

# **INSTALATION, OPERATION & MAINTENANCE MANUAL**

**FOR**

**PA-1001A Series  
SIGNAL CONDITIONER  
& CONVERTORS**

# **SIGNAL CONDITIONER & CONVERTERS**

## PA1001A Series

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### **INTRODUCTION:**

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The PA1001A series preamplifiers/signal conditioners and converters are suitable for use with either magnetic or RF type pickup coils and allow convenient interfacing with process measuring devices and digital electronics.

When used with Magnetic type pickups they accept low level signals and produces a pulse output, while providing rejection of unwanted noise and false signals.

A RF type pickup reduces the pickup drag associated with conventional magnetic pickups, resulting in a significant increase in the usable range. The PA1001A series excite a RF type pickup with a 20KHz signal. Motion of ferrous material is sensed and the motion modulates the coil field and subsequent conditioning provides a pulse output signal.

The output signal of the PA1001A series have a square pulse wave form, each pulse representative of an actuator (rotor blade, gear tooth, turbine blade, etc.) passing by the sensing area of the pickup.

#### **Four output signal options are available:**

- i. TTL/CMOS compatible
- ii. Open collector
- iii. 0 to 10VDC square wave and
- iv. A square wave that is tied to the input power.

The unit is powered by a user supplied 8 to 30 VDC filtered power supply. An on-board regulator provides the required regulation and noise rejection.

Optional features include factory installed pulse scaling and field installable plug in modules for Analog output. Pulse scaling provides the user with scaling options of  $\div 2$ ,  $\div 4$ ,  $\div 8$ ,  $\div 16$ ,  $\div 32$ ,  $\div 64$ , or  $\div 128$ , which is useful when a remote device has a maximum count speed that is less than the pulse-generating device. Analog output provides a current and voltage outputs proportional to RPM, flow rate etc.

## CHARACTERISTICS AND SPECIFICATIONS:

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### POWER INPUT:

- Voltage: 8-30 VDC
- Current Draw: 125mA @ 24VDC, with all options equipped.
- Reverse polarity protected

### PICKUP INPUT:

#### RF Pickup:

- Modulation Carrier Frequency: 20KHz
- Input Frequency: 2 Hz to 5KHz, adjustable trigger level
- Trigger Sensitivity: 20 millivolt peak to peak (minimum)
- Carrier Adjustment: to allow precise tuning of carrier signal to physical environment (e.g. air gap, wall thickness)
- Maximum Air Gap: 0.160"
- Preferred Coil Inductance: 1.0 milliHenry +/- 10%
- Maximum Distance From Pickup To Preamplifier 100 feet

#### Magnetic Pickup:

- Input protected, RF and band pass filtered
- Input Frequency: 0 to 10KHz, adjustable trigger level
- Trigger Sensitivity: 4 millivolt RMS (minimum)  
NOTE: At 4mV frequency range 10 Hz to 3KHz
- Input Impedance: 40K Ohms (nominal)
- Maximum Input Signal: 600 Volts RMS
- Maximum Distance From Pickup To Preamp: 100 feet

### PULSE OUTPUTS:

- TTL/CMOS (Standard); Fan-out of 5 TTL/CMOS loads
- Open Collector: Maximum **OFF** state voltage 30 VDC  
Maximum **ON** current 0.40 amps
- 0 to 10 VDC square wave
- Square wave tied to input voltage
- Pulse scaling (option): ÷2, ÷4, ÷8, ÷16, ÷32, ÷64, or ÷128 user selectable.

### CURRENT OUTPUT OPTION:

- Accuracy +/- 0.05% of full-scale +/-200 PPM/°C.
- Available range 4 to 20mA.
- Output suitable for driving floating or grounded loads.
- Maximum loop impedance 500 ohms.
- Response time 0.3 seconds for 10 to 90 %.

### VOLTAGE OUTPUT OPTION:

- Accuracy +/- 0.05% of full-scale +/-200 PPM/°C.
- Available range 0 to 5VDC or 0 to 10VDC, user selectable.
- Impedance less than 10 ohms.
- Response time 0.3 seconds for 10 to 90 %.

**ENVIRONMENTAL:**

- OPERATING: -40°C TO 85°C
- STORAGE: -40°C TO 150°C

**ENCLOSURES:**

- Unit is intended for mounting in a conduit box and comes with 2 ½" on center mounting holes. An optional explosion proof or NEMA-4x enclosure is available upon request.

**APPROVALS:**

- EN50081-1:1992 Generic Emission Standard
- EN50082-2:1995 Generic Immunity Requirements
- CE compliant to EMC Directive 89/336/EEC for uses in residential, commercial, light or heavy industrial environments.

**INSTALLATION AND WIRING DETAILS:**

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In considering the interconnections between the PA1001A and the measurement system some attention must be given to anticipated noise sources and to the coupling of these noise sources to the interconnecting wiring.

Noise signals may be coupled into the wiring between the pickup coil, the PA1001A, and the electronic measuring systems. In general, utilizing a shielded, twisted pair for the interconnection greatly reduces this coupling. The shield should be grounded on both ends of the cable.

However, even with proper interconnecting cabling, cross talk with other signal lines or power lines may still occur and should be avoided. Physical isolation of the wiring reduces the chance of potential problems.

The pickup coil should not be located more than 100 feet from the PA1001A preamplifier. It is recommended that the PA1001A be installed on or near the pickup coil to assure optimum performance.

**INSTALLATION:**

The Model PA1001A should be placed in a convenient location that maintains access to the unit should repairs or readjustment is required.

Connections to the terminal block should be carefully dressed to avoid having bare wires extend past the screw clamp on the terminal block. This is particularly important when the PC card is mounted within an explosion proof enclosure. Wires should be neatly dressed near bottom of enclosure to prevent problems when cover is installed.

For compliance with EMI/RFI requirements the pre-amplifier must be installed in a metal enclosure such as a suitable NEMA 4 (e.g. GUAC) junction box. The enclosure must be properly grounded. Also a grounding strap is required from the enclosure to the power supply common (pin 7).

The cable entry requires 360° grounding coverage to the enclosure case. This is obtained by using twisted pair with full braid cable and a cable fitting that provides a metal to metal cable clamping connection. The insulation of the cables should be stripped back to allow for connection to the terminal block and allow for the cable fitting to clamp onto the braided shield. Any open areas should then be covered using foil tape.

In hazardous locations where metal conduit is used, 360° grounding are achieved. All cable shields should be terminated to the enclosure-grounding stud.

## Wiring For RF Pickup Coil:

1. Connect a two conductor shielded cable from the pickup to Terminals 5 and 6. Connect the shield to Terminal 4 (see Figure 1). NOTE: It is also preferable that the pickup coil be grounded to the shield.
2. Connect a power source, which must be within 8-30 VDC, to Terminals 7 and 8. The Plus voltage is connected to Terminal 8 and the Return to Terminal 7 (see Figure 1).
3. Connect the Pulse output wire to Terminal 3, and connect the Pulse common to Terminal 4 (see Figure 1).
4. Set Jumper HD2 (see Figure 3) to the RF position.
5. Configure Jumper HD1 (see Figure 3) to the desired pulse output as follows:

<u>Pulse Output Type</u>	<u>HD1 Jumper Configuration</u>
Open Collector	JP2
Square Wave to Vin	JP1 and JP2
TTL/CMOS	JP1, JP2 and JP3
0-10 VDC Square Wave	JP1, JP2 and JP4

6. Install pickup (e.g. in meter) and provide power to PA1001A. Use a digital voltmeter set to DC voltage and attach the positive lead to Terminal 6 and the common lead to Terminal 2. Adjust the Carrier Adjustment (R2) (see Figure 3) to a reading of 3.00 VDC to fine-tune the pickup for air gap, wall thickness, etc.
7. With power still supplied to PA1001A determine if pulse output is being generated in the absence of motion. Adjust the RF Trigger (R24) (see Figure 3) clock wise until the false pulsation has stopped. If pulsation continues when adjusted fully clock wise, check that all shields have been properly terminated and grounded.

## WIRING FOR RF PICK-UP

### NOTE:

1. ALL CABLES SHOULD BE TWISTED PAIR WITH FULL BRAIDED SHIELD
2. ALL SHIELDS SHOULD BE CONNECTED TO THE CHASSIS GROUND

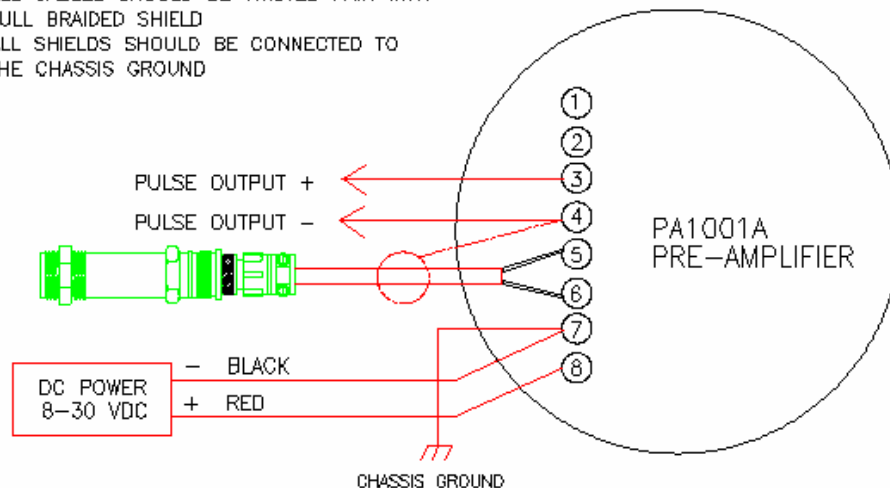


Figure 1

## Wiring For Magnetic Pickup Coil:

1. Connect a two conductor shielded cable from the pickup to Terminals 1 and 2. Connect the shield to Terminal 4 (see Figure 2). NOTE: It is also preferable that the pickup coil be grounded to the shield.
2. Connect a power source, which must be within 8-30 VDC, to Terminals 7 and 8. The Plus voltage is connected to Terminal 8 and the Return to Terminal 7(see Figure 2).
3. Connect the Pulse output wire to Terminal 3, and connect the Pulse common to Terminal 4 (see Figure 2).
4. Set Jumper HD2 (see Figure 3) to the MAG position.
5. Configure Jumper HD1 (see Figure 3) to the desired pulse output as follows:

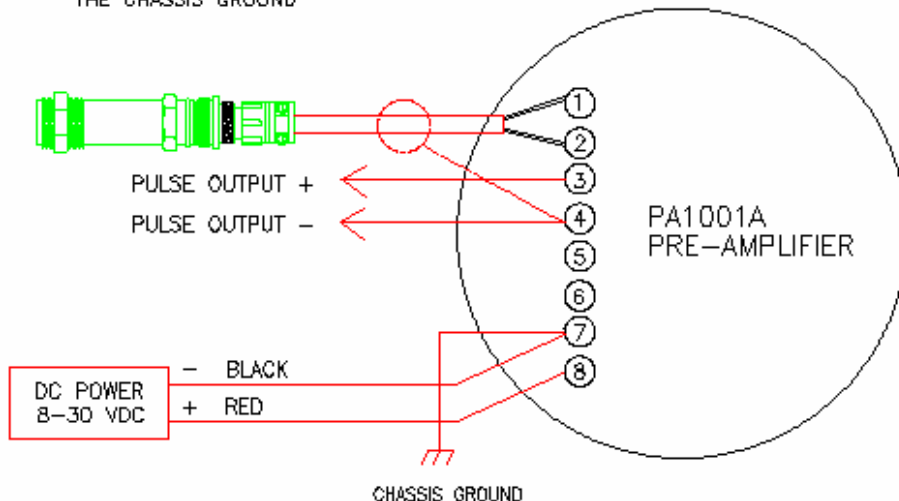
<u>Pulse Output Type</u>	<u>HD1 Jumper Configuration</u>
Open Collector	JP2
Square Wave to Vin	JP1 and JP2
TTL/CMOS	JP1, JP2 and JP3
0-10 VDC Square Wave	JP1, JP2 and JP4

5. Install pickup (e.g. in meter) and provide power to PA1001A. Determine if pulse output is being generated in the absence of motion. Adjust the MAG Trigger (R19) (see Figure 3) clock wise until the false pulsation has stopped.

## WIRING FOR MAGNETIC PICK-UP

**NOTE:**

1. ALL CABLES SHOULD BE TWISTED PAIR WITH FULL BRAIDED SHIELD
2. ALL SHIELDS SHOULD BE CONNECTED TO THE CHASSIS GROUND



**Figure 2**

### Analog Output Option:

1. For current output, wire two conductor, shielded cable to terminals 2 (common) and 3 (current output).
2. For voltage output, wire two conductor, shielded cable to terminals 2 (common) and 1 (voltage output).

## WIRING PRE-AMPLIFIER WITH CONVERTER

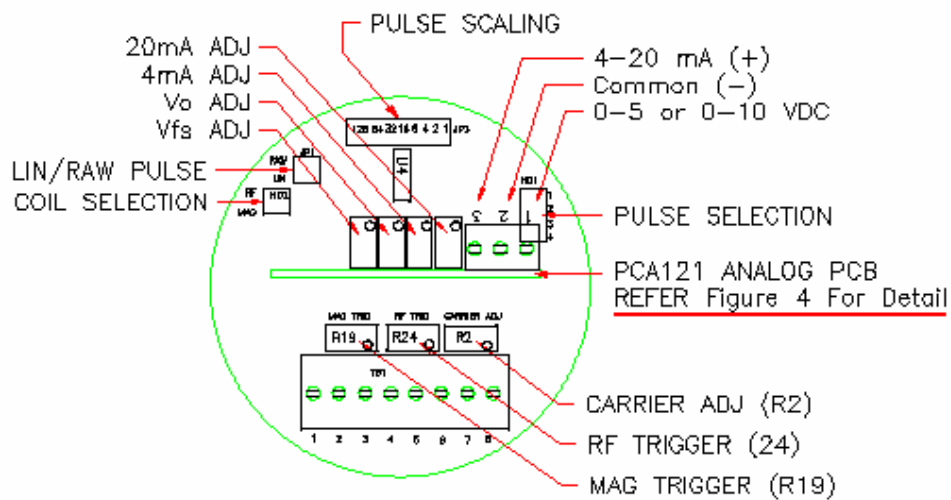


Figure 3

## **CONTROLS AND ADJUSTMENTS:**

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### **STANDARD PRE-AMPLIFIER ADJUSTMENTS:**

**CARRIER ADJUSTMENT:** A twenty turn control used to precisely tune the specific sensing depth, wall thickness, material type, air gap, etc. of the RF pickup coil.

**RF TRIGGER:** A twenty turn control used to set the trigger level of the RF coil input above the ambient noise level.

**MAG TRIGGER:** A twenty turn control used to set the trigger level of the Magnetic coil input above the ambient noise level.

**COIL SELECTION:** A two-position jumper that is used to select the desired pickup coils to be used as the input.

<u>Input Coil Type</u>	<u>HD2 Setting</u>
RF	RF
Magnetic	MAG

**LINRAW PULSE:** A two-position jumper that is used to select the desired Pulse train.

<u>Pulse Type</u>	<u>JP1 Setting</u>
Raw pulse train	RAW
Linearized pulse train	LIN
(NOT AVAILABLE YET)	

**PULSE SELECTION:** A four-position jumper that is used to select the Desired type of pulse output.

<u>Pulse Output Type</u>	<u>HD1 Jumper Settings</u>
Open Collector	JP2
Square Wave to Vin	JP1 and JP2
TTL/CMOS	JP1, JP2 and JP3
0-10 VDC Square Wave	JP1, JP2 and JP4

### **PULSE SCALING ADJUSTMENTS:**

**PULSE SCALER:** A 8 position jumper header located on PA1001 circuit board which is used in programming the desired pulse output scaling (Division of 1, 2, 4, 8, 16, 32, 64, or 128). Factory set with division of 1 as standard.



## **ANALOG OUTPUT ADJUSTMENTS (PCA-121):**

<b>20mA ADJ</b>	A twenty turn adjustment which is used to set current output to the desired span corresponding to the equivalent full scale range. (i.e. 20 mA at 100 RPM).
<b>4mA ADJ</b>	A twenty-turn adjustment that is used to set the current output signal to the desired zero value. (i.e. 4mA at zero RPM).
<b>V<sub>FS</sub> ADJ</b>	A twenty-turn adjustment that is used to set the voltage output to the desired span corresponding to the equivalent full scale range. (i.e. 5VDC or 10 VDC at 100 RPM).
<b>V<sub>O</sub> ADJ</b>	A twenty-turn adjustment that is used to set the voltage output signal to the desired zero value. (i.e. 0 VDC at zero RPM).
<b>COARSE RANGE ADJ</b>	A dual in line DIP switch which is located on the PCA-121 board, which is used to perform a coarse range adjustment for the input frequency range.
<b>V<sub>FS</sub> SELECTION</b>	A two position jumper (JP1) that is used to select the desired voltage output range of either 0 to 5VDC or 0 to 10VDC.

## **CALIBRATION PROCEDURE:**

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In order to perform field calibration and troubleshoot the PA1001A, the following equipments are recommended.

<b>MANUFACTURER</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
Fluke	8060A	True RMS Multimeter
Topward	8112	Digital Function Generator
Viz	WD-755	Multi Function Counter
Spectrol	8-TOOO	Adjustment Tool

**Table - 1**

**(Coarse Range Adjustment):**

<b>Frequency Range</b>	<b>Switch Position</b>
50 to 100Hz	1
100 to 200Hz	2
200 to 400Hz	3
400 to 800Hz	4
800 to 1600Hz	5
1600 to 3200Hz	6
3200 to 6400Hz	7
6400 to 12800Hz	8

## FOR CURRENT OUTPUT:

- Connect a digital milliampmeter or equivalent, across the current output terminals.
- On the PCA-121 select the “Coarse Range Adj” that corresponds to the maximum input frequency. Refer to Table - 1 for selection options.
- Adjust “4mA ADJ” control for desired “Zero” current (i.e. 4mA).
- Inject the full-scale test frequency while adjusting “20mA ADJ” for current equal to SET (SPAN).
- Iterate above steps until no change is observed.

## FOR VOLTAGE OUTPUT:

**NOTE: For proper adjustment of the voltage-output, First Perform calibration of the current output.**

- Connect a digital voltmeter across the voltage output terminals.
- On the PCA-121 select the “Coarse Range Adj” that corresponds to the maximum input frequency. Refer to Table -1 for selection options.
- Adjust “V<sub>O</sub> ADJ” for 0.00 volts).
- Inject the test frequency while adjusting “V<sub>FS</sub> ADJ” for voltage equal to SET (SPAN).
- Iterate above steps until no change is observed.

## Control and Adjustment Detail for the PCA-121

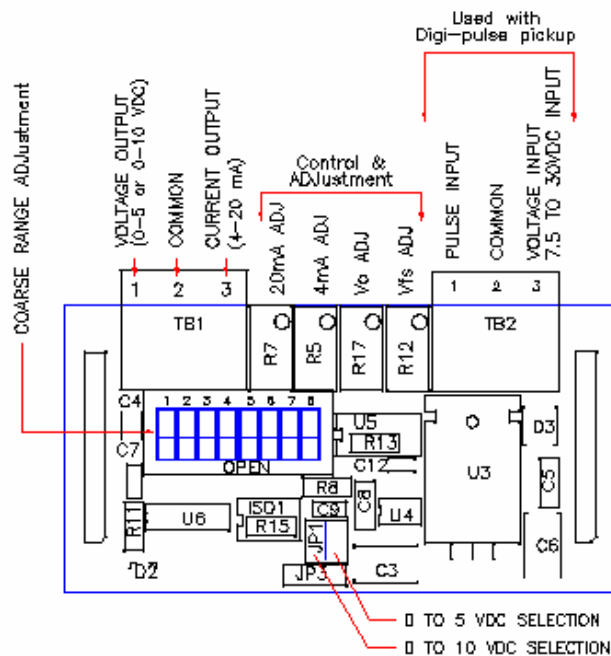


Figure 4

**Ordering Information**

**PA-1001A    IA    B    1                    w**

**Series:** \_\_\_\_\_

**Options:** \_\_\_\_\_

- 1 = Pulse Output
- 1A = Pulse and Analog output
- 1PS = With pulse scaling

**Mounting:** \_\_\_\_\_

- C = Explosion Proof Enclosure
- B = Nema-4X Enclosure
- P = Panel Mount

**Operating Voltage:** \_\_\_\_\_

- 1 = 24 VDC (8 to 30 VDC)
- 2 = 110 VAC 50/60 Hz
- 3 = 220 VAC 50/60 Hz

**Electrical Interface**  
 W = Mounted Integral to Flowmeter  
 X = 10 feet cable attached to mating connector  
 Y = 25 feet cable attached to mating connector  
 Z = Customer Specific Length (250 feet max.)

**Ordering Information For  
 PCA-121 For Digi-Pulse Pickup**

**PCA-121    B    1                    w**

**Series:** \_\_\_\_\_

**Mounting:** \_\_\_\_\_

- C = Explosion Proof Enclosure
- B = Nema-4X Enclosure
- P = Panel Mount

**Operating Voltage:** \_\_\_\_\_

- 1 = 24 VDC (8 to 30 VDC)
- 2 = 110 VAC 50/60 Hz
- 3 = 220 VAC 50/60 Hz