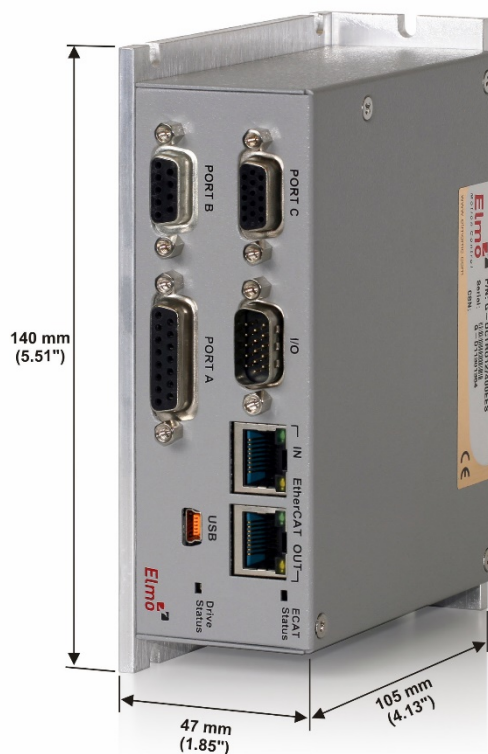


# Gold DC Trombone Digital Servo Drive Installation Guide EtherCAT and CAN



# Notice

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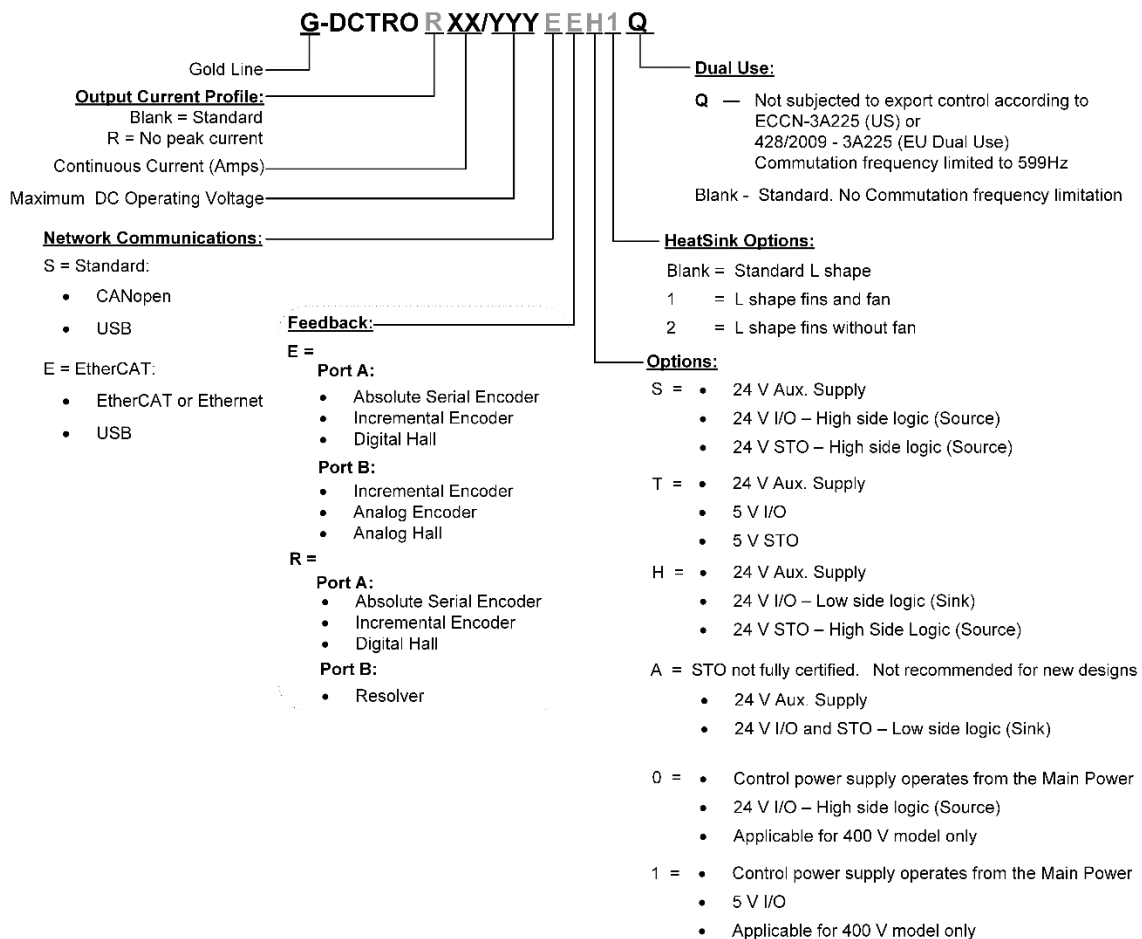
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## Catalog Number





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## **Chapter 1: This Installation Guide**

This installation Guide details the technical data, pinouts, wiring, and power connectivity of the Gold DC Trombone. 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 Trombone, 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 Trombone 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 Trombone 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 Trombone 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 Trombone to an approved isolated auxiliary power supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Gold DC Trombone, 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 Trombone 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 Trombone 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 Trombone series of digital servo drives are highly resilient and operate from a DC Power Voltage Input source. They are designed to deliver the highest density of power and intelligence. The Gold DC Trombone delivers up to **10 kW of continuous power** or **16 kW of peak power** in a compact package.

The digital drives are part of Elmo's advanced Gold Line. They operate from a DC power source in current, velocity, position and advanced position modes, in conjunction with a permanent-magnet synchronous brushless motor, DC brush motor, linear motor or voice coil. They are designed for use with any type of sinusoidal and trapezoidal commutation, with vector control. The Gold DC Trombone 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 drive is easily set up and tuned using Elmo Application Studio (EASII) software tools. The Windows based application enables users to quickly and simply configure the servo drive for optimal use with their motor. The Gold DC Trombone, as part of the Gold Line, is fully programmable with Elmo's motion control language.

Power to the drives is provided by a DC power source (not included with the Gold DC Trombone).

Since the power stage is fully isolated from the control stage, the DC rectifier can be fed directly from the mains, without the need for a bulky and expensive transformer.

If backup functionality is required to store control parameters in the event of a mains power outage, then an A, H, S, or T optional Gold DC Trombone should be used, with an external 24 VDC isolated supply connected to it.

**Note:** The backup functionality can operate from an isolated voltage source within the range of **18 to 30 VDC**.

Whenever backup functionality is not required, Gold DC Trombone models with the 0 or 1 Option (only for 400 V models) in the catalog number (section Catalog Number) can be used, i.e., they do not have a 24 V control supply. In these models, a smart control-supply algorithm enables the Gold DC Trombone to operate with only the main power supply VP+ and VN-, with no need for a 24 VDC auxiliary power supply for the logic.

The Gold DC Trombone is a stand-alone version of the Gold Trombone module (PCB-mounted). Another pluggable version, the Gold Solo Trombone is also available.



## Chapter 4: Technical Information

### 4.1 Physical Specifications

Feature	Units	All Types
Weight	g (oz)	650 g (22.9 oz) for standard L shape 1100 g (38.8 oz) for L shape fins and fan
Dimensions	mm (in)	105 x 140 x 47 (4.13" x 5.51" x 1.85")
Mounting method		Panel / Wall Mounted

### 4.2 Technical Data for the 400 V Type

Feature	Units	6/400	12/400	16/400	R17/400	R22/400
Minimum supply voltage	VDC	A, H, S, or T in P/N*: 50 0 or 1 Option in P/N: 100				
Nominal supply voltage	VDC	325				
Maximum supply voltage	VDC	400				
Maximum continuous power output	kW	2	4	5	5.5	7
Efficiency at rated power (at nominal conditions)	%	> 98				
Auxiliary supply voltage option	VDC	18 V to 30 V Only for Control Supply A/H/S/T Option Models				
Auxiliary power supply	VA	7				
Continuous current limit (I <sub>c</sub> ) Amplitude sinusoidal/DC trapezoidal commutation	A	6	12	16	17	22
Sinusoidal continuous RMS current limit (I <sub>c</sub> )	A	4.2	8.5	11.3	12	15.5
Peak current limit	A	2 x I <sub>c</sub>			No peak	





### 4.3 Technical Data for the 800 V Type

Feature	Units	8/800	12/800	R11/800	R16/800
Minimum supply voltage	VDC	A, H, S, or T Option in P/N*: 95+			
Nominal supply voltage	VDC	560 for 400 VAC 680 for 480 VAC			
Maximum supply voltage	VDC	780			
Maximum continuous power output	kW	5	7.5	7	10
Efficiency at rated power (at nominal conditions)	%	> 98			
Auxiliary supply voltage option	VDC	18 V to 30 V Only for Control Supply A/H/S/T Option Models			
Auxiliary power supply	VA	7			
Continuous current limit (Ic) Amplitude sinusoidal/DC trapezoidal commutation	A	8	12	11	16
Sinusoidal continuous RMS current limit (Ic)	A	5.7	8.5	7.8	11.3
Peak current limit	A	2 x Ic		No peak	

\*See section Catalog Number for details on the part number. The A, H, S, or T Option appears in models where there is a 24 V control supply. If there is a 0 or 1 Option, the control power supply operates from the main power.

Note on current ratings: The current ratings of the Gold DC Trombone 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 Auxiliary Supply

Feature	Details
Auxiliary power supply	<i>Isolated DC source only</i>
Auxiliary supply input voltage	18 VDC to 30 VDC
Auxiliary supply input power	7

## 4.5 Product Features

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



## 4.6 Environmental Conditions

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

### 4.6.1 Gold Line

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



## 4.7 Gold Line Standards and Certifications

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

Main Standards	Item
The related standards below apply to the performance of the servo drives as stated in the environmental conditions in section 4.6.1 Gold Line above.	
<b>STO IEC 61800-5-2:2007 SIL 3</b>	Adjustable speed electrical power drive systems – Safety requirements – Functional
<b>EN ISO 13849-1:2008 PL e, Cat 3</b>	Safety of machinery — Safety-related parts of control systems.
<b>Approved IEC/EN 61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>Recognized UL 508C</b>	Power Conversion Equipment
<b>In compliance with UL 840</b>	Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment
<b>Conformity with CE 2006/95/EC</b>	Low-voltage directive 2006/95/EC
<b>Recognized CSA C22.2 NO. 14-13</b>	Industrial Control Equipment

### 4.7.1 Dual Use

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

The operating frequency of the Gold Line products is “factory limited” to  $\leq 599$  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 5: Installation

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

### 5.1 Unpacking the Drive Components

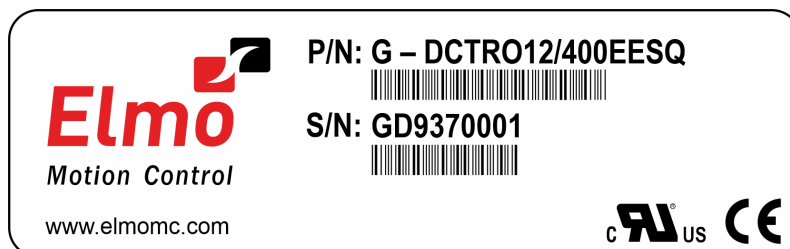
Before you begin working with the Gold DC Trombone, verify that you have all of its components, as follows:

- The Gold DC Trombone servo drive
- The Elmo Application Studio (EAS) software and software manual

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

#### To unpack the Gold DC Trombone:

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



**Figure 1: Gold DC Trombone Part Number Sticker**

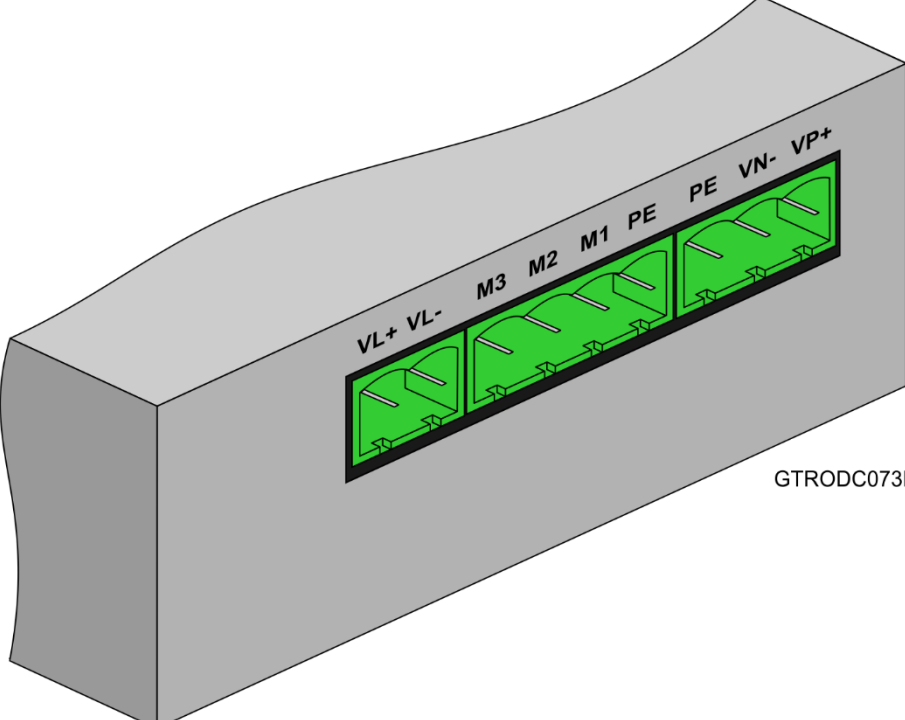
4. Verify that the Gold DC Trombone type is the one that you ordered, and ensure that the voltage meets your specific requirements.

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

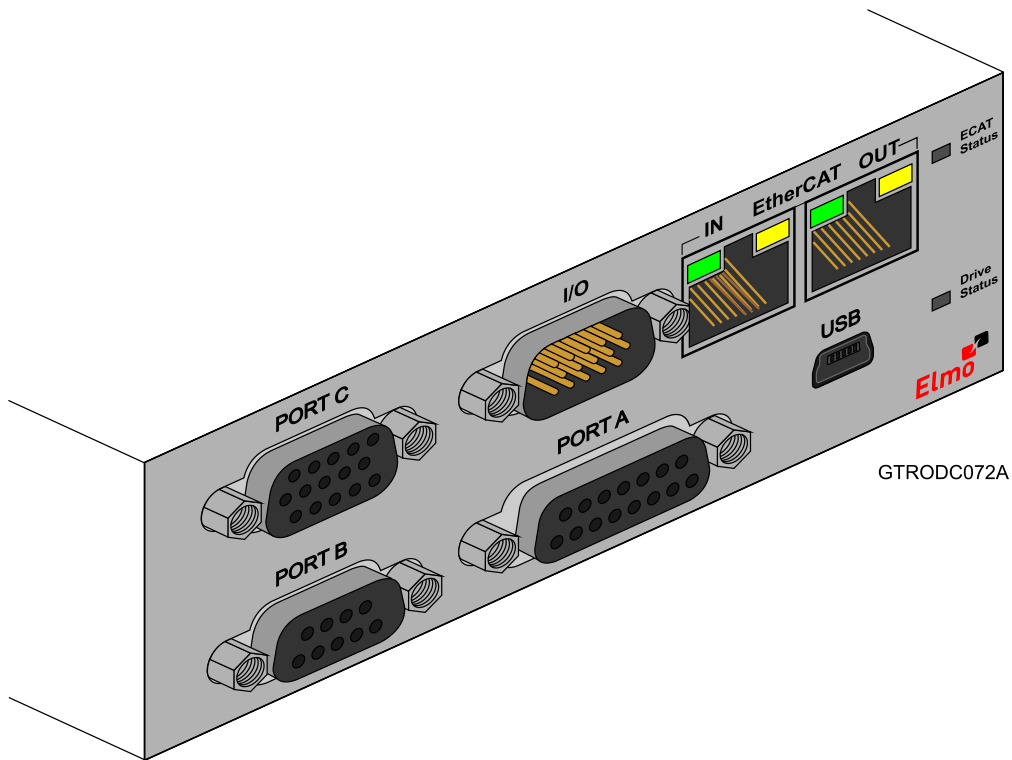


## 5.2 Connector Types

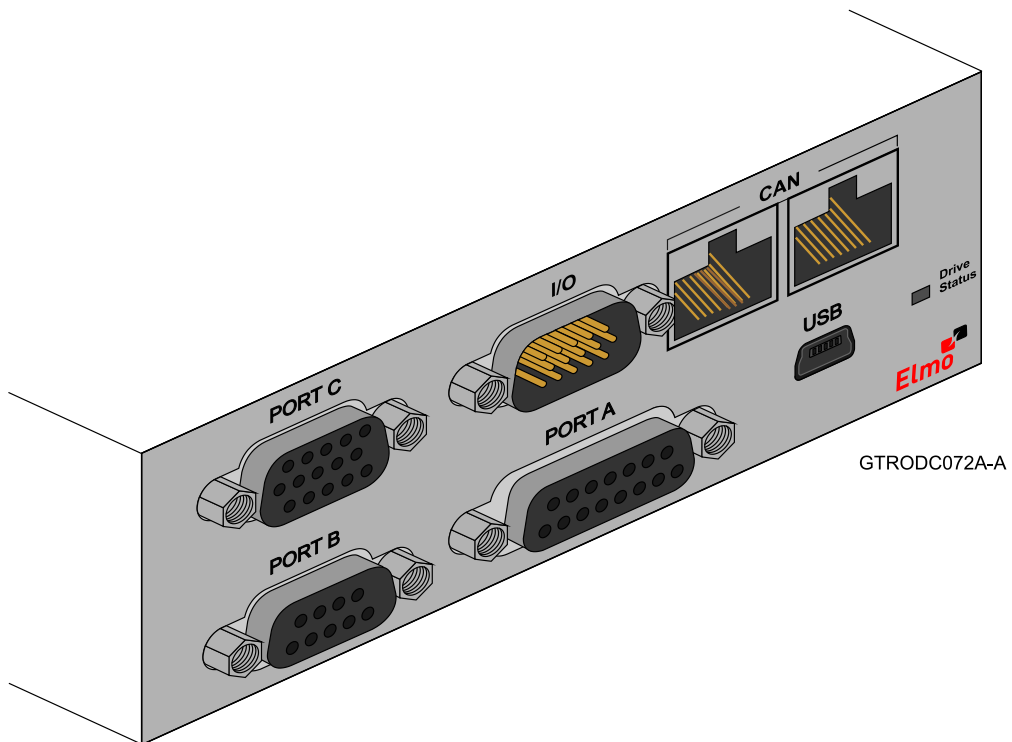
The Gold DC Trombone has the following ten connectors.

Pins	Type	Function
<b>Bottom Connectors</b>		
 <p>GTRODC073B</p>		
2	5.08 mm Phoenix high current	24 V
4	7.62 mm Phoenix high current	Motor Connector
3	7.62 mm Phoenix high current	Power Connector

Pins	Type	Function
<b>Front Connectors</b>		



Front Connectors - EtherCAT



Front Connectors - CAN



Pins	Type	Function
15	Socket D-Type	Port A
9	Socket D-Type	Port B
15	Socket High Density D-Type	Port C and Safety
15	Pin High Density D-Type	I/O
4	USB Device Type Mini B	USB communication
<b>EtherCAT Version</b>		
8	RJ-45	EtherCAT_IN/Ethernet communication
8	RJ-45	EtherCAT OUT communication
<b>CAN Version</b>		
8	RJ-45	CAN
8	RJ-45	CAN

**Table 1: Connector Types**

The pinouts in Chapter 6: Wiring describe the function of each pin in the Gold DC Trombone connectors that are listed in Table 1.

### 5.2.1 Mating Connector Types

Mating Pin Connector	Function	Manufacturing P/N (Pheonix)
2 Pin	VL	MSTB 2,5/ 2-ST-5,08
3 Pin	Main DC Input	GMSTB 2,5 HCV/ 3-ST-7,62
4 Pin	Motor Power	GMSTB 2,5 HCV/ 4-ST-7,62



### 5.3 Mounting the Gold DC Trombone

The Gold DC Trombone 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 Trombone (see the diagram below).

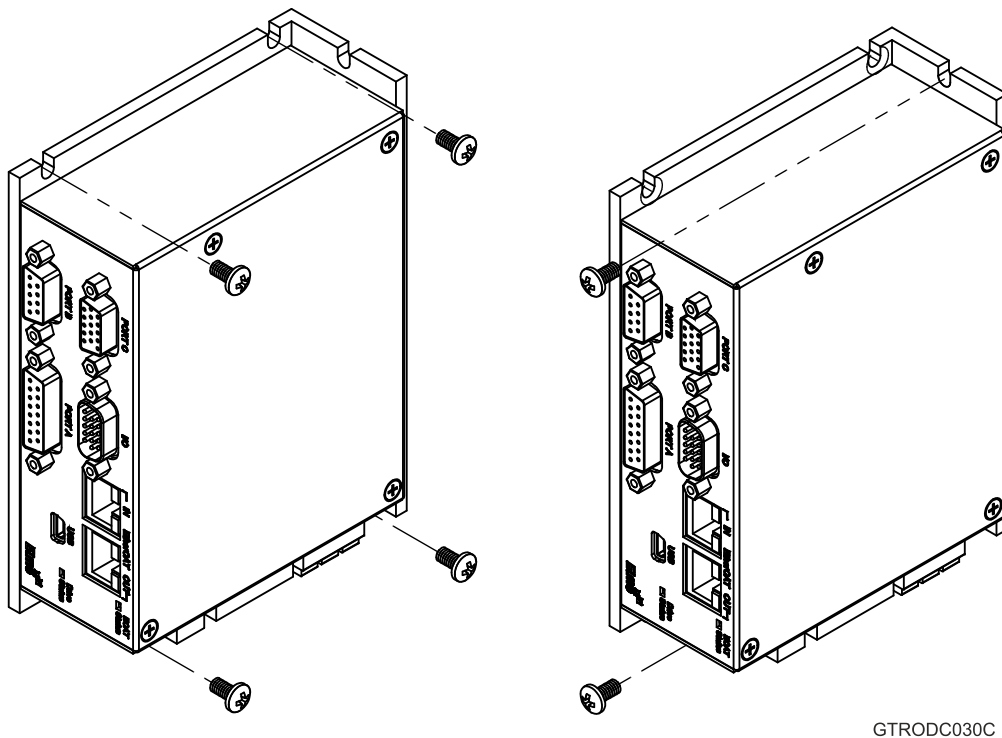


Figure 2: Mounting the Gold DC Trombone with standard L-shape heat-sink

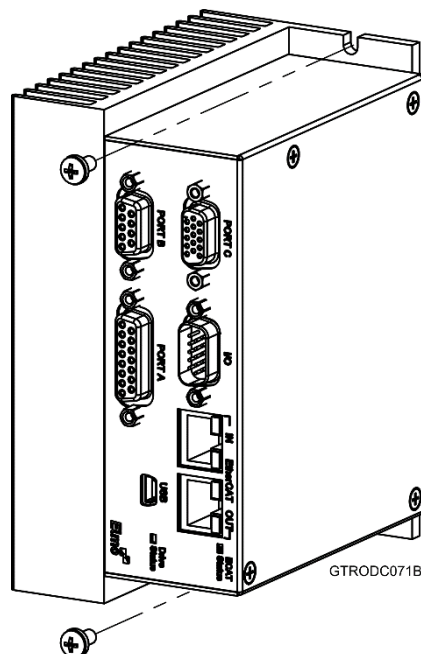


Figure 3: Mounting the Gold DC Trombone with L-shape heat-sink fins and fan



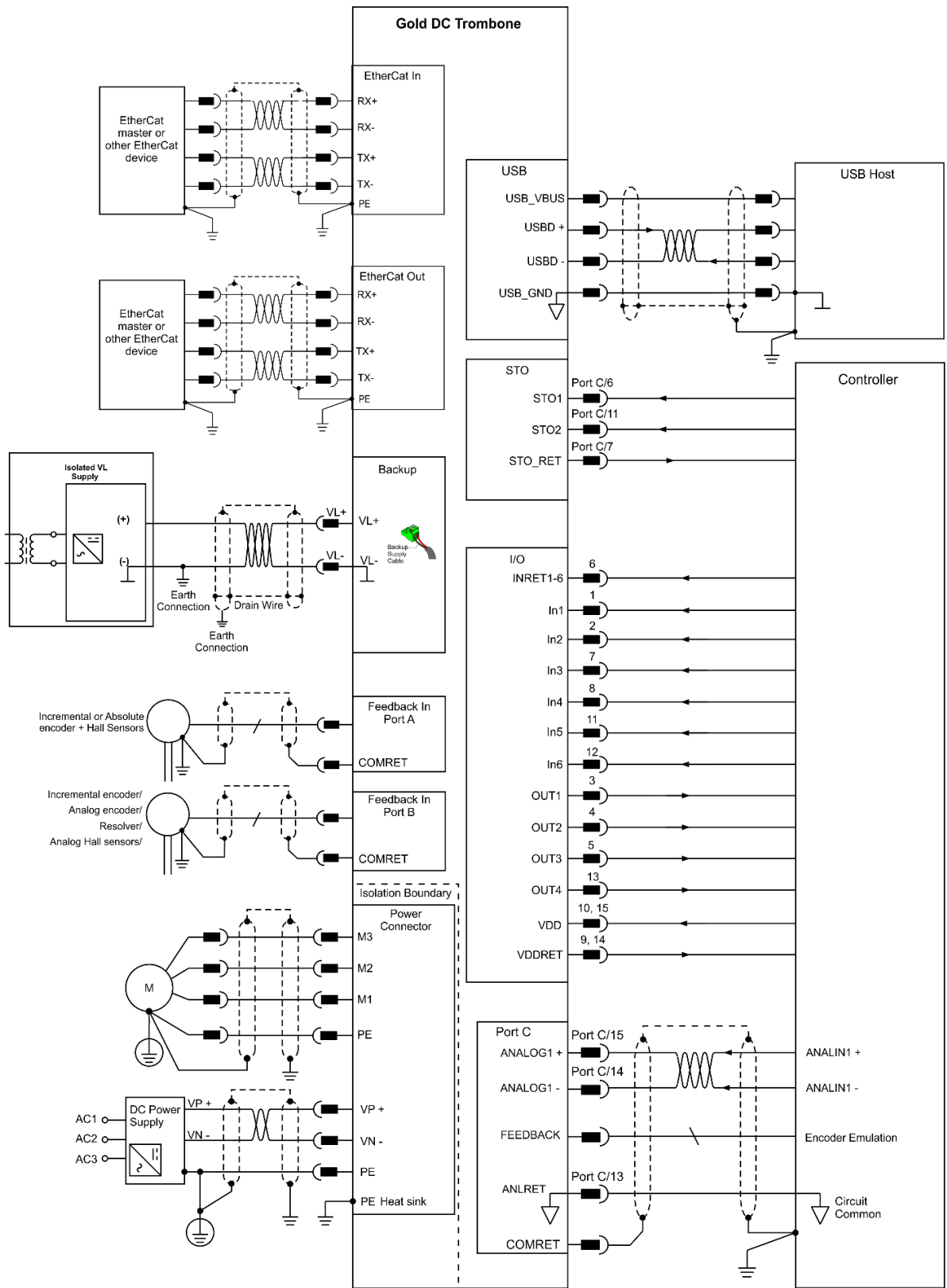
## 5.4 Connection Diagrams

There are two connection diagrams for EtherCAT and two for CAN that show the two different ways of connecting the power supply:

- 400 V and 800 V A, H, S, or T options (the catalog number has an A, H, S, or T option) that feature backup functionality and require an auxiliary 24 V backup supply. The drive will not be operative without the external 24 VDC supply.
- 400 V model without backup functionality with a 0 or 1 option. The drive's internal DC/DC converter is fed from the VP+ and VN- of the internal drive's bus line.

### 5.4.1 Connection Diagrams for EtherCAT Version

The following describes the connection diagrams for the EtherCAT version.



GTRODC001F

**Figure 4: Gold DC Trombone EtherCAT Connection Diagram – with Backup Functionality (A, H, S, or T options)**

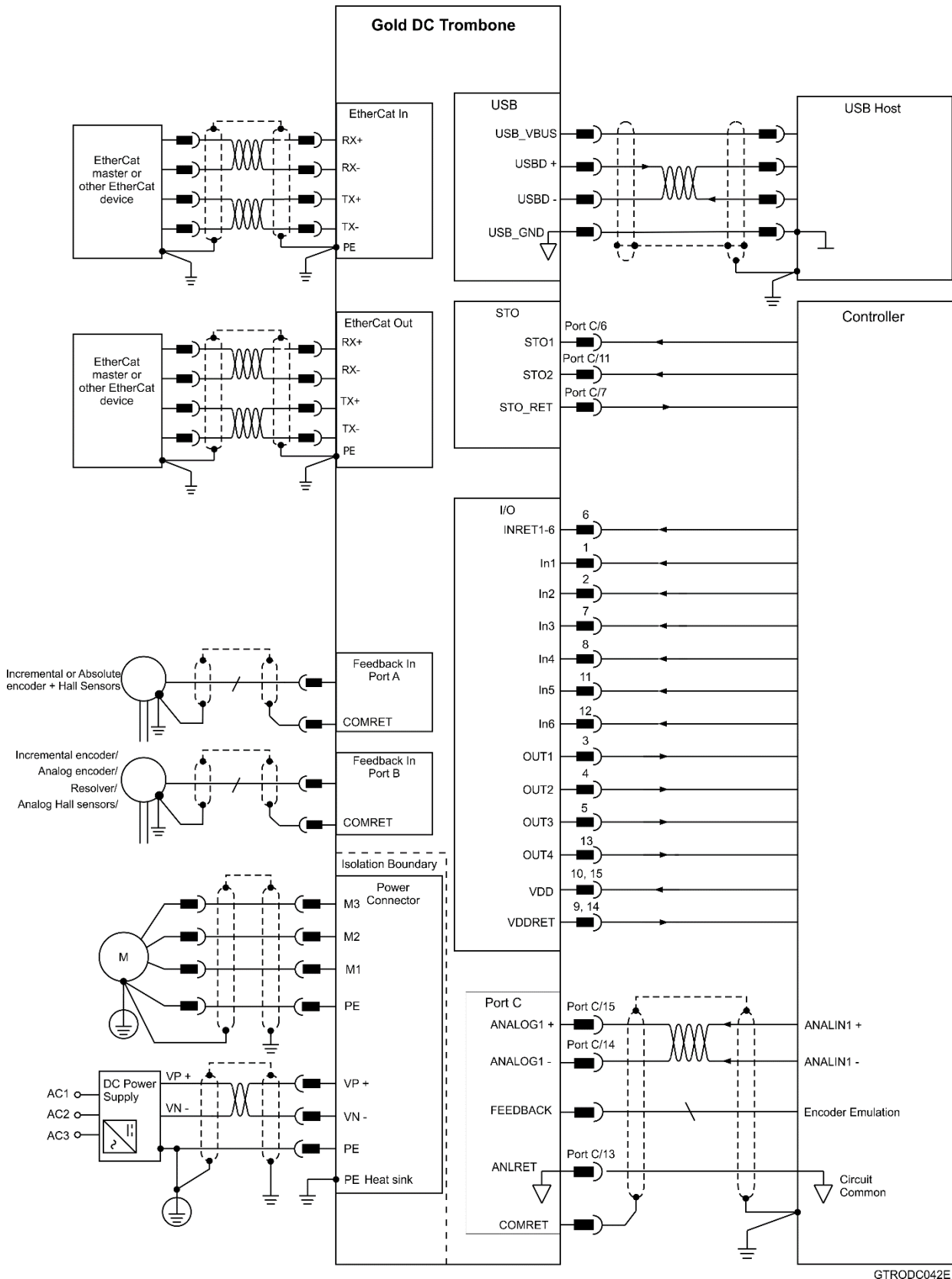
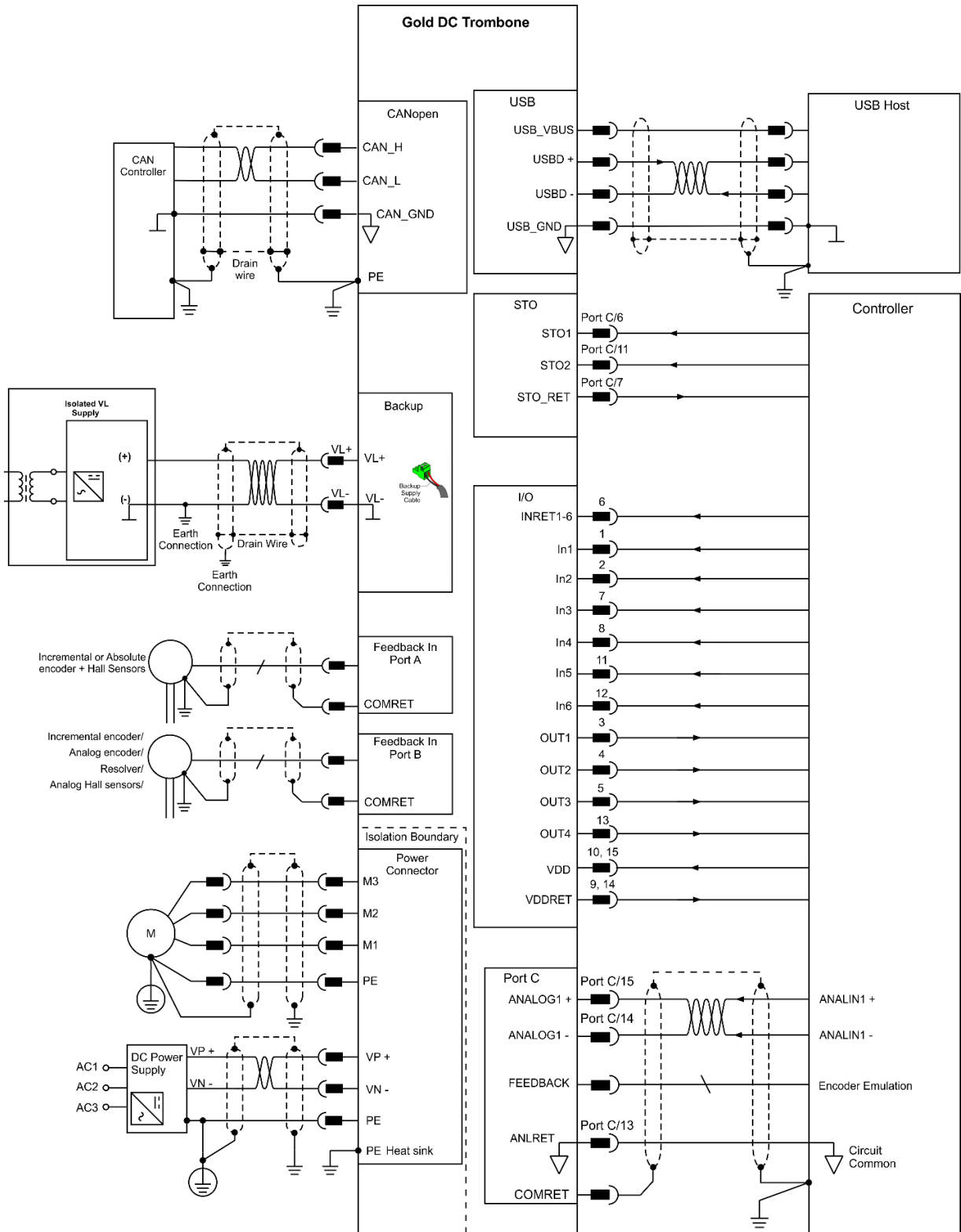


Figure 5: Gold DC Trombone EtherCAT Connection Diagram – 400 V without Backup Functionality for Model Drives with 0 or 1 Options

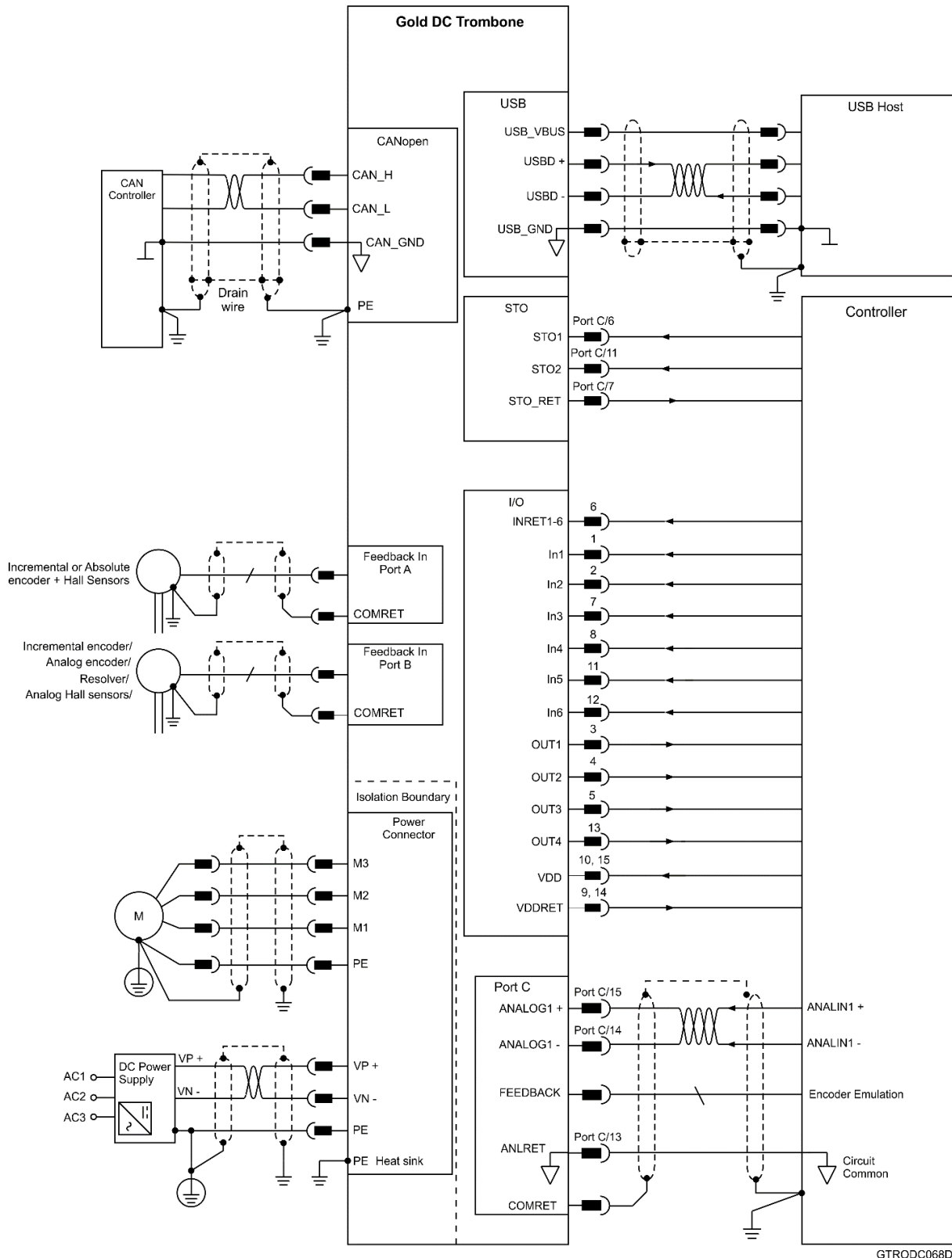
### 5.4.2 Connection Diagrams for CAN Version

The following describes the connection diagrams for the CAN version.



GTRODC067D

**Figure 6: Gold DC Trombone CAN Connection Diagram – with Backup Functionality (A, H, S, or T options)**



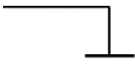
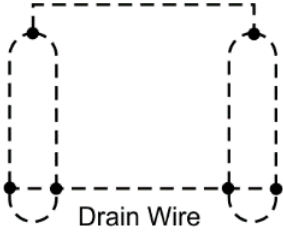
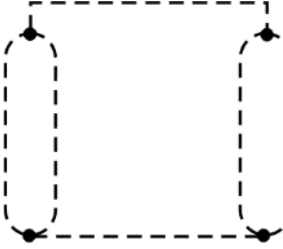
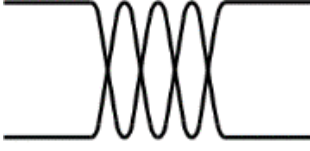


**Figure 7: Gold DC Trombone CAN Connection Diagram – 400 V without Backup Functionality for Model Drives with 0 or 1 Options**

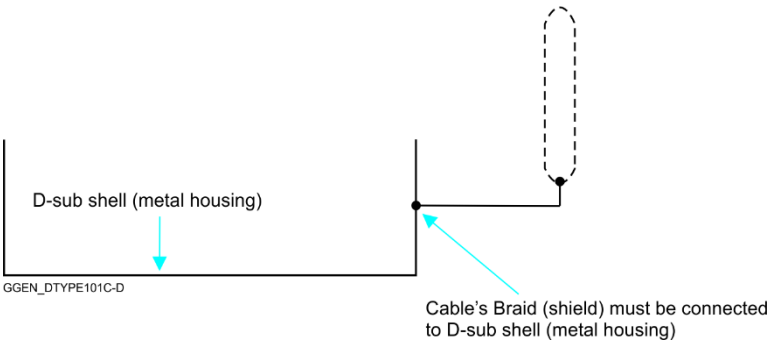
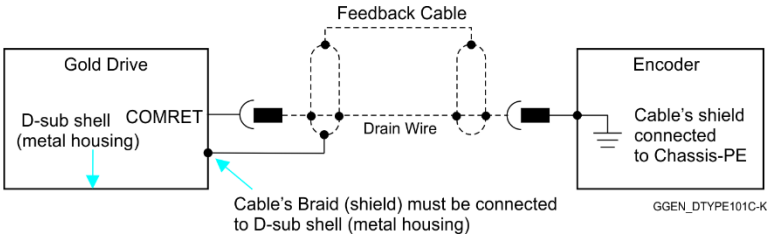
## Chapter 6: Wiring

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

The following table legend describes the wiring symbols detailed in all installation guides.

Wiring Symbol	Description
 <p>GGEN_DTYPE_DCTRO101A-A</p>	Earth connection (PE)
 <p>GGEN_DTYPE_DCTRO101A-B</p>	Earth Connection
 <p>GGEN_DTYPE_DCTRO101A-C</p>	Common at the Controller
 <p>GGEN_DTYPE_DCTRO101A-D</p>	<p>Shielded cable with drain wire.</p> <p>The drain wire is a non-insulated wire that is in direct contact with the braid (shielding).</p> <p>Shielded cable with drain wire significantly simplifies the wiring and earthing.</p>
 <p>GGEN_DTYPE_DCTRO101A-E</p>	Shielded cable braid only, without drain wire.
 <p>GGEN_DTYPE_DCTRO101A-F</p>	Twisted-pair wires



Wiring Symbol	Description
 <p>D-sub shell (metal housing)</p> <p>Cable's Braid (shield) must be connected to D-sub shell (metal housing)</p> <p>GGEN_DTYP101C-D</p>	<p>D-type Connector: The cable's braid (Shield) must be connected to the D-sub shell (metal housing)</p>
 <p>Gold Drive</p> <p>D-sub shell (metal housing)</p> <p>COMRET</p> <p>Feedback Cable</p> <p>Drain Wire</p> <p>Encoder</p> <p>Cable's shield connected to Chassis-PE</p> <p>Cable's Braid (shield) must be connected to D-sub shell (metal housing)</p> <p>GGEN_DTYP101C-K</p>	<p>Encoder Earthing.</p> <p>The cable's shield is connected to the chassis (PE) in the connector.</p> <p>Earthing the Encoder and connecting the Earth (PE) to the drive COMRET is mandatory to insure reliable operation, high noise immunity and rejection of voltage common mode interferences.</p>

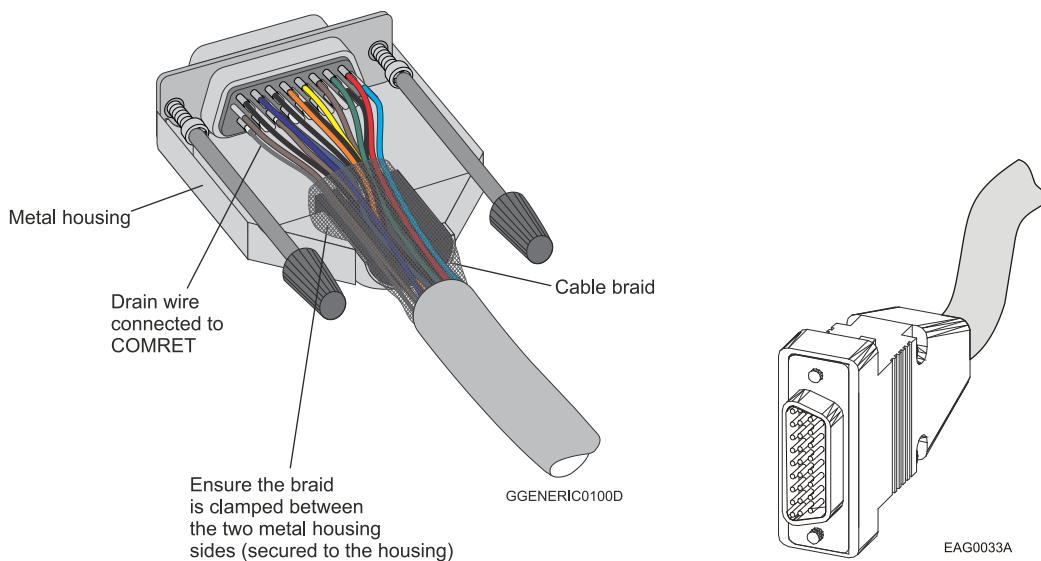




## 6.1 Basic Recommendations

### 6.1.1 General

1. Use shielded cables. For best results, the cable should have an aluminum foil shield covered by copper braid, and should contain a drain wire.  
Use 24, 26 or 28 AWG twisted-pair shielded with drain wire cables.
2. Keep the cable as short as possible.  
Do not mount the power cables of the motor and power bus in the proximity of the control and feedback cables.
3. Ensure that in normal operating conditions, the “earth connection” wires and shield of the control cables *carry no current*. The only time these conductors carry current is under abnormal conditions, when electrical equipment has become a potential shock or fire hazard while conducting external EMI interferences directly to ground, in order to prevent them from affecting the drive. Failing to meet this requirement might result in drive/controller/host failure.
4. After completing the wiring, carefully inspect all wires to ensure tightness, good solder of joints and general safety.



**Figure 8: D-Type Cable Assemblies**

5. Use only a D-Sub connector with a **metal housing** (Figure 8).
6. Make sure the braid shield is in tight contact with the metal housing of the D-type connector (Figure 8).

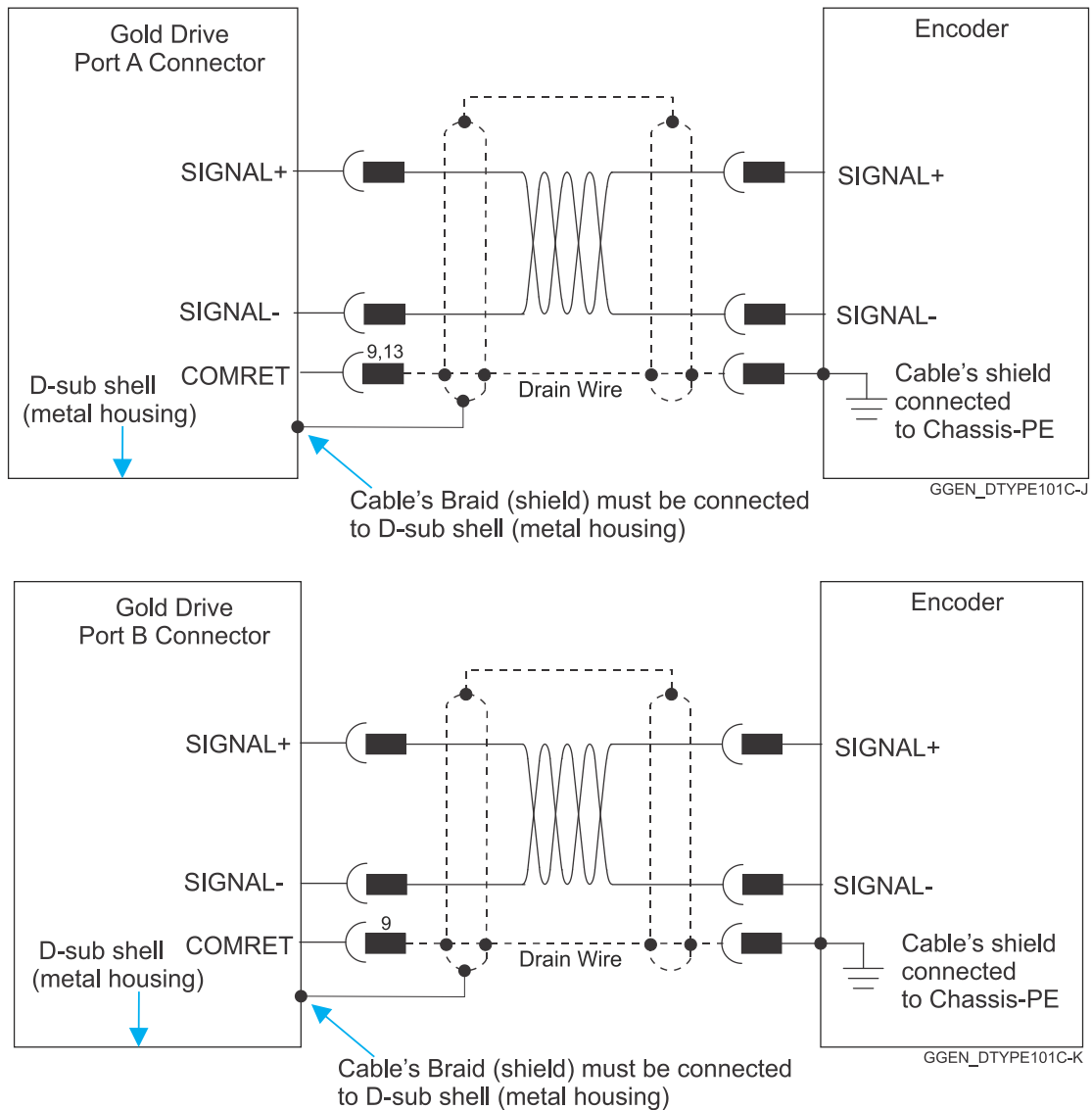
### 6.1.2 Feedback Cable Port A and Port B Connector

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

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

- a. At the drive, connect the feedback drain wire to one of the COMRET terminals in the D-Type feedback connector (Figure 9).
- b. At the motor, connect the feedback cable drain wire to the GND motor chassis terminal of the feedback connector.

The drawings below display two earth connections.



**Figure 9: Feedback Port A and B Cable Assemblies**



### 6.1.3 Feedback Cable Port C Connector

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

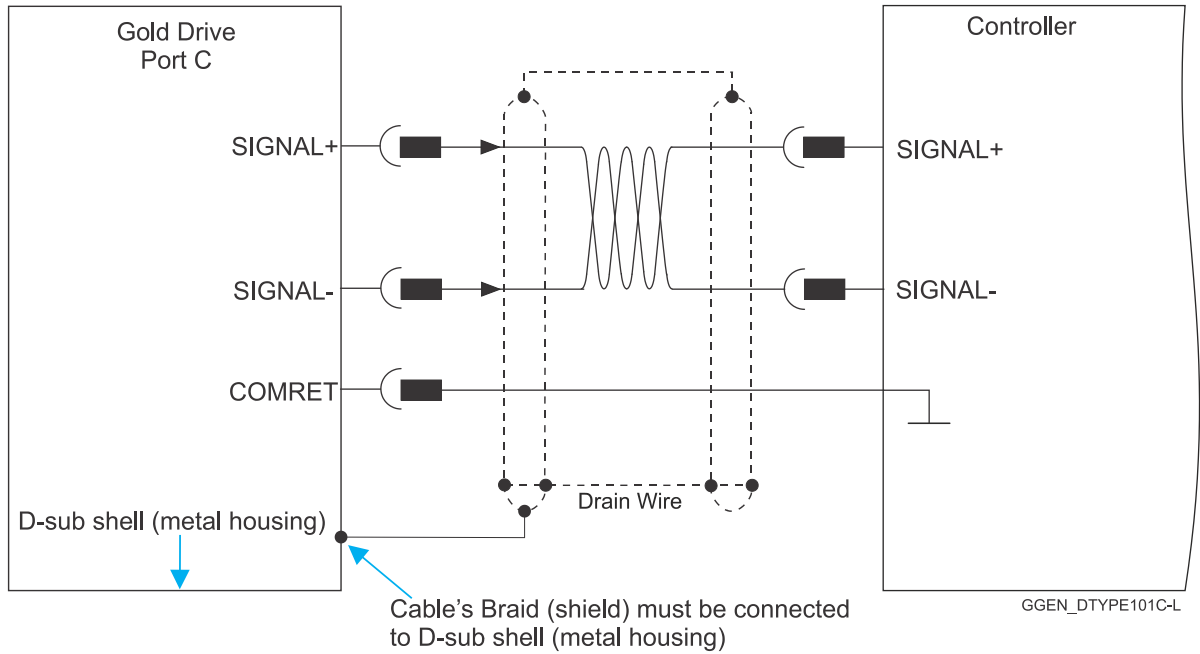


Figure 10: Feedback Port C Cable Assemblies

### 6.1.4 IO Cable Connector

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

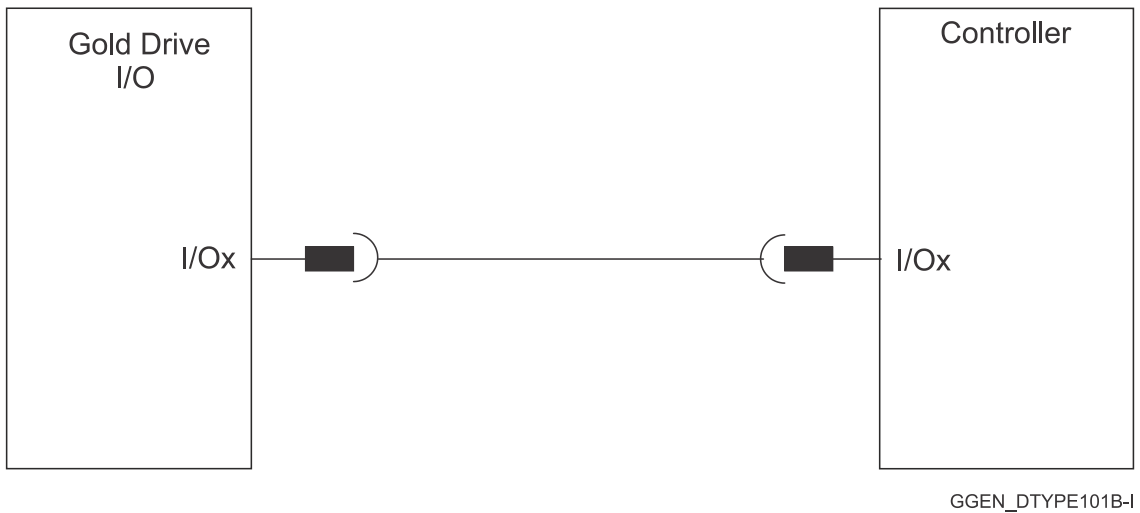


Figure 11: Feedback IO Cable Assemblies



### 6.1.5 STO (Port C) Cable Connector

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

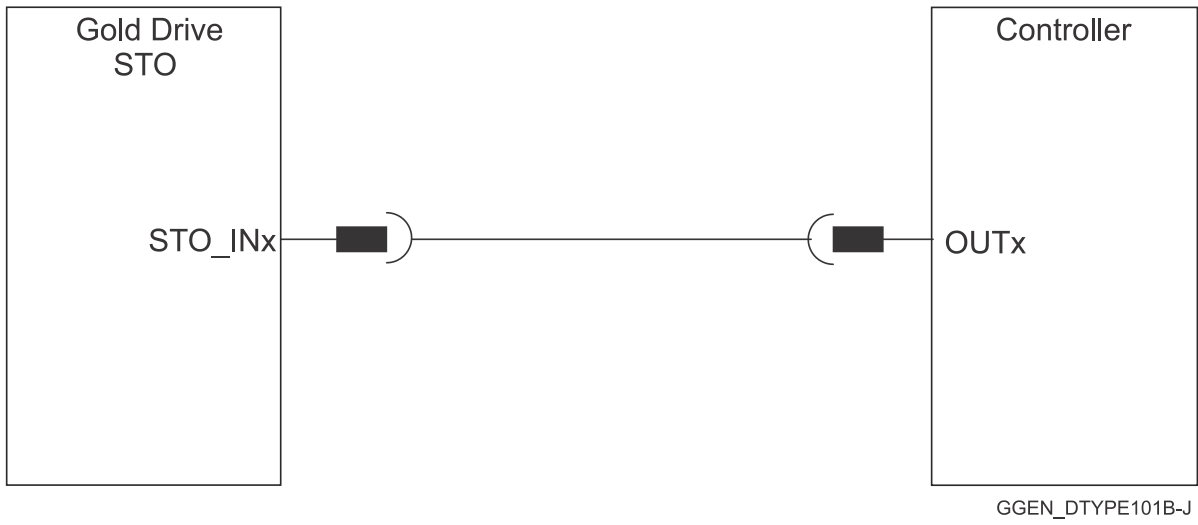


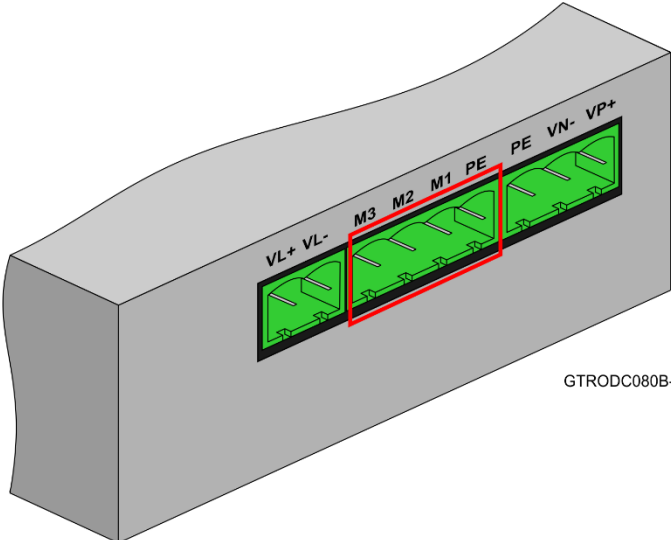
Figure 12: STO Cable Assemblies

## 6.2 Motor Power Connector Pinouts

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

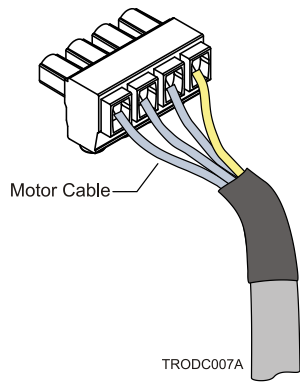
Pin	Function	Cable	
		Brushless Motor	Brushed DC Motor
M3	Motor phase	Motor	Motor
M2	Motor phase	Motor	Motor
M1	Motor phase	Motor	N/C
PE	Earth Connection	Motor	Motor



GTRODC080B-B

**4-Pin Pluggable 7.62 mm Phoenix High Current**



TRODC007A

**4-Pin Phoenix Plug-in Connector**

Table 2: Connectors for Motor

To power the drive, connect the M1, M2, M3, and PE pins on the Gold DC Trombone. The phase connection is arbitrary as Elmo Application Studio II (EAS II) will establish the proper commutation automatically during setup. When tuning a number of drives, you can copy the setup file to the other drives and thus avoid tuning each drive separately. In this case the motor-phase order must be the same as on the first drive.

- For best immunity, it is highly recommended to use a 4-wire shielded (not twisted) cable for the motor connection. The gauge is determined by the actual current consumption of the motor.
- Connect the cable shield to the closest ground connection at the motor end.
- For better EMI performance, the shield should be connected to Earth Connection (PE terminal).
- Ensure that the motor chassis is properly grounded.

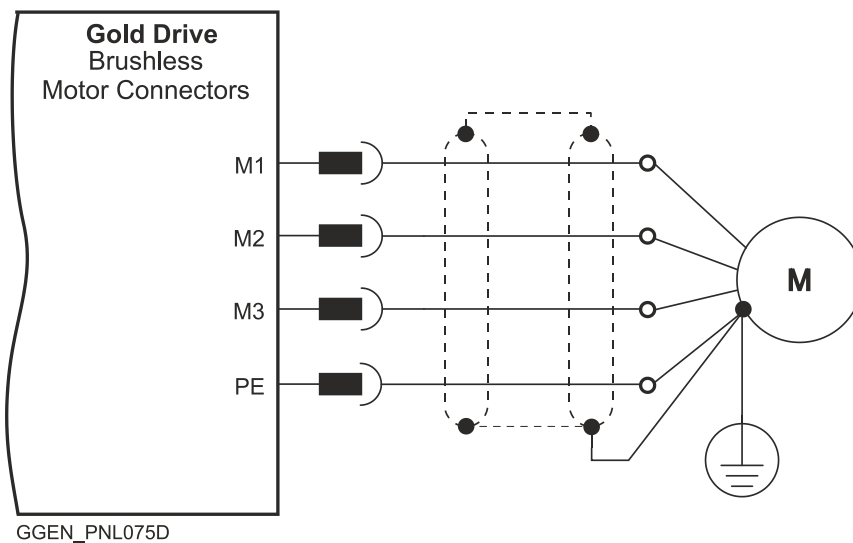


Figure 13: Brushless Motor Power Connection Diagram

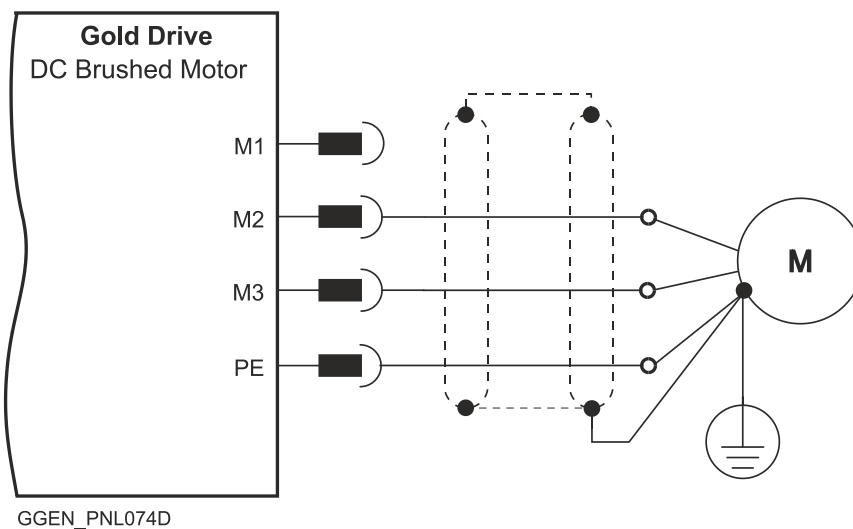


Figure 14: Brushed Motor Power Connection Diagram

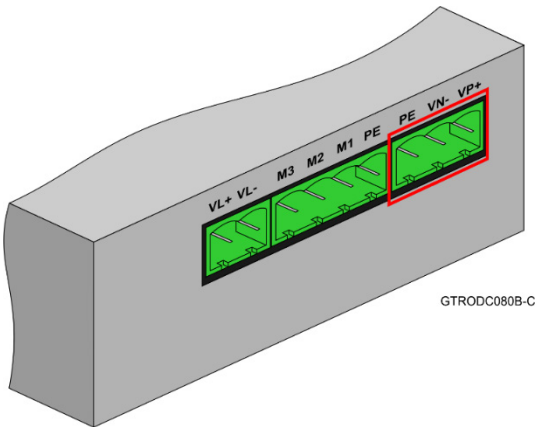
### 6.3 Main Power

The Gold DC Trombone receives power from main supply and delivers power to the motor.

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

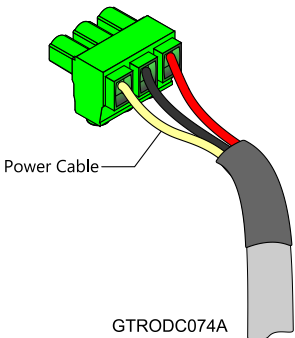
Pin	Function	Cable
PE	Earth Connection	DC Power
VN-	DC Negative Power input	DC Power
VP+	DC Positive Power input	DC Power



GTRODC080B-C

**3-Pin Pluggable 7.62 mm Phoenix High Current**



Power Cable

GTRODC074A

**3-Pin Phoenix Plug-in Connector**

**Table 3: Connectors for Main Power**

The DC power for the Gold DC Trombone is delivered from a separated power supply. Elmo recommends using the Tambourine power supply for servo applications designed for use in conjunction with Elmo drives.

The following sections contain topology recommendations for implementing three-phase and a single-phase supply chains.

The power stage of the Gold DC Trombone is fully isolated from the other sections of the Gold DC Trombone, such as the control-stage and the heat sink. **This isolation allows the user to connect the common of the control section to the PE, a connection which significantly contributes to proper functionality, safety and EMI immunity, leading to better performance of the Gold DC Trombone.**

In addition, this isolation simplifies the requirements of the DC power supply that is used to power the DC bus of the Gold DC Trombone, by allowing it to operate with a direct-to-mains connection eliminating the need for a bulky and expensive isolation transformer.

However, as well as operating from a non-isolated/direct-to-mains DC power supply, the Gold DC Trombone can also operate from an isolated power supply or batteries.

When rectifying an AC voltage source, the AC voltage level for the G-TROXX/400 servo drive must be limited to 270 VAC so as not to exceed the maximum 390 VDC. Similarly, for the G-TROXX/800 servo drive, the AC is limited to 528 VAC input (Phase to Phase), so as not to exceed the maximum 747 VDC (in the case of an 800 VDC drive).

### 6.3.1 Direct-to-Mains Power Source

This section relates to the configuration of the drive, which is connected directly to the mains.

#### To connect the non-isolated AC power supply:

1. For best noise immunity, a shielded (not twisted) cable is recommended (not mandatory) for the DC input cable.
2. A 3-wire shielded cable should be used:
  - a. Connect the main input cable to the VP+ and VN- terminals of the main input connector.
  - b. For safety requirements, the green/yellow-wire must be connected to the earth connection (PE terminal). Connect the Earth Connection wire to the PE terminal on the main DC connector.
  - c. For better EMI performance, the shield should be connected to Earth Connection (PE).
3. The gauge of the cable strands is determined by the actual current of the drive.



#### Caution For all the following Topologies:

- Do not connect VN- to PE. In a direct-to-mains connection the VN- must *not* be connected to the PE, as this will cause irreparable damage to the system.
- Take care and note that in a direct-to-mains connection the Neutral point is *not* the most negative voltage level. It is the mid-point level of the rectified DC bus.

#### 6.3.1.1 Three-Phase Direct-to-Mains Connection Topology

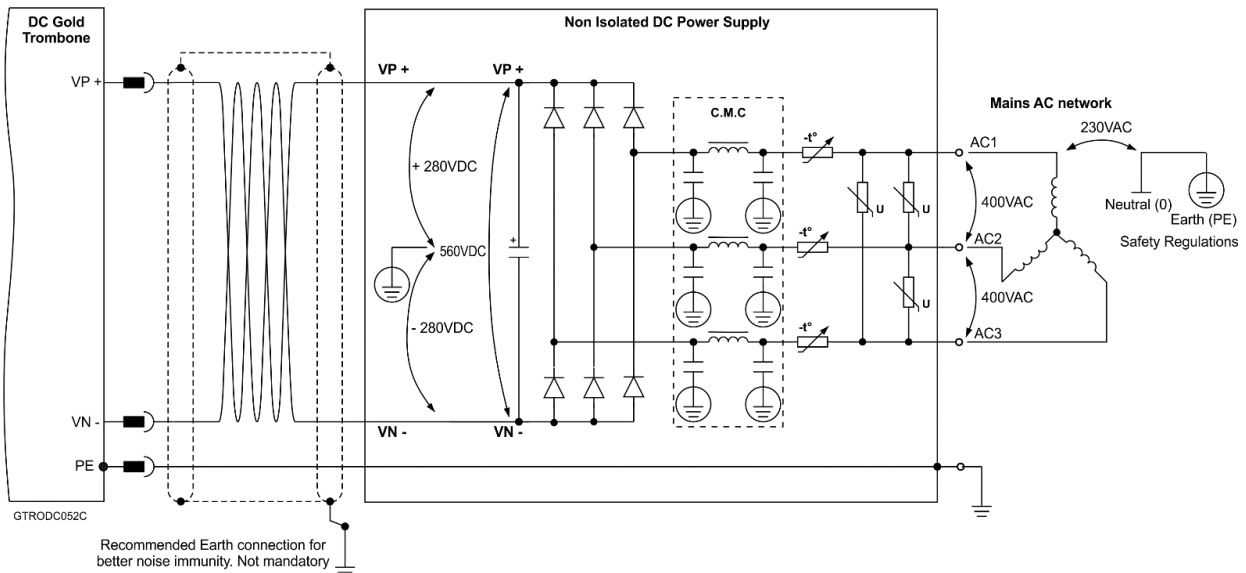


Figure 15: Non-Isolated Three-Phase Connection Topology





### 6.3.1.2 Single-Phase Direct-to-Mains Connection Topology

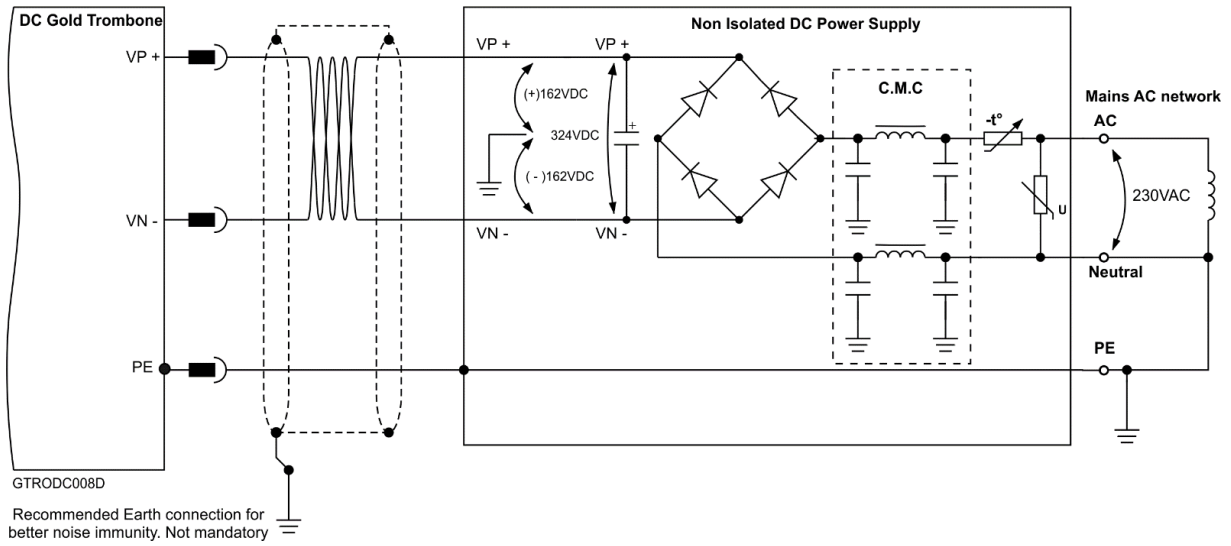


Figure 16: Non-Isolated Single-Phase Connection Topology

The Power Supply is connected directly to the mains AC line.

### 6.3.1.3 Multiple Connections Topology

In a multi-axis application it is likely that a single power supply can feed several drives in parallel. The power supply is connected directly to the mains AC line and it feeds more than one drive.

This topology is efficient and cost saving, by reducing the number of power supplies and the amount of wiring. Most importantly it utilizes an energy sharing environment among all the drives that share the same DC bus network.

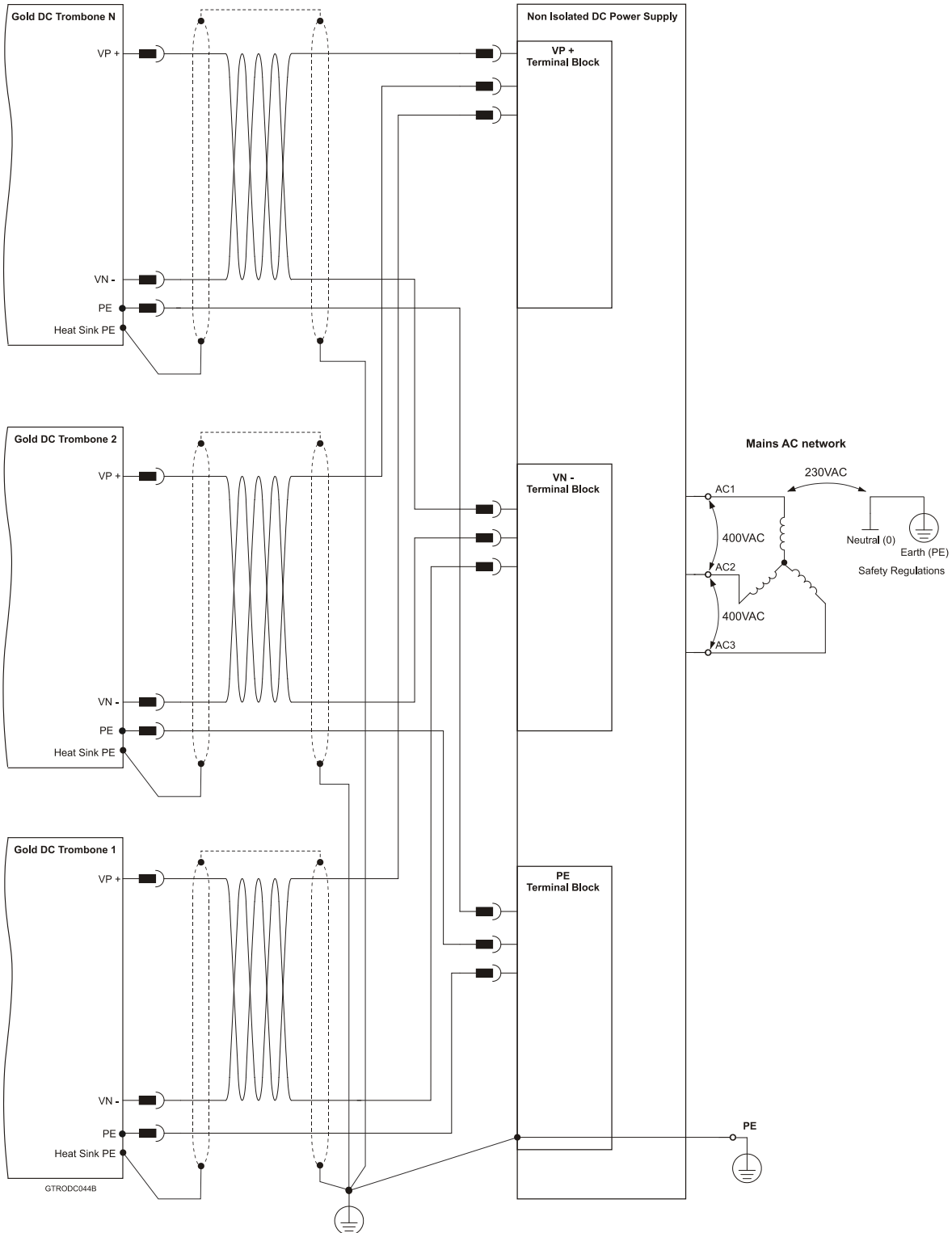


Figure 17: Non-Isolated Three-Phase Multiple Connection Topology



### 6.3.2 Battery Power Supply

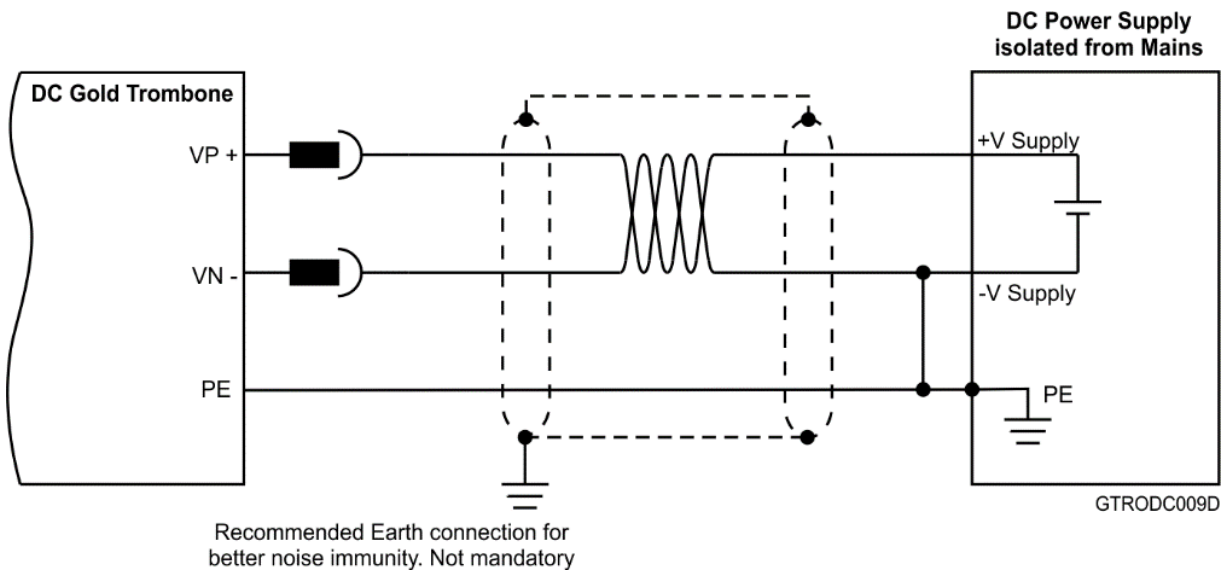


Figure 18: Battery Connection Topology

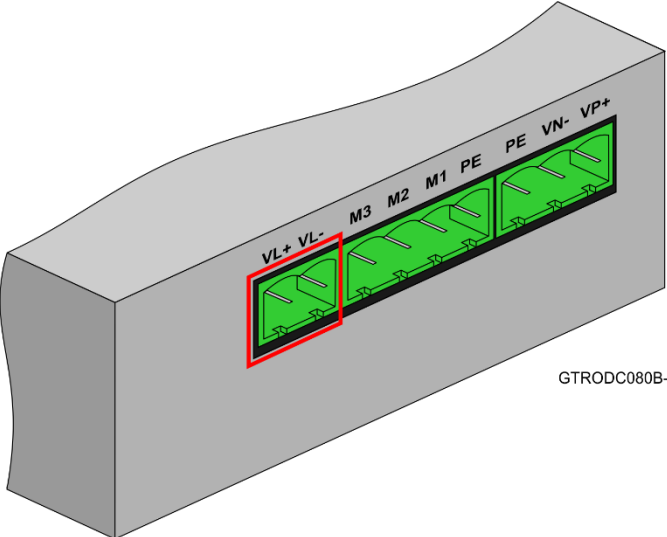
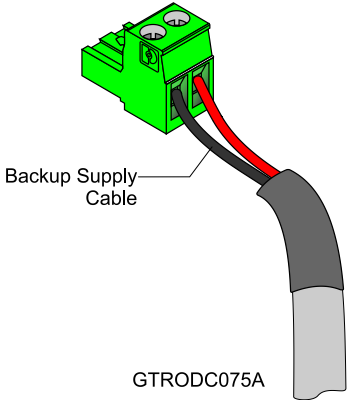


**Caution:** When using batteries, it is recommended to connect the negative pole to the PE. When doing so, the charger of the battery **must** be isolated from the mains by an isolation transformer.

## 6.4 Auxiliary Power

Optional Backup Supply in A, H, S, or T option drives.

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

Pin	Function	Cable
<b>A, H, S, or T option type</b>		
VL+	+24 V Auxiliary Supply Input Positive	DC Power
VL-	24 V RET Auxiliary Supply Input Return	DC Power
 <p style="text-align: right;">GTR0DC080B-A</p> <p><b>2-Pin Pluggable 5.08 mm Phoenix High Current</b></p>		 <p style="text-align: center;">GTR0DC075A</p> <p><b>2-Pin Phoenix Plug-in Connector</b></p>

**Table 4: Auxiliary Power Connector**

In drives that have a 0 or 1 Option (only for 400 V model) in the catalog number, a smart control-supply algorithm enables the Gold DC Trombone to operate with the main power supply only, *with no need for an auxiliary supply voltage to supply the drive's logic section.*

**Note** that in such a model there is no backup ability at all.

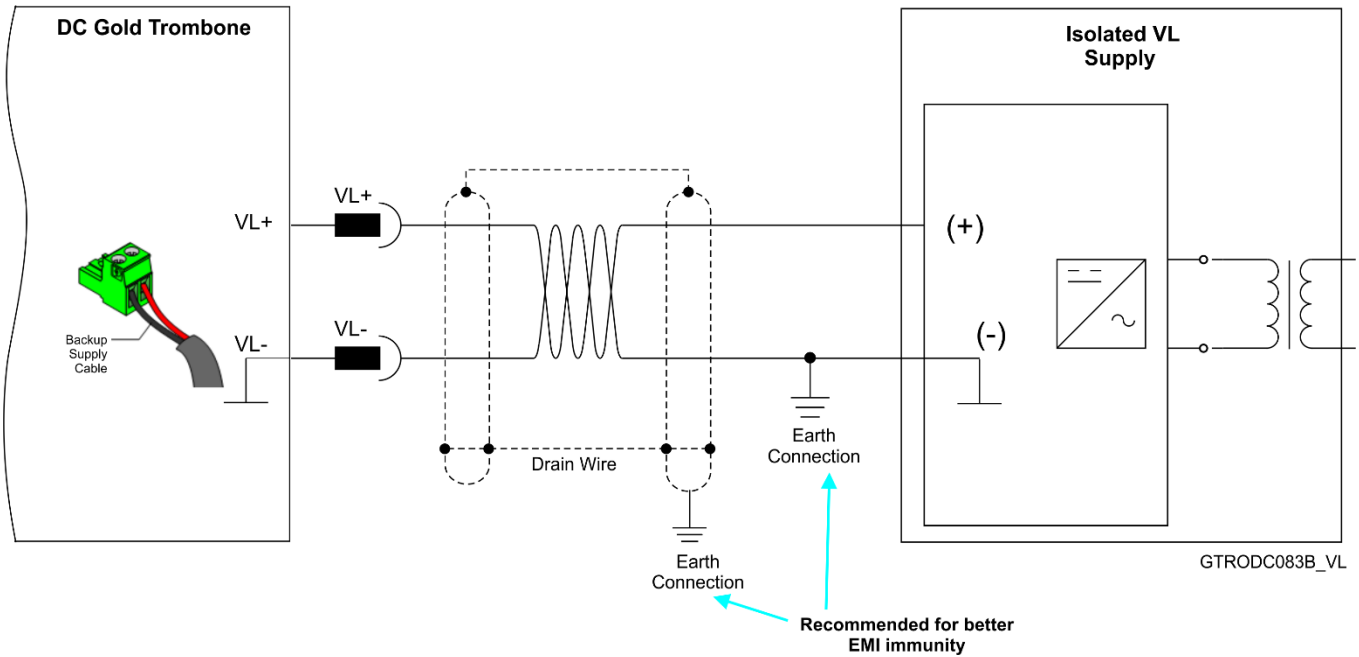
If backup functionality is required to store control parameters in the event of a mains power outage, then an A, H, S, or T options Gold DC Trombone should be used, with an external 24 VDC isolated supply connected to it.

Note that the A, H, S, or T options Gold DC Trombone always requires an external 24 VDC power supply, regardless of whether or not backup functionality is required.

Connect the auxiliary 24 VDC power supply as described below.

**To connect the 24 VDC backup supply:**

1. Use a 24 AWG twisted pair shielded cable. The shield should be braided.
2. The source of the 24VDC backup supply must be isolated from the Mains.
3. For safety and EMI reasons, connect the return of the 24VDC backup supply to the closest Earth Connection (PE).
4. Connect the cable shield to the closest ground (PE) near the power source.
5. Before applying power, first verify that the polarity of the connection is correct.



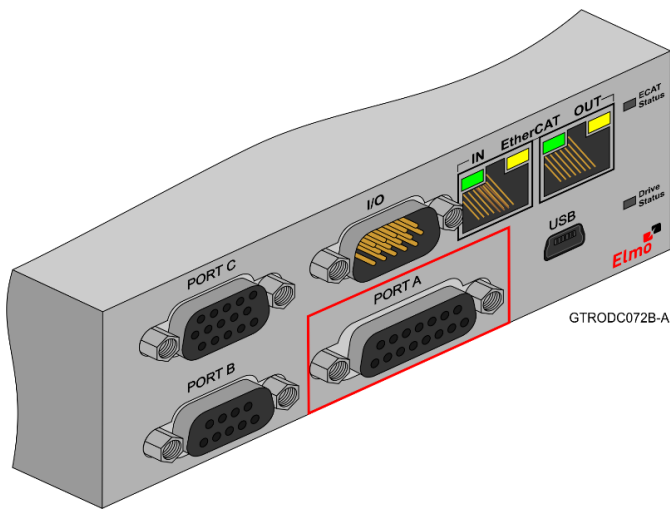
**Figure 19: 24 VDC Backup Supply VL Connection Diagram**

## 6.5 Port A

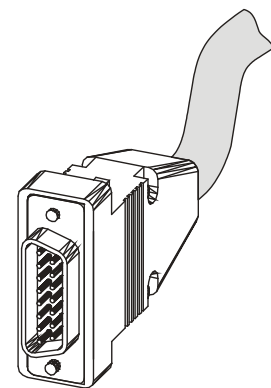
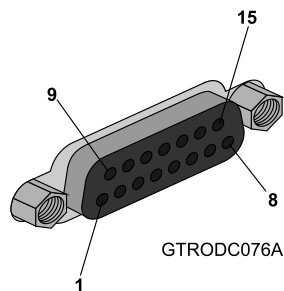
See Section 10.3 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Incremental Encoder			Absolute Serial Encoder	
Pin on Port A	Signal	Function	Signal	Function
12,4	+5V	Encoder +5V supply	+5V	Encoder +5V supply
3,9,11,13	COMRET	Common return	COMRET	Common Return
6	PortA_ENC_A+	Channel A+	ABS_CLK+	Abs encoder clock +
5	PortA_ENC_A-	Channel A-	ABS_CLK-	Abs encoder clock -
15	PortA_ENC_B+	Channel B+	ABS_DATA+	Abs encoder data +
14	PortA_ENC_B-	Channel B-	ABS_DATA-	Abs encoder data -
8	PortA_ENC_INDEX+	Index+	Reserved	Reserved
7	PortA_ENC_INDEX-	Index-	Reserved	Reserved
2	HA	Hall sensor A	HA	Hall sensor A
10	HB	Hall sensor B	HB	Hall sensor B
1	HC	Hall sensor C	HC	Hall sensor C

### Pin Positions



15-Socket D-Type Female Connector

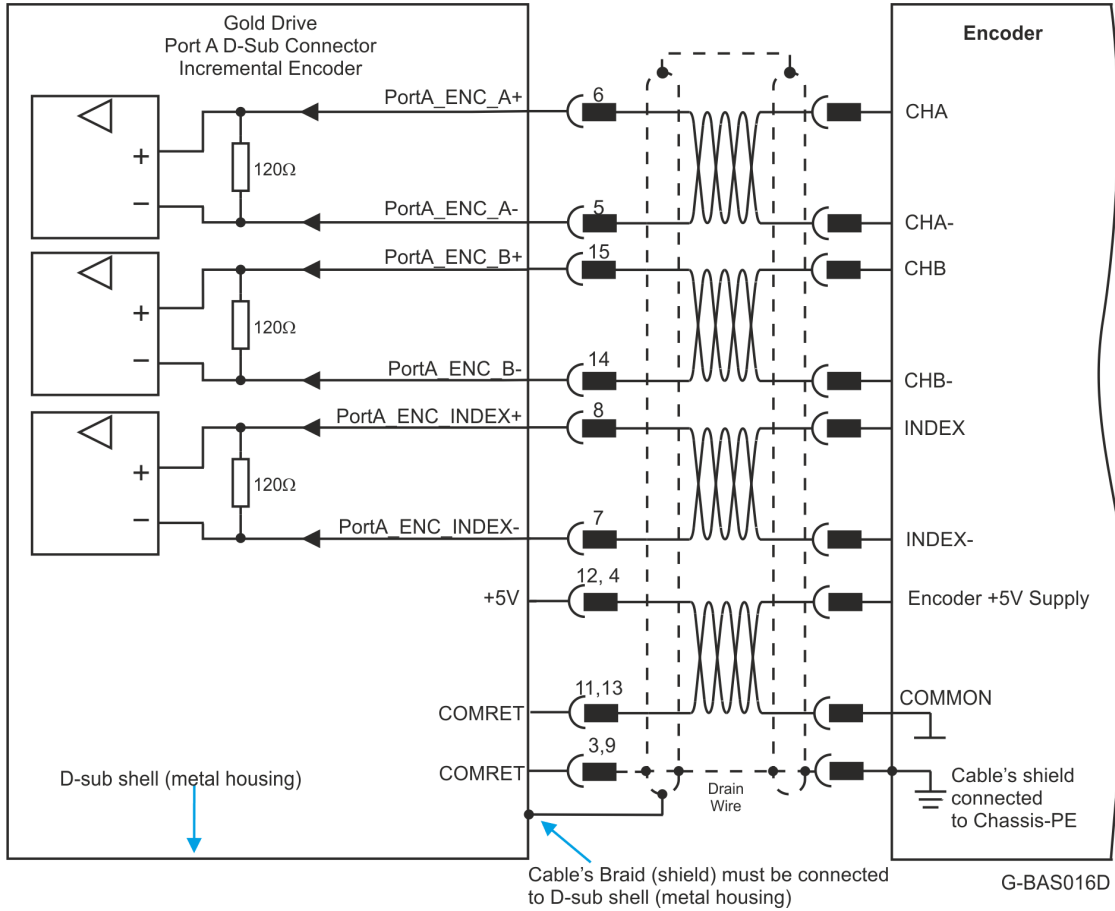


15-Pin D-Type Male Connector

Table 5: Port A Pin Assignments

### 6.5.1 Incremental Encoder

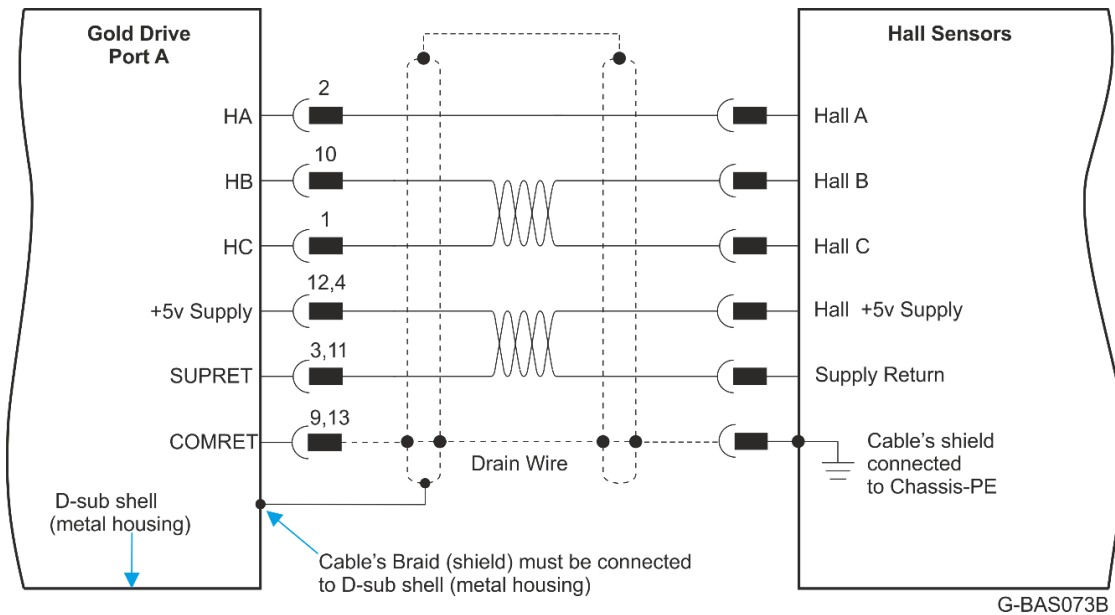
The following figure describes the connections at Port A for the Incremental encoder.



**Figure 20: Port A D-Type Incremental Encoder Input – Recommended Connection Diagram**

### 6.5.2 Hall Sensor

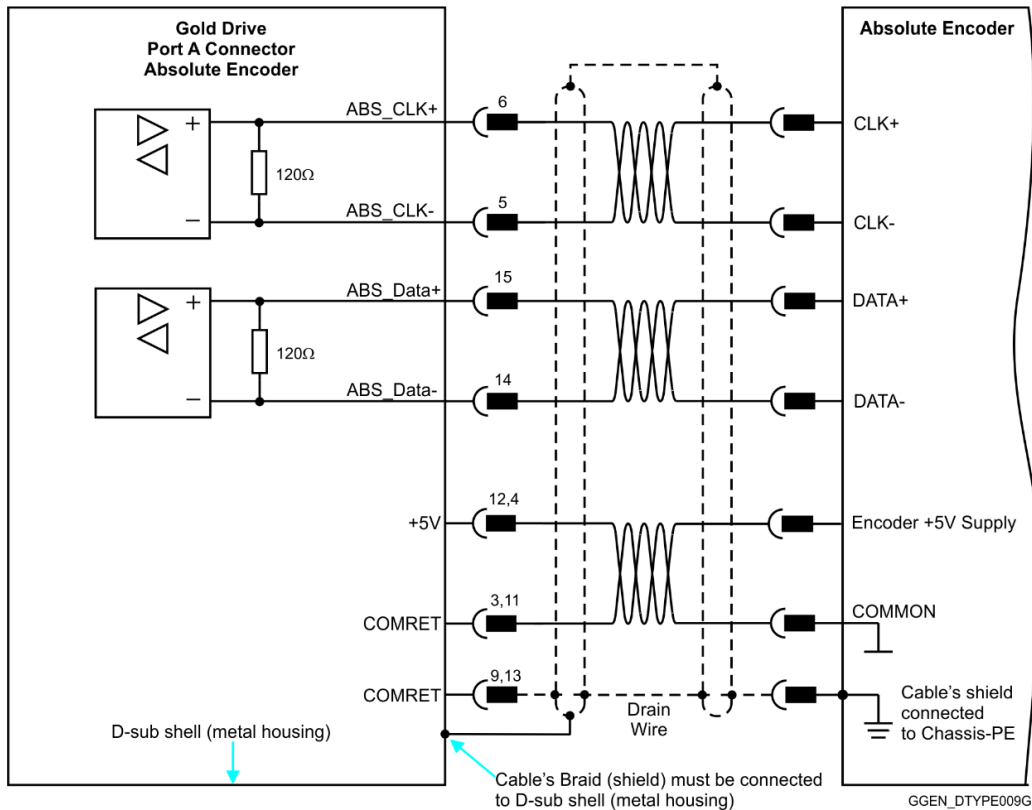
The following figure describes the connections at Port A for the Hall Sensor.



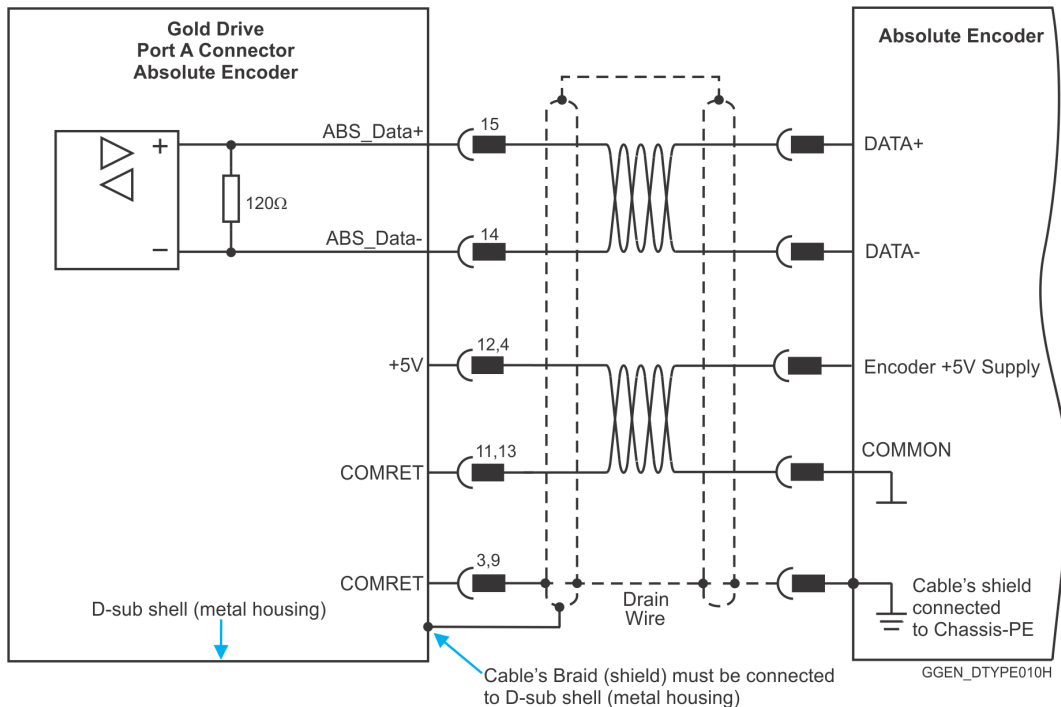
**Figure 21: Hall Sensor Connection Diagram**

### 6.5.3 Absolute Serial Type Encoder

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

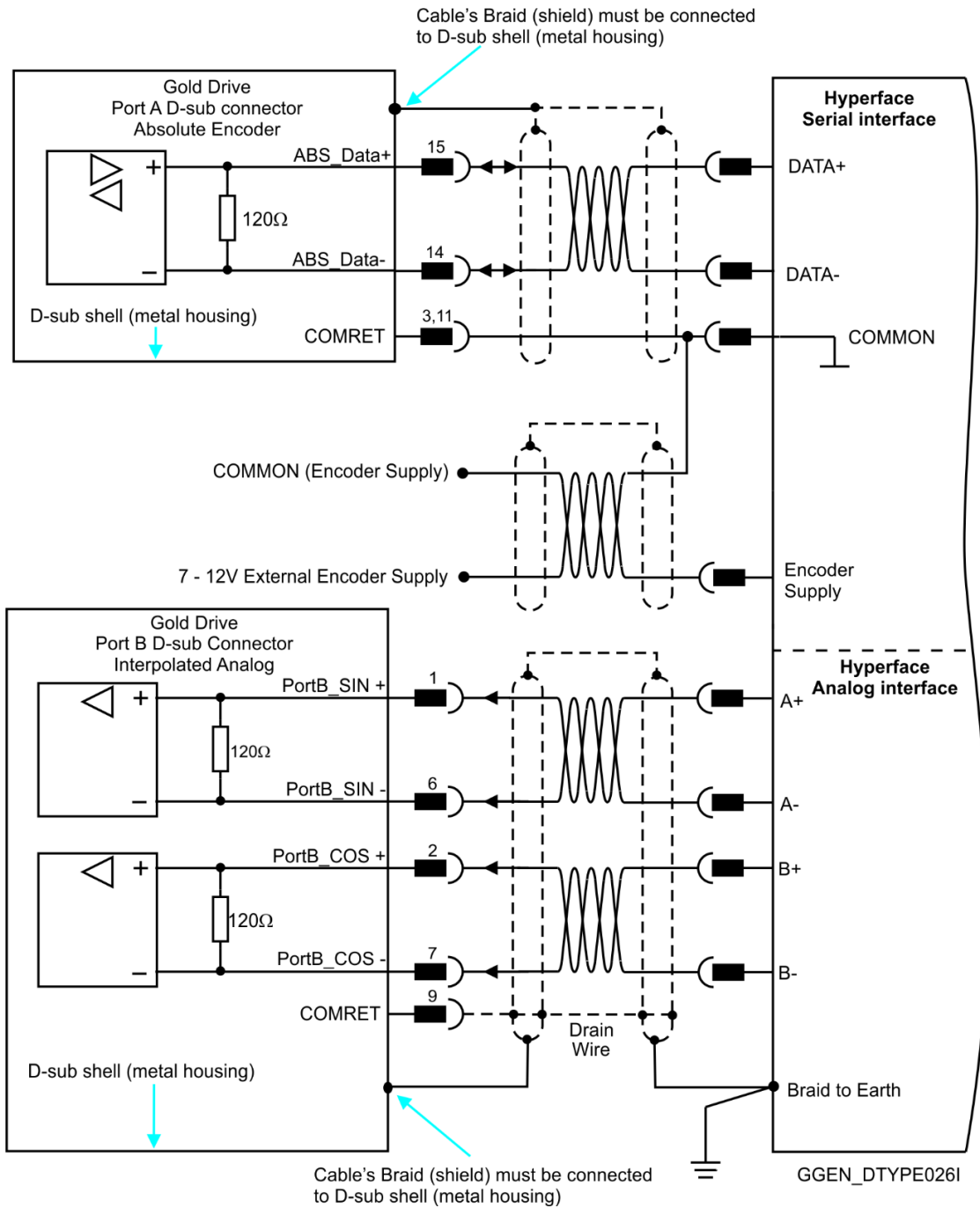


**Figure 22: Absolute Serial Encoder – Recommended D-Type Connection Diagram for EnDAT, Biss, and SSI**



**Figure 23: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)**





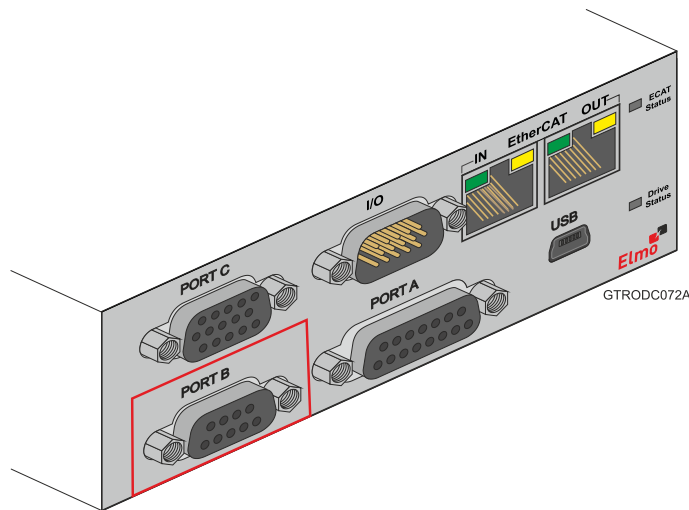
**Figure 24: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Stegmann Hiperface**

## 6.6 Port B

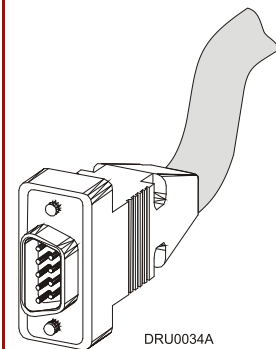
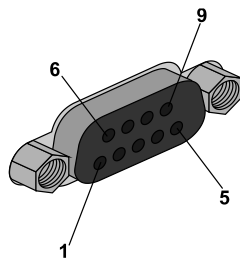
See Section 10.4 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Incremental or Interpolated Analog Encoder			Resolver	
G-DCTROXXX/YYYYXEXXQ			G-DCTROXXX/YYYYXRXXQ	
Pin on Port B	Signal	Function	Signal	Function
4	+5V	Encoder +5V supply	NC	
5,9	COMRET	Common Return	COMRET	Common Return
1	PortB_ENC_A+/SIN+	Incremental Encoder A+ / Sine+	SIN+	Sine+
6	PortB_ENC_A-/SIN-	Channel A- / Sine-	SIN-	Sine-
2	PortB_ENC_B+/COS+	Channel B+ / Cosine+	COS+	Cosine+
7	PortB_ENC_B-/COS-	Channel B- / Cosine-	COS-	Cosine-
3	PortB_ENC_INDEX+	Index+	RESOLVER_OUT+	Vref f=1/TS, 50 mA Max.
8	PortB_ENC_INDEX-	Index -	RESOLVER_OUT-	Vref complement f= 1/TS, 50 mA Max.

### Pin Positions



9-Pin D-Type Female Connector

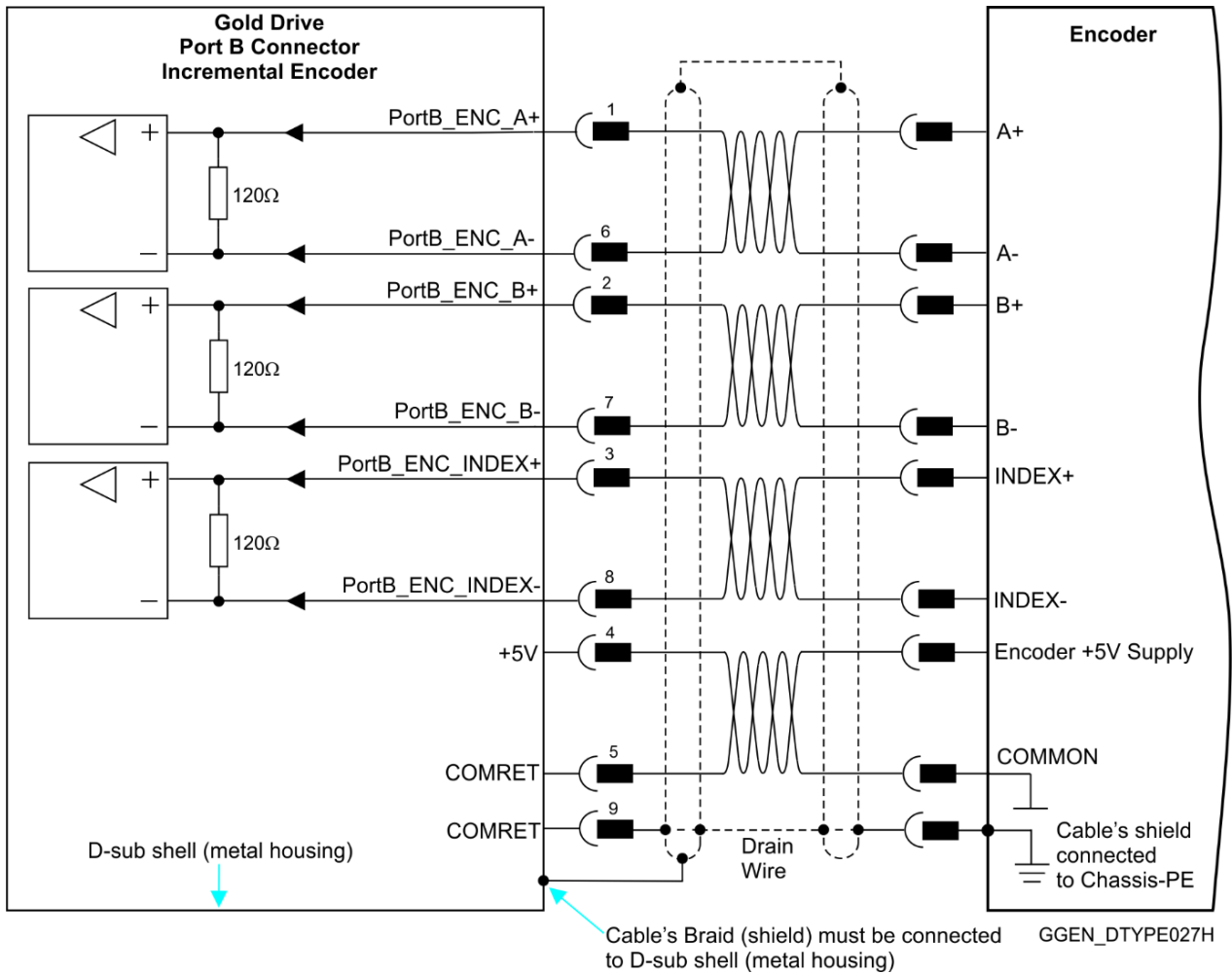


9-Pin D-Type Male Connector

Table 6: Port B Pin Assignments

### 6.6.1 Incremental Encoder

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



**Figure 25: Port B Incremental Encoder Input – Recommended D-Type Connection Diagram**

### 6.6.2 Interpolated Analog Encoder

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

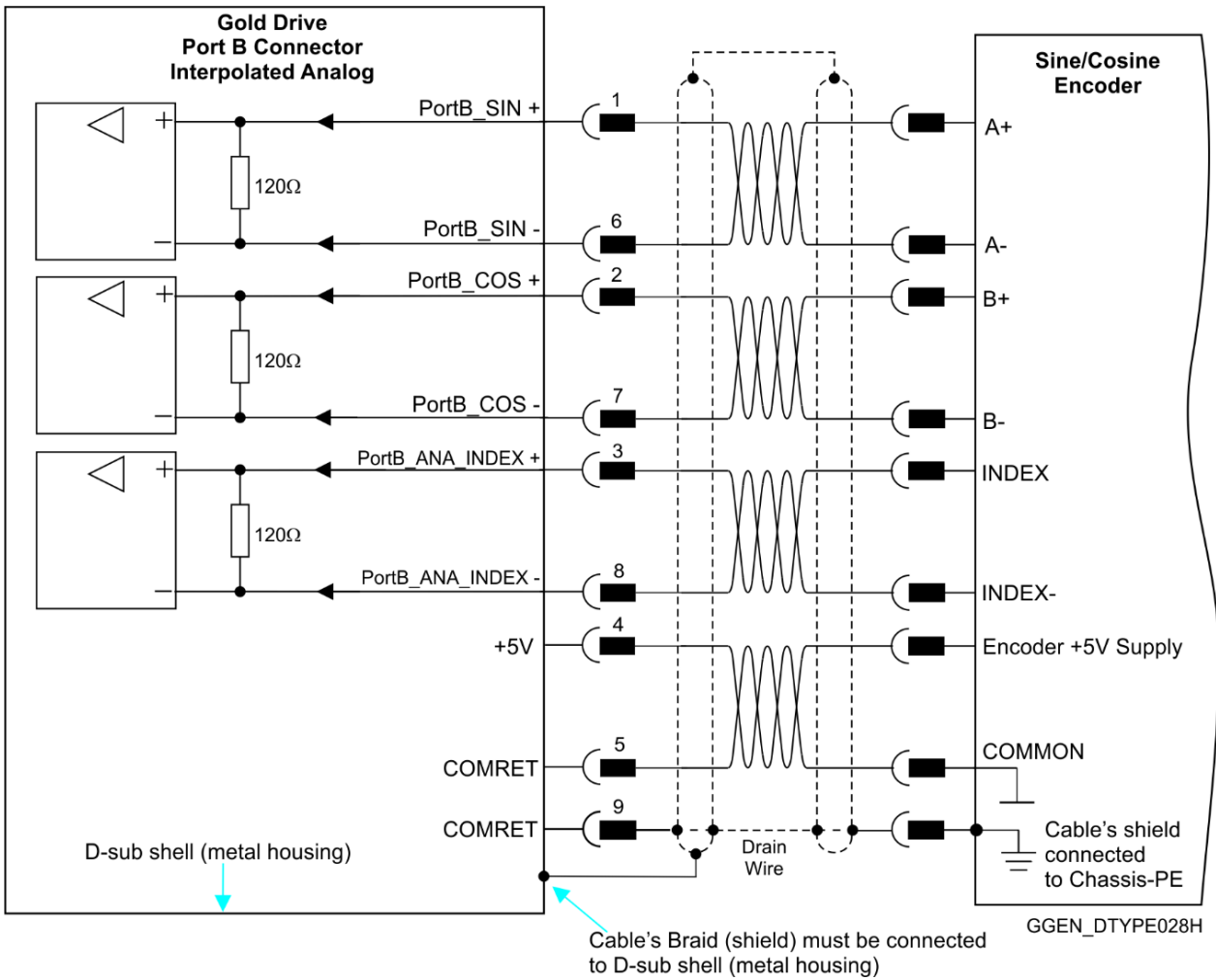


Figure 26: Port B - Interpolated Analog Encoder D-Type Connection Diagram



### 6.6.3 Resolver

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

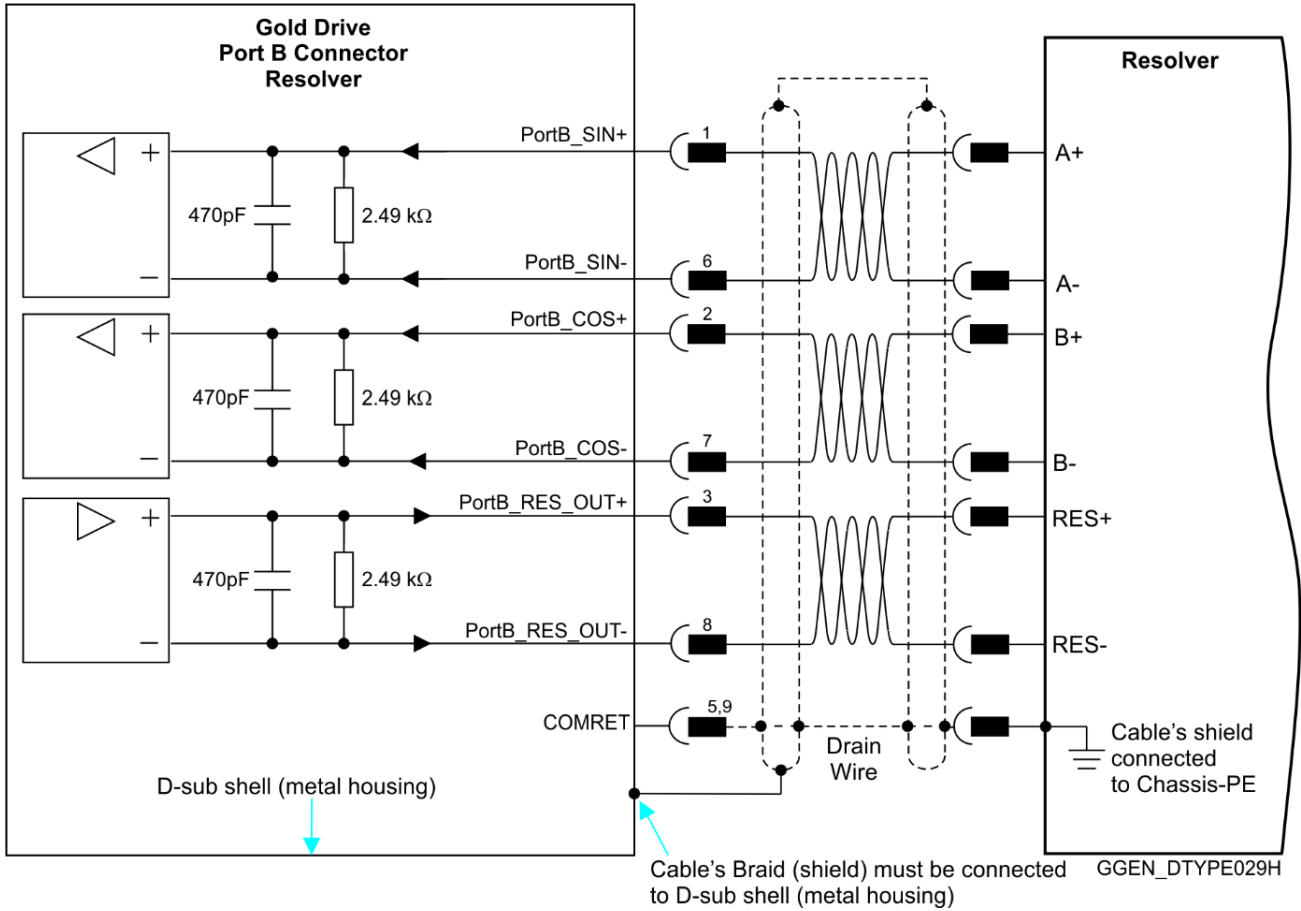


Figure 27: Port B – Resolver D-Type Connection Diagram



## 6.7 Port C, Analog Input, and STO

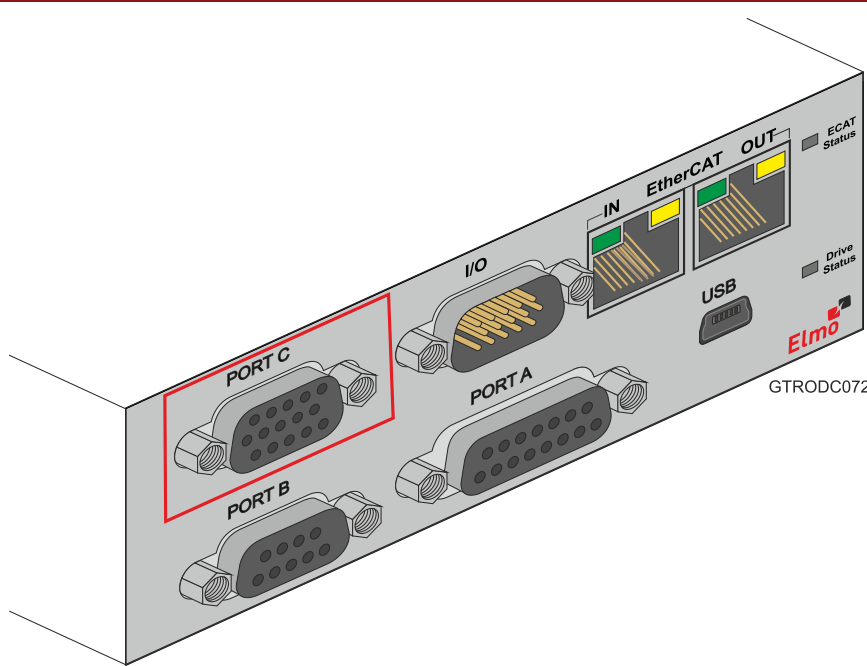
The Port C connector includes the following functions:

- Port C: Refer to Sections 10.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details
- STO: See Chapter 9 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.

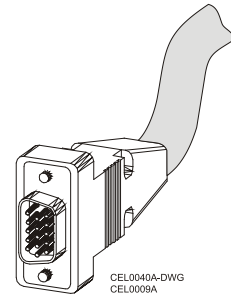
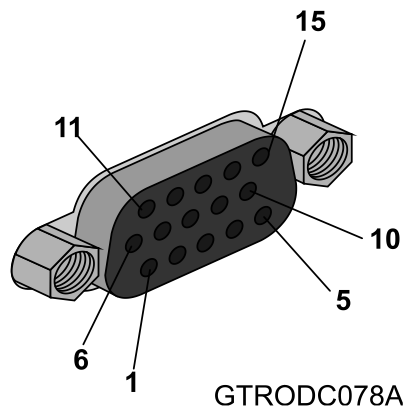
Pin on Port C	Signal	Function
1	PortC_ENCO_A+	Buffered Channel A+ output/Pulse+/PWM+
2	PortC_ENCO_A-	Buffered Channel A- output / Pulse- / PWM-
3	PortC_ENCO_B+	Buffered Channel B+ output / Dir+
4	PortC_ENCO_B-	Buffered Channel B- output / Dir-
5	PortC_ENCO_Index+	Buffered Channel INDEX+ output
6	STO1	STO 1 input (default 24 V)
7, 12	STO_RET	STO signal return
8	Reserved	Reserved
9	COMRET	Common return
10	PortC_ENCO_Index-	Buffered Channel INDEX- output
11	STO2	STO 2 input (default 24 V)
13	ANLRET	Analog ground
14	ANALOG1-	Analog input 1-
15	ANALOG1+	Analog input 1+



### Pin Positions



**15-Socket High Density D-Type Connector**



**15-Pin High Density D-Type Male Connector**

**Table 7: Port C Feedback Out and STO Analog In**

### 6.7.1 Port C

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

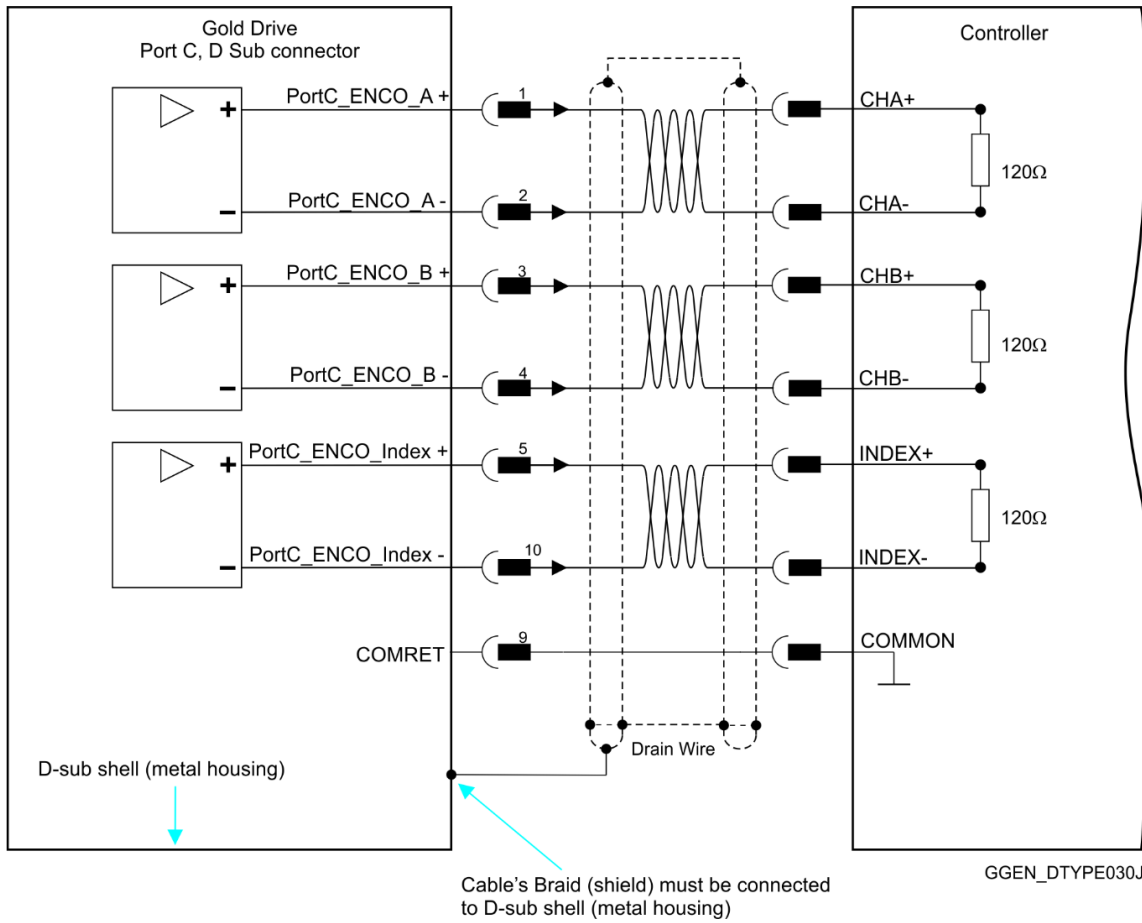


Figure 28: Emulated Encoder Differential Output – Recommended D-Type Connection Diagram

### 6.7.2 Analog Input

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

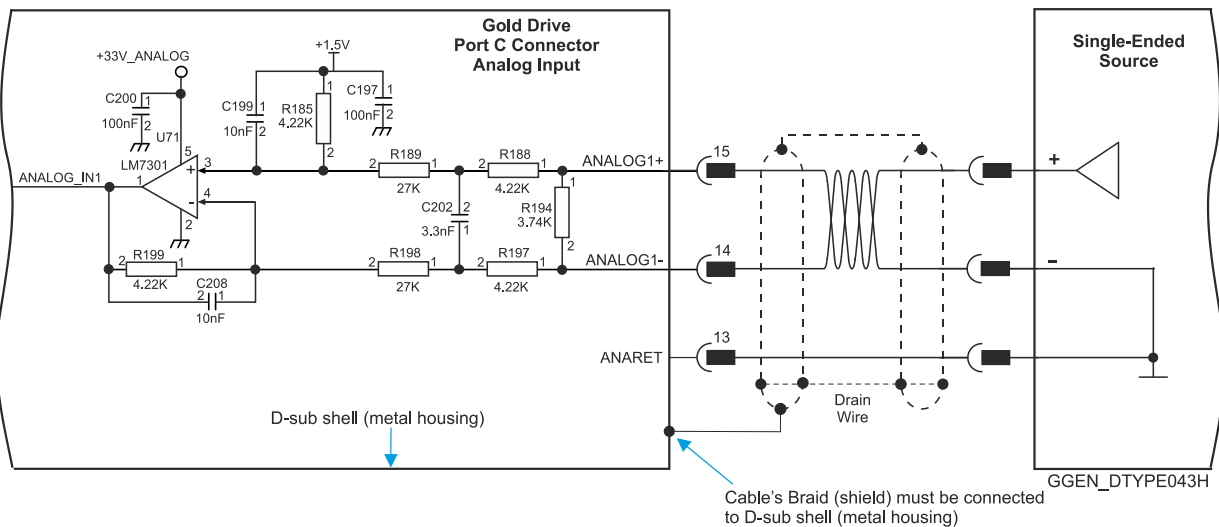


Figure 29: Differential Analog D-Type Input



## 6.7.3 STO

The following circuits describe the STO wiring options.

### 6.7.3.1 Source Mode PLC Voltage Level

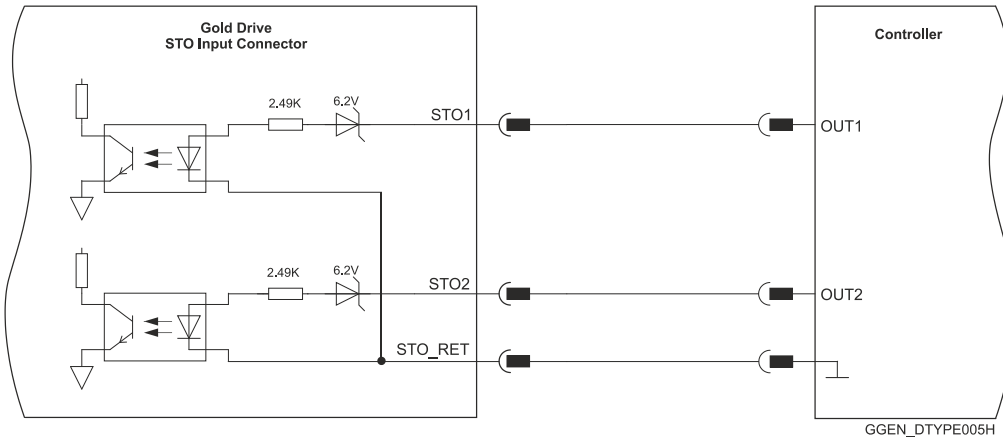


Figure 30: STO D-Type Input Connection – PLC Source Option

### 6.7.3.2 TTL Mode TTL Voltage Level

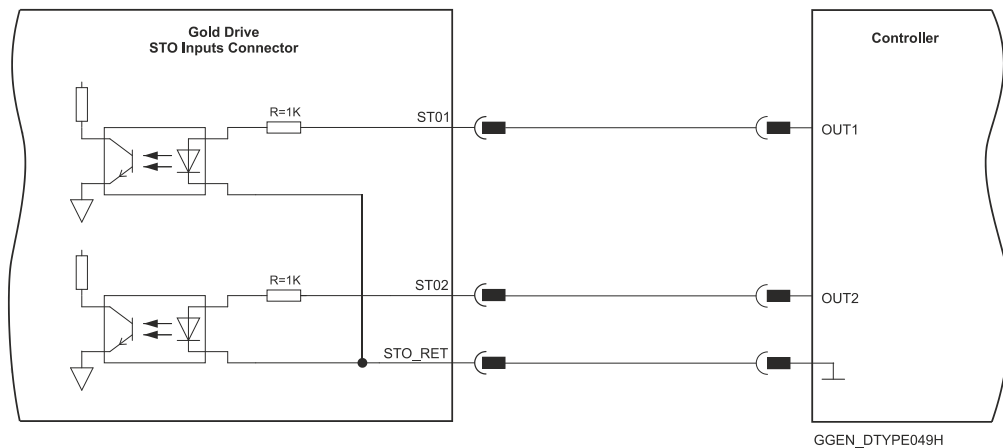


Figure 31: STO Input Connection – TTL Option

### 6.7.3.3 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.**

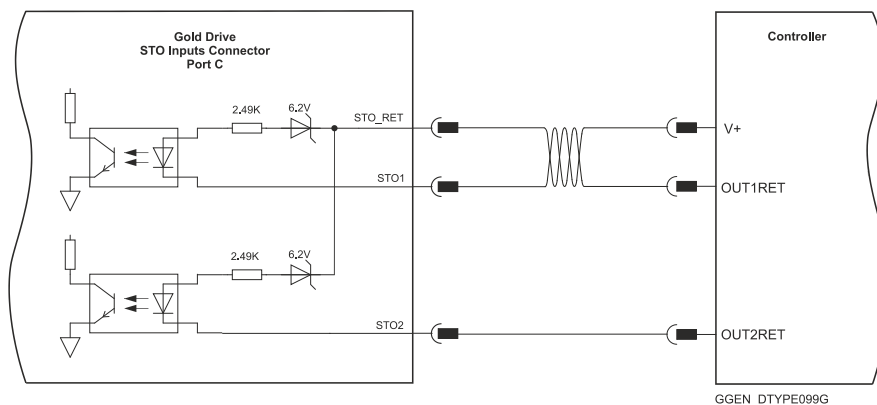


Figure 32: STO Input Connection – Sink Option



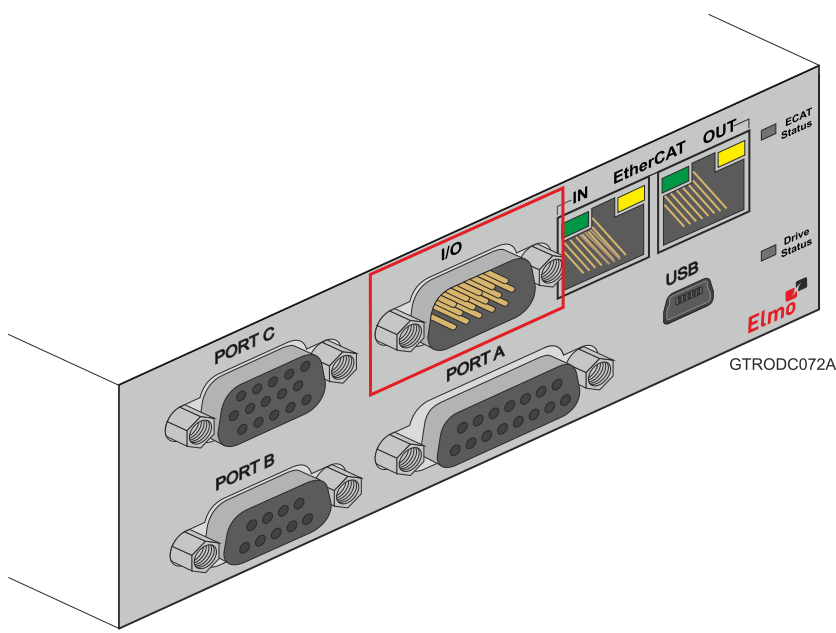
## 6.8 Digital Inputs and Outputs

Refer to Chapter 11 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

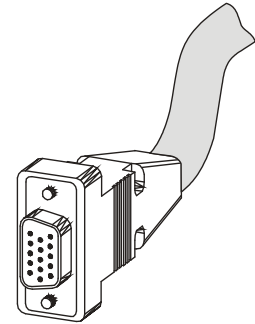
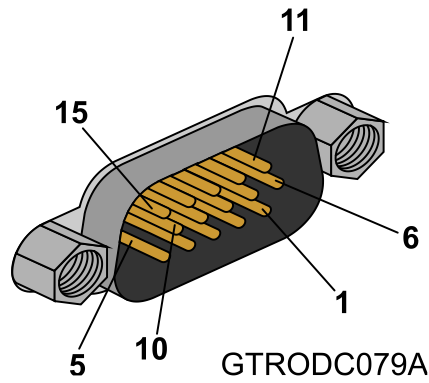
Pin on I/O	Signal	Function
1	IN1	Programmable digital input 1
2	IN2	Programmable digital input 2
7	IN3	Programmable digital input 3
8	IN4	Programmable digital input 4
11	IN5	Programmable digital input 5
12	IN6	Programmable digital input 6
6	INRET1-6	Programmable inputs 1 - 6 return for standard version Programmable positive inputs 1 - 6 for <b>A</b> or <b>H</b> option
3	OUT1	Programmable output 1
4	OUT2	Programmable output 2
5	OUT3	Programmable output 3
13	OUT4	Programmable output 4
10, 15	VDD	Supply for out 1-4
9, 14	VDDRET	Supply return for out 1-4



### Pin Positions



15-Pin High Density D-Type Male Connector



15-Pin High Density D-Type Female Connector

Table 8: I/O Connector Pin Assignments



### 6.8.1 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.

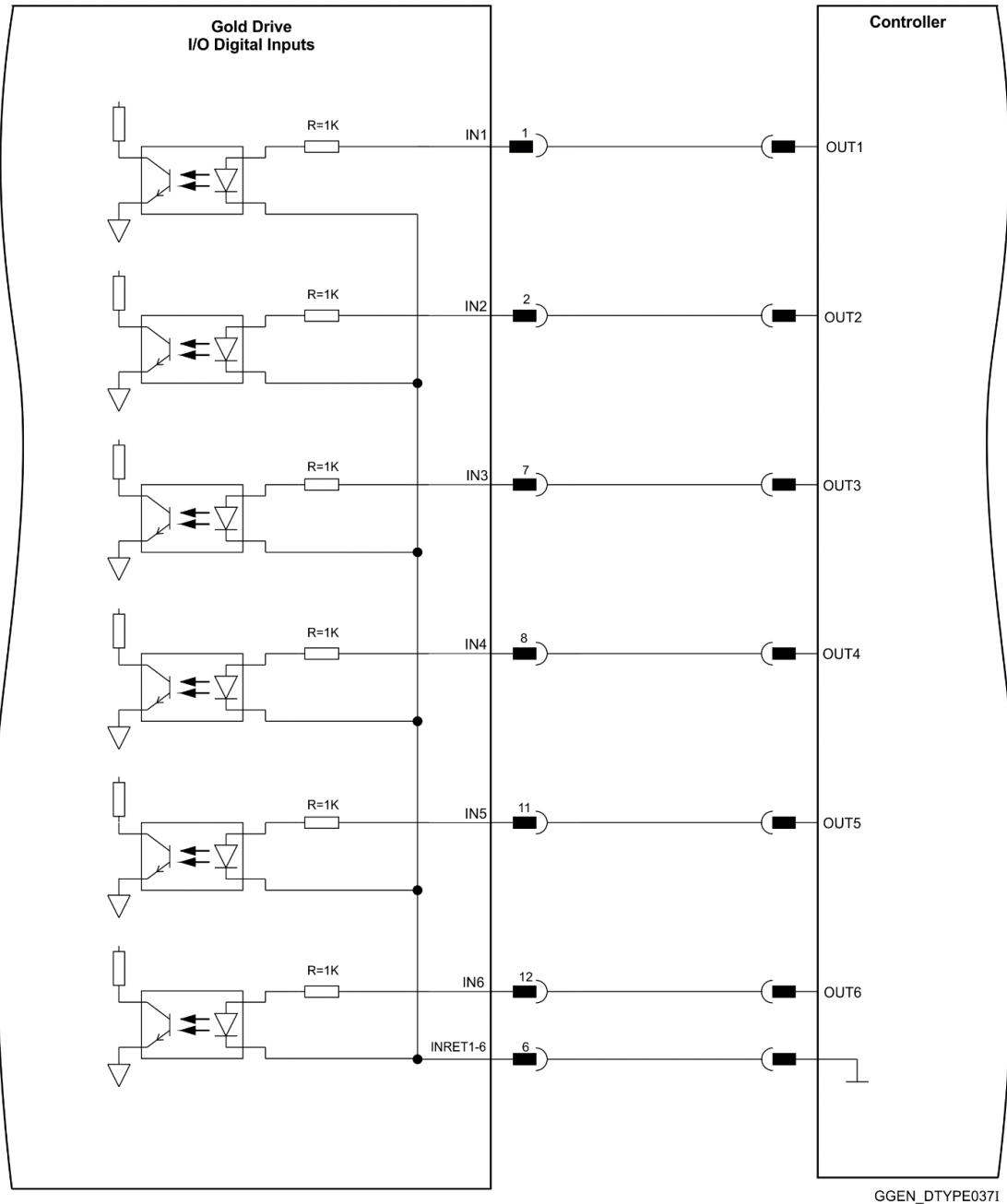


Figure 33: Digital Input TTL Mode D-Type Connection Diagram

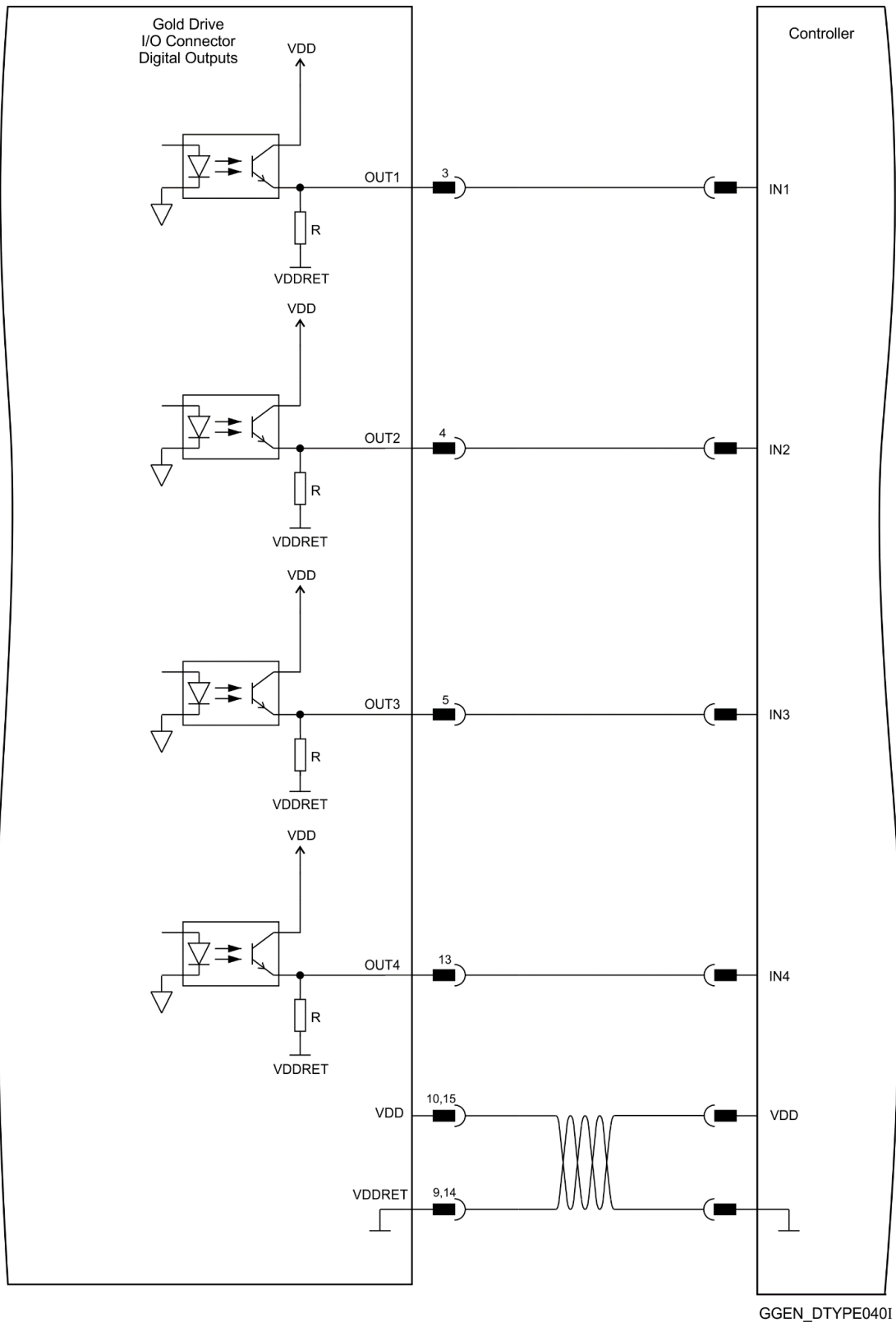


Figure 34: Digital Output D-Type Connection Diagram – TTL Option

## 6.8.2 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.

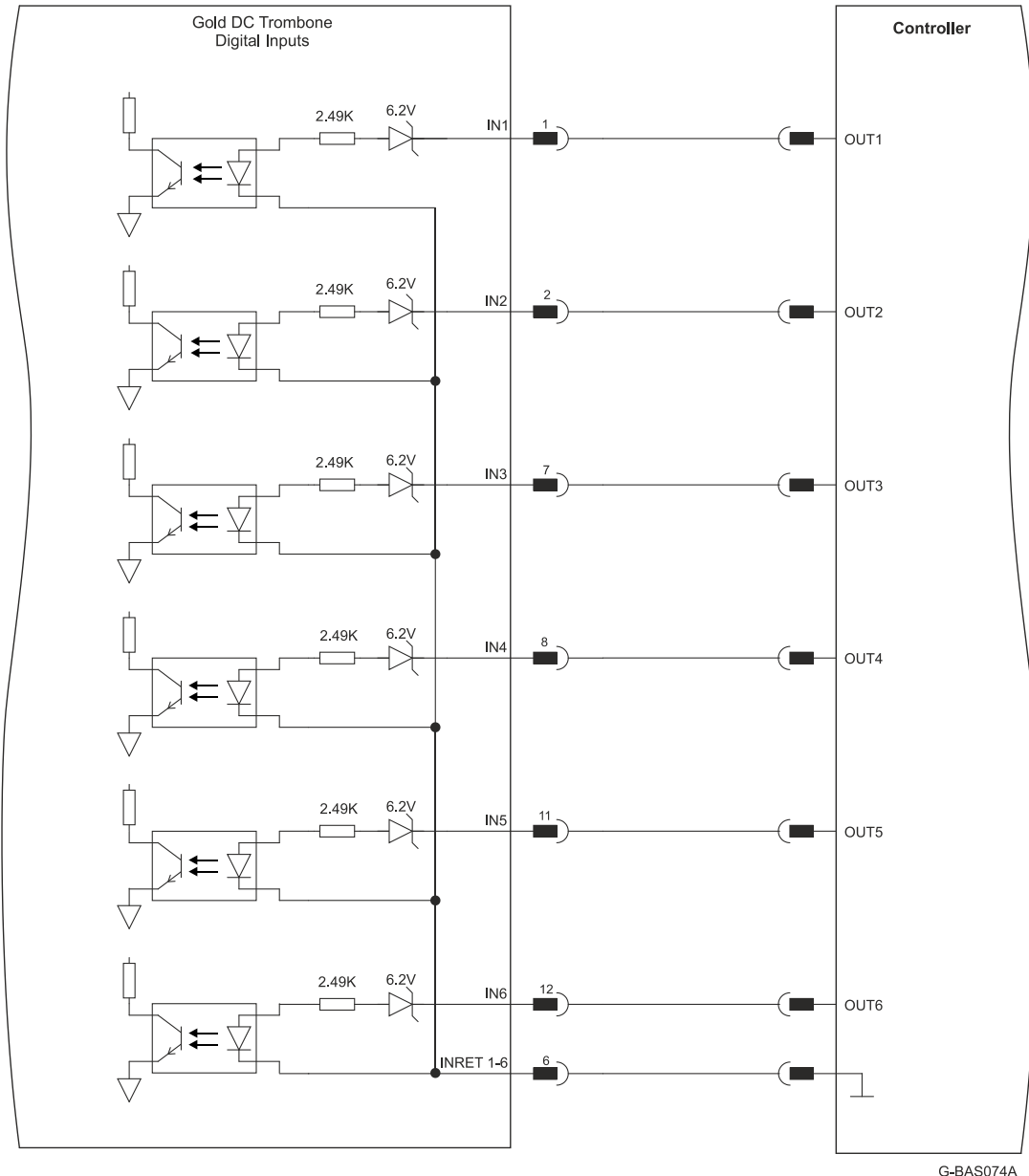


Figure 35: Digital Input D-Type Connection Diagram – Source PLC Option

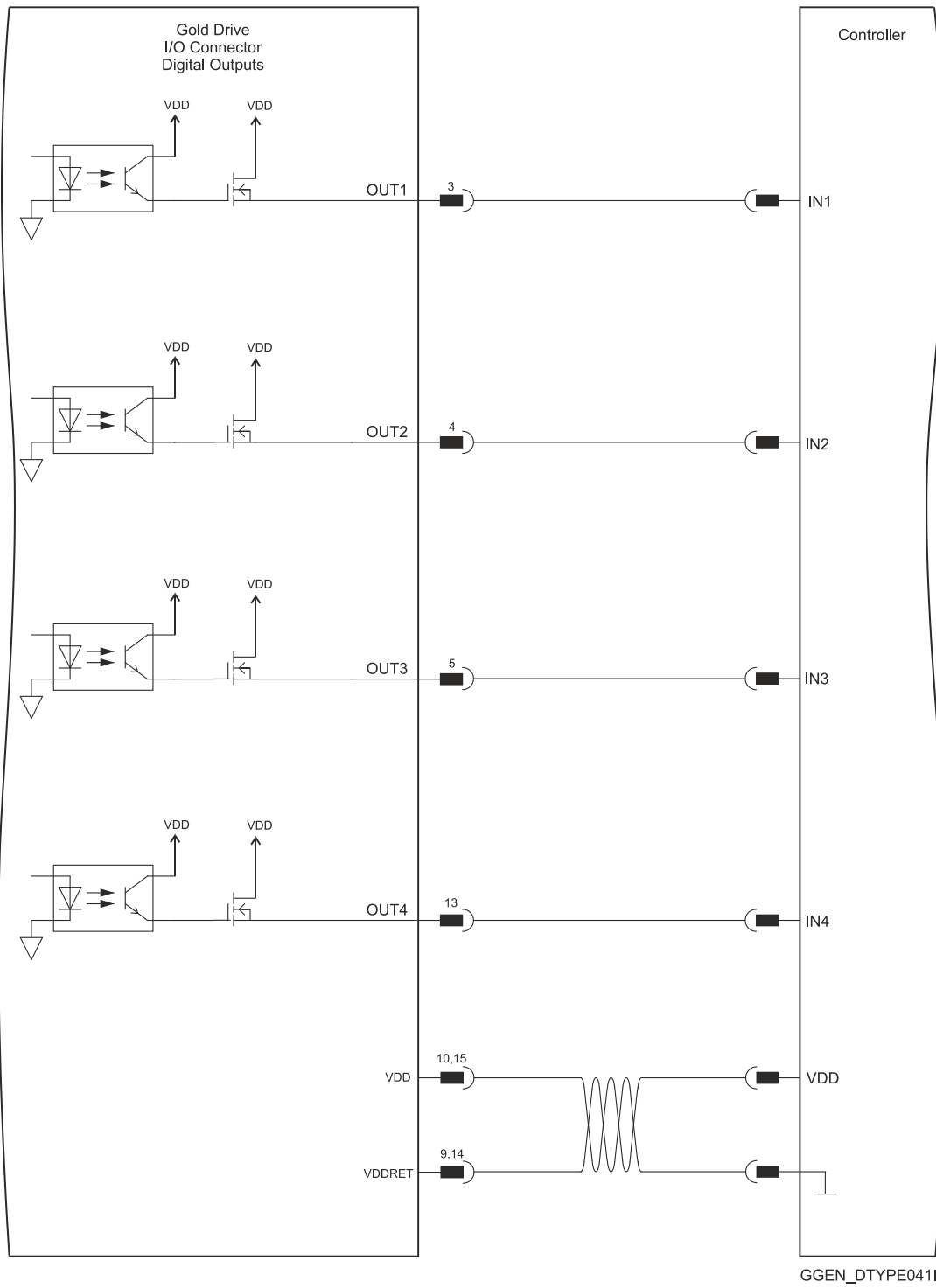
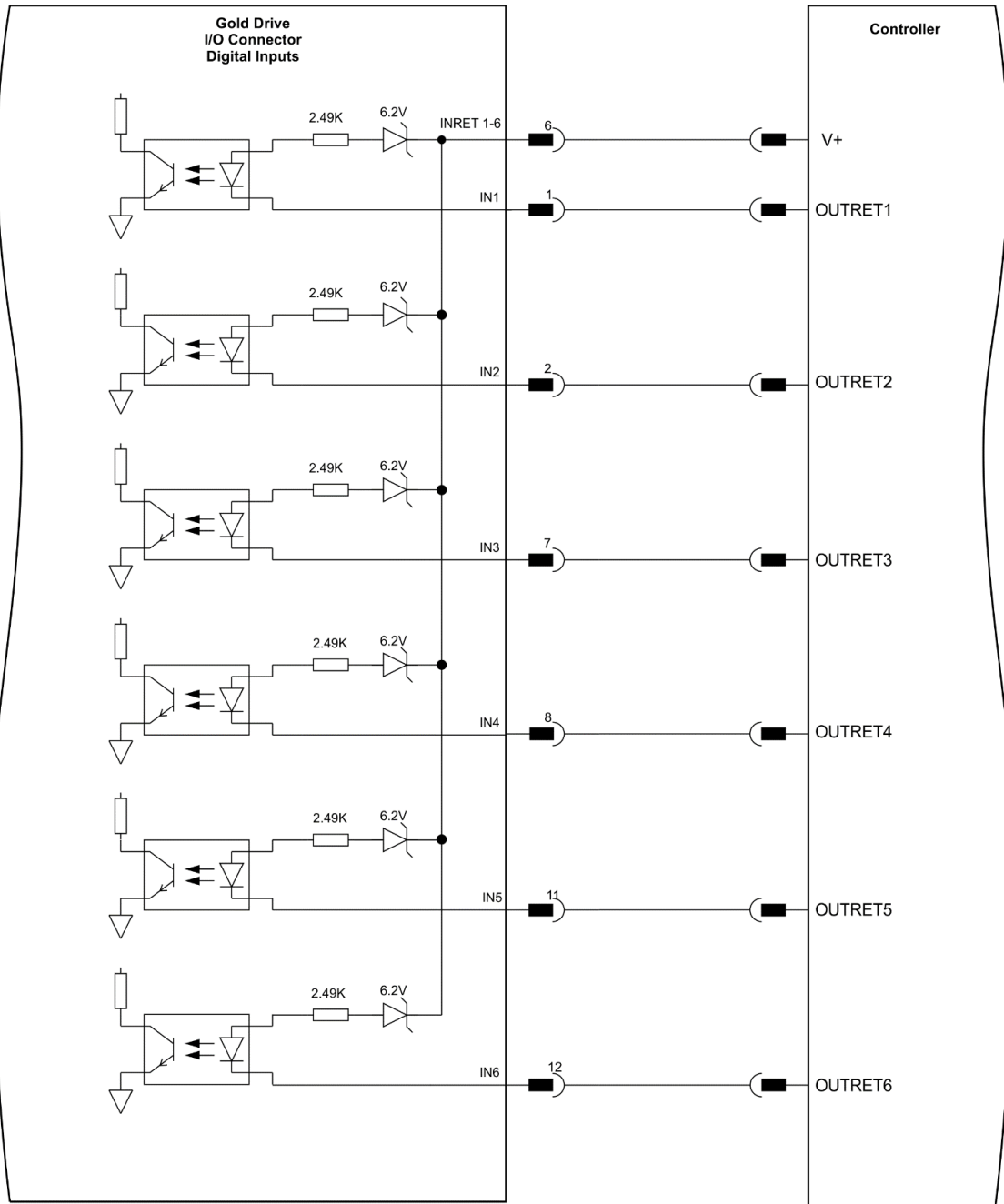


Figure 36: Digital Output D-Type Connection Diagram – Source PLC Option



### 6.8.3 Digital Input and Output Sink Mode

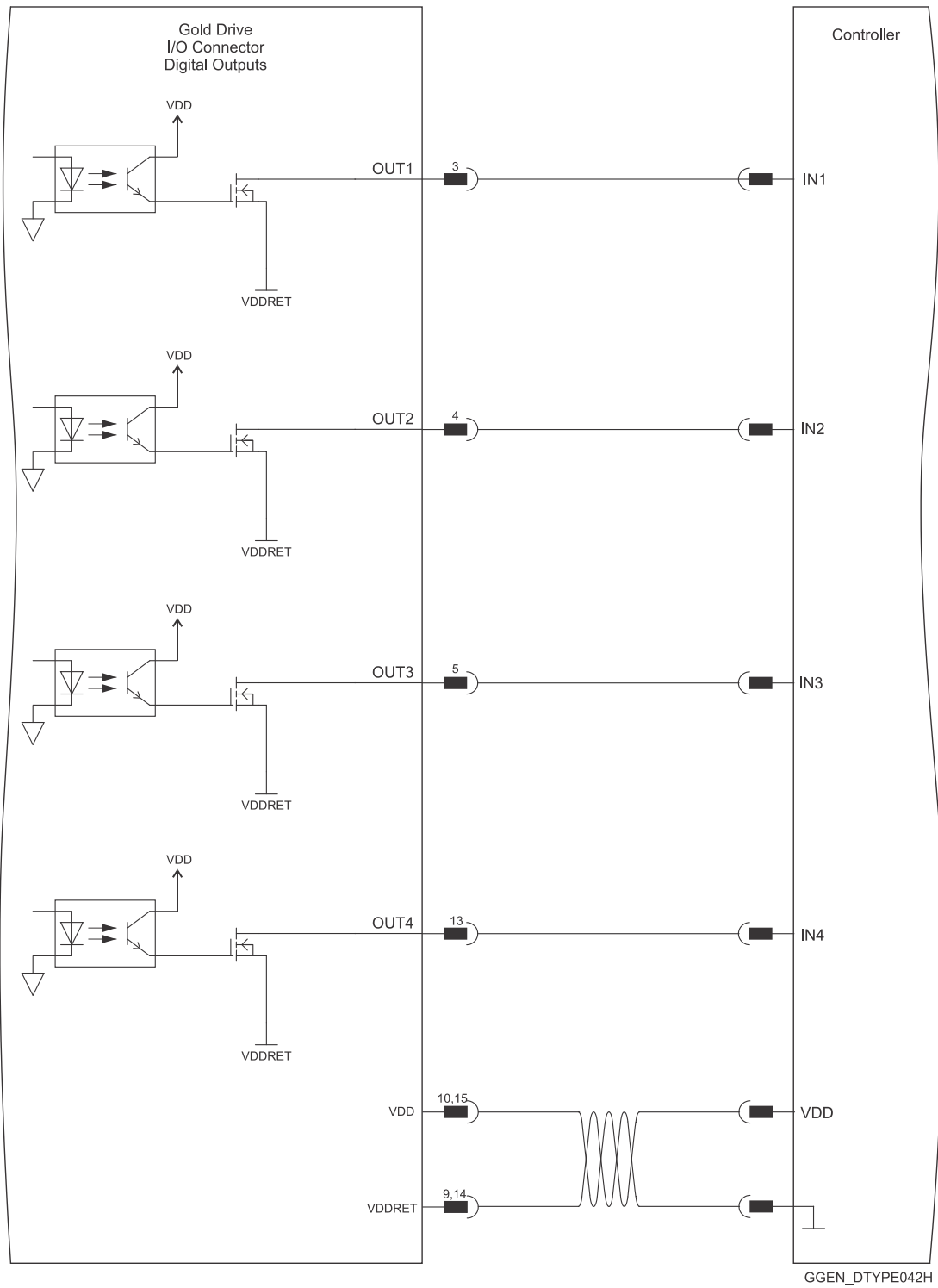
The following figure describes the connections at the I/O Port for the Digital Input and Output Sink Mode.



GGEN\_DTTYPE039H

Figure 37: Digital Input Sink Mode – PLC voltage level D-Type Connection Diagram





**Figure 38: Digital Output as Sink Configuration D-Type Connection Diagram**

## 6.9 USB 2.0

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

Pin on USB	Signal	Function
1	USB VBUS	USB VBUS 5V
2	USBD-	USB _N line
3	USBD+	USB _P line
5	USB COMRET	USB communication return

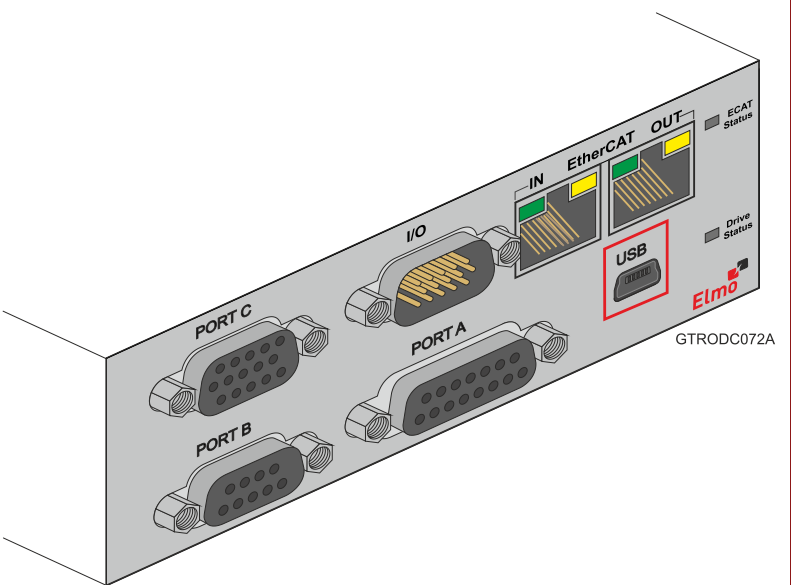
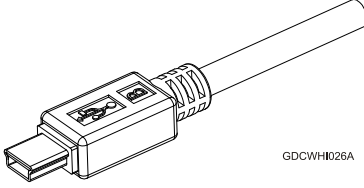
Pin Positions	
	 <p><b>USB Device Mini B Plug</b></p>

Table 9: USB 2.0 Pin Assignments

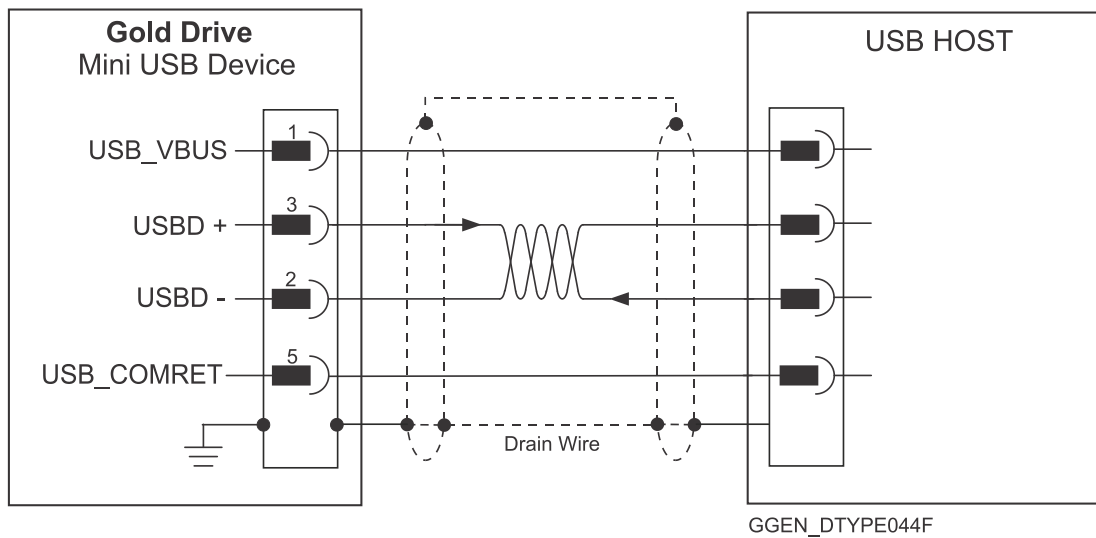
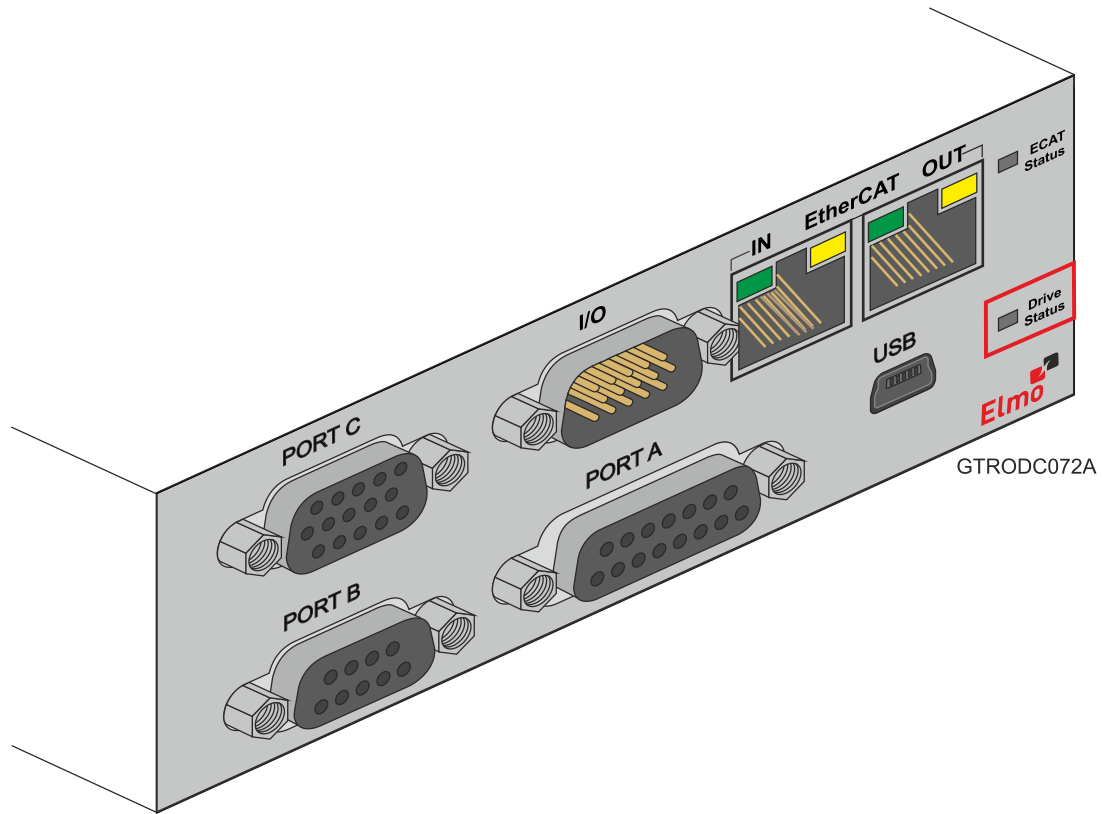


Figure 39: USB Network Diagram

## 6.10 Drive Status Indicator

The Gold DC Trombone is equipped with several light-emitting diode (LED) indicators.



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

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

## 6.11 EtherCAT Communications Version

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

Fieldbus Type	Product Number
EtherCAT	G-DCTRO XX/YYYEXXXQ

### 6.11.1 EtherCAT IN/Ethernet Pinouts

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

	Signal	Function
1	EtherCAT_IN_TX+	EtherCAT in transmit +
2	EtherCAT_IN_TX-	EtherCAT in transmit -
3	EtherCAT_IN_RX+	EtherCAT in receive +
4/5	N/A	
6	EtherCAT_IN_RX-	EtherCAT in receive -
7/8	N/A	

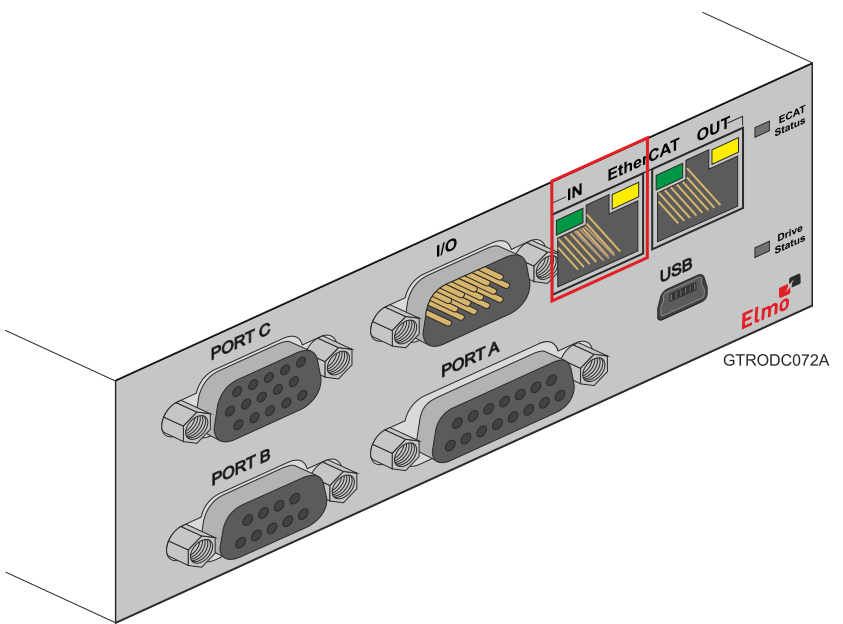
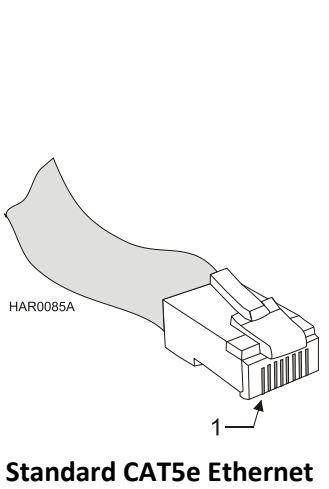
Pin Positions	
 <p style="text-align: center;"><b>EtherCAT IN RJ-45 Connector</b></p>	 <p style="text-align: center;"><b>Standard CAT5e Ethernet Cable</b></p>

Table 10: EtherCAT In Connector Pin Assignments

### 6.11.2 EtherCAT OUT Pinouts

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

Pin	Signal	Function
1	EtherCAT_OUT_TX+	EtherCAT out transmit +
2	EtherCAT_OUT_TX-	EtherCAT out transmit -
3	EtherCAT_OUT_RX+	EtherCAT out receive +
4/5	N/A	
6	EtherCAT_OUT_RX-	EtherCAT out receive -
7/8	N/A	

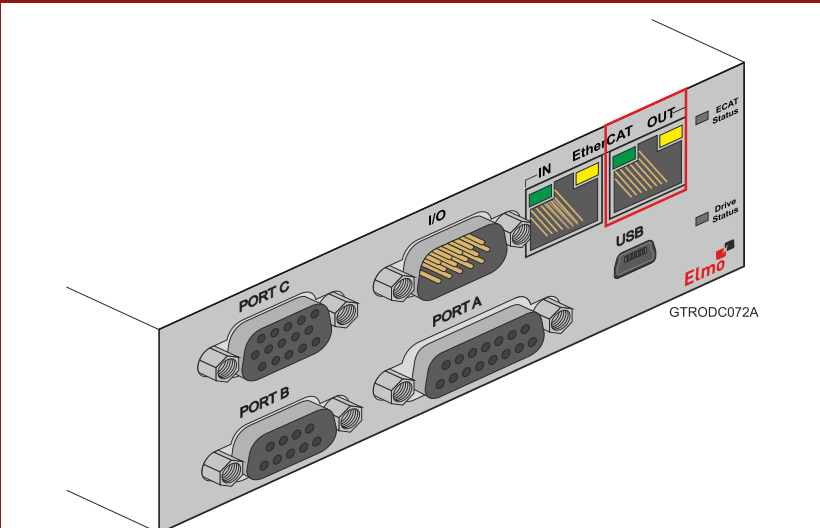
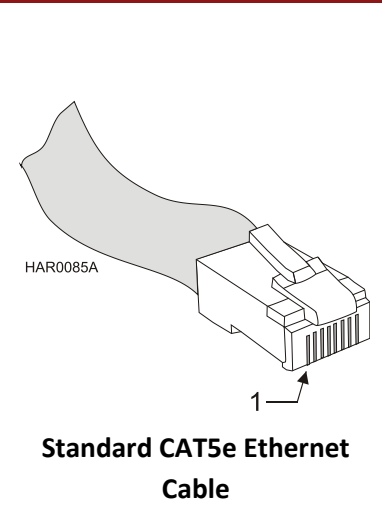
Pin Positions	
 <p><b>EtherCAT OUT RJ-45 Connector</b></p>	 <p><b>Standard CAT5e Ethernet Cable</b></p>

Table 11: EtherCAT Out Connector Pin Assignments

### 6.11.3 EtherCAT Wiring

Figure 40 describes the wiring diagram for the EtherCAT connections.

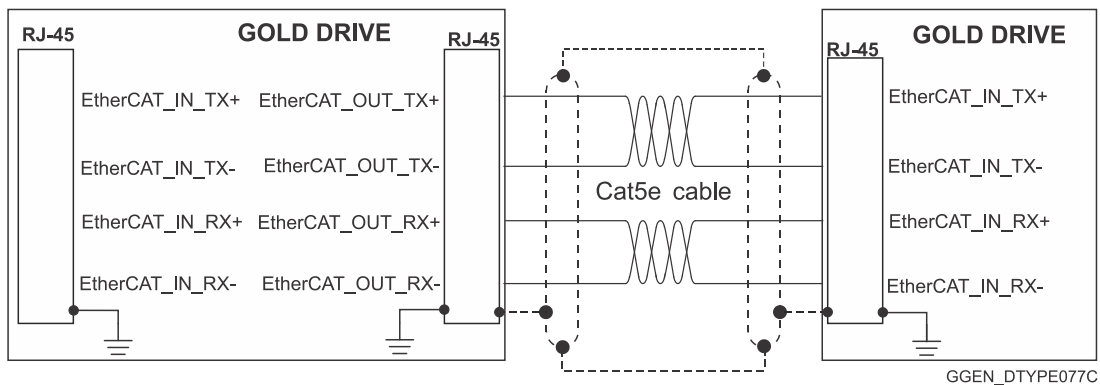


Figure 40: EtherCAT RJ-45 Connections

### 6.11.4 EtherCAT Link Indicators

This section is only relevant for EtherCAT (P/N G-DCTRO XX/YYYEXXXQ) products only.

The Gold DC Trombone can serve as an EtherCAT slave device. For this purpose it has two RJ-45 connectors, which are designated as EtherCAT In and EtherCAT Out. Each of these RJ-45 connectors has two status LEDs, which are shown in Figure 41.

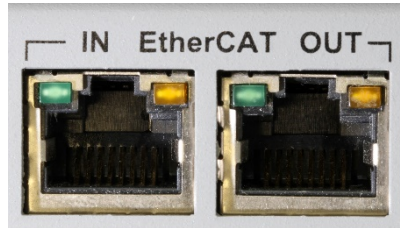
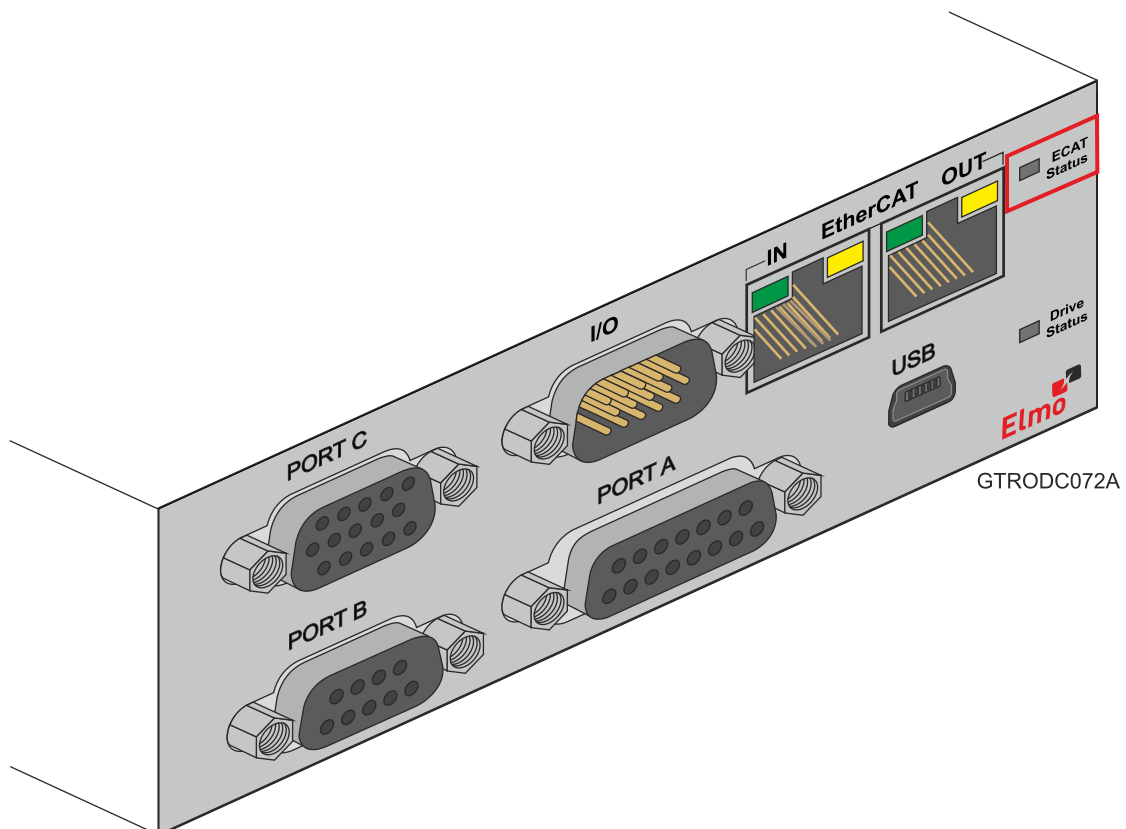


Figure 41: Ethernet Connector LEDs

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

### 6.11.5 EtherCAT Status Indicator



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.

## 6.12 CAN Communications Version

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

Fieldbus Type	Product Number
CAN	G-DCTRO XX/YYYSXXXQ

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

Pin	Signal	Function
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	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

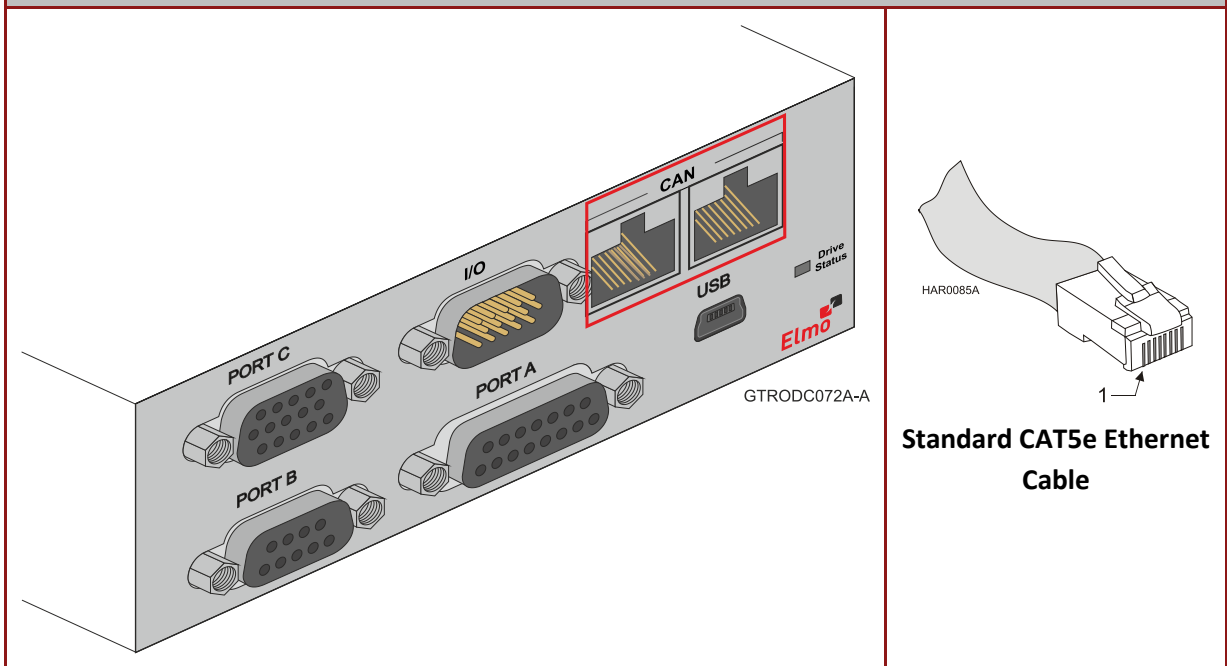
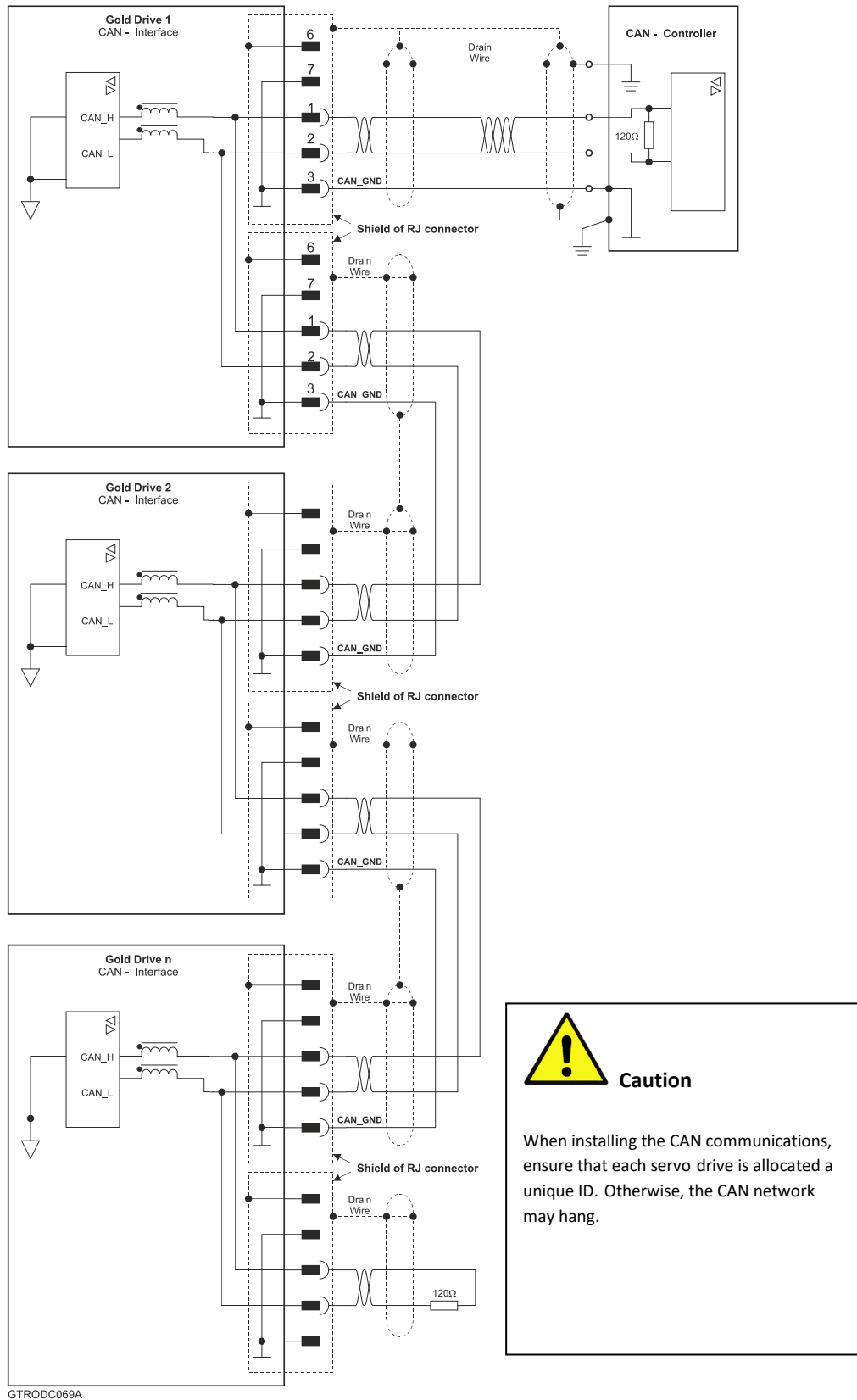


Table 12: CAN In/Out Connectors Pin Assignments

### 6.12.1 CAN Wiring

Figure 42 describes the CAN wiring diagram below.



**Figure 42: Gold DC Trombone Connection Diagram – CAN**





## 6.13 Heat Dissipation

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

### 6.13.1 Gold DC Trombone Thermal Data

- Heat dissipation capability ( $\theta$ ): Approximately 3.0 °C/W
- Thermal time constant: Approximately 600 seconds (thermal time constant means that the Gold DC Trombone will reach 2/3 of its final temperature after 10 minutes)
- Shut-off temperature: 86 °C to 88 °C (measured on the heat sink)

### 6.13.2 Heat Dissipation Data

Heat Dissipation is shown graphically below in Figure 43 and Figure 44.

**It should be noted that no external heatsink is required for power dissipation less than 20 W.**

**For higher power, the Gold DC Trombone should be mounted on the application chassis.**

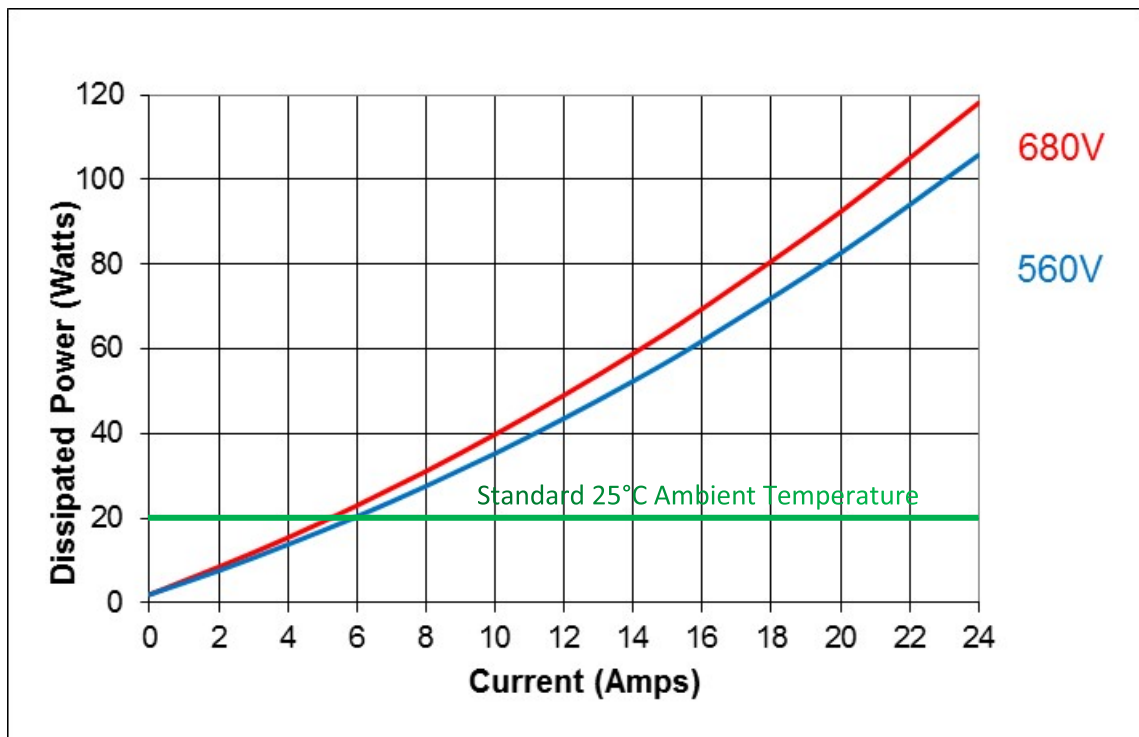


Figure 43: Dissipation versus Current Graph for 560 and 680 VDC for Standard L-Shape Heatsink

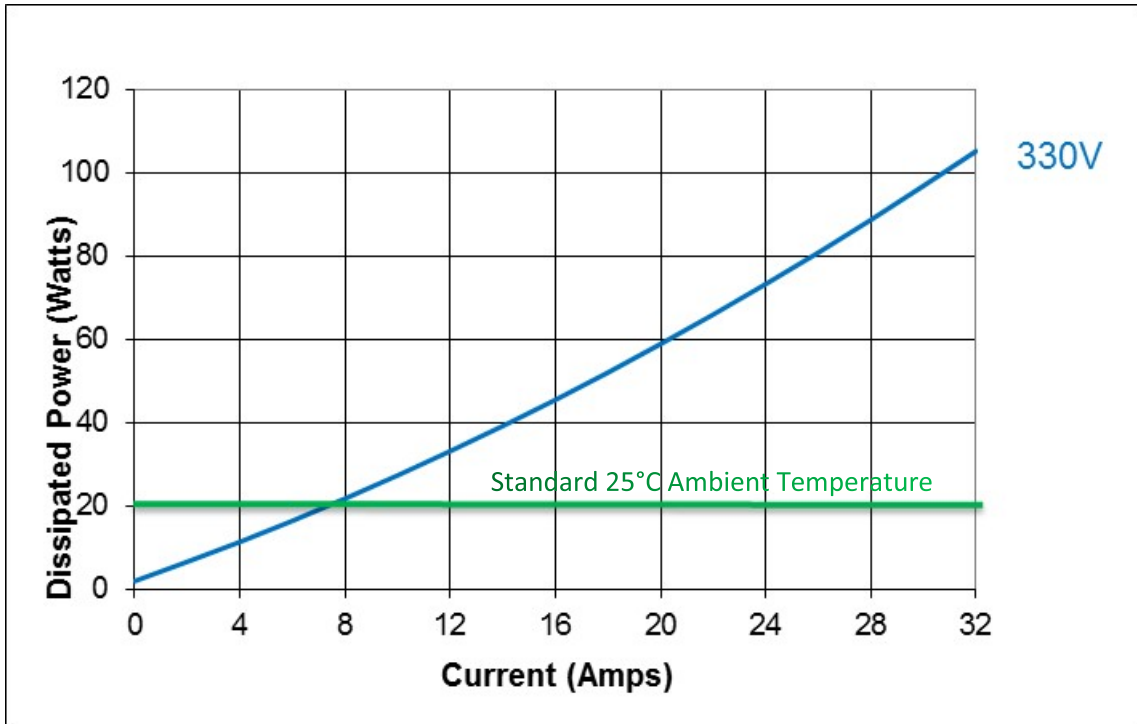


Figure 44: Dissipation versus Current Graph for 330 VDC for Standard L-Shape Heatsink

### 6.13.3 How to Use the Charts

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

**To determine if your application needs a heat sink:**

1. Allow maximum heat sink temperature to be 80 °C or less (shunt down is 6 °C to 8 °C higher).
2. Determine the ambient operating temperature of the Gold DC Trombone as  $\leq 40$  °C.
3. Calculate the allowable temperature increase according to the following example: For an ambient temperature of 40 °C,  $\Delta T = 80$  to 40°C = 40°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.



## Chapter 7: Powering Up

After the Gold DC Trombone 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.

### 7.1 Initializing the System

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



## Chapter 8: Gold DC Trombone Dimensions

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

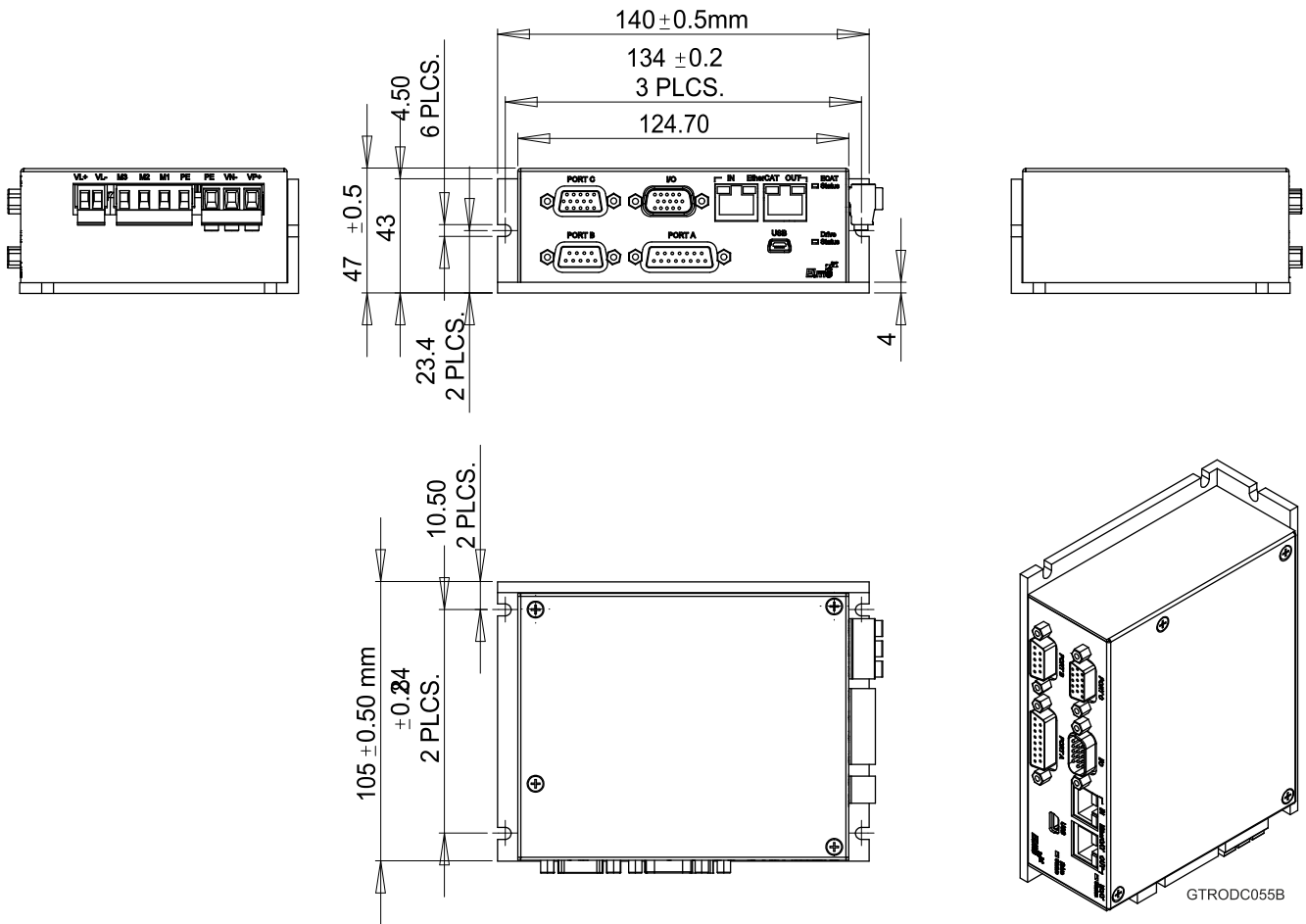
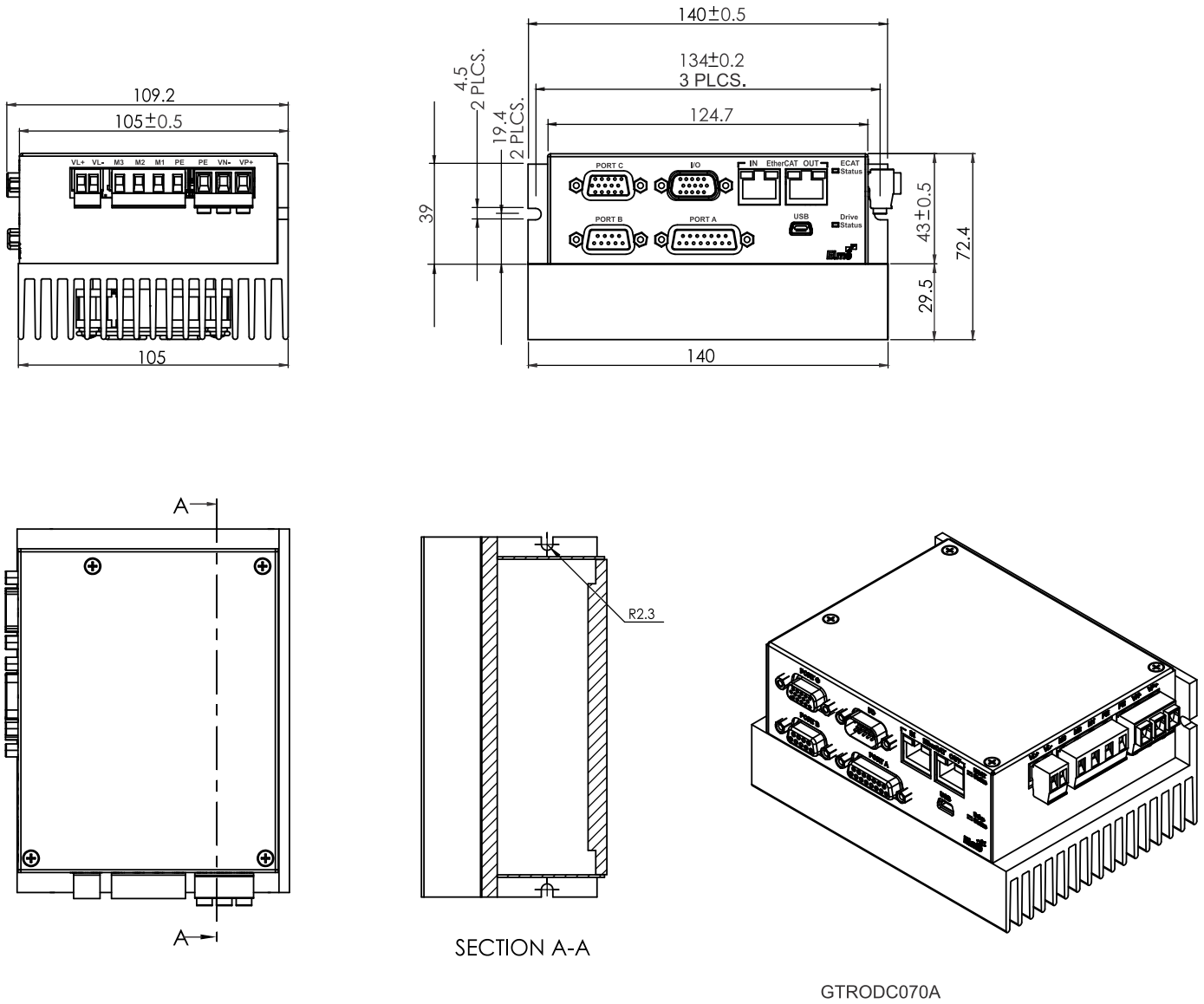


Figure 45: Gold DC Trombone Dimensions with standard L-shape heat-sink



GTRODC070A

Figure 46: Gold DC Trombone Dimensions with L-shape heat-sink fins and fan

