MXH MULTIPLIER BOARD

OPTION MANUAL

P/N: EDO110 (V1.6)

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CHAPTER 1: DESCRIPTION AND CONFIGURATION

In This Section:

1.1. Introduction

The MXH multiplier board is designed for use with rotary or linear sine wave encoders to increase encoder resolution. The MXH, a higher resolution version of the original MX Multiplier, provides a multiplication factor of times 10, 50, 100, 200, 250, or 500. When used with an appropriate controller, the quadrature of the output signals provides an additional times 4 factor to yield the effective multiplication of times 40, 200, 400, 800, 1000, or 2000. Custom values are available from 5 to 2,048 multiplication (after x4 controller multiplication). MXH multiplication factors may vary in .25 increments from x1 (MXH1) to x256 (MXH256) (i.e., MXH1.25, MXH1.5, … MXH255.75, MXH256). Possible combinations include any that, when multiplied by 4, equal an integer (i.e., acceptable values are x5.25, x5.5, x11, etc.; unacceptable values are x5.4, x5.7, etc). MXH multiplication factors from x256 (MXH256) to x512 (MXH512) may vary in increments of 1.0 (i.e., MXH256, MXH257, … MXH511, MXH512). A MXH multiplier board with the cover off is shown in Figure 1-1.

Figure 1-1. MXH Multiplier Board

The MXH multiplier board connects between the encoder and the appropriate axis controller. Refer to Figure 1-2 for an example configuration. This connection does not affect Hall effect or limit signals; instead, it is a simple add-in that uses mostly standard cables.

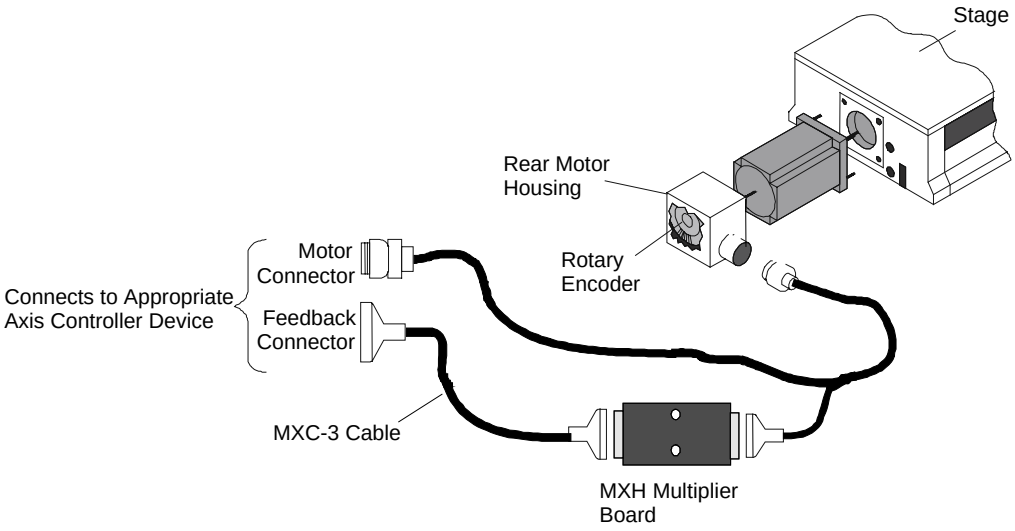


Figure 1-2. MXH Multiplier Board Configuration

1.2. Multiplier Signals

The multiplier board accepts 1 V peak-to-peak voltage input signals. The outputs are square wave, RS-422 TTL compatible signals. The input marker signal is expected to be active high and located at the 255° point of the 360° electrical cycle. The plots illustrated in Figure 1-3 show typical input and output signals (cosine, sine, and marker).

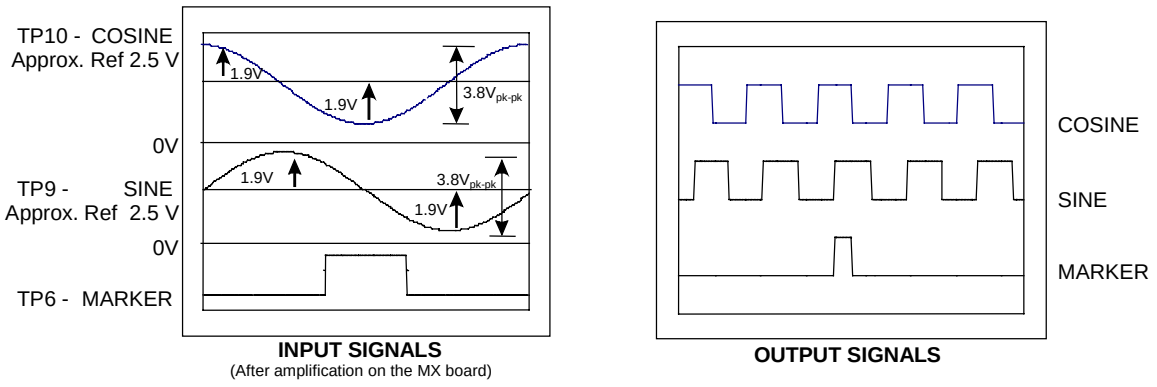


Figure 1-3. Plot of Input and Output Signals

1.3. Multiplier Board Setup

The MXH Multiplier is designed to work with perfectly sinusoidal signals with no DC bias (offset). The actual magnitude of the sine and cosine signals is not as important as the value of one signal relative to the other. The MXH multiplier is a “ratio-metric” device, which means that the sine and cosine signals should be adjusted for equal peak amplitudes. Any gain- imbalance between the sine and cosine signals will result in cyclic - interpolation errors in the MXH output.

Any DC bias (offset) in sine or cosine will also cause cyclic interpolation errors in the multiplied output.

The gain and DC bias can be adjusted for each signal on the MXH multiplier circuit board.

1.3.1. Oscilloscope

Generally, systems operating at less than optimum performance due to interpolation errors will exhibit the following symptoms:

1. A constant whining noise can be heard when running at low speeds.
2. At high speeds, a chirping noise can be heard when the table is accelerating and decelerating.
3. Using Aerotech’s application software as a diagnostic tool, a harmonic or a sub-harmonic of the fundamental encoder frequency may be seen in the position error or velocity error plots of the axis scope window.

1.3.2. Equipment/Tools Required

1. A two-channel oscilloscope capable of being isolated from ground and displaying a Lissajou pattern (X, Y) of the sine and cosine encoder signals
2. Small slotted tip screwdriver or adjustment tool.

The amplified signals can not exceed 4V peak-to-peak or a loss of accuracy occurs.

1.3.3. Adjustment Procedure

1. Verify that oscilloscope is isolated from ground.

An oscilloscope that is not isolated may cause permanent damage to the multiplier.

2. Connect signal common of scope to TP5 (2.5VDC reference voltage), channel A scope probe to TP10 (COS-N), and channel B scope probe to TP9 (SIN-N). Refer to Figure 1-6 for MXH part locations.
3. Display encoder signals as a Lissajou pattern on the oscilloscope (x y mode).
4. Set channels A & B of the oscilloscope for 0.5 volts DC per division, and zero the scope reference to the center of the display.
5. Move table over the entire range of travel at a low speed, and verify that the peak to peak amplitude of the circular pattern is between 2 to 3.9 Vp-p.
6. Move the table to the area where the amplitude is the largest, and verify or adjust for the following. (See Diagram A – Diagram H in Figure 1-4 and Figure 1-5 for examples.)
   - 6.1. COS-N gain is 3.8 Vp-p (+/- 0.1 Vp-p). Adjust R16 if necessary.
   - 6.2. COS-N DC offset is 0 VDC (+/- 0.1 VDC). Adjust R15 if necessary.
   - 6.3. SIN-N gain is equal to COS-N gain (+/- 0.1 Vp-p). Adjust R18 if necessary.
   - 6.4. SIN-N DC offset is 0 VDC (+/- 0.1 VDC). Adjust R17 if necessary.
   - 6.5. Phase error is 0 degrees (+/- 4.5 Degrees). Adjust R14 if necessary.
   - 6.6. Repeat steps 6.1 through 6.5
7. Move table over the entire range of travel at a low speed and verify the following information in Table 1-1.

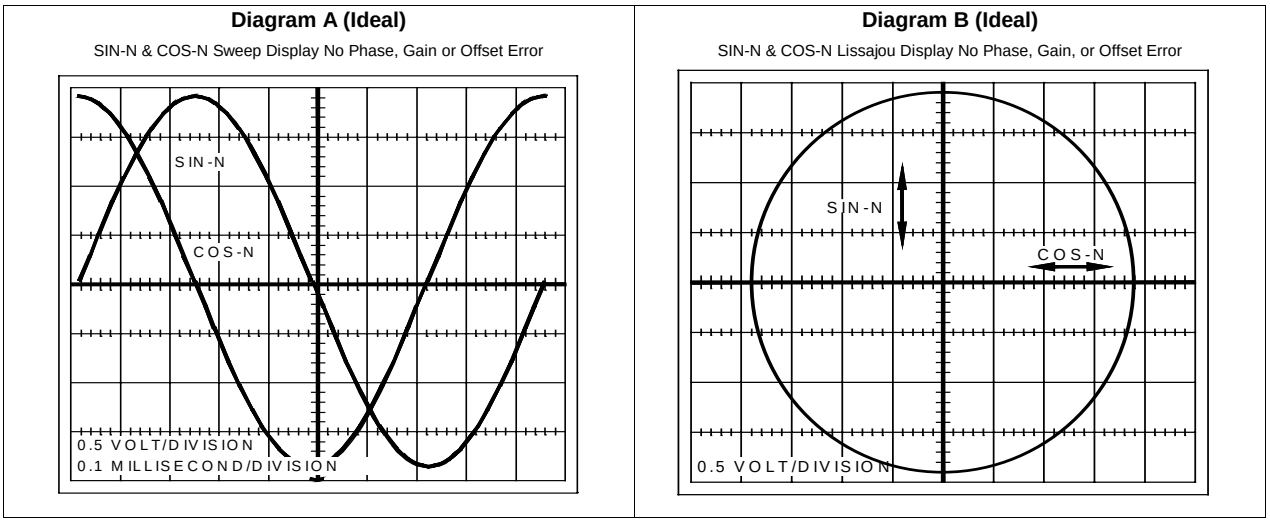


Figure 1-4. Ideal Oscilloscope Displays (Sweep and Lissajou)

Diagram C (Not Optimum)

SIN-N & COS-N Lissajou Display DC Offset Error: SIN-N –0.1V, COS-N +0.1V

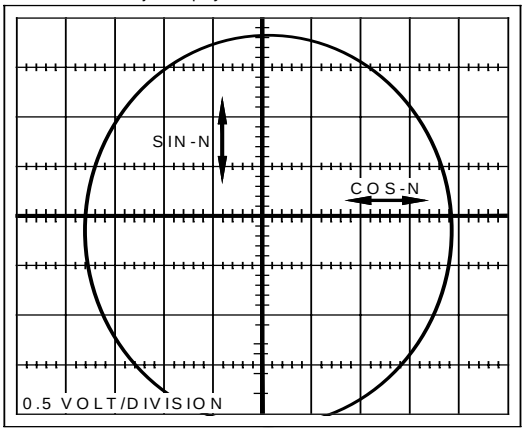


Diagram D (Not Optimum)

SIN-N & COS-N Lissajou Display Gain Error: SIN-N 3Vp-p, COS-N 3.8Vp-p

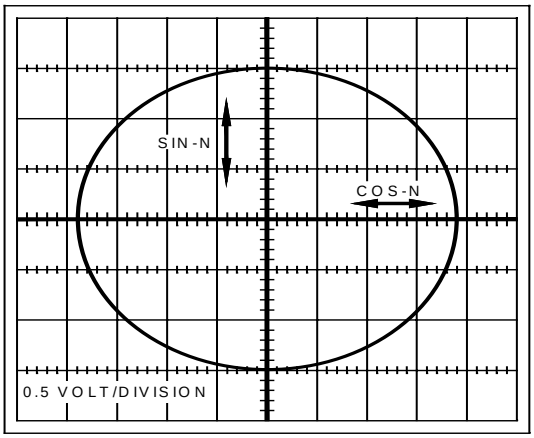


Diagram E (Not Optimum)

SIN-N & COS-N Lissajou Display Showing Phase Error of +4.5º

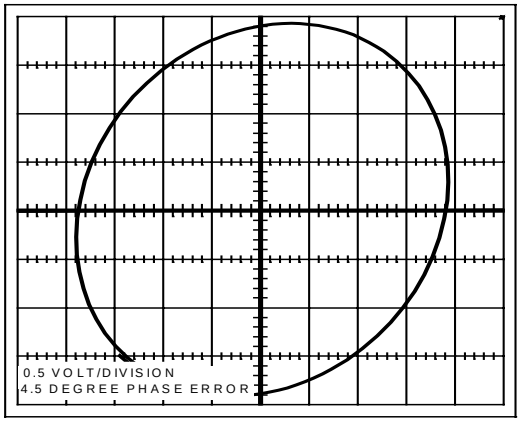


Diagram F (Not Optimum)

SIN-N & COS-N Lissajou Display Showing Phase Error of -4.5º

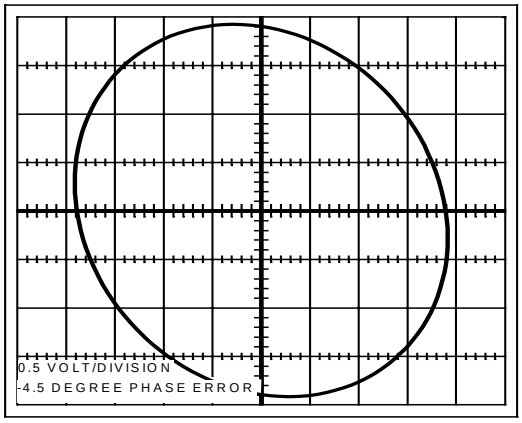


Diagram G (Not Optimum)

SIN-N & COS-N Lissajou Display Showing Phase Error of + 9º

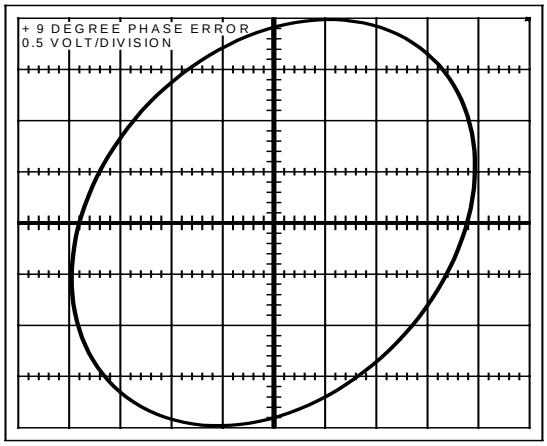


Diagram H (Not Optimum)

SIN-N & COS-N Lissajou Display Showing Phase Error of - 9º

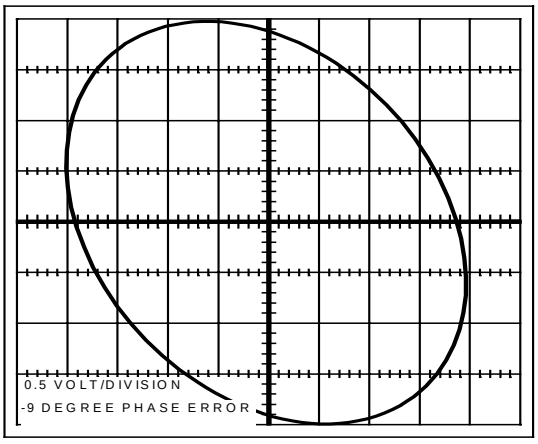


Figure 1-5. Not-Optimum Oscilloscope Lissajou Displays

Table 1-1. Stage Table Verification Chart

Lissajou Pattern	Optimum	Acceptable
Signal Amplitude	3 to 3.8 Vp-p	2 to 4.0 Vp-p
Gain Error	≤ 2.5% of Signal Amplitude (V_{p-p})	≤ 5.0% of Signal Amplitude (V_{p-p})
DC Offset Error	≤ 2.5% of Signal Amplitude (V_{p-p})	≤ 5.0% of Signal Amplitude (V_{p-p})
Phase Error	≤ 4.5 º	≤ 9.0 º

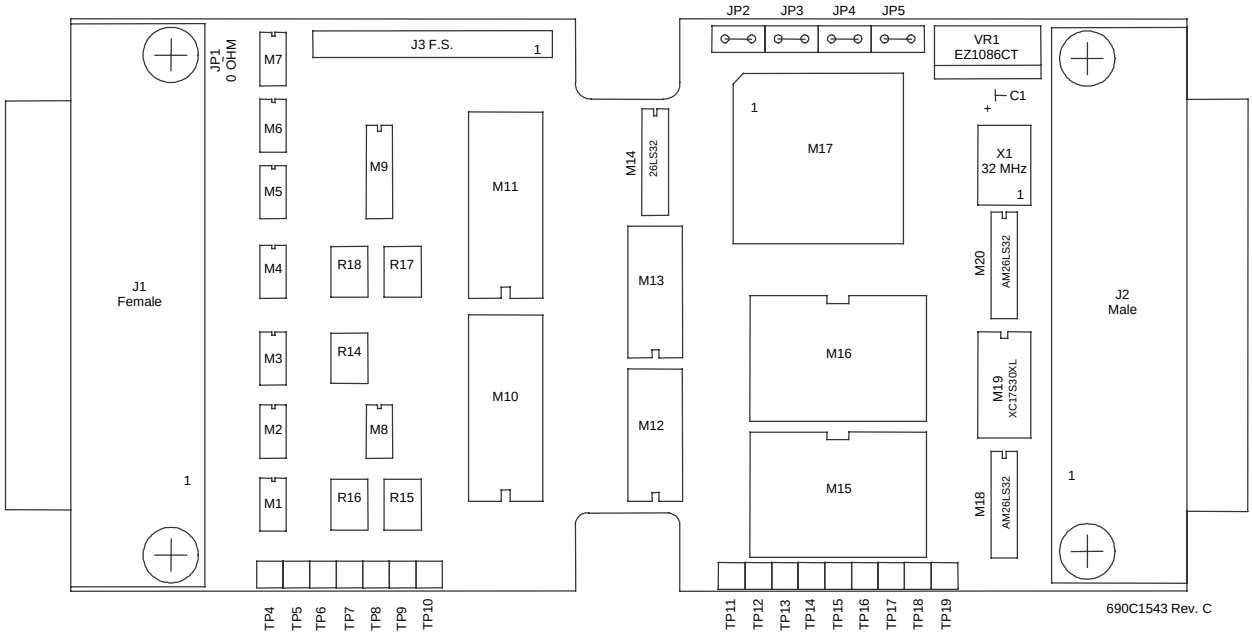


Figure 1-6. MXH Multiplier Board Hardware Locations

1.4. Hardware Configurations

The amplified input signals at Test Points TP9 and TP10 (Refer to Figure 1-6 for locations) should be configured for normal 3.8 V peak-to-peak signals, see the explanation in Section 1.3. However, the multiplier board has an acceptable range of amplified input signals from 2V peak-to-peak to 4V peak-to-peak.

The following sections discuss the hardware used to configure the MXH multiplier board. The hardware is accessible by removing two screws securing the dust cover to the board.

1.4.1. Fault Circuitry (JP1) (Rev A Only)

The fault circuitry detects input signal magnitudes below 0.5 Volt peak-to-peak. If a fault is detected, all outputs are set to a high impedance state. Fault detection is enabled with jumper JP1 in. Removing JP1 defeats fault detection. For jumper location, refer to Figure 1-6.

1.4.2. Marker Pulse Jumper (JP4)

The marker pulse jumper in the default setting of JP4 sets the pulse width to the minimum pulse width. In this case, the marker is one output pulse wide and is qualified with the input marker. When JP4 is out, the marker signal of the encoder is an output and is the same width as the input pulse and no qualification is performed. For jumper location, refer to Figure 1-6.

1.4.3. Reset Circuitry (JP5)

The default setting (jumper in) of the reset circuitry jumper (JP5) resets the board if a fault is detected. The faults that can occur are a loss of 5V, loss of clock signal, and low input signal magnitudes.

1.4.4. Pulse Width Jumpers (JP2 & JP3)

Table 1-2. Settings for Pulse Width Jumpers

JP2	JP3	Function
		Minimum pulse width = 0.03125 µs Master clock frequency = 32 MHz
		Minimum pulse width = 0.0625 µs (default) Master clock frequency = 16 MHz (default)
		Minimum pulse width = 0.125 µs Master clock frequency = 8 MHz
		Minimum pulse width = .25 µs Master clock frequency = 4 MHz

1.4.5. Test Points

Table 1-3 lists the test points available on the MXH multiplier boards.

Table 1-3. MXH Multiplier Board Test Points

Test Points	Function
TP4	Ground
TP5	Sin Reference (Approx. 2.5V)
TP6	Squared up marker signal from encoder
TP7	Cos reference (Approx. 2.5V)
TP8	NC
TP9	Amplified input sine wave (0 - 5V)
TP10	Amplified input cosine wave (0 - 5V)
TP11	A/D sample clock
TP12	HDC
TP13	LDC
TP14	M14 Flash reset
TP15	M13 Flash reset
TP16	Flash Ready/Busy signal
TP17	Output marker, square wave
TP18	Output sine, square wave
TP19	Output cosine, square wave

1.4.6. Connectors (J1 & J2)

There are two connectors on the MXH multiplier board; J1, which receives signals from a sinusoidal encoder, and J2, that outputs the frequency-multiplied RS-422 pulses. The "multiplied" signals are then taken to the controller through the breakout or interface boards. J1 is a 25-pin female "D" style connector. J2 is a 25-pin male "D" style connector. The pinouts for these connectors are listed in Table 1-4 and Table 1-5. The MXH box only uses the SIN, COS, and Marker signals. Hall effect, Limit, and the rest of the signals are passed directly through the MXH box with minor or no modification. As with any high frequency signal transfer over cables, strict guidelines for interconnecting cables should be followed for noise-less, properly phased signal delivery. Figure 1-7 is an illustration of the MXH encoder cable with the pinouts.

Table 1-4. Pinouts for Connector J1

Pin	Signals	Description
1	Shield	Tied to motor ground. Grounded when connected to an interface board through chassis and J2, pin 1.
2		Tied to J2-2
3	Encoder +5V	Supplies 5V to encoder
4	Ground	Analog ground. Supplies ground to encoder, tied up with J1, pins 20, 21.
5	Hall Effect B	From motor, directly connected to J2-5. 10K pull-up attached.
6	Marker -	Analog sinusoidal input from encoder.
7	Marker +	Analog sinusoidal input from encoder.
8		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
9		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
10	Hall Effect A	From motor, directly connected to J2-10. 10K pull-up attached.
11	Hall Effect C	From motor, directly connected to J2-11. 10K pull-up attached.
12	CW Limit	From motor, directly connected to J2-12. 10K pull-up attached.
13		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
14	COS +	Analog sinusoidal input from encoder.
15	COS -	Analog sinusoidal input from encoder.
16	+5V	Supplies 5V to encoder
17	SIN +	Analog sinusoidal input from encoder.
18	SIN -	Analog sinusoidal input from encoder.
19		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
20	Ground	Analog ground. Supplies ground to encoder, tied up with J1, pins 4, 21.
21	Ground	Analog ground. Supplies ground to encoder, tied up with J1, pins 4, 20.
22	Home Limit	Directly connected to J2, pin 22. 10K pull-up attached.
23		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
24	CCW Limit	Directly connected to J2, pin 24. 10K pull-up attached.
25		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).

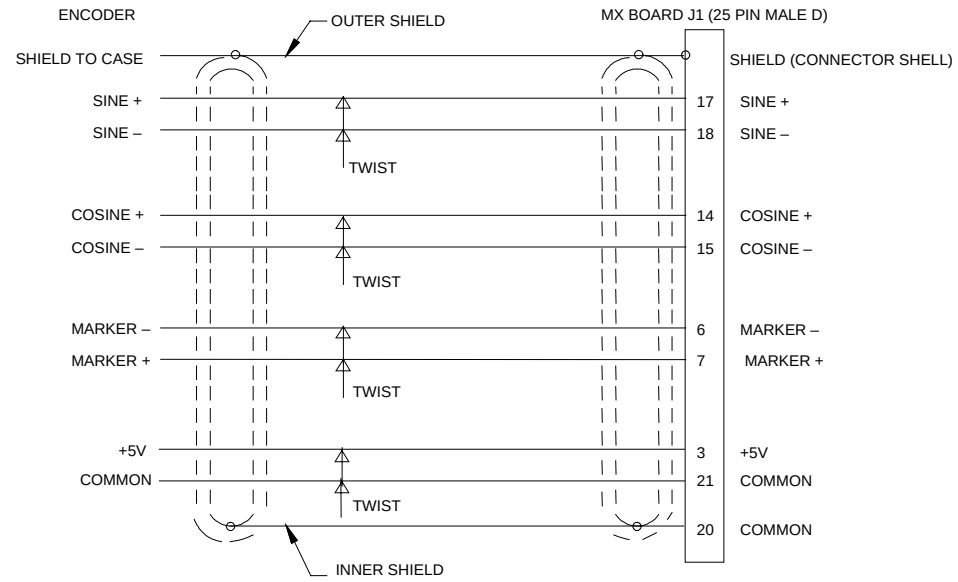
Table 1-5. Pinouts for Connector J2

Pin	Signals	Description
1	Shield	Grounded when connected to an interface board.
2		Tied to J1-2
3	Encoder +5V	Supplies 5V to motor encoder through J1, pin 3.
4	Ground	Supplies ground to encoder, tied up with J2, pins 20, 21.
5	Hall Effect B	Brings Hall signal directly from motor to interface board through J1, pin 5.
6	Marker -	Multiplied RS-422 out from MXH to interface board.
7	Marker +	Multiplied RS-422 out from MXH to interface board.
8		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
9		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
10	Hall Effect A	Brings Hall signal directly from motor to interface board through J1, pin 10.
11	Hall Effect C	Brings Hall signal directly from motor to interface board through J1, pin 11.
12	CW Limit	Brings Hall signal directly from motor to interface board through J1, pin 12.
13		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
14	COS +	Multiplied RS-422 out from MXH to interface board.
15	COS -	Multiplied RS-422 out from MXH to interface board.
16	+5V	Supplies 5V from the interface board to MXH, tied to J1, pin 16.
17	SIN +	Multiplied RS-422 out from MXH to interface board.
18	SIN -	Multiplied RS-422 out from MXH to interface board.
19		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
20	Ground	Supplies ground to encoder, tied up with J2, pins 4, 21.
21	Ground	Supplies ground to encoder, tied up with J2, pins 4, 20.
22	Home Limit	Brings Home Limit directly from motor to interface board through J1, pin 22.
23		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).
24	CCW Limit	Brings CCW Limit directly from motor to interface board through J1, pin 24.
25		Output option dependent. See Section 1.4.8. (also Figure 1-12 through Figure 1-15).

Table 1-6. MXH Cable Options

Cable	Description
MXC-xx	MXH to controller cable
BFCMX-xx	MXH to motor or controller cable
DC-DDMX-xx	ADR to MX box feedback cable
DC-MSOMX-xx	DC Brush Motor to MXH cable
PFCMX-xx	MXH to (controller) flying lead cable

"xx" is the available length in feet



Note: Maximum Cable Length Is 10 Meters
Twisted Pairs Are 1-4 Turns / Inch

Figure 1-7. MXH Encoder Cable Pinouts

1.4.7. Potentiometers

For the location of the pots on the MXH multiplier board, refer to Figure 1-6.

Table 1-7. MXH Multiplier Board Potentiometers

Pot	Function
R14	Phase adjust between sine and cosine signals
R15	Balance for encoder cosine signal
R16	Gain adjust for encoder cosine signal
R17	Balance for encoder sine signal
R18	Gain adjust for encoder sine signal

1.4.8. Output Options

The following Digital Differential Factory options are available; refer to Figure 1-12, Figure 1-13, Figure 1-14, and Figure 1-15. All four of these options provide RS-422 differential square wave output signals produced after multiplication. Options 1-3 add additional outputs providing RS-422 signals from the un-multiplied input signals

Table 1-8. Digital Differential Factory Options

Option Code	Description
NONE	Differential square wave sine / cosine multiplied signals (standard)
-1	Differential square wave output of un-multiplied sine signal
-2	Differential square wave output of un-multiplied sine and cosine signals
-3	Differential square wave output of un-multiplied sine, cosine and marker (unqualified) signals.

1.5. Output Pulse Clock Speed

The output sine and cosine pulse trains are interpolated to spread out the pulses evenly throughout the .5 µs sample period. The output pulse can be clocked at four different frequencies depending on the input frequency and the pulse width jumper settings. The output clock can be 4 MHz, 8 MHz, 16 MHz, or 32 MHz.

The following chart in Figure 1-8 shows the count spacing over a .5 µs period with the clock set to 32 MHz. Sixteen counts per .5 µ second sample period generates the maximum of 32 million counts per second.

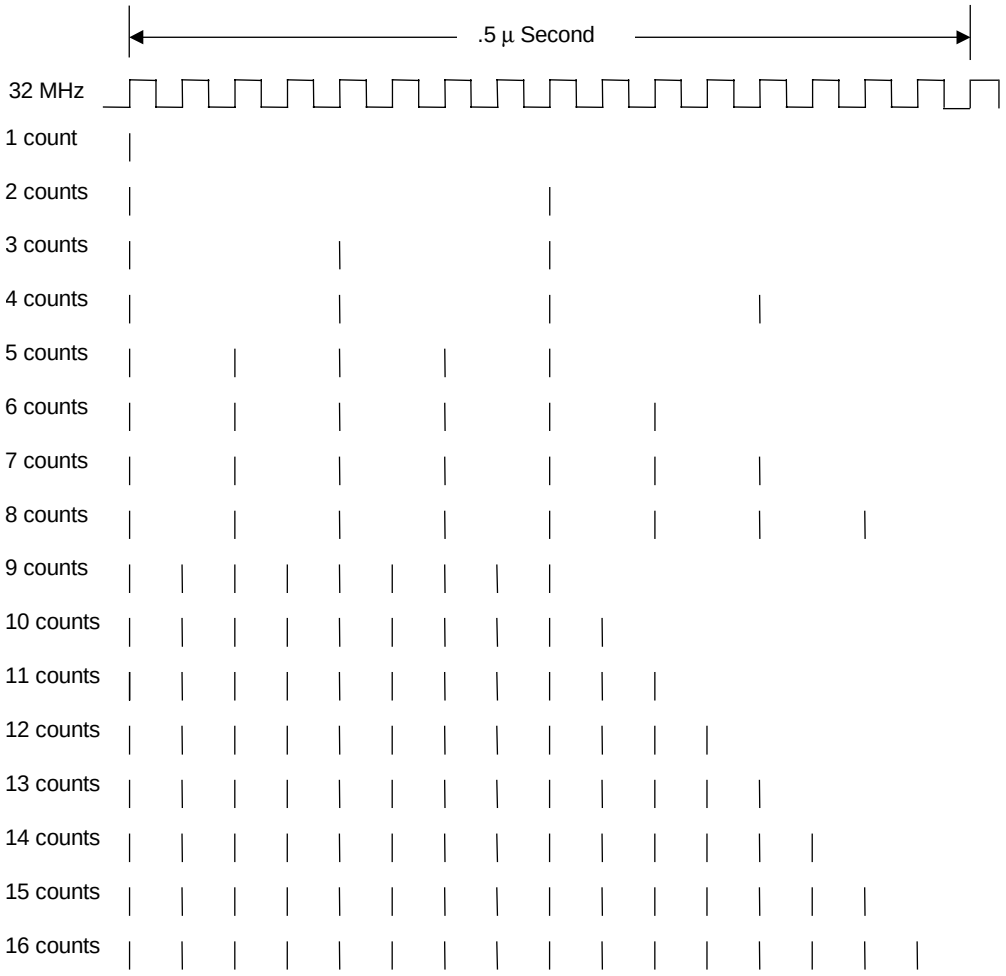


Figure 1-8. 32 MHz Count Spacing

The following chart in Figure 1-9 shows the count spacing over a .5 µs period with the clock set to 16 MHz. Eight counts per .5 µ second sample period generates the maximum of 16 million counts per second.

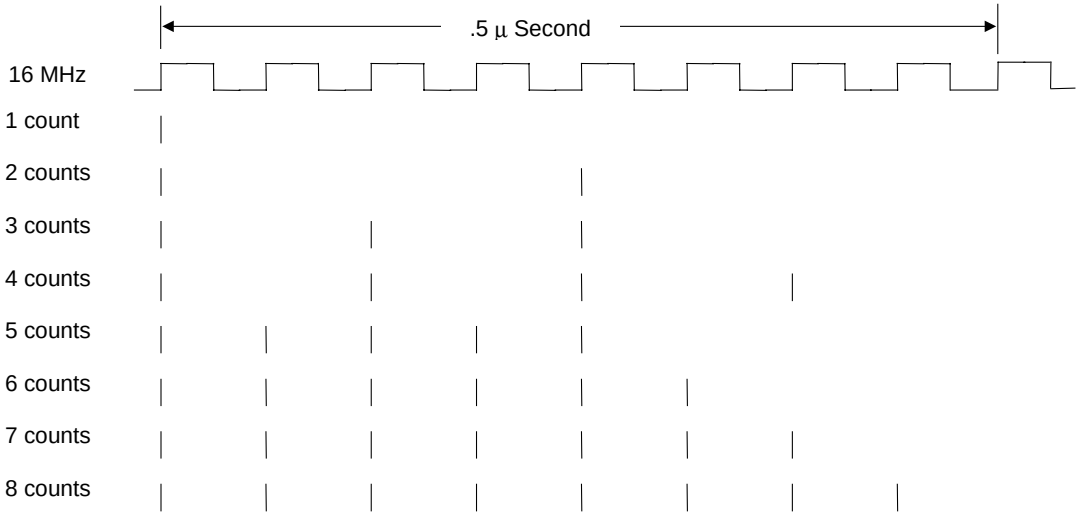


Figure 1-9. 16 MHz Count Spacing

The following chart in Figure 1-10 shows the count spacing over a .5 µs period with the clock set to 8 MHz. Four counts per .5 µ second sample period generates the maximum of 8 million counts per second.

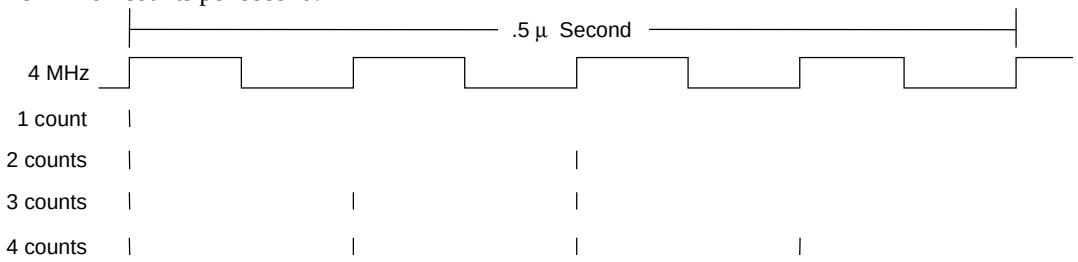


Figure 1-10. 8 MHz Count Spacing

The following chart in Figure 1-11 shows the count spacing over a .5 µs period with the clock set to 4 MHz. Two counts per .5 µ second sample period generates the maximum of 4 million counts per second.

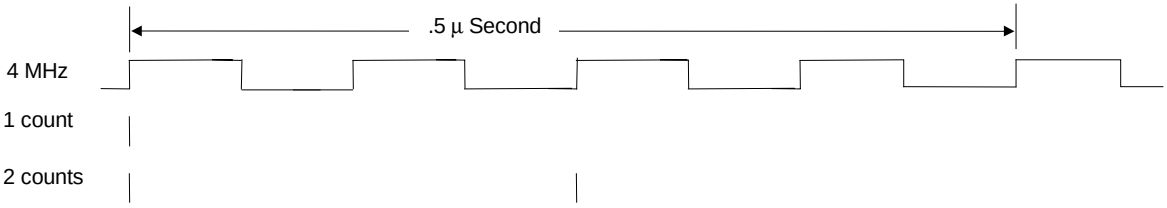


Figure 1-11. 4 MHz Count Spacing

1.6. MXH Multiplier Board Specifications

The specifications for the MXH multiplier board models are shown in Table 1-9. Figure 1-12 shows a simplified schematic of the MXH.

Table 1-9. MXH Multiplier Board Models and Specifications

Model	Interpolation (1,2)	Clock Freq. (3) (MHz)	Max Input Freq. (kHz)	Min Edge Separation (µs)	Min Pulse Width (µs)
MXH10	X40	32	800	.03125	.03125
		16	400	.0625	.0625
		8	200	.125	.125
		4	100	.25	.25
MXH50	X200	32	160	.03125	.03125
		16	80	.0625	.0625
		8	40	.125	.125
		4	20	.25	.25
MXH100	X400	32	80	.03125	.03125
		16	40	.0625	.0625
		8	20	.125	.125
		4	10	.25	.25
MXH200	X800	32	40	.03125	.03125
		16	20	.0625	.0625
		8	10	.125	.125
		4	5	.25	.25
MXH250	X1000	32	32	.03125	.03125
		16	16	.0625	.0625
		8	8	.125	.125
		4	4	.25	.25
MXH500	X2000	32	16	.03125	.03125
		16	8	.0625	.0625
		8	4	.125	.125
		4	2	.25	.25

1. Interpolation includes x 4 from quadrature – i.e., MXH50 has a net interpolation of x 200 (x 50 from MXH and x 4 from quadrature).
2. Custom values are available from x1 to x512 multiplication, effectively producing x4 through x2,048, after the controller's x4 multiplicatoin. Multiplication selections possible in any 0.25 increments up to 256 which multiplies into an integer after x 4 (i.e., 5.25, 5.5, or 33, etc. Unacceptable values are 5.4, 5.7, etc) and in increments of 1.0 from 256 to 512.
3. JP2, JP3 set Clock Frequency

1.6.1. MXH Multiplier Board Electrical Specifications

The electrical specifications for the MXH multiplier board are shown in Table 1-10.

Table 1-10. MXH Multiplier Board Electrical Specifications

Parameters		Values
Output Signal		Square Wave, RS--422, TTL-Compatible
Power Supply		4.75 V (min) – 5.25 V (max)
Current Consumption (w/o encoder)	No Terminators on Controller	250 mA
	180 ohm Terminators on Controller	320 mA

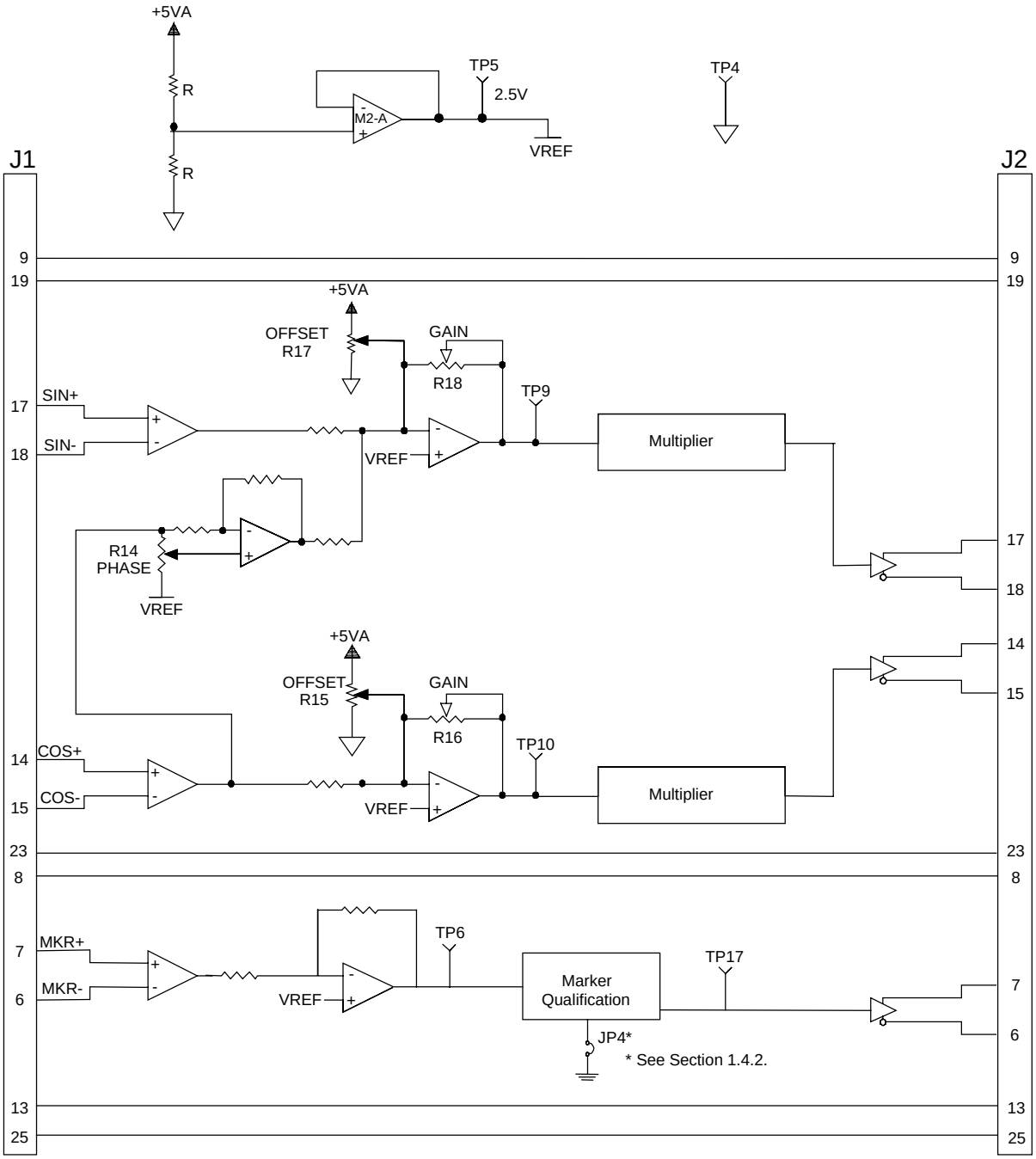


Figure 1-12. MXH General Configuration (No Output Option Selected)

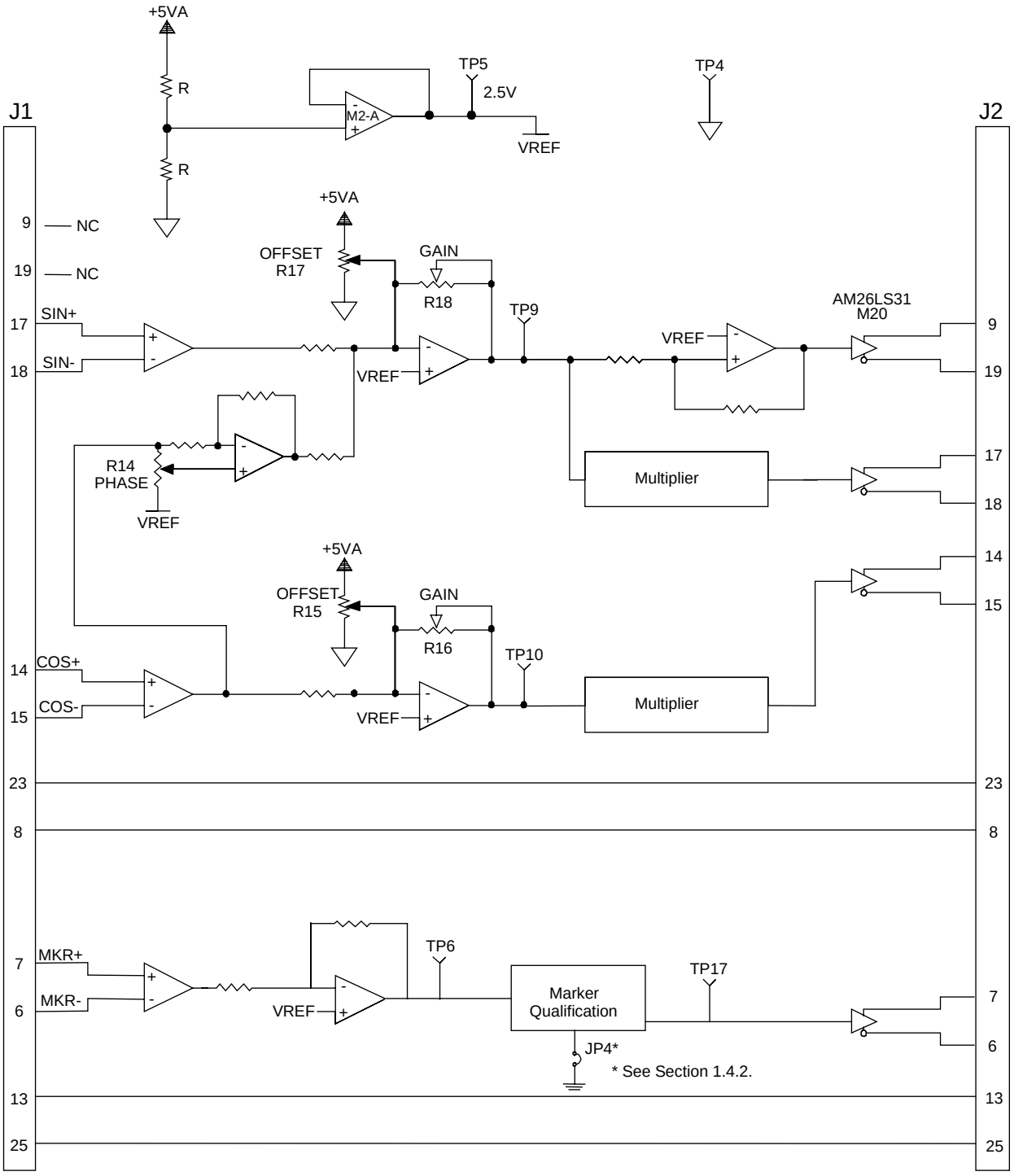


Figure 1-13. MXH Option -1 (Sine Differential Square Wave Output)

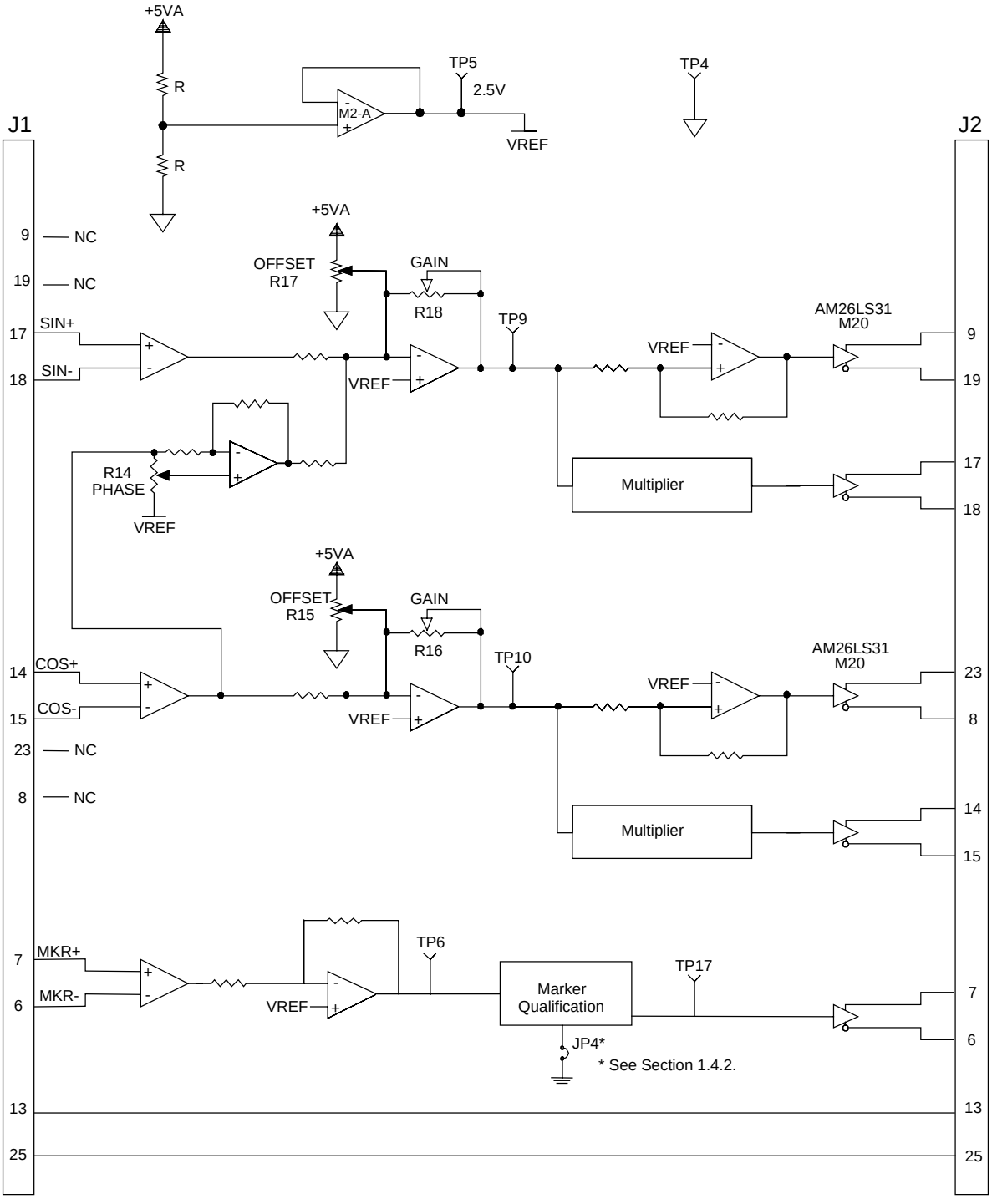


Figure 1-14. MXH Option -2 (Sine & Cosine Differential Square Wave Output)

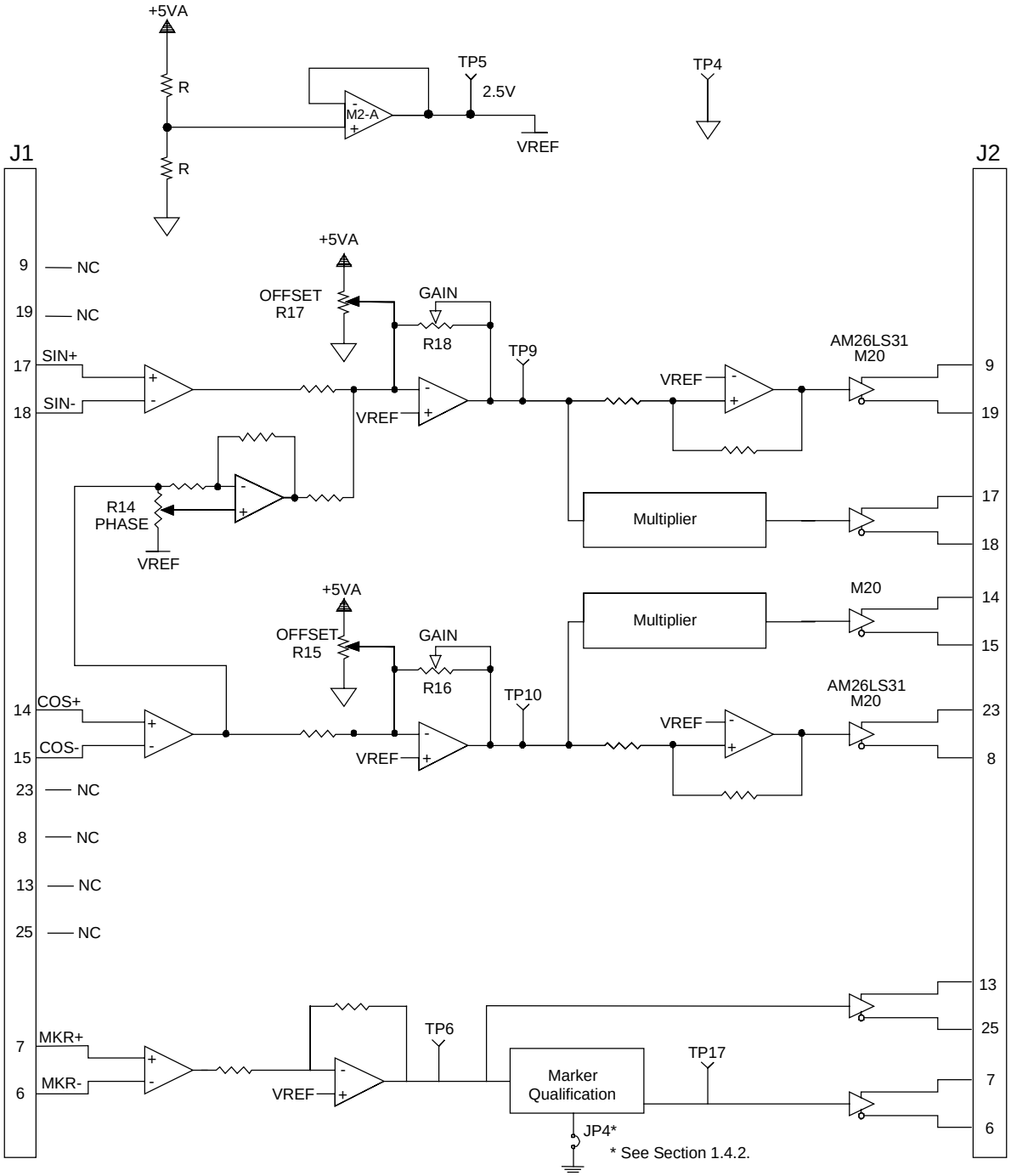


Figure 1-15. MXH Option -3 (Sine, Cosine, and Marker Differential Square Wave Output)

1.7. Physical Dimensions

Figure 1-16 illustrates the dimensions of the MXH multiplier.

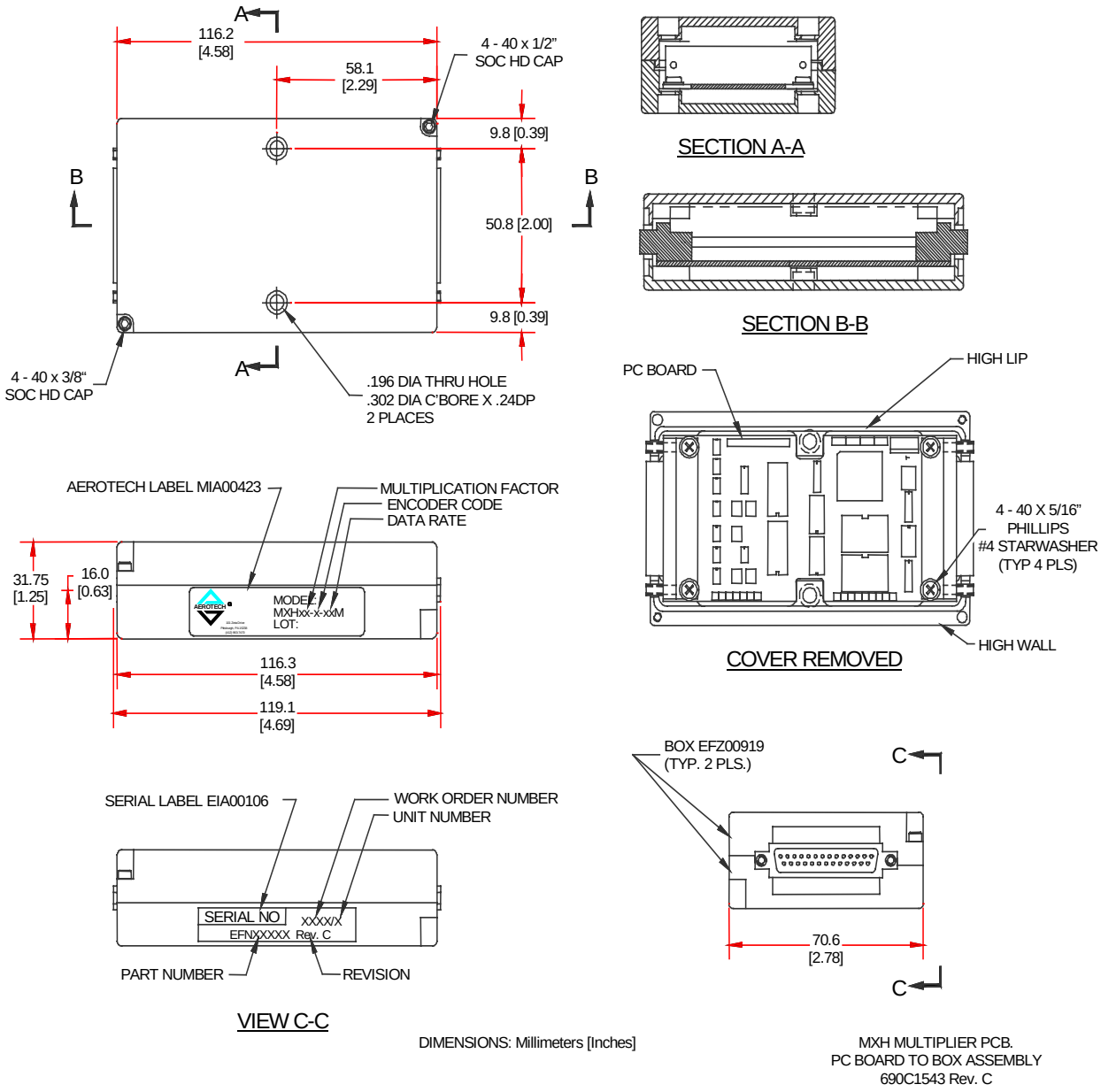


Figure 1-16. MXH Multiplier Dimensions

1.8. Part Number and Ordering Information

The multiplication factor desired and input signal generated by the encoder will determine what MXH multiplier to order. Table 1-11 provides information regarding part numbers for ordering the correct MXH multiplier.

Table 1-11. MXH Multiplier Board Ordering Information Example (MXH-250-D-16M)

MXH	-250	-D	-16M
Multiplier Series	**Multiplier**	**Input Signal**	**Output Frequency**
	10, 50, 100, 200, 250, 500	-D	-4M, -8M, -16M, -32M

Table 1-12. MXH Multiplier Board Options

MXH Series Multiplier	
MXH10	External 10-times (net 40-times interpolation with quadrature) multiplier
MXH50	External 50-times (net 200-times interpolation with quadrature) multiplier
MXH100	External 100-times (net 400-times interpolation with quadrature) multiplier
MXH200	External 200-times (net 800-times interpolation with quadrature) multiplier
MXH250	External 250-times (net 1000-times interpolation with quadrature) multiplier
MXH500	External 500-times (net 2000-times interpolation with quadrature) multiplier
MXHn-D	External “n”-times custom resolution. Consult factory.
Input Signal	
-D	1 V_{p-p} input signal
Output Data Rate	
-4M	4 MHz output signal
-8M	8 MHz output signal
-16M	16 MHz output signal
-32M	32 MHz output signal
Accessories (to be ordered as a separate line item)	
MXC-nn	Multiplier to controller cable; specify length ‘-nn’ in feet

Note: MXH Multipliers available in –A and –B versions as factory supplied configuration. Multiplication selections possible in any 0.25 increments up to MXH256 which multiplies into an integer after x 4 (i.e., 5.25, 5.5, 11, or 33, etc. Unacceptable values are 5.4, 5.7, etc), 1.0 increments from MXH256 to 512.

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APPENDIX A: WARRANTY AND FIELD SERVICE

In This Section:

Aerotech, Inc. warrants its products to be free from 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 which 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, where 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 or 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.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. 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. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. 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 (30) days after the issuance of a return authorization number will be subject to review.

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 air freight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, 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 (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (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 service 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.

Company Address

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

Phone: (412) 963-7470
Fax: (412) 963-7459
TWX: (710) 795-3125

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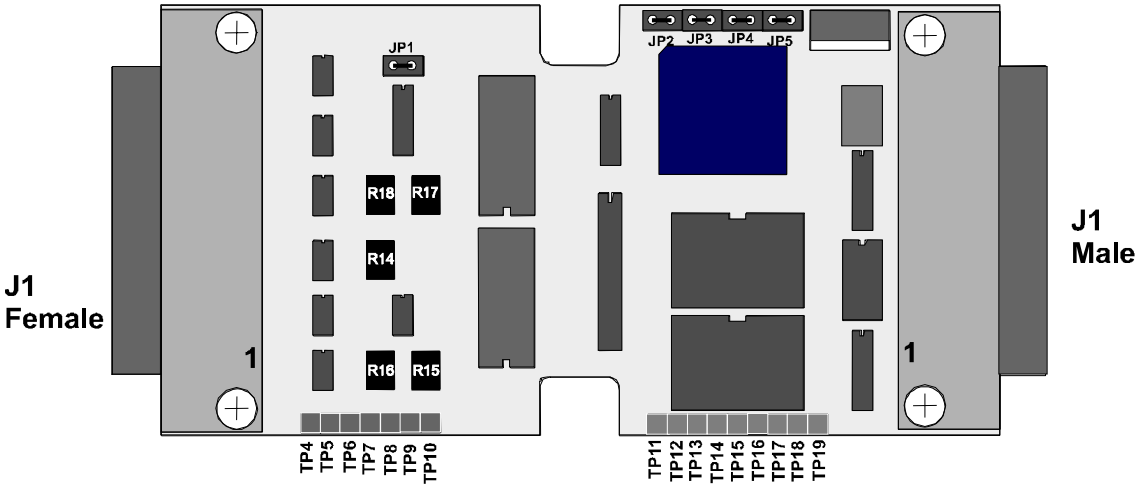
APPENDIX B: MXH MULTIPLIER BOARD (REV A)

In This Section:

B.1. MXH Multiplier Board Hardware Locations



NOTE: Rev A is obsolete, see Figure 1-6 on page 1-6 for the current revision (Rev. C).

Figure B-1. MXH Multiplier Board Hardware Locations (REV A)

B.2. MXH Multiplier Board PCB. PC Board to Box Assembly

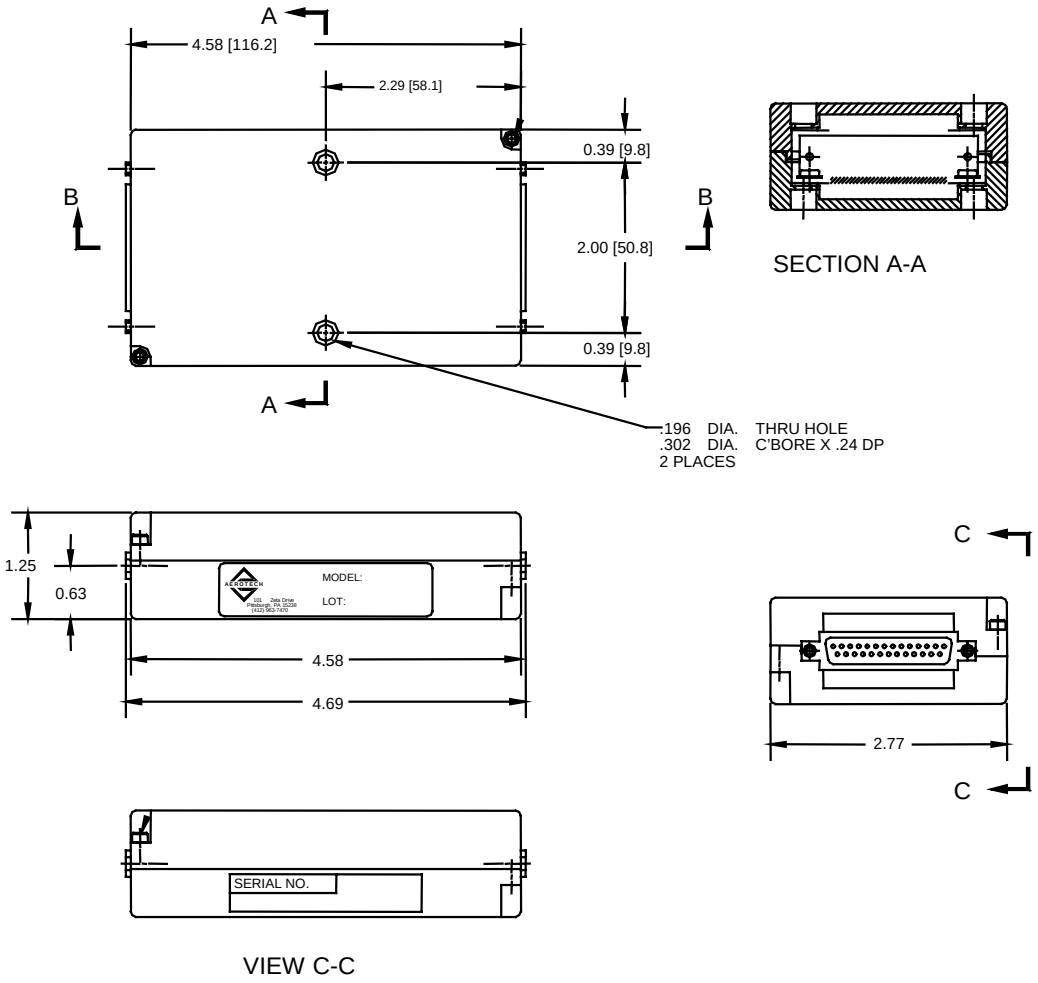


Figure B-2. MXH Multiplier Board Dimensions (REV A)

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Numbers

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

R

S

T

W

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REVISION HISTORY

In This Section:

Revisions

The following section provides the user with general information regarding the latest changes to this manual. Extensive changes, if made, may not be itemized – instead, the section or chapter will be listed with "extensive changes" in the corresponding General Information cell.

Table R-1. Revisions

Revision	Section(s) Affected	General Information
1.5	1.4.6.	Table 1-4 and Table 1-5: Pin Descriptions updated
	1.6.	Table 1-9: #2 note (below the table) updated
1.4	1.1.	Text changes/additions
	1.3.3.	Figure 1-4 and Figure 1-5, diagrams updated.
		Figure 1-6 – drawing error fixed (M1, M2 mislabeled as M5 and M6)
	1.4.1.	Note added indicating that the section applies only to Rev A of the MXH
	1.4.6.	Table 1-6 updated
	1.4.8.	Text and Table 1-8 updated
	1.6.	Text added to Table 1-9 notes
		Figures 1-12 through 1-15 have replaced the original Figure 1-12
	Appendix B	Note on Rev A obsolescence added to Figure B-1

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READER'S COMMENTS

MXH Multiplier Board Option Manual
P/N EDO110, June 2005

Please answer the questions below and add any suggestions for improving this document. Is the information:

	Yes	No
Adequate to the subject?	____	____
Well organized?	____	____
Clearly presented?	____	____
Well illustrated?	____	____
Would you like to see more illustrations?	____	____
Would you like to see more text?	____	____

How do you use this document in your job? Does it meet your needs?
What improvements, if any, would you like to see? Please be specific or cite examples.

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