KURZ™ INSTRUMENTS, INC.

Model 565DC
DC-Powered Mass Flow Meters
User's Guide

Customer Name: _____

P.O. Number: _____

Date of Order: _____

Complete Model Number: _____

Kurz™ Order Number: _____

Serial Number: _____

Document Number: 360105, Rev. B

2411 GARDEN ROAD • MONTEREY, CA 93940 • TLX 172275 • (800) 424-7356 NATIONWIDE • (408) 646-5911 • FAX (408) 646-8901

Unit Description Sheet

Complete Model Number: _____

Serial Number:

Kurz Order Number:

Customer P. O. Number:

Gas Calibration:
____ Air
____ Other (specify): _____

Calibration Reference Temperature:
____ Standard (25° C, 77° F)
____ Other (specify): _____

Calibration Reference Pressure:
____ Standard (760 mm Hg, 29.92 in Hg)
____ Other (specify): _____

Maximum Flow: _____

Inlet & Exit Fitting Size: _____

Maximum Pressure Loss (in inches of water) at Full Scale: _____

Engineering Units:
____ SFPM
____ SCFM
____ SCCM
____ SLPM
____ lbs/min
____ Other (specify): _____

Power Supply Input:
____ Standard (18-24 Vdc)
____ Other (specify): _____

Output Signal:

____ Non-linear 0-5 Vdc (standard 560)

____ Linear 0-5 Vdc (standard 565)

____ Non-Linear, Isolated 4-20 mA (560)

____ Linear, Isolated 4-20 mA (565)

____ Non-Linear, Non-Isolated 4-20 mA (560)

____ Linear, Non-Isolated 4-20 mA (565)

____ Other (specify): _____

Probe & Sensor:

____ Teflon-Coated Sensor

____ Epoxy-Coated Sensor

____ Other: _____

High Temperature Applications:

____ HT Rated to 250° C

Electronics Enclosures:

____ 437 Board Included in One-PiecePackage

____ None - Unmounted 437 Circuit Board

____ 437 Board Mounted in NEMA 12 Enclosure

____ 437 Board Mounted in NEMA 4 Enclosure

____ 437 Board Mounted in Rack-Module, 1.4"

____ 437 Board Mounted in Rack-Module, 2.8"

____ 19" Rack Chassis with Guides

____ Bench Enclosure for 19" Rack Chassis

Power Supply:

____ Rack Mount

____ NEMA-enclosed

____ 191-2.4: 2.4 Amp Power Supply

____ 191RM-4.8: 4.8 Amp Power Supply

____ 191RM-12: 12 Amp Power Supply

____ 115 VAC 50/60 Hz Version

____ 220VAC 50 Hz Version

____ Other: _____

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Document Title: *Model 560 and Model 565 DC-Powered Mass Flow Meters User's Guide*

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Warranty Statement

The Kurz Model 560 and 565 DC-Powered Mass Flow Meters are 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.

Special Precautions for Installation with Hazardous Gases

We at Kurz have done everything reasonable to ensure the safety of users of Kurz equipment. Even so, we are aware that special situations can arise that can result in an unsafe condition if hazardous gases are involved.

It is the responsibility of the user to properly install the product and especially to check for leakage in the extended plumbing and to properly seal conduit fittings, etc., according to the relevent codes.

An example is the installation of a Model 555 insertion mass flow meter in which the Model 455 probe is inserted into the ball valve retractor assembly. It is the responsibility of the user to ensure that the assembly does not leak upon initial installation and to perform rountine maintenance (such as replacing the seals, etc.) on a regular basis and to verify the safety of the entire installation.

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Figures

Tables

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 560 and 565 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 560 or 565 DC-Powered Mass Flow Meter, including model number, serial number, Kurz order number, and customer purchase order number. It also lists any options you ordered with your 560 or 565. Check the options listed against your original order and against the actual contents of the shipping carton. Report any discrepancies immediately to Kurz Instruments Incorporated at (408) 646-5911.

Quick Set-Up Guide

The Quick Set-Up Guide is a chart summarizing much of the information presented in the rest of the manual. You can use the chart to refresh your memory after you read the relevant sections of the manual. Or, if you feel that you do not need the more detailed information presented in the rest of the manual, you can attempt to install your 560 or 565 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 560 and 565 flow meters. 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 560 or 565. This section explains how to determine the correct location for installation, as well as how to perform the physical installation. You should read thoroughly the parts of this section that apply to your installation before you install the 560 or 565. **You may also want to read Section 5, "Testing," before you install the meter.**

Section 3: Operation and Maintenance

This section explains how to calculate actual velocities from the standard velocities reported by the 560 or 565, 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 560 and 565 flow meters. Contact Kurz Instruments for a complete, up-to-date list of available options.

Section 5: Testing

This section explains some of the tests you can perform on the 560 or 565 to determine whether or not it is operating properly. Although the meters are 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

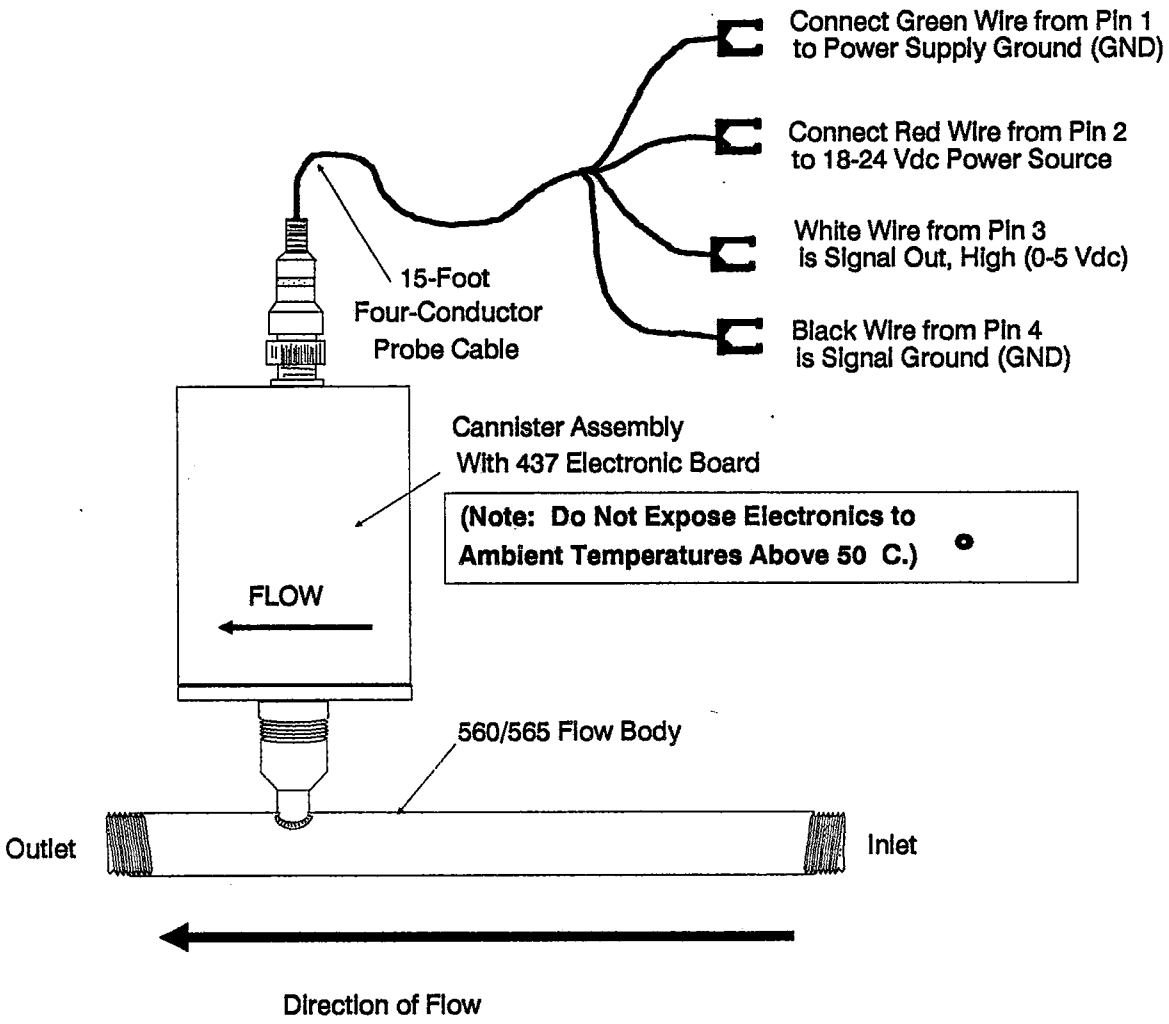
The appendix contains detailed component layout drawings and circuit diagrams of the various components of the 560 and 565. This information is not needed by most users in routine operation of the unit. It is provided as an aid to those users who want to perform more detailed maintenance and testing 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 560 or 565. Kurz Instruments recommends that you read applicable sections of the manual before attempting installation.**



Section 1: Product Overview

This section contains a general description of the Model 560 and Model 565 DC-Powered Mass Flow Meters. It explains how these meters work and lists their features and specifications. All information in this guide applies equally to all 560 and 565 models unless specifically identified as applying to a particular model or models.

1.1 Description

The 560 and 565 DC-Powered Mass Flow Meters are rugged, very low maintenance instruments ideally suited to monitoring relatively clean air or gas flows. The 560 and 565 come with an attached flow body, designed to be installed in gas or air lines. Pressure drops across these mass flow meters are minimal (typically about 2 inches of water, or 1/15th of one psi) due to their energy-efficient design.

The 560 and 565 have all the same features, except for one. The 437 electronics board included with the Model 565 DC-Powered Linear Mass Flow Meter contains the hardware necessary to output a linearized 0-5 Vdc signal representing the measured mass flow. The 437 electronics board included with the Model 560 DC-Powered Mass Flow Meter does not contain the required linearization components and therefore outputs a non-linearized 0-5 Vdc signal.

The 560 and 565 Mass Flow Meters can be used stand-alone or intergrated into a wide range of OEM instruments and systems. Some of the 565 applications include:

- heating, ventilating, and air conditioning (HVAC) systems
- laminar flow ceilings, bench hoods, and duct monitoring systems in semiconductor manufacturing facilities
- airborne engine test systems (to monitor gas turbine bleed air)
- air control systems in hospitals and other medical facilities

The 560 and 565 are best used in commercial applications where the flow to be measured is not heavily laden with particulate contamination and the temperature of the air or gas flow does not exceed 125° C. For extremely hot, dirty, or corrosive industrial environments, Kurz recommends the even more robust 505 Industrial Mass Flow Meter.

The 560 and 565 are available in many sizes to suit a wide range of applications. Table 1-1 lists the various models and summarizes some of their characteristics.

Table 1-1. *560/565 Sizes and Specifications*

Range	Model	MNPT Fittings X Length	Maximum Pressure Drop (In Inches of Water)
0-50 SCCM	560/565-1-00	1/4" x 6"	0.05
0-150 SCCM	560/565-2-00	1/4" x 6"	0.05
0-500 SCCM	560/565-3-00	1/4" x 6"	0.05
0-1500 SCCM	560/565-4-00	1/4" x 6"	0.1
0-5 SLPM	560/565-5-00	1/4" x 6"	0.3
0-15 SLPM	560/565-6-00	1/4" x 6"	0.5
0-1 SCFM	560/565-6-02	1/4" x 6"	2.0
0-50 SLPM	560/565-7-02	3/8" x 6"	2.0
0-3 SCFM	560/565-7-04	3/8" x 7"	5.0
0-5 SCFM	560/565-7-06	3/8" x 7"	10.0
0-3 SCFM	560/565-7A-00	1/2" x 8"	1.0
0-5 SCFM	560/565-7A-02	1/2" x 8"	3.0
0-10 SCFM	560/565-7A-04	1/2" x 8"	11.0
0-5 SCFM	560/565-8-00	3/4" x 10"	0.9
0-10 SCFM	560/565-8-02	3/4" x 10"	3.5
0-15 SCFM	560/565-8-04	3/4" x 10"	8.0
0-25 SCFM	560/565-8-06	3/4" x 10"	9.0
0-15 SCFM	560/565-9-00	1" x 12"	2.2
0-25 SCFM	560/565-9-02	1" x 12"	6.0
0-50 SCFM	560/565-9-04	1" x 12"	12.0

As shown in the Quick Set-up Guide in the front of this manual (page xv), the 560 and 565 consist of the following basic components:

- DuraFlo™ ceramic flow sensor installed within the flow body as shown in Figure 1-1 (Models 560/565-8 and larger flow meters have a window around the sensor that is not shown in Figure 1-1)

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

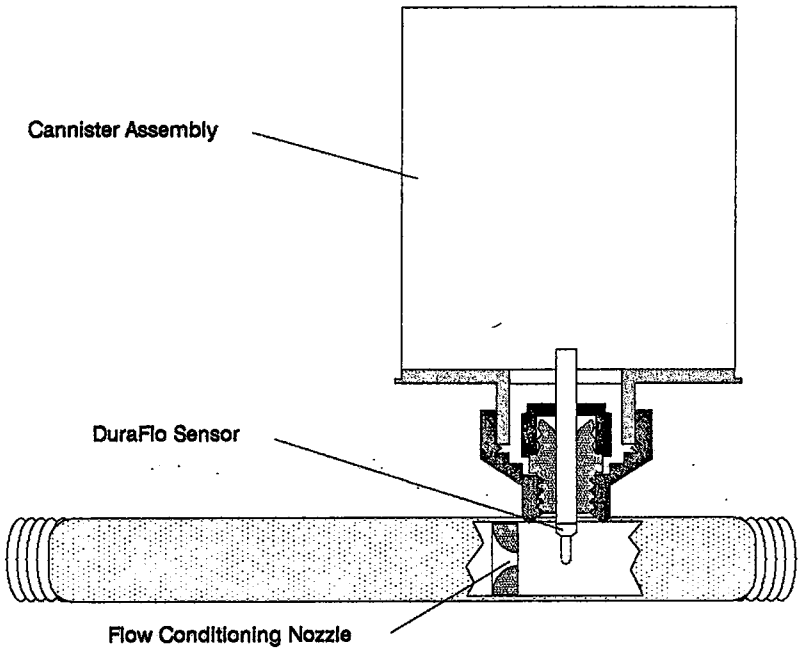
- 316 stainless steel flow body to be installed in the air or gas line

- 437 Electronics Board housed in rugged, weather-resistant enameled aluminum cannister assembly mounted on the flow body (The 437 board can be unmounted, mounted in a NEMA 4 or NEMA 12 enclosure, or mounted in a rack module — refer to Section 4, "Options.")

- 15-foot four-conductor cable for interfacing the flow meter to a power supply and the device used to collect and/or display the output

An illustration of the sensor's placement in the flow body is provided in Figure 1-1.

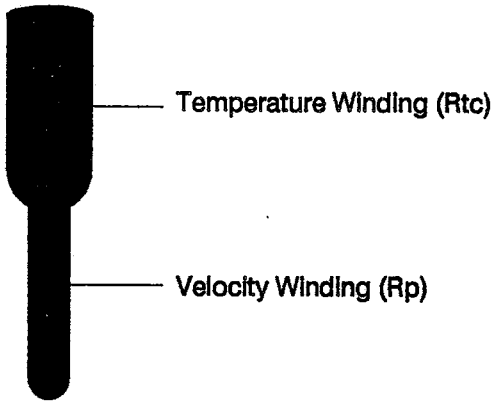
Figure 1-1. *Sensor's Placement in 560/565 Flow Body*



1.2 How the Sensor Works

The DuraFlo sensor used in the 560 and 565 is in fact two sensors in one: a temperature sensor and a velocity sensor. The DuraFlo sensor consist of reference-grade platinum windings wound around a ceramic mandrel and enclosed in a single glass sheath. The temperature sensor (R_{tc}) is located at the base of the sensor. The velocity sensor (R_p) is located at the tip of the sensor. Figure 1-2 shows a close-up view of the DuraFlo sensor.

Figure 1-2. *DuraFlo Sensor*



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 DuraFlo sensor's standard rating is for nonexplosive gases. An optional safety temperature limiting option is available. Contact Kurz Instruments for more information on using the 560 or 565 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 draw that is measured by the 560 and 565 flow meters.

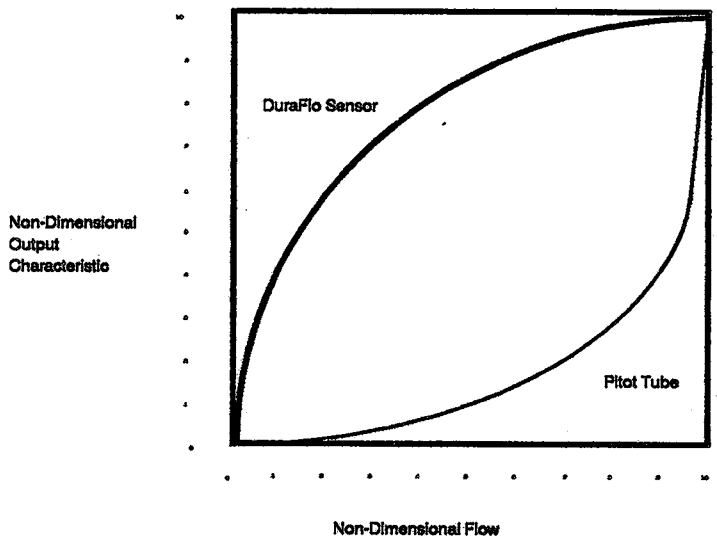
The sensor is directly measuring mass flow (i.e., the number of molecules carrying heat away from the velocity sensor), and is calibrated in **standard** units, which are referenced to a temperature of 25° C and atmospheric pressure of 760 mm Hg. In other words, air at 25° C and 760 mm Hg, flowing at 100 cubic feet per minute (CFM) will produce a reading of 100 **standard** cubic feet per minute (SCFM)[1]. A 100 CFM flow at a different temperature or pressure produces a reading in SCFM 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 on the 437 electronics board in the cannister assembly mounted on the flow body of the meter. The temperature sensor leg (R_{tc}) is input to the positive side of an operational amplifier as a reference. The bridge is activated through an offset differential of the two legs. The sensor is heated with current through the R_p winding. Resistance increases until it balances with the minus input of the operational amplifier, which drives a power transistor to provide bridge current.

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 DuraFlo 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 DuraFlo sensor at low flow rates.

1 Standard 560 and 565 calibration is in SCCM, SLPM, or SCFM, depending on the model. Other engineering units are also available – refer to Section 4, "Options".

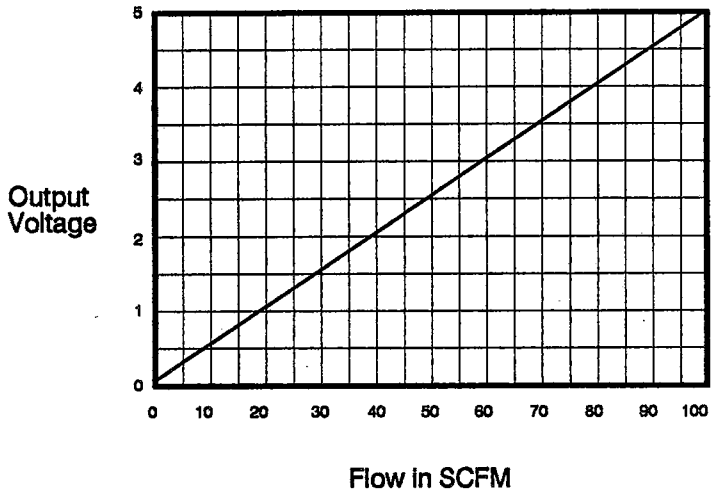
Figure 1-3. *Sensor Output vs Flow*



Zero and span circuitry on the 437 electronics board converts the signal from the sensor to a non-linear 0-5 Vdc signal that has approximately the same curve as shown above. This non-linear 0-5 Vdc is output from the 560.

However, the 437 board in the Model 565 contains an additional linearizer circuit that converts the nonlinear voltage into a linear voltage that is directly proportionate to flow velocity: 0 Vdc indicates no flow, 5 Vdc indicates maximum measurable flow, and 2.5 Vdc indicates a flow exactly half of the maximum measurable flow, as shown in Figure 1-4.

Figure 1-4. *Linearized 0-5 Vdc Output of the 565 Models*



Additional circuitry on the 437 board will convert the non-linear (560) or linear (565) output voltage to an 4-20 mA output if the 560 or 565 was ordered with the non-isolated option (-I).

1.3 Features and Specifications

Some of the outstanding features of the 560 and 565 are summarized below:

Rugged Construction

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

Unsurpassed Accuracy

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

Automatic Temperature and Pressure Compensation

The 560 and 565 directly measure mass velocity. No computations are necessary to compensate for temperature and pressure changes.

Excellent Low-Speed Sensitivity

Unlike pitot-tube and orifice-plate sensors, the DuraFlo sensor in the 560 and 565 accurately measures very low flow rates.

Convenient Non-Linear or Linear Output

The 560's non-linear and the 565'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 560 and 565 is factory-calibrated in a National Bureau of Standards (NBS) traceable wind tunnel. Packaged with your 560 or 565 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 560 and 565 are given in Table 1-2. All specifications apply to all models except where noted.

Table 1-2. *560 and 565 Specifications*

Sensor Construction:	Reference-grade 385 platinum RTD-type windings around a high-purity ceramic core, sheathed in glass (epoxy, and glass wetted parts)
Accuracy:	± 2% of reading ± .5% of full scale (560 models) ± 3% of reading ± .5% of full scale (565 models)
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

Table 1-2. *560 and 565 Specifications (continued)*

Sensor Operating Temperature Range:	0° C to +125° C standard HT rated sensor optionally available for temperatures from 0° C to +250° C **NOTE:** The 437 electronics board is rated only to 125° F. Specify a remote-mounted enclosure for the electronics if the portion of the meter **outside** the flow body will be exposed to temperatures higher than 125° F. (See Section 2.5.3 for information on high-temperature installations.)
Flow Body Construction:	316 stainless steel
Flow Body Dimensions:	Dimensions range from 1/4" by 6" (560/565-1) to 1" by 12" (560/565-9)
Electronics Hookup:	A 15-foot four-conductor cable is supplied to connect the transducer to the 18-24 Vdc input and 0-5Vdc output.
Electronics Board Enclosure:	2.75" X 4.75" X 1.13" enameled aluminum cannister. (Refer to Section 4 for information on optional configurations.)
Output:	Non-linear (560) or linear (565) 0-5 Vdc standard, nonisolated 4-20 mA outputs optionally available on the 437 electronics board. Isolated 4-20 mA output available with optional electronics board. See Section 4 for further information. For other nonstandard outputs, consult factory.

End of Section 1

Section 2: Installation

This section explains how to install your Model 560 or 565 DC-Powered Mass Flow Meter. The instructions given in this section are necessarily general in nature; every installation is unique. If you need further assistance with your installation, contact your local Kurz representative, or contact Kurz Instruments, Inc. at (408) 646-5911.

2.1 Checking the Contents of the Shipping Carton

Open the shipping carton and remove the protective foam packaging material that covers the flow meter 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 and pipe schedule shown on the calibration certificate are correct.

2.1.1 560/565 Without Options

If you ordered your 560 or 565 without any options, the contents of the shipping carton should be as shown in the Quick Set-Up Guide in the front of the manual.

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.")

2.1.2 560/565 With Options

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

If you ordered your 560 or 565 with the 437 electronics board in a NEMA enclosure, 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 Flow Meter Location

The flow body itself provides the required unobstructed runs upstream and downstream from the sensor. Even so, it is a good idea to install the 560 or 565 near the center of a long, straight pipe section, if possible.

Unless it has been specifically calibrated for another orientation, the flow meter must be installed in a horizontal run, with the cannister extending straight up. You must therefore choose a location where there is sufficient clearance for the cannister, plus two or three inches for maneuver.

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 cannister close to hot ducts or pipes. Provide sufficient clearance between the duct or stack and the cannister assembly so that the ambient temperature around the cannister is less than 50° C.

2.3 Orientation

Note that the flow body is not symmetrical - it has a long end and a short end (relative to the T-connection for the cannister assembly). You must install the 560 or 565 so that flow enters through the long end of the flow body and exits through the short end. This orientation is illustrated in the Quick Set-Up Guide at the front of this manual.

2.4 High-Temperature Installations

If the cannister assembly is exposed to high temperatures above 50° C, the 437 board should be mounted remote to the flow body. For these applications you can select the optional NEMA, rack-mount, or PC-board configurations. Refer to the Section 4, "Options".

2.5 Connecting the Meter to the 18-24Vdc Input and 0-5 Vdc Output

A 15-foot four-conductor cable is included with all configurations of the 560 and 565 flow meters. The standard configuration of these meters includes a cannister assembly mounted perpendicular to the flow body. One end of the cable terminates in a connector that screws onto the end of the cannister assembly. The other end of the cable provides four wires terminated with spade lugs that can be connected to the power supply and to the output device used to monitor the 0-5 Vdc output from the meter. The connector pinout is shown in Figure 2-1. The pin description of the connector and cable is provided in Table 2-1.

Figure 2-1. *Connector Pinout on the 560/565 Cannister Assembly*

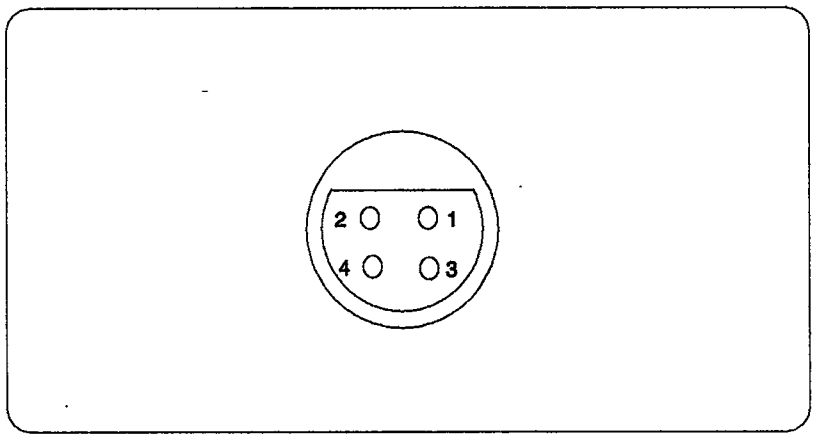


Table 2-1. *Pin Description of the Connector on the 560/565 Cannister Assembly*

PIN DESCRIPTION		
Wire Color	Pin No.	Description
Green	1	Power Supply Ground (Gnd)
Red	2	Power In (18-24 Vdc)
White	3	Signal Out, High (5 Vdc or 4-20 mA)
Black	4	Signal Ground (Gnd)

End of Section 2

Section 3: Operation and Maintenance

This section describes the operation and routine maintenance of the Model 560 and 565 DC-Powered Mass Flow Meters.

3.1 Operation

Once you have installed the 560 or 565 as described in Section 2, operation is primarily a matter of maintaining the 18-24Vdc power source to the flow meter. As long as power is supplied to this unit, the flow body is correctly installed in the line to be monitored, and all wiring connections are correctly made, the flow meter will continue to operate for prolonged periods without intervention.

3.1.1 0-5 Vdc Output

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

The output from pin 3 of this connector is a non-linear (560) or linearized (565) 0-5 Vdc signal. Zero Vdc indicates no flow over the sensor; 5 Vdc indicates the maximum measurable flow. The non-linear intermediate voltages output from the 560 flow meter will not be directly proportionate to velocity. These voltages will fall on a curve, closely approximating the curve shown in Figure 1-2 on page 1-5. In comparison, the linear intermediate voltages output from the 565 do indicate intermediate flows directly proportionate to the voltage of the signal.

You can use the 0-5 Vdc output in a variety of ways:

- Order the 560 or 565 with a remote digital panel meter or a rack-mount multichannel LCD display.

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

- Order your flow meter with the optional nonisolated 4-20 mA output circuitry installed on the 437 electronics board. If an isolated 4-20 mA output is required, order the Model 132 Isolated 4-20 mA Board with your meter. See Section 4, "Options" for more information concerning these options. Either of these 4-20 mA options allow for almost unlimited distances between the output signal and a receiving device[1].

3.1.2 Calculating Actual Velocities

For most air-flow monitoring applications, the **mass** of the flowing gas is the relevant variable. The DuraFlo sensor was designed with this fact in mind. The 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 flow reading obtained for air at a different temperature and/or pressure will not be the actual volumetric flow of that air.

Generally, standard flow is a much more useful measurement than actual flow. Sometimes, however, you may want to calculate the **actual** flow 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 flow from indicated flow is given below:

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

where:

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

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

F_{act} = Actual air flow in cubic feet per minute.

F_{ind} = Indicated flow in standard cubic feet per minute.

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

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

where

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

P_a = Actual pressure in inches of mercury.

3.2 Routine Maintenance

The 560 and 565 flow meters are virtually maintenance free. The only routine maintenance operations required are recalibration and occasional cleaning.

3.2.1 Recalibration

The factory calibration of the 560 and 565 remain stable over periods of up to several years. To maintain NBS traceability, however, Kurz Instruments recommends that your flow meter be recalibrated annually. You can perform the recalibration yourself or you can return the meter to Kurz for recalibration. Unless you have an accurate in-house flow-calibration facility, it is probably preferable to return the instrument to Kurz[2].

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

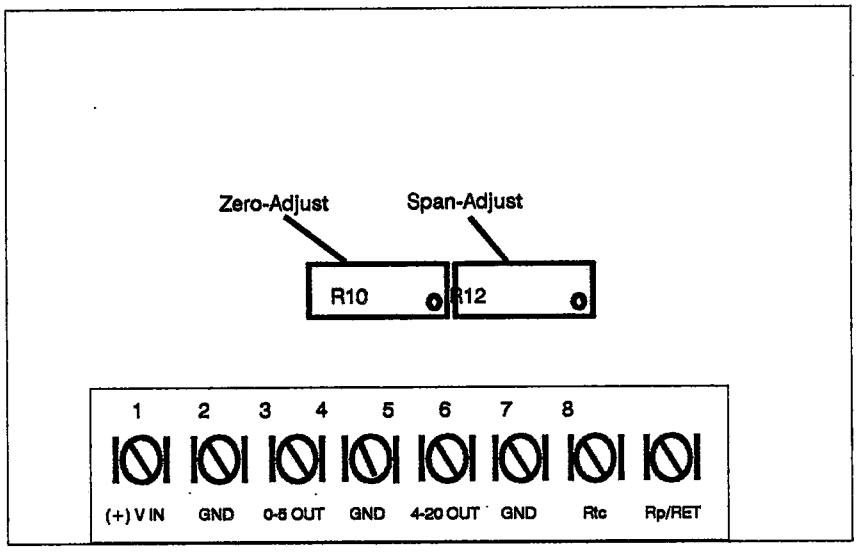
- a digital voltmeter accurate to +/-.001 Vdc
- a flat-bladed screwdriver with a narrow blade and a long shaft

The velocity calibration procedure consists of running a flow of known velocity through the flow meter[3] and adjusting the zero and span potentiometers (R10 and R12, respectively) on the 437 circuit board. Figure 3-1 shows their locations.

2 If your flow meter 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 or span controls.

3 If possible, perform the recalibration with the flow body in a horizontal position, as shown in the Quick Set-Up Guide on page xv. The factory calibration is performed with the flow meter 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 3-1. *437 Electronics Board: Zero and Span Potentiometers*



Step 1: Set the flow velocity to 0 SFPM.

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

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

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

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

4 Remember, the flow meter 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 zero and span circuit on the 437 board requires factory adjustment – contact Kurz Instruments.

3.2.2 Cleaning the Sensor

The flow meter's sensor is far more resistant to particulate contamination than pitot tube or orifice plate sensors. Nevertheless, the 560 and 565 perform best when kept relatively free of contamination. You should therefore remove the flow body and the sensor and check the sensor at regular intervals, cleaning both the flow body and the sensor if necessary.

The dirtier the flow being measured, the more frequently the flow body and sensor should be checked. In relatively clean flows it may be sufficient to check and clean the flow body and sensor annually while the probe is removed for recalibration. In very dirty flows a much shorter interval may be appropriate[5]. 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.

For cleaning small flow bodies, Kurz recommends that you use a small camel's hair brush and water, followed by an alcohol rinse. In the case of larger flow bodies, the sensor can be removed for separate cleaning. Use a fine wire brush, crocus cloth, or fine grit emery cloth to remove built-up contamination from the sensor. Clean the sensor only when power is off. Be careful not to damage the sensor during removal or reinsertion.

End of Section 3

5 If your application requires the monitoring of very dirty flows, Kurz Instruments recommends that you use the 505 Linear Mass Flow Meter rather than the 560 or 565.

Section 4: Options

This section lists and describes some of the more popular options available with the Model 560 and 565 DC-Powered Mass Flow Meters. The options discussed in this section are

- Specialty Gas Calibrations
- 4-20 mA Output
- HT High Temperature Sensor
- Coated Sensors
- Rack-Module Electronics Packaging
- NEMA Enclosures
- Unmounted 437 Electronics Board
- 110 or 220 Vac Power Supply
- LCD Digital Display
- Optional Engineering Units
- Dual Alarm
- Totalizer
- 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 560 and 565 calibration is for air at 25° C (77° F) and 760 mm (29.92 in) of mercury.

You can order your flow meter calibrated for a gas (or gas mixture) other than air. When you order a specialty gas calibration, you specify the reference temperature and pressure as well as gas mixture by weight or volume, 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.

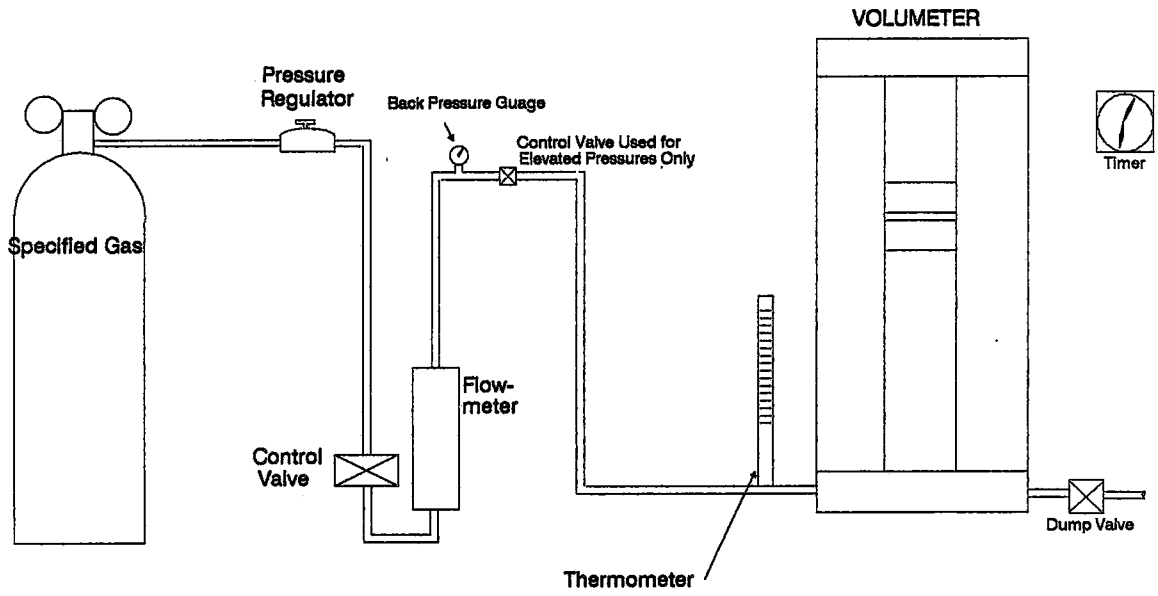
- Flue Mixtures
- Argon (A_r)
- Carbon Dioxide (CO_2)
- Carbon Monoxide (CO)
- Helium (He)
- Hydrogen (H_2)
- Nitrogen (N_2)
- Oxygen (O_2)

Specialty gas calibrations are performed for Kurz Instruments by an independent calibration laboratory. The flow meter 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 full scale for the 560, +/-3% of full scale for the 565.

The calibration laboratory uses volume provers and other NBS traceable equipment 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 diagramed in general terms in Figure 4-1.

Figure 4-1. *Specialty Gas Calibration*



4.2 4-20 mA Output

Standard 560 and 565 output is a 0-5 Vdc signal.

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

4.2.1 Non-Isolated

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

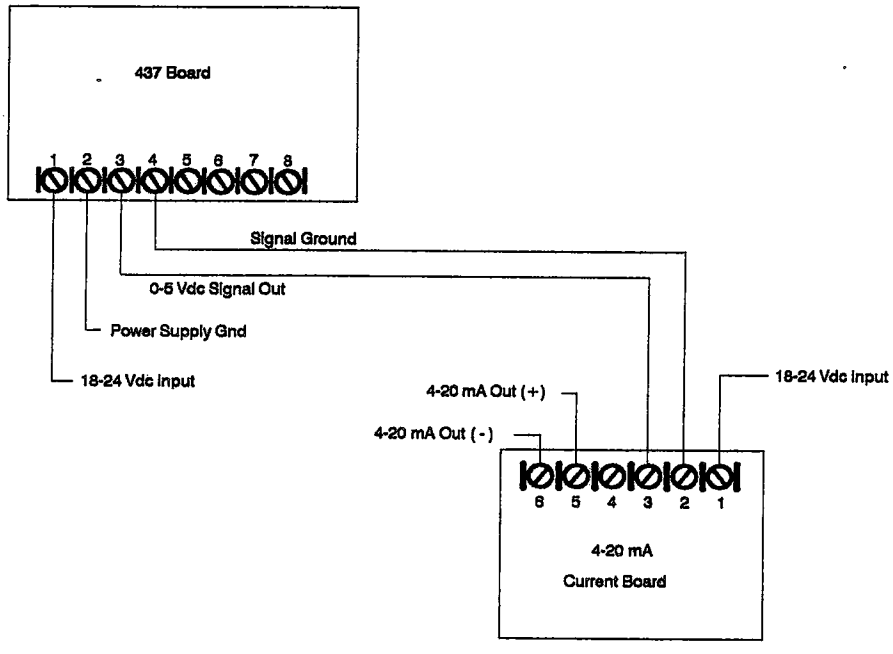
The circuitry for the non-isolated 4-20 mA circuitry is provided on the 437 board. When the 437 is configured to provide the 4-20 mA output, the 0-5 Vdc output is disabled.

4.2.2 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 437 board. Isolated 4-20 mA output is available using the Model 132 4-20 mA current board. In this configuration, the flow meter should be ordered with the 437 electronics board placed in a NEMA enclosure or rack module (-N or -RM configurations).

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

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



NOTE: Except for providing a 18-24 Vdc power source to the 4-20 mA boards via terminal 1, 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 HT High Temperature Sensor

The standard DuraFlo sensor is rated for temperatures from 0° C to +125° C. The optional HT high temperature sensor is rated from 0° C to +250° C.

4.4 Coated Sensors

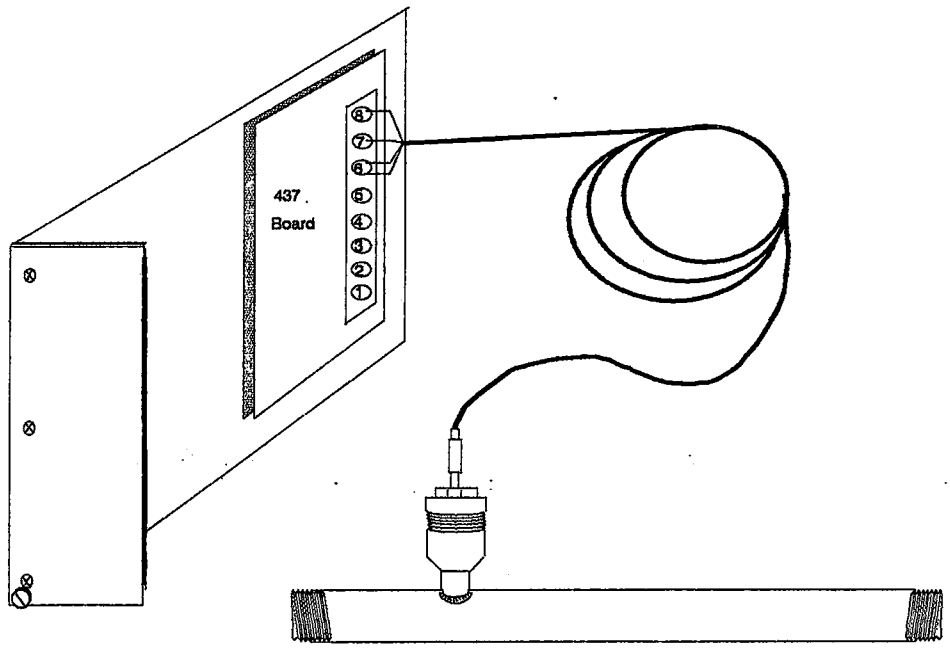
The DuraFlo sensor can be coated to provide additional resistance to corrosive gases and contaminants. The type of coating that is applied to the sensors will be dependent on the type of gas flow. Epoxy and teflon coatings are two of the most popular options.

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

4.5 Rack-Module Electronics Packaging (560/565-RM)

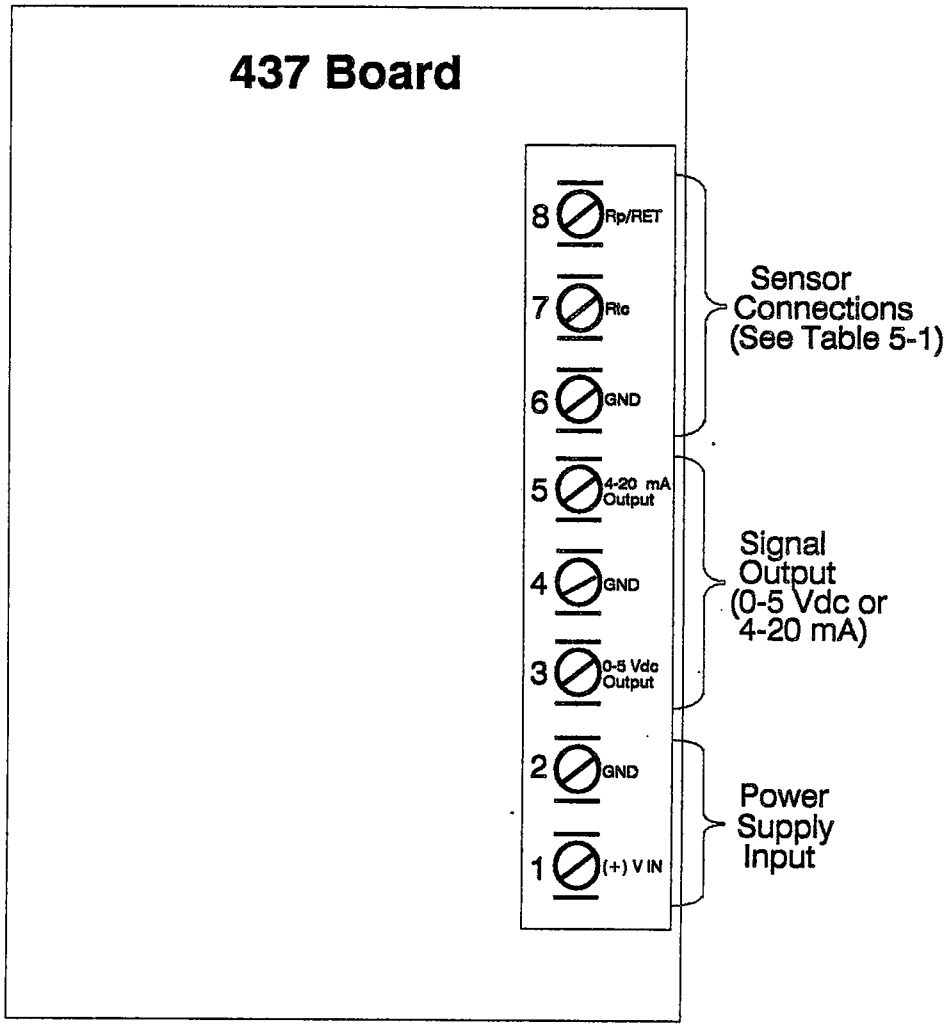
The 437 electronics board is provided in a rack module if you purchased the 560-RM or 565-RM. The 437 board is mounted on the baseboard of a 1.4"-wide (1/12) rack module, as shown in Figure 4-3.

Figure 4-3. *560/565-RM (With 437 Electronics Board Mounted in a Rack Module)*



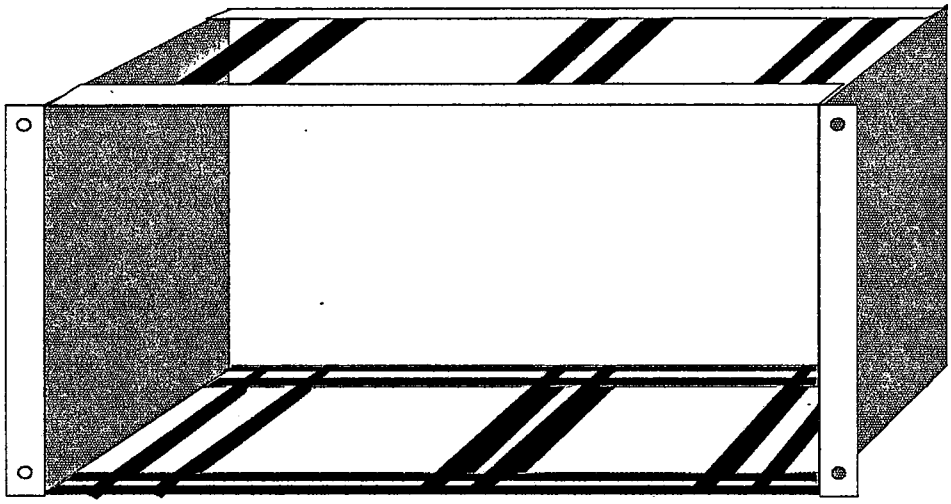
The 15-foot conductor cable connects directly to the 437 board at the back of the rack module. To install the 560-RM or 565-RM, connect the power supply input and ground lines to the terminal screws on the 437 board as shown in Figure 4-4. The 0-5 Vdc output and signal ground lines are also available at the terminal strip.

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



You can mount the flow meter rack module in your own standard 19"-wide rack chassis, or you can order the Model 2015 rack chassis, shown in Figure 4-5, from Kurz Instruments. The 2015 rack chassis houses up to twelve 1.4" 560/565-RM modules or nine 560/565-RM modules and one 4.2" Multichannel Display (see section 4-11). The 19" rack chassis can be placed in a bench enclosure when the unit requires testing or service.

Figure 4-5. *Model 2015 Rack Chassis*

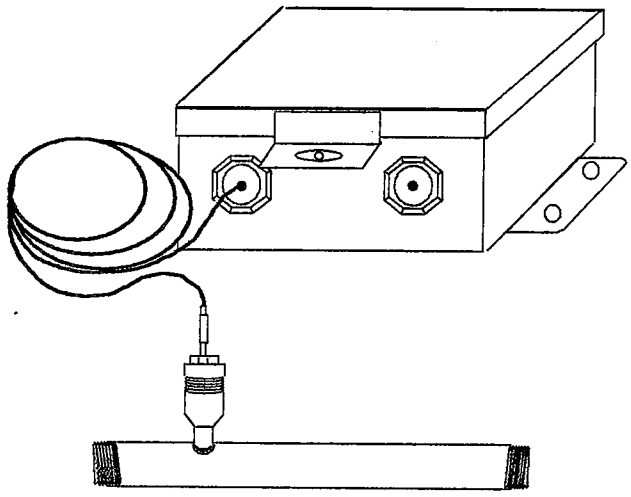


4.6 NEMA Enclosures (560/565-N4 or 560/565-N12)

If you ordered the 560/565-N4 or 560/565-N12, the 437 board is housed in a NEMA 4 or NEMA 12 painted steel enclosure. NEMA 12 enclosures are intended for indoor use primarily to provide protection against contact with the enclosed equipment and protect the enclosed electronics against dust, falling dirt, and dripping non-corrosive liquids. The more rugged NEMA 4 enclosures can be used inside or outside, and provide protection against wind-blown dust and rain, splashing water, and hose-directed water. NEMA 4 enclosures also remain undamaged by the formation of ice on the enclosure.

The probe cable is interfaced to the 437 board through a strain-relief connector on the front of the NEMA enclosure as illustrated in Figure 4-6. Another connector is available to provide the required power and ground inputs to the 437 board and to connect the 0-5 Vdc output signal and ground to the receiving device. Refer to Figure 4-4, on page 4-6, for the location of the terminal connections on the 437 board.

Figure 4-6. *Model 560/565-N12 in a NEMA 12 Enclosure*



4.7 Unmounted 437 Electronics Board (560/565-PC)

If you purchased the 560-PC or 565-PC, you can mount the 437 electronics board in your own enclosure. The 560-PC and 565-PC come with the flow body, a 15-foot four-conductor cable, and the 437 electronics board (without enclosure). Figure 4-4, on page 4-6, shows the locations of the terminal screws for connecting the power supply's 18-24 Vdc and ground lines to the 437 board and to connect the 0-5 Vdc output signal and ground to a receiving device.

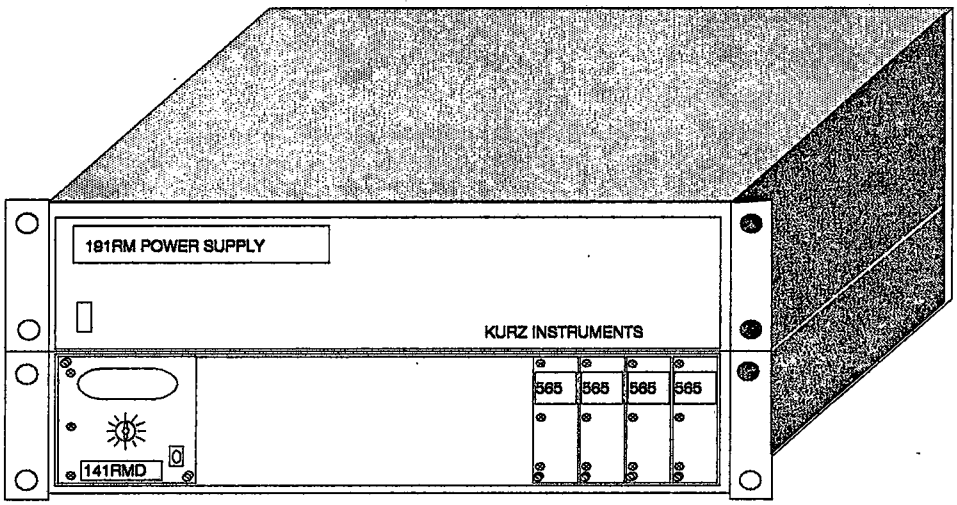
Refer to the 437 PCB assembly drawing included in Appendix A for exact locations of the four mounting holes on the 437 board.

4.8 Power Supplies

An 18-24 Vdc power source and power supply ground must be supplied to the flow meter's 437 electronics board. The 18-24 Vdc and ground can be supplied through the cable attached to the cannister assembly on the flow meter, or directly to the 437 board itself when it is installed in a rack module (560/565-RM), NEMA enclosure (560/565-N4/N12), or custom enlosure (560/565-PC).

The 191-2.4 Power Supply is a 2.4 Amp supply enclosed in a NEMA 12 enclosure. For rack-mounted configurations, the 191RM-4.8 (4.8 Amp) and 191RM-12 (12 Amp) rack mount power supplies are available in 115V/50-60 Hz or 220V/50 Hz configurations to provide the 18-24 Vdc input to the flow meters. Figure 4-7 shows a possible configuration of a system using multiple 565 flow meters, a 141RMD Multichannel LCD Display, and a rack mount 191RM power supply.

Figure 4-7. *191RM Power Supply, 141RMD Multichannel LCD Display, and Multiple 565-RM Flow Meters Configured in two 19" Rack Chassis*



4.9 141RMD Multichannel LCD Digital Display

The standard 0-5 Vdc output of up to twelve 560 or 565 flow meters can be connected to the 141RMD Multichannel LCD Display. The 141RMD is a 4.2" rack module that displays the flow rate of the selected flow meter (one of twelve) in Standard Cubic Centimeters Per Minute (SCCM), Standard Liters Per Minute (SLPM), Standard Cubic Feet Per Minute (SCFM), or other optionally selected units.

4.10 Optional Engineering Units

The standard units of measurement displayed on the panel meters of 560 and 565 flow meters so equipped are Standard Cubic Centimeters Per Minute (SCCM), Standard Liters Per Minute (SLPM), or Standard Cubic Feet Per Minute (SCFM), depending on the size of the meter. Readouts in other units of measurement, including Pounds Mass Per Minute, are optionally available. If you prefer any other unit, contact Kurz Instruments for more information.

4.11 Dual Alarm

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

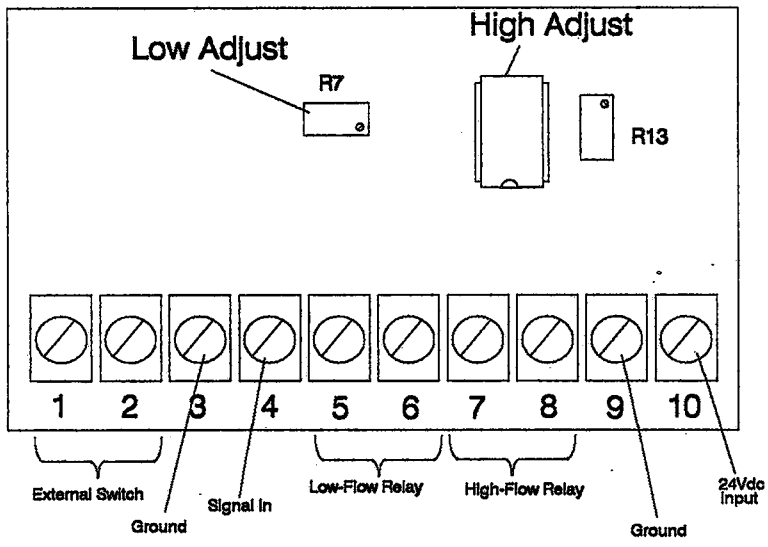
As shipped, the low alarm relay is activated when the flow falls below 20% of the full range and the high alarm relay is activated when flow exceeds 80% of the full range.

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

To set the low alarm value, you must, with the 111R1 board properly connected, run a flow whose volume represents the desired low alarm limit through the flow body of the meter. 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 through the flow body and adjust the high-adjust potentiometer until the high-flow relay closes.

Figure 4-8. *Model 111R1 Dual Alarm Board*



4.12 Totalizer

The flow meter 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 4.10.

The totalizer is available in resettable and nonresettable versions and can be either panel mounted in the NEMA enclosure or provided in a rack-module.

4.13 Sensor Safety Circuit

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

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

End of Section 4

Section 5: Testing

This section describes some of the bench testing procedures you can perform on the 560 and 565 flow meters. You may want to perform these tests before you install the meter and/or at regular intervals thereafter to verify that the unit is functioning properly.

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

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

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

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

- No flow is moving through the flow body.

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

	Color			
Signal	Wire	Standard Cable	HT or Tefzel Cable	Terminal
R_{tc}	White	Black	White/Blue	7
R_p	Red	Red	White/Orange	8
R_{tc} GND	White	White	White	6
R_p GND	Red	*Shield*	White/Green	6
Shield	-	-	*Shield*	*

* Shield is used when the 437 electronics is not in the cannister. The shield is connected to earth ground in the electronics enclosure. The circuit ground used on the 437 board (i.e. R_{tc} GND, R_p GND, and GND) is not connected to any other ground.

5.1 Power-On Voltage Test

The following procedure will verify operation of the major functional circuits on the 437 electronics board used in the 560 and 565. 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 2) and each of the points listed below. The correct voltage for each point is listed below. The points are called out in Figure 5-1 on page 5-4.

Step1: Check the bridge voltage: 3.5 Vdc +/- 2.5%.

Check the voltage between ground (terminal screw 2) and the junction of zener diode D5 and resister R2. 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 through the flow body), and 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 meter.

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

Check the voltage between ground and right leg of capacitor C3 (or pin 4 of U1, U2, or U3). This is the +15 Vdc supply voltage and should read +15 Vdc, +/- 3%. This voltage is used to generate the -9 Vdc supply which is used to generate the -5 Vdc reference voltage. The +15 Vdc supply is also used in the zero and span circuit, in the linearization circuit (565 only), and for the voltage to current conversion when the 4-20 mA option is installed.

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

Check the voltage between ground and the left leg of R16 (or pin 11 of U1, U2, or U3). This is the -9 Vdc voltage and should read -9 Vdc +/- 3%. This voltage is used to generate the -5 Vdc reference voltage. It is also used in the zero and span circuit as well as the linearization circuit (565 only) on the 437.

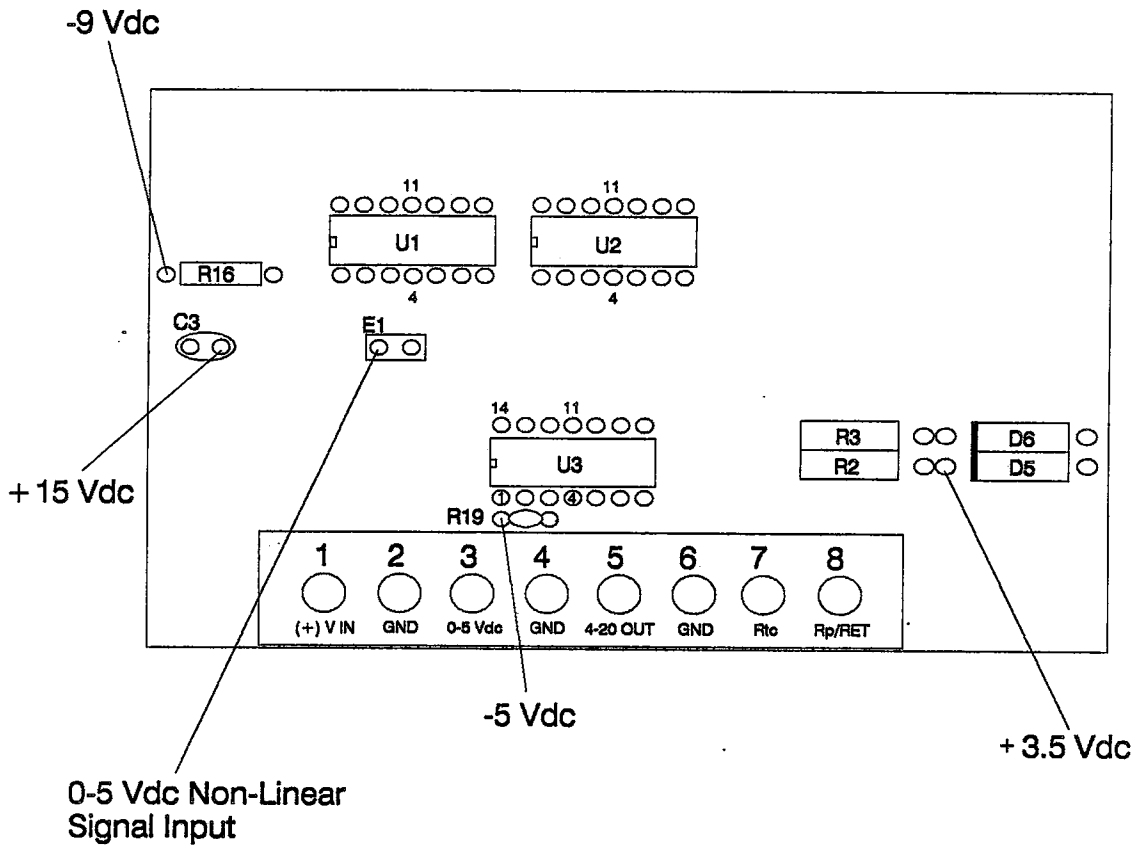
Step 4: Check the -5 Vdc reference voltage supply: -5 Vdc +/- .01%

Check the voltage between ground and the left leg of R19 (or pin 1 of U3). This is the -5 Vdc reference voltage and should read -5 Vdc +/- .01%. This voltage is used in the zero and span circuit as well as the linearization circuit (565 only) on the 437.

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

Check the voltage between ground and either leg of jumper E1 (or pin 14 of U3). This tests the zero and span circuitry (as long as the other voltages are correct). On the 437 board used in the 565, this voltage is input to the linearization circuit to provide the 0-5 Vdc or 4-20 mA linear output.

Figure 5-1. *437 Electronics Board Test Points*



End of Section 5

Appendix A: Component Layout Drawings

This appendix contains layout drawings for the flow meter and its components. These drawings are included as an aid to those users who want to perform their own testing and servicing.

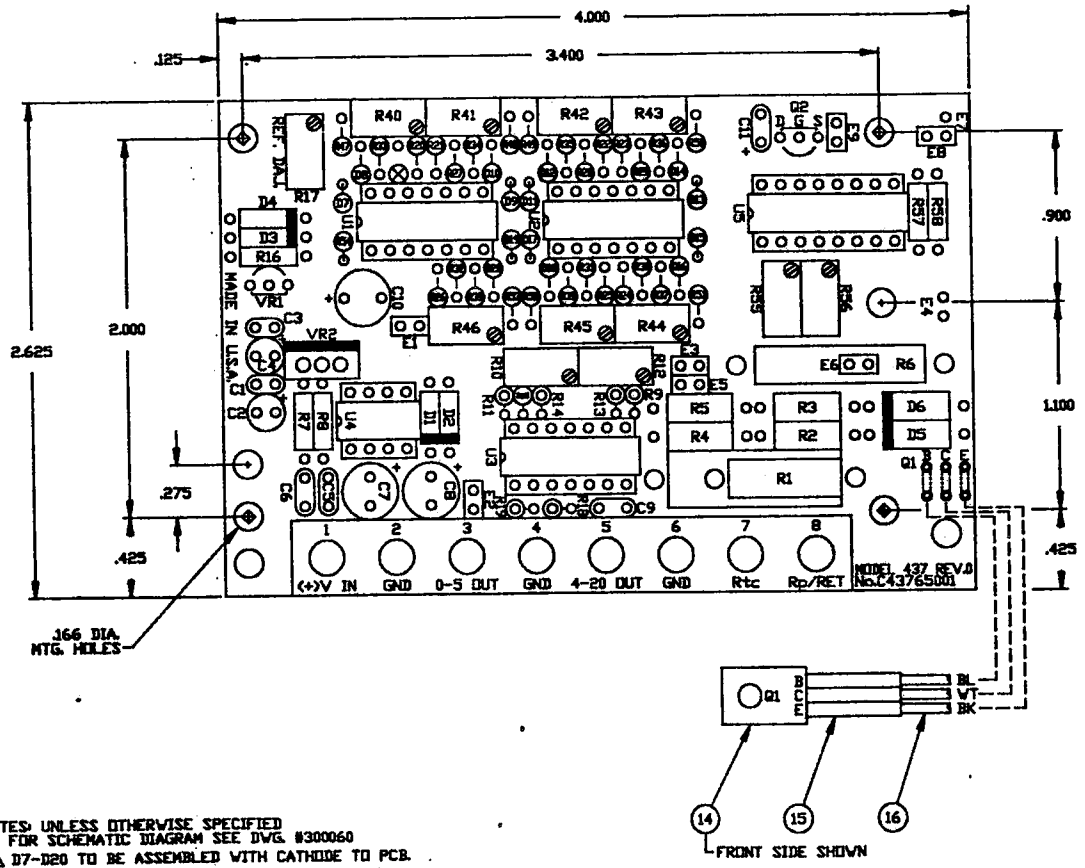
NOTE: If you want to perform your own warranty service, you must first obtain written authorization from Kurz Instruments. **Unauthorized service performed during the warranty period voids your warranty.** Please read the warranty statement at the front of this guide before performing any service.

The following drawings are included in this appendix:

Drawing No.	Description
420123, Rev A	Model 437 PCB Component Layout
B50030, Rev B	Model 430/435/560/565 Flow Body Cover Detail
420005, Rev C	Model 131 PCB Component Layout
420006, Rev B	Model 132 PCB Component Layout
420099, Rev B	Model 111R1 Dual Alarm Component Layout
420001, Rev B	Model 101 Totalizer Component Layout

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO.# A47214 , A45741801	9-9-88 B. SAXON	9/9/88	NA	9/9/88

JUMPER CONFIGURATION TABLE	
JUMPER	DESCRIPTION
E1	CLOSE FOR LINEAR OUTPUT @ TERM. #3 (-02)
E2	CLOSE FOR NON-LIN OUTPUT @ TERM. #3 (-01)
E3	CLOSE FOR VOLTAGE MODE
E4,E5	CLOSE FOR CURRENT MODE, (-)RET. IN @ TERM. #8
E6	CLOSE IF TEMP. LIMITING CIRCUIT (SAFETY) NOT REQ'D
E7,E9	CLOSE FOR 0-20mA NON-ISO OUTPUT @ TERM. #5.
E8	CLOSE FOR 4-20mA NON-ISO OUTPUT @ TERM. #5.



NOTES: UNLESS OTHERWISE SPECIFIED
1. FOR SCHEMATIC DIAGRAM SEE DWG. #300060
2. D7-D20 TO BE ASSEMBLED WITH CATHODE TO PCB.
3. R1,R6,D5,D6 TO BE ASSEMBLED WITH 1/8"±1/16" FROM PCB.
4. R6,D5,D6 TO BE ASSEMBLED FOR TEMP. LIMITING (SAFETY PURPOSES) ONLY.
5. CUT Q1 LEADS TO 5/16"±1/16" BEFORE SOLDERING TO WIRES.
6. FOR OEM CUSTOMERS KURZ WILL PROVIDE A HEATSINK ATTACHED TO Q1, CUSTOMER TO MOUNT TRANSISTOR AND HEATSINK ONTO CUSTOMER'S SYSTEM.
7. FOR CURRENT MODE OPTION REMOVE R2-R5, C9, Q1 AND USE R1 AS CURRENT SENSE RESISTOR.

PART No. IDENT.	
PART No.	DESCRIPTION
-01	NON-LINEAR CIRCUIT
-02	LINEAR CIRCUIT

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 ± 0.0050
NEXT ASSEMBLY
ORIG. RELEASE DATE

APPROVALS		
DRAWN BY	B. SAXON	DATE 9-9-88
CHECKED BY		DATE 9-9-88
DESIGN	N/A	DATE
APPROVED		DATE 9-9-88
RELEASED	N/A	DATE

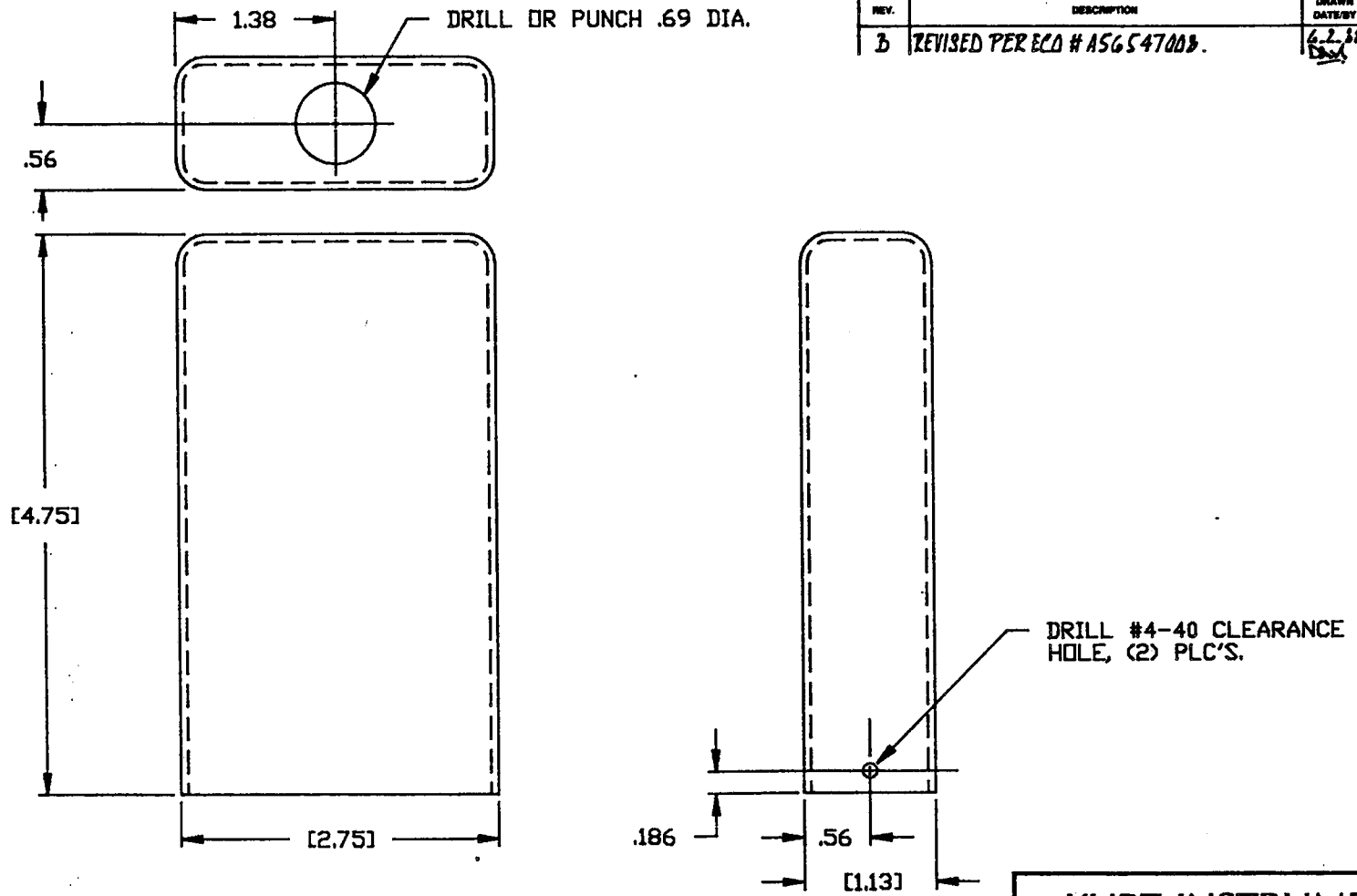
KURZ INSTRUMENTS INC.

TITLE: PCB, ASSY, 437

DWG. SIZE	DWG. NO.	REV.
C	420123	A

SCALE 2 : 1 SHEET 1 OF 1

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
B	REVISED PER ECO # A5654700B.	6.2.88 DDW	6-3-88	NA	6.6.88 DDW



NOTES:
1. MAT'L: MODIFY FROM ZERO MFG. CO. PRODUCT #Z18-44A.
2. FINISH: PAINT COLOR OFF-WHITE #27778 (FED-STD 595A) OR EQUIV.

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	DDW	DATE 6.2.88
CHECKED BY	B. Golden	DATE 6-3-88
DESIGN	NA	DATE
APPROVED	DDW	DATE 6-6-88
BASELINED	NA	DATE

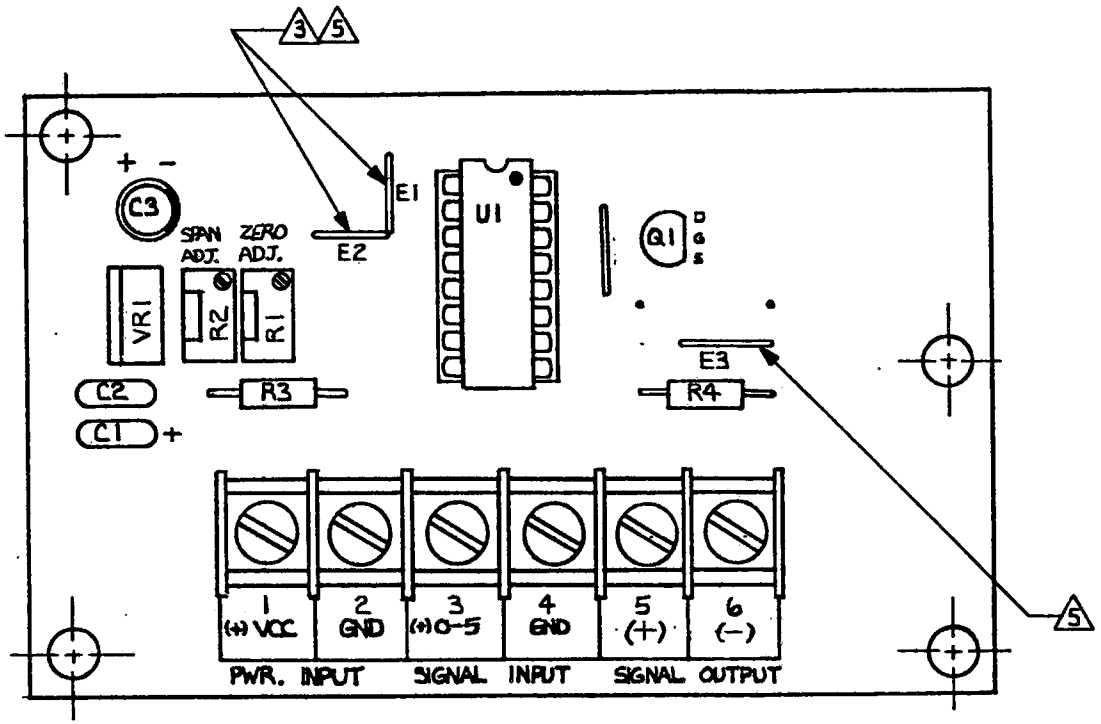
KURZ INSTRUMENTS INC.

TITLE: MODEL 430/435/560/565 FLOW BODY COVER DETAIL

L3

DWG. SIZE: B | DWG. NO.: B50030 | REV.: B | SCALE: FULL | SHEET: 1 OF 1

REVISIONS			
REV.	DESCRIPTION	APVD	DATE
A	RELEASED FOR PRODUCTION	DT/[illegible]/DT	7/20/86
B	REVISED TO CLARIFY OPTIONS	JC/DT/[illegible]	7/25/86
C	REVISED DELETED 1-5 VDC OUT OPTION	J.C 9/15/86 / ST/[illegible]	9-15-86



ALL COMPONENTS SHOWN INSTALLED

2

2

NOTES:

1. FOR SCHEMATIC DIAGRAM SEE # B1313O002.

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	MODEL 131 RI NON ISOLATED OUTPUT COMPONENT LAYOUT
CHK'D Drawz	3/7/86	
APP'D [illegible]	3/14/86	
		B 42.0005 REV. C SHT 1 OF 1

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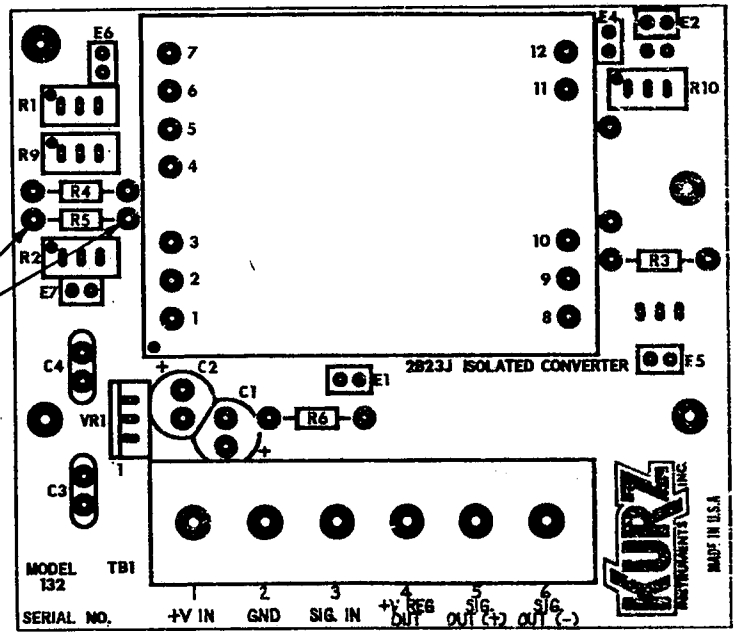
NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM 300003
2. FOR OPTION 4-20mA IN, 4-20 mA OUT ADD A WIRE JUMPER BETWEED PADS.
3. MICRO JUMPER SHALL BE USED AS REQUIRED.

REVISIONS					
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED, DELETED 4-20mA IN, 0-5 VDC OUT OPTION	J.C. 3/15/86	D.T. 3/15/86		MB 3/15/86
B	REVISED PER ECO No A13247005	[illegible] 6-17-86	TE 6-17-86	N/A	[illegible] 6/20/86



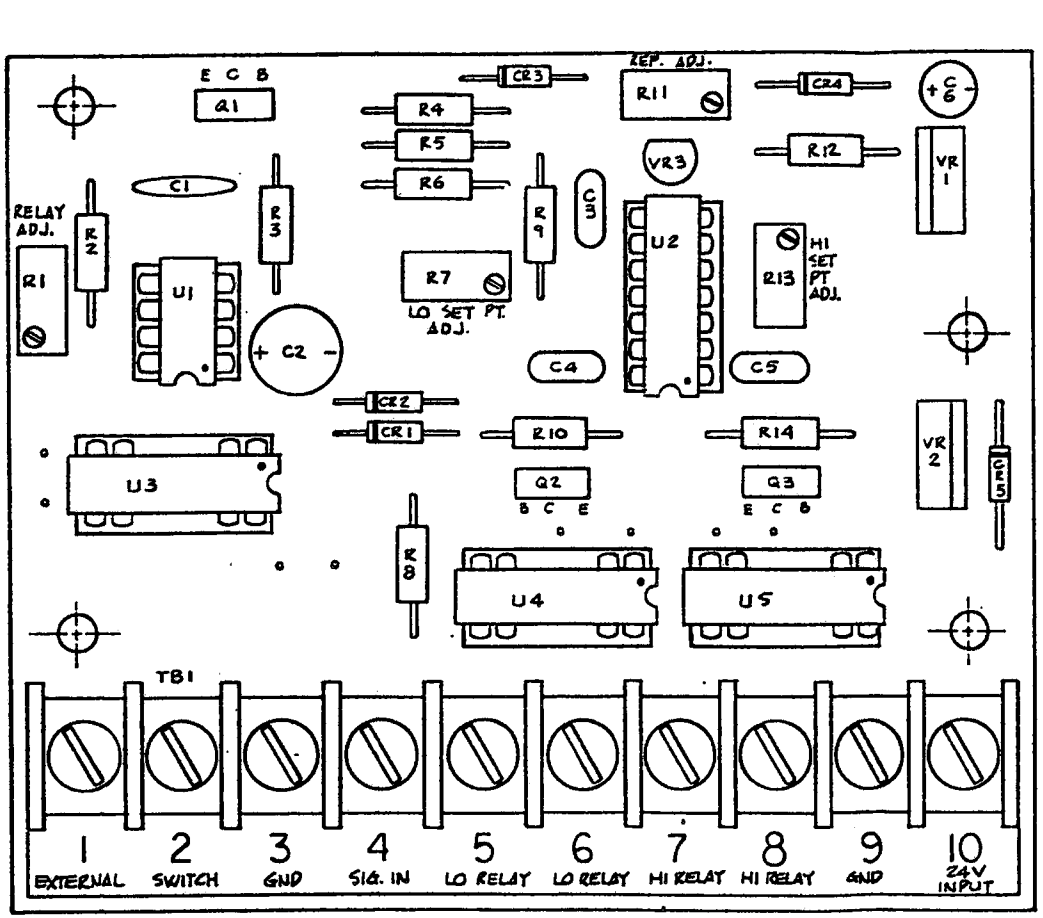
ALL COMPONENTS SHOWN INSTALLED

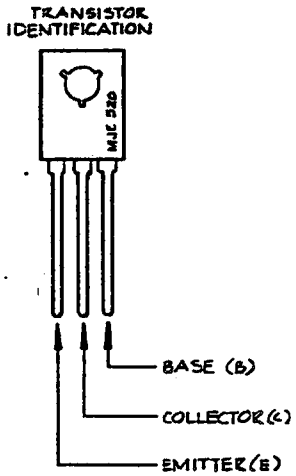
JUMPER CONFIGURATION	
OPTION	INSTALL
0-5 VDC IN 0-20 mA	E2 E5.
0-5 VDC IN 4-20 mA OUT	E4.E5.
4-20 mA IN 4-20 mA OUT	E1.E2.E5.E6

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 8-13-86 CHECKED BY D Park DATE 8.15.86 DESIGN DATE APPROVED M P Ellwanger DATE 8/18/86 ENGINEER DATE	TITLE L3 MODEL 132 ISOLATED SIGNAL OUTPUT CONVERTER COMPONENT LAYOUT DWG. SIZE C DWG. NO. 420006 REV. B SCALE 2:1 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	AB/DT
B	REVISED PER ECO # M7214, A1147002, A1247002	9-8-86 B.SAXON	





NOTES :

1. THIS DWG. TO BE USED IN CONJUNCTION W/ SCHEMATIC DIAGRAM DWG. # 30002D
2. LAST REF. DES. USED ARE : TB1, VR3, Q3, CR5, C6, R14, & U5.

KURZ

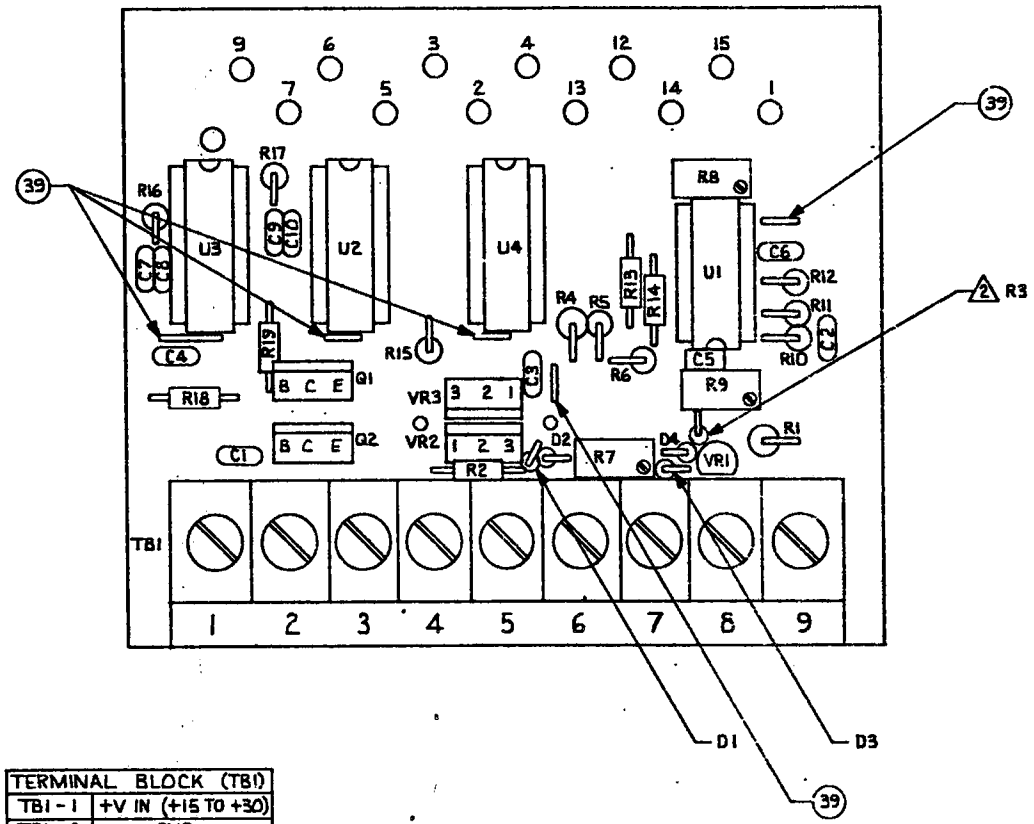
SCALE : 2/1
TOLERANCE
.XX ± .01
.XXX ± .003

DRN BY: V Finn	11-2-84	PCB , ASSY , 1111R1	
CHKD: Guerra	7-15-85		
APVD: [illegible]	7/16/85		
		B 420099	REV. B SHT 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM 300001
2. USE R3 ONLY WITH 4-20mA INPUT, KURZ TO ASSEMBLE AS REQ'D.
3. ALL DIODES TO BE ASSEMBLED WITH THE CATHODE TO THE P.C.B.

REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN ENG/DEPT	APPROVED BY DEPT
A	REVISED PER ECO A10147001	JC 2-4-87	2-4-87	N/A	CAL
B	REVISED PER ECO No 47246	1-29-88	2-2-88	N/A	2/2/88



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

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/32
ANGLES ± 0° 30'
DECIMALS
.X ± 0.1
.XX ± 0.05
.XXX ± 0.025
.XXXX ± 0.0010
ORIG. RELEASE DATE
NEXT ASSEMBLY

APPROVALS

DESIGN BY	J. CAREAGA	8-25-86
CHECKED BY		8-26-86
DRAWING		
APPROVED		9/26/86
ENGINEERING		

KURZ INSTRUMENTS INC.

TITLE
MODEL 101
TOtotalizer
COMPONENT LAYOUT

DWG. SIZE	DWG. NO.	REV.
C	4-20001	B
SCALE NONE	SHEET 1 OF 1	