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# **CA03 SIGNAL CONDITIONER**

## **Installation, Operation and Maintenance Manual**

SERIAL NUMBER \_\_\_\_\_

The specifications contained in this manual are subject to change without notice and any user of these specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications that have been changed and are no longer in effect.

## **CA03 SIGNAL CONDITIONER Installation, Operation and Maintenance Manual**

**TM-87917 REV. H**

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**TM-87917**  
**REVISIONS**

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## 1.0 SCOPE

This manual is provided for information and guidance of personnel responsible for the installation and operation of the CA03 Signal Conditioner manufactured by Flow Technology, Inc. of Phoenix, Arizona.

## 2.0 PURPOSE

The purpose of this manual is to provide information detailing the operational characteristics of the CA03 Signal Conditioner.

This manual does not contain information or instructions for custom application(s).

## 3.0 DESCRIPTION

The CA03 is used in conjunction with a modulated carrier (RF) pickoff to eliminate the effects of magnetic drag on the rotor. The pickoff coil senses the rotation of the flowmeter rotor and provides a modulated input signal to the CA03. The Signal Conditioner converts the input signal to a pulse output. The frequency of the pulse output is proportional to the rotation of the flowmeter rotor. The CA03 amplifies the signal to provide a clean signal for a long distance.

The CA03 is packaged in a 3½-inch explosion-proof or a NEMA 4X enclosure.

## 4.0 INSPECTION, INSTALLATION, AND OPERATION

### 4.1 INSPECTION

The equipment is ready for immediate installation upon receipt. However, the unit should be checked to assure that no damage occurred during shipment. At least, a visual inspection for broken or loose components should be conducted.

## 4.2 INSTALLATION

The explosion-proof housing can be mounted on top of the flowmeter or on the end of the conduit. Figure 1 shows the wiring diagram for the CA03. All connections are made to the terminal strip.

The Signal Conditioner should be located within 100 feet of the flowmeter, since the performance of the unit is affected by the characteristics of the connecting cable. Belden #8761 or equivalent (22 gauge, single pair, shielded instrument cable) is recommended for connecting the pickoff to the CA03.

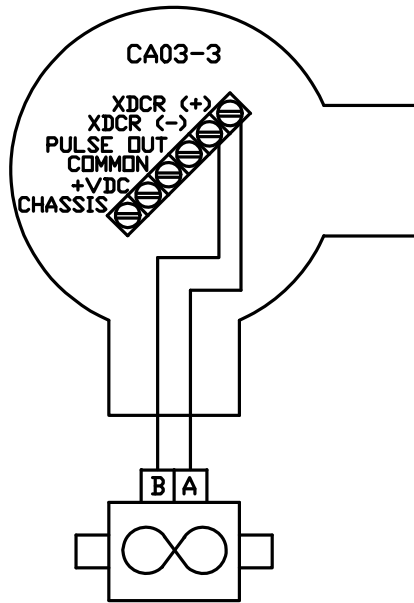
**NOTE: Adjust carrier level to 9 to 10 volts peak to peak for the CA03-4-x-xxxx-x-x, the CA03-x-D-xxxx-x-x and the CA03-4-D-xxxx-x-x Amplifiers.**

## 4.3 OPERATION

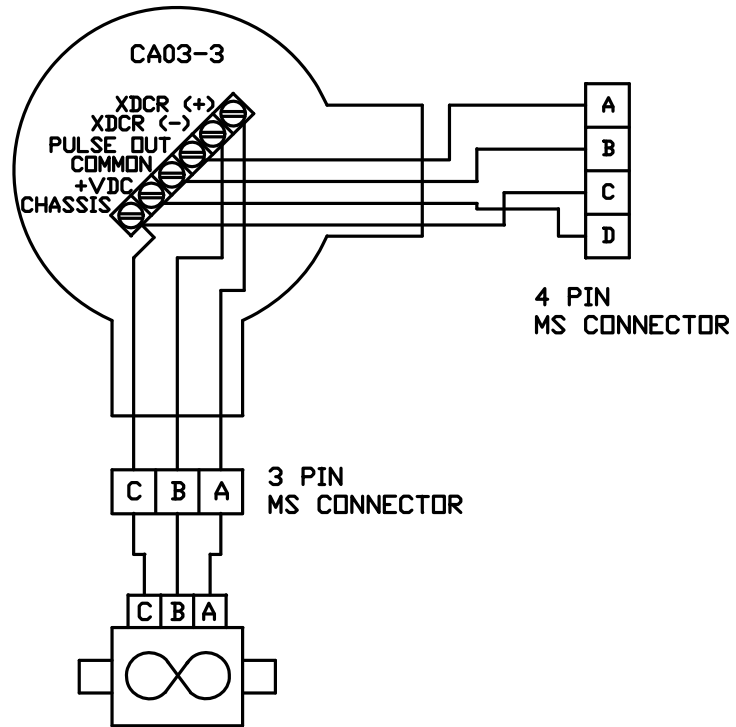
A pickoff provides a low level signal to the CA03 Signal Conditioner. The low level signal is amplified and converted to an output pulse signal whose frequency is proportional to the rotation of the flowmeter rotor.

### **CAUTION**

**DO NOT remove the cover of an explosion proof enclosure located in a hazardous area while power is applied.**



CA03 Wiring Diagram  
Conduit Hub



CA03 Wiring Diagram  
MS CONNECTOR



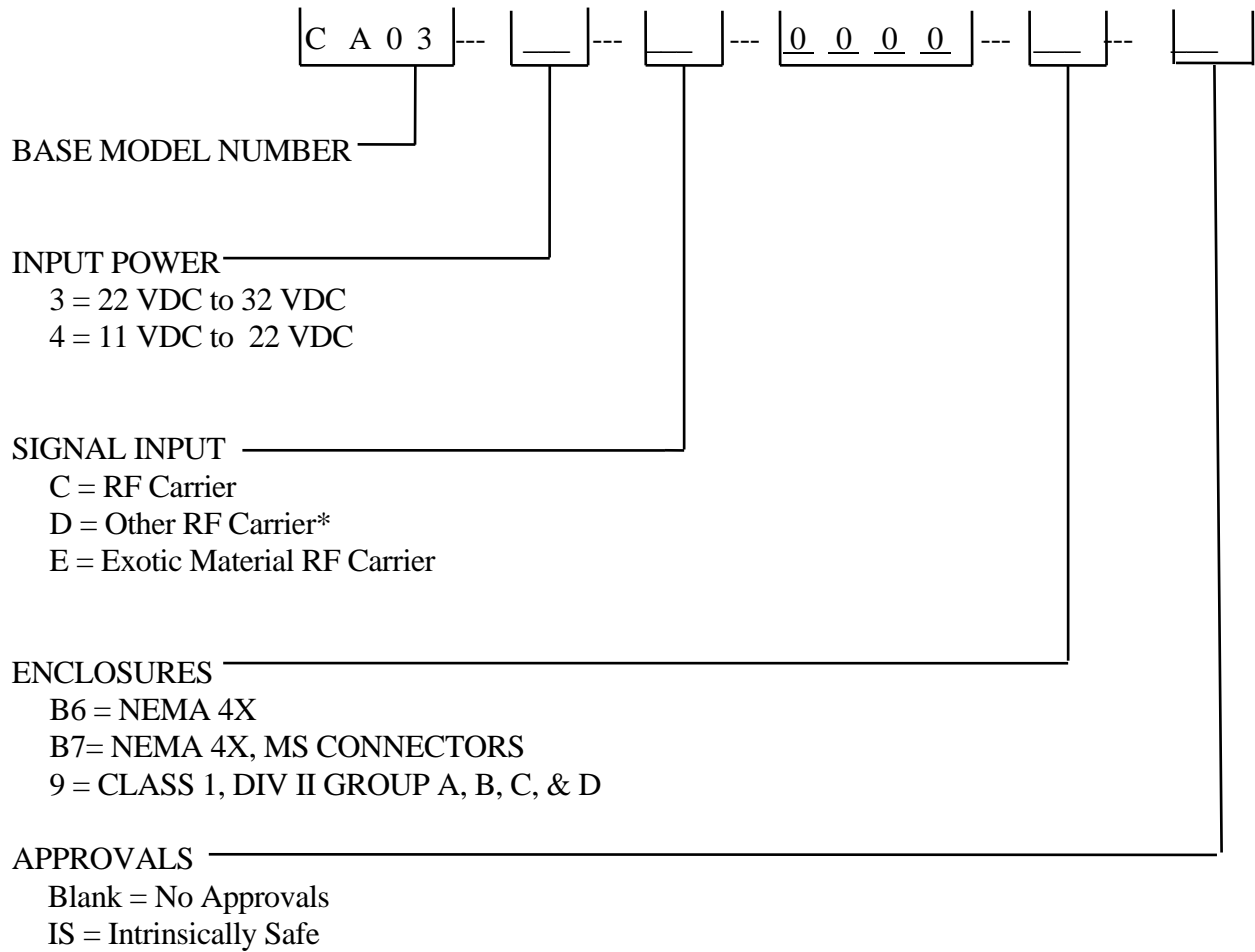
## 5.0 SPECIFICATIONS

Refer to Figure 2 for dimensions of the Explosion-proof, Class 1 Div II, Groups A, B, C & D and the NEMA 4X enclosures.

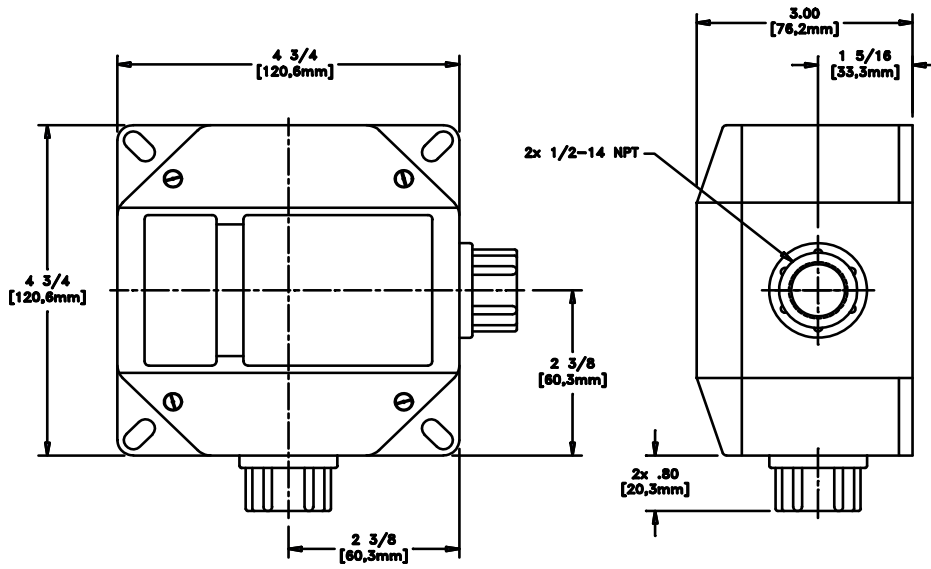
<u>Power Requirements:</u>	+22 VDC to 32 VDC at 30mA +11 VDC to 22 VDC at 30mA
<u>Signal Input:</u>	
Frequency Range	5 to 3500 Hz. Varies as a function of cable characteristics, rotor mass and distance between pickoff coil and flowmeter rotor.
Oscillator Frequency	Approximately 45K Hz at approximately 10 Volts peak-to-peak
Coil (Pickoff) Inductance	1 MilliHenry
Coil (Pickoff) Resistance	10 OHMS $\pm$ 10%
Cable Length	100 feet (30 meters) maximum from pickoff of amplifier, in an electrical noise free environment.
Signal Output:	Pulse output 0 - 10 Volts peak-to-peak for +22 VDC to 32 VDC at 30mA power option and 0 - 8 Volts for +11 VDC to 22 VDC at 30mA power option.
<u>Environmental:</u>	
Temperature Range Operating & Storage	-40°C to +85°C (-40°F to +185°F)
Humidity Range Operating & Storage	5 to 95%, Non-Condensing

TABLE 1

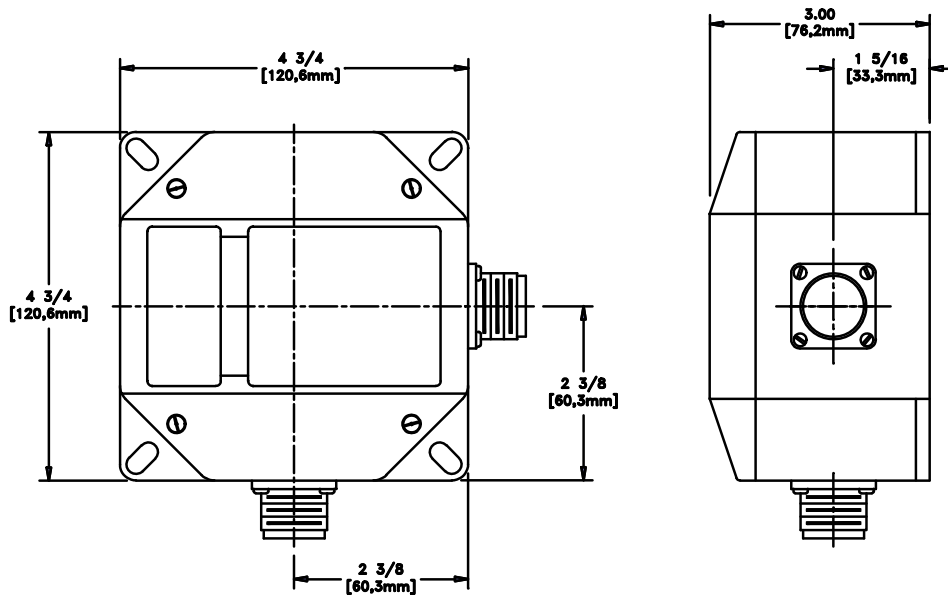
CA03 MODEL NUMBERING SYSTEM



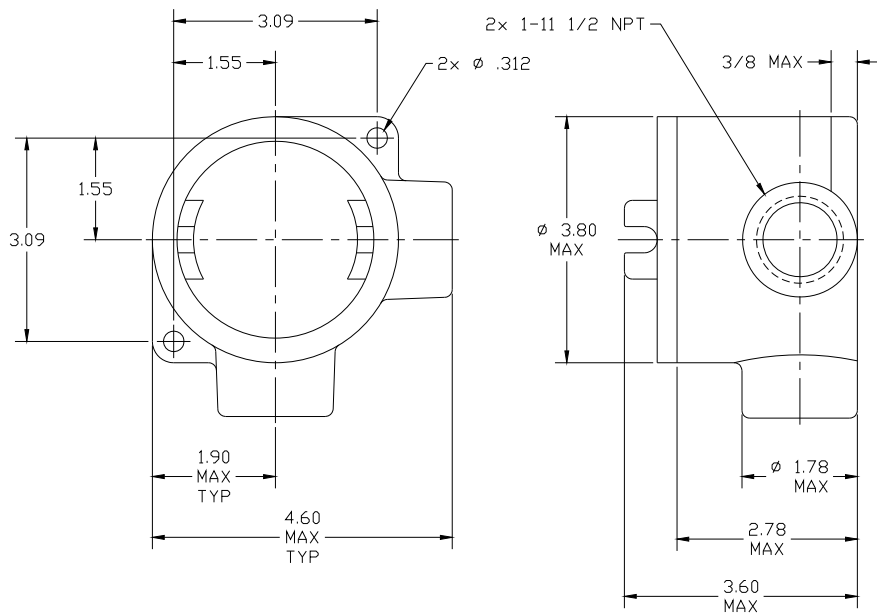
\* Non-Standard pickoff (other manufacturer)



NEMA 4X ENCLOSURE  
W/CONDUIT HUBS



NEMA 4X ENCLSOURE  
W/MS CONNECTORS



GROUP D, EXPLOSION PROOF ENCLOSURE  
 Figure 2. CA03 Enclosures.

## 6.0 MAINTENANCE

### 6.1 PERIODIC MAINTENANCE

There is no maintenance required for the CA03 Signal Conditioner. Cleaning normally associated with electronic equipment is recommended on an as-needed basis.

### 6.2 SPARE PARTS

It is recommended that one Printed Circuit Board Sub-Assembly, Flow Technology, Inc. Part Number 02-12758-101, and a box of 1/8 Amp PICO fuses, Flow Technology, Inc. Part Number 23-12403-1, be maintained as spare parts for each unit in service.

### 6.3 TROUBLESHOOTING

The Troubleshooting Guide lists some of the most common failures encountered with the Signal Conditioner and the corrective action to take for each symptom.

### 6.4 SCHEMATIC

Figure 3 shows the schematic for the CA03 Signal Conditioner.

## TROUBLESHOOTING GUIDE

The following guide shows some of the common problems that may occur during the operation of the Signal Conditioner. Various symptoms are listed as well as the probable cause of the symptom followed by remarks and corrective suggestions.

<b>TROUBLESHOOTING GUIDE</b>		
<b>SYMPTOM</b>	<b>PROBABLE CAUSE</b>	<b>REMARKS/SUGGESTIONS</b>
No voltage at the positive Side of C1	Blown fuse.	Replace 1/8 Amp fuse.
No voltage at the positive Side of C2.	Defective regulator IC	Replace regulator IC2 with same type.
No 45 KHz carrier signal at the Collector of Q1.	Defective pickoff coil OR Transistor Q1 is defective.	Check pickoff for $10\Omega \pm 10\%DC$ resistance; if not $10\Omega \pm 10\%$ , replace pickoff. Replace Q1.
There is no 4V peak-to-peak Detected signal at collector of Q2 when flowmeter rotor is turning.	Transistor Q2 has failed.	Replace Transistor Q2.
No sine wave appears at pin 7 of IC1B when flowmeter rotor is turning.	Amplifier IC1B is defective.	Replace amplifier IC1.
No output pulse appear at the collector of transistor Q3.	Transistor Q3, or diode CR2 are defective. OR The external load is shorted.	Replace transistor Q3 or diode CR2.  OR Locate short in load and repair.

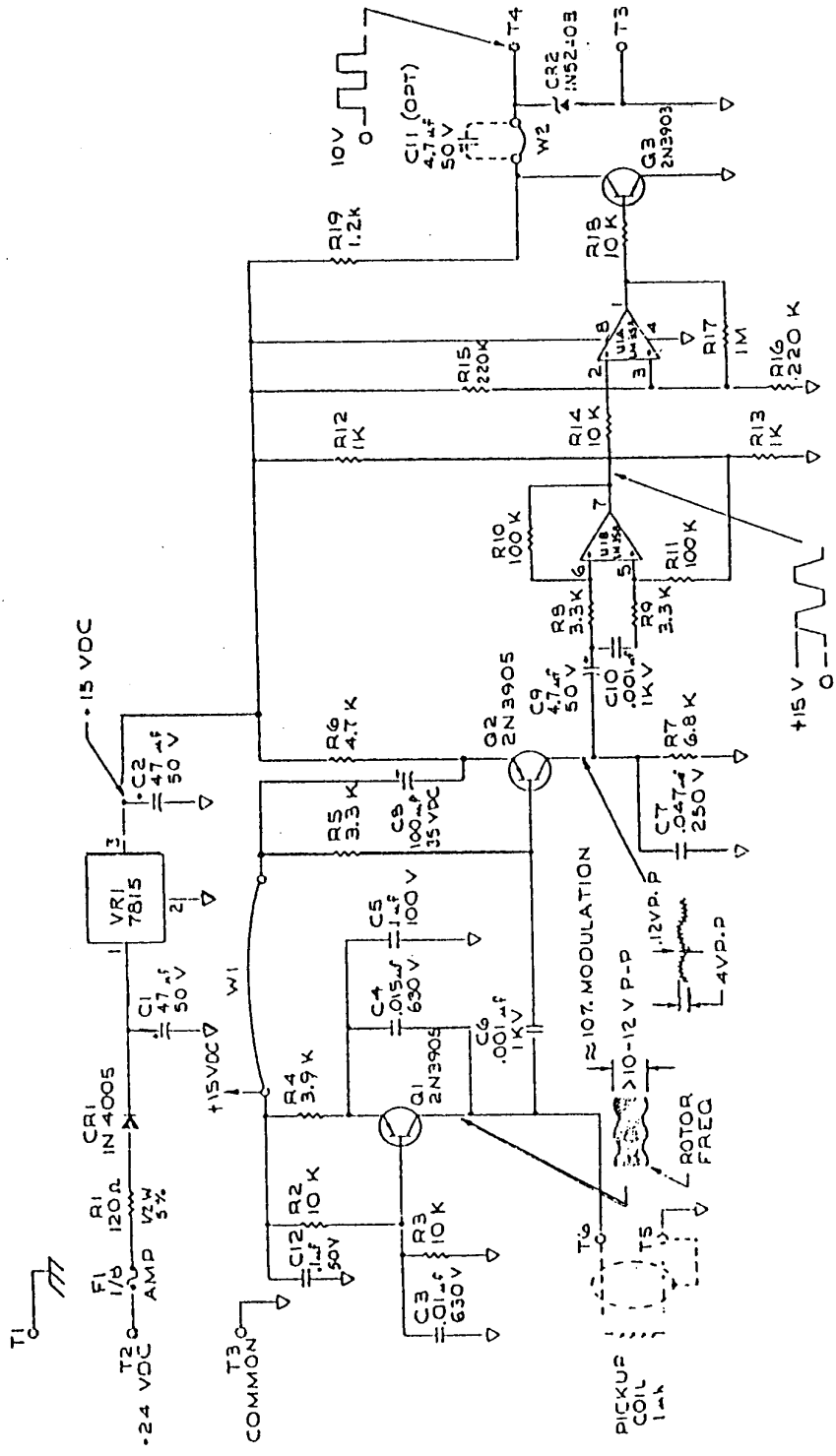


Figure 3. CA03 Signal Conditioner Schematic.

## 7.0 THEORY OF OPERATION

### 7.1 FUNCTIONAL DESCRIPTION

The CA03 Signal Conditioner consists of five (5) basic sections: a voltage regulator, an oscillator, an amplitude detector, an amplifier filter and an output buffer.

#### 7.1.1 Voltage Regulator

The voltage regulator is a three terminal device that provides a regulated +15 VDC or +8 VDC (depending on model) to the CA03 amplifier sections. The regulator includes current limiting, thermal shutdown protection and safe area compensation.

#### 7.1.2 Oscillator

The oscillator circuit consists of transistor, Q1, and its associated components. The pickoff coil and capacitor, C4, determine the oscillator frequency at approximately 45 KHz. The oscillator level should be greater than 6 Volts peak-to-peak. The 45 KHz carrier modulates at approximately 10% when the flowmeter rotor is turning.

#### 7.1.3 Amplitude Detector

From the oscillator section, the modulated signal passes into the amplitude detector. This stage consists of Q2 and its associated components. The modulated signal is filtered in this section to roll off most of the 45 KHz carrier. The detected signal at this point is approximately 4 Volts peak-to-peak with approximately 0.12 Volts peak-to-peak carrier imposed on it.

#### 7.1.4 Amplifier Filter

After detection, the signal passes into an amplifier filter consisting of IC1B and its associated components. Further filtering and amplification to a saturated sine wave takes place in this section.

Capacitor, C10, permits further filtering by applying the 45 KHz carrier to the differential input of IC1B. Because the 45 KHz is applied to both inputs, the carrier is canceled out by the common mode rejection of amplifier IC1B. The 4 Volt peak-to-peak detected signal only appears at pin 6 of IC1B because capacitor C10 acts as a block to the detected signal. Amplifier IC1B is approximately 7 VDC or 4 VDC (depending on model) with less than 0.5 Volts of noise for no flow through the flowmeter.



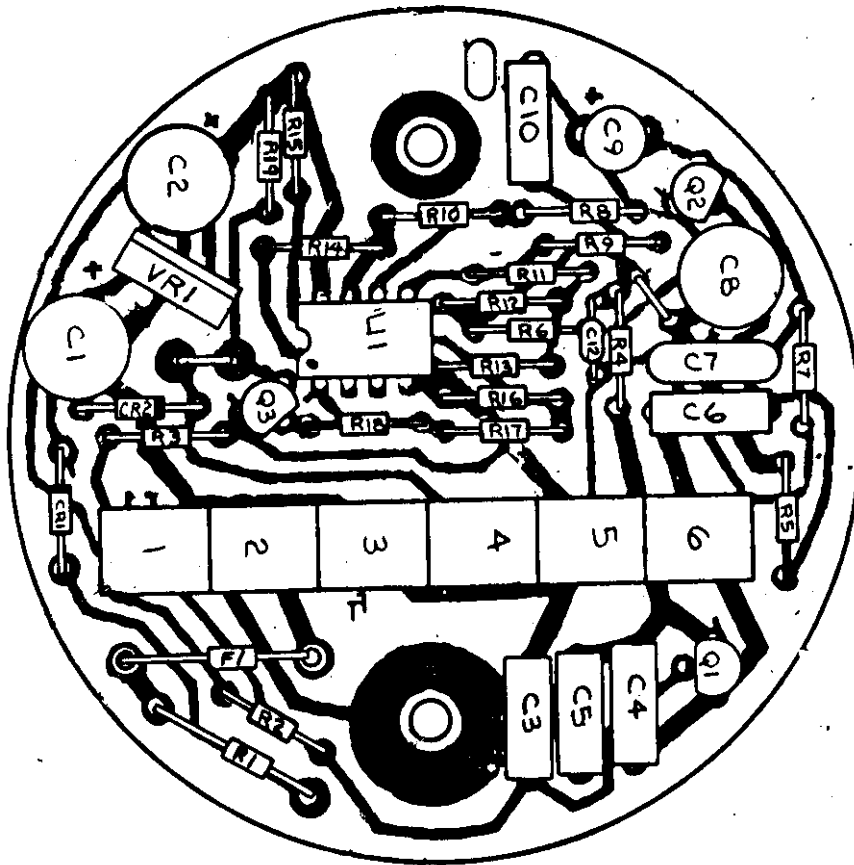
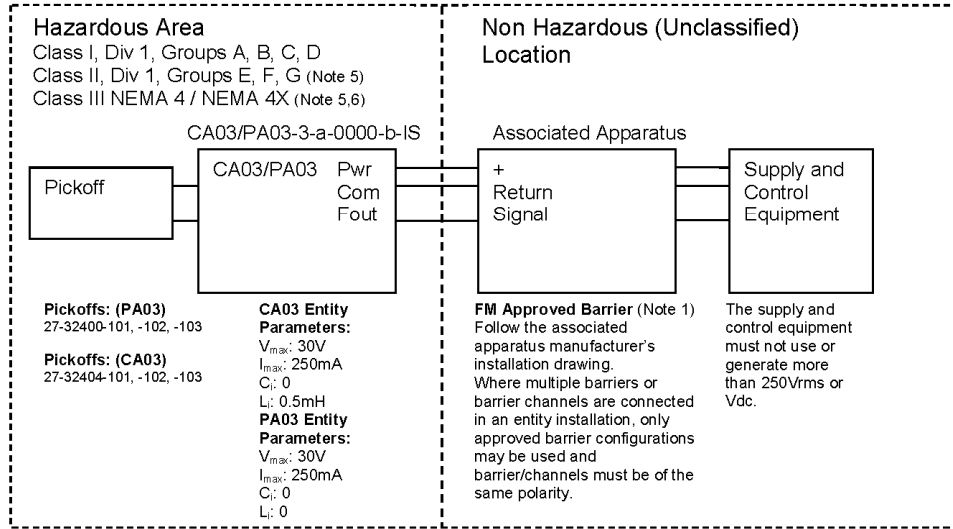


Figure 4. Component Layout.

# APPENDIX A: INSTALLATION OF INTRINSICALLY SAFE UNITS

## CA03/PA03



### Notes:

- The barrier must be approved under the FM entity concept.
- Installation must be in accordance with ANSI/ISA-RP12-06-01 (Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instruments Part 1: Intrinsic Safety) and the ANSI-NFPA 70 (National Electrical Code)
- The structure to which the CA03/PA03 and pickoffs are mounted must be at the same earth potential as the barrier earth ground.
- Supply (Pwr) and signal (Fout) must be run in individual twisted shielded pairs.
- Only the -102 pickoff sensors are suitable for Class II and Class III hazardous locations.
- The NEMA 4X rating applies to the CA03/PA03-3-a-0000B6-c enclosure only.
- The maximum cable inductance between the PA03 and associated apparatus must not exceed 3.8mH.
- The CA03 is a 5-30 volt powered device, which outputs a 0-10V pulse.
- The PA03 is a 22-30 volt powered device, which outputs a 0-10V pulse.

Equipment that is FM approved for intrinsic safety may be connected to FM approved barriers based on the "Entity Concept". The combination is then intrinsically safe if the FM entity concept is acceptable to the authority having jurisdiction (AHJ) of the installation.

The FM approved barrier must meet the following criterion:

$$V_{oc} \text{ or } U_o \leq V_{max} \text{ or } U_i$$

$$I_{sc} \text{ or } I_o \leq I_{max} \text{ or } I_i$$

$$C_o \text{ or } C_o \geq C_i + C_{cable}$$

$$L_o \text{ or } L_o \geq L_i + L_{cable}$$

The configuration of the associated apparatus must be FM approved under entity concept

**No changes may be made to this drawing without FM approval**

Installation Control Drawing	Last ECO	Date	Approved	
	21225	9/27/10	R REED	
TITLE: <b>FM Installation Control Drawing</b> <b>CA03/PA03 SIGNAL CONDITIONER</b>	PREPARED	DATE	APPROVED	DATE
	J. Walker	4/12/2010		
Size	Drawing No.	Rev	Sheet 7 of 8	
A	76-61827	H		

SF-69985 Rev A per ECO 20855