FLUID COMPONENTS INTERNATIONAL LLC

COMPONENT MAINTENANCE MANUAL

FCI Document Control Number: 06EN003235 Rev. B

AIR FLOW SWITCH, MD-11 EMI

PART NUMBERS

P012583

RECORD OF REVISIONS

Rev.	Description	Date
A	See Revision NC for changes.	
B	***updated Entire Document***	07/23/07
	Incorporated all pages into one document and renumbered pages.	
	Updated proprietary statement on title page.	
	Added proprietary statement, document number and revision on all pages.	
	Updated zip and FAX numbers on page 6.	
	Changed output signal to 0.5 VDC ± 0.5 VDC on page 12, Section C (3) and page 13, Section D (3).	
	Changed output signal to 18+/-1 VDC from 17± 1 VDC on page 12, Section C (5) and page 13, Section D (5).	

SERVICE BULLETIN LIST

Service Bulletin information is placed in this list when the Service Bulletin is incorporated into this manual.

S.B. NUMBER	DESCRIPTION	PARTS ADDED OR CHANGED	INCORPORATED IN REVISION	EFFECTIVITY

LIST OF EFFECTIVE PAGES

TABLE OF CONTENTS

INTRODUCTION

1. General

   A. This manual provides maintenance instructions for the P012583.

   B. The information in this abbreviated manual covers the description, operation, testing, cleaning and inspection of this equipment.

   C. The Air Flow Switch is manufactured by Fluid Components Intl, LLC, San Marcos, California (CAGE CODE 64818).

2. Ordering of Parts

   Ordering of parts is to be directed as follows:

   Fluid Components International LLC
   1755 La Costa Meadows Drive
   San Marcos, California 92078-5115
   Attention: Customer Service
   Phone: (800) 854-1993 or FAX: (760) 736-6250

3. Manual Requests

   Requests for copies of publications should be directed to the address shown in Paragraph 2.

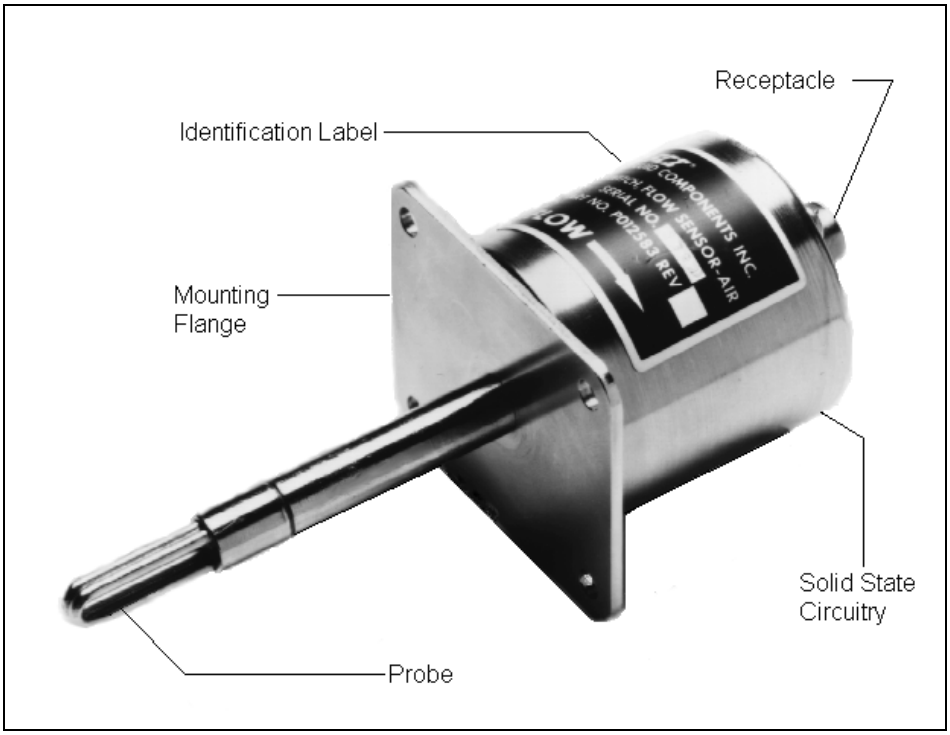
4. Manual Revisions

   This manual will be revised as necessary to reflect current information

DESCRIPTION AND OPERATION

1. Description

The P012583 Air Flow Switch monitors the mass air flow in aircraft Environmental Cooling Systems. Figure 1 shows the Air Flow Switch. The Switch can be set to switch over a wide flow range. The instrument consists of a probe that is in physical contact with the air flow and electronic switch circuitry that detects flow rate changes. The instrument has no moving parts, is lightweight, compact, qualified to RTCA/DO-160B, reliable and maintenance free. Some of the typical applications for this Air Flow Switch are to monitor secondary air supply lines that lead to the avionics manifold, cargo areas, main cabin and lavatories. The physical and operational characteristics of the Air Flow Switch are listed in Figure 2. Figure 3 shows the outline dimensions of the Air Flow Switch for proper mounting to the air flow system.

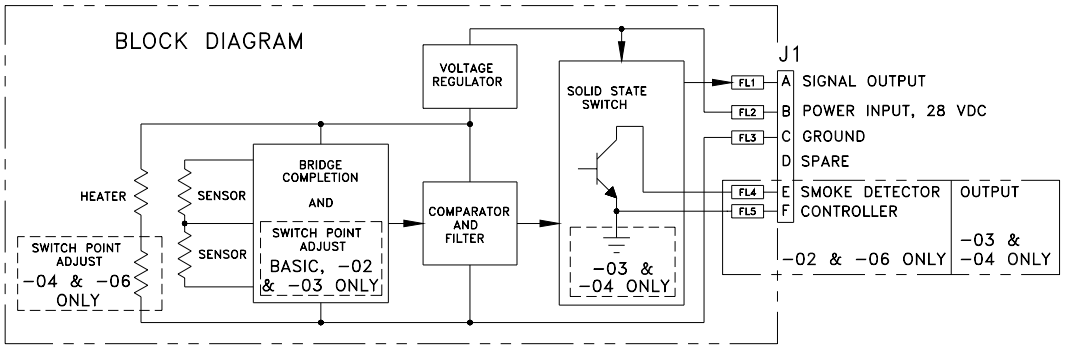


Model P012583 Air Flow Switch
Figure 1

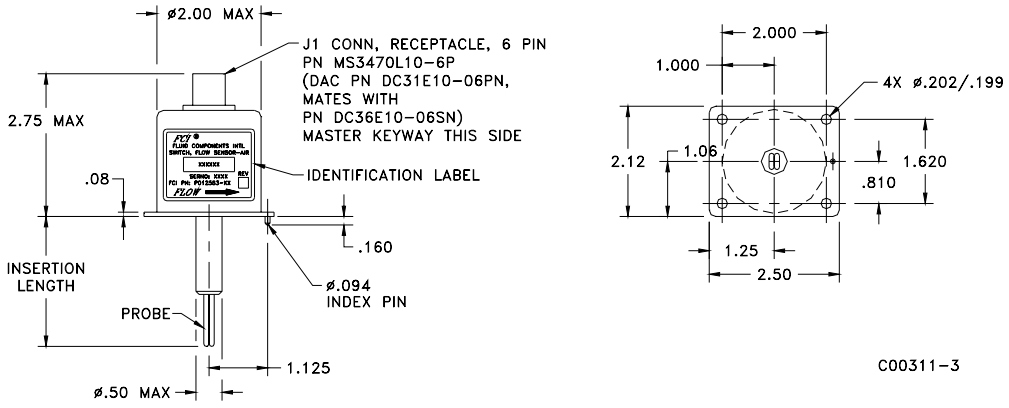
Item	Characteristic
Process Connection	Flange mount with a .094 inch (0.24 cm) diameter index pin.
Insertion Length	1.46 or 3 inches depending on dash number. See Figure 3.
Material	All wetted surfaces 316 stainless steel with nickel braze per AMS4777. Electronics enclosure is aluminum, coated with electroless nickel plate per MIL-C-26074B.
Repeatability	±1% full signal range at constant conditions.
Time Response	10 seconds to respond to a low flow condition.
Switch Point Adjustment	Factory set and calibrated. See Figure 3 for details.
Power Input	28 VDC +1.5, -6 VDC.
Flow Rate	See Figure 3 for details.
Power Consumption	85 mA maximum.
Electrical Connection	Receptacle M83723/2R1006N
EMI Protection	Radiated and susceptibility tests per MIL-STD-45662 and DO-160B.
Lightening Protection	Single and multiple stroke lightening test per DAC specification WZZ7000.
Operating Temperature (-01, -02, -03, -04, -06)	-65° to 180°F. (-54° to 82°C).
Weight	6.4 Ounces (181 grams) maximum.
Qualification	RTCA-DO-160B.

Leading Particulars
Figure 2

CONFIGURATION TABLE			
FCI PN	DESCRIPTION	3 SENSOR SET POINT	4 INSERTION LENGTH
P012583	AIR FLOW ECS	1500 +/- 100 BFPM	3.00 +/- .09 INCHES
P012583-02	AIR FLOW SMOKE DETECTION SYSTEM	3.00 ±.30 SFPS	1.46 +/- .09 INCHES
P012583-03	AIR FLOW SENSOR	13.46 ±.67 SFPS	3.00 +/- .09 INCHES
P012583-04	AIR FLOW SENSOR	7.6 ±1.0 SFPS	3.00 +/- .09 INCHES
P012583-05			
P012583-06	AIR FLOW SMOKE DETECTION SYSTEM II	.28 ±.03 SFPS	1.46 +/- .09 INCHES



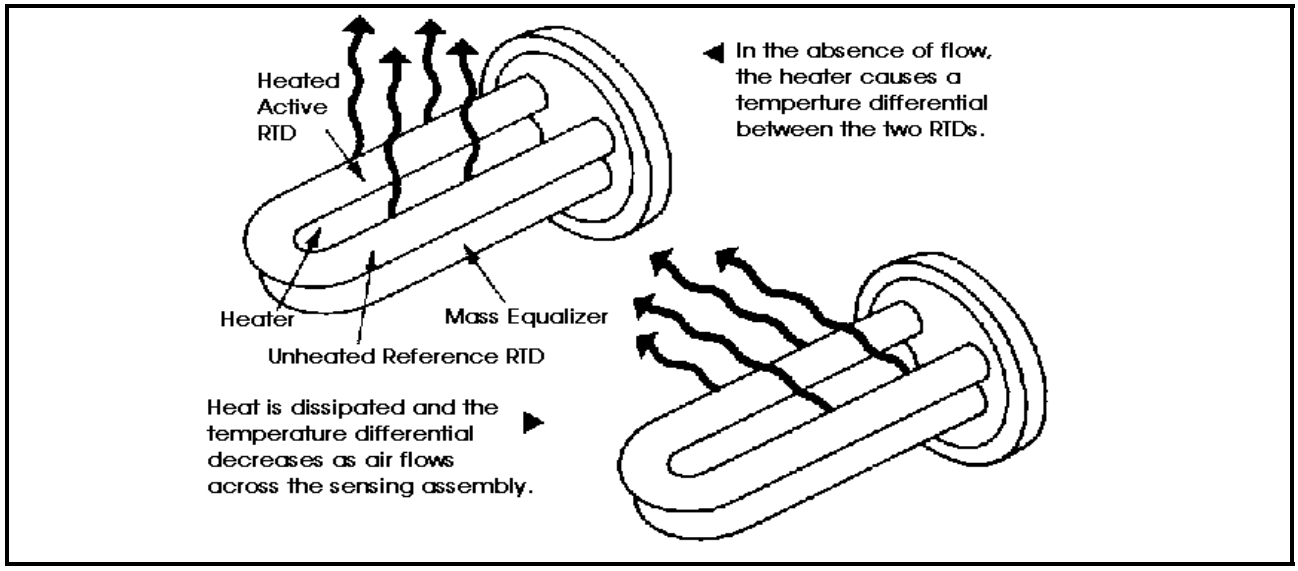
FLOW RATE	CONFIGURATIONS		
	BASIC, -02, -03, -04, -06	BASIC, -02, -03, -06	-04
	OUTPUT PIN A	OUTPUT PINS E & F	OUTPUT PINS E & F
LOW FLOW	2 mA @ 1 VDC MAX	LEAKAGE <10 uA @ 28 VDC	SINK <150 mA @ .5 VDC MAX
HIGH FLOW	2 mA @ 17 VDC MIN	SINK <150 mA @ .5 VDC MAX	LEAKAGE <10 uA @ 28 VDC



Outline Dimensions
Figure 3

2. Operation

The probe consists of two thermowells (hollow tubes) of the same size, shape and mass that are welded together. One thermowell contains 2 platinum Resistance Temperature Detectors (RTDs). The other thermowell contains a heater element and an empty space for mass equalization (see Figure 4). The RTD located next to the heater element is known as the active RTD. The other RTD is known as the reference RTD. Since the active RTD is next to the heater, the temperature at the walls of the thermowell are always above the temperature of the process media. The temperature at the reference RTD is the temperature of the process media. When the process media is flowing past the active RTD a quantity of heat is carried off into the flow stream. The amount of heat taken from the active RTD is a function of the air flow rate. A Delta Temperature (ΔT) exists between the RTD thermowells and a proportional Delta Resistance (ΔR) exists between the active and the reference RTDs that the circuitry measures. The relationship of ΔT to the flow rate is calculated by the circuitry. The circuitry converts the ΔR to an off or on signal that is sent to the aircraft's alarm system.



TESTING

1. General

The Air Flow Switch (referred to as switch) is easy to troubleshoot. Due to the simplicity of design, switch failures can be as simple to correct as removing debris that has collected on the probe. If the switch is newly installed, check that the Flow Arrow on the Identification Label points in the same direction as the air flow in the system.

2. Test Equipment

Pigtail type cable attached to a DC36E10-06SN Connector.

Precision Digital Multi-Meter (DMM)

DC Power Supply capable of supplying 28 VDC at 160 mA

Stop Watch

Approximately a 4-ounce (120 ml) container of water (optional)

3. Test Procedure

A. Preliminary Verifications

Before removing the instrument for bench testing, verify the following:

(1) The impedance of the load on the switch output must be at least 8.5 KΩ. An impedance less than this value can result in false output signals.

(2) The output of the switch is not tied together with the output of another switch. Outputs between two or more switches can not be tied together with the output of another flow switch; they must be monitored independently. Tying the output of two switches together can render the switch inoperable.

B. Preparation for Bench Testing For All Model Dash Numbers

(1) Disconnect the electrical connection receptacle and remove the switch from the process piping.

(2) Set up the switch on a bench top for testing.

(3) Mate the electrical connection with a DC36E10-06SN pigtail type cable to access power and switch point terminals.

(4) Connect a 28 VDC power supply (+) lead to terminal B (power input) and the (-) lead to C (ground).

(5) Connect a DMM (+) lead to terminal A (signal input/output) and the (-) lead to C (ground). This monitors the output signal, either 17 VDC - High; or 1 VDC - Low.

C. Bench Test switch Set Point (Option 1),

Power cycling is one of two ways to test the switch.

Removing the power on the switch will cause the active (heated) RTD to cool. After the active RTD has cooled to the same temperature as the reference RTD and the power is reapplied, the bridge voltage input is at its lowest point. A high flow condition is simulated and the output signal should be High; 17 VDC. As the active RTD heats up, the bridge voltage input rises simulating a low flow condition and the output signal should change to 1 VDC. Follow the procedure below.

(1) Monitor the output voltage signal across pins A and C as described above.

WARNING: ONLY QUALIFIED PERSONNEL SHOULD ATTEMPT TO TEST THIS SWITCH. THE OPERATOR ASSUMES ALL RESPONSIBILITIES FOR SAFE PRACTICES WHILE TROUBLESHOOTING.

(2) Apply power.

(3) Let the Switch self-heat for approximately 1 minute. The output should read 0.5 VDC ± 0.5 VDC.

(4) Remove the power and let the switch cool for 3 minutes.

(5) Re-apply the power. The output signal should read 18 VDC ± 1 VDC.

(6) Continue to monitor the output signal and verify that it drops to approximately 1 VDC. The output should change states from 17 VDC to 1 VDC within 120 seconds.

D. Bench Test Switch Set Point (Option 2).

Liquid exposure is the second way to test the Switch.

Immersing the Switch probe in water rapidly cools the active RTD and simulates a high air flow condition. The user can observe the output signal change between 1 VDC - in still air (no flow) to 17 VDC - in liquid (high air Flow). Follow the procedure below.

WARNING: ONLY QUALIFIED PERSONNEL SHOULD ATTEMPT TO TEST THIS SWITCH. THE OPERATOR ASSUMES ALL RESPONSIBILITIES FOR SAFE PRACTICES WHILE TROUBLESHOOTING.

(1) Apply power as described above. Let the switch sit on the bench top in still air.

(2) Wait approximately 3 minutes for the switch to stabilize.

(3) Monitor the output – verify that the output is 0.5 VDC ± 0.5 VDC in still air (this is a "no flow" or very low flow condition.

(4) Immerse the probe (oval-shaped thermowells 1 inch in length) in water and let stabilize for approximately 2 minutes

(5) Monitor the output - verify that the output is 18 VDC ± 1 VDC in liquid (this is a simulated high flow condition).

E. Conclusion

If the above conditions have been verified and problems are still being experienced please contact the FCI customer Service Department as shown in Paragraph 2 of the introduction.

If one or more of the above tests have failed, contact the FCI Customer Service Department and arrange to have the Switch sent back for repair or replacement.

CLEANING

1. Cleaning Solutions

CAUTION: DO NOT USE SANDPAPER OR METAL INSTRUMENTS TO SCRAPE THE SWITCH WHEN CLEANING.

A. Use cleaning solutions that are compatible with the air ducting.

B. Remove foreign material from the external surfaces with a moist cloth and then dry with a soft clean cloth.

INSPECTION/CHECK

1. General Condition

Visually inspect the switch periodically for physical damage. The switch should be free of corrosion, and cracks.

2. Probe Condition

Visually inspect the probe portion of the switch for physical damage. The probe should be free of corrosion, cracks and dents.

REPAIR

The switch is not field repairable: If it fails to operate properly return it to FCI at the address in paragraph 2 of the Introduction.