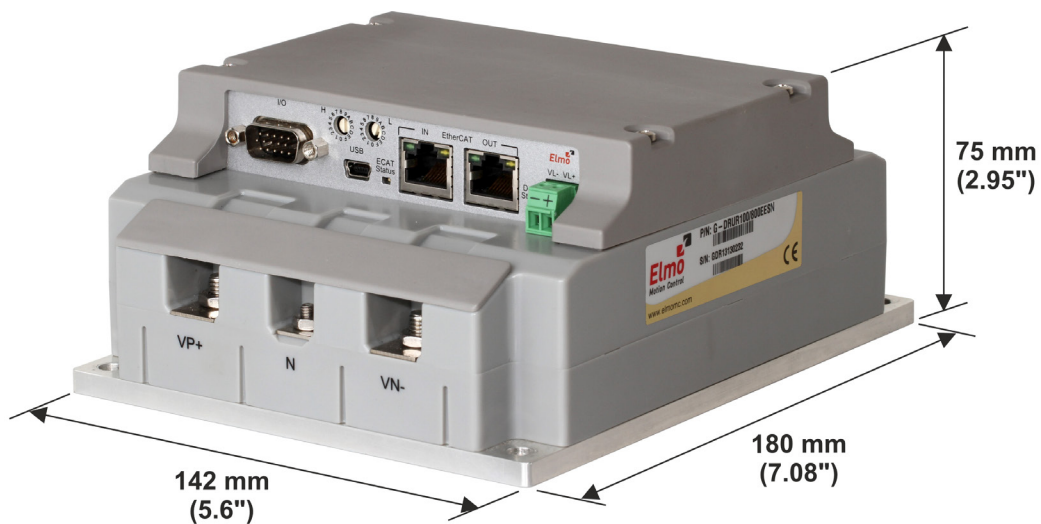


# Gold Drum HV (High Voltage) Digital Servo Drive Installation Guide EtherCAT and CAN



# Notice

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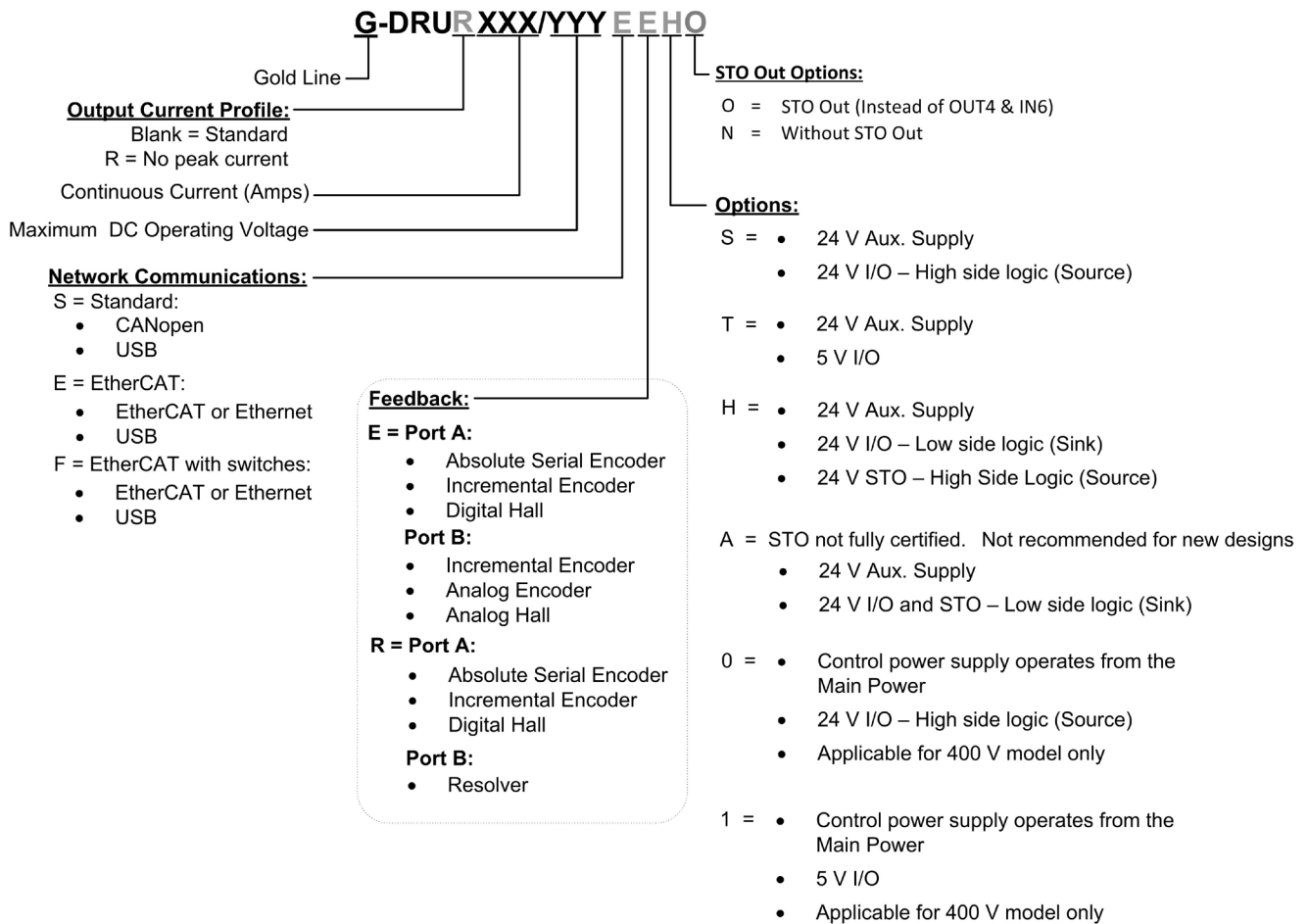
Document no. MAN-G-DRUMHVIG-EC (Ver. 1.404)

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## Catalog Number



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## Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Drum HV (High Voltage). 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 Drum HV (High Voltage), 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 Drum HV (High Voltage) 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 Drum HV (High Voltage) 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.



## 1.1 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 Drum HV (High Voltage) 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.



## 1.2 Cautions

- The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- When connecting the Gold Drum HV (High Voltage) 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 Drum HV (High Voltage), 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

## 1.3 CE Marking Conformance

The Gold Drum HV (High Voltage) 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 Drum HV (High Voltage) 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.

## 1.4 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 Drum HV (High Voltage) 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 Drum HV (High Voltage) delivers up to **65 kW of continuous 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 Drum HV (High Voltage) 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 drives are easily set up and tuned using Elmo Application Studio software tools. This Windows-based application enables users to quickly and simply configure the servo drive for optimal use with their motor. The Gold Drum HV (High Voltage), 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 Drum HV (High Voltage)).

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 S, T, or A-model Gold Drum HV (High Voltage) 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 Drum HV (High Voltage) models that have the 0 or 1 option (only for 400 V model) in the catalog number (refer to the section Catalog Number above) 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 Drum HV (High Voltage) to operate with only the main power supply VP+ and VN-, with no need for a 24 VDC auxiliary power supply for the logic.



## Chapter 4: Technical Information

### 4.1. Physical Specifications

Feature	Units	All Types
Weight	g (oz)	1.65 Kg (58.202 oz)
Dimension	mm (in)	180 x 142 x 75.2 (7.08" x 5.53" x 2.96")
Mounting method		Panel / Wall Mounted

### 4.2. Technical Data for 400 V Drive

Feature	Units	50/400	R100/400
Minimum supply voltage	VDC	*For H, S, T, or A option = 50 For 0 or 1 option = 100	
Nominal supply voltage	VDC	325	
Maximum supply voltage	VDC	400	
Maximum continuous power output	kW	16.5	33
Efficiency at rated power (at nominal conditions)	%	> 98	
Auxiliary supply voltage option	VDC	18 to 30 VDC (only in H, S, T, or A option)	
Auxiliary power supply	VA	≤5 VA without external loading ≤7 VA with full external loading	
Continuous current limit (I <sub>c</sub> ) Amplitude sinusoidal/DC trapezoidal commutation	A	50	100
Continuous RMS sinusoidal commutation current limit (I <sub>c</sub> )	A	35	71
Peak Current	A	100	No Peak





### 4.3. Technical Data for 800 V Drive

Feature	Units	35/800	50/800	R70/800	R100/800
Minimum supply voltage	VDC	*For H, S, T, or A option = 95			
Nominal supply voltage	VDC	560 for 400 VAC 680 for 480 VAC			
Maximum supply voltage	VDC	780			
Maximum continuous power output	kW	22.5	32.5	45	65
Efficiency at rated power (at nominal conditions)	%	> 98			
Auxiliary supply voltage option	VDC	18 to 30 VDC (only in H, S, T, or A option)			
Auxiliary power supply	VA	≤5 VA without external loading ≤7 VA with full external loading			
Continuous current limit (I <sub>c</sub> ) Amplitude sinusoidal/DC trapezoidal commutation	A	35	50	70	100
Continuous RMS sinusoidal commutation current limit (I <sub>c</sub> )	A	25	35	50	71
Peak Current	A	70	100	No Peak	No Peak

**For both the above Technical Data tables:**

\*Refer to the section Catalog Number above for details on the part number. The H, S, T, or A 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 Drum HV (High Voltage) are given in units of DC amperes (ratings that are used for trapezoidal commutation or DC motors). The RMS (sinusoidal commutation) value is the DC value divided by 1.41.



### 4.3.1. 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	< 5 VA (this includes the 5 V/200 mA load for the main encoder only) <7 VA (this includes the 5 V/400 mA load on the main encoder and feedback B)

### 4.3.2. Product Features

Main Feature	Details	Presence / 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)	√
	STO Output Status (instead of OUT4 & IN6)	√
<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 ±10 V	1
<b>Feedback</b>	Standard Port A, B, & C	√
<b>Communication Option</b>	USB	√
	EtherCAT without switches, <i>or</i>	√
	EtherCAT with switches, <i>or</i>	√
	CAN	√



## 4.4. Environmental Conditions

You can guarantee the safe operation of the Gold Drum HV (High Voltage) by ensuring that it is installed in an appropriate environment.

### 4.4.1. 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



## 4.5. Gold Line Standards

The following table describes the Main Standards of the Gold Drum HV (High Voltage) 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 4.4.1 Gold Line above.	
<b>STO IEC 61800-5-2:2007 SIL 3</b>	Adjustable speed electrical power drive systems – Safety requirements – Functional
<b>EN ISO 13849-1:2008 PL e, Cat 3</b>	Safety of machinery — Safety-related parts of control systems.
<b>Approved IEC/EN 61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>Recognized UL61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>In compliance with UL 508C</b>	Power Conversion Equipment
<b>In compliance with UL 840</b>	Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment
<b>Conformity with CE 2006/95/EC</b>	Low-voltage directive 2006/95/EC
<b>Recognized CSA C22.2 NO. 14-13</b>	Industrial Control Equipment



## Chapter 5: Installation

The Gold Drum HV (High Voltage) 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 Drum HV (High Voltage), verify that you have all of its components, as follows:

- The Gold Drum HV (High Voltage) servo drive
- The Elmo Application Studio (EAS) software and software manual

The Gold Drum HV (High Voltage) is shipped in a cardboard box with Styrofoam protection.

#### To unpack the Gold Drum HV (High Voltage):

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 Drum HV (High Voltage) you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Gold Drum HV (High Voltage). It looks like this:



4. Verify that the Gold Drum HV (High Voltage) 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.



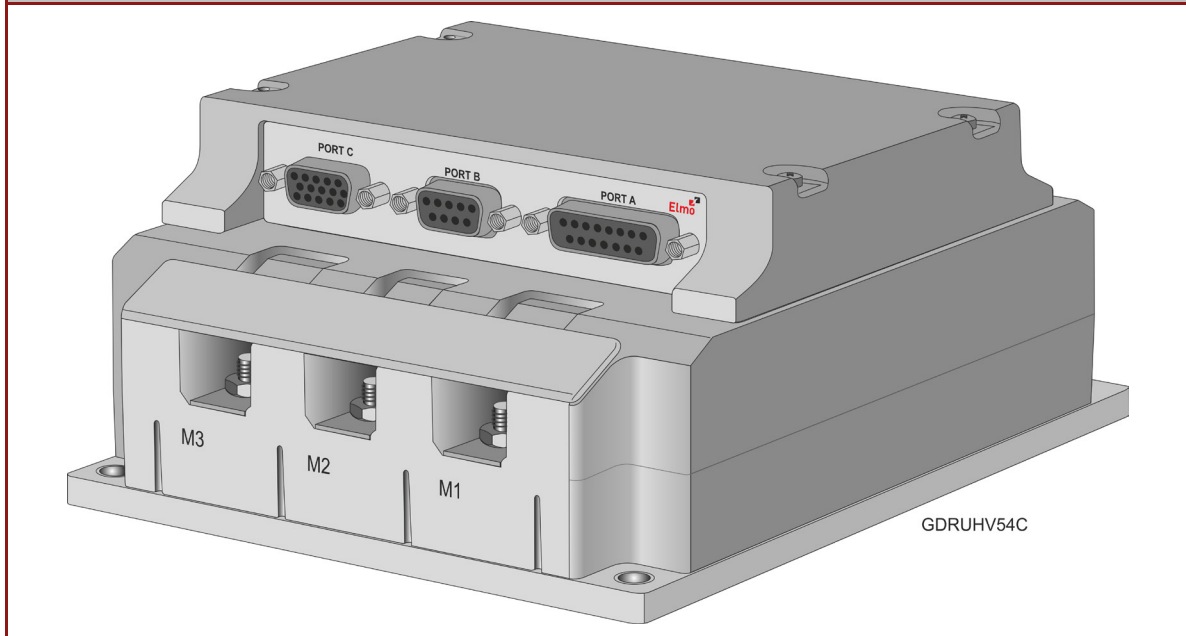
## 5.2. Connector Types

The Gold Drum HV (High Voltage) has the following ten connectors.

Type	Function	Port	Connector Location
Terminal Lug + M4 Spring Washer + M4 Nut	Power	N Not in use	
Terminal Lug + M6 Spring Washer + M6 Nut	Power	VP+, VN-	
	Motor	M1, M2, M3	
Terminal Lug + M5 Flat Washer + M5 Spring Washer + M5 screw	Earth Connection	PE, PE, PE, PE	

Pins	Type	Function
------	------	----------

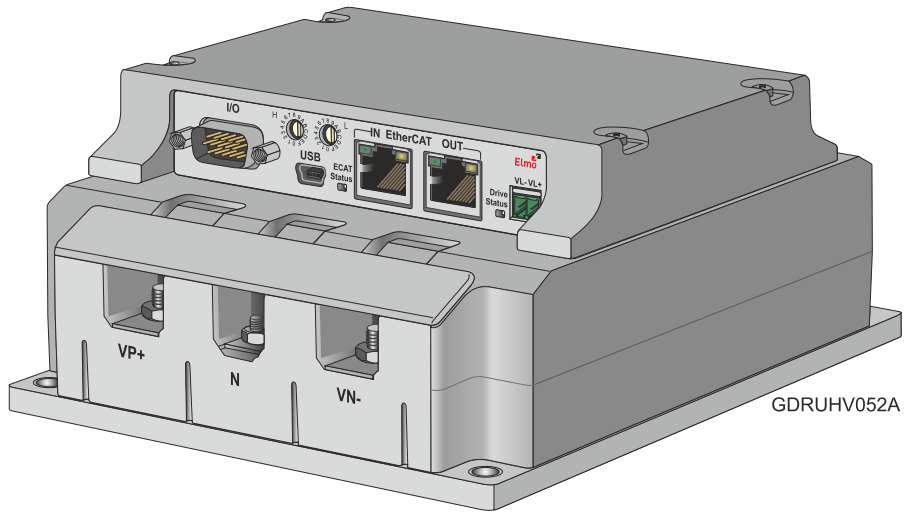
### Rear Connectors



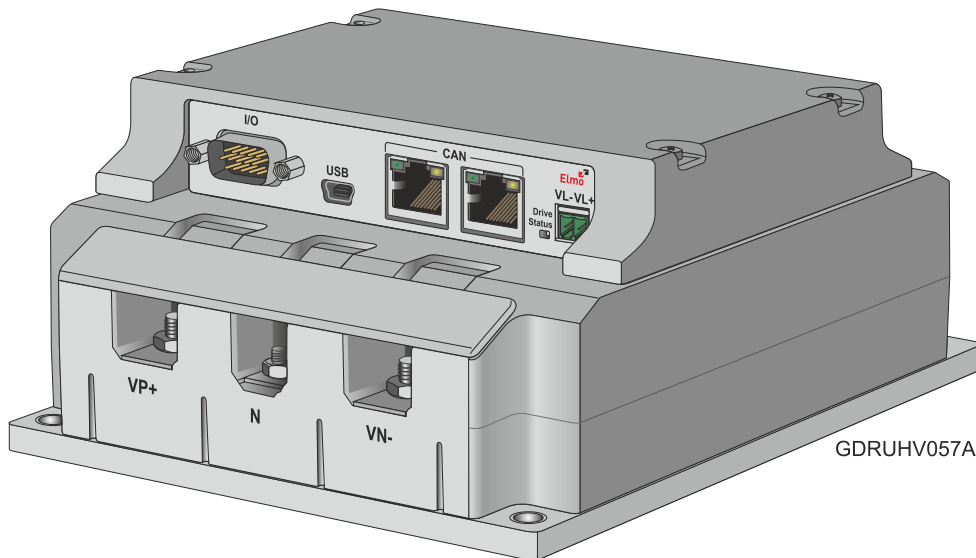
15	Socket D-Type	Port A
9	Socket D-Type	Port B
15	Socket High Density D-Type	Port C and Functional Safety(STO)



## Front Connectors



**Front Connectors – EtherCAT**



**Front Connectors – CAN**

Pins	Type	Function
15	Pin High Density D-Type	I/O
4	USB Device Type Mini B	USB communication
2	3.81 mm Phoenix high current	Auxiliary Supply
<b>EtherCAT Version</b>		
8	RJ-45	Ethernet/EtherCAT_IN communication
8	RJ-45	EtherCAT OUT communication
<b>CAN Version</b>		
8	RJ-45	CAN In communication
8	RJ-45	CAN Out communication



### 1.4.1 Mating Connector Types

Mating Pin Connector	Function	Manufacturing P/N (Pheonix)
2 Pin	VL	MC 1,5/ 2-ST-3,81





### 5.3. Mounting the Gold Drum HV (High Voltage)

The Gold Drum HV (High Voltage) has been designed for standard mounting by wall mounting along the back (can also be mounted horizontally on a metal surface).

Use M6 round head screws, one through each opening in the heat sink, to mount the Gold Drum HV (High Voltage) (see the diagram below). For further details on installing the Drum to the Heat Sink, refer to the document *GOLD DRUM HV Heat Sink Assembly Installation Guide (P/N MAN-G-DRUMHVHSIG)*.

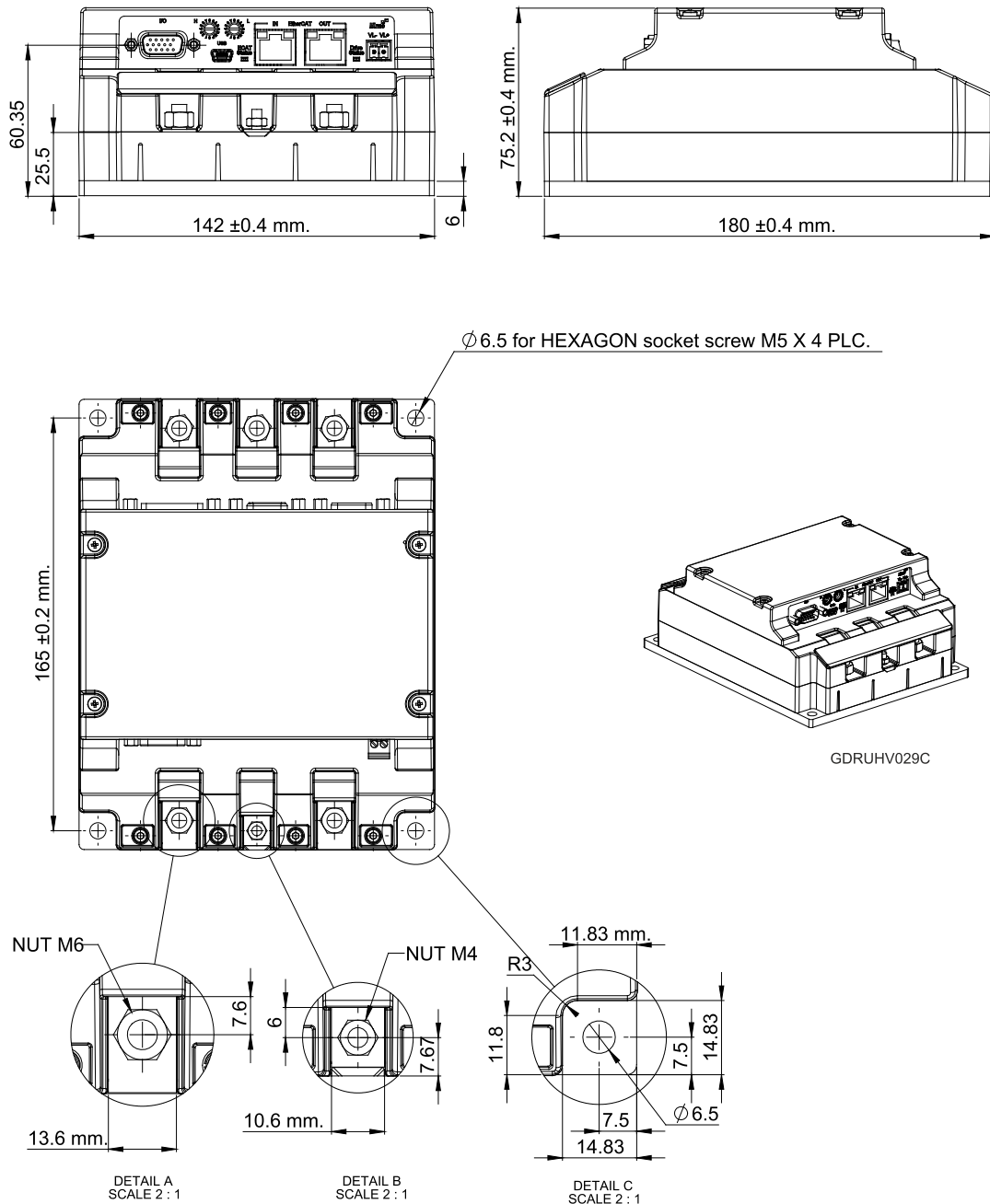


Figure 1: Mounting the Gold Drum HV (High Voltage)



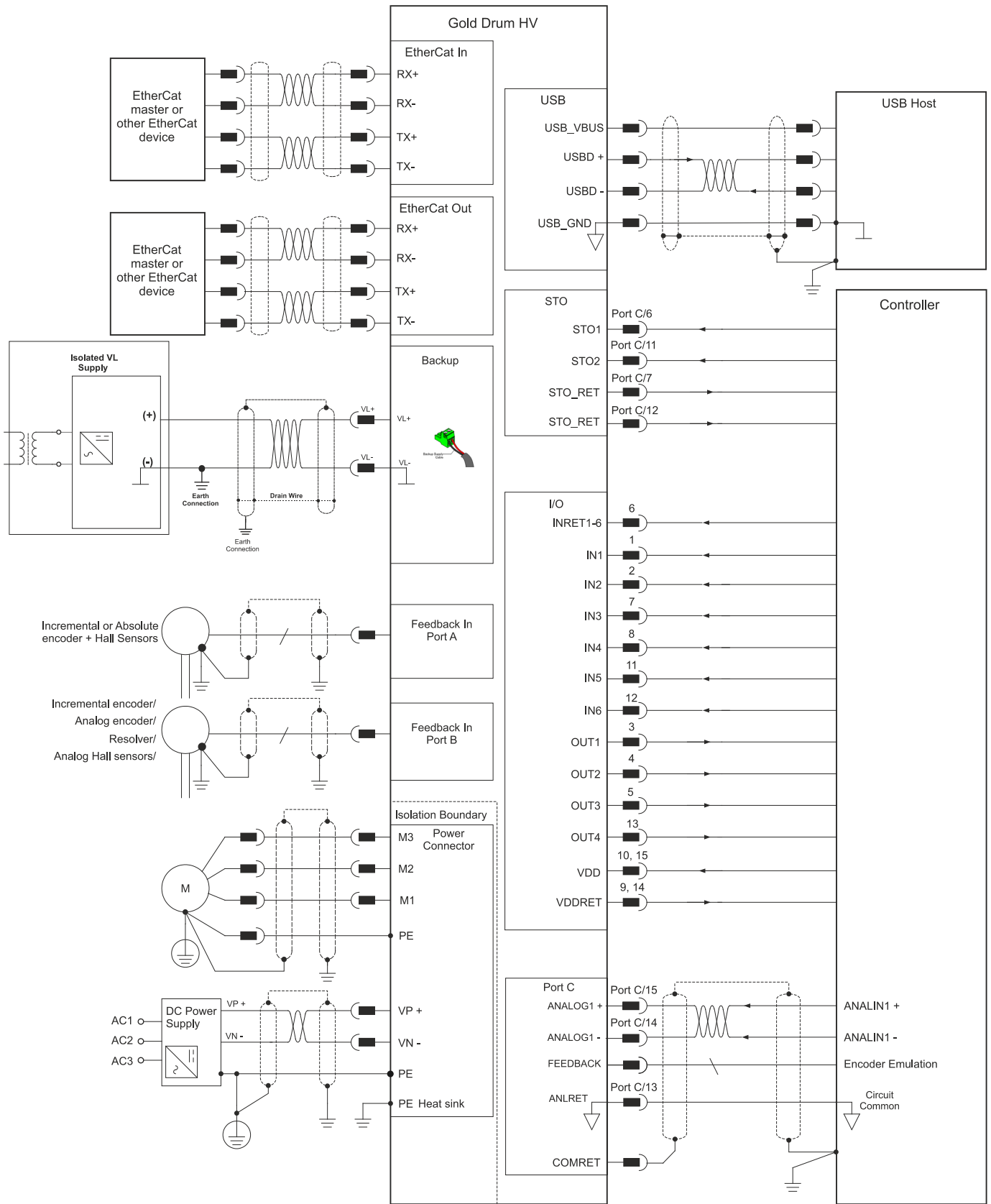
## 5.4. Connection Diagrams

There are two connection diagrams for EtherCAT and two for CAN showing the two different methods of connecting the power supply in the Gold Drum HV (High Voltage) models:

- 400 V and 800 V H, S, T, or A (the catalog number has an H, S, T, or A option) featuring a backup functionality and requiring 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.

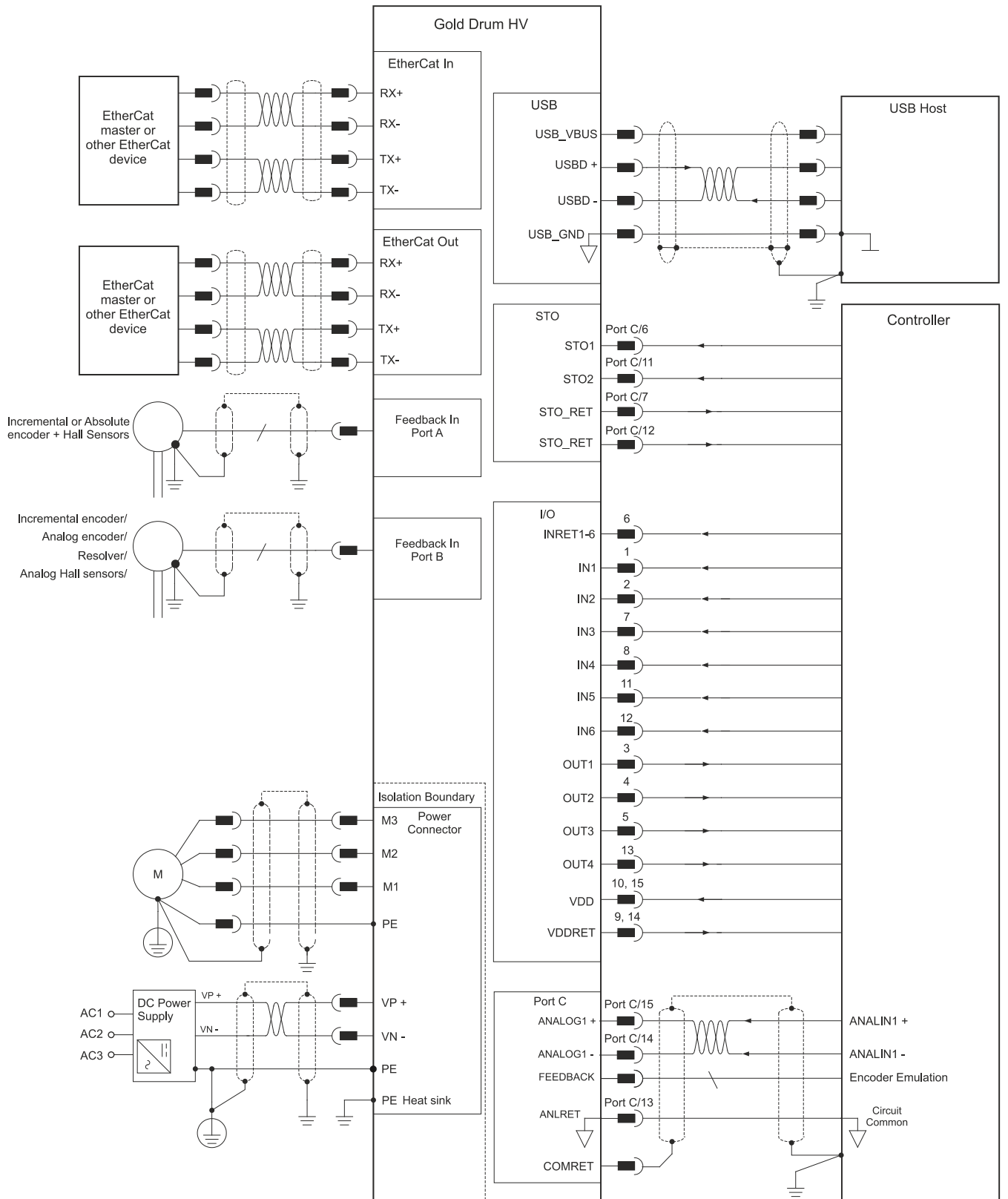
### 5.4.1. Connection Diagrams for EtherCAT Version

The following describes the connection diagrams for the EtherCAT version.



GDRUHV001D

**Figure 2: Gold Drum HV (High Voltage) Connection Diagram for EtherCAT – with Power Supply Backup Functionality (H, S, T, or A Option)**

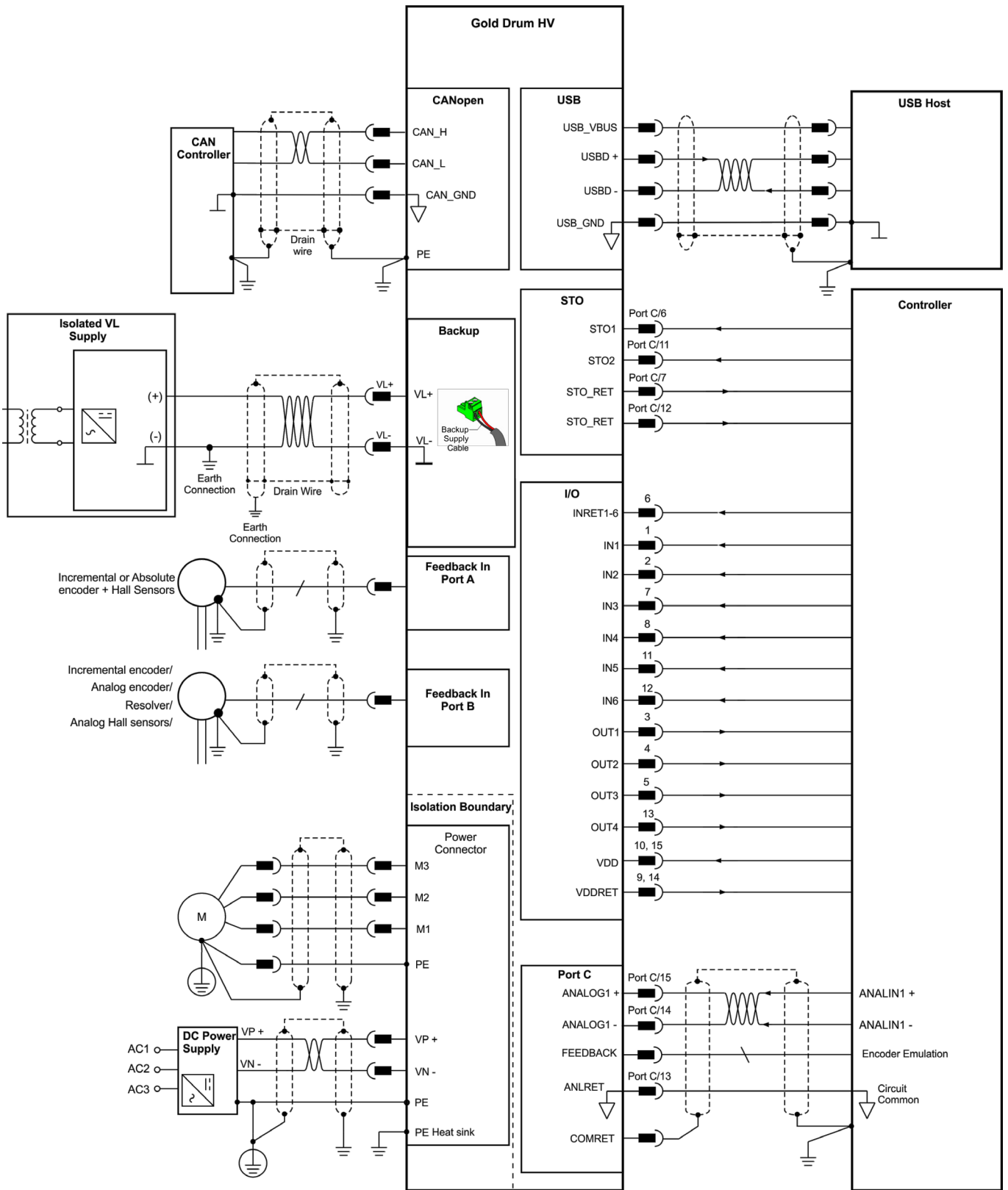


GDRUHV002D

**Figure 3: Gold Drum HV (High Voltage) Connection Diagram for EtherCAT – 400 V without Power Supply Backup Functionality for 0 or 1 Options**

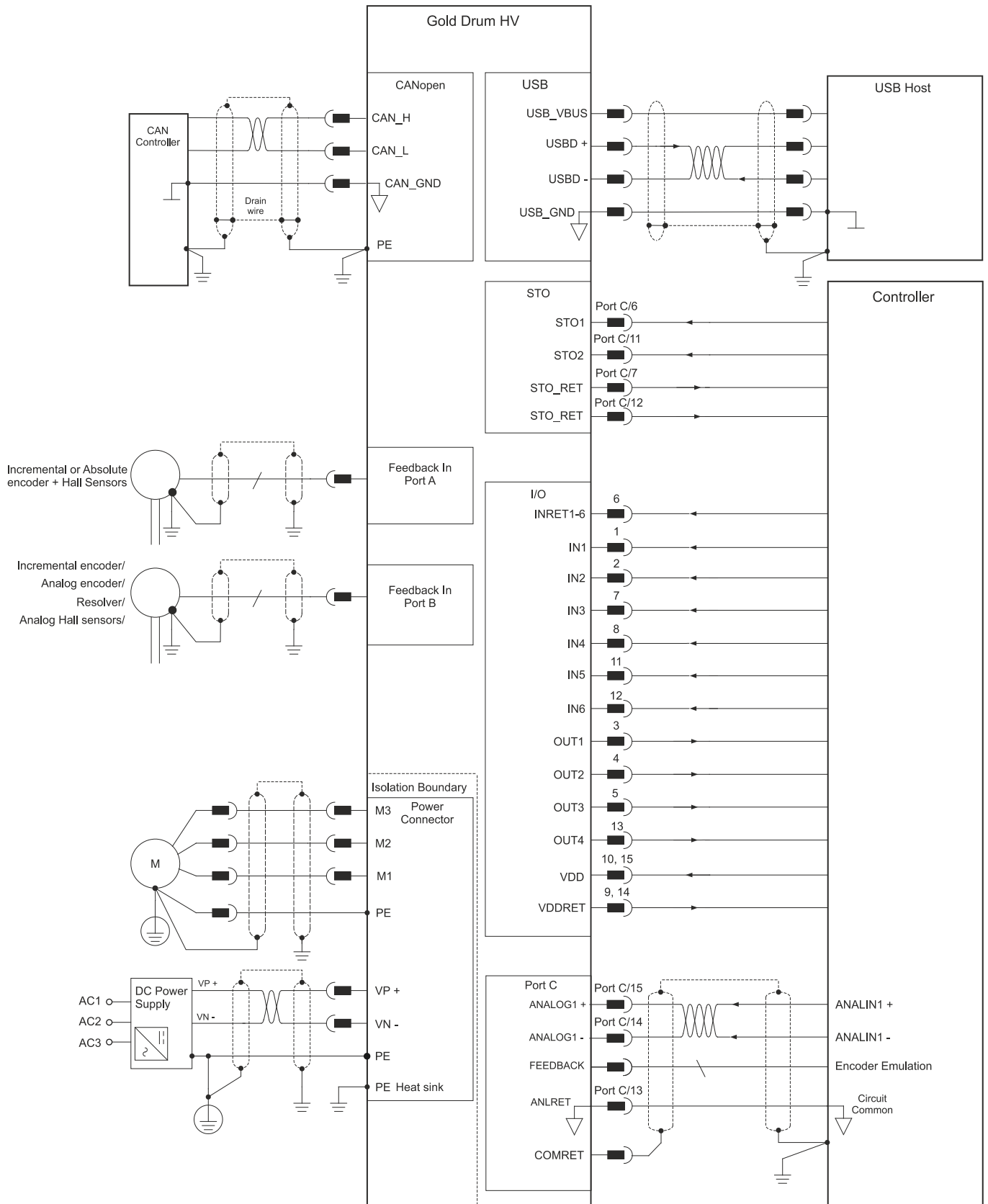
### 5.4.2. Connection Diagrams for CAN Version

The following describes the connection diagrams for the CAN version.



GDRUHV0500

Figure 4: Gold Drum HV (High Voltage) Connection Diagram for CAN – with Power Supply Backup  
 Functionality (H, S, T, or A Option)



GDRUHV051C


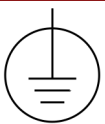
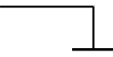
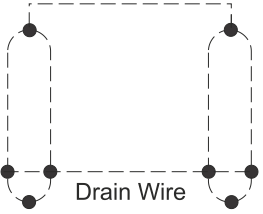
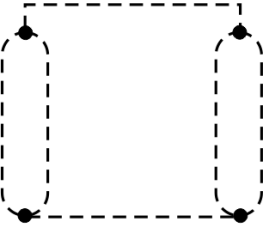
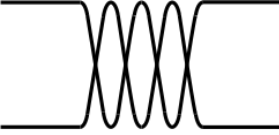
**Figure 5: Gold Drum HV (High Voltage) Connection Diagram for CAN – 400 V without Power Supply Backup Functionality for Model Drives with 0 or 1 Option**



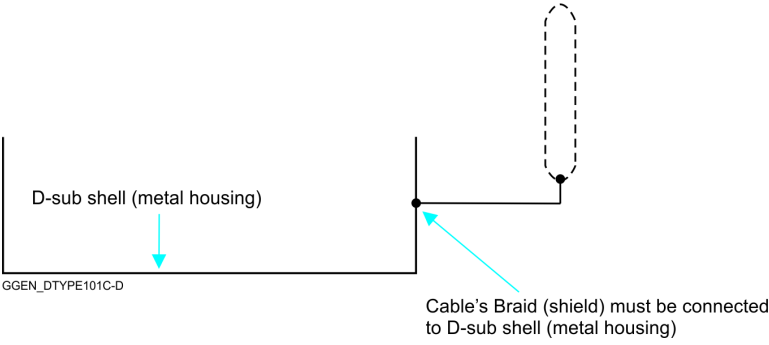
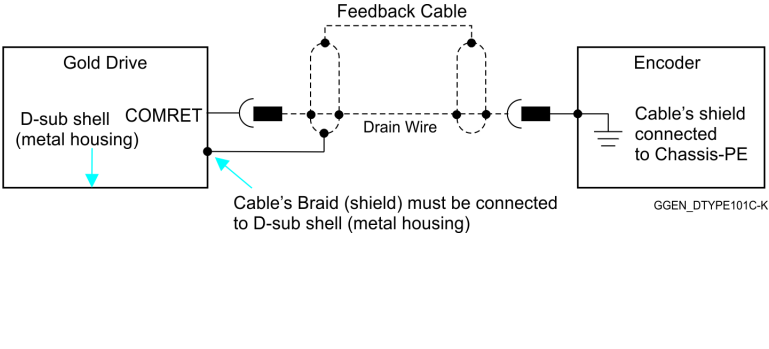
## Chapter 6: Wiring

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_DTYPE101C-A</p>	Earth connection (PE)
 <p>GGEN_DTYPE101C-B</p>	Earth Connection
 <p>GGEN_DTYPE101C-C</p>	Common at the Controller
 <p>Drain Wire</p> <p>GGEN_DTYPE101A-A</p>	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
 <p>GGEN_DTYPE101C-E</p>	Shielded cable braid only, without drain wire.
 <p>GGEN_DTYPE101C-F</p>	Twisted-pair wires



Wiring Symbol	Description
 <p>GGEN_DTYPPE101C-D</p>	<p>D-type Connector: The cable's braid (Shield) must be connected to the D-sub shell (metal housing)</p>
 <p>GGEN_DTYPPE101C-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>

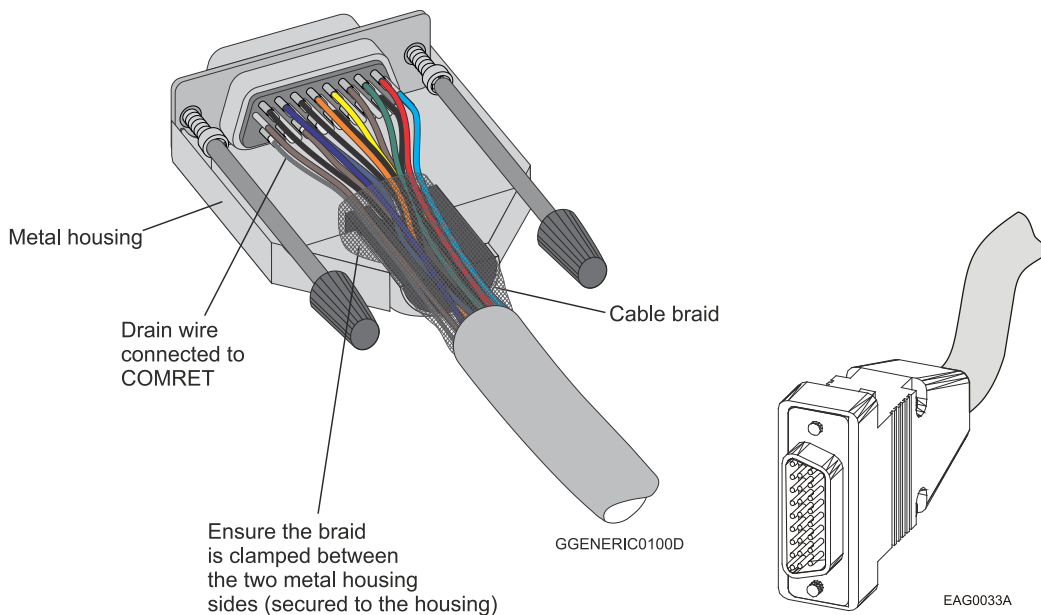




## 6.1. Basic Recommendations

### 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 6: D-Type Cable Assemblies**

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



### 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 7).
- 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.

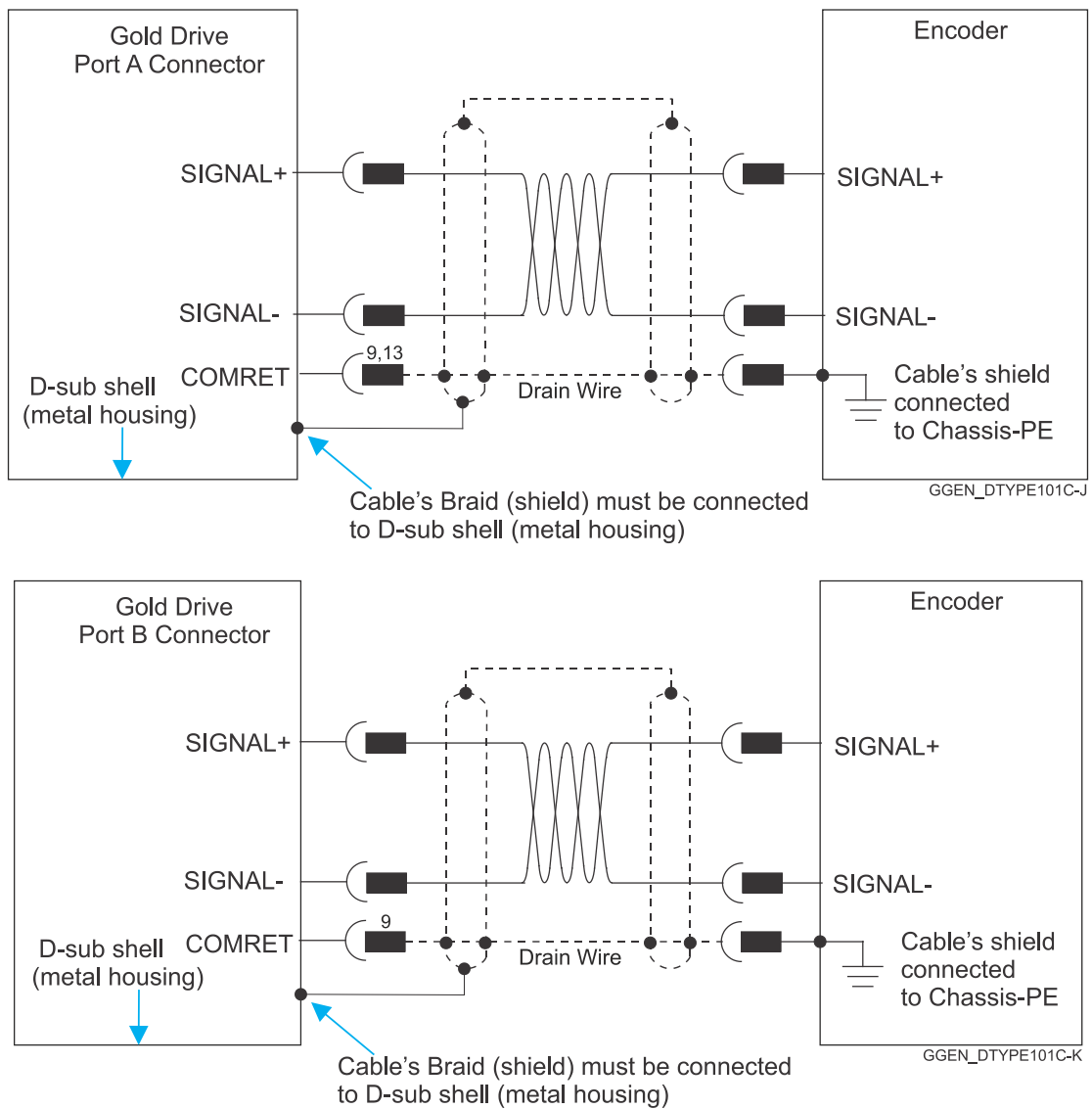


Figure 7: Feedback Port A and B Cable Assemblies



### 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.

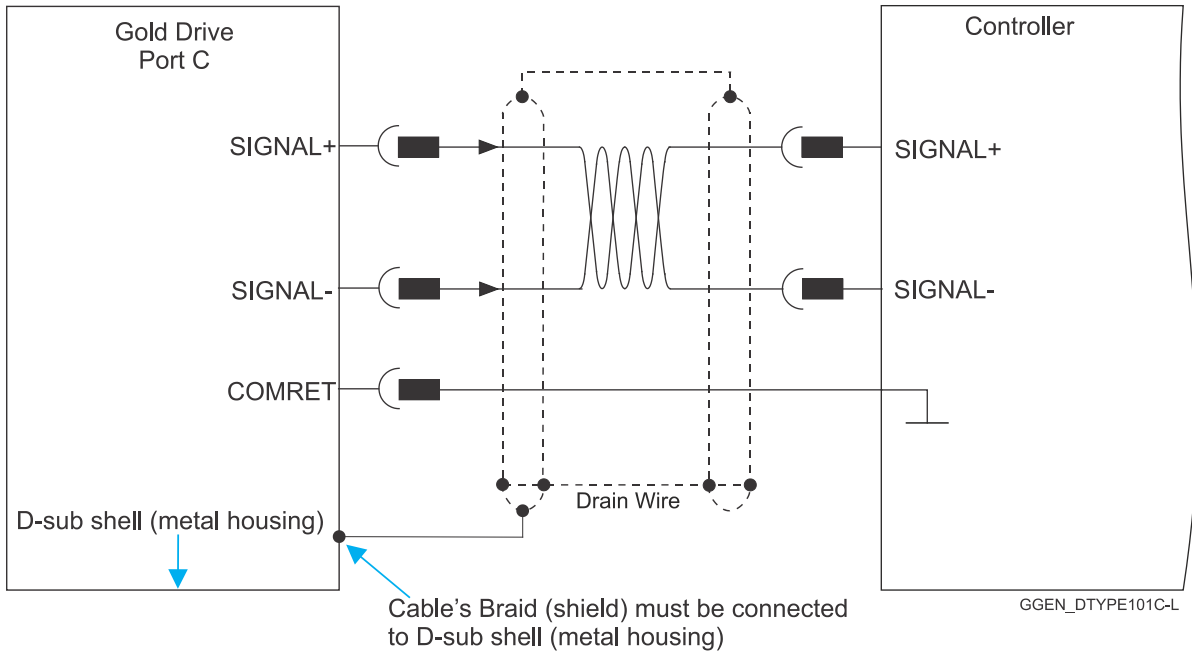


Figure 8: Feedback Port C Cable Assemblies

### 6.1.4. IO Cable Connector

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

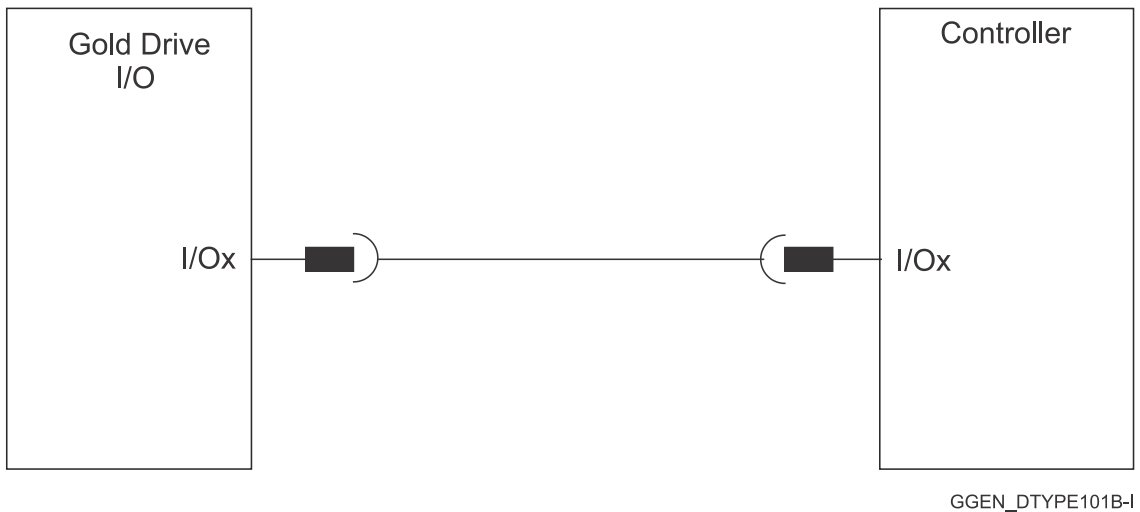


Figure 9: Feedback IO Cable Assemblies



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

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

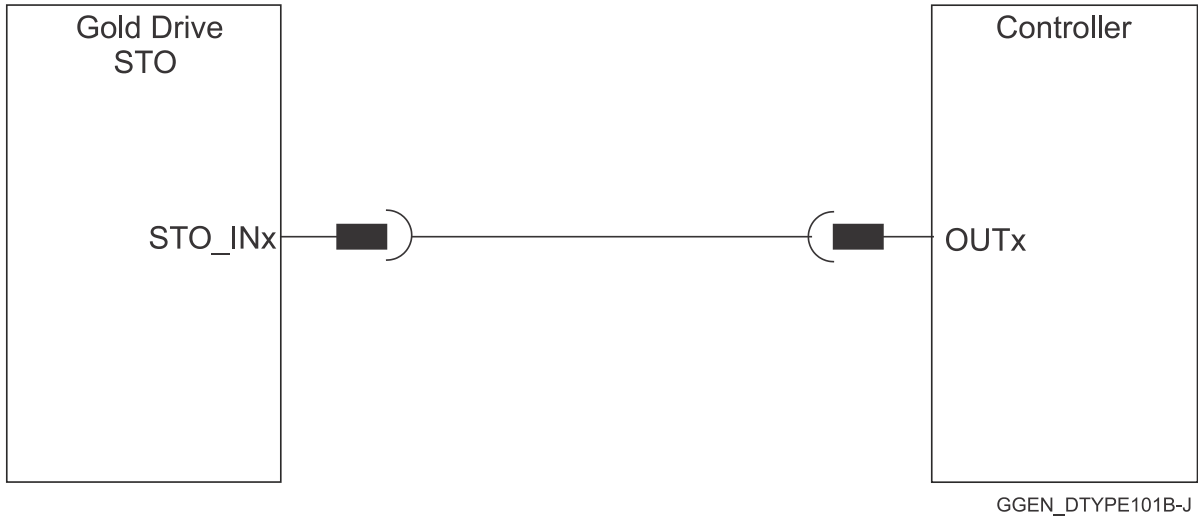


Figure 10: STO Cable Assemblies



## 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

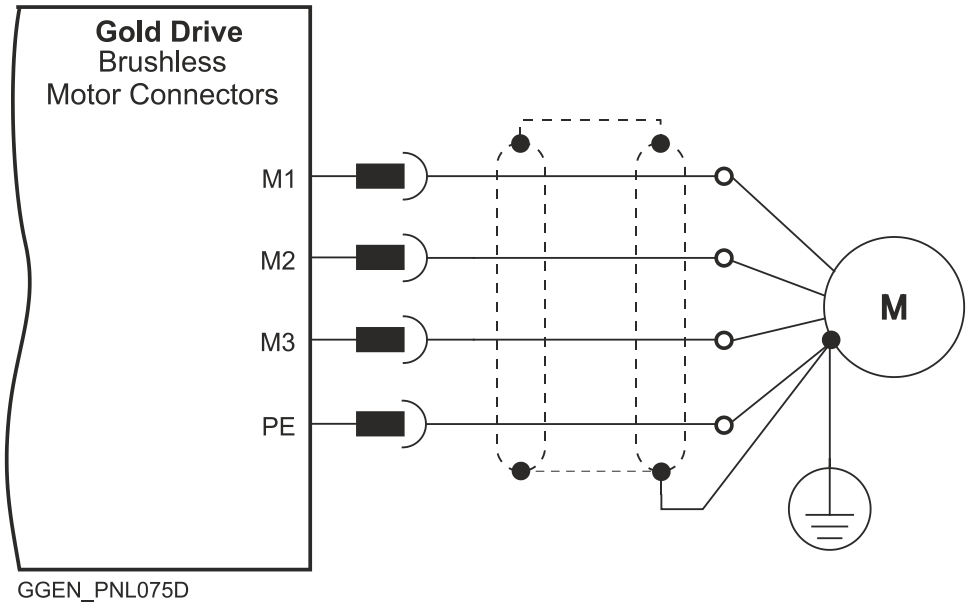


Figure 11: Brushless Motor Power Connection Diagram

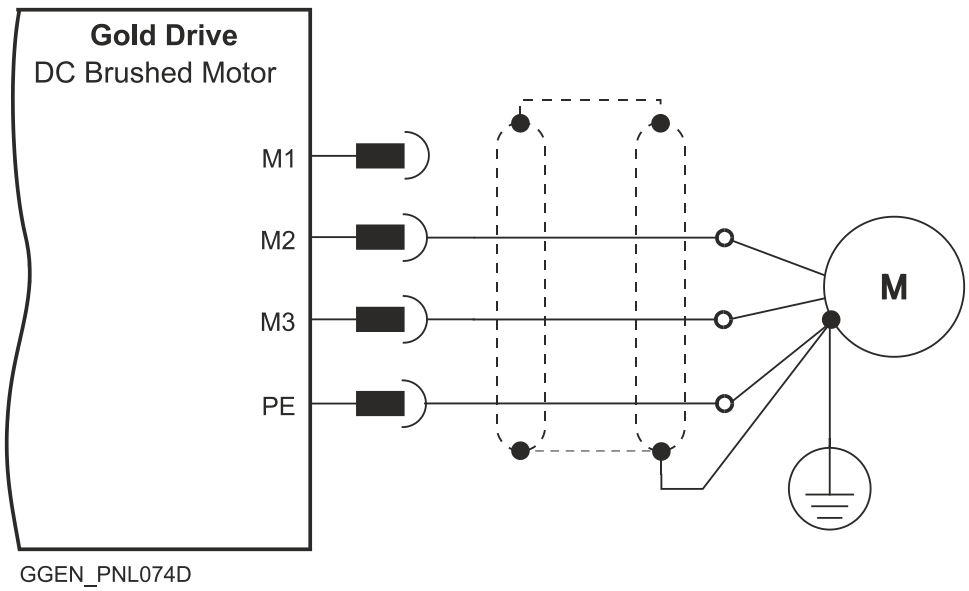


Figure 12: Brushed Motor Power Connection Diagram

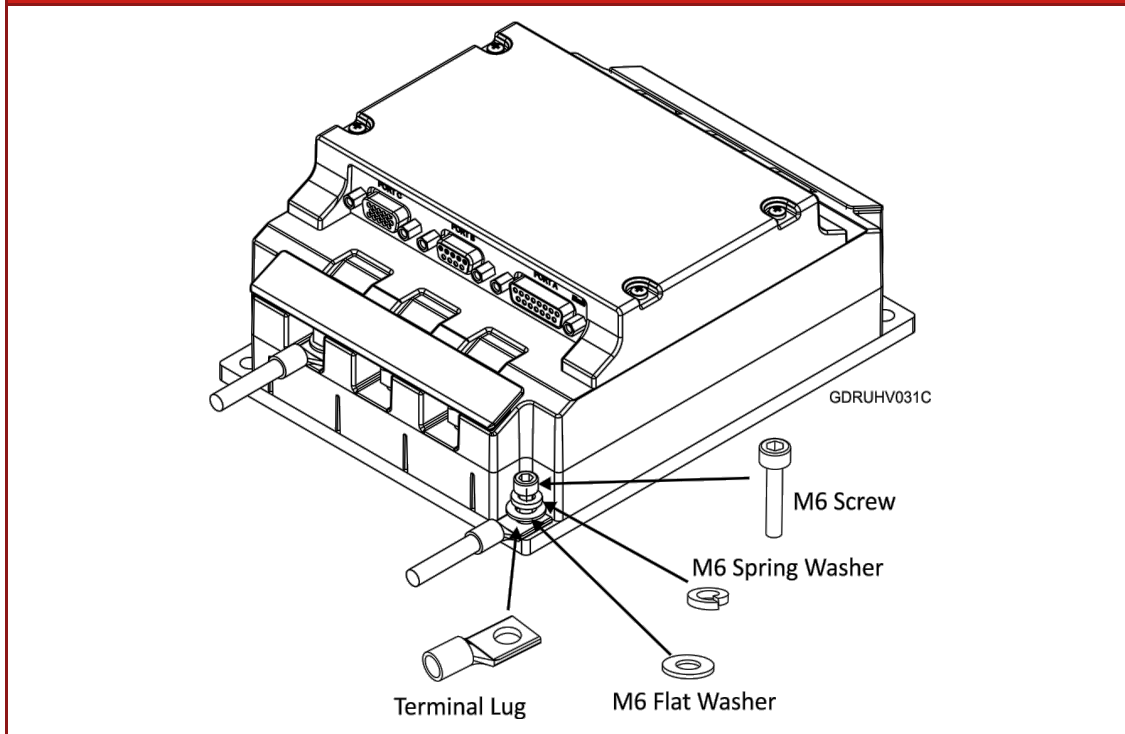


### 6.3. Connecting the DC Power and the Motor Power Cables

This section describes the installation of the cable terminal lugs for both the Main Power Cables to VP+, VN-, and PE terminals on the Gold Drum HV (High Voltage), and the Motor Power cables to the M1, M2, M3, and PE terminals on the Gold Drum HV (High Voltage).

**Note:** When connecting several motors, all the motor phases must be connected in an identical sequence.

#### Step 1: PE Earth Connection



#### Step 2: Power and Motor Connection

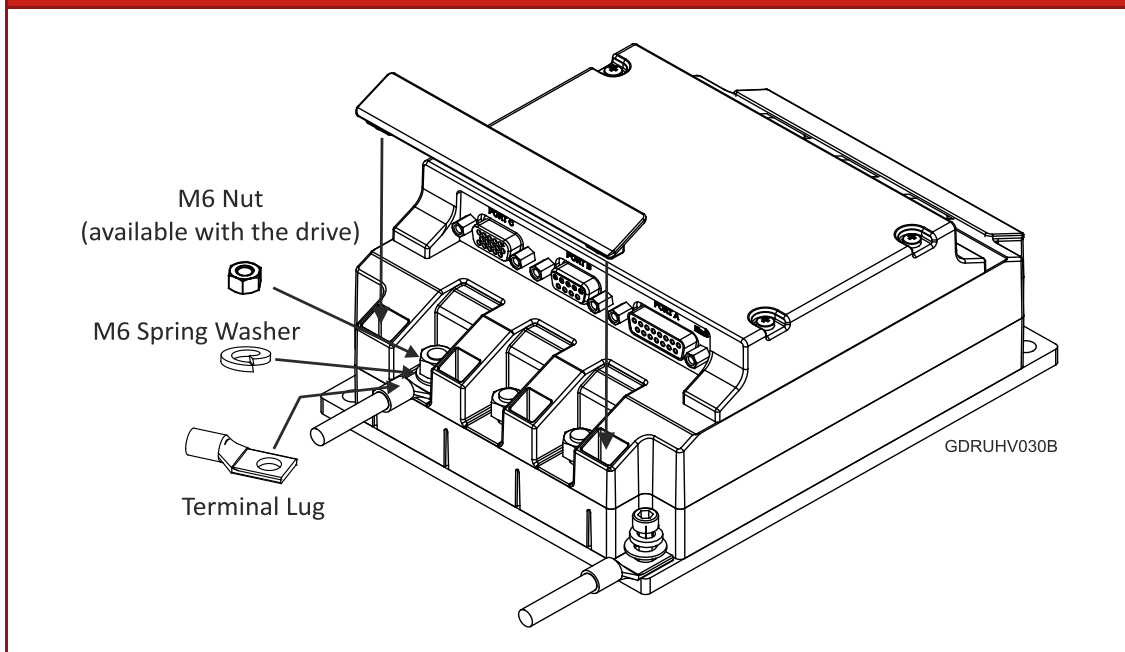


Table 1: Connecting the Main Power and Motor Cables



5. Connect the appropriate terminal lugs from the Motor Power cables to the M1, M2, M3, and PE terminals on the Gold Drum HV (High Voltage).
  - a. Install the motor cable to the drive using a barrel connector, M6 spring washer, and secure with an M6 nut (to the drive). The required M6 nut torque is 3 Nm.
  - b. Install the PE wire to the drive, using a barrel connector, M5 flat washer, M5 spring washer, and secure with an M5 screw to the heat-sink. The required M5 screw torque is 3 Nm.

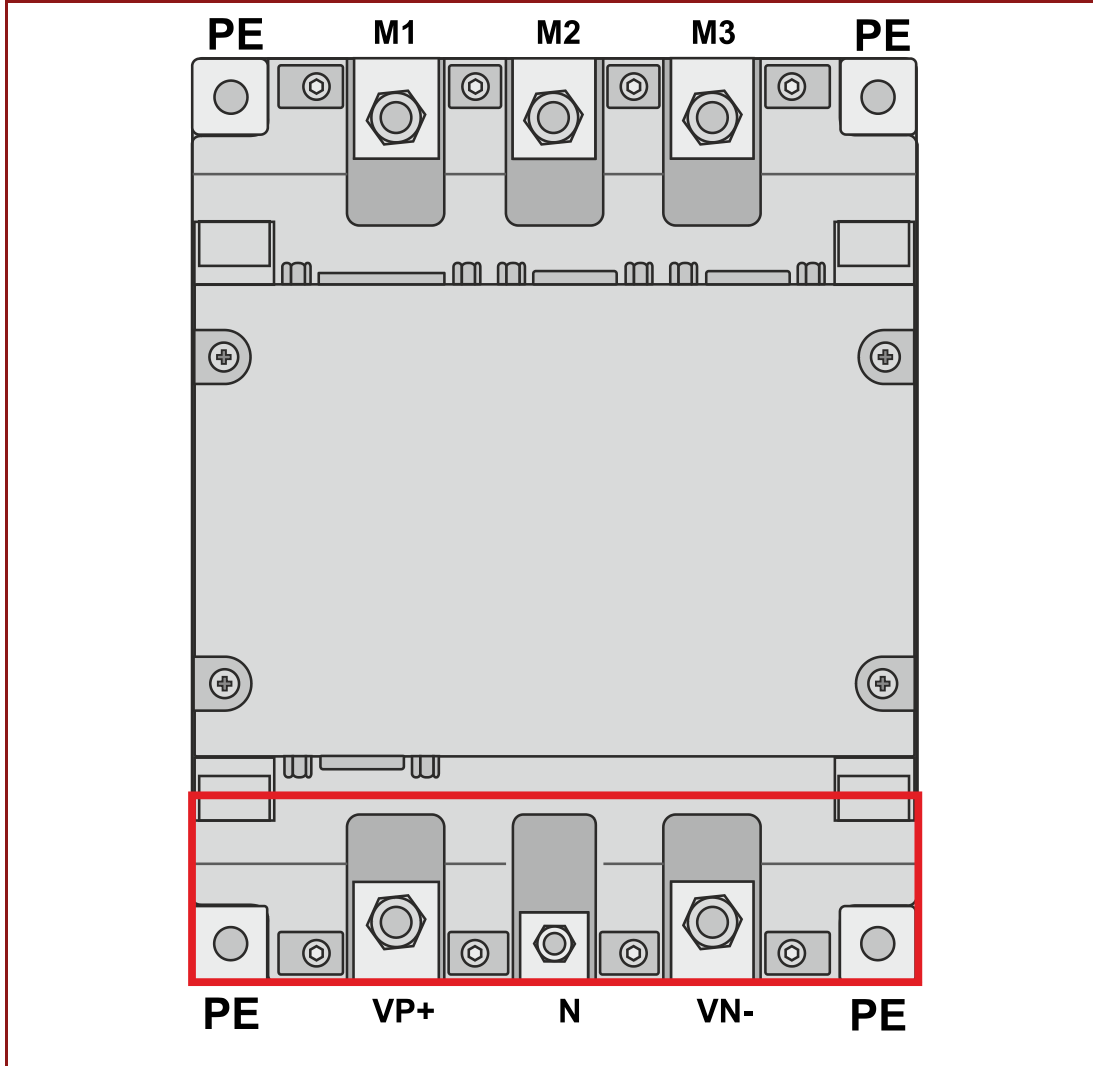




### 6.4. Main Power, Control Power

The Gold Drum HV (High Voltage) receives power from main and control supplies and delivers power to the motor.

Pin	Function	Cable
PE	Earth Connection	DC Power
VN-	DC Negative Power input	DC Power
N	Not in use	DC Power
VP+	DC Positive Power input	DC Power

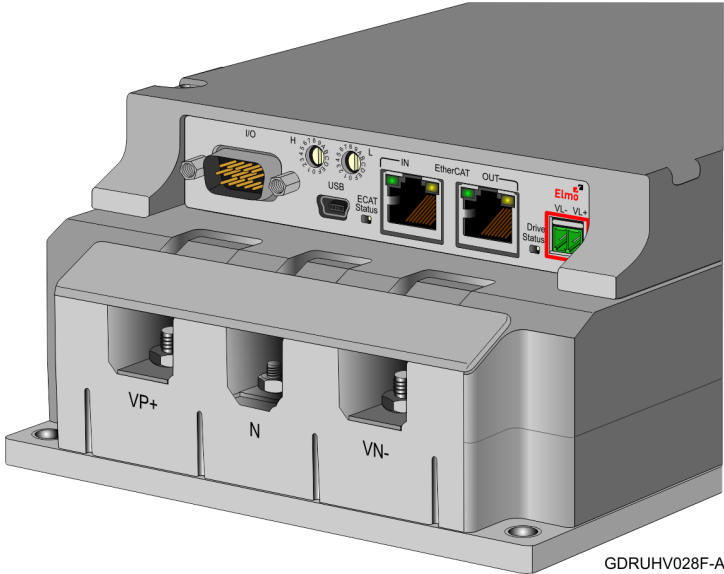




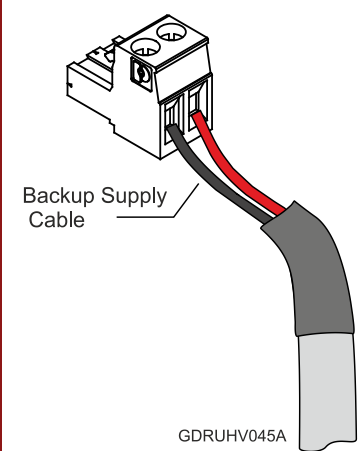
### 6.4.1. Optional Backup Supply (S, T, A or H option drives)

Pin	Function	Cable
<b>S, T, A or H option type</b>		
VL+	+24 V Auxiliary Supply Input Positive	DC Power
VL-	24 V RET Auxiliary Supply Input Return	DC Power



**2-Pin Pluggable 3.81 mm Phoenix High Current**



**2-Pin Phoenix Plug-in Connector**

Table 2: Auxiliary 24 VDC Backup Supply Pins and Polarity



## 6.4.2. Main Power

The DC power for the Gold Drum HV (High Voltage) is delivered from a separated rectifying unit (supplied by the user). Elmo recommends using the Tambourine 100 rectifier specifically designed for use with Elmo drives which offers a range of versatile options.

The following sections contain topology recommendations for implementing a three-phase supply chain.

The power stage of the Gold Drum HV (High Voltage) is fully isolated from the other sections of the Gold Drum HV (High Voltage), 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 Drum HV (High Voltage).

In addition, this isolation simplifies the requirements of the DC power supply that is used to power the DC bus of the Gold Drum HV (High Voltage), by allowing it to operate with a non-isolated DC power source (a direct-to-mains connection) which eliminates 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 Drum HV (High Voltage) can also operate from an isolated power supply or batteries.

When rectifying the AC voltage source, the AC voltage-level must be limited as follows:

Drive Model (V)	AC voltage-level limit (VAC)	DC Maximum (VDC)
400	270	390
800	528	747

### 6.4.2.1. Direct-to-Mains Power Source

This section relates to the configuration of the power supply and drive, which are connected directly to the mains.

**To connect the non-isolated DC power supply (Table 1):**

1. For best immunity, it is highly recommended to use twisted cables for the DC power supply cable. A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the motor.
2. Connect both ends of the cable shield to the closest PE connections.  
Tie one end to the power supply's PE terminal, and tie the other end either to one of the four mounting screws of the drive's heat sink-PE.
3. Connect the appropriate terminal lugs from the DC Power Input cables to the VP+, VN-, and PE terminals on the Gold Drum HV (High Voltage).
  - a. To close the power supply cable into the drive, use the barrel connector, M6 spring washer and M6 nut (in the drive). The required torque is 3 Nm.
  - b. To close the PE wire into the drive, use the barrel connector, M6 flat washer, M6 spring washer and M6 screw to the heat sink. The required torque is 3 Nm.



### 6.4.2.1.a Three-Phase Direct-to-Mains Connection Topology

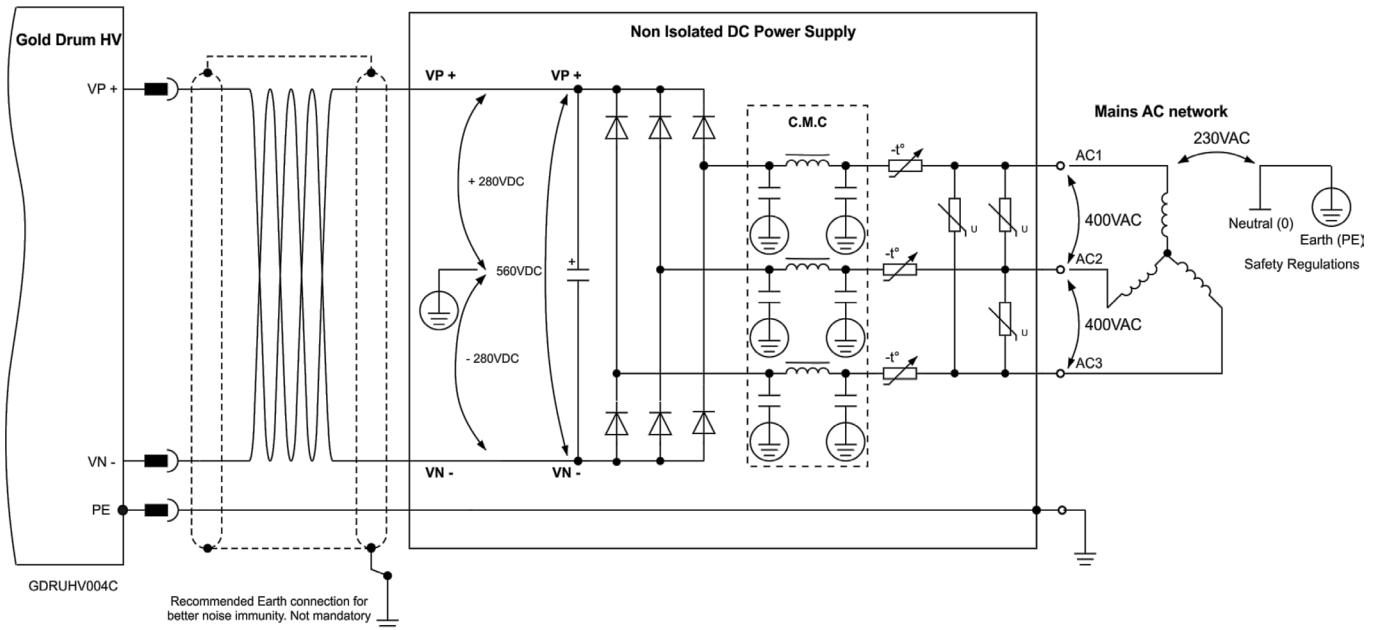


Figure 13: Non-Isolated Three-Phase Connection Topology



#### Caution:

- 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.



### 6.4.2.1.b 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.

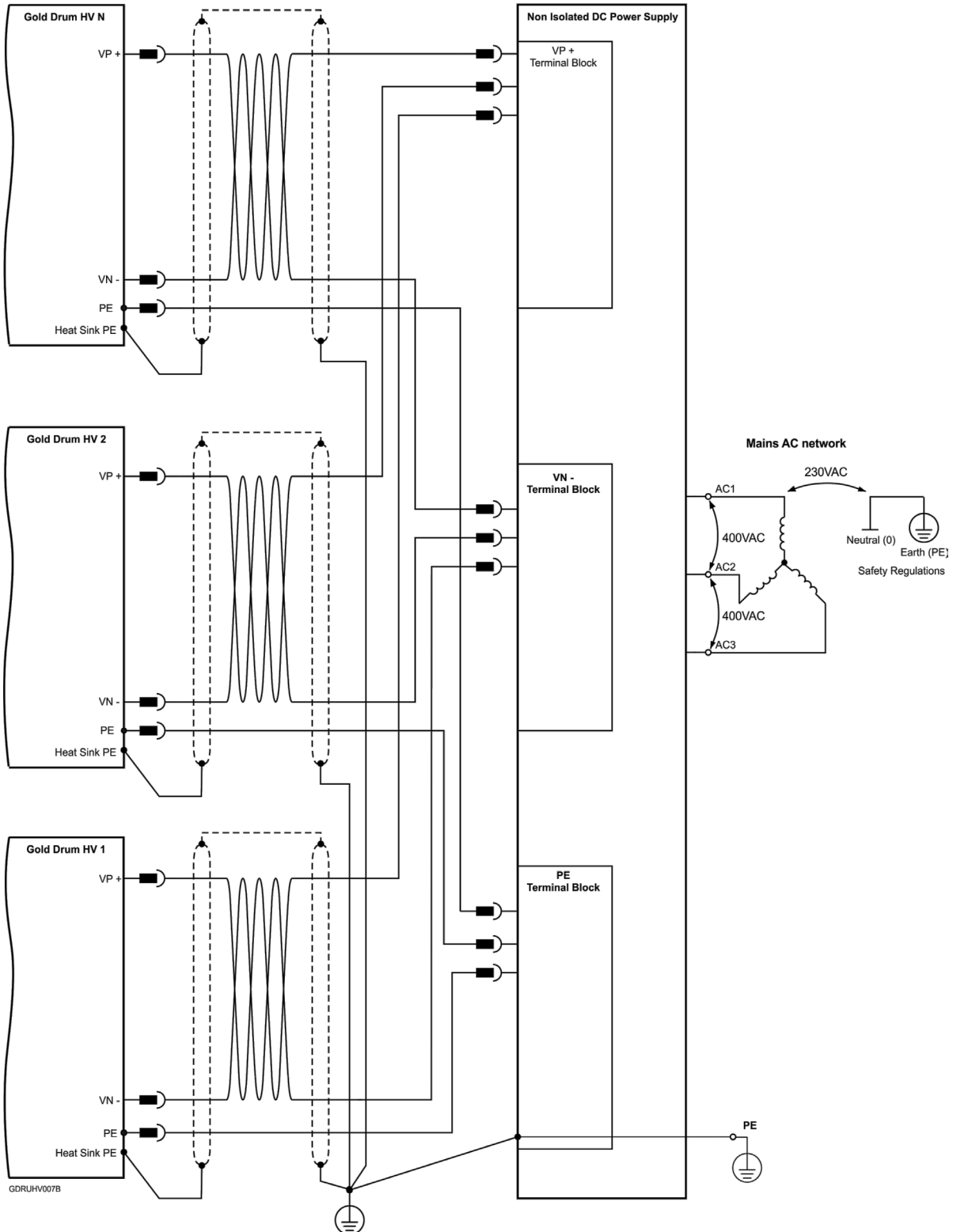


Figure 14: Non-Isolated Three-Phase Multiple Connection Topology



### 6.4.2.2. Battery Power Supply

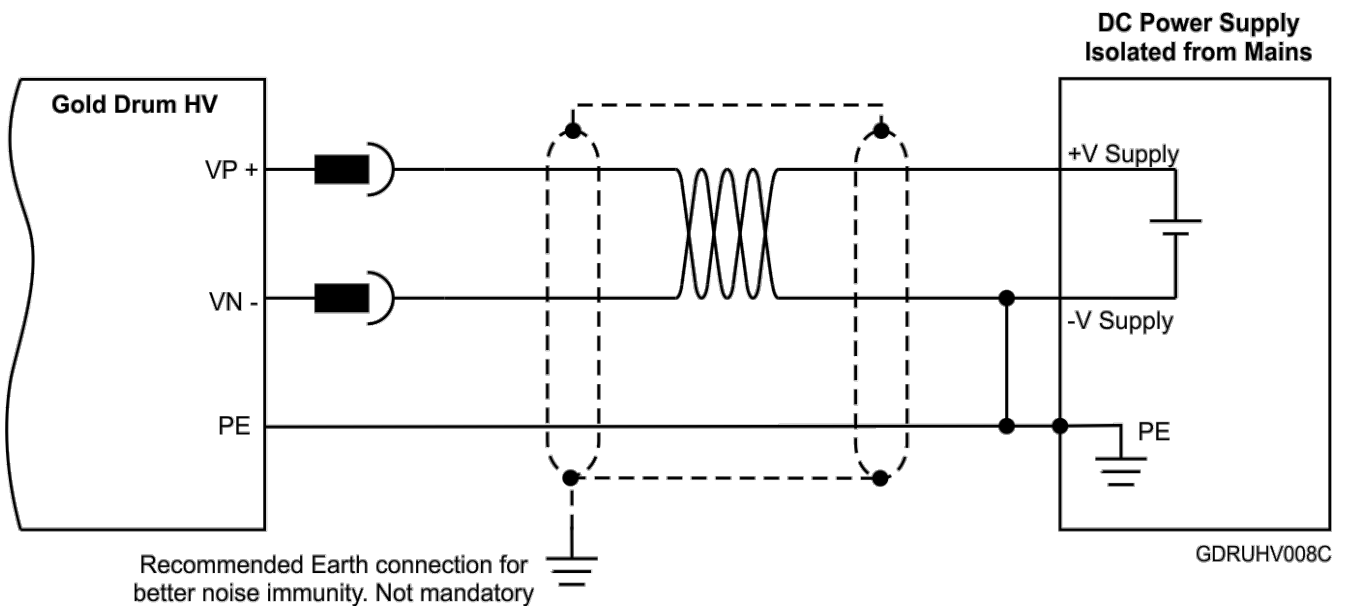


Figure 15: Battery Connection Topology



**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.



### 6.4.3. Control and Backup Supply

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 Drum HV (High Voltage) 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 S, T, or A-model Gold Drum HV (High Voltage) should be used, with an external 24 VDC isolated supply connected to it.

Note that the S, T, or A-model Gold Drum HV (High Voltage) 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.

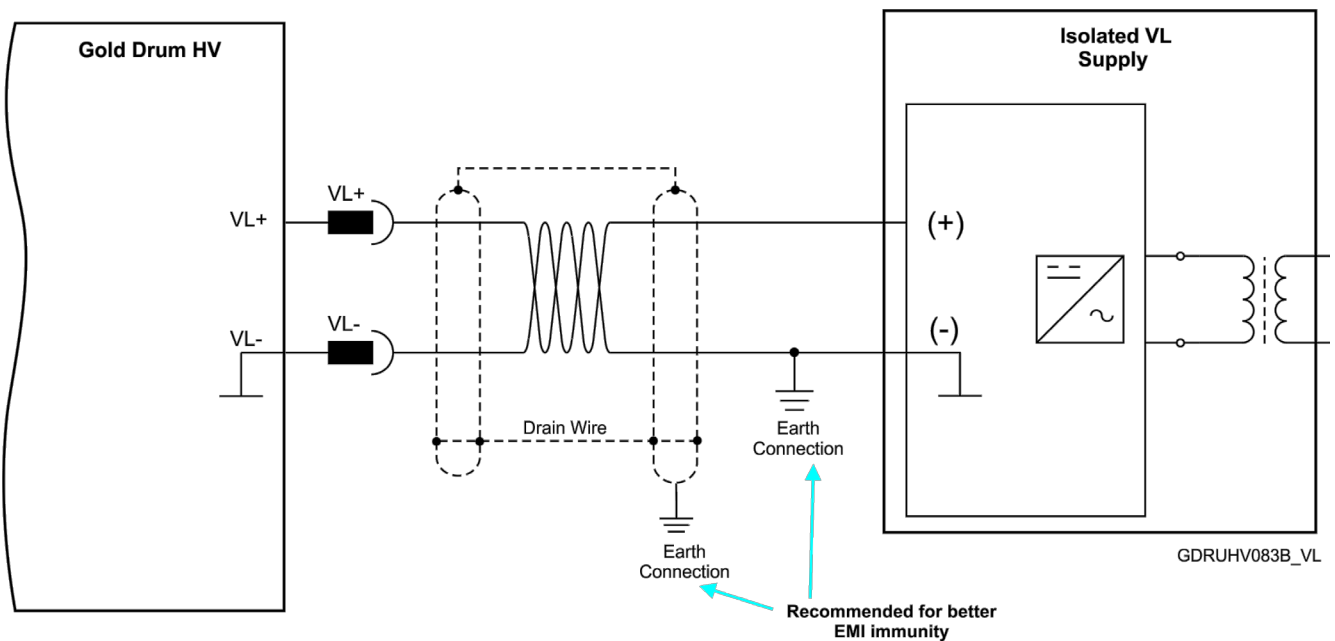


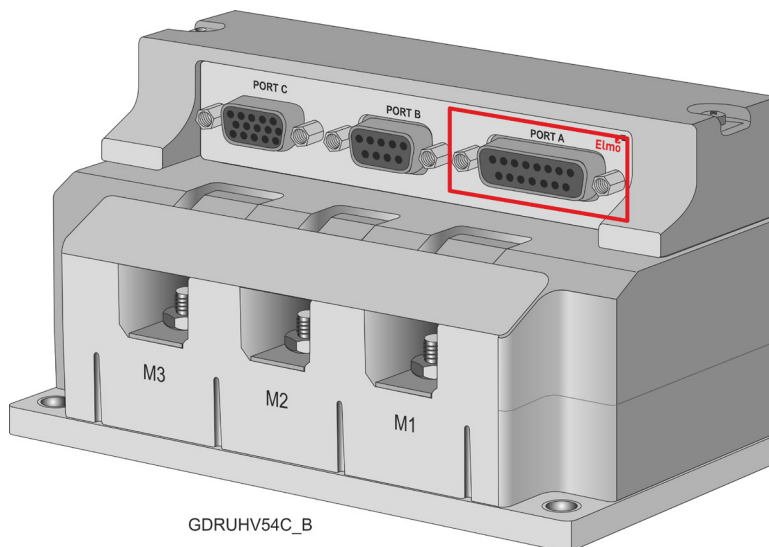
Figure 16: 24 VDC Control & Backup Supply VL Connection Diagram

## 6.5. Port A

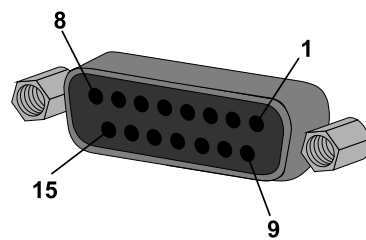
See Section 10.3 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Port A	Incremental Encoder		Absolute Serial Encoder	
Pin	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

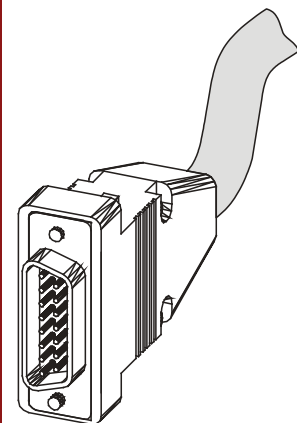


GDRUHV54C\_B



GDRUHV053A

15-Pin D-Type Female Connector



15-Pin D-Type Male Connector

Table 3: Port A Pin Assignments



### 6.5.1. Incremental Encoder

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

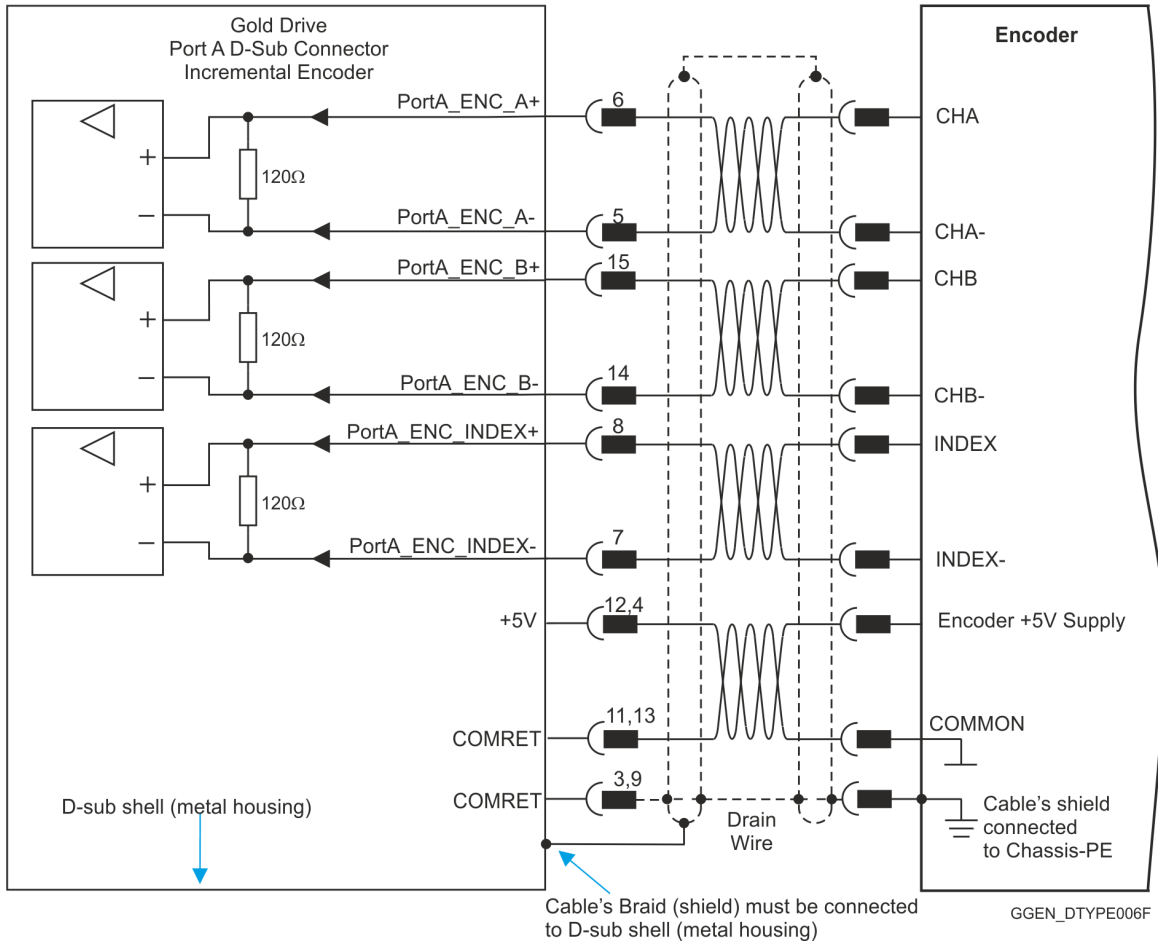


Figure 17: Port A D-Type Incremental Encoder Input – Recommended Connection Diagram

### 6.5.2. Hall Sensor

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

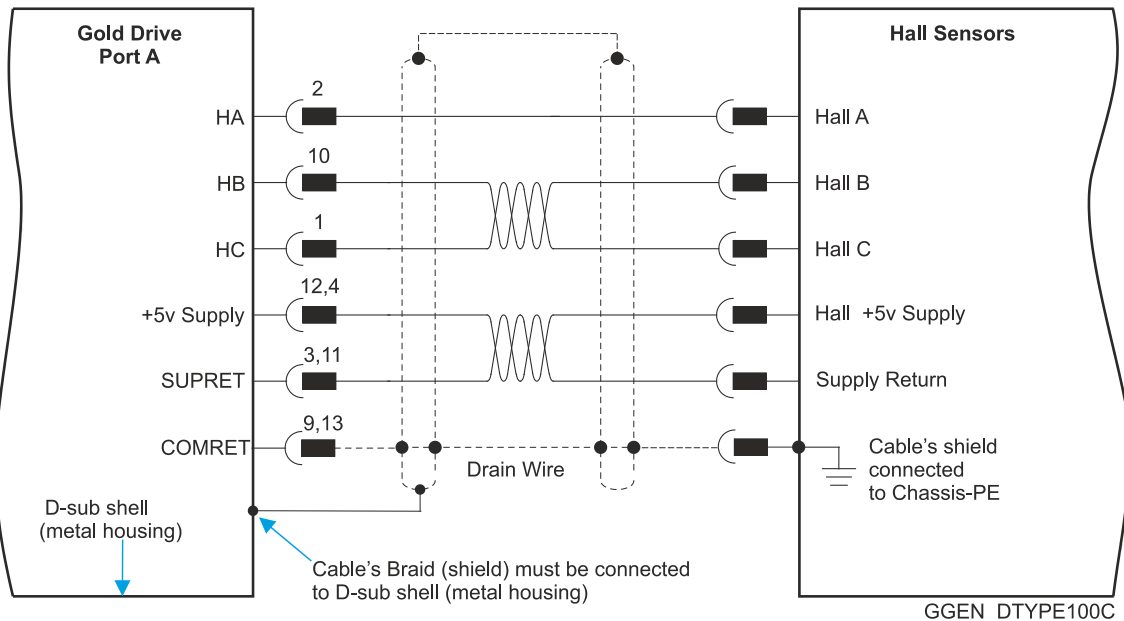
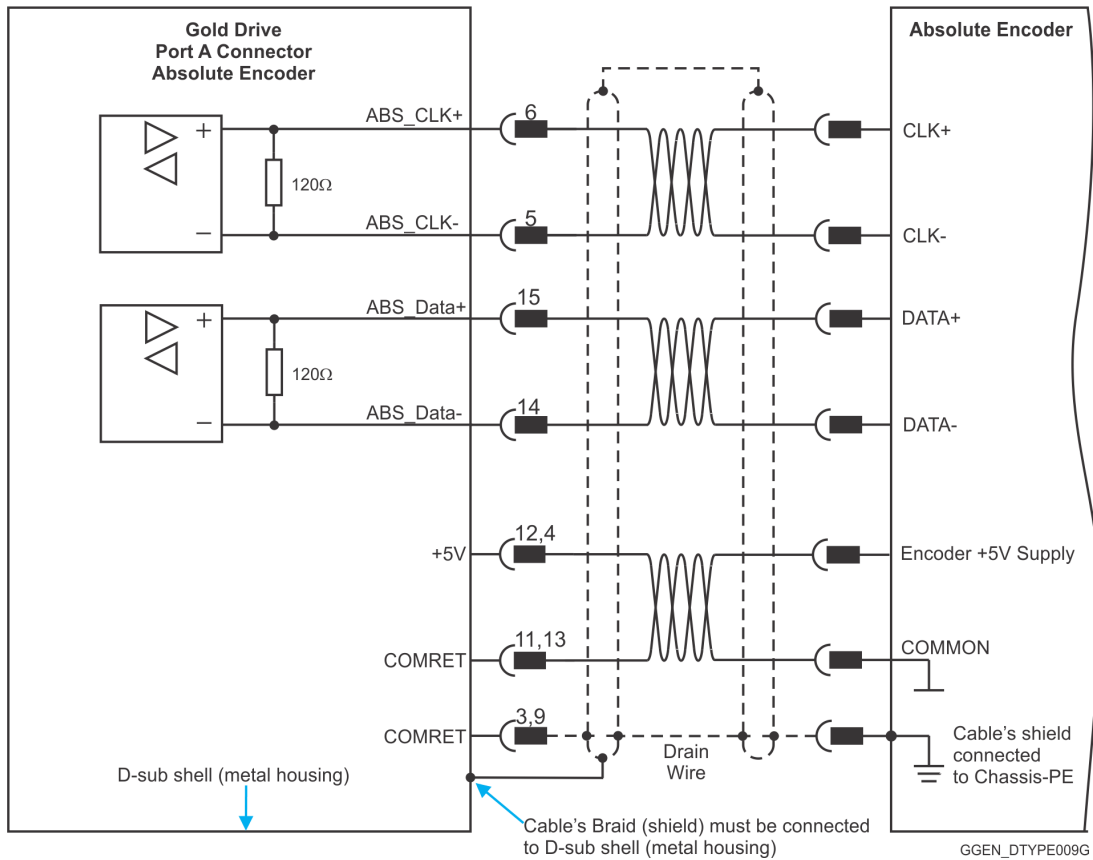


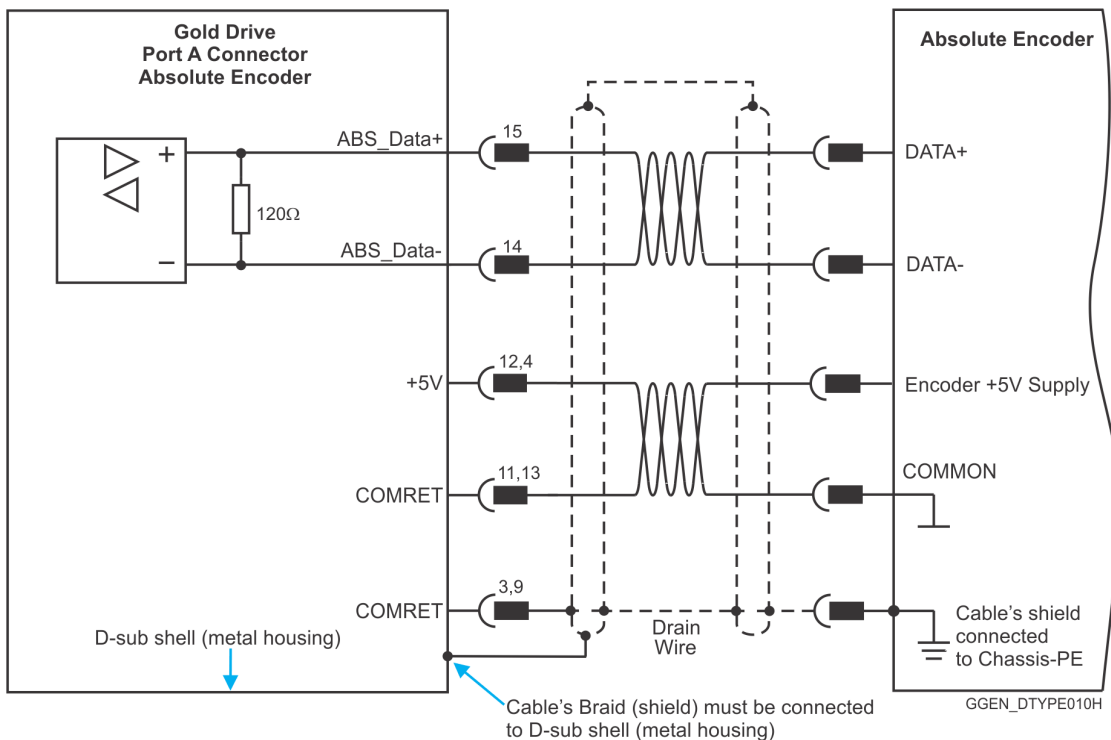
Figure 18: Hall Sensor Connection Diagram

### 6.5.3. Absolute Serial Type Encoder

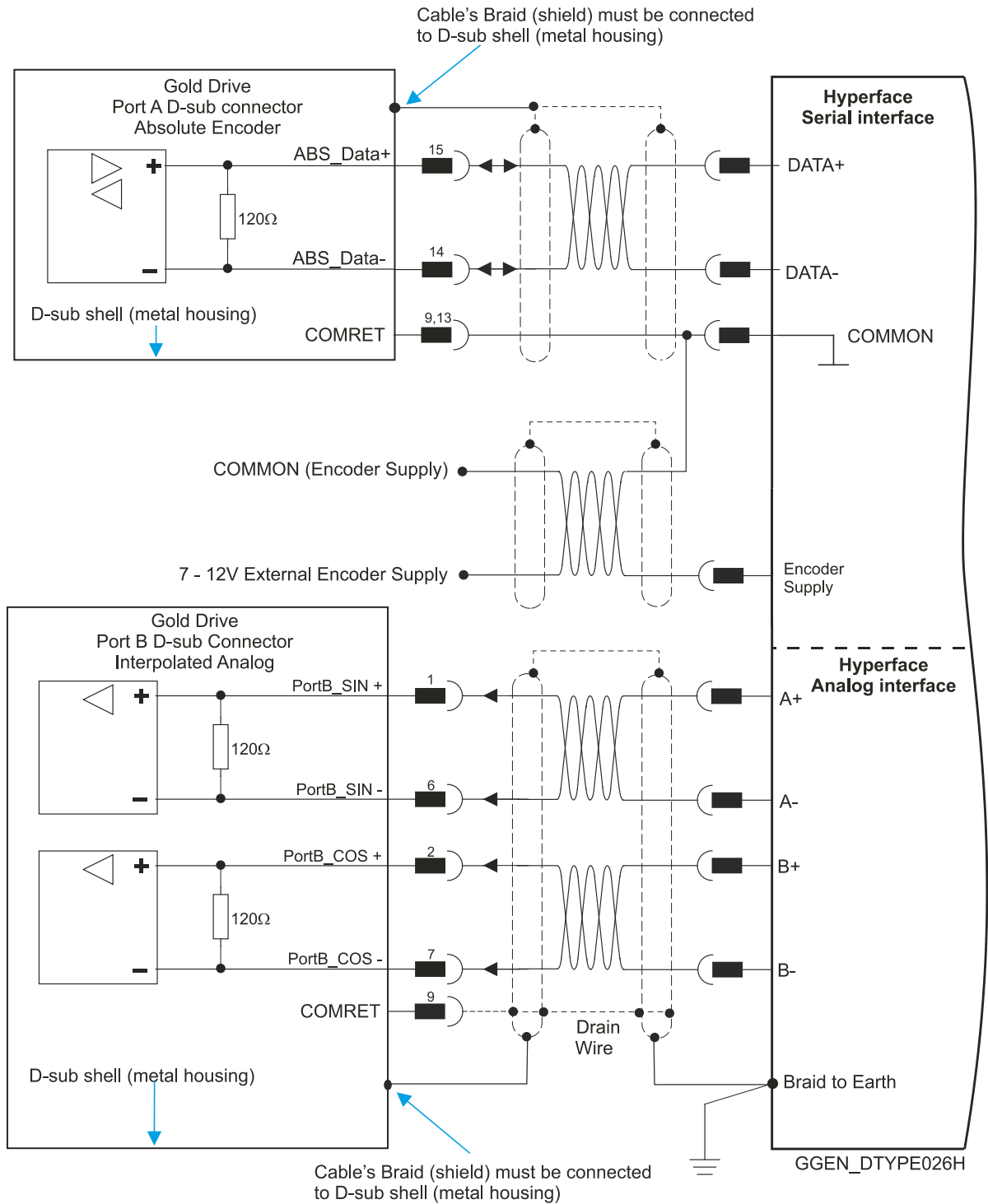
The following figures describe the connections at Port A for the Absolute Serial type encoders.



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



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



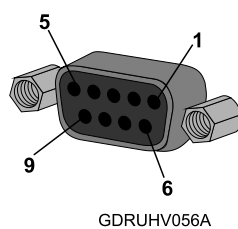
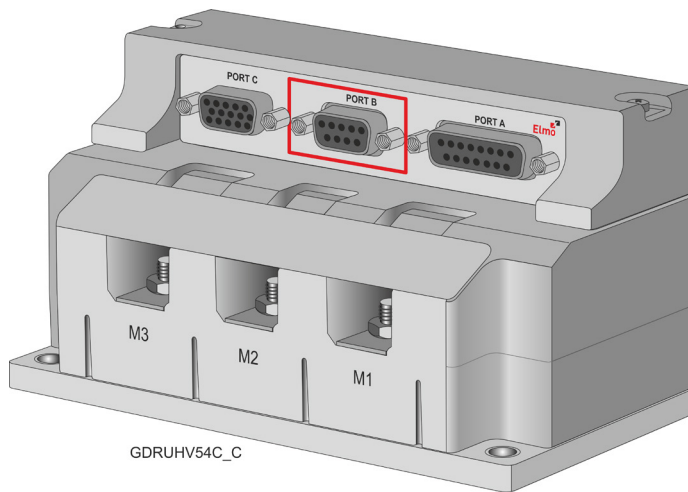
**Figure 21: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Stegmann Hiperface**

## 6.6. Port B

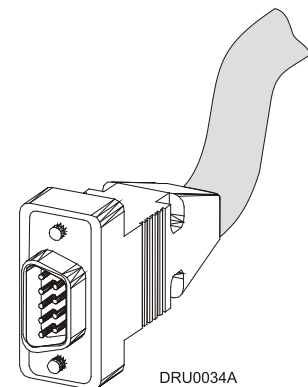
See Section 10.4 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

Port B		Incremental or Interpolated Analog Encoder	Resolver	
		<b>G-DRU</b> XXX/YYY <b>X</b> EXX	<b>G-DRU</b> XXX/YYY <b>X</b> RXX	
Pin	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_OU T+	Vref f=1/TS, 50 mA Max.
8	PortB_ENC_INDEX-	Index -	RESOLVER_OU T-	Vref complement f= 1/TS, 50 mA Max.

### Pin Positions



**9-Pin D-Type Female Connector**

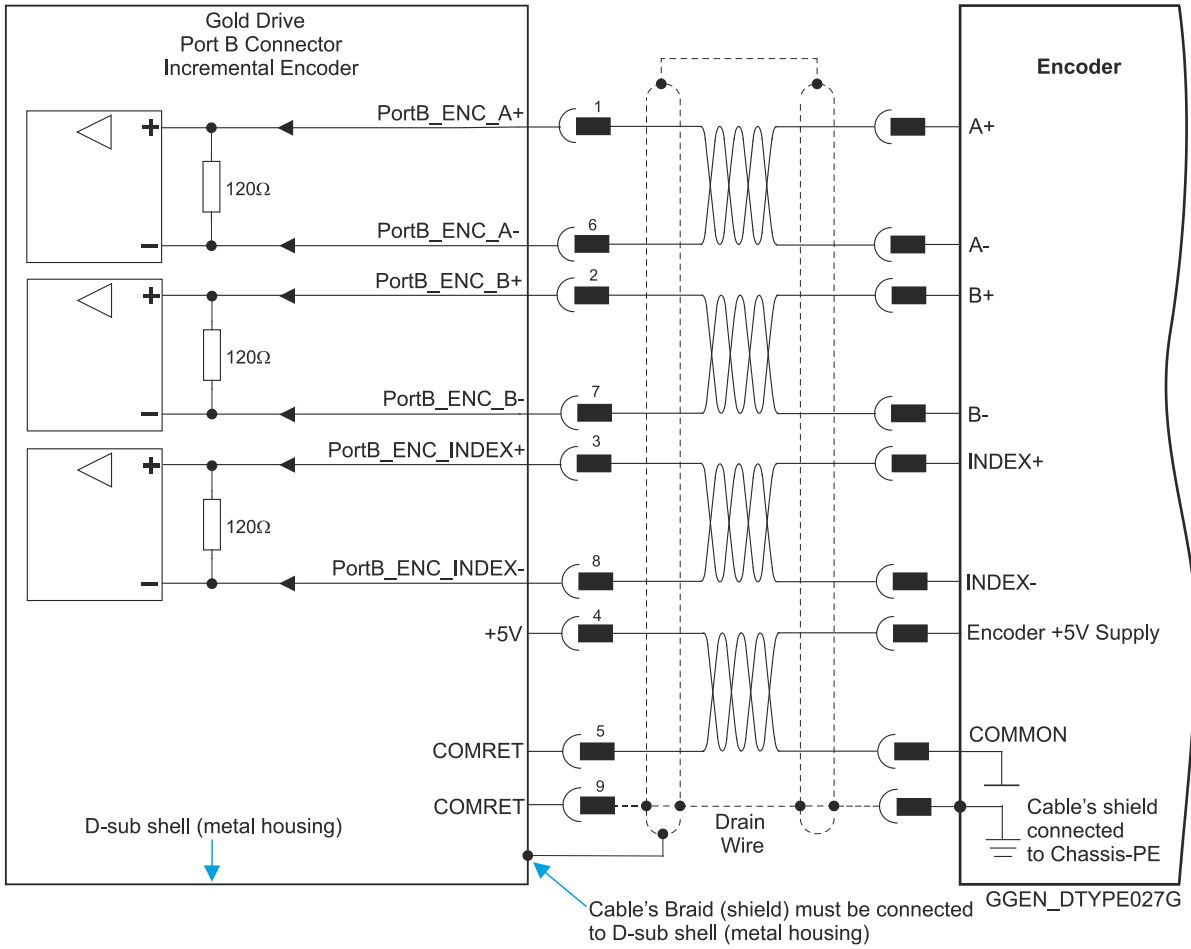


**9-Pin D-Type Male Connector**

**Table 4: Port B Pin Assignments**

### 6.6.1. Incremental Encoder

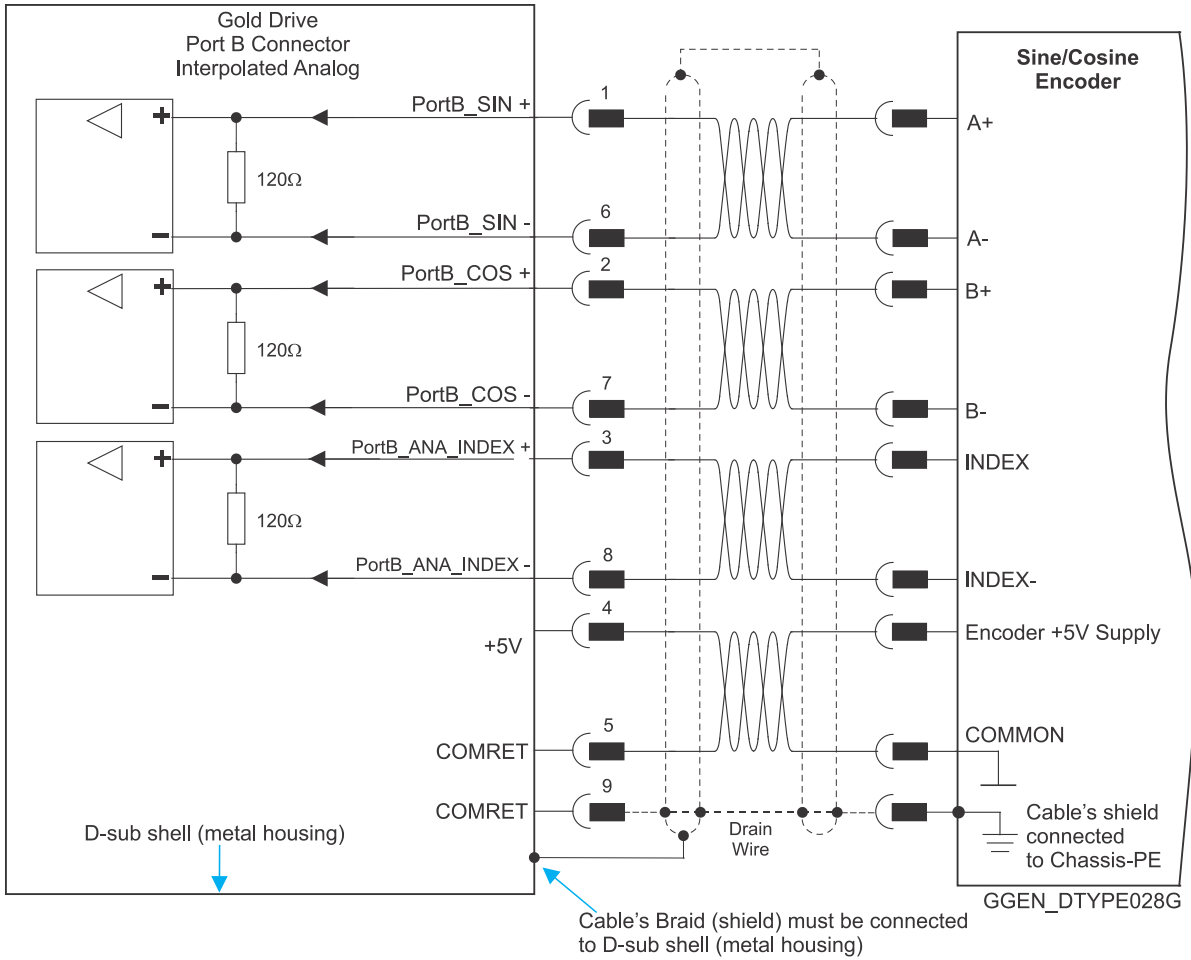
The following figure describes the connections at Port B for the Incremental encoder.



**Figure 22: 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 23: 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.

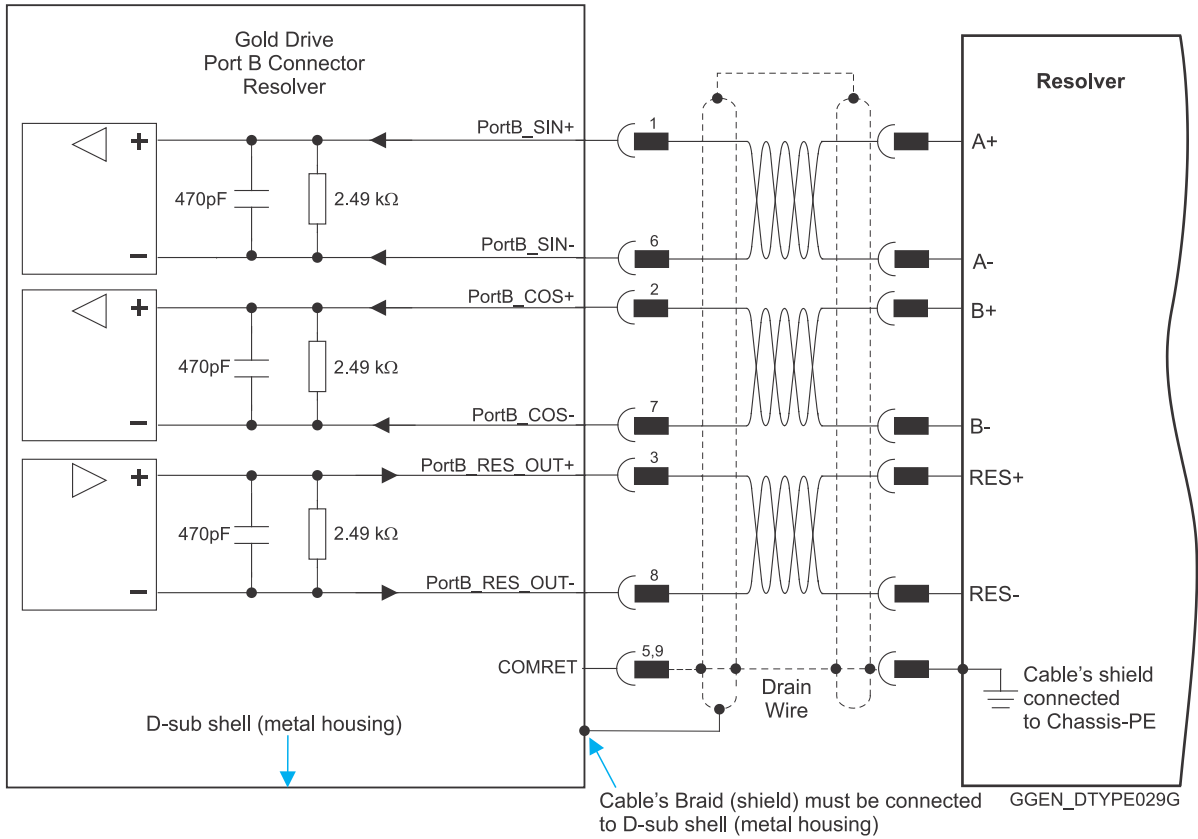


Figure 24: Port B – Resolver D-Type Connection Diagram



## 6.7. Port C, Analog Input, and STO

The Port C connector includes the following functions:

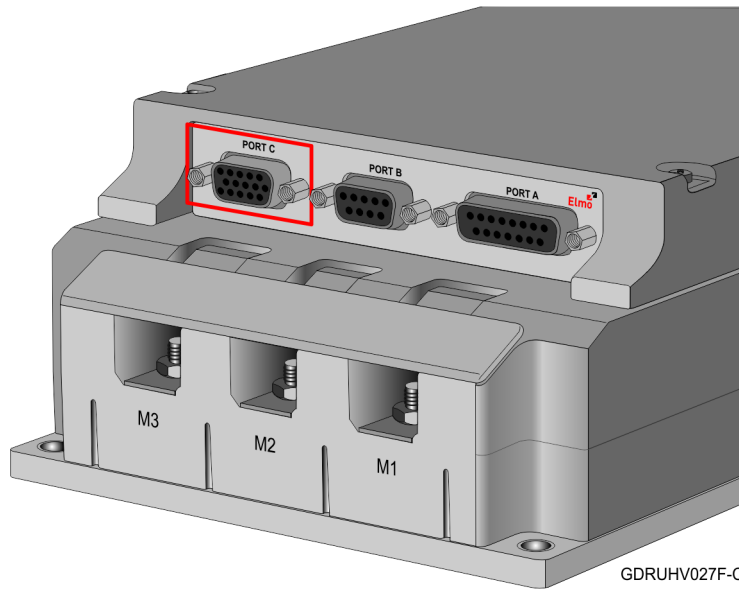
- **Port C:** Refer to Sections 10.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details
- **STO:** See Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.
- **Analog input:** See Section 11.2 in the in the MAN-G-Panel Mounted Drives Hardware manual 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+

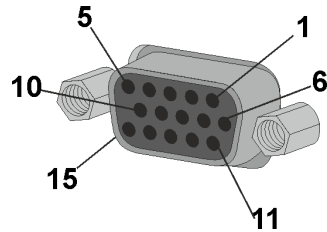




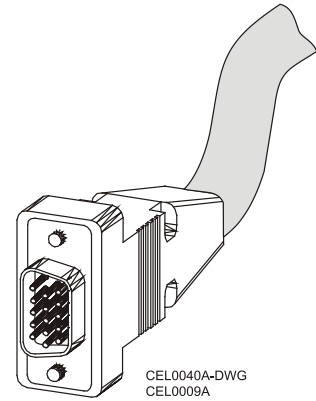
### Pin Positions



GDRUHV027F-C



15-Socket High Density D-Type Connector



CEL0040A-DWG  
CEL0009A

15-Pin High Density D-Type Male Connector

Table 5: Port C Pin Assignments

### 6.7.1. Port C

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

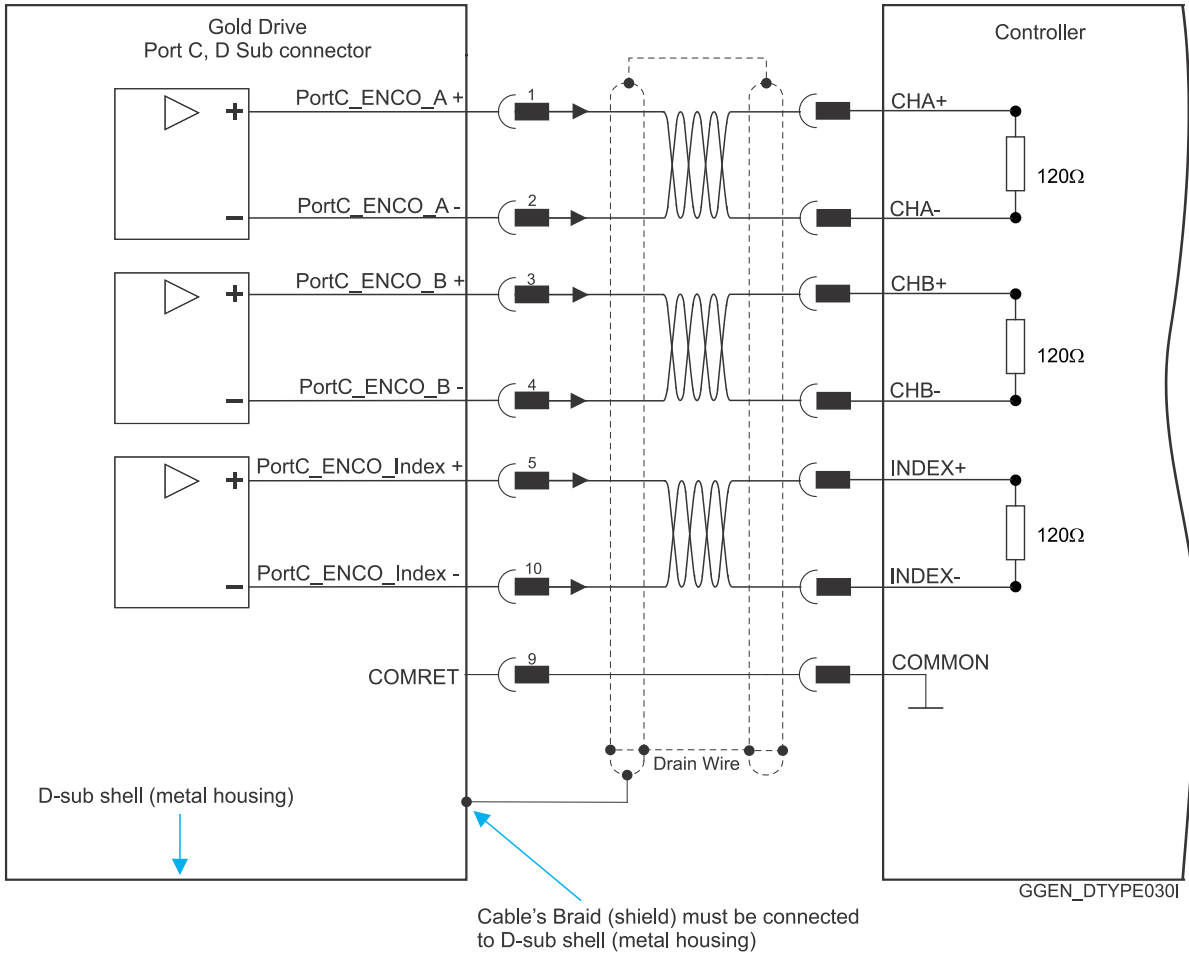


Figure 25: Emulated Encoder Differential Output – Recommended D-Type Connection Diagram

### 6.7.2. Analog Input

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

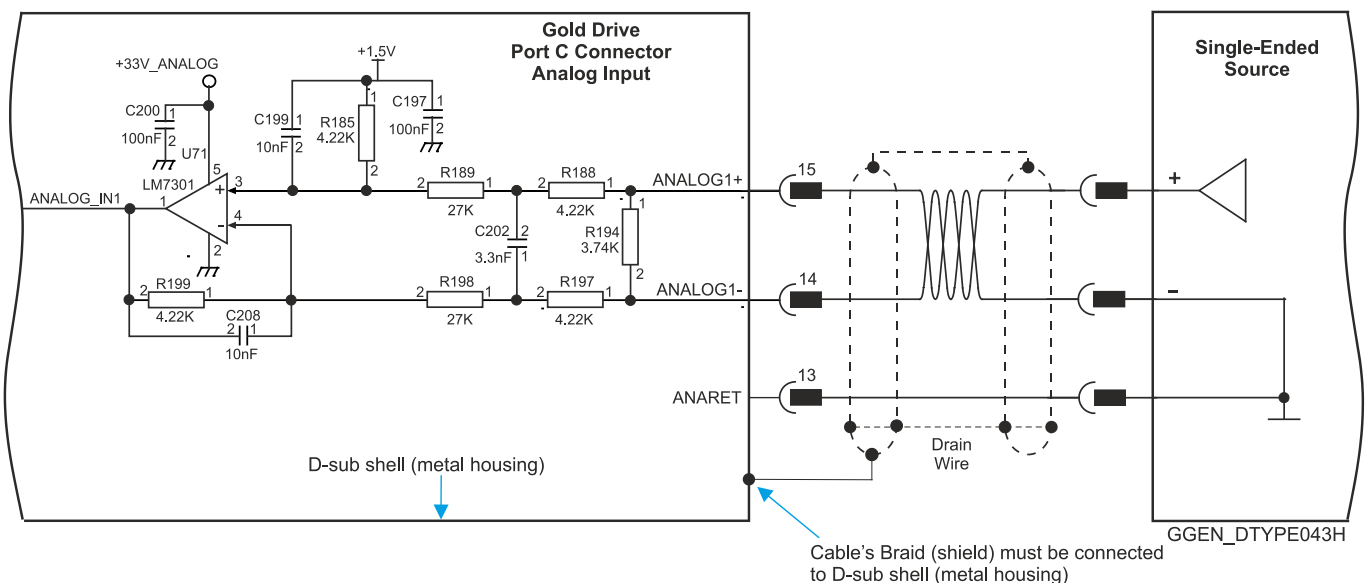


Figure 26: Differential Analog D-Type Input



### 6.7.3. STO

The following circuits describe the STO wiring options.

#### 6.7.3.1. Source Mode PLC Voltage Level

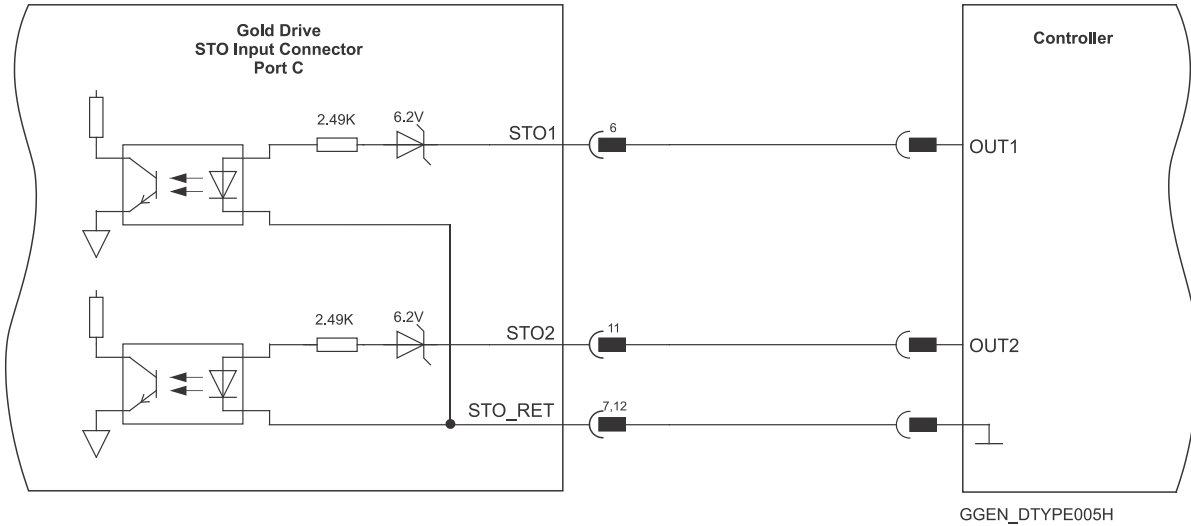


Figure 27: STO D-Type Input Connection – PLC Source Option

#### 6.7.3.2. TTL Mode TTL Voltage Level

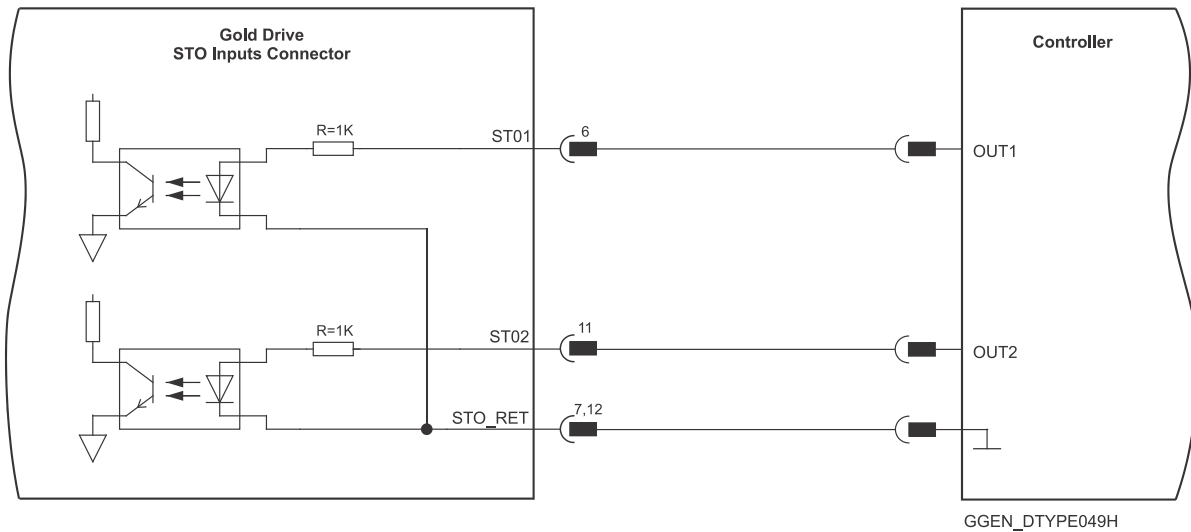


Figure 28: STO Input Connection – TTL Option



### 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.**

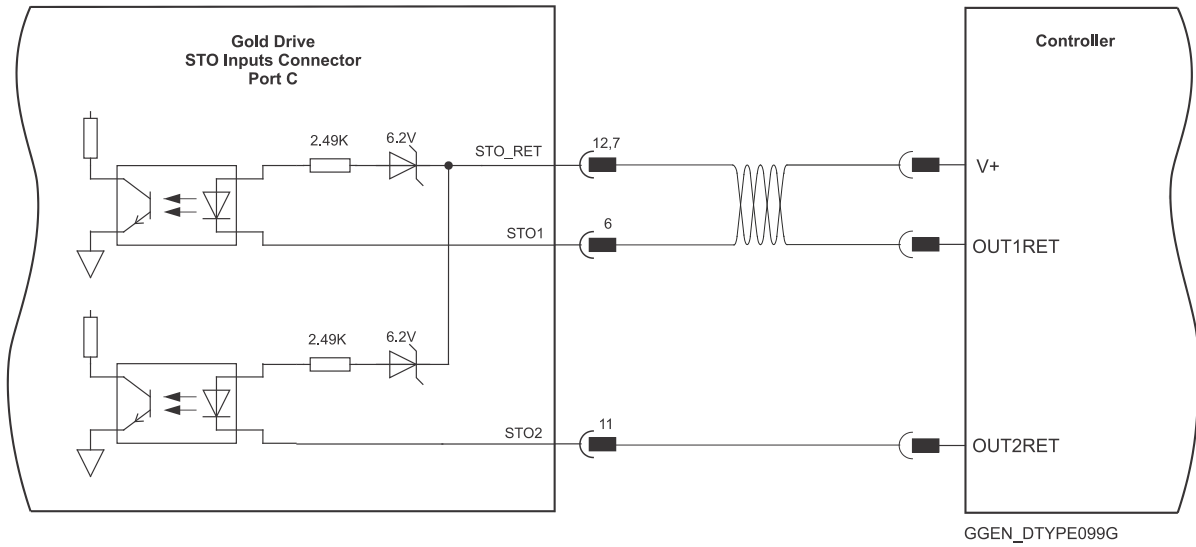


Figure 29: STO D-Type Input Connection – Sink Option



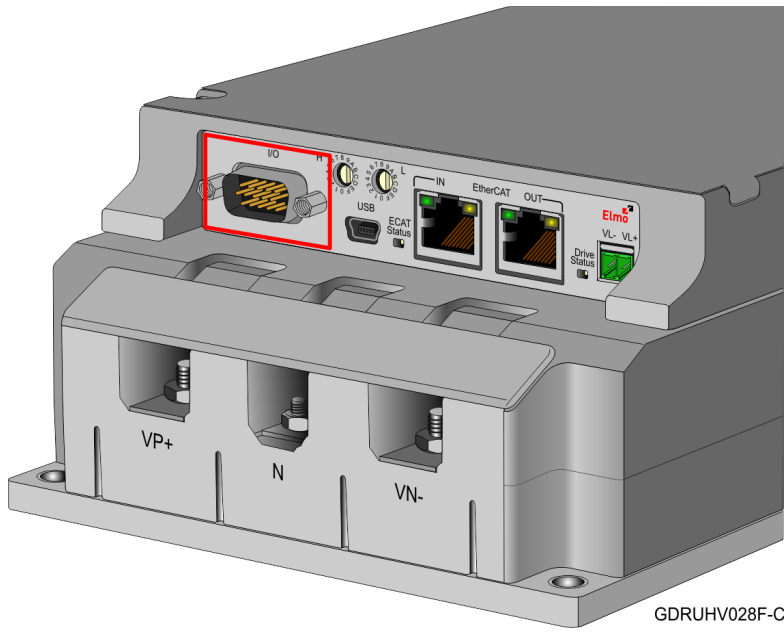
## 6.8. Digital Inputs and Outputs

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

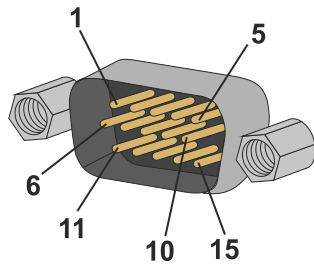
I/O Pins	Signal	Function
1	IN1	High speed programmable input 1
2	IN2	High speed programmable input 2
7	IN3	High speed programmable input 3
8	IN4	High speed programmable input 4
11	IN5	High speed programmable input 5
12	IN6	High speed programmable input 6 <b>or</b>
		STO OUT Collector in the <b>O</b> version
6	INRET1-6	Programmable inputs 1 to 6 return for the Source version
		Programmable positive input 1 to 6 for the Sink version
3	OUT1	Programmable output 1
4	OUT2	Programmable output 2
5	OUT3	Programmable output 3
13	OUT4	Programmable output 4
		<b>or</b> STO OUT Emitter in the <b>O</b> version
10, 15	VDD	Supply for out 1-4
9, 14	VDDRET	Supply return for out 1-4



**Pin Positions**

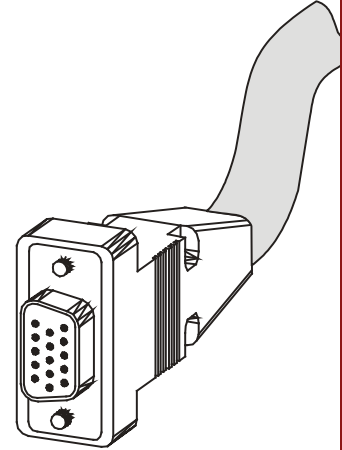


GDRUHV028F-C



GDRUHV035F

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



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

**Table 6: 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.

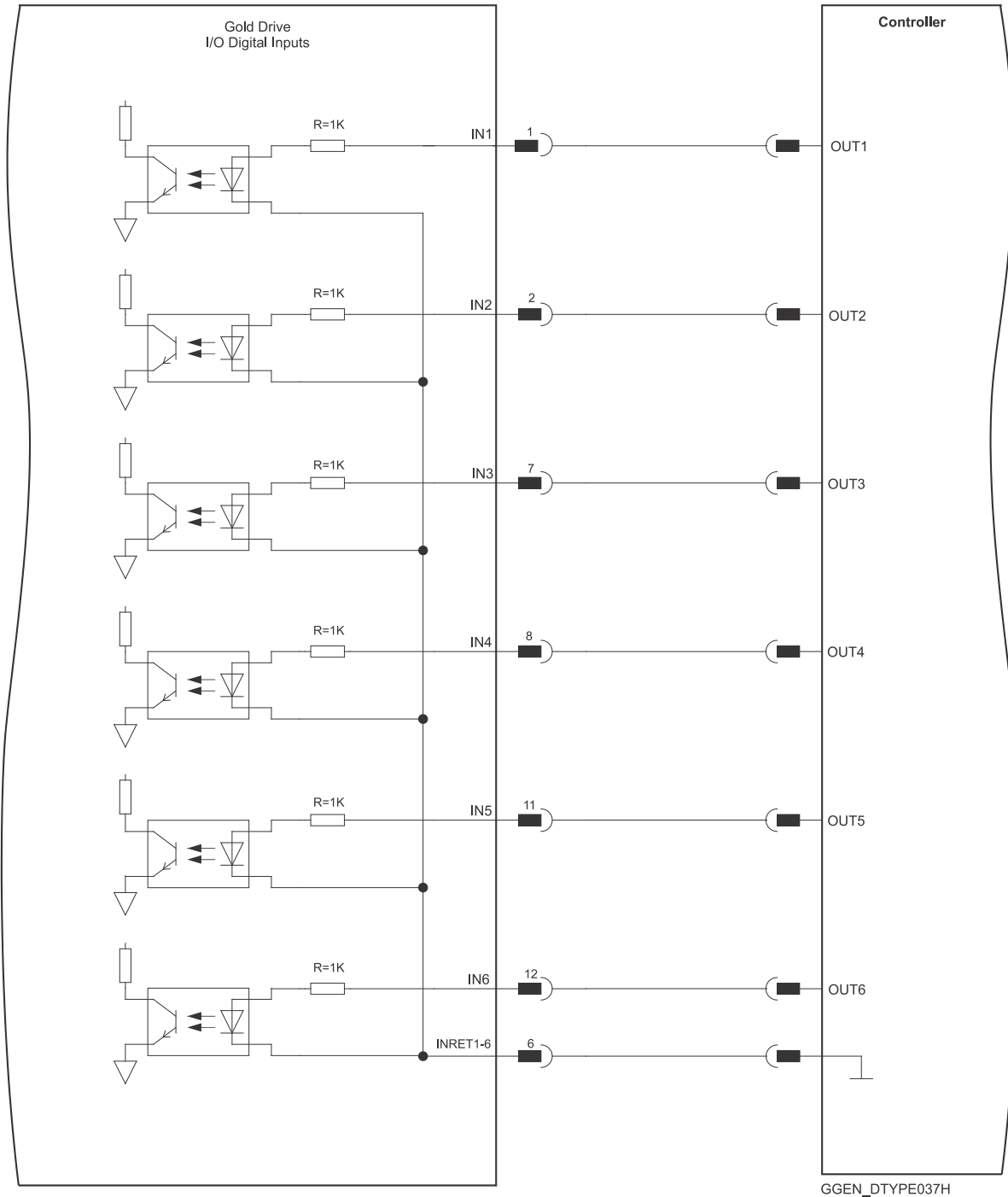


Figure 30: Digital Input TTL Mode D-Type Connection Diagram

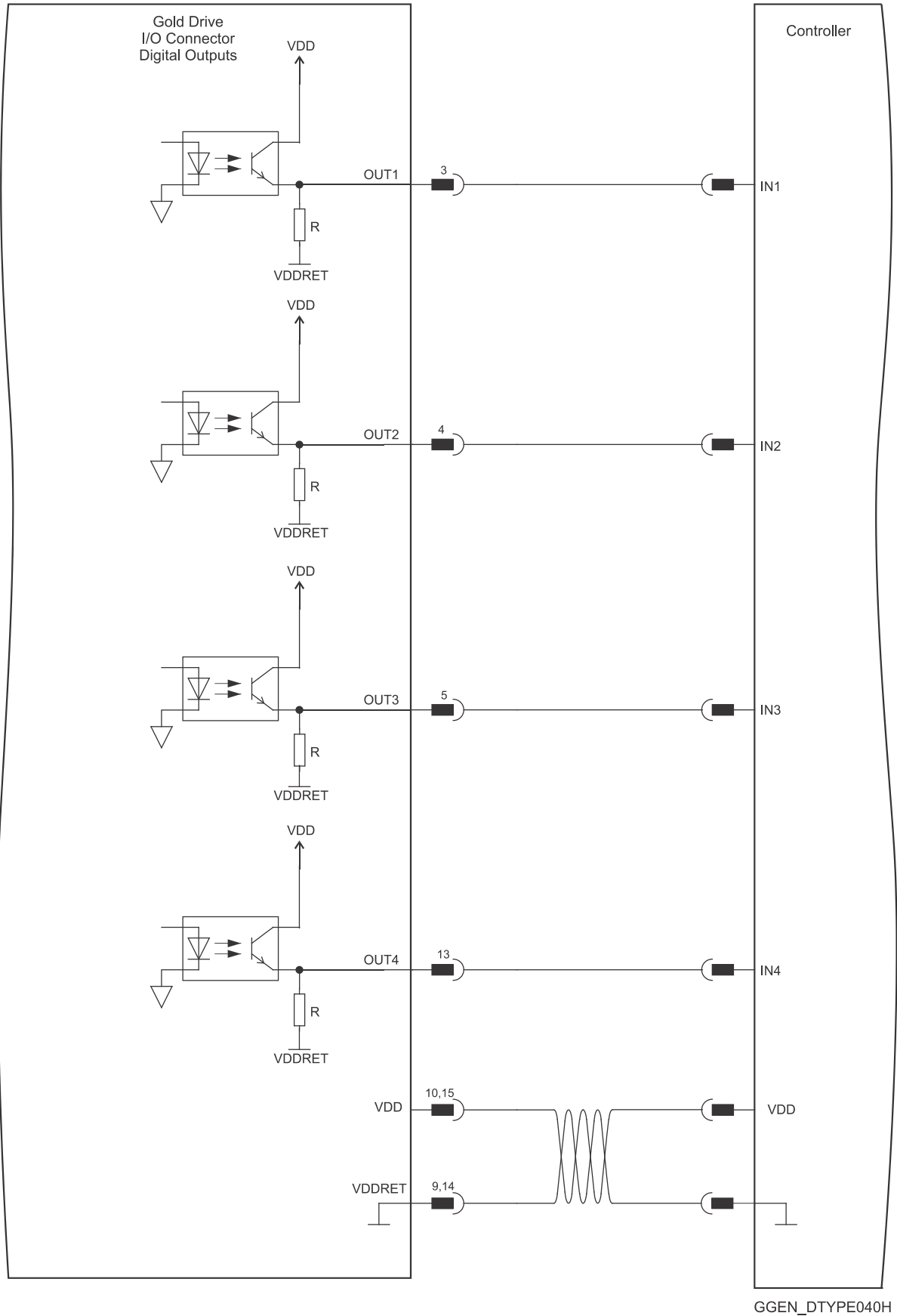


Figure 31: Digital Output D-Type Connection Diagram – TTL Option





### 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.

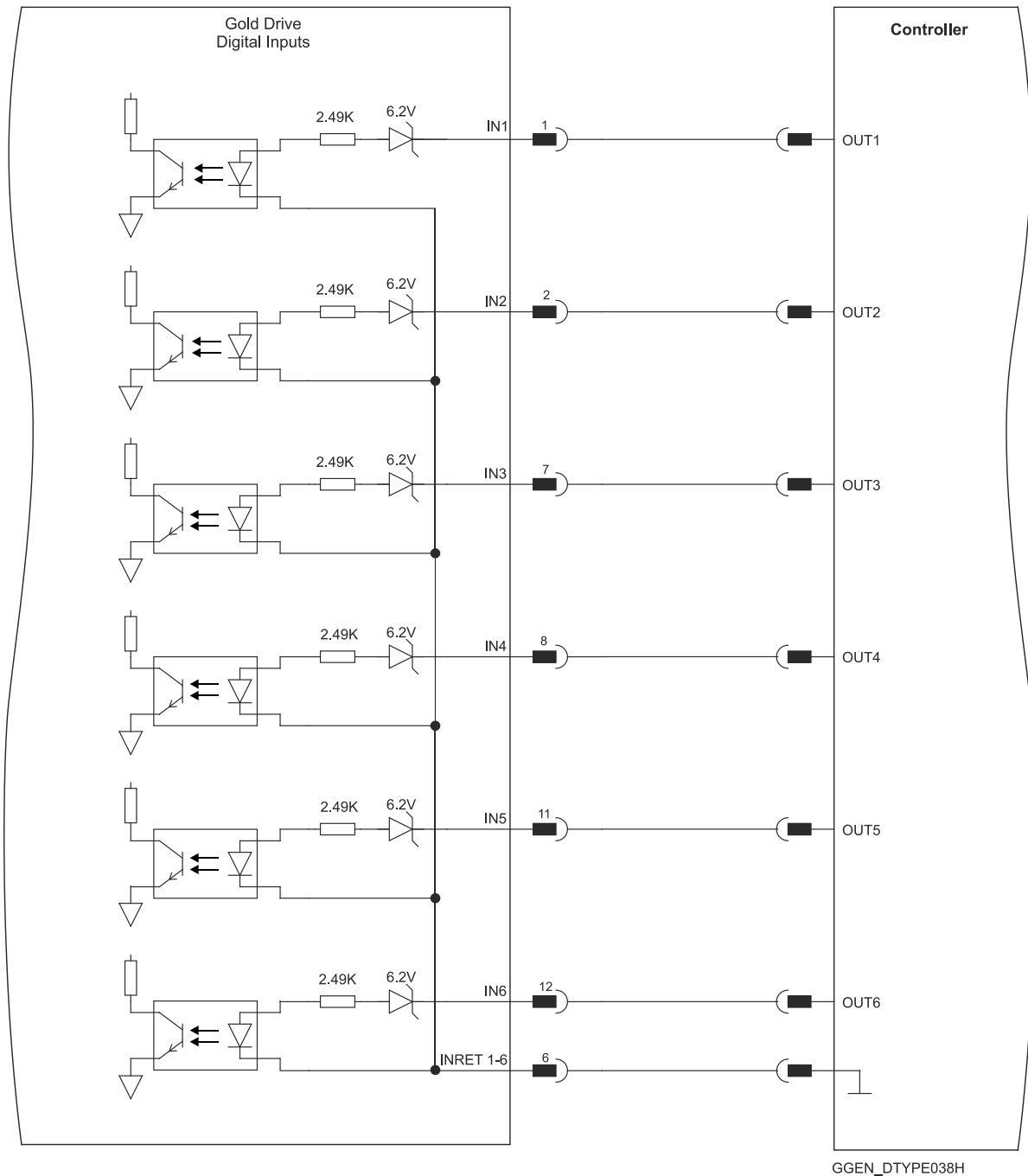
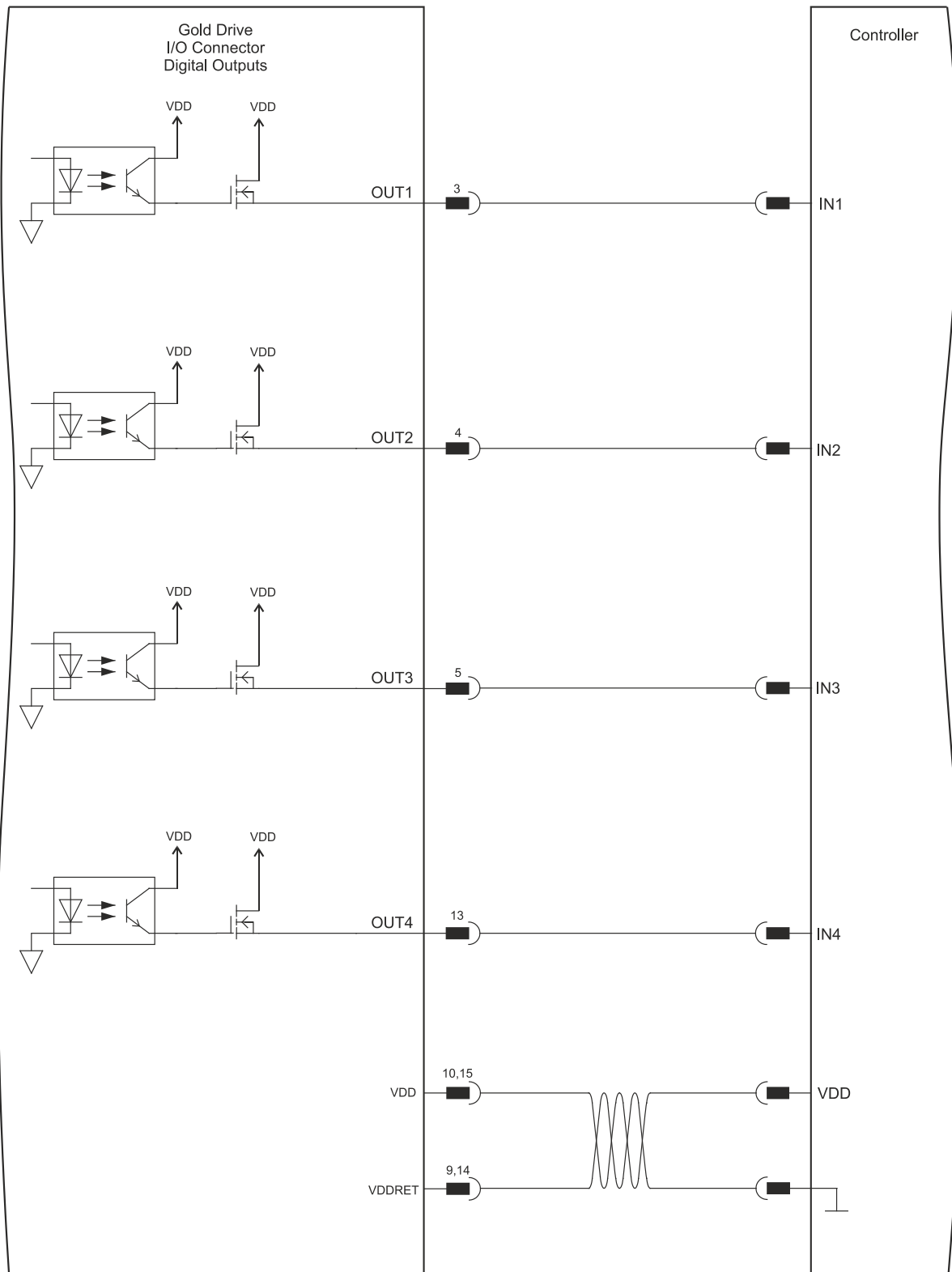


Figure 32: Digital Input D-Type Connection Diagram – Source PLC Option



GGEN\_DTYPE041I

Figure 33: 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.

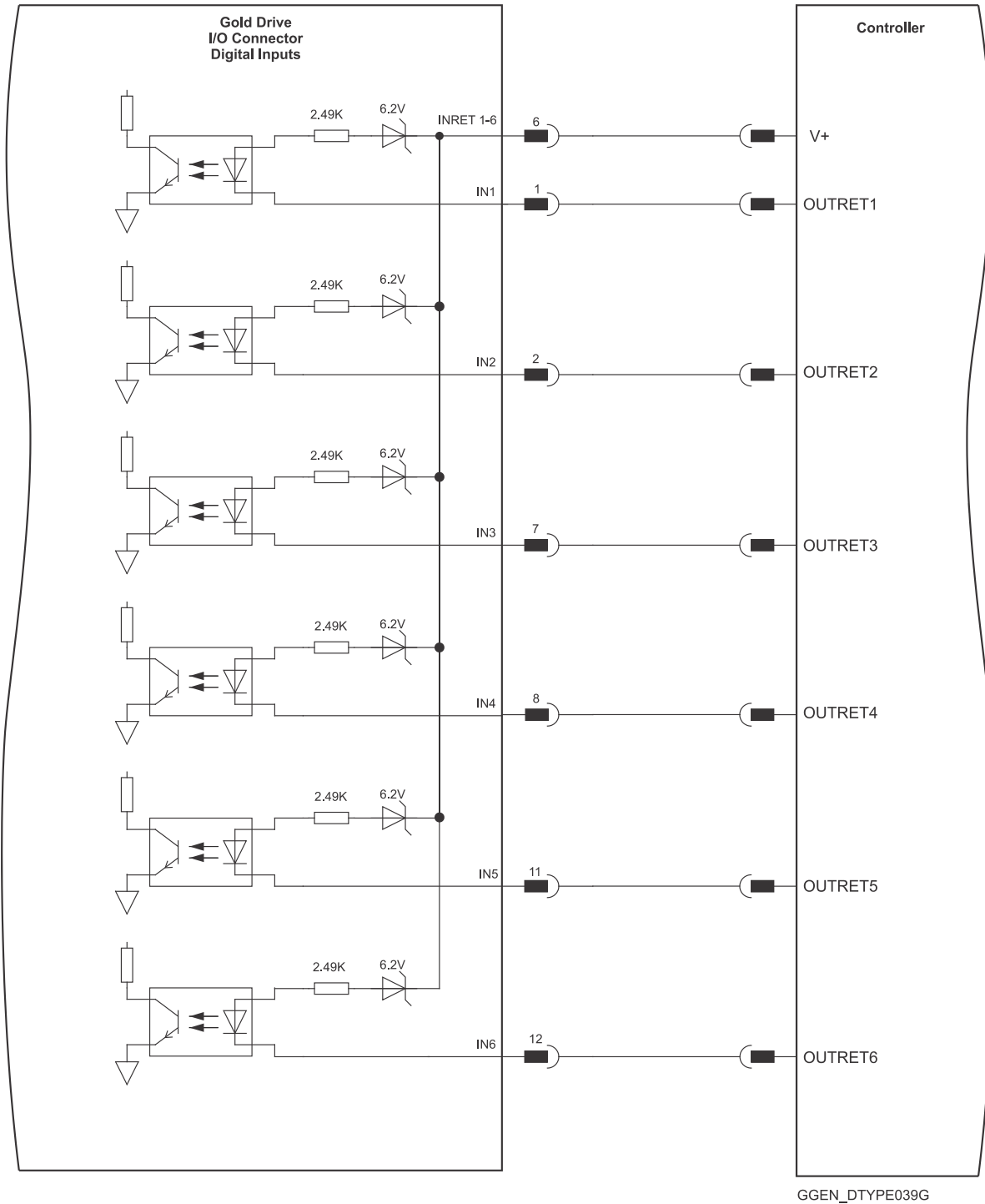


Figure 34: Digital Input Sink Mode – PLC voltage level D-Type Connection Diagram





## 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

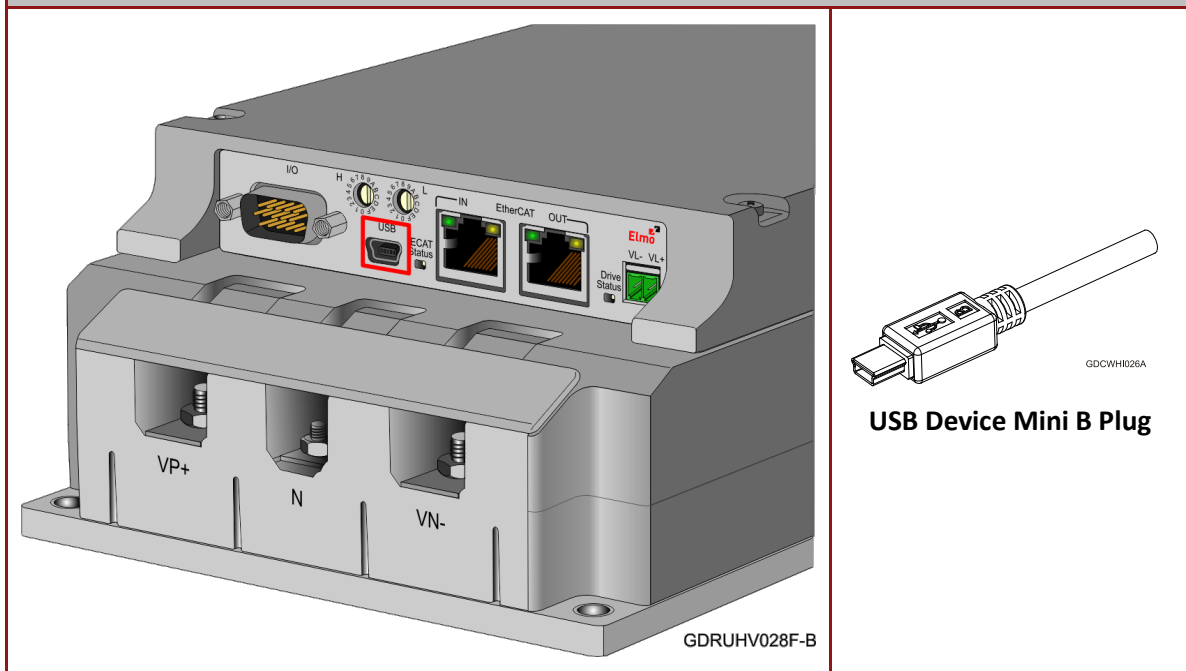
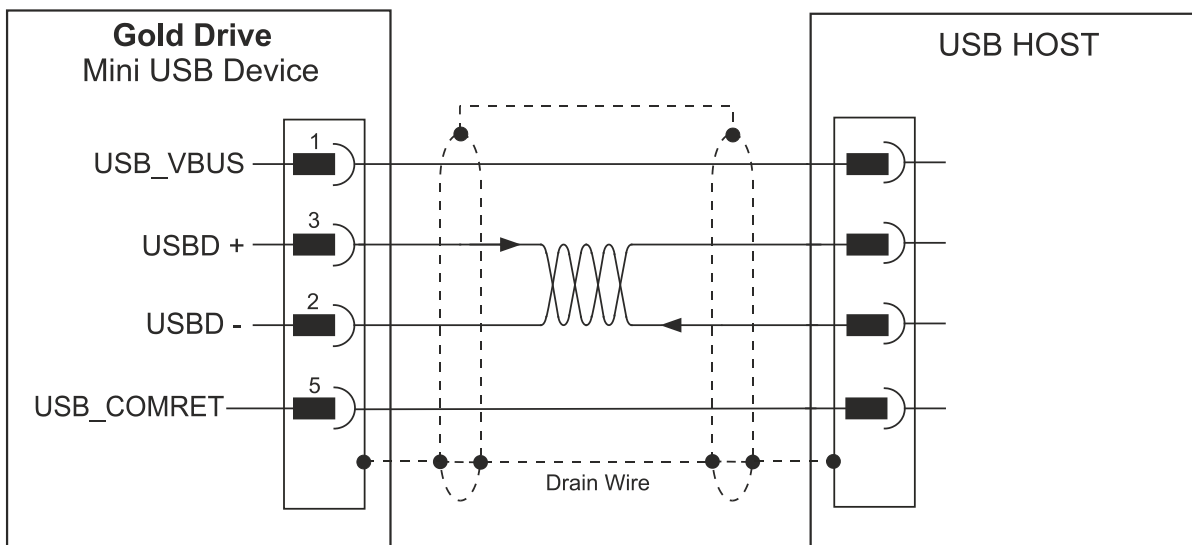


Table 7: USB 2.0 Pin Assignments



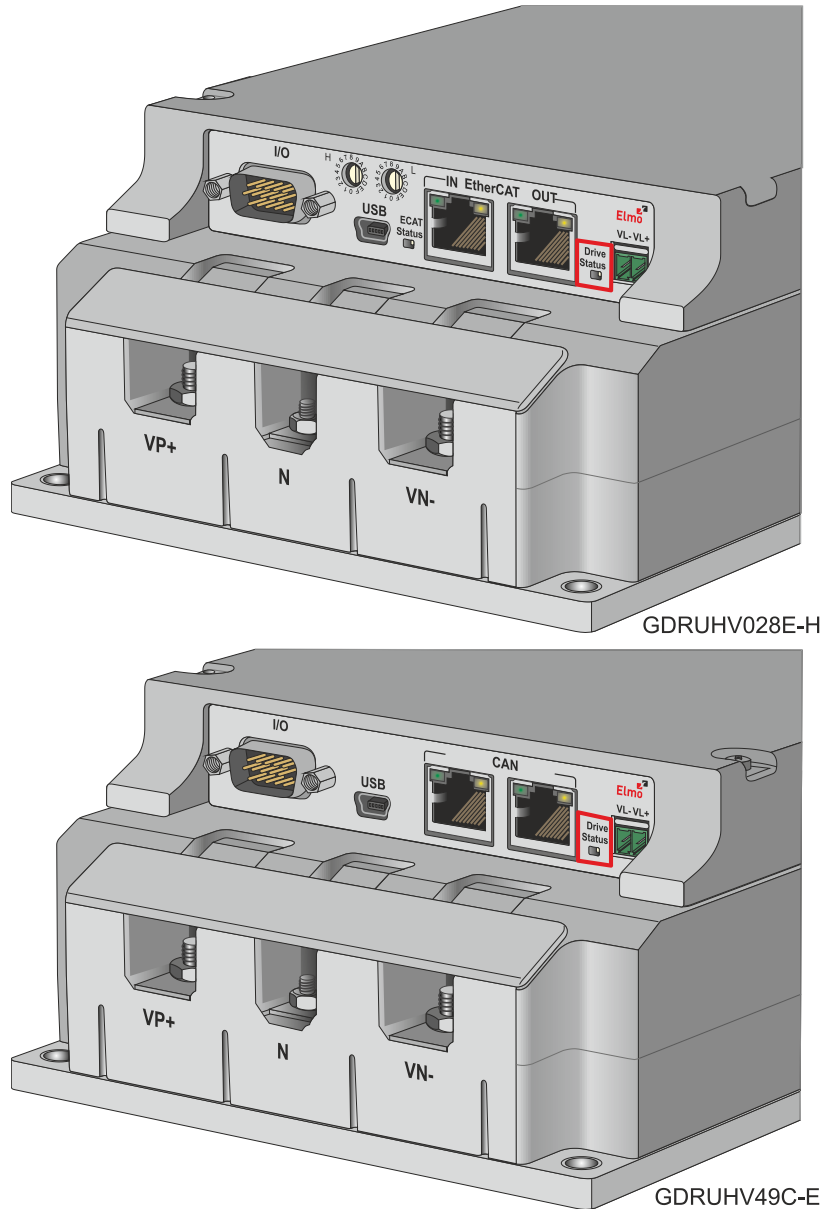
GGEN\_DTTYPE044G

Figure 36: USB Network Diagram



## 6.10. Drive Status Indicators

The Gold Drum HV (High Voltage) is equipped with several light-emitting diode (LED) indicators. The Drive Status Indicator red/green dual LED is used for immediate indication of the Initiation and Working states.



**Figure 37: Drive Status Indicator**

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

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



## 6.11. EtherCAT Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Gold Drum HV (High Voltage) supports the following EtherCAT fieldbus type industrial network protocol:

Fieldbus Type	Product Number
EtherCAT	G-DRU XXX/YYYEXXX

### 6.11.1. EtherCAT IN/Ethernet Pinouts

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

Pin on EtherCAT IN	Signal	Function
1	EtherCAT_IN_TX+/Ethernet_TX+	EtherCAT in transmit+/Ethernet transmit +
2	EtherCAT_IN_TX-/Ethernet_TX-	EtherCAT in transmit-/Ethernet transmit -
3	EtherCAT_IN_RX+/Ethernet_RX+	EtherCAT in receive+/Ethernet receive +
4/5	N/A	
6	EtherCAT_IN_RX-/Ethernet_RX-	EtherCAT in receive-/Ethernet receive -
7/8	N/A	

#### Pin Positions

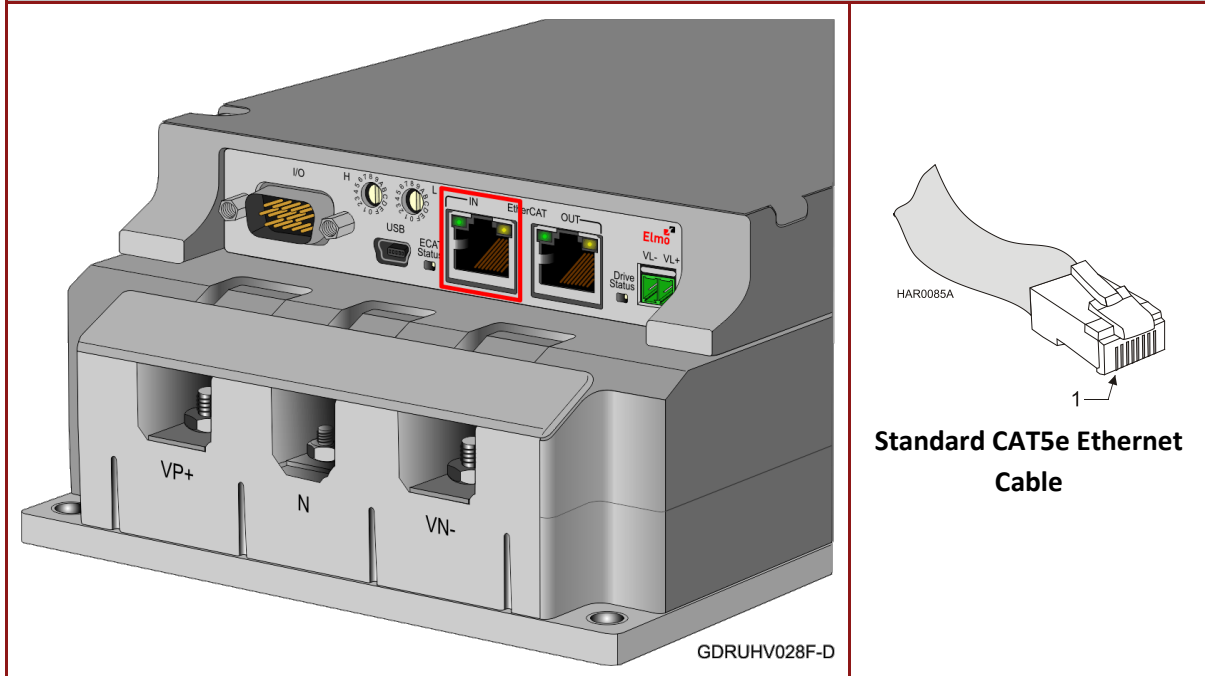


Table 8: EtherCAT In Connector Pin Assignments

### 6.11.2. EtherCAT OUT Pinouts

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

Pin on EtherCAT OUT	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 style="text-align: right;">GDRUHV028F-E</p>	<p><b>Standard CAT5e Ethernet Cable</b></p>

Table 9: EtherCAT Out Connector Pin Assignments

### 6.11.3. EtherCAT Wiring

Figure 38 describes the wiring diagram for the EtherCAT connections.

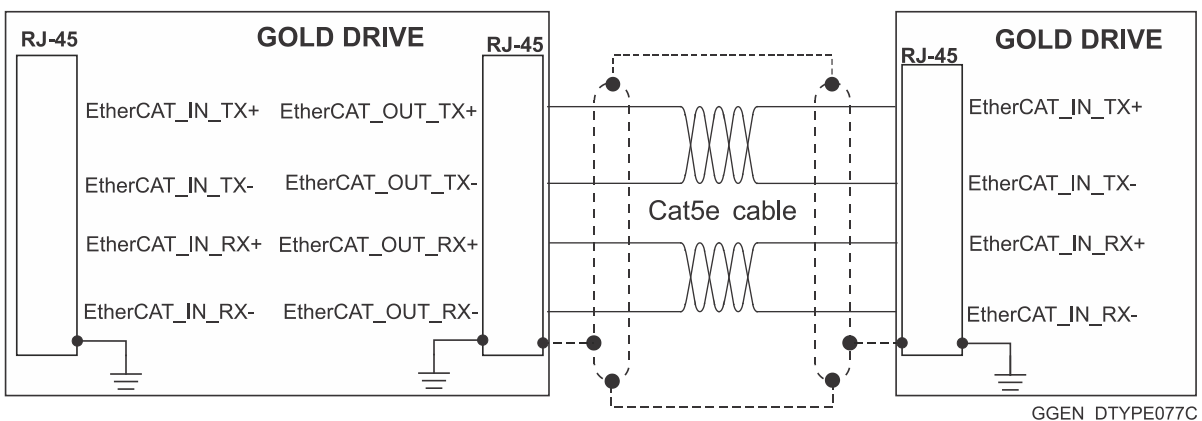


Figure 38: EtherCAT RJ-45 Connections





### 6.11.4. EtherCAT Link Indicators

This section is only relevant for EtherCAT products only.

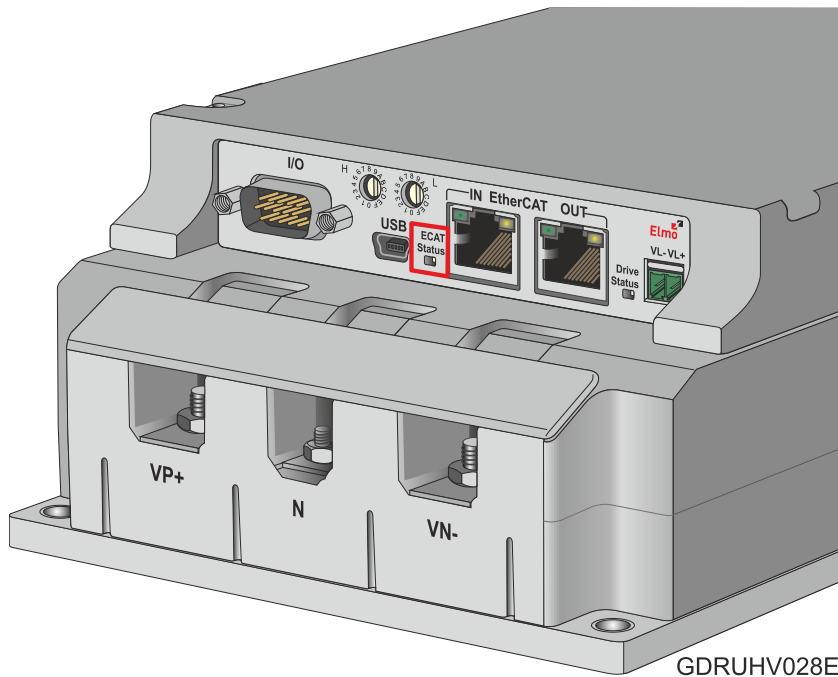
The Gold Drum HV (High Voltage) can serve as an EtherCAT slave device. For this purpose it has two RJ-45 connectors, which are designated as EtherCAT In and EtherCAT Out. Each of these RJ-45 connectors has two status LEDs, which are shown in Figure 39.



Figure 39: 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.

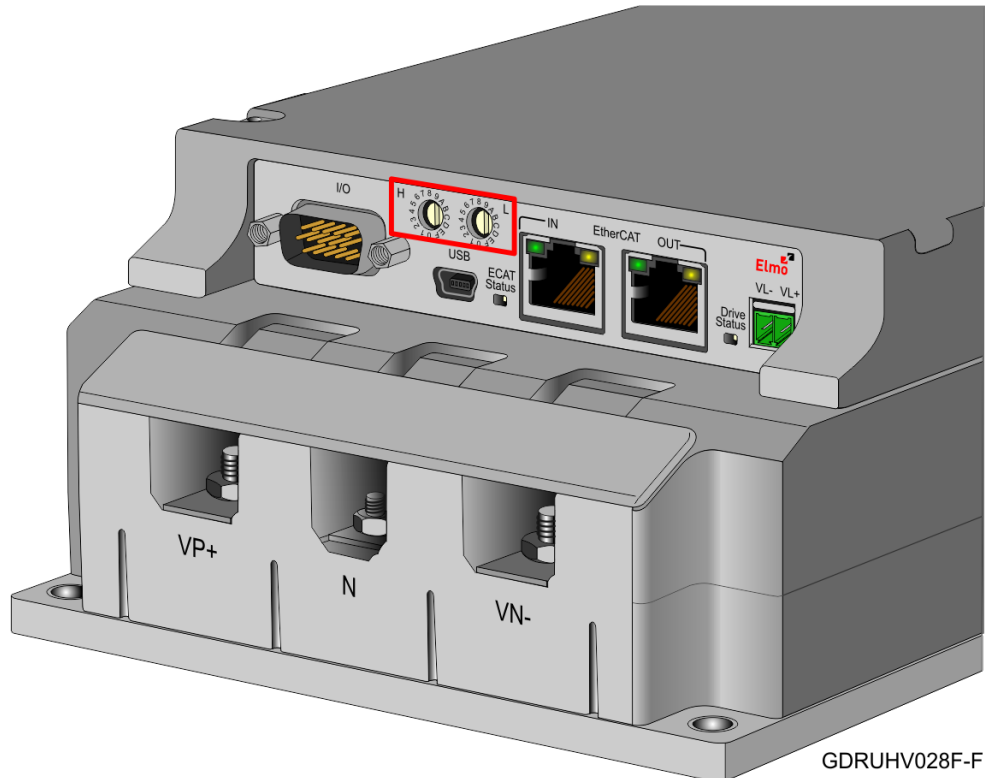
### 6.11.5. EtherCAT Status Indicator



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.

### 6.11.6. EtherCAT Rotary Switches

**Note:** This option is only for the **G-DRUXXXX/YYYYFXXX** type.



**Figure 40: Position of EtherCAT Address Switches on G-Drum HV**

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



## 6.12. CAN Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. The Gold Drum HV (High Voltage) supports the following CAN fieldbus type industrial network protocol.

Fieldbus Type	Product Number
CAN	G-DRU XXX/YYYSXXX

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

Pin on CAN	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

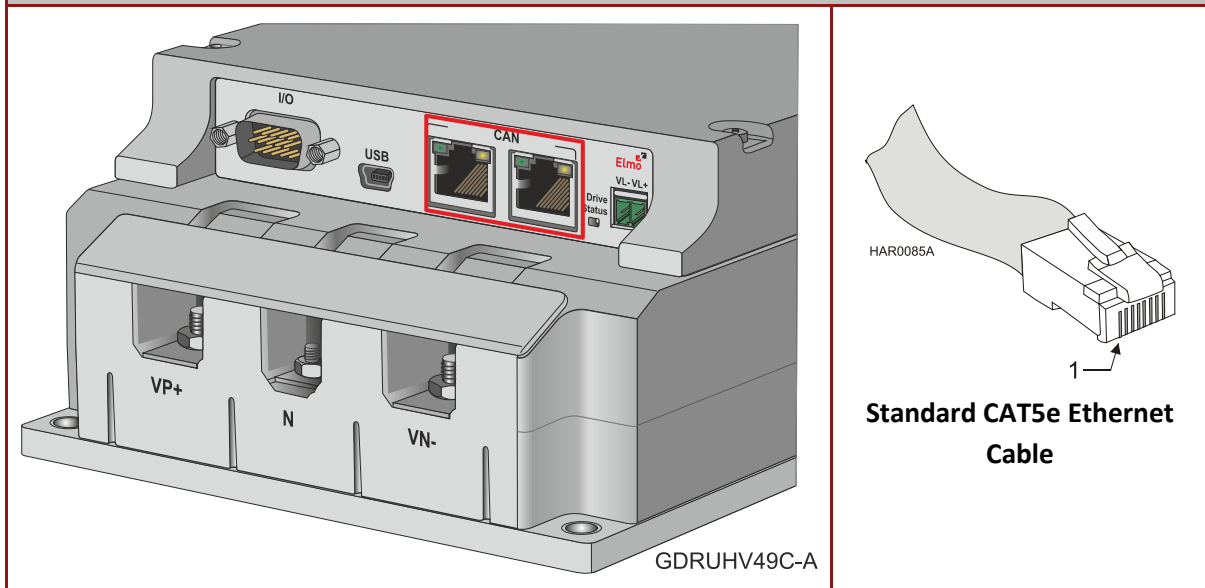
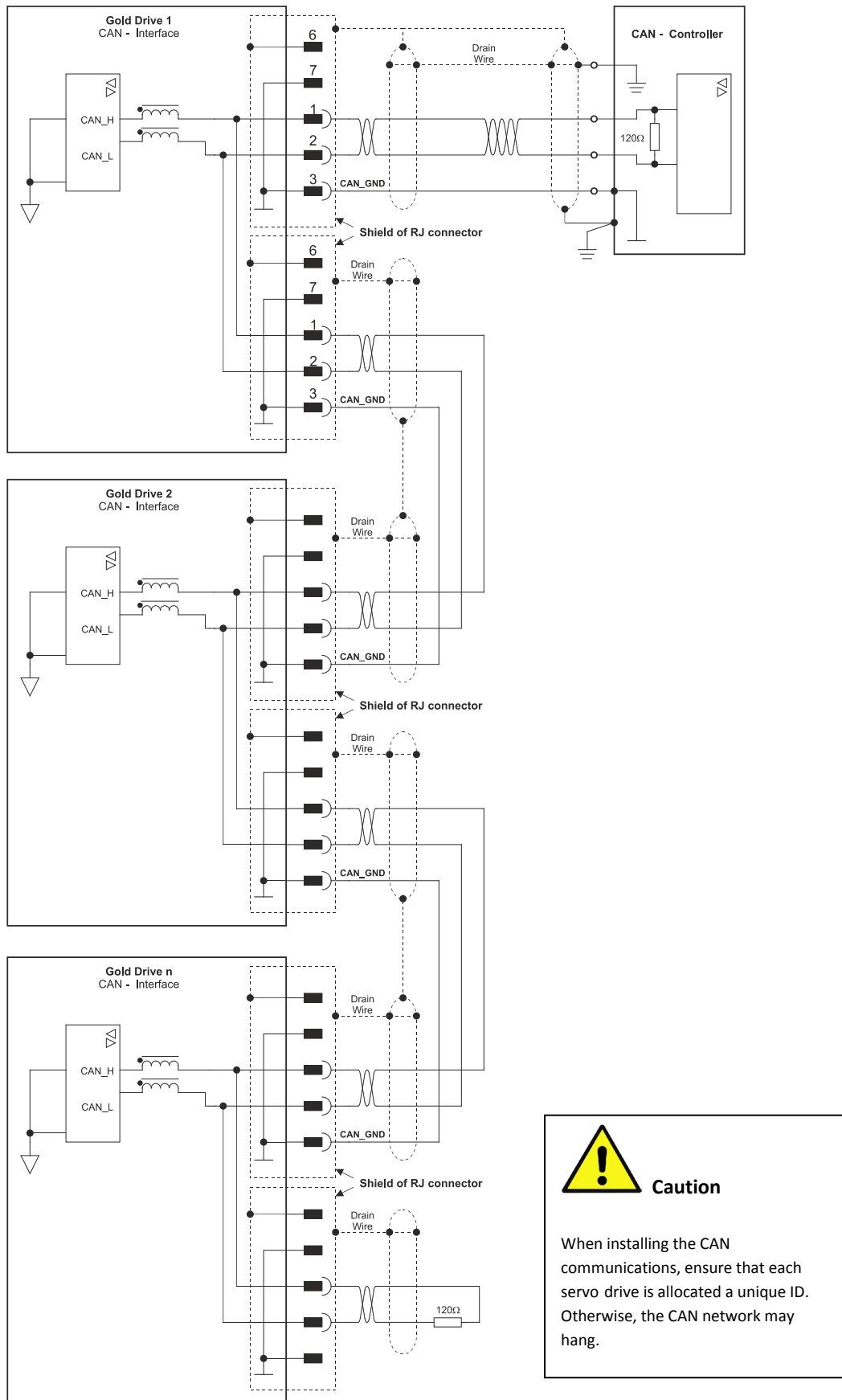


Table 10: CAN In/Out Connector Pin Assignments



### 6.12.1. CAN Wiring

Figure 41 describes the CAN wiring diagram below.



GDRUHV059A

**Figure 41: Gold Drum HV (High Voltage) Connection Diagram – CAN**



## 6.13. Heat Dissipation

For full power output capability the Gold Drum HV (High Voltage) is designed to be mounted on an external heat-sink. It is highly recommended that the “Wall” on which the Drum is mounted will have heat dissipation capabilities. The Gold Drum HV (High Voltage) at “free air convection” (without an additional heat-sink) can dissipate around 12 W for 40°C ambient temperature and not exceeding 80 °C on the heat sink.

When “Free Air Convection” is sufficient for the application it is recommended to leave approximately 10 mm of space between the Gold Drum HV (High Voltage)'s heat sink and any other assembly.

For more information, refer to Elmo's application note: *Drum HV Thermal Management*

When attaching to an external heat-sink, it is recommended to use N5 surface treatment and thermal foil or smearing thermal compound.

For more details, refer to Elmo's *Drum HV Heat Sink Installation Guide*,  
P/N MAN-G-DRUMHVHSIG.

### 6.13.1. Gold Drum HV (High Voltage) Thermal Data

- Free air convection thermal resistance ( $\theta$ ): Approximately 7 to 8°C/W.
- Thermal time constant: Approximately 40 minutes/ 2400 seconds (thermal time constant means that the Gold Drum HV (High Voltage) will reach 2/3 of its final temperature after 40 minutes).
- Self-heat dissipation capability (no external heat sink): 20 W for 40°C/W temperature rise.
- Shut-off temperature: 86 to 88°C.
- The thermal resistance when connecting to an external heat sink using a thermal conductive compound/foil. By proper smearing of the surface a significant improvement of the thermal resistance is achieved: 0.03°C/W.



### 6.13.2. Heat Dissipation Data

Heat Dissipation is shown graphically below:

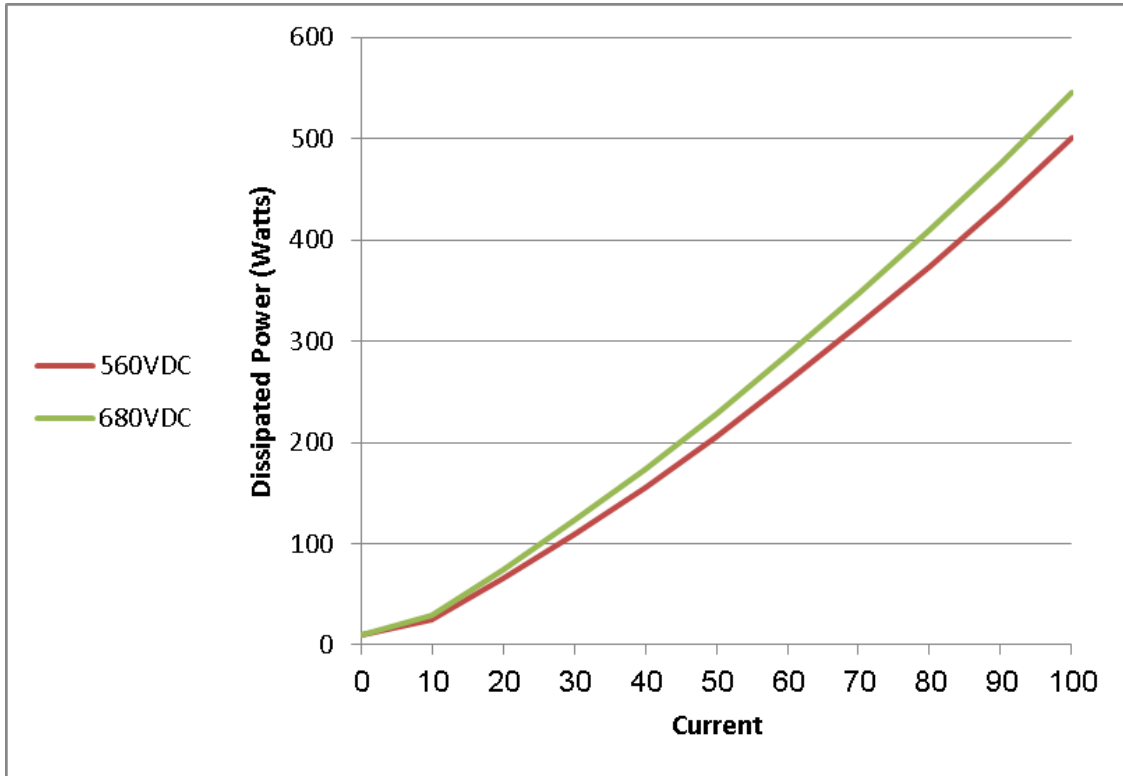


Figure 42: Dissipation versus Current Graph for 560 and 680 VDC

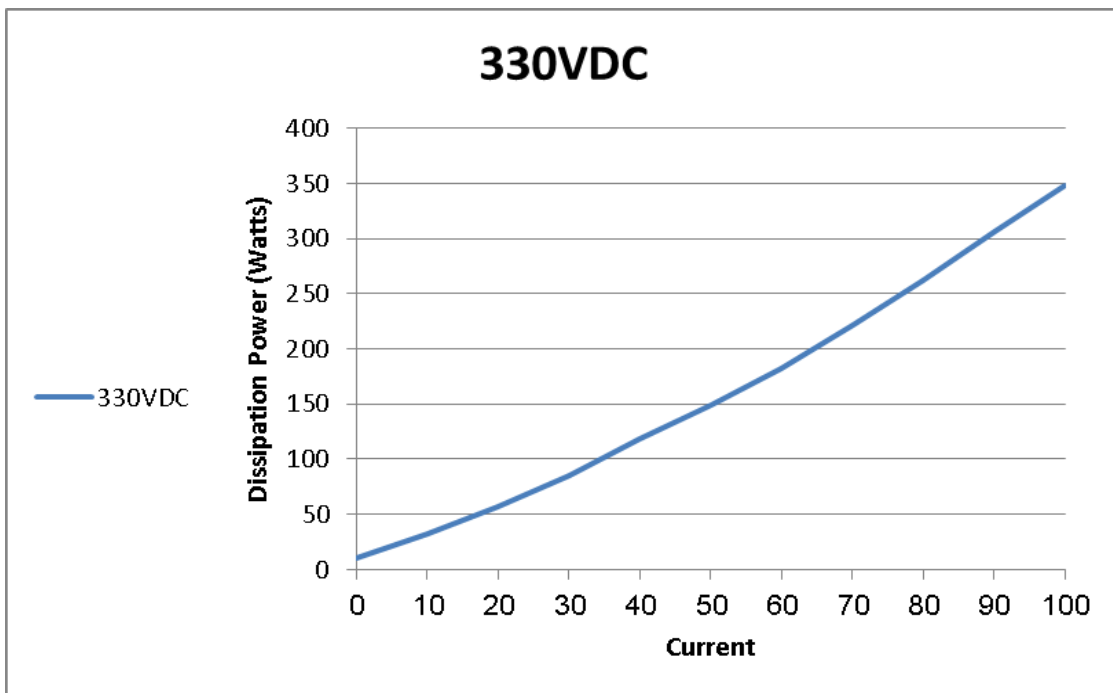


Figure 43: Dissipation versus Current Graph for 330 VDC



### 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 Drum HV (High Voltage) as  $\leq 40^{\circ}\text{C}$ .
3. Calculate the allowable temperature increase according to the following example: For an ambient temperature of 40 °C,  $\Delta T = 80$  to  $40^{\circ}\text{C} = 40^{\circ}\text{C}$
4. Use the chart to find the actual dissipation power of the drive. Follow the voltage curve to the desired output current and then find the dissipated power.

### 6.14. Powering Up

After the Gold Drum HV (High Voltage) is connected to its device, it is ready to be powered up.



**Caution:**

Before applying power, ensure that the DC supply is within the specified range and that the proper plus-minus connections are in order.

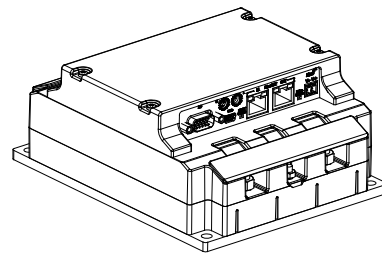
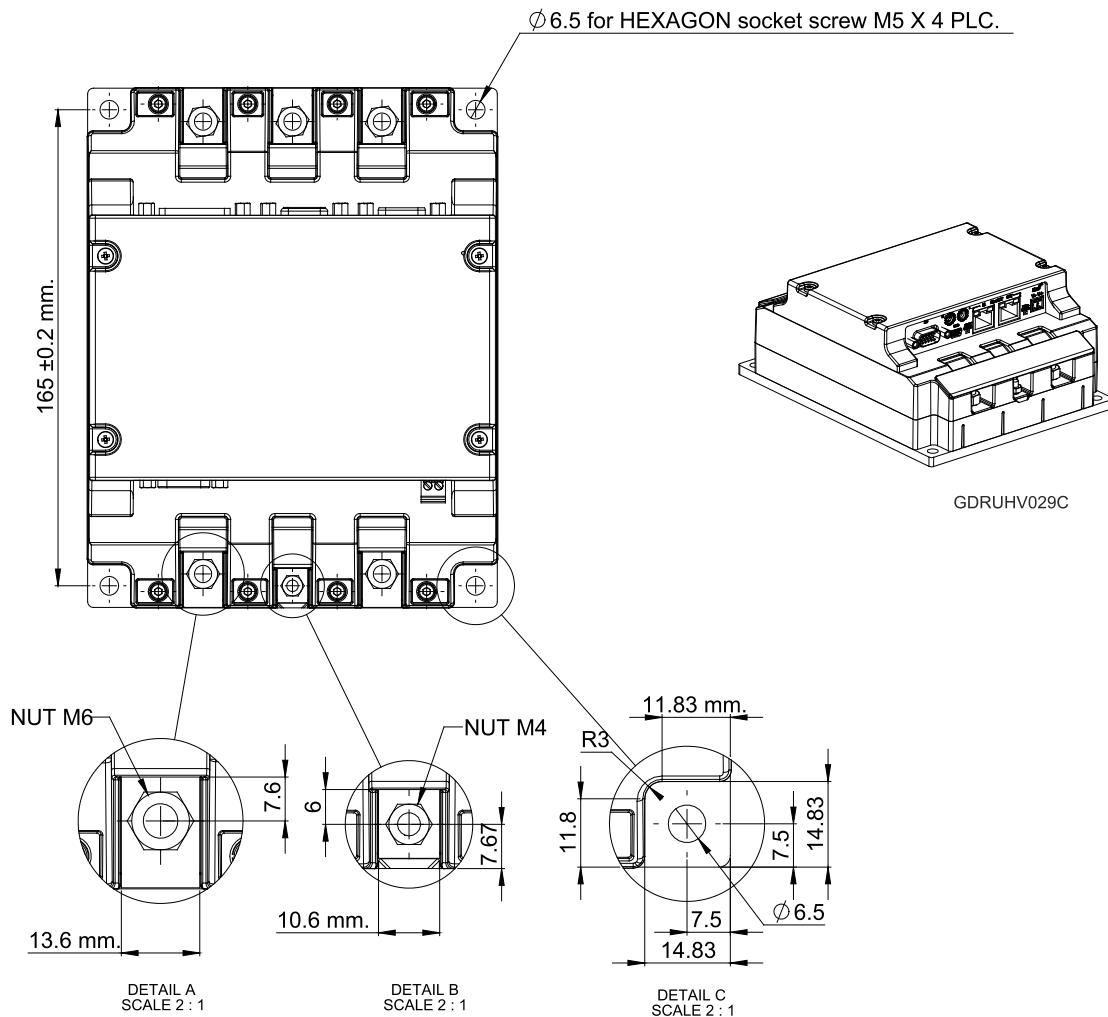
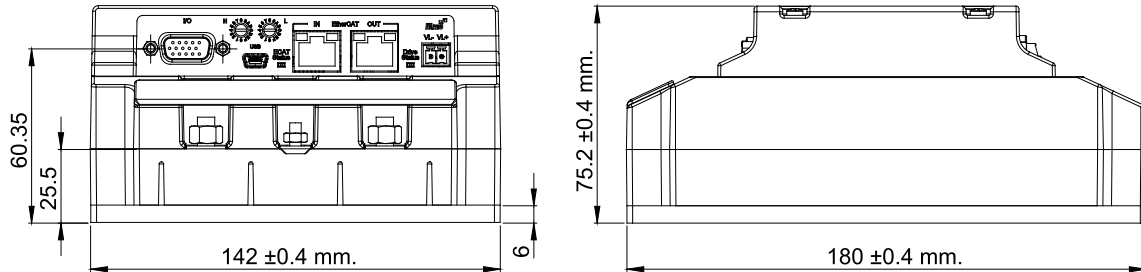
### 6.15. Initializing the System

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



## Chapter 7: Gold Drum HV (High Voltage) Dimensions

This chapter provides detailed technical information regarding the Gold Drum HV (High Voltage).



GDRUHV029C



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