

Gold Drum (D-Sub Connectors) Digital Servo Drive Installation Guide EtherCAT and CAN



Notice

This guide is delivered subject to the following conditions and restrictions:

- This guide contains proprietary information belonging to Elmo Motion Control Ltd. Such information is supplied solely for the purpose of assisting users of the Gold Drum servo drive in its installation.
- The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice.
- Information in this document is subject to change without notice.

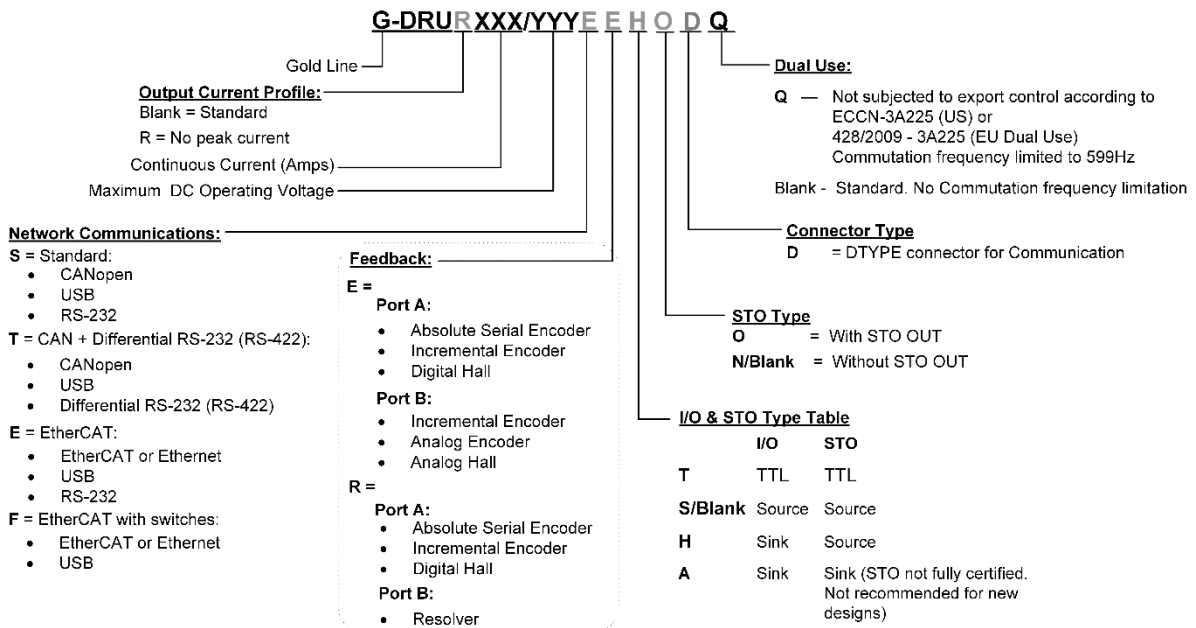
Document no. MAN-G-DRUM(DTYPE)IG-EC (Ver. 1.411)

Copyright © 2021

Elmo Motion Control Ltd.

All rights reserved.

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.
Ver. 1.401	Feb 2015	Small changes to sections 4.2 and 2.4
Ver. 1.402	July 2015	Changes to Part Number
Ver. 1.403	Aug 2015	Changes to technical specifications
Ver. 1.404	Nov 2015	Added R150/100 to section Technical Data up to 100V
Ver. 1.405	Jun 2016	Update with small changes
Ver. 1.406	Aug 2017	Update to Warranty, and label
Ver. 1.407	Nov 2017	Update G-DRU 18/400 Power data in section 4.3
Ver. 1.408	Dec 2017	Corrected height of Gold Drum in section 4.1
Ver. 1.409	Jun 2019	Small correction to PN to enlargen diagram.
Ver. 1.410	Dec 2020	General Minor Updates
Ver. 1.411	Sept 2021	Minor Update



- Chapter 1: This Installation Guide 6**
- Chapter 2: Safety Information 6**
 - 2.1. Warnings 7
 - 2.2. Cautions..... 7
 - 2.3. CE Marking Conformance..... 7
 - 2.4. Warranty Information 7
- Chapter 3: Product Description..... 8**
- Chapter 4: Technical Information..... 9**
 - 4.1. Physical Specifications..... 9
 - 4.2. Technical Data Up to 100V 9
 - 4.3. Technical Data from 200V 10
 - 4.4. VL Logic Supply 10
 - 4.5. Product Features 11
 - 4.6. Environmental Conditions 12
 - 4.6.1. Gold Line 12
 - 4.7. Gold Line Standards and Certifications 13
 - 4.7.1. Dual Use..... 13
- Chapter 5: Unpacking the Drive Components 14**
- Chapter 6: Gold Drum with D-Type Connectors and Indicators 15**
 - 6.1. Connector Types..... 15
- Chapter 7: Mounting the Gold Drum..... 17**
- Chapter 8: Gold Drum Connection Diagrams 18**
- Chapter 9: Wiring..... 20**
 - 9.1. Introduction..... 20
 - 9.2. Basic Recommendations 22
 - 9.2.1. General 22
 - 9.2.2. Feedback Cable Port A and Port B Connector 23
 - 9.2.3. Feedback Cable Port C Connector 24
 - 9.2.4. IO Cable Connector..... 24
 - 9.2.5. STO (Port C) Cable Connector..... 25
 - 9.3. Motor Power Connector Pinouts 26
 - 9.4. Main Power Input and Motor Connections..... 28
 - 9.5. Connecting the DC Power and the Motor Power Cables 29
 - 9.6. Main Power 30
 - 9.6.1. Power Supply Connections 30
 - 9.6.1.1. Gold Drum Power Supply Connections 31
 - 9.6.1.2. Multiple Connections Topology..... 31
 - 9.7. VL Logic Supply(P2)..... 32
 - 9.7.1. VL Logic Supply(P2)..... 32

9.8.	Drive Status Indicator	33
9.9.	Port A and Port B (P1).....	34
9.9.1.	Incremental Encoder(P1).....	36
9.9.2.	Hall Sensor(P1)	36
9.9.3.	Absolute Serial Type Encoder(P1)	37
9.9.4.	Interpolated Analog Encoder(P1).....	39
9.9.5.	Resolver(P1).....	40
9.10.	Port C Connector - Port C, Analog, and STO (P3)	41
9.10.1.	Port C(P3).....	43
9.10.2.	Analog Input(P3).....	43
9.10.3.	STO(P3)	44
	9.10.3.1. Source Mode PLC Voltage Level Input.....	44
	9.10.3.2. TTL Mode TTL Voltage Level Input	44
	9.10.3.3. SINK Mode – PLC Voltage Level Input	45
	9.10.3.4. STO Output(P2).....	46
9.11.	Digital Inputs and Outputs (P2)	47
9.11.1.	Digital Input and Output TTL Mode(P2)	49
9.11.2.	Digital Input and Output PLC Source Mode(P2).....	51
9.11.3.	Digital Input and Output Sink Mode(P2)	53
9.12.	Communications (P4)	55
9.12.1.	USB 2.0(P4)	58
9.12.2.	EtherCAT Communications Version	59
	9.12.2.1. EtherCAT Wiring(P4).....	59
	9.12.2.2. EtherCAT Status Indicator.....	60
	9.12.2.3. EtherCAT Address Switches.....	61
9.12.3.	CAN Communications Version.....	62
	9.12.3.1. CAN Wiring(P4).....	62
9.12.4.	RS-232(P4)	64
9.12.5.	RS-422 (Differential RS-232) Communication(P4).....	65
Chapter 10:	Powering Up	66
10.1.	Initializing the System	66
Chapter 11:	Heat Dissipation	67
11.1.	Gold Drum Thermal Data	67
11.2.	Heat Dissipation Data.....	68
11.3.	How to Use the Charts	69
Chapter 12:	Gold Drum Dimensions.....	70



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 D-Type 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 including; multiple power rating selections, two different communications options, a variety of feedback selections and I/O configuration possibilities.



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 60 (5.28" x 3.74" x 2.36")
Mounting method		Wall/Panel Mount

4.2. Technical Data Up to 100V

Feature	Units	*70/48	*70/60	*R90/60	50/100	*R75/100	100/100	R150/100
Minimum supply voltage	VDC	11	14	14	14	14	14	14
Nominal supply voltage	VDC	42	50	50	50	50	50	50
Maximum supply voltage	VDC	48	59	59	59	59	59	59
Maximum continuous power output	W	2700	3400	4300	4000	6000	8035	12000
Efficiency at rated power (at nominal conditions)	%	> 97						
Max output voltage		97% of DC bus voltage at f=22 kHz						
V _L Logic supply input voltage	VDC	14 to 60						
V _L 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
Sinusoidal continuous RMS current limit (I _c)	A	50	50	63	35	53	71	106
Peak current limit	A	2 x I _c	2 x I _c	No Peak	2 x I _c	No Peak	2 x I _c	No Peak

Table 1: Power Ratings

Note:

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



4.3. Technical Data from 200V

Feature	Units	35/200	R60/200	18/400	R26/400
Minimum supply voltage	VDC	46		50	
Nominal supply voltage	VDC	170		325	
Maximum supply voltage	VDC	195		400	
Maximum continuous power output	W	5600	9600	5600	11500
Efficiency at rated power (at nominal conditions)	%	> 97			
Max output voltage		97% of DC bus voltage at f=22 kHz			
V _L Logic supply input voltage	VDC	14 to 60			
V _L 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	35	60	18	26
Sinusoidal continuous RMS current limit (I _c)	A	25	42	12.7	18.4
Peak current limit	A	2 x I _c	No Peak	2 x I _c	No Peak

Table 2: Power Ratings

4.4. 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.



4.5. Product Features

Main Feature	Details	Presence and No.
STO	TTL	√
	PLC Source	√
	PLC Sink (is not fully certified, and not recommended for new designs)	√
Digital Input Option	TTL	6
	PLC Source	6
	PLC Sink	6
Digital Output Option	TTL	4
	PLC Source	4
	PLC Sink	4
Analog Input	Differential ±10V	1
Feedback	Standard Port A, B, & C	√
Communication Option	USB	√
	EtherCAT with/without switches	√
	CAN	√
	RS-232	√
	Differential RS-232 (RS-422)	√



4.6. Environmental Conditions

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

4.6.1. Gold Line

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



4.7. 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 4.6.1 Gold Line above.	
STO IEC 61800-5-2:2007 SIL 3	Adjustable speed electrical power drive systems – Safety requirements – Functional
EN ISO 13849-1:2008 PL e, Cat 3	Safety of machinery — Safety-related parts of control systems.
Approved IEC/EN 61800-5-1	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
Recognized UL61800-5-1	Adjustable speed electrical power drive systems Safety requirements – Electrical, thermal and energy
Recognized UL 508C	Power Conversion Equipment
In compliance with UL 840	Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment
Conformity with CE 2006/95/EC	Low-voltage directive 2006/95/EC
Recognized CSA C22.2 NO. 14-13	Industrial Control Equipment

4.7.1. Dual Use

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

The operating frequency of the Gold Line products is “factory limited” to ≤ 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

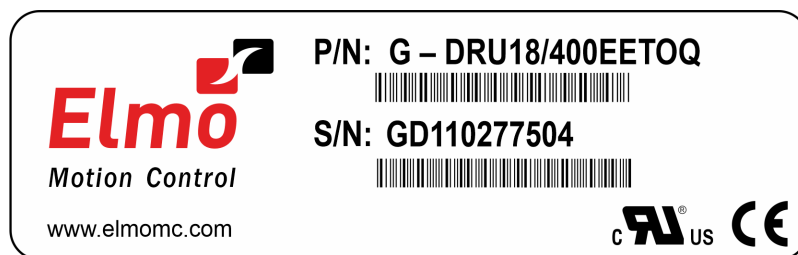
Before you begin working with the Gold Drum, verify that you have all of its components, as follows:

- The Gold Drum servo drive
- The Elmo Application Studio (EASII) 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 D-Type Connectors and Indicators

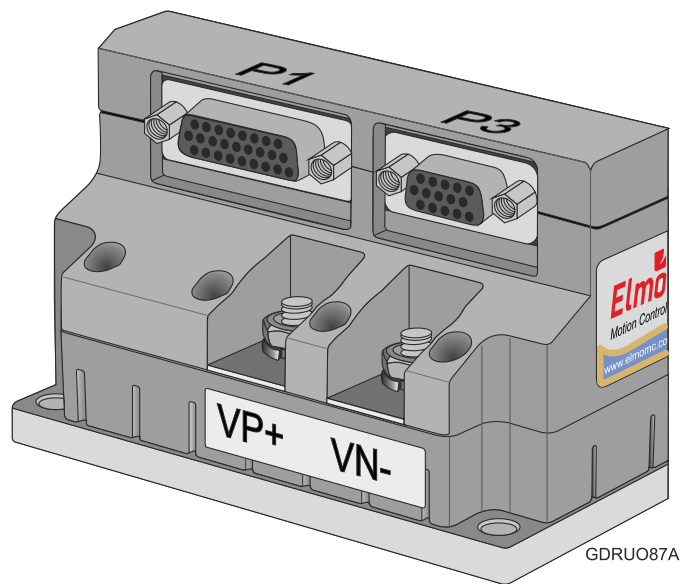
6.1. Connector Types

The Gold Drum with D-Type connectors has four 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	

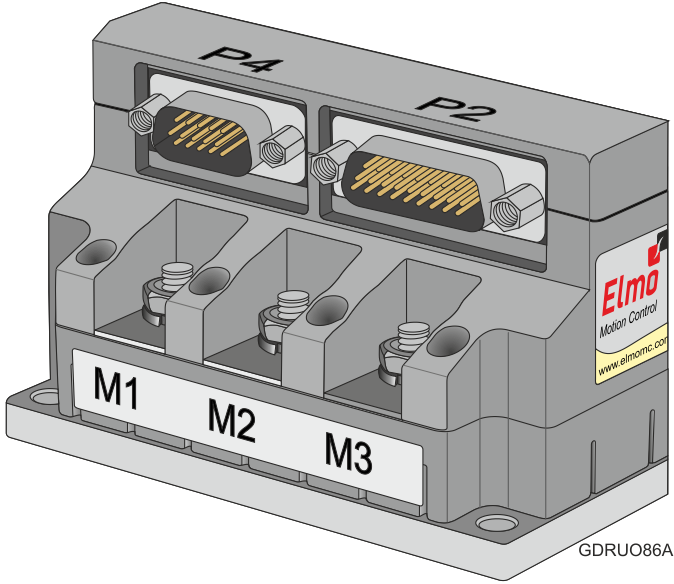
Pins	Name	Type	Function
------	------	------	----------

Rear Connectors



15	P3	D-Type High Density, female	Port C, Analog and STO
26	P1	D-Type High Density, female	Port A and Port B



Pins	Name	Type	Function
Front Connectors			
			
15	P4	D-Type, High Density, male	Communications
26	P2	D-Type, High Density, male	I/Os



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).

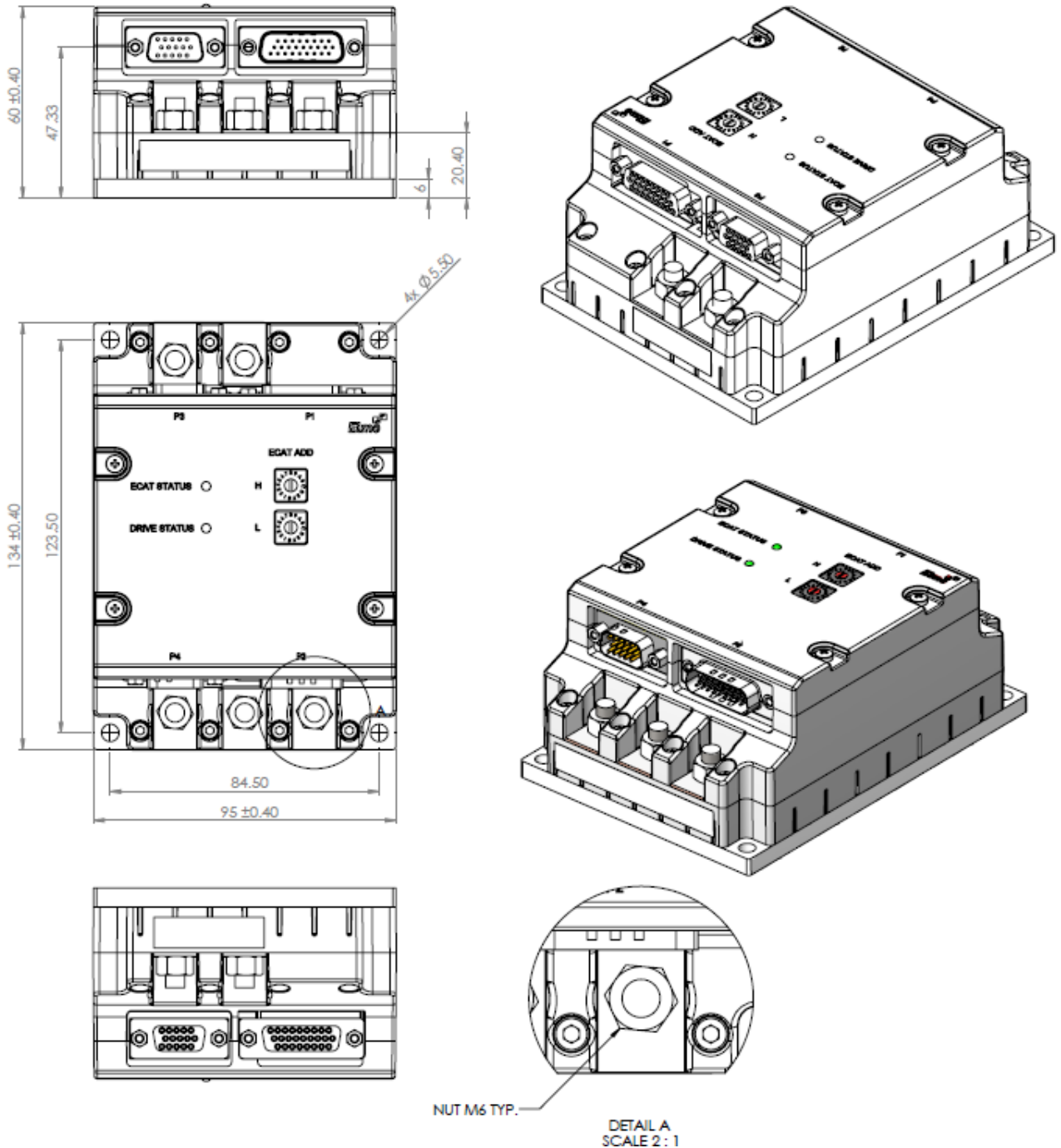
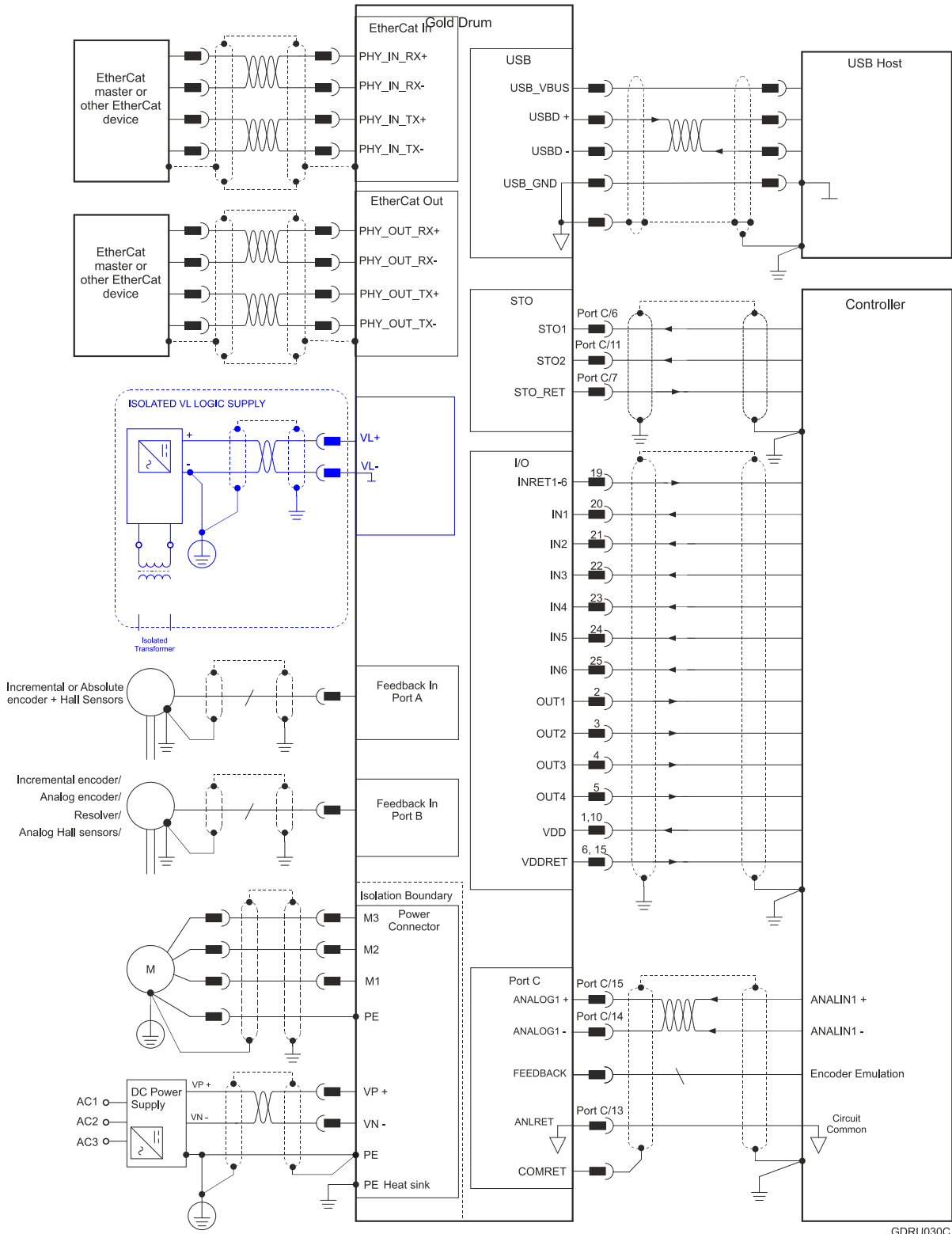


Figure 1: Mounting the Gold Drum with D-Type Connectors



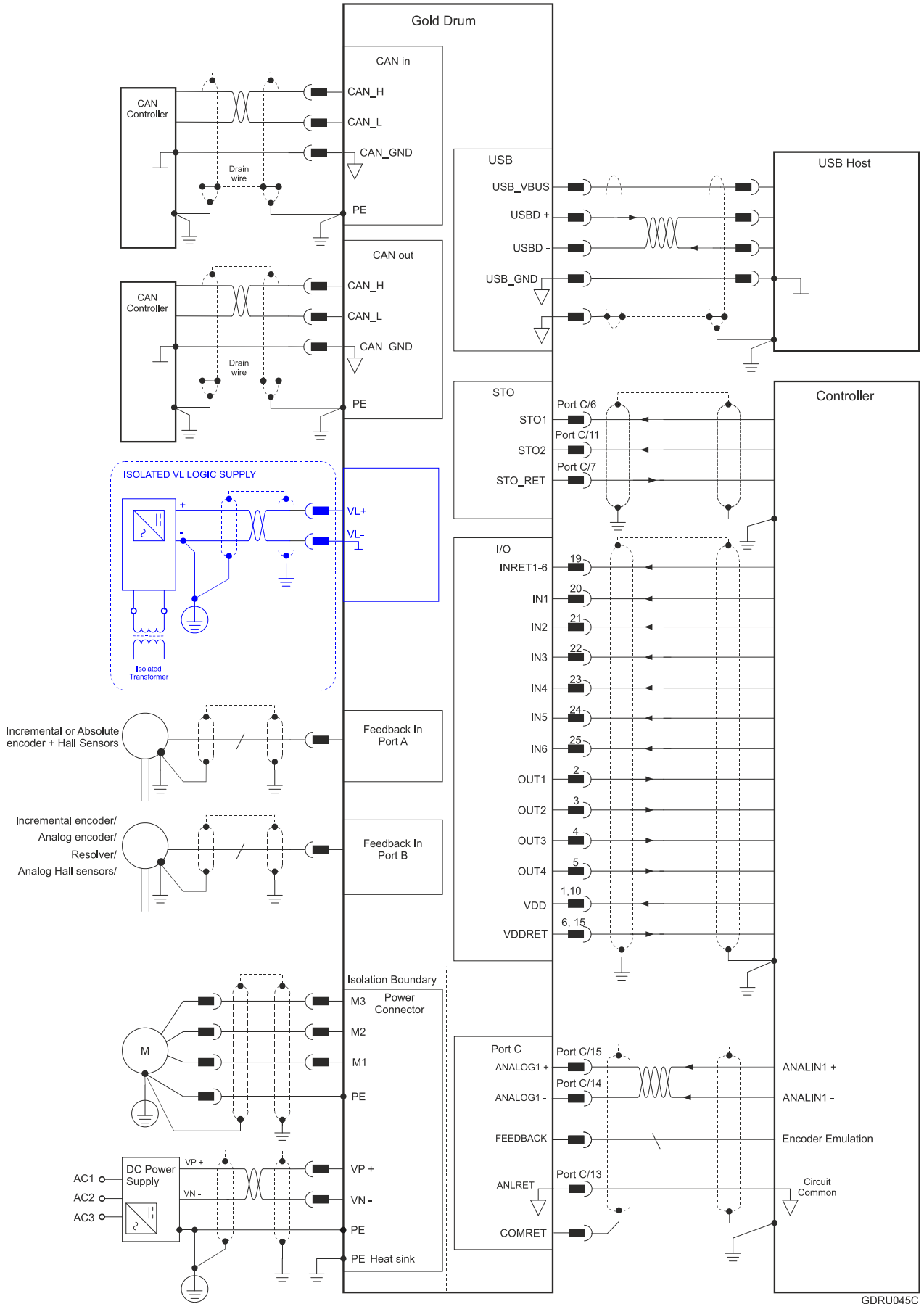
Chapter 8: Gold Drum Connection Diagrams



GDRU030C

Figure 2: Gold Drum Connection Diagram - EtherCAT

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



GDRU045C

Figure 3: Gold Drum Connection Diagram - CAN



Chapter 9: Wiring

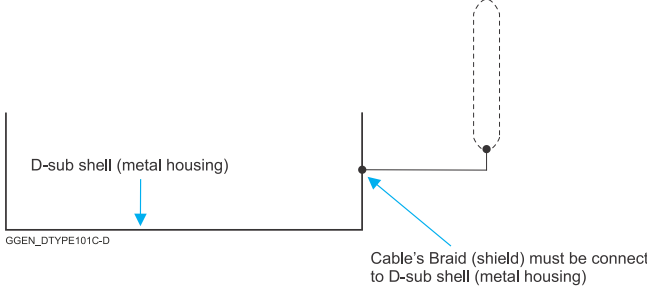
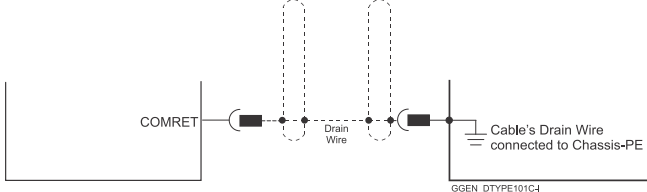
9.1. Introduction

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>GGEN_DTYPE101C-D</p> <p>D-sub shell (metal housing)</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>GGEN_DTYPE101C4</p> <p>COMRET</p> <p>Drain Wire</p> <p>Cable's Drain Wire connected to Chassis-PE</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>



9.2. Basic Recommendations

9.2.1. 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.

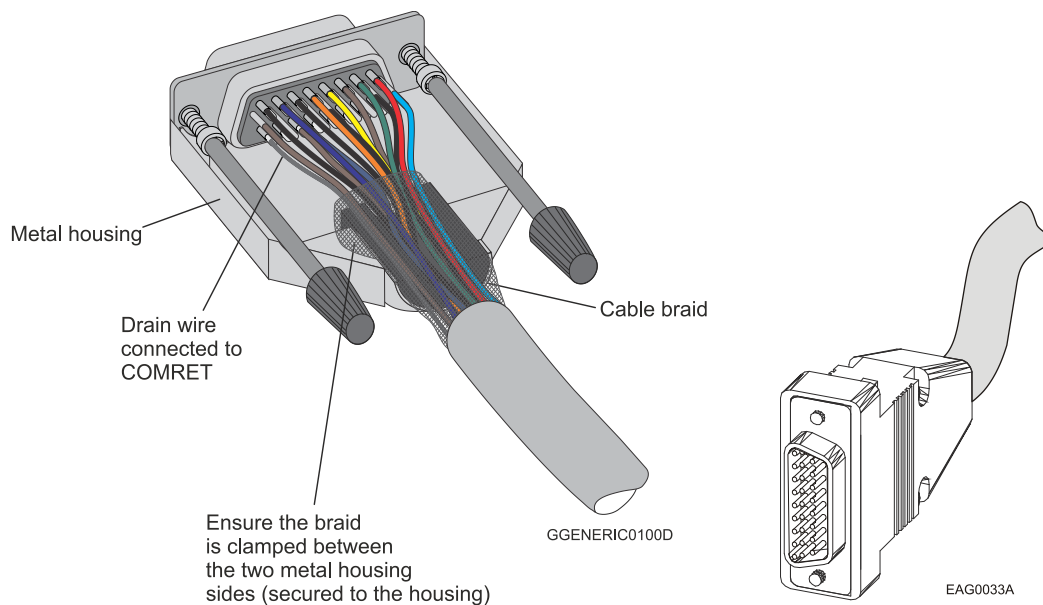


Figure 4: D-Type Cable Assemblies

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).



9.2.2. 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.

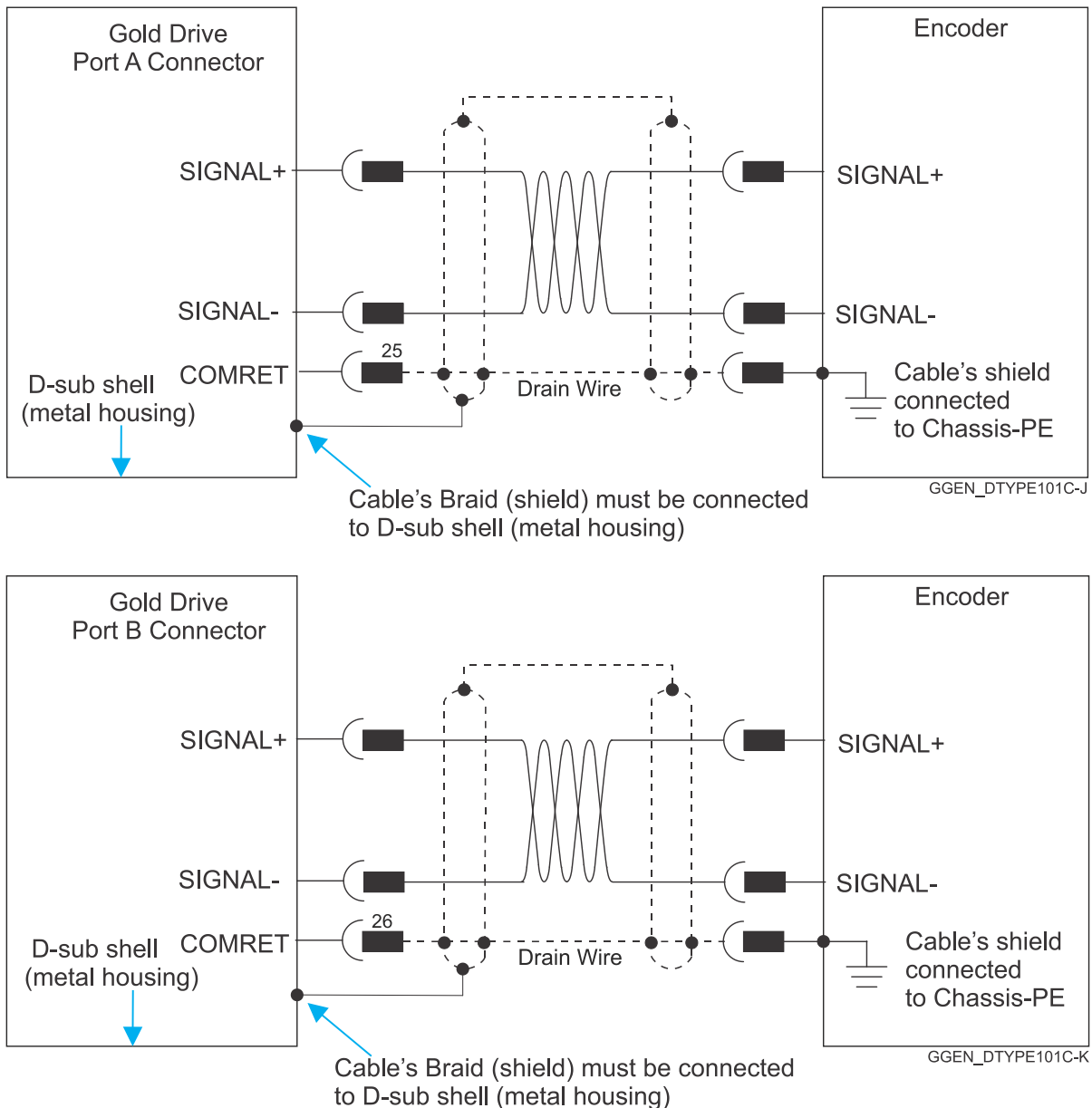


Figure 5: Feedback Port A and B Cable Assemblies



9.2.3. 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.

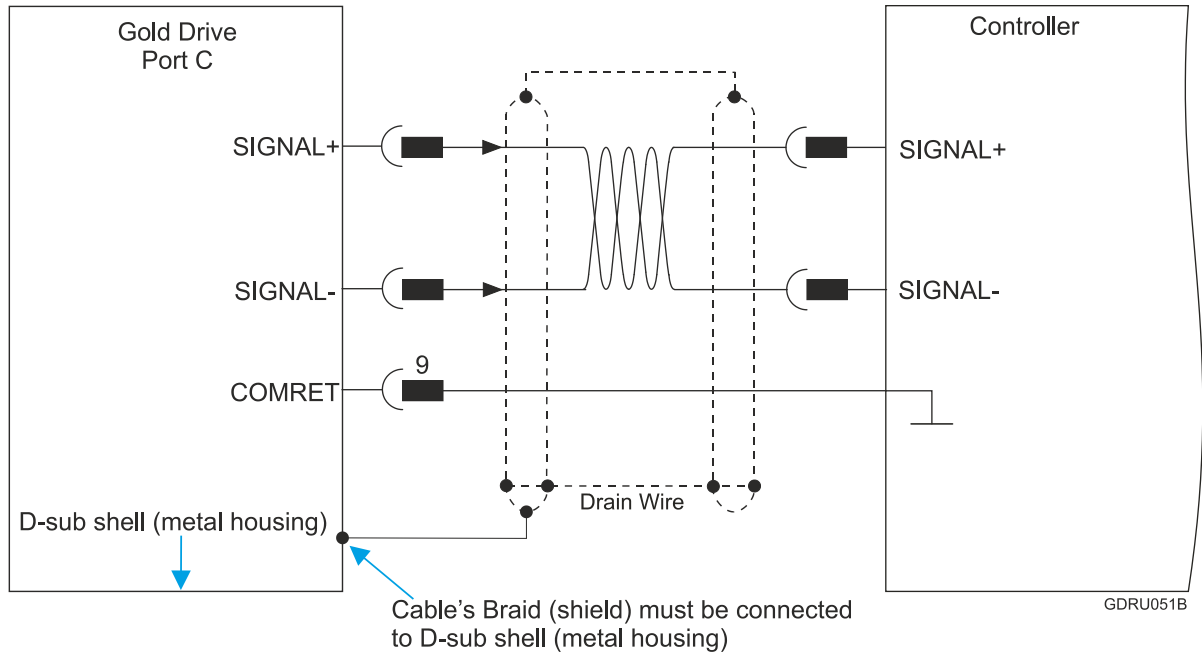


Figure 6: Feedback Port C Cable Assemblies

9.2.4. IO Cable Connector

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

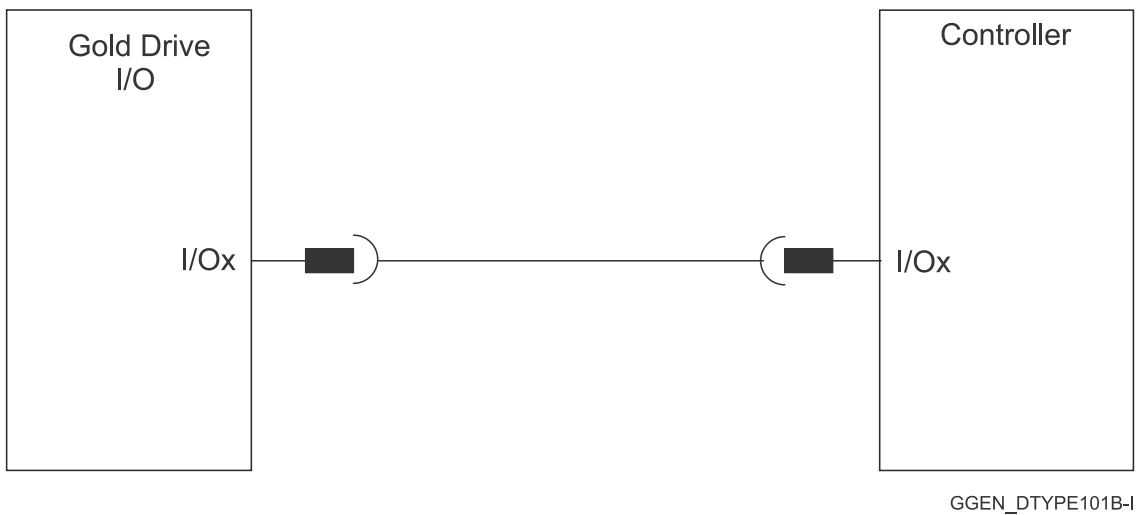


Figure 7: Feedback IO Cable Assemblies



9.2.5. STO (Port C) Cable Connector

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

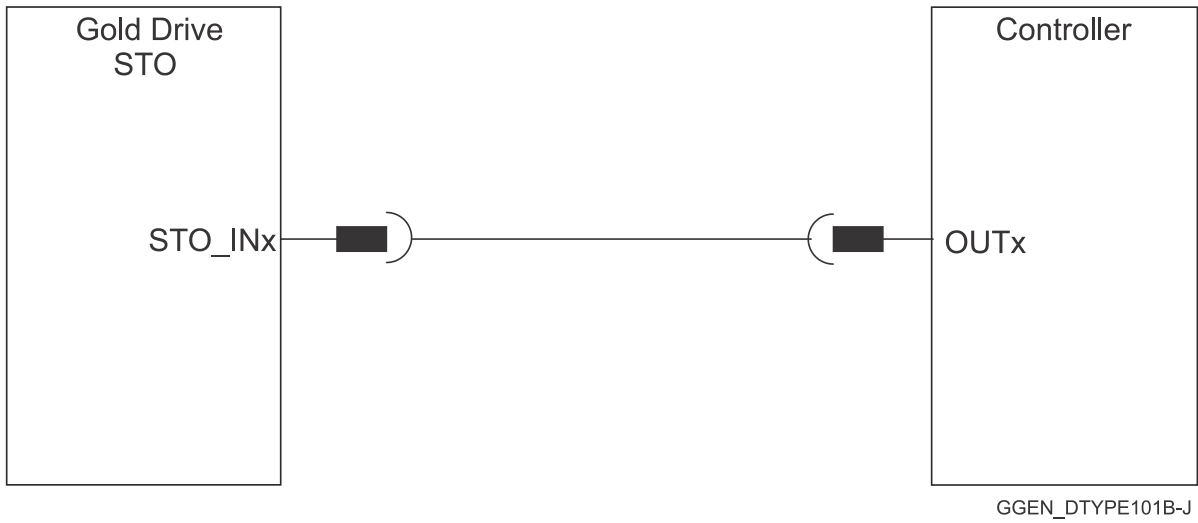


Figure 8: STO Cable Assemblies

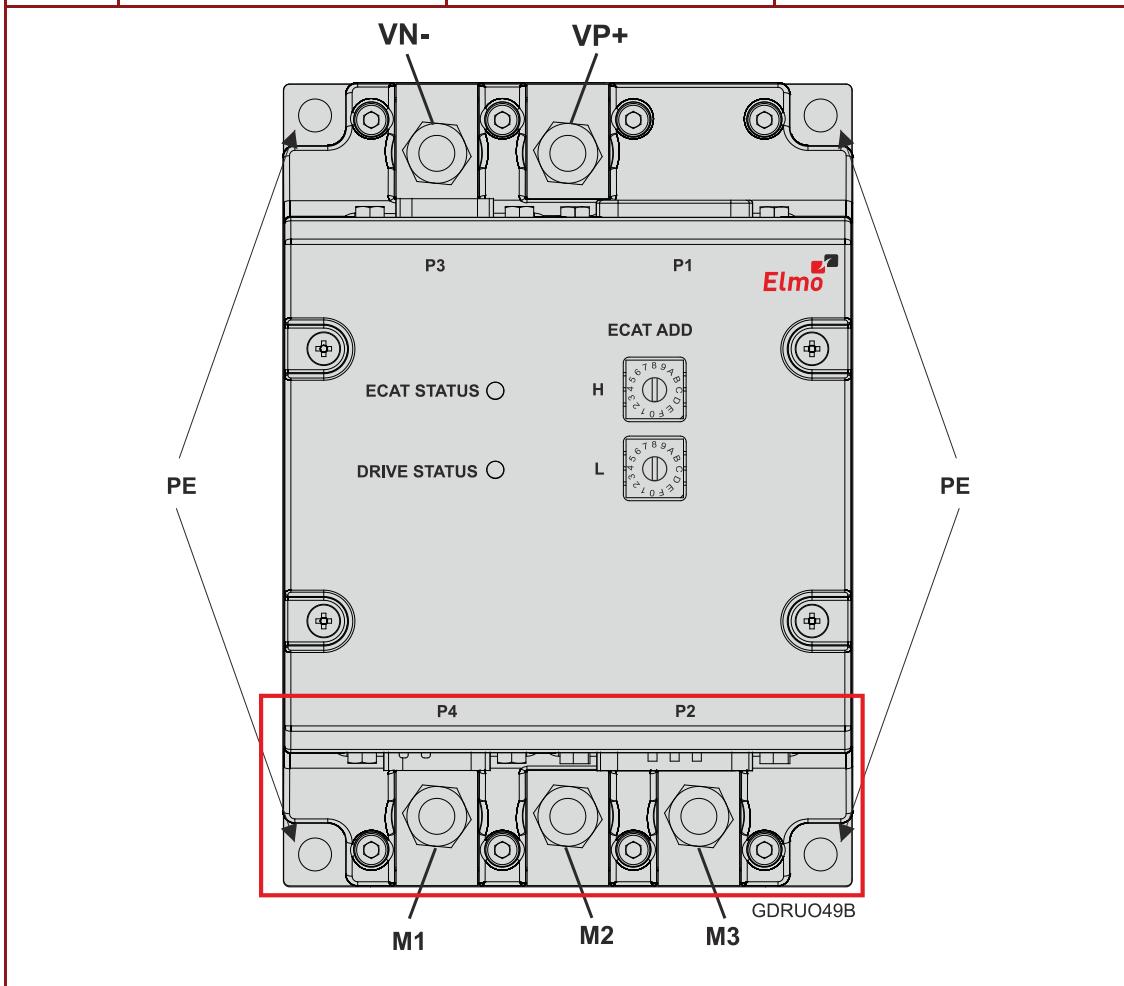


9.3. Motor Power Connector Pinouts

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
M3	Motor phase	Motor	Motor
M2	Motor phase	Motor	Motor
M1	Motor phase	Motor	N/C
PE	Protective Earth	Motor	Motor



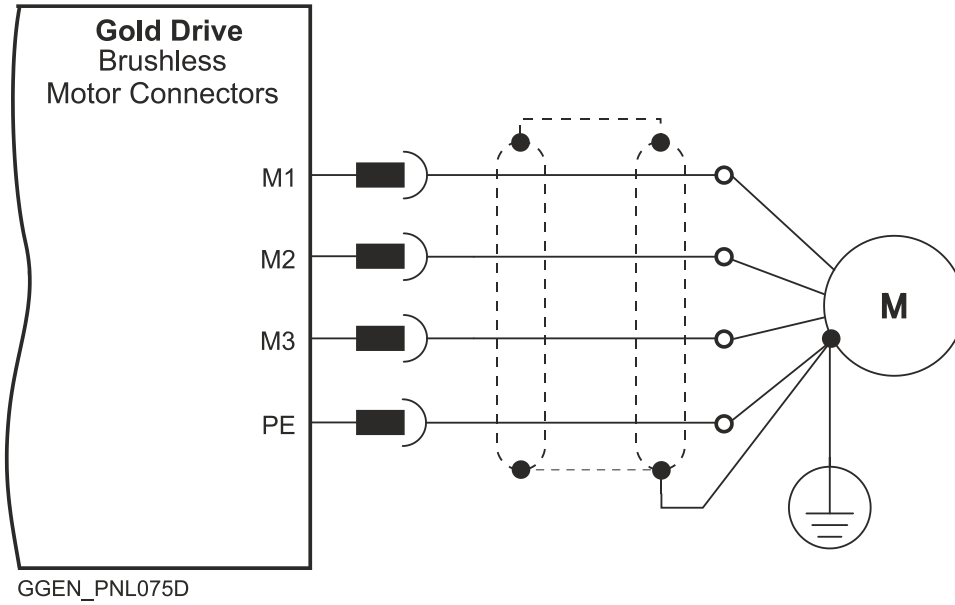


Figure 9: Brushless Motor Power Connection Diagram

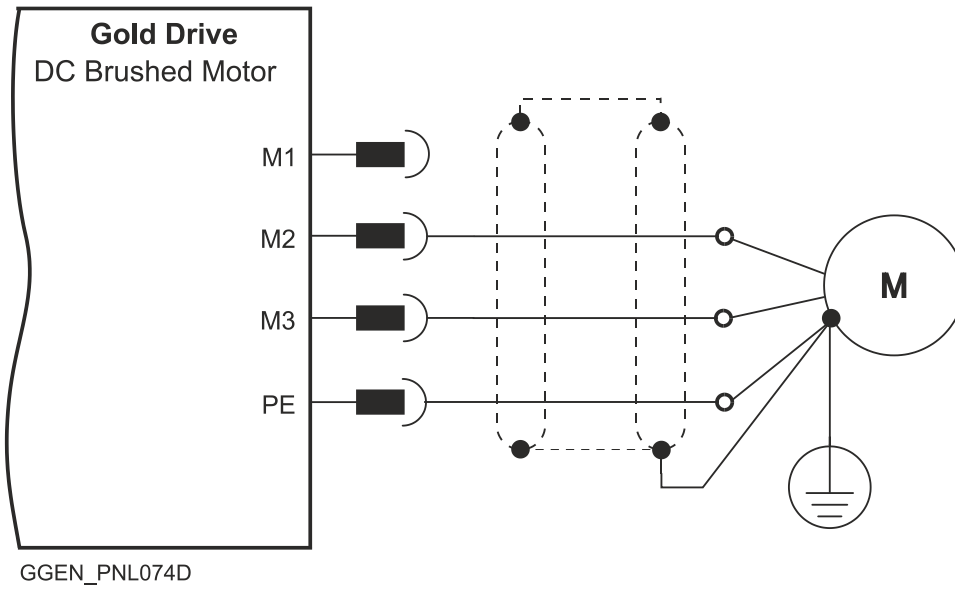


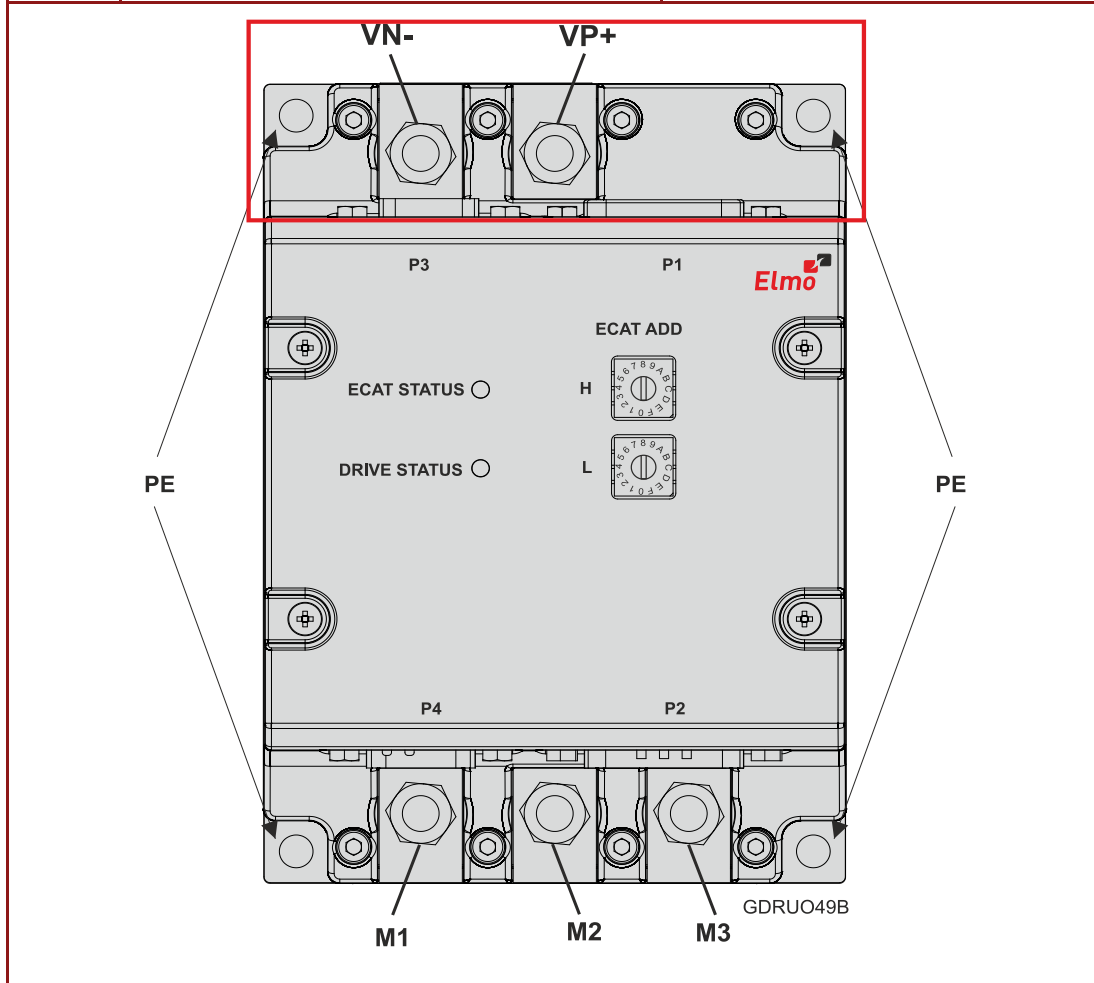
Figure 10: DC Brushed Motor Power Connection Diagram



9.4. Main Power Input and Motor Connections

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

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





9.5. 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.

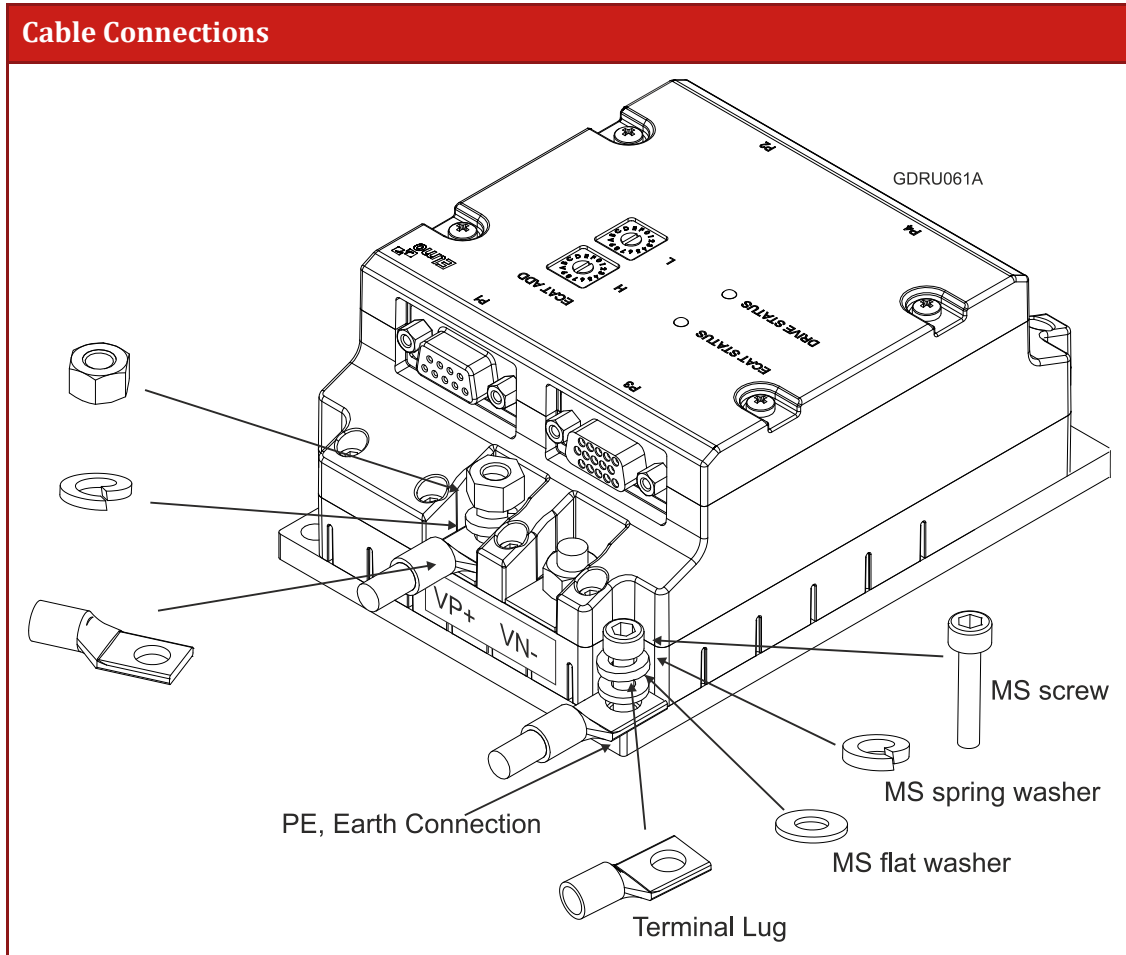


Table 3: Connecting the PE Cables

1. Connect the appropriate terminal lugs from the DC Power Input cables to the VP+, VN-, and PE terminals on the Gold Drum as shown in Table 3.
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 servo drives which offers a range of versatile options.

9.6. 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.

9.6.1. 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.



9.6.1.1. Gold Drum Power Supply Connections

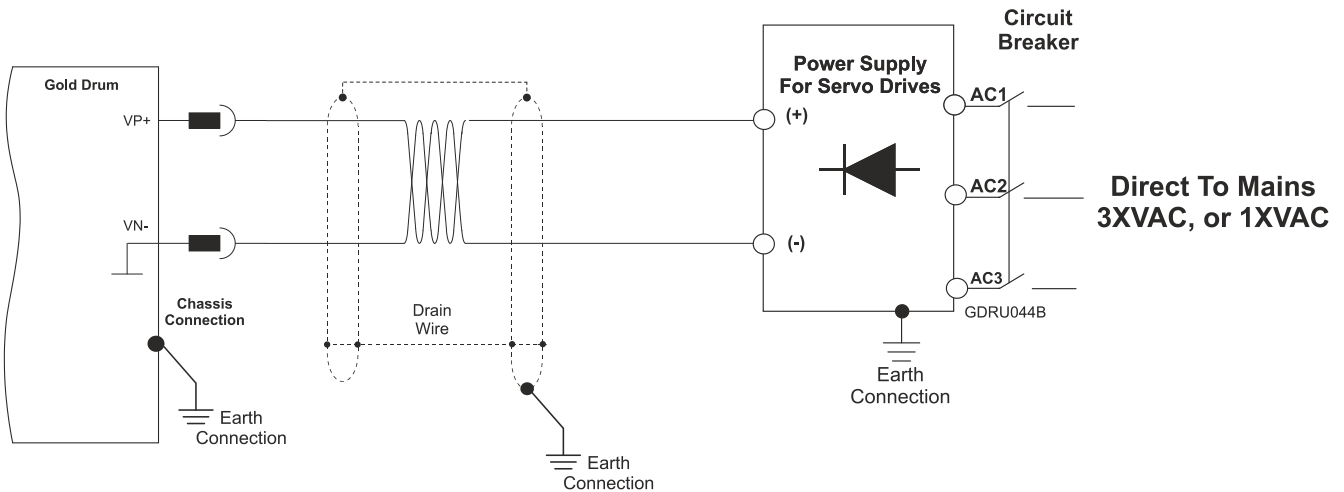


Figure 11: Non-Isolated from the Mains DC Power Supply connection

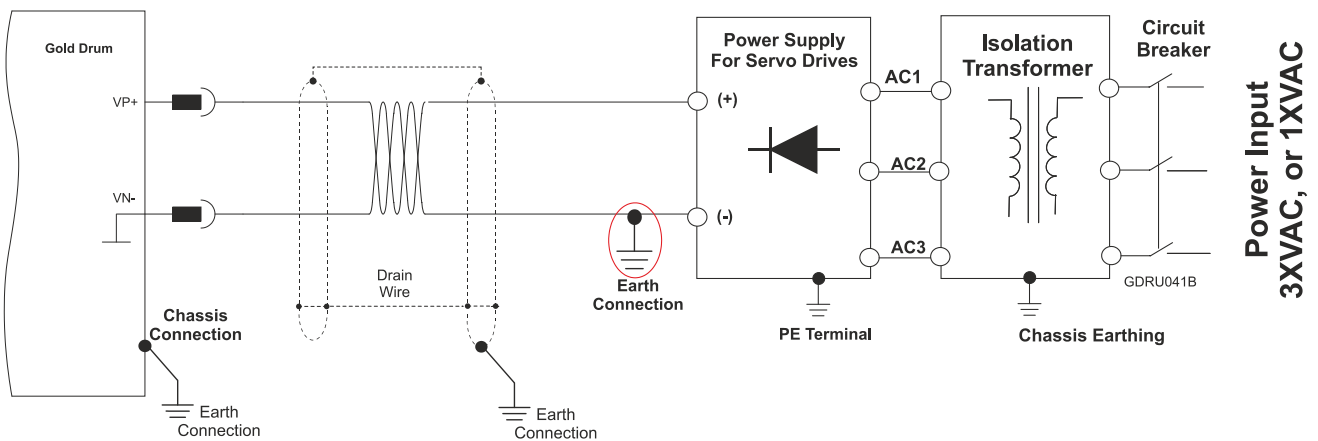


Figure 12: Isolated from the Mains DC Power Supply connection



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).

9.6.1.2. 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.



9.7. VL Logic Supply(P2)

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.

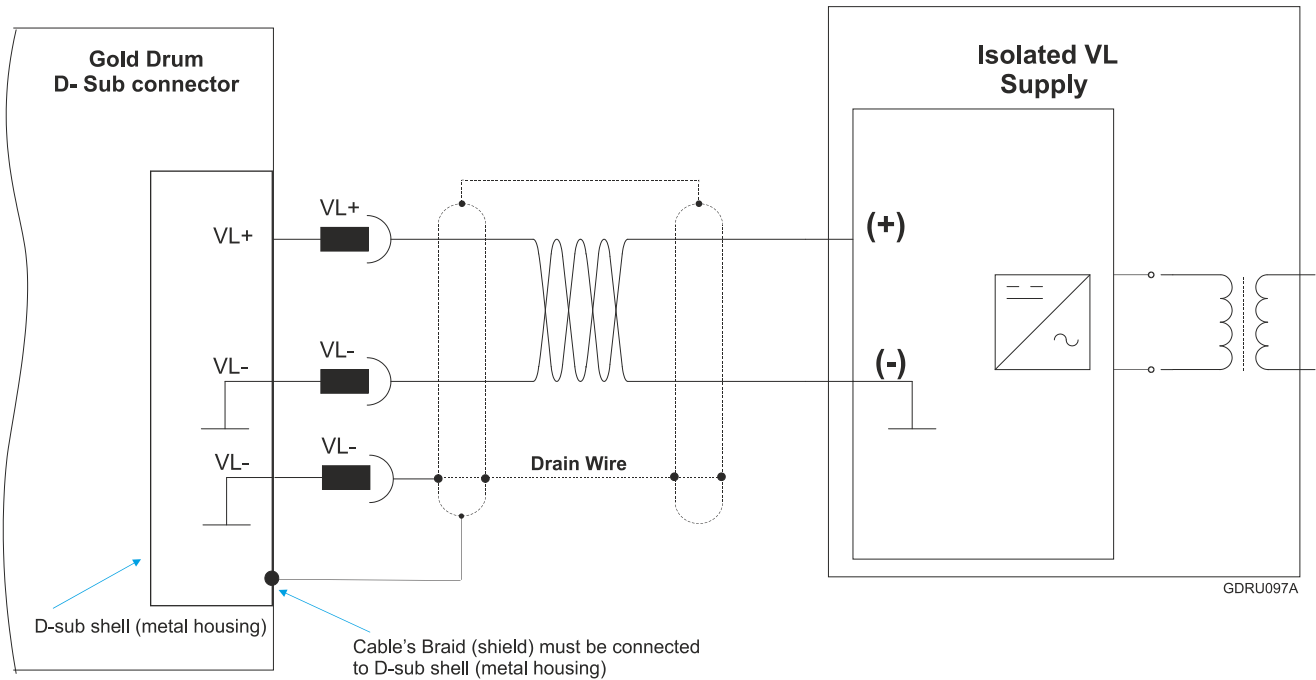


Figure 13: VL Logic Supply Connection Diagram

9.7.1. VL Logic Supply(P2)

Pins	Signal	Function	Cable
7, 8	VL+	Positive input terminal of the logic (Control & Encoders) power supply	VL Logic Supply Cable
9, 18	VL-	Negative (-) terminal of logic power supply	VL Logic Supply Cable

Table 4: VL Logic Supply Pins and Polarity



9.8. Drive Status Indicator

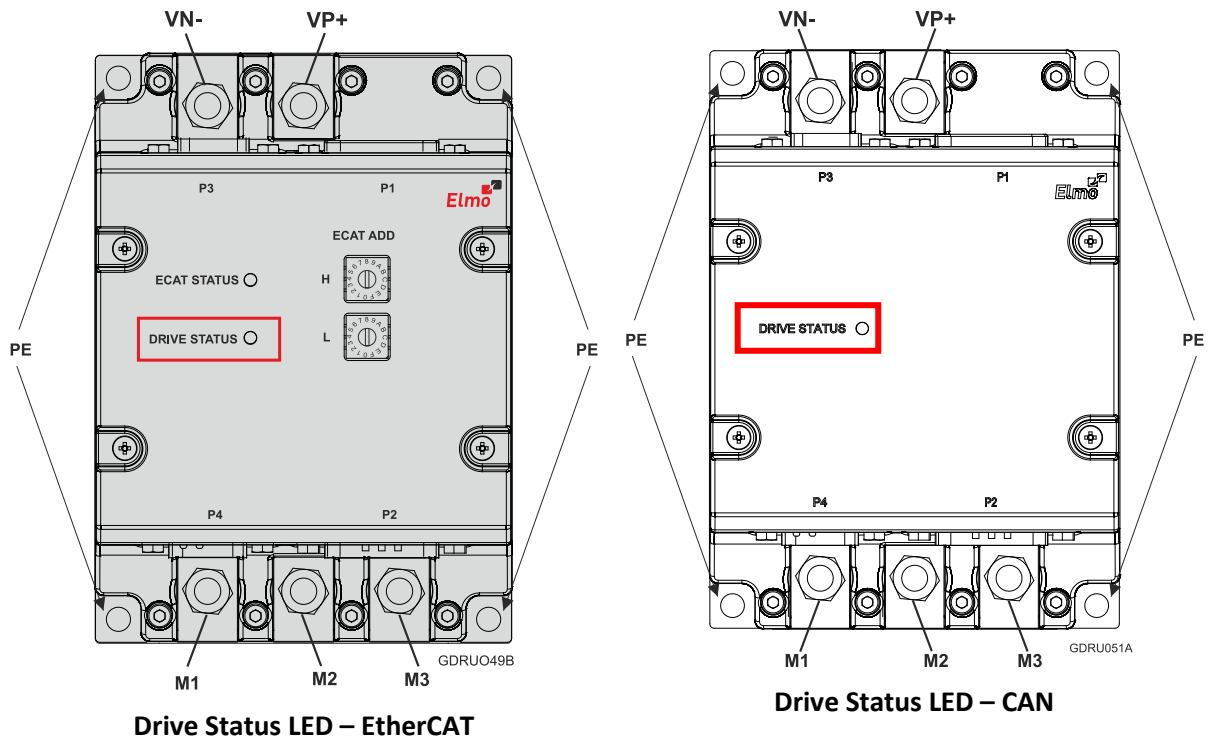


Figure 14: Drive Status LEDs

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).



9.9. Port A and Port B (P1)

The Gold Drum Port A and Port B connector is a D-Type connector with 26 high density female pins. See Section 10.3 and 10.4 in the manual: MAN-G-Panel Mounted Drives Hardware for full details.

Common Pins and their Signals				
Pin (P1)	Signal	Function	Signal	Function
1,6,10,15	+5V	Encoder +5V supply	+5V	Encoder +5V supply
5, 14, 25, 26	COMRET	Common Return	COMRET	Common Return
24	Not Connected	Not Connected	Not Connected	Not Connected

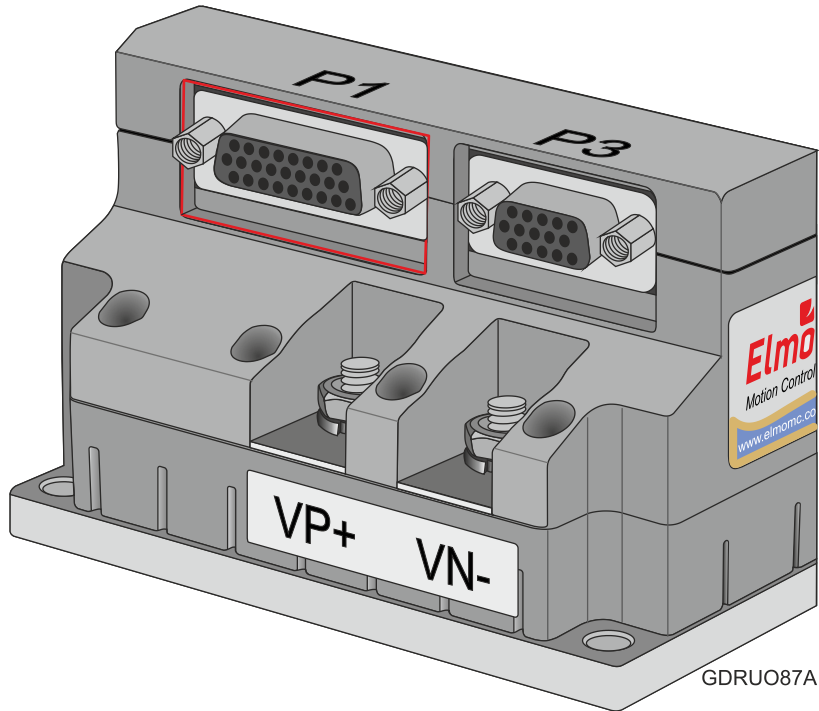
Port A		Incremental Encoder		Absolute Serial Encoder	
Pin on P1	Signal	Function	Signal	Function	Function
11	PortA_ENC_A+	Channel A+	ABS_CLK+	Abs encoder clock +	
2	PortA_ENC_A-	Channel A-	ABS_CLK-	Abs encoder clock -	
12	PortA_ENC_B+	Channel B+	ABS_DATA+	Abs encoder data +	
3	PortA_ENC_B-	Channel B-	ABS_DATA-	Abs encoder data -	
13	PortA_ENC_INDEX+	Index+	Reserved	Reserved	
4	PortA_ENC_INDEX-	Index-	Reserved	Reserved	
19	HA	Hall sensor A	HA	Hall sensor A	
20	HB	Hall sensor B	HB	Hall sensor B	
21	HC	Hall sensor C	HC	Hall sensor C	

Port B		Incremental or Interpolated Analog Encoder		Resolver	
Pin on P1	Signal	Function	Signal	Function	Function
16	PortB_ENC_A+/SIN+	Channel A+ / Sine+	SIN+	Sine+	
7	PortB_ENC_A-/SIN-	Channel A- / Sine-	SIN-	Sine-	
17	PortB_ENC_B+/COS+	Channel B+ / Cosine+	COS+	Cosine+	
8	PortB_ENC_B-/COS-	Channel B- / Cosine-	COS-	Cosine-	
18	PortB_ENC_INDEX+	Index+	RESOLVER_OUT+	Vref f=1/TS, 50 mA Max.	

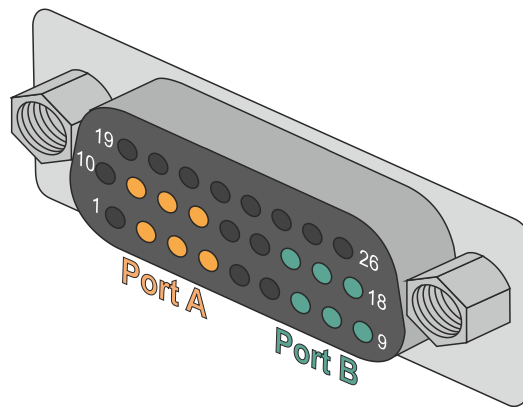


Port B	Incremental or Interpolated Analog Encoder	Resolver
9	PortB_ENC_INDEX-	Index -
		RESOLVER_OUT-
		Vref complement f= 1/TS, 50 mA Max.

P1 Pin Position



GDRU087A



GDRU087A-A

**26-Pin D-Type High Density Female Connector
 (Elmo P.N. JCB-111026FG)**

Table 5: Port A and B Pin Assignments



9.9.1. Incremental Encoder(P1)

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

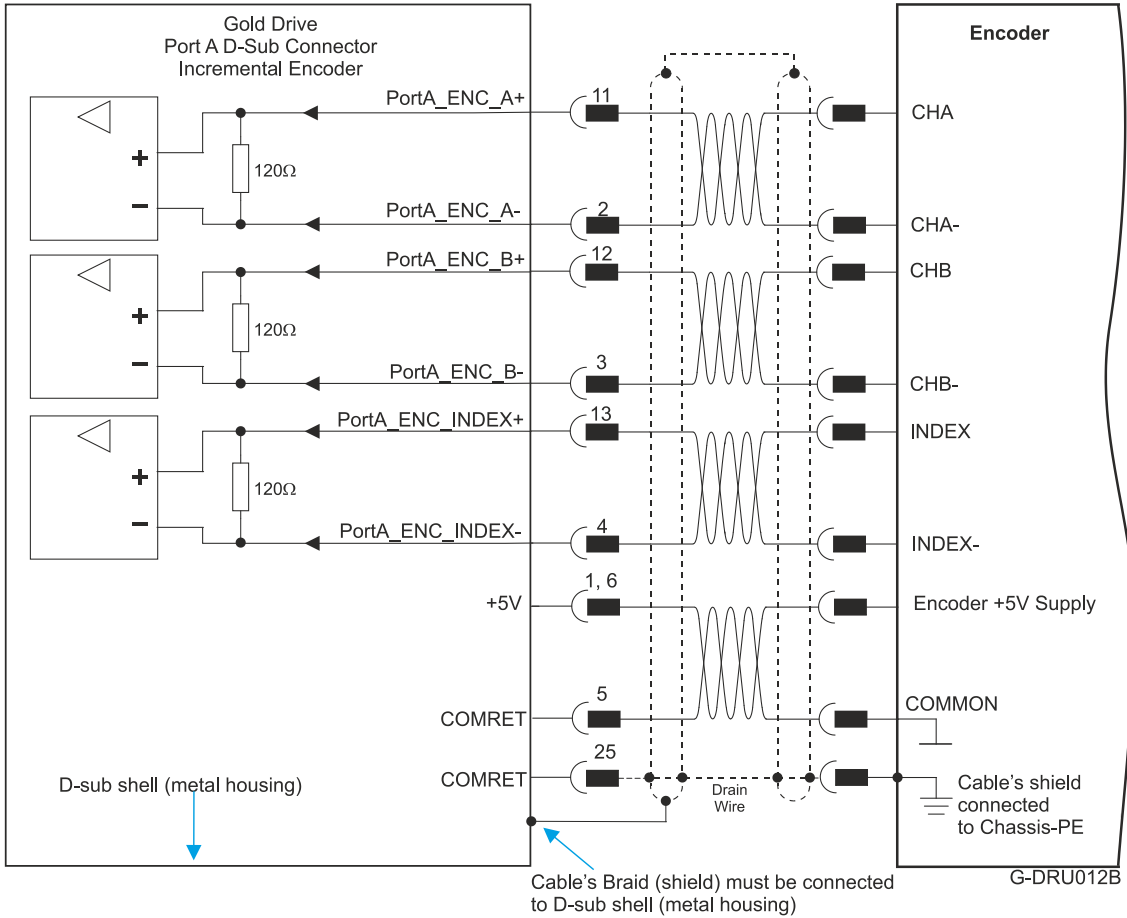


Figure 15: Port A D-Type Incremental Encoder Input – Recommended Connection Diagram

9.9.2. Hall Sensor(P1)

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

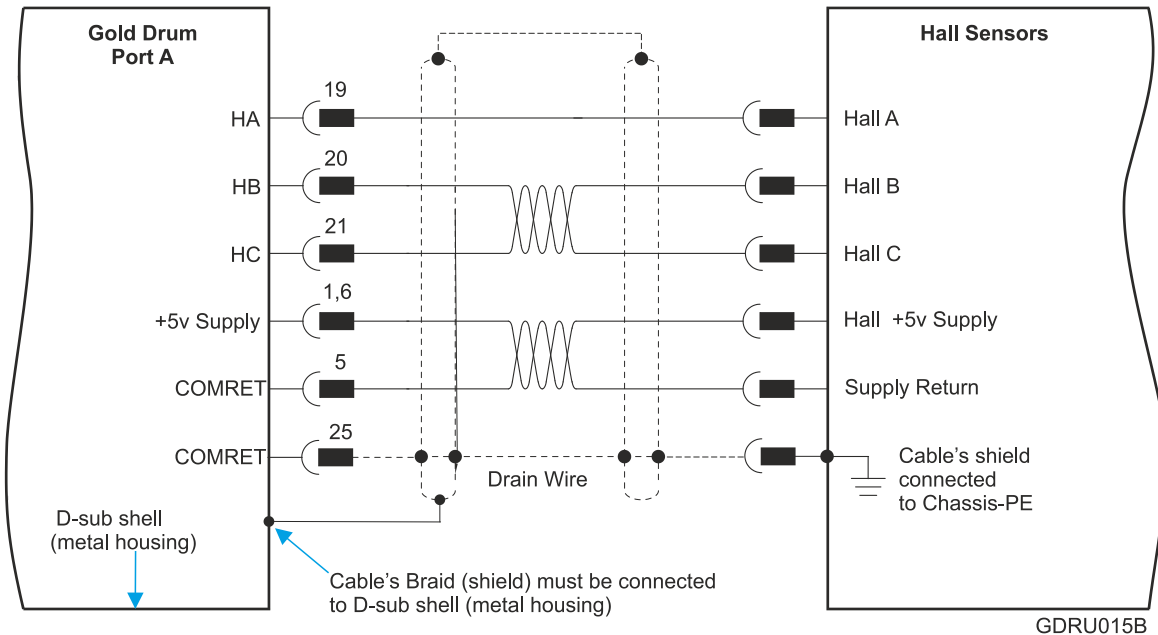


Figure 16: Hall Sensor Connection Diagram



9.9.3. Absolute Serial Type Encoder(P1)

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

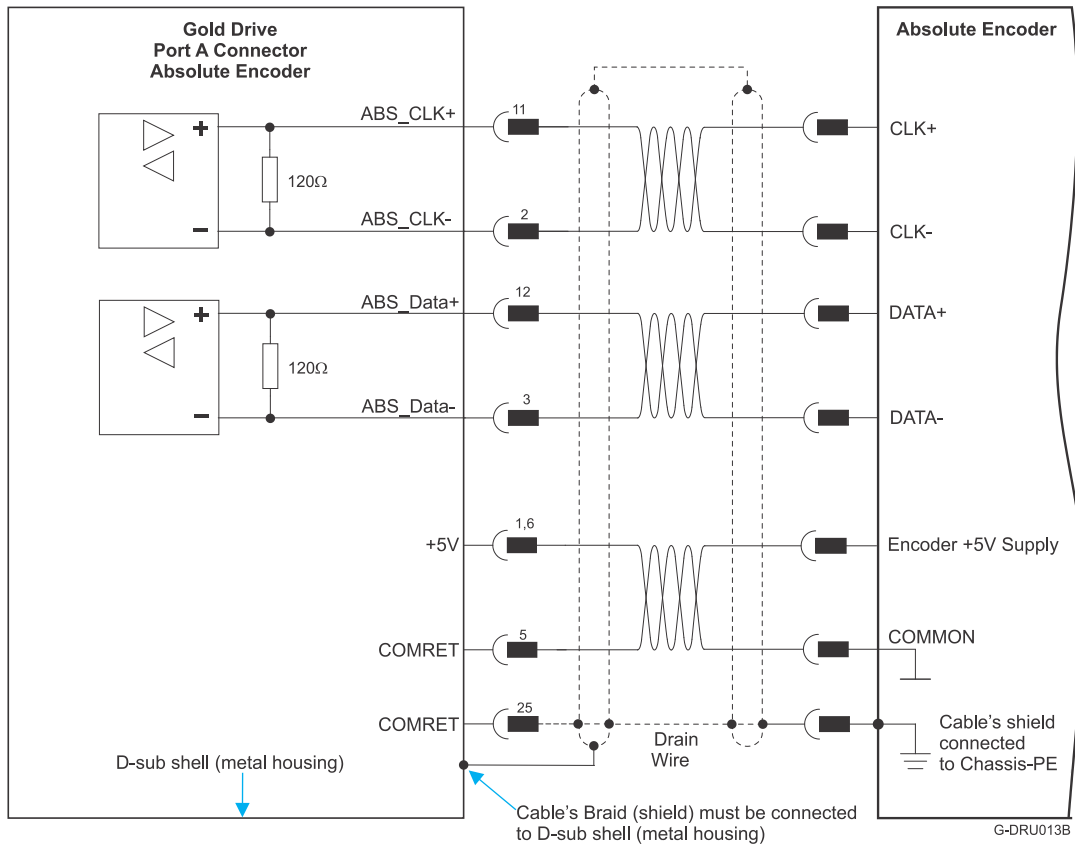


Figure 17: Absolute Serial Encoder – Recommended D-Type Connection Diagram for EnDAT, Biss, and SSI

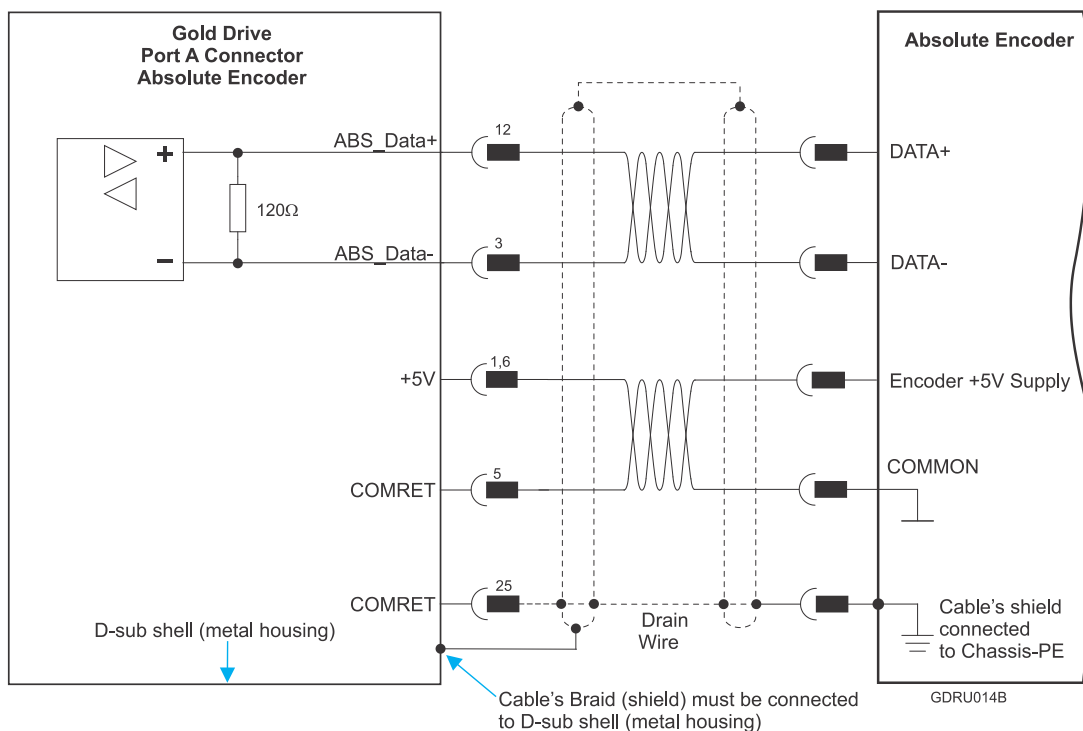


Figure 18: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Sensors Supporting Data Line Only (NRZ types, e.g., Panasonic / Mitutoyo / Sanyo Danki / Tamagawa)

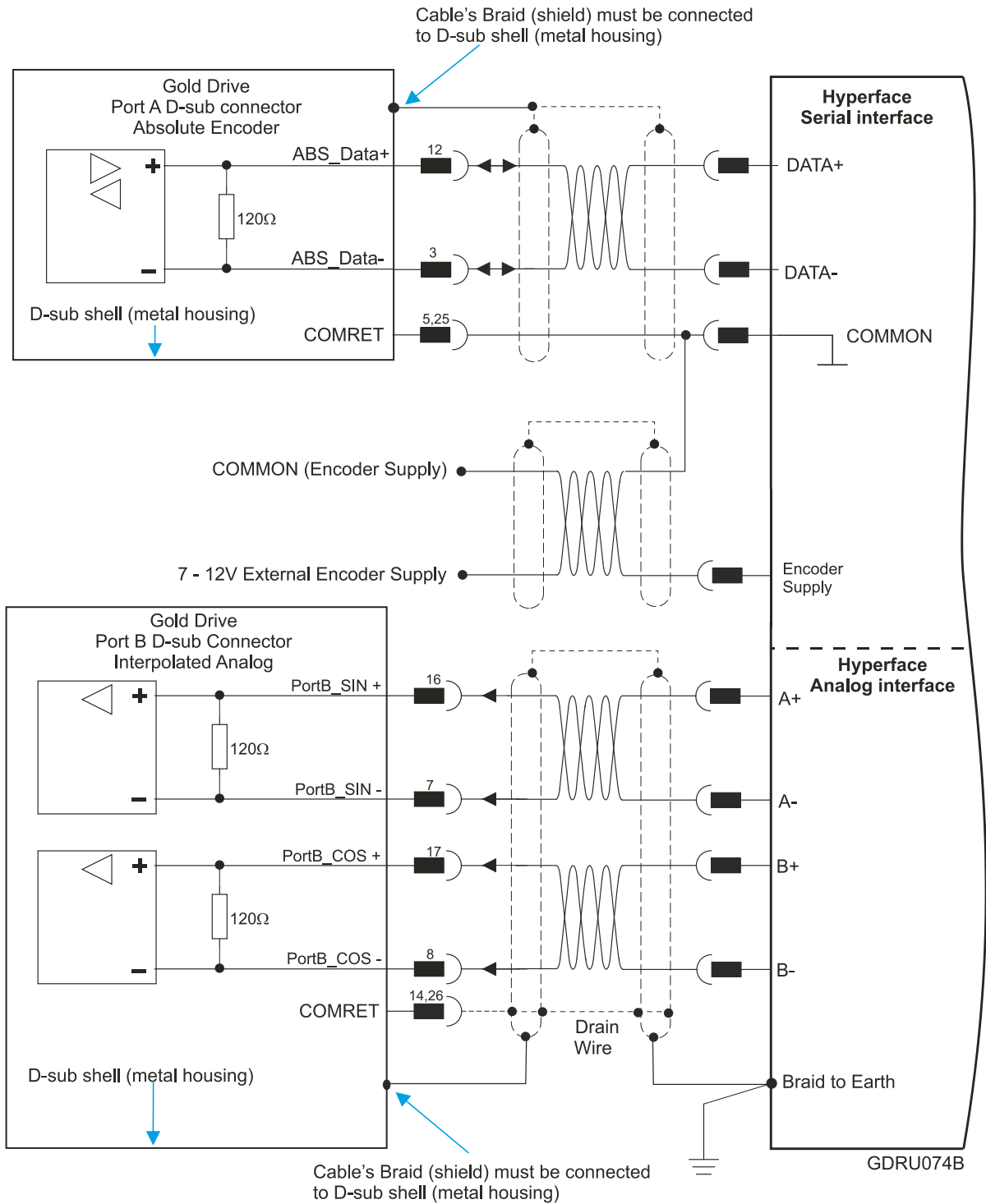


Figure 19: Absolute Serial Encoder – Recommended D-Type Connection Diagram for Stegmann Hiperface

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



9.9.4. Interpolated Analog Encoder(P1)

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

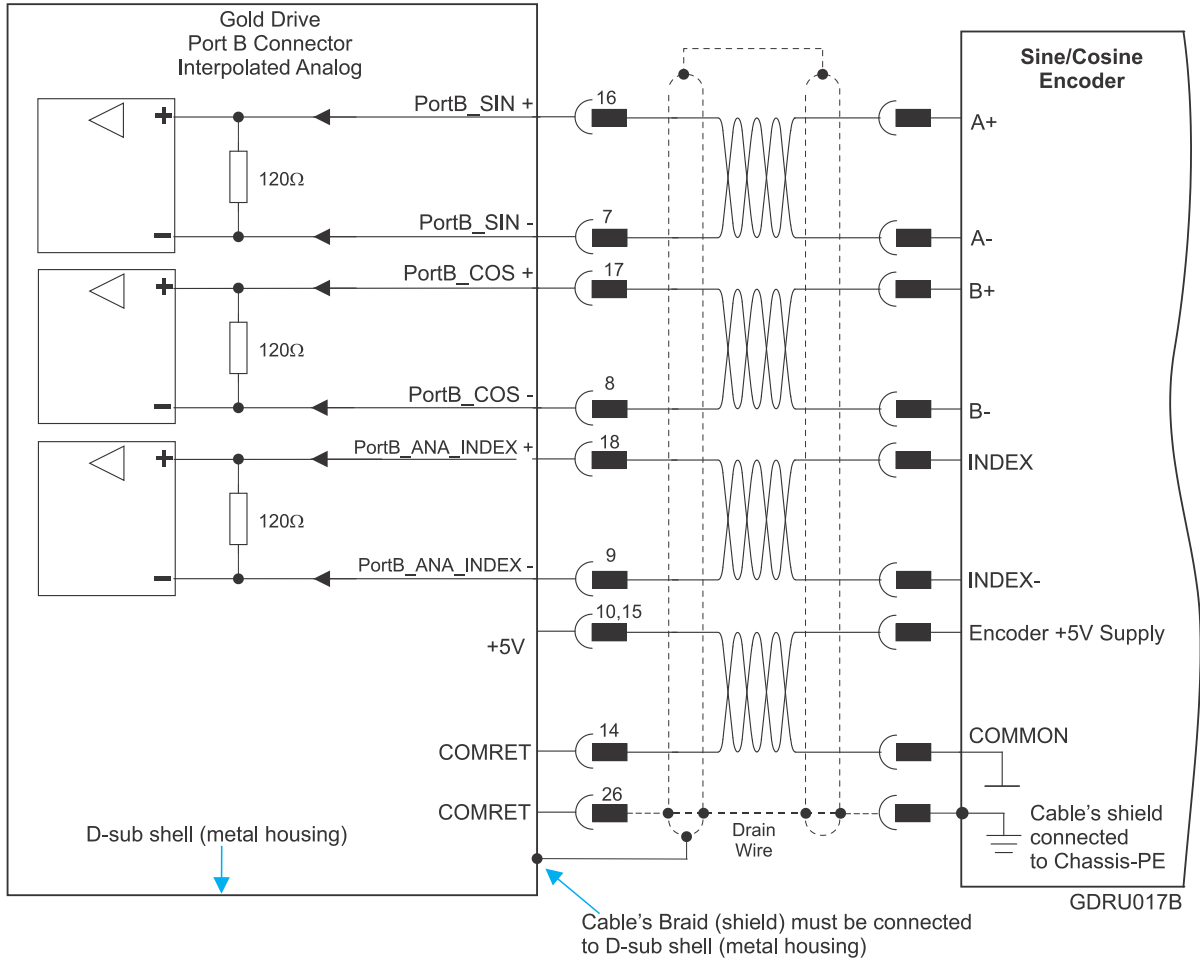


Figure 20: Port B - Interpolated Analog Encoder D-Type Connection Diagram



9.9.5. Resolver(P1)

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

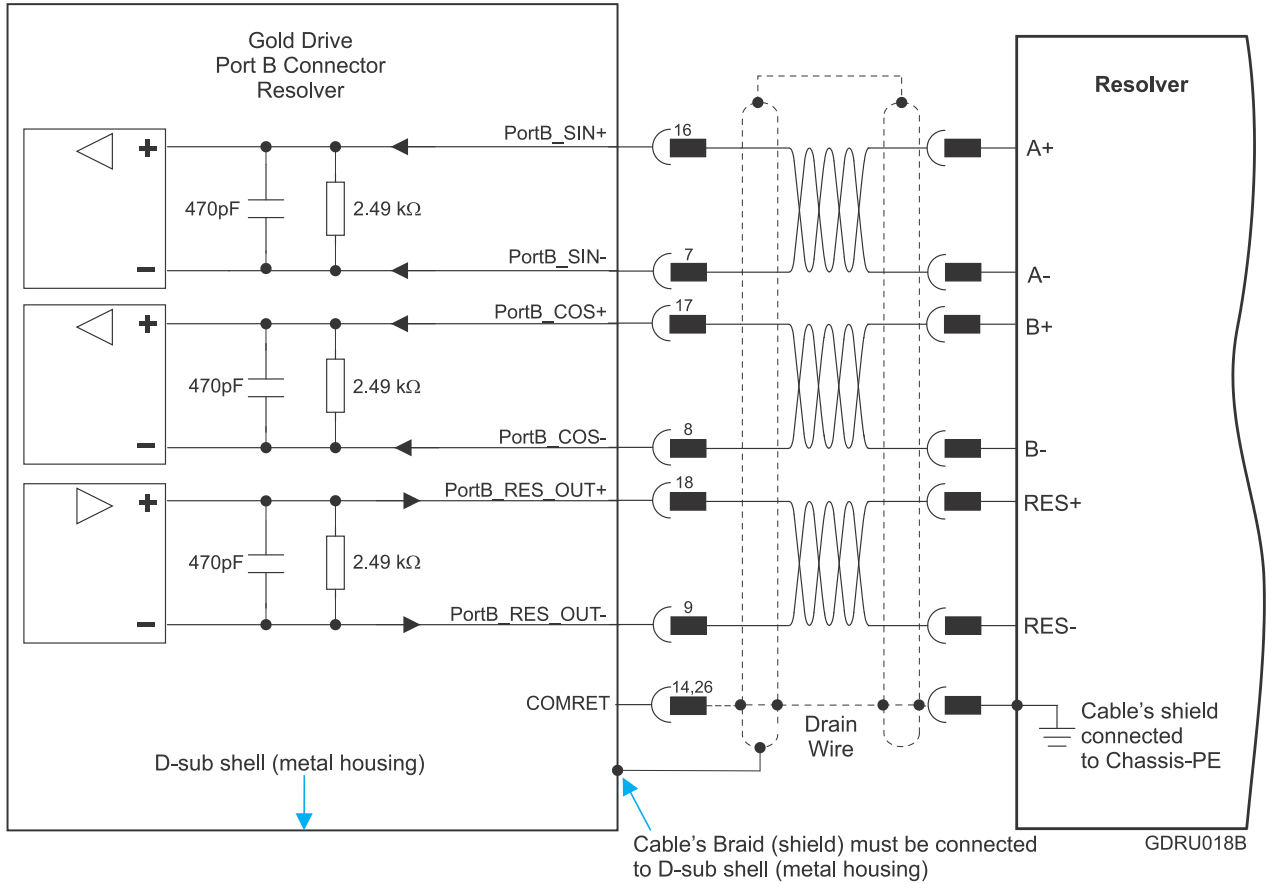


Figure 21: Port B – Resolver D-Type Connection Diagram



9.10. Port C Connector - Port C, Analog, and STO (P3)

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

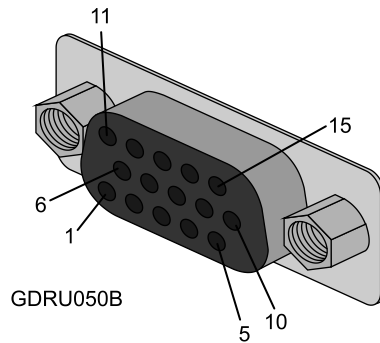
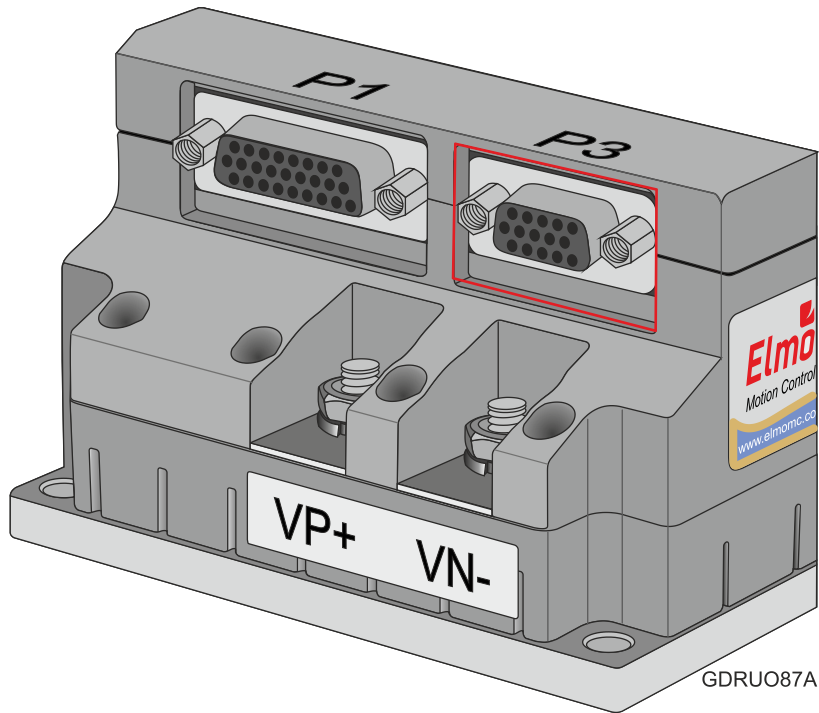
The Port C connector includes the following functions:

- 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 P3	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	STO_RET	STO signal return
8	None	Not Connected
9	COMRET	Common Return
10	PortC_ENCO_Index-	Buffered Channel INDEX- output
11	STO2	STO 2 input (default 24 V)
12	STO_RET	STO Signal Return
13	ANLRET	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(P3)

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

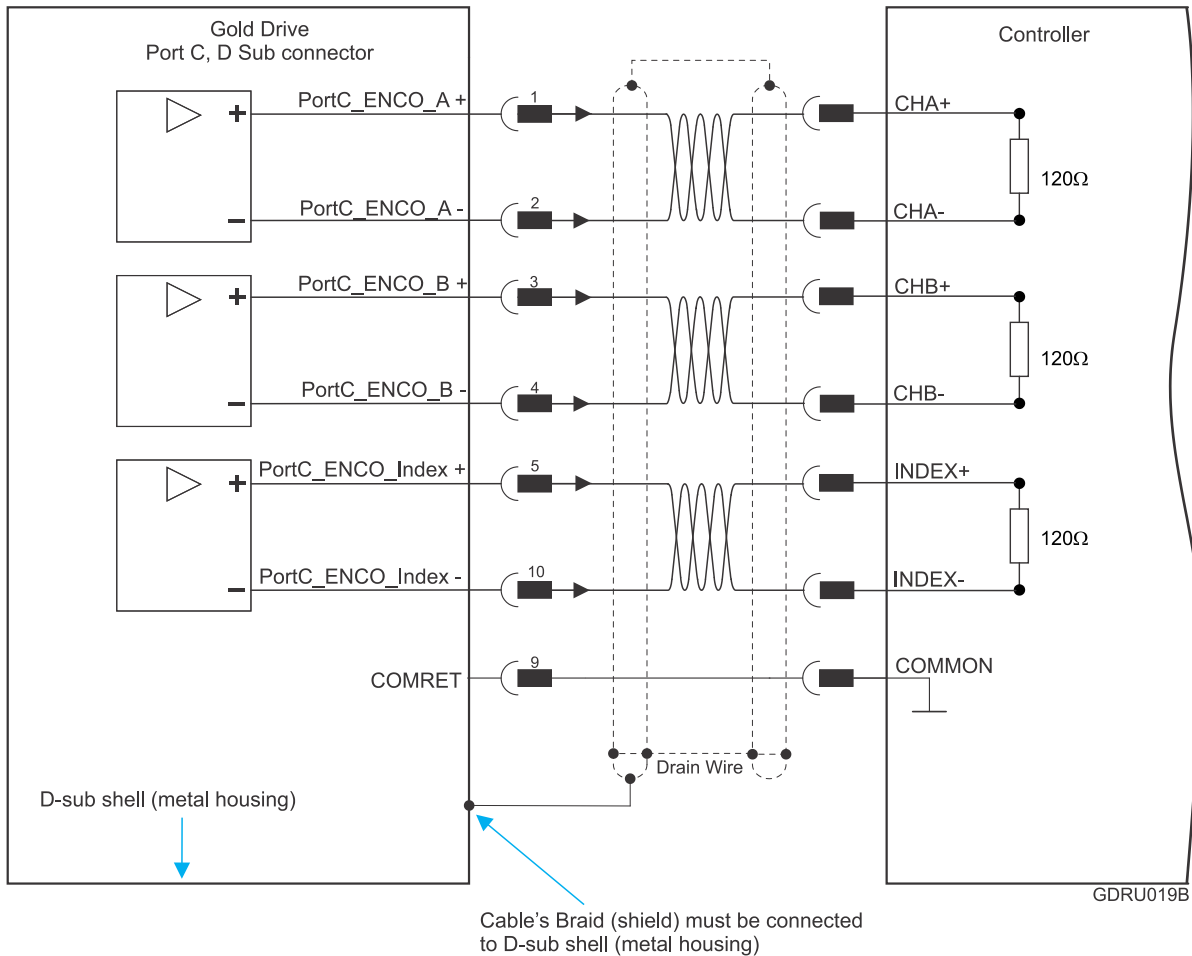


Figure 22: Emulated Encoder Differential Output – Recommended D-Type Connection Diagram

9.10.2. Analog Input(P3)

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

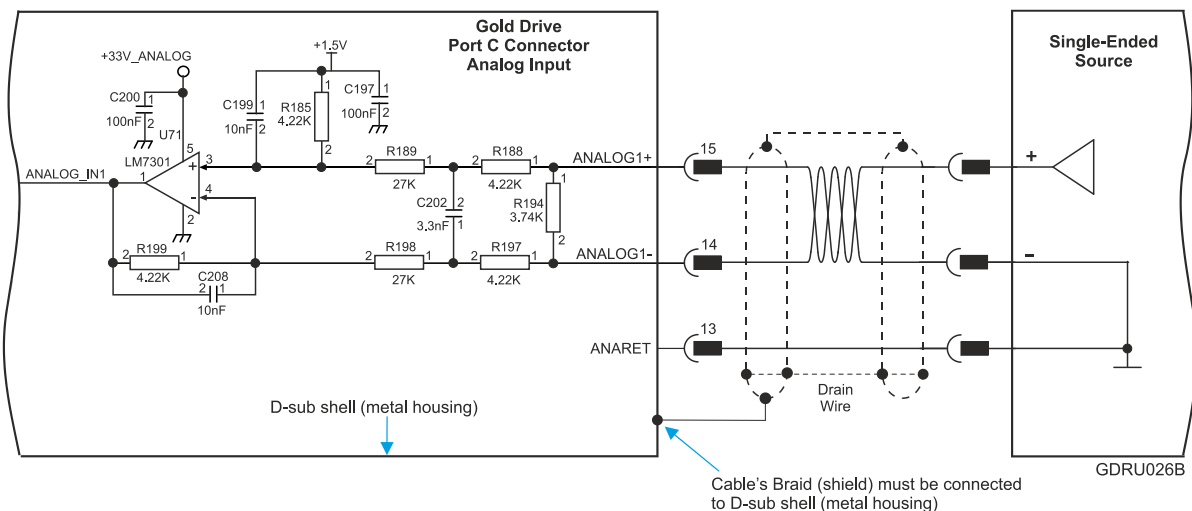


Figure 23: Differential Analog D-Type Input



9.10.3. STO(P3)

The following circuits describe the STO wiring options.

9.10.3.1. Source Mode PLC Voltage Level Input

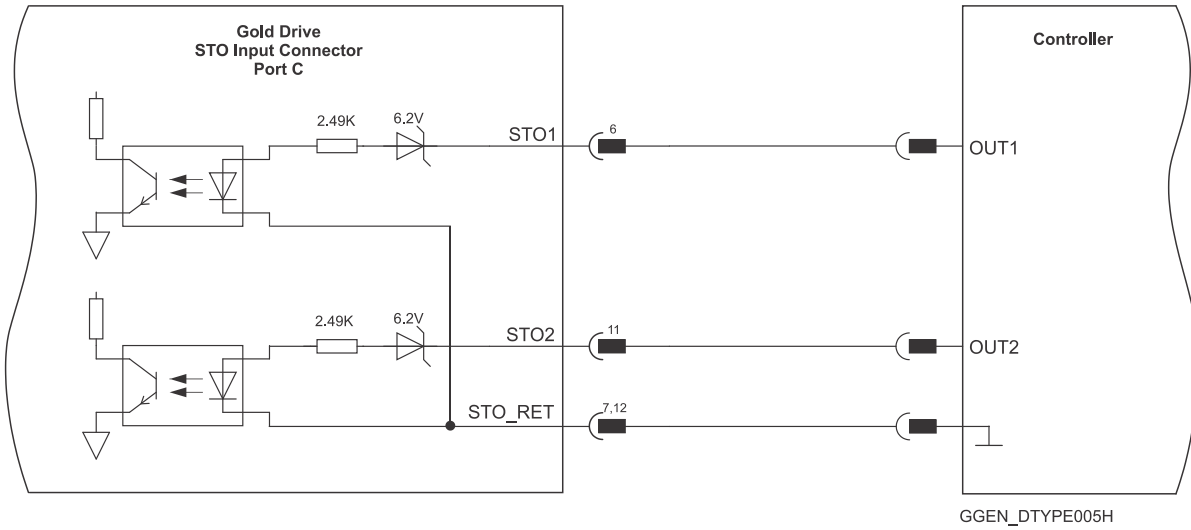


Figure 24: STO D-Type Input Connection – PLC Source Option

9.10.3.2. TTL Mode TTL Voltage Level Input

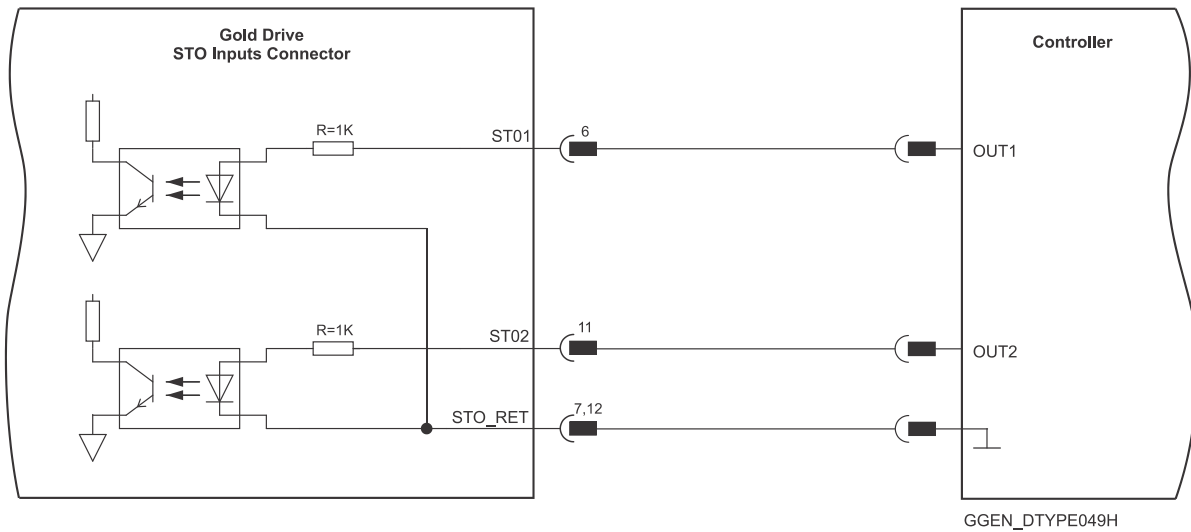


Figure 25: STO Input Connection – TTL Option



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.

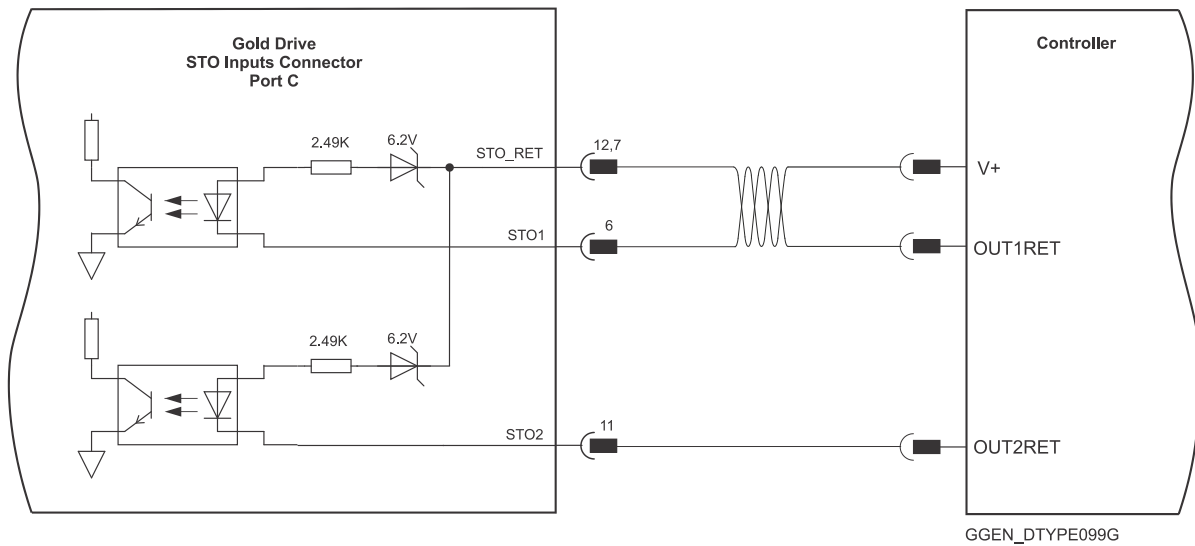


Figure 26: STO D-Type Input Connection – Sink Option



9.10.3.4. STO Output(P2)

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 OUT 4 will not be available. Refer to Figure 27 below for details of the connections. Refer to Chapter 9 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

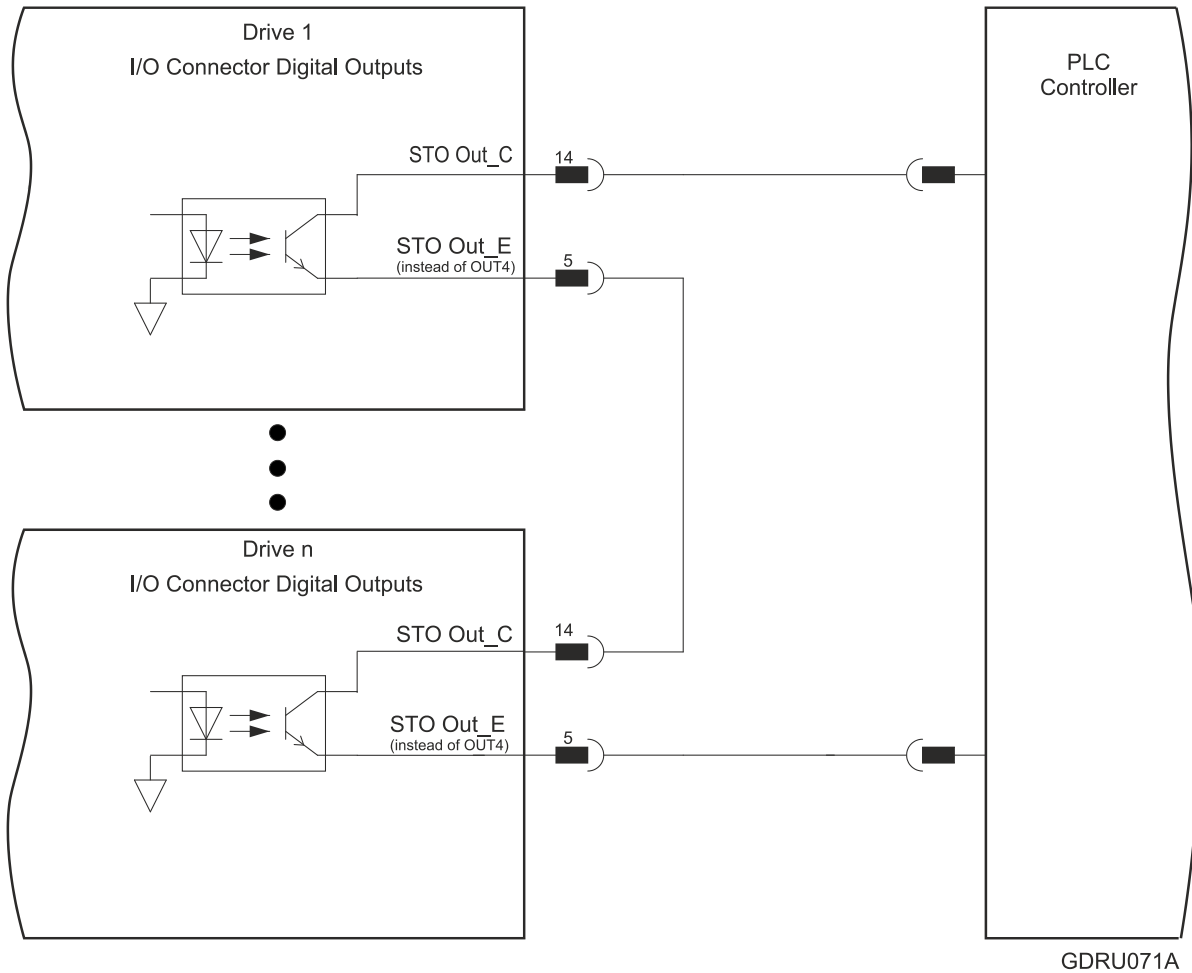


Figure 27: STO Output



9.11. Digital Inputs and Outputs (P2)

The Gold Drum Port C connector is a D-Type connector with 26 high density male pins. Refer to Chapter 11 in the in the MAN-G-Panel Mounted Drives Hardware manual for full details.

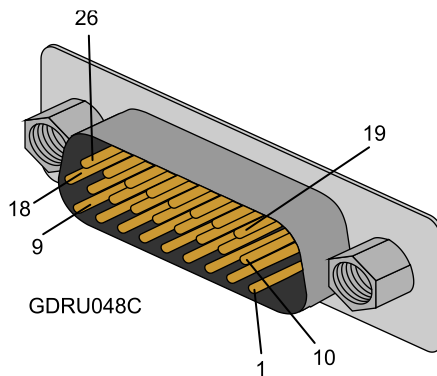
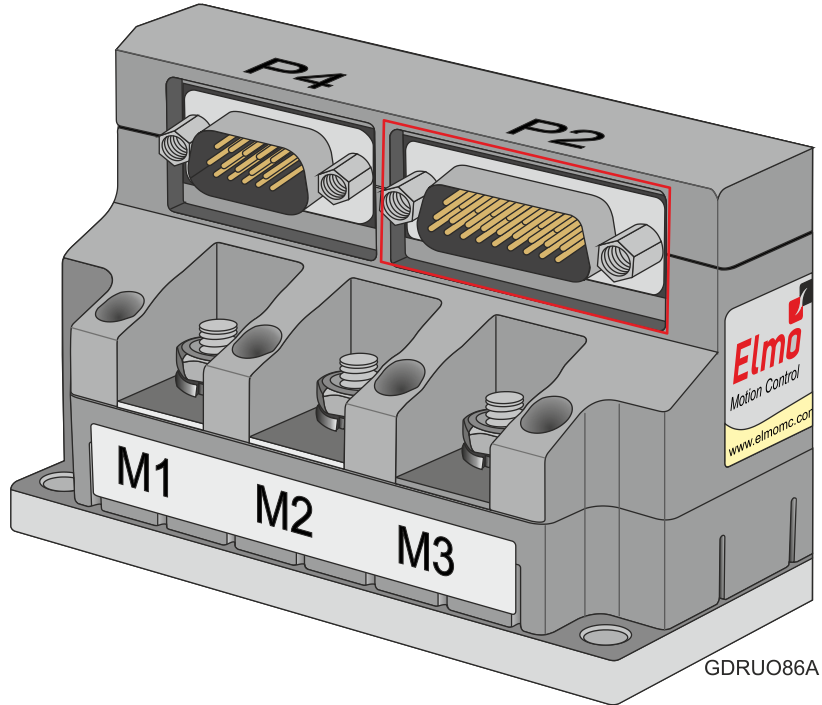
The following table lists the digital input pin assignments.

I/O Pins(P2)	Signal	Function
1, 10	VDD	Supply for out 1-4
2	OUT1	Programmable output 1
3	OUT2	Programmable output 2
4	OUT3	Programmable output 3
5	OUT4	Programmable output 4
	STO_OUT_E	STO Emitter output option (see Catalog/Part Number options)
6, 15	VDDRET	Supply return for out 1-4
7, 8	VL+	VL Supply Input Positive
9, 18	VL-	VL RET Supply Input Return
11, 12, 13, 16, 17, 26	None	Not Connected
14	STO_OUT_C	STO Collector output option (see Catalog/Part Number options)
19	INRET1-6	Programmable inputs 1 to 6 return for the standard version Programmable positive input 1 to 6 for the Sink version
20	IN1	High Speed, programmable input 1 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
21	IN2	High Speed, programmable input 2 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
22	IN3	High Speed, programmable input 3 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
23	IN4	High Speed, programmable input 4 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
24	IN5	High Speed, programmable input 5 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)



25	IN6	High Speed, programmable input 6 (event capture, home, general purpose, RLS, FLS, INH, PWM & direction input, pulse & direction input)
----	-----	----------------------------------------------------------------------------------------------------------------------------------------

Pin Position



**26-Pin D-Type Male Connector
(Elmo P.N. JCB-205026M0)**

Table 7: I/O Pin Assignments



9.11.1. Digital Input and Output TTL Mode(P2)

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

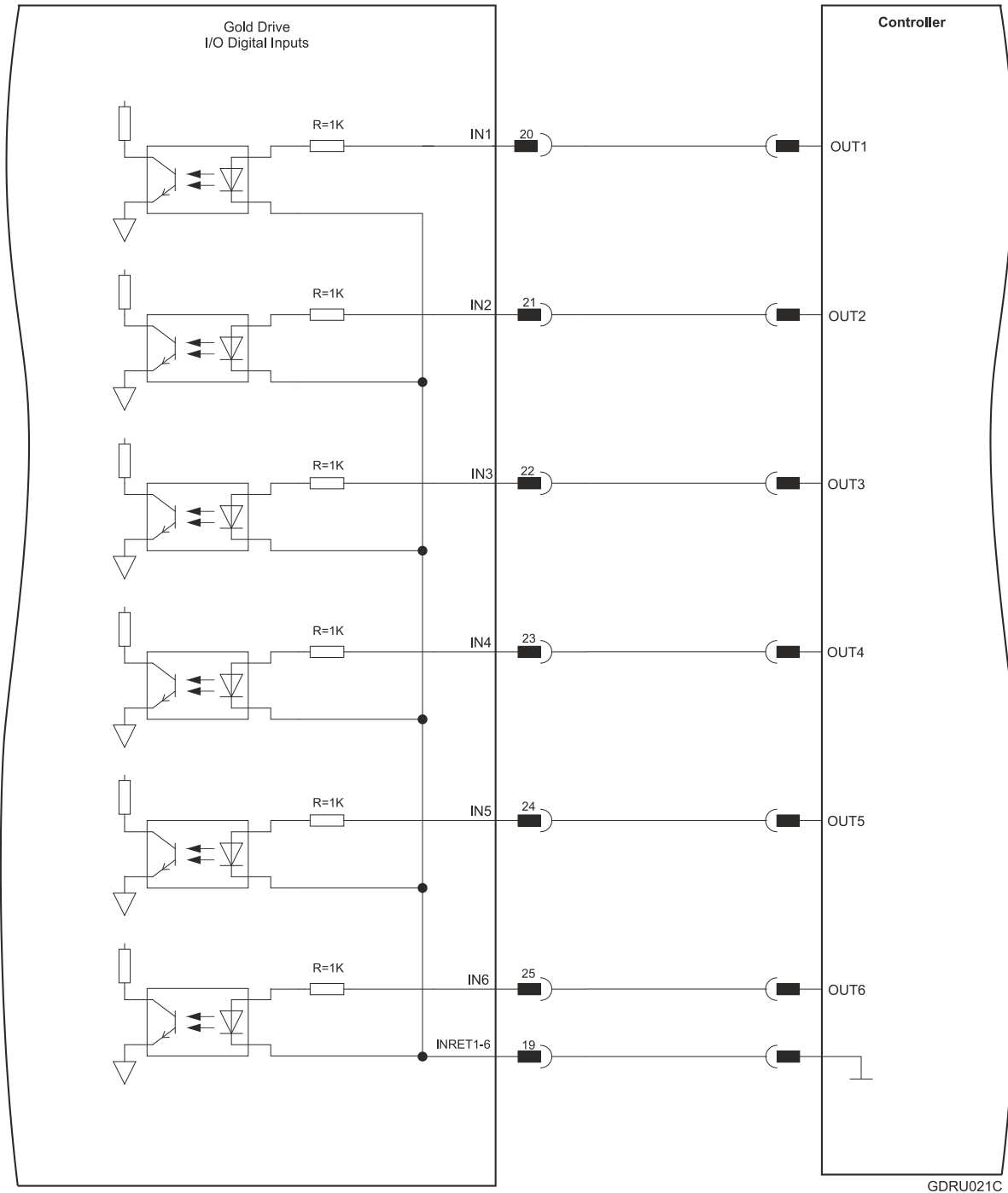


Figure 28: Digital Input TTL Mode D-Type Connection Diagram

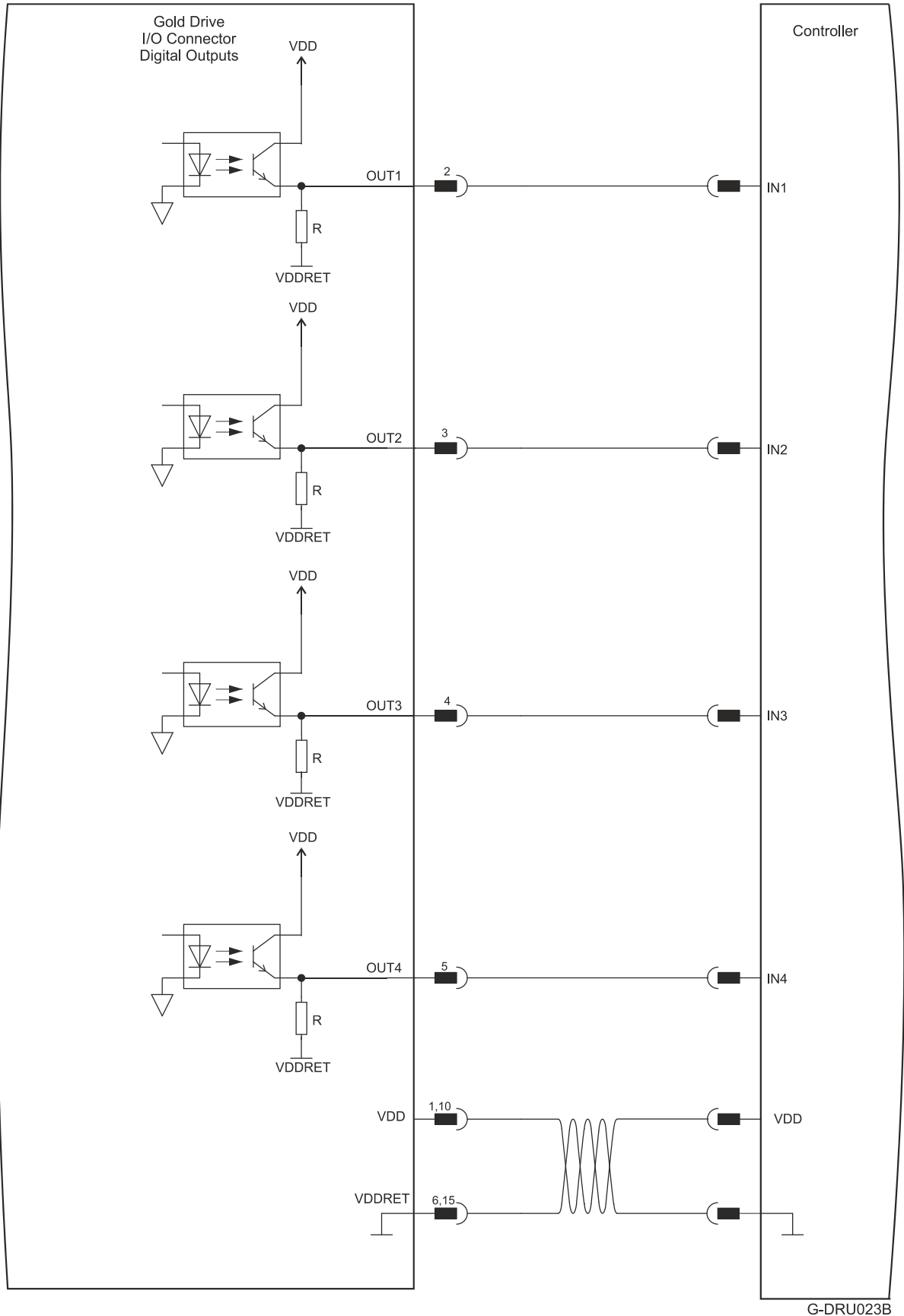


Figure 29: Digital Output D-Type Connection Diagram – TTL Option



9.11.2. Digital Input and Output PLC Source Mode(P2)

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

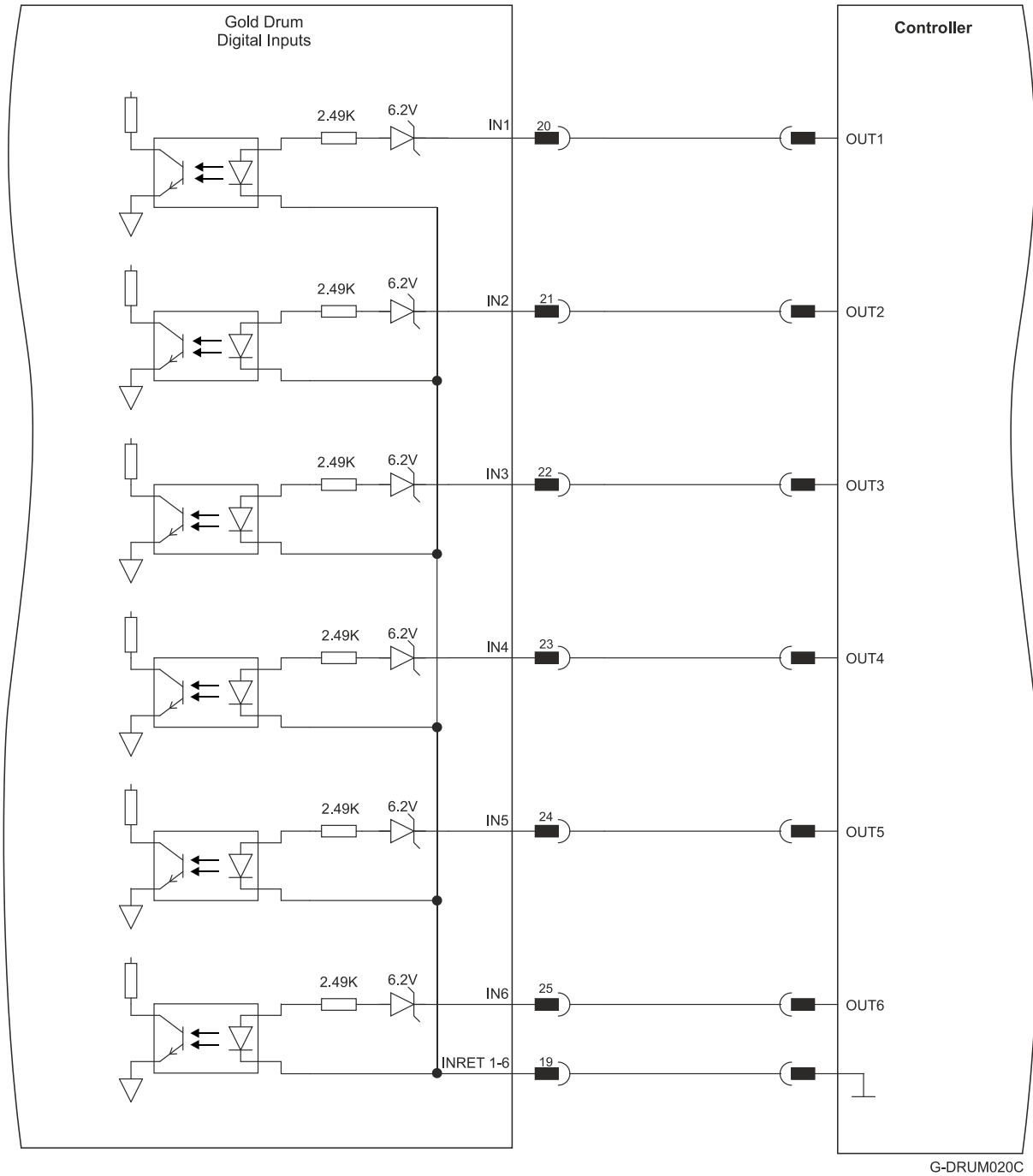
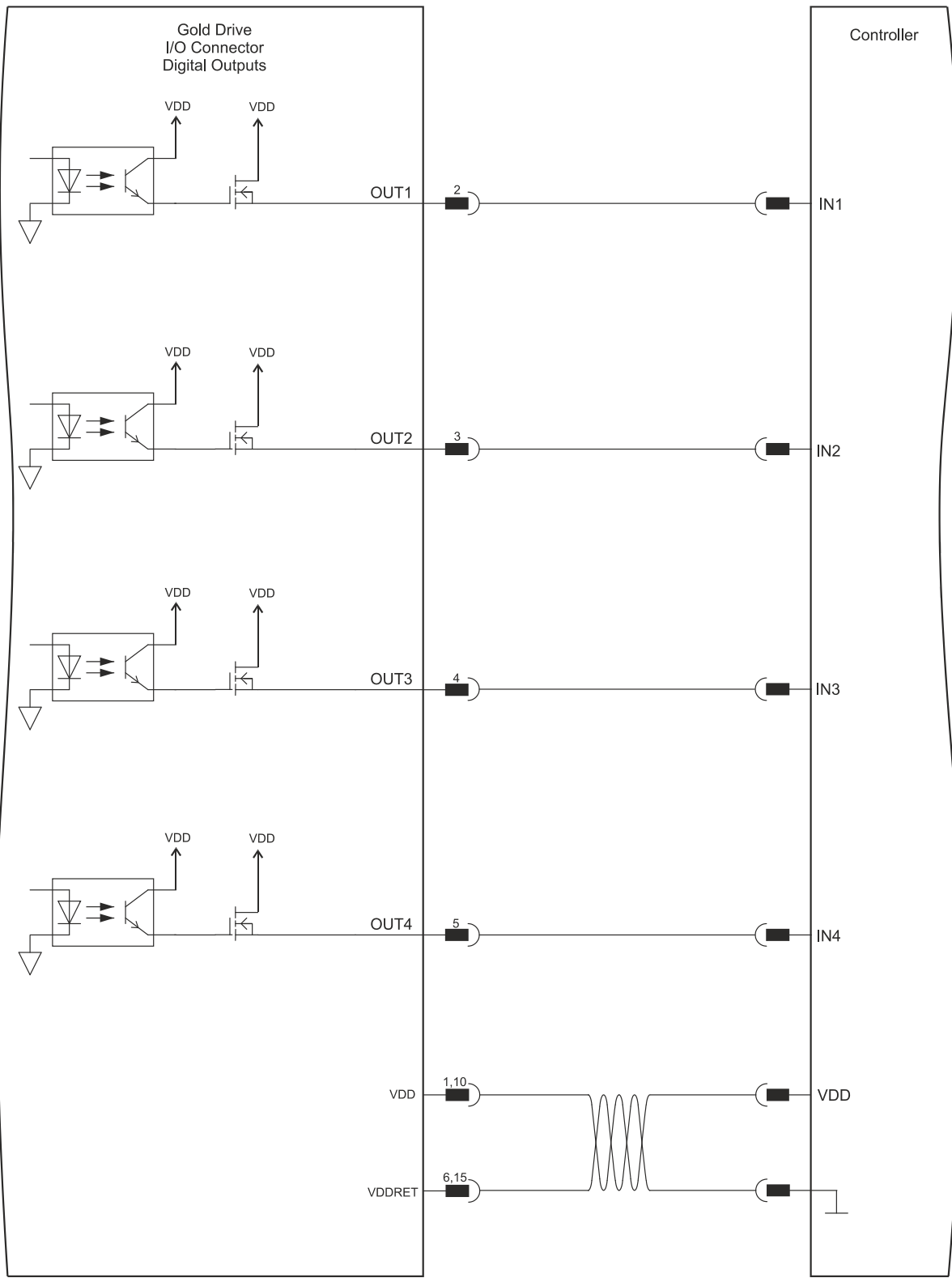


Figure 30: Digital Input D-Type Connection Diagram – Source PLC Option



G-DRU022B

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



9.11.3. Digital Input and Output Sink Mode(P2)

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

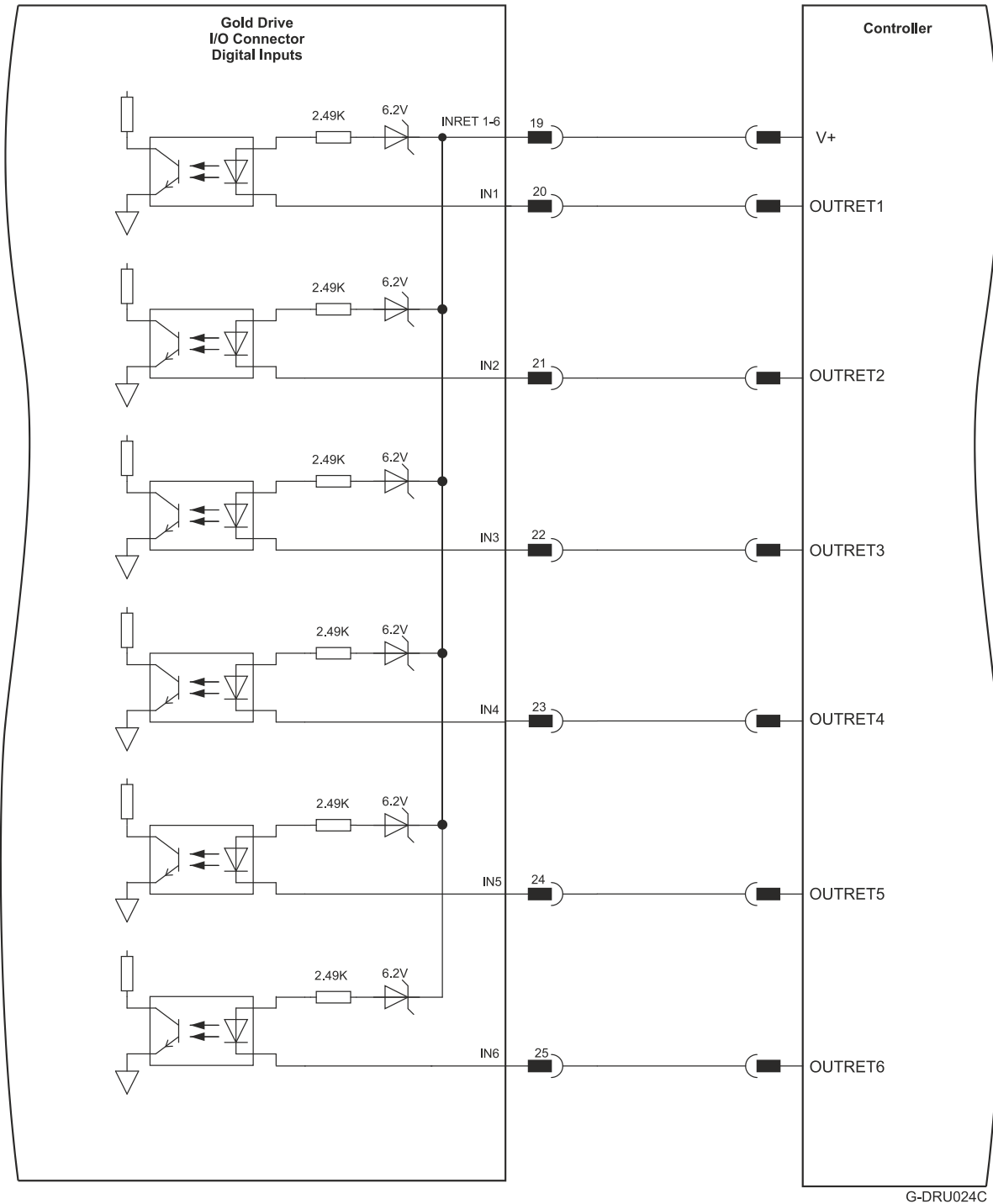


Figure 32: Digital Input Sink Mode – PLC voltage level D-Type Connection Diagram

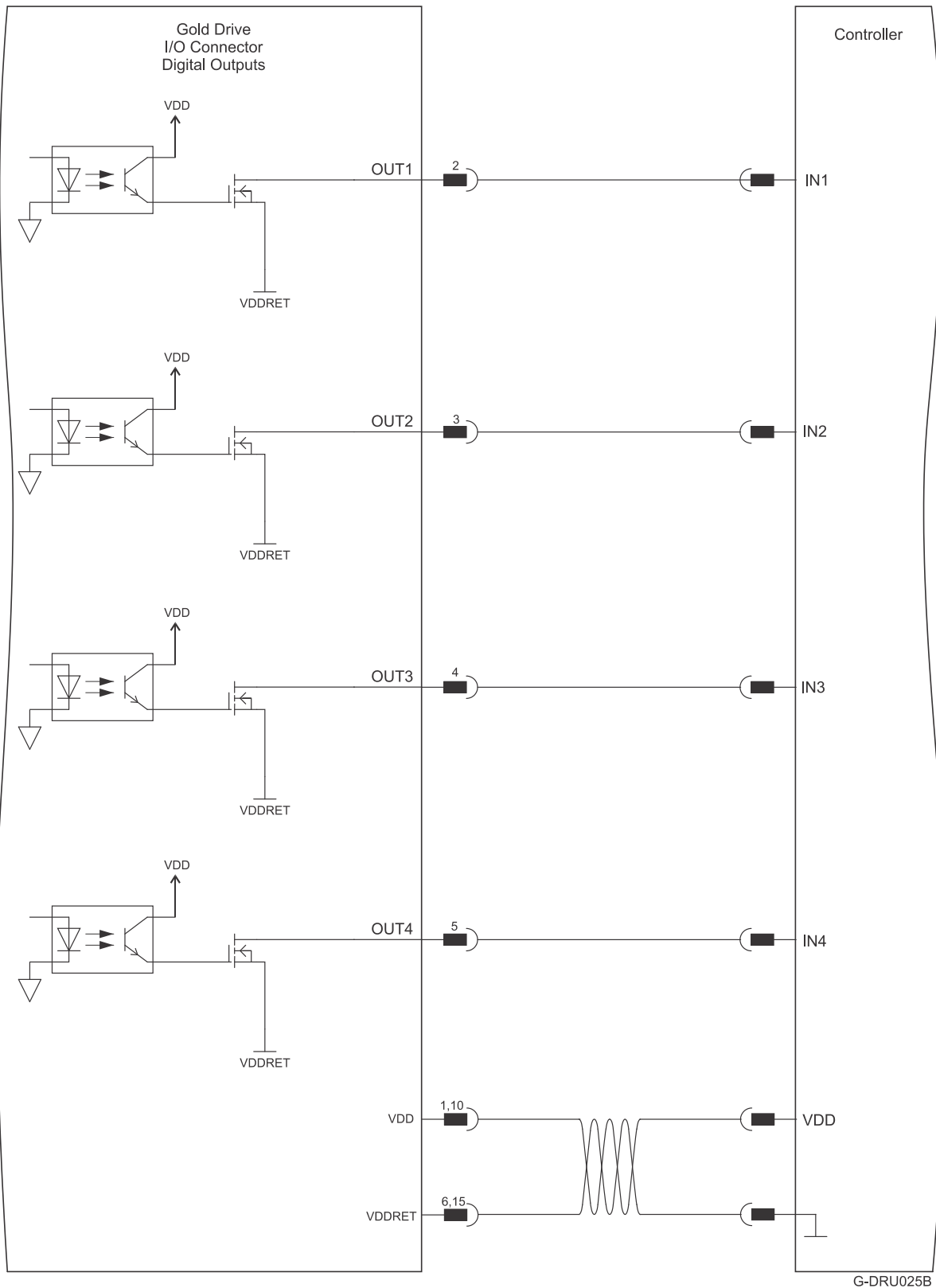


Figure 33: Digital Output as Sink Configuration D-Type Connection Diagram



9.12. Communications (P4)

The Gold Drum Communication connector is a D-Type connector with 15 high density male pins.

The Communication connector includes the following functions:

- EtherCAT communication connectors: See Section 12.2 MAN-G-Panel Mounted Drives Hardware manual for full details.
- CAN communication connectors: See Section 12.4 MAN-G-Panel Mounted Drives Hardware manual for full details.
- USB: See Section 12.1 in the MAN-G-Panel Mounted Drives Hardware manual for full details.
- RS-232: See Section 12.5 MAN-G-Panel Mounted Drives Hardware manual for full details.

EtherCAT Network Communication Version (Part Number E or F)

Pin on P4	Signal	Function
1	USB VBUS	USB VBUS 5V
2	USBD+	USB _P line
3	USBD-	USB _N line
4	COMRET	Common Return
5	USB_SHIELD	
6	RS232_TX	RS-232 Transmit
7	ECAT_IN_TX+	EtherCAT In Transmit
8	ECAT_IN_RX+	EtherCAT In Receive +
9	ECAT_OUT_TX+	EtherCAT Out Transmit+
10	ECAT_OUT_RX+	EtherCAT Out Receive+
11	RS232_RX	RS-232 Receive
12	ECAT_IN_TX-	EtherCAT In Transmit
13	ECAT_IN_RX-	EtherCAT In Receive -
14	ECAT_OUT_TX-	EtherCAT Out Transmit-
15	ECAT_OUT_RX-	EtherCAT Out Receive-

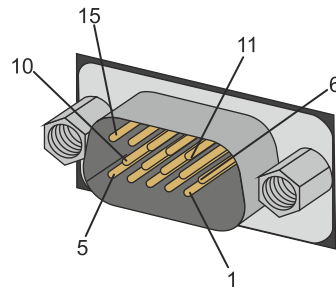
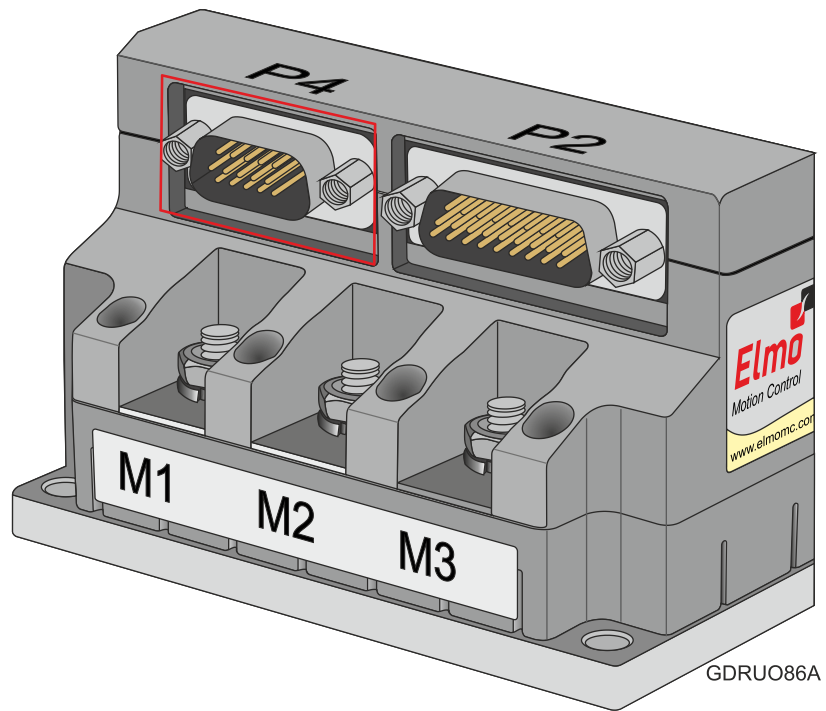


CAN Network Communication Version (Part Number S or T)

Pin on P4	Signal	Function
1	USB VBUS	USB VBUS 5V
2	USBD+	USB _P line
3	USBD-	USB _N line
4	COMRET	Common Return
5	USB_SHIELD	
6	RS232_TX/RS422_TX-	RS-232 Transmit/RS422 Transmit-(Differential RS-232)
7	RS422_RX+	RS422 Receive+(Differential RS-232)
8	Not in use	Not in use
9	CANH	CAN_H bus line (dominant high)
10	CANH	CAN_H bus line (dominant high)
11	RS232_RX/RS422_TX+	RS-232 Receive/ RS422 Transmit+(Differential RS-232)
12	RS422_RX-	RS-422 RX-(Differential RS-232)
13	Not in use	Not in use
14	CANL	CAN_L bus line (dominant low)
15	CANL	CAN_L bus line (dominant low)



Pin Position



**15-Pin D-Type High Density Male Connector
(Elmo P.N. JCB-106315MC)**

Table 8: Communication Pin Assignments



9.12.1. USB 2.0(P4)

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

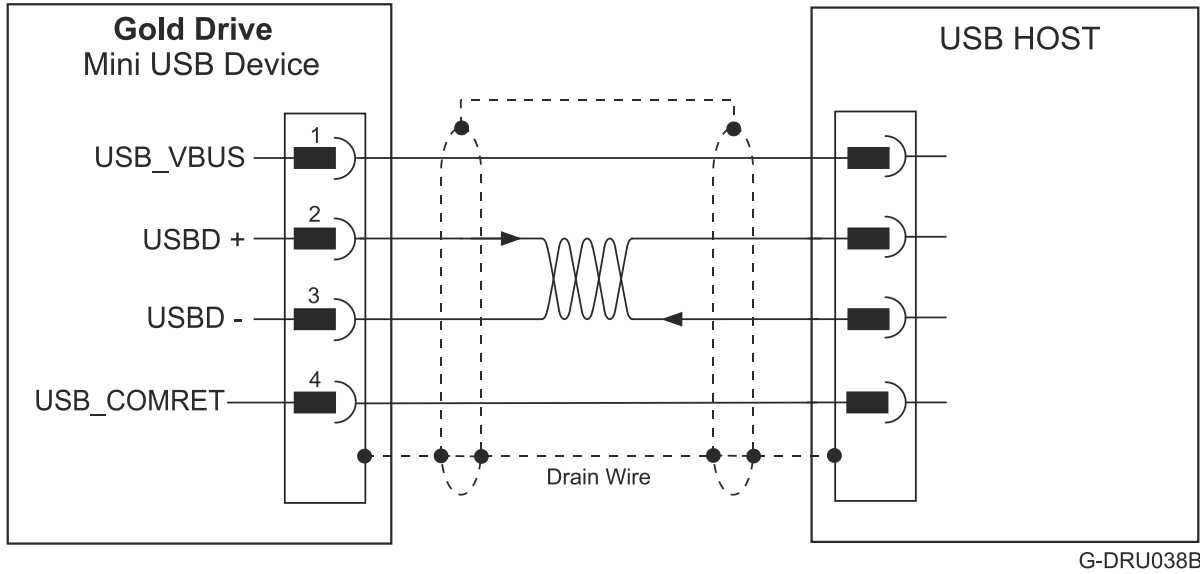


Figure 34: USB Network Diagram



9.12.2. 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.

9.12.2.1. EtherCAT Wiring(P4)

Figure 35 describes the wiring diagram for the EtherCAT connections.

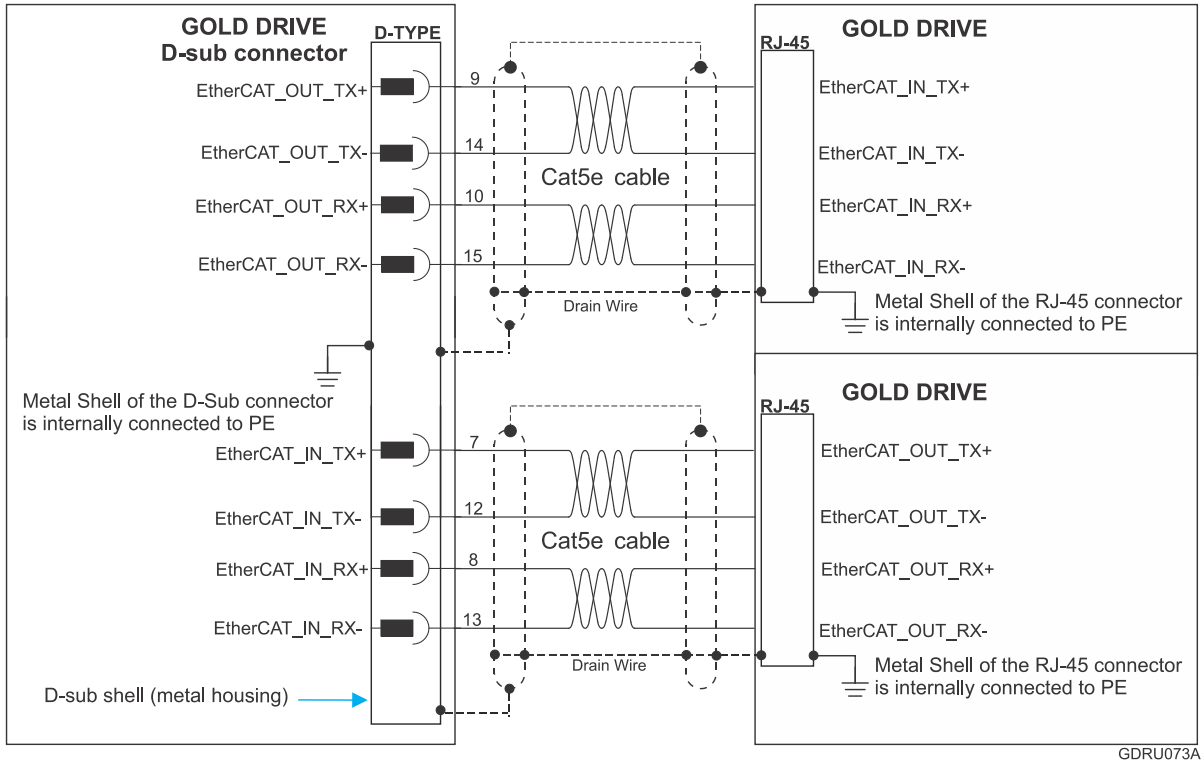


Figure 35: EtherCAT with D-Type Connections



9.12.2.2. EtherCAT Status Indicator

Figure 36 displays the LEDs available in the EtherCAT Version

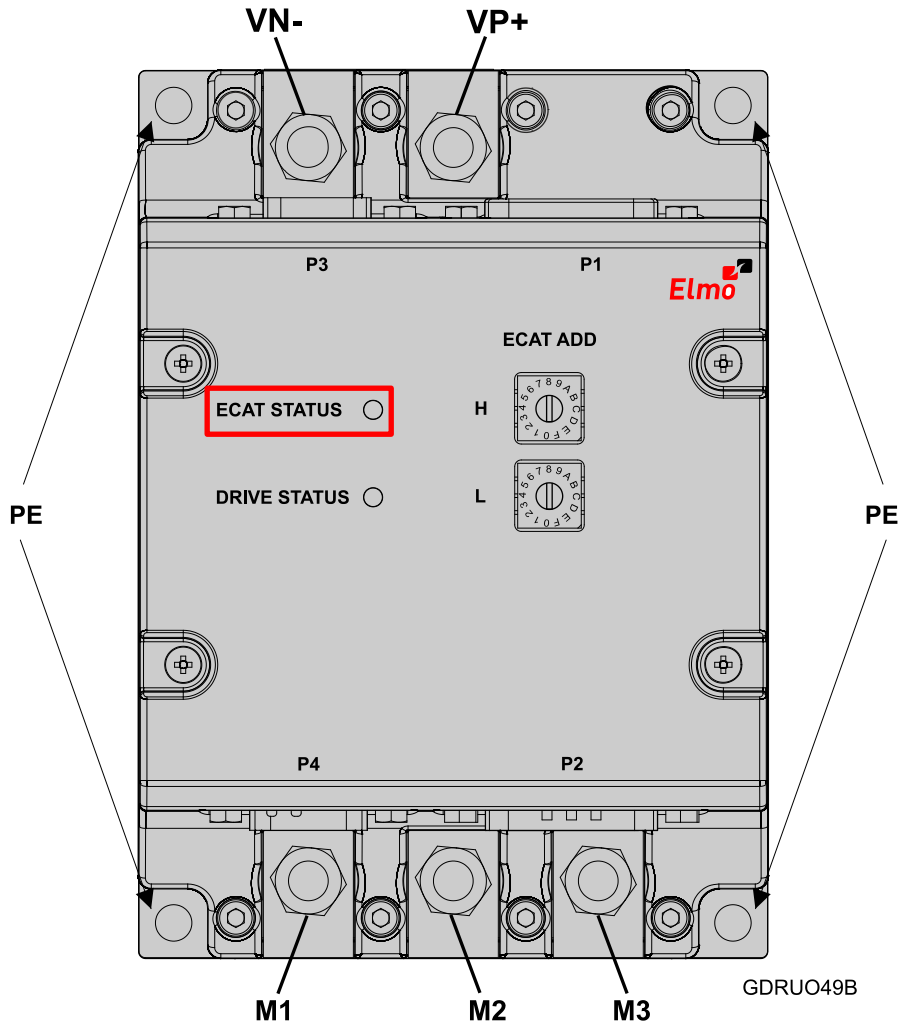


Figure 36: Drive Status LEDs

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.



9.12.2.3. EtherCAT Address Switches

Figure 37 displays the switches available in the EtherCAT Version

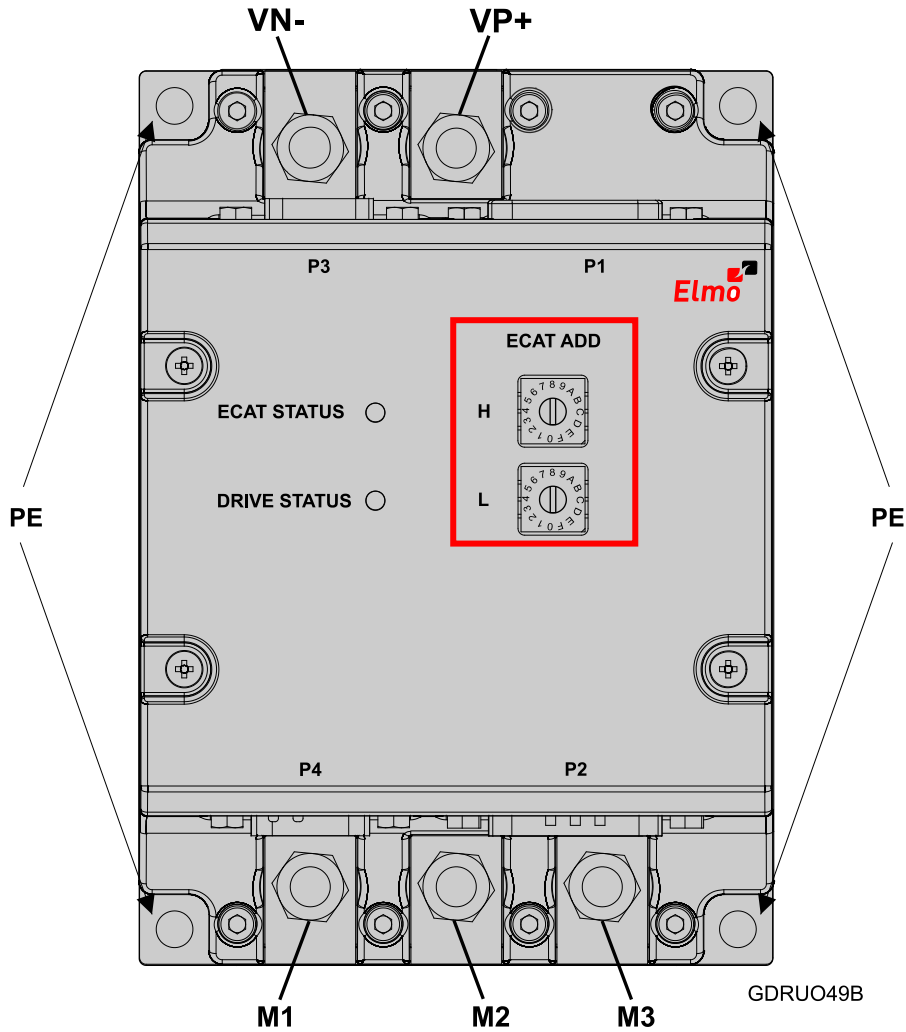


Figure 37: EtherCAT Address Switches

The EtherCAT address switches sets the ECAT address (L is ADD low, H is ADD hi). Figure 37 above, allow the user to define a unique node ID to a slave. The two rotary switches offer up to 255 addresses, with the 0 setting referring to No alias address.

The positions of the switches on the drive are shown in Figure 37. Use a screwdriver to set the low and high bytes values of the drive EtherCAT address. This address is only retrieved after power-up.



9.12.3. CAN Communications Version

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

9.12.3.1. CAN Wiring(P4)

Figure 38 describes the CAN wiring diagram on the next page.

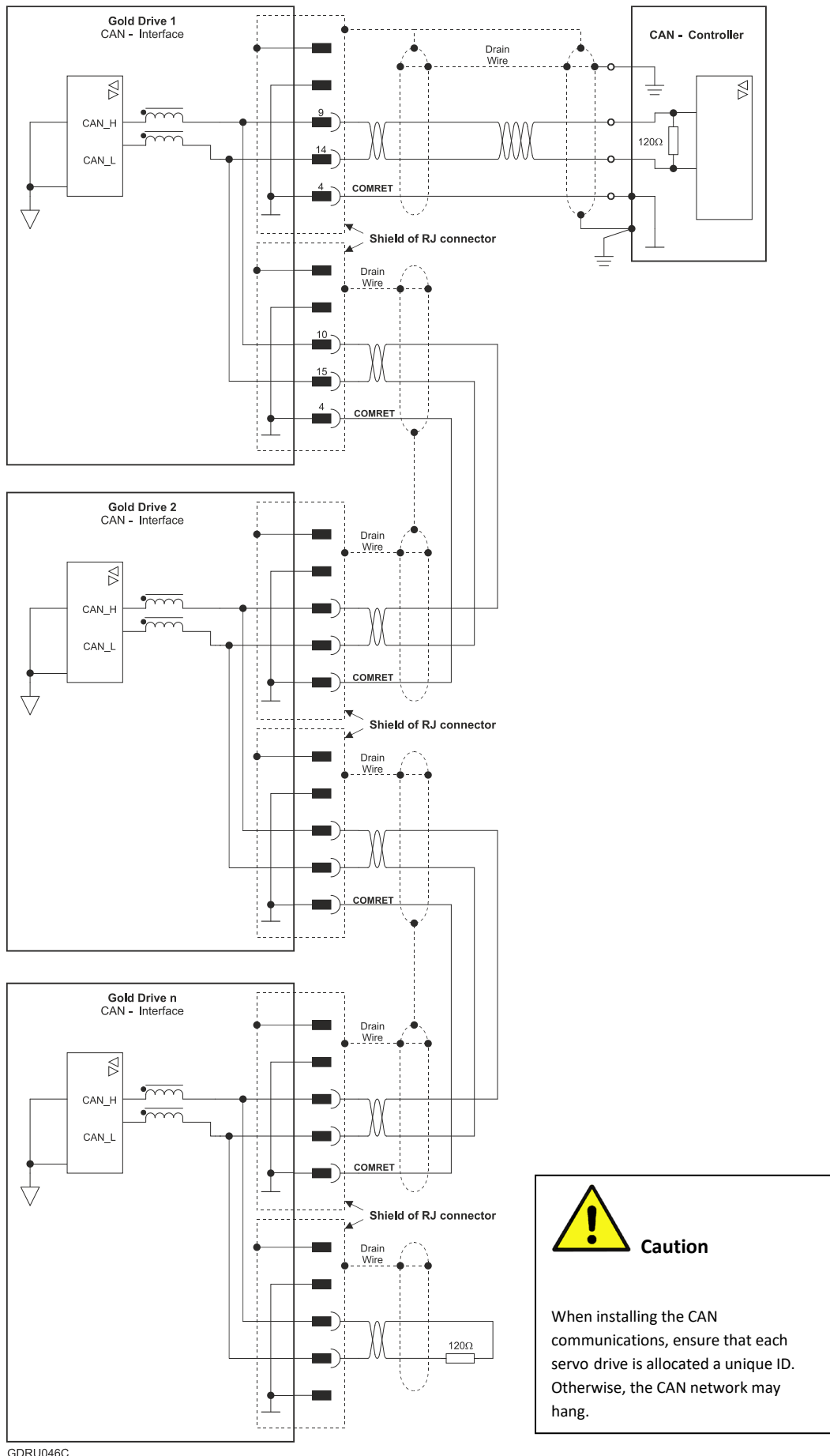


Figure 38: Gold Drum Connection Diagram – CAN



9.12.4. RS-232(P4)

The following is the recommended for RS-232 cabling:

1. Connect the shield to the ground of the host (PC). Usually, this connection is soldered internally inside the connector at the PC end. You can use the drain wire to facilitate connection.
2. The RS-232 communication port is **non-isolated**.
3. Ensure that the shield of the cable is connected to the shield of the connector used for RS-232 communications. The drain wire can be used to facilitate the connection.

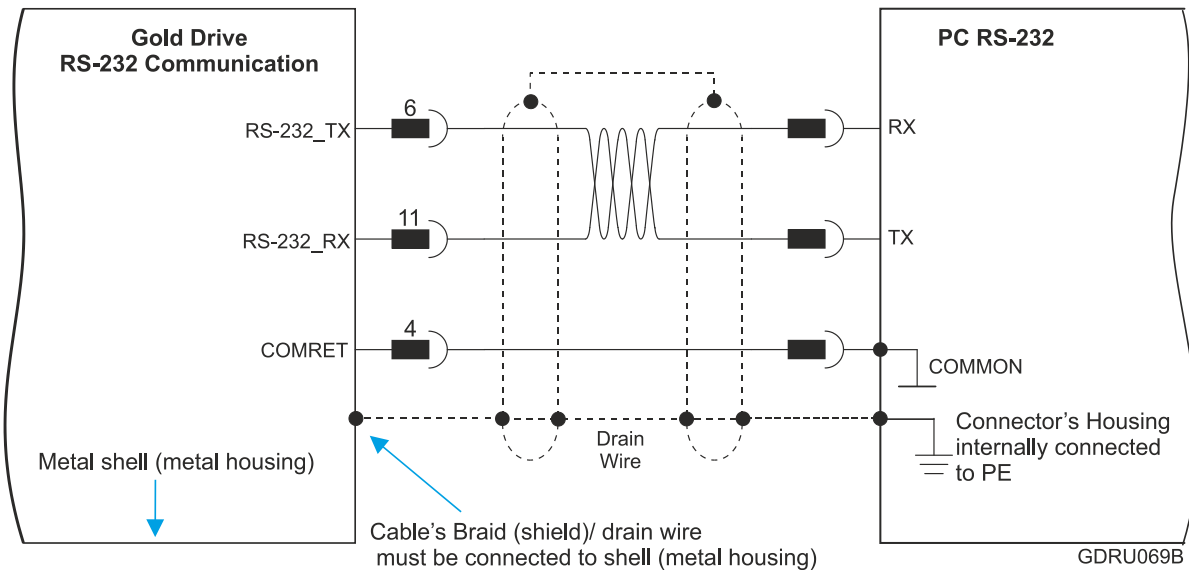


Figure 39: RS-232 Connection Diagram Example



9.12.5. RS-422 (Differential RS-232) Communication(P4)

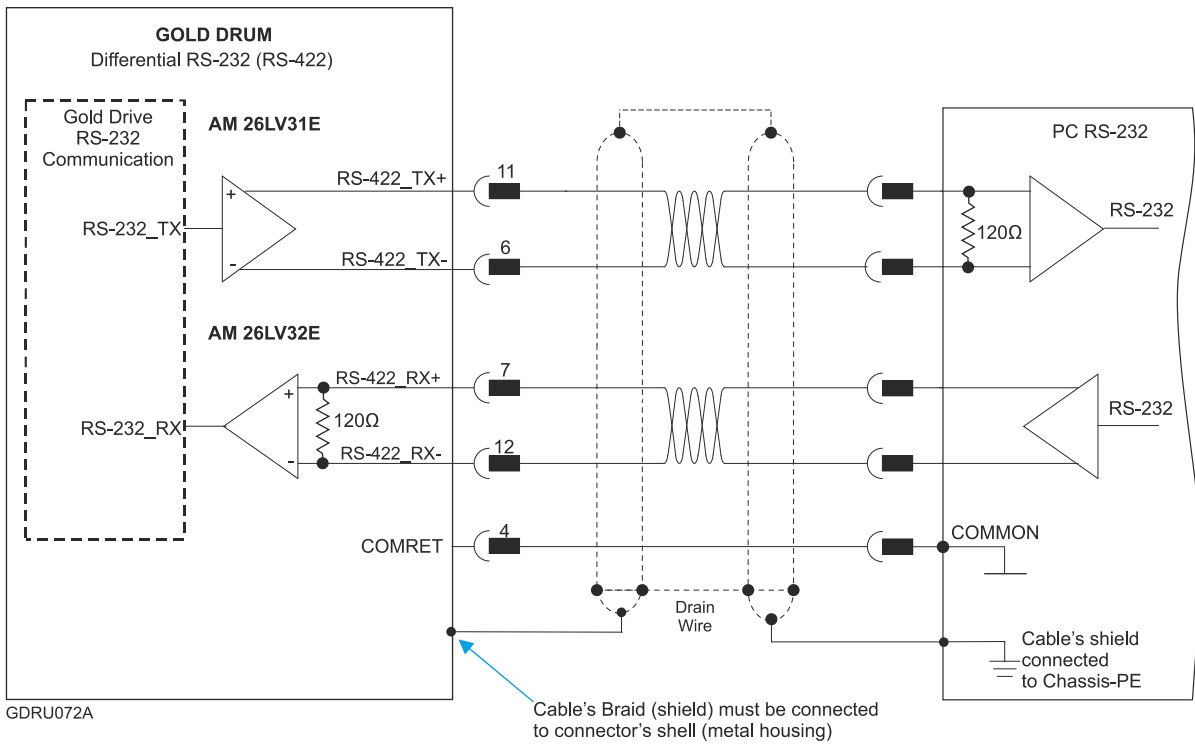


Figure 40: RS-422 (Differential RS-232) Communication Connection Diagram



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 Gold Drum is designed to be mounted on an external heat-sink. It is highly recommended that the “Wall” on which the Gold Drum is mounted will have heat dissipation capabilities. The Gold 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 Gold Drum's heat sink and any other assembly.

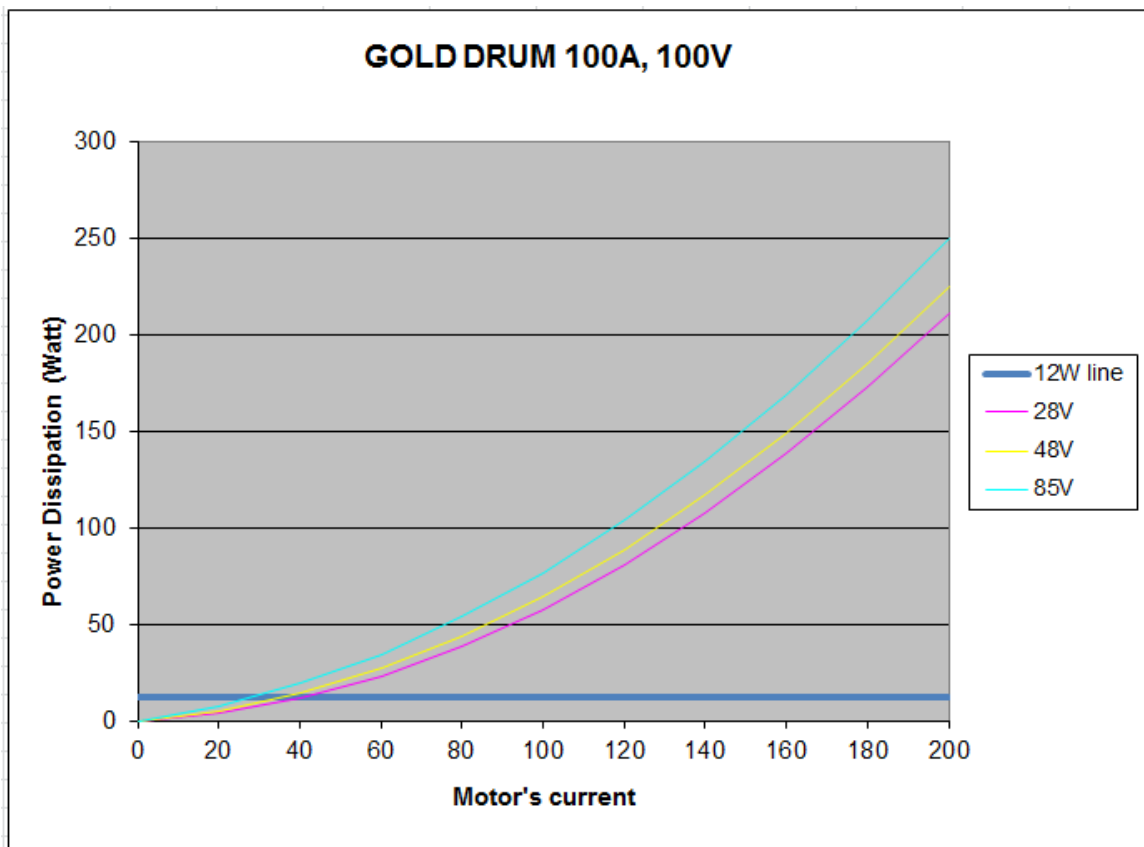
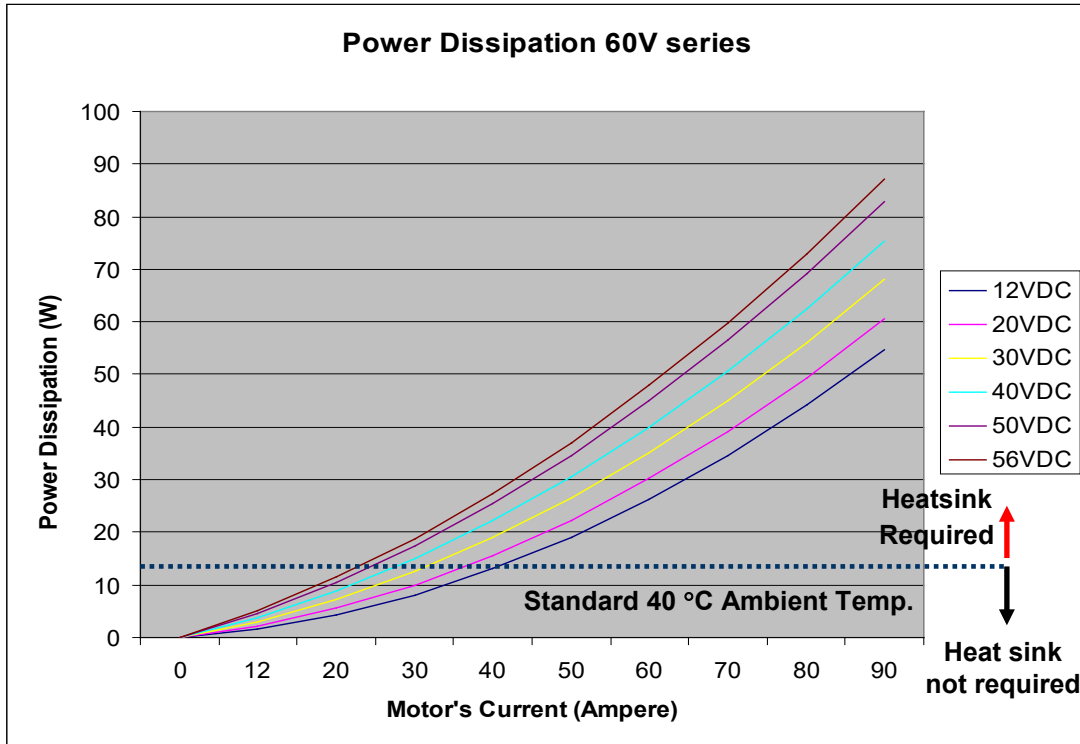
11.1. Gold Drum Thermal Data

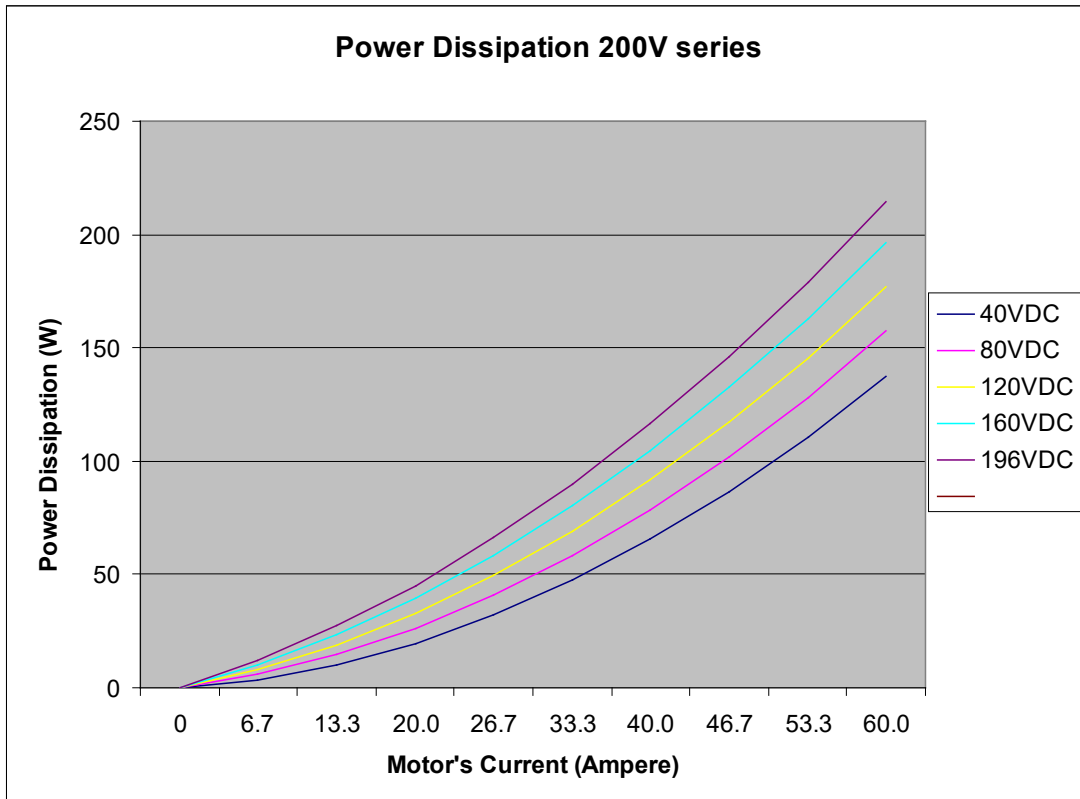
- Free air convection thermal resistance (θ): Approximately 3.6 to 4 °C/W.
- Thermal time constant: Approximately 40 minutes/ 2400 seconds (thermal time constant means that the Gold Drum will reach 2/3 of its final temperature after 4 minutes).
- Self- heat dissipation capability (no external heat sink): 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 μm : 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 ≤ 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.

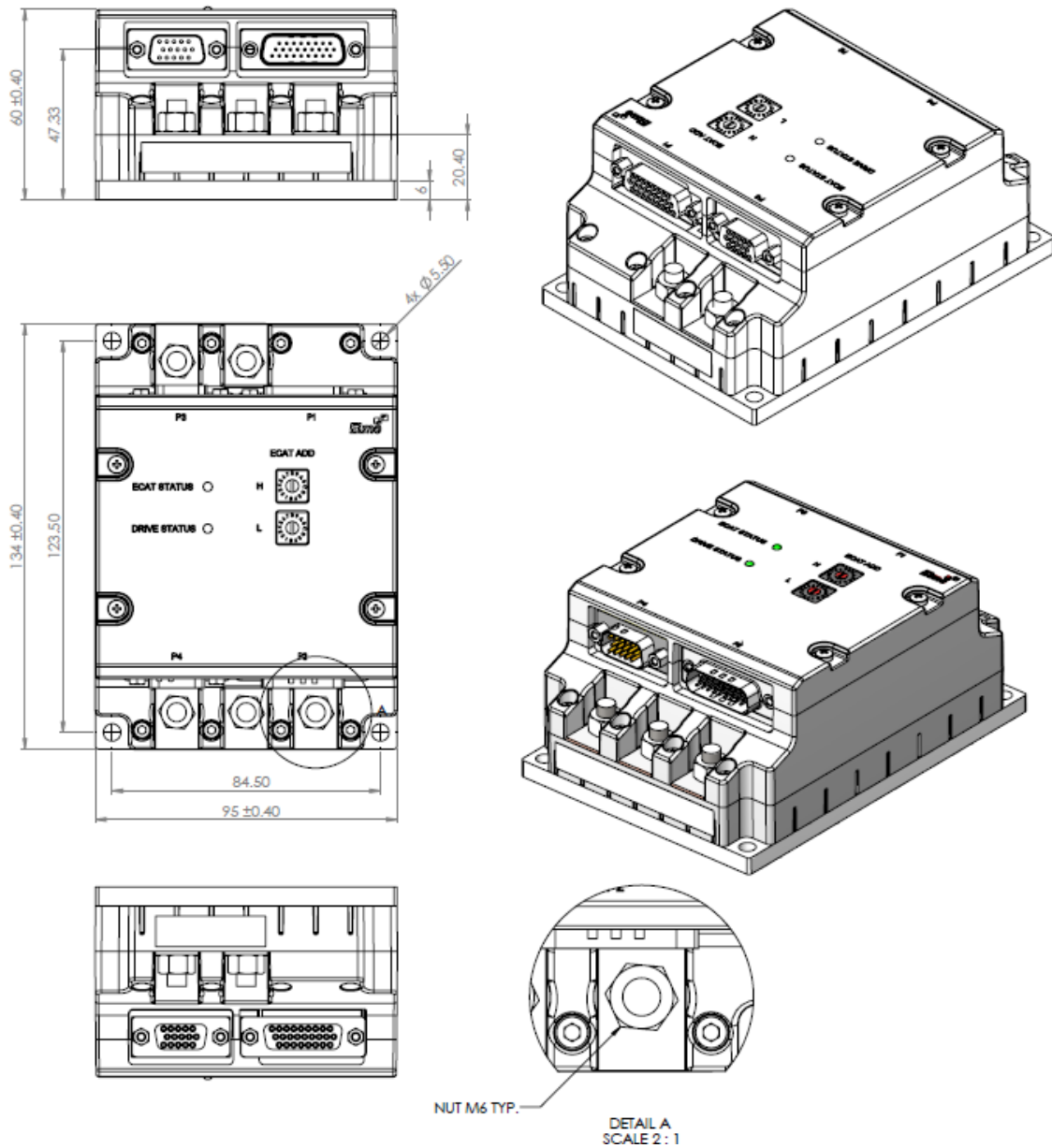


Figure 41: Gold Drum with D-Type Connectors

Inspiring Motion

Since 1988

For a list of Elmo's branches, and your local area office, refer to the Elmo site www.elmomc.com

