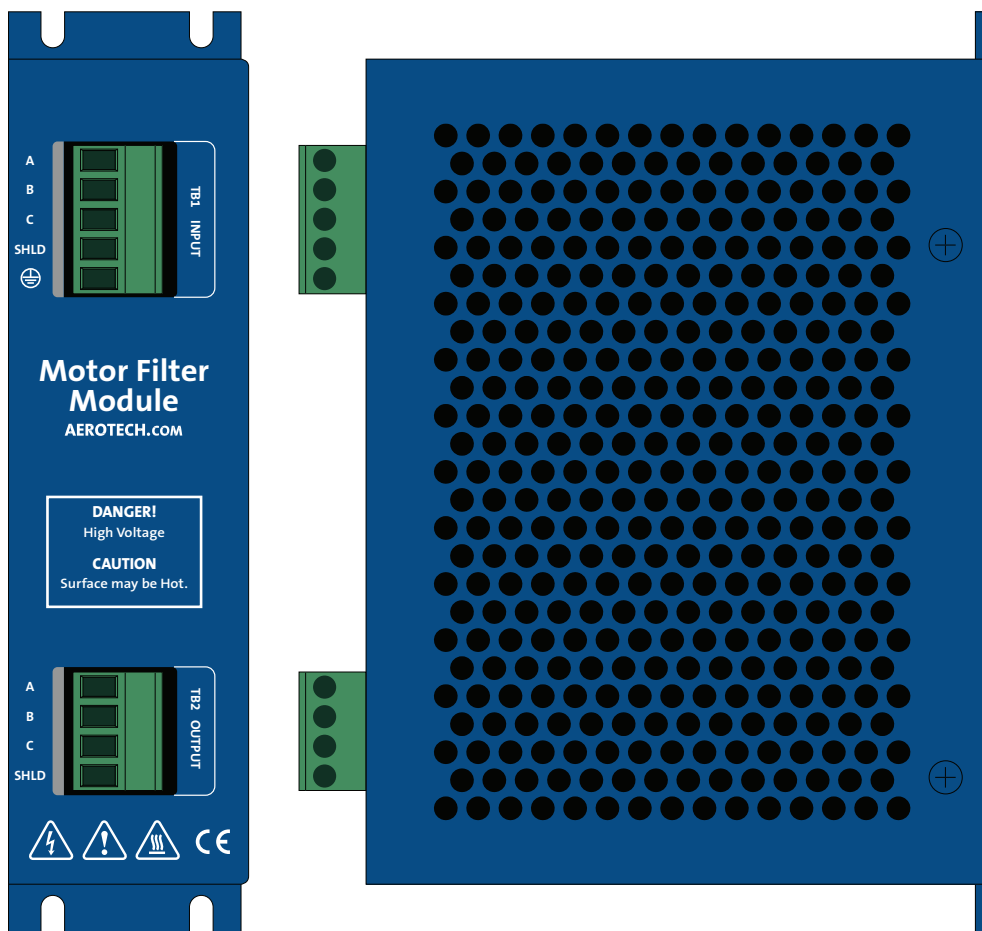




Motor Filter Module Hardware Manual

P/N: EDU218
Revision: 1.05.00



Global Technical Support

Go to www.aerotech.com/global-technical-support for information and support about your Aerotech products. The website provides downloadable resources (such as up-to-date software, product manuals, and Help files), training schedules, and PC-to-PC remote technical support. You can also complete Product Return (RMA) forms and get information about repairs and spare or replacement parts. For immediate help, contact a service office or your sales representative. Have your customer order number available before you call or include it in your email.

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EU Declaration of Conformity

Manufacturer Aerotech, Inc.
Address 101 Zeta Drive
Pittsburgh, PA 15238-2897
USA

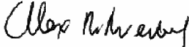
Product MFM10-1 (Motor Filter Module with 10 A RMS Cable)
MFM10-2 (Motor Filter Module with 5 A RMS Cable)

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 61010-1:2010 Safety requirements for electrical equipment

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

Agency Approvals

Aerotech, Inc. Model MFM10-1 and MFM10-2 have been tested and found to be in accordance to the following listed Agency Approvals:

- Approval / Certification:** CUS NRTL
- Approving Agency:** TUV SUD America Inc.
- Certificate #:** U8 17 01 68995 023
- Standards:** UL 61010-1:2012; CAN/CSA-C22.2 No. 61010-1:2010

Safety Procedures and Warnings

Read this manual in its entirety before installing, operating, or servicing this product. If you do not understand the information contained herein, contact an Aerotech representative before proceeding. Strictly adhere to the statements given in this section and other handling, use, and operational information given throughout the manual to avoid injury to you and damage to the equipment. The following statements apply wherever the Warning or Danger symbol appears within this manual.

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. Refer to www.aerotech.com for the most up-to-date information.



DANGER: This product contains potentially lethal voltages. To reduce the possibility of electrical shock, bodily injury, or death the following precautions must be followed.

1. Disconnect electrical power before servicing equipment.
2. Disconnect electrical power before performing any wiring.
3. Access to the Motor Filter Module and component parts must be restricted while connected to a power source.
4. To minimize the possibility of electrical shock and bodily injury, extreme care must be exercised when any electrical circuits are in use. Suitable precautions and protection must be provided to warn and prevent persons from making contact with live circuits.
5. Install the Motor Filter Module inside a rack or enclosure.
6. Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
7. All components must be properly grounded in accordance with local electrical safety requirements.
8. Operator safeguarding requirements must be addressed during final integration of the product.



DANGER: The Motor Filter Module case temperature may exceed 70°C in some applications. A clearance of at least 10 mm is recommended on all sides of the device.



WARNING: To minimize the possibility of electrical shock, bodily injury or death the following precautions must be followed.

1. Use of this equipment in ways other than described by this manual can cause personal injury or equipment damage.
2. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
3. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
4. Do not expose this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
5. If the product is used in a manner not specified by the manufacturer, the protection provided by the product can be impaired and result in damage, shock, injury, or death.
6. Operators must be trained before operating this equipment.
7. All service and maintenance must be performed by qualified personnel.
8. This product is intended for light industrial manufacturing or laboratory use. Use of this product for unintended applications can result in injury and damage to the equipment.

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Chapter 1: Motor Filter Module

Aerotech's Motor Filter Modules (MFM1, MFM2, MFM10-1, MFM10-2) are designed to connect inline between a PWM amplifier and the motor, preferably close to the amplifier. The filters reduce high frequency content in the motor leads by up to 10dB and lessens the impact of PWM signals on sensitive third party sensors or other system components.



DANGER: Install the Motor Filter Module inside a rack or enclosure.

The MFM filters do not completely remove PWM switching waveforms present on the motor leads. Aerotech linear amplifiers are recommended for extremely noise sensitive applications.

- The MFM1 and MFM10-1 includes a 10 A cable compatible with Aerotech CP and HPe amplifiers.
- The MFM2 and MFM10-2 includes a 5 A cable compatible with Aerotech MP amplifiers.

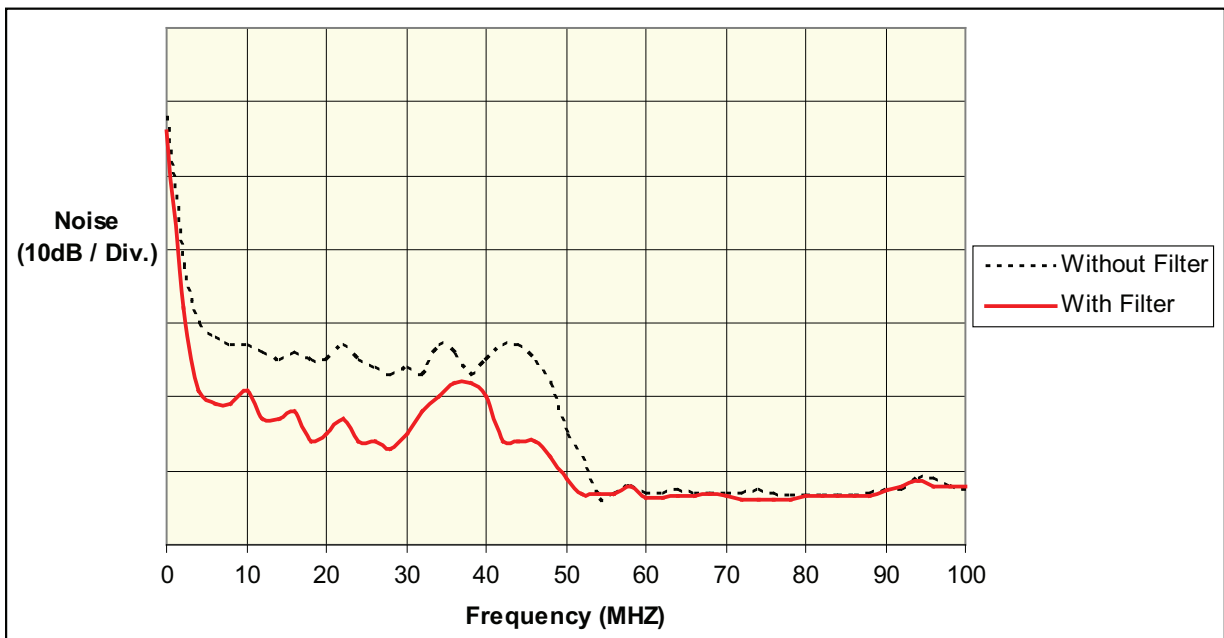


Figure 1-1: Noise Reduction Plot

1.1. Electrical Specifications

The specifications for the Motor Filter Module are indicated in the table below.

Table 1-1: Motor Filter Module Electrical Specifications

Specification	MFM1	MFM2	MFM10-1	MFM10-2
Voltage (max)	160 VDC		340 VDC	
Current (DC RMS or Continuous AC Peak)	10 A	5 A	10 A	5 A
Additional Inductance (line-line)	.8 mH ⁽¹⁾			
1. The digital current gains must be adjusted to compensate for the additional inductance added by the filter				

Table 1-2: TB1 Motor Power Input Connection


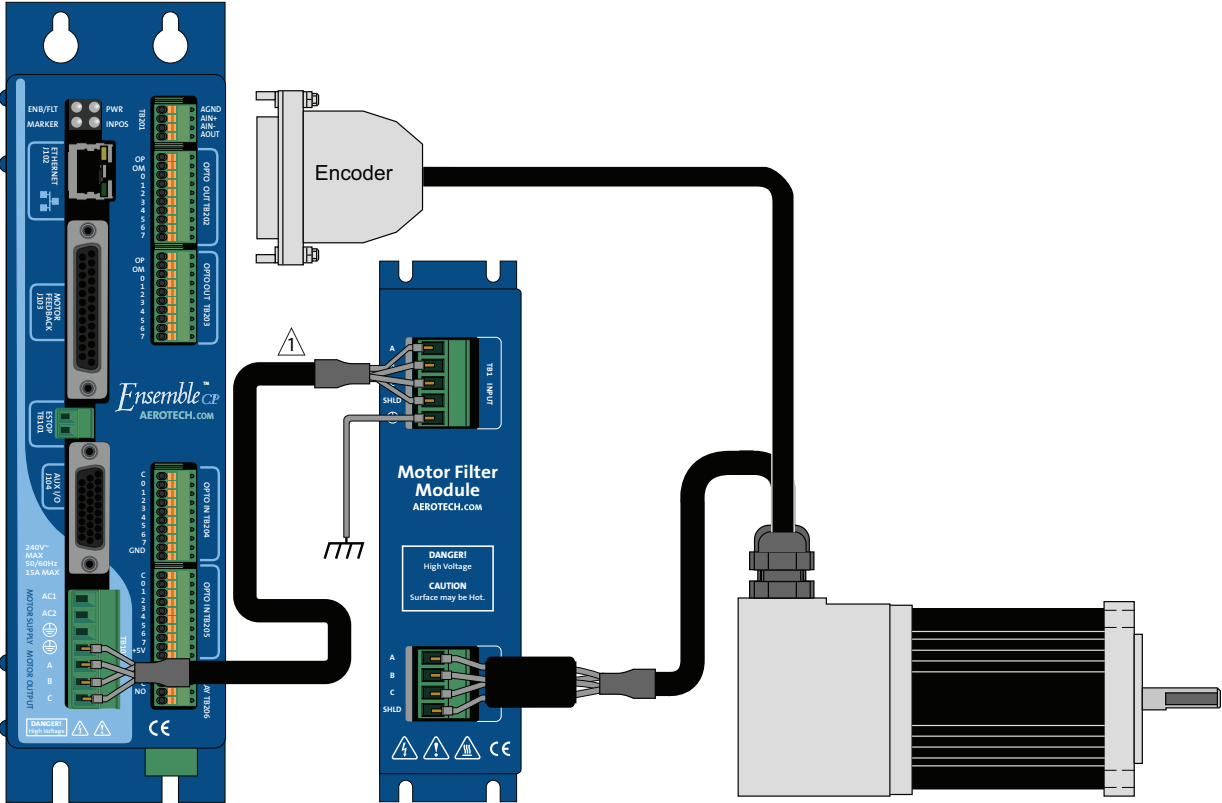
Pin	Description	Recommended Wire Size
A	Motor Phase A from Amplifier	Application Dependent (see amplifier hardware manual) 10 A: 16 AWG / 1.31 mm ² 5 A: 20 AWG / .52 mm ² Insulation Rating = 300 V
B	Motor Phase B from Amplifier	
C	Motor Phase C from Amplifier	
SHLD	Motor Shield	
	MFM chassis ground (required for safety)	

Table 1-3: TB2 Motor Power Output Connection

Pin	Description	Recommended Wire Size
A	Motor Phase A to Motor	Application Dependent (see amplifier hardware manual) 10 A: 16 AWG / 1.31 mm ² 5 A: 20 AWG / .52 mm ² Insulation Rating = 300 V
B	Motor Phase B to Motor	
C	Motor Phase C to Motor	
SHLD	Motor Shield	

Table 1-4: Terminal Block Mating Connector

Connector	Type	Aerotech P/N	Phoenix P/N	Wire Size: AWG [mm ²]
TB1	5-Pin Terminal Block	ECK00212	1754504	12-30 [3.3 - 0.0516]
TB2	4-Pin Terminal Block	ECK01042	1754481	12-30 [3.3 - 0.0516]



⚠ AEROTECH DRIVE TO MOTOR FILTER CABLE OPTIONS
 P/N: C23121-3 (16 AWG): 10 A, included with MFM1 and MFM10-1
 P/N: C23122-3 (20 AWG): 5 A, included with MFM2 and MFM10-2

Figure 1-2: MFM Wiring

1.2. Mechanical Specifications



DANGER: The Motor Filter Module case temperature may exceed 70°C in some applications. A clearance of at least 10 mm is recommended on all sides of the device.

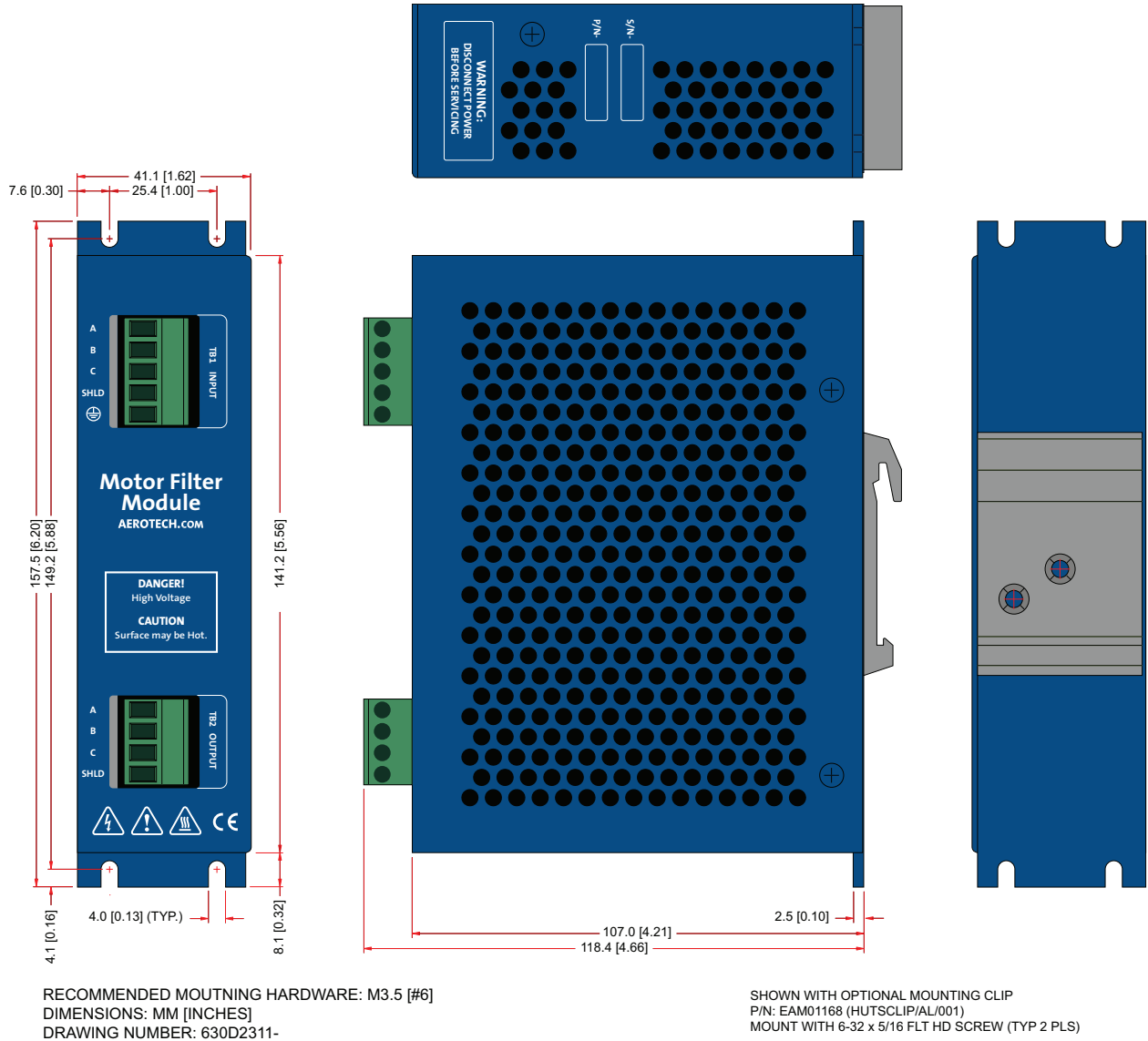


Figure 1-3: Motor Filter Module Dimensions

1.3. Environmental Specifications

The environmental specifications for the Motor Filter Module are listed below.

Ambient Temperature	Operating: 0° to 50°C (32° to 122° F)
	Storage: -30° to 85°C (-22° to 185° F)
Humidity	Maximum relative humidity is 80% for temperatures up to 31°C. Decreasing linearly to 50% relative humidity at 40°C. Non condensing.
Altitude	Up to 2000 meters.
Pollution	Pollution degree 2 (normally only non-conductive pollution).
Use	Indoor use only.

1.4. Preventative Maintenance

The Motor Filter Module and external wiring should be inspected monthly. Inspections may be required at more frequent intervals, depending on the environment and use of the system.



DANGER: Always disconnect the Mains power connection before opening the Motor Filter Module .



DANGER: To minimize the possibility of bodily injury or death, disconnect all electrical power prior to performing any maintenance or making adjustments to the equipment.



DANGER: Before performing any tests, be aware of lethal voltages inside the Motor Filter Module and at the input and output power connections. A qualified service technician or electrician should perform these tests.

Table 1-5: Preventative Maintenance

Check	Action to be Taken
Visually Check chassis 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.
Inspect cooling vents.	Remove any accumulated material from vents.
Check for fluids or electrically conductive material exposure.	Any fluids or electrically conductive material must not be permitted to enter the Motor Filter Module.
Visually inspect all cables and connections.	Tighten or re-secure any loose connections. Replace worn or frayed cables. Replace broken connectors.

Cleaning

The Motor Filter Module chassis 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 Motor Filter Module 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 Motor Filter Module while cleaning. Do not allow cleaning substances or other fluids to enter the Motor Filter Module or to get on to any of the connectors. Avoid cleaning labels to prevent removing the label information.

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
1.05.00	<ul style="list-style-type: none">• Updated: EU Declaration of Conformity• Added: Agency Approvals
1.04.00	<ul style="list-style-type: none">• Updated metalwork and silkscreens• Updated Declaration of Conformity• Added MFM10-1, MFM10-2 and removed MFM30
1.03.00	<ul style="list-style-type: none">• General Revision• Updated Declaration of Conformity• Added Safety Procedures and Warnings section• Added Insulation Rating to Table 1-2 and Table 1-3• Added Environmental Specifications section• Added Preventative Maintenance section
1.02.00	<ul style="list-style-type: none">• Added MFM1 and MFM2 part numbers• Updated wiring drawing: Figure 1-2
1.01.00	<ul style="list-style-type: none">• Added Cable (MFM to Drive) information to drawing: Figure 1-2• Added MP-DIN part information to drawing: Figure 1-3
1.00.00	New Manual

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