INSTRUMENTS INC.

# Model 430DC/435DC DC-Powered Air Velocity Transducer User's Guide

360101, Revision D

# Unit Description Sheet

**Complete Model Number:** ______________________________

**Serial Number:** ______________________________

**Kurz Order Number:** ______________________________

**Customer P. O. Number:** ______________________________

**Gas Calibration:**
- ☐ Air
- ☐ Other (specify): ____________________

**Calibration Reference Temperature:**
- ☐ Standard (25° C, 77° F)
- ☐ Other (specify): ____________________

**Calibration Reference Pressure:**
- ☐ Standard (760 mm Hg, 29.92 in Hg)
- ☐ Other (specify): ____________________

**Velocity Range:**
- ☐ 0-100 SFPM 0-1.5 SMPS
- ☐ 0-300 SFPM 0-6 SMPS
- ☐ 0-1,250 SFPM 0-15 SMPS
- ☐ 0-2,500 SFPM 0-30 SMPS
- ☐ 0-6,000 SFPM 0-60 SMPS
- ☐ 0-12,000 SFPM
- ☐ Other (specify): ____________________

**Engineering Units:**
- ☐ SFPM
- ☐ SCFM/$ft^2$
- ☐ lbs mass/min/$ft^2$
- ☐ SCFM
- ☐ lbs/min
- ☐ SMPS
- ☐ Other (specify): ____________________

**Line or Duct Size** (for SCFM and lbs/min only): ____________________

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# Table of Contents

**Figures**

# About This Book

This book contains five sections and an appendix, each of which is briefly described below. The book also contains a Unit Description Sheet and a Quick Set-Up Guide. The book is not designed to be read cover to cover; rather, it is designed to present information to the 430DC and 435DC user in as accessible a manner as possible.

## Organization

### Unit Description Sheet

This sheet is found in the front of the book, immediately following the title page. It contains important identifying information about your 430DC or 435DC DC-Powered Air Velocity Transducer, including model number, serial number, Kurz order number, and customer purchase order number. It also lists any options you ordered with your transducer. Check the options listed against your original order and against the actual contents of the shipping carton. Report any discrepancies immediately to Kurz Instruments Incorporated at (408) 646-5911.

### Quick Set-Up Guide

The Quick Set-Up Guide is a chart summarizing much of the information presented in the rest of the manual. You can use the chart to refresh your memory after you read the relevant sections of the manual. Or, if you feel that you do not need the more detailed information presented in the rest of the manual, you can attempt to install your 430DC or 435DC referring only to the Quick Set-Up chart. Kurz Instruments does **not**, however, recommend the latter approach.

### Section 1: Product Overview

This section introduces you to the purpose, principles of operation, and features of the 430DC and 435DC transducers. You can safely skip this section if you are already familiar with that information.

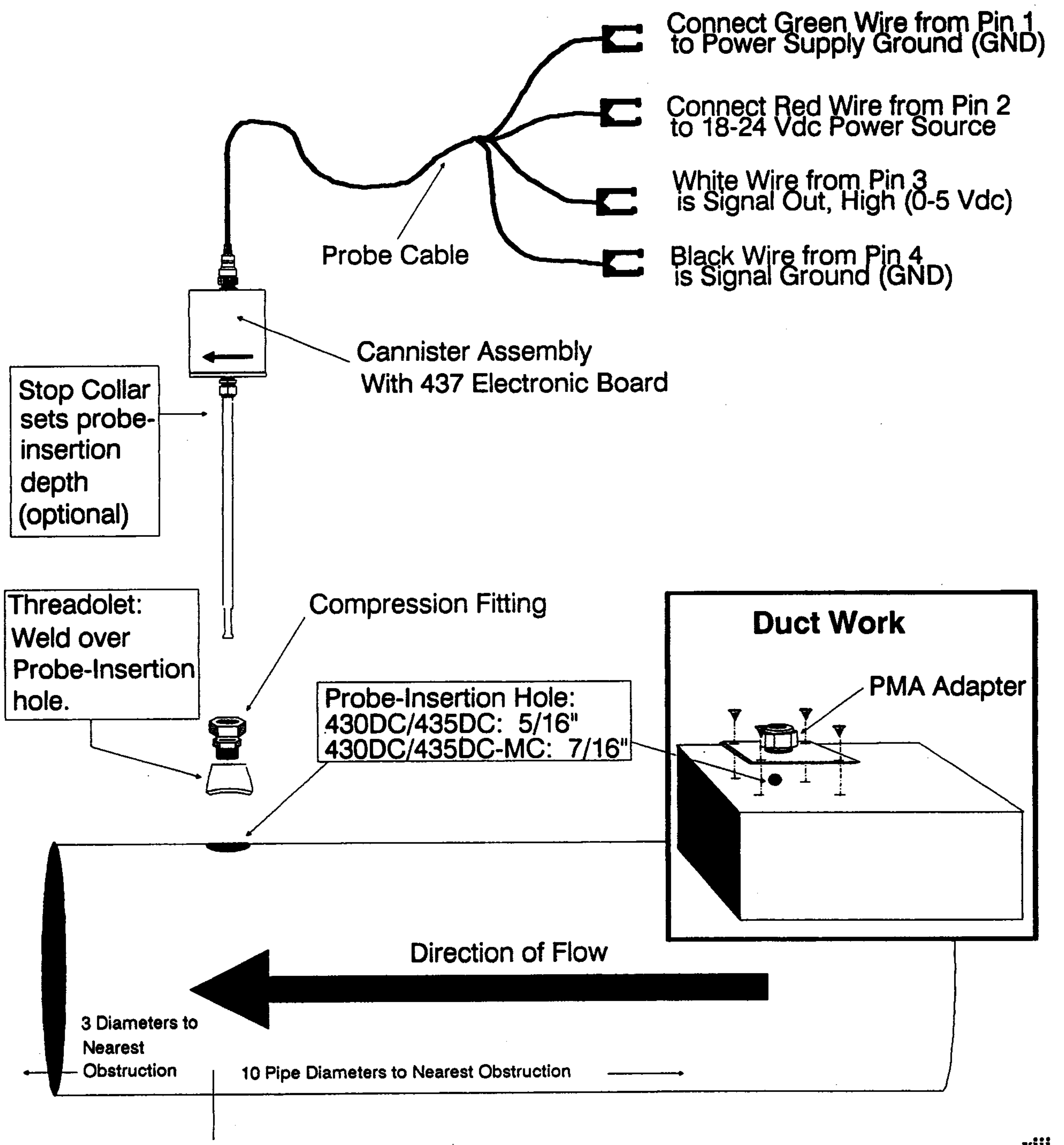
### Section 2: Installation

Section 2 explains, in necessarily general terms, how to install your transducer. This section explains how to determine the correct location for installation, as well as how to perform the physical installation in pipes and flat or round ductwork. You should read thoroughly the parts of this section that apply to your installation before you install the 430DC or 435DC. **You may also want to read Section 5, "Testing ," before you install the transducer.**

# Quick Set-Up Guide

The quick set-up chart below summarizes much of the information presented in this manual. It does not, however, contain all the information you may need for safe and satisfactory installation of your 430DC or 435DC. Kurz Instruments recommends that you read applicable sections of the manual before attempting installation.

**Important Note: Do NOT Place Cannister Next to Hot Ducts or Stacks, Ambient Temperature Must Be 50° C or Less.**



# Section 1: Product Overview

This section contains a general description of the DC-Powered Air Velocity Transducers. It explains how the transducers work and lists their features and specifications.

## 1.1 Description

The 430DC, 430DC-MC, 435DC, and 435DC-MC DC-Powered Air Velocity Transducers are rugged, very low maintenance instruments ideally suited to monitoring relatively clean air or gas flows in small ducts, pipes, or similar enclosed channels.

The four models are distinguished by the following characterisitics:

430DC: Outputs a non-linear 0-5 Vdc signal representing flow velocity; uses Duraflo sensor

430DC-MC: Outputs a non-linear 0-5 Vdc signal representing flow velocity; uses mini MetalClad sensor

435DC: Outputs a linear 0-5 Vdc signal representing flow velocity; uses Duraflo sensor

430DC-MC: Outputs a linear 0-5 Vdc signal representing flow velocity; uses mini MetalClad sensor

These models will be referred to generically as the 430DC and 435DC except when specific features of 430DC-MC or 435DC-MC are being discussed.

The 430DC and 435DC consist of the following basic components:

- Duraflo™ (430DC and 435DC) or mini MetalClad™ (430DC-MC and 435DC-MC) sensor mounted in a protective window at one end of the probe support

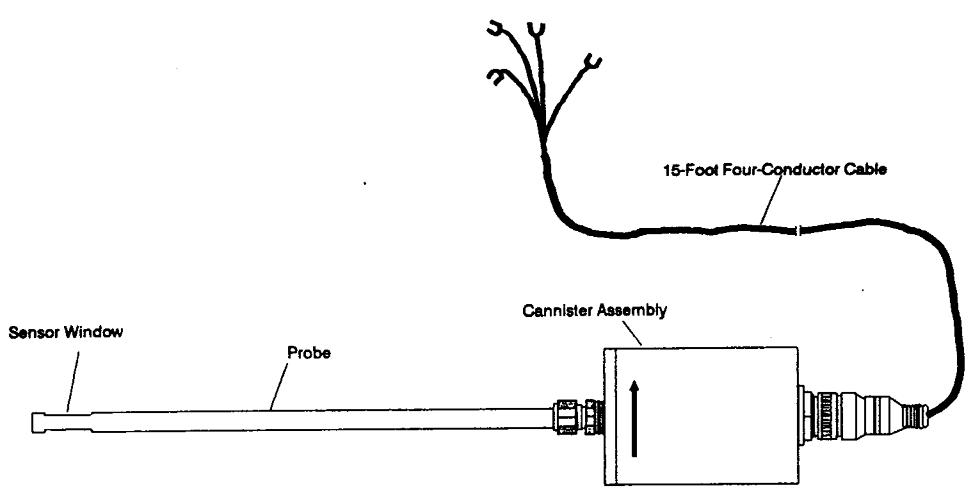
  **NOTE:** The sensor shipped with your transducer was specifically matched to your unit's electronics during factory calibration. Sensors are **not** interchangeable between different units.

- 12-inch long, 1/4-inch diameter 316 stainless steel probe support (Nonstandard lengths from 3 to 48 inches are optionally available.)

- 437 Electronics Board housed in rugged, weather-resistant enameled aluminum cannister assembly at the end of the probe. (The 437 board can be unmounted, mounted in a NEMA 1 or NEMA 4 enclosure, or mounted in a rack module – refer to Section 4, "Options.")

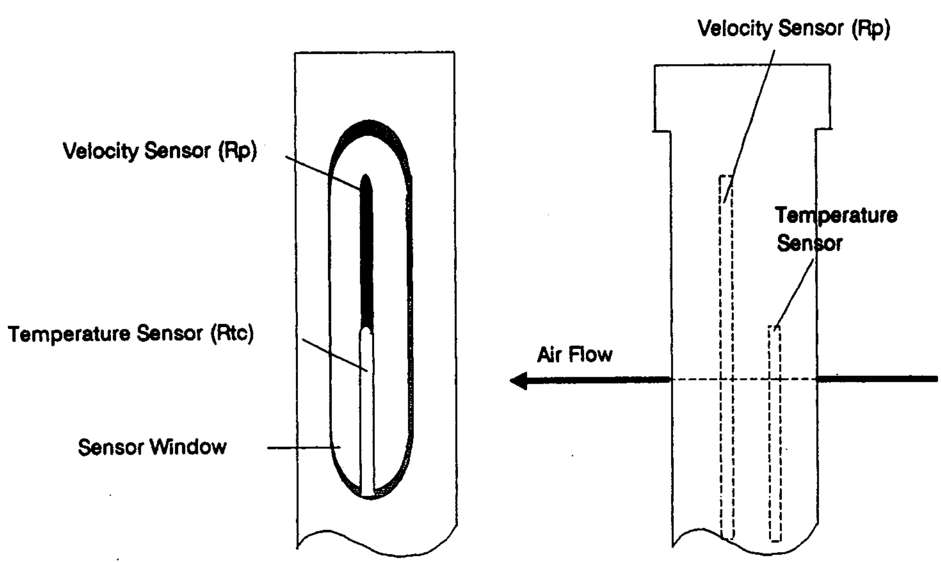
Figure 1-1 shows the basic components of the 430DC and 435DC.

Figure 1-1. *430DC/435DC Basic Components*




**Important Note: The cannister assembly should NOT be placed close to a hot duct or stack. Provide enough clearance between the duct or stack and the cannister assembly so that the ambient temperature at the cannister is not above 50° C.**

Figure 1-3. *Mini MetalClad Sensor: Two Views*

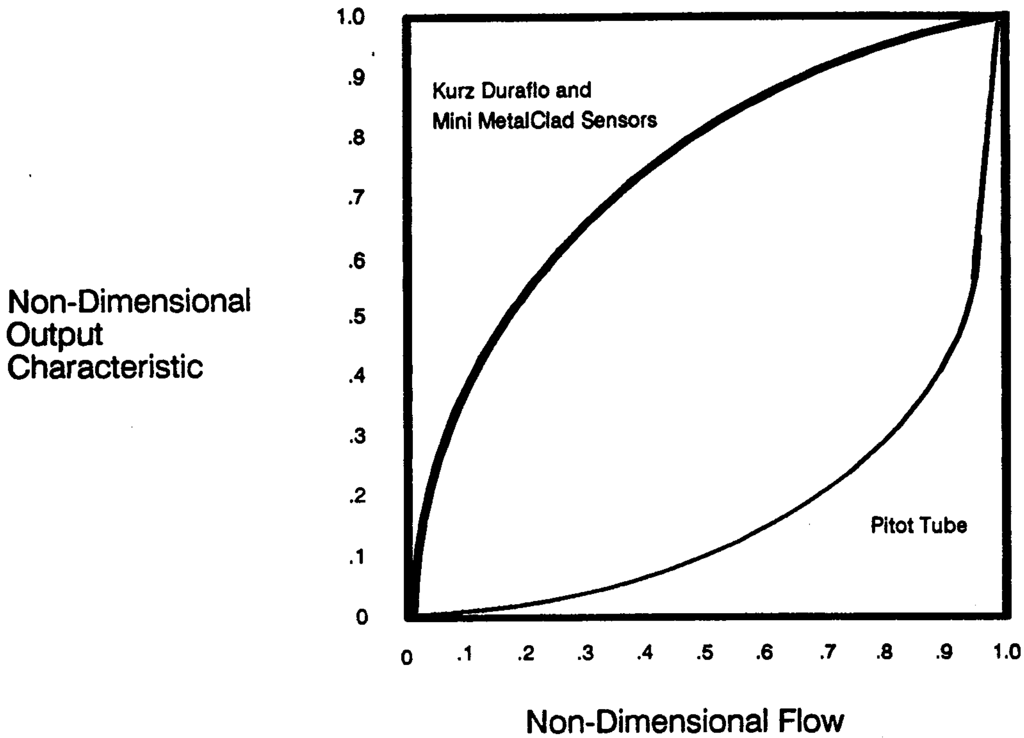



The temperature sensor senses the ambient temperature of the air flow. The velocity sensor is then heated to approximately 75° to 100° F **above** the ambient temperature and is maintained at the same level of temperature differential (overheat) above the ambient temperature regardless of changes in ambient temperature or air velocity.

**CAUTION: The transducer sensor's standard rating is for nonexplosive gases. An optional safety temperature limiting option is available. Contact Kurz Instruments for more information on using the 430DC or 435DC (and 430DC-MC or 435DC-MC) sensor in explosive gas flows.**

Because the temperature sensor compensates for fluctuations in ambient temperature, the amount of electrical power needed to maintain the velocity sensor's overheat is affected only by the flow of air or other gases over the sensor: The greater the velocity of the flow, the greater its cooling effect on the sensor and the greater the electrical power needed to maintain the sensor's overheat. It is this power or current draw that is measured by the 430DC and 435DC.

Figure 1-4. *Sensor Output vs Flow*




Zero and span circuitry on the 437 electronics board converts the signal from the sensor to a non-linear 0-5 Vdc signal that has approximately the same curve as shown above. This non-linear 0-5 Vdc signal is output from the 430DC unless the non-isolated 4-20mA option (-I) was ordered. If this option was ordered, the 430DC outputs a non-linear 4-20mA signal.

However, the 437 board in the 435DC and 435DC-MC contains an additional linearizer circuit that converts the nonlinear voltage into a linear voltage that is directly proportionate to flow velocity: 0 Vdc indicates no flow, 5 Vdc indicates maximum measurable flow, and 2.5 Vdc indicates a flow exactly half of the maximum measurable flow, as shown in Figure 1-5.

## 1.3 Features and Specifications

Some of the outstanding features of the 430DC and 435DC are summarized below:

### Rugged Construction

The Duraflo and mini MetalClad sensor is exceptionally durable in normal use. It is resistant to both dirt and corrosion; unlike pitot-tube and orifice-plate sensors, its performance is not significantly degraded by operation in a dirty atmosphere.

### Unsurpassed Accuracy

The Duraflo and MetalClad sensor windings are Resistor Temperature Detector (RTD)-type windings of reference-grade platinum 385.

### Automatic Temperature and Pressure Compensation

The 430DC and 4355DC directly measure mass velocity. No computations are necessary to compensate for temperature and pressure changes.

### Excellent Low-Speed Sensitivity

Unlike pitot-tube and orifice-plate sensors, the 430DC and 435DC can accurately measure flows down to 20 SFPM.

### Convenient 0-5 Vdc Output

The 430DC outputs a non-linear 0-5 Vdc signal. The 435DC outputs a linear 0-5 Vdc signal. This output signal is convenient for digital panel meters, voltmeters, chart recorders, and computers. Other outputs are optionally available.

### NBS-Traceable Calibration

Every 430DC and 435DC is factory-calibrated in a National Bureau of Standards (NBS) traceable wind tunnel. Packaged with your transducer is a Calibration Certificate showing output voltage vs air velocity. The factory calibration is for air at 25° C and 760 mm Hg. Calibration for other gases, temperatures, and pressures is available at an additional charge.

Table 1-1 (continued)

| | |
|---|---|
| **Probe Construction:** | 430DC/435DC: 316 stainless steel, epoxy, and glass wetted parts<br>430DC-MC/435DC-MC: 316 stainless steel and epoxy wetted parts |
| **Probe Dimensions:** | 430DC/435DC: 1/4" outside diameter; 12" length standard; lengths from 3" to 48" optionally available<br>430DC/435DC-MC: 3/8" outside diameter; 12" length standard; lengths from 3" to 48" optionally available |
| **Electronics Hookup:** | A 15-foot four-conductor cable is supplied to connect the transducer to the 18-24 Vdc input and 0-5Vdc output. |
| **Electronics Board Enclosure:** | 2.75" X 4.75" X 1.13" enameled aluminum cannister. (Refer to Section 4 for information on optional configurations.) |
| **Output:** | 430DC and 430DC-MC: Non-linear 0-5 Vdc standard<br>435DC and 435DC-MC: Linear 0-5 Vdc standard<br>Non-isolated 4-20 mA outputs optionally available on the 437 electronics board. Isolated 4-20 mA output available with optional electronics board. See Section 4 for further information. For other nonstandard outputs, consult factory. |

**End of Section 1**

# Section 2: Installation

This section explains how to install your Model 430DC or 435DC DC-Powered Air Velocity Transducer. The instructions given in this section are necessarily general in nature; every installation is unique. If you need further assistance with your installation, contact your local Kurz representative, or contact Kurz Instruments, Inc. at (408) 646-5911.

## 2.1 Checking the Contents of the Shipping Carton

Open the shipping carton and remove the protective foam packaging material that covers the 430DC or 435DC and any options shipped with it. Check to see that the shipping carton contains everything you ordered.

Make sure the NBS traceable calibration certificate is included. Verify that the line size (if applicable) and pipe schedule shown on the calibration certificate are correct.

### 2.1.1 430DC/435DC Without Options

If you ordered your transducer without any options, the contents of the shipping carton should be as shown in Figure 1-1, "430DC/435DC Basic Components."

If the contents of the shipping carton are correct, proceed with the installation. (If you prefer to test the unit before you install it, refer now to Section 5, "Testing.")

### 2.1.2 430DC/435DC with Options

Any options you ordered should be specified on the Unit Description Sheet at the front of this manual. Available options are listed, described, and (where applicable) pictured in Section 4, "Options". If the options specified on the Unit Description Sheet do not match the options you ordered or the options actually shipped, contact Kurz immediately.

If you ordered your transducer with the 437 electronics board in a NEMA enclosure, check inside this unit and remove any desiccant or other packaging material you find there.

## 2.3 Determining Probe Insertion Depth

Because the sensor can, at any one time, measure velocity at only one point within your pipe or ductwork, it is important that the sensor be mounted at a point where velocity closely approximates the average velocity within the pipe or duct. You can approach the problem of determining a point of average velocity in a variety of ways, depending primarily upon the accuracy your application requires.

### 2.3.1 Center Mounting

Under some circumstances, it may be appropriate to assume that the center point of the pipe or duct represents a point of average velocity. Such circumstances include the following:

- A high degree of accuracy is not critical to your application.
- The pipe or duct to be monitored is so small that it is impractical to mount the sensor anywhere other than at the center of the pipe or duct.
- Flow profile is known to be turbulent and of high velocity; many points of average velocity are likely.
- Flow profile is known to be very uniform.

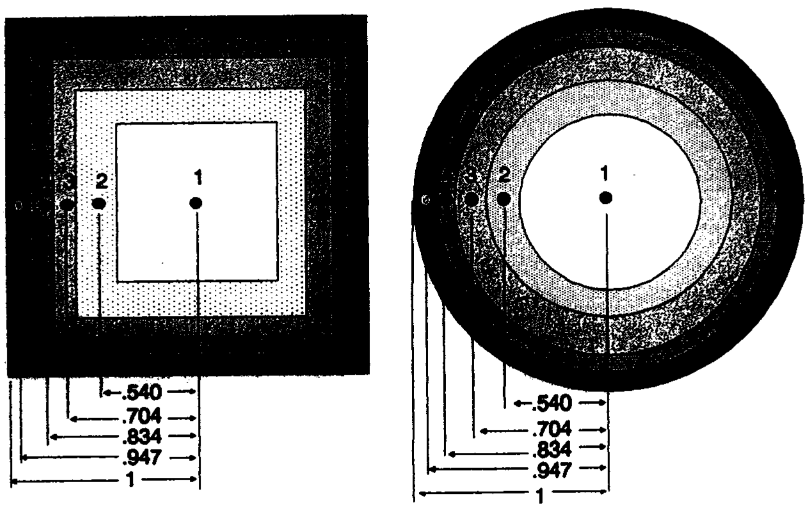
Even under the circumstances listed above, however, you may want to perform at least a half traverse (described below at 2.3.2) before deciding on center mounting.

Step 6: Select the point at which you will permanently mount the sensor. This should be the point whose velocity reading most nearly approximates the average velocity computed at Step 5.

If none of the points monitored yields a reading sufficiently close to the computed average, you may want to repeat the procedure, using a larger number of areas and points. Alternatively, you may want to perform the somewhat more complicated double-traverse averaging described at 2.3.3 below.

Figure 2-2 shows cross sections of square and round ducts, each with five areas and five monitoring points for a half-traverse averaging operation.

Figure 2-2. *Equal-Area Half Traverse*




In Figure 2-2, the unshaded area that contains Point 1 represents one square unit. Each of the shaded areas containing points 2, 3, 4, and 5 also represents one square unit. The total cross-sectional area of each duct is five square units.

## 2.3.3 Double-Traverse Averaging

Double-traverse averaging is similar to half-traverse averaging, but requires a second probe-insertion hole and more monitoring points. The procedures for performing the traverse and obtaining an average are described below:

Step 1: Divide a cross section of the pipe or duct into a number of equal, concentric areas (see Figure 2-3). The number of areas you use depends on the the uniformity of flow within the pipe or duct and on the degree of accuracy you require: The more areas you use, the more accurate your computed average will be.

Step 2: Identify four points to monitor for each area (see Figure 2-3)[3].

Step 3: Drill a hole in the pipe or duct 1/16"-inch larger in diameter than the probe (5/16" for the 430DC/435DC; 7/16" for the 430DC-MC/435DC-MC).

Step 4: Insert the probe into the pipe or duct through one of the probe-insertion holes and take a velocity reading at each of the points in line with that hole.[4] Repeat the process for the other hole.

You can most easily determine the position of the sensor within the pipe or duct by using a pencil or other marker to mark off appropriate measurements on the probe before you insert it.

Be sure the window of the probe's protective shield is aligned with the direction of flow so that airflow over the sensor is unobstructed.

3 Note that the center contains only one monitoring point. The reading from that point must be counted four times in the averaging operation to give each area equal weight.

4 Do not take a reading at the point nearest the probe-insertion hole; such a reading might be influenced by leakage or turbulence caused by the hole. Instead, substitute the reading from the corresponding point nearest the far wall of the duct or pipe. Be sure to remove the protective rubber cap from the 435DC's sensor before you attempt to take readings.

In Figure 2-3, the unshaded area of each duct, which contains Point 1, represents one square unit. Each of the shaded areas containing points 2, 3, 4, and 5 also represents one square unit. The total cross-sectional area of each duct is five square units.

The numbers shown below the ducts give the positions of points 2, 3, 4, and 5 relative to the distance from Point 1 to the wall of the duct. That is, from Point 1 to Point 2 is 54% of the distance from Point 1 to the wall of the duct; from Point 1 to Point 3 is 70.4% of the distance from Point 1 to the wall of the duct; and so on. You can extrapolate from these numbers the actual measurements for any pipe or square duct divided into five equal areas. Table 2-2 shows an example of averaging readings from a duct like one of those shown in Figure 2-3.

Table 2-2. *Double-Traverse Velocity Averaging Example*

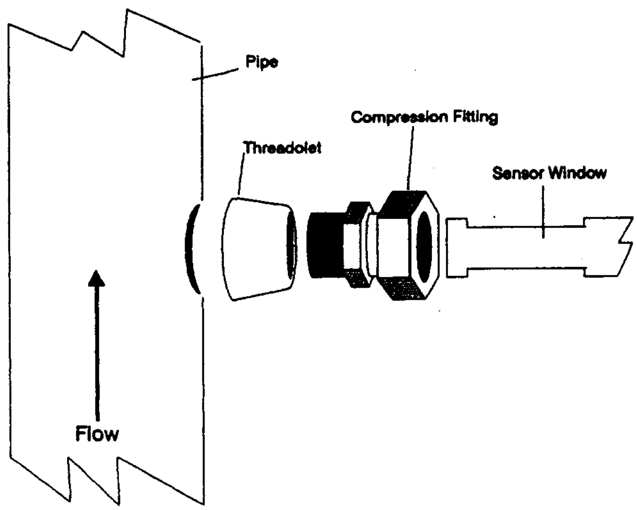
| From\Points | 1 | 2 | 3 | 4 | 5 | Sum | Average |
|---|---|---|---|---|---|---|---|
| Left | 1200 | 1150 | 1100 | 1000 | 700 | 5150 | 1030 |
| Right | 1200 | 1140 | 1115 | 1020 | 700 | 5175 | 1035 |
| Top | 1200 | 1200 | 1175 | 1100 | 800 | 5475 | 1095 |
| Bottom | 1200 | 1175 | 1150 | 1050 | 800 | 5375 | 1075 |
| **Sum:** | 4800 | 4665 | 4540 | 4170 | 3000 | 21,175 | 4235 |
| **Average:** | 1200 | 1166 | 1135 | 1043 | 750 | 5294 | 1059 |

In the example, the average velocity from the 20 points sampled[5] is 1059 SFPM. The bottom Point 4, with a measured velocity of 1050 SFPM, is closest to the average velocity. You would therefore permanently mount the 435DC with its probe inserted to the correct depth to align the sensor with the bottom Point 4.

5 Point 1 is counted four times.

Figure 2-4 shows the hardware needed to mount the transducer in a pipe.

Figure 2-4. *Mounting Hardware, Pipe*




Weld the Threadolet coupler directly over the probe-insertion hole in the pipe in which you are installing the transducer (refer to Section 2.2 for determining the location of the probe-insertion hole). Then thread the tube compression fitting firmly into the coupler.

## 2.4.2 Duct Mounting

To mount the 430DC or 435DC in a duct constructed of thin-wall sheetmetal, order the appropriate mounting adapter from Kurz Instruments.

For installation of a 430DC or 435DC in flat ductwork, order mounting adapter PMA-04. For installation of a 430DC-MC or 435DC-MC in flat ductwork, order mounting adapter PMA-06. The mounting adapter consists of a compression fitting welded to a 3"-by-3" steel plate with four corner mounting holes, as shown in Figure 2-5.

### 2.5.1 Very Low Velocity Installations

The transducer's sensor is exceptionally accurate at flow rates well below those that can be accurately measured by pitot-tube or orifice-plate type instruments. The 430DC and 435DC can accurately measure flows down to 20 SFPM – the equivalent of less than 1/4 mile per hour.

### 2.5.2 Sensor Alignment

Make sure the probe is rotated such that the sensor window allows unobstructed flow of air over the sensor.

### 2.5.3 High-Temperature Installations

The 430DC and 435DC, configured with a longer 24-inch probe, is recommended for pipes and ducts up to 24 inches in diameter. In fact, only 12 inches of probe support is required to position the sensor in the center of a 24-inch diameter pipe. The extra 12 inches of probe support is provided to allow space between the pipe or duct and the cannister assembly on the end of the probe support. We recommend that the cannister not be exposed to ambient temperatures above 50° C. That space helps keep the electronics at or below their rated temperature of 70° C, even when the temperature of the flow inside the pipe or duct is substantially higher than 70° C.

If the extra space provided between the outside of the pipe or duct and the cannister assembly is not sufficient to keep the electronics at or below 70° C, the 437 linearizer board must be mounted in a remote enclosure (see Section 4.7).

## 2.6 Connecting to an 18-24Vdc Input and 0-5Vdc Output

A 15-foot four-conductor cable is included with all configurations of the 430DC and 435DC. The standard configuration of the transducer includes a cannister assembly at the end of the probe to house the 437 circuit board. One end of the cable terminates in an connector that screws onto the end of the cannister assembly. The other end of the cable provides four wires terminated with spade lugs that can be connected to the power supply and to the output device used to monitor the linearized output from the probe. The pin description of the connector and cable is provided in Table 2-3.

# Section 3: Operation and Maintenance

This section describes the operation and routine maintenance of the Model 430DC and 435DC DC-Powered Air Velocity Transducers.

## 3.1 Operation

Once you have installed the transducer as described in Section 2, operation is primarily a matter of maintaining the 18-24Vdc power source to the 430DC or 435DC. As long as power is supplied to this unit, the probe is correctly installed in the pipe or duct to be monitored, and all wiring connections are correctly made, the transducer will continue to operate for prolonged periods without intervention.

### 3.1.1 0-5 Vdc Output

To derive useful data from the operation of the transducer, you can monitor the Signal Out line (0-5 Vdc) connected to Pin 3 of the 4-pin connector at the end of the cannister assembly. When the 15-foot cable supplied with the transducer is attached to the connector on the cannister assembly, the signal is available on the white wire at the end of the cable.

The output from pin 3 of this connector is a non-linear (430DC) or linearized (435DC) 0-5 Vdc signal. Zero Vdc indicates no flow over the sensor; 5 Vdc indicates the maximum measurable flow. The non-linear intermediate voltages output from the 430DC will not be directly proportionate to velocity. These voltages will fall on a curve, closely approximating the curve shown in Figure 1-4 on page 1-7. In comparison, the linear intermediate voltages output from the 435DC **do** indicate intermediate flows directly proportionate to the voltage of the signal.

The formula for deriving actual velocity from indicated velocity is given below:

$$V_{act} = V_{ind} \frac{d_s}{d_a}$$

where:

$d_s$ = Standard air density (25° C; 760 mm Hg).

$d_a$ = Actual air density at local temperature and barometric pressure.

$V_{act}$ = Actual air velocity in feet per minute.

$V_{ind}$ = Indicated velocity in standard feet per minute.

Although the intermediate steps are not shown here, by dividing out the known quantities, the formula can be restated as

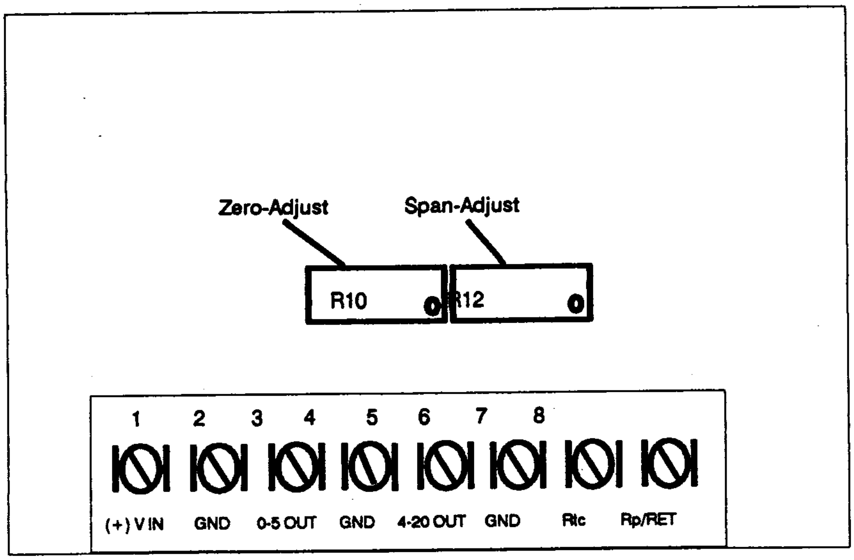
$$V_{act} = V_{ind} \; 0.05578 \; \frac{T_a}{P_a}$$

where

$T_a$ = Actual temperature in degrees Rankine (degrees R = Degrees F + 459.67).

$P_a$ = Actual pressure in inches of mercury.

Figure 3-1. *437 Electronics Board: Zero and Span Potentiometers*




Step 1: Set the flow velocity to 0 SFPM.

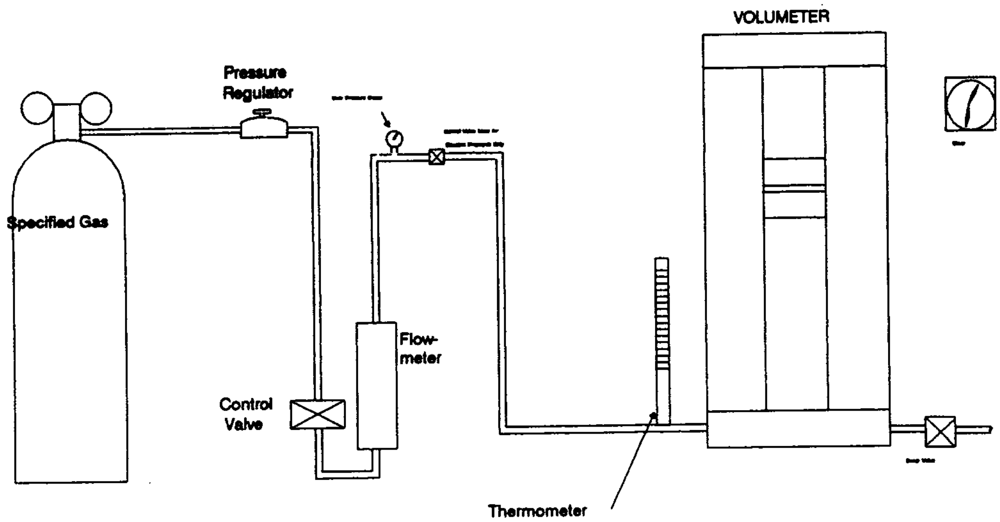
Step 2: Check the voltage between Terminal Screw 3 (linear output) and Terminal Screw 4 (ground). If necessary, adjust the zero-control potentiometer up or down until you get a reading of zero volts.

**NOTE:** You should check for zero voltage either immediately after powering the transducer or after first running flow past the sensor and then returning to zero flow. This is necessary because, after several minutes at zero flow in a small air volume, the heat produced by the velocity sensor ($R_p$) begins to affect the ambient temperature sensor ($R_{tc}$).

Step 3: Set the flow velocity to the maximum for which your transducer is calibrated[4].

4 Remember, the 430DC and 435DC is calibrated in standard units, not actual units. Therefore, if the airflow you use to perform the recalibration is not at the standard reference temperature of 25° C (77° F) or the standard reference pressure of 760 mm (29.92 in) Hg, you will have to adjust the actual flow rate used in recalibration to equal the desired standard flow rate. To do so, use the formula given at 3.1.2

Figure 4-1. *Specialty Gas Calibration*




## 4.2 4-20 mA Output

Standard 430DC output is a non-linear 0-5 Vdc signal. Standard 435DC output is a linear 0-5 Vdc signal.

Optional 4-20 milliamp (mA) output is available in both non-isolated and isolated versions. 4-20 mA output is appropriate when the distance between the transducer and a device receiving the output signal is such that a significant voltage drop would occur in the standard 0-5 Vdc signal. 4-20 mA output is unaffected by distance, as long as the total resistance in the loop is less than 800 ohms.

### 4.2.1 Non-Isolated

Non-isolated 4-20 mA output is appropriate when there is no need to isolate the electronics of the receiving device from the electronics of the 437 circuit board. When 4-20 mA output is non-isolated, the optional 4-20 mA circuit on the 437 board shares the electrical ground of the entire 430DC or 435DC provided by the ground signal of the power supply.

The circuitry for the non-isolated 4-20 mA circuitry is provided on the 437 board. When the 437 is configured to provide the 4-20 mA output, the 0-5 Vdc output is disabled.

The Model 132 isolated 4-20 mA current board is mounted on standoffs beside the 437 board and connected to the 0-5 Vdc and signal ground lines on the 437 board. An 18-24 Vdc input should be provided on terminal 1 of the 131 board. These connections are shown in Figure 4-2

## 4.3 Custom Probe Lengths

The standard probe length for the 430DC and 435DC is 12". Other lengths from 3" to 48" are optionally available.

If you believe you require a probe more than 48 inches long, you should consider moving up to a multi-point, multi-sensor velocity averaging array such as the Kurz EVA 4000 or EVA 4100.

## 4.4 HT High Temperature Sensor

The standard 430DC and 435DC sensor is rated for temperatures from 0° C to +125° C.

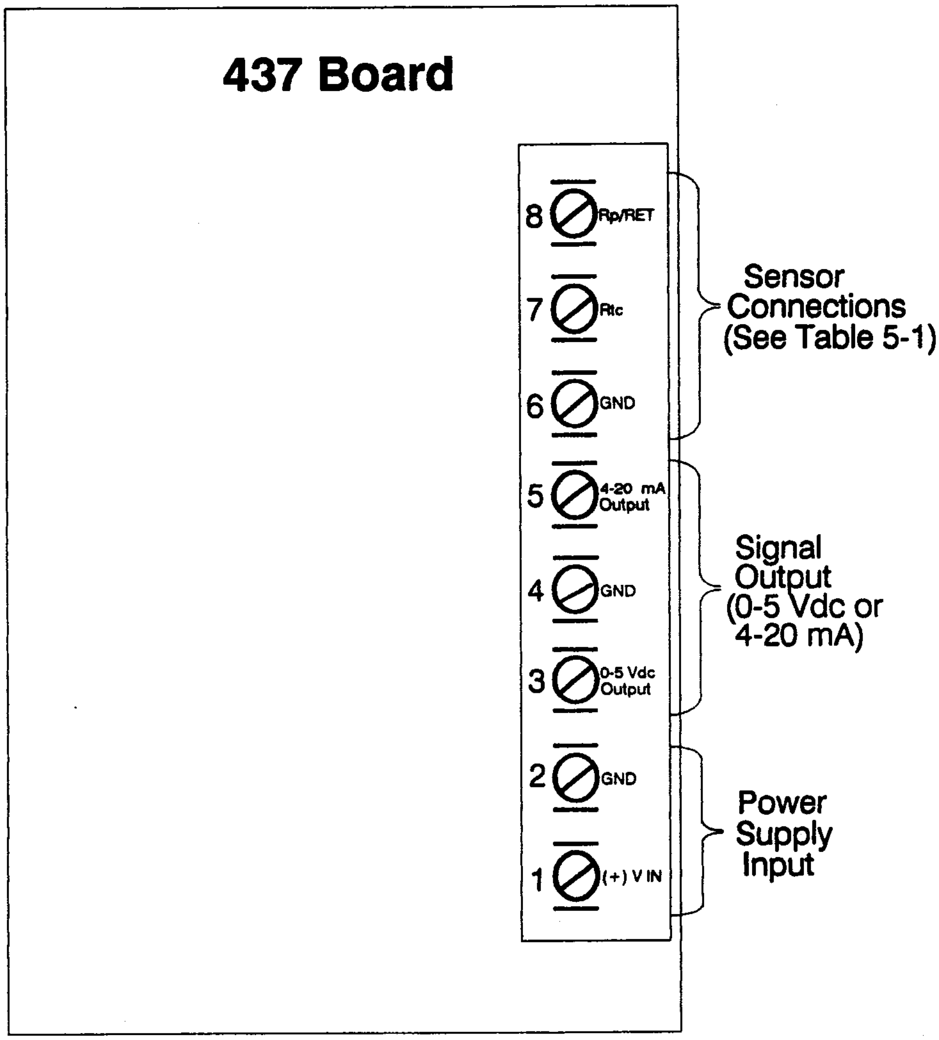
The optional HT high temperature sensor is rated from 0° C to +250° C.

## 4.5 Coated Sensors

The Duraflo and mini MetalClad sensors can be coated to provide additional resistance to corrosive gases and contaminants. The type of coating that is applied to the sensors will be dependent on the type of gas flow. Epoxy and teflon coatings are two of the most popular options.

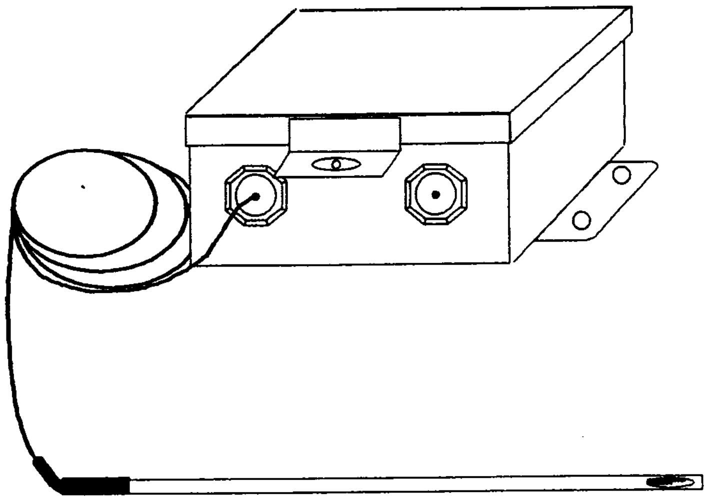
The transducer sensors are highly resistant to particulate contamination. For particularly dirty flows containing resinous or sticky materials, however, you may wish to order the special teflon-coated sensor. The teflon-coated sensor generally allows longer intervals between cleanings and is more easily cleaned if it does become heavily loaded with contaminants.

Figure 4-4. *Terminal Strip on the 437 Board*




You can mount the 430DC-RM or 435DC-RM in your own standard 19"-wide rack chassis, or you can order the Model 2015 rack chassis, shown in Figure 4-5, from Kurz Instruments. The 2015 rack chassis houses up to twelve 1.4" 430DC/435DC-RM or nine of these rack modules and one 4.2" Multichannel Display (see section 4-11). The 19" rack chassis can be placed in a bench enclosure when the unit requires testing or service.

Figure 4-6. *Model 430DC/435DC-N1 in a NEMA 1 Enclosure*



## 4.8 Unmounted 437 Electronics Board (430DC/435DC-PC)

If you purchased the 430DC-PC or 435DC-PC, you can mount the 437 electronics board in your own enclosure. The transducer comes with the probe, a 15-foot four-conductor cable, and the 437 electronics board (without enclosure). Figure 4-4, on page 4-7, shows the locations of the terminal screws for connecting the power supply's 18-24 Vdc and ground lines to the 437 board and to connect the 0-5 Vdc output signal and ground to a receiving device.

Refer to the 437 PCB assembly drawing included in Appendix A for exact locations of the four mounting holes on the 437 board.

## 4.9 Power Supplies

A 18-24 Vdc power source and power supply ground must be supplied to the 435DC's 437 electronics board. The 18-24 Vdc and ground can be supplied through the cable attached to the cannister assembly on the transducer, or directly to the 437 board itself when it is installed a rack module (430DC/435DC-RM), NEMA 1 enclosure (430DC/435DC-N1), or custom enlosure (430DC/435DC-PC).

If you prefer a unit not listed, contact Kurz Instruments for more information.

- Standard Cubic Feet per Minute per square foot (SCFM/ft$^2$).

- Pounds Mass per Minute per square foot.

- Standard Cubic Feet per Minute (SCFM). SCFM, unlike SCFM/ft$^2$, is a direct measure of the mass of air flowing through your pipe or duct. If you want a readout in SCFM you must supply Kurz with the exact cross-sectional area (in square feet) of your pipe or duct at the point where the transducer will be permanently mounted.

- Pounds per Minute (lbs/min). Again, this is a direct measure of the mass of air flowing through your pipe or duct. If you want a readout in lbs/min you must supply Kurz with the exact cross-sectional area (in square feet) of your pipe or duct at the point where the transducer will be permanently mounted.

- Standard Meters per Second (SMPS)

## 4.12 Dual Alarm

The Model 111R1 dual alarm board allows you to activate an audible alarm or other device of your choice based on the velocity sensed by the transducer. The board provides two relays, one of which is activated when velocity drops below a specified minimum, and one of which is activated when velocity exceeds a specified maximum. You set both maximum and minimum values by adjusting potentiometers on the 111R1 printed circuit board. You could, for example, specify that the low alarm relay be activated when velocity falls below 10% of full range, and that the high alarm relay be activated when velocity exceeds 90% of full range.

As shipped, the low alarm relay is activated when the velocity falls below 20% of the full range and the high alarm relay is activated when the flow velocity exceeds 80% of the full range.

The low-adjust and high-adjust potentiometers are shown in Figure 4-8, as are the terminal screws used to connect the 111R1 board to other devices.

## 4.14 Sensor Safety Circuit

The optional sensor safety circuit on the 437 board limits the temperature that the velocity sensor can reach in the unlikely event of a serious failure. The sensor safety circuit employs a ballast-resistor/zener combination to limit the amount of power supplied to the sensor. You must specify the gas in which you intend to use the sensor – the calibration of the safety circuit is gas specific. It is strongly recommended that you select this option if your transducer will be used to monitor the flow of explosive gases.

**NOTE:** Even with the sensor safety circuit installed, the sensor normally operates at an overheat of approximately 100° F **above** the ambient temperature of the gas flow it is monitoring. It is the user's responsibility to ensure that the ambient temperature of an explosive gas flow is kept substantially **BELOW** the ignition temperature of the gas. Contact Kurz Instruments if you need further information about using the 430DC or 435DC in explosive gas flows.

**End of Section 4**

# Section 5: Testing

This section describes some of the bench testing procedures you can perform on the Model 430DC and 435DC. You may want to perform these tests before you install the transducer and/or at regular intervals thereafter to verify that the unit is functioning properly.

NOTE: Any warranty service to be performed at the customer's site must be previously approved in writing by Kurz Instruments. Nonwarranty service should be performed only by a certified electrical technician. Refer to Appendix A for component layouts and schematics.

Before you perform the test, check to make sure that the following conditions are met:

- The 437 electronics board is properly wired to a power supply. The 18-24 Vdc input should be wired to terminal screw 1 and power supply ground should be wired to terminal screw 2 (refer to Figure 4-4 on page 4-7). The power supply should be turned on only after all connections have been checked.

- The wires from the sensor are correctly connected to the terminal strip of the 437 (refer to Figure 4-4 on page 4-7 and Table 5-1). The wires from the sensor are normally connected before shipment but should be checked for this test. The colors of the sensor wires vary, depending on the kind of wire or cable used – Refer to Table 5-1. With the standard cable the sensor cable's metal shield serves as a conductor and should be connected to ground.

- No flow is moving past the sensor.

Step 2: Check the +15 Vdc voltage supply: +15 Vdc +/- 3%

Check the voltage between ground and right leg of capacitor C3 (or pin 4 of U1, U2, or U3). This is the +15 Vdc supply voltage and should read +15 Vdc, +/- 3%. This voltage is used to generate the -9 Vdc supply which is used to generate the -5 Vdc reference voltage. The +15 Vdc supply is also used in the zero and span circuit, in the linearization circuit (435DC only), and for the voltage to current conversion when the 4-20 mA option is installed.

Step 3: Check the -9 Vdc voltage supply: -9 Vdc +/- 3%

Check the voltage between ground and the left leg of R16 (or pin 11 of U1, U2, or U3). This is the -9 Vdc voltage and should read -9 Vdc +/- 3%. This voltage is used to generate the -5 Vdc reference voltage. It is also used in the zero and span circuit as well as the linearization circuit (435DC only) on the 437.

Step 4: Check the -5 Vdc reference voltage supply: -5 Vdc +/- .01%

Check the voltage between ground and the left leg of R19 (or pin 1 of U3). This is the -5 Vdc reference voltage and should read -5 Vdc +/- .01%. This voltage is used in the zero and span circuit as well as the linearization circuit (435DC only) on the 437.

Step 5: Check the non-linear signal: 0-5 Vdc +/- .025 Vdc at zero; +/- .125 at full span.

Check the voltage between ground and either leg of jumper E1 (or pin 14 of U3). This tests the zero and span circuitry (as long as the other voltages are correct). This voltage is then linearized (435DC only) to provide the 0-5 Vdc or 4-20 mA linear output.

# Appendix A: Component Layout Drawings

This appendix contains components layout drawings for the Model 430DC/435DC transducer and its components. These drawings are included as an aid to those users who want to perform their own testing and servicing as described in the manual.

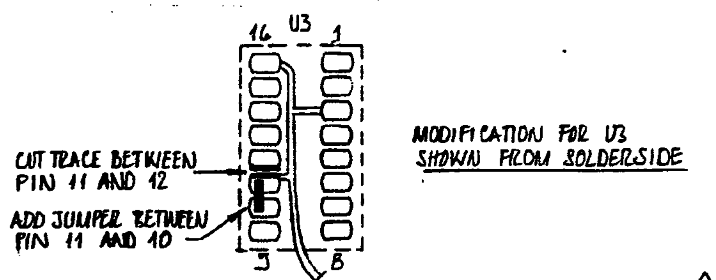
**NOTE:** If you want to perform your own warranty service, you must first obtain written authorization from Kurz Instruments. **Unauthorized service performed during the warranty period voids your warranty.** Please read the warranty statement at the front of this guide before performing any service.

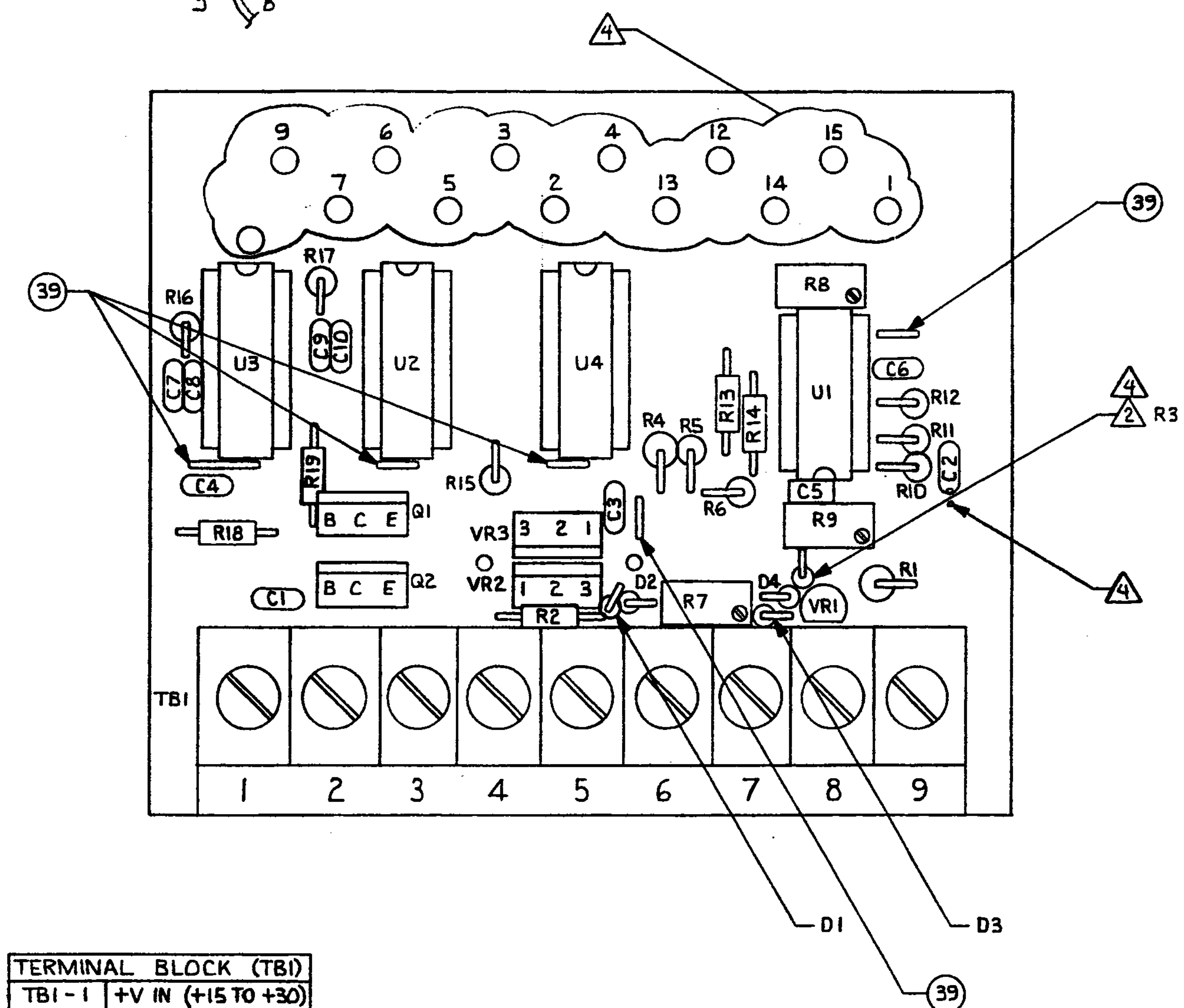
The following drawings are included in this appendix:

| Drawing No. | Description |
|---|---|
| 420001, Rev F | Model 101 Totalizer Component Layout |
| 420006, Rev B | Model 132 Isolated Signal Output Converter Component Layout |
| 420099, Rev B | PCB, Assy., 111R1 |
| 420123, Rev D | PCB, Assy., 437 |
| 700435–01, Rev D | Series 430DC/435DC Assy. |
| 700435–04, Rev A | Model 435DC–MC–7–PC. |

NOTES: UNLESS OTHERWISE SPECIFIED
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM 300001
2. (2) USE R3 ONLY WITH 4-20mA INPUT, KURZ TO ASSEMBLE AS REQD.
3. ALL DIODES TO BE ASSEMBLED WITH THE CATHODE TO THE P.C.B.
4. (4) MASK OFF THESE PADS BEFORE WAVE SOLDERING.

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV. | DESCRIPTION | DRAWN DATE/BY | CHECK DATE/BY | DESIGN DATE/BY | APPROVED DATE/BY |
| A | REVISED PER ECO A10147001 | J.C. 3-4-87 | 3-12-87 | N/A | |
| B | REVISED PER ECO No 47246 | 1-30-89 | 2-2-89 GF | N/A | 2/2/89 |
| C | REVISED PER ECO No. 47370 | NH 8.31.90 | BF 9-10-90 | N/A | BPL 9-10-90 |
| D | REVISED PER ECO NO. 47722 | 3.21.91 | 3-22-91 | N/A | GF 3/22/91 |
| E | REVISED PER ECO NO. 47768 & 47758 | 5-8-91 | 5/8/91 | N/A | BPL 5-8-91 |
| F | REVISED PER ECO 47448 | | 11/8/91 | N/A | 11/8/91 |




| | | | | |
|---|---|---|---|---|
| | 39 | A/R | | WIRE JUMPER |
| | 38 | | | |
| 540386 | 37 | 2 | R16,R17 | RESISTOR 221K 1/8W 1% |
| 540581 | 36 | 1 | R15 | RESISTOR .5Ω 1/4W 5% |
| 540591 | 35 | 1 | R12 | RESISTOR 100K 1/8W 1% |
| 540462 | 34 | 1 | R10 | RESISTOR 499K 1/8W 1% |
| 540264 | 33 | 1 | R6 | RESISTOR 49.9K 1/8W 1% |
| 540397 | 32 | 1 | R5 | RESISTOR 249K 1/8W 1% |
| 540440 | 31 | 1 | R4 | RESISTOR 392K 1/8W 1% |
| (2) 540131 | 30 | 6 | R3,11,13,14,18,19 | RESISTOR 10K 1/8W 1% |
| 540062 | 29 | 1 | R2 | RESISTOR 2.21K 1/8W 1% |
| 540398 | 28 | 1 | R1 | RESISTOR 255Ω 1/8W 1% |
| 540569 | 27 | 1 | R9 | RESISTOR POTENTIOMETER 50K |
| 540570 | 26 | 1 | R8 | RESISTOR POTENTIOMETER 500K |
| 540565 | 25 | 1 | R7 | RESISTOR POTENTIOMETER 10K |
| | 24 | | | |
| 580055 | 23 | 1 | VR3 | VOLTAGE REGULATOR 7805 |
| 580058 | 22 | 1 | VR2 | VOLTAGE REGULATOR 7812 |
| 580054 | 21 | 1 | VR1 | VOLTAGE REGULATOR LM336 5.0V |
| 460052 | 20 | 3 | | SOCKET 16 PIN |
| 460048 | 19 | 1 | | SOCKET 14 PIN |
| | 18 | | | |
| 610011 | 17 | 1 | U3 | I.C. 74C221 |
| 610010 | 16 | 2 | U2,U4 | I.C. CD4040B |
| 610012 | 15 | 1 | U1 | I.C. VFQ-1C |
| | 14 | | | |
| 580042 | 13 | 2 | Q1,Q2 | TRANSISTOR 2N6388 |
| | 12 | | | |
| 580001 | 11 | 4 | D1,D2,D3,D4 | DIODE IN914 |
| | 10 | 1 | | |
| | 9 | | | |
| 510003 | 8 | 1 | C6 | CAPACITOR 220PF 100V CER |
| 510029 | 7 | 1 | C5 | CAPACITOR .001µf 50V CER |
| 510006 | 6 | 8 | C1-C4,C7-C10 | CAPACITOR .1µf 50V CER |
| | 5 | | | |
| 460104 | 4 | 1 | TB1 | TERMINAL MARKER STRIP 9 PIN .375 CENTERS |
| 460076 | 3 | 1 | TB1 | TERMINAL STRIP 9 PIN, BEAU, .375 CENTERS |
| | 2 | | | |
| 420066 | 1 | 1 | | MODEL 101 PCB |
| PART No. | ITEM | QTY | REF DES | DESCRIPTION |

PARTS LIST

| TERMINAL BLOCK (TB1) | |
|---|---|
| TB1-1 | +V IN (+15 TO +30) |
| TB1-2 | GND |
| TB1-3 | 1st COUNTER |
| TB1-4 | 2nd COUNTER |
| TB1-5 | -V IN (-15 OR -18) |
| TB1-6 | +12 OUT |
| TB1-7 | +5 OUT |
| TB1-8 | GND |
| TB1-9 | SIG. IN. 0-5 VDC |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/32
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.03
.XXX ± 0.005
.XXXX ± 0.0010
ORIG. RELEASE DATE

NEXT ASSEMBLY

| APPROVALS | DATE |
|---|---|
| DRAWN BY J. CAREAGA | 8-25-86 |
| CHECKED BY | 8-26-86 |
| DESIGN N/A | |
| APPROVED | 8/26/86 |
| BASELINED N/A | |

**KURZ INSTRUMENTS INC.**

TITLE: MODEL 101 TOTALIZER COMPONENT LAYOUT

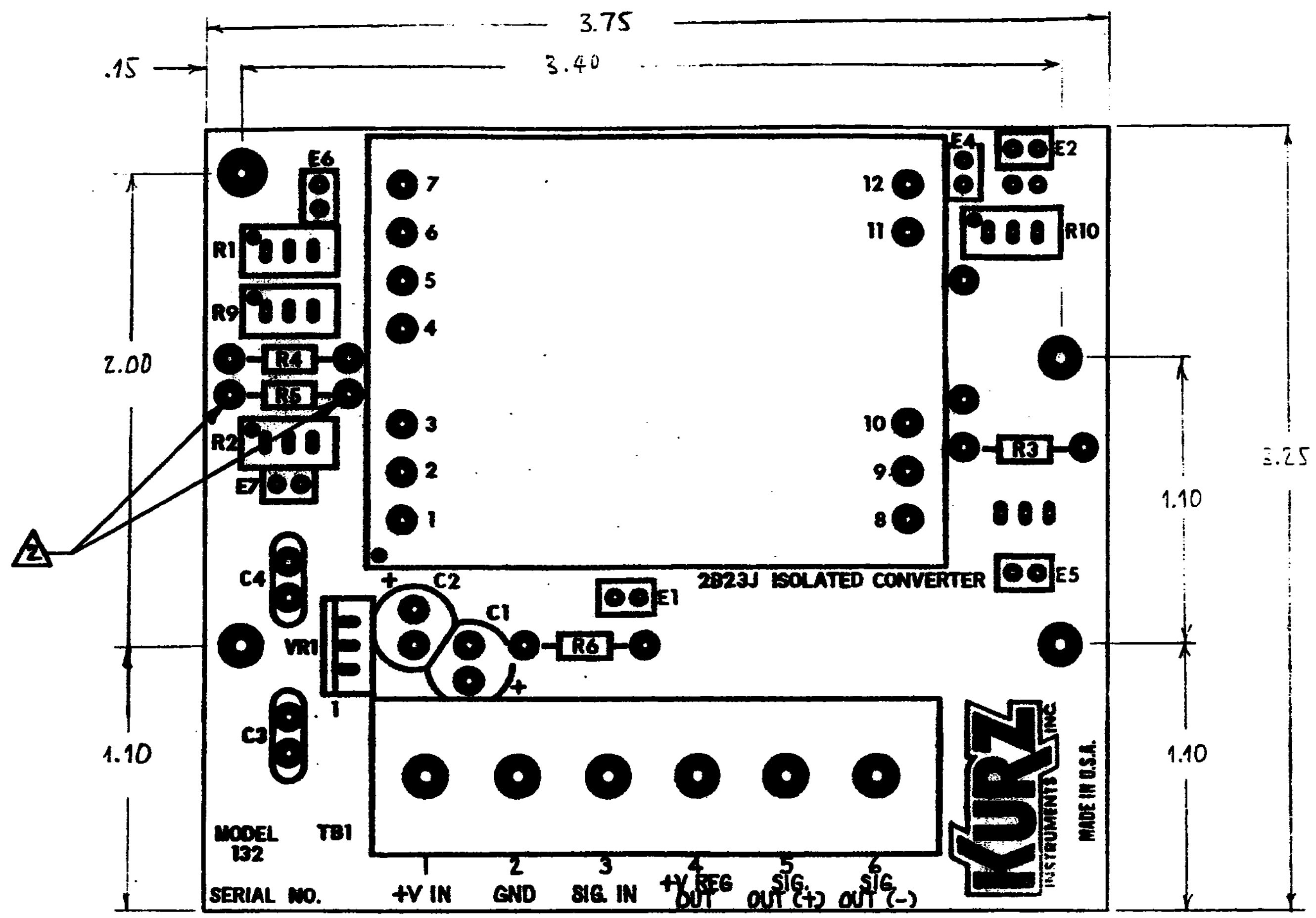
DWG. SIZE: C | DWG. NO. 4-20001 | REV. F
SCALE: NONE | SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM 300005
2. (△2) FOR OPTION 4-20mA IN, 4-20mA OUT ADD A WIRE JUMPER BETWEED PADS.
3. (△3) MICRO JUMPER SHALL BE USED AS REQUIRED.

REVISIONS

| REV | DESCRIPTION | DRAWN DATE | CHECK DATE | DESIGN DATE | APPROVED DATE |
|---|---|---|---|---|---|
| A | REVISED, DELETED 4-20mA IN, 0-5 VDC OUT OPTION | J.C. 9/15/86 | D.T. 9/15/86 | | MHG 9/15/86 |
| B | REVISED PER ECO No A13247005 | 6-17-88 | TE 6-17-88 | N/A | 6/20/88 |




ALL COMPONENTS SHOWN INSTALLED

| OPTIONS | ITEM | QTY | REF DES | DESCRIPTION |
|---|---|---|---|---|
| 4-20mA IN | 13 | 1 | R5 | WIRE JUMPER |
| | 12 | 1 | R6 | RESISTOR 249 Ω |
| | 11 | 1 | R4 | RESISTOR 9.09 K |
| 4-20mA OUT | 10 | 1 | R3 | RESISTOR 301 Ω |
| | 9 | 1 | R9 | RESISTOR POTENTIOMETER SELECTED |
| | 8 | 1 | R2 | RESISTOR POTENTIOMETER 50K |
| 0-5 VDC IN | 10 | 2 | R4, R5 | RESISTOR 9.09K |
| | 9 | 1 | R3 | RESISTOR 301Ω |
| 4-20mA OUT | 8 | 2 | R1, R2 | RESISTOR POTENTIOMETER 2K |
| | 12 | 1 | R5 | RESISTOR 200K |
| 0-5 VDC IN | 11 | 1 | R4 | RESISTOR 10K |
| | 10 | 1 | R3 | RESISTOR 121Ω |
| 0-20mA OUT | 9 | 1 | R2 | RESISTOR POTENTIOMETER 500K |
| | 8 | 1 | R1 | RESISTOR POTENTIOMETER 2K |
| USED ON ALL OPTIONS | 7 | 7 | E1-E7 | 2 PIN HEADER MOLEX |
| | 6 | 1 | VR1 | VOLTAGE REGULATOR 7815 |
| | 5 | 2 | C3, C4 | CAPACITOR .1uf 50V CER |
| | 4 | 2 | C1, C2 | CAPACITOR 10 uf 25V |
| | 3 | 1 | | ISOLATED V/I CONVERTER 2B23J |
| | 2 | 1 | TB1 | TERMINAL BLOCK, 6 PIN |
| | 1 | 1 | | 132 PC BOARD |

PARTS LIST

(△3) JUMPER CONFIGURATION

| OPTION | INSTALL |
|---|---|
| 0-5 VDC IN 0-20mA | E2, E5, |
| 0-5 VDC IN 4-20mA OUT | E4, E5, |
| 4-20mA IN 4-20mA OUT | E1, E2, E5, E6 |

| | |
|---|---|
| NEXT ASSEMBLY | N/A |
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES | TOLERANCES ARE: FRACTIONS ± 1/32; ANGLES ± 0°-30'; DECIMALS .X ± 0.1, .XX ± 0.03, .XXX ± 0.005, .XXXX ± 0.0010 |
| DRAWN BY | J. CAREAGA, 8-13-86 |
| CHECKED BY | D. Dick, 8-15-86 |
| APPROVED | M. F. Elledge, 8/18/86 |

# KURZ INSTRUMENTS INC.

TITLE: MODEL 132 ISOLATED SIGNAL OUTPUT CONVERTER COMPONENT LAYOUT

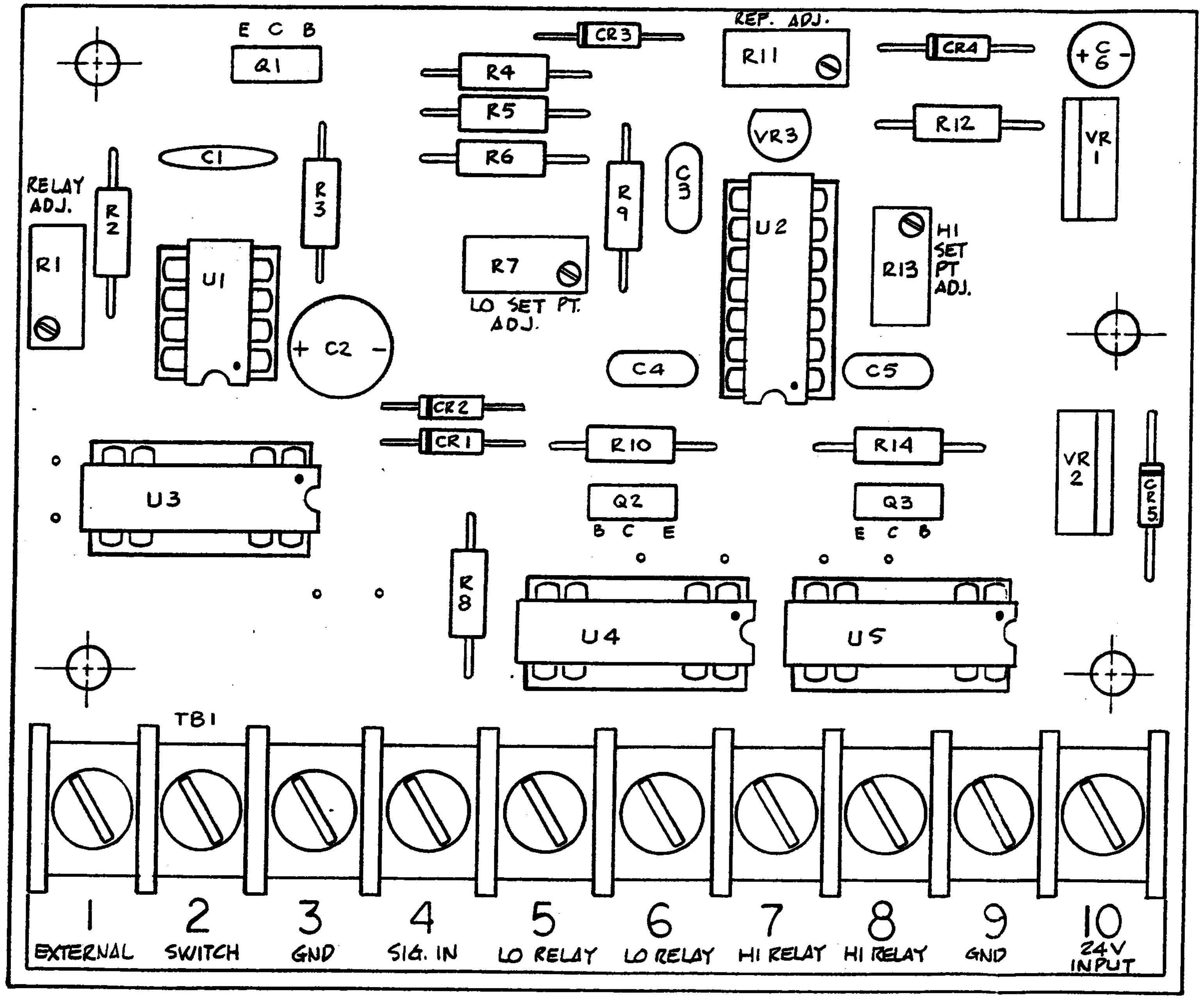
| DWG SIZE | DWG NO. | REV. |
|---|---|---|
| C | 420006 | B |

SCALE 2:1 — SHEET 1 OF 1

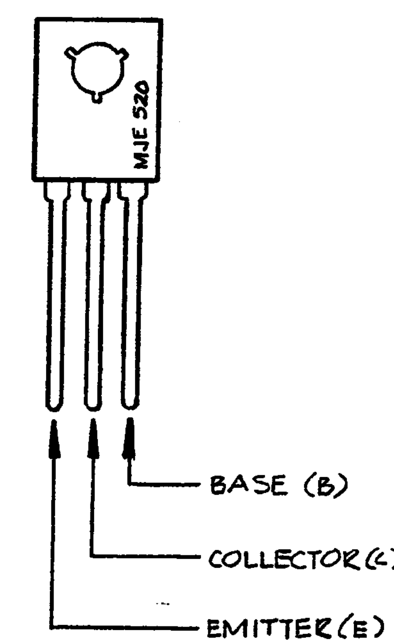
BISHOP GRAPHICS/ACCUPRESS REORDER NO. A36294

| PART NO. | DESCRIPTION |
|---|---|
| -01 | DUAL ALARM W/O TIMER ( DO NOT STUFF U1, U3, CR1, CR2, C1, C2, Q1, R1, R2, R3 ) |
| -02 | DUAL ALARM W/ TIMER ( STUFF ALL ) |

| REVISIONS | | | |
|---|---|---|---|
| REV. | DESCRIPTION | DATE | APVD |
| A | UPDATED AND NOTES ADDED | 7-10-85 | AQ/DT |
| B | REVISED PER ECO #A47214, A1147002, A1247002 | 9-8-88 B.SAXON | 9-20-88 |




TRANSISTOR IDENTIFICATION




| REF. DEG. | DESCRIPTION | QTY. |
|---|---|---|
| U4,5 | IC SIGMA RELAY #191TE1A1-5S OR #191TE1C1-5S | 2 |
| U3 | IC SIGMA RELAY #191TE1C1-5S | 1 |
| U2 | IC OP-AMP LM 324 | 1 |
| U1 | IC 555 TIMER | 1 |
| R9,12 | RESISTOR .5Ω, MF, 5% | 2 |
| R4 | RESISTOR 4.99 KΩ, MF, 1% | 1 |
| R3,5,6,8 | RESISTOR 10 KΩ, MF, 1% | 4 |
| R2,10,14 | RESISTOR 1 KΩ, MF, 1% | 3 |
| R7,11,13 | POTENTIOMETER 20 KΩ | 3 |
| R1 | POTENTIOMETER 500 KΩ | 1 |
| C6 | CAPACITOR 10 µf, 25 V, ELEC. | 1 |
| C3,4,5 | CAPACITOR .02 µf, 50 V MYLAR | 3 |
| C2 | CAPACITOR 100 µf, 16 V, ELEC. | 1 |
| C1 | CAPACITOR .01 µf, 50V, CER. | 1 |
| CR5 | DIODE IN4001 | 1 |
| CR1,2,3,4 | DIODE IN4148 OR IN914 | 4 |
| Q1,2,3 | TRANSISTOR MJE 520 | 3 |
| VR3 | " 2.5V LM336 | 1 |
| VR2 | " 5V (7805) | 1 |
| VR1 | VOLTAGE REGULATOR 12V (7812) | 1 |
| TB1 | TERMINAL BLOCK 10 TERMINALS. | 1 |
| | 8 PIN DIP SOCKET | 1 |
| | 14 PIN DIP SOCKET | 4 |
| | 112 DUAL ALARM PCB | 1 |

PARTS LIST

NOTES:

1. THIS DWG. TO BE USED IN CONJUNCTION W/ SCHEMATIC DIAGRAM DWG. # 300026
2. LAST REF. DEG. USED ARE: TB1, VR3, Q3, CR5, C6, R14, & U5.

KURZ INSTRUMENTS INC.

SCALE : 2/1
TOLERANCE
.XX ± .01
.XXX ± .003

| | | |
|---|---|---|
| DRN BY: DTrinh | 11-2-84 | PCB, ASSY, 111R1 |
| CHKD: Guerra | 7-15-85 | |
| APVD: | 7/15/85 | |
| B | 420099 | REV. B SHT 1 OF 1 |

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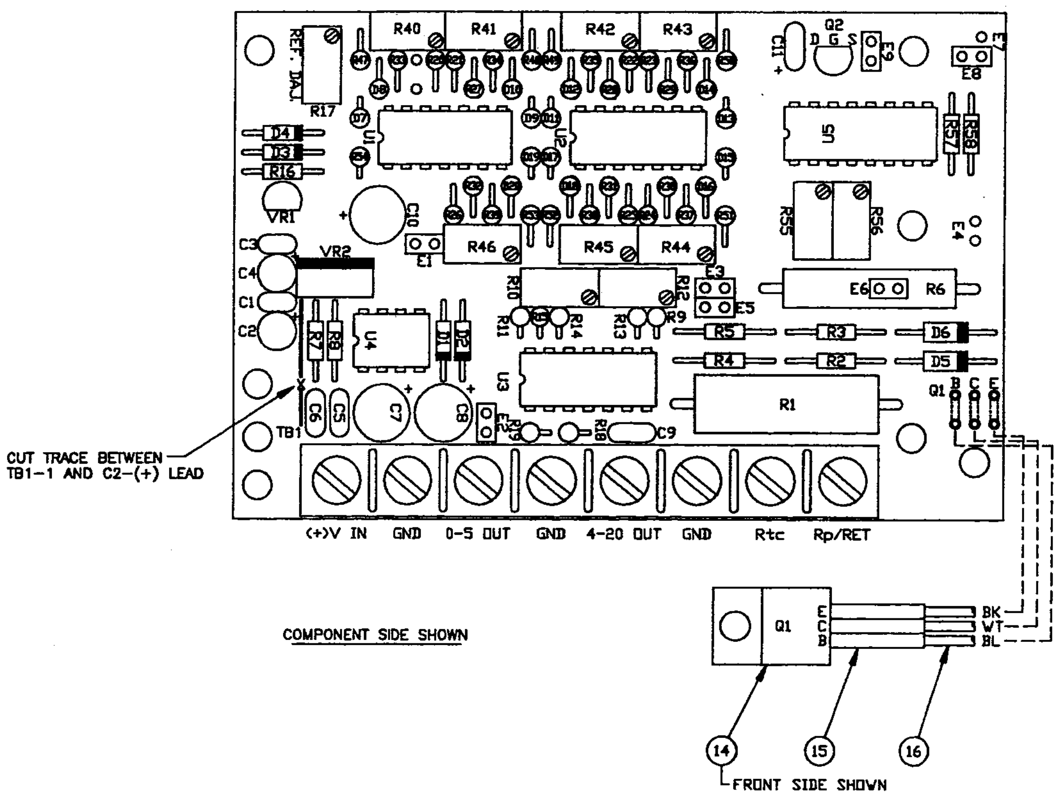
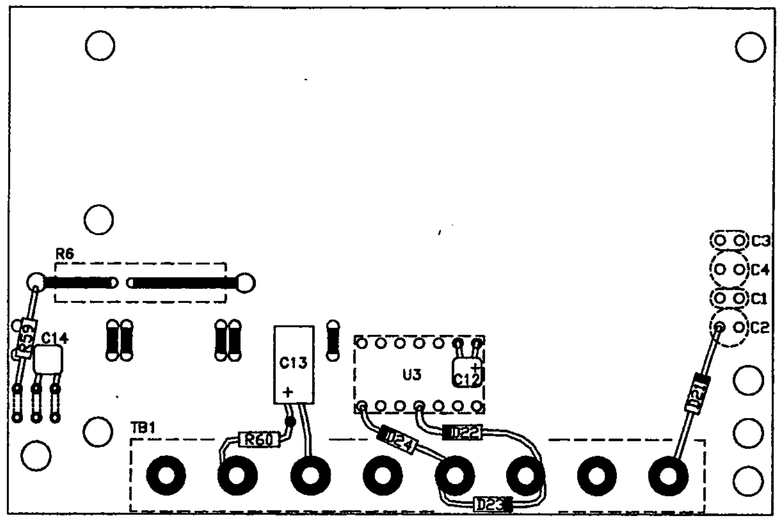
| REVISIONS | | | | | |
|---|---|---|---|---|---|
| REV. | DESCRIPTION | BY | CHKD | APRVD | DATE |
| A | REVISED PER ECO #A47214,A43647001 | B.S. | DT | DT | 9.9.88 |
| B | REVISED PER ECO #47275 | T.E. | DT | DT | 4.7.89 |
| C | REVISED PER ECO #47781 | AC | TE | TE | 7.17.91 |
| D | REVISED PER ECO No. 47857 | D.T. | BKK | BC | 11.1.91 |


COMPONENT SIDE SHOWN




ASSEMBLY FROM SOLDER SIDE

| QTY. | PART No. | REF. DES. | DESCRIPTION | ITEM |
|---|---|---|---|---|
| 1 | 330015 | U5 | IC, CONV, 4-20mA, #XTR110BG. | 62 |
| 1 | | R13 | RESISTOR, SELECTED. (SPAN) | 61 |
| 1 | | R11 | RESISTOR, SELECTED. (ZERO) | 60 |
| 5 | | R1-5 | RESISTOR, SELECTED. (TEMP. COMP.) | 59 |
| 2 | 580027 | D5,6 | SEMI, DIODE, 1N5346B, 9.1V, 5W. | 58 |
| 1 | 540549 | R6 | RESISTOR, OHMITE, 15 OHM, 5W. | 57 |
| | | | | 56 |
| | | | | 55 |
| 1 | 540221 | R60 | RESISTOR, METF. 30.1 K OHM, .125 W. | 54 |
| 1 | 540097 | R59 | METF. 4.99 K OHM, .125 W | 53 |
| 1 | 540223 | R58 | METF. 31.6 OHM, .125 W. | 52 |
| 1 | 540264 | R57 | METF. 49.9 K OHM, .125 W. | 51 |
| 2 | 540568 | R55,56 | POT. TRIMMER, 100 K OHM. | 50 |
| | | | | 49 |
| 7 | 540581 | R33-39 | CARB. .5 OHM .250 W. | 48 |
| 1 | 540199 | R32 | METF. 23.2 K OHM, .125 W. | 47 |
| 1 | 540215 | R31 | METF. 28.0 K OHM, .125 W. | 46 |
| 1 | 540234 | R30 | METF. 35.7 K OHM, .125 W. | 45 |
| 1 | 540257 | R29 | METF. 46.4 K OHM, .125 W. | 44 |
| 1 | 540292 | R28 | METF. 69.8 K OHM, .125 W. | 43 |
| 1 | 540346 | R27 | METF. 140 K OHM, .125 W. | 42 |
| 8 | 540187 | R15,20-26 | METF. 20.0 K OHM, .125 W. | 41 |
| | | | | 40 |
| 8 | 540566 | R17,40-46 | POT. TRIMMER, 20 K OHM. | 39 |
| 2 | 540564 | R10,12 | POT. TRIMMER, 2.0 K OHM. | 38 |
| 1 | 540103 | R16 | METF. 5.62 K OHM, .125 W. | 37 |
| | | | | 36 |
| 1 | 540123 | R14 | METF. 9.09 K OHM, .125 W. | 35 |
| | | | | 34 |
| 12 | 540131 | R8,9,18,19,47-54 | METF. 10.0 K OHM, .125 W. | 33 |
| 1 | 540001 | R7 | RESISTOR, METF. 1.0 K OHM, .125 W. | 32 |
| | | | | 31 |
| | | | | 30 |
| 1 | 510011 | C13 | CAP, ELECT, 4.7uF, 25V | 29 |
| 2 | 510010 | C11,12 | CAP, TAN, 1.0uF, 35V | 28 |
| 3 | 510016 | C7,8,10 | CAP, ELECT, 100uF, 16V | 27 |
| 3 | 510008 | C5,6,9 | CAP, POLY, 0.02uF, 50V | 26 |
| 2 | 510014 | C2,4 | CAP, ELECT, 10uF, 35V. | 25 |
| 3 | 510006 | C1,3,14 | CAP, CER, 0.10uF, 50V | 24 |
| | | | | 23 |
| | | | | 22 |
| 1 | 580053 | VR1 | REGULATOR, LM336, 2.5V. | 21 |
| 1 | 580059 | VR2 | REGULATOR, LM7815, (+)15V. | 20 |
| 1 | 580017 | D24 | DIODE, 1N5242B, 12V, ZENER | 19 |
| 3 | 580002 | D21-23 | DIODE, 1N4001 | 18 |
| 1 | 580052 | Q2 | TRANSISTOR, DMOS, FET, #VP0116N3 | 17 |
| 1/2FT | 290127 | Q1 | WIRE, TFZ, 22GA., TWIST | 16 |
| 1/8FT | 250007 | Q1 | HEATSHRINK, BLACK, 1/8" O.D., 1/2" LG. | 15 |
| 1 | 580085 | Q1 | TRANSISTOR, TIP41A | 14 |
| 18 | 580001 | D1-4,7-20 | DIODE, 1N4148 | 13 |
| | | | | 12 |
| 1 | 610019 | U4 | IC, ANA, TIMER, LM555. | 11 |
| 1 | 610032 | U3 | IC, ANA, QUAD OP-AMP, LT1014 | 10 |
| 2 | 610003 | U1,2 | IC, ANA, QUAD OP-AMP, LM324 | 9 |
| | | | | 8 |
| | | | | 7 |
| 7 | 460218 | E1-3,5,6,8,9 | CON, 2 PIN. | 6 |
| | | | | 5 |
| | | | | 4 |
| | | | | 3 |
| 1 | 460228 | TB1 | CON, TERMINAL BL, 8 PIN | 2 |
| 1 | 420142 | | PCB, FAB, 437. | 1 |

PARTS LIST

NOTES:

1. FOR SCHEMATIC DIAGRAM SEE DWG. #300060
2. D7-D20 TO BE ASSEMBLED WITH CATHODE TO PCB. (SEE DETAIL A)
3. R1,R6,D5,D6 TO BE ASSEMBLED WITH 1/8"±1/16" FROM PCB.
4. (REMOVED)
5. CUT Q1 LEADS TO 5/16"±1/16" BEFORE SOLDERING TO WIRES.
6. (REMOVED)
7. (REMOVED)
8. PARTS TO BE ASSEMBLED AS REQUIRED BY KURZ

| | | | | |
|---|---|---|---|---|
| NEXT ASSEMBLY | UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES | APPROVALS | | |
| | TOLERANCES ARE | DRAWN BY B.SAXON | DATE 9.9.88 | |
| | FRACTIONS ± 1/32 | CHECKED BY D.T. | DATE 9.9.88 | |
| | ANGLES ± 0°-30' | APPROVED D.T. | DATE 9.9.88 | |
| | DECIMALS .X ± 0.1, .XX ± 0.01, .XXX ± 0.005, .XXXX ± 0.0010 | | | |
| | ORIG. RELEASE DATE 9.9.88 | | | |

# KURZ INSTRUMENTS, INC.

TITLE: *PCB, ASSY, 437.*

| DWG. SIZE | DWG. NO. | REV. |
|---|---|---|
| D | 420123 | D |
| | SCALE 2 : 1 | SHEET 1 OF 1 |