KURZ
INSTRUMENTS INC.

Series 7500 Mass Flow Control Systems
User's Guide

March 1989

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, and a Quick Set-Up Guide. The book is not designed to be read cover to cover; rather, it is designed to present information to the 7500 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 7500 Mass Flow Control System, including model numbers, serial numbers, Kurz order number, and customer purchase order number. It also lists any options you ordered with your 7500. 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 of an illustration that summarizes much of the information presented in the rest of the manual. You can use the illustration 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 7500 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 7500 Mass Flow Control System. You can safely skip this section if you are already familiar with that information.

Section 2: Installation

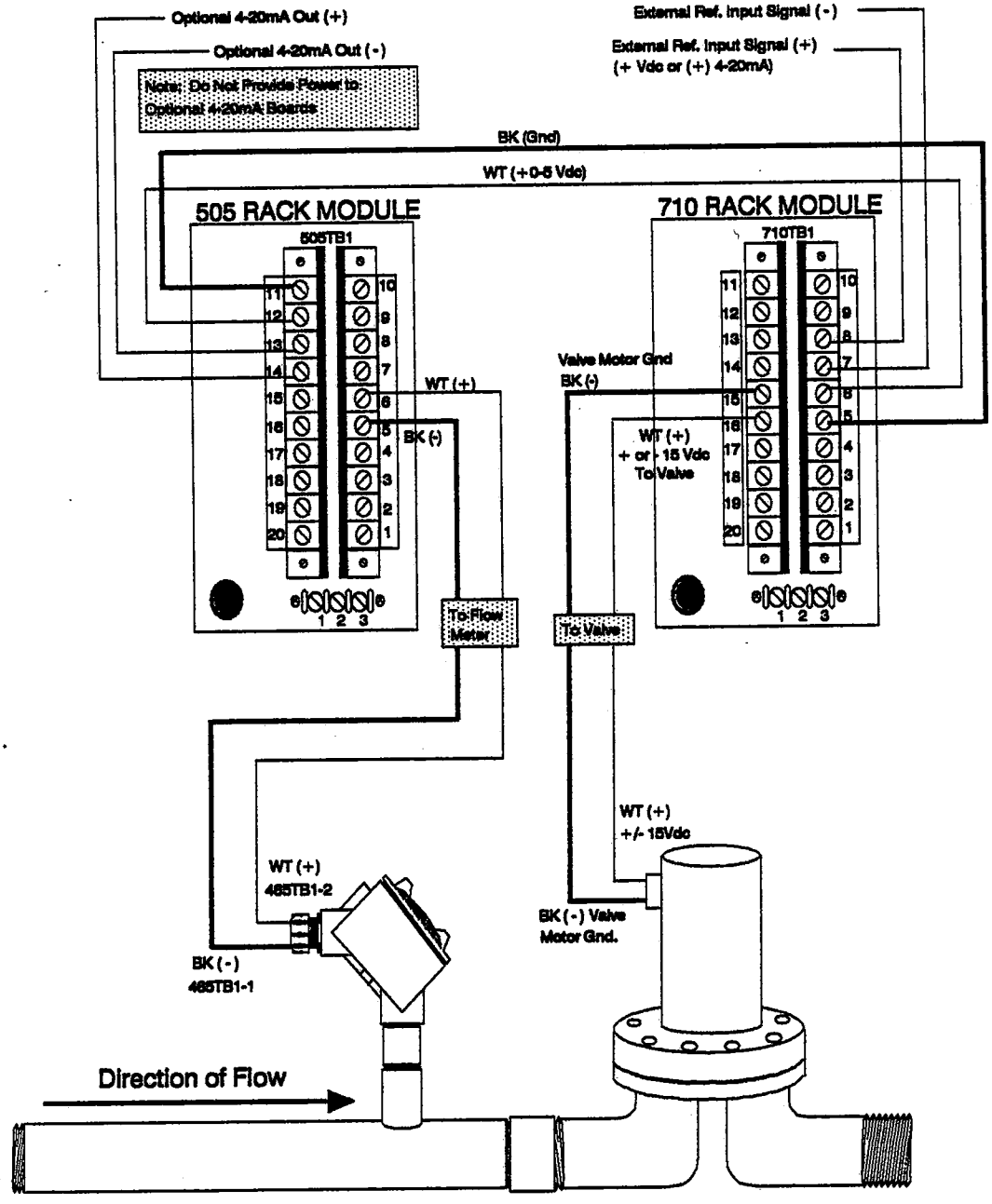
Section 2 explains, in necessarily general terms, how to install your 7500. This section explains how to determine the correct location for installation, as well as how to perform the physical installation. You should read thoroughly the parts of this section that apply to your installation before you install the 7500. **You may also want to read Section 5, "Testing," before you install the 7500.**

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. **They do not, however, contain all the information you may need for safe and satisfactory installation of your 7500. Kurz Instruments recommends that you read the manual before attempting installation.**



Section 1: Product Overview

This section contains a general description of the Series 7500 Mass Flow Control System. It explains how the flow controller works and lists its features and specifications.

1.1 Description

The Kurz Series 7500 Mass Flow Control Systems are state of the art mass flow controllers for use in the most demanding process requirements. The 7500 Mass Flow Control System can be used in applications requiring gas flow control in addition to flow metering. Our customers have used the 7500 to control anhydrous ammonia flows in a water treatment plant and to control argon gas flows in automated welding stations. The 7500 has also been integrated into gas monitoring systems built for nuclear power plants and for nuclear sampling systems.

The 7500 is composed of three basic subsystems:

- A fast response Model 505 Mass Flow Meter provides a 0-5 Vdc output signal linearly proportional to the measured flow. The 505 Mass Flow Meter consists of two assemblies. The first assembly is the flow meter (containing the mass flow sensor and current-transmitter board) mounted perpendicular on the flow body. The second assembly is the 505 rack module containing the power-supply/linearizer board.

- The Series 710 Electronic Valve Controller opens or closes the control valve after comparing the 505 flow meter's 0-5 Vdc output signal to a user-selectable internal or external setpoint value. The 710 also provides all the control and function switches to operate the 7500 system as well as an LDC digital display used in system operation.

- The Series 730 Electric Rotary Ramp Metering Valve provides precise flow control in conjunction with 710 controller.

Figure 1-1, on the following page, shows an illustration of the 7500 system components.

Each of these components is described in the following subsections.

1.2 The 505 Mass Flow Meter

The Model 505 Mass Flow Meters come with an attached flow body and are designed to be installed in lines carrying air or other gases. It is extremely rugged and resistant to contamination, and is therefore particularly suitable for hot, dirty, or corrosive industrial environments. Because of the 505's exceptionally energy-efficient design, pressure drops across the 505 are extremely low, typically about two inches of water, or 1/15 of one psi.

The 505 is available in many sizes to suit a wide range of applications. Table 1-1 lists the various 505 models and summarizes some of their characteristics.

Table 1-1. *505 Sizes and Specifications*

Maximum Flow/Units of Flow		Model Number	Inlet & Outlet Fitting Size	Maximum Pressure Drop (in inches of water) at Full Scale	Recommended Allowable Working Pressure (psi)
0-50	SCCM	505-1-00	1/4" MNPT x 6"	.05	1000
0-150	SCCM	505-2-00	1/4" MNPT x 6"	.05	1000
0-500	SCCM	505-3-00	1/4" MNPT x 6"	.05	1000
0-1500	SCCM	505-4-00	1/4" MNPT x 6"	.1	1000
0-5	SLPM	505-5-00	1/4" MNPT x 6"	.3	1000
0-15	SLPM	505-6-00	1/4" MNPT x 6"	.5	1000
0-50	SLPM	505-6-04	1/4" MNPT x 6"	5.0	1000
0-50		505-7-02	3/8" MNPT x 7"	.06	1000
0-1	SCFM	505-6-02	1/4" MNPT x 6"	2.0	1000
0-1		505-7-0	3/8" MNPT x 7"	.02	1000

Table 1-1 (continued). *505 Sizes and Specifications*

Maximum Flow/Units of Flow		Model Number	Inlet & Outlet Fitting Size	Maximum Pressure Drop (in inches of water) at Full Scale	Recommended Allowable Working Pressure (psi)
0-150	SCFM	505-9B-06	2" MNPT x 24"	.52	1000
0-150		505-10A-00	3" MNPT x 36"	2.6	900
0-175	SCFM	505-10-02	2 1/2" MNPT x 30"	8.0	1000
0-200	SCFM	505-10A-02	3" MNPT x 36"	4.6	900
0-200		505-11-00	4" MNPT x 48"	2.3	800
0-200		505-11-01	4" MNPT x 12"	2.3	800
0-300	SCFM	505-10-04	2 1/2" MNPT x 30"	10.5	1000
0-300		505-10A-04	3" MNPT x 36"	10.5	900
0-300		505-11-02	4" MNPT x 48"	5.1	800
0-300		505-11-03	4" MNPT x 12"	5.1	800
0-400	SCFM	505-10A-06	3" MNPT x 36"	7.0	900
0-400		505-11-04	4" MNPT x 48"	7.0	800
0-400		505-11-05	4" MNPT x 12"	7.0	800
0-500	SCFM	505-12-00	6" MNPT x 66"	2.0	300
0-500		505-12-01	6" MNPT x 18"	2.0	300
0-600	SCFM	505-11-06	4" MNPT x 48"	6.7	800
0-600		505-11-07	4" MNPT x 12"	6.7	800
0-750	SCFM	505-12-02	6" MNPT x 66"	4.5	300
0-750		505-12-03	6" MNPT x 18"	4.5	300

1.2.1 505 Basic Components

All the 505s consist of the same basic components:

- DuraFlo™ ceramic flow sensor (Models 505-1 through 505-6), Mini MetalClad™ all-metal sensor (Models 505-7 through 505-9), or MetalClad™ all-metal sensor (Models 505-10 through 505-13).

  NOTE: The sensor shipped with your 505 was specifically matched to your unit's electronics during factory calibration. Sensors are **not** interchangeable between different 505s.

- 316 stainless steel flow body with male National Pipe Thread fittings (MNPT)

- Two-wire current transmitter board housed in a weatherproof junction box attached to the flow body

- Power-supply/linearizer board unit housed in a rack module

All information is this guide applies equally to all 505 models unless specifically identified as applying only to a particular model or models.

Figure 1-2 shows the basic components of the 505.

Figure 1-2. *505 Basic Components:*

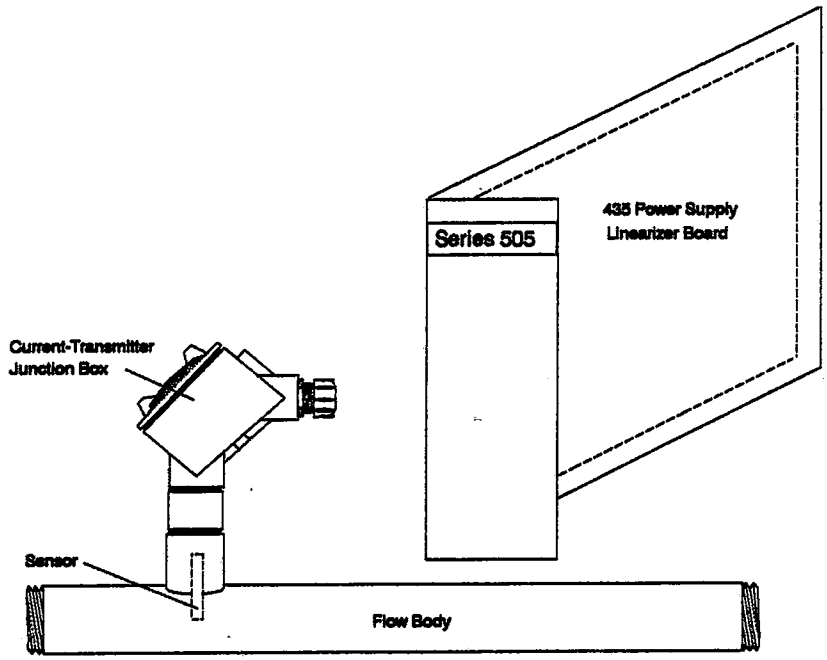
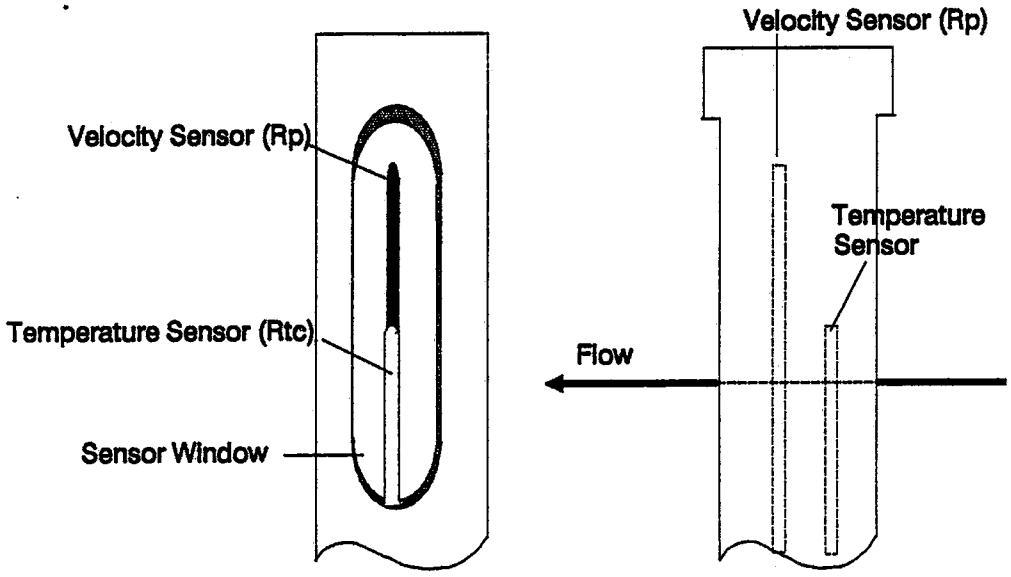


Figure 1-4. *The Mini MetalClad and MetalClad Sensor: Two Views*

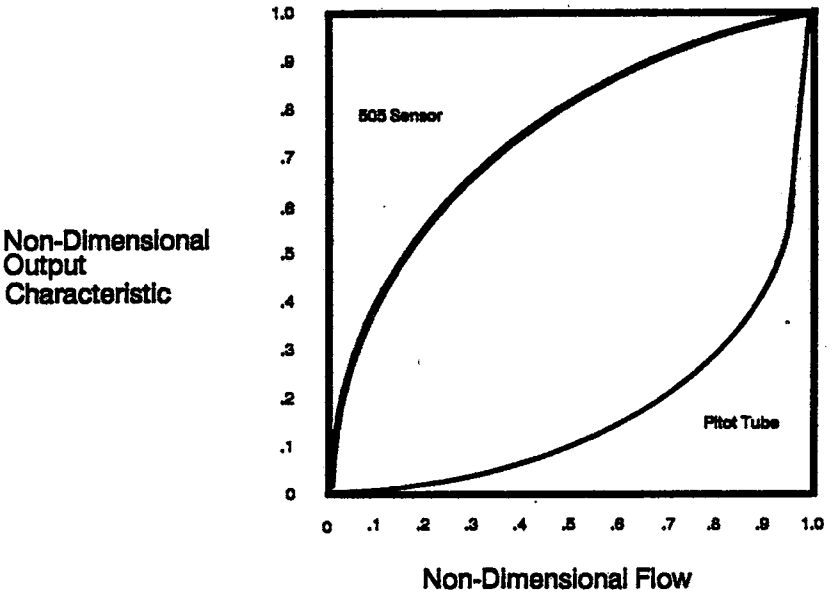


All Kurz sensors operate in the same manner. The temperature winding senses the ambient temperature of the flow. The velocity winding is then heated to approximately 75° to 100° F **above** the ambient temperature and is maintained at the same level of temperature differential (overheat) above the ambient temperature regardless of changes in ambient temperature.

CAUTION: The standard rating on the 505 sensor is for nonexplosive gases. If you plan to use it in flows of explosive gases, contact Kurz Instruments.

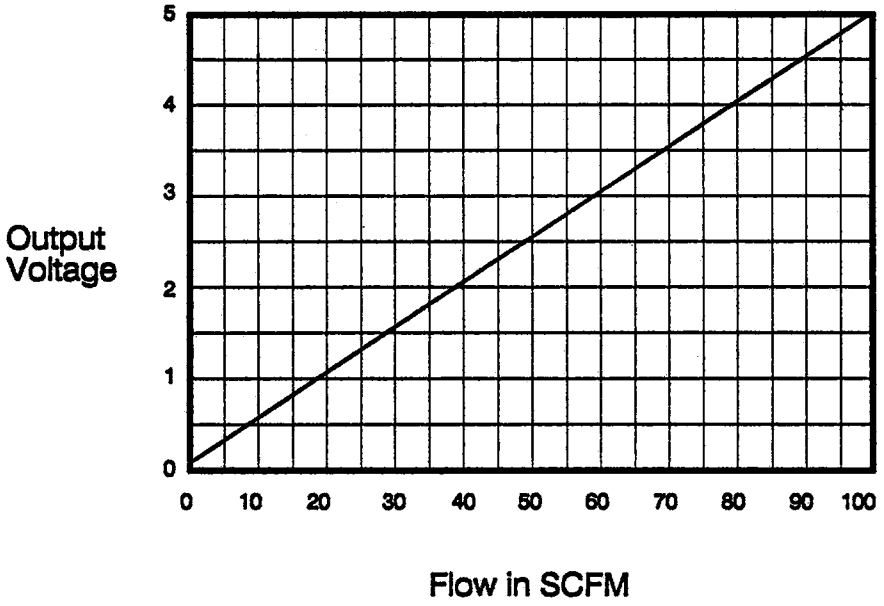
Because the temperature winding compensates for fluctuations in ambient temperature, the amount of electrical power needed to maintain the velocity winding's overheat is affected only by the flow of air or other gases over the sensor: The greater the flow, the greater its cooling effect on the sensor 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 505.

Figure 1-5. *Sensor Output vs Flow*



The linearizer converts the nonlinear draw into a linear voltage that is directly proportionate to flow: 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 1-6.

Figure 1-6. *Linearized Output*



The 710 then applies this error signal to the 730 control valve to open or close the valve until the setpoint is reached. The +15 Vdc signal opens the valve and the -15 Vdc signal closes the valve. The valve stays in it's last position until it receives an error signal, and moves only while an error signal is present.

The setpoint reference signal that is compared to the 505's output signal can be generated by the 710 Controller or can be input externally to the 710 Controller. Using an external setpoint reference allows the setpoint (and therefore the flow rate) to vary according to computer control or respond to the state of other process variables. This also allows one flow control system to be slaved to another, to create a blending system for example.

The 710 controller board inside the 710 rack module includes a power supply that generates regulated +5 Vdc, +15 Vdc, and -15 Vdc supplies. The comparator circuit on the 710 board compares the 505's output signal to the setpoint reference signal and generates an error signal. Power transisitors on the 710 board drive the 730 valve motor with a +15 or -15 Vdc error signal.

The 710 controller is supplied in a standard 4.2"-wide rack module, which includes a 4 1/2-digit character LCD display, setpoint adjust potentiometer, switches for automatic or manual valve operation, and a provision for the external setpoint signal. Remote inputs (external set point signals) are usually of the same type and in the same units as the process variable input (with the exception of the 710-07-RMD). A typical 710 rack module is illustrated in Figure 1-7.

1.4 The 730 Electric Rotary Ramp Metering Valve

The Kurz Series 730 Electric Rotary Ramp Metering Valve provides the metering required for both isokinetic and constant flow control operations. The 730 is an electrical metering valve that combines the electric drive motor, the valve body, and limit switches into a well designed integrated package.

The standard valve incorporates a high torque DC gear motor designed to be operated by "error signals" (+ 15 or -15 Vdc signals) from the Series 710 Controller. The flow coefficient (C_v) of the 730 is linear over a wide range due to its nearly 300 degree rotation between a complete flow shutoff and full open. The standard full open to full close time is 30 seconds, unless an optional valve speed has been specified. In addition, the orifice size is unaffected by changes in system pressure and the valve remains in its last position during constant flow or during power shutoff.

Because the motor is used only when the valve must move to a new position during flow control, the motor operates only for brief periods and is usually idle. In this type of application the motor should enjoy an extremely long life and should not require replacement of the brushes.

The standard 730 valve is constructed of type 304 stainless steel and includes an O-Ring sealed motor cover with a 1/2" FNPT (female National Pipe Thread) conduit fitting. The Series 730 valves may be used with most fluids, including steam and liquids. Special materials of construction may be specified for hostile fluids or environments.

The cover of the valve can be removed for servicing or hookup by removing the 4 socket cap screws circumferentially mounted to the base of the valve motor cover housing. See Section 5 for information on servicing.

1.5 Specifications

The specifications for the system components included in the 7500 are summarized below.

1.5.1 505 Mass Flow Meter Specifications

Table 1-2. *505 Specifications*

Sensor Construction:	Reference-grade 385 platinum RTD-type windings around a high-purity ceramic core, sheathed in glass (Models 505-1 through 505-6) or stainless steel (Models 505-7 through 505-13).
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 flow for 11 data points, including zero flow.

Table 1-2. *505 Specifications* (continued)

Operating Temperature Range of Electronics:	-20° C to +60° C Units with high temperature sensors (HT or HHT) use current-transmitter enclosure placed remote from the flow body via a 15-foot cable
Power Supply:	110VAC/60Hz Standard 220VAC/50-60Hz power supply optionally available
Output:	Linear 0-5 Vdc standard. Isolated and nonisolated 4-20 mA outputs optionally available. For other nonstandard outputs, consult factory.
Linearization:	11 breakpoint analog voltage offset type (11 amplifier stages) plus zero and span. Optional digital linearizer available, see Options section

Table 1-3. *710 Specifications* (continued)

Enclosure:	Standard: 4.2" wide by 7" high rack module Optional 7500 system packages are available that house all system components in one large NEMA enclosure.
Signal In:	Accepts 0-5 Vdc process variable input normally provided by 505 Mass Flow Meter. Alternatively accepts 0-5 Vdc process variable input provided externally. 710 controller modules that accept a 4-20 mA, 0-2 Vdc, or 1-5 Vdc process variable signal are also available. Consult factory regarding other external inputs.
Signal Out:	+15 Vdc or -15 Vdc signal drives the 730 valve over a two-wire hookup (2nd wire is ground)
Hookup:	Rear-mounted barrier screw terminal provided for hookup of signal in and valve control signal

Table 1-4. *730 Specifications* (continued)

Cycle Times:	Full CLOSE to full OPEN is normally approximately 35 to 40 seconds when the 2426:1 ratio gearmotor is used. Less pronounced gear ratios result in faster cycle times, but can result in loss of some precision in fine metering. Select other cycle times only where flow is rapidly changing. It is very simple and economical to swap out gearmotors in the field with only a screwdriver should you wish to change the valve cycle time.
Hookup:	Two-wire hookup. One wire is ground. The other wire carries the + 15 Vdc or -15 Vdc signal from the 710 controller that opens or closes the valve respectively.
Motor Cover:	The cover for the motor is constructed of the same material as the valve (e.g. 316 stainless steel covers are provided with 316 stainless steel valves). All motor covers include cable fitting which may be removed to run conduit into the 1/2" FNPT fitting provided.
Shutoff:	While a pressure assisted shutoff plug is a standard feature, the 730 valves are metering valves, not shutoff valves. For users requiring 100% confidence in total shutoff we recommend installation of a simple normally open closed solenoid valve downstream of the Kurz 730 valve.

Section 2: Installation

This section explains how to install your 7500 Mass Flow Controller. 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

Normally no special precautions need to be observed during unpacking of your flow control system. Depending on the number of systems or system components, the electronics for the 7500 (710 Controller and 505 Power-Supply/Linearizer rack modules) may or may not be shipped in the same physical box as the 505 Flow Meter and 730 Valve.

Of course, any external damage to the package(s) should be reported to the carrier. Open the shipping carton(s) and remove the protective foam packaging material that covers the 7500 and any options shipped with it. Check to see that the shipping carton contains everything you ordered. If you ordered your 7500 without any options, the contents of the shipping carton should be as shown in Figure 1-1.

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.

Usually the 505 Mass Flow Meter and the 730 Electric Rotary Ramp Metering Valve are already mated or piped together. In most cases the valve will be installed downstream from the 505 flow meter.

Make sure the NBS-traceable calibration certificate for the 505 Mass Flow Meter is included. Verify that the line size and pipe schedule shown on the calibration certificate are correct.

2.3 Installing the 505 Mass Flow Meter

2.3.1 Determining Flow Meter Location

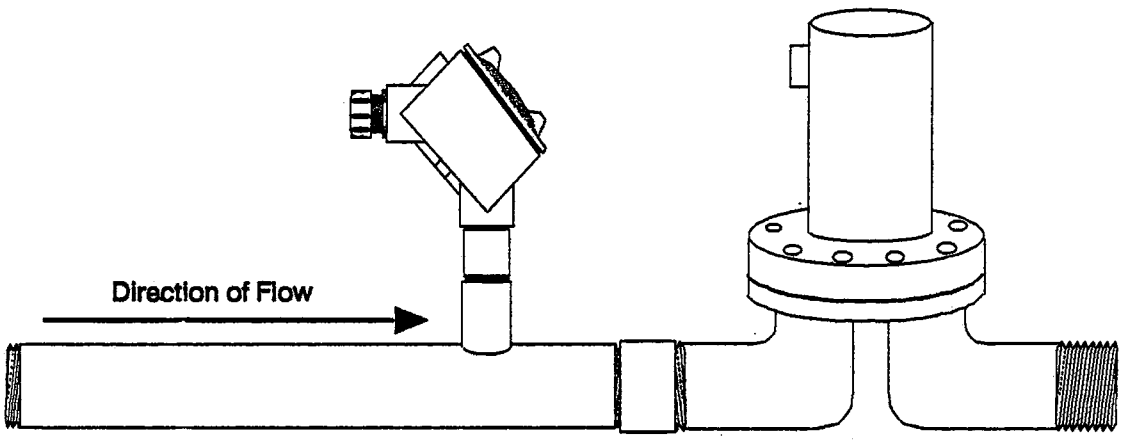
The flow body itself provides the required unobstructed runs upstream and downstream from the sensor. Even so, it is a good idea to install the 505 near the center of a long, straight pipe section, if possible.

Unless it has been specifically calibrated for another orientation, the flow meter must be installed in a horizontal run, with the junction box extending straight up. You must therefore choose a location where there is sufficient clearance for the junction box.

2.3.2 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 junction box). You must install the 505 so that flow enters through the long end of the flow body and exits through the short end. Figure 2-1 illustrates the position of the flow meter is relation to the flow.

Figure 2-1. *Flow Meter's Position in Relation to Flow*



In consulting Table 2-1, there are two things you should bear in mind:

- Table 2-1 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 2-1. *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

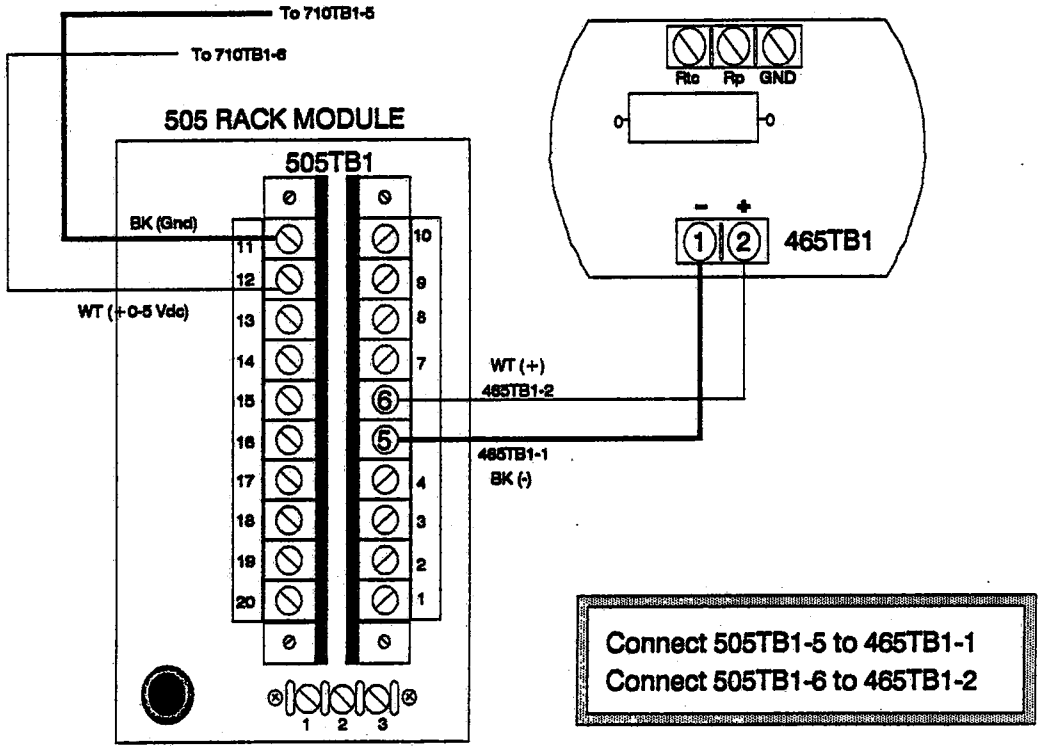
WARNING: Always unplug the power cords for the 710 and 505 rack modules before you make connections. Failure to unplug or disconnect the power cord will result in severe shock hazard and possible damage to the circuits and/or sensor.

2.4.1 Connecting the 465 Current-Transmitter to the 505 Rack Module

The two-wire current loop must be connected between the 465 Current-Transmitter Board in the 505 flow meter and the 505 rack module containing the 435R1 Power-Supply/Linearizer Board. The 7500 system is shipped with 15 feet of wire already connected to the current-transmitter terminals and exiting a conduit fitting on the junction box of the flow meter. You can either splice longer wires onto the existing wires or replace them with wires of your own. Make sure that the wire gauge and length do not cause the resistance in the current-loop to exceed 4 ohms.

The black wire attached to terminal 1 of 465TB1 is the return signal. You should connect this wire to terminal 5 on the back of the 505 rack module. The white wire attached to terminal 2 of 465TB1 is the +24 Vdc power supply. You should connect this wire to terminal 6 on the back of the 505 rack module. These connections are shown in Figure 2-3. Note that, because of the 505's reverse polarity protection, the connections between the 465 Current-Transmitter Board and the 505 rack module can be reversed without damaging the 505.

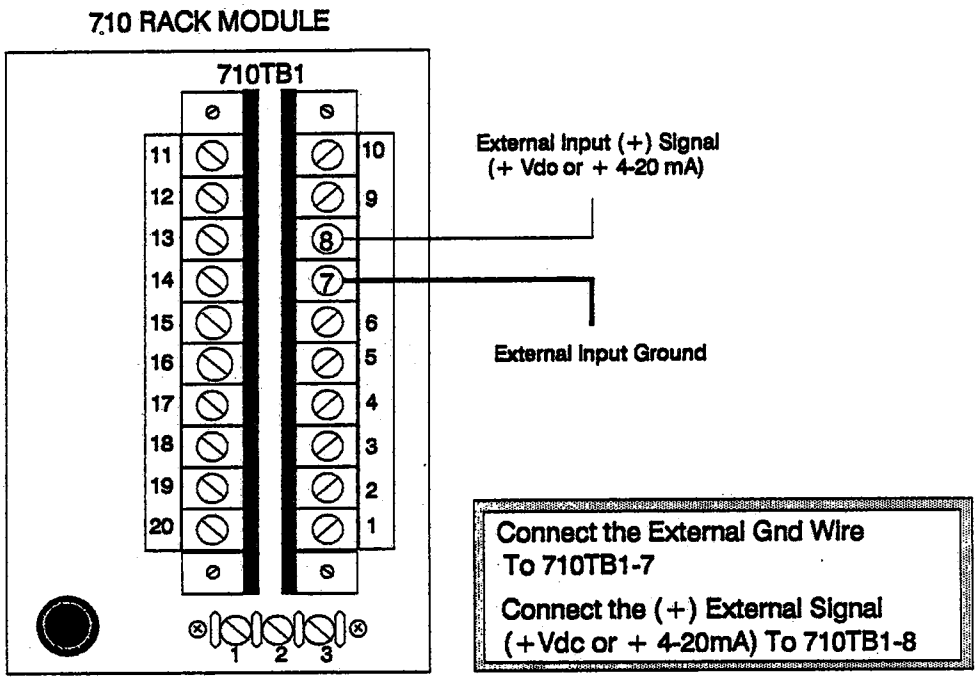
Figure 2-3. *Two-wire Current Loop Connections*



2.4.3 Connecting an External Setpoint Signal

If you are using an external setpoint reference signal to control the flow, connect the inputs to the 710 rack module as shown in Figure 2-5. These connections can be used to input either an external voltage or 4-20 mA reference signal.

Figure 2-5. *Connecting an External Setpoint Reference Signal to the 710*



Section 3: Operation and Maintenance

This section describes the operation and routine maintenance of the 7500 Mass Flow Control System.

3.1 Operation

As discussed in the previous sections, the 7500 system controls flow by comparing the 0-5 Vdc or optional 4-20 mA output signal generated by the 505 Mass Flow Meter to a setpoint reference voltage or 4-20 mA signal. When the actual rate of flow (as indicated by the output signal from the 505) is less than the setpoint flow rate (as indicated by a setpoint reference signal) the 710 outputs a + 15 Vdc error signal to open the valve thereby increasing flow. When the actual rate of flow (as indicated by the output signal from the 505) is greater than the setpoint flow rate (as indicated by a setpoint reference signal) the 710 outputs a -15 Vdc error signal to close the valve thereby decreasing flow.

The setpoint reference signal can be generated by the 710 Controller or can be input externally to the 710 Controller. The valve stays in it's last position until it receives an error signal, and moves only while an error signal is present.

The simplest way to explain the modes of operation for the 7500 is to explain the functions of the control switches. Typically the Series 505 Mass Flow Meter rack module will have an ON/OFF switch only. All the other controls for the standard 7500 are on the 710 Controller rack module. As shown in Figure 3-1 on the next page, these operator controls include:

ON/OFF Switch

DISPLAY Select Switch

FUNCTION Select Switch

MANUAL VALVE OPEN/CLOSE Switch

SET-POINT ADJ. Locking Potentiometer

3.1.1 The DISPLAY Select Switch

The DISPLAY select switch allows you to choose the type of reading that is displayed on the LCD display. The reading will be displayed in your particular control system's engineering units (typically a unit of flow or lbs.). Depending on the switch position, the LCD display indicates:

1.) the actual flow

2.) the 7500's internal setpoint flow

3.) the external setpoint flow (if used)

Normally the DISPLAY select will be set FLOW RATE. The reading displayed is the flow as measured by the 505 Mass Flow Meter. Because the flow meter is directly upstream of the flow control valve, the reading displayed is the actual current rate of flow control.

The other two positions on the DISPLAY select switch are used to display the setpoint flow rate in engineering units. When the DISPLAY switch is set to the SET-POINT position, the LCD display provides a flow reading derived from the 7500's internal setpoint reference voltage as set by the SET-POINT ADJ. locking potentiometer. This SET-POINT switch position should be selected when adjusting the SET-POINT ADJ. locking potentiometer to set or change the 7500's internal flow control setpoint.

You can select to use an external 0-5 Vdc or other external setpoint in place of the 7500's internal setpoint. The external setpoint is selected using the FUNCTION select switch described in the next subsection. When the DISPLAY select switch is set to EXTERNAL INPUT the display provides a flow reading derived from the external setpoint reference voltage or 4-20 mA reference input. This display is helpful when setting or changing the external setpoint signal used to control the flow.

3.1.4 The SET-POINT ADJ. Locking Potentiometer

This locking potentiometer allows you to adjust the 7500's internal setpoint reference signal. This 10-turn potentiometer trims the supplied 0-5 Vdc (or optional 4-20 mA) setpoint signal to the level by which the 505's signal output signal will be compared.

3.2 Calculating Actual Flow

For most air-flow monitoring applications, the **mass** of the flowing gas is the relevant variable. The 505's 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.

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).

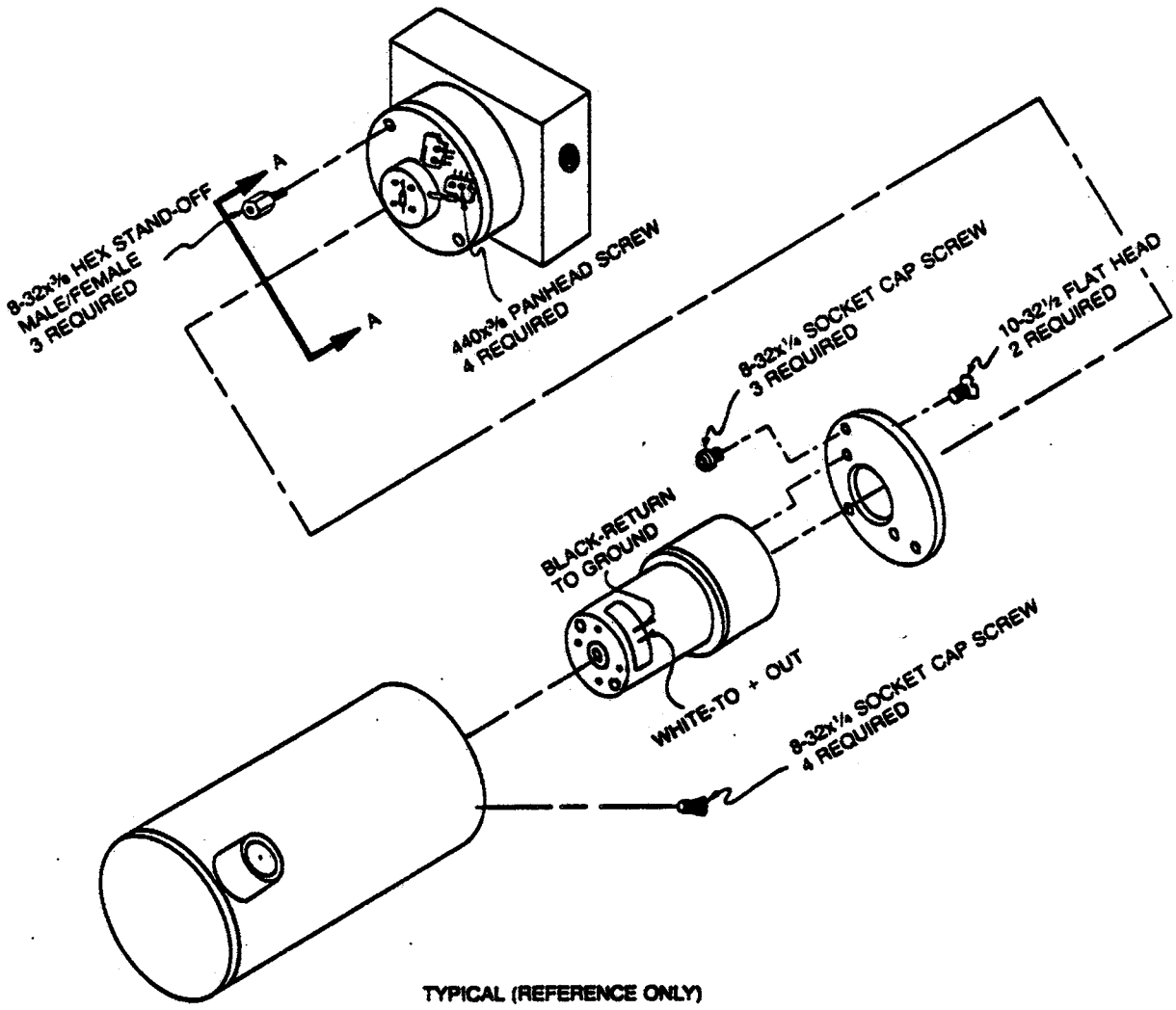
d_a = Actual air density at local temperature and barometric pressure.

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

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

To disassemble smaller valves refer to Figure 3-2. First remove the motor cover housing by removing the 4 socket cap screws placed around the base of the valve's motor cover housing. Before you remove the motor you will need to remove the motor lead wires. It may be helpful to mark the leads with a + or - to indicate how the wires should be reinstalled.

Figure 3-2. *Motor Assembly*

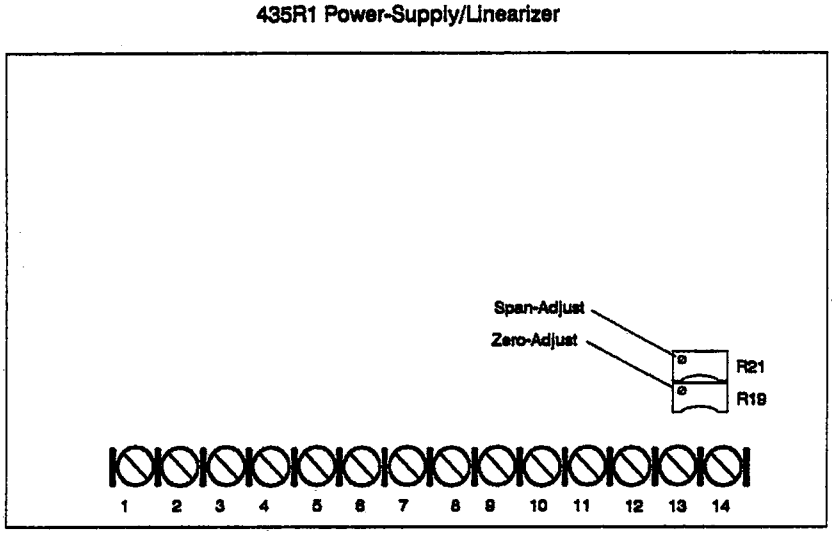


If you do recalibrate the 505 yourself, follow the procedure described below. You will need:

- 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 505 and adjusting the zero and span potentiometers on the 435R1 Power-Supply/Linearizer Board. Figure 3-3 shows their locations.

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



Step 1: Set the flow to 0.

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 505 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 winding (R_p) begins to affect the ambient temperature winding (R_{tc}).

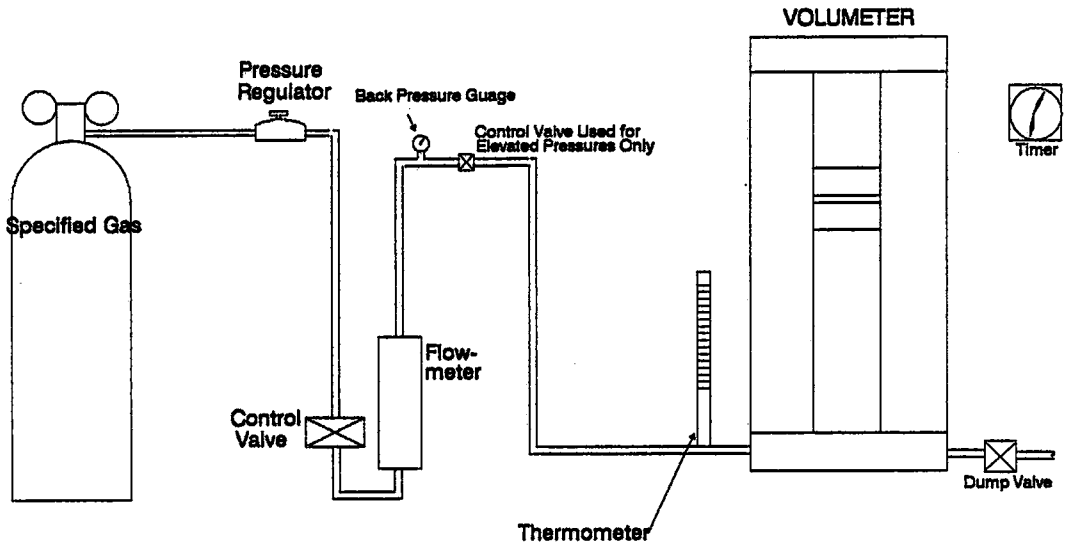
Section 4: Options

This section lists and describes some of the more popular options available with the 7500 Mass Flow Control System. The options discussed in this section are

- Specialty Gas Calibrations
- 220 Vac/60 Hz Power Supply
- 4-20 mA Output
- HT High-Temperature Sensor
- HHT Very-High-Temperature Sensor
- Teflon-Coated Sensor
- Remote Current-Transmitter Electronics
- NEMA Enclosure For 7500 Electronics
- Optional Engineering Units
- Dual Alarm
- Totalizer
- Sensor Safety Circuit
- Smaller 740 Valve Series
- Dual Range Option
- Alternative Power-Supply\Linearizer Boards

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

Figure 4-1. *Specialty Gas Calibration*



4.2 220 Vac/60 Hz Power Supply

The standard power supply used in the 505 and 710 rack modules is 110 Vac/60 Hz.

220 Vac/60Hz power supplies are optionally available.

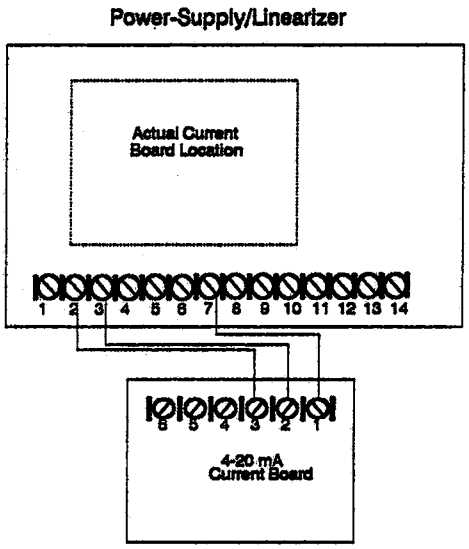
4.3 4-20 mA Output

The standard output from the 505 Mass Flow Meter is a linearized 0-5 Vdc signal. An optional 4-20 milliamp (mA) board can be installed to convert this linear 0-5 Vdc signal to a 4-20 mA signal. Non-isolated (Model 131) and isolated (Model 132) versions are available.

A 4-20 mA output signal is appropriate when the distance between the 505 rack module and the device receiving the linearized signal is such that a significant voltage drop would occur in the standard 0-5 Vdc signal. A 4-20 mA output signal is unaffected by distance, as long as the total resistance in the loop is less than 800 ohms.

When the 4-20 mA board is mounted on standoffs above the main 435R1 Power-Supply/Linearizer Board in the 505 rack module it is connected to that board as shown in Figure 4-3.

Figure 4-3. *4-20 mA Current Board Connections*



Alternatively, the 4-20 mA board may have been installed in it's own rack module. In this case the linearized 0-5 Vdc output from the 505 flow meter will be input to the 4-20 mA module as shown in Figure 4-4. The 131RM or 132RM will also get power and ground from the 505 rack module.

The 4-20 mA board converts the 0-5 Vdc signal and signal ground to (+) and (-) 4-20 mA signals. The 4-20 mA signals are output on terminals 13 and 14 on the back of the Model 131 or 132 rack module, also shown in Figure 4-4.

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 435R1 Power-Supply/Linearizer Board. Electrical isolation between the receiving device and the system prevents ground loop problems. Isolated 4-20 mA output is achieved by routing the 505's 0-5 Vdc output signal and signal ground to the inputs of the Model 132 4-20 mA Current Board or Module.

4.4 HT High-Temperature Sensor

The standard 505 sensor is rated for temperatures from 0° C to 125° C.

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

4.5 HHT Very-High-Temperature Sensor Option with the 465R5 Current-Transmitter Board

The standard 505 sensor is rated for temperatures from 0° C to +125° C.

The optional HHT very-high-temperature sensor is rated from 0° C to +500° C. The HHT sensor is only available on Models 505-10 through 505-13.

If you have purchased the HHT sensor option, the 465R4 Current-Transmitter Board (normally installed in the junction box on the head of the 505 Mass Flow Meter) is replaced by the 465R5 Current-Transmitter Board.

4.6 Teflon-Coated Sensor

The standard 505 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.

4.9 Optional Engineering Units

The standard units of measurement displayed on the LCD digital display of 710 module 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 some other unit, contact Kurz Instruments for more information.

4.10 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 4-6, 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.

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.)

4.13 740 Flow Control Valve

For flow control of slower flows or where increased flow control is required, the 740 valve may be substituted for the standard 730 valve. The 740 valve is operated in the same way as the 730 valve. It opens and closes dependent on the error signal transmitted from the 710 Controller.

However, the 740 uses + and - 13 Vdc error signals to open or close the valve. Therefore the 710 controller board is modified to transmit a + 13 Vdc error signal to open the 740 valve and a - 13 Vdc error signal to close the 740 valve.

End of Section 4

Section 5: Testing

This section describes some of the bench testing procedures you can perform on the 710R1 Controller Board, 435R1 Power-Supply/Linearizer Board, 465R4 Current-Transmitter Board, and optional 465R5 Current-Transmitter Board.

You may want to perform these tests before you install the 7500 system 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 Testing the 710R1 Board

To perform the tests for the 710R1 board, you will need an ohmmeter and a digital voltage meter accurate to within +/-.001 Vdc.

The test consists of checking the the contacts of the operator control switches and checking the voltage between the DC ground terminals and test points specified. First test all switch contacts using the ohmmeter. Refer to drawing number 340085 in Appendix A for the contact locations.

Next test the voltage between the specified terminals on Terminal Block 1 (TB1) of the 710R1 board. These test points are indicated in the illustration shown in Figure 5-1.

Error Signal:

Measure the voltage between terminals 11 (motor ground) and 10 (error signal). With the FUNCTION select switch set to FLOW CONTROL and the DISPLAY select switch set to FLOW RATE, make note of the current flow rate. Next, turn the DISPLAY select switch set to SET-POINT, make note of the current setpoint.

Vary the setpoint by adjusting the SET-POINT ADJ. potentiometer. As you adjust the SET-POINT ADJ. locking potentiometer to a higher setpoint, a +15 Vdc (or optional +13 Vdc) motor error signal should be output from the 710 board. As you adjust the SET-POINT ADJ. potentiometer to a lower setpoint, a -15 Vdc (or optional -13 Vdc) motor error signal should be output from the 710 board. Return the setpoint to the original setting.

5.2 Power-On Voltage Test for the 435R1 Board

To perform the power-on voltage test for the 435R1 Power-Supply Linearizer Board, you will need a digital voltage meter accurate to within +/-.001 Vdc.

This test consists of checking the voltage between DC Ground (terminal screw 3) and each of nine test points (TP1-TP9) on the 435R1 board. The correct voltage for each test point is listed below. Figure 5-2 shows the location of the test points.

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

5.3 Current-Transmitter Board Bridge-Voltage Tests

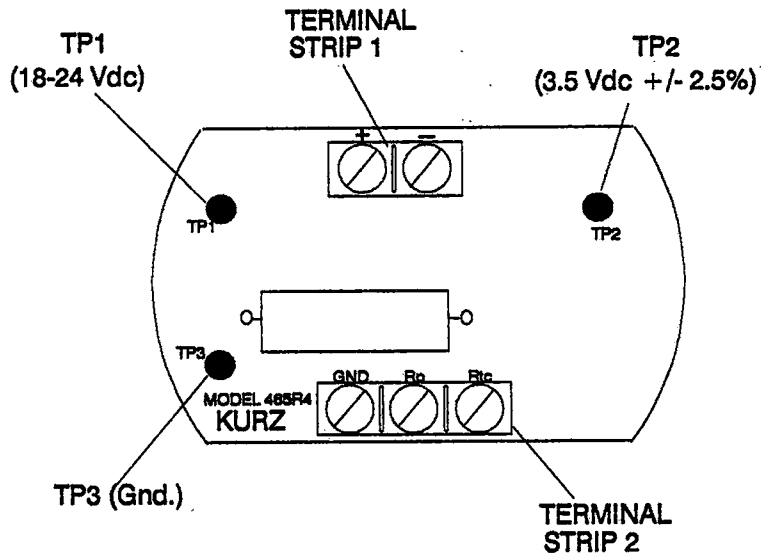
To perform the test on the 465R4 or 465R5 Current-Transmitter Boards you will need a digital voltage meter accurate to within +/-.001 Vdc. Each test procedure consists of checking the voltage between DC ground and each of the points indicated.

If you are calibrating a 465R4 Current-Transmitter Board, perform the testing procedure described in subsection 5.3.1. If you are calibrating a 465R5 Current-Transmitter Board, perform the procedure listed in subsection 5.3.2.

5.3.1 Testing the 465R4 Current-Transmitter Board

The test for the 465R4 Current-Transmitter Board consists of checking the voltages between pairs of test points on the board. The test points are labeled on the board itself as "TP1", "TP2", and "TP3". They are called out for easy reference in Figure 5-3.

Figure 5-3. *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.

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

TB. 1	SIGNAL DIRECTION		DESCRIPTION	
1	OUT		CIRCUIT GROUND	GND
2	OUT		REG. (+) SUPPLY	+15 VDC
3	OUT		CIRCUIT GROUND	GND
4	OUT		REG. (-) SUPPLY	-15 VDC
5	IN		CIRCUIT GROUND	GND
6	IN		MASS FLOW SIGNAL	0-5 VDC LINEAR
7	IN		EXT.	(-) 4-20 MA
8	IN		INPUT	(+) 4-20 MA
9	IN	(OPT.)	CIRCUIT GROUND	GND
10	IN		161 TEMP. INPUT	0-5 VDC LINEAR
11	OUT		CIRCUIT GROUND	GND
12	OUT		DISPLAY SWITCH SELECTED OUTPUT	± 0-5 VDC
13	OUT	(OPT.)	CURRENT LOOP	(-) 4-20 MA
14	OUT		OUTPUT	(+) 4-20 MA
15	OUT		VALVE MOTOR GROUND	GND
16	OUT		(+) OR (-) SUPPLY TO VALVE	(+) OR (-) 15 VDC
17	IN	(OPT.)	CIRCUIT GROUND	GND
18	IN		142 FLOW SIGNAL	0-5 VDC LINEAR
19	OUT	(OPT.)	UNREG. (-) SUPPLY	-24 VDC
20	OUT		UNREG. (+) SUPPLY	+24 VDC

TB. 2			
1			AC
2	IN	POWER INPUT	AC GND
3			ACC

Notes: Wire direct when supplied into Kurz enclosure (unless otherwise specified.)

KURZ INSTRUMENTS INC. CARMEL VALLEY CALIFORNIA

APPROVALS	DATE
INITIATED D Tracy	10-12-87
CHECKED [illegible]	[illegible]
APPROVED M. F. Kurz-Jr	10-17-87

TITLE: Model 7500 Flow Controller
Model 710 (1/4 or 1/6 RM)
rear-mounted terminal board
description. (4-20 MA ext. input)

DWG NO. 340208 | REV. 0 | SHT 1 OF 1

15053

TB. 1	SIGNAL DIRECTION		DESCRIPTION	
1	OUT		CIRCUIT GROUND	GND
2	OUT		REG. (+) SUPPLY	+15 VDC
3	OUT		CIRCUIT GROUND	GND
4	OUT		REG. (-) SUPPLY	-15 VDC
5	IN		CIRCUIT GROUND	GND
6	IN		MASS FLOW SIGNAL	0-5 VDC LINEAR
7	IN		EXT.	GND
8	IN		INPUT	(+) 0-5 VDC
9	IN	(OPT.)	CIRCUIT GROUND	GND
10	IN		161 TEMP. INPUT	0-5 VDC LINEAR
11	OUT		CIRCUIT GROUND DISPLAY SWITCH	GND
12	OUT		SELECTED OUTPUT	± 0-5 VDC
13	OUT	(OPT.)	CURRENT LOOP	(-) 4-20 MA
14	OUT		OUTPUT	(+) 4-20 MA
15	OUT		VALVE MOTOR GROUND	GND
16	OUT		(+) OR (-) SUPPLY TO VALVE	(+) OR (-) 15 VDC
17	IN	(OPT.)	CIRCUIT GROUND	GND
18	IN		142 FLOW SIGNAL	0-5 VDC LINEAR
19	OUT	(OPT.)	UNREG. (-) SUPPLY	-24 VDC
20	OUT		UNREG. (+) SUPPLY	+24 VDC

TB. 2			
1			AC
2	IN	POWER INPUT	AC GND
3			ACC

Notes: Wire direct when supplied into Kurz enclosure (unless otherwise specified.)

APPROVALS	DATE
INITIATED DTrinh	10-28-85
CHECKED JDYoung	10-29-85
APPROVED MFEld. JF	10-29-85

TITLE: Model 7500 Flow Controller
Model 710 (1/4 or 1/6 RM)
rear-mounted terminal board
description. (0-5 VDC ext. input)

DWG NO. 5[illegible]209 | REV. 0 | SHT 1 OF 1

KURZ INSTRUMENTS INC CARMEL VALLEY CALIFORNIA

A 19003

TB. 1	SIGNAL DIRECTION	DESCRIPTION	
1	OUT	CIRCUIT GND	GND
2	OUT (OPT.)	(+) SUPPLY	(+) V
3	OUT (OPT.)	CIRCUIT GND	GND
4	OUT (OPT.)	(-) SUPPLY	(-) V
5	IN	(-) RETURN (TO	RETURN
6	OUT	(+) SUPPLY XMTR)	+ VDC NOMINAL
7		GND	
8			
9		SPARE	
10			
11	OUT	SIGNAL	GND
12	OUT	OUTPUT	0-5 VDC LINEAR
13	OUT (OPT.)	CURRENT LOOP	(-) 4-20 mA
14	OUT (OPT.)	OUTPUT	(+) 4-20 mA
15		SPARE	
16			
17			
18			
19			
20			

TB. 2			
1	IN	POWER INPUT	AC
2	IN		AC GND
3	IN		ACC

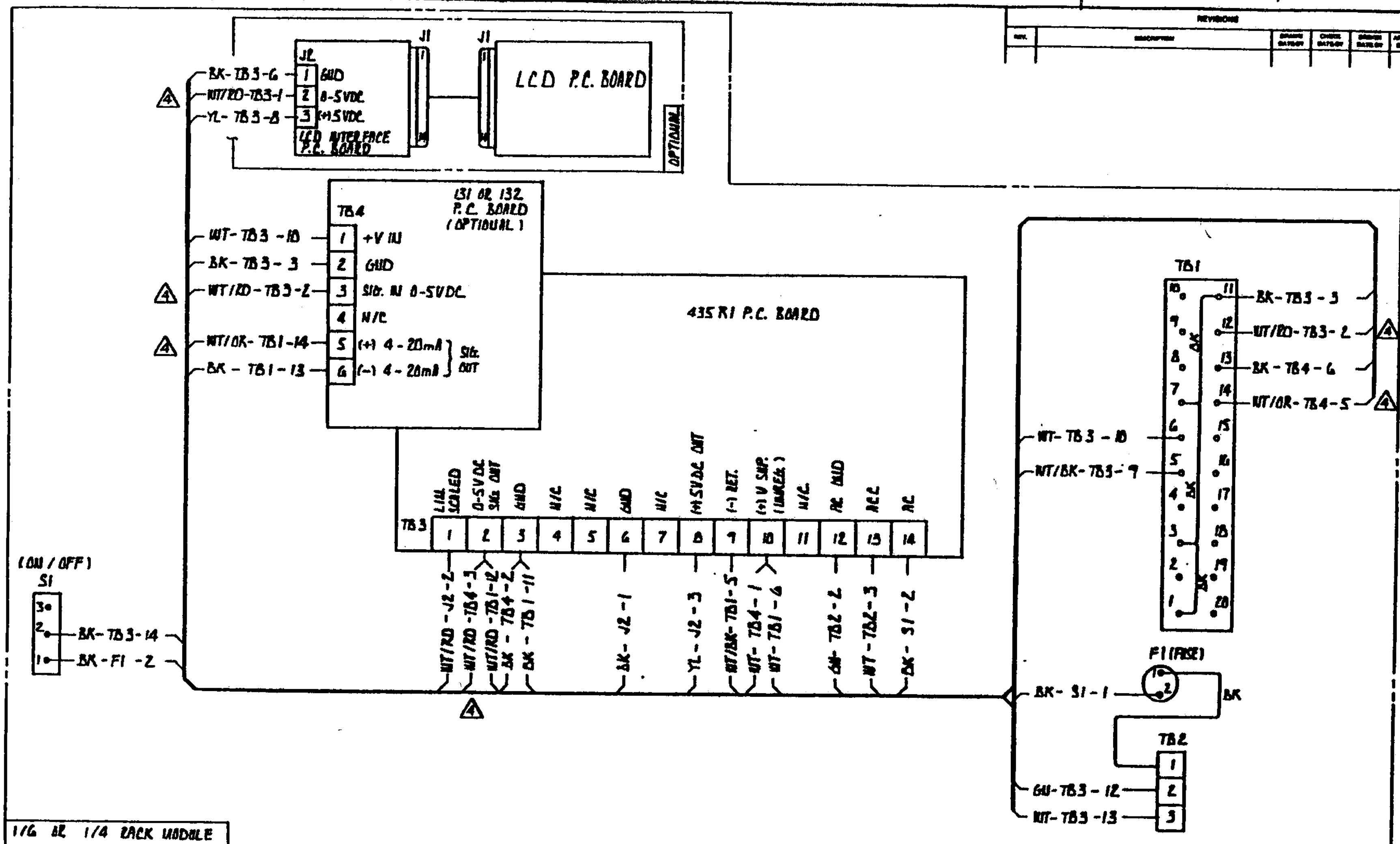
APPROVALS		DATE
INITIATED	J. Dickens	3/20/86
CHECKED	D Smith	3/20/86
APPROVED	D Smith	10/21/86

KURZ INSTRUMENTS INC CARMEL VALLEY CALIFORNIA

TITLE: Linear Output Module (1/4 or 1/6 RM)
Two-wire sensor input
Rear-mounted terminal description.

DWG NO. 3[illegible] REV. 0 SHT 1 OF 1

A 19003



NOTES:
1. REF. DES. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS.
2. ALL WIRES SHALL BE A MIN. OF #22 AWG.
3. THIS WIRING DIAGRAM TO BE USE FOR SERIES 151, 505, 455 AND 555 SYSTEM.
4. WIRE COLORS SHOWN ARE FOR MASS FLOW. FOR VELOCITY CHANGE: WT/RD TO WT/PR AND WT/OR TO WT/BL.

REAR MOUNTED TERMINAL BOARD DESCRIPTION

PIN	DESCRIPTION	PIN	DESCRIPTION
1	CIRC. GND (OPT.)	11	CIRC. GND
2	(+) V SUPPLY (OPT.)	12	0-5V DC LINEAR
3	CIRC. GND (OPT.)	13	(-) 4-20mA (OPT.)
4	(-) V SUPPLY (OPT.)	14	(+) 4-20mA (OPT.)
5	(-) RET.	15	N/C
6	(+) 24 VDC SUP.	16	N/C
7	CIRC. GND	17	N/C
8	N/C	18	N/C
9	N/C	19	N/C
10	N/C	20	N/C

KURZ INSTRUMENTS INC.

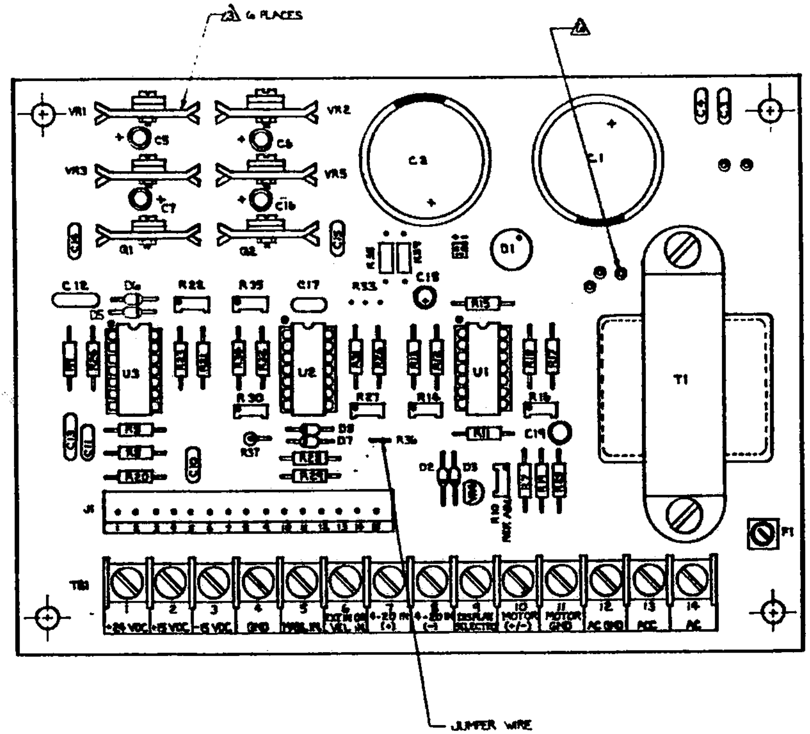
RACK MODULE INTERNAL WIRING DIAGRAM (435RI W/ 131 OR 132 AND DISPLAY OPTIONS)

DWG. SIZE: C | DWG. NO.: 341CC16 | REV.: 0 | SCALE: NONE | SHEET 1 OF 1

NEXT ASSEMBLY: N/A

DATE: 8-12-87 / 8-12-87 / 8-13-87

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	ADDED R36, R37, R38, R39, CHANGED C1 AND C2. ADDED NOTES 4 & 5 ADDED J1 PIN DESCRIPTION REMOVED R33 R38 R39 CHANGE R30 TO 20K AND R36 TO 15KΩ.	2/25/86	
B	CHANGED PER ECO A7104-7001 AND A71047002	5/7/87	



NOTES: UNLESS OTHERWISE SPECIFIED.

1. THIS DWG. TO BE USED IN CONJUNCTION W/ SCHEMATIC DIAGRAM DWG. 300019, 300020, 300022.
2. LAST REF. DES. USED ARE: TB1, J1, F1, T1, U3, D8, Q3, VR5, C21, R42, S4.

3. SEE DWG.# A70003 FOR HEAT SINK ASSY.
4. D5, D6 TO BE SELECTED AND ASSEMBLED W/1/8" CLEARENCE FROM BOARD.
5. FOR ENVIRONMENTAL REQUIREMENT USE MALLORY CAPACITOR 3500 µF - 40V
6. T1 CENTER TAP WIRE (STRIPPED) SOLDER TO PAD INDICATED.
7. T1 MOUNTING HARDWARE-#10-32 X 1/4" SCR., WASHER, NUT 2 PLACES.

REF DES.	DESCRIPTION	QTY.
R7, R30, R33	POTENTIOMETER 20K	3
R16, R16, R22, R35	POTENTIOMETER 2K	4
R25	RESISTOR 100Ω - 1% - 1W F03437	1
R24	RESISTOR 392 KΩ	1
R17, R20, R23, R34	RESISTOR 9.09 KΩ	4

PART LIST.

REF DES.	DESCRIPTION	QTY.
R13	13.3 KΩ	1
R12, R15, R19, R21, R26, R28, R29, R31, R32	10 KΩ	9
R9, R37	4.99 KΩ	2
R8, R11, R15	SELECTED	3
R7	RESISTOR 6.04 KΩ	1
C18, C19	CAPACITOR SELECTED	2
C12, C13	CAPACITOR .1 µF - 100 VDC	2
	22 AWG. SOLID TIN JUMPER WIRE	1
C5, C6, C7, C16	CAPACITOR 10 µF - 25VDC	4
C3, C4, C10, C11, C14, C15, C17	CAPACITOR .02 µF - 50VDC	7
5 C1, C2	CAPACITOR 3500 µF - 35VDC - MC MLP332M35V (M)	2
4 D5, D6	SELECTED	2
7 T1	TRANSFORMER # 8435A-60	1
D2, D3, D7, D8	DIODE IN 914	4
D1	BRIDGE RECTIFIER CSC B20S	1
VR5	VOLTAGE REGULATOR # 7824 + HEATSINK + HARDWARE (#4-40 X 3/8 RD HD SCR, NUT, WASHER)	1
VR4	VOLTAGE REGULATOR LM 336 - 2.5 V	1
VR3	VOLTAGE REGULATOR # 7915 + HEATSINK + HARDWARE (#4-40 X 3/8 RD HD SCR, NUT WASHER)	1
VR2	VOLTAGE REGULATOR # 7805 + HEATSINK + HARDWARE (#4-40 X 3/8 RD HD SCR, NUT, WASHER)	1
VR1	VOLTAGE REGULATOR # 7815 HEATSINK + HARDWARE (#4-40 X 3/8 RD HD SCR, NUT WASHER)	1
Q2	TRANSISTOR # 2N6668 + HEATSINK + HARDWARE (#4-40 X 3/8 RD HD SCR, NUT, WASHER)	1
Q1	TRANSISTOR # 2N6388 + HEAT SINK + HARDWARE (#4-40 X 3/8 RD HD SCR, NUT WASHER)	1
U1, U2, U3	OP - AMP LM 324	3
	14 PIN SOCKET	3
F1	PCB MOUNTED FUSE HOLDER	1
J1	15 PIN MOLEX CONNECTOR	1
TB1	14 PIN TERMINAL BLOCK	1
	710 PCB	1

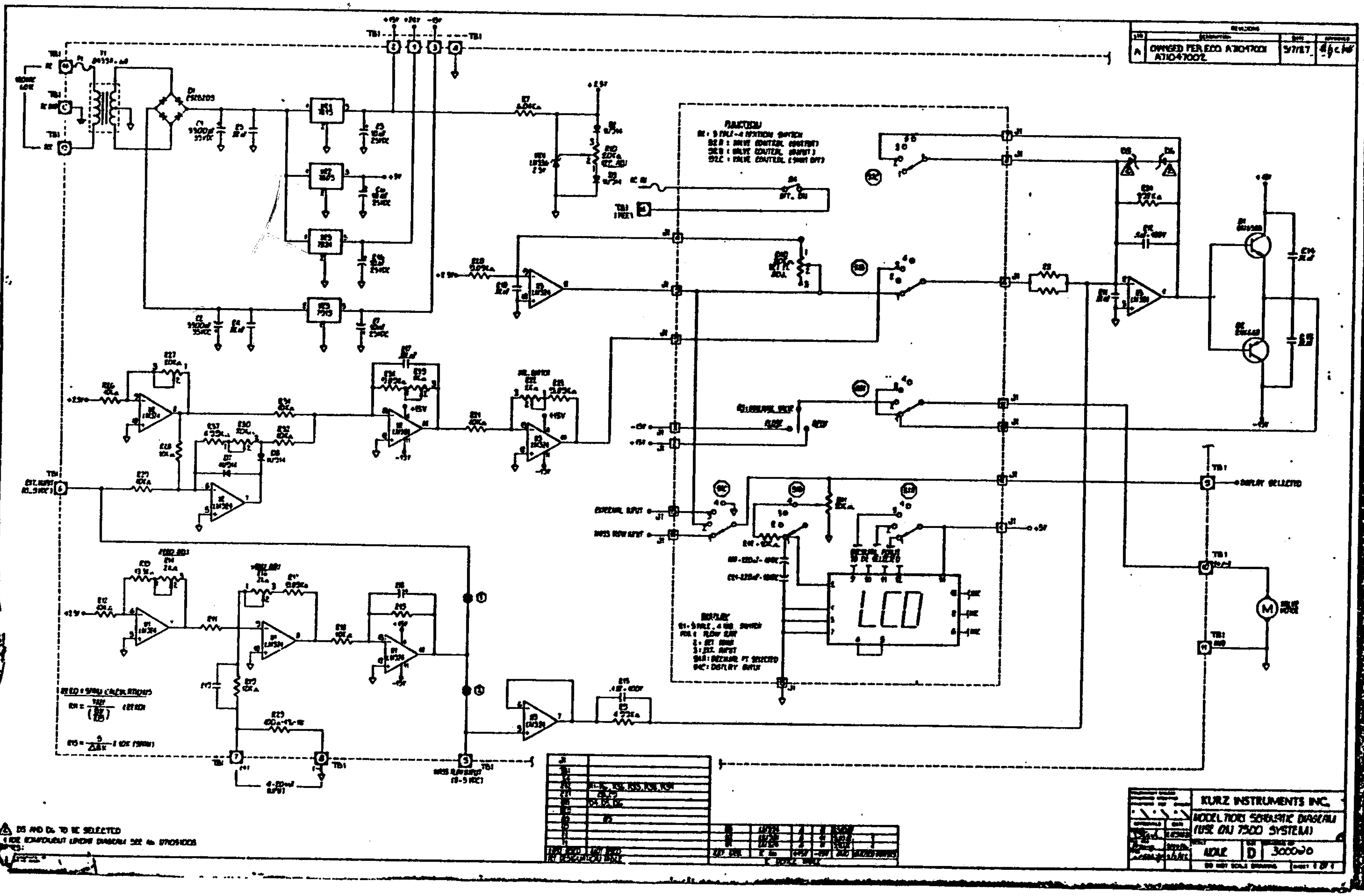
PART LIST

KURZ INSTRUMENTS Inc

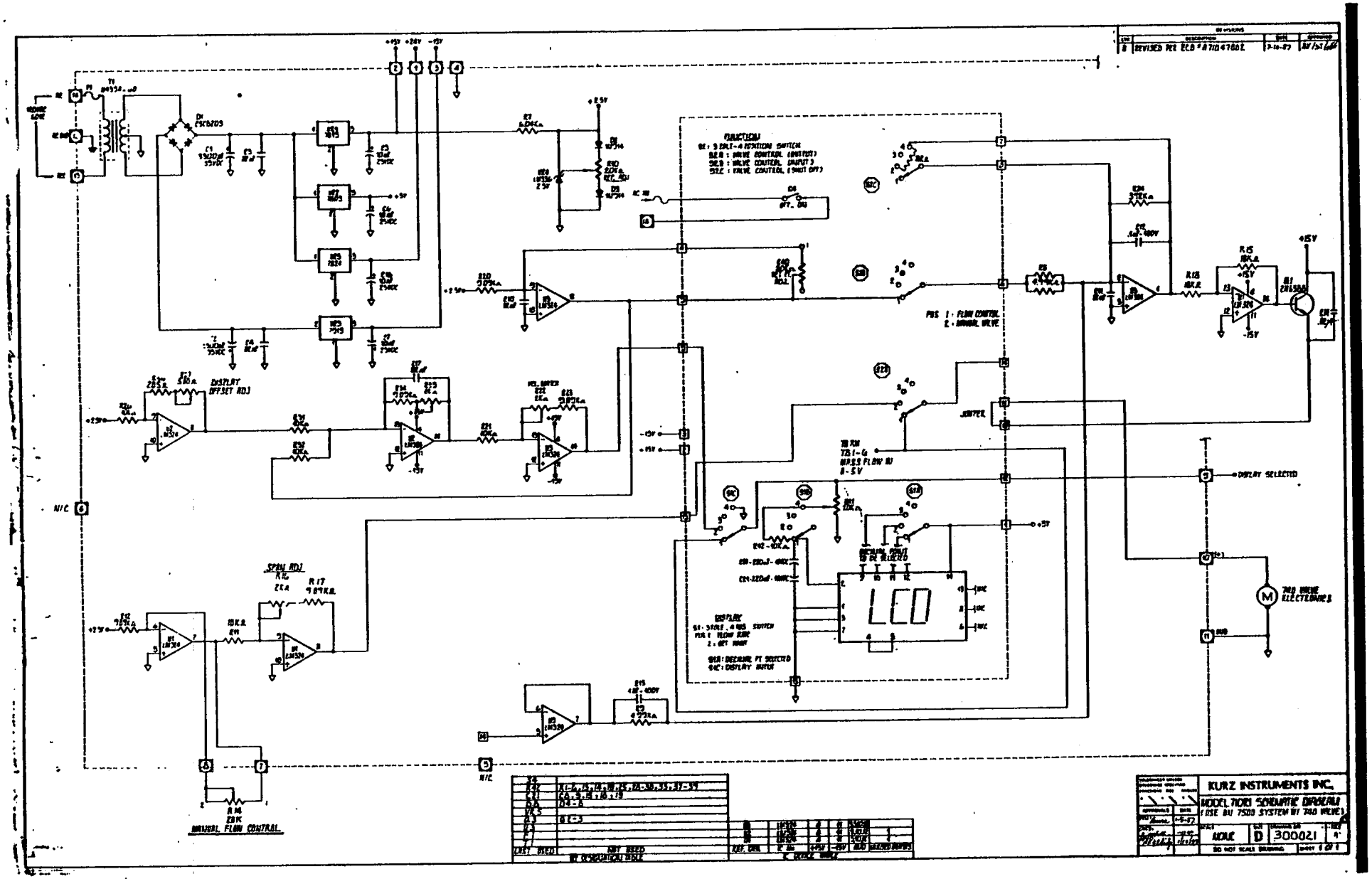
MODEL 710 RI FLOW CONTROLLER COMPONENT LAYOUT

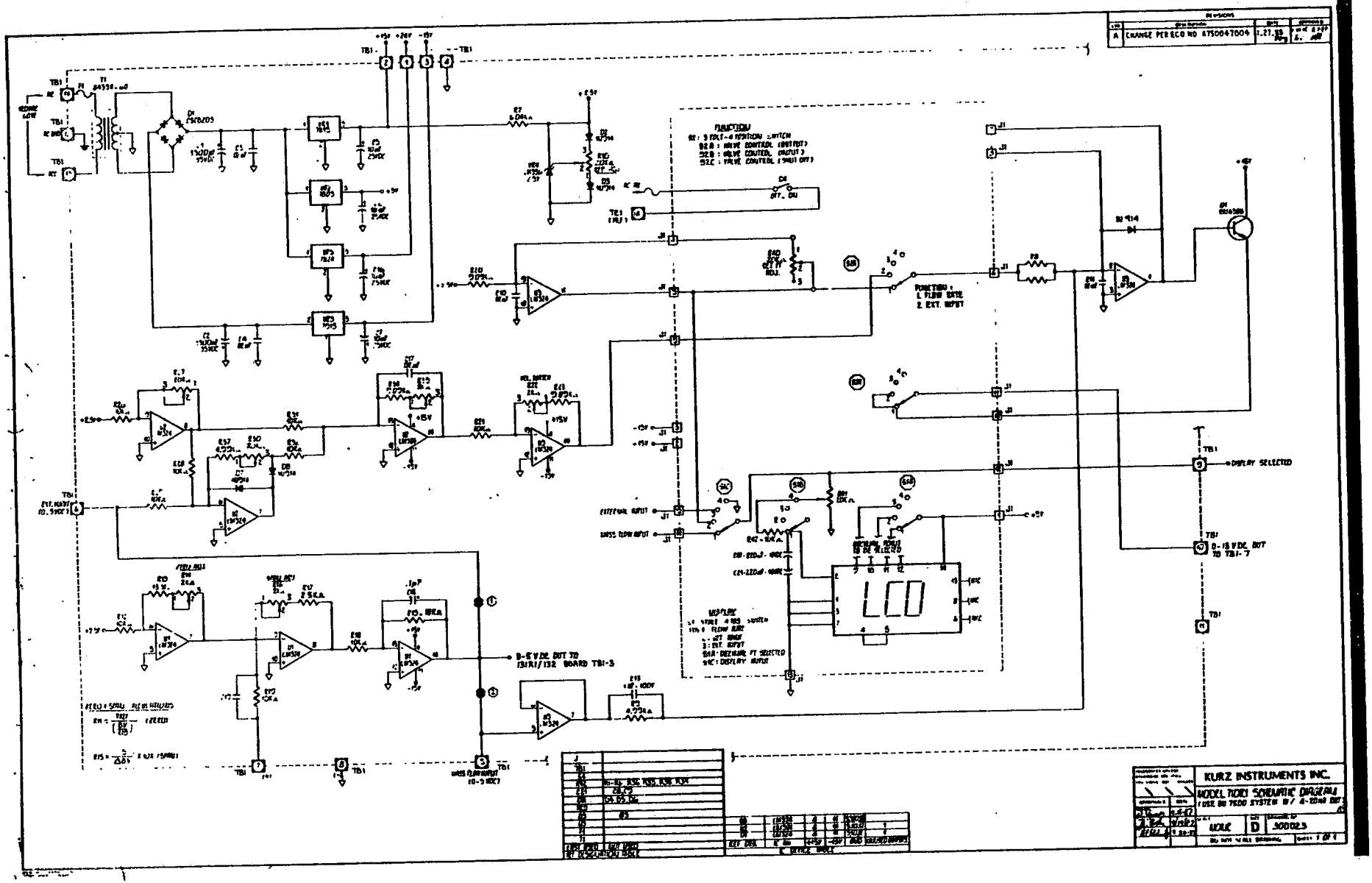
SCALE	SIZE	DRAWING NO.
2/1	D	420049

DO NOT SCALE DRAWING — SHEET 1 OF 1



CHANGED PER ECO. A7C47001
A7C47002
LCD
KURZ INSTRUMENTS INC.
MODEL 7101 SCHEMATIC DIAGRAM
(USE ON 7500 SYSTEM)
NONE
D
300020
DS AND D6 TO BE SELECTED


KURZ INSTRUMENTS INC.
MODEL 7100 SCHEMATIC DIAGRAM
(USE W/ 7500 SYSTEM W/ 760 VALVE)
D
300021
MANUAL FLOW CONTROL
DISPLAY SELECTED
760 VALVE ELECTRONICS
DISPLAY OFFSET ADJ
SPAN ADJ
JUMPER
LCD


KURZ INSTRUMENTS INC.
MODEL 7100 SCHEMATIC DIAGRAM
FOR USE W/ 7100 SYSTEM W/ 4-20mA OUT
D
500023
DISPLAY SELECTED
0-10 VDC OUT TO TB1-7
0-5 VDC OUT TO 151R1/132 BOARD TB1-5
FUNCTION:
1. FLOW RATE
2. EXT. INPUT
LCD

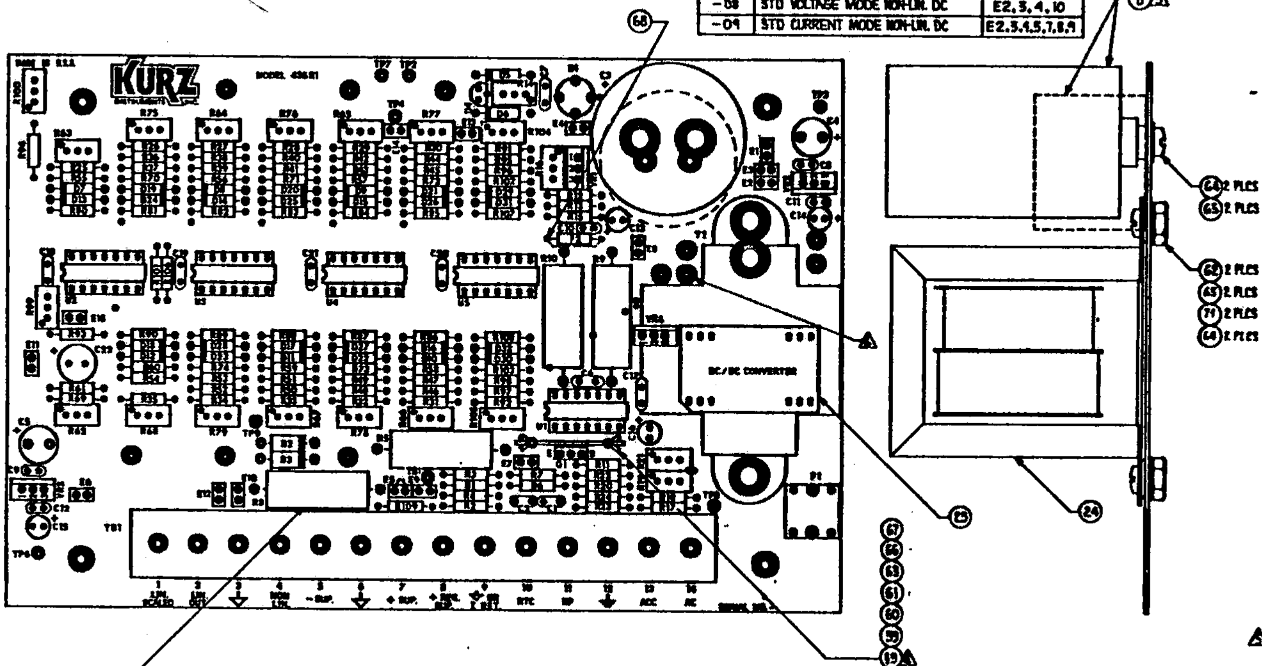
NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM # 300015
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. A70003.
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 TB1-9 (CURRENT RETURN).

JUMPER CONFIGURATION TABLE

PART NO.	DESCRIPTION	CLOSE JUMPER
-01	HEAVY DUTY, CURRENT MODE, 220V	E5,7,8,9,12
-02	HEAVY DUTY VOLTAGE MODE, LIN.	E10, 12
-03	HEAVY DUTY CURRENT MODE	E5, 7, 8, 9, 12
-04	HEAVY DUTY VOLTAGE MODE NON-LIN.	E10
-05	HEAVY DUTY CURRENT MODE NON-LIN.	E5, 7, 8, 9
-06	STD VOLTAGE MODE DC, LIN.	E2,3,4,10,12
-07	STD CURRENT MODE DC, LIN.	E2,3,4,5,7,8,9,12
-08	STD VOLTAGE MODE NON-LIN. DC	E2, 3, 4, 10
-09	STD CURRENT MODE NON-LIN. DC	E2,3,4,5,7,8,9

LTR	DESCRIPTION
A	REVISED PER ECO'S A43547005 & A43547006, REF ECO A43547007
B	REVISED PER ECO A43547007
C	REVISED PER ECO A43547005 A43547010 AND A43547011
D	REVISED PER ECO # A47214



ITEM	QTY	REF DES	DESCRIPTION
57	32	R109, R1-5,9-10,17,18,23, R14,37,39,41,43, R45,47,49,51,53,57, 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	R40	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 4.0 K 1% 1/8W OR 1/4W
43	19	R11,13,69,80-90,99, R101,106-108	RESISTOR 10K 1% 1/8W OR 1/4W
42	2	R20,22	RESISTOR 9.09K 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	[illegible]	RESISTOR POT 20K 1%
36	7	R61-65,75-77,14	RESISTOR POT 10K 1%
35	1	R19,100	RESISTOR POT 5K 1%
34	1	R2,21,6	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-24S (?)
23			
22	4	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	C6	CAP SELECTED
8	1	C3	CAP 3300µF, 35V
7	2	C4,5	CAP 220µF, 50V
6	1	C22	CAP 100µF, 16V
5	3	C13-15	CAP 10µF, 25V
4	6	C7-12	CAP .1µF, 50V
3	3	C1,2,6	CAP .02µF, 50V
2	5	C17-21	CAP .01µF, 50V
1	1		MODEL 435RI PCB
ITEM	QTY	REF DES	DESCRIPTION

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,C4,8.
E5,7,8,9	CURRENT MODE, DO NOT INSTALL C1,2,6,D2,3,Q1,R1-7,9,10.
E6	FOR 24 V FROM TB1-7.
E10	VOLTAGE MODE, INSTALL C1,2,6,D2,3,Q1,R1-7,9,10,101.
E11	FOR 15V FROM TB1-7.
E12	FOR LINEAR SECTION.
E13,14	OPTIONAL INVERTER OR BREAK POINT.
E15	ADJUST FOR X-5 VDC OUT.

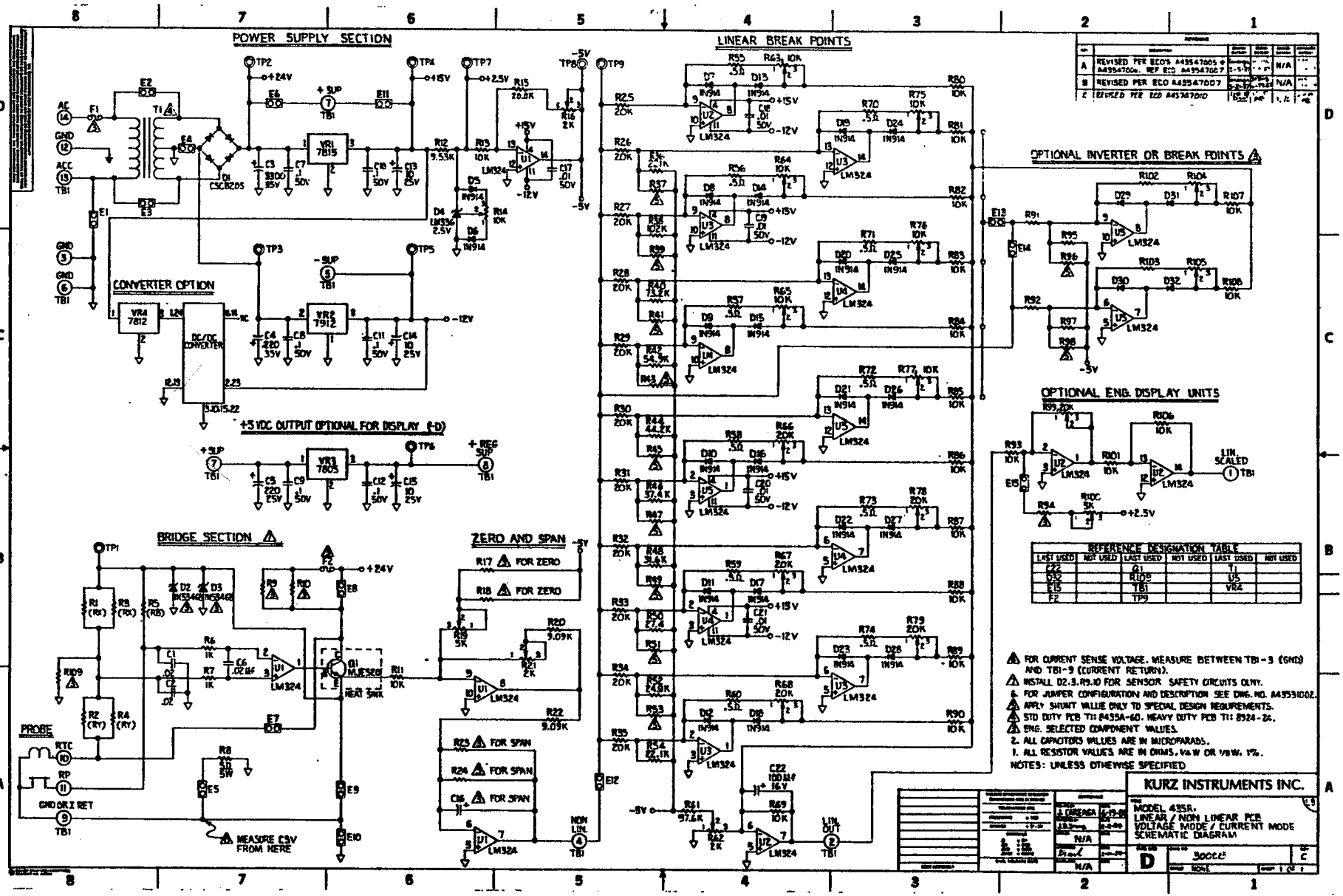
ITEM	QTY	REF DES	DESCRIPTION
71	2		SPACER, #10, NYLON (?)
70	A/R		SHUNT, 2 PIN
69	14	E2-4,6-15	HEADER, 2 PIN
68	3	E2,E5	WIRE, 22 AWG SOLID TIN
67	1		WASHER COMPRESSED
66	1		WASHER #4 STAR
65	4		WASHER #10 STAR
64	4		SCREW #10-32 X 1/2 PHIL PAN HEAD
63	1		SCREW #4-40 X 5/16 PHIL PAN HEAD
62	2		NUT #10-32
61	1		NUT #4-40
60	1		KOOLEX PAD
59	1		HEATSINK
58			

KURZ INSTRUMENTS INC.

PCB, ASSY., 435RI

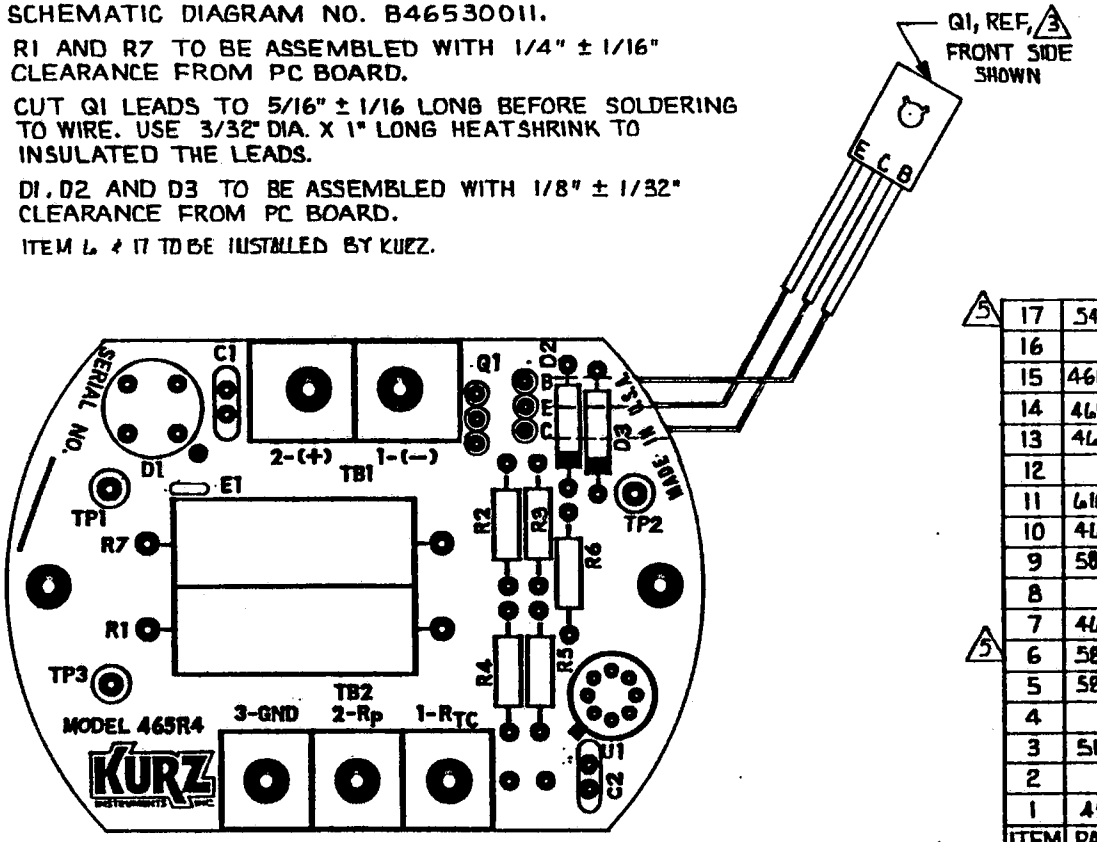
SIZE D | DWG NO. 420019 | REV D

N/A


POWER SUPPLY SECTION
LINEAR BREAK POINTS
CONVERTER OPTION
+5 VDC OUTPUT OPTIONAL FOR DISPLAY (-D)
BRIDGE SECTION
ZERO AND SPAN
OPTIONAL INVERTER OR BREAK POINTS
OPTIONAL ENG. DISPLAY UNITS
PROBE
MEASURE CSV FROM HERE
REFERENCE DESIGNATION TABLE
NOTES: UNLESS OTHERWISE SPECIFIED
KURZ INSTRUMENTS INC.
MODEL 435R
LINEAR / NON LINEAR PCB
VOLTAGE MODE / CURRENT MODE
SCHEMATIC DIAGRAM

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.



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	6-3-87
B	REVISED PER ECO A46547009	[illegible] 5-7-88	[illegible] 5-7-88	N/A	[illegible] 5-7-88
C	REVISED PER ECO 47214	BSAXON 9-1-88	[illegible] 9-17-88	N/A	[illegible] 9-19-88

PART NO. I.D. TABLE	
PART NO.	DESCRIPTION
-01	6" LONG WIRE ON Q1
-02	15" LONG WIRE ON Q1
-03	28" LONG WIRE ON Q1

ITEM	PART NO.	QTY	REF. DES.	DESCRIPTION
5 17	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
5 6	580027	2	D2, D3	DIODE, IN5346B 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	LENGTH: STD - OPT. EVA	
E	BK	#22	6"	15", 28"
C	WT	#22	6"	15", 28"
B	BL	#22	6"	15", 28"

N/A
NEXT ASSEMBLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/32
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.05
.XXX ± 0.010
.XXXX ± 0.0010
DWG. RELEASE DATE

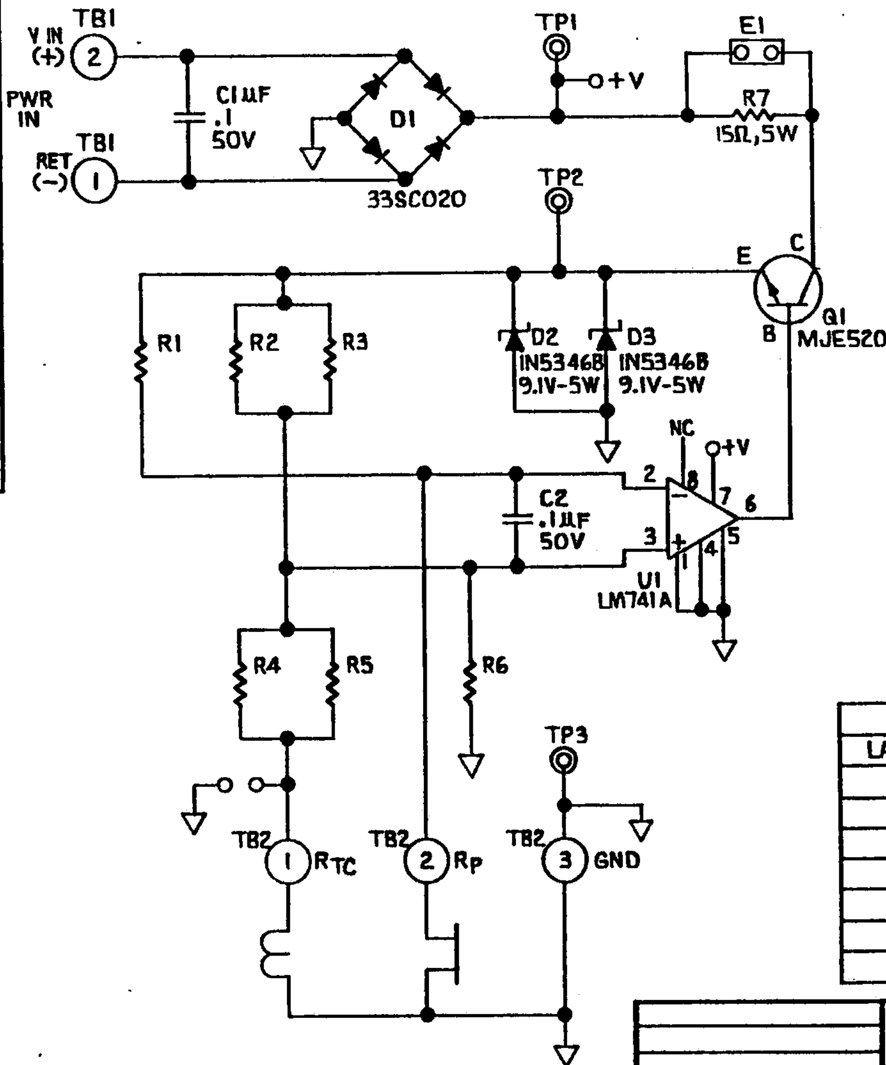
APPROVALS		
DRAWN BY	J. CAREAGA	DATE 2-5-87
CHECKED BY	[illegible]	DATE 2-13-87
DESIGN	N/A	DATE
APPROVED	[illegible]	DATE 2-13-87
BASELINED	N/A	DATE

KURZ INSTRUMENTS INC.

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

L2

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



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	6-3-87
B	REVISED PER ECO A465 4109	3-7-88	3-7-88	N/A	3-7-88

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
DWG. RELEASE DATE

APPROVALS

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

KURZ INSTRUMENTS INC.

L2

TITLE: MODEL 465R4 NON INTERCHANGEABLE CURRENT P.C BOARD SCHEMATIC DIAGRAM

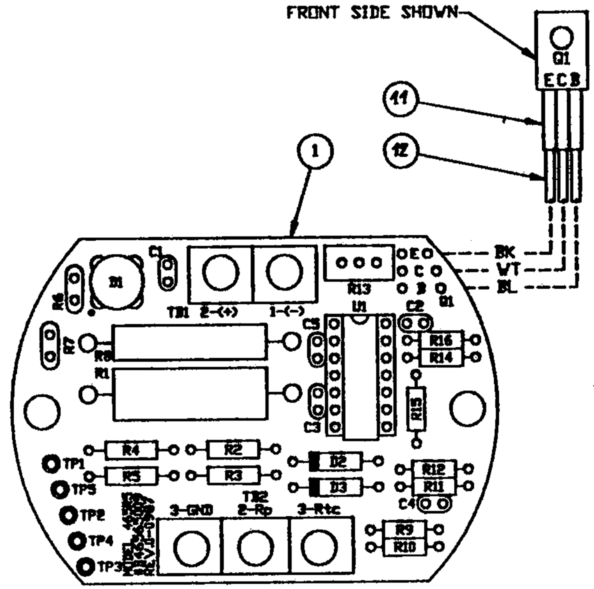
DWG. SIZE: B | DWG. NO.: 300045 | REV.: B
SCALE: NONE | SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A3629

REVISIONS

REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO A46547011	11-16-87	11-25-87	NA	12-12-87
B	REVISED PER ECO # 47214	9-9-88		N/A	

PART NO. IDENT.	
PART NO.	DESCRIPTION
-01	6" LONG WIRE ON Q1
-02	15" LONG WIRE ON Q1
-03	28" LONG WIRE ON Q1



PARTS LIST

NOTE	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-TRV-3 PIN-3/8 CENTER
	2	1	46905801	TB1	TERMINAL STRIP-TRV-2 PIN-3/8 CENTER
	1	1	42212501		PRINTED CIRCUIT BOARD, #B46565009.

NOTES:

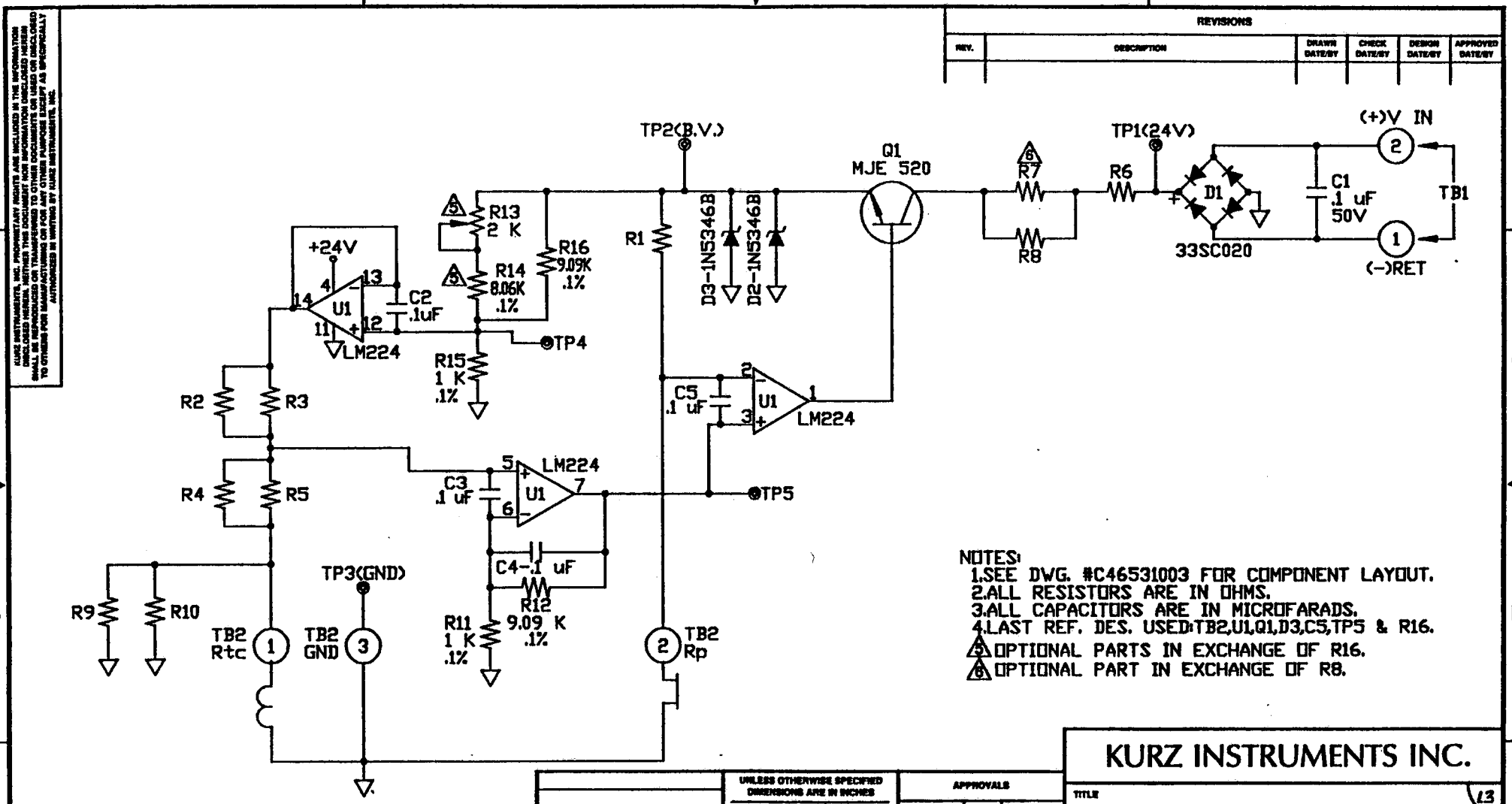
1. SEE DWG. #B46530003 FOR SCHEMATIC DIAGRAM.
2. R1 & R8 TO BE ASSEMBLED WITH 1/4"±1/16" FROM PCB.
3. (△) CUT Q1 LEADS TO 5/16"±1/16" LG. BEFORE SOLDERING TO WIRE.
4. D1,D2 & D3 TO BE ASSEMBLED WITH 1/8" FROM PCB.
5. (△) USE 6" WIRE LENGTH FOR STD., FOR EVA USE 15" OR 28".
6. (△) OPTIONAL PARTS IN EXCHANGE 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	NA
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOLERANCES ARE: FRACTIONS	± 1/32
ANGLES	± 0°-30'
DECIMALS .X / .XX / .XXX / .XXXX	± .1 / ± .03 / ± .005 / ± .0010
APPROVALS: DRAWN BY	D. Tari, 10.6.87
CHECKED BY	
DESIGN	NA
APPROVED	
RELEASED	NA

KURZ INSTRUMENTS INC.

TITLE: PCB, ASSY, 465R5

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



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.

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

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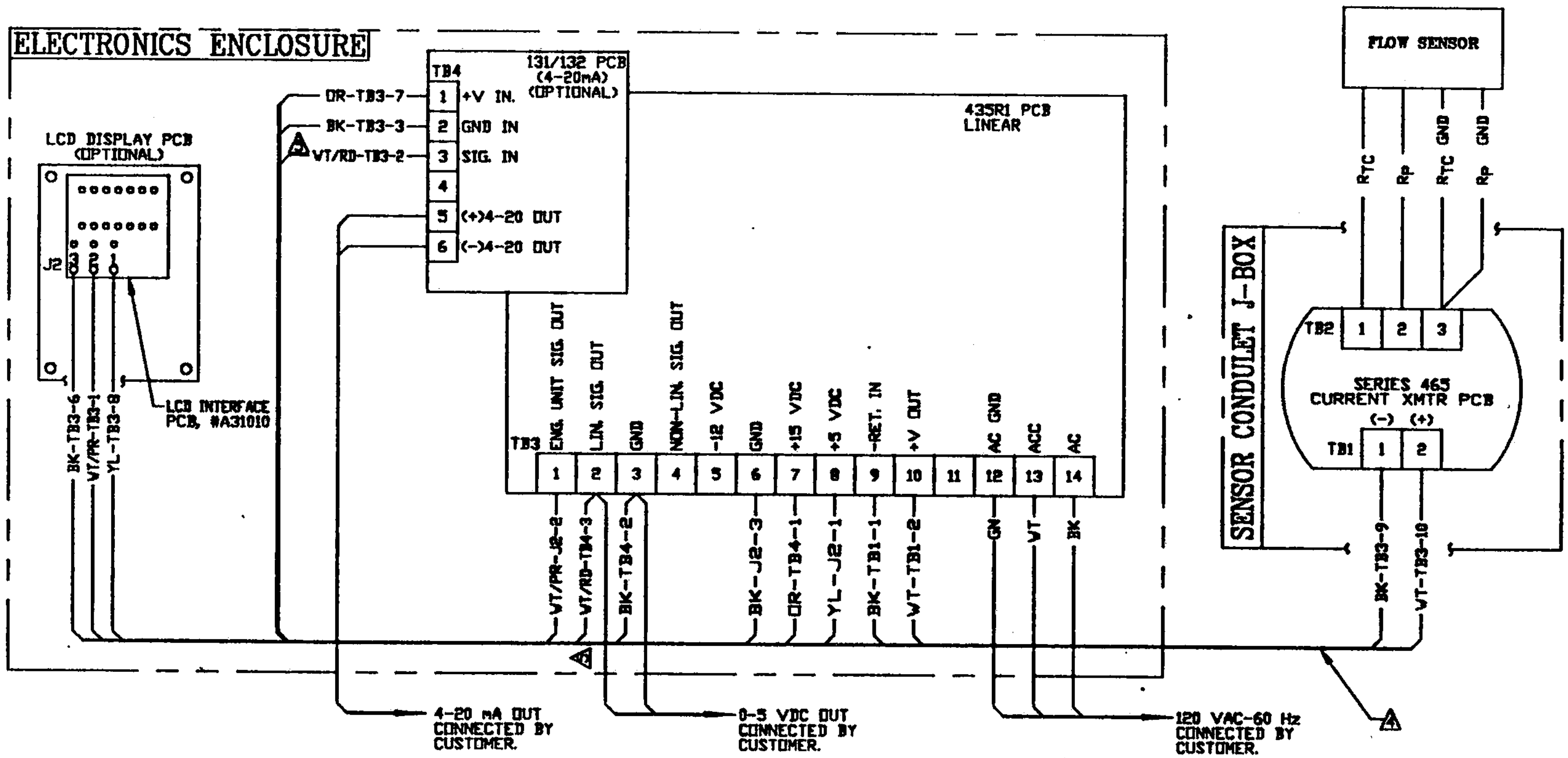
	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVALS		KURZ INSTRUMENTS INC.	
	TOLERANCES ARE	DRAWN BY DPrink	DATE 3/20/87	TITLE	13
	FRACTIONS ± 1/32	CHECKED BY JDYoung	DATE 10-15-87	MODEL 465R5 SCHEMATIC DIAGRAM	
	ANGLES ± 0°-30'	DESIGN NA	DATE		
	DECIMALS .X ± 0.1 .XX ± 0.03 .XXX ± 0.005 .XXXX ± 0.0010	APPROVED MFEldridge	DATE 10-16-87	DWG. SIZE B	DWG. NO. 300046 REV. 0
N/A NEXT ASSEMBLY	ORIG. RELEASE DATE	BASELINED 0 NA	DATE	SCALE NONE	SHEET 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL REF. DES. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPPONENTS.
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.

REVISIONS: A — REVISED PER ECO No. A45541005, A47150, A55541005. 1.28.98



KURZ INSTRUMENTS INC.

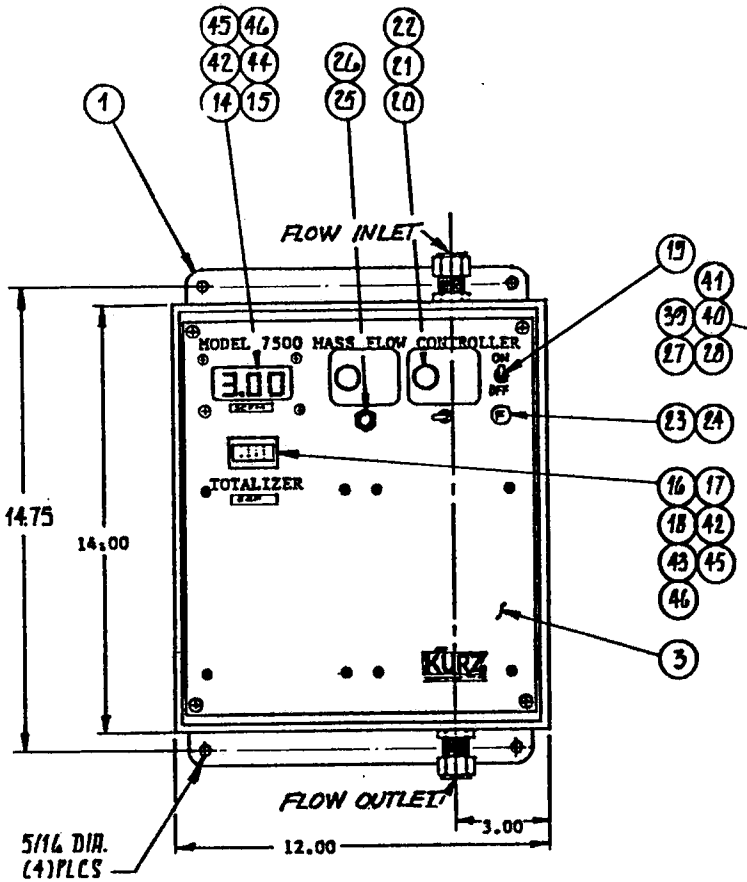
SERIES 456/555/505
SYSTEM WIRING DIAGRAM

SIZE	DWG. NO.	REV.
C	340055	A

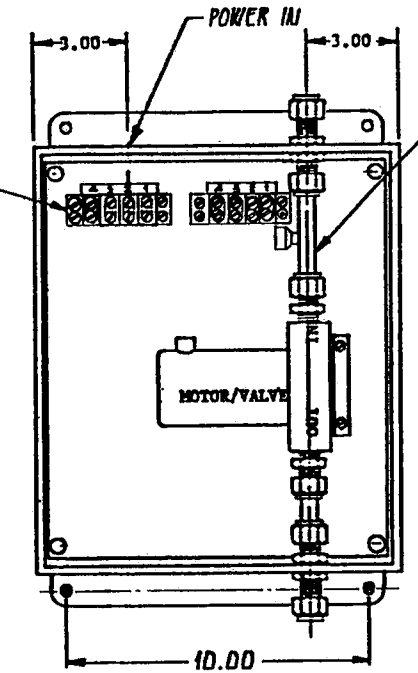
SCALE: NONE — SHEET 1 OF 1

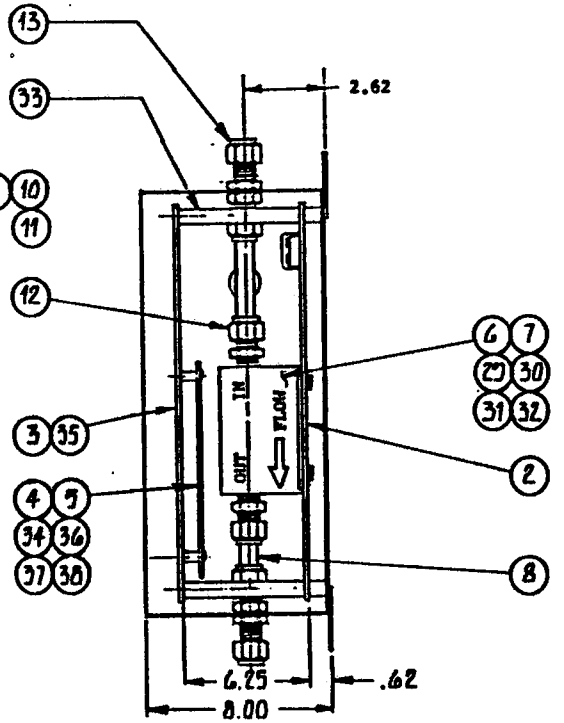
NEXT ASSEMBLY: NA

FRONT VIEW SHOWN W/ COVER REMOVED.



FRONT VIEW SHOWN W/
FACE PLATE & COVER REMOVED.



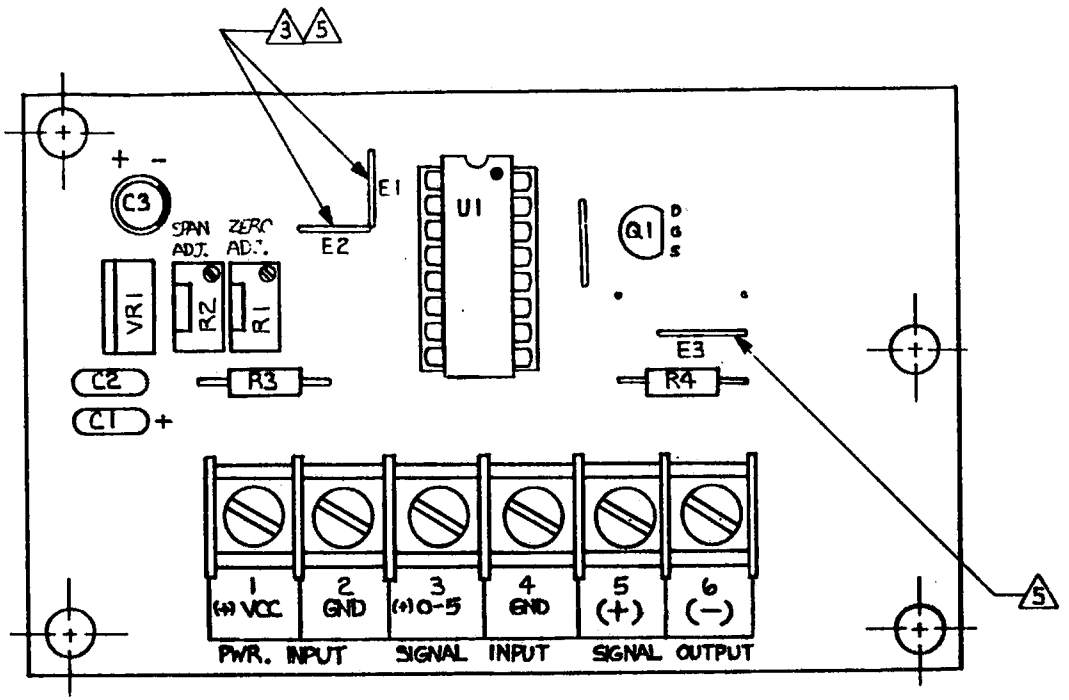


NOTES:
1. WEIGHT APPROX. : 50 LBS.
2. SEE PARTS LIST No. 1083A4501.
3. THIS DWG. BEING PREPARED TO GA TECHNOLOGIES CONTROL DOCUMENT No. 0390-0106.

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 DTrask DATE 8.18.86 CHECKED BY Alma DATE 8-22-86 DESIGN DATE APPROVED [illegible] DATE 8/22/86 BASELINED DATE	KURZ INSTRUMENTS INC. TITLE: MODEL 7500 MASS FLOW CONTROL SYSTEM ASSEMBLY. DWG. SIZE B DWG. NO. 1083B7001 REV. D SCALE 1/4 SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	APVD	DATE
A	RELEASED FOR PRODUCTION	DTA	7/13/84
B	REVISED TO CLARIFY OPTIONS	DC/LF/	7/12/85
C	REVISED DELETED 1-5 VDC OUT OPTION	[illegible]	3.15.86



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 10uF - 25 VDC	1
8	C2	CAPACITOR .02uF - 50 VDC	1
7	C1	CAPACITOR 1uF - 35 VDC TANTALUM MALLORY # TDC105K035 NLE	1
2 6	Q1	TRANSISTOR CHANNEL ENHANCEMENT MODE VERTICAL DMOS POWER FET'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 - BEAU 6-PIN 3/8" CENTERS	1
1		PCB - B13165003	1

PARTS LIST

NOTES:

1. FOR SCHEMATIC DIAGRAM SEE # 300028.
2. ITEMS #4 AND #6 ARE ELECTRO STATIC SENSITIVE DEVICES THEY HAVE TO BE HANDLED & ASSEMBLED AT A STATIC FREE STATION ONLY.
3. OPTION -- FOR 4-20 mA OUT INSTALL E1.
4. REMOVED.
5. OPTION -- FOR 0-20 mA OUT REMOVE E1 AND INSTALL E2 AND E3

KURZ INSTRUMENTS INC.

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

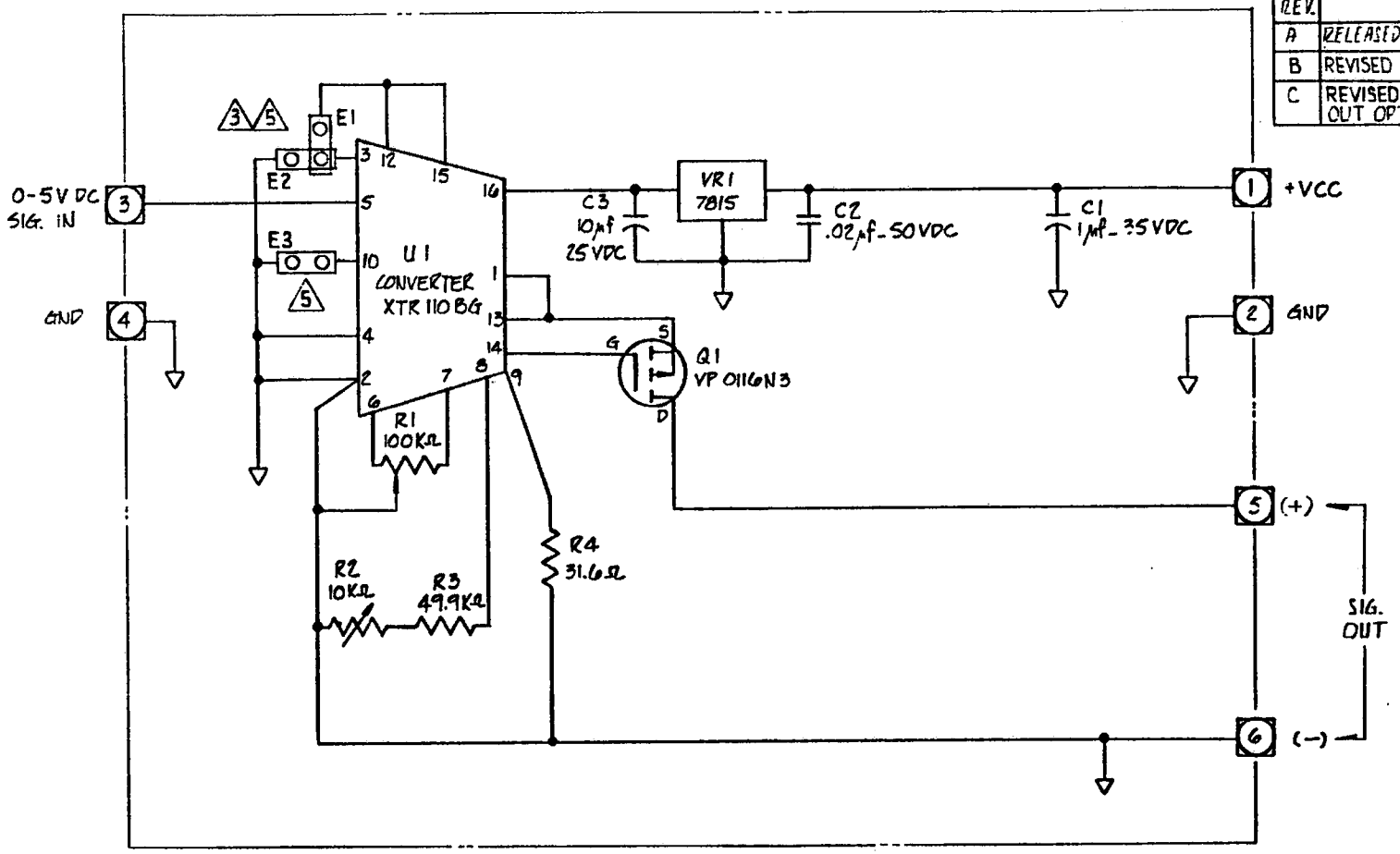
DRAWN G. FOSTER 2/18/86

MODEL 131 R1
NON ISOLATED OUTPUT
COMPONENT LAYOUT

B 42.0005 REV. C SHT 1 OF 1

POST OFFICE BOX 848 • 20 VILLAGE SQUARE • CARMEL VALLEY, CALIFORNIA 93924 • (408) 659-3421 • TELEX 337786

REVISIONS			
REV.	DESCRIPTION	APVD	DATE
A	RELEASED FOR PROD.	DT/JH/DT	7/9/86
B	REVISED TO CLARIFY OPTIONS	JC/[illegible]/[illegible]	7/29/86
C	REVISED DELETED 1-5 VDC OUT OPTION	J.C 9/15/86	11/5/86



NOTES:

1. FOR COMPONENT DIAGRAM LAYOUT SEE DWG. # 420005.
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.

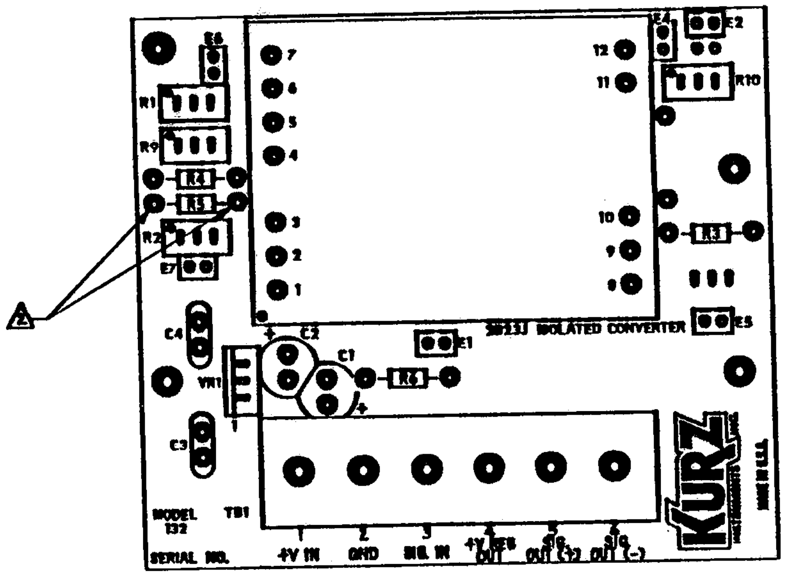
SCALE : NONE
TOLERANCE
.XX ± .01
.XXX ± .003

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

POST OFFICE BOX 849 • 20 VILLAGE SQUARE • CARMEL VALLEY, CALIFORNIA 93924 • (408) 659-3421 • TELEX 337786

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

LTR	DESCRIPTION				
A	REVISED DE = ED 4 20mA IN, 0-5 VDC OUT OPTION	J.C.	B.T.		
B	REVISED PER ECO No A13247005			N/A	



ALL COMPONENTS SHOWN INSTALLED

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

PARTS LIST

3

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

N/A

J. CAREAGA 8-13-86

KURZ INSTRUMENTS INC.

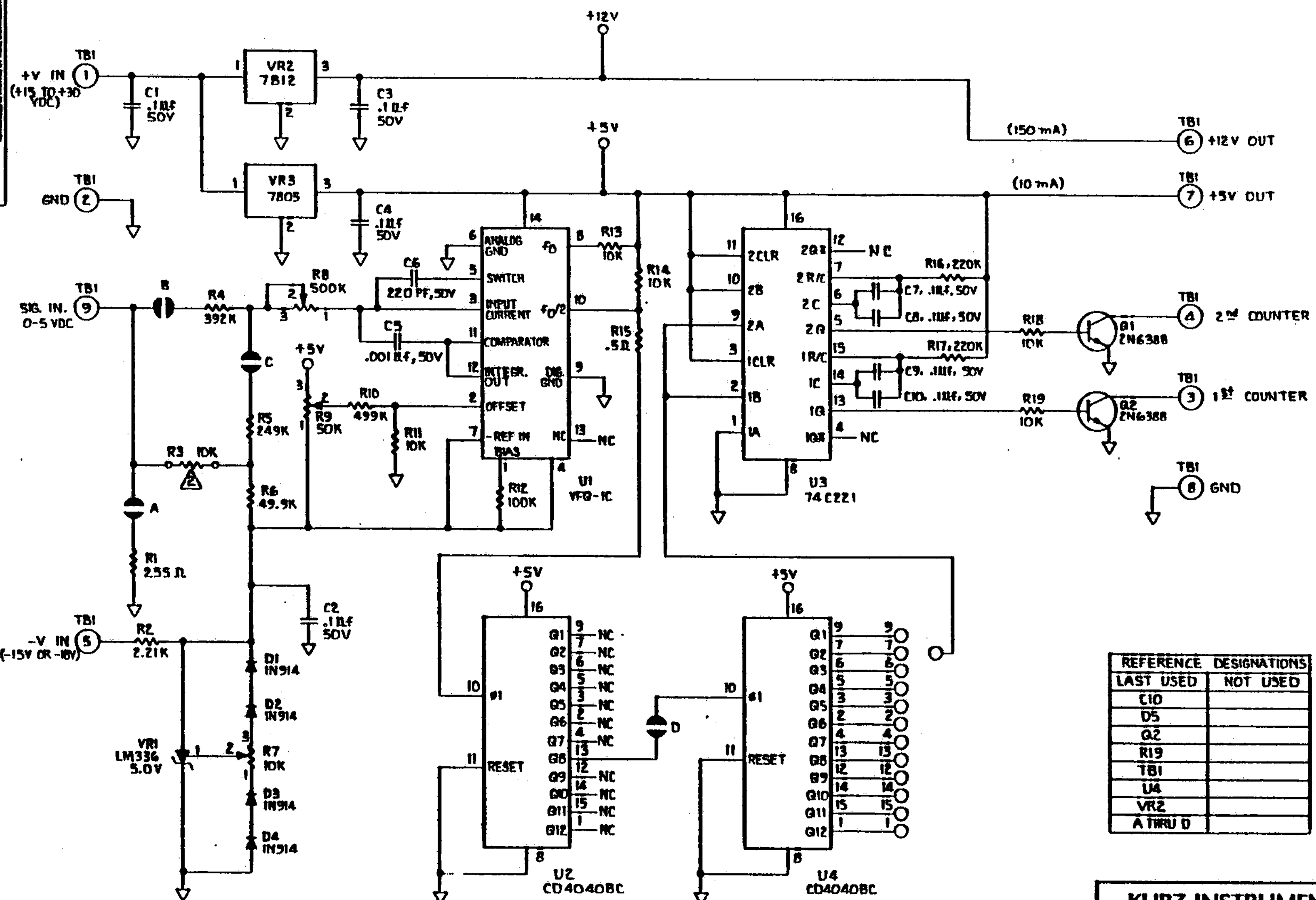
MODEL 132
ISOLATED SIGNAL OUTPUT CONVERTER
COMPONENT LAYOUT

C 420006 B

SCALE 2:1 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.

REV	DESCRIPTION				
A	REVISED PER ECO No A10141003			N/A	



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

KURZ INSTRUMENTS INC.

MODEL 101
TOTALIZER
SCHEMATIC DIAGRAM

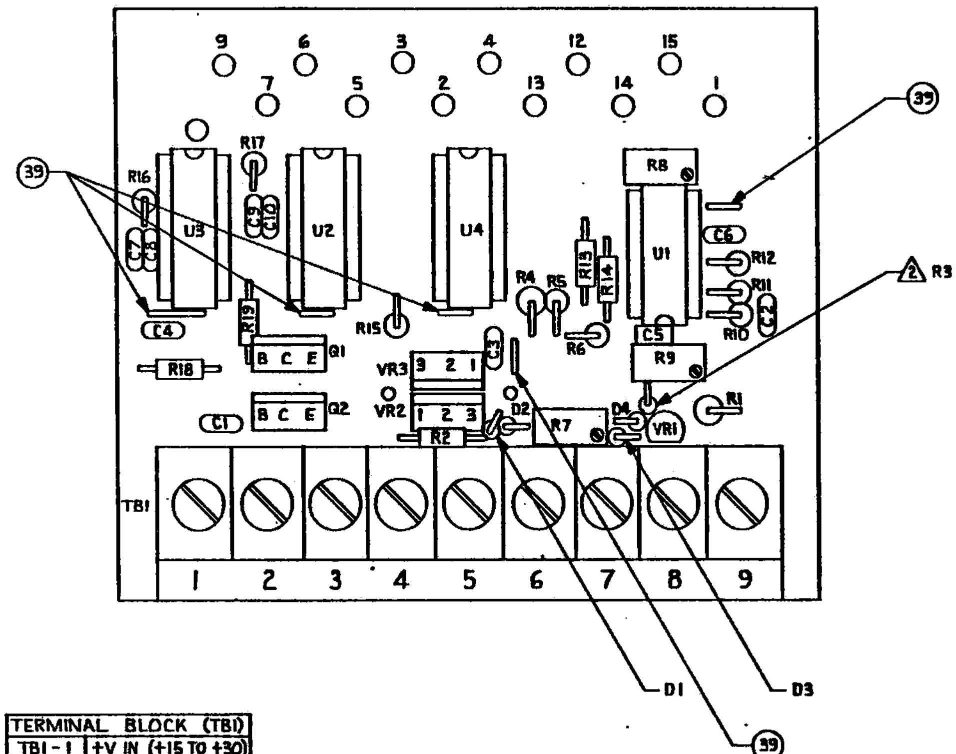
SIZE: C — DWG NO: 300001 — REV: A
SCALE: NONE — SHEET 1 OF 1

L.CARRENGA 8-5-86

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 REQD.
3. ALL DIODES TO BE ASSEMBLED WITH THE CATHODE TO THE P.C.B.

REVISIONS

REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	DESIGN DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO A10147001	J.C. 3-4-87	3-5-87	N/A	[illegible]
B	REVISED PER ECO No 47246	1-30-89	2-2-89	N/A	2/2/89



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

PARTS LIST

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%
30 (△2)	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 .001µF 50V CER
6	8	C1-C4, C7-C10	CAPACITOR .1µF 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

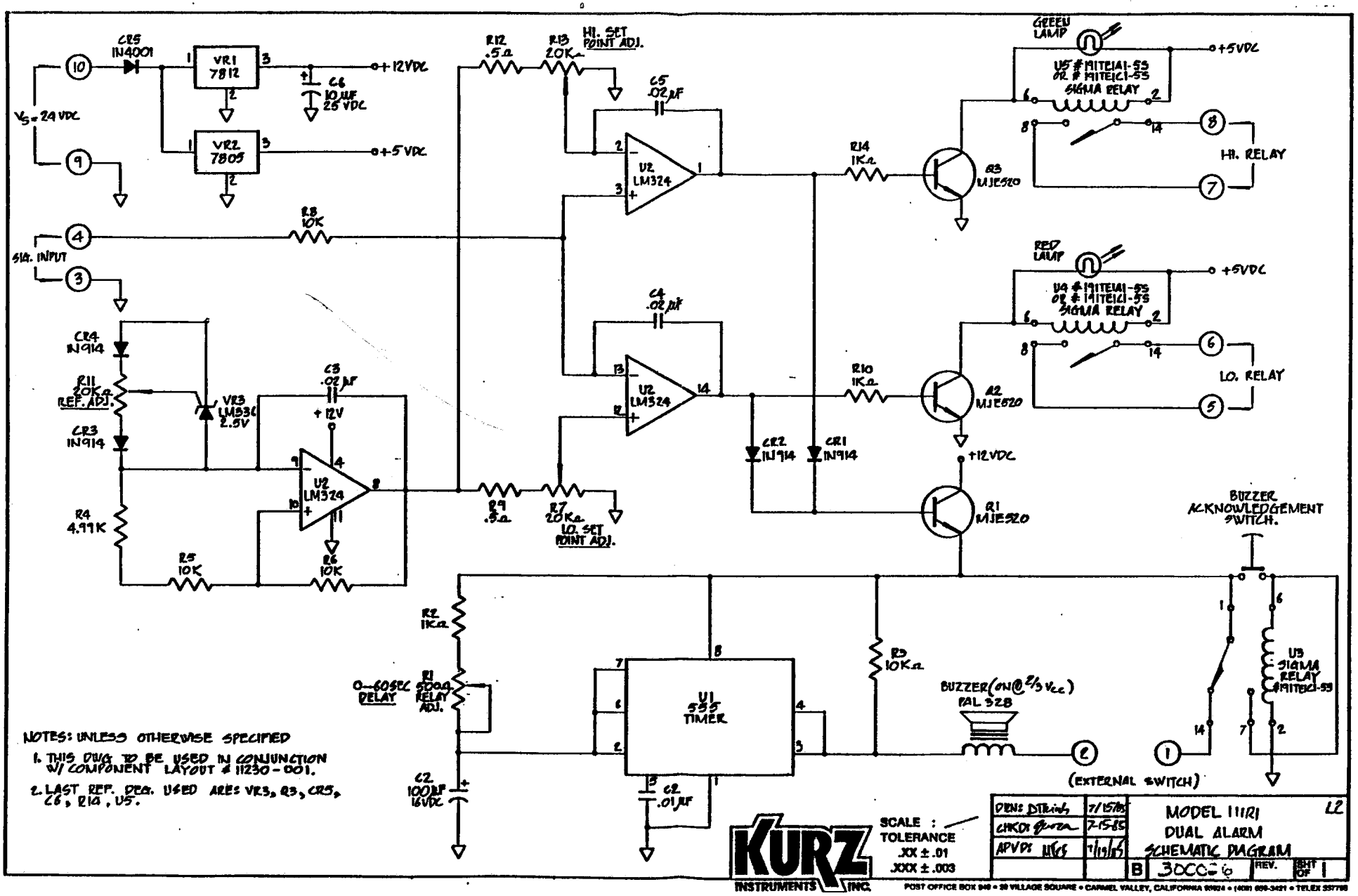
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE: FRACTIONS ± 1/64, ANGLES ± 0°-30'

APPROVALS: DRAWN BY J. CAREAGA 8-25-86; CHECKED BY [signature] 8-26-86; APPROVED [signature] 8/26/86

KURZ INSTRUMENTS INC.

TITLE: MODEL 101 TOTALIZER COMPONENT LAYOUT

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



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: DTBirch	7/15/85	MODEL 1111RI DUAL ALARM SCHEMATIC DIAGRAM L2
CHKD: Gurza	7-15-85	
APVD: MKS	7/19/85	B 30CC-6 REV. SHT OF 1

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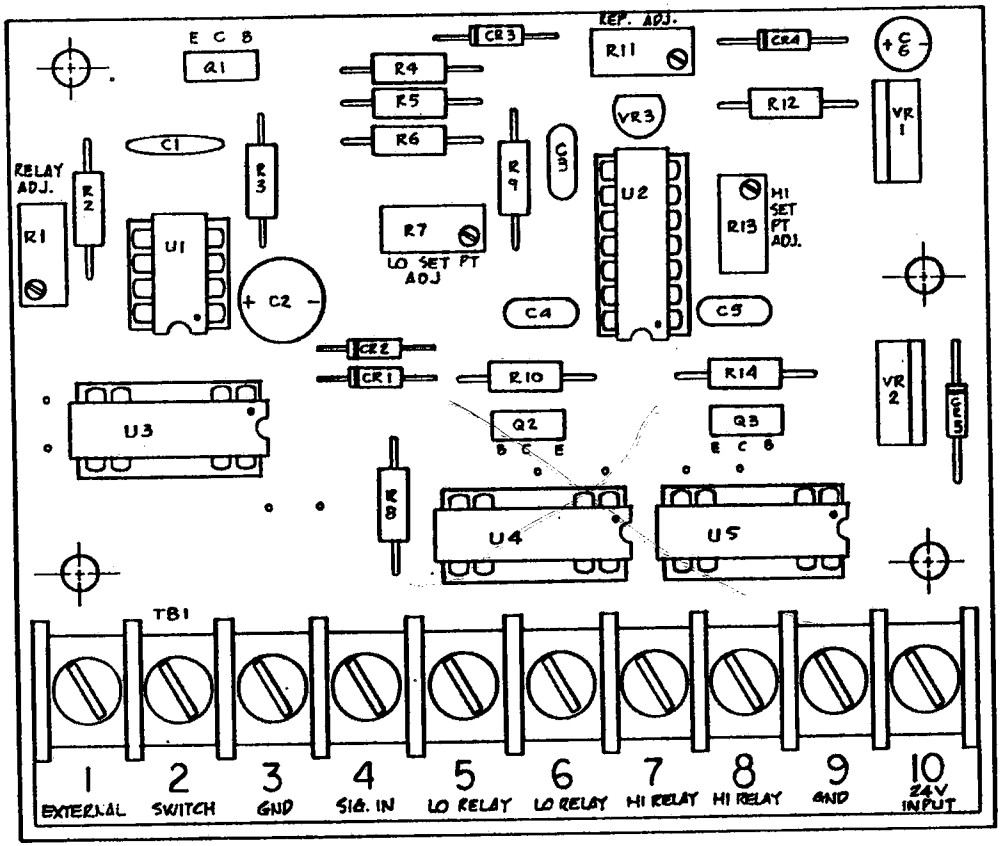
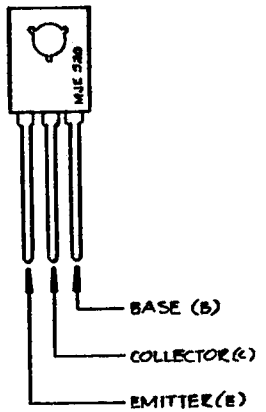
PART NO.	DESCRIPTION
-01	DUAL ALARM W/O TIMER (DO NOT STUFF U1,U3,CR1,CR2,C1,C2,Q1,R1,R2,R3)
-02	DUAL ALARM W/ TIMER (STUFF ALL)

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



TRANSISTOR IDENTIFICATION



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

PARTS LIST

NOTES :

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

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

DRN BY: DTFinly	11-2-84	PCB, ASSY, 111R1
CHK'D: Guerra	2-15-85	
APV'D: [illegible]	7/15/85	
	B	420099 REV. B SHT 1 OF 1

KURZ INSTRUMENTS INC.

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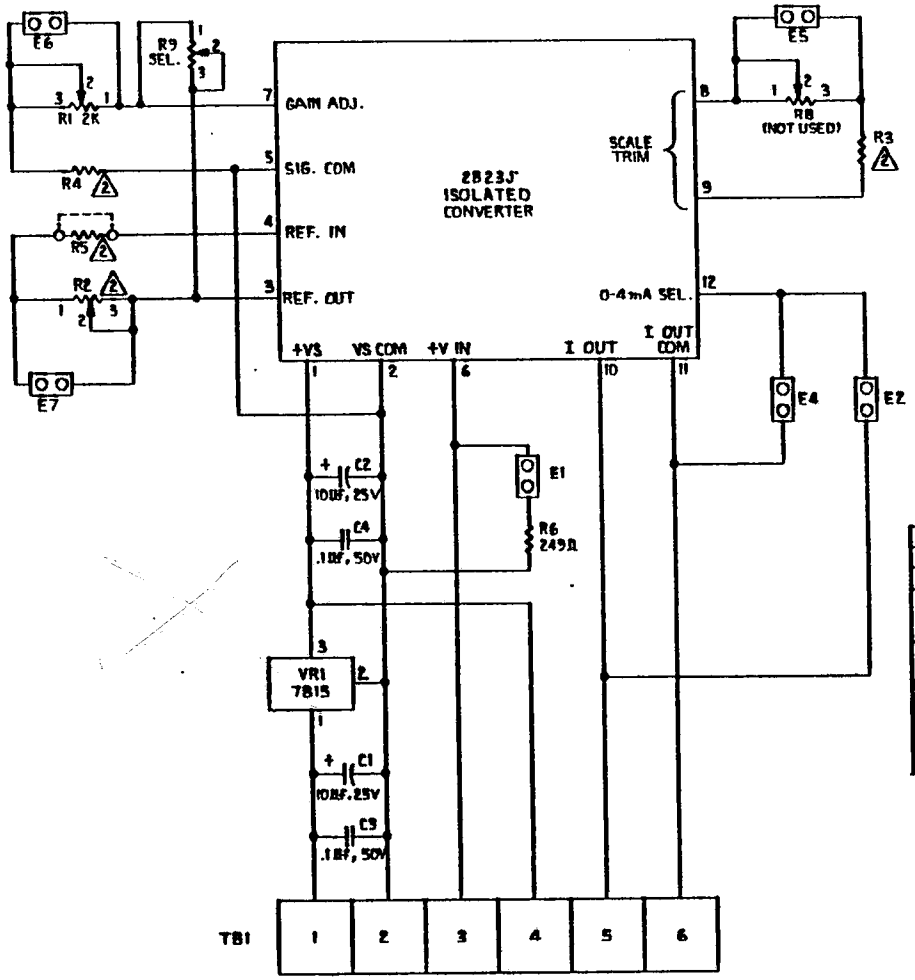
NOTES: UNLESS OTHERWISE SPECIFIED
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT C1323100I.
⚠2 FOR OPTIONS SEE 'OPTIONS TABLE'.

REV	DESCRIPTION				
A	REVISED DELETED 4-20mA IN, 0-5 VDC OUT OPTION	J.C. 11/5/86			
B	REVISED PER ECO No. A1324700A			N/A	



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,R7,R8,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	

KURZ INSTRUMENTS INC.

MODEL 132
ISOLATED SIGNAL OUTPUT CONVERTER
SCHEMATIC DIAGRAM

SIZE	DWG. NO.	REV
C	300003	B
SCALE NONE	SHEET 1 OF 1	

Appendix A: Component Layout and Schematic Drawings

This appendix contains components layout and schematic drawings for the 7500 system and its components. These drawings are included as an aid to those users who want to perform their own testing and servicing.

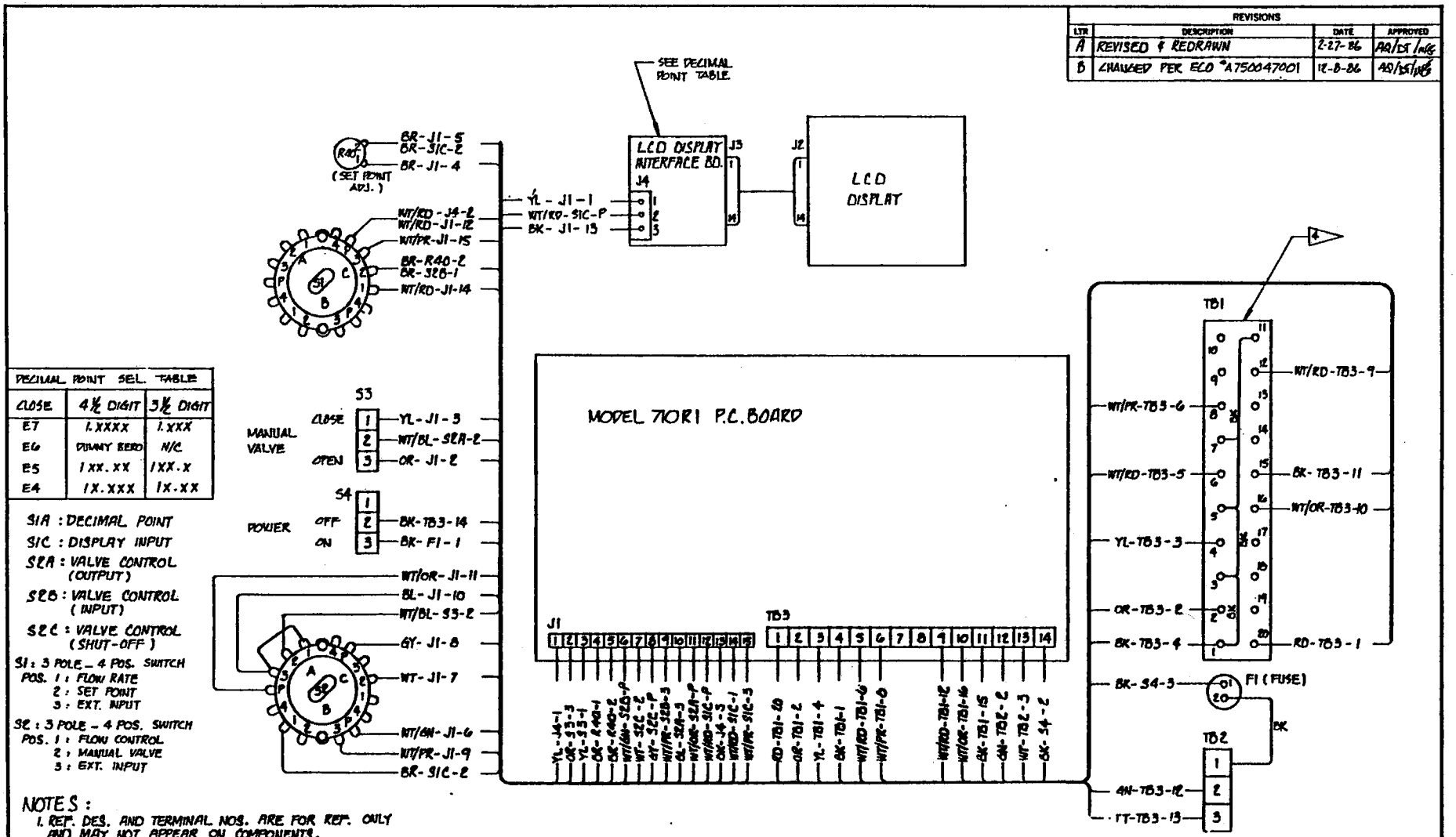
NOTE: If you want to perform your own warranty service, you must first obtain written authorization from Kurz Instruments. **Unauthorized service performed during the warranty period voids your warranty.** Please read the warranty statement at the front of this guide before performing any service.

The following drawings are included in this appendix:

Drawing No.	Description
340088, Rev B	Model 7500 Flow Controller 710RMD Wiring Diagram
1300C3202, Rev 0	Model 7500 System Interconnection Wiring Diagram (4-20mA Ext. Input)
340095, Rev B	Valve/Motor Wiring Interconnection
340209, Rev 0	Model 7500 Flow Controller Model 710 (1/4 or 1/6 RM) rear-mounted terminal board description. (0-5 VDC ext. input)
340208, Rev 0	Model 7500 Flow Controller Model 710 (1/4 or 1/6 RM) rear-mounted terminal board description. (4-20 MA ext. input)
340225, Rev 0	Linear Output Module (1/4 or 1/6 RM) Two-wire sensor input Rear-mounted terminal description
340016, Rev 0	Rack Module Internal Wiring Diagram (435R1 w/ 131 or 132 and Display Options)

Drawing No.	Description
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

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REVISED & REDRAWN	2-27-86	AA/DST/MG
B	CHANGED PER ECO #A750047001	12-8-86	AA/DST/MG



DECIMAL POINT SEL. TABLE		
CLOSE	4½ DIGIT	3½ DIGIT
E7	1.XXXX	1.XXX
E6	DUMMY BOARD	N/C
E5	1XX.XX	1XX.X
E4	1X.XXX	1X.XX

S1A : DECIMAL POINT
S1C : DISPLAY INPUT
S2A : VALVE CONTROL (OUTPUT)
S2B : VALVE CONTROL (INPUT)
S2C : VALVE CONTROL (SHUT-OFF)

S1 : 3 POLE – 4 POS. SWITCH
POS. 1 : FLOW RATE
2 : SET POINT
3 : EXT. INPUT

S2 : 3 POLE – 4 POS. SWITCH
POS. 1 : FLOW CONTROL
2 : MANUAL VALVE
3 : EXT. INPUT

NOTES :
1. REF. DES. AND TERMINAL NOS. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS.
2. ALL WIRES SHALL BE A MIN. OF #22 AWG., EXCEPT RIBBON CABLE USED ON J2.
3. REMOVED 12-8-86
4. SEE DWG #340208 AND #340209 FOR REAR-MOUNTED TERM. BOARD DESCRIPTION.
5. FOR 0-5 VDC EXT. INPUT USE TB1-7 AND TB1-8. FOR 4-20 mA EXT. INPUT, SEE WIRING MODIFICATION TABLE.

WIRING MODIFICATION TABLE FOR 4-20mA EXT. INPUT	
REMOVE	ADD
1. WT/PR FROM TB1-8 TO TB3-6	1. JUMPER FROM TB1-5 TO TB1-11
2. JUMPER FROM TB1-5 TO TB1-7	2. BK FROM TB1-7 TO TB3-8
	3. WT/BL FROM TB1-8 TO TB3-7

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS DEC ANGLES ± / ± / ±

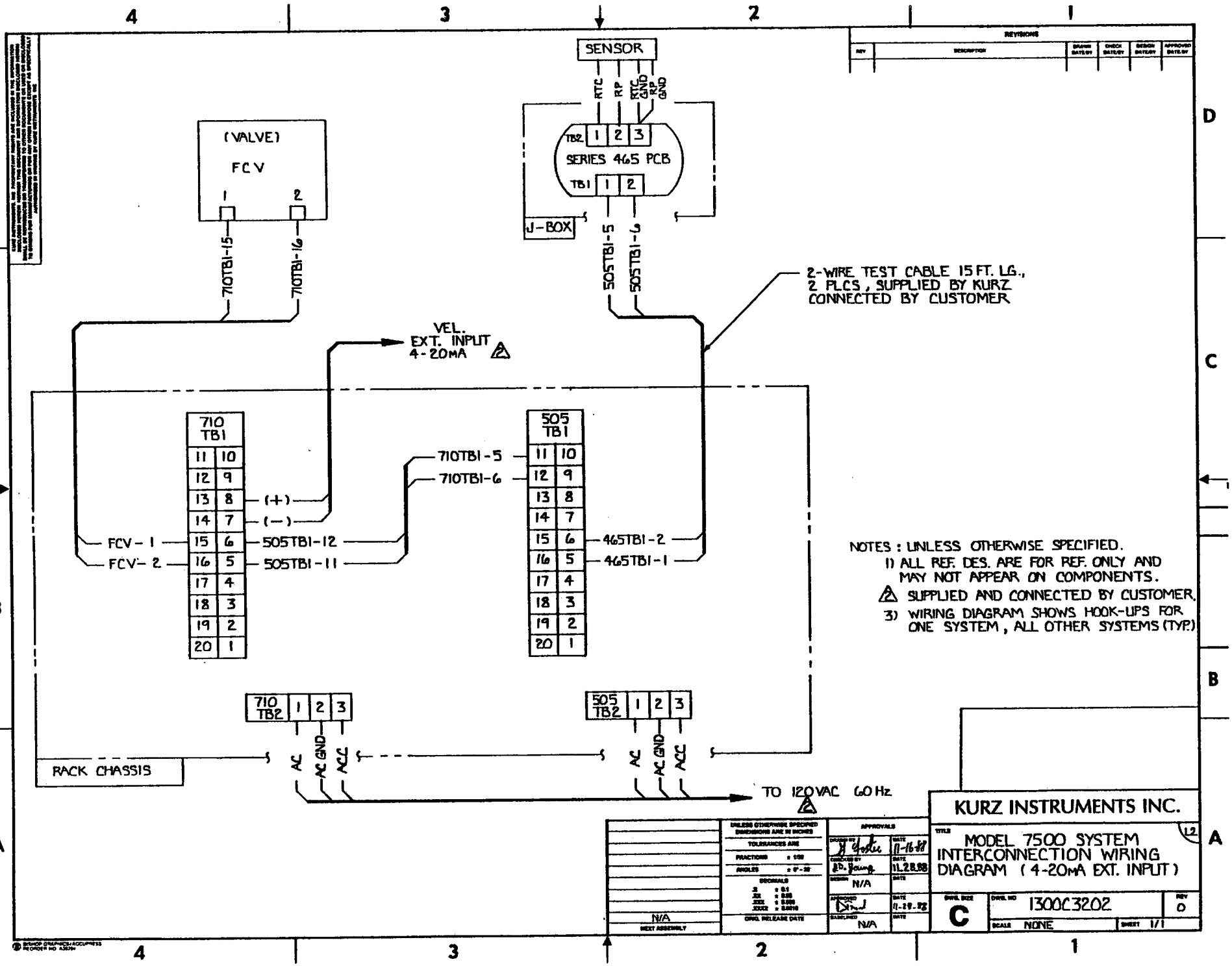
APPROVALS	DATE
DRAWN	12-27-86
CHECKED	3-3-86
APPD	3-3-86

KURZ INSTRUMENTS INC.

MODEL 7500 FLOW CONTROLLER
710 RMD WIRING DIAGRAM

SCALE: | SIZE: C | DRAWING NO. 340088

DO NOT SCALE DRAWING | SHEET 1 OF 1



NOTES: UNLESS OTHERWISE SPECIFIED.

1) ALL REF. DES. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS.
2) SUPPLIED AND CONNECTED BY CUSTOMER.
3) WIRING DIAGRAM SHOWS HOOK-UPS FOR ONE SYSTEM, ALL OTHER SYSTEMS (TYP.)

KURZ INSTRUMENTS INC.

MODEL 7500 SYSTEM INTERCONNECTION WIRING DIAGRAM (4-20mA EXT. INPUT)

DWG. NO 1300C3202 REV 0

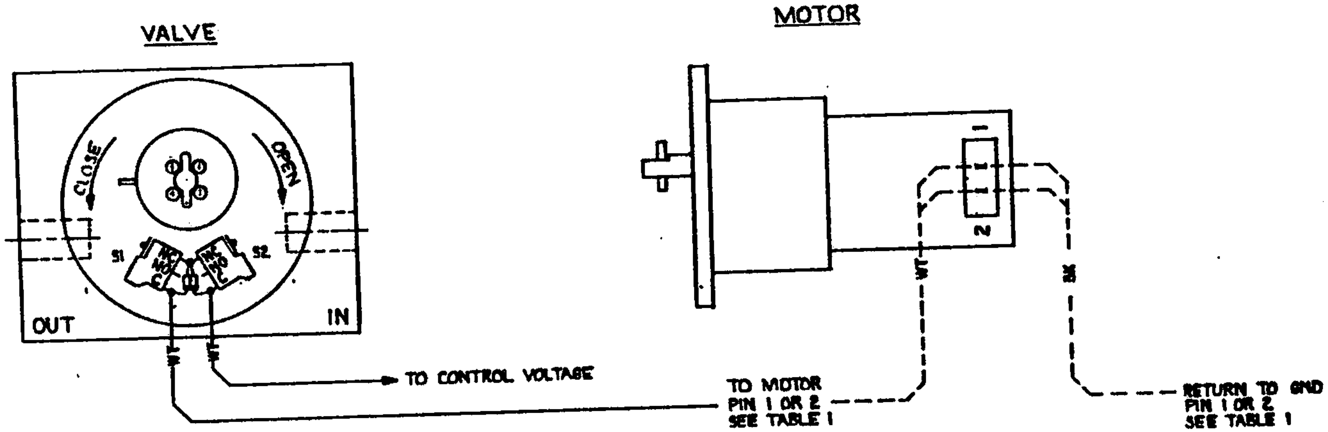
SIZE C SCALE NONE SHEET 1/1

N/A

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

NOTES: UNLESS OTHERWISE SPECIFIED

1. WIRES SHALL BE A MINIMUM OF #22 AWG.
2. REFERANCE DESIGNATIONS ARE FOR REFERANCE ONLY AND MAY NOT APPEAR ON ACTUAL PART.



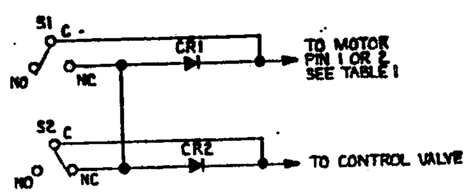


TABLE 1					
VALVE		+ TO MOTOR			
OPEN	CLOSE	RATIO	ROTATION	PIN 1	PIN 2
X		5.9:1	CW	BK	WT
X		11.5:1	CW	BK	WT
X		19.7:1	CCW	WT	BK
X		38.3:1	CCW	WT	BK
X		65.5:1	CW	BK	WT
X		127.7:1	CW	BK	WT
X		218.4:1	CCW	WT	BK
X		426:1	CCW	WT	BK
X		728:1	CW	BK	WT
X		1419:1	CW	BK	WT
X		2426:1	CCW	WT	BK
X		4730:1	CCW	WT	BK

KURZ INSTRUMENTS INC.

VALVE/MOTOR WIRING INTERCONNECTION

APPROVALS	DATE
J. CAREAGA	5-13-86
[illegible]	5-14-86
[illegible]	5-15-86

SCALE / | SIZE C | DRAWING NO. 340095

DO NOT SCALE DRAWING | SHEET 1 OF 1