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# ARB 96 Adjustable Ramp Buffer Instruction Manual

## 1.0 INTRODUCTION

These instructions refer to the above model. Supplementary sheets are attached if the unit has special options or features. For detailed specifications, see page 4 or refer to the Data Bulletin. All ADTECH instruments are factory calibrated and supplied with a label detailing the calibration. Adjustments are normally not necessary. A simple check should be performed to verify calibration before installation to ensure that it matches the field requirement.

## 2.0 GENERAL DESCRIPTION

The ADTECH ARB 96 is a Non-Isolated Adjustable Ramp Buffer that accepts a process input signal of 1-5 vdc or 4-20 ma dc and limits/controls the rate of output change. If the input rate of change exceeds the preset high and/or low rate limits, the output will ramp at the preset rate only.

An external contact input allows the output to be instantaneously reset to 0% of range for the duration of the contact command as standard.

Optionally the ARB 96 may be specified with a TRACK/HOLD feature. In the TRACK mode the output follows the input as a standard Rate Limited Transmitter. On command (i.e.) HOLD, the output signal is held "frozen" until the HOLD command is removed; Option I 37.

Power Option P 1 Non-Isolated 24 vdc provides negative output signal and negative DC power common rail connection.

The output is a true current source and provides process signals such as 4-20 ma, 0-1 ma, 0-10 ma, 1-5 ma and 10-50 ma dc or alternatively, a voltage signal of 5 vdc full scale. Other current and voltage **Inputs/Outputs (I/O)** are available as specified on the Data Bulletin.

## 3.0 INSTALLATION

The instrument is supplied in a general purpose enclosure as standard. NEMA 4, 7 or 12 and plug in chassis enclosures are optionally available. Installation area/location must agree with the supplied instruments including operating temperature and ambient conditions.

### Mounting

Refer to the appropriate outline drawing for mounting and clearance dimensions. The instrument is surface mounted with two #10-32 screws on 8.00 inch centers.

### Electrical Connections

The wire used to connect the instrument to the control system I/O should be a twisted pair(s) and sized according to normal practice. Shielded cable is not normally necessary (if used, the shield must be grounded at the input negative of the ADTECH instrument and left floating at the sensor).

A 12 position barrier terminal block with #6-32 screws and 3/8" spacing is provided for I/O and power connection. A housing ground terminal marked G is also provided.

## Controls

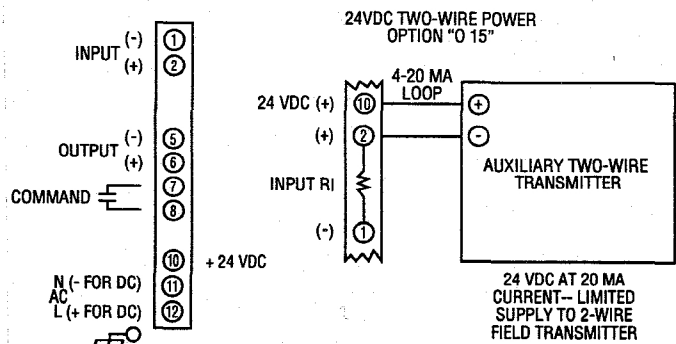
Multiturn INPUT ZERO, OUTPUT ZERO, SPAN, UP-RATE and DOWN-RATE controls are provided to calibrate the instrument. The multiturn controls are accessible through the instrument front panel and are clearly marked for ease of use.

## 4.0 MAINTENANCE

These instruments are electronic and require no maintenance except periodic cleaning and calibration verification. If the unit appears to be mis-operating it should be checked as installed per section 6.0 or removed for a bench check per sections 6.0-7.0. MOST problems are traced to field wiring and/or associated circuits. If the problem appears to be with the instrument, proceed to sections 6.0 and 7.0.

## 5.0 CONNECTIONS

Standard connections are shown below and on the instrument face plate, Data Bulletin or on attached supplementary sheets.



NOTE: No customer connection to Terminals 3 & 4.

## 6.0 CALIBRATION

To perform a calibration check or re-calibration of the instrument follow this procedure.

- A. Carefully remove the instrument from the housing to gain access to the PC board components, observing normal safety and equipment precautions.
- B. Make sure the I/O wiring is properly connected and that the correct power source per the label is also connected. The instrument must be at normal power for a minimum of 2 minutes before proceeding to C.
- C. The input signal source(s) must be adjustable from 0 to 100% in steps of 10% or at least 25%. The source(s) should be either precalibrated or an accurate meter must be used to monitor the input(s).
- D. The output may be monitored either as a direct voltage for a voltage output signal or as a current that can be represented as a voltage across a resistor shunt.
- E. Turn the multiturn potentiometer marked UP-RATE and DOWN-RATE full CW. This sets the Ramp rates at their fastest times for the particular jumper configuration.
- F. Temporarily set jumpers J14, J15, J16 and J18 to position B.
- G. Set the input source to the minimum input value and adjust the multiturn potentiometer marked IN-ZERO to provide 0.000 vdc from TP1(+) to Terminal #1(-). Also adjust the multiturn potentiometer marked OUT-ZERO to provide the minimum calibrated output (e.g.) 4.00 ma  $\pm$  0.01 ma dc.
- H. Set the input source to the maximum value and adjust the multiturn potentiometer marked SPAN to provide the maximum calibrated output (e.g.) 20.00  $\pm$  0.01 ma dc.
- I. Repeat steps G and H until within calibration;  $\pm$  0.1%.
- J. From the RAMP TIME SELECTION TABLE Section 8.0 look up the value of N corresponding to the smaller of the UP RAMP TIME and DOWN RAMP TIME and calculate the frequencies;

$$f_{up} = \frac{4096N}{T_{up}} \text{ Hz}, \quad f_{down} = \frac{4096N}{T_{down}} \text{ Hz}$$

where  $T_{up}$  and  $T_{down}$  are UP RAMP TIME and DOWN RAMP TIME in seconds.

- K. To set the UP-RAMP TIME: connect a frequency counter from pin 13 of  $Z_9$  to Term #5; set the input source to 100% of the maximum input signal and adjust the multiturn potentiometer marked UP-RATE to provide a frequency equal to  $f_{up}$ .
- L. To set the DOWN-RAMP TIME: connect a frequency counter from pin 13 of  $Z_9$  to Term #5; set the input source to the zero signal value and adjust the multiturn potentiometer marked DOWN-RATE to provide a frequency equal to  $f_{down}$ .
- M. Repeat steps K and L until within calibration;  $\pm$  0.1% of frequency.
- N. Note the jumper configuration corresponding to the value of N in the table, and reset jumpers J14, J15, J16 and J18 accordingly. This step provides the actual desired UP RATE and DOWN RATE.
- O. This completes the calibration.

## 7.0 FIELD TROUBLE SHOOTING GUIDE

This section offers a simple, first level trouble-shooting aid for an apparent instrument malfunction.

### SYMPTOM      CORRECTIVE ACTION

- |           |   |
|-----------|---|
| No output | <ol style="list-style-type: none"> <li>1. Check the input and output connections carefully.</li> <li>2. Check that the power supply polarity is correct and that power is present on the instrument terminals.</li> <li>3. Check that the input source(s) is correct and that it changes magnitude between zero and full scale values when so adjusted.</li> <li>4. If the output is a current signal (4-20 ma, etc.), make sure the output loop is complete and that the correct meter range is selected.</li> </ol> |
|-----------|---|

All external checks are complete. Problem seems to be internal.

The following information is provided for a qualified technician or serviceman as check points for use in internal troubleshooting.

<u>CHECKPOINT/ COMPONENT</u>	<u>VOLTAGE/RANGE</u>
(across) C20	26 $\pm$ 4 vdc
Term 1(-) to $E_2(+)$	12 $\pm$ 0.6 vdc
Term 1(-) to $E_1(+)$	-12 $\pm$ 0.6 vdc
Term 1(-) to pin 19 of $Z_4(+)$	9.4 $\pm$ 0.5 vdc

## 8.0 TABLES, OUTLINES/MOUNTING

**INPUT TABLE**

OUTPUT SIGNAL FULL SCALE	INPUT SHUNT RI
50 ma dc	100 ohm, 1/2 W
20 ma dc	250 ohm, 1/2 W
10 ma dc	499 ohm
1 ma dc	4.99K ohm
10 vdc	See Note 1
5 vdc	Out

NOTE 1: R69 = 150K, R46 = 100K,  
RI = out

**RAMP TIME TABLE**

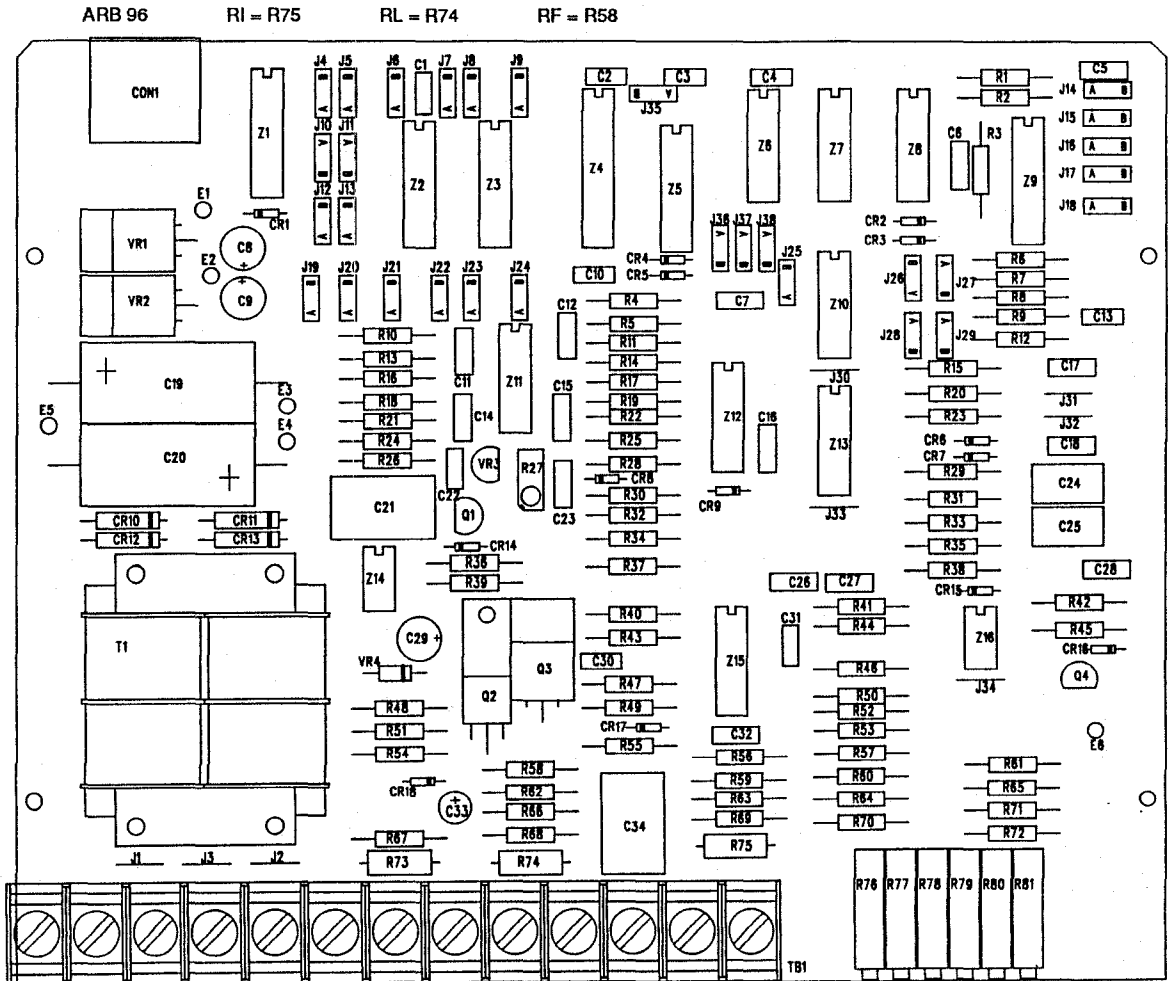
RAMP TIME (T) FULL SCALE	NB	J14	J15	J16	J18
0.160 - 0.32 sec.	1	B	B	B	B
0.320 - 0.64 sec.	2	B	B	B	A
0.64 - 1.28 sec.	4	B	B	A	B
1.28 - 2.56 sec.	8	B	B	A	A
2.56 - 5.12 sec.	16	B	A	B	B
5.12 - 10.24 sec.	32	B	A	B	A
10.24 - 20.48 sec.	64	B	A	A	B
20.48 - 40.96 sec.	128	B	A	A	A
0.67 - 1.33 min.	256	A	B	B	B
1.33 - 2.66 min.	512	A	B	B	A
2.66 - 5.32 min.	1024	A	B	A	B
5.32 - 10.64 min.	2048	A	B	A	A
10.64 - 21.30 min.	4096	A	A	B	B
21.30 - 42.60 min.	8192	A	A	B	A
42.60 - 85.2 min.	16,384	A	A	A	B
85.2 - 170.0 min.	32,768	A	A	A	A

NOTE B: A & B are two selectable positions of a jumper.

**OUTPUT TABLE**

OUTPUT SIGNAL FULL SCALE	OUTPUT SHUNT RL	FEEDBACK RES RF
50 ma dc	NONE	20 ohm
20 ma dc	NONE	49.9 ohm
10 ma dc	NONE	100 ohm
1 ma dc	NONE	1K ohm
10 vdc	604 ohm, 1/4 W	49.9 ohm
5 vdc	250 ohm, 1/2 W	49.9 ohm

NOTE A: Components as shown may or may not be present on the p.c. board due to design updates or options.



## 9.0 SPECIFICATIONS

### INPUT SIGNALS

- 4-20 ma dc (Z in 250 ohms)
- 10-50 ma dc (Z in 100 ohms)
- 0-1 ma dc (Z in 5K ohms)
- 0-10 ma dc (Z in 500 ohms)
- 1-5 vdc (Z in 10 megohms)
- 0-5 vdc (Z in 10 megohms)
- 0-10 vdc (Z in 100K ohms)
- Other zero based current and voltages available
- Low impedance current inputs, 1/10 standard (Option I 18)

### OUTPUT SIGNALS/OUTPUT DRIVE

	AC Power	DC Power
a. 4-20 ma dc	0-1000 ohms max.	0-900 ohms max.
b. 10-50 ma dc	0-400 ohms max.	0-350 ohms max.
c. 0-1 ma dc	0-20,000 ohms max.	0-18,000 ohms max.
d. 1-5 vdc	250 ohms Z out	250 ohms Z out
e. 0-10 vdc	500 ohms Z out	500 ohms Z out

Or zero based in the same ranges. Other voltage and currents optional.

### PERFORMANCE

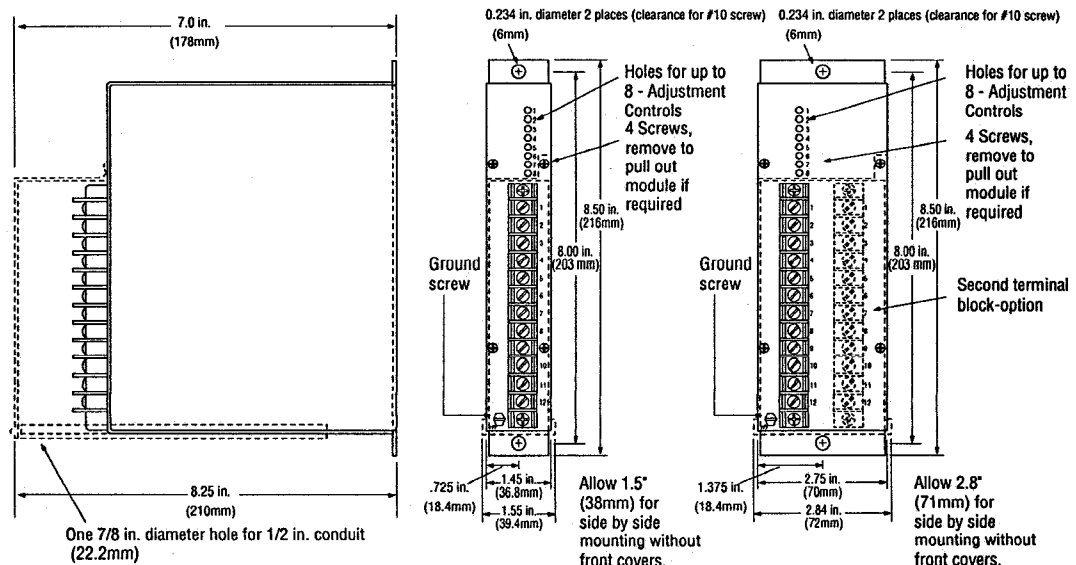
- Calibrated Accuracy:**  $\pm 0.1\%$
- Linearity:**  $\pm 0.1\%$  maximum,  $\pm 0.04\%$  typical
- Repeatability:**  $\pm 0.05\%$  maximum
- Temperature Stability:**  $\pm 0.01\%/^{\circ}\text{F}$  maximum,  $\pm 0.004\%/^{\circ}\text{F}$  typical
- Load Effect:**  $\pm 0.01\%$  zero to full load
- Output Ripple:** 10 mv P/P maximum
- Response Time:** 150 milliseconds
- Temperature Range:**  $0^{\circ}$  to  $140^{\circ}\text{F}$  ( $-18^{\circ}$  to  $60^{\circ}\text{C}$ ) operating  
 $-40^{\circ}$  to  $185^{\circ}\text{F}$  ( $-40^{\circ}$  to  $85^{\circ}\text{C}$ ) storage
- Power Supply Effect:**  $\pm 0.05\%$  for a  $\pm 10\%$  power variation

Note: All accuracies are given as a percentage of span

### POWER

- 115 vac:  $\pm 10\%$ , 50/60 Hz, 3 watts, 0.7 Pf (standard)
- 24 vdc:  $\pm 10\%$  isolated, 3 watts (Option P2)
- 48 vdc:  $\pm 10\%$  isolated, 3 watts (Option P3)
- 125 vdc: Nominal (105-140 vdc) isolated, 3 watts (Option P4)
- 230 vac:  $\pm 10\%$ , 50/60 Hz, 3 watts, 0.7 PF (Option P5)

## 10.0 OUTLINE & MOUNTING





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# AXB 53 Non-Isolated Analog Multiplier Module Instruction Manual

## 1.0 INTRODUCTION

These instructions refer to the above model. Supplementary sheets are attached if the unit has special options or features. For detailed specifications, see page 4 or refer to the Data Bulletin. All ADTECH instruments are factory calibrated and supplied with a label detailing the calibration. Adjustments are normally not necessary. A simple check should be performed to verify calibration before installation to ensure that it matches the field requirement.

## 2.0 GENERAL DESCRIPTION

The ADTECH AXB 53 is a Non-Isolated Multiplier Module that accepts two process input signals of 1-5 vdc or 4-20 ma dc multiplying one by the other ( $K AB = D$ ) and provides a single control signal output such as 4-20 ma dc representing the computation. Option 0 44 provides an additional pulse output. Power Option P 1 Non-Isolated 24 vdc provides negative output signal and negative DC power common rail connection. The output is a true current source and provides process signals such as 4-20 ma, 0-1 ma, 0-10 ma, 1-5 ma and 10-50 ma dc or alternatively, a voltage signal of 5 vdc full scale. Other current and voltage **Inputs/Outputs (I/O)** are available as specified on the Data Bulletin.

## 3.0 INSTALLATION

The instrument is supplied in a general purpose enclosure as standard. NEMA 4, 7 or 12 and plug in chassis enclosures are optionally available. Installation area/location must agree with the supplied instruments including operating temperature and ambient conditions.

### Mounting

Refer to the appropriate outline drawing for mounting and clearance dimensions. The instrument is surface mounted with two #10-32 screws on 8.00 inch centers.

### Electrical Connections

The wire used to connect the instrument to the control system I/O should be a twisted pair(s) and sized according to normal practice. Shielded cable is not normally necessary (if used, the shield must be grounded at the input negative of the ADTECH instrument and left floating at the sensor).

A 12 position barrier terminal block with #6-32 screws and 3/8" spacing is provided for I/O and power connection. A housing ground terminal marked G is also provided.

### Controls

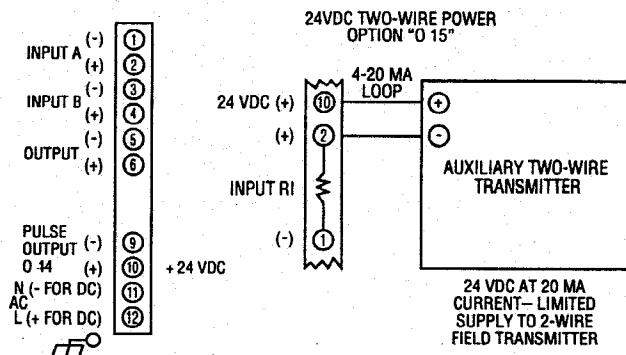
Multiturn OUTPUT ZERO, KA, KB, ZA, ZB and Optional RATE controls are provided to calibrate the instrument. The multiturn controls are accessible through the instrument front panel and are clearly marked for ease of use. Two Internal INPUT SPAN multiturn controls are also provided.

## 4.0 MAINTENANCE

These instruments are electronic and require no maintenance except periodic cleaning and calibration verification. If the unit appears to be mis-operating it should be checked as installed per section 6.0 or removed for a bench check per sections 6.0-7.0. MOST problems are traced to field wiring and/or associated circuits. If the problem appears to be with the instrument, proceed to sections 6.0 and 7.0.

## 5.0 CONNECTIONS

Standard connections are shown below and on the instrument face plate, Data Bulletin or on attached supplementary sheets.



## 6.0 CALIBRATION

To perform a calibration check or re-calibration of the instrument follow this procedure.

- A. Carefully remove the instrument from its housing to gain access to the PCB components, observing normal safety and equipment precautions.
- B. Make sure the I/O wiring is properly connected and that the correct power source per the label is also connected. The instrument must be at normal power for a minimum of 2 minutes before proceeding to C.
- C. The input signal source(s) must be adjustable from 0 to 100% in steps of 10% or at least 25%. The source(s) should be either precalibrated or an accurate meter must be used to monitor the input(s).
- D. The output may be monitored either as a direct voltage for a voltage output signal or as a current that can be represented as a voltage across a resistor shunt.
- E. Set input source A to the minimum calibrated input and adjust the multiturn potentiometer marked ZA to provide 0.000 vdc from TP1 to Terminal #1.
- F. Set input source A to the maximum value and adjust the internal multiturn potentiometer R32 to provide 0.000 vdc from TP1(+) to VREF(+). Also adjust the multiturn potentiometer marked KA fully CW.
- G. Repeat E and F until within  $\pm 0.005$  V.
- H. Set input source B to the minimum calibrated input and adjust the multiturn potentiometer marked ZB to provide 0.000 vdc from TP2(+) to Terminal #1(-).
- I. Set input source B to the maximum value and adjust the internal multiturn potentiometer R29 to provide 0.000 vdc from TP2(+) to VREF(+). Also adjust the multiturn potentiometer marked KB fully CW.
- J. Repeat G and H until within  $\pm 0.005$  V.
- K. Set input sources A and B at the minimum input value and adjust the multiturn potentiometer OUT-ZERO to provide the minimum calibrated output  
e.g.)  $4.00 \pm 0.01$  ma dc
- L. Set input sources A and B at the maximum input values and adjust the multiturn potentiometer marked KA to provide the maximum calibrated output  
(e.g.)  $20.00 \pm 0.01$  ma dc
- M. The unit should now be checked for linearity as follows:
  1. Set input source B to the maximum input and check the output by changing the input source A. The output should follow the input A linearly.
  2. Set input sources A at the maximum and check the output by changing the input source B. The output should follow the input linearly.
- N. This completes the calibration.

## 6.1 PULSE OUTPUT

If the AXB 53 has been supplied with Option O 44 pulse output refer to O 44 Supplement sheet for calibration details.

## 7.0 FIELD TROUBLE SHOOTING GUIDE

This section offers a simple, first level trouble-shooting aid for an apparent instrument malfunction.

<u>SYMPTOM</u>	<u>CORRECTIVE ACTION</u>
No output	<ol style="list-style-type: none"><li>1. Check the input and output connections carefully.</li><li>2. Check that the power supply polarity is correct and that power is present on the instrument terminals.</li><li>3. Check that the input source(s) is correct and that it changes magnitude between zero and full scale values when so adjusted.</li><li>4. If the output is a current signal (4-20 ma, etc.), make sure the output loop is complete and that the correct meter range is selected.</li></ol>

All external checks are complete. Problem seems to be internal.

The following information is provided for a qualified technician or serviceman as check points for use in internal troubleshooting.

<u>CHECKPOINT/ COMPONENT</u>	<u>VOLTAGE/ RANGE</u>
(across) C25	$26 \pm 4$ vdc
(across) C29	$12 \pm 0.6$ vdc
(across) VR1	$6.9 \pm 0.35$ vdc
(across) R26	0.2 - 1 vdc

## 8.0 TABLES, PCB LAYOUT

### INPUT TABLE

INPUT SIGNAL FULL SCALE	INPUT SHUNT RI
50 ma dc	100 ohm, 1/2 W
20 ma dc	250 ohm, 1/2 W
10 ma dc	499 ohm
1 ma dc	4.99K ohm
10 vdc	See Note 1
5 vdc	None

All selected resistors are 1%, M.F.,  
1/4 W, 50 PPM, unless otherwise noted

NOTE 1: R61, R64 = 110 K, R60, R62 = 100 K

NOTE 2: Delete R51, R57 for true zero inputs

### OUTPUT TABLE

OUTPUT SIGNAL FULL SCALE	OUTPUT SHUNT RL	FEEDBACK RES RF
50 ma dc	NONE	20 ohm
20 ma dc	NONE	49.9 ohm
10 ma dc	NONE	100 ohm
1 ma dc	NONE	1K ohm
10 vdc	604 ohm, 1/4 W	49.9 ohm
5 vdc	250 ohm, 1/2 W	49.9 ohm

All selected resistors are 1%, M.F., 1/4 W, 50 PPM, unless otherwise noted.

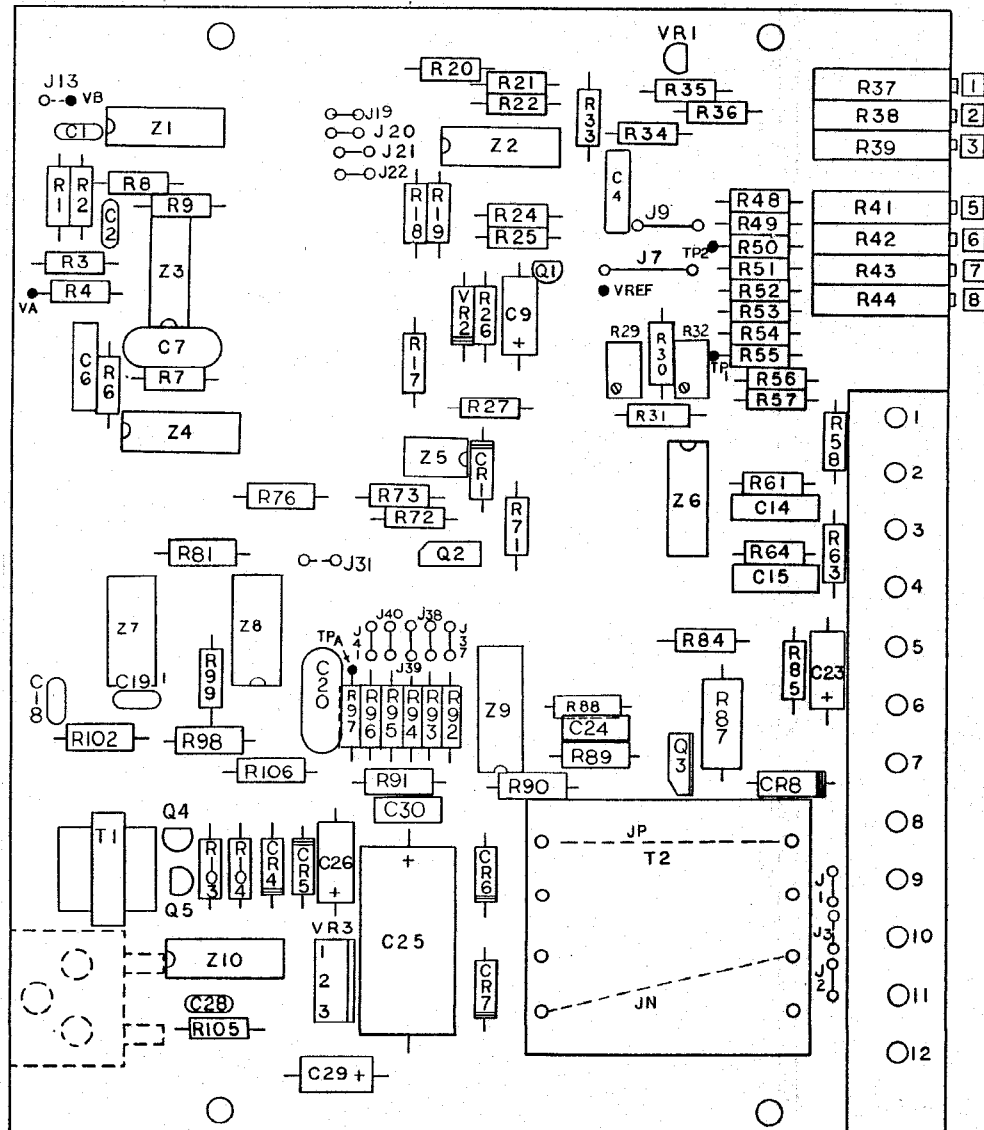
NOTE A: Components as shown may or may not be present on the p.c. board due to design updates or options.

AXB 53

RI = R58, 63

RL = R85

RL = R29



## 9.0 SPECIFICATIONS

### INPUT/OUTPUT

#### INPUT SIGNALS

- 4-20 ma dc (Z in 250 ohms)
- 10-50 ma dc (Z in 100 ohms)
- 0-1 ma dc (Z in 5K ohms)
- 0-10 ma dc (Z in 500 ohms)
- 1-5 vdc (Z in 10 megohms)
- 0-5 vdc (Z in 10 megohms)
- 0-10 vdc (Z in 100K ohms)
- Other zero based current and voltages available
- Low impedance current inputs, 1/10 standard (Option I 18)

#### OUTPUT SIGNALS/OUTPUT DRIVE

	AC Power	DC Power
a. 4-20 ma dc	0-1000 ohms max.	0-900 ohms max.
b. 10-50 ma dc	0-400 ohms max.	0-350 ohms max.
c. 0-1 ma dc	0-20,000 ohms max.	0-18,000 ohms max.
d. 1-5 vdc	250 ohms Z out	250 ohms Z out
e. 0-10 vdc	500 ohms Z out	500 ohms Z out

Zero based current and voltages in the above ranges are standard (e.g.) 0-20 ma, 0-5 vdc. Other voltage and currents optional.

#### PERFORMANCE

- Calibrated Accuracy:**  $\pm 0.1\%$
- Linearity:**  $\pm 0.1\%$  maximum,  $\pm 0.04\%$  typical
- Repeatability:**  $\pm 0.05\%$  maximum
- Temperature Stability:**  $\pm 0.01\%/^{\circ}\text{F}$  maximum,  $\pm 0.004\%/^{\circ}\text{F}$  typical
- Load Effect:**  $\pm 0.01\%$  zero to full load
- Output Ripple:** 10 mv P/P maximum
- Response Time:** 150 milliseconds
- Temperature Range:**  $0^{\circ}$  to  $140^{\circ}\text{F}$  ( $-18^{\circ}$  to  $60^{\circ}\text{C}$ ) operating  
 $-40^{\circ}$  to  $185^{\circ}\text{F}$  ( $-40^{\circ}$  to  $85^{\circ}\text{C}$ ) storage
- Power Supply Effect:**  $\pm 0.05\%$  for a  $\pm 10\%$  power variation

Note: All accuracies are given as a percentage of span

#### POWER

- 115 vac:  $\pm 10\%$ , 50/60 Hz, 3 watts, 0.7 Pf (standard)
- 24 vdc:  $\pm 10\%$  non-isolated, 3 watts (Option P1)
- 24 vdc:  $\pm 10\%$  isolated, 3 watts (Option P2)
- 48 vdc:  $\pm 10\%$  isolated, 3 watts (Option P3)
- 125 vdc: Nominal (105-140 vdc) isolated, 3 watts (Option P4)
- 230 vac:  $\pm 10\%$ , 50/60 Hz, 3 watts, 0.7 PF (Option P5)

## 10.0 OUTLINE & MOUNTING

