KURZ
INSTRUMENTS INC.

Model 455 Industrial Air Velocity Transducers User's Guide

(with 435-R1 Analog Linearizer)

June 1989

Attention: Manual User

Please note that there has been a product change. The 465R4 and 465R5 current transmitter boards have been upgraded to a 465R6 and 465R7.

Details on the operation, installation and tests procedures for these new components are outlined in the **Addendum: Product Change Notice** *found at the end of this manual just before the appendix.*

Unit Description Sheet

Unit shipped is: ____ 455-08

____ 455-16

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 SCFM

____ 0-300 SCFM

____ 0-1,250 SCFM

____ 0-2,500 SCFM

____ 0-6,000 SCFM

____ 0-12,000 SCFM

____ Other (specify): ________________

Engineering Units: ____ SFPM

____ SCFM/ft^2

____ lbs mass/min/ft^2

____ SCFM

____ lbs/min

____ Other (specify): ________________

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

Power Supply: ____ Standard (110-115 Vac/50-60 Hz)

____ 220 Vac/50-60 Hz

____ Vdc (specify voltage): __________

Output Signal: ____ Standard (linear 0-5 Vdc)

____ 4-20 mA 4 mA = ________ 20 mA = ______

____ Other (specify): ______________________

OPTIONS: ____ Model 111 Dual Alarm Board

Sensor: ____ Teflon-Coated Sensor

____ Chrome Plated

____ Titanium

____ Sensor Safety Circuit

____ Other: ______________________________

High Temperature Applications:

____ HT Rated to 250° C

____ HHT Rated to 500° C

____ Remote Current-Transmitter Electronics

Electronics Enclosures: ____ Rack-Module, 2.8"

____ Rack-Module, 4.2"

Displays: ____ Panel-Mounted LCD

____ Rack-Module LCD

____ Remote LCD

Totalizers: ____ Panel-Mounted Totalizer

____ Rack-Module Totalizer

____ Resettable Totalizer

Other Options (specify):

____

____

____

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Document Title: *Model 455 Industrial Air Velocity Transducers User's Guide*
Document Number: 360110 Rev. B
Publication Date: June 1989

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Threadolet is a trademark of Bonney Forge, a Gulf and Western Manufacturing company.

Warranty Statement

The Kurz Model 455 Industrial Air Velocity Transducer is warranted to be free from defects in material or workmanship for one year from the date of shipment from the factory. Kurz's obligation is limited to repairing, or at its option, replacing products and components that, on verification, prove to be defective. Warranty work will be performed at the factory in Monterey, California. Kurz shall not be liable for installation charges, for expenses of buyer for repairs or replacement, for damages from delay or loss of use, or other indirect or consequential damages of any kind. Kurz extends this warranty only upon proper use and/or installation of the product in the application for which it is intended and does not cover products that have been serviced or modified by any person or entity other than Kurz Instruments Incorporated and its authorized service technicians. This warranty does not cover damaged sensors, units that have been subjected to unusual physical or electrical stress, or upon which the original identifications marks have been removed or altered.

Transportation charges for material shipped to the factory for warranty repair are to be paid for by the shipper. Kurz will return items repaired or replaced under warranty prepaid. No items shall be returned for warranty repair without prior authorization from Kurz. Call Kurz Instruments service department at (408) 646-5911 to obtain a return authorization number.

This warranty contains the entire obligation of Kurz Instruments Incorporated. No other warranties, expressed, implied, or statutory are given.

Important Notice

The MetalClad sensor used in the Model 455 Industrial Air Velocity Transducer produces heat during normal operation. The sensor is designed for use in flows of air and other **NONEXPLOSIVE** gases. The sensor should not be used in flows of explosive gases unless it is equipped with the optional sensor safety circuit described in section 4.14 of this guide. Even when so equipped, the sensor can reach temperatures sufficient to ignite explosive gases unless the temperature of the gas flow itself is kept within established limits. **DO NOT USE THIS SENSOR IN FLOWS OF EXPLOSIVE GASES WITHOUT FIRST CONTACTING KURZ INSTRUMENTS FOR DETAILED SAFETY INFORMATION. FAILURE TO HEED THIS WARNING COULD RESULT IN EXPLOSION, DAMAGE TO FACILITIES, SERIOUS INJURY, OR DEATH.**

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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, a Quick Set-Up Guide, and an index. The book is not designed to be read cover to cover; rather, it is designed to present information to the 455 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 Model 455 Industrial 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 455. 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 consists primarily of 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 455 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 Model 455. 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 455. This section explains how to determine the correct location for installation, as well as how to perform the physical installation in pipes, stacks, and flat or round ductwork. You should read thoroughly the parts of this section that apply to your installation before you install the 455. **You may also want to read Section 5, "Testing ," before you install the 455.**

Section 3: Operation and Maintenance

This section explains how to calculate actual velocities from the standard velocities reported by the 455, how to recalibrate the unit, and how and when to clean the sensor. Refer to this section as needed.

Section 4: Options

This section lists and explains most of the options available with the 455. Contact Kurz Instruments for a complete, up-to-date list of available options.

Section 5: Testing

This section explains two tests you can perform on the 455 to determine whether or not it is operating properly. Although the 455 is thoroughly tested before it leaves the factory, you may want to run the tests described in Section 5 to make sure that the unit has not been damaged in transit. Whether or not you do so depends largely on your judgment of the complexity of your installation: If installation and possible later removal are relatively easy, it probably makes more sense to go ahead and install the unit without extensive preinstallation testing. If your installation is a difficult one, and removing the unit later for testing would be more time consuming than the testing procedures themselves, you should probably test before you install.

Appendix A: Component Layout and Schematic Drawings

The appendix contains detailed component layout drawings and circuit diagrams of the various components of the 455. This information is not needed by most 455 users in routine operation of the unit. It is provided as an aid to those users who want to perform more detailed maintenance and testing operations than those described in sections 3 and 5.

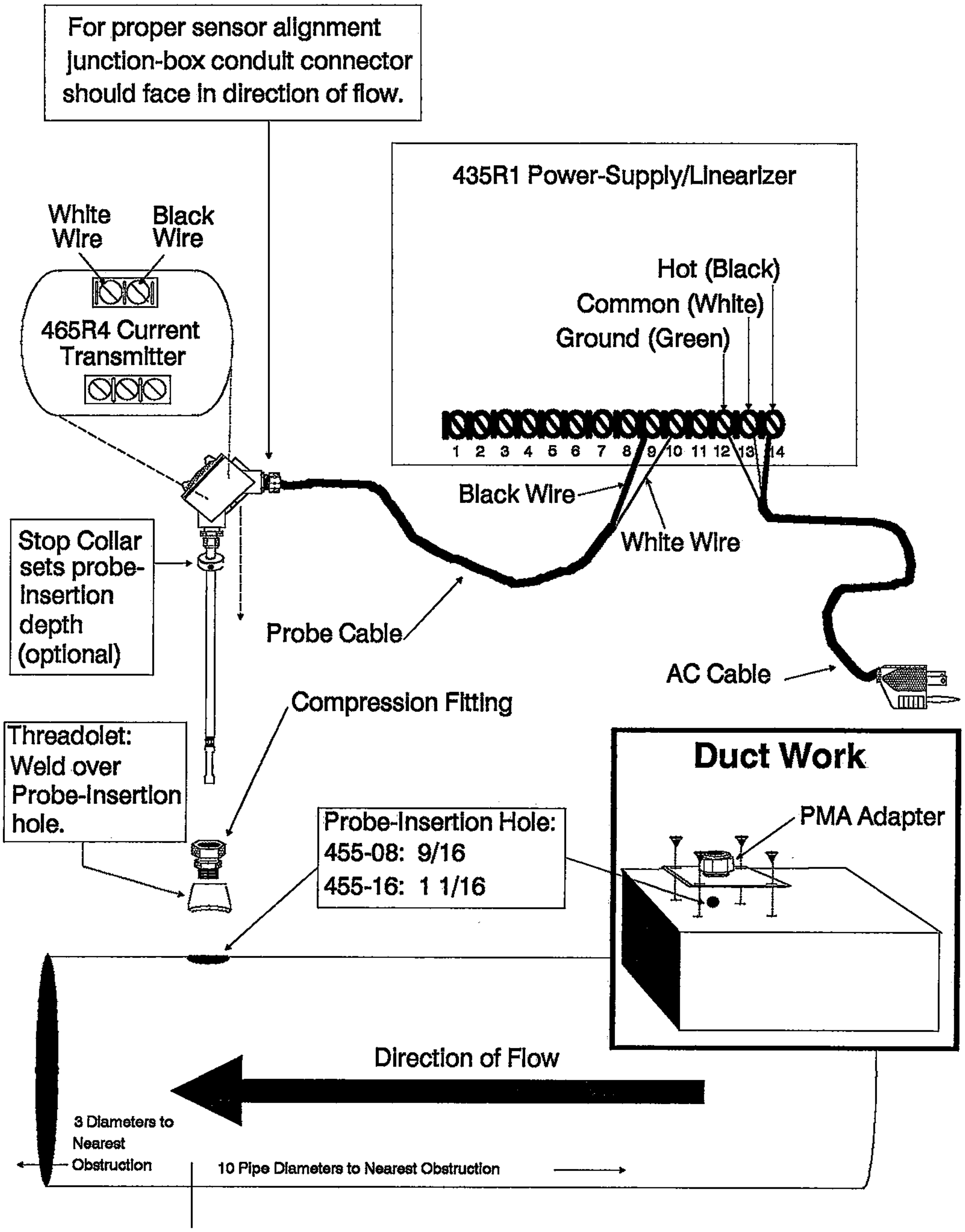
About the Art in This Book

The computer-generated art in the main sections of this book is intended to illustrate particular points under discussion. It includes only as much detail as is relevant to the discussion at hand. No attempt has been made to accurately scale these drawings or to include details not under discussion in the text that precedes and follows each drawing. If you need more detailed and precise visual information, refer to Appendix A, which contains reproductions of actual engineering drawings.

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 455. Kurz Instruments recommends that you read the manual before attempting installation.

Important Note: Do NOT install the junction box close to a hot duct or stack. The ambient temperature around the junction box should not exceed 50° C.



Section 1: Product Overview

This section contains a general description of the Model 455-08 and 455-16 Industrial Air Velocity Transducers. It explains how the transducers work and lists their features and specifications.

1.1 Description

The Model 455 Industrial Air Velocity Transducer is designed to monitor the flow of air or other gases within pipes, stacks, flues, ductwork, and similar enclosed channels. It is extremely rugged and resistant to contamination, and is therefore particularly suitable for hot, dirty, or corrosive industrial environments.

The 455 is available in two sizes to suit a wide range of applications:

- The 455-08 is generally for monitoring velocity in lines from a minimum of four inches in diameter up to approximately 24 inches in diameter (or in ducts up to 24 inches across in their smaller dimension).

- The 455-16 is generally for lines from 24 to 72 inches in diameter (or ducts from 24 to 72 inches across), but can be used in lines down to a minimum of six inches. See Kurz EVA 4000 product information for larger multipoint applications.

Both the 455-08 and the 455-16 consist of the same basic components:

- MetalClad™ all-metal flow sensor mounted in a protective window at one end of the probe

  NOTE: The sensor shipped with your 455 was specifically matched to your unit's electronics during factory calibration. Sensors are **not** interchangeable between different 455s.

- 316 stainless steel probe support

- Two-wire current transmitter housed in a weatherproof aluminum junction box at the other end of the probe support

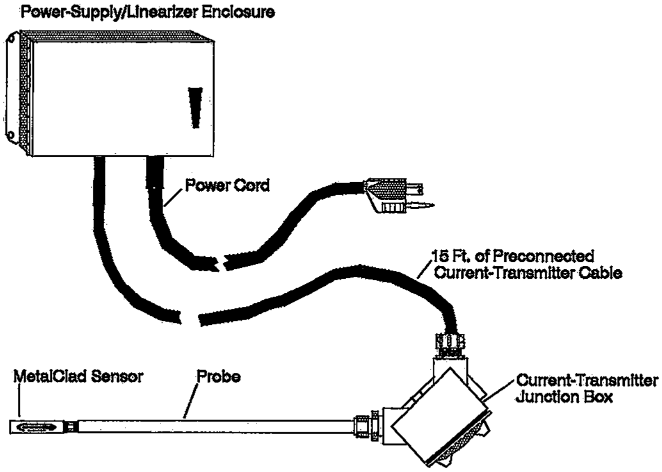
- Power-supply/linearizer unit housed in a steel enclosure with mounting brackets

The only significant difference between the 455-08 and the 455-16 is the size of the probe support. The 455-08 probe is 0.5 (8/16) inch in diameter and 24 inches long (24-inch probe length is standard; other lengths can be ordered). The 455-16 probe is 1.0 (16/16) inch in diameter and 60 inches long (60-inch probe is standard; other lengths can be ordered).

All information is this guide applies equally to the 455-08 and the 455-16 unless specifically identified as applying only to one or the other.

Figure 1-1 shows the basic components of the 455-08 with the standard probe.

Figure 1-1. *455 Basic Components*

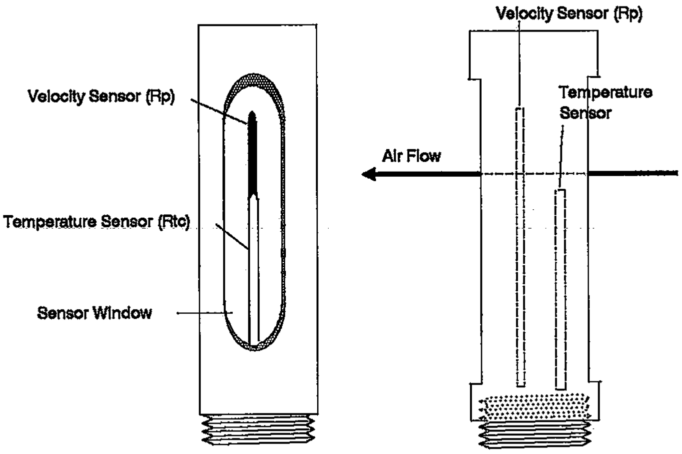


1.2 How the Sensor Works

The 455's MetalClad sensor is in fact two sensors in one: a temperature sensor and a velocity sensor. Both sensors consist of reference-grade platinum windings wound around a ceramic mandrel and enclosed in a single stainless steel sheath. The temperature sensor (R_{tc}) is the shorter of the MetalClad's two sensor elements. The velocity sensor (R_p) is the longer of the two elements.

Figure 1-2 shows a close-up view of the MetalClad sensor within its protective sensor window.

Figure 1-2. *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 MetalClad sensor's standard rating is for nonexplosive gases. If you plan to use it in flows of explosive gases, Kurz strongly recommends that you purchase the optional probe safety circuit (described in Section 4.14). That circuit prevents the velocity sensor from ever reaching the ignition temperature of a specified explosive gas, provided the temperature of the gas flow itself is kept within appropriate guidelines. Contact Kurz Instruments for more information on using the MetalClad 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 455.

Because the sensor is directly measuring mass flow (i.e., the number of molecules carrying heat away from the velocity sensor), it is calibrated in **standard** units, which are referenced to a temperature of 25° C and atmospheric pressure of 760 mm Hg. In other words, air at 25° C and 760 mm Hg, flowing at 100 feet per minute (FPM) will produce a reading of 100 **standard** feet per minute (SFPM)[1]. A 100 FPM flow at a different temperature or pressure produces a reading in SFPM that accurately compensates for the temperature or pressure differential.

The temperature and velocity sensors form two legs of a balanced Wheatstone bridge. The bridge circuitry itself is contained in the current-transmitter junction box at one end of the probe.

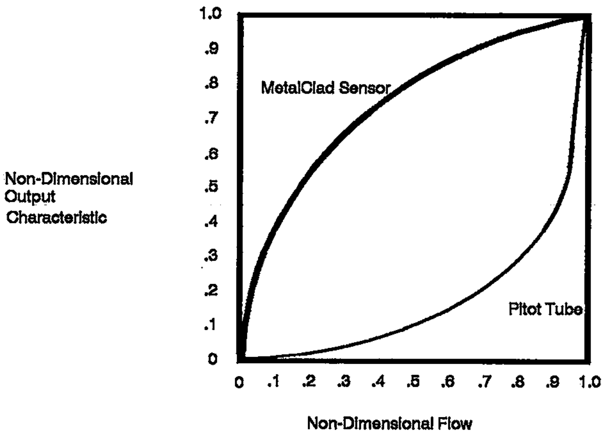
The printed circuit board (PCB) housed in the power-supply/linearizer unit has two main functions: to supply direct-current (dc) power to the current transmitter and to transform the nonlinear current draw received from the MetalClad sensor into a linear 0-5 volt dc (Vdc) signal.

The signal received from the sensor is nonlinear in that the amount of power needed to maintain the velocity sensor's overheat is not directly proportionate to the velocity of the airflow. Instead, the power-consumption curve is fairly steep at low flow rates and relatively flatter at higher rates of flow. Figure 1-3 shows the MetalClad sensor's output curve as flow increases. Figure 1-3 also shows the corresponding curve for a pitot-tube type sensor. Note the greatly superior sensitivity of the MetalClad sensor at low flow rates.

---

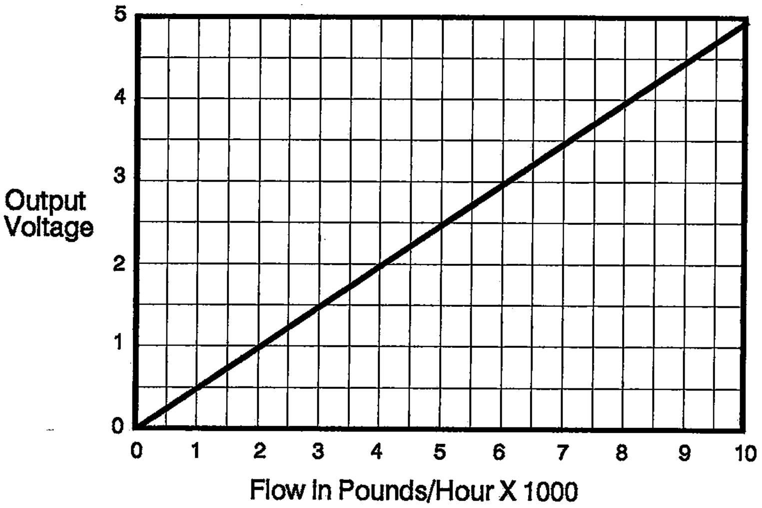
[1] Standard 455 calibration is in SFPM. Other engineering units are also available--refer to Section 4, "Options".

Figure 1-3. *Sensor Output vs Flow*



The linearizer converts the nonlinear draw 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 1-4.

Figure 1-4. *Linearized Output*



1.3 Features and Specifications

Some of the outstanding features of the 455 are summarized below:

Rugged Construction

The MetalClad sensor, with its 316 stainless steel sheath, is virtually indestructible in normal use. It is highly resistant to both dirt and corrosion; unlike pitot-tube and orifice-plate sensors, its performance is not degraded by operation in a dirty atmosphere.

Unsurpassed Accuracy

The 455's sensor windings are Resistor Temperature Detector (RTD)-type windings of reference-grade platinum 385.

Two-Wire Hookup

The 455's two-wire hookup between the current transmitter and the power-supply/linearizer unit allows for cable loop lengths of 1000 feet or more (refer to Section 2, "Installation"). The 455 also features reverse polarity protection for power input, making it almost impossible to hook the current transmitter to the power-supply/linearizer incorrectly.

Automatic Temperature and Pressure Compensation

The 455 directly measures mass flow. No computations are necessary to compensate for temperature and pressure changes.

Excellent Low-Speed Sensitivity

Unlike pitot-tube and orifice- plate sensors, the 455 can accurately measure flows down to 20 SFPM.

Convenient Linear Output

The 455's linear 0-5 Vdc output is convenient for digital panel meters, voltmeters, chart recorders, and computers. Other outputs are optionally available.

NBS-Traceable Calibration

Every 455 is factory-calibrated in a National Board of Standards (NBS) traceable wind tunnel. Packaged with your 455 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.

The specifications of the 455 are given in Table 1-1.

Table 1-1. *455 Specifications*

Sensor Construction:	Reference-grade 385 platinum RTD-type windings around a high-purity ceramic core, sheathed in 316 stainless steel
Accuracy:	+/-(2% of reading + 1/2% of full scale)
Repeatability:	+/- 0.25%
Response Time:	1 second
Calibration:	Factory calibrated in NBS-traceable wind tunnel for air at 25° C and 760 mm Hg. Includes Calibration Certificate showing output voltage vs air velocity for 11 data points, including zero flow.
Sensor Operating Temperature Range:	-55° C to +250° C standard HHT rated sensor optionally available for temperatures from -55° C to +500° C **NOTE:** Current-transmitter electronics not rated above 125° F. Specify remote-mounted electronics if the portion of the probe **outside** the pipe or duct to be monitored will be exposed to temperatures higher than 125° F. (See Section 2.5.2 for information on high-temperature installations.)
Probe Construction:	316 stainless steel

Table 1-1 (continued)

Probe Dimensions:	455-08: 1/2" outside diameter; 24" length standard; lengths from 3" to 48" optionally available 455-16: 1" outside diameter; 60" length standard; lengths from 12" to 72" optionally available
Current Transmitter Enclosure:	Weatherproof aluminum junction box. Rated for hazardous environments: Class I groups C & D; Class II groups E, F, & G.
Electronics Hookup:	Two-wire twisted pair. Reverse polarity protection.
Power-Supply/Linearizer Enclosure:	8" x 6" x 4" NEMA-type steel enclosure with mounting brackets; green hammertone enamel finish. (When optional modules such as digital displays or totalizers are included, a larger enclosure may be used.)
Output:	Linear 0-5 Vdc standard. Isolated and nonisolated 4-20 mA outputs optionally available. For other nonstandard outputs, consult factory.
Power Supply:	110 Vac/60 Hz standard. 220 Vac and dc powered models optionally available.

End of Section 1

Section 2: Installation

This section explains how to install your Model 455 Industrial 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 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 455 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.

2.1.1 455 Without Options

If you ordered your 455 without any options, the contents of the shipping carton should be as shown in Figure 1-1, "455 Basic Components."

Check inside the power-supply/linearizer unit and remove any desiccant or other packaging material you find there.

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.")

2.1.2 455 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.

Unless you ordered your 455 with the rack-module electronics option, the contents of the shipping carton include a NEMA-type box housing the power-supply/linearizer unit. Check inside this unit and remove any desiccant or other packaging material you find there.

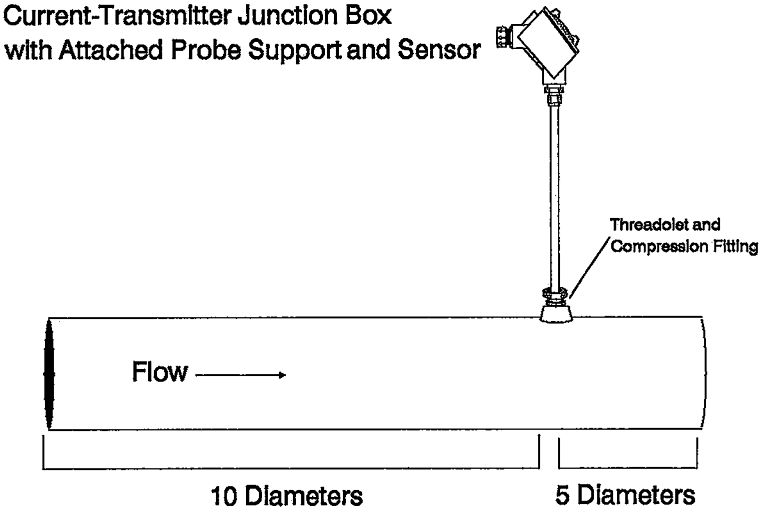
If the contents of the shipping carton are correct, proceed with the installation. (If you prefer to test the unit before you install it, refer now to Section 5, "Testing.")

2.2 Determining Probe Location

If possible, you should locate the probe at least three pipe or duct diameters upstream and ten diameters downstream from the nearest bend, elbow, or other obstruction in the pipe or duct to be monitored. The chosen location should also provide sufficient clearance for inserting and removing the 455 probe; that is, the clearance between the pipe or duct and any obstruction should equal at least the length of the probe, plus the current-transmitter junction box, plus two or three inches for maneuver. Correct probe location is illustrated in Figure 2-1.

Important Note: The electronic components on the 437 board are not warranted to operate above 70° C. Therefore we recommend that you do not place the junction box close to hot ducts or pipes. Provide sufficient clearance between the duct or stack and the junction box so that the ambient temperature around the junction box is less than 50° C.

Figure 2-1. *Probe Location*



2.3 Determining Probe Insertion Depth

Because the 455's MetalClad 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.

2.3.2 Half-Traverse Averaging

You can, with a fair degree of accuracy, determine the average velocity within a pipe or duct, and a specific point at which velocity closely approximates that average, by traversing the sensor once across the center line of the pipe or duct, from the far wall to the center[1]. 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 2-2). 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 a point to monitor for each area (see Figure 2-2).

Step 3: Drill a hole in the pipe or duct 1/16-inch larger in diameter than the probe (9/16" for the 455-08; 1 1/16" for the 455-16).

Step 4: Insert the probe into the pipe or duct and take a velocity reading at each of the points selected at Step 2.

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 MetalClad sensor is unobstructed.

Step 5: Compute an arithmetic average of the readings obtained at Step 4.

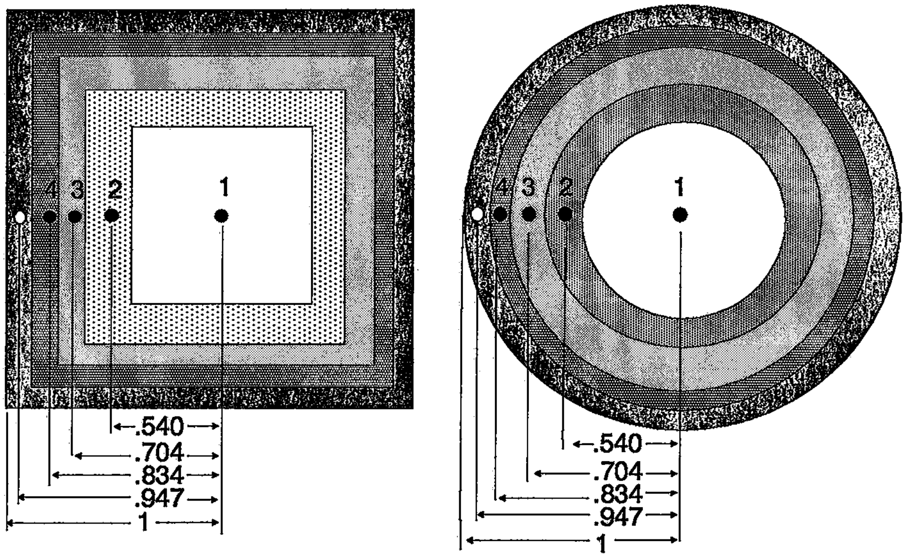
[1] If the size of the pipe or duct is such that the probe will not reach all the way across it, you can perform the traverse from the center to the near wall. In that case, however, you should omit the reading nearest the wall of the pipe or duct (see Figure 2-2) because that reading may be influenced by turbulence or leakage caused by the probe-insertion hole.

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.

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 2-1 shows an example of averaging readings from a duct like one of those shown in Figure 2-2.

Table 2-1. *Half-Traverse Velocity Averaging Example*

Point	Velocity Reading (SFPM)
1	1000
2	950
3	800
4	700
5	500
Total:	3950
Average:	790

In the example, the average velocity from the five points sampled is 790 SFPM. Point 3, with a measured velocity of 800 SFPM, is closest to the average velocity. You would therefore permanently mount the 455 with its probe inserted to the correct depth to align the sensor with Point 3.

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)[1].

Step 3: Drill two holes in the pipe or duct at right angles to each other. Each hole should be 1/16-inch larger in diameter than the probe (9/16" for the 455-08; 1 1/16" for the 455-16).

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.[2] 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 MetalClad sensor is unobstructed.

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[1] 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.

[2] 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.

Step 5: Compute an arithmetic average of the readings obtained at Step 4. Count the single Point-1 reading four times in determining the average.

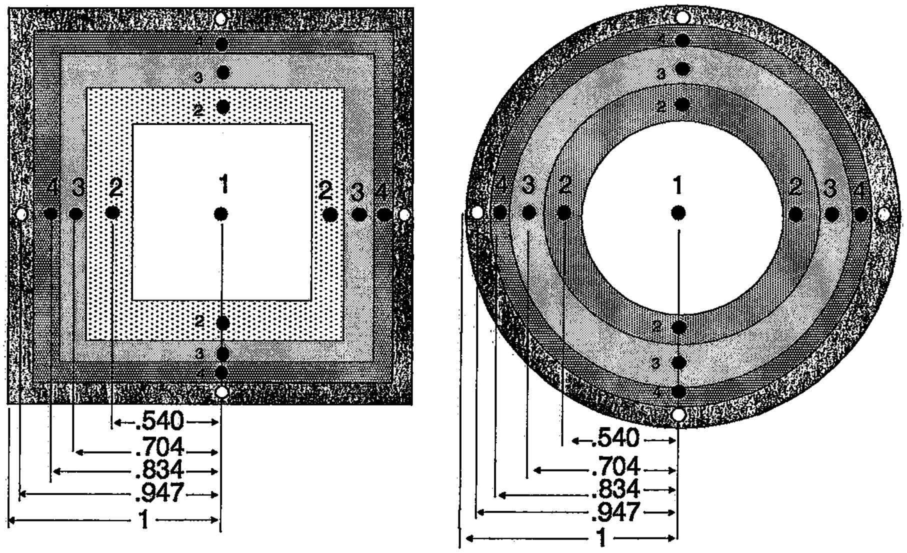
Step 6: Select the point at which you will permanently mount the sensor. This should be the point whose velocity reading most nearly approximates the average velocity computed at Step 5.

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.

Step 7: Be sure you seal the probe-insertion hole that will **not** be used when you permanently mount the probe.

Figure 2-3 shows cross sections of both square and round ducts, each with five areas and 17 monitoring points for a double-traverse averaging operation.

Figure 2-3. *Equal-Area Double Traverse*



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[1] 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 455 with its probe inserted to the correct depth to align the sensor with the bottom Point 4.

If you find that the flow profile within the pipe or duct you are monitoring changes, or if you cannot find a single point that closely enough approximates the computed average velocity, you may want to consider moving to a multi-point, multi-sensor velocity averaging array such as the Kurz EVA 4000.

---

[1] Point 1 is counted four times.

2.4 Mounting the Compression Fitting

The 455 is held in place by means of a compression fitting attached to the outside of the pipe or duct in which the probe is to be mounted. The hardware and procedures necessary to attach the compression fitting vary, depending on whether the installation is for a pipe (or stack) or for a sheet-metal duct. Installations of both kinds are described below.

2.4.1 Pipe/Stack Mounting

All hardware needed to mount the 455 in a pipe or stack is readily available from most hardware supply dealers. You can, however, order the necessary hardware from Kurz Instruments if you want to.

You will need:

- **Threadolet™ carbon steel coupler**[1]. If you order the Threadolet from Kurz, you must specify the size of NPT (National Pipe Thread) pipe the Threadolet is to be welded to, as well as the wall thickness of that pipe (Schedule 40, 80, etc.). If you are installing a 455-08, the Threadolet you use must accept a 1/2"- to-1/2" MNPT (Male National Pipe Thread) tube compression fitting. If you are installing a 455-16, the Threadolet you use must accept a 1"-to-1" MNPT tube compression fitting.

- **Tube compression fitting**[2]. If you are installing a 455-08, use a 0.5" AD 0.5" fitting. For a 455-16, use a 1" AD 1" fitting.

- **Adjustable stop collar with setscrew (optional).** You can attach a stop collar to the 455 probe to ensure that the probe is not inserted beyond the appropriate depth.

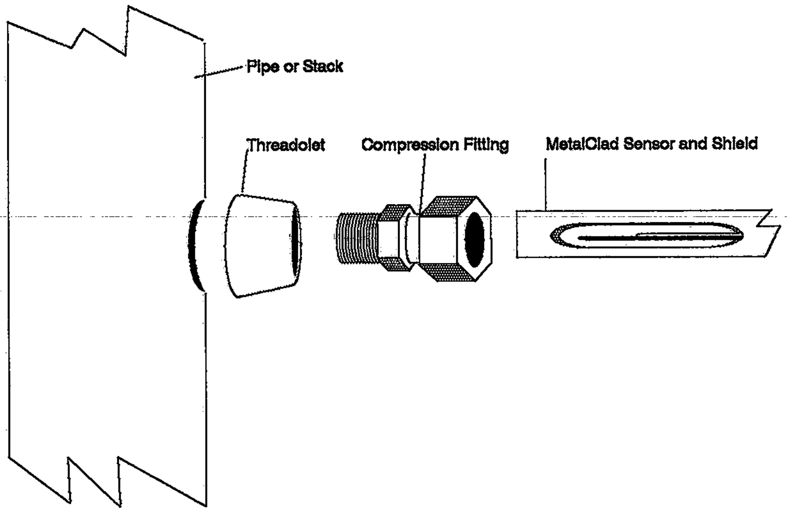
Figure 2-4 shows the hardware needed to mount the 455 in a pipe or stack.

---

[1] Threadolet fittings are also available in aluminum and stainless steel.

[2] Standard compression fitting is brass. Compression fittings are optionally available in 304 stainless steel with teflon ferrules.

Figure 2-4. *Mounting Hardware, Pipe/Stack*



Weld the Threadolet coupler directly over the probe-insertion hole in the pipe in which you are installing the 455 (refer to Section 2.2 for determining the location of the probe-insertion hole). Then thread the tube compression fitting firmly into the coupler.

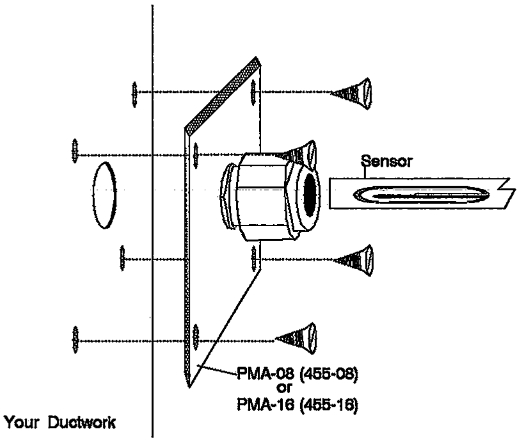
2.4.2 Duct Mounting

To mount the 455 in a duct constructed of thin-wall sheetmetal, order the appropriate mounting adapter from Kurz Instruments.

For installation of a 455-08 in flat ductwork, order mounting adapter PMA-8. To install a 455-16, order mounting adapter PMA-16. Each mounting adapter consists of a compression fitting of the appropriate size welded to a 3"-by-3" steel plate with four corner mounting holes, as shown in Figure 2-5.

Curved probe mounting adapters (CPMA) are also available for curved ductwork. Specify CPMA-08-*radius* for the 455-08, CPMA-16-*radius* for the 455-16. In both cases, *radius* is replaced by the actual radius of your ductwork.

Figure 2-5. *PMA Mounting Adapter for Duct Installation*



2.5 Installing the Probe

Once you have mounted the compression fitting to the stack or duct, installing the probe consists simply of inserting the probe to the predetermined depth (see Section 2.3) and tightening the compression fitting to hold the probe in place. Using the metal stop collar is a convenient way of ensuring proper probe insertion depth.

2.5.1 Sensor Alignment

Make sure the probe is rotated such that the window of the sensor shield allows unobstructed flow of air over the sensor and the shorter R_{tc} element is upstream of the longer R_p element. One easy way to do this is to make sure that the current-transmitter junction box (which remains outside the pipe or duct) is oriented such that the conduit connection is facing directly toward the direction of flow in the pipe or duct. This ensures correct sensor orientation because the junction-box conduit connection and the sensor shield window are parallel.[1]

---

[1] When the 455 is shipped from the factory the conduit connector and the shield window are parallel. You should, however, check that this is still the case before relying on the method described.

2.5.2 High-Temperature Installations

The Model 455-08, with its 24-inch probe support, 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 current-transmitter junction box on the end of the probe support. That space helps keep the current-transmitter electronics at or below their rated temperature of 70^{o} C, even when the temperature of the flow inside the pipe or duct is substantially higher than 70o C.

The same rationale is behind the 455-16's 60-inch probe support: It allows the sensor to be positioned in the center of a 72-inch diameter pipe or duct, with approximately 24 inches of clearance left between the outside of the pipe or duct and the current-transmitter junction box. You should not try to use the 455-16 to monitor flow in pipes or ducts larger than 72 inches in diameter. Larger diameter pipes and ducts require multi-point, multi-sensor velocity averaging arrays such as the Kurz EVA 4000 or EVA 4100.

The ambient temperature at the junction box should not exceed 50° C. If the extra space provided between the outside of the pipe or duct and the current-transmitter junction box is not sufficient to keep the current-transmitter electronics at or below 70^{o}C, you must specify optional remote current-transmitter electronics (see Section 4.8).

2.6 Installing the Power-Supply/Linearizer Unit

You can install the power-supply/linearizer unit almost anywhere. The only requirements are these:

- Standard 110-volt AC power must be available. (220-volt AC units and DC units are optionally available.)
- The total resistance in the two-wire current-transmitter loop must not exceed 4 ohms[1].

---

[1] In practical terms, this requirement is met if the voltage drop from the power supply to the sensor does not exceed 4 Vdc. Therefore, you can check the voltage drop in an already-installed unit, rather than calculate resistance using Table 2-3.

The second requirement is worth looking at a little more closely. Loop resistance is primarily a function of wire size: The larger the diameter of the wire, the lower the resistance per foot of wire. You can therefore position the power-supply/linearizer unit quite a distance from the probe and current-transmitter junction box if you use sufficiently heavy wire. Fifteen feet of 18 gauge wire is supplied with the 455. If that doesn't suit your needs, consult Table 2-3 to determine the wire gauge required for the run you have in mind.

In consulting Table 2-3, there are two things you should bear in mind:

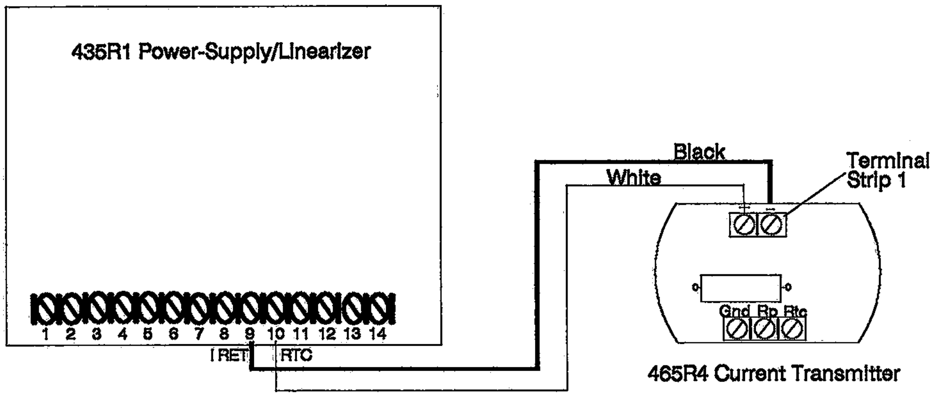
- Table 2-3 applies to stranded copper wire at 65° F. Resistance in other kinds of wire, or in stranded copper wire at different temperatures, will vary.
- American Wire Gauge (AWG) numbers are inversely proportionate to the size of wire they apply to. That is, the smallest AWG number specifies the **largest** wire and vice versa.

Table 2-3. *Approximate Loop Resistance in Current-Transmitter Wire*

AWG#	Ohms/Ft	Maximum Loop (Ft)	Maximum Run (Ft)
4	.0003	13,333	6,667
8	.0005	8,000	4,000
10	.0008	5,000	2,500
12	.002	2,000	1,000
14	.003	1,333	667
16	.005	800	400
18	.008	500	250
20	.012	333	167
22	.019	211	105
24	.030	133	67
28	.077	52	26

If you do decide to substitute current-transmitter wire of your own for that supplied with the 455, refer to Figure 2-6 for correct connections between the current-transmitter board inside the current-transmitter junction box and the power-supply/linearizer board. Note that, because of the 455's reverse polarity protection, the connections shown in Figure 2-6 can be reversed without affecting the performance of the 455. It is necessary only that the two wires from Terminal-Strip 1 of the current-transmitter board be connected to the terminal screws on the power-supply/linearizer board labeled "RTC" (terminal screw 10) and "I RET" (terminal screw 9).

Figure 2-6. *465R4 Current Transmitter to 435R1 Power-Supply/Linearizer Connections*



If you remove the supplied power cord from the power-supply/linearizer unit and instead hard-wire the unit to your power supply, connect the AC wires as follows:

- Hot wire (black) to Terminal Screw 14 (labeled "AC").
- Common wire (white) to Terminal Screw 13 (labeled "ACC").
- Ground (green) to Terminal Screw 12 (labeled with the ⏚ symbol).

End of Section 2

Section 3: Operation and Maintenance

This section describes the operation and routine maintenance of the Model 455 Industrial Air Velocity Transducer.

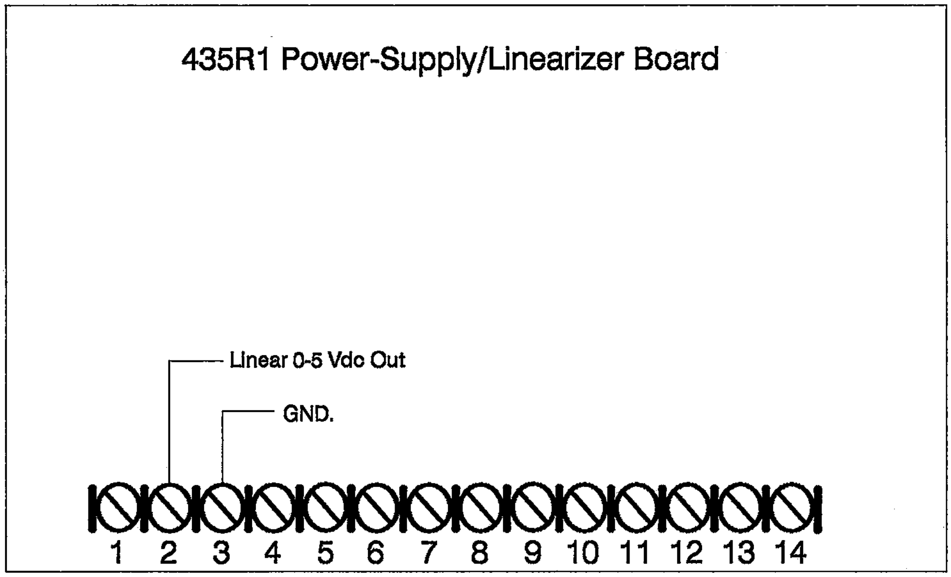
3.1 Operation

Once you have installed the 455 as described in Section 2, operation is primarily a matter of maintaining power to the power-supply/linearizer unit. 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 455 will continue to operate for prolonged periods without intervention.

3.1.1 Linear Output

To derive useful data from the operation of the 455, you must of course tap into the power-supply/linearizer unit's output. That output is a linearized 0-5 Vdc signal from Terminal Screw 2 (see Figure 3-1). Zero Vdc from Terminal Screw 2 indicates no flow over the sensor; 5 Vdc indicates the maximum measurable flow; intermediate voltages indicate intermediate flows directly proportionate to the voltage of the signal.

Figure 3-1. *Power-Supply/Linearizer Board: Linearized Output*



You can use the linearized output in a variety of ways:

- Order the power-supply/linearizer unit from Kurz Instruments with a factory-installed LCD digital panel meter (see Section 4, "Options"). You can then read the output, calibrated in the engineering units of your choice, directly from the power-supply/linearizer unit.

- Feed the output directly to your own panel meter, voltmeter, chart recorder, or computer. If you choose this option, the power-supply/linearizer unit and the device receiving its signal should be no more than 50 feet apart.

- Order your 455 with optional isolated or nonisolated 4-20 mA output (see Section 4, "Options"). This allows for almost unlimited distances between the power-supply/linearizer unit and a device receiving its signal[1].

3.1.2 Calculating Actual Velocities

For most air-flow monitoring applications, the **mass** of the flowing gas is the relevant variable. The 455's MetalClad sensor was designed with this fact in mind. The MetalClad sensor accurately registers mass flow at any temperature and pressure. Its output is therefore calibrated in standard units.

Those units are referenced to a standard temperature of 25° C (77° F) and standard atmospheric pressure of 760 mm (29.92 inches) of mercury. A velocity reading obtained for air at a different temperature and/or pressure will not be the actual velocity of that air.

Generally, standard velocity is a much more useful measurement than actual velocity. Sometimes, however, you may want to calculate the **actual** velocity of an airflow whose temperature or pressure differs significantly from the standard temperature and pressure.

---

[1] The distance is limited only to the extent that the total electrical resistance in the loop must not exceed 800 ohms.

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 Rankin (degrees R = Degrees F + 459.67).

P_a = Actual pressure in inches of mercury.

3.2 Routine Maintenance

The 455 is virtually maintenance free. The only routine maintenance operations required are recalibration and occasional cleaning.

3.2.1 Recalibration

The factory calibration of the 455 remains stable over periods of up to several years. To maintain NBS traceability, however, Kurz Instruments recommends that your 455 be recalibrated annually.You can perform the recalibration yourself or you can return the 455 to Kurz for recalibration. Unless you have an accurate in-house flow-calibration facility, it is probably preferable to return the instrument to Kurz[1].

If you do recalibrate the 455 yourself, follow the procedure described below. You will need:

- a digital voltmeter accurate to +/-.001 Vdc
- a flat-bladed screwdriver with a narrow blade and a long shaft

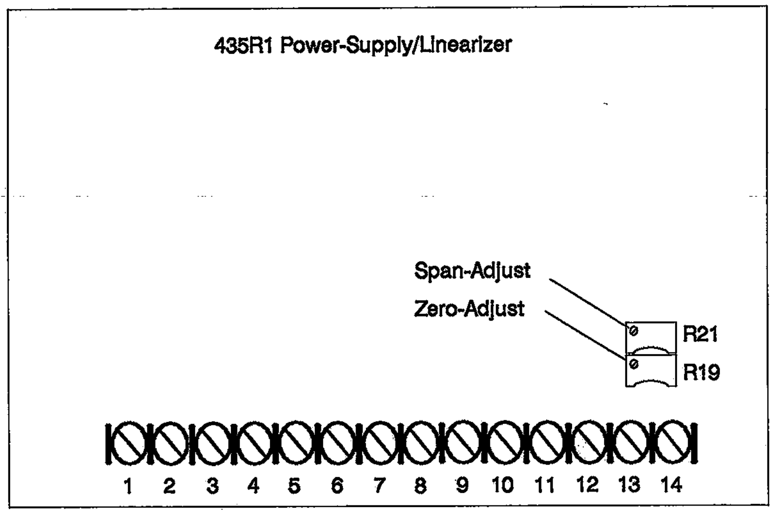
The velocity calibration procedure consists of inserting the sensor[2] in a flow of known velocity and adjusting the zero and span potentiometers on the power-supply/linearizer circuit board. Figure 3-2 shows their locations.

---

[1] If your 455 requires recalibration while still under warranty, you should return it to Kurz Instruments. Kurz will not perform a free recalibration under warranty if you have already made adjustments to zero, span, or linearization controls.

[2] If possible, perform the recalibration with the sensor in an upright position. The factory calibration is performed with the sensor in this position. Any other position may result in a slightly inaccurate zero reading because the heating effect of the velocity sensor changes slightly as its orientation changes.

Figure 3-2. *Power-Supply/Linearizer Board: Zero and Span Potentiometers*



Step 1: Set the flow velocity to 0 SFPM.

Step 2: Check the voltage between Terminal Screw 2 (linear output) and Terminal Screw 3 (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 455 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 455 is calibrated[1].

Step 4: If necessary, adjust the span-control potentiometer up or down until the voltage between terminal screws 2 and 3 is five volts.

---

[1] Remember, the 455 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

If either zero or span cannot be adjusted to its proper value using the zero-control and span- control potentiometers, the linearizer requires factory adjustment – contact Kurz Instruments.

3.2.2 Cleaning the Sensor

The 455's MetalClad sensor is far more resistant to particulate contamination than pitot tube or orifice plate sensors. Nevertheless, the 455 performs best when it is kept relatively free of contamination. You should therefore remove the probe and check the sensor at regular intervals, cleaning it if necessary.

The dirtier the flow being measured, the more frequently the sensor should be checked. In relatively clean flows it may be sufficient to check and clean the sensor annually while the probe is removed for recalibration. In very dirty flows a much shorter interval may be appropriate. If you are measuring a dirty flow, you should probably begin by checking the sensor at short intervals. You can then move to longer intervals if the sensor is not becoming heavily loaded between checks.

When the sensor does need to be cleaned, use a fine wire brush, crocas cloth, or fine grit emery cloth to remove built-up contamination from the sensor. Clean the sensor only when power is off.

Some MetalClad sensors may have small specks of excess metal adhering to their stainless steel sheaths. This is normal and in no way degrades the performance of the 455. Do not attempt to remove such specks; doing so may change the unit's calibration.

End of Section 3

Section 4: Options

This section lists and describes some of the more popular options available with the Model 455 Industrial Air Velocity Transducer. The options discussed in this section are

- Specialty Gas Calibrations
- 220 Vac/60 Hz Power Supply
- 4-20 mA Output
- Custom Probe Lengths
- HHT Very-High Temperature Sensor
- Teflon-Coated Sensor
- Dual Velocity/Temperature Sensor
- Remote Current-Transmitter Electronics
- Rack-Module Electronics Packaging
- LCD Digital Display
- Optional Engineering Units
- Totalizer
- Dual Alarm
- Sensor Safety Circuit

Other custom options may be available. Contact Kurz Instruments if you have special needs not covered by the options described in this section.

4.1 Specialty Gas Calibrations

Standard 455 calibration is for air at 25° C (77° F) and 760 mm (29.92 in) of mercury.

You can order your 455 calibrated for a gas (or gas mixture) other than air. When you order a specialty gas calibration, you specify the reference temperature and pressure, in accordance with your application. Calibrations available include those listed below. For information on the availability of calibrations for gases other than those listed, contact Kurz Instruments.

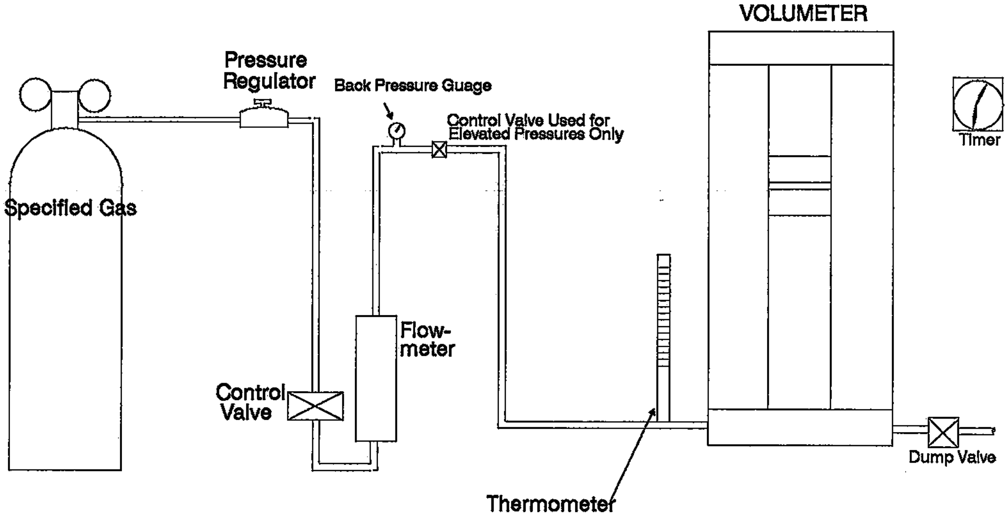
- Flue Mixtures
- Argon (A_r)
- Carbon Dioxide (CO_2)
- Carbon Monoxide (CO)
- Helium (He)
- Hydrogen (H_2)
- Nitrogen (N_2)
- Oxygen (O_2)

Specialty gas calibrations are performed for Kurz Instruments by an independent calibration laboratory. The 455 is calibrated in a flow of the specified gas at eleven data points evenly spaced between zero and maximum rated flow. An NBS-traceable certification is furnished for each instrument so calibrated. The accuracy of specialty gas calibrations is the same as that for air: +/-(2% of reading + 1/2% of full scale).

The calibration laboratory uses a liquid displacement prover for flowmeter calibration. A flow of the specified gas is directed into the calibrated prover for a precisely timed period. The volume of gas in the prover is then determined. The provers are calibrated to an accuracy of one part in 2,000, an accuracy of 0.1%.

The calibration procedure is shown in general terms in Figure 4-1.

Figure 4-1. *Specialty Gas Calibration*



4.2 220 Vac/60 Hz Power Supply

The standard 455 power supply is 110 Vac/60 Hz.

220 Vac/60Hz power supplies are optionally available.

4.3 4-20 mA Output

Standard 455 output is a linearized 0-5 Vdc signal.

Optional 4-20 milliamp (mA) output is available in both nonisolated and isolated versions. 4-20 mA output is appropriate when the distance between the power-supply/linearizer enclosure and a device receiving the linearized 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.

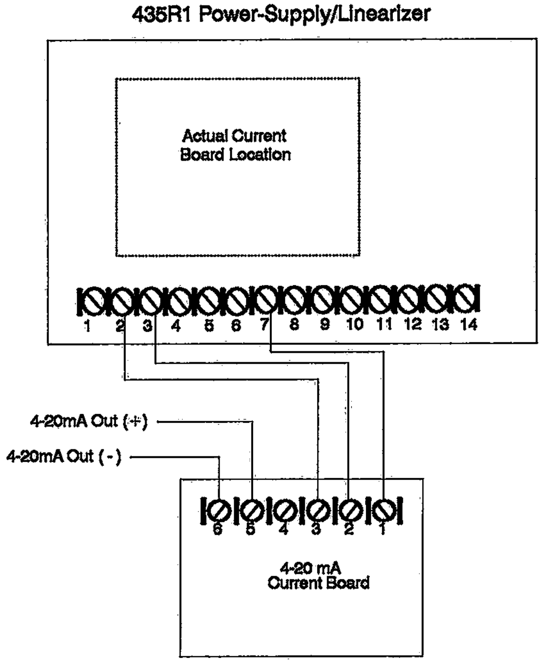
NOTE: Kurz Instruments 4-20 mA output modules are self-powered. Do not supply your own current to the 4-20 mA output loop.

4.3.1 Nonisolated

Nonisolated 4-20 mA output is appropriate when there is no need to isolate the electronics of the receiving device from the electronics of the power-supply/linearizer board. When 4-20 mA output is nonisolated, the 4-20 mA output board shares the electrical ground of the entire 455.

Nonisolated 4-20 mA output is achieved by adding the Model 131 4-20 mA current board to the power-supply/linearizer unit. The 131 board is mounted on standoffs above the main power-supply/linearizer board and is connected to that board as shown in Figure 4-2.

Figure 4-2. *4-20 mA Current Board Connections*



4.3.2 Isolated

Isolated 4-20 mA output is appropriate when it is necessary to isolate the electronics of the receiving device from the electronics of the power-supply/linearizer board.

Isolated 4-20 mA output is achieved by adding the Model 132 4-20 mA current board to the power-supply/linearizer unit. The 132 board is mounted on standoffs above the main power-supply/linearizer board and is connected to that board as shown in Figure 4-2.

4.4 Custom Probe Lengths

The standard probe length for the 455-08 is 24". Other lengths from 3" to 48" are optionally available.

The standard probe length for the 455-16 is 60". Other lengths from 12" to 72" are optionally available.

If you believe you require a probe more than 72 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.

4.5 HHT Very-High Temperature Sensor

The standard 455 MetalClad sensor is rated for temperatures from -55° C to +250° C.

The optional HHT very-high temperature MetalClad sensor is rated from -55° C to +500° C. Each HHT MetalClad sensor is paired and calibrated with a 465R5 Current-Transmitter Board instead of the 465R4 board used with the standard MetalClad sensor. The wiring interconnections between the 435R1 board and the 465R5 board are identical to the connections between 435R1 board and the 465R4 board.

In high temperature applications it is important to provide sufficient clearance or insulation between the hot duct or stack and the junction box of the 455 so that the ambient temperature around the junction box does not exceed 50° C. If this is not possible the current-transmitter electronics can be placed in a separate enclosure and mounted remote from the probe.

4.6 Teflon-Coated Sensor

The standard 455 MetalClad sensor is highly resistant to particulate contamination. For particularly dirty flows containing resinous or sticky materials, however, you may wish to order the special teflon-coated MetalClad sensor.

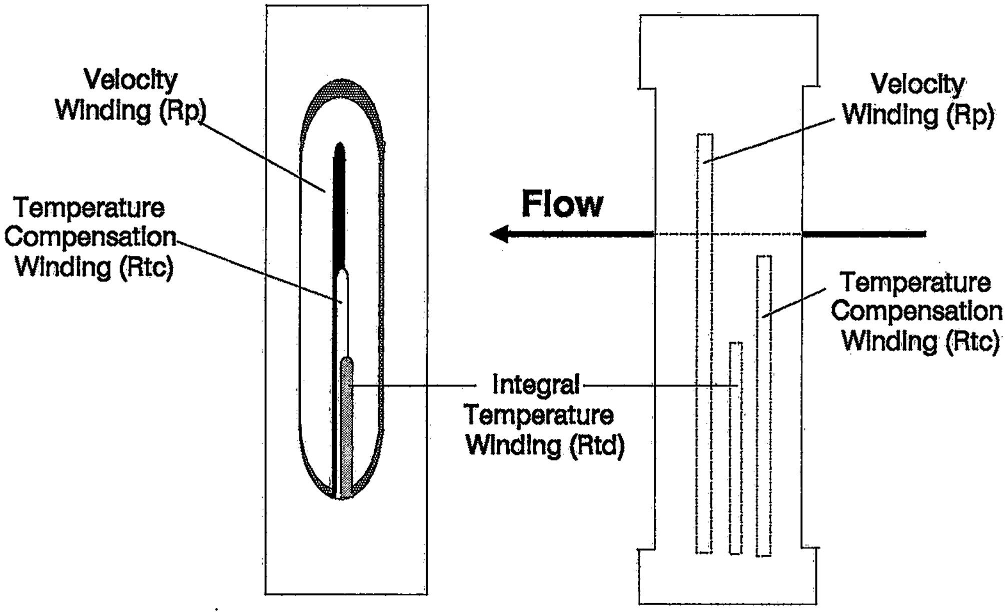
The teflon-coated sensor generally allows longer intervals between cleanings and is more easily cleaned if it does become heavily loaded with contaminants.

4.7 Temperature Option - Triple-Sting Sensor

The standard 455 MetalClad sensor contains both a velocity sensing winding and a temperature sensing winding. The standard sensor does not, however, give simultaneous output of temperature and velocity. The 455 is available with an optional triple-sting sensor with a separate output for gas stream temperature. The triple-sting sensor employs a separate sensor winding dedicated to gas stream temperature. A linear 0-5 Vdc output, proportional to the temperature range, can be used as input to an instrument of your choice. An optional panel-mounted or rack-module LCD display can be installed to indicate the temperature in degrees Fahrenheit.

455s equipped with the triple-sting sensor are identified by a "T" in their model number: 455T-08, 455T-16. Figure 4-3 shows a close-up view of the triple-sting sensor within its protective window.

Figure 4-3. *Integral Temperature Sensor: Two Views*



The velocity sensor (R_p) and the temperature sensor (R_{tc}) function exactly as they do in the dual-sting sensor to provide a velocity reading. The third winding, the integral temperature sensor, determines the temperature in the duct or stack and sends a signal through two wires to its own 604 Temperature Current-Transmitter Board. Therefore the 455-T has two current-transmitter boards inside the junction box. The velocity and temperature elements (Rp and Rtc) of the velocity sensor are connected to the 465 Current-Transmitter Board. The temperature sensor is connected to the 604 Current-Transmitter Board. However, no additional sensor windows are required because the sensor measures both temperature and velocity.

The 604 Current-Transmitter Board transmits the temperature signal (current) to the 430 Post Scaler over a two-wire connection, just as with the velocity sensor and the 465 Current-Transmitter. The 430 Post Scaler converts the current signal from the 604 to a 0-5 Vdc linear signal calculated to the temperature range you've specified at the time of purchase.

4.8 Remote Current-Transmitter Electronics

Current-transmitter electronics are normally housed in a junction box on the end of the probe support opposite the sensor. If, however, your installation is such that a current-transmitter junction box on the end of the probe support could not be kept at or below an ambient temperature of 50° C, you can order optional remote current-transmitter electronics.

Note: You should never alter the length of the wiring between the sensor and the 465 board. The sensor, 465 board, and wiring has been calibrated together to provide the most accurate measurements.

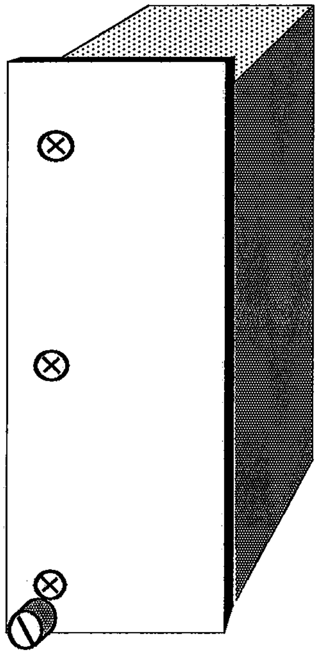
4.9 Rack-Module Electronics Packaging

The power-supply/linearizer circuit board of a standard 455 is mounted in a NEMA-type steel enclosure that measures 8" x 6" x 4".

The power-supply/linearizer board is also available in either of two rack-module packages, ready for mounting in a standard, 19"-wide by 7"-high rack chassis.

The standard power-supply/linearizer board without standoff-mounted options fits inside a 2.8"-wide rack module, shown in Figure 4-4.

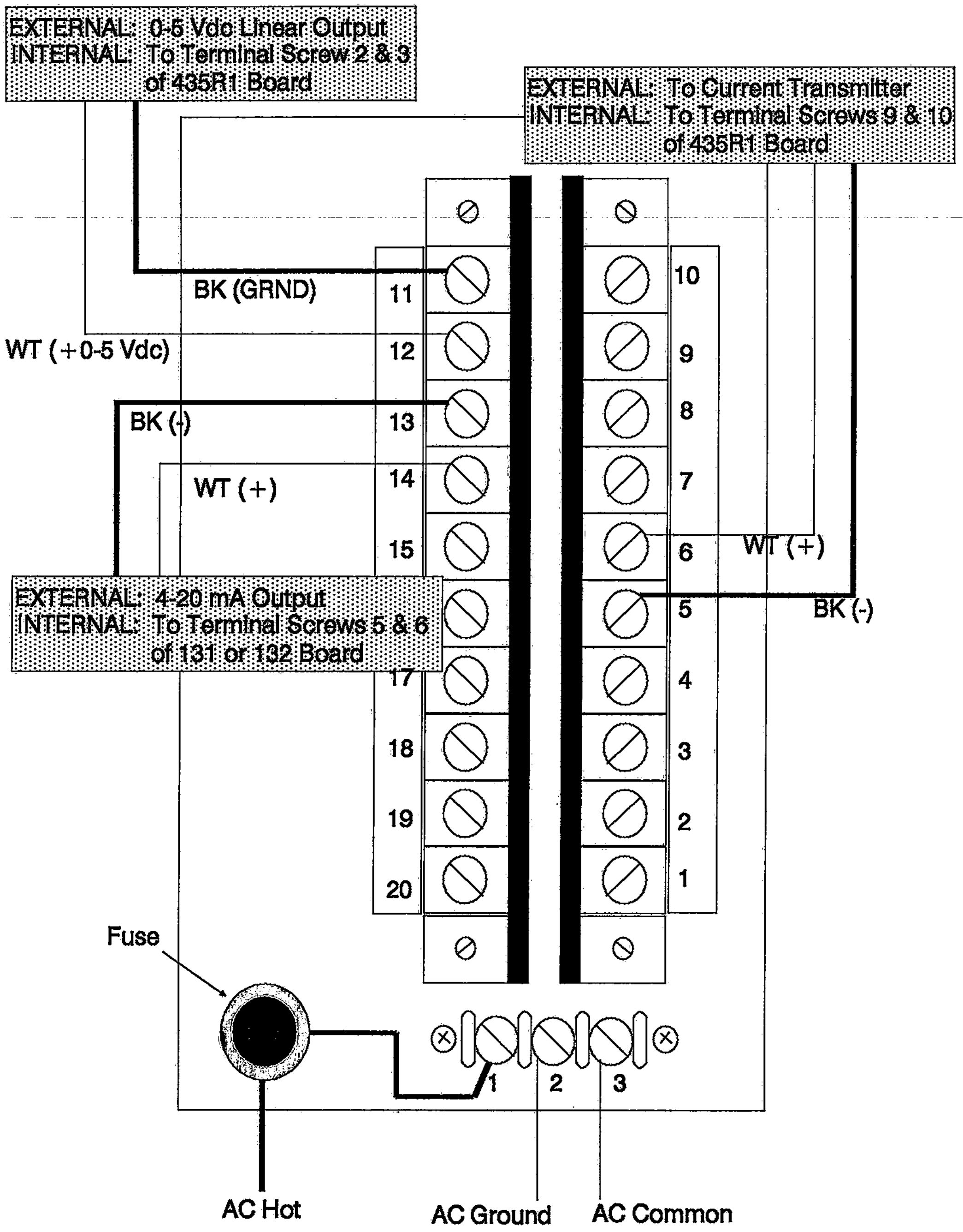
Figure 4-4. *Power-Supply/Linearizer in 2.8" Rack Module*



A power-supply/linearizer board that includes standoff-mounted options may require a 4.2"-wide rack module, depending on the options included.

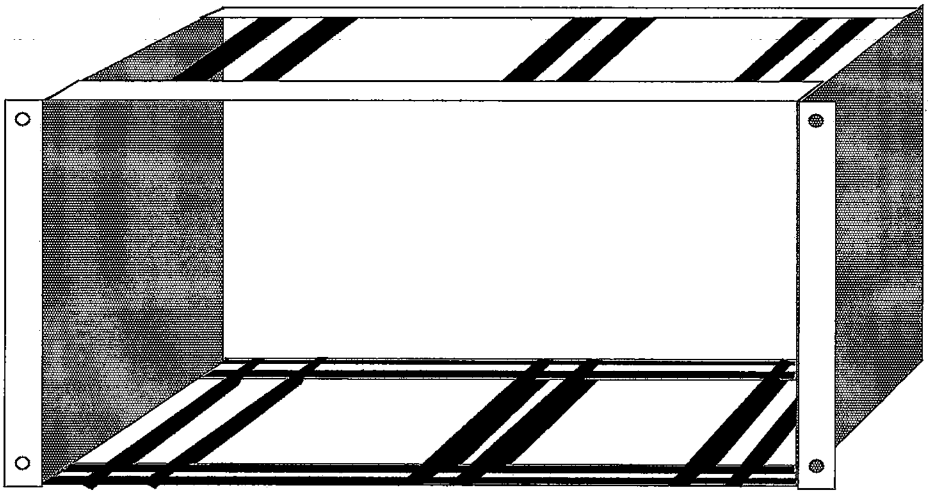
The terminal screws on the back of the rack module are shown in Figure 4-5.

Figure 4-5. *Rack-Module Terminal Screws*



You can mount the power-supply/linearizer rack module in your own standard 19"-wide rack chassis, or you can order the Model 2015 rack chassis, shown in Figure 4-6, from Kurz Instruments. The 2015 rack chassis houses up to six 2.8" rack modules or four 4.2" rack modules.

Figure 4-6. *Model 2015 Rack Chassis*



4.10 LCD Digital Display

The 455's standard 0-5 Vdc output can be connected directly to either of two optional 4 1/2- digit[1] LCD digital displays.

A remote digital display is also available if you have the 4-20 mA output option (see Section 4.3 above).

4.10.1 Panel-Mounted LCD

For 455s employing the standard NEMA-type power-supply/linearizer enclosure, a panel-mounted LCD is available. The LCD panel is mounted above the power-supply/linearizer board on standoffs within the enclosure. The enclosure itself is available with or without a viewing window in its cover. Figure 4-7 shows both arrangements.

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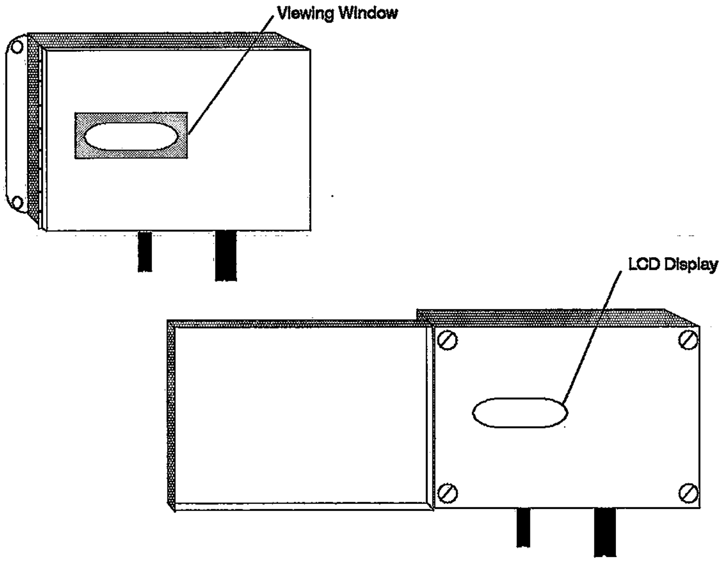
[1] The display actually contains five digits. The rightmost, or least significant, digit displays only a zero (0). The leftmost digit displays either a zero or a one (1). Thus, the largest displayable number is 19990.

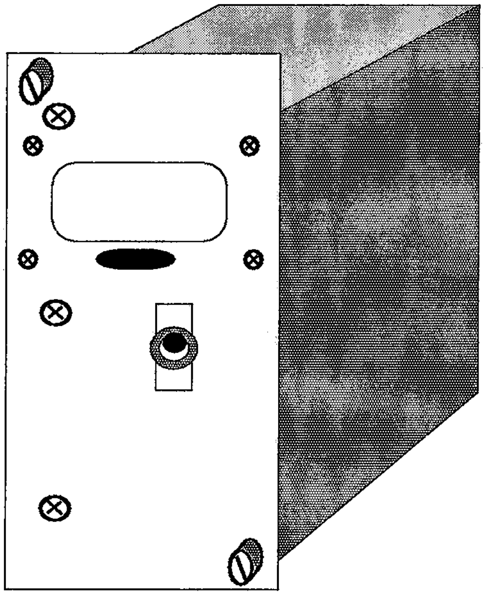
Figure 4-7. *Panel-Mounted Digital Displays*



4.10.2 Rack-Module Display

For 455s with power-supply/linearizer boards packaged in rack modules, an LCD digital display housed in a separate rack module is available and is shown in Figure 4-8.

Figure 4-8. *Rack-Module Digital Display*



4.10.3 Connecting the Digital Display

Both digital displays are wired to the power- supply/linearizer board in the same way. Three wires: white with a red stripe, black, and yellow, are hardwired to the display. They are connected to the power-supply/linearizer board as follows:

- White with red stripe to the terminal screw labeled "LIN. OUT" (Terminal Screw 2).
- Black to ground (Terminal Screw 3).
- Yellow to the terminal screw labeled " + REG. SUP." (Terminal Screw 8).

4.10.4 Remote Digital Display

This option is available if you need a digital display remote from the power-supply/linearizer enclosure. The remote digital display connects to terminal screws 5 and 6 of the 4-20 mA current board.

4.11 Optional Engineering Units

The standards units of measurement displayed on the panel meters of 455s so equipped are Standard Feet Per Minute (SFPM). Readouts in other units of measurement are optionally available. Some of the more common units of measurement available are listed below. 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 455 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 455 will be permanently mounted.

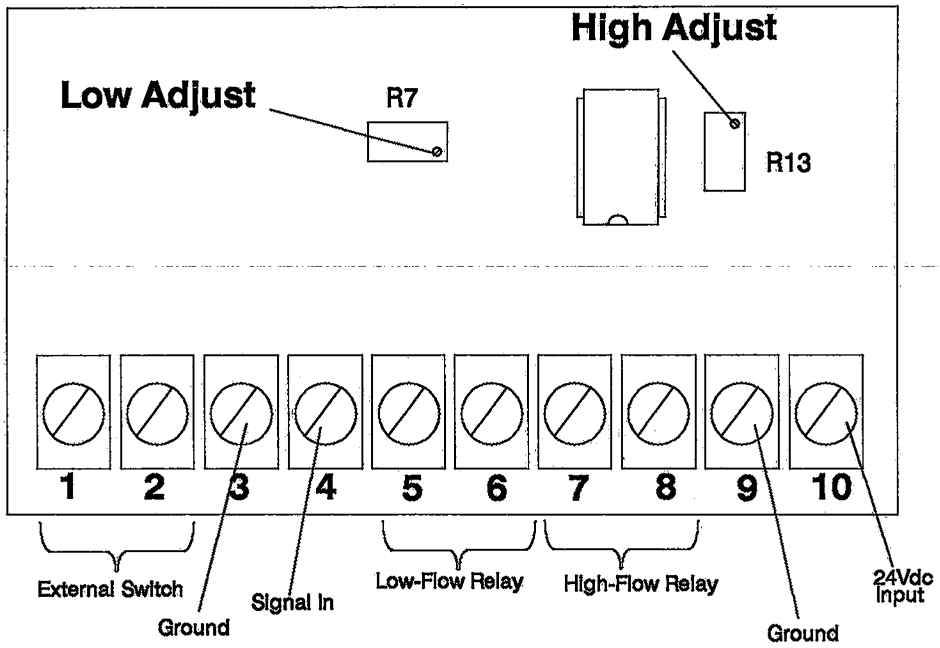
4.12 Dual Alarm

The Model 111 dual alarm board allows you to activate an audible alarm or other device of your choice based on the velocity sensed by the 455. 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. 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 4-9, as are the terminal screws used to connect the 111R1 board to other devices.

To set the low alarm value, you must, with the 111R1 board properly connected, run a flow whose velocity represents the desired low alarm limit past the transducer's sensor. You then adjust the low-adjust potentiometer until the low-flow relay closes. To set the high alarm value, run a flow at the desired high alarm limit past the sensor and adjust the high-adjust potentiometer until the high-flow relay closes.

Figure 4-9. *Model 111R1 Dual Alarm Board*



4.13 Totalizer

The Model 455 is available with the optional Model 101 Totalizer. The totalizer counts and records the total units of flow that have passed the sensor. The totalizer is available calibrated in any of the engineering units discussed above at 4.11.

The totalizer is available in resettable and nonresettable versions and can be either panel mounted or rack-module mounted.

4.14 Sensor Safety Circuit

The optional sensor safety circuit on the current-transmitter 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 455 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 more than 100° F **BELOW** the ignition temperature of the gas. (A good rule of thumb is to keep flow temperature at least 20% below the gas's ignition temperature.)

End of Section 4

Section 5: Testing

This section describes some of the bench testing procedures you can perform on the power-supply/linearizer board and the current-transmitter board.

You may want to perform these tests before you install the 455 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.

5.1 Power-On Voltage Test

To perform the power-on voltage test, you will need a digital voltage meter accurate to within +/-.001 Vdc.

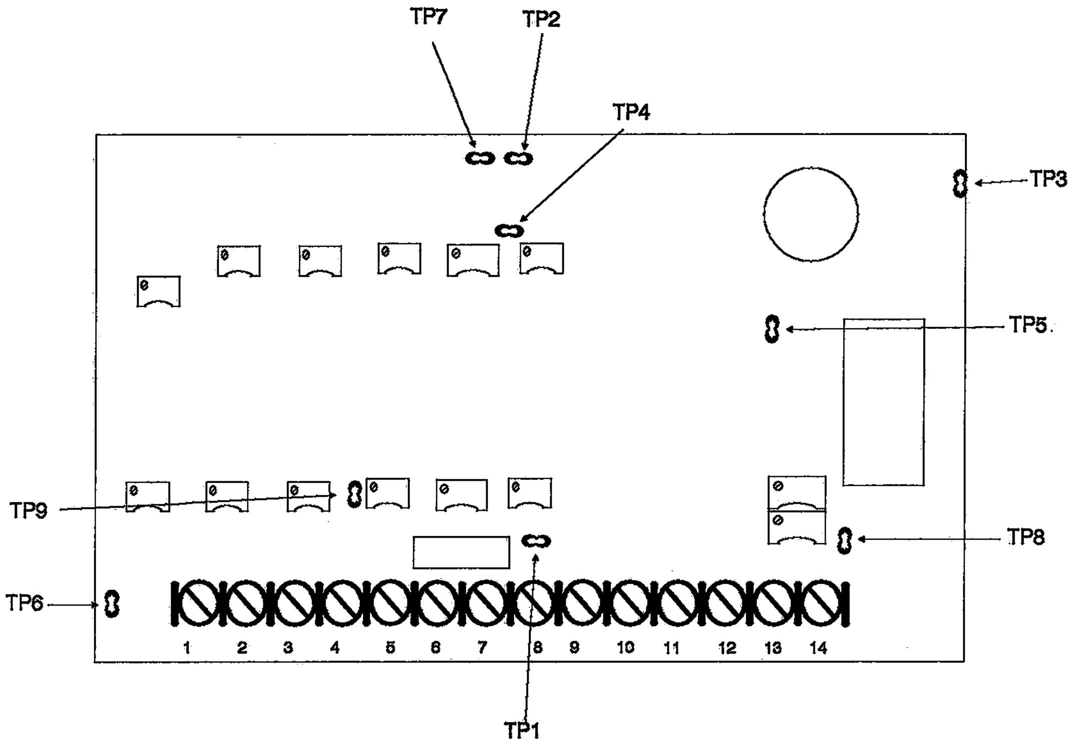
The test consists of checking the voltage between DC ground (Terminal Screw 3) and each of nine test points on the 435R1 Power Supply/Linearizer Board. The correct voltage for each test point is listed below.

Test Point 1, Current Sense Voltage:	+.6 Vdc to 2.000 Vdc +/- 2.5% (this is nominal; refer to the calibration certificate for your unit's exact rated voltage)
Test Point 2, Unregulated Supply Voltage:	+25 Vdc +/- 5 Vdc
Test Point 3, Unregulated Supply Voltage:	-25 Vdc +/- 5 Vdc
Test Point 4, Regulated Supply Voltage:	+15 Vdc +/- 3%

Test Point 5, Regulated Supply Voltage:	-12 Vdc +/- 3%
Test Point 6, Regulated Supply Voltage:	+5 Vdc +/- 3%
Test Point 7, Reference Voltage:	+2.49 Vdc +/- .01%
Test Point 8, Reference Voltage:	-5 Vdc +/- .01%
Test Point 9, Nonlinear Signal Input to Linearizer Circuitry:	0-5 Vdc +/- .025 Vdc at zero; +/- .125 Vdc at full span. **Turn power off immediately if unusually high voltage is present after 10 seconds.**

The test points are labeled “TP1” through “TP9” on the circuit board itself, and are called out in Figure 5-1 for quick reference.

Figure 5-1. *Power-Supply/Linearizer Board Test Points*



5.2 465 Current-Transmitter Board Bridge-Voltage Test

The standard 455 contains a current-transmitter board inside the junction box at the top of the probe. Alternatively, for high temperature applications, this current-transmitter board may be placed in another enclosure mounted remote from a hot duct or stack. All models excepting the HHT-version of the 455 include the 465R4 Current-Transmitter Board. The 455s with an HHT sensor contain the 465R5 Current-Transmitter Board. The test procedure for the 465R4 Current-Transmitter Board is provided in subsection 5.2.1. The test procedure for the 465R5 Current-Transmitter Board is provided in subsection 5.2.2.

To perform the current-transmitter board bridge-voltage test, you will need a digital voltage meter accurate to within +/-.001 Vdc.

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

- The 465 Current-Transmitter Board is properly wired to the 435R1 Power-Supply/Linearizer Board. The two wires from Terminal Strip 1 on the current-transmitter board should be connected to terminal screws 9 (I RET) and 10 (RTC) on the 435R1 Power-Supply/Linearizer Board (refer to Figure 2-6). The 465R4 and 465R5 boards are connected to the 435R1 board in this same way.

- The four wires from the sensor are correctly connected to Terminal Strip 2 of the 465 Current-Transmitter Board. The colors of the sensor wires may vary, depending on the kind of cable used - refer to Table 5-1. The connections from the sensor to the current-transmitter board is the same for the 465R4 as it is for the 465R5 board.

- No flow is moving past the sensor.

- AC power is supplied to the power-supply/linearizer board.

Table 5-1. *Sensor Cable Wire Colors and Terminal Connections*

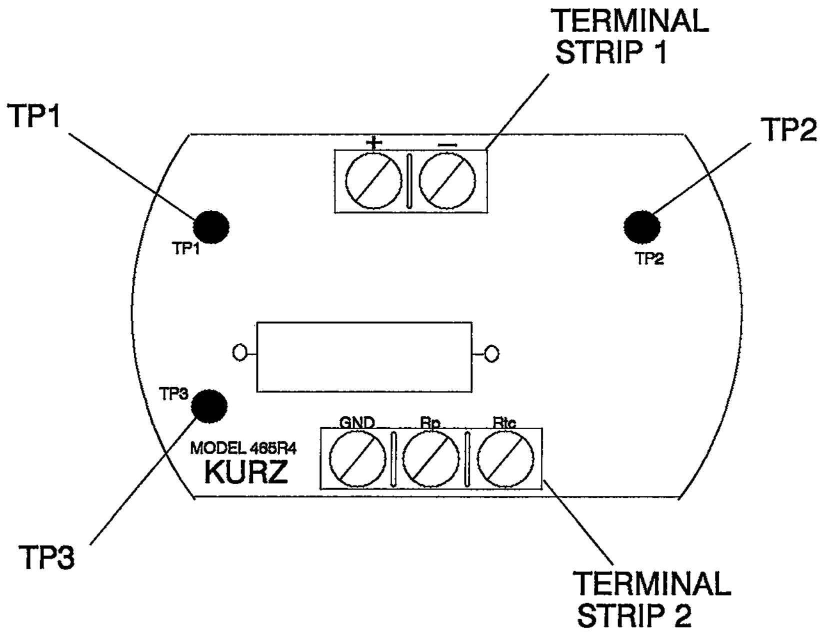
	Color			
Wire	Standard	Teflon	Tefzel	Terminal
R_{tc}	White/Blue	White	White/Blue	1
R_p	White/Orange	Red	White/Orange	2
R_{tc} GND	White	White	White	3
R_p GND	White/Green	Red	White/Green	3
Shield	*shield*	N/A	*shield*	*

* Shield is used on remote current-transmitter electronics and is connected to earth ground at electronics. The circuit ground used on the current-transmitter board (i.e. R_{tc} GND, R_p GND, and GND) is not connected to any other ground.

5.2.1 Testing the 465R4 Current-Transmitter Board

The test consists of checking the voltages between pairs of test points on the 465R4 Current-Transmitter Board. The test points are labeled on the board itself as "TP1", "TP2", and "TP3". They are called out for easy reference in Figure 5-2.

Figure 5-2. *465R4 Current-Transmitter Board Test Points*



Step 1: Check the voltage between TP1 and TP3 (ground). This is the unregulated supply voltage (from the 435R1 board) and should read in the range of 18-24 Vdc.

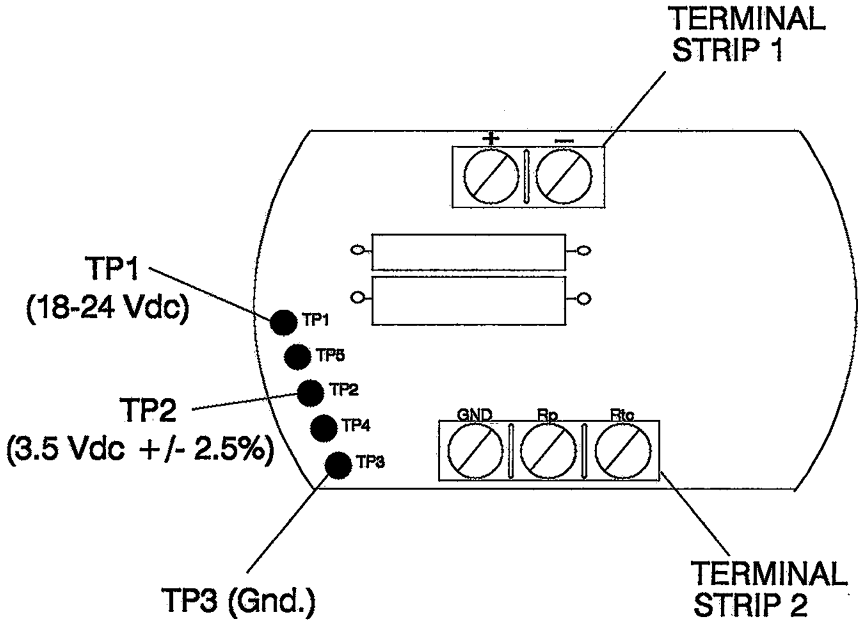
Step 2: Check the voltage between TP2 and TP3 (ground). This is the bridge voltage and should read 3.5 Vdc +/- 2.5% (this is the nominal reading; refer to your calibration certificate for the exact rated voltage of your unit).

CAUTION: If the bridge voltage is +5 Vdc or more (with no flow moving past the sensor), and the voltage does not start to drop below five volts within five to ten seconds, turn power off **immediately**. Supplying power for more than five to ten seconds under these conditions may result in damage to the probe.

5.2.1 Testing the 465R4 Current-Transmitter Board

The test consists of checking the voltages between pairs of test points on the 456R5 Current-Transmitter Board. The test points are labeled on the board itself as "TP1", "TP2", "TP3", "TP4", and "TP5". They are called out for easy reference in Figure 5-3. Only "TP1", "TP2", and "TP3" are used during this test procedure.

Figure 5-3. *465R5 Current-Transmitter Board Test Points*



Step 1: Check the voltage between TP1 and TP3 (ground). This is the unregulated supply voltage (from the 435R1 board) and should read in the range of 18-24 Vdc.

Step 2: Check the voltage between TP2 and TP3 (ground). This is the bridge voltage and should read 3.5 Vdc +/- 2.5% (this is the nominal reading; refer to your calibration certificate for the exact rated voltage of your unit).

CAUTION: If the bridge voltage is +5 Vdc or more (with no flow moving past the sensor), and the voltage does not start to drop below five volts within five to ten seconds, turn power off **immediately.** Supplying power for more than five to ten seconds under these conditions may result in damage to the probe.

End of Section 5

ADDENDUM: PRODUCT CHANGE NOTICE

Product Change Notice & Addendum to the Manual

Component: 465R4 and 465R5 Current-Transmitter Boards

The 465R4 and 465R5 Current-Transmitter Boards have been replaced by the new 465R7 Current-Transmitter Board. The new 465R7 will be used in all products previously using the 465R4 and 465R5 boards, except for those products that are FM-Approved. The 465R6 Current-Transmitter Board will be used in all FM-Approved products until the 465R7 board is approved.

If you have an FM-Approved Kurz product, please read the information on the 465R6 Current-Transmitter Board starting on page 5 of this addendum. If you have any other Kurz product that uses a 465 Current-Transmitter Board, please read the following information on the 465R7 Current-Transmitter Board.

The 465R7 Current-Transmitter Board

Changes in Operation

The 465R7 Current-Transmitter Board operates the same way as the 465R4 and 465R5 boards. The 465R7 is designed to provide more accurate results when the temperature in the duct or stack is beyond 125° C. Other than that, no other changes should be apparent.

Changes to the Installation Procedure

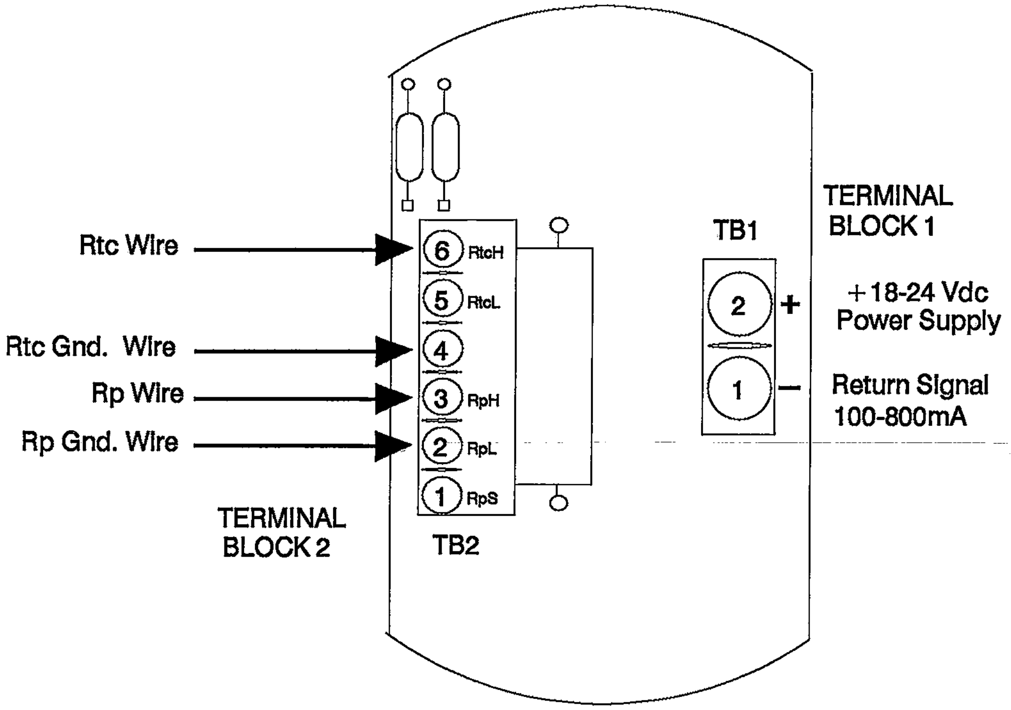
This change will only affect the way the sensor wires are connected to the current-transmitter board. Terminal Block 2 (TB2), the terminal block used to connect the sensor wires to the current-transmitter board, is now a 6-pin terminal block.

The connections from the current-transmitter board to the linearizer board (455, 505, and 555) or to the Series 195 Current-Transmitter Enclosure (EVA 4000, IK-EVA 4200, and 7500) do not change.

-AT Models

All models used to measure air or gas in ambient temperatures (0° to 125° C) use a four-conductor cable to connect the sensor to the 465R7 board. Figure 1 shows how to connect the 465R7 to the sensor when a four-conductor sensor cable is used.

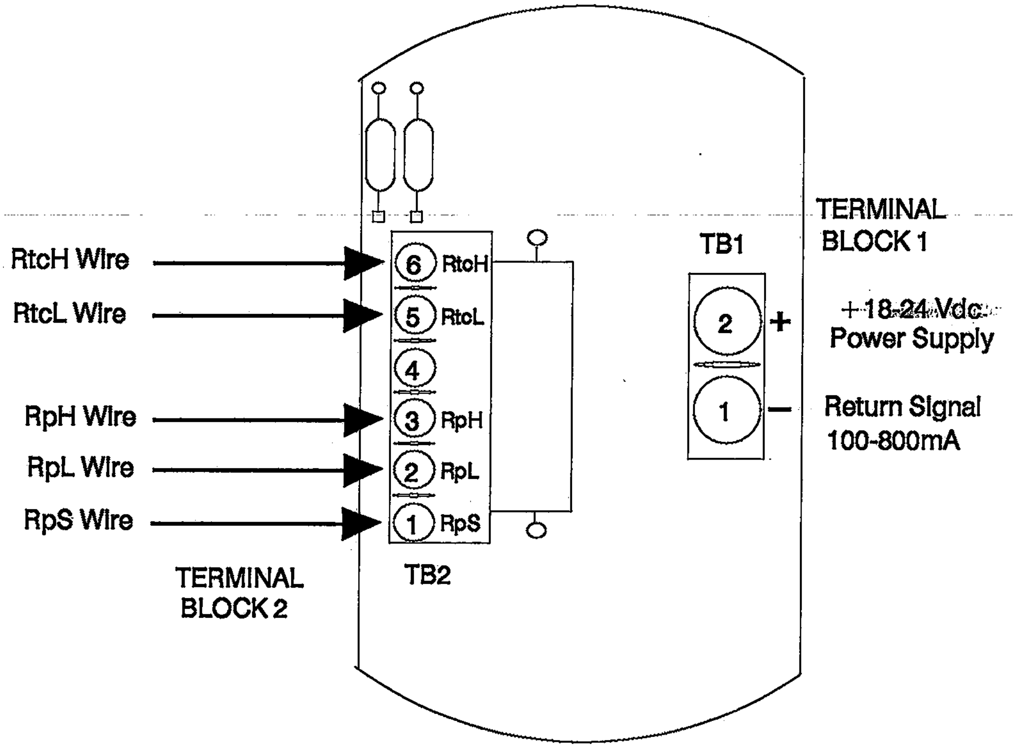
Figure 1. *Connecting a Four-Conductor Sensor Cable to the 465R7*



-HT and -HHT Models

For -HT (0° to 250° C) or -HHT (0° to 500 °C) applications, a 5-conductor cable connects the sensor and the 465R7 Current-Transmitter Board. Figure 2 shows how to connect the 465R7 to the sensor when a five-conductor sensor cable is used.

Figure 2. *Connecting a Five-Conductor Sensor Cable to the 465R7*



Changes to the Test Procedure

The 465R7 Current-Transmitter Boards does not have test points labeled on the board. You can, however, do some checks for proper supply voltages and sensor current. Refer to Figure 4 for the location of the points where the voltages and current can be measured.

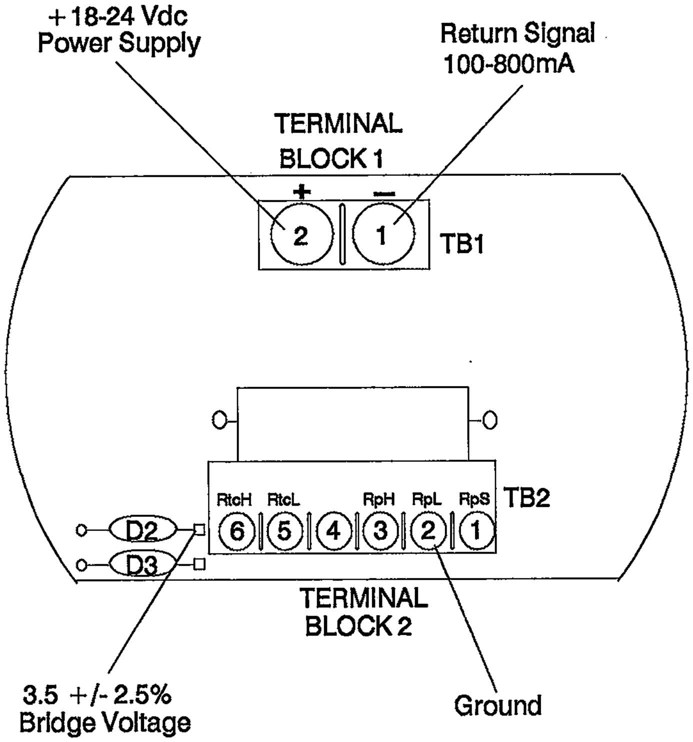
Step 1. Check the Ground. Place the ground lead of a DVM to chassis ground. Place the positive lead on the DVM to terminal 2 on Terminal Block 2 (TB2-2, Gnd.). There should be no voltage measured between chassis ground the ground at TB2-2.

Step 2. Check the +24 Vdc Input. Place the negative or ground lead of the DVM on terminal 2 on TB2 (TB2-2, Gnd.). Place the positive lead of the DVM on terminal 2 of TB1 (TB1-2, +24 Vdc). The voltage should be +18-24 Vdc.

Step 3. Check the Bridge Voltage. Place the negative or ground lead of the DVM on terminal 2 on TB2 (TB2-2, Gnd.). Place the positive lead of the DVM on the leg of diode D2 closest to Terminal Block 2 (TB2). The voltage should be a minimum of 2.0 Vdc, typically +3.5 Vdc +/- 2.5%, and a maximum of 8 Vdc.

Step 4. Check the Return Signal. Using a meter that can measure current, measure the amount of current at Terminal 1 of Terminal Block 1 (TB1-1, RET.). The current should be in the 100-600mA range, dependent on the amount of flow measured by the sensor.

Figure 3. *Voltage and Current Check Points on the 465R7 Board*



The 465R6 Current-Transmitter Board

Changes in Operation

The 465R6 Current-Transmitter Board operates the same way as the 465R4 and 465R5 boards. The 465R6 Current-Transmitter board has all the capabilities of the older boards but has also been FM-Approved.

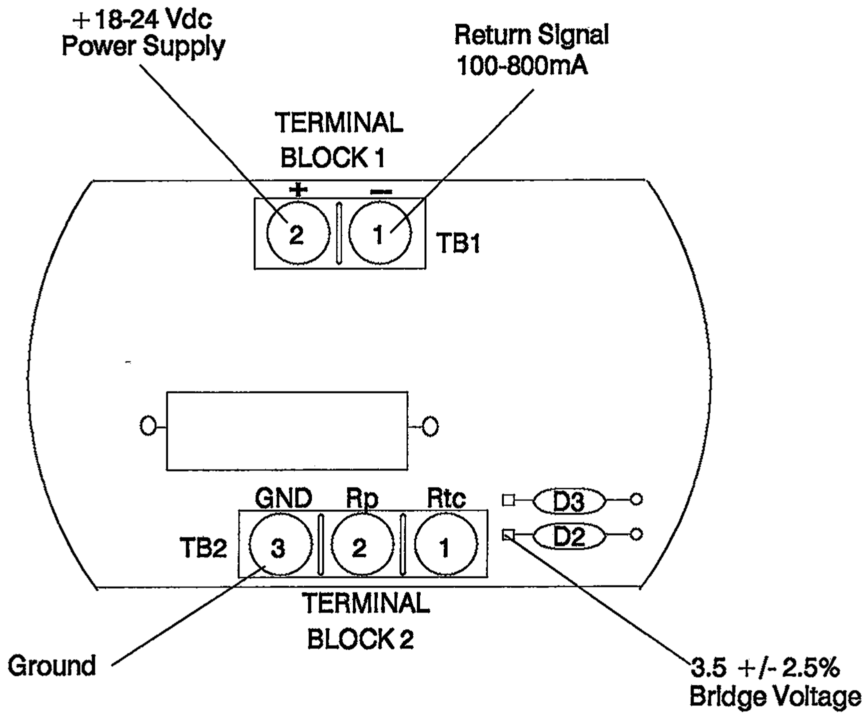
Changes to the Installation Procedure

The installation procedure for the 465R6 is identical to the procedures used for the 465R4 and 465R5.

Changes to the Test Procedure

The 465R6 Current-Transmitter Board does not have test points labeled on the board. You can, however, do some checks for proper supply voltages and the sensor current. Refer to Figure 4 for the location of the points where the voltages and current can be measured.

Figure 4. *Voltage and Current Check Points on the 465R6 Board*



Step 1. Check the Ground. Place the ground lead of a DVM to chassis ground. Place the positive lead of the DVM to terminal 3 on Terminal Block 2 (TB2-3, Gnd.). There should be no voltage measured between chassis ground the ground at TB2-3.

Step 2. Check the +24 Vdc Input. Place the negative or ground lead of the DVM on terminal 3 on TB2 (TB2-3, Gnd.). Place the positive lead of the DVM on terminal 2 of TB1 (TB1-2, +24 Vdc). The voltage should be +18-24 Vdc.

Step 3. Check the Bridge Voltage. Place the negative or ground lead of the DVM on terminal 3 on TB2 (TB2-3, Gnd.). Place the positive lead of the DVM on the leg of diode D2 closest to Terminal Block 2 (TB2). The voltage should be a minimum of 2.0 Vdc, typically +3.5 Vdc +/- 2.5%, and a maximum of 8 Vdc.

Step 4. Check the Return Signal. Using a meter that can measure current, measure the amount of current at Terminal 1 of Terminal Block 1 (TB1-1, RET.). The current should be in the 100-600mA range, dependent on the amount of flow measured by the sensor.

Appendix A: Component Layout and Schematic Drawings

This appendix contains components layout and schematic drawings for the Model 455 (with 435-R1 Analog Linearizer) and its components. These drawings are included as an aid to those users who want to perform their own testing and servicing.

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**
420019, Rev D	Model 435R1 PCB Assembly (Components Layout)
300013, Rev C	Model 435R1 Linear/Non-Linear PCB Voltage Mode/Current Mode Schematic Diagram
420032, Rev C	Model 465R4 Non-Interchangeable Current P.C. Board Component Layout
300045, Rev B	Model 465R4 Non-Interchangeable Current P.C. Board Schematic Diagram
420126, Rev B	Model 465R5 Component Layout
300046, Rev 0	Model 465R5 Schematic Diagram
420046, Rev B	Model 604 Components Layout
300052, Rev A	Model 604 Schematic Diagram
420015, Rev 0	Model 430 Post Scaler Component Layout
300011, Rev 0	Model 430 Post Scaler Schematic Diagram

Drawing No.	Description
340055, Rev A	Series 455/555/505 System Wiring Diagram
340052, Rev C	Series 455-T or 555-T Insertion Gas Vel. or Mass Flow & Temp. System Wiring Diagram
700455-01, Rev A	Probe Assembly, 450-06
700455-02, Rev A	Probe Assembly, 450-08
700455-03, Rev A	Probe Assembly, 450-16
C70013, Rev 0	Standard Electronics Enclosure, Assembly
C70017, Rev 0	NEMA 4 Electronics Enclosure, Assembly
C70019, Rev 0	NEMA 4X Electronics Enclosure with Window, Assembly
420005, Rev C	Model 131 PCB Component Layout
300028, Rev C	Model 131 PCB Schematic Diagram
420006, Rev B	Model 132 PCB Component Layout
300003, Rev B	Model 132 PCB Schematic Diagram
420129, Rev 0	Single-Range LCD Display Interface Component Layout
300054, Rev 0	Single-Range LCD Display Interface Schematic Diagram
420099, Rev B	Model 111R1 Dual Alarm Component Layout
300026	Model 111R1 Dual Alarm Schematic Diagram
420001, Rev B	Model 101 Totalizer Component Layout
300001, Rev A	Model 101 Totalizer Schematic Diagram

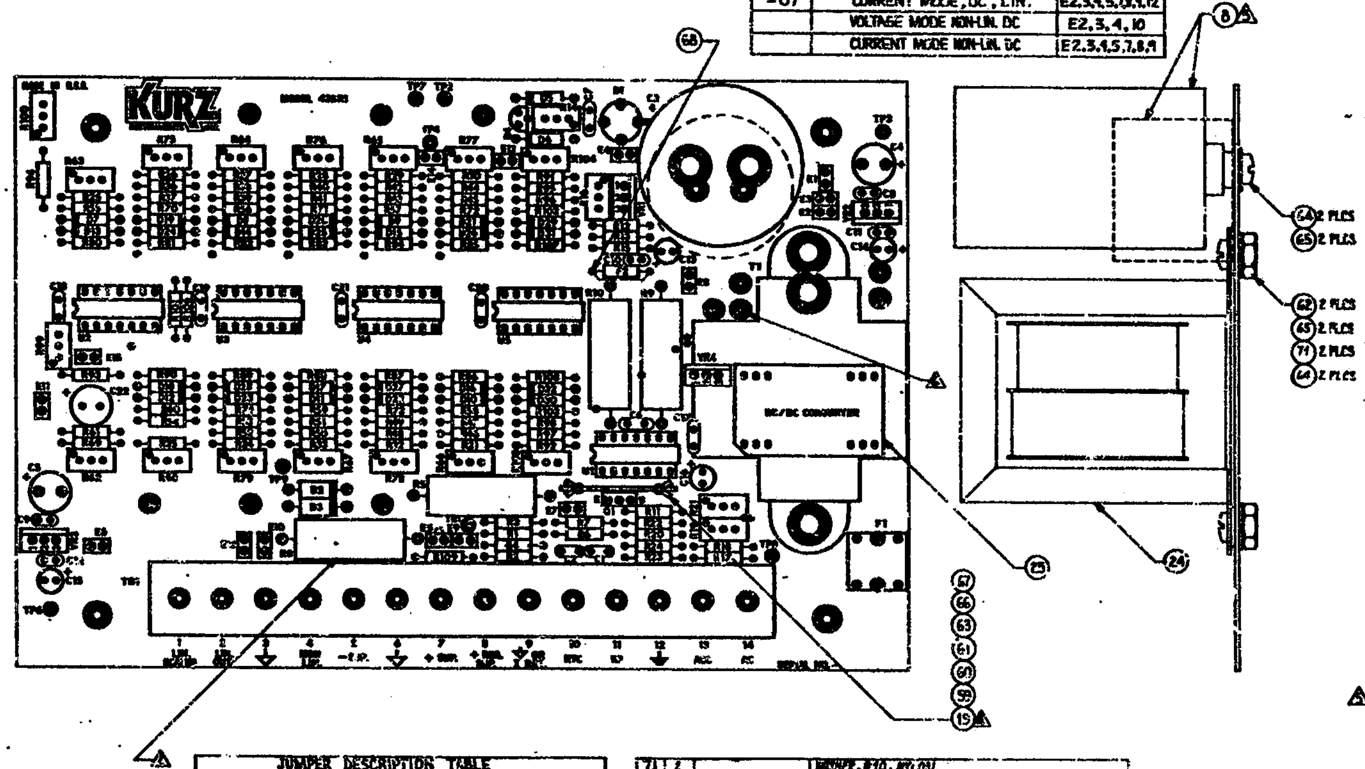
NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM # 300012.
2. R5,8-10,D1-3 TO BE ASSEMBLED WITH 1/4" CLEARANCE FROM PC BOARD.
3. FOR NON-LINEAR OPTIONS (-04, -05, -08, -09), DO NOT ASSEMBLE R25-106, D7-32, C18-22, U2-5.
4. FOR HEATSINK TO TRANSISTOR ASSEMBLY SEE DWG. NO. A70005.
5. MALLORY CAPACITOR TO BE USED FOR NUCLEAR UNITS ONLY, 3500µF, 40V.
6. T1 CENTER TAP WIRE (STRIPPED) SOLDERED TO PAD INDICATED.
7. INSTALL D2,3,R9,10 FOR SENSOR SAFETY CIRCUITS ONLY.
8. FOR CURRENT SENSE VOLTAGE, MEASURE BETWEEN TB1-3 (GND) AND TB1-5 (CURRENT RETURN).

JUMPER CONFIGURATION TABLE

PART NO.	DESCRIPTION	CLOSE JUMPER
	HEAVY DUTY, CURRENT MODE, 220V	E5,7,8,9,12
	HEAVY DUTY VOLTAGE MODE, LIN.	E10, 12
-03	HEAVY DUTY, CURRENT MODE, LIN	E5,7,8,9,12
-04	HEAVY DUTY, VOLTAGE MODE, NON-LIN.	E10
-05	HEAVY DUTY, CURRENT MODE, NON-LIN.	E5,7,8,9
	VOLTAGE MODE DC, LIN.	E2,3,4,10,12
-07	CURRENT MODE, DC, LIN.	E2,3,4,5,7,8,9,12
	VOLTAGE MODE NON-LIN. DC	E2,3,4,10
	CURRENT MODE NON-LIN. DC	E2,3,4,5,7,8,9

A	REVISED PER ECO'S A43547005 + A43547006. REF ECO A43547007	[illegible]	[illegible]	N/A	[illegible]
B	REVISED PER ECO A43547007	[illegible]	[illegible]	N/A	[illegible]
C	REVISED PER ECO A43547009 A4354700[illegible] AND A43547911.	[illegible]	[illegible]	[illegible]	[illegible]
D	REVISED PER ECO # A47214	[illegible]	[illegible]	N/A	[illegible]



JUMPER DESCRIPTION TABLE

JUMPER	DESCRIPTION
E1	TIES COMMON GND AND CHASSIS GND - TO REMAIN OPEN.
E2,3,4	USE A DC/DC CONVERTER, DO NOT INSTALL T1,VR2,C4,6.
E5,7,8,9	CURRENT MODE, DO NOT INSTALL C1,2,6,D2,3,Q1,R6-7,[illegible]
E6	FOR 24V FROM TB1-7.
E10	VOLTAGE MODE, INSTALL C1,2,6,D2,3,Q1,R6-7,9,12,[illegible]
E11	FOR 15V FROM TB1-7.
E12	FOR LINEAR SECTION.
E13,14	OPTIONAL INVERTER OR BREAK POINT.
E15	ADJUST FOR X-5 VDC OUT.

ITEM	QTY	REF DES	DESCRIPTION
71	2		[illegible]
70	A/R		SHUNT, 2 PIN
69	14	E2-4,6-15	HEADER, 2 PIN
68	3	E2,E5	WIRE, 22 AWG SOLID TIN
67	1		WASHER COMPRESSED
66	1		WASHER #4 STAR
65	4		WASHER #10 STAR
64	4		SCREW #10-32 X 1/4 PHIL PAN HEAD
63	1		SCREW #4-40 X 5/16 PHIL PAN HEAD
62	2		NUT #10-32
61	1		NUT #4-40
60	1		KOOLEX PAD
59	1		HEATSINK
58			
57	32	R109 R1-5,9-10,17,18,23 R24,37,39,41,43 R45,47,49,51,53,91 R92,94-98,102-105	RESISTOR, SELECTED
56	1	R36	RESISTOR 121K 1% 1/8W OR 1/4W
55	1	R38	RESISTOR 102K 1% 1/8W OR 1/4W
54	1	R61	RESISTOR 97.6K 1% 1/8W OR 1/4W
53	1	R40	RESISTOR 73.2K 1% 1/8W OR 1/4W
52	1	R42	RESISTOR 54.9K 1% 1/8W OR 1/4W
51	1	R44	RESISTOR 44.2K 1% 1/8W OR 1/4W
50	1	R46	RESISTOR 37.4K 1% 1/8W OR 1/4W
49	1	R48	RESISTOR 31.6K 1% 1/8W OR 1/4W
48	1	R50	RESISTOR 27.4K 1% 1/8W OR 1/4W
47	1	R52	RESISTOR 24.9K 1% 1/8W OR 1/4W
46	1	R54	RESISTOR 22.1K 1% 1/8W OR 1/4W
45	11	R25-35	RESISTOR 20K 1% 1/8W OR 1/4W
44	1	R15	RESISTOR 2.0 K 1% 1/8W OR 1/4W
43	19	R11,13,69,80-90,95 R101,106-108	RESISTOR 10K 1% 1/8W OR 1/4W
42	2	R20,22	RESISTOR 5.09K 1% 1/8W OR 1/4W
41	1	R12	RESISTOR 9.53K 1% 1/8W OR 1/4W
40	2	R6,7	RESISTOR 1K 1% 1/8W OR 1/4W
39	1	R8	RESISTOR 5Ω 1% 5W
38	11	R55-60,70-74	RESISTOR .5Ω 1% 1/8W OR 1/4W
37	6	R66-68,78,79,99	RESISTOR POT 20K 1%
36	7	R63-65,75-77,14	RESISTOR POT 10K 1%
35	2	R19,100	RESISTOR POT 5K 1%
34	3	R62,21,16	RESISTOR POT 2K 1%
33			
32	1	VR2	VOLTAGE REGULATOR 7912
31	1	VR1	VOLTAGE REGULATOR 7815
30	1	VR3	VOLTAGE REGULATOR 7805
29			
28	5	U1-5	SOCKET, 14 PIN
27	5	U1-5	IC LM324 OP-AMP
26			
25			DC/DC CONVERTER
24	1	T1	TRANSFORMER 8124A-245
23			
22	8	TP1-4,6-9	TEST POINT
21	1	TB1	14 POSITION TERMINAL STRIP
20			
19	1	Q1	TRANSISTOR MJE520
18			
17	1	F1	FUSE SELECTED
16			
15	4	D29-32	DIODE SELECTED
14	1	D4	REF. VOLT. REG. LM336 2.5V
13	24	D5-28	DIODE 1N914 OR 1N4148
12	2	D2,3	DIODE 1N5346B
11	1	D1	BRIDGE RECTIFIER CSCB20S
10			
9	1	C16	CAP SELECTED
8	1	C3	CAP 3300UF,35V
7	2	C4,5	CAP 220UF,30V
6	1	C22	CAP 100UF,16V
5	3	C13-15	CAP 10UF,25V
4	6	C7-12	CAP .1UF,50V
3	3	C1,2,6	CAP .02UF,50V
2	5	C17-21	CAP .01UF,50V
1	1		MODEL 435R1 PCB

KURZ INSTRUMENTS INC.

PCB, ASSY., 435R1

J. CARENBA 6-30-86

N/A

N/A

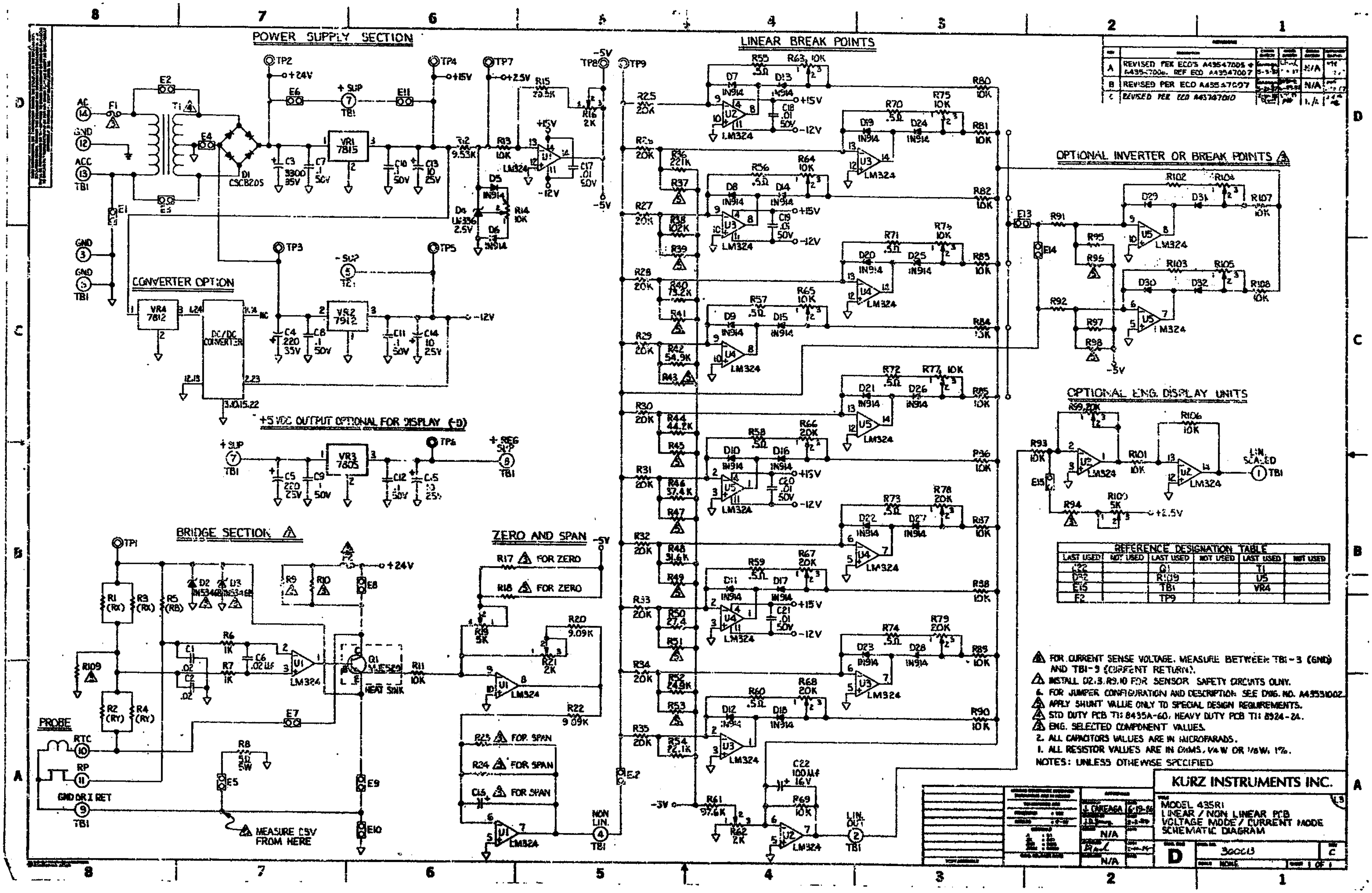
D

420019

D

SCALE 1:1

SHEET 1 OF 1



REV					
A	REVISED PER ECO'S A43547005 + A435-7006. REF ECO A43547007	5-5-87		N/A	
B	REVISED PER ECO A43547007			N/A	
C	REVISED PER ECO A43747010			N/A	

REFERENCE DESIGNATION TABLE

LAST USED	NOT USED	LAST USED	NOT USED	LAST USED	NOT USED
C22		Q1		T1	
D32		R109		U5	
E15		TB1		VR4	
F2		TP9			

△8 FOR CURRENT SENSE VOLTAGE, MEASURE BETWEEN TB1-3 (GND) AND TB1-9 (CURRENT RETURN).

△7 INSTALL D2,3,R9,10 FOR SENSOR SAFETY CIRCUITS OLNY.

6. FOR JUMPER CONFIGURATION AND DESCRIPTION SEE DWG. NO. A43531002.

△5 APPLY SHUNT VALUE ONLY TO SPECIAL DESIGN REQUIREMENTS.

△4 STD DUTY PCB T1: 8435A-60, HEAVY DUTY PCB T1: 8924-24.

△3 ENG. SELECTED COMPONENT VALUES.

2. ALL CAPACITORS VALUES ARE IN MICROFARADS.

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W OR 1/8W, 1%.

NOTES: UNLESS OTHEWISE SPCCIFIED

KURZ INSTRUMENTS INC.

MODEL 435RI
LINEAR / NON LINEAR PCB
VOLTAGE MODE / CURRENT MODE
SCHEMATIC DIAGRAM

J. ORNEAGA 6-19-86
N/A
N/A

D

300013

C

NONE

1 OF 1

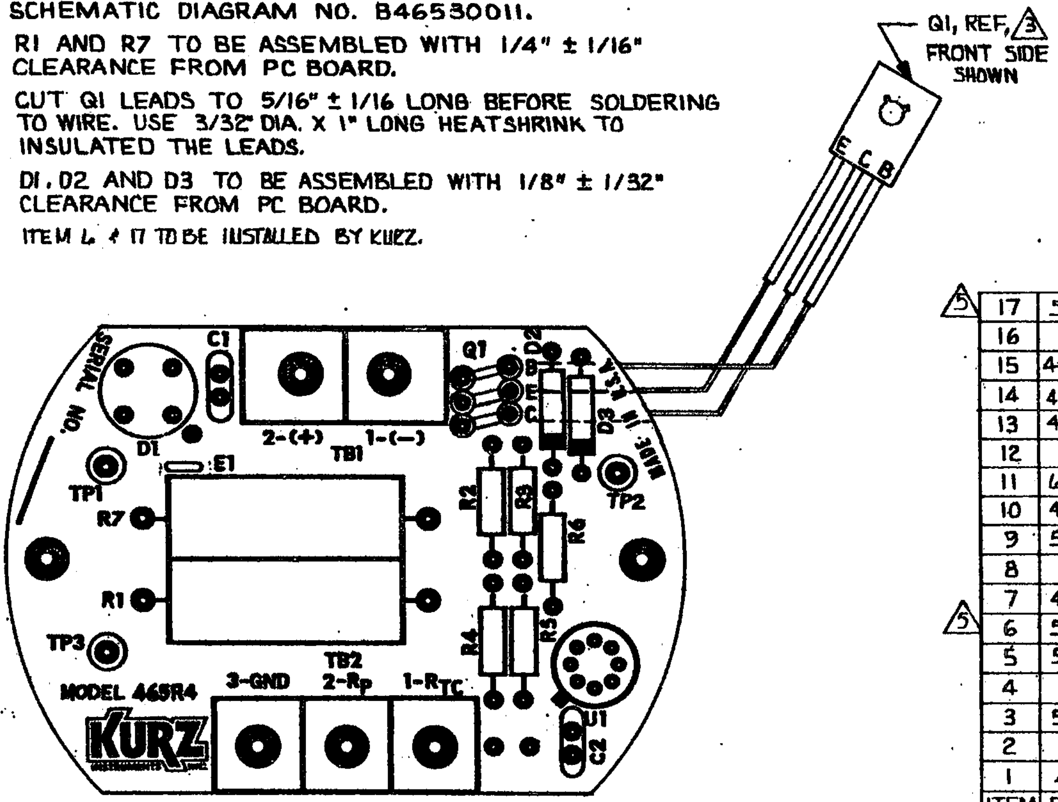
NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM NO. B46530011.
2. R1 AND R7 TO BE ASSEMBLED WITH 1/4" ± 1/16" CLEARANCE FROM PC BOARD.

△3 CUT Q1 LEADS TO 5/16" ± 1/16 LONG BEFORE SOLDERING TO WIRE. USE 3/32" DIA. X 1" LONG HEATSHRINK TO INSULATED THE LEADS.

4. D1, D2 AND D3 TO BE ASSEMBLED WITH 1/8" ± 1/32" CLEARANCE FROM PC BOARD.

△5 ITEM 6 & 17 TO BE INSTALLED BY KURZ.



REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO A47114	Careaga 5-26-87	D.V. 6-1-87	N/A	MTG 6-5-87
B	REVISED PER ECO A46547009	[illegible] 3-9-88	[illegible] 3-9-88	N/A	[illegible] 3-9-88
C	REVISED PER ECO 47214	B.SAXON 9-1-88	[illegible] 9-15-88	N/A	[illegible] 9/12-88

ITEM	PART NO.	QTY	REF. DES.	DESCRIPTION
17 △5	540549	1	R7	RESISTOR, 15Ω, 5W, OHMITE, ± 1%
16		6	R1-R6	RESISTOR, SELECTED
15	460202	3	TP1-TP3	CON. PIN, PCB TEST LEAD PINS
14	460060	1	TB2	TERMINAL STRIP TRW 3 PIN 3/8 CENTER
13	460058	1	TB1	TERMINAL STRIP TRW 2 PIN 3/8 CENTER
12				
11	610009	1	U1	IC, LM741A OP AMP
10	460045	1		SOCKET, 8 PIN, ROUND
9	580041	1	Q1	TRANSISTOR, MJE520
8		1	E1	JUMPER TIN WIRE (22 AWG)
7	460161	A/R		SHUNT, 2 PIN
6 △5	580027	2	D2, D3	DIODE, IN5346 B 9.1V 5W
5	580066	1	D1	BRIDGE RECTIFIER 33SC020
4				
3	510006	2	C1, C2	CAP .1µF 50V
2				
1	420084	1		MODEL 465R4 PCB

PARTS LIST

TRANSISTOR Q1 WIRE TABLE		
Q1	COLOR	AWG
E	BK	#22
C	WT	#22
B	BL	#22

N/A
NEXT ASSEMBLY

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

APPROVALS

DRAWN BY J. CAREAGA	DATE 2-5-87
CHECKED BY JHYoung	DATE 2-13-87
DESIGN N/A	DATE
APPROVED Dlut	DATE 2-13-87
BASELINED N/A	DATE

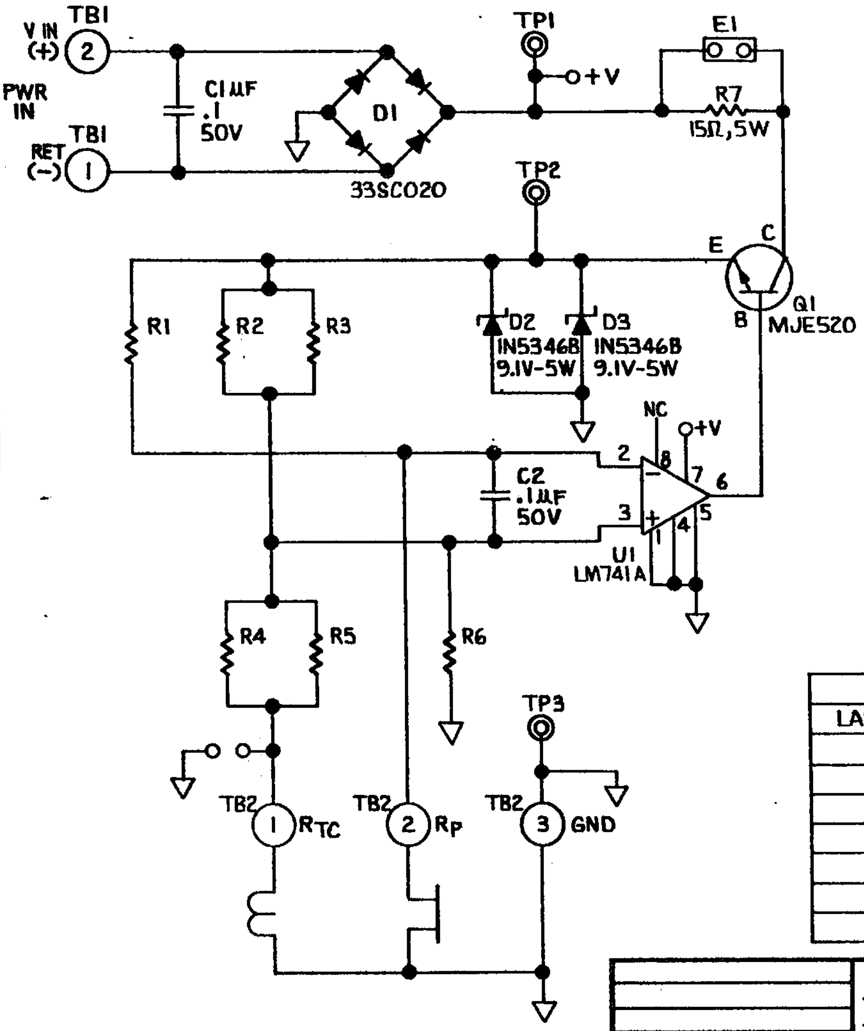
KURZ INSTRUMENTS INC.

L2

TITLE
CURRENT PC BOARD,
NON INTERCHANGEABLE,
MODEL 465R4,
COMPONENT LAYOUT

DWG. SIZE B
DWG. NO. 420032
REV. C
SCALE 2 : 1
SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A5220



REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO A47114	Careaga 5-26-87	D.V. 6-1-87	N/A	MG 6-5-87
B	REVISED PER ECO A465 A709	Wib 3-9-88	Dinial 3-9-88	N/A	Dinial 3-9-88

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT NO. B46531011.
2. R1 - R6 TO BE SELECTED (TEMP. COMP.).
3. R7, D2 AND D3 TO BE INSTALLED BY KURZ.

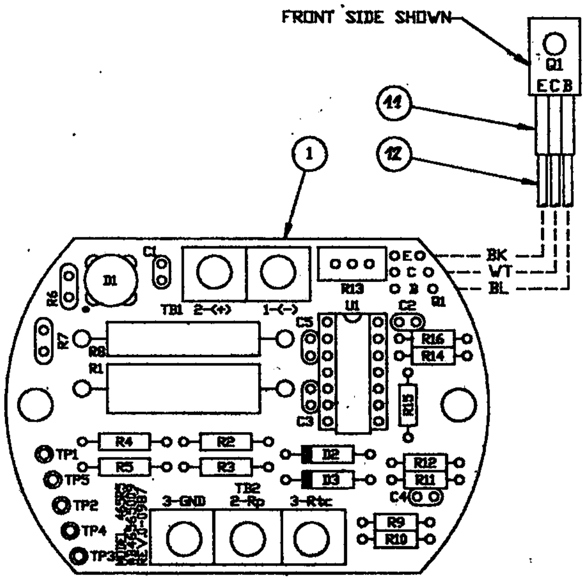
REF. DES. TABLE	
LAST USED	NOT USED
C2	
D3	
E1	
Q1	
R7	
TB2	
U1	

DASH NO.	DESCRIPTION
-001	NON INTERCHANGEABLE WITH INTRISIC SAFETY E1 OPEN
-002	NON INTERCHANGEABLE W/OUT INTRISIC SAFETY DO NOT INSTALL R7, D2, D3. CLOSE E1

N/A NEXT ASSEMBLY	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	APPROVALS DRAWN BY J. CAREAGA — DATE 2-5-87 CHECKED BY JYoung — DATE 2-13-87 DESIGN N/A — DATE APPROVED Dinial — DATE 2-13-87 BASELINED N/A — DATE	KURZ INSTRUMENTS INC. TITLE MODEL 465R4 NON INTERCHANGEABLE CURRENT P.C BOARD SCHEMATIC DIAGRAM L2 DWG. SIZE B DWG. NO. 300045 REV. B SCALE NONE SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A36293

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO A46547011	12-14-87	12-15-87 A.V.	N/A	12-18-87
B	REVISED PER ECO # 47214	9-9-88	9/14/88	N/A	9/12/88 DBJ



PART NO.	DESCRIPTION
-01	6" [illegible]
-02	[illegible]
-03	28" [illegible]

	ITEM	QTY	STOCK No.	REF. DES.	DESCRIPTION
⚠6	23	1	54956401	R13	RESISTOR -POT, TRIMMER, 2K OHM.
	22	1	54960701	R16	METALF, 9.09K OHM, 1/8W, .1%.
⚠6	21	1	54911801	R14	METALF, 8.06K OHM, 1/8W.
	20	1	54960701	R12	METALF, 9.09K OHM, 1/8W, .1%.
	19	2	54960601	R11,R15	METALF, 1K OHM, 1/8W, .1%.
	18	AR	54954901	R8	15 OHM, 5W, OHMITE
⚠8 ⚠7	17	AR		R7	PTC, SELECTED
⚠8	16	AR		R6	PTC, SELECTED
	15	2		R9,10	- SELECTED BY TEMP. COMP.
	14	5		R1-R5	RESISTOR - SELECTED BY TEMP. COMP.
	13	5	46920201	TP1-TP5	CONNECTOR, PCB TEST POINT TERMINALS.
⚠5	12	3			WIRE, 22 AWG., TEFZEL, COLOR AS SPEC'D.
	11	3			HEATSHRINK, BLACK, 1/8 O.D.x1/2" LG.
⚠3	10	1	58904101	Q1	SEMI., TRANSISTOR MJE520.
	9	1	61900201	U1	IC, OP-AMP, LM 224.
	8	1	46904801		DIP SOCKET, 14 PIN
	7	AR		C2-C5	CAP, SELECTED.
	6	1	51900601	C1	CAP., .1 UF-50V
	5	AR	58902701	D2,D3	SEMI, DIODE 1N5346B, 9.1V, 5W
	4	1	58906601	D1	BRIDGE RECTIFIER- 33SC020
	3	1	46906001	TB2	TERMINAL STRIP-TRW-3 PIN-3/8 CENTER
	2	1	46905801	TB1	TERMINAL STRIP-TRW-2 PIN-3/8 CENTER
	1	1	42212501		PRINTED CIRCUIT BOARD, #B46565009.

PARTS LIST

NOTES:
1. SEE DWG. #1300046 FOR SCHEMATIC DIAGRAM.
2. R1 & R8 TO BE ASSEMBLED WITH 1/4"±1/16" FROM PCB.
⚠3 CUT Q1 LEADS TO 5/16"±1/16" LG. BEFORE SOLDERING TO WIRE.
4. D1,D2 & D3 TO BE ASSEMBLED WITH 1/8" FROM PCB.
⚠5 USE 6" WIRE LENGTH FOR STD. FOR EVA USE 15" OR 28".
⚠6 OPTIONAL PARTS IN EXCHANGE OF R16.
⚠7 OPTIONAL PART IN EXCHANGE OF R8.
⚠8 *INSTALL JUMPERS IN PLACE OF R6 & R7 IF R6 & R7 NOT REQ'D.*

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
DWG. RELEASE DATE

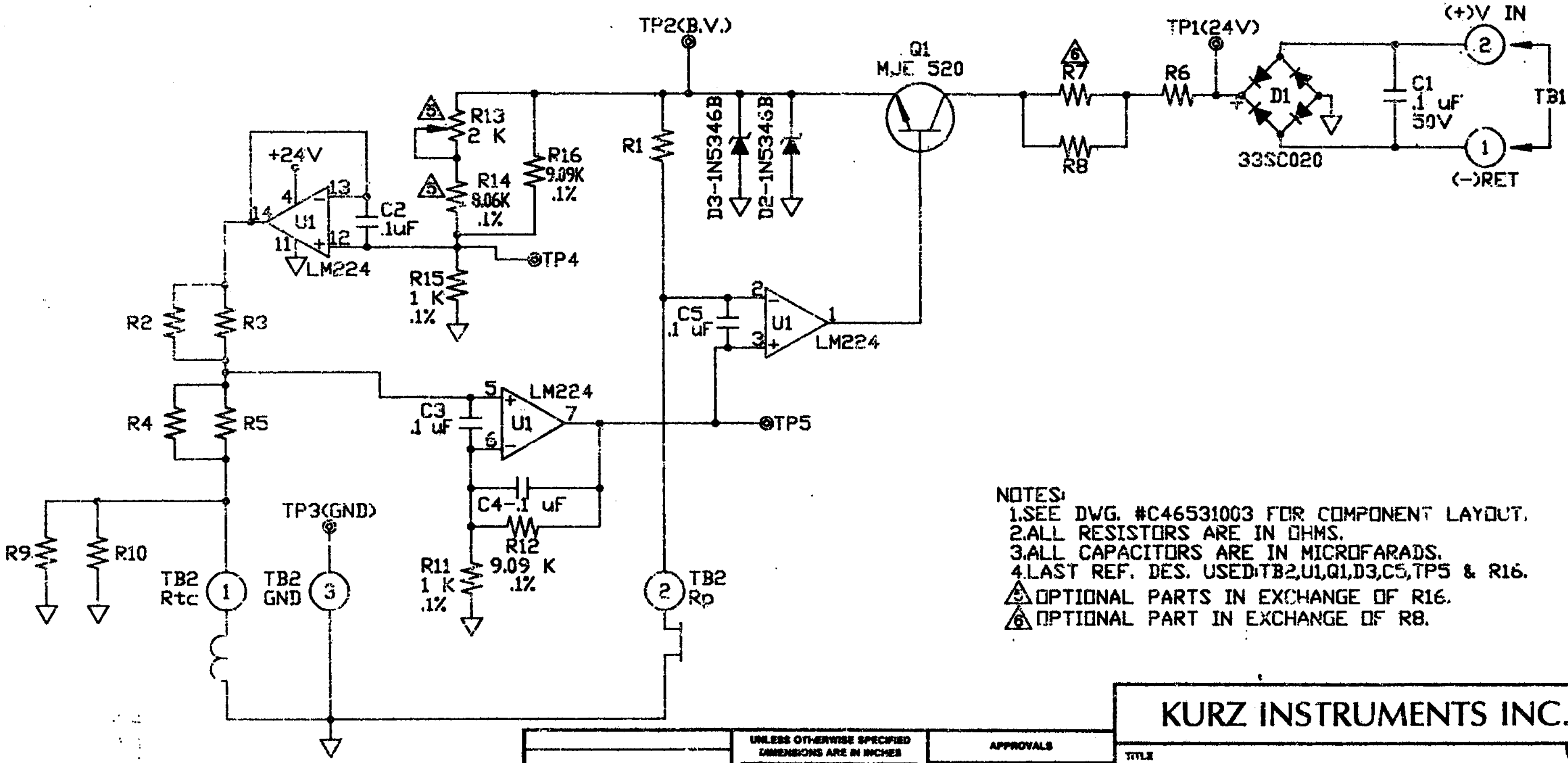
APPROVALS
DRAWN BY: DTasch DATE: 10.6.87
CHECKED BY: DATE: 10-6-87
DESIGN: N/A DATE:
APPROVED: DATE: 10-6-87
RELEASED: N/A DATE:

KURZ INSTRUMENTS INC.

TITLE: PCB, ASSY., 465R5 COMPONENT LAYOUT

DWG. SIZE: C
DWG. NO.: 420126
REV.: B
SCALE: 2/1
SHEET: 1 OF 1

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY



NOTES:
1.SEE DWG. #C46531003 FOR COMPONENT LAYOUT.
2.ALL RESISTORS ARE IN OHMS.
3.ALL CAPACITORS ARE IN MICROFARADS.
4.LAST REF. DES. USED:TB2,U1,Q1,D3,C5,TP5 & R16.
⚠5 OPTIONAL PARTS IN EXCHANGE OF R16.
⚠6 OPTIONAL PART IN EXCHANGE OF R8.

N/A
NEXT ASSEMBLY

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

APPROVALS	
DRAWN BY Dprink	DATE 5/20/87
CHECKED BY JD Young	DATE 10-15-87
DESIGN NA	DATE
APPROVED	DATE 10-10-87
BASELINED NA	DATE

KURZ INSTRUMENTS INC.

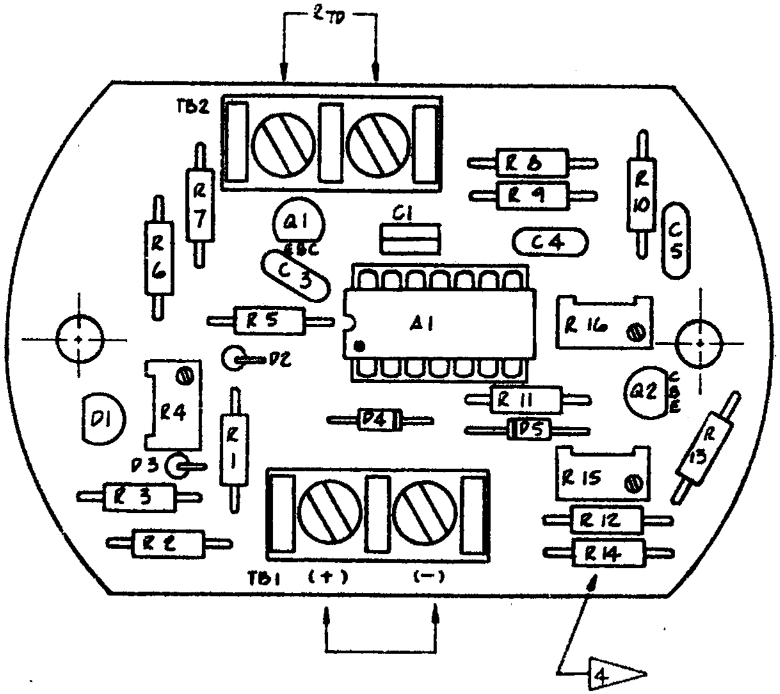
TITLE
MODEL 465R5
SCHEMATIC DIAGRAM

13

DWG. SIZE B
DWG. NO. 3CCC416
REV. 0
SCALE NONE
SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO A36283

REV. A: A1_ PIN No. CORRECTED. 2/27/86 DT.
REV. B : CORRECTED R14 VALUE. 3-11-86 AQ /DT./MFG
(FROM 100KΩ TO 100Ω)



NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DWG. TO BE USED IN CONJUNCTION W/ SCHEMATIC DIAGRAM DWG #60430-006.
2. LAST REF. DEG. USE ARE : A1, Q2, C5, D5 & R16.
3. D2 & D3 TO BE ASSEMBLED W/ CATHODE TO PC BOARD.
4. C2 TO BE ASSEMBLED ON BACK OF PCB.

R 14	RESISTOR 100Ω	1
C5	CAPACITOR SEL	1
R 15	POTENTIOMETER 10 KΩ	1
R 4, 16	POTENTIOMETER 20 KΩ	2
R12	RESISTOR 221 KΩ	1
R11, 13	SELECTED	2
R8, 10	49.9 KΩ	2
R6	66.5 KΩ	1
R5	1 KΩ	1
R3	4.99 K	1
R1, 2, 7, 9	RESISTOR 100 KΩ	4
D5	DIODE IN 4735	1
D2, 3, 4	DIODE IN 914	3
D1	VOLTAGE REGULATOR LM 336 – 2.5 V	1
C3, 4	CAPACITOR .02 μF	2
C2	CAPACITOR .01 μF	1
C1	CAPACITOR .001 μF	1
Q2	TRANSISTOR 2N 4126	1
Q1	TRANSISTOR 2N 3904	1
A1	OP-AMP LM 324	1
	14 PIN SOCKET	1
	2 PIN TERMINAL STRIP, TRW w/ ENDS REMOVED	2
	604 PCB	1
	PARTS LIST	

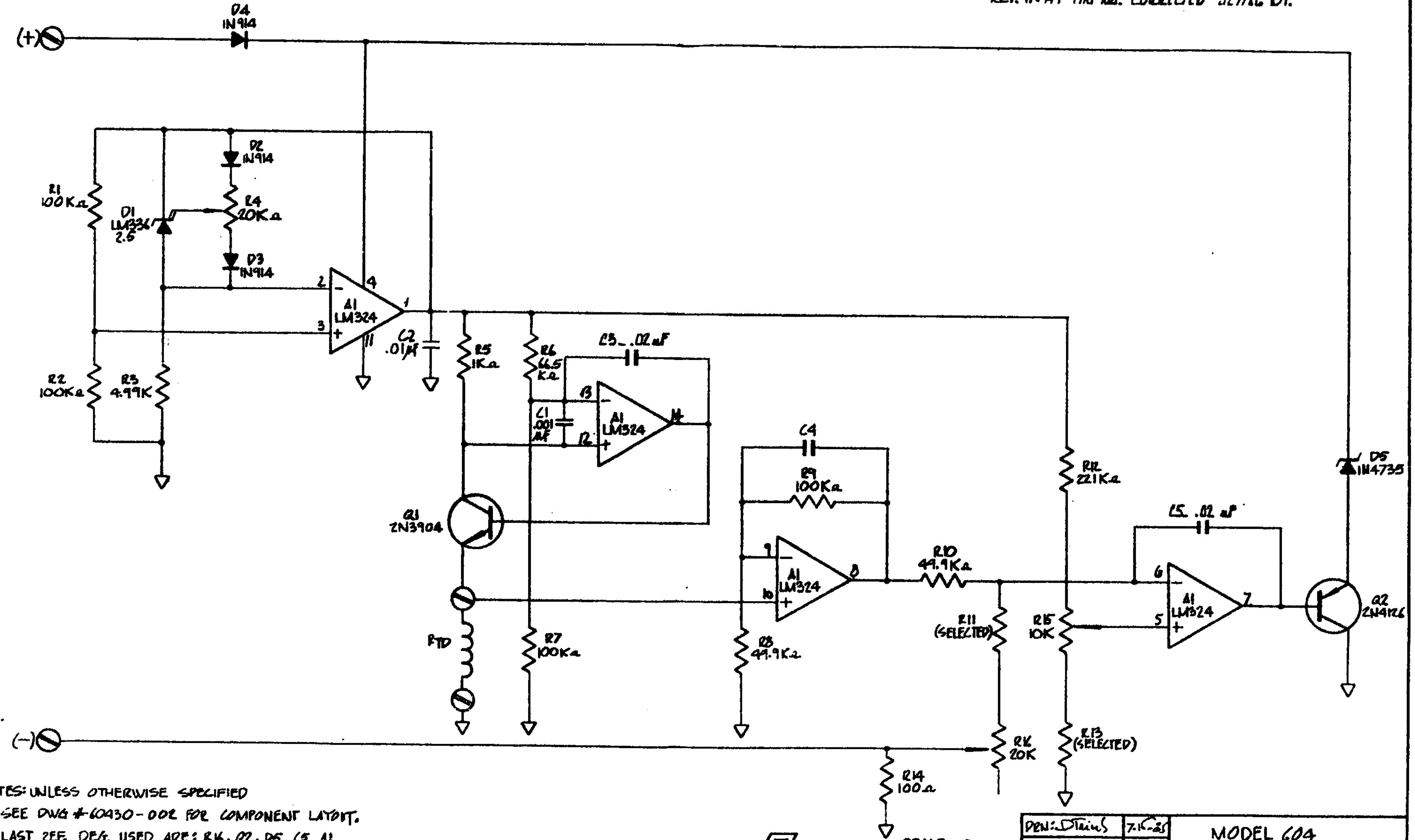
KURZ INSTRUMENTS INC.

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

DRN BY: Quon	7-17-85	MODEL 604 COMPONENTS LAYOUT
CHKD BY: DTran	7-22-85	
APVD BY: MV.	7/22 85	
		B 420046 REV. B SHT 1 OF 1

POST OFFICE BOX 849 • 20 VILLAGE SQUARE • CARMEL VALLEY, CALIFORNIA 93924 • (408) 659-3421 • TELEX 337795

REV. A: A1 PIN No. CORRECTED 2/27/86 DT.



NOTES: UNLESS OTHERWISE SPECIFIED

1. SEE DWG #60430-002 FOR COMPONENT LAYOUT.
2. LAST REF. DES. USED ARE: R16, Q2, D5, C5, A1.

KURZ INSTRUMENTS INC.

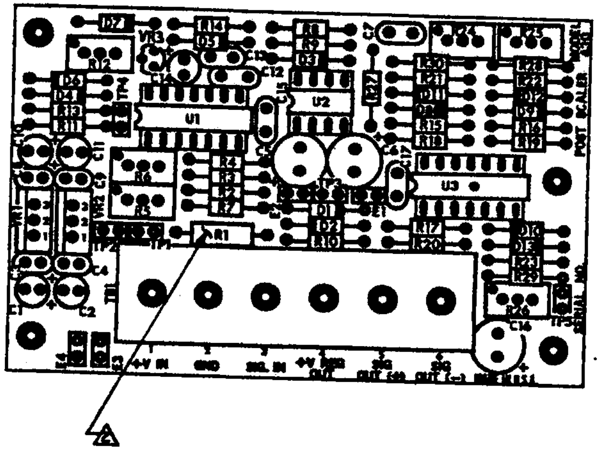
SCALE :
TOLERANCE
.XX ± .01
.XXX ± .003

DRN: DTrins 7-16-85
CHKD: Jmora 7-22-85
APVD: NKG 7/23/85

MODEL 604
SCHEMATIC DIAGRAM

B 3CC052 REV. A SHT 1 OF 1

POST OFFICE BOX 849 • 20 VILLAGE SQUARE • CARMEL VALLEY, CALIFORNIA 93924 • (408) 659-3421 • TELEX 337796



ALL COMPONENTS SHOWN INSTALLED

+5V SUP FOR DISPLAY	40	1	TP2	J PIN OR WIRE
	39			
	38	[illegible]	VR2	VOLTAGE REGULATOR 7805
	37			
	36	2	[illegible]	CAPACITOR .1 µf 50V CER.
	35	2	[illegible]	CAPACITOR [illegible] 25V ELEC

3 BREAK POINT LINEAR SECTION	56	4	R27-R30	RESISTOR 10K 1/8W OR 1/4W, 1%
	55	3	R21, R22, R23	RESISTOR .5Ω 1/8W OR 1/4W, 1%
	54	3	R18, R19, R20	RESISTOR SELECTED
	53	3	R15, R16, R17	RESISTOR 20K 1/8W OR 1/4W, 1%
	52	3	R24, R25, R26	RESISTOR POTENTIOMETER 20K
	51			
	50	1		SOCKET 14 PIN
	49			
	48	1	U3	IC LM324
	47			
	46	1	E1	2 PIN HEADER MOLEX
	45			
	44	6	D8-D13	DIODE IN914
	43			
	42	1	C17	CAPACITOR .01 µf 50V CER
	41	1	C16	CAPACITOR 100 µf 16V ELEC.

OPTIONS	ITEM	QTY	REF DES	DESCRIPTION
STANDARD VOLTAGE MODE	34			
	33	1	R11	RESISTOR 4.99K 1/8W OR 1/4W, 1%
	32	3	R9, R13, R14	RESISTOR 10K 1/8W OR 1/4W, 1%
	31	1	R8	RESISTOR 1K 1/8W OR 1/4W, 1%
	30	2	R4, R7	RESISTOR 9.09K 1/8W OR 1/4W, 1%
	29	2	R3, R10	RESISTOR SELECTED
	28	1	R2	RESISTOR 10 K 1/8W OR 1/4W, 1%
	27	1	R1	RESISTOR 100Ω 1/2W
	26	1	R12	RESISTOR POTENTIOMETER 10K
	25	2	R5, R6	RESISTOR POTENTIOMETER 2K
	24			
	23	1	VR3	VOLTAGE REGULATOR LM336 5V
	22	1	VR1	VOLTAGE REGULATOR 7815
	21	1		SOCKET 8 PIN
	20	1		SOCKET 14 PIN
	19			
	18	1	U2	IC 555 TIMER
	17	1	U1	IC LM324
	16			
	15	4	TP1, TP3-TP5	J PIN OR WIRE
	14	3	E2, E3, E4	2 PIN HEADER MOLEX
	13			
	12			
	11	7	D1 - D7	DIODE IN914
	10			
	9	1	C15	CAPACITOR .01 µf 50V CER
	8	3	C7, C12, C13	CAPACITOR .02 µf 50V MYLAR
	7	2	C5, C6	CAPACITOR 100 µf 16V ELEC
	6	2	C3, C8	CAPACITOR .1 µf 50V CER
	5	3	C1, C10, C14	CAPACITOR 10 µf 25V ELEC
	4			
	3	1	TB1	TERMINAL BLOCK, 6 PIN
	2			
	1			MODEL 430 PCB

PARTS LIST

NOTES: UNLESS OTHERWISE SPECIFIED
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM 300011
⚠2 FOR CURRENT INPUT INSTALL R1.

KURZ INSTRUMENTS INC.

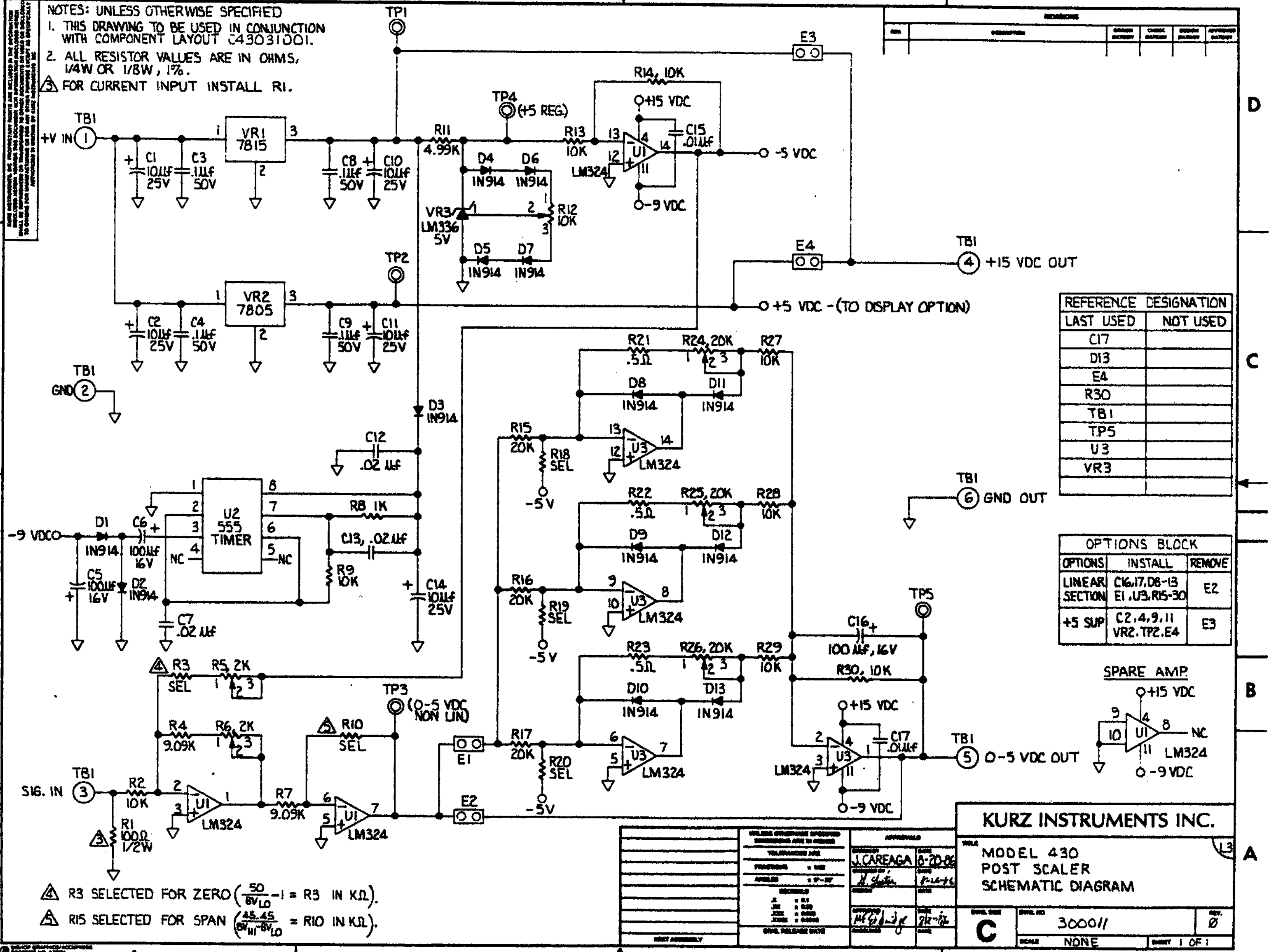
MODEL 430
POST SCALER
COMPONENT LAYOUT

J. CAREAGA 8-21-86
7-24-86
N/A
C
420015
REV 2

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT C43031001.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W OR 1/8W, 1%.

△3 FOR CURRENT INPUT INSTALL R1.



REFERENCE DESIGNATION	
LAST USED	NOT USED
C17	
D13	
E4	
R30	
TB1	
TP5	
U3	
VR3	

OPTIONS BLOCK		
OPTIONS	INSTALL	REMOVE
LINEAR SECTION	C16,17,D8-13 E1,U3,R15-30	E2
+5 SUP	C2,4,9,11 VR2,TP2,E4	E3

△4 R3 SELECTED FOR ZERO $\left(\frac{50}{8V_{LO}}-1 = R3\right.$ IN KΩ$\left.\right)$.

△5 R15 SELECTED FOR SPAN $\left(\frac{45.45}{8V_{HI}-8V_{LO}} = R10\right.$ IN KΩ$\left.\right)$.

J. CAREAGA 8-20-86

8-26-86

KURZ INSTRUMENTS INC.

MODEL 430
POST SCALER
SCHEMATIC DIAGRAM

C

3000//

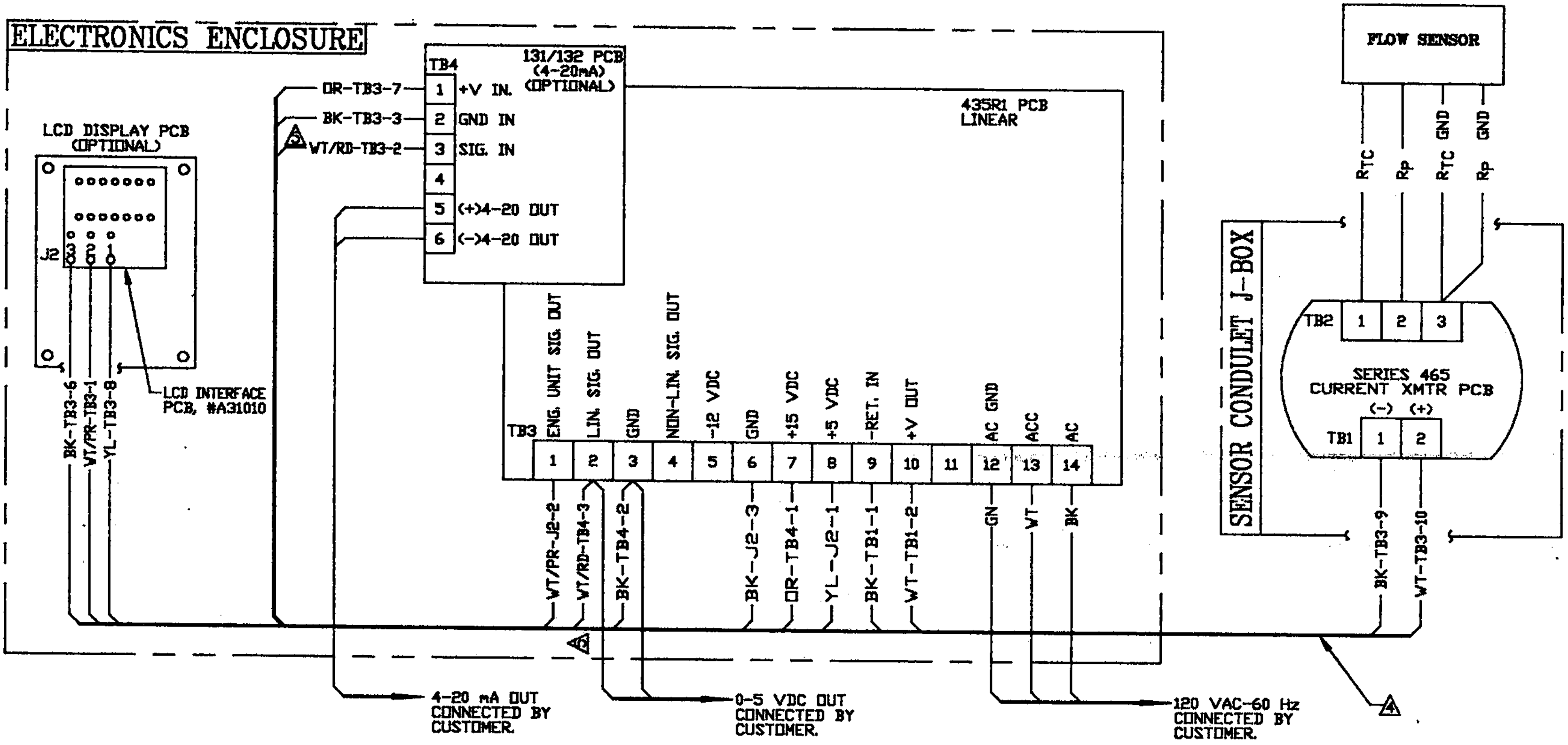
Ø

NONE

SHEET 1 OF 1

REV.	DESCRIPTION	DRAWN	CHECK	DESIGN	APPROVED
A	REVISED PER ECO No. A45547005, A47150, A55541005.	1.20.88	1-20-88	NA	1-20-88

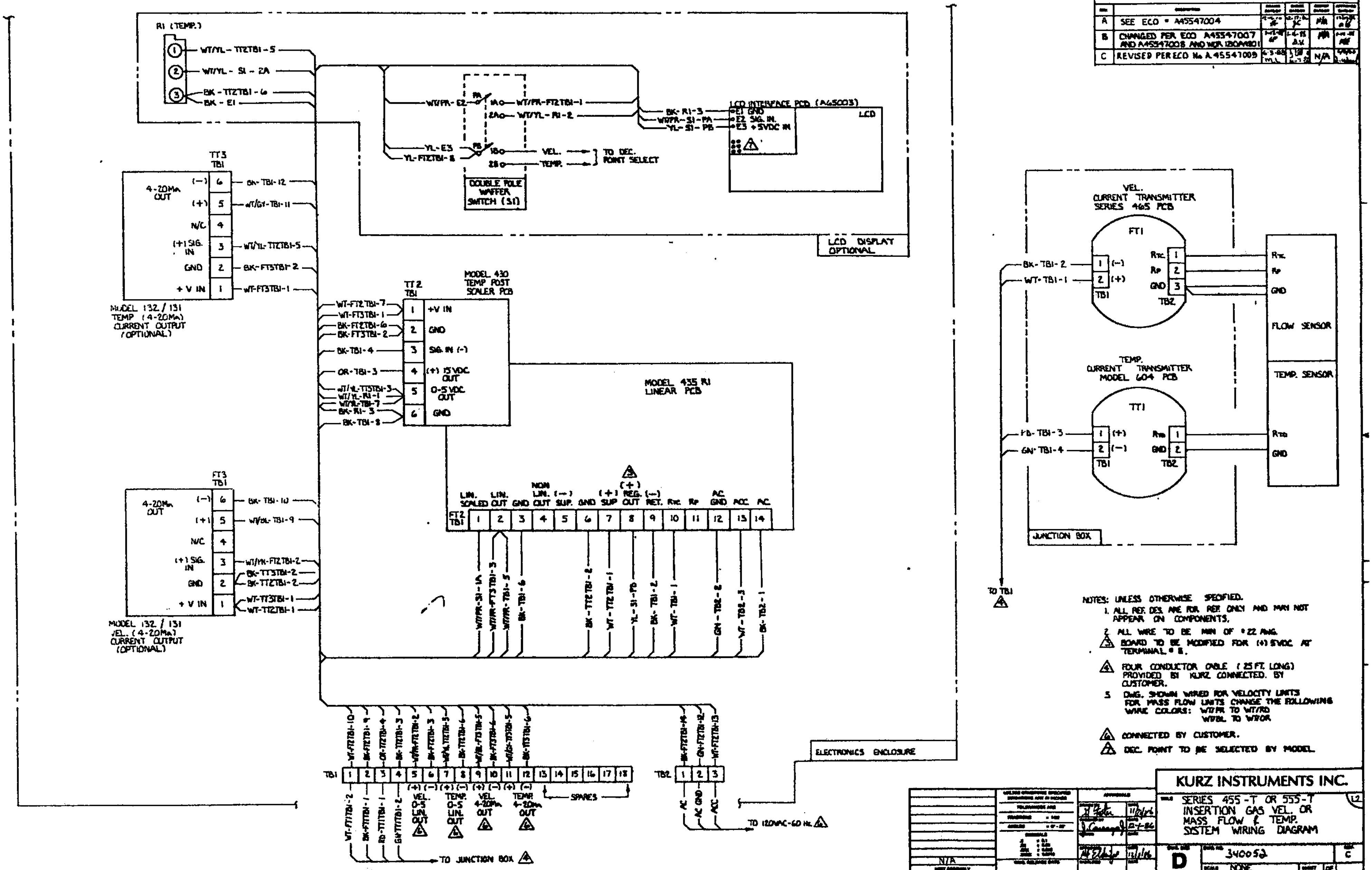
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL REF. DES. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS.
2. ALL WIRES TO BE A MIN. OF #22 AWG.
3. INSULATION SPADE LUGS TO BE USED FOR ALL CONNECTIONS.
4. TWO WIRE CABLE, 15 FT. LG. PROVIDED BY KURZ, CONNECTED BY CUSTOMER.
5. WIRE COLORS SHOWN ARE FOR MASS FLOW UNITS; FOR VELOCITY UNITS CHANGE COLOR FROM WT/RD TO WT/PR.



KURZ INSTRUMENTS INC.

TITLE: SERIES 455/555/505 SYSTEM WIRING DIAGRAM

DRAWN BY	N. Dial 1.20.88
CHECKED BY	1-20-88
DESIGN	NA
APPROVED BY	1-20-88
RELEASED	NA
NEXT ASSEMBLY	NA
DWG. SIZE	C
DWG. NO.	348055
REV.	A
SCALE	NONE
SHEET	1 OF 1



A	SEE ECO # A45547004	[illegible]	[illegible]	[illegible]	[illegible]
B	CHANGED PER ECO A45547007 AND A45547008 AND WOR 120A4801	[illegible]	[illegible] A.V.	[illegible]	[illegible]
C	REVISED PER ECO No A 45547009	6-3-88	[illegible]	N/A	[illegible]

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL REF. DES. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS.
2. ALL WIRE TO BE MIN OF # 22 AWG.
3. BOARD TO BE MODIFIED FOR (+) 5VDC AT TERMINAL # 8.
4. FOUR CONDUCTOR CABLE (25 FT. LONG) PROVIDED BY KURZ CONNECTED. BY CUSTOMER.
5. DWG. SHOWN WIRED FOR VELOCITY UNITS FOR MASS FLOW UNITS CHANGE THE FOLLOWING WIRE COLORS: WT/PR TO WT/RD
   WT/BL TO WT/OR
6. CONNECTED BY CUSTOMER.
7. DEC. POINT TO BE SELECTED BY MODEL.

N/A

11/24/86

12-1-86

12/1/86

KURZ INSTRUMENTS INC.

SERIES 455-T OR 555-T
INSERTION GAS VEL. OR
MASS FLOW & TEMP.
SYSTEM WIRING DIAGRAM

L2

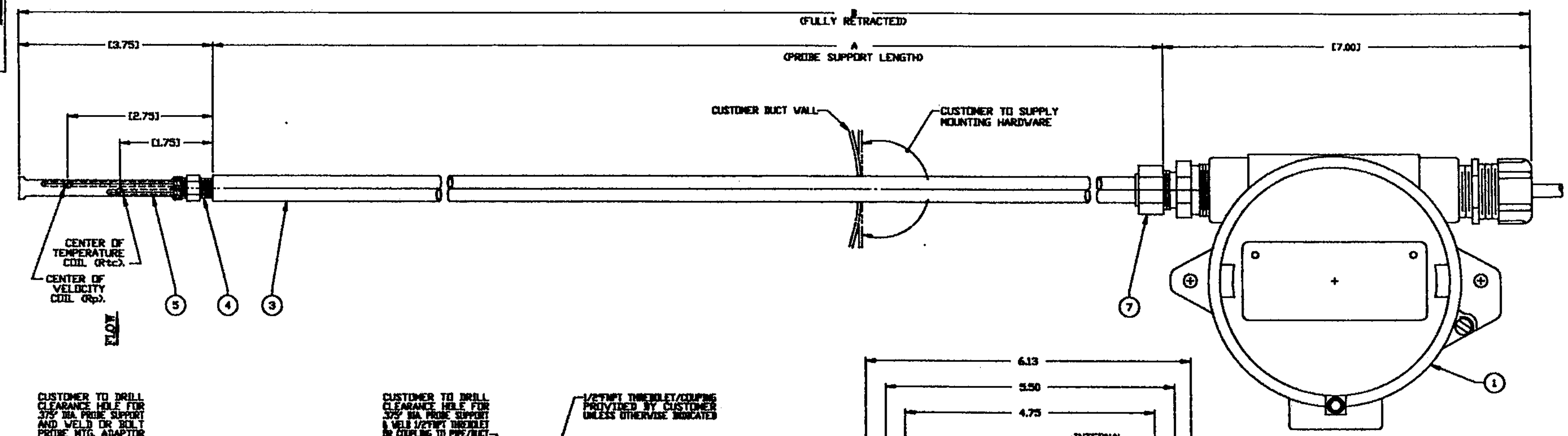
D

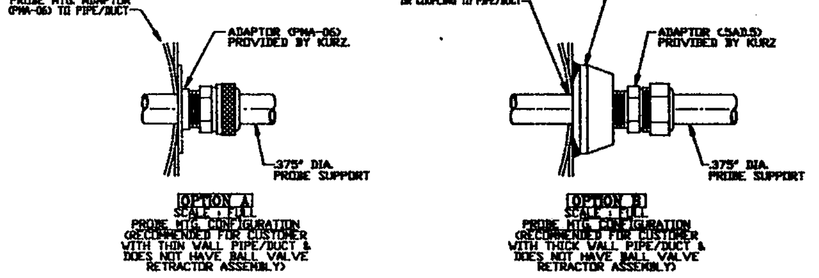
340052

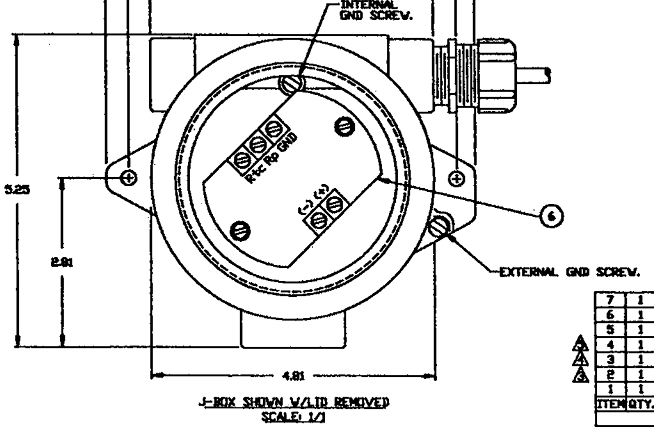
C

NONE

OF 1







NOTES: UNLESS OTHERWISE SPECIFIED
1. CENTER OF VELOCITY COIL (Rp) SHOULD BE @ A POINT OF AVERAGE FLOW (NORMALLY @ CENTER OF THE PIPE/DUCT).
2. FOR TEMP. BELOW 250°C/482°F USE HI-PURITY GOOP (OR EQUIV.) FOR ALL THREAD CONNECTIONS.
FOR TEMP. BETWEEN 250°C/482°F & 482°C/900°F USE SILVER GOOP (OR EQUIV.) FOR ALL THREAD CONNECTIONS.
3. TWO WIRE CABLE, 50 FT. LG. SUPPLIED BY KURZ, CONNECTED TO ELECTRONICS ENCLOSURE BY CUSTOMER. TEFZEL INSULATED CABLE WILL BE PROVIDED FOR NUCLEAR ORDERS ONLY.
4. PROBE SUPPORT LENGTH MAY CHANGE BASED ON CUSTOMER PIPE/DUCT SIZE OR SPECIAL REQUIREMENT.(USE DIM. TABLE
5. SENSOR WILL BE SELECTED BASED ON CUSTOMER REQUIREMENT (PIPE/DUCT SIZE, TEMP., ETC.)

DIMENSION TABLE

A = D/2 + 6"(ADJUSTABLE LG.)
B = A + 10.75"
WHERE:
A: PROBE SUPPORT LENGTH
B: FULLY RETRACTED LENGTH
D: CUSTOMER PIPE/DUCT OUTSIDE DIAMETER OR TOTAL SPANNER LENGTH.

	ITEM	QTY.	STOCK No.	DESCRIPTION
	7	1	010310	COMPRESSION FITTING 1/2 TUBE X 3/4 MNPT S.S.
	6	1	420032	CURRENT TRANSMITTER PCB, SERIES 465.
	5	1	150200	SENSOR WINDOW, 316 S.S.
△5	4	1		METAL SENSOR, SERIES 4456.
△4	3	1		PROBE SUPPORT
△3	2	1		CABLE, 2-WIRE, 15 FT. LG.
	1	1	900583	J-BOX, KILLARK ENCLOSURE SUB-ASSY

PARTS LIST

KURZ INSTRUMENTS INC.

PROBE ASSEMBLY, 450-06

T. ELLIS 4.21.87

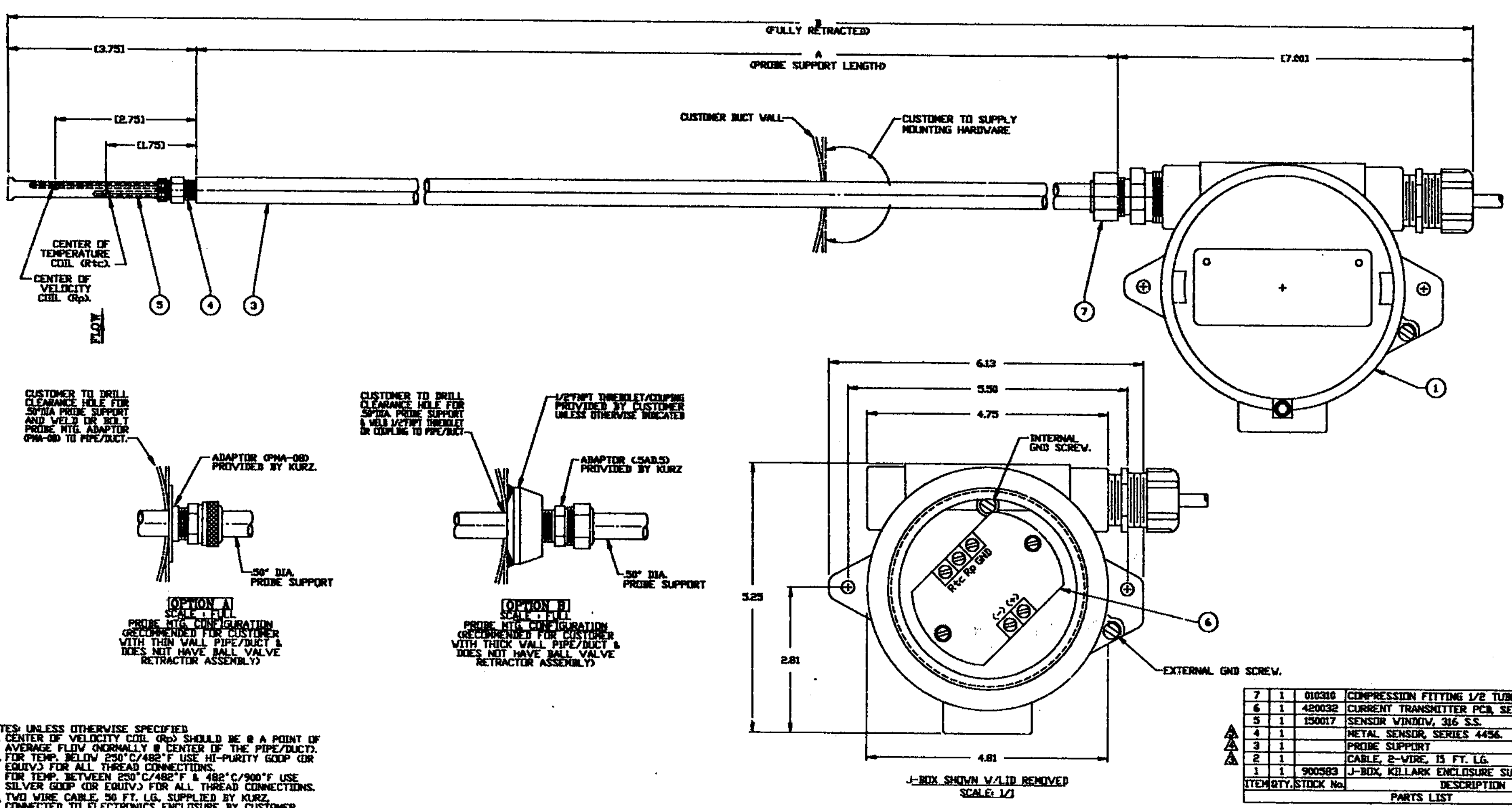
D

700455_01

A

A REVISED AND REDRAWN PER ECO [illegible]
47214

A	[illegible]	[illegible]



NOTES: UNLESS OTHERWISE SPECIFIED
1. CENTER OF VELOCITY COIL (Rp) SHOULD BE @ A POINT OF AVERAGE FLOW (NORMALLY @ CENTER OF THE PIPE/DUCT).
2. FOR TEMP. BELOW 250°C/482°F USE HI-PURITY GOOP (OR EQUIV) FOR ALL THREAD CONNECTIONS.
FOR TEMP. BETWEEN 250°C/482°F & 482°C/900°F USE SILVER GOOP (OR EQUIV) FOR ALL THREAD CONNECTIONS.
⚠3 TWO WIRE CABLE, 50 FT. LG. SUPPLIED BY KURZ. CONNECTED TO ELECTRONICS ENCLOSURE BY CUSTOMER. TEFZEL INSULATED CABLE WILL BE PROVIDED FOR NUCLEAR ORDERS ONLY.
⚠4 PROBE SUPPORT LENGTH MAY CHANGE BASED ON CUSTOMER PIPE/DUCT SIZE OR SPECIAL REQUIREMENT.(USE DIM. TABLE
⚠5 SENSOR WILL BE SELECTED BASED ON CUSTOMER REQUIREMENT (PIPE/DUCT SIZE, TEMP., ETC.)

DIMENSION TABLE
A = D/2 + 6"(ADJUSTABLE LG.)
B = A + 10.75"
WHERE:
A: PROBE SUPPORT LENGTH
B: FULLY RETRACTED LENGTH
D: CUSTOMER PIPE/DUCT OUTSIDE DIAMETER OR TOTAL SPANNER LENGTH.

	ITEM	QTY.	STOCK No.	DESCRIPTION
	7	1	010310	COMPRESSION FITTING 1/2 TUBE X 3/4 MNPT S.S.
	6	1	420032	CURRENT TRANSMITTER PCB, SERIES 465.
	5	1	150017	SENSOR WINDOW, 316 S.S.
⚠5	4	1		METAL SENSOR, SERIES 4456.
⚠4	3	1		PROBE SUPPORT
⚠3	2	1		CABLE, 2-WIRE, 15 FT. LG.
	1	1	900583	J-BOX, KILLARK ENCLOSURE SUB-ASSY

PARTS LIST

N/A

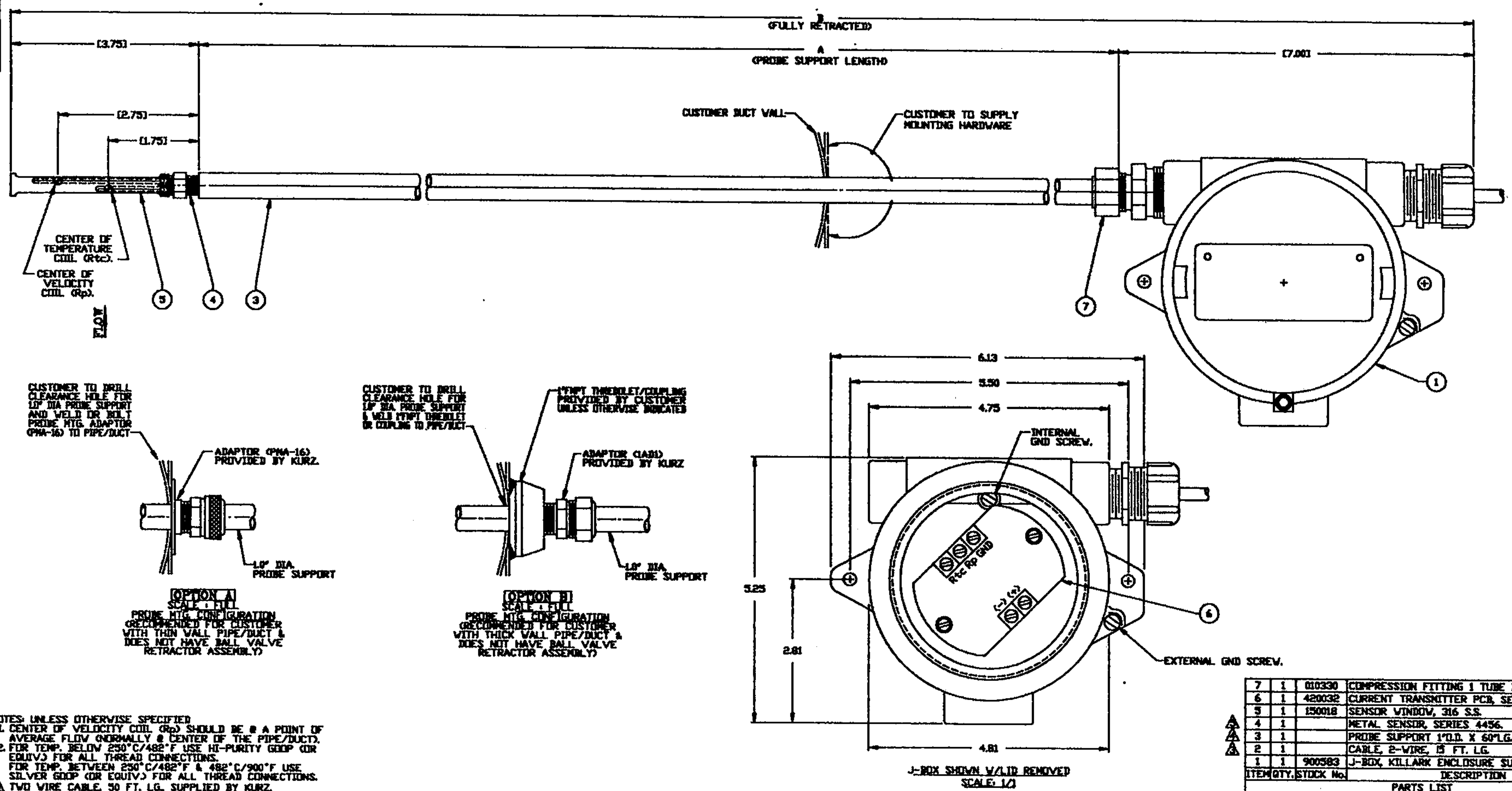
T. ELLIS 5.11.89
5/15/89
N/A
5/15/89
N/A

KURZ INSTRUMENTS INC.

PROBE ASSEMBLY, 450-08

12

D
700455_02
A
FULL
1 OF 1



NOTES: UNLESS OTHERWISE SPECIFIED
1. CENTER OF VELOCITY COIL (Rp) SHOULD BE @ A POINT OF AVERAGE FLOW (NORMALLY @ CENTER OF THE PIPE/DUCT).
2. FOR TEMP. BELOW 250°C/482°F USE HI-PURITY GOOP (OR EQUIV.) FOR ALL THREAD CONNECTIONS.
FOR TEMP. BETWEEN 250°C/482°F & 482°C/900°F USE SILVER GOOP (OR EQUIV.) FOR ALL THREAD CONNECTIONS.
3 TWO WIRE CABLE, 50 FT. LG., SUPPLIED BY KURZ, CONNECTED TO ELECTRONICS ENCLOSURE BY CUSTOMER. TEFZEL INSULATED CABLE WILL BE PROVIDED FOR NUCLEAR ORDERS ONLY.
4 PROBE SUPPORT LENGTH MAY CHANGE BASED ON CUSTOMER PIPE/DUCT SIZE OR SPECIAL REQUIREMENT.(USE DIM. TABLE
5 SENSOR WILL BE SELECTED BASED ON CUSTOMER REQUIREMENT (PIPE/DUCT SIZE, TEMP., ETC.)

DIMENSION TABLE

A = D/2 + 6"(ADJUSTABLE LG.)
B = A + 10.75"
WHERE:
A: PROBE SUPPORT LENGTH
B: FULLY RETRACTED LENGTH
D: CUSTOMER PIPE/DUCT OUTSIDE DIAMETER OR TOTAL SPANNER LENGTH.

ITEM	QTY.	STOCK No.	DESCRIPTION
7	1	010330	COMPRESSION FITTING 1 TUBE X 3/4 MNPT S.S.
6	1	420032	CURRENT TRANSMITTER PCB, SERIES 465.
5	1	150018	SENSOR WINDOW, 316 S.S.
4	1		METAL SENSOR, SERIES 4456.
3	1		PROBE SUPPORT 1"O.D. X 60"LG. (STD)
2	1		CABLE, 2-WIRE, 15 FT. LG.
1	1	900583	J-BOX, KILLARK ENCLOSURE SUB-ASSY

PARTS LIST

KURZ INSTRUMENTS INC.

PROBE ASSEMBLY, 450-16

T. ELLIS 4.21.87
6/21/9
UA
6/21/9
UA

D

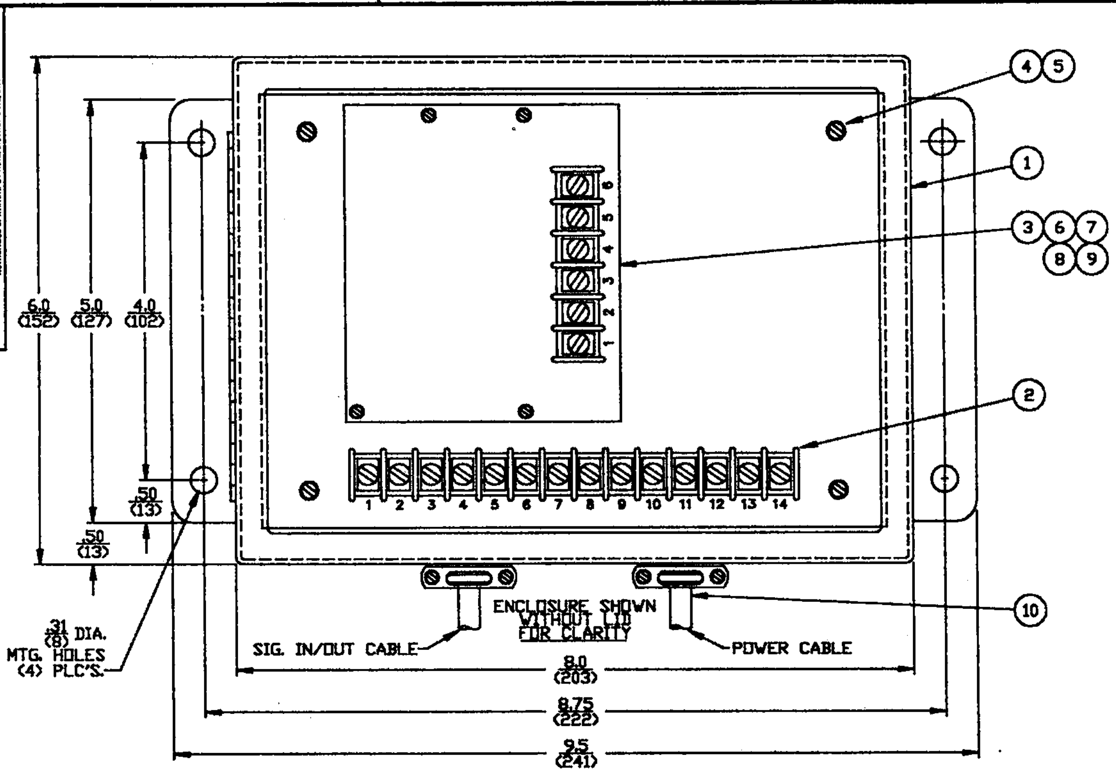
700 455_05

A

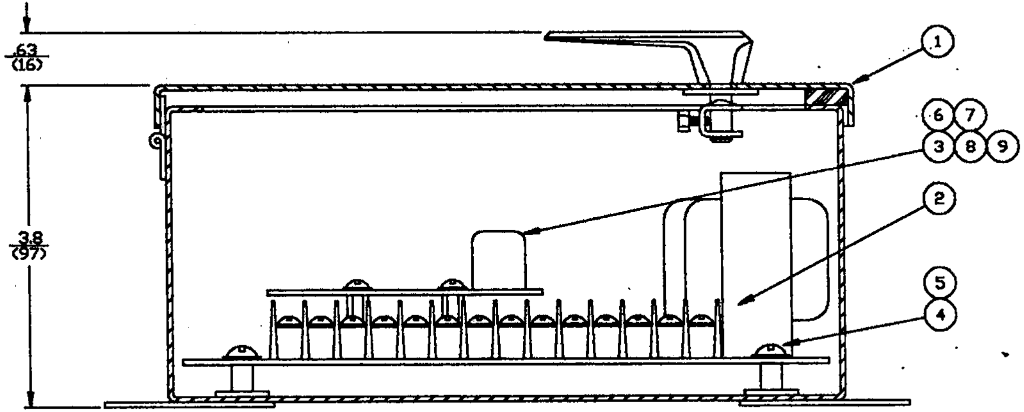
FULL

1 OF 1

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	ENGR DATE/BY	APPROVED DATE/BY



NOTES:
1. DIMENSIONS IN PARENTHESIS ARE IN MILIMETERS.
2. WEIGHT APPROX.: 2 LBS.



QTY.	ITEM	STOCK No.	DESCRIPTION
1	10	290061	POWER CORD, 6 FT. LG., BELDEN #17047.
8	9		HDW, INTERNAL LOCK WASHER, #4.
4	8		HDW, NUT, #4-40, HEX.
4	7		HDW, SCREW, #4-40x5/16" LG., PAN HD.
4	6		HDW, STAND OFF, #4-40x7/8" LG., M/F.
4	5		HDW, INTERNAL LOCK WASHER, #10.
4	4		HDW, SCREW, #10-32x3/8" LG., PAN HD.
1	3	420006	PCB, ASSY., 132, #C13231001.
1	2	420020	PCB, ASSY., 435R1, #D43531001-004.
1	1	110009	ENCLOSURE, 080604, STD.

PARTS LIST

NEXT ASSEMBLY

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

APPROVALS	
DRAWN BY DDiel	DATE 7-12-88
CHECKED BY J. Foster	DATE 7-13-88
DESIGN GA	DATE
APPROVED DDiel	DATE 7-14-88
RELEASED AM	DATE

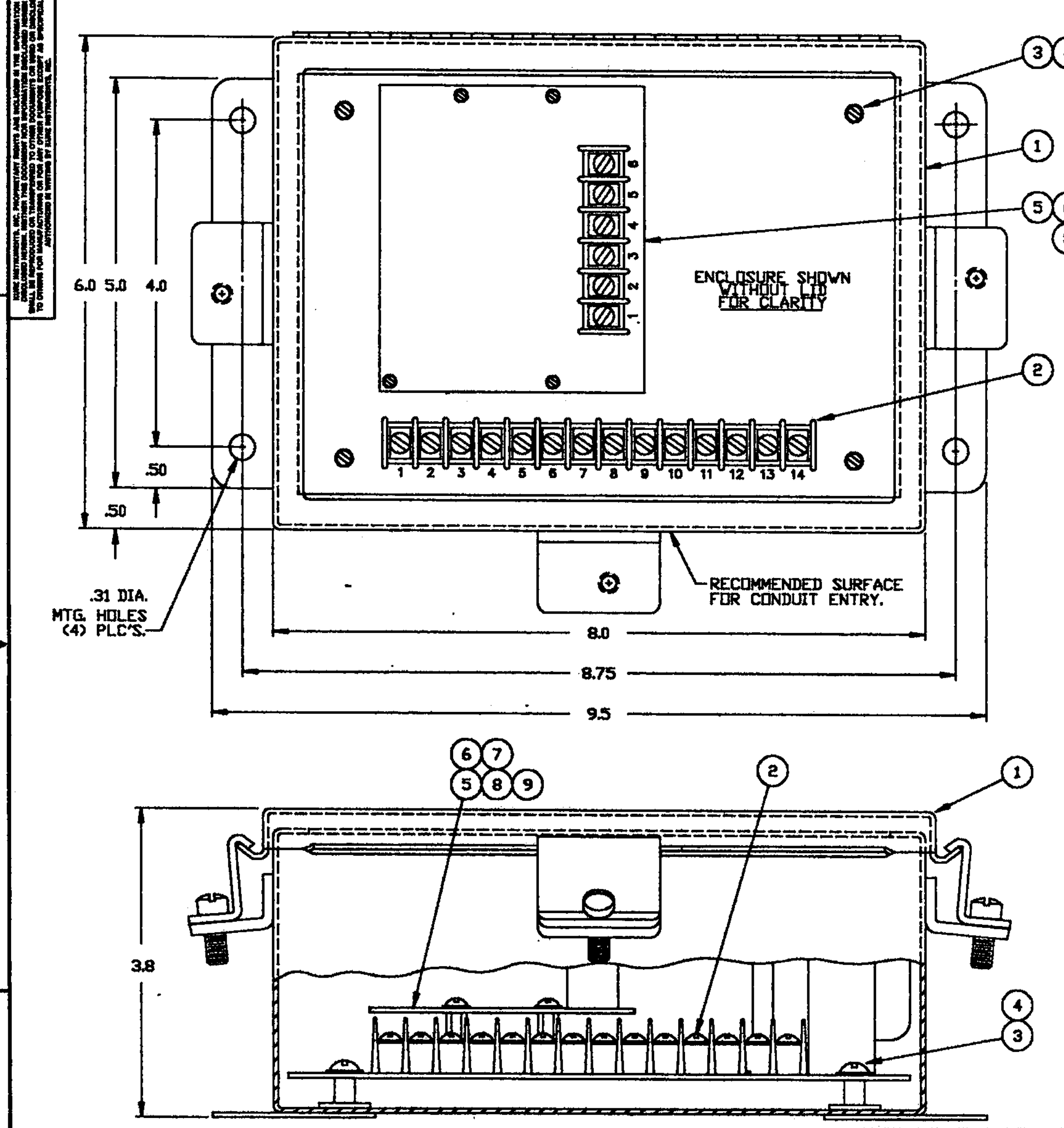
KURZ INSTRUMENTS INC.

TITLE
ENCLOSURE, ELECTRONICS
-080604 ASSY.

12

DWG. SIZE	DWG. NO.	REV.
C	C70013	0
	SCALE FULL	SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS



NOTES:
⚠ PART(S) NOT SHOWN FOR CLARITY.
2. WEIGHT APPROX. : 2 LBS.

QTY.	ITEM	STOCK No.	DESCRIPTION
⚠ 1	10	29906101	POWER CORD, 6 FT. LG., BELDEN #17047.
8	9		HDW, INTERNAL LOCK WASHER, #4.
4	8		HDW, NUT, #4-40, HEX.
4	7		HDW, SCREW, #4-40x5/16" LG., PAN HD.
4	6		HDW, STAND OFF, #4-40x7/8" LG., M/F.
1	5	42200601	PCB, ASSY., 132, #C13231001.
4	4		HDW, INTERNAL LOCK WASHER, #10.
4	3		HDW, SCREW, #10-32x3/8" LG., PAN HD.
1	2	42202001	PCB ASSY., 435R1, #D43531001-004.
1	1	11902501	ENCLOSURE, NEMA 4, HOFFMAN #A-806CHNF.

PARTS LIST

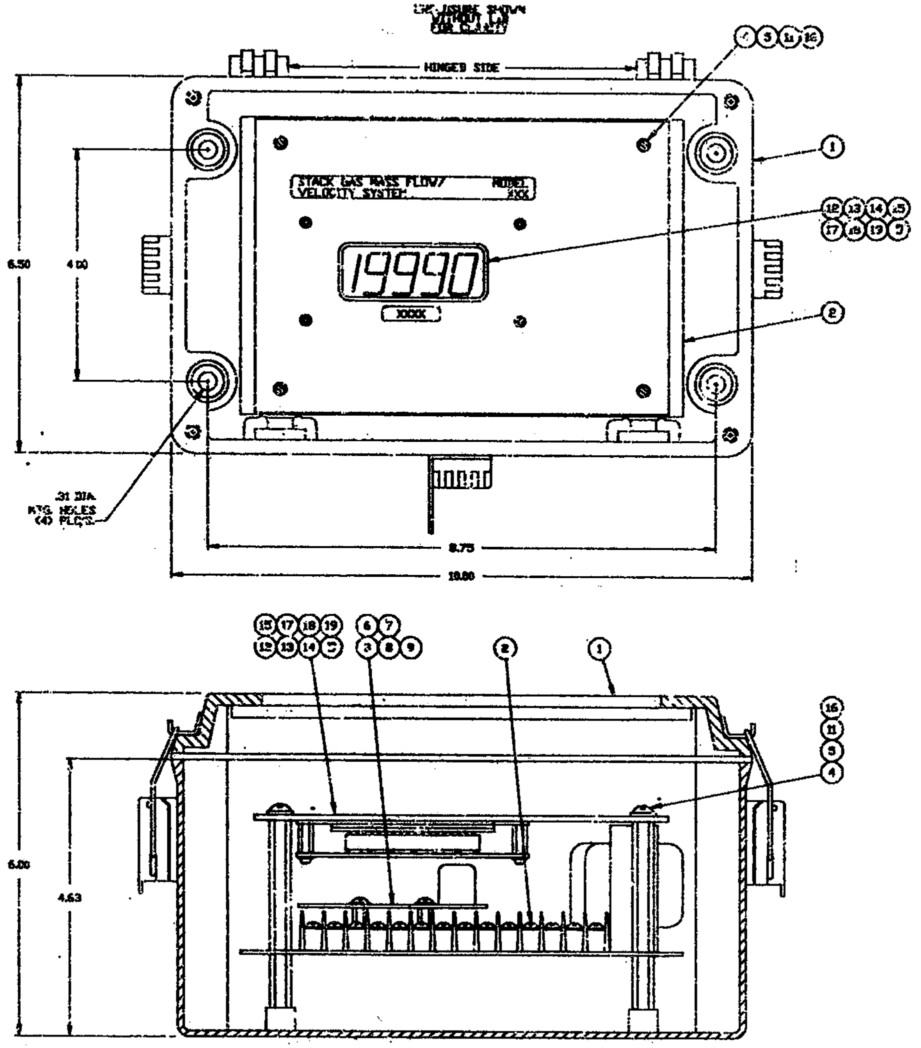
KURZ INSTRUMENTS INC.

TITLE
ENCLOSURE, ELECTRONICS,
-080604, -N4, ASSY.

DRAWN BY	D. Dial	DATE	7.26.88
CHECKED BY	G. Foster	DATE	8-22-88
DESIGN	AJA	DATE	
APPROVED	D. Dial	DATE	9-12-88
RELEASED	AJA	DATE	

NEXT ASSEMBLY

DWG. SIZE C
DWG. NO. C7D017
REV. 0
SCALE FULL
SHEET 1 OF 1



NOTES:
1. PART(S) NOT SHOWN FOR CLARITY
2. WEIGHT APPROX. 2 LBS

QTY.	ITEM	STOCK No.	DESCRIPTION
4	19		HDW, STAND OFF, #4-40x1/2" LG, F/F.
4	18		HDW, SCREW, #4-40x3/16" LG, ROUND HD.
4	17		HDW, SCREW, #4-40x3/16" LG, FLAT HD.
4	16		HDW, STAND OFF, #10-32x2.25" LG, M/F
1	15	420129	PCB, LCD INTERFACE, #A5[illegible]
1	14	370071	LCD LENS.
1	13		LIQUID CRYSTAL DISPLAY.
1	12	140123	FACE PLATE, LCD, #A15001.
4	11		HDW, STAND OFF, #10-32x1" LG, HEX, M/F.
1	10	290061	POWER CORD, 6 FT. LG, BELDEN #17047.
12	9		HDW, INTERNAL LOCK WASHER, #4
4	8		HDW, NUT, #4-40, HEX.
4	7		HDW, SCREW, #4-40x5/16" LG, PAN HD.
4	6		HDW, STAND OFF, #4-40x7/8" LG, M/F.
4	5		HDW, INTERNAL LOCK WASHER, #10.
4	4		HDW, SCREW, #10-32x3/8" LG, PAN HD.
1	3	420006	PCB, ASSY, 132, #C13231001.
1	2	420020	PCB, ASSY, 435R1, #D43531001-004.
1	1		ENCLOSURE, 100606, FIBER GLASS.

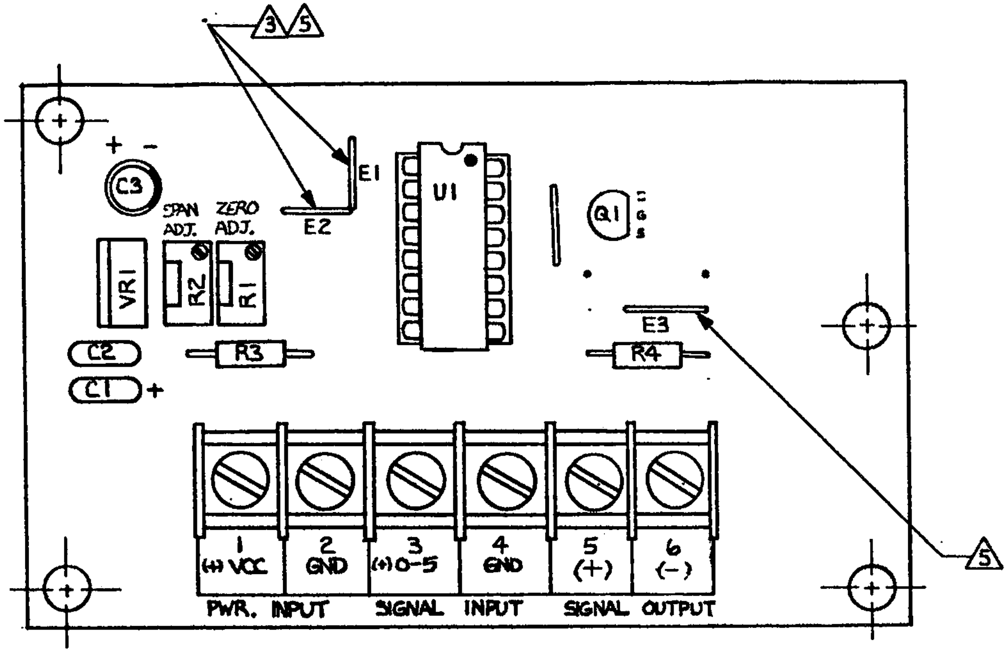
PARTS LIST

KURZ INSTRUMENTS INC.

TITLE
ENCLOSURE, ELECTRONICS
-100606, -[illegible]4XT. ASSY.

D
D70015
SCALE FULL
SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	A'VD	DATE
A	RELEASED FOR PRODUCTION	DT/[illegible]/DT	7/5/86
B	REVISED TO CLARIFY OPTIONS	JC/DT/[illegible]	7/22/86
C	REVISED DELETED 1-5 VDC OUT OPTION	J.C 9/15/86 DT/[illegible]	9-15-86



ALL COMPONENTS SHOWN INSTALLED

ITEM NO.	REF. DES.	DESCRIPTION	QTY.
12	R4	RESISTOR 31.6 Ω	1
11	R3	RESISTOR 49.9 KΩ	1
10	R1,R2	POTENTIOMETER 100 KΩ # 64W104	2
9	C3	CAPACITOR 10μF - 25 VDC	1
8	C2	CAPACITOR .02μF - 50 VDC	1
7	C1	CAPACITOR 1μF - 35 VDC TANTALUM MALLORY # TDC105K035NLE	1
△2 6	Q1	TRANSISTOR CHANNEL ENHANCEMENT MODE VERTICAL DMOS POWER F.E.T.S SUPER TEX # VP0116N3	1
5	VR1	VOLTAGE REGULATOR +15V #7815	1
△2 4	U1	IC VOLTAGE TO CURRENT CONVERTER/ TRANSMITTER BURR-BROWN #XTR110BG.	1
3		DIP SOCKET - 16 PIN	1
2		TERMINAL BLOCK- "AU 6-PIN 3/8" CENTERS	1
1		PCB - B13165003	1

PARTS LIST

NOTES:

1. FOR SCHEMATIC DIAGRAM SEE # B13130002.

△2 ITEMS #4 AND #6 ARE ELECTROSTATIC SENSITIVE DEVICES THEY HAVE TO BE HANDLED & ASSEMBLED AT A STATIC FREE STATION ONLY.

△3 OPTION - FOR 4-20mA OUT INSTALL E1.

△4 REMOVED.

△5 OPTION - FOR 0-20mA OUT REMOVE E1 AND INSTALL E2 AND E3

KURZ INSTRUMENTS INC.

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

DRAWN BY G. FOSTER 2/18/86
[illegible] [illegible]
APVD [illegible] [illegible]

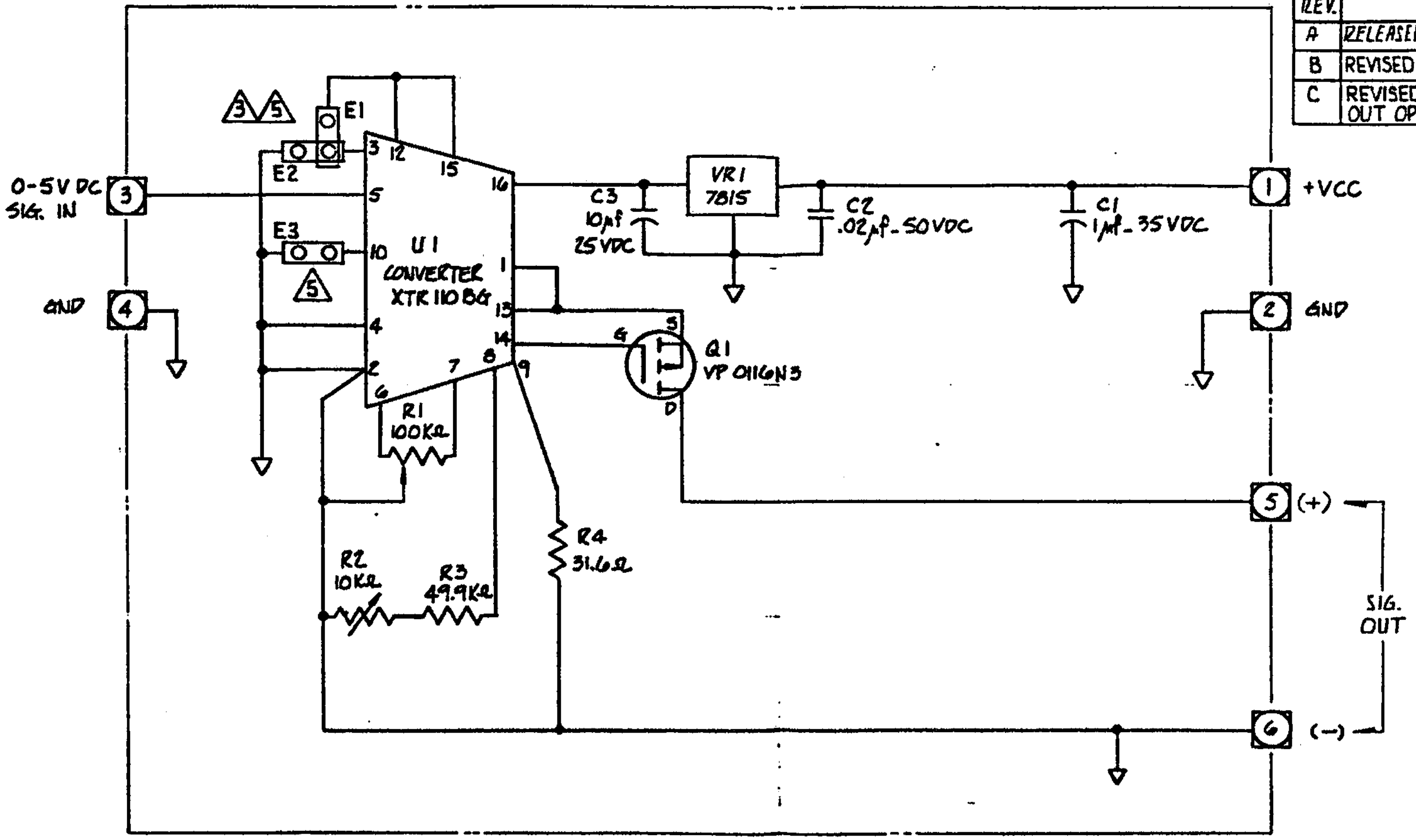
MODEL 131 RI
NON ISOLATED OUTPUT
COMPONENT LAYOUT

B 420005 REV. C SHT 1 OF 1

POST OFFICE BOX 849 • 20 VILLAGE SQUARE • CARMEL VALLEY, CALIFORNIA 93924 • (408) 659-3421 • TELEX 337795

REVISIONS

REV.	DESCRIPTION	APVD		DATE
A	RELEASED FOR PROD.	DT/IH IDT		7/9/86
B	REVISED TO CLARIFY OPTIONS	JC/DT/IH		7/28/86
C	REVISED DELETED 1-5 VDC OUT OPTION	J.C 9/15/86	DT HG	9/15/86



NOTES:

1. FOR COMPONENT DIAGRAM LAYOUT SEE DWG. # B13131001.
2. LAST REFERENCE DESIGNATIONS USED ARE U1, Q1, VR1, C3, R5.
3. OPTION FOR 4-20mA OUT INSTALL E1.
4. REMOVED.
5. OPTION FOR 0-20mA OUT REMOVE E1 AND INSTALL E2 AND E3.

KURZ INSTRUMENTS INC.

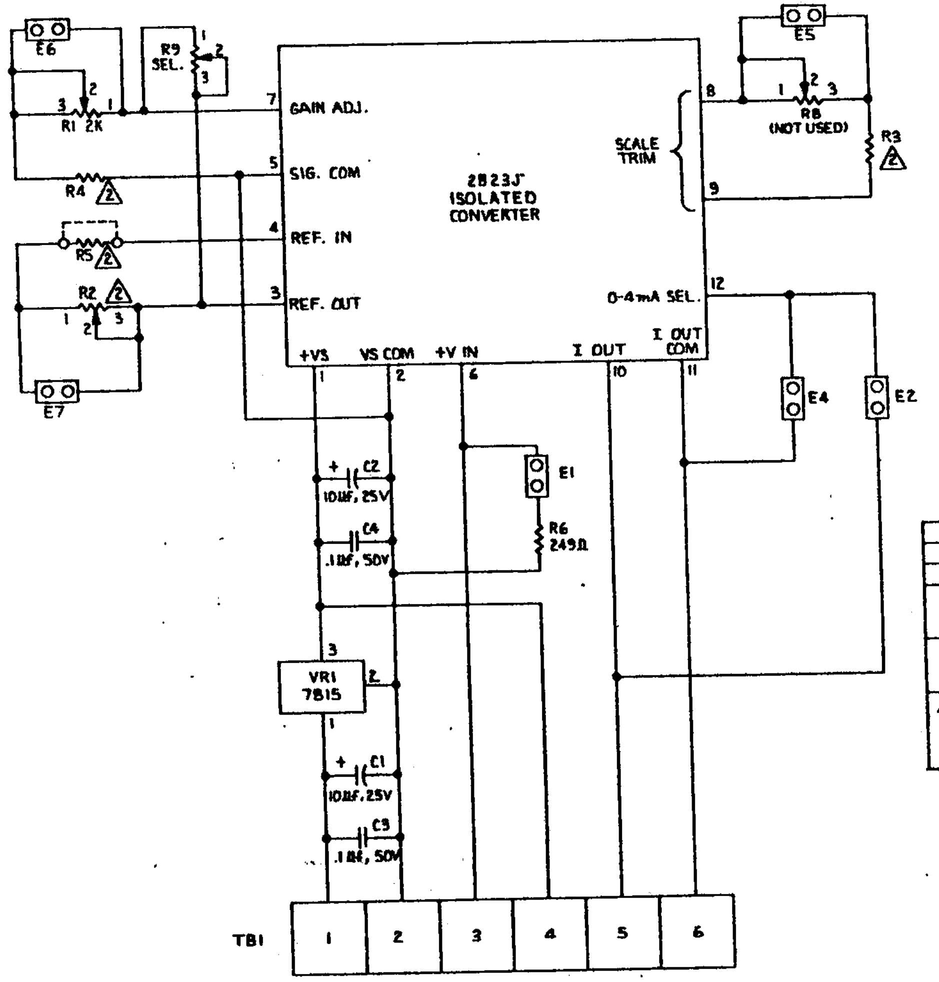
SCALE : NONE
TOLERANCE
.XX ± .01
.XXX ± .003

DRN : Aurora	2-14-86	MODEL 131R1 NON-ISOLATED OUTPUT SCHEMATIC DIAGRAM			L3
CHKD: D.Kirk	3-6-86				
APVD:					
		B	300028	REV. C	SHT 1 OF 1

POST OFFICE BOX 849 • 20 VILLAGE SQUARE • CARMEL VALLEY, CALIFORNIA 93924 • (408) 659-3421 • TELEX 337795

A	REVISED DELETED 4-20mA IN,0-5 VDC OUT OPTION	J.C. 9/15/86	9/15/86		9/15/86
B	REVISED PER ECO No A132 470D4	6-16-88	6/17/88	N/A	6/23/88

NOTES: UNLESS OTHERWISE SPECIFIED
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT C13231001.
⚠2 FOR OPTIONS SEE 'OPTIONS TABLE'.



REFERENCE DESIGNATION TABLE	
LAST USED	NOT USED
C4	
E7	E3
R10	R7, R8
TB1	
2823J CONVERTER	

⚠2 OPTIONS TABLE

OPTION		TERMINAL BLOCK (TB1)						DO NOT INSTALL	COMPONENT VALUE
IN	OUT	TB1-1	TB1-2	TB1-3	TB1-4	TB1-5	TB1-6		
0-5 VDC	4-20 mA	+V	GND	SIG. IN (+)	SIG IN (-)	4-20 OUT (+)	4-20 OUT (-)	R6,R7,R8,R9,R10 E1,E2,E3,E6,E7	R1 & R2 2K R3 301Ω R4 & R5 9.09K
0-5 VDC	0-20 mA	+V	GND	SIG. IN (+)	SIG. IN (-)	0-20 OUT (+)	0-20 OUT (-)	R6,R7R8,R9,R10 E1,E3,E4,E6,E7	R1 2K R2 500K, R3 121Ω R4 10K, R5 200K
4-20 mA	4-20 mA	+V	GND	RET IN	SUP OUT	4-20 OUT (+)	4-20 OUT (-)	R1,R5,R7,R8,R10 E3,E4,E7	R2 50K R3 301Ω R4 9.09K R5 WIRE JUMPER R6 249Ω R9 SELECTED

N/A

J. CAREAGA 8-13-86
8-15-86

KURZ INSTRUMENTS INC.

MODEL 132
ISOLATED SIGNAL OUTPUT CONVERTER
SCHEMATIC DIAGRAM

L3

C

300003

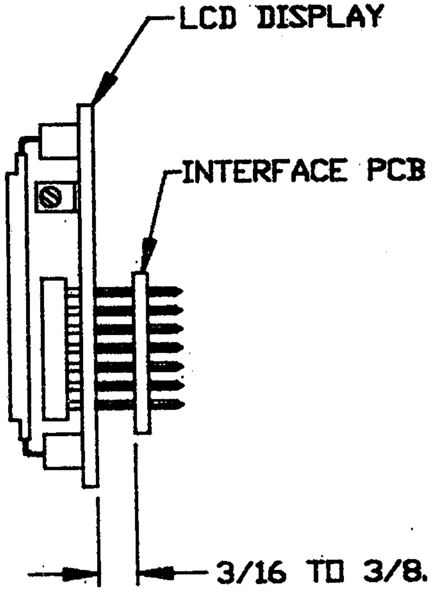
B

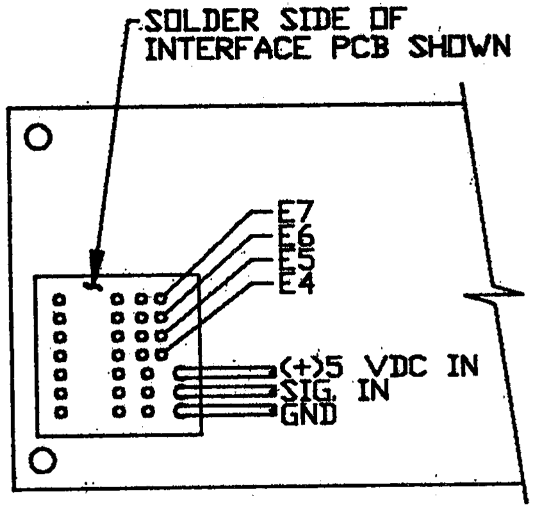
NONE

1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED
1. SEE DWG. No. A30020 FOR SCHEMATIC DIAGRAM.

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY





N/A	
NEXT ASSEMBLY	

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

APPROVALS	
DRAWN BY	DATE 7.17.87
CHECKED BY	DATE 7-17-87
DESIGN N/A	DATE
APPROVED	DATE 7-17-8
BASELINED N/A	DATE

KURZ INSTRUMENTS INC.

TITLE L2

SINGLE RANGE LCD
DISPLAY INTERFACE PCB
ASSEMBLY DETAIL.

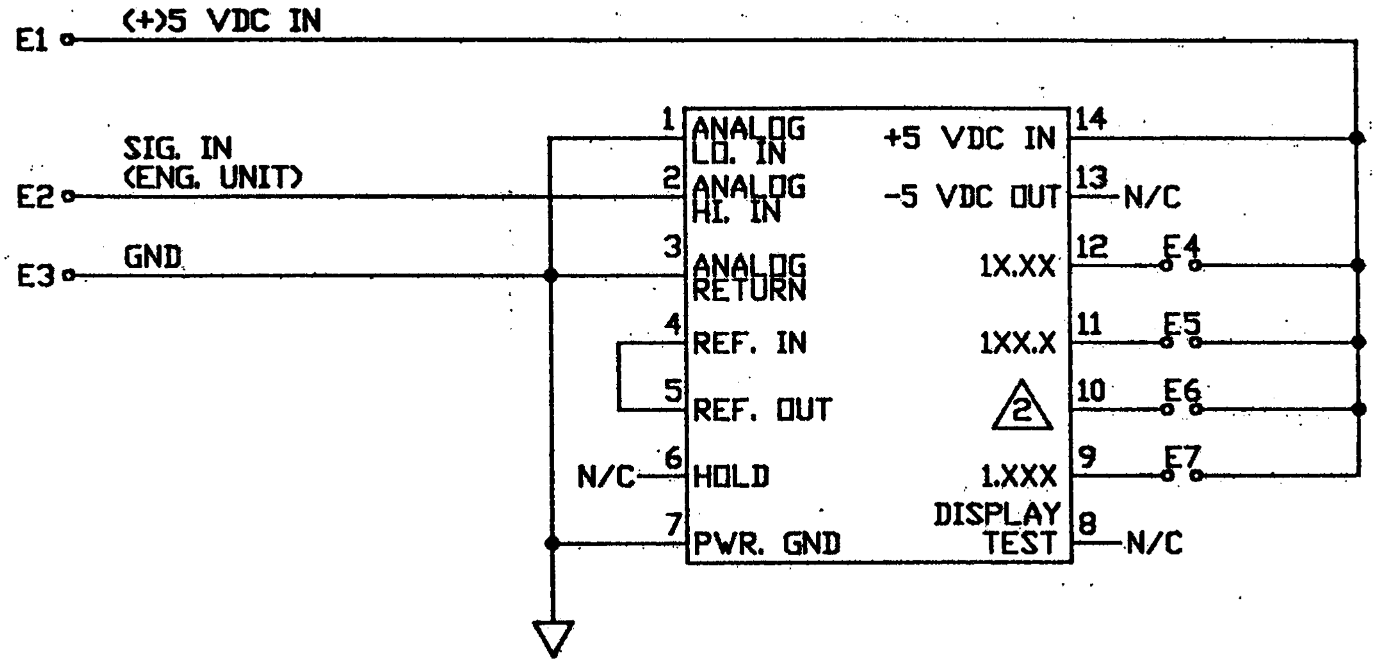
DWG. SIZE	DWG. NO.	REV.
A	420129	D
	SCALE FULL	SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS

NOTES: UNLESS OTHERWISE SPECIFIED
1. SEE DWG. No. A31010 FOR ASSY. DETAIL.
⚠2 PIN 10 HAS DUAL FUNCTIONS:
A) POLARITY INVERTER FOR 3.5 DIGIT LCD.
B) DUMMY ZERO FOR 4.5 DIGIT LCD.

REVISIONS

REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY



KURZ INSTRUMENTS INC.

N/A	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVALS
NEXT ASSEMBLY	TOLERANCES ARE	DRAWN BY DTaicl DATE 7.17.87
	FRACTIONS ± 1/32	CHECKED BY JDYoung DATE 7-17-87
	ANGLES ± 0° - 30'	DESIGN N/A DATE
	DECIMALS .X ± 0.1 .XX ± 0.03 .XXX ± 0.005 .XXXX ± 0.0010	APPROVED DATE 7-17-87
	ORIG. RELEASE DATE	BASELINED N/A DATE

TITLE L3

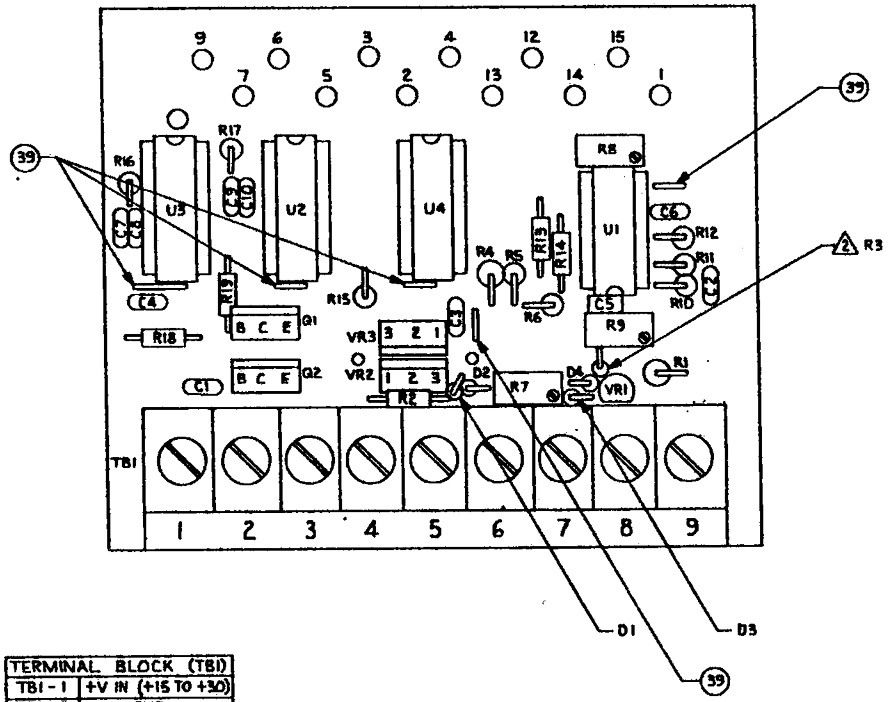
SINGLE RANGE LCD DIPLAY
INTERFACE SCHEMATIC DIAGRAM.

DWG. SIZE A
DWG. NO. 300054
REV. 0
SCALE NONE
SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A36292

A	REVISED PER ECO A10147001	3-4-87	3-4-87	

NOTES: UNLESS OTHERWISE SPECIFIED
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM 300001
⚠2 USE R3 ONLY WITH 4-20mA INPUT.
3. ALL DIODES TO BE ASSEMBLED WITH THE CATHODE TO THE P.C.B.



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

ITEM	QTY	REF DES	DESCRIPTION
39	A/R		WIRE JUMPER
38			
37	2	R16.R17	RESISTOR 221K 1/8W 1%
36	1	R15	RESISTOR .5Ω 1/8W 5%
35	1	R12	RESISTOR 100K 1/8W 1%
34	1	R10	RESISTOR 499K 1/8W 1%
33	1	R6	RESISTOR 49.9K 1/8W 1%
32	1	R5	RESISTOR 249K 1/8W 1%
31	1	R4	RESISTOR 392K 1/8W 1%
⚠2 30	6	R3.11.13.14.18.19	RESISTOR 10K 1/8W 1%
29	1	R2	RESISTOR 2.21K 1/8W 1%
28	1	R1	RESISTOR 255Ω 1/4W 1%
27	1	R9	RESISTOR POTENTIOMETER 50K
26	1	R8	RESISTOR POTENTIOMETER 500K
25	1	R7	RESISTOR POTENTIOMETER 10K
24			
23	1	VR3	VOLTAGE REGULATOR 7805
22	1	VR2	VOLTAGE REGULATOR 7812
21	1	VR1	VOLTAGE REGULATOR LM336 5.0V
20	3		SOCKET 16 PIN
19	1		SOCKET 14 PIN
18			
17	1	U3	I.C. 74C221
16	2	U2.U4	I.C. CD4040BC
15	1	U1	I.C. VFQ-1C
14			
13	2	Q1.Q2	TRANSISTOR 2N6388
12			
11	4	D1.D2.D3.D4	DIODE 1N914
10	1		
9			
8	1	C6	CAPACITOR 220PF 50V CER
7	1	C5	CAPACITOR .001Uf 50V CER
6	8	C1-C4.C7-C10	CAPACITOR .1Uf 50V CER
5			
4			TERMINAL MARKER STRIP 9 PIN .375 CENTERS
3	1	TB1	TERMINAL STRIP 9 PIN, BEAU, .375 CENTERS
2			
1	1		MODEL 101 PCB

PARTS LIST

KURZ INSTRUMENTS INC.

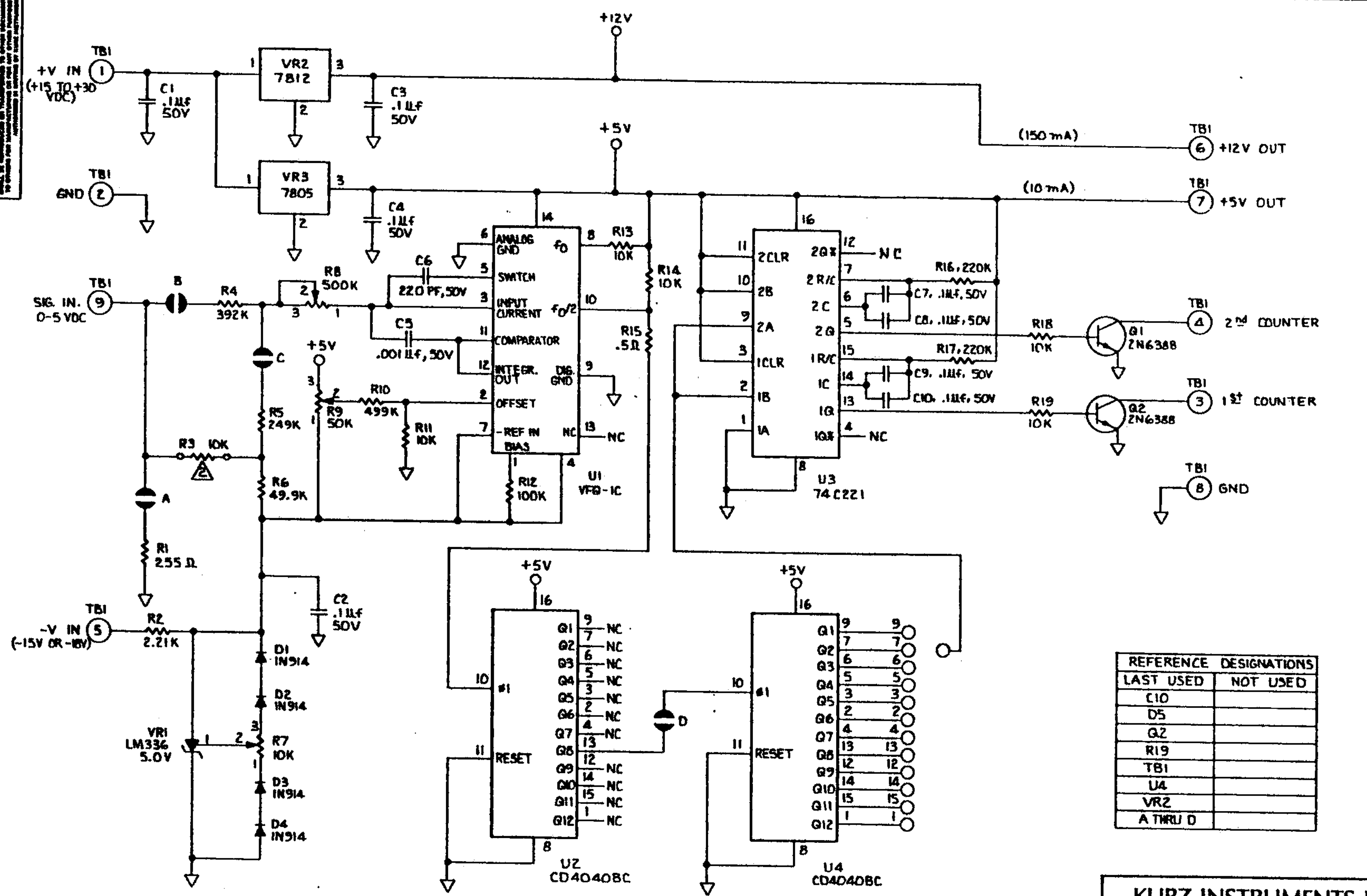
MODEL 101
TOTALIZER
COMPONENT LAYOUT

APPROVALS
J. CAREAGA 8-25-86
8-26-86
W Eldridge 9 Dec '86

C
4-20001
REV. A
SCALE NONE
SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT C10131003.
2 USE ONLY WITH 4-20 mA INPUT.

A	REVISED PER ECO № A10147003			N/A	



REFERENCE DESIGNATIONS	
LAST USED	NOT USED
C10	
D5	
Q2	
R19	
TB1	
U4	
VR2	
A THRU D	

J. CAREAGA 8-25-86
8-25-86
7/26/86

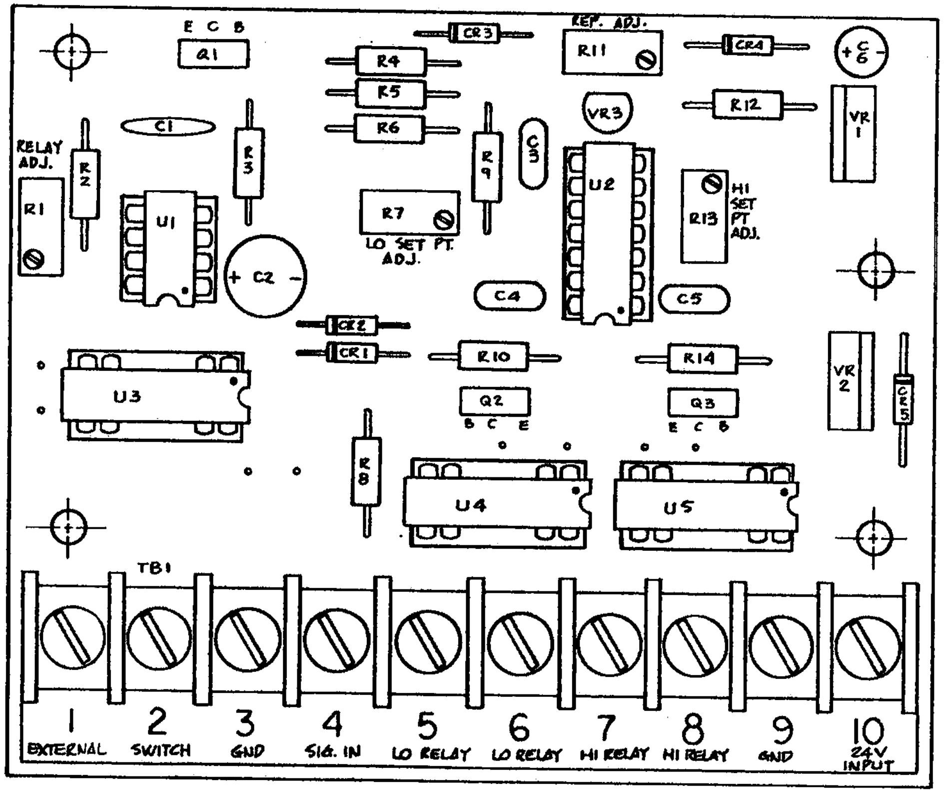
KURZ INSTRUMENTS INC.

MODEL 101
TOTALIZER
SCHEMATIC DIAGRAM

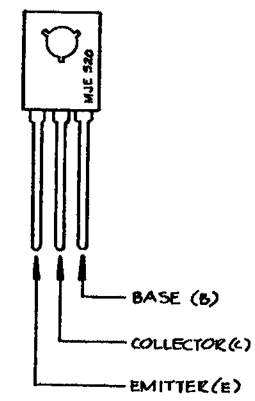
C
300001
A
NONE
SHEET 1 OF 1

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, A11247002	9-8-88 B.SAYON	1-2./8?



TRANSISTOR IDENTIFICATION



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.

U4,5	IC SIGMA RELAY #191TE1A1-55 OR #191TE1C1-55	2
U3	IC SIGMA RELAY #191TE1C1-55	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, 50 V, CER.	1
CR5	DIODE 1N4001	1
CR1,2,3,4	DIODE 1N4148 OR 1N914	4
Q1,2,3	TRANSISTOR MJE 520	3
VR3	" 2.5V LM336	1
VR2	" 5 V (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
REF. DEG.	DESCRIPTION	QTY.

PARTS LIST

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

KURZ INSTRUMENTS INC.

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

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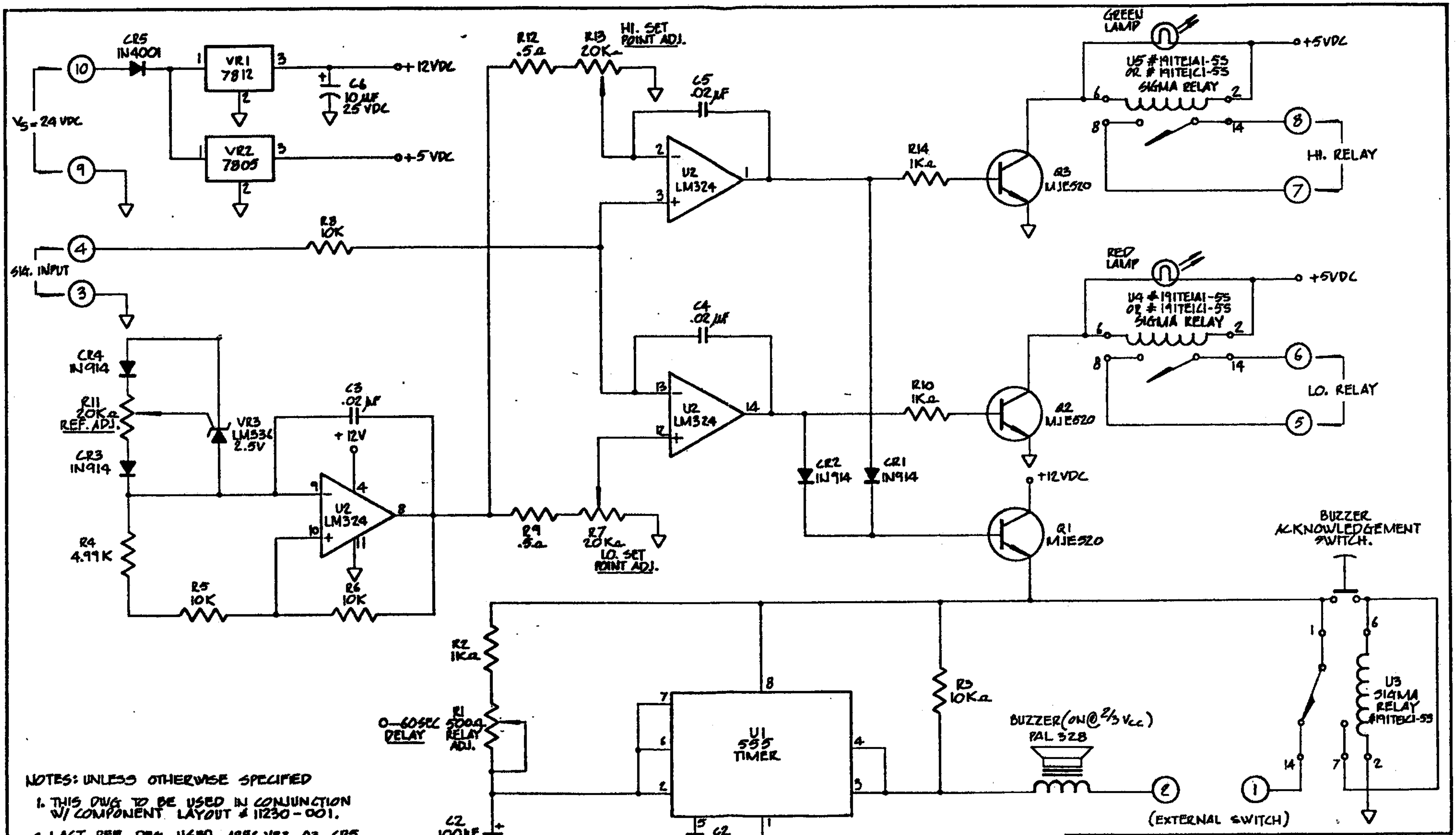

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DWG TO BE USED IN CONJUNCTION W/ COMPONENT LAYOUT # 11230-001.
2. LAST REF. DES. USED ARE: VR3, Q3, CR5, C6, R14, U5.

KURZ INSTRUMENTS INC.

SCALE : —
TOLERANCE
.XX ± .01
.XXX ± .003

DRN: DTking	7/15/85	MODEL 111R1 DUAL ALARM SCHEMATIC DIAGRAM L2
CHKD: Garza	7-15-85	
APVD: MCS	7/15/85	
		B 30CC-6 REV. SHT 1 OF 1

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