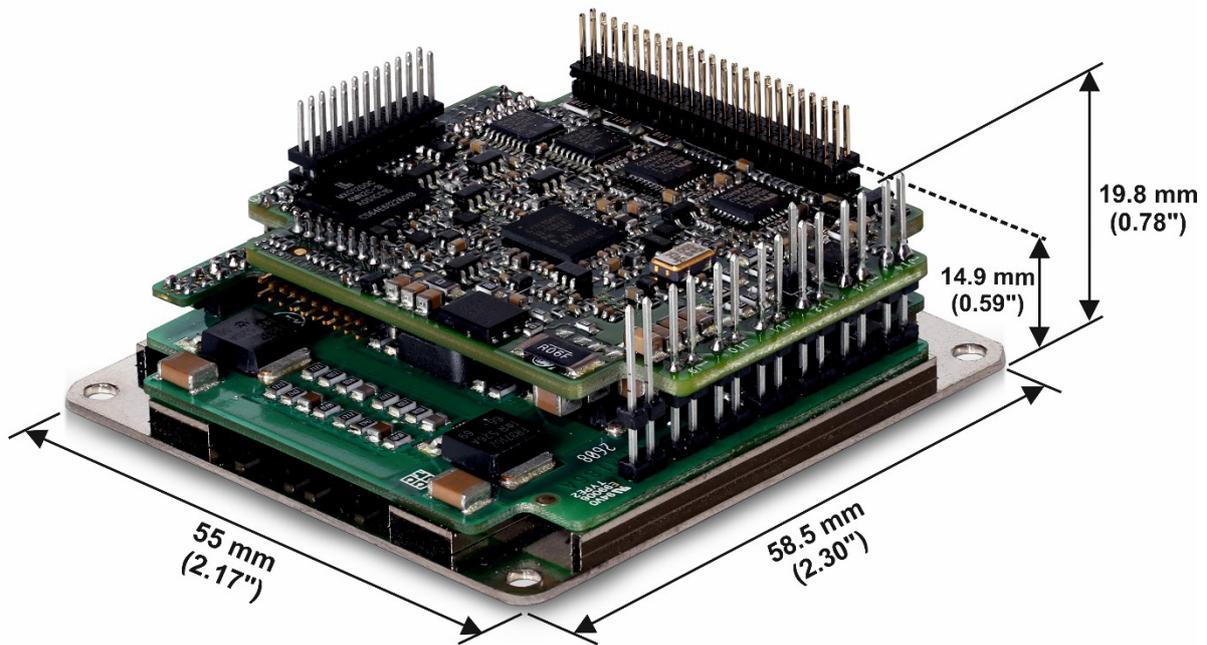


Gold Bell Digital Servo Drive Installation Guide



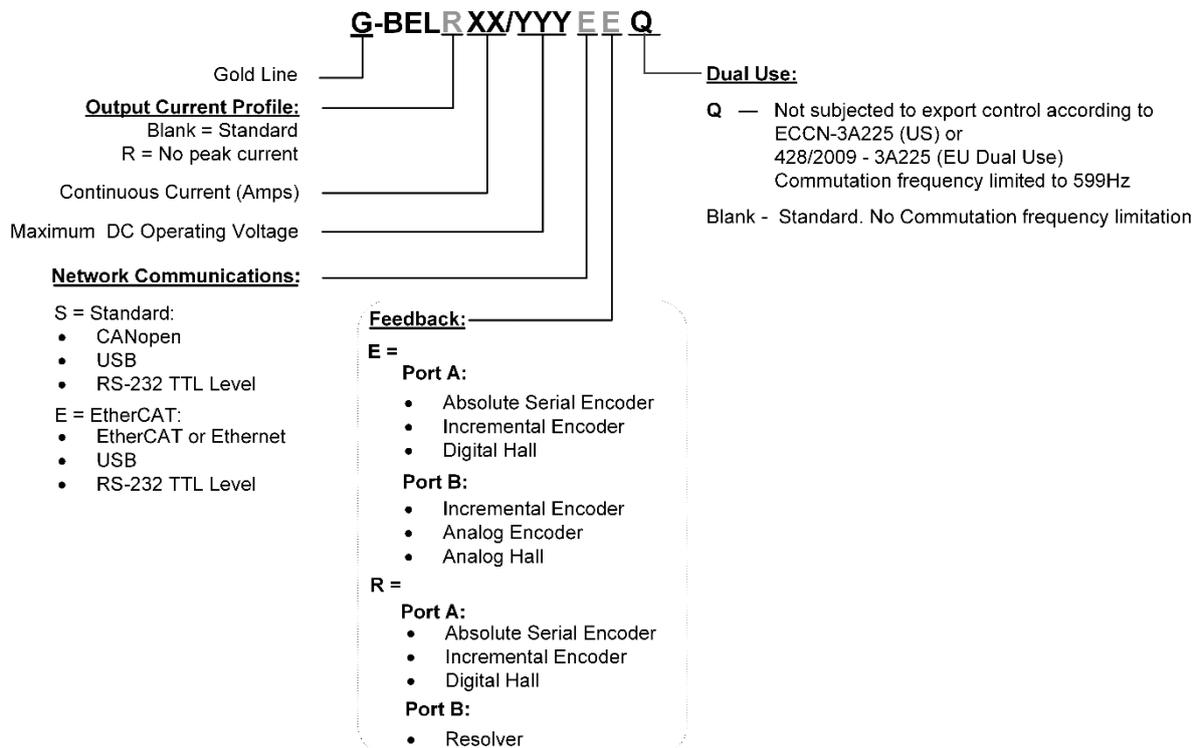
Notice

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 Bell 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.
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Catalog Number





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Chapter 1: This Installation Guide

This installation Guide details the technical data, pinouts, and power connectivity of the Gold Bell. For a comprehensive detailed description of the functions and connections of the Board Level Module (BLM) drive, refer to the MAN-G-Board Level Modules Hardware Manual.

Chapter 2: Safety Information

In order to achieve the optimum, safe operation of the Gold Bell, it is imperative that you implement the safety procedures included in this installation guide. This information is provided to protect you and to keep your work area safe when operating the Gold Bell and accompanying equipment.

Please read this chapter carefully before you begin the installation process.

Before you start, ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

Only qualified personnel may install, adjust, maintain and repair the servo drive. A qualified person has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating motors.

The Gold Bell contains electrostatic-sensitive components that can be damaged if handled incorrectly. To prevent any electrostatic damage, avoid contact with highly insulating materials, such as plastic film and synthetic fabrics. Place the product on a conductive surface and ground yourself in order to discharge any possible static electricity build-up.

To avoid any potential hazards that may cause severe personal injury or damage to the product during operation, keep all covers and cabinet doors shut.

The following safety symbols are used in this and all Elmo Motion Control manuals:



Warning:

This information is needed to avoid a safety hazard, which might cause bodily injury or death as a result of incorrect operation.



Caution:

This information is necessary to prevent bodily injury, damage to the product or to other equipment.



Important:

Identifies information that is critical for successful application and understanding of the product.



2.1 Warnings

- To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the servo drive while the power source is on.
- Power cables can carry a high voltage, even when the motor is not in motion. Disconnect the Gold Bell from all voltage sources before servicing.
- The high voltage products within the Gold Line range contain grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- After shutting off the power and removing the power source from your equipment, wait at least 1 minute before touching or disconnecting parts of the equipment that are normally loaded with electrical charges (such as capacitors or contacts). Measuring the electrical contact points with a meter, before touching the equipment, is recommended.



2.2 Cautions

- The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- When connecting the Gold Bell to an approved isolated control power supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Gold Bell, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.
- Make sure that the Safe Torque Off is operational

2.3 CE Marking Conformance

The Gold Bell is intended for incorporation in a machine or end product. The actual end product must comply with all safety aspects of the relevant requirements of the European Safety of Machinery Directive 2006/42/EC as amended, and with those of the most recent versions of standards EN 60204-1 and EN ISO 12100 at the least, and in accordance with 2006/95/EC.

Concerning electrical equipment designed for use within certain voltage limits, the Gold Bell meets the provisions outlined in 2006/95/EC. The party responsible for ensuring that the equipment meets the limits required by EMC regulations is the manufacturer of the end product.

2.4 Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All Elmo drives are warranted for a period of 12 months from the date of shipment. No other warranties, expressed or implied — and including a warranty of merchantability and fitness for a particular purpose — extend beyond this warranty.



Chapter 3: Product Description

The Gold Bell is an advanced high power density servo drive delivering up to **1.6 kW of continuous power** or **3.2 kW of peak power** in a 49.4 cc (3.02 in³) package (55 x 59 x 15 mm or 2.17" x 2.32" x 0.6"). The Gold Bell is designed to be mounted on a PCB by soldering its pins directly to the PCB.

This advanced, high power density servo drive provides top performance, advanced networking and built-in safety, as well as a fully featured motion controller and local intelligence. Power to the Gold Bell is provided by a DC power source which is isolated from the Mains. The Gold Bell can operate with single or dual power supplies. If separation between the main DC power source and a control supply is required, then a control supply (isolated from the Mains) is required.

The drive can operate as a stand-alone device or as part of a multi-axis system in a distributed configuration on a real-time network.

The Gold Bell drive is easily set up and tuned using the Elmo Application Studio (EASII) software tools. As part of the Gold product line, it is fully programmable with the Elmo motion control language. For more information about software tools refer to the Elmo Application Studio Software Manual.

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

3.1.1 Accessories

- Cable Kit (TBD)



Chapter 4: Technical Information

4.1 Physical Specifications

Feature	Units	All Types
Weight	g (oz)	55 g (1.94 oz)
Dimension	mm (in)	48.5 cc (2.96 in ³) package (55±0.2 x 58.5±0.2 x 14.9±0.5 mm or 2.17" x 2.30" x 0.59")
Mounting method		PCB mount

4.2 Technical Data

Feature	Units	1/100	2.5/100	5/100	10/100	15/100	20/100
Minimum supply voltage	VDC	12					
Nominal supply voltage	VDC	85					
Maximum supply voltage	VDC	95					
Maximum continuous power output	W	80	200	400	800	1200	1600
Efficiency at rated power (at nominal conditions)	%	> 99					
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz					
Control supply	VDC	12 to 95 VDC (up to 6 VA inc. 5 V/2 x 200 mA for encoder)					
Amplitude sinusoidal/DC continuous current	A	1.0	2.5	5	10	15	20
Sinusoidal continuous RMS current limit (I _c)	A	0.7	1.8	3.5	7	10.6	14.1
Peak current limit	A	2 x I _c					

Table 1: Technical Data

Note on current ratings: The current ratings of the Gold Bell are given in units of DC amperes (ratings that are used for trapezoidal commutation or DC motors). The RMS (sinusoidal commutation) value is the DC value divided by 1.41.



Elmo offers a 200 VDC maximum output rating selection of Gold Bell, according to the following technical data:

Feature	Units	3/200	6/200	9/200
Minimum supply voltage	VDC	12		
Nominal supply voltage	VDC	170		
Maximum supply voltage	VDC	195		
Maximum continuous power output	W	480	960	1450
Efficiency at rated power (at nominal conditions)	%	> 99		
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz		
Control supply	VDC	12 to 95 VDC (up to 6 VA inc. 5 V/2 x 200 mA for encoder)		
Amplitude sinusoidal/DC continuous current	A	3	6	9
Sinusoidal continuous RMS current limit (Ic)	A	2.1	4.2	6.3
Peak current limit	A	2 x Ic		

4.3 Control Supply

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

4.4 Product Features

Main Feature	Details	Presence / No.
STO	TTL	√
Digital Input Option	TTL	6
Digital Output Option	Open Collector-emitter (isolated)	2
	TTL 3.3V (non-isolated)	2
Analog Input	Differential ±10V	1
	Single Ended	1
Feedback	Standard Port A, B, & C	√
Communication Option	USB	√
	EtherCAT	√
	CAN	√
	RS-232 TTL level	√



4.5 Environmental Conditions

You can guarantee the safe operation of the Gold Bell by ensuring that it is installed in an appropriate environment. The following table describes the certified environmental conditions for STO of the Gold series servo drives.

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



Chapter 5: Standards and Certifications

5.1 Functional Safety

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

5.2 Electrical Safety

Specification	Details
IEC/EN 61800-5-1:2007	Adjustable speed electrical power drive systems Part 5-1: Safety requirements – Electrical, thermal and energy
Recognized UL 61800-5-1	Adjustable speed electrical power drive systems: Safety requirements – Electrical, thermal and energy
CSA C22.2 NO. 274-17	Adjustable speed drives

5.3 Electromagnetic Compatibility

Specification	Details
EN 61800-3:2004/A1:2011	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
EN 61800-5-2: 2017 Annex E	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional



5.4 Environmental

Specification	Details
IEC60068-2-78	Damp heat, steady state
IEC60068-2-6	Vibration (sinusoidal)
IEC60068-2-2	Dry heat
IEC60068-2-27	Shock

5.5 Other Compliant Standards

For other compliant standards refer to the

[MAN-G-Board Level Modules Hardware Manual section 17.7](#) or refer to the Elmo website:

<https://www.elmomc.com/capabilities/standards-compliance/gold-family/>

5.6 CE Declaration

Refer to the complete EC Declaration of Conformity available on the internet at:

https://www.elmomc.com/wp-content/uploads/dlm_uploads/2018/05/Gold-Line-CE-Declaration-of-Conformity.pdf.

5.7 Dual Use

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

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

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



Chapter 6: Installation

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

6.1 Unpacking the Drive Components

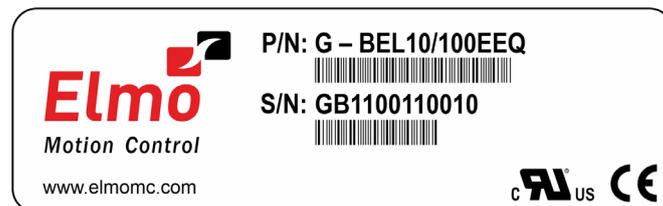
Before you begin working with the Gold Bell, verify that you have all of its components, as follows:

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

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

To unpack the Gold Bell:

1. Carefully remove the servo drive from the box and the Styrofoam.
2. Check the drive to ensure that there is no visible damage to the instrument. If any damage has occurred, report it immediately to the carrier that delivered your drive.
3. To ensure that the Gold Bell you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Gold Bell. It looks like this:



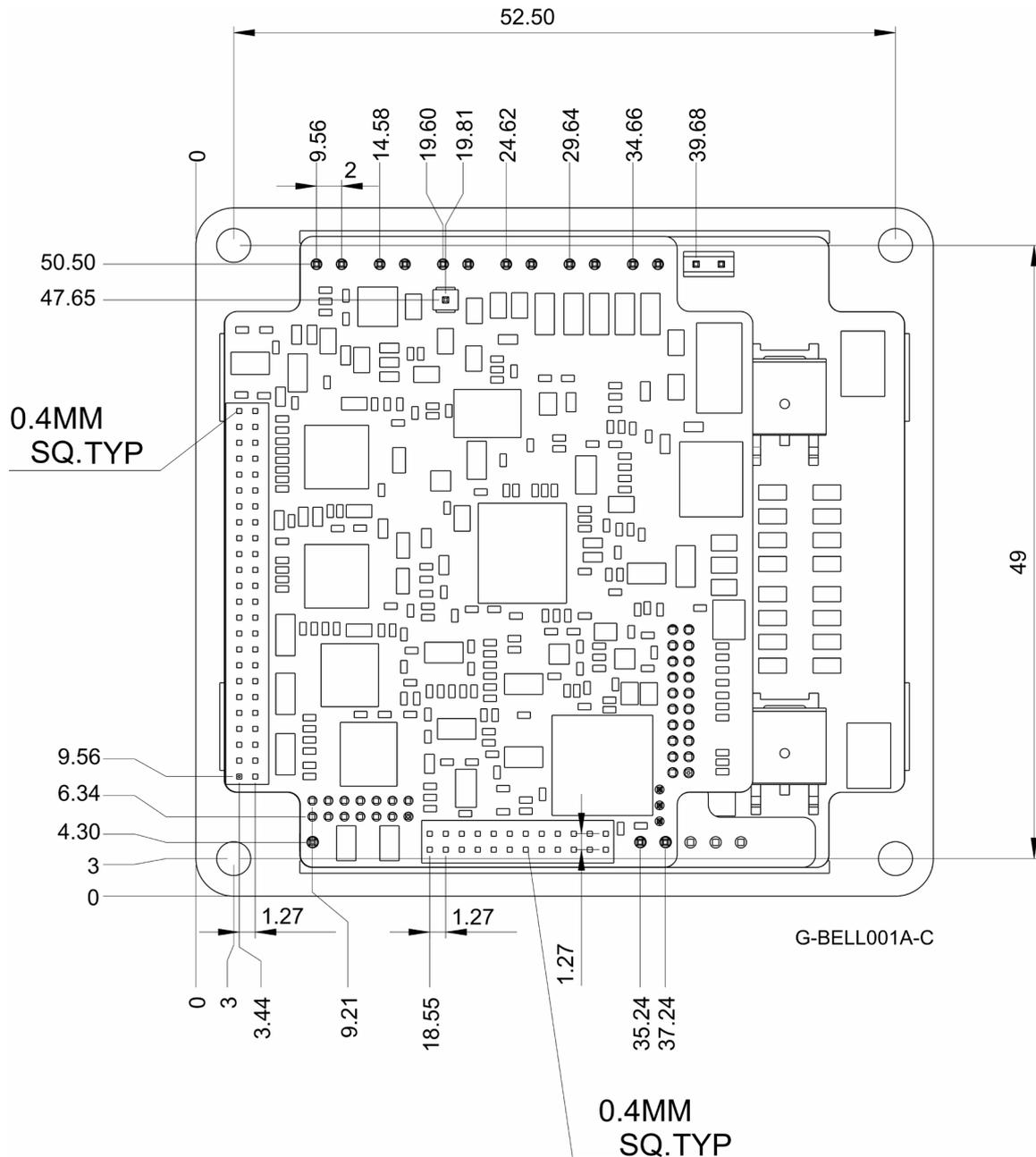
4. Verify that the Gold Bell type is the one that you ordered, and ensure that the voltage meets your specific requirements.

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



Chapter 7: Mounting the Gold Bell

The Gold Bell was designed for mounting on a printed circuit board (PCB) via 1.27 mm pitch 0.41 mm square pins and 2 mm pitch 0.51 mm square pins. When integrating the Gold Bell into a device, be sure to leave about 1 cm (0.4") outward from the heat sink to enable free air convection around the drive. We recommend that the Gold Bell be soldered directly to the board. Alternatively, though this is not recommended, the Gold Bell can be attached to socket connectors mounted on the PCB. If the PCB is enclosed in a metal chassis, we recommend that the Gold Bell be screw-mounted to it as well to help with heat dissipation. The Gold Bell has screw-mount holes on each corner of the heat sink for this purpose – see below.



All measurements are in mm.

Figure 1: Gold Bell Dimensions



Chapter 8: Integrating the Gold Bell on a PCB

The Gold Bell is designed to be mounted on a PCB by soldering its pins directly to the PCB. Refer to Chapter 5 in the MAN-G-Board Level Modules Hardware Manual and the drawings in the Gold Line Whistle Design Guide MAN-G-WHIIDG for further information.

8.1 Power Returns (PR)

In the Gold Bell, the power stage and control stage are internally connected, and the negative node of the DC power bus is designated as PR

The maximum realistic Power Return is achieved using a plane, which connects between the Gold Drive and the power source. The impedance on this plane must be as low as possible to reduce the impedance between the “Grounds”. This effectively reduces the levels of common mode differences, interferences, EMI etc.

8.2 COMRET

For details of the COMRET, refer to the section 5.4 in the MAN-G-Board Level Modules Hardware Manual.

8.3 Earth Connection (PE)

The PE (Earth connection) terminal is connected internally in the drive to the Gold Bell’s chassis (heat-sink + metal cover) which serves as an EMI common plane. Any other assembly metallic parts (such as the chassis) should also be connected to the PE.

Under normal operating conditions, the PE trace carries no current. The only time these traces carry current is under unusual conditions (such as when the device has become a potential shock or fire hazard while conducting external EMI interferences directly to ground). When connected properly the PE trace prevents these hazards from affecting the drive.



8.4 Power Return (PR), Common Return (COMRET) and Earth Connections (PE)

Safety regulations (UL61800-5-1, IEC61800-5-1, and UL508C) require that the servo drive, as a “stand alone”, must withstand breakdown voltages of 2KV for the 200V models, and 1.7KV for the 100V models, between PE to PR. However, the connections between PE to PR and the COMRET are essential for the safe operation of the servo drive. Therefore the following topology must be used:

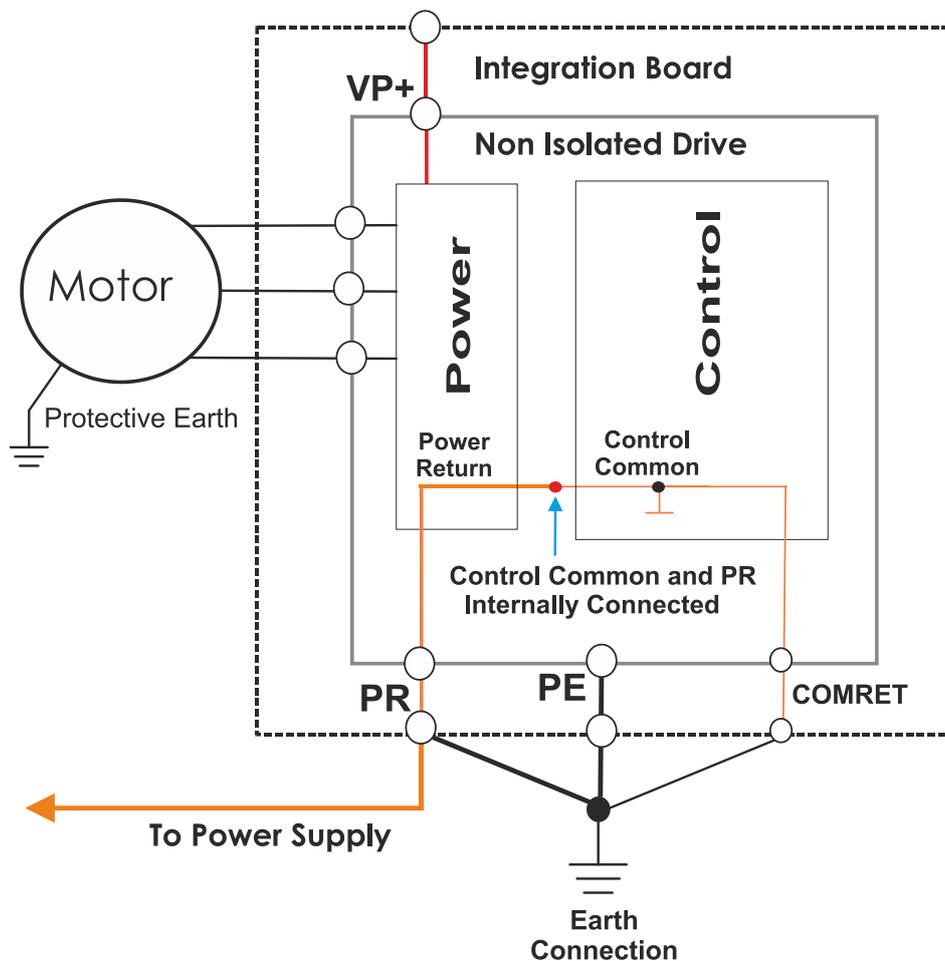


Figure 2: Gold Bell Earth Connections

The connections to PE are essential, but must be done externally to the integration board.



8.5 Power Conductors PCB layout

The PCB virtually divided into two zones; Power Zone, and Control & Communication Zone.

- **Power Zone**
This area is dedicated to Power conductors only: VP+, PR, PE, VL+, VL-, VN- and motor leads.
- **Control and Communication Zone**
This area of the PCB is dedicated to Control low level signals

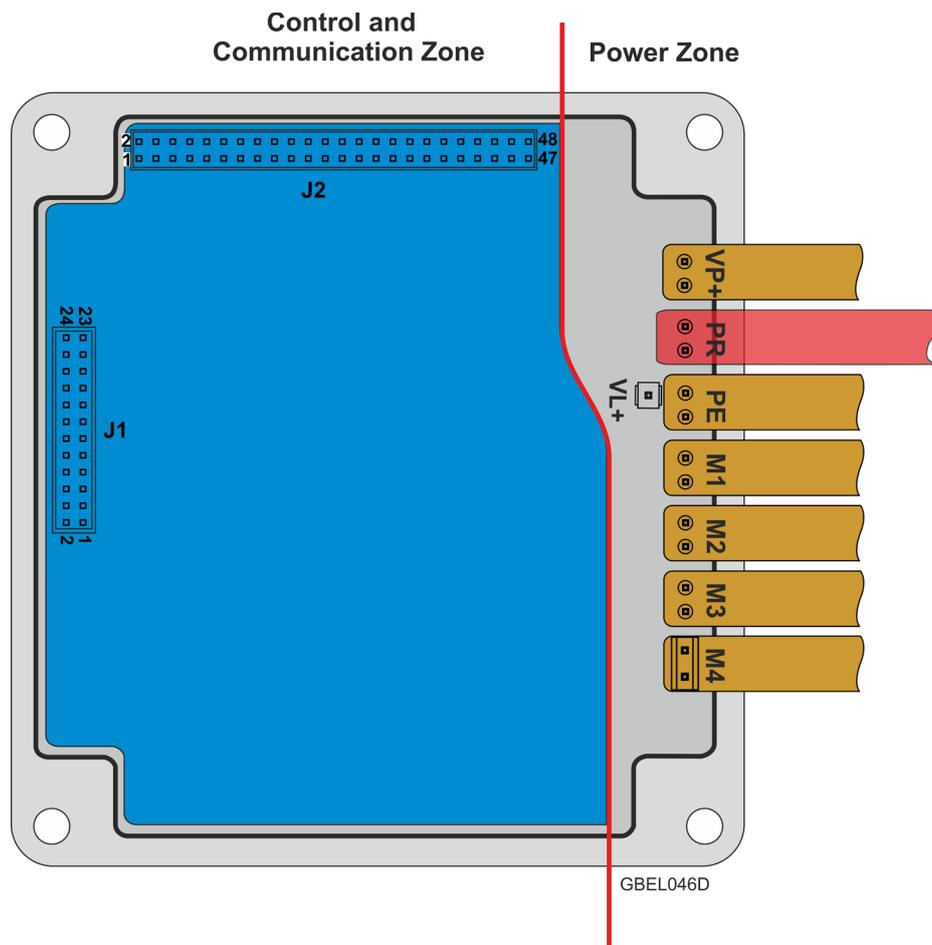


Figure 3: Gold Bell Power Conductors PCB layout

For more details, refer to the section 5.4 in the MAN-G-Board Level Modules Hardware Manual.



Chapter 9: The Gold Bell Connection Diagram

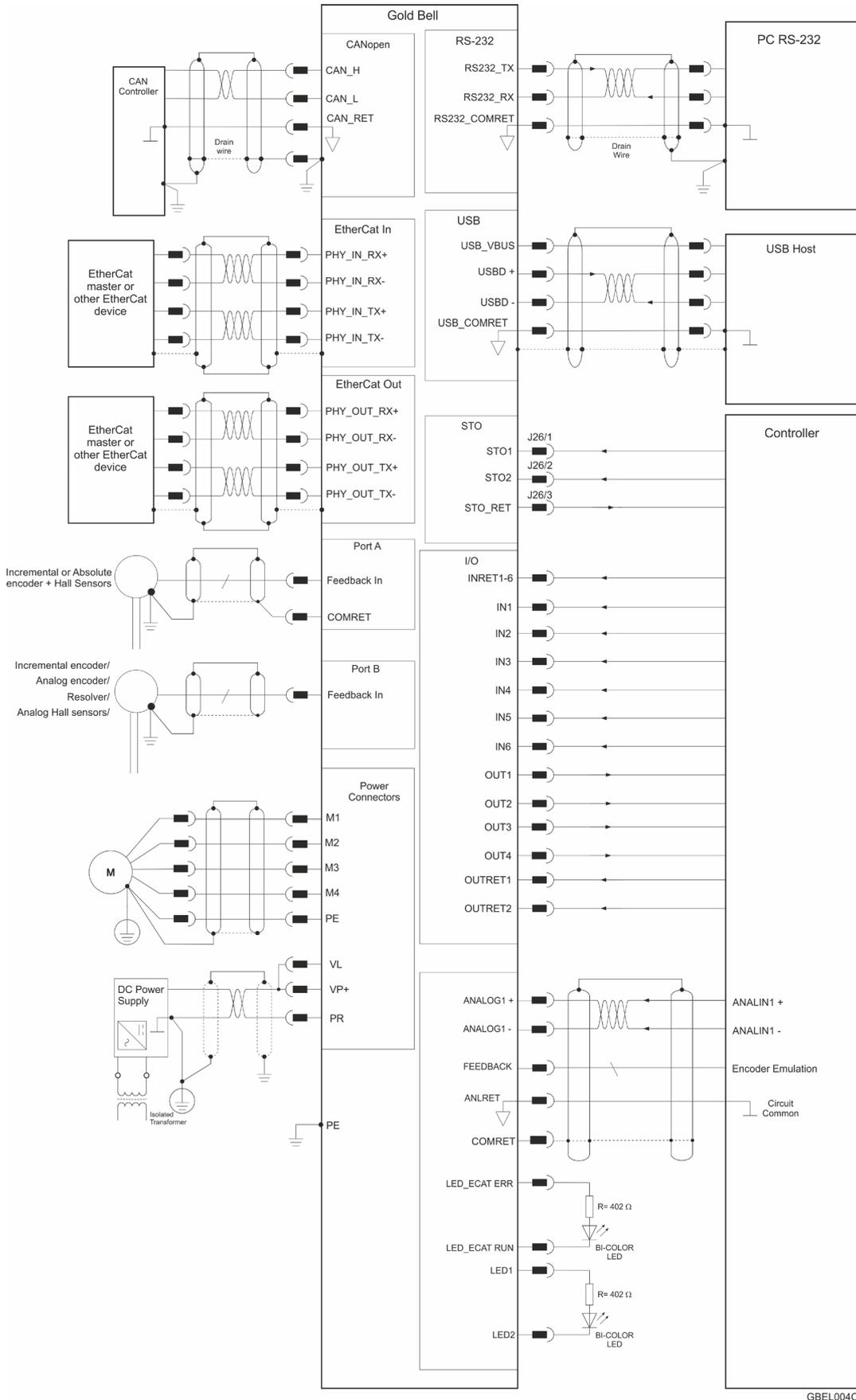


Figure 4: The Gold Bell Connection Diagram



Chapter 10: PCB Connections

10.1 Wiring legend

The following table legend describes the wiring symbols detailed in all installation guides. All the wiring diagrams show wiring for D-TYPE connectors.

Wiring Symbol	Description
 GGEN_101D-A	Earth connection (PE)
 GGEN_101D-B	Earth Connection
 GGEN_101D-C	Common at the Controller
 GGEN_101D-D	Shielded cable with drain wire. The drain wire is a non-insulated wire that is in direct contact with the braid (shielding). Shielded cable with drain wire significantly simplifies the wiring and earthing.
 GGEN_101D-E	Shielded cable braid only, without drain wire.
 GGEN_101D-F	Twisted-pair wires
 GGEN_DTYPE101C-Q	
<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>	



10.2 Connector Types

The Gold Bell has nine connectors.

10.2.1 Connector Types

Port	Pins	Type	Function
J2	2x24	1.27 mm pitch, 0.41 mm sq	Feedbacks, Digital Halls, Analog Inputs, Communications
J1	2x12		I/O, LEDs, STO
M4	1x2	2 mm pitch, 0.51 mm sq	Motor power output 4
M3	1x2		Motor power output 3
M2	1x2		Motor power output 2
M1	1x2		Motor power output 1
PE	1x2		Protective earth
PR	1x2		Power input return
VP+	1x2		Positive power input
VL+	1x1	Control power input	

Connector Location

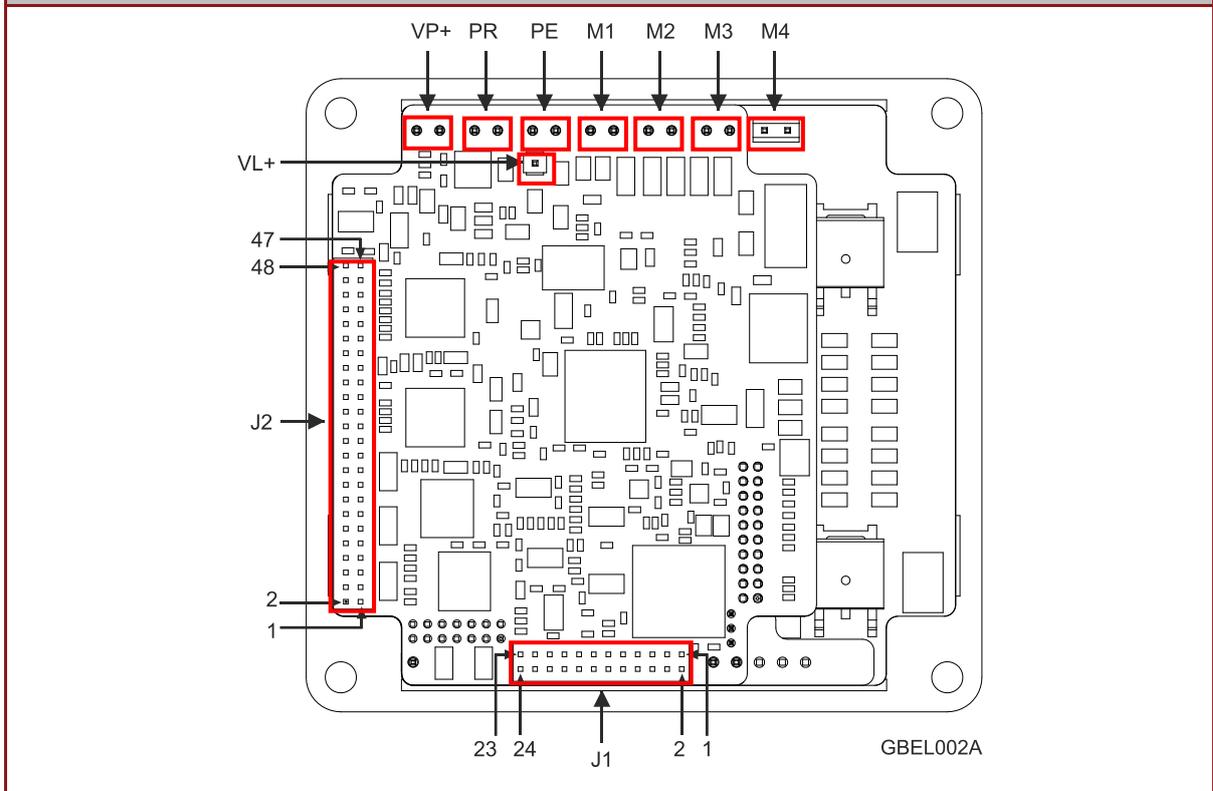


Table 2: Connector Types



10.3 Drive Status Indicator

For details of the Drive Status Indicator wiring, refer to the Chapter 7 in the MAN-G-Board Level Modules Hardware Manual.

10.4 Motor Power Connector Pinouts

For full details see Chapter 8 in the MAN-G-Board Level Modules Hardware Manual.

Pin	Function	Cable		
		Brushless Motor	Brushed DC Motor	Stepper Motor
PE	Protective Earth	Motor	Motor	Motor
M1	Motor phase	Motor	No Connection	Motor
M2	Motor phase	Motor	Motor	Motor
M3	Motor phase	Motor	Motor	Motor
M4	Motor phase	No Connection	No Connection	Motor

Pin Positions	

Table 3: Motor Connector

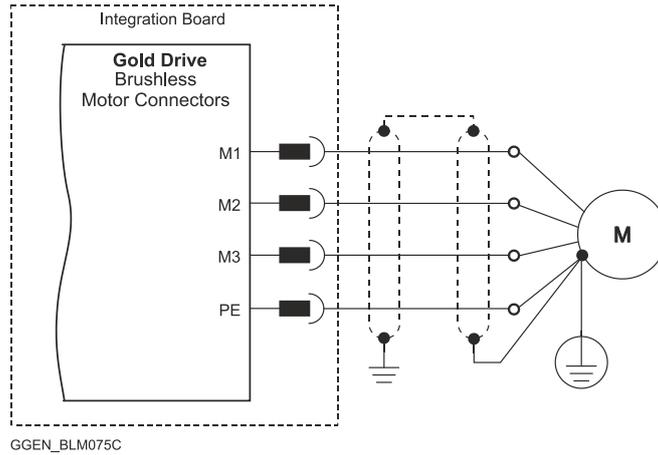


Figure 5: Brushless Motor Power Connection Diagram

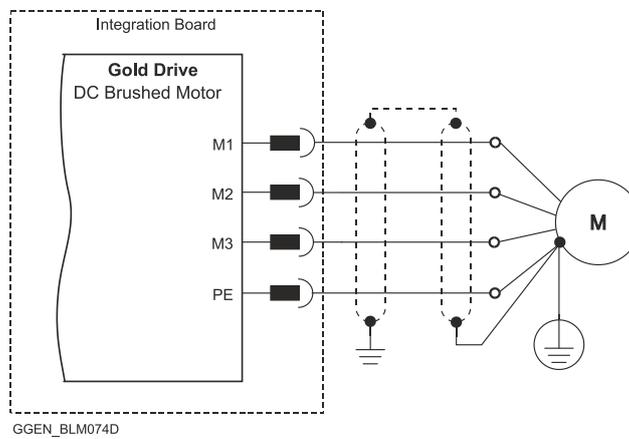


Figure 6: DC Brushed Motor Power Connection Diagram

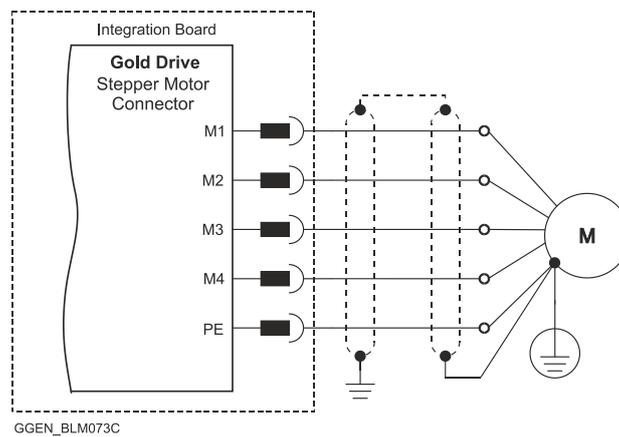


Figure 7: Stepper Motor Power Connection Diagram



10.5 Main Power and Control Connector

There are two power ratings for the Gold Bell:

- 100V for is 12 to 95 VDC
- 200V for the 12 to 195 VDC

For power rating 200V

Two DC power sources are required, a DC power source of 12 to 195V isolated from the Mains, and a control supply 12 to 95V (isolated from the Mains) for the logic.

For power rating of 100V

Only a single DC Power source of 12 to 95 VDC isolated from the Mains, is required for the main power and also for the control power. However, a control power supply can be added for the logic.

10.5.1 Main Power

Pin	Function	Cable	Pin Positions
VP+	Pos. Power input	Power	
PR	Power return	Power	
PE	Protective earth	Power	
Connector Type: 2 mm pitch 0.51 mm sq			

Table 4: Connector for Main Power

Note: The 12V to 195V DC power source must be from the Mains.

Connect the DC power source cable to the VP+ and PR terminals on the main power connector.

To connect your integration board to the DC power source:

1. The DC power supply source must be isolated from the Mains.
2. For best immunity, it is highly recommended to use twisted and shielded cables for the DC power source. A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the motor.
3. Connect the cable shield to the closest earth connection near the power supply.
4. Connect the PE to the closest earth connection near the power supply.
5. Connect the PR to the closest earth connection near the power supply.
6. Before applying power, first verify the polarity of the connection.



10.5.2 Control Supply

The Control supply is required for the 200V power rating, and can be added for the 100V power rating.

Note: The source of the Control Supply must be from the Mains.

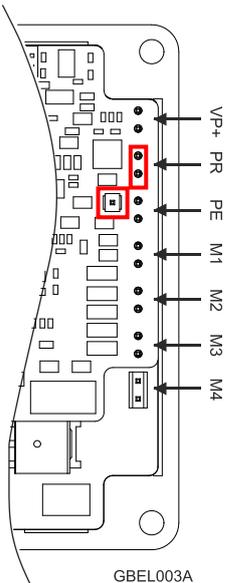
Pin	Function	Pin Positions
VL+	Control Supply Input	
PR	Control Supply Return	
Connector Type: 2 mm pitch 0.51 mm sq		

Table 5: Control Supply Pins

Connect the VL+ and PR terminal to the **Control** Connector.

To connect your integration board to the control supply:

1. The source of the control supply must be isolated from the Mains.
2. For safety reasons, connect the return (common) of the control supply source to the closest earth connection near the control supply source
3. Connect the cable shield to the closest earth connection near the control supply source
4. Before applying power, first verify the polarity of the connection.



10.5.3 Power Supply for the Power Rating 200 V

For Power Rating 200 V, two DC power sources are required, a main power 12 to 195V DC power source isolated from the Mains, and a control power supply 12 to 95V (isolated from the Mains) for the logic. The following figure describes the connection of main power and control.

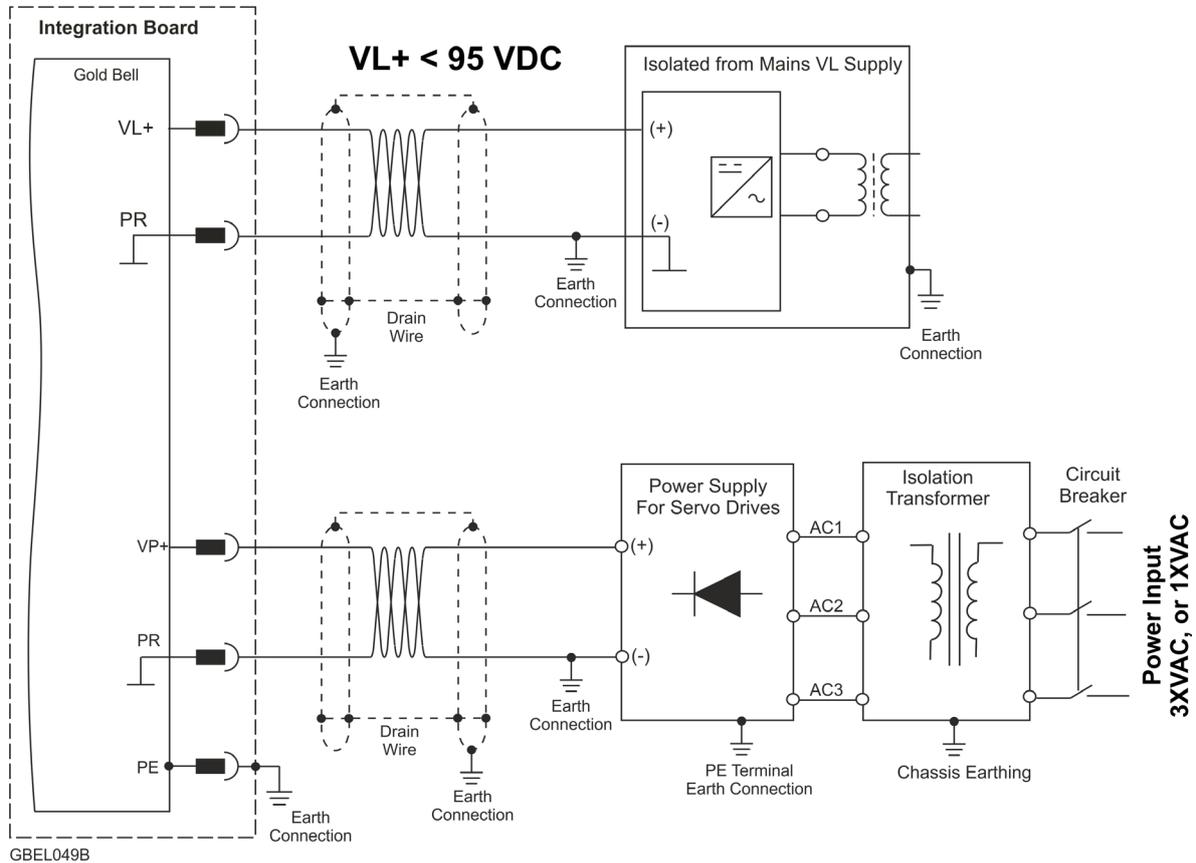


Figure 8: Power Supply Connection Diagram for Power Rating 200V

Note: Make sure to connect the PR to the closest earth connection near the power supply.



10.5.4 Power Supply for power rating 100 V

10.5.4.1 Single Power Supply

Only one power supply is required for the main and control power.

* It is strongly recommended to add a filter on the VL+ Input Pin at the Gold Bell, in order to avoid interference from the power stage e.g. noises. The following figure describes the filter recommended.

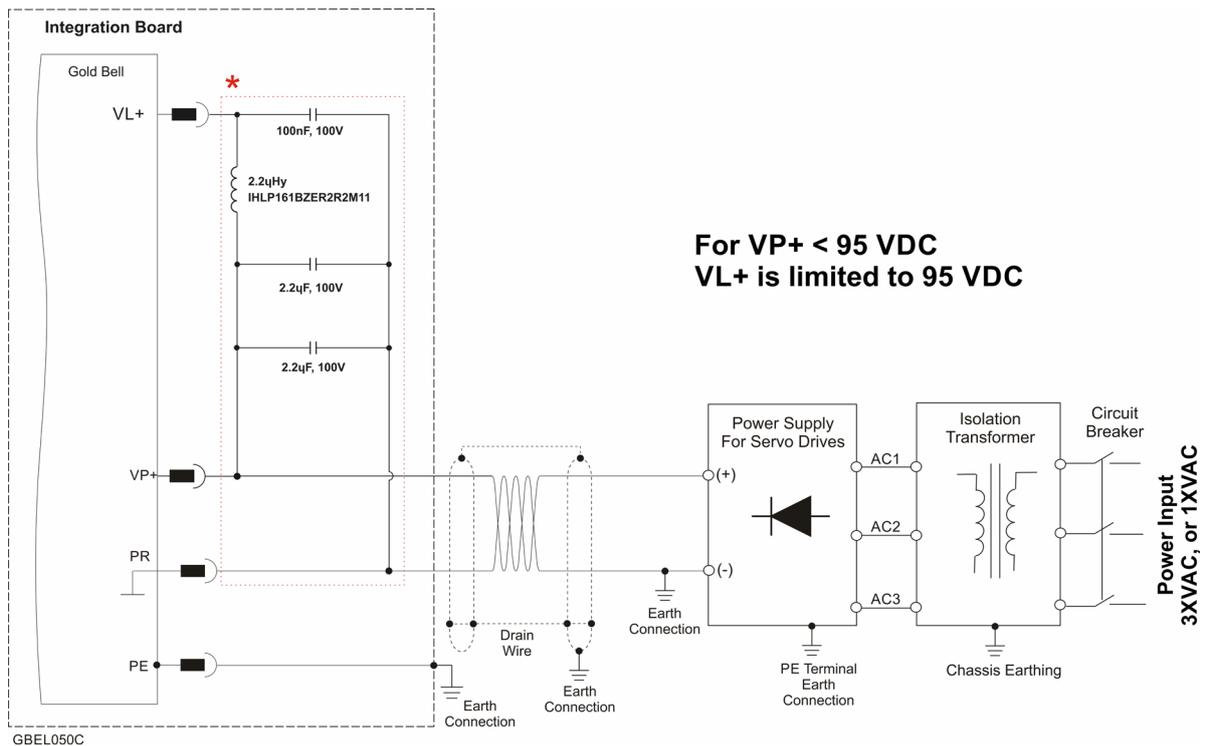


Figure 9: Single Power Supply Connection Diagram with VL+ Connected Internally to Recommended Filter

Note: Make sure to connect the PR to the closest earth connection near the power supply.



10.5.4.2 Shared Supply

A single DC Power Supply can supply the power for logic as well as the main power. If separation between the main DC power source and a control supply is required, then a control supply (isolated from the Mains) can be connected by implementing "diode coupling" (Figure 11).

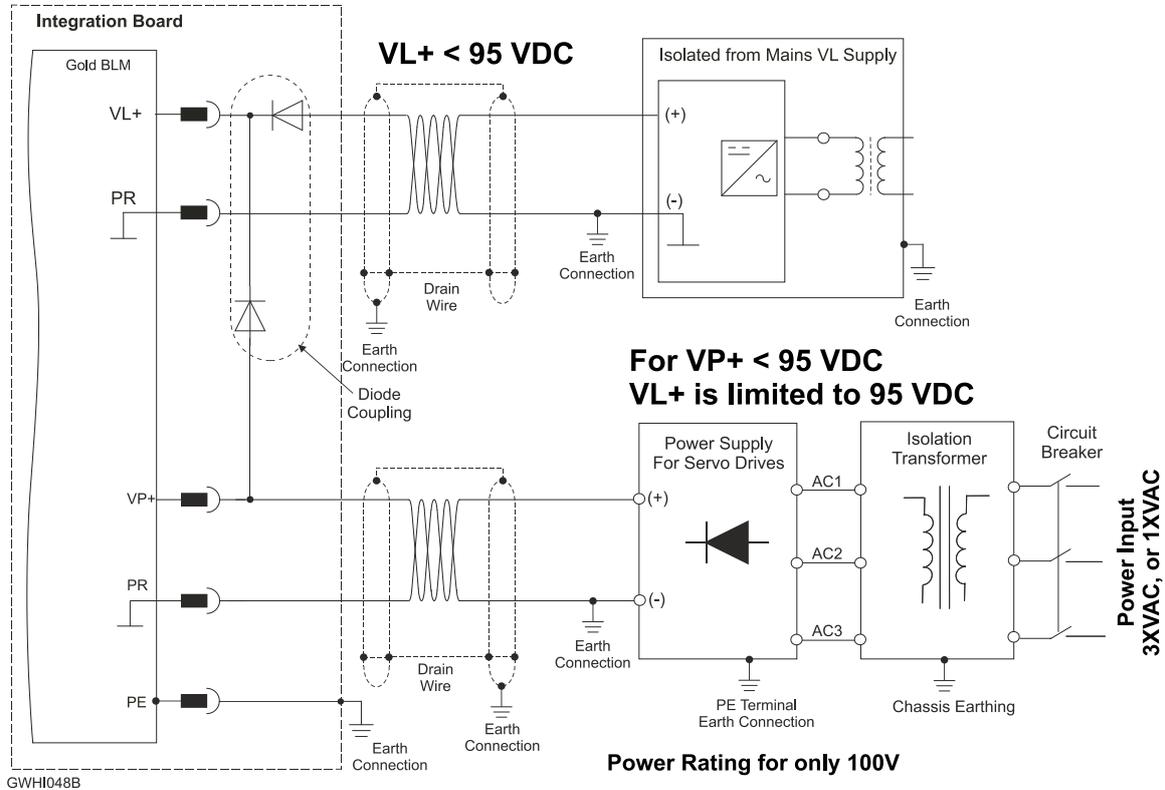
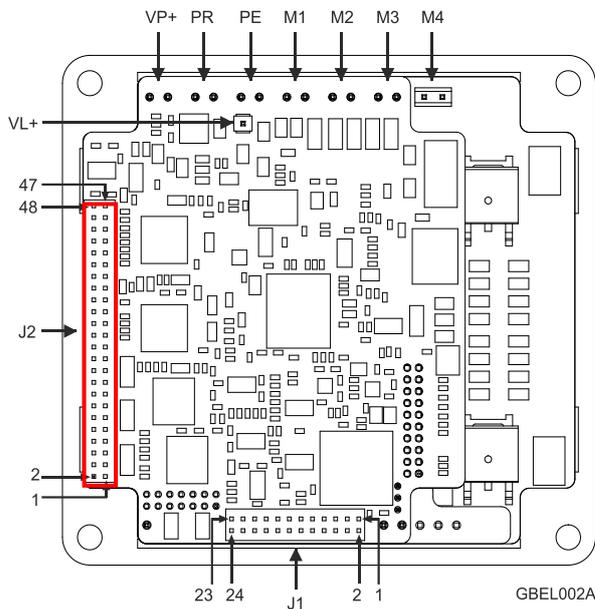


Figure 11: Shared Optional Power Supply Connection Diagram

Note: Make sure to connect the PR to the closest earth connection near the power supply.



10.6 Connector J2 - Feedback, Analog Inputs, RS-232, USB, EtherCAT, Ethernet, and CAN



Feedback A/B/C, Digital Halls – see Chapter 10: Feedbacks in the MAN-G-Board Level Modules Hardware Manual.

Analog Inputs - For full details on Analog Inputs, see Chapter 12 in the MAN-G-Board Level Modules Hardware Manual.

RS-232 – For full details on RS-232 see section 14.4 in the MAN-G-Board Level Modules Hardware Manual.

USB 2.0 – For full details on USB see section 14.1 in the MAN-G-Board Level Modules Hardware Manual.

EtherCAT/Ethernet – For full details on EtherCAT/Ethernet see section 14.2. in the MAN-G-Board Level Modules Hardware Manual.

CAN – For full details on CAN see section 14.3 in the MAN-G-Board Level Modules Hardware Manual.

Connector Type: 1.27 mm pitch 0.41 mm sq

Note regarding the EtherCAT and CAN communication options:

The J2 Connector exports all supported communication links. However, note that CAN and EtherCAT are not available in the same version of the Gold Bell and are thus not operational simultaneously. See the part number diagram in Section 6.1 above for the different Gold Bell configurations.

Pin (J2)	Signal	Function
1	PortA_ENC_A+ /ABS_CLK+	Port A- channel A/ Absolute encoder clock+
2	PortC_ENCO_A-	Port C- channel A complement output
3	PortA_ENC_A-/ABS_CLK-	Port A- channel A complement / Absolute encoder clock-
4	PortC_ENCO_A+	Port C- channel A output
5	PortA_ENC_B+/ABS_DATA+	Port A - channel B/ Absolute encoder Data+
6	PortC_ENCO_B-	Port C - channel B complement output
7	PortA_ENC_B-/ABS_DATA-	Port A - channel B complement / Absolute encoder Data-
8	PortCENCO_B+	Port C - channel B output
9	PortA_ENC_INDEX+	Port A – index



Pin (J2)	Signal	Function
10	PortC_ENCO_INDEX-	Port C - index complement output
11	PortA_ENC_INDEX-	Port A - index complement
12	PortC_ENCO_INDEX+	Port C - index output
13	PortB_ENC_A+/SIN+	Port B - channel A/SIN+
14	HC	Hall sensor C input
15	PortB_ENC_A-/SIN-	Port B - channel A complement/SIN-
16	HB	Hall sensor B input
17	PortB_ENC_B+/COS+	Port B - channel B/COS+
18	HA	Hall sensor A input
19	PortB_ENC_B-/COS-	Port B - channel B complement/COS-
20	ANARET	Analog return
21	PortB_ENC_INDEX+/ANALOG_I+ /RESOLVER_OUT+	Port B - Channel_Index+ /Analog_Index+/Resolver_Out+
22	ANALOG1+	Analog input 1
23	PortB_ENC_INDEX-/ANALOG_I- /RESOLVER_OUT-	Port B - Channel_Index /Analog_Index /Resolver_Out Compliments
24	ANALOG1-	Analog input 1 complement
25	COMRET	Common return
26	+3.3V	3.3 V supply voltage for EtherCAT LEDs
27	PHY_IN_RX+	EtherCAT In receive
28	EtherCAT: PHY_OUT_RX+	EtherCAT Out receive
	CAN: Reserved	Reserved
29	PHY_IN_RX-	EtherCAT In receive complement
30	PHY_OUT_RX-	EtherCAT Out receive complement
31	COMRET	Common return
32	COMRET	Common return
33	PHY_IN_TX+	EtherCAT In transmit
34	EtherCAT: PHY_OUT_TX+	EtherCAT Out transmit complement
	CAN: Reserved	Reserved
35	PHY_IN_TX-	EtherCAT In transmit complement



Pin (J2)	Signal	Function
36	EtherCAT: PHY_OUT_TX-	EtherCAT Out transmit complement
	CAN: Reserved	Reserved
37	PHY_IN_LINK_ACT	EtherCAT In active LED
38	EtherCAT: PHY_OUT_LINK_ACT	EtherCAT Out active LED
	CAN: CAN_L	CAN_L BUS Line(dominant low)
39	PHY_IN_SPEED	EtherCAT In Speed LED
40	EtherCAT: PHY_OUT_SPEED	EtherCAT Out Speed LED
	CAN: CAN_H	CAN_H BUS Line(dominant high)
41	USBD-	USB data complement
42	USBD+	USB data
43	COMRET	Common return
44	USB_VBUS	USB VBUS 5V
45	RS232_RX /SB_OUT	There are two options for this pin: Option 1: RS232 receive (default) Option 2: Serial Bus output for extended I/O (refer to Chapter 13 of the MAN-G-Board Level Modules Hardware Manual.)
46	COMRET	Common return
47	+5VE	Encoder +5 V supply
48	RS232_TX /SB_IN	There are two options for this pin: Option 1: RS232 transmit (Default) Option 2: Serial Bus IN for extended I/O (refer to Chapter 13 of the MAN-G-Board Level Modules Hardware Manual.)

Table 6: Connector J2 – Feedback and Analog Input



10.6.1 Feedback Port A

Port A supports the following sensor inputs:

- Digital Hall sensors
- Incremental encoder or absolute serial encoder, depending on the specific model
- Differential pulse-width modulation (PWM) signal input can be connected to port A
- Differential Pulse & Direction signal inputs can be connected to port A

10.6.1.1 Incremental Encoder

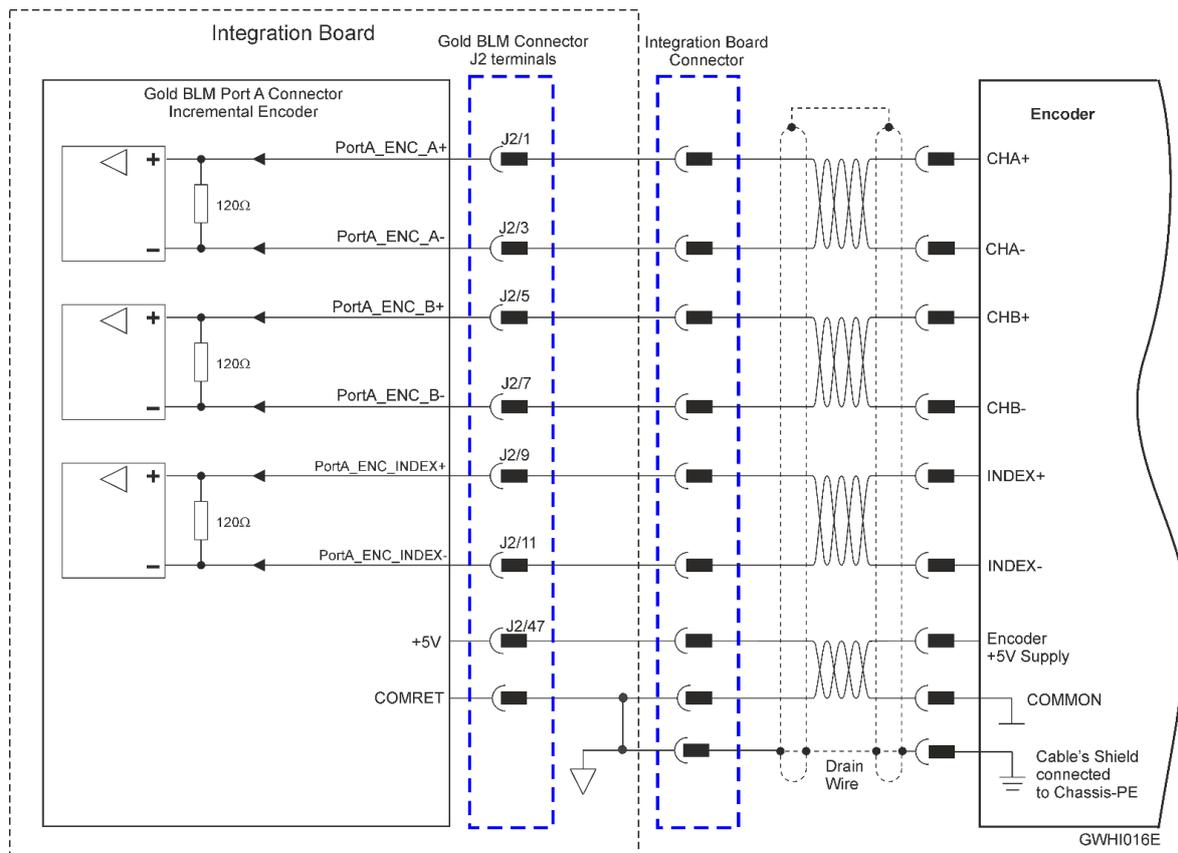


Figure 12: Port A Incremental Encoder Input – Recommended Connection Diagram



10.6.1.2 Hall Sensors

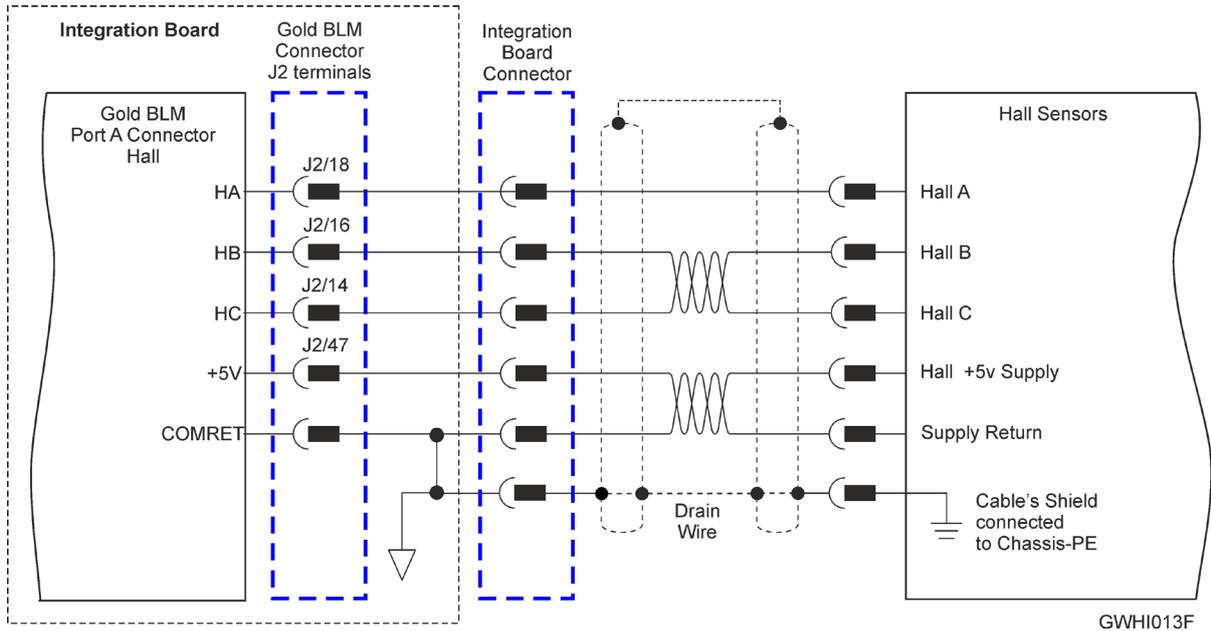


Figure 13: Hall Sensors Connection Diagram



10.6.1.3 Absolute Serial Encoder

The following Absolute Encoder are supported:

- Endat 2.2
- Biss C and Biss B
- Panasonic
- Tamagawa
- SSI
- Sanyo Danki
- Hiperface

The following is the diagram connection of the Endat, Biss, SSI:

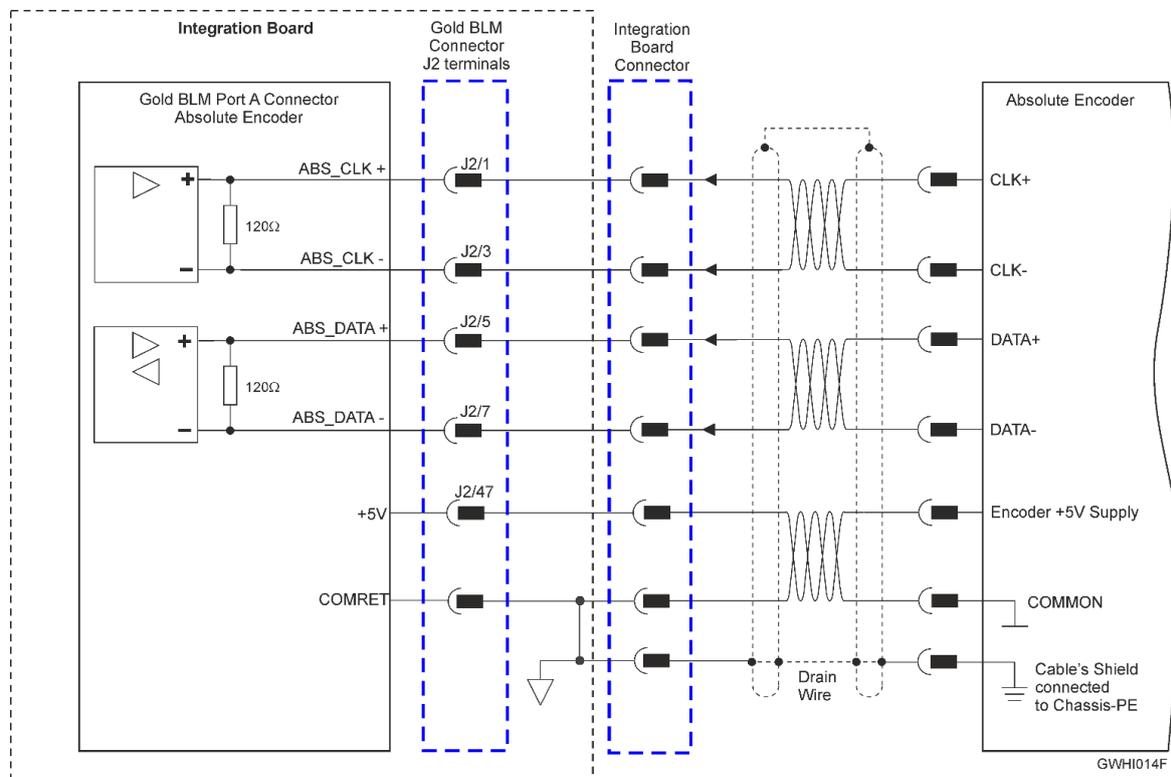


Figure 14: Absolute Serial Encoder – Recommended Connection Diagram for Endat, Biss, SSI



The following is the diagram connection of the Panasonic, Tamgawai, Sanyo-Danki:

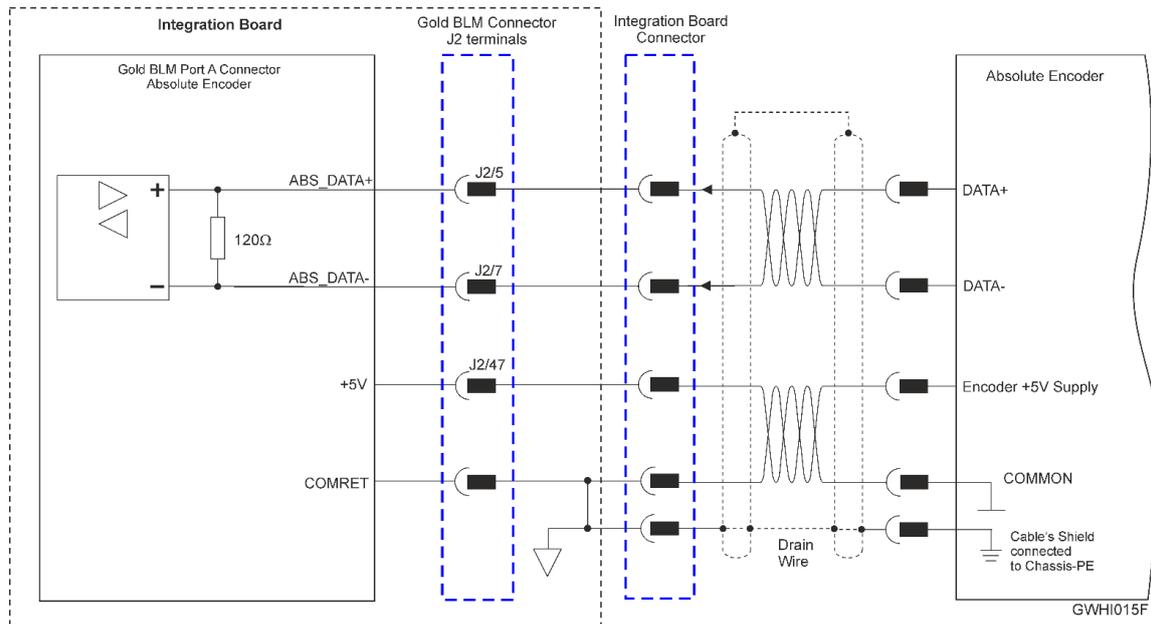


Figure 15: Absolute Serial Encoder – Recommended Connection Diagram for Panasonic, Tamgawai, Sanyo-Danki



10.6.1.4 Hiperface

The following figure describes the connection diagram.

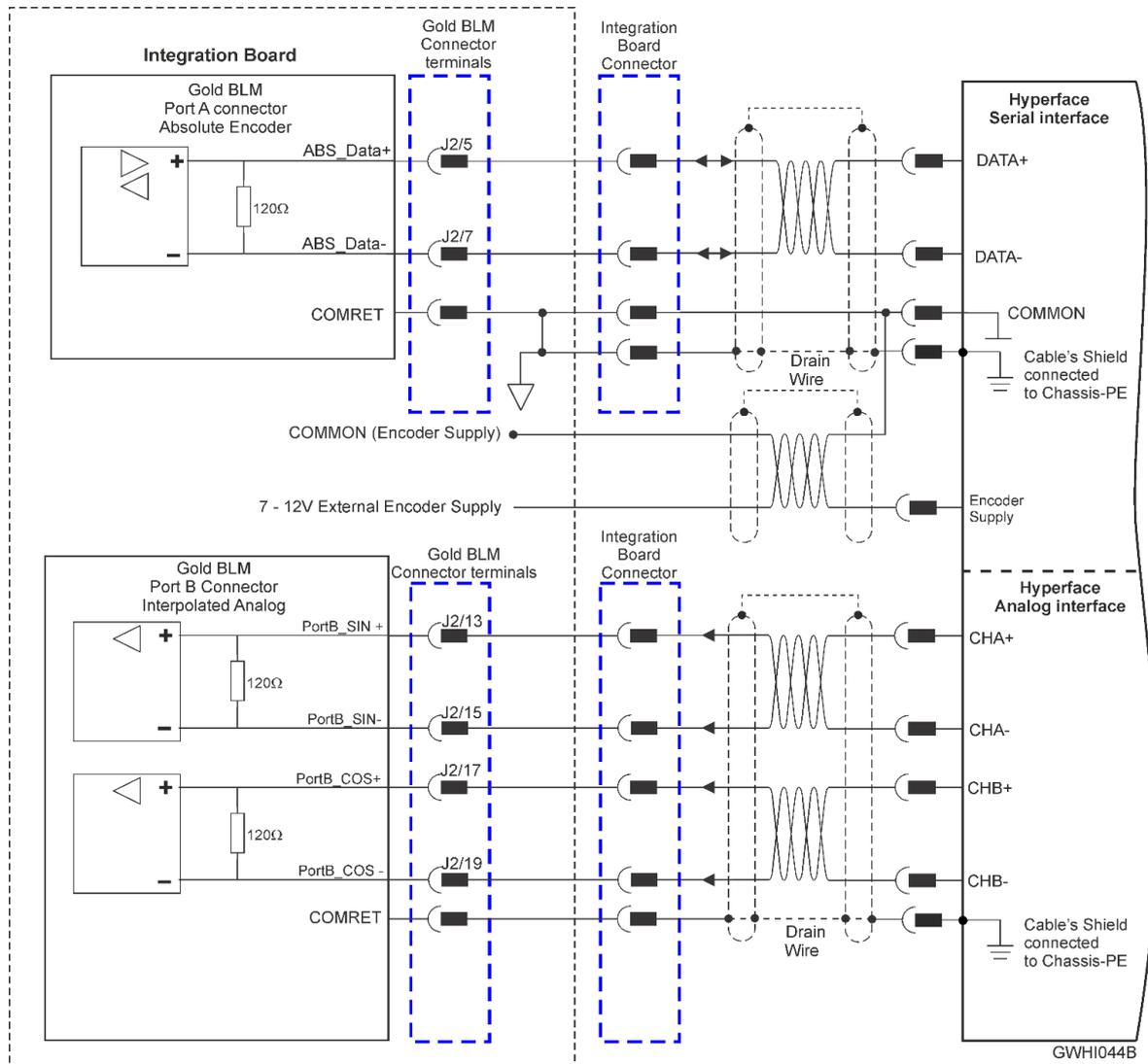


Figure 16: Absolute Serial Encoder – Recommended Connection Diagram for Stegmann Hiperface

Note: When the Hiperface protocol is used the RS232 is not available



10.6.2 Feedback Port B

Port B supports any of the following sensors:

- Incremental encoder, interpolated analog encoder or analog Hall sensors

Or

- Resolver (separate hardware option)

Differential PWM signal input can be connected to port B

Differential Pulse & Direction signal inputs can be connected to port B

10.6.2.1 Incremental Encoder

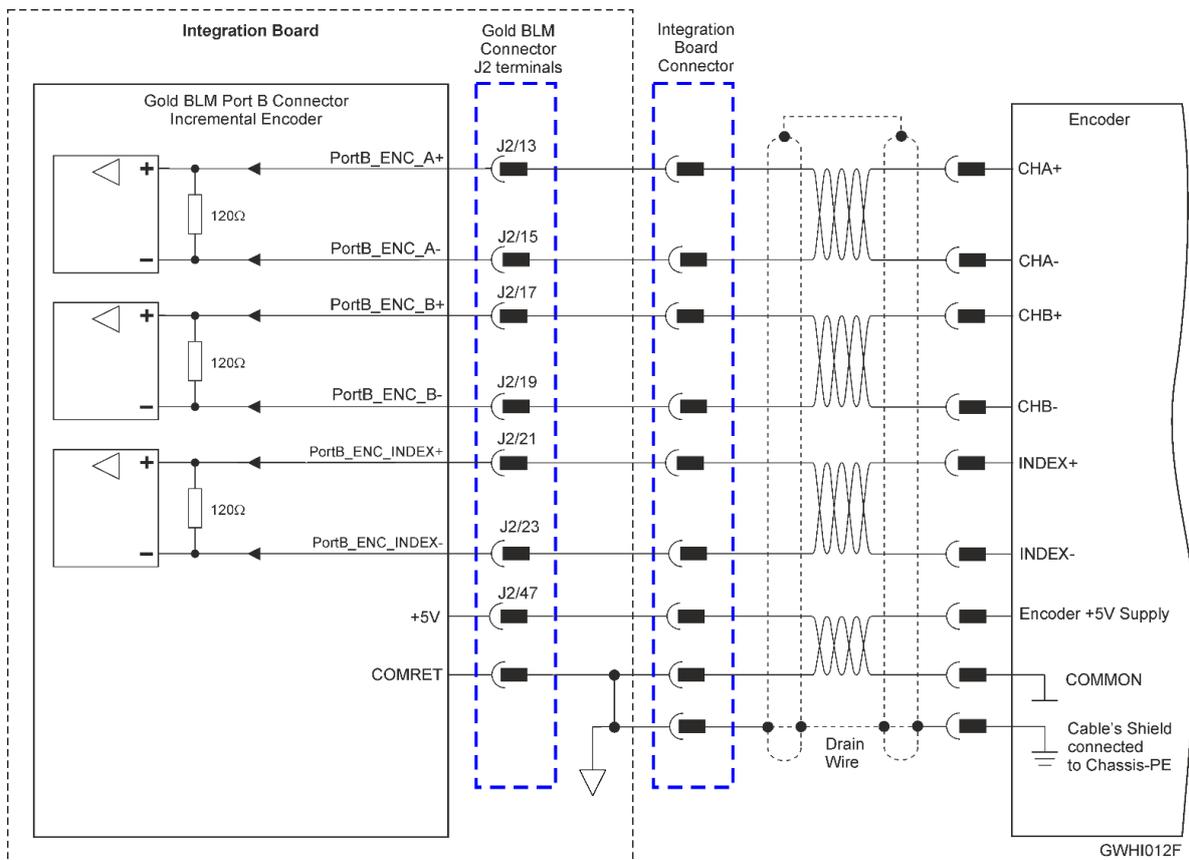


Figure 17: Port B Incremental Encoder Input – Recommended Connection Diagram



10.6.2.2 Interpolated Analog (Sine/Cosine) Encoder

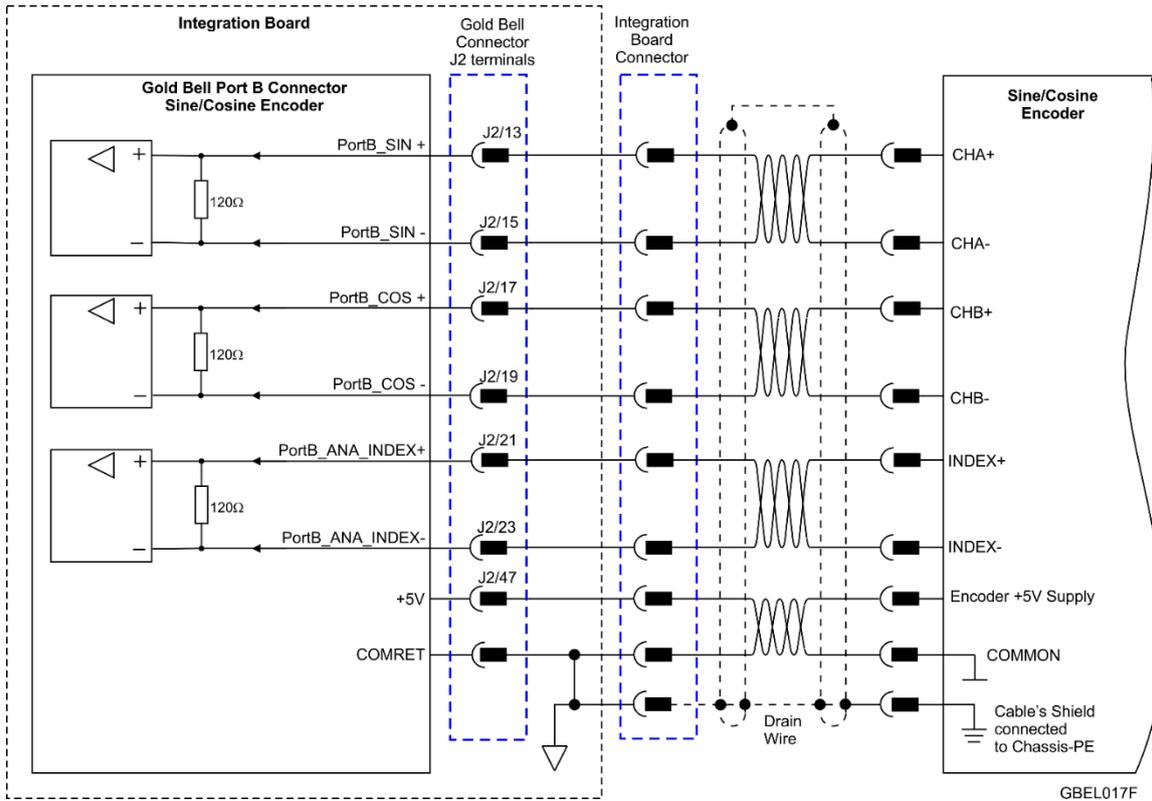


Figure 18: Port B - Interpolated Analog Encoder Connection Diagram

10.6.2.3 Resolver

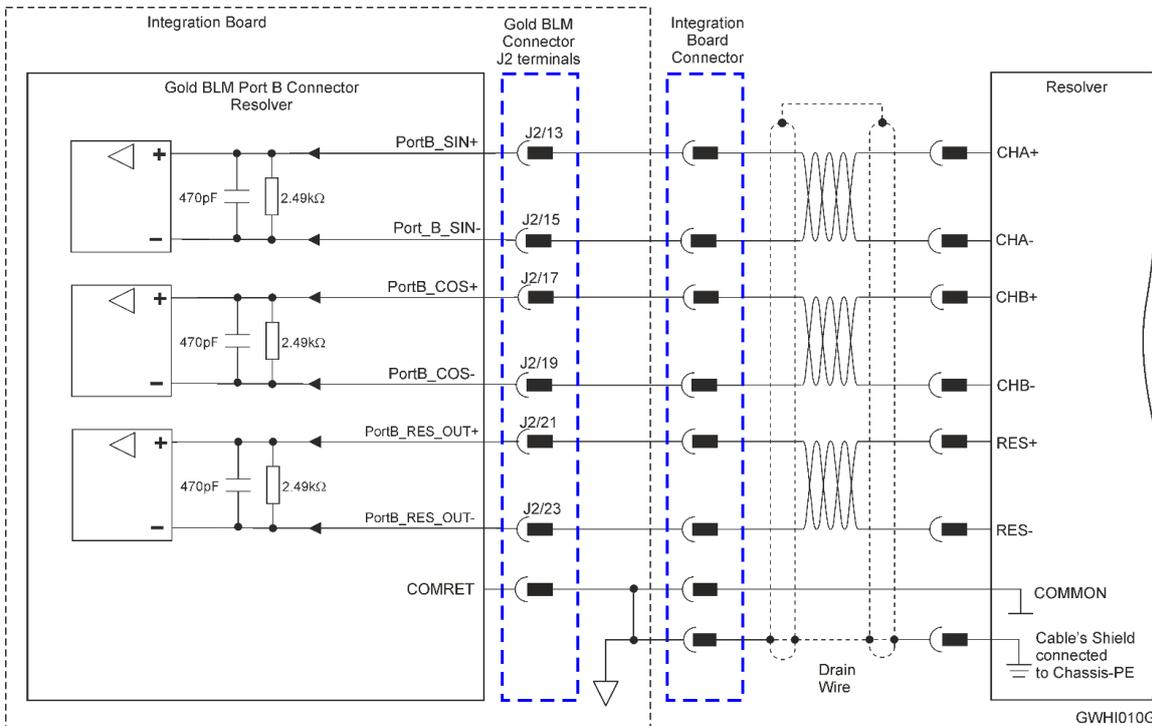


Figure 19: Port B - Resolver Connection Diagram



10.6.3 Port C – Emulated Encoder Output

Port C provides emulated encoder output derived from port A or port B feedback inputs, or from internal variables.

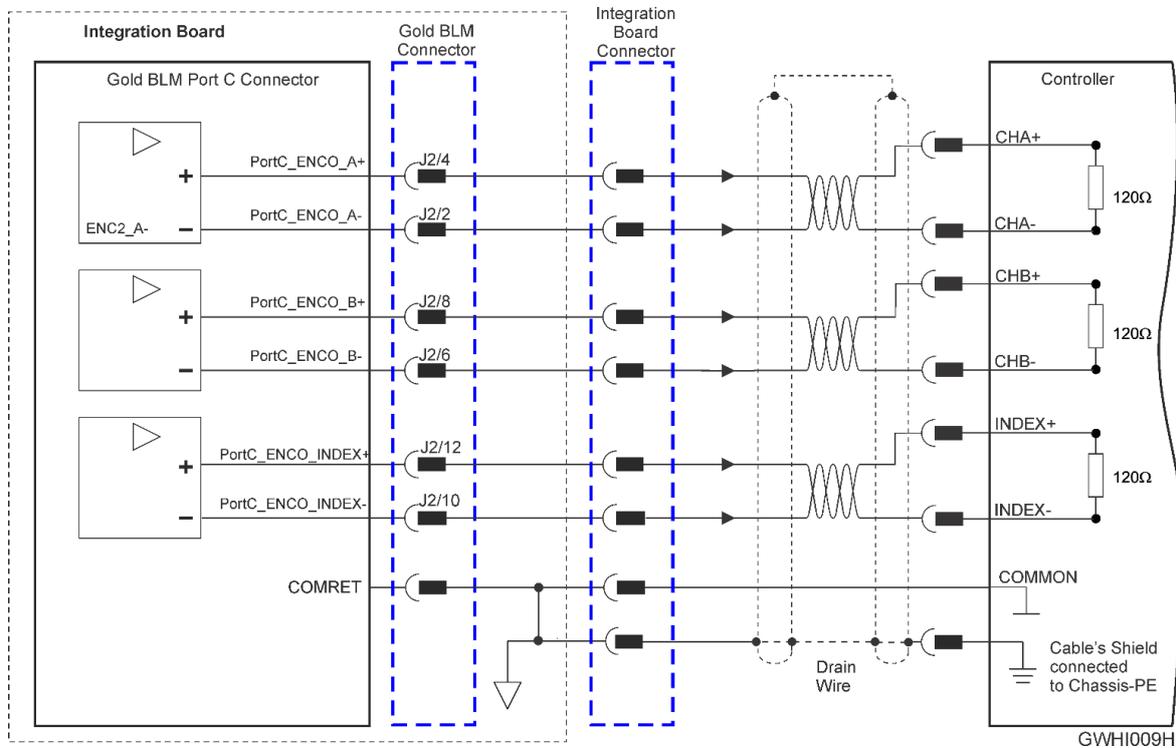


Figure 20: Emulated Encoder Differential Output – Recommended Connection Diagram



10.6.4 Analog Inputs

There are two possible types of Analog Inputs in the Gold Bell:

- Analog Input 1 – Differential ± 10 V using Connector J2 in the Gold Bell
- Analog Input 2 – Single ended using Connector J1 in the Gold Bell

10.6.4.1 Analog Input 1

The following circuit (Figure 21) describes the internal interface of the Analog input.

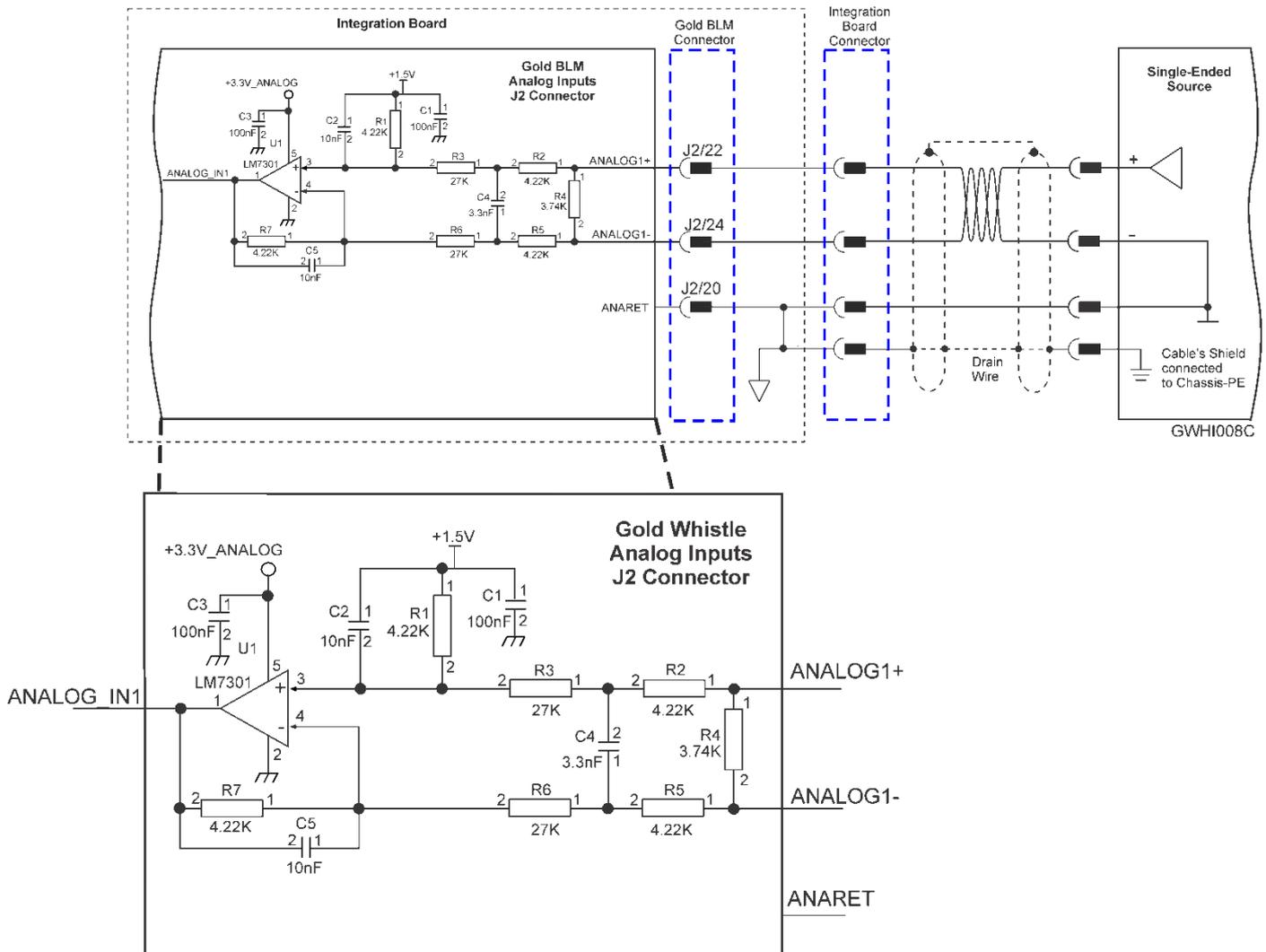


Figure 21: Analog Input with Differential ± 10 V



10.6.4.2 Analog Input 2

The Gold Bell allows an additional single ended Analog input. Figure 22 describes the input interface of the Analog_input2 in the Gold Bell. It also describes implementation examples for a differential analog input of 10V:

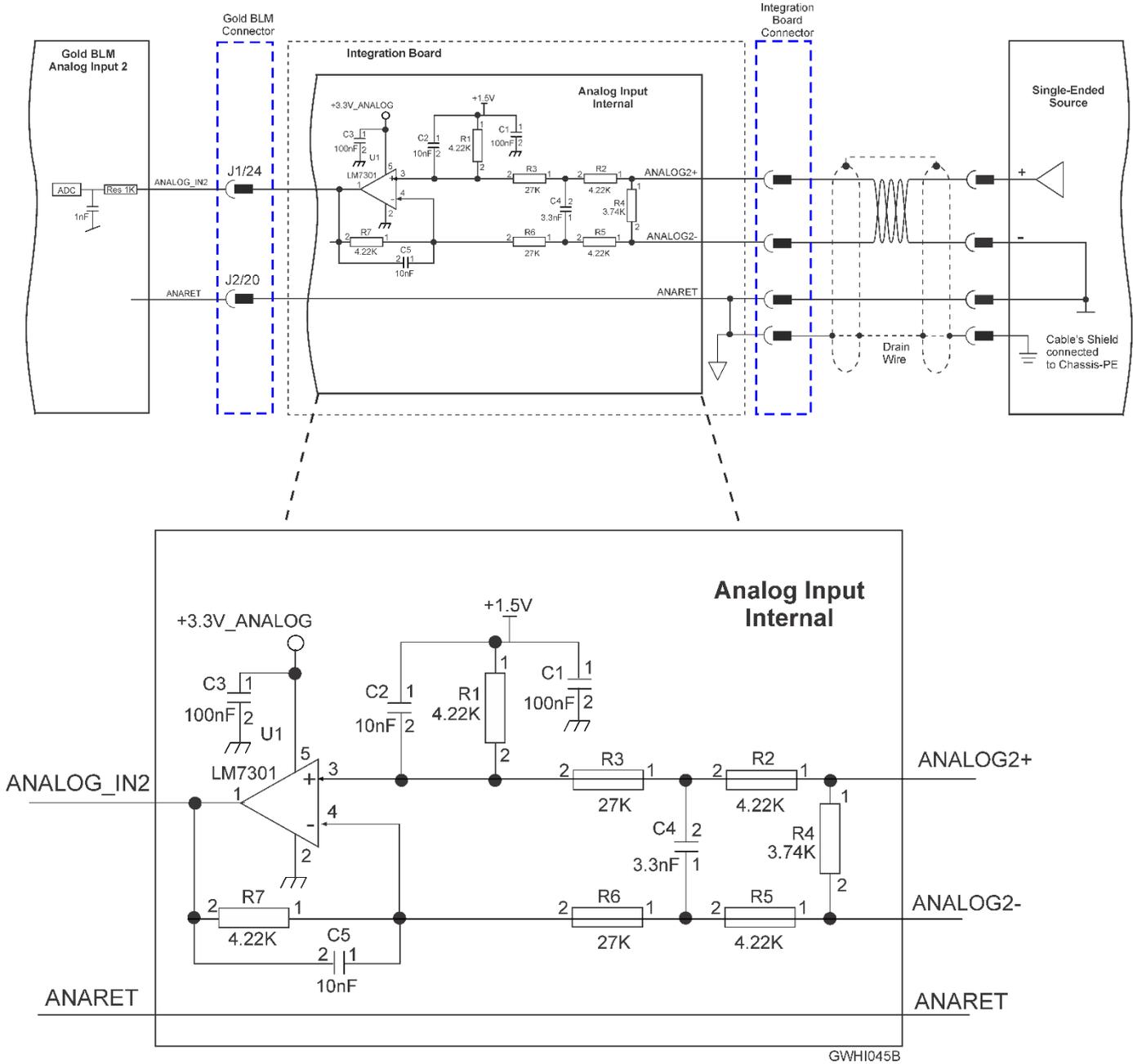


Figure 22: Analog Input 2 Example



10.6.5 RS232 TTL Logic Level

Figure 23 describes the standard RS232 connection diagram.

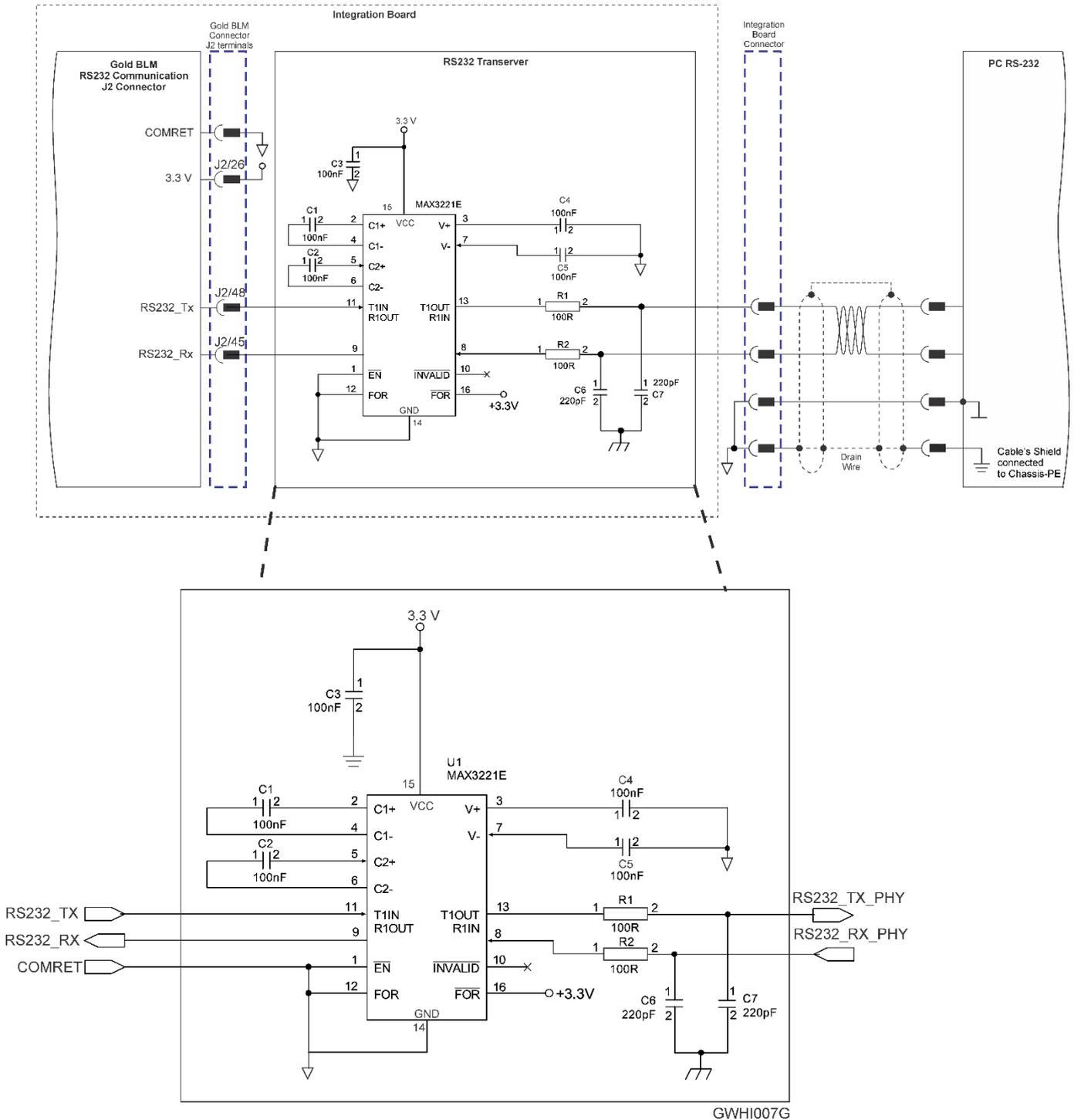


Figure 23: Standard RS232 Voltage Level incorporating RS232 TX/RX Transceiver Connection Diagram



10.6.6 USB 2.0

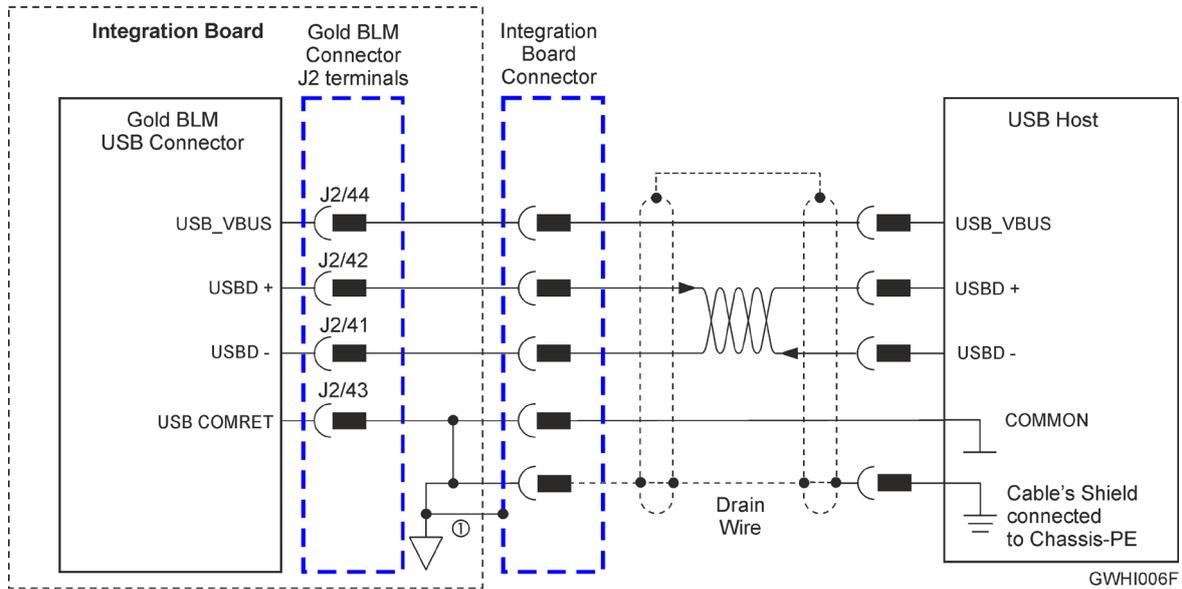


Figure 24: USB Network Diagram

Note 1: In the Gold Bell the shield of the USB connector should be connected to the COMRET and not the PE.



10.6.7 EtherCAT/Ethernet

The Gold Bell serves as an EtherCAT slave device, therefore it includes EtherCAT_IN and EtherCAT_OUT ports. It also includes LED indicators. The EtherCAT_IN port can be configured to an Ethernet port.

The following figure describes EtherCAT connection with a standard RJ-45 connector that includes transformer isolation.

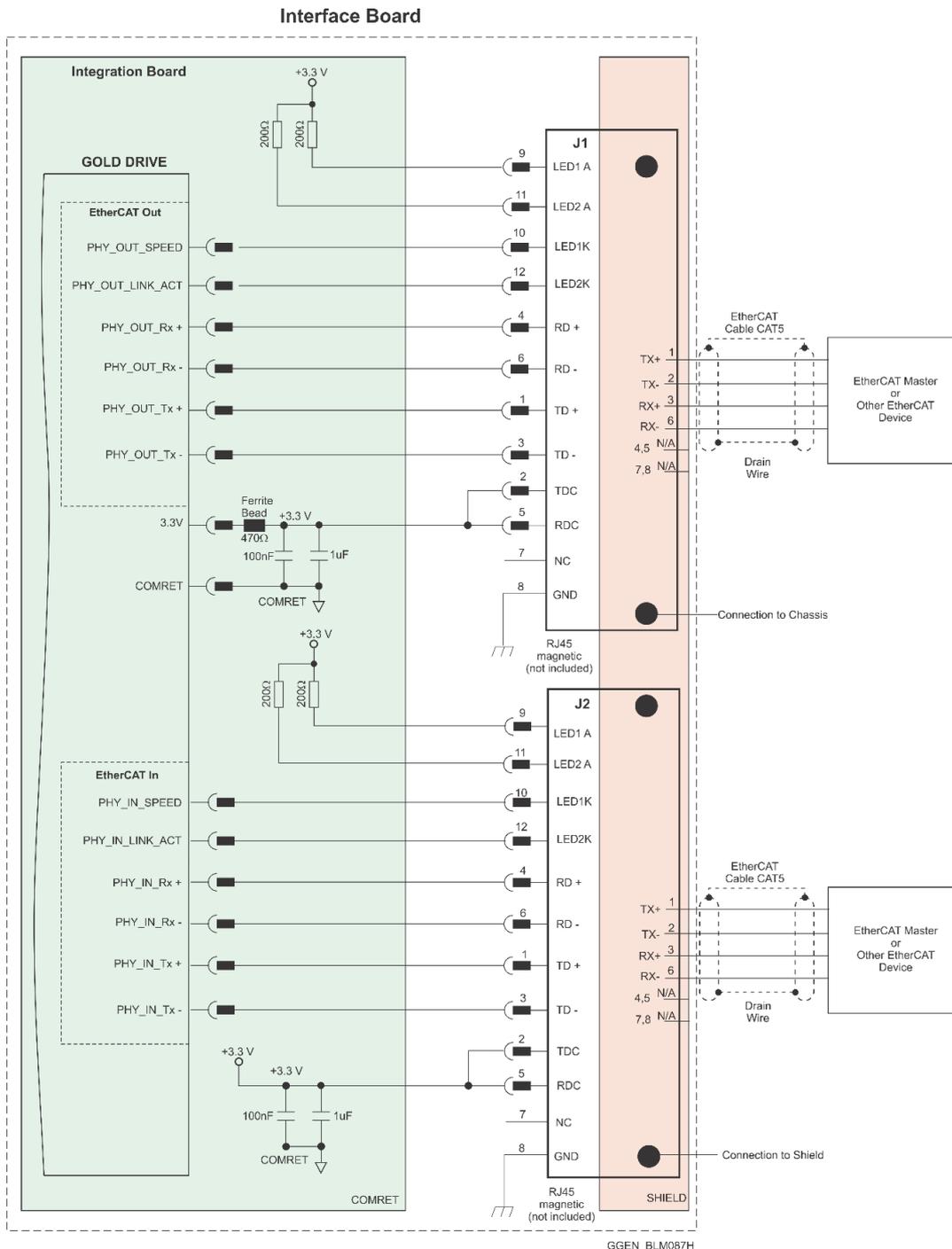
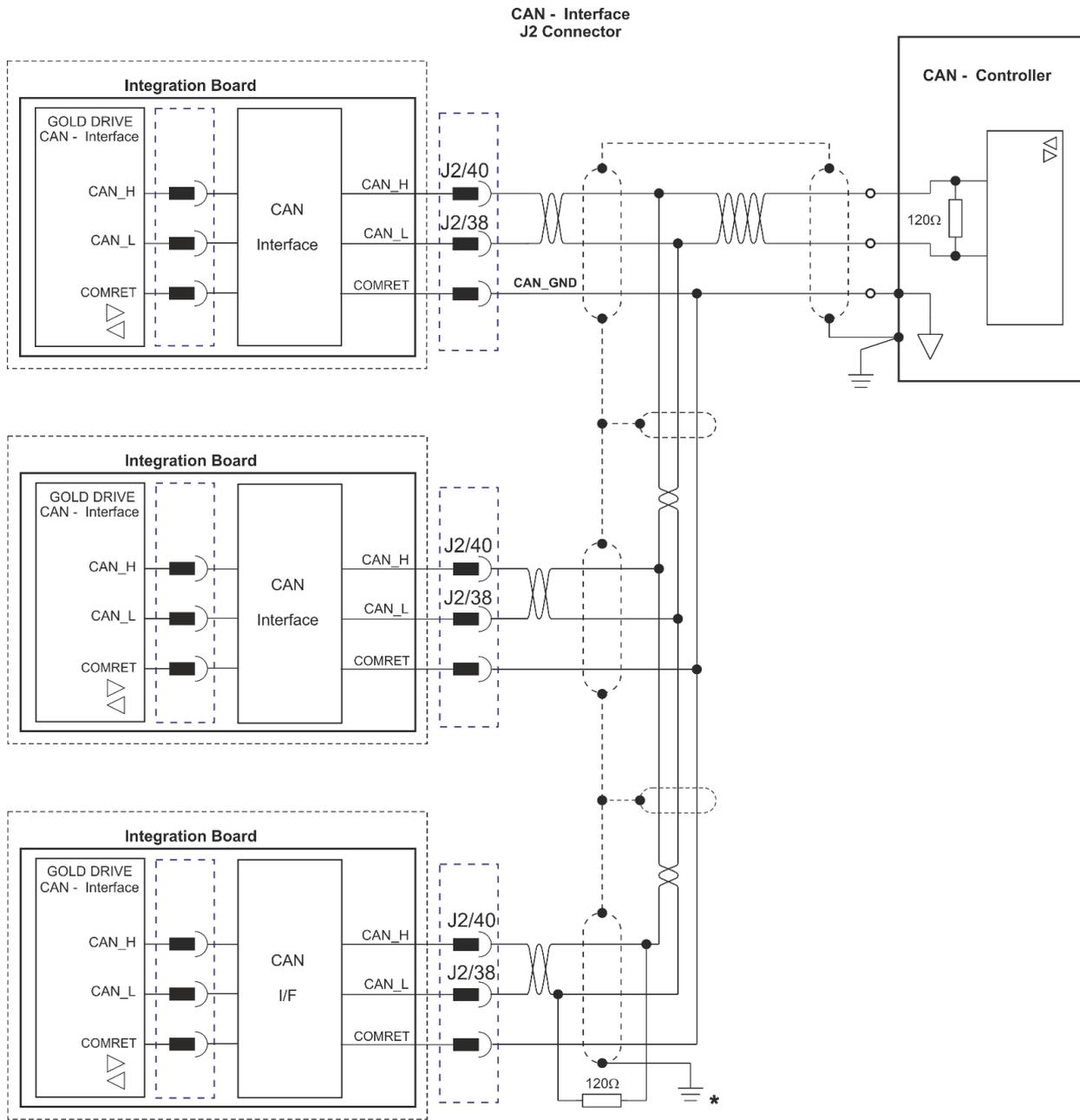


Figure 25: EtherCAT Connection Schematic with Diagram Sign of 3.3V



10.6.8 CAN

Figure 26 displays the CAN connectivity.



GWHI018C

* Note: If cable is long (>5M) it is recommended to ground at both ends

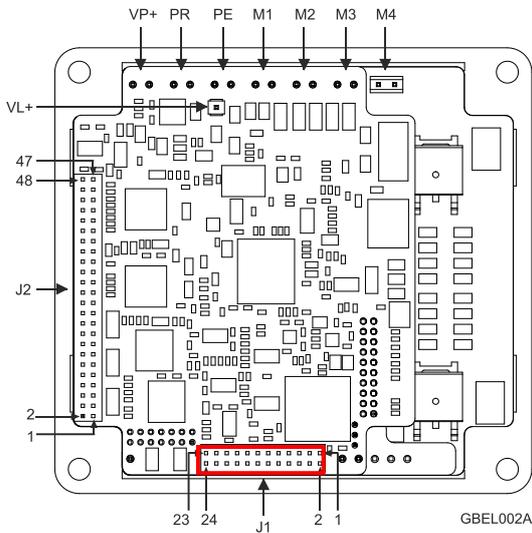
Figure 26: CANbus Connections

Important:

A 120 Ω termination resistor should be connected at each end of the network cable.



10.7 Connector J1 - Digital I/O, Analog Inputs, LEDs, and STO



For full details on Digital and Analog I/Os, see Chapter 11 and 12 in the MAN-G-Board Level Modules Hardware Manual.

For full details on the LEDs, see Chapter 7 Drive Status Indicator, and section 14.2.6 EtherCAT Status Indicator in the in the MAN-G-Board Level Modules Hardware manual for full details.

For full details on STO, see Chapter 9 in the in the MAN-G-Board Level Modules Hardware manual for full details.

Connector Type: 1.27 mm pitch 0.41 mm sq

Pin (J1)	Signal	Function
1	SB_Load	Serial Bus Load for extended IO (refer to Chapter 13 of the MAN-G-Board Level Modules Hardware manual)
2	SB_Clock	Serial Bus_Clock (9.375Mhz) for extended IO (refer to Chapter 13 of the MAN-G-Board Level Modules Hardware manual)
3	INRET1_6	Programmable digital inputs 1–6 return
4	IN1	Programmable digital input 1
5	IN2	Programmable digital input 2
6	IN3	Programmable digital input 3
7	IN4	Programmable digital input 4
8	IN5	Programmable digital input 5
9	IN6	Programmable digital input 6
10	STO_RET	STO signal return
11	STO2	Safety 2 input
12	STO1	Safety 1 input
13	LED_ETHERCAT ERR	LED Status EtherCAT ERR
14	LED_ETHERCAT RUN	LED Status EtherCAT RUN
15	OUT2	Programmable output 2



Pin (J1)	Signal	Function
16	OUT1	Programmable output 1
17	OUTRET2	OUT 2 return
18	OUTRET1	OUT 1 return
19	LED2	Bi-color indication output 2 (Cathode)
20	LED1	Bi-color indication output 1 (Cathode)
21	OUT4	Programmable output 4 not isolated (3.3V TTL level)
22	OUT3	Programmable output 3 not isolated (3.3V TTL level)
23	COMRET	Common return
24	ANALOG_IN2	Analog input 2

Table 7: Connector J1 – I/O, LEDs



10.7.1 Digital Inputs

10.7.1.1 TTL voltage level

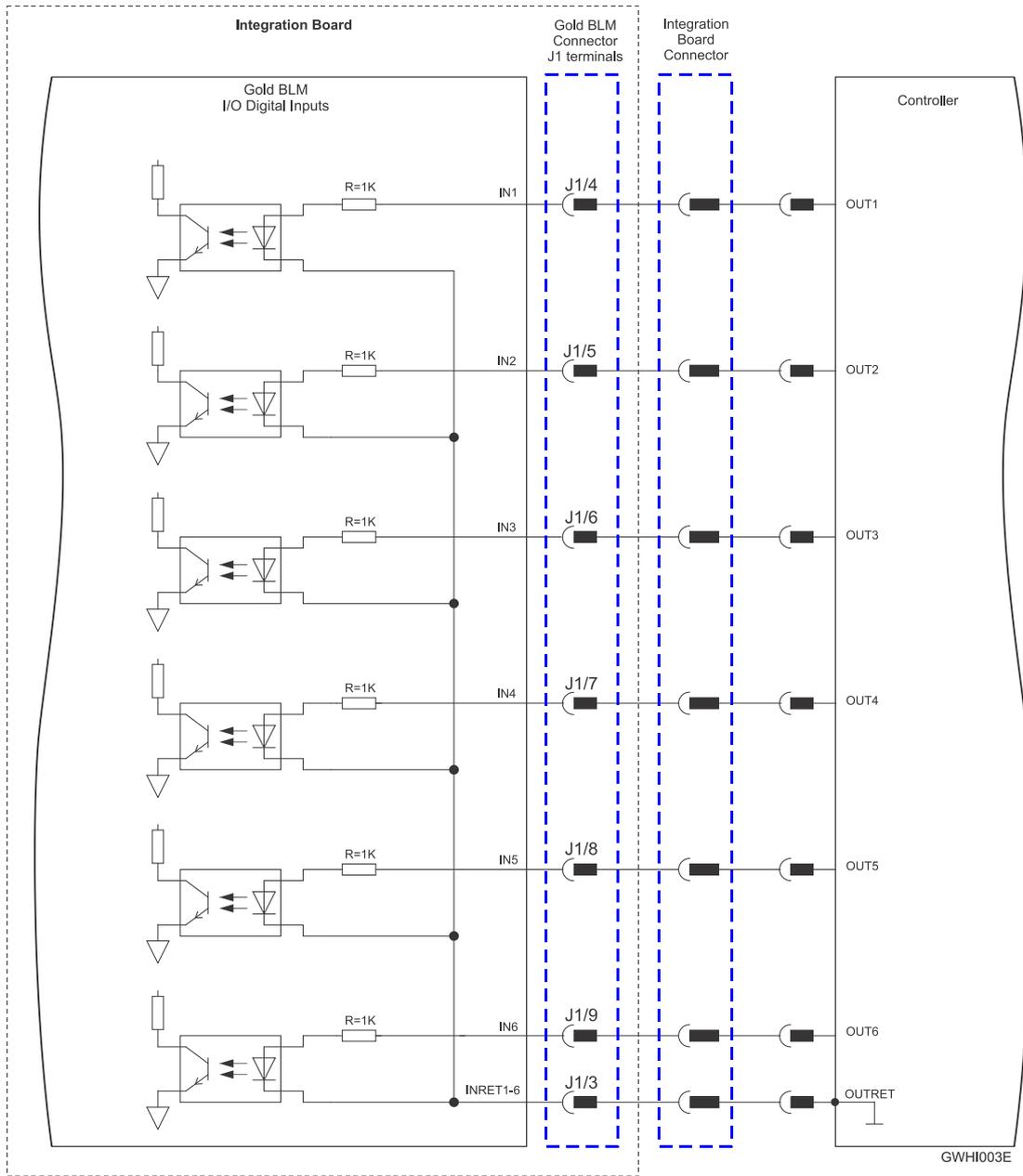


Figure 27: Digital Input TTL Mode Connection Diagram



10.7.2 Digital Outputs

10.7.2.1 Isolated Open Collector and Open Emitter

The following diagram describes the OUT1 and OUT2 outputs:

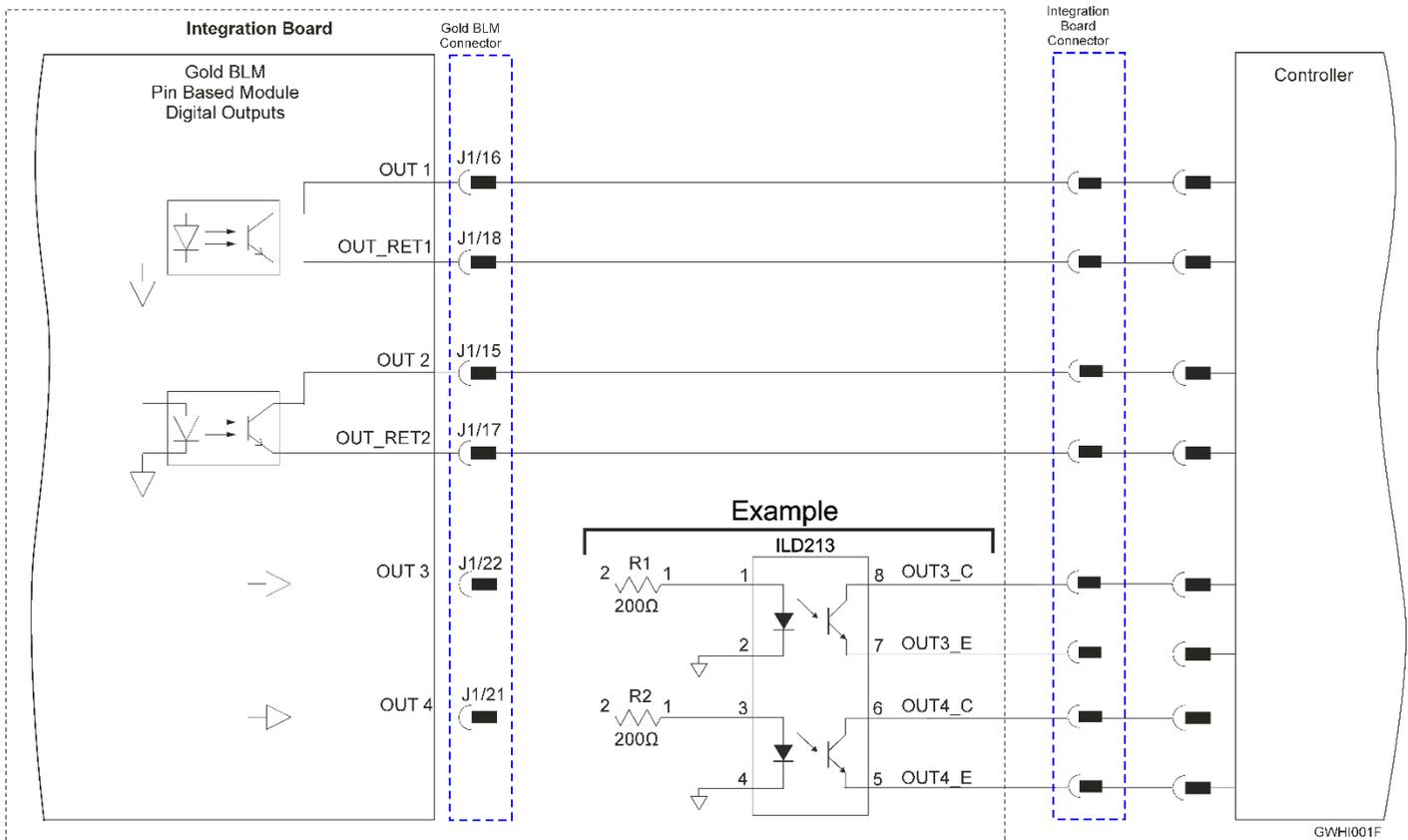


Figure 28: Digital Output Connection Diagram – Isolated Open Collector and Open Emitter Connection

10.7.3 Analog Inputs

For details of the Analog Input 2 – Single ended using Connector J1 in the Gold Bell, refer to the section 10.6.4 Analog Inputs for details.



10.7.4 STO Input Interfaces - TTL Mode

The diagram below describes the TTL option connection for the STO input interfaces.

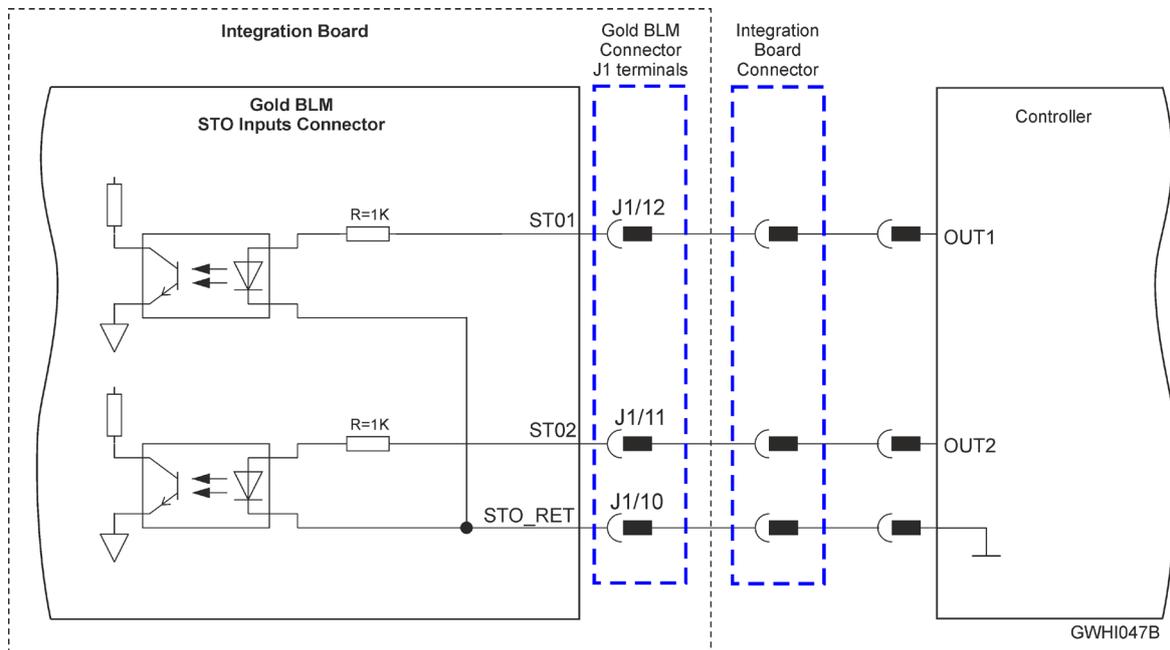


Figure 29: STO Input Connection – TTL Option

10.7.5 EtherCAT Status Indicator

For details of the EtherCAT Status Indicator, refer to the section 14.2.6 EtherCAT Status Indicator in the in the MAN G Board Level Modules Hardware manual for full details.



Chapter 11: Powering Up

After the Gold Bell is connected to its device, it is ready to be powered up.



Caution:

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

11.1 Initializing the System

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



Chapter 12: Heat Dissipation

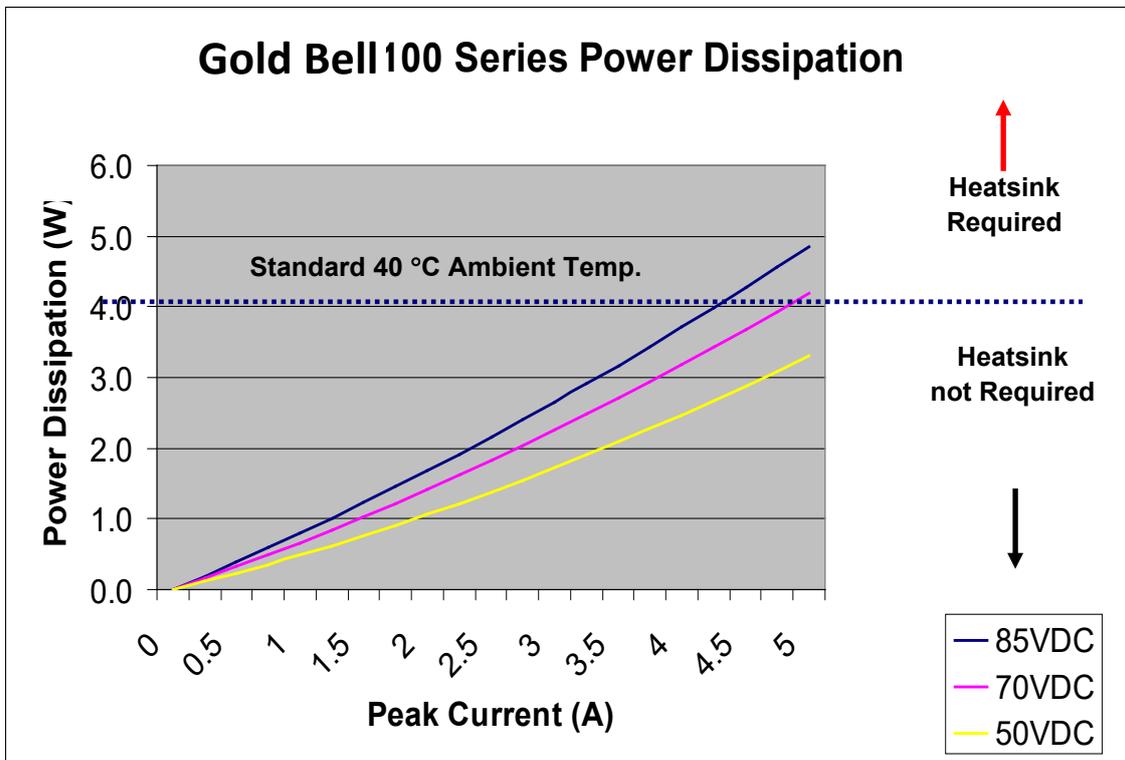
The best way to dissipate heat from the Gold Bell is to mount it so that its heat-sink faces up. For best results leave approximately 10 mm of space between the Gold Bell's heat-sink and any other assembly.

12.1 Thermal Data

- Heat dissipation capability (θ): Approximately 10 °C/W.
- Thermal time constant: Approximately 240 seconds (thermal time constant means that the Bell will reach two-thirds of its final temperature after 4 minutes.)
- Shut-off temperature: 86 °C – 88 °C (measured on the heat-sink).

12.2 Heat Dissipation Data

Heat dissipation is shown graphically below:





12.3 How to Use the Charts

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

To determine if your application needs a heat-sink:

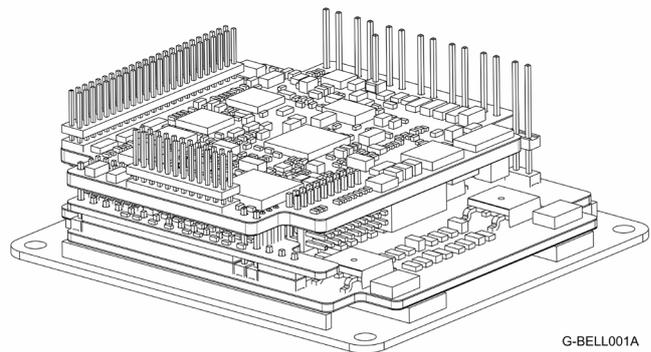
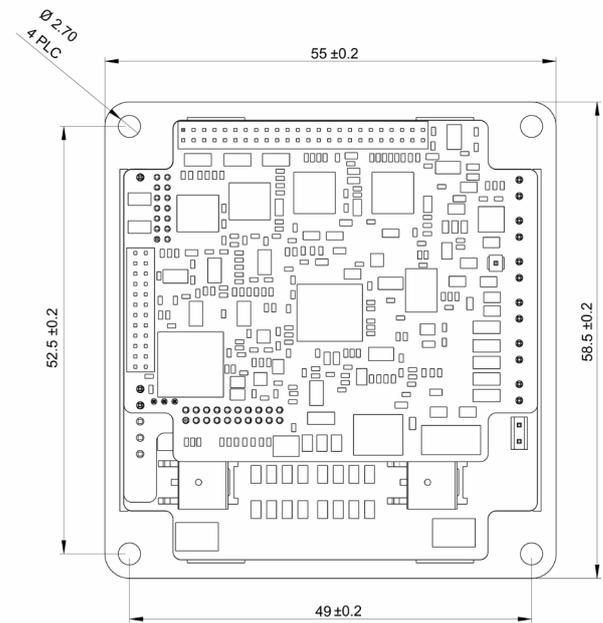
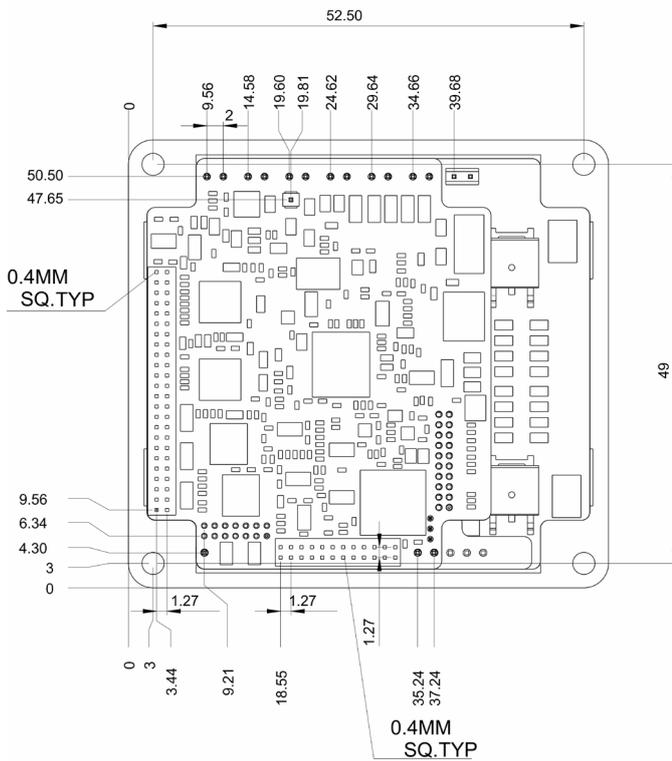
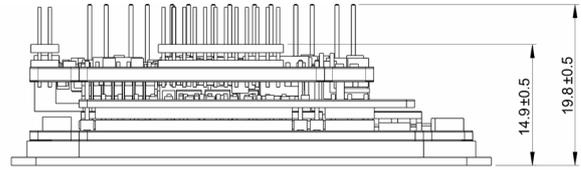
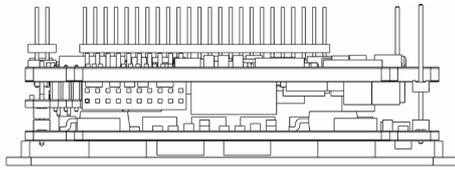
1. Allow the maximum heat-sink temperature to be 80 °C or less.
2. Determine the ambient operating temperature of the Gold Bell.
3. Calculate the allowable temperature increase as follows:
 - For an ambient temperature of 40 °C, $\Delta T = 80\text{ °C} - 40\text{ °C} = 40\text{ °C}$.
4. Use the chart to find the actual dissipation power of the drive. Follow the voltage curve to the desired output current and then find the dissipated power.
5. If the dissipated power is below 4 W, the Gold Bell will not need additional cooling.

Note: The chart above shows that no heat-sink is needed when the heat-sink temperature is 80°C, the ambient temperature is 40 °C and the heat dissipated is 4 W.



Chapter 13: Dimensions

This chapter provides detailed technical dimensions regarding the Gold Bell.



G-BELL001A

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