



Encoder Limit Adapter (ELA) Hardware Manual

Revision: 2.02.00



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EU Declaration of Conformity


Manufacturer Aerotech, Inc.
Address 101 Zeta Drive
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USA
Product Encoder Limit Adapter
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.

EN 61010-1:2001	Safety requirements for electrical equipment
-----------------	----------------------------------------------

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

Chapter 1: Product Overview

The Encoder Limit Adapter (ELA) provides the capability to convert single-ended optical encoders to differential encoders and to convert end-of-travel (EOT) limit switches to or from current-sourcing to current-sinking. All other signals pass directly through the ELA.

The ELA connects in series with an existing 25-pin D-style connector.

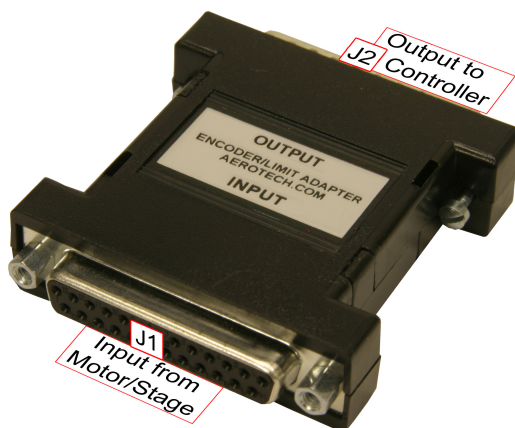


Figure 1-1: The Encoder Limit Adapter

The ELA contains differential line driver outputs, and opto-isolated limit outputs.

Table 1-1: Electrical Specifications

Description	Value or Type
Input Voltage (to J2 from the controller)	5VDC
Input Current	.07 A
Encoder Input Format	Open Collector or TTL
Encoder Input Frequency (Max)	250,000 Hz
Output Voltage	0 - 5 V, differential centered at 2.5 V, 1 mA max drive current
Comparator Reference Threshold (Internal)	2.5 VDC (=Supply Voltage / 2)
Hysteresis	1%

The outline dimensions for the ELA are shown in [Figure 1-2](#).

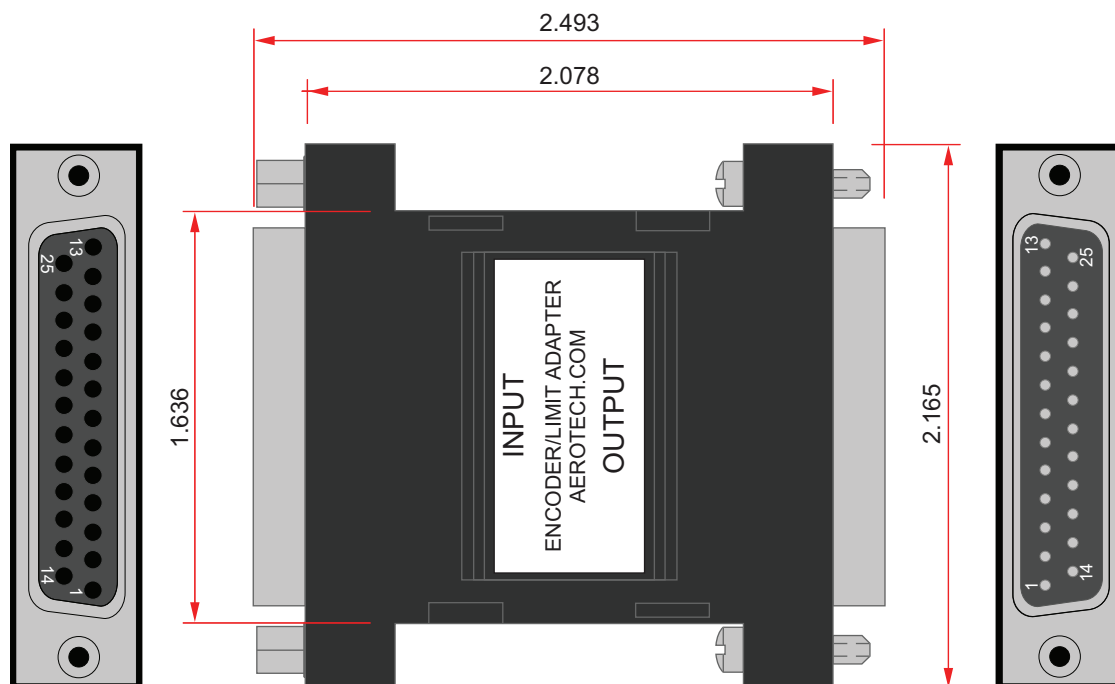


Figure 1-2: ELA Dimensions

1.1. Safety Procedures and Warnings

The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those individuals performing the procedures and/or damage to the equipment.



WARNING: Improper operation of this equipment may result in personal injury or damage to the equipment. The user must read this manual and related documentation thoroughly before operating the equipment.



DANGER: To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the ELA is connected to a power source.

1.2. J1 and J2 Connector Pin Assignment

The following table indicates the pin assignments for the J1 and J2 connectors on the ELA.

Table 1-2: J1 and J2 Pin Assignments

Pin #	Description	J1	J2
1	Chassis Frame	Pass Through	
2	Motor Over Temperature Thermistor	Pass Through	
3	+5V Power for Encoder	Pass Through	
4	No Connection	Pass Through	
5	Hall Effect Sensor B (Brushless Motors Only)	Pass Through	
6	Encoder Marker Reference Pulse -	Input	Output
7	Encoder Marker Reference Pulse +	Input	Output
8	Reserved	Pass Through	
9	Reserved	Pass Through	
10	Hall Effect Sensor A (Brushless Motors Only)	Pass Through	
11	Hall Effect Sensor C (Brushless Motors Only)	Pass Through	
12	Clockwise End of Travel Limit	Input	Output
13	Optional Brake - Output	Pass Through	
14	Encoder Cosine +	Input	Output
15	Encoder Cosine -	Input	Output
16	+5V Power for Limit Switches	Input	Output
17	Encoder Sine +	Input	Output
18	Encoder Sine -	Input	Output
19	Reserved	Pass Through	
20	Signal Common for Limit Switches	Figure 1-6	
21	Signal Common for Encoder	Pass Through	
22	Home Switch	Input	Output
23	Encoder Fault	Pass Through	
24	Counterclockwise End of Travel Limit	Input	Output
25	Optional Brake + Output	Pass Through	

1.3. Jumper Location

The jumpers must be configured within the ELA. All signals, other than the three encoder channels and the three end-of-travel limits pass directly through the ELA.

The plastic case has two integral molded tabs on each side that secure the cover in place. Open these tabs slightly to remove the cover and access the jumpers.

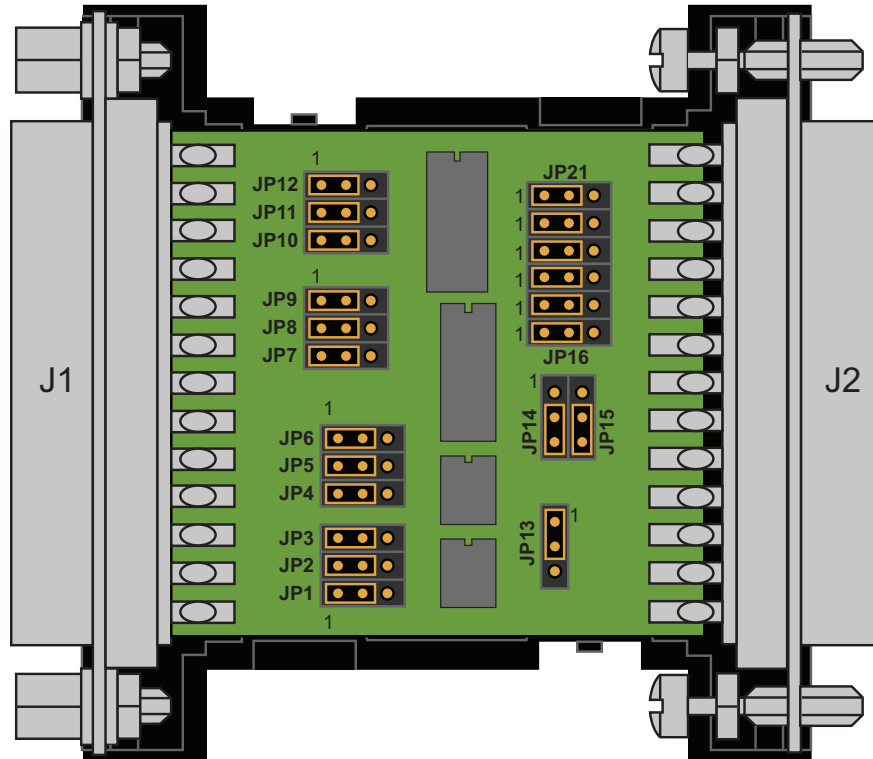


Figure 1-3: ELA Jumper Locations

1.4. Encoder Interface Configuration

Figure 1-4 illustrates the three-channel optical encoder input and output circuitry. The encoder input receiver is a MAX991 device and the output device is a 26LS31 line driver.

The encoder interface may be by-passed directly to the output of the ELA for a differential encoder input signal, or configured for a single-ended encoder input, with an external reference bias voltage, or an internal 2.5-volt bias voltage. If no external bias voltage is present, the internal 2.5-volt bias must be selected.

Each of the three channels (SIN/COS/MRK, also known as A/B/Z) of the encoder may be configured separately, however, in almost all cases, all three encoder channels will be configured the same. Also, if any of the three channels of the encoder are bypassed to the output, all encoder signals must be bypassed to the output.

The Single-Ended mode without an internal reference (Ext. reference mode) would be used if the encoder input signal does not have a peak value of 5 volts. In this case, the user would want to use an external reference, which is 50% of the peak value of the input encoder signal. Create a resistive divider network to bias the input at 50% (refer to Figure 1-5) and connect your encoder signals to SIN, COS, and MRK.

Refer to Section 1.3. Jumper Location for jumper locations on the ELA.

Table 1-3: Encoder Sine Signal Input Jumper Configuration

Mode	JP7	JP8	JP9	JP13
Single-Ended without Reference (ext. required)	1-2	2-3	1-2	1-2
Single-Ended with internal 2.5V Reference ⁽¹⁾	1-2	1-2	1-2	1-2
Encoder Bypass Mode (Differential Encoder) ⁽²⁾	2-3	1-2	2-3	2-3
1. denotes a default jumper position				
2. all or none of the three channels of the encoder must be in bypass mode.				

Table 1-4: Encoder Cosine Signal Input Jumper Configuration

Mode	JP1	JP2	JP3	JP13
Single-Ended without Reference (ext. required)	1-2	2-3	1-2	1-2
Single-Ended with internal 2.5V Reference ⁽¹⁾	1-2	1-2	1-2	1-2
Encoder Bypass Mode (Differential Encoder) ⁽²⁾	2-3	1-2	2-3	2-3
1. denotes a default jumper position				
2. all or none of the three channels of the encoder must be in bypass mode.				

Table 1-5: Encoder Marker Signal Input Jumper Configuration

Mode	JP4	JP5	JP6	JP13
Single-Ended without Reference (ext. required)	1-2	2-3	1-2	1-2
Single-Ended with internal 2.5V Reference ⁽¹⁾	1-2	1-2	1-2	1-2
Encoder Bypass Mode (Differential Encoder) ⁽²⁾	2-3	1-2	2-3	2-3
1. denotes a default jumper position				
2. all or none of the three channels of the encoder must be in bypass mode.				

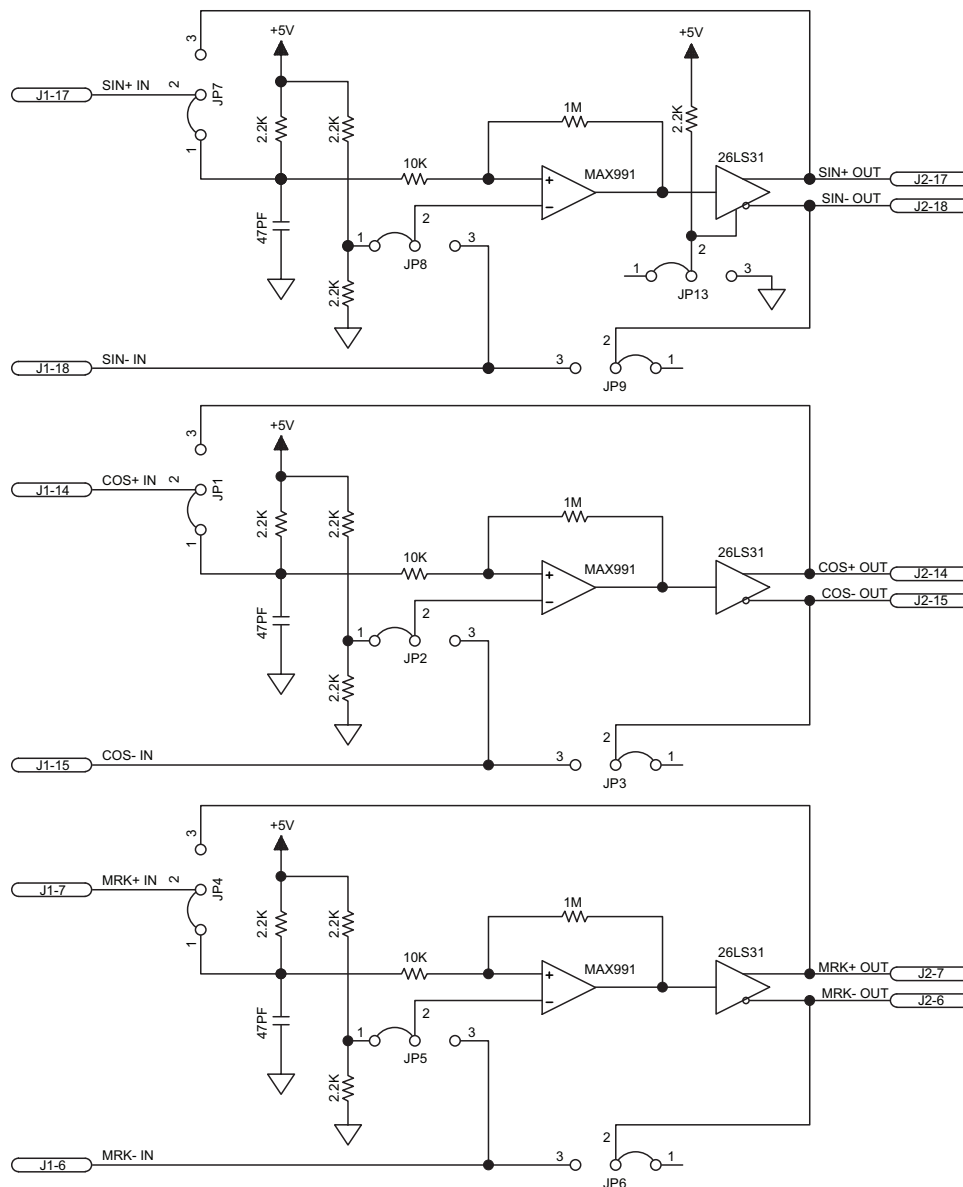


Figure 1-4: Encoder Interface

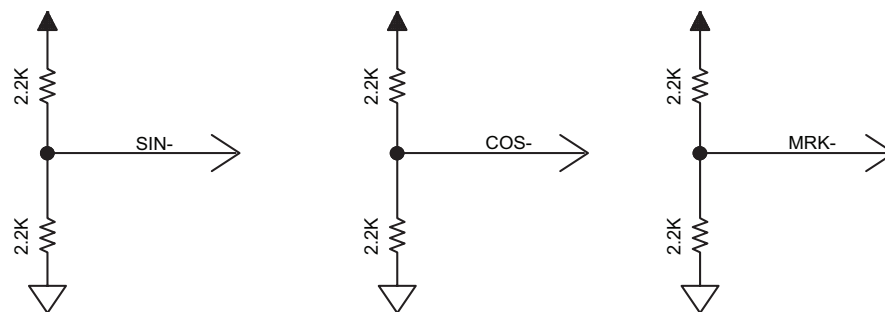


Figure 1-5: Reference Voltage Bias Dividers for Single-Ended Encoders

1.5. End of Travel (EOT) Limit Configuration

Figure 1-6 illustrates the end-of-travel limit input and output circuitry. The EOT limit input and output device is a PS2815-4 opto-isolator.

Refer to [Section 1.3. Jumper Location](#) for jumper locations on the ELA.

EOT Inputs

The end-of-travel (EOT) limit inputs may be configured for one of two voltages to power the limits, which is defined by jumper JP14 and JP15. Each of the EOT limit inputs to the ELA may also be configured for current sourcing/sinking, by changing jumpers JP10, JP11 and JP12.

Table 1-6: EOT Limit Input Jumper Configuration

EOT Limit	Jumper	Current Sinking	Current Sourcing
CW EOT Limit Input	JP12	1-2*	2-3
CCW EOT Limit Input	JP11	1-2*	2-3
Home Limit Input	JP10	1-2*	2-3
* default			

Table 1-7: EOT Limit Power Jumper Configuration

Limit Power Mode	Jumper	Setting
Limit Power from Encoder Power (J1-J16)	JP14, JP15	2-3*
Limit 5V Power from Limit Power	JP14, JP15	1-2
* default		

EOT Outputs

The end-of-travel (EOT) limit output interface may be configured for current sourcing/sinking EOT limit outputs, as well as the output drive current value from the ELA.

Table 1-8: EOT Limit Output Jumper Configuration

EOT Limit	Jumper	Current Sinking	Current Sourcing
CW EOT Limit Input	JP18, JP21	1-2*	2-3
CCW EOT Limit Input	JP17, JP20	1-2*	2-3
Home Limit Input	JP16, JP19	1-2*	2-3
* default			

Table 1-9: EOT Limit Output Current Jumper Configuration

Output Current	Output Voltage	CW	CCW	Home
10 mA	24 V	R5A, R5B= 2.2k	R4A, R4B= 2.2k	R1A, R1B= 2.2k
5 mA	12 V	R5A, R5B= 2.2k	R4A, R4B= 2.2k	R1A, R1B= 2.2k
2 mA	5 V	R5A, R5B= 2.2k	R4A, R4B= 2.2k	R1A, R1B= 2.2k
10 mA	5 V	R5A, R5B= 100	R4A, R4B= 100	R1A, R1B= 100
R1A, R1B, R5A, R5B default value is 2.2kΩ				

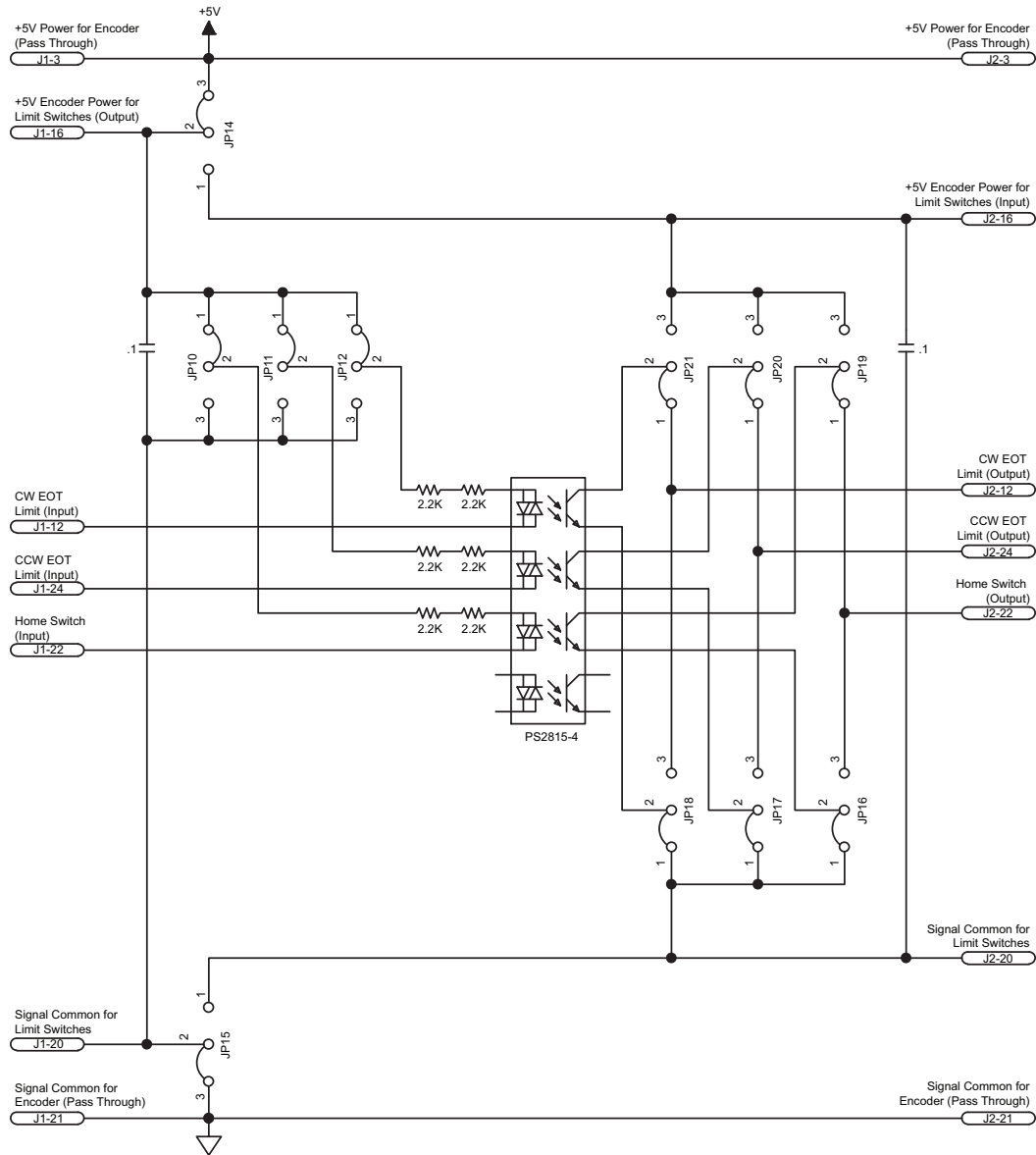


Figure 1-6: End of Travel Limit Interface

1.6. Pass-Through Circuitry

The following figure illustrates the signals that are directly passed through the ELA.

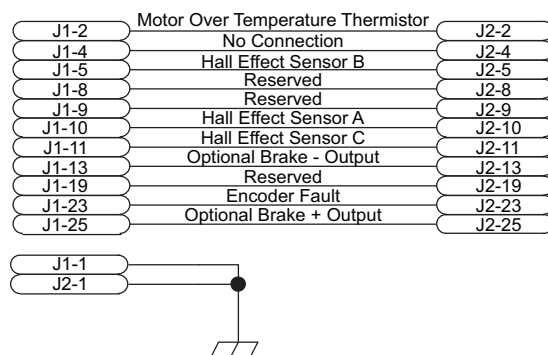


Figure 1-7: Pass-Through Circuitry

1.7. Preventative Maintenance

The ELA and external wiring should be inspected monthly. Inspections may be required at more frequent intervals, depending on the environment and use of the system. [Table 1-10](#) lists the recommended items, which should be inspected.



DANGER: To minimize the possibility of electrical shock and bodily injury or death, disconnect power (Mains disconnect) before servicing equipment.

Table 1-10: Preventative Maintenance

Check	Action to be Taken
Visually inspect ELA enclosure for loose or damaged parts / hardware. NOTE: Internal inspection is not required.	Parts should be repaired as required. If internal damage is suspected, these parts should be checked and repairs made if necessary.
Check for fluids or electrically conductive material exposure.	Any fluids or electrically conductive material must not be permitted to enter the ELA. NOTE: Disconnect power to avoid shock hazard.
Visually inspect all cables and connections.	Tighten or re-secure any loose connections. Replace worn or frayed cables. Replace broken connectors.

Cleaning

The ELA enclosure can be wiped with a clean, dry, soft cloth. The cloth may be slightly moistened if required with water or isopropyl alcohol to aid in cleaning if necessary. In this case, be careful not to allow moisture to enter the ELA or onto exposed connectors / components. Fluids and sprays are not recommended because of the chance for internal contamination, which may result in electrical shorts and/or corrosion. The electrical power must be disconnected from the ELA while cleaning. Do not allow cleaning substances or other fluids to enter the ELA or to enter any of the connectors. Cleaning of the labels should be avoided to prevent removing them.

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 <https://www.aerotech.com/global-technical-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
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Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Description
2.02.00	General manual update
2.01.00	Updated Jumper Settings for JP2, JP5, and JP8: Section 1.4 .
2.00.00	Added pin number detail to drawing: Figure 1-2
1.00.00	New Manual

