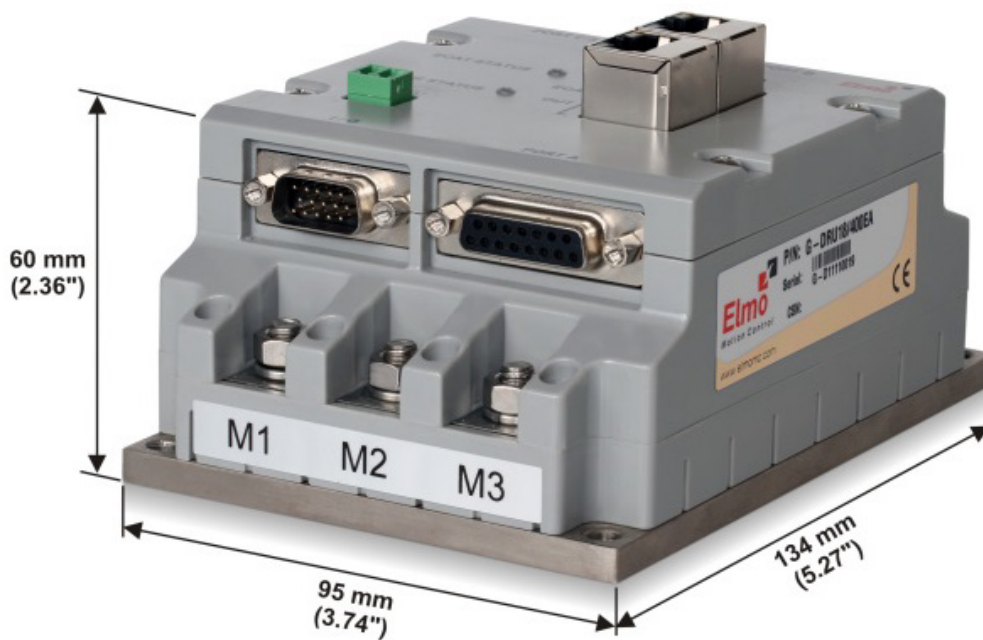


# **Gold Drum (RJ-45 Connectors) Digital Servo Drive Installation Guide EtherCAT and CAN**



# Notice

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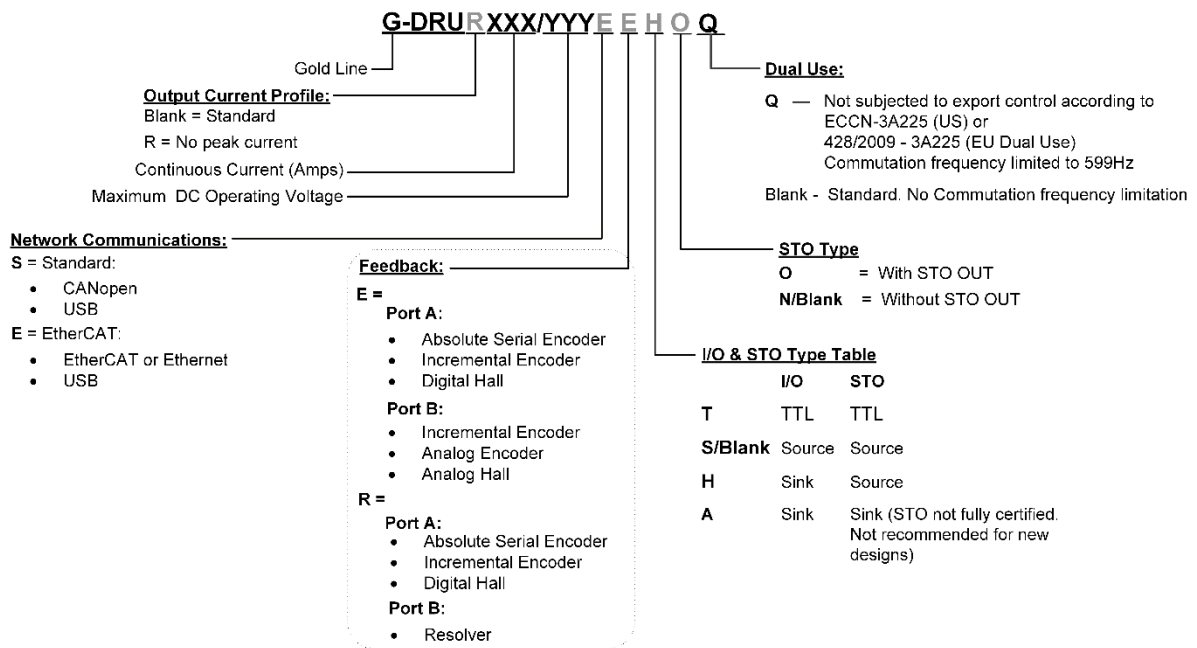
Document no. MAN-G-DRUM(RJ45)IG-EC (Ver. 1.410)

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## Catalog Number



## Revision History

Version	Date	Details
Ver. 1.300	Aug 2013	Update to Part Number, change of AP to A Update to the minimum supply voltage from 24 V to 14 V
Ver. 1.400	June 2014	New format. Document split to two version; D-Type and RJ-45.
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Ver. 1.402	Oct 2014	Addition of STO OUT details to sections 9.10.3.4, and 9.11
Ver. 1.403	Jan 2015	Small changes to sections 4.2 and 2.4
Ver. 1.404	July 2015	Changes to Part Number
Ver. 1.405	Nov 2015	Addition of R150/100 to section Technical Data
Ver. 1.406	June 2016	Small upgrade changes
Ver. 1.407	Aug 2017	Changes to Warranty and label
Ver. 1.408	Nov 2017	Changes to section 4.2 Technical Data for all 400V models
Ver. 1.409	Dec 2020	General Minor Updates
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## Chapter 1: This Installation Guide

The Gold Drum offers two optional connector types: Gold Drum with RJ-45 Connectors and Gold Drum with D-Type Connectors. This installation Guide details the technical data, pinouts, and power connectivity of the Gold Drum with RJ-45 connections. 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, 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 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 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 Drum 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 Drum 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, 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 Drum 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 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 Drum series of digital servo drives are highly resilient and designed to deliver the highest density of power and intelligence. The Gold Drum delivers up to **8.0 kW of continuous /16.0 kW peak power** , and **9.6 kW of continuous power** with R type drives, in a compact package.

This advanced, high power density servo drive operates 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 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, as part of the Gold Line, is fully programmable with Elmo's motion control language.

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.

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

The Gold Drum offers two optional types: Gold Drum with RJ-45 Connectors and Gold Drum with D-Type Connectors.



## Chapter 4: Technical Information

### 4.1. Physical Specifications

Feature	Units	All Types
Weight	g (oz)	700 g (24.7 oz)
Dimensions	mm (in)	134 x 95 x 72 (5.3" x 3.7" x 2.84")
Mounting method		Wall/Panel Mount

### 4.2. Technical Data

Feature	Units	*70/48	*70/60	*R90/60	50/100	*R75/100	100/100	R150/100	35/200	R60/200	18/400
Minimum supply voltage	VDC	11	14		14				46		50
Nominal supply voltage	VDC	42	50		85				170		325
Maximum supply voltage	VDC	48	59		95				195		400
Maximum continuous power output	W	2700	3400	4300	4000	6000	8035	12000	5600	9600	5600
Efficiency at rated power (at nominal conditions)	%	> 97									
Max output voltage		97% of DC bus voltage at f=22 kHz									
V <sub>L</sub> Logic supply input voltage	VDC	14 to 60									
V <sub>L</sub> Logic supply input power	VA	≤ 4 VA without external loading of 5V (Encoders) ≤ 6 VA with full external loading of 5V (Encoders)									
Amplitude sinusoidal continuous current	A	70	70	90	50	75	100	150	35	60	18
Sinusoidal continuous RMS current limit (I <sub>c</sub> )	A	50	50	63	35	53	71	106	25	42	12.7
Peak current limit	A	2 x I <sub>c</sub>	2 x I <sub>c</sub>	No Peak	2 x I <sub>c</sub>	No Peak	2 x I <sub>c</sub>	No Peak	2 x I <sub>c</sub>	No Peak	2 x I <sub>c</sub>

Table 1: Power Ratings

#### Note:

\* Not recommended for new designs. The 100/100 covers those current/ voltage ratings with higher efficiency



#### 4.2.1. VL Logic Supply

Feature	Details
Logic power supply	Isolated DC source only
Logic supply input voltage	14 to 60 VDC
Logic supply input power	≤ 4 VA without external loading of 5V (Encoders) ≤ 6 VA with full external loading of 5V (Encoders)

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

#### 4.2.2. Product Features

Main Feature	Details	Presence and No.
<b>STO</b>	TTL	√
	PLC Source	√
	PLC Sink (is not fully certified, and not recommended for new designs)	√
<b>Digital Input Option</b>	TTL	6
	PLC Source	6
	PLC Sink	6
<b>Digital Output Option</b>	TTL	4
	PLC Source	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	√
	CAN	√



## 4.3. Environmental Conditions

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

### 4.3.1. Gold Line

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



## 4.4. Gold Line Standards and Certifications

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

Main Standards	Item
The related standards below apply to the performance of the servo drives as stated in the environmental conditions in section 4.3.1 Gold Line above.	
<b>STO IEC 61800-5-2:2007 SIL 3</b>	Adjustable speed electrical power drive systems – Safety requirements – Functional
<b>EN ISO 13849-1:2008 PL e, Cat 3</b>	Safety of machinery — Safety-related parts of control systems.
<b>Approved IEC/EN 61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>Recognized UL61800-5-1</b>	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
<b>Recognized UL 508C</b>	Power Conversion Equipment
<b>In compliance with UL 840</b>	Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment
<b>Conformity with CE 2006/95/EC</b>	Low-voltage directive 2006/95/EC
<b>Recognized CSA C22.2 NO. 14-13</b>	Industrial Control Equipment

### 4.4.1. Dual Use

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

The operating frequency of the Gold Line products is “factory limited” to  $\leq 599$  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: Unpacking the Drive Components

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

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

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

### To unpack the Gold Drum:

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



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

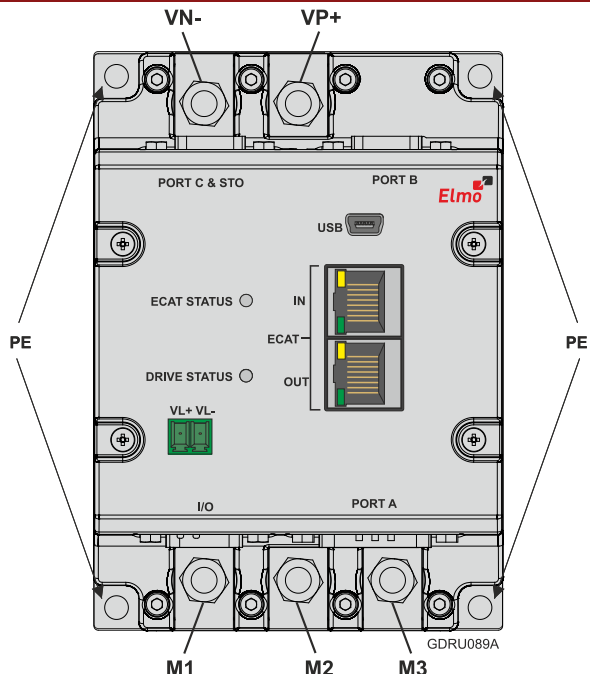
The part number at the top provides the type designation. Refer to the appropriate part number in the section Catalog Number at the beginning of the installation guide.



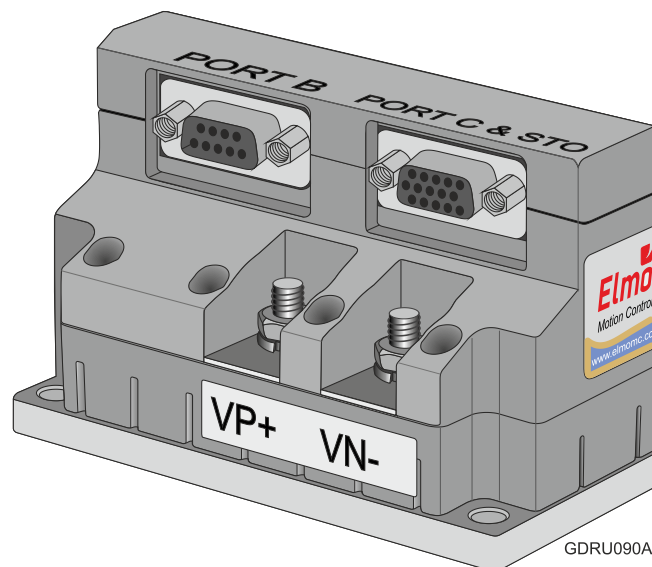
## Chapter 6: Gold Drum with RJ-45 Connectors and Indicators

### 6.1. Connector Types

The Gold Drum with RJ-45 connectors has ten connector types as follows:

Type	Function	Port	Connector Location
Barrel Connector + M6 Spring Washer + M6 Nut	Power	VP+, VN-	
	Motor	M1, M2, M3	
Barrel Connector + M5 Flat Washer + M5 Spring Washer + M5 screw	Earth Connection	PE, PE, PE, PE	

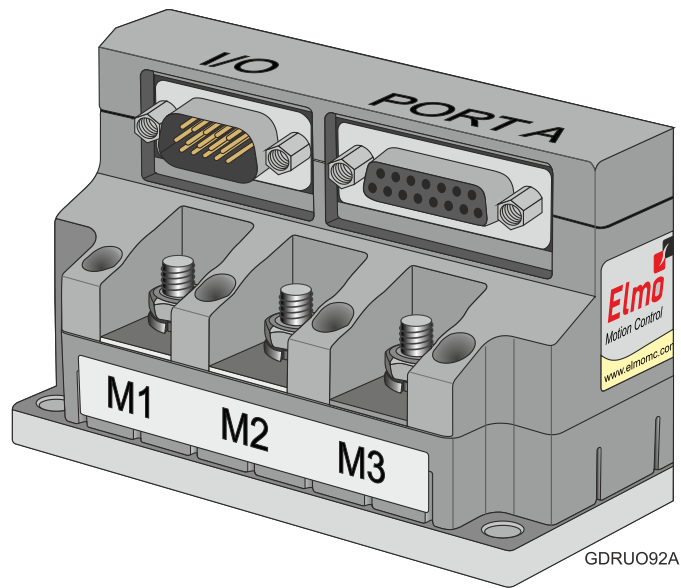
#### Front Connectors



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

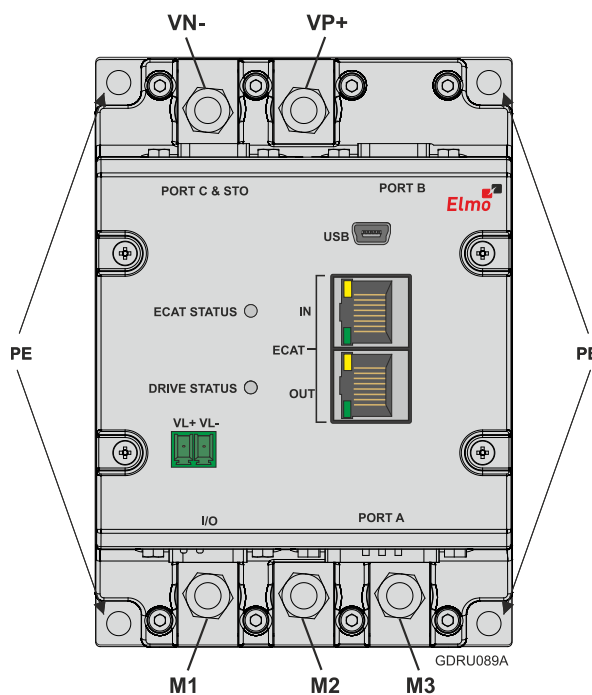


## Rear Connectors

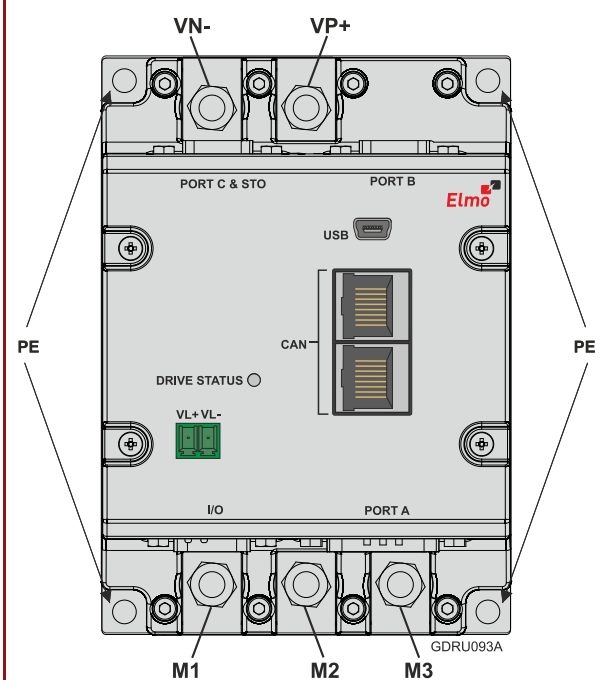


Pins	Type	Function
15	Pin High Density D-Type	I/O
15	Socket D-Type	Port A

## Top Connectors



Top Connectors – EtherCAT



Top Connectors – CAN

Pins	Type	Function
5	USB Device Type Mini B	USB communication
2	3.81 mm Phoenix	VLogic Supply



EtherCAT Version		
Pins	Type	Function
8	RJ-45	Ethernet/EtherCAT_IN communication
8	RJ-45	EtherCAT OUT communication
CAN Version		
Pins	Type	Function
8	RJ-45	CAN In
8	RJ-45	CAN Out



## Chapter 7: Mounting the Gold Drum

The Gold Drum has been designed for standard mounting by wall mounting along the back.

Use M5 round head screws, one through each opening in the heat sink, to mount the Gold Drum (see the diagrams below).

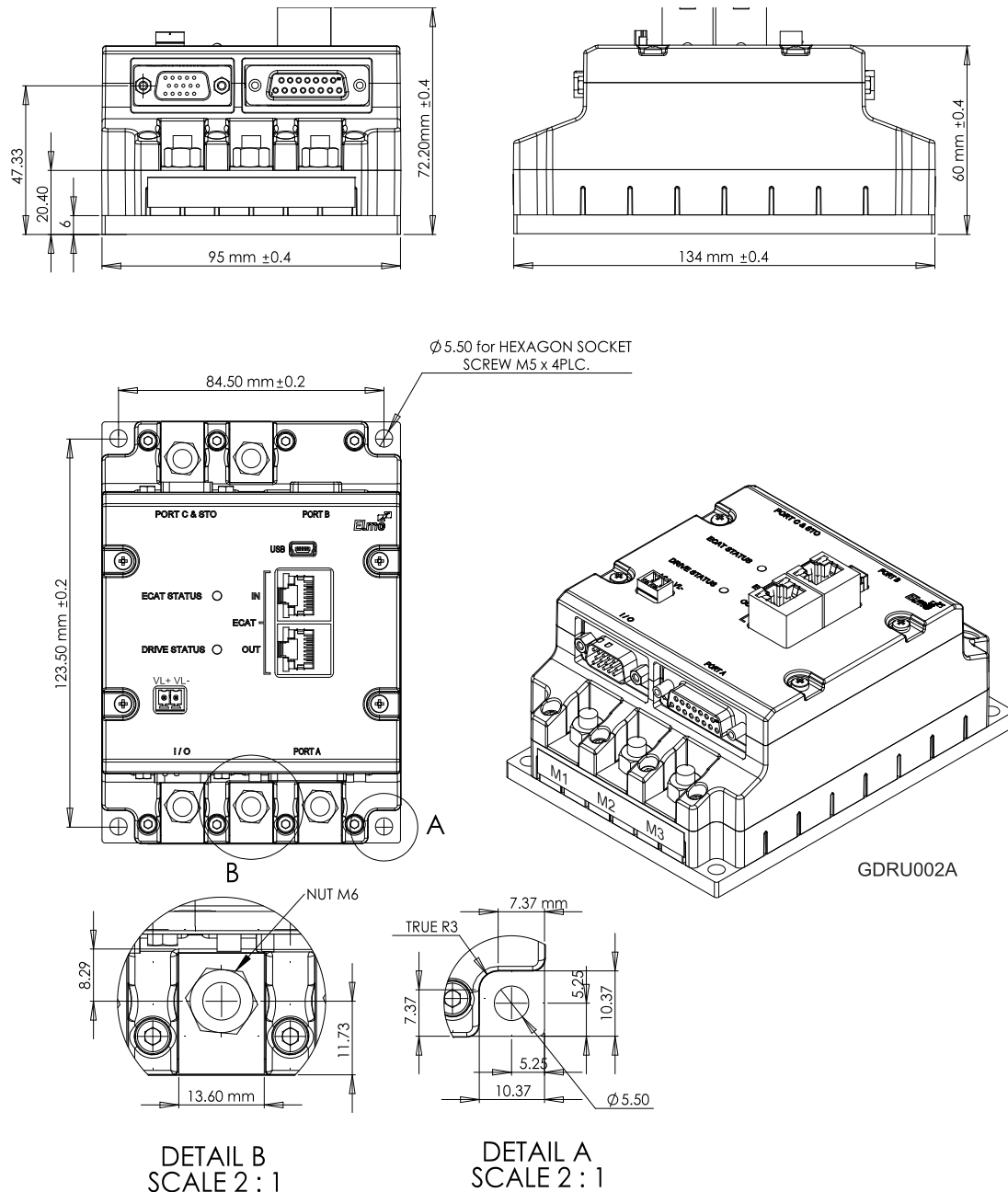


Figure 1: Mounting the Gold Drum with RJ-45 Connectors



## Chapter 8: Gold Drum Connection Diagrams

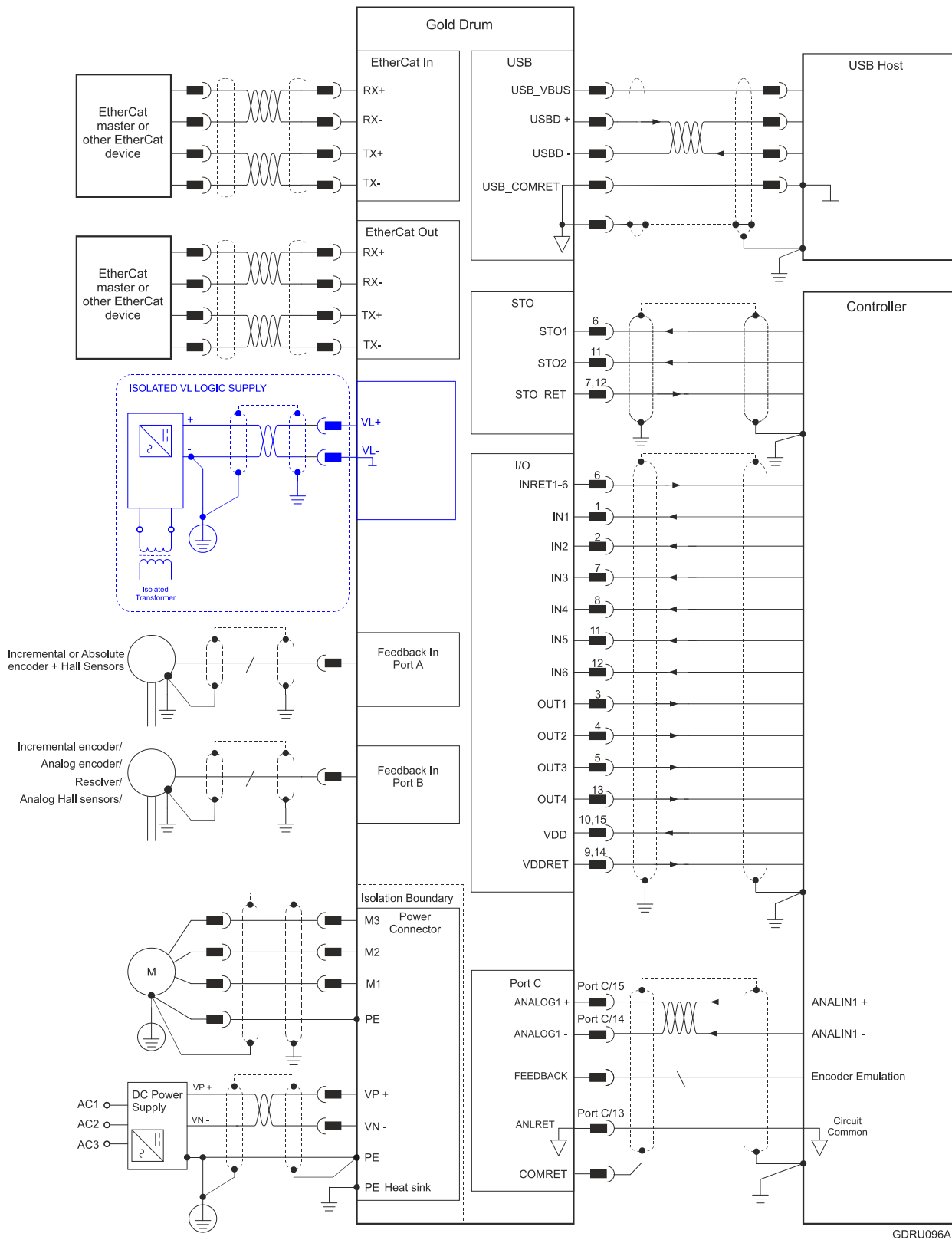
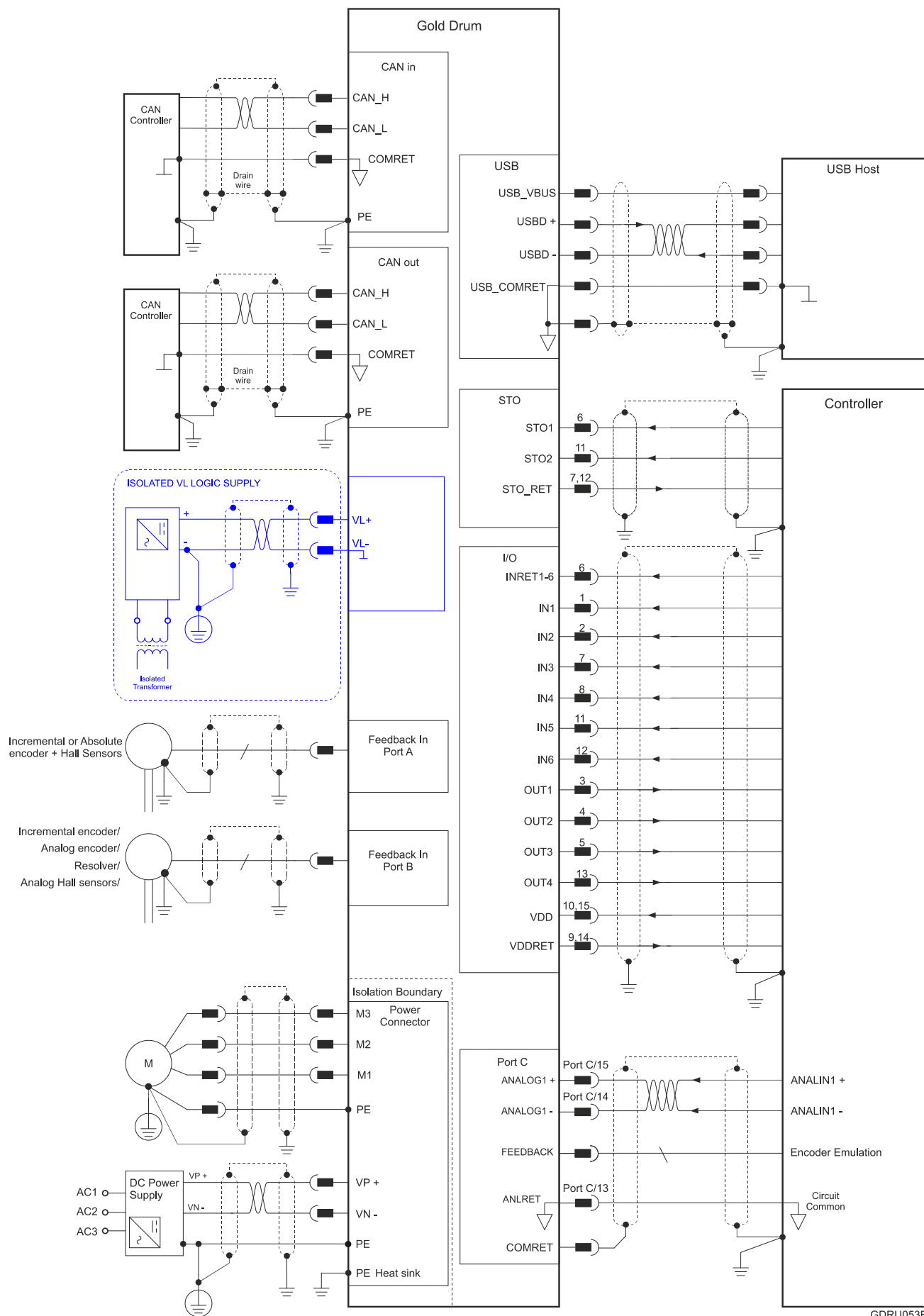


Figure 2: Gold Drum Connection Diagram - EtherCAT

**Note:** The drive requires an external VL Logic power supply; the drive cannot operate without it.



GDRU053B




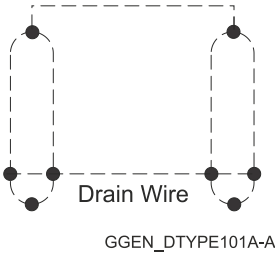
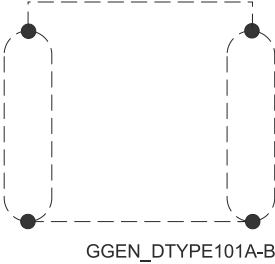
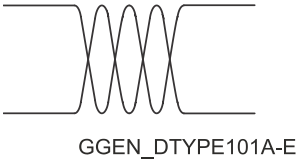
Figure 3: Gold Drum Connection Diagram - CAN



## Chapter 9: Wiring

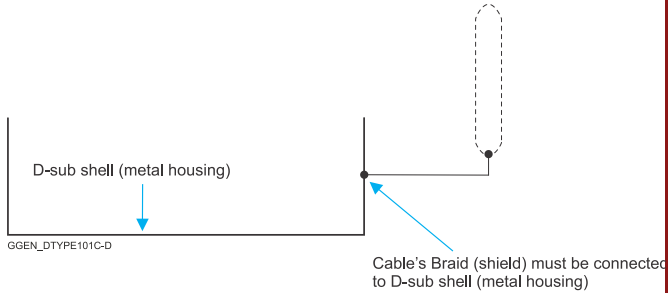
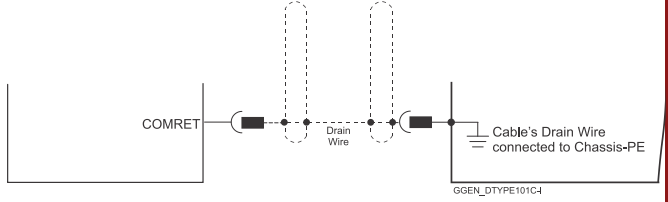
Once the product is mounted, you are ready to wire the device. Proper wiring, grounding and shielding are essential for ensuring safe, immune and optimal servo performance of the drive.

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

Wiring Symbol	Description
	Earth connection (PE)
	Protective Earth Connection
	Common at the Controller
	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
	Shielded cable braid only, without drain wire.
	Twisted-pair wires





Wiring Symbol	Description
 <p>D-sub shell (metal housing)</p> <p>GGEN_DTYPE101C-D</p> <p>Cable's Braid (shield) must be connected to D-sub shell (metal housing)</p>	<p>D-type Connector: The cable's braid (Shield) must be connected to the D-sub shell (metal housing)</p>
 <p>COMRET</p> <p>Drain Wire</p> <p>Cable's Drain Wire connected to Chassis-PE</p> <p>GGEN_DTYPE101C4</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>



## 9.1. Basic Recommendations

### 9.1.1. General

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

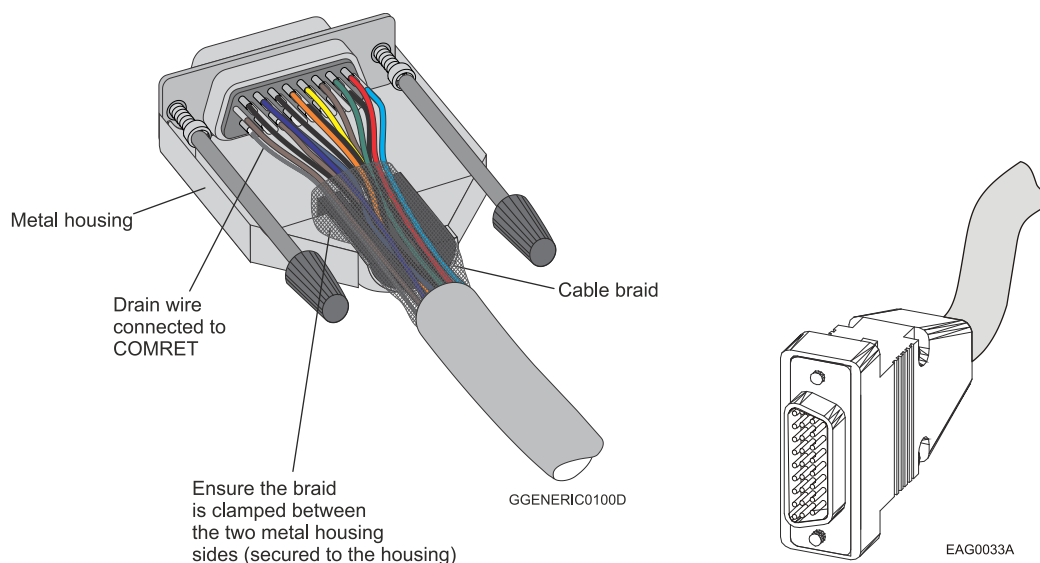


Figure 4: D-Type Cable Assemblies

5. Use only a D-Sub connector with a **metal housing** (Figure 4).
6. Make sure the braid shield is in tight contact with the metal housing of the D-type connector (Figure 4).



### 9.1.2. 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 5).
- 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.

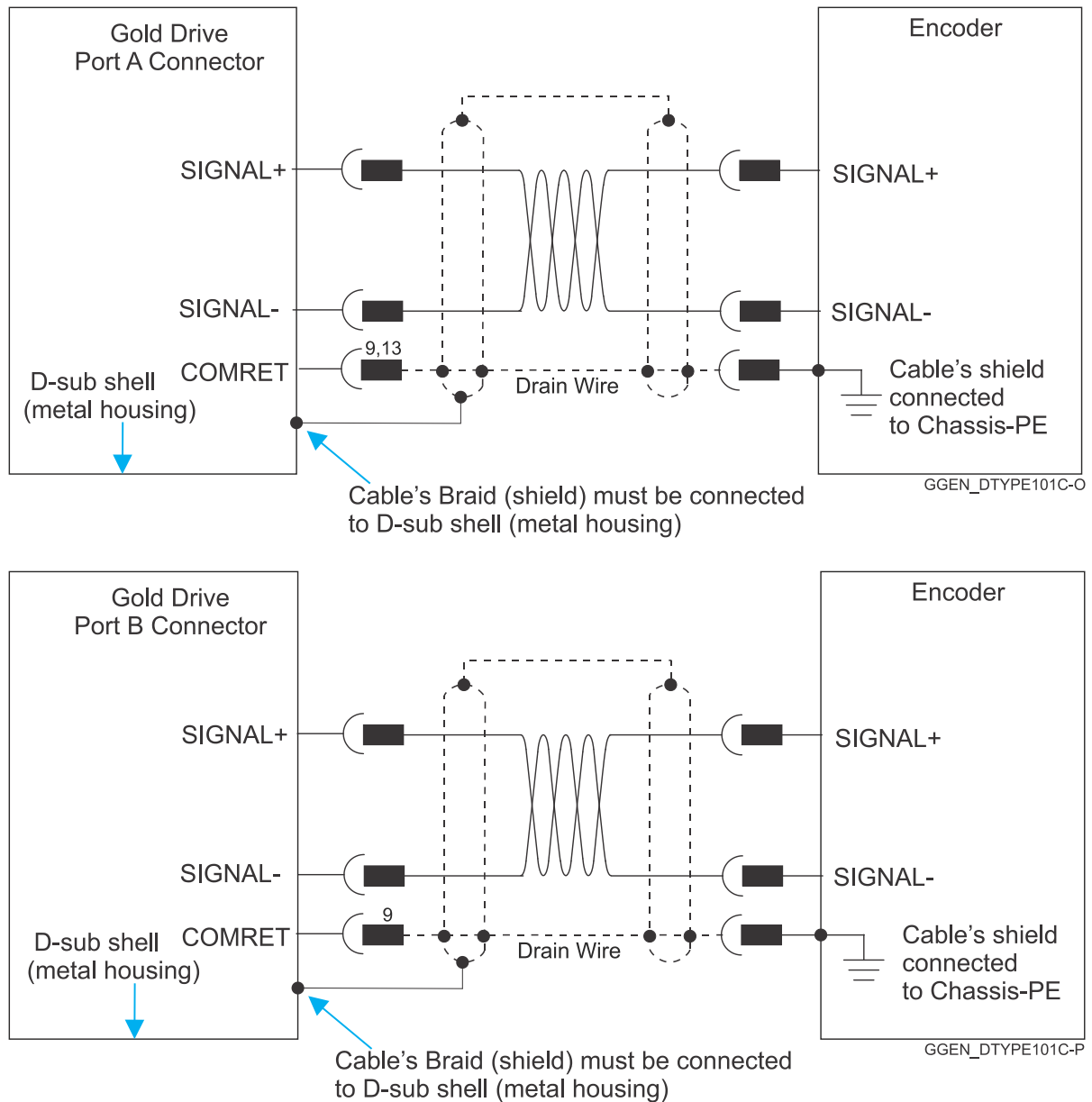


Figure 5: Feedback Port A and B Cable Assemblies



### 9.1.3. Feedback Cable Port C Connector

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

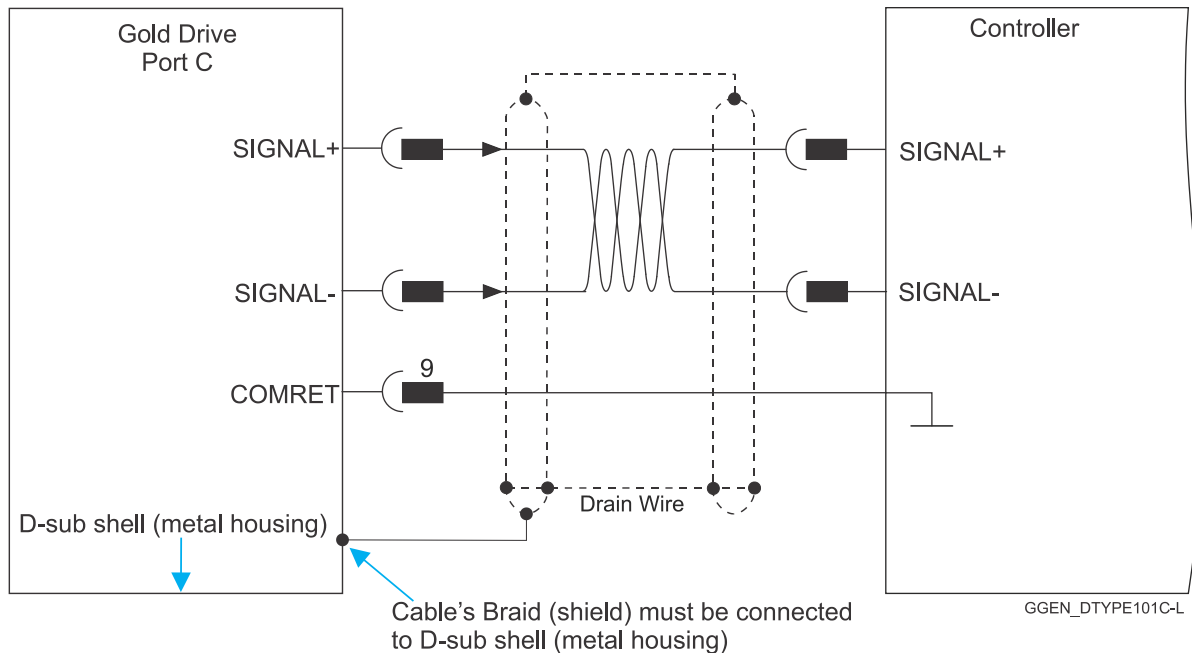


Figure 6: Feedback Port C Cable Assemblies

### 9.1.4. IO Cable Connector

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

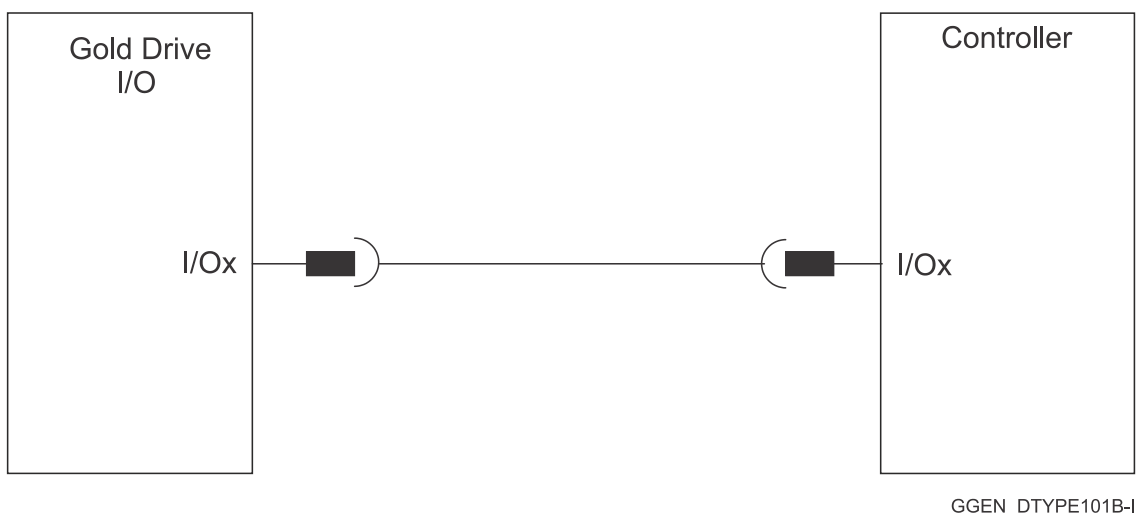


Figure 7: Feedback IO Cable Assemblies



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

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

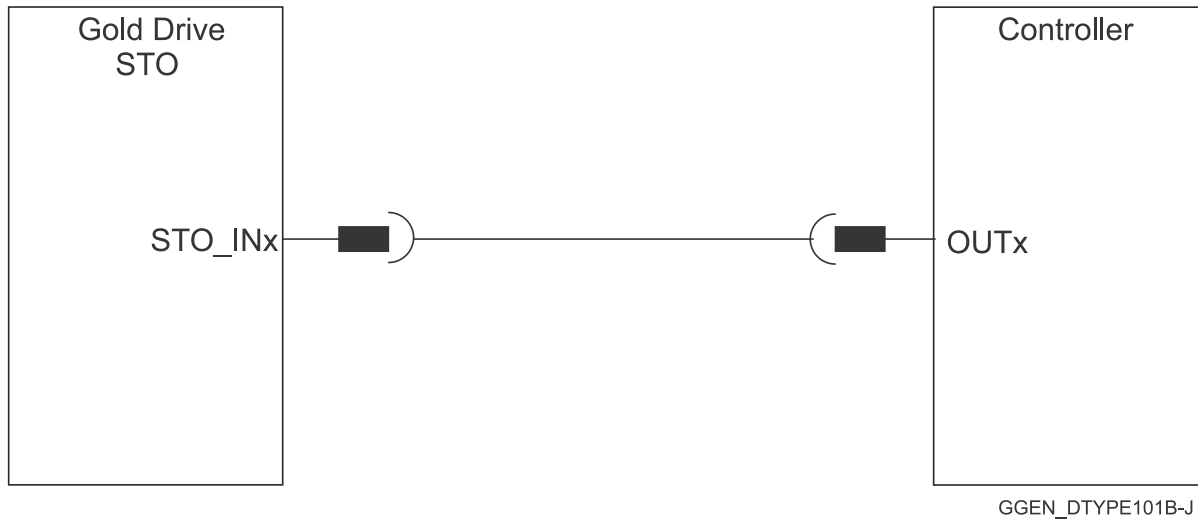


Figure 8: STO Cable Assemblies



## 9.2. Motor Power Connector Pinouts

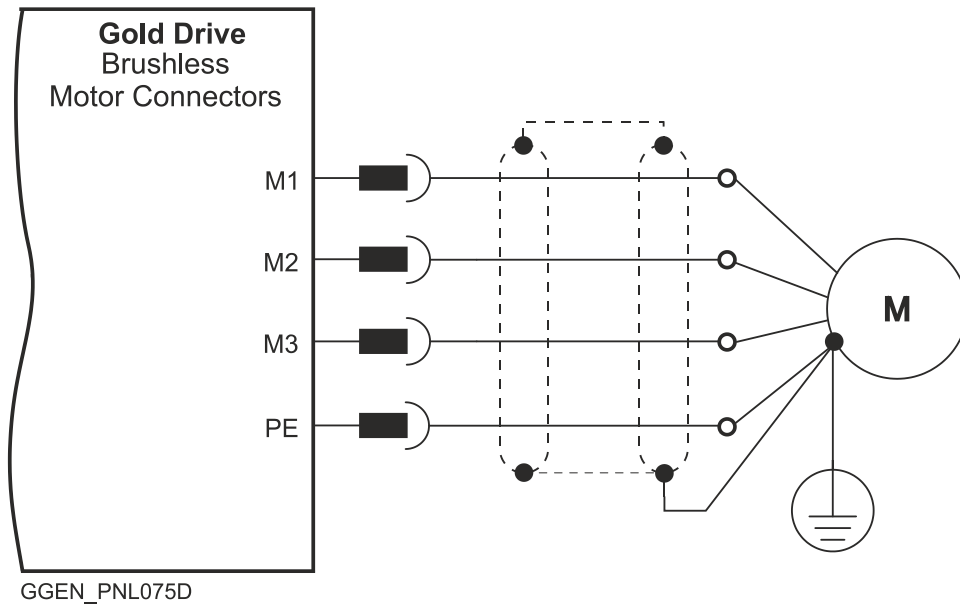
The Gold Drum receives power from main and VL Logic supplies and delivers power to the motor.

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

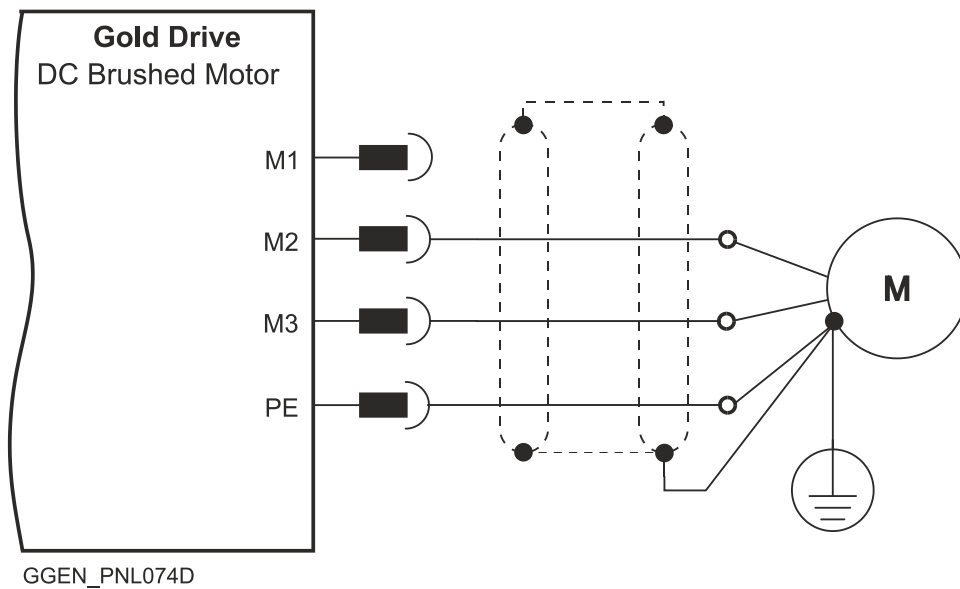
Pin	Function	Cable	
		Brushless Motor	Brushed DC Motor
<b>M3</b>	Motor phase	Motor	Motor
<b>M2</b>	Motor phase	Motor	Motor
<b>M1</b>	Motor phase	Motor	N/C
<b>PE</b>	Protective Earth	Motor	Motor

The diagram illustrates the physical layout of the Gold Drum (GDRU089A-A) with various connectors and indicators. At the top, there are two large circular connectors labeled VN- and VP+. Below these are PORT C & STO and PORT B. A USB port is located in the center. Below the USB port are two RJ-45 ports labeled IN and OUT, with ECAT status and DRIVE STATUS indicators. At the bottom, there are two green rectangular connectors labeled VL+ and VL-. The bottom section of the unit is highlighted with a red box and contains three large circular connectors labeled M1, M2, and M3. The unit is labeled GDRU089A-A.



**Figure 9: Brushless Motor Power Connection Diagram**



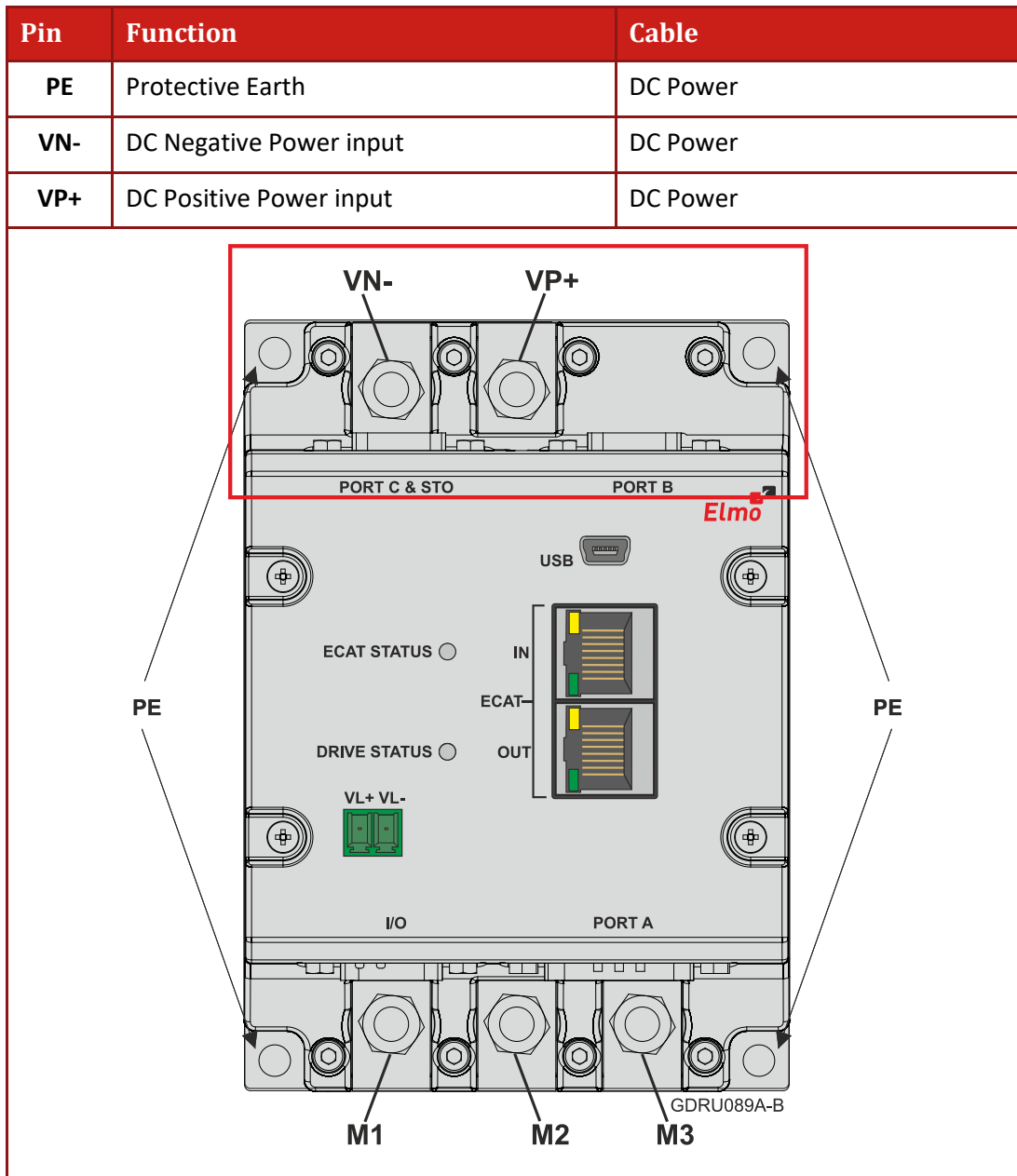
**Figure 10: DC Brushed Motor Power Connection Diagram**



### 9.3. Main Power Connector Pinouts

For connection details refer to the Chapter 8: Gold Drum Connection Diagrams for full details.

For electrical details refer to Chapter 8 in the in the MAN-G-Panel Mounted Drives Hardware manual.

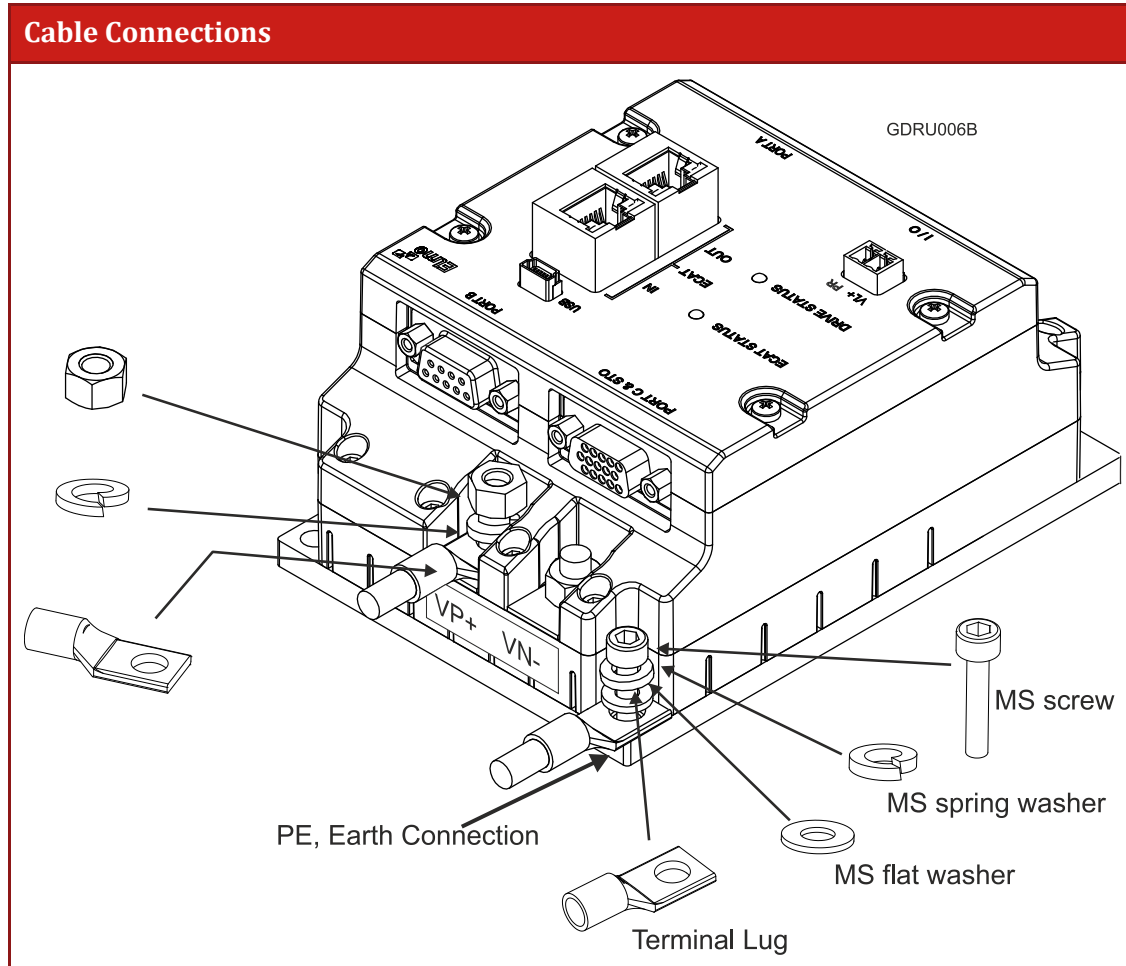






## 9.4. Connecting the DC Power and the Motor Power Cables

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, and the Motor Power cables to the M1, M2, M3, and PE terminals on the Gold Drum.



**Table 2: Connecting the PE Cables**

1. Connect the appropriate terminal lugs from the Main Power cables to the VP+, VN, and PE terminals on the Gold Drum as shown in Table 2.
2. Connect the appropriate terminal lugs from the Motor Power cables to the M1, M2, M3, and PE terminals on the Gold Drum.
  - 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.

The phase connection could be arbitrary as Elmo Application Studio (EASII) 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.



The DC power for the Gold Drum is delivered from a separated rectifying unit (supplied by the user). Elmo recommends using one of Elmo's Tambourine rectifiers specifically designed for use with Elmo drives which offers a range of versatile options.

## 9.5. Main Power

The power stage of the Gold Drum is fully isolated from the other sections of the Gold Drum, such as the control-stage and the heat sink. This allows powering of the Gold Drum in two ways:

1. Direct to mains power supply connection. The Gold Drum is powered by a power source that is not isolated from the mains.
2. Isolated from the mains Power supply connection. The Power supply of the Gold Drum is isolated from the mains by an isolation transformer, or the power source is a battery isolated from the mains.

The Gold Drum series is offered with six different operating voltage ranges. This allows optimum servo performance and superior efficiency at any voltage. When rectifying an AC voltage source, the AC voltage level must be limited to the "voltage supply" rating shown in Table 1, section 4.2 Technical Data.

### 9.5.1. Power Supply Connections

This section relates to the configuration of the power supply and drive, which is the DC power source for the Gold Drum.

#### Connection:

1. For best EMI emission and immunity, it is highly recommended to use twisted and shielded cable for the DC power supply cable. The gauge is determined by the actual current consumption of the motor.
2. The Motor's cable must not be twisted! Twisted wires create capacitance between the wires and thus increase the EMI.  
In very long Motor twisted cables (>50m) this Capacitance might activate the short circuit protection.
3. Connect the Power wires and cables as recommended in the connection diagrams.



### 9.5.1.1. Gold Drum Power Supply Connections

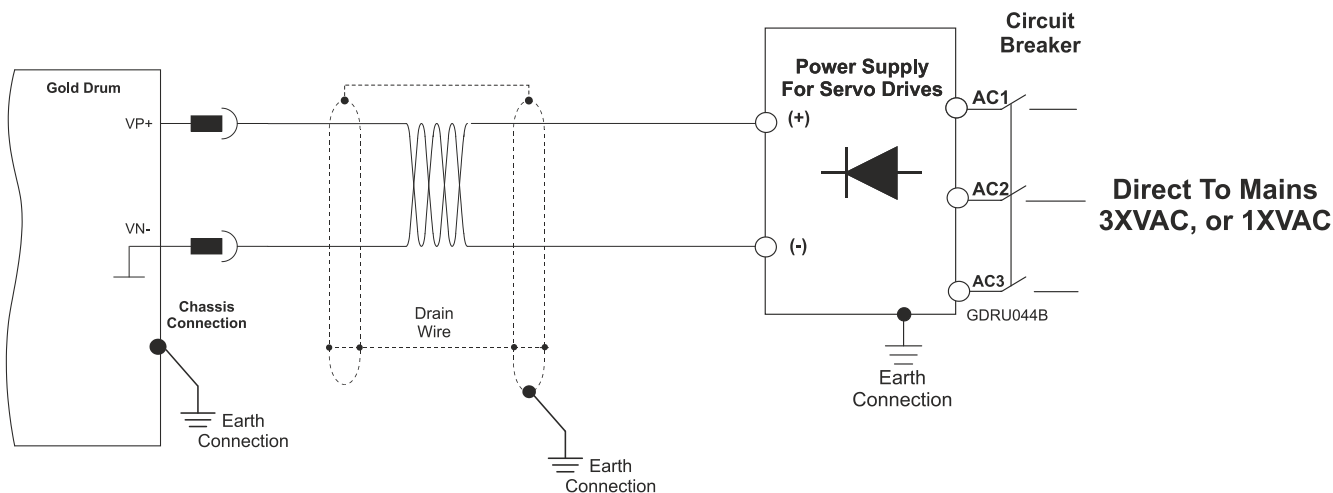


Figure 11: Non-Isolated from the Mains DC Power Supply connection

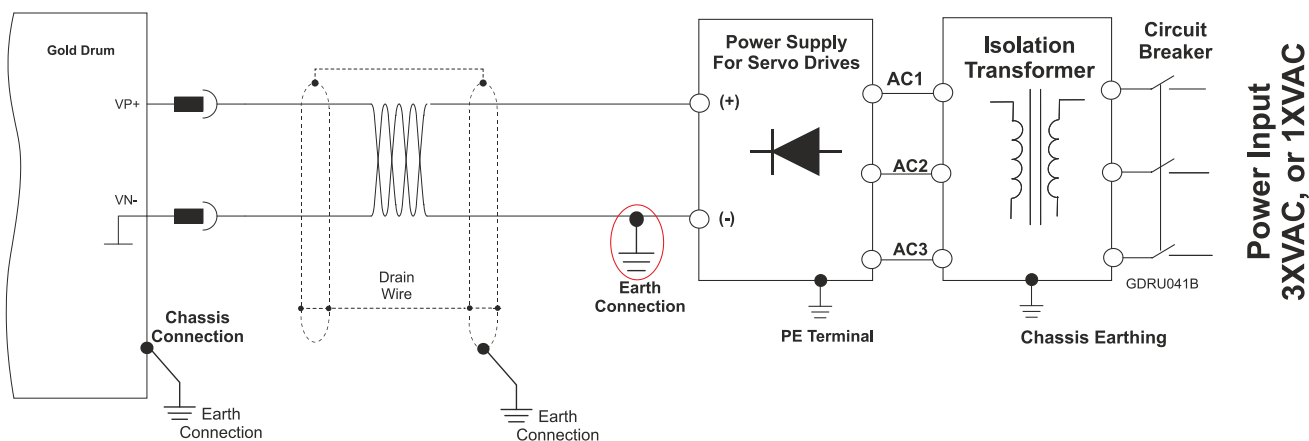


Figure 12: Isolated from the Mains DC Power Supply connection



#### Important Notice

- In the Isolated connection the G-DRU **VN-** terminal **MUST** be connected to the "Earth Connection" (marked in red in Figure 12 above).
- In the **Non Isolated** Connection ( direct to Mains) the **VN-** terminal **MUST NOT** be connected to "Earth Connection"(PE) (Figure 11).

### 9.5.1.2. 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.



## 9.6. VL Logic Supply

Connect the VL Logic power supply as described below.

**To connect the VL Logic supply:**

1. Use a 24 – 26 AWG twisted pair shielded cable. The shield should have braid and Drain wire.
2. The source of the VL supply must be isolated from the Mains.
3. Before applying power, first verify that the polarity of the connection is correct.

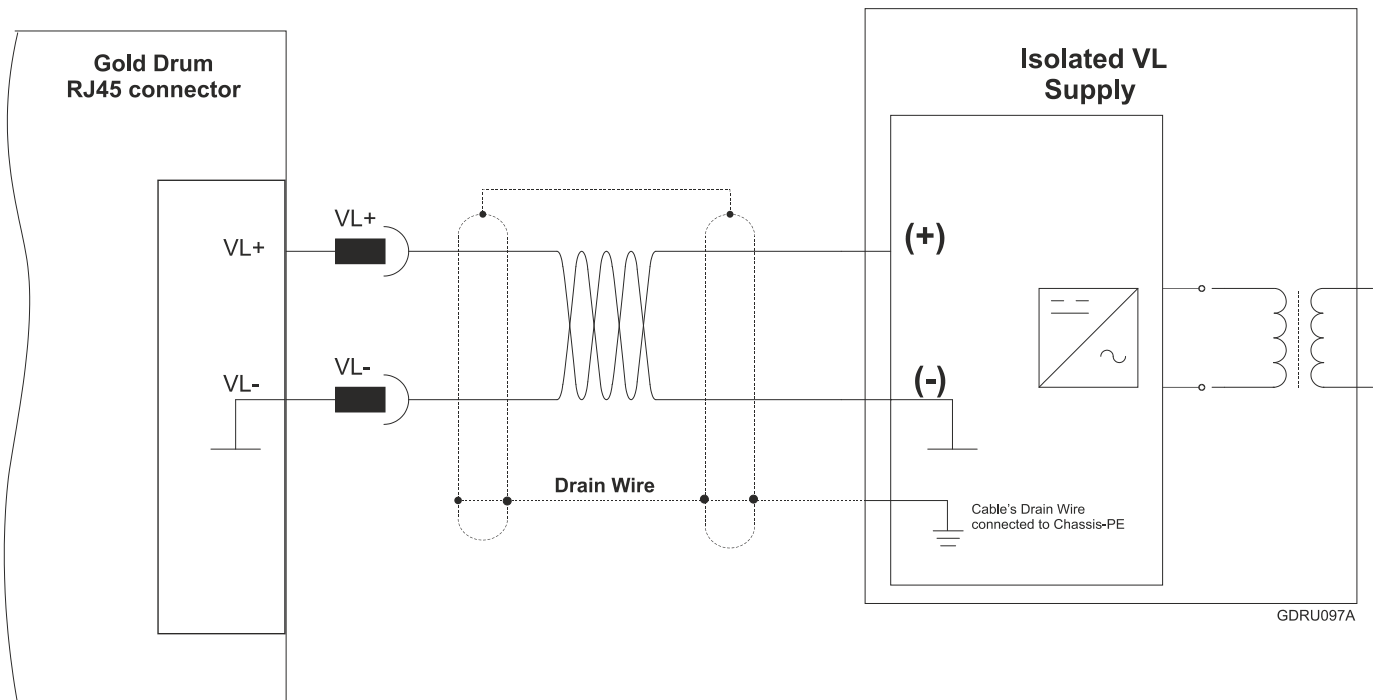


Figure 13: VL Logic Supply Connection Diagram



### 9.6.1. VL Logic Supply

Pin	Function	Cable
VL+	Positive input terminal of the logic (Control & Encoders) power supply	VL Logic Supply Cable
VL-	Negative (-) terminal of logic power supply	VL Logic Supply Cable

2-Pin Pluggable 3.81 mm Phoenix

VLogic Supply Cable

GDRU028B

2-Pin Phoenix Plug-in Connector

Table 3: VL Logic Supply Pins and Polarity



## 9.7. Drive Status Indicator

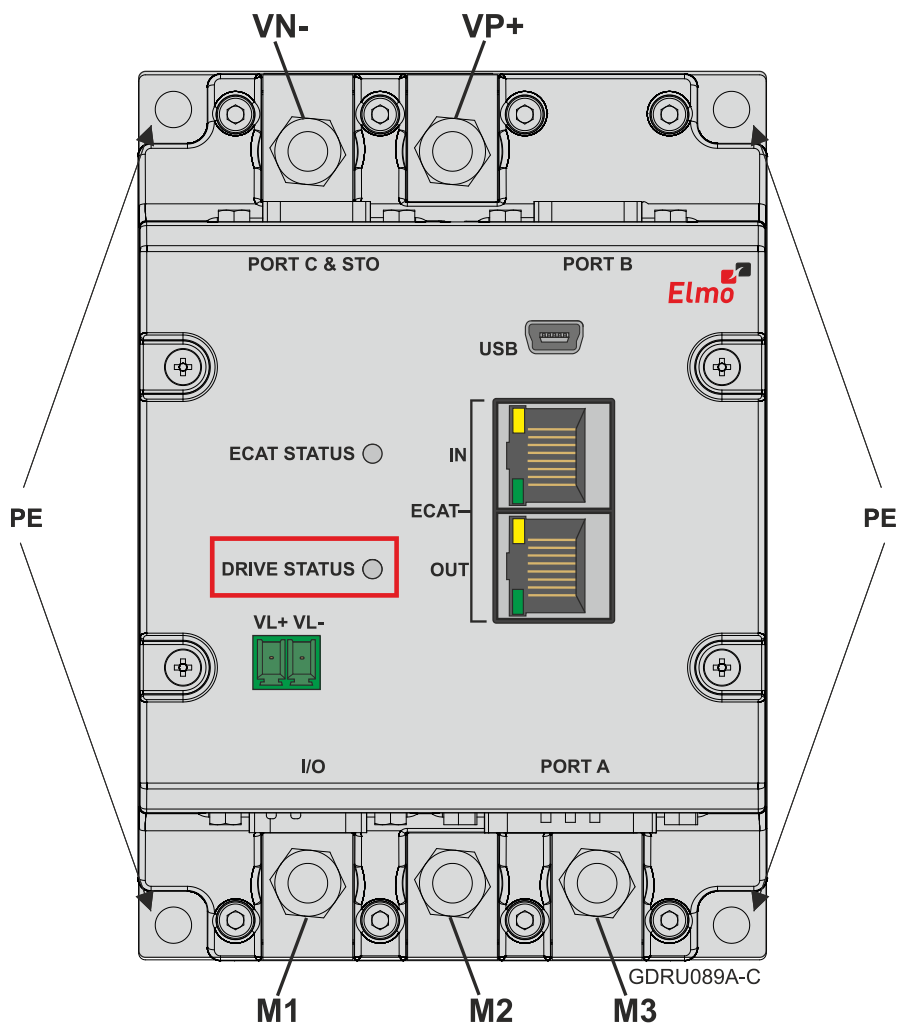


Figure 14: Drive Status LEDs

This 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).



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

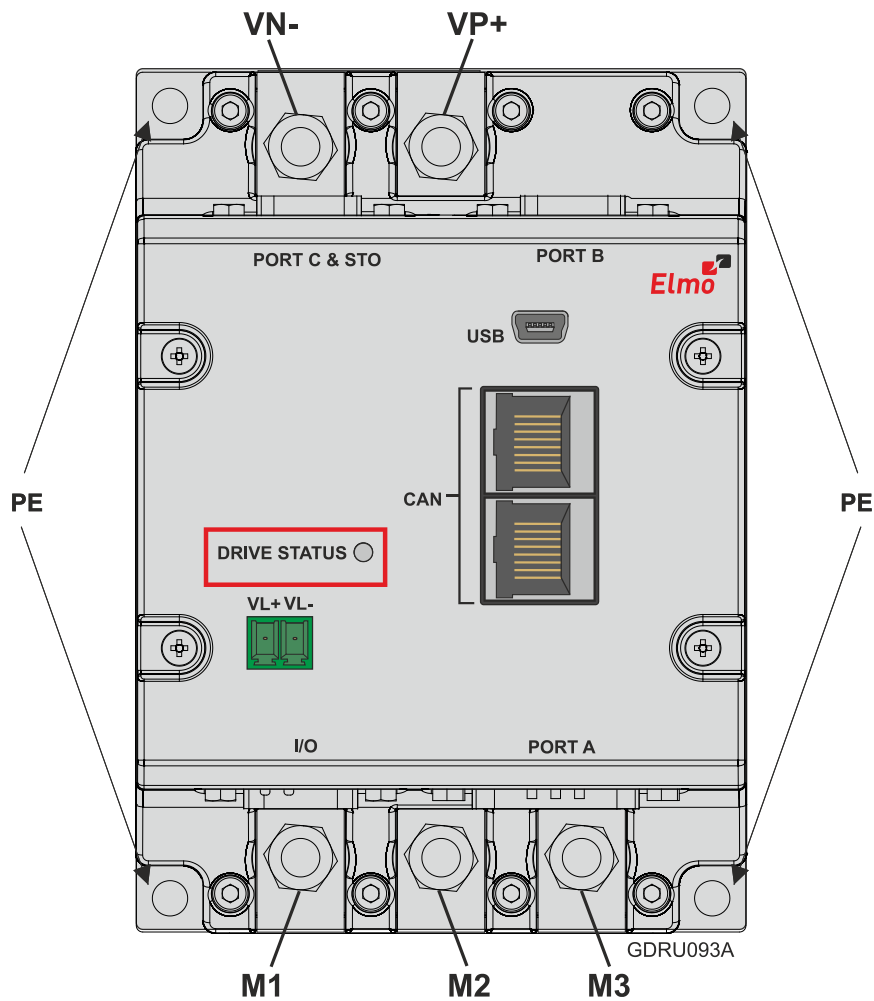


Figure 15: Gold Drum Status Indicator - CAN

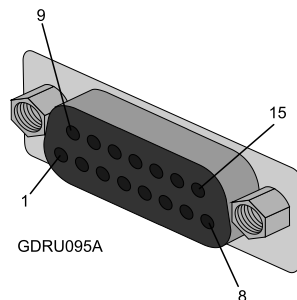
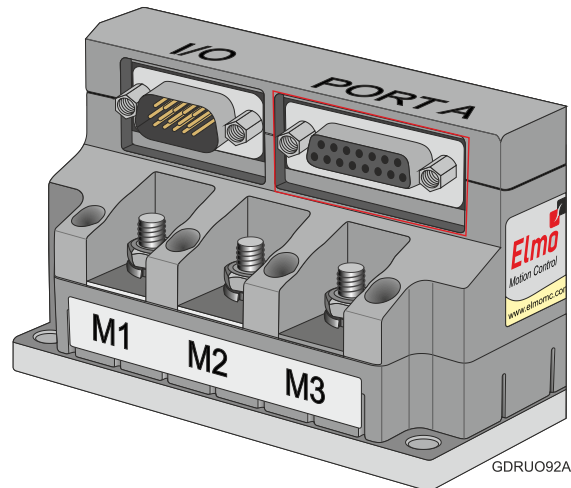


## 9.8. Port A Connector

See Section 10.3 in the manual: MAN-G-Panel Mounted Drives Hardware 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 Position



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

**Table 4: Port A Pin Assignments**





## 9.8.1. Incremental Encoder

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

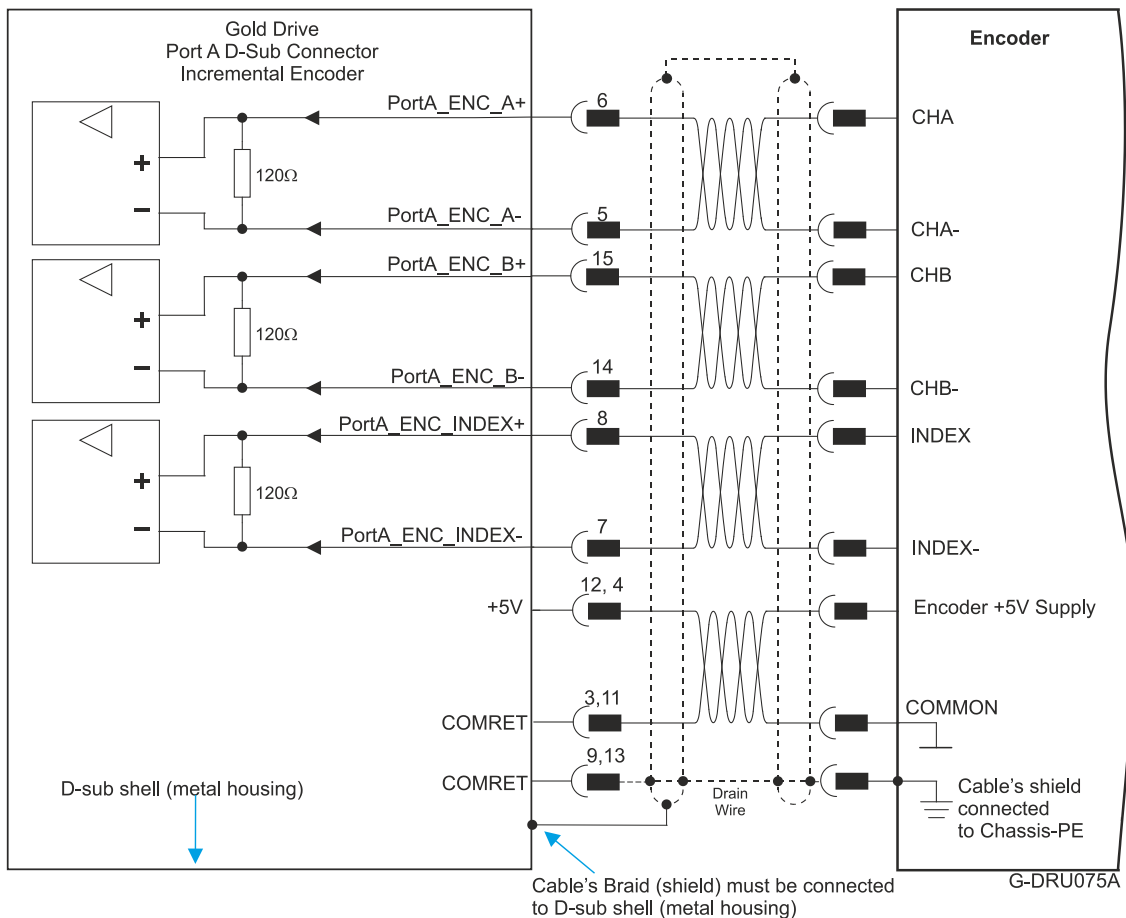


Figure 16: Port A Shrouded Type Connection Incremental Encoder Input – Recommended

## 9.8.2. Hall Sensor

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

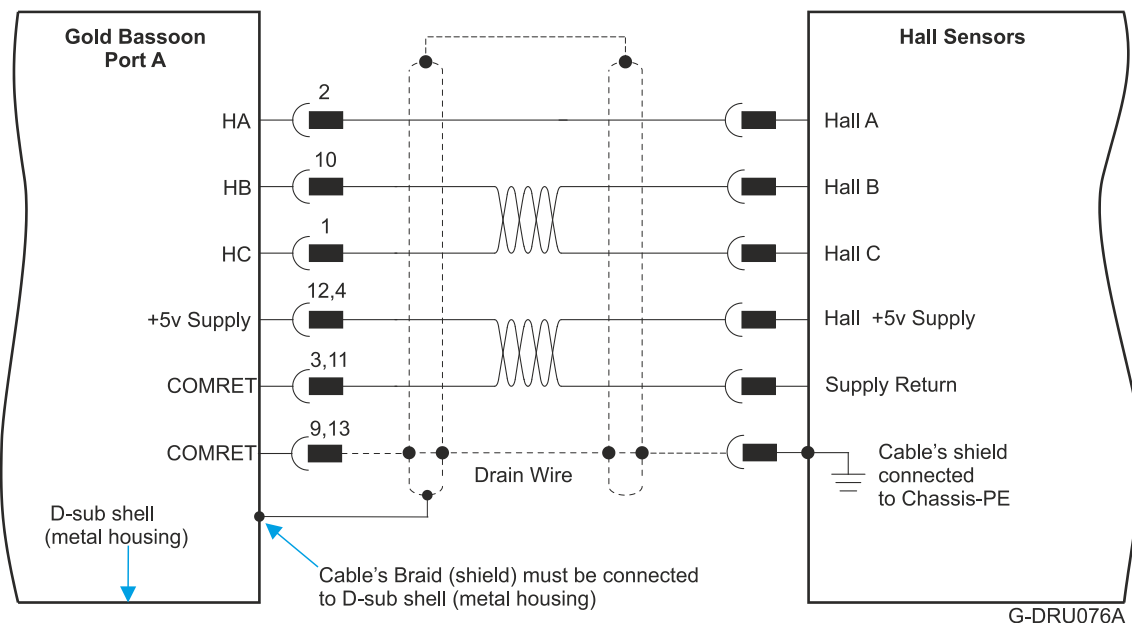


Figure 17: Hall Sensor Connection Diagram



### 9.8.3. Absolute Serial Type Encoder

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

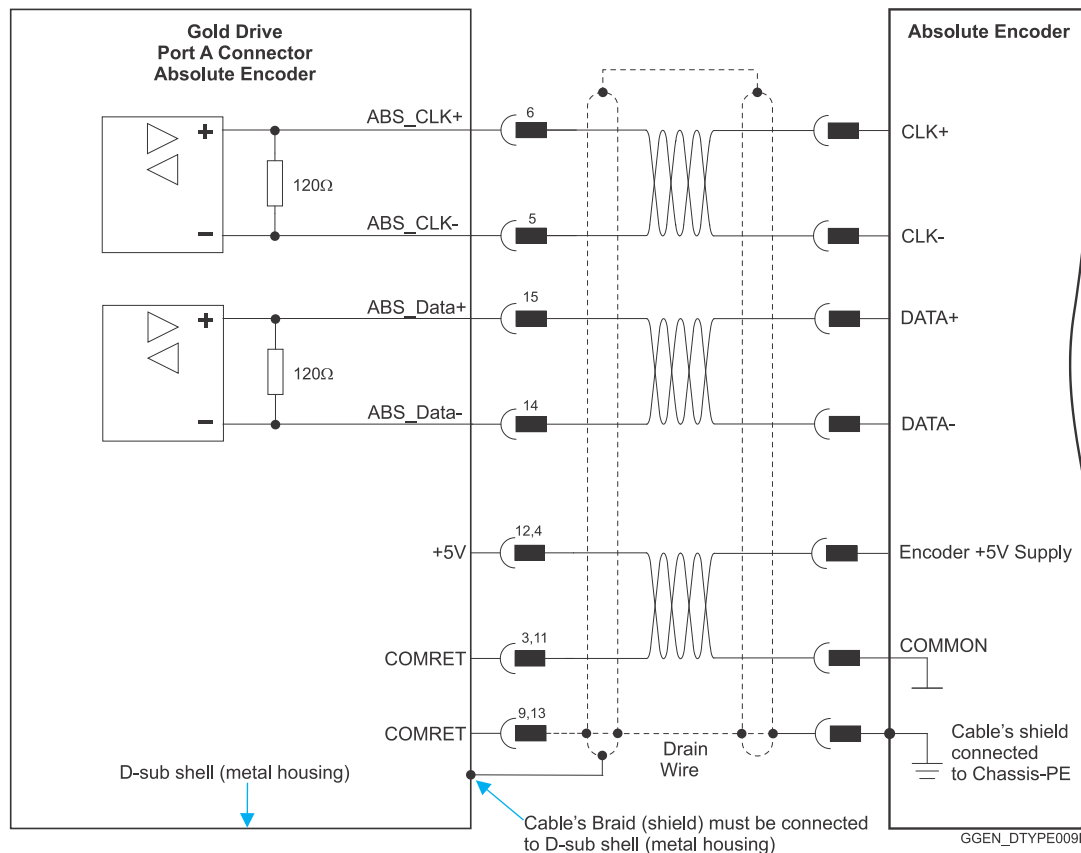


Figure 18: Absolute Serial Encoder – Recommended D-Type Connection Diagram for EnDAT, Biss, and SSI

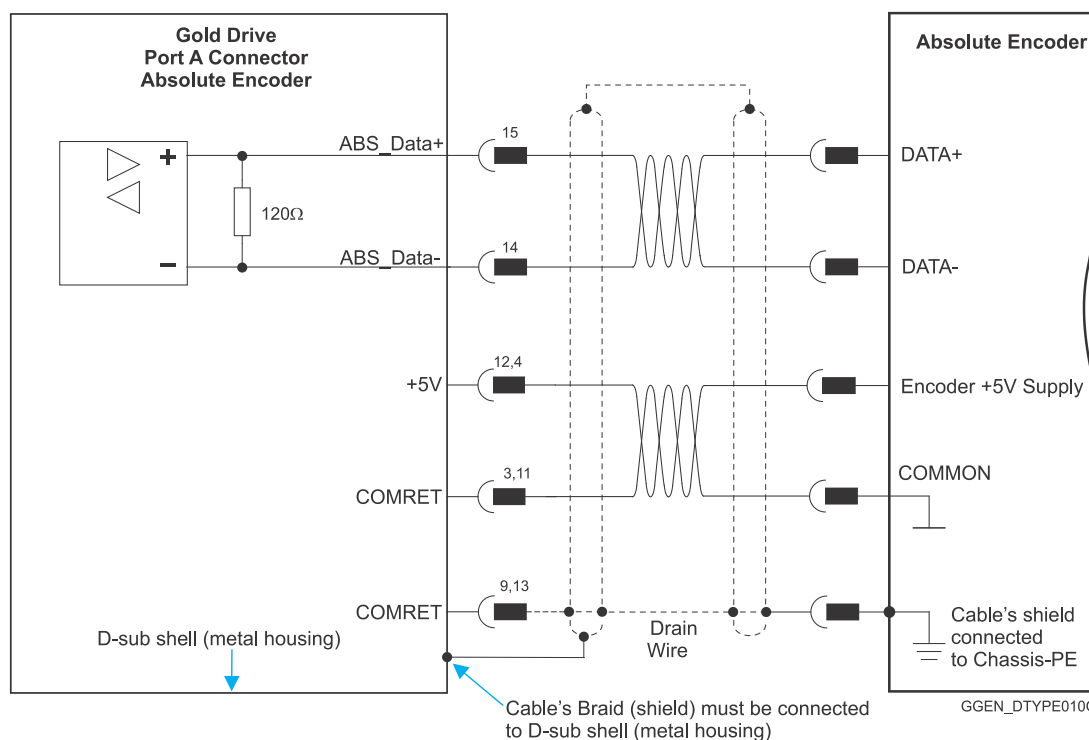
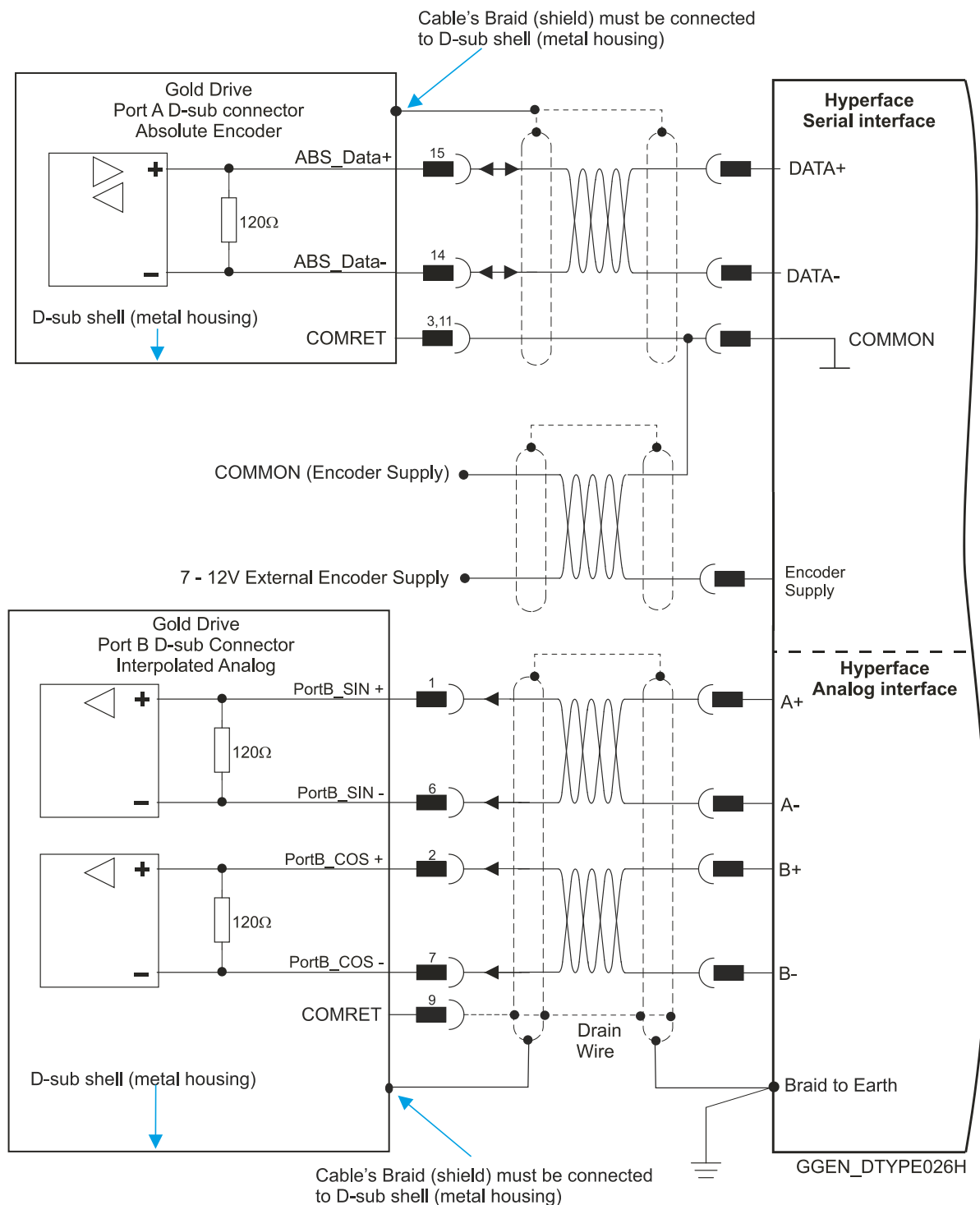


Figure 19: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)



**Figure 20: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Stegmann Hiperface**

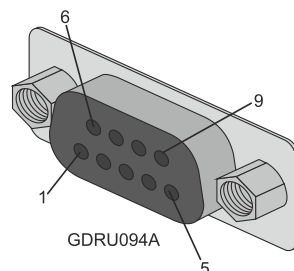
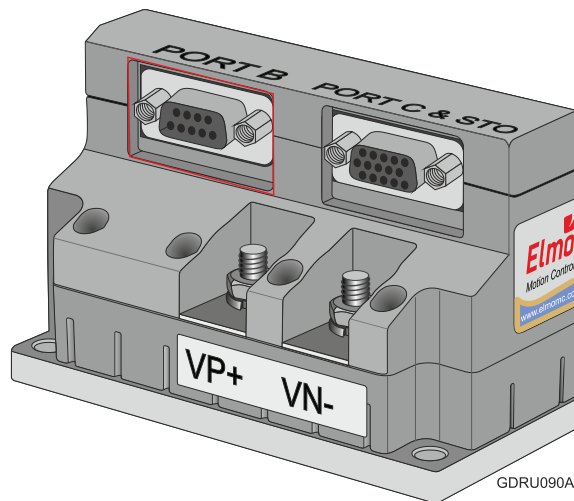


## 9.9. Port B Connector

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

Port B	Incremental or Interpolated Analog Encoder		Resolver	
	G-DRUXXX/YYYEEAP		G-DRUXXX/YYYERAP	
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_OUT+	Vref f=1/TS, 50 mA Max.
8	PortB_ENC_INDEX-	Index -	RESOLVER_OUT-	Vref complement f= 1/TS, 50 mA Max.

### Pin Position



9-Pin D-Type Female Connector

Table 5: Port B Pin Assignments



### 9.9.1. Incremental Encoder

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

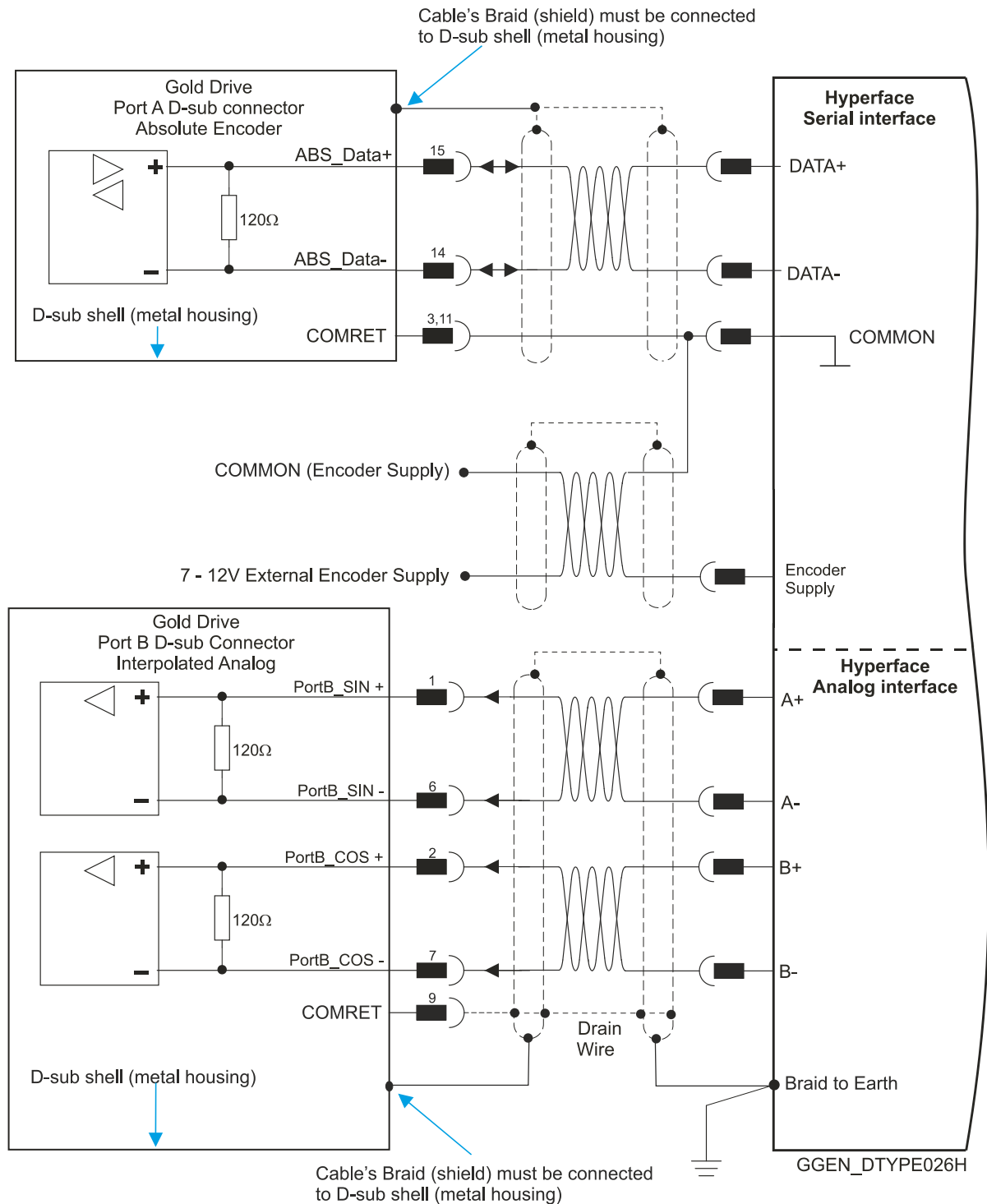


Figure 21: Port B Incremental Encoder Input – Recommended D-Type Connection Diagram



## 9.9.2. Interpolated Analog Encoder

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

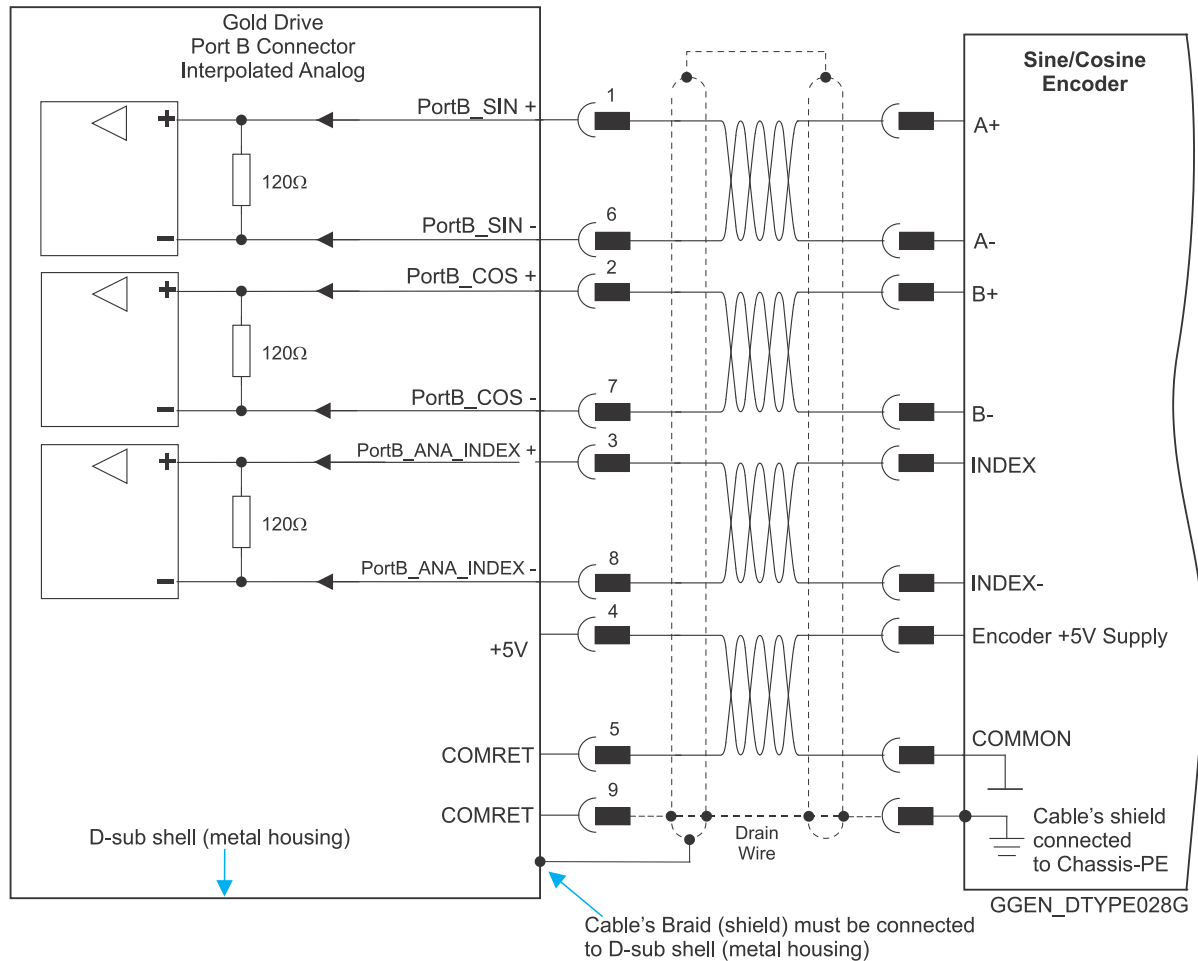
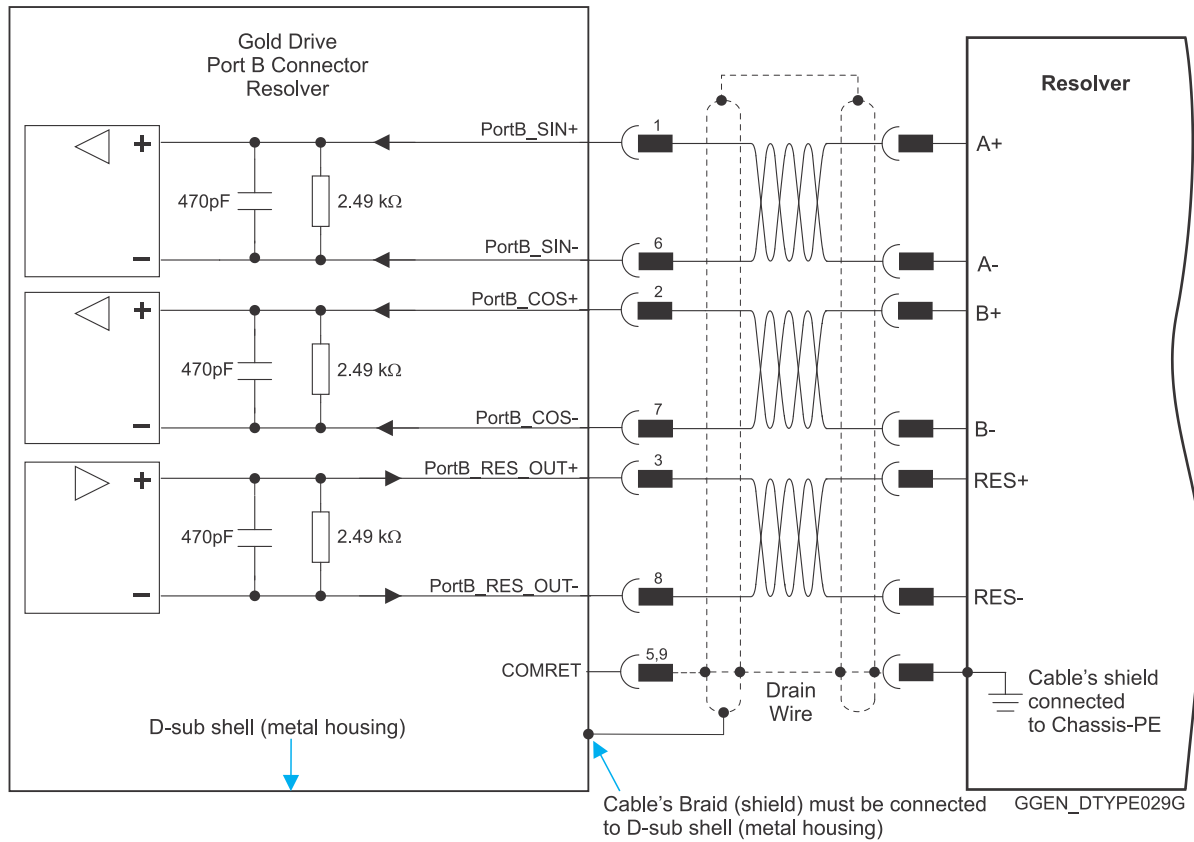


Figure 22: Port B - Interpolated Analog Encoder D-Type Connection Diagram



### 9.9.3. Resolver

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



**Figure 23: Port B – Resolver D-Type Connection Diagram**



## 9.10. Port C Connector - Port C, Analog, and STO

The Gold Drum Port C connector is a D-Type connector with 15 high density female pins.

The Port C connector includes the following functions:

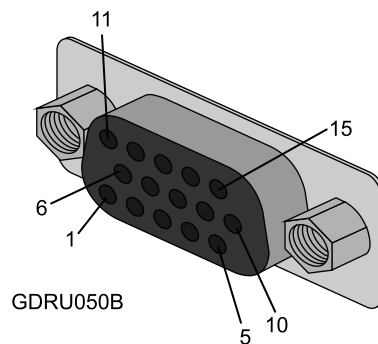
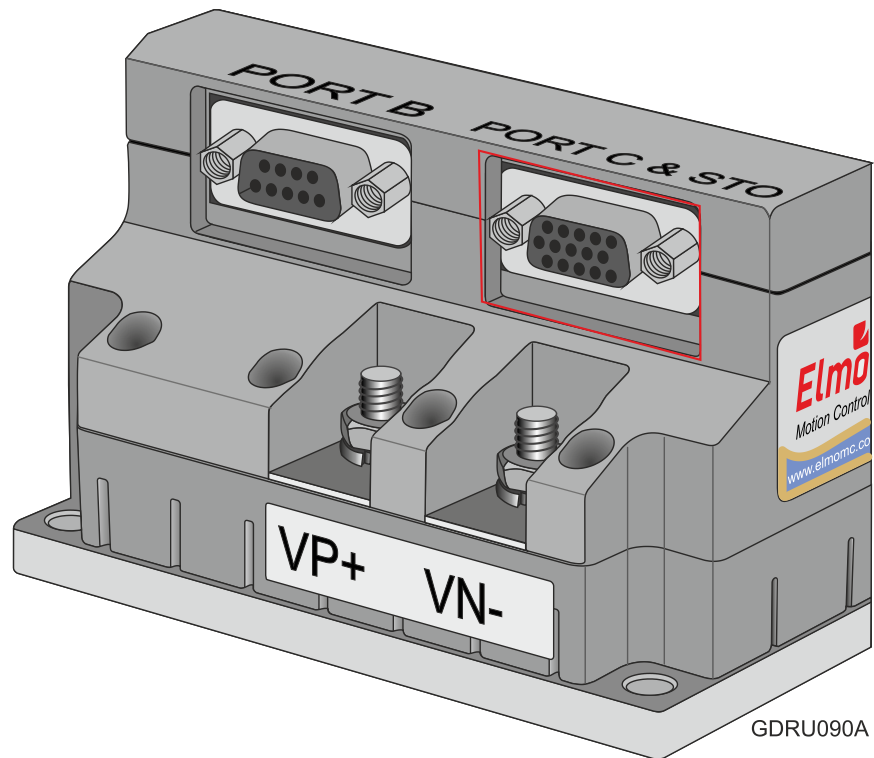
- Port C: Refer to Sections 10.5 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details
- STO: See Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.
- Analog input: See Section 11.2 in the in the MAN-G-Panel Mounted Drives Hardware manual for full 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	ANARET	Analog ground
14	ANALOG1-	Analog input 1-
15	ANALOG1+	Analog input 1+





## Pin Position



**15-Pin D-Type High Density Female Connector  
(Elmo P.N. JCB-116315FC)**

**Table 6: Port C Pin Assignments**



### 9.10.1. Port C

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

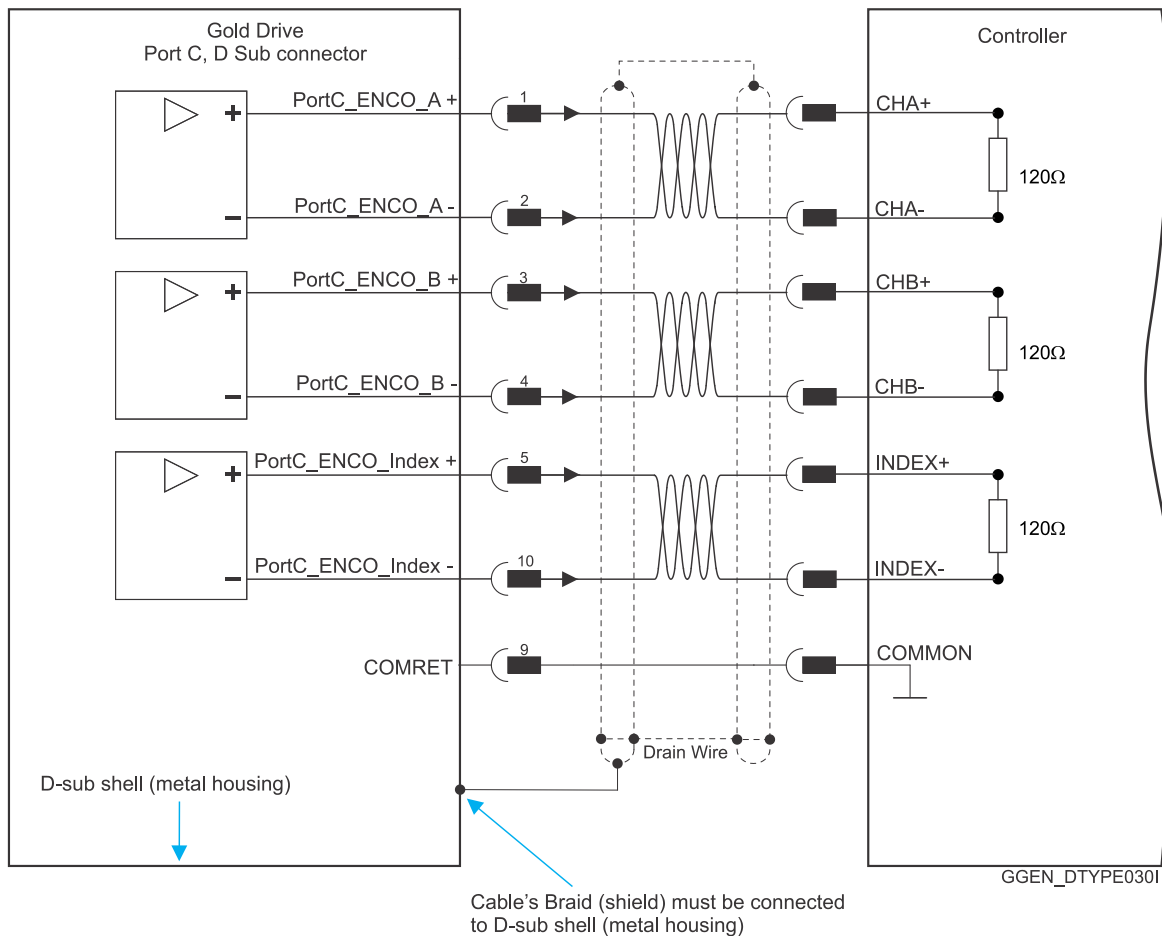


Figure 24: Emulated Encoder Differential Output – Recommended D-Type Connection Diagram

### 9.10.2. Analog Input

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

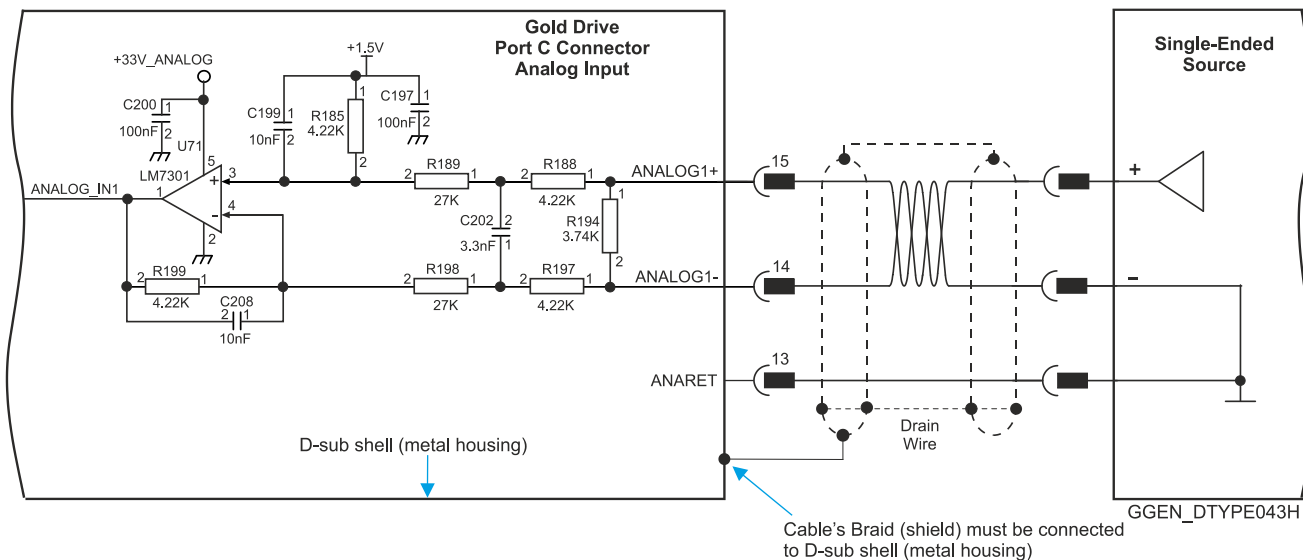


Figure 25: Differential Analog D-Type Input



### 9.10.3. STO

The following circuits describe the STO wiring options.

#### 9.10.3.1. Source Mode PLC Voltage Level Input

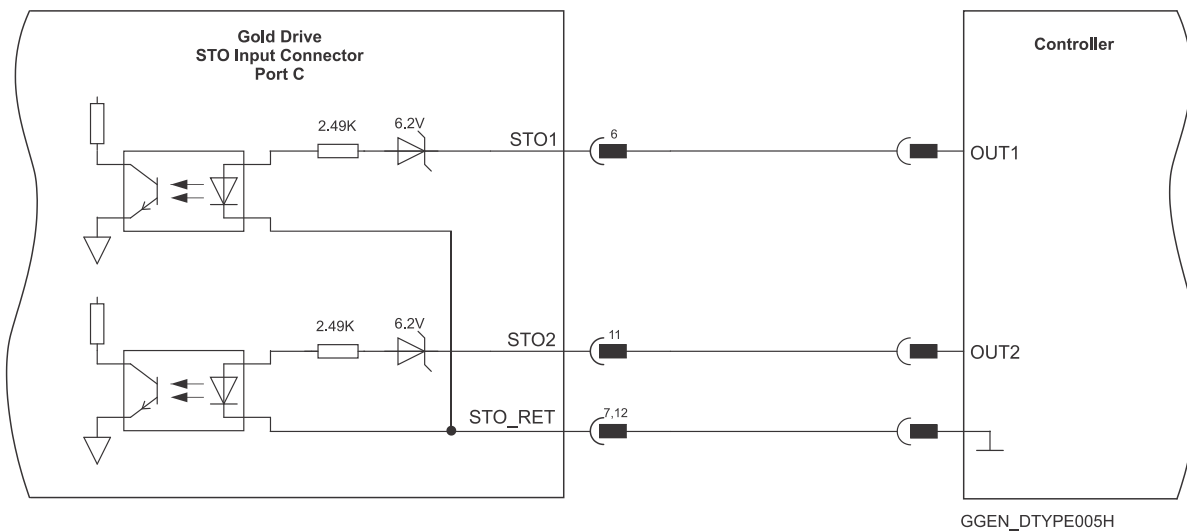


Figure 26: STO Input Connection – PLC Source Option

#### 9.10.3.2. TTL Mode TTL Voltage Level Input

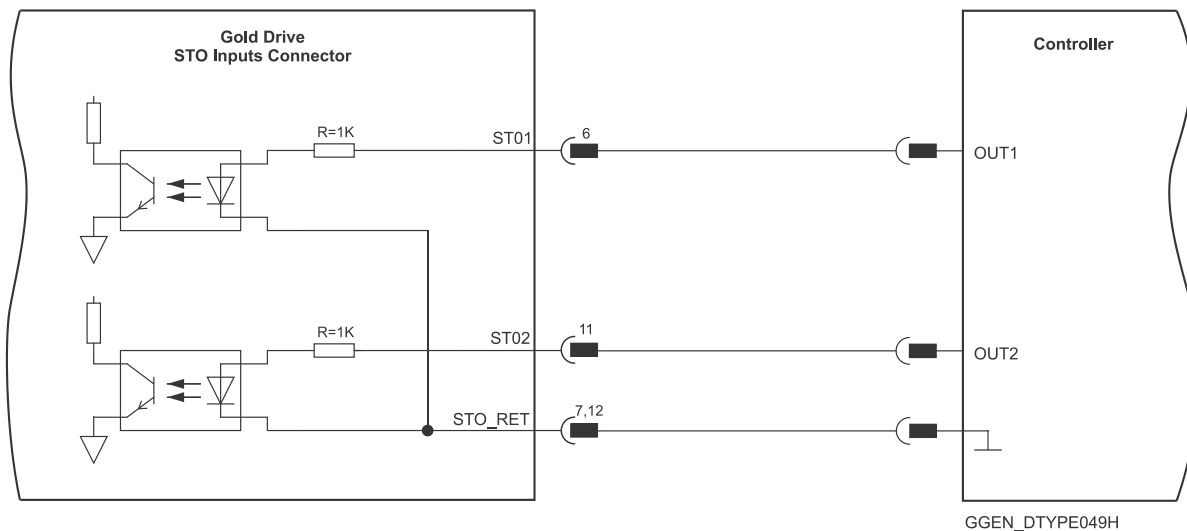


Figure 27: STO Input Connection – TTL Option



### 9.10.3.3. SINK Mode – PLC Voltage Level Input

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.**

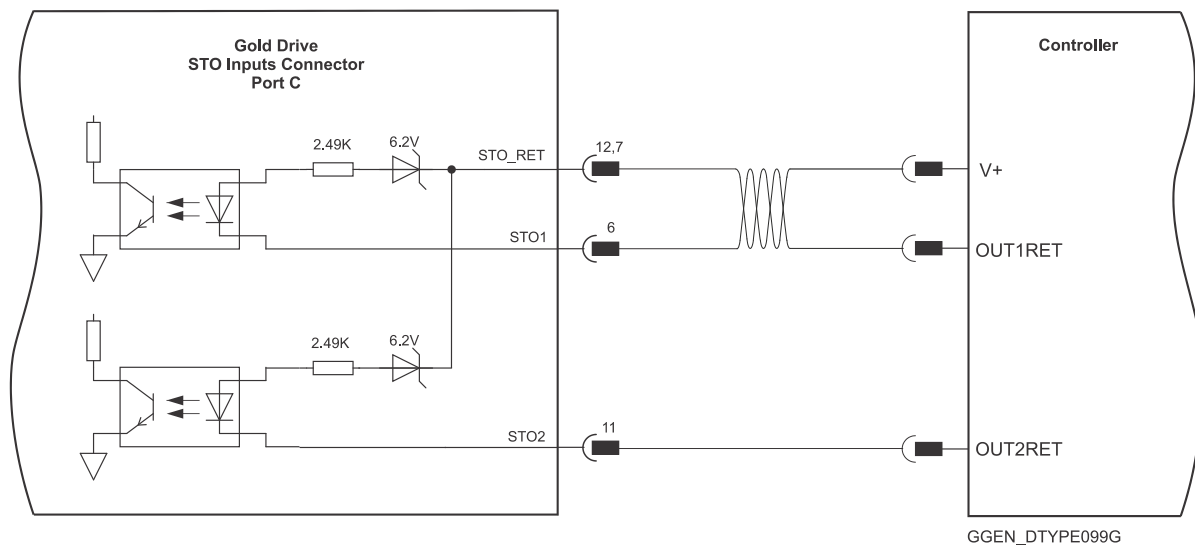


Figure 28: STO D-Type Input Connection – Sink Option



#### 9.10.3.4. STO Output

There are two available options:

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

If the STO STATUS OUT is configured, then the OUT 4 pin (connector P4) will not be available, and the collector/emitter use the IO connector P4 pins. Refer to Figure 29 below for details of the connections, and refer to Chapter 9 in the MAN-G-Panel Mounted Drives Hardware manual for full details.

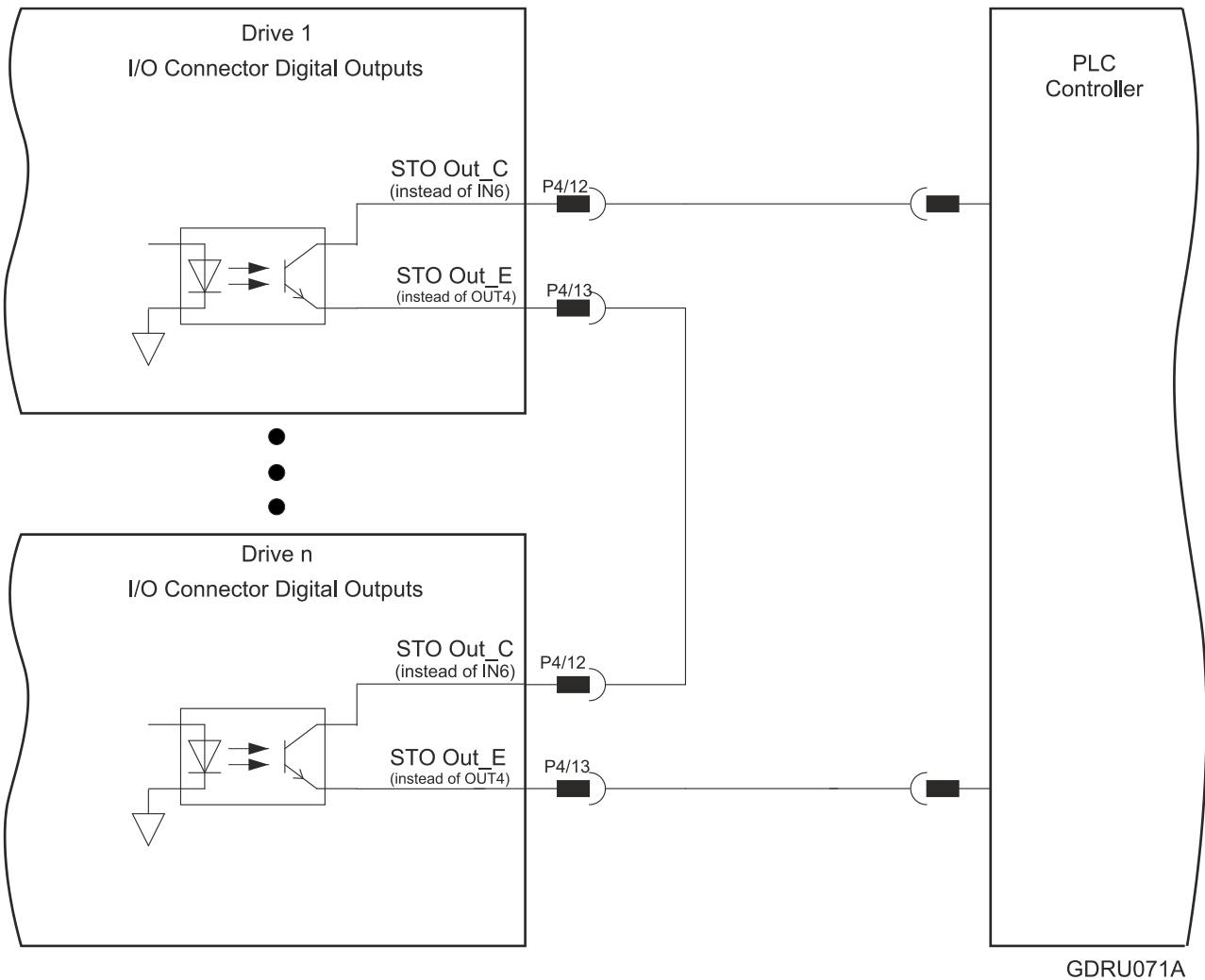


Figure 29: STO Output



## 9.11. Digital Inputs and Outputs

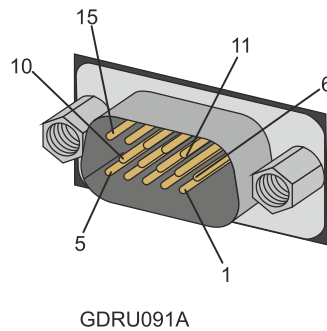
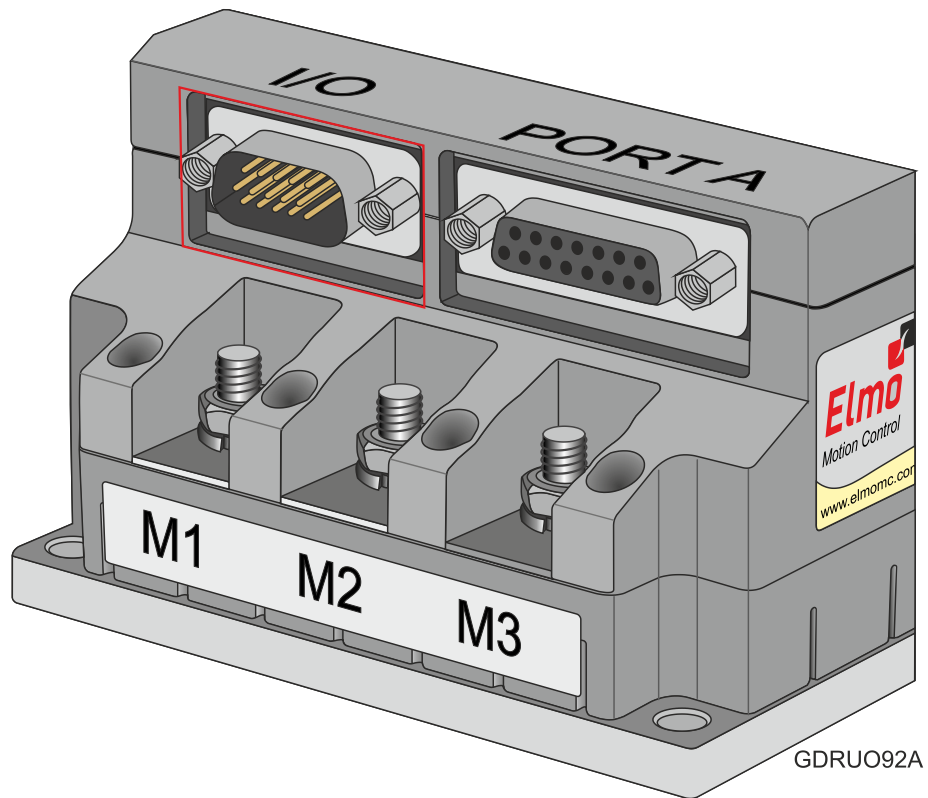
The Gold Drum Port C connector is a D-Type connector with 15 high density male pins. Refer to Chapter 11 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

The following table lists the digital input pin assignments.

I/O Pins (P4)	Signal	Function
1	IN1	High Speed, programmable input 1 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
2	IN2	High Speed, programmable input 2 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
7	IN3	High Speed, programmable input 3 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
8	IN4	High Speed, programmable input 4 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
11	IN5	High Speed, programmable input 5 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
12	IN6 / STO_OUT_C	High Speed, programmable input 6 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input) or STO OUT Collector
6	INRET1-6	Programmable inputs 1 to 6 return for the standard 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 / STO_OUT_E	Programmable output 4 or STO Output Or STO OUT Emitter
10, 15	VDD	Supply for out 1-4
9, 14	VDDRET	Supply return for out 1-4



## Pin Position



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

**Table 7: I/O Pin Assignments**



### 9.11.1. 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.

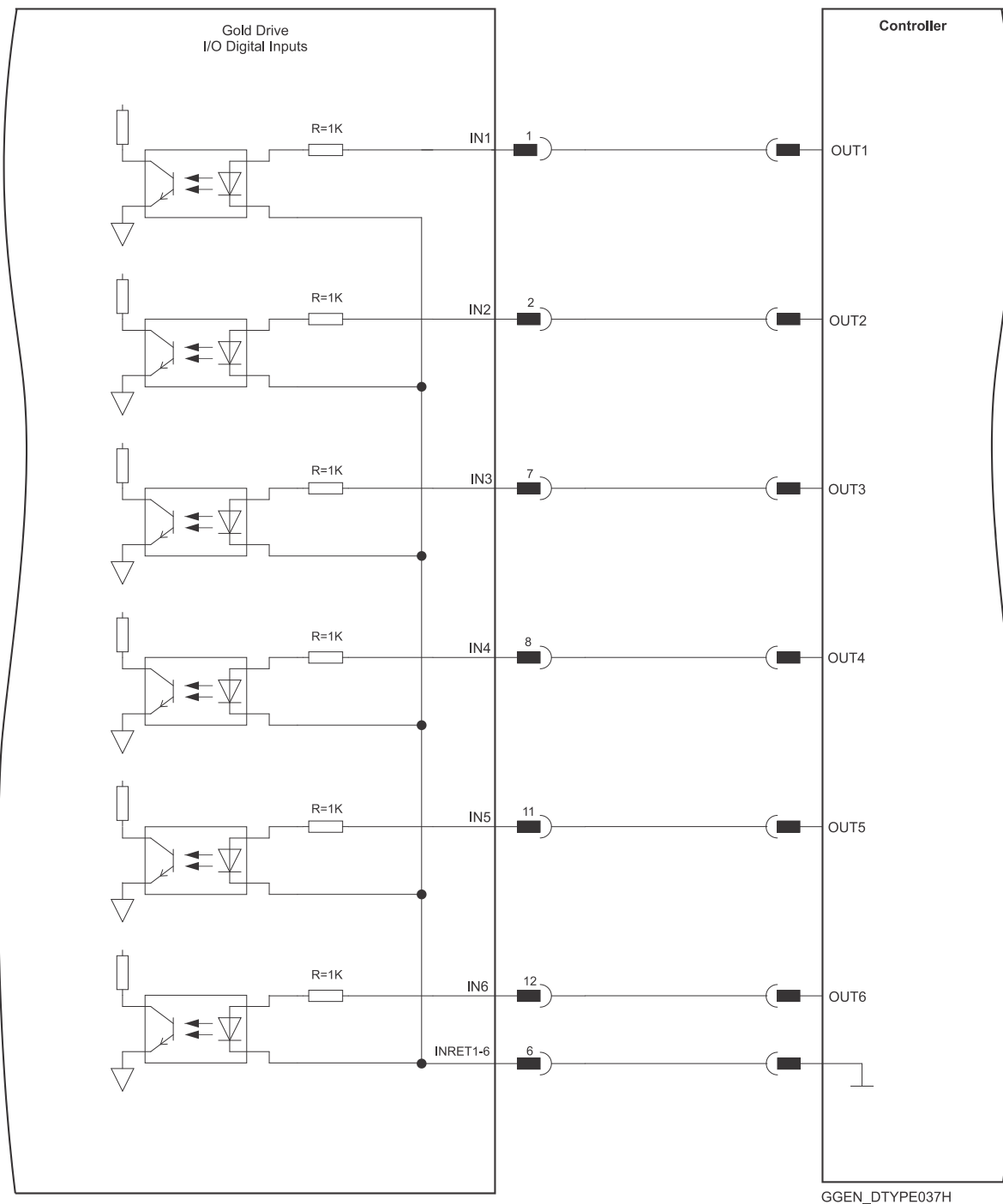
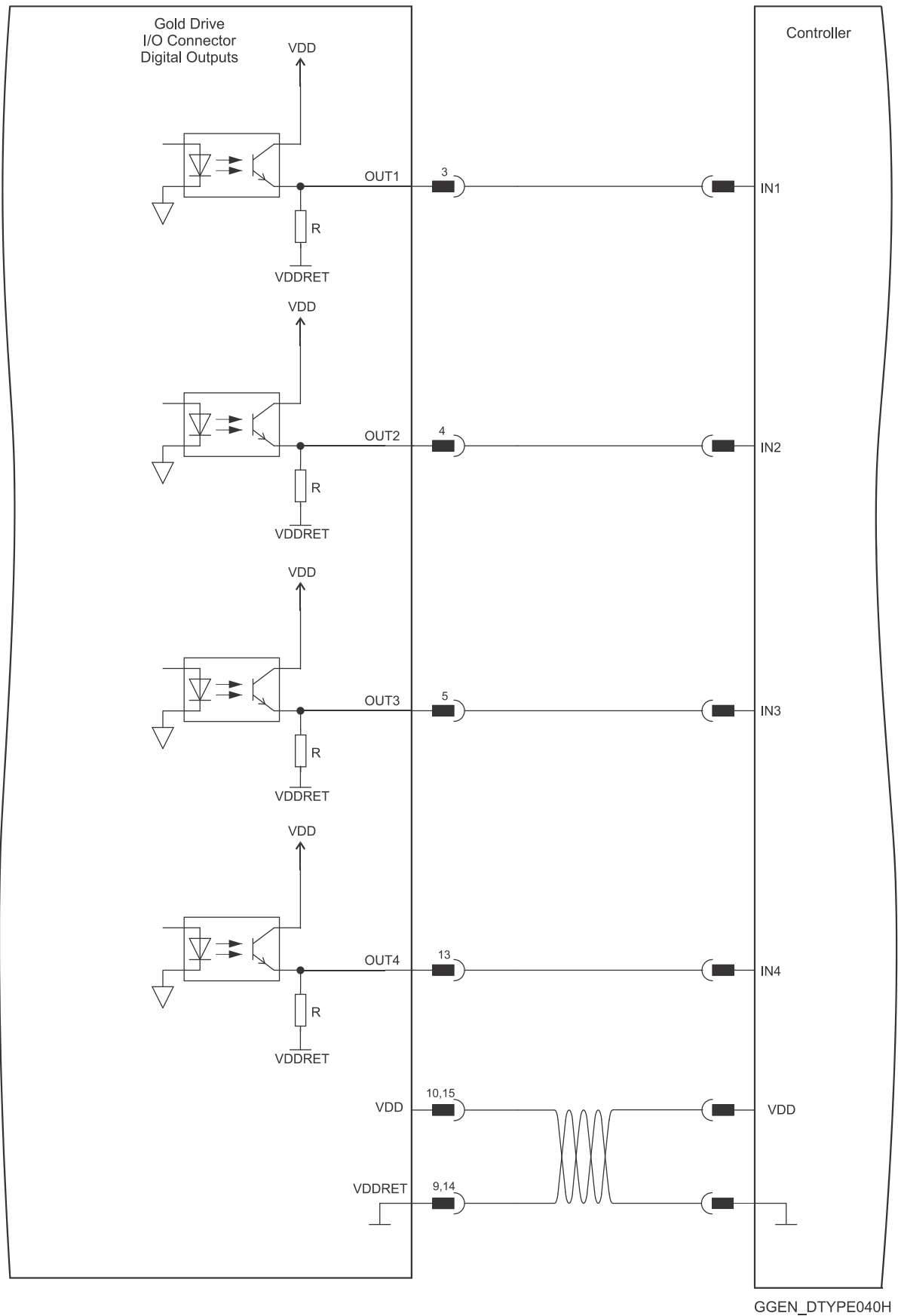


Figure 30: Digital Input TTL Mode D-Type Connection Diagram





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



### 9.11.2. 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.

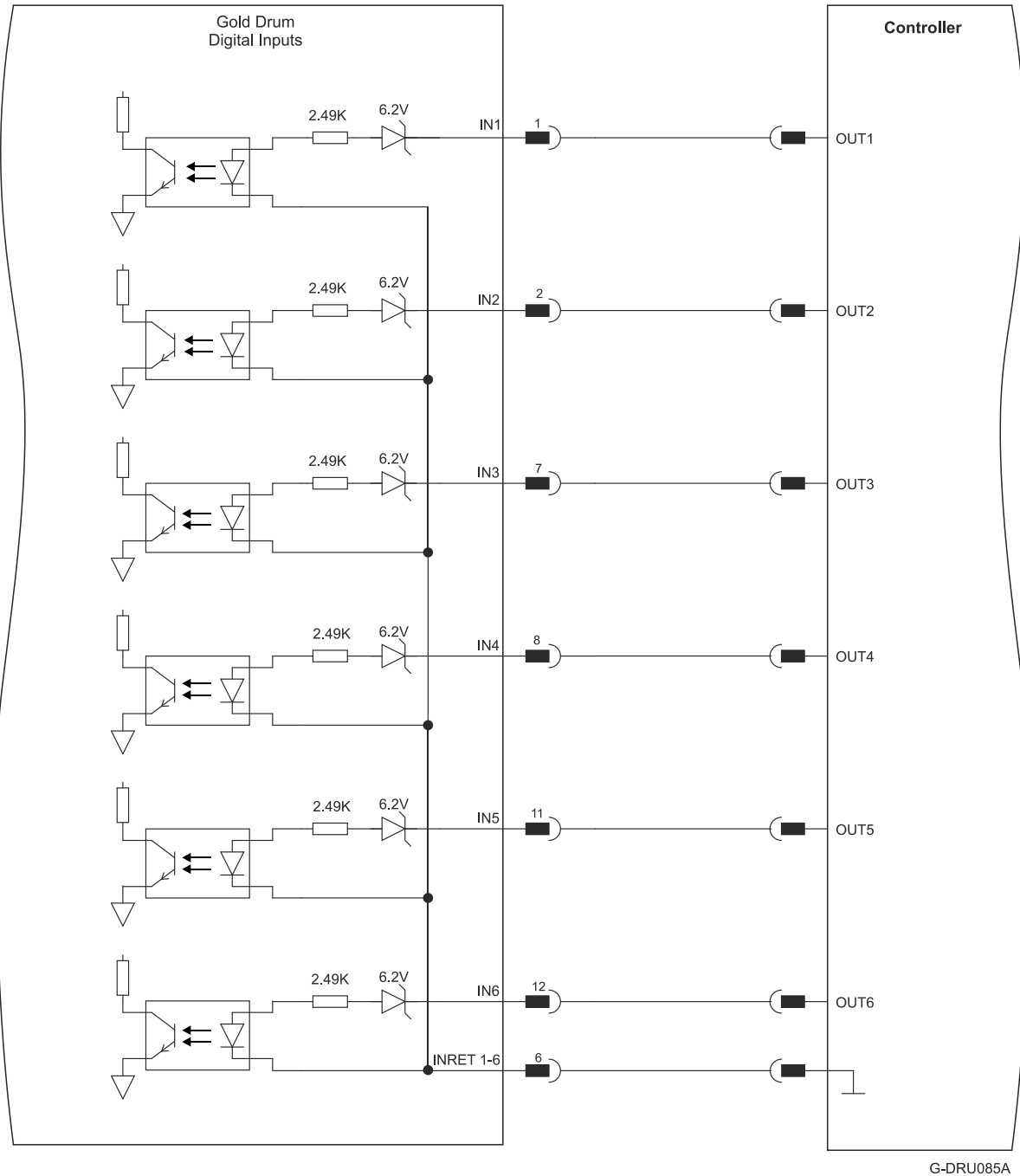


Figure 32: Digital Input D-Type Connection Diagram – Source PLC Option

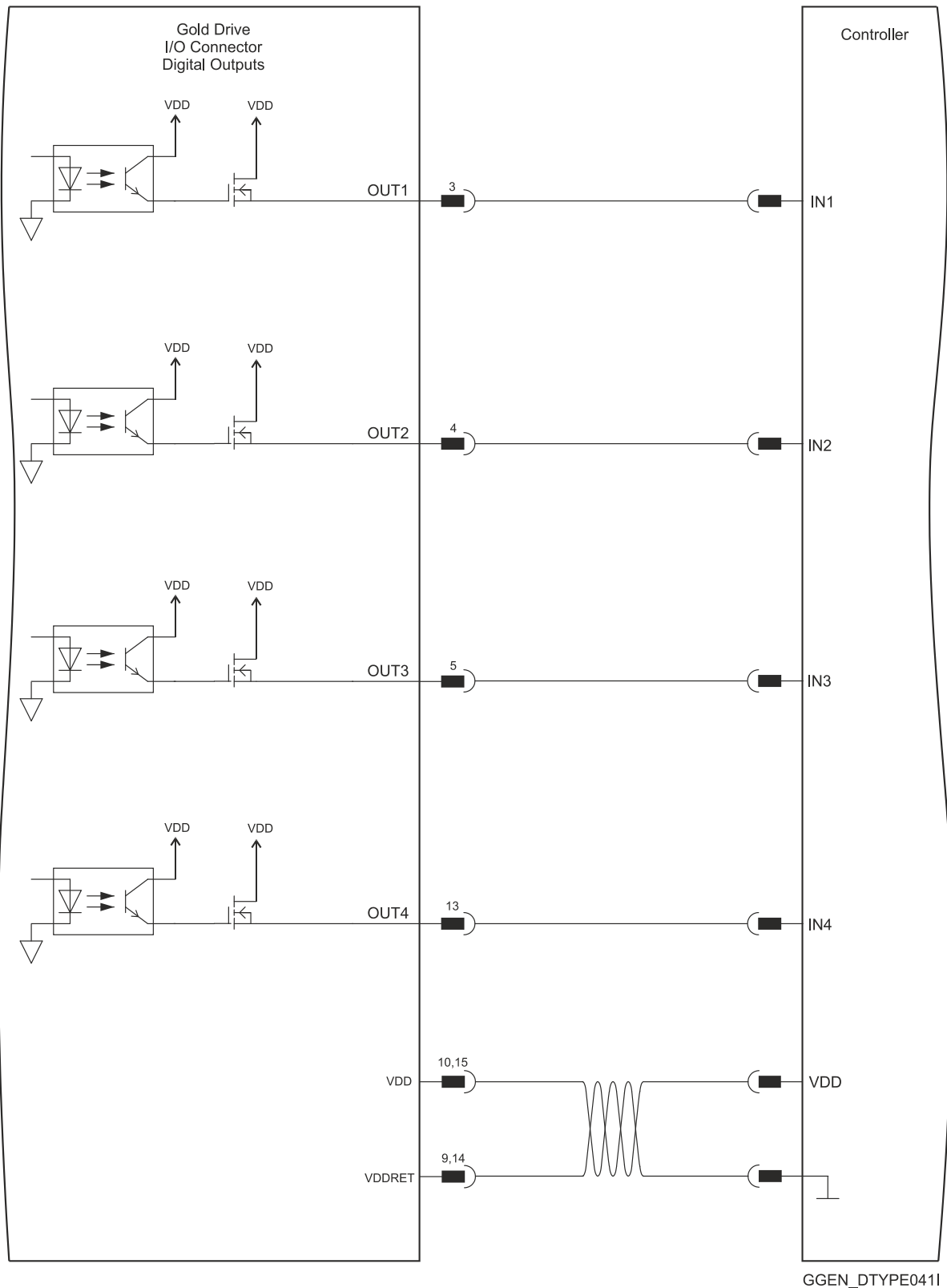


Figure 33: Digital Output D-Type Connection Diagram – Source PLC Option



### 9.11.3. 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.

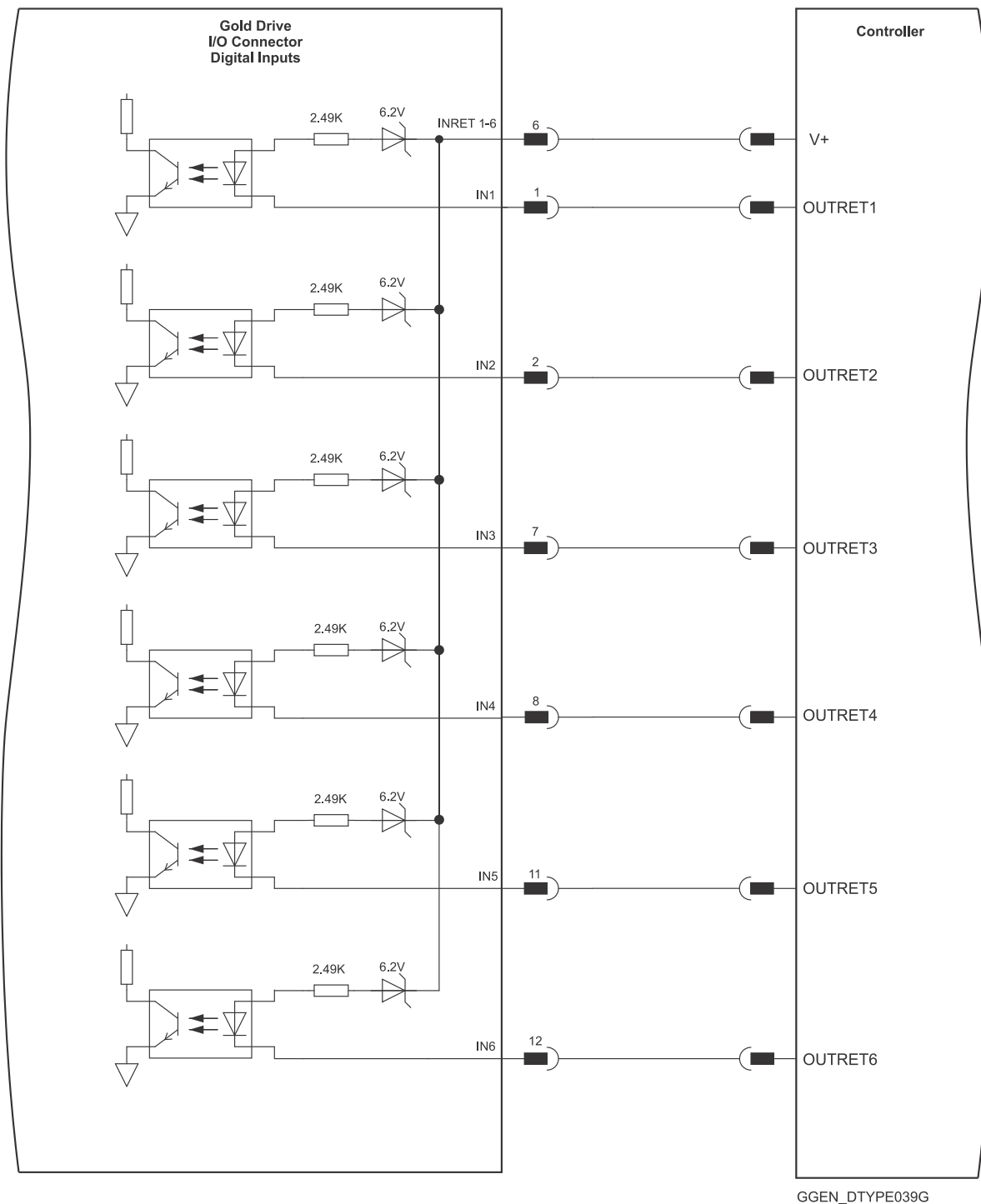
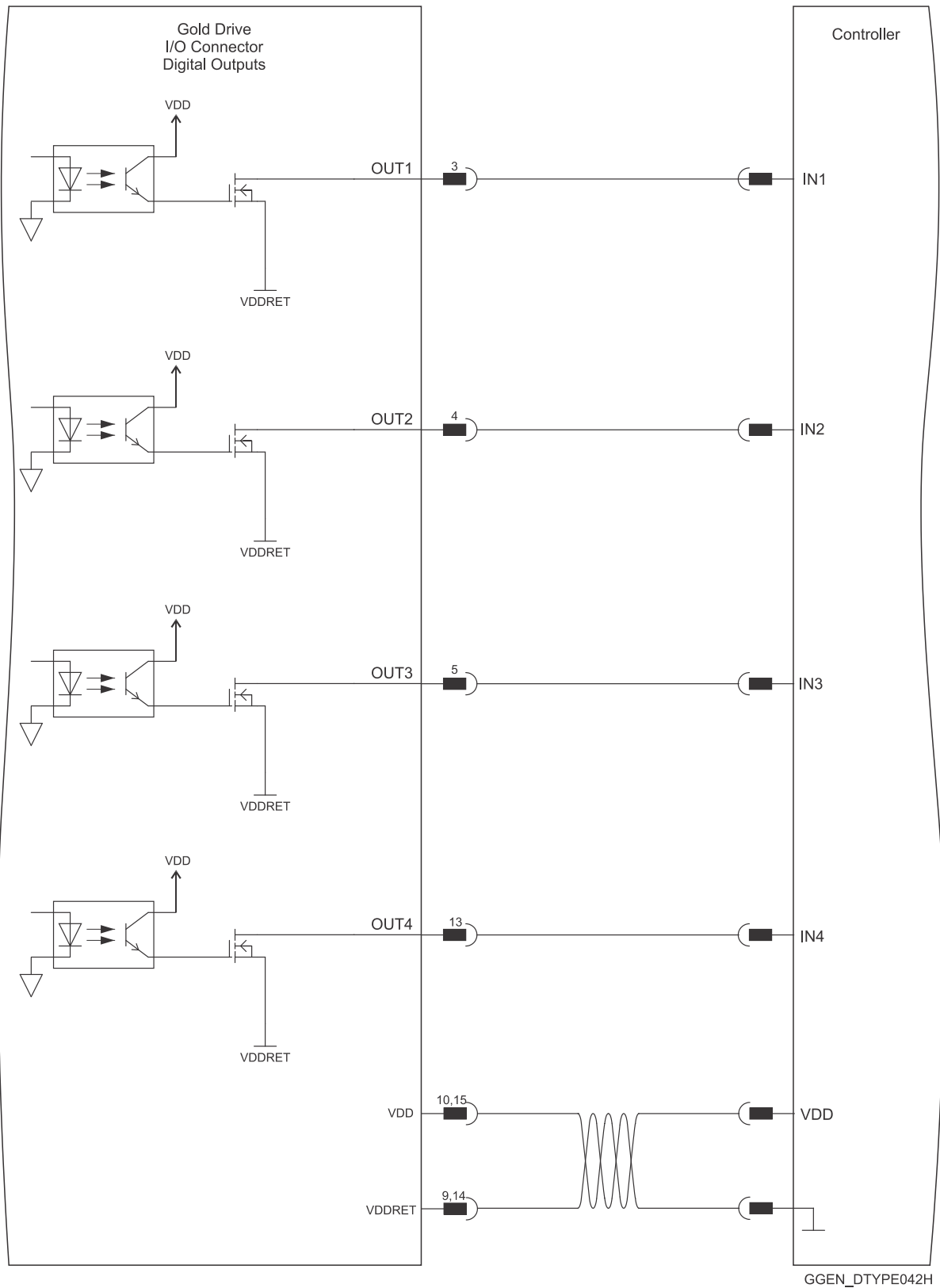


Figure 34: Digital Input Sink Mode – PLC voltage level D-Type Connection Diagram



**Figure 35: Digital Output as Sink Configuration D-Type Connection Diagram**



## 9.12. USB

See Section 12.1 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
4	N/A	N/A
5	USB COMRET	USB communication return

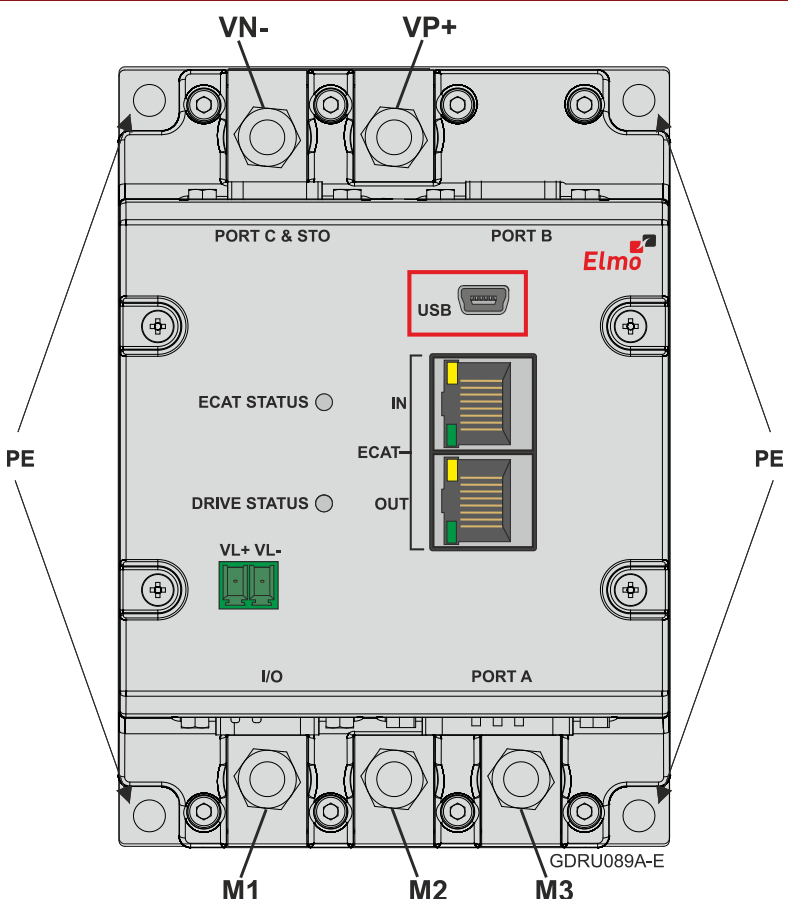
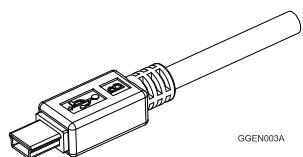
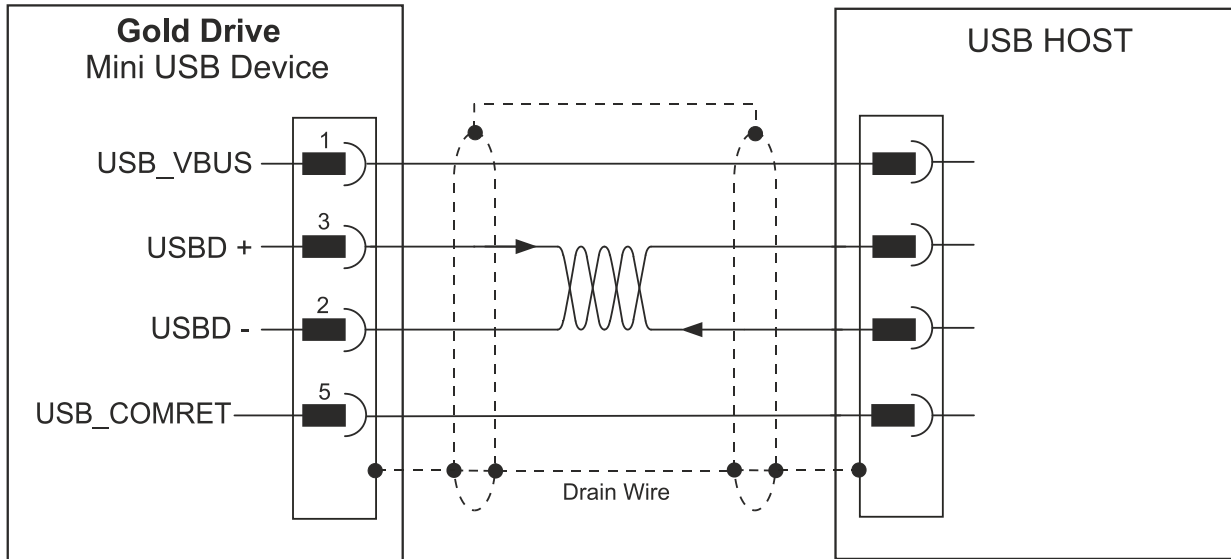
Pin Position	
	 GGEN003A <b>USB Device Mini B Plug</b>

Table 8: USB 2.0 Pin Assignments



G-DRU084A

Figure 36: USB Network Diagram



## 9.13. EtherCAT Communications Version

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

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

### 9.13.1. EtherCAT IN/Ethernet

Pin on EtherCAT IN	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	

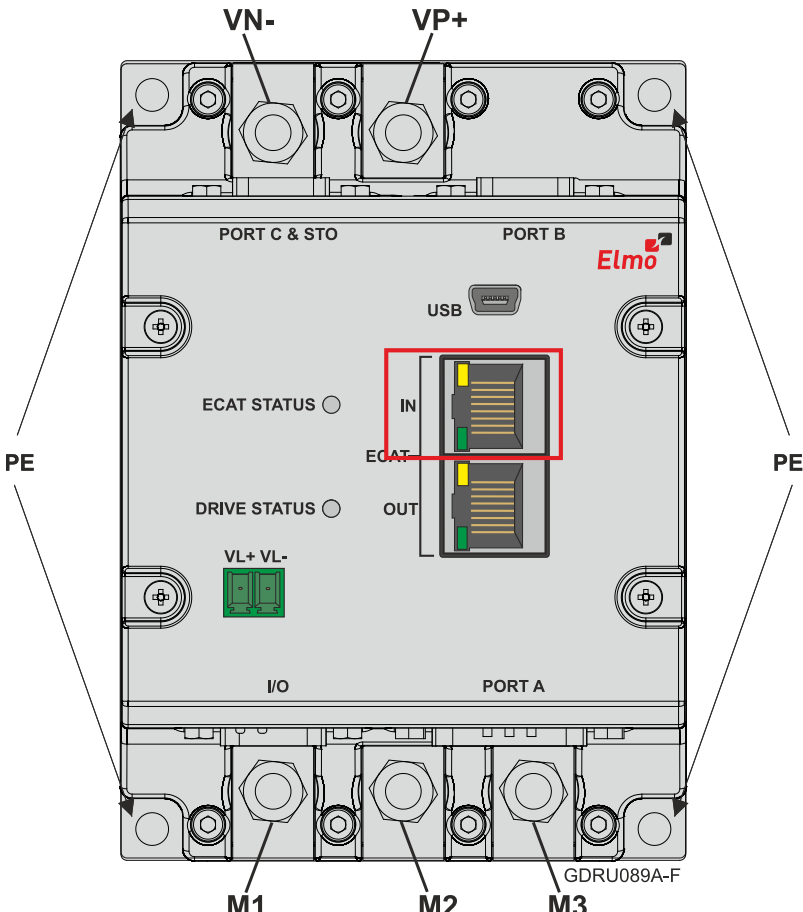
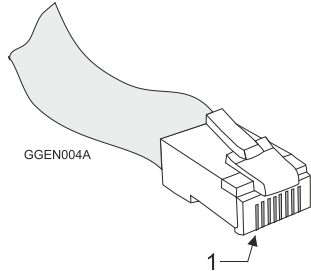
Pin Position	
	 <p>Standard CAT5e Ethernet Cable</p>

Table 9: EtherCAT In Connector Pin Assignments





### 9.13.2. EtherCAT OUT

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 Position

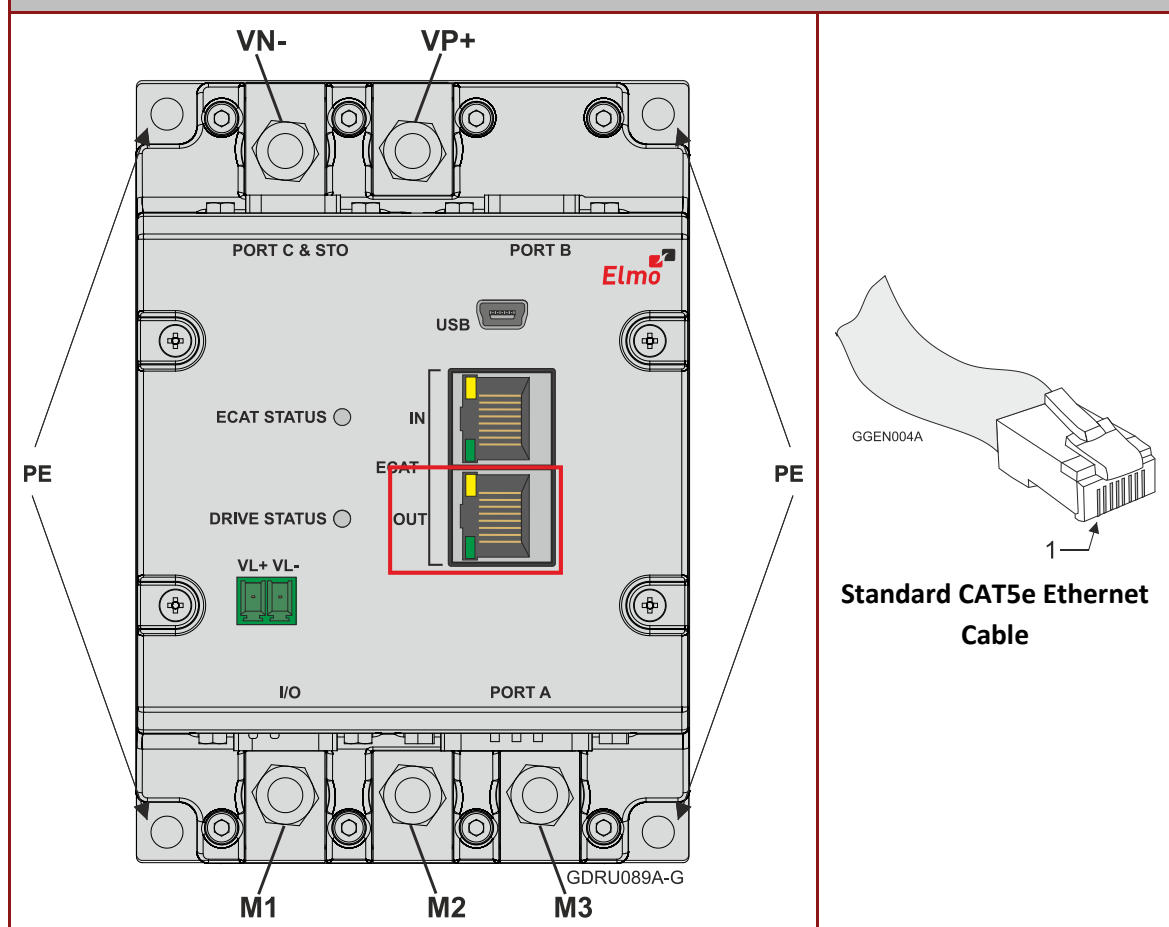


Table 10: EtherCAT Out Connector Pin Assignments



### 9.13.3. EtherCAT Wiring

Figure 37 describes the wiring diagram for the EtherCAT connections.

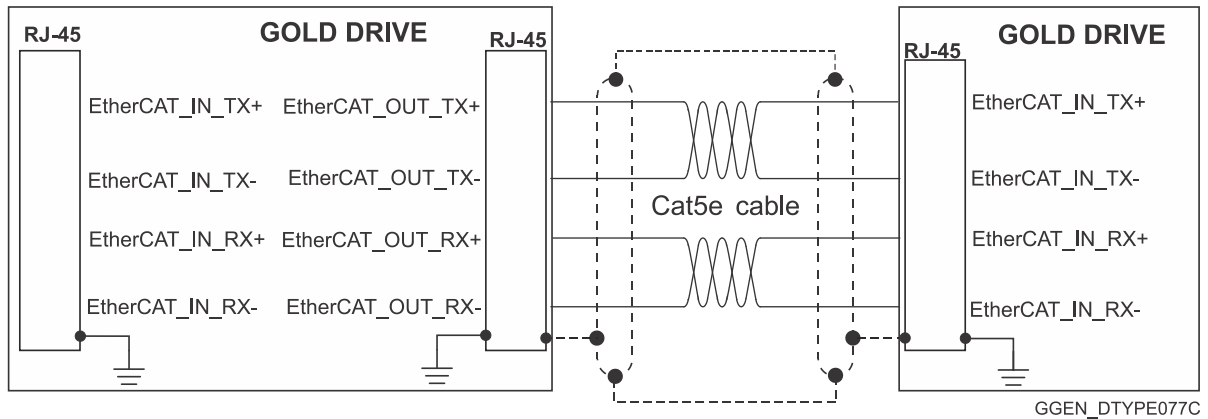


Figure 37: EtherCAT RJ-45 Connections

### 9.13.4. EtherCAT Status Indicator

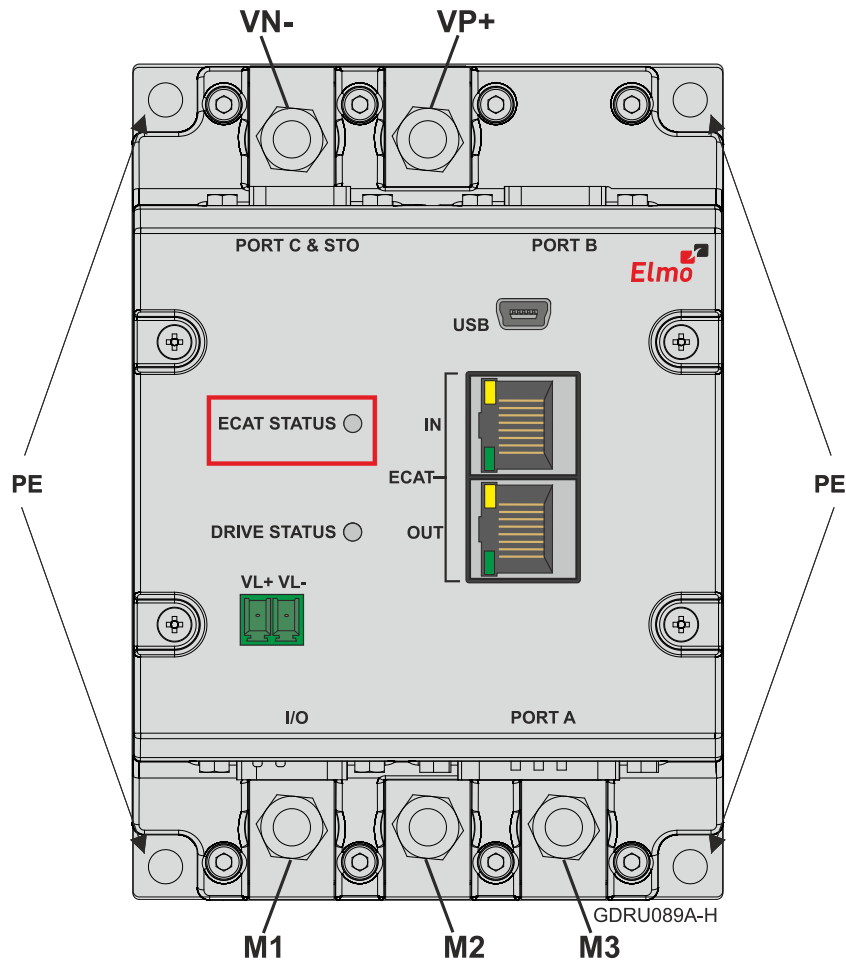


Figure 38: Drive Status LEDs

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.



## 9.14. CAN Communications Version

Fieldbus communications are industrial network protocols for real-time distributed control that allows connection of servo drives. See Section 12.4 in the MAN-G-Panel Mounted Drives Hardware manual for the electrical diagram.

Pin	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 Position

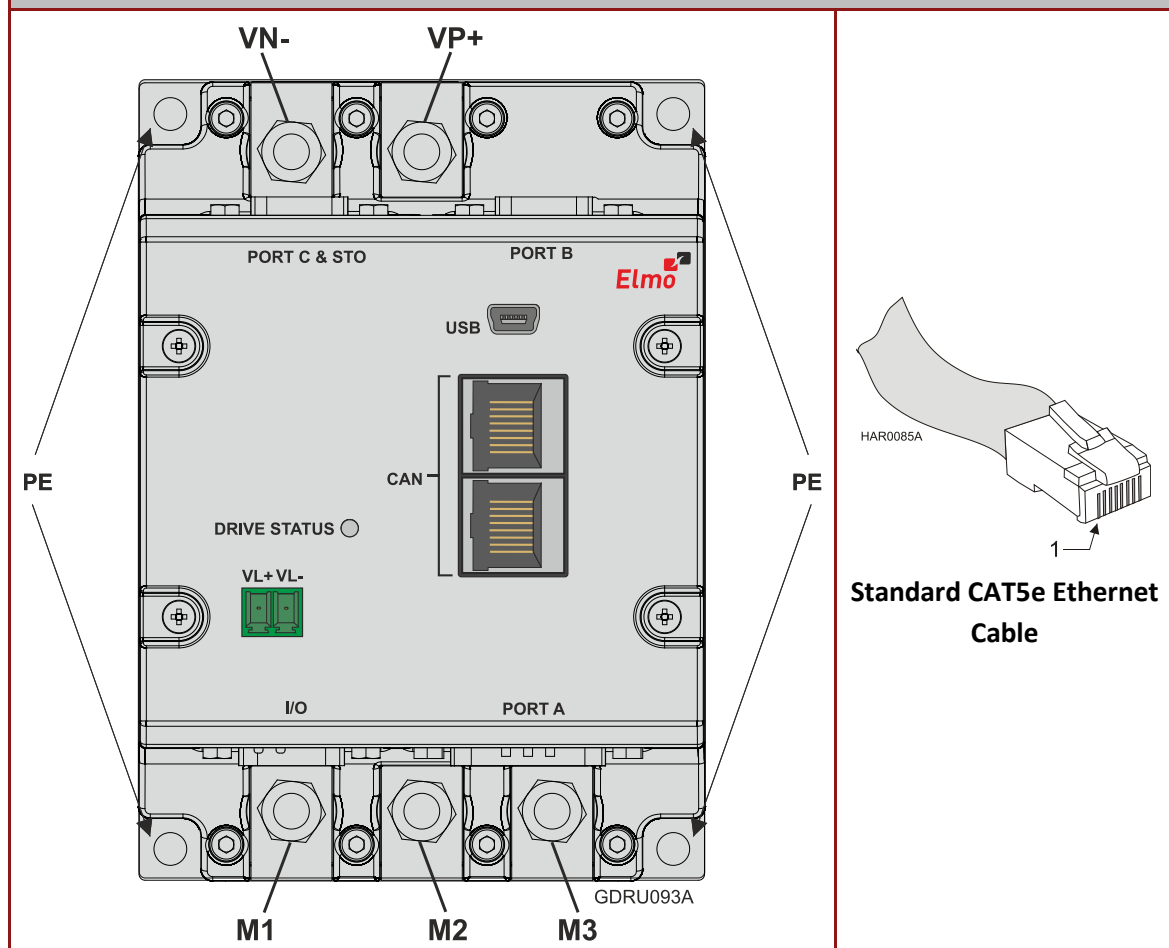
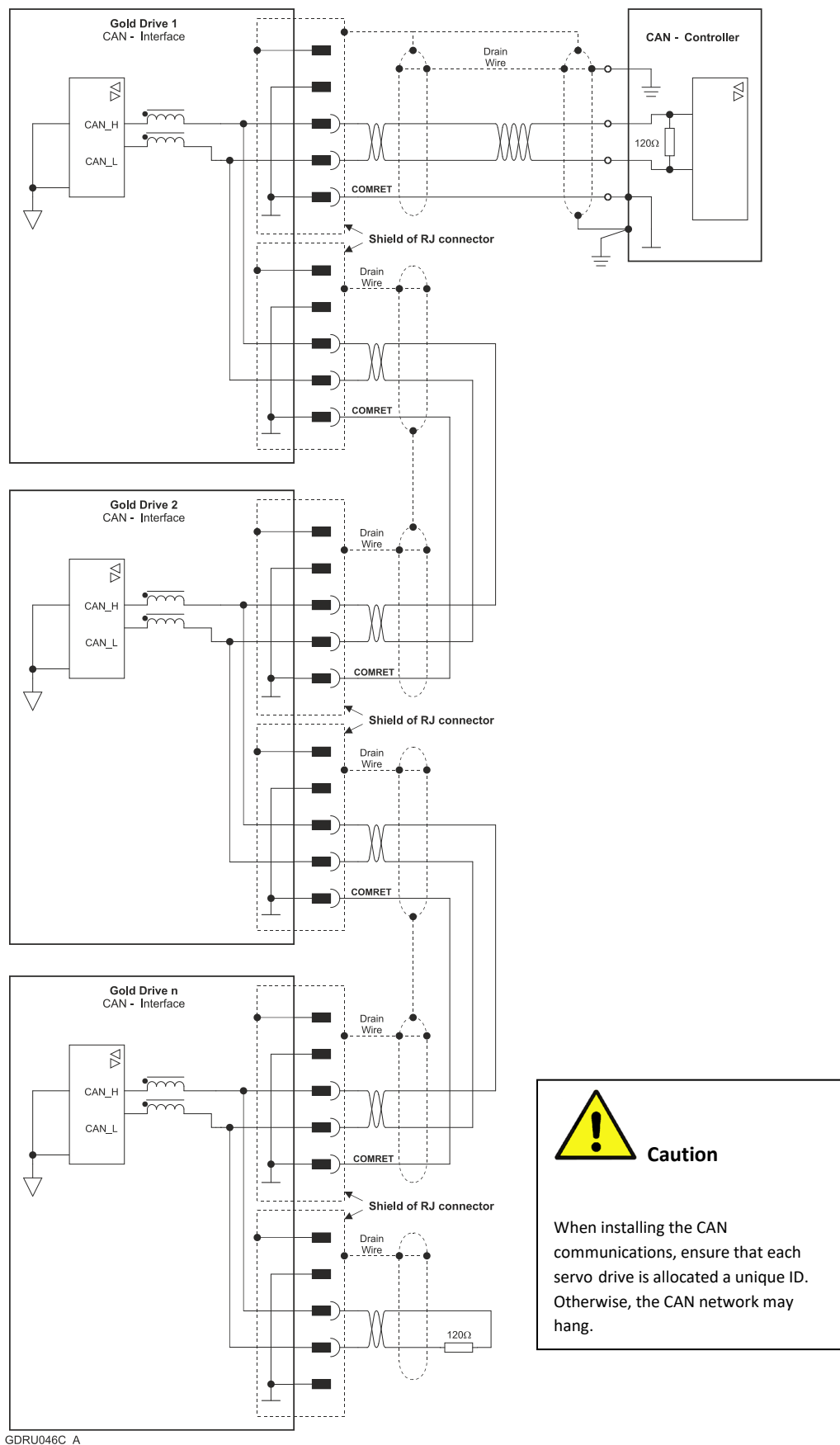


Table 11: CAN Connectors Pin Assignments

### 9.14.1. CAN Wiring

Figure 39 describes the CAN wiring diagram below.



**Figure 39: Gold Drum Connection Diagram – CAN**



## Chapter 10: Powering Up

After the Gold Drum 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.

### 10.1. Initializing the System

After the Gold Drum 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 11: Heat Dissipation***

For full power output capability the Drum 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 Drum 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 Drum's heat sink and any other assembly.

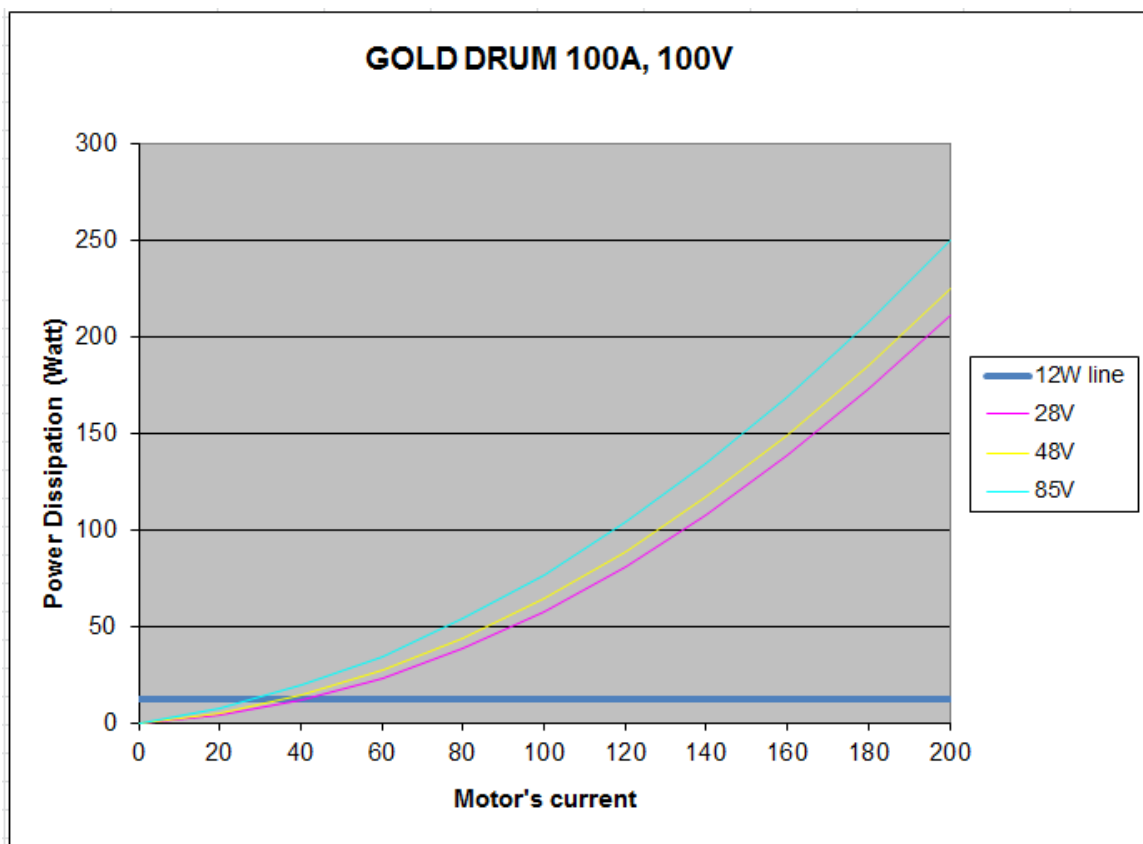
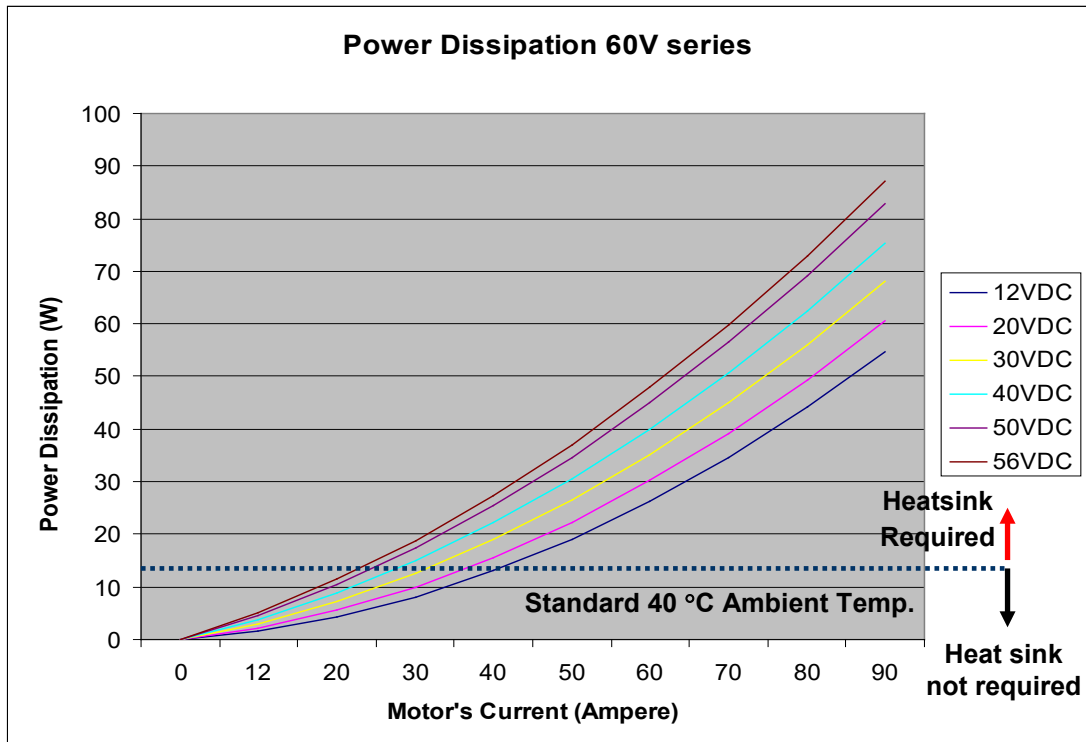
### **11.1. Drum Thermal Data**

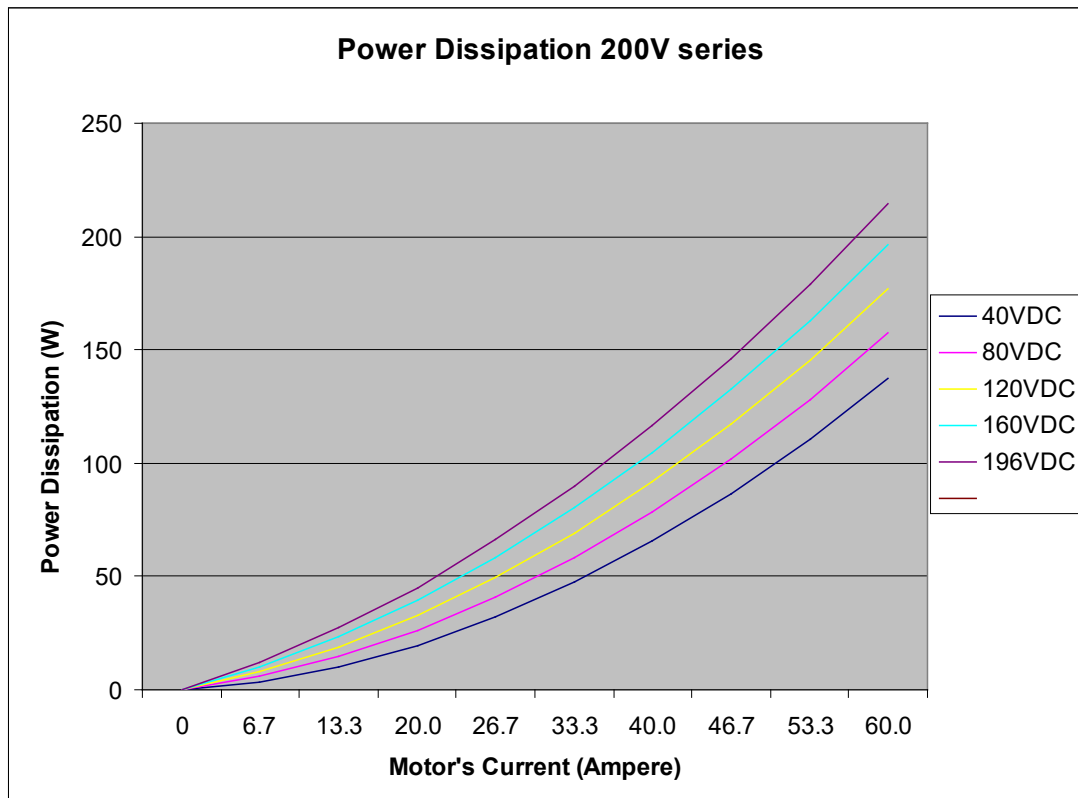
- Free air convection thermal resistance ( $\theta$ ): Approximately 3.6 to 4 °C/W.
- Thermal time constant: Approximately 40 minutes/ 2400 seconds (thermal time constant means that the Drum will reach 2/3 of its final temperature after 4 minutes).
- Self-heat dissipation capability (no external heat-sink): 12 W for 40 °C/W temperature rise.
- Shut-off temperature: 86 °C to 88 °C (measured on the heat sink).
- The thermal resistance when connecting to an external heat sink:
  - The surface of the external heat-sink is 50  $\mu\text{m}$ : 0.18 °C/W.
  - Thermal conductive compound. By proper Smearing of the surface a significant improvement of the thermal resistance is achieved: 0.13 °C/W



## 11.2. Heat Dissipation Data

Heat Dissipation is shown in graphically below:





### 11.3. 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).
4. Determine the ambient operating temperature of the Drum as  $\leq 40$  °C.
5. Calculate the allowable temperature increase according to the following example: For an ambient temperature of 40 °C,  $\Delta T = 80$  °C to 40 °C = 40 °C
6. 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.
7. If the dissipated power is below 12W the Drum needs no additional cooling.

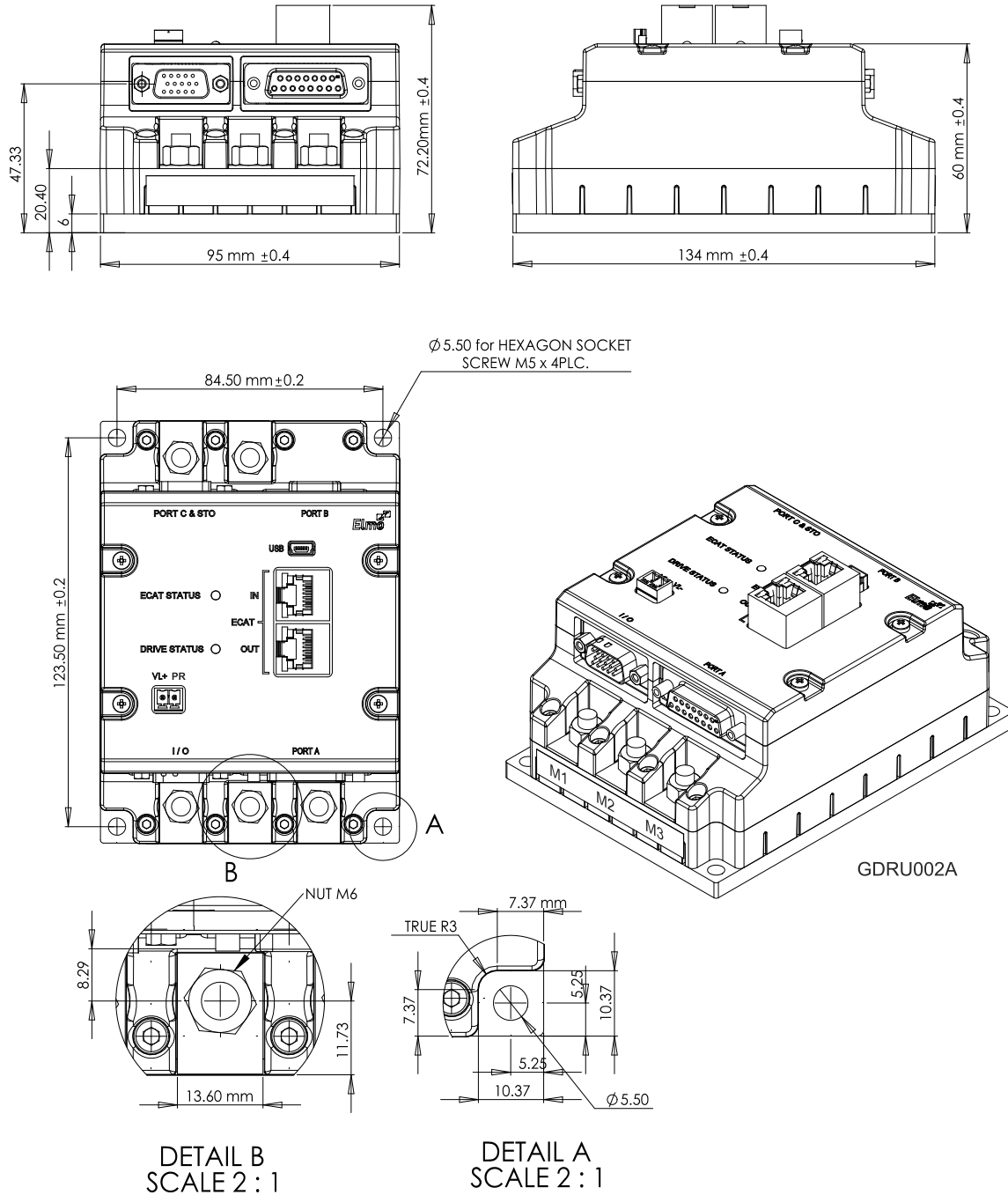
**Note:** The chart above shows that no heat sink is necessary when the heat sink temperature is 80 °C, ambient temperature is 40 °C and heat dissipated is 12 W.





## Chapter 12: Gold Drum Dimensions

This chapter provides detailed technical information regarding the Gold Drum.



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