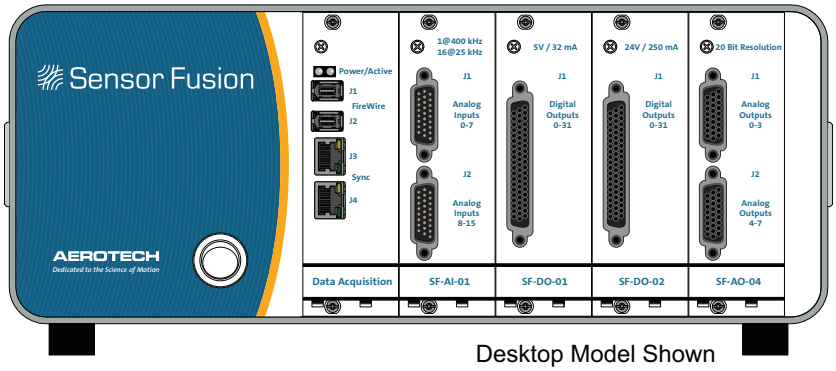
Sensor Fusion Hardware Manual

P/N: EDU220 (Revision 1.00.00)



Desktop Model Shown

Dedicated to the Science of Motion

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Technical Support

Go to www.aerotech.com/service-and-support.aspx 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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NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. Refer to www.aerotech.com for the most up-to-date information.

NOTE: All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. The most recent system drawings and schematics can be found on your software DVD or on www.aerotech.com.

NOTE: 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.

NOTE: This product is intended for light industrial manufacturing or laboratory use.

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EC Declaration of Conformity

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

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

2006/95/EC	Low Voltage Directive

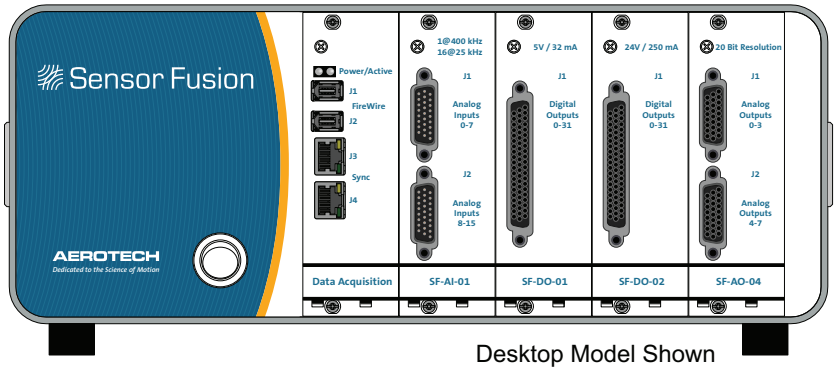
and is in conformity with the applicable requirements of the following documents when installed and used in accordance with the manufacturer's supplied installation instructions.

EN 61010-1	Safety requirements for electrical equipment

Name	/ Alex Weibel
Position	Engineer Verifying Compliance
Location	Pittsburgh, PA
Date	December 2, 2013

Chapter 1: Introduction

Aerotech's Sensor Fusion is a highly-configurable data acquisition and playback module. Using up to four interchangeable cards, the Sensor Fusion provides support for digital inputs, digital outputs, analog inputs, analog outputs and encoder inputs. The Sensor Fusion encoder input card also provides support for Aerotech's Position Synchronized Output (PSO) feature, with four PSO outputs. The Sensor Fusion can be configured to record various I/O configurations, as well as play back recorded data. The Sensor Fusion can be easily integrated with existing A3200 systems to provide additional I/O capabilities.



Desktop Model Shown

Figure 1-1: Sensor Fusion

Table 1-1: Feature Summary

Sensor Fusion Cards	
SF-AI-01	16 differential analog inputs with 18-bit resolution Voltage (±10 V) or current (4 mA – 20 mA) input 400 kHz maximum sampling rate of 1 analog input 25 kHz maximum sampling of 16 analog inputs
SF-AI-02	16 differential analog inputs with 18-bit resolution Voltage (±10 V) or current (4 mA – 20 mA) input 400 kHz maximum sampling rate of 4 analog inputs 100 kHz maximum sampling of 16 analog inputs
SF-DI-01	32 digital inputs 10 MHz maximum sampling rate
SF-DO-01	32 digital outputs 5.5 V maximum output voltage Sourcing or sinking configuration with a maximum current of 32 mA 6.25 MHz maximum update rate
SF-DO-02	32 digital outputs 24 V maximum output voltage Sinking configuration with a maximum current of 250 mA 6.25 MHz maximum update rate
SF-AO-01	8 analog outputs with 16-bit resolution ±10 V maximum output voltage 500 kHz maximum update rate
SF-AO-02	16 analog outputs with 16-bit resolution ±10 V maximum output voltage 500 kHz maximum update rate
SF-AO-03	4 analog outputs with 20-bit resolution ±10 V maximum output voltage 500 kHz maximum update rate
SF-AO-04	8 analog outputs with 20-bit resolution ±10 V maximum output voltage 500 kHz maximum update rate
SF-ENC-01	4 line drive square wave quadrature encoder inputs 1 MHz maximum sampling rate 4 Position Synchronized Outputs
Additional Features	
• 64 MB of internal memory for Data Recording and Data Playback	

Table 1-2: Accessories

Cables	
FireWire	Refer to Section 2.1.1.
26-Pin Cable	Refer to Section Chapter 3.
62-Pin Cable	Refer to Section Chapter 3.
Breakout Blocks	
26-Pin	Refer to Section Chapter 3.
62-Pin	Refer to Section Chapter 3.

1.1. Electrical Specifications

The specifications for the Sensor Fusion are indicated in the table below.

Table 1-3: Electrical Specifications

Specification	Value
Source Voltage	85-264 VAC
Frequency Range	47-63 Hz
Peak Inrush	40 A

1.2. Mechanical Specifications

Dimensions for each model are displayed below.

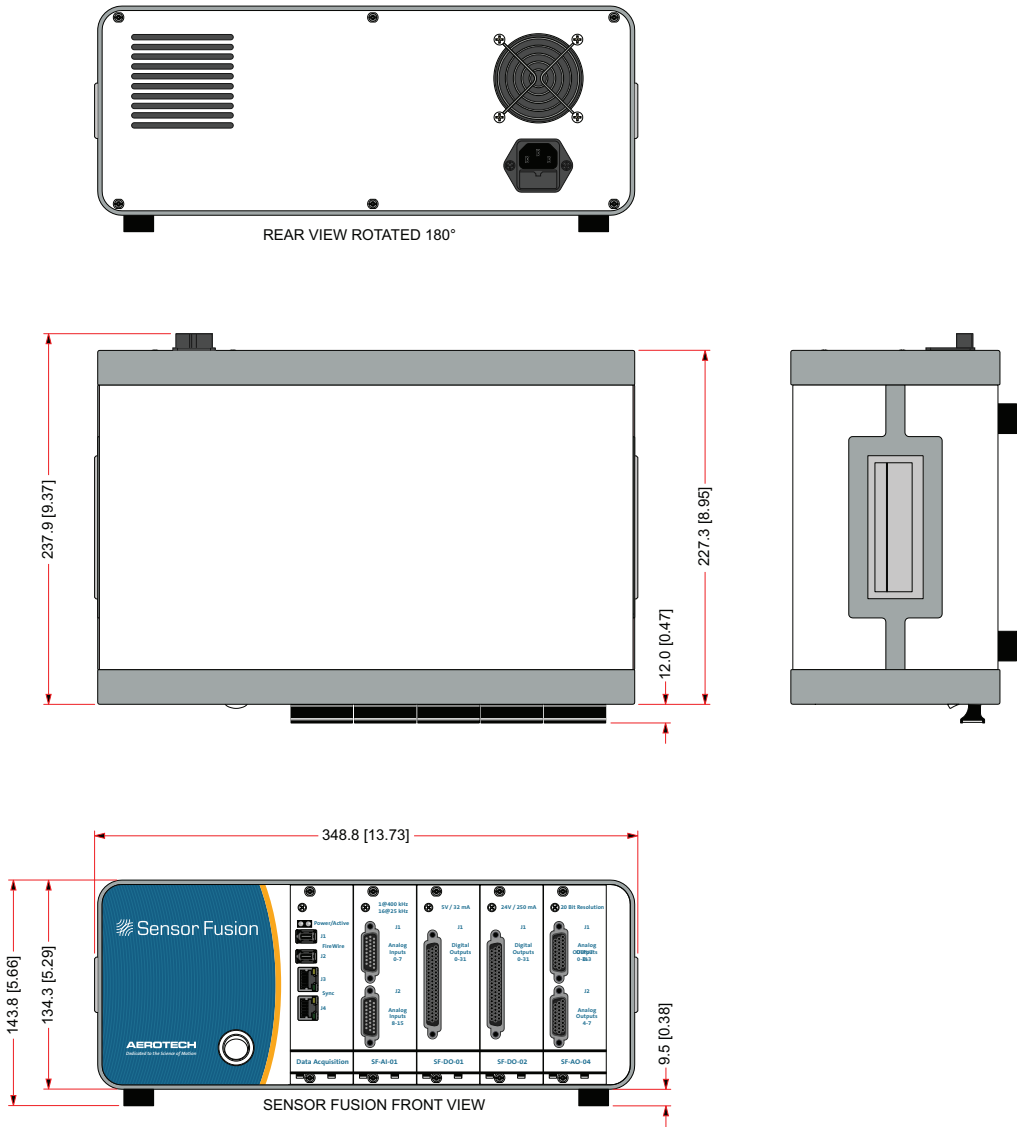


Figure 1-2: Sensor Fusion Desktop Dimensions

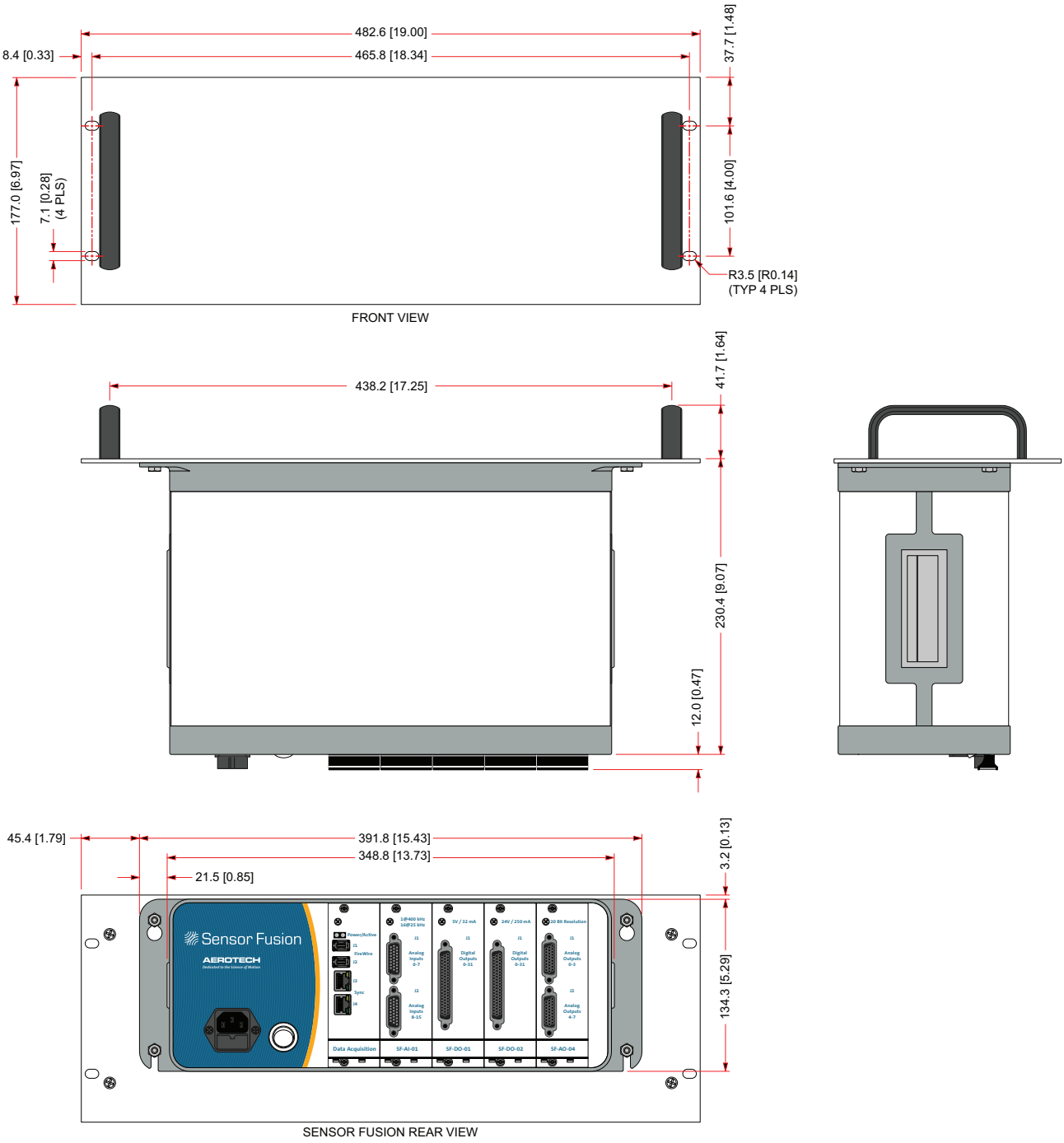


Figure 1-3: Sensor Fusion Rack Mount Dimensions

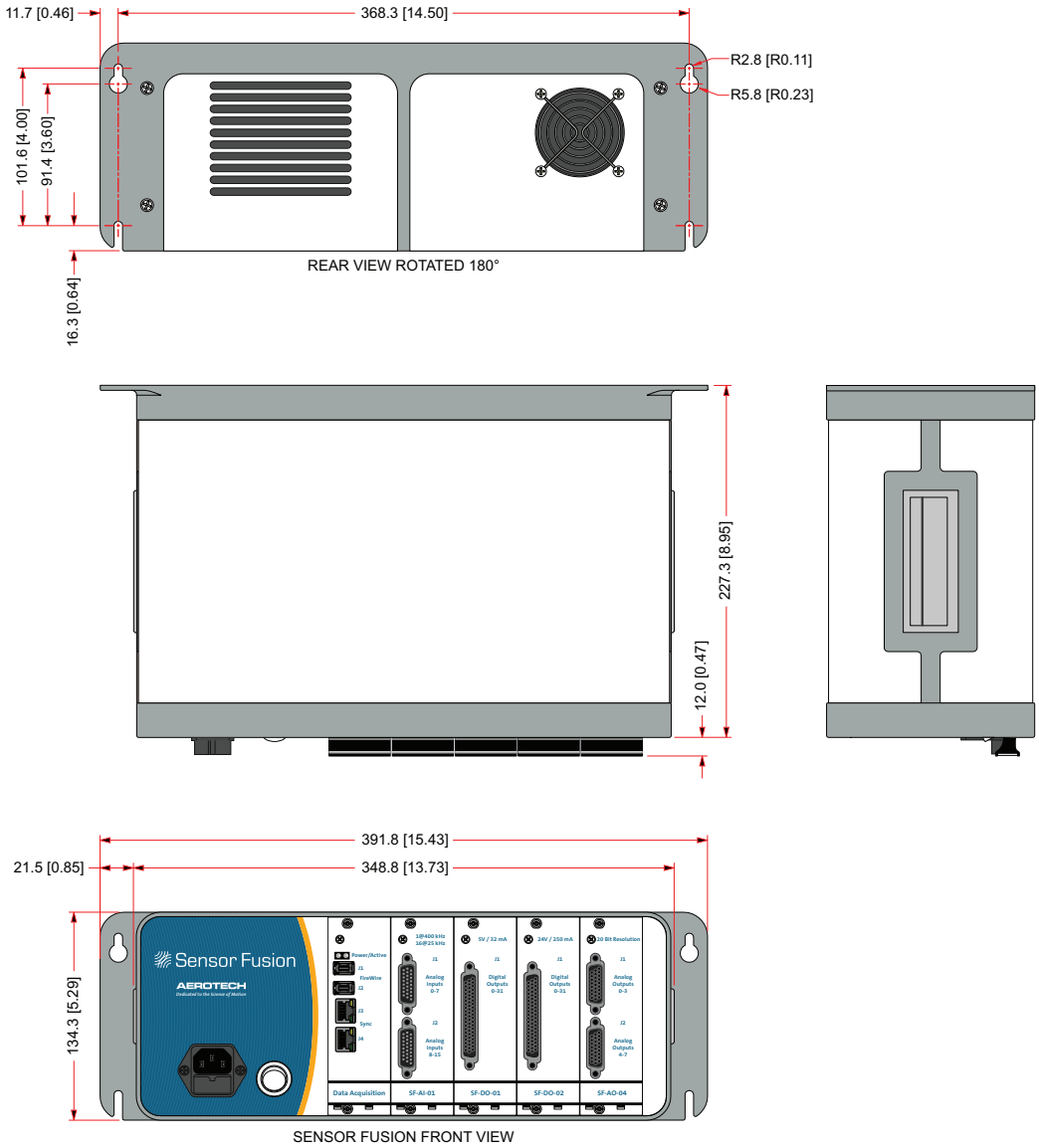


Figure 1-4: Sensor Fusion Panel Mount Dimensions

1.3. Card Installation

For new card installation or to access a current card's jumpers, card removal and/or installation procedures are shown in Figure 1-5.

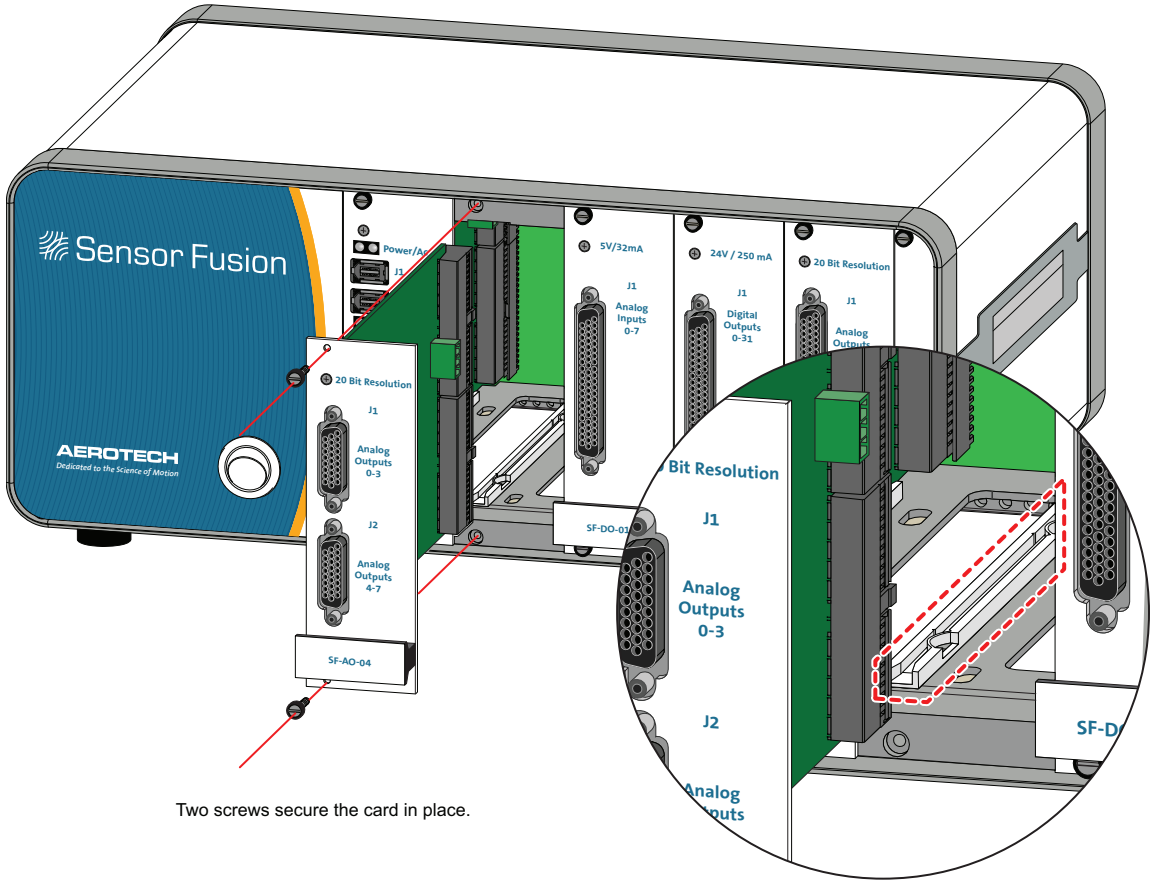
Two screws in the face of the Sensor Fusion secure the card in place.

Two internal rails along the top and bottom guide the card into the proper seating.

Press the card's handle down to assist in card removal.

When returning a card into its slot, a misalignment of the card's connectors can damage or bend the Sensor Fusion's internal connector pins.

DANGER: Always disconnect the Mains power connection before opening the Sensor Fusion chassis.



Two screws secure the card in place.

DETAIL A:
Slide the card along the two guide rails
(bottom (shown) and on top) for proper card placement.

Figure 1-5: Card Installation

Chapter 2: Configuration

This section describes the minimum hardware installation and configuration requirements for the Sensor Fusion drive chassis.

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. Operators should be trained before operating this equipment.

NOTE: The Sensor Fusion (all Aerotech equipment) is not to be used in a manner not specified by Aerotech, Inc.

DANGER: To minimize the possibility of bodily injury and electrical shock, make certain that electrical power is disconnected (Mains disconnect) before performing system maintenance or wiring.

WARNING: All service and maintenance must be performed by qualified personnel.

DANGER: To minimize the possibility of electrical shock and bodily injury when servicing the equipment, ensure that all electrical power switches are in the off position and disconnect main power (Mains disconnect).

NOTE: All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. The most recent system drawings and schematics can be found on your software CD ROM or on www.aerotech.com.

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

2.1. Data Acquisition Card

The Sensor Fusion data acquisition card is required for all Sensor Fusion module configurations to operate. This card contains the control logic for the I/O cards and provides the FireWire interface needed to connect to the A3200 software motion controller.

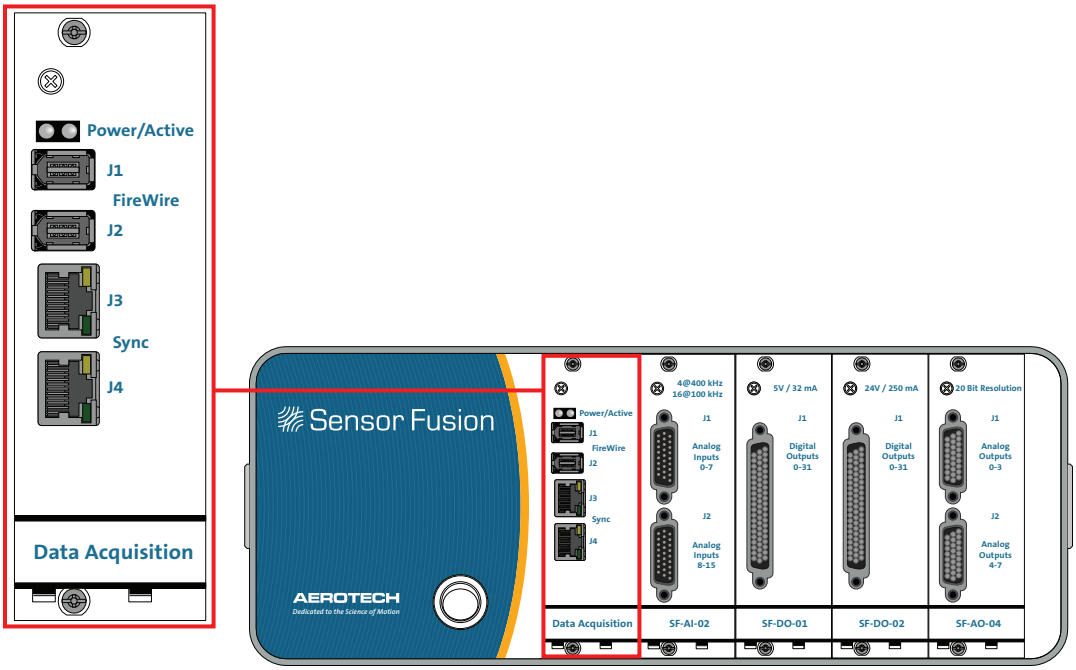


Figure 2-1: Data Acquisition Card

NOTE: These jumpers are reserved for Aerotech use and should not be changed without explicit instructions from an Aerotech employee.

2.1.1. FireWire Interface

The FireWire bus is the high-speed communications connection to the Sensor Fusion operating at 400 megabits per second. All command and configuration information is sent via the FireWire port.

The following table lists compatible FireWire cards, repeaters, and cables available for use with the Sensor Fusion.

Table 2-1: FireWire Card Part Numbers

Part Number	Description
NFIRE-PCI	OHCI compliant FireWire PCI interface card, 3 port
NFIRE-PCIE	OHCI compliant FireWire PCIe x1 interface card, 2 port
NFIRE-PCI-TI-LP	Low Profile, OHCI compliant, PCI
NFIRE-PCIE-GOF	FireWire PCIE X1 Glass Optical Fiber Board

Table 2-2: FireWire Repeaters (for cables exceeding 4.5 m (15 ft) specification)

Part Number	Description
NFIRE-RPTR-1394A-1394A	Extender for copper cable lengths greater than 4.5 m (15 feet).
NFIRE-RPTR-1394A-GOF	Glass Optical Fiber FireWire Repeater, Qty. 1 (Fiber Cable not included)

Table 2-3: FireWire Cables (copper and glass fiber)

Part Number	Description
NCONNECT-4500-66	4.5 m (15 ft) long, 6 pin to 6 pin
NCONNECT-3000-66	3 m (10 ft) long, 6 pin to 6 pin
NCONNECT-1800-66	1.8 m (6 ft) long, 6 pin to 6 pin
NCONNECT-900-66	900 mm (3 ft) long, 6 pin to 6 pin
NCONNECT-381-66	381 mm (15 in) long, 6 pin to 6 pin
NCONNECT-228-66	228 mm (9 in) long, 6 pin to 6 pin
NCONNECT-10000-GOF	10 m (32.8 ft), glass fiber Optical cable
NCONNECT-15000-GOF	15 m (49.2 ft), glass fiber Optical cable
NCONNECT-20000-GOF	20 m (65.6 ft), glass fiber Optical cable
NCONNECT-30000-GOF	30 m (101.7 ft), glass fiber Optical cable

2.1.2. Communication Channel Setting

The Device Number setting of switch S1 is configured at the factory. The Sensor Fusion uses four sequential communication channels starting at the default device number 29 (and includes channels 30, 31, and 32).

NOTE: Each device on an A3200 network must have a unique communication channel number.

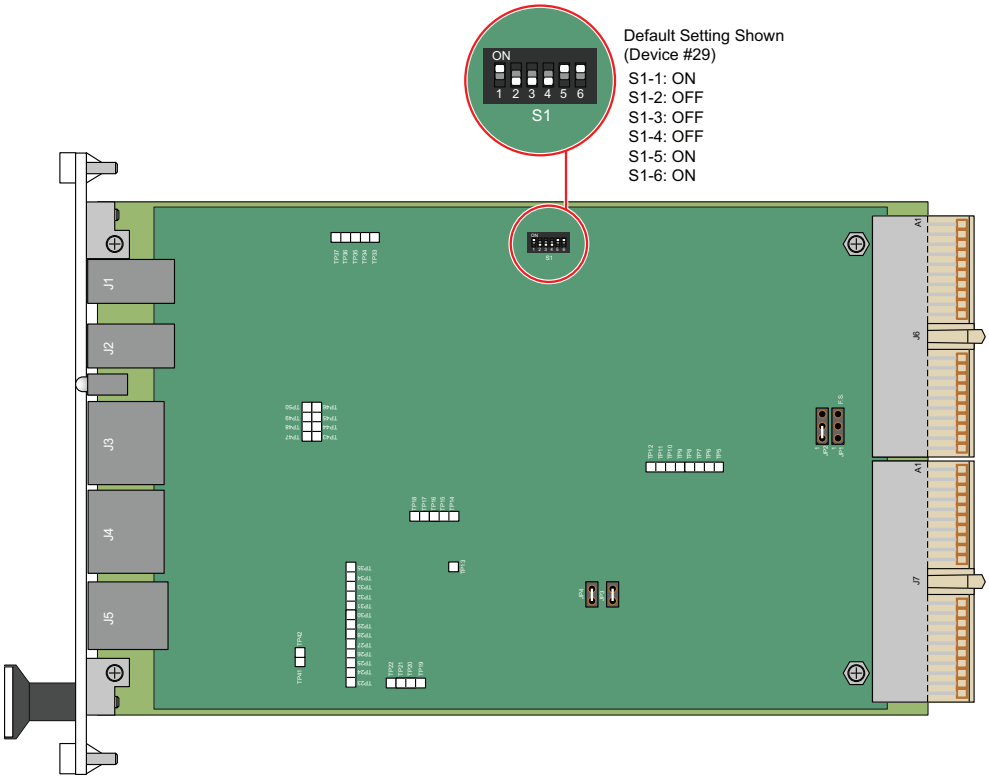


Figure 2-2: Device Number Switch Location (S1)

Table 2-4: Device Number Switch Settings (S1)

Device #	Switch Settings (Off is indicated by "-")					
	1	2 (MSB)	3	4	5	6 (LSB)
29 - 32	ON	-	-	-	ON	ON

2.2. SF-AI-01 Card

The SF-AI-01 analog input card has 16 differential analog input channels. All input channels are multiplexed to a single 18-bit analog-to-digital converter (ADC) and can be independently configured (by jumper setting) for voltage (±10 V) or current (4-20 mA) input. Because all inputs share a single ADC, the maximum sampling rate depends on the number of inputs being sampled.

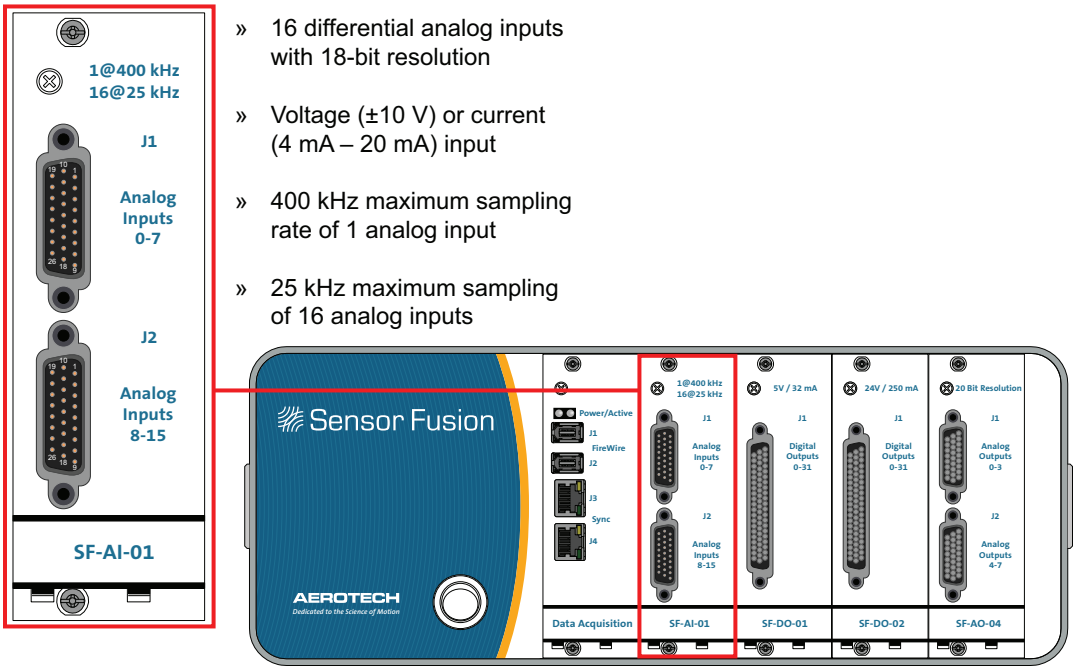


Figure 2-3: SF-AI-01 Card

Table 2-5: SF-AI-01 Sample Rates

Analog Input #	Max Sample Rate (kHz)	Analog Input #	Max Sample Rate (kHz)
0	400.00	8	44.44
1	200.00	9	40.00
2	133.33	10	36.36
3	100.00	11	33.33
4	80.00	12	30.77
5	66.67	13	28.57
6	57.14	14	26.67
7	50.00	15	25.00

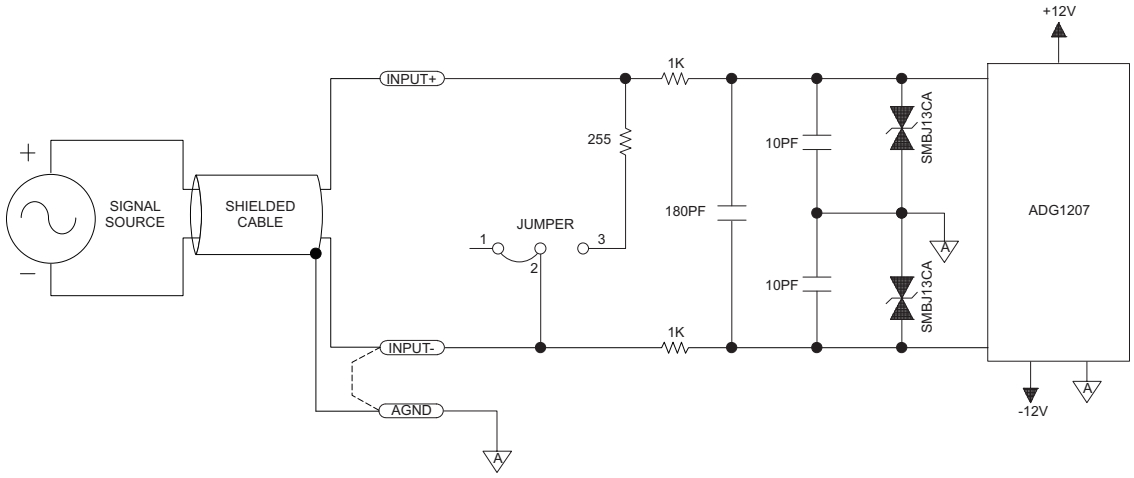


Figure 2-4: SF-AI-01 Representative Circuit

Table 2-6: SF-AI-01 J1 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AGND	Ground	N/A	
2	INPUT2-	Analog Input 2 -	Input	
3	INPUT2+	Analog Input 2 +	Input	
4	AGND	Ground	N/A	
5	INPUT1-	Analog Input 1 -	Input	
6	INPUT1+	Analog Input 1 +	Input	
7	AGND	Ground	N/A	
8	INPUT0-	Analog Input 0 -	Input	
9	INPUT0+	Analog Input 0 +	Input	
10	AGND	Ground	N/A	
11	INPUT5-	Analog Input 5 -	Input	
12	INPUT5+	Analog Input 5 +	Input	
13	AGND	Ground	N/A	
14	INPUT4-	Analog Input 4 -	Input	
15	INPUT4+	Analog Input 4 +	Input	
16	AGND	Ground	N/A	
17	INPUT3-	Analog Input 3 -	Input	
18	INPUT3+	Analog Input 3 +	Input	
19	AGND	Ground	N/A	
20	Reserved	Reserved	Output	
21	AGND	Ground	N/A	
22	INPUT7-	Analog Input 7 -	Input	
23	INPUT7+	Analog Input 7 +	Input	
24	AGND	Ground	N/A	
25	INPUT6-	Analog Input 6 -	Input	
26	INPUT6+	Analog Input 6 +	Input	

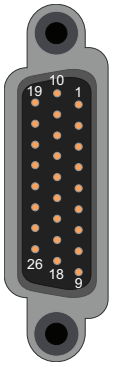
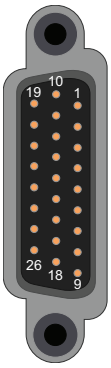


Table 2-7: SF-AI-01 J2 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AGND	Ground	N/A	
2	INPUT10-	Analog Input 10 -	Input	
3	INPUT10+	Analog Input 10 +	Input	
4	AGND	Ground	N/A	
5	INPUT9-	Analog Input 9 -	Input	
6	INPUT9+	Analog Input 9 +	Input	
7	AGND	Ground	N/A	
8	INPUT8-	Analog Input 8 -	Input	
9	INPUT8+	Analog Input 8 +	Input	
10	AGND	Ground	N/A	
11	INPUT13-	Analog Input 13 -	Input	
12	INPUT13+	Analog Input 13 +	Input	
13	AGND	Ground	N/A	
14	INPUT12-	Analog Input 12 -	Input	
15	INPUT12+	Analog Input 12 +	Input	
16	AGND	Ground	N/A	
17	INPUT11-	Analog Input 11 -	Input	
18	INPUT11+	Analog Input 11 +	Input	
19	AGND	Ground	N/A	
20	Reserved	Reserved	Output	
21	AGND	Ground	N/A	
22	INPUT15-	Analog Input 15 -	Input	
23	INPUT15+	Analog Input 15 +	Input	
24	AGND	Ground	N/A	
25	INPUT14-	Analog Input 14 -	Input	
26	INPUT14+	Analog Input 14 +	Input	

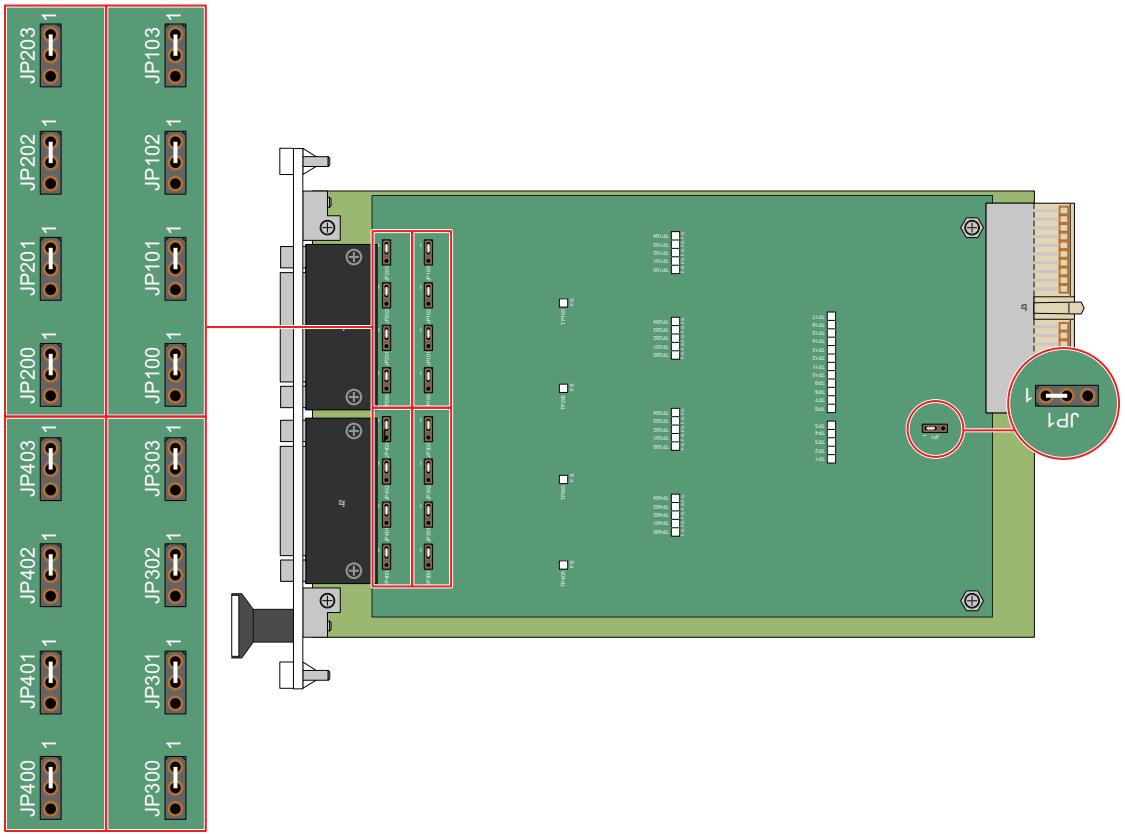


Figure 2-5: SF-AI-01 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-8: SF-AI-01 Jumper Configuration

Jumper	Setting	Description	Input
JP1(2)	1-2 (1)	Write Not Allowed	N/A
	2-3	Write Allowed	
JP100	1-2 (1)	Voltage Input	Input 3
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP101	1-2 (1)	Voltage Input	Input 0
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP102	1-2 (1)	Voltage Input	Input 1
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP103	1-2 (1)	Voltage Input	Input 2
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP200	1-2 (1)	Voltage Input	Input 6
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP201	1-2 (1)	Voltage Input	Input 4
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	

Jumper	Setting	Description	Input
JP202	1-2 (1)	Voltage Input	Input 7
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP203	1-2 (1)	Voltage Input	Input 5
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP300	1-2 (1)	Voltage Input	Input 11
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP301	1-2 (1)	Voltage Input	Input 8
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP302	1-2 (1)	Voltage Input	Input 9
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP303	1-2 (1)	Voltage Input	Input 10
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP400	1-2 (1)	Voltage Input	Input 14
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP401	1-2 (1)	Voltage Input	Input 12
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP402	1-2 (1)	Voltage Input	Input 15
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP403	1-2 (1)	Voltage Input	Input 13
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	

(1) Default
(2) Reserved for Aerotech use; do not change without explicit instruction from Aerotech

2.3. SF-AI-02 Card

The SF-AI-02 high speed analog input card has 16 differential analog input channels. The 16 input channels are grouped into four groups of four channels each, with all channels in a single group multiplexed to a single 18-bit analog-to-digital converter (ADC). Each channel can be independently configured (by jumper setting) for voltage (±10 V) or current (4-20 mA) input. Because multiple inputs share a single ADC, the maximum sampling rate depends on the number of inputs being sampled.

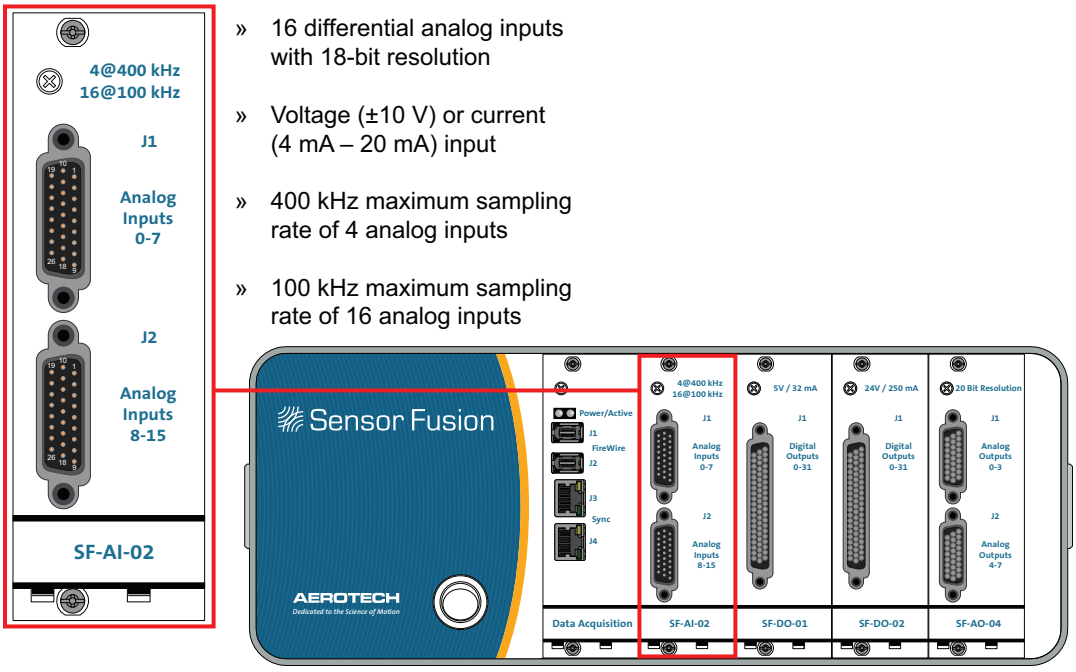


Figure 2-6: SF-AI-02 Card

Table 2-9: SF-AI-02 Sample Rates

Analog Input Number	Maximum Sample Rate (kHz)
0, 4, 8, 12	400.00
1, 5, 9, 13	200.00
2, 6, 10, 14	133.33
3, 7, 11, 15	100.00

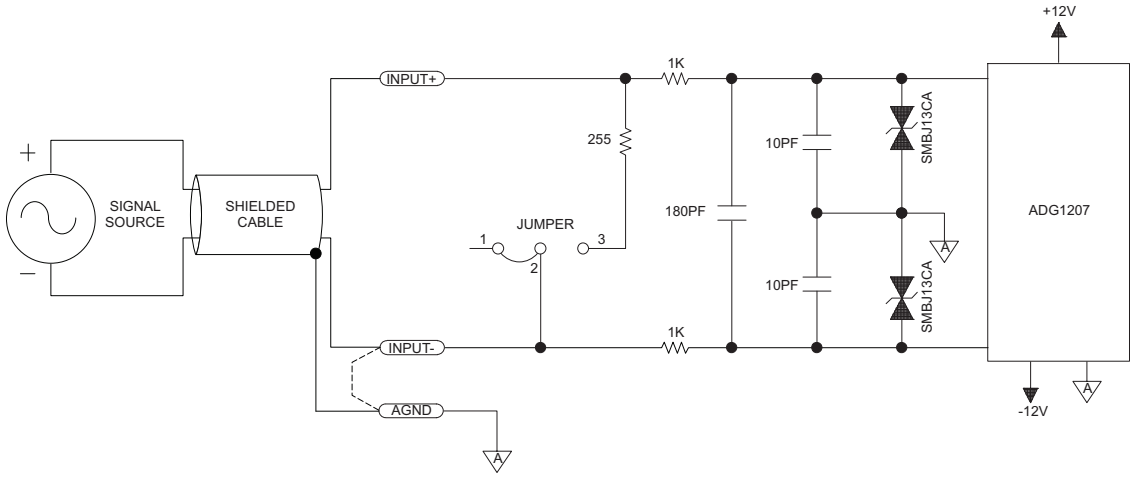


Figure 2-7: SF-AI-02 Representative Circuit

Table 2-10: SF-AI-02 J1 Pinout

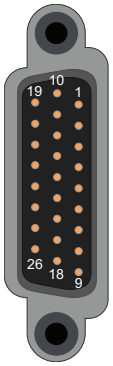
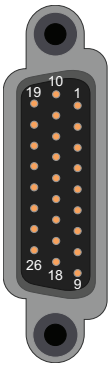
Pin#	Label	Description	In/Out/Bi	Connector
1	AGND	Ground	N/A	
2	INPUT2-	Analog Input 2 -	Input	
3	INPUT2+	Analog Input 2 +	Input	
4	AGND	Ground	N/A	
5	INPUT1-	Analog Input 1 -	Input	
6	INPUT1+	Analog Input 1 +	Input	
7	AGND	Ground	N/A	
8	INPUT0-	Analog Input 0 -	Input	
9	INPUT0+	Analog Input 0 +	Input	
10	AGND	Ground	N/A	
11	INPUT5-	Analog Input 5 -	Input	
12	INPUT5+	Analog Input 5 +	Input	
13	AGND	Ground	N/A	
14	INPUT4-	Analog Input 4 -	Input	
15	INPUT4+	Analog Input 4 +	Input	
16	AGND	Ground	N/A	
17	INPUT3-	Analog Input 3 -	Input	
18	INPUT3+	Analog Input 3 +	Input	
19	AGND	Ground	N/A	
20	Reserved	Reserved	Output	
21	AGND	Ground	N/A	
22	INPUT7-	Analog Input 7 -	Input	
23	INPUT7+	Analog Input 7 +	Input	
24	AGND	Ground	N/A	
25	INPUT6-	Analog Input 6 -	Input	
26	INPUT6+	Analog Input 6 +	Input	

Table 2-11: SF-AI-02 J2 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AGND	Ground	N/A	
2	INPUT10-	Analog Input 10 -	Input	
3	INPUT10+	Analog Input 10 +	Input	
4	AGND	Ground	N/A	
5	INPUT9-	Analog Input 9 -	Input	
6	INPUT9+	Analog Input 9 +	Input	
7	AGND	Ground	N/A	
8	INPUT8-	Analog Input 8 -	Input	
9	INPUT8+	Analog Input 8 +	Input	
10	AGND	Ground	N/A	
11	INPUT13-	Analog Input 13 -	Input	
12	INPUT13+	Analog Input 13 +	Input	
13	AGND	Ground	N/A	
14	INPUT12-	Analog Input 12 -	Input	
15	INPUT12+	Analog Input 12 +	Input	
16	AGND	Ground	N/A	
17	INPUT11-	Analog Input 11 -	Input	
18	INPUT11+	Analog Input 11 +	Input	
19	AGND	Ground	N/A	
20	Reserved	Reserved	Output	
21	AGND	Ground	N/A	
22	INPUT15-	Analog Input 15 -	Input	
23	INPUT15+	Analog Input 15 +	Input	
24	AGND	Ground	N/A	
25	INPUT14-	Analog Input 14 -	Input	
26	INPUT14+	Analog Input 14 +	Input	

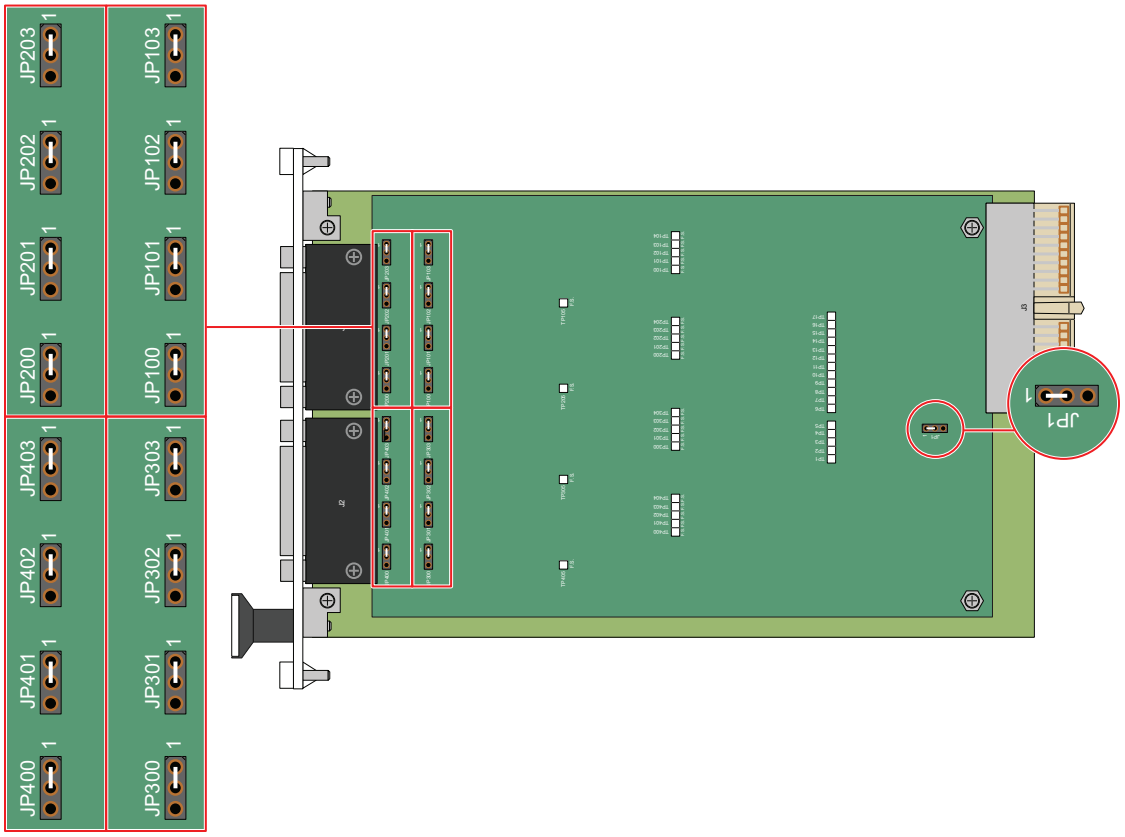


Figure 2-8: SF-AI-02 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-12: SF-AI-02 Jumper Configuration

Jumper	Setting	Description	Input
JP1(2)	1-2 (1)	Write Not Allowed	N/A
	2-3	Write Allowed	
JP100	1-2 (1)	Voltage Input	Input 3
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP101	1-2 (1)	Voltage Input	Input 0
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP102	1-2 (1)	Voltage Input	Input 1
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP103	1-2 (1)	Voltage Input	Input 2
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP200	1-2 (1)	Voltage Input	Input 6
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP201	1-2 (1)	Voltage Input	Input 4
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	

Jumper	Setting	Description	Input
JP202	1-2 (1)	Voltage Input	Input 7
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP203	1-2 (1)	Voltage Input	Input 5
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP300	1-2 (1)	Voltage Input	Input 11
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP301	1-2 (1)	Voltage Input	Input 8
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP302	1-2 (1)	Voltage Input	Input 9
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP303	1-2 (1)	Voltage Input	Input 10
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP400	1-2 (1)	Voltage Input	Input 14
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP401	1-2 (1)	Voltage Input	Input 12
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP402	1-2 (1)	Voltage Input	Input 15
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	
JP403	1-2 (1)	Voltage Input	Input 13
	2-3	Current Input (I-V convertor for 4 - 20 mA current input)	

(1) Default
(2) Reserved for Aerotech use; do not change without explicit instruction from Aerotech

2.4. SF-DO-01 Card

The SF-DO-01 digital output card has 32 isolated digital outputs arranged in two groups of 16 outputs. Each output can change at up to 6.25 MHz and source or sink up to 32 mA of current. The outputs are connected to the internal 5V supply (default configuration) but can be connected to an externally-supplied voltage in the range of 1.65 - 5.5 V by changing jumper JP2 (for outputs 0-15) or JP3 (for outputs 16-31).

Bank 0 (outputs 0-15) and Bank 1 (outputs 16-31) commons are isolated from each other. Each bank has its own isolated power supply used to power its logic circuit. All of the outputs in a given bank share a common connection. Connect at least one common per output up to the maximum of 13.

- » 32 digital outputs
- » 5.5 V maximum output voltage
- » Sourcing or sinking configuration with a maximum current of 32 mA
- » 6.25 MHz maximum update rate

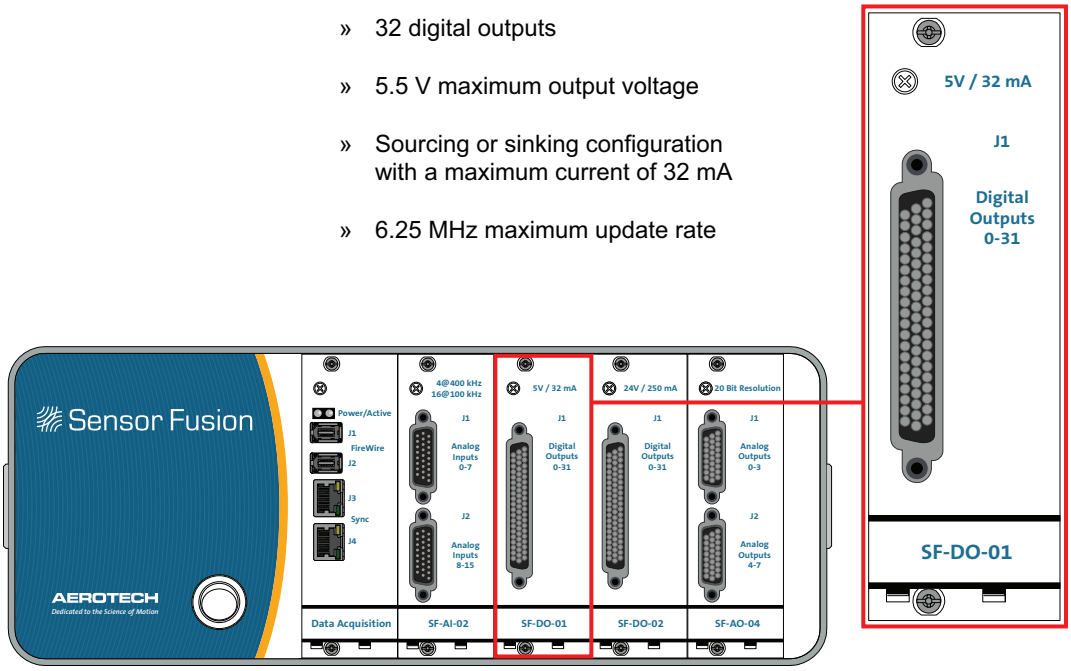


Figure 2-9: SF-DO-01 Card

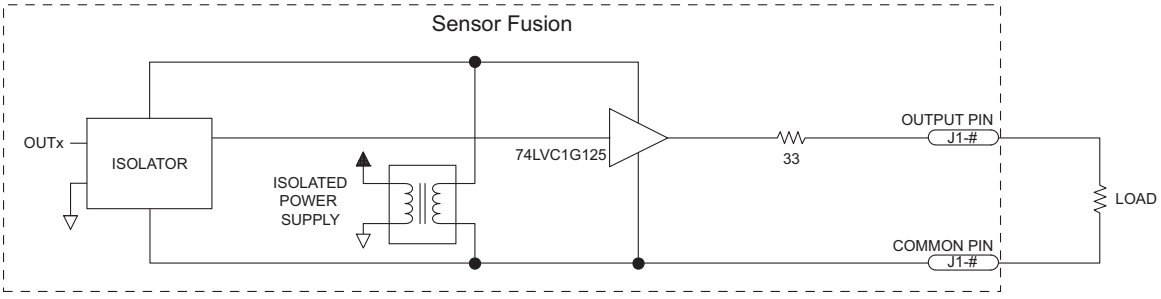
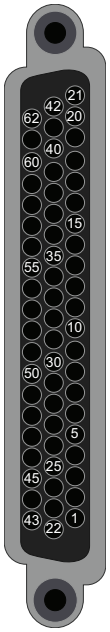


Figure 2-10: SF-DO-01 Representative Circuit

Table 2-13: SF-DO-01 J1 Pinout

Pin	Description	In/Out/Bi	Connector
2	Digital Output 0	Output	
44	Digital Output 1	Output	
3	Digital Output 2	Output	
45	Digital Output 3	Output	
4	Digital Output 4	Output	
46	Digital Output 5	Output	
5	Digital Output 6	Output	
47	Digital Output 7	Output	
6	Digital Output 8	Output	
48	Digital Output 9	Output	
7	Digital Output 10	Output	
49	Digital Output 11	Output	
8	Digital Output 12	Output	
50	Digital Output 13	Output	
9	Digital Output 14	Output	
51	Digital Output 15	Output	
1	Common for digital Outputs 0-15	x	
22-32	Common for digital Outputs 0-15	x	
43	Common for digital Outputs 0-15	x	
52	Common for digital Outputs 0-15	x	
12	Digital Output 16	Output	
54	Digital Output 17	Output	
13	Digital Output 18	Output	
55	Digital Output 19	Output	
14	Digital Output 20	Output	
56	Digital Output 21	Output	
15	Digital Output 22	Output	
57	Digital Output 23	Output	
16	Digital Output 24	Output	
58	Digital Output 25	Output	
17	Digital Output 26	Output	
59	Digital Output 27	Output	
18	Digital Output 28	Output	
60	Digital Output 29	Output	
19	Digital Output 30	Output	
61	Digital Output 31	Output	
11	Common for digital Outputs 16-31	x	
21	Common for digital Outputs 16-31	x	
33-42	Common for digital Outputs 16-31	x	
53	Common for digital Outputs 16-31	x	
62	Common for digital Outputs 16-31	x	



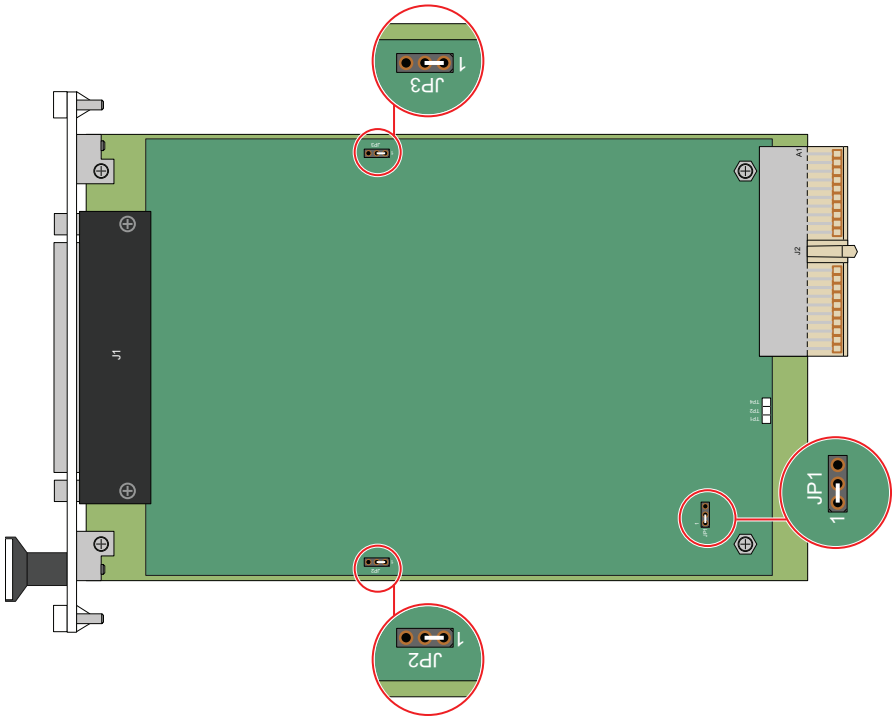


Figure 2-11: SF-DO-01 Card Jumper Locations

NOTE: Jumper (JP1, JP2, and JP3) are factory configured as 1-2. This setting is required for proper operation and should not be changed without explicit instruction from an Aerotech employee.

2.5. SF-DO-02 Card

The SF-DO-02 digital output card has 32 isolated digital outputs supporting a maximum update frequency of 6.25 MHz. The output circuit is an open-drain configuration which can sink up to 250 mA and supports voltages up to 24 V. Each output has overcurrent protection. During an overload condition, the output will automatically turn off for approximately one second before attempting to turn back on. This cycling will continue until the overload condition is cleared.

Bank 0 (outputs 0-15) and Bank 1 (outputs 16-31) commons are isolated from each other. Each bank has its own isolated power supply used to power its logic circuit. All of the outputs in a given bank share a common connection. Connect at least one common per output up to the maximum of 13.

- » 32 digital outputs
- » 24 V maximum output voltage
- » Sinking configuration with a maximum current of 250 mA
- » 6.25 MHz maximum update rate

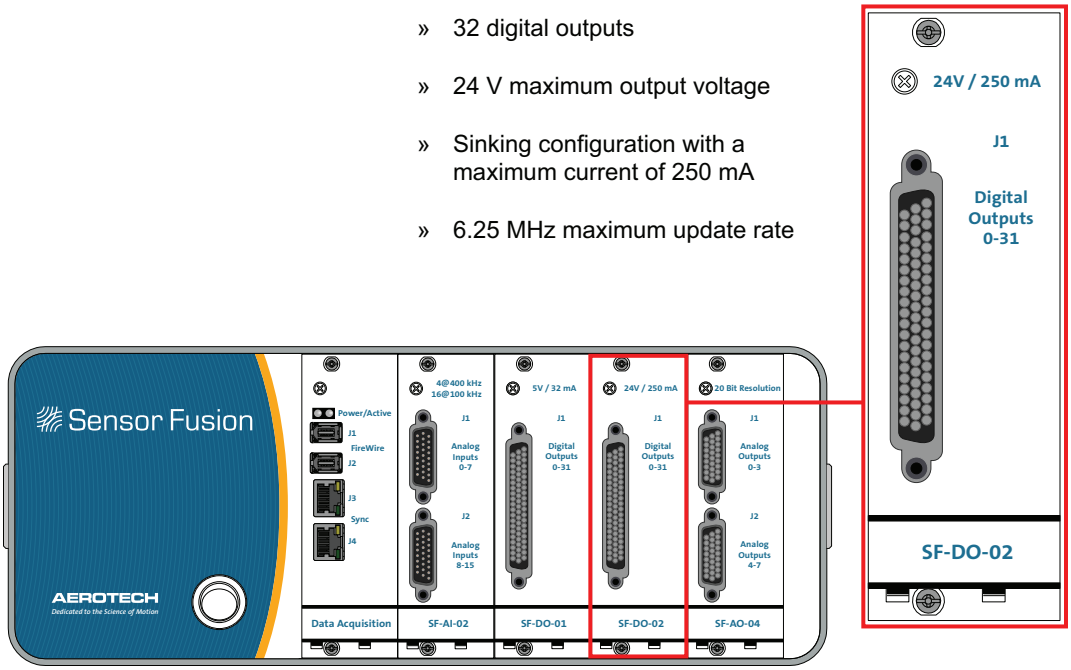


Figure 2-12: SF-DO-02 Card

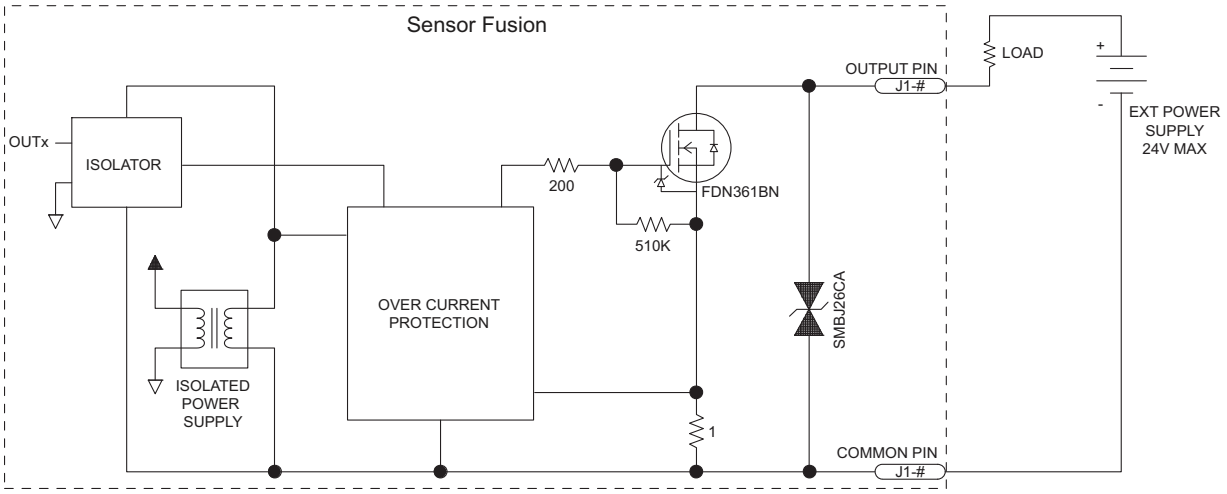
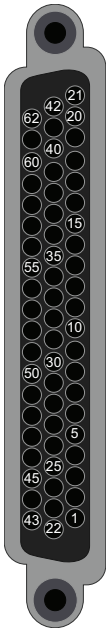


Figure 2-13: SF-DO-02 Representative Circuit

Table 2-14: SF-DO-02 J1 Pinout

Pin	Description	In/Out/Bi	Connector
2	Digital Output 0	Output	
44	Digital Output 1	Output	
3	Digital Output 2	Output	
45	Digital Output 3	Output	
4	Digital Output 4	Output	
46	Digital Output 5	Output	
5	Digital Output 6	Output	
47	Digital Output 7	Output	
6	Digital Output 8	Output	
48	Digital Output 9	Output	
7	Digital Output 10	Output	
49	Digital Output 11	Output	
8	Digital Output 12	Output	
50	Digital Output 13	Output	
9	Digital Output 14	Output	
51	Digital Output 15	Output	
1	Common for digital Outputs 0-15	x	
22-32	Common for digital Outputs 0-15	x	
43	Common for digital Outputs 0-15	x	
52	Common for digital Outputs 0-15	x	
12	Digital Output 16	Output	
54	Digital Output 17	Output	
13	Digital Output 18	Output	
55	Digital Output 19	Output	
14	Digital Output 20	Output	
56	Digital Output 21	Output	
15	Digital Output 22	Output	
57	Digital Output 23	Output	
16	Digital Output 24	Output	
58	Digital Output 25	Output	
17	Digital Output 26	Output	
59	Digital Output 27	Output	
18	Digital Output 28	Output	
60	Digital Output 29	Output	
19	Digital Output 30	Output	
61	Digital Output 31	Output	
11	Common for digital Outputs 16-31	x	
21	Common for digital Outputs 16-31	x	
33-42	Common for digital Outputs 16-31	x	
53	Common for digital Outputs 16-31	x	
62	Common for digital Outputs 16-31	x	



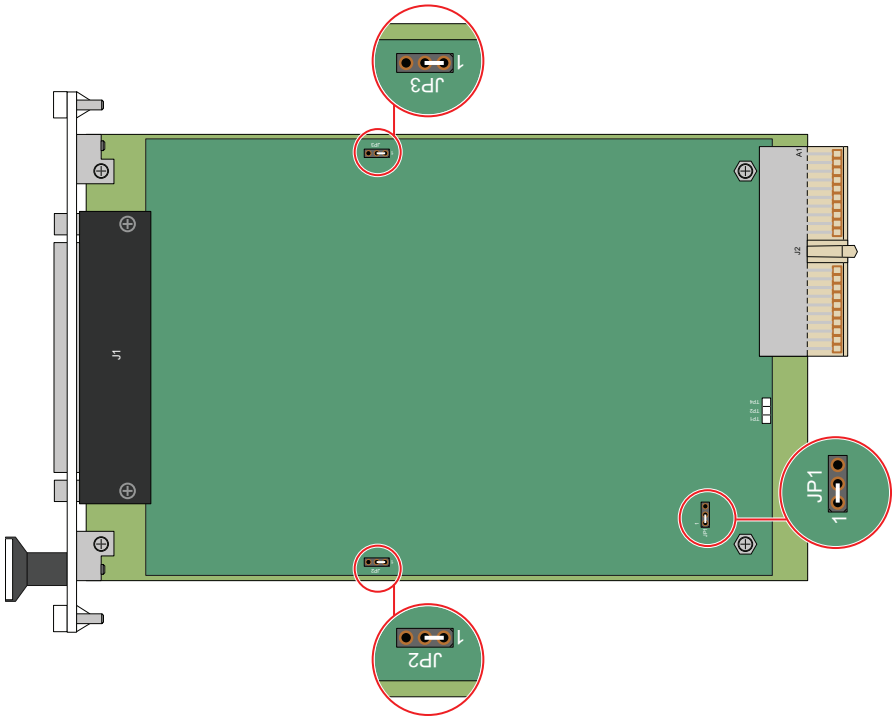


Figure 2-14: SF-DO-02 Card Jumper Locations

NOTE: Jumper (JP1, JP2, and JP3) are factory configured as 1-2. This setting is required for proper operation and should not be changed without explicit instruction from an Aerotech employee.

2.6. SF-DI-01 Card

The SF-DI-01 card has two banks of 16 digital bit inputs designed for 5 V operation. Each bank is optically isolated from the main logic supply and from the other bank. All of the common connections of a given bank should be connected to the signal common of the driving source for best signal integrity. The DI-01 card has jumper configurable termination allowing pull-up, pull-down, 24 V compatibility, and custom termination options. Each input bit is independently configurable using the jumpers listed in Table 2-16 and Table 2-17.

Figure 2-16 shows the input resistor jumper configurations.

» 32 digital inputs

» 10 MHz maximum sampling rate

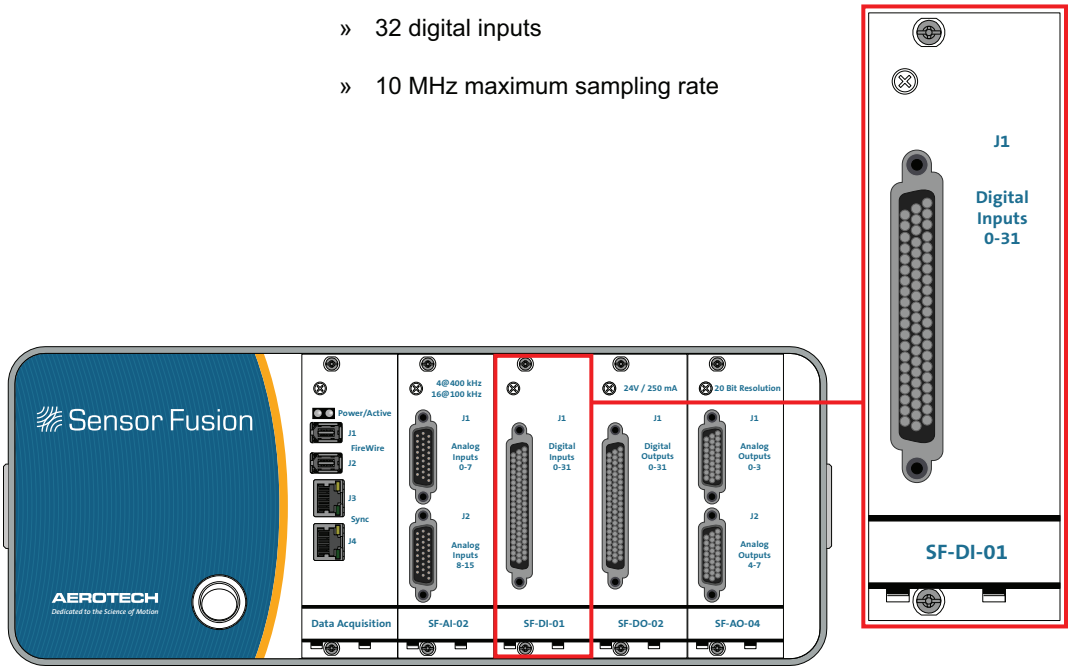


Figure 2-15: SF-DI-01 Card

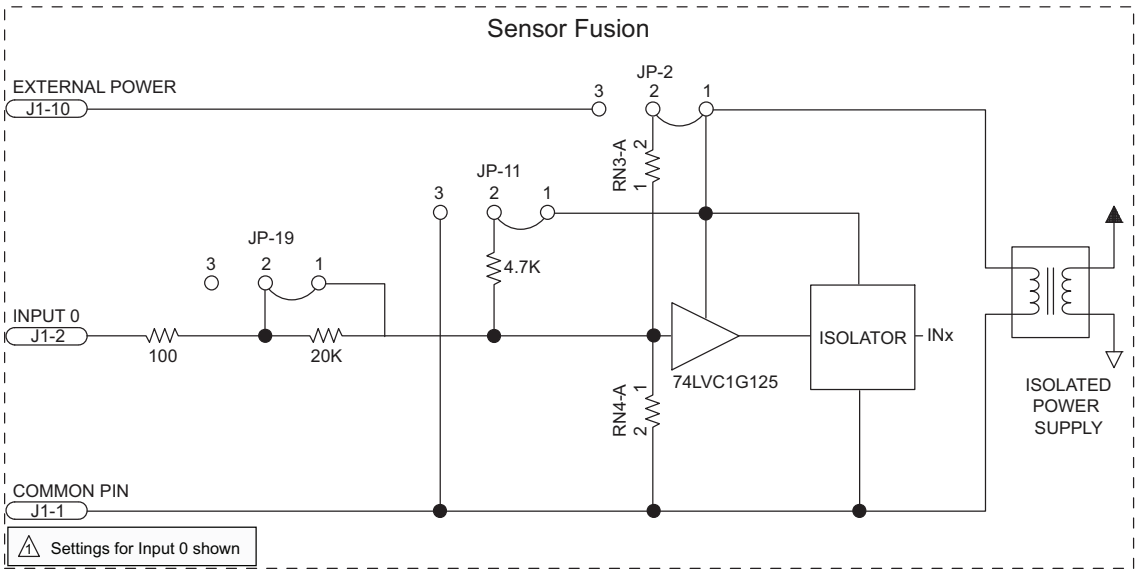
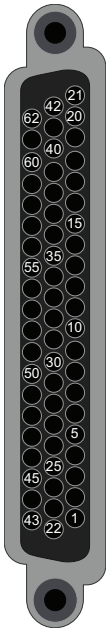


Figure 2-16: SF-DI-01 Representative Circuit

Table 2-15: SF-DI-01 J1 Pinout

Pin	Description	In/Out/Bi	Connector
2	Digital Input 0	Input	
44	Digital Input 1	Input	
3	Digital Input 2	Input	
45	Digital Input 3	Input	
4	Digital Input 4	Input	
46	Digital Input 5	Input	
5	Digital Input 6	Input	
47	Digital Input 7	Input	
6	Digital Input 8	Input	
48	Digital Input 9	Input	
7	Digital Input 10	Input	
49	Digital Input 11	Input	
8	Digital Input 12	Input	
50	Digital Input 13	Input	
9	Digital Input 14	Input	
51	Digital Input 15	Input	
1	Common for digital Inputs 0-15	x	
22-32	Common for digital Inputs 0-15	x	
43	Common for digital Inputs 0-15	x	
52	Common for digital Inputs 0-15	x	
10	Power supply for optional resistors (Inputs 0-15)	x	
12	Digital Input 16	Input	
54	Digital Input 17	Input	
13	Digital Input 18	Input	
55	Digital Input 19	Input	
14	Digital Input 20	Input	
56	Digital Input 21	Input	
15	Digital Input 22	Input	
57	Digital Input 23	Input	
16	Digital Input 24	Input	
58	Digital Input 25	Input	
17	Digital Input 26	Input	
59	Digital Input 27	Input	
18	Digital Input 28	Input	
60	Digital Input 29	Input	
19	Digital Input 30	Input	
61	Digital Input 31	Input	
11	Common for digital Inputs 16-31	x	
21	Common for digital Inputs 16-31	x	
33-42	Common for digital Inputs 16-31	x	
53	Common for digital Inputs 16-31	x	
62	Common for digital Inputs 16-31	x	
20	Power supply for optional resistors (Inputs 16-31)	x	

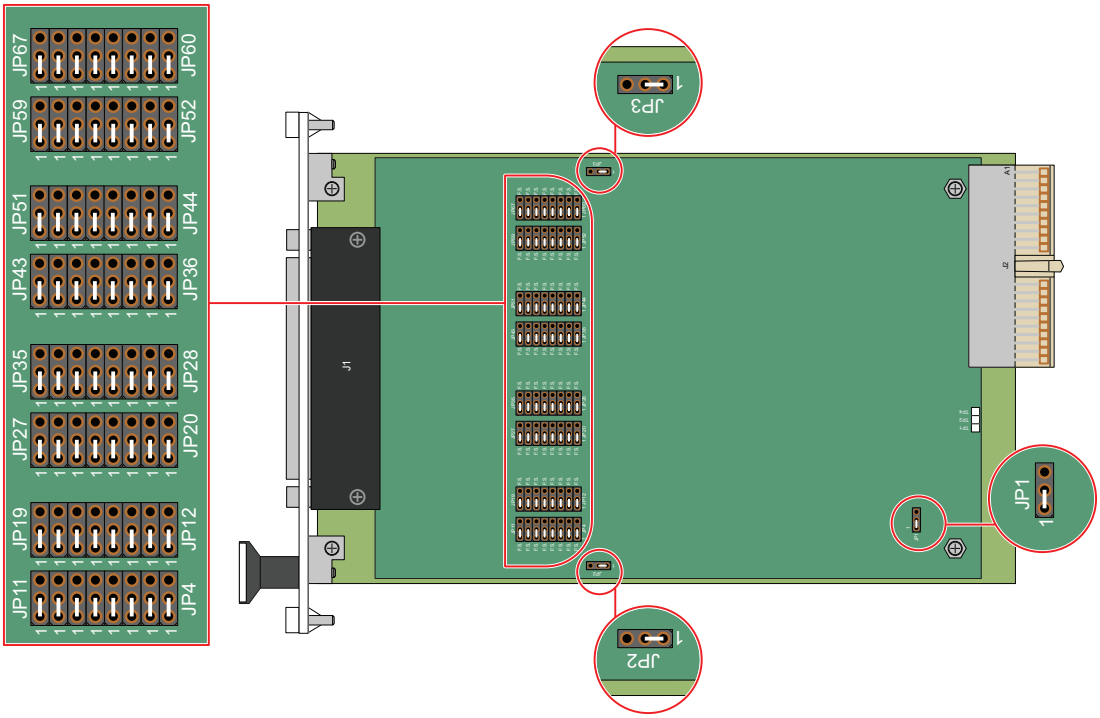


Figure 2-17: SF-DI-01 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-16: SF-DI-01 Jumper Configuration (Inputs 0-15)

Input #	Jumper	4.7 K Pull-Up to Internal 5 V	4.7 K Pull-Down to Internal Common	24 V Compatible Input
0	JP11	1-2	2-3	2-3
	JP19	1-2	1-2	2-3
1	JP10	1-2	2-3	2-3
	JP18	1-2	1-2	2-3
2	JP9	1-2	2-3	2-3
	JP17	1-2	1-2	2-3
3	JP8	1-2	2-3	2-3
	JP16	1-2	1-2	2-3
4	JP7	1-2	2-3	2-3
	JP15	1-2	1-2	2-3
5	JP6	1-2	2-3	2-3
	JP14	1-2	1-2	2-3
6	JP5	1-2	2-3	2-3
	JP13	1-2	1-2	2-3
7	JP4	1-2	2-3	2-3
	JP12	1-2	1-2	2-3
8	JP27	1-2	2-3	2-3
	JP35	1-2	1-2	2-3
9	JP26	1-2	2-3	2-3
	JP34	1-2	1-2	2-3
10	JP25	1-2	2-3	2-3
	JP33	1-2	1-2	2-3
11	JP24	1-2	2-3	2-3
	JP32	1-2	1-2	2-3
12	JP23	1-2	2-3	2-3
	JP31	1-2	1-2	2-3
13	JP22	1-2	2-3	2-3
	JP30	1-2	1-2	2-3
14	JP21	1-2	2-3	2-3
	JP29	1-2	1-2	2-3
15	JP20	1-2	2-3	2-3
	JP28	1-2	1-2	2-3

Table 2-17: SF-DI-01 Jumper Configuration (Inputs 16-31)

Input #	Jumper	4.7 K Pull-Up to Internal 5 V	4.7 K Pull-Down to Internal Common	24 V Compatible Input
16	JP43	1-2	2-3	2-3
	JP51	1-2	1-2	2-3
17	JP42	1-2	2-3	2-3
	JP50	1-2	1-2	2-3
18	JP41	1-2	2-3	2-3
	JP49	1-2	1-2	2-3
19	JP40	1-2	2-3	2-3
	JP48	1-2	1-2	2-3
20	JP39	1-2	2-3	2-3
	JP47	1-2	1-2	2-3
21	JP38	1-2	2-3	2-3
	JP46	1-2	1-2	2-3
22	JP37	1-2	2-3	2-3
	JP45	1-2	1-2	2-3
23	JP36	1-2	2-3	2-3
	JP44	1-2	1-2	2-3
24	JP59	1-2	2-3	2-3
	JP67	1-2	1-2	2-3
25	JP58	1-2	2-3	2-3
	JP66	1-2	1-2	2-3
26	JP57	1-2	2-3	2-3
	JP65	1-2	1-2	2-3
27	JP56	1-2	2-3	2-3
	JP64	1-2	1-2	2-3
28	JP55	1-2	2-3	2-3
	JP63	1-2	1-2	2-3
29	JP54	1-2	2-3	2-3
	JP62	1-2	1-2	2-3
30	JP53	1-2	2-3	2-3
	JP64	1-2	1-2	2-3
31	JP52	1-2	2-3	2-3
	JP60	1-2	1-2	2-3

The EXTERNAL POWER connection is used to supply 5V power for optional terminating resistor networks RN1-16.

Inputs 0-15 use JP2 2-3 setting and external power connection J1-10.

Inputs 16-31 use JP3 2-3 setting and external power connection J1-20.

Table 2-18: Resistor Network Configuration

Input #	Pull-Up Network	Pull-Down Network
0	RN3 1-2	RN4 1-2
1	RN3 3-4	RN4 3-4
2	RN3 5-6	RN4 5-6
3	RN3 7-8	RN4 7-8
4	RN1 1-2	RN2 1-2
5	RN1 3-4	RN2 3-4
6	RN1 5-6	RN2 5-6
7	RN1 7-8	RN2 7-8
8	RN7 1-2	RN5 1-2
9	RN7 3-4	RN5 3-4
10	RN7 5-6	RN5 5-6
11	RN7 7-8	RN5 7-8
12	RN8 1-2	RN6 1-2
13	RN8 3-4	RN6 3-4
14	RN8 5-6	RN6 5-6
15	RN8 7-8	RN6 7-8
Input #	**Pull-Up Network**	**Pull-Down Network**
16	RN11 1-2	RN12 1-2
17	RN11 3-4	RN12 3-4
18	RN11 5-6	RN12 5-6
19	RN11 7-8	RN12 7-8
20	RN9 1-2	RN10 1-2
21	RN9 3-4	RN10 3-4
22	RN9 5-6	RN10 5-6
23	RN9 7-8	RN10 7-8
24	RN15 1-2	RN16 1-2
25	RN15 3-4	RN16 3-4
26	RN15 5-6	RN16 5-6
27	RN15 7-8	RN16 7-8
28	RN13 1-2	RN14 1-2
29	RN13 3-4	RN14 3-4
30	RN13 5-6	RN14 5-6
31	RN13 7-8	RN14 7-8

2.7. SF-AO-01 Card

The SF-AO-01 card has eight 16-bit analog outputs. Each output can change at up to 500 kHz. The outputs are connected to an internal ±12 V supply (default configuration) but can be connected to an externally supplied voltage in the range of ±5 V to ±18 V by changing jumpers JP29, JP30, and JP31.

There are four options for the output voltage of each output.

- Output voltage range is ±10 V (default setting)
- Output voltage range is ±5V
- Output voltage range is ± an externally supplied voltage
- Output voltage range is ± the output voltage of another output

» 8 analog outputs with 16-bit resolution

» ±10 V maximum output voltage

» 500 kHz maximum update rate

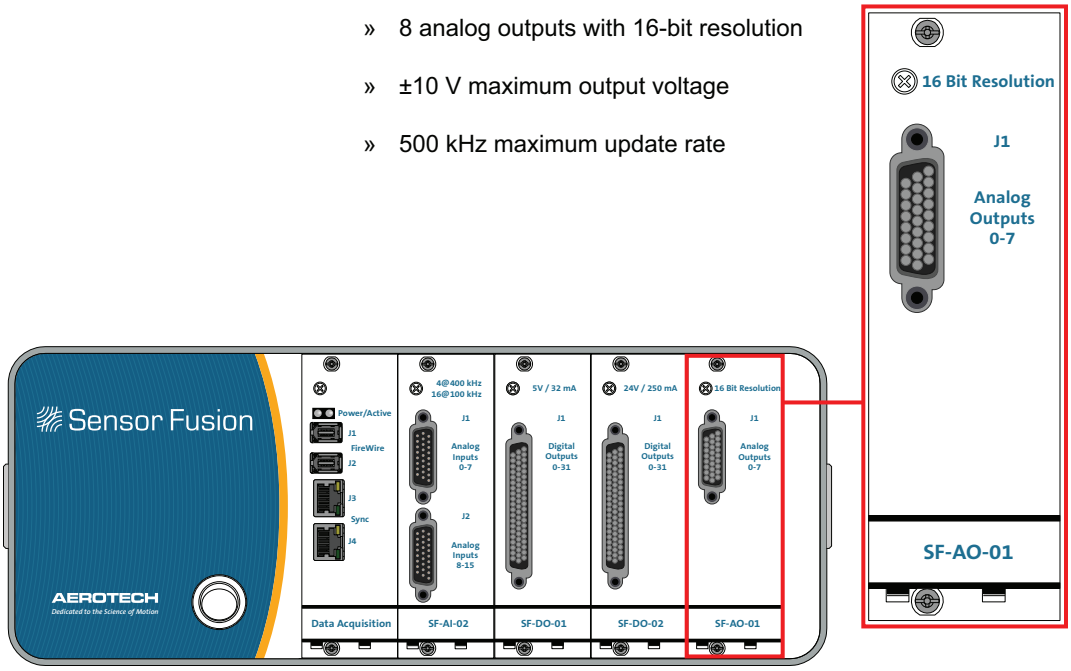


Figure 2-18: SF-AO-01 Card

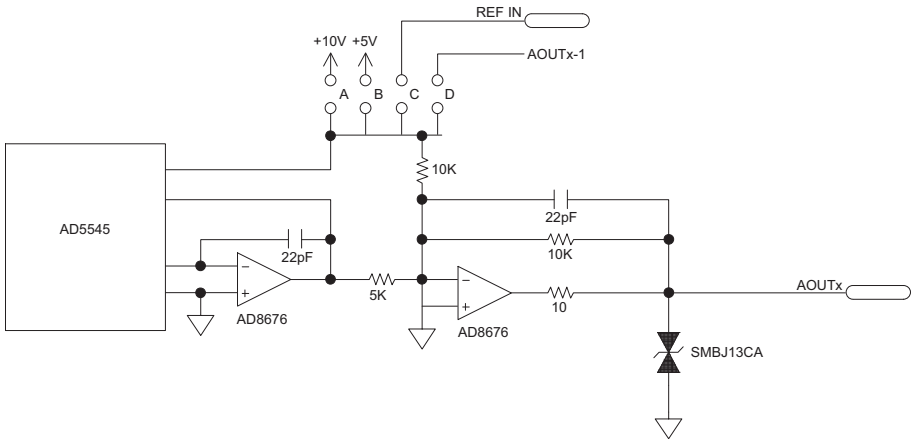
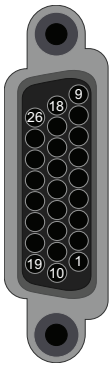


Figure 2-19: SF-AO-01 Representative Circuit

Table 2-19: SF-AO-01 J1 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AOUT0	Analog Output 0	Output	
2	GND	Ground	N/A	
3	GND	Ground	N/A	
4	AOUT1	Analog Output 1	Output	
5	GND	Ground	N/A	
6	GND	Ground	N/A	
7	AOUT2	Analog Output 2	Output	
8	GND	Ground	N/A	
9	-VA EXT	External Voltage Source Input -	Input	
10	AOUT3	Analog Output 3	Output	
11	GND	Ground	N/A	
12	GND	Ground	N/A	
13	AOUT4	Analog Output 4	Output	
14	GND	Ground	N/A	
15	GND	Ground	N/A	
16	AOUT5	Analog Output 5	Output	
17	GND	Ground	N/A	
18	+VA EXT	External Voltage Source Input +	Input	
19	AOUT6	Analog Output 6	Output	
20	GND	Ground	N/A	
21	GND	Ground	N/A	
22	AOUT7	Analog Output 7	Output	
23	GND	Ground	N/A	
24	REFIN 4-7	External Reference Voltage Input for Outputs 4-7	Input	
25	GND	Ground	N/A	
26	REFIN 0-3	External Reference Voltage Input for Outputs 0-3	Input	

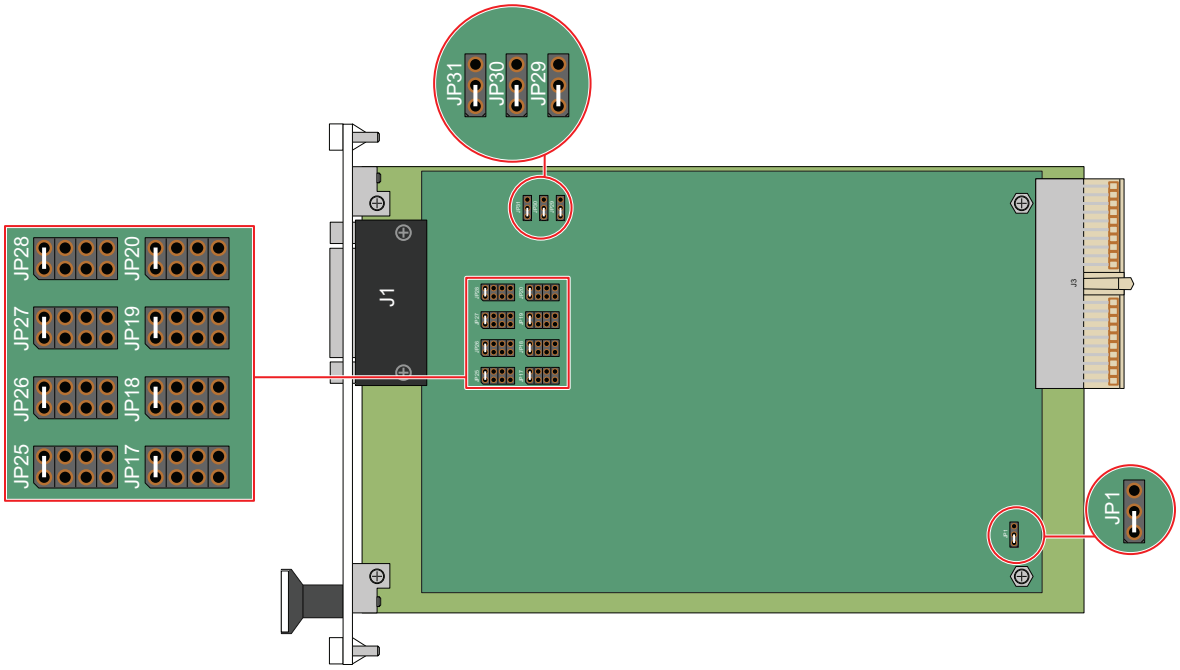


Figure 2-20: SF-AO-01 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-20: SF-AO-01 Jumper Configuration

Jumper	Setting	Description
JP1	1-2 (1)	Write Not Allowed
	2-3	Write Allowed
JP17	1-2 (1)	Output 4 range is ±10 V
	3-4	Output 4 range is ±5 V
	5-6	Output 4 range is ± the voltage on J1, pin 24
	7-8	Output 4 range is ± the voltage output of Output 5
JP18	1-2 (1)	Output 5 range is ±10 V
	3-4	Output 5 range is ±5 V
	5-6	Output 5 range is ± the voltage on J1, pin 24
	7-8	Output 5 range is ± the voltage output of Output 6
JP19	1-2 (1)	Output 6 range is ±10 V
	3-4	Output 6 range is ±5 V
	5-6	Output 6 range is ± the voltage on J1, pin 24
	7-8	Output 6 range is ± the voltage output of Output 7
JP20	1-2 (1)	Output 7 range is ±10 V
	3-4	Output 7 range is ±5 V
	5-6	Output 7 range is ± the voltage on J1, pin 24
	7-8	N/A
JP25	1-2 (1)	Output 0 range is ±10 V
	3-4	Output 0 range is ±5 V

Jumper	Setting	Description
	5-6	Output 0 range is ± the voltage on J1, pin 26
	7-8	Output 0 range is ± the voltage output of Output 1
JP26	1-2 (1)	Output 1 range is ±10 V
	3-4	Output 1 range is ±5 V
	5-6	Output 1 range is ± the voltage on J1, pin 26
	7-8	Output 1 range is ± the voltage output of Output 2
JP27	1-2 (1)	Output 2 range is ±10 V
	3-4	Output 2 range is ±5 V
	5-6	Output 2 range is ± the voltage on J1, pin 26
	7-8	Output 2 range is ± the voltage output of Output 3
JP28	1-2 (1)	Output 3 range is ±10 V
	3-4	Output 3 range is ±5 V
	5-6	Output 3 range is ± the voltage on J1, pin 26
	7-8	Output 3 range is ± the voltage output of Output 4
JP29	1-2 (1)	Outputs 0-7 connected to internal negative supply
	2-3	Outputs 0-7 connected to external negative supply
JP30	1-2 (1)	Outputs 0-7 connected to internal ground
	2-3	Outputs 0-7 connected to external ground
JP31	1-2 (1)	Outputs 0-7 connected to internal positive supply
	2-3	Outputs 0-7 connected to external positive supply
(1) Default		

2.8. SF-AO-02 Card

The SF-AO-02 card has sixteen 16-bit analog outputs. Each output can change at up to 500 kHz. The outputs are connected to an internal ±12 V supply (default configuration) but can be connected to an externally supplied voltage in the range of ±5 V to ±18 V by changing jumpers JP29, JP30, and JP31.

There are four options for the output voltage of each output.

- Output voltage range is ±10 V (default setting)
- Output voltage range is ±5V
- Output voltage range is ± an externally supplied voltage
- Output voltage range is ± the output voltage of another output

» 16 analog outputs with 16-bit resolution

» ±10 V maximum output voltage

» 500 kHz maximum update rate

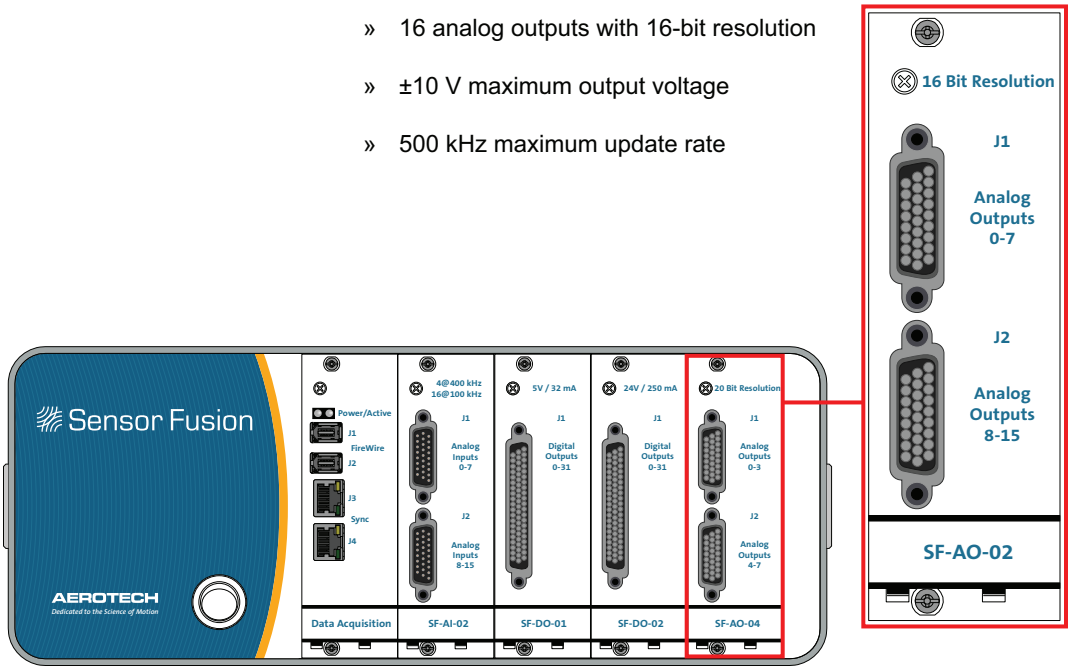


Figure 2-21: SF-AO-02 Card

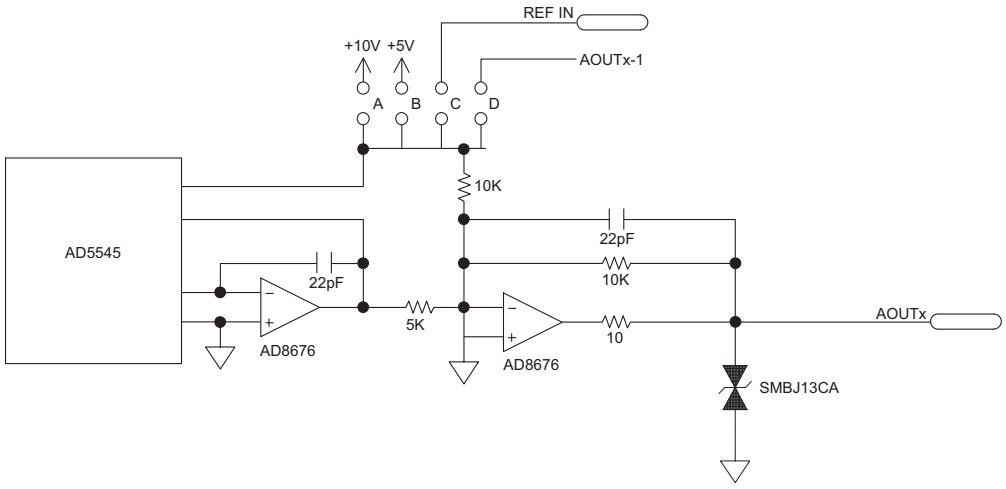


Figure 2-22: SF-AO-02 Representative Circuit

Table 2-21: SF-AO-02 J1 Pinout

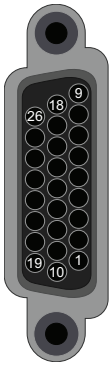
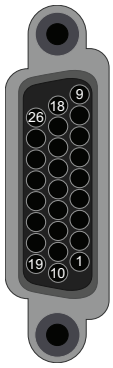
Pin#	Label	Description	In/Out/Bi	Connector
1	AOUT0	Analog Output 0	Output	
2	GND	Ground	N/A	
3	GND	Ground	N/A	
4	AOUT1	Analog Output 1	Output	
5	GND	Ground	N/A	
6	GND	Ground	N/A	
7	AOUT2	Analog Output 2	Output	
8	GND	Ground	N/A	
9	-VA 1 EXT	External Voltage Source Input -	Input	
10	AOUT3	Analog Output 3	Output	
11	GND	Ground	N/A	
12	GND	Ground	N/A	
13	AOUT4	Analog Output 4	Output	
14	GND	Ground	N/A	
15	GND	Ground	N/A	
16	AOUT5	Analog Output 5	Output	
17	GND	Ground	N/A	
18	+VA 1 EXT	External Voltage Source Input +	Input	
19	AOUT6	Analog Output 6	Output	
20	GND	Ground	N/A	
21	GND	Ground	N/A	
22	AOUT7	Analog Output 7	Output	
23	GND	Ground	N/A	
24	REFIN 4-7	External Reference Voltage Input for Outputs 4-7	Input	
25	GND	Ground	N/A	
26	REFIN 0-3	External Reference Voltage Input for Outputs 0-3	Input	

Table 2-22: SF-AO-02 J2 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AOUT8	Analog Output 8	Output	
2	GND	Ground	N/A	
3	GND	Ground	N/A	
4	AOUT9	Analog Output 9	Output	
5	GND	Ground	N/A	
6	GND	Ground	N/A	
7	AOUT10	Analog Output 10	Output	
8	GND	Ground	N/A	
9	-VA 2 EXT	External Voltage Source Input 2 -	Input	
10	AOUT11	Analog Output 11	Output	
11	GND	Ground	N/A	
12	GND	Ground	N/A	
13	AOUT12	Analog Output 12	Output	
14	GND	Ground	N/A	
15	GND	Ground	N/A	
16	AOUT13	Analog Output 13	Output	
17	GND	Ground	N/A	
18	+VA 2 EXT	External Voltage Source Input 2 +	Input	
19	AOUT14	Analog Output 14	Output	
20	GND	Ground	N/A	
21	GND	Ground	N/A	
22	AOUT15	Analog Output 15	Output	
23	GND	Ground	N/A	
24	REFIN 12-15	External Reference Voltage Input for Outputs 12-15	Input	
25	GND	Ground	N/A	
26	REFIN 8-11	External Reference Voltage Input for Outputs 8-11	Input	

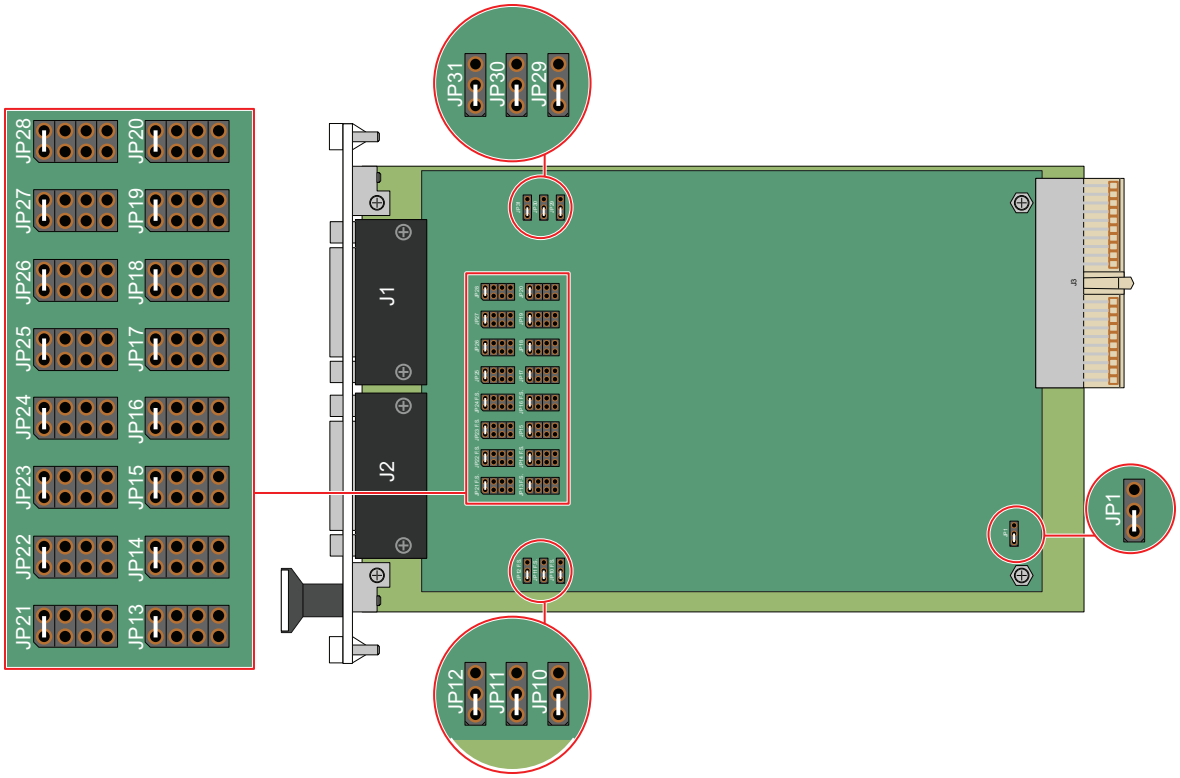


Figure 2-23: SF-AO-02 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-23: SF-AO-02 Jumper Configuration

Jumper	Setting	Description
JP1	1-2 (1)	Write Not Allowed
	2-3	Write Allowed
JP10	1-2 (1)	Outputs 8-15 connected to internal negative supply
	2-3	Outputs 8-15 connected to external negative supply
JP11	1-2 (1)	Outputs 8-15 connected to internal ground
	2-3	Outputs 8-15 connected to external ground
JP12	1-2 (1)	Outputs 8-15 connected to internal positive supply
	2-3	Outputs 8-15 connected to external positive supply
JP13	1-2 (1)	Output 12 range is ±10 V
	3-4	Output 12 range is ±5 V
	5-6	Output 12 range is ± the voltage on J2, pin 24
	7-8	Output 12 range is ± the voltage output of Output 13
JP14	1-2 (1)	Output 13 range is ±10 V
	3-4	Output 13 range is ±5 V
	5-6	Output 13 range is ± the voltage on J2, pin 24
	7-8	Output 13 range is ± the voltage output of Output 14
JP15	1-2 (1)	Output 14 range is ±10 V

Jumper	Setting	Description
	3-4	Output 14 range is ±5 V
	5-6	Output 14 range is ± the voltage on J2, pin 24
	7-8	Output 14 range is ± the voltage output of Output 15
JP16	1-2 (1)	Output 15 range is ±10 V
	3-4	Output 15 range is ±5 V
	5-6	Output 15 range is ± the voltage on J2, pin 24
	7-8	N/A
JP17	1-2 (1)	Output 4 range is ±10 V
	3-4	Output 4 range is ±5 V
	5-6	Output 4 range is ± the voltage on J1, pin 24
	7-8	Output 4 range is ± the voltage output of Output 5
JP18	1-2 (1)	Output 5 range is ±10 V
	3-4	Output 5 range is ±5 V
	5-6	Output 5 range is ± the voltage on J1, pin 24
	7-8	Output 5 range is ± the voltage output of Output 6
JP19	1-2 (1)	Output 6 range is ±10 V
	3-4	Output 6 range is ±5 V
	5-6	Output 6 range is ± the voltage on J1, pin 24
	7-8	Output 6 range is ± the voltage output of Output 7
JP20	1-2 (1)	Output 7 range is ±10 V
	3-4	Output 7 range is ±5 V
	5-6	Output 7 range is ± the voltage on J1, pin 24
	7-8	N/A
JP21	1-2 (1)	Output 8 range is ±10 V
	3-4	Output 8 range is ±5 V
	5-6	Output 8 range is ± the voltage on J2, pin 26
	7-8	Output 8 range is ± the voltage output of Output 9
JP22	1-2 (1)	Output 9 range is ±10 V
	3-4	Output 9 range is ±5 V
	5-6	Output 9 range is ± the voltage on J2, pin 26
	7-8	Output 9 range is ± the voltage output of Output 10
JP23	1-2 (1)	Output 10 range is ±10 V
	3-4	Output 10 range is ±5 V
	5-6	Output 10 range is ± the voltage on J2, pin 26
	7-8	Output 10 range is ± the voltage output of Output 11
JP24	1-2 (1)	Output 11 range is ±10 V
	3-4	Output 11 range is ±5 V
	5-6	Output 11 range is ± the voltage on J2, pin 26
	7-8	Output 11 range is ± the voltage output of Output 12
JP25	1-2 (1)	Output 0 range is ±10 V
	3-4	Output 0 range is ±5 V
	5-6	Output 0 range is ± the voltage on J1, pin 26
	7-8	Output 0 range is ± the voltage output of Output 1
JP26	1-2 (1)	Output 1 range is ±10 V
	3-4	Output 1 range is ±5 V
	5-6	Output 1 range is ± the voltage on J1, pin 26
	7-8	Output 1 range is ± the voltage output of Output 2
JP27	1-2 (1)	Output 2 range is ±10 V

Jumper	Setting	Description
	3-4	Output 2 range is ±5 V
	5-6	Output 2 range is ± the voltage on J1, pin 26
	7-8	Output 2 range is ± the voltage output of Output 3
JP28	1-2 (1)	Output 3 range is ±10 V
	3-4	Output 3 range is ±5 V
	5-6	Output 3 range is ± the voltage on J1, pin 26
	7-8	Output 3 range is ± the voltage output of Output 4
JP29	1-2 (1)	Outputs 0-7 connected to internal negative supply
	2-3	Outputs 0-7 connected to external negative supply
JP30	1-2 (1)	Outputs 0-7 connected to internal ground
	2-3	Outputs 0-7 connected to external ground
JP31	1-2 (1)	Outputs 0-7 connected to internal positive supply
	2-3	Outputs 0-7 connected to external positive supply
(1) Default		

2.9. SF-AO-03 Card

The SF-AO-03 card has four 20-bit analog outputs. Each output can change at up to 500 kHz. The outputs are connected to an internal ±12 V supply (default configuration) but can be connected to an externally supplied voltage in the range of ±5 V to ±18 V by changing jumpers JP29, JP30, and JP31.

There are eight options for the output voltage of each output.

- Output voltage range is ±10 V (default setting)
- Output voltage range is ±5V
- Output voltage range is ± an externally supplied voltage
- Output voltage range is ± the output voltage of another output
- Output voltage range is 0 to 10 V
- Output voltage range is 0 to 5 V
- Output voltage range is 0 to an external supplied voltage
- Output voltage range is 0 to the output voltage of another output

» 4 analog outputs with 20-bit resolution

» ±10 V maximum output voltage

» 500 kHz maximum update rate

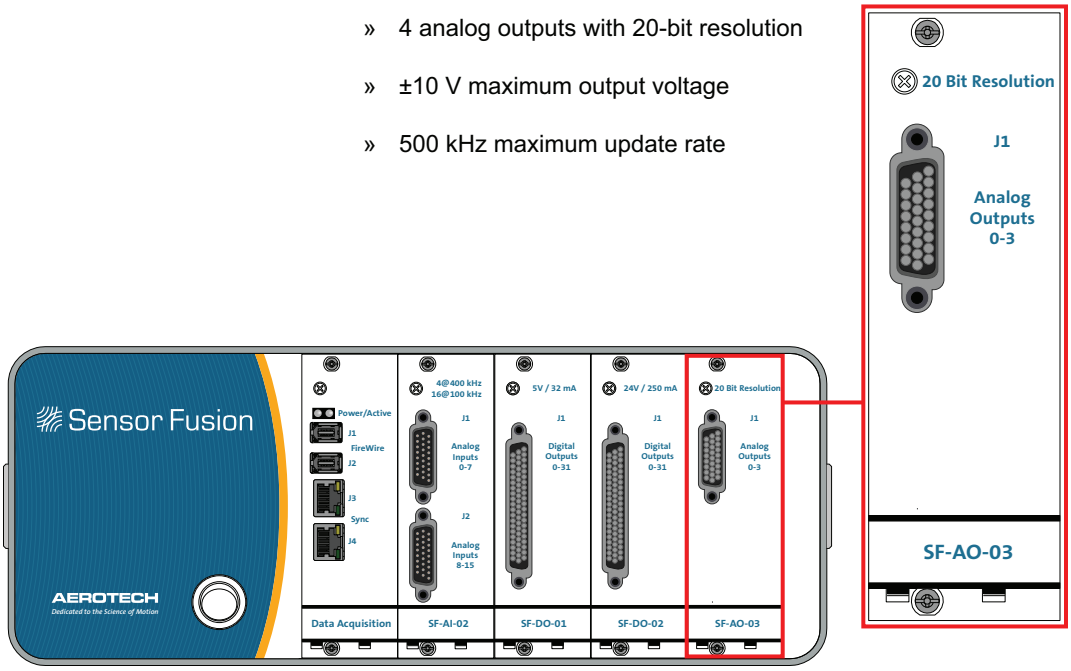


Figure 2-24: SF-AO-03 Card

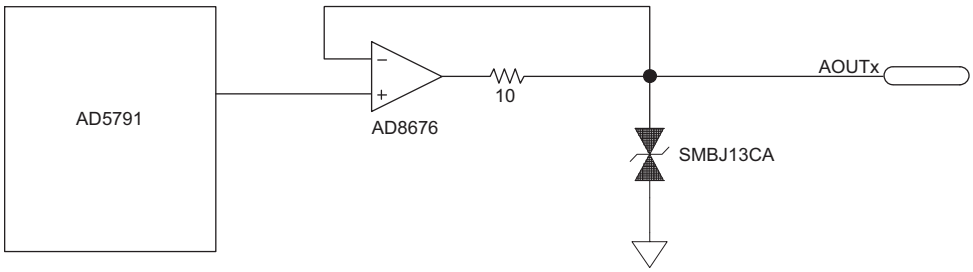
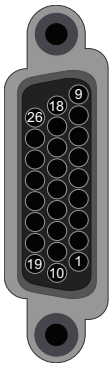


Figure 2-25: SF-AO-03 Representative Circuit

Table 2-24: SF-AO-03 J1 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AOUT0	Analog Output 0	Output	
2	GND	Ground	N/A	
3	GND	Ground	N/A	
4	AOUT1	Analog Output 1	Output	
5	GND	Ground	N/A	
6	GND	Ground	N/A	
7	AOUT2	Analog Output 2	Output	
8	GND	Ground	N/A	
9	-VA EXT	External Voltage Source Input -	Input	
10	AOUT3	Analog Output 3	Output	
11	GND	Ground	N/A	
12	GND	Ground	N/A	
13	Reserved	Reserved	N/A	
14	GND	Ground	N/A	
15	GND	Ground	N/A	
16	Reserved	Reserved	N/A	
17	GND	Ground	N/A	
18	+VA EXT	External Voltage Source Input +	Input	
19	Reserved	Reserved	N/A	
20	GND	Ground	N/A	
21	GND	Ground	N/A	
22	Reserved	Reserved	N/A	
23	GND	Ground	N/A	
24	Reserved	Reserved	N/A	
25	GND	Ground	N/A	
26	REFIN 0-3	External Reference Voltage Input for Outputs 0-3	Input	

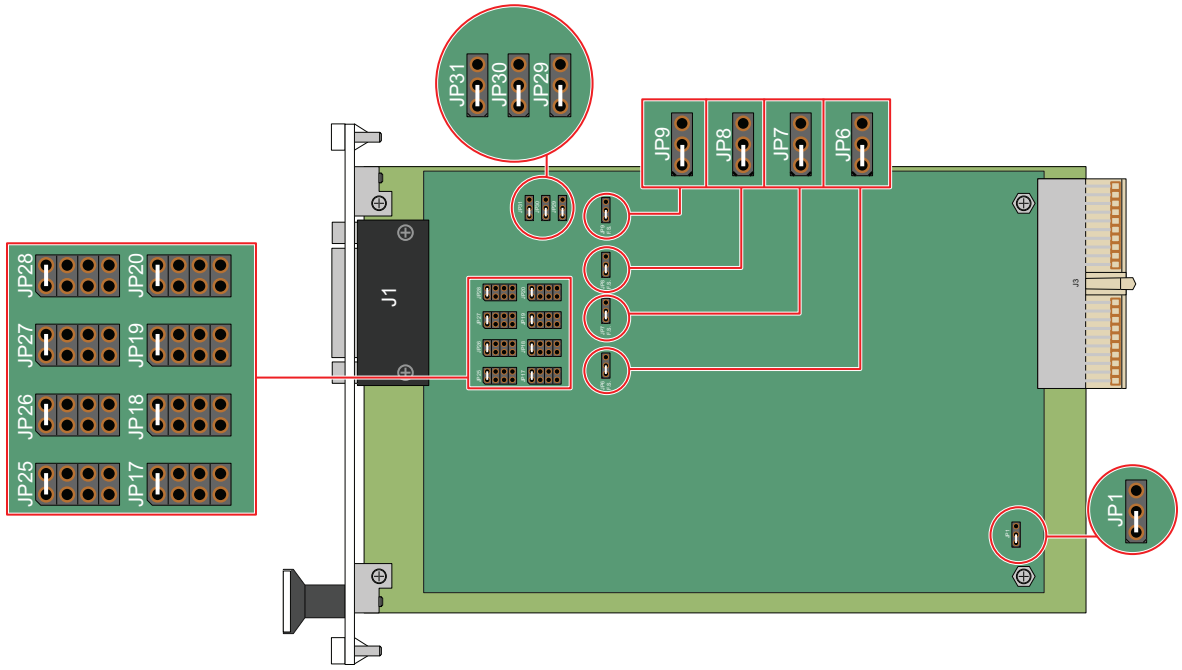


Figure 2-26: SF-AO-03 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-25: SF-AO-03 Jumper Configuration

Jumper	Setting	Description
JP1	1-2 (1)	Write Not Allowed
	2-3	Write Allowed
JP6	1-2 (1)	Output 0 is a bipolar output
	2-3	Output 0 is a unipolar output
JP7	1-2 (1)	Output 1 is a bipolar output
	2-3	Output 1 is a unipolar output
JP8	1-2 (1)	Output 2 is a bipolar output
	2-3	Output 2 is a unipolar output
JP9	1-2 (1)	Output 3 is a bipolar output
	2-3	Output 3 is a unipolar output
JP25	1-2 (1)	Output 0 range is ±10 V
	3-4	Output 0 range is ±5 V
	5-6	Output 0 range is ± the voltage on J1, pin 26
	7-8	Output 0 range is ± the voltage output of Output 1
JP26	1-2 (1)	Output 1 range is ±10 V
	3-4	Output 1 range is ±5 V
	5-6	Output 1 range is ± the voltage on J1, pin 26
	7-8	Output 1 range is ± the voltage output of Output 2
JP27	1-2 (1)	Output 2 range is ±10 V
	3-4	Output 2 range is ±5 V

Jumper	Setting	Description
	5-6	Output 2 range is ± the voltage on J1, pin 26
	7-8	Output 2 range is ± the voltage output of Output 3
JP28	1-2 (1)	Output 3 range is ±10 V
	3-4	Output 3 range is ±5 V
	5-6	Output 3 range is ± the voltage on J1, pin 26
	7-8	N/A
JP29	1-2 (1)	Output 0-3 connected to internal negative supply
	2-3	Output 0-3 connected to external negative supply
JP30	1-2 (1)	Output 0-3 connected to internal ground
	2-3	Output 0-3 connected to external ground
JP31	1-2 (1)	Output 0-3 connected to internal positive supply
	2-3	Output 0-3 connected to external positive supply
(1) Default		

2.10. SF-AO-04 Card

The SF-AO-04 card has eight 20-bit analog outputs. Each output can change at up to 500 kHz. The outputs are connected to an internal ±12 V supply (default configuration) but can be connected to an externally supplied voltage in the range of ±5 V to ±18 V by changing jumpers JP29, JP30, and JP31.

There are eight options for the output voltage of each output.

- Output voltage range is ±10 V (default setting)
- Output voltage range is ±5V
- Output voltage range is ± an externally supplied voltage
- Output voltage range is ± the output voltage of another output
- Output voltage range is 0 to 10 V
- Output voltage range is 0 to 5 V
- Output voltage range is 0 to an external supplied voltage
- Output voltage range is 0 to the output voltage of another output

» 8 analog outputs with 20-bit resolution

» ±10 V maximum output voltage

» 500 kHz maximum update rate

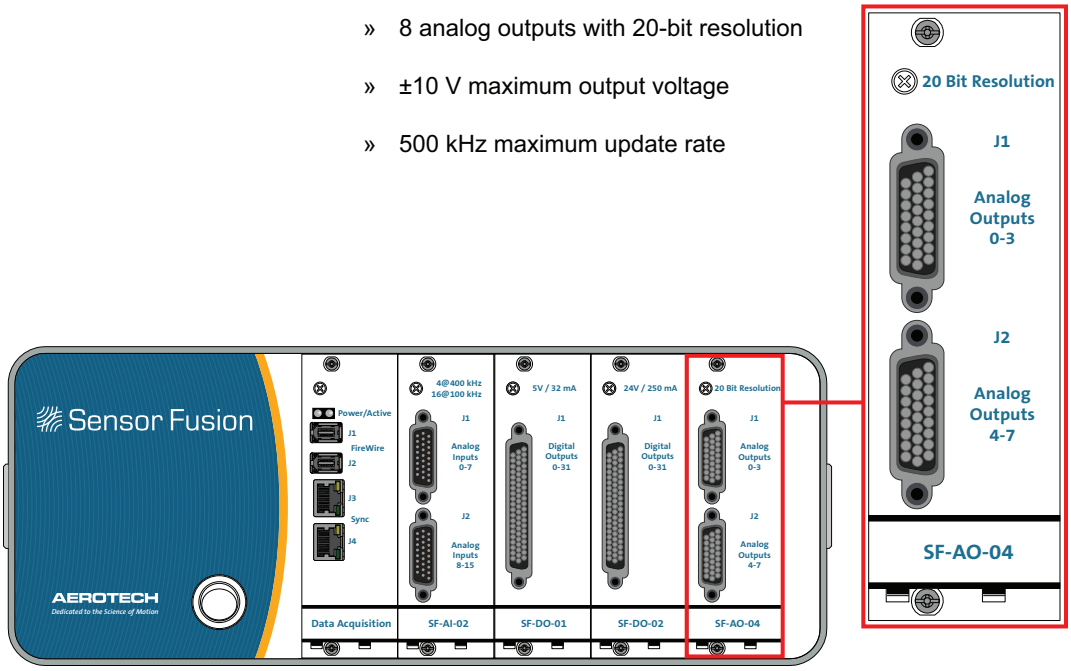


Figure 2-27: SF-AO-04 Card

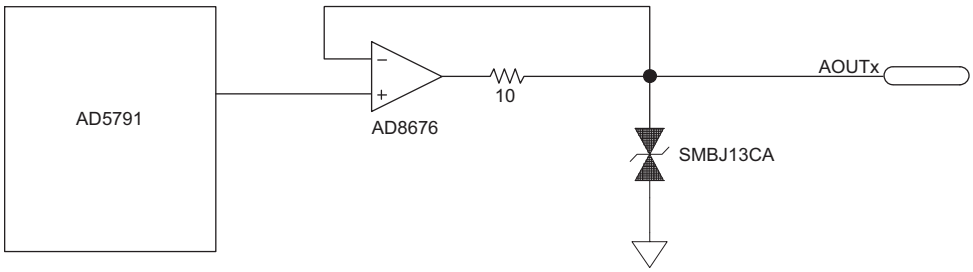


Figure 2-28: SF-AO-04 Representative Circuit

Table 2-26: SF-AO-04 J1 Pinout

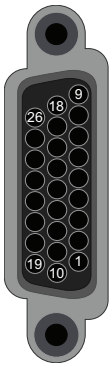
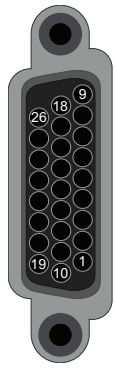
Pin#	Label	Description	In/Out/Bi	Connector
1	AOUT0	Analog Output 0	Output	
2	GND	Ground	N/A	
3	GND	Ground	N/A	
4	AOUT1	Analog Output 1	Output	
5	GND	Ground	N/A	
6	GND	Ground	N/A	
7	AOUT2	Analog Output 2	Output	
8	GND	Ground	N/A	
9	-VA 1 EXT	External Voltage Source Input -	Input	
10	AOUT3	Analog Output 3	Output	
11	GND	Ground	N/A	
12	GND	Ground	N/A	
13	Reserved	Reserved	N/A	
14	GND	Ground	N/A	
15	GND	Ground	N/A	
16	Reserved	Reserved	N/A	
17	GND	Ground	N/A	
18	+VA 1 EXT	External Voltage Source Input +	Input	
19	Reserved	Reserved	N/A	
20	GND	Ground	N/A	
21	GND	Ground	N/A	
22	Reserved	Reserved	N/A	
23	GND	Ground	N/A	
24	Reserved	Reserved	N/A	
25	GND	Ground	N/A	
26	REFIN 0-3	External Reference Voltage Input for Outputs 0-3	Input	

Table 2-27: SF-AO-04 J2 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	AOUT4	Analog Output 4	Output	
2	GND	Ground	N/A	
3	GND	Ground	N/A	
4	AOUT5	Analog Output 5	Output	
5	GND	Ground	N/A	
6	GND	Ground	N/A	
7	AOUT6	Analog Output 6	Output	
8	GND	Ground	N/A	
9	-VA 2 EXT	External Voltage Source Input 2 -	Input	
10	AOUT7	Analog Output 7	Output	
11	GND	Ground	N/A	
12	GND	Ground	N/A	

Pin#	Label	Description	In/Out/Bi	Connector
13	Reserved	Reserved	N/A	
14	GND	Ground	N/A	
15	GND	Ground	N/A	
16	Reserved	Reserved	N/A	
17	GND	Ground	N/A	
18	+VA 2 EXT	External Voltage Source Input 2 +	Input	
19	Reserved	Reserved	N/A	
20	GND	Ground	N/A	
21	GND	Ground	N/A	
22	Reserved	Reserved	N/A	
23	GND	Ground	N/A	
24	Reserved	Reserved	N/A	
25	GND	Ground	N/A	
26	REFIN 4-7	External Reference Voltage Input for Outputs 4-7	Input	

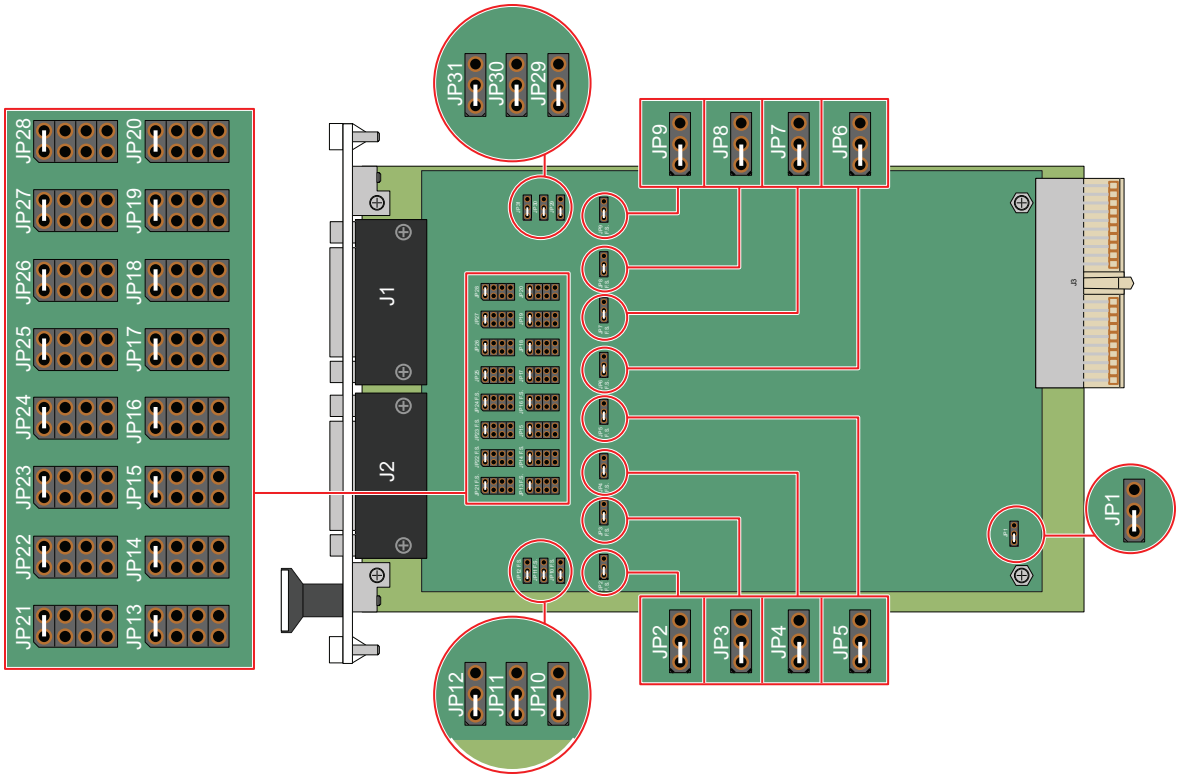


Figure 2-29: SF-AO-04 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-28: SF-AO-04 Jumper Configuration

Jumper	Setting	Description
JP1	1-2 (1)	Write Not Allowed
	2-3	Write Allowed
JP2	1-2 (1)	Output 4 is a bipolar output
	2-3	Output 4 is a unipolar output
JP3	1-2 (1)	Output 5 is a bipolar output
	2-3	Output 5 is a unipolar output
JP4	1-2 (1)	Output 6 is a bipolar output
	2-3	Output 6 is a unipolar output
JP5	1-2 (1)	Output 7 is a bipolar output
	2-3	Output 7 is a unipolar output
JP6	1-2 (1)	Output 0 is a bipolar output
	2-3	Output 0 is a unipolar output
JP7	1-2 (1)	Output 1 is a bipolar output
	2-3	Output 1 is a unipolar output
JP8	1-2 (1)	Output 2 is a bipolar output
	2-3	Output 2 is a unipolar output
JP9	1-2 (1)	Output 3 is a bipolar output

Jumper	Setting	Description
	2-3	Output 3 is a unipolar output
JP10	1-2 (1)	Outputs 4-7 connected to internal negative supply
	2-3	Outputs 4-7 connected to external negative supply
JP11	1-2 (1)	Outputs 4-7 connected to internal ground
	2-3	Outputs 4-7 connected to external ground
JP12	1-2 (1)	Outputs 4-7 connected to internal positive supply
	2-3	Outputs 4-7 connected to external positive supply
JP21	1-2 (1)	Output 4 range is ±10 V
	3-4	Output 4 range is ±5 V
	5-6	Output 4 range is ± the voltage on J2, pin 26
	7-8	Output 4 range is ± the voltage output of Output 5
JP22	1-2 (1)	Output 5 range is ±10 V
	3-4	Output 5 range is ±5 V
	5-6	Output 5 range is ± the voltage on J2, pin 26
	7-8	Output 5 range is ± the voltage output of Output 6
JP23	1-2 (1)	Output 6 range is ±10 V
	3-4	Output 6 range is ±5 V
	5-6	Output 6 range is ± the voltage on J2, pin 26
	7-8	Output 6 range is ± the voltage output of Output 7
JP24	1-2 (1)	Output 7 range is ±10 V
	3-4	Output 7 range is ±5 V
	5-6	Output 7 range is ± the voltage on J2, pin 26
	7-8	N/A
JP25	1-2 (1)	Output 0 range is ±10 V
	3-4	Output 0 range is ±5 V
	5-6	Output 0 range is ± the voltage on J1, pin 26
	7-8	Output 0 range is ± the voltage output of Output 1
JP26	1-2 (1)	Output 1 range is ±10 V
	3-4	Output 1 range is ±5 V
	5-6	Output 1 range is ± the voltage on J1, pin 26
	7-8	Output 1 range is ± the voltage output of Output 2
JP27	1-2 (1)	Output 2 range is ±10 V
	3-4	Output 2 range is ±5 V
	5-6	Output 2 range is ± the voltage on J1, pin 26
	7-8	Output 2 range is ± the voltage output of Output 3
JP28	1-2 (1)	Output 3 range is ±10 V
	3-4	Output 3 range is ±5 V
	5-6	Output 3 range is ± the voltage on J1, pin 26
	7-8	N/A
JP29	1-2 (1)	Output 0-3 connected to internal negative supply
	2-3	Output 0-3 connected to external negative supply
JP30	1-2 (1)	Output 0-3 connected to internal ground
	2-3	Output 0-3 connected to external ground
JP31	1-2 (1)	Output 0-3 connected to internal positive supply
	2-3	Output 0-3 connected to external positive supply
(1) Default		

2.11. SF-ENC-01 Card

The SF-ENC-01 card has 4 encoder inputs that can be sampled at up to 1 MHz and four Position Synchronized Output (PSO) channels. Each encoder input accepts an RS-422 differential quadrature line drive signal in the range of 0 to 5 V. The encoder interface accepts a 10 MHz (max) encoder signal frequency (25 nsec minimum edge separation), producing 40 million counts per second after times four (x4) quadrature decoding.

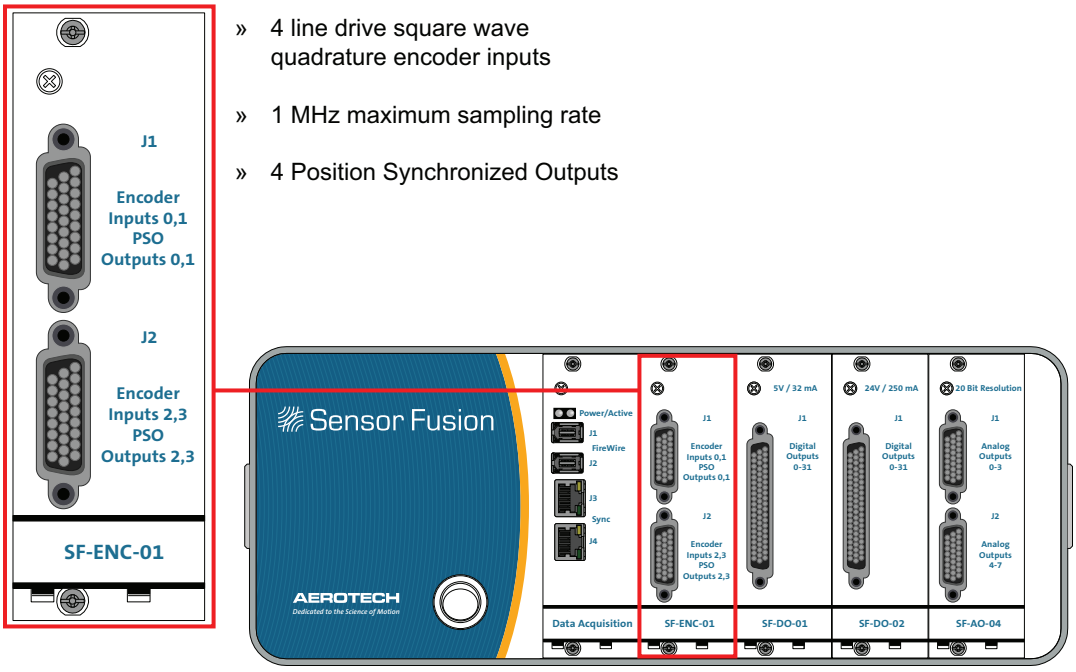


Figure 2-30: SF-ENC-01 Card

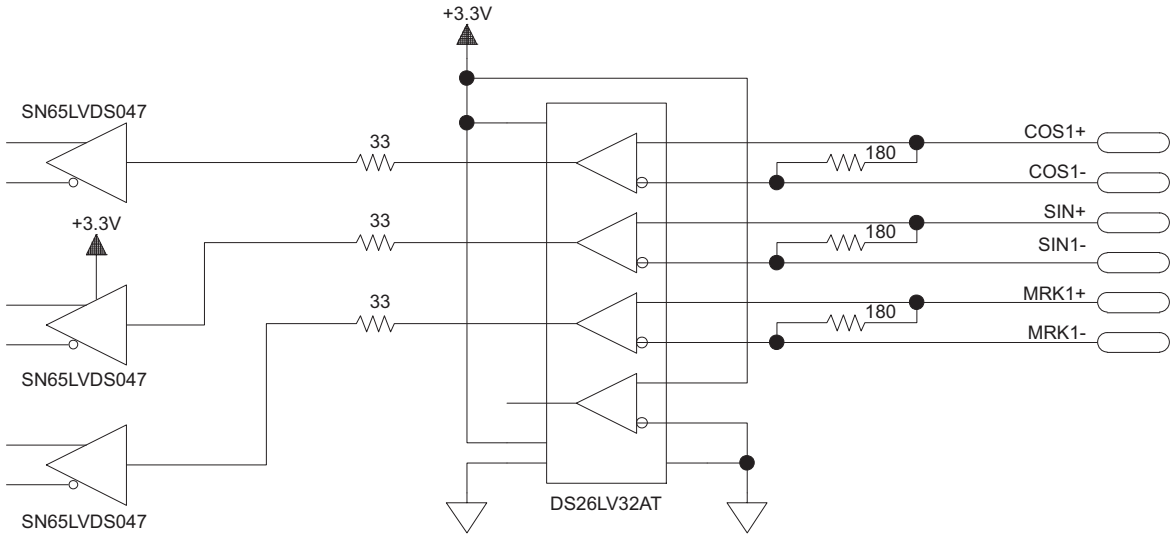


Figure 2-31: SF-ENC-01 Representative Circuit

The PSO output channels are electrically isolated and require an external power source to operate. Each output can be used to source (or sink) current (as shown in Figure 2-32 and Figure 2-33).

By default, each jumper (JP2-JP5) is installed in the 1-2 position for normally-open operation (refer to Table 2-33). Normally-closed operation (JPx set to position 2-3) should be used with caution because the Sensor Fusioncannot maintain the closed state when AC mains power is turned off. The normally-closed setting should not be used when failsafe operation is required.

Table 2-29: SF-ENC-01 Output Specifications

Description	Specification
Maximum Voltage	24 V
Current	250 mA
Latency	120 ns
Maximum Frequency	5 MHz

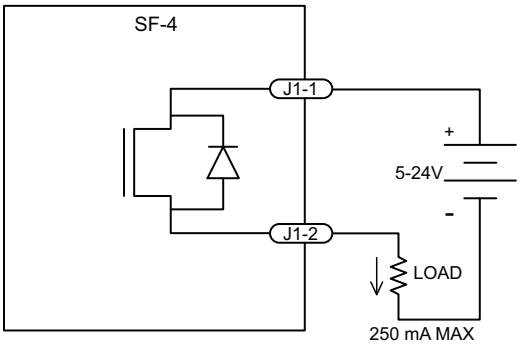


Figure 2-32: PSO Output Sources Current

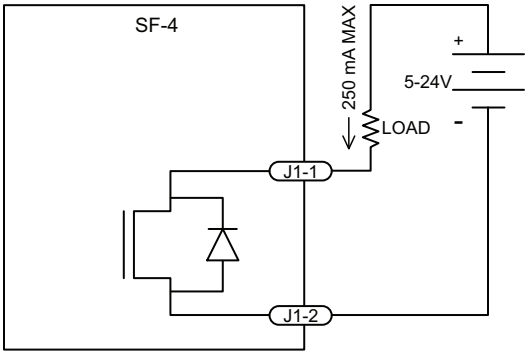


Figure 2-33: PSO Output Sinks Current

Table 2-30: SF-ENC-01 Fuse Replacement

Fuse	Description	Size	Aerotech P/N	Manufacturer's P/N
F1	Polyswitch resettable fuse	0.5 A	--	RAYCHEM SMDC050
F2	Polyswitch resettable fuse	0.5 A	--	RAYCHEM SMDC050

Table 2-31: SF-ENC-01 J1 Pinout

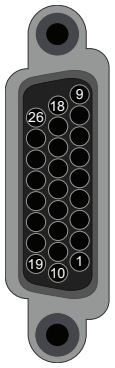
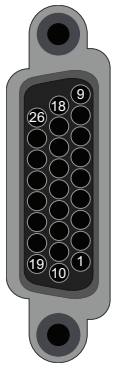
Pin#	Label	Description	In/Out/Bi	Connector
1	PSO1+	PSO Output 1+	Output	
2	PSO1-	PSO Output 1-	Output	
3	PSO2+	PSO Output 2+	Output	
4	PSO2-	PSO Output 2-	Output	
5	SIN1+	Encoder Sine 1+	Input	
6	SIN1-	Encoder Sine 1-	Input	
7	COS1+	Encoder Cosine 1+	Input	
8	COS1-	Encoder Cosine 1-	Input	
9	GND	Ground	N/A	
10	MRK1+	Encoder Marker Reference 1+	Input	
11	MRK1-	Encoder Marker Reference 1-	Input	
12	ENC1 3+5V			
13	ENC1 3+5V			
14	SIN2+	Encoder Sine 2+	Input	
15	SIN2-	Encoder Sine 2-	Input	
16	COS2+	Encoder Cosine 2+	Input	
17	COS2-	Encoder Cosine 2-	Input	
18	GND	Ground	N/A	
19	MRK2+	Encoder Marker Reference 2+	Input	
20	MRK2-	Encoder Marker Reference 2-	Input	
21	Reserved	Reserved	N/A	
22	Reserved	Reserved	N/A	
23	Reserved	Reserved	N/A	
24	Reserved	Reserved	N/A	
25	Reserved	Reserved	N/A	
26	Reserved	Reserved	N/A	

Table 2-32: SF-ENC-01 J2 Pinout

Pin#	Label	Description	In/Out/Bi	Connector
1	Reserved	Reserved	N/A	
2	Reserved	Reserved	N/A	
3	PSO3+	PSO Output 3+	Output	
4	PSO3-	PSO Output 3-	Output	
5	SIN3+	Encoder Sine 3+	Input	
6	SIN3-	Encoder Sine 3-	Input	
7	COS3+	Encoder Cosine 3+	Input	
8	COS3-	Encoder Cosine 3+	Input	
9	GND	Ground	N/A	
10	MRK3+	Encoder Marker Reference 3+	Input	
11	MRK3-	Encoder Marker Reference 3-	Input	
12	ENC3 3+5V			
13	ENC3 3+5V			
14	SIN4+	Encoder Sine 4+	Input	
15	SIN4-	Encoder Sine 4-	Input	
16	COS4+	Encoder Cosine 4+	Input	
17	COS4-	Encoder Cosine 4-	Input	
18	GND	Ground	N/A	
19	MRK4+	Encoder Marker Reference 4+	Input	
20	MRK4-	Encoder Marker Reference 4-	Input	
21	Reserved	Reserved	N/A	
22	Reserved	Reserved	N/A	
23	Reserved	Reserved	N/A	
24	Reserved	Reserved	N/A	
25	Reserved	Reserved	N/A	
26	Reserved	Reserved	N/A	

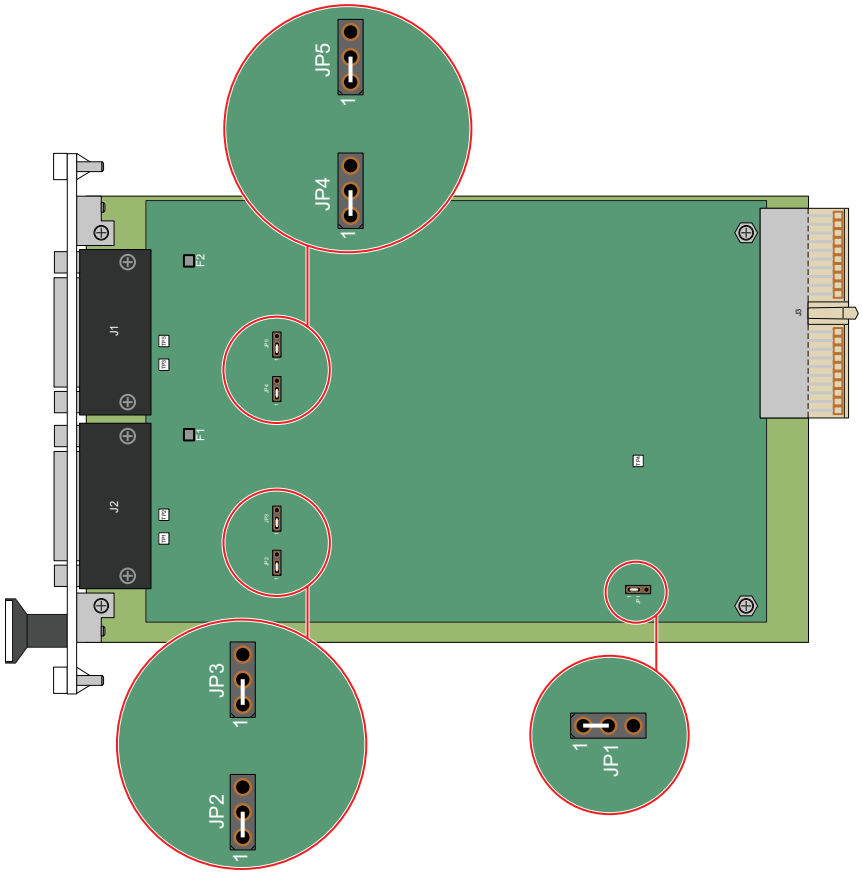


Figure 2-34: SF-ENC-01 Card Jumper Locations

NOTE: JP1 is reserved for Aerotech use and should not be changed without explicit instruction from an Aerotech employee.

Table 2-33: SF-ENC-01 Jumper Configuration

Jumper	Setting	Description
JP1	1-2 (1)	Write Not Allowed
	2-3	Write Allowed
JP2	1-2 (1)	PSO Output Channel 2 Normally-Open Operation
	2-3	PSO Output Channel 2 Normally-Closed Operation
JP3	1-2 (1)	PSO Output Channel 3 Normally-Open Operation
	2-3	PSO Output Channel 3 Normally-Closed Operation
JP4	1-2 (1)	PSO Output Channel 0 Normally-Open Operation
	2-3	PSO Output Channel 0 Normally-Closed Operation
JP5	1-2 (1)	PSO Output Channel 1 Normally-Open Operation
	2-3	PSO Output Channel 1 Normally-Closed Operation
(1) Default		

Chapter 3: Standard Cables

Table 3-1: Standard Cables

Board	Aerotech P/N	Manufacturer P/N	Description
SF-AI	ECZ01231	L-COM CHD26MF-2.5	Male 26-pin to Female 26-pin cable
SF-AO	ECZ01231	L-COM CHD26MF-2.5	Male 26-pin to Female 26-pin cable
SF-DI	CBL-62HDM-62HDF-7	L-COM CHD62MF-2.5	Male 62-pin to Female 62-pin cable
SF-DO	CBL-62HDM-62HDF-7	L-COM CHD62MF-2.5	Male 62-pin to Female 62-pin cable
SF-ENC	ECZ01231	L-COM CHD26MF-2.5	Male 26-pin to Female 26-pin cable
	C23760	N/A	SF-ENC-01 to CP/CL/HPe/HLe (J104/J105/J205/J205) • 1.8 m (5.9 ft) or 5.0 m (16 ft)
	C23770	N/A	SF-ENC-01 to two CP/CL/HPe/HLes (J104/J105/J205/J205) • 1.8 m (5.9 ft) or 5.0 m (16 ft) from drive to SF • 1 m (3 feet) between drives
	C23780	N/A	SF-ENC-01 to MP/ML (J201) • 1.8 m (5.9 feet) length
	C23790	N/A	SF-ENC-01 to two MP/MLs (J201) • 1.8 m (5.9 ft) from drive to SF • 1 m (3 ft) between drives
	C23800	N/A	SF-ENC-01 to MP/ML (J201) and CP/CL/HPe/HLe (J104/J105/J205/J205) • 1.8 m (5.9 ft) from drive to SF • 1 m (3 ft) between drives
	C23810	N/A	SF-ENC-01 (J1 or J2) to Npaq (J8) • 1.8 m (5.9 ft) or 5.0 m (16 ft)
	C23820	N/A	SF-ENC-01 (J1 and J2) to Npaq (J8) • 1.8 m (5.9 feet) or 5.0 m (16 feet)

Table 3-2: Breakout Blocks

Board	Aerotech P/N	Manufacturer P/N
SF-AI	SF-BB-26F	Phoenix 2322414/L-COM CHD26MF-2.5
SF-AO	SF-BB-26M	Phoenix 5528354/L-COM CHD26MF-2.5
SF-DI	SF-BB-62M	Phoenix 2322391/L-COM CHD62MF-2.5
SF-DO	SF-BB-62M	Phoenix 2322391/L-COM CHD62MF-2.5
SF-ENC	SF-BB-26M	Phoenix 5528354/L-COM CHD26MF-2.5

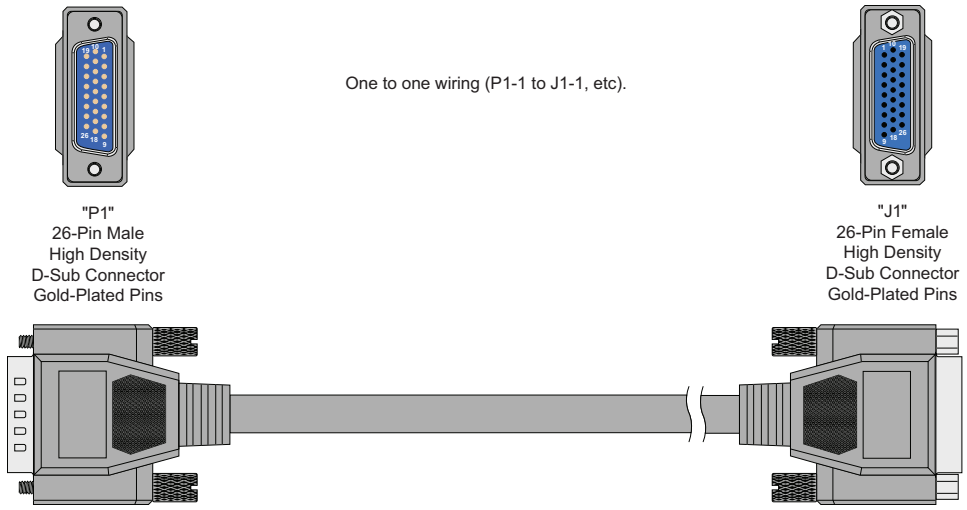


Figure 3-1: ECZ01231 Cable Drawing

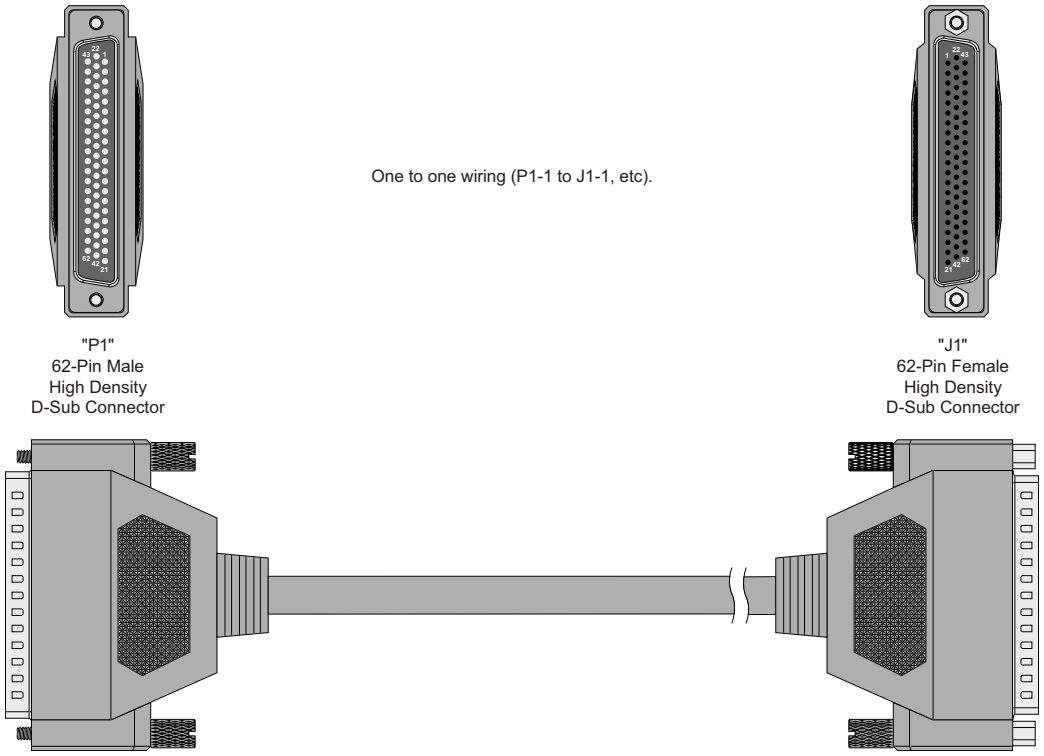
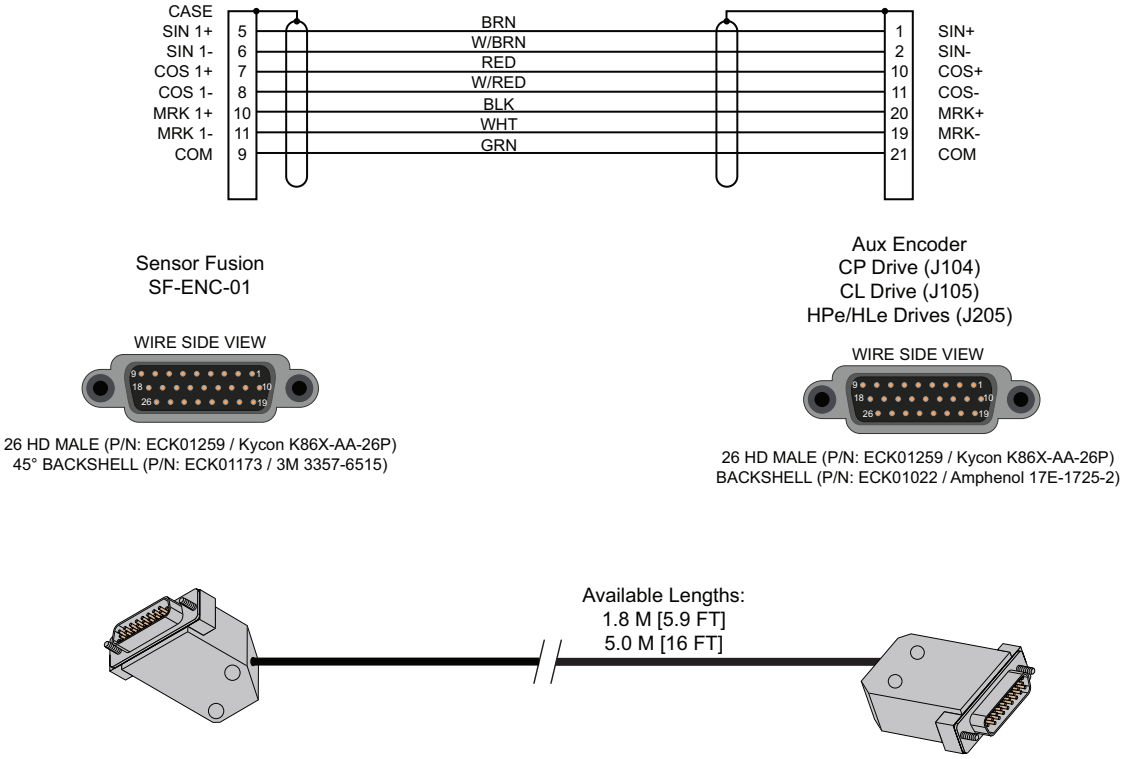


Figure 3-2: CBL-62HDM-62HDF-7 Cable Drawing



Sensor Fusion Cable: Encoder Input from CL/CP/HPe/HLe
SF FB-26HD-26HD-MAX100DM (P/N: C23760)
Drawing Number: 630B2376-

Figure 3-3: C23760 Cable Drawing

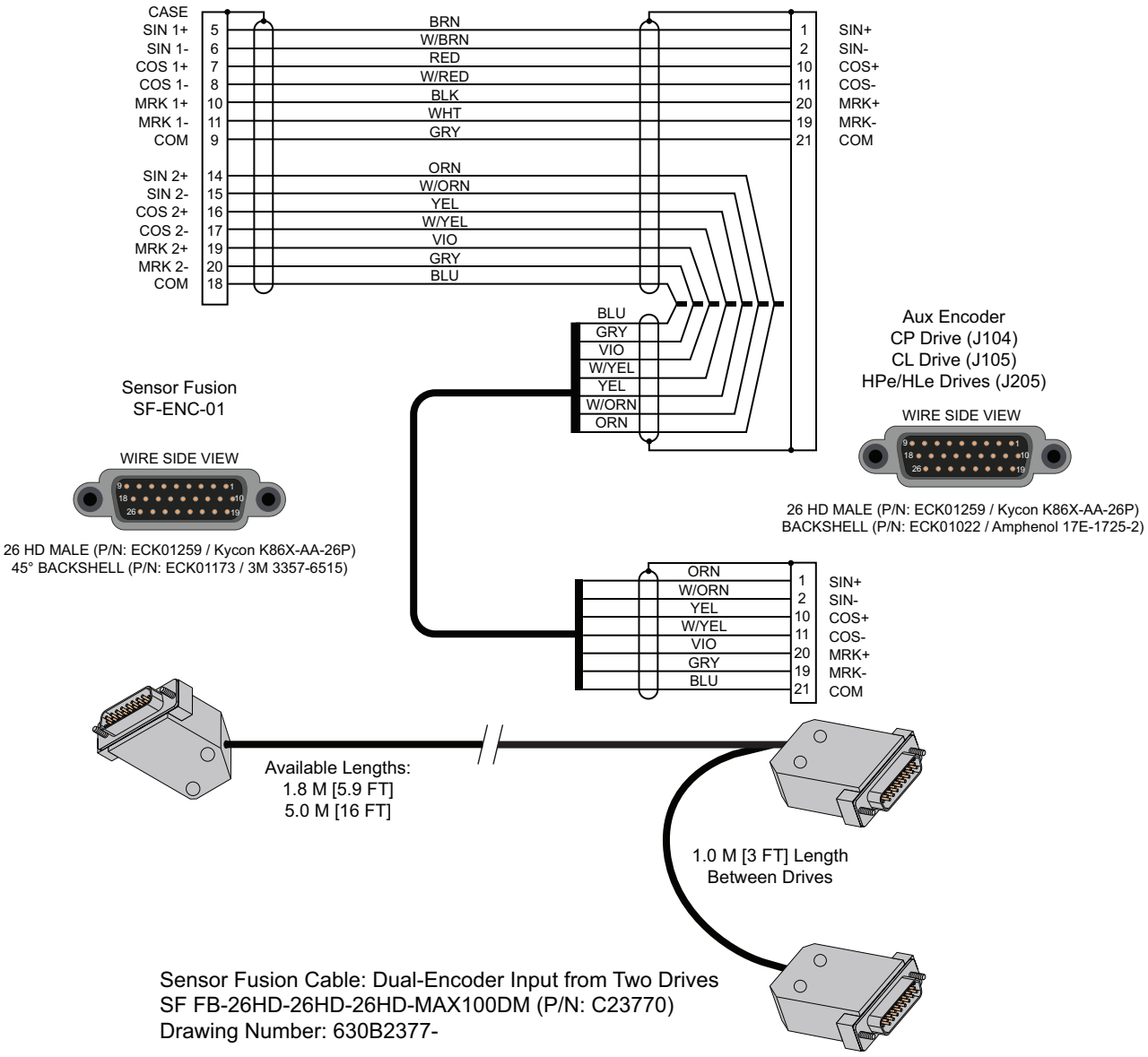
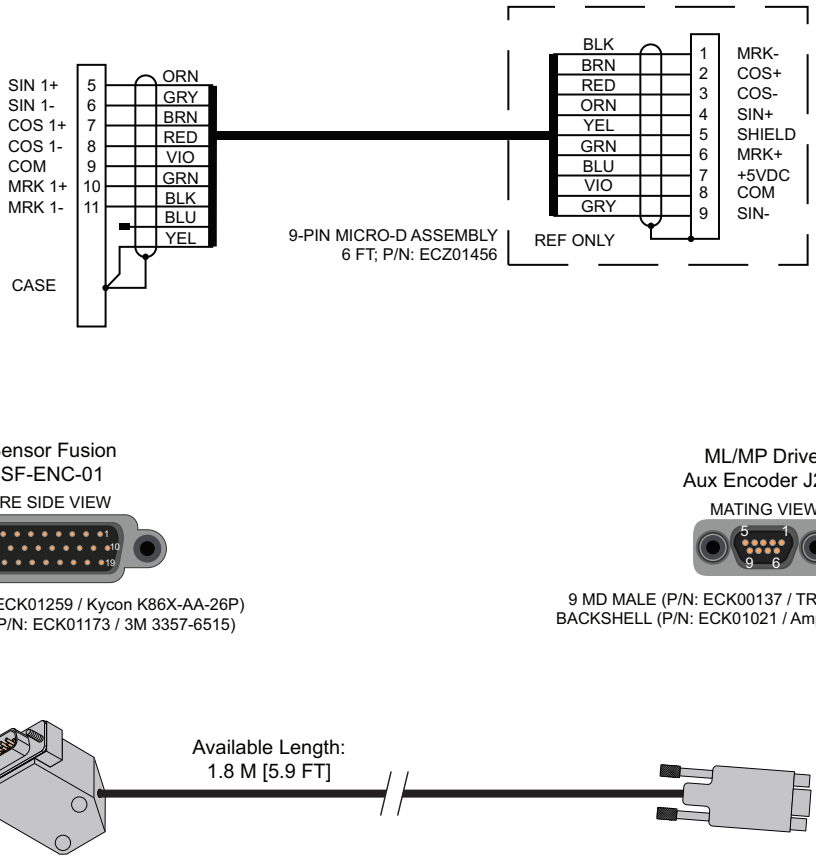
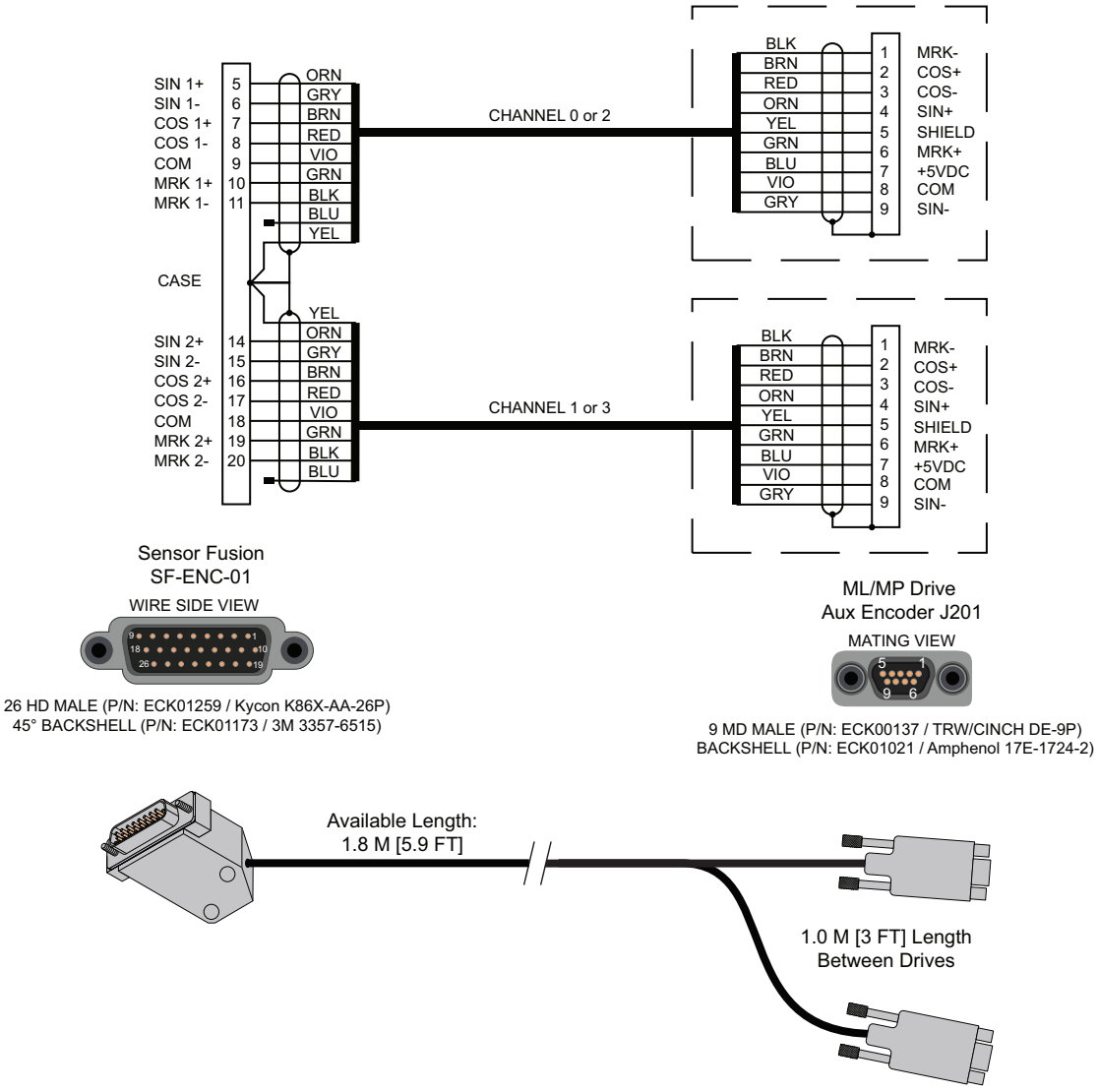


Figure 3-4: C23770 Cable Drawing



Sensor Fusion Cable: Single Encoder Input from ML/MP
SF FB-26HD-9MD-MAX18DM (P/N: C23780)
Drawing Number: 630B2378-

Figure 3-5: C23780 Cable Drawing



Sensor Fusion Cable: Dual-Encoder Input from ML/MP
SF FB-26HD-9MD-9MD-MAX18DM (P/N: C23790)
Drawing Number: 630B2379-

Figure 3-6: C23790 Cable Drawing

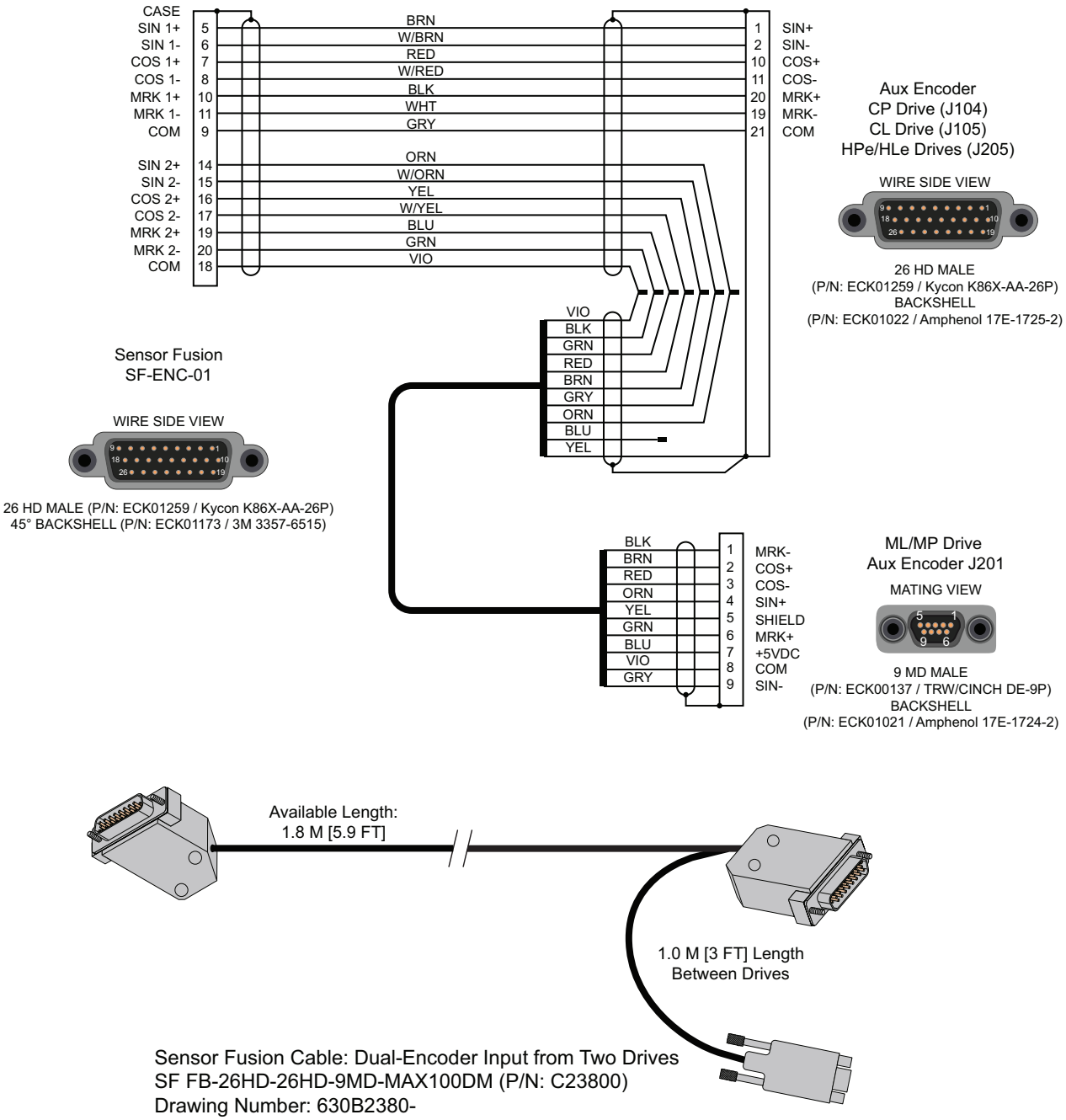
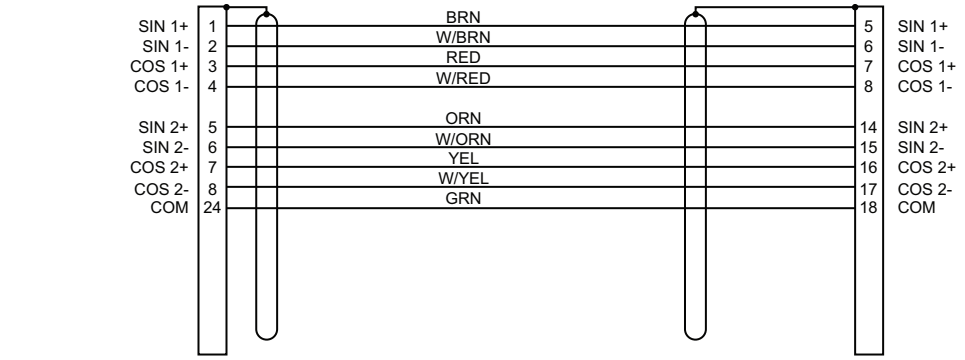
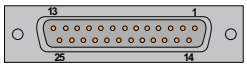


Figure 3-7: C23800 Cable Drawing



Npaq
J8

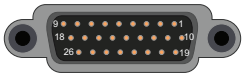
WIRE SIDE VIEW



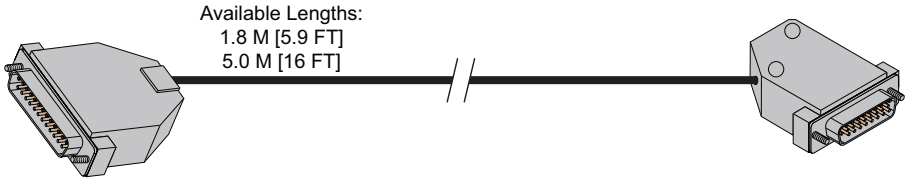
25 PIN MALE (P/N: ECK00101 / TRW/CINCH DB25P)
BACKSHELL (P/N: ECK00656 / Amphenol 17-1726-2)

Sensor Fusion
SF-ENC-01

WIRE SIDE VIEW



26 HD MALE (P/N: ECK01259 / Kycon K86X-AA-26P)
45° BACKSHELL (P/N: ECK01173 / 3M 3357-6515)



Sensor Fusion Cable: Dual Encoder Input from Npaq
SF FB-26HD-25D-MAX100DM (P/N: C23810)
Drawing Number: 630B2381-

Figure 3-8: C23810 Cable Drawing

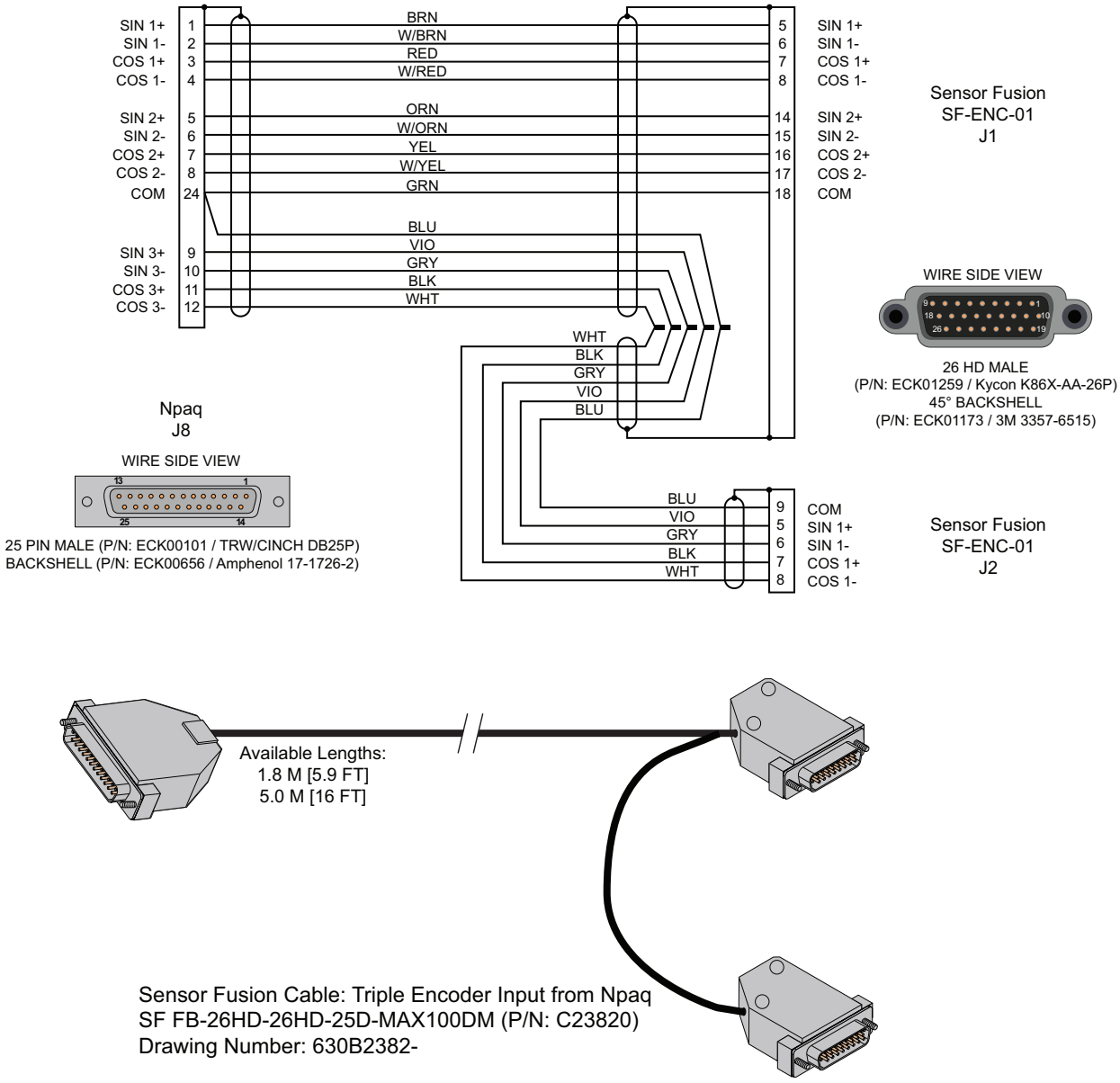


Figure 3-9: C23820 Cable Drawing

Chapter 4: Maintenance

The Sensor Fusion and external wiring should be inspected monthly. Inspections may be required at more frequent intervals, depending on the environment and use of the system. The table below lists the recommended checks that should be made during these inspections.

DANGER: To minimize the possibility of bodily injury and electrical shock, make certain that electrical power is disconnected (Mains disconnect) before performing system maintenance or wiring.

Table 4-1: 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 Sensor Fusion.
Visually inspect all cables and connections.	Tighten or re-secure any loose connections. Replace worn or frayed cables. Replace broken connectors.

Cleaning

The Sensor Fusion 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 Sensor Fusion 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 Sensor Fusion while cleaning. Do not allow cleaning substances or other fluids to enter the Sensor Fusion 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 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, 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 airfreight 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: +1-412-963-7470
Fax: +1-412-963-7459

Appendix B: Revision History

Rev #	Date	Description
1.00.00	December 2, 2013	New Manual

Why Partner with Aerotech?

Aerotech offers its customers a number of important advantages as a single-source provider:

Vertical Integration
Our expertise in motors, amps, controls and stages enables us to provide a complete optimized solution.

Interconnectability
Aerotech systems are designed to work together. This allows you to spend time and resources on your process, not on system integration.

System Checkout
Prior to shipment, all systems are fully assembled and checked out. All system parameters are factory-set based on your specifications.

Documentation
All systems are fully documented. System interconnect-drawings, specification sheets and stage certification plots are included with every system.

Support & Service
Because all system elements are designed and manufactured by Aerotech, we provide the highest level of technical knowledge available. Unlike companies that only manufacture part of the system, Aerotech manufactures all of the system components, minimizing service time.

Single-Source Solution
Aerotech designs and manufactures precision stages, motors, drives and controllers giving you all of the components needed for a complete system.

Application Experience
Since 1970, Aerotech has completed thousands of motion control projects, spanning an extensive range of applications.

R&D
Our engineering teams are dedicated to product development and continuous improvement.

Technology Leader
Aerotech engineers are continuously updating existing products and introducing new products. We are truly "Dedicated to the Science of Motion."

Quality
Aerotech is an ISO 9001 certified supplier with a rigorous quality program.

Worldwide Presence
Aerotech is committed to supporting customers worldwide. We operate full sales and service facilities in the United Kingdom, Germany, Japan, Taiwan and China. We also maintain a growing number of direct field sales and application engineering offices throughput North America, and work with representatives across the globe.

Corporate Headquarters • Pittsburgh, PA • USA

Aerotech UK | **Aerotech Germany** | **Aerotech Japan** | **Aerotech China** | **Aerotech Taiwan**

Worldwide Training and Support

Aerotech Inc (U.S.A.)

Aerotech Ltd (United Kingdom)

Aerotech GmbH (Germany)

Aerotech KK (Japan)

Aerotech offers comprehensive worldwide training and customer service either at customer facilities or at one of our Aerotech training centers.

Our Training Program Features:

- *Standard and customized courses*
- *Hands-on training with Aerotech positioning systems*
- *Interactive training with experienced instructors*
- *Comfortable, spacious facilities*

Installation and Start up (Commissioning)

Startup and commissioning services minimize startup times, reduce cost and accelerate time-to-production. By combining our product knowledge with your process and application expertise, new systems and applications can be completed faster at a reduced overall cost.

Engineering Support

Aerotech provides complete engineering support for our products, including on-site support and maintenance, and remote support via phone, fax, website and/or WebEx® software. As a manufacturer staffed by engineers, we understand the unacceptability of downtime.

Training

Comprehensive training classes are designed to help our customers realize the full potential of our products. By demonstrating all of a product's features and how to use them, customers have been able to reduce startup time and quickly optimize their applications. Our classes have been developed, and continually upgraded, using feedback from our customers.

Since 1970, Aerotech has designed motion control and positioning systems and components with an unsurpassed track record of reliability. When you make the choice to purchase from Aerotech, we urge you to learn how to get the most from your new products. We provides both on-site (your facility) and/or in-house (our facility) training for our customers' convenience.