

SERIES 132 ISOLATED 4-20 mA CURRENT TRANSMITTER

The series 132 is a optional board which typically scales the standard 0-5 DC output of the EVA sensors into 4-20 mA. Many users select this option to re-transmit from the system electronics the average duct or stack velocity signal. Occasionally, some users also re-transmit the sample flow rate signal in 4-20 mA format. The series 132 units are available in rack modules of 1.4 inches wide. These units have a corresponding 132RM model number (1/12 rack).

Series 132 isolated current transmitters are primarily required when signals must be transmitted over long distances. With the use of voltage signal transmission over long wire runs, a significant amount of voltage drop will occur resulting in a signal error. Substituting a current loop signal source in place of the voltage source solves this transmission line loss problem. The way this is achieved is as follows, the current transmitter provides at its outputs a voltage and senses the return current as a feed back signal. This return current is proportional to the applied input signal. Loop control is maintained as long as the applied voltage is sufficient to cause the required feed back current. It is readily seen that this circuit corrects out any signal losses due to signal line resistances and voltage drops.

USER GUIDE
IK-EVA 4200 MULTI-POINT ISOKINETIC
SAMPLING SYSTEM

Engineering Document No. 420035001

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2411 Garden Road
Monterey, CA 93940
800-424-7356
408-646-5911

IK-EVA 4200 SYSTEM DESCRIPTION

The portions of this manual that pertain to the customers system are as noted and defined herein. Other sections of this manual are not applicable.

Customer purchase order number _____

Kurz order number _____

Kurz project number _____

Equipment model number _____

Serial number(s) _____

Design particulars:

Stack or duct flow range _____

Stack or sample flow range _____

Stack or duct inside dimensions _____

Stack or duct temperature range _____

Input power requirements:

115 VAC / 60 HZ (+ or - 10 %) _____

220 VAC / 60 HZ (+ or - 10 %) _____

Other _____

Signal outputs:

0 - 5 Volts DC linear _____

4 - 20 mA linear (optional) _____

Other _____

Probe assembly:

IK - BAR - 12 _____ Aluminum _____ 316 SS _____
Other _____
IK - BAR - 24 _____ Aluminum _____ 316 SS _____
Other _____

Mounting configuration:

TSSE _____
TSDE _____
Other _____

Mounting hardware:

FMA _____
CFMA _____
DESC _____
FDESC _____

Enclosure specification:

Series 195 Model _____
Series 193 Model _____

Electronic specification:

Series 465, Model _____ Series 151, Model _____
Series 505, Model _____ Series 730, Model _____
Series 191, Model _____ Series 710, Model _____

Options:

Series 132, Model _____ Series 133, Model _____
Series 161, Model _____ Series 101, Model _____
Series 171, Model _____ Series 111, Model _____
Series ETI, Model _____

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The modular nature of the IK-EVA systems has the result that every installation is different. Kurz attempts to provide reasonable documentation generic in nature and covering typical systems and installations. No guarantee is made that documentation to the equipment produced as-built. Extensive typical drawings are available for use in field installation. Customers who desire as-built drawings and manuals should contact the factory for price quotations.

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Shipping dates given by the Company are approximate and are based on prompt receipt of all necessary information regarding the order. The company will use its best efforts to meet the ARO date provided the Buyer supplies all necessary information and data promptly, but cannot be held responsible for its failure to do so for causes beyond its reasonable control.

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Shipments are f.o.b. factory, Monterey, CA, freight and insurance prepaid and added, or freight collect unless otherwise requested and agreed to by the Company. If insurance is being provided by the Buyer a formal statement of Buyer responsibility must accompany purchase order. Customer is responsible for notification in writing to the Company within 72 hours of any loss or damage of the shipment if the shipment was made f.o.b. destination. In the absence of specific instructions, the Company will select the carrier.

CHANGES

The Buyer may from time to time, but only with the written consent of the Company, make any change in the order. In the event of any such change, the Buyer shall pay to the Company the reasonable costs and other expenses (including engineering expenses and all commitments to its suppliers and sub-contractors incurred by the Company prior to receipt of notice of such change for all work rendered unnecessary by such change or incurred by the Company thereafter for all work required to effect such change. In either case, an amount determined by the Company in its discretion by applying to the amount such costs and other expenses and the Company's usual rate of profit for similar work. In the event of any such change, the Company shall further be entitled to revise its price and delivery schedules to reflect such change.

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In the event of cancellation, the Buyer shall be liable for the payment of reasonable cancellation charges, which shall not exceed the unit retail list price of the items cancelled and shall include, among other things, expenses already incurred by the Company, actual liabilities against Commitments incident to the order involved, and properly allowable indirect charges as well as a reasonable profit. No delivery delay requested by Buyer on an order placed under this Agreement shall be effective unless covered by an amendment to the order that provides for the payment of any agreed upon costs the delay imposes on the Company and that is accepted on the Company's printed acknowledgement form. Standard products only once delivered may be returned at the Company's discretion and upon approval from the Company in Monterey, CA, at a minimum charge for restocking of 20% of list price. Return shipping charges are of Buyer's expense.

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Unless otherwise agreed to by the Company, the criterion for acceptance of the Company's products including options shall be the successful operation of the product and options using the Company's standard test procedures applicable to the product and options involved. All acceptance tests shall be run by Company personnel at the Company's factory, unless otherwise allowed for and agreed to by the Company.

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Transportation charges for material shipped to the factory for warranty repair are to be paid by the shipper. The Company will return items repaired or replaced under warranty prepaid. No items shall be returned for warranty repair without prior authorization from the Company.

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The company will, at its own expense, defend any suit against the Buyer for the infringement of United States patents and trademarks by products purchased from the Company and in any such suit will satisfy any final award for infringement; except that the Company assumes no obligation to defend or assume liability for damages (consequential or otherwise) resulting from infringements (a) of patent claims covering any other products or any contemplated equipment or any assembly, combination, method or process, in which, or in the manufacture or testing of which any such products purchased from the Company may be used (notwithstanding that such products purchased from the Company may have been assigned only for use in or may only be useful in such other patented products or such patented equipment, assembly, circuit, combination, method, or process, or in the manufacture or testing thereof and that such products purchased from the Company may have been purchased and sold for such use), or (b) resulting from designs supplied by the purchaser, or for any trademark infringement involving any marketing or branding applied by the Company or involving any marking or branding applied at the request of the buyer.

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The company will supply reasonable written documentation including operator instructions. Factory and on-site training in use and operation of the Company's products may be made available at Buyer's expense, subject to acceptance by the Company.

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The Company shall retain title to and possession of any models, patterns, dies, molds, jigs, fixtures and other tools made for or obtained in connection with this contract unless otherwise agreed to by the Company.

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All quotations are made and all orders are accepted by the Company with reference to the laws of the State of California, the rights and duties of all persons and the construction and effect of all provision thereof shall be governed by and construed according to the laws of that state.

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10/1/88

FORWARD

The IK-EVA 4200 USER GUIDE is designed to serve several purposes. Among them are:

Instruction Manual:

The level of information presented on the Kurz 4200 Isokinetic Sampling System includes instruction manual level material. This includes "Installation," "Hookup" and "Operation" sections as well as complete drawings, parts lists and schematics.

Seminar Reference Information:

This publication is also intended to be supporting material at Kurz Isokinetic Technology Seminars, or at the more general Kurz Mass Flow Technology and Applications Seminars.

Sales Literature:

The Kurz 4200 Isokinetic Systems are built in modular fashion from other products standard in the Kurz line. While the principal engineer (customer) may understand the 4200 System thoroughly, other people, such as project engineers, safety officers, procurement people and engineering committees need complete information on the 4200 Isokinetic Systems also.

Detailed Product Specification Information:

Since the IK-EVA 4200 Isokinetic Systems are specific to the application or installation, numerous choices must be made by the user when ordering a 4200 system. These include decisions such as the number of velocity sensors needed, number of sample withdrawal points needed, size of the sample collection filter or whether to use a filter at all and whether options such as velocity profilers and stack totalizers are required. Potential users and specifiers of IK-EVA 4200 systems can use this manual for information regarding customer-specified components. Also, feel free to call the factory for further applications assistance.

INTRODUCTION TO ISOKINETIC SAMPLING

The purpose of isokinetic sampling is to withdraw a representative sample of the particles in a fluid stream at the same rate (velocity) at which the fluid flows through the stack. Under such conditions, minimal interference is imparted on the fluid, such that particles in the fluid do not cross streamlines either to enter or to bypass the sampling nozzles. Non-isokinetic sampling generally results in a non-representative sample that is distorted with respect to particle size, the degree of this distortion being more pronounced with larger particles.

Isokinetic sampling means that the sample flow rate is proportional to the flow rate in the duct or stack. It should be noted that isokinetic sampling is not required to obtain a representative sample of a gaseous pollutant. It is more theoretically correct, however, to obtain a flow-proportional sample to facilitate measurement of the total mass emission rate of a gaseous pollutant. For example, a cogeneration facility in Southern California used isokinetic sampling in conjunction with an NO_x analyzer to demonstrate air quality compliance necessary for their operating permit.

Isokinetic sampling is required for all extractive, particulate, source-measurement methods (EPA Methods 5 and 17 for example) and in sampling airborne, radioactive materials (ANSI N13.1-1969). EPA Method five is a manual test method which uses a Pitot tube for measuring velocity and a calibrated orifice for measuring sample flow rate at each specified sample point in the duct or stack being tested. A complex series of calculations are required to set the proper sample flow rate at each sample point. Equal sample times are used at each point where each sample point represents the center of an equal area of flow within the duct or stack, thereby obtaining an accurate isokinetic sample of the entire area of the duct or stack.

Continuous isokinetic sampling systems have generally used several fixed sampling nozzles and velocity sensors mounted within the duct, each of which are located at the center of equal flow areas, thereby performing an "instantaneous" velocity traverse. Many systems use an averaging, multipoint Pitot tube to measure the average velocity and a sampling "rake" (with several nozzles) to withdraw the sample. Generally, an orifice-type flow meter is used to measure the total sample flow rate, with the flow rate held proportional to the average velocity. Pneumatic isokinetic systems as described may be manually or automatically operated.

FUTURE ISOKINETIC SAMPLING TECHNOLOGY DEVELOPMENTS

Kurz Instruments have been pioneers in isokinetic sampling technology since the early days of the science when experimenters pieced together their own contraptions. Kurz has dramatically improved the quality of the isokinetic sample with the development of the 4200 system. The 4200 has evolved over a two year period and includes such outstanding features as:

All metal high temperature thermal mass flow sensors. These sensors allow unprecedented performance by sensing true mass flow and operating in the harshest of environments.

Unique single turn Electric Rotary Ramp Flow Control Valve invented at Kurz. This new flow control valve alone allows new achievements in control over the isokinetic sampling rate.

The 4200 is an integrated, modular Isokinetic Sampling System that uses the most advanced mass flow sensing technology in the world today. The 4200 System has become a standard product in the Kurz line, yet it represents a product so advanced it will be considered state of the art for the next decade. The 4200 is the premier isokinetic sampling product extant today. Kurz is proud of the 4200 System. It reflects Kurz Instruments' commitment to maintaining their pioneering leadership in isokinetic technology.

FUTURE ISOKINETIC SAMPLING TECHNOLOGY DEVELOPMENTS

Kurz today is aggressively continuing development of new isokinetic sampling technologies. This includes work on improving sensor performance, increasing system modularity, making available new types of isokinetic samplers with new levels of performance and automation. Some developments have completed design and engineering stages and are only waiting for you, the customer, to create the demand for them. These developments include:

Kurz I:K-Bar sensors for providing multipoint averaged stack velocity sensors for larger stacks. The Kurz K-Bar line is Kurz's newest line of high performance sensors. A K-Bar is a probe made up of any number of individual sensors plugged together in a modular building block style. The K-Bar when used in isokinetic systems is referred to as an I:K-Bar. It's perfect for larger stacks and users desiring multi-sensor averaging of their stack flows.

Automatic Filter Cartridge Changers. 4200 Isokinetic Systems are available that include automatic filter cartridge changers that include indexing hoppers to supply fresh cartridges and store in the order of use cartridges with sample.

Real Time Gravimetric Readout of Sample. Kurz has designed a gravimetric device that can be mounted in the filter or sample box on the Isokinetic Sampling Probe in order to provide a real time readout of the weight of the sample collected. This gravimetric device directly measures the weight of the sample collected and is independent of particle size and composition, and may be verified by an actual weight measurement.

Kurz looks forward to sharing with you many exciting developments in isokinetic sampling technology in the future. We welcome an active dialog with all those interested in isokinetic sampling. Please feel free to call our toll-free number 800-4-AIRFLO, to discuss any isokinetic or mass flow measuring requirement anytime. Kurz looks forward to working with you to solve your applications engineering problems.

SYSTEM OVERVIEW

Kurz Series 4200 Continuous Automatic Isokinetic Stack Sampling System is a continuous, automatic, isokinetic stack sampling system. It is composed of a series of sampling nozzles paired with a number of EVA 4000 stack or duct velocity sensors. A mass flow meter measures sample flow in an isokinetic control system loop so that the sample is pulled at particle rates identical to velocity in the stack. The control electronics and the sample rate flow-control valve (usually) are mounted inside a larger NEMA type housing that may be remotely mounted with respect to the isokinetic sampling probe(s). A vacuum supply is external to this housing and may be supplied by the customer, or if supplied by Kurz, mounted anywhere convenient to the user.

Operation of the 4200 is fairly simple and straightforward. First, the EVA 4000 stack velocity sensors provide 0-5Vdc signals linearly proportional to stack velocity. These signals are averaged to provide an external setpoint input to the 4200 controller module. Secondly, a linear, thermal mass flow meter provides 0-5 Vdc signals linearly proportional to the sample flow rate. The Kurz Series 4200 Isokinetic Sampler Controller accepts the abovementioned 0-5 Vdc input signals from the sample rate mass flow meter, compares it to the setpoint signal derived from the stack velocity sensors, and sends an error signal to either open or close the control valve until the isokinetic flow control point is reached. The "Series 4200" name refers to an integrated KURZ Isokinetic Sampler Controller System, in general. It should be noted, however, that the 4200 system consists of many components that comprise standard products when sold separately, and a brief description of each subsystem follows:

- 1) The EVA 4000 System with either the K-BAR 12 or K-BAR 24 Probe Elements.
- 2) A single or dual sampling nozzle and manifold system which is attached to the K-BAR probe.
- 3) A sampling manifold system which brings the sample from each IK-BAR isokinetic probe together and into the isokinetic control electronics.
- 4) System Electronics consisting of:

- Series 151 RM Signal Conditioner/Linearizer
- Series 192 Power Supply
- Series 4200 Automatic Isokinetic Controller Module
- Series 505 Sample Rate Mass Flow Meter
- Series 730 Sample Flow Rate Flow Control Valve

The IK-EVA 4200 utilizes the K-BAR 24 size velocity probe for large ducts and temperatures up to 500°F and the K-BAR 12 size velocity sensors for smaller ducts. Since the sampling lines run through the mounting flange, the velocity sensor current transmitters are separately mounted in an individual enclosure. The system electronics are usually mounted in the series 193 electronics enclosure, although other configurations may be used. The sampling pump (available as an option) can be mounted separately exterior to the enclosure. Although aluminum K-BAR probes may be ordered, all sampling nozzles and manifolds are constructed of type 316 Stainless Steel. Filter holders for sample collection are not included, but are optionally available.

The customer is to supply a flanged spool piece to the duct which will mate with the sensor and sampling array.

THE MULTIPOINT STACK VELOCITY SENSOR AND ELECTRONICS (EVA 4000)

Stack or duct velocities are measured using the EVA 4000 multipoint airflow measuring probes. The EVA 4000 uses Kurz's own all metal, thermal mass flow sensor. Wiring from each sensor on the probe runs to a transmitter enclosure which houses a small circuit card for each sensor used. The current outputs are electrically tied together.

The signal conditioning, linearization and power supply board is mounted in a rack module found in the 4200 system enclosure. The current transmitters located in the EVA transmitter enclosures allow long cable runs with no signal degradation. The currents are high level signals of a few hundred milliamps. National Bureau of Standards (NBS) Traceable calibration is standard with Calibration data and Certificate provided for each sensor. Kurz EVA stack mass velocity sensors automatically correct for changes in gas temperature and density. Therefore, readings are automatically referenced to standard conditions. Kurz Instruments has adopted standard conditions of 25°C (77°F) & 760 mm Hg (29.92 in Hg).

IK-BAR 12 ISOKINETIC PROBES

The IK-BAR 12 Isokinetic Probes use the 0.75" diameter sensor sections assembled with 3/8" NPT pipe nipples. EVA IK-BAR 12 Electronic Velocity Array probes and are usually specified for smaller stacks and ducts, typically 4 ft. and under. They are available in either Aluminum or 316 Stainless Steel. Up to five velocity sensors may be used on the probe assembly, and either a single or dual sampling rake may be used. A temperature sensor may be added to the velocity probe assembly, but the probe is still limited to a maximum of five sensors due to space limitations on running sensor wiring through the sensor windows. Kurz recommends that single-ended IK-BAR 12 probe assemblies be no more than 36" in length, increasing to 72" for double-ended IK-BAR 12 probe assemblies. Radiation resistant wiring may be specified as an option for temperatures to 150°C. Standard temperature rating is 500°F.

IK-BAR 24 ISOKINETIC PROBES

The IK-BAR 24 Isokinetic Probes use the 1.5" diameter EVA Electronic Velocity Array probes and are usually specified for larger stacks and ducts, typically exceeding 4 ft. They are available in either Aluminum or 316 Stainless Steel. Up to seven velocity sensors may be used on the probe assembly, and either single or dual sampling rakes may be used.

A temperature sensor may be added to the velocity probe assembly, but the probe is still limited to a maximum of seven sensors due to space limitations on running sensor wiring thru the sensor windows. Kurz recommends that single-ended IK-BAR 24 probe assemblies be no more than 72" in length, increasing to 144" for double-ended IK-BAR 24 probe assemblies. Radiation resistant wiring may be specified as an option. Standard temperature rating is 500°F.

IK-EVA PROBE INSTALLATION CONFIGURATIONS SINGLE AND DUAL ISOKINETIC SYSTEMS

This is a wetted part on the isokinetic probe assembly used for mounting the IK-BAR 12 to a duct or stack. The flange can be specified in either Aluminum or 316 Stainless Steel.

TRANSMITTER SEPARATE, SINGLE ENDED (TSSE)

Model designations incorporating -TSSE within the model number refers to Transmitter Separate, Single Ended, IK-BAR assembly. The IK-BAR assemblies are mounted to the gas stream conduit by means of a flanged spool piece. The spool piece for the IK-BAR 12 shall consist of a 5" pipe nipple welded to a 5" class 150 ANSI flange. The spool piece for the IK-BAR 24 shall consist of a 6" pipe nipple welded to a 6" class 150 ANSI flange.

TRANSMITTER SEPARATE, DOUBLE ENDED (TSDE)

Model designations incorporating -TSDE within the model number refers to Transmitter Separate, Double Ended, IK-BAR assemblies. These assemblies require the same spool piece as noted in the TSSE write up. In addition to the spool piece a support cup is provided for the opposite end of the assembly. The support cup for the IK-BAR 12 is sized to accept a 3/8" pipe nipple. The support cup for the IK-BAR 24 is sized to accept a 1" pipe nipple.

IK-EVA TRANSMITTER ENCLOSURES SINGLE AND DUAL ISOKINETIC SYSTEMS

These are the remote transmitter enclosures that house a circuit card for each of the sensors used with a probe(s). Normally, 25 ft. of cable is supplied between the probe assembly(s) and the transmitter enclosures.

At the transmitter enclosure the current outputs of each of the sensors are transmitted to the main system signal processing electronics to allow each sensor to be monitored at the control panel. Enclosures are available in either painted steel or 304 stainless steel.

Series 195 separately mounted transmitter enclosures are available in various sizes based on system requirements. Enclosures are provided with field wiring terminals to allow user to terminate sensor and signal output wires easy access.

IK-EVA 4200 SAMPLING MANIFOLD

Applicable to both K-BAR 12 and K-BAR 24 based systems, a sampling manifold is necessary for systems having more than one IK-EVA probe, or when a probe uses dual sampling rakes, in order to bring the entire sample to a common point. We use 316 Stainless Steel tubing and flow junction headers with mounting provisions. Usually, the sample manifold system is peculiar to each installation, and will be detailed on drawings supplied by the factory.

SAMPLE COLLECTION

A filter or sample box (we use the terms interchangeably) is optional. Most customers supply their own or route the sample into an analytical train. Kurz can supply a fiberglass, NEMA type enclosure to be mounted near the 4200 probe. These sample boxes usually hold a stainless steel four-inch filter assembly and a shut-off valve to allow filter removal and replacement. For very small sample rates, Kurz can supply a filter box with a 47mm filter. For installations where the system control electronics are to be some distance from the sampling site, filter boxes can be supplied which also mount the sample rate mass flow meter and control valve. Kurz will be happy to quote on and furnish a design for any specific customer requirements, including systems with automatic filter changers.

AUTOMATIC ISOKINETIC SAMPLING CONTROL MODULE
IK-EVA 4200 AND IK-EVA 4200D

This model number incorporates all of the electronic modules used for the EVA velocity sensors and for automatic isokinetic control. Modules include:

- Series 4200 Isokinetic Controller Module,
- Series 151 RM Signal Conditioner/Linearizer,
- Series 192 System Power Supply
- Series 505 Sample Rate Mass Flow Meter
- Series 730 Sample Rate Flow Control Valve.
- Series 193 Enclosure.

All electronic components are furnished in the rack module configuration. The standard sample flow rate will be between 1 & 5 SCFM full scale. In most cases, reasonably sized sampling nozzles may be furnished to accommodate the duct or stack velocity and the number of sample points. Please consult the factory for special situations. The standard outputs are 0-5 Vdc for the average velocity and for the sample flow rate. All of the Kurz options are available for use with the IK-EVA 4200 system. The Model IK-EVA 4200D is a dual sample automatic isokinetic system and simultaneously furnishes two independent isokinetic samples. This system includes a unique automatic circuit which samples at a constant sampling rate below a preassigned stack velocity and isokinetically at higher velocities. This allows measurements at near zero stack flow conditions.

EVA ELECTRONIC VELOCITY ARRAYS

The stack velocity probes in IK-EVA systems are composed of one or more probes, each consisting of one or more individual EVA sensors configured as multi-sensor probes using a series pipe connection. This chapter describes the EVA sensor: theory of operation, physical construction, construction of multiple sensor probes, sensor transmitter cards (Wheatstone bridge), method of averaging sensor signals and sensor specifications.

CONSTRUCTION OF MULTIPLE-SENSOR PROBES:

Usually two-or-more EVA sensors are arranged on a single probe by piping the protective flow "windows" (housing the sensors) together via connecting pipe nipples. Wiring for each sensor runs through these nipples, as well as through holes drilled lengthwise through the EVA sensor windows.

SENSOR TRANSMITTER CARDS:

Each sensor has its own accompanying "transmitter card" (a small, printed circuit board). The card contains a Wheatstone bridge and components comprising a two-wire current mode transmitter. The Wheatstone bridge is tuned using proprietary, Kurz "temp comp" techniques. Since the wiring between the sensor and transmitter card is part of the Wheatstone bridge, it must not be cut, shortened or lengthened. Most EVA systems are designed so that the individual sensor wires run out through the probe installation flange, then through customer-supplied conduit to the transmitter card enclosure. This enclosure is normally mounted within 25 ft. of the probes.

METHOD OF AVERAGING SENSOR SIGNALS:

Individual sensor currents are transmitted over the two-wire hookup and are converted to voltage at the system electronics enclosure. A two-wire run for each sensor is necessary such that the individual flow signals may be linearized. Once the signal arrives at the system electronics enclosure, its own dedicated linearizer adjusts the voltage-versus-flow to a linear function. Thereafter, linear 0-5 Vdc signals are summed to produce the average velocity signal for the entire EVA array.

SENSOR SPECIFICATIONS:

CONSTRUCTION:

Proprietary 316 Stainless Steel, TIG-welded, Hermetic-Sheath Thermal Mass Flow Sensor with Reference-grade 385 Platinum RTD-type winding; High-Grade Ceramic Core.

REPEATABILITY:

±0.25%

RESPONSE TIME:

1 second

SENSOR OPERATING TEMPERATURE RANGE:

Standard High-temperature: -55 to 250°C

Very High-temperature option: -55 to 500°C

SERIES 195 VELOCITY SENSOR TRANSMITTER ENCLOSURE

IK-EVA 4200 Systems use EVA sensors for stack or duct velocity. The transmitter electronics, with one circuit card for each individual EVA sensor, are housed in the transmitter enclosure near the sensors (generally within 25 ft.).

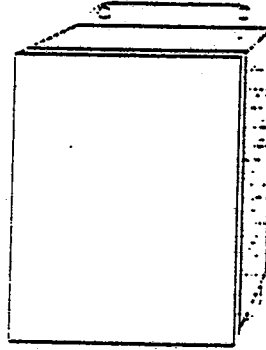
Transmitter enclosures come in various sizes based on the system design requirements. The transmitter enclosures will house a number of circuit cards each wired to the input and output field wiring terminals within the enclosure. also connected to the circuit cards are the bridge power transistors. Power transistors require a heat sink to maintain acceptable operating temperatures. These heat sinks are mounted on the exterior of the enclosure to allow the heat to be carried away by convection.

Enclosures are designed and constructed to be weather resistant and withstand the environment. The enclosures are industrial quality NEMA 4 type, and easily mounted with the four mounting ears provided.

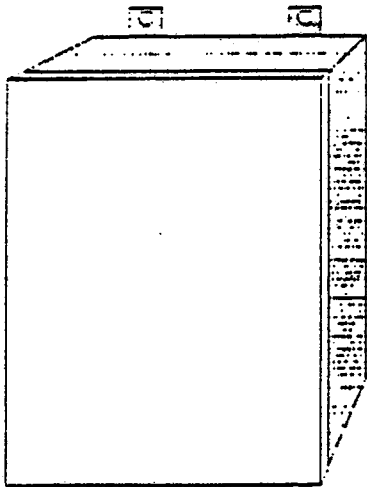
In some cases the user must penetrate the Series 195 enclosure and add conduit fittings to allow wiring of the system. If this requirement applies, be careful not to let metal chips deposit themselves on or around the electrical circuits.

**TRANSMITTER
ENCLOSURE**

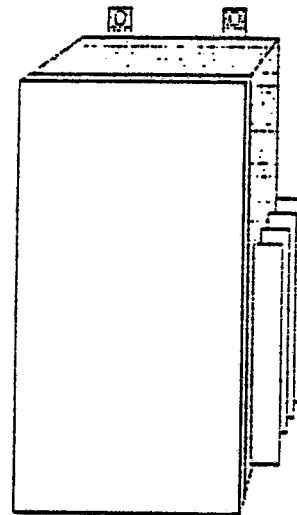
Model 195-141206 Transmitter Enclosure
for K-BAR 12 or 24 TSSE or TSDE
Configurations. Maximum of 6 Sensors.
(14" x 12" x 6") Weather-resistant



Model 195-201608 Transmitter Enclosure
for K-BAR 12 or 24 TSSE or TSDE
Configurations. Maximum of 8 Sensors.
(20" x 16" x 8") Weather-resistant



Model 195-221310-N4 Transmitter Enclosure
for K-BAR 12 & 24 TSSE & TSDE
Configurations Maximum of 9 sensors,
Industrial Quality Enclosure with heavy
duty field wiring terminals
(21.75" H x 12.5" W x 10" D) NEMA 4



Note that all Series 195 Transmitter Enclosures contain field wiring terminals.

Series 193 System Enclosure

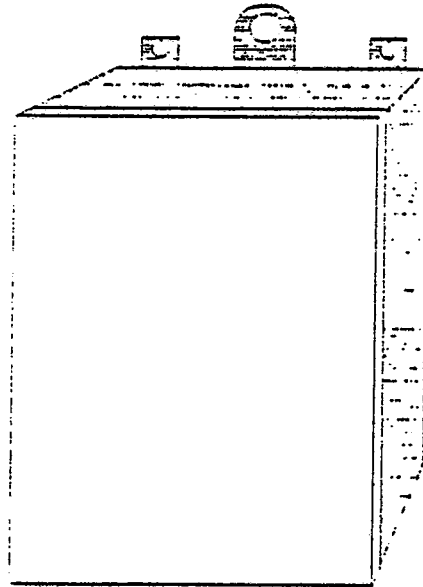
IK-EVA System electronics may be enclosed by a NEMA-4 type housing, which holds the 19-inch Rack Chassis containing the system electronics. A number of system enclosures are optionally available. It also encloses the system interconnection termination blocks and individual functional modules contained within the 19-inch rack chassis.

The system enclosure provides power to the Series 505 Mass Flow Meter and a control signal to the Series 730 Rotary Ramp Control Valve, both are mounted within the lower portion of the enclosure. Some systems may contain dual valves and mass flow meters.

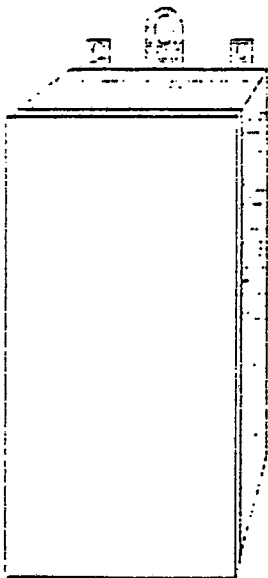
Conduit penetrations must be made by the field installation crew as required to provide a throughway for the field interconnect wiring. Caution should be exercised to assure that no metal shavings are allowed to settle on or around the system electronics.

Mounting ears are provided for attachment of the enclosure to a supporting wall or mounting rails. Four large ears are provided to meet this mounting requirement. Good quality 3/8 bolts should be used to attach the system enclosure to the supporting surface.

Model 193RC-483612-FWT-N12 Electronics Enclosure
with field wiring terminals, mounting rails
that accept two (included) rack chassis. Painted
(Cream color) Steel, wall mount.
(48" H x 36" W x 12" D) NEMA 12
(Uses any 191RM Series Power Supply)



Model 193RC-482212-FWT Electronics Enclosure
with field wiring terminals, mounting rails
that accept rack chassis. Painted Steel, wall mount.
(48" H x 22" W x 12" D) NEMA 4 type
(Uses any 191RM Series Power Supply)
(Includes rack chassis as needed)



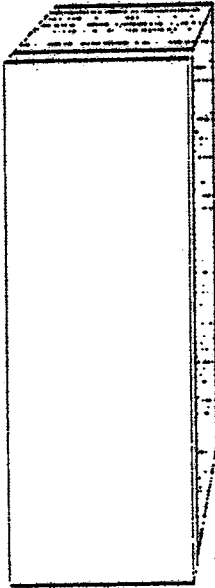
Model 193RC-483612-FWT-N12W Electronics Enclosure
Same as above but with 29" H x 19" W polycarbonate
window mounted to cover.

Model 193RC-483612-FWT-N4 Electronics Enclosure
Same as above except NEMA 4 rated.

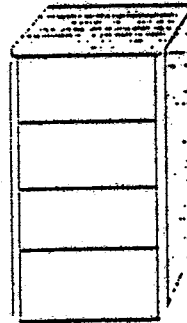
Model 193RC-483612-FWT-N4W Electronics Enclosure
Same as above except NEMA 4 rated and with
29" H x 19" W polycarbonate window mounted to cover.

ELECTRONICS ENCLOSURE

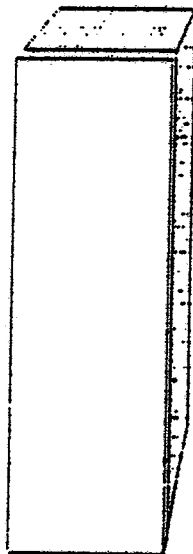
Model 193RC-722532-FWT Free-Standing Floor-Mounted Electronics Enclosure with field wiring terminals and mounting rails that accept rack chassis.
Painted Steel, floor mount, (72" H x 25" W x 32" D)
NEMA 4 type (Uses any 191RM Series Power Supply)



Model 193CR-402422 Free-standing Light-Duty Rack Cabinet Electronics Enclosure for INDOOR USE ONLY.
Includes louvered rear door for terminal access.
Includes rack chassis as needed. (40" H x 24" W x 22" D)
(Uses any 191RM Series Power Supply)



Model 193CR-702422 Free-standing Light-Duty Rack Cabinet Electronics Enclosure for INDOOR USE ONLY.
Includes louvered rear door for terminal access.
Includes rack chassis as needed. (70" H x 24" W x 22" D)
(Uses any 191RM Series Power Supply)



Series 193 OPTIONS:

**Floor stand kit. Includes 4 factory-installed feet;
raises any Series 193 Enclosure 6" off floor.**

UNPACKING

Normally no special precautions need to be observed during unpacking of your isokinetic sampling system. Of course, any external damage to the package should be reported to the carrier.

We recommend completion of electrical connections (i.e.: bench test) soon after unpacking, turning the unit on, and verifying that the zero point has not drifted and that an upscale response results when air flows over the sensors. Engineering Drawing sections may also be used to verify system operation.

The system electronics and current transmitter enclosures should be unpacked from their crates and visually inspected. Prior to their bench test mentioned above, all parts should be examined for any visually detectable shipping damage.

Remove any protective packing from the sensor "window" areas. The probe assembly and the EVA sensors especially should be inspected for any sign of damage. Even though the sensors are sheathed with a 316 stainless steel, damage could result if the system crates were improperly handled during shipment. Sensors should not be bent.

We recommend storing the crates that your 4200 System arrived in for your future convenience should it be necessary to return all or part of the system for repair or recalibration.

All boxes and crates should be inspected for mounting hardware and miscellaneous system equipment prior to storage.

INSTALLATION

There are a number of steps to be taken during installation of your 4200 system. Note that some steps require that prior planning has been done, decisions have been made and necessary supplies have been ordered. Generally, installation steps are as follow:

1. Install the IK-EVA probes in the plant vent, duct or stack.

Prepare the vent, duct or stack for sensor installation.

Each vent, duct or stack must be prepared for the IK-EVA probe per Kurz installation drawings provided with the system. These drawings provide the suggested layout, duct modifications and installation drawings.

Typically, duct preparation consists of the following:

1. Cutting an access hole for the IK-EVA probes and support structure.
2. Modifying the duct to include mounting provisions such as "spool piece" or flange to which the IK-EVA probes mount.
3. Weld the double-ended support fitting, if used, to the opposite duct wall.

Kurz provides a "cup-like" fitting for installation by the customer with double-ended systems. The double-ended fitting or "cup" provides a more rigid system mounting. It should be installed along the center line of the IK-EVA probe on the opposite duct wall.

A clearance hole, with the approximate ID of the "cup" should be drilled prior to "cup" installation.

Install the IK-EVA probe(s) in the prepared duct or vent.

Secure the IK-EVA probe(s) with mounting hardware (i.e.: flange bolts, screws, etc.).

2. Decide where the current transmitter electronics enclosure (Series 195) for the IK-EVA system is to be mounted.

The current transmitter enclosure is a NEMA 4 Enclosure 3/8" or 5/16" bolts, with lockwashers and flatwashers, should be used in mounting. Using this hardware and fastening all four ears results in adequate support for the enclosure.

The enclosure houses the Series 465 Current Transmitter PC Boards and customer field wiring terminations. It should be located as near as possible to the vent or stack in which the EVA sensors (on the IK-EVA probe) are located, the location being limited by the EVA sensor cable length (typically 25 feet). Electrical power is not required for this enclosure, since the PC Board power comes from the main system electronics enclosure. Each Series 465 is connected to one EVA sensor. Wiring should be accomplished per the system drawings provided by Kurz for this project.

Enclosure door clearance for general system operation and troubleshooting should be provided (as with the main electronics enclosure).

3. Decide where the system electronics enclosure will be located.

Depending on the size of your system, this can be either the:

Model 193 - 482212 enclosure, 48" H x 22" W x 12" D, NEMA 4, with wall mounting ears on 16" centers.

(or the)

Model 193 - 722532 free standing floor mounted enclosure, 72" H x 25" W x 32" D.

The model 193 - 482212 enclosure, complete with system electronics, typically weighs approximately 350 lbs. When wall mounting an object of this weight, Kurz recommends using premium quality bolts and nuts. All four mounting ears should be used.

Floor mounting the larger 193 - 722532 enclosure is less critical, unless seismic concerns apply. Again, Kurz would recommend using only the highest quality fasteners in an installation configuration offering generous safety factors.

System Enclosures includes display's and operator controls, so they should be located somewhere convenient to the user. Electrical power must be available also. Because most 4200 Systems include the flow control valve(s) within the System Enclosure, bear in mind that you will have to run sample line, or simple vacuum line, between the Isokinetic Probe Assembly mounted in the stack and the 4200 System Electronics Enclosure mounted, presumably, on the ground. So, normally, you will want to mount the System Enclosure as close to the stack as possible. The system vacume source is supplied by either the customer or vendor as required.

On 4200 Systems in which the user has elected to have the sample rate mass flow meter and flow control valve mounted close to the Isokinetic Probe Assemblies themselves, more flexibility exists in mounting the System Electronics Enclosure hundreds of feet away from the stack or inside a control room. For control room installations the NEMA housing may be dispensed with altogether. System electronics can then be mounted in standard 19" relay racks. For these type of installations, the vacuum source (or vacuum pump assembly) can and should be mounted close to the isokinetic probe(s).

4. Install system interconnection wiring between the electronics and components.

Interface wiring should be completed per the Kurz system drawings provided with your system. Interconnection terminals -- along with field spare terminals -- are provided in the upper portion of the system main electronics enclosure and current transmitter electronics enclosure.

5. Prior to system power up, confirm that interconnection wiring is installed properly.

Perform point-to-point tests to assure that signal cables, power cables, ground wires and other system connections are complete. This will minimize any equipment failures due to improper wiring.

Confirm system wiring per the Kurz system drawings provided with your equipment and architect engineer or OEM equipment vendor drawing to assure that terminations have not been changed or altered during the design process or during installation.

Assure that any other equipment interfacing with the IK-EVA System has been installed, with interconnections properly made. (i.e.: Kurz Flow Controller System or customer radiation monitoring equipment).

NOTE: DO NOT POWER SYSTEM UP UNTIL THIS CHECKOUT PROCEDURE IS SATISFACTORILY COMPLETED.

6. Power up system.

Initiate power to the Kurz equipment. Confirm power level to enclosure (i.e.: 120 VAC \pm 10%).

Within the system enclosure, turn the key switch power switches to the ON position. Also, turn on any module power switches. Assure that all fuses or other circuit protection are not failing.

7. Hook up the sample line between the Isokinetic Probe Assembly and the flow control valve within the 4200 System Electronics Enclosure.

On standard 4200 Isokinetic Systems the flow control valve is mounted inside the System Electronics Enclosure. The sample line runs between the Isokinetic Probe Assembly mounted in the system enclosure (with some kind of sample collection means, such as a filter box, presumably in the middle).

As a final note, bear in mind that the sample will be collected prior to flowing thru the flow control valve and the vacuum pump. If you find upon inspection that the sampling line becomes dirty with time, or that the flow control valve becomes dirty and needs periodic cleaning, we recommend you install a large in-line filter downstream of the sample collection filter in order to catch dirt (or sample) before it has a chance to enter the flow control valve. Long sample line runs that might allow generation of water condensate in the line should consider installing a water trap in-line and upstream of the flow control valve. Water will not damage the valve, and there are water traps on the vacuum pump anyway, but in order to ensure isokinetic performance is uninterrupted it is still a good idea to have a water trap upstream of the flow control valve. Remember this recommendation is only for long sample line runs and where water has been discovered.

QUICK GUIDE TO HOOKING UP THE 4200 SYSTEM

There are four major types of electrical connections required to complete the system interconnection. They are:

1. Individual sensor wires from velocity sensors on IK-EVA probe to current transmitter (Series 465) located in the Series 195 Electronics Enclosure.

2. Signal inputs to main electronics enclosure.

- 2.1 Source: Series 4000 EVA Sensors. Type: Current signals from Series 195 Current Transmitter Electronics Enclosure. Destination: System Electronics Enclosure.

3. Power input to main electronics enclosure, (110Vac/60Hz typ.).

4. Output Signals from main electronics enclosure.

1. Eva Sensor linear output signal representing average duct or stack velocity.

2. Sample rate mass flow meter linear output signal.

3. Velocity profiler output signal for individual velocity sensor output reading (if provided with system electronics).

4. Any 4-20mA outputs for retransmission of above signals.

Electrical connections for the above listed functions are provided on the terminals as shown on the included engineering drawings. Recommended wire size, signal level, terminal board location and additional comments are provided. As mentioned in the section on installation, the field-wiring connections should be verified by testing prior to the initiation of system power in order to minimize electronics damage due to possible wiring errors.

Refer to the Kurz wiring diagrams included in the Engineering Drawings section for additional information on: 1. wiring the probes to the intermediate junction box (transmitter box), 2. wiring to the system electronic enclosure, 3. wiring AC power, 4. plumbing the probe(s) sample line(s) to the manifold assembly, then to the sample flow controller (in the system electronics enclosure), 5. drawings of terminal strip within the boxes along terminal descriptions, 6. point-to-point wiring diagrams and instructions.

OPERATION - GETTING STARTED

After the completion of system installation and interconnection the following steps will allow the operator to initialize the EVA System operation.

LIST OF OPERATOR SWITCHES

INPUT POWER

ON/OFF SWITCH: Self Explanatory

POWER SUPPLY

ON/OFF SWITCH: Self Explanatory

SERIES 151 OR 151/142 SIGNAL CONDITIONER MODULE(S)

ON/OFF SWITCH: Self Explanatory

SENSOR POINT SELECTION SWITCH: Selects sensor output to be switched to front panel jack (J1).

SYSTEM INITIALIZATION PROCEDURE

1. Turn key lock power switches to the "ON" position.
2. Turn power supply power switch to the "ON" position.
3. Turn SERIES 151 OR 151/142 power switch to the "ON" position.

At this point, if there is flow in the plant vent or duct, the EVA system should be sensing the flow rate and providing an output signal. This may be verified by testing the output terminations in the top of the 193 main electronics enclosure. Refer to the system drawings in Section 14 for specific terminal assignments.

If the EVA system includes a velocity profiler, Series 151/142 the following procedures may also be followed.

4. Select a sensor using the rotary "POINT SELECTOR" switch S1 or S2 (for larger EVA systems).
5. Conduct a DVM to the output signal connector J1 on the module front panel.
6. Monitor the individual sensor flow rate. (0-5 VDC corresponds to the system flow range.)
7. Select another sensor (if desired) and monitor its output signal.

8. Return the "POINT SELECTOR" switch to the AVG (average) position to return the EVA system to normal operations.

9. If the Series 151 module has a "D" or "RMD" option the average signal may be monitored by simply reading the signal at the display. Likewise the same is true for the Series 151/142 modules. However with the addition of the 142 to the 151 individual sensor signals may be read at the local readout.

FUSED MODULES

Series 151 Signal Conditioner Module (0.5A)

Series 151/142 Velocity Profiler Module (0.5A)

NOTE: The Series 151/142 replaces the previous 142 Series modules.

Series 191 Power Supply (2.0A)

NOTE: The Series 191 replaces the previous 192 Series.

Main Power Fuses (Qty 2 or 3, 2.0A)

Perhaps the simplest way to explain operation is to explain the functions of the control switches. Typically the stack velocity sensor electronic rack module and the sample mass flow rate electronic rack module will have ON/OFF switches only. Basic functional controls for the Series 4200 Isokinetic Sampling System will therefore be found on the 4200 Isokinetic Sampler Controller rack module. We'll describe the controls and what they do in that section of the manual.

THE SAMPLE INLET NOZZLE AND SAMPLE MANIFOLD:

Where this is decided

Sampling nozzles are either machined as part of the sampling manifold assembly or fabricated as removable thread on style nozzles. This screw-on nozzle allows users to change sampling rates by simply changing nozzles. These nozzles may be ordered from Kurz Instruments Inc.. The digital display on the 4200 Isokinetic Sampler Controller electronics module must be rescaled to new engineering units matching the new full scale sampling rate along with adjustments to the velocity vs sample rate signal matching circuit, ~~this is however a simple task.~~ The 4200 System will continue to sample isokinetically, since the system will continue to match the velocity of the flow past the sample rate mass flow sensor to that of the stack flow past the EVA sensors after adjustments.

A sampling manifold consists of one or more sample inlet nozzle tubes feeding a common convergence manifold assembly. The design of the manifold assembly and nozzles take into consideration the gas stream velocity and desired extraction sample rate. In addition the design is such that the particle deposition and fall out are kept to a minimum, based on a computer aided analysis of the sample assembly and its individual parts.

The user is required to provide the connecting tubing for the interface of the sample manifold assembly to the system sampling source, the particulate filter and/or the wide range gas monitor. Design of the interconnect tubing by the user should take into consideration particle deposition and fall out.

Flow summing blocks are required when two or more gas sampling manifolds are used to gather a representative gas stream sample. These summing blocks add the individual gas flow streams into one larger flow stream to the particulate and/or wide range gas monitor.

FILTER HOLDERS AND SAMPLE COLLECTION BOXES

An optional Filter or Sample Box Assembly can be mounted in close proximity of the Isokinetic Probe Assembly or nearby on the stack or duct. They contain a filter for sample collection and a ball valve to shut off the sample line during filter changes. TWO basic versions of filter box assemblies are available, and are described on this following page.

1. 4" Filter Holder. This is the more popular of the sample box configurations. A 4" filter holder manufactured by Kurz is included in the fiberglass sample box.

2. 47mm Filter Holder. This configuration substitutes a 47mm filter for the 4" filter holder mentioned above, and is used for low flow versions of the 4200 (See System Specifications).

THE VACUUM PUMP

Kurz Instruments can provide an optional high quality Rotary Vane Vacuum Pump with the Kurz 4200 Systems. This is an oil-less vacuum pump which has an integral AC drive motor. The drive motor will require 1/4 - 3/4 horsepower to operate based on system requirements. A vacuum relief valve is included in the vacuum line piping inside the 4200 System Enclosure. The pump used will pull between 1 & 10 CFM at 0" Hg again based on the system design. The vacuum pump assembly will weigh between 5 & 50 lbs.

SERIES 465 CURRENT BOARD

TWO WIRE SIGNAL TRANSMISSION:

Most Kurz thermal anemometers include two-wire signal transmission circuitry, that allows the sensor/flow transducers to be situated over 1000 feet from the signal conditioning and power supply electronics. No additional power supply is needed at the location of the flow transducer.

In considering the two wire system, let us first see how we transmit a signal from our sensor to the signal conditioning circuits in our non-two-wire systems. A good example of such a system is one of Kurz's portable, battery powered instruments. The two platinum RTD windings in the sensor represent two legs of a Wheatstone bridge. Therefore, the probe cable is an integral part of the sensor circuit. Since cables have their own resistance values, temperature compensation and calibration are dependent on an exact, known cable length. If the cable length is altered, a calibration error is introduced, and recalibration is required. Since the probe cable is a conductor and has a voltage signal across it, the cable does not normally exceed 50 feet in length. Greater lengths impart too much electrical resistance in the bridge circuit.

In Kurz systems having a two wire signal transmission, feature the entire bridge circuit which is part of the current mode circuit board is contained in the conduit junction box. The junction box is mounted to the flow transducer. This circuit allows transmission of the signal over a two wire system. It should be noted that the current output from the flow transducer is not the industry standard 4-20 mA, but our own current, based on calibration of the instrument.

To summarize some of the advantages of the two wire signal transmission method:

- 1 The output and power leads are the same, no other power source is needed for the sensor.
- 2 Current is drawn from a remote power supply in proportion to sensor signal changes.
- 3 The current mode has very high line noise immunity, allowing the use of a simple twisted pair of wires.

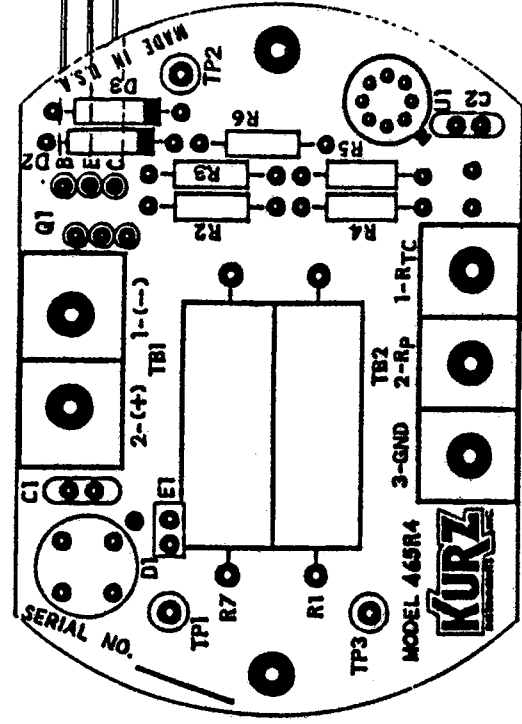
The two wire cable has two attachment points, the screw terminals on the transducer printed circuit board in the flow transducer junction box and the screw terminals on the main signal conditioning and power supply board. The total loop resistance for the two conductors should be 4 ohms or less.

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NOTES: UNLESS OTHERWISE SPECIFIED

- THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM NO. B46530011.
- R1 AND R7 TO BE ASSEMBLED WITH 1/4" ± 1/16" CLEARANCE FROM PC BOARD.
- CUT Q1 LEADS TO 5/16" ± 1/16" LONG BEFORE SOLDERING TO WIRE. USE 3/32" DIA. X 1" LONG HEATSHRINK TO INSULATE THE LEADS.
- DI, D2 AND D3 TO BE ASSEMBLED WITH 1/8" ± 1/32" CLEARANCE FROM PC BOARD.

Q1, REF. Δ FRONT SIDE SHOWN



Q1	COLOR	AWG	LENGTH: STD - OPT. EVA
E	BK	#22	12" 15" 20"
C	WT	#20	6"
B	BL	#22	12" 15" 20"

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOLERANCES ARE	
FRACTIONS	± 1/32
DECIMALS	± 0.005
ANGLES	± 0.1°
SPACINGS	± 0.010
DRILL RELEASE DATE	
NEXT ASSEMBLY	N/A

APPROVALS	
DESIGNED BY	J. CAREAGA
DATE	2-5-87
DESIGNED BY	J. CAREAGA
DATE	2-5-87
DESIGNED BY	N/A
DATE	
DESIGNED BY	N/A
DATE	2-15-87
DESIGNED BY	N/A
DATE	

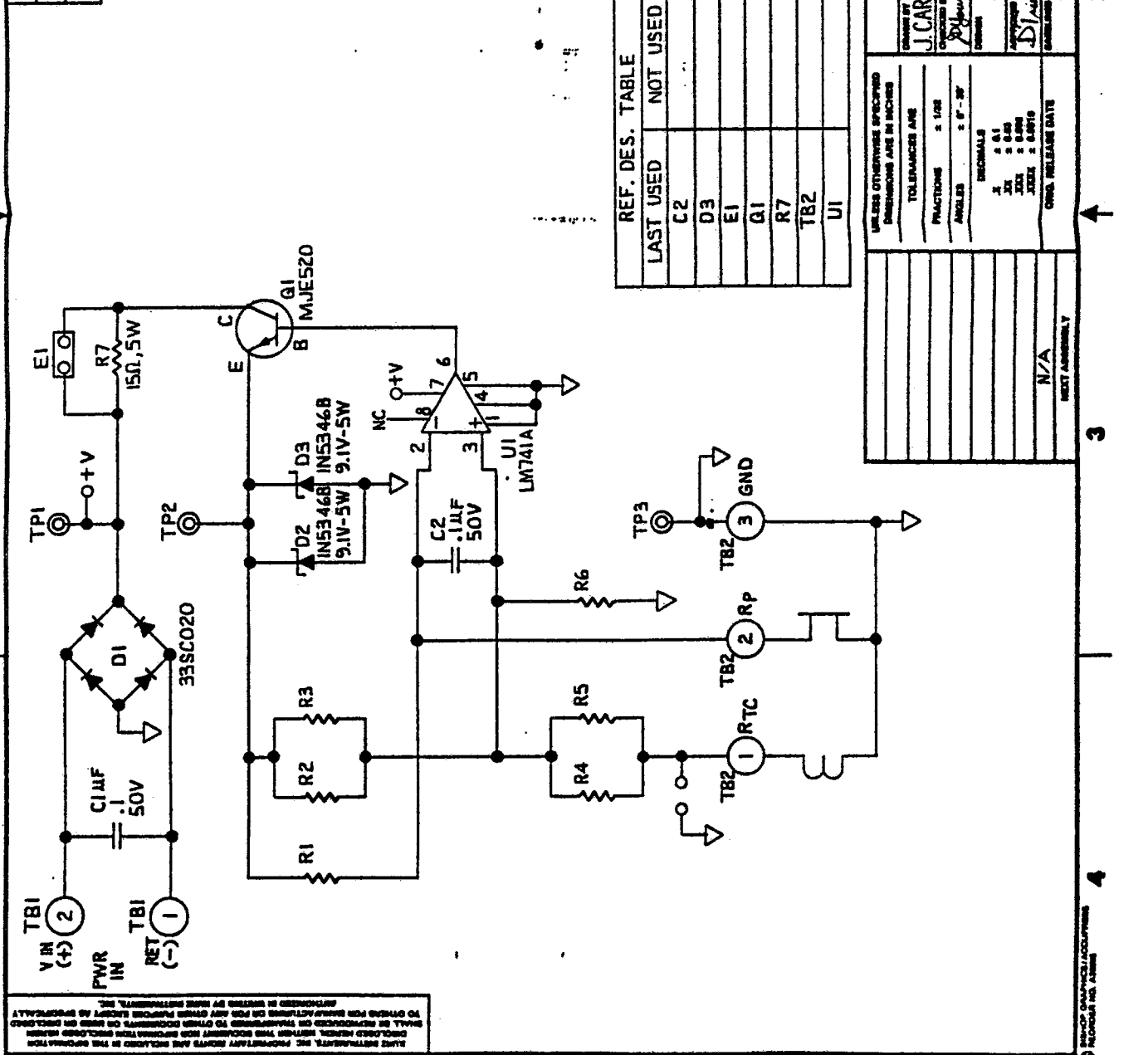
PARTS LIST				
ITEM	PART NO.	QTY	REF. DES.	DESCRIPTION
1		1		MODEL 465R4 PCB
2		2	C1, C2	CAP .1UF 50V
3		2	D1, D2, D3	DIODE, IN5346 B 9.1V 5W
4		1	DI	BRIDGE RECTIFIER 33SC020
5		1	DI	BRIDGE RECTIFIER 33SC020
6		2	D2, D3	DIODE, IN5346 B 9.1V 5W
7		1	A/R	SHUNT, 2 PIN
8		1	EI	HEADER, 2 PIN
9		1	Q1	TRANSISTOR, MJE520
10		1	Q1	TRANSISTOR, MJE520
11		1	UI	IC, LM741A OP AMP
12		1	UI	IC, LM741A OP AMP
13		1	TBI	TERMINAL STRIP TRW 2 PIN 3/8 CENTER
14		1	TB2	TERMINAL STRIP TRW 3 PIN 3/8 CENTER
15		3	TP1-TP3	CON. PIN, PCB TEST LEAD PINS
16		6	R1-R6	RESISTOR, SELECTED
17		1	R7	RESISTOR, 15Ω, 5W, OHMMITE, ± 1%

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

REV.	DESCRIPTION	ISSUED DATE	BY	APPROVED DATE	BY
4	REVISED PER ECO A47114	3-23-87	J.C.	3-23-87	J.C.

TITLE	
MODEL 465R4	NON INTERCHANGEABLE CURRENT PC BOARD COMPONENT LAYOUT
ENGR. NO.	B46531011
SCALE	2:1
SHEET	1 OF 1

REVISIONS			
REV.	DESCRIPTION	DESIGNED BY	CHECKED BY
A	REVISED PER ECO A47114	5-26-87	RV
		11-17	N/A
			APPROVED DATE
			AMG
			6-9-87



- NOTES: UNLESS OTHERWISE SPECIFIED
- THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT NO. B46531011.
 - R1-R6 TO BE SELECTED (TEMP. COMP).

REF. DES. TABLE	DESCRIPTION
C2	NON INTERCHANGEABLE WITH INTRINSIC SAFETY E1 OPEN
D3	NON INTERCHANGEABLE W/OUT INTRINSIC SAFETY DO NOT INSTALL R7.D2.D3. CLOSE E1
E1	
G1	
R7	
TB2	
U1	

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

KURZ INSTRUMENTS INC.

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

DATE 2-5-87
DESIGNED BY J. CAREAGA
CHECKED BY [Signature]
DATE 2-13-87
DATE N/A

SCALE B
DRWG. NO. B46530011
REV. A

SHEET 1 OF 1

APPROVALS

DESIGNED BY J. CAREAGA
DATE 2-5-87
CHECKED BY [Signature]
DATE 2-13-87
DATE N/A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE
 FRACTIONS ± .100
 ANGLES ± 0°-30'

DECIMALS
 .2 ± .01
 .5 ± .005
 .6 ± .005
 .8 ± .005
 1.0 ± .005

DATE N/A
DATE N/A
DATE N/A

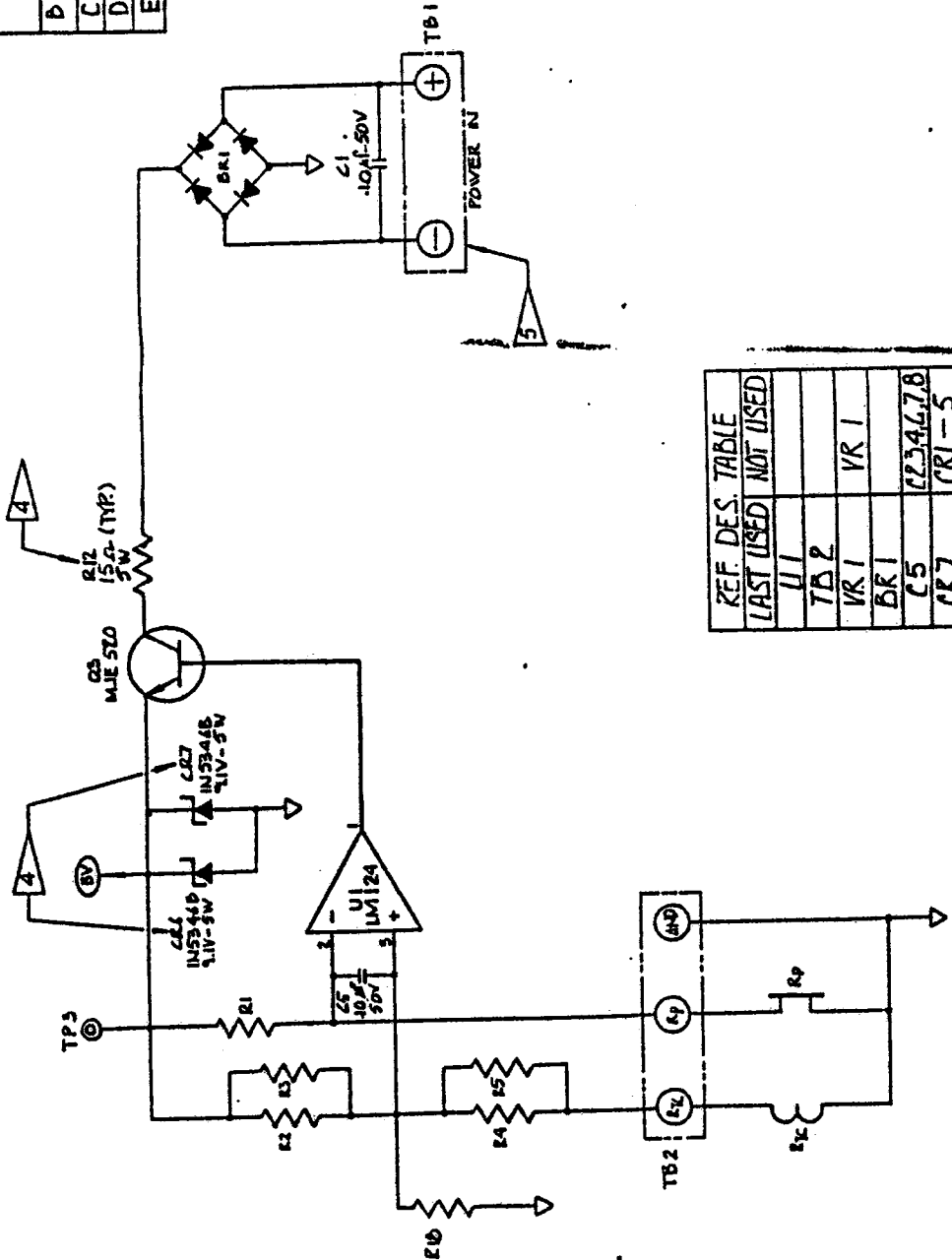
DATE N/A
DATE N/A
DATE N/A

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REVISIONS

REV.	DESCRIPTION	DATE	REV./CHG./AMZ
A	REMOVED C2, C6 & R1, R10 ADDED R18. CHANGED C1, S FROM .001M TO .1M AND Q3 FROM MJE 570 TO MJE 520	3-31-86	0A/DX /MB
B	CHANGED PER P&R # 465-98002	4-11-86	BA/DI /MB
C	CHANGED CB VALUE TO SELECTED	7-23-86	EC/BA /BT
D	REVISED PER ECO A46547004	12-16-86	IC/BAF/BA
E	REVISED PER ECO A47114	5-26-87	IC/DV /MB

- NOTES:
- THIS DWG. TO BE USED IN CONJUNCTION W/ COMPONENT LAYOUT # 46531002.
 - R1-R5, R10 TO BE SELECTED (TEMP COMP.).
 - V_S = +24V (FOR K-BAR)
V_S = +36V (FOR HEAVY DUTY 435 LINEAR PC BOARD)
 - CR6, 7 & R12 : INTRINSIC SAFETY CIRCUIT (OPTIONAL) NOT APPLICABLE FOR UNITS HAVING BV > 9V.
 - CIRCUIT STILL FUNCTION EVEN LEADS ARE REVERSED.
 - CB TO BE USED W/ METAL SENSOR ONLY.



REF.	DES.	TABLE
U1	LM124	NOT USED
TB2		
VR1	VR1	
BR1		
C5	22, 46, 7, 8	
CR7	CR1-5	
A3	Q1, 2	
P4	PI-4	
R1	R6-11, 13-17	

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



REV. BY: Aaaa	DATE: 1-11-86	MODEL: 465R3 CURRENT
CHKD BY: Jind	DATE: 2-11-86	PC BOARD MODIFIED
APP'D: Jind	DATE: 2/11/86	SCHEMATIC DIAGRAM
B D 465300001		REV. E 1987.1

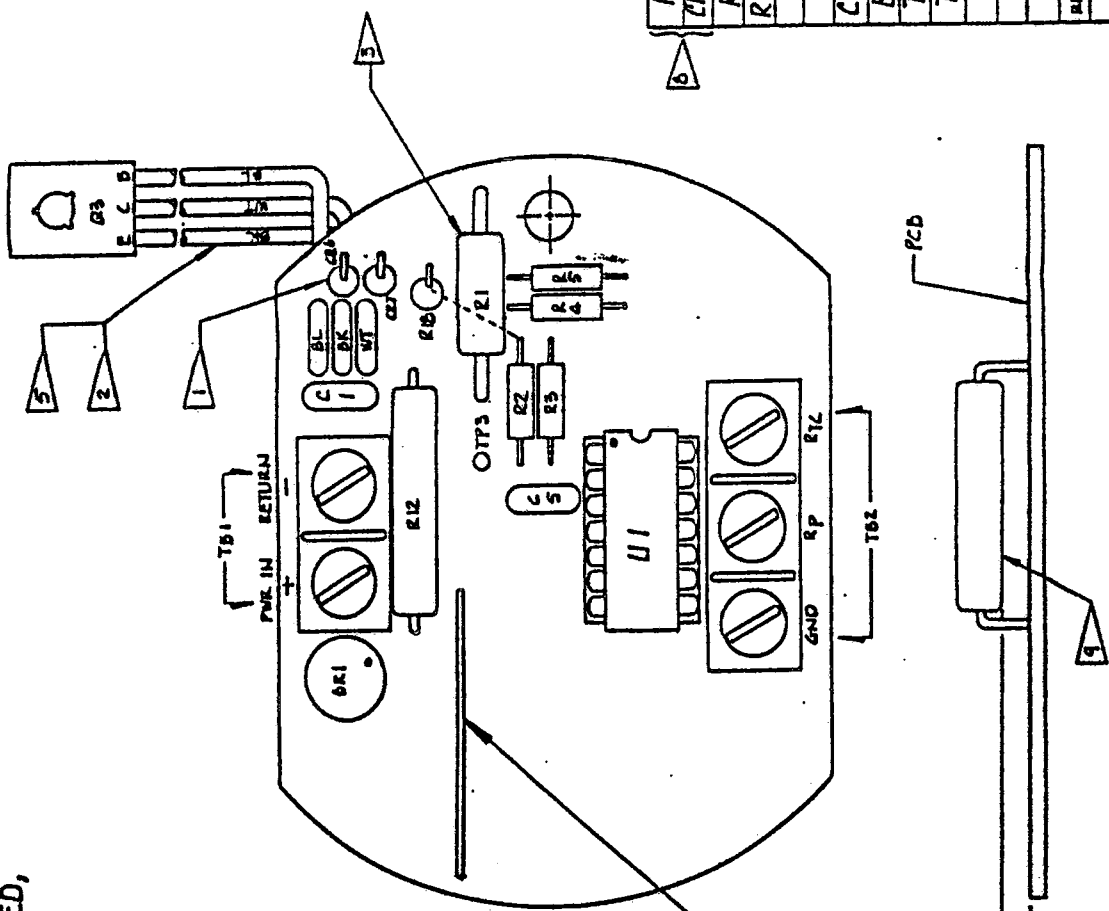
NOTES: UNLESS OTHERWISE SPECIFIED,

- > CRG 4 7 TO BE ASSEMBLED W/ CATHODE TO PCB.
- > STD. PCB USE 6" x 22 AWG. TWISTED TEFZEL
- > R1 TO BE ASSEMBLED 1/4" CLEARANCE FROM PCB.
- 4. THIS DWG. TO BE USED IN CONJUNCTION W/ SCHEMATIC DIAGRAM # D 46550001.
- > CUT Q3 LEADS TO 1/4" x 5/16" LONG BEFORE SOLDER TO WIRE, USE 3/32 DIA. x 1" LONG HEATSINK TO INSULATE THE LEADS
- > STANDARD BOARD TO HAVE A JUMPER IN PLACE OF R15.

7. REMOVED.

FOR INTRINSIC SAFETY CIRCUIT ONLY.

- > R12 TO BE ASSEMBLED 1/8" CLEARANCE FROM P.C.B. BOARD.
- 10. TOLERANCE ON ALL DIM. TO BE: ± 1/16".



REV.	DESCRIPTION	DATE	BY
A	REMOVED CRG 6 1 Q1; R9, 10 ADDED R8; C18. CHANGED C1 I CS FROM .02MF TO .1MF AND Q5 FROM MJE 570 TO MJE 520	3-21-68	DA MB
B	NOTE B - ADDED, REMOVED C18	4-7-68	DA MB
C	CHANGED PER PER # 46548002	4-22-68	DA MB
D	CHANGED PER ECO # A46547003	5-14-68	DA MB
E	CHANGED C8 VALUE TO SELECTED	7-23-68	JL MB
F	REVISED PER ECO A46547004	12-16-68	DA MB
G	REVISED PER ECO A46547007+A47104	5-26-69	JL MB

REF. DES.	DESCRIPTION	QTY.
R12	RESISTOR 15Ω, 5W OHMITE (TYP.)	1
CR6.7	DIODE IN 5346 B, 9.1V, 5W	2
R18	RESISTOR SELECTED	1
R1-5	RESISTOR SELECTED (TEMP. COMP.)	5
Q3	TRANSISTOR MJE 520	1
C15	CAPACITOR .1µF - 50V MONOLITHIC	2
B1	BRIDGE RECTIFIER 35SCD2D	1
TDZ	TERMINAL STRIP TRW 3 PIN	1
TD1	TERMINAL STRIP TRW 2 PIN	1
U1	QUAD OP-AMP LM124	1
	14 PIN DIP SOCKET	1
	465-R3 PCB	1
REA. DES.	DESCRIPTION	QTY.

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

KURZ
INSTRUMENTS INC.

REV.	DESCRIPTION	DATE	BY
1	MODEL 465-R3 CURRENT	1-15-68	MB
2	P.C. BOARD MODIFIED	1-17-68	MB
3	COMPONENT LAYOUT	3-15-68	MB

PORT OFFICE BOX # 20 RELEASE SQUARE - GAINES, VALLEY, CALIFORNIA 95626 • (916) 628-3274 • FAX # 916-628-3274

4200 SYSTEM ISOKINETIC SAMPLER CONTROLLER MODULE

The Kurz 4200 system uses an flow is designed for use with the KURZ Series 730 electric control valves. The 4200 Controller accepts the stack velocity sensor's output as an external setpoint. It then compares the output from the sample mass flow meter to this external setpoint. If the two signals agree, isokinetic sampling is occurring. If not, the comparator sends a signal to the Series 730 valve. The 730 valve, by either opening or closing, increases or decreases the sampling rate until isokinetic sampling is restored.

LIST OF OPERATOR SWITCHES:

ON/OFF	Self-Explanatory
DISPLAY	Selects Velocity SFPM, Sample SCFM, Set-Point SCFM or Temperature degF
FUNCTION	Selects Isokinetic, Constant Flow Control, Manual Valve
MANUAL VALVE	Momentary Toggle Open or Close
FLOW CONTROL SETPOINT ADJUST	Locking Potentiometer

show picture here with callouts!

DESCRIPTION OF OPERATION SWITCHES

ON/OFF:

Self Explanatory Toggle Switch

DISPLAY:

Velocity SFPM:

When the DISPLAY select switch is on this position the indication displayed on the LCD readout is a reading expressed in standard feet per minute of stack velocity. The signal displayed comes from the stack velocity sensor.

Sample SCFM:

This is the position the switch will normally be on when operating the isokinetic sampler system. The reading displayed will be in engineering units and will be displaying the signal from the Series 505 sample rate mass flow sensor mounted inside the Series 193 enclosure. This flow rate is actual sample flow rate being extracted from the gas stream.

electronics

Setpoint SCFM:

In this position the display provides a reading derived from the setpoint reference voltage as set by the front-panel mounted Flow Control Setpoint Adjust locking potentiometer. It is possible to operate the 4200 system non-isokinetically by selecting the Constant Flow Control position selectable with the FUNCTION select switch. During non-isokinetic operation, that is, operation under constant flow control, a sample is pulled from the stack at a constant flow rate. In order to sample at a constant rate, the 4200 derives a flow control setpoint from the front panel mounted Setpoint Adjust locking potentiometer. Under constant flow control the system does not even look at the stack velocity sensor. Conversely, under isokinetic control the stack velocity sensor signal provides the varying setpoint to the 4200 Controller. So, this switch position is the one you will use when setting up or changing the flow control setpoint of your system via the front panel mounted locking Setpoint Adjust potentiometer. When this switch position is selected, the digital display will give an indication in engineering units of the setpoint derived from the Setpoint Adjust locking potentiometer on the front of the 4200 Controller module. Indeed, you can see the digital display readings change as you manually turn the Setpoint Adjust locking potentiometer.

Temperature degF:

When this switch position is selected the reading indicated on the digital display will be the stack temperature in degrees F. The signal comes from a standalone Platinum RTD mounted on the 4200 probe support. The temperature range is 0 to 500 degF.

NOTE: Temperature is an optional feature and is only provided if specified.

FUNCTION:

Isokinetic:

This is the position the FUNCTION select switch is normally on during operation as an isokinetic stack sampler. This position selects isokinetic control. The stack velocity sensor serves as a varying setpoint for flow control functions. The in-situ sample rate mass flow sensor built into the sampling line provides the sample flow rate signal to the flow control comparator. When the stack velocity sensor and the sample flow rate sensor are in balance isokinetic sampling is occurring and the flow control comparator does nothing (and leaves the flow control valve undisturbed). Any imbalance of course causes action in the flow control valve until an isokinetic sampling rate is restored.

Constant Flow Control:

This is the position the FUNCTION select switch would normally be set on to operate the 4200 as a constant sample rate flow controller. Or in other words to pull the sample from the stack at a constant rate rather than isokinetically sampling by tracking to the stack velocity. When operating as under Constant Flow Control, the flow control system in the 4200 Controller rack module makes use of its own internal setpoint signal as set via the front panel mounted setpoint adjustment potentiometer. The setpoint adjustment potentiometer provides a voltage reference signal that is inverted by the controller circuitry and fed into a comparator along with the flow signal from the sampling rate mass flow sensor mounted in series with the sampling line (on the isokinetic stack probe). The comparator then generates a voltage error signal which it sends to the flow control valve to change its position (either open or close it as needed any amount needed). The comparator generates the error signal to drive the valve based on the imbalance between the flow signal and the setpoint signal. Normally, the error signal sent to the valve drives the valve motor to open the valve if it is a positive 15 Vdc signal and drives the motor to close the valve if it is a minus 15 Vdc signal. The valve stays in its last position until it receives an error system, and only moves while an error signal is present.

why (when) would you want to do this?

signal

Manual Valve:

When this switch position is selected the controller allows the operator to manually operate the MANUAL VALVE switch. This switch allows the operator to manually open or close the valve at will. The switch is a momentarily closed toggle switch. Since the valve starts moving and keeps moving either toward open or toward close only when a plus or minus 15 Vdc voltage is applied to its motor, the operator must hold down the switch in the desired position to create opening motion or closing motion in the valve. When released the MANUAL VALVE switch automatically springs back to the non-active center position. If the operator desired to see the effect on flow of manually opening or closing the valve the DISPLAY select switch should be set on Sample SCFM.

MANUAL VALVE:

This is a momentary closed center off switch which allows the operator to manually open or close the flow control valve to a degree proportional to how long the operator holds the switch down. Valve motor speed is typically 30 seconds from full open to full close although other speeds are often specified. Thus, the operator would have to hold the switch down a full 30 seconds to move from full closed to full open, or 15 seconds to move from full closed to half open, etc. The FUNCTION select switch must have Manual Valve selected in order for the operator to use the MANUAL VALVE Open/Close toggle switch. Further, the DISPLAY select switch is normally set on Sample SCFM to allow the operator to verify that flow is indeed changing as the valve is manually opened or closed.

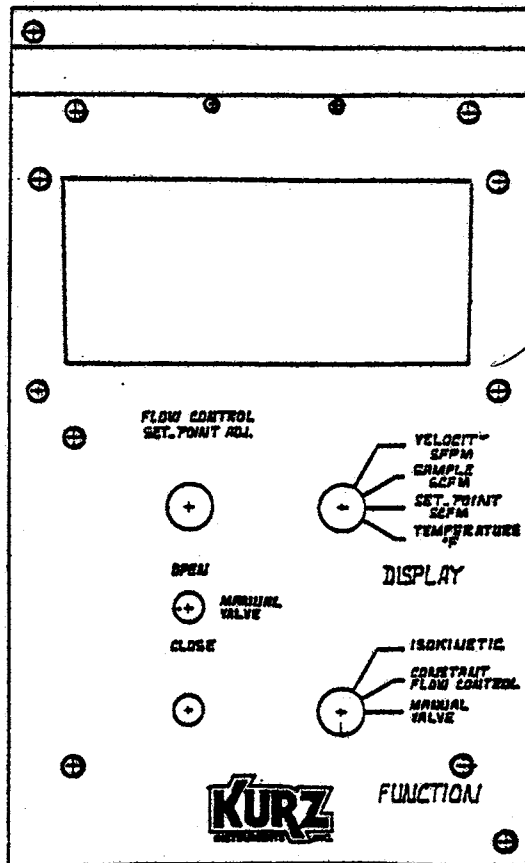
FLOW CONTROL SETPOINT ADJUST:

This is the front panel mounted locking potentiometer to provide setpoint adjustment when the KURZ Isokinetic Sampler Controller system is relying on an onboard setpoint signal rather than isokinetically tracking the stack velocity sensor. This front-panel mounted locking potentiometer has a simple potentiometric effect on a supplied voltage which it trims to between 0 and 5 Vdc to supply the setpoint signal to the controller comparator. This potentiometer is a 10-turn potentiometer.

2.5V per turn?

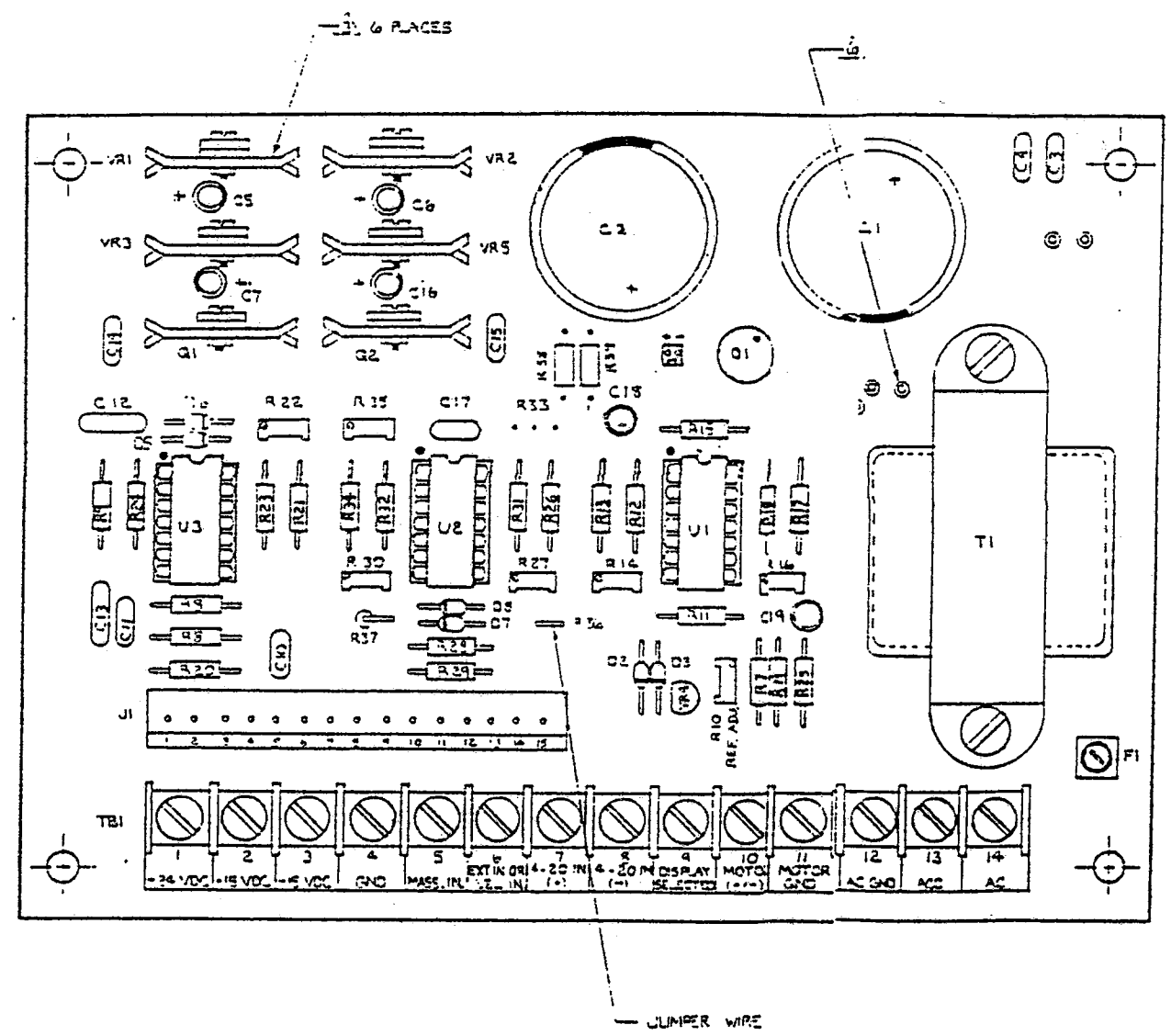
A NOTE ABOUT OPERATION UNDER CONSTANT FLOW CONTROL:

During operation as a constant flow controller the sample rate mass flow sensor is operating as a simple mass flow meter. Normally, Kurz mass flow meters, such as the Series 505, have a 10:1 rangeability or better. In flow meters such as the 505 the mass flow sensor sits behind a flow conditioning nozzle and also has typically 10 pipe diameters straight section upstream of the nozzle and mass flow sensor. This provides good flow conditioning.



MODEL 4200 ISOKINETIC SAMPLER RACK PANEL

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	ADDED R36, R37, R38, R39, CHANGED C1 AND C2, ADDED NOTES, ADDED J1 PIN DESCRIPTION, REMOVED R33, R35, R38, CHANGE R30 TO 20K AND R35 TO 15K.	2/25/86	J. H. [unclear]
B	CHANGED PER ESD A71047001 AND A71047002	5/7/87	J. H. [unclear]

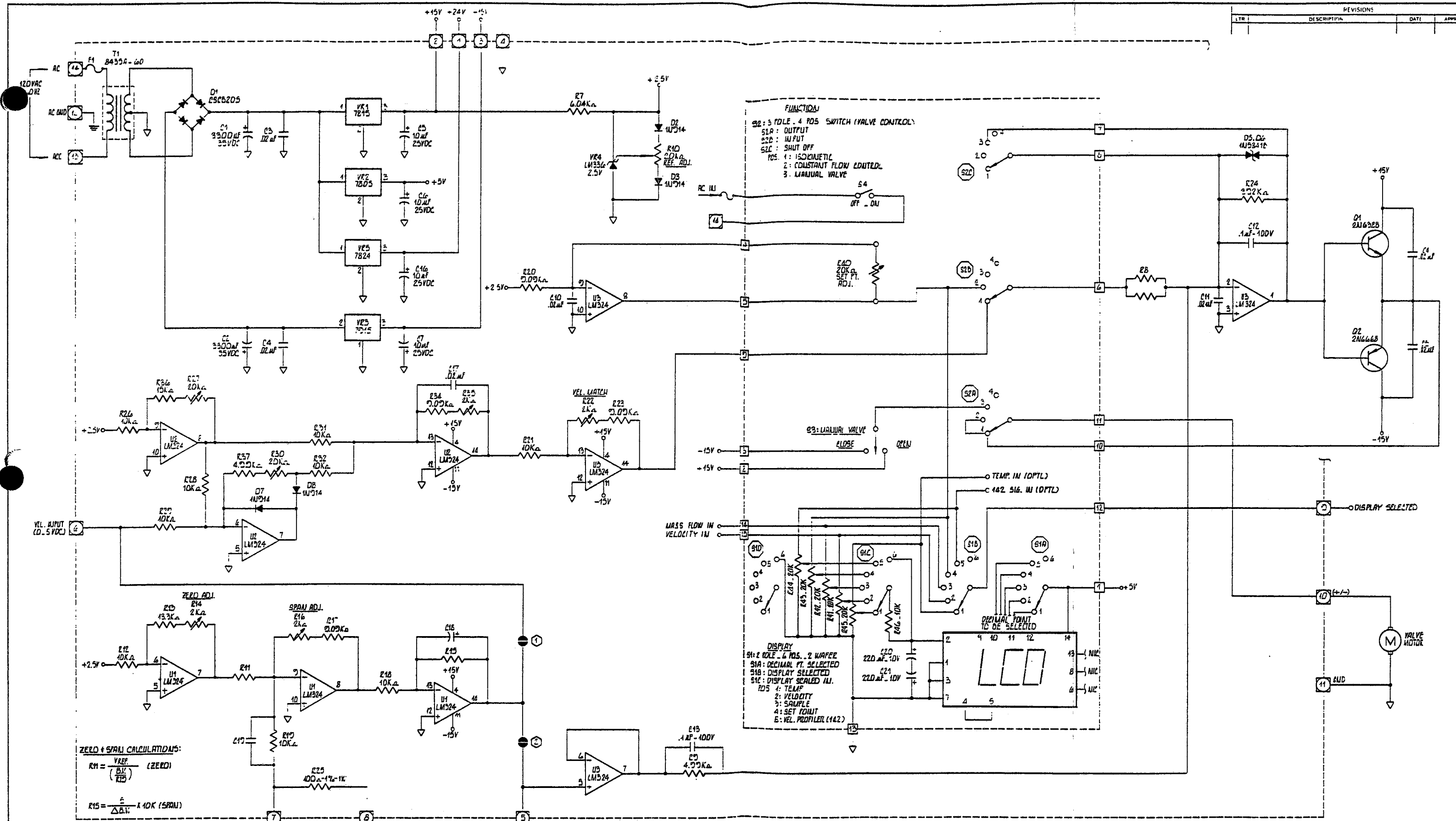


REF. DES.	DESCRIPTION	QTY.
R13	13.3 K Ω	1
R12, R19, R19, R21, R20, R28, R29, R31, R32	10 K Ω	9
R4, R37	4.99 K Ω	2
R3, R11, R151	SELECTED	3
R7	RESISTOR 6.04 K Ω	1
C18, C19	CAPACITOR SELECTED	2
C12, C13	CAPACITOR .1 μ F - 100VDC	2
	22AWG SOLID TIN JUMPER WIRE	1
C5, C6, C15, C16	CAPACITOR 10 μ F - 25VDC	4
C3, C4, C10, C11, C14, C15, C17	CAPACITOR .02 μ F - 50VDC	7
C1, C2	CAPACITOR 3300 μ F - 35VDC - MIC (MPL 0532M 35V (40))	2
D5, D6	SELECTED	2
T1	TRANSFORMER * 2435A-60	1
D2, D3, D7, D8	DIODE IN 914	4
D1	BRIDGE RECTIFIER CSC 320S	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 + HEATSINK - 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

- NOTES: UNLESS OTHERWISE SPECIFIED.
- THIS DWG. TO BE USED IN CONJUNCTION W/ SCHEMATIC DIAGRAM DWG. 071031007, 071030003, 071031004.
 - LAST REF. DES. USED ARE: TB1, J1, F1, T1, U3, D8, D3, VR5, C21, R42, S4.
- ▲ SEE DWG. # A70003 FOR HEAT SINK ASSY.
 - ▲ D5, D6 TO BE SELECTED AND ASSEMBLED W/ 1/16" CLEARANCE FROM BOARD
 - ▲ FOR ENVIRONMENTAL REQUIREMENT USE HALLOW CAPACITOR 1500 μ F - 40V
 - ▲ T1 CENTER TAP WIRE (STRIPPED) SOLDER TO PAD INDICATED.
 - ▲ T1 MOUNTING HARDWARE - #10-32 X 1/4" SCR., WASHER, NUT 2 PLACES.

REF. DES.	DESCRIPTION	QTY.
R7 R10 R30	POTENTIOMETER 20K	3
R14, R16, R22, R35	POTENTIOMETER 2K	4
R25	RESISTOR 100 Ω - 1% - IV R3437	1
R24	RESISTOR 392 K Ω	1
R17, R20, R23, R34	RESISTOR 9.09 K Ω	4
REF. DES.	DESCRIPTION	QTY.

PART LIST	
DESCRIPTION	QTY.
KURZ INSTRUMENTS Inc	
MODEL 710 RI FLOW CONTROLLER COMPONENT LAYOUT	
2/1	D 071031005



ZERO & SPAN CALCULATIONS:

$$R1 = \frac{V_{REF}}{\frac{B.V.}{R15}} \quad (\text{ZERO})$$

$$R15 = \frac{E}{\Delta B.V.} \times 10K \quad (\text{SPAN})$$

R1	10K	1/4W	5%
R2	10K	1/4W	5%
R3	10K	1/4W	5%
R4	10K	1/4W	5%
R5	10K	1/4W	5%
R6	10K	1/4W	5%
R7	10K	1/4W	5%
R8	10K	1/4W	5%
R9	10K	1/4W	5%
R10	10K	1/4W	5%
R11	10K	1/4W	5%
R12	10K	1/4W	5%
R13	10K	1/4W	5%
R14	10K	1/4W	5%
R15	10K	1/4W	5%
R16	10K	1/4W	5%
R17	10K	1/4W	5%
R18	10K	1/4W	5%
R19	10K	1/4W	5%
R20	10K	1/4W	5%
R21	10K	1/4W	5%
R22	10K	1/4W	5%
R23	10K	1/4W	5%
R24	10K	1/4W	5%
R25	10K	1/4W	5%

U1	LM324	4	44	5540C
U2	LM324	4	44	5540C
U3	LM324	4	44	5540C
U4	LM324	4	44	5540C
U5	LM324	4	44	5540C
T1	7815	1	44	5540C
T2	7824	1	44	5540C
T3	7824	1	44	5540C
T4	7824	1	44	5540C
T5	7824	1	44	5540C
T6	7824	1	44	5540C
T7	7824	1	44	5540C
T8	7824	1	44	5540C
T9	7824	1	44	5540C
T10	7824	1	44	5540C
T11	7824	1	44	5540C
T12	7824	1	44	5540C
T13	7824	1	44	5540C
T14	7824	1	44	5540C
T15	7824	1	44	5540C
T16	7824	1	44	5540C
T17	7824	1	44	5540C
T18	7824	1	44	5540C
T19	7824	1	44	5540C
T20	7824	1	44	5540C
T21	7824	1	44	5540C
T22	7824	1	44	5540C
T23	7824	1	44	5540C
T24	7824	1	44	5540C
T25	7824	1	44	5540C

1 FOR COMPONENT LAYOUT DIAGRAM SEE No. D71031005

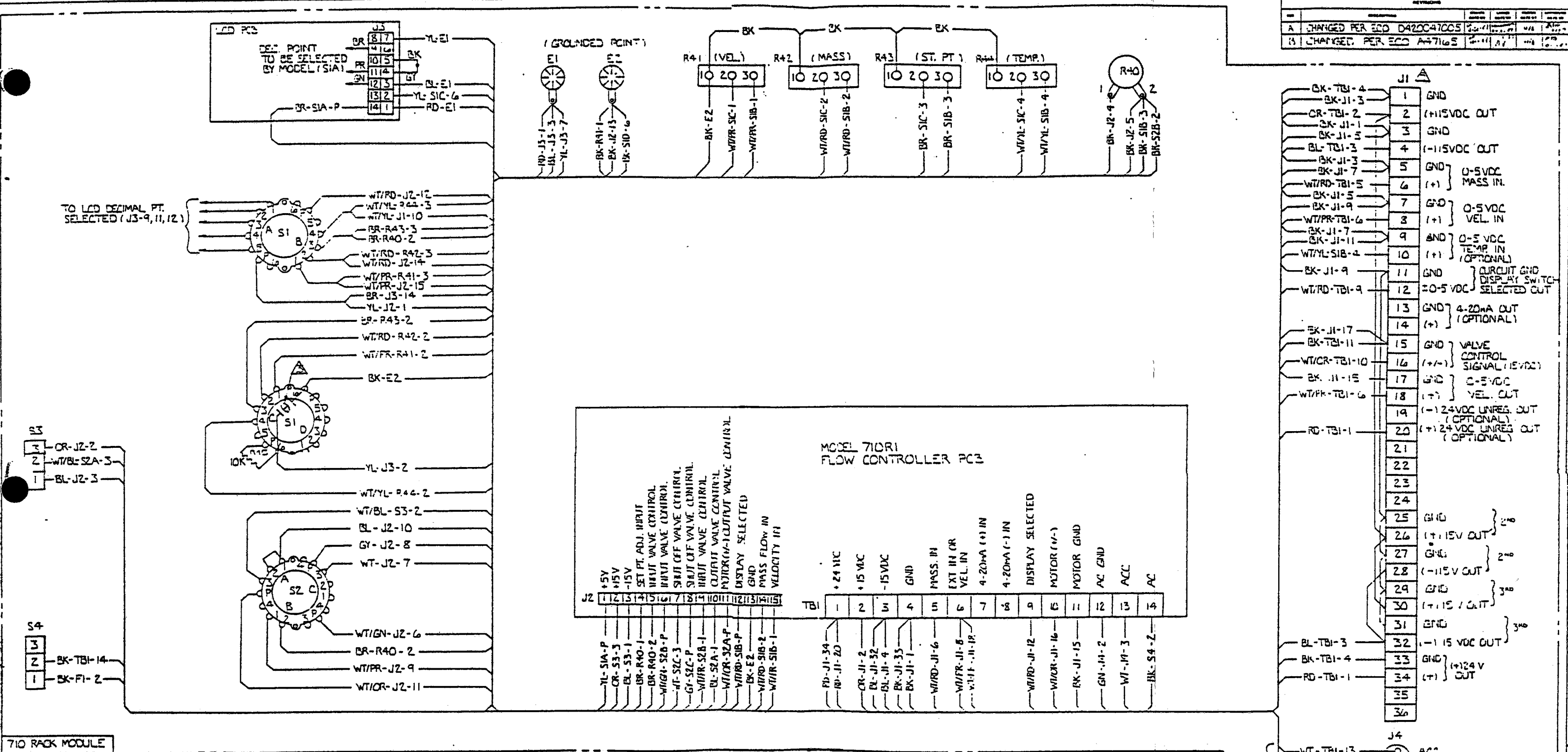
TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES

KURZ INSTRUMENTS INC.

MODEL T10R1 SCHEMATIC DIAGRAM (USE ON 4200 SYSTEM)

APPROVALS	DATE
DESIGNED BY: BIRN	2/26/86
CHECKED BY: J.D.	2/28/86
SCALE	SIZE
NONE	D
DRAWING NO.	D7103003

DO NOT SCALE DRAWING 1 SHEET 1 OF 1



A	CHANGED PER ECO D420047005	2/2/77	W/S	...
B	CHANGED PER ECO A-7165	2/2/77	W/S	...

- NOTES: UNLESS OTHERWISE SPECIFIED.
- ALL REF. DES. ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS.
 - ALL WIRES SHALL BE A MIN. OF #22AWG, EXCEPT ON RIBBON CABEL USED FOR J3.
CAP: 100µF-10V NONPOLARIZED (C20 f 21: 2-200µF-10V).
 - MIN. OF 18 AWG. WIRE.
 - USE FEMALE 36 PIN CONNECTOR W/ MALE PINS

- SIA: DECIMAL POINTS
 SIB: DISPLAY SWITCH SELECTED OUTPUT LINEAR.
 SIC: DISPLAY SCALED INPUT
 POS: 1. VELOCITY
 2. SAMPLE
 3. SET POINT
 4. TEMP.
- S2A: VALVE CONTROL (OUTPUT)
 S2B: VALVE CONTROL (INPUT)
 S2C: VALVE CONTROL (SHUTOFF)
 POS: 1. ISOKINETIC
 2. CONSTANT FLOW CONTROL
 3. MANUAL VALVE

LCD DECIMAL POINT		
DECIMAL PT.	4-1/2 DIGIT	3-1/2 DIGIT
BR-J3-9	1. XXXX	1. LXXX
WT-J3-10	DUMMY ZERO	N/C
PR-J3-11	1XX.XX	1XX.X
GN-J3-12	1X.XXX	1X.XX

DATE	BY	CHKD	DATE

KURZ INSTRUMENTS INC.

MODEL 4200 IK-EVA
 710R1D INTERNAL WIRING
 DIAGRAM (W/ 36-PIN CONNECTOR)

DATE: 12/15/77
 BY: [Signature]
 CHKD: [Signature]

ECO: D420032025

The Series 151 and 142 Option

Series 151 electronics incorporate signal conditioning, linearization and multipoint averaging of the sensor signals connected to the series 151 unit.

The series 151 unit receives one or more sensor flow input signals through a field wiring terminal strip. The maximum number of signal inputs for each series 151 unit is eight (8).

An example of the number of linear cards required is as follows: If the system requirement was five (5) sensors then five (5) linear cards would be required located at the mother board. If the system required eight (8) sensors, then eight (8) linear cards would be required. However, if the requirement was for nine to sixteen sensors an auxiliary module would be required.

This auxiliary 151 a slave unit A will be summed with the master unit. As many as three (3) auxiliary units may be summed with the master unit for a maximum of thirty-two (32) sensors averaged together.

Sensor signals are in the form of a current loop. Voltage is sensed by means of current path through a high quality current sense resistor associated with it. The current sense resistors are located on a mother board which also has attached to it the signal conditioning, linearization and multipoint averaging electronic circuits. The signal conditioning and linearization of the flow signals are performed by one or more linear circuit cards. These cards are mounted to the mother board on standoffs. The power input and signals in and out are connected from mother board to linear circuit card by means of gold plated snap-on connectors and ribbon cables.

Signal from the current sense resistor is input to the linear circuit cards through the above-mentioned ribbon cable connector. This signal is zero-based (normalized to zero) and spanned (adjusted for maximum) to yield a signal over the calibrated flow range of zero to five (0-5) volts DC. The adjusted signal in turn is adjusted once again through a linearization method to give an output signal proportional to flow. This output signal is scaled for zero to five (0-5) volts DC linear. Signal from the linear output is sent via the ribbon cable to the mother board to be summed and averaged with any other linear output signals.

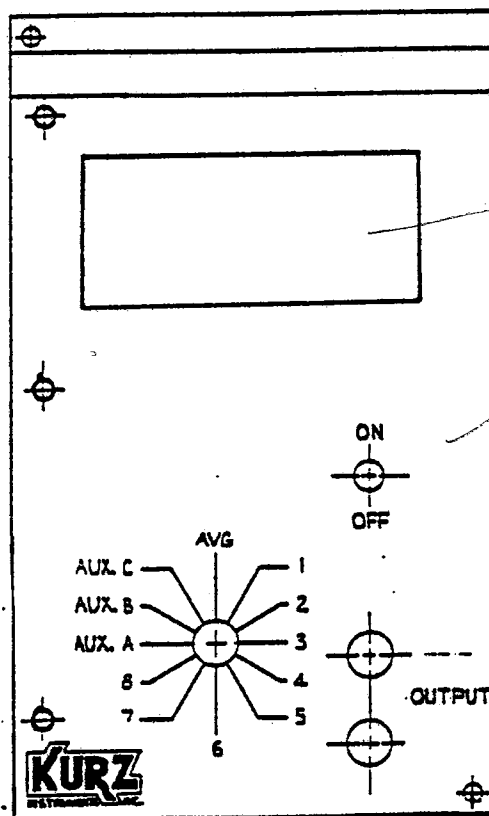
If there are more than eight (8) sensor signals, the average signal(s) from the auxiliary slave module(s) will be summed and averaged with the master module. This in turn yields an overall system signal average. The voltage level output signal for the system average is a linear zero to five (0-5) volts DC.

The 142 profiler option allows the system user to read the individual signals by selecting them through rotation of a selector switch and banana plug jacks which brings out the linear voltages. The first position on the master panel with a 142 option would be averaged with sensor positions following, up to a maximum of eight. The selector switch will be locked out at a position representing the maximum number of sensors if less than eight. The auxiliary modules will have switch positions of nine through sixteen, seventeen through twenty-four, and twenty-five through thirty-two for auxiliary modules A, B and C respectively.

The auxiliary modules do not have an average position, as the average is the overall system average.

The D-option provides the user with a 4-1/2 digit display readout for direct reading of the system flow.

As noted above the 142 and -D are optional and are not provided the user unless specified in the customer purchase order.

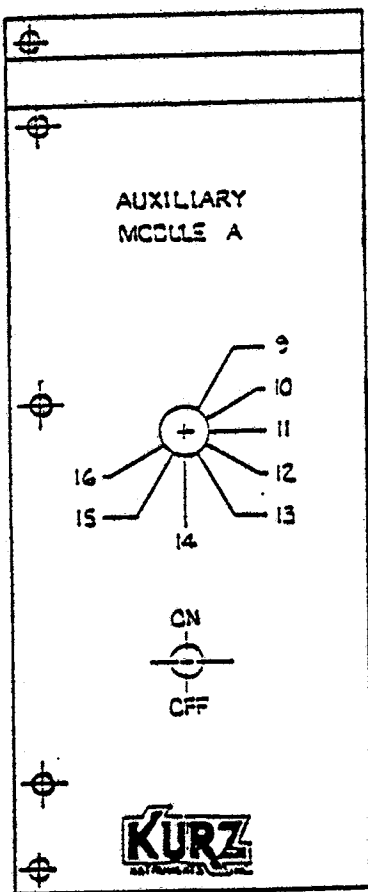


D option only?

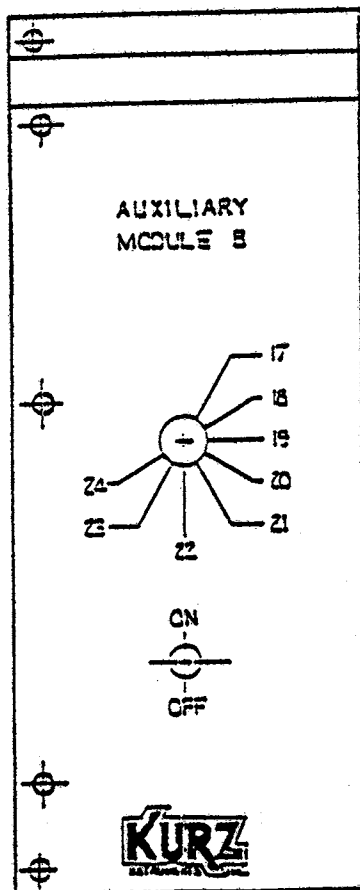
Does this look the same with or without the 142 option?

MODEL 151 MASTER PANEL

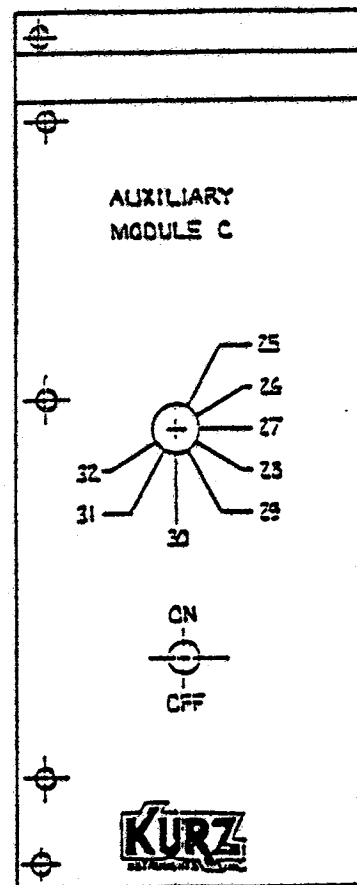
MODEL 151 SLAVE PANELS



AUX. PANEL A



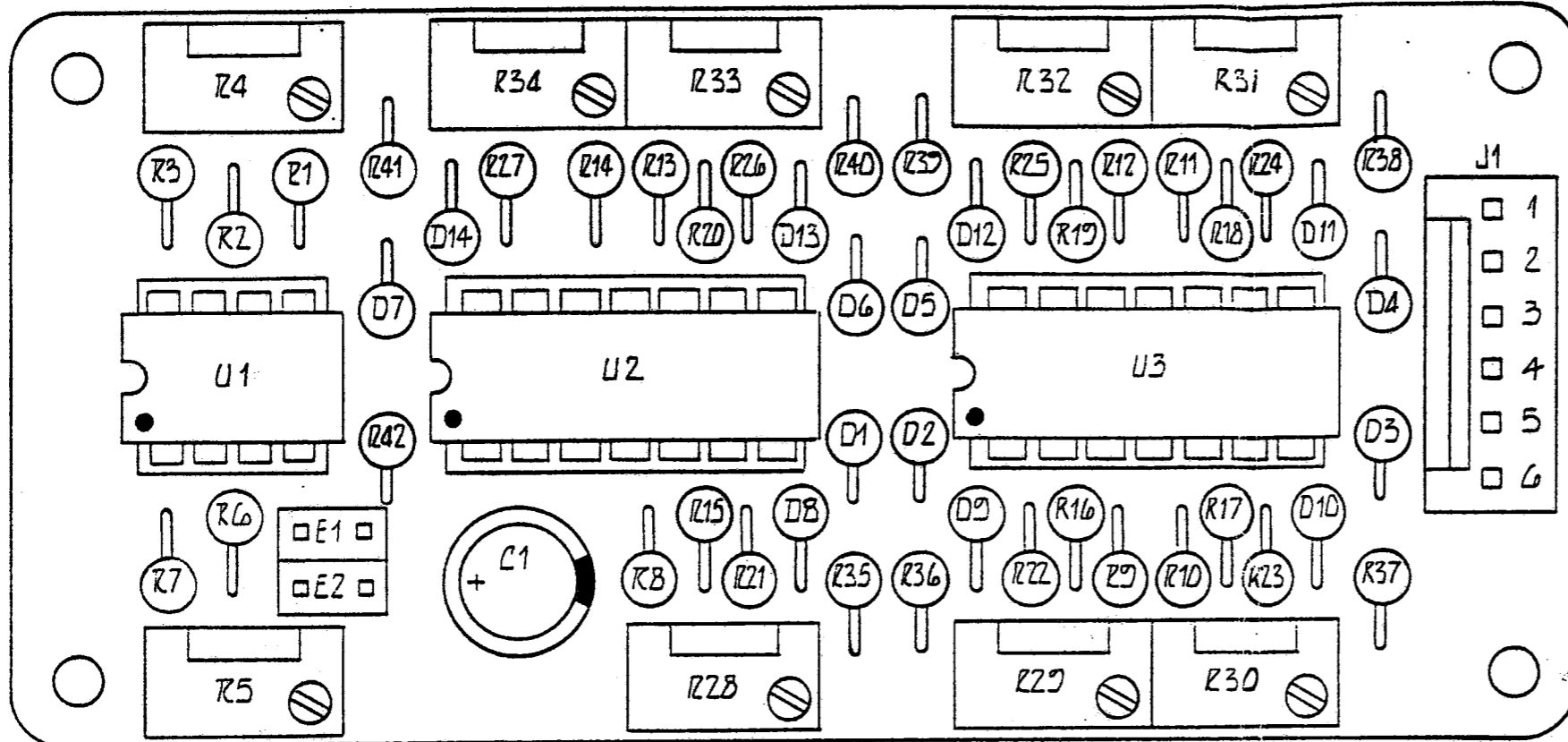
AUX. PANEL B



AUX. PANEL C

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REVISIONS				
REV.	DESCRIPTION	DRAWN DATE/BY	CHECK DATE/BY	APPROVED DATE/BY
A	REVISED PER ECO A14347005	Carson 3-30-87	J 4-1-87	MLB 4/1/87



RET. IN
 -5V
 -12V
 GND
 +15V
 LIN. OUT

ITEM	REF. DES.	DESCRIPTION	QTY
21	R4	POTENTIOMETER - 10 K Ω	1
20	R17	RESISTOR 35.7 K Ω	1
19	R16	28.1 K Ω	1
18	R15	23.2 K Ω	1
17	R8, R10	20 K Ω	7
16	R7	SELECTED	1
15	R6	9.09 K Ω	1
14	R3	9.09 K Ω	1
13	R2	SELECTED	1
12	R1	RESISTOR 10 K Ω	1
11	R28, R34	POTENTIOMETER - 20 K Ω 64W203	7
10	R5	POTENTIOMETER - 2 K Ω 60W202	1
9	C1	CAPACITOR - 100 μ F - 16V ELECTROLYTIC	1
8	D1, D14	DIODE - 1N914	14
7	E1, E2	HEADER - 2 PIN (.100) - MOLEX	2
6	U2, U3	IC - OP. AMP. - LM324	2
5	U1	IC - OP. AMP. - LM2904	1
4		SOCKET - DIP - 14 PIN	2
3		SOCKET - DIP - 8 PIN	1
2	J1	CENTER HEADER (.100) - MOLEX No. 22-11-2062	1
1		PRINTED CIRCUIT BOARD No. A14365003	1

PARTS LIST

26	R42	RESISTOR	10K Ω	1
25	R35, R41		10K Ω	7
24	R21, R27		.5 Ω	7
23	R20		140 K Ω	1
22	R19		69.8 K Ω	1
21	R18	RESISTOR	46.4 K Ω	1

PARTS LIST CONT.

- NOTES:
- SEE DWG. No. B14330002 FOR SCHEMATIC DIAGRAM.
 - ALL DIODES TO BE ASSEMBLED WITH CATHODE TO PCB.
 - MICRO SHUNT (JUMPER) TO BE USED WITH ITEM 7 AS REQ'D.
 - FOR NON-LIN. SIG. OUT U2, U3, D1, D14, C1, R8 - R42 ARE NOT REQ'D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	TOLERANCES ARE	APPROVALS	
	FRACTIONS = 1/32	DRAWN BY D. Dieck	DATE 7/11/86
	ANGLES = 0° - 30°	CHECKED BY J. Carson	DATE 9/3/86
	DECIMALS .X = 0.1 .XX = 0.03 .XXX = 0.005 .XXXX = 0.0010	DESIGN	DATE
ORIG. RELEASE DATE	APPROVED M. Feldner	DATE 9/11/86	
	BASELINED	DATE	

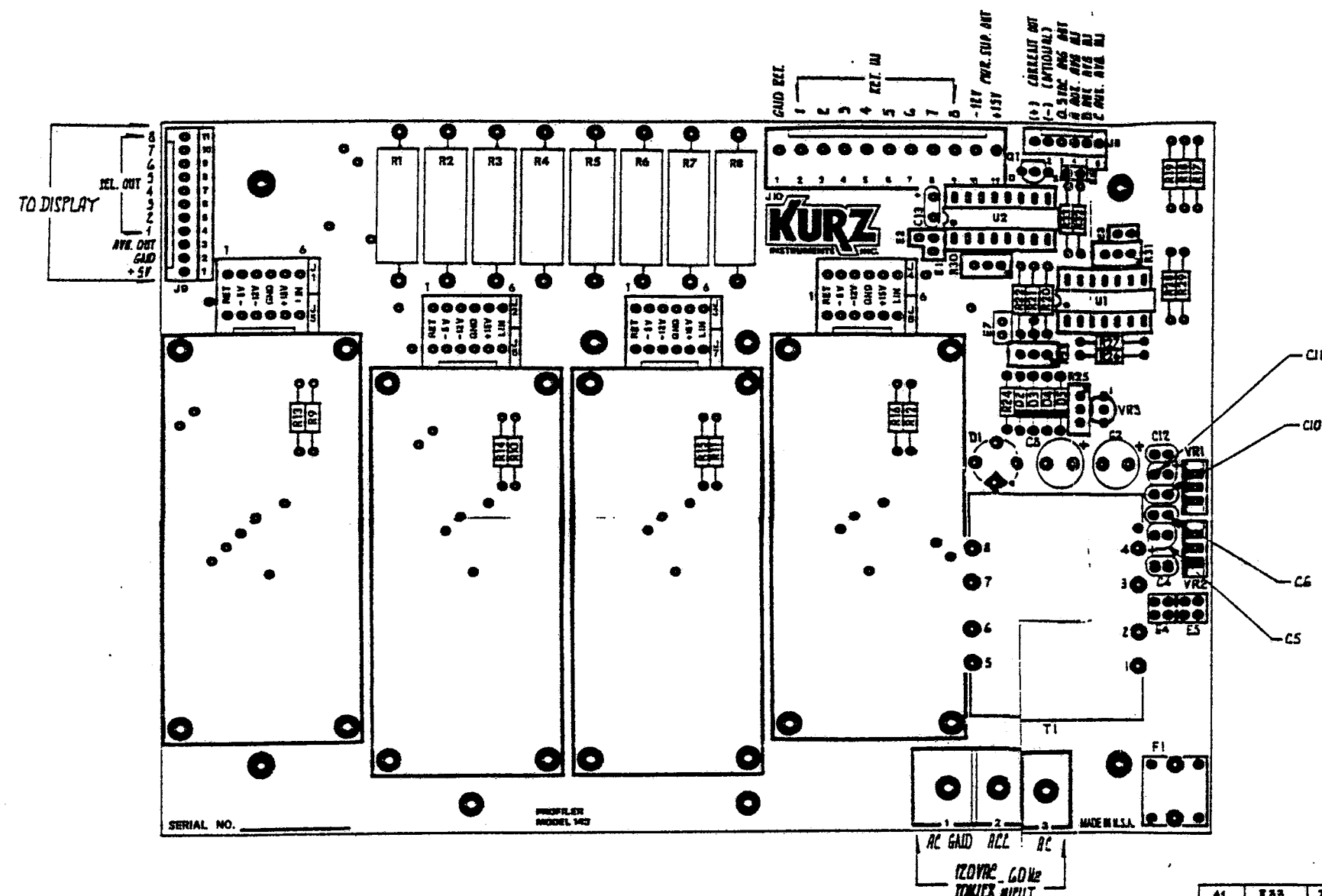
KURZ INSTRUMENTS INC.

LZ

MODEL 143 - PROFILER
 SIGNAL LINEARIZER (NON-LIN.)
 COMPONENT ASSY. LAYOUT.

DWG. SIZE B	DWG. NO. B14331002	REV. A
SCALE 3/1	SHEET 1 OF 1	

REVISIONS			
NO.	DESCRIPTION	DATE	BY
A	REVISED PER ECO 314347008		N/A
B	REVISED PER ECO 314347010		N/A

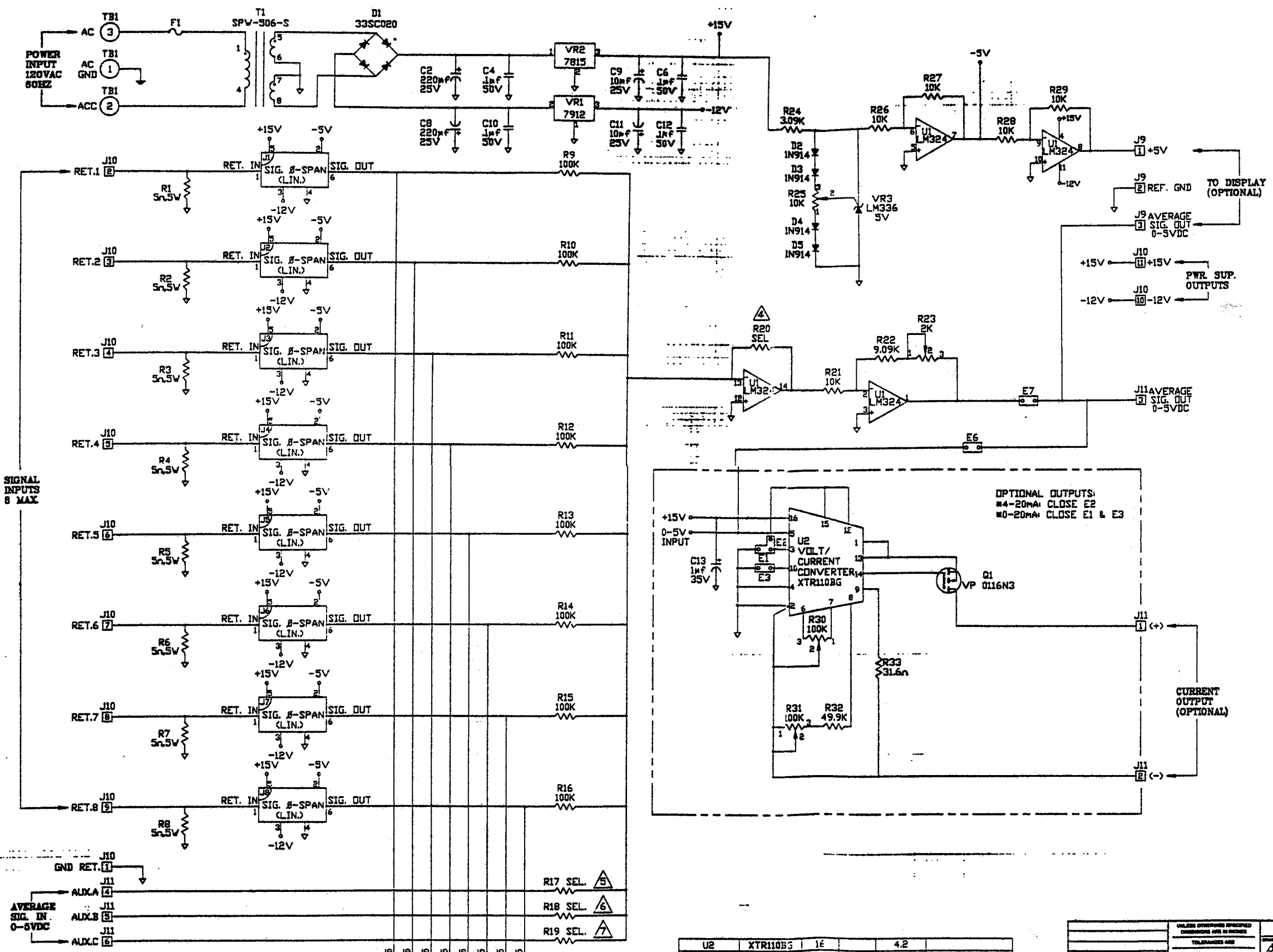


ITEM	REF. DES.	DESCRIPTION	QTY
32	Z25	RESISTOR 10K Ω	1
31	Z28	10K Ω	1
30	Z27	10K Ω	1
29	Z26	10K Ω	1
28	Z24	3.09K Ω	1
27	Z22	7.09K Ω	1
26	Z21	10K Ω	1
25	Z20	SELECTED	1
24	R7, R10	SELECTED	5
23	R7, R16	100K Ω	AR
22	Z1, Z8	RESISTOR 5.0 .5W DALE	AR
21	Z25	POTENTIOMETER 10K Ω .64W403	1
20	Z25	POTENTIOMETER 2K Ω .64W402	1
19	C1, C10, C2	CAPACITOR .1 μ F .50V CERAMIC	4
18	C5, C8	CAPACITOR 10 μ F .25V ELECTROLYTIC	2
17	C2, C6	CAPACITOR 220 μ F .25V ELECTROLYTIC	2
16			
15	J0	CELTIC HEADER (.156) MOLEX 03.72.211.11PW	1
14	J0	(.100) MOLEX 22.11.2112.11PW	1
13	J1, J8, J9	CENTER HEADER (.100) MOLEX 22.11.2062.6PW	3
12	VR3	VOLTAGE REGULATOR +5V . LM356 . 5V	1
11	VR2	5V . LM356	1
10	VR1	VOLTAGE REGULATOR -12V . LM7512	1
9	D2, D5	DIODE 1N914	4
8	D1	BRIDGE RECTIFIER .9532020 . MURTEL	1
7	U1	IC, OP. AMP LM324	1
6		SOCKET . DIP . 14 PIN	1
5		FUSE HOLDER . POWER DYNAMICS	1
4	F1	FUSE . SELECTED	1
3	T1	TRANSFORMER .3PW.506.3 FROM MAMMETICS	1
2		TERMINAL BLOCK . 5PIN .518 CENTER BEAU	1
1		PRINTED CIRCUIT BOARD No. 614345001	1

ITEM	REF. DES.	DESCRIPTION	QTY
41	R33	RESISTOR 31.6 Ω	1
40	Z32	RESISTOR 42.5 K Ω	1
39	R31	POTENTIOMETER 100K Ω .64W404	1
38	Z30	POTENTIOMETER 100K Ω .64W104	1
37	C13	CAPACITOR 1 μ F .35T TRUJ	1
36	E1, 3, 6, 7	HEADER . 2 PIN . MOLEX	AR
35	Q1	TRANSISTOR .DMOS POWER FET SUPERTEX . 170M6A3	1
34	U2	IC, VOLTAGE / CURRENT CONVERTER BURK BRUNN . ITH103G	1
33		SOCKET . DIP . 16 PIN	1

- NOTES:
- SEE DWG. No. D14350001 FOR SCHEMATIC DIAGRAM.
 - USED AS REQUIRED.
 - ELECTROSTATIC SENSITIVE DEVICES SHALL BE HANDLED AND ASSEMBLED AT STATIC FREE STATION ONLY.
 - MICRO SHUNT (JUMPER) SHALL BE USED AS REQUIRED.
 - RESISTORS R1 THRU R8 TO BE MOUNTED 1/4" UP OFF THE PCB.

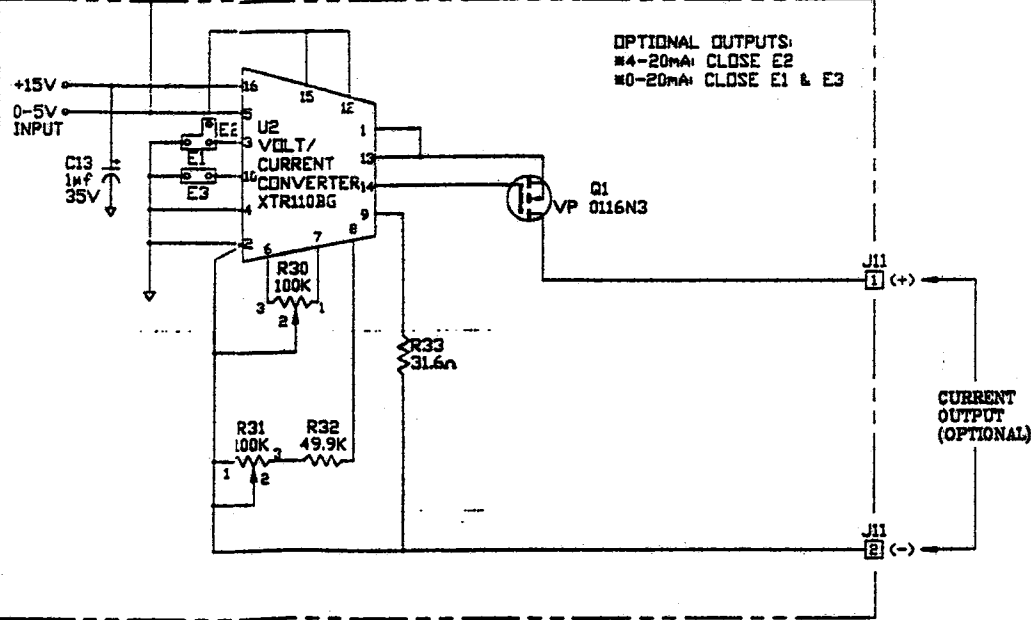
OPTIONAL PARTS LIST		APPROVALS		PARTS LIST	
DATE	BY	DATE	BY	DATE	BY
KURZ INSTRUMENTS INC.		MODEL 143 - PROFILER POWER SUPPLY AND AVERAGER COMPONENT ASST. LAYOUT		D14331001	
DATE: 7-16-86		DRAWN: [Signature]		REV: B	
CHECKED: [Signature]		DATE: 7-6-87		BY: [Signature]	



- NOTES: UNLESS OTHERWISE SPECIFIED
- SEE DWG. NO. D14331001 FOR COMPONENT ASSY. LAYOUT.
 - ALL RESISTORS ARE IN OHMS 1/8 OR 1/4 W ± 1%.
 - SEE DWG. NO. B14330002 FOR SIGNAL β-SPAN (LIN./NON-LIN.) SCHEMATIC DIAGRAM.
- △ R20 SELECTED FOR SPAN:
R20 = TOTAL NO. OF SENSORS (MAX. OF 32)
100K
 - △ R17 SELECTED FOR AUXILIARY A:
R17 = NO. OF SENSORS @ AUX. A
100K
 - △ R18 SELECTED FOR AUXILIARY B:
R18 = NO. OF SENSORS @ AUX. B
100K
 - △ R19 SELECTED FOR AUXILIARY C:
R19 = NO. OF SENSORS @ AUX. C
100K

SIGNAL INPUTS 8 MAX

AVERAGE SIG. IN 0-5VDC



REF. DES.	IC. NO.	1	2	3	4	5	6	7	8
U2	XTR110B3	1E			4.2				
U1	LM324	4	11	3.5,10,12					

REF. DES. I.C. NO. +15V -12V GND UNUSED OUTPUTS

LAST USED	NOT USED
D5	
R33	
C13	C1,C3,C7,C9
E7	E4,E5
J11	
VR3	
Q1	
F1	
T1	

REF. DES. TABLE

KURZ INSTRUMENTS INC.

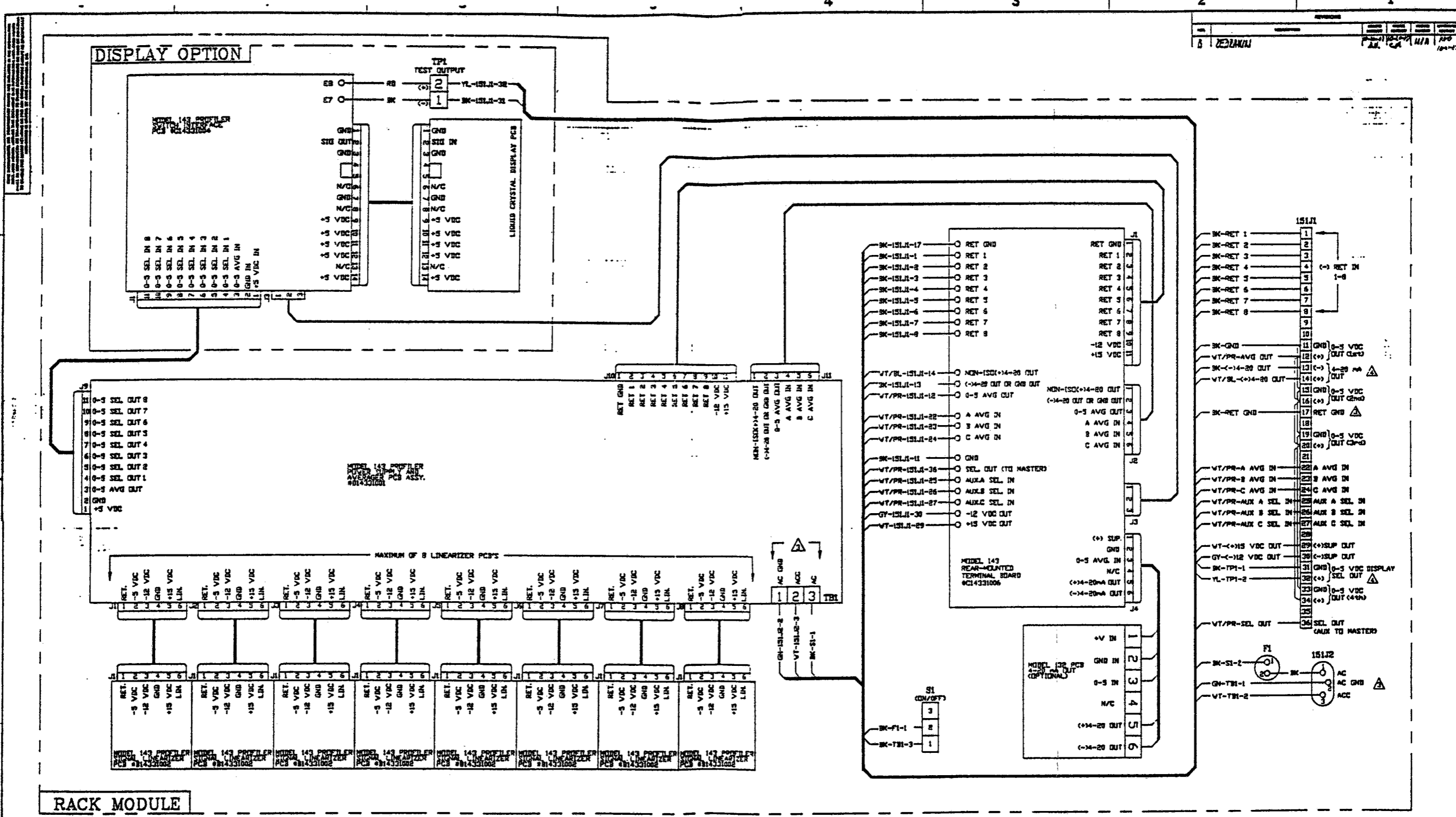
MODEL 143 PROFILER LINEAR SIGNAL POWER SUPPLY AND AVERAGER SCHEMATIC DIAGRAM

DWG. NO. D 14330001

SCALE NAME

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	TOLERANCES ARE	APPROVALS
FRACTIONS	± .005	DATE 11-14-87
ANGLES	± .01°	DATE 12-1-77
DECIMALS	± .001	DATE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS	TOLERANCES ARE	APPROVALS
FRACTIONS	± .01	DATE
ANGLES	± .1°	DATE
DECIMALS	± .01	DATE

J9 J9 J9 J9 J9 J9 J9 J9
1 2 3 4 5 6 7 8
SEL 0-5VDC OUT TO DISPLAY (OPT.)

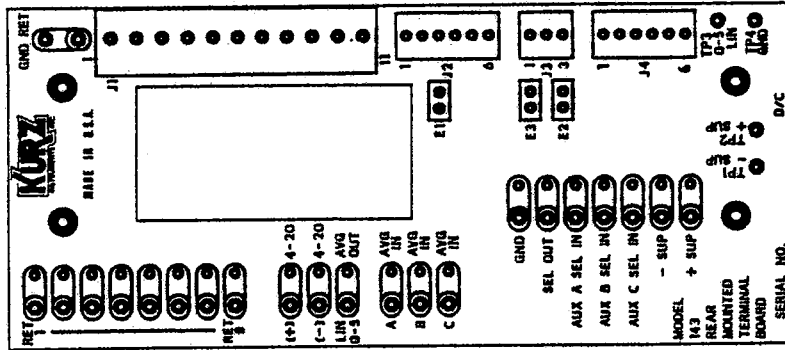


RACK MODULE

NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL WIRES SHALL BE A MIN. OF 22 AWG.
 2. REFERENCE DESIGNATORS AND PIN NUMBERS ARE FOR REF. ONLY AND MAY NOT APPEAR IN COMPONENTS.
 3. MINIMUM OF 22 AWG ARE RECOMMENDED FOR THESE CONNECTIONS.
 4. OPTIONAL.

KURZ INSTRUMENTS INC.																																																																																																																																																																																																																																																																			
<table border="1"> <tr> <th>REV.</th> <th>DATE</th> <th>BY</th> <th>CHKD.</th> </tr> <tr> <td>1</td> <td>10-16-77</td> <td>D. Vandy</td> <td></td> </tr> <tr> <td>2</td> <td>10-28-77</td> <td>J. 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DATE	BY	CHKD.	1	10-16-77	D. Vandy		2	10-28-77	J. Yule		3				4				5				6				7				8				9				10				11				12				13				14				15				16				17				18				19				20				21				22				23				24				25				26				27				28				29				30				31				32				33				34				35				36				37				38				39				40				41				42				43				44				45				46				47				48				49				50				<table border="1"> <tr> <td>MODEL 151 MASTER PANEL VELOCITY LINEAR PROFILER RM INTERNAL WIRING DIAGRAM (N/MOLEX CONNECTOR)</td> </tr> <tr> <td>DATE: 10-16-77</td> </tr> <tr> <td>BY: D. Vandy</td> </tr> <tr> <td>CHKD: J. Yule</td> </tr> <tr> <td>REV: 1</td> </tr> <tr> <td>REV: 2</td> </tr> <tr> <td>REV: 3</td> </tr> <tr> <td>REV: 4</td> </tr> <tr> <td>REV: 5</td> </tr> <tr> <td>REV: 6</td> </tr> <tr> <td>REV: 7</td> </tr> <tr> <td>REV: 8</td> </tr> <tr> <td>REV: 9</td> </tr> <tr> <td>REV: 10</td> </tr> <tr> <td>REV: 11</td> </tr> <tr> <td>REV: 12</td> </tr> <tr> <td>REV: 13</td> </tr> <tr> <td>REV: 14</td> </tr> <tr> <td>REV: 15</td> </tr> <tr> <td>REV: 16</td> </tr> <tr> <td>REV: 17</td> </tr> <tr> <td>REV: 18</td> </tr> <tr> <td>REV: 19</td> </tr> <tr> <td>REV: 20</td> </tr> <tr> <td>REV: 21</td> </tr> <tr> <td>REV: 22</td> </tr> <tr> <td>REV: 23</td> </tr> <tr> <td>REV: 24</td> </tr> <tr> <td>REV: 25</td> </tr> <tr> <td>REV: 26</td> </tr> <tr> <td>REV: 27</td> </tr> <tr> <td>REV: 28</td> </tr> <tr> <td>REV: 29</td> </tr> <tr> <td>REV: 30</td> </tr> <tr> <td>REV: 31</td> </tr> <tr> <td>REV: 32</td> </tr> <tr> <td>REV: 33</td> </tr> <tr> <td>REV: 34</td> </tr> <tr> <td>REV: 35</td> </tr> <tr> <td>REV: 36</td> </tr> <tr> <td>REV: 37</td> </tr> <tr> <td>REV: 38</td> </tr> <tr> <td>REV: 39</td> </tr> <tr> <td>REV: 40</td> </tr> <tr> <td>REV: 41</td> </tr> <tr> <td>REV: 42</td> </tr> <tr> <td>REV: 43</td> </tr> <tr> <td>REV: 44</td> </tr> <tr> <td>REV: 45</td> </tr> <tr> <td>REV: 46</td> </tr> <tr> <td>REV: 47</td> </tr> <tr> <td>REV: 48</td> </tr> <tr> <td>REV: 49</td> </tr> <tr> <td>REV: 50</td> </tr> </table>	MODEL 151 MASTER PANEL VELOCITY LINEAR PROFILER RM INTERNAL WIRING DIAGRAM (N/MOLEX CONNECTOR)	DATE: 10-16-77	BY: D. Vandy	CHKD: J. Yule	REV: 1	REV: 2	REV: 3	REV: 4	REV: 5	REV: 6	REV: 7	REV: 8	REV: 9	REV: 10	REV: 11	REV: 12	REV: 13	REV: 14	REV: 15	REV: 16	REV: 17	REV: 18	REV: 19	REV: 20	REV: 21	REV: 22	REV: 23	REV: 24	REV: 25	REV: 26	REV: 27	REV: 28	REV: 29	REV: 30	REV: 31	REV: 32	REV: 33	REV: 34	REV: 35	REV: 36	REV: 37	REV: 38	REV: 39	REV: 40	REV: 41	REV: 42	REV: 43	REV: 44	REV: 45	REV: 46	REV: 47	REV: 48	REV: 49	REV: 50
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NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USE IN CONJUNCTION
 WITH SCHEMATIC DIAGRAM NO. C14330007.
 SEE JUMPER POSITION TABLE FOR
 JUMPER CONFIGURATION.



△

MASTER		JUMPER POSITION TABLE			AUXILIARY			
JUMPER	DESCRIPTION	JUMPER	OPEN	CLOSE	JUMPER	OPEN	CLOSE	DESCRIPTION
E1	C-CURRENT NON-ISO @ PIN 13	X			E1	X		NC
E2	AUX A SEL IN	X			E2	X		NC
E3	X				E3		X	SEL OUT TO MASTER

△

ITEM	QTY	PART NO.	REF. DES.	DESCRIPTION
10	4	46920201	TPI-4	CON. PIN. PCB TEST LEAD PINS
9				
8	A/R	46916101		2-PIN SHUNT, GOLD, 15-29-1027
7	3	46915901	E1.2.3	4-PIN HDR. GOLD, ID-89-2043
6				
5	1	46916201	J3	3-CIRC HDR. MOLEX, 22-11-2032
4	2	46916301	J2.4	6-CIRC HDR. MOLEX, 22-11-2062
3	1	46916501	J1	11-CIRC HDR. MOLEX, 09-72-2111
2				
1	1			P.C. BOARD NO. C14365009

PARTS LIST

ITEM	QTY	PART NO.	REF. DES.	DESCRIPTION
1	1			P.C. BOARD NO. C14365009
PARTS LIST				
KURZ INSTRUMENTS INC.				
MODEL 143, VELOCITY LINER PROFILER, REAR MOUNTED TERMINAL BOARD WITH 36 PIN CONNECTOR CUTOUT COMPONENT LAYOUT				
DATE	REV	BY	CHKD	APP'D
3-11-87	1	J. S. ...	J. S. ...	J. S. ...
3-19-87	2	J. S. ...	J. S. ...	J. S. ...
WITH 13 CONNECTOR UNPLUGGED FOR TESTING AND REPAIR				
SERIAL NO. C14331006				

1. This schematic diagram is intended to show the electrical connections between the components of the instrument and the external circuitry. It is not intended to show the physical layout of the components on the printed circuit board (PCB).

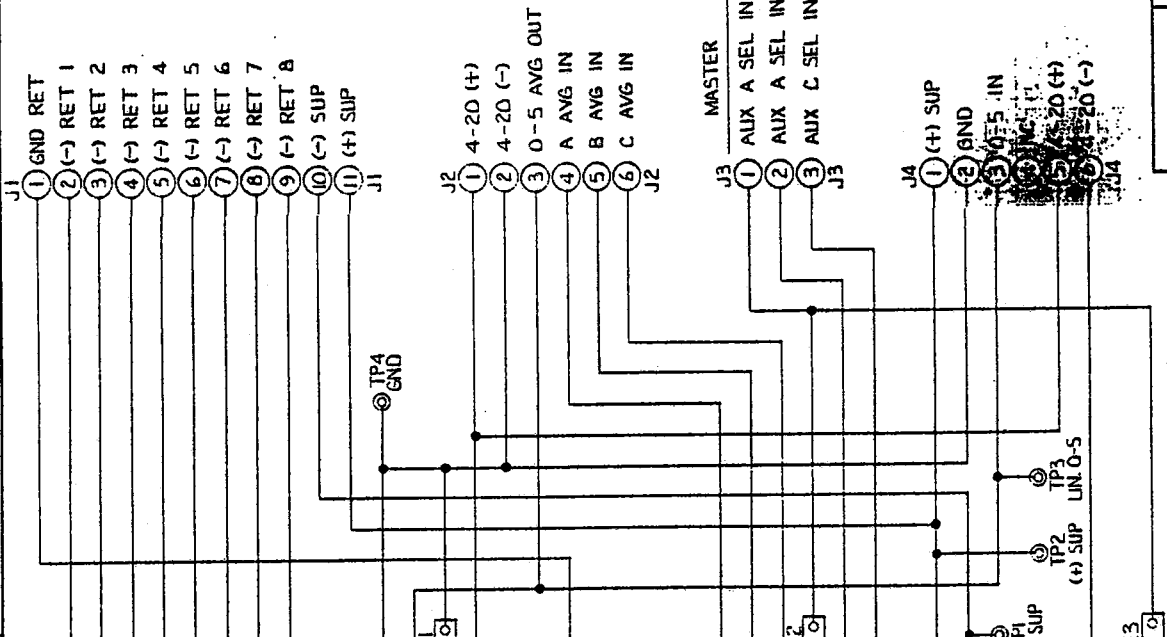
2. The components shown in this diagram are standard components and are not to be construed as a list of parts. The actual components used in the instrument may vary from those shown in this diagram.

3. The connections shown in this diagram are for the standard configuration of the instrument. The connections for optional features may vary from those shown in this diagram.

4. The connections for the master and auxiliary jumpers are shown in this diagram. The connections for the master and auxiliary jumpers may vary from those shown in this diagram.

36 POSITION CONNECTOR TO PCB

- (-) RET 1 (1)
- (-) RET 2 (2)
- (-) RET 3 (3)
- (-) RET 4 (4)
- (-) RET 5 (5)
- (-) RET 6 (6)
- (-) RET 7 (7)
- (-) RET 8 (8)
- NC (9)
- NC (10)
- GND (11)
- 1st LIN 0-5 VDC OUT (+) (12)
- 4-20 mA OUT (-) (13)
- 4-20 mA OUT (+) (14)
- 2nd LIN 0-5 VDC OUT (+) (15)
- OPTIONAL (16)
- RET GND (17)
- NC (18)
- NC (19)
- 3rd LIN 0-5 VDC OUT (+) (20)
- OPTIONAL (21)
- A AVG IN (22)
- B AVG IN (23)
- C AVG IN (24)
- AUX A SEL IN (25)
- AUX B SEL IN (26)
- AUX C SEL IN (27)
- NC (28)
- (+) SUP OUT (29)
- (-) SUP OUT (30)
- GND (31)
- SEL OUT (32)
- OPTIONAL (33)
- 0-5 DC (34)
- NC (35)
- NC (36)
- SEL OUT (AUX TO MASTER) (37)



JUMPER POSITION TABLE		AUXILIARY	
MASTER	JUMPER	DESCRIPTION	DESCRIPTION
OPEN	CLOSE	NON-TSO @ PIN 13	SEL IN
	X		E1
	X	AUX A SEL IN	E2
	X	NC	E3

REF. DES. TABLE	
LAST USED	NOT USED
E3	
J4	

MASTER		AUXILIARY	
JUMPER	DESCRIPTION	JUMPER	DESCRIPTION
OPEN	CLOSE	OPEN	CLOSE
	X		E1
	X		E2
	X		E3

APPROVALS

DESIGNED BY: [Signature] DATE: 3-11-87

CHECKED BY: [Signature] DATE: 3-12-87

DATE: 3-12-87

SCALE: NONE

REV: 1 OF 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

FINISHES: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

W/A

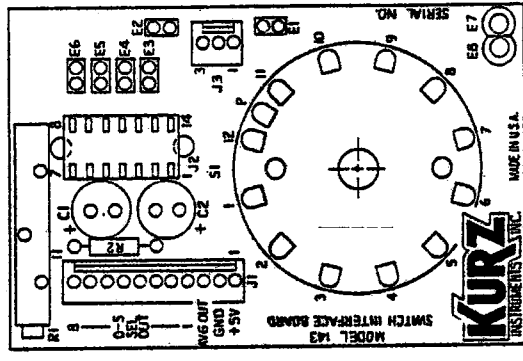
KURZ INSTRUMENTS INC.

MODEL 143 VELOCITY LINEAR PROFILER, REAR MOUNTED TERMINAL BOARD WITH 36 PIN CONNECTOR (OUTPUT, SCHEMATIC DIAGRAM)

FORM NO. C143 30007

REV. 1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM #C14330003.
 2. JUMPER TO BE USED WITH ITEM 8. SEE JUMPER POSITION TABLE.



JUMPER POSITION TABLE

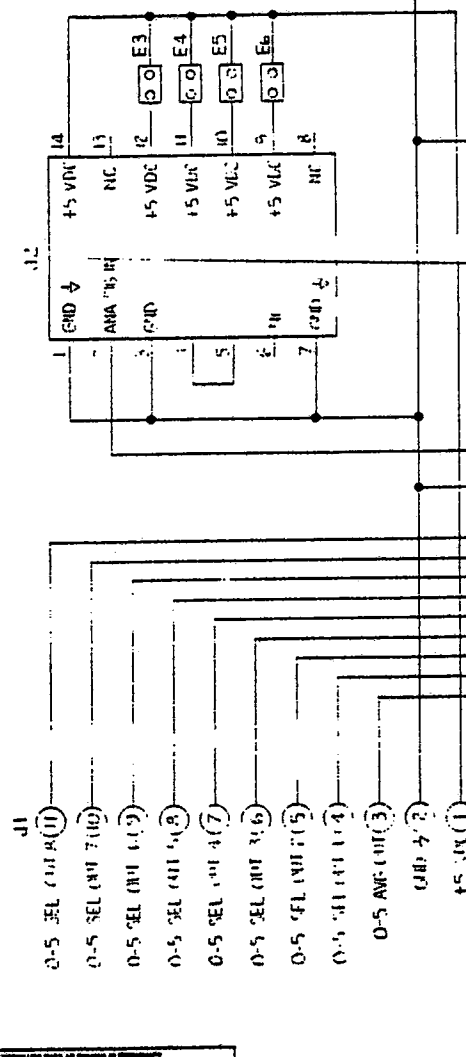
JUMPER	MASTER		DESCRIPTION	JUMPER		AUXILIARY		DESCRIPTION
	OPEN	CLOSE		OPEN	CLOSE	OPEN	CLOSE	
E1	X		AUX A SEL IN MASTER # PIN 10	E1		X		NC
E2	X		NC	E2			X	SEL OUT TO MASTER
E3		X	DEC PT 1A.XX	E3		X		NC
E4		X	DEC PT 1A.XX	E4		X		NC
E5		X	O (ZERO)	E5		X		NC
E6		X	DEL PT 1.XXX	E6		X		NC

15	1	S1	SWITCH, 1 POLE WAFER #T-5
14			
13	1	R2	RESISTOR 10K, 1%, 1/4W OR 1/8W
12	1	R1	RESISTOR PRT 20K, 1%
11			
10	2	C1, C2	CAPACITOR 220UF, 10V
9			
8	6	E1-E3, E4, E5, E6	JUMPER, (.100) 2 PIN MOLEX HEADER, (.100) 2 PIN MOLEX
7			
6			
5	1	J2	SOCKET, DIP, 14 PIN
4	1	J3	CENTER HEADER, (.100) MOLEX NO. 22-11-203
3	1	J1	CENTER HEADER, (.100) MOLEX NO. 22-11-210
2			
1	1		PRINTED CIRCUIT BOARD NO. C14365005
		REF. DES.	DESCRIPTION

KURZ INSTRUMENTS INC.
 MODE 143
 VELOCITY LINEAR PROFILER
 SWITCH INTERFACE BOARD
 COMPONENT LAYOUT

DATE: 7-16-88
 DRAWN BY: J. CONRAGH
 CHECKED BY: J. S. RYAN
 APPROVED BY: J. S. RYAN
 SCALE: 2:1
 SHEET: 1 OF 1

REV	DATE	DESCRIPTION	BY	CHKD



NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONNECTION WITH COMPONENT LAYOUT #L14331004.
 2. SEE JUMPER POSITION TABLE FOR JUMPER PLACEMENT.
 3. SWITCH S1 AUXILIARY A, B AND C DESCRIPTION:

NO. OF SENSORS	MASTER	AUXILIARY
1-8	USE A5 T5	---
9-16	SWITCH AT "AUX. A"	ADD AUX. MODULE A
17-24	SWITCH AT "AUX. B"	ADD AUX. MODULE B
25-32	SWITCH AT "AUX. C"	ADD AUX. MODULE C

REFERENCE DESIGNATION	LAST USED	NOT USED
E1		
E2		
E3		
E4		
E5		
E6		

JUMPER	MASTER		AUXILIARY		DESCRIPTION
	OPEN	CLOSE	OPEN	CLOSE	
E1	X		X		NC
E2		X		X	SEL OUT TO MASTER
E3		X		X	NC
E4		X		X	NC
E5		X		X	NC
E6		X		X	NC

0-5 SEL OUT	1	2	3	4	5	6	7	8	AUX SEL OUT
0-5 SEL OUT	1	2	3	4	5	6	7	8	AUX SEL OUT
0-5 SEL OUT	9	10	11	12	13	14	15	16	AUX SEL IN
0-5 SEL OUT	17	18	19	20	21	22	23	24	AUX SEL IN
0-5 SEL OUT	25	26	27	28	29	30	31	32	POLE
0-5 SEL OUT	33	34	35	36	37	38	39	40	AUX C SEL IN

KURZ INSTRUMENTS INC.

MODEL L143
 VELOCITY LINEAR PROFILER
 SWITCH INTERFACE BOARD
 X-HEMATIC DIAGRAM

DATE: 11-15-66
 DRAWN: L14330003
 CHECKED: J.F.L.

APPROVED: [Signature]
 DATE: 11-15-66

DESIGNED BY: [Signature]
 DATE: 11-15-66

CHECKED BY: [Signature]
 DATE: 11-15-66

REVISIONS:

NO.	DESCRIPTION	DATE

VELOCITY LINEAR PROFILER
 SWITCH INTERFACE BOARD
 X-HEMATIC DIAGRAM

DATE: 11-15-66
 DRAWN: L14330003
 CHECKED: J.F.L.

SERIES 191 POWER SUPPLIES

Series 191 power supplies are provided within the series 193 system enclosure for purposes of powering up the sensor assemblies. The power supplies are sized based on the current demand of the combined individual sensor currents.

The series 191 power supplies operate on an input supply voltage of 115 VAC/60 HZ. Provided by the series 191 supply is a regulated 20-24 Volts DC.

The power supplies are typically attached to a 19 inch rack panel and secured in place near the top portion of the series 193 system enclosure.

Wiring terminals are provided at the rear of the power supply, mounted to a bracket attached to the supply. These terminals allow the supply to be removed and replaced as a unit to aid in serviceability of the supply.

SERIES 191 POWER SUPPLIES

The table below shows power-supply selections matched with the number of sensors you plan to use.

No. Sensors	Power Supply
1-3	191-2.4 or 191RM-2.4
4-7	191-4.8 or 191RM-4.8
8-15	191-12 or 191RM-12

POWER SUPPLY

Model 191-2.4 Power Supply (2.4 Amp)

For use with Series 193 Fan-Cooled Enclosures

Model 191-4.8 Power Supply (4.8 Amp)

For use with Series 193 Fan-Cooled Enclosures

Model 191RM-4.8 Rack Mount Power Supply (4.8 Amp)

5.25" High x 19" Wide Rack Panel. For use with Series 193 Rack Chassis Equipped Enclosures

Model 191-12 Power Supply (12 Amp)

For use with Series 193 Fan-Cooled Enclosures

Model 191RM-12 Rack Mount Power Supply (12 Amp)

5.25" High x 19" Wide Rack Panel. For use with Series 193 Rack Chassis Equipped Enclosures

Operation of any Series 191 Power Supply at 220 Vac/50 Hz

Add -X to Series 191 model number.

THE SAMPLE RATE MASS FLOW SENSOR AND ELECTRONICS

The mass flow sensors for the sample flow rate is identical to a standard Kurz 505 mass flow meter. The Series 505 are rugged, industrial-grade, extended-life solid state flowmeters which feature type 304 stainless steel construction as standard. The sample mass flow rate sensor has its own two-wire current transmitter. The sample rate mass flow meter also allows long cable runs from a few feet to hundreds of feet with no signal degradation, by virtue of its two-wire current mode transmitters. In the 4200 system, electronics for the sample rate mass flow sensor are mounted in a rack module inside the 4200 system enclosure. Overall accuracy is two percent of reading + 1/2 percent at full scale. Repeatability is 0.25 percent. The linear 0-5Vdc output signal is available on the rack module's rear-mounted terminal strip. NBS-traceable calibration is standard, along with calibration data and certificate. KURZ mass flowmeters automatically correct for changes in gas temperature and density. Therefore, readings are automatically referenced to standard conditions without any tedious manual calculations. Flow is usually scaled in SCFM. Reference conditions are 25'C (77'F) & 760 mm Hg (29.92" Hg). At these conditions air weighs .074 lbs/cubic foot.

PRINCIPLE OF OPERATION

The Kurz Series 505 Mass Flow Meters use the Kurz unique "DuraFlo" TM probe, which consists of a rugged cylindrical constant-temperature thermal sensor. The sensor responds to gas mass flow across the heated sensor. The mass flow sensor is heated to a constant temperature above that of the gas stream while the temperature sensor is used as a reference for temperature compensation purposes. temperature compensation is stable over a range of -20'C to +60'C.

The mass flow probe is not a fragile hot wire. Because it is rugged and large, it is breakage resistant, relatively insensitive to particulate contamination, and manually cleanable. The Kurz flow meter does not use flow restrictions to measure flow rate, hence it has a very low pressure drop.

SERIES 435 ANALOG LINEARIZER BOARD

Kurz flow sensors have a nonlinear flow curve and require linearization if a proportional flow to voltage signal is desired. The series 435 analog linear boards provide a highly accurate flow signal after the flow signal has been linearized.

The series 435 board may operate either as a voltage mode or current mode linearizer. Sensors transmit a flow signal to the series 435 circuitry at which point the signal is normalized to a level of .000 volts DC at the no flow condition and 5.000 volts DC with the full scale flow rate. This 0-5 volt DC signal is nonlinear and must be broken up into segments and adjusted to yield a linear output signal.

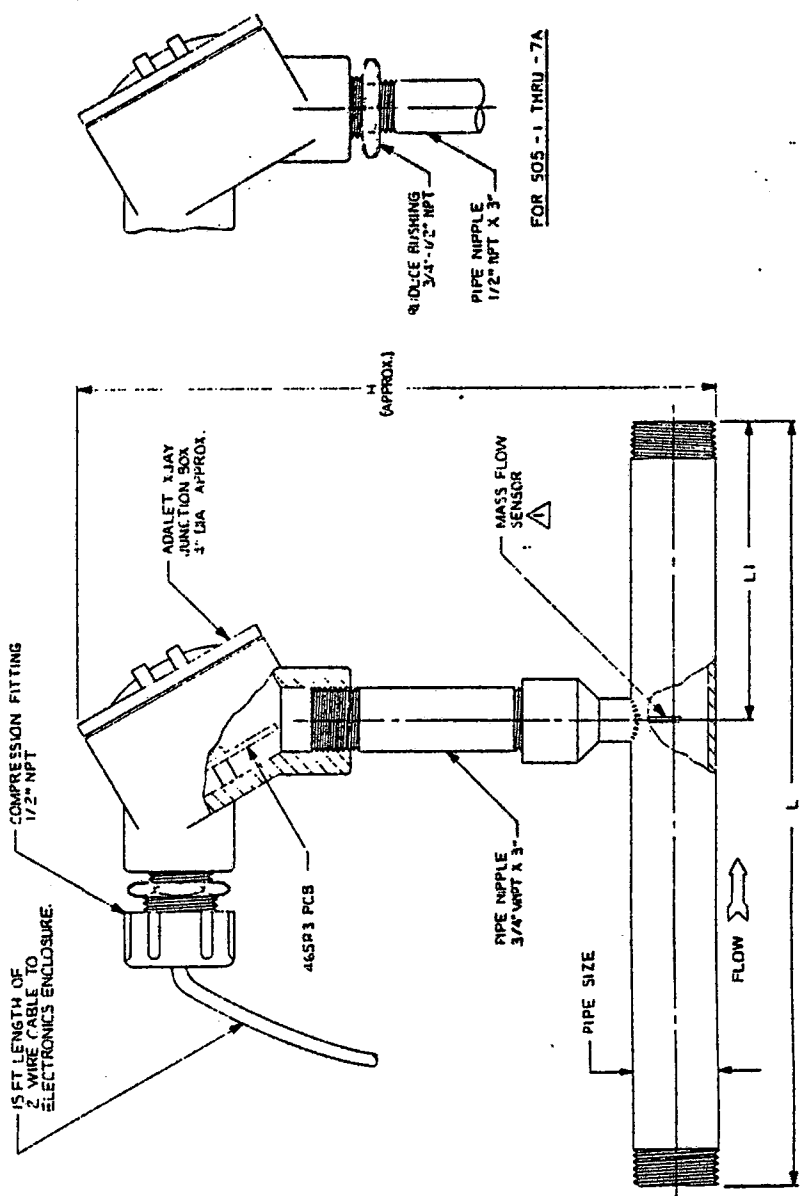
Series 435 analog linearizer boards utilize a break-point linearizer system to achieve a linear output signal for a nonlinear input signal. This system requires a number of break-points to get the desired linear output signal accuracy.

Analog breakpoint linearizers operate as follows, a series of amplifiers are set up to trip at preselected levels. The individual amplifiers are adjusted as required such that a linear voltage output will result. Each amplifier output is added at a summing amplifier. What happens is this, as the flow signal increases more amplifiers turn on and sum together to provide the linear output signal.

The series 435 analog linearizer has an integral power supply that provides power both to the linear circuitry and also to the flow transducer. The unregulated voltage powers up the flow transducer, however the linearizer requires regulated supplies and this is achieved with the use of zener diodes or voltage regulators.

These analog breakpoint style linear boards have many adjustment potentiometers and must only be adjusted by a factory trained technician or qualified personnel with the proper test and calibration equipment. Any nonfactory calibration will void the warranty.

NOTES: UNLESS OTHERWISE SPECIFIED
 THE PROBE IS CALIBRATED WITH A MATCHED CIRCUIT BOARD.
 THE PROBE MUST NOT BE DISASSEMBLED FROM THE FLOW BODY
 AS THIS WOULD INVALIDATE THE CALIBRATION.



MODEL NO.	PIPE SIZE MNPT	STD SCHED.	L	LI	H	TP PSI	AWP PSI
505 - (1-6)	1/4"	40	6.00"	2.50"	7.50"	2000	1000
505 - 7 - (XX)	3/8"	40	7.00"	2.50"	7.50"	2000	1000
505 - 7A - (XX)	1/2"	40	8.00"	3.00"	7.75"	2000	1000
505 - 8 - (XX)	3/4"	40	10"	3.00"	9.00"	2000	1000
505 - 9 - (XX)	1"	40	12"	3.50"	9.50"	2000	1000
505-9A - (XX)	1-1/2"	40	18"	4.00"	10.00"	2000	1000
505-9B - (XX)	2"	40	24"	5.00"	10.50"	2000	1000
505-10 - (XX)	2-1/2"	40	30"	6.00"	11.00"	2000	1000
505-10A - (XX)	3"	40	36"	6.50"	11.50"	1900	950
505-10B - 00	3-1/2"	40	42"	7.00"	12.00"	1750	875
505-11 - (XX)	4"	40	48"	8.00"	12.50"	1600	800
505-12 - (XX)	6"	10	66"	10.00"	15.00"	600	300
505-13 - (XX)	8"	10	78"	12.00"	16.50"	500	250

FOR 505 - 1 THRU - 7A

KURZ INSTRUMENTS INC.

MODEL 505 - 1 TO - 13
 FLOWBODY ASSEMBLY LAYOUT

REV. NO. **C** PART NO. **C50500087**

DATE **10/1/78** DRAWN **NDNE** CHECKED **10/1/78**

APPROVALS

DESIGNED BY **J. AREAGA** DATE **10/1/78**

CHECKED BY **[Signature]** DATE **10/1/78**

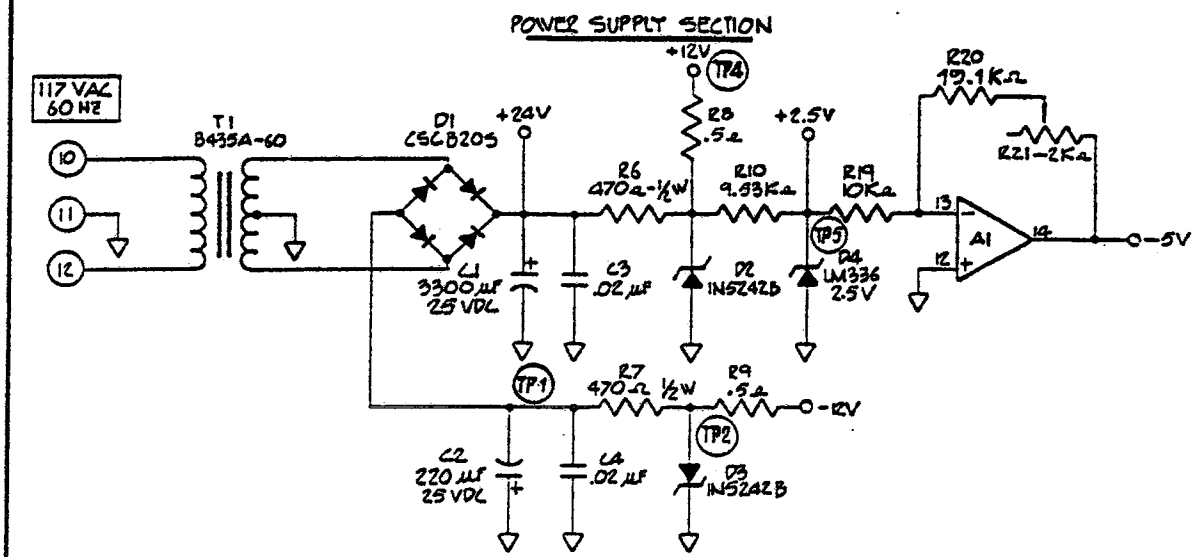
DATE **10/1/78**

SCALE **NONE**

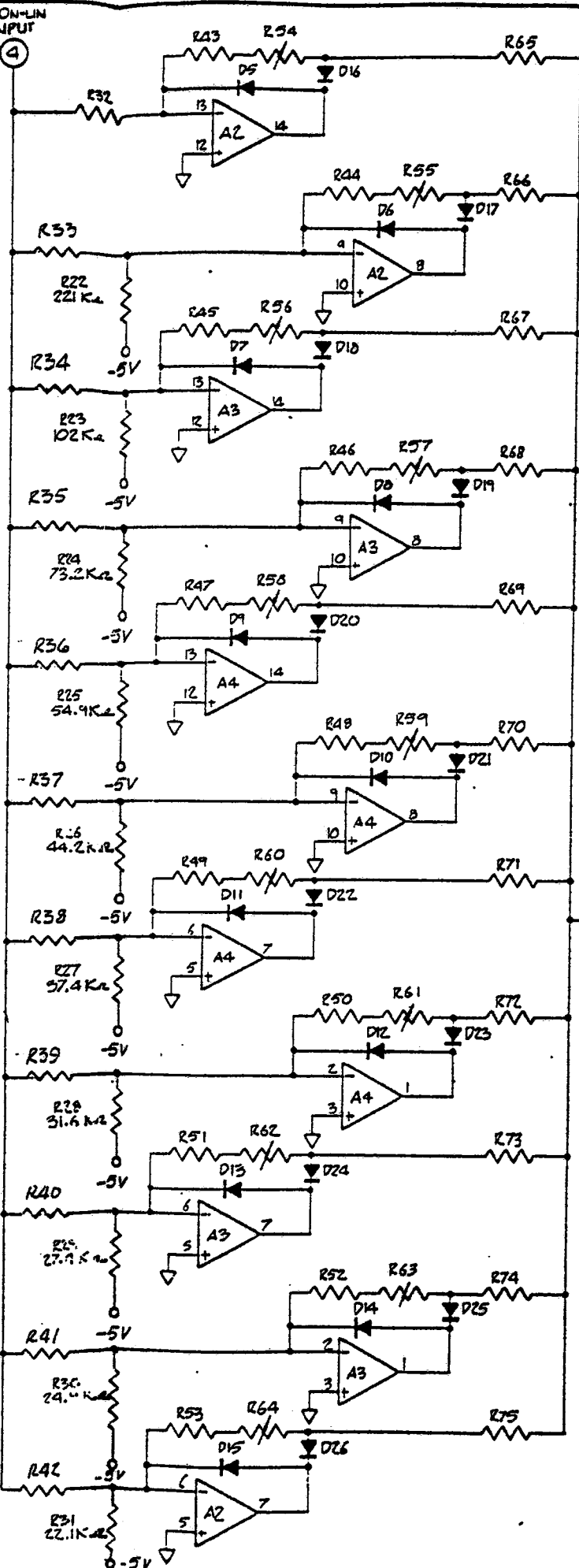
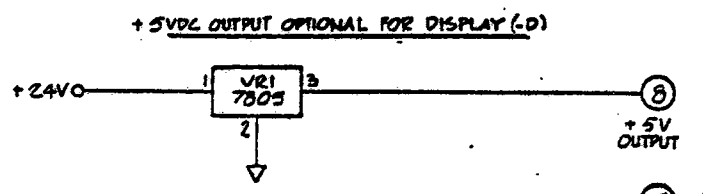
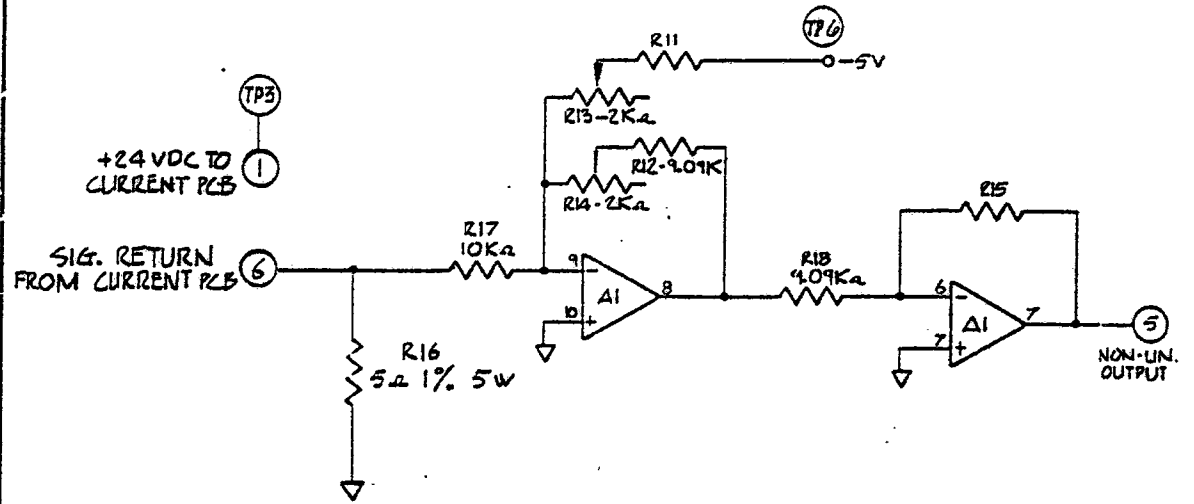
OF **1**

REV.	DATE	DESCRIPTION

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	CHANGED PER DCR # 48031 ; 48032 AND 48033	12-13-85	D. Traub
B	REVISED PER ECO A47102	4-1-87 J.C. / J.V.	D. Traub



BRIDGE SECTION:
 R11 : SELECTED (FOR ZERO)
 R15 : SELECTED (FOR SPAN)



LINEAR SECTION
 R32 - R42 = 20K Ω
 R43 - R53 = .5 Ω
 R54 - R59 = 10K Ω (POT)
 R60 - R64 = 20K Ω (POT)
 R65 - R75 = 10K Ω
 D5 - D24 - 1N914 (OR 1N4148)
 A2 - A4 - LM324

2. FOR HEAVY DUTY PCB:
 T1 : 8724-24
 C1 : 3500µF-40V
 C2 : 220µF-35V
 R6, R7 : 1000 Ω -1W (DALE RS-1A)
 1. THIS DWG TO BE USED IN CONJUNCTION
 W/ COMP. LAY OUT # C31003.
 NOTES:

REFERENCE DESIGNATION	DESCRIPTION
R78	R1-R5
C5	Q1
D26	
A4	
T1	
LAST USED	NOT USED
REFERENCE DESIGNATION TABLE	

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

APPROVALS: [Signature] DATE: 6-26-85

DRIVER: [Signature] SCALE: NONE SIZE: C DRAWING NO: C30007B REV: B

Kurz Instruments Inc.
 MODEL 435 LINEAR PCB
 CURRENT MODE
 SCHEMATIC DIAGRAM

DO NOT SCALE DRAWING SHEET 1 OF 1

SERIES 730 ELECTRIC ROTARY RAMP METERING VALVES

The Series 730 Electric Rotary Ramp Metering Valves represent a new concept in electrically actuated metering valves. Within the 730 Series family of valves, a specific model will be selected for your particular system. Unlike competitive electrical metering valves, the Series 730 combines the electric drive motor, the valve body and limit switches into a well-designed, integrated package. The flow coefficient (Cv) is linear over a wide range due to its nearly 300 degree rotation between shutoff and full open. A remarkable feature of the 730 is that it incorporates a complete flow shutoff feature not found in other fine metering valves. 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. The standard valve incorporates a high-torque, DC gear motor designed to be operated by error signals from the 4200 Isokinetic Controller. Each valve is constructed of aluminum or 316 stainless steel and includes an O-Ring sealed motor cover with a 1/2-inch FNPT conduit fitting. Only two wires are required to operate the standard Series 730 valve for ease of installation. The standard full open to full close time is 60 seconds, but other valve speeds can be specified. 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.

REV	DESCRIPTION	DATE	APPROVED
1			

NOTES: UNLESS OTHERWISE SPECIFIED
 1. WIRES SHALL BE A MINIMUM OF #22 AWG
 2. REFERENCE NUMBERS ARE FOR REFERENCE ONLY AND MAY NOT APPEAR ON ACTUAL PART.

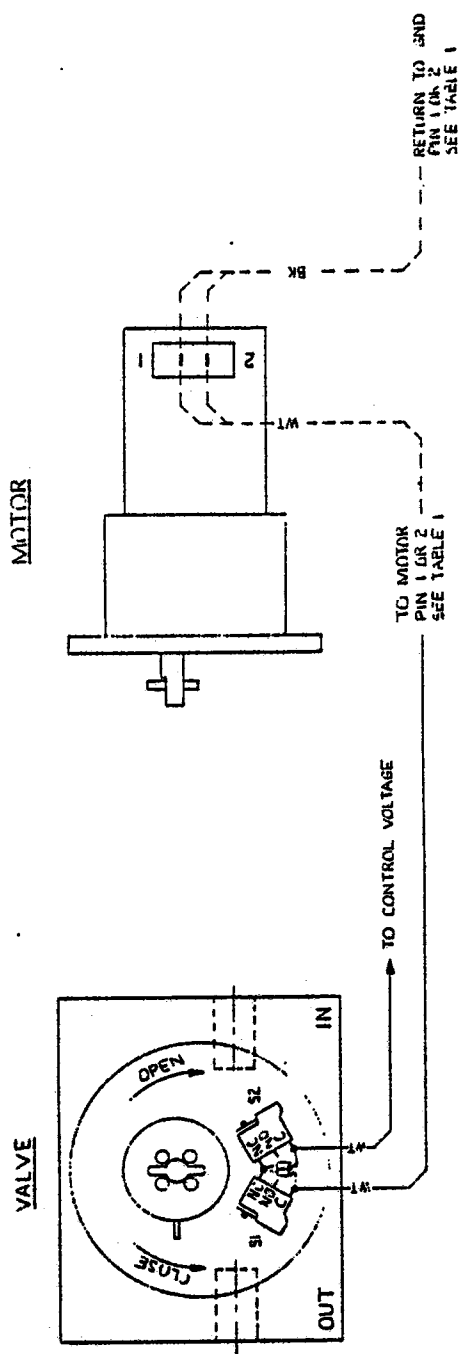
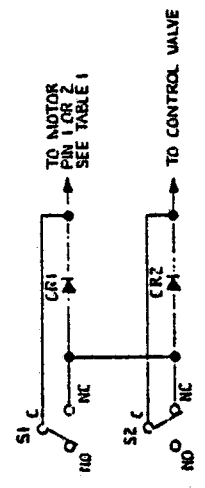


TABLE 1
+ TO MOTOR

VALVE	FIELD POSITION	PIN 1	PIN 2
OPEN	CW	BK	WT
CLOSE	CCW	WT	BK
X	CW	WT	BK
X	CCW	BK	WT
X	CW	WT	BK
X	CCW	BK	WT
X	CW	WT	BK
X	CCW	BK	WT
X	CW	WT	BK
X	CCW	BK	WT
X	CW	WT	BK
X	CCW	BK	WT
X	CW	WT	BK
X	CCW	BK	WT



KURZ INSTRUMENTS INC.		VALVE/MOTOR WIRING INTERCONNECTION	
APPROVED	DATE	SCALE	DRAWING NO.
TC/REAGA	5-13-86	C	C-32012
DO NOT SCALE DRAWING		SHEET 1 OF 1	

A VALVE DESIGNED EXPRESSLY FOR FLOW CONTROL PRODUCES A HIGH

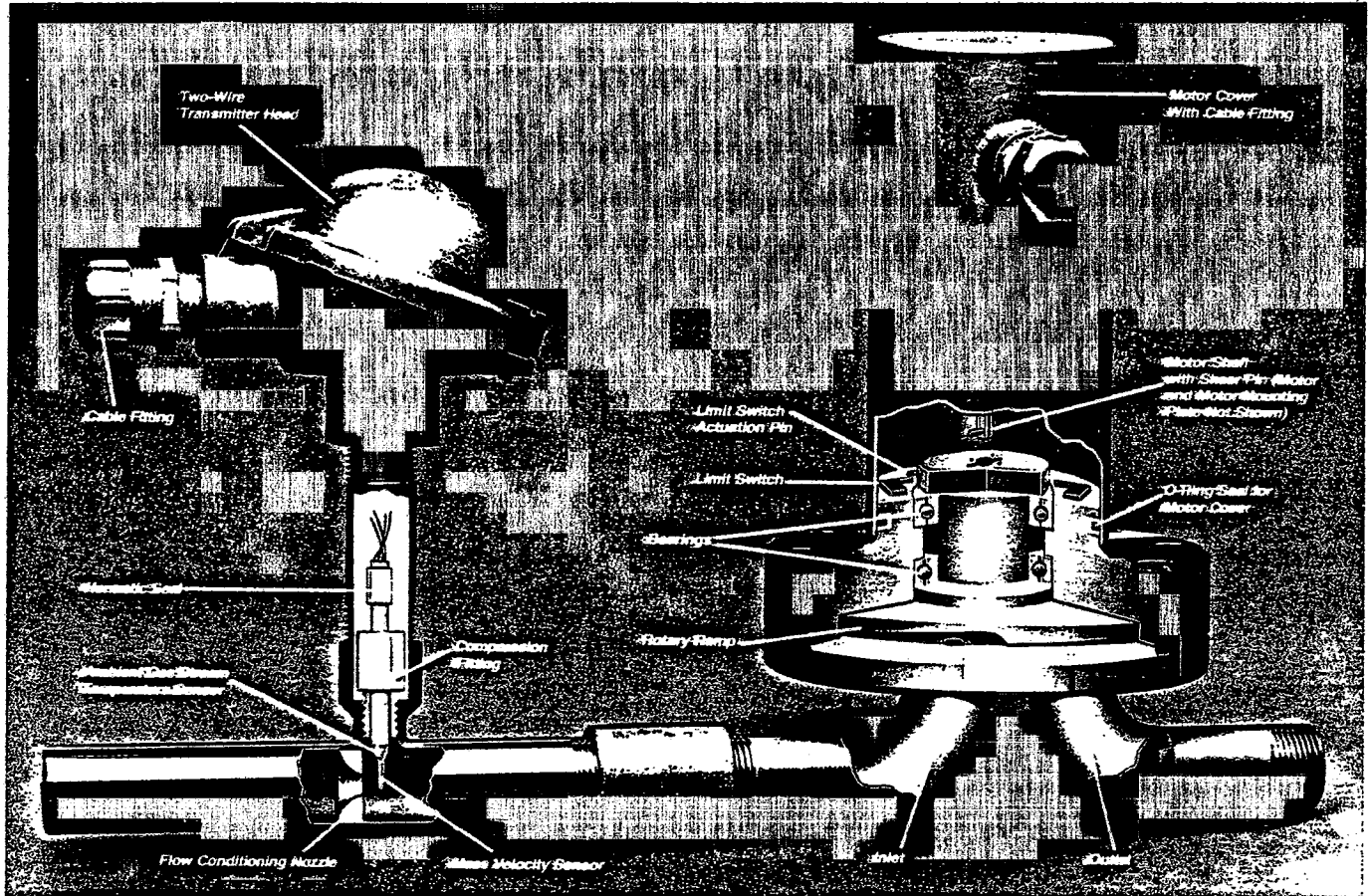


FIGURE C_v TO SELECT A VALVE

1. To find C_v

$$C_v = \frac{\text{SCFM} \sqrt{(460 + ^\circ\text{F}) G}}{22.67 \sqrt{\text{PSIA} \times \Delta P}}$$

G = Specific Gravity of the Gas

PSIA = Absolute Pressure on Inlet Side of Valves

SCFM = Standard Cubic Feet Per Minute
(25°C 760 mmHg)

ΔP = Differential Pressure across the Valves

2. Select the next highest value for C_v to allow for full flow.

3. To calculate the estimated pressure drop across the valve for a select C_v :

$$\Delta P = \frac{(\text{SCFM})^2 (460 + ^\circ\text{F}) (G)}{513.7 (P_1) (C_v)^2}$$

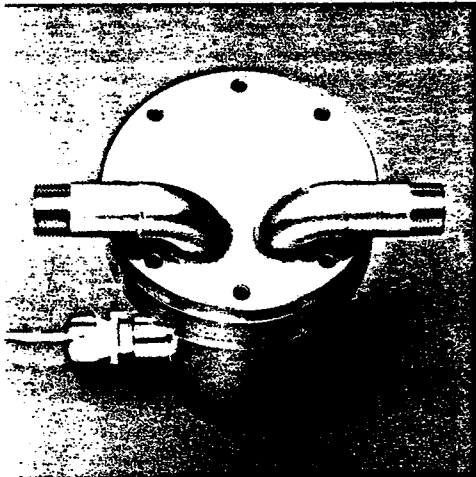
P_1 = Inlet Pressure Absolute

C_v = For Valve

G = Specific gravity of the Gas

Note: When the upstream pressure is more than twice the downstream pressure the ΔP value used is half the absolute upstream pressure. Example: 264.7 psi absolute upstream venting to atmosphere or 14.7 psi absolute downstream use 132.4 as the ΔP .

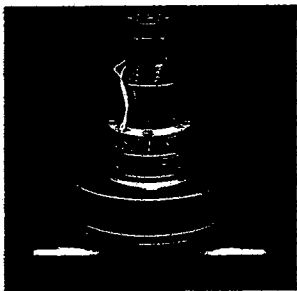
H PERFORMANCE SYSTEM



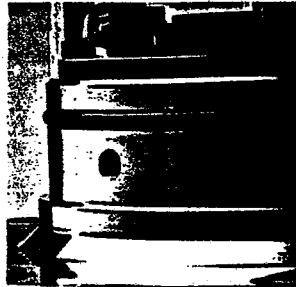
The Series 730 Flow Control Valve

"An appealing feature of the 730 valve is the extent to which the electric drive motor, the valve body and limit switches have been combined into a technically superior, aesthetically pleasing, integrated package."

The Series 730 Valves were expressly designed by Dr. Kurz for mass flow control applications. The design utilizes a rotating disc with a precision mathematically modeled helix machined onto the face. We call this helix the "ramp". This disc rotates over an inlet orifice and an outlet orifice which are perpendicularly disposed relative to the face of the disc. The orifices are sized for the specified Cv or coefficient of flow. A DC gearmotor is used to rotate the disc or "valve rotor" to meter flow. Because the 24Vdc motor is only intermittently active, and is never operated at more than 15Vdc, extremely long motor lives are enjoyed.

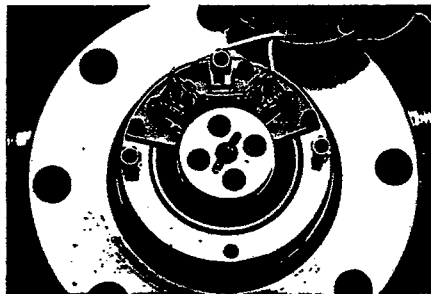


This photo shows the 730 Series Valve with the motor cover removed. Note that the motor is fixed to a motor mounting plate which is, in turn, mounted to the valve body via standoffs. Snap apart electrical connectors (not shown in this photo) allow motor interchange in the field without any tools other than a screwdriver.



Note the O-Ring circumferentially disposed around the valve body for providing a motor cover environmental seal.

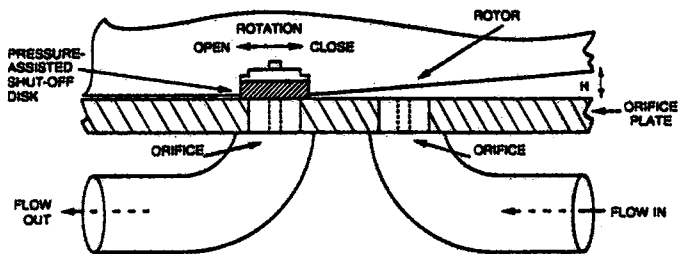
Series 730 Valves are available in 6061-T6 Aluminum, or 316 Stainless Steel. Motor cover housings are always the same material as the rest of the valve. The motor covers include a cable fitting, but this may be removed in order to run conduit directly into the 1/2" FNPT fitting. The motor cover may be removed for valve servicing, motor interchange or hookup by removing the 4 socket cap screws circumferentially mounted to the base of the valve motor cover housing.



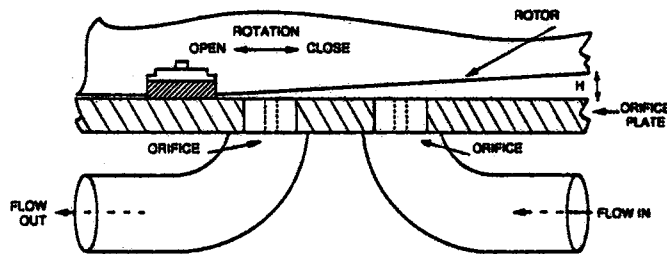
This photo shows the microswitches that function as rotor travel limit switches, and correspond to Full Open and Full Close valve positions. Note that they are actuated by a pin protruding from the valve rotor bearing cap. The valve rotor bearing cap also accepts the DC gearmotor shaft and its shear pin. Note the diodes wired across the limit switches. When the limit switches break the circuit to prevent any further rotation, the diodes allow reverse polarity voltage to flow to move the rotor in the opposite direction and off the limit switches.



Note the Shear Pin Protruding from the DC Gear Motor Shaft.



CROSS SECTION OF VALVE SHOWING SHUT-OFF POSITION



CROSS SECTION OF VALVE SHOWING SLIGHTLY OPENED POSITION

OUTPUT

Linear 0-5 Vdc, 20 ma Maximum.

LINEARIZATION

11 breakpoint analog voltage offset type (11 amplifier stages) plus zero and span.
Optional DIGITAL linearizer available.

**MASS FLOW METER
PHYSICAL SPECIFICATIONS**

CONSTRUCTION

304 stainless steel standard, schedule 40, MNPT, 316 S.S. and Monel optionally available.

PRESSURE RATING

See model selection table in 505 brochure.

TRANSMITTER ENCLOSURE

Aluminum weatherproof junction box. Class I groups C,D; Class II groups E,F,G. Rated for hazardous environments.

DIMENSIONS

See model selection table in 505 brochure.

**SERIES 710 ELECTRONIC VALVE
CONTROLLER**

DISPLAY

4½ digit LCD display driven by 3½ digit IC voltmeter. Maximum engineering units displayed 19990. Least significant digit is a static zero provided for convenience in readability.

OPERATOR CONTROLS

ON/OFF

DISPLAY SELECT: Flow Rate, Setpoint, External Input

FUNCTION SELECT: Flow Control, Manual Valve, External Input

MANUAL VALVE

SETPOINT ADJUST

SETPOINT SPAN

0-100% of flow

SETPOINT ACCURACY

± 1%

POWER

110VAC/60Hz

ENCLOSURE

4.2" wide x 7" high rack module standard.

SIGNAL IN

Accepts 0-5Vdc process variable input normally provided by 505 Series Mass Flow Meter. Alternatively accepts 0-5Vdc process variable input provided externally. 710 controller modules are also available which accept 0-2Vdc, 4-20ma, or 1-5Vdc process variable signals. Consult factory regarding other external inputs.

SIGNAL OUT

Plus and minus 15Vdc, drives 730 Series valve over two-wire hookup (2nd wire is ground).

HOOKUP

Rear mounted barrier screw terminal provided for hookup of signal in and valve control signal out.

**SERIES 730 ELECTRIC ROTARY RAMP™
METERING VALVES**

CONSTRUCTION

Available in 304 stainless steel, 316 S.S. and 6061-T6 aluminum. See 730 Valve model selection table. Monel construction optionally available in some cases.

SEALS

Viton™ fluoro-carbon standard. Other materials available for best compatibility with application include: Fluorosilicone, Nitrile or Buna N, Ethylene Propylene, Butyl, Polyacrylate.

MOTOR

24Vdc gearmotor derated by operation at 15Vdc maximum. Available in several gear ratios to effect different OPEN/CLOSE cycle times. Normally highest available gearing is used to achieve most precise (smallest) movement in output shaft. This results in finest incremental movement of valve rotor (e.g. most precise valve actuation).

Available gear ratios are: 2426:1, 1804:1, 1419:1, 728:1, 426:1, 218.4:1, 65.5:1.

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. Consult your local Kurz Representative or Factory Applications Engineer.

Note that it is very simple and economical to swap out gearmotors in the field with only a screwdriver should you wish to change valve cycle time.

HOOKUP

Two-wire. One wire is ground. The second wire carries the +15Vdc or -15Vdc which opens or closes the valve respectively.

MOTOR COVER

Aluminum cover provided with aluminum valves. 304 stainless steel cover provided with 304 S.S. valves. 316 stainless steel cover provided with 316 S.S. valves. All motor covers include cable fitting which may be removed to run conduit into the ½" FNPT fitting provided.

SHUTOFF

While a pressure assisted shutoff plug is a standard feature, the Kurz 730 Series Valves are metering valves, not shutoff valves. For users requiring 100% confidence in total shutoff we recommend installation of a simple normally closed solenoid valve downstream of the Kurz valve. The solenoid valve may be automatically opened when the Kurz valve moves off the full closed position limit switch in the Series 730 Valve.

LIMIT SWITCHES

Microswitches installed at the full closed and full open positions of the 730 Series valves break the circuit to the valve and prohibit further motion until reverse polarity voltage is received to move the valve off the limit switch. As mentioned above, these limit switches may also be used to control a shutoff solenoid valve downstream of the Kurz Series 730 Valve.

IMPORTANT NOTICE

Specifications are subject to change without notice. Kurz Instruments reserves the right to make engineering changes and product improvements at any time and without prior notice. Consult your local Kurz Representative or a Factory Application Engineer for information regarding current specifications.

IN NORTH AMERICA



(1-800-424-7356)

SAMPLE FLOW RATE TOTALIZER

This unit is a six-digit resettable or non-resettable (customer specified) totalizer which fits into the 4200 System Enclosure. The totalizer is a stand-alone rack module unit. It converts an analog input voltage to frequency, which is then divided to yield the desired pulses to increment the mechanical counter. The counter will hold reading during power off conditions, of course. In the 4200 System, the totalizer is usually set up so that one count (one digit on the counter) equals 1 SCFM of sample flow.

MODEL 101RM FLOW TOTALIZER MODULE

The 101RM Flow Totalizer module is 1.4 inches wide (1/12 rack), with six non-resettable digits. This totalizer, and other units listed below, may be set up at the factory to totalize total duct or stack flow in any units convenient to the user. Examples would be SCFM or Pounds Per Hour, etc. The totalizer uses a voltage-to-frequency converter which in turn increments a mechanical counter. Divide-by logic and jumpers allow the totalizer to be set-up as desired, and the mechanical counter holds its count during power off states. This counter is non-resettable since many users want to avoid having the counter reset to zero casually by any passersby.

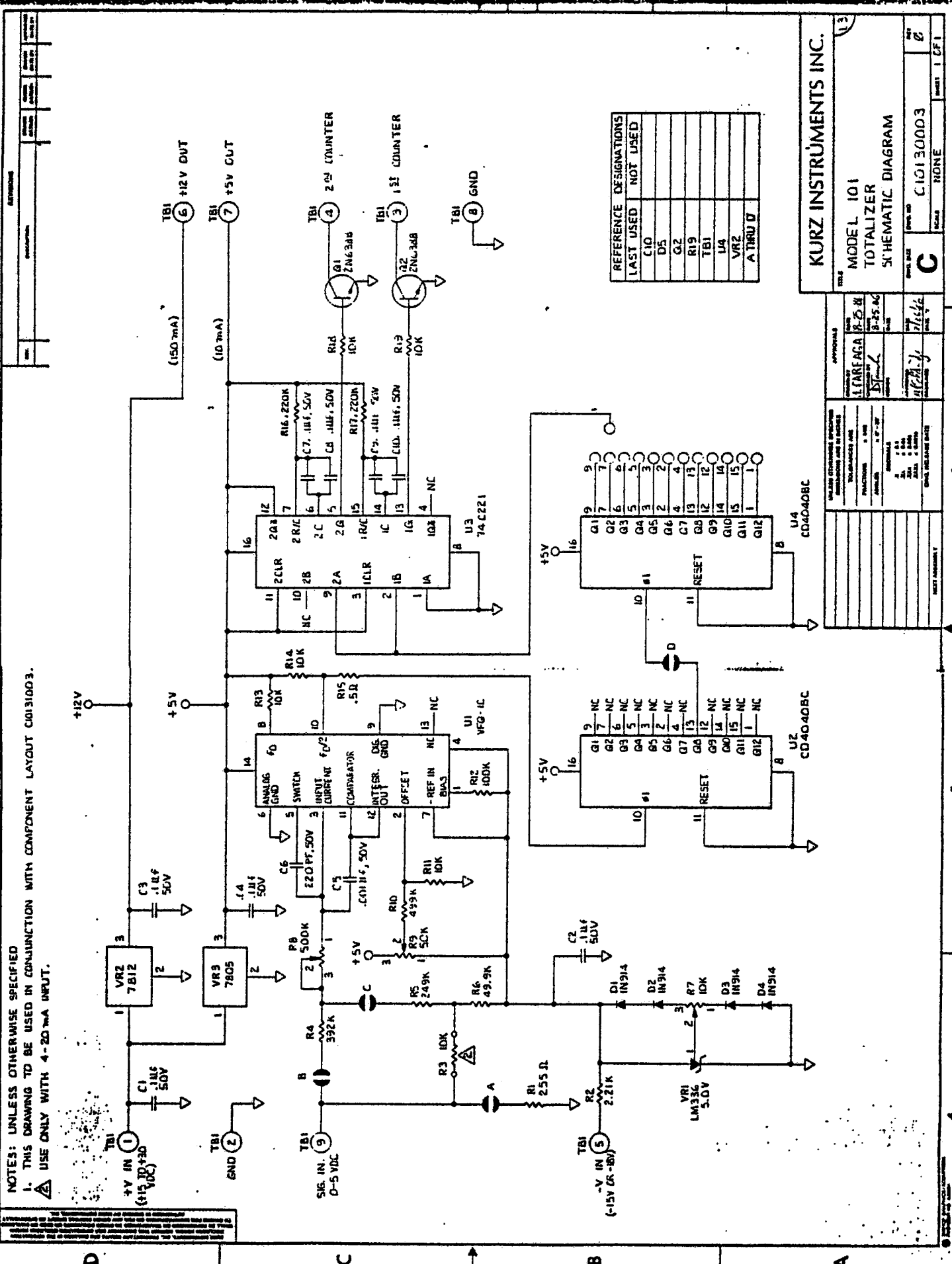
MODEL 101SRM FLOW TOTALIZER MODULE

This module is 2.8 inches wide (1/6 rack) and includes six resettable digits. It is identical to the 101RM above except that the counter may be reset to zero via a pushbutton on the front of the rack panel.

MODEL 101S/111RM FLOW TOTALIZER/ALARM MODULE

This module combines a resettable totalizer with a dual alarm module. It is 2.8 inches wide (1/6 rack). The totalizer is identical to the 101S mentioned above. The dual alarm board has two contact closures with 5 amp rating. A common use is to trip alarms for high and low flowrates.

NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT C10130003.
 2. USE ONLY WITH 4-20 mA INPUT.



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

KURZ INSTRUMENTS INC.

MODEL 101
 TOTALIZER
 SCHEMATIC DIAGRAM

REV. 02
 DATE 10/13/00
 SCALE NONE
 SHEET 1 OF 1

APPROVALS

DESIGNED BY: J. T. ...
 CHECKED BY: ...
 DATE: ...

REVISIONS

NO. 1: ...
 NO. 2: ...
 NO. 3: ...

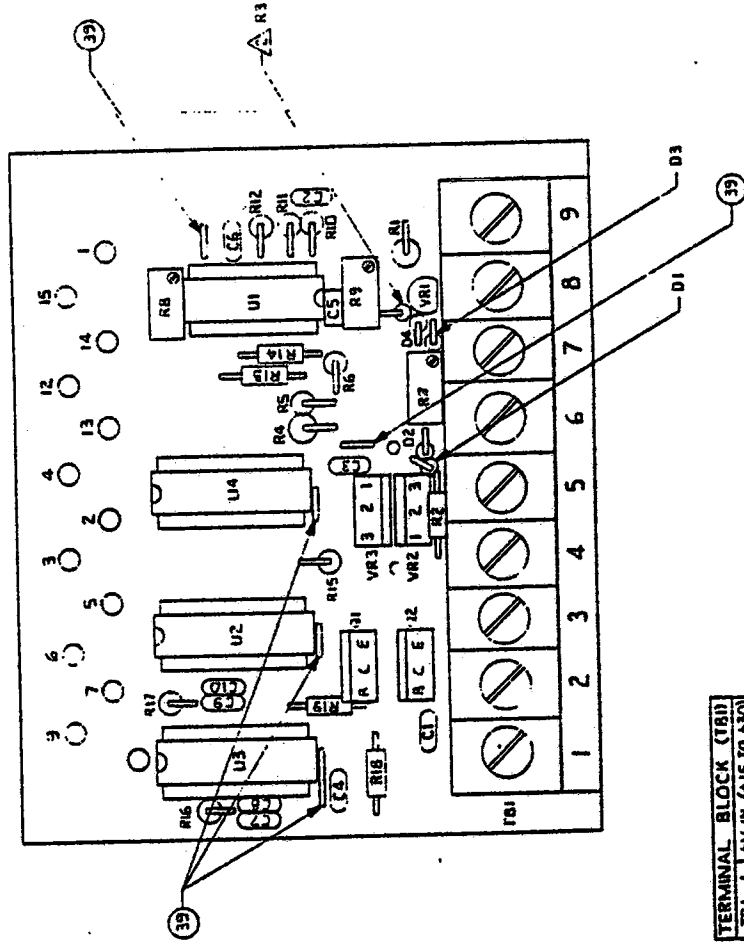
WARRANTY INFORMATION

WARRANTY PERIOD: 1 YEAR
 PARTS: ...
 LABOR: ...

WARRANTY EXCLUSIONS

1. ...
 2. ...
 3. ...

NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM C1013003.
 2. USE R3 ONLY WITH 4-20mA INPUT.
 3. ALL DIODES TO BE ASSEMBLED WITH THE CATHODE TO THE P.C.B.



TERMINAL BLOCK (TBI)
TBI-1 +V IN (+15 TO +30)
TBI-2 GND
TBI-3 1ST COUNTER
TBI-4 2ND COUNTER
TBI-5 -V IN (-15 OR -10)
TBI-6 +I2 OUT
TBI-7 +I5 OUT
TBI-8 GND
TBI-9 SUP. IN. 0-5 VDC

QTY	WIRE NUMBER	DESCRIPTION
33	24R	RESISTOR 221K 1/8W 1%
34	R16 R17	RESISTOR 5.1K 1/8W 5%
35	R15	RESISTOR 100K 1/8W 1%
36	R12	RESISTOR 499K 1/8W 1%
37	R10	RESISTOR 49.9K 1/8W 1%
38	R5	RESISTOR 242K 1/8W 1%
39	R4	RESISTOR 2.21K 1/8W 1%
40	R3	RESISTOR 225.0 1/4W 1%
41	R1	POTENTIOMETER 500K
42	R2	RESISTOR 225.0 1/4W 1%
43	R7	RESISTOR 10K
44	VR3	VOLTAGE REGULATOR 7805
45	VR2	VOLTAGE REGULATOR 7812
46	VR1	VOLTAGE REGULATOR 1M336 5.0V
47	U1	IC 74C221
48	U3	IC CD4040BC
49	U2, U4	IC VFO-IC
50	U1	TRANSISTOR 2N6308
51	D1, D2	DIODE 1N914
52	D1, D2, D3, D4	CAPACITOR 220PF 50V CER
53	C6	CAPACITOR 0.01UF 50V CER
54	C5	CAPACITOR 0.1UF 50V CER
55	C1-C4, C7-C10	TERMINAL MARKER STRIP 9 PIN .375 CENTERS
56	TBI	TERMINAL STRIP 9 PIN .BEAU, .375 CENTERS
57	TBI	MODEL 101 PCB
58	REF DES	DESCRIPTION
59	ITEM QTY	

PARTS LIST

KURZ INSTRUMENTS INC.

MODEL 101
 TOTALIZER
 COMPONENT LAYOUT

DATE: 8-25-84
 DRAWN BY: J. CARAGA
 CHECKED BY: [Signature]
 APPROVED BY: [Signature]

REV. NO. C
 QUANTITY C10131003
 NAME NONE
 SHEET 1 OF 1

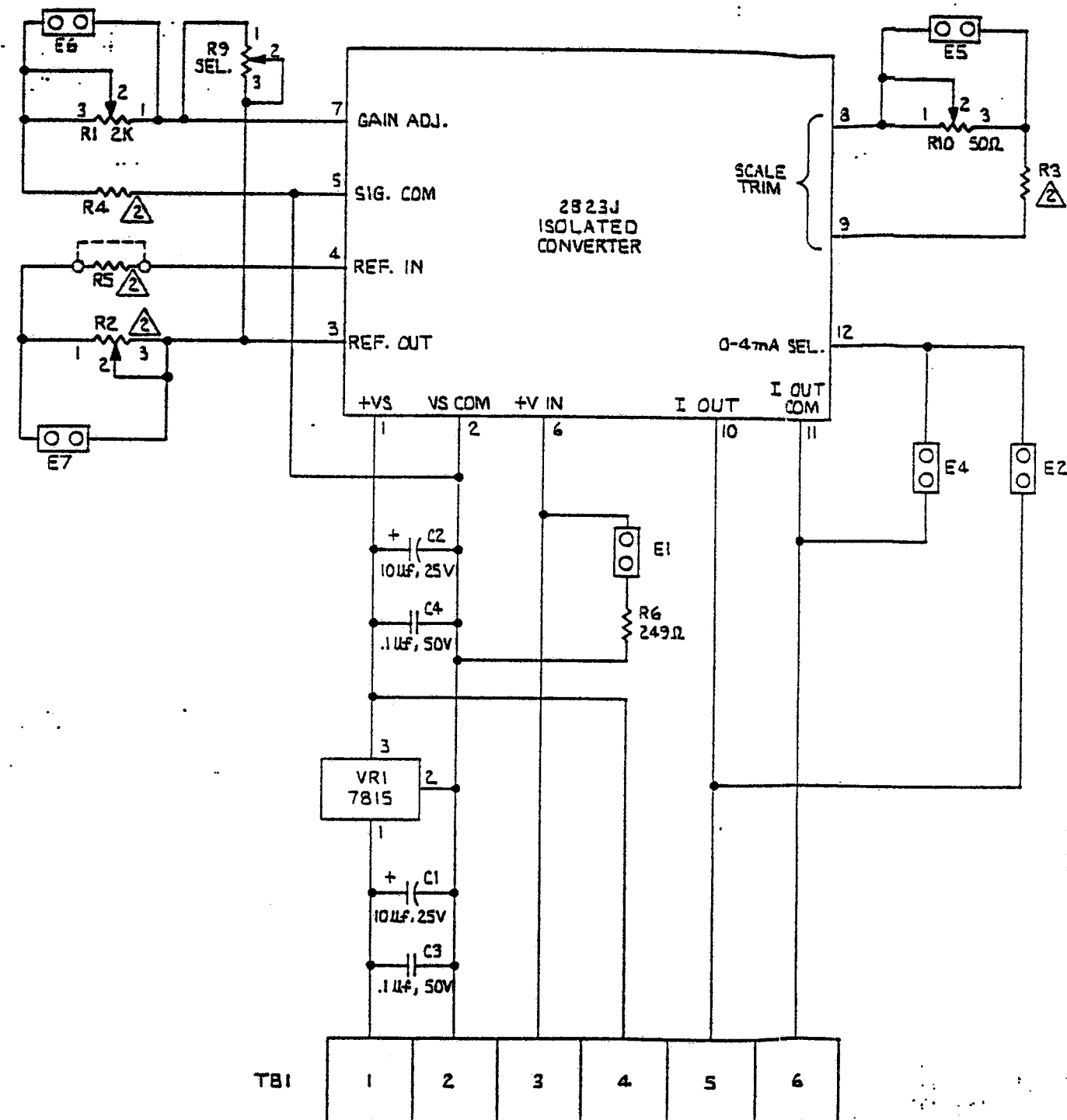
ITEM	QTY	DESCRIPTION
1	1	MODEL 101 PCB
2	1	TERMINAL STRIP 9 PIN .BEAU, .375 CENTERS
3	1	TERMINAL MARKER STRIP 9 PIN .375 CENTERS
4	1	CAPACITOR 0.1UF 50V CER
5	1	CAPACITOR 220PF 50V CER
6	1	DIODE 1N914
7	1	TRANSISTOR 2N6308
8	1	IC VFO-IC
9	1	IC CD4040BC
10	1	IC 74C221
11	1	POTENTIOMETER 500K
12	1	VOLTAGE REGULATOR 1M336 5.0V
13	1	VOLTAGE REGULATOR 7812
14	1	VOLTAGE REGULATOR 7805
15	1	RESISTOR 10K
16	1	RESISTOR 225.0 1/4W 1%
17	1	RESISTOR 2.21K 1/8W 1%
18	1	RESISTOR 49.9K 1/8W 1%
19	1	RESISTOR 499K 1/8W 1%
20	1	RESISTOR 100K 1/8W 1%
21	1	RESISTOR 221K 1/8W 1%

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

REVISIONS				
REV.	DESCRIPTION	ORIGIN	CHECK	DATE
A	REVISED DELETED 4-20 mA IN, 0-5 VDC CUT OPTION	J.C.	D.P.	1/15/86

THIS DRAWING IS THE PROPERTY OF KURZ INSTRUMENTS INC. IT IS TO BE USED ONLY FOR THE MANUFACTURE OF THE INSTRUMENTS SPECIFIED HEREIN. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF KURZ INSTRUMENTS INC.

D
 C
 B
 A



LAST USED	NOT USED
C4	
E7	E3
R10	R7, R8
TBI	
2B23J CONVERTER	

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

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		APPROVALS	
TOLERANCES ARE		DRAWN BY	DATE
FRACTIONS = 1/32		J. CAREAGA	8-13-86
ANGLES = 9° - 30°		CHECKED BY	DATE
DECIMALS		Dimitri	5-15-86
X = 0.1		DESIGN	DATE
XX = 0.05		APPROVED	DATE
XXX = 0.005		U. H. King	5/15/86
XXXX = 0.001		SCHEDULED	DATE
NG. RELEASE DATE			

KURZ INSTRUMENTS INC.

TITLE
 MODEL 132
 ISOLATED SIGNAL OUTPUT CONVERTER
 SCHEMATIC DIAGRAM

L3

DRWG. SIZE C	DRWG. NO. C13230001	REV. A
SCALE NONE	SHEET 1 OF 1	

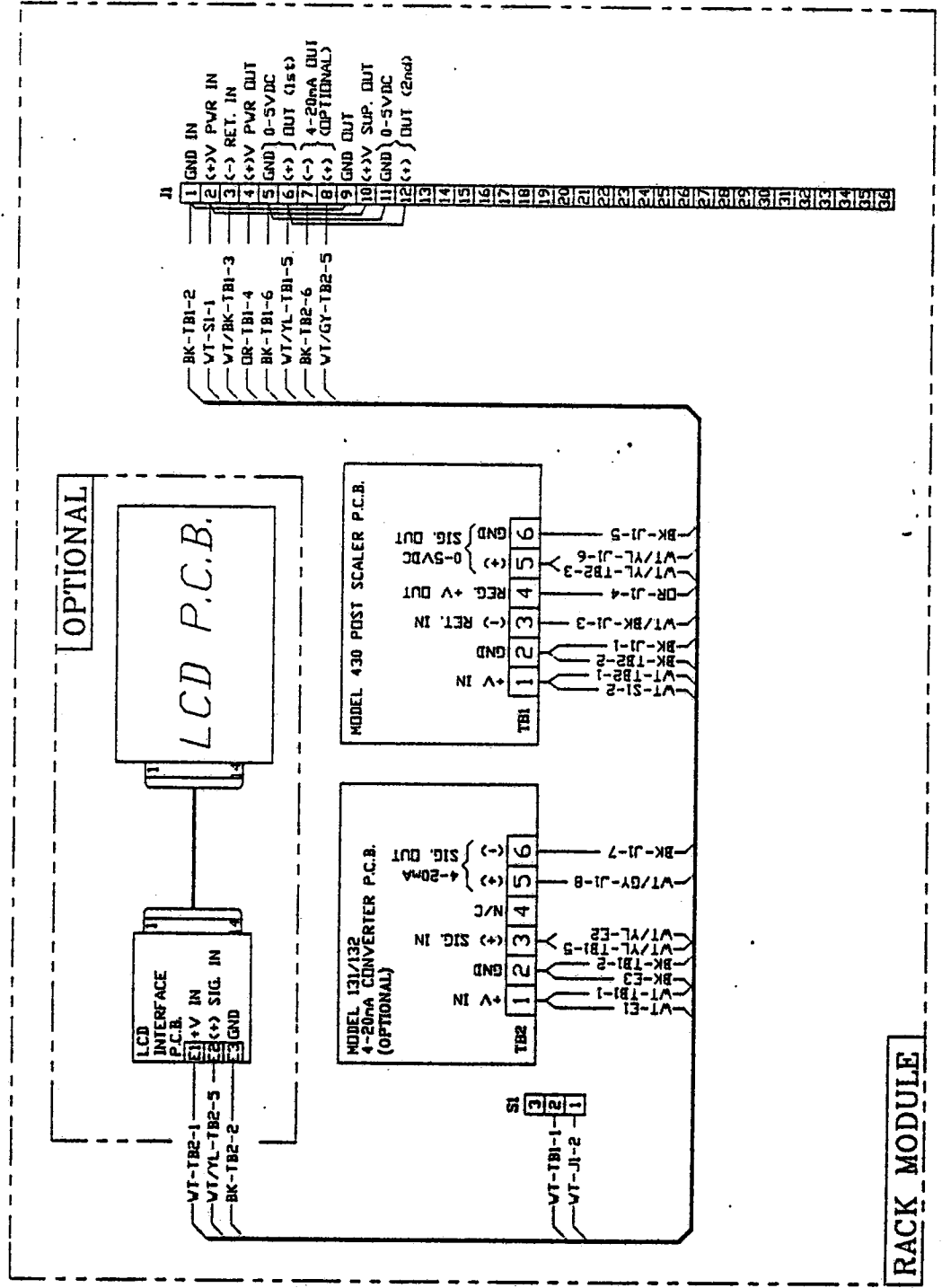
MODEL 161RM TEMPERATURE MODULE

A special EVA sensor with a third winding that functions as a platinum RTD may be substituted in place of one of the regular EVA sensors used on the IK-EVA probe assembly. This temperature sensor will then wire to the system electronics enclosure via the two wire hookup feature. At the system electronics enclosure, the model 161RM temperature module provides a linear output of 0-5 Vdc. If the user desires to further transmit the signal from the system electronics enclosure, we recommend adding another 132RM 4-20 mA output module. Available ranges are 0-250°F, 0-500°F and 0-1000°F, depending on the specified EVA sensor temperature rating. The 161RM module is 2.8 inches wide (1/6 rack).

MODEL 161RM-D DIGITAL TEMPERATURE MODULE

This module is the same as the 161RM described above, except it includes a direct-reading digital display and is 4.2 inches wide.

REV	DESCRIPTION	DATE	BY
1	REVISED REL ECD-R11J47001	11/16/77	MIG

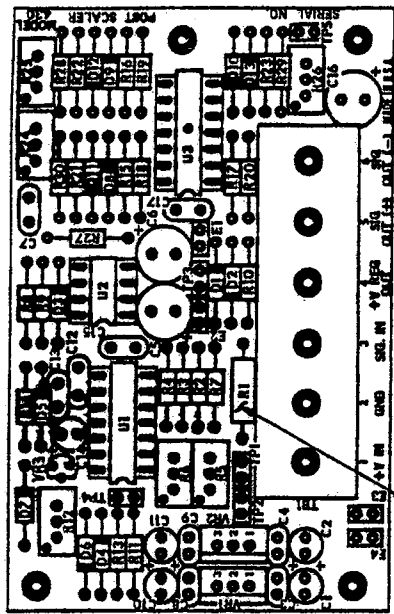


NOTES: UNLESS OTHERWISE SPECIFIED
 1. REF. DES. AND TERM. NO. ARE FOR REF. ONLY AND
 2. MAY NOT APPLY TO COMPONENTS.
 3. ALL WIRES TO BE A MIN. OF #22 AWG

KURZ INSTRUMENTS INC.	
MODEL 161 RACK MODULE	INTERNAL WIRING DIAGRAM
DATE: 11/16/77	BY: MIG
SCALE: NONE	HEET: 1 OF 1

APPROVALS	DATE
DESIGNED BY: M. J. ...	11/16/77
CHECKED BY: ...	11/16/77
APPROVED BY: ...	11/16/77

REVISIONS	
NO.	DESCRIPTION



ALL COMPONENTS SHOWN INSTALLED

40	1	TP2	J PIN OR WIRE
39	38	VR2	VOLTAGE REGULATOR 7805
37	36	C1-C9	CAPACITOR 100UF 50V CER
35	35	C2-C16	CAPACITOR 100UF 25V ELEC

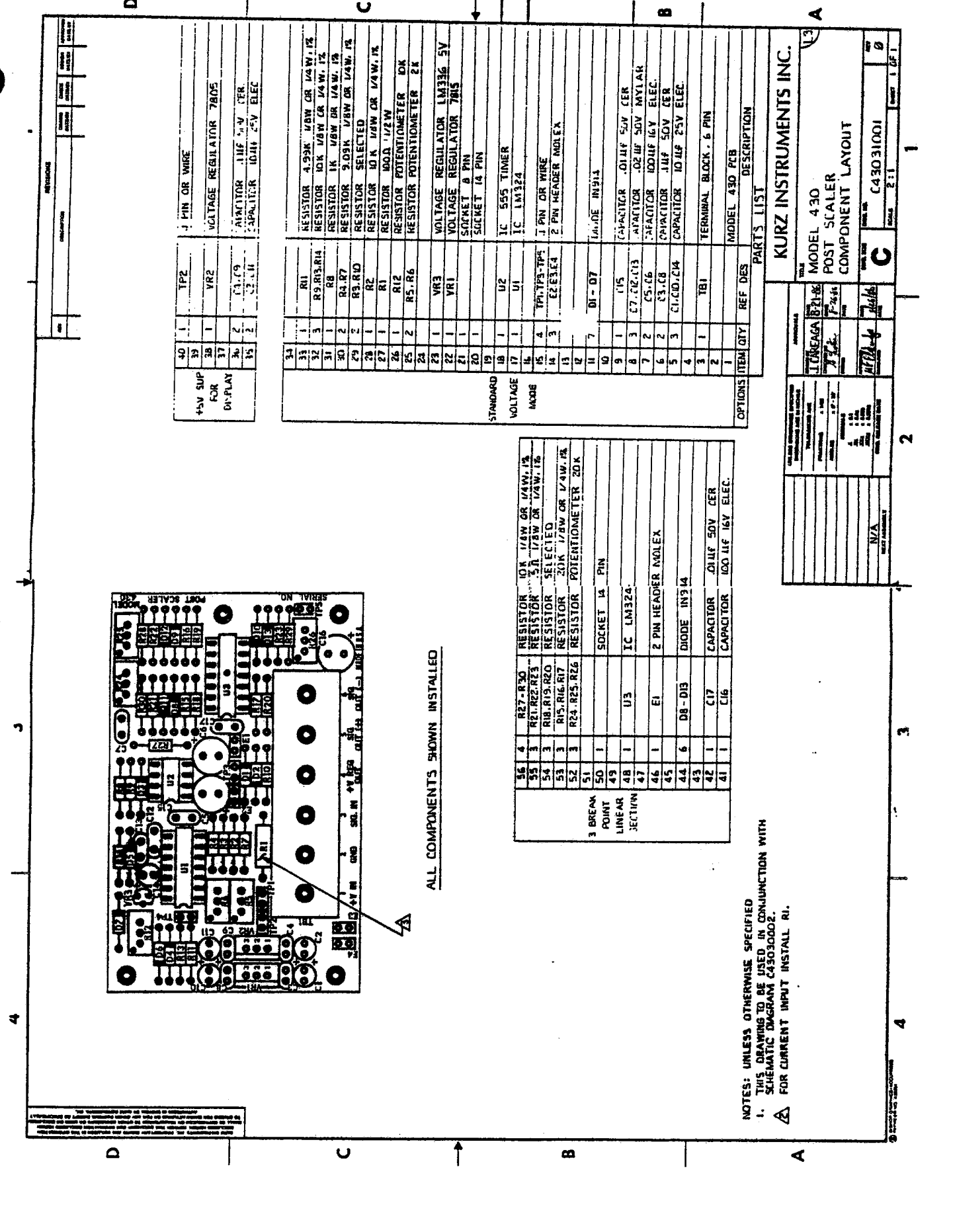
34	33	R1	RESISTOR 4.99K 1/8W OR 1/4W 1% 1% 1/8W OR 1/4W, 1%
32	32	R9-R13, R14	RESISTOR 10K 1/8W OR 1/4W, 1%
31	31	RB	RESISTOR 1K 1/8W OR 1/4W, 1%
30	2	R4, R7	RESISTOR 9.09K 1/8W OR 1/4W, 1%
29	2	R3, R10	RESISTOR SELECTED
28	1	R2	RESISTOR 10K 1/8W OR 1/4W, 1%
27	1	R1	RESISTOR 600Ω 1/2W
26	1	R12	RESISTOR POTENTIOMETER 10K
25	2	R5, R6	RESISTOR POTENTIOMETER 2K
24			
23	1	VR3	VOLTAGE REGULATOR LM336 5V
22	1	VR1	VOLTAGE REGULATOR 7815
21	1		
20	1		
19	1		
18	1	U2	IC 555 TIMER
17	1	U1	IC LM324
16	4	TP1, TP2, TP4	J PIN OR WIRE
15	3	E2-E14	2 PIN HEADER MOLEX
14	3		
13			
12			
11	7	D1-D7	DIODE IN3114
10			
9	1	I15	CAPACITOR 01UF 50V CER
8	3	C7, C12, C13	CAPACITOR 100UF 50V MYLAR
7	2	C5, C6	CAPACITOR 100UF 16V ELEC
6	2	C3, C8	CAPACITOR 10UF 50V CER
5	3	C1, C4, C14	CAPACITOR 10UF 25V ELEC
4			
3	1	TB1	TERMINAL BLOCK - 6 PIN
2			
1			

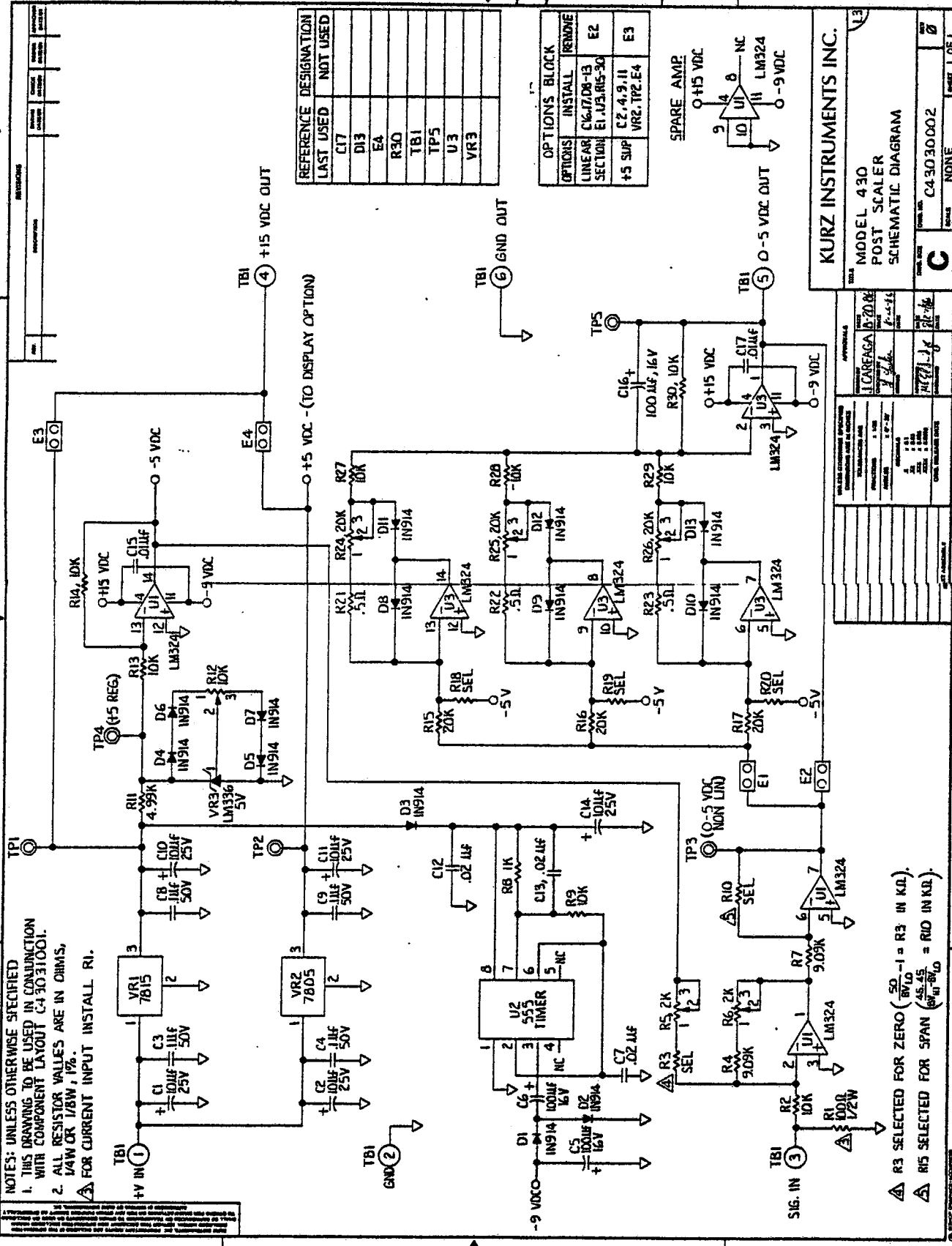
36	4	R27-R30	RESISTOR 10K 1/4W OR 1/4W, 1%
35	3	R21, R22, R23	RESISTOR 5.1K 1/8W OR 1/4W, 1%
54	3	R18, R19, R20	RESISTOR SELECTED
53	3	R15, R16, R17	RESISTOR 20K 1/8W OR 1/4W, 1%
52	3	R24, R25, R26	RESISTOR POTENTIOMETER 20K
51			
50	1		
49			
48	1	U3	IC LM324
47			
46	1	E1	2 PIN HEADER MOLEX
45			
44	6	D8-D13	DIODE IN314
43			
42	1	C17	CAPACITOR 01UF 50V CER
41	1	C16	CAPACITOR 100UF 16V ELEC

NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM C4303002.
 2. FOR CURRENT INPUT INSTALL R1.

OPTIONAL PARTS LIST

ITEM	QTY	REF	DES	DESCRIPTION
1	1			MODEL 430 PCB
PARTS LIST				
KURZ INSTRUMENTS INC.				
MODEL 430				
POST SCALER				
COMPONENT LAYOUT				
C		C43031001		
SCALE	2:1			
DATE				
DRAWN BY				
CHECKED BY				



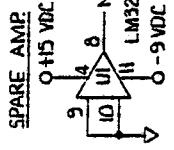


NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONDUCTION LAYOUT C43031001.
 2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W OR 1/8W, 1%.
 3. FOR CURRENT INPUT INSTALL R1.

▲ R3 SELECTED FOR ZERO (50 -1 = R3 IN KΩ).
 ▲ R5 SELECTED FOR SPAN (55.45 = R5 IN KΩ).

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

OPTIONS BLOCK	INSTALL	REMOVE
LINEAR	C16, D8-13	E2
SECTION	E1, U3, R5-30	E3
+5 SUP	VR2, TP2, E4	



KURZ INSTRUMENTS INC.

MODEL 430
 POST SCALER
 SCHEMATIC DIAGRAM

DATE: 10-20-88
 DRAWN BY: J. J. J.
 CHECKED BY: J. J. J.
 PART NO.: C43030002

1 2 3 4

1 2 3 4

SERIES 111 DUAL ALARM

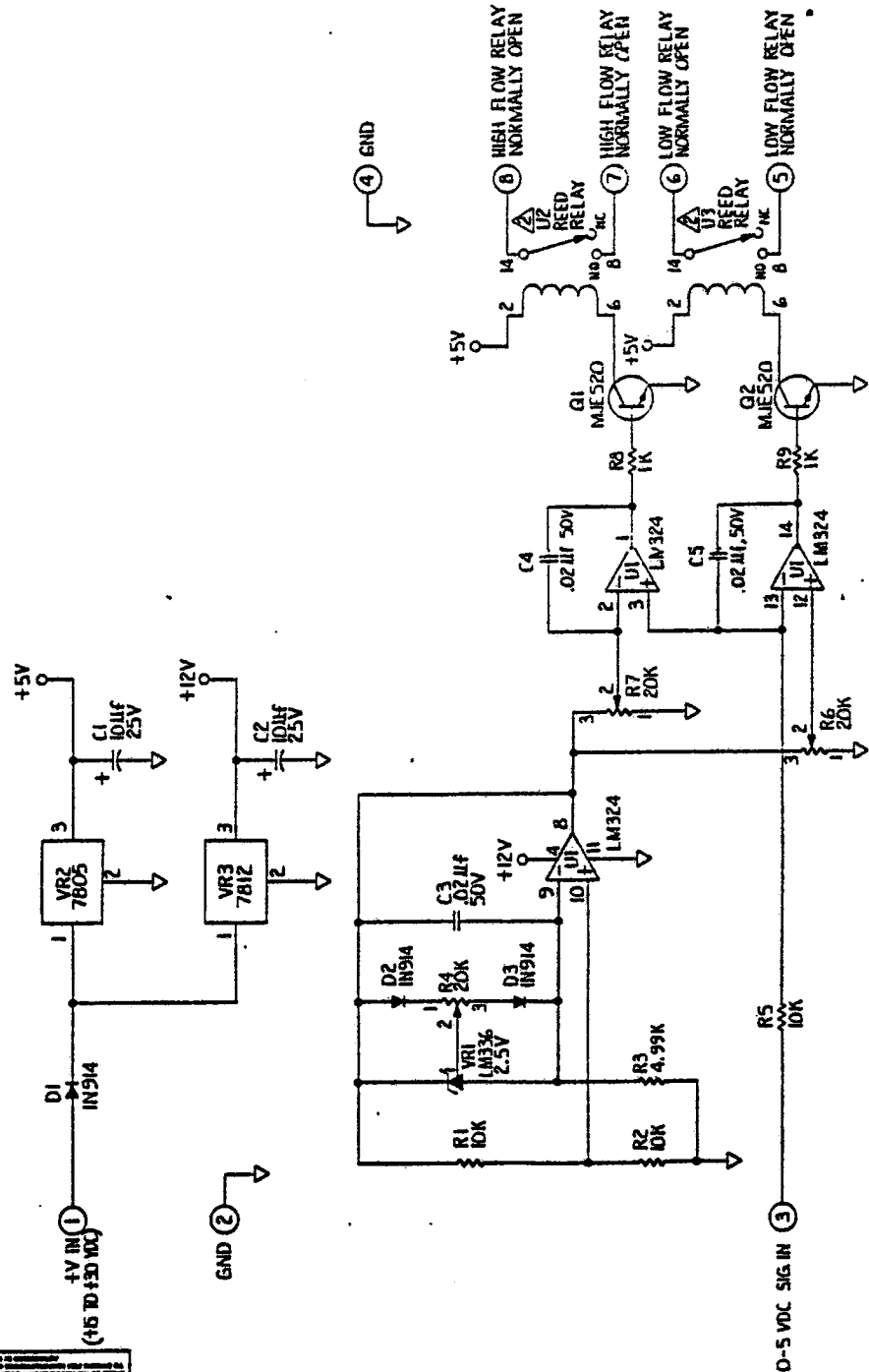
Series 111 dual alarm units provide the user with adjustable set points one high and one low. The circuit operation is basic and straight forward. A reference signal is adjusted for each setpoint (high & low), the resulting signals are present at comparator amplifiers which also sense the feedback flow signals and in turn will trigger an alarm. When the setpoint is crossed over the amplifier turns on a transistor which in turn causes the relay to energize.

Dual Alarm units are provided with 1/2 amp relays in the normally open position, on energizing they close. Optionally available are 5 amp contacts in either the N/O or N/C position. Relays may also be set up for fail safe operation such that under power failure they will de energize to alarm.

The Series 111 units are also sold in rack module configurations and carry the 111RM model number. This module is 1.4 inches wide (1/12 rack), has two 1/2 amp relay closures, and is commonly used for high and low flow alarms. Rack modules with the 5 amp option require the next larger rack size, 2.8 inches wide (1/6 rack).

REVISED PER ECO A1114 7001

NOTES: UNLESS OTHERWISE SPECIFIED
 1. THIS DRAWING TO BE USED IN CONJUNCTION WITH COMPONENT LAYOUT A11131001.
 1. OPTION: 5 AMP REGULATED - DELETE REED RELAY U2 AND U3.
 ADD JUMPER WIRE ON U2 BETWEEN PIN 2 + 14 AND PIN 6 + 8.
 ADD JUMPER WIRE ON U3 BETWEEN PIN 2 + 14 AND PIN 6 + 8.
 CHANGE VR2 FROM LM7805 TO LM7806 FOR 5 AMP RELAY ONLY.



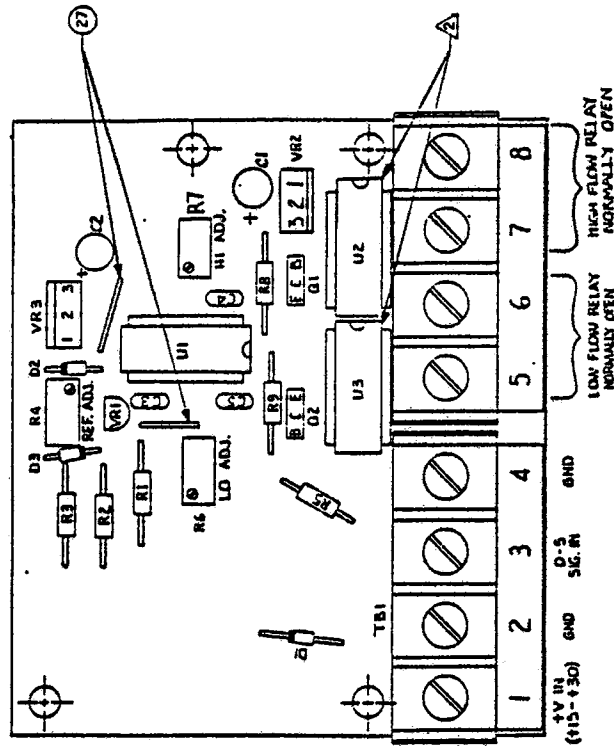
KURZ INSTRUMENTS INC.
 MODEL 111
 DIGITAL ALARM
 SCHEMATIC DIAGRAM

DESIGNED BY	J. CAREAGA
DATE	8-22-86
REVISED BY	S.M. 11
DATE	5-11-84
APPROVED BY	A.P.H.
DATE	8/24/86
SCALE	1:1
WORK NO.	C11130001
FIGURE	FIGURE
SHEET	1 OF 1

FOR THE OPERATING PERSONNEL
 CONSULT THE USER MANUAL
 FOR THE MODEL 111 DIGITAL ALARM

NOTES: UNLESS OTHERWISE SPECIFIED

- THIS DRAWING TO BE USED IN CONJUNCTION WITH SCHEMATIC DIAGRAM C11130001.
- OPTION: 5 AMP REGULATED - DELETE REED RELAY U2 AND U3.
 ADD JUMPER WIRE ON U2 BETWEEN PIN 2 + 1A AND PIN 4 + 8.
 ADD JUMPER WIRE ON U3 BETWEEN PIN 2 + 1A AND PIN 6 + B.
 CHANGE VR2 FROM LM7805 TO LM7806 FOR 5 AMP RELAY ONLY.



ITEM	QTY	REF DES	DESCRIPTION
28	1	WIRE	WIRE JUMPER, TIN
27	1	VR3	VOLTAGE REGULATOR LM7812
26	1	VR2	VOLTAGE REGULATOR LM7805
25	1	VR1	VOLTAGE REGULATOR LM336 2.5V
24	1	U3	IC REED RELAY SIGMA 191TEIC1-53
23	1	U2	IC REED RELAY SIGMA 191TEIC1-53
22	1	U1	IC LM324 OP-AMP
21	1	D3	DIODE 1N914
20	1	C5	CAPACITOR .02UF, 50V NYLAR
19	1	C4	CAPACITOR .02UF, 25V ELEC.
18	1	C3	CAPACITOR .02UF, 25V ELEC.
17	1	C2	CAPACITOR .02UF, 25V ELEC.
16	1	C1	CAPACITOR .02UF, 25V ELEC.
15	1	TBI	TERMINAL BLOCK 4 PIN
14	1	TBI	TERMINAL BLOCK 4 PIN
13	1	TBI	TERMINAL BLOCK 4 PIN
12	1	TBI	TERMINAL BLOCK 4 PIN
11	1	TBI	TERMINAL BLOCK 4 PIN
10	1	TBI	TERMINAL BLOCK 4 PIN
9	1	TBI	TERMINAL BLOCK 4 PIN
8	1	TBI	TERMINAL BLOCK 4 PIN
7	1	TBI	TERMINAL BLOCK 4 PIN
6	1	TBI	TERMINAL BLOCK 4 PIN
5	1	TBI	TERMINAL BLOCK 4 PIN
4	1	TBI	TERMINAL BLOCK 4 PIN
3	1	TBI	TERMINAL BLOCK 4 PIN
2	1	TBI	TERMINAL BLOCK 4 PIN
1	1	TBI	TERMINAL BLOCK 4 PIN

KURZ INSTRUMENTS INC.

MODEL 111
 DUAL ALARM
 COMPONENT LAYOUT

REVISED PER ECO A11A7001

DATE: 1/22/84
 DRAWN BY: [Signature]
 CHECKED BY: [Signature]

ITEM: C
 PARTS LIST

SCALE: NONE

FIGURE: 1 OF 1

MODEL ETI-RM ELAPSED TIME INDICATOR MODULE
(optional)

The ETI-RM is 2.8 inches wide (1/6 rack). The ETI counts hours and operates anytime the system is under power. ETI's allow the user a local indication of elapsed time, such that a total sample time may be known for various monitoring purposes. An alternate purpose may be to set and maintain a service schedule on the system.

The ETI is powered by 115 VAC/60 HZ and provides a local readout in hours of elapsed time, based on how many hours the system has been powered up. The user should keep a record of the elapsed time any time the filters are replaced or the system is shut down to allow accurate effluent monitoring.



APPROVALS	DATE	TITLE:		
INITIATED <i>MF Eldred</i>	<i>4/14/85</i>	KII Equipment Storage Requirements		
CHECKED <i>Trink</i>	<i>5/1/86</i>			
APPROVED <i>MF Eldred</i>	<i>5/1/86</i>			
		DWG NO. A37001	REV. A	SHT 1 OF 14

A 19003

1. PURPOSE

1.1 This specification provides general storage criteria and specifies the minimum storage and maintenance requirements for the supplied equipment for periods up to five years at the manufacturer's facilities, the plant sites, or other storage facilities.

1.2 The storage and maintenance requirements herein are to be implemented by the Owner or Contractor wherever the equipment is assigned to storage, either at the sites or at other facilities. Since these requirements identify the final storage environments, they are also to be utilized by KII Projects, Design Engineering and Quality Assurance-Engineering Equipment and Installation to develop proper Vendor packaging.

1.3 The requirements herein and additional or maintenance requirements given in KII approved Vendor instruction manuals or storage instructions are considered minimum warranty. Actual storage conditions may require additional special considerations. In the case of conflicts between this specification and KII approved Vendor manual or special instructions, the more stringent requirements shall apply.

2. APPLICABLE DOCUMENTS, CODES, AND STANDARDS

2.1 The equipment storage requirements described by this specification shall be designed in accordance with the following documents to the extent specified herein.

2.2 Codes and Standards

2.2.1 Military Standards and Specifications

- a. Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification.

MIL-D-3464
MIL-B-131

- b. Barrier Material, Water Vaporproof, Flexible

2.2.2 American National Standards Institute (ANSI)

- a. Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants, ANSI N45.2.9 - 1974.

3. DESCRIPTION



INITIATED MPC

9/9/55

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3.1 The preservation of equipment during all warehousing or in-plant storage consists primarily of keeping the equipment CLEAN AND DRY and protecting it from physical damage. This is best assured through planning and implementation of a storage program, including provisions for adequate facilities and for periodic inspection and maintenance of all equipment. Accordingly, this document provides equipment and material storage requirements for use in development of a storage program. The storage, maintenance, and environmental requirements in Section 4 and Table 1, plus KII approved Vendor manuals or approved Vendor storage instructions, should be sufficient guidance for the program to be formulated. However, it should be recognized that the actual storage conditions may require additional precautions, and good judgement must be exercised on the part of the personnel responsible for the storage. Basic responsibility for storage at the plant sites belongs to the Owner.

3.2 The maintenance of clean and dry storage via a temperature controlled heated warehouse for as much of the equipment as possible is emphasized. Such storage conditions limit equipment and air temperature changes in the warehouse, thereby reducing the possibility of condensation on the equipment. Condensation occurs when the equipment temperature is allowed to drop below the dewpoint of the surrounding air. If the equipment and air temperature limitations do not control condensation, as might occur under very humid conditions, it may be advisable to reduce the relative humidity of the air by dehumidification, thus reducing the dewpoint temperature. For example, under 90 percent relative humidity and 80°F air temperature the dewpoint is 76.5°F, whereas at 40 percent relative humidity and 80°F air temperature the dewpoint is 32.5°F.

3.3 To establish storage criteria, three environmental categories of storage are defined as they relate to the general types of areas normally available for storage. Equipment is then assigned to one of the categories. These categories are: Inside Heated (IH), Inside Unheated (IU), and Outside (O). Another type of storage occurs at the plant sites when equipment is moved into the plant buildings for installation and is defined as in-plant storage.

3.4 Definitions of terms used herein as follows:

- a. CONTRACTOR--The agency under contract for storage of the equipment.
- b. OWNER--The customer, i.e. the power company.



- c. SHALL and SHOULD--This document contains both mandatory and guidance information. "Shall" or "must" indicates mandatory requirements, while "should" or "may" indicates recommendations as good practice. Deviations or substitutions for mandatory requirements shall require approval by KII Design Engineering. Recommendations are not mandatory.

3.5 The specifications herein are divided into General Storage and Maintenance Requirements (Section 4.1), Special Considerations for Storage (Section 4.2), and a listing of KII supplied equipment (Table 1).

4. REQUIREMENTS

4.1 General Storage and Maintenance Requirements

4.1.1 Storage and Maintenance Program

4.1.1.1 A most important part of equipment warranty protection is a planned, periodic inspection and maintenance program including documented results. This is to ensure that storage is provided in a proper manner without degradation of the equipment. A storage program shall be developed by the responsible Contractor or Owner for all equipment. At the plant site the program shall include receipt inspection through in-plant storage at the equipment's final location and continue until the start of pre-operational testing. Basic responsibility for the site program and storage rests with the Owner.

4.1.1.2 The storage program shall fulfill the following requirements for control of items while in storage.

- a. Inspections and examinations shall be performed on a periodic basis. Minimum quarterly inspections are recommended with monthly inspections as appropriate. Any deficiencies shall be corrected and documented. Some characteristics to be verified during these inspections are:

- Identification and marking
- Protective covers and seals
- Coating and preservatives
- Lubrication
- Desiccants or nitrogen atmosphere
- Physical damage
- Cleanliness



KII should be notified as soon as possible (not to exceed 30 days) concerning any physical damage or need for repairs.

- b. The care of items in storage shall be established by developing written procedures of instructions in accordance with requirements herein and the KII approved vendor instruction manuals or storage instructions.
- c. Written records shall be prepared to document the inspections performed, the performance of maintenance, and the disposition of nonconformances and repairs.

4.1.1.3 Receipt inspection shall be performed on all incoming equipment to be stored. As part of the inspection, the packaging and components shall be inspected for damage and be inventoried for completeness. The appropriate damage or shortage reports shall be prepared promptly.

4.1.1.4 Receipt inspection should be performed without destroying the shipping/storage protection provided by the manufacturer. If it is necessary to remove seals such as tank covers, pipe caps, polyethylene wrappings, these shall be replaced prior to storage. The receipt inspection shall also determine or verify that the packaging is sufficient protection for the type storage instructions/manuals.

4.1.1.5 The equipment storage is subject to audit in conformance with this specification, KII approved Vendor storage instructions/manuals, and the Contractor's program.

4.1.2 Storage Facilities Requirements

4.1.2.1 Inside Heated (comparable to Level B of ANSI 45.2.2)

4.1.2.1.1 Inside heated (IH) category is defined as storage in a clean, fire resistant, weathertight, well ventilated building (warehouse). The temperature of the warehouse is to be controlled with heating and ventilating systems to ensure that condensation of moisture does not occur on stored parts. This is the optimum storage condition for all equipment, except for special equipment such as electronic devices which may require humidity control within specified limits.

4.1.2.1.2 Other requirements for IH storage are as follows:



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- a. Internal cleanliness of equipment and flow elements shall be maintained by closing openings where possible by plugging, capping and/or sealing with tape (approved types). But weld preps on valves and spool pieces shall be reinstalled over plywood to better protect the weld preparation.
- b. All equipment shall be protected against rodent and insect damage. Electrical equipment, and motors in particular, shall be provided with screens, shields, etc., to preclude entry.
- c. Equipment shall be protected from mechanical damage. The proper use of racks, pallets, and handling equipment so arranged as to minimize damage to the stored equipment during handling.
- d. All equipment shall be protected from dust and dirt. Large equipment should be covered with polyethylene if it is not adequately protected in its as-shipped condition. Small equipment should be bagged in polyethylene or stored in clean, closed boxes. Note that small parts are generally listed for warehouse storage where they can be under inventory control to reduce risk of loss.

4.1.2.2 Inside Unheated (comparable to Level C of ANSI 45.2.2)

4.1.2.2.1 Inside unheated (IU) category applies to storage within a building as defined in storage but is not heated. IU also applies to individual housing made only for a large component such as the shroud or steam dryer. Any building provided as an individual housing made only for large components shall meet the same requirements as for any other IU building. A wood or other framed shelter with only polyethylene walls does not afford complete weather protection and does not meet IU requirements.

4.1.2.2.2 Other requirements for IU storage are:

- a. All those listed under IH storage, 4.1.2.1.2, items a through d.
- b. The equipment shall be stored off the floor on suitable skids, pallets or racks.



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- c. All water or other liquid capable of freezing at outside temperatures shall be drained from the equipment prior to storage and/or such verification obtained. This is particularly applicable to heat exchangers, equipment having cooling water coils, gages, etc. which may have been test operated or hydrostatically tested.
- d. Preservative coating applied to the equipment or added shall be maintained, i.e., paint, oils and contact preservatives.

4.1.2.2.3 In addition, a subcategory, inside unheated controlled (IUC) is utilized in Table 1 to identify the need for special protection against condensation for a component or part thereof. IUC also applies to condensate protection for the entire component if it is equipped with electrical or air operated devices. Listed below are four methods by such condensate protection may be provided, and all require periodic inspection and maintenance.

- a. Bagged desiccant within a sealed enclosure. The desiccant may be inside the component for internal protections, and/or the entire component may be sealed in a container or wrap with a desiccant enclosed. A means of checking the relative humidity with the enclosure/container shall be provided and the desiccant changed when indicated. A vapor barrier wrap other than polyethylene must be used to reduce frequency of desiccant change.
- b. Local heating by strip heaters, light bulbs, etc., inside a tent-like structure to maintain the equipment surfaces degrees above the ambient air temperature.
- c. Pressurized nitrogen atmosphere to minimize condensation and oxidation on internal surfaces.
- d. Approved preservatives to protect unpainted carbon steel surfaces. Such preservatives shall be in accordance with the KII approved Vendor instructions or approved KII Engineering.

The selection of an IUC method for a particular component shall be by the Contractor or Owner, unless specifically designated herein or in the KII approved Vendor's instructions.

4.1.2.3 Outside Storage (comparable to Level D of ANSI 45.2.2)



4.1.2.3.1 Outside Storage (O) is subject to the site location considerations given in Section 4.2.2 and the requirements listed below:

- a. Items c and d as listed under 4.1.2.2.2.
- b. On equipment where internal cleanliness or operation could be adversely affected by dirt or contamination, openings shall be plugged, capped, or otherwise sealed. All plugs and caps shall be securely attached to the equipment to prevent their inadvertent removal. Large items such as tanks and heat exchangers, with all openings tightly covered, need not be crated, but the established preservatives shall be maintained.
- c. All equipment and equipment containers shall be stored off the ground on suitable skids or cribbing and covered to protect the equipment surfaces from direct exposure to the weather. Canvas cloth or other weather resistant material must be used. The covering shall be lashed down and provide drainage of precipitation without formation of water pools. CLEARANCE BETWEEN THE COVERED EQUIPMENT AND THE GROUND LEVEL SHALL BE SUFFICIENT TO PERMIT AIR CIRCULATION, THUS MINIMIZING CONDENSATION ON THE EQUIPMENT.

4.1.2.4 In-Plant Storage

4.1.2.4.1 In-Plant storage at the site is storage of the equipment in the plant usually at or near its final installed location while it is being installed and/or readied for operation. Because of the surrounding construction work, it is during these storage periods that the equipment is often least protected from dust, dirt, and moisture. Careful planning surveillance is required in-plant to assure that the equipment is adequately protected. In-plant storage shall meet the minimum environmental requirements specified in Table 1 for up to one year of storage, including all other general area requirements and considerations herein. Planning for such storage may require utilization of special procedures to keep the equipment clean and dry. Temporary covering, heating facilities, and routine storage shall be employed. Construction operation is to be planned so that dust-producing operations or unusual conditions of dampness are minimized where the equipment is located. For example:

- a. Clean the area before the equipment is introduced and establish routine housekeeping inspections.



- b. Minimize water that is allowed in the lower drywell areas. Prevent flooding of equipment by providing operable sump pumps and alarm systems before the equipment is placed in the area.
- c. Energize electric motor space heaters as soon as the motor is moved out of the warehouse to the installed position.
- d. Plan to have the control room enclosed and heated, and a humidity indicator in operation before installing control and instrumentation equipment.
- e. Provide temporary heat and coverings to keep the equipment protected from dirt and above the dewpoint of the surrounding air.

4.1.2.4.2 Note that control panels, racks, vertical boards, and instrumentation are most vulnerable to plant construction conditions. Covering/protective measures per (e) above are required to assure that cleanliness and dryness is maintained.

4.2 Special Considerations

4.2.1 This section provides recommendations and requirements to assist in the development of storage areas and in the selection of protective materials at all storage sites.

4.2.2 The storage location and the compatibility of materials with the equipment must be considered when providing on-site packaging or repackaging of equipment. The storage location affects the degree of protection required against atmosphere constituents such as halides, sulfides, industrial fumes, etc. The nearer the sea coast of heavy industrial areas are to the storage area, the more protection from the atmosphere is required. It is most important the stainless steels or nickel based alloys be protected from contamination by halides or low melting point elements. The Contractor or Owner should factor in any unique storage conditions such as high chloride soils and/or industrial fumes, and apply any additional requirements above the KII minimum requirements when the storage program is established.

4.2.3 Some equipment parts such as O-rings, shaft packing, insulation, contact switches, and gasket material may deteriorate in long-term storage despite optimum conditions. Therefore, the Owner's pre-operational maintenance program should identify and schedule procurement for the replacement of these parts.



4.2.4 In some cases insurance underwriters require warehouse sprinkler systems and may limit package storage for more effective sprinkler protection; therefore, insurance requirements should be factored into the storage program.

4.2.5 Spare Parts

4.2.5.1 The Owner shall establish a program for spare parts receipt inspection, storage, maintenance, and control of issue. The program shall provide IH storage for all parts with packaging to keep the equipment clean and dry.

4.2.6 Identification

4.2.6.1 The identity of all equipment shall be verified and so identified while in storage by marking or tagging. This applies whether the equipment is crated, boxed, or stored inside without covering, and shall be accomplished so that the equipment is identifiable without opening or disturbing its storage condition. The following identification/markings is required:

- a. Equipment part number
- b. Purchase order number, item serial numbers, and quantity.
- c. Equipment name or description
- d. Project name and unit number

4.2.6.2 It is recommended that the above markings appear on two sides of each outer container, in letters at least 1/2 inches high in weatherproof ink or paint.

4.2.6.3 Where applicable, shipping skids or crates should be stenciled with handling instructions such as "fork lift here only, use no hooks", etc.

4.2.6.4 Direct marking on stainless steel, nickel alloys, and other metallic materials are permitted with the following materials, providing they are completely removed prior to any system cleaning or plant heating operations. KII engineering approval is required for use of any other materials.

- a. Black tip markers and ball point pens
- b. Common lead pencils



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- c. Dykem steel blue, DX-100, Dykem Company, layout fluid
- d. Sprayon No. 603, Sprayon Products, layout fluid
- e. Nissen "no chloride" white metal marker
- f. Carter's "marks-a-lot" black pen

4.2.6.4.1 Colloidal graphite is alcohol mixture, Dispersion #156, or KII approved equal, may be used for marking without the necessity for removal prior to heating.

4.2.6.4.2 Crayon and chalk marking materials are NOT PERMITTED on stainless steels or nickel based alloys unless the material has been KII approved for use.

4.2.7 Preservatives (Corrosion Inhibitors)

4.2.7.1 Preservatives are used primarily on carbon steel surfaces and include paints, oils, greases, and a number of trudenane compounds such as Colomoline, Tectal, Immunol, etc. Preservatives applied at a Vendor's plant shall be left intact during storage. Should the reapplication of preservatives be required at the site, only those already approved for use through instruction manuals, KII approved Vendor storage instructions, or specified in the ordering data for the equipment involved may be used without KII Engineering approval.

4.2.7.1.1 If the preservative is to be used on inside surfaces that will be wetted during plant operation, the preservative shall meet two criteria: (1) be completely removable by cold water flushing, and (2) be low in sulfur and halogens so that it will not contaminate stainless or nickel alloys. Approved preservatives for carbon steel which meet these requirements are:

- a. Solution of 1/2 percent sodium nitrate, 1/4 percent disodium phosphate and 1/4 percent monosodium phosphate (commercially supplied as Kemtron #485, Chemical Supply Co.), or Immunol GE, Harry Miller Corporation.
- b. Immunol #1722, or Immunol NF, Harry Miller Corporation.
- c. Hydrin-X, Daubert Chemical Co.

4.2.7.2 Preservatives used to protect carbon steel weld preparation shall also meet the above requirements and not be detrimental to the weld quality. One such product is Deoxaluminite, Special Chemicals Corp.



4.2.7.3 KII Engineering approval is required for use of any preservative on stainless steel surfaces or any other surfaces directly exposed to reactor water.

4.2.8 Desiccants

4.2.8.1 The use of desiccants with austenitic stainless steel requires prior KII approval. Desiccants which may be used upon approval are limited to a non-halogenated type such as silica gel. The desiccant must meet MIL-D-3464 Type II non-dusting type and be contained (bags) and installed with the containers supported so that they will not be in direct contact with the component surfaces. Desiccant placed inside of equipment must be accounted for by marking/tagging the outside of the equipment. Desiccant may be used with carbon steel components without KII approval providing the particular desiccant used is one of those listed below.

- a. Protec - Sorb 121, X1591 (silica gel) - W. R. Grace and Co.
- b. Eagle Silica Gel 12867 - Eagle Chemical Co.
- c. Desiccata No. 25 Filtrol, Corporation

4.2.9 Tapes (Pressure-Sensitive)

4.2.9.1 Pressure-sensitive tapes are normally used for sealing polyethylene film wrappings, flange covers, small openings, containers, etc. Only KII approved tapes shall be used on stainless steel, nickel base alloys, and other materials exposed to the reactor primary system. Wherever tape contact with metal occurs, remove all adhesive with acetone or toluene immediately after tape removal. The tapes approved for use are as follows:

- a. Clothbacked (Not PVC treated)
 - (1) Polyken #222, Kendall Company (silver color)
 - (2) Polyken #224, Kendall Company (silver color)
 - (3) Dutch Brand #357, Nashua Corporation (silver color)
 - (4) Permaceal P69, Johnson & Johnson



b. Polyethylene

(1) #480, 3M Company

(2) Ex-Cor-Pe-12, Nashua Corp.

c. Polyester (Mylar)

(1) #850, Black 3M Company

4.2.10 Wrapping Material and Tarpaulins

4.2.10.1 Flexible materials used to wrap or cover components made of stainless steel or nickel base alloys shall be limited to the following:

- a. Clear polyethylene film
- b. Clear polyethylene film with thread reinforcement - equal to Type 55 manufactured by Griffolyn Company, Houston, Texas
- c. Canvas cloth (fire retardant types)
- d. Green colored polyethylene film: #01797, Plicose Mfg. Corporation or Polyfuff #1056 from Shott International Incorporated
- e. Fire retardant polyethylene, white, visqueen, Ethyl Corporation
- f. Vapor proof barrier materials for use with desiccant shall meet Mil-B-131; Marvelseal 1311, 360 and B-117-E from Marvellum Company

Polyvinyl chloride (PVC) plastic films shall not be used due to their high chloride content.

4.2.10.2 Polyethylene film is a good wrap or tarp to keep items clean, but is not a vaporproof barrier and permits passage of water vapor. When polyethylene is used to wrap an item for storage, the film should be left open and allowed to "breathe" freely so that the air inside the package is allowed to change readily, thus minimizing condensation.

4.2.10.3 If asbestos is used on stainless steel it shall be kept dry. If wetting does occur, the asbestos shall be removed and the stainless area rinsed with tap or demineralized water to remove the potential harmful effects of leached out chlorides.



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4.2.11 Lubrication. Lubrication oils/greases shall be applied in accordance with KII approved Vendor manual or special storage procedure instructions.

4.2.12 Stainless Steel Storage

4.2.12.1 Stainless Steel is not subject to harmful oxidation in the presence of moisture; therefore equipment constructed entirely of stainless steel may be stored Outside or Inside Unheated, subject to protection from dirt and mechanical damage as desired herein. If stainless steel becomes discolored with rust, it may be caused by surface iron contamination. A light rust film on the steel is not considered detrimental. However, to minimize rust it is recommended that stainless steel be stored where iron or carbon steel material cannot come in direct contact with its surfaces. Check carbon steel banding of packaging to assure that it is not in direct contact with stainless steel.

4.2.12.2 Components composed entirely of stainless steel should not be kept tightly wrapped and sealed, but be loosely packaged with provisions for ample circulation of air. This is particularly true of polyethylene wrapping which is porous and will trap moisture inside the package and generally degrade the entire package.

4.2.13 Carbon Steel Storage

4.2.13.1 Rusting of carbon steel surfaces is of primary concern in carbon steel equipment storage. A light film of soft rust is not considered detrimental, but pitting and heavy rust and scale formation must be avoided. The preservatives which meet cleaning requirements are only effective for a short period of time in the presence of moisture (1-3 months); therefore, if such preservatives are utilized for any unheated storage, the equipment must be periodically inspected to insure satisfactory condition.

Example:

TABLE 1

<u>Equipment Type</u>	<u>Storage Requirement</u>	<u>Reference Section</u>
1) Electronic or Electrical	(IH)	4.1.2 - 4.1.2.2
2) Carbon Steel Parts Painted or Unpainted	(IUC) or better	4.1.2.2.3, a-d
3) Flow Sensor Assembly	(IUC) or better	4.1.2.2.3, a-d
4) Stainless Steel Assembly, Parts or Hardware	(O) or better	4.1.2.3.1, a-c

Note: Where equipment types are mixed, as in assembled goods, the more stringent storage requirements shall be employed.



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