KURZ™
INSTRUMENTS INC.
MONTEREY, CALIFORNIA

Model 90/91
Zero/Span Test and Field Calibrator
User's Guide

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INTRODUCTION

The Kurz Instruments, Inc., Models 90 and 91 Zero/Span Test and Field Calibrator provides two valuable functions for the user or technician. These are verification of zero and span setpoints and performance of in-situ calibration for the Series 155 Mass Flow Computer input circuitry. The Model 90 has a timer with the capability of automatic Zero/Span verification. The Model 91 lacks the automatic feature.

FIELD CALIBRATION

The field calibrator allows the user or technician to verify system calibration without removing Series 155 Mass Flow Computer or it's associated wiring.

A calibrated digital voltmeter (DVM) with 4½ digits and ± 0.1% accuracy is required for this procedure along with the appropriate ***Calibration Data and Certification Document*** for the channel under test.

The ***Calibration Data and Certification Document*** lists Current Sense Voltages in the column labelled "CSV VDC" for each calibration point. Corresponding velocity or mass flow values for each calibration point are listed in the column labelled " Velocity Meters/Sec" or "Velocity Feet/Min". The first calibration point indicates a no-flow condition.

Before starting any procedure contained in this document, the following steps should be noted or verified.

- ☆ Performance of this procedure requires knowledge of user or technician level security codes.
- ☆ All wiring is properly connected.
- ☆ AC power is available and applied to the instrument.
- ☆ These procedure are performed with power applied to the instrument, appropriate steps must be taken to prevent contact with potentially dangerous electrical energy or serious damage to personnel and/or equipment.
- ☆ When the **CALIBRATOR** switch (SW1) is placed in the "**ON**" position, the unit is no longer monitoring actual flow rates. Verify that removal of this equipment from service will not compromise personnel or equipment safety. The **CALIBRATOR** switch must be placed the "**OFF**" position when returning the instrument to service.

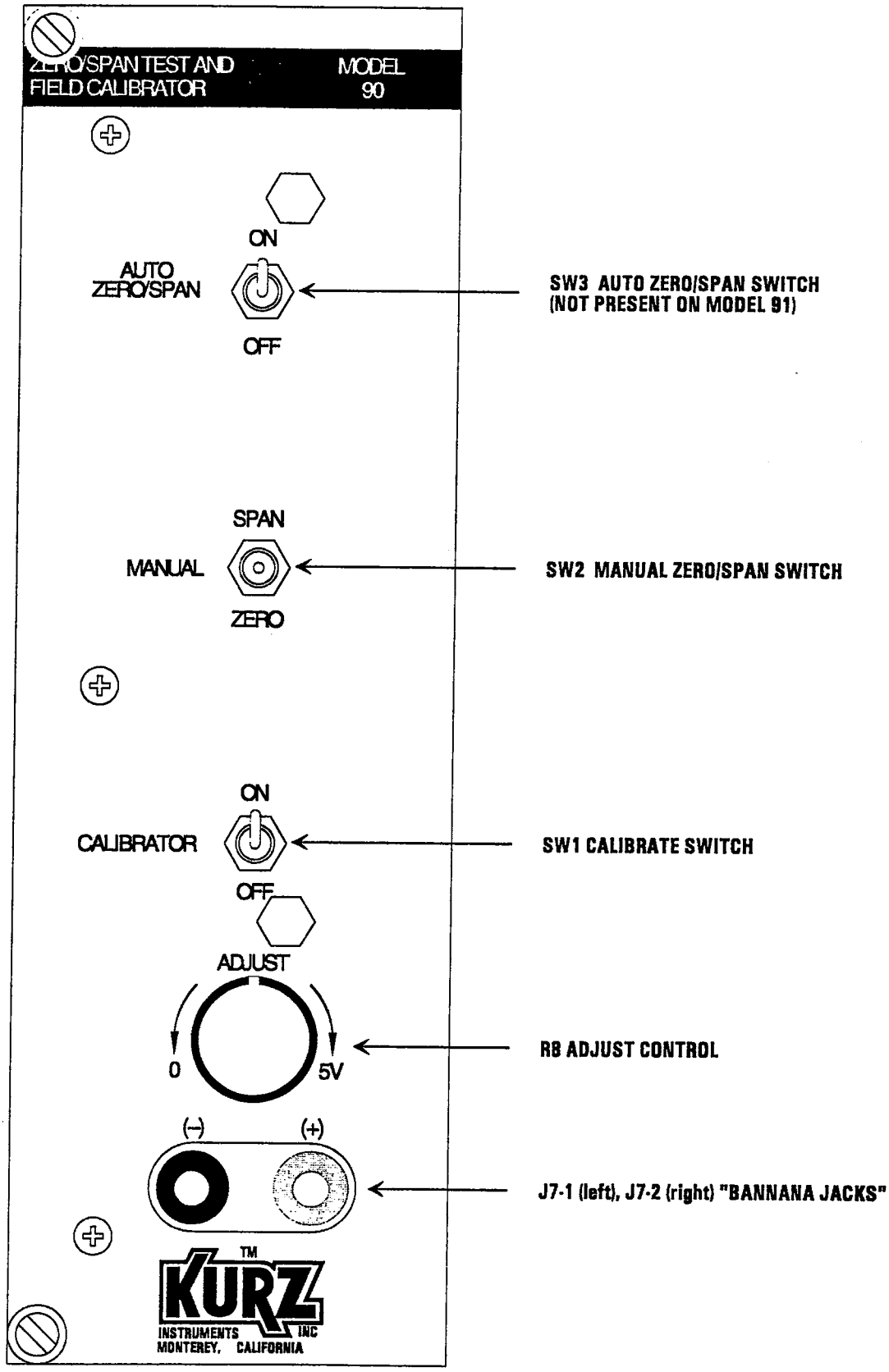

Figure 1, Model 90/91 Front Panel Controls

INPUT CALIBRATION

Refer to Figure 2 for component location.

1. Enter the Program Mode using technician level access code.

2. Press [P] until the message "PRESS ENTER TO CALIBRATE" appears on the front panel LCD, then press [E].

3. Press the up (YES) or down (NO) arrow until the message "PRESS ENTER FOR INPUT CAL" appears on the front panel LCD, then press [E].

4. Press [P] until you see the "SET ZERO VOLTS..." prompt for the channel you wish to calibrate. If you inadvertently pass the desired channel, pressing [C] once will return you to step 3.

5. When you see the message "SET ZERO VOLTS..." for the channel you wish to calibrate, place CALIBRATE switch in the **"ON"** position.

6. Connect DVM to front panel "Banana" jacks J7-2 (+, RED) and J7-1 (–, BLACK)

7. Turn ADJUST control (R8) until the DVM indicates approximately 0.000 VDC.

8. Press the up (YES) or down (NO) arrow until the front panel LCD displays the same voltage indicated in step 7. Then press [E].

9. When you see the message "SET SPAN VOLTS...", turn ADJUST control (R8) until the DVM indicates approximately 3.000 VDC.

10. Press the up (YES) or down (NO) arrow until the front panel LCD displays the same voltage indicated in step 9. Then press [E].

11. This completes the input calibration process for one channel. If you wish to continue for the other channels (up to a maximum of 22 depending upon instrument configuration) return to step 4 for each desired channel.

CALCULATIONS

Item	Description	Method Obtained	Enter Value Here	Where Used
1	100% Mass Flow Rate	Determined from full scale span of meter requiring verification		To calculate Items 2 and 3
2	90% Mass Flow Rate	Item 1 × .9		To determine Item 4
3	10% Mass Flow Rate	Item 1 × .1		To determine Item 5
4	10% Average Velocity	Procedure on page 7 "Adjust and Record 'Zero' and 'Span' Flowrate Values", step 9		To set up linearizer for drift check verification channel
5	10% Input Voltage			
6	90% Average Velocity	Procedure on page 7 "Adjust and Record 'Zero' and 'Span' Flowrate Values", step 11		To set up linearizer for drift check verification channel
7	90% Input voltage			
8	15% Velocity	(Item 6 ÷ .9) × .15		To set low alarm for drift check verification
9	50% Velocity	(Item 6 ÷ .9) × .5		To set drift check operating reference
10	85% Velocity	(Item 6 ÷ .9) × .85		To set high alarm for drift check verification

Table 1, Flow Calculations

ZERO/SPAN DRIFT CHECK AND VERIFICATION

Two relays configured as low (zero) and high (span) alarms provide the Zero/Span drift check feature for the Series 155 Mass Flowmeter Computers. The Model 90 Zero/Span Test and Field Calibrator provides both manual and automatic operation while the Model 91 has manual operation only. Typically, the Zero function is set to 10% of normal full-scale indication and the Span function is set to 90% of full scale indication depending upon the regulatory requirements of the facility. Normally these values are calculated from the meter reporting the average stack or duct flow subject to regulation. During the drift check process, voltage and flow readings are compared with original settings to confirm system accuracy.

Implementation of this feature requires the following steps:

1. Calculate required flow rates.
2. Adjustment of Zero/Span Drift Check Values
3. Verification of external control functions
4. Selection and set up of Zero/Span Drift Check channel.
5. Set Up of verification meter.
6. Alarm set up.
7. Alarm verification.

Calculate Flow Rates

First obtain the "Span" value for the meter monitoring mass flow in the stack or duct requiring verification. Enter this value in the column labelled "Enter Value Here" for item 1. Determine the 90% and 10% flowrate values using the multipliers indicated in the column labelled "Method Obtained" for items 2 and 3, and enter the calculated values in the appropriate space. When the 90% and 10% flow rates have been determined, proceed to page 7 and perform the procedure "Adjustment of Drift Check Zero and Span Values".

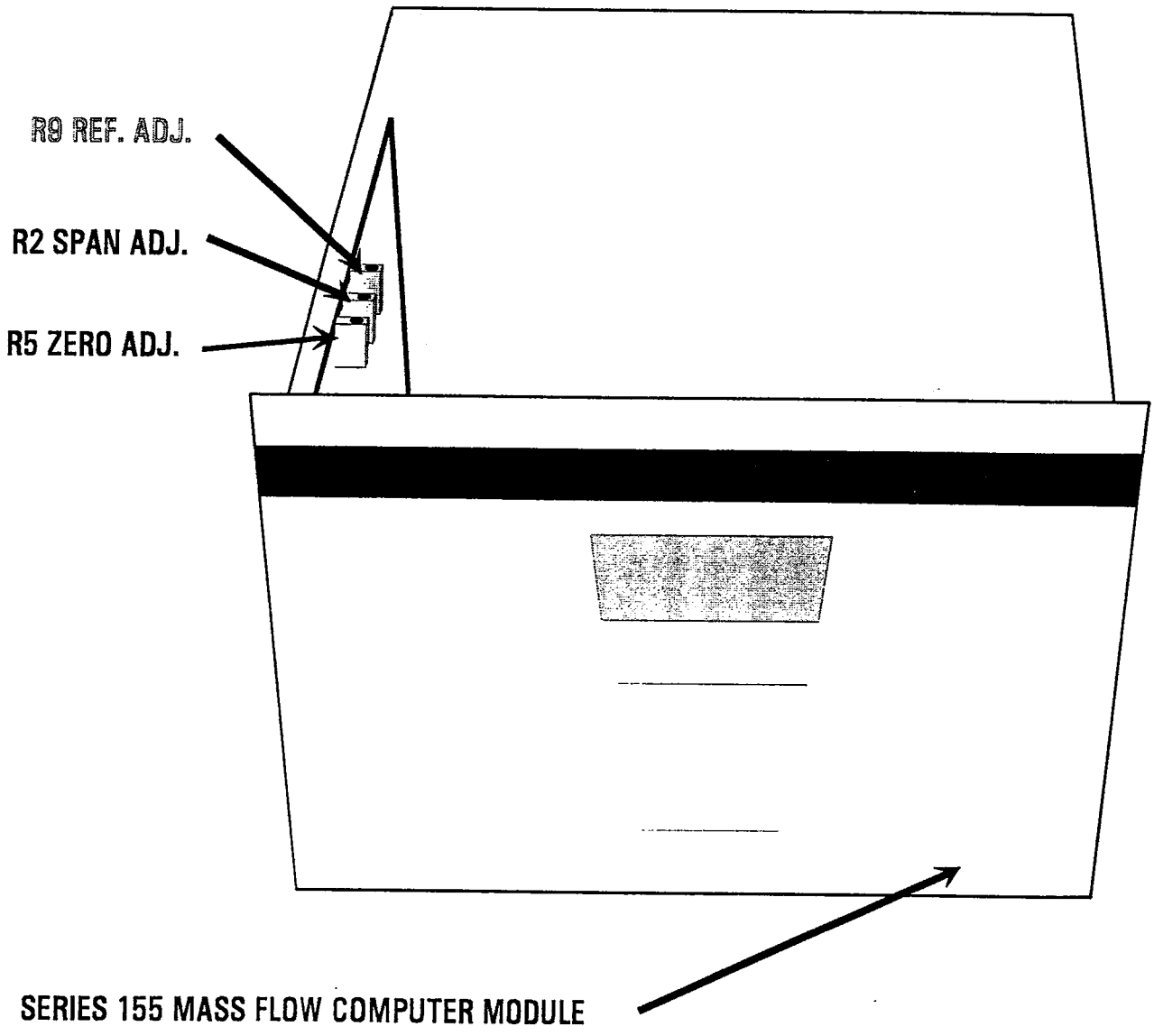

Figure 2, Component Location, Zero/Span Ajustments

Adjustment of Drift Check Zero and Span Values

Using the 10% and 90% flow rates caluculated in table 1, page 4, adjust the Zero and Span values used to perform the Zero/Span Drift Check. Extend the Model 155 Mass Flow Computer module sufficiently for access to R2 and R5 on the 420237 board and perform the following steps:

Refer to Figure 2 for component locations.

ADJUST AND RECORD "ZERO" AND "SPAN" FLOWRATE VALUES.

1. From the Executive Mode, press [D] to enter the Display Mode.
2. Press [D] until you see the message "FLOW RATE XXX.XXX UNITS" where "UNITS" represents the engineering units for your instrument.
3. Press [H] to hold the display.
4. Hold MANUAL ZERO/SPAN switch (SW1) on the Model 90/91 front panel in the ZERO position and adjust resistor R5 on the 420237 board in the Model 155 module until the front panel display indicates 10% of full scale value as recorded in CALCULATE FLOW RATES. Note: This may take several seconds depending upon the number of input channels and boxcar settings.
5. Record flowrate indication and release switch SW1.
6. Hold MANUAL ZERO/SPAN switch (SW1) on the Model 90/91 Front Panel in the SPAN position and adjust resistor R2 on the 420237 board in the Model 155 module until the front panel display indicates 90% of full scale value as recorded in CALCULATE FLOW RATES.
7. Record flowrate indication and release switch SW1.
8. Press [C] to clear the hold function.

Steps 8 through 12 will be used to set up the verification channel linearizers.

9. Press [D] until you see the message "AVERAGE VELOCITY XXX.XXX SFPM" (units depend upon system configuration) on the front panel LCD.
10. Hold MANUAL ZERO/SPAN switch (SW1) on the Model 90/91 Front Panel in the ZERO position. Record velocity as Item 4 in Table 1.
11. Hold MANUAL ZERO/SPAN switch (SW1) on the Model 90/91 Front Panel in the SPAN position. Record average velocity as Item 6 in Table 1.
12. Press [D] until you see the message "A=XXX.XXX SFPM INPUT=X.XXX VDC" (units depend upon system configuration) on the front panel LCD.
13. Hold MANUAL ZERO/SPAN switch (SW1) on the Model 90/91 Front Panel in the ZERO position. Record voltage as Item 5 in Table 1.

14. Hold MANUAL ZERO/SPAN switch (SW1) on the Model 90/91 Front Panel in the SPAN position. Record average velocity as Item 7 in Table 1.

15. Verify that the 4-20 mA output referenced to this meter (TB6A or TB6B depending upon configuration) reads 10% of flowrate range and record value.

16. Verify that the 4-20 mA output referenced to this meter (TB6A or TB6B depending uon configuration) reads 90% of flowrate range and record value.

VERIFY EXTERNAL CONTROL FUNCTION

Refer to Figure 3 for component locations.

1. Short terminals 9 and 10 of TB9 together.

2. Verify that the flowrate indications and 4-20 mA values match the 10% flowrate data previously recorded.

3. Remove short from terminals 9 and 10 of TB9.

4. Short terminals 11 and 12 of TB9 together.

5. Verify that the flowrate indications and 4-20 mA values match 90% flowrate data previously recorded.

6. Remove short from terminals 11 and 12 of TB9.

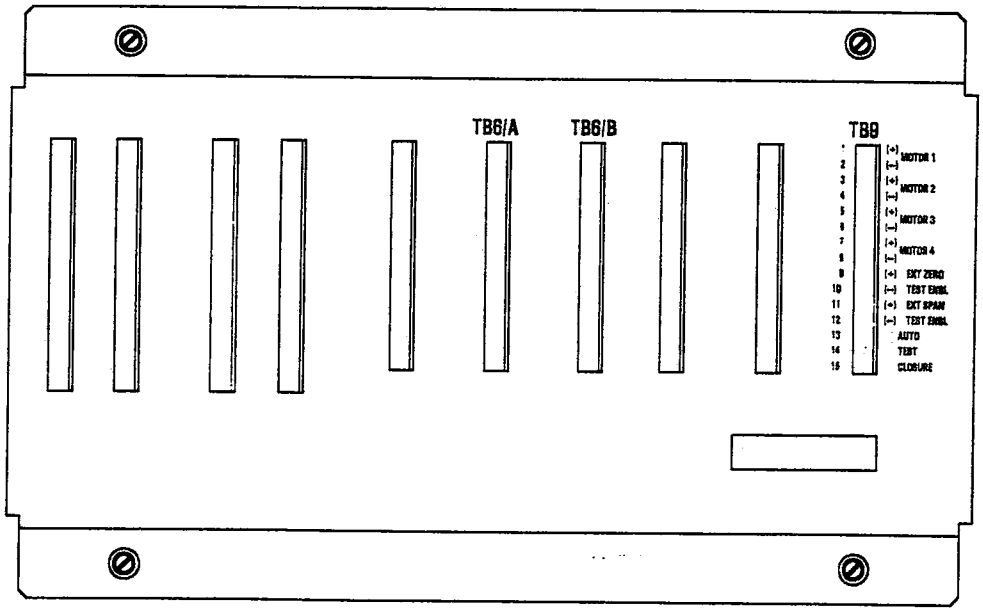

Figure 3, External Control Terminals

Select Zero/Span Drift Check Verification Input Channel

In order to implement the Zero/Span Drift Check Verification feature it is necessary to set up an unused input channel. This is done by placing a jumper on J4 of the 420237 board mounted on the left side (when viewed from the top, front) of a Model 155 Mass Flow Computer module as shown in Figure 4. J4 is a 50 pin connector supplied with a shorting jumper. Pin 1 is at the bottom of the board. Pins 1 and 2 are for channel A, 3 and 4 for channel B and so on. The first unused input channel should be used for this feature. As an example, if your instrument is configured for 6 Kurz flow and/or temperature elements then channel 7 would be the correct selection for the Zero/Span Drift Check feature and the jumper would be placed on pins 13 and 14 as shown in Figure 4.

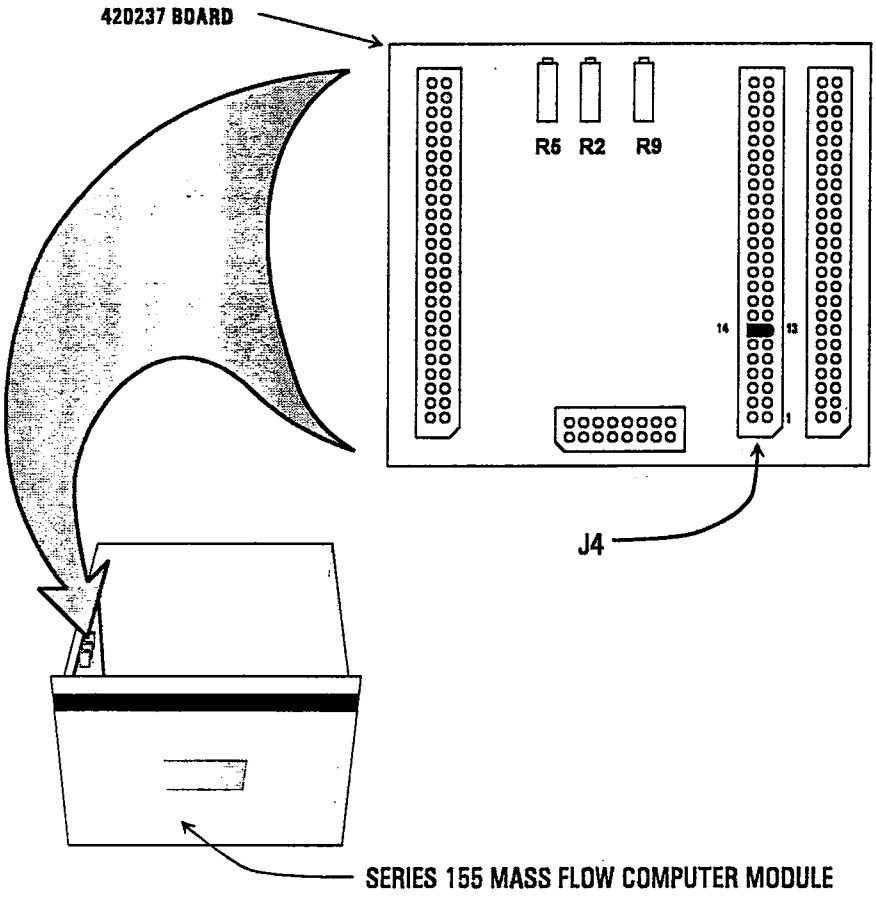

Figure 4, Input Channel Selection, J4 Location

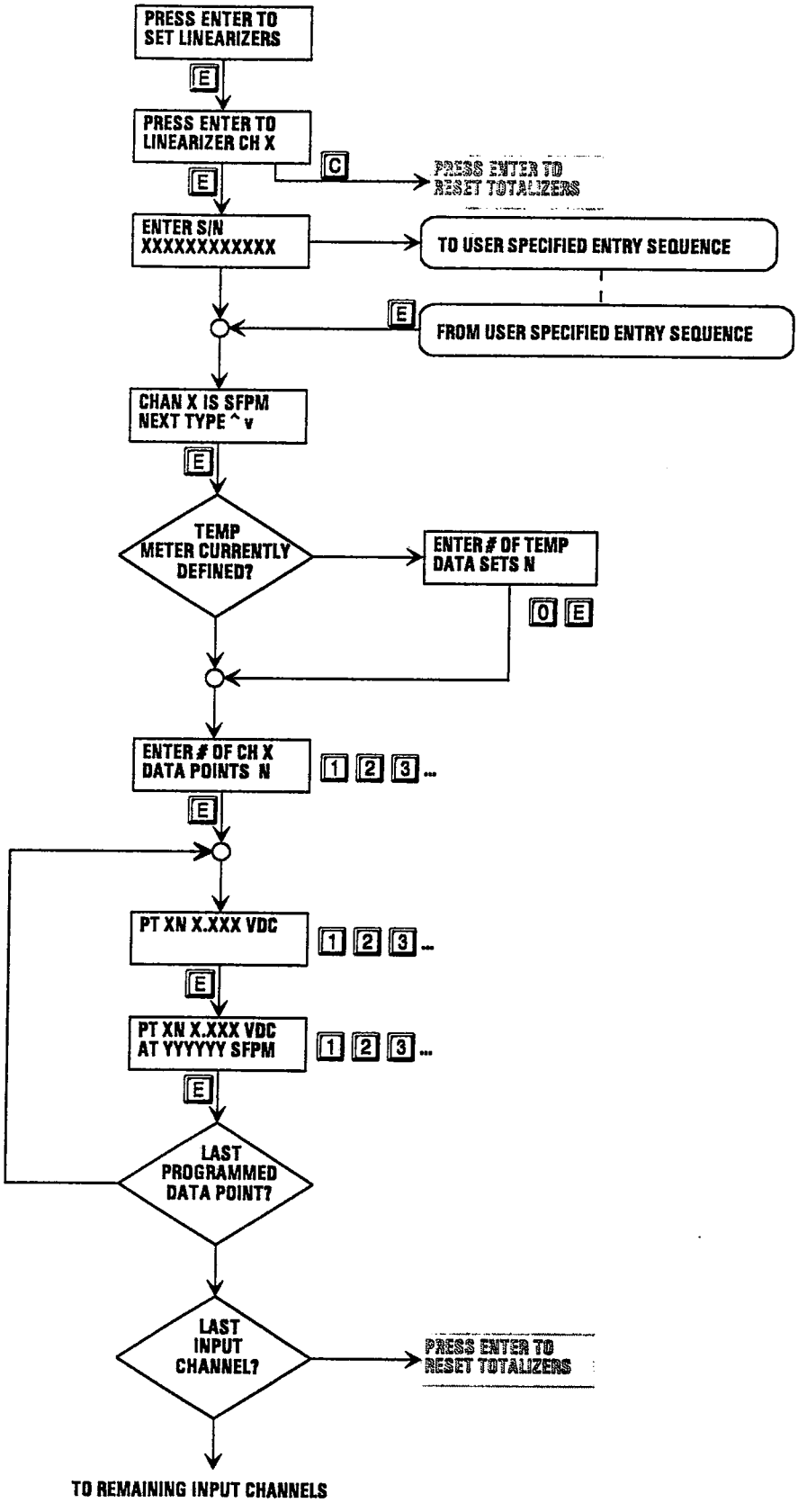

Figure 5, Program Menu, Set Linearizers

Set Up Zero Span Drift Check Verification Input Channel

An unused input channel provides a signal source for the verification meter. This is usually the first available channel in your system. For example, if your system is configured with Kurz flow or temperature elements in channels A through J then the verification meter will use channel K for an input. The technician will enter the "SET LINEARIZER" function in the Program Mode and perform the following steps:

1. Enter the Program Mode using the technician level access code.

2. Press the up (YES) or down (NO) arrow until the message "PRESS ENTER TO SET LINEARIZERS" is displayed on the front panel LCD, then press [E].

3. Press the up (YES) or down (NO) until the message"PRESS ENTER TO LINEARIZE CH X" (where "X" is the first available input channel) appears on the front panel LCD, then press [E].

4. Using the keypad, enter a serial number associated with the Zero/Span function such as "Zero/Span", then press [E].

5. Press the up (YES) or down (NO) arrow until the message on the front panel LCD indicates the proper engineering units (SFPM or SMPS) for your system, then press [E].

Note: If you see the message "ENTER # OF TEMPERATURE DATA SETS 'N'" proceed to step 6. If you see the message "ENTER # OF CH 'X' DATA POINTS 'N'" proceed to step 7.

6. Press [0], [E] in response to the message "ENTER # OF TEMPERATURE DATA SETS 'N'" as temperature compensation is not needed for this feature.

6. Press [2], [E], in response to the message "ENTER # OF CH X DATA POINTS N", where X in the current input channel and N is the default number of data points. This step will replace the number of default data points with 2.

7. When the message "POINT X1 Y.YYY VDC" appears on the front panel LCD, use the keypad to specify the voltage recorded as item 5, Table 1 as the 10% Input Voltage value, then press [E].

8. When the message "POINT X1 Y.YYY VDC AT ZZZZZZ SFPM" appears on the front panel LCD, use the keypad to specify the velocity recorded as item 4, Table 1 as the 10% Average Velocity, then press [E].

9. Repeat steps 7 and 8 for data point 2 using the 90% values of voltage and velocity recorded as items 7 and 6, Table 1.

10. Press [C] to return to the main programming menu.

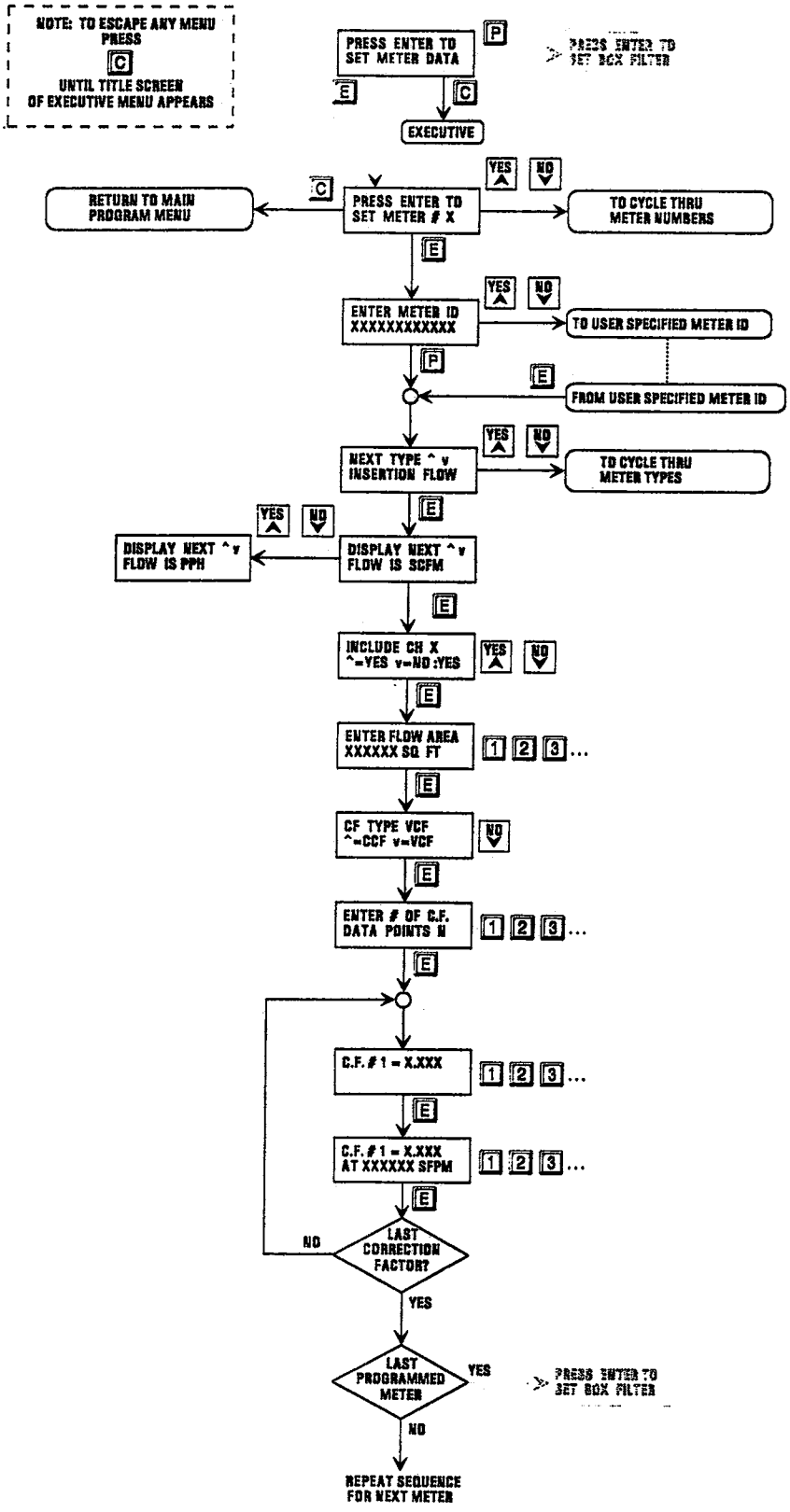

Figure 6, Program Menu, Set Meter Data

Set Up Zero/Span Drift Check Verification Meter

An unassigned meter will be set up for the verification meter. This is usually the first available meter in your system. For example, if meter 01 through 03 are already assigned, the verification meter should be meter 04. *Note: If all configured meters are assigned, one of the previously assigned meters must be reconfigured for this function.* The user or technician will enter the "SET METER DATA" function in the Program Mode and perform the following steps:

1. From the Program Mode press the up (YES) or down (NO) arrow until the message "PRESS ENTER TO SET METER DATA" appears on the front panel LCD, then press [E].

2. Press the up (YES) or down (NO) arrow until the message "PRESS ENTER TO SET METER # X" (where "X" indicates the first unassigned meter number) appears on the front panel LCD, then press [E].

3. Using the keypad specify the desired meter ID such as "ZERO/SPAN", then press [E].

4. Press [E] to accept the meter type as "INSERTION FLOW".

5. Press the up (YES) or down (NO) arrow until the message "DISPLAY NEXT ^v FLOW IS SCFM" (or whichever engineering units are appropriate for your instrument) appears on the front panel LCD, then press [E].

6. The next messages will ask you which channels to include. Press the down (NO) arrow and [E] to bypass the channels used as inputs by Kurz flow or temperature elements. Press the up (YES) arrow and [E] to accept the channel specified in step 3 of "SET UP ZERO/SPAN DRIFT CHECK VERIFICATION INPUT CHANNEL". Press the down (NO) arrow and [E] for any remaining unused channels.

7. Press [E] to accept the default flow area of 1 square foot.

8. Since correction factors are not required for this feature, press [E] until you see the message "PRESS ENTER TO SET METER X", then press [C]. to enter the main Program Menu. Note: if the meter just programmed is the last configured meter then you will enter the main Program menu by default when all meter parameters have been entered. This is indicated by the message "PRESS ENTER TO SET BOX FILTER".

9. Proceed to page O-11 to designate the alarm points required to annunciate and verify the Zero/Span Drift Check feature.

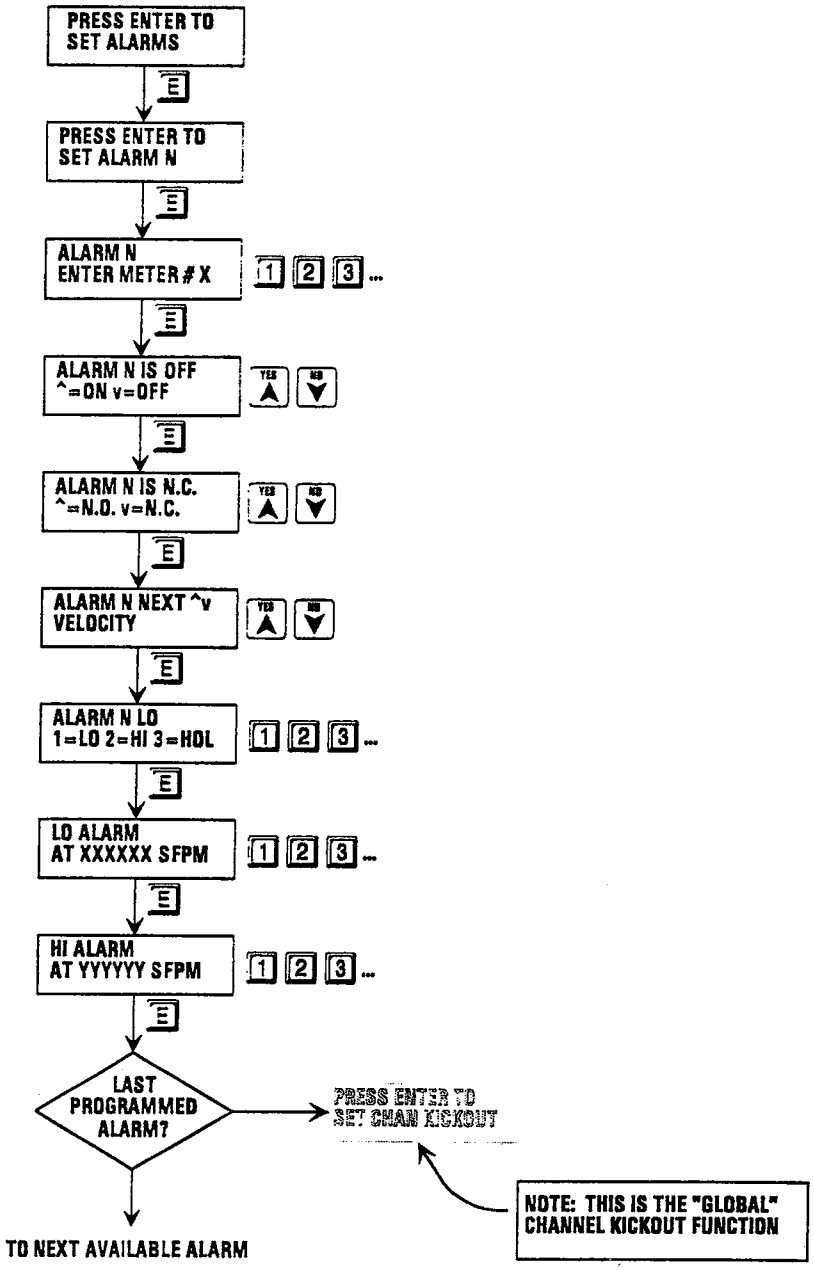

Figure 7, Program Menu, Set Alarms

Designate Alarm Points

When a Zero Span Drift Check is performed, the normal inputs are temporarily removed from service. By designating two alarm relays as zero and span check respectively, these relays can be used to notify the Control Room Operator, or as inputs to a Sequence of Events Recorder, to verify that any reported process anomalies are the result of a test procedure and not an actual alarm condition. Two unassigned relays must be available to implement this feature. To designate the alarms the user or technician should follow the below listed procedure.

1. From the Program Menu, press the up (YES) or down (NO) arrow until the following message appears on the front panel LCD, "PRESS ENTER TO SET ALARMS", then press [E].

2. Press the up (YES) or down (NO) arrow until the message "PRESS ENTER TO SET ALARM N" (where "N" is the first available alarm number) appears on the front panel LCD, then press [E].

3. When the message "ALARM N ENTER METER # X" appears, press the up (YES) or down (NO) arrow until "X" is the number of the meter assigned to the Zero/Span Drift Check function as defined in step 2 of "Set Up Zero/Span Drift Check Verification Meter", then press [E].

4. Press the up (YES) or down (NO) arrow until the message "ALARM N IS ON" appears on the front panel LCD, then press [E].

5. When the message "ALARM N IS N.C. ^=N.O. v=N.C." appears on the front panel LCD, press the up (YES) or down (NO) arrow to select either N.O. (normally open) or N.C. (normally closed) as required by your system, then press [E].

6. Press the up (YES) or down (NO) arrow to select the type of alarm (usually velocity) required for this feature, then press [E].

7. When the message "ALARM N IS LO 1=LO 2=HI 3=HOL" appears, press 1 to select lo alarm, then press [E].

8. When the message "LO ALARM AT XXX.XXX SFPM" (or SMPS) appears, use the keypad to specify the value recorded as 15% Velocity, Item 8, Table 1, then press [E]. You should now see the message "PRESS ENTER TO SET ALARM Y" where "Y" is the next available alarm number.

9. Repeat steps 3 through 6 for hi alarm setpoint.

10. When the message "ALARM Y IS LO 1=LO 2=HI 3=HOL" appears, press 2 to select hi alarm, then press [E].

11. When the message "HI ALARM AT XXX.XXX SFPM" (or SMPS), use the keypad to specify the value recorded as 85% Velocity, Item 10, Table 1, then press [E].

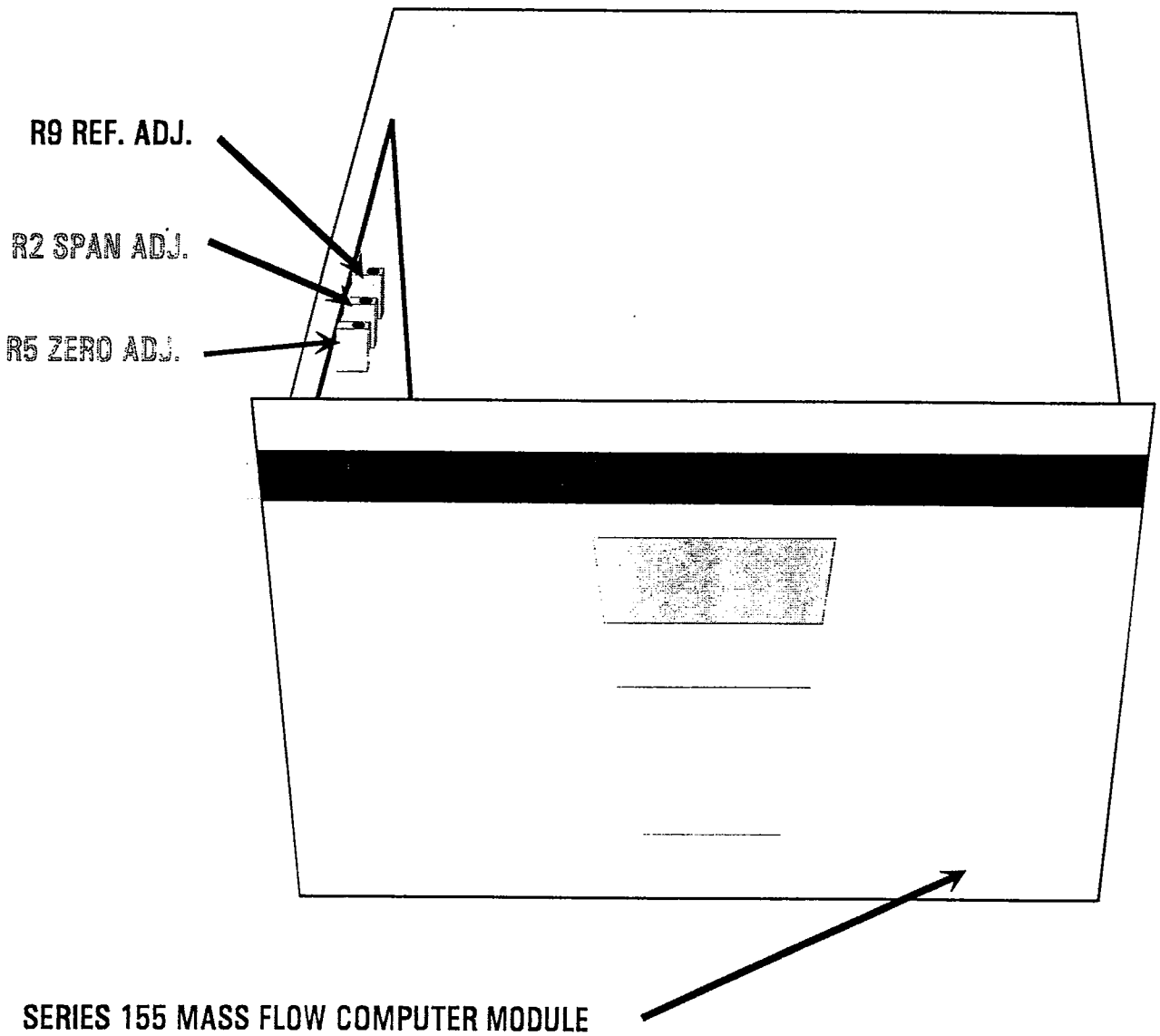

Figure 8, Set Up Zero/Span Drift Check Operate Reference

Set Up Zero/Span Drift Check Operate Reference

This procedure establishes a simulated mass flow input for the Zero/Span Drift Check input channel. Approximating a mid-range input eliminates nuisance alarms during normal operation.

1. Extend the Model 155 Mass Flow Computer sufficiently to access Reference Adjust R9 located on the 420237 board as indicated in Figure 8.

2. From the Executive Meny, press [D] on the keypad until the message "DISPLAY NEXT ^v METER # 1" appears on the front panel LCD.

3. Press the up (YES) or down (NO) arrow until the meter number assigned to the Zero/Span Drift Check as specified in step 2 of "Set Up Zero/Span Drift Check Verification Meter appears on the front panel LCD.

4. Press [D] until you see the average flow indication on the front panel LCD.

5. Adjust Reference Adjust R9 on the 420237 board until average flow indication is approximately 50% of the full scale span value used for calculating Zero/Span drift check values.

6. Insert Model 155 Mass Flow Computer module into chassis and secure with floating lock nut.

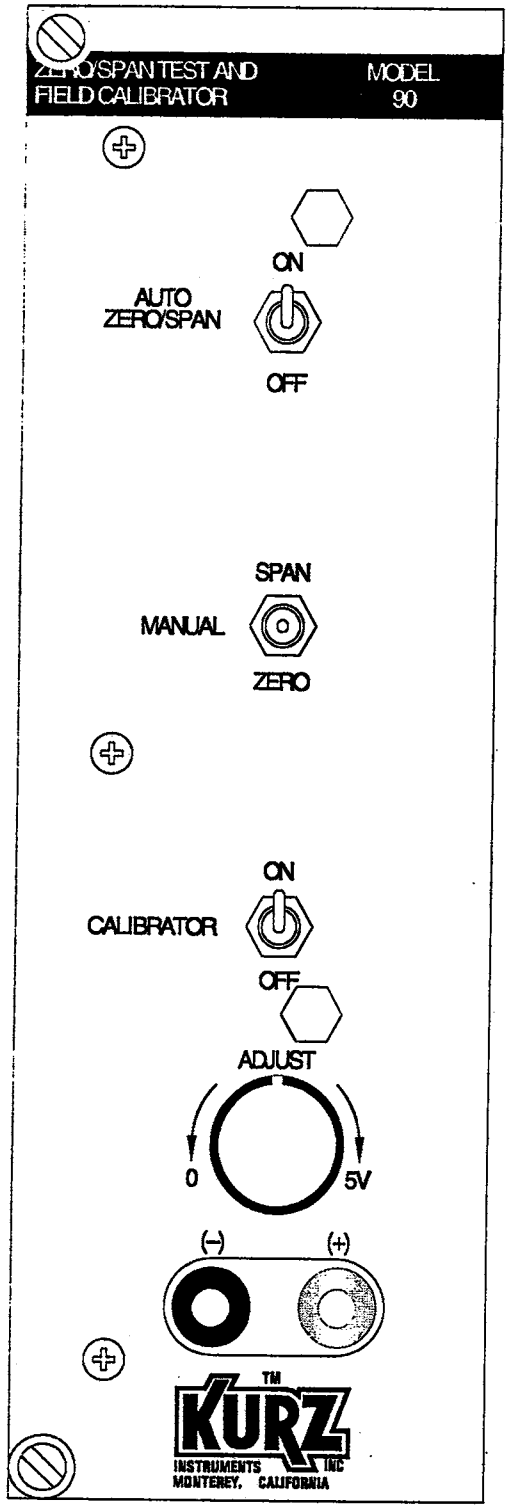

Figure 9, Verify Zero/Span Drift Check Operation

Verify Zero/Span Drift Check Operation

This procedure allows the user or technician to verify that the Zero/Span Drift Check alarm relays operate properly. The technique used to verify relay operation is dependant upon how the Model 155 Mass Flow Computer is integrated into the user's system. Ideally some form of annunciation in the control room indicates initiation of the Zero/Span Drift Check function as this not only verifies operation of the instrument but also the interface between Kurz equipment and plant systems. If this is not possible, operation of Kurz equipment can be verified at the alarm terminals located on the P.C.B. Cover Assy. 140198 as indicated in Figure 9. Use of an ohmmeter to check continuity or a voltmeter to determine high or low signal levels at the appropriate terminals will verify operation of the relays.

1. Hold the "Manual Zero Span" switch SW3 on the Model 90/91 front panel in the "**ZERO**" position.

2. You should see a low alarm message on the front panel LCD. Verification of alarm relay actuation depends upon your system configuration as described above.

3. Hold the "Manual Zero Span" switch SW3 on the Model 90/91 front panel in the "**SPAN**" position.

4. You should see a high alarm message on the front panel LCD. Verification of alarm relay actuation depends upon your system configuration as described above.

5. Release the "Manual Zero Span" switch SW3. Verify that the alarms are reset and the front panel LCD indicates the mid-range mass flow value specified in step 5 of "Set Up Zero/Span Drift Check Operate Reference".