ADDENDUM

PLEASE NOTE THAT THE CIRCUIT BOARDS IN THE 155Jr HAVE BEEN REVISED. THE TERMINAL CONNECTIONS HAVE CHANGED SLIGHTLY. PLEASE REFER TO THE ENCLOSED WIRING DIAGRAM FOR THE NEW TERMINAL LOCATIONS AND PIN-OUTS.

MODEL 155Jr

USER'S GUIDE

360156 Rev. A

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Document Title: Series 155Jr Mass Flow Computer User's Guide
Document Number: 360156, Revision A
Publication Date: January 3, 1995

LIMITED WARRANTY-PRODUCT
(Liability for Repair or Replacement Only)

The Company's products are warranted to be free from defects in material and workmanship for one year from date of shipment from the factory. The Company's obligation is limited to repairing, or at their option, replacing products and components which, on verification, prove to be defective, at the factory in Monterey, CA. The customer is responsible for materials of construction selection and for materials suitability for the intended use of Kurz equipment. The company shall not be liable for installation charges, for expenses of Buyer for repairs or replacement, for damages for delay of loss of use, or other indirect or consequential damages of any kind. The Company extends this warranty only upon proper use and/or installation of the product in the application for which intended and does not cover products which have been modified without the Company's approval or which have been subjected to unusual physical or electrical stress, or upon which the original identification marks have been removed or altered.

Whenever the design of the equipment to be furnished of the system in which it is to be incorporated originate with the buyer, manufacturer's warranty is limited specifically to matters relating to furnishing of equipment free of defects in material and workmanship and assumes no responsibility for implied warranties of fitness for purpose or use.

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.

KURZ INSTRUMENTS INC.
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Monterey, CA 93940

July 11, 1996

CE COMPLIANCE ADDENDUM FOR THE MODEL 155JR USERS MANUAL P/N 360156 Rev. A.

This covers models 155Jr, 155Jr-Ex, 155Jr-ExW and 155Jr-Tr

To ensure CE compliance to the heavy industrial equipment immunity standard EN50082-2 and the light industrial, commercial and residential equipment emissions standard EN50081-2, the units must be installed per the field wiring diagrams 340155-29 or 340155-50.

The Declaration of CE compliance is Kurz doc. number 430005 Rev. B and the test report is number 430008 Rev. B.

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RETURN SHIPMENT

The shipper pays for equipment transportation to Kurz Instruments, Inc. for warranty repair. Kurz Instruments, Inc. returns repaired equipment back to the customer under warranty prepaid.

To return equipment to Kurz Instruments, Inc., follow these steps:

1. Obtain a Return Materials Authorization (RMA) number from Kurz Instruments, Inc., Customer Service:

   Telephone: (800) 424-7356 Ask for Customer Service
   FAX: (408) 646-1033

DO NOT RETURN ANY EQUIPMENT WITHOUT AN RMA NUMBER.

2. Your correspondence must include:

   - ✔ The Kurz Instruments, Inc. purchase order number on the customer invoice.
   - ✔ Reference all documents and correspondence to the RMA number.
   - ✔ The name and telephone number, including Area Code and extension (if any) of the person Kurz Instruments, Inc. can contact regarding the equipment.
   - ✔ The address to which the equipment is to be returned.
   - ✔ A description of the problem and the application conditions, an authorization of the work, and a request for the corrections to be performed at the Kurz Instruments, Inc. factory.

3. Kurz Instruments, Inc. requires a confirmed purchase order before performing non-warranty work.

4. Return the equipment and required documents to this address:

   Kurz Instruments, Inc.
   2411 Garden Road
   Monterey, CA. 93940

   Attn: Customer Service
   RMA # _____

5. It is the customer's responsibility to clean equipment before it is returned. Kurz Instruments, Inc. is not equipped to clean potentially hazardous chemical compounds. Dirty or contaminated equipment will be returned to the customer.

INTRODUCTION

The Kurz Instruments, Inc. Model 155Jr is the smallest and most popular of the Series 155 microprocessor-based Mass Flow Computers. The Model 155Jr provides precise mass flow calculations utilizing Kurz Instruments, Inc. two-wire current loop mass flow and temperature elements. Multiple correction factors allow users to obtain accurate flow measurements even with stack flow profile changes at differing gas velocities. Optional Velocity/Temperature Mapping (VTM) ensures accuracy over wide temperature and velocity ranges. The Model 155Jr is fully compatible with Kurz Instruments, Inc. Insertion Mass Flow Elements (Series 450), Inline Mass Flow Elements (Series 500) and Temperature Elements.

A front panel mounted membrane keyboard and Liquid Crystal Display (LCD) allow the user or technician to view system time and date, sensor voltages, flow rates, total flow, and system parameters. Tree -structured, menu-driven displays prompt the user or technician through the steps necessary to monitor or alter operation of the Model 155Jr. Access security codes allow operation, calibration, and configuration of the system while preventing casual alteration critical data.

APPLICATIONS

Due to the flexibility offered by ADAM™ programming, the Model 155Jr Mass Air Flow Computer is a superior instrument for gas flow measurement. When mated with the proper Kurz Instruments, Inc. flow and temperature elements, air, flue gases, volatile hydrocarbons, inert gases, hydrogen, ammonia, and other gases can be measured with precision.

The Model 155Jr provides mass flow outputs in Standard Cubic Feet per Minute (SCFM), Standard Cubic Feet per Hour (SCFH), Standard Cubic Meters per Minute (SCMM), Standard Cubic Meters per Hour (SCMH), Pounds Per Hour (PPH), and Kilograms per Hour (KGH). It can also provide standard velocity, temperature, total flow and elapsed time. This makes it ideal for both stand-alone applications or as an accurate signal source for process control. The availability of 0-5 VDC or 4-20 mA linear outputs allows connection (through the proper isolation devices) to single or multi-loop controllers, programmable controllers, or to a distributed control system (DCS). Optional PID control in conjunction with the Kurz Instruments, Inc. Model 730 line of rotary flow control valves, permits process control without the complexity of additional components. Table I-1 below lists the recommended input and meter configurations for a Model 155Jr.

CONFIGURATION	INPUT CHANNEL		METERS		OUTPUTS	
Single Mass Flow Series 450 or 500	A	Mass Flow Element	1	Mass Flow (SCFM...etc)	1	Linear Mass Flow
	B	NOT USED	–	–	2	–
Single Mass Flow with Temperature Series 450T or PT	A	Mass Flow Element	1	Mass Flow (SCFM...etc)	1	Linear Mass Flow
	B	Temperature Element	2	Temperature (DEGF or DEGC)	2	Temperature
Dual Mass Flow (Low Power only) Series 410 or 510	A	Mass Flow Element	1	Mass Flow (SCFM...etc)	1	Linear Mass Flow (either CH A or B)
	B	Mass Flow Element	2	Mass Flow (SCFM...etc)		
			3	Sum Flow (SCFM...etc)	2	Sum Flow

Table I-1, Model 155Jr, Recommended Configurations

STANDARD FEATURES

The following standard features are available with this instrument:

- ☆ Corrosion resistant, NEMA 4X enclosure.
- ☆ 115 VAC 50/60 Hz operation.
- ☆ Sealed membrane, twenty button keypad for data entry.
- ☆ Two-line, 16 character Liquid Crystal Display (LCD).
- ☆ Display in English or International units.
- ☆ Tree-structured menus with help screens.
- ☆ 24 hour clock/calendar.
- ☆ Multi-level security access codes.
- ☆ Lagrangian polynomial linear interpolation for maximum accuracy.
- ☆ User defined meter identification.
- ☆ Multi-Point calibration factors.
- ☆ Flow totalizer.
- ☆ User defined flow area.
- ☆ Accurate, easy digital calibration of inputs and outputs.
- ☆ RS232C, 9 pin port for connection to ASCII terminal which "echos" keypad functions.
- ☆ 0-5 VDC linear analog output.
- ☆ Software to upload/download configuration data utilizing IBM® compatible personal computer.

OPTIONAL FEATURES

In addition to the list of features standard with the Model 155Jr, the following options may be added to meet site-specific requirements:

- ☆ Velocity/Temperature Mapping for electronic temperature compensation.
- ☆ 24 VDC or 230 VAC 50/60 Hz operation.
- ☆ 1-PID controller to drive Kurz Instruments, Inc. Model 730 Rotary Flow Control Valve.
- ☆ Up to four, 5 amp alarm relays.
- ☆ Up to two, 4-20 mA analog outputs
- ☆ Additional 0-5 VDC linear analog output.
- ☆ Secondary RS232C data communication port.

Consult your Kurz Instruments, Inc. representative for other options that may be available to meet application-specific requirements.

MECHANICAL INSTALLATION

This section provides an overview of mechanical installation requirements of the Model 155Jr Mass Flow Computer. As a safety precaution, use only the highest quality tools and materials. Actual installation details will be directed by the user's system configuration. Some general guidelines include the following:

- Mount the Model 155Jr enclosure in a location conducive to safe operation of the keypad and display.
- Ensure adequate lighting for viewing of the Liquid Crystal Display.
- Do not mount the Model 155Jr enclosure in direct sunlight. Although ambient temperatures may not exceed component limits, insolation can cause internal temperatures in excess of design maximums.
- Ensure that the enclosure can be opened for maintenance without exposing internal components to damaging environments.
- Ensure that conduit penetrations or mounting hardware do not allow the intrusion of liquids into the Model 155Jr enclosure.
- Refer to the attached drawings for outline dimensions and mounting specifications for the Model 155Jr enclosure.

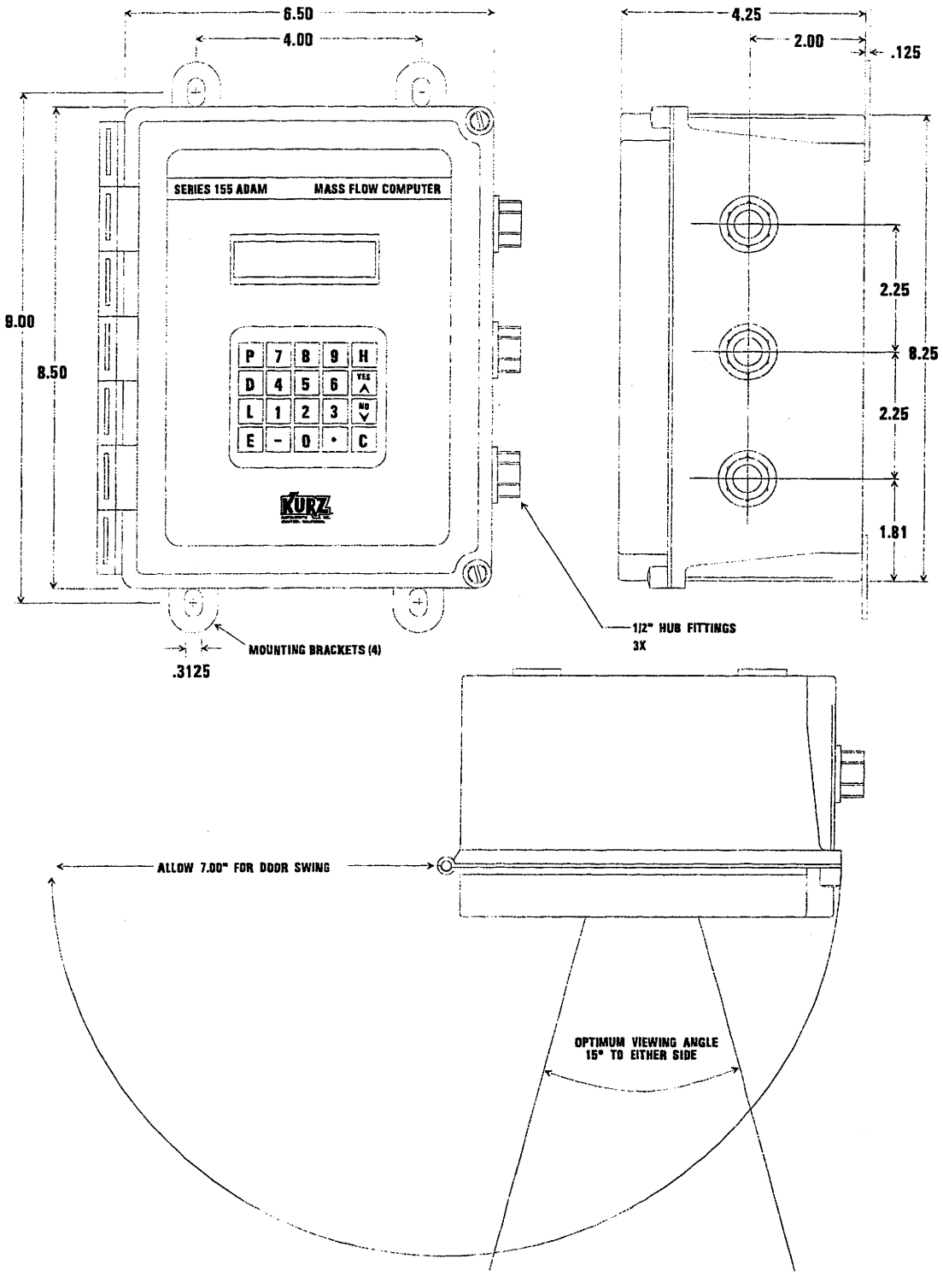


Figure I-1, Installation Dimensions, NEMA 4X Type Enclosure

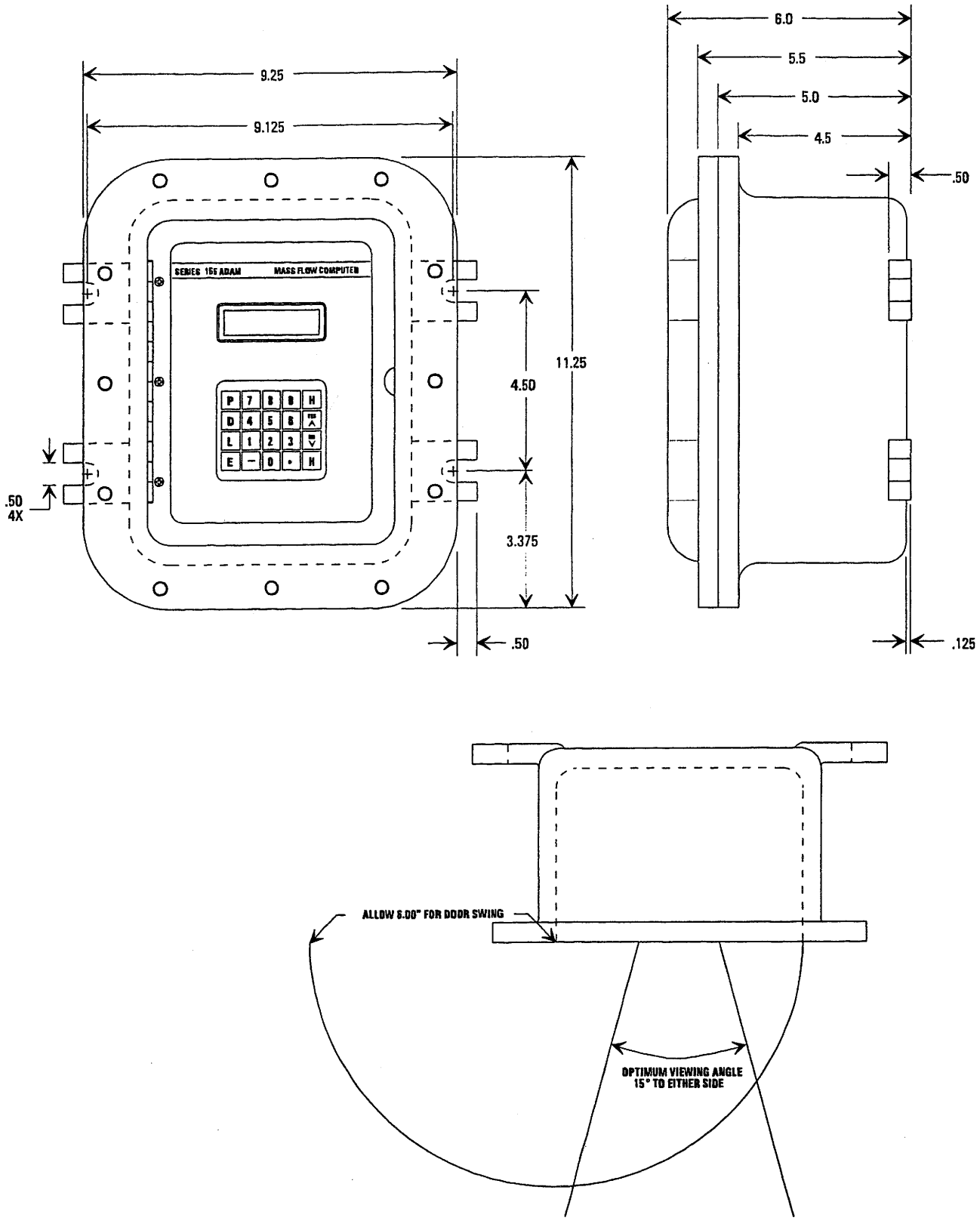


Figure I-2, Installation dimensions, NEMA Type 7 Enclosure

ELECTRICAL SAFETY

The Kurz Instruments, Inc. Model 155Jr is a Mass Flow Computer intended for use only within the guidelines specified in this document. Operation should only be attempted by persons sufficiently trained for the specific functions this instrument performs.

All wiring including conduit installation, fusing and other circuit protection must be performed in compliance with national, state or province, and local codes, and good engineering practice. Adequate grounding must be provided. Foreign power can be introduced into the equipment enclosure through alarm and externally powered current loops. Do not assume that because supply power to the Model 155Jr has been switched off and locked out the equipment is free of hazardous electrical potentials. Verification that foreign power is removed from the equipment before servicing must be performed. If a procedure necessitates the presence of hazardous energy, ensure that all personnel are in compliance with applicable safety regulations with regard to clothing, equipment, and techniques.

This manual does not intend or attempt to instruct personnel in the proper performance of their profession, skill, or craft. Installation should only be performed by qualified electrical, electronic, or instrument mechanics.

WARNINGS and **CAUTIONS** included in this document indicate to the user that certain hazards to personnel and/or equipment may exist in the normal operation of the equipment. A **WARNING** indicates an operation or procedure that has the potential of causing personal injury or death. It is important to note that the primary hazard may be due to injury sustained in response to a non-lethal potential and not the electrical shock itself. A **CAUTION** indicates an operation with the potential to cause equipment damage, or loss of data. Although undocumented procedures or "short-cuts" may give the same apparent results as steps listed in this document, the documented procedures have been performed and known to function as specified. Failure to follow the procedures as outlined in this document shall absolve Kurz Instruments, Inc., and its agents from any resulting liability.

ELECTRICAL INSTALLATION

This section provides an overview of the electrical installation requirements for the Model 155Jr Mass Flow Computer. **It is the customer's responsibility to ensure compliance with all national, state, and local electrical codes.** The customer provides all shielded cables, wires and conduit. Site specific requirements will be determined by the customer but the following points should be considered in all installations:

- All input and output wiring should be housed in well-grounded, metallic conduit to reduce the effects of radio frequency interference (RFI).

- In environments where large amounts of electrical noise is present, a dedicated ground may be required. Do not run the dedicated ground in conduit with other conductors. It is recommended that the dedicated ground be run in non-metallic conduit to minimize capacitive coupling of noise spikes.

- Power sources to the instrument should be clean, stable, and within the tolerances listed in Table I-2.

AVAILABILITY	SOURCE	TOLERANCE	FREQUENCY
STANDARD	115 VAC	± 10%	50/60 Hz
OPTIONAL	230 VAC	± 10%	50/60 Hz
OPTIONAL	24 VDC	± 0.5%	N/A

Table I-2, Model 155Jr, Power Requirements

Before turning on the Model 155Jr, perform the following steps.

1. Check system wiring against Kurz Instruments, Inc. drawings provided with your equipment and architect/engineering drawings for your facility to ensure that instrument terminations are correct.

2. Ensure that all wiring between Kurz Instruments, Inc. equipment and other system equipment is compatible.

3. Perform point-to-point tests to ensure that signal cables, power cables, ground wires and other system connections are complete. This test minimizes failures caused by improper wiring.

4. **DO NOT** supply power to the system until this check-out is complete.

MAJOR COMPONENTS

The major electrical components in a Model 155Jr Mass Flow Computer are mounted on three printed circuit boards. The CPU Board (ASSY. NO. 420221), VF/8 Board (ASSY. NO. 420218), and the Interface Board (ASSY. NO. 420211)

CPU Board

The CPU Board contains a microprocessor with its related circuitry. A 20-button keypad and the two-line, 16 character Liquid Crystal Display (LCD) are also attached to the CPU Board. This board is mounted to the door of a Type 4 enclosure or on a hinged panel behind the cover of a Type 7 enclosure.

VF/8 Board

The VF/8 Board provides the analog to digital (A/D) and digital to analog (D/A) conversions for the various Model 155Jr functions. This board is mounted on standoffs behind the CPU Board. **There are no user serviceable components on the CPU and VF/8 Boards.**

Interface Board

The Interface Board is of primary interest to the user or technician. This board contains a low voltage power supply providing the required DC voltages necessary to operate the Model 155Jr. The Interface Board is attached inside the back wall of either enclosure type. Four ribbon cables connect the Interface Board to the CPU and VF/8 Boards. Table I-3 and Figure I-3 illustrate the interconnection among these boards. Also on this board are termination points for all connections to Kurz flow and temperature element electronics boards and any outputs specified for the instrument. Refer to Figure I-4 and Table I-4 for the location of these components.

INTERFACE BOARD (420211)	TO
J1	VF8 Board (420218), J1
J2	VF8 Board (420218), J2
J3	CPU Board (420221), J4
J4	CPU Board (420221), J1

Table I-3, Interconnection Table, Interface, VF8, and CPU Boards.

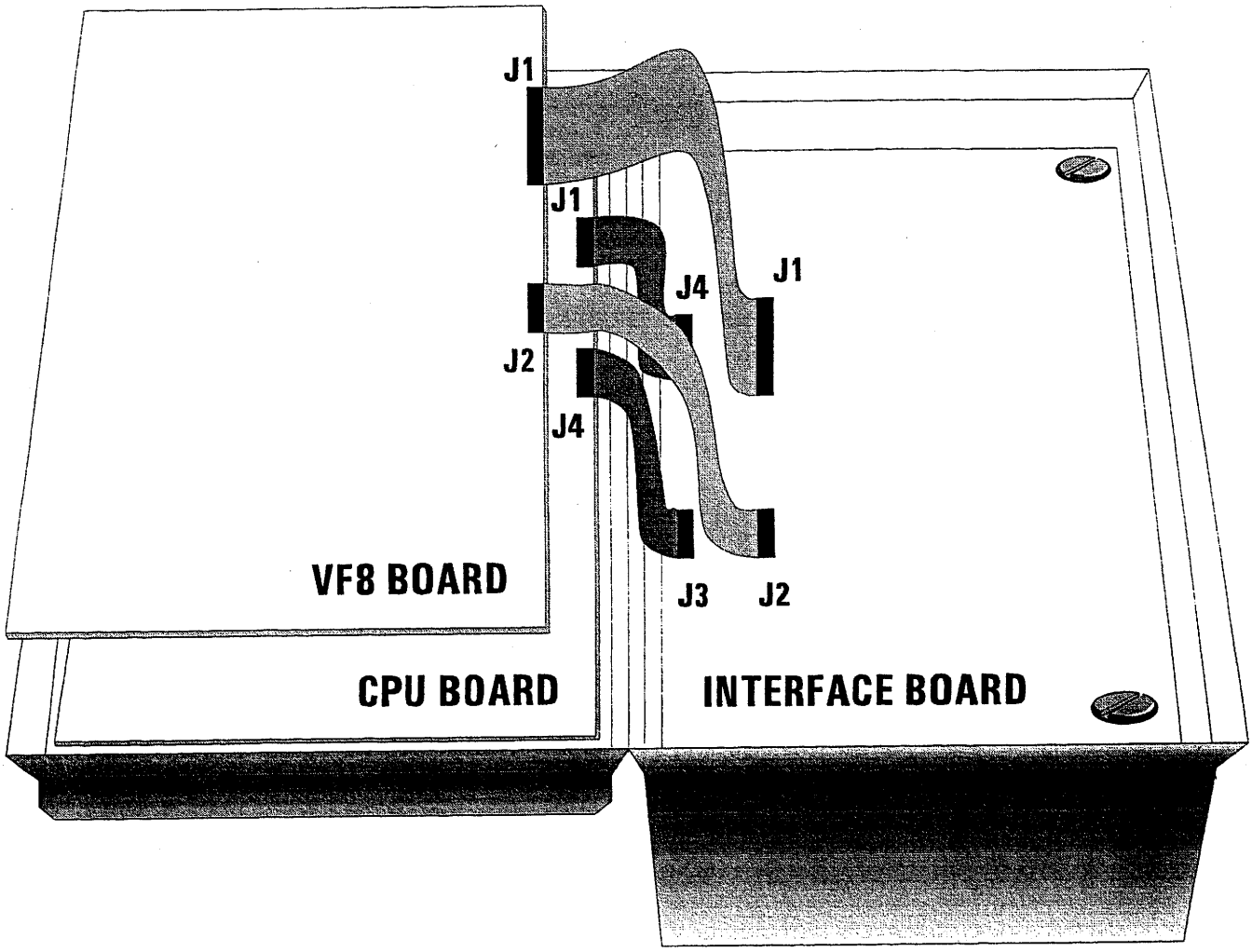


Figure I-3, Interconnection diagram, Interface, VF/8, and CPU Boards

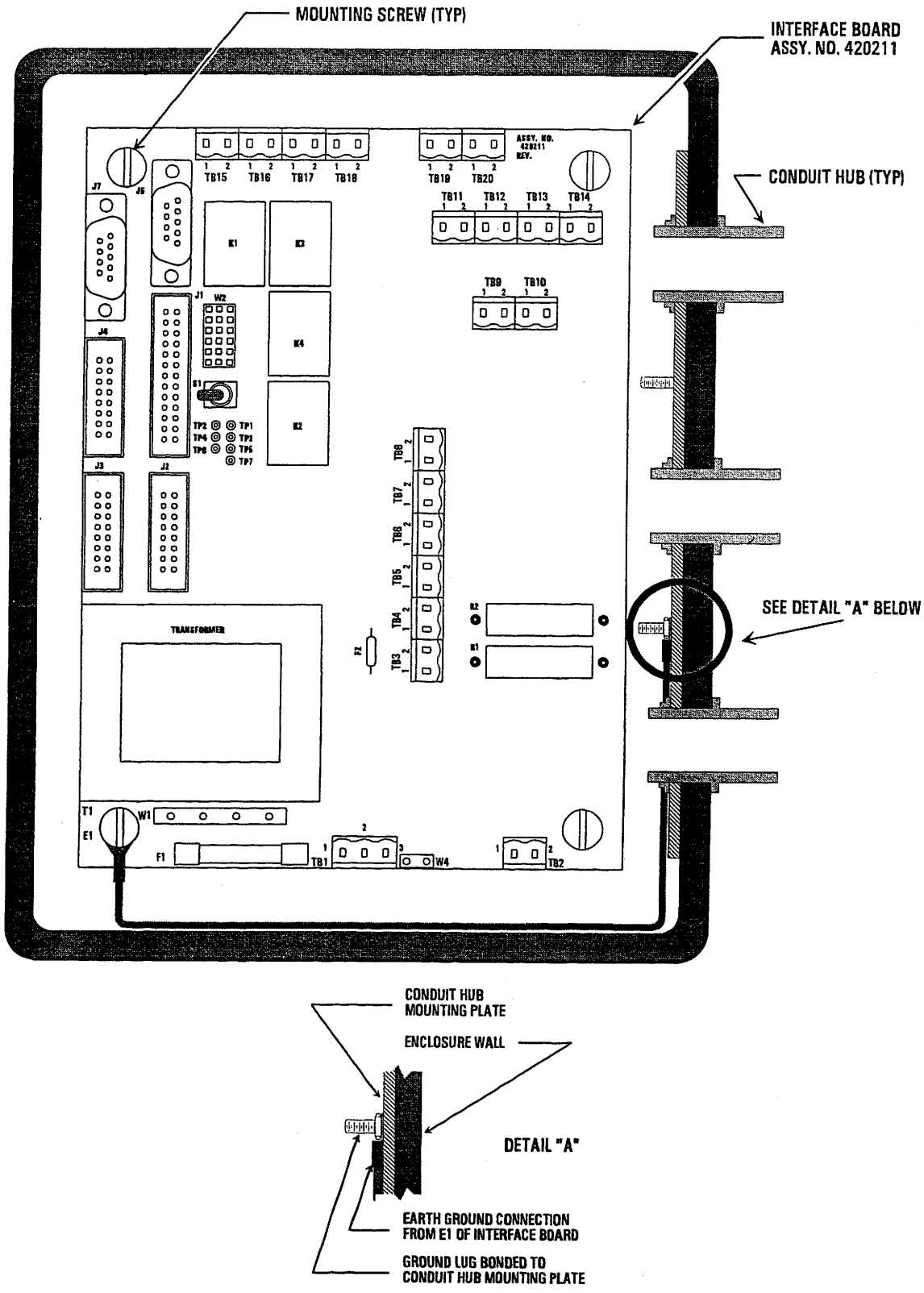


Figure I-4, Interface Board, Component Location

The Interface Board provides termination points, calibration switch, and jumpers necessary for installation and service of the Model 155Jr Mass Flow Computer. Table I-4 lists these components and general location on the Interface Board (see Figure I-4). The user or technician should review this table before attempting installation or service of the Model 155Jr.

COMPONENT	ITEM	LOCATION
E1	Earth ground connection	Bottom left
F1	AC input fuse	Bottom left
F2	24 VDC fuse	Lower center
J1	Ribbon Connector to J1, VF8 board (ASSY No. 420218)	Upper left
J2	Ribbon connector to J2, VF8 board (ASSY No. 420218)	Center left
J3	Ribbon connector to J4, CPU board (ASSY No. 420221)	Center left
J4	Ribbon connector to J1, CPU board (ASSY No 420218)	Upper left
J5	RS232C ASCII Terminal Port	Upper left
J7	RS232C Data Port (Opt)	Upper left
K1 - K4	Alarm output relays	Upper center
R1	Channel A Current Sense Resistor	Center right
R2	Channel B Current Sense Resistor	Center right
S1	Zero/Span calibrate switch	Center left
T1	AC input step-down transformer	Lower left
TB1	AC input power connections	Bottom center
TB2	DC input power connections	Bottom right
TB3	Channel A input connections	Center right
TB4	Channel B input connections	Center right
TB5 - TB8	Not used in Model 155Jr	Center right
TB9	Analog output 1, 0-5VDC	Upper right
TB10	Analog output 2, 0-5VDC (Opt)	Upper right
TB11 - TB12	Analog output 1, 4-20mA (Opt)	Upper right
TB13 - TB14	Analog output 2, 4-20mA (Opt)	Upper right
TB15	Alarm relay 1 output	Top left
TB16	Alarm relay 2 output	Top left
TB17	Alarm relay 3 output	Top center
TB18	Alarm relay 4 output	Top center
TB19	Control Valve output 1 (Opt)	Top right
TB20	Not used in Model 155Jr	Top right
TP1 - TP7	Low voltage DC Power Supply test points	Center left
W1	AC input power selection jumper	Lower left
W2	Shorting bar header for Normal/Calibrate operation	Center left
W4	Signal/earth ground jumper	Bottom center

Table I-4, Interface Board, Component Location

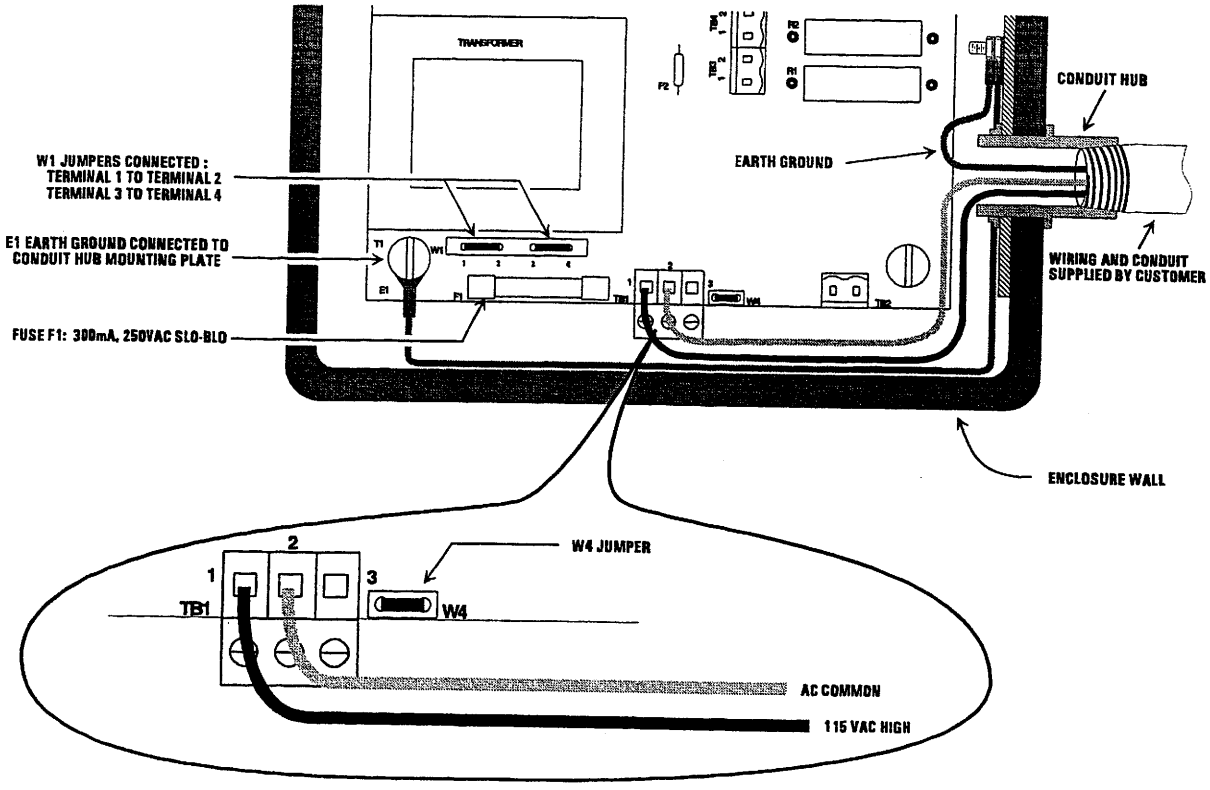


Figure I-5, Model 155Jr Interface Board, Power Supply Wiring, 115 VAC

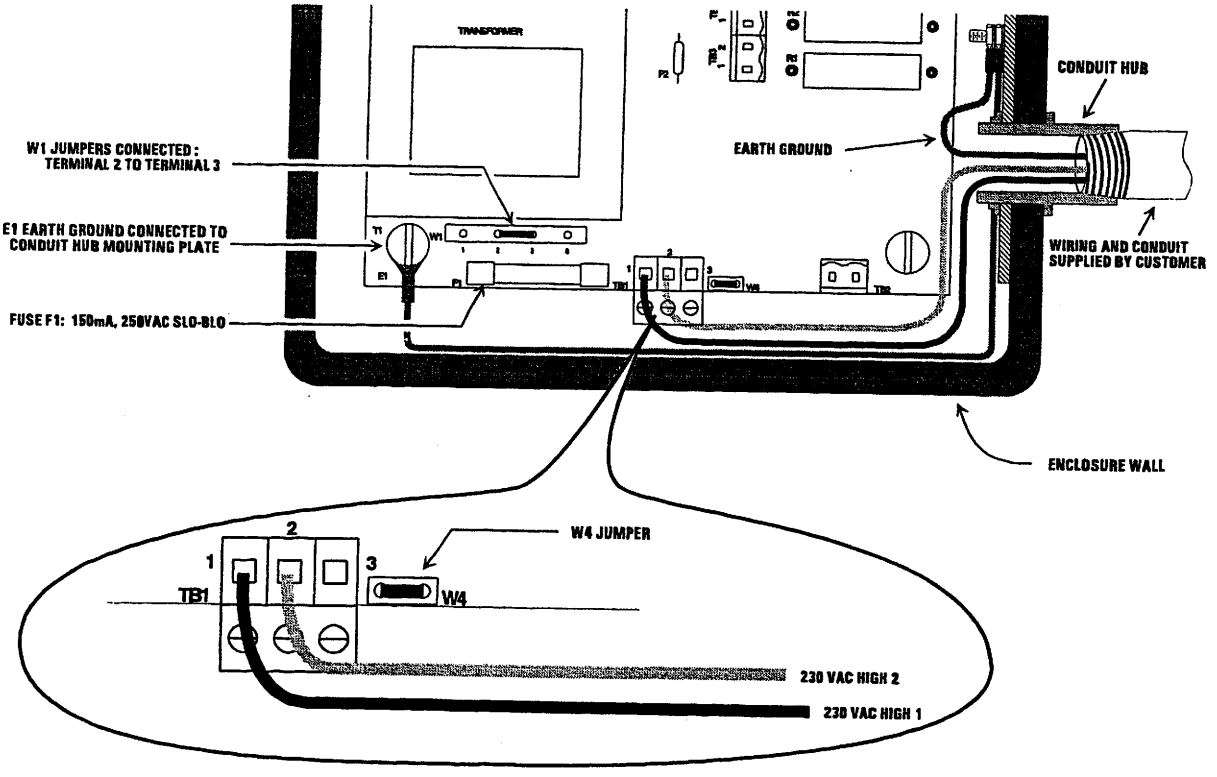


Figure I-6, Model 155Jr Interface Board, Power Supply Wiring, 230 VAC

POWER SUPPLY CONNECTIONS

115 VAC Input Wiring

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

Incoming AC power is connected to TB1, AC high to pin 1 and AC common to pin 2. Earth ground should be connected to the ground stud on the conduit hub mounting plate as indicated in Figure I-5. F1 is a 300 mA, 250 volt 3AG type slo-blo fuse providing AC input circuit protection. F2 is a 4 A, 24 VDC slow blow "Pico Fuse" providing low voltage (24 VDC) circuit protection. F2 is partially hidden under the Phoenix™ connector in TB3.

For 115 VAC operation, pins 1 and 2 of W1 are shorted together as are pins 3 and 4. A wire jumper is installed in W4 tying signal and power grounds to a common point.

Terminal E1 is connected to the ground stud on the conduit hub mounting plate. The conduit hub mounting plate should be grounded in accordance with local codes and good engineering practice.

230 VAC Input Wiring

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

AC power is connected to TB1 pins 1 and 2. Earth ground should be connected to the ground stud on the conduit hub mounting plate as indicated in Figure I-6. F1 is a 150 mA, 250 volt 3AG type slo-blo fuse providing AC input circuit protection. F2 is a 4 A, 24 VDC slow blow "Pico Fuse" providing low voltage (24 VDC) circuit protection. F2 is partially hidden under the Phoenix™ connector in TB3.

For 230 VAC operation, pins 2 and 3 of W1 are shorted together. A wire jumper is installed in W4 tying signal and power grounds to a common point.

Terminal E1 is connected to the ground stud on the conduit hub mounting plate. The conduit hub mounting plate should be grounded in accordance with local codes and good engineering practice.

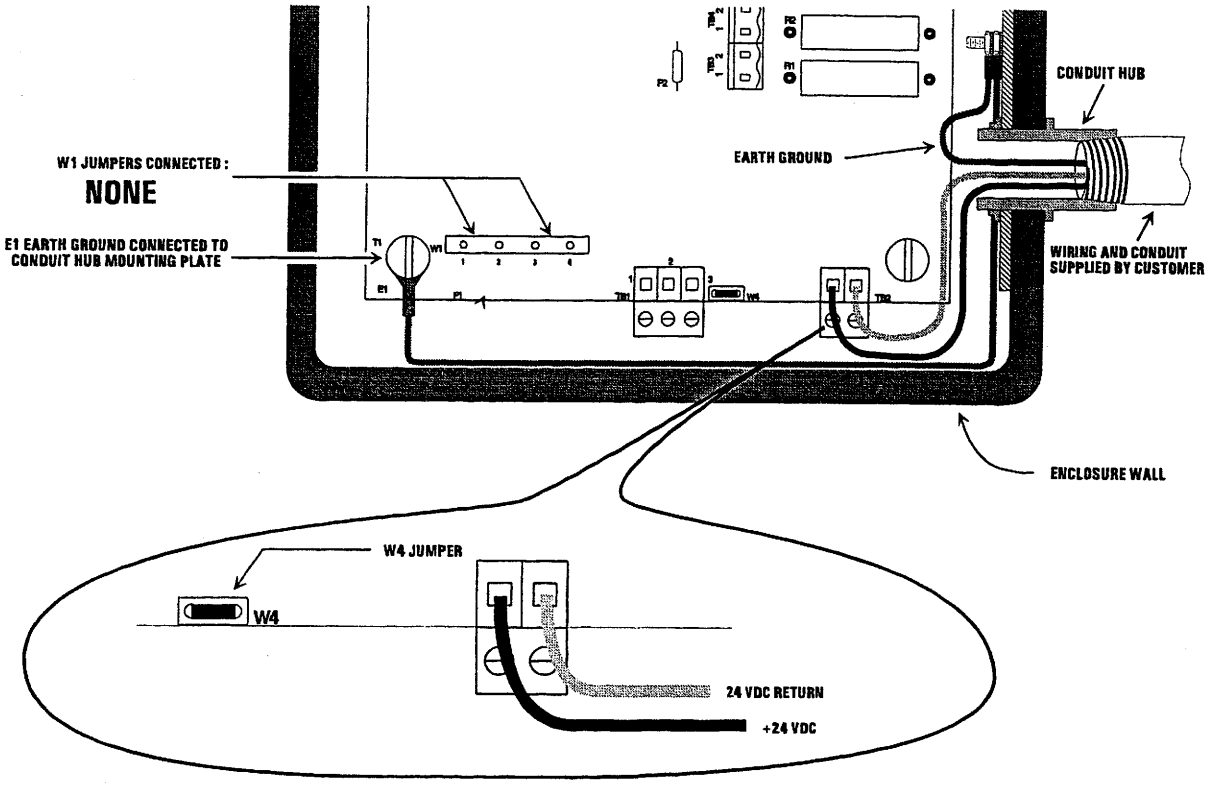


Figure I-7, Model 155Jr Interface Board Power Supply Wiring, 24 VDC

24 VDC Input Wiring

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

An external +24 VDC can be used to power the Model 155Jr mother board. In this application, the positive lead is connected to TB2, pin 1. The DC return is connected to TB2, pin 2. Earth ground should be connected to the ground stud on the conduit hub mounting plate as indicated in Figure I-7. Transformer T1 and Fuse F1 are absent in this configuration. Fuse F2 is a 4 Amp, slow blow pico fuse providing low voltage (+24 VDC) circuit protection. F2 is partially hidden under the Phoenix™ connector inserted in TB3.

A wire jumper is installed in W4 tying signal and power grounds to a common point.

Terminal E1 is connected to the ground stud on the conduit hub mounting plate. The conduit hub mounting plate should be grounded in accordance with local codes and good engineering practice.

POWER SUPPLY TEST POINTS

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

Low voltage DC power supplies are mounted on the Interface Board. Table I-5 lists the outputs from these power supplies and the appropriate test point. Figure I-8 illustrates the location of these test points. Note that the value for TP1 must be checked with a 4½ digit voltmeter or better.

LOW VOLTAGE VALUE	TOLERANCE	TEST POINT
+2.500	1%	1
+5	5%	2
- 9	5%	3
+ 10	5%	4
- 5	5%	5
+ 12	5%	6
+ 15	5%	7
Low Voltage Ground	-	8

Table I-5, Low Voltage Test Points

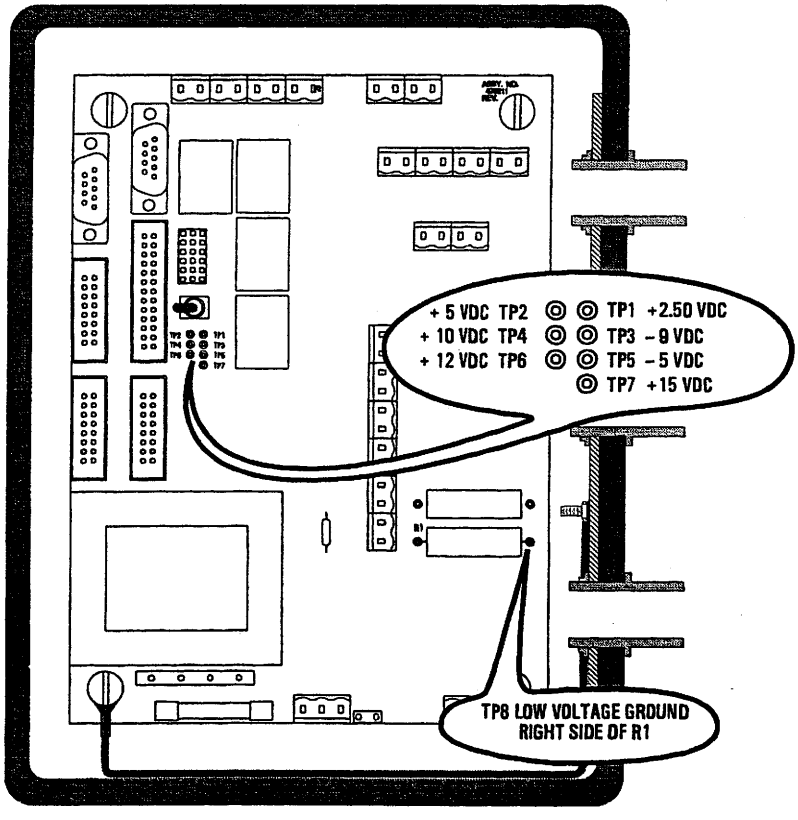


Figure I-8, Model 155Jr Interface Board Low Voltage Test Points

FIELD TERMINATIONS

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

Field terminations to the Model 155Jr for input power, input from Kurz flow and temperature element electronics boards, analog, and alarm outputs are made using Phoenix™ connectors. These connectors consist of two parts, a header mounted to the Interface Board, and a plug to which the field wiring is connected. The header and plug are constructed with a flat surface on one mating surface and a radius on the other (see Figure I-9). This provides a means to easily orient the plug and header correctly. Do not use force to seat the plug into the header! If they do not fit easily there is a problem. Either the plug is incorrectly oriented or there is an obstruction or damage to the plug or header. Inspect the plug and header before inserting to verify correct orientation and the absence of obstruction.

WARNING: These connectors have not been tested or certified as a switching device for this application. Remove power from the circuit before removing or inserting the plug into the header.

The Phoenix™ connectors used for the Model 155Jr have 0.2" (5.08mm) centers. The plug end is intended for wire sizes 22 to 12 AWG and is rated at 250 VAC, 10A.

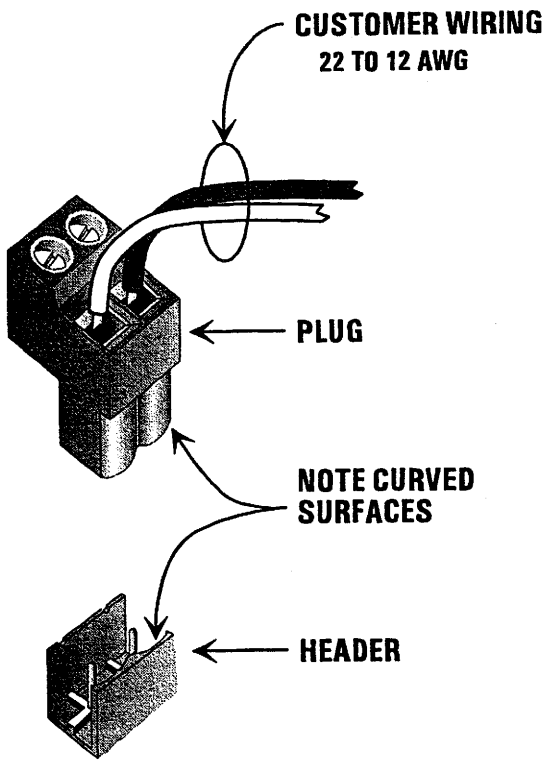


Figure I-9, Phoenix™ Connector, Orientation and Wiring

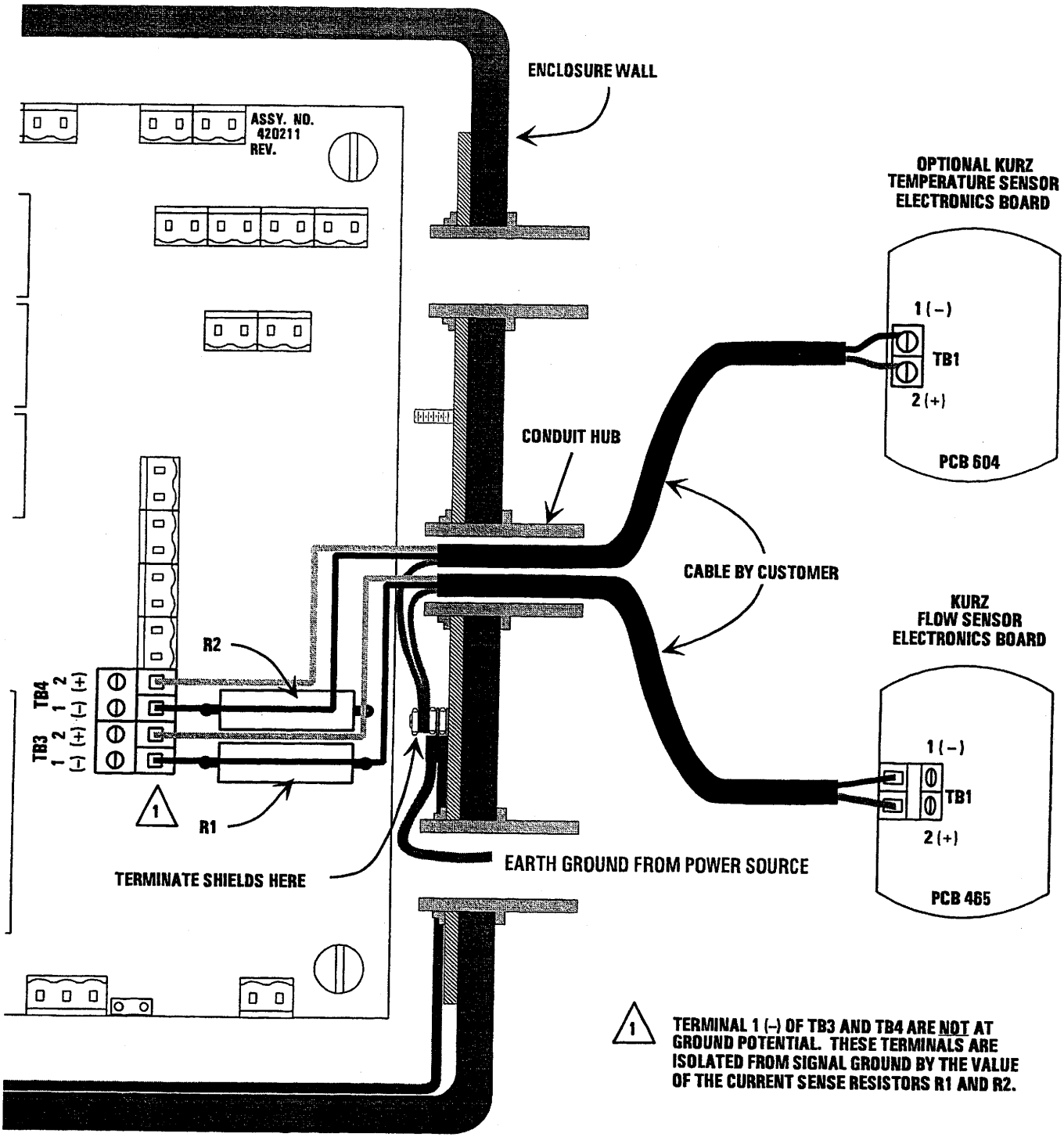


Figure I-10, Model 155Jr, Input Signal Wiring.

Flow and Temperature Element Input Wiring

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

Figure I-10 illustrates the interconnection between a Model 155Jr Mass Flow Computer and its flow and temperature elements. Signal inputs to the Model 155Jr from Kurz two wire mass flow and temperature elements are brought to terminals TB3 and TB4 (channels A and B). Terminals TB5 through TB8 (channels C through F) are not used in the Model 155Jr. The input from a Kurz mass flow element is connected with the (—) lead to pin 1, (+) lead to pin 2. The current sense resistor for a Kurz two wire flow transmitter is a 5Ω, 5 Watt, precision resistor, do not connect a Kurz mass flow element to a Model 155Jr Interface Board input with any other value.

If fitted with an optional Kurz temperature element, this device will also be connected (—) lead to pin 1 (+) lead to pin 2. The current sense resistor for a Kurz temperature transmitter is a 250Ω, 1/2 Watt precision resistor. Do not connect a Kurz temperature element to a Model 155Jr Interface Board input with any other value.

All cable shields should be connected to the studs mounted on the conduit hub mounting plate as indicated in Figure I-10.

In all cases, the sensor element connection wire loop resistance should not exceed 4Ω. Table I-5 lists maximum recommended distances for common wire sizes.

AWG NUMBER	OHMS PER FOOT	MAXIMUM RECOMMENDED DISTANCE	
		LOOP	RUN
4	.0003	13,333	6,667
8	.0005	8,000	4000
10	.0008	5,000	2,500
12	.002	2,000	1,000
14	.003	1,333	667
16	.005	800	400
18	.008	500	250
20	.012	333	167
22	.019	211	105
24	.030	133	67
28	.007	52	26

Table I-6. Maximum Flow or Temperature Element Two-wire Loop Distances

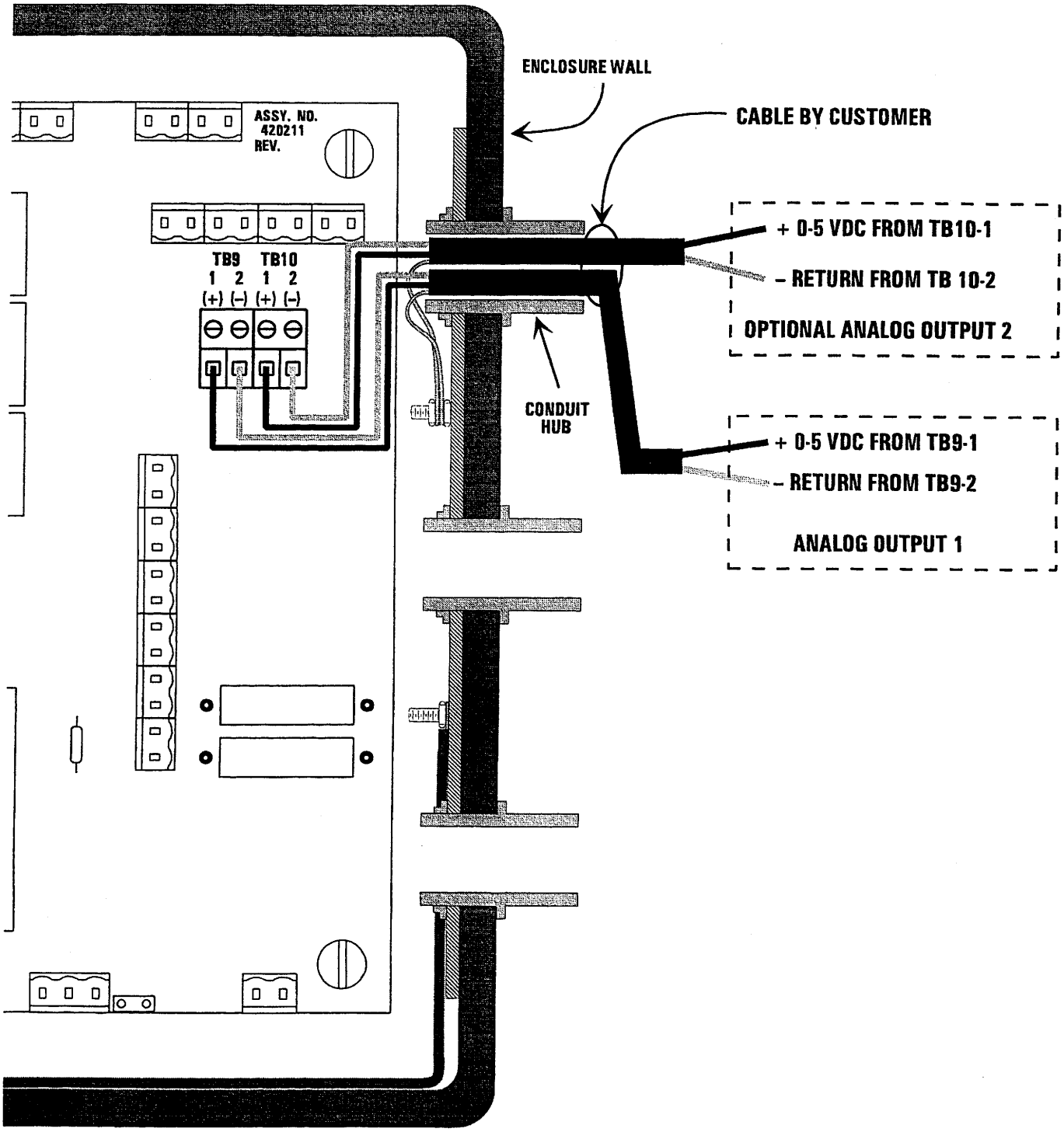


Figure I-11, Analog Output Wiring, 0-5 VDC

0-5 Vdc Output Signal Wiring

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

A standard feature of the Model 155Jr Mass Flow Computer is a single 0-5 VDC analog output. A second 0-5 VDC analog output can be ordered as an option. These outputs are suitable for short distances only. This output should be connected to high impedance terminations (≥100 KΩ). Kurz Instruments, Inc. recommends a maximum distance of 50 feet (15 meters). For signal transmissions over longer distances, the optional 4-20 mA outputs should be ordered. These outputs can be assigned to any programmed meter (see page O-33). It is important to note that an individual output cannot be configured as both 0-5 VDC and 4-20 mA.

Table I-7 lists the 0-5 VDC analog output connections illustrated in Figure I-11.

OUTPUT	+ (0-5 VDC)	– (SIGNAL GROUND)
1 (Standard)	TB9-1	TB9-2
2 (Optional)	TB10-1	TB10-2

Table I-7, 0-5 VDC Analog Output Connections

TB9 on the interface board is the termination point of Analog Output 1. Pin 1 is the 0-5 volt source while pin 2 is the ground. TB10 on the interface board is the termination point for optional Analog Output 2 with pin 1 being the 0-5 volt source and pin 2 is ground.

A two-wire, shielded cable should be used to connect this output to the desired destination. A lug bonded to the grounding plate where the hubs enter the enclosure should be used to terminate the cable shields. To prevent ground loop currents, the cable shield should not be connected at the other end.

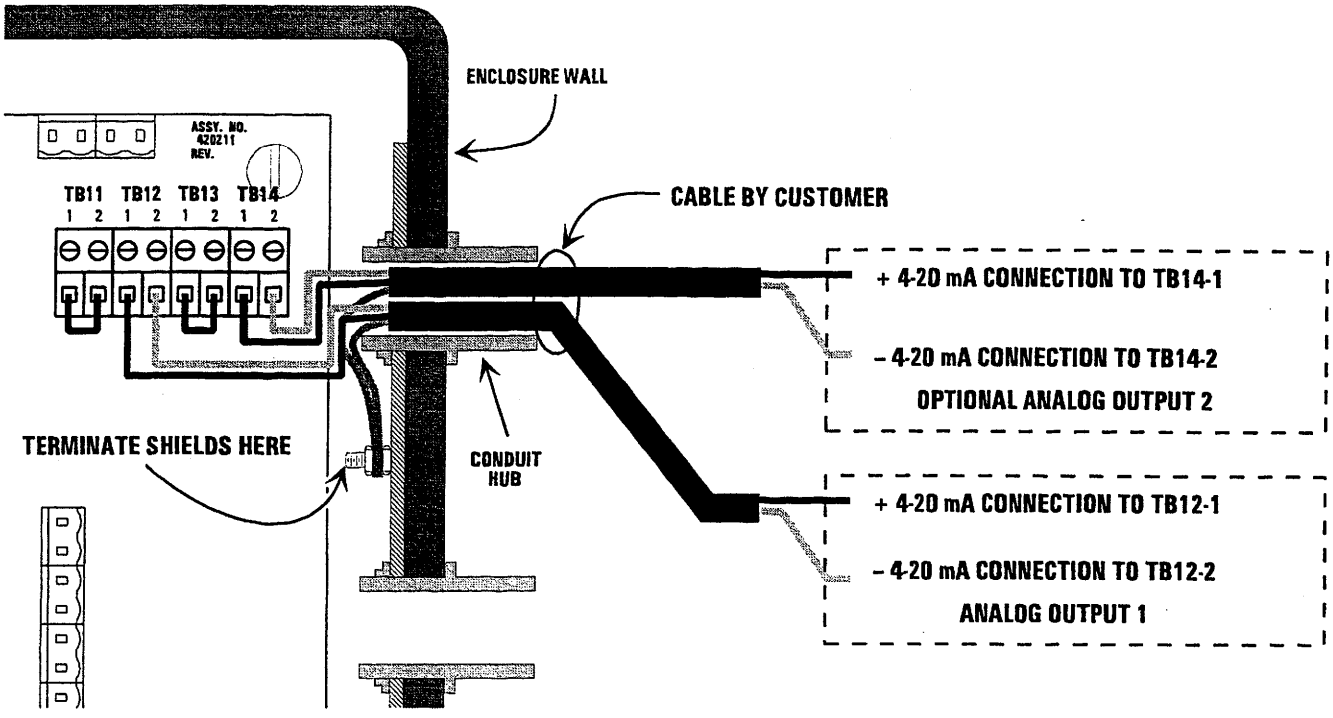


Figure I-12, Analog Output Wiring, 4-20 mA, Self-Powered

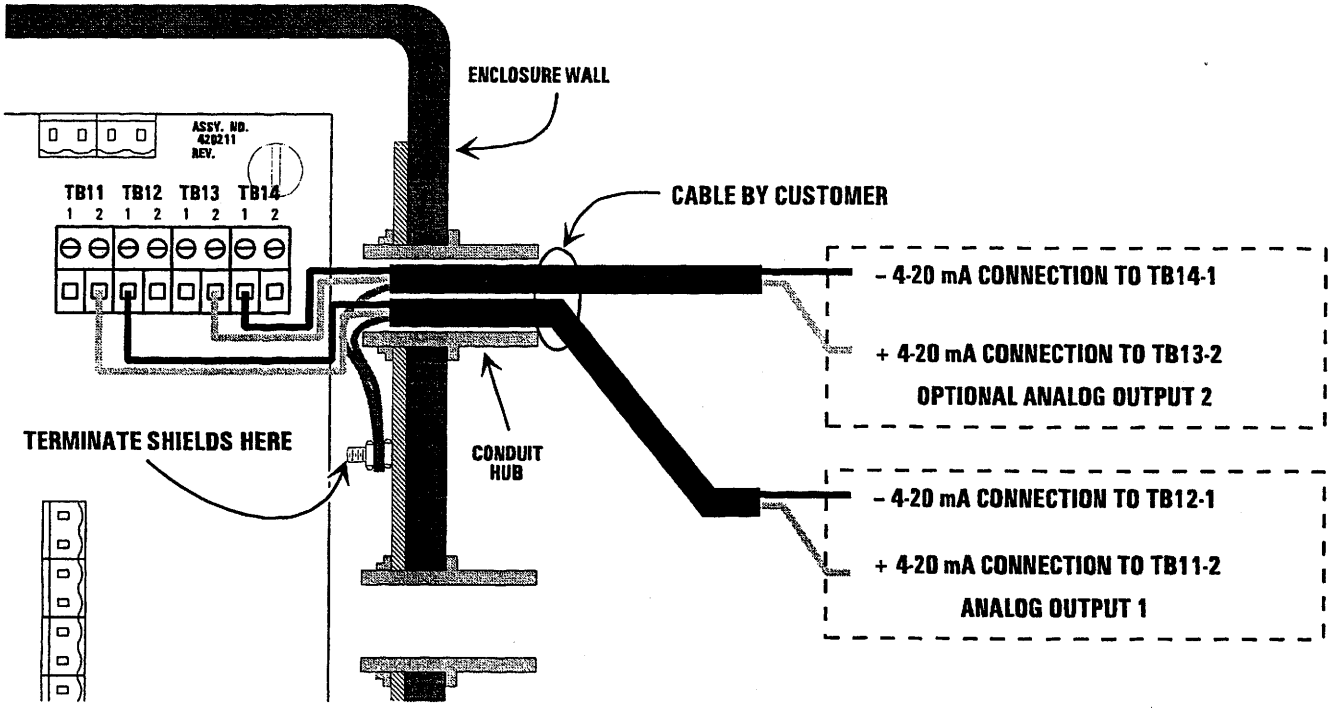


Figure I-13, Analog Output Wiring, 4-20 mA, Externally (Loop) Powered

4-20mA Analog Output Connections

Two optional 4-20mA outputs are available to provide signal transmission over long distances. Terminals on TB11 and TB12 for Output 1 or TB13 and TB14 for Output 2 provide necessary connections. These outputs can be self-powered by the Model 155Jr or externally (loop) powered by the user. Refer to the following text along with Figures I-12 and I-13 for proper wiring. Remember, an analog output (1 or 2) can only be configured as either a voltage or current output, not both.

SELF-POWERED CONNECTIONS

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

For Output 1, connect a jumper between pins 1 and 2 of TB11. Then connect a two-wire shielded cable to TB12, pin 1 positive, pin 2 negative. For output 2, insert a jumper between pins 1 and 2 of TB13. Then connect a two-wire shielded cable to TB14, pin 1 positive, pin 2 negative. **Do not connect the Model 155Jr 4-20 mA outputs directly to a device having the same ground. The receiving device must have isolated inputs or an external isolation device must be used.** If the device at the termination end (loop controllers, DCS, chart recorders, etc.) requires a voltage input, a precision, 250 Ω, precision resistor should be connected across the positive and negative terminals of the device. Do not connect the resistor at the Model 155Jr end of the loop.

EXTERNALLY (LOOP) POWERED CONNECTIONS

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

WARNING: Performance of this procedure may introduce foreign power to the enclosure. Comply will all applicable safety procedures and practices before proceeding.

There are no jumpers used in this configuration. For output 1, The positive lead from the current source should be connected to TB11-2 and the negative lead to TB12-1. For output 2, connect the positive lead from the current source to TB13-2 and the negative lead to TB14-1. **Do not connect the Model 155Jr 4-20 mA outputs directly to a device having the same ground. The receiving device must have isolated inputs or an external isolation device must be used.** A 250 Ω, precision resistor should be used to terminate the loop if a voltage input is required. Do not connect the resistor at the Model 155Jr end of the loop.

OUTPUT		+ CONNECTION	– CONNECTION	JUMPERS
Self Powered	1	TB12-1	TB12-2	TB11-1 TO TB11-2
	2	TB14-1	TB14-2	TB13-1 TO TB13-2
Loop Powered	1	TB11-2	TB12-1	NONE
	2	TB13-2	TB14-1	NONE

Table I-8, 4-20mA Analog Output Connections

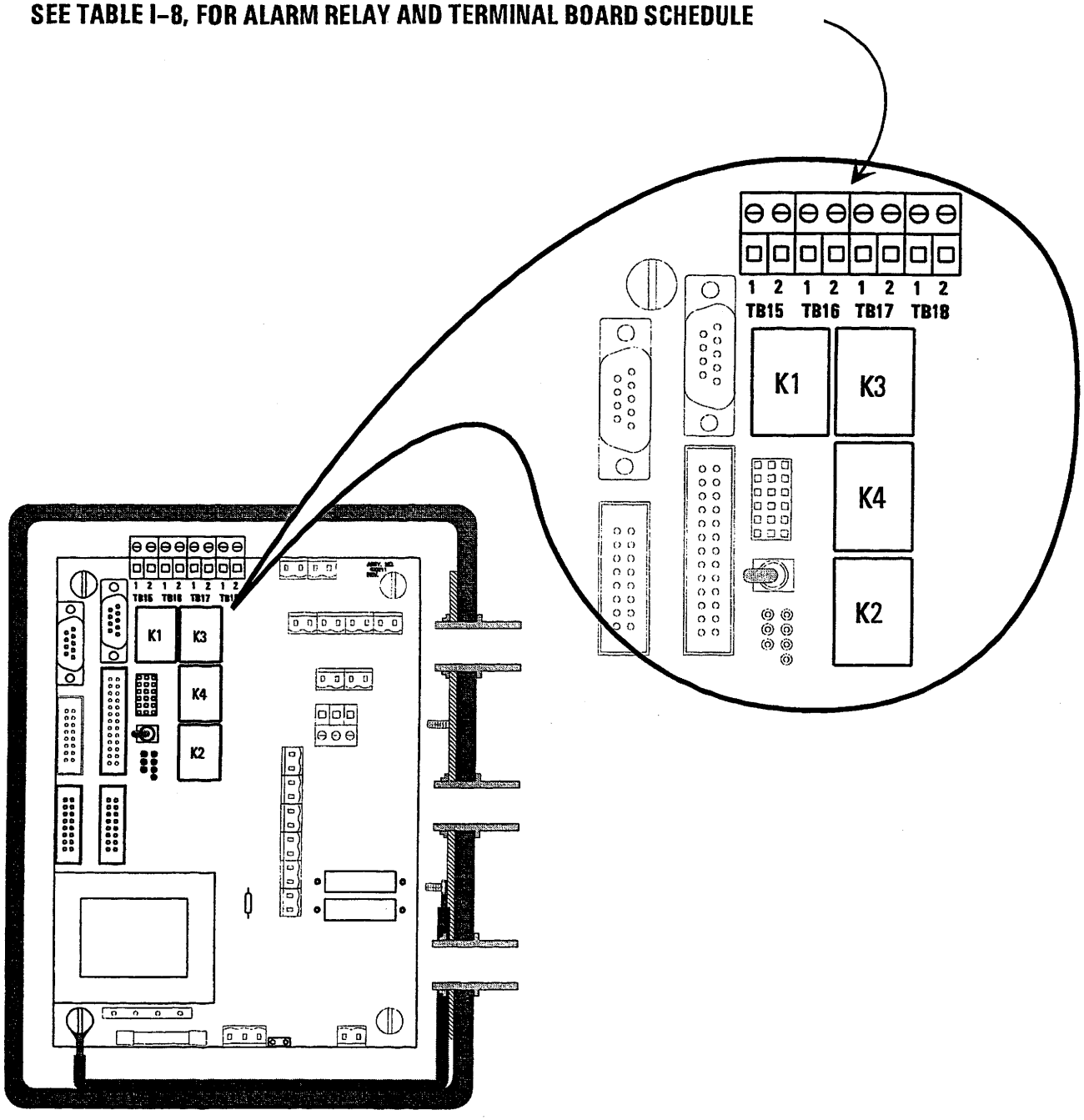


Figure I-14, Interface Board, Location,Alarm Relays and Output Terminals

Alarm Output Connections

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

WARNING: Performance of this procedure may introduce foreign power to the enclosure. Comply will all applicable safety procedures and practices before proceeding.

Standard configuration for a Model 155Jr Mass Flow Computer provides one alarm configured as a Channel Kickout alarm. Up to 3 more alarms (for a total of 4) may be ordered as an option. If the Model 155Jr is configured for more than one alarm, the last alarm will be the Channel Kickout. These alarms provide an indication on the front panel LCD when "tripped". Remote annunciation of alarm status is provided by relays K1 through K4 and TB15 through TB18, mounted on the Interface Board. These relays are programmable for normally open (N.O.) or normally closed (N.C.) operation to suit site-specific requirements. **It is important to note that this feature only functions correctly if the instrument is operating normally, regardless of programmed configurations, the alarm contacts default to open if a loss of power to the instrument occurs.** Refer to Table I-9 and Figure I-14 for the physical configuration and location of these components.

ALARM	RELAY	TERMINALS
1	K1	TB15
2	K2	TB16
3	K3	TB17
4	K4	TB18

Table I-9, Alarm Relays and Terminals

FAULT ISOLATION

WARNING: Performance of these procedures may expose personnel to hazardous potentials. Comply will all applicable safety procedures and practices before proceeding.

Most system faults can be traced to simple wiring or configuration errors. Table I-10 lists common fault indications and directs the technician to appropriate section(s) in this manual.

INDICATION	POSSIBLE FAULT	SUGGESTED ACTION
Does Not Turn On (Blank Screen)	No Input Power.	Check Input Power (pp I-12 → I-15).
	F1 or F2 open.	Check Fuse (pp I-12 → I-15).
	Defective Low Voltage Power Supply.	Check Power Supply Test Points (pg I-16).
	Improper Connection Between Boards.	Check Interconnection (pg I-9).
Incorrect Flow Indication	Wiring Between Model 155Jr and sensor electronics boards.	Check Wiring (pg I-18).
	Meter not Properly Set-Up.	Check Meter Setup (pg O-21).
	Linearizer not Properly Set-Up.	Check Linearizer (pg O-53).
	W1 Jumper in Calibration Position.	Place Jumper in Correct Position (pg O-45).
	Defective sensor electronics board.	Verify correct voltages with ***Calibration Data and Certification Document***.
	Defective Current Sense Resistor	Check Resistor (pg I-19).
Incorrect Analog Output	Analog Output Not Properly Set-Up.	Check Set Analog Output (pg O-33).
		Check Output Calibration (pg O-47).
Incorrect Alarm Output	Alarm Not Turned On.	Verify that alarm is turned on (pg O-35).
	Incorrect High and/or Low Setpoints.	Check Setpoints (pg O-35).
	Contact Configuration not Correct	Check Configuration (pg O-35).

Table I-10, Fault Isolation Table

ERROR CODES

ADAM™ provides 4 error codes to alert the user or technician of system malfunctions. If a software error occurs, one of the following message will appear on the front panel LCD.

SYSTEM ERROR
012-1---

This message indicates a "check sum" error when the totalizer value is verified by ADAM™ software. This error may occur when the equipment is powered up. The error is non-destructive, that is, when [C] is pushed to clear the message the current totalizer value is retained.

SYSTEM ERROR
012--2--

When this error message appears, the system configuration resets to a default state. The default state turns on all possible meters, input channels , output channels, and alarms even if your system was not originally configured for them. Normally this does not cause a problem in the function of your instrument. **Previously configured meter data such as meter ID, engineering units, zero and span information, high and low setpoints, etc. will be retained.** For instance, if Meter 01 was originally configured as an in-line flow meter reading data from input channel A, Meter 01 would still retain that configuration. Two possible problems could follow an error code of 012--2--. PID configuration (if so equipped) **will** be lost; and the scan time required for the ADAM™ to complete all calculations may increase significantly. If originally configured for a limited number of meters (eg. 1 or 2) the software will default to the maximum of 16 with a resultant increase in program time required to poll all 16 meters for data.

Your original configuration can only be restored through the use of Kurz Instruments, Inc., optional upload/download software and an IBM™ PC compatible computer.

SYSTEM ERROR
012---3-

This message indicates that the ADAM™ software detected a linearizer error. Error code 012---3- is "destructive". **All** linearizer data will reset to the following factory defaults:

Range	0-6000 SFPM
# of Data Points	15
CSV-VDC	0-5

SYSTEM ERROR
012----4

Error code 012----4 is an "everything else" error. You will retain Totalizer, configuration, and linearizer data. Alarms, analog output, meter data, and PID data will all reset to system defaults. Again, this is a "destructive" error and all data for these functions must be re-entered.

SYSTEM ERROR
012--23-

It is possible to have more than one error code displayed at once. This message indicates both error code 2 and 3 have occurred.

OPERATION

Operation of the Kurz Instruments, Inc. Model 155Jr is accomplished through the use of a twenty-button keypad and two-line, sixteen character Liquid Crystal Display (LCD). Both these items are mounted on the instrument door as shown in Figure O-1. Menu-driven prompts direct the user through all steps necessary to perform normal operations. To read system information or specify calibration and configuration data the user responds to prompts from the front panel display.

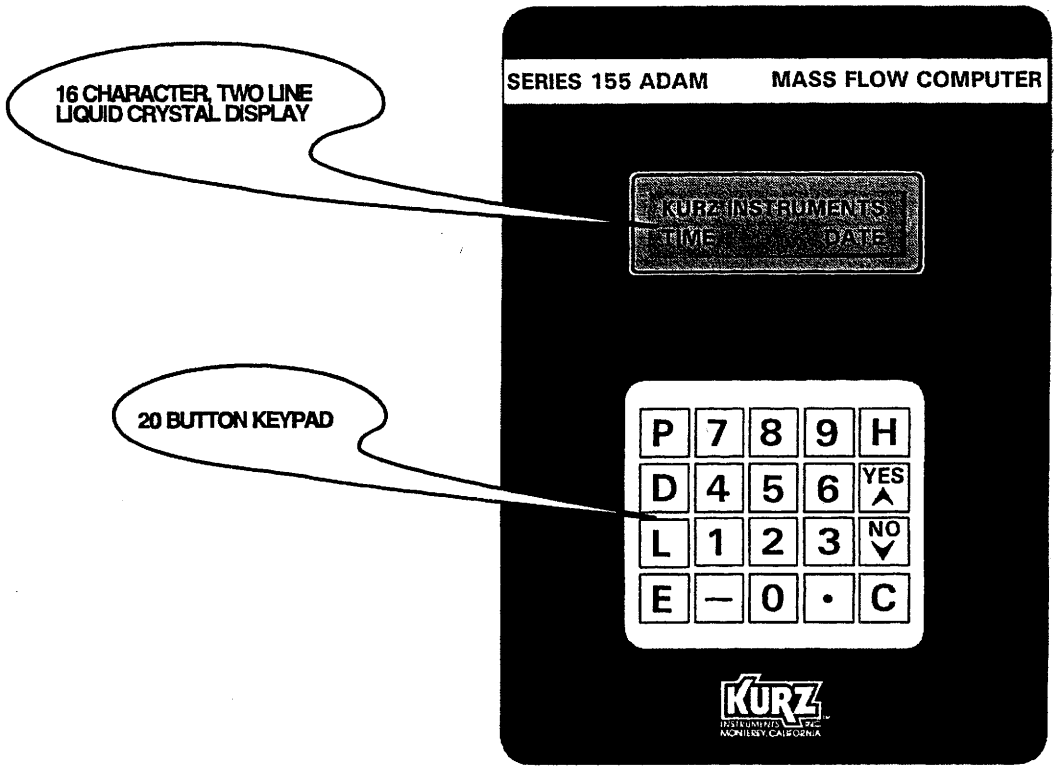
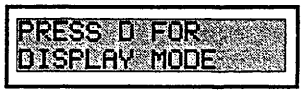


Figure O-1, Model 155Jr, Front Panel Displays and Indicators

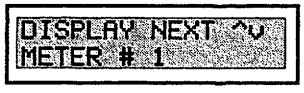
HOW TO USE THE KEYPAD AND LIQUID CRYSTAL DISPLAY

Illustrated below are typical displays along with an explanation of each. Refer to the Table of Contents for detailed information on specific menus and functions.

This is the initial or "title" display in the Executive Mode. The top line displays the Kurz Instruments title while the system time (in 24 hour notation) and date is shown on the bottom line. This display will indicate to the operator or technician that they have successfully exited the Display, Program, or Help Menus.



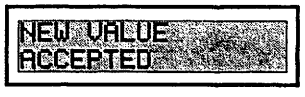
This message prompts the user to press [D] on the keypad to cause the Model 155Jr to enter the Display Mode and show its menu. There is no need to press the enter ([E]) button, the instrument will proceed directly to the selected mode.



Any message that shows the ^v symbol as illustrated at the right of the top line prompts the user to press the up (YES) or down (NO) arrow on the keypad to cycle through the available options for that section of the menu. Press [E] to select the option indicated on the bottom line.

In this example the operator is prompted to enter the user or technician level access code. The operator would press the keypad buttons in the correct six digit sequence and then press [E]. Note that as the numbers are entered a string of asterisks (******) will show on the screen to prevent unauthorized personnel from seeing the code.

When in the Program Mode, this display is asking the operator to specify the alarm setpoint in Standard Feet Per Minute. If the numerical value is correct as displayed, the operator would press [E]. If the numerical value is not correct, the operator would use the keypad to directly enter the desired number and then press [E]. Small changes in the value can also be entered by using the up (YES) or down (NO) arrows.

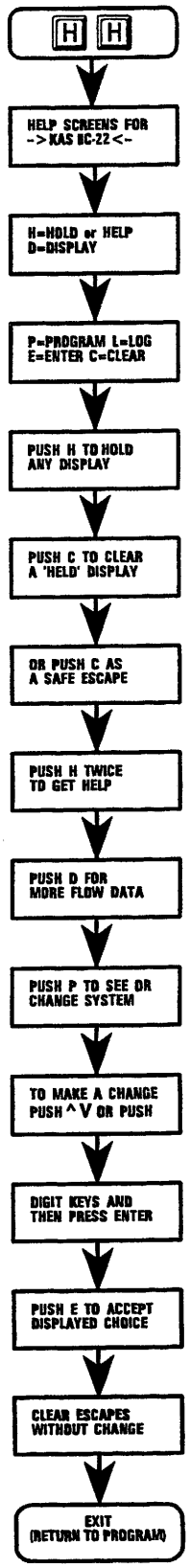


This message is seen in response to an operation such as the one immediately above. When an operator specifies a value, software will determine if it is within the programmed, acceptable range. If so, this message is displayed briefly before the next program step is executed.

If this message is seen in response to data entry the value specified by an operator is **NOT** within the programmed, acceptable range. When this occurs the operator is again prompted to specify the data.

HELP SCREENS

Programmed into the Model 155Jr are a series of help screens to assist the user. When the user presses [H] [H], the messages shown on the right will appear on the front panel LCD. Each message will be visible for 4 seconds. This feature can be initialized anywhere in the program. When the sequence is complete the program will return to the function being performed when the help screens were selected.



The first message displayed lists the software revision of that instrument. You will need to know the revision number when contacting Kurz Instruments, Inc., concerning your instrument.

If you need to hold the display for any reason, pressing [H] will cause the message "HOLD IS ACTIVATED" to appear on the LCD and then the message showing when the hold feature was initialized will reappear and stay on the screen. Pressing [C] will release the "hold" and return the system to normal operation. **All other commands are inoperative until the "hold" is released.**

Pressing [C] repeatedly ([C] [C] [C]...) will return the instrument to the opening message of the Executive Mode. This is a handy feature if the user needs to exit the Display, Program, or Help Modes without completing a sequence.

Pressing [D] while in the Display Mode will advance the menu to the next message. The same function is performed in the Program Mode by pressing [P].

Note: In many cases it is possible to advance the menu by pressing the [E] button. This practice is strongly discouraged as use of the [E] button unless specifically directed to do so by a program prompt can result in alteration or loss of critical data!

Pressing the up (YES) or down (NO) arrow is mostly used to make a selection. When selecting which meter to display for instance, pressing the up (YES) or down (NO) arrow will cycle the selections (meter 1, meter 2,...). The up (YES) or down (NO) arrows are also used for stepping through the character set when entering alpha-numeric data such as meter ID's. In some instances, pressing up (YES) or down (NO) arrow can change numerical data.

The digit keys [1] [2] [3],... are used for specifying values such as alarm points, reference voltages, and flow areas.

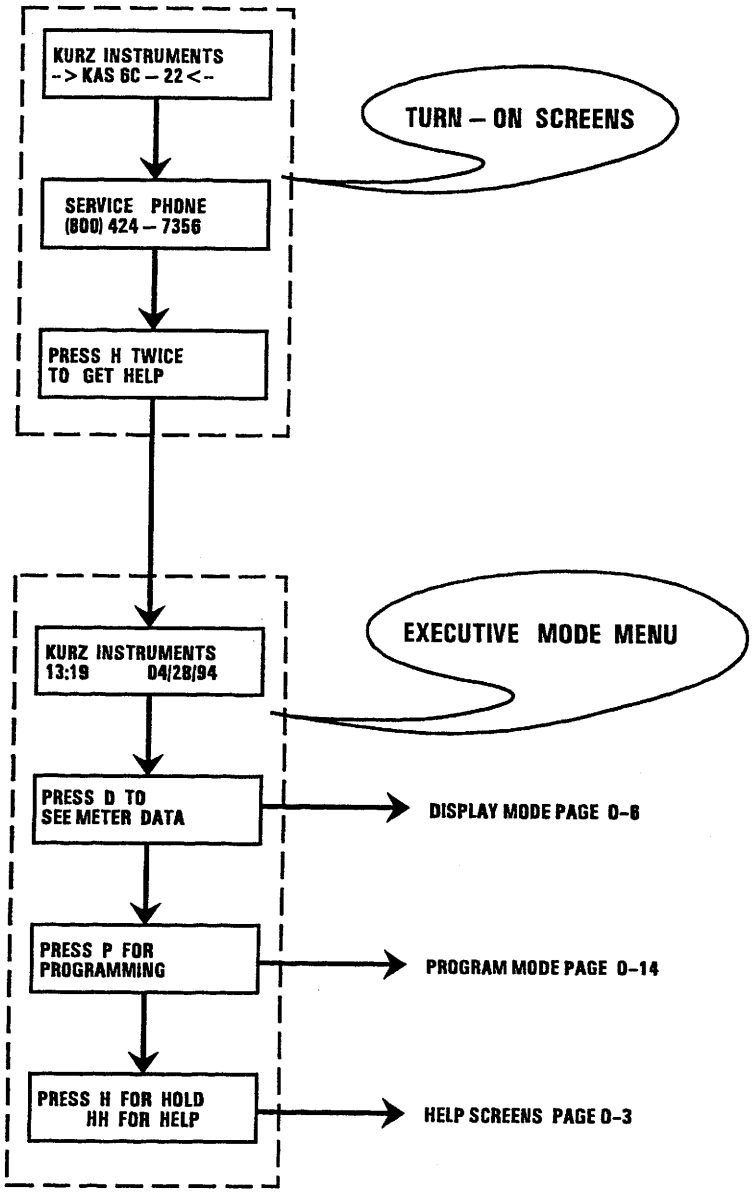


Figure O-2, Turn-On and Executive Menu

MENUS

A specific set of messages called menus are associated with each mode of operation. These are explained in the following text.

When power is applied to the instrument, the first three messages displayed give the following information.

KURZ INSTRUMENTS -->KAS 6C-22<--	Displays the Kurz Instruments name and the installed software version. This number is important if you need to contact Kurz Instruments, Inc. concerning problems with the instrument. Press [H] if you need to hold the display to write down the number. Pressing [C] will allow the next message to be displayed. **The software version is also displayed in the opening message of the Help Menu.**
SERVICE PHONE (800) 424-7356	Displays the toll-free service number for Kurz Instruments, Inc. Press [H] if you need to hold the display to write down the number. Pressing [C] will allow the next message to be displayed.
PRESS H TWICE TO GET HELP	Prompts the user to press [H] [H] for access to the Help Menu. Help is available from any menu in the program.

After these three screens are displayed, the Model 155Jr will enter the Executive Mode.

EXECUTIVE MODE

After the Executive Mode has started the instrument initiates the Automatic Display Loop. This is a default loop the system will return to if the keyboard is inactive for five minutes or when the [C] key is used to exit another menu.

KURZ INSTRUMENTS 13:19 04/28/94	Displays the Kurz Instruments title, system time and date
PRESS D TO SEE METER DATA	Prompts the user to press [D] to enter the Display Mode. This allows the user to view flow data or optional temperature or PID data.
PRESS P FOR PROGRAMMING	Prompts the user to press [P] to enter the Programming Mode. With the proper access code this function allows the user to set up the Model 155Jr to suit site specific requirements.
PRESS H FOR HOLD HH FOR HELP	Prompts the user to press [H] to hold the current message for viewing. This option can be exercised at any time. Press [C] to resume operation. Press [H] [H] to advance to the Help Screens.

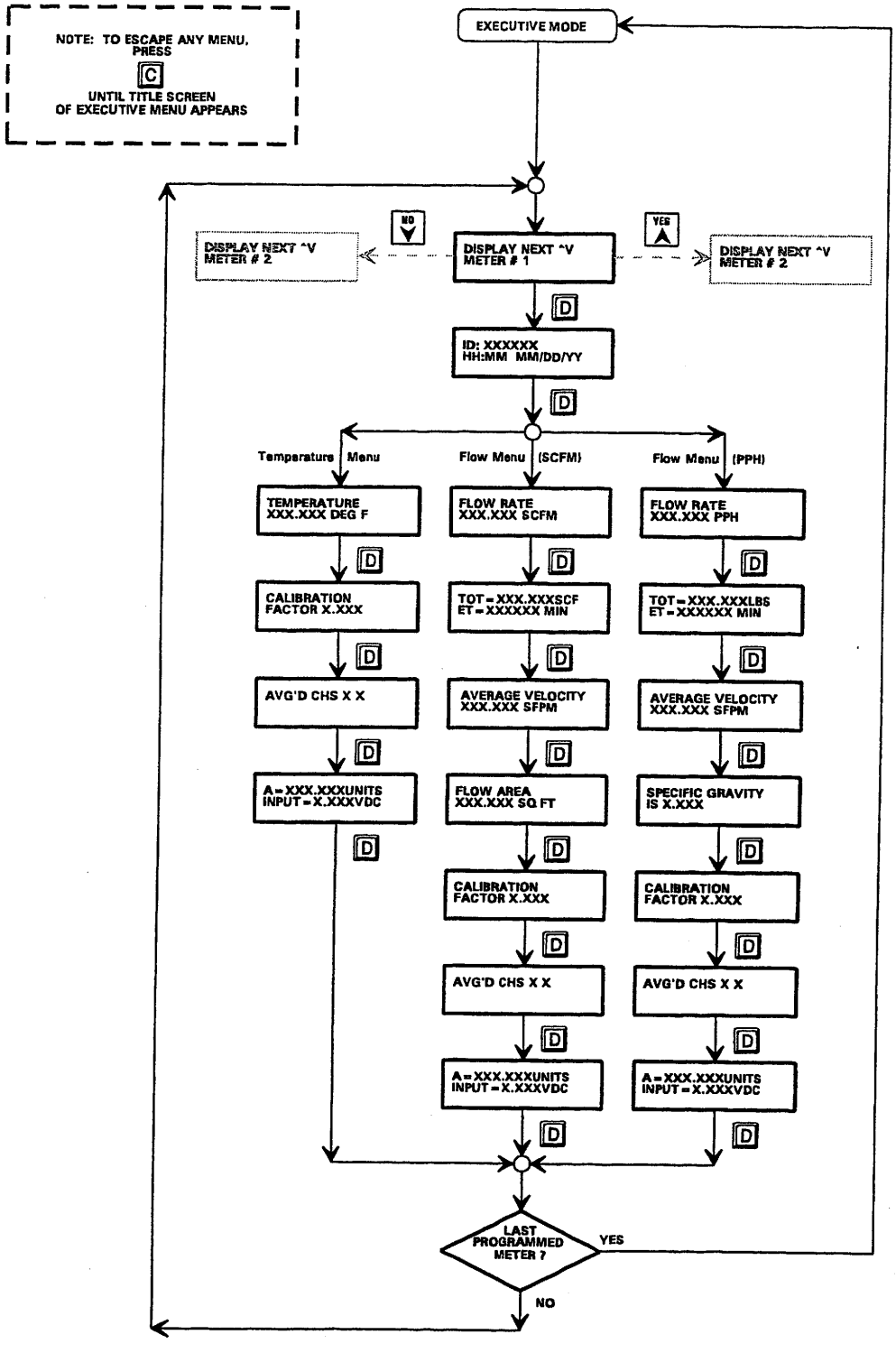


Figure O-3, Display Mode, Menu Tree

DISPLAY MODE

Pressing [D] when in the Automatic Display Loop will place the instrument in the Display Mode. The Display Menu is shown in Figure O-3. Since there are several paths or "branches" to the menu, this type of chart is known as a "menu tree". Which branch the menu follows depends upon system configuration and user selection.

METER DISPLAY MENU

DISPLAY NEXT ^ V METER # 1

This message prompts the user to press the up or down arrows to select the desired meter. Pressing the up arrow will advance the meter to the next higher number, 1..2.., pressing the down arrow will decrement the count, ..2..1. When you have the desired meter number displayed, press [D] to view the next menu item.

ID: XXXXXX HH:MM MM/DD/YY

This screen displays an identifier (ID:) for the meter just selected. Although the 155Jr will assign a default meter ID (METER-000001, etc.), the customer can generate specific meter identifications in the Programming Mode. If necessary, the system time and date on the lower line can be set in the Programming Mode. Press [D] to view the next menu item.

From this point the menu can split into one of three branches. This is determined by whether the selected meter has been programmed for flow based on cubic feet or meters, flow based on pounds or kilograms, or temperature in °F or °C. Display in English or International units is determined by factory level programming.

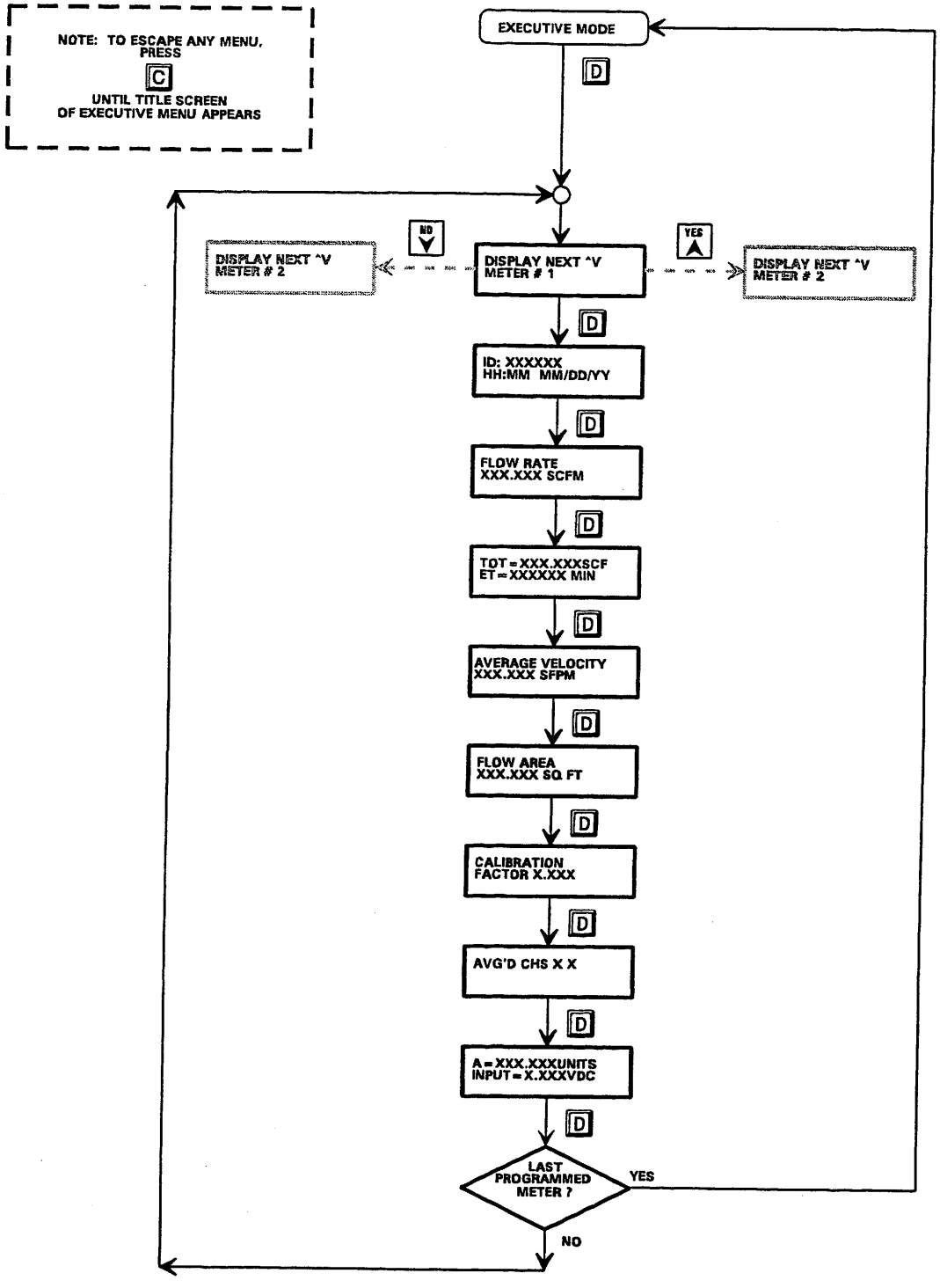


Figure O-4, Display Menu Tree, Flow Meter, SCFM/SCMM

FLOW METER (STANDARD CUBIC FEET OR STANDARD CUBIC METERS)

FLOW RATE XXX.XXX SCFM

Displays the current flow rate in Standard Cubic Feet per Minute (SCFM) or Standard Cubic Feet Per Hour (SCFH) past the sensor. Engineering units will be in Standard Cubic Meters per Minute (SCMM) or Standard Cubic Meters Per Hour (SCMH) on instruments configured for International Units. Press [D] to view the next menu item.

TOT = XXXXXX SCF ET = XXXXXX MIN

Displays the total flow, in Standard Cubic Feet (SCF), past the sensor and the elapsed time, in minutes, since the last reset. Engineering units will be in Standard Cubic Meters (SCM) on instruments configured for International Units. Press [D] to view the next menu item.

AVERAGE VELOCITY XXX.XXX SFPM

Displays the average velocity of all input channels assigned to this meter. This value includes any correction factors (see below). For applications with only one flow sensor this "average" is the corrected flow past the element. Units will be Standard Meters Per Second (SMPS) on instruments configured for International Units. Press [D] to view the next menu item.

FLOW AREA XXX.XXX SQ FT

Flow area represents total stack or duct area at the point where the sensor is inserted into the process. Note that the engineering units will be in square feet if programmed for English units or square meters for International Units. Press [D] to view the next menu item.

CALIBRATION FACTOR X.XXX

Calibration factor is a programmable correction used to compensate for an uneven profile in a stack or duct. Up to 7 correction factors can be programmed for each meter. Press [D] to view the next menu item.

AVG'D CHS A B

Displays all the channels (sensors) that are included in the average velocity calculations. The Model 155Jr is intended for a maximum of two inputs so this display will only show channel A and/or B as being active. A "?" in place of the channel designation indicates channel has been removed from average calculation (see Channel Kickout, page O-41). Press [D] to view the next menu item.

A=XXX.XXX UNITS INPUT= X.XXX VDC

Displays flow data before correction factors and actual input voltage for each active channel listed on the previous screen. This is the last display for a selected meter. Press [D] to view the next meter. If you are currently viewing the last meter, pressing [D] will exit to the title screen of the Executive Menu.

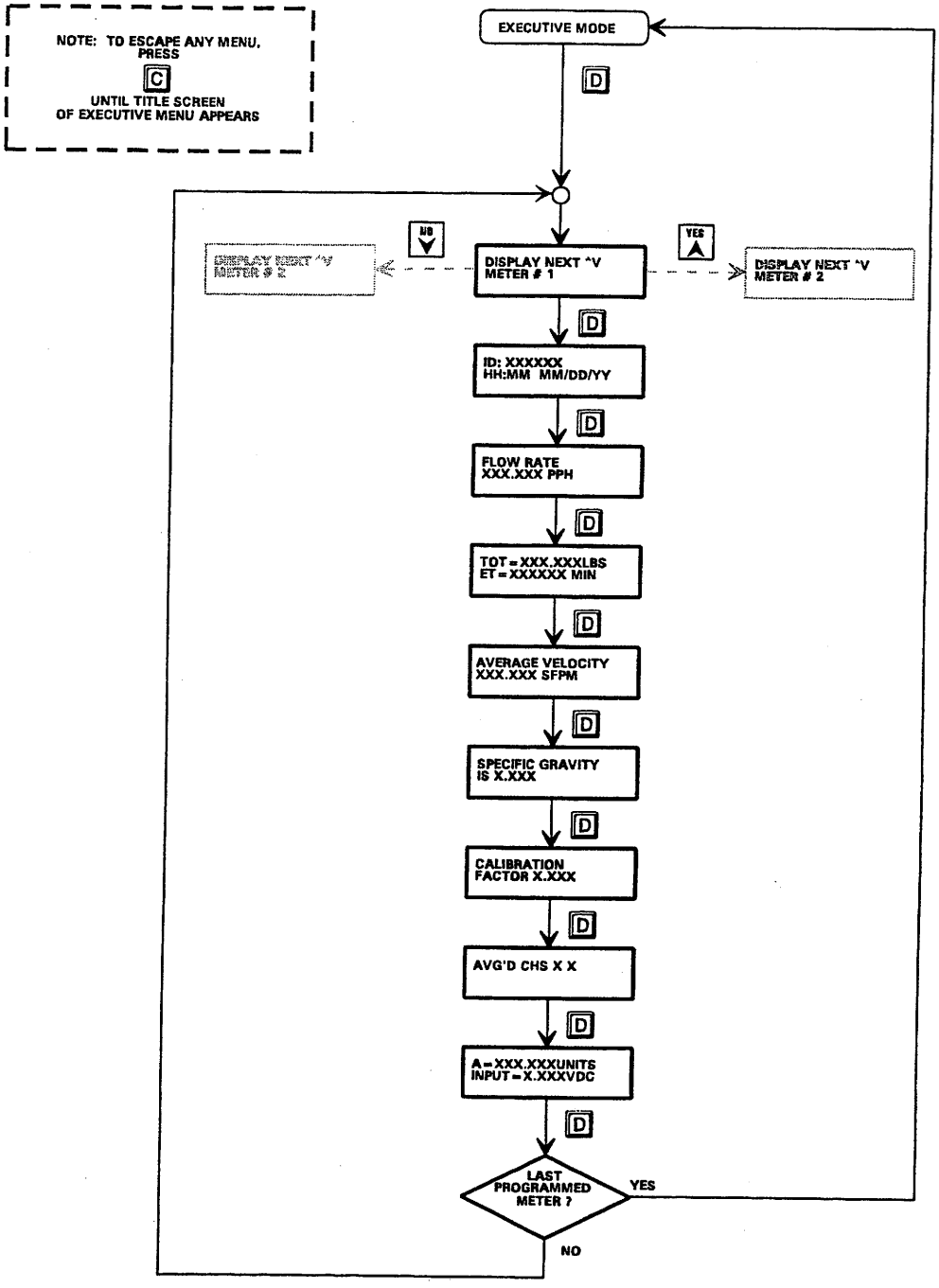


Figure O-5, Display Menu Tree, Flow Meter (PPH/KGH)

FLOW METER (PPH OR KGH)

FLOW RATE XXX.XXX PPH	Displays the current flow rate in Pounds Per Hour (PPH) past the sensor. Engineering units will be in Kilograms Per Hour (KGH) on instruments configured for International Units. Press [D] to view the next menu item.
TOT= XXXXXX LBS ET = XXXXXX MIN	Displays the total flow, in pounds, past the sensor and the elapsed time, in minutes, since the last reset. Engineering units will be in Kilograms (KG) on instruments configured for International Units. Press [D] to view the next menu item.
AVERAGE VELOCITY XXX.XXX SFPM	Displays the average velocity of all input channels assigned to this meter. This value includes any correction factors (see below). For applications with only one flow sensor this "average" is the corrected flow past the element. Units will be Standard Meters Per Second (SMPS) on instruments configured for International Units. Press [D] to view the next menu item.
SPECIFIC GRAVITY XXX.XXX	Represents the specific gravity of the gas being measured, relative to air. Press [D] to view the next menu item.
FLOW AREA XXX.XXX SQ FT	Flow area represents total stack or duct area at the point where the sensor is inserted into the process. Note that the engineering units will be in square feet if programmed for English Units or square meters for International Units. Press [D] to view the next menu item.
CALIBRATION FACTOR X.XXX	Calibration factor is a programmable correction used to compensate for an uneven profile in a stack or duct. Up to 7 correction factors can be programmed for each meter. Press [D] to view the next menu item.
AVG'D CHS A B	Displays all the channels (sensors) that are included in the average velocity calculations. The Model 155Jr is intended for a maximum of two inputs so this display will only show channel A and/or B as being active. A "?" in place of the channel designation indicates channel has been removed from average calculation (see Channel Kickout, page O-41). Press [D] to view the next menu item.
A=XXX.XXX UNITS INPUT= X.XXX VDC	Displays flow data before correction factors and actual input voltage for each active channel listed on the previous screen. This is the last display for a selected meter. Press [D] to view the next meter. If you are currently viewing the last meter, pressing [D] will exit to the title screen of the Executive Menu.

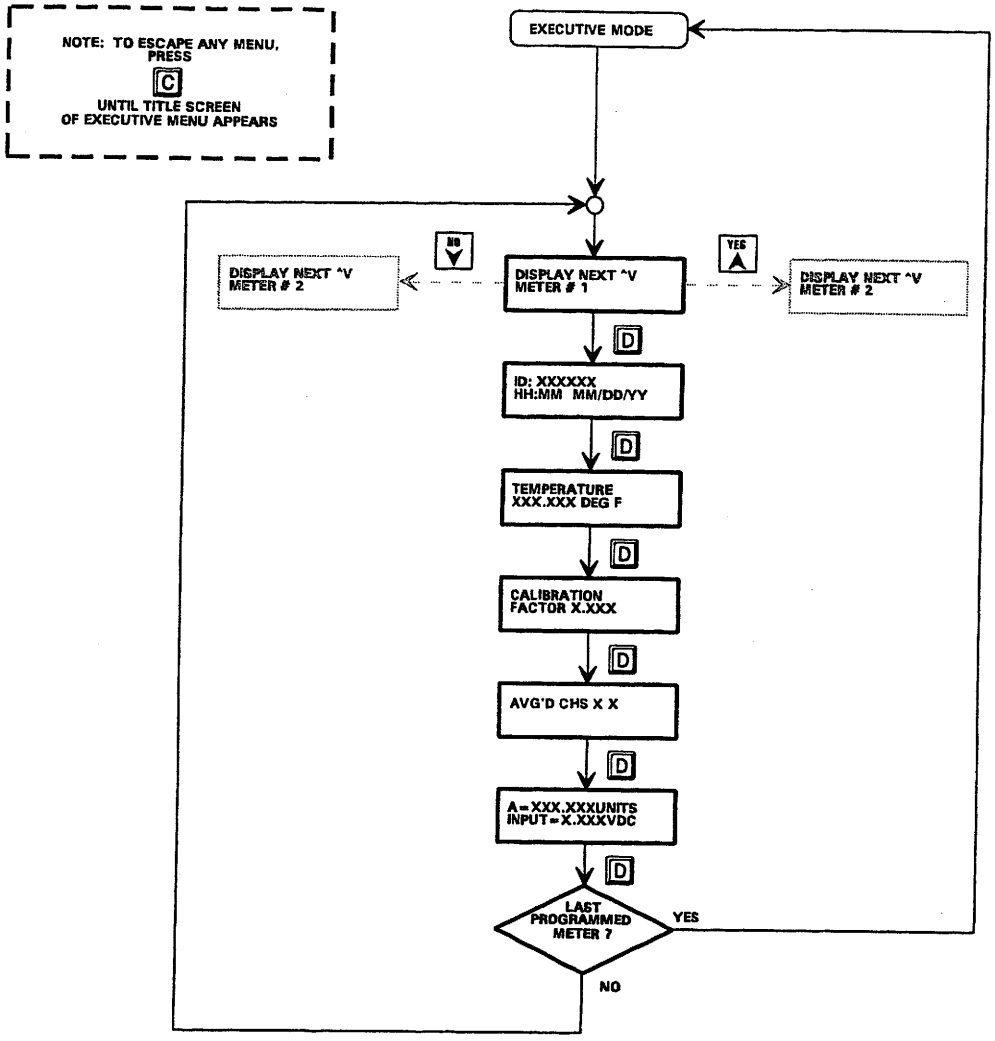


Figure O-6, Display Menu Tree, Temperature Meter

TEMPERATURE METER

TEMPERATURE XXX.XXX DEG F

Displays the current process temperature in degrees Fahrenheit, (DEG F), at the location of the temperature probe. Engineering units will be degrees Centigrade, (DEG C), on instruments configured for International Units. Press [D] to view the next menu item.

CALIBRATION FACTOR X.XXX

Calibration factor is a programmable correction used to compensate for an uneven profile in a stack or duct. Up to 7 correction factors can be programmed for each meter. Press [D] to view the next menu item.

AVG'D CHS B

Displays the channel of the Temperature Element. When the Model 155Jr is configured for a temperature element it is connected to channel B. Press [D] to view the next menu item.

B=XXX.XXX UNITS INPUT= X.XXX VDC

Displays temperature and actual input voltage for the active channel listed on the previous screen. This is the last display for a selected meter. Press [D] to view the next meter. If you are currently viewing the last meter, pressing [C] will exit to the Executive Menu.

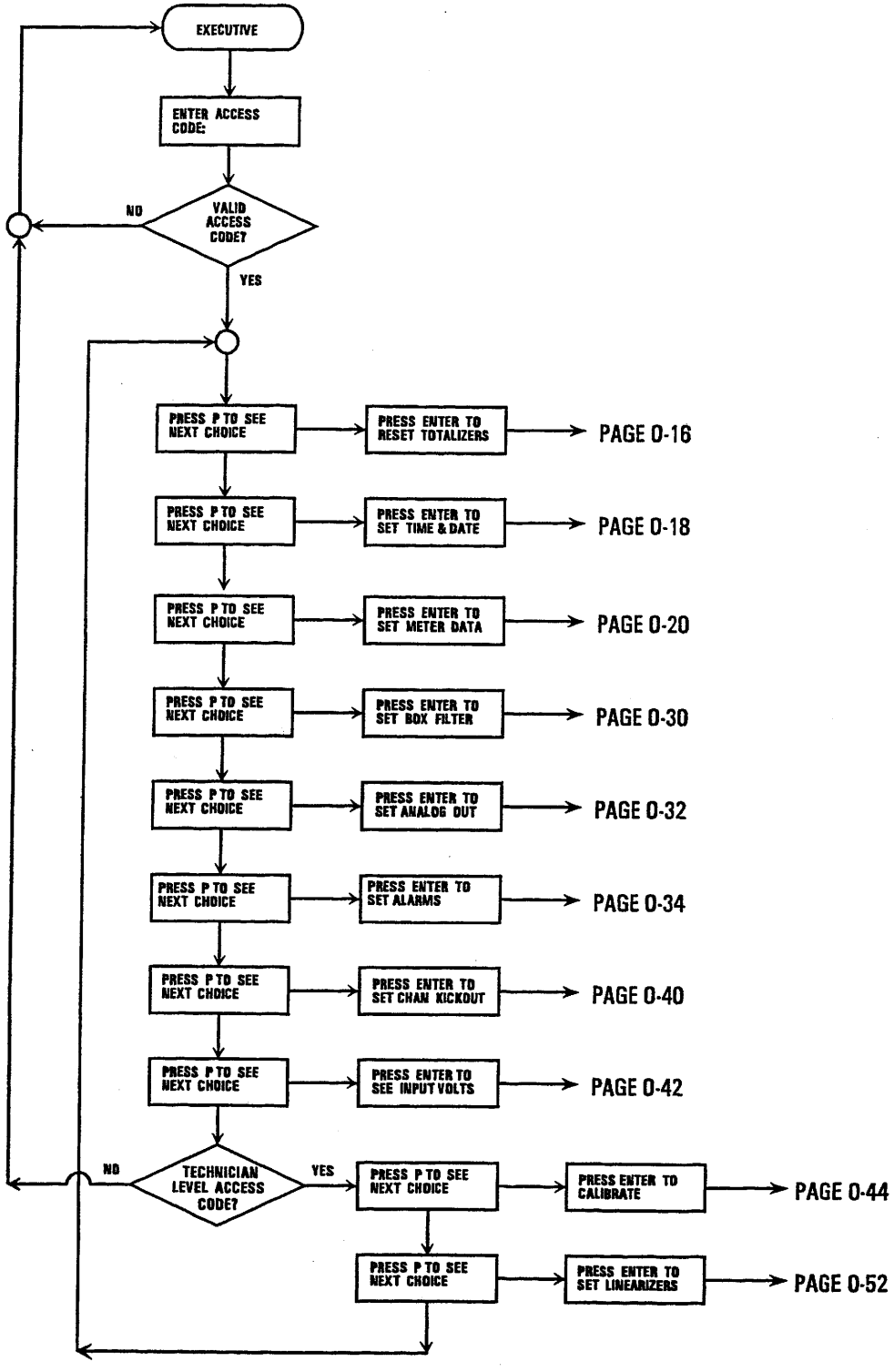


Figure O-7, Program Mode, Menu Choices

PROGRAM MODE

The Program Mode functions permit the operator to set up the Model 155Jr to suit site specific requirements. Pressing [P] while in the Automatic Display Loop will start the sequence allowing the operator to enter the Program Mode. To prevent unauthorized access to programming data, security access codes are required to initiate this mode of operation. There are two levels of access available to the operator, user level and technician level. For User Level press [1][2][3][4][5][6][E], for Technician Level press [6][5][4][3][2][1][E]. These codes are the factory defaults and can be changed using the optional Upload/download software and an IBM™ PC or 100% compatible computer. Table 8 lists the functions that may be performed in the Program Mode and the level of access required.

PROGRAM FUNCTION	ACCESS PERMITTED (✓ = available, NA = not available)	
	USER LEVEL	TECHNICIAN LEVEL
Reset Totalizers	✓	✓
Set Time and Date	✓	✓
Set Meter Data	✓	✓
Set Box Filter	✓	✓
Set Analog Out	✓	✓
Set Alarms	✓	✓
Set Channel Kickout	✓	✓
See Input Volts	✓	✓
Calibrate	NA	✓
Set Linearizers	NA	✓

Table O-1, Program Mode, Menu Functions

RESET TOTALIZERS

CAUTION: Performance of this procedure will result in the loss of totalizer data. If necessary record critical data before resetting the totalizers.

All mass flow meters have a totalizer function. This feature keeps a running total of the meter units (SCFM, SCMM, PPH, etc.) and the elapsed time in minutes since the last reset. If no manual reset is initiated, the totalizer function will reset automatically after 999999 minutes. **Execution of this command will reset the totalizers and elapsed time counters for all meters configured in this instrument.**

PRESS ENTER TO SET TOTALIZERS	Press [E] if you wish to reset the totalizer function. Press [P] if you wish to move to the next function. To prevent inadvertent use of this function you will be asked to verify this selection before the totalizer is reset.
ARE YOU SURE? ^=YES V=NO :NO	This message is displayed when the users presses [E] in response to the above prompt. "NO" is shown as the default response. Press [C] if you wish to exit without resetting the totalizers and elapsed time counter at this time. Press the up (YES) arrow to verify that you wish to reset the totalizer.
ARE YOU SURE? ^=YES V=NO :YES	This message is displayed when the user presses the up (YES) arrow in response to the above prompt. If you decide **NOT** to reset the totalizers, press [C] to exit this function, otherwise, press [E] to reset the totalizers at this time.
TOTALIZERS ARE RESET	This message is displayed when the user presses [E] in response to the previous prompt. At this time, the elapsed time counter and the totalizers for all meters configured in this instrument will reset to zero.

SET SYSTEM TIME AND DATE

This feature allows the user to adjust the system time and date to suit time zones, or Daylight Savings Time. Note that the entire sequence must be completed for the changes to take effect.

12:00	1/01/99
12	

This message prompts the user to specify the desired hour value using a 24 hour clock. The user can respond to this prompt by using either the up (YES) or down (NO) arrow, or by direct entry using the number keys. Press [E] when the desired number appears on the lower line of the display.

12:00	1/01/99
00	

This message indicates that the program has accepted the hour value and now prompts the user to specify the desired minute value. Enter the desired value using the technique described above.

12:00	1/01/99
	01

This message indicates that the program has accepted the minute value and now prompts the user to enter the desired numerical value for the month. Note the "leading zero" on the lower line. This numeral will be truncated (removed) from the display. Enter the desired value using the technique described above.

12:00	1/01/99
	01

This message indicates that the program has accepted the month value and now prompts the user to specify the desired numerical value for the day. Enter the desired value using the technique described above.

12:00	01/01/99
	99

This message indicates that the program has accepted the day value and now prompts the user to specify the desired numerical value for the year. Enter the desired value using the technique described above

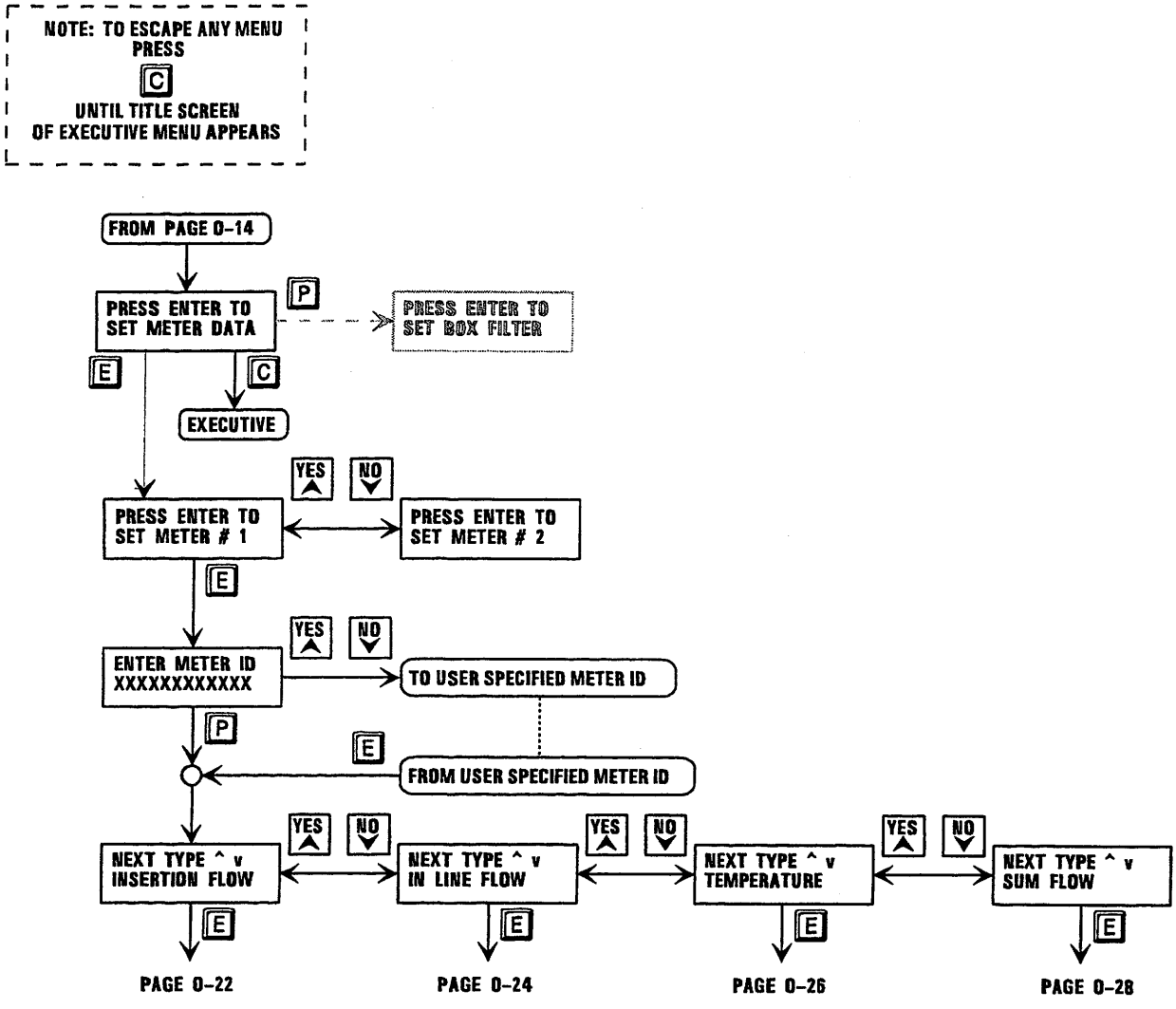


Figure O-10, Program Menu, Set Meter Data

SET METER DATA

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

This Menu and it's sub-Menus is used to configure a meter (up to a maximum of 16) for the specific type of sensor and installation parameters required by the user. These parameters include type of flow measurement, specific gravity (if required), flow area of the duct or stack, type of correction factors, number of correction factors, and correction factor values.

PRESS ENTER TO SET METER # 1	This message prompts the user to press [E] to set meter data for meter number 1. If the instrument is configured for more than one meter the user can press the up (YES) or down (NO) arrow to select the desired meter before pressing [E].
ENTER METER ID METER – 000001	This message prompts the user to enter a meter identification. The box at the left illustrates the factory default ID for meter 1. If this is acceptable, press [P]. The user can enter up to 12 alpha-numeric characters by using the up (YES) or down (NO) arrows to cycle through the Model 155Jr character set (see appendix B). When the desired character is displayed on the lower line, press [E] to select that character.
ENTER METER ID M	This message indicates that the user pressed [E] in response to the previous prompt. The "M" on the lower line would be either an "N" or "L" had the user pressed the up (YES) or down (NO) arrow. To accept the displayed character, press [E].
ENTER METER ID ME	This message indicates that the user pressed [E] in response to the previous prompt, accepting the "M". Note that the instrument acknowledged the action by displaying the next character of the existing meter ID. Continue to enter the desired meter ID.
NEXT TYPE ^ V INSERTION FLOW NEXT TYPE ^ V INLINE FLOW NEXT TYPE ^ V TEMPERATURE NEXT TYPE ^ V SUM FLOW	When one of these prompts is displayed, the instrument has accepted the meter ID and is asking the user to select a meter definition. By pressing the up (YES) or down (NO) arrow the user can cycle through the available selections. Press [E] when the desired meter definition is shown on the lower line of the display. At this point in the program one of four sub-Menus will be displayed depending upon the selected meter definition.

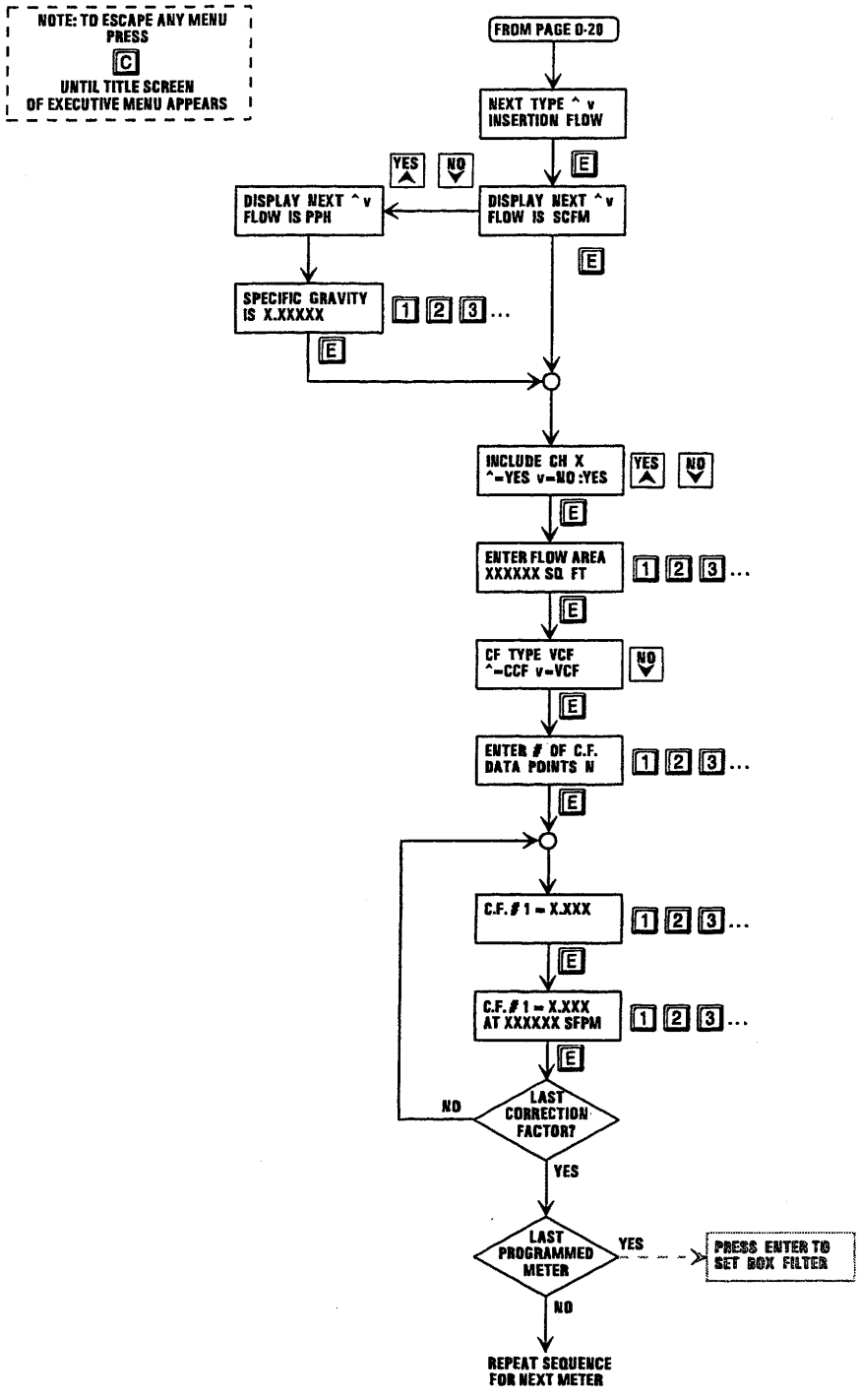


Figure 0-11, Program Menu, Set Meter Data, Insertion Flow Meter

INSERTION MASS FLOW METER

This type of meter is used with a Series 450 Insertion Mass Flow Element, or equivalent.

DISPLAY NEXT ^ V FLOW IS SCFM	Press the up (YES) or down (NO) arrow to select flow measurement in Standard Cubic Feet per Minute, Standard Cubic Feet per Hour, or Pounds Per Hour. If the instrument is programmed for International Units the choices will be Standard Cubic Meters per Minute (SCMM), Standard Cubic Meters per Hour (SCMH), or Kilograms Per Hour (KGH).
SPECIFIC GRAVITY IS X.XXXXX	This message will only be displayed if the user selected PPH or KGH in the previous step. Use the numeric keys to specify the specific gravity of the gasses being measured, then press [E]. The factory default value is 1.
INCLUDE CH X ^=YES v=NO : YES	Press the up (YES) arrow to include the indicated channel in average flow calculations for this meter. Press the down (NO) arrow to exclude the indicated channel from average flow calculations for this meter. When the desired selection appears to the right of the colon press [E].
ENTER FLOW AREA XXXXXX SQ FT	Use the numeric keys to specify the area of the stack or duct (in square feet) where the probe is mounted. Engineering units will be in square feet for instruments programmed in English Units or square meters when programmed for International Units. (1 square foot is the default value.)
CF TYPE VCF ^=CCF v=VCF	Variable Correction Factor (VCF) is the proper selection for a Model 155Jr. Do **not** select CCF as this feature only applies to multi-channel systems. Press the up (YES) or down (NO) arrow until the letters "VCF" appear after the words "CF TYPE", then press [E].
ENTER # OF C.F. DATA POINTS N	Use the numeric keys to specify the number of data points that require a correction factor up to a maximum of seven (7). Press [E] to enter the specified number.
C.F. #1 = X.XXX	The factory default correction factor is 1.000. To change this value, specify the desired value using the numeric keys. The up (YES) or down (NO) arrows may be used to make small changes to the value. Press [E] to enter the desired value. Multiple Correction Factors must be entered in ascending order of flow rate. For example, if C.F. 1 is applied at 1000 SFPM then C.F. 2 must be entered at a value **greater** than 1000 SFPM and so on.
C.F. #1 = X.XXX AT XXXXXX SFPM	Use the numeric keys to specify the velocity to which the correction factor is applied. Press [E] to enter the desired value. Repeat these steps for the remaining C.F. data points specified for this meter.

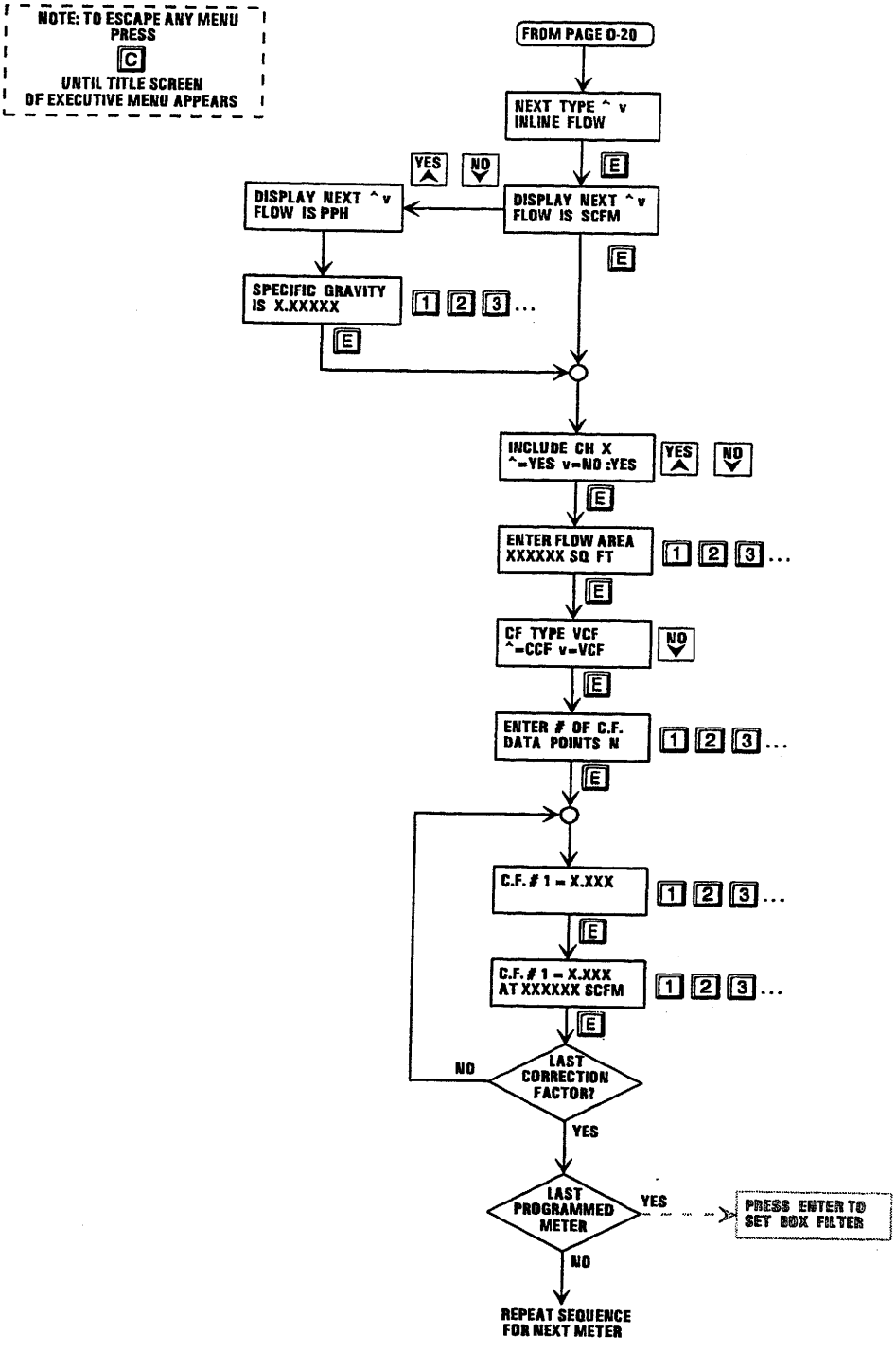


Figure O-12, Program Menu, Set Meter Data, Inline Flow Meter

INLINE MASS FLOW METER

This type of meter is used with a Series 500 In-Line Mass Flow Element, or equivalent. Note: To define a meter as "inline" requries at least one input channel defined with mass flow units, SCFM, SCMH, etc. If no mass flow input is defined the message "ENTRY NOT IN VALID RANGE" will be seen when attempting to configure an "inline" meter.

DISPLAY NEXT ^ V FLOW IS SCFM	Press the up (YES) or down (NO) arrow to select flow measurement in Standard Cubic Feet per Minute, Standard Cubic Feet per Hour, or Pounds Per Hour. If the instrument is programmed for International Units the choices will be Standard Cubic Meters per Minute (SCMM), Standard Cubic Meters per Hour (SCMH), or Kilograms Per Hour (KGH).
SPECIFIC GRAVITY IS X.XXXXX	This message will only be displayed if the user selected PPH or KGH in the previous step. Use the numeric keys to specify the specific gravity of the gasses being measured, then press [E]. The factory default value is 1.
INCLUDE CH X ^=YES v=NO : YES	Press the up (YES) arrow to include the indicated channel in average flow calculations for this meter. Press the down (NO) arrow to exclude the indicated channel from average flow calculations for this meter. When the desired selection appears to the right of the colon press [E].
ENTER FLOW AREA XXXXXX SQ FT	Use the numeric keys to specify the area of the stack or duct (in square feet) where the probe is mounted. Engineering units will be in square feet for instruments programmed in English Units or square meters when programmed for International Units. (1 square foot is the default value.)
CF TYPE VCF ^=CCF v=VCF	Variable Correction Factor (VCF) is the proper selection for a Model 155Jr. Do **not** select CCF as this feature only applies to multi-channel systems. Press the up (YES) or down (NO) arrow until the letters "VCF" appear after the words "CF TYPE", then press [E].
ENTER # OF C.F. DATA POINTS N	Use the numeric keys to specify the number of data points that require a correction factor up to a maximum of seven (7). Press [E] to enter the specified number.
C.F. #1 = X.XXX	The factory default correction factor is 1.000. To change this value, specify the desired value using the numeric keys. The up (YES) or down (NO) arrows may be used to make small changes to the value. Press [E] to enter the desired value. Multiple Correction Factors must be entered in ascending order of flow rate. For example, if C.F. 1 is applied at 1000 SCFM then C.F. 2 must be entered at a value **greater** than 1000 SCFM and so on.
C.F. #1 = X.XXX AT XXXXXX SCFM	Use the numeric keys to specify the flow rate to which the correction factor is applied. Press [E] to enter the desired value. Repeat these steps for the remaining C.F. data points specified for this meter.

TEMPERATURE METER

This meter set-up is used for temperature measurements using input from the Kurz Instruments, Inc. Series 450T or 450PT Insertion Mass Flow Element which incorporates an FDT sensor. To define a meter as "temperature" requries at least one input channel configured for a temperature input. If no temperature input is defined the message "ENTRY NOT IN VALID RANGE" will be seen when attempting to configure a "temperature" meter.

INCLUDE CH B ^=YES v=NO : YES

Press the up (YES) or down (NO) arrow to specify which channel is configured as a temperature meter. In a Series 155Jr, channel B should be selected. The display will only cycle through the number of available channels. Press [E] to enter the selection.

CF TYPE VCF ^=CCF v=VCF

Variable Correction Factor (VCF) is the proper selection for a Model 155Jr. Do **not** select CCF as this feature only applies to multi-channel systems. Press the up (YES) or down (NO) arrow until the letters "VCF" appear after the words "CF TYPE", then press [E].

ENTER # OF C.F. DATA POINTS N

Use the numeric keys to specify the number of correction factor data points required up to a maximum of seven (7). Press [E] to enter the selection.

C.F. #1 = X.XXX

The factory default correction factor is 1.000. To change this value, specify the desired value using the numeric keys. The up (YES) or down (NO) arrows may be used to make small changes to the value. Press [E] to enter the desired value. Multiple Correction Factors must be entered in ascending order of flow rate. For example, if C.F. 1 is applied at 100 DEGF then C.F. 2 must be entered at a value **greater** than 100 DEGF and so on.

C.F. #1 = X.XXX AT XXXXXX DEGF

Use the numeric keys to specify the temperature at which the correction factor is to be applied. Press [E] to enter the desired value. Repeat these steps for the remaining C.F. data points specified for this meter.

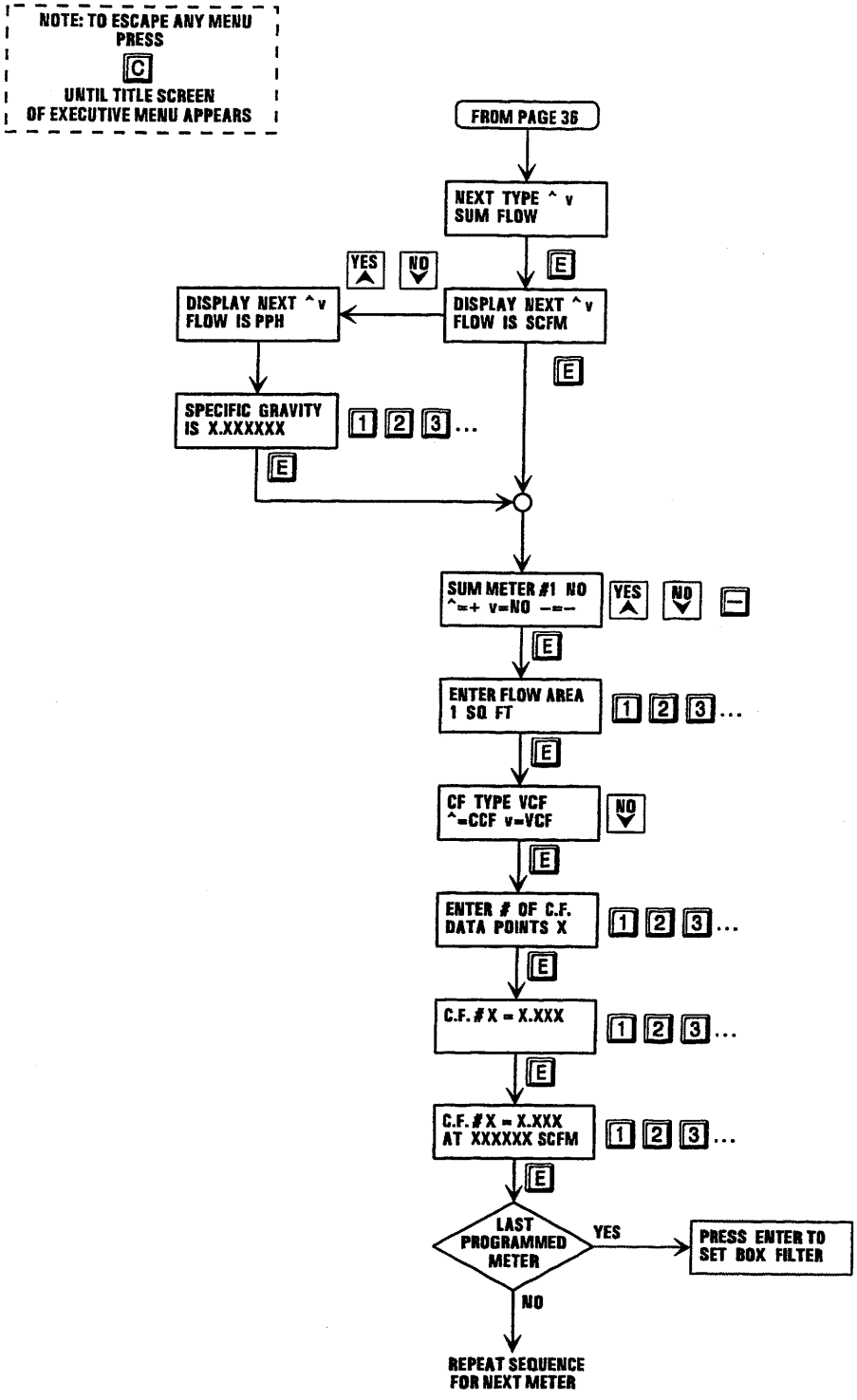


Figure O-14, Program Menu, Set Meter Data, Sum Flow Meter

SUM FLOW METER

The Sum Flow meter function is used to display the sum or difference of previously defined meters **having the same units** (SCFM, or SCMM, etc). Since a Series 155Jr is usually configured for only one Mass Flow Element input, this function is not normally used.

DISPLAY NEXT ^V FLOW IS SCFM	Press the up (YES) or down (NO) arrow to specify the type of flow measurement required. When the desired selection appears on the lower line, press [E] to make the selection.
DISPLAY NEXT ^V FLOW IS PPH	
SPECIFIC GRAVITY IS X.XXX	This message is displayed if the user selected PPH or KGH in the previous step. The factory default value is 1.000. Use the numeric keys to change the value if necessary. Press [E] to enter the value.
SUM METER #1 NO ^=+ v=NO –=–	Press the up (YES) arrow to add the flow value from meter #1, press the down (NO) arrow to exclude meter #1, or press [–] to subtract the flow value from meter #1 from the summation feature. When the desired selection has been made press [E] to enter. This function will be repeated for all programmed meters.
ENTER FLOW AREA XXXXXX SQ FT	Use the numeric keys to specify the area of the stack or duct (in square feet) where the probe is mounted. Engineering units will be in square feet for instruments programmed in English Units or square meters when programmed for International Units. (1 square foot is the default value)
CF TYPE VCF ^=CCF v=VCF	Variable Correction Factor (VCF) is the proper selection for a Model 155Jr. Do **not** select CCF as this feature only applies to multi-channel systems. Press the up (YES) or down (NO) arrow until the letters "VCF" appear after the words "CF TYPE", then press [E].
ENTER # C.F. DATA POINTS N	Use the numeric keys to specify the number of data points that require a correction factor up to a maximum of seven (7). Press [E] to enter the specified number.
C.F. #1 = X.XXX	The factory default correction factor is 1.000. To change this value, specify the desired value using the numeric keys. The up (YES) or down (NO) arrows may be used to make small changes to the value. Press [E] to enter the desired value. Multiple Correction Factors must be entered in ascending order of flow rate. For example, if C.F. 1 is applied at 1000 SCFM then C.F. 2 must be entered at a value **greater** than 1000 SCFM and so on.
C.F. #1 = X.XXX AT XXXXXX SCFM	Use the numeric keys to specify the flow rate to which the correction factor is applied. Press [E] to enter the desired value. Repeat these steps for the remaining C.F. data points entered for this meter.

155Jr Manual Addendum

10-17-97 2 pm, BBB

Set Input Filter (KAS 6.60 and higher)

Each input channel has a first order low pass filter. It is specified with a time constant in the ADAM menus. The time constant is the time required for the output to reach 63% of the input for a step change. The time required for the output to reach 99 % of the input is 4.6 time constants. The default value is 0.5 seconds.

Example: To set the filter at 10.5 seconds on channel B we do the following.

Enter Programming mode: Press **P** and the access code ****** then **E** for enter.

Scroll down by pressing the **P** key until you reach the menu for "set input filter" where you press enter

Then you select the channel you want with the up down arrows, B in this case and then **E** for enter

Next at the screen "new time constant" you type the value in seconds (0 to 3600 s) using the decimal point if needed and press **E** for enter.

So we type 10.5 and **E**.

Finally, you press the **C** or clear key twice to get out of the programming mode and back to the starting screen.

The low pass filter has replaced the box car filter (KAS 6.54 and lower) to improve the performance of the data filtering. To convert a system which has a Box Car filter to the time constant we first compute the time the box car was active.

Box Car time = [0.2 + 0.1 x (number of enabled channels)] x (Box Car size) seconds.

Then divide the box car time by 4.6 and you have the equivalent time constant.

SET BOX FILTER

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

Inputs to the Model 155Jr are filtered using an algorithm know as a "boxcar filter". This feature takes the average of the last several readings. Setting the box filter size specifies the number of readings to be averaged. The acceptable range of numbers is 1 through 64. Specifying 1 for the filter size indicates that no averaging be performed. Factory default for this feature is 4. It should be noted that increasing the number of readings will increase the cycle time of the instrument and slow down response to changes in flow rate.

ENTER CHAN A FOR BOX FILTER

Press the up (YES) or down (NO) arrow to specify the desired channel. Press [E] to enter the selection.

ENTER NEW BOX FILTER SIZE 4

Use the numeric keys or the up (YES) or down (NO) arrow to specify the number of readings to be included in the filter. Press [E] to enter the selection. The factory default setting is 4.

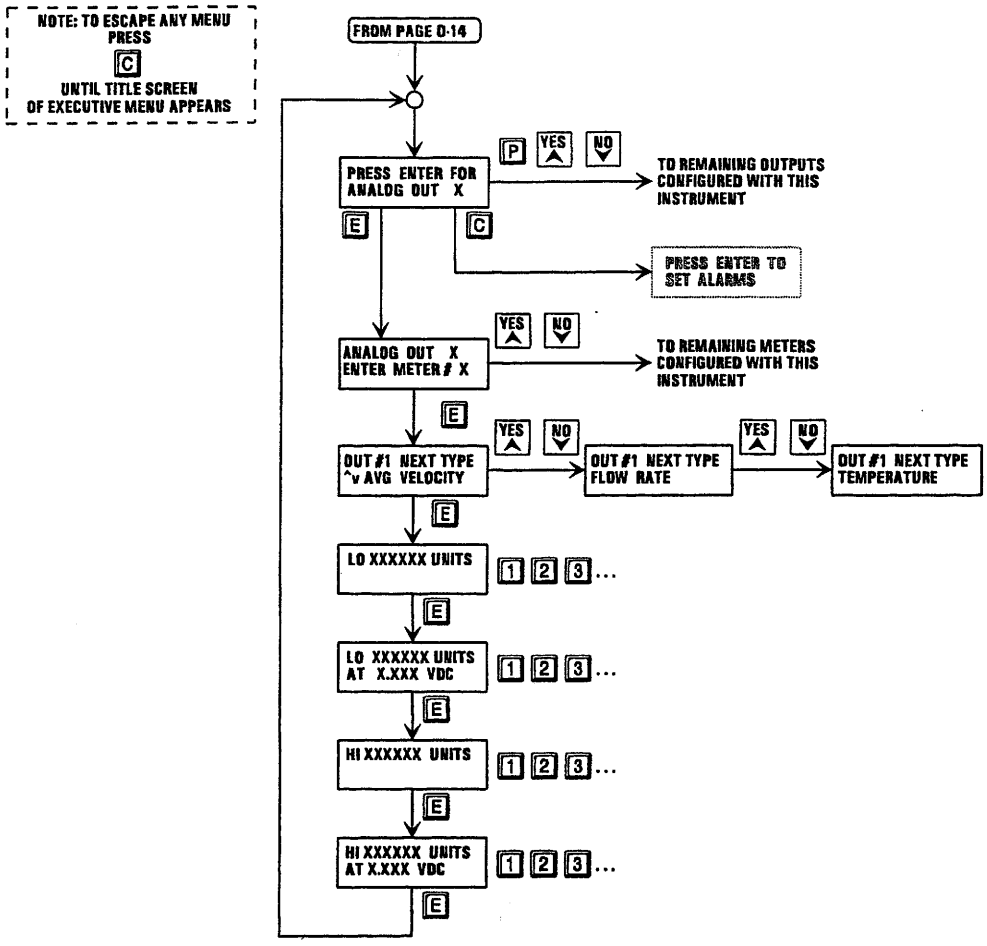


Figure O-16, Program Menu, Set Analog Output

SET ANALOG OUTPUT

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

This feature allows the user to set up the available analog output channels to suit specific requirements. The user can specify which meter will be represented by the output, the high and low ranges in units (SCFM, etc.) and the high and low voltages that indicate those units.

PRESS ENTER FOR ANALOG OUT X	Press [P] or the up (YES) or down (NO) arrow to specify the desired output channel. Press [E] to enter the selection. To exit the Set Analog function press [C].
ANALOG OUT X ENTER METER# X	Press up (YES) or down (NO) arrow to specify which meter the selected output will represent. Press [E] to enter the selection.
OUT #X NEXT TYPE ^v AVG VELOCITY	Press the up (YES) or down (NO) arrow to specify which function the output represents. When the desired function appears on the lower line, press [E] to enter the selection.
OUT #X NEXT TYPE ^v FLOW RATE	
OUT #X NEXT TYPE ^v TEMPERATURE	
LO XXXXXX UNITS	Use the numeric keys to specify the low process value. Units will depend upon meter definition. International Units will be displayed if the instrument is so configured.
LO XXXXXX UNITS AT X.XXX VDC	Use the numeric keys to specify the low volts value (default is 0.0 VDC). Note: When setting up a current output, 0.0 VDC = 4 mA. Press [E] to enter the selection.
HI XXXXXX UNITS	Use the numeric keys to specify the high process value. Units will depend upon meter definition. International Units will be displayed if the instrument is so configured.
HI XXXXXX UNITS AT X.XXX VDC	Use the numeric keys to specify the high volts value (default is 5.0 VDC). Note: When setting up a current output, 5.0 VDC = 20 mA. Press [E] to enter the selection.

Note: Pressing [E] on the last step will return the program to the analog output selection screen even if you are on the last programmed alarm. To exit the Set Analog Output feature, press [C] when you see the message "PRESS ENTER FOR ANALOG OUTPUT X". This will advance the Program Menu to the Set Alarms function.

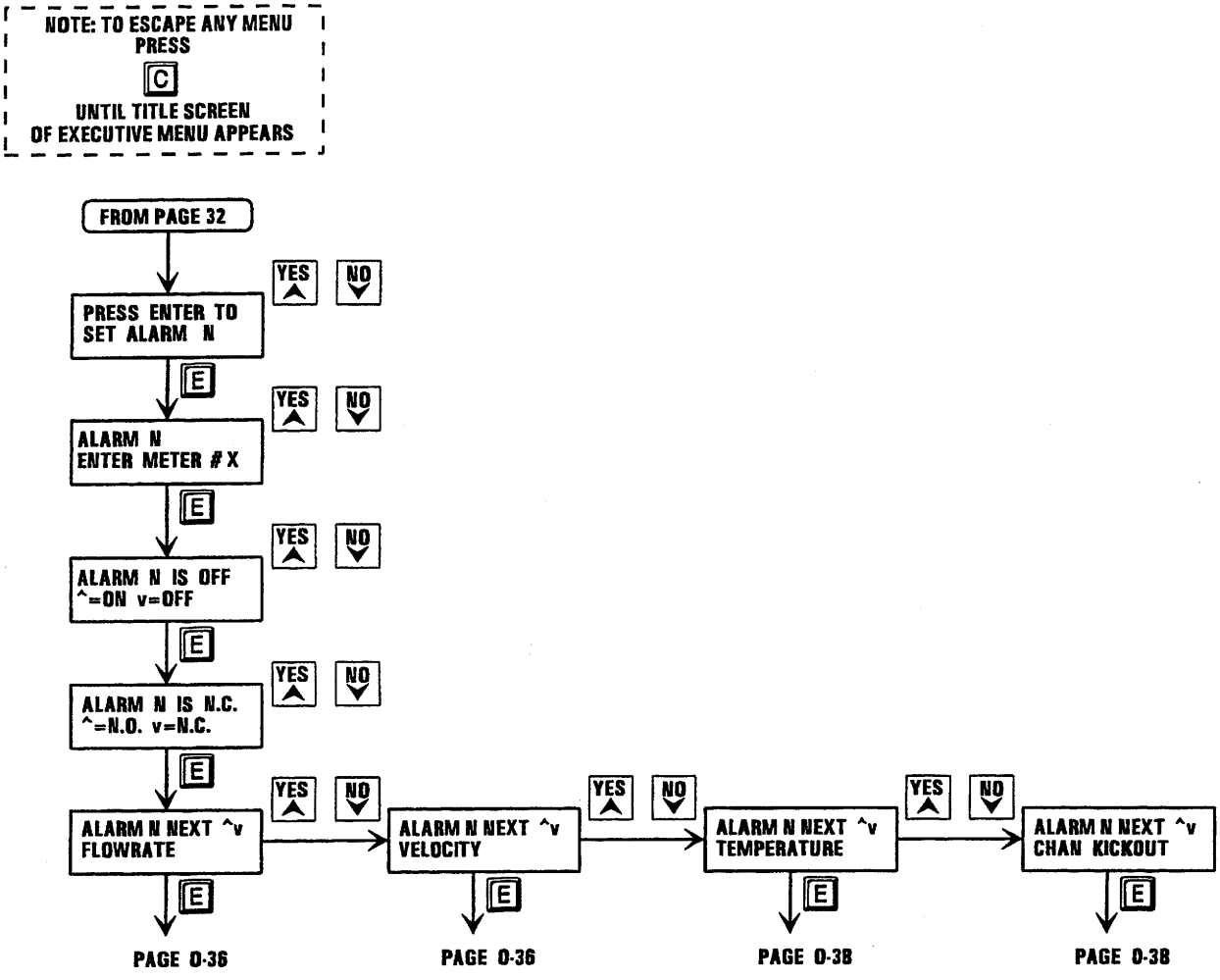


Figure O-17, Program Menu, Set Alarms

SET ALARMS

The Set Alarms feature of allows the user to assign an alarm to a specific meter. If the value reported by the assigned meter is outside acceptable limits, the alarm associated with that meter will annunciate the out of tolerance condition. A maximum of 4 alarms may be ordered for the Model 155Jr. Each alarm has an associated relay (see hook-up details on page I-24 of the Installation Section). Note that the last programmed alarm will always be assigned to the "global" Channel Kickout feature (see page O-41). If no alarms are specified by the customer, Alarm 1 and its associated relay will be factory configured as the "global" Channel Kickout. **Although an alarm may be programmed as normally open (N.O.) or normally closed (N.C.), all alarm contacts will fail to the N.O. if supply power to the Model 155Jr Mass Flow Computer is removed.**

PRESS ENTER TO SET ALARM N	Press the up (YES) or down (NO) arrow to specify the desired alarm then press [E].
ALARM N ENTER METER # X	Press the up (YES) or down (NO) arrow to specify which meter data to use for the alarm, then press [E].
ALARM N IS OFF ^ = ON v = OFF	Press the up (YES) or down (NO) arrow to turn the alarm ON or OFF then press [E].
ALARM N IS N.C. ^ = N.O. v = N.C.	Press the up (YES) or down (NO) arrow to specify the desired alarm contact configuration , then press [E].
ALARM N NEXT ^ v FLOWRATE	Press the up (YES) or down (NO) arrow to specify which type of alarm is required. When the desired function is displayed on the lower line press [E] to enter the selection.
ALARM N NEXT ^ v VELOCITY	
ALARM N NEXT ^ v TEMPERATURE	
ALARM N NEXT ^ v CHANNEL KICKOUT	

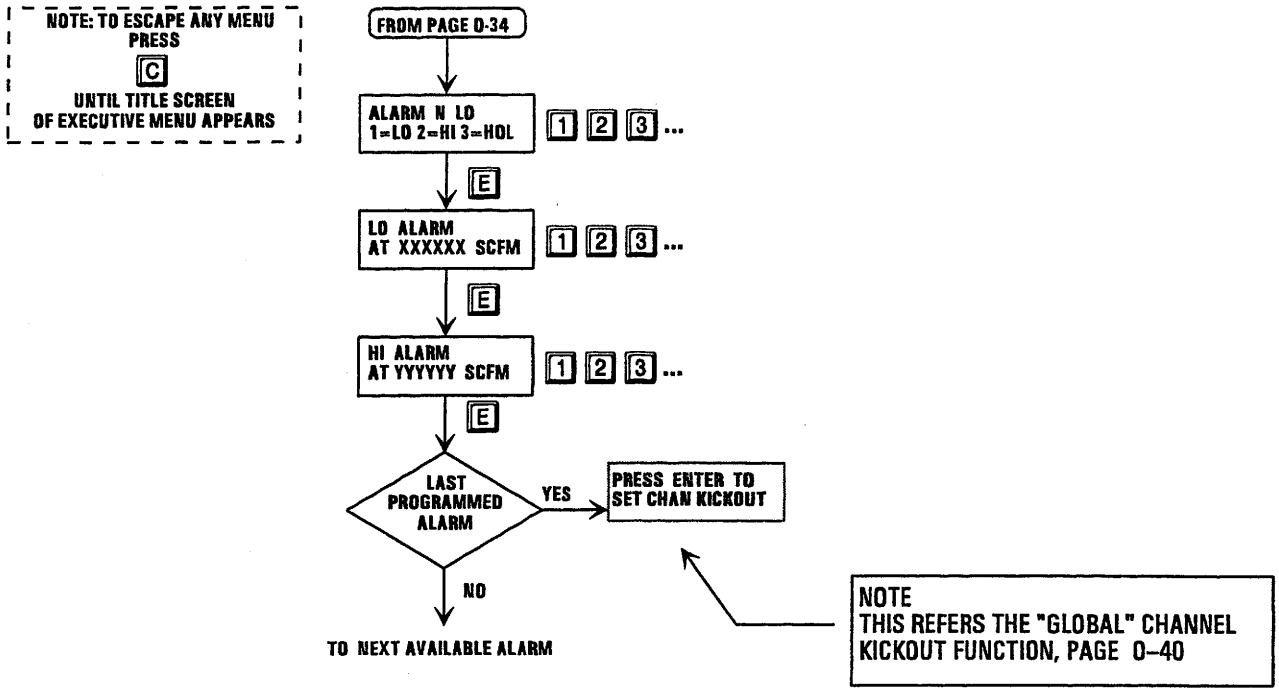


Figure O-18, Program Menu, Set Alarms (Mass Flow Rate).

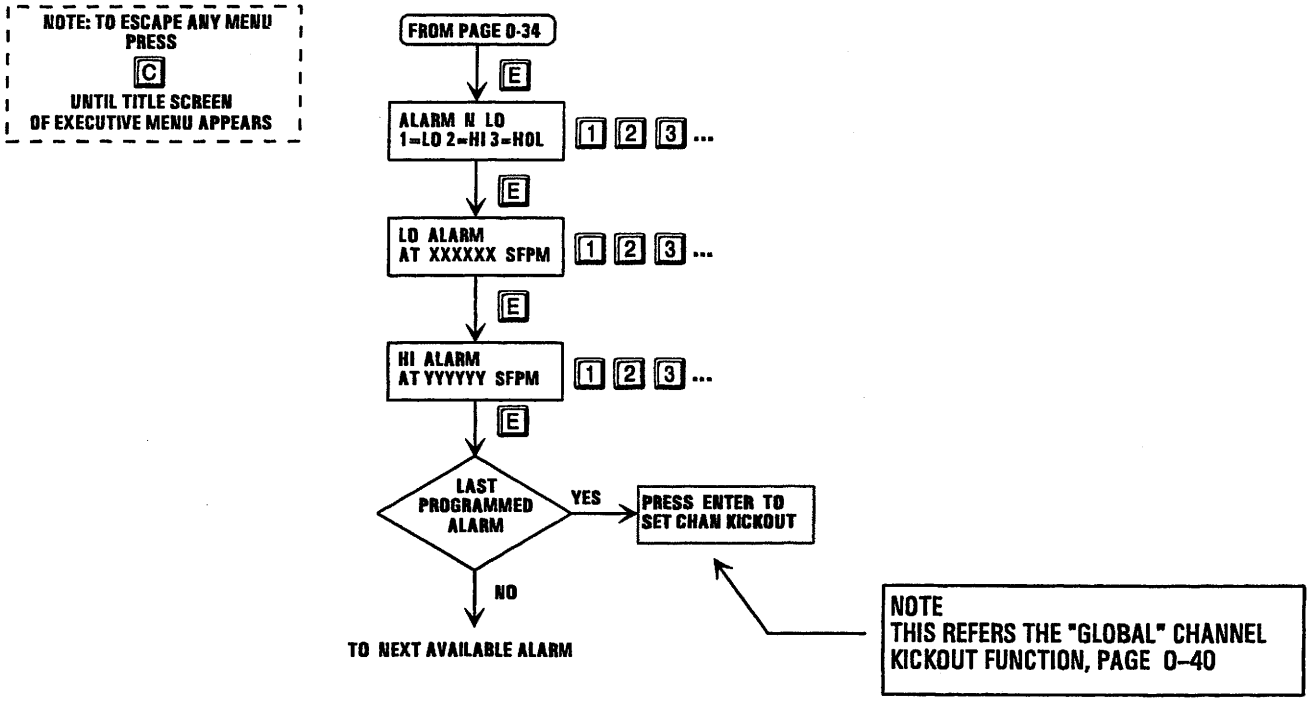


Figure O-19, Program Menu, Set Alarms (Velocity)

SET ALARMS (MASS FLOW RATE)

ALARM N LO 1=LO 2=HI 3=HOL	Press [1], [2], or [3] to designate the alarm as a low alarm, high alarm, or high/low alarm. A high/low alarm will cause an alarm indication if the flow rate is above the high alarm setpoint or below the low alarm setpoint.
LO ALARM AT XXXXXX SCFM	Prompts the user to specify the desired low alarm setpoint in SCFM, SCFH, or PPH. If the instrument is programmed for International Units, the display will read in SCMM, SCMH, or KGH. Press [E] if the displayed value is correct. If the displayed value is incorrect, use the numeric keys to display the desired value. When the correct value is indicated press [E] to make the selection.
HI ALARM AT YYYYYY SCFM	Prompts the user to specify the desired high alarm setpoint in SCFM, SCFH, or PPH. If the instrument is programmed for International Units, the display will read in SCMM, SCMH, or KGH. Press [E] if the displayed value is correct. If the displayed value is incorrect, use the numeric keys to display the desired value. When the correct value is indicated press [E] to make the selection.

SET ALARMS (VELOCITY)

ALARM N LO 1=LO 2=HI 3=HOL	Press [1], [2], or [3] to designate the alarm as a low alarm, high alarm, or high/low alarm. A high/low alarm will cause an alarm indication if the flow rate is above the high alarm setpoint or below the low alarm setpoint.
LO ALARM AT XXXXXX SFPM	Prompts the user to specify the desired low alarm setpoint in SFPM. If the instrument is programmed for International Units, the display will read in SMPS. Press [E] if the displayed value is correct. If the displayed value is incorrect, use the numeric keys to display the desired value. When the correct value is indicated press [E] to make the selection.
HI ALARM AT YYYYYY SFPM	Prompts the user to specify the desired high alarm setpoint in SFPM. If the instrument is programmed for International Units, the display will read in SMPS. Press [E] if the displayed value is correct. If the displayed value is incorrect, use the numeric keys to display the desired value. When the correct value is indicated press [E] to make the selection.

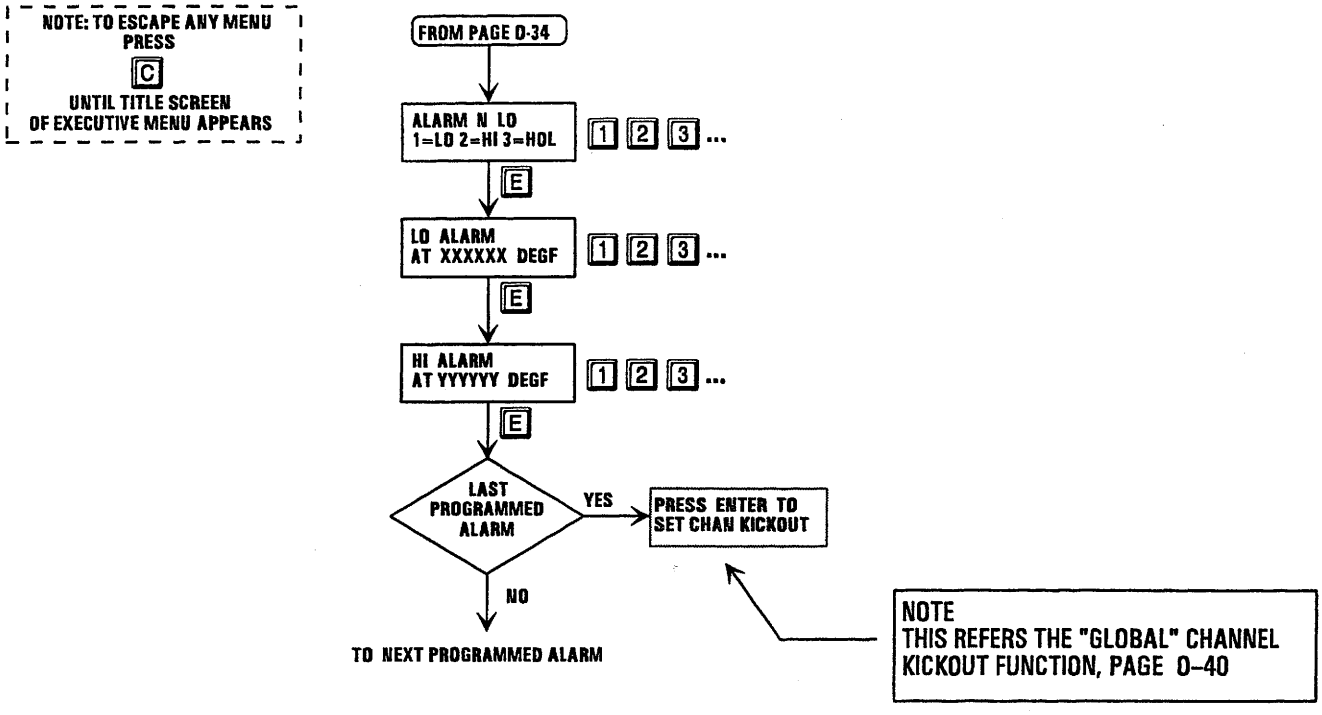


Figure 0-20, Program Menu, Set Alarms, (Temperature)

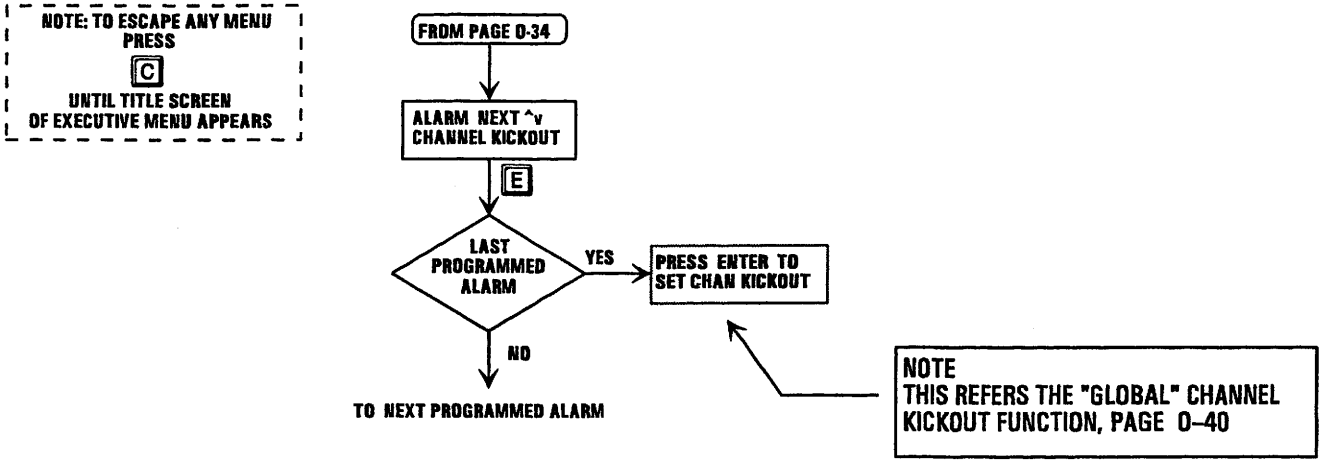


Figure 0-21, Program Menu, Set Alarms (Channel Kickout)

SET ALARMS (TEMPERATURE)

ALARM N LO 1=LO 2=HI 3=HOL

Press [1], [2], or [3] to designate the alarm as a low alarm, high alarm, or high/low alarm. A high/low alarm will cause an alarm indication if the temperature is above the high alarm setpoint or below the low alarm setpoint.

LO ALARM AT XXXXXX DEGF

Prompts the user to specify the desired low alarm setpoint in degrees Fahrenheit. If the instrument is programmed for International Units, the display will read in degrees Celsius (DEGC). Press [E] if the displayed value is correct. If the displayed value is incorrect, use the numeric keys to display the desired value. When the correct value is indicated press [E] to make the selection.

HI ALARM AT YYYYYY DEGF

Prompts the user to specify the desired high alarm setpoint in degrees Fahrenheit. If the instrument is programmed for International Units, the display will read in degrees Celsius (DEGC). Press [E] if the displayed value is correct. If the displayed value is incorrect, use the numeric keys to display the desired value. When the correct value is indicated press [E] to make the selection.

SET ALARMS (CHANNEL KICKOUT)

Although a global kickout feature is provided (see page O-41) often site requirements dictate an alarm dedicated to a particular meter. The Channel Kickout option of the Set Alarms feature will allow the user to assign an alarm to a specified meter. This alarm will initiate when the values reported by that meter exceed allowable limits. The upper and lower limits set in the Channel Kickout menu are used as determining criteria.

ALARM N NEXT ^v CHAN KICKOUT

The alarm established under this menu will annunciate an out of tolerance value for the selected meter. Upper and lower setpoints are determined by high and low kickout percentages established in the Set Channel Kickout Menu (see page 0-41). The "Global" Channel Kickout feature described on page O-41 must be turned on before the Set Alarms Channel Kickout will function. Press [E] when this screen is visible to make the selection.

SET CHANNEL KICKOUT (GLOBAL)

This feature is also known as the "Global" channel kickout. When multiple sensors are available the individual channels are averaged to provide an output representative of stack or duct conditions (flow or temperature). If an individual channel were to fail it's output could cause an out of tolerance average indication. When initiated the channel kickout feature will remove from the average calculations any channel whose output falls outside of a user-definable range relative to % of the highest value listed in the linearization table of the ***Calibration Data and Certification Document.*** It is important to note that the "Global" Channel Kickout feature must be "ON" in order for the Set Alarms Channel Kickout feature to function (see page O-39).

CHAN KICKOUT OFF **^ = ON v = OFF**

Prompts the user to press the up (YES) or down (NO) arrow to turn the channel kickout function on or off. When the desired indication appears on the top line, press [E].

HIGH KICKOUT AT **110 % FULL SCALE**

Prompts the user to specify the high setpoint for channel kickout. The factory default is 110 % of the full scale value listed in the linearization table of the ***Calibration Data and Certification Document.*** If the value is correct, press [E]. If the value is not correct, use the numeric keys to specify the desired value, then press [E].

LOW KICKOUT AT **-1 % FULL SCALE**

Prompts the user to specify the low setpoint for channel kickout. The factory default is -1% of the full scale value listed in the linearization table of the ***Calibration Data and Certification Document.*** If the value is correct, press [E]. If the value is not correct, use the numeric keys to specify the desired value, press [−], then press [E]. **Note that to enter a "minus" value, the number must be entered first , then press the [−] key.**

ALARM N OFF **^=ON v = OFF**

Press the up (YES) or down (NO) arrow to indicate whether nor the channel kickout feature is to initiate an alarm. The channel kickout feature is automatically assigned to the last programmed alarm.

ALARM N N.O. **^=ON v=OFF**

Press the up (YES) arrow to configure the alarm contacts as normally open (N.O.). Press the down (NO) arrow to configure the alarm contacts as normally closed (N.C.). Press [E] to complete the selection.

SEE INPUT VOLTS

This feature allows the user to view the flow rate or temperature and input volts (Current Sense Voltage) for each input channel. The flow rate or temperature units will be those defined in the linearization table of the ***Calibration Data and Certification Document.***

A = XXXXXX UNITS INPUT=Y.YYY VDC

Displays the flow rate or temperature and input volts for the indicated channel. No correction factors have been applied to these values. Units will be as defined in the linearization table. This data may also be viewed in the Display Mode. Press [C] to exit this display.

This is the last user level menu available in the Program Mode. If the Program Mode was entered with the user level access code the next message to appear will display the following prompt; "PRESS ENTER TO RESET TOTALIZERS". This starts the sequence of menu choices again. If the Program Mode was entered with the technician level access code the ADAM™ software will proceed to the calibrate functions starting on page O-45.

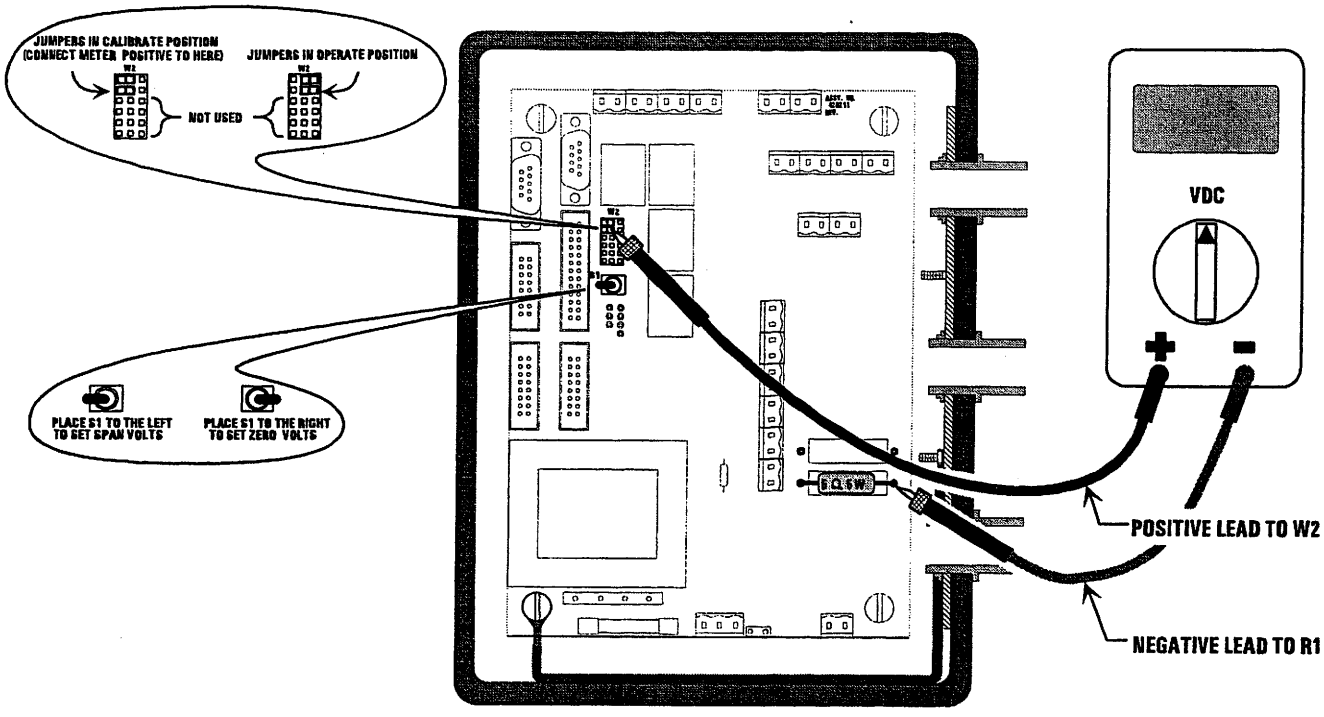


Figure O-24, Calibrate Input, Hardware Setup

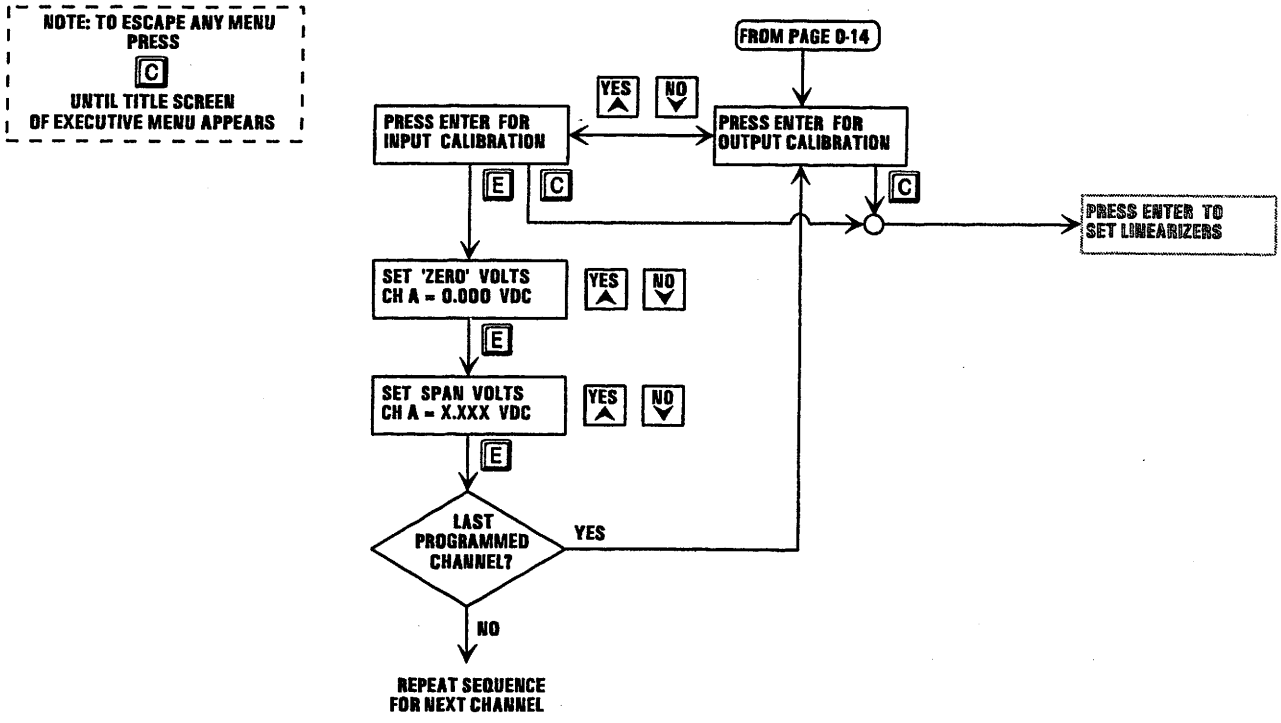


Figure O-25, Program Menu, Input Calibration

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Monterey, CA 93940

July 25, 1996

ADDENDUM FOR THE NEW AND IMPROVED POWER SUPPLY "MOTHERBOARD"

This replaces INPUT CALIBRATION Section on page 0-45.:

INPUT CALIBRATION

WARNING: **Performance of this procedure may expose personnel to hazardous potentials. Comply with all applicable safety procedures and practices before proceeding.**

CAUTION: **Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.**

1. Connect negative lead of the DVM to TP8 (top lead of Current Sense Resistor R1, signal ground) as indicated in Figure 0-24A (AC Version).*
2. Connect positive lead of the DVM such that it makes electrical contact with TP9 as indicated in Figure 0-24A.

   *Note: For DC Version, see Figure 0-24B.

3. Use the 155JR keypad and front panel LCD to perform the following steps:

Set Zero Volts CH A =0.000 VDC	Ensure that switch S3 is toggled to the left (CAL) and S1 to the right (ZERO). This will apply 0.0 VDC to the input. Press the up (YES) or down (NO) arrow until the VDC value on the lower line of the display matches the DVM indication. Press E to enter the value.
Set Span Volts CH A =0.000 VDC	Toggle switch S1 to the left (SPAN). This will apply approximately 2.5 VDC to the input. Press the up (YES) or down (NO) arrow until the VDC value on the lower line of the display matches the DVM indication. Press E to enter the value.

4. Repeat these steps for any remaining input channels. When all input channels have been calibrated, remove the DVM leads from the instrument, and return switches S2 and S3 to operate.

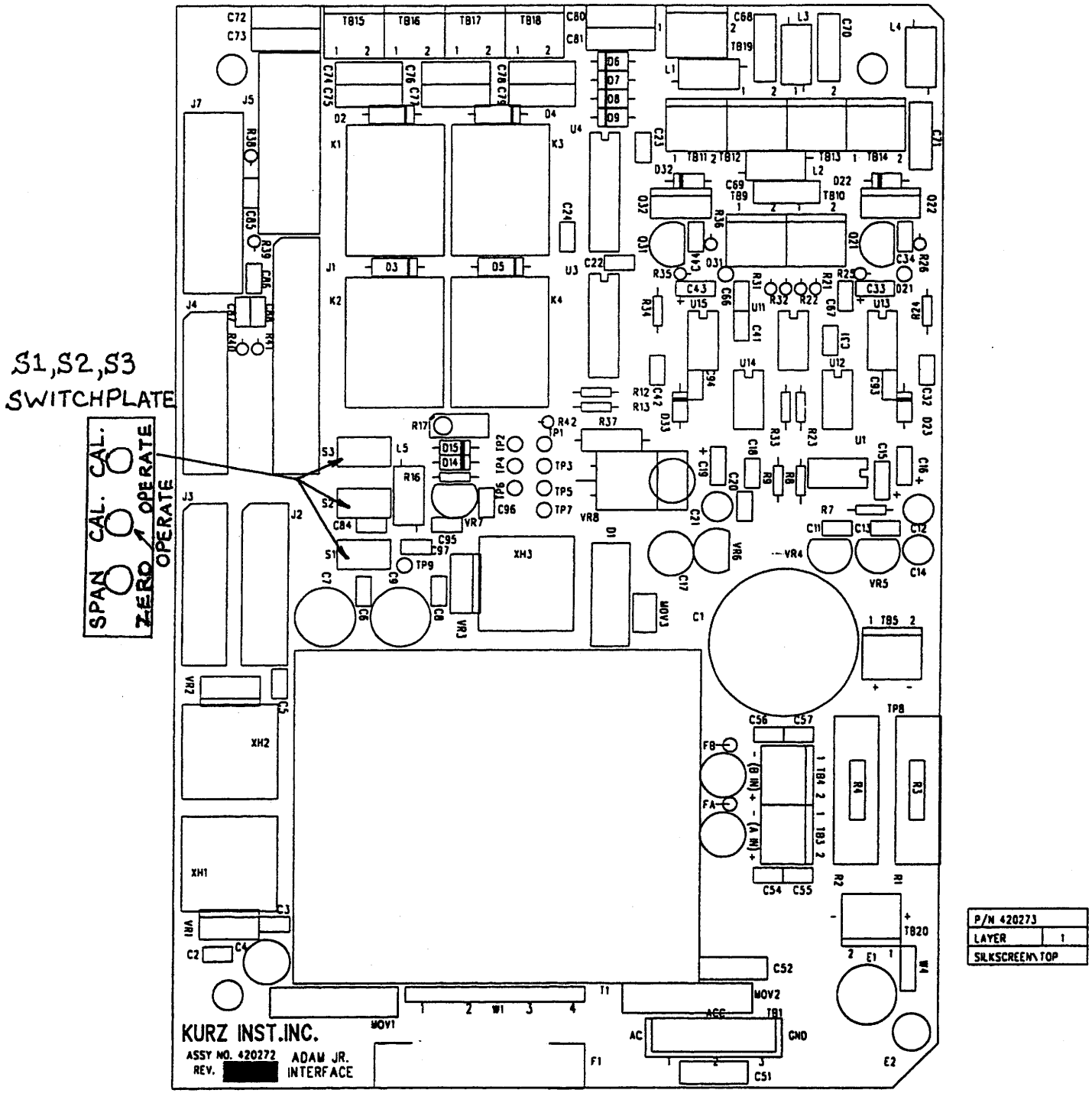


FIGURE 0-24A

AC VERSION

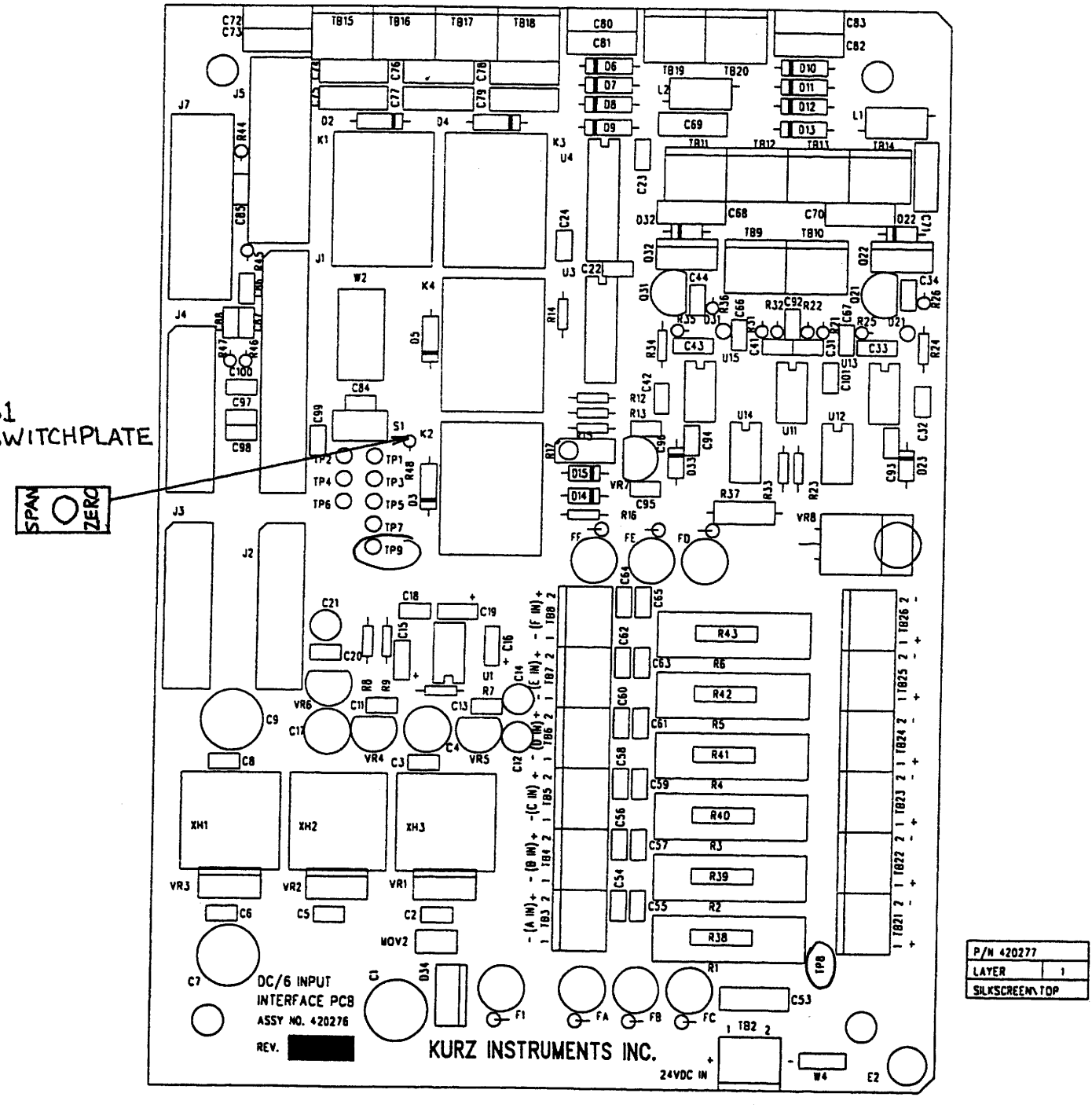


FIGURE 0-24B

DC VERSION

CALIBRATE

The Model 155Jr is equipped with an on-board feature allowing the technician to calibrate the input and output circuits. Both of these procedures require the use of a calibrated 4½ digit voltmeter with 0.1% accuracy. Calibration of this instrument is performed with power on. If the instrument under calibration is part of an integrated system and connected to other equipment **be sure that this procedure will not compromise personnel or equipment safety**. Note that external alarm or monitoring circuitry can introduce foreign power sources into the Model 155Jr enclosure.

PRESS ENTER FOR OUTPUT CAL.

Press the up (YES) or down (NO) arrow to specify input or output calibration. When the desired function is displayed on the lower line press [E] to enter the selection.

PRESS ENTER FOR INPUT CAL.

INPUT CALIBRATION

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply with all applicable safety procedures and practices before proceeding.

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

1. Remove shorting plug from the two right-hand pins of jumper block W2 for the channel to be calibrated (channel A is the top set of pins, channel B is the second from the top, etc.) and place the shorting plug on the two left-hand pins as indicated in Figure O-24.

2. Connect negative lead of the DVM to the right lead of Current Sense Resistor R1 (signal ground) as indicated in Figure O-24.

3. Connect positive lead of the DVM such that it makes electrical contact with one of the shorting plugs in jumper block W2 as indicated in Figure O-24.

4. Use the keypad and front panel LCD to perform the following steps:

SET ZERO VOLTS CH A =0.000 VDC

Ensure that switch SW1 is toggled to the right. This will apply 0.0 VDC to the input. Press the up (YES) or down (NO) arrow until the VDC value on the lower line of the display matches the DVM indication. Press [E] to enter the value.

SET SPAN VOLTS CH A = X.XXX

Toggle switch SW1 to the left. This will apply approximately 2.5 VDC to the input. Press the up (YES) or down (NO) arrow until the VDC value on the lower line of the display matches the DVM indication. Press [E] to enter the value. Repeat these steps for any remaining input channels.

5. When all input channels have been calibrated, remove the DVM leads from the instrument, place the shorting plugs in the operate position on jumper block W2 as indicated in Figure O-24, and proceed to the output calibration feature.

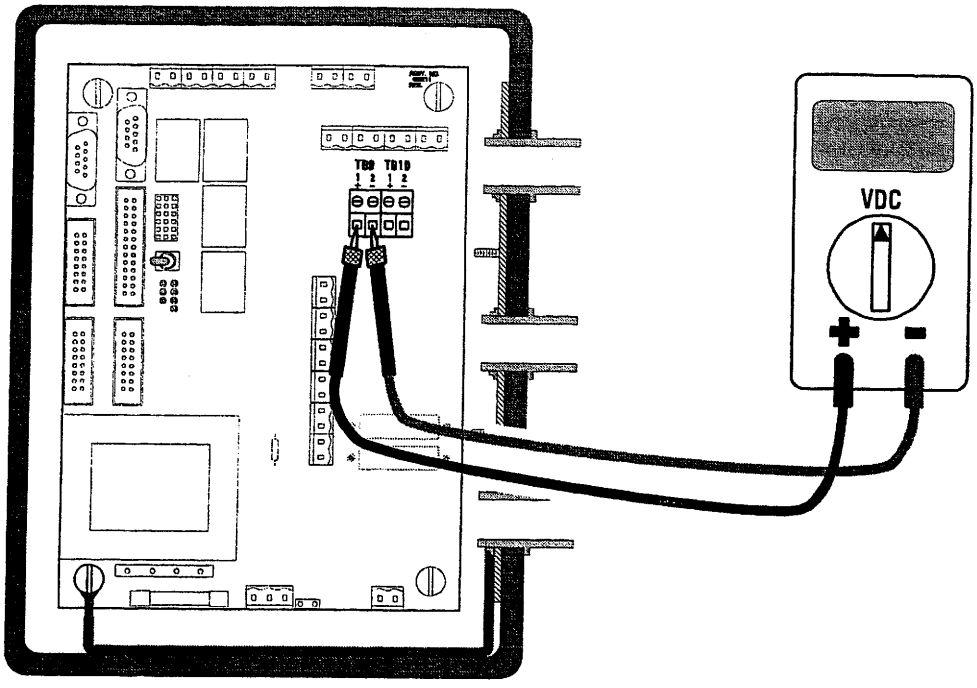


Figure O-26, Output Calibration, 0-5 VDC, Hardware Setup

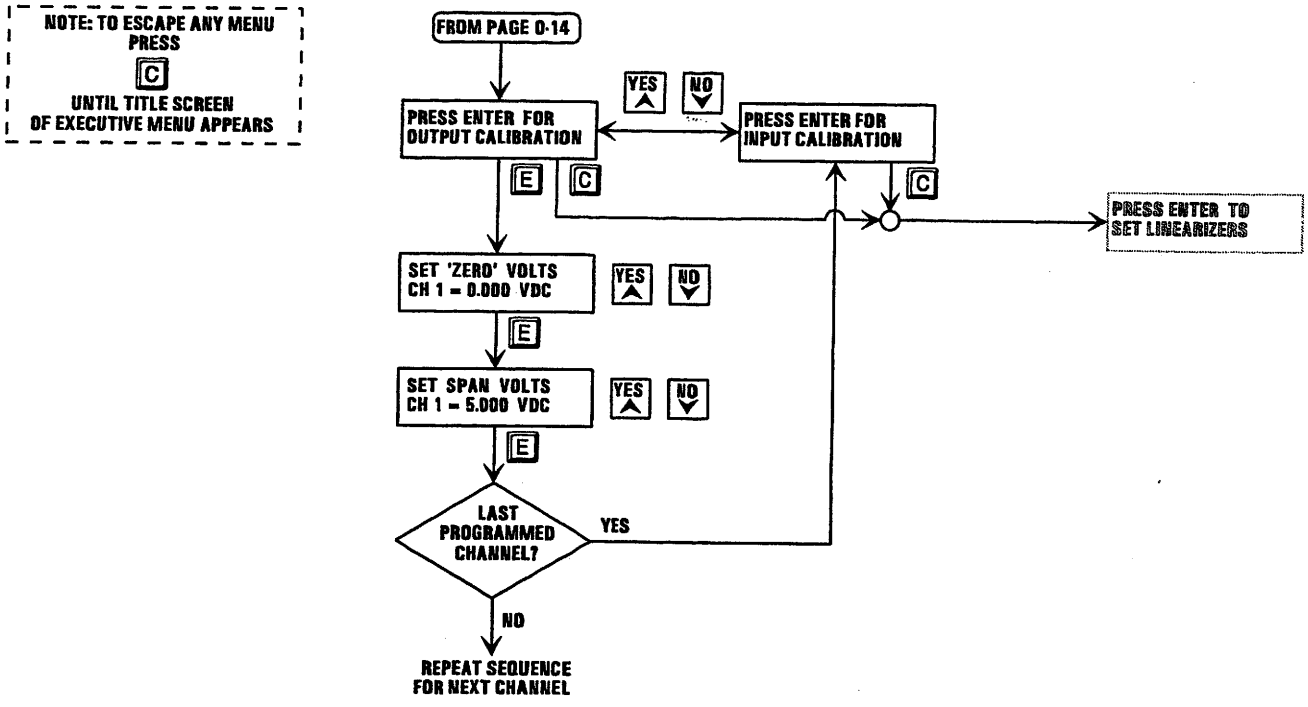


Figure O-27, Program Menu, Output Calibration

OUTPUT CALIBRATION

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply with all applicable safety procedures and practices before proceeding.

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

Model 155Jr standard configuration features a single 0-5 VDC analog output representative of the meter selected with the "SET ANALOG OUT" function. If desired, a second 0-5 VDC output can be ordered as an option. For signal transmission greater than 50 ft (15 meters) up to two optional, 4-20 mA current drivers may be substituted for the 0-5 VDC outputs. Output calibration procedures will depend upon the presence of these options. The procedure listed below is for 0-5 VDC outputs. To calibrate 4-20 mA outputs turn to page O-49.

Output Calibrate (0-5 VDC)

To calibrate a 0-5 VDC analog output from the Model 155Jr, perform the following steps.

1. Connect a DVM as indicated in Figure O-27 and Table O-2 for the appropriate channel.

CHANNEL	METER POSITIVE	METER NEGATIVE
1	TB9-1	TB9-2
2	TB10-1	TB10-2

Table O-2, Output Calibration, Meter Connection, 0-5 VDC.

2. Use the keypad and front panel LCD to perform the next two steps.

SET 'ZERO' VOLTS CH 1 = 0.000 VDC	Press the up (YES) or down (NO) arrow until the DVM reads 0.000 VDC, then press [E].

SET SPAN VOLTS CH 1 = 5.000 VDC	Press the up (YES) or down (NO) arrow until the DVM reads 5.000 VDC, then press [E].

3. If your instrument is configured for a second analog output, you will be prompted to set the zero volt level for channel 2. Proceed to the appropriate instructions for channel two (0-5 VDC or 4-20 mA) and connect the DVM as indicated. Recalibration is required if a channel output has been changed from one type to another (4-20mA to 5 VDC or 5 VDC to 4-20mA).

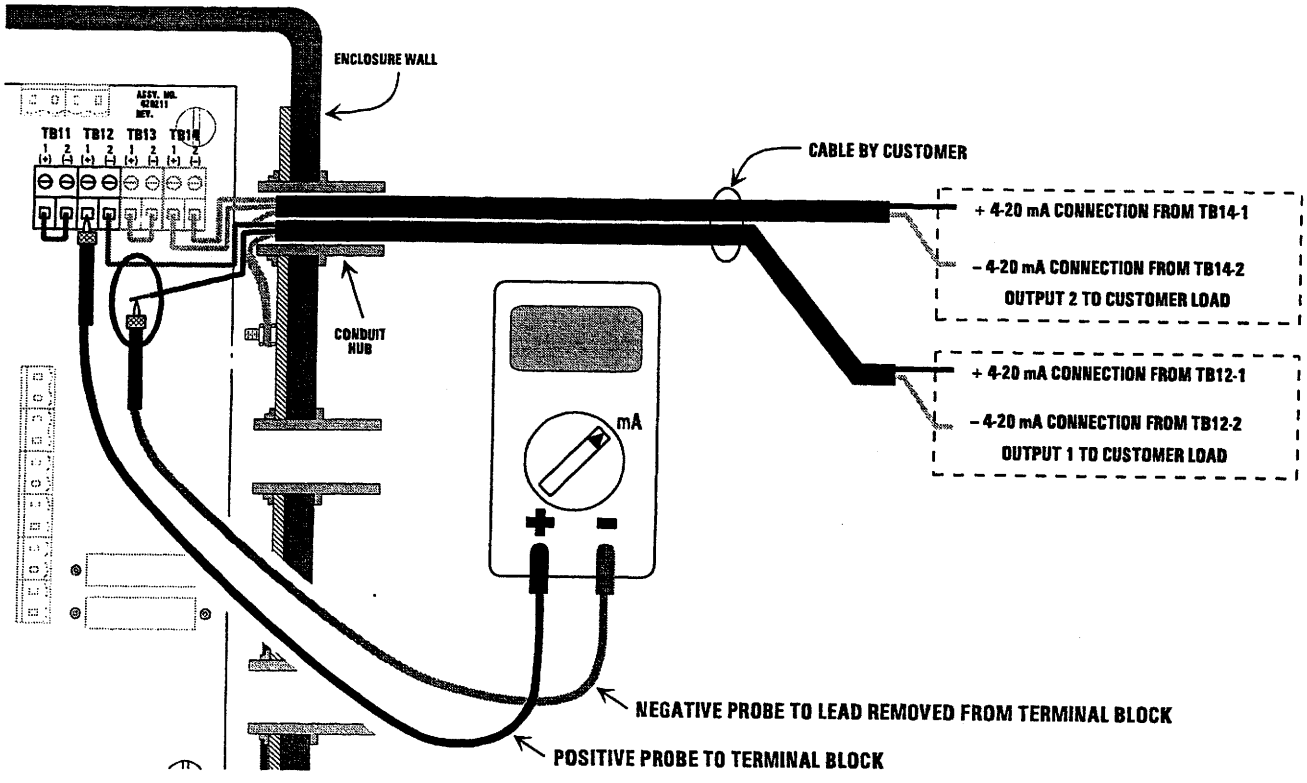


Figure O-28, Output Calibration, 4-20mA (Self Powered), Hardware Setup

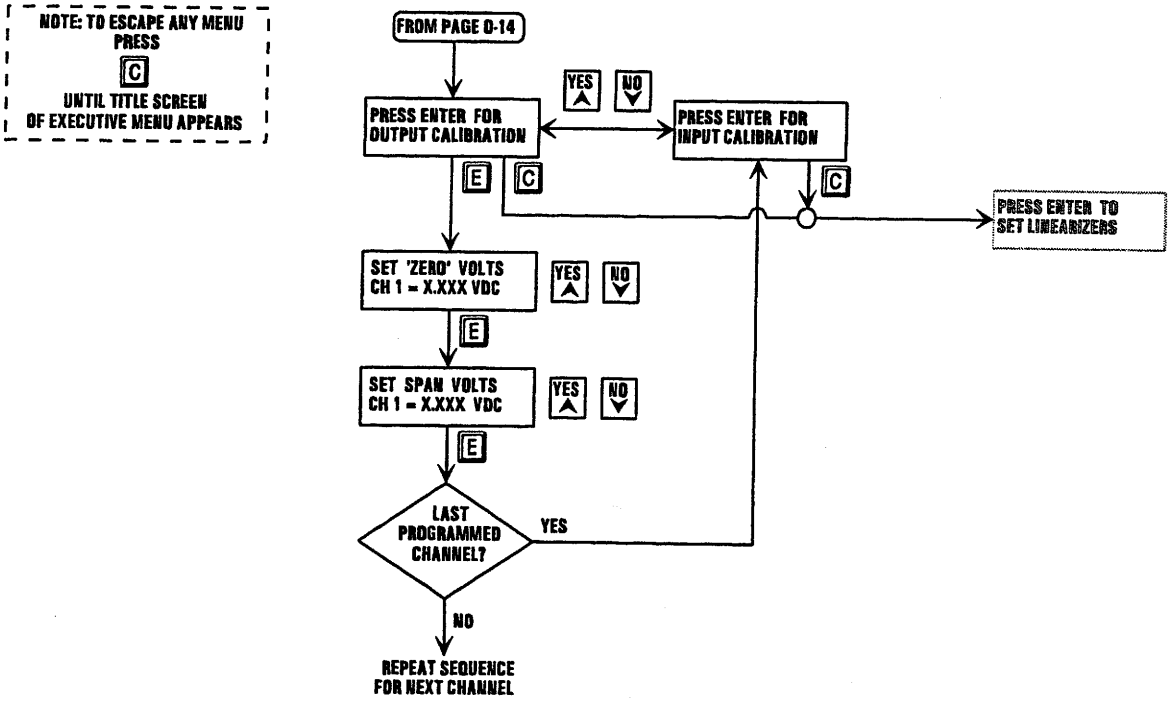


Figure O-29, Program Menu, Output Calibration

Output Calibrate (4-20 mA)

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply with all applicable safety procedures and practices before proceeding.

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

If your instrument is configured for optional 4-20mA outputs one of two procedures will apply. For self powered output (utilizing the Model 155Jr current source) follow the procedure listed on this page. The self powered configuration is easily identified by the presence of jumpers connecting pins 1 and 2 of TB11 and TB13. If the output is loop powered by an external current source, turn to page O-51.

1. Connect a DVM as indicated in Figure O-28 and Table O-3 for the appropriate channel.

CHANNEL	METER CONNECTIONS
1	In series with TB12-1
2	In series with TB14-1

Table O-3, Output Calibration Meter Connection, 4-20 mA Self Powered

2. Use the keypad and front panel LCD to perform the next two steps. Note that the display will refer to a "voltage" output for zero and span even though the actual output is current driven.

SET 'ZERO' VOLTS CH 1 = X.XXX VDC

Press the up (YES) or down (NO) arrow until the DVM reads 4.0 mA, then press [E].

SET SPAN VOLTS CH 1 = X.XXX VDC

Press the up (YES) or down (NO) arrow until the DVM reads 20.0 mA, then press [E].

3. If your instrument is configured for a second analog output, you will be prompted to set the zero volt level for channel 2. Proceed to the appropriate instructions for channel two (0-5 VDC or 4-20 mA) and connect the DVM as indicated. Recalibration will be required if a channel output has been changed from one type to another (4-20mA to 5VDC or 5VDC to 4-20mA).

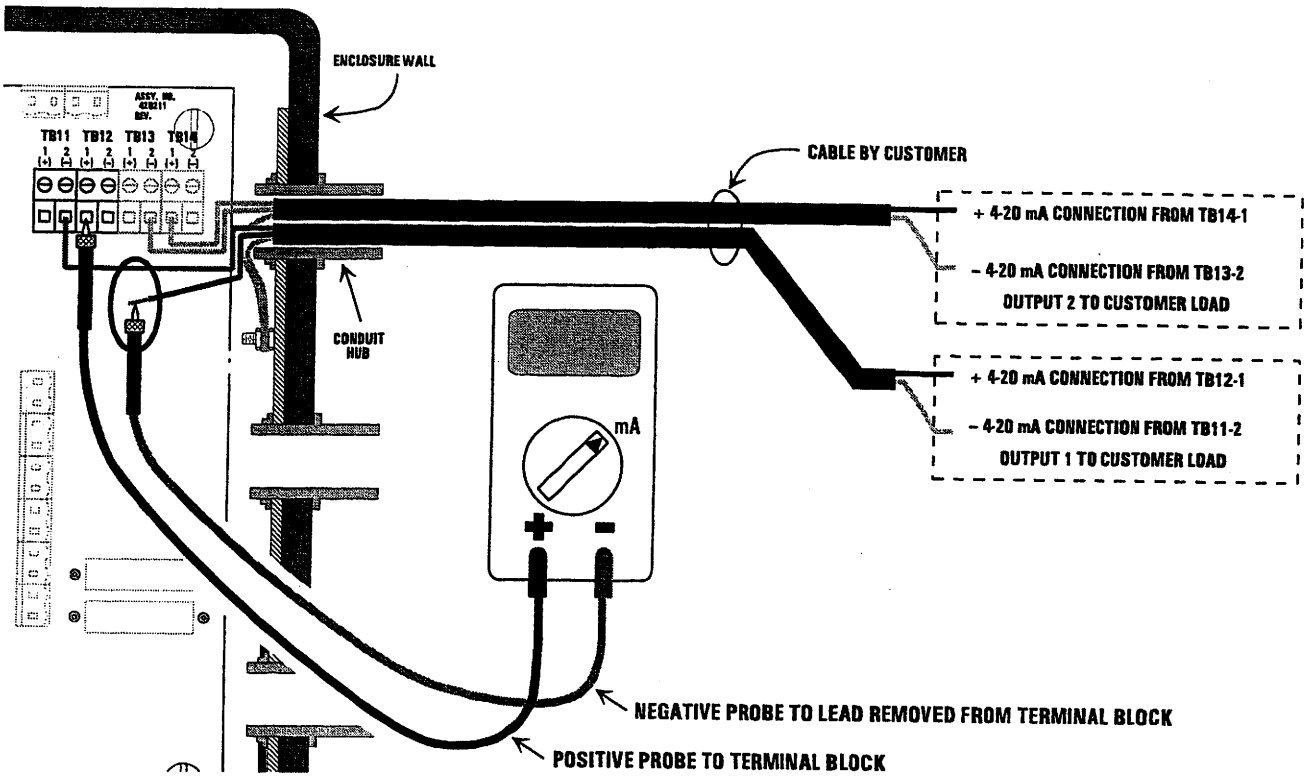


Figure O-30, Output Calibration, 4-20mA Externally Powered, Hardware Setup

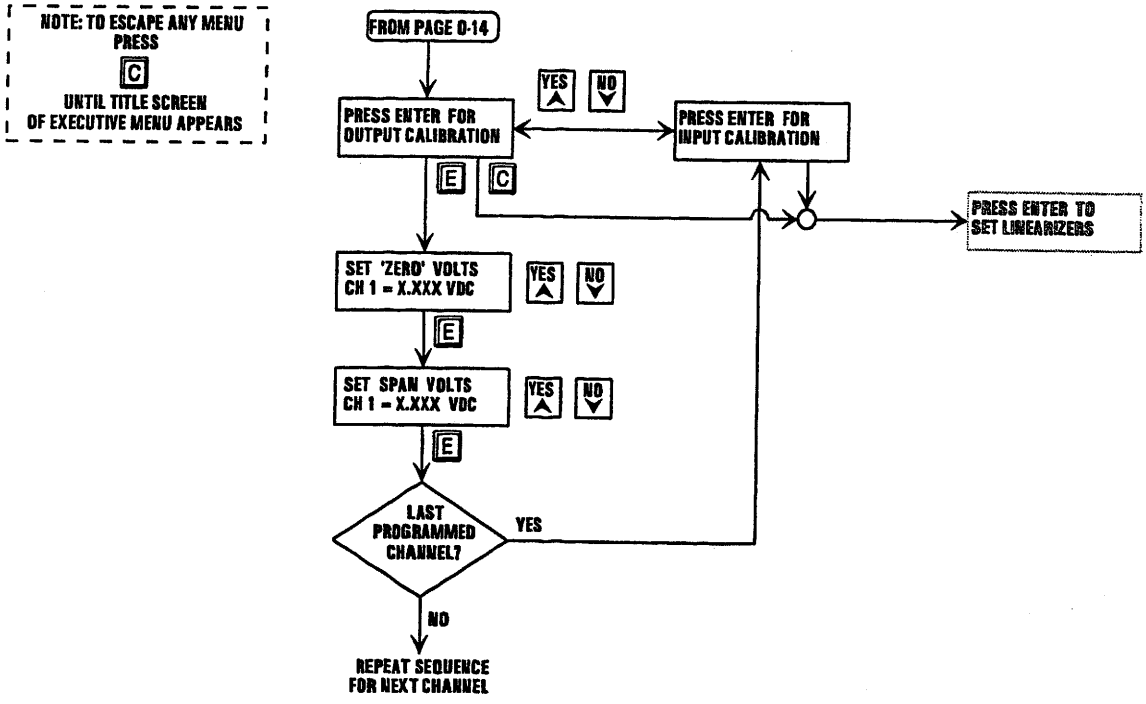


Figure O-31, Program Menu, Output Calibration

Output Calibrate (4-20 mA, Externally Powered)

WARNING: Performance of this procedure may expose personnel to hazardous potentials. Comply with all applicable safety procedures and practices before proceeding.

WARNING: Performance of this procedure may introduce foreign power to the enclosure. Comply with all applicable safety procedures and practices before proceeding.

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

For a loop powered output (utilizing an external current source) follow the procedure listed on this page. The presence of jumpers on TB11 and/or TB13 indicate that the current drivers are self powered. If the output is self powered by the Model 155Jr, turn to page O-49.

1. Connect a DVM as indicated in Figure O-30 and Table O-4 for the appropriate channel.

CHANNEL	METER CONNECTIONS
1	In series with TB12-1
2	In series with TB14-1

Table O-4, Output Calibration Meter Connections, 4-20 mA Loop Powered

2. Use the keypad and front panel LCD to perform the next two steps. Note that the display will refer to a "voltage" output for zero and span even though the actual output is current driven.

SET 'ZERO' VOLTS CH 1 = X.XXX VDC

Press the up (YES) or down (NO) arrow until the DVM reads 4.0 mA, then press [E].

SET SPAN VOLTS CH 1 = X.XXX VDC

Press the up (YES) or down (NO) arrow until the DVM reads 20.0 mA, then press [E].

3. If your instrument is configured for a second analog output, you will be prompted to set the zero volt level for channel 2. Proceed to the appropriate instructions for channel two (0-5 VDC or 4-20 mA) and connect the DVM as indicated.

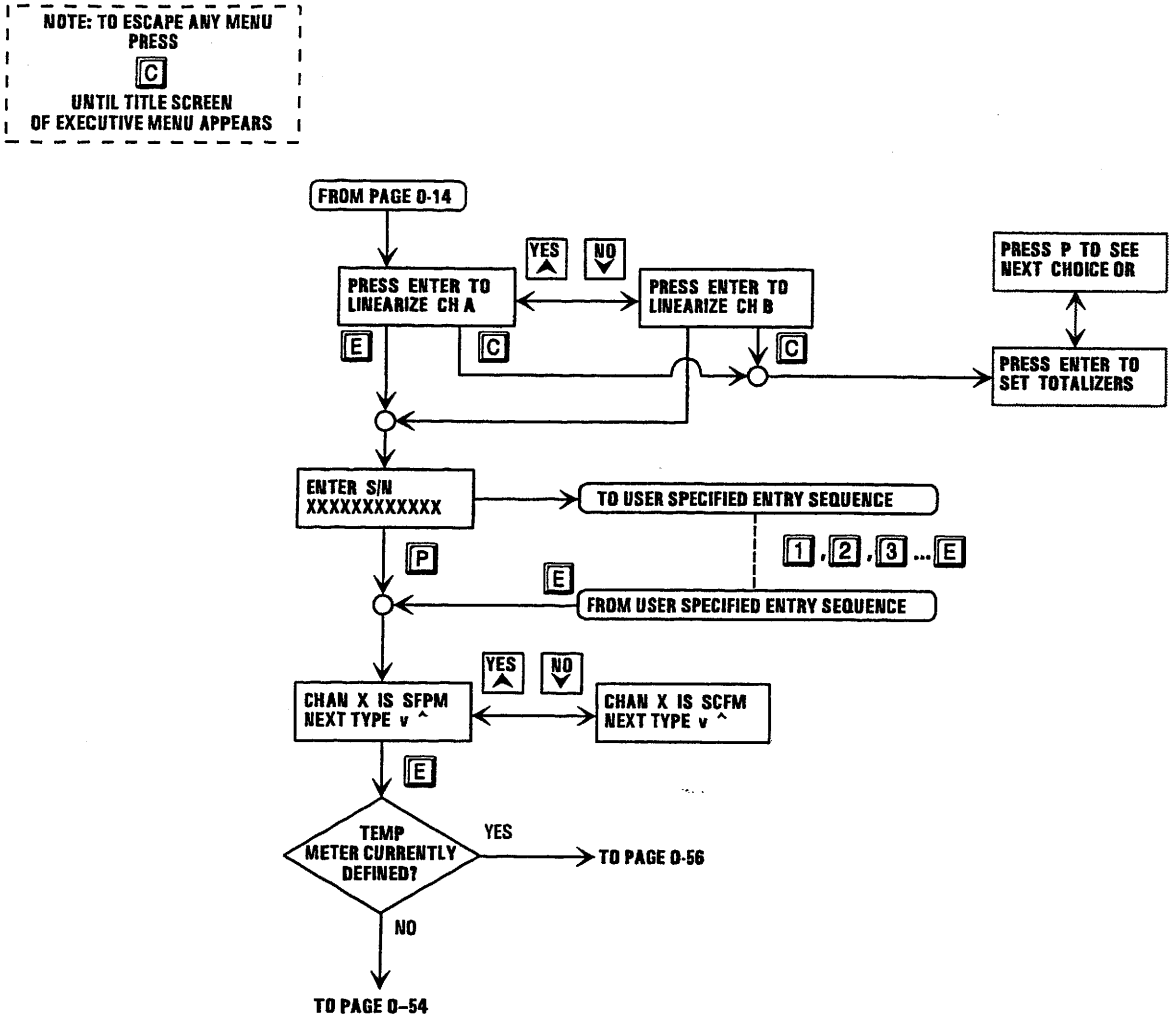


Figure 0-32, Program Menu, Set Linearizers, Initial Menu

SET LINEARIZERS

CAUTION: Performance of this procedure may alter instrument response to input signals. Ensure that the correct procedures and data are used for this calibration.

This procedure allows the technician to verify or enter data for a particular flow element. This should be done any time a sensor is changed or returned from the calibration lab. To perform this procedure you will need the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** supplied with the instrument. Ensure that the serial number of the actual element matches the number listed on the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT***. Look at the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** to determine if your instrument is configured for Velocity Temperature Mapping (VTM). An instrument with VTM capabilities will have flow data listed at two or three temperatures as indicated by the example on page A-8. **You must have an input channel set up for temperature and a temperature meter defined before VTM set-up can be performed.** Page A-4 is an example without VTM. Perform the steps listed below and then proceed to the appropriate page to complete the procedure.

PRESS ENTER TO LINEARIZE CH N	Press the up (YES) or down (NO) arrow to cycle the display through all available channels. When the desired channel is shown, press [E] to enter the selection.
ENTER S/N XXXXXXXXXXXX	This step identifies the serial number of the flow element connected to the selected channel. If the serial number is correct, press [P] to advance to the next step. If the serial number is incorrect, use the up (YES) or down (NO) arrow keys to enter the desired characters (up to a maximum of 12). See Appendix B for instructions and list of available characters.
CHAN N IS SFPM NEXT TYPE ^v CHAN N IS SCFM NEXT TYPE ^v CHAN N IS DEGF NEXT TYPE ^v	Press the up (YES) or down (NO) arrow to select the proper units for this channel as specified on the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT***. If the instrument is programmed for International Units the following options will be presented: SMPS SCMM DEGC Press [E] to enter the selection.

If your instrument does not have a temperature meter defined or you are setting up one now, proceed to page O-55. If your instrument has a temperature meter defined, proceed to page O-57.

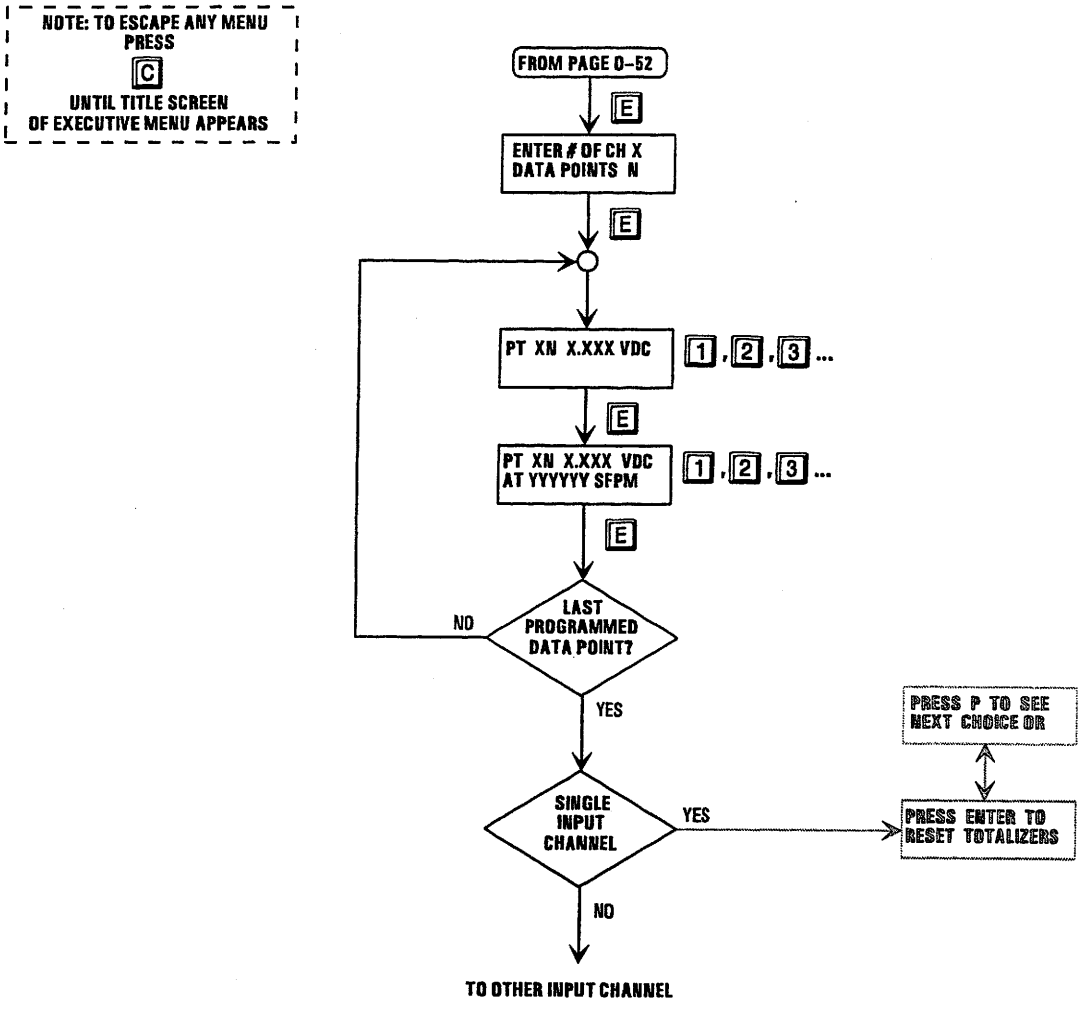


Figure O-33, Program Menu, Set Linearizers (No VTM)

The procedure listed on this page should be used if your instrument is **NOT** currently configured for a temperature meter. If your instrument is configured for a temperature meter, go to page O-57.

ENTER # OF CH X DATA POINTS N

Use the numeric keys to specify the number of data points as indicated on the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.*** (15 maximum) Press [E] to enter the selection.

PT XN X.XXX VDC

Use the numeric keys to specify the voltage listed in the column labeled "CSV VDC" for point number 1 in the Sensor Calibration Data table of the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.*** Press [E] tp enter the voltage.

PT XN X.XXX VDC AT YYYYYY SFPM

Use the numeric keys to specify the flow unit value (in SFPM, SMPS, ...) for point number 1 in the Sensor Calibration Data table of the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.*** Press [E] to enter the value. Repeat these two steps for each data point.

If configured for a single input channel the program will return to the menu selection screens prompting the user to either reset the totalizers or press [P] to view other menu choices.

When a Model 155Jr is configured for multiple input channels the user will be prompted to enter the number of data points for the other channel, **even when this information has just been entered.** If configured for multiple input channels, the user must press [C] to exit the Set Linearizers Menu.

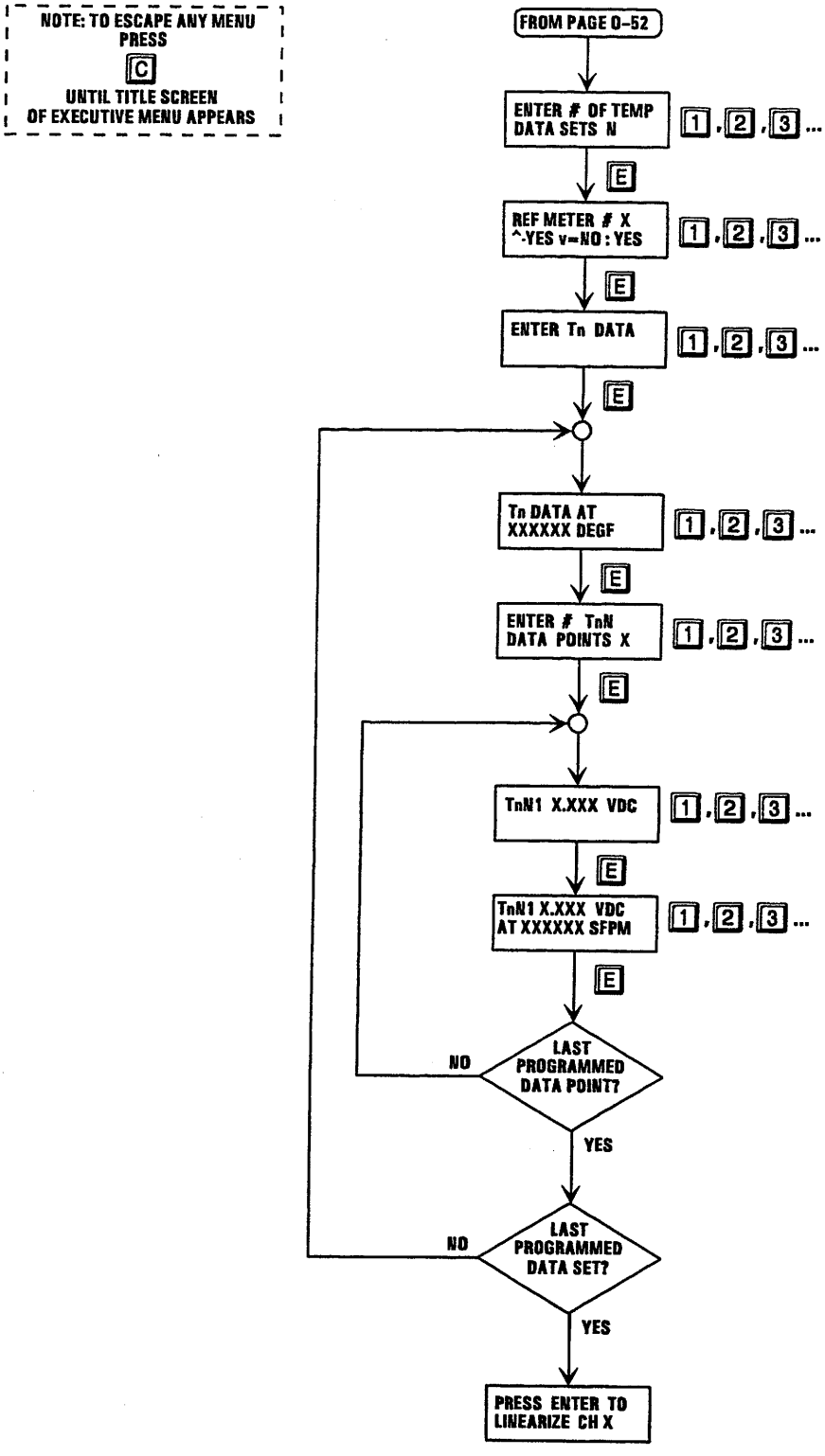


Figure O-34, Program Menu, Set Linearizers (With VTM)

SET LINEARIZERS (WITH VTM)

Note that a temperature meter must be defined in the "Set Meter" menu before this procedure can be performed.

ENTER # OF TEMP DATA SETS N	Use the number keys to enter the number of temperature data sets as specified on the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** for your instrument. See the sample document on page A-8.
REF METER # X ^=YES v=NO : YES	Press the up (YES) or down (NO) arrow to indicate which **previously set-up meter** data will be used as a temperature reference. Note that the temperature reference meter must already be defined in the "Set Meter Data" function of the Program Menu (see page O-27).
ENTER Tn DATA	Use the number keys to enter the desired data set number "Tn" (1,2, or 3). This entry cannot exceed the number of data sets previously specified as "N".
Tn DATA AT XXXXXX DEGF	Use the number keys to enter the temperature at which this data set was taken. This information is available on the ***CALIBRATION AND CERTIFICATION DOCUMENT*** for your instrument.
ENTER # TnN DATA POINTS X	Press the up (YES) or down (NO) arrow to select the proper number of data points as specified on the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** (maximum of 7). Press [E] to enter the selection.
TnN1 X.XXX VDC	Use the numeric keys to specify the voltage listed in the column labeled "CSV VDC" for point number 1 in the Sensor Calibration Data table of the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.*** Press [E] to enter the voltage.
TnN1 X.XXX VDC AT XXXXXX SFPM	Use the numeric keys to specify the flow unit value (SFPM, SMPS, ...) for point number 1 in the Sensor Calibration Data table of the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.*** Press [E] to enter the value. Repeat these two steps for each data point.

When all the data points have been entered for a given data set the user will be prompted to enter the data points for the next data set. When all flow data has been entered for each data set the user will be prompted to set up channel "X", with "X" being the next channel number. To exit the "Set Linearizer" function, press [C] after entering all required information.

GLOSSARY

Words in italics are defined elsewhere in the glossary.

465 Card	A name given to the *Kurz Instruments, Inc., Flow Sensor Electronics Board*. This device generates a current proportional to gas flow past a *sensor*.
604 Card	A name given to the *Kurz Instruments, Inc., Temperature Sensor Electronics Board*. This device generates a current proportional to gas temperature at the sensor.
ADAM Jr	Name given to the *Model 155Jr* which is the smallest of the *Series 155 Mass Flow Computers* utilizing the *Kurz Instruments, Inc., ADAM™* software.
ADAM™	Name given to the *Kurz Instruments, Inc.*, Series 155 line of Mass Flow Computers utilizing Kurz Airflow System (*KAS*) software to determine flow rates in a *stack or duct* based upon data obtained from *Flow Elements.*
Alarm	When configured, the user can set up *alarms* providing annunciation for out-of-tolerance conditions. High alarms, low alarms and high/low alarms are possible.
Analog Output	A 0-5 VDC or 4-20 mA output available from *Kurz Instruments, Inc., Series 155 Mass Flow Computers*.
Box Car Filter	Type of data filter that generates an output based on the average of a specified number of readings.
C.C.F.	Configuration Correction Factor. Used with *Flow Perfect* software in conjunction with multiple flow *sensors*. Not usually found in the *Model 155Jr.*
C.S.V.	Current Sense Voltage. Voltage developed across the *Current Sense Resistor* by the current from a *Kurz Instruments, Inc., flow* or *temperature sensor electronics board.*
Channel	Name given to input or output lines to/from *Series 155 Mass Flow Computers*. *Input channels* are designated by a letter (A, B, C,...), *output channels* are indicated by a number (1, 2, 3,...).
Channel Kickout	Function of the *ADAM®* software that will remove an *input channel* from average calculations if that *channel* reports a flow rate outside of a definable range. Purpose is to remove from flow calculations any input outside of accepted parameters.
CPU Board	Printed circuit board in the *Series 155 Mass Flow Computers* that performs the necessary calculations to determine gas flow based on input from *Kurz Instruments, Inc., flow transmitters*. Contains interface circuitry for the 20 button *keypad* and *LCD*.

Current Sense Resistor	A resistor mounted on the *Interface Board*. This resistor is in series with current signal from a *Kurz Instruments, Inc., flow* or *temperature transmitter*. Value of the *Current Sense Resistor* is 5Ω, 5 Watts for a flow sensor or 250Ω, ½ Watt for a temperature sensor
DCS	Distributed Control System. A complex process control device found in large manufacturing or power generation facilities. These devices usually control and monitor the entire process. *Series 155 Mass Flow Computers* can provide outputs compatible with these devices.
Dedicated Ground	A type of ground connection for electronic equipment. A dedicated ground should have no other equipment connected to the ground wire. The wire should be run in non-metallic conduit with no other conductors including grounds. A dedicated ground should be a straight run of conductor, directly connected to the plant ground grid.
DEG C	Degrees Celsius
DEG F	Degrees Fahrenheit
Discrete Output	Term used to define outputs with on/off states. *Alarm* outputs from *Series 155 Mass Flow Computers* are an example of discrete outputs. The *alarm* state can be defined as either open or closed contacts.
Display Menu	A series of messages and prompts appearing on the front pane *LCD* of a *Kurz Instruments, Inc. Series 155 Mass Flow Computer.* These messages and prompts present flow and *meter* information. No alteration of data can be performed with the Display Menu.
Display Mode	A mode of operation in which the *Kurz Instruments, Inc. Series 155 Mass Flow Computers* will allow the user to view flow and *meter* information. This mode of operation does not support alteration of data.
EVA	Electronic Velocity Array. A device which places multiple *flow elements* in a gas stream. The number and placement of these elements is dependent upon the flow *profile* in the *stack or duct* at the point where the *EVA* is inserted into the gas stream. Not used with *Model 155Jr Mass Flow Computers*.
Executive Menu	A series of messages and prompts appearing on the front panel *LCD* of a *Kurz Instruments, Inc., Series 155 Mass Flow Computer*. After the *Turn On Screens* appear the instrument will display a Kurz Instruments logo on the top line and the system time and date on the bottom. Following messages will prompt the use to press various keys to initiate other modes of operation. When the sequence is complete it will start over.
Executive Mode	Default mode of operation. This mode will be entered after the *Turn On* Screens appear. The instrument will return (default) to this mode if no operation has been performed on the *keypad* for 5 minutes. In this mode the instrument is functioning normally, processing information received from its *sensors*.

Flow Perfect	Function in Kurz Instruments, Inc. ADAM™ software that will compensate (in multiple sensor systems) for loss of individual sensors and still provide accurate mass flow data.
Input Channel	Means by which flow and/or temperature data is acquired by a *Series 155 Mass Flow Computer. Input channels* are indicated by letter designations (A, B, C,...)
Insolation	Radiant energy from the sun acting upon an entity. This energy can heat the entity to significantly higher temperatures than ambient air temperatures. Significant in that insolation can heat electronic instruments to above design maximums and cause component failure.
Interface Board	Printed circuit board in a *Kurz Instruments, Inc. Model 155Jr* that contains the power supplies, termination points for *input channel* and *output channel* leads, input power, and test points for low voltage power supplies and input/output signals. Also known as *Power Supply Board* and *Motherboard*.
Isolated 4-20 mA Output	A type of current driver that is not referenced to signal ground.
K-Bar	A Kurz multi-sensor Mass Flow Element primarily used for larger ducts and stacks.
KAS	Kurz Airflow System. Name given to the software used in *Series 155 Mass Flow Computers* to calculate flow and temperature values. Will be followed by revision number such as KAS-6.5. This number can be viewed in either the Start-up Screen or Help Screen of the front panel *LCD.*
Keypad	20 button, membrane type input device mounted on the front panel of *Series 155 Mass Flow Computers* providing user input to the instrument.
KGH	Kilograms per Hour
Kurz Instruments, Inc.	The Leader in Mass Flow Technology for Process and Environmental Measurements. (1-800-424-7356)
LCD	Liquid Crystal Display. Monitoring device mounted on the front panel of *Series 155 Mass Flow Computers* that provide the user or technician with messages. These messages display flow or meter data, user prompts, and responses to data entry from the *keypad.*
Linearizer Table	A table plotting flow rates against *Current Sense Voltage*. Used to establish the relationship between *sensor* output and gas flow. When entered into Series 155 Mass Flow Computers this relationship is used to generate flow data. Table is unique for each *sensor.*

Linearizer	A function of the *Series 155 Mass Flow Computers* that generates a directly proportional, linear output from a directly proportional, non-linear input provided from *flow* or *temperature elements*.
Loop Powered	Used to describe a 4-20 mA loop powered from equipment other than a *Series 155 Mass Flow Computer*.
Mass Flow Element	Device placed in the gas stream to detect mass flow rate. A Model 450 Insertion *Flow Element* or Model 500 Inline *Flow Element* are examples.
Mass Flow Computer	A name for the *Kurz Instruments, Inc.*, product line of flow measuring devices that compute mass flow from data obtained by flow *sensors*. These devices can then transmit that data to other equipment through the use of *analog* and/or *discrete outputs*.
Menu Tree	A method of displaying programming instructions in a flow chart style. Called menu "tree" because each programming option leads to a specific "branch" or series of operations and messages.
meter	Note the lower case "m". This signifies a programmable function in all *ADAM® Series 155 Mass Flow Computers* that will display data as configured by the factory or user.
Meter	Note the upper case "M". Basic International Unit (IU) of measure. Equivalent to 39.37 inches.
Model 155Jr	Smallest of the *Series 155 Mass Flow Computers*. Normally configured for a maximum of two inputs, however, if ordered for use with an external 24VDC power supply a maximum of 6 inputs can be used.
Motherboard	A term often applied to the *Interface Board* of *Series 155 Mass Flow Computers*.
Output Channel	Means by which *meter* data can be transmitted to external equipment such as chart recorders, *PLC's* or a *DCS*. *Series 155 Mass Flow Computers* can provide either 0-5 VDC or 4-20 mA outputs. Output channels are identified by number designation (1, 2, 3,...).
Pico Fuse	Solder-in fuse similar in appearance to small resistor or diode.
PID	Proportional-Integral-Derivative. Type of closed loop process control allowing precise operation of a final control element (usually a valve or mechanical positioner) based upon calculations performed on inputs such as flow, temperature, or pressure.
PLC	Programmable Logic Controller. Small micro-processor controlled device used for process control. *Series 155 Mass Flow Computers* can provide outputs compatible with these devices.

Power Supply Board	A term sometimes applied to the *Interface Board* of *Series 155 Mass Flow Computers.* So called because the *Interface Board* contains the AC input circuitry and low voltage DC power supplies.
PPH	Pounds Per Hour.
Program Menu	A series of messages and prompts appearing on the *LCD* of a *Kurz Instruments, Inc., Series 155 Flow Computer.* These messages and prompts guide the technician through steps necessary to perform technician level *setup* routines.
Program Mode	A mode of operation in which the *Kurz Instruments, Inc. Series 155 Mass Flow Computer* will allow the technician to perform appropriate *setup* routines. Requires *Technician level access code*. Default code as shipped from the factory is 654321.
RFI	Radio Frequency Interference. Also known as EMI (Electro-Magnetic Interference. Noise generated by electrical or electronic equipment that causes signal degradation. Typically caused by transmitting equipment, brush type motors or generators, and switch contacts including magnetic starters. Although proper grounding, bonding, and shielding techniques minimize the effects of RFI, it is considered better engineering practice to eliminate noise at the source.
RMA	Returned Materials Authorization. Must accompany equipment returned to *Kurz Instruments, Inc.,* for service.
R_p	Resistance Temperature Device (RTD) used to sense gas velocity. Part of a *Mass Flow Element* inserted into the gas stream to determine flow rate.
R_{tc}	Resistance Temperature Device (RTD) used to sense gas temperature. Part of a *Mass Flow Element* inserted into the gas stream to determine flow rate.
SCFH	Standard Cubic Feet per Hour
SCFM	Standard Cubic Feet per Minute
SCMH	Standard Cubic Meters per Hour
SCMM	Standard Cubic Meters per Minute
Self Powered	Used to describe a 4-20 mA loop utilizing the internal current driver of *Series 155 Mass Flow Computers.*
Sensor	That part of a *Flow Element* containing flow and/or temperature sensitive devices.
Series 155	A product line of *Kurz Instruments, Inc.,* Mass Flow Computers utilizing *KAS* software to generate mass flow data based on information provided by Kurz *mass flow* and/or *temperature elements*.

Setup	Means by which the user or technician optimize a *Series 155 Mass Flow Computer* for the application. Some functions are configured at the factory but the user can set up *meter* parameters, *alarm* setpoints, *analog outputs*, *box filters*, and other plant-specific requirements utilizing the *program mode*.
SFPM	Standard Feet Per Minute
SMPS	Standard Meters Per Second
Specific Gravity	Unit of measure used in calculations to determine gas flow in Pounds Per Hour or Kilograms Per Hour.
Stack or Duct	Refers to the equipment containing the gas flow being measured. May be an actual stack, duct or pipe carrying a gaseous material.
Stack or Duct Area	Cross sectional area of the stack or duct at the sensor insertion point.
Standard Conditions	25° C @ 760 mm Hg or 77° F @ 29.92 in Hg
Technician Level Access Code	Access code that allows technician level configuration and calibration of *Series 155 Mass Flow Computers*. Default code is 654321.
Temperature Element	Device that generates a current proportional to gas temperature.
Totalizer	Function of *Series 155 Mass Flow Computers* that keeps a running total of gas flow being measured. (Example: SCF)
Turn on Screens	Initial messages displayed when power is first applied to a *Series 155 Mass Flow Computer*.
Upload/ Download	Optional software allowing use of an IBM compatible computer to monitor and program *Series 155 Mass Flow Computers*
User Level Access Code	Access Code that allows User Level configuration of *Series 155 Mass Flow Computers*. Default code is 123456.
V.C.F.	Variable Correction Factor. User entered correction factor which, when calculated with average Kurz velocity and *stack or duct area* results in a corrected flow rate tailored to plant specific conditions.
Velocity Temperature Mapping	Also known as VTM. This is a feature of ADAM™ software and Series 155 Calibration that will compensate for the different thermal properties of gases over wide changes in temperature and flow.
VF8 Board	Printed circuit board in *Series 155 Mass Flow Computers* that contains circuitry converting analog input signals into digital data for use by the CPU. Connected to Interface Board by ribbon cables.

155 SERIES SETUP
AND CALIBRATION CERTIFICATION

CUSTOMER CODE: 000000
PART NUMBER: 000000-00-00-00-00-00-00-00-00
SERIAL NUMBER: AA0000
SOFTWARE LEVEL: KAS 6C-22

METER SETUP

METER No.	METER I.D.	METER TYPE	METER UNITS	FLOW AREA	INCLUDED CHANNELS
01	*	INSERTION FLOW ELEMENT	METRIC	*	A

ANALOG OUTPUT SETUP

ANALOG OUT No.	ASSIGNED METER #	0 - 5 VOLT RANGE	4 - 20mA RANGE
1	01	N/A	*

LINEARIZATION DATA

INPUT CHANNELS:	UNITS:	RANGE:	FLOW ELEMENT S/N:
A	NMPS	**	DLI17230F

ALARMS SETUP

ALARM NO.:	TYPE:	ASSIGNED METER #:	RELAY STATE	SETPOINT
1 THRU 3	*	*	*	*
4	CH. KICKOUT	-	*	*

INPUT/OUTPUT CALIBRATION

INPUT CHANNEL CALIBRATED: A
OUTPUT CHANNEL CALIBRATED: 1

REF. DVM S/N: 2001 CAL. DUE DATE: 6-3-95

* To be entered by customer based on specific application.
** See flow element calibration certificate.

CALIBRATION TECHNICIAN: John Doe DATE: 7-19-94

Q.C. INSPECTOR: Jane Doe DATE: 7-19-94

SHEET 1 OF 2

1-800-424-7356
(408)-646-5911

KURZ INSTRUMENTS, INC.
2411 GARDEN ROAD., MONTEREY
CA., U.S.A. 93940

FAX(408)-646-8901

Figure A-1, Sample 155 Series Setup and Calibration Certification (No VTM)

HOW TO READ THE 155 SERIES SETUP AND CALIBRATION CERTIFICATION (NO VTM)

IT IS IMPORTANT TO NOTE THAT CERTIFICATIONS YOU RECEIVE REFLECT SETUP OF THE INSTRUMENT WHEN IT LEAVES THE FACTORY. A RECORD OF ANY CHANGES MADE AFTER RECEIPT OF THE INSTRUMENT ARE THE USER'S RESPONSIBILITY.

In the header information, you will find a CUSTOMER CODE, a unique number assigned to your order, the PART NUMBER, a six digit "Parent Number" for your Mass Flow Computer along with a series of two digit option codes, the SERIAL NUMBER of the instrument, and the SOFTWARE LEVEL indicating which revision of the ADAM™ software is installed in your instrument.

In the "METER SETUP" category you find information indicating that this instrument is setup for a single meter (METER No. 01). The METER I.D. has a factory default (Meter 000001) however, the user may assign a unique identification to suit plant needs. The METER TYPE is for an INSERTION FLOW ELEMENT (450 Series). Other options for meter type would include INLINE FLOW ELEMENT (such as a 500 Series) or Temperature. The FLOW AREA column would list the area of the process duct or stack being measured. The factory default value is one square foot. **IF YOUR STACK OR DUCT HAS A DIFFERENT VALUE YOU MUST ENTER IT BEFORE ACCURATE FLOW INFORMATION CAN BE PROCESSED BY YOUR EQUIPMENT.** The final column is INCLUDED CHANNELS. If your instrument is configured for multiple input channels, all channels reporting to this meter would be listed here.

The "ANALOG OUTPUT SETUP" category lists one output (ANALOG OUTPUT No. 1). The ASSIGNED METER No. column indicates that the output uses meter no. 01 data. The N/A listed under 0-5 VOLT RANGE tells the user that the voltage output is not configured. The asterisk (*) listed under 4-20mA RANGE implies that this is a user defined function.

LINEARIZATION DATA is specified for all INPUT CHANNELS. In this example Channel A is the only input. The UNITS column lists the engineering units of measure. NMPS means Normal Meters Per Second. The double asterisks (**) under RANGE refer the user to the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** for the particular flow element listed in the FLOW ELEMENT S/N column.

"ALARMS SETUP" in the example indicates that four alarms were configured from the factory ALARM NO(s) 1 through 3 were left for user setup as to TYPE (H, L, or HOL), ASSIGNED METER # (meter 01 is the only option in this case), RELAY STATE (N.O. or N.C.) and SETPOINT (flow rate at which the alarm is to be initiated). ALARM NO 4 is the channel kickout alarm. This alarm is configured at the factory to be the last alarm. If no alarms are ordered, channel kickout will be ALARM NO 1. The desired RELAY STATE and SETPOINT should be set by the user to suit site specific requirements.

The "INPUT/OUTPUT CALIBRATION" section lists the calibrated input and output channels along with the serial number and calibration due date of the DVM used for the calibration process.

The final section contains signatures of the CALIBRATION TECHNICIAN, Q.C. INSPECTOR and the calibration dates. SHEET 1 OF 2 indicates there are two sheets to this package, the second one being the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.***

Kurz Model 400D Wind Tunnel Calibration System

FLOW ELEMENT CALIBRATION REFERENCE
Model no: 450-08-AT-12, Serial no: 1757
NIST Calibration Due Date: 03-22-1995

MASS FLOW COMPUTER
Model no: 155Jr
Serial no: AJ0249

---> Sensor Calibration Data <---

Filename	:	DLI7230F
Date	:	07-19-1994
Customer Code/Name	:	000000
Purchase Order No	:	123456
Model No	:	752633-03-24-60-01-88-01-03
Serial No	:	DLI7230F
Flow Units	:	Meters/Sec
Fluid	:	Air

Point No.	Velocity Meters/Sec	Velocity Ft/Min	CSV VDC
1	0.000	0.0	0.648
2	1.002	197.2	1.012
3	1.531	301.4	1.083
4	3.018	594.1	1.201
5	5.046	993.3	1.301
6	7.590	1494.2	1.386
7	10.014	1971.4	1.442
8	15.091	2970.8	1.538
9	20.047	3946.4	1.610
10	30.129	5911.4	1.730

This instrument was calibrated with NIST traceable equipment having a rated total system uncertainty of ±1.03% at 12000 SFPM, ±1.17% at 6000 SFPM, ±.85% at 1000 SFPM and ±1.37% at 100 SFPM. Refer to Kurz 400D Calibation System Analysis, Kurz Doc. No. 28019, for details. This calibration is traceable to National Institute of Standards and Technology Test No. 836-TN 253088 8361608 Purchase Order No. P5558-01 and meets the requirements of MIL-STD-45662A.
STANDARD CONDITIONS: 0 °C and 1.0133 Bars

WIND TUNNEL OPERATOR: John Doe Date: 7/19/94

QUALITY CONTROL: Jane Doe Date: 7-19-94

Sheet 2 of 2

Figure A-2, Sample Calibration Data and Certification Document (No VTM)

HOW TO READ THE CALIBRATION DATA AND CERTIFICATION DOCUMENT (NO VTM)

The ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** provides calibration data for all sensors in your system. The section directly below the title block describes the system used for calibration of your equipment. On the left margin is information for the reference flow element giving its Model No., Serial No., and NIST Calibration Due Date. The Model No. and Serial No. of the Mass Flow Computer used in the calibration process is given on the right side of this section.

The section titled "Sensor Calibration Data" lists the actual calibration data for a single flow element. The FILENAME, DATE, CUSTOMER CODE/NAME, and PURCHASE ORDER NO. are listed to help provide a reference to your equipment if contacting the factory is required. The MODEL NO, SERIAL NO, FLOW UNITS, and FLUID identify the specific flow element.

Measured data for the element is given in table format. The number of points for which flow data is taken is listed in the left column (DATA POINTS). For each data point, Current Sense Voltage (CSV VDC) is measured and recorded for the flow rates given in the columns labelled VELOCITY. Note that the velocity is shown in both International and English units. The Current Sense Voltage values are used in setting up the Linearizers.

The last section lists qualifying standards for the calibration equipment and has dated signatures of the wind tunnel operator and quality control inspector.

155 SERIES SETUP AND CALIBRATION CERTIFICATION

CUSTOMER CODE: 123456
PART NUMBER: 000000-00-00-00-00-00-00-00-00
SERIAL NUMBER: AA1234
SOFTWARE LEVEL: KAS-6.41

METER SETUP

METER No.	METER I.D.	METER TYPE	METER UNITS	FLOW AREA	INCLUDED CHANNELS
01	*	INSERTION	ENGLISH	*	A
02	*	TEMPERATURE	ENGLISH	N/A	B

ANALOG OUTPUT SETTING

ANALOG OUTPUT No.	ASSIGNED METER #	0 - 5 VOLT RANGE	4 - 20mA RANGE
1	01	N/A	*
2	02	N/A	*

LINEARIZATION DATA

INPUT CHANNELS	UNITS:	RANGE:	FLOW ELEMENT S/N:
A	SFPM	**	AAA1234F
B	DEGF	**	AAA1234F-T

ALARMS SETUP

ALARM NO.:	TYPE:	ASSIGNED METER #:	RELAY STATE:	SETPOINT:
1	CH.KICKOUT	-	*	*

INPUT/OUTPUT CALIBRATION

INPUT CHANNEL CALIBRATED: A,B
OUTPUT CHANNEL CALIBRATED: 1,2

REF. DVM S/N: 2031 CAL. DUE DATE: 1-3-95

* To be entered by customer based on specific application.
** See flow element calibration cerficate.

CALIBRATION TECHNICIAN: John Doe DATE: 10-11-94

Q.C. INSPECTOR: Jane Doe DATE: 10-12-94

SHEET 1 OF 1

1-800-424-7356
(408)-646-5911

KURZ INSTRUMENTS, INC.
2411 GARDEN RD., MONTEREY
CA., U.S.A. 93940

FAX (408)-646-8901

Figure A-3, Sample 155 Series Setup and Calibration Certification (With VTM)

HOW TO READ THE 155 SERIES SETUP AND CALIBRATION CERTIFICATION (WITH VTM)

IT IS IMPORTANT TO NOTE THAT CERTIFICATIONS YOU RECEIVE REFLECT SETUP OF THE INSTRUMENT WHEN IT LEAVES THE FACTORY. A RECORD OF ANY CHANGES MADE AFTER RECEIPT OF THE INSTRUMENT ARE THE USER'S RESPONSIBILITY.

In the header information, you will find a CUSTOMER CODE, a unique number assigned to your order, the PART NUMBER, a six digit "Parent Number" for your Mass Flow Computer along with a series of two digit option codes, the SERIAL NUMBER of the instrument, and the SOFTWARE LEVEL indicating which revision of the ADAM™ software is installed in your instrument.

In the "METER SETUP" category you find information indicating that this instrument is setup for two meters (METER No. 01 and METER No. 02). Asterisks indicate that the user should assign a unique identification to suit plant needs. The METER TYPE for meter 01 is for an INSERTION FLOW ELEMENT (450 Series). Meter 02 is configured for a Kurz Temperature element electronics board. Another option for meter type is INLINE FLOW ELEMENT (500 Series). The FLOW AREA column would list the area of the process duct or stack being measured. The factory default value is one square foot. **IF YOUR STACK OR DUCT HAS A DIFFERENT VALUE YOU MUST ENTER IT BEFORE ACCURATE FLOW INFORMATION CAN BE PROCESSED BY YOUR EQUIPMENT.** The final column is INCLUDED CHANNELS. If your instrument is configured for multiple input channels, all channels reporting to this meter would be listed here.

The "ANALOG OUTPUT SETUP" category lists two output (ANALOG OUTPUT No. 1 and No. 2). The ASSIGNED METER No. column indicates that analog output no. 1 uses meter no. 01 data, and analog output no. 2 uses meter no. 02 data. The N/A's listed under 0-5 VOLT RANGE tells the user that the voltage output is not configured. The asterisks (*) listed under 4-20mA RANGE implies that user must congfigure the "sero" and "span" ranges to suit his requriements. See the appropriate section of the User's Guide.

LINEARIZATION DATA is specified for all INPUT CHANNELS. In this example Channel A is the Mass flow input and Channel B is the Termperature input. The UNITS column lists the engineering units of measure. SFPM means Standard Feet Per Miniute. The double asterisks (**) under RANGE refer the user to the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** for each flow element listed in the FLOW ELEMENT S/N column.

"ALARMS SETUP" in the example indicates that one alarm was configured from the factory as the Channel Kickout alarm (Note, this is the "Global" channel kickout.) ASSIGNED METER # is left blank indicating that this alarm is not tied to any one meter but will indicate a failure of meter 01or 02. RELAY STATE (N.O. or N.C.) and SETPOINT are left blank for the user to configure.
The "INPUT/OUTPUT CALIBRATION" section lists the calibrated input and output channels along with the serial number and calibration due date of the DVM used for the calibration process.

The final section contains signatures of the CALIBRATION TECHNICIAN, Q.C. INSPECTOR and the calibration dates. SHEET 1 OF 2 indicates there are two sheets to this package, the second one being the ***CALIBRATION DATA AND CERTIFICATION DOCUMENT.***

CALIBRATION DATA AND CERTIFICATION DOCUMENT
KURZ INSTRUMENTS, INC.
2411 GARDEN ROAD
MONTEREY, CALIFORNIA. 93940
1-(800)-424-7356 (408)-646-5911
FAX (408)-646-8901 TELEX 172275

Kurz Model 400D Wind Tunnel Calibration System (74°F data only)

FLOW ELEMENT CALIBRATION REFERENCE
Model no: 450-08-AT-12, Serial no:
NIST Calibration Due Date:

MASS FLOW COMPUTER
Model no: 155JR
Serial no: AJ0249

---> Sensor Calibration Data <---

Filename : DLI12345F
Date : 090-27-94
Customer Code/Name : 123456/
Purchase Order No :
Model No : 123456-08-26-16-02-88-01-08
Serial No : DLI12345F
Fluid : AIR

74 °F		400 °F		740 °F	
Velocity SFPM	CSV VDC	Velocity SFPM	CSV VDC	Velocity SFPM	CSV VDC
0.0	0.6765	0.0	0.6650	0.0	0.7800
609.4	1.1804	609.4	1.1810	609.4	1.2620
1012.0	1.2701	1010.0	1.2570	1010.0	1.3250
2053.1	1.4155	2050.1	1.3720	2050.1	1.4190
4059.2	1.5952	4025.3	1.5100	4025.3	1.5340
6068.7	1.7229	6068.7	1.6000	6068.7	1.6080
9000.1	1.8534	9000.1	1.6930	9000.1	1.6830

This instrument was calibrated with NIST traceable equipment having a rated total system uncertainty of ±1.03% AT 12000 sfpm, ±1.17% AT 6000 sfpm, ±.85% at 1000 SFPM and ±1.37% at 100 SFPM. Refer to Kurz 400D Calibration System Error Analysis, Kurz Doc. No. 28019, for details. This calibration is traceable to National Institute of Standards and Technology Test No. Purchase Order No. and meets the requirements of MIL-STD 45662A.
STANDARD CONDITIONS : 77 °F and 29.92 inHg.

WIND TUNNEL OPERATOR: John Doe DATE : 10-11-94

QUALITY CONTROL: Jane Doe DATE : 10-12-94

Figure A-4, Sample Calibration Data and Certification Document (With VTM)

HOW TO READ THE CALIBRATION DATA AND CERTIFICATION DOCUMENT (WITH VTM)

The ***CALIBRATION DATA AND CERTIFICATION DOCUMENT*** provides calibration data for all sensors in your system. The section directly below the title block describes the system used for calibration of your equipment. On the left margin is information for the reference flow element giving its Model No., Serial No., and NIST Calibration Due Date. The Model No. and Serial No. of the Mass Flow Computer used in the calibration process is given on the right side of this section.

The section titled "Sensor Calibration Data" lists the actual calibration data for a single flow element. The FILENAME, DATE, CUSTOMER CODE/NAME, and PURCHASE ORDER NO. are listed to help provide a reference to your equipment if contacting the factory is required. The MODEL NO, SERIAL NO, FLOW UNITS, and FLUID identify the specific flow element.

Measured data for the element is given in table format. Note that there are three sets of velocity data (known as data sets), given for 74°F, 400°F, and 740°F. For each data set and data point, Current Sense Voltage (CSV VDC) is given for the flow rates given in the columns labelled VELOCITY. The Current Sense Voltage values are used in setting up the Linearizers.

The last section lists qualifying standards for the calibration equipment and has dated signatures of the wind tunnel operator and quality control inspector.

There are 59 characters (including a "blank") in the ADAM™ character set. These characters are for the user or technician's use when assigning meter ID's or other functions requiring alphanumeric entry. The table below lists these characters.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9
:	;	<	=	>	?	@	Display will return to "A" and start the sequence over.																				

Table B-1, ADAM™ Character Set

When prompted to enter data such as "METER ID" the user would press the up (YES) or down (NO) arrow until the desired character appeared in the front panel LCD. If the desired character is not adjacent to the one currently displayed, maintain pressure on either the up (YES) or down (NO) arrow. The longer you hold the button down, the faster the characters will pass by on the LCD. When the desired character appears on the LCD, press [E] to make the selection. Note: there is no backspace function, if you enter a number or letter by mistake, press [C] to exit that step and start over. When you have entered the entire string of desired characters, press [P] to finish the entry process and move to the next program step.

SERIES 155 MASS FLOW COMPUTER SERIAL PORT CONNECTIONS

Before the Upload/download software can be used, the proper connections between a Model 155 Mass Flow Computer and an IBM PC® compatible computer must be established. Model 155 Mass Flow Computers have one "Primary" terminal port, but can be ordered with a "Secondary" printer port. The serial ports (RS-232) for a Model 155Jr Mass Flow Computer use a DB-9 female connector, Models 155 A and above use a DB-25 female connector. All ADAM™ RS-232 ports use the following protocol:

Baud Rate:	1200
Parity:	None or Ignore
Data Bits:	8
Stop Bits:	1 or 2
Start/Stop Enable:	Enable
Control Character:	Normal
Line Feed:	Yes

Primary Port Terminal Connections

The primary RS-232 port provides the following functions:

- Communication between a Model 155 Mass Flow Computer and a remote ASCII terminal or an IBM™ compatible Personal Computer.
- Factory Configuration
- Upload/download of configuration files

Figures C-1, C-2, and C-3 list the cable configurations required for connection to Model 155 Mass Flow Computers.

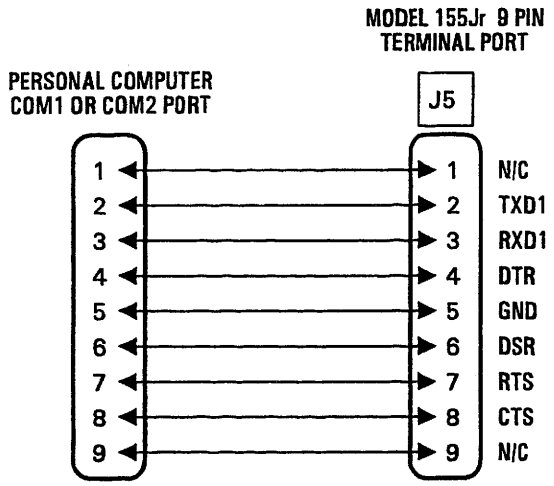


Figure C-1, Model 155Jr Primary Port, 9 Pin to 9 Pin Cable Configuration.

If the communications port on your Personal Computer uses a DB-25 connector, a 9 pin to 25 pin, "straight through" adapter may be used. Note that the Model 155Jr does **NOT** require a null-modem type of connection

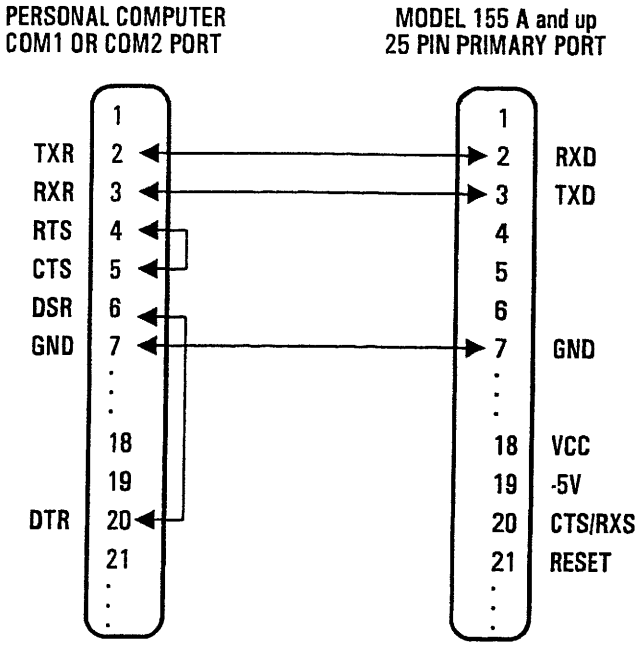


Figure C-2, Model 155A and up, Primary Port, 25 pin to 25 Pin Cable Configuration.

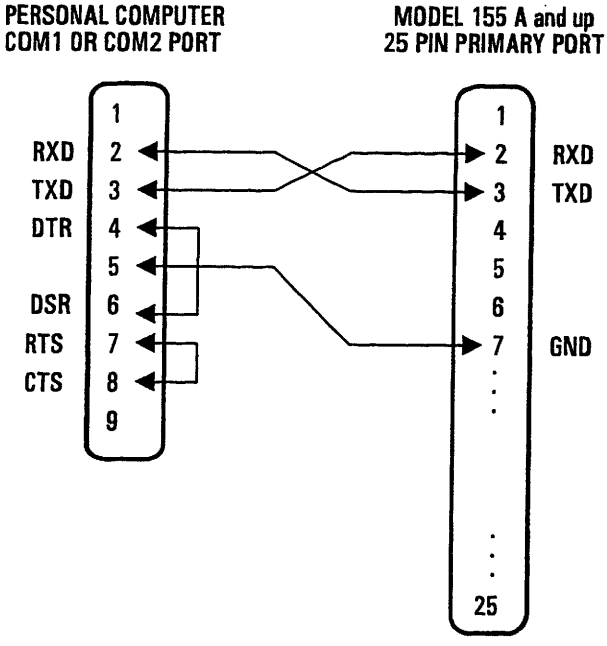


Figure C-3, Model 155A and up, Primary Port, 9 Pin to 25 Pin Cable Configuration.

Note: Jumpers must be installed in the connector as indicated in Figures C-2 and C-3.

UPLOAD/DOWNLOAD PROGRAM

You can upload configuration files from your Personal Computer's hard drive to a Model 155 Mass Flow Computer or download previously stored configuration files from your hard drive to your Model 155. You can also save the information stored in a configuration file on your computer's hard drive to a printable file.

These instructions assume that you have correctly connected the cables from the Series 155 Mass Flow Computer to your Personal Computer.

You must first create a directory on the hard drive of your Personal Computer called LOAD. Copy the diskette supplied with your documentation into the directory C:\LOAD. To start the Upload/Download program change to the C:\LOAD directory and type MENU. Then press [ENTER] to start the program.

Once you have started the Menu Program, the following options appear on the Personal Computer screen:

1. Move configuration from ADAM to PC.
   - This option moves the ADAM configuration
   - from the ADAM to a file on the PC.
2. Move configuration from PC to ADAM.
   - This option moves the ADAM configuration
   - from a file on the PC to the ADAM.
3. Create a printable configuration file.
   - This option creates a printable file of a previously
   - saved ADAM configuration file on the PC.
4. Enter ADAM terminal mode.
   - this option allows the PC to be used
   - as a terminal interface to the ADAM.
5. Enter serial printer mode.
   - This option allows the PC to save
   - data from the serial printer port.
6. Exit to DOS.
   - This option returns control to the DOS command line prompt.

Enter number of desired action : _

Note: Options 4 and 5 are not supported at this level. Contact your Kurz Sales Representative to implement these options.

*PRESS SHIFT +key to activate echo port.

Uploading Configuration Files to a Personal Computer

A configuration file contains the unique data entered into the micro-processor of a Model 155 Mass Flow Computer. It defines the applications that the system will perform. Each configuration file has a unique DOS file name such as DUCT-A.

To upload configuration files from a Model 155 Mass Flow Computer to your Personal Computer, perform the following steps:

1. Enter the Menu Program as described on page C-3.

2. Select option 1 from the menu by typing 1. Then press ENTER.

3. You are then prompted to enter the communications port number that connects the Personal Computer to your Model 155. Type 1 or 2 to select the correct port. Then press ENTER.

4. You are then prompted to enter the name of the configuration file. Type the desired path and file name of the file you wish to save, then press ENTER.

   For example, the following command would upload the configuration file of a Model 155 Mass Flow Computer to a file named DUCT_A (there is no file extension) in the DUCT sub-directory of your Personal Computer's C drive.

   C:\DUCT\DUCT_A ENTER

5. After a short wait you will see messages echoing to the screen of your Personal Computer indicating that the configuration file is uploading from the Model 155 Mass Flow Computer to your hard drive.

6. When the process is complete the message *UPLOAD COMPLETE* will appear on the screen of your Personal Computer and then you will be returned to the Menu Program screen.

Downloading Configuration Files to a Model 155 Mass Flow Computer

Downloading configuration files to a Model 155 Mass Flow Computer from your Personal Computer is only necessary if field changes have been made to your instrument.

Note: If you modify the configuration files in any manner, be sure to retain a copy of the updates so in the event you require assistance from the Kurz Instruments Customer Service Department you will have current configuration files.

To download configuration files from your Personal Computer to a Model 155 Mass Flow Computer, perform the following steps:

1. Enter the Program Menu as described on page C-3.

2. Select option 2 from the menu by typing 2. Then press [ENTER].

3. You are then prompted to enter the communications port number that connects the Personal Computer to your Model 155. Type 1 or 2 to select the correct port. Then press [ENTER].

4. You are then prompted to enter the name of the configuration file. Type the desired path and file name of the configuration file you wish to download from your Personal Computer to a Model 155, then press [ENTER].

   For example, the following command would download a configuration file named DUCT_A (there is no file extension) in the DUCT sub-directory of your Personal Computer's C drive to a Model 155.

   C:\DUCT\DUCT_A [ENTER]

5. After a short wait you will see messages echoing to the screen of your Personal Computer indicating that the configuration file is downloading from your hard drive to the Model 155 Mass Flow Computer.

6. When the process is complete the message *DOWNLOAD COMPLETE* will appear on the screen of your Personal Computer and then you will be returned to the Menu Program screen.

Note: The system can function with incorrect data, but it will be inaccurate!

Creating Printable Configuration Files

Before you can create a printable configuration file, you must first upload the configuration file from a Model 155 Mass Flow Computer to your Personal Computer's hard drive.

To create a printable file of a configuration file uploaded from a Model 155 Mass Flow Computer to your hard drive, perform the following steps:

1. Enter the Program Menu as described on page C-3.

2. Select option 3 from the menu by typing 3. Then press [ENTER].

3. You are prompted to enter the name of the configuration file. Type the desired path and file name of the configuration file you wish to convert to a printable file, then press [ENTER]. For example,

   C:\DUCT\DUCT_A [ENTER]

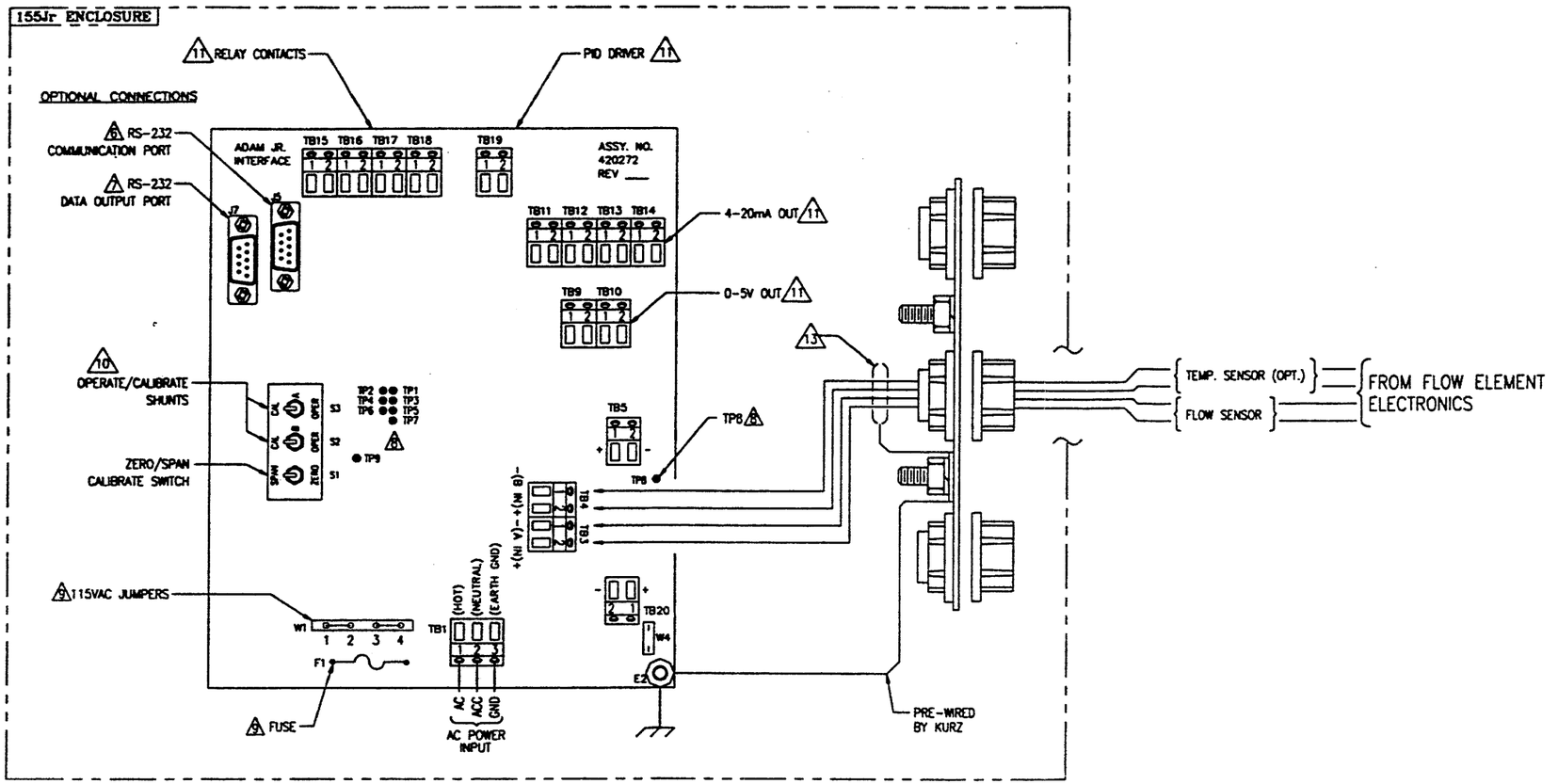
3. You are then prompted to enter the name of the output (printable) file. Type the desired path and file name of the configuration file you wish to convert to a printable file, then press [ENTER]. For example, the following command creates a printable file called DUCT_A.PRN in the DUCT sub-directory of the C drive (note the .PRN extension).

   C:\DUCT\DUCT_A.PRN [ENTER]

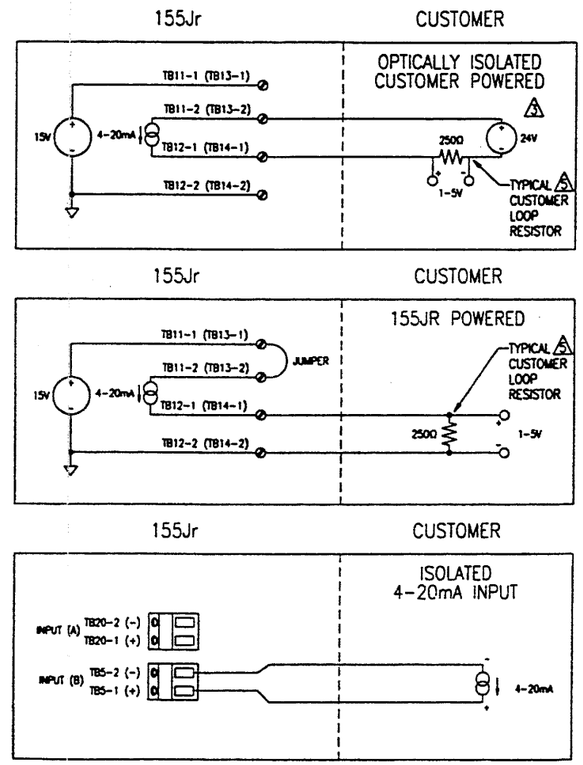
6. When the process is complete the message *DUMP COMPLETE* will appear on the screen of your Personal Computer and then you will be returned to the Menu Program screen.

7. To print your file, use the DOS PRINT or COPY commands. See your DOS manual for information about how to use these commands.

REVISIONS					
REV.	DESCRIPTION	BY	CHKD	APPRVD	DATE
A	RELEASE TO PRODUCTION	DFS	TW	BL	10/6/92
B	REVISED PER ECO B47090	DFS	TW	BBB	8/19/93
C	REVISED PER ECO B47123	DFS	TW	BBB	10/18/93
D	REVISED PER ECO B47138	DFS	TW	CHM	2/18/94
E	REVISED PER ECO B47149	ADK	TW	CHM	3/20/95
F	REVISED PER ECO B47268	DFS	BBB	TW	6.9.95
G	REVISED PER ECO B47280	GF	BBB	GF	8/16/95
H	REVISED PER ECO B47285	FM	BBB	TW	9-12-95



SAMPLE DIAGRAMS, 4-20mA CONNECTIONS



NOTES:

1. THIS WIRING DIAGRAM IS USED IN CONJUNCTION WITH PARENT NUMBERS 750101, 750104, 750105 AND 750107.
2. REF. DESIGNATORS AND PIN NUMBERS ARE FOR REF. ONLY, AND MAY NOT APPEAR ON COMPONENTS

3 15 TO 50 VDC.

4 TB3-1 THRU TB4-1 (INPUTS A THRU B) 0-5 VDC MAX.
TB3-2 THRU TB4-2 (OUTPUTS A THRU B) 18 TO 24 VDC.

5 MAXIMUM LOOP SERIES RESISTOR VALUE=500Ω.

6 RS-232 COMMUNICATIONS PORT

J5

PIN		CUSTOMER CONNECT
N/C	1	9 PIN TO 9 PIN
TXD1	2	CABLE, STRAIGHT
RXD1	3	THROUGH
DTR	4	
GND	5	
DSR	6	
RTS	7	
CTS	8	
N/C	9	

7 RS-232 DATA OUTPUT PORT

J7

PIN		CUSTOMER CONNECT
N/C	1	9 PIN TO 9 PIN
TXDO	2	CABLE, STRAIGHT
RXDO	3	THROUGH
DTR	4	
GND	5	
DCDO	6	
RTSO	7	
CTSO	8	
N/C	9	

8 TEST POINTS.
TP1 +2.500 REF
TP2 +5V
TP3 -9V
TP4 +10V
TP5 -5V
TP6 +12V
TP7 +15V
TP8 GND REF (LEAD ON R1)
TP9 INPUT CAL.

9 1 2 3 4
115VAC (STD.)
F1 IS 0.3 AMP 3AG SLO-BLO KURZ P/N 630055

1 2 3 4
230VAC (OPT.)
F1 IS .15 AMP 3AG SLO-BLO KURZ P/N 630054

10 SHUNT POSITION
CHANNEL CALIBRATE
OPERATE MODE

11 OPTIONAL CONNECTIONS

TB5	1 (+)	INPUT B
TB5	2 (-)	
TB9	1 (+) 0-5V	ANALOG OUT 1
TB9	2 GND	
TB10	1 (+) 0-5V	ANALOG OUT 2
TB10	2 GND	
TB11	1	4-20mA OUT 1
TB11	2	
TB12	1	
TB12	2	
TB13	1	4-20mA OUT 2
TB13	2	
TB14	1	
TB14	2	
TB15	1	ALARM OUT 1
TB15	2	
TB16	1	ALARM OUT 2
TB16	2	
TB17	1	ALARM OUT 3
TB17	2	
TB18	1	ALARM OUT 4
TB18	2	
TB19	1 (+)	PID #1
TB19	2 (-)	
TB20	1 (+)	INPUT A
TB20	2 (-)	

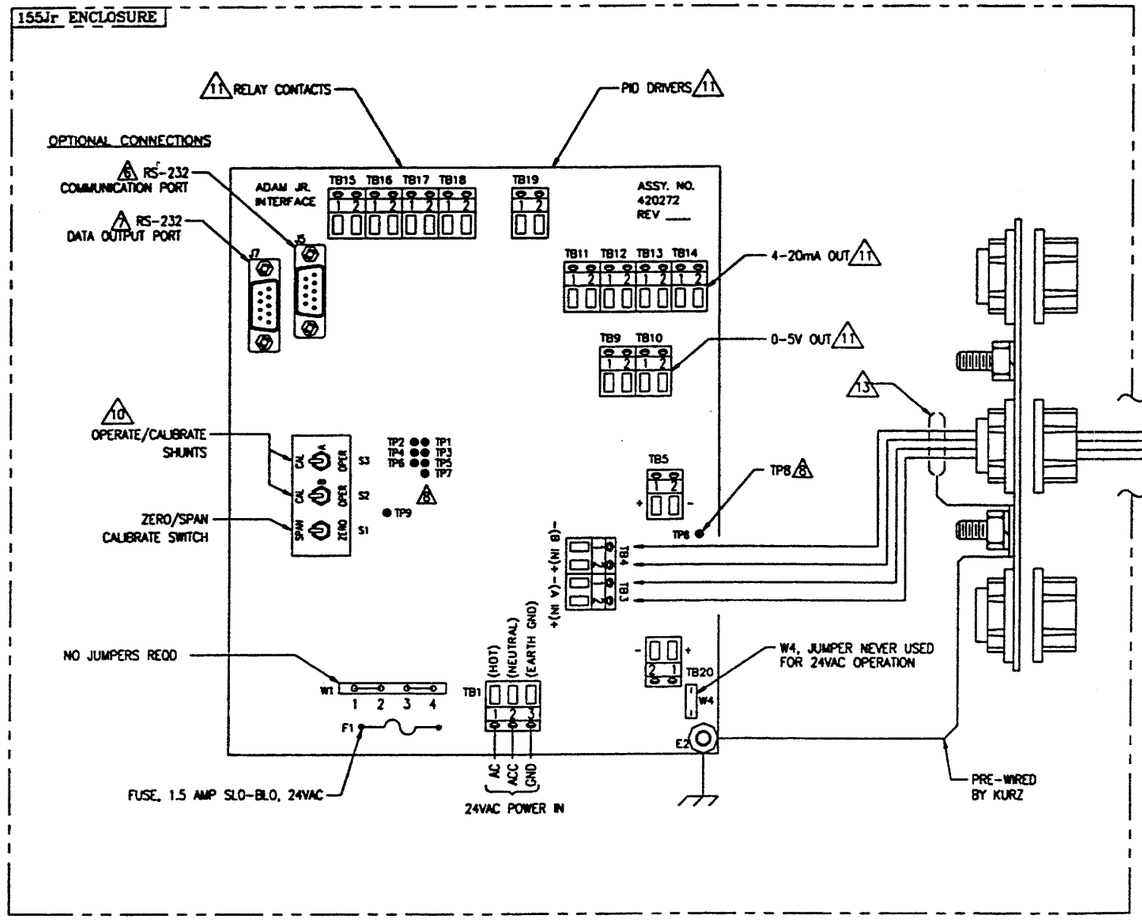
12 EXTERNAL INPUT OPTION

TB20-1	INPUT A (+ EXT.)
TB20-2	INPUT A (- EXT.)
TB5-1	INPUT B (+ EXT.)
TB5-2	INPUT B (- EXT.)

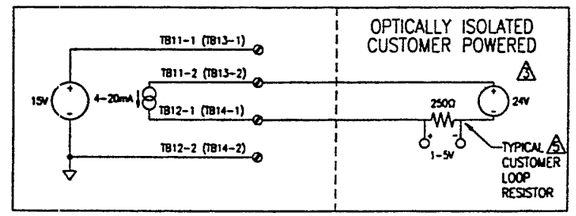
13 CONNECT INPUT/OUTPUT SHIELDS TO GROUND BUS BAR.

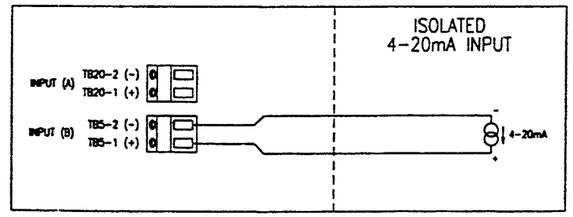
14. W4 JUMPER REQUIRED TO CONNECT DC GND TO EARTH GND (E2). (NEVER USE FOR 24VAC OPERATION)

750107	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVALS	KURZ INSTRUMENTS, INC.
750105	TOLERANCES ARE:	DRAWN BY D.F.SINGLETON 9/29/92	WIRING DIAGRAM, HOOK-UP, 155 JR.
750104	FRACTIONS ± 1/16	CHECKED BY T. WILSON 10/6/92	
750106	ANGLES ± 1°-0'	APPROVED B. LESKO 10/6/92	
NEXT ASSEMBLY	DECIMALS .X ± 0.1 .XX ± 0.03 .XXX ± 0.010		DWG. SIZE D — DWG. NO. 340155-29 — REV. H
	DWG. RELEASE DATE		SCALE NONE — SHEET 1 OF 2



SAMPLE DIAGRAMS, 4-20mA CONNECTIONS

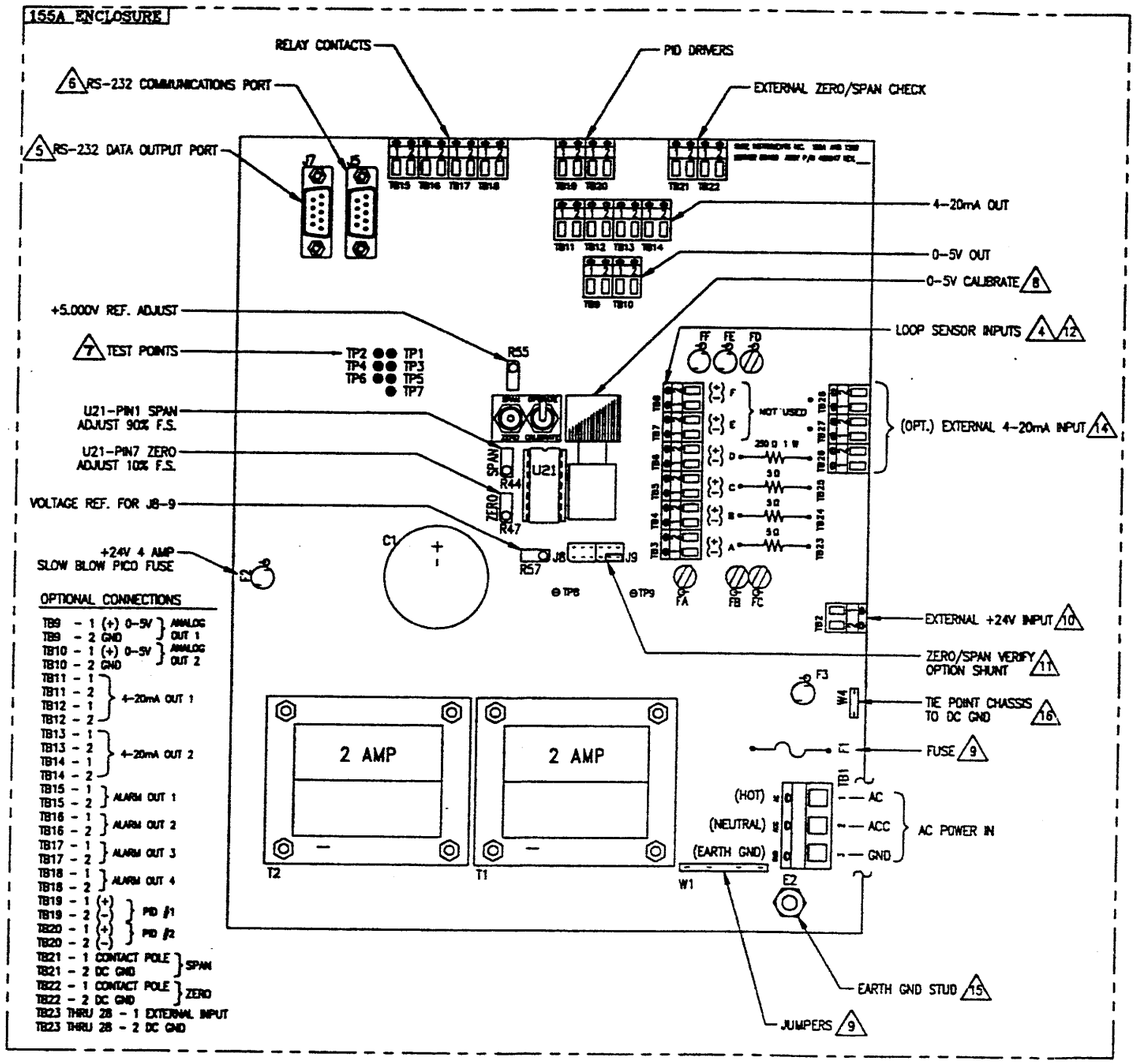


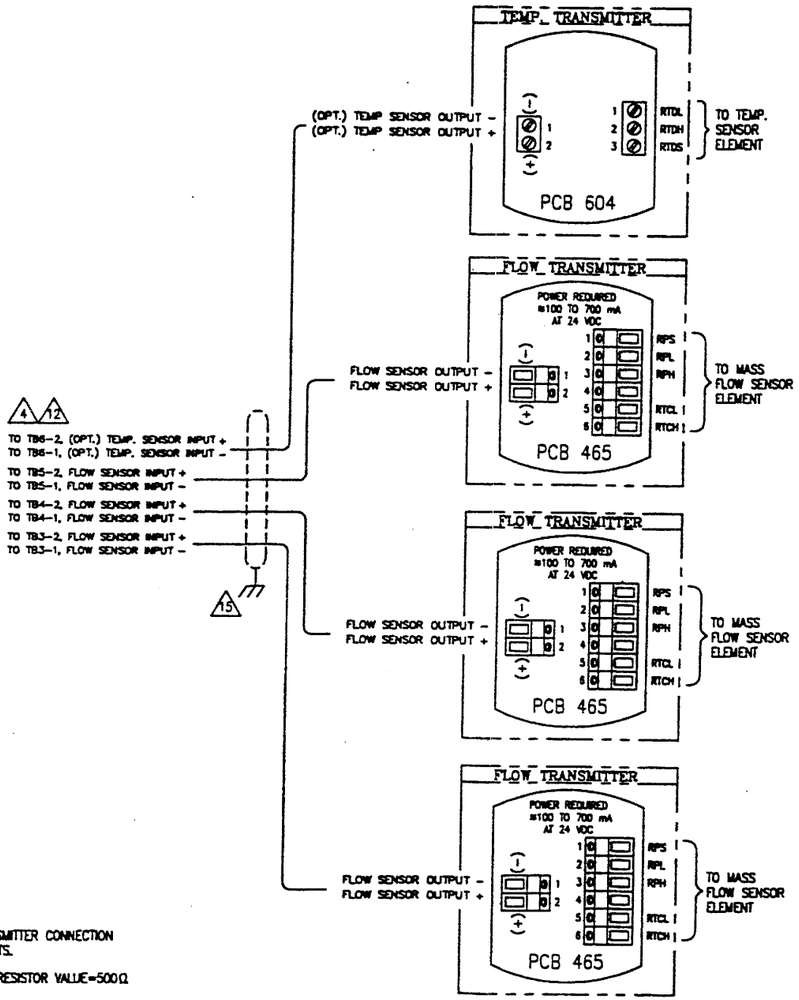


HOOK-UP FOR 24VAC OPTION

DWG. SIZE	DWG. NO.	REV.
D	340155-29	H
SCALE 1" = 1"	SHEET 2	

REVISIONS					
REV.	DESCRIPTION	BY	CHKD	APPVD	DATE
A	INITIAL RELEASE	DFS	———	———	———
B	REVISED PER ECO 847123	DFS	TW	BBB	10/18/93
C	REVISED PER ECO 847138	DFS	BBB	CHM	3-30-94
D	REVISED PER ECO 847213	ADK	BQ	TW	10/27/94





NOTES:

1. THIS WIRING DIAGRAM IS USED IN CONJUNCTION WITH PARENT NUMBER 750206, 750207 & 750208.
2. REF. DESIGNATORS AND PIN NUMBERS ARE FOR REF. ONLY, AND MAY NOT APPEAR ON COMPONENTS

3 15 TO 50 VDC.

4 TB3–1 THRU TB8–1 (INPUTS A THRU F) 0–5 VDC MAX.
TB3–2 THRU TB8–2 (OUTPUTS A THRU F) 18 TO 24 VDC.

5 RS-232 COMMUNICATIONS PORT

J5

PIN		CUSTOMER CONNECT
N/C	1	9 PIN TO 9 PIN
TXD1	2	CABLE, STRAIGHT
RXD1	3	THROUGH
DTR	4	
GND	5	
DSR	6	
RTS	7	
CTS	8	
N/C	9	

6 RS-232 DATA OUTPUT PORT

J7

PIN		CUSTOMER CONNECT
N/C	1	9 PIN TO 9 PIN
TXDO	2	CABLE, STRAIGHT
RXDO	3	THROUGH
DTR	4	
GND	5	
DCDO	6	
RTSO	7	
CTSO	8	
N/C	9	

7 TEST POINTS.
TP1 5.0 REF
TP2 +5V
TP3 –9V
TP4 +10V
TP5 –5V
TP6 +12V
TP7 +15V

8 CALIBRATION TEST POINTS.
TP8 (+)
TP9 (GND)

9 W1
1 2 3 4
115VAC (STD.)
.75 AMP 3AG SLO–BLO
P/N 630058 (F1)

W1
1 2 3 4
230VAC (OPT.)
.375 AMP 3AG SLO–BLO
P/N 630056 (F1)

10 TB2 P1 +
P2 DC GND

11 JUMPER LOCATION WHEN NOT USED. SEE MANUAL.

12 FOR FLOW/TEMP. TRANSMITTER CONNECTION TO LOOP SENSOR INPUTS.

13 MAXIMUM LOOP SERIES RESISTOR VALUE=500Ω

14 EXTERNAL INPUT OPTION
TB26–1 EXTERNAL INPUT (+ EXTERNAL INPUT)
TB26–2 EXTERNAL INPUT (– EXTERNAL INPUT)

15 CONNECT INPUT/OUTPUT SHIELDS TO CONDUIT HUB FITTINGS AND TO EARTH GND (E2).

16 W4 JUMPER REQUIRED TO CONNECT DC GND TO EARTH GND (E2).

17. MINIMUM WIRE SIZE: 18 GA. (EXCEPT SENSOR INPUT WIRES. SELECT CABLE LENGTH AND WIRE GAGE SO THAT THE LOOP RESISTANCE DOES NOT EXCEED 4.0 OHMS. REFER TO MANUAL.)

750208
750207
750206
NEXT ASSEMBLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/32
ANGLES ± 0°–30'
DECIMALS
.X ± 0.1
.XX ± 0.01
.XXX ± 0.005
.XXXX ± 0.0010
DRWG RELEASE DATE

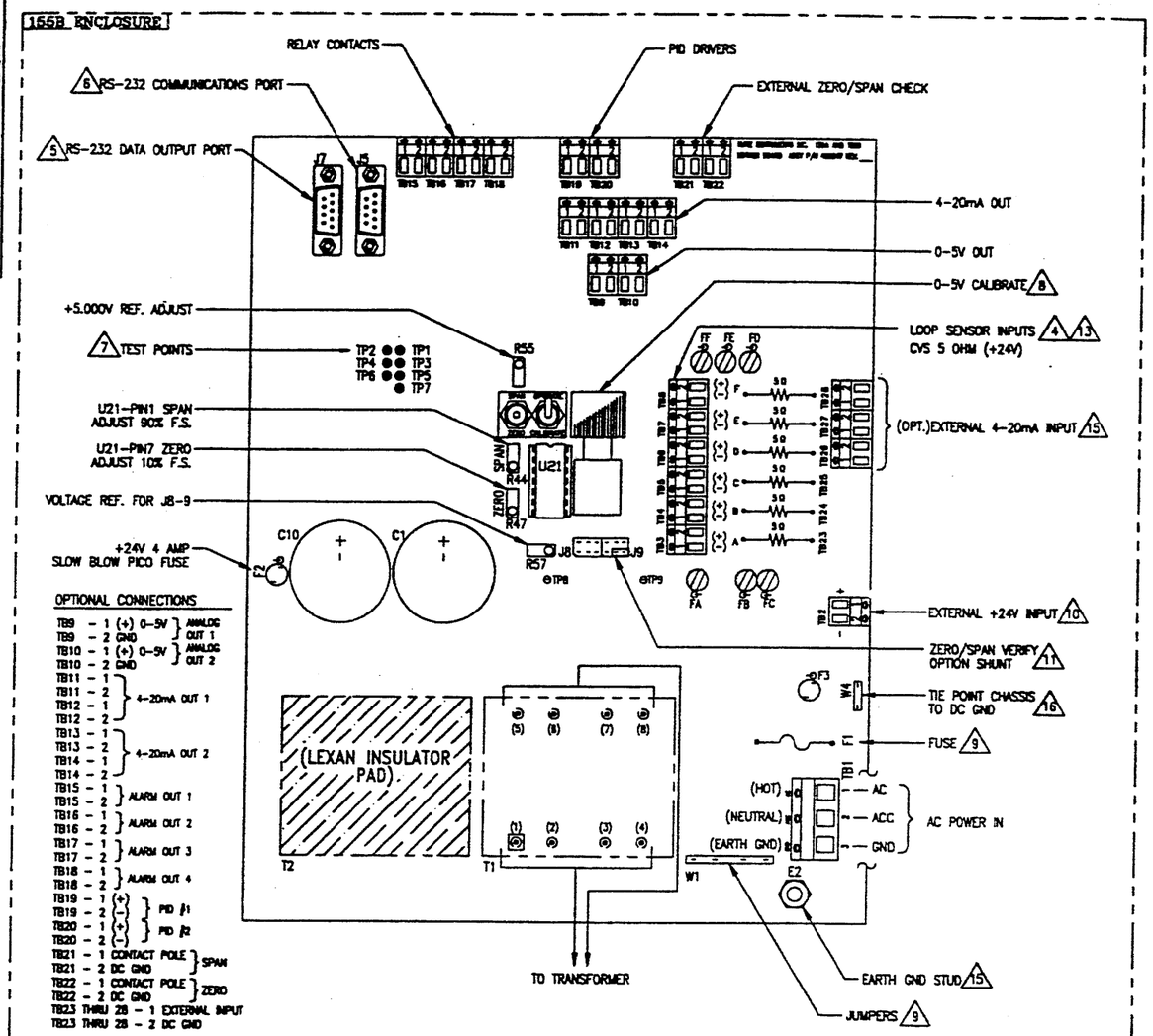
APPROVALS		
DRAWN BY	D.F SINGLETON	8/16/93
CHECKED BY	B.QUERFURTH	9/21/93
APPROVED	T. WILSON	9/21/93

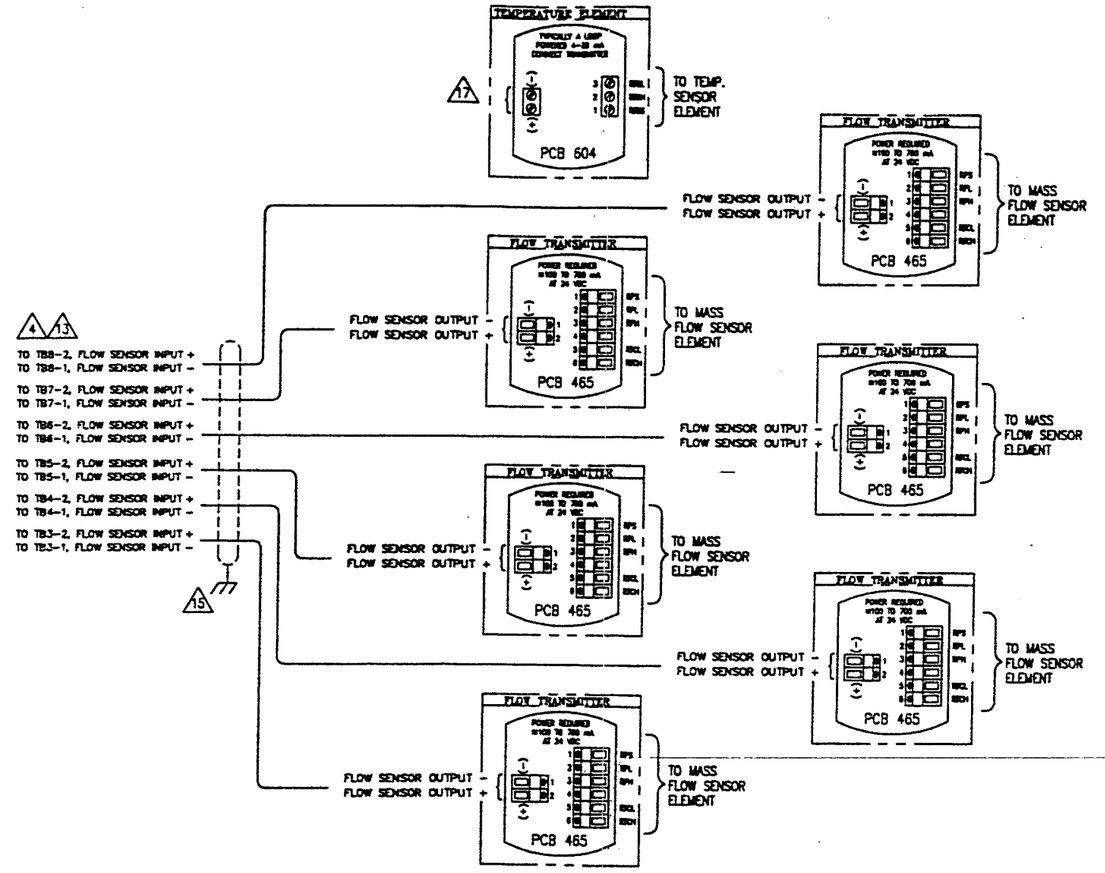
KURZ INSTRUMENTS, INC.

FIELD WIRING DIAGRAM, HOOK–UP, 155A, W/MODEL 90

DWG. SIZE D | DWG. NO. 340155–44 | REV. D | SCALE NONE | SHEET 1 OF 2

REVISIONS					
REV.	DESCRIPTION	BY	CHKD	APPVD	DATE
A	INITIAL RELEASE	DFS	----	----	----
B	REVISED PER ECO B47123	DFS	TW	BBB	10/18/93
C	REVISED PER ECO B47138	DFS	BBB	CHM	3-30-94
D	REVISED PER ECO B47213	ADK	BQ	TW	10/27/94





NOTES:

1. THIS WIRING DIAGRAM IS USED IN CONJUNCTION WITH PARENT NUMBER 750235.
2. REF. DESIGNATORS AND PIN NUMBERS ARE FOR REF. ONLY AND MAY NOT APPEAR ON COMPONENTS

3 15 TO 50 VDC.

4 TB3-1 THRU TB8-1 (INPUTS A THRU F) 0-5 VDC MAX.
TB3-2 THRU TB8-2 (OUTPUTS A THRU F) 18 TO 24 VDC).

5 RS-232 COMMUNICATIONS PORT

J5

PIN		CUSTOMER CONNECT
N/C	1	9 PIN TO 9 PIN CABLE, STRAIGHT THROUGH
TXD1	2	
RXD1	3	
DTR	4	
GND	5	
DSR	6	
RTS	7	
CTS	8	
N/C	9	

6 RS-232 DATA OUTPUT PORT

J7

PIN		CUSTOMER CONNECT
N/C	1	9 PIN TO 9 PIN CABLE, STRAIGHT THROUGH
TXD0	2	
RXD0	3	
DTR	4	
GND	5	
DCD0	6	
RTSO	7	
CTSO	8	
N/C	9	

7 TEST POINTS.
TP1 5.0 REF
TP2 +5V
TP3 -9V
TP4 +10V
TP5 -5V
TP6 +12V
TP7 +15V

8 CALIBRATION TEST POINTS.
TP8 (+)
TP9 (GND)

9 W1
1 2 3 4
115VAC (STD.)
1.2 AMP 3AG SLO-BLO
P/N 630059 (F1)
W1
1 2 3 4
230VAC (OPT.)
0.6 AMP 3AG SLO-BLO
P/N 630057 (F1)

10 TB2-1 +
TB2-2 DC GND

11 JUMPER LOCATION WHEN NOT USED. SEE MANUAL.

12 MAXIMUM LOOP SERIES RESISTOR VALUE=500Ω.

13 FOR FLOW/TEMP. TRANSMITTER CONNECTION TO LOOP SENSOR INPUTS.

14 EXTERNAL INPUT OPTION
TB27-1 (OR TB28-1) EXTERNAL INPUT (- EXTERNAL INPUT)
TB27-2 (OR TB28-2) EXTERNAL INPUT (+ EXTERNAL INPUT)

15 CONNECT INPUT/OUTPUT SHIELDS TO CONDUIT HUB FITTINGS AND TO EARTH GND (E2).

16 W4 JUMPER REQUIRED TO CONNECT DC GND TO EARTH GND (E2).

17 OPTIONAL TEMP. TRANSMITTER FOR LAST UNUSED CHANNEL (E OR F). 250 Ω 1 W RESISTOR REQUIRED.

18. MINIMUM WIRE SIZE: 18 GA.
(EXCEPT SENSOR INPUT WIRES. SELECT CABLE LENGTH) AND WIRE GAGE SO THAT THE LOOP RESISTANCE DOES NOT EXCEED 4.0 OHMS. REFER TO MANUAL.)

	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	APPROVALS			KURZ INSTRUMENTS, INC.
	TOLERANCES ARE: FRACTIONS ± 1/32; ANGLES ± 0°-30'; DECIMALS .X ± 0.1, .XX ± 0.01, .XXX ± 0.005, .XXXX ± 0.0010	DRAWN BY D.F SINGLETON	DATE 6/16/93		FIELD WIRING DIAGRAM, HOOK-UP, 155B, W/MODEL 90
		CHECKED BY B.QUEDERFURTH	DATE 9/21/93		
		APPROVED T. WILSON	DATE 9/23/93		
750235 NEXT ASSEMBLY	ORIG. RELEASE DATE				DWG. SIZE D; DWG. NO. 340155-45; REV. D; SCALE NONE; SHEET 1 OF 2