Encoder Conditioning Unit (ECU) Hardware Manual

Revision: 1.01.00

Global Technical Support

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EU Declaration of Conformity

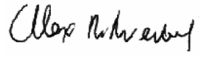
Manufacturer	Aerotech, Inc.
Address	101 Zeta Drive Pittsburgh, PA 15238-2897 USA
Product	ECU
Model/Types	All

This is to certify that the aforementioned product is in accordance with the applicable requirements of the following Directive(s):

2014/35/EU	Low Voltage Directive LVD
2011/65/EU	RoHS 2 Directive

and has been designed to be in conformity with the applicable requirements of the following documents when installed and used in accordance with the manufacturer's supplied installation instructions.

BS EN 61000
BS EN 55011

Name	 / Alex Weibel
Position	Engineer Verifying Compliance
Location	Pittsburgh, PA

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Chapter 1: Encoder Conditioning Unit (ECU)

The ECU interface is designed for use with any 1 Vpp analog encoder.

It dynamically applies Automatic Offset, Balance and Gain Control (AOC, ABC, AGC) to the input signals. Accurate, constant amplitude 1 Vpp industry standard signals are then output.

A tri-colored LED indicates input signal strength and allows ease of setup for optimum performance. If this LED is not visible when the interface is installed, a separate external setup signal can be used and a calibration cycle also helps to simplify installation.

These features result in the output signals having very low cyclic error, typically less than 50 nm.

The interface is fully RoHS compliant and also supports readheads with single or dual limit outputs.

- Compatible with all standard 1 Vpp analog output readheads
- Outputs accurate, industry standard, 1 Vpp analog differential signals
- Low cyclic error
- Tri-color integral setup LED
- User selectable automatic gain control (AGC)
- Automatic offset and balance control (AOC and ABC)
- Single or dual-limit capability

1.1. Interface Features

1.1.1. Self-Tuning Active Correction

The ECU interface actively corrects for input signal imperfections to optimize system accuracy. Corrections are made for the following:

Automatic Offset Control (AOC)	adjusts offset independently for the sine and cosine signals
Automatic Gain Control (AGC)	ensures consistent 1 Vpp signal amplitude
Automatic Balance Control (ABC)	adjusts the gain to equalize the sine and cosine signals

These correction mechanisms operate over the full working speed range of the readhead. The user can disable/enable the AGC by pressing the calibrate button for greater than 3 seconds.

1.1.2. LED Indicators

The tri-colored SETUP LED provides visual feedback of signal strength and error condition for setup and diagnostic use. It flashes Off momentarily to indicate a reference mark, up to 100 mm/s only

Table 1-1: Setup LED

Color	State	Indication	%
Purple	FLASHING	High Signal Alarm Condition	>135%
	ON	High Signal	>110% and <135%
Blue	FLASHING	Over Speed Alarm Condition	
	ON	Optimum Signal	>90% and <110%
Green	ON	Acceptable Signal	>70% and <90%
Orange	ON	Low Signal	>50% and <70%
Red	ON	Unacceptable Signal	>20% and <50%
	FLASHING	Unacceptable Signal Alarm Condition	<20%

The Yellow CAL/AGC LED indicates when the ECU is in a calibration routine and whether or not AGC is active

Table 1-2: CAL/AGC LED

Color	State	Indication
Yellow	ON	AGC active
	OFF	AGC inactive
	SLOW FLASH	calibration routine
	FAST FLASH	calibration failure

1.1.3. Calibration Procedure

The calibration procedure is required to optimize the gain, balance and offset of the analog input signals in the ECU interface.These settings are then stored and recalled for initial use at startup.

To calibrate the system, the following sequence should be carried out:

- Prior to calibration, AGC should be off. To switch AGC on or off, the calibrate button should be pressed for more than 3 seconds. When AGC is on, the CAL/AGC LED will be on and when AGC is off, the CAL/AGC LED will be off.
- Install the readhead and set up to obtain optimum (1 Vpp) signal amplitude
- Enter the calibration routine by pressing the CALIBRATE button momentarily. The calibration routine is indicated by slow flashing of the CAL/AGC LED.
- Traverse the readhead slowly past the scale until the CAL/AGC LED stops flashing. The calibration cycle is now complete.

If calibration fails, the CAL/AGC LED will flash quickly instead of switching off. If this happens the CALIBRATE button should be pressed momentarily to exit the calibration routine. The calibration procedure should then be repeated.

If the unit continues to fail calibration, factory default settings should be restored by powering down, then pressing the CALIBRATE button as power is re-applied. The calibration procedure should then be repeated.

NOTE: To exit the calibration routine at any time, the CALIBRATE button should be pressed momentarily.

1.2. Operating and Electrical Specifications

Table 1-3: Analog Specifications

Specification		Description
Power Supply	5 V -5% + 10%	**ANALOG**: 150 mA current consumption (interface only), when terminated with 120 Ω. Provision is given to feed a maximum of an additional 100 mA to the readhead. The interface will be fully active <300 ms after power is applied. Encoder systems must be powered from a 5 V dc supply complying with the requirements for SELV of standard EN (IEC) 60950. Provision is given for remote sensing via two conductors of the cable. The interface and readhead are protected from reverse voltage and over voltage of up to 12 V.
	Ripple	200 mVpp maximum @ frequency up to 500 kHz maximum
Acceleration	Operating	500 m/s^2 BS EN 60068-2-7:1993 (IEC 68-2-7:1983)
Shock	Non-Operating	1000 m/s^2, 6 ms, 1/2 sine BS EN 60068-2-27:1993 (IEC 68-2-27:1987)
Vibration	Operating	100 m/s^2, 55 to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995)
Temperature	Storage	-20°C to +70°C
	Operating	0°C to +55°C
Humidity	Storage	95% maximum relative humidity (non-condensing)
	Operating	80% maximum relative humidity (non-condensing)
Sealing		IP40
Mass		95 g
EMC Compliance		BS EN 61000 BS EN 55011
Connectors (input/output)		15-Pin D type socket/plug

1.3. I/O Signals

The ECU interface is designed to be used with industry standard 1 Vpp readheads. Cos, Sin, and reference mark differential input signals should have nominal signal amplitude of 1 Vpp developed across 120 Ω input termination resistor.

One or two open collector limit switch signals, active high or active low can also be input.

Table 1-4: 15 Pin 'D' Type Socket

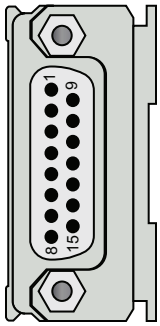
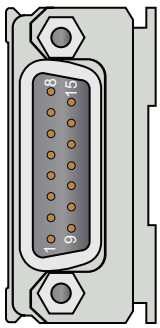
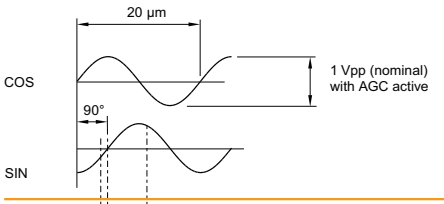
Pin	Signal	Description	Connector
1	COS-N	Cosine-N	
2	SIN-N	Sine-N	
3	MRK	Reference mark	
4	5 V	5 V power supply	
5	5 V	5 V power supply	
6	-	Not connected	
7	SETUP	Setup signal/second (P) limit switch on dual limit readheads	
8	V_q	First (Q) limit switch	
9	COS	Cosine	
10	SIN	Sine	
11	MRK-N	Reference mark	
12	COM	0 V power supply	
13	COM	0 V power supply	
14	-	Do not connect	
15	Inner	Cable's inner shield connection to 0 V	

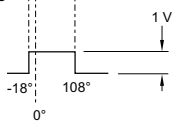
Table 1-5: 15 Pin 'D' Type Plug

Pin	Signal	Description	Connector
1	COS-N	Cosine-N	
2	SIN-N	Sine-N	
3	MRK	Reference mark	
4	5 V	5 V power supply	
5	5 V	5 V power supply	
6	BID	Bi/uni-directional reference mark select	
7	SETUP	Setup signal/P limit switch on dual limit readheads	
8	V_q	Q limit switch	
9	COS	Cosine	
10	SIN	Sine	
11	MRK-N	Reference mark	
12	COM	0 V power supply	
13	COM	0 V power supply	
14	DIR	Direction selector for reference mark	
15	-	Not connected	

Incremental 2 channels differential sinusoids in quadrature (90° phase shifted)



Reference



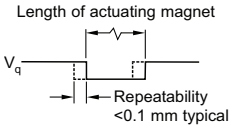
Differential pulse V_0 -18° to 108°. Duration 126° (electrical). Repeatability of position (uni-directional) maintained within ±10 °C from installation temperature and for speed <250 mm/s.

NOTE: The set-up LED on the ECU interface cannot be used for reference mark set-up. Only the readhead LED should be used for this purpose.

Limit

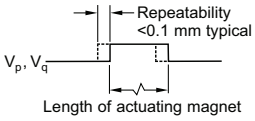
Open collector output

Single limit



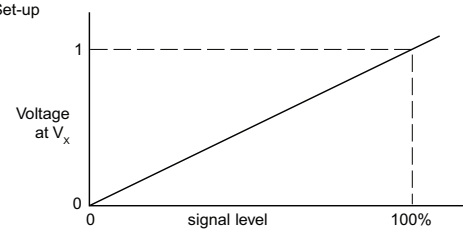
Asynchronous pulse Q

Dual limit



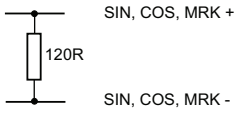
Asynchronous pulse P, Q

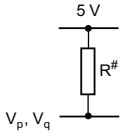
Set-up



Setup signal voltage proportional to signal amplitude

Recommended signal termination

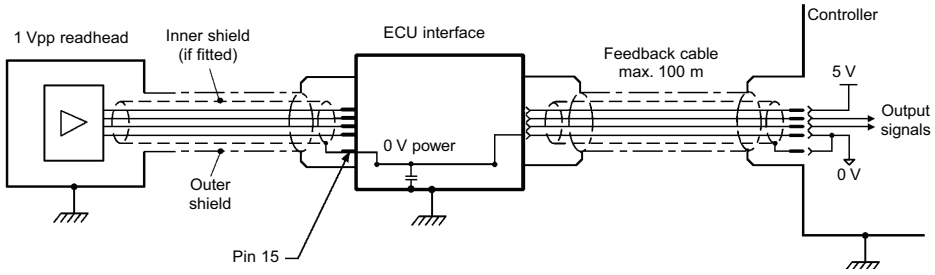




#Select R so that the maximum current does not exceed 20 mA.

Electrical connections

Grounding and shielding



NOTE: Extension cable inner shield must be connected to 0V at customer electronics only

Figure 1-1: Analog Output Specifications

WARNING: The outer shield should be connected to the earth ground. The inner shield should be connected to 0V. Care should be taken to ensure that the inner and outer shields are insulated from each other. If the inner and outer shields are connected together, this will cause a short between 0V and earth, which could cause electrical noise issues.

1.4. Dimensions

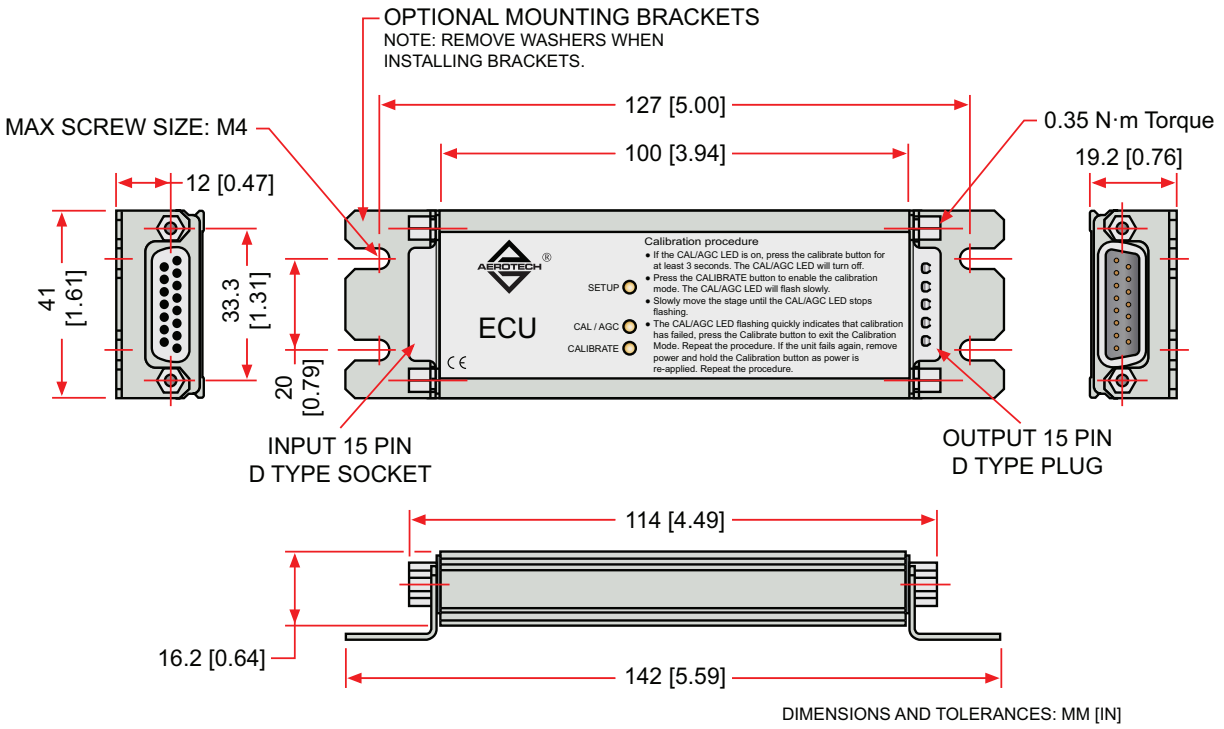


Figure 1-2: ECU Dimensions

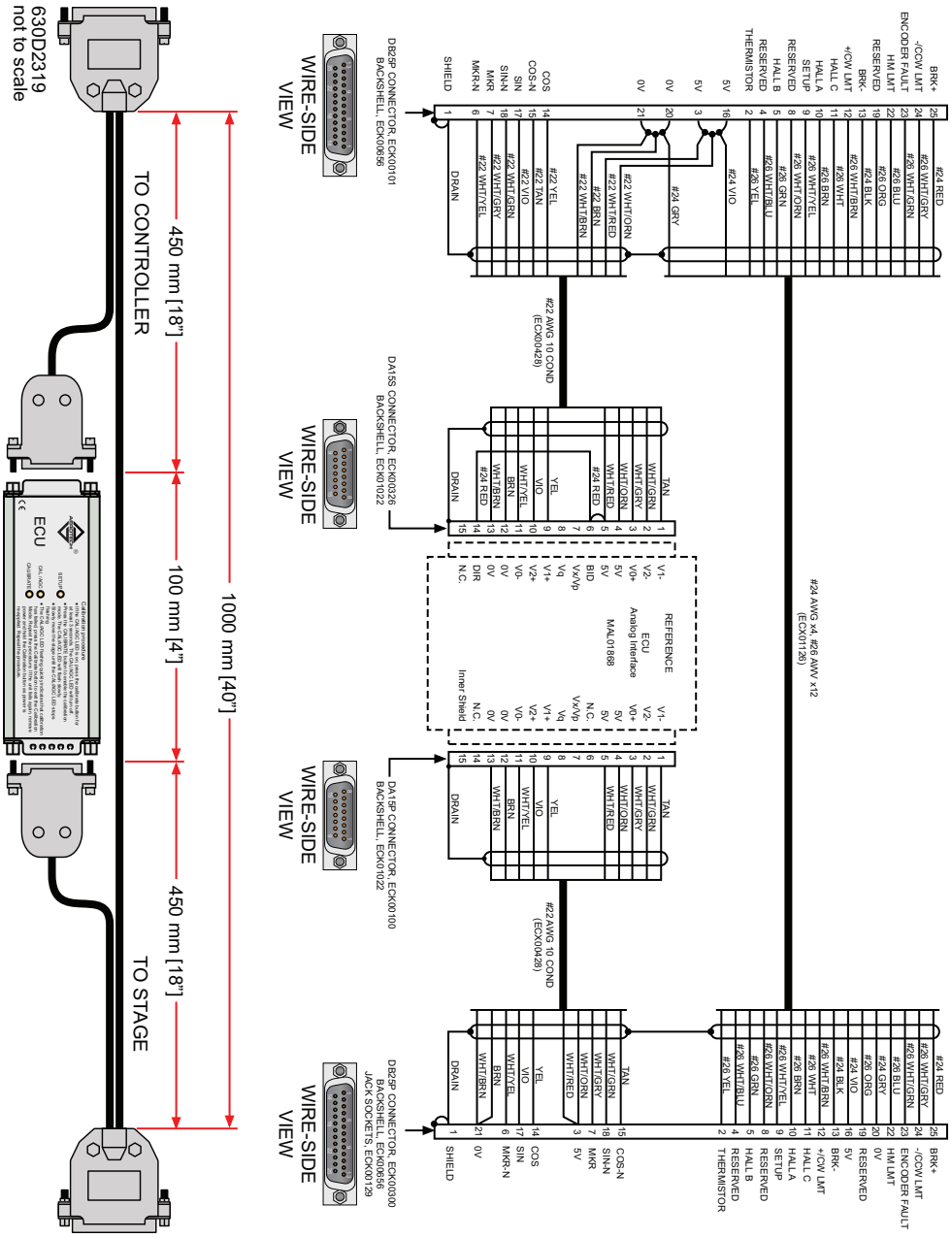


Figure 1-3: ECU Standard Interconnection Cable (C23190)

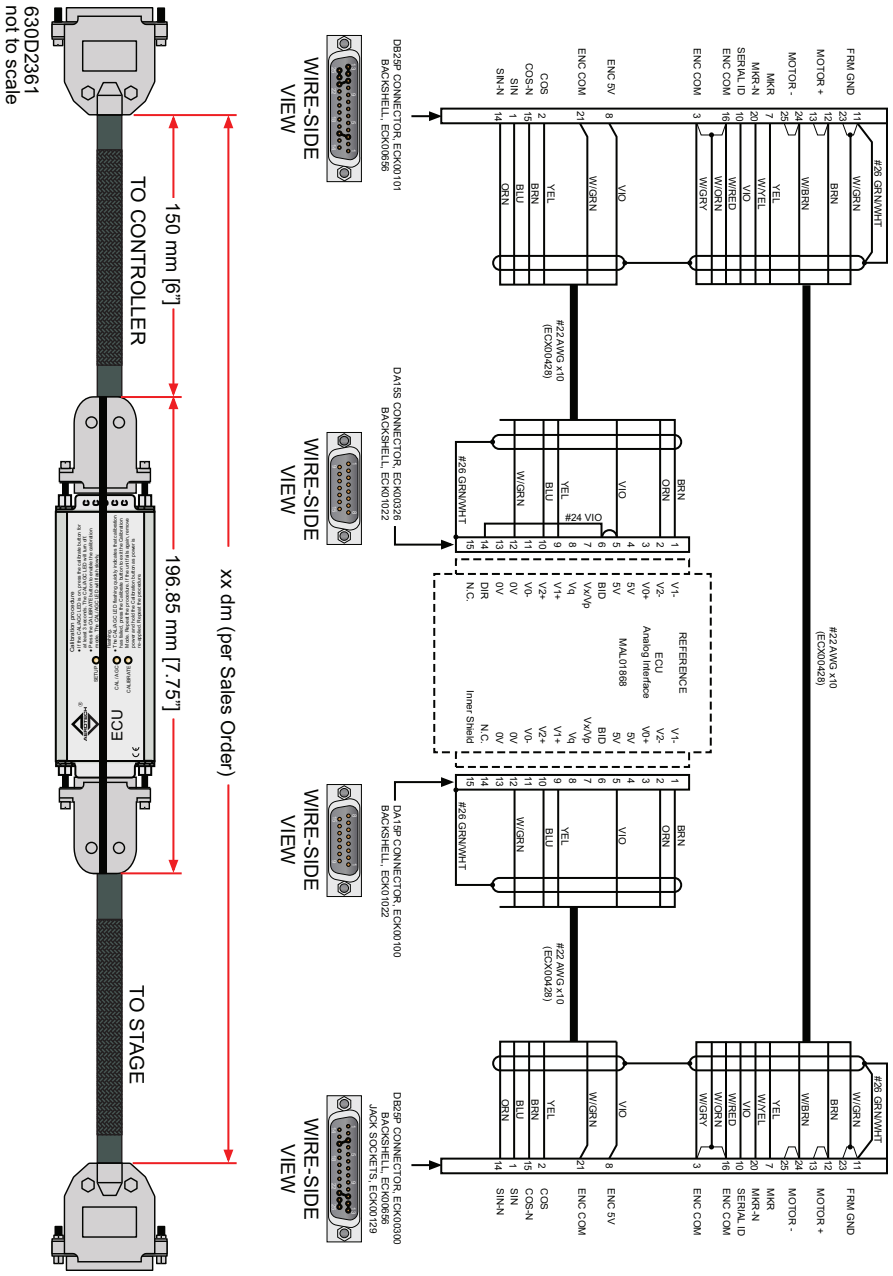


Figure 1-4: ECU Cable for TLG (C23610)

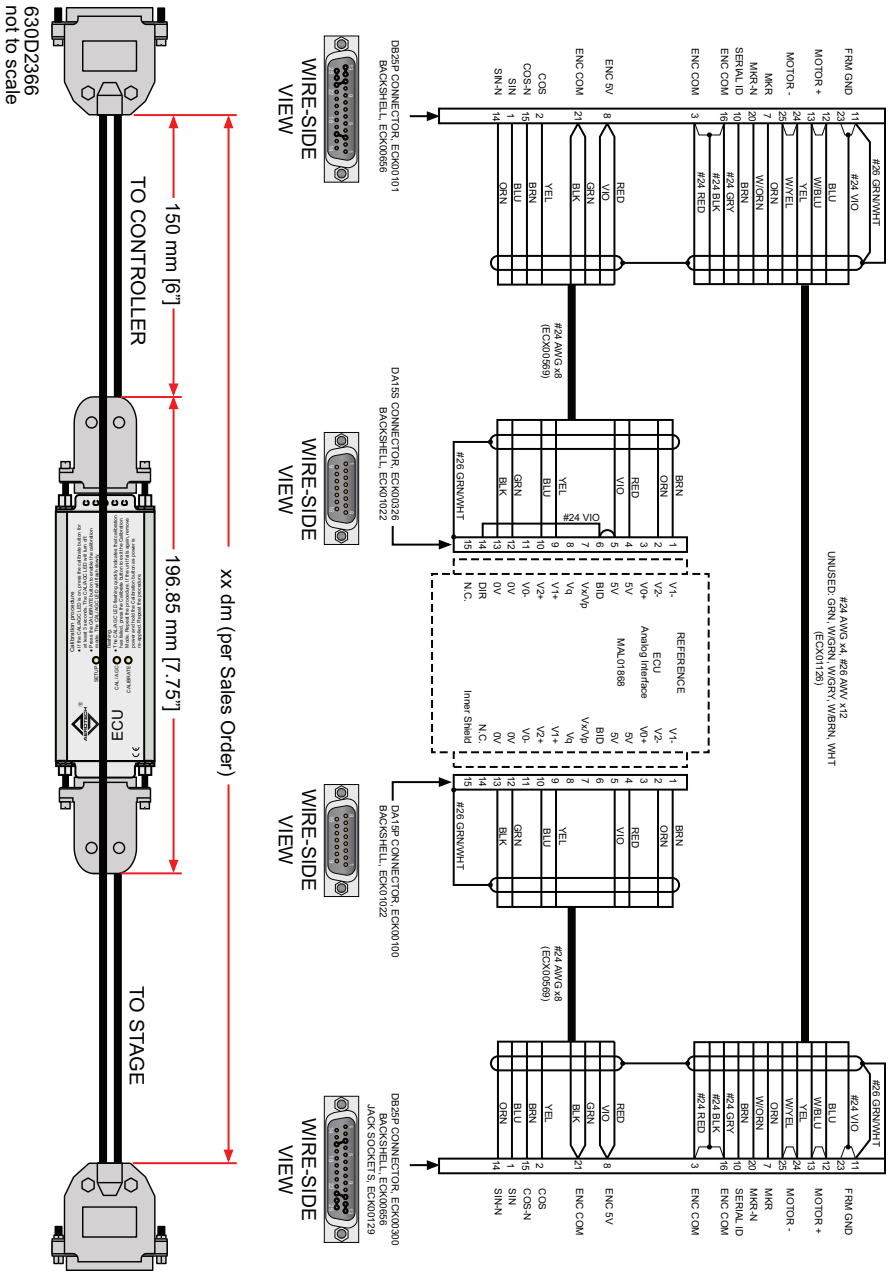


Figure 1-5: ECU Hi-Flex Cable for TLG (C23660)

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from harmful defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability on any claim for loss or damage arising out of the sale, resale, or use of any of its products shall in no event exceed the selling price of the unit.

THE EXPRESS WARRANTY SET FORTH HEREIN IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE. IN NO EVENT SHALL AEROTECH BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES.

Return Products Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within thirty (30) days of shipment of incorrect material. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. A "Return Materials Authorization (RMA)" number must accompany any returned product(s). The RMA number may be obtained by calling an Aerotech service center or by submitting the appropriate request available on our website (www.aerotech.com). Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than thirty (30) days after the issuance of a return authorization number will be subject to review.

Visit http://www.aerotech.com/service-and-support.aspx for the location of your nearest Aerotech Service center.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an expedited method of return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Fixed Fee Repairs - Products having fixed-fee pricing will require a valid purchase order or credit card particulars before any service work can begin.

All Other Repairs - After Aerotech's evaluation, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within thirty (30) days of notification will result in the product(s) being returned as is, at the buyer's expense.

Repair work is warranted for ninety (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following “On-Site Non-Warranty Repair” section apply.

On-site Non-Warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Service Locations

http://www.aerotech.com/contact-sales.aspx?mapState=showMap

USA, CANADA, MEXICO	CHINA	GERMANY
Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	Aerotech China Full-Service Subsidiary Phone: +86 (21) 3319 7715	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720

JAPAN	TAIWAN	UNITED KINGDOM
Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773	Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649

Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Description
1.01.00	Updated Declaration of Conformity
1.00.00	New Manual

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