INSTRUCTION MANUAL

B2A COMPACT
Thermocouple Vacuum Instrument

Part # : 2-3014-042

TELEVAC
A DIVISION OF THE FREDERICKS COMPANY
2400 PHILMONT AVENUE
HUNTINGDON VALLEY, PA 19006

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I- Description

The Model B2A Compact gauge is an analog display thermocouple type instrument that will monitor pressures between 1 micron and 20,000 microns

The vacuum measuring system consists of an instrument, an interconnecting cable, a power cable and a thermocouple gauge tube which senses the vacuum. The measured vacuum is displayed on an analog meter. An output voltage of 0 to 10 volts (or optional mV) is available on the back panel.

(See Figure 1 and Figure 2).

FIGURE 1 – FRONT PANEL

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FIGURE 2 – REAR PANEL

II – PRINCIPLES OF OPERATION

The 2A thermocouple gauge tube consist of a metal shell containing a filament heated by a constant current. A thermocouple is welded to a conduction bridge at the center of this heater element, thereby providing a means of directly measuring the bridge temperature (Figure 3).

The temperature of the bridge increases as the air is removed from the system since, with less air available, there is a reduced cooling effect. Since a thermocouple's voltage increases temperature, the signal from the sensor increases as the pressure in the system is reduced. Thus, at the low end of the instrument's pressure range (i.e. 1 micron), the thermocouple signal is maximum. Conversely, at the higher end of the pressure range (i.e. 20,000 microns) the increased cooling effect of the gas in the vacuum system produces a lower output from the thermocouple element. The driving voltage to the meter and to the "voltage" output, therefore, also increases with a reduction in pressure. (See Figure 4).

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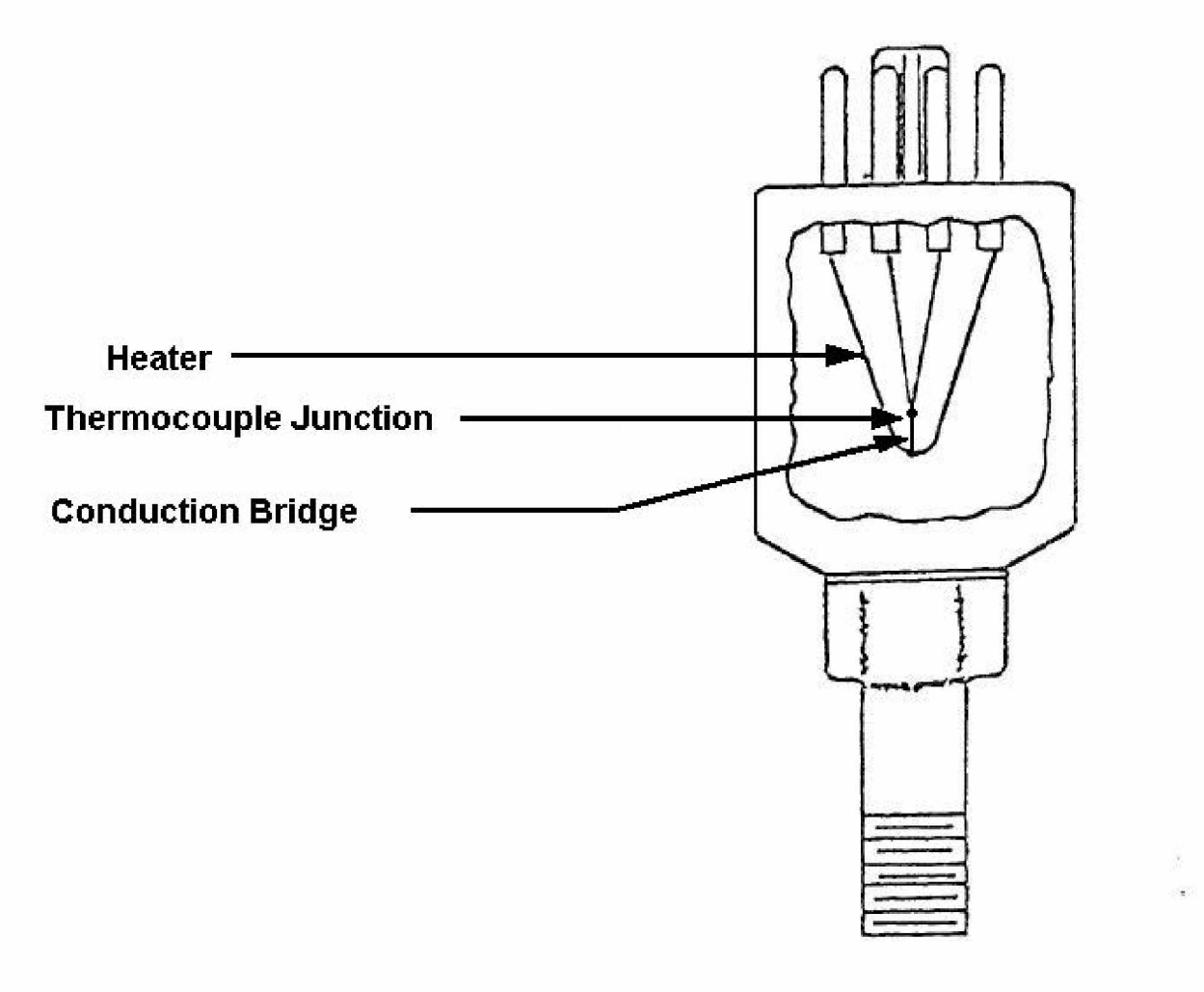

FIGURE 3 – THERMOCOUPE GAUGE TUBE

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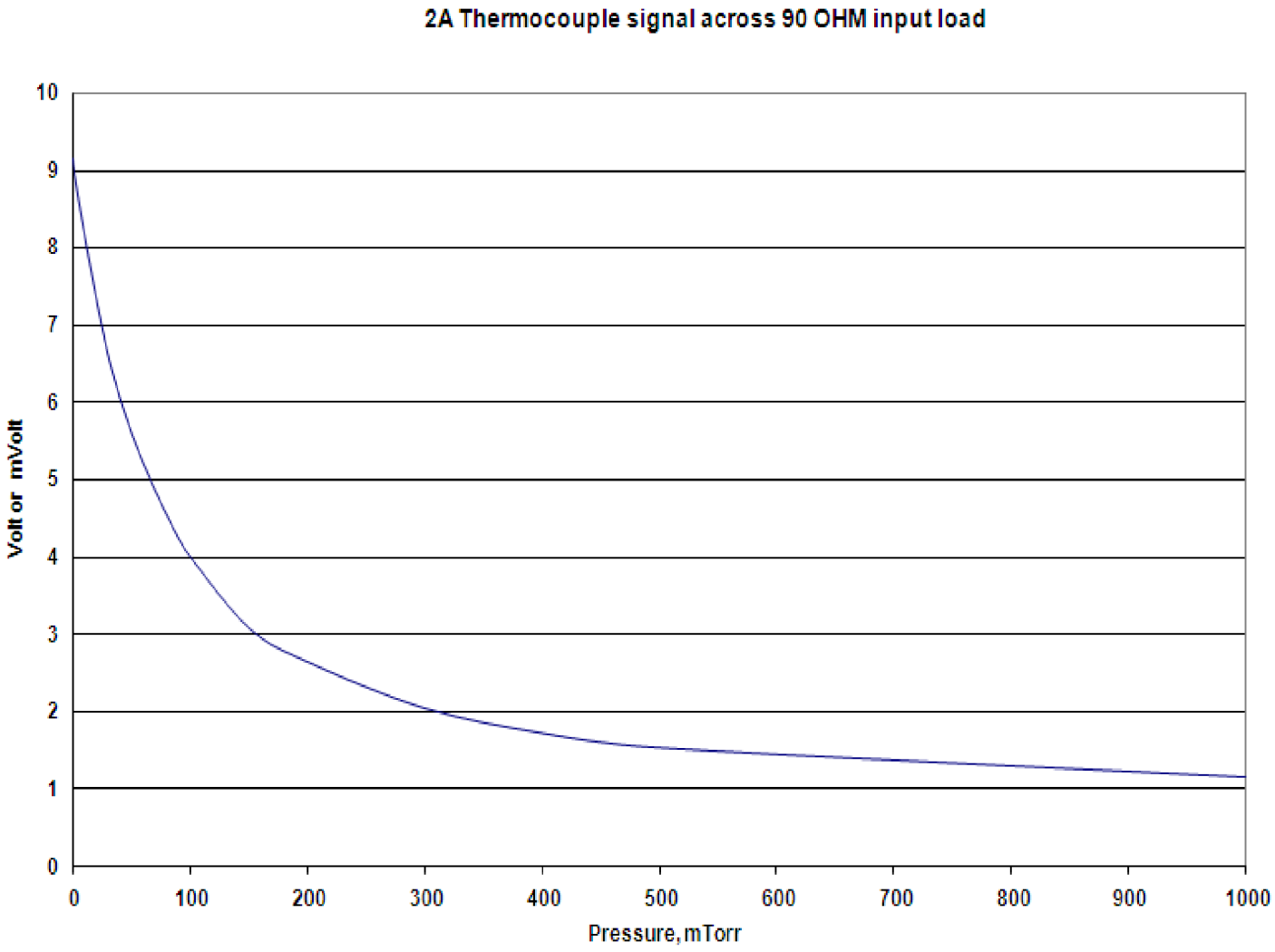

FIGURE 4 – ANALOG OUTPUT

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III. THERMOCOUPLE TYPE VACUUM SENSOR

All thermocouple elements are pre-oxidized under controlled conditions to provide interchangeability of tubes without the need for recalibration. In addition, this process provides high stability and minimizes the effect of contamination. The amplified non-linear analog thermocouple signal is displayed on a meter scale calibrated directly in microns. The meter scale provides the highest resolution at the lower end (1 to 500 microns) of the pressure range.

IV. OPERATION

The instrument may be panel mounted in any convenient location, provided it is not subject to excessive vibration. The “normal care” associated with analog meter type equipment should be taken into consideration.

Gauge tubes should be mounted on the vacuum system in a vertical position, open end extending downward, with the threaded joint thoroughly coated with an acceptable vacuum sealant. Optional mountings (using “O” ring compression fittings) are available.

To prepare for operation, connect the sensor cables between the thermocouple tube and the rear of the instrument. Observe the pin orientation on the gauge tube and the mating connector to assure proper operation. Push the cable connector into the instrument’s mating jack and then slip the spade lug for the shield under the ground screw and tighten.

The standard instrument is factory calibrated to a ten foot cable, unless a special cable length is specified at time of order. To ensure proper operating conditions, it is necessary to use factory manufactured cables, since all cables contain temperature compensation components. Cable length may affect the calibration of the vacuum measurement, especially if cable lengths are extended over 50 feet. Refer to the Appendix for calibration procedures.

Contamination of the gauge tube, caused by the process occurring in the vacuum vessel, is a critical factor affecting the measurement of high vacuum. Depending upon the degree of contamination and the accuracy required, it is recommended that sensor tubes be periodically replaced and that thermocouple tube filters (with line of sight baffles) be used to protect these gauge tubes.

Typically the gauge tubes incorporate a 1/8” National Pipe Thread (1/8” NPT) fitting for connection to the vacuum system. Other mounting configurations are available.

Once the cables are connected between the rear panel of the instrument and the thermocouple sensors, the power can be turned on. After the electrical power is applied, the instrument will require a warm-up period of fifteen minutes to stabilize the electronics before accurate readings are achieved. Very little maintenance is required to keep the unit in operation.

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The instrument may be turned on at any time, since atmospheric pressure will not harm the gauge tube elements or cause overdrive on the metering circuit.

The indicating meter will measure the system pressure correctly between 1 and 20,000 microns. Instruments are calibrated to read correctly for dry air or nitrogen.

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V. MAINTENANCE OF THE INSTRUMENT IN SERVICE

The vacuum measuring gauges, if installed properly, require very little maintenance under normal operating conditions. If the unit should cease to operate properly, certain checks can be made:

1. If a thermocouple gauge tube simulator is available it can be used.
   The thermocouple gauge tube simulators are designed to be used as a check to see if the T/C cable and the T/C instrument are working properly.

   To use the simulator, disconnect the cable from the T/C tube and plug the thermocouple gauge tube simulator in its place. Check the meter reading of the instrument, it should correspond to the pressure that is written on the thermocouple gauge tube simulator's label. The 2A simulator has a blue label and is marked for use with the 2A. Although no maintenance is required to keep the T/C tube simulator in working condition, a periodic check should be done against a calibrated standard unit.

2. If you do not have a thermocouple simulator tube, it is still possible to check the operation of the instrument if you are able to reduce the system pressure to 10^{-5} Torr. At this pressure, the thermocouple gauge should read at the "red line" to the left of the scale. if desired, a minor calibration adjustment can be made as shown on Page 9 . If instrument still appears to respond incorrectly, a new gauge tube should be substituted to restore the instrument to proper operation.

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VI. CALIBRATION

All instrumentation is calibrated at the factory. No further calibration at the customer's facility should be required.

For a reliable recalibration at a later date, it is necessary to have a reference standard vacuum system whose pressure is known to be accurate. For such a calibration, the instrument, sensor tube and cable should be returned to the factory for recertification. However, if the vacuum calibration verification must be done at the customer's facility, equipment of certifiable accuracy should be operated by a knowledgeable vacuum technician.

NOTE: For calibration procedures see the Appendix.

VII. CALIBRATION VERIFICATION

1. Connect sensor to the known vacuum source.
2. Plug unit into 115VAC. Allow 15 minutes' warm-up.
3. Pump the system down to high vacuum. At 10^{-5} Torr verify that the T/C gauge reads

   At the "red line" which is just left of the 1 micron mark. If not, adjust the heater

   Adjust potentiometer on the rear panel.
4. Make a comparison table of indicated pressure on the instrument to that of the

   Reference vacuum standard. The comparisons should be made typically at "0". (red line) 10, 100, and 400 microns.

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VIII. TROUBLESHOOTING

Troubleshooting of the circuit or components is similar to any industrial electrical equipment, i.e., checking for circuit continuity, shorts, grounds, resistor values, etc.

Generally, those familiar with electrical equipment should have no difficulty locating faults in either gauge or meter unit by systematically proceeding through the circuit. The enclosed diagram should facilitate maintaining the instrument. In order to troubleshoot the unit, your gauge tube and cable must be in working condition and plugged into the unit.

NOTE: If, after doing some or all of the above, the unit is still inoperative, return to the factory for repair.

IX. SPECIFICATIONS

Range	1 – 20,000 microns
Calibration medium	Dry air
Oper. Temp. (tube)	-1 degree to +65degrees Celsius
Power	115VAC ± 10% or 230VAC ± 10%
Frequency	60 Hz or 50 Hz
Fuse	3/8 Amp slow-blow
Display	1 Ma Pivot & Jewel Meter
Weight (instrument)	5 lbs. max.

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X. Dimensions (See Figure 6 below)

FRONT PANEL WITH BEZEL	MM	INCHES
Height	101	3.98
Width	129.5	5.10
Mounting Screws	#6-32	#6-32
CASE BEHIND BEZEL		
Barrel Diameter	70	2.75
Depth		
Excluding connectors	117.6	4.63
Including connectors	159 (approx.)	6.25

PANEL CUTOUT (See Figure 6 below)

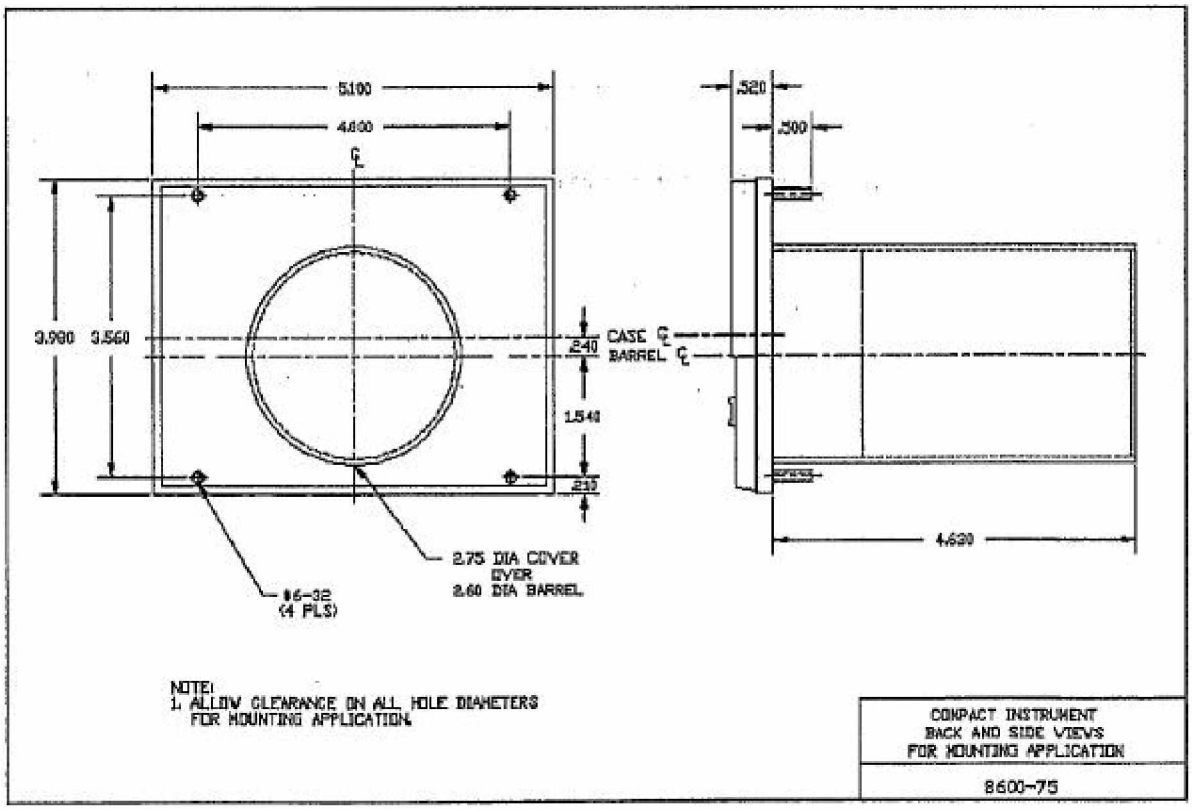

FIGURE 5 – DIMENSIONS AND PANEL CUTOUT

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XI. UNPACKING AND INSPECTION

Before each unit is installed or operated, a quick inspection should be performed and the following noted:

a. Damage to the case or front panel (scratches, nicks, dents, cracks, etc.)

b. Missing: screws, switches or switch hardware.

c. Broken barrier strips, etc.

d. Broken or loose components within instrument

Should any of the above problems be encountered, contact the factory immediately. Any

Unauthorized repairs will void the warranty.

XII. WARRANTY INFORMATION

The Fredericks Company warrants all instruments and instruments and components to be free of defects in materials and workmanship. Our obligation under this warranty is limited to servicing or adjusting any instrument returned to us and replacing any part, except those specifically exempt from this guarantee, which shall, within one year after delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination should disclose to our satisfaction to have been defective. Those portions specifically exempt from this guarantee are gauge tubes and batteries as well as meters which have been disassembled or physically damaged. The factory does not assume any other obligation than that stated in this warranty nor does it authorize any person to assume for them any other liability in connection with the sale, service or use of these instruments.

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XIII – CALIBRATION AND REPAIR

CALIBRATION PROCEDURE

1. With the power disconnected and the instrument on a solid, vibration-free surface, adjust the mechanical zero using the black screw centered under the logo. Adjust until the indicator lines up with the line at the right hand side of the scale. (See Figure 1).

Power cable into a power Plug the source, turn the instrument on and allow it to warm up for 15 minutes

2. Connect the thermocouple sensor to a vacuum system with a calibrated high vacuum sensor attached and evacuate the system to 1 x 10^{-5} Torr or lower. Connect the instrument under test to the thermocouple sensor using the cable specified (normally 10 feet)

3. Next adjust the heater adjust potentiometer to give a “red line” reading on the meter scale. (See Figure 2)

Note: For instruments equipped with recorder output; check recorder output voltage. It Should be 10V (or optionally 10mV).

4. Connect the thermocouple sensor (gauge tube) to a vacuum system with a calibrated high vacuum sensor attached and evacuate the system to 1 x 10^{-5} Torr or lower. Connect the instrument under test to the thermocouple sensor using the cable length specified (normally 10 feet)

5. Connect a digital voltmeter to recorder output terminals. Adjust the external heater adjust potentiometer to give 10V.

6. Next adjust the meter span potentiometer to give a “red line” reading on the meter scale.

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