
Evaluation Board

for the

Whistle, Bell & Guitar

User Guide

(Also for the Hornet, Tweeter and Hawk)



May 2010 (Ver. 1.4)



www.elmomc.com

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Related Products:

Product	Catalog Number	Installation Guide
Whistle	WHI- AXX -YYYY	MAN-WHISIG (available on the Website)
Bell	BEL- AXX -YYYY	MAN-BELIG
Guitar	GUI- ARXX -YYYY	MAN-GUIIG (available on the Website)

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Version	Release Date	Changes/Remarks
Ver 1.4	May 2010	MTCR 04-010-01: Update to Table 2-4.
Ver 1.3	July 2009	MTCR 03-009-46: Tables 2-1, 2-3: Changes in DC Motor Cable column. Table 2-2: Motor Power section: AC Motor Cable column removed. DC Motor Cable changed to Stepper Motor.
Ver 1.2	February 2009	Table 2-9: Pins 10-15 "General input return" changed to "General input".
Ver 1.1	October 2008	Updates to section 2.9.3 for differential pulse-and-direction outputs
Ver. 1.0	August 2008	Initial release

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Contents

Chapter 1: Safety Information.....	1-1
1.1 Warnings	1-2
1.2 Cautions.....	1-2
1.3 Directives and Standards.....	1-3
1.4 CE Mark Conformance.....	1-3
1.5 Warranty Information.....	1-3
Chapter 2: Combined Evaluation Board	2-1
2.1 Introduction	2-1
2.2 Before You Begin	2-1
2.2.1 Site Requirements.....	2-1
2.2.2 Unpacking the Evaluation Board	2-2
2.3 Whistle.....	2-3
2.3.1 Connecting the Whistle to the Evaluation Board.....	2-3
2.3.2 The Whistle & Connectors on the Evaluation Board.....	2-4
2.3.3 Evaluation Board Block Diagram (Whistle).....	2-5
2.3.4 Whistle Connections on the Evaluation Board.....	2-6
2.3.5 User Connectors	2-7
2.3.6 Connecting the Power/Motor Cable to the Whistle.....	2-8
2.3.7 Connecting the Motor Power to the Whistle	2-9
2.3.8 Connecting the Main Power to the Whistle	2-9
2.3.9 Auxiliary Supply for the Whistle (Optional)	2-10
2.4 Bell.....	2-12
2.4.1 Connecting the Bell to the Evaluation Board.....	2-12
2.4.2 The Bell & Connectors on the Evaluation Board.....	2-13
2.4.3 Bell Evaluation Board Block Diagram	2-14
2.4.4 Bell Connections on the Evaluation Board	2-15
2.4.5 User Connectors	2-16
2.4.6 Connecting the Power/Motor Cable to the Bell	2-17
2.4.7 Connecting Motor Power to the Bell	2-18
2.4.8 Connecting the Main Power to the Bell.....	2-18
2.4.9 Auxiliary Supply (optional) for Bell	2-19
2.5 Guitar.....	2-21
2.5.1 Connecting the Guitar to the Evaluation Board.....	2-21
2.5.2 The Guitar & Connectors on the Evaluation Board.....	2-22
2.5.3 Evaluation Board Block Diagram (Guitar).....	2-23
2.5.4 Guitar Connections on the Evaluation Board.....	2-24
2.5.5 User Connectors	2-25
2.5.6 Connecting the Power/Motor Cable	2-26
2.5.7 Connecting the Motor Power.....	2-27
2.5.8 Connecting the Main Power to the Guitar.....	2-27
2.5.9 Auxiliary Supply (optional) for Guitar	2-28
2.6 Feedback and Control Cable Assemblies.....	2-30
2.7 Main Feedback.....	2-30
2.8 Main Buffered Output Port	2-40
2.9 Auxiliary Feedback (Bi-directional).....	2-42
2.9.1 Main and Auxiliary Feedback Combinations.....	2-43
2.9.2 Auxiliary Feedback (FEEDBACK B).....	2-44

2.9.2.1 Emulated Encoder Outputs Option on FEEDBACK B (YA[4]=4).....	2-44
2.9.2.2 Differential Auxiliary Encoder Input Option on FEEDBACK B (YA[4]=2).....	2-47
2.9.3 Pulse-and-Direction Input Option on FEEDBACK B (YA[4]=0)	2-49
2.9.4 I/O Cables	2-51
2.10 General I/O Port.....	2-51
2.10.1 Digital Input & DIP Switch Settings	2-53
2.10.2 Digital Output.....	2-54
2.10.3 Analog Input.....	2-55
2.11 Communications.....	2-56
2.11.1 RS-232 Communication	2-56
2.11.2 CANopen Communication	2-57
2.12 Powering Up	2-59
2.13 Initializing the System.....	2-59

Appendix A: Technical Specifications..... A-1

A.1 Evaluation Board Dimensions.....	A-1
A.1.1 Dimensions (Whistle).....	A-1
A.1.2 Dimensions (Bell)	A-2
A.1.3 Dimensions (Guitar).....	A-3
A.2 Environmental Conditions	A-4
A.3 Evaluation Board Connections.....	A-4
A.3.1 Backup Power Supply (Optional)	A-5
A.4 Feedbacks	A-6
A.4.1 Feedback Supply Voltage.....	A-6
A.5 I/Os.....	A-6
A.5.1 Digital Input Interfaces.....	A-6
A.6 Digital Output Interface.....	A-8
A.7 Communications.....	A-10
A.8 Mechanical Specifications.....	A-10
A.9 Standards Compliance	A-11
A.9.1 Quality Assurance.....	A-11
A.9.2 Design	A-11
A.9.3 Safety.....	A-11
A.9.4 EMC.....	A-11
A.9.5 Workmanship	A-11
A.9.6 PCB.....	A-12
A.9.7 Packing.....	A-12
A.9.8 WEEE*	A-12
A.9.9 RoHS	A-12

Appendix B: Cables	B-1
B.1 Cable Photos.....	B-1
B.2 Cable Kits	B-1
B.2.1 Main Feedback Cable (CBL-DFDBK-1)	B-2
B.2.2 Auxiliary Feedback and Main Buffered Output Cable (CBL-CELAUX-1)	B-3
B.2.3 General I/O (CBL-CELIO1-1)	B-4
B.2.4 Communication Cables	B-5
B.2.4.1 RS-232 Communication (CBL-RJ452321-1)	B-5
B.2.4.2 CAN Communication (CBL-RJ45CAN1-1).....	B-6
B.3 Guidelines for Making Your Own Cables.....	B-6
B.3.1 Recommended Wire Cross Sections	B-7
B.3.2 Feedback and Control Cable Assemblies.....	B-8
B.4 Accessory Kits.....	B-9

Chapter 1: Safety Information

In order to achieve the optimum, safe operation of the Evaluation Board, 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 Evaluation Board 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 Evaluation Board 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 manual:

	Warning: This information is needed to avoid a safety hazard, which might cause bodily injury.
	Caution: This information is necessary for preventing damage to the product or to other equipment.
	Note: This is auxiliary information that ensures the correct operation of the equipment.

1.1 Warnings

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

1.2 Cautions

	The Evaluation Board contains hot surfaces and electrically-charged components during operation.
	The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide. Furthermore, the power supply must be isolated from hazardous live voltages using reinforced or double insulation in accordance to approved safety standards.
	When connecting the Evaluation Board to an approved 12 ~ 195V DC auxiliary power supply, connect it through a line that is isolated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
	Before switching on the Evaluation Board, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.

1.3 Directives and Standards

The Evaluation Board conforms to the following industry safety standards:

Safety Standard	Item
In compliance with UL508c	Power Conversion Equipment
In compliance with UL840	Insulation Coordination, Including Clearance and Creepage Distances of Electrical Equipment
In compliance with UL60950-1 (formerly UL1950)	Safety of Information Technology Equipment, Including Electrical Business Equipment
In compliance with EN60204-1	Low Voltage Directive, 73/23/EEC

The Evaluation Board has been developed, produced, tested and documented in accordance with the relevant standards. Elmo Motion Control is not responsible for any deviation from the configuration and installation described in this documentation. Furthermore, Elmo is not responsible for the performance of new measurements or ensuring that regulatory requirements are met.

1.4 CE Mark Conformance

The Evaluation Board 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 98/37/EC as amended, and with those of the most recent versions of standards EN60204-1 and EN292-2 at the least.

According to Annex III of Article 13 of Council Directive 93/68/EEC, amending Council Directive 73/23/EEC concerning electrical equipment designed for use within certain voltage limits, the Evaluation Board meets the provisions outlined in Council Directive 73/23/EEC. The party responsible for ensuring that the equipment meet the limits required by EMC regulations is the manufacturer of the end product.

1.5 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 time of installation, or 18 months from time of shipment, whichever comes first. No other warranties, expressed or implied – and including a warranty of merchantability and fitness for a particular purpose – extend beyond this warranty.

Chapter 2: Combined Evaluation Board

2.1 Introduction

The combined Evaluation Board has the following advantages:

1. It can evaluate three different types of drives:
 - Whistle
 - Bell
 - Guitar
2. D-type, RJ and Phoenix connectors can be easily connected to the Evaluation Board.
3. The Evaluation Board has the following additional features:
 - Main buffered output
 - Differential ports for auxiliary feedback input/output
 - Powerful digital outputs ($I_{out} \leq 250$ mA)
 - Flexibility in digital inputs (from $5\text{ V} \leq V_{in} \leq 24\text{ V}$)
 - Powerful output for the brake (separate output via a Phoenix connector)
 - Support for CAN Communication in daisy chain mode
 - Visual indication of all the digital outputs and the Brake.
 - Intelligent power supply coupling.

2.2 Before You Begin

2.2.1 Site Requirements

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

Feature	Value
Ambient operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Maximum operating altitude	10,000 m (30,000 ft)
Maximum relative humidity	90% non-condensing
Operating area atmosphere	No flammable gases or vapors permitted in area



The Evaluation Board dissipates its heat by natural convection. The maximum operating ambient temperature of 0 °C to 40 °C (32 °F to 104° F) must not be exceeded. Refer to the Heat Dissipation section of the relevant installation guide for further details.

2.2.2 Unpacking the Evaluation Board

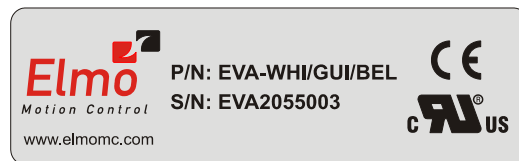
Before you begin working with the Evaluation Board system, verify that you have all of its components, as follows:

- The Evaluation Board
- This document – the Whistle, Bell & Guitar Evaluation Board User Guide. (You can download the PDF version from the Elmo web site.)
- CBL-EVAUNIKIT01 (cable kit)
- ACC-KIT-BEL/WHI01 (spacers and screws)
- ACC-KIT-GUI01 (spacers and screws)
- ACC-TRM-01 (RJ-45 terminator connector)

The Evaluation Board is shipped in a cardboard box with styrofoam protection.

To unpack the Evaluation Board:

1. Carefully remove the Evaluation Board from the box and the Styrofoam.
2. Check the Evaluation Board 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 Evaluation Board you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Evaluation Board. It looks like this:



2.3 Whistle

This section explains how to connect the Whistle to the Evaluation Board, and provides details about all the connectors.

2.3.1 Connecting the Whistle to the Evaluation Board

Each Whistle has 51 pins; therefore, great care should be taken aligning its pins with the sockets on the board when assembling. Push the Whistle into the Evaluation Board firmly and evenly.

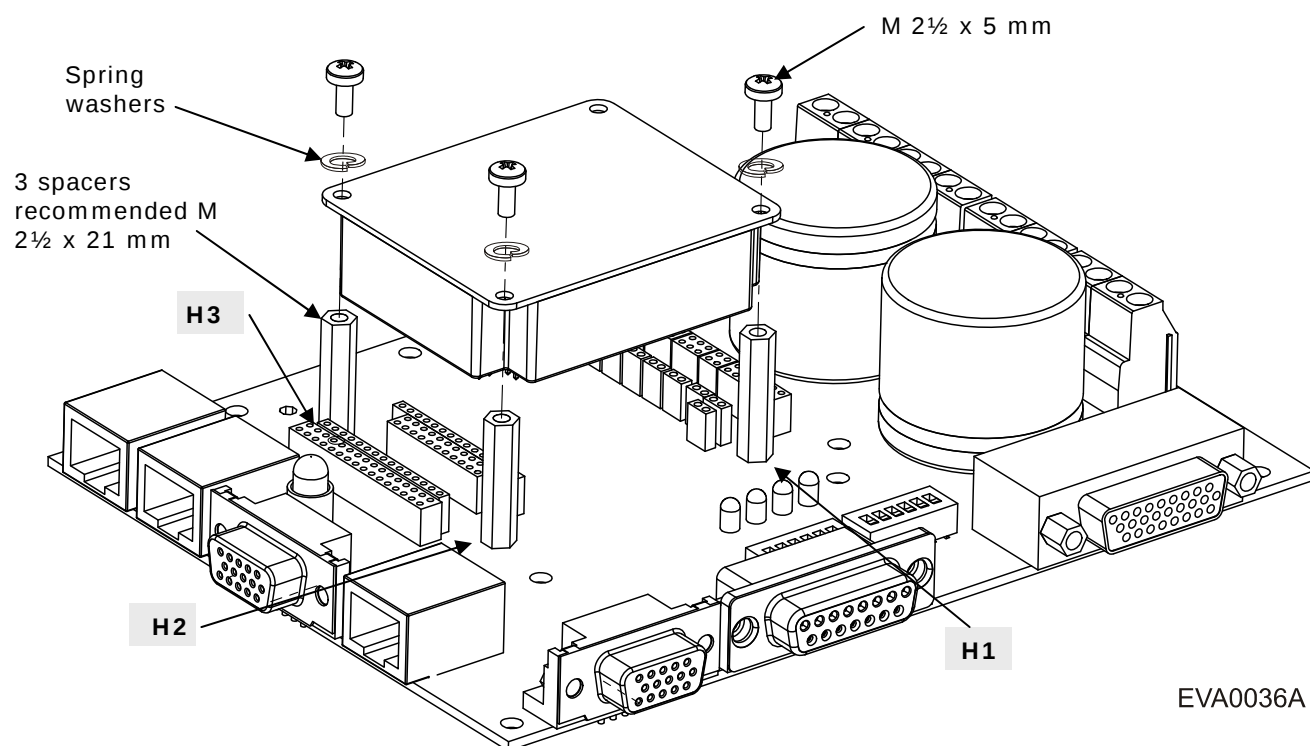


Figure 2-1: Assembling the Whistle on the Evaluation Board

2.3.2 The Whistle & Connectors on the Evaluation Board

The diagram below shows the Whistle placed on the Evaluation Board.

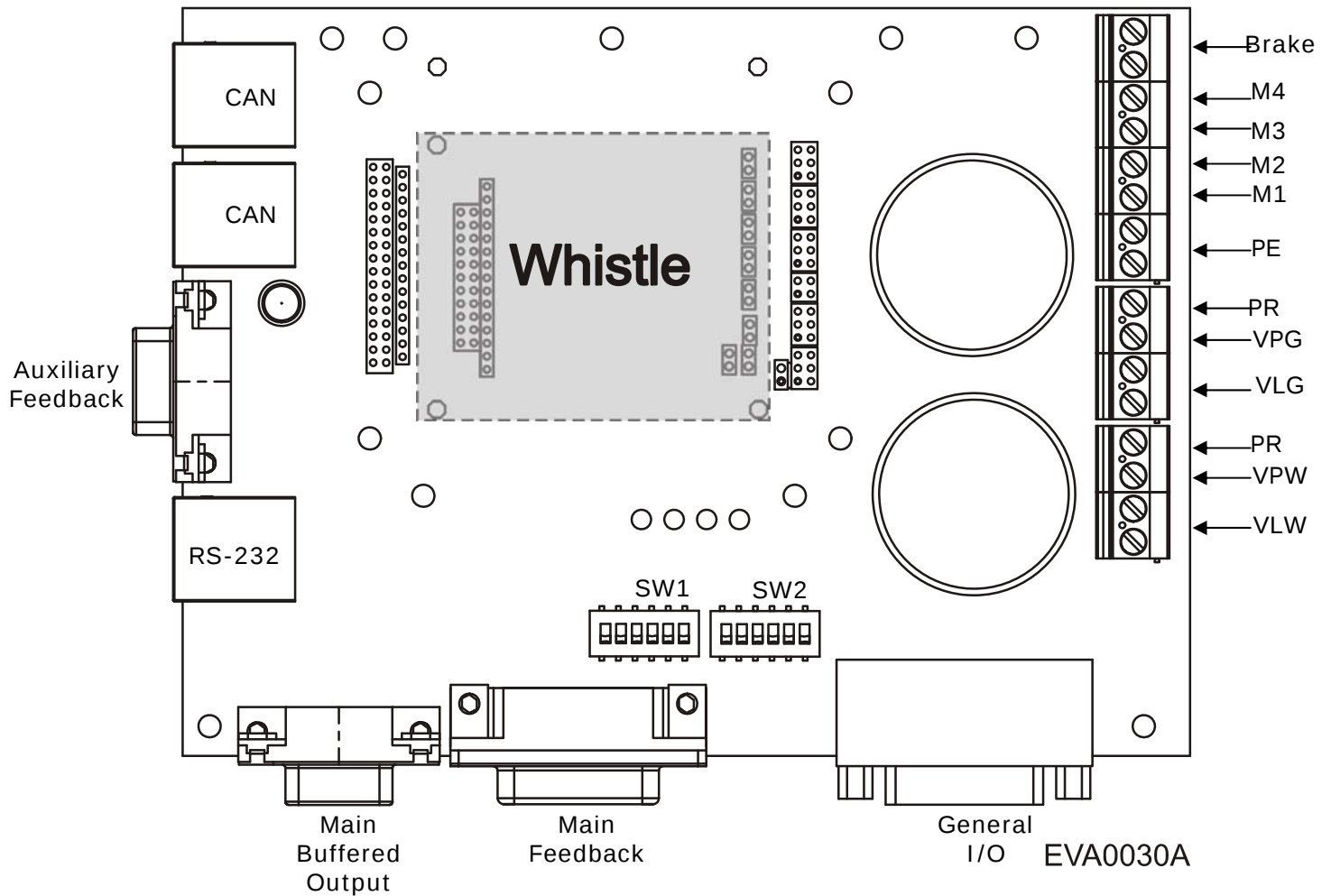


Figure 2-2: The Whistle, connectors and ports on the Evaluation Board

2.3.3 Evaluation Board Block Diagram (Whistle)

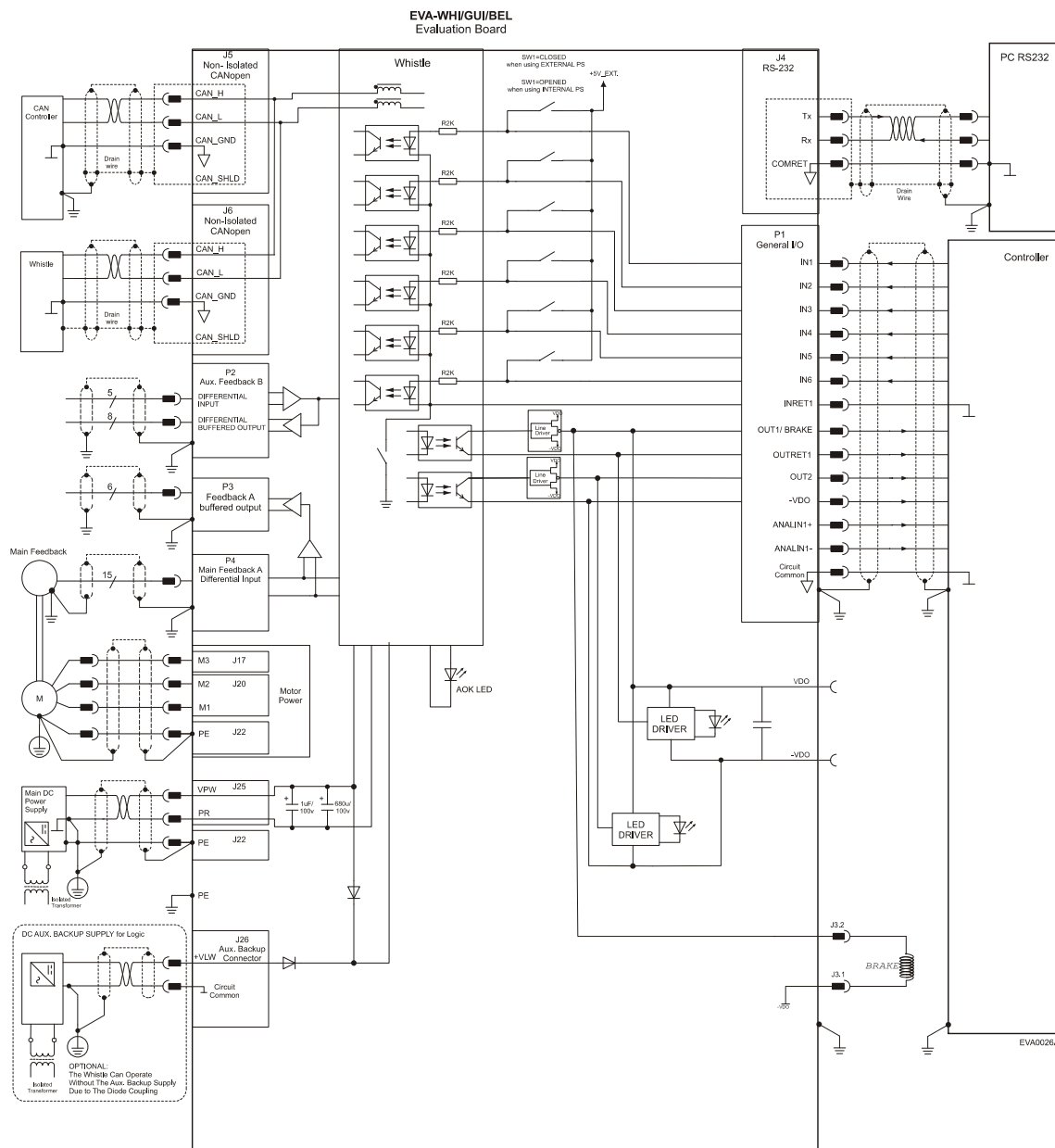
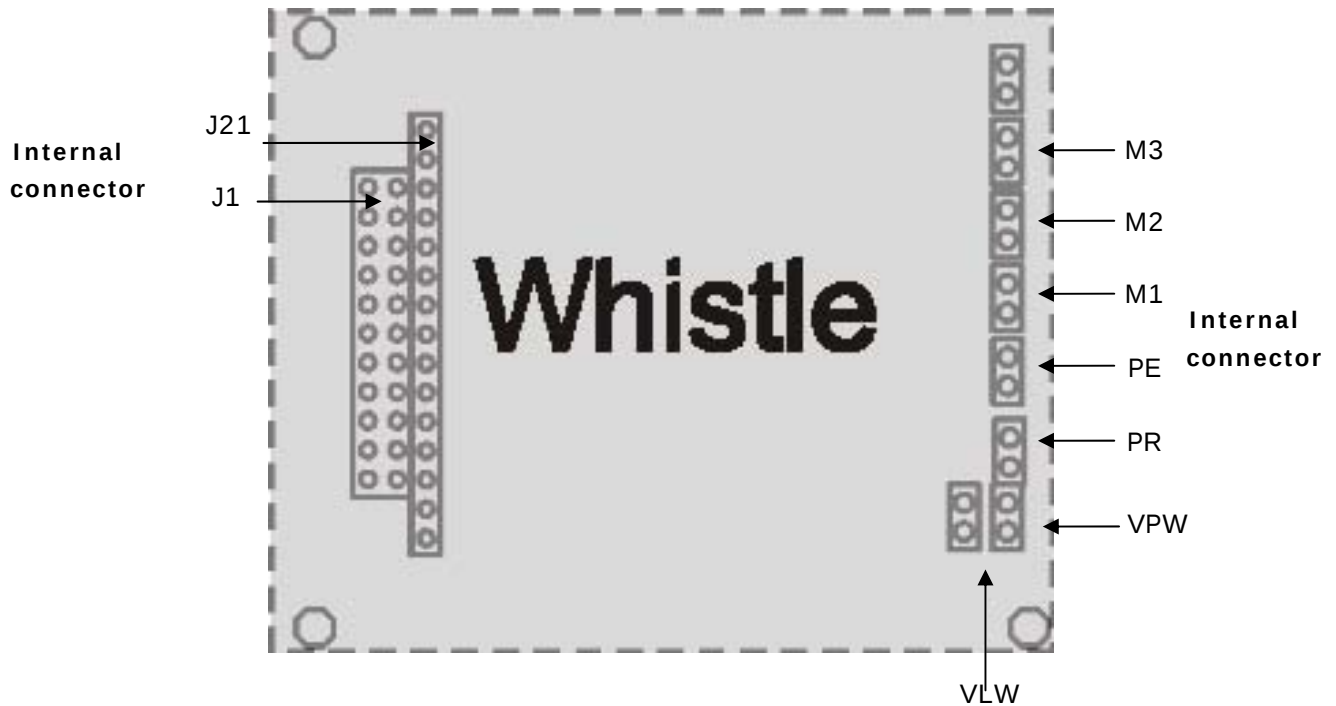


Figure 2-3: Evaluation Board Block Diagram (Whistle)

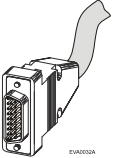
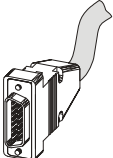
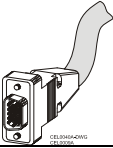
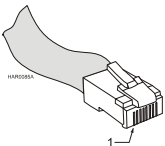
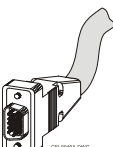
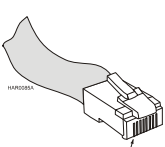
2.3.4 Whistle Connections on the Evaluation Board

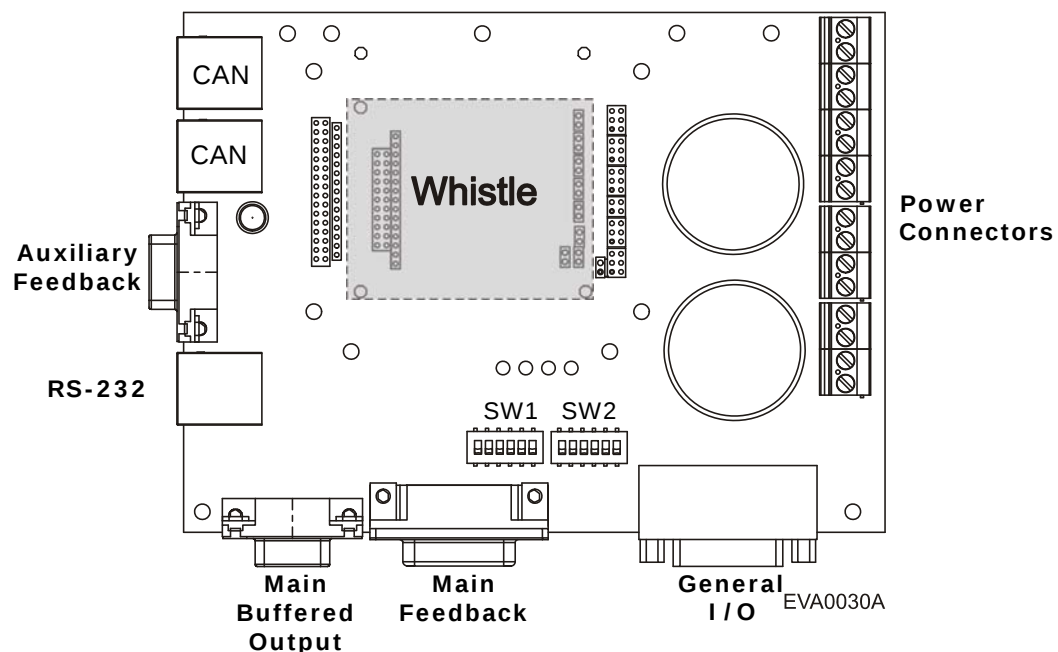
The Whistle is connected to the Evaluation Board by 2mm pitch header connectors (0.51 mm SQ). Upon assembly, the Whistle's J1, J21 and Power pins should be pressed directly into their respective sockets. Great care should be taken with alignment to avoid bending the pins.

Note: All the connectors below are *internal* connectors.

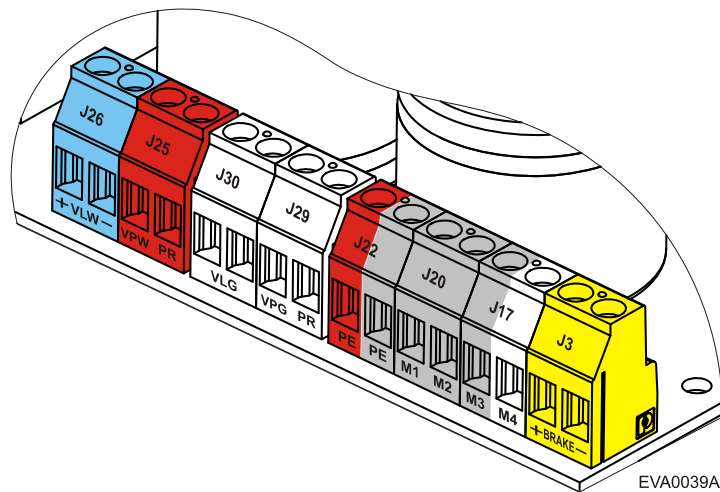


2.3.5 User Connectors

Type	On-Board Connector	Complementary Cable Name	Catalog No.	Cable/Plug Picture
General I/O	26-pin high density D-Sub Plug	General I/O Connector (Male)	JCW-200226M	
	1 m cable	General cable (8 pairs)	WIP-028X2X24	
Main Feedback	15-pin D-Sub Socket	General Purpose Main Feedback Cable	CBL-DFDBK-1	
Main Buffered Output	15-pin high density D-Sub Socket	Main Feedback Buffered Output Cable	CBL-CELIO2-1	
RS-232	8-pin RJ-45 socket	RS-232 Cable	CBL-RJ45RS2321-1	
Auxiliary Feedback	15-pin high density D-Sub Socket	Auxiliary Feedback Cable	CBL-CELAUX-1	
CANopen Communication	2x 8-pin RJ-45 socket	CAN Cable	CBL-RJ45CAN1-1	



2.3.6 Connecting the Power / Motor Cable to the Whistle



	Pin no.	Pin name	Function	
BRAKE	J3.1	BRAKE-	Motor brake, negative	
	J3.2	BRAKE+	Motor brake, positive	
MOTOR POWER			AC Motor Cable	DC Motor Cable
	J17.1	M4	NC	NC
	J17.2	M3	Motor	Motor
	J20.1	M2	Motor	Motor
	J20.2	M1	Motor	NC
PROTECTIVE	J22.1	PE	Protective earth	
EARTH	J22.2	PE	Protective earth	
WHISTLE POWER	J25.1	PR	Power input, common	
	J25.2	VPW+	Power input, positive	
WHISTLE AUXILIARY POWER	J26.1	VLW-	Power for logic, common	
	J26.2	VLW+	Power for logic, positive	
GUITAR POWER	J29.1	PR	NC	
	J29.2	VPG+	NC	
GUITAR AUXILIARY POWER	J30.1	VLG-	NC	
	J30.2	VLG+	NC	

Table 2-1: Connectors for Main Power and the Motor

2.3.7 Connecting the Motor Power to the Whistle

Connect the motor power cable to the M1, M2 and M3 terminals of the main power connector, and the fourth wire to the PE (Protective Earth). The phase connection order is arbitrary because the Composer will establish the proper commutation automatically during setup. If several motors/drive combinations are designed to operate in an identical manner, we recommend downloading the program into all the drives and connecting them in the same way.

Connect the shield of the cable to the closest ground connection at the motor end.

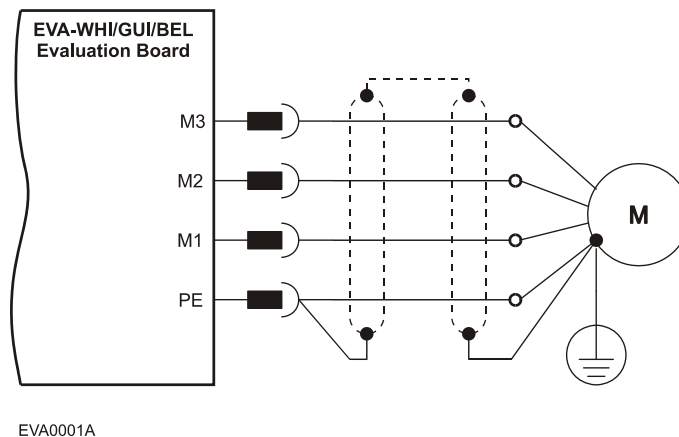


Figure 2-4: AC Motor - Power Connection Diagram

2.3.8 Connecting the Main Power to the Whistle

Connect the main power supply cable to the VPW+ and PR terminals of the main power connector.

Power to the Whistle is provided by a 12 ~ 95 VDC source. A “smart” control-supply algorithm enables the Whistle to operate with a power supply only, with no need for an auxiliary 24 V supply. If backup functionality is required for storing control parameters in case of power-outs, an external 24 VDC power supply can be connected, providing maximum flexibility and optional backup functionality when needed.



Notes for connecting the DC power supply:

- *The source of the 12 ~ 95 VDC Main Power Supply must be isolated.*
- For optimal noise immunity, it is highly recommended to use twisted and shielded cables for the DC power supply cable, such as a 3-wire shielded cable. The gauge is determined by the actual current consumption of the motor.
- Connect the cable shield to the closest ground connection near the power supply.
- Connect the PE to the closest ground connection near the power supply.
- Connect the PR to the closest ground connection near the power supply.

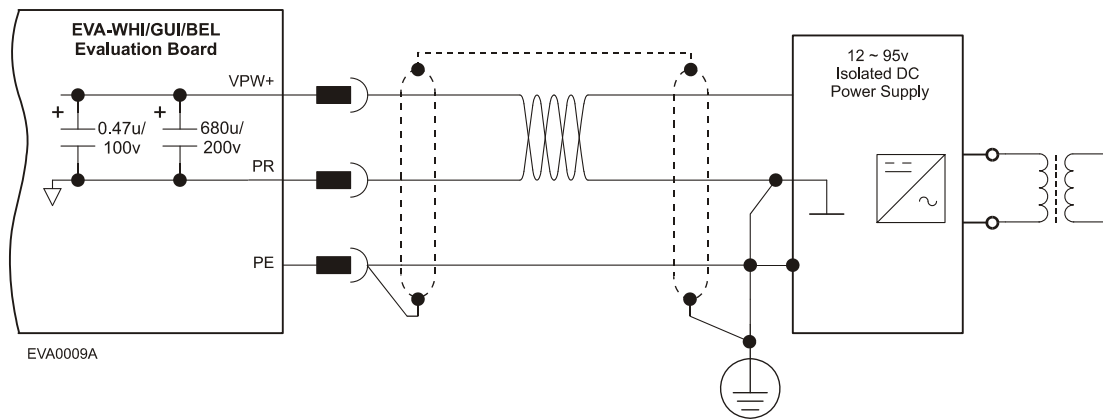


Figure 2-5: Main Power Supply Connection Diagram

2.3.9 Auxiliary Supply for the Whistle (Optional)



Notes for 12 ~ 95 VDC Auxiliary Supply connections:

- The source of the 12 ~ 95 VDC Auxiliary Supply must be isolated from the main supply.
- For safety reasons, connect the return (common) of the Auxiliary Supply source to the nearest ground.
- Connect the cable shield to the ground that is nearest to the Auxiliary Supply source.
- Before applying power, verify the polarity of the connection.



Caution: Power for the Whistle must come from the Main Supply and **not** from the Auxiliary Supply.

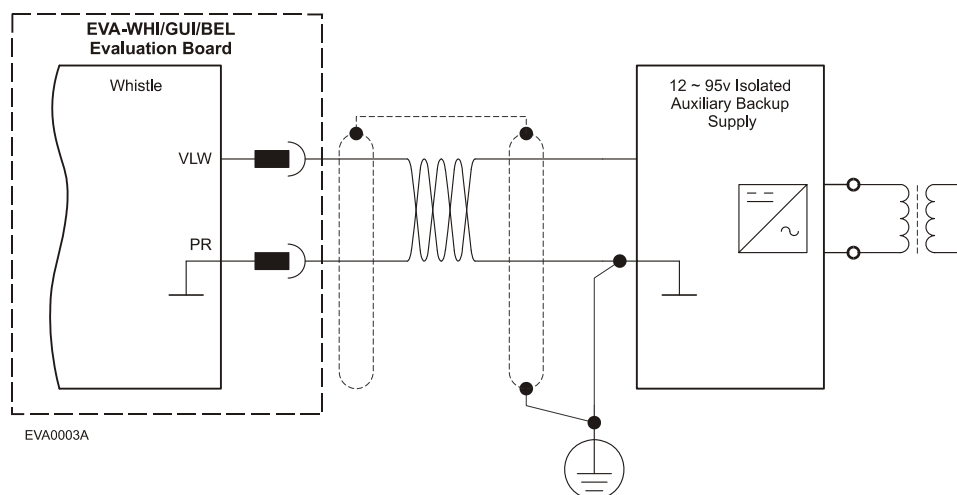


Figure 2-6: Auxiliary Supply Connection Diagram

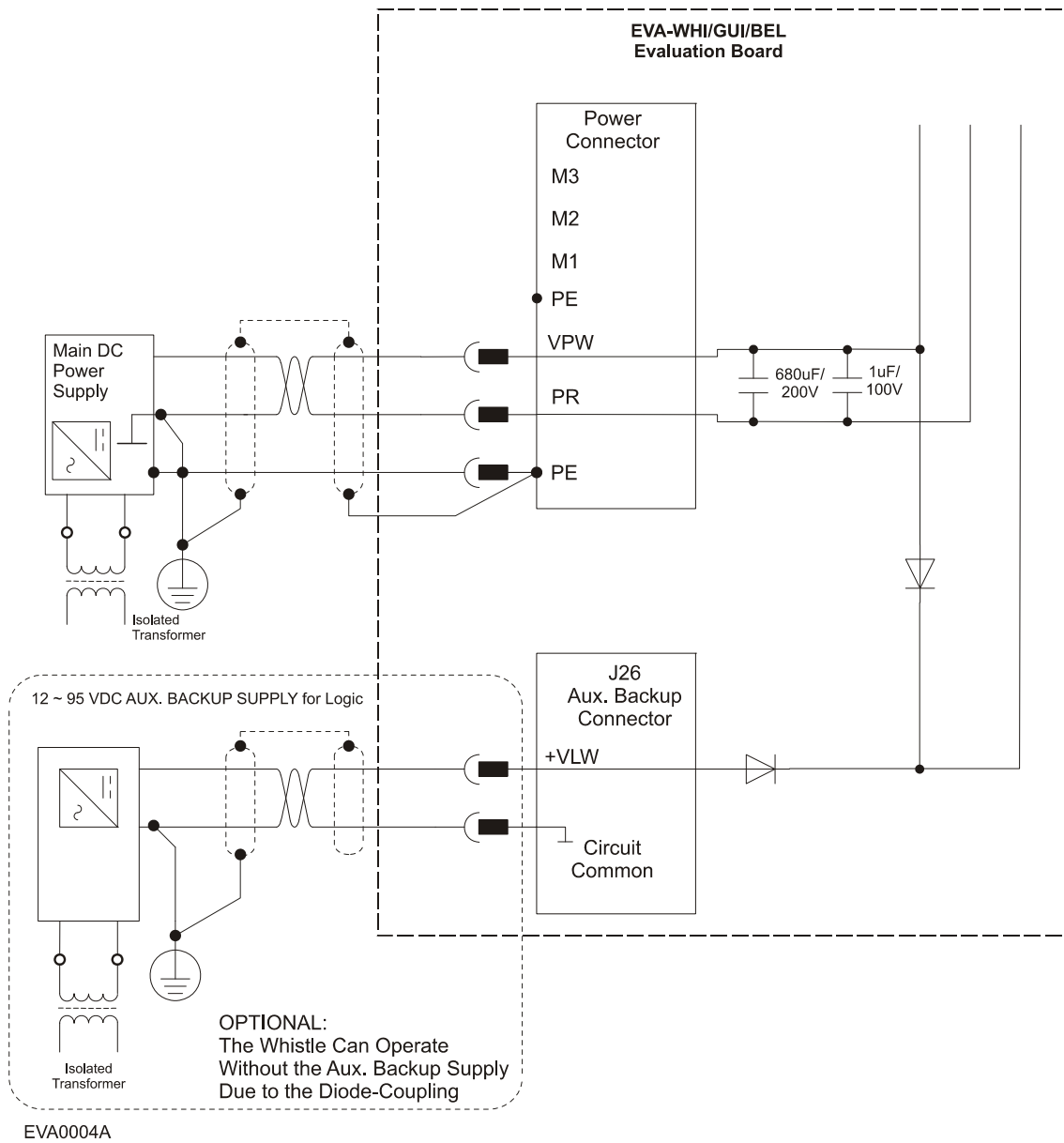


Figure 2-7: Shared Supply Connection Diagram

2.4 Bell

This section explains how to connect the Bell to the Evaluation Board, and provides details about all the connectors.

2.4.1 Connecting the Bell to the Evaluation Board

Each Bell has 53 pins; therefore, great care should be taken aligning its pins with the sockets on the board when assembling. Push the Bell into the Evaluation Board firmly and evenly.

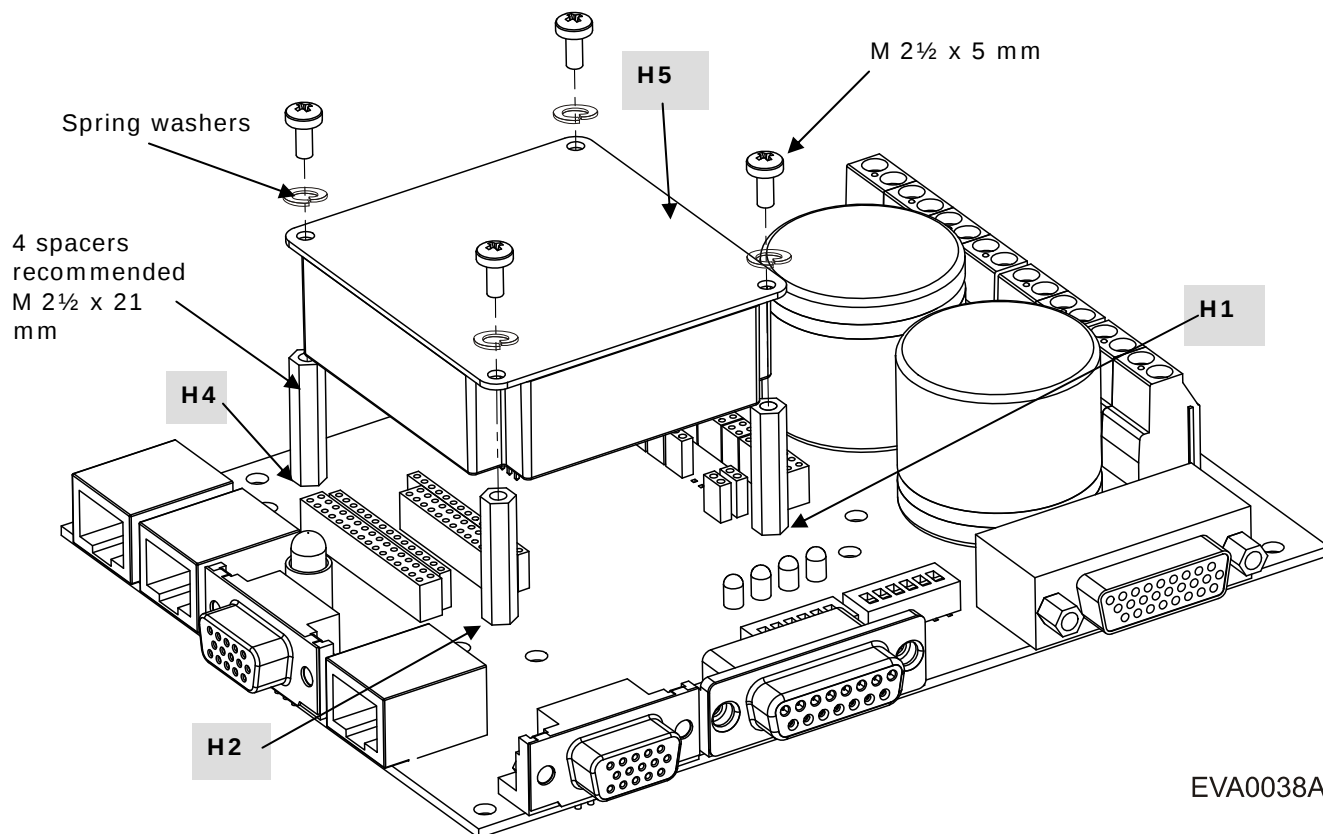


Figure 2-8: Assembling the Bell on the Evaluation Board

2.4.2 The Bell & Connectors on the Evaluation Board

The diagram below shows the Bell placed on the Evaluation Board.

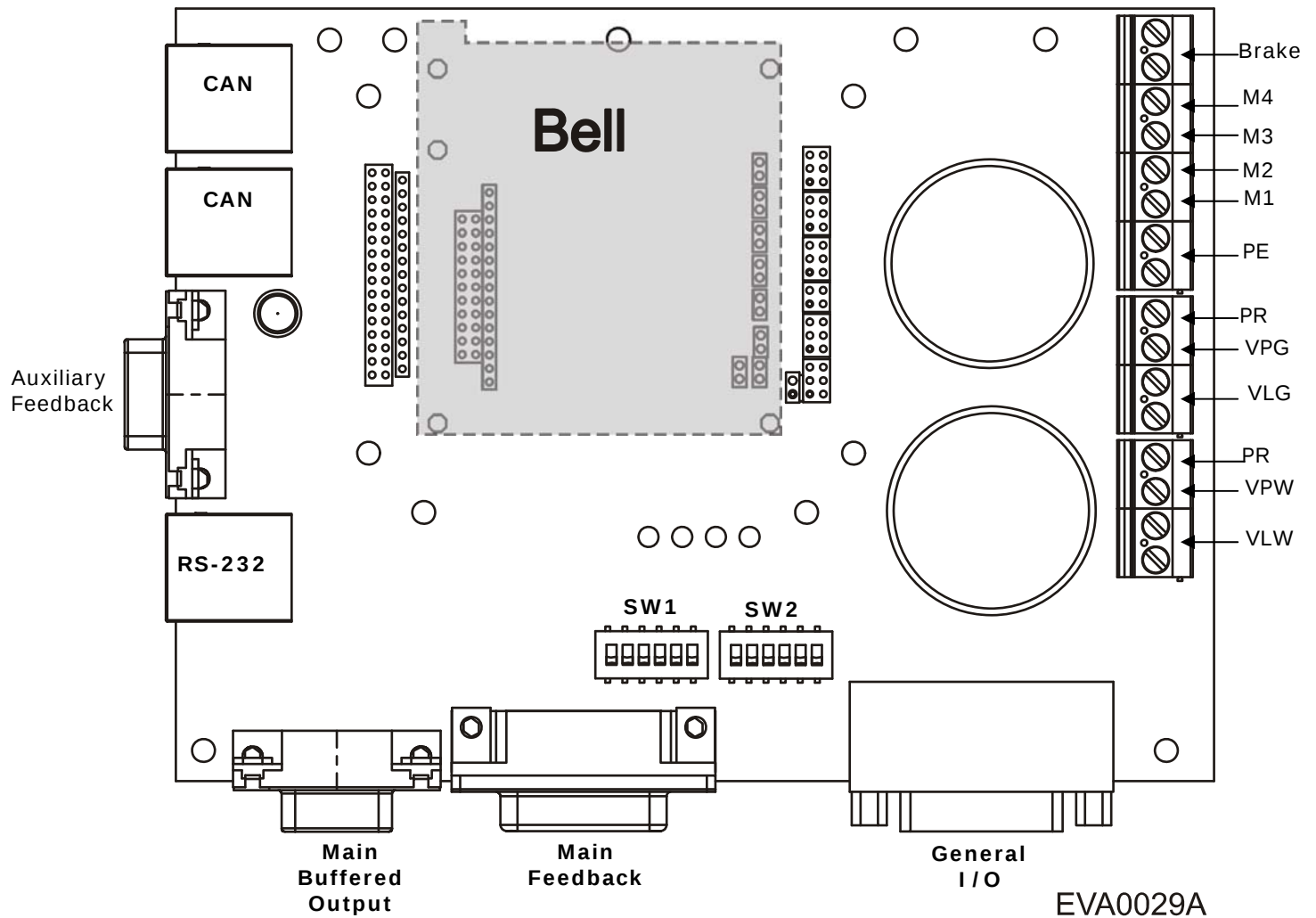


Figure 2-9: The Bell, connectors and ports on the Evaluation Board

2.4.3 Bell Evaluation Board Block Diagram

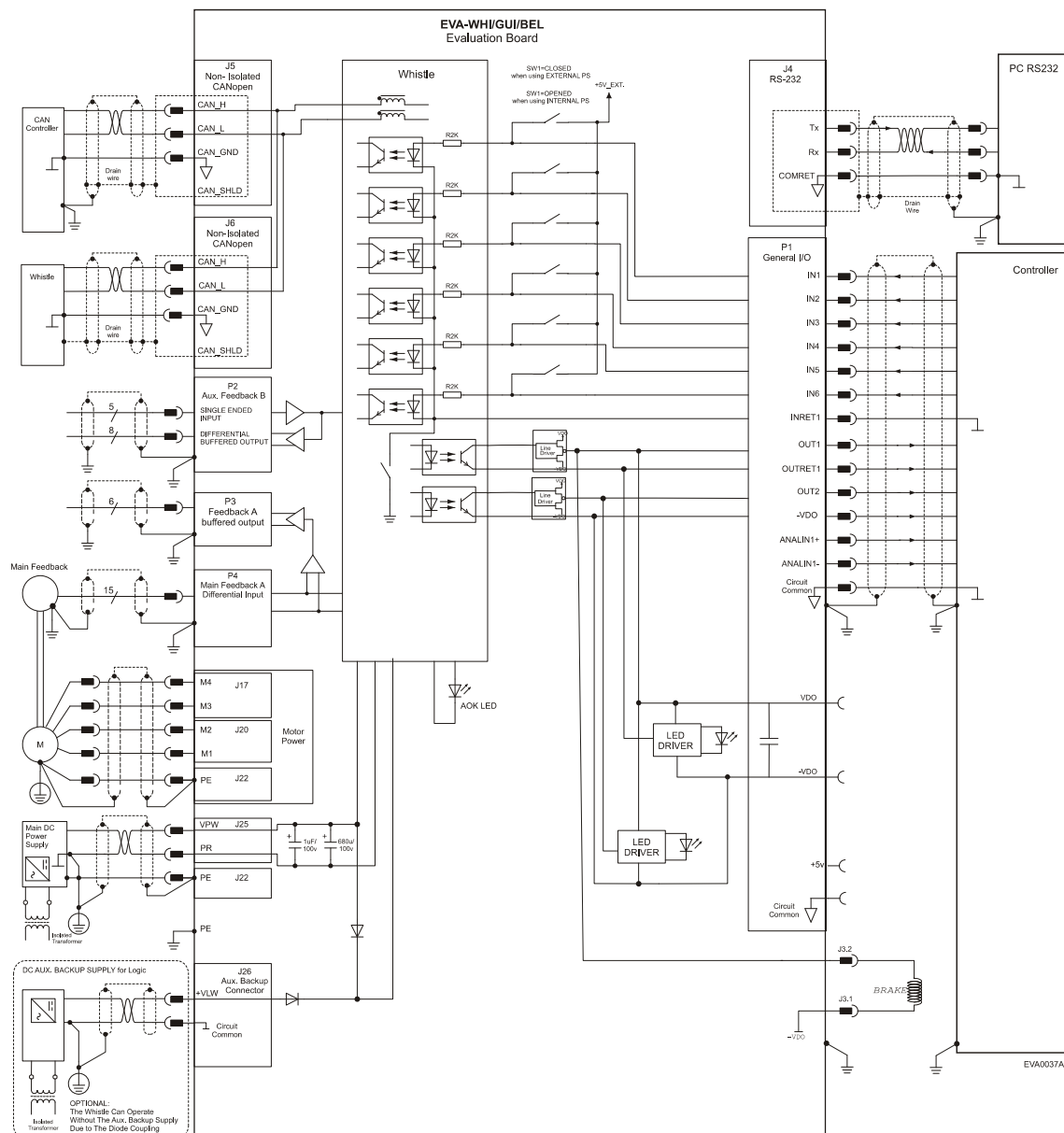
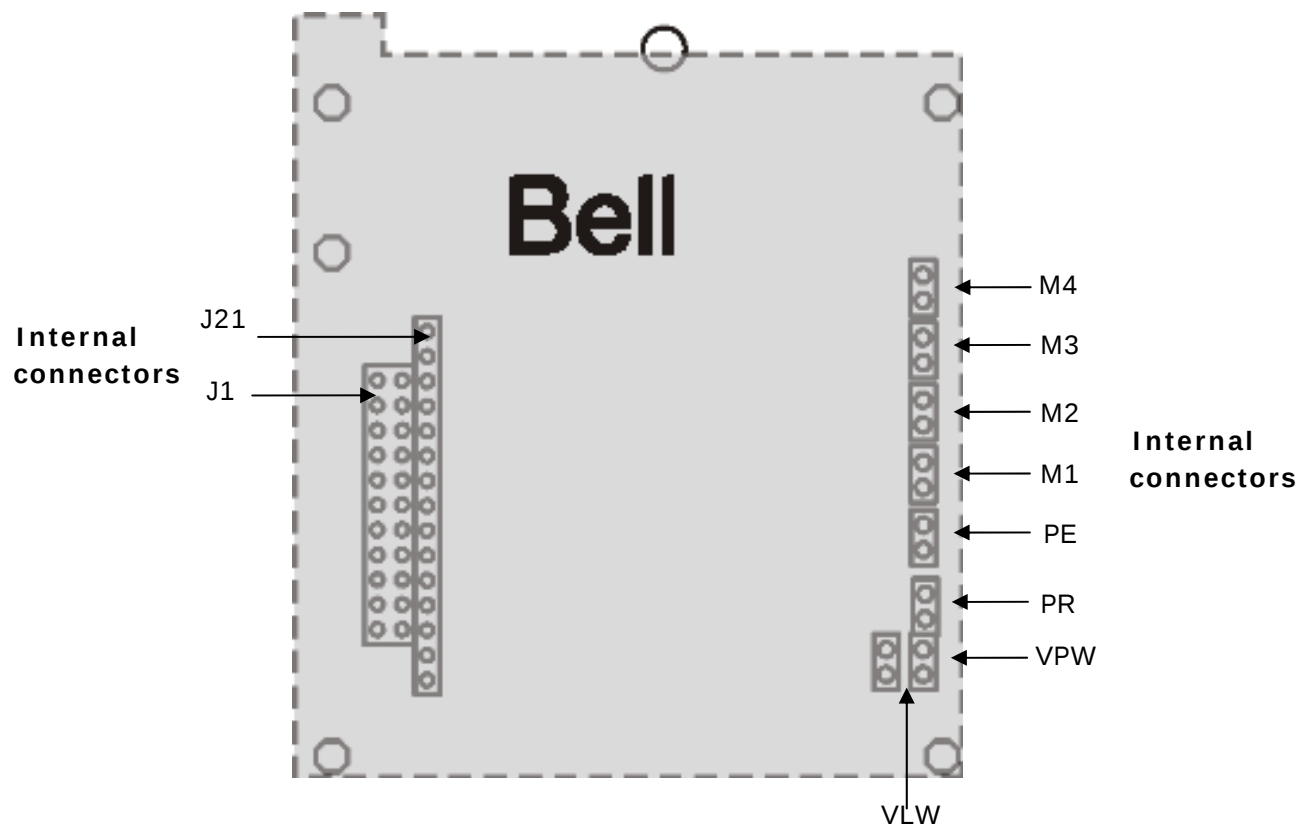


Figure 2-10: Bell Evaluation Board Block Diagram

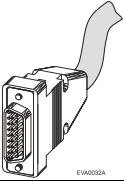
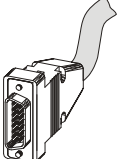
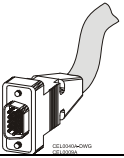
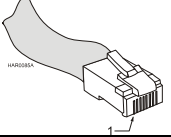
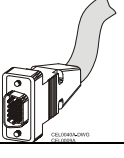
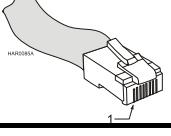
2.4.4 Bell Connections on the Evaluation Board

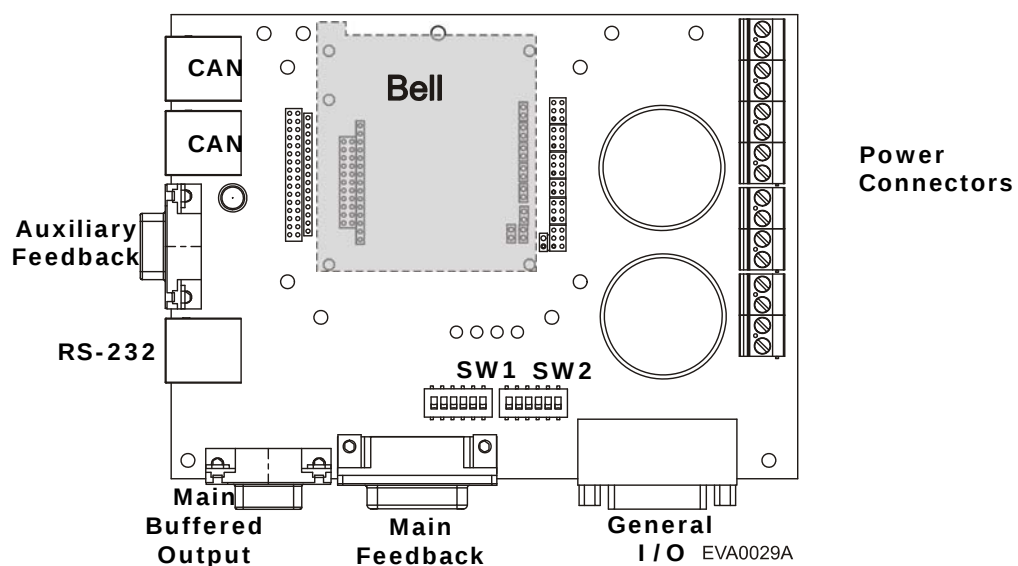
The Bell is connected to the Evaluation Board by 2mm pitch header connectors (0.51 mm SQ). Upon assembly, the Bell's J1, J21 and Power pins as well the Guitar's J2, J10 and Power pins should be pressed directly into their respective sockets. Great care should be taken with alignment to avoid bending the pins.

Note: All the connectors below are *internal* connectors.

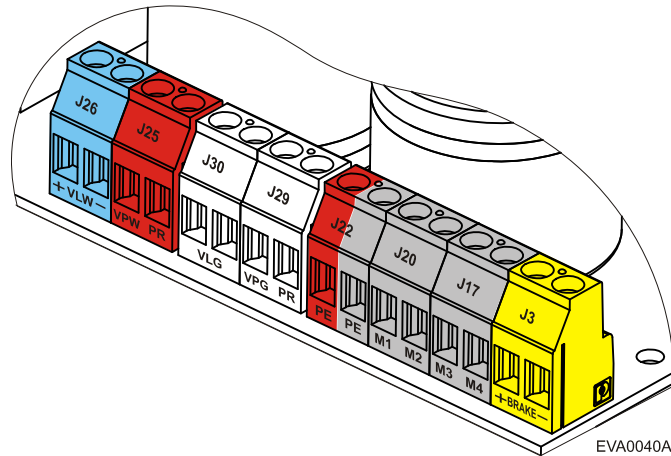


2.4.5 User Connectors

Type	On-Board Connector	Complementary Cable Name	Catalog. No.	Cable/ Plug Picture
General I/O	26-pin high density D-Sub Plug	General I/O Connector (Male)	JCW-200226M	
	1 m cable	General cable (8 pairs)	WIP-028X2X24	
Main Feedback	15-pin D-Sub Socket	General Purpose Main Feedback Cable	CBL-DFDBK-1	
Main Buffered Output	15-pin high density D-Sub Socket	Main Feedback Buffered Output Cable	CBL-CELIO2-1	
RS-232	8-pin RJ-45 socket	RS-232 Cable	CBL-RJ45RS2321-1	
Auxiliary Feedback	15-pin high density D-Sub Socket	Auxiliary Feedback Cable	CBL-CELAUX-1	
CAN open Communication	2x 8-pin RJ-45 socket	CAN Cable	CBL-RJ45CAN1-1	



2.4.6 Connecting the Power / Motor Cable to the Bell



	Pin no.	Pin name	Function
BRAKE	J3.1	BRAKE-	Motor brake, negative
	J3.2	BRAKE+	Motor brake, positive
MOTOR POWER			Stepper Motor
	J17.1	M4	Motor
	J17.2	M3	Motor
	J20.1	M2	Motor
	J20.2	M1	Motor
PROTECTIVE	J22.1	PE	Protective earth
EARTH	J22.2	PE	Protective earth
WHISTLE POWER	J25.1	PR	Power input, common
	J25.2	VPW+	Power input, positive
WHISTLE AUXILIARY POWER	J26.1	VLW-	Power for logic, common
	J26.2	VLW+	Power for logic, positive
GUITAR POWER	J29.1	PR	NC
	J29.2	VPG+	NC
GUITAR AUXILIARY POWER	J30.1	VLG-	NC
	J30.2	VLG+	NC

Table 2-2: Connectors for Main Power and the Motor

2.4.7 Connecting Motor Power to the Bell

Connect the motor power cable to the M1, M2, M3 and M4 terminals of the main power connector, and the fifth wire to the PE (Protective Earth). The phase connection order is arbitrary because the Composer will establish the proper commutation automatically during setup. If several motors/drive combinations are designed to operate in an identical manner, we recommend downloading the program into all the drives and connecting them in the same way.

Connect the shield of the cable to the closest ground connection at the motor end.

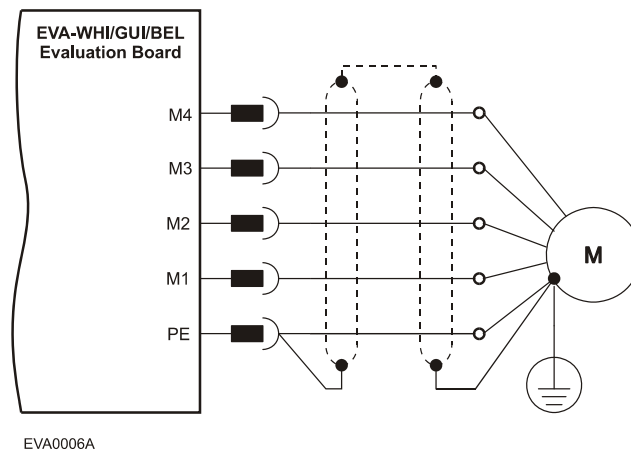


Figure 2-11: AC Motor - Power Connection Diagram

2.4.8 Connecting the Main Power to the Bell

Connect the main power supply cable to the VPW+ and PR terminals of the main power connector.

Power to the Bell is provided by a 12 ~ 95 VDC source. A “smart” control-supply algorithm enables the Bell to operate with a power supply only, with no need for an auxiliary 24 V supply. If backup functionality is required for storing control parameters in case of power-outs, an external 24 VDC power supply can be connected, providing maximum flexibility and optional backup functionality when needed.



Notes for connecting the DC power supply:

- *The source of the 12 ~ 95 VDC Main Power Supply must be isolated.*
- For best immunity, it is highly recommended to use twisted and shielded cables for the DC power supply cable. A 3-wire shielded cable should be used. The gauge is determined by the actual current consumption of the motor.
- Connect the cable shield to the closest ground connection near the power supply.
- Connect the PE to the closest ground connection near the power supply.
- Connect the PR to the closest ground connection near the power supply.

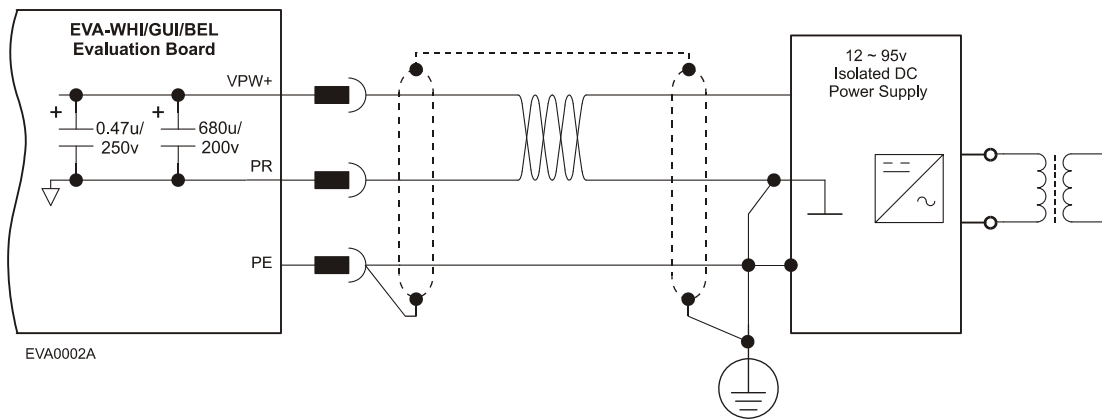


Figure 2-12: Main Power Supply Connection Diagram

2.4.9 Auxiliary Supply (optional) for Bell



Notes for 12 ~ 95 VDC Auxiliary Supply connections:

- The source of the 12 ~ 95 VDC Auxiliary Supply must be isolated from the main supply.
- For safety reasons, connect the return (common) of the Auxiliary Supply source to the closest ground near to it.
- Connect the cable shield to the closest ground near the Auxiliary Supply source.
- Before applying power, first verify the polarity of the connection.



Caution: Power to the Bell must come from the Main Supply and **not** from the Auxiliary Supply.

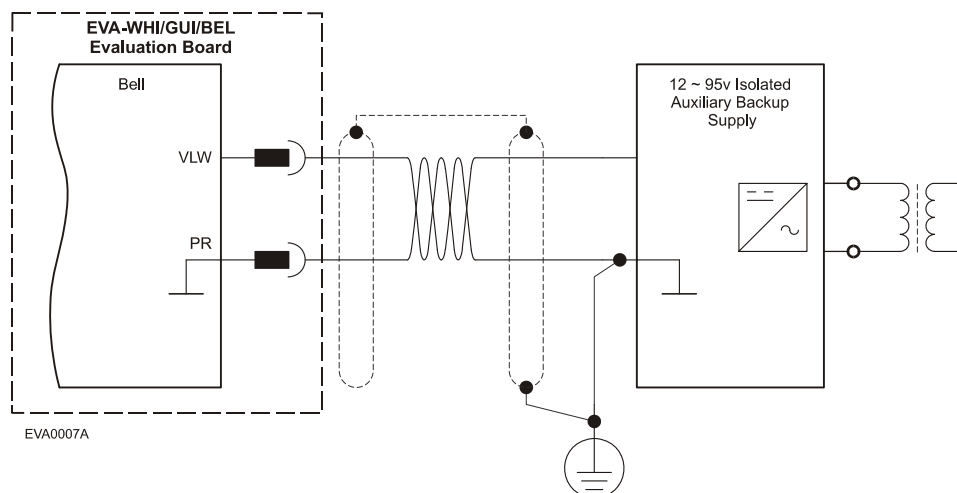


Figure 2-13: Auxiliary Supply Connection Diagram

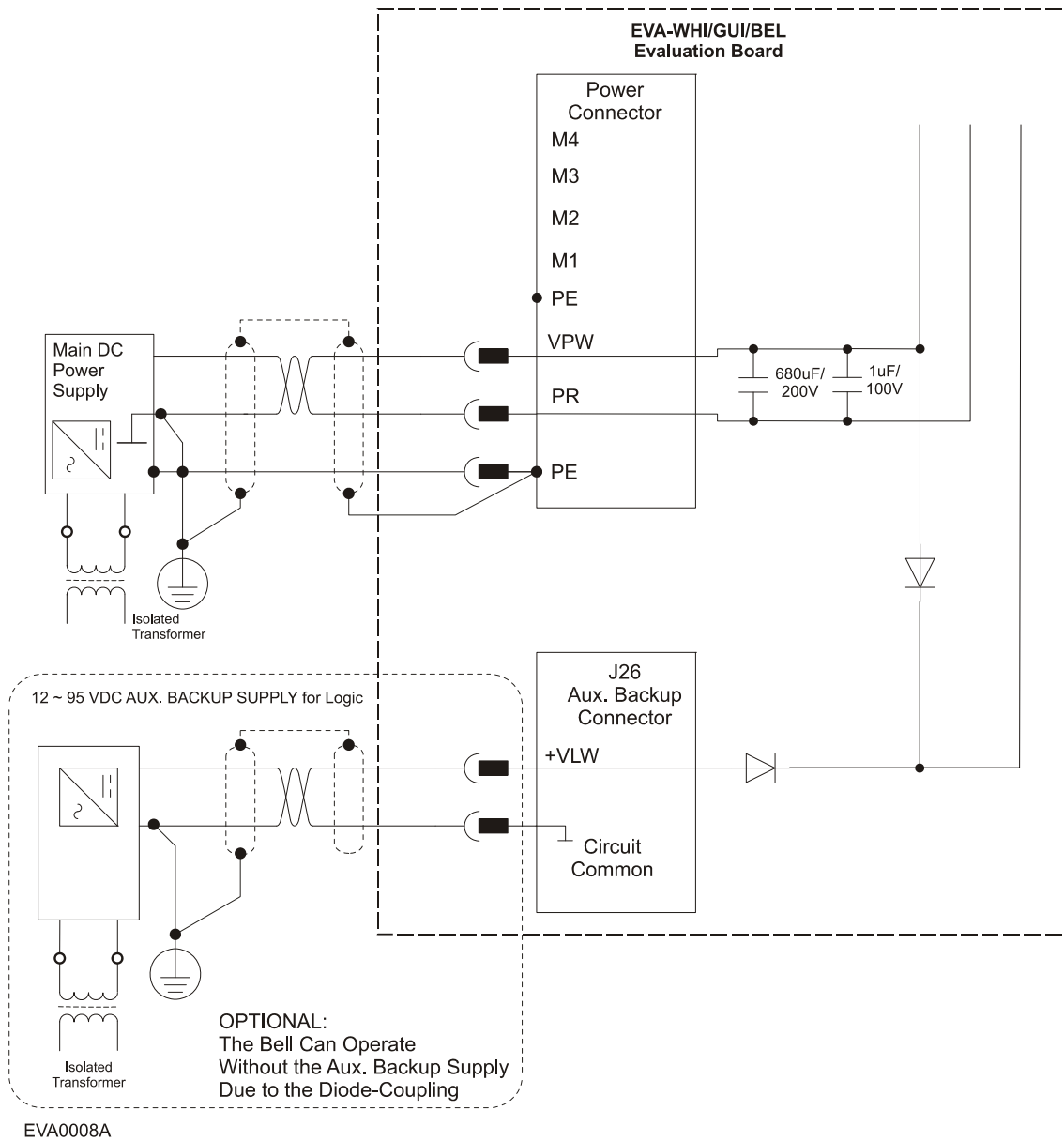


Figure 14: Shared Supply Connection Diagram

2.5 Guitar

This section explains how to connect the Guitar to the Evaluation Board, and provides details about all the connectors.

2.5.1 Connecting the Guitar to the Evaluation Board

Each Guitar has 83 pins; therefore, great care should be taken aligning its pins with the sockets on the board when assembling. Push the Guitar into the Evaluation Board firmly and evenly.

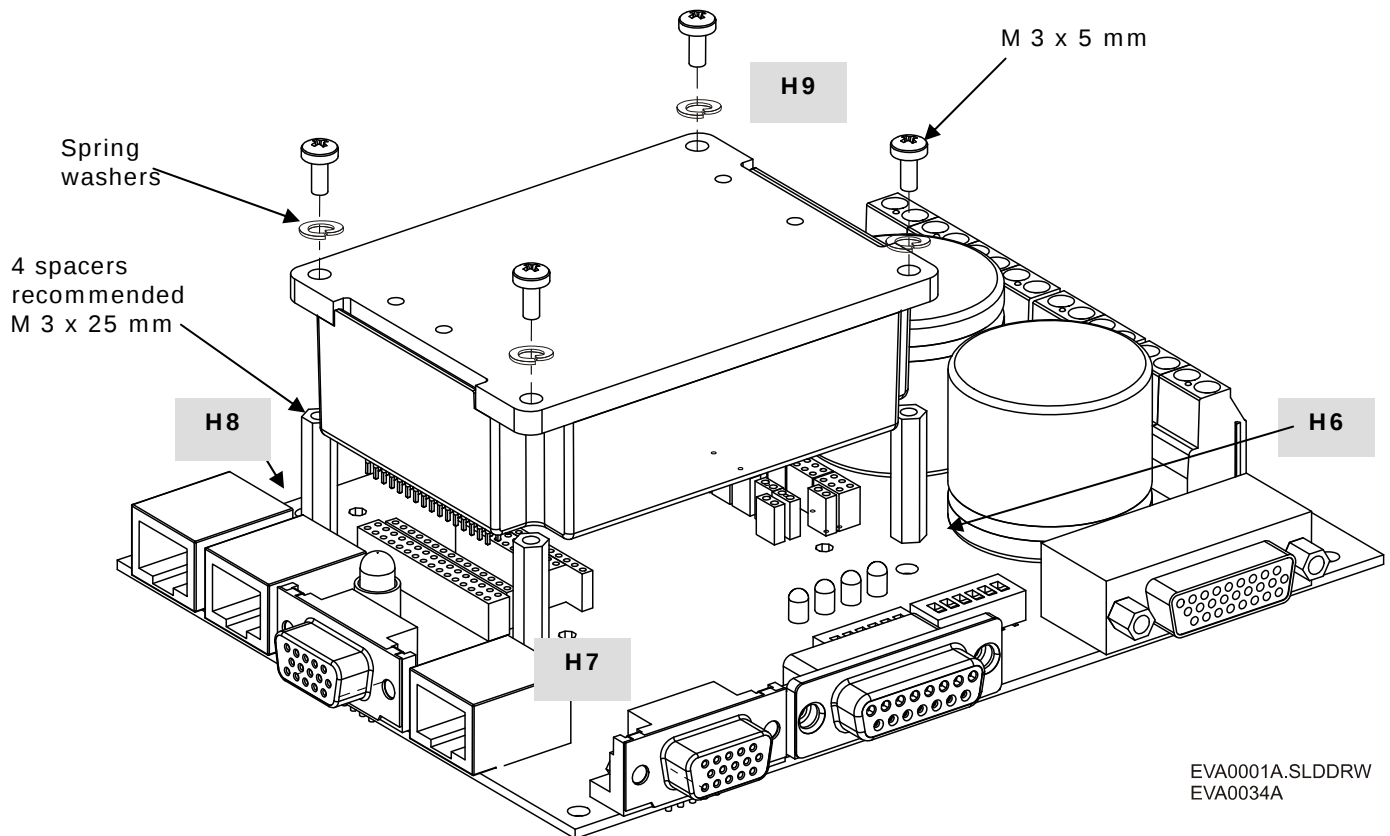


Figure 2-15: Assembling the Guitar on the Evaluation Board

2.5.2 The Guitar & Connectors on the Evaluation Board

The diagram below shows the Guitar placed on the Evaluation Board.

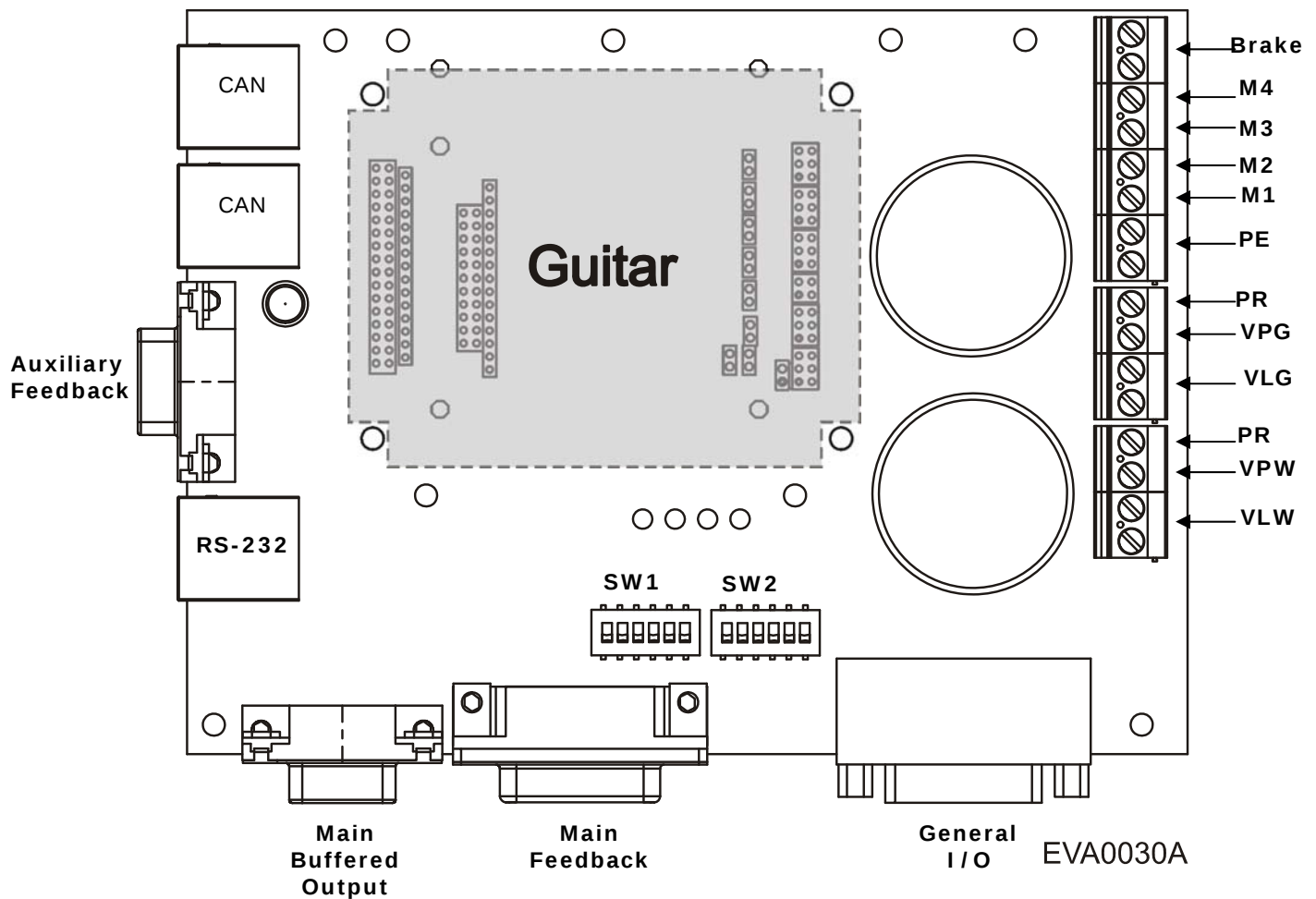


Figure 2-16: The Guitar, connectors and ports on the Evaluation Board

2.5.3 Evaluation Board Block Diagram (Guitar)

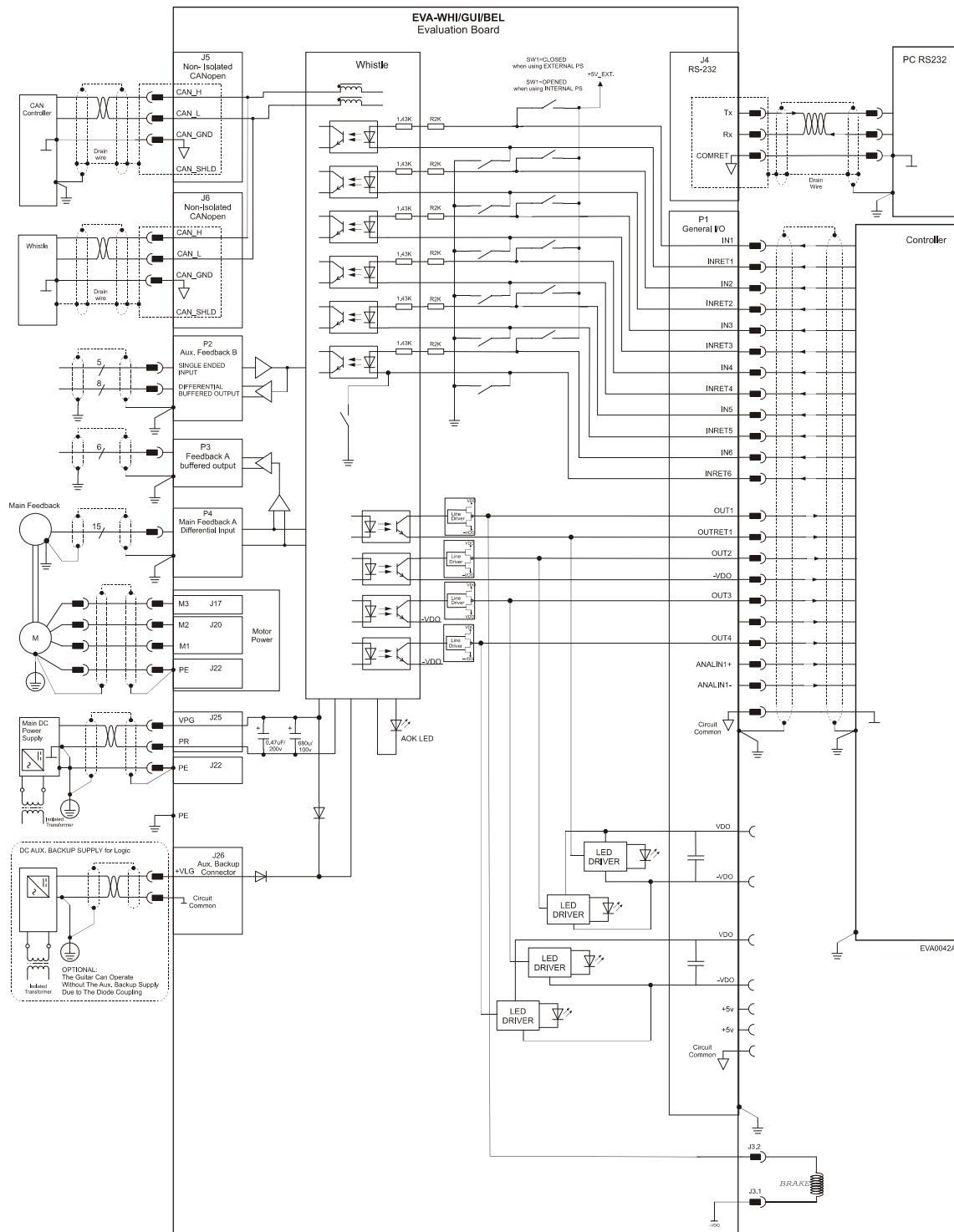
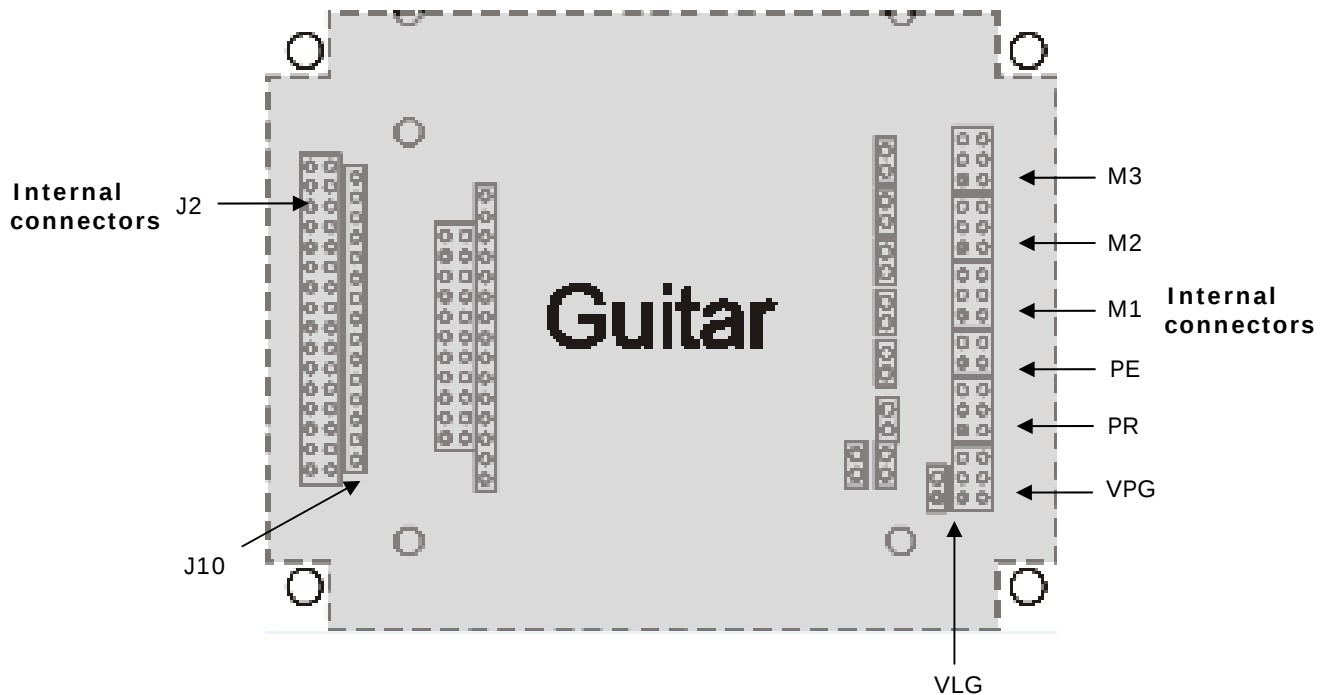


Figure 2-17: Evaluation Board Block Diagram (Guitar)

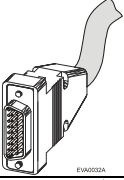
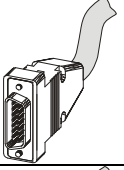
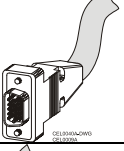
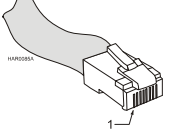
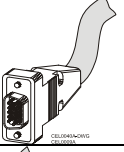
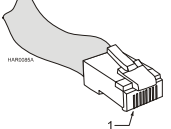
2.5.4 Guitar Connections on the Evaluation Board

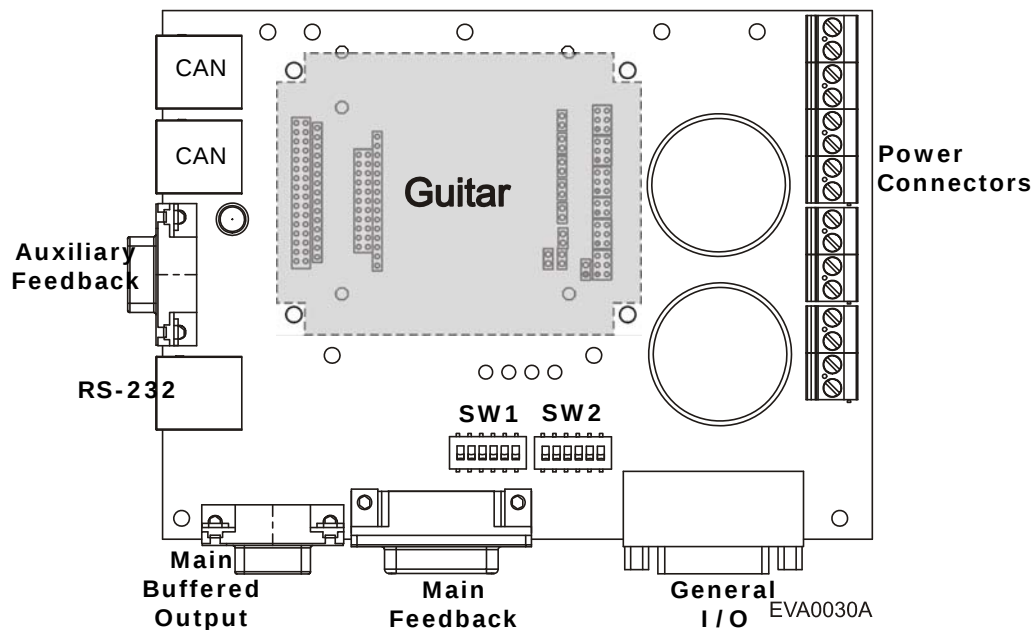
The Guitar is connected to the Evaluation Board by 2mm pitch header connectors. Upon assembly, Guitar's J2, J10 and Power pins should be pressed directly into their respective sockets. Great care should be taken with alignment to avoid bending the pins.

Note: All the connectors below are *internal* connectors.

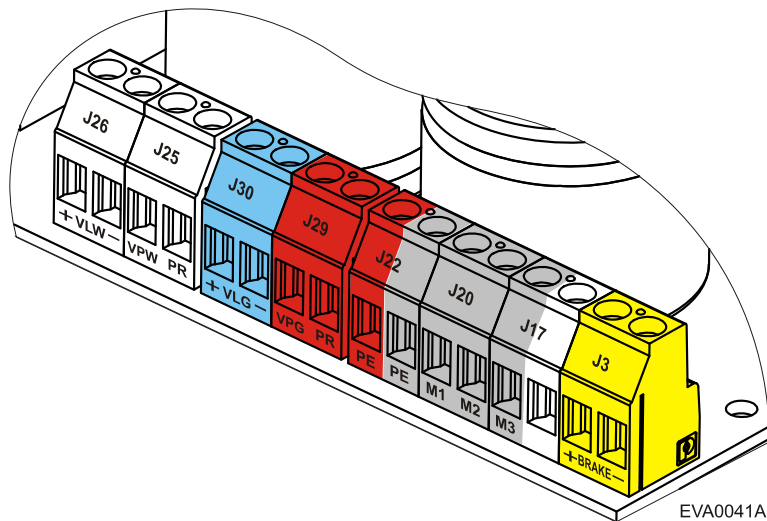


2.5.5 User Connectors

Type	On-Board Connector	Complementary Cable Name	Catalog No.	Cable/ Plug Picture
General I/O	26-pin high density D-Sub Plug	General I/O Connector	JCW-200226M	
Main Feedback	15-pin D-Sub Socket	General Purpose Main Feedback Cable	CBL-DFDBK-1	
Main Buffered Output	15-pin high density D-Sub Socket	Main Feedback Buffered Output Cable	CBL-CELIO2-1	
RS-232	8-pin RJ-45 socket	RS-232 Cable	CBL-RJ45RS2321-1	
Auxiliary Feedback	15-pin high density D-Sub Socket	Auxiliary Feedback Cable	CBL-CELAUX-1	
CAN open Communication	2x 8-pin RJ-45 socket	CAN Cable	CBL-RJ45CAN1-1	



2.5.6 Connecting the Power / Motor Cable



	Pin no.	Pin name	Function	
BRAKE	J3.1	BRAKE-	Motor brake, negative	
	J3.2	BRAKE+	Motor brake, positive	
MOTOR POWER			AC Motor Cable	DC Motor Cable
	J17.1	M4	NC	NC
	J17.2	M3	Motor	Motor
	J20.1	M2	Motor	Motor
	J20.2	M1	Motor	NC
PROTECTIVE	J22.1	PE	Protective earth	
EARTH	J22.2	PE	Protective earth	
WHISTLE POWER	J25.1	PR	NC	
	J25.2	VPW+	NC	
WHISTLE AUXILIARY POWER	J26.1	VLW-	NC	
	J26.2	VLW+	NC	
GUITAR POWER	J29.1	PR	Power input, common	
	J29.2	VPG+	Power input, positive	
GUITAR AUXILIARY POWER	J30.1	VLG-	Power for logic, common	
	J30.2	VLG+	Power for logic, positive	

Table 2-3: Connectors for Main Power and the Motor

2.5.7 Connecting the Motor Power

Connect the motor power cable to the M1, M2 and M3 terminals of the main power connector, and the fourth wire to the PE (Protective Earth). The phase connection order is arbitrary because the Composer will establish the proper commutation automatically during setup. If several motors/drive combinations are designed to operate in an identical manner, we recommend downloading the program into all the drives and connecting them in the same way.



Notes for connecting the motor cables:

- For best noise immunity, it is highly recommended to use a shielded (not twisted) cable for the motor connection, such as a 4-wire shielded cable. The gauge is determined by the actual current consumption of the motor.
- Connect the shield of the cable to the closest ground connection at the motor end.

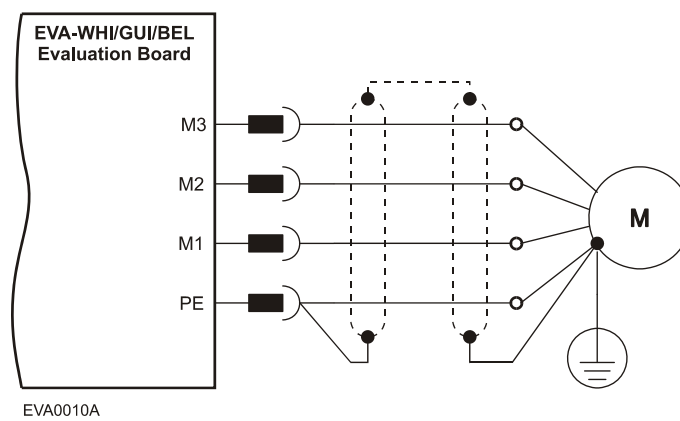


Figure 2-18: AC Motor - Power Connection Diagram

2.5.8 Connecting the Main Power to the Guitar

Connect the main power supply cable to the VPW+ and PR terminals of the main power connector.

Power to the Guitar is provided by a 12 ~ 195 VDC source. A “smart” control-supply algorithm enables the Guitar to operate with a power supply only, with no need for an auxiliary 24 V supply. If backup functionality is required for storing control parameters in case of power-outs, an external 24 VDC power supply can be connected, providing maximum flexibility and optional backup functionality when needed.



Notes for connecting the DC power supply:

- *The source of the 12 ~ 195 VDC Main Power Supply must be isolated.*
- For best noise immunity, it is highly recommended to use twisted and shielded cables for the DC power supply cable, such as a 3-wire shielded cable. The gauge is determined by the actual current consumption of the motor.
- Connect the cable shield to the closest ground connection near the power supply.
- Connect the PE to the closest ground connection near the power supply.
- Connect the PR to the closest ground connection near the power supply.

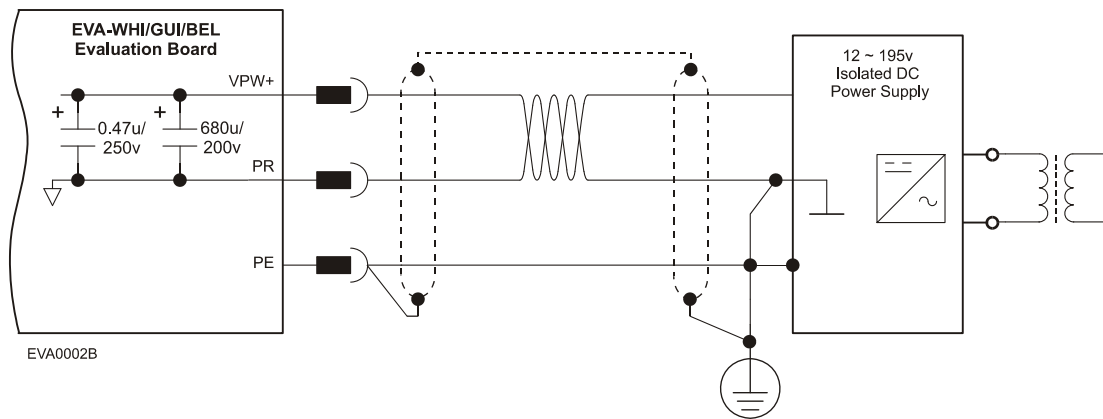


Figure 2-19: Main Power Supply Connection Diagram

2.5.9 Auxiliary Supply (optional) for Guitar



Notes for 12 ~ 195 VDC Auxiliary Supply connections:

- The source of the 12 ~ 195 VDC Auxiliary Supply must be isolated from the main.
- For safety reasons, connect the return (common) of the Auxiliary Supply source to the closest ground near to it.
- Connect the cable shield to the closest ground near the Auxiliary Supply source.
- Before applying power, first verify the polarity of the connection.



Caution: Power to the Guitar must come from the Main Supply and **not** from the Auxiliary Supply.

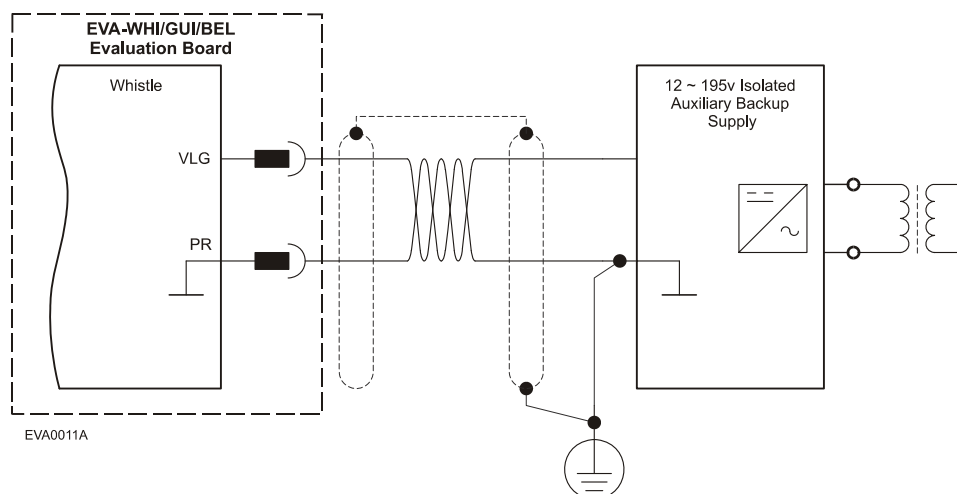


Figure 2-20: Auxiliary Supply Connection Diagram

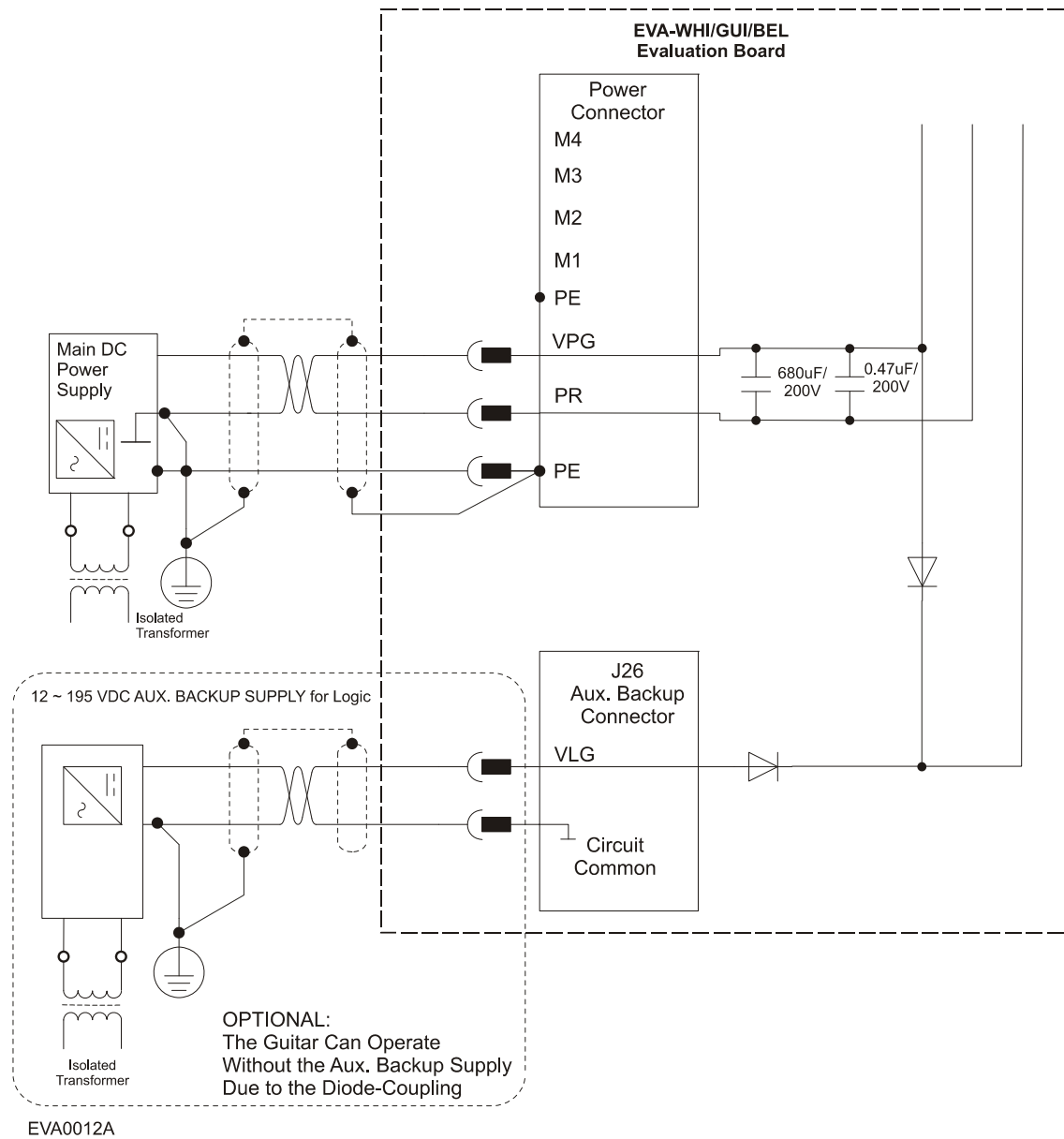


Figure 2-21: Shared Supply Connection Diagram

2.6 Feedback and Control Cable Assemblies

The EVA-WHI/GUI/BEL features easy-to-use D-sub type connections for all Control and Feedback cables. Below are instructions and diagrams describing how to assemble those cables.

- Use 24, 26 or 28 AWG twisted-pair shielded cables (24 AWG cable is recommended). For best results, the shield should have aluminum foil covered by copper braid.
- Use only a D-sub connector with a **metal housing**.
- Attach the braid shield tightly to the metal housing of the D-type connector.
- On the motor side connections, ground the shield to the motor chassis.
- On controller side connections, follow the controller manufacturer's recommendations concerning the shield.

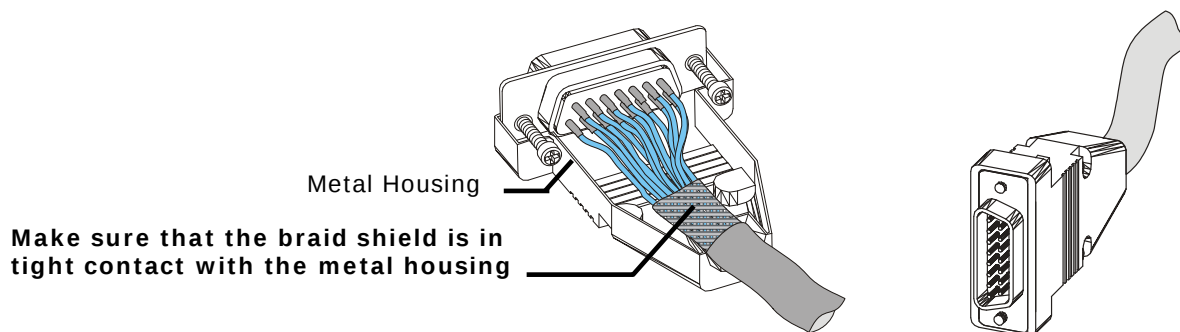


Figure 2-22: Feedback and Control Cable Assemblies



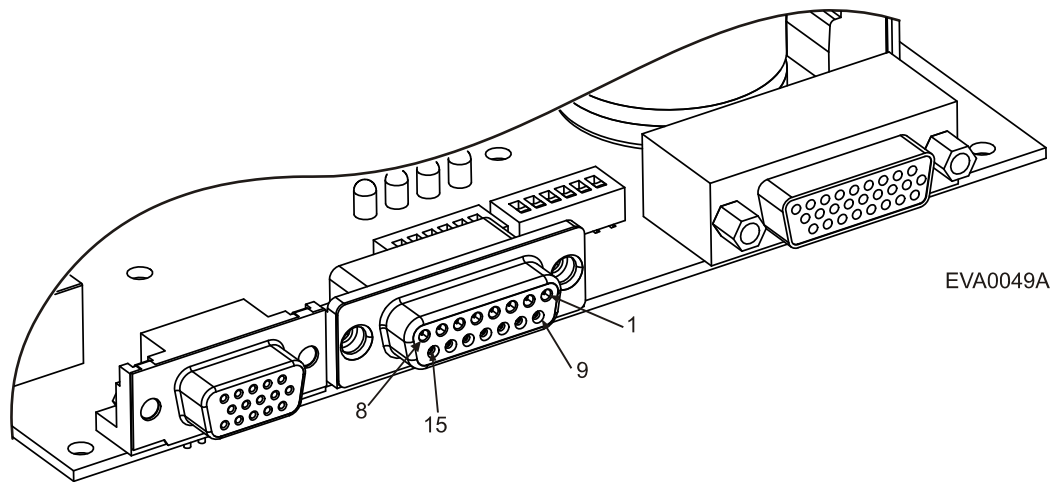
Note: All D-sub type connectors, used with the Evaluation Board, should be assembled in this way.

2.7 Main Feedback

The Main Feedback port is used to transfer feedback data from the motor to the drive.

The Evaluation Board accepts the following as a main feedback mechanism:

- Incremental encoder only
- Incremental encoder with digital Hall sensors
- Digital Hall sensors only
- Incremental Analog (Sine/Cosine) encoder (option)
- Resolver (option)
- Tachometer and Potentiometer (option)



The Main Feedback port on the Evaluation Board has a 15-pin D-sub socket. Connect one end of the Main Feedback cable from the motor to the Main Feedback connector on the Evaluation Board.

Incremental Encoder			Interpolated Analog Encoder		Resolver		Tachometer and Potentiometer	
WHI/ BELL/GUI XX/YYY_			WHI/ BELL/GUI XX/YYYYI		WHI/BELL/GUI XX/YYYYR		WHI/ BELL/GUI XX/YYYYT	
Pin	Signal	Function	Signal	Function	Signal	Function	Signal	Function
1	HC	Hall sensor C input	NC	Hall sensor C input	NC	-	HC	Hall sensor C input
2	HA	Hall sensor A input	NC	Hall sensor A input	NC	-	HA	Hall sensor A input
3	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return
4	+5V	Encoder/ Hall +5V supply	+5V	Encoder/ Hall +5V supply	+5V	Encoder/ Hall +5V supply	+5V	Encoder/ Hall +5V supply
5	CHA-	Channel A complement	A-	Sine A complement	S3	Sine A complement	Tac 1-	Tacho Input 1 Neg. (20 V max)
6	CHA	Channel A	A+	Sine A	S1	Sine A	Tac 1+	Tacho Input 1 Pos. (20V max)
7	INDEX-	Index complement	R-	Reference complement	R2	Vref complement f= 1/TS, 50mA Max.	NC	-
8	INDEX	Index	R+	Reference	R1	Vref f=1/TS, 50mA max.	POT	Potentiometer Input
9	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return

	Incremental Encoder		Interpolated Analog Encoder		Resolver		Tachometer and Potentiometer	
	WHI/ BELL/GUI XX/YYY_		WHI/ BELL/GUI XX/YYYYI		WHI/BELL/GUI XX/YYYYR		WHI/ BELL/GUI XX/YYYYT	
Pin	Signal	Function	Signal	Function	Signal	Function	Signal	Function
10	HB	Hall sensor B input	NC	Hall sensor B input	NC	-	HB	Hall sensor B input
11	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return
12	+5V	Encoder/ Hall +5V supply	+5V	Encoder/Hall +5V supply	+5V	Encoder/ Hall +5V supply	+5V	Encoder/Hall +5V supply
13	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return	SUPRET	Supply return
14	CHB-	Channel B complement	B-	Cosine B complement	S4	Cosine B complement	Tac 2-	Tacho Input 2 Neg. (50 V max)
15	CHB	Channel B	B+	Cosine B	S2	Cosine B	Tac 2+	Tacho Input 2 Pos. (50 V max)

Table 2-4: Main Feedback Cable Pin Assignments

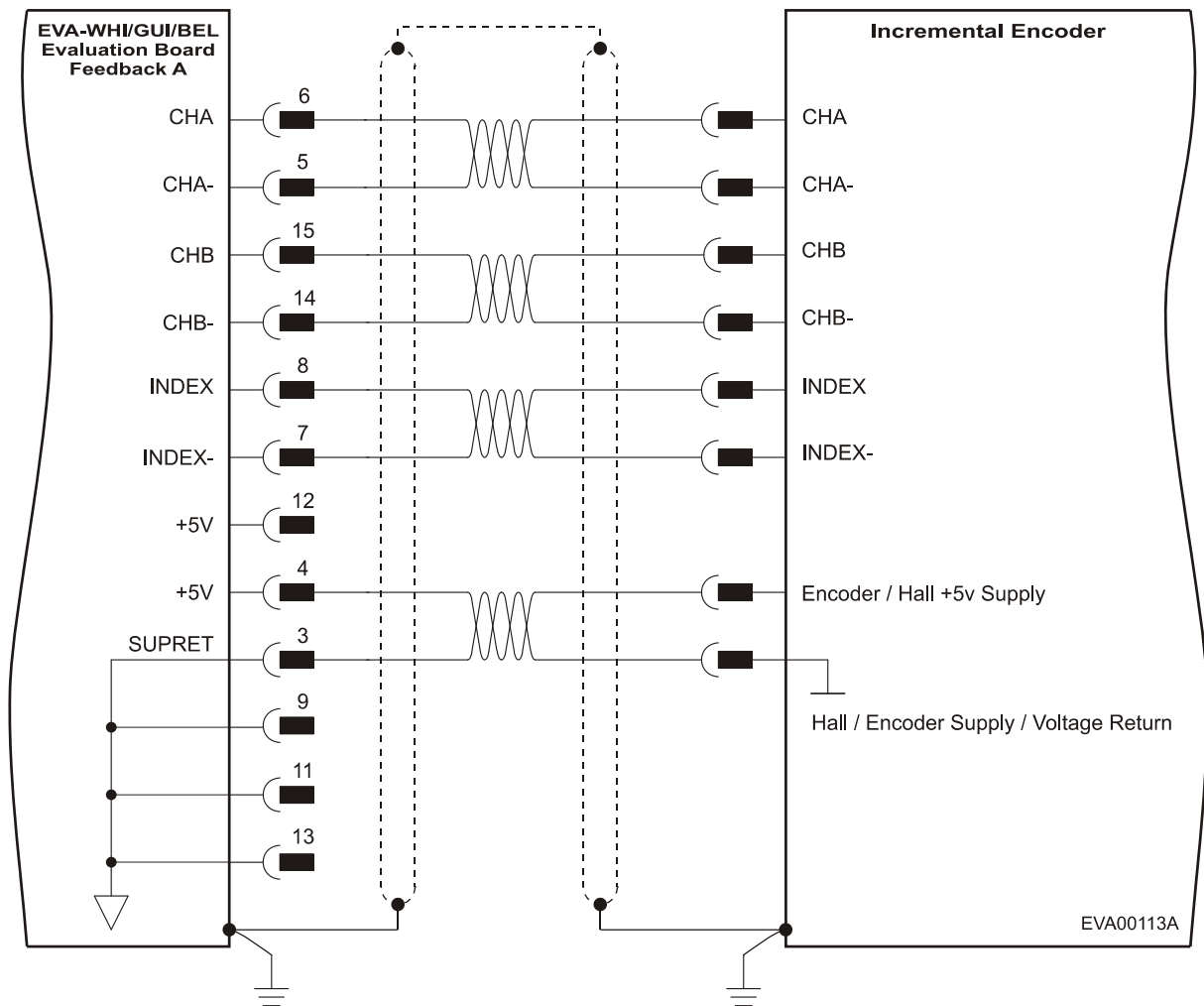


Figure 2-23: Main Feedback - Incremental Encoder

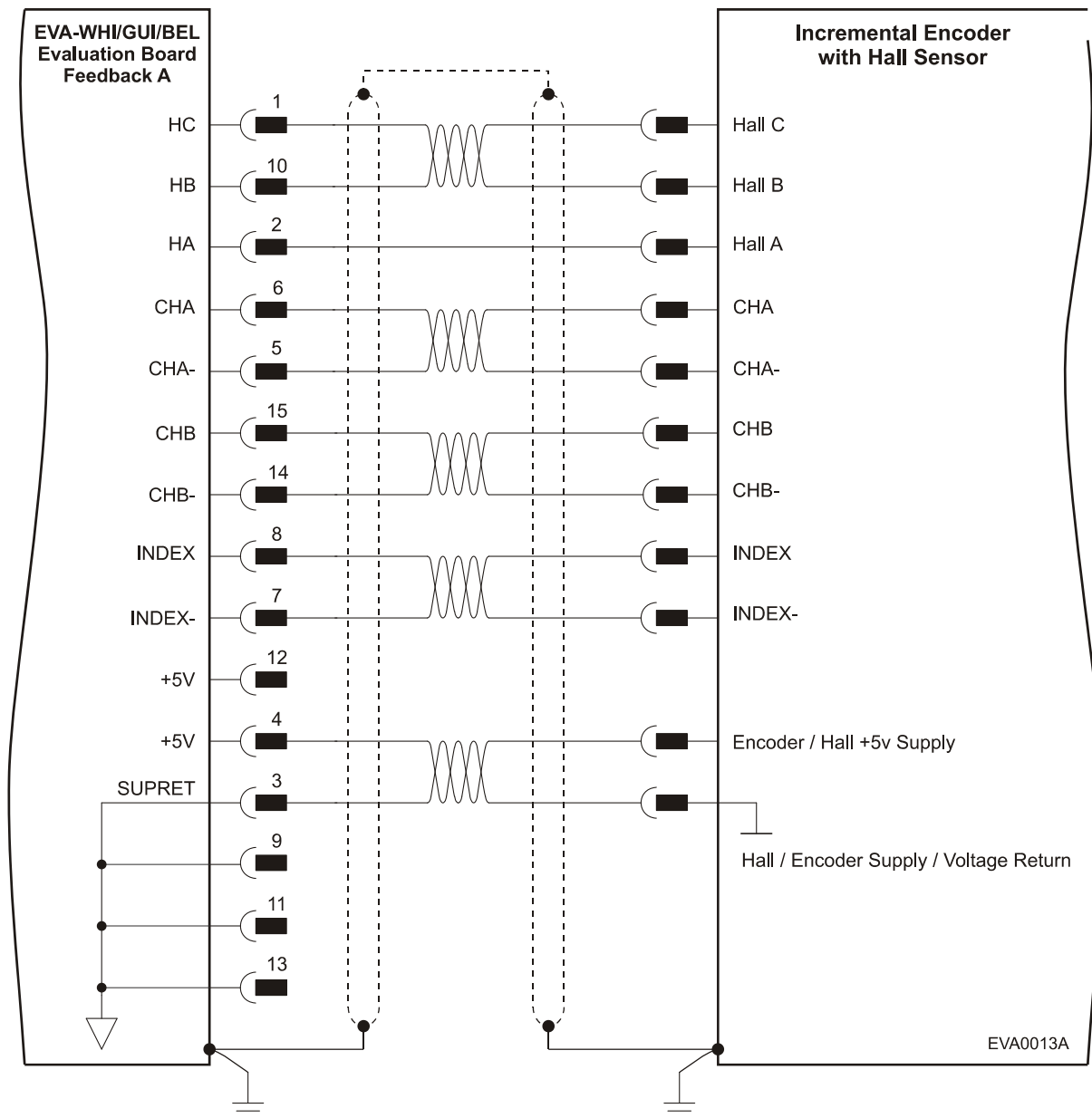


Figure 2-24: Main Feedback- Incremental Encoder with Hall Sensors Connection Diagram

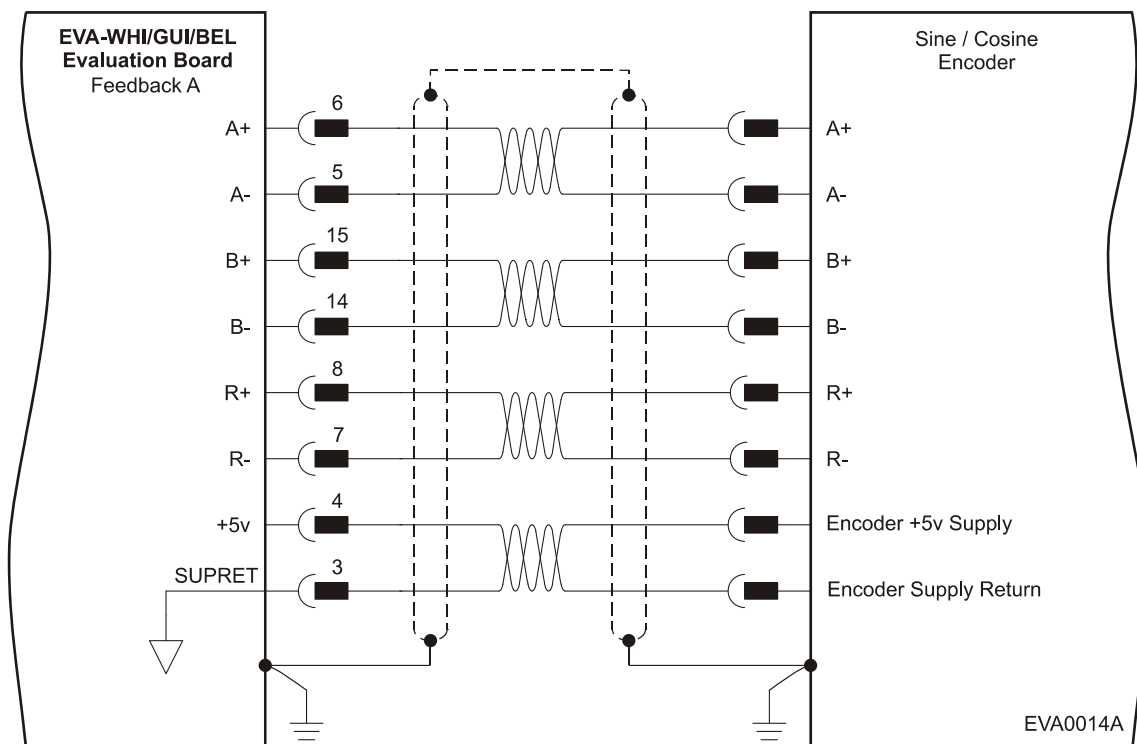


Figure 2-25: Main Feedback - Interpolated Analog Encoder Connection Diagram

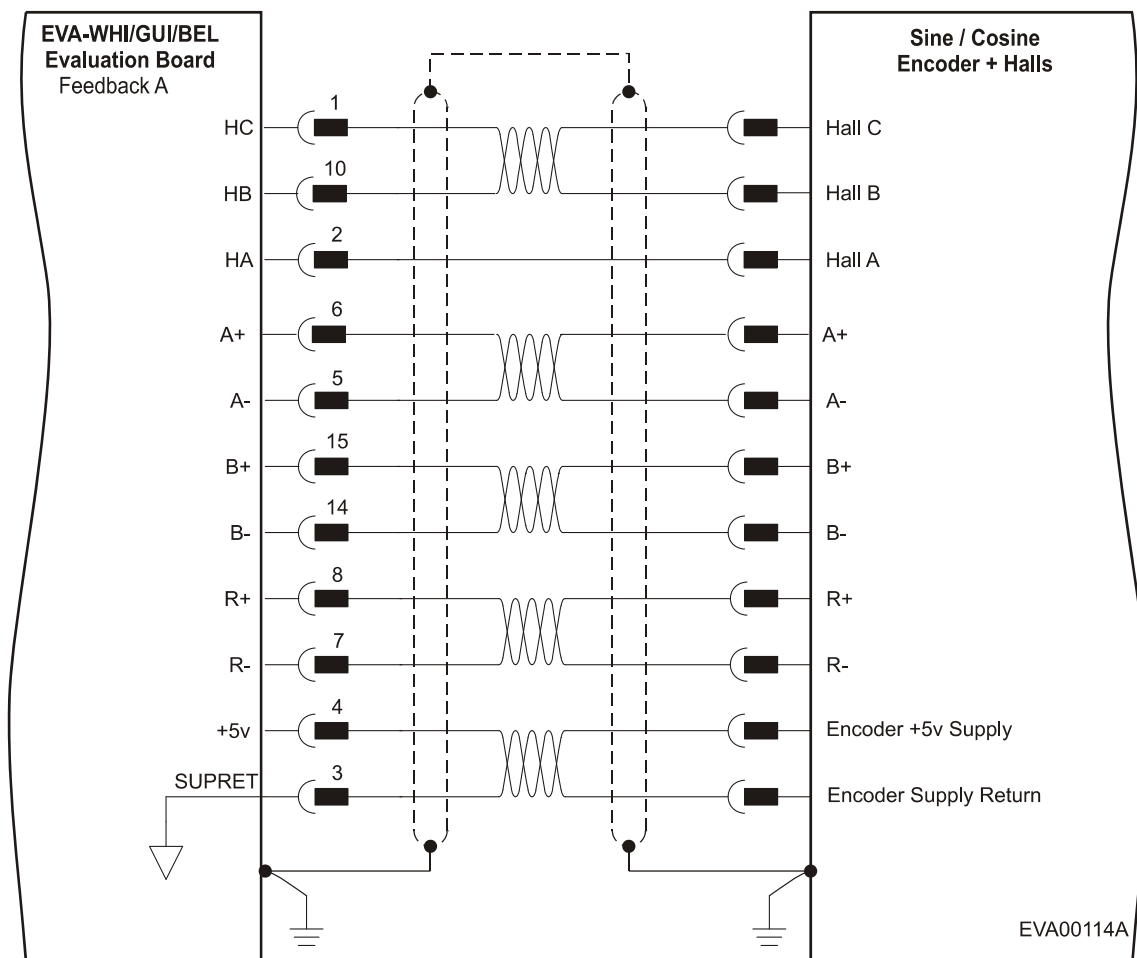


Figure 2-26: Main Feedback - Interpolated Analog Encoder with Hall Sensors Connection Diagram

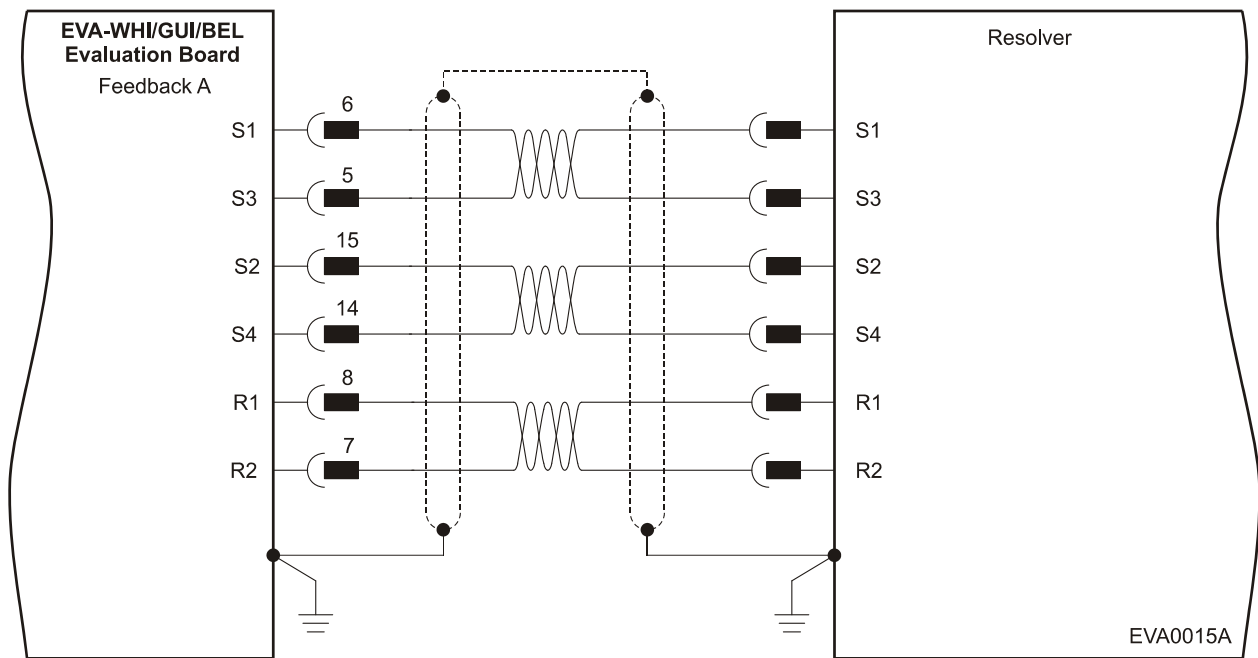


Figure 2-27: Main Feedback - Resolver Connection Diagram

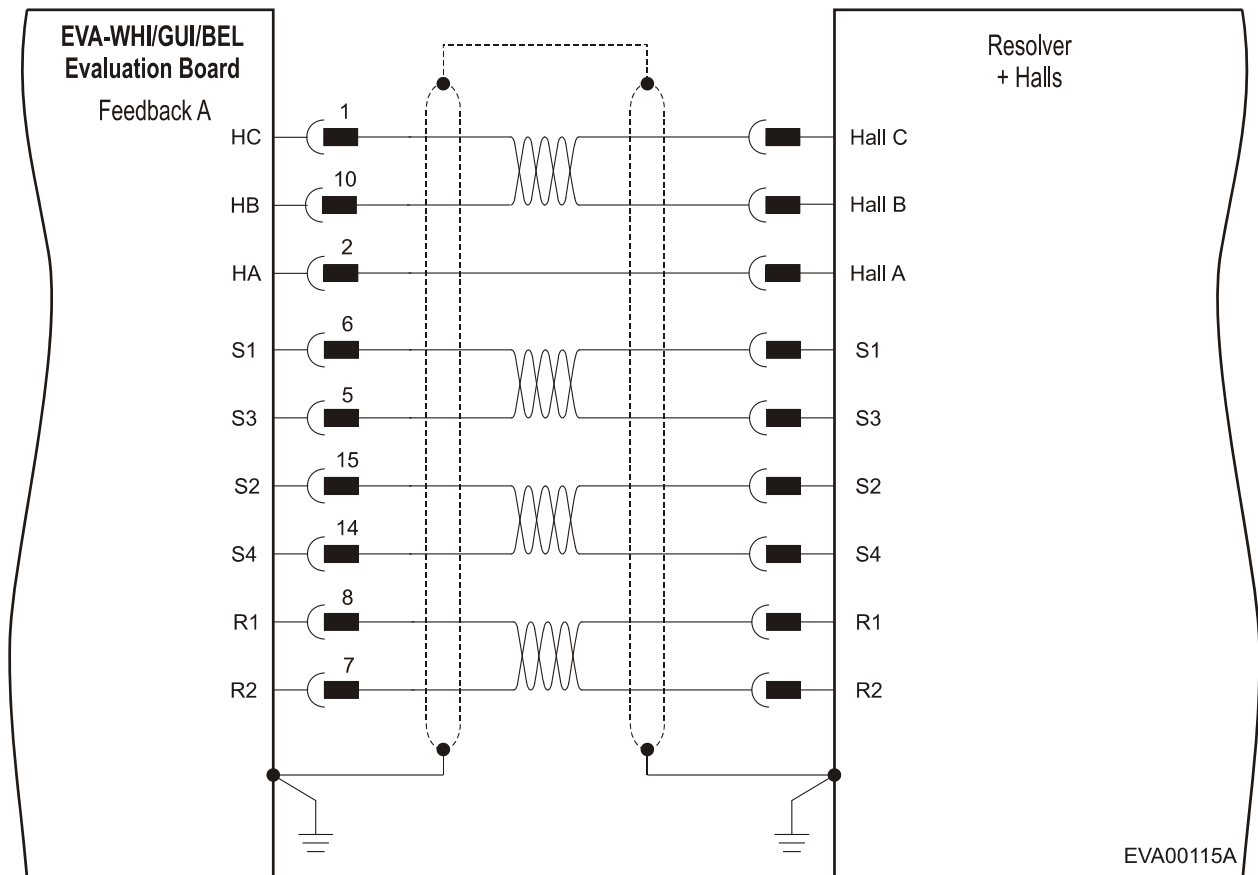


Figure 2-28: Main Feedback - Resolver + Halls Connection Diagram

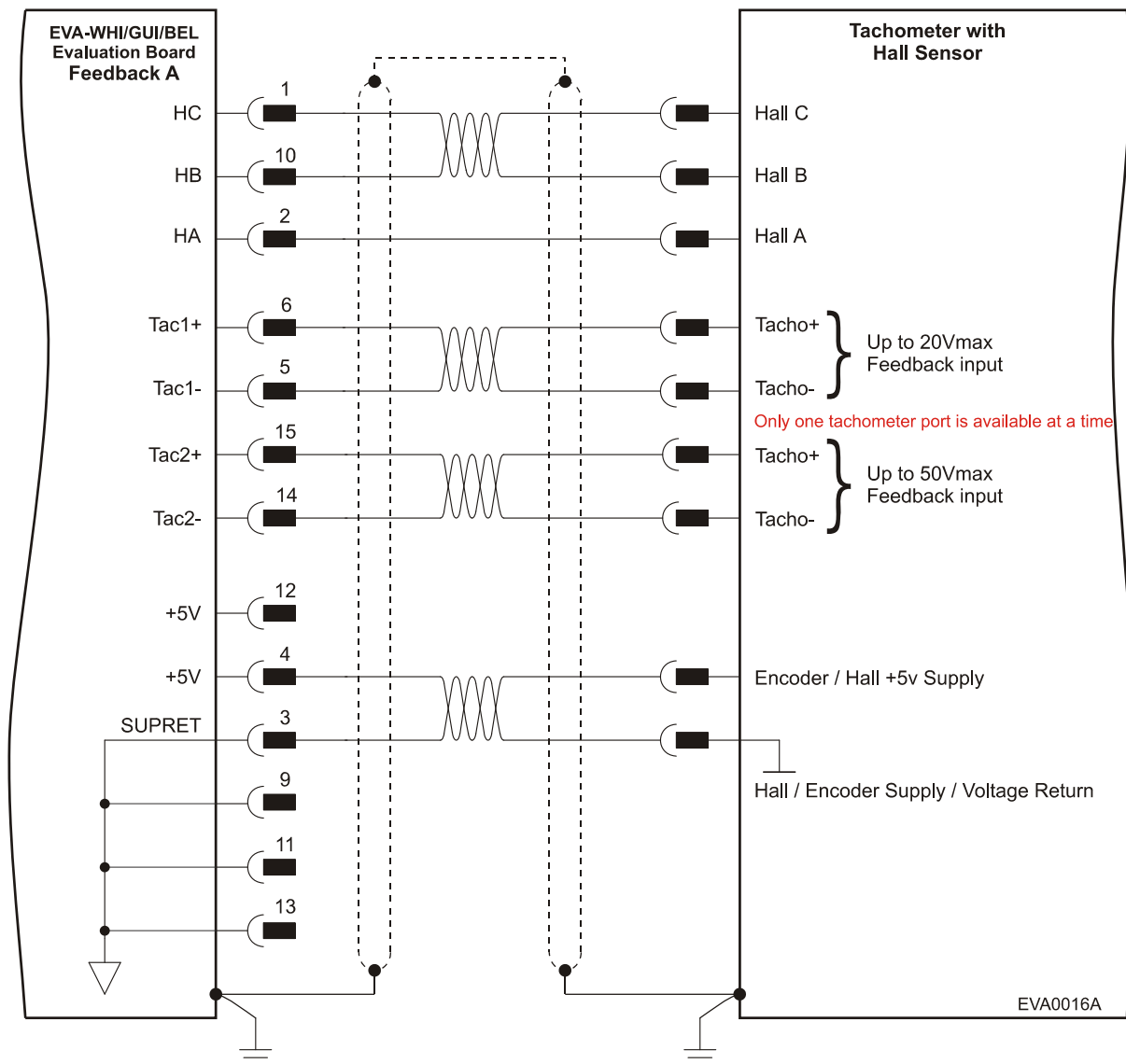


Figure 2-29: Main Feedback - Tachometer Feedback with Digital Hall Sensor
Connection Diagram for Brushless Motors

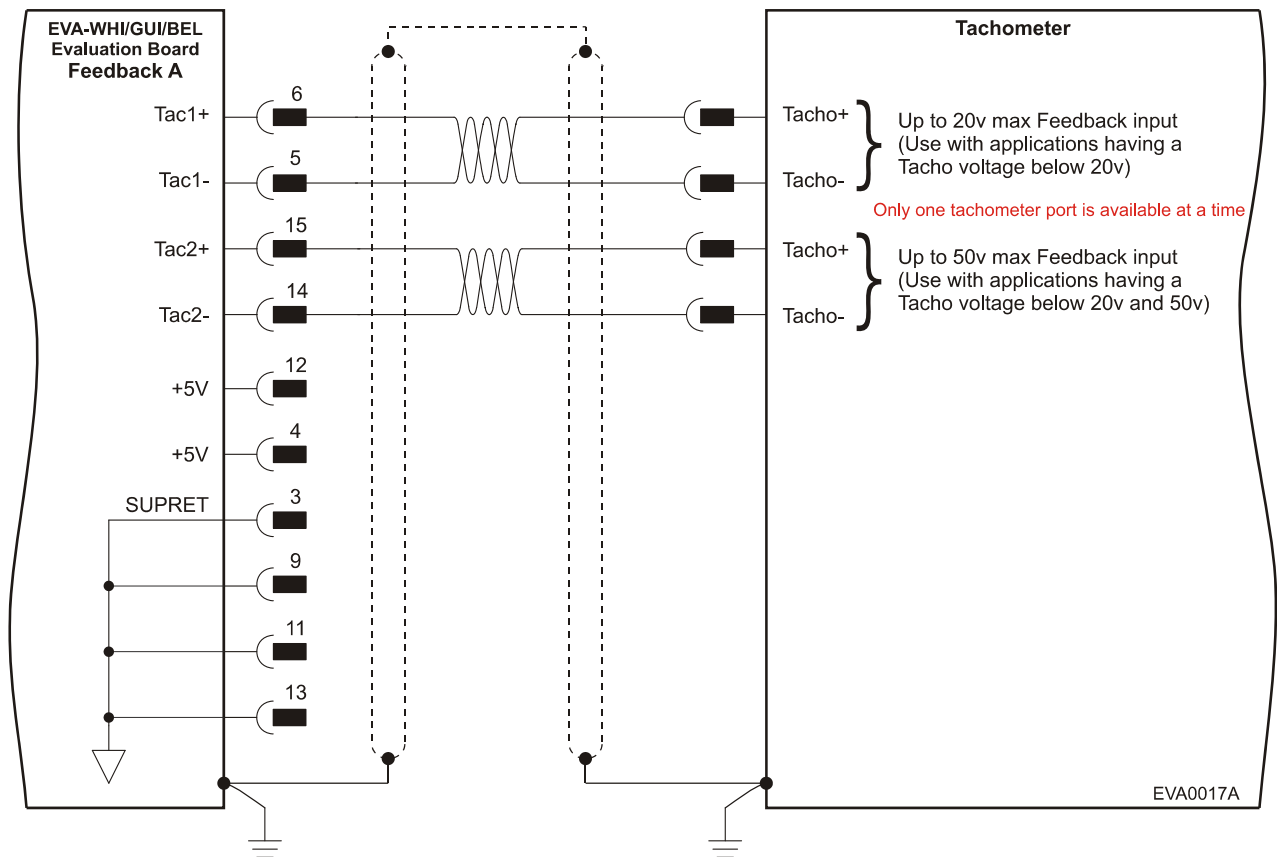


Figure 2-30: Main Feedback - Tachometer Feedback Connection Diagram for Brush Motors

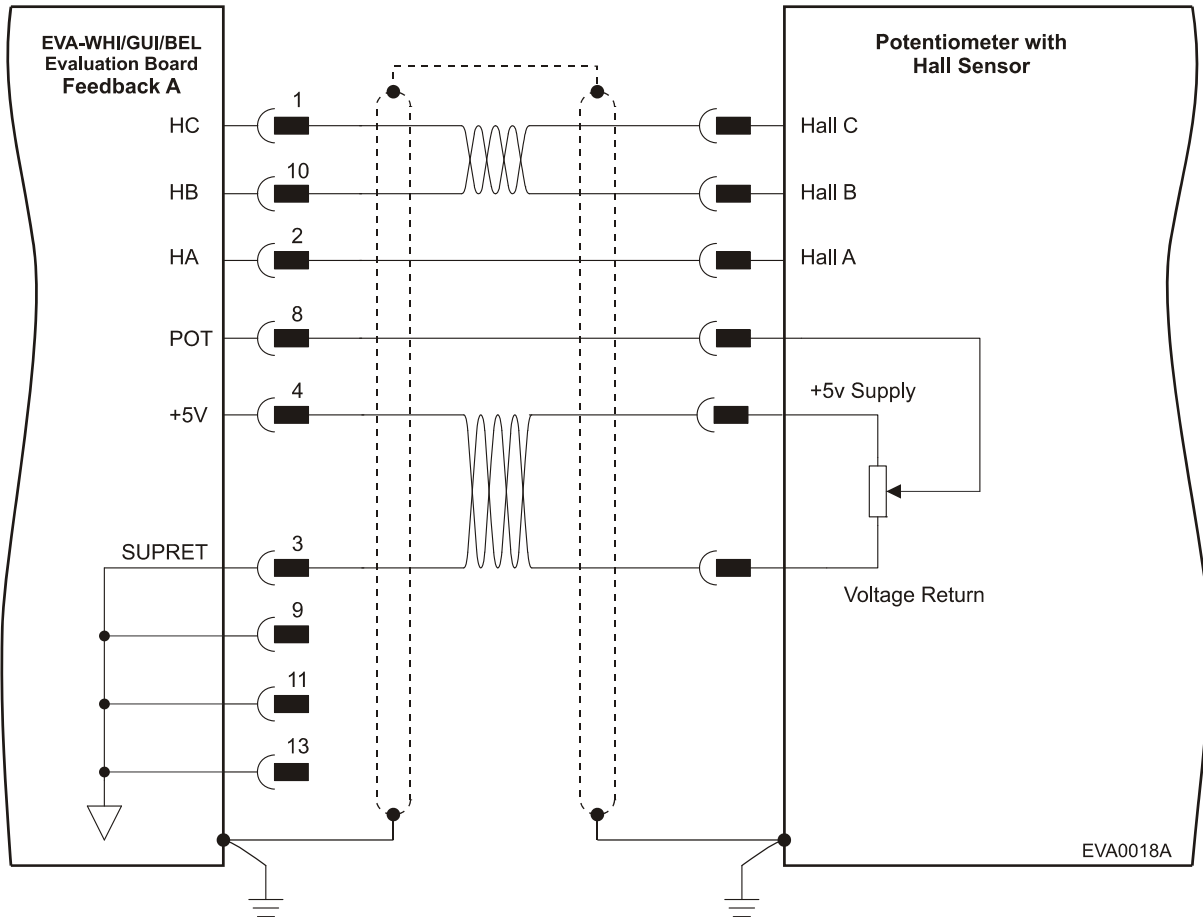


Figure 2-31: Main Feedback – Potentiometer Feedback with Digital Hall Sensor Connection Diagram for Brushless Motors

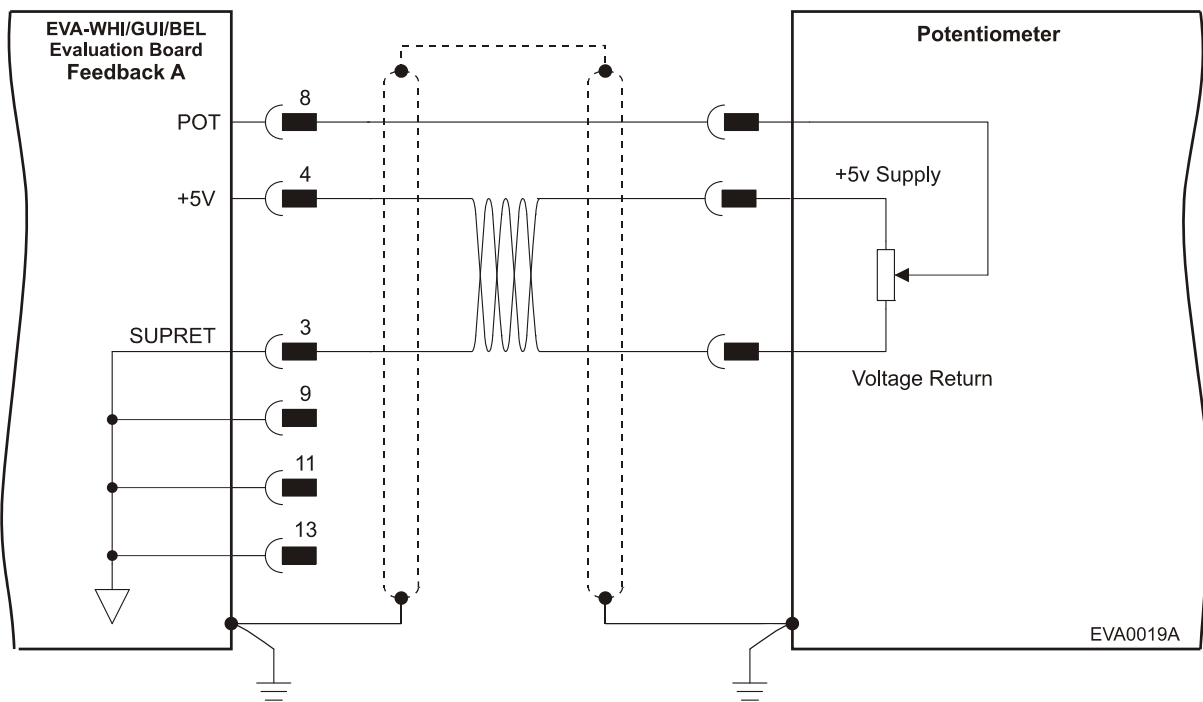
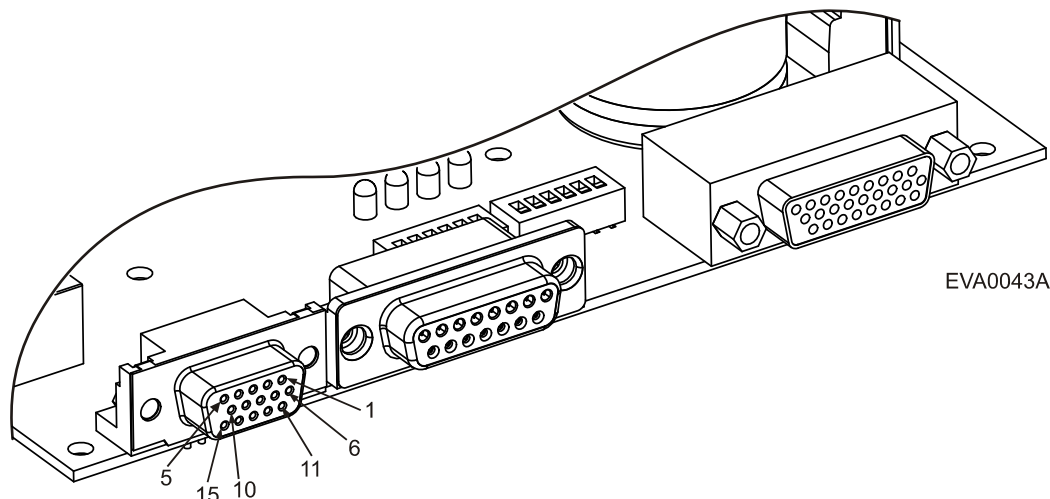


Figure 2-32: Main Feedback - Potentiometer Feedback Connection Diagram for Brush Motors and Voice Coils

2.8 Main Buffered Output Port

This port provides Differential Buffered Outputs (of the Main Feedback) for another axis. It has a 15-pin high density D-sub socket with the following pin-outs. It is only used for digital encoders.



Pin	Signal	Function
1	NC	Not connected
2	NC	Not connected
3	NC	Not connected
4	NC	Not connected
5	NC	Not connected
6	CHAO	Channel A output
7	CHAO-	Channel A complement output
8	NC	Not connected
9	NC	Not connected
10	NC	Not connected
11	CHBO	Channel B output
12	CHBO-	Channel B complement output
13	INDEXO	Index output
14	INDEXO-	Index complement output
15	NC	Not connected

Table 2-5: Main Buffered Output Port - Pin Assignments

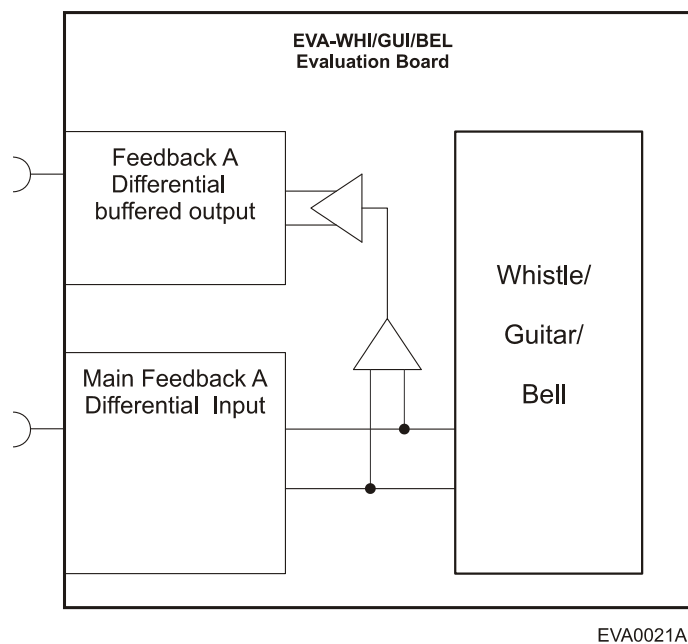


Figure 2-33: Main Buffered Output Port - Block Diagram

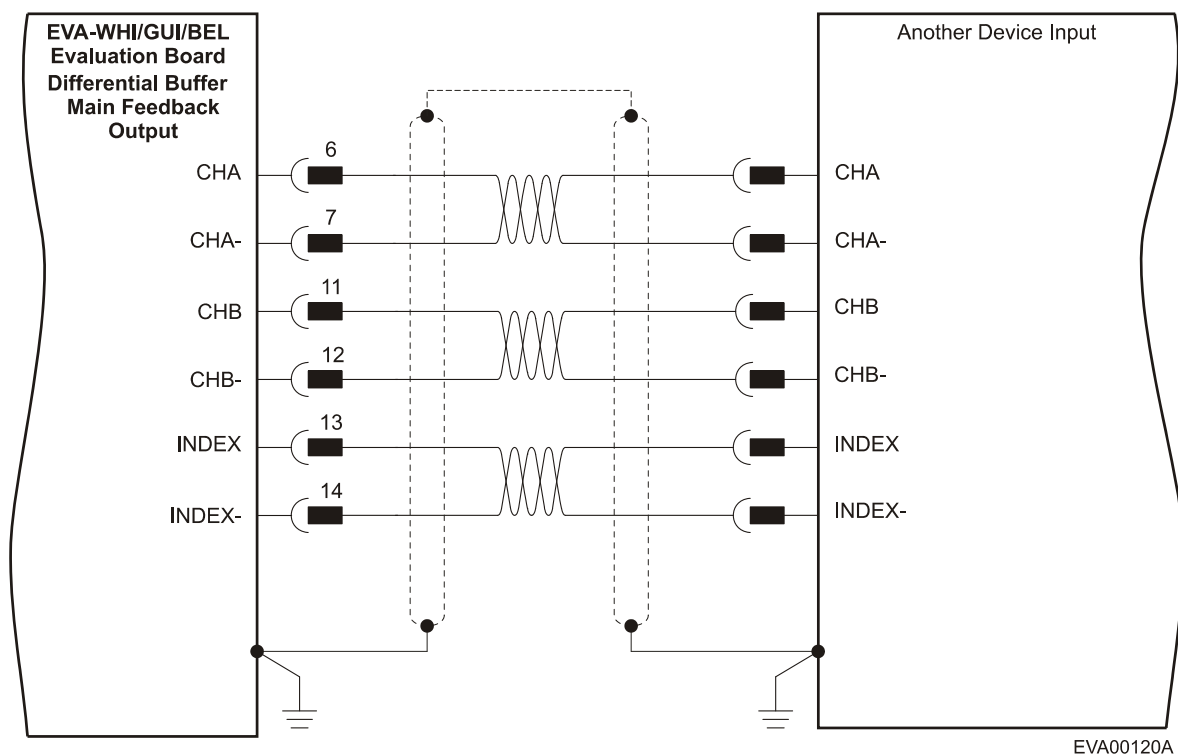


Figure 2-34: Main Buffered Output Port (Differential Main Feedback Output) - Connection Diagram

2.9 Auxiliary Feedback (Bi-directional)

When using one of the auxiliary feedback options, the relevant functionality of the AUX FEEDBACK's ports are software selected for that option. Refer to the *SimpliQ Command Reference Manual* for detailed information about Auxiliary Feedback setup.

For auxiliary feedback, one of the following options can be selected:

- a. **Emulated encoder outputs**, used to provide differential buffered emulated, encoder signals to another controller or drive. This option can be used when:
 - A Resolver or Analog Encoder is used as a main feedback device.
 - The Evaluation Board is used as a current amplifier to provide position data to the position controller.
 - The Evaluation Board is used in velocity mode, to provide position data to the position controller.
 - The Evaluation Board is used as a master in follower or ECAM mode.
- b. **Differential auxiliary input**, for the input of position data of the master encoder in follower or ECAM mode.
- c. **Pulse-and-direction input**, for single-ended input of pulse-and-direction position commands.

Connect the auxiliary feedback cable into the AUX FEEDBACK port on the Evaluation Board.

The Aux. Feedback connector has two ports – B1 and B2.

Port B2 has three pairs of differential buffered outputs.

There are two modes of operation for this interface:

- **Mode 1** (YA[4]=4)

When the Auxiliary port of the Whistle/Guitar/Bell is set by the software to act as an emulated encoder output (this is practical only when using Resolver, Analog-Encoder, Tachometer and Potentiometer as the main feedback):

- B1 input becomes inactive.
- B2 presents emulated differential buffered encoder output signals of the Main Feedback.

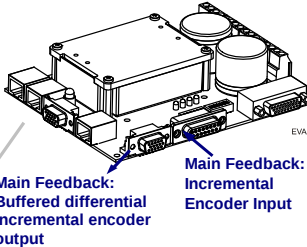
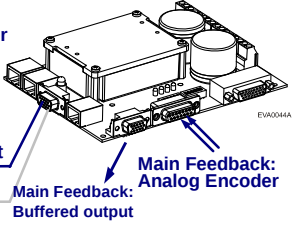
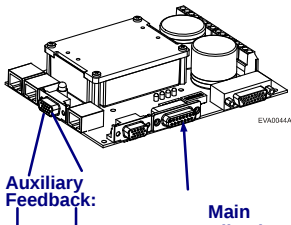
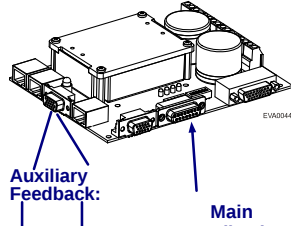
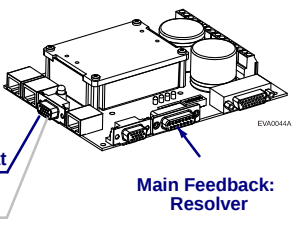
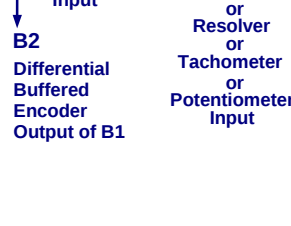
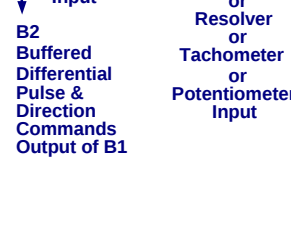
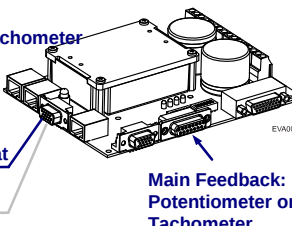
- **Mode 2** (YA[4]=2 or YA[4]=0) :

When the Auxiliary port of the WHI/GUI/BEL is set by software to act as an input:

- B1 becomes an active differential input.
- B2 presents differential buffered encoder output signals of B1.

2.9.1 Main and Auxiliary Feedback Combinations

The Main Feedback is always used in motion control devices whereas Auxiliary Feedback is often, but not always used. The Auxiliary Feedback connector on the Whistle Evaluation Board has two ports (B1 and B2). When used in combination with Main Feedback, the Auxiliary Feedback can be set, by software, as follows:

SW Setting	Auxiliary Feedback		
	YA[4] = 4 (Aux. Feedback: output)	YA[4] = 2 (Aux. Feedback: input)	YA[4] = 0 (Aux. Feedback: input)
Incremental Encoder Input	★ There is no Auxiliary Feedback option when an Incremental Encoder is the Main Feedback device.  Main Feedback: Buffered differential incremental encoder output Main Feedback: Incremental Encoder Input		
Interpolated Analog (Sin/Cos) Encoder Input	★ B2 - output Analog Encoder position data emulated in Differential, buffered, incremental Encoder format  Main Feedback: Analog Encoder Main Feedback: Buffered output B1 - not available	 Auxiliary Feedback: B1 Buffered Differential Incremental Encoder Input Main Feedback: Incremental Encoder or Analog Encoder or Resolver or Tachometer or Potentiometer Input	 Auxiliary Feedback: B1 Buffered Differential Pulse & Direction Commands Input Main Feedback: Incremental Encoder or Analog Encoder or Resolver or Tachometer or Potentiometer Input
Resolver Input	★ B2 - output Resolver position data emulated in differential, buffered, incremental Encoder format  Main Feedback: Resolver Main Feedback: Buffered output B1 - not available	 Auxiliary Feedback: B1 Buffered Differential Incremental Encoder Input Main Feedback: Incremental Encoder or Analog Encoder or Resolver or Tachometer or Potentiometer Input	 Auxiliary Feedback: B1 Buffered Differential Pulse & Direction Commands Input Main Feedback: Incremental Encoder or Analog Encoder or Resolver or Tachometer or Potentiometer Input
Potentiometer or Tachometer Input	★ B2 - output Resolver or Tachometer position data emulated in differential, buffered, incremental Encoder format  Main Feedback: Potentiometer or Tachometer Main Feedback: Buffered output B1 - not available		

Typical Applications	★ Any application where the main encoder is used, not only for the drive, but also for other purposes such as position controllers and/or other drives. ★ Analog Encoder applications where position data is required, in the Encoder's quadrature format, for other purposes such as position controllers and/or other drives. ★ Resolver applications where position data is required in the Encoder's quadrature format, for other purposes such as position controllers and/or other drives. ★ Tachometer and potentiometer applications where position data is required in the Encoder's quadrature format, for other purposes such as position controllers and/or other drives.	Any application where two feedbacks are used by the drive. The Auxiliary Feedback port serves as an input for the auxiliary incremental encoder. For applications such as Follower, ECAM, or Dual Loop.	Any application where two feedbacks are used by the drive. The Auxiliary Feedback port serves as an input for Pulse & Direction Commands.
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2.9.2 Auxiliary Feedback (FEEDBACK B)

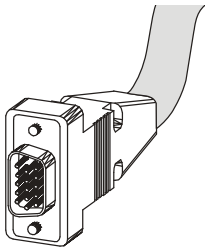
When using one of the auxiliary feedback options, the relevant functionality of FEEDBACK B ports are software selected for that option. Refer to the *SimpliQ Command Reference Manual* for detailed information about FEEDBACK B setup.

2.9.2.1 Emulated Encoder Outputs Option on FEEDBACK B (YA[4] = 4)

Through FEEDBACK B (Ports B1 and B2) the Evaluation Board can provide **two simultaneous buffered main, or emulated, encoder signals** to other controllers or drives. This option can be used when:

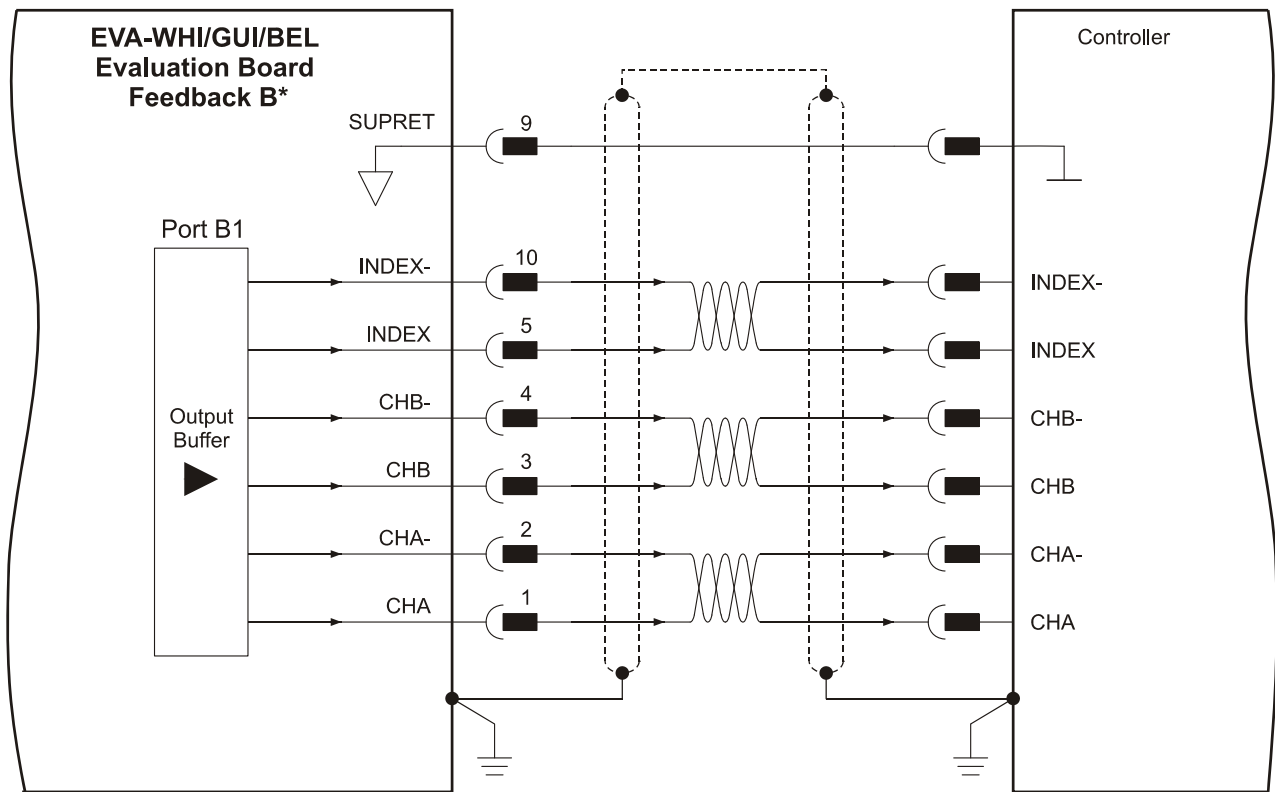
- The device being tested is used as a current amplifier to provide position data to the position controller.
- The device being tested is used in velocity mode, to provide position data to the position controller.
- The device being tested is used as a master in Follower or ECAM mode.

Below are the signals on the Auxiliary Feedback ports when set up to run as a buffered outputs or emulated outputs of the main encoder (on FEEDBACK A):

Port	Pin	Signal	Function	Pin Position
B1	1	CHA	Auxiliary channel A high output	 15 Pin high density D-Sub Plug
B1	2	CHA-	Auxiliary channel A low output	
B1	3	CHB	Auxiliary channel B high output	
B1	4	CHB-	Auxiliary channel B low output	
B1	5	INDEX	Auxiliary index high output	
B2	6	CHAO	Buffered channel A output	
B2	7	CHAO-	Buffered channel A complement output	
PWR	8	+5V	Encoder supply voltage	
PWR	9	SUPRET	Encoder supply voltage return	 15 Pin high density D-sub Socket
B1	10	INDEX-	Auxiliary index low output	
B2	11	CHBO	Buffered channel B output	
B2	12	CHBO-	Buffered channel B complement output	
B2	13	INDEXO	Buffered index output	
B2	14	INDEXO-	Buffered index complement output	
PWR	15	SUPRET	Supply return	

*Table 2-6: Main Encoder Buffered Outputs or Emulated Encoder Outputs on FEEDBACK B
- Pin Assignments*

FEEDBACK B on the “top” of the device being tested has a 15-pin high density D-sub socket. Connect the Auxiliary Feedback cable, from the controller or other device, to FEEDBACK B using a 15-pin, high density D-Sub plug with a metal housing. When assembling the Auxiliary Feedback cable, follow the instructions on page A-1.



EVA0022A

Figure 2-35: Main Encoder Buffered Output or Emulated Encoder Output on FEEDBACK B - Connection Diagram

2.9.2.2 Differential Auxiliary Encoder Input Option on FEEDBACK B (YA[4]=2)

The device being tested can be used as a slave by receiving the position of the master encoder data (on Port B1) in Follower or ECAM mode. In this mode Port B2 provides **differential buffered auxiliary outputs** for the next slave axis in Follower or ECAM mode.

Below are the signals on the Auxiliary Feedback port when set up to run as a differential auxiliary encoder input:

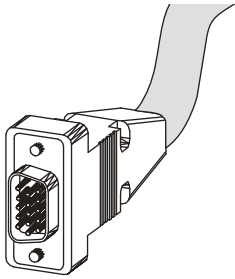
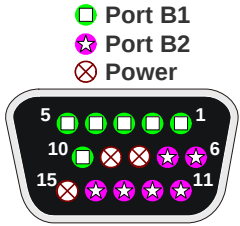
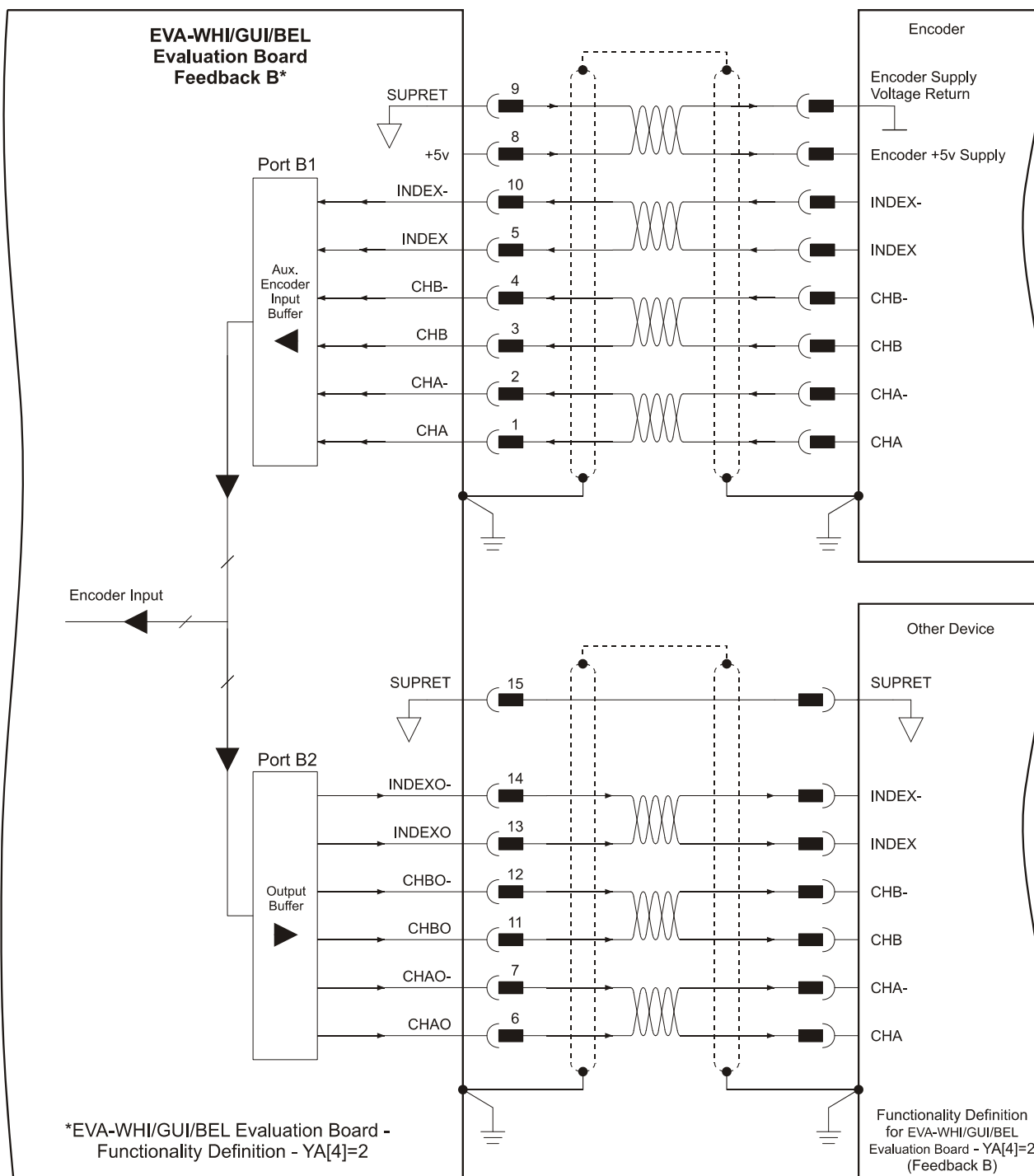
Port	Pin	Signal	Function	Pin Position
B1	1	CHA	Auxiliary channel A high input	 15 Pin high density D-Sub Plug
B1	2	CHA-	Auxiliary channel A low input	
B1	3	CHB	Auxiliary channel B high input	
B1	4	CHB-	Auxiliary channel B low input	
B1	5	INDEX	Auxiliary Index high input	
B2	6	CHAO	Buffered channel A output	
B2	7	CHAO-	Buffered channel A complement output	
PWR	8	+5V	Encoder supply voltage	 15 Pin high density D-Sub Socket
PWR	9	SUPRET	Encoder supply voltage return	
B1	10	INDEX-	Auxiliary index low input	
B2	11	CHBO	Buffered channel B output	
B2	12	CHBO-	Buffered channel B complement output	
B2	13	INDEXO	Buffered index output	
B2	14	INDEXO-	Buffered index complement output	
PWR	15	SUPRET	Supply return	

Table 2-7: Differential Auxiliary Encoder Input Option on FEEDBACK B
Pin Assignments

FEEDBACK B on the “top” of the device being tested has a 15-pin high density D-sub socket. Connect the Auxiliary Feedback cable from the feedback device to FEEDBACK B using a 15-pin, high density D-Sub plug with a metal housing. When assembling the Auxiliary Feedback cable, follow the instructions on page A-1.



EVA0023A

Figure 2-36: Differential Auxiliary Encoder Input Option on FEEDBACK B - Connection Diagram

2.9.3 Pulse-and-Direction Input Option on FEEDBACK B (YA[4]=0)

This mode is used for input of differential pulse-and-direction position commands on Port B1. In this mode Port B2 provides **differential buffered pulse-and-direction outputs** for another axis.

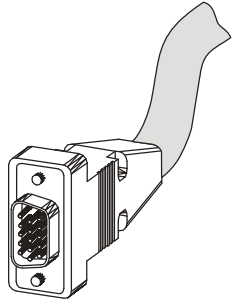
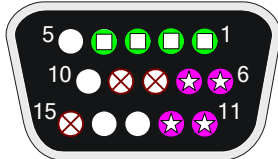
Port	Pin	Signal	Function	Pin Position
B1	1	PULS/CHA	Pulse/ Auxiliary channel A high <i>input</i>	 15 Pin D-Sub Plug
B1	2	PULS-/CHA-	Pulse-/ Auxiliary channel A low <i>input</i>	
B1	3	DIR/CHB	Direction/ Auxiliary channel B high <i>input</i>	
B1	4	DIR-/CHB-	Direction-/ Auxiliary channel B low <i>input</i>	
	5	NC	Do not connect this pin	
B2	6	CHAO	Channel A output	
B2	7	CHAO-	Channel A complement output	
PWR	8	+5V	Encoder supply voltage	
PWR	9	SUPRET	Encoder supply voltage return	
	10	NC	Do not connect this pin	
B2	11	CHBO	Channel B output.	 15 Pin D-Sub Socket
B2	12	CHBO-	Channel B complement output	
	13	NC	Do not connect this pin	
	14	NC	Do not connect this pin	
PWR	15	SUPRET	Supply return	

Table 2-8: *Pulse-and-Direction Auxiliary Encoder Pin Assignment on FEEDBACK B*

FEEDBACK B on the “top” of the Evaluation Board has a 15-pin high density D-sub socket. Connect the Auxiliary Feedback cable from the Pulse and Direction Controller to FEEDBACK B using a 15-pin, high density D-Sub plug with a metal housing. When assembling the Auxiliary Feedback cable, follow the instructions in Section B-3.2.

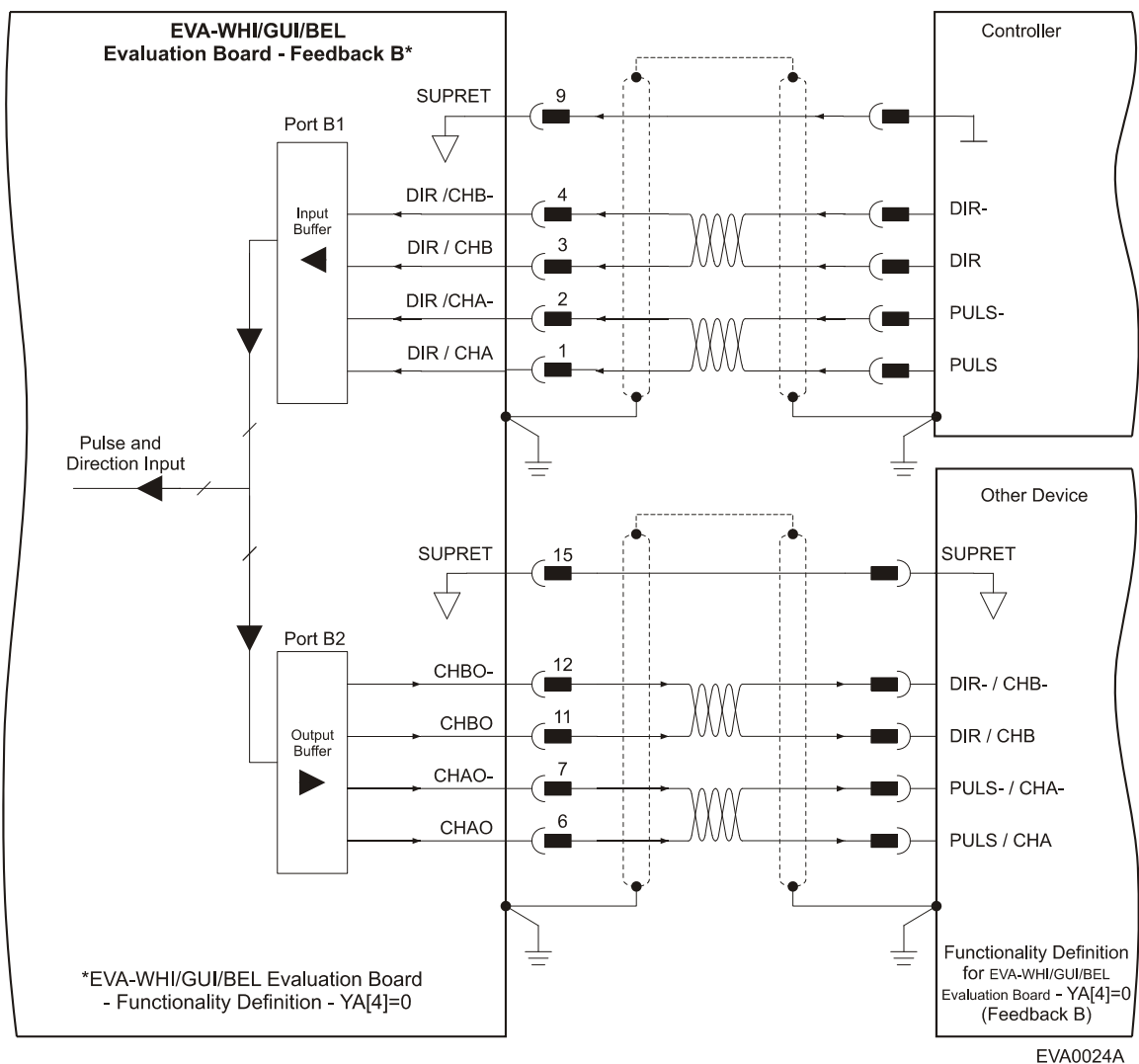


Figure 2-37: Pulse-and-Direction Input Option on FEEDBACK B - Connection Diagram

2.9.4 I/O Cables

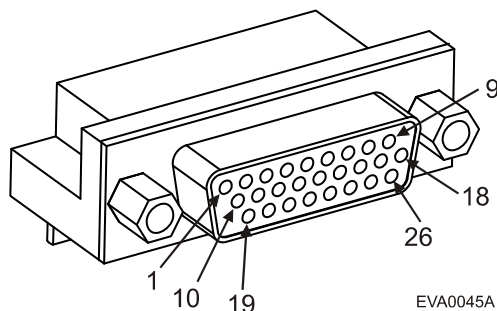
The Evaluation Board has I/O ports, P1 and J2. J1 is a general I/O which can be used to connect 6 digital inputs and 5 digital outputs. J2 is an input port for connecting up to 4 separate digital inputs and 2 analog inputs:

I/O	WHI	GUI	BELL
Digital Input	6	6 differential	6
Digital Output	2	4	2
Analog Input	1	1	1

2.10 General I/O Port

The Evaluation Board has 6 digital inputs, 2 digital outputs and a single analog input.

The General I/O port has a 26-pin high density D-Sub plug with the following pin-outs.



Pin	Signal	Function
1	INRET1	General input return 1
2	INRET2	General input return 2
3	INRET3	General input return 3
4	INRET4	General input return 4
5	INRET5	General input return 5
6	INRET6	General input return 6
7	+5V_EXT	Non-isolated +5V supply voltage
8	SUPRET	Supply return
9	AN1+	Analog input 1 (positive)
10	IN1	General input 1
11	IN2	General input 2
12	IN3	General input 3
13	IN4	General input 4
14	IN5	General input 5

Pin	Signal	Function
15	IN6	General input 6
16	SUPRET	Supply return
17	+5V_EXT	Non-isolated +5V Supply Voltage
18	AN1-	Analog input 1 (negative)
19	OUTP4	Programmable output 4
20	OUTP3	Programmable output 3
21	OUTP2	Programmable output 2
22	OUTP1	Programmable output 1
23	-VDO	Input of an external +24V RETURN
24	-VDO	Input of an external +24V RETURN
25	VDO	Input of an external +24V, for supplying the LED drivers and Brake. Can be either isolated or not – depending on the user's application requirements.
26	VDO	Input of an external +24V, for supplying the LED drivers and Brake. Can be either isolated or not – depending on the user's application requirements.

Table 2-9: General I/O Port and Cable - Pin Assignments

2.10.1 Digital Input & DIP Switch Settings

Digital Input can be configured in one of 2 ways:

1. When the controller's signal level is provided by an external source (user power supply) via the General I/O connector, the 6 DIP switches (SW1, SW2) that are on must be set to OFF (open).
2. In order to use an internal power supply for applying a high signal level to the inputs – set the 6 DIP switches as follows: SW1-positive (5V) and SW2-return (0V) to ON (closed).

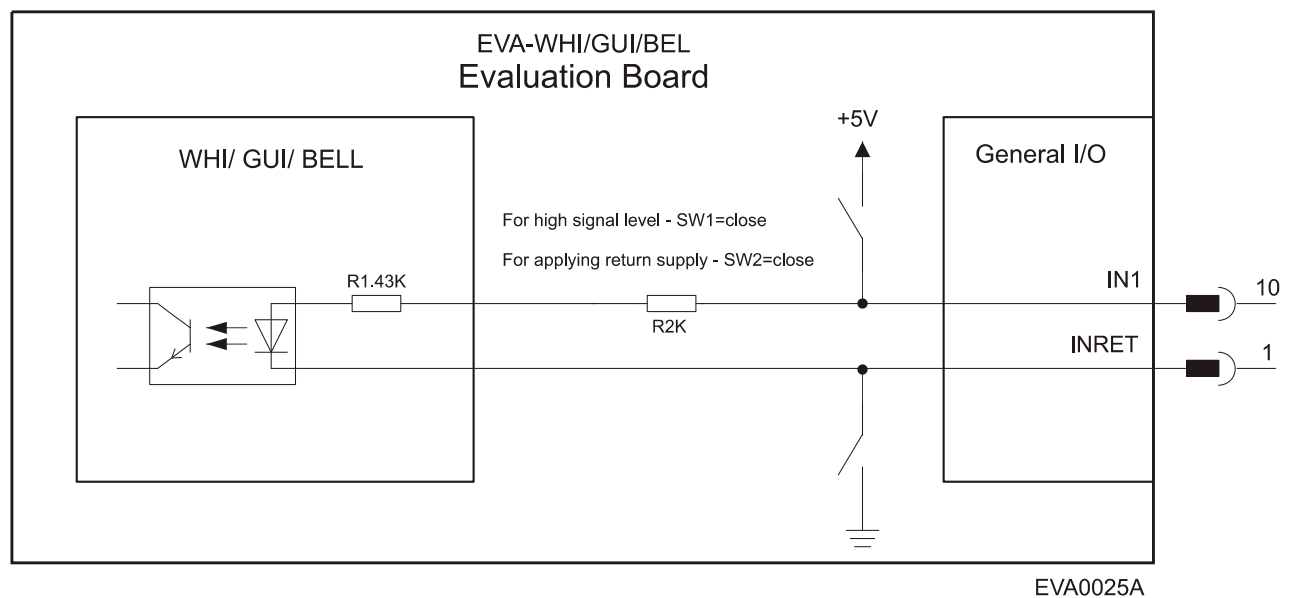


Figure2-38: Connection Diagram of a Typical Digital Input (1 of 6 DI)

When connecting the Whistle or Bell to the Evaluation Board, the input signal is single ended and the return power is via INRET1 (D1.1, general I/O connector).

When connecting the Guitar to the Evaluation Board, the input signal is differential. The inputs should be connected to IN and INRET – their index number must correspond to each other, e.g., IN1 and INRET1, etc.

2.10.2 Digital Output

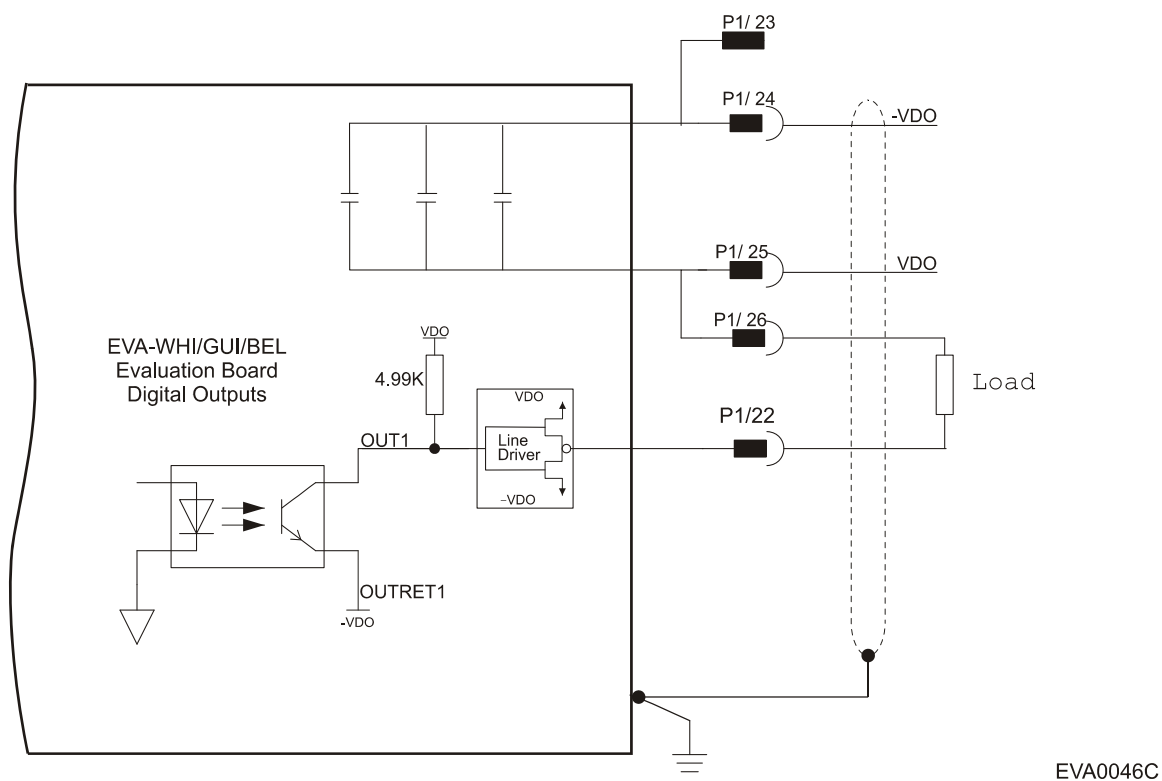


Figure 2-39: Connection Diagram of a Typical Digital Output (1 of 6) - Sink

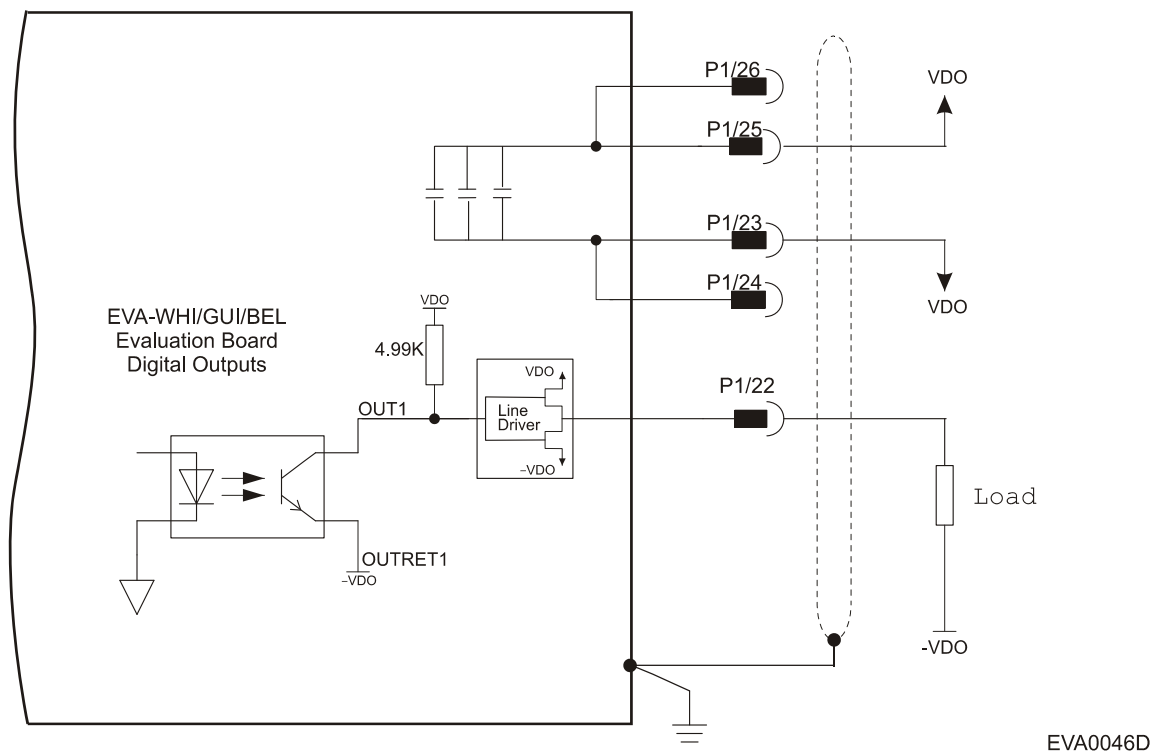


Figure 2-40: Connection Diagram of a Typical Digital Output (1 of 6) - Source

There is an option to operate the Motor Break. It should be connected to the J3 power connector. The logic for Motor Brake operation comes from Digital Output 1 (DOUT1). So remember: if you connect the Motor Break to the Evaluation Board, define it in the Composer software and remember that you cannot use DOUT1 for digital output; use DOUT2 - DOUT4 instead.

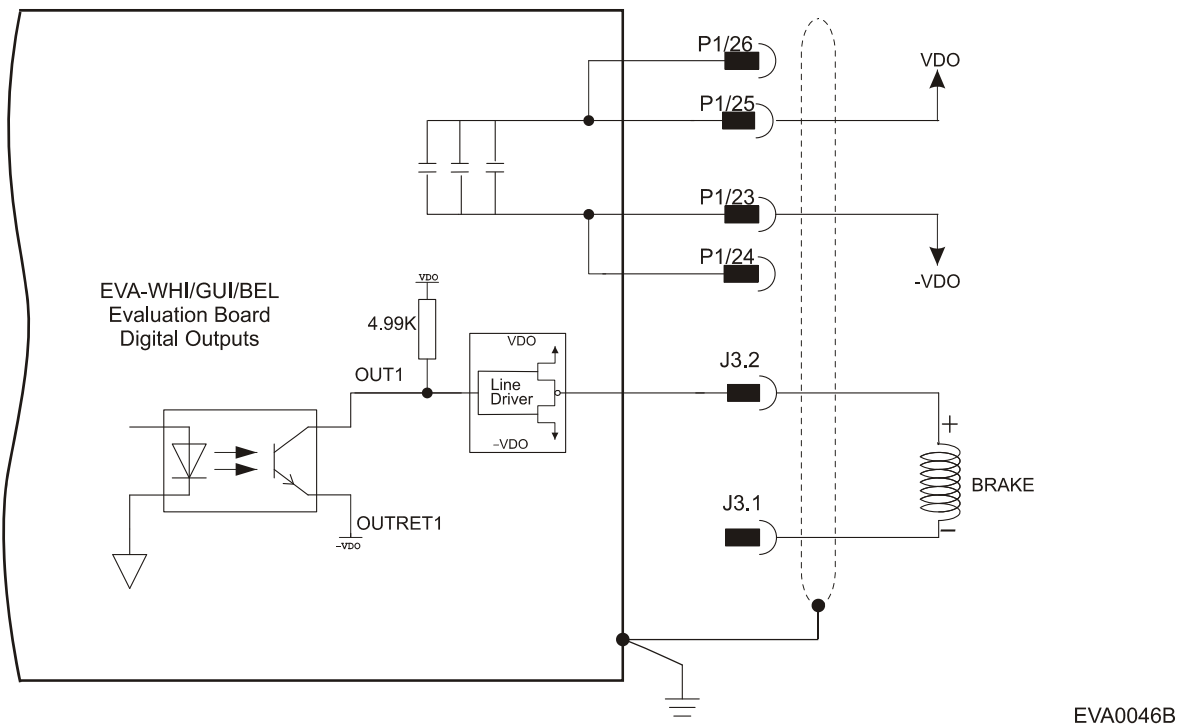


Figure 2-41: Connection Diagram with Brake Option

2.10.3 Analog Input

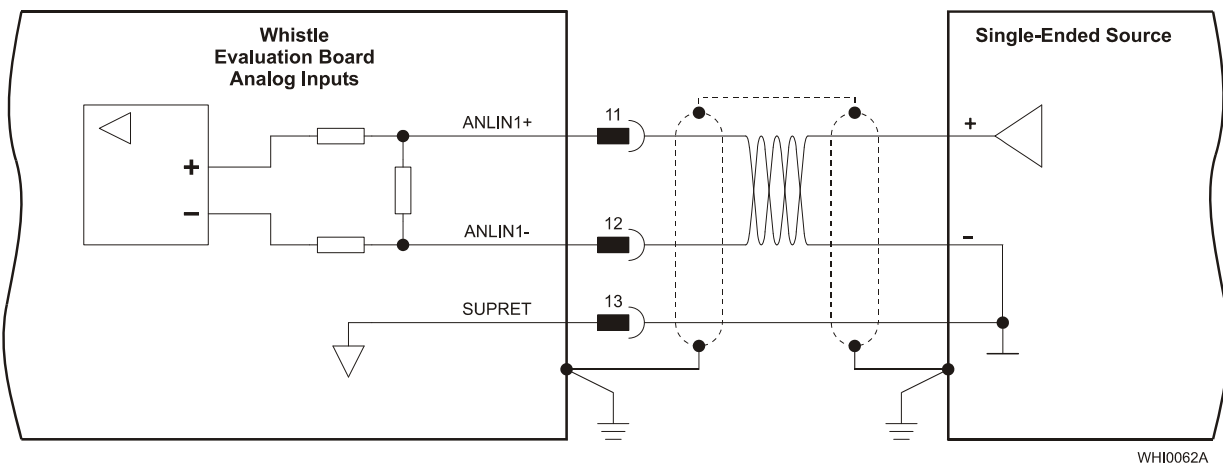


Figure 2-42: Analog Input with Single-ended Source

2.11 Communications

The communication cables use an 8-pin RJ-45 plug that connects to the RS-232 and CANopen ports on the Evaluation Board.

The communication interface may differ according to the user's hardware. The Evaluation Board can communicate using the following options:

- a. RS-232, full duplex
- b. CANopen

RS-232 communication requires a standard, commercial 3-core null-modem cable connected from the Evaluation Board to a serial interface on the PC. The interface is selected and set up in the Composer software.

In order to benefit from **CANopen** communication, the user must have an understanding of the basic programming and timing issues of a CANopen network.

For ease of setup and diagnostics of CAN communication, RS-232 and CANopen can be used simultaneously.

2.11.1 RS-232 Communication



Notes for connecting the RS-232 communication cable:

- 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.
- The Evaluation Board's RS-232 communications port is **non-isolated**.
- The male RJ plug must have a shield cover.
- Ensure that the shield of the cable is connected to the shield of the RJ plug. The drain wire can be used to facilitate the connection.
-

Pin	Signal	Function	Pin Location
1	—	—	
2	—	—	
3	Tx	RS-232 transmit	
4	—	—	
5	COMRET	Communication return	
6	Rx	RS-232 receive	
7	—	—	
8	—	—	

Table 2-10: RS-232 Cable - Pin Assignments

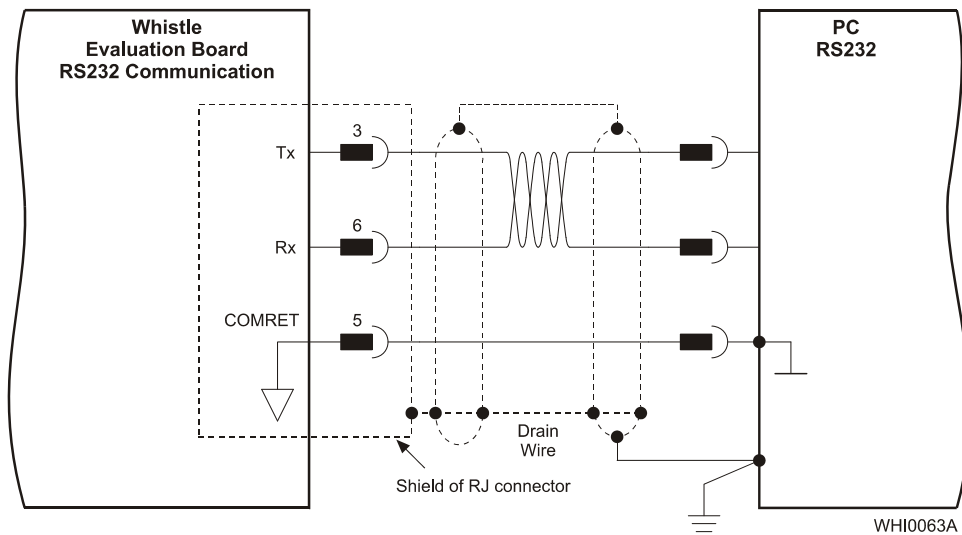


Figure 2-43: RS-232 Connection Diagram

2.11.2 CANopen Communication



Notes for connecting the CANopen communication cable:

- For “daisy-chain” connections use 26 or 28 AWG twisted pair shielded cables. For best results, the shield should have aluminum foil and be covered by copper braid with a drain wire.
- 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.
- The Evaluation Board’s CANopen ports are **non-isolated**.
- The male RJ plug must have a shield cover.
- Ensure that the shield of the cable is connected to the shield of the RJ plug. The drain wire can be used to facilitate the connection.
- Connect a termination 120-Ohm resistor at each of the two ends of the network cable.
- There is an option for adding this resistor onboard (Thru-Hole or SMD):

Pin	Signal	Function	Pin Position
1	CAN_H	CAN_H busline (dominant high)	
2	CAN_L	CAN_L busline (dominant low)	
3	CAN_GND	CAN ground	
4	—	—	
5	—	—	
6	CAN_SHLD	Shield, connected to the RJ plug cover	
7	CAN_GND	CAN Ground	
8	—	—	

Table 2-11: CANopen Cable - Pin Assignments

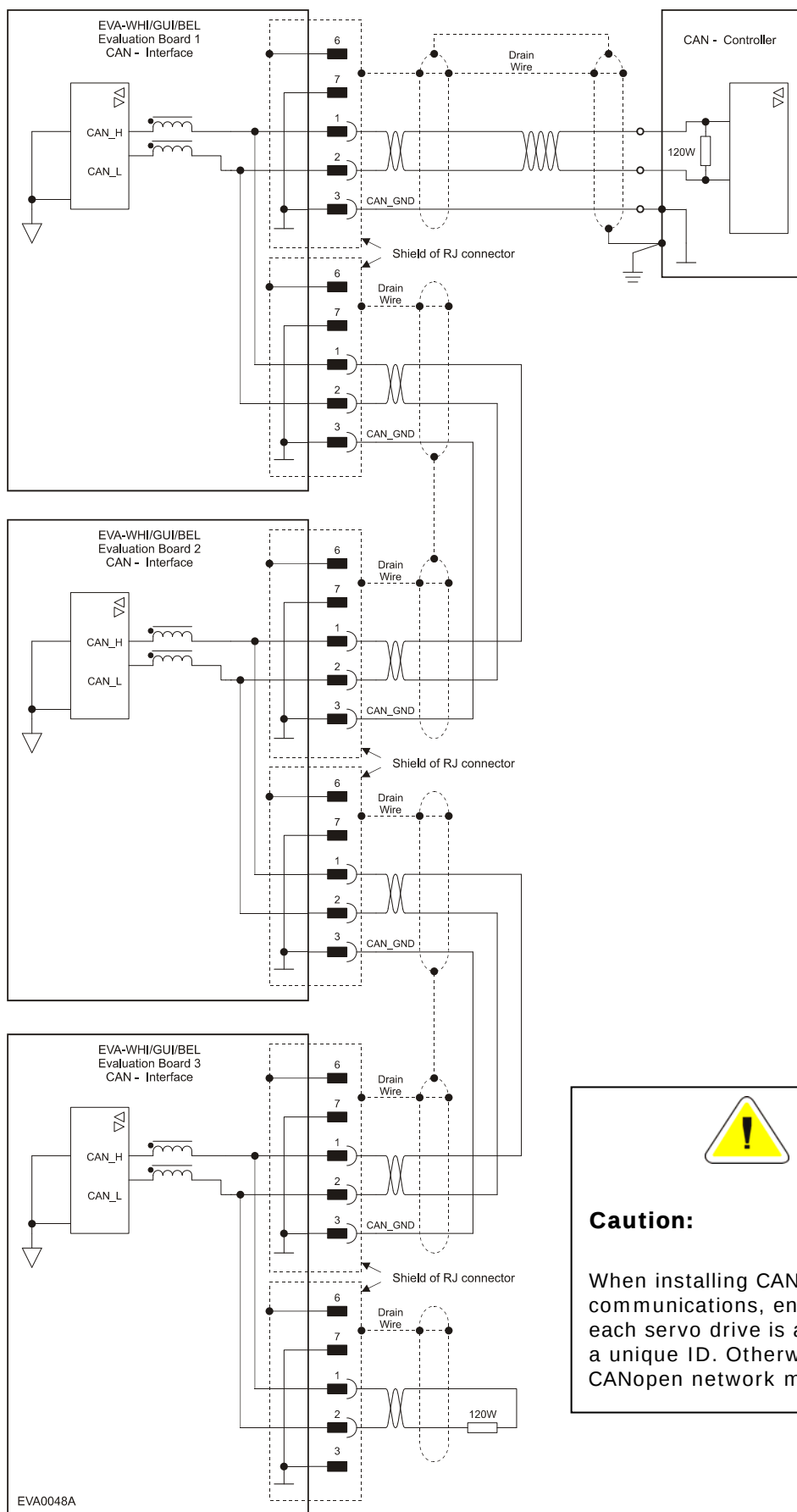


Figure 2-44: CANopen Connection Diagram

2.12 Powering Up

After the device is mounted on the Evaluation Board and the cables have been connected to their devices, the Evaluation Board 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.

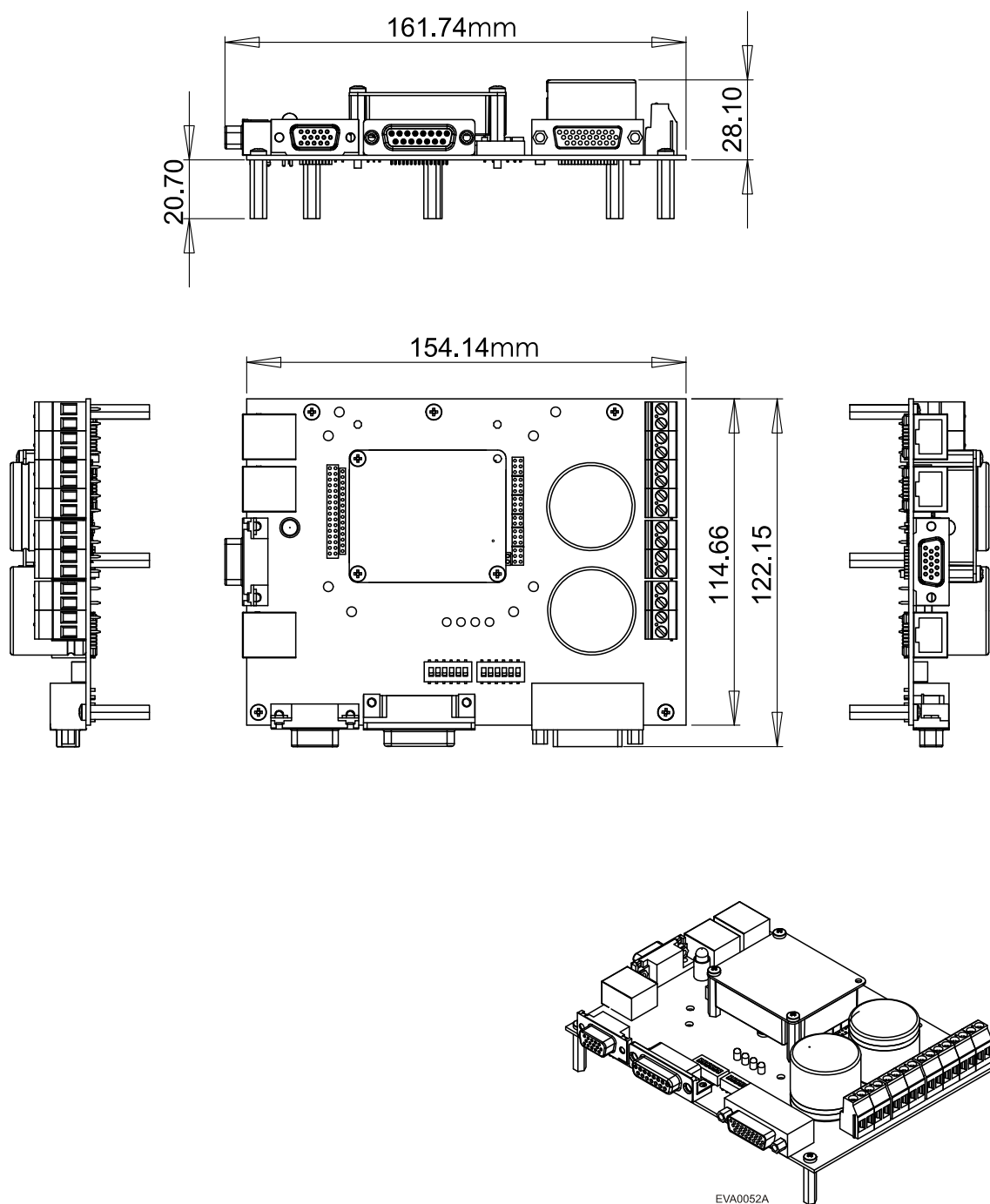
2.13 Initializing the System

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

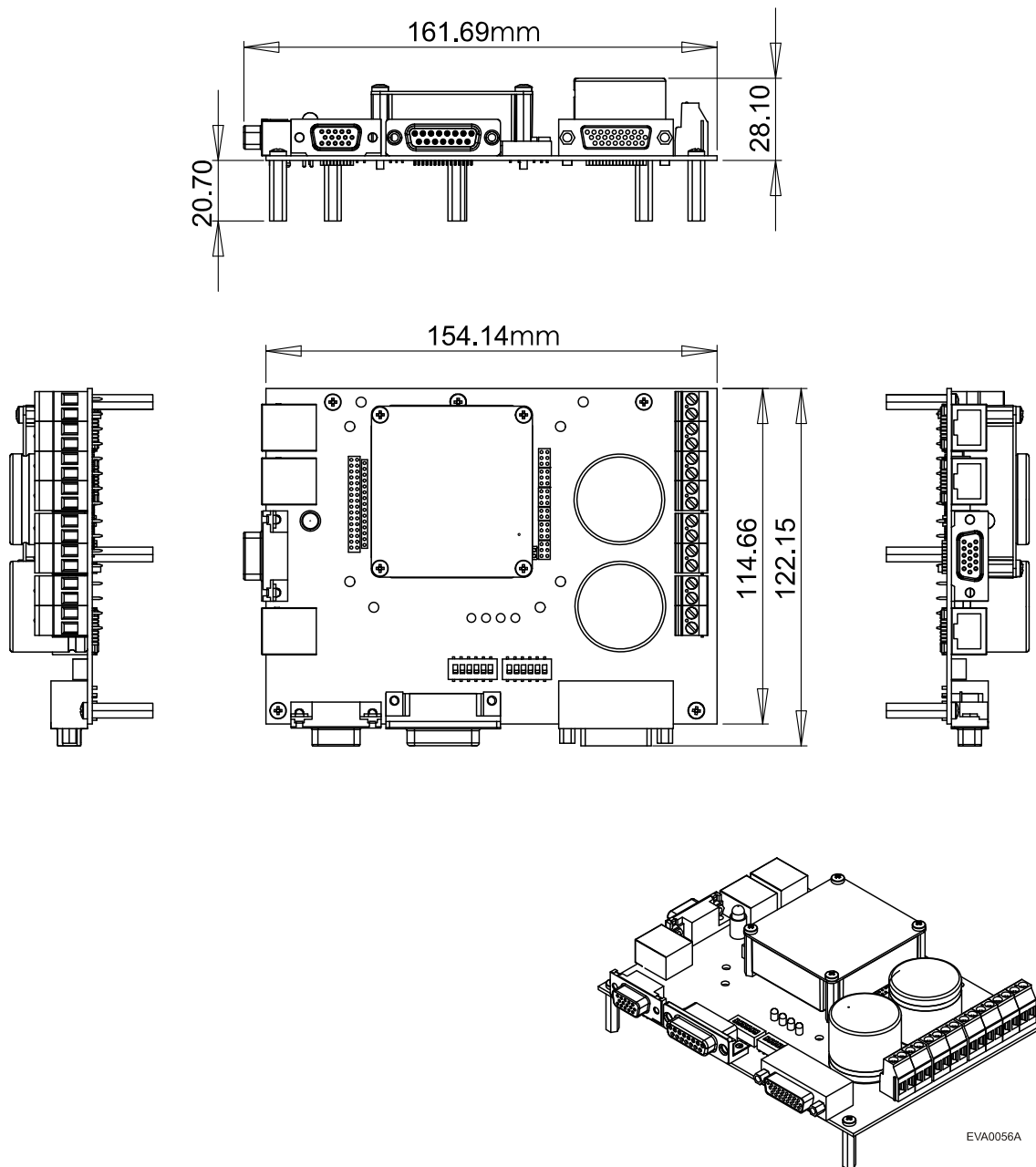
Appendix A: Technical Specifications

A.1 Evaluation Board Dimensions

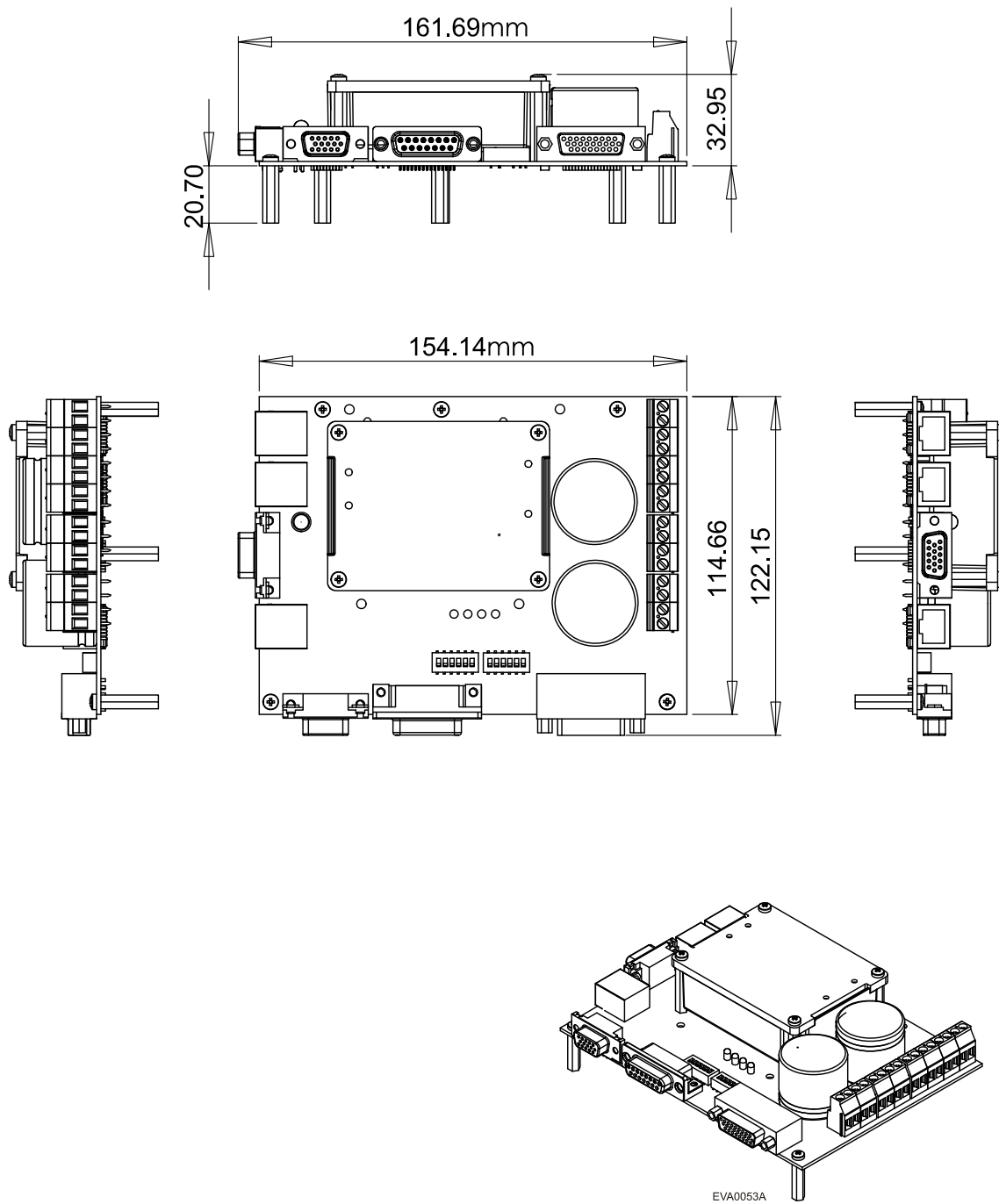
A.1.1 Dimensions (Whistle)



A.1.2 Dimensions (Bell)



A.1.3 Dimensions (Guitar)



A.2 Environmental Conditions

Feature	Details
Ambient operating temperature	0 °C – 40 °C (32 °F – 104 °F)
Storage temperature	-20 °C – 85 °C (-4 °F – +185 °F)
Maximum humidity	90% non-condensing
Protection level	

A.3 Evaluation Board Connections

The following connectors are used for wiring the Evaluation Board.

Pin No.	Type	Manufacturer & Part No.	Mating Connector	Port
5	5.08 mm Pitch Plug	Phoenix plug	Phoenix Plug (supplied) MKDS 3/ 2-5,08	BRAKE-, BRAKE+, M4, M3, M2, M1, PE, PE, PR, VPW+, VLW-, VLW+, PR, VPG+, VLG,- VLG+



Table A-1: Power Connectors at the side of the Evaluation Board

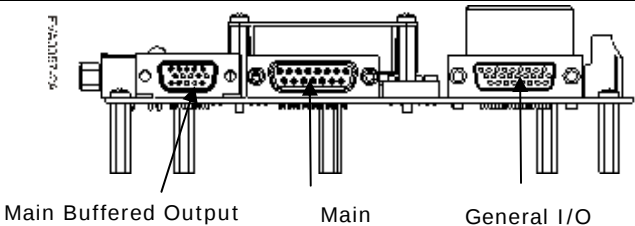
PinNo.	Type	Port
		
15	D-Sub Socket	MAIN FEEDBACK (P4)
15	High Density D-Sub Plug	MAIN BUFFERED OUTPUT (P3)
26	High Density D-Sub Socket	General I/O

Table A-2: Connectors on the Front of the Evaluation Board

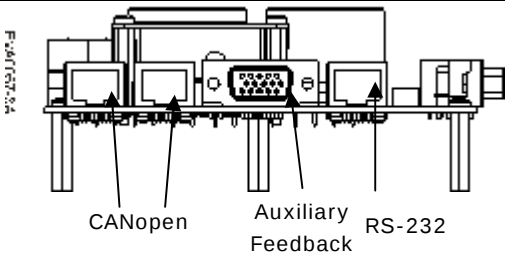
PinNo.	Type	Port
		
8	RJ-45	CAN (J5)
8	RJ-45	CAN (J6)
15	High Density D-Sub Socket	AUX. FEEDBACK
8	RJ-45	RS-232

Table A-3: Connectors on the side of the Evaluation Board

A.3.1 Backup Power Supply (Optional)

Feature	Details
Auxiliary power supply	DC source only
Auxiliary supply input voltage	12 VDC ~ 195 VDC Guitar 12 VDC ~ 95 VDC Whistle/ Bell
Auxiliary supply input power	< 7.5 VA (this includes the 5 V/2x200 mA load for the main and auxiliary encoders)



Note: The Evaluation Board can operate without a 24 Volt back-up power supply.

A.4 Feedbacks

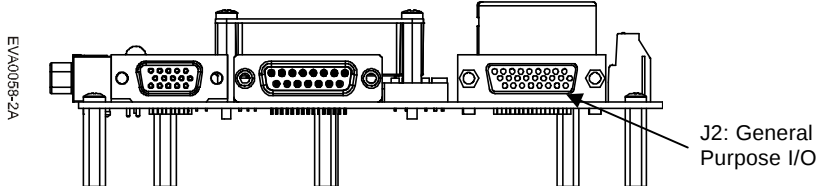
A.4.1 Feedback Supply Voltage

Feature	Details
Main encoder supply voltage	5 V $\pm 5\%$ @ 200 mA maximum
Auxiliary encoder supply voltage	5 V $\pm 5\%$ @ 200 mA maximum

A.5 I/Os

The Evaluation Board has: 6 Digital Inputs; 1 Analog Input and 2 Digital Outputs (Whistle and Bell) or 4 Digital Outputs (Guitar).

A.5.1 Digital Input Interfaces

Feature	Details
	
Type of input	- Optically isolated - Single ended - PLC level
Input current	$I_{in_max} \frac{V_{in} - 1.5V}{3.43K} = 1.2mA \text{ @ } V_{in} = 5V$ $I_{in_max} \frac{V_{in} - 1V}{3.43K} = 6.7mA \text{ @ } V_{in} = 30V$
High-level input voltage	5 V < V_{in} < 30 V, 5 V typical
Low-level input voltage	0 V < V_{in} < 1 V
Minimum pulse width	> 4 x TS, where TS is sampling time
Execution time (all inputs): the time from application of voltage on input until execution is complete	If input is set to one of the built-in functions — Home, Inhibit, Hard Stop, Soft Stop, Hard and Soft Stop, Forward Limit, Reverse Limit or Begin — execution is immediate upon detection: $0 < T < 4 \times TS$ If input is set to General Input, execution depends on the program. Typical execution time: $\cong 0.5$ msec.

Feature	Details
High-speed inputs – minimum pulse width, in high-speed mode (IN5 – IN6)	$T < 5 \mu\text{sec}$ Notes: - Home mode is high-speed mode and can be used for fast capture and precise homing. - High speed input has a digital filter set to the same value as the digital filter (EF) of the main encoder. - Highest speed is achieved when turning on optocouplers.

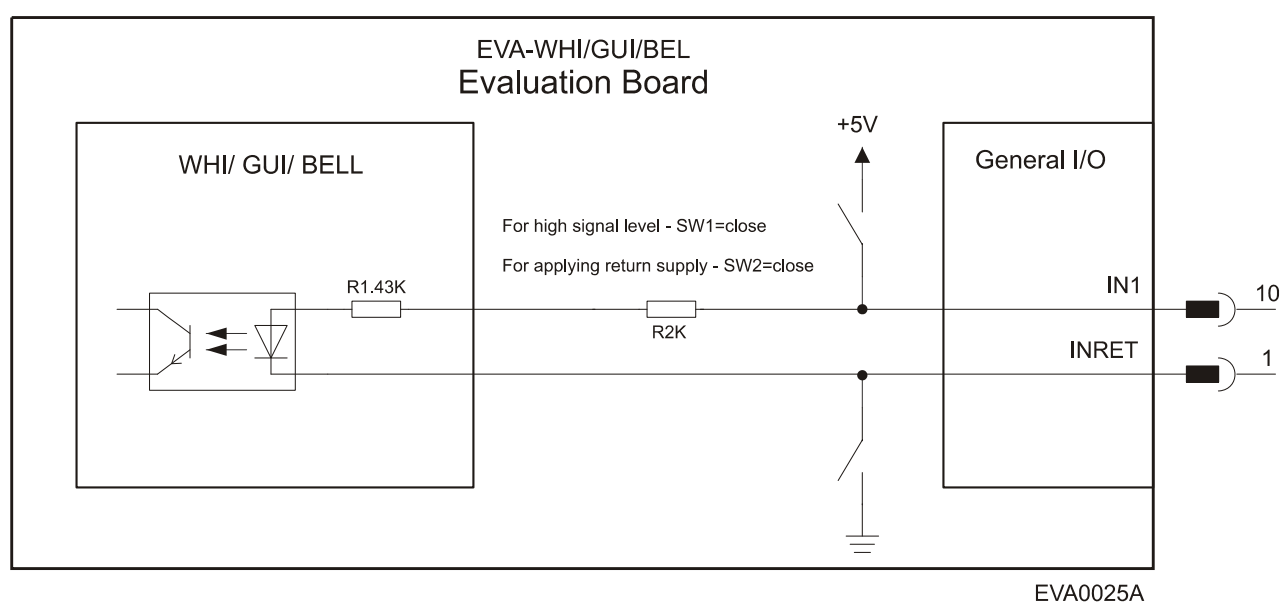
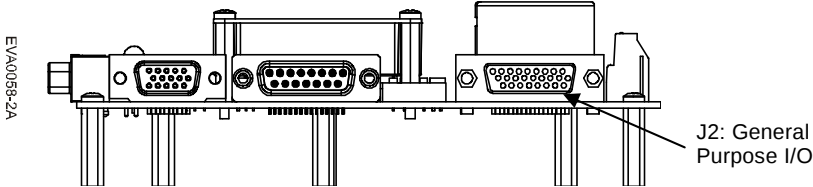
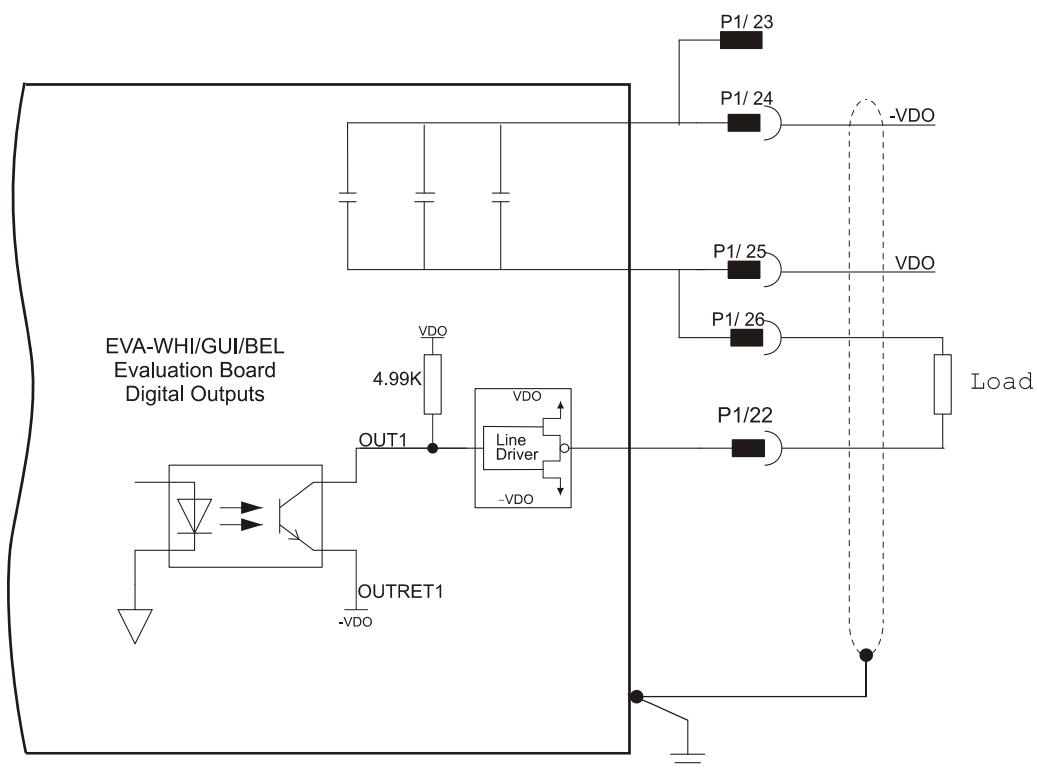


Figure A-1: Digital Input Schematic

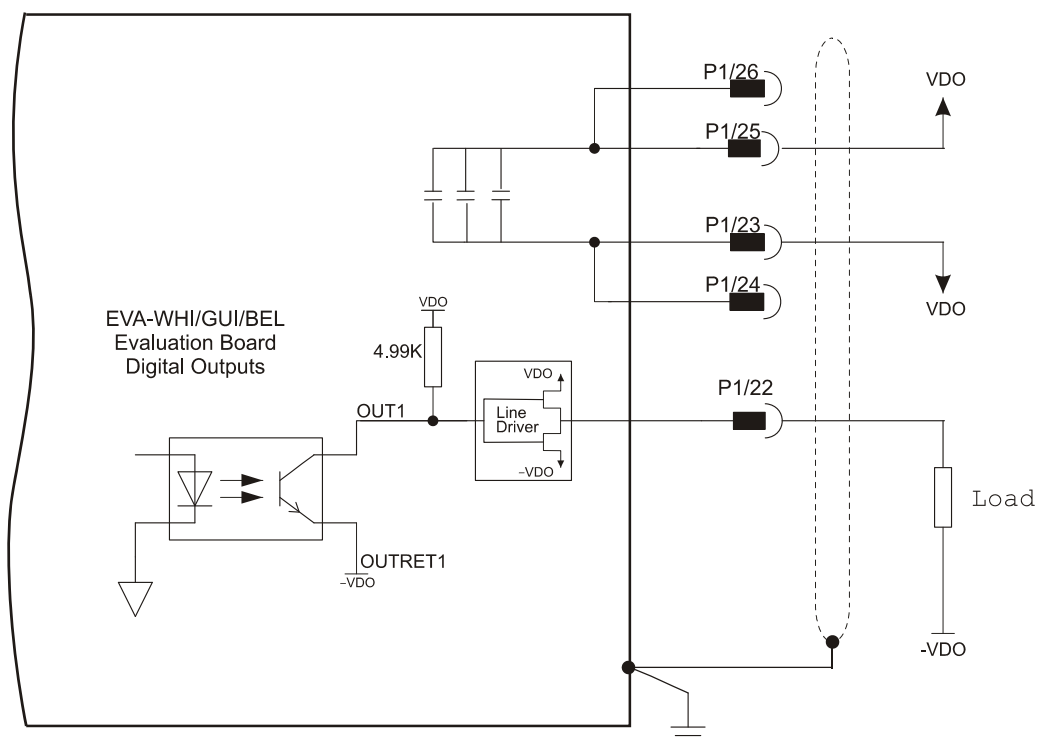
A.6 Digital Output Interface

Feature	Details
	
Type of output	▪ Optically isolated ▪ Open collector and open emitter
Supply output (VDO)	$5V < VDO < 30V$
Max. output current $I_{out(max)}$ ($V_{out} = Low$)	$I_{max} < 250mA$
VOL at maximum output voltage (low level)	$0 \leq V_{out(low)} \leq 1.25V$
VOH at minimum output voltage (high level)	$VDO - 1.25V \leq V_{out(high)} \leq VDO$
RL	External resistor RL must be selected to limit output current to no more than 250 mA. $R_l = \frac{V_{DO} - 5 \otimes I}{I_{o(max)}}$
Executable time	If output is set to one of the built-in functions – Home Flag, Brake or AOK – execution is immediate upon detection: $0 < T < 4 \times TS$ If output is set to General Output and is executed from a program, the typical time is approximately 0.5 msec.



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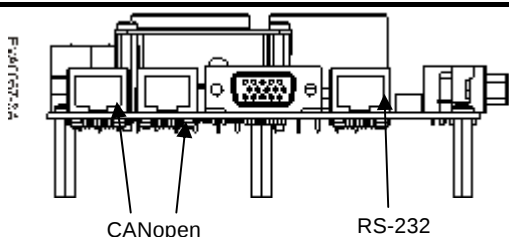
Figure A-2: Digital Output Schematic (Sink mode)



EVA0046D

Figure A-3: Digital Output Schematic (Source mode)

A.7 Communications

Specification	Details
	
RS-232	Signals: ▪ Rx/D , Tx/D , Gnd ▪ Full duplex, serial communication for setup and control. ▪ Baud Rate of 9,600 ~ 115,200 bit/sec.
CANopen	CANbus Signals: ▪ CAN_H, CAN_L, CAN_GND ▪ Maximum Baud Rate of 1 Mbit/sec. Version: ▪ DS 301 V4.01 Device Profile (drive and motion control): ▪ DS 402

A.8 Mechanical Specifications

Feature	Details
Overall dimensions	Whistle, Bell: 161.7 x 122.1 x 48.8 mm (6.37 x 4.81 x 1.92 in) Guitar: 161.7 x 122.1 x 53.7 mm (6.37 x 4.81 x 2.11 in)
Weight	250 g (8.8 oz)

A.9 Standards Compliance

A.9.1 Quality Assurance

Specification	Description
ISO 9001:2008	Quality Management

A.9.2 Design

Specification	Description
MIL-HDBK- 217F	Reliability prediction of electronic equipment (rating, de-rating, stress, etc.)
▪ IPC-D-275 ▪ IPC-SM-782 ▪ IPC-CM-770 ▪ UL508c ▪ UL840	Reliability prediction of electronic equipment (rating, de-rating, stress, etc.) Printed wiring for electronic equipment (clearance, creepage, spacing, conductors sizing, etc.)
In compliance with VDE0160-7 (IEC68)	Type testing

A.9.3 Safety

Specification	Description
In compliance with UL508c	Power conversion equipment
In compliance with UL840	Insulation coordination, including clearance and creepage distances of electrical equipment
In compliance with UL60950	Safety of information technology equipment, including electrical business equipment
In compliance with EN60204-1	Low voltage directive, 72/23/EEC

A.9.4 EMC

Specification	Description
In compliance with EN55011 and EN61000	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment. Electromagnetic compatibility (EMC)

A.9.5 Workmanship

Specification	Description
In compliance with IPC-A-610, level 3	Acceptability of electronic assemblies

A.9.6 PCB

Specification	Description
In compliance with IPC-A-600 , level 2	Acceptability of printed circuit boards

A.9.7 Packing

Specification	Description
In compliance with EN100015	Protection of electrostatic sensitive devices

A.9.8 WEEE *

Specification	Description
In compliance with 2002/96/EC	Waste Electrical and Electronic Equipment regulations

* Please send out-of-service Elmo drives to the nearest Elmo sales office.

A.9.9 RoHS

Specification	Description
In compliance with 2002/95/EC (effective July 2006)	Restrictions on Application of Hazardous Substances in Electric and Electronic Equipment

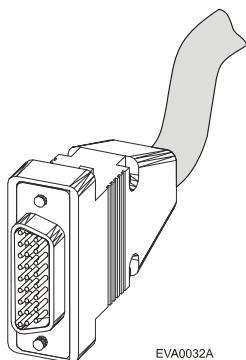
Appendix B: Cables

B.1 Cable Photos

 Main Feedback: CBL-DFDBK-1	 Aux. Feedback & Main Buffered Output: CBL-CELAUX-1
 RS-232 Com: CBL-RJ452321-1	 CAN Com: CBL-RJ45CAN1-1

B.2 Cable Kits

A full set of cables is supplied with the Evaluation Board – Catalog Number CBL-EVAUNIKIT01. The cables are all 1 m in length. Each set contains the cables listed below. Additional Cable Kits and individual cables (individually or in multiples of 10) are available from Elmo.

Cable Application	Cable Part. No.	
Main Feedback	CBL-DFDBK-1	
Auxiliary Feedback	CBL-CELAUX-1	
Main Buffered Output	CBL-CELAUX-1	
General I/O	WIP-028X2X24: The 1 m cable JCW-200226M: The 26-pin connector for the cable JCC-200115OC: The 15-pin connector for the hood	
RS-232 Communications	CBL-RJ452321-1	
CAN Communications	CBL-RJ45CAN1-1	

B.2.1 Main Feedback Cable (CBL-DFDBK-1)

The Main Feedback cable (CBL-DFDBK-1) is made of 24-AWG shielded cable with a 15-pin D-sub plug. It connects to the MAIN FEEDBACK port on the Evaluation Board. It is open on the motor side so that it can be connected to customer-specific connectors.

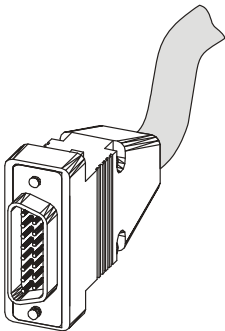
Pin No.	Color	Pairs	
1	Green	Pair	15 Pin D-sub Plug 
10	Yellow		
2	Pink		
3	White	Pair	
4	Brown		
5	Orange	Pair	
6	Cyan		
7	Blue	Pair	
8	Red		
9	-		
11	-		
12	-		
13	-		
14	Black	Pair	
15	Purple		



Figure B-1: Single-sided Main Feedback Cable (Part No. CBL-DFDBK-1)

B.2.2 Auxiliary Feedback and Main Buffered Output Cable (CBL-CELAUX-1)

CBL-CELAUX-1 is a 24-AWG shielded cable with a 15-pin High-Density D-sub plug. It can be connected to the Evaluation Board's AUX. FEEDBACK port or its MAIN BUFFERED OUTPUT port.

Four options, described in the *Auxiliary Feedback* section are available for auxiliary feedback (this is in addition to a fifth option described in the *Main Buffered Output Port* section):

- Main encoder buffered outputs
- Differential encoder inputs
- Single-ended encoder input
- Pulse-and-direction input

The general pinout of this cable is as follows:

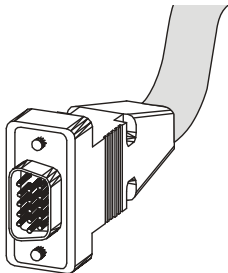
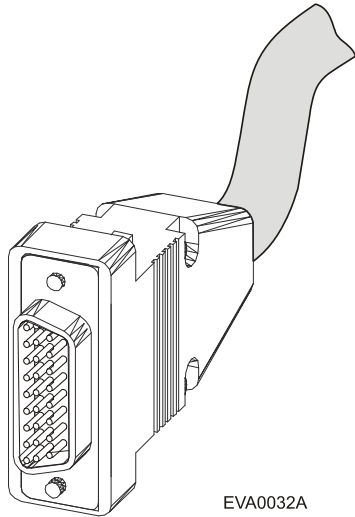
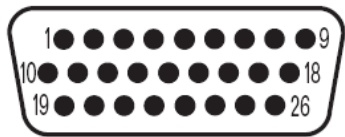
Pin No.	Color	Pair	Pin Position
1	Cyan	Pair	 15 Pin high density D-Sub Plug
2	Orange		
3	Purple	Pair	
4	Black		
5	Red	Pair	
10	Blue		
6	Pink	Pair	
7	Grey		
8	Brown	Pair	
9	White		
11	Yellow	Pair	
12	Green		
13	White/Red	pair	
14	White/Black		
15	White/Yellow		



Figure B-2: Auxiliary Feedback Cable (Part No. CBL-CELAUX-1)

B.2.3 General I / O (CBL-CELIO1-1)

The digital input cable kit is a 24-AWG shielded cable. It has eight pairs of wires.

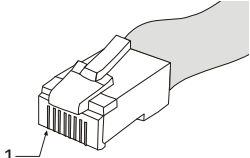
Pin No.	Signal	Function	
1	INRET1	General input return 1	 EVA0032A
2	INRET2	General input return 2	
3	INRET3	General input return 3	
4	INRET4	General input return 4	
5	INRET5	General input return 5	
6	INRET6	General input return 6	
7	+5V_EXT	Non-isolated +5V Supply Voltage	
8	SUPRET	Supply return	
9	AN1+	Analog input 1 (positive)	
10	IN1	General input return 1	
11	IN2	General input return 2	
12	IN3	General input return 3	
13	IN4	General input return 4	
14	IN5	General input return 5	
15	IN6	General input return 6	
16	SUPRET	Supply return	
17	+5V_EXT	Non-isolated + 5V Supply Voltage	
18	AN1-	Analog input 1 (negative)	
19	OUTP4	Programmable output 4	
20	OUTP3	Programmable output 3	
21	OUTP2	Programmable output 2	
22	OUTP1	Programmable output 1	
23	-VDO	Input of an external +24 V RETURN	
24	-VDO	Input of an external +24 V RETURN	
25	VDO	Input of an external +24 V, for supplying the LED drivers and Brake. Isolation is optional – it depends on the user's application requirements.	
26	VDO	Input of an external +24 V, for supplying the LED drivers and Brake. Isolation is optional – it depends on the user's application requirements.	

B.2.4 Communication Cables

The communication cables use a 26-AWG twisted pair shielded cable. They are connected using an 8-pin RJ-45 plug. Elmo drives can communicate using the following options:

- RS-232, full duplex
- CANopen

B.2.4.1 RS-232 Communication (CBL-RJ452321-1)

RJ45 Pin No.	Color	D-type Female Pin No.	Signal	Description	
3	Brown	2	Tx	RS-232 transmit	
5	White	5	COMRET	Communication return	
6	Green	3	Rx	RS-232 receive	
Body	Drain Wire	Body	Shield	Cable shield	

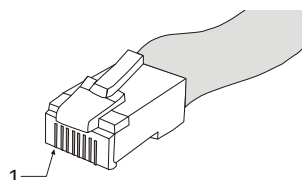


The shields of the RJ-45 and D-type plugs are connected to each other through the cable braid.



Figure B-3: RS-232 Communications Cable (Part No. CBL-RJ452321-1)

B.2.4.2 CAN Communication (CBL-RJ45CAN1-1)

RJ45 Pin No.	Color	D-type Female Pin No.	Signal	Description	
1	Green	7	CAN-H	CAN_H bus line	
2	Yellow	2	CAN_L	CAN_L bus line	
3	White	3	CAN_GND	CAN ground	
4	—	—	—	—	
5	—	—	—	—	
7	—	—	—	—	
8	—	—	—	—	
Body	Drain Wire	Body	Shield	Cable shield	



The shields of the RJ-45 and D-type plugs are connected to each other through the cable braid.



Figure B-4: CAN Cable (Part No. CBL-RJ45CAN1-1)

B.3 Guidelines for Making Your Own Cables

Proper wiring, grounding and shielding are essential for ensuring safe, insulated and optimal servo performance of the Evaluation Board. If you do not plan to use cables provided by Elmo, follow the instructions below carefully.



Follow these instructions to ensure safe and proper wiring.

- Use twisted pair shielded cables for control, feedback and communication connections. For best results, the cable should have an aluminum foil shield covered by copper braid, and should contain a drain wire.

The drain wire is a non-insulated wire that is in contact with parts of the cable, usually the shield. It is used to terminate the shield and act as a grounding connection.

- The impedance of the wire must be as low as possible. The size of the wire must be thicker than actually required by the carrying current. A 24, 26 or 28 AWG wire for control and feedback cables is satisfactory although 24 AWG is recommended.
- Use shielded wires for motor connections as well. If the wires are long, ensure that the capacitance between the wires is not too high: $C < 30 \text{ nF}$ is satisfactory for most applications.
- Keep all wires and cables as short as possible.
- Keep the motor wires as far away as possible from the feedback, control and communication cables.
- Ensure that in normal operating conditions, the shielded wires and drain *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 can result in drive/controller/host failure.
- After completing the wiring, carefully inspect all wires to ensure tightness, good solder joints and general safety.

B.3.1 Recommended Wire Cross Sections

Function	Connection	Details
Motor	PE, M1, M2, M3	18 AWG
Auxiliary power	VL, PR	24 AWG
Feedback and Control	MAIN FEEDBACK AUX FEEDBACK GENERAL I/O MAIN BUFFERED OUTPUT	24 AWG twisted pair shielded cables as described below (Section B.3.2)
Communications	RS-232 CANopen	26 AWG twisted pair shielded cables as described below (Section B.3.2)

B.3.2 Feedback and Control Cable Assemblies

The Evaluation Board features easy-to-use D-sub type connections for all Control and Feedback cables. Below are instructions and diagrams describing how to assemble those cables.

- Use 24, 26 or 28 AWG twisted-pair shielded cables (24 AWG cable is recommended). For best results, the shield should have aluminum foil covered by copper braid.
- Use only a D-sub connector with a **metal housing**.
- Attach the braid shield tightly to the metal housing of the D-type connector.
- On the motor side connections, ground the shield to the motor chassis.
- On controller side connections, follow the controller manufacturer's recommendations concerning the shield.

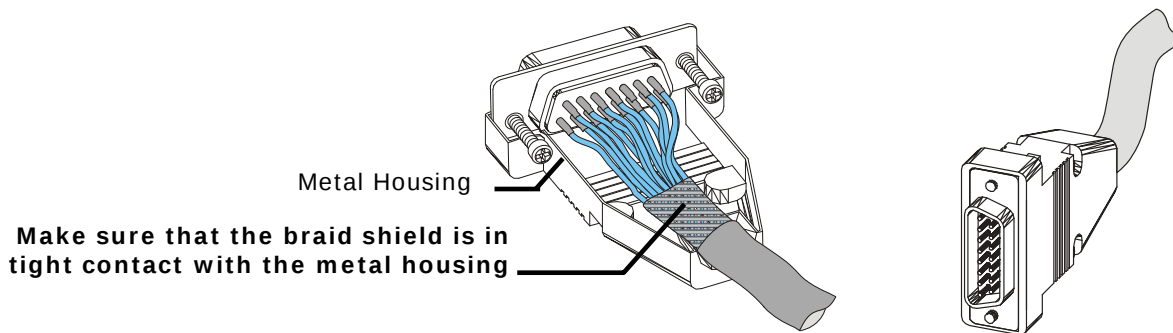


Figure B-5: Feedback and Control Cable Assemblies



Note: All D-sub connectors, used with the Evaluation Board, should be assembled in this way.

B.4 Accessory Kits

Cable Part. No.	Accessory Kit
ACC-KIT-BEL/WHI01	Spacers and screws
ACC-KIT-GUI01	Spacers and screws
ACC-TRM-01	Terminator Connector

The spacers and screws are for attaching the Elmo drive to the Evaluation Board.

The connector is for adjusting the resistance of the Elmo drive to the Evaluation Board. It is for use only when using CAN communication when it is connected to the spare CAN port.



ACC-KIT-GUI01



ACC-KIT-BEL/WHI01



ACC-TRM-01

Figure B-6: Evaluation Board Accessories