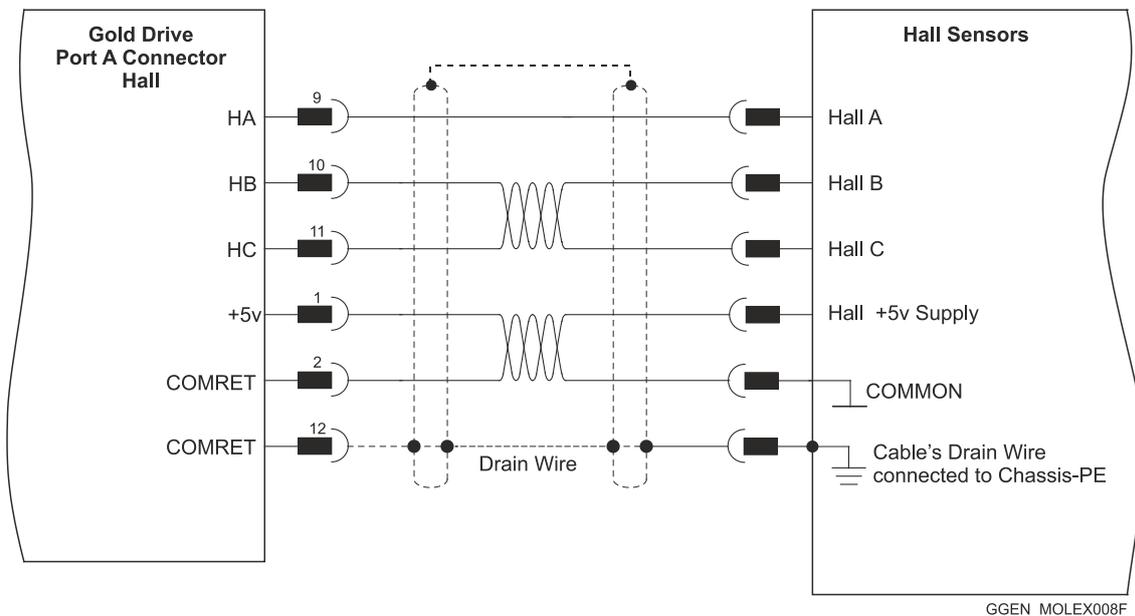


Figure 19: Shrouded Type Hall Sensors Connection Diagram



### 7.6.3. Absolute Serial Encoder

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

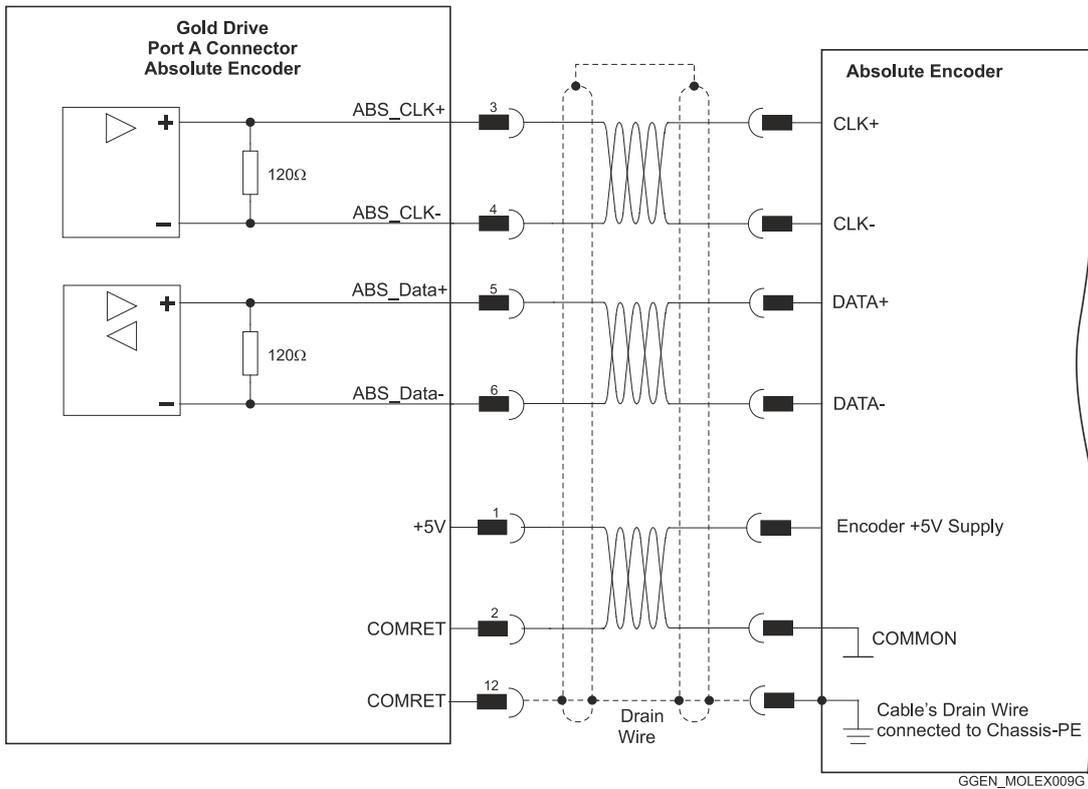


Figure 20: Absolute Serial Encoder – Recommended Connection Diagram for EnDAT, Biss, SSI

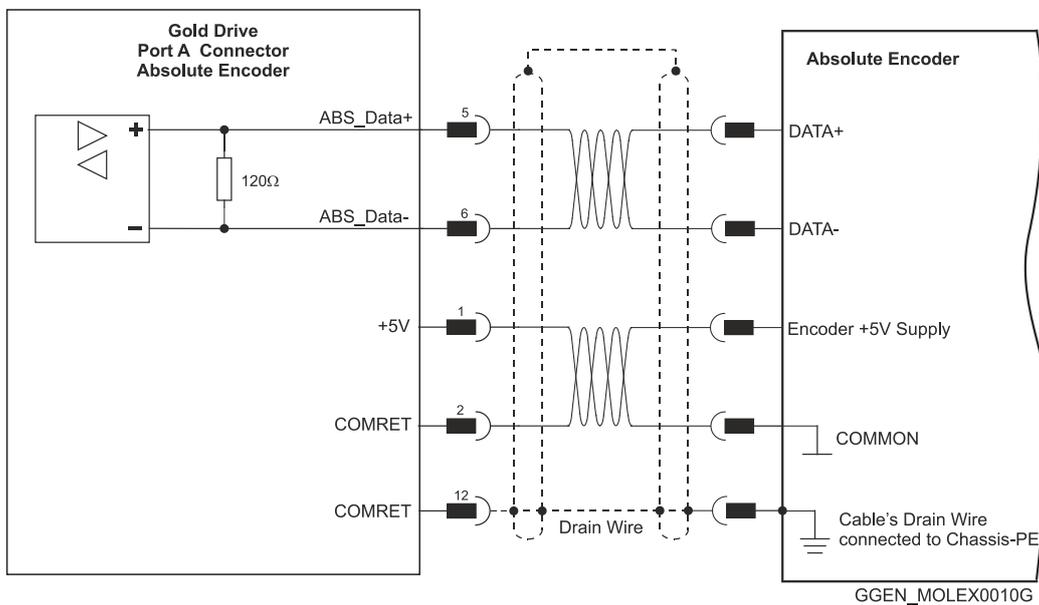
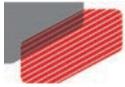


Figure 21: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)



### 7.6.3.1. Hiperface

The following figure describes the connection diagram.

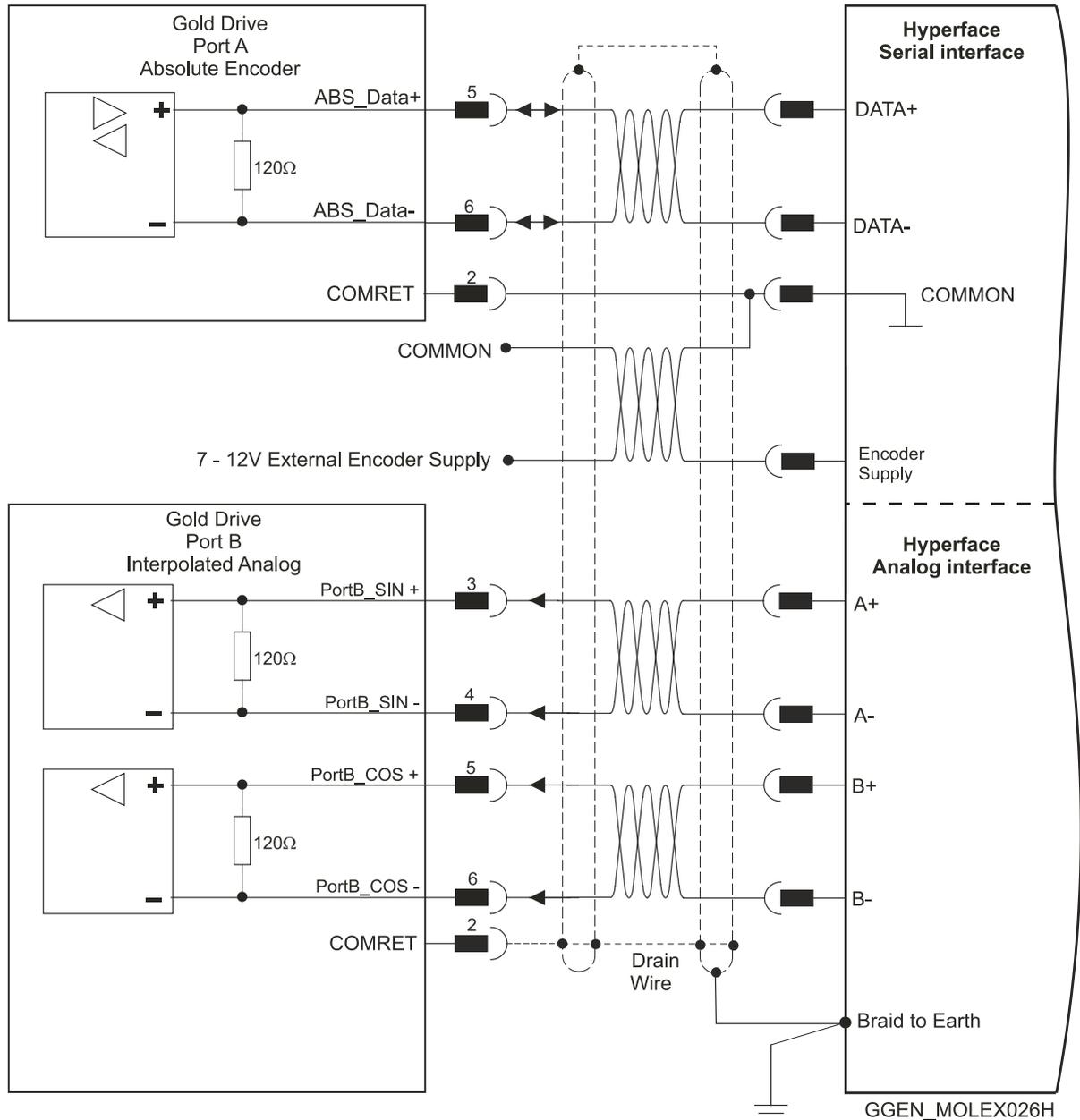
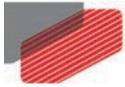


Figure 22: Absolute Serial Encoder – Recommended Shrouded Type Connection Diagram for Stegmann Hiperface

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



## 7.7. 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-SOLBELXXX/YYYYEX			G-SOLBELXXX/YYYYRX	
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 (2x4) Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 8: Port B Pin Assignments



### 7.7.1. Incremental Encoder

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

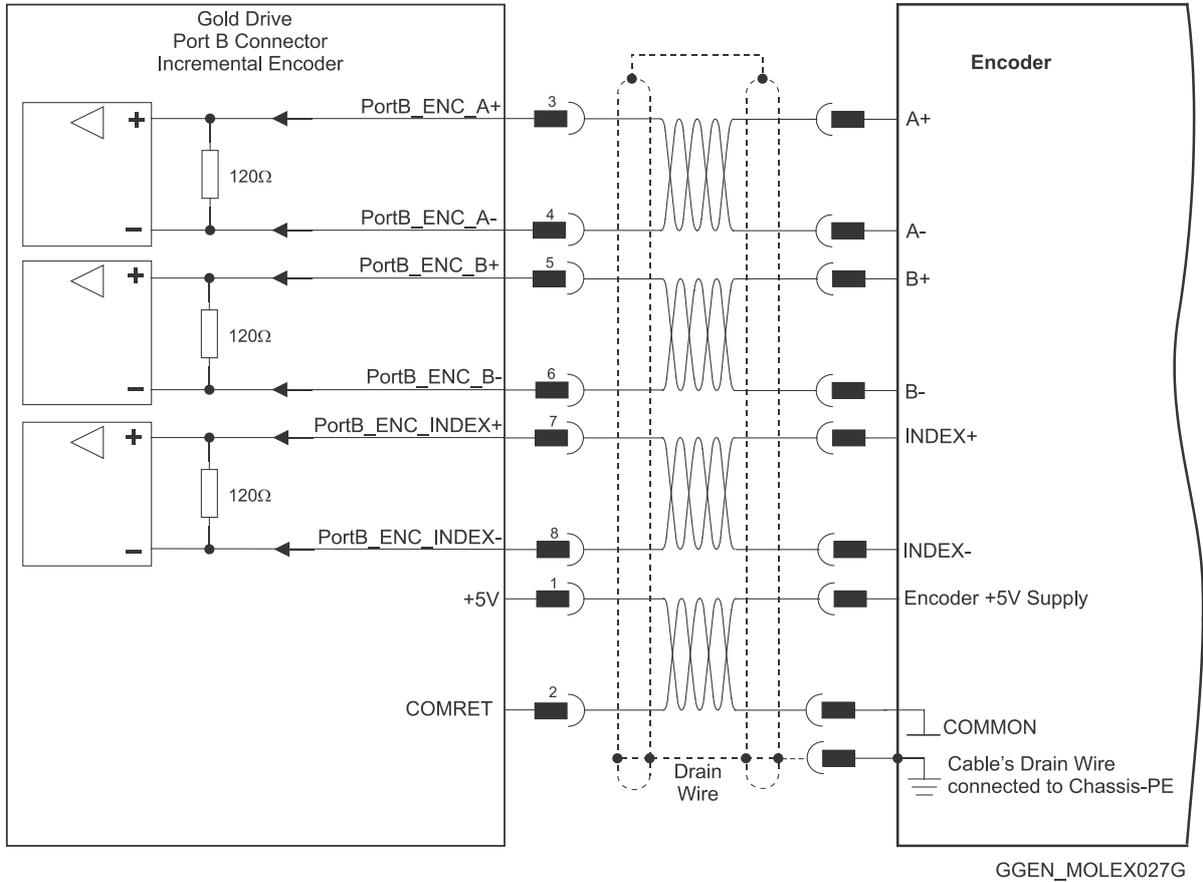


Figure 23: Port B Incremental Encoder Input – Recommended Connection Diagram



### 7.7.2. Interpolated Analog Encoder

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

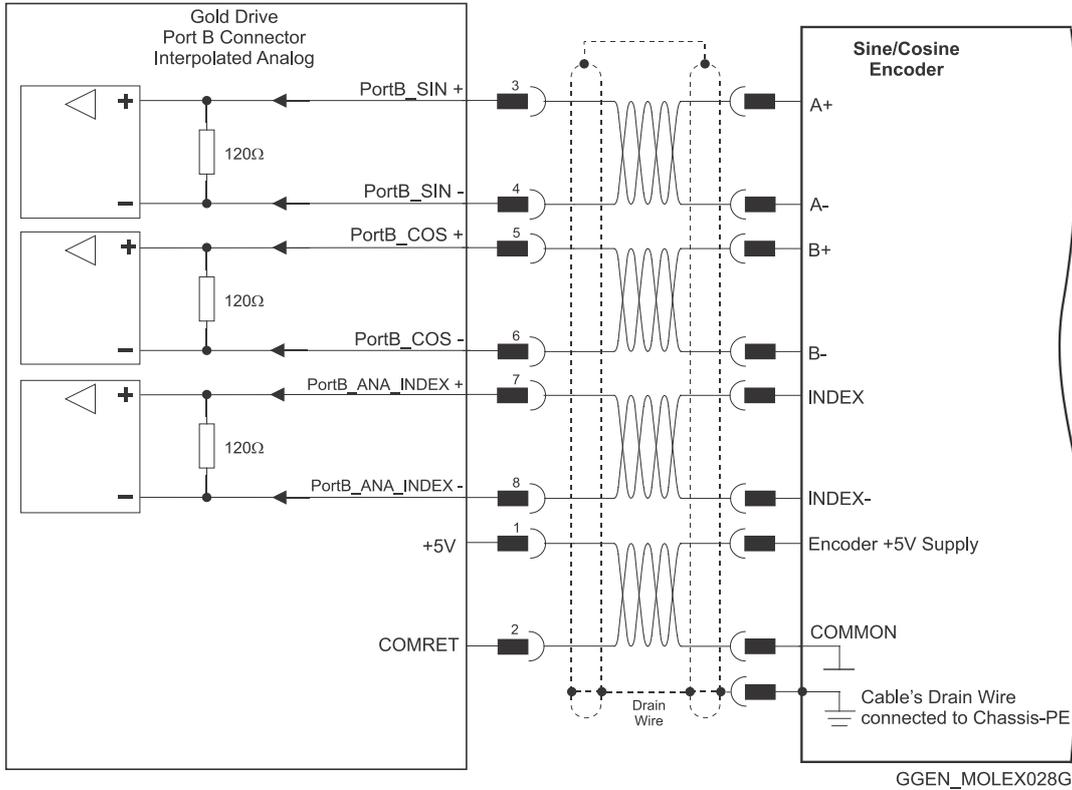


Figure 24: Port B - Interpolated Analog Encoder Shrouded Type Connection Diagram

### 7.7.3. Resolver

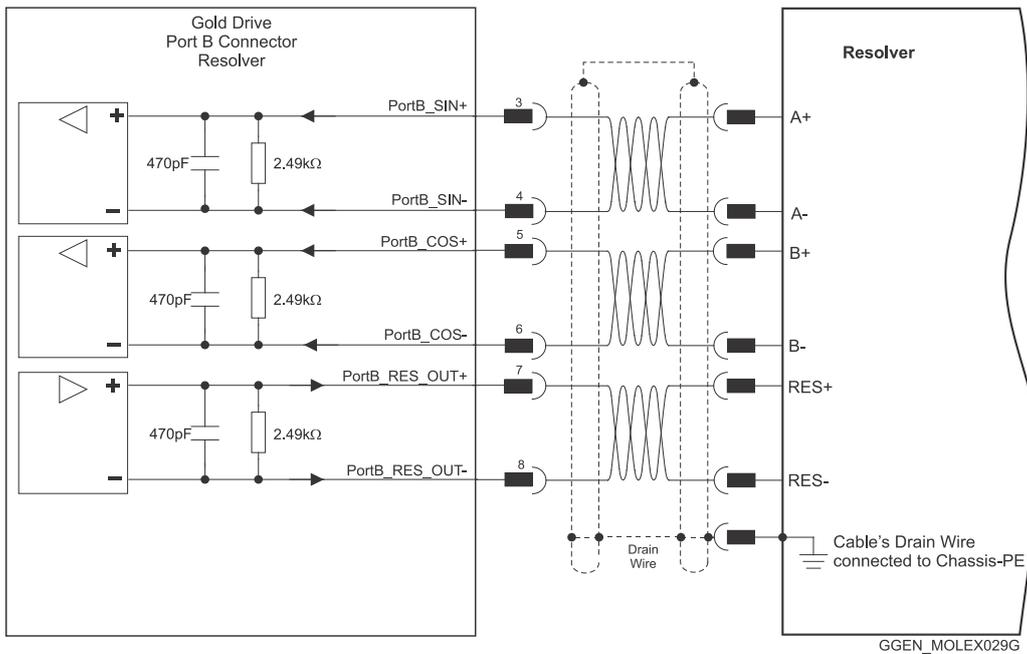
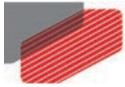


Figure 25: Port B – Resolver Shrouded Type Connection Diagram



## 7.8. 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	Programmable input 6 (High speed)
19	Reserved	Reserved
20	Reserved	Reserved
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



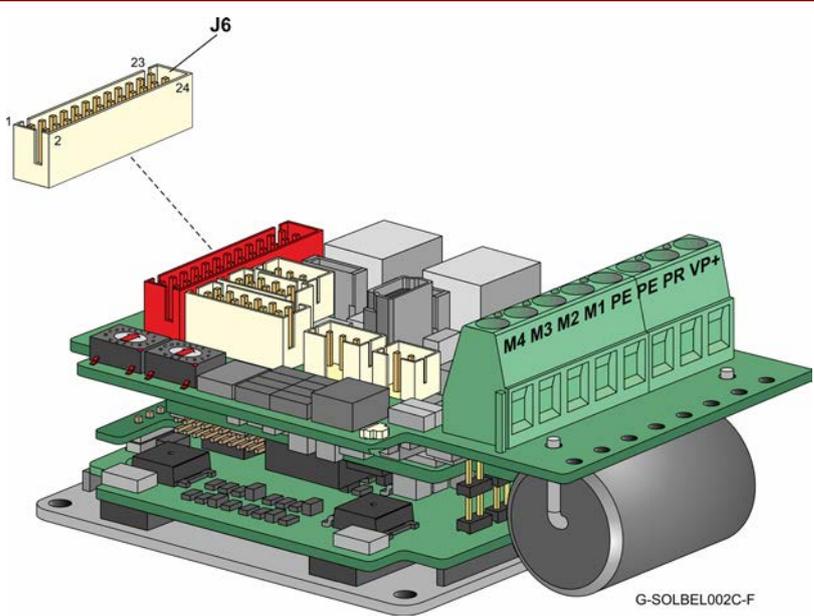
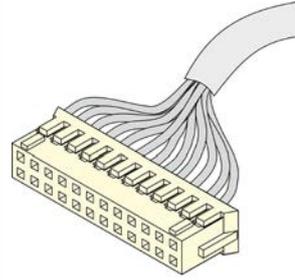
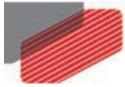
Pin Positions	Cable Connector
 <p data-bbox="869 828 997 851">G-SOLBEL002C-F</p>	 <p data-bbox="1212 571 1340 593">G-SOLBEL-506A</p> <p data-bbox="1101 604 1332 638"><b>24-Pin (2x12) Plug</b></p> <p data-bbox="1109 672 1372 828">This cable is included in the cable kit described in Section 3.1.</p>

Table 9: Port C Feedback Out and I/O



### 7.8.1. Port C – Emulated Encoder Output

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

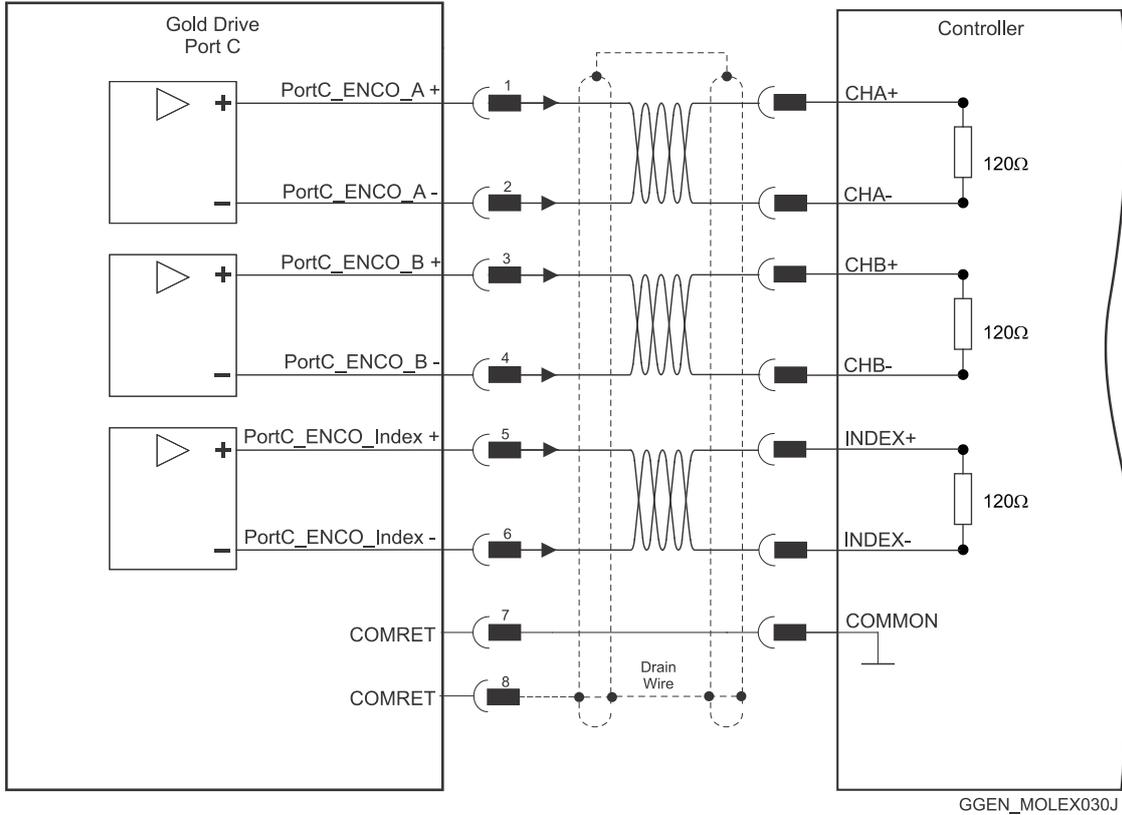


Figure 26: Emulated Encoder Differential Output – Recommended Connection Diagram

Note that the user is required to connect a 120 Ω termination at the end of each differential line.

### 7.8.2. Analog Input

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

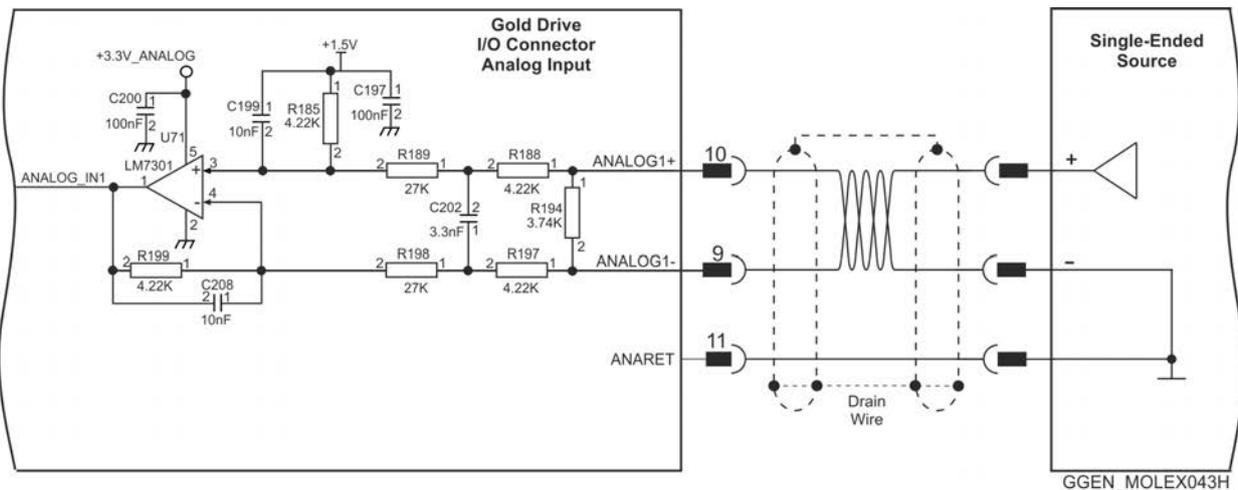
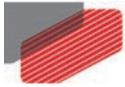


Figure 27: Differential Analog Input



### 7.8.3. 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.

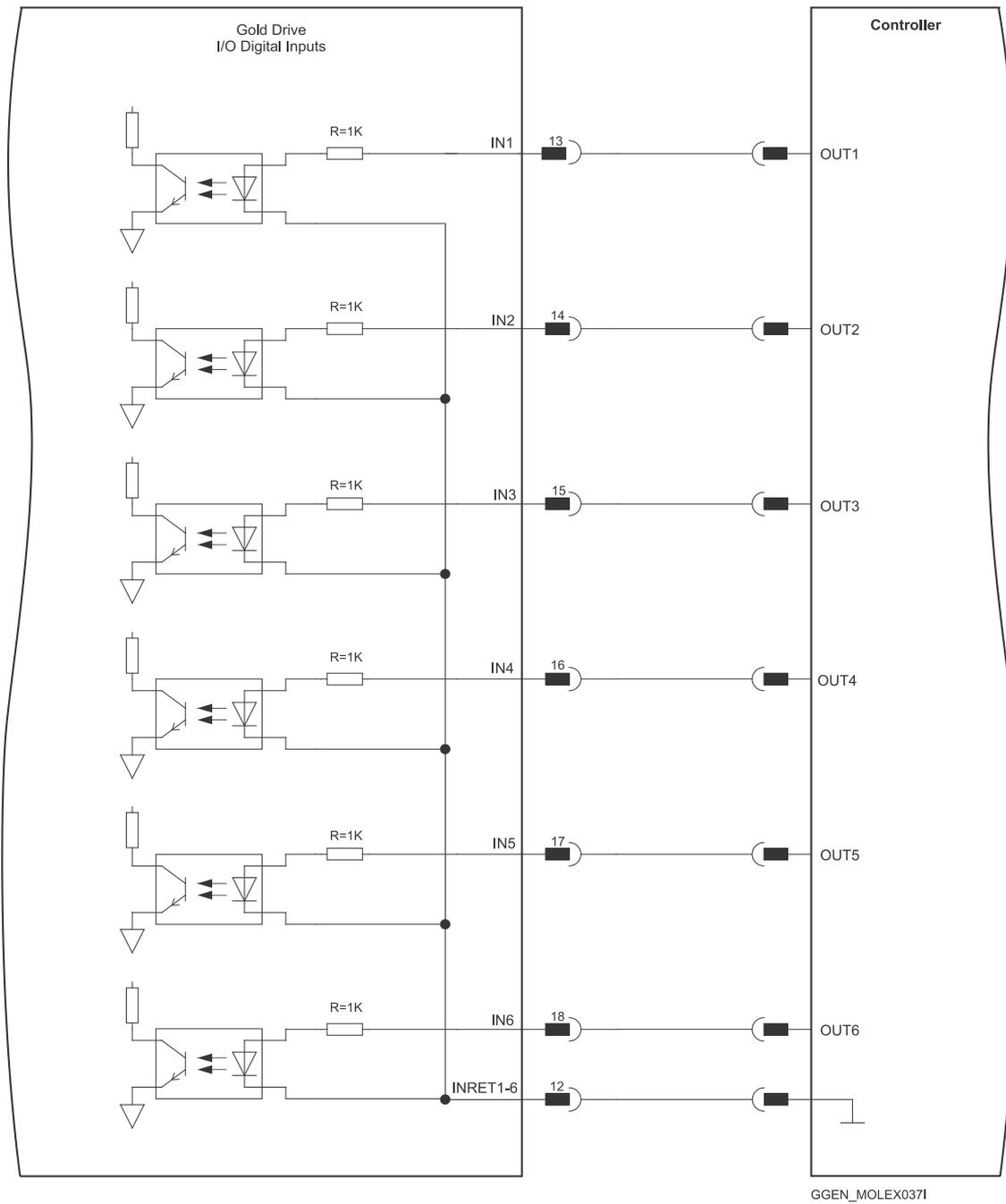


Figure 28: Digital Input TTL Mode Connection Diagram

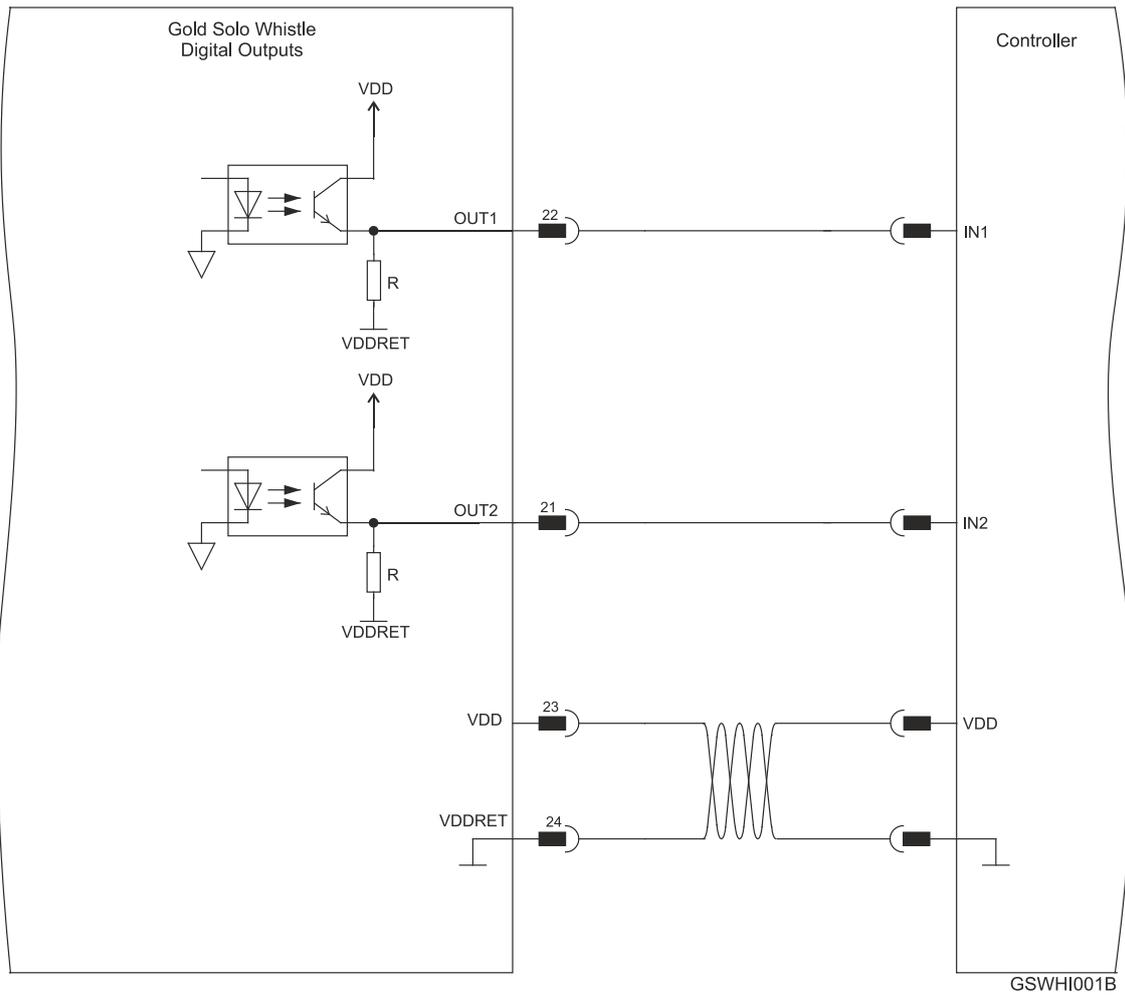
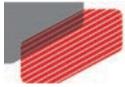


Figure 29: Digital Output Connection Diagram – TTL Option



### 7.8.4. 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.

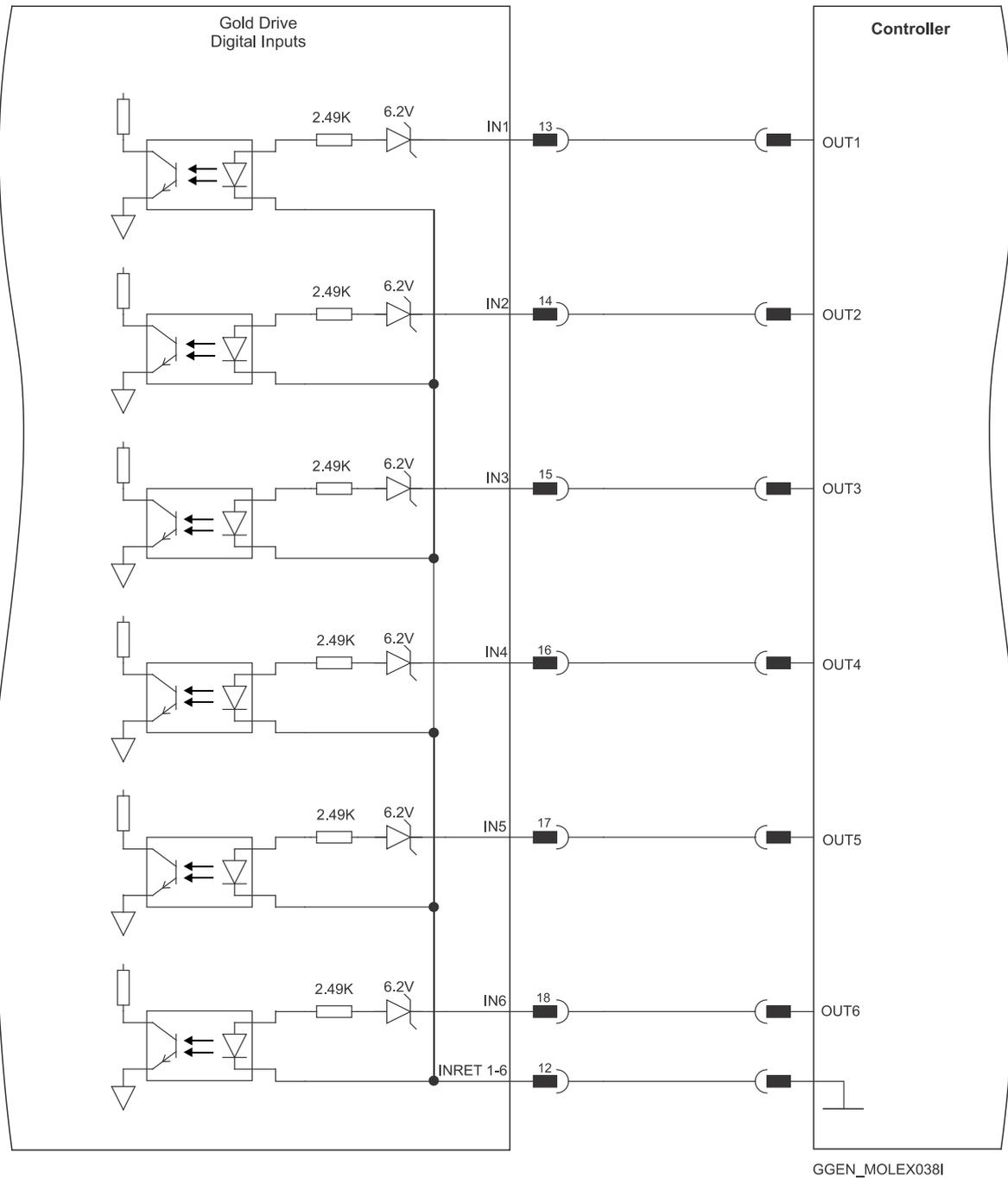


Figure 30: Digital Input Connection Diagram – Source PLC Option

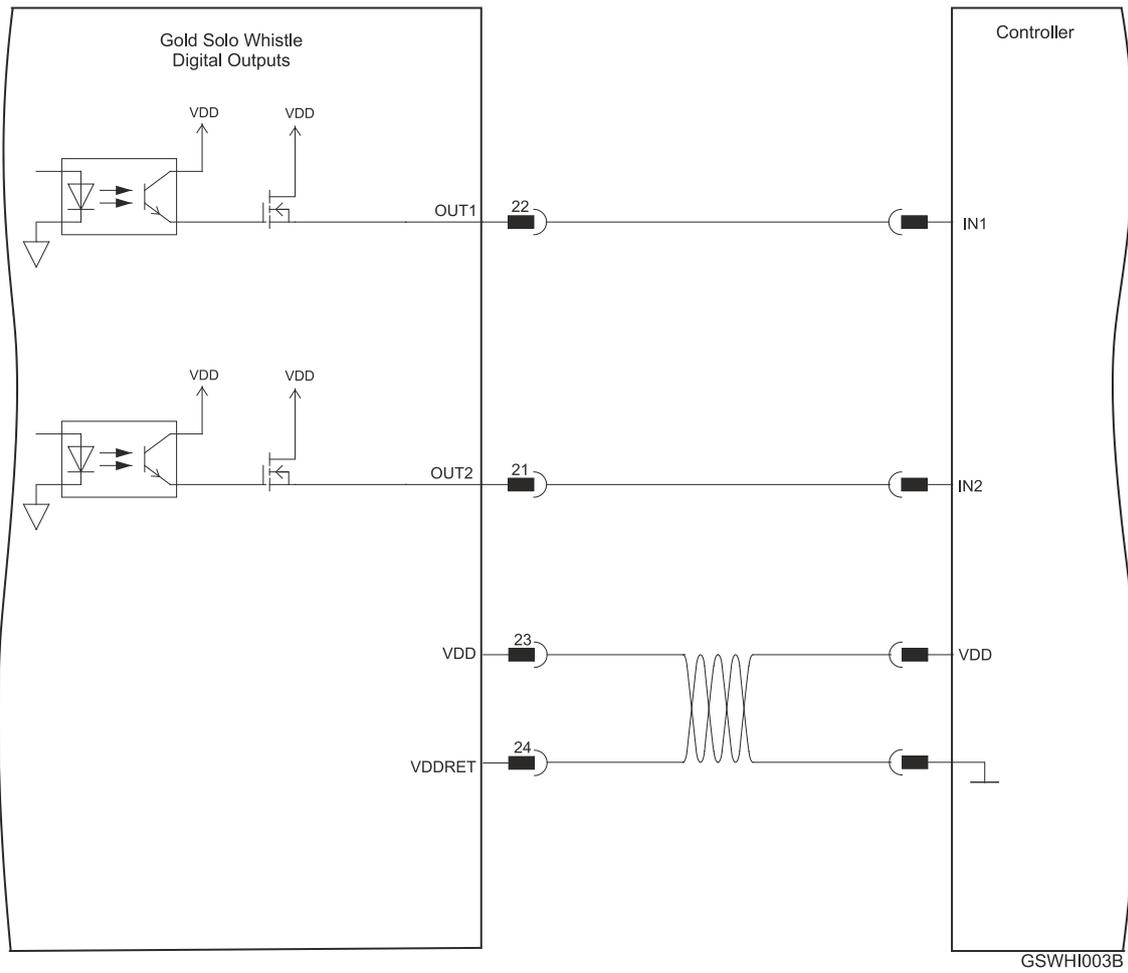
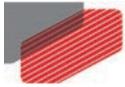


Figure 31: Digital Output Connection Diagram – Source PLC Option



### 7.8.5. 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.

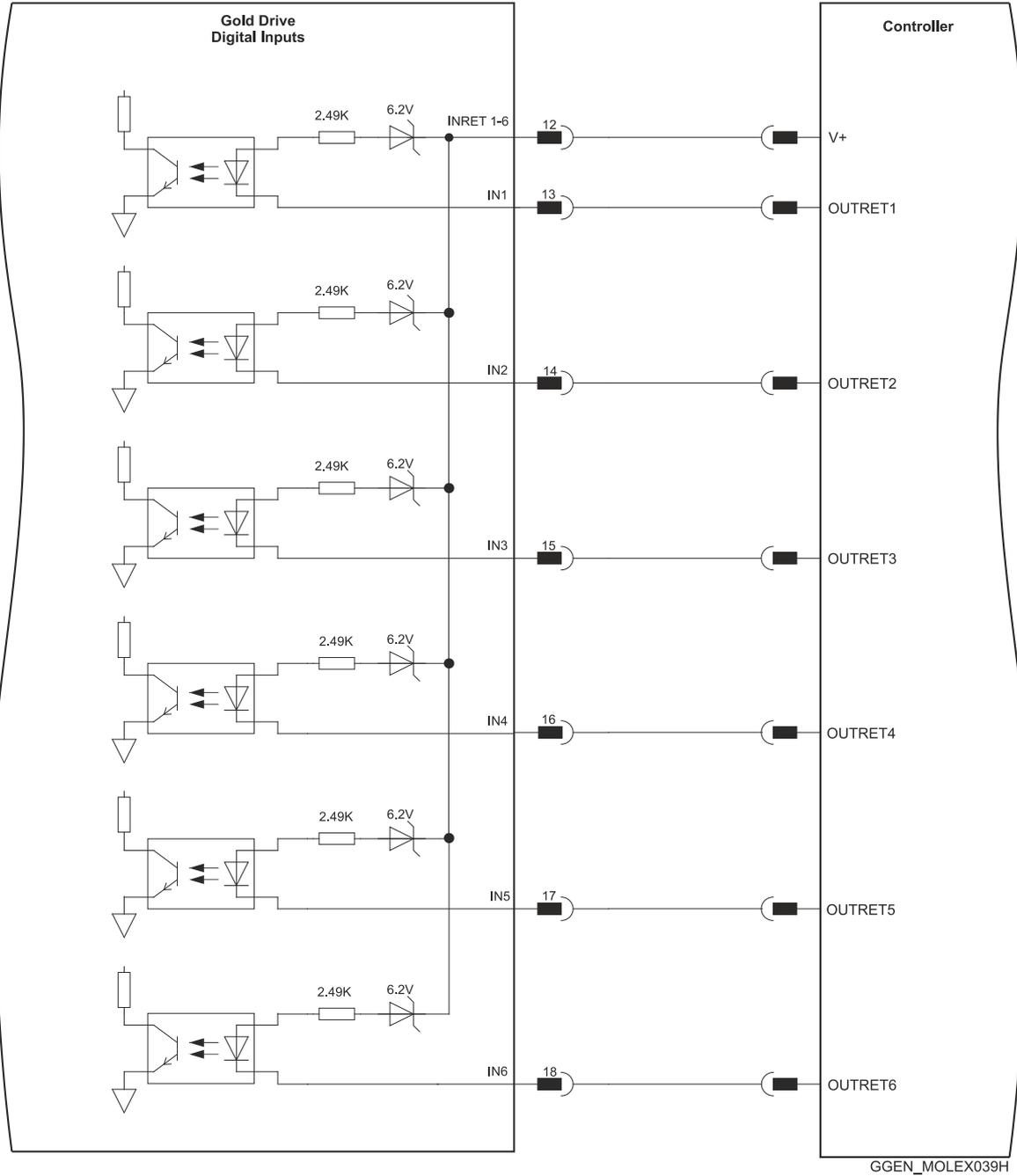
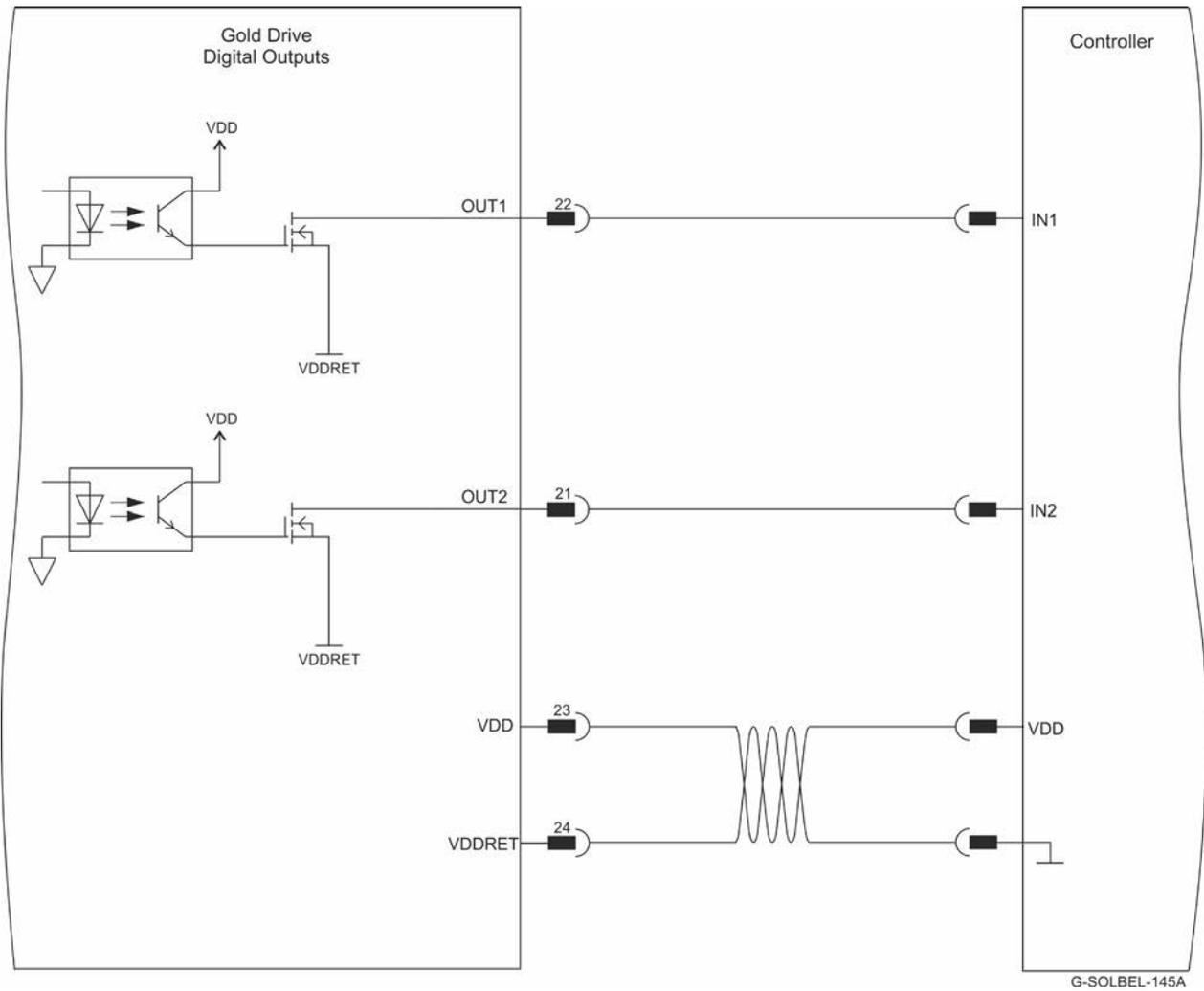


Figure 32: Digital Input Sink Mode – PLC voltage level Molex Type Connection Diagram



**Figure 33: Digital Output as Sink Configuration Molex Type Connection Diagram**



## 7.9. 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
5	USB COMRET	USB communication return

Pin Positions	Cable Connector
<p style="text-align: center;">G-SOLBEL002C-G</p> <p style="text-align: center;">J9</p>	<p style="text-align: center;">GDCWH026A</p> <p style="text-align: center;"><b>USB Device Mini-B Plug</b></p>

Table 9: USB Device Mini-B - Pin Assignments

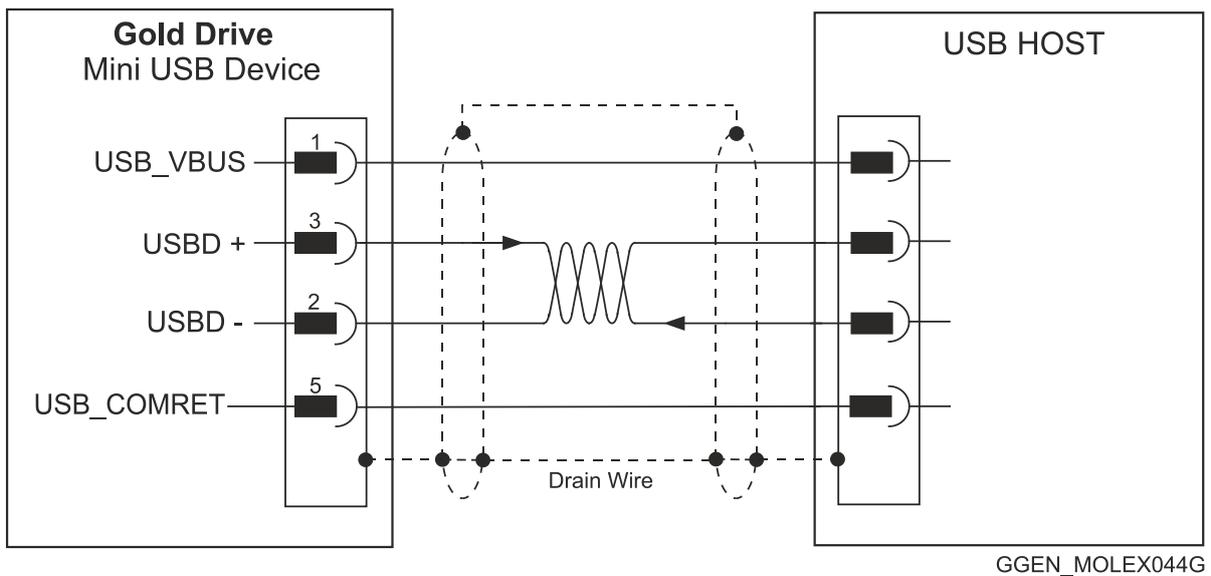
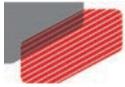


Figure 34: USB Network Diagram



## 7.10. RS-232 Connector (J21)

See section 12.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Pin (J21)	Signal	Function
1	RS232_Rx	RS-232 receive
2	RS232_Tx	RS-232 transmit
3	RS232_COMRET	RS-232 communication return

Pin Positions	Cable Connector
<p style="text-align: right;">G-SOLBEL002C-H</p>	<p style="text-align: center;"><b>3-Pin Plug</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 10: RS-232 Pin Assignments

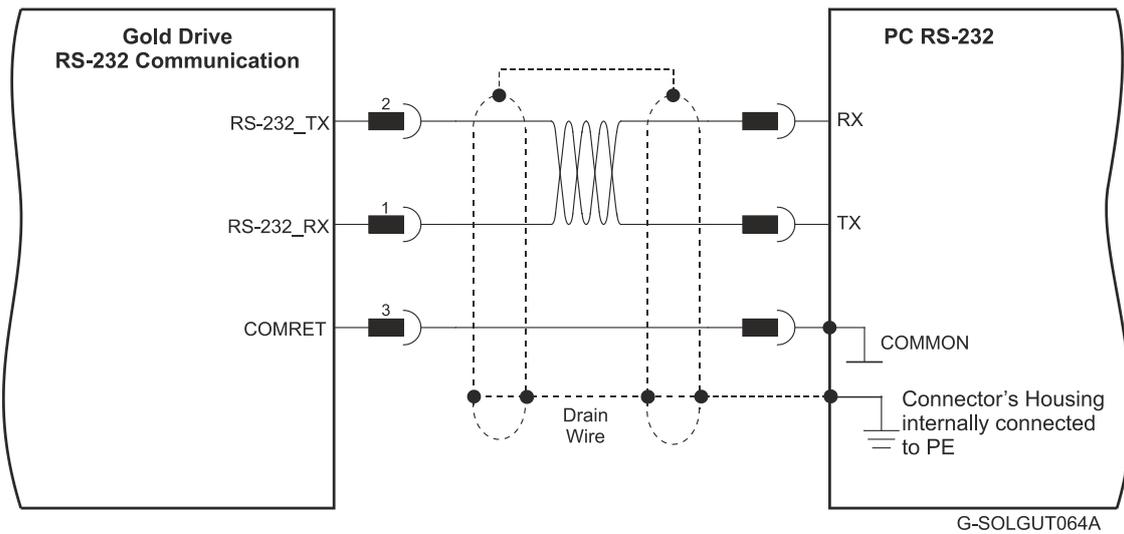
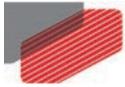


Figure 35: RS-232 Connection Diagram



## 7.11. EtherCAT Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Gold Solo Bell (1 mm pitch E/C Conn.) supports the following EtherCAT fieldbus type industrial network protocol:

Fieldbus Type	Product Number
EtherCAT	G-SOLBEL XX/YYE <sup>XX</sup>

### 7.11.1. EtherCAT IN/Ethernet Connector (J900)

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

Pin (J900)	Signal	Function
1	EtherCAT_IN_TX+/Ethernet_TX+	EtherCAT in/Ethernet transmit +
2	EtherCAT_IN_TX-/Ethernet_TX-	EtherCAT in/Ethernet transmit -
3	EtherCAT_IN_RX+/Ethernet_RX+	EtherCAT in/Ethernet receive +
4	EtherCAT_IN_RX-/Ethernet_RX-	EtherCAT in/Ethernet receive -
5	COMRET	Shield drain wire

Pin Positions	Cable Connector
	<p><b>Ethernet Cable Connector</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 11: EtherCAT IN / Ethernet Pin Assignments



### 7.11.2. EtherCAT OUT Connector (J901)

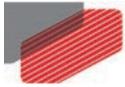
See Section 12.2 in the MAN-G-Panel Mounted Drives Hardware manual for the electrical diagram.

Pin (J901)	Signal	Function
1	EtherCAT_OUT_TX+	EtherCAT out transmit +
2	EtherCAT_OUT_TX-	EtherCAT out transmit -
3	EtherCAT_OUT_RX+	EtherCAT out receive +
4	EtherCAT_OUT_RX-	EtherCAT out receive -
5	COMRET	Shield drain wire

Pin Positions	Cable Connector
	<p><b>Ethernet Cable Connector</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

Table 12: EtherCAT OUT Pin Assignments



### 7.11.3. EtherCAT Options

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

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

#### 7.11.3.1. EtherCAT Communication

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



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

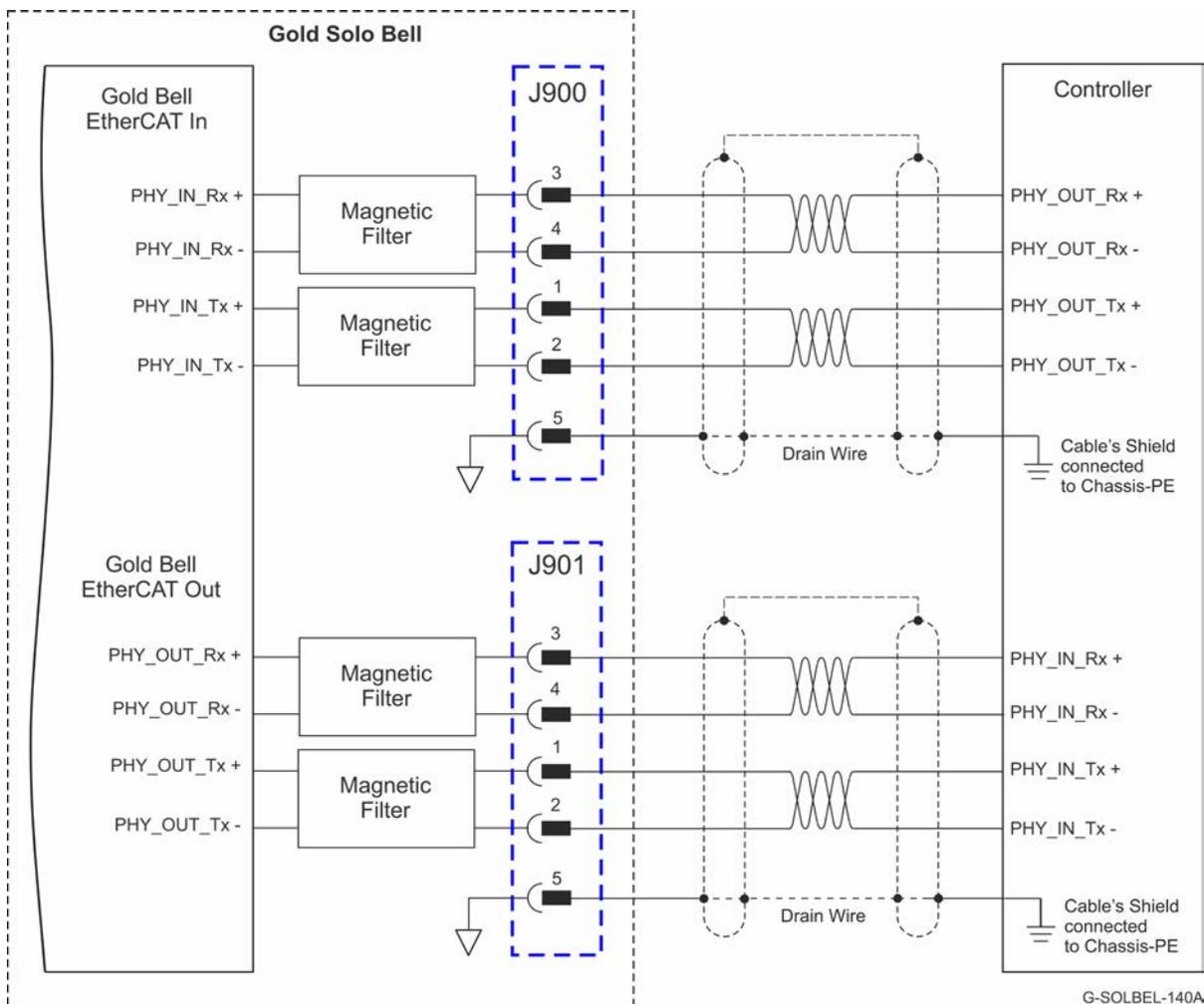
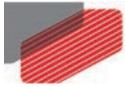
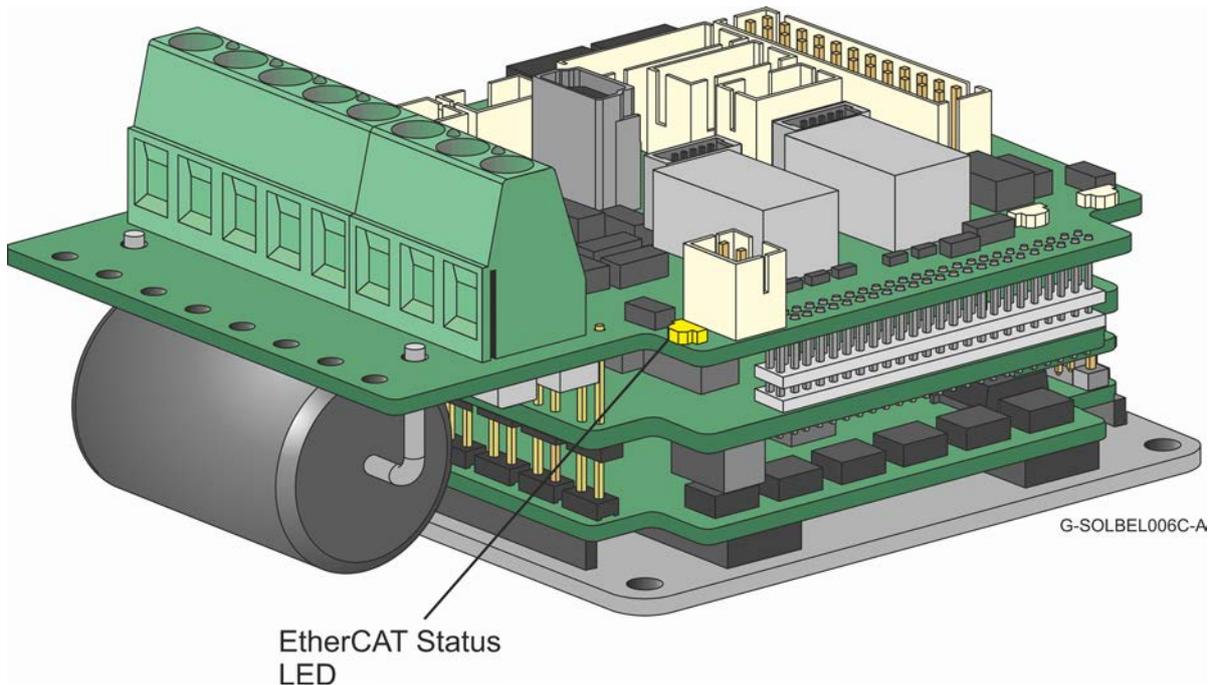


Figure 36: EtherCAT Connection Schematic Diagram



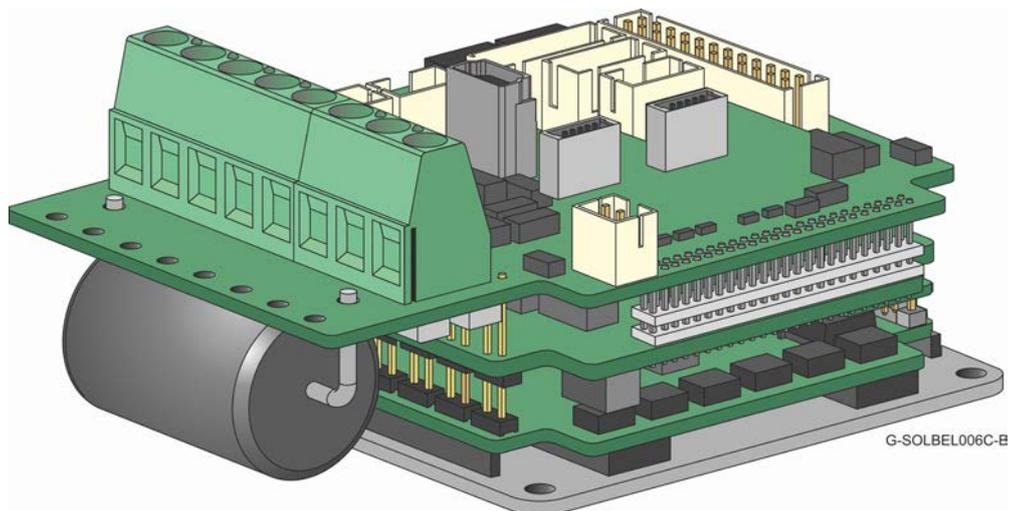
### 7.11.3.2. EtherCAT Status Indicator



**Figure 37: EtherCAT Status LED**

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

**Note:** There is no Gold Solo Bell (1 mm pitch E/C Conn.) ECAT Status indicator equivalent in the CAN version, refer to the figure below.

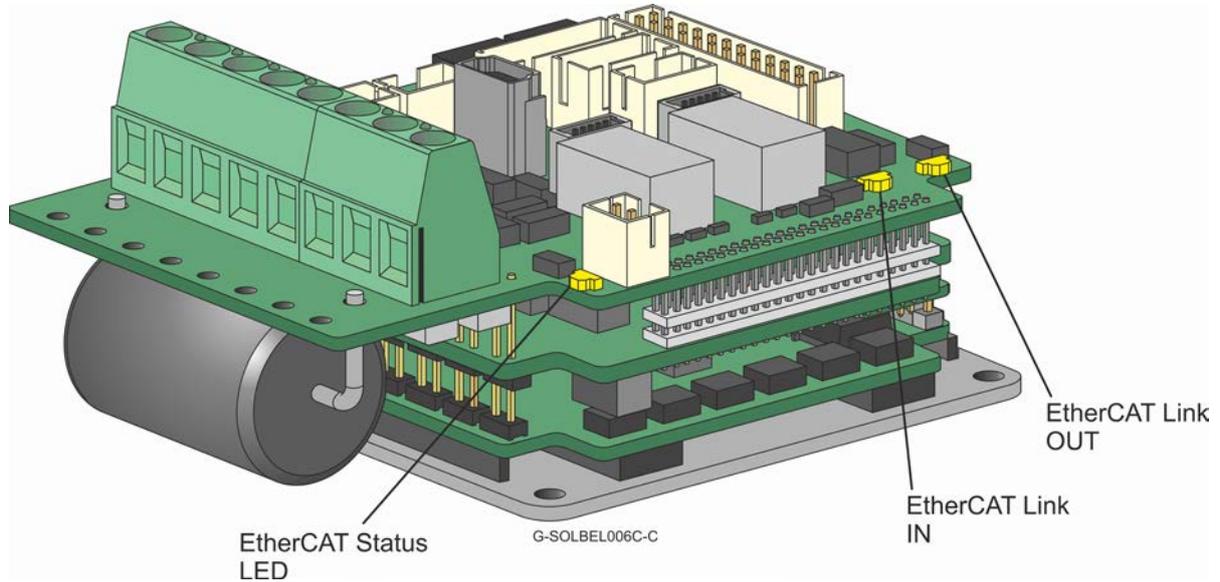


**Figure 38: Gold Solo Bell (1 mm pitch E/C Conn.) - CAN**



### 7.11.3.3. EtherCAT Link Indicators

The Gold Solo Bell (1 mm pitch E/C Conn.) can serve as an EtherCAT slave device. For this purpose it has two Ports J900 and J901, which are designated as EtherCAT In and EtherCAT Out. Each of these Ports has a status LED; EtherCAT In and EtherCAT Out, which are shown in Figure 39.



**Figure 39: Ethernet Connector LEDs**

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



### 7.11.3.4. EtherCAT Address Switches

Figure 40 displays the switches available in the EtherCAT Version

EtherCAT Switches

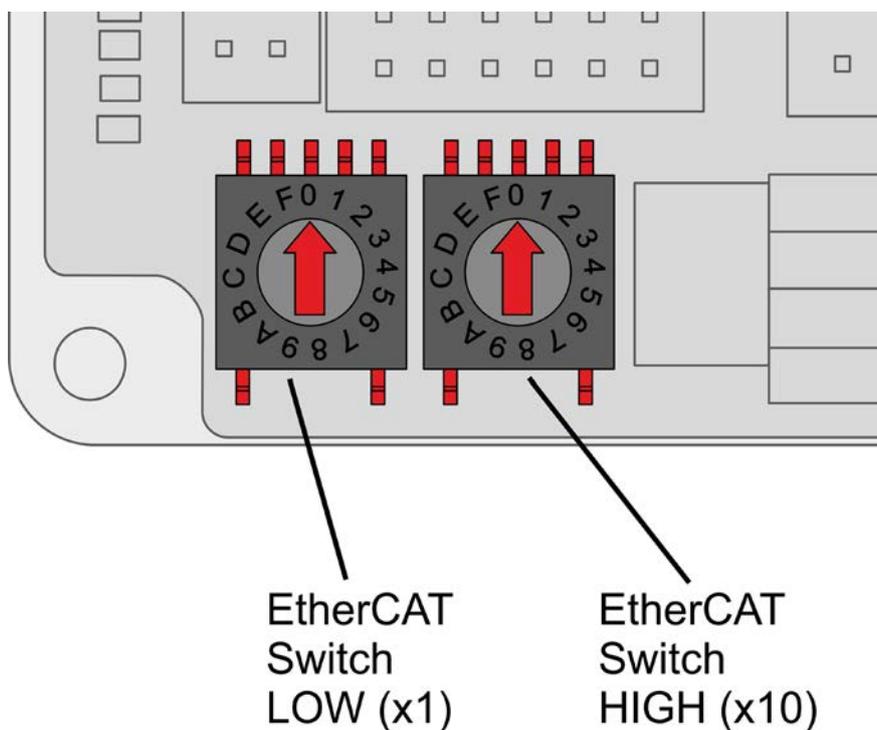
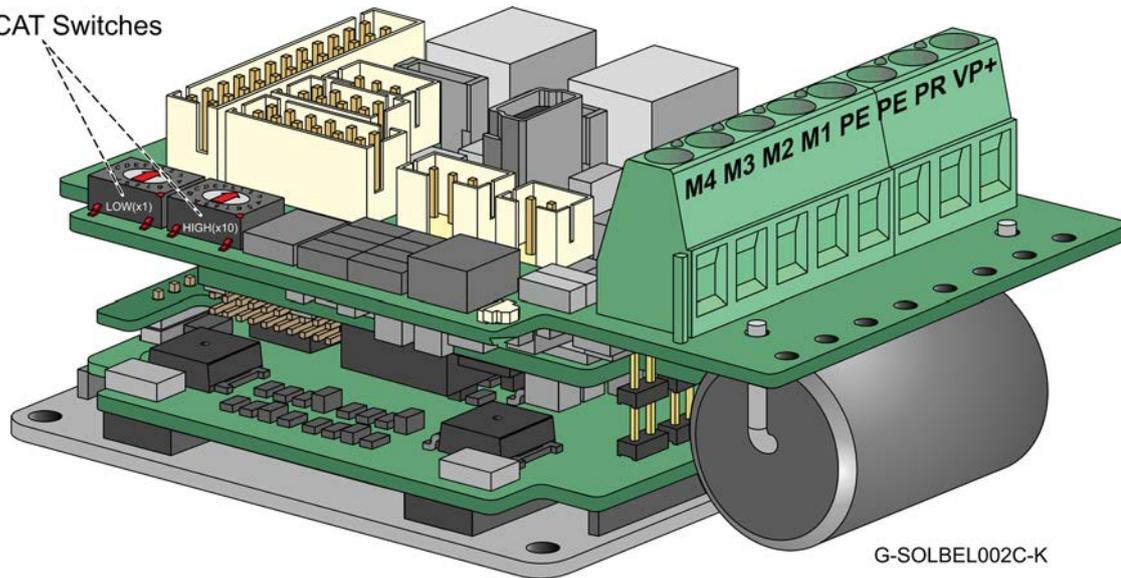


Figure 40: EtherCAT Address Switches

The EtherCAT address switches sets the ECAT address (LOW is ADD low, HIGH is ADD high). 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.

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.



## 7.12. CAN Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Gold Solo Bell (1 mm pitch E/C Conn.) supports the following CAN fieldbus type industrial network protocol:

Fieldbus Type	Product Number
CAN	G-SOLBELXX/YYYYSXX

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

### 7.12.1. CAN Connectors (J900, J901)

Pin (J900, J901)	Signal	Function
1	NC	NC
4	CAN_L	CAN_L bus line (dominant low)
3	CAN_H	CAN_H bus line (dominant high)
2	CAN_RET	CAN Return
5	COMRET	Shield drain wire

Pin Positions	Cable Connector
	<p><b>CAN Cable Connector</b></p> <p>This cable is included in the cable kit described in Section 3.1.</p>

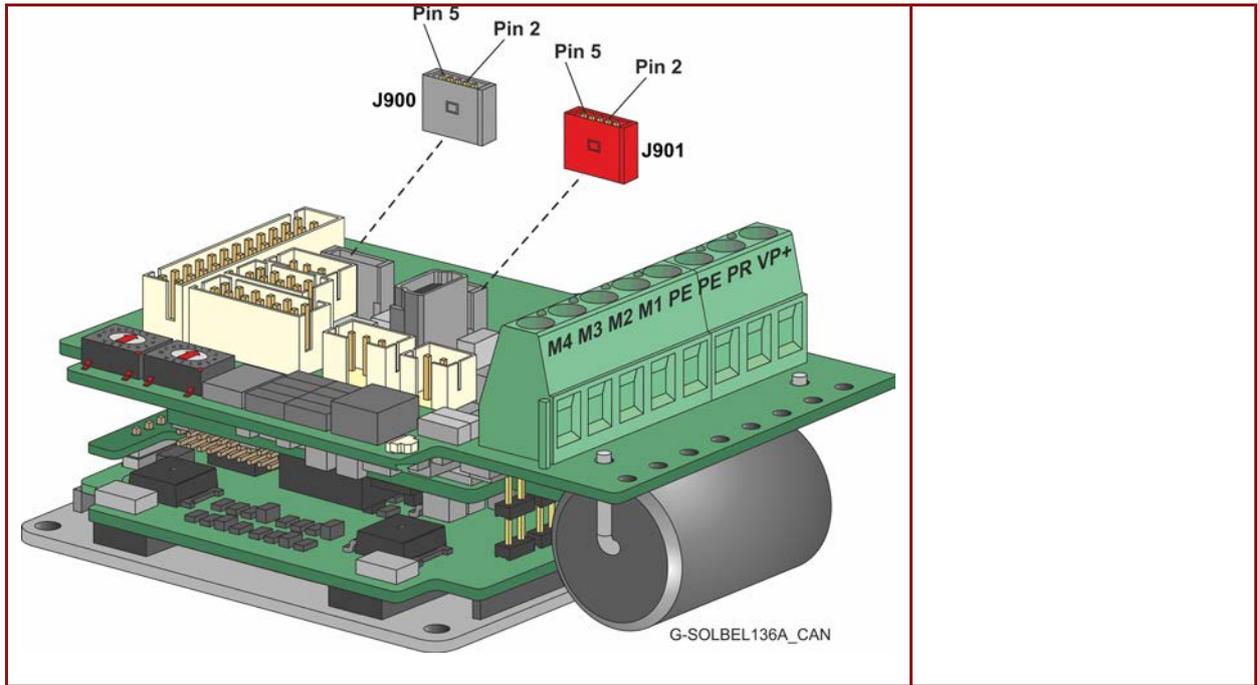
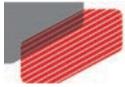
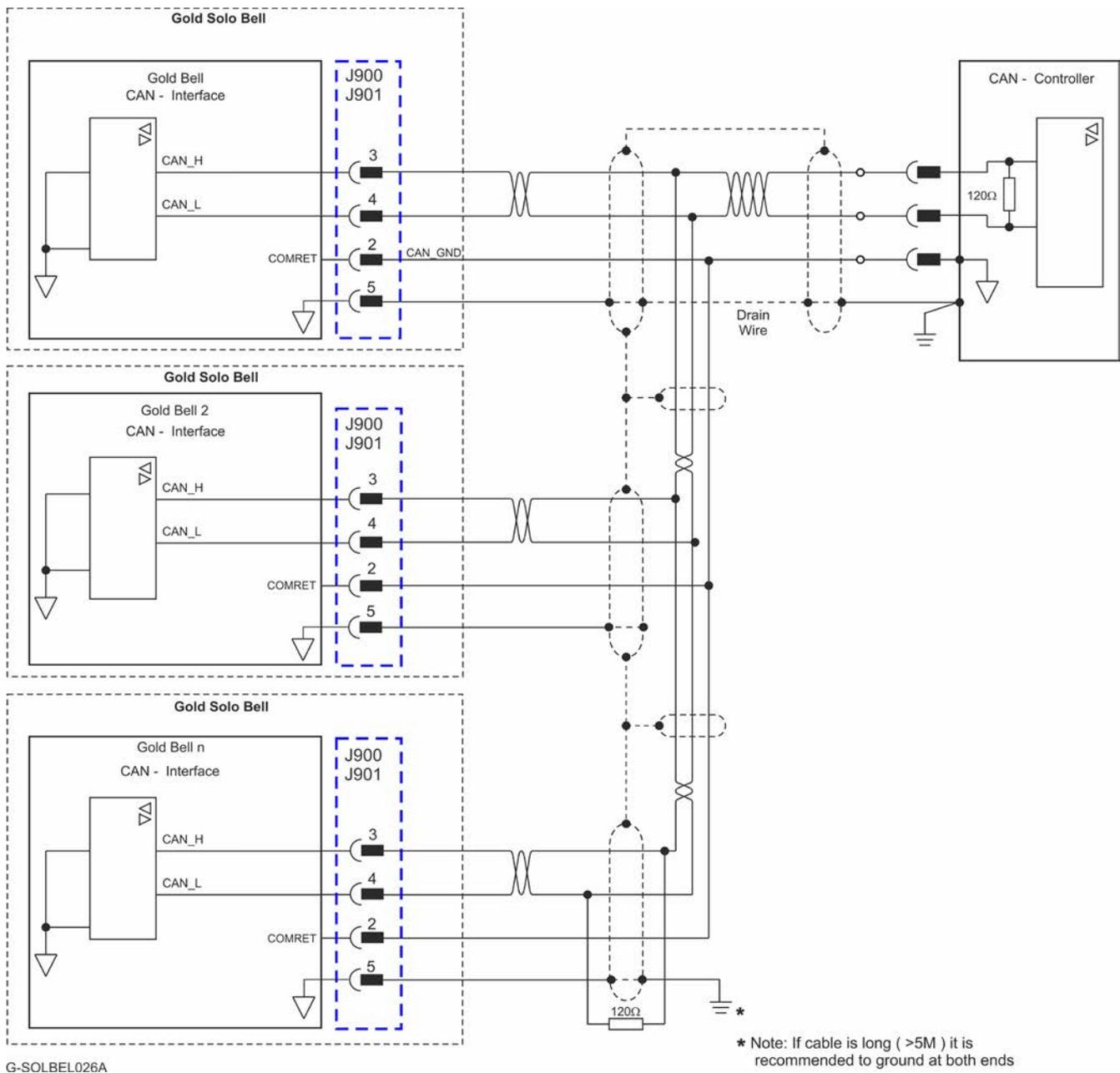


Table 13: CAN Connector Pin Assignments



### 7.12.2. CAN Wiring



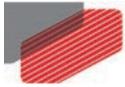
G-SOLBEL026A

Figure 41: CAN Network Diagram – Drop Off Topology



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

**Note:** Daisy chain topology can also be accomplished using J901.



## 7.13. Powering Up

After the Gold Solo Bell (1 mm pitch E/C Conn.) 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.

## 7.14. Initializing the System

After the Gold Solo Bell (1 mm pitch E/C Conn.) 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*.



## 7.15. Heat Dissipation

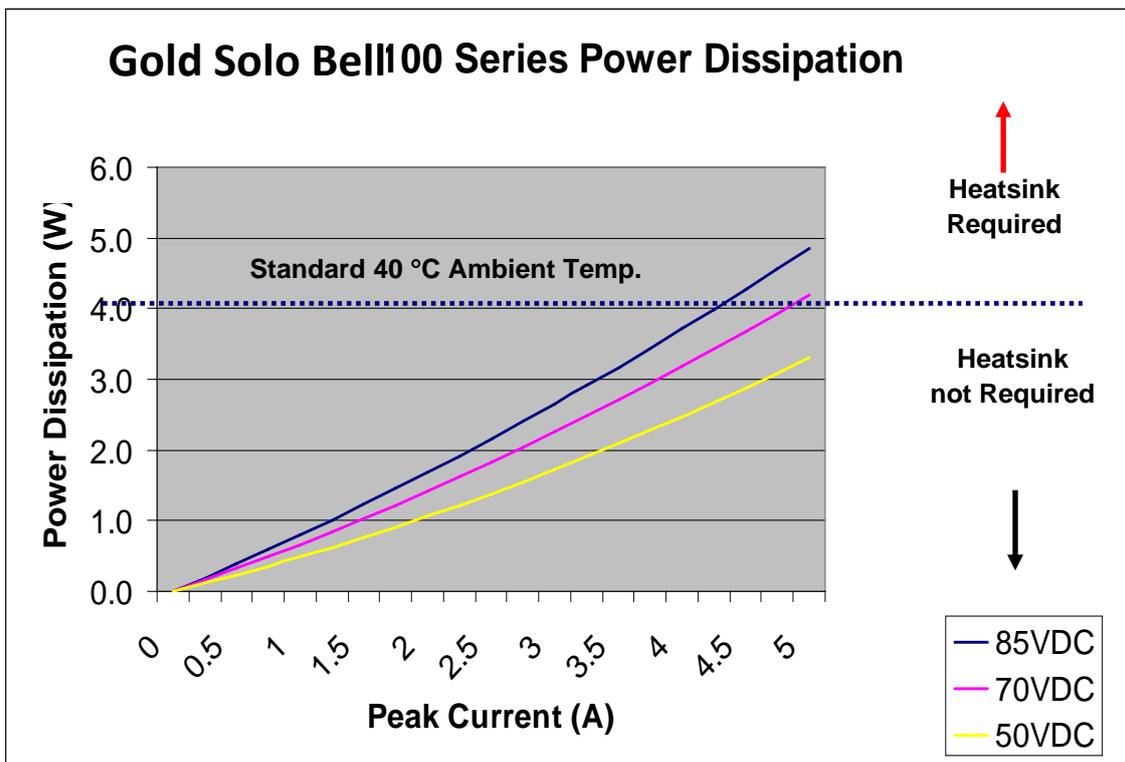
The best way to dissipate heat from the Gold Solo Bell (1 mm pitch E/C Conn.) is to mount it so that its heat sink faces up. For best results leave approximately 10 mm of space between the Gold Solo Bell (1 mm pitch E/C Conn.)'s heat sink and any other assembly.

### 7.15.1. Thermal Data

- Heat dissipation capability ( $\theta$ ): Approximately 10 °C/W
- Thermal time constant: Approximately 240 seconds (thermal time constant means that the Solo Whistle will reach 2/3 of its final temperature after 4 minutes)
- Shut-off temperature: 86 °C to 88 °C (measured on the heat sink)

### 7.15.2. Heat Dissipation Data

Heat dissipation is shown graphically below:



### 7.15.3. 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 Solo Whistle.
3. Calculate the allowable temperature increase as follows:
  - For an ambient temperature of 40 °C ,  $\Delta T = 80^{\circ}\text{C} - 40^{\circ}\text{C} = 40^{\circ}\text{C}$



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 4 W the Solo Whistle will need no additional cooling.

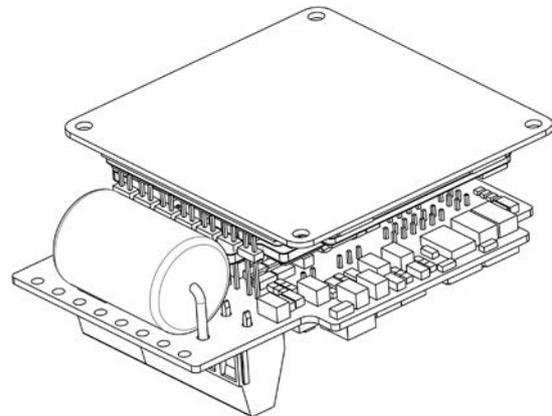
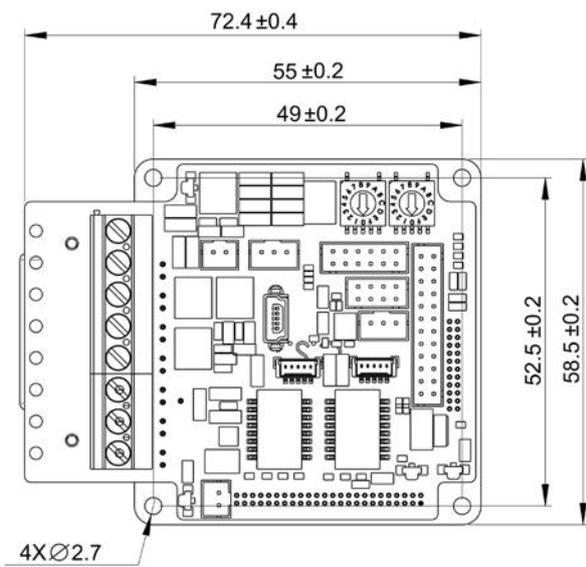
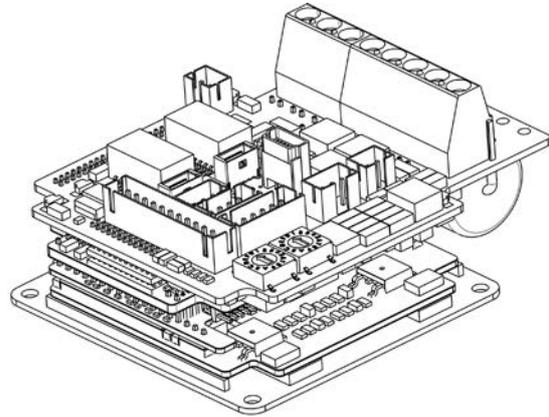
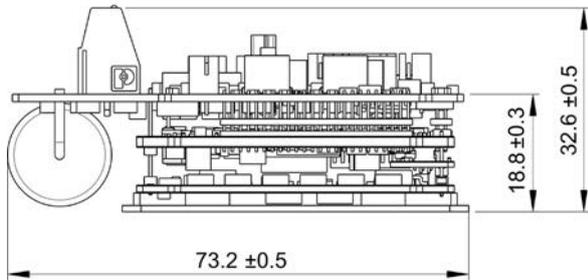
**Note:**

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 4 Watts.



## Chapter 8: Dimensions

This chapter provides detailed technical dimensions regarding the Gold Solo Bell (1 mm pitch E/C Conn.).



G-SOLBEL039B

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