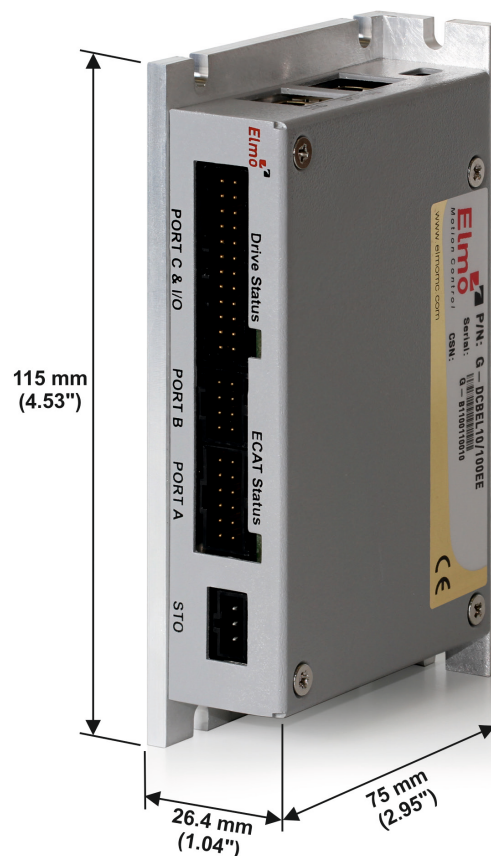


Gold DC Bell Digital Servo Drive Installation Guide EtherCAT and CAN



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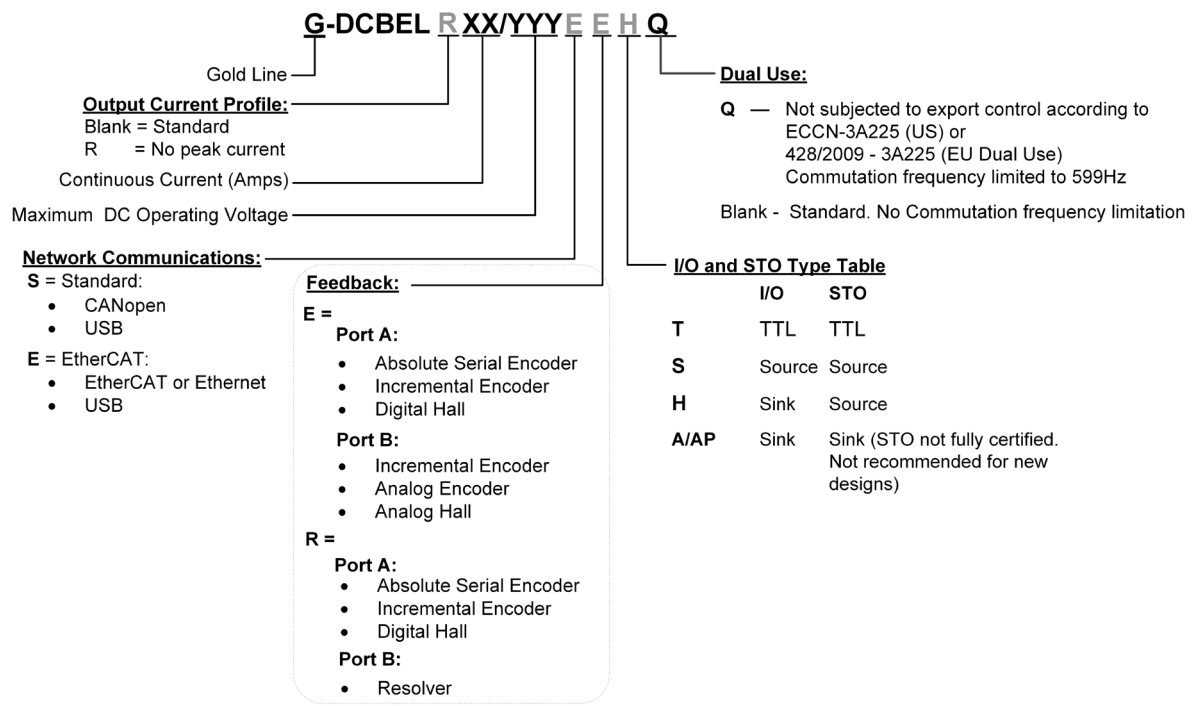
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Catalog Number



Cable Kit

Catalog number: CBL-GDCWHIKIT02 (can be ordered separately)

For further details, see the documentation for this cable kit ([MAN-G-DCWHI-CBLKIT.pdf](#)).

Revision History

Version	Date	Details
Ver. 1.200	Aug 2014	Initial release in new format
Ver. 1.201	Feb 2015	Updated
Ver. 1.202	Jul 2015	Updated
Ver. 1.203	Mar 2016	Updated
Ver. 1.204	May 2016	P/N Updated
Ver. 1.205	Aug 2017	Updated
Ver. 1.206	Nov 2020	Updated
Ver. 1.207	Sept 2021	Updated
Ver. 1.208	Dec 2021	Updated
Ver. 1.209	Jan 2023	Updated
Ver. 1.210	Aug 2023	Added Heat Dissipation



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Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold DC Bell. 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 DC Bell, 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 DC Bell 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 DC Bell 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 DC Bell 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 DC Bell 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 DC Bell, 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 DC Bell 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 DC Bell 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 DC Bell is an advanced high power density servo drive delivering up to **1.2 kW of continuous power** or **2.4 kW of peak power** in a 230.075 cc (14.04 in³) package (115 x 75 x 26.4 mm or 4.5" x 3.0" x 1.04").

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 DC Bell 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 a control power supply for the logic.

The Gold DC Bell 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 DC Bell 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 DC Bell is available in a variety of options. There are multiple power rating options, two different communications options, a variety of feedback selections and I/O configuration possibilities.

3.1.1. Accessories

Cable Kit, catalog number: CBL-GDCWHIKIT02 (can be ordered separately)

For further details, see the documentation for this cable kit ([MAN-G-DCWHI-CBLKIT.pdf](#)).



Chapter 4: Technical Information

4.1. Physical Specifications

Feature	Units	All Types
Weight	g (oz)	267 g (9.42 oz)
Dimensions	mm (in)	115 x 75 x 26.4 mm (4.5" x 3.0" x 1.04")
Mounting method		Wall Mount / Book Shelf

4.2. Technical Data

Feature	Units	1/100	2.5/100	5/100	10/100	15/100
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
Efficiency at rated power (at nominal conditions)	%	> 99				
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz				
Control power supply	VDC	12–95 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
Sinusoidal continuous RMS current limit (I _c)	A	0.7	1.8	3.5	7	10.6
Peak current limit	A	2 x I _c				

Table 1: Power Ratings

Note on current ratings: The current ratings of the Gold DC Bell 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.



Elmo offers a 200 VDC maximum output rating selection of Gold DC Bell, 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)		
Amplitude 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		

4.3. Control Supply

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



4.4. Product Features

Main Feature	Details	Presence and No.
STO	TTL, <i>or</i>	√
	PLC Source, <i>or</i>	√
	PLC Sink (is not fully certified, and not recommended for new designs)	√
Digital Input Option	TTL, <i>or</i>	6
	PLC Source, <i>or</i>	6
	PLC Sink	6
Digital Output Option	TTL, <i>or</i>	4
	PLC Source, <i>or</i>	4
	PLC Sink	4
Analog Input	Differential ±10V	1
Feedback	Standard Port A, B, & C	√
Communication Option	USB	√
	EtherCAT option	√
	CAN option	√



4.5. Environmental Conditions

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

Chapter 5: Standards and Certifications

5.1. Functional Safety

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



	programmable electronic safety-related systems
--	--

5.2. Electrical Safety

Specification	Details
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.

5.7. Dual Use

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

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

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



Chapter 6: Installation

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

6.1. Unpacking the Drive Components

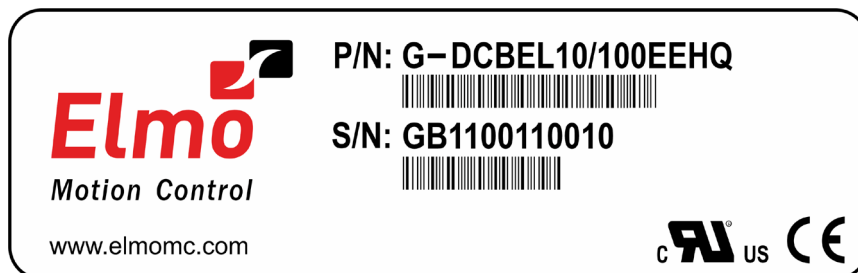
Before you begin working with the Gold DC Bell, verify that you have all of its components, as follows:

- The Gold DC Bell servo drive
- The Elmo Application Studio software and software manual

The Gold DC Bell is shipped in a cardboard box with Styrofoam protection.

To unpack the Gold DC Bell:

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



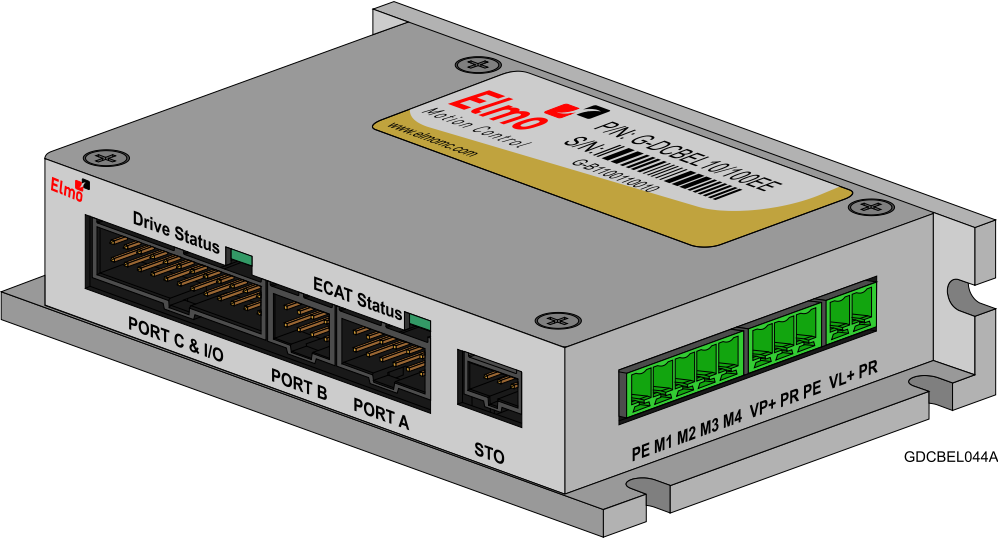
4. Verify that the Gold DC Bell type is the one that you ordered, and ensure that the voltage meets your specific requirements.

The part number at the top provides the type designation. Refer to the appropriate part number in the section Catalog Number at the beginning of the installation guide.



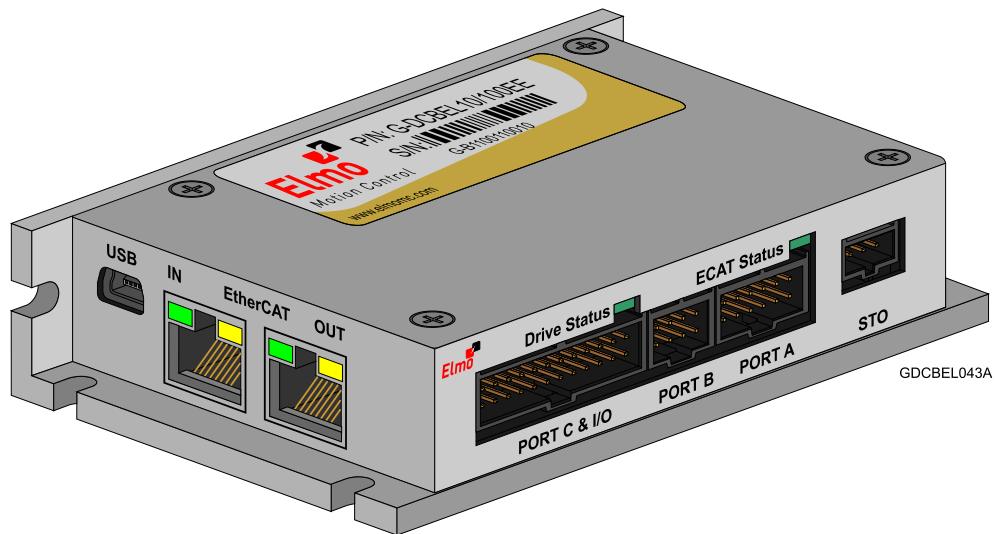
6.2. Connector Types

The Gold DC Bell has ten connectors.

No. Pins	Type	Function
Bottom Connectors		
		
5	Phoenix 3.81 mm Pitch	Motor phases+PE
3	Phoenix 3.81 mm Pitch	Main Power
2	Phoenix 3.81 mm Pitch	Control supply input

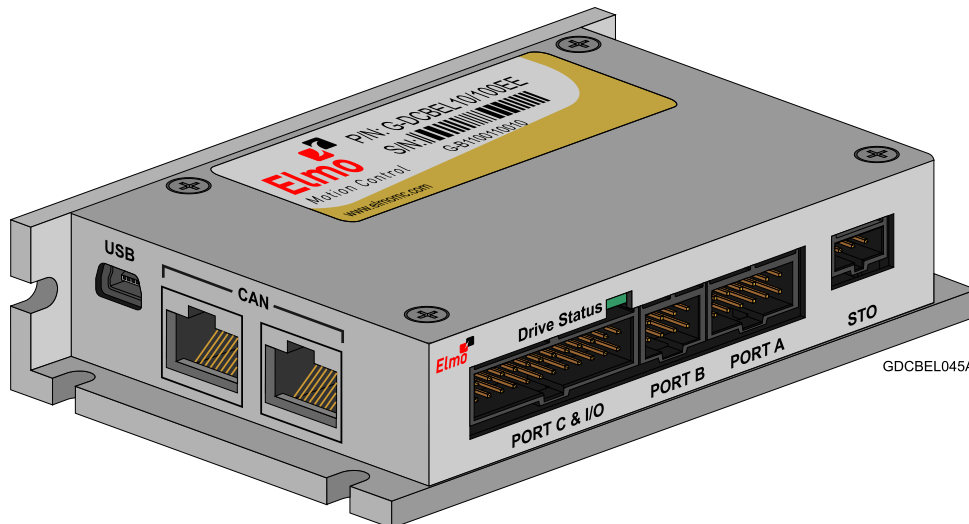


Front Connectors



GDCBEL043A

Front Connectors - EtherCAT



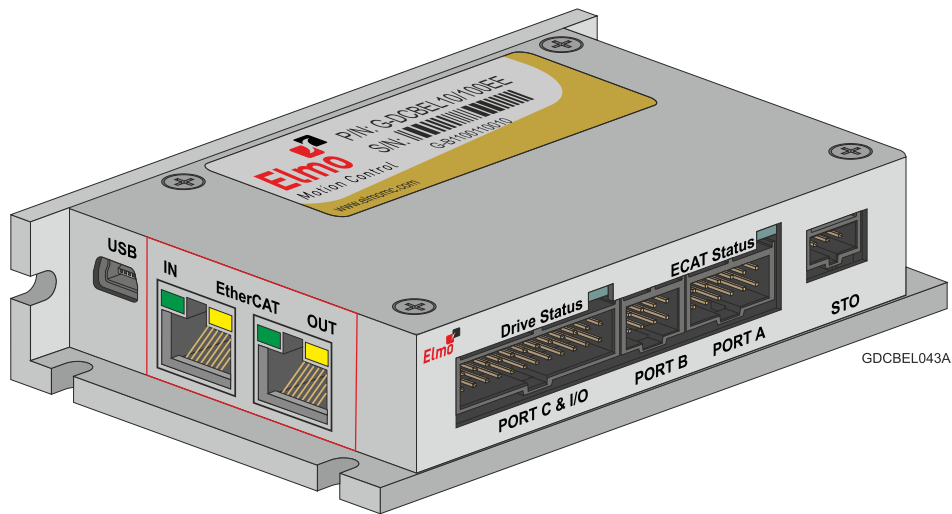
GDCBEL045A

Front Connectors - CAN

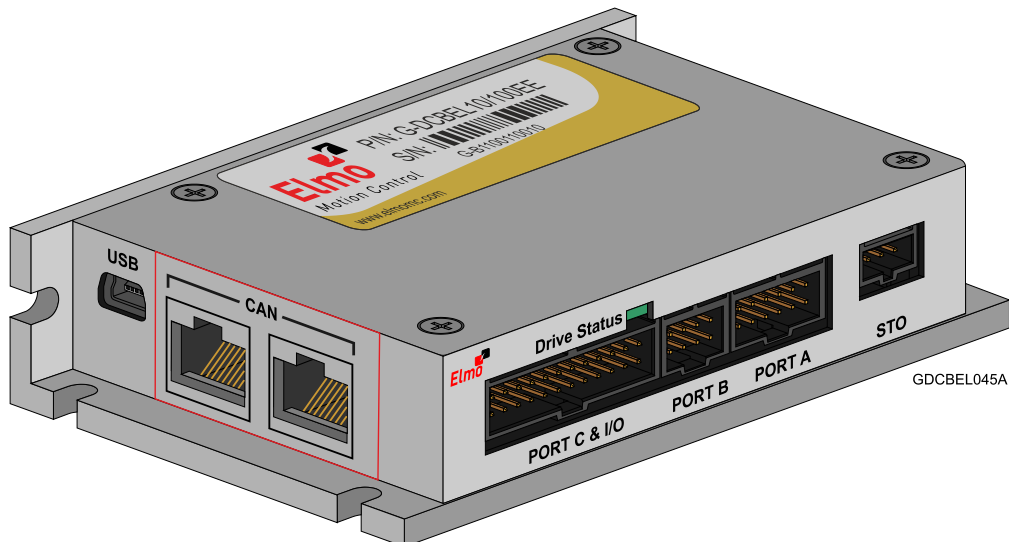
3	2.54 mm Pitch Molex	STO
24	2.54 mm Pitch Molex	Feedback port C and I/O
8	2.54 mm Pitch Molex	Feedback port B
12	2.54 mm Pitch Molex	Feedback port A



Top Connectors



Top Connectors - EtherCAT



Top Connectors - CAN

5	USB Device Mini-B	USB
EtherCAT Version		
8	RJ-45	EtherCAT In
8	RJ-45	EtherCAT Out
CAN Version		
8	RJ-45	CAN
8	RJ-45	CAN

Table 2: Connector Types

The pinouts in Chapter 7: Wiring describe the function of each pin in the Gold DC Bell connectors that are listed in Table 2.



6.3. Mounting the Gold DC Bell

The Gold DC Bell has been designed for two standard mounting options:

- Wall Mount along the back (can also be mounted horizontally on a metal surface)
- Book Shelf along the side

M4 round head screws, one through each opening in the heat sink, are used to mount the Gold DC Bell (see the diagram below).

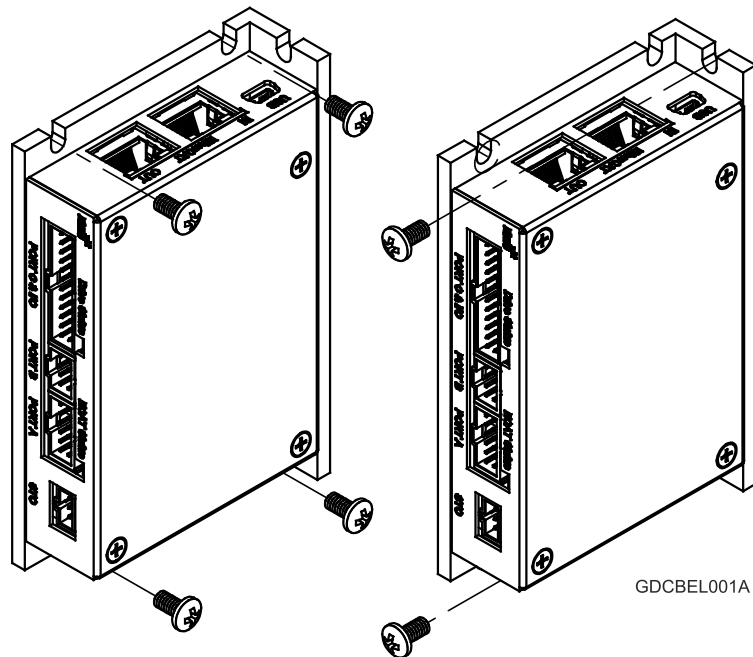


Figure 1: Mounting the Gold DC Bell



6.4. The Gold DC Bell Connection Diagram

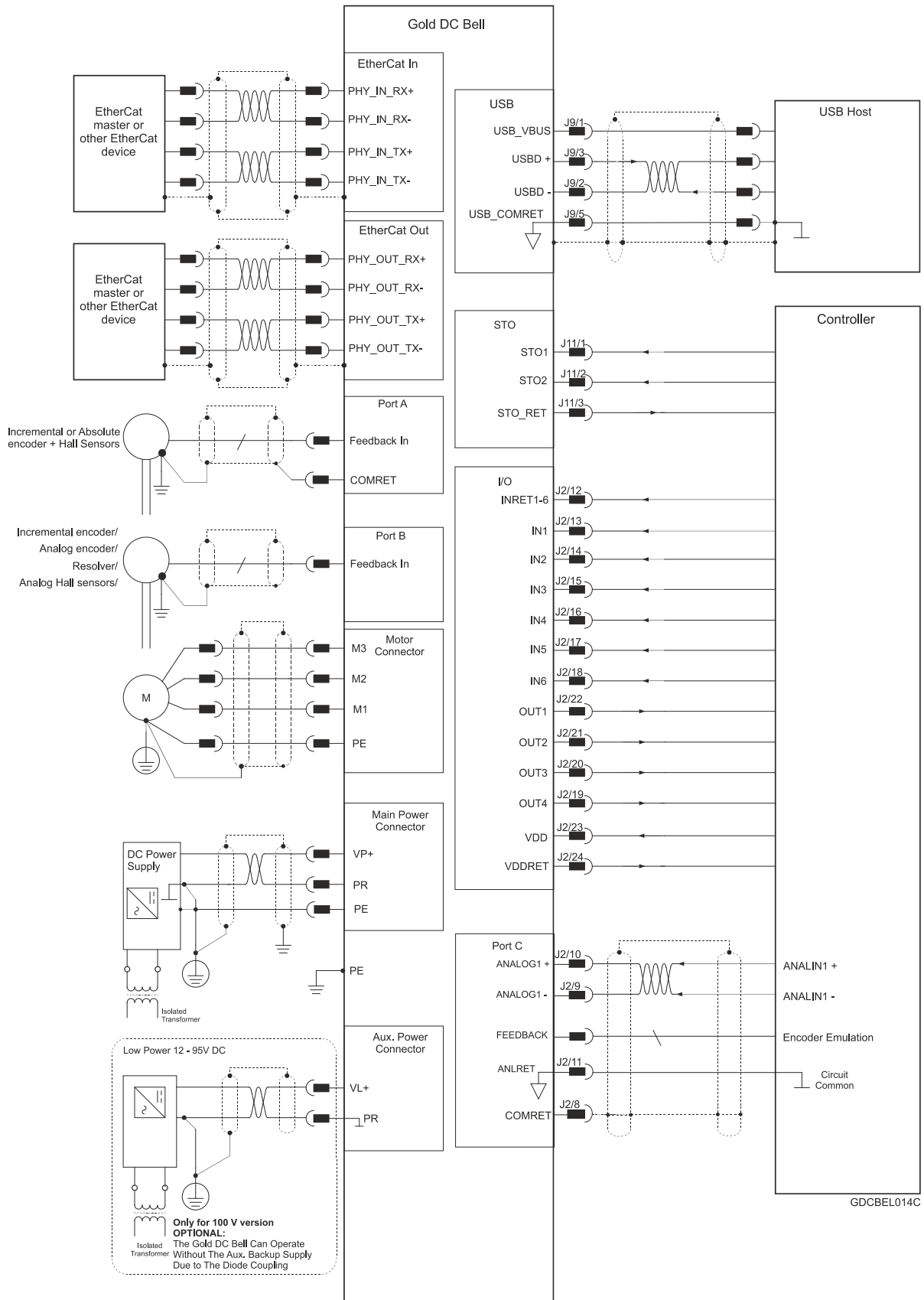


Figure 2: The Gold DC Bell Connection Diagram - EtherCAT

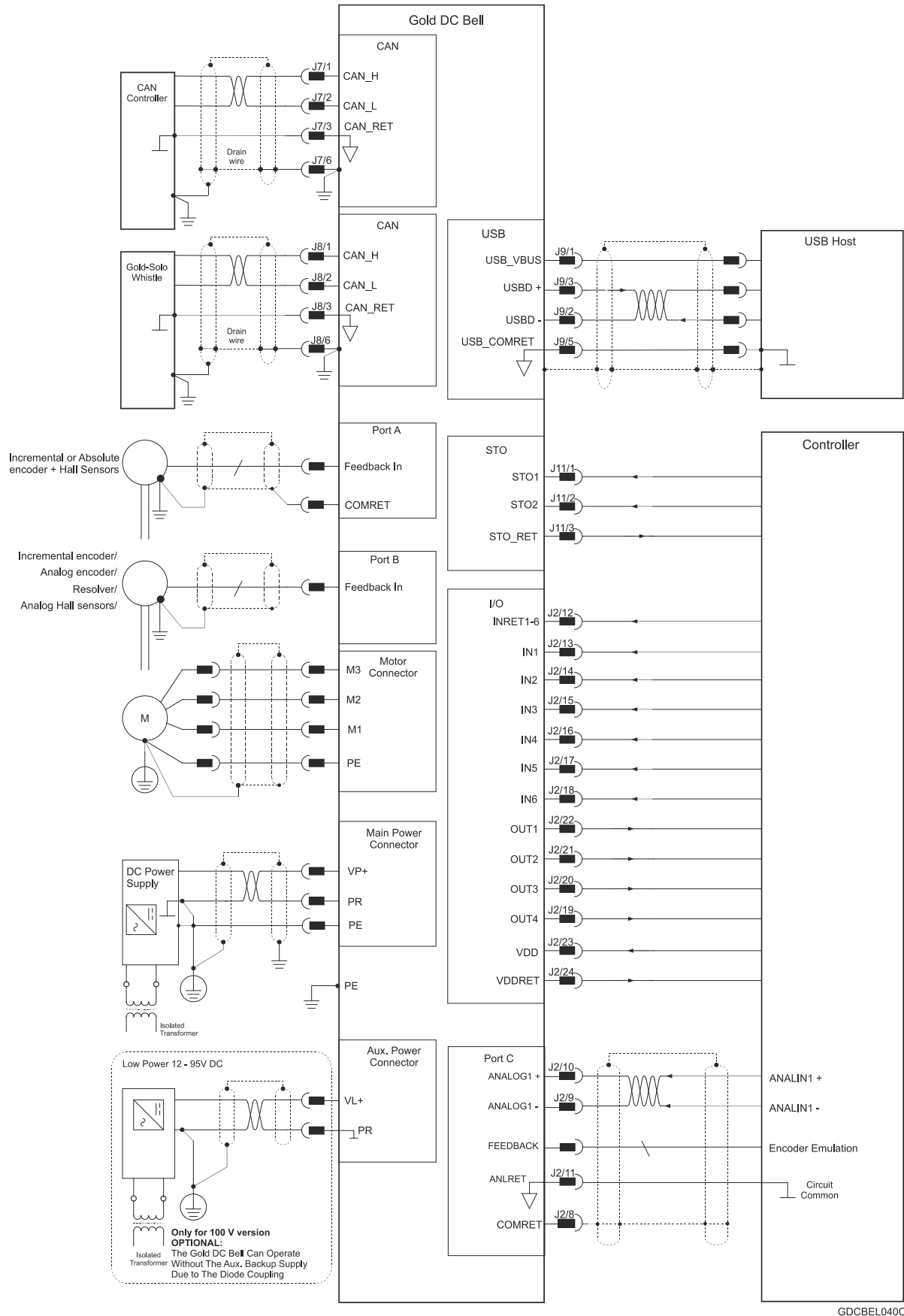


Figure 3: The Gold DC Bell Connection Diagram – CAN



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
 GGEN_DTYPE101A-A	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
 GGEN_DTYPE101A-B	Shielded cable braid only, without drain wire.
 GGEN_DTYPE101A-E	Twisted-pair wires
 GGEN_DTYPE101C-I	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.

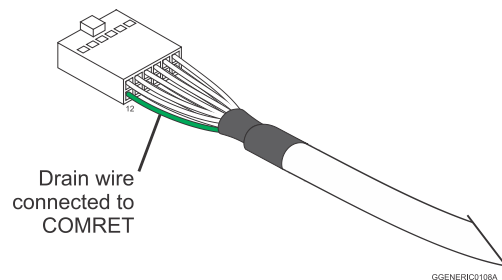


Figure 4: Feedback and Molex Control Cable Assemblies

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 5).

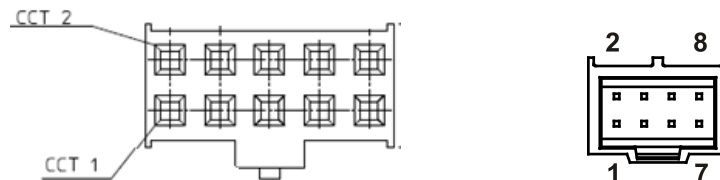


Figure 5: Molex vs Elmo Technical Diagram Examples Showing Pinout Numbers

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.



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 Molex 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 6).

The drawing displays two earth connections.

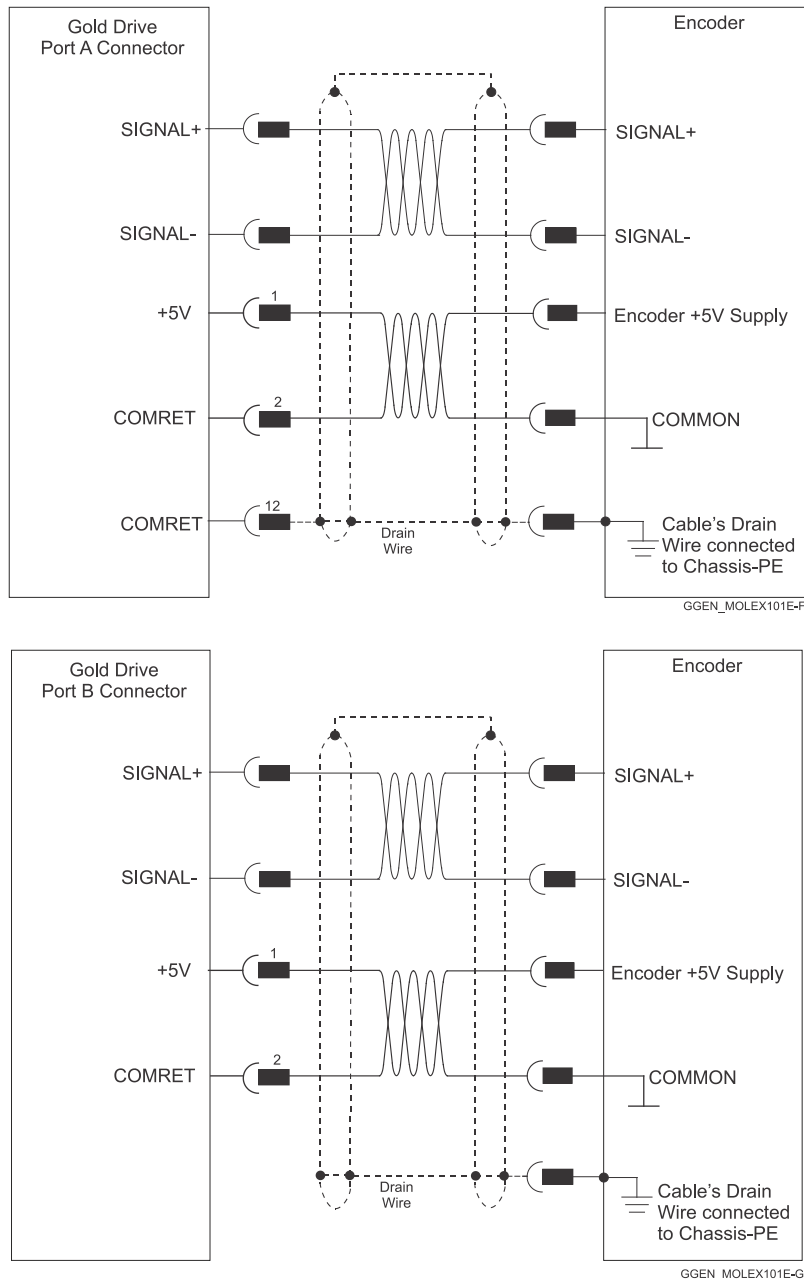


Figure 6: Feedback Port A and B Cable Assemblies



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.

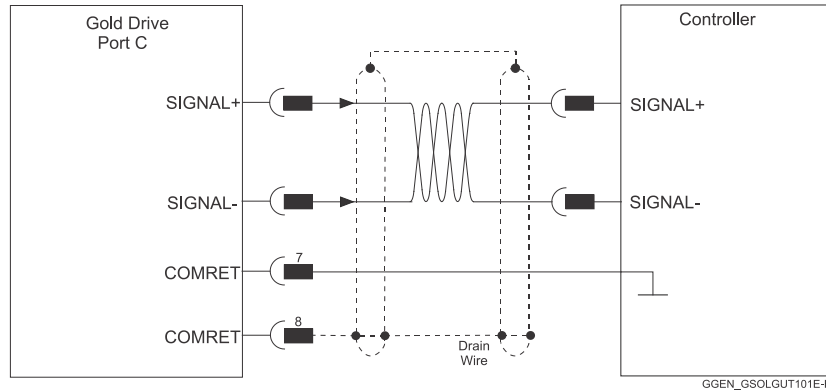


Figure 7: Feedback Port C Cable Assemblies

7.1.4. IO Cable Connector

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

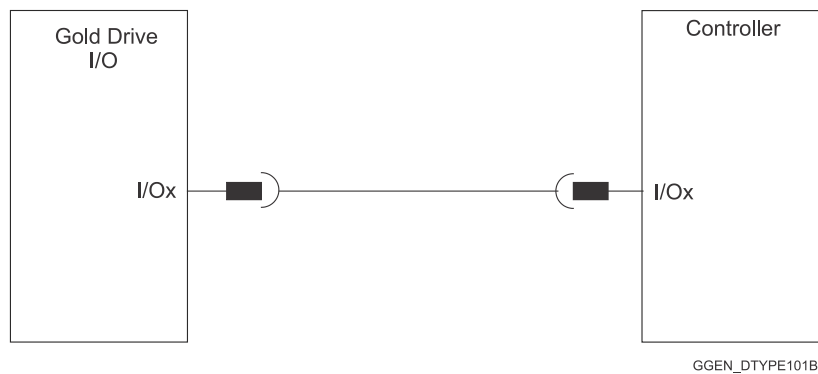


Figure 8: Feedback IO Cable Assemblies

7.1.5. STO (Port C) Cable Connector

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

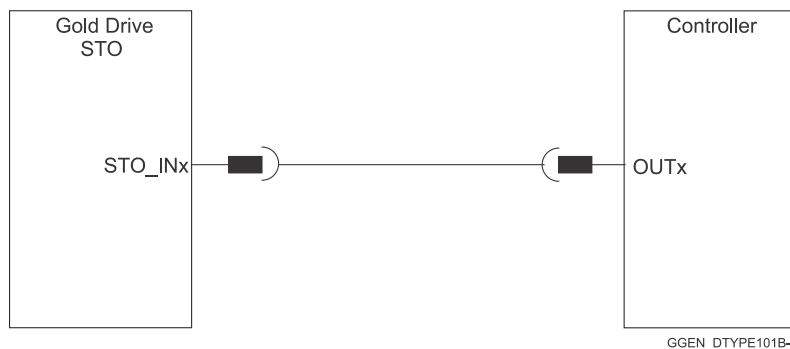


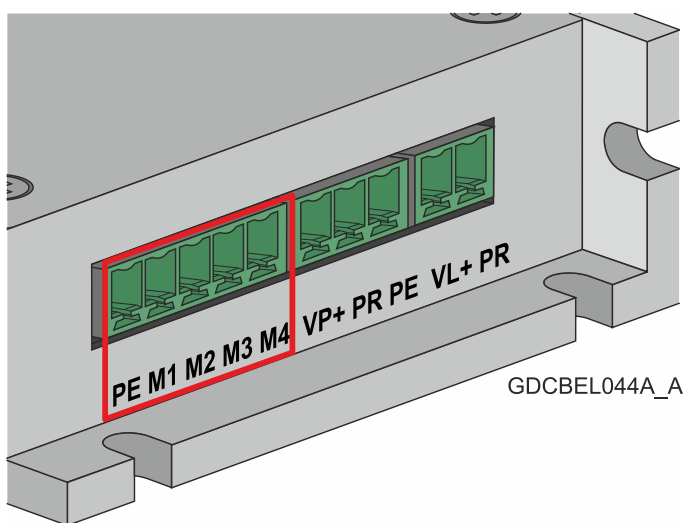
Figure 9: STO Cable Assemblies



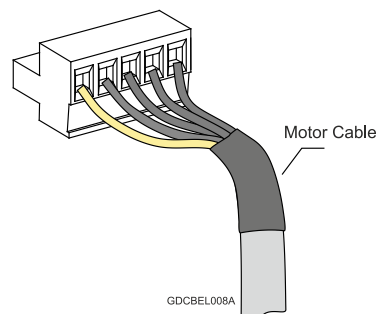
7.2. Motor Power Connector Pinouts(J14)

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

Pin(J14)	Signal	Function	Cable		
			Brushless Motor	Brushed DC Motor	Stepper Motor
1	PE	Protective Earth	Motor	Motor	Motor
2	M1	Motor phase	Motor	N/C	Motor Phase 1+
3	M2	Motor phase	Motor	Motor	Motor Phase 1-
4	M3	Motor phase	Motor	Motor	Motor Phase 2+
5	M4	Motor phase	N/C	N/C	Motor Phase 2-



5-Pin Phoenix 3.81 mm Pitch



5-Pin Phoenix Plug-in Connector

Table 3: Connectors for Motor

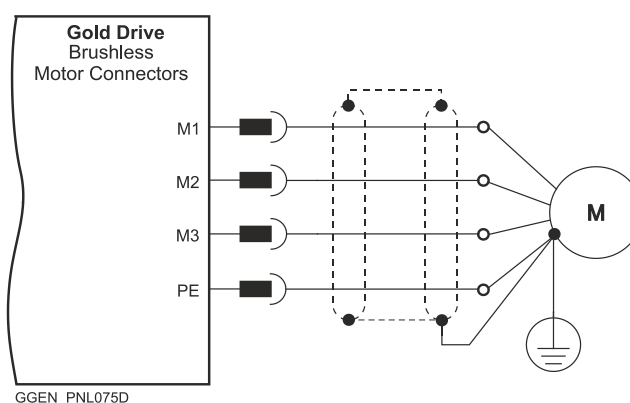


Figure 10: Brushless Motor Power Connection Diagram

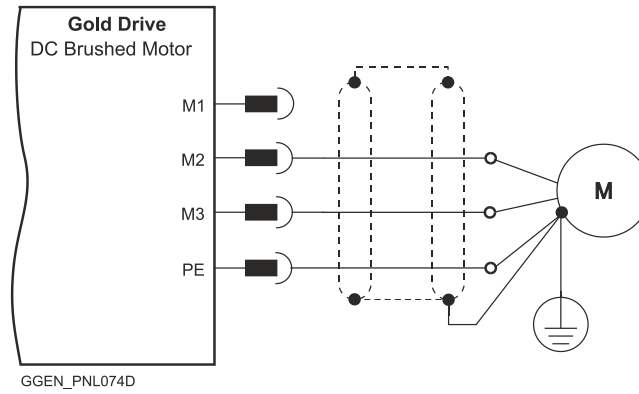


Figure 11: DC Brushed Motor Power Connection Diagram

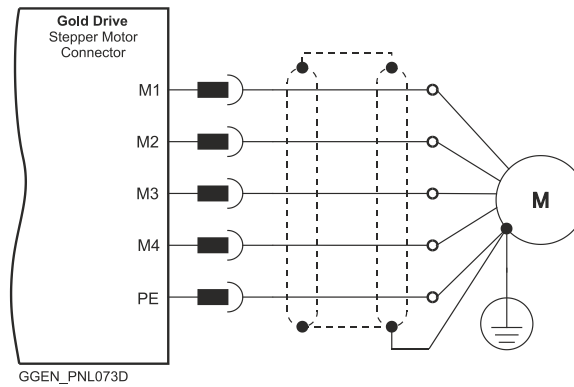


Figure 12: Stepper Motor Power Connection Diagram



7.3. Main and Control Power

The Gold DC Bell 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 DC Bell Power rating is 12 to 195 VDC**
- **There are Two power ratings for Gold DC Bell; 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 DC Bell is provided by a 12–95 VDC single isolated DC power source (not included with the Gold DC Bell). A “smart” control-supply algorithm enables the Gold DC Bell 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 DC Bell’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 DC Bell, therefore the correct power supply must be used, according to the maximum operating voltage of the Gold DC Bell. Refer to section 4.2 Technical Data.



7.3.2. Main Power (J13)

Pin(J13)	Signal	Function	Cable
3	VP+	Positive Power input	DC Power
2	PR	Power return	DC Power
1	PE	Protective earth	DC Power

<p>3-Pin Phoenix 3.81 mm Pitch</p>	<p>3-Pin Phoenix Plug-in Connector</p>
------------------------------------	--

Table 4: Connectors for Main Power

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(J12)

Pin(J12)	Signal	Function	Cable
1	VL+	Control Supply Input	DC Power
2	PR	Control Supply Return	DC Power

2-Pin Phoenix 3.81 mm Pitch

Aux. Power Cable

2-Pin Phoenix Plug-in Connector

Table 5: Control Power Connector – Pin Assignments



Caution: Power from the Gold DC Bell 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
4. Before applying power, first verify the polarity of the connection.



7.3.3.1. 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.

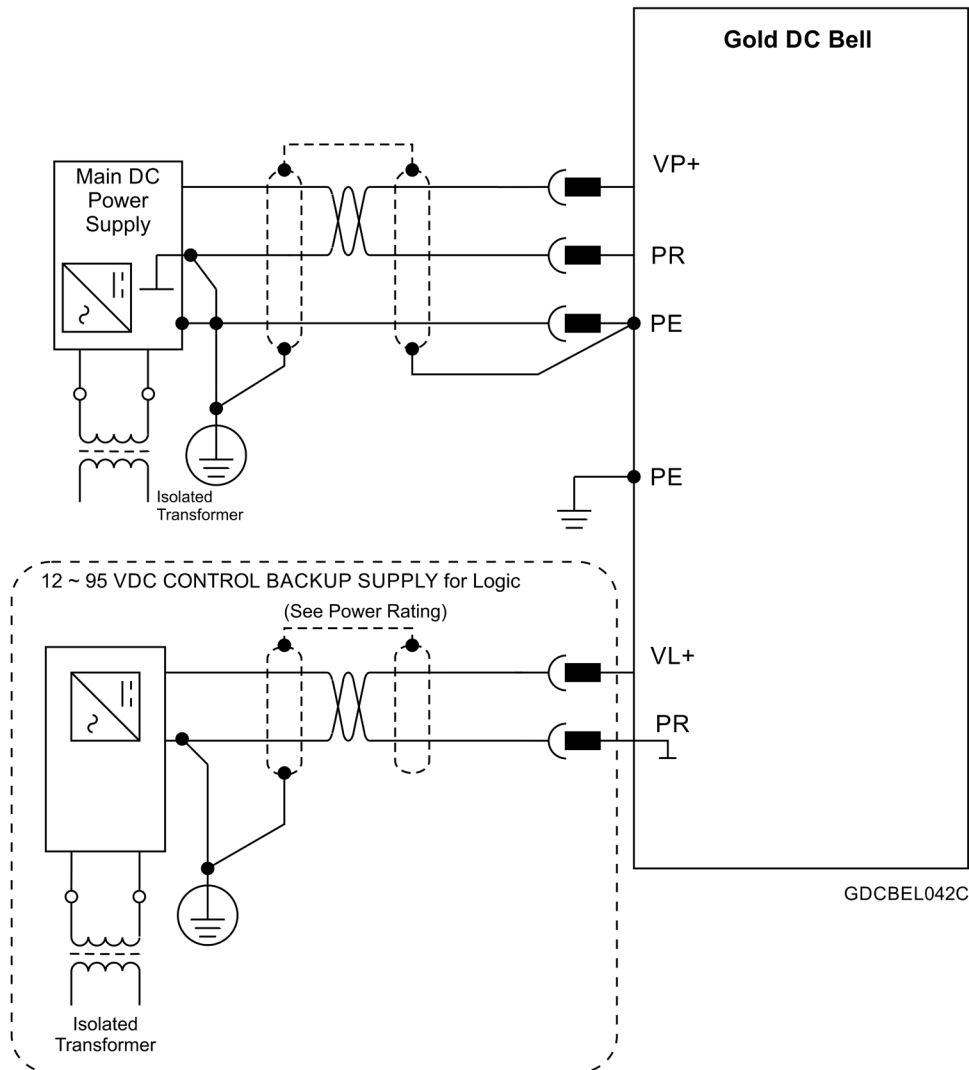


Figure 13: 200 VDC Power Source Connection Diagram



7.3.3.2. Power Rating 100 V

7.3.3.2.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 DC Bell to operate with only one power supply with no need for an control power supply for the logic.

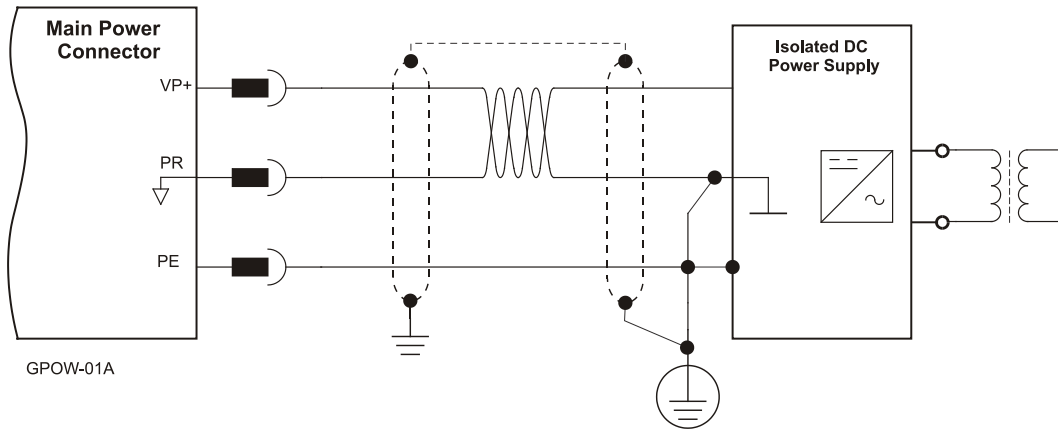


Figure 14: Main Power Supply Connection Diagram (no Control Supply)

7.3.3.2.b Optional Backup Supply

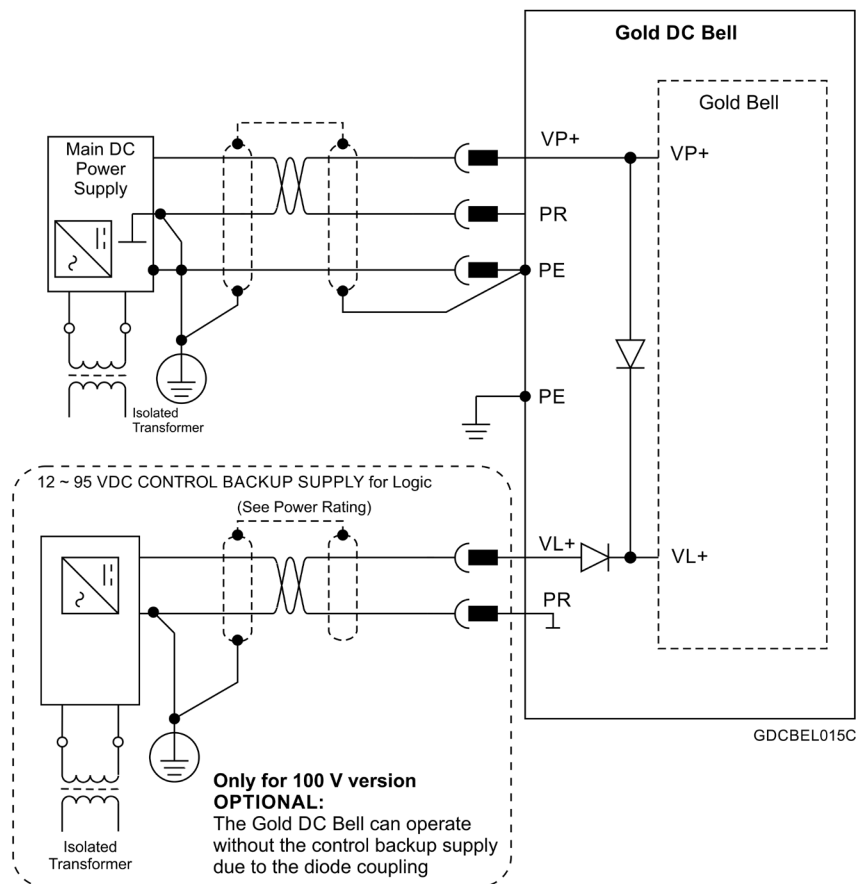


Figure 15: Control Power Supply Connections Diagram



7.4. 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.

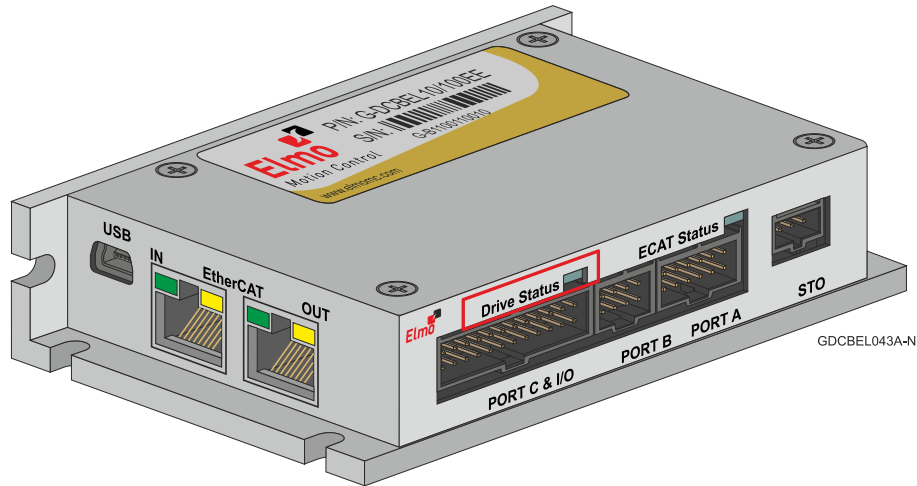


Figure 16: Drive Status Indicator - EtherCAT

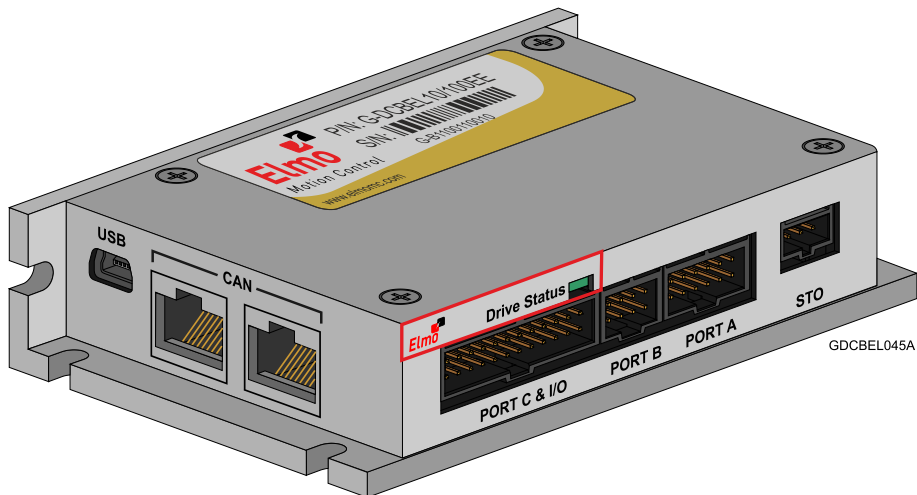


Figure 17: Drive Status Indicator - CAN

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

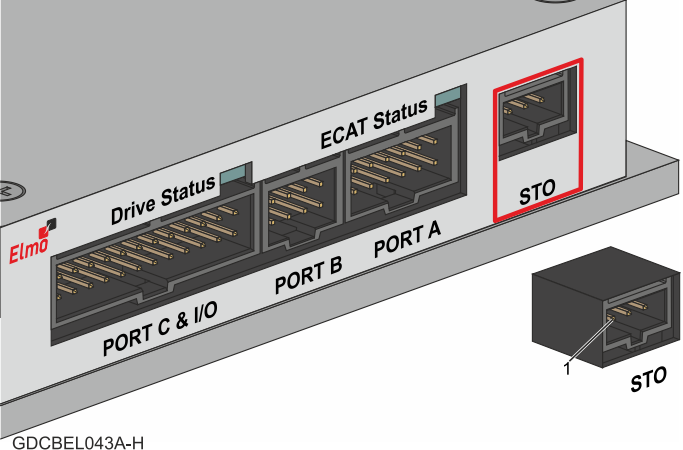
- **Initiation state:** In this state the LED indicates whether the drive is in the boot state (blinking red) or in the operational state (steady red).
- **Working state:** In this state the LED indicates whether the drive is in an amplifier failure state (red) or is ready to enable the motor (green).



7.5. STO (Safe Torque Off)(J11)

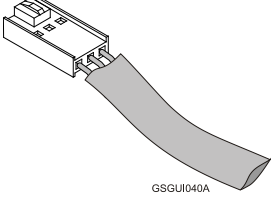
See Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Pin(J11)	Signal	Function
1	STO1	STO1 input (default 24 V)
2	STO2	STO2 input (default 24 V)
3	STO_RET	STO signal return



GDCBEL043A-H

3-Pin 2.54 mm Pitch Molex



GSGUI040A

3-Pin Molex Plug

This cable is included in the cable kit described in Section 3.1.1.

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.

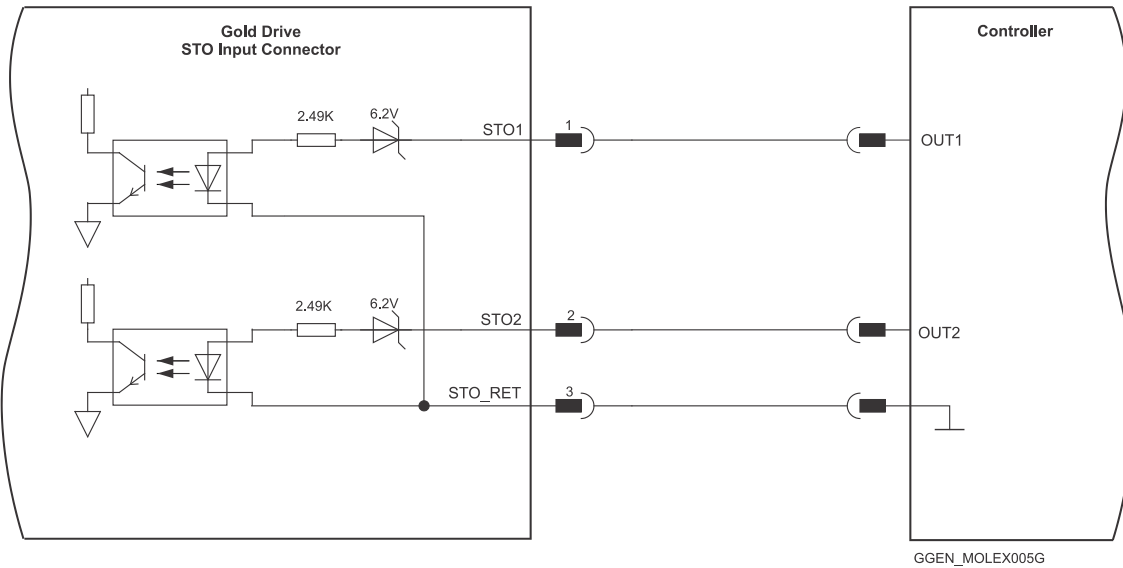


Figure 18: STO Molex Type Input Connection – PLC Source Option

7.5.2. TTL Mode – TTL Voltage Level

Refer to the diagrams below for TTL option connection.

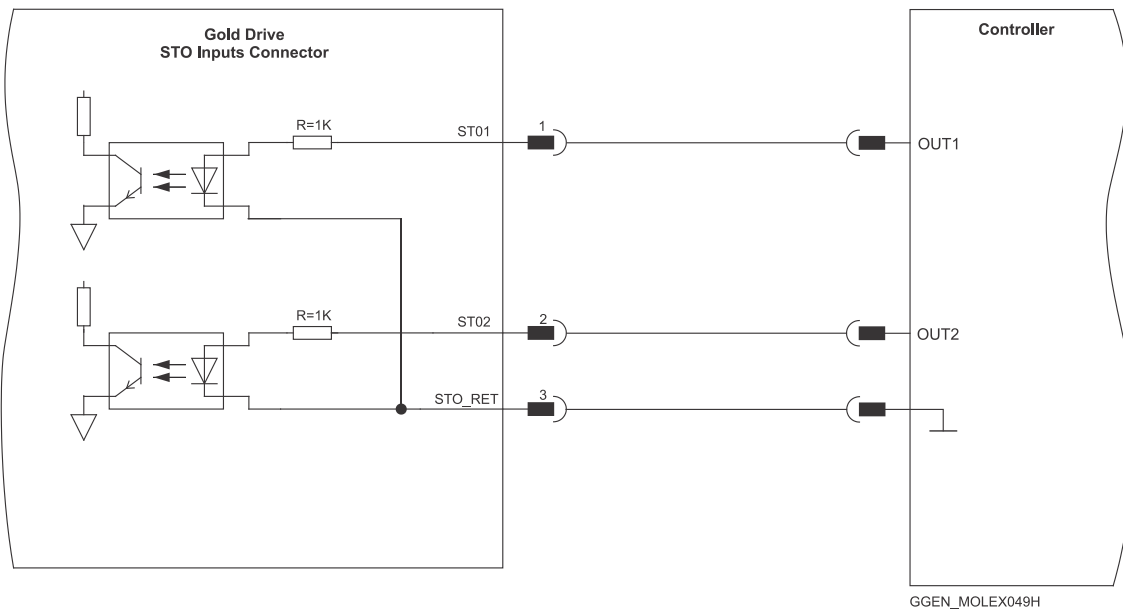


Figure 19: STO Input Connection – TTL Option



7.5.3. Sink Mode – PLC Voltage Level

Refer to the diagrams below for the PLC Sink option connections which is not fully certified for STO.
This option is not recommended for new designs.

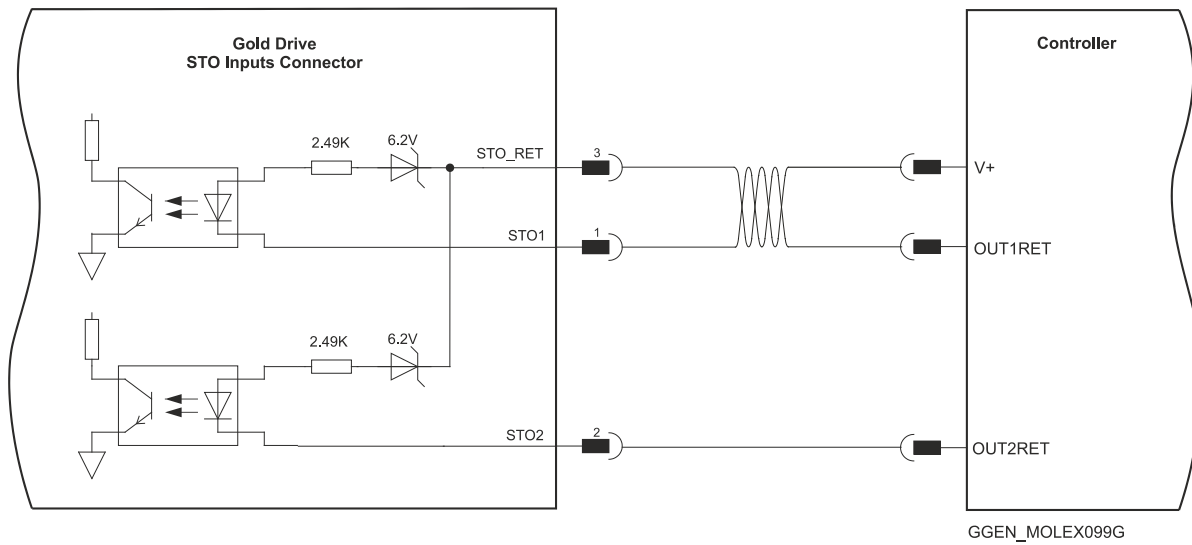


Figure 20: STO Input Connection – Sink Option



7.6. Port A(J1)

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

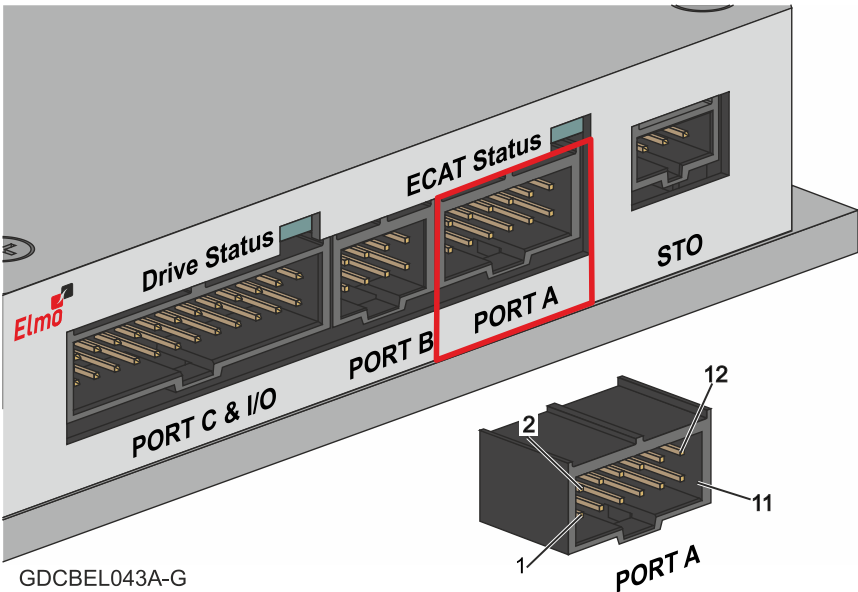
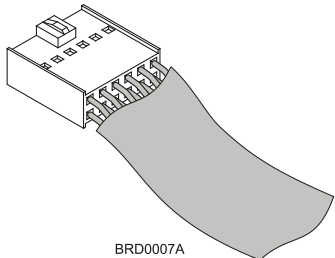
Incremental Encoder			Absolute Serial Encoder	
Pin(J1)	Signal	Function	Signal	Function
1	+5V	Encoder +5V supply	+5V	Encoder +5V supply
2	COMRET	Common Return	COMRET	Common Return
3	PortA_ENC_A+	Channel A +	ABS_CLK+	Absolute encoder clock+
4	PortA_ENC_A-	Channel A -	ABS_CLK-	Absolute encoder clock-
5	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>GDCBEL043A-G</p> <p>12-Pin 2.54 mm Pitch Molex</p>			 <p>BRD0007A</p> <p>12-Pin Molex Plug</p> <p>This cable is included in the cable kit described in Section 3.1.1.</p>	

Table 7: Port A Pin Assignments



7.6.1. Incremental Encoder

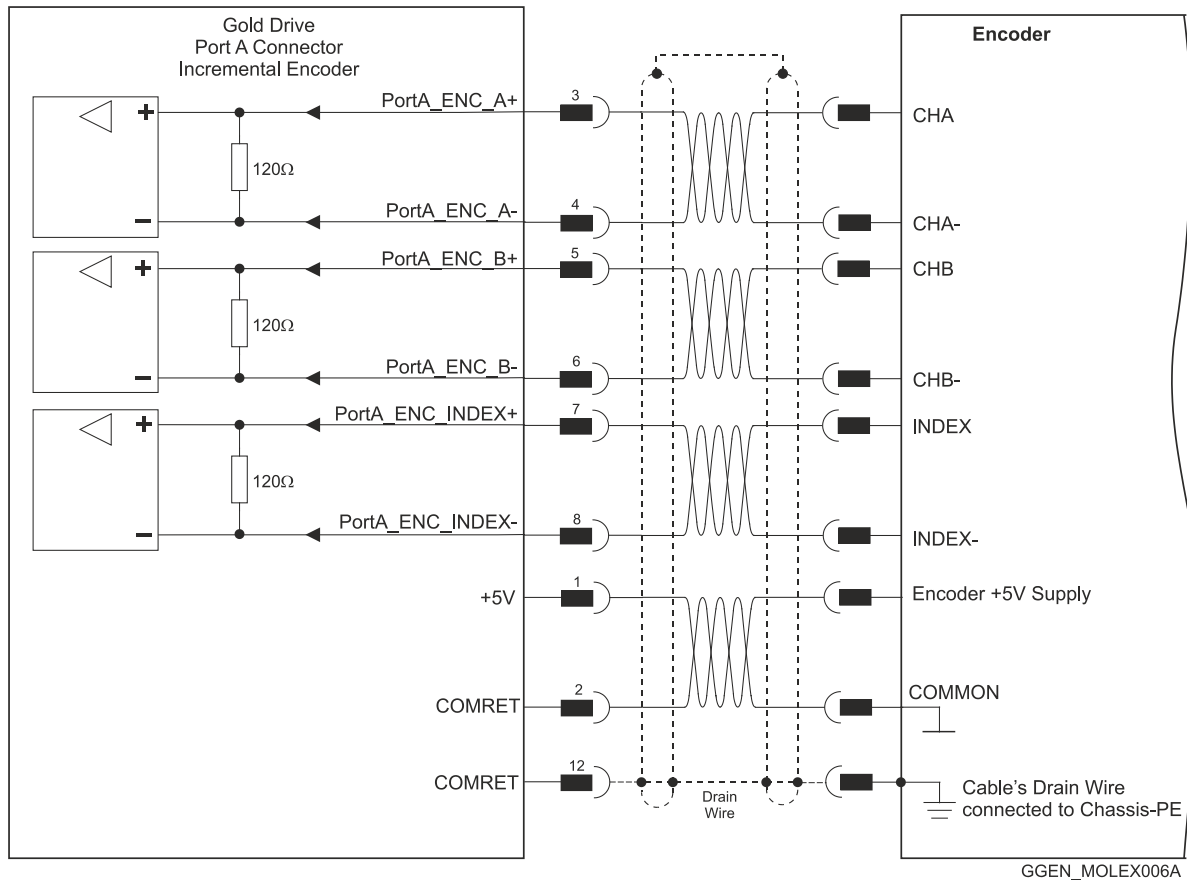


Figure 21: Port A Molex Type Incremental Encoder Input – Recommended Connection Diagram

7.6.2. Halls Sensor

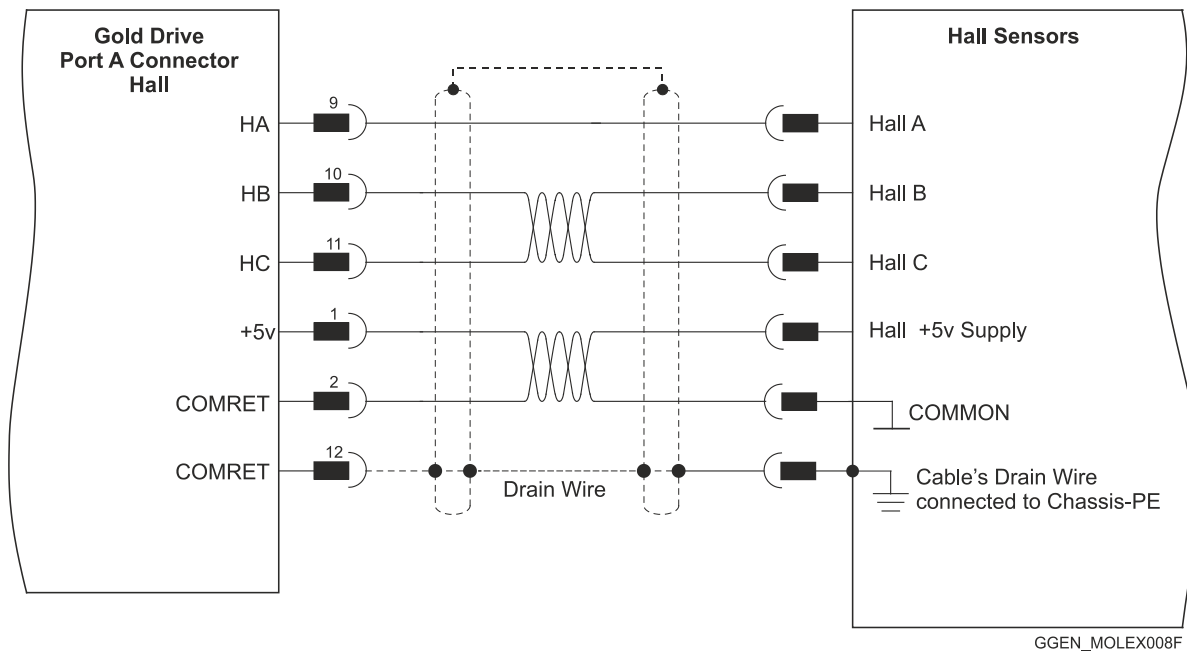


Figure 22: Molex Type Hall Sensors Connection Diagram



7.6.3. Absolute Serial Encoder

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

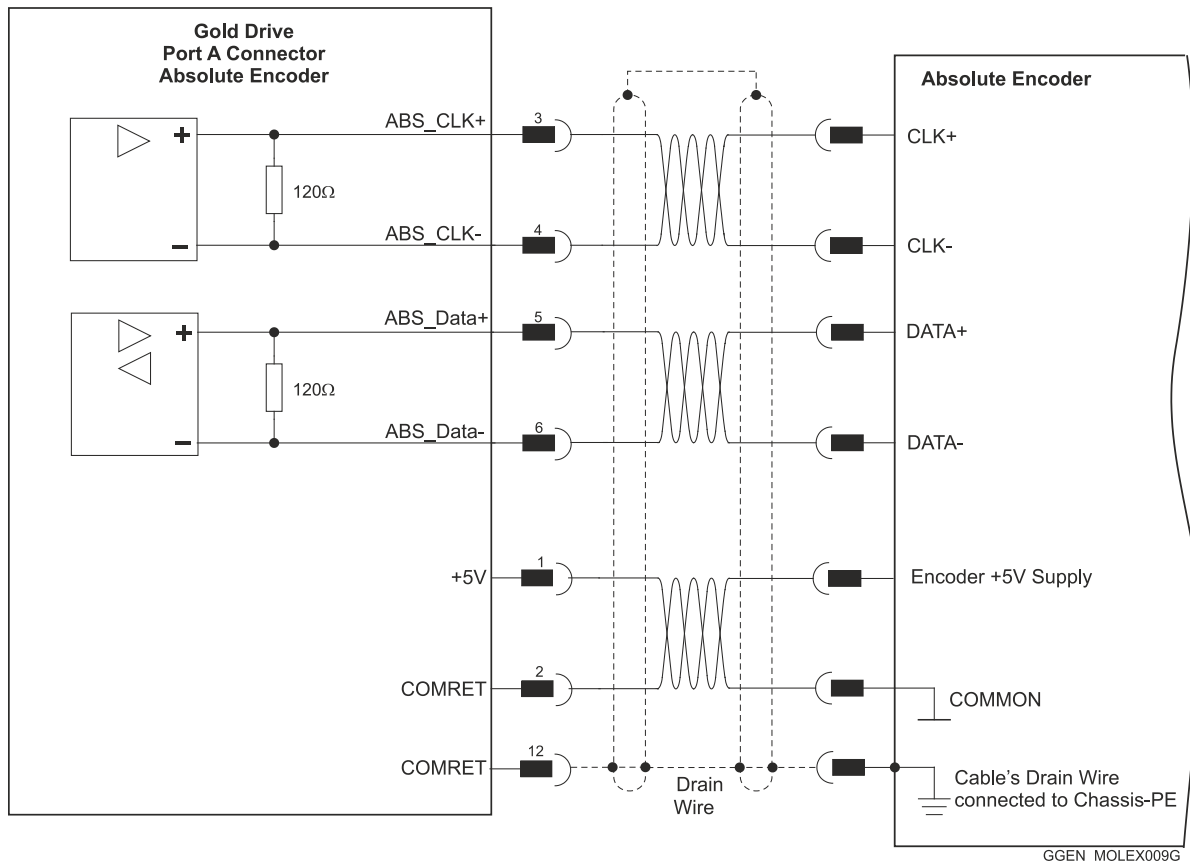


Figure 23: Absolute Serial Encoder – Recommended Connection Diagram for EnDAT, Biss, SSI

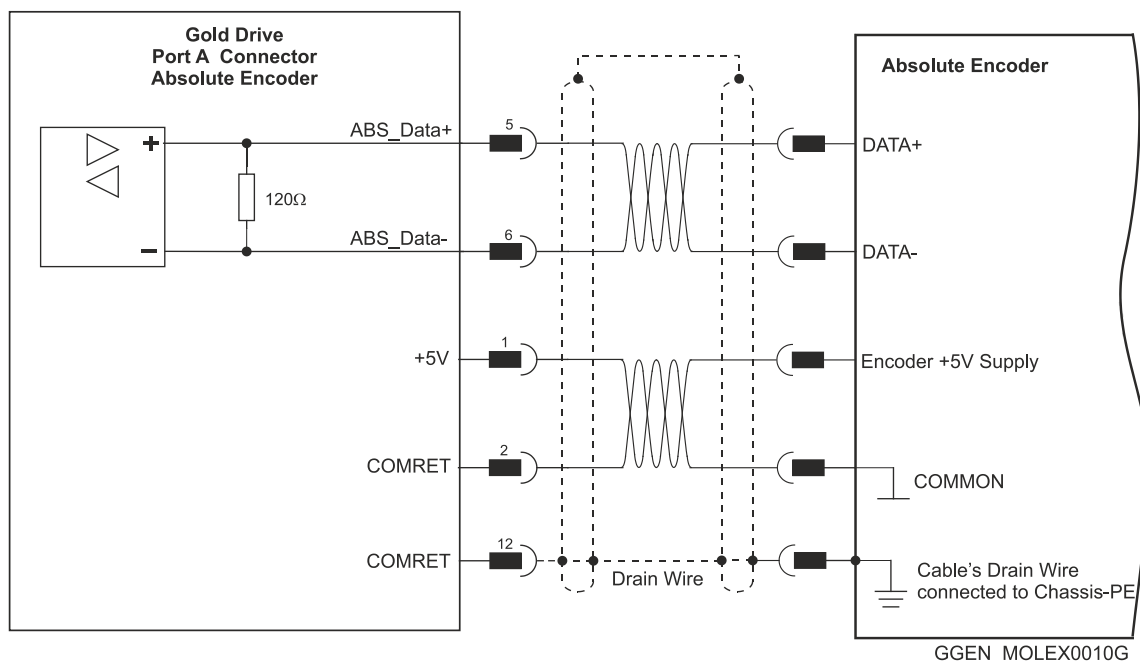


Figure 24: Absolute Serial Encoder – Recommended Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)



7.6.3.1. Hiperface

The following figure describes the connection diagram.

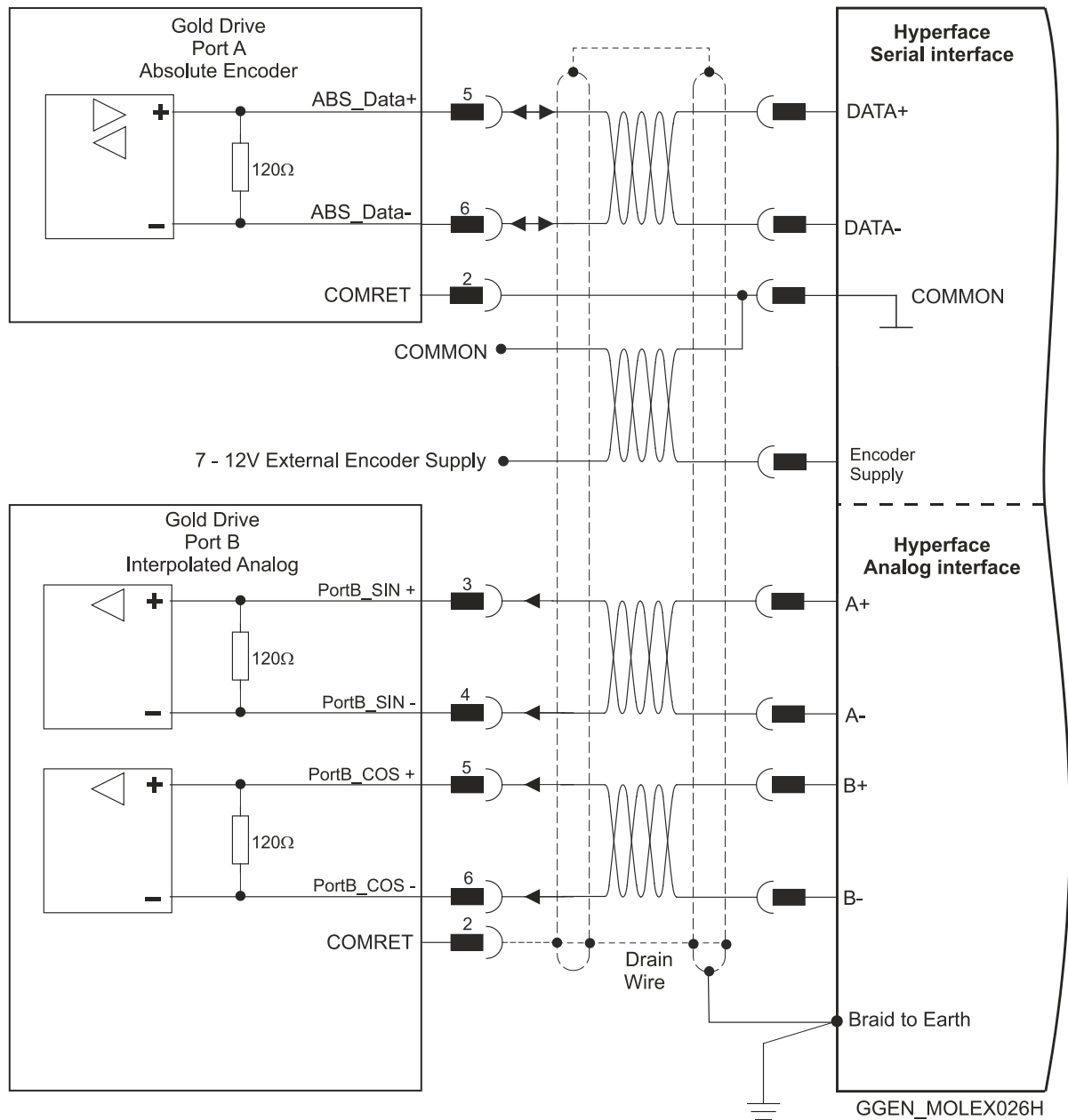


Figure 25: Absolute Serial Encoder – Recommended Molex Type Connection Diagram for Stegmann Hiperface



7.7. Port B(J3)

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-DCBEL ^{xxx} / ^{yyyy} E ^{xx} Q			G-DCBEL ^{xxx} / ^{yyyy} R ^{xx} Q	
Pin(J3)	Signal	Function	Signal	Function
1	+5 V	Encoder +5 V 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 Maximum

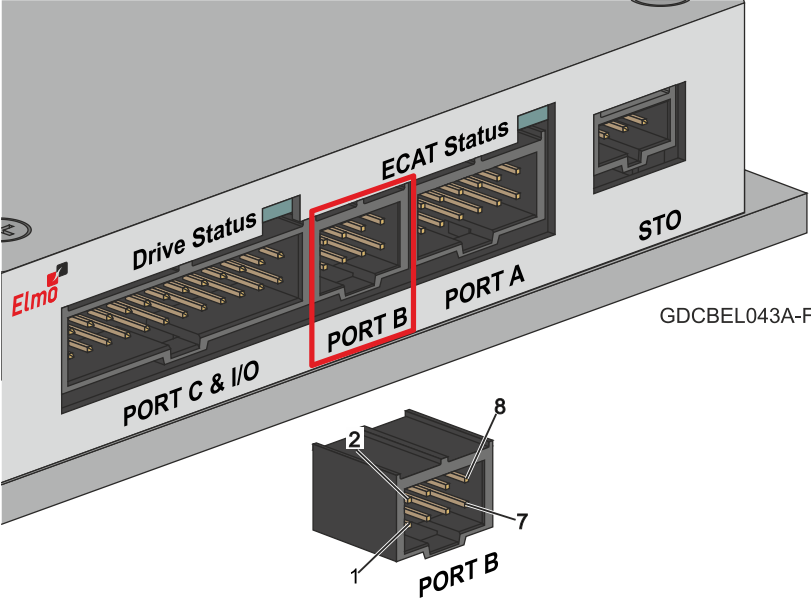
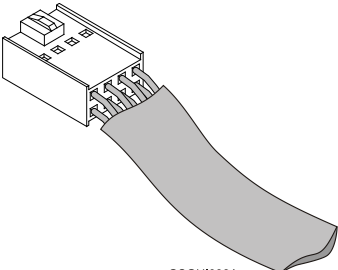
Pin Positions	Cable Connector
 <p style="text-align: center;">8-Pin 2.54 mm Pitch Molex</p>	 <p style="text-align: center;">8-Pin Molex Plug</p> <p>This cable is included in the cable kit described in Section 3.1.1.</p>

Table 8: Port B Pin Assignments



7.7.1. Incremental Encoder

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

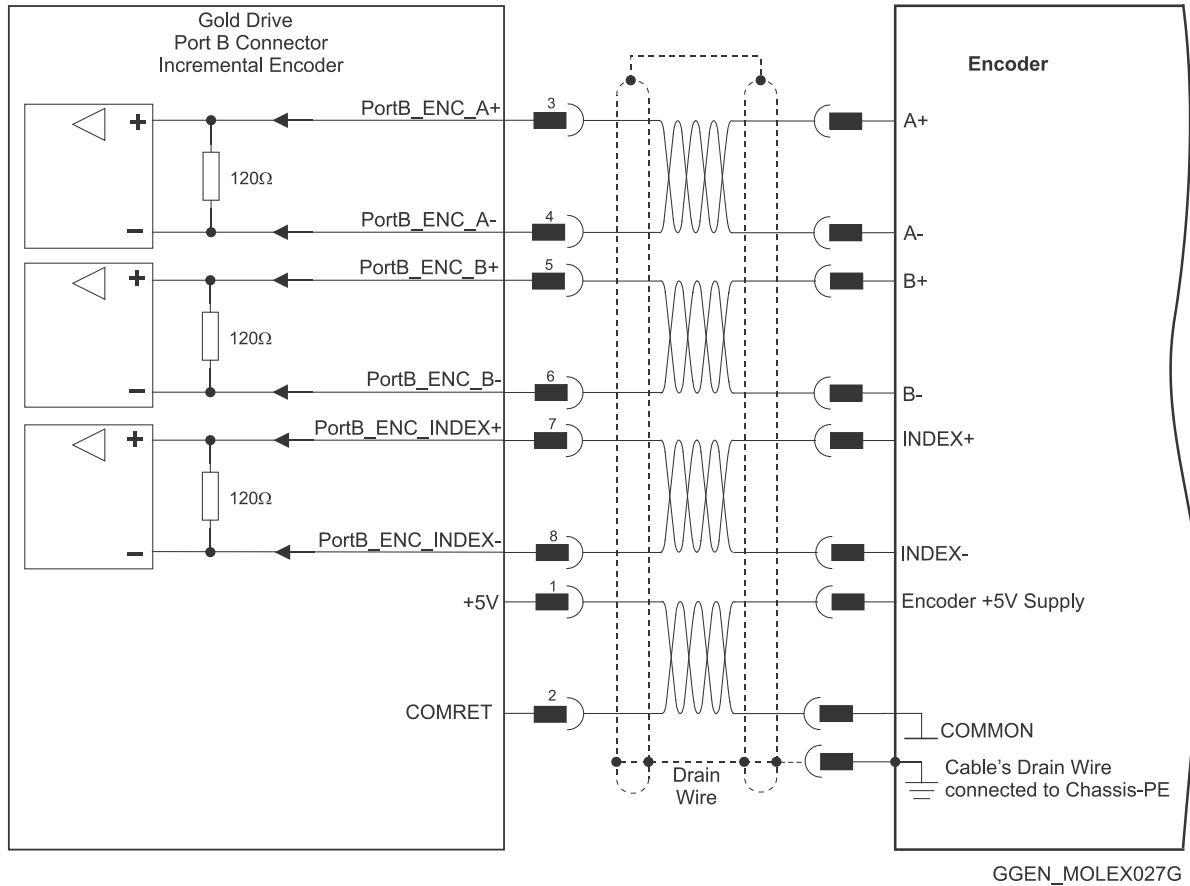


Figure 26: Port B Incremental Encoder Input – Recommended Connection Diagram



7.7.2. Interpolated Analog Encoder

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

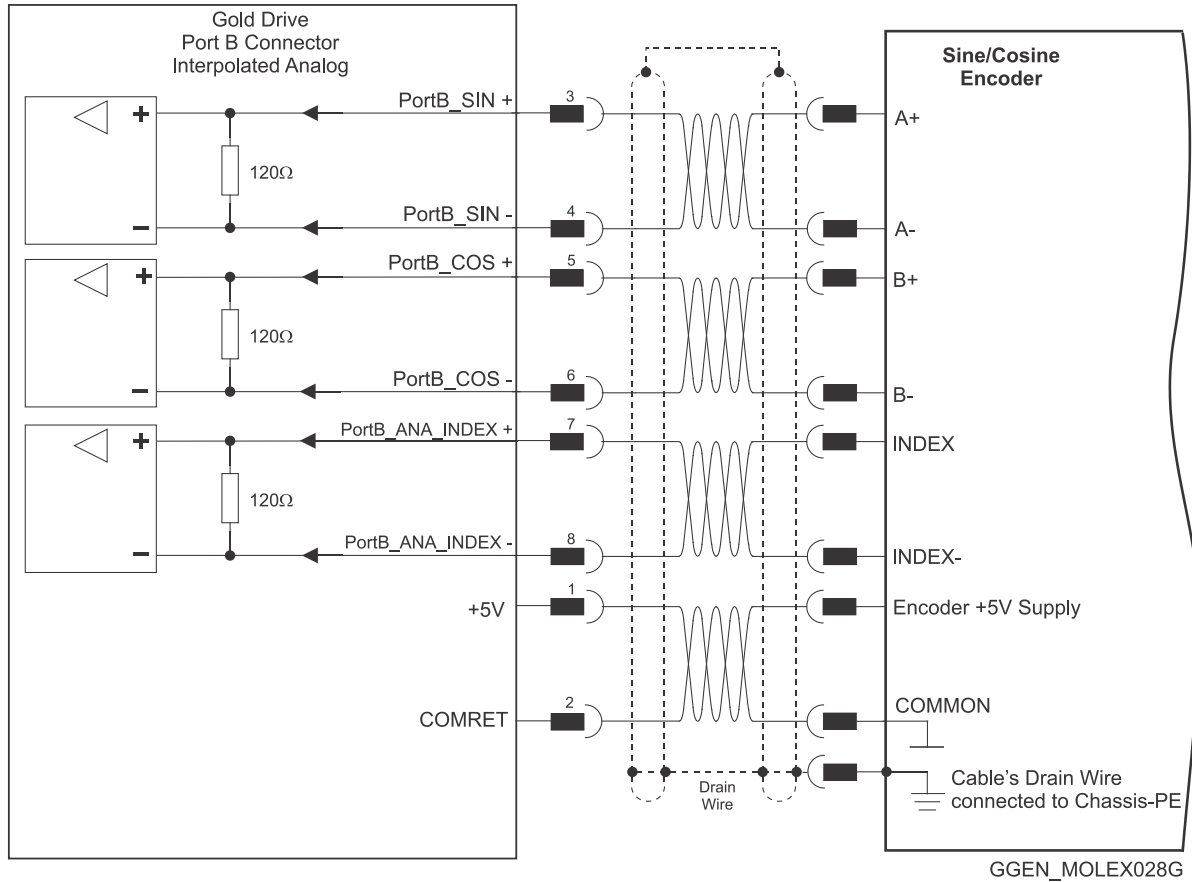


Figure 27: Port B - Interpolated Analog Encoder Molex Type Connection Diagram



7.7.3. Resolver

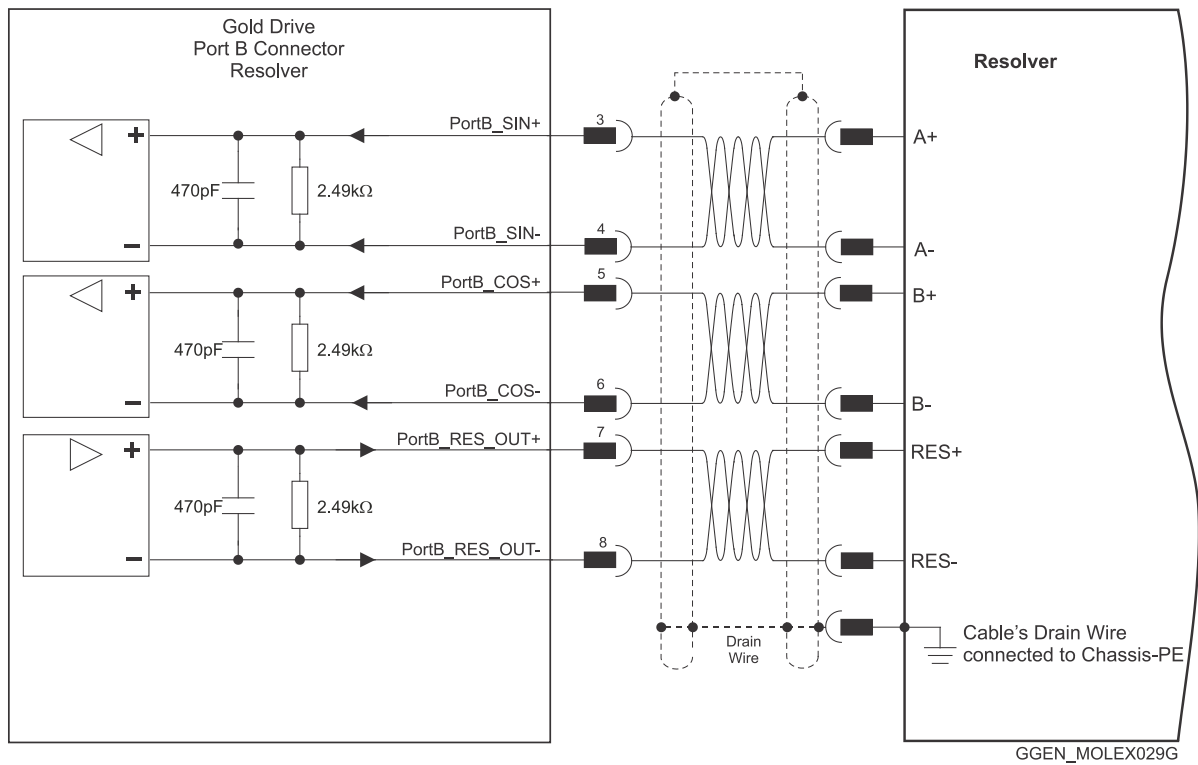


Figure 28: Port B – Resolver Molex Type Connection Diagram



7.8. Port C, Digital I/Os, and Analog Inputs(J2)

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(J2)	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
14	IN2	Programmable input 2
15	IN3	Programmable input 3
16	IN4	Programmable input 4
17	IN5	Programmable input 5
18	IN6	Programmable input 6
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 MAN-G-Panel Mounted Drives Hardware Manual for VDD specification
24	VDDRET	VDD supply return



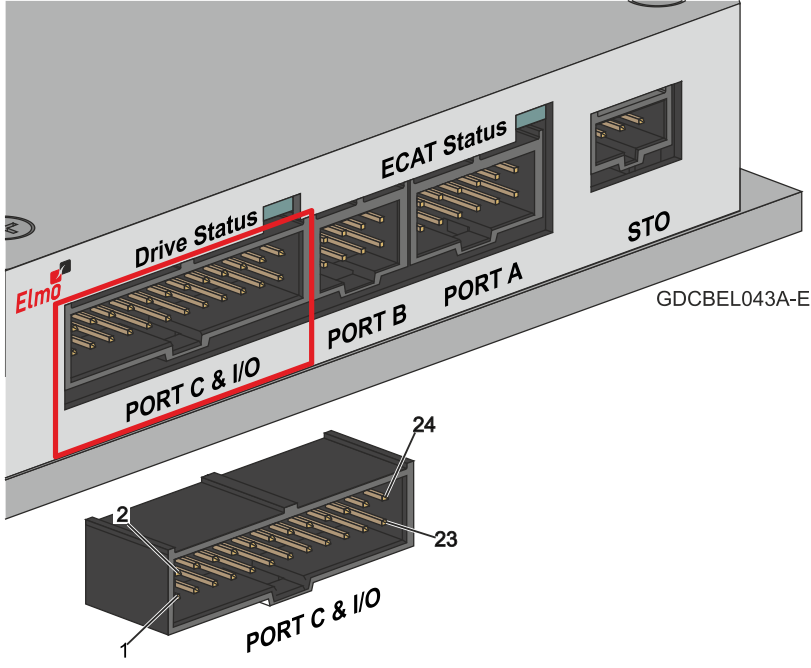
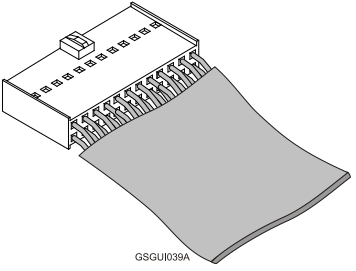
Pin Positions	Cable Connector
 <p>24-Pin 2.54 mm Pitch Molex</p>	 <p>24-Pin Molex Plug</p> <p>This cable is included in the cable kit described in Section 3.1.1.</p>

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.

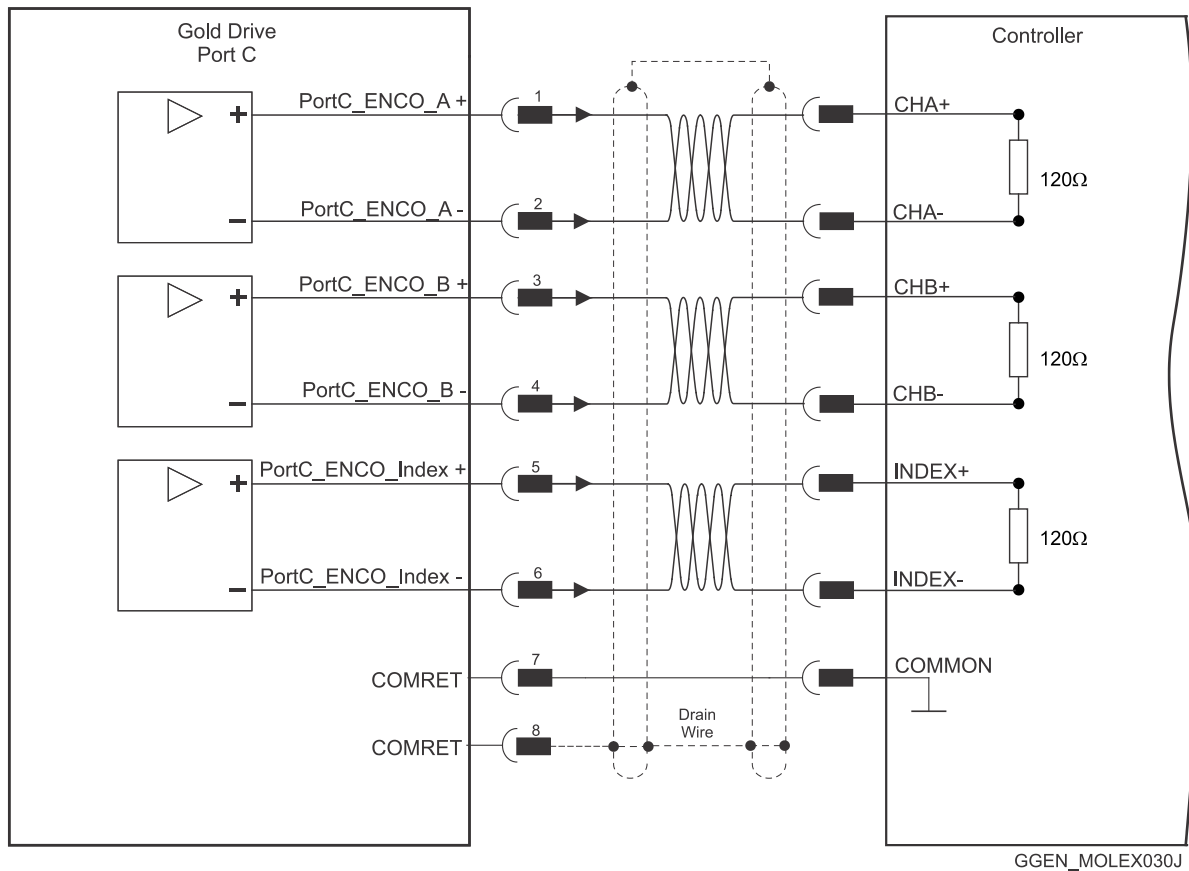


Figure 29: Emulated Encoder Differential Output – Recommended Connection Diagram

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.

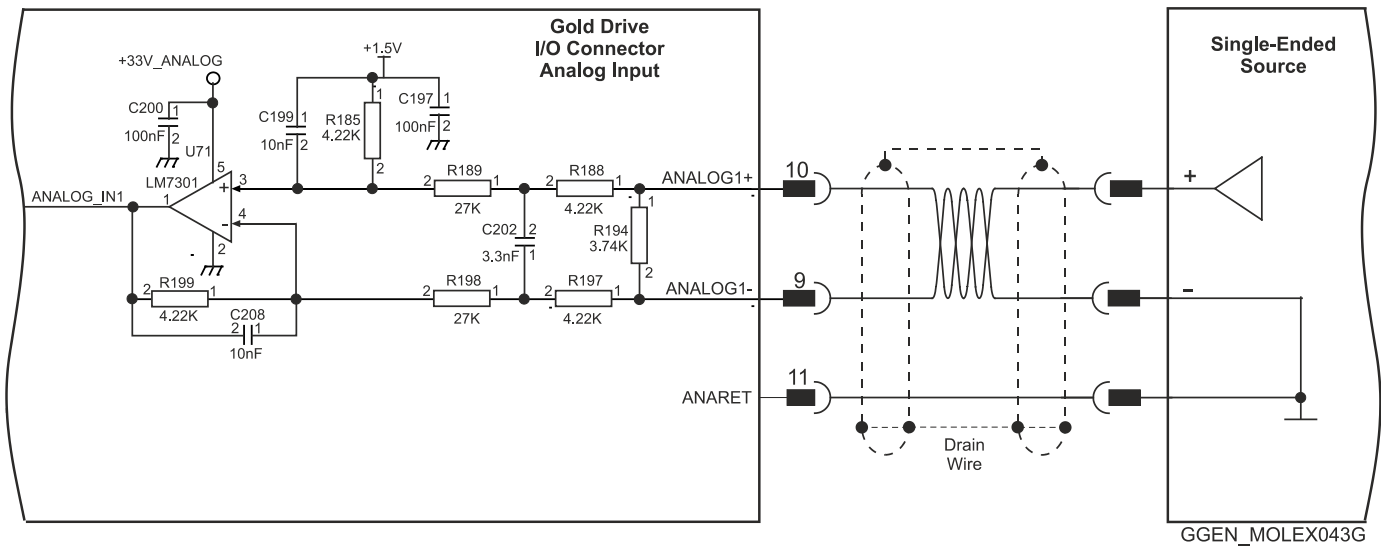


Figure 30: Differential Analog Input



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.

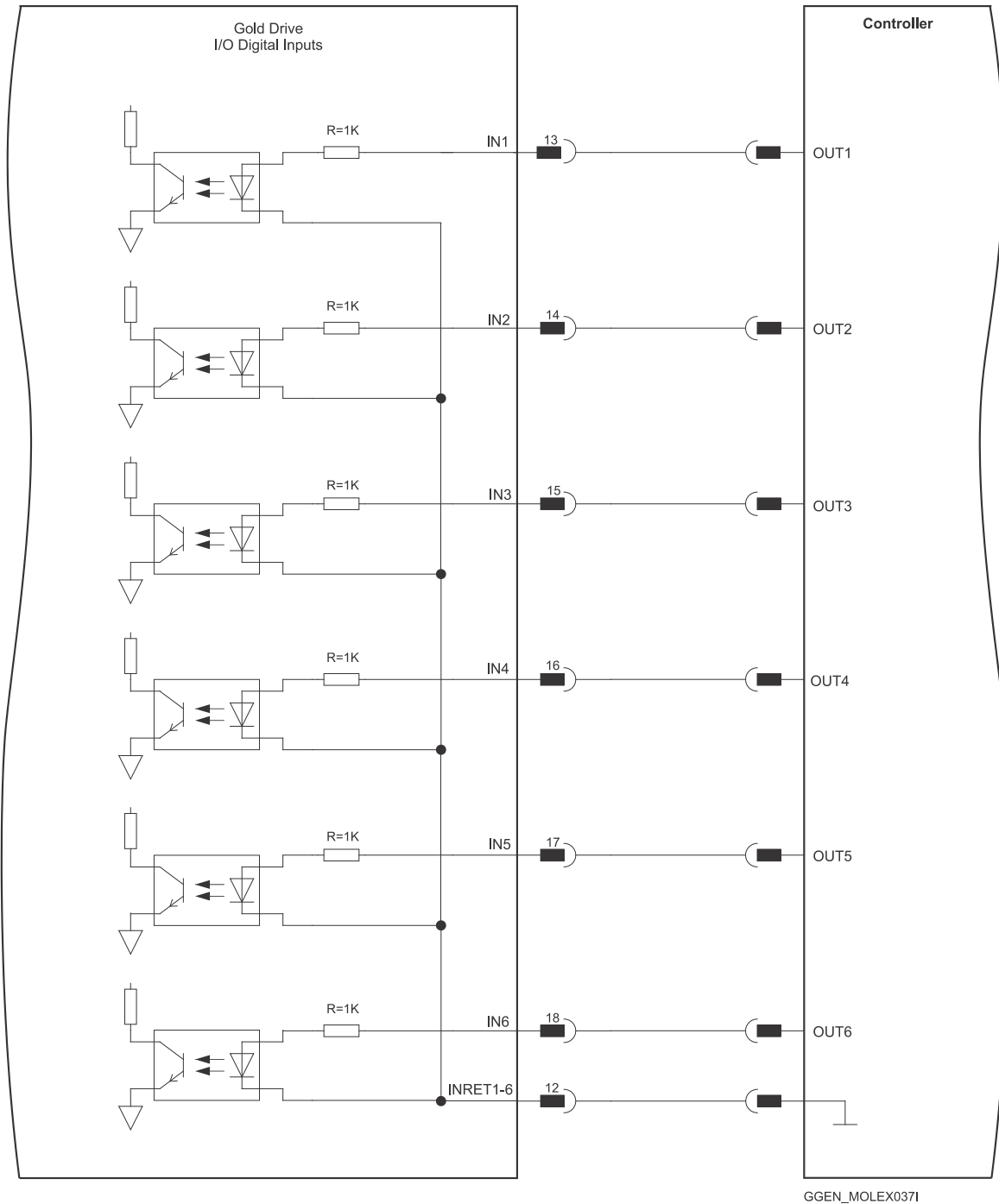


Figure 31: Digital Input TTL Mode Connection Diagram

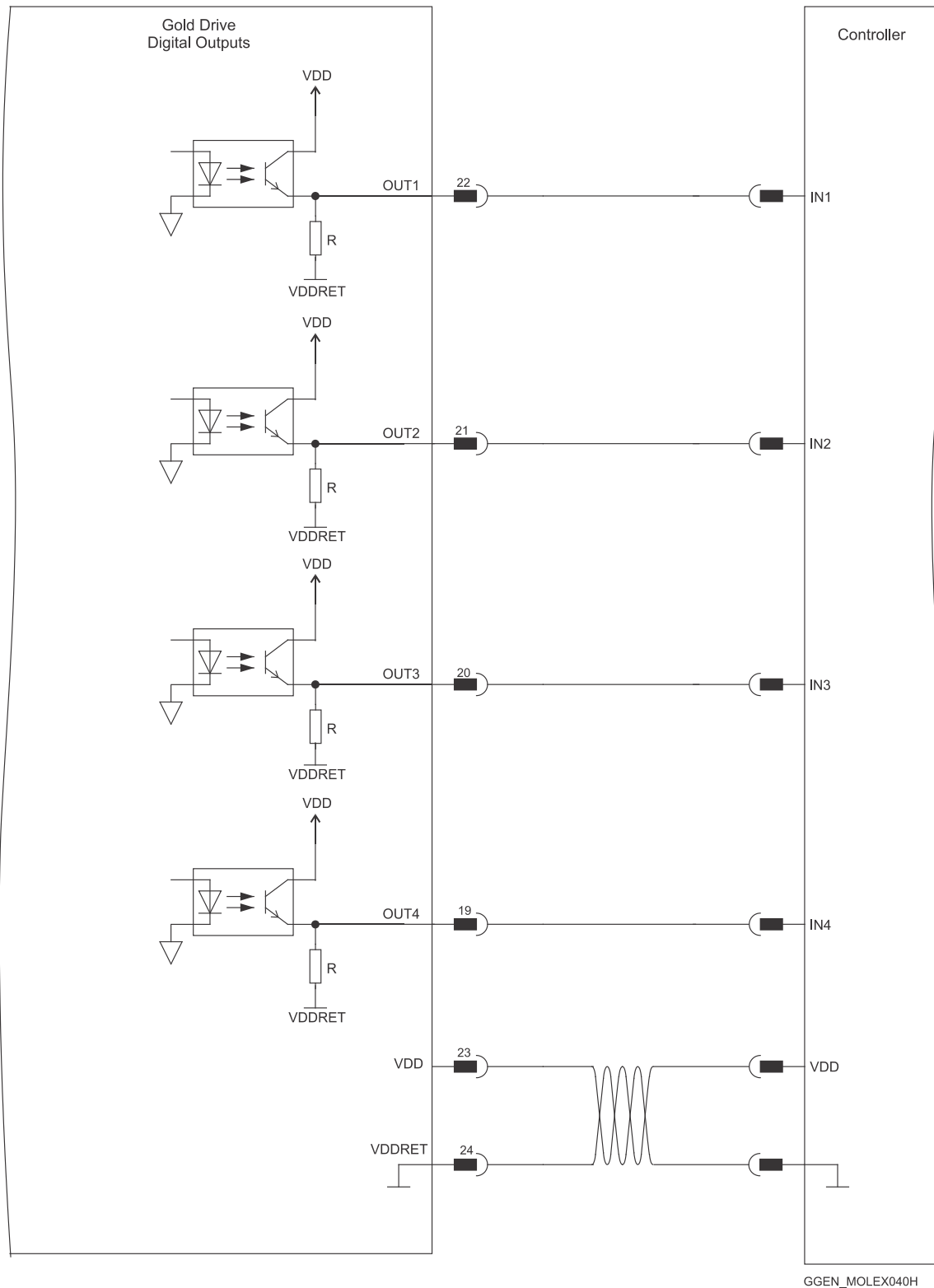


Figure 32: Digital Output Connection Diagram – TTL Option



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.

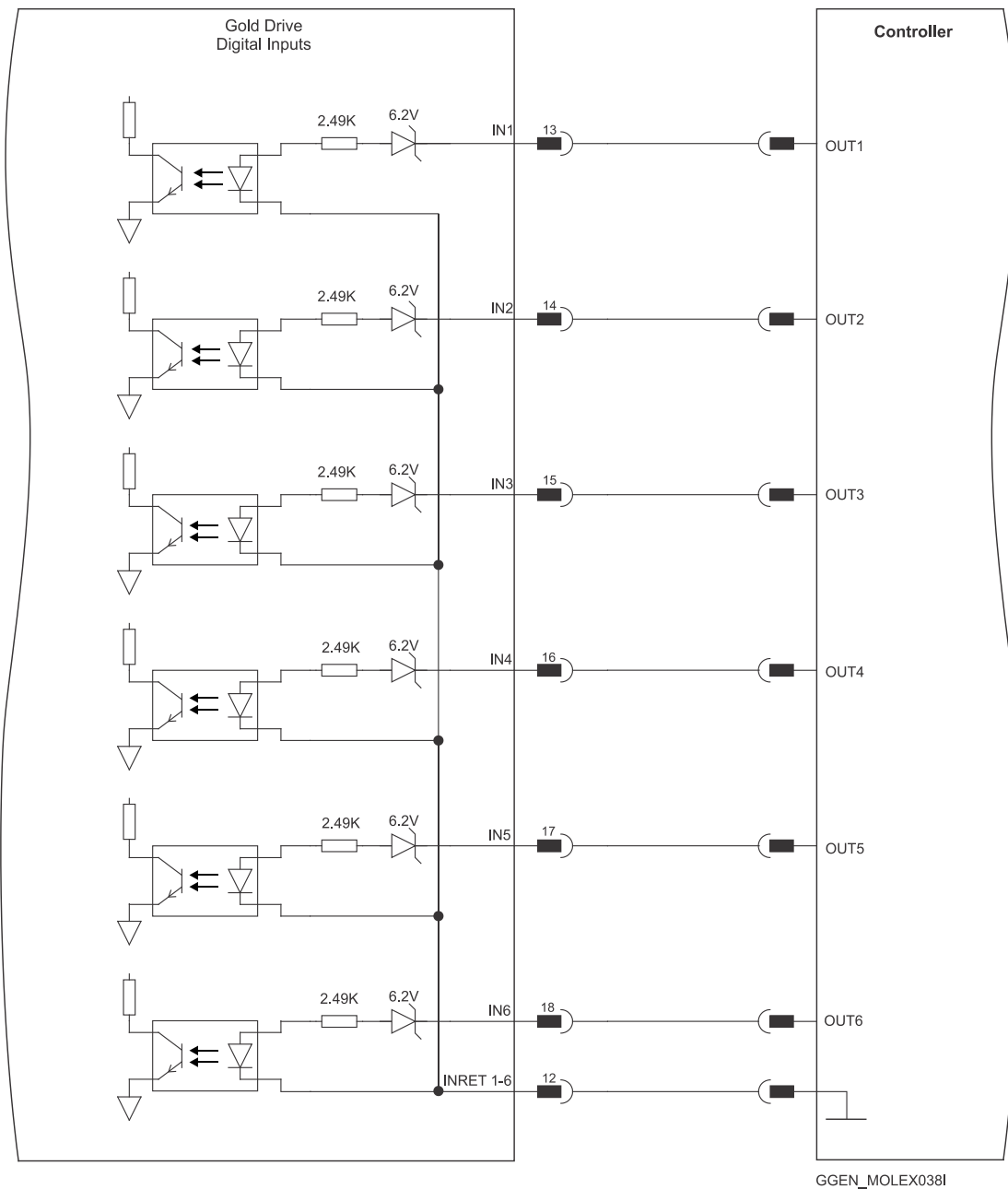


Figure 33: Digital Input Connection Diagram – Source PLC Option

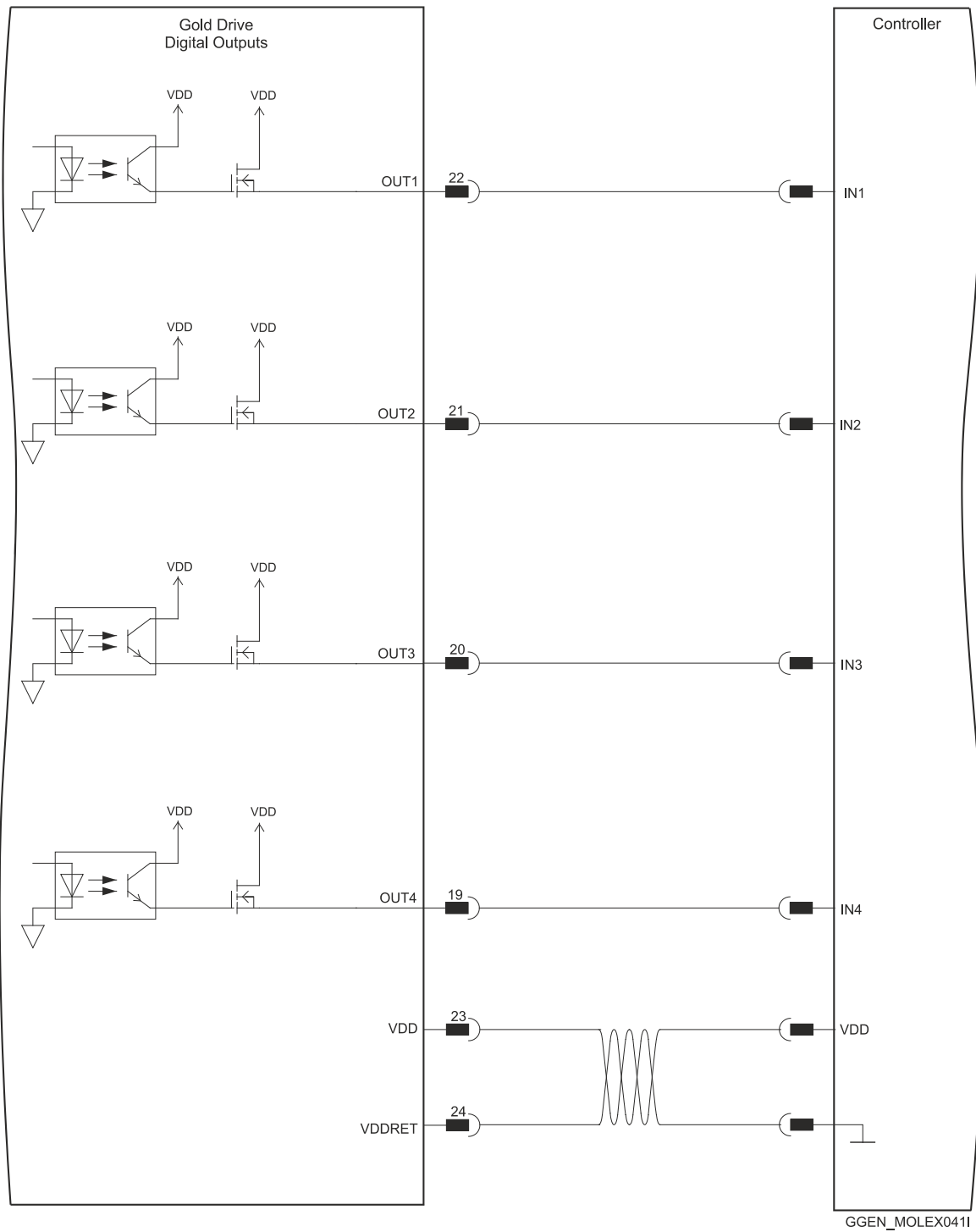


Figure 34: Digital Output Connection Diagram – Source PLC Option



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.

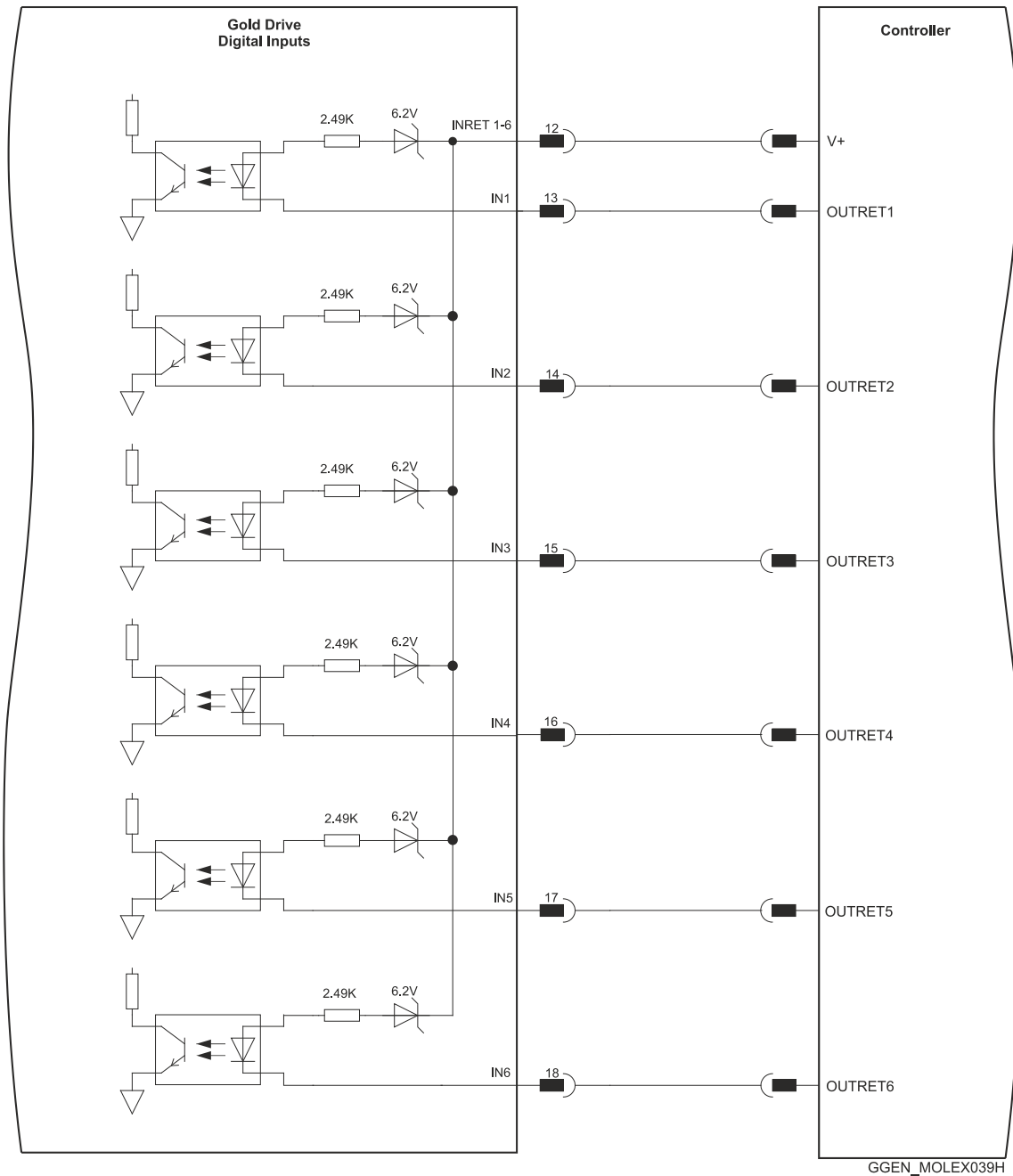


Figure 35: Digital Input Sink Mode – PLC voltage level Molex Type Connection Diagram

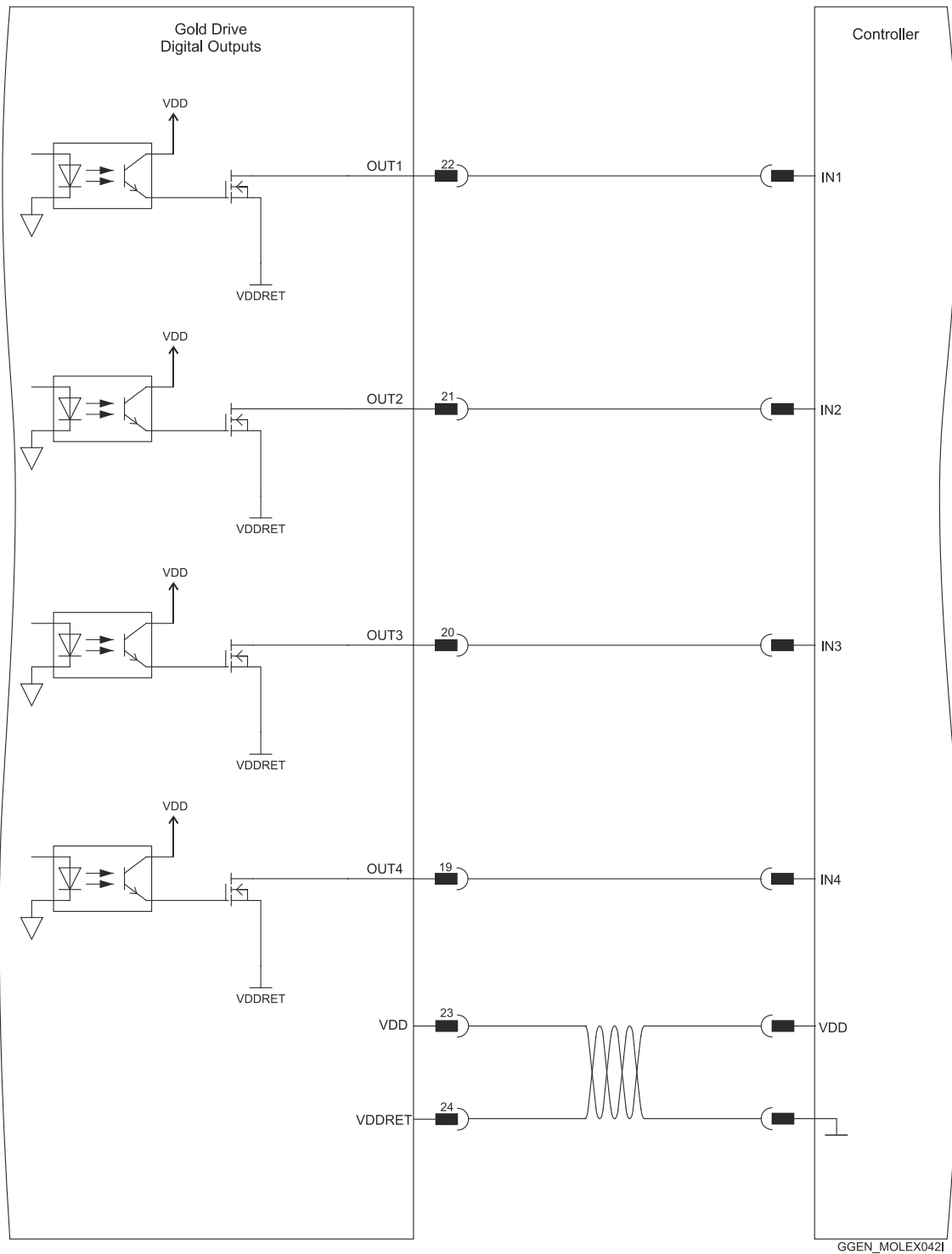


Figure 36: Digital Output as Sink Configuration Molex Type Connection Diagram



7.9. USB 2.0(J9)

The USB Network consists of Host controller and multiple devices. The Gold DC Bell is a USB Device. 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

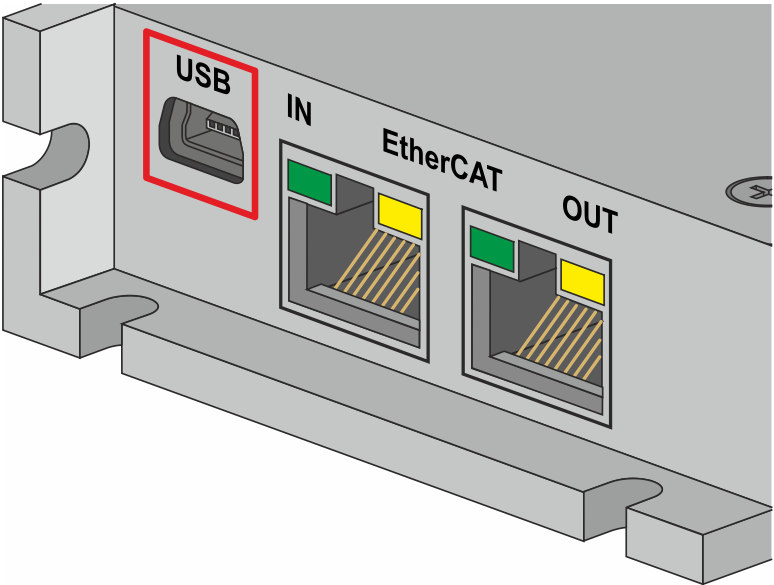
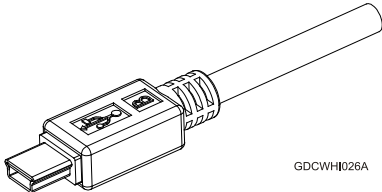
Pin Positions	Cable Connector
 <p>GDCBEL043A-L</p> <p>USB Device Mini-B</p>	 <p>GDCWH1026A</p> <p>USB Device Mini-B Plug</p>

Table 10: USB 2.0 Pin Assignments

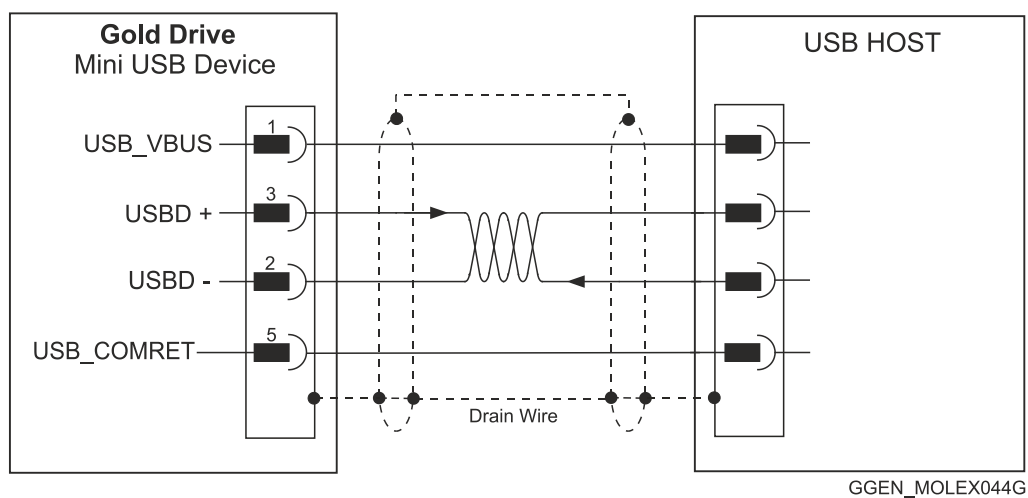


Figure 37: USB Network Diagram



7.10. EtherCAT Communication Version

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

Fieldbus Type	Product Number
EtherCAT	G-DCBELXX/YYYEXXQ

7.10.1. 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	

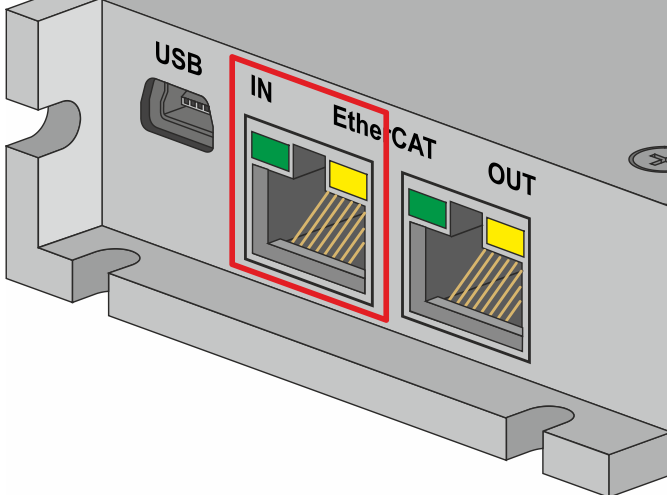
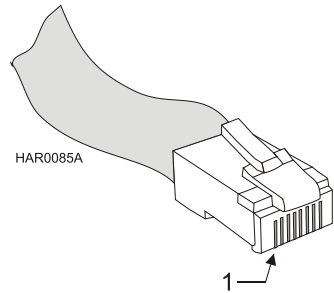
Pin Positions	Cable Connector
 <p>GDCBEL043A-K</p> <p>8-Pin RJ-45</p>	 <p>Standard Ethernet CAT5 Cable</p>

Table 11: EtherCAT In Pin Assignments



7.10.2. EtherCAT OUT(J8)

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

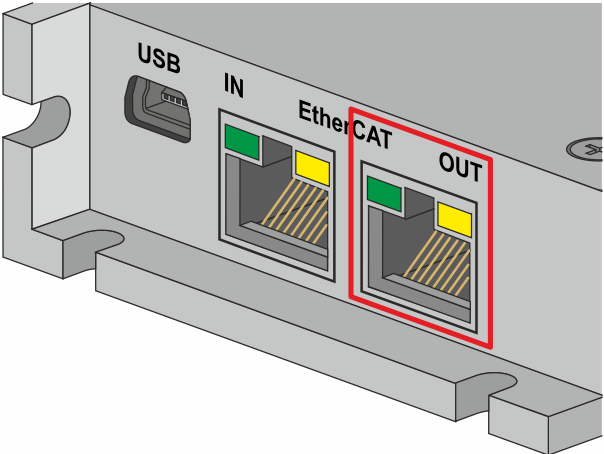
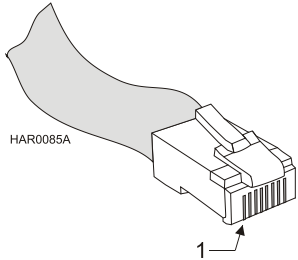
Pin(J8)	Signal	Function
1	EtherCAT_OUT_TX+	EtherCAT in transmit +
2	EtherCAT_OUT_TX-	EtherCAT in transmit -
3	EtherCAT_OUT_RX+	EtherCAT in receive +
4, 5	N/A	
6	EtherCAT_OUT_RX-	EtherCAT in receive -
7, 8	N/A	
Pin Positions		Cable Connector
 8-Pin RJ-45 GDCBEL043A-J		 Standard Ethernet CAT5 Cable

Table 12: EtherCAT Out Pin Assignments

7.10.3. therCAT Wiring

Figure 38 describes the wiring diagram for the EtherCAT connections.

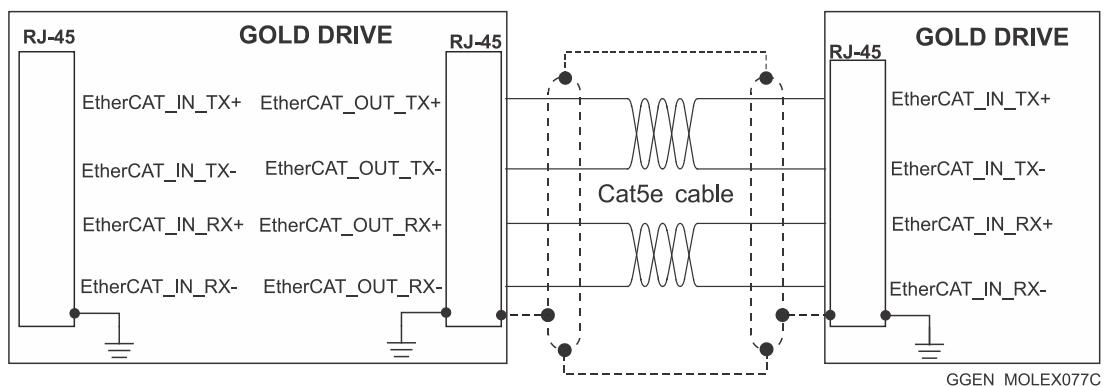


Figure 38: EtherCAT RJ-45 Connections



7.10.4. EtherCAT Status Indicator

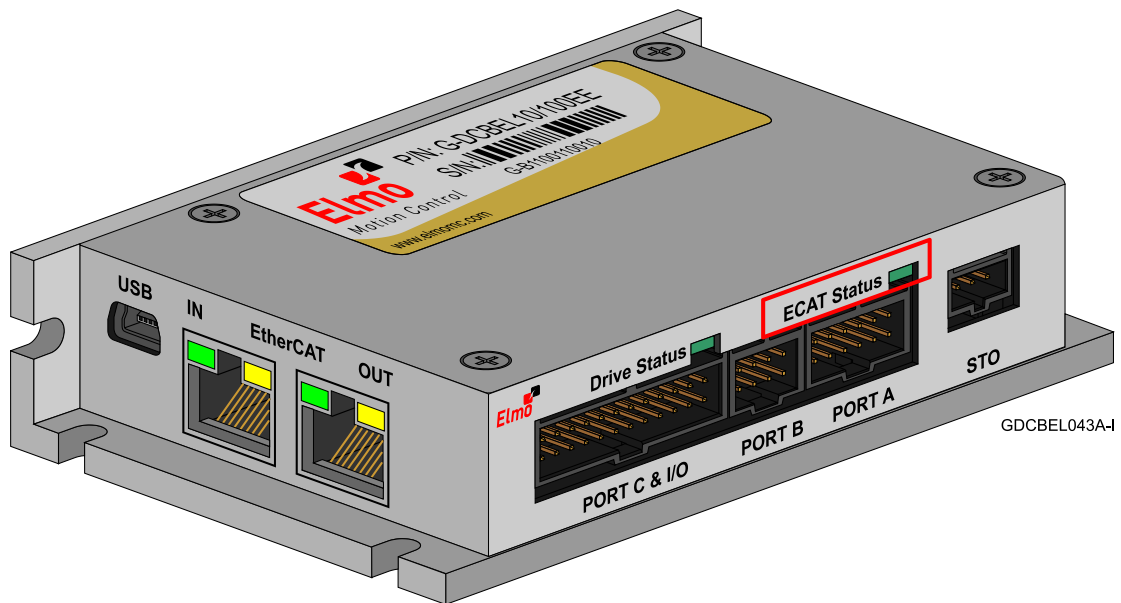


Figure 39: EtherCAT Status LED

The EtherCAT status indicator is a red/green dual LED. It combines run indication (when it is green) and error indication (when it is red) of the EtherCAT device. For further details, see the EtherCAT Manual.

Note: There is no Gold DC Bell ECAT Status indicator equivalent in the CAN version, refer to the figure below.

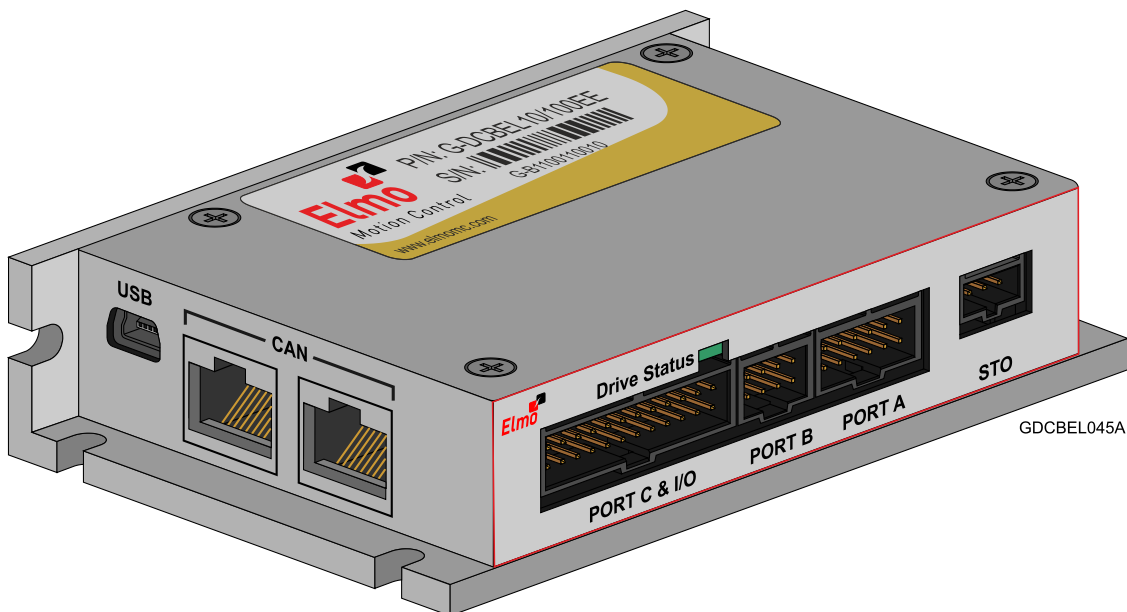


Figure 40: Gold DC Bell Status Indicator - CAN



7.11. CAN Communication Version

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

Fieldbus Type	Product Number
CAN	G-DCBEL XX/YYYYSXXQ

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

Pin (J7/J8)	Signal	Function
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	COMRET (CAN_RET)	CAN Return
4, 5	N/A	—
6	CAN_SHLD	Shield, connected to the RJ plug cover
7	CAN_RET	CAN Return
8	N/A	—

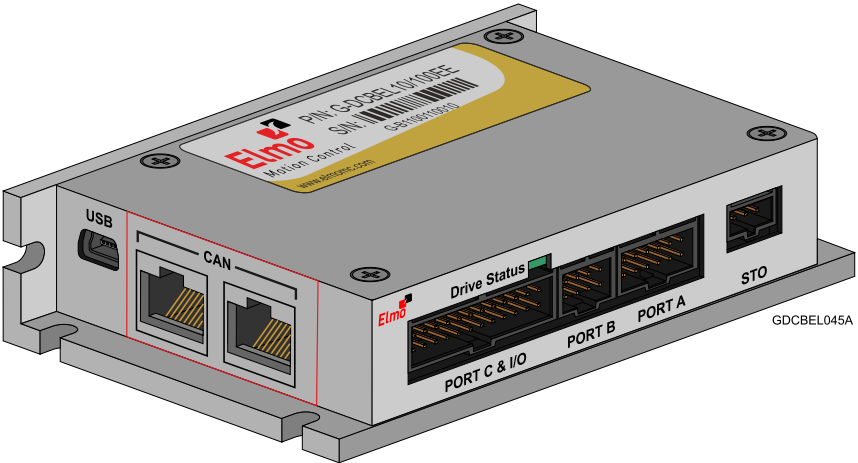
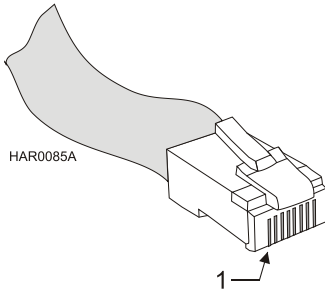
Pin Positions	Cable Connector
	 Standard CAT5e Ethernet Cable

Table 13: CAN In/Out Connectors Pin Assignments



7.11.1. CAN Wiring

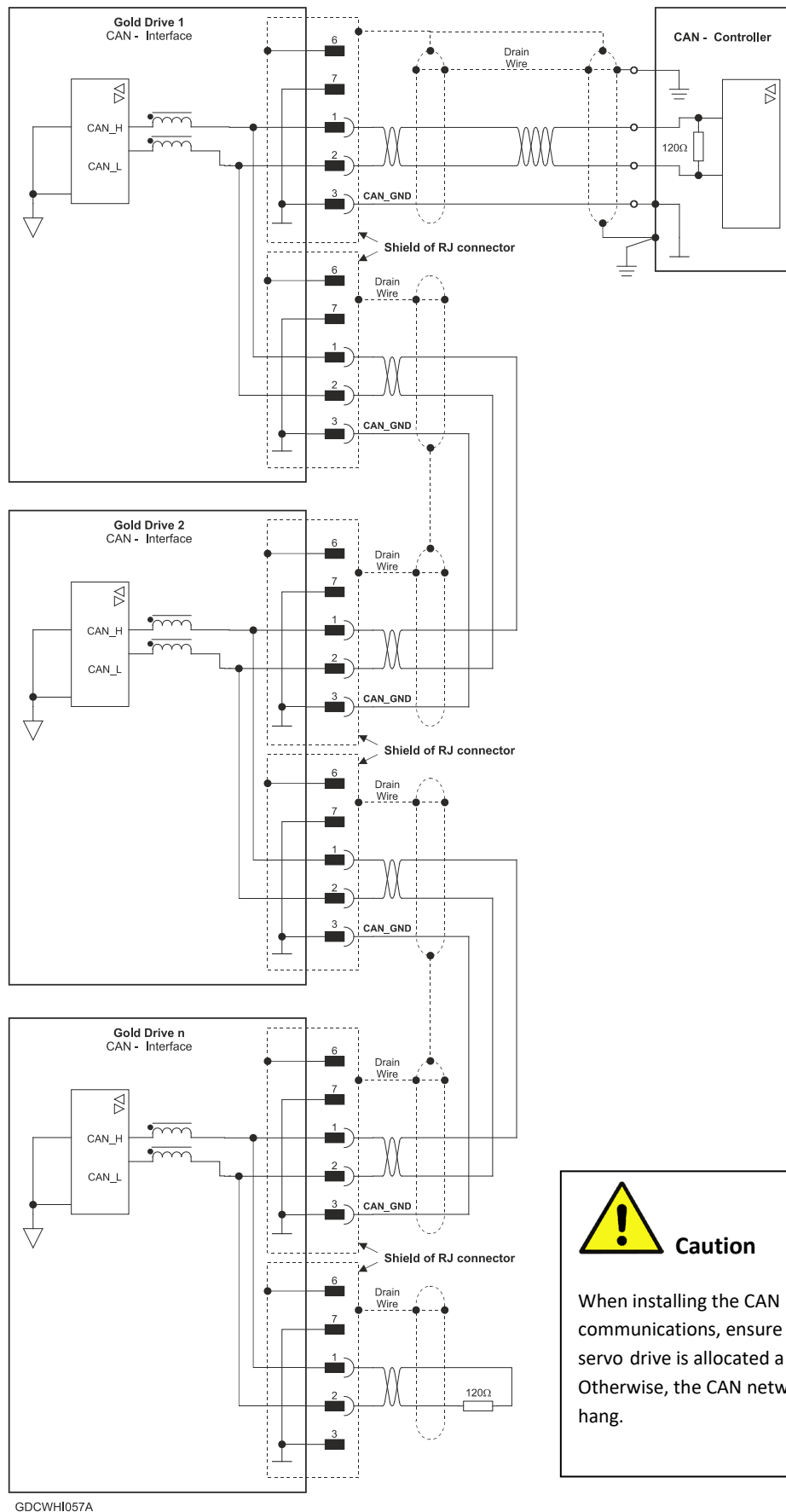


Figure 41: Gold DC Bell Connection Diagram – CAN



7.12. Powering Up

After the Gold DC Bell 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.

7.13. Initializing the System

After the Gold DC Bell 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*.

7.14. Heat Dissipation

The best way to dissipate heat from the Gold DC Bell is to back-side wall-mount it (see 6.3 Mounting the Gold DC Bell). For best results leave approximately 10 mm of space between the Gold DC Bell's heat sink and any other assembly.

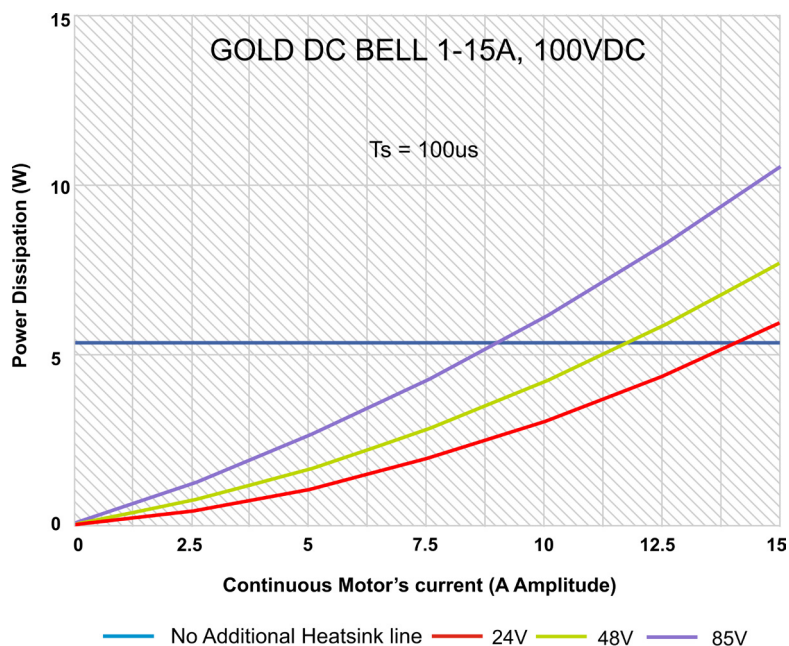
7.14.1. Thermal Data

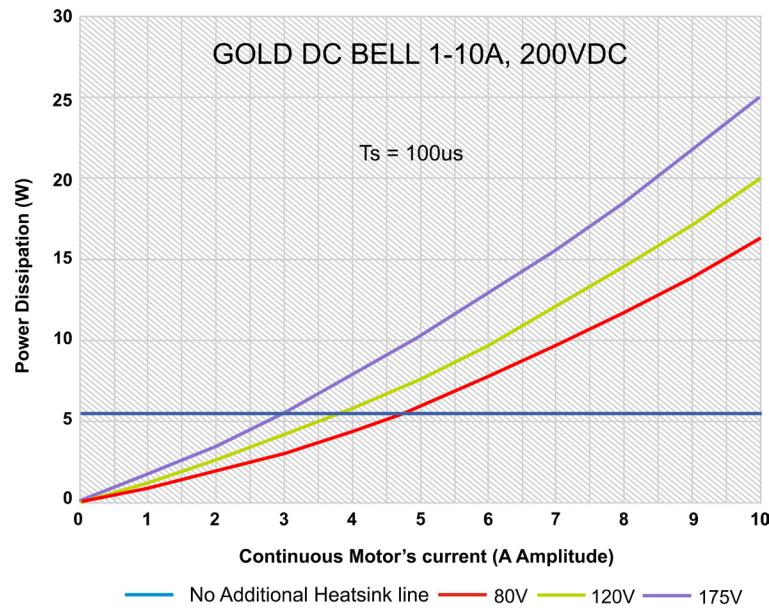
Heat dissipation capability (θ): Approximately 4 °C/W

Note: The heat dissipation capability is non-linear at low currents.

7.14.2. Heat Dissipation Data

Heat dissipation is shown graphically below:





7.14.3. How to Use the Charts

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

To determine if your application heat dissipation requires an additional heat sink:

1. Determine the power dissipation according to the motor type support, "continuous current", and the DC bus voltage curve.
2. If the DC bus is not one of the two curves above, estimate the dissipation by interpolation. The estimation error is not critical.
3. The chart is calculated for continuous current operation. If the actual operation is pulsed current, add 25% to 30% to the power dissipation of the average (RMS) current.
4. When the Heat sink temperature reaches $\approx 85^{\circ}\text{C}$, the Gold DC Bell will shut down. Design the system for continuous operation so that the maximum Heat Sink temperature should be no higher than between 80°C to 82°C .
5. If the average heat dissipation is less than $\approx 5.5\text{W}$, there will be no requirement for an additional external heat sink.
If the average Heat dissipation is higher than 5.5W , then an additional heat dissipation means is required, usually by connecting to an additional external heat-sink.
6. When an external Heat-Sink is required, calculate the thermal resistance of the heat sink according to:

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



Chapter 8: Dimensions

This chapter provides detailed technical information regarding the Gold DC Bell.

