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**HANS RUDOLPH, inc.**

8325 COLE PARKWAY, SHAWNEE, KANSAS 66227 U.S.A.

# Data Sheet...

## PNEUMOTACH AMPLIFIER 1

Series 1110

Analog Output for Flow and Pressure

### DESCRIPTION

The Hans Rudolph Pneumotach Amplifier 1 (PA-1) provides the instrumentation necessary to produce an analog output proportional to flow when connected to any of our standard pneumotachs. It will also provide an analog output of an independent auxiliary pressure signal for measurement of pressure anywhere in the circuit.

The Pneumotach Amplifier 1 works with any of the Hans Rudolph Linear Bi-directional screen Pneumotachs. These are available in eight different calibrated flow ranges in heated and non-heated versions. Hans Rudolph Pneumotachs are sold separately. Refer to Data Sheet 691037 for complete information and part numbers.

The Pneumotach Amplifier 1 (PA-1) measures gas flow using the differential pressure method. As gas flows through the pneumotach a small differential pressure is produced at the output pressure ports on the pneumotach. These ports are connected to the Pneumotach Amplifier 1 flow input ports with a small diameter tube. The differential pressure signal is measured by a sensitive +/- 2cmH<sub>2</sub>O pressure transducer and amplified to provide an analog output proportional to the flow rate. A linearizing circuit corrects for the slight nonlinearity of the pneumotach output. An additional differential pressure sensor is provided for measuring pressure in the airway by connecting the positive pressure port to the airway and leaving the other port open to atmosphere. It can also be used to measure a differential pressure by connecting both sensor ports to different points in the circuit.

The analog outputs can be configured for different voltage ranges to ease connection to your data acquisition system. The outputs can be configured for unipolar or bipolar operation in each output range. Offset and gain adjustment pots are available for adjusting the zero and calibration.

### FEATURES

- Use with Hans Rudolph Linear Screen Pneumotachs. Flow Ranges from 0-3, 0-5, 0-10, 0-35, 0-100, 0-160, 0-400 & 0-800 lpm.
- Pressure measurement -70 to 70 cmH<sub>2</sub>O (6.9 kPa), -140 to 140 cmH<sub>2</sub>O (13.7 kPa) or custom ranges available on request.
- Zero and gain adjust pots for both outputs.
- BNC type analog output jacks.
- Flow direction indicator LED.
- Custom pressure transducers available at extra cost

### SPECIFICATIONS

- Analog flow output in ranges of 0 to 2, -1 to 1, 0 to 5, -2.5 to 2.5, 0 to 10 or -5 to 5 volts.
- Analog pressure output -1 to 1 or -5 to 5 volts. Both ranges can be offset 20% to create a unipolar signal.
- 115 or 230 VAC, 50/60 Hz supply.
- 203 mm (8 in.) W x 178 mm (7 in.) D x 63 mm (2.5 in.) H size.

### ORDERING INFORMATION

(Power Cord Set is included please specify the country)

P/N	Description
113252	<b>Pneumotach Amplifier 1 (PA1)</b> configured for ONE Pneumotach (Flow) and ONE Auxiliary Pressure range of -70 to 70 cmH <sub>2</sub> O (-6.9 to 6.9 kPa)
113253	<b>Pneumotach Amplifier 1 (PA1)</b> configured for ONE Pneumotach (Flow) and ONE Auxiliary Pressure range of -140 to 140 cmH <sub>2</sub> O (-13.7 to 13.7 kPa)
113834	<b>Pneumotach Amplifier 1 (PA1)</b> configured for TWO Pneumotachs (Flow)
955072	<b>Calibration PA1 and ONE Pneumotach</b>



### Optional &/or Replacement Parts for Auxiliary Pressure

- 200122 **Hose barb**, 3.17 mm (.125 in.) pressure port **Installed** at auxiliary location per customer specifications for pressure measurement.
- 200123 **Female luer lock pressure port** **Installed** at auxiliary location per customer specifications for pressure measurement.
- 171212 **Coupler**, male luer lock to 3.17 mm (.125 in.) hose barb, required for connecting single tube assembly (666006) to auxiliary pressure port when ordering option 200123.
- 666007 **Dual tube assembly**, 3.17mm (.125 in.) ID with male luer lock fittings to mate pneumotach to Pneumotach Amplifier 1 (supplied with PA-1).
- 666006 **Single tube assembly**, 3.17 mm (.125 in.) ID with male luer lock for connection to auxiliary pressure port on PA-1 (supplied with PA-1).

### PNEUMOTACH INFORMATION

SERIES	APPLICATION	FLOW RANGE (LPM)
8430/8431	MOUSE	0-3
8420-8421	Mouse, Rat, Guinea Pig	0-5
8410/8411	<sup>1</sup> Premature, Feline	0-10
8300/8311	<sup>2</sup> Neonate, Rabbit	0-10
3500/4500	<sup>3</sup> Infant, Small Canine	0-35
3719/4719	Pediatrics, Canine	0-100
3700/4700	Pediatrics, Adults at rest, Large Canine	0-160
3830/4830	Adult PFT, Spirometry	0-400
3813/4813	Athlete, Spirometry	0-800

<sup>1</sup> Less than 38 week gestational  
<sup>2</sup> Birth to one month  
<sup>3</sup> 1-12 months

**CAUTION: This device is for research purposes only, do not base clinical decisions on information obtained from this device.**

# OPERATION INSTRUCTIONS

## SERIES 1110 PNEUMOTACH AMPLIFIER 1 (PA-1)

The Series 1110 Pneumotach Amplifier 1 (PA-1) is designed to be used with the Hans Rudolph linear pneumotachs to provide an analog output proportional to the flow. It also provides a pressure sensor that can be used to measure airway pressure or a differential pressure between two points in a circuit.

Please consider purchasing the optional 955072 PA-1 Calibration with your Hans Rudolph Linear Pneumotach when purchasing your PA-1. This option allows for the matching of the full range of your voltage output with that of the full scale PNT output. We can also supply you with different pressure transducers output and/or a dual flow pressure transducer as a custom ordering option.

### SETUP

**Voltage Selection.** The device can be powered by either 115 or 230 VAC. Make sure you select the proper voltage before you turn on the device. The operating voltage is selected by the orientation of the fuse drawer in the power input module. The two aligned pointers on the power input module indicate the selected voltage. To change the operating voltage a small screwdriver can be used to carefully lift the fuse drawer out of the module. Insert the fuse drawer so that the selected voltage pointer aligns with the pointer on the housing.

**Flow Connection** The pneumotach is connected to the Pneumotach Amplifier 1 with two 0.125 inch (3.17 mm) inside diameter tubes supplied with PA-1 ref: P/N 666007 Dual tube assembly with luer lock connectors. Keep the tubing as short as possible to improve the frequency response of the pneumotach. Connect the pneumotach port closest to the patient to the P- connection on the flow input. The other tube should be connected to the P+ port on the flow input. This will cause inhale flow to produce a positive voltage on the analog output.

**Pressure Connection** The pressure sensor ports can be connected to an airway pressure port in the circuit using a single tube supplied with PA-1 ref: 666006 Single Tube Assembly connected to the P+ input. The pressure sensor can be used to measure a differential pressure by connecting the high pressure to the P+ input and the low pressure to the P- input. You can use the differential mode to measure airway resistance by connecting the P- to an esophageal balloon and the P+ to the airway pressure.

**Analog Outputs** The analog output for the flow and pressure are provided on the two BNC jacks on the front panel. These can be connected directly to a recording device or data acquisition system using a cable with BNC connectors. The range of the analog output can be configured by the user for several different ranges. The output range is set with jumpers inside the device. To change the output range remove the two screws from the bottom of the device and then lift off the top half of the enclosure. Refer to table 1 for the jumper settings for the various output ranges. The flow output and pressure output can be set independently.

**Table 1 Output Range Jumper Settings**

Output Range	Flow	Pressure	Zero Output
-1 to +1 volts	JP11	JP4	0 volts
0 to + 2 volts	JP11, JP12	JP4, JP5	+1 volts
-2.5 to 2.5 volts	JP10	JP3	0 volts
0 to 5 volts	JP10,JP12	JP3, JP5	+2.5 volts
-5 to +5 volts	JP9	JP2	0 volts
0 to 10 volts	JP9,JP12	JP2, JP5	+5 volts

### OPERATION

Before turning on the device make sure that the voltage selection is set for the operating voltage you are using. Connect the power cord and turn on the unit. A power LED on the front will illuminate to indicate power is applied. For best results, allow the device to warm up for 10 minutes before use. Connect the flow and pressure connections and the analog outputs to the recording device.

#### Zero Adjust

Both the flow and pressure analog output can be adjusted to set the voltage at zero flow and zero pressure. Use a small screwdriver to adjust the zero if necessary. The flow indicator LED will be off when the flow output is near zero volts.

#### Gain Adjust

The scaling on the flow and pressure outputs can be adjusted with the gain pot. To adjust the gain you will need to supply a known flow or pressure and adjust the pot so that the output is at the desired voltage. The pressure sensor has been factory calibrated so that the maximum pressure produces the full scale voltage output. The flow gain may need to be adjusted because each pneumotach has a somewhat different output at full scale flow.

#### Flow LED

During operation, the flow LED will turn on to indicate that flow is present and it will change color to indicate the direction of the flow. When pressure is higher on the P+ port than on the P- port the LED will be green and the output voltage will be positive. When the flow is reversed the LED will be red and the voltage will be negative. When there is no flow the LED will be off. If you set the jumpers for an output range that does not have the zero flow at zero volts then the LED will be green continuously.

### ADDITIONAL CALIBRATION ADJUSTMENTS

Additional calibration adjustment can be made by adjusting the potentiometers inside the Pneumotach Amplifier 1 enclosure. If you find that the zero or gain adjustment requires more range than is available with the potentiometer adjustments on the front panel, you can adjust the range with the pots on the circuit board.

Several test points are provided on the board for testing the circuit function. A test point labeled GND can be used as the ground reference for the measurements.

#### Flow Zero

With no flow and no pressure applied to the flow inputs the flow zero can be set. Measure the voltage between the GND test point and TP10. The voltage should be zero volts for proper operation. The zero can be adjusted with pot R62. It is located near the back edge of the circuit board. An offset can be applied here but it is recommended to use the zero pot on the front panel.

#### Flow Gain

The gain for the flow signal can be adjusted if necessary by adjusting pot R60 located near the pressure sensor for the flow. Before adjusting this pot make sure that the zero is properly set and the gain range is set with the jumpers as described in Table 1. You should set the gain pot on the front panel to mid-range before adjusting R60. Apply a known flow to the pneumotach and measure the output at the BNC connector. Adjust R60 to the desired output voltage at the known flow rate.

#### Pressure Zero

The zero pressure output can be adjusted by setting pot R15 and measuring the voltage at the BNC connector. The zero adjust pot on the front panel should be in the mid-range position. If you have selected a unipolar output, the voltage will be shifted to 1/2 scale.

#### Pressure Gain

Set the gain adjust on the front panel to mid-range and adjust pot R8 to adjust the gain. Apply a known pressure to the pressure input and measure the output on the BNC connector. Make sure the range jumpers are set as desired and described in Table 1.



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