SimpIIQ Line

MOLWhistle Digital Servo Drives Installation Guide

August 2021

Elmo Motion Control

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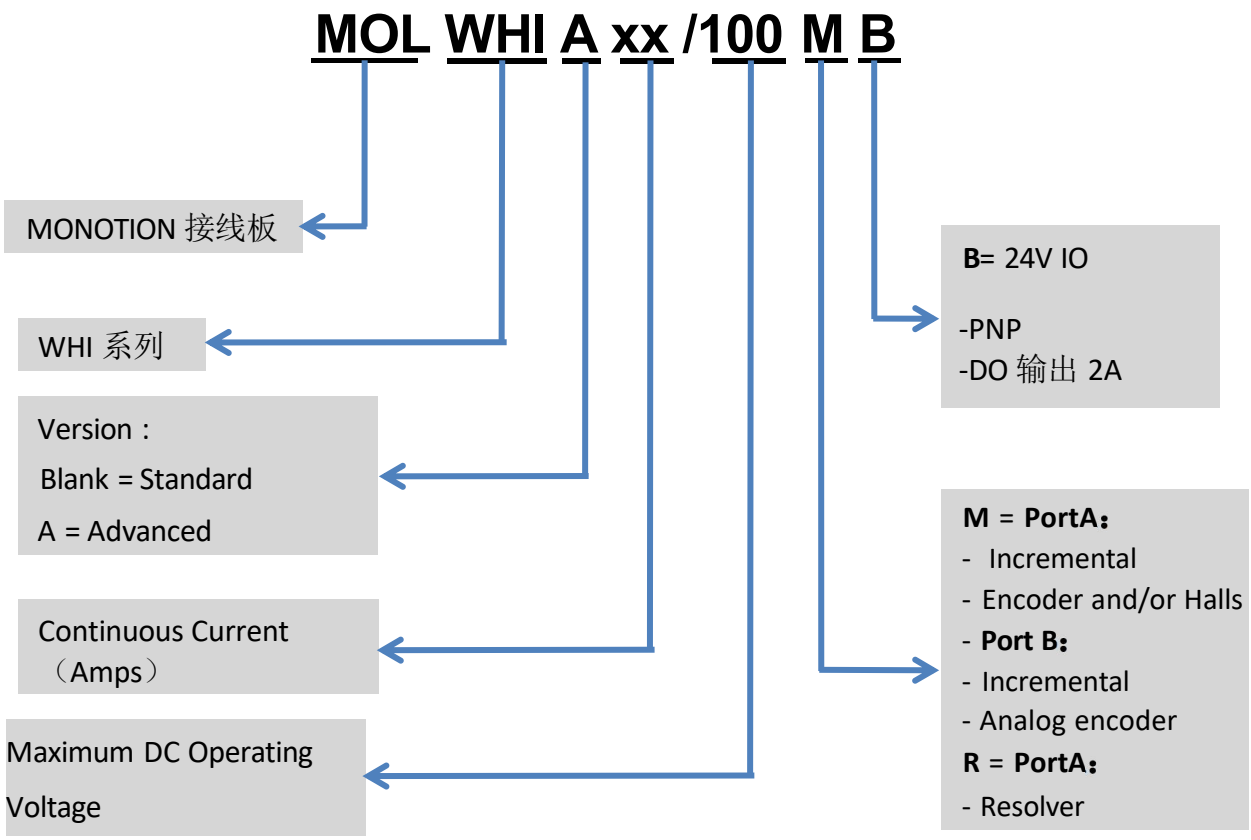
Catalog Numbers



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1.Chapter1:Safety Information

In order to achieve the optimum, safe operation of the MOL Whistle servo drive, 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 MOL Whistle as well as the 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 MOLWhistle servo drives contain 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

Cleaning after soldering
To avoid damage to the product's acrylic coating, the MOLWhistle drive must not be cleaned after soldering with soluble solvents or water-based cleaners.

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 MOLWhistle from all voltage sources before it is opened for servicing.

The MOL Whistle servo drive 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 MOLWhistle servo drive contains hot surfaces and electricallycharged components during operation.

The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.

When connecting the MOLWhistle to an approved 12~95 VDC auxiliary power supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.

Before switching on the MOLWhistle, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.

1.3. Directives and Standards

TheMOLWhistle drives conform 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 MOLWhistle servo drive 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 MOL Whistle servo drive 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 Solo Whistle drive 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.

2. Chapter2:introduction

The MOL is an integrated solution designed to simply and efficiently connect Elmo's Whistle servo drive directly to the application. The solution consists of the Whistle together with a convenient connection interface which either eliminates or reduces development time and resources when designing an application's PCB board. This installation guide describes the MOL Whistle servo drive and the steps for its wiring, installation and power-up. Following these guidelines ensures maximum functionality of the drive and the systems to which it is connected

2.1. Drive Description

The MOLWhistle series of digital servo drives are designed to deliver "the highest density of power and intelligence" . The MOLWhistle delivers up to 4000 W of continuous power in a 2 in^3 (74 x 33 x 46.5 mm) 38 cc package.

The MOLWhistle are designed for OEMs. They operate from a DC power source in current, velocity, position and advanced position modes, in conjunction with a permanent-magnet synchronous brushless motor, DC brush motor, linear motor or voice coil. They are designed for use with any type of sinusoidal and trapezoidal commutation, with vector control. The MOLWhistle can operate as a stand-alone device or as part of a multi-axis system in a distributed configuration on a real-time network.

The drives are easily set up and tuned using Elmo's Composer software tools. This Windows-based application enables users to quickly and simply configure the servo drive for optimal use with their motor. The MOLWhistle, as part of the SimplIQproduct line, are fully programmable with Elmo Composer motion control language.

Power to the drives is provided by a 12 to 195 VDC isolated DC power source (not included with the MOLWhistle). A "smart" control-supply algorithm enables The MOLWhistle to operate with only one power supply in up to 100 V models with no need for an auxiliary power supply for the logic. For 200 V models, the auxiliary power supply in the range of 12 -95 V is always required.

If backup functionality is required for storing control parameters in case of power-loss, an external 12 to 95 VDC isolated supply should be connected (via the +VL terminal on the MOLWhistle) providing maximum flexibility and backup functionality when needed.

Note: This backup functionality can operate from any voltage source within the 12 to 95 VDC range. This is much more flexible than to be restricted by only using a standard 24 VDC power supply.

If backup power is not needed in up to 100 V models, two terminals (VP and VL) are shorted so that the main power supply will also power the control/logic supply. In this way there is no need for a separate control/logic supply.

The MOLWhistle are available in two models:

- The Standard models are basic servo drives which operate in current, velocity and position modes include PT & PVT. They operate simultaneously via RS-232 and CAN DS 301, DS 305, DS 402 communications and feature a third-generation programming environment.
- The Advanced models include all the motion capabilities and communication options included in the Standard model, as well as advanced positioning capabilities-ECAM, Follower and Dual Loop-and increased program size.

The two models operate with both RS-232 and CAN communication.

2.2. Product Features

2.2.1. Current Control

- Fully digital
- Sinusoidal commutation with vector control or trapezoidal commutation with encoderand/or digital Hall sensors
- 12-bit current loop resolution
- Automatic gain scheduling, to compensate for variations in the DC bus power supply

2.2.2. Velocity Control

- Fully digital
- Programmable PI and FFW (feed forward) control filters
- Sample rate two times current loop sample time
- "On-the-fly" gain scheduling
- Automatic, manual and advanced manual tuning and determination of optimal gain and phase margins

2.2.3. Position Control

- Programmable PIP control filter
- Programmable notch and low-pass filters
- Position follower mode for monitoring the motion of the slave axis relative to a master axis, via an auxiliary encoder input
- Pulse-and-direction inputs
- Sample time: four times that of the current loop
- Fast event capturing inputs
- PT and PVT motion mod

2.2.4. Advanced Position Control

This relates to the Advanced model only.

- Position-based and time-based ECAM mode that supports a non-linear follower mode, in which the motor tracks the master motion using an ECAM table stored in flash memory
- Dual (position/velocity) loop
- Fast output compare (OC)

2.2.5. Communication Options

MOLWhistle users can use two communication options:

- RS-232 serial communication
- CAN for fast communication in a multi-axis distributed environment

2.2.6. Feedback Options

- Incremental Encoder – up to 20 Mega-Counts (5 Mega-Pulse) per second
- Digital Halls – up to 2 kHz
- Incremental Encoder with Digital Halls for commutation – up to 20 Mega- Counts per-second for encoder
- Interpolated Analog (Sine/Cosine) Encoder – up to 250 kHz (analog signal)
  1. Internal Interpolation - up to x4096
  2. Automatic Correction of amplitude mismatch, phase mismatch, signals offset
  3. Auxiliary emulated, unbuffered, single-ended, encoder output
- Resolver
  1. Programmable 10 to 15 bit resolution
  2. Up to 512 revolutions per second (RPS)
  3. Auxiliary emulated, unbuffered, single-ended, encoder output
- Tachometer, Potentiometer
- Elmo drives provide supply voltage for all the feedback options

2.2.7. Fault Protection

The MOLWhistle include built-in protection against possible fault conditions, including:

- Software error handling
- Status reporting for a large number of possible fault conditions
- Protection against conditions such as excessive temperature, under/over voltage, loss of commutation signal, short circuits between the motor power outputs and between each output and power input/return
- Recovery from loss of commutation signals and from communication errors

2.3. System Architecture

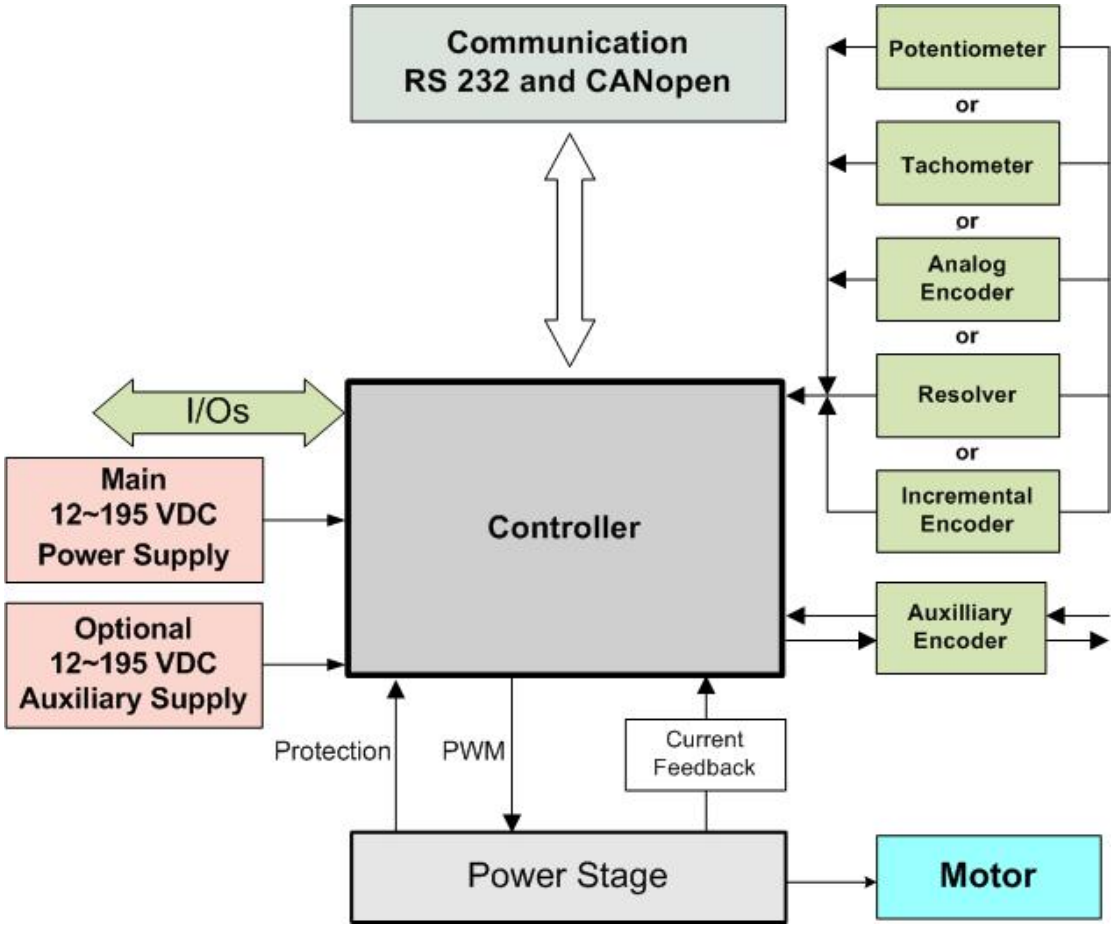


Figure 2-1: Solo Whistle System Block Diagram

2.4. How to Use this Guide

In order to install and operate your Elmo Solo Whistle servo drive, you will use this manual in conjunction with a set of Elmo documentation. Installation is your first step; after carefully reading the safety instructions in the first chapter, the following chapters provide you with installation instructions as follows:

Chapter 3, Installation, provides step-by-step instructions for unpacking, mounting, connecting and powering up the Solo Whistle.
The Appendix, Technical Specifications, lists all the drive ratings and specifications.

Upon completing the instructions in this guide, your Solo Whistle servo drive should be successfully mounted and installed. From this stage, you need to consult higherlevel Elmo documentation in order to set up and fine-tune the system for optimal operation. The following figure describes the accompanying documentation that you will require.

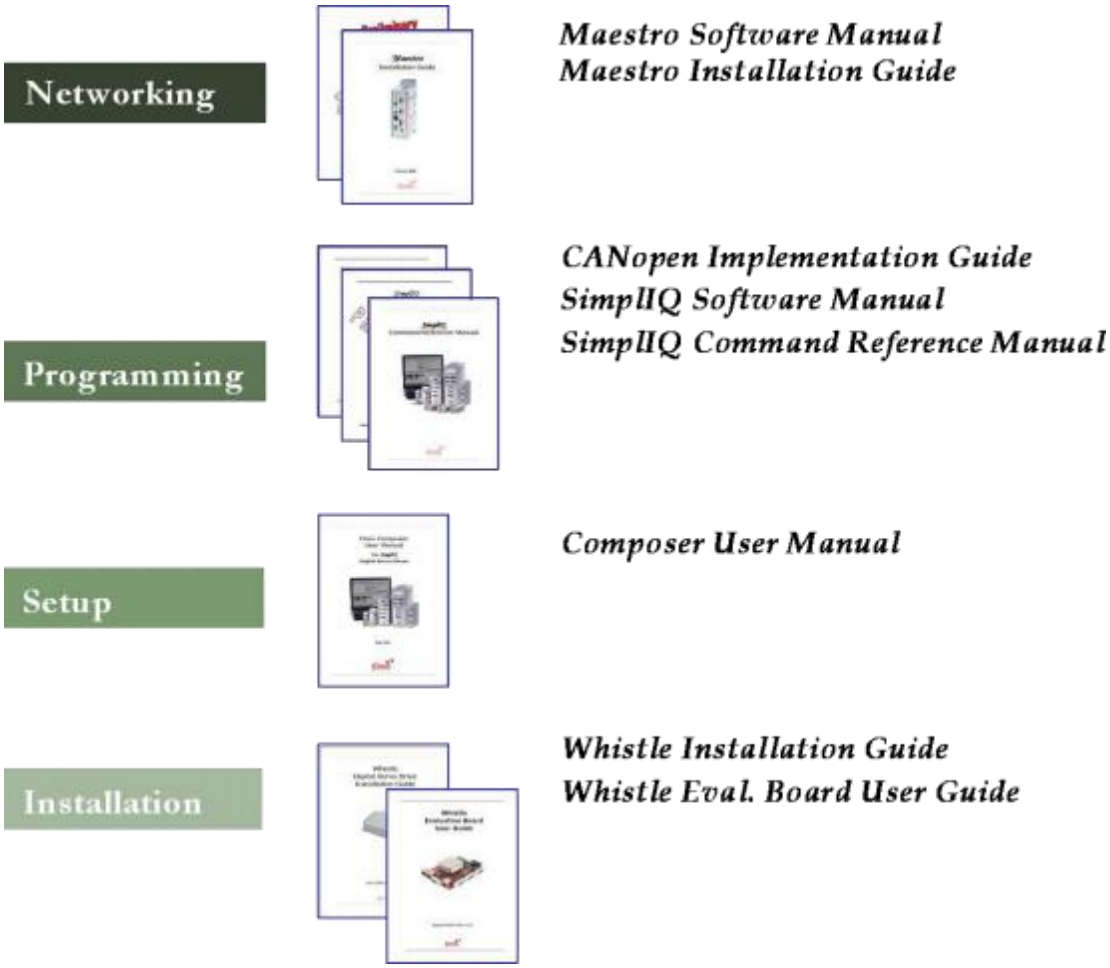


Figure 2: Elmo Digital Servo Drive Documentation Hierarchy

As depicted in the previous figure, this installation guide is an integral part of the MOLWhistle and documentation set, comprising:

- The MOLWhistle Evaluation Board User Guide contains information about how to use the MOLWhistle Evaluation Board and Cable Kit
- The Composer Software Manual, which includes explanations of all the software tools that are part of Elmo's Composer software environment
- *The SimplIQCommand Reference Manual*, which describes, in detail, each software command used to manipulate The MOLWhistle motion controller
- *The SimplIQSoftware Manual*, which describes the comprehensive software used with the MOLWhistle

3. Chapter3: Installion

3.1. Site Requirements

You can guarantee the safe operation of The MOLWhistle by ensuring that they are installed in an appropriate environment.

Feature	Value
Ambient operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Maximum relative humidity	90% non-condensing
Operating area atmosphere	No flammable gases or vapors permitted in area
Models for extended environmental conditions are available.	

The MOLWhistle dissipate heat by convection. The maximum operating ambient temperature of 0 °C to 40 °C (32 °F to 104° F) must not be exceeded.

3.2. Unpacking the Drives

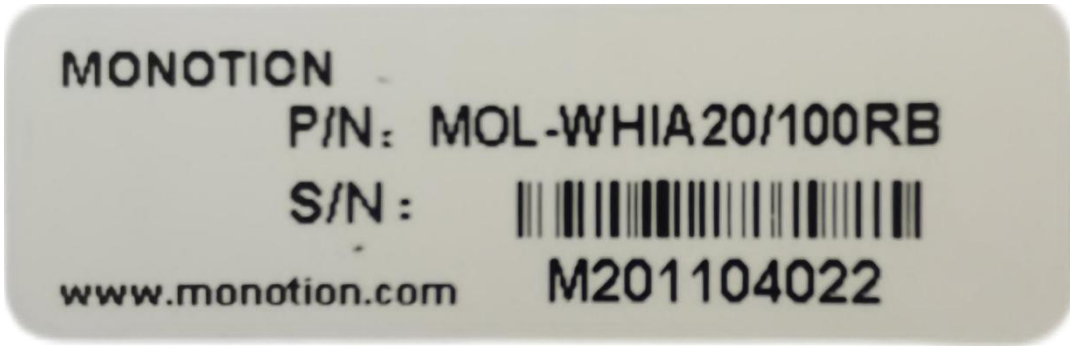
Before you begin working with the MOLWhistle , verify that you have all of their components, as follows:

- The MOLWhistle servo drives
- The Composer software and software manual

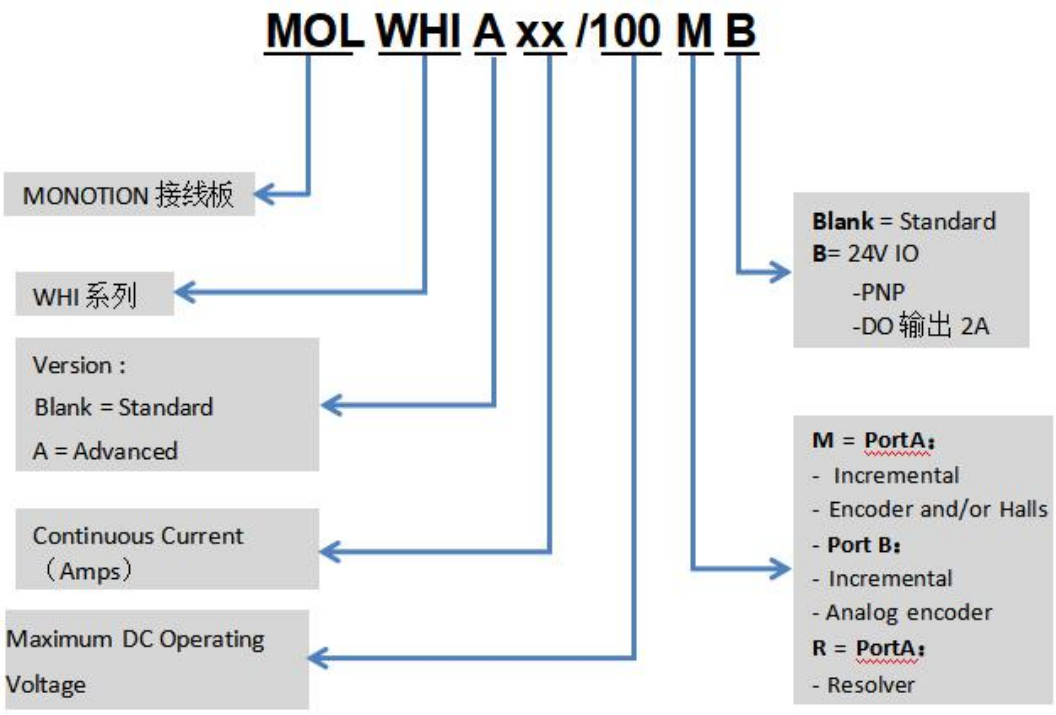
The MOLWhistle are shipped in a cardboard box with Styrofoam protection.

To unpack The MOLWhistle:

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



The part number at the top gives the type designation as follows:



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

3.3. Connector Types

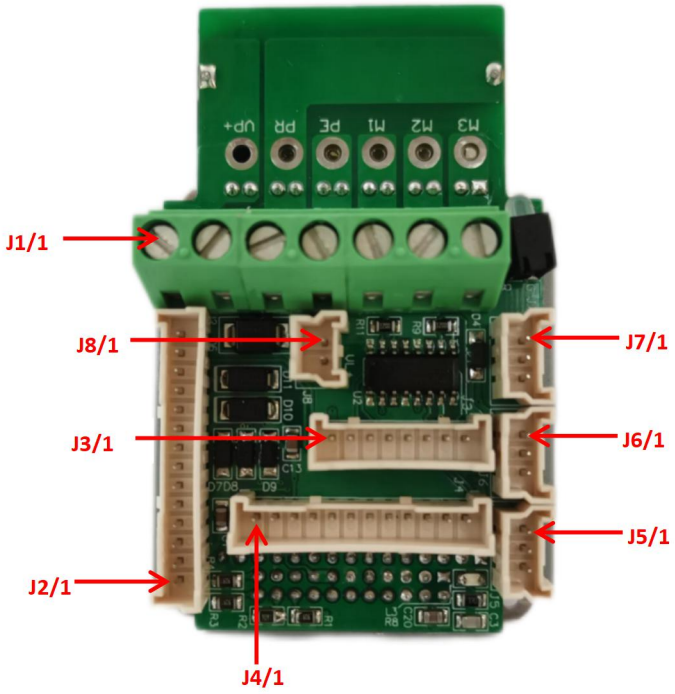
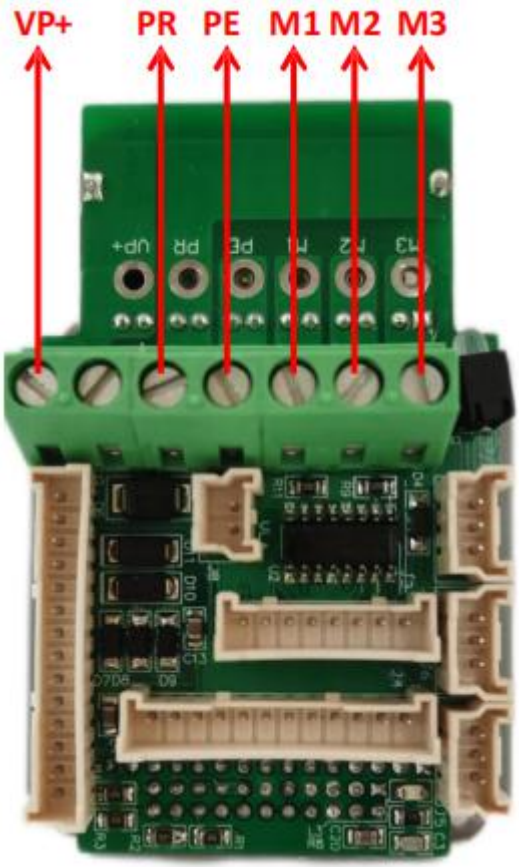
No. Pins	Type	Port	Function
7	5 mm Pitch	J1	Power Connector
14	2 mm Pitch	J2	I/O
8	2 mm Pitch	J3	Auxiliary Feedback
12	2 mm Pitch	J4	Main Feedback
3	2 mm Pitch	J5	RS232
3	2 mm Pitch	J6	CANIN
3	2 mm Pitch	J7	CANOUT
2	2 mm Pitch	J8	Control Supply
Connector Locations			
			

Table 3-1: Connector Types

Note: Throughout this chapter there are a pair of diagrams of the MOLWhistle. The diagram on the left is the MOLWhistle with connectors and the diagram on the right shows the product with wires.

3.4. Main Power、Motor Power – J1

Pin	Signal	Function		
J1/1	VP+(电源+）	Pos. power input		
J1/3	PR(电源-）	Power return		
			Brushless Motor	***Brush Motors***
J1/4	PE	Protective earth	Motor	Motor
J1/5	M1	Motor phase	Motor	N/C
J1/6	M2	Motor phase	Motor	Motor
J1/7	M3	Motor phase	Motor	Motor
Pin Positions				
 Main Power、Motor Power – J1				
	When connecting several drives to several motors, all should be wired in the same motor phases and feedback sequences. This will enable the same ***SimplIQ*** program to run on all drives			

3.4.1. Connecting Main Power

Power to the MOLWhistle is provided by a 12 to 95 VDC source. A smart control-supply algorithm enables the MOLWhistle to operate with the power supply only, with no need for an auxiliary 24 volt supply.If backup functionality is required (for storing control parameters in case of power-outs) an additional backup supply can be connected by implementing "diode coupling" to the VL+.

The source of the 12 ~ 95 VDC Main Power Supply must be isolated.

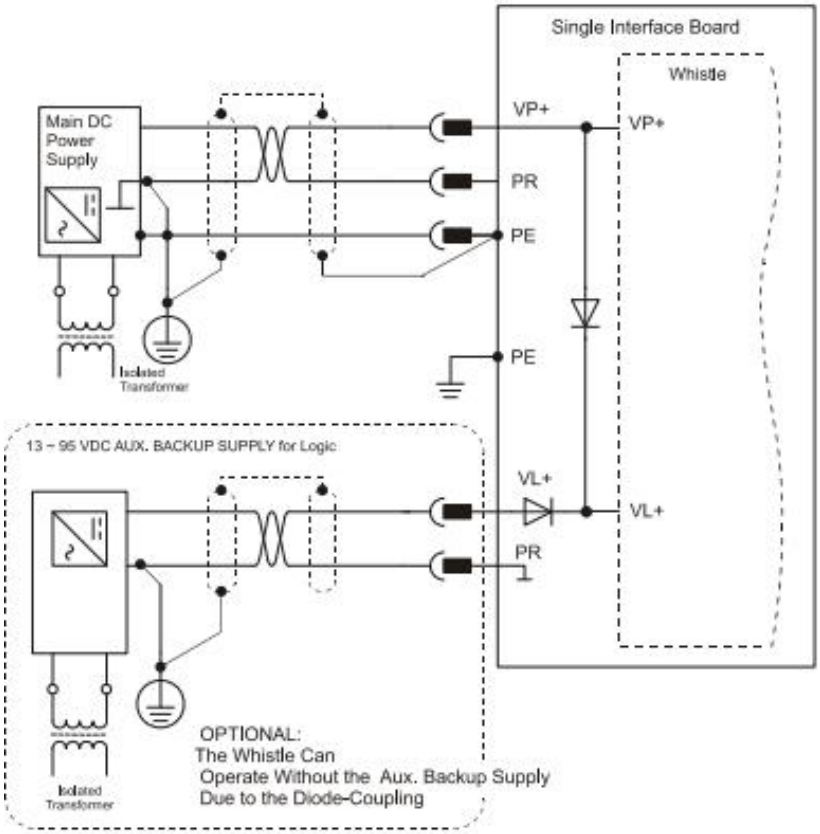


Figure 3-1: Main Power Supply Connection iagrm

3.4.2. Connecting Motor Power

Connect the M1, M2, M3 and PE pins on the MOLWhistle. The phase connection is arbitrary as the Composer will establish the proper commutation automatically during setup. However, if you plan to copy the setup to other drives, then the phase order on all copy drives must be the same.

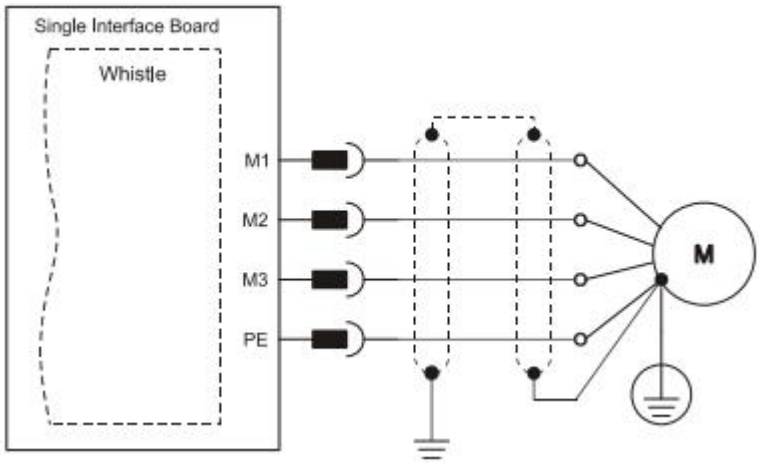


Figure 3-2: Brushless Motor Power Connection Diagram

3.5. Main Feedback(J4)

The Main Feedback port is used to transfer feedback data from the motor to the drive. In order to copy the setup to other drives, the phase order on all copy drives must be the same. The MOLWhistle can accept any one of the following devices as a main feedback mechanism:

- Incremental encoder only
- Incremental encoder with digital Hall sensors
- Digital Hall sensors only
- Resolver (option)

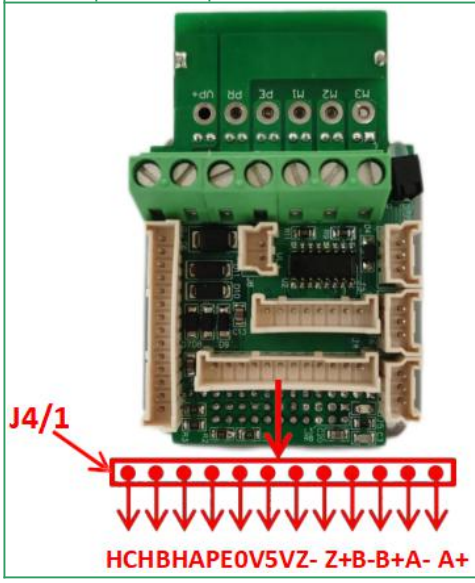
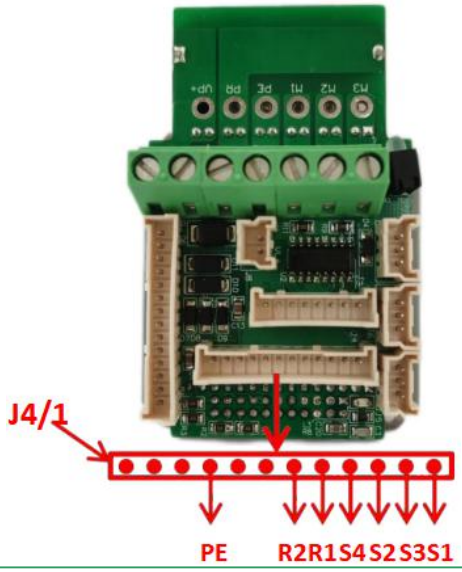
	IncrementalEncoder		**Resolver**	
	MOL-WHIA XX/YY MB		MOL-WHIA XX/YY RB	
Pin	Signal	Function	Signal	Function
J4/1	HC	Hall sensor Cinput	NC	-
J4/2	HB	Hall sensor Binput	NC	-
J4/3	HA	Hall sensor Ainput	NC	
J4/4	PE	Protective Earth	PE	Protective Earth
J4/5	0V	Supply return complement	0V	Supply return complement
J4/6	+5V	Encoder/Hall+5V supply	+5V	Encoder/Hall +5V supply
J4/7	INDEX-	Index complement	R2	Vrefcomplement f= 1/TS,50mAMaximum
J4/8	INDEX+	Index	R1	Vref f=1/TS, 50mA Max
J4/9	CHB-	Channel B complement	S4	Cosine B complement,
J4/10	CHB	ChannelB	S2	Cosine B
J4/11	CHA-	Channel A complement	S3	Sine Acomplement
J4/12	CHA	ChannelA	S1	Sine A
				

Table 3-3: Main Feedback Pin Assignments

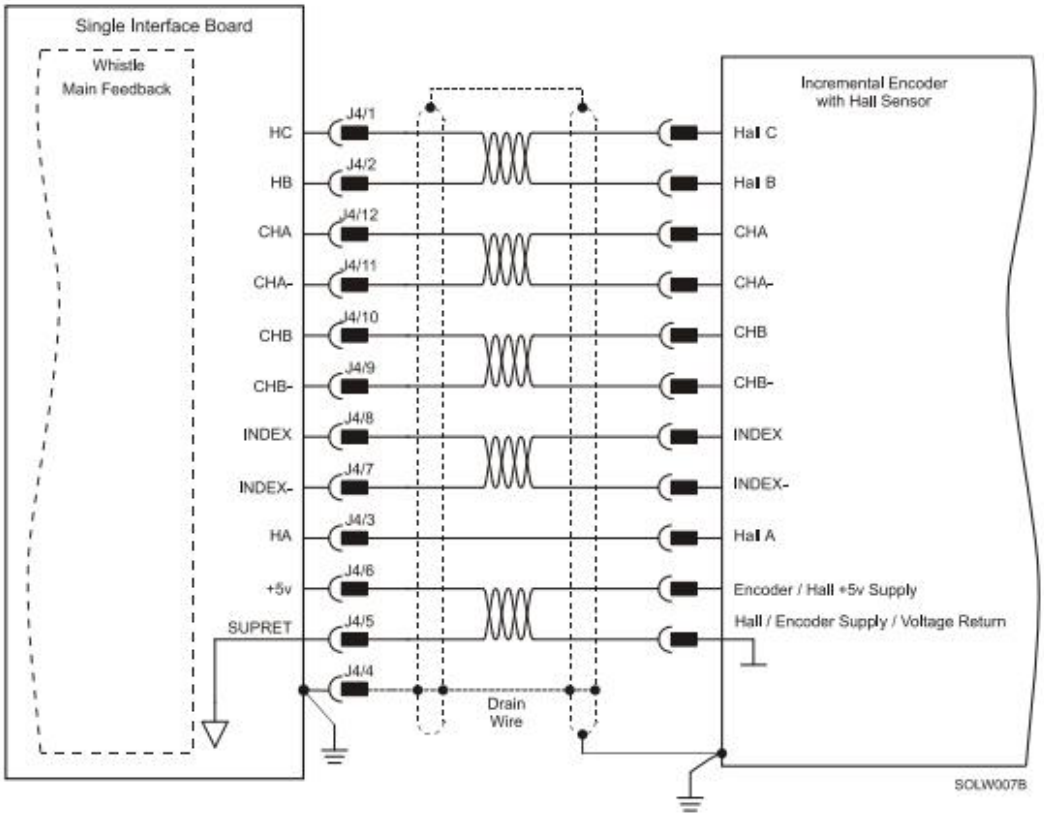


Figure 3-4: Main Feedback- Incremental Encoder with Digital Hall Sensor Connection Diagram

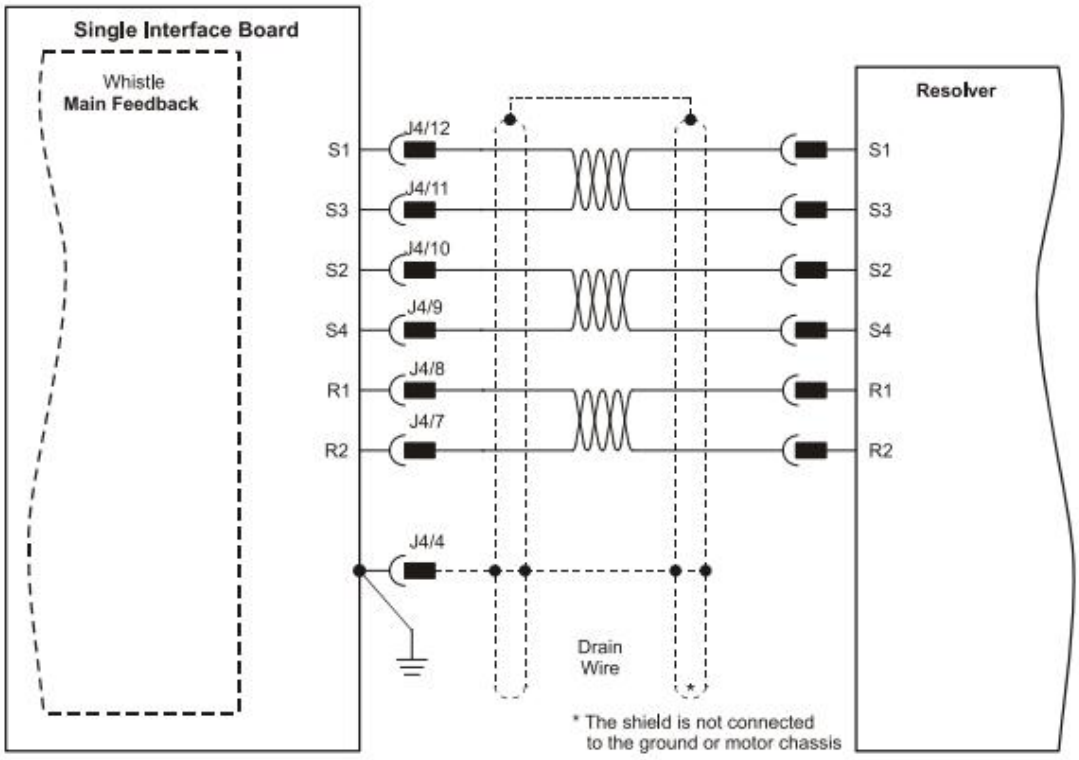


Figure 3-5: Main Feedback – Resolver Connection Diagram

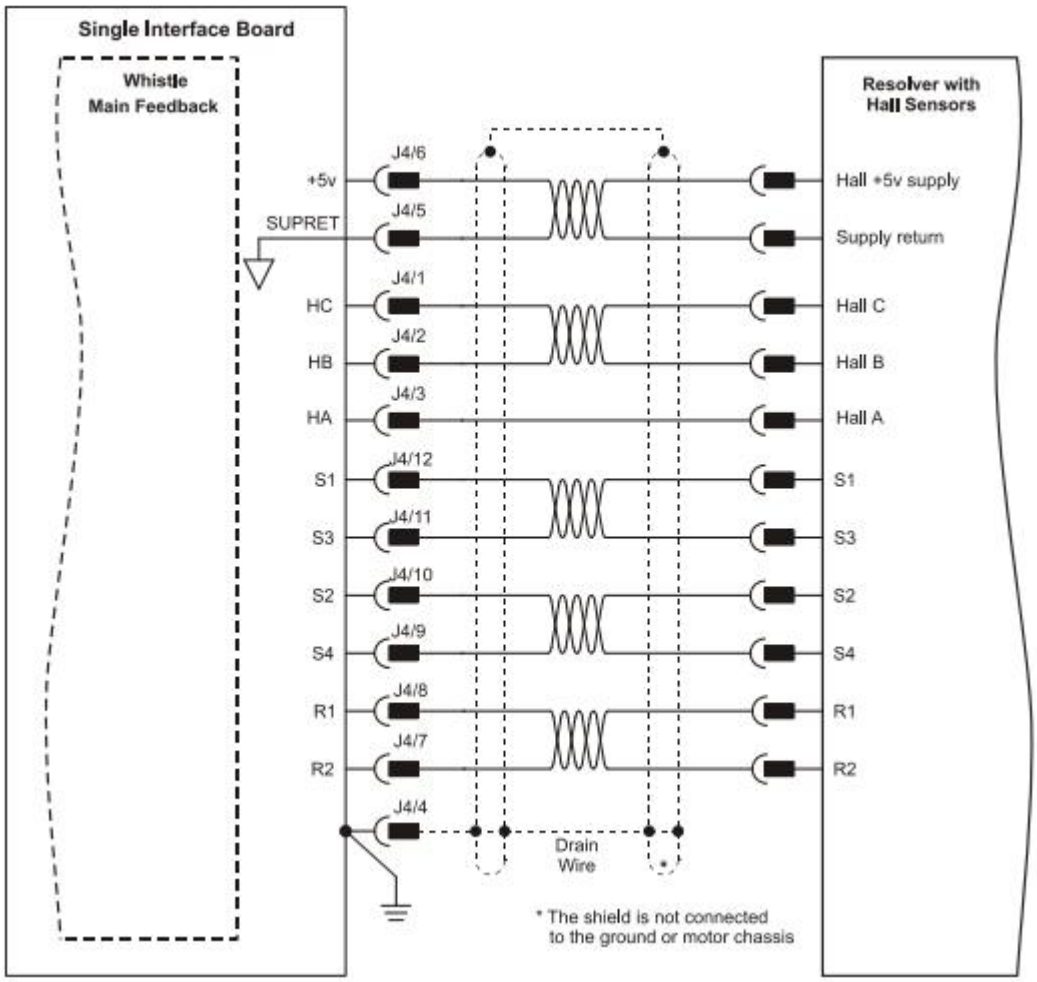


Figure 3-6: Main Feedback – Resolver with Digital Hall Sensor Connection Diagram

3.6. Auxiliary Feedback

When using one of the Auxiliary Feedback options, the relevant functionality of the Auxiliary Feedback's ports are software- and hardware-selected for that option. Refer to the SimplIQ Command Reference Manual for detailed information about Auxiliary Feedback setup.

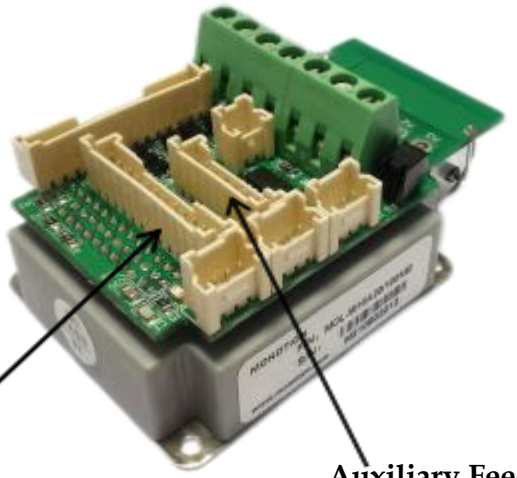
3.6.1. Auxiliary Feedback Operation Modes

- Auxiliary input (Composer command: YA[4]=2 or YA[4]=0) - see section 3.6.3 & 3.6.4

Differential auxiliary inputs, for the input of position data of the master encoder in follower or ECAM mode. This mode can also be used for differential pulse-and-direction position commands.

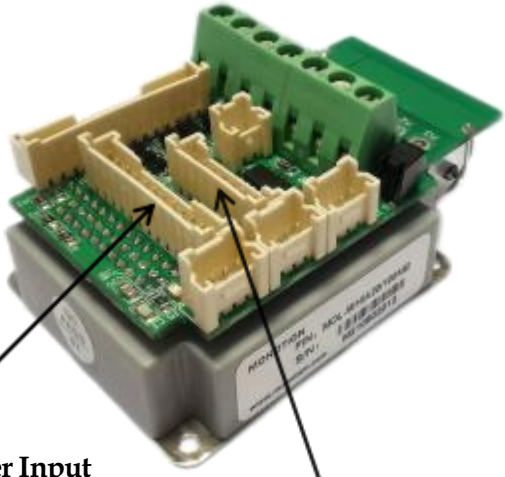
3.6.2. Main and Auxiliary Feedback Combinations

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 MOLWhistle has three bi-directional pins (CHA, CHB and INDEX). When used in combination with Main Feedback, the Auxiliary Feedback can be set, by software, as follows:

<table>
<tr><th>SW Setting
Main Feedback</th><th>Auxiliary Feedback: Input
YA[4] = 2
(Auxiliary Feedback: input)</th></tr>
<tr><td>Incremental Encoder Input</td><td rowspan="3"> 
Main Feedback:
Incremental Encoder Input
OR Interpolated Analog (Sin/Cos) Encoder Input
OR Resolver
Auxiliary Feedback:
Differential Auxiliary Encoder Input</td></tr>
<tr><td>Interpolated Analog (Sin/Cos) Encoder Input</td></tr>
<tr><td>Resolver Input</td></tr>
<tr><td>Typical Applications</td><td>● 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.</td></tr>
</table>

<table>
<tr><th>SW Setting
Main Feedback</th><th>Auxiliary Feedback: Input</th></tr>
<tr><td></td><td>YA[4] = 0
(Auxiliary Feedback: input)</td></tr>
<tr><td>Incremental Encoder Input

Interpolated Analog (Sin/Cos) Encoder Input

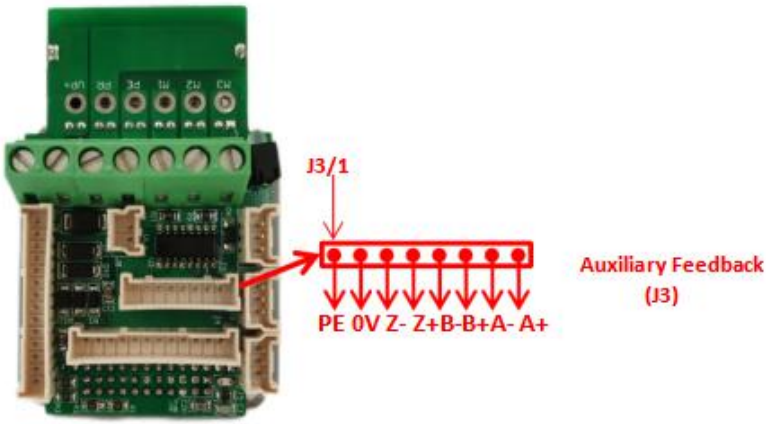
Resolver Input</td><td> 
Main Feedback:
Incremental Encoder Input
OR Interpolated Analog (Sin/Cos) Encoder Input
OR Resolver
OR Potentiometer
OR Tachometer

Auxiliary Feedback:
Differential Pulse & Direction Commands Input</td></tr>
<tr><td>Typical Applications</td><td>● Any application where two Feedbacks are used by the drive.
● The Auxiliary Feedback port serves as an input for Pulse & Direction Commands.</td></tr>
</table>

3.6.3. Auxiliary Feedback: Differential Encoder Input Option(YA[4]=2)

Pin	Signal	Function
J3/1	PE	Protective Earth
J3/2	COMRET	Common Return
J3/3	INDEX-	Auxiliary Index complement Input
J3/4	INDEX	Auxiliary Index Input
J3/5	CHB-	Auxiliary channel B complement input
J3/6	CHB	Auxiliary channel B input
J3/7	CHA-	Auxiliary channel A complement input
J3/8	CHA	Auxiliary channel A input

Pin Positions



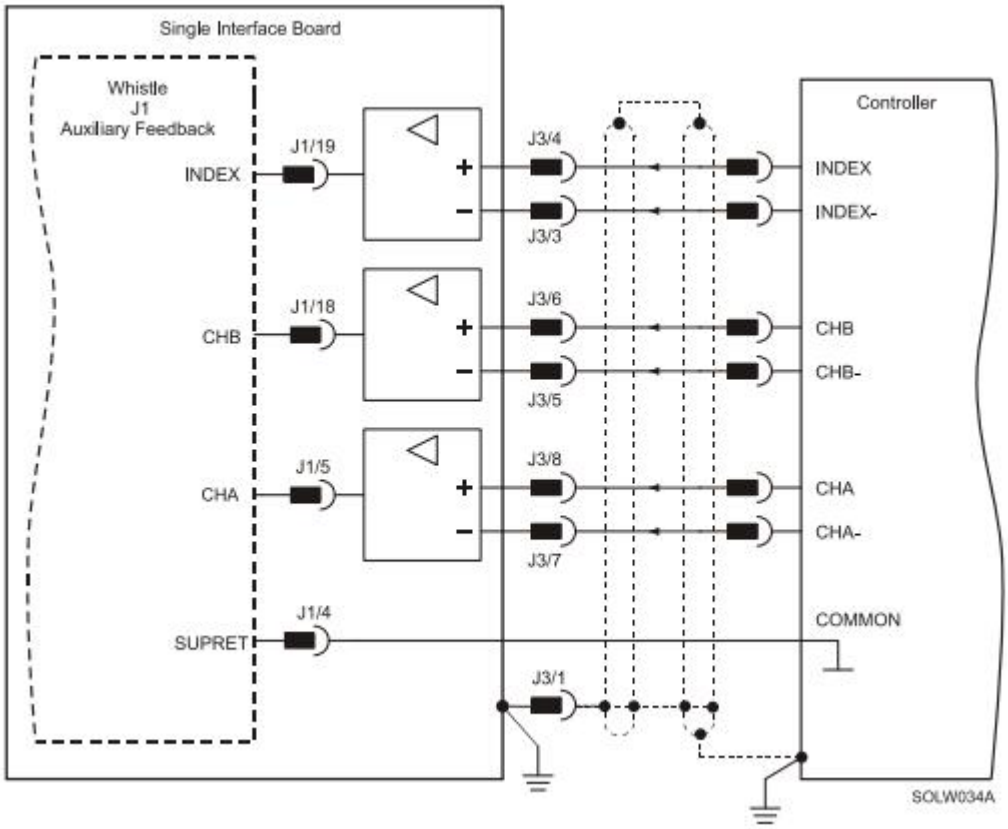


Figure 3-13: Differential Auxiliary Encoder Input Option Diagram

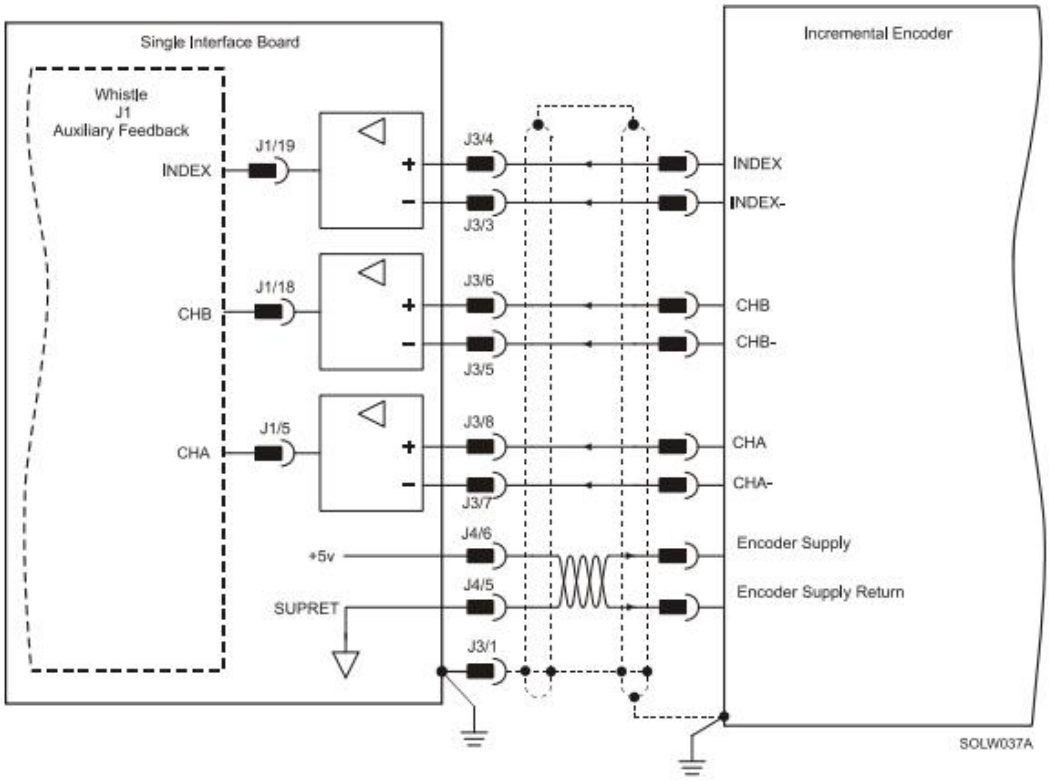


Figure 3-14: Differential Auxiliary Encoder Input Option Diagram

3.6.4. Auxiliary Feedback: Differential Pulse-and-Direction Input Option (YA[4]=0)

Pin	Signal	Function
J3/1	PE	Protective Earth
J3/2	COMRET	Common Return
J3/3	NA	Do not connect this pin
J3/4	NA	Do not connect this pin
J3/5	CHB-	Auxiliary Direction complement *input*
J3/6	CHB	Auxiliary Direction *input*
J3/7	CHA-	Auxiliary Pulse complement *input*
J3/8	CHA	Auxiliary Pulse *input*
Pin Positions		

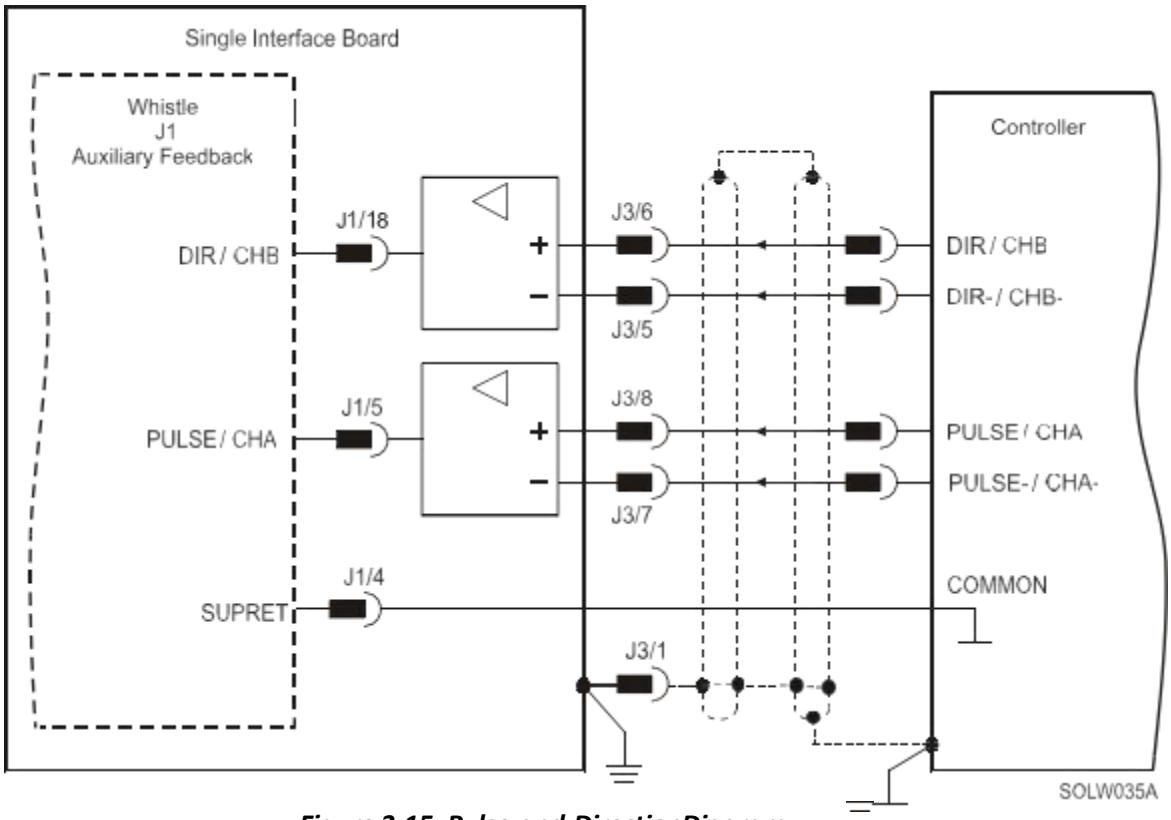


Figure 3-15: Pulse-and-DirectionDiagram

3.7. I/Os

The MOLWhistle has four digital inputs, two digital outputs and one analog input.

3.7.1. Digital Input

The digital input level signal can be 24 V (PLC).

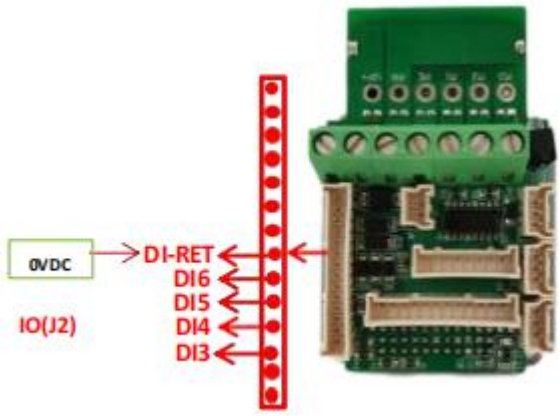
Pin	Signal	Function
J2/3	IN3	Programmable input 3 (general purpose, RLS, FLS, INH)
J2/4	IN4	Programmable input 4 (general purpose, RLS, FLS, INH)
J2/5	IN5	Hi-Speed Programmable input 5 (event capture, Main Home, general purpose, RLS, FLS, INH)
J2/6	IN6	Hi-Speed Programmable input 6 (event capture, Auxiliary Home, general purpose, RLS, FLS, INH)
J2/7	INRET	Programmable input return
Pin Positions		
		

Table 3-3: Digital Input Pin Assignments

3.7.1.1. Digital Input 24 V (PLC)

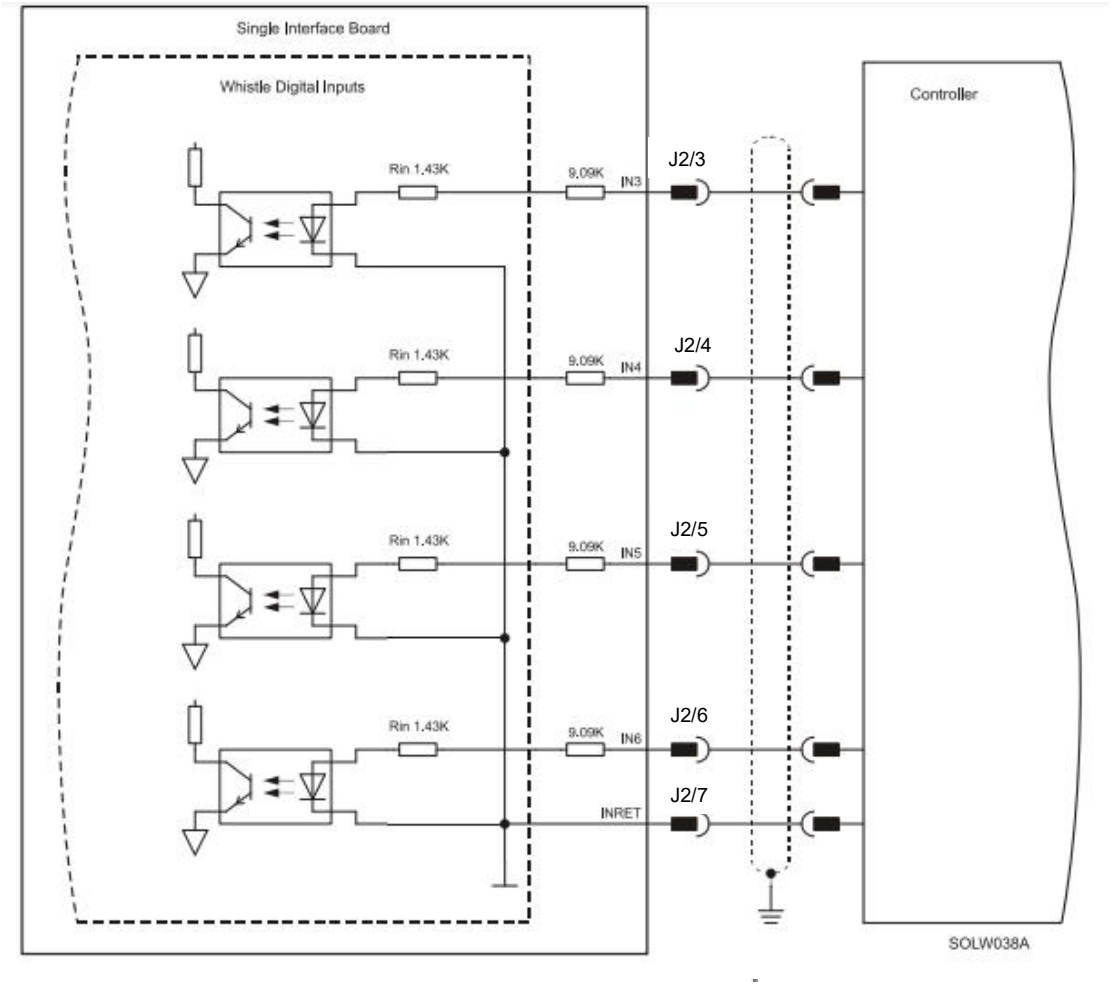


Figure 3-17: Digital Input 24 Connection Diagram

3.7.2. Digital Output

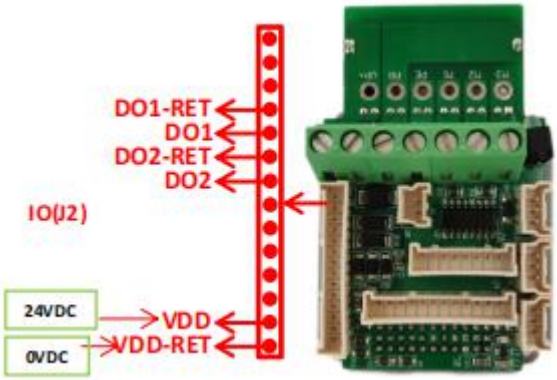
Pin	Signal	Function
J2/1	VDD-RET	0V
J2/2	VDD	24VDC
J2/8	OUT2	Programmable digital output 2
J2/9	OUTRET2	Programmable digital output return 2
J2/10	OUT1	Programmable digital output1
J2/11	OUTRET1	Programmable digital output return 1
Pin Positions		
		

Table 3-4: Digital Output Pin Assignment

3.7.3. Analog Input

Pin	Signal	Function
J2/12	ANLIN1+	Analog input 1+
J2/13	ANLIN1-	Analog input 1-
J2/14	ANLRET	Analog return
Pin Positions		

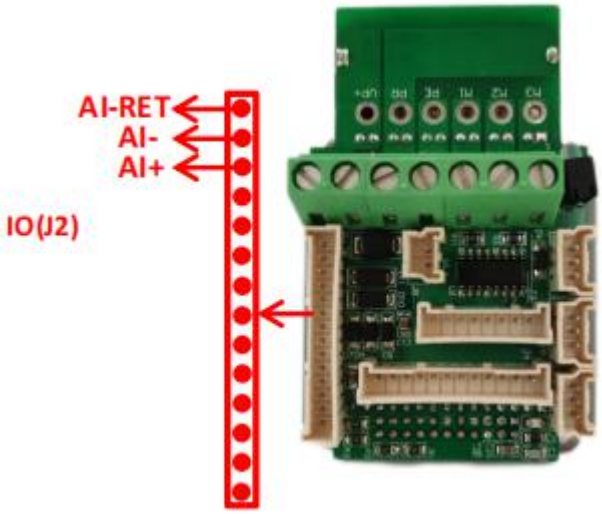


Table 3-5: Analog Input Pin Assignments

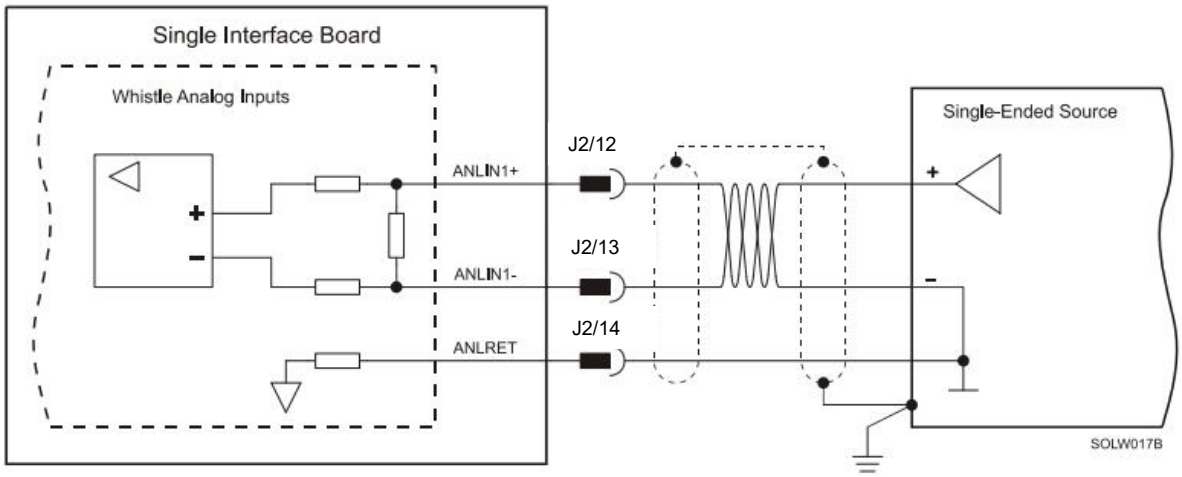


Figure 3-19: Analog Input with Single-ended Source

3.8. Communications

The communication interface may differ according to the user's hardware. The MOLWhistle 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 MOLWhistle 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.

3.8.1. 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 RS-232 communication port is non-isolated.

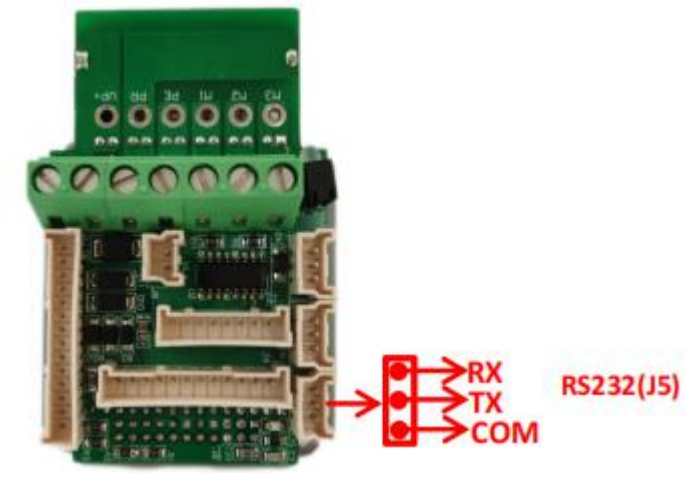
Pin	Signal	Function
J5/1	RS232 Rx	RS-232 receive
J5/2	RS232 Tx	RS-232 transmit
J5/3	RS232 COMRET	Communication return
Pin Positions		
		

Table 3-6: RS-232 Pin Assignments

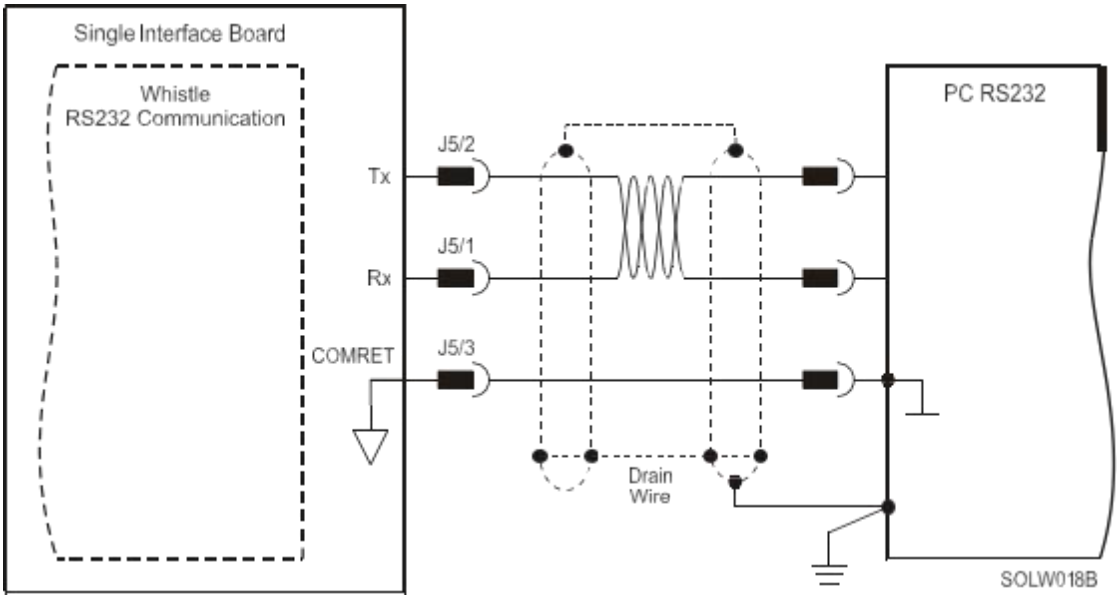


Figure 3-20: RS-232 Connection Diagram

3.8.2. CANopen Communication

Notes for connecting the CANopen 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.
- Make sure to have a 120-Ohm resistor termination at each of the two ends of the network cable.
- The MOLWhistle's CAN ports are non-isolated.

Pin CANIN	Pin CANOUT	Signal	Function
J6/1	J7/1	CAN-GND	CAN ground
J6/2	J7/2	CAN-L	CAN_L busline (dominant low)
J6/3	J7/3	CAN-H	CAN_H busline (dominant high)
Pin Positions			

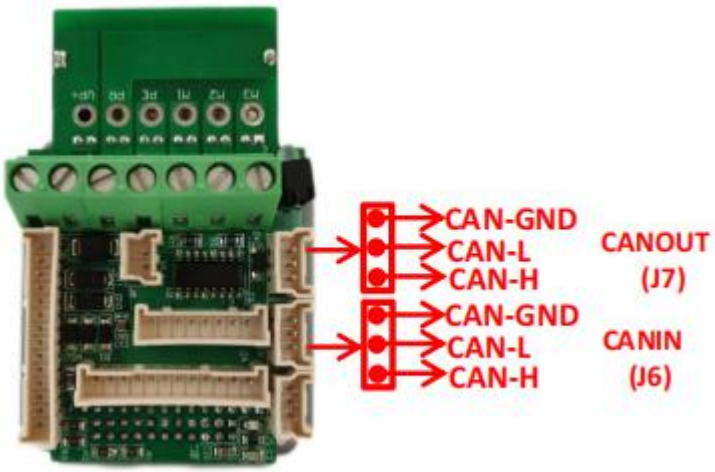


Table 3-7: CANopen - Pin Assignments

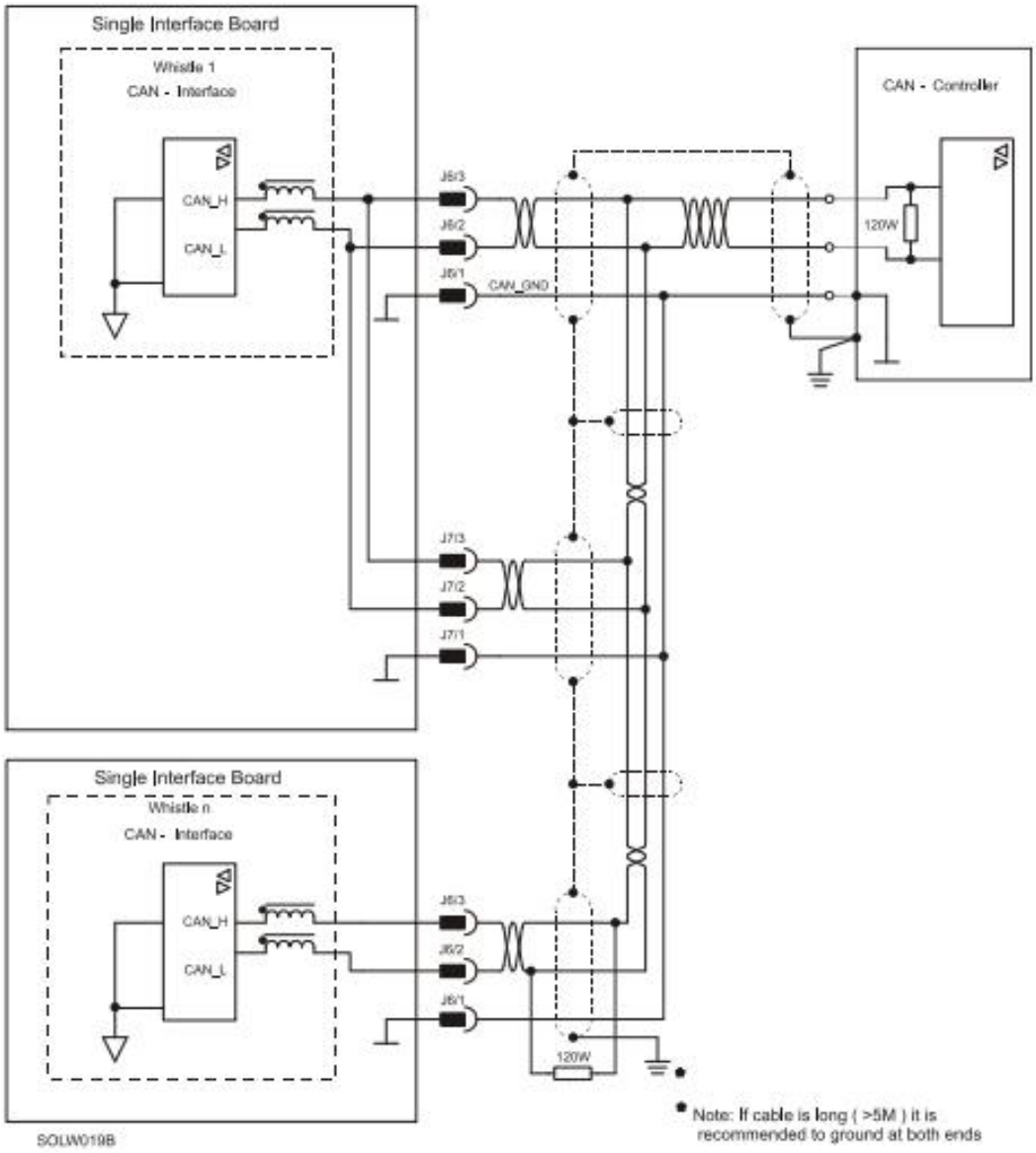


Figure 3-21: CANopen Network Diagram

Caution: When installing CANopen communication, ensure that each servo drive is allocated a unique ID. Otherwise, the CANopen network may hang.

3.9. Powering 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.

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

3.9.1. Initializing the System

After the MOLWhistle 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.

3.10. Heat Dissipation

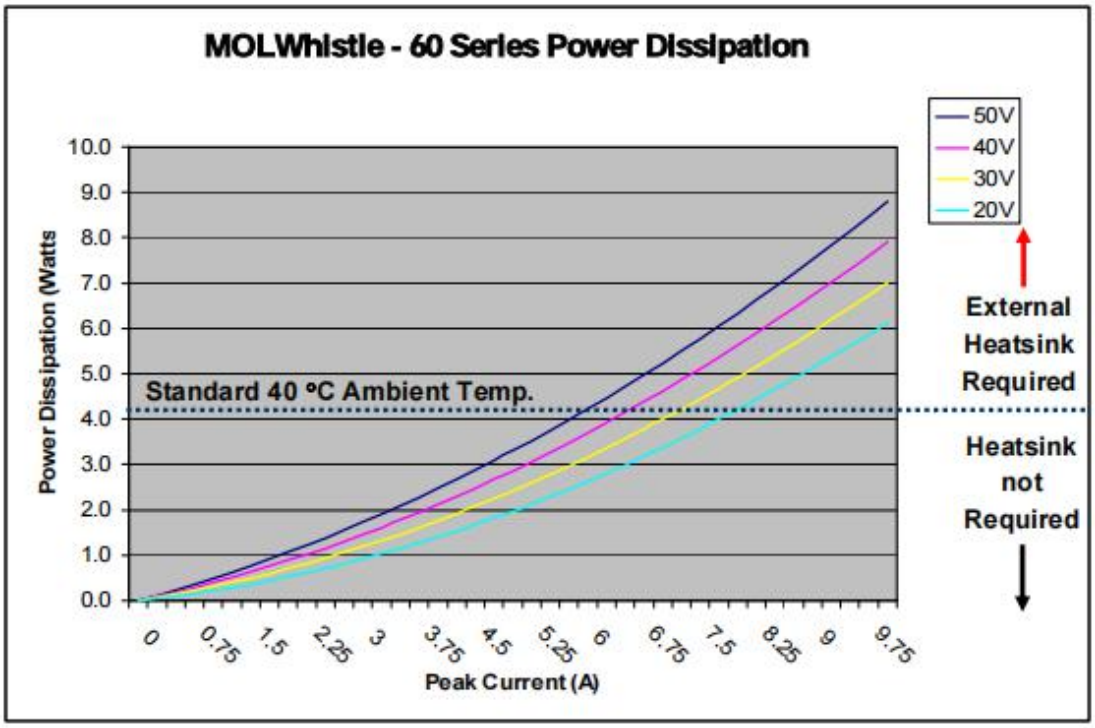
The best way to dissipate heat from the MOLWhistle is to mount it so that its heat sink faces up. For best results leave approximately 10 mm of space between the MOLWhistle's heat sink and any other assembly.

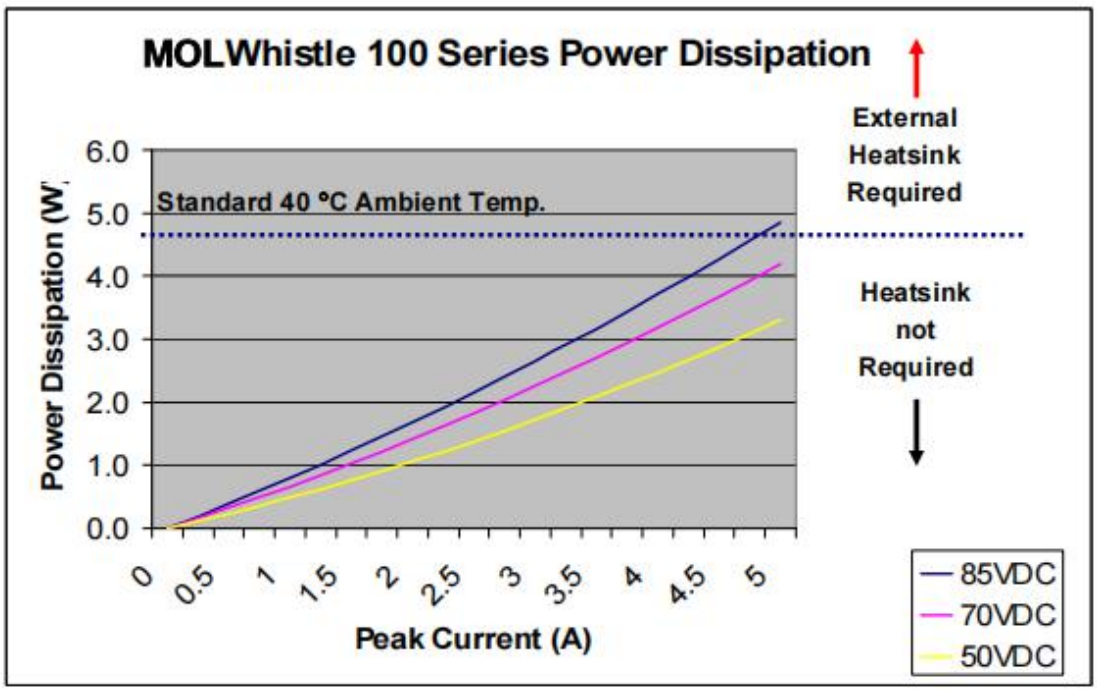
3.10.1. MOLWhistle Thermal Data

- Heat dissipation capability (θ): Approximately 10 °C/W.
- Thermal time constant: Approximately 240 seconds (thermal time constant means that the MOLWhistle will reach 2/3 of its final temperature after 4 minutes).
- Shut-off temperature: 86 °C – 88 °C (measured on the heat sink)

3.10.2. Heat Dissipation Data

Heat dissipation is shown in graphically below:





3.10.3. 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 maximum heat sink temperature to be 80 °C or less.
2. Determine the ambient operating temperature of the MOLWhistle.
3. Calculate the allowable temperature increase as follows:

- For an ambient temperature of 40 °C , ΔT= 80°C – 40 °C = 40 °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 MOLWhistle will need no additional cooling.

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

4.Appendix: MOL Whistle Technical Specifications

A 1.Features

A1.1. Motion Control Modes

- Current/Torque - up to 14 kHz sampling rate
- Velocity - up to 7 kHz sampling rate
- Position - up to 3.5 kHz sampling rate

A1.2. Advanced Positioning Control Modes

- PTP, PT, PVT, ECAM, Follower, Dual Loop, Current Follower
- Fast event capturing inputs
- Fast output compare (OC)
- Motion Commands: Analog current and velocity, PWM current and velocity

A1.3. Advanced Filters and Gain Scheduling

- “On-the-fly” gain scheduling of current and velocity
- Velocity and position with “1-2-4” PIP controllers
- Automatic commutation alignment
- Automatic motor phase sequencing

A1.4. Fully Programmable

- Third generation programming structure with motion commands -
- "Metronome"
- Event capturing interrupts
- Event triggered programming

A1.5. Feedback Options

- Incremental Encoder – up to 20 Mega-Counts (5 Mega-Pulse) per second
- Digital Halls – up to 2 kHz
- Incremental Encoder with Digital Halls for commutation – up to 20 Mega-Counts per second for encoder
- Interpolated Analog Sine/Cosine Encoder – up to 250 kHz (analog signal)
  1. Internal Interpolation - up to x4096
  2. Automatic Correction of amplitude mismatch, phase mismatch, signal offset
  3. Emulated encoder outputs
- Analog Hall Sensor
- Resolver
  1. Programmable 10~15 bit resolution
  2. Up to 512 revolutions per second (RPS)
  3. Emulated encoder outputs
- Tachometer & Potentiometer
- Provide power (5 V, 200 mA max) for one Encoder, Resolver or Hall.

A1.6. Input/Output

- One Analog Input – up to 14-bit resolution
- Six programmable Digital Inputs, optically isolated (two of which are fast event capture inputs).
  1. Inhibit/Enable motion
  2. Software and analog referencestop

3. Motion limitswitches
4. Begin on input
5. Abort motion
6. Homing
7. General-purpose

- Two programmable Digital Outputs, optically isolated (open collector) one with fast output compare (OC)
  8. Brake Control
  9. Amplifier fault indication
  10. General-purpose
  11. Servo enableindication
- PWM current command output for torque and velocity

A1.7. Built-In Protection

- Software error handling
- Abort (hard stops and soft stops)
- Status reporting
- Protection against:
  1. Shorts between motor poweroutputs
  2. Shorts between motor power output andpowerinput/return
  3. Failure of internal powersupplies
  4. Over temperature

① Continuous temperature measurement; temperature can be read on the fly; warning can be initiated x degrees before temp disable is activated.

  5. Over/Under voltage
  6. Loss of feedback
  7. Following error
  8. Current limits

A1.8. Accessories

- Heat sinks

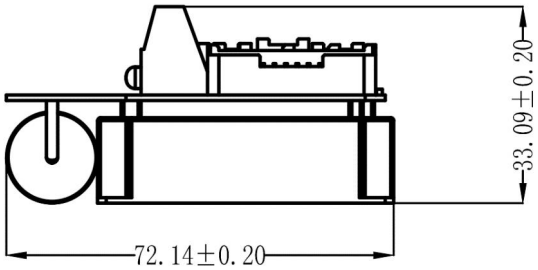
A1.9. Status Indication

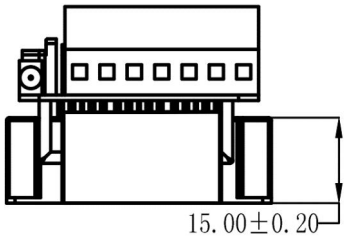
- Output for a bi-color LED

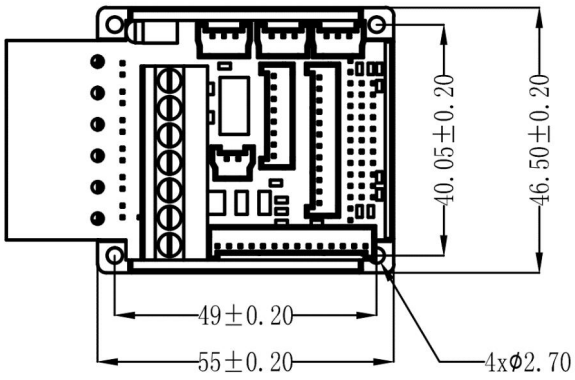
A1.10. Automatic Procedures

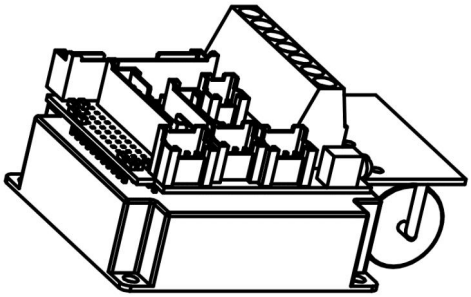
- Commutation alignment
- Phase sequencing
- Current loop offset adjustment
- Current loop gain tuning
- Current gain scheduling
- Velocity loop offset adjustment
- Velocity gain tuning
- Velocity gain scheduling
- Position gain tuning

A 2. *MOLWhistle Dimensions*









A 2.1. MOLWhistle Power Ratings

Feature	Units	A5/100	20/100	20/100R	AR50/100	6/200
Minimum supply voltage	VDC	12				24
Nominal supply voltage	VDC	85				170
Maximum supply voltage	VDC	95				195
Maximum continuous power output	W	400	800	800	4000	960
Efficiency at rated power (at nominal conditions)	%					
Maximum output voltage		> 95% of DC bus voltage at f=22 kHz				
Auxiliary power supply	VDC	12 – 95 VDC (up to 2.5 VA inc. 5 V/200 mA for encoder)				
Amplitude sinusoidal/DC continuous current	A	5	20	20	50	6
Sinusoidal continuous RMS current limit (I_c)	A	3.5	14.1	14.1	35.4	4.24
Peak current limit	A					
Weight	g (oz)	50 g (1.8 ounces)				
Dimensions	mm (in)	(74 x 33 x 46.5 mm)				
Digital in/Digital out/Analog in		4/2/1				

A 3. 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
Maximum operating altitude	Up to 10,000 m (30,000 ft)
Protection level	

A 3.1. Auxiliary Supply

Feature	Details
Auxiliary power supply	*Isolated DC source only*
Auxiliary supply input voltage	12 VDC ~ 95 VDC
Auxiliary supply input power	< 2.5 VA (this includes the 5 V/200 mA load for the main encoder only)

A 4. Control Specifications

A 4.1. Current Loop

Feature	Details
Controller type	Vector, digital
Compensation for bus voltage variations	"On-the-fly" automatic gain scheduling
Motor types	▪ AC brushless (sinusoidal) ▪ DC brushless (trapezoidal) ▪ DC brush ▪ Linear motors ▪ "Voice" coils
Current control	▪ Fully digital ▪ Sinusoidal with vector control ▪ Programmable PI control filter based on a pair of PI controls of AC current signals and constant power at high speed
Current loop bandwidth	< 2.5 kHz
Current loop sampling time	Programmable 70 - 120 µsec
Current sampling rate	Up to 16 kHz; default 11 kHz

A 4.2. Velocity Loop

Feature	Details
Controller type	PI
Velocity control	▪ Fully digital ▪ Programmable PI and FFW control filters ▪ "On-the-fly" gain scheduling ▪ Automatic, manual and advanced manual tuning
Velocity and position feedback options	▪ Incremental Encoder ▪ Digital Halls ▪ Interpolated Analog (sin/cos) Encoder (optional) ▪ Resolver (optional) ▪ Tachometer and Potentiometer (optional) **Note:** With all feedback options, 1/T with automatic mode switching is activated (gap, frequency and derivative).
Velocity loop bandwidth	< 350 Hz
Velocity loop sampling time	140 - 240 µsec (2x current loop sample time)
Velocity loop sampling rate	Up to 8 kHz; default 5.5 kHz
Velocity command options	▪ Analog ▪ Internally calculated by either jogging or step **Note:** All software-calculated profiles support on-the-fly changes.

A 4.3. Position Loop

Feature	Details
Controller type	“1-2-4” PIP
Position command options	▪ Software ▪ Pulse and Direction ▪ Analog Potentiometer
Position loop bandwidth	< 80 Hz
Position loop sampling time	280 - 480 µsec (4x current loop sample time)
Position loop sampling rate	Up to 4 kHz; default 2.75 kHz

A 5. Feedbacks

A 5.1. Feedback Supply Voltage

The MOLWhistle has two feedback ports (Main and Auxiliary). The drive supplies voltage to the main feedback device only.

Feature	Details
Main encoder supply voltage	5 V ±5% @ 200 mA maximum

A 5.2. Main Feedback Options

A 5.2.1. Incremental Encoder Input

Feature	Details
Encoder format	▪ A, B and Index ▪ Differential ▪ Quadrature
Interface	RS-422
Input resistance	Differential: 120 Ω (TBD)
Maximum incremental encoder frequency	Maximum absolute: 5 MHz pulses
Minimum quadrature input period (PIN)	112 nsec
Minimum quadrature input high/lowperiod (PHL)	56 nsec
Minimum quadrature phase period (PPH)	28 nsec
Maximum encoder input voltage range	Common mode: ±7 V Differential mode: ±7 V

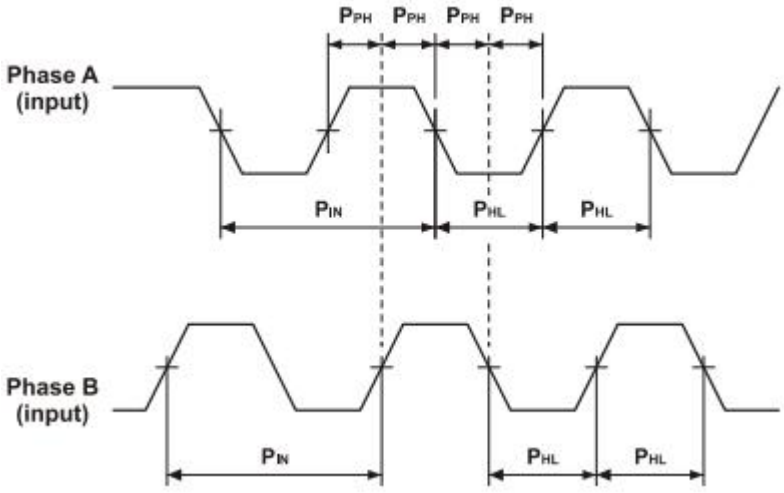


Figure A-1: Main Feedback - Encoder Phase Diagram

A 5.2.2. Digital Halls

Feature	Details
Halls inputs	▪ HA, HB, HC . ▪ Single ended inputs ▪ Built in hysteresis of 1 V for noise immunity
Input voltage	Nominal operating range: 0 V < VIn_Hall < 5 V Maximum absolute: -1 V < VIn_Hall < 15 V High level input voltage: V InHigh > 2.5 V Low level input voltage: V InLow < 1 V
Input current	Sink current (when input pulled to the common): 3mA Source current: 1.5 mA (designed to also support open collector Halls)
Maximum frequency	fMAX ：2kHz

A 5.2.3.Interpolated Analog Encoder (Sine/Cosine)

Feature	Details
Analog encoder format	Sine and Cosine signals
Analog input signal level	▪ Offset voltage: 2.2 V – 2.8 V ▪ Differential, 1 V peak to peak
Input resistance	Differential 120 Ω
Maximum analog signal frequency	fMAX ：250 kHz
Interpolation multipliers	Programmable: x4 to x4096
Maximum “counts” frequency	80 mega-counts/sec “internally”
Automatic errors correction	Signal amplitudes mismatch Signal phase shift Signal offsets
Encoder outputs	See Auxiliary Encoder Outputs specifications (A.5.3)

A 5.2.4. Resolver

Feature	Details
Resolverformat	▪ Sine/Cosine ▪ Differential
Inputresistance	Differential 2.49kΩ
Resolution	Programmable: 10 ~ 15bits
Maximum electrical frequency(RPS)	512 revolutions/sec
Resolver transferratio	0.5
Referencefrequency	1/Ts (Ts = sample time in seconds)
Reference voltage	Supplied by the MOLWhistle
Reference current	Up to ±50mA
Encoder outputs	See Auxiliary EncoderOutputspecifications (A.5.3)

A 5.2.5. Tachometer*

Feature	Details
Tachometer format	Differential
Maximum operatingdifferential voltage for TAC1+,TAC1-	±20 V
Maximum absolute differential input voltage for TAC1+,TAC1-	±25 V
Maximum operatingdifferential voltage for TAC2+,TAC2-	±50 V
Maximum absolute differential input voltage for TAC2+,TAC2-	±60 V
Input resistance for TAC1+,TAC1-	46kΩ
Input resistance for TAC2+,TAC2-	100kΩ
Resolution	14 bit

❖ Only one Tachometer port can be used at a time (either TAC1+/TAC1- or TAC2+/TAC2-). TAC1+/TAC1- is used in applications with having a Tachometer of less than 20 V. TAC2+/TAC2- is used in applications with having a Tachometer of between 20 V and 50V.

A 5.2.6. Potentiometer

Feature	Details
Potentiometer Format	Single-ended
Operating Voltage Range	0 ~ 5 V supplied by the MOLWhistle
Potentiometer Resistance	100 Ω ~ 1 kΩ … above this range, linearity is affected detrimentally
Input Resistance	100kΩ
Resolution	14 bit

A 5.3. Auxiliary Feedback Port (output mode YA[4]= 4)

Feature	Details
Encoder output and main buffered output	▪ A, B, Index ▪ Differential outputs ▪ Quadrature
Interface	RS-422
Output current capability	▪ Driving differential loads of 200 Ω on INDEX/INDEX-, CHB/CHB- and CHA/CHA- pairs
Available as options	▪ Simultaneous buffered outputs of main-incremental encoder input ▪ Simultaneous emulated encoder outputs of analog encoder input ▪ Simultaneous emulated encoder outputs of resolver input
Maximum frequency	fMAX : 5 MHz pulses/output
Index (marker)	Length of pulse is one quadrature (one quarter of an encoder cycle) and synchronized to A&B

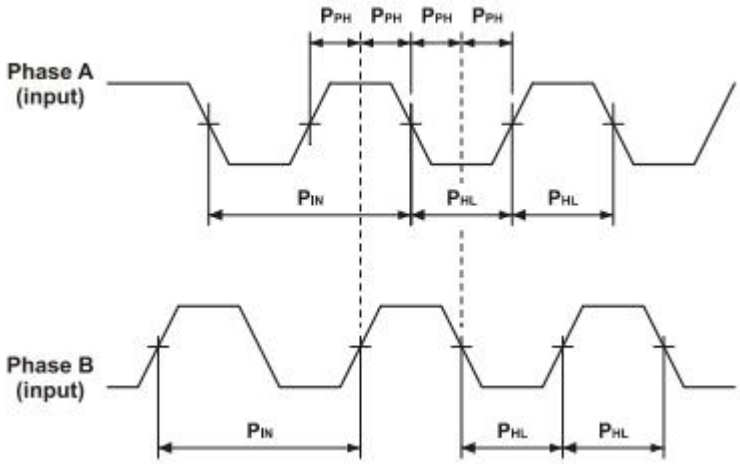


Figure A-2: Auxiliary Feedback - Encoder Phase Diagram

A 5.4. Auxiliary Feedback Port (input mode YA[4]= 2, 0)

Feature	Details
Encoder input, pulse and directioninput	▪ A, B, Index ▪ Differential
Input voltage	Vin Low: 0 V < VIL < 0.8 V Vin High: 2 V < VIH < 5V Maximum absolute voltage: 0 < Vin < 5.5 V Input current: ±1 µA
Available as options	▪ Differential Buffered Encoder inputs ▪ Differential Buffered Pulse and Direction inputs
Edge separation between A &B	Programmable number of clocks to allow adequate noise filtering at remote receiver of emulated encoder signals
Index (marker):	Length of pulse is one quadrature (one quarter of an encoder cycle) and synchronized to A&B

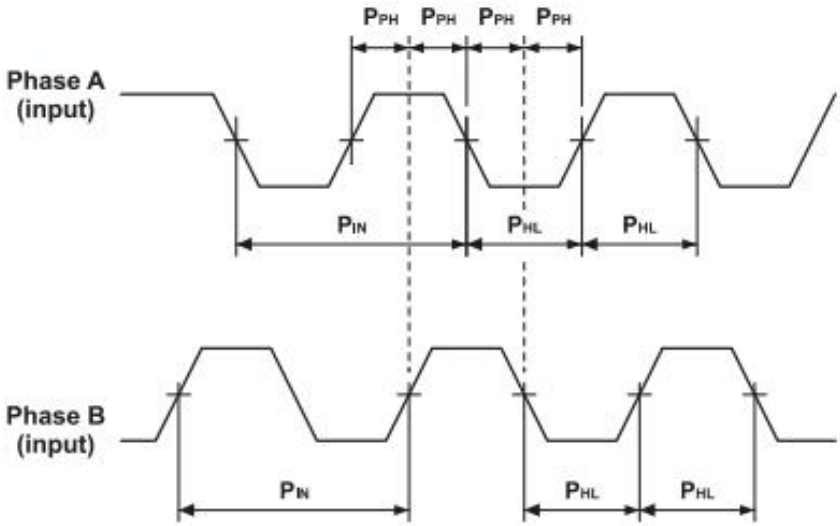
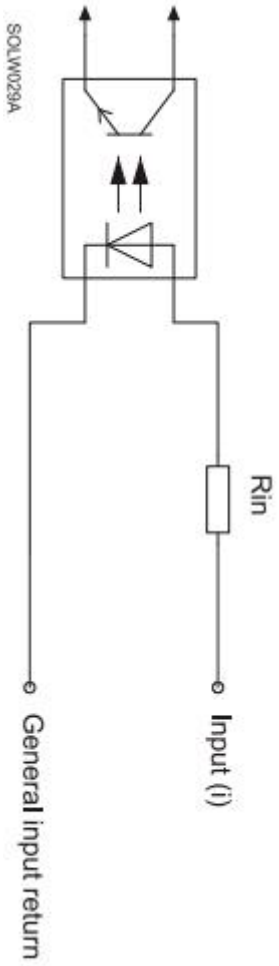


Figure A-3: Auxiliary Feedback - Encoder Phase Diagram

A 6. I/Os

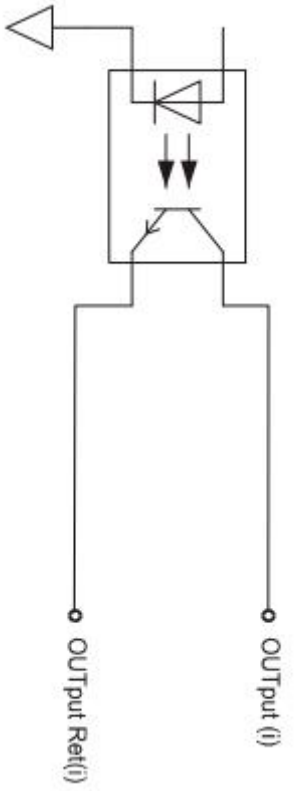
The MOLWhistle has 4 Digital Inputs, 2 Digital Outputs and 1 Analog Input.

A 6.1. Digital Input Interfaces

Feature	Details	Schematic Diagram
Type of input	▪ Optically isolated ▪ All four inputs share one signal return line	
Input current for 24V DIlevel	Rin=10.52k, Iin = 2.2 mA @ Vin = 24V	
High-level input voltage	5 V < Vin < 24V	
Low-level input voltage	0 V < Vin < 1V	
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<4xTS If input is set to General input, execution depends on program. Typical execution time: ≅ 0.5 msec.	
High-speed inputs – 5 & 6 minimum pulse width, in high-speed mode	T < 5 µsec **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 same value as digital filter (EF) of main encoder. ▪ Highest speed is achieved when turning on optocouplers.	

DigitalInput Schematic

A 6.2. Digital Output Interface

Feature	Details	Connector Location
Type of output	▪ Optically isolated ▪ Open collector and open emitter	 ***Digital Output Schematic***
Maximumsupply output (Vcc)	30 V	
Max. output current Iout (max) (Vout =Low)	Iout (max) ≤ 2A	
VOL at maximum output voltage (low level)	Vout (on) ≤24 V	
RL	External resistor RL must be selected to limit output current to no more than 10 mA. $R_L = \frac{Vcc - VOL}{Io(max)}$	
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 x TS If output is set to General output and is executed from a program, the typical time is approximately 0.5 msec.	

A 6.3. Analog Input

Feature	Details
Maximum operating differential voltage	± 10 V
Maximum absolute differential input voltage	± 16 V
Differential input resistance	3.74 kΩ
Analog input command resolution	14-bit

A 7. Communications

Specification	Details
RS-232	**Signals:** ▪ RxD , TxD , Gnd ▪ Full duplex, serial communication for setup and control. ▪ Baud Rate of 9,600 ~ 57,600 bit/sec.
CANopen	**CANbus Signals:** ▪ CAN_H, CAN_L, CAN_GND ▪ Maximum Baud Rate of 1 Mbit/sec. **Version:** ▪ DS 301 V4.01 **Layer Setting Service and Protocol Support:** ▪ DS 305 **Device Profile** (drive and motion control)**:** ▪ DS 402

A 8. Pulse Width Modulation (PWM)

Feature	Details
PWM resolution	12-bit
PWM switching frequency on the load	2/Ts (factory default 22 kHz on the motor)

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*

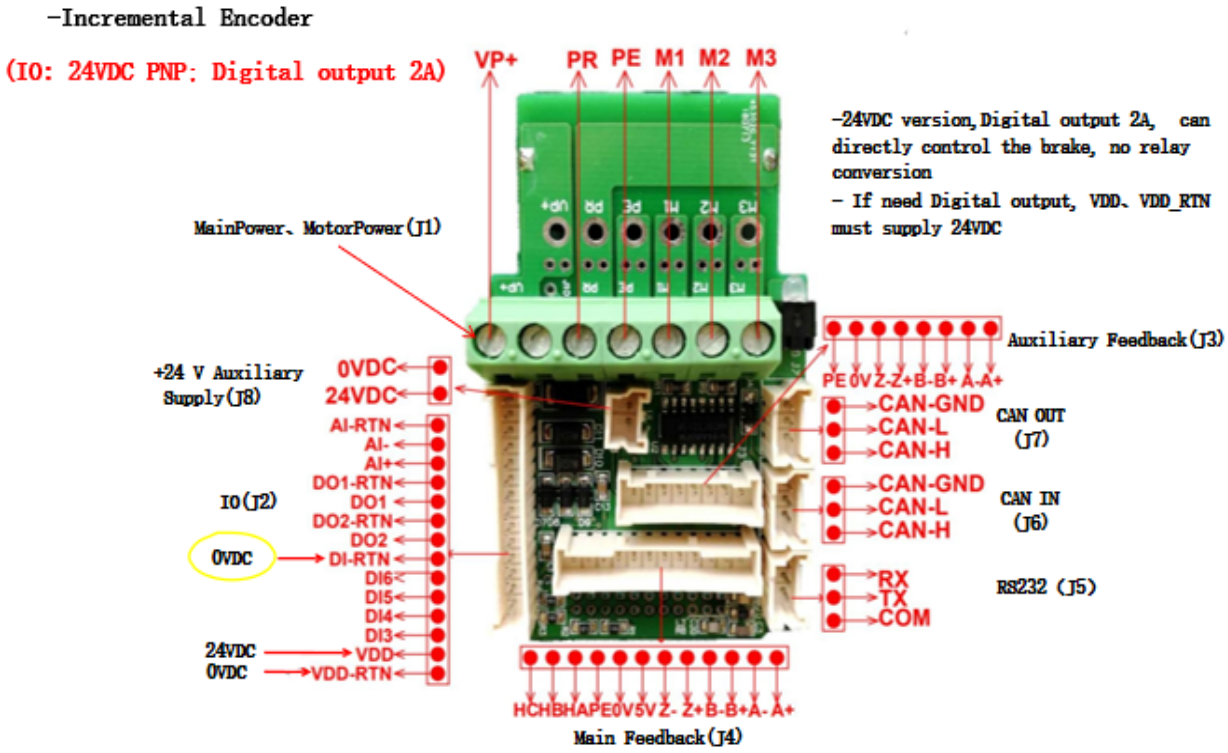
Specification	Description
In compliance with **2002/96/EC**	Waste Electrical and Electronic Equipment regulations

* 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

A 10. *MOLWhistle interface diagram*



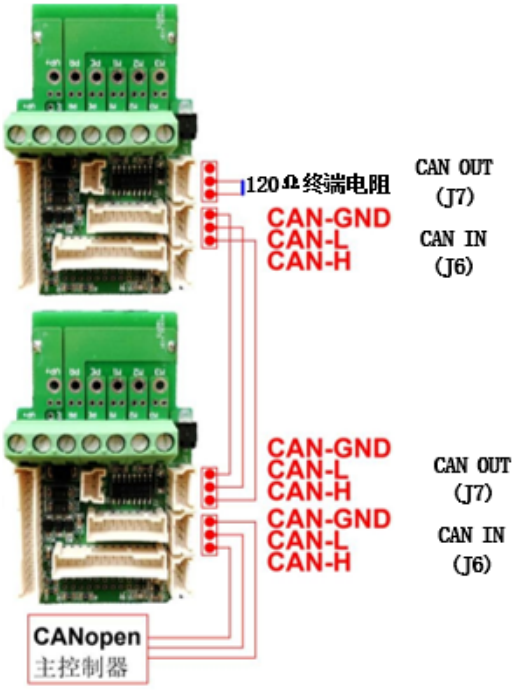
A 11. *CANopen Network topology and Settings*

The CANopen network topology is as follows:

●Set CANopen ID and baud rate by Composer-- terminal
-PP [13] set ID
-PP[14] Set the baud rate. Refer to Elmo CR manual page 3 - 112 for details

●Such as:
- Drive 1, ID set to 1, so PP[13]=1 -- Enter
- Drive 2, ID set to 2, so PP[13]=2 -- Enter

The Baud rate of the primary controller must be consistent with that of all drives, such as 500K

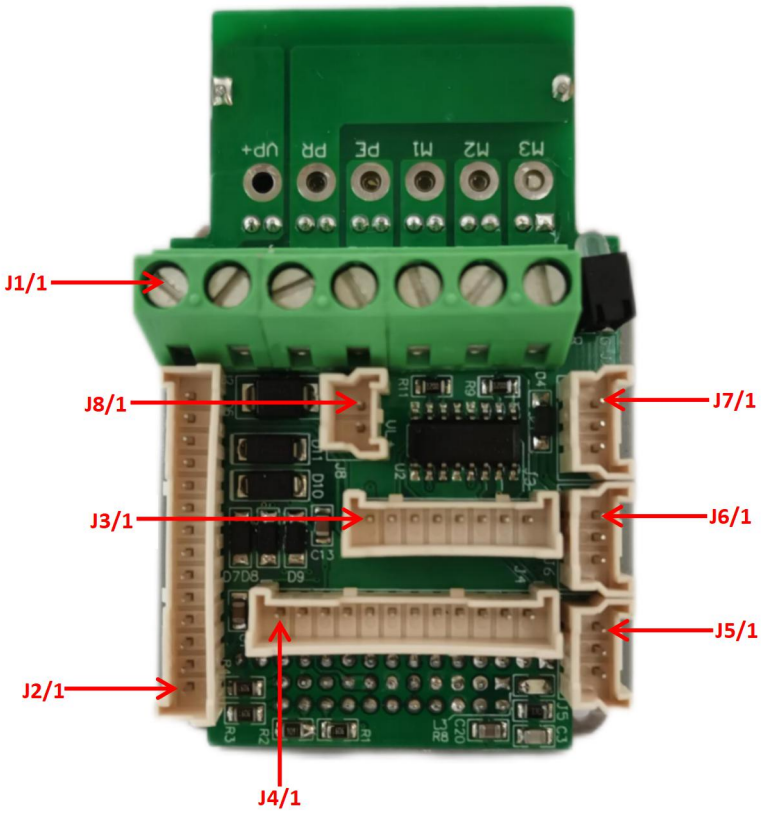


Chapter5：MOL Whistle Cable Kit- CBL-MOLWHIKIT

5.1. MOL Whistle Connectors

The table below presents the connector panel of the Solo Whistle drive and specifies the cable connectors.

Pins	Type	Connector Manufacturer and Part Number	Port
7	3.5 mm Pitch	Wires	J1
14	2 mm Pitch	Molex 35507 1200	J2
8	2 mm Pitch	Molex 35507 0800	J3
12	2 mm Pitch	Molex 35507 1200	J4
3	2 mm Pitch	Molex 35507 0300	J5
3	2 mm Pitch	Molex 35507 0300	J6
3	2 mm Pitch	Molex 35507 0300	J7
2	2 mm Pitch	Wires	J8
Connector Locations			



5.2. Cable Kit Details

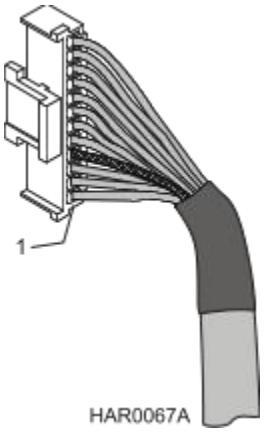
The kit contain six cables in CBL-MOLWHIKIT for the MOLWhistle between 28 to 24 AWG. All the cables are 1 m long. The contents of each kit are listed below:

Cable Application	CBL-MOLWHIKIT	Pins	Pins Location
Main Feedback	CBL-MOLFBK1M	12	J4
Auxiliary Feedback	CBL-MOLAUXFBK1M	8	J3
RS232 Communication	MOL-RS232	3	J5
	RS232-USB	Standard RS232 cable	
CANIN	MOL-CAN1R	3	J6
CANOUT	MOL-CAN0.3	3	J7
	MOL-CANT（120Ω resistor termination）	3	J7
CBL-MOLIO1	I/O Cable	14	J2

5.3. Main Feedback Cable (CBL-MOLFBK1M)

The main feedback cable is provided as a cable between 28 to 24 AWG, six twisted-pair shielded. There is one type of feedback cable, which uses a 12-pin Molex 2 mm pitch plug on the *SimplIQ* side.

The Main Feedback Cable (CBL-MOLFBK1M) is open on the motor side so that it can be connected to customer-specific connectors.

Pin No.	Color	Twisted & Shielded Wire	Description	
1	Black/white		see Installation Guide	
2	Red/white		see Installation Guide	
3	Brown/white		see Installation Guide	
4	Drain wire		see Installation Guide	
5	Blank	Pair	see Installation Guide	
6	Red			
7	orange/white	Pair	see Installation Guide	
8	orange			
9	blue/white	Pair	see Installation Guide	
10	blue			
11	Green/white	Pair	see Installation Guide	
12	green			

The specific functionality of each pin is fully outlined in the MOLWhistle *Installation Guide*.

Figure 1 : Main Feedback Cable (Part No. CBL-MOLFBK1M)

5.4. Auxiliary Feedback Cable (CBL-MOLAUXFBK1M)

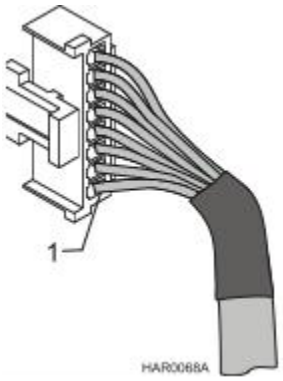
The auxiliary feedback cable is provided as a cable between 28 to 24 AWG twisted-pair shielded. It is connected using an 8-pin Molex 2 mm pitch plug.

Four options — described in the *Auxiliary Feedback* section(s) in the MOLWhistle *Installation Guide* — are available for auxiliary feedback:

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

The Auxiliary Feedback cable (CBL-MOLAUXFBK1M) is open on the motor side so that it can be connected to customer-specific connectors.

The general pinout of the auxiliary feedback cable is as follows:

Pin No.	Color	Twisted & Shielded Wire	Description	
1	Drain wire		see Installation Guide	
2	Blank		see Installation Guide	
3	orange/white	Pair	see Installation Guide	
4	orange			
5	blue/white	Pair	see Installation Guide	
6	blue			
7	Green/white	Pair	see Installation Guide	
8	green			

The specific functionality of each pin is fully outlined in the MOLWhistle *Installation Guides*.

Figure 2: Auxiliary Feedback Cable (Part No. CBL-MOLAUXFBK1M)

5.5. Communication Cables

The communication cables are provided as cables between 26 AWG two twisted pair shielded. They are connected using a 3-pin Molex 2 mm pitch plug. Elmo drives can communicate using the following options:

- RS-232, full duplex
- CAN open (CAN in & CAN out)

The Communication Cables (MOL-RS232) ,It is connected using a 3-pin Molex 2 mm pitch plug connector to the MOLWhistle J5(RS232) connector,and using a D-type 9-pin female connector to the standard RS232 communication cable.

5 5.1.RS232 Communication Cable (MOL-RS232)

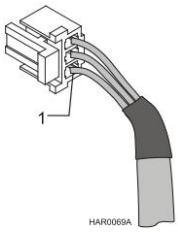
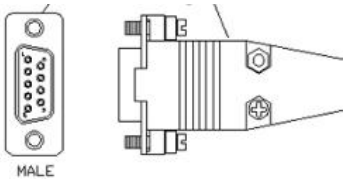
	Pin No.	Color	Signal	Pin No.	
	1	blue	RX	3	
	2	blue/white	TX	2	
	3	Brown/white	COMRET	5	

Figure 3: RS232 Communication Cable (Part No. MOL-RS232)

5 5.2. CAN In Communication Cables (MOL-CAN1R)

The Communication Cables (MOL-CAN1R) ,It is connected using a 3-pin Molex 2 mm pitch plug connector to the MOLWhistle J6(CANIN) connector,and using a RJ45 connector to the controller .

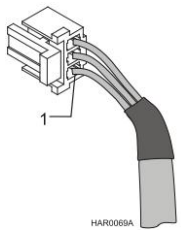
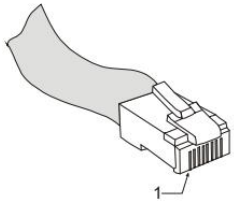
	Pin No.	Color	Signal	Pin No.	
	1	Orange/White	CAN_GND	3	
	2	Green	CAN_L	2	
	3	Green/white	CAN_H	1	

Figure 4: CAN In Communication Cable (Part No.MOL-CAN1R)

5 5.3. CAN Out Communication Cables (MOL-CAN0.3)

The Communication Cables (MOL-CAN0.3) is 20 cm long and is used to daisy-chain CAN nodes. On the MOLWhistle, this cable is connected to the External Dual Can Port. They are connected using a
3-pin Molex 2 mm pitch plug.

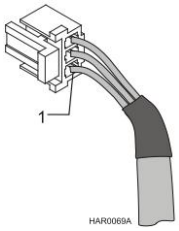
Pin No.	Color	Twisted & Shielded Wire	Signal	Description	
1	Orange/White		CAN_GND	CAN ground	
2	Green	Pair	CAN_L	CAN_L busline (dominant low)	
3	Green/white		CAN_H	CAN_H busline (dominant high)	

Figure 5: CAN Out Communication Cable (Part No.MOL-CAN0.3)

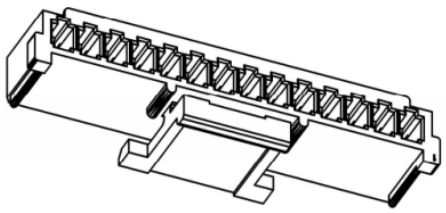
5 5.4. CAN Terminator (MOL-CANT)

The CAN terminator is used only for CAN applications. It is used to terminate the CAN communication line.
The CAN terminations prevent the CAN signal reflection at the end of the physical lines. The reflection suppresses the CAN signal which may lead to Error Frames and causes the CAN
controller message to be discarded.120 Ω resistors are required on both physical ends of the CAN network to prevent the signal reflection.

5.6. I/O Cable (CBL-MOLIO1)

The I/O cable is provided as a cable between 28 to 24 AWG, seven twisted-pair shielded. There is one type of I/O cable, which uses a 14-pin Molex 2.0 mm pitch plug on the *SimplIQ* side.

The I/O Cable (CBL-MOLIO1) is open on the controller side so that it can be connected to customer-specific connectors.

Pin No.	Color	Description	
1	Black	VDD-RET	
2	Red	VDD	
3	Black/White	DI3	
4	Red/White	DI4	
5	Brown/White	DI5	
6	Purple/white	DI6	
7	Purple	DI-RET	
8	Blue	DO2	
9	Blue/white	DO2-RET	
10	Green	DO1	
11	Green/white	DO1-RET	
12	Orange	AI+	
13	Orange/White	AI-	
14	Brown	AI-RET	

The specific functionality of each pin is fully outlined in the Solo Whistle *Installation Guide*.

Figure 5: I/O Cable (Part No. CBL-MLXFDBK)