PARAGON CONTROLS INCORPORATED

Technical Data Sheet

FIC-1001-M CONSTANT VOLUME FLOW CONTROLLER WITH INDICATION

DESCRIPTION

The **FIC-1001-M** is a dedicated analog electronic three-mode controller with transducers, square root extractor, and scaling circuit with process indication, housed in a compact enclosure. The **FIC-1001-M** is designed to maintain a constant flow through a fan or duct section. Unlike other systems that incorporate a standard proportional band, reset (integral), and derivative (P,I,D) control, the **FIC-1001-M** incorporates inverse derivative with proportional and integral control (P,I,1/D), making the controller very responsive, without hunting and overshooting, as is often seen in standard less precise P,I,D controllers.

The measured air volume is independently indicated on a front mounted magnehelic pressure gauge scaled in cubic feet per minute (cfm).

Features

- Local indication of the measured air volume
- Locally adjustable delta cfm setpoint with system interlock mode
- Remote setpoint for control of constant cfm via the building management systems
- Jumper selectable control action (reverse and direct)
- Jumper selectable control mode values to allow for adjustment of P,I,1/D to match system dynamics
- 0 to 10 VDC output interface signal, linear to air volume, available for data acquisition and building management system monitoring
- Control package is factory tested and calibrated to each system specification to ensure a trouble free installation and system commissioning
- All test points and adjustments are easily accessible behind the hinged front cover

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FIC-1001-M Technical Specifications

Differential Pressure Transmitter

1. **Operating Ranges**
   From 0 to 1200 FPM up to 0 to 10,000 FPM
2. **Accuracy**
   ±1% of span
3. **Hysteresis and Dead Band**
   Non-detectable
4. **Linearity**
   ±1% of span
5. **Repeatability**
   Within 0.2% of output
6. **Response**
   Less than 0.5 seconds for full span output
7. **Temperature Effects**
   Less than ±0.03% FS/^{o}F, over 40 to 100^{o}F
8. **Overpressure**
   5 psi proof and 25 psi burst pressure
9. **Output Signal**
   0 to 5 VDC

Square Root Extractor/Scaling Multiplier

10. **Input Signal**
    0 to 5 VDC
11. **Output Signal**
    0 to 10 VDC
12. **Accuracy**
    ±0.2% of span
13. **Hysteresis and Dead Band**
    Within 0.01% of span
14. **Repeatability**
    Within 0.01% of output
15. **Response**
    Less than 5.0 seconds for full span input
16. **Linearity**
    ±0.2% of span

Three Mode Flow Controller (P, I, 1/D)

17. **Proportional Band**
    Adjustable from 1% to 100%
18. **Reset**
    Adjustable from 1 to 6 repeats per minute
19. **Inverse Derivative**
    Adjustable from 0.5 to 5 minutes per repeat
20. **Hysteresis and Dead Band**
    Within 0.01% of span
21. **Repeatability**
    Within 0.01% of span
22. **Tracking Accuracy**
    ±0.1% of span
23. **Output Signal**
    0 to 10 VDC or 4 to 20 mADC

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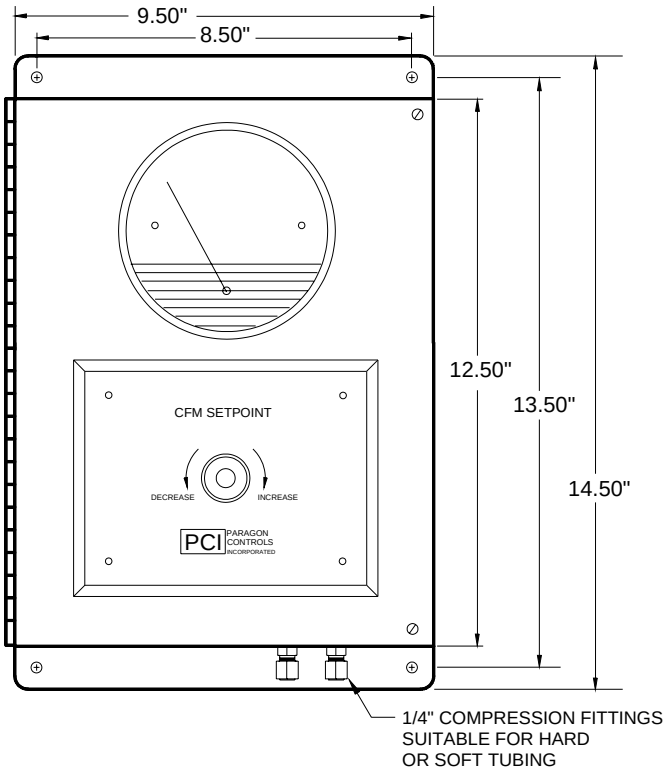
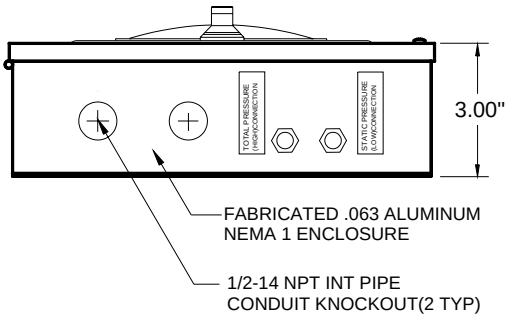
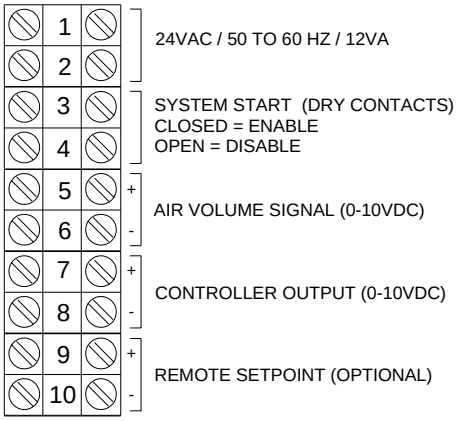
FIC-1001-M Dimensions





FIC-1001-M Field Connections

TERMINAL TB1
INPUT POWER &
SIGNAL INTERFACE



1/4" PNEUMATIC BULKHEAD
COMPRESSION FITTING

A TOTAL PRESSURE (HIGH)
AIR VOLUME
B STATIC PRESSURE (LOW)

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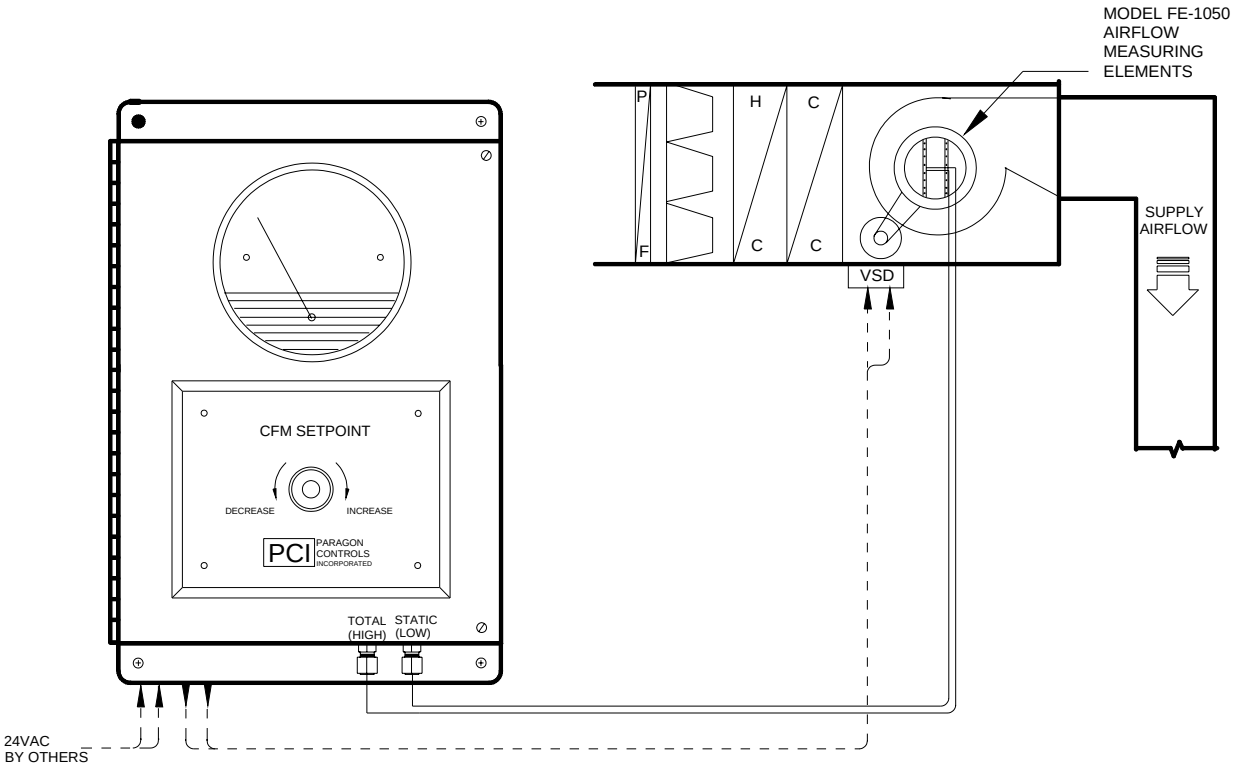
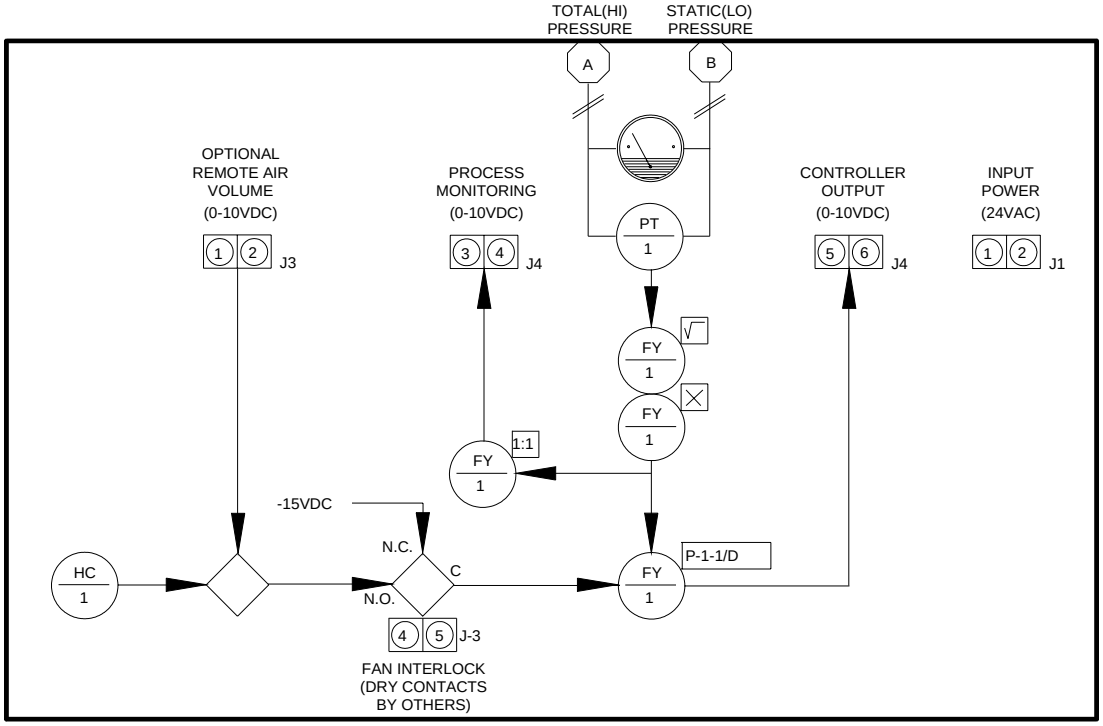
FIC-1001-M System Interface Diagram



FIC-1001-M Instrument Diagram



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FIC-1001-M Specification Guide

SECTION 15_____
AIRFLOW MEASUREMENT AND CONTROL SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes labor, materials, equipment, skills and related services necessary to furnish and install the airflow measurement and control systems indicated in the Contract Documents.

1.02 REFERENCES

A. The General Provisions of the Contract, including condition of the Contract and Division 1 of the specifications apply to the work in this Section.

B. Refer to Section 15___ for control requirements.

1.03 SUBMITTALS

A. Submit shop drawings and descriptive data in accordance with Section 15____ for the following:

1. Constant volume airflow measurement and control system.

PART 2 – PRODUCTS

2.01 AIRFLOW MEASUREMENT AND CONTROL SYSTEM

A. Provide air measurement station(s) model FE-1050/FE-1500 as manufactured by Paragon Controls Incorporated, or approved equal, in the sizes and types as shown on the Contract Drawings.

B. The airflow measurement system (AMS) shall be a model FIC-1001-M as manufactured by Paragon Controls Incorporated capable of directly measuring and controlling the required airflow rate

C. Each airflow sensing element shall be designed and built to comply with, and provide results in accordance with, accepted practice for duct system traversing as defined in the ASHRAE Handbook of Fundamentals, AMCA publication #203, as well as the Industrial Ventilation Handbook. The number of sensing ports on each element, and the quantity of elements utilized at each installation, shall comply with ASHRAE Standard #111 for equal area duct traversing. Each element shall be of a dual integral chambered design.

D. Each airflow measuring element shall contain multiple total and static pressure sensing ports placed along the leading edge of the cylinder. The static pressure chamber shall incorporate dual offset static taps on opposing sides of the averaging chamber, so as to be insensitive to flow angle variations of as much as +/- 20 degrees in the approaching air stream.

E. The AMS shall provide two analog output signals. One shall be linear to the measured airflow rate, which shall be monitored by the building management system. The other shall be an analog output signal, which shall modulate the control damper to maintain the required airflow rate.

F. The AMS shall receive two inputs from the building management system. One analog input signal for required air volume set point, and one binary input to allow for start/stop interlock. The AMS shall also have local set point capability. The controller shall utlize this set point input in the event of loss of input from the building management system.

G. The AMS shall provide measurement and control accuracy of ±3% over the required operating range.

PART 3 – EXECUTION

3.01 INSTALLATION CONSIDERATIONS

A. Primary Elements shall be installed in strict accordance with the manufacture's published requirements.

B. These elements serve as the primary signals for the maintaining of the required airflow rate; therefore, it shall be the responsibility of the contractor to verify the installation with the manufacturer to assure that accurate primary signals are obtained.

C. The naming of any manufacturer does not automatically constitute acceptance of their standard product nor waive their responsibility to comply totally with all requirements of the proceeding specification.

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Engineering Reference Table

VELOCITY VERSUS VELOCITY PRESSURE
V = VELOCITY IN FEET PER MINUTE P_V = VELOCITY PRESSURE IN INCHES H_2O

V	P_V	V	P_V	V	P_V	V	P_V	V	P_V	V	P_V	V	P_V	V	P_V
180	0.0020	620	0.0240	1060	0.0701	1500	0.1403	1940	0.2346	2760	0.4749	3640	0.8260	5300	1.7512
190	0.0023	630	0.0247	1070	0.0714	1510	0.1422	1950	0.2371	2780	0.4818	3660	0.8351	5350	1.7844
200	0.0025	640	0.0255	1080	0.0727	1520	0.1440	1960	0.2395	2800	0.4888	3680	0.8443	5400	1.8180
210	0.0027	650	0.0263	1090	0.0741	1530	0.1459	1970	0.2420	2820	0.4958	3700	0.8535	5450	1.8518
220	0.0030	660	0.0272	1100	0.0754	1540	0.1479	1980	0.2444	2840	0.5028	3720	0.8627	5500	1.8859
230	0.0033	670	0.0280	1110	0.0768	1550	0.1498	1990	0.2469	2860	0.5099	3740	0.8720	5550	1.9204
240	0.0036	680	0.0288	1120	0.0782	1560	0.1517	2000	0.2494	2880	0.5171	3760	0.8814	5600	1.9551
250	0.0039	690	0.0297	1130	0.0796	1570	0.1537	2020	0.2544	2900	0.5243	3780	0.8908	5650	1.9902
260	0.0042	700	0.0305	1140	0.0810	1580	0.1556	2040	0.2595	2920	0.5316	3800	0.9002	5700	2.0256
270	0.0045	710	0.0314	1150	0.0825	1590	0.1576	2060	0.2646	2940	0.5389	3820	0.9097	5750	2.0613
280	0.0049	720	0.0323	1160	0.0839	1600	0.1596	2080	0.2697	2960	0.5462	3840	0.9193	5800	2.0973
290	0.0052	730	0.0332	1170	0.0853	1610	0.1616	2100	0.2749	2980	0.5536	3860	0.9289	5850	2.1336
300	0.0056	740	0.0341	1180	0.0868	1620	0.1636	2120	0.2802	3000	0.5611	3880	0.9386	5900	2.1702
310	0.0060	750	0.0351	1190	0.0883	1630	0.1656	2140	0.2855	3020	0.5686	3900	0.9483	5950	2.2071
320	0.0064	760	0.0360	1200	0.0898	1640	0.1677	2160	0.2909	3040	0.5762	3920	0.9580	6000	2.2444
330	0.0068	770	0.0370	1210	0.0913	1650	0.1697	2180	0.2963	3060	0.5838	3940	0.9678	6050	2.2819
340	0.0072	780	0.0379	1220	0.0928	1660	0.1718	2200	0.3017	3080	0.5914	3960	0.9777	6100	2.3198
350	0.0076	790	0.0389	1230	0.0943	1670	0.1739	2220	0.3073	3100	0.5991	3980	0.9876	6150	2.3580
360	0.0081	800	0.0399	1240	0.0959	1680	0.1760	2240	0.3128	3120	0.6069	4000	0.9975	6200	2.3965
370	0.0085	810	0.0409	1250	0.0974	1690	0.1781	2260	0.3184	3140	0.6147	4050	1.0226	6250	2.4353
380	0.0090	820	0.0419	1260	0.0990	1700	0.1802	2280	0.3241	3160	0.6225	4100	1.0480	6300	2.4744
390	0.0095	830	0.0429	1270	0.1006	1710	0.1823	2300	0.3298	3180	0.6304	4150	1.0737	6350	2.5139
400	0.0100	840	0.0440	1280	0.1021	1720	0.1844	2320	0.3356	3200	0.6384	4200	1.0997	6400	2.5536
410	0.0105	850	0.0450	1290	0.1037	1730	0.1866	2340	0.3414	3220	0.6464	4250	1.1261	6450	2.5937
420	0.0110	860	0.0461	1300	0.1054	1740	0.1888	2360	0.3472	3240	0.6545	4300	1.1527	6500	2.6340
430	0.0115	870	0.0472	1310	0.1070	1750	0.1909	2380	0.3531	3260	0.6626	4350	1.1797	6550	2.6747
440	0.0121	880	0.0483	1320	0.1086	1760	0.1931	2400	0.3591	3280	0.6707	4400	1.2070	6600	2.7157
450	0.0126	890	0.0494	1330	0.1103	1770	0.1953	2420	0.3651	3300	0.6789	4450	1.2346	6650	2.7570
460	0.0132	900	0.0505	1340	0.1119	1780	0.1975	2440	0.3712	3320	0.6872	4500	1.2625	6700	2.7986
470	0.0138	910	0.0516	1350	0.1136	1790	0.1998	2460	0.3773	3340	0.6955	4550	1.2907	6750	2.8406
480	0.0144	920	0.0528	1360	0.1153	1800	0.2020	2480	0.3834	3360	0.7038	4600	1.3192	6800	2.8828
490	0.0150	930	0.0539	1370	0.1170	1810	0.2042	2500	0.3897	3380	0.7122	4650	1.3480	6850	2.9253
500	0.0156	940	0.0551	1380	0.1187	1820	0.2065	2520	0.3959	3400	0.7207	4700	1.3772	6900	2.9682
510	0.0162	950	0.0563	1390	0.1205	1830	0.2088	2540	0.4022	3420	0.7292	4750	1.4066	7000	3.0549
520	0.0169	960	0.0575	1400	0.1222	1840	0.2111	2560	0.4086	3440	0.7378	4800	1.4364	7100	3.1428
530	0.0175	970	0.0587	1410	0.1239	1850	0.2134	2580	0.4150	3460	0.7464	4850	1.4665	7200	3.2319
540	0.0182	980	0.0599	1420	0.1257	1860	0.2157	2600	0.4214	3480	0.7550	4900	1.4969	7300	3.3223
550	0.0189	990	0.0611	1430	0.1275	1870	0.2180	2620	0.4280	3500	0.7637	4950	1.5276	7400	3.4140
560	0.0196	1000	0.0623	1440	0.1293	1880	0.2203	2640	0.4345	3520	0.7725	5000	1.5586	7500	3.5069
570	0.0203	1010	0.0636	1450	0.1311	1890	0.2227	2660	0.4411	3540	0.7813	5050	1.5899	7600	3.6010
580	0.0210	1020	0.0649	1460	0.1329	1900	0.2251	2680	0.4478	3560	0.7901	5100	1.6216	7700	3.6964
590	0.0217	1030	0.0661	1470	0.1347	1910	0.2274	2700	0.4545	3580	0.7990	5150	1.6535	7800	3.7930
600	0.0224	1040	0.0674	1480	0.1366	1920	0.2298	2720	0.4612	3600	0.8080	5200	1.6858	7900	3.8909
610	0.0232	1050	0.0687	1490	0.1384	1930	0.2322	2740	0.4681	3620	0.8170	5250	1.7184	8000	3.9900

Above P_V Values Are Based On Standard Air Density Of 0.075 lbm/ft^3 Which Is Air At 68°F, 50% Relative Humidity, And 29.92" Hg.
The equation for converting air volume (Q) into velocity (V) and velocity pressure (P_V) is:

$$V = \frac{Q}{A} \qquad P_V = \left(\frac{V}{C}\right)^2 \times \rho$$

Where:
V = Velocity, in fpm
Q = Flow, in cfm
A = Area, in ft^2
C = 1096.7
ρ = Density of air, in lb/ft^3
P_V = Velocity pressure, in inches H_2O

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