SYSTEM ALARM/LN_2 MONITOR
Model 1786

Instruction Manual
January, 1980

CANBERRA INDUSTRIES, INC.
45 Gracey Avenue
Meriden, Connecticut 06450

Telephone: (203) 238-2351

Table of Contents

SYSTEM ALARM/LN_2 MONITOR
Model 1786

Section 1

INTRODUCTION

The Model 1786 LN_2 Monitor protects LN_2 cooled detector systems against accidental warm-up by monitoring liquid level in the dewar and providing audible and visual warning of low liquid level.

These units have provisions for turning off detector bias when an alarm condition occurs to protect detector and electronics from damage. In the case of low LN_2 level, shutdown does not occur until at least 20 minutes after the condition is sensed, in order that on-going analyses be allowed to continue without interruption.

Section 2

SPECIFICATIONS

2.1 INPUTS

LN_2 DETECTOR	Rear panel BNC connector accepts input signal from remote sensing element which is supplied with the unit.
CONTROLLED AC INPUT	Rear panel 3-wire line cord input accepts and routes 115 VAC through alarm controlled relay to appropriate instruments in the system such as a Canberra Model 3001A or 3002 High Voltage Power Supply.

2.2 OUTPUTS

AUDIBLE	Front panel buzzer gives audible warning of alarm condition.
LN_2 LEVEL	Front panel indicator light gives warning of alarm condition due to low LN_2 level.
CONTROLLED AC OUTPUT	Rear panel 3-wire 115 volt receptacle provides relay controlled power to associated instrument such as a High Voltage Power Supply.
H.V. CONTROL	Rear panel BNC connector contact closure is grounded during alarm conditions, and is open circuited during normal conditions: provides signal for remote shutdown of Detector Bias Supply.
H.V. OFF INDICATOR	Front panel indicator lamp lights when the controlled circuit and H.V. Control outputs are disabled.

2.3 CONTROLS

SETUP-ACTIVATE	Front panel toggle switch which disables high voltage (in setup position) to allow setup and checkout of alarm circuits without damage to associated equipment. Also disables the buzzer and the 115 VAC output.
LN_2 LEVEL	Front panel lighted pushbutton switch which is depressed to clear alarm once alarm situation is corrected.

2.4 CONNECTORS

LN_2 SENSOR INPUT, H.V. CONTROL	Rear panel, BNC, UG-1094/U.
CONTROLLED AC INPUT	Rear panel, 5 foot 3-wire line cord.
CONTROLLED AC OUTPUT	Rear panel, 3-wire 115 VAC power outlet.

2.5 POWER REQUIREMENTS

+24 VDC – 30 mA
- 24 VDC – 0 mA
+12 VDC – 5 mA
- 12 VDC – 5 mA
115 VAC – 30 mA

2.6 PHYSICAL

SIZE

AEC Standard single-width NIM module 1.35 x 8.714 inches (3.43 x 22.13 cm) per TID-20893 (Rev.).

WEIGHT

2.4 lbs. (1.1 kg).

2.7 ACCESSORIES

LN_2 Sensor supplied with unit.

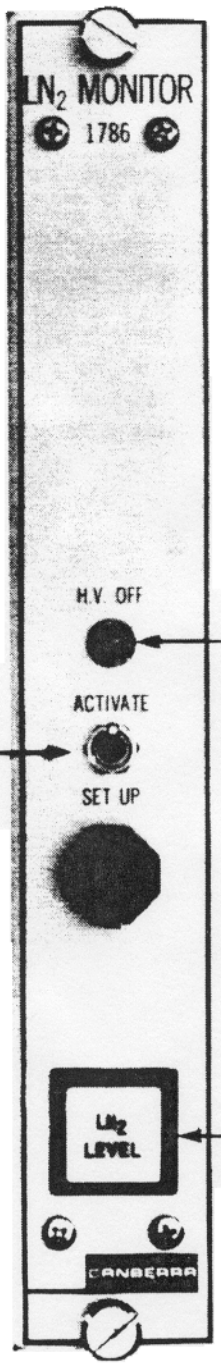
Section 3

CONTROLS AND CONNECTORS

3.1 GENERAL

To obtain a working knowledge of the controls and connectors of the 1786, it is suggested that the user study the explanations given on the front and rear panel drawings in this section before using the instrument.

3.2 FRONT PANEL

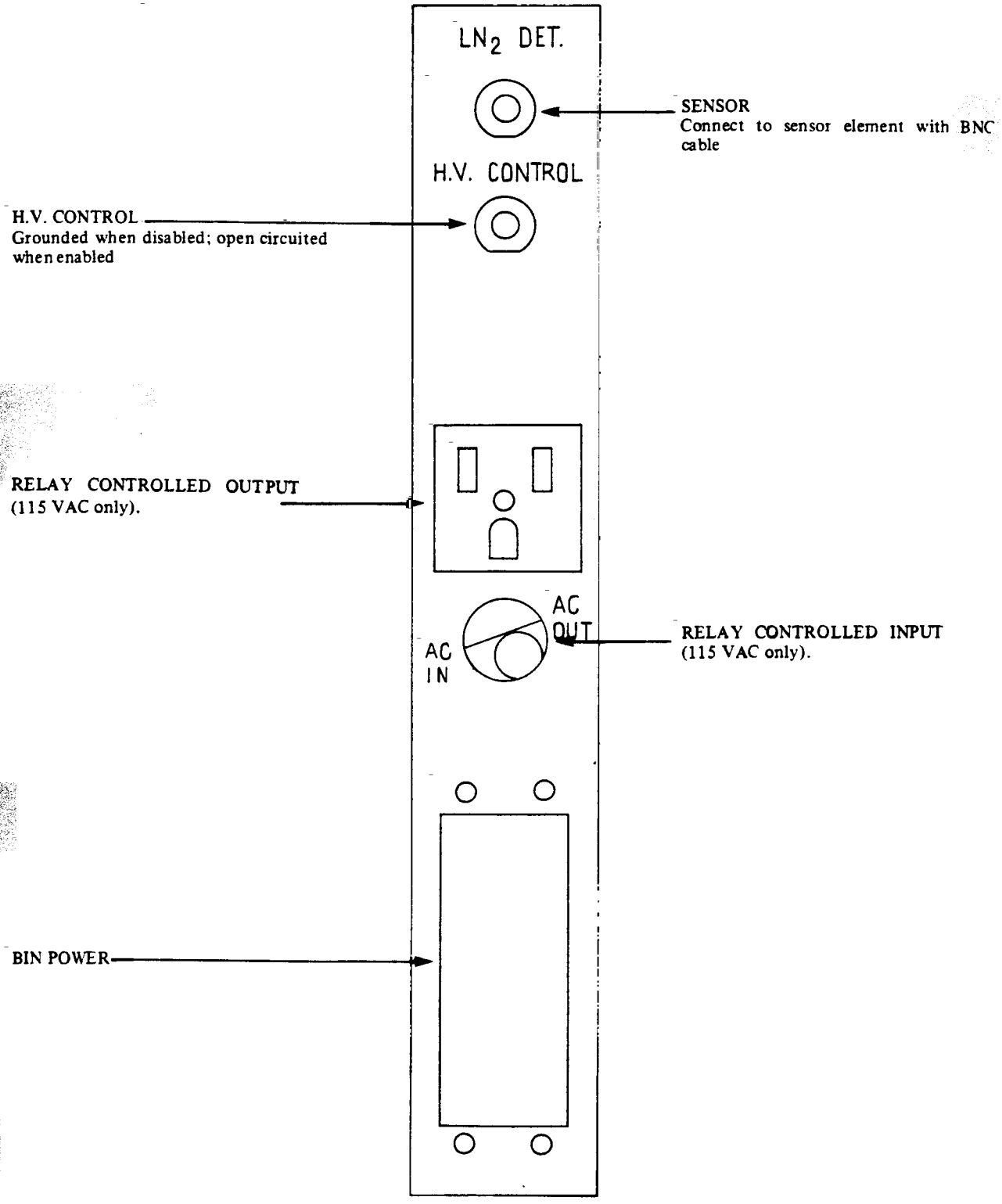


SETUP/ACTIVATE
Setup disables buzzer, controlled output and H.V. Control circuits so that unit can be checked out without distraction to the operator or damage to the detector.

H.V. OFF
Indicator lights when controlled AC and H.V. control circuits are disabled.

LN_2 LEVEL
Pushbutton switch lights when LN_2 level drops below sensor. Depress to reset.

3.3 REAR PANEL



Section 4

OPERATING INSTRUCTIONS

4.1 GENERAL

This section of the instruction manual covers the installation and operation of the instrument.

4.2 INSTALLATION

The Canberra Model 2000 Bin and Power Supply, or other bin and power supply systems conforming with the mechanical and electrical standards set by AEC Report TID-20893 (Rev.), will accommodate the Model 1786. The right side cover of the one width NIM module acts as a guide for insertion of the instrument. Secure the module in place by turning the two front panel captive screws clockwise until finger tight. It is recommended that the NIM bin power switch be OFF whenever the module is installed or removed.

The Model 1786 can be safely operated where the ambient air temperature is between 0°C and +50°C (+120°F maximum). Perforations in the top and bottom sides permit cooling air to circulate through the module. When relay rack mounted along with other "heat generating" equipment, adequate clearance should be provided to allow for sufficient air flow through both the perforated top and bottom covers of the NIM bin.

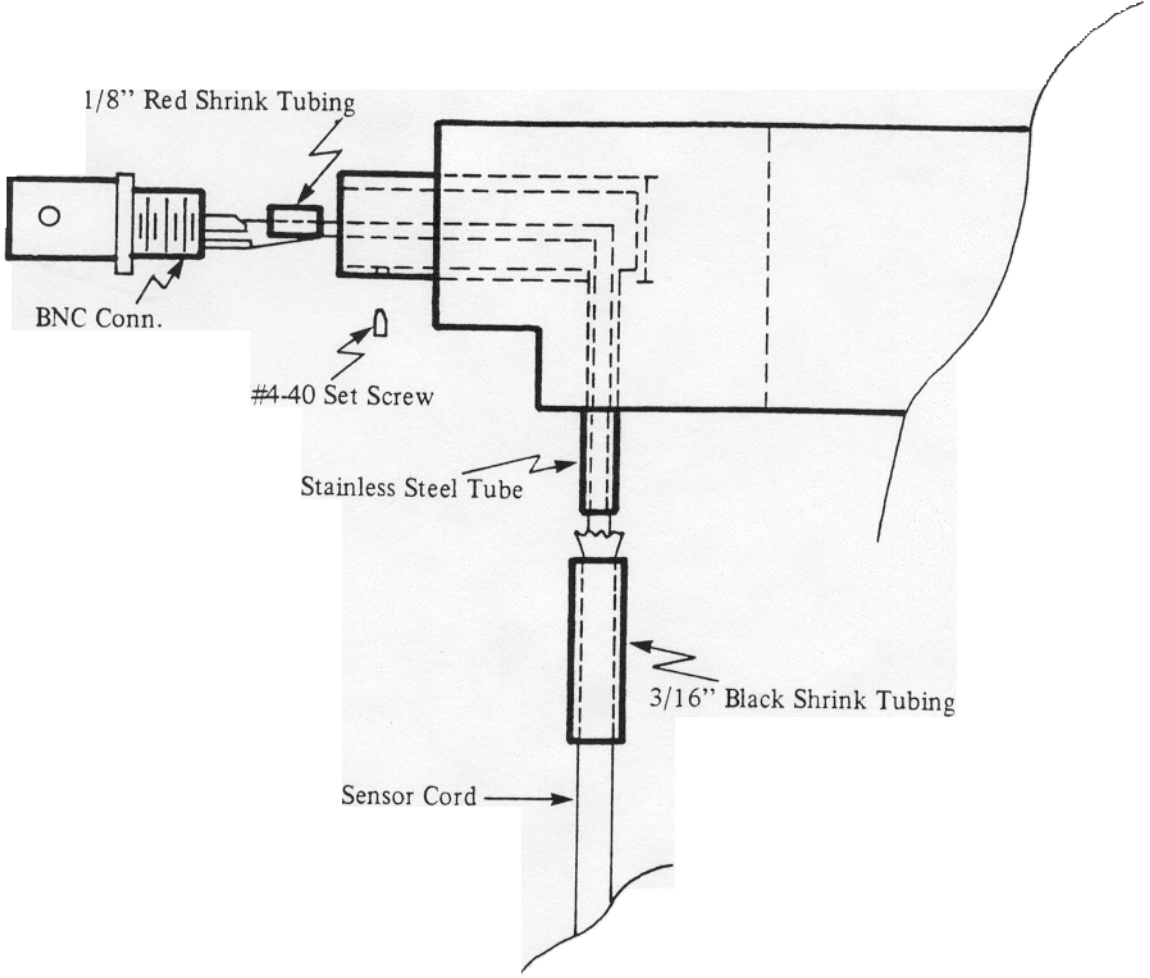
4.2.1 LN_2 MONITOR

The Model 1786 may be used with a variety of Canberra cryostats and with other cryostats as well. If it is supplied with a Canberra detector system or cryostat, the LN_2 sensor will be shipped fully assembled and ready to connect to the instrument with a BNC cable. For dipstick cryostat (Series 7500 and 7600) the sensor is terminated with a BNC connector in the cryostat collar. For integral type cryostats (Series 7900) the sensor dangles from the dewar neck plug and the BNC connector is located in the top of the neck plug.

For other cryostats or for retrofit on Canberra cryostats where information is incomplete, the sensor is supplied unassembled with a length of 20 inches. Suggested assembly instructions are given below.

LN_2 PROBE ASSEMBLY INSTRUCTIONS

1. Cut fiberglass sleeving on sensor cord to length (a length equal to 2/3 of the working liquid level).
2. Slide piece of 3/16" x 1" black heatshrink tubing over sensor cord.
3. Using diagonal cutters, bend out three small barbs on edge of stainless steel tubing.
4. Pull wires through stainless steel tubing.
5. Slide fiberglass sleeving over barbs on stainless steel tubing.
6. Slide black heatshrink tubing over stainless tubing and heat in place.
7. Stretch fiberglass sleeving to straighten wires.
8. Cut wires leaving approximately one inch extending and strip 1/4 inch of insulation.
9. Slide piece of 1/8" x 3/8" red heatshrink tubing over red wire.



10. Solder red wire to center terminal of BNC connector, and yellow wire to outer terminal.

    Slide red heatshrink tubing over center terminal and heat in place.

2. Carefully push BNC connector in place and tighten set screw with Allen wrench provided.

NOTE: For installation in other type collars or cryostats, the customer should improvise using these instructions only as a guide.

After the sensor is installed, connect it to the Model 1786 sensor input with a BNC cable. If the controlled AC output or the H.V. control circuits are to be used then connect one or the other to the instrument being controlled. The H.V. control output is a contact closure ground when disabled and open circuited when enabled. It can control remote shutdown inputs on some H.V. Bias supplies. The Controlled Output is a relay controlled circuit which simply passes whatever is on the controlled input when enabled. This is typically 115 VAC for operating H.V. supplies such as the Canberra 3001A or 3002.

4.3 SET-UP AND CHECK-OUT

1. With the Model 1786 installed as previously described, set the Setup/Activate switch to Setup, turn the detector bias voltage to zero and turn Bin power on in that order.

2. Depress the LN_2 pushbutton and observe that the light goes out, if initially lit.

3. Put the Setup/Activate switch to Activate.

4. Withdraw the sensor from the liquid Nitrogen and position it about 1/2 inch above the surface of the liquid. The warning signal should occur within five minutes.

5. Observe that the controlled output and H.V. Control circuits become disabled after 20 to 30 minutes. (The H.V. Off indicator will light at this time).

6. Put the sensor back into the LN_2.

7. Depress the LN_2 level pushbutton and note that its light extinguishes.

4.4 OPERATION

Having observed the operation of the instrument by going through a checkout in the previous section. the unit is now ready to be put to use. The detector bias voltage can now be set to the prescribed level and the system is functional.

4.5 CALIBRATION AND MAINTENANCE

If the LN_2 probe is changed, the Model 1786 must be re-calibrated.

4.5.1 LN_2 MONITOR CALIBRATION

a. Connect a resistor decade box to the rear panel LN_2 DET BNC.

b. Set the decade box for 5.6 k ohms. Monitor TP1 with a voltmeter and adjust RV3 for an indication of +13.5 volts.

c. Press the LN_2 button, its light should go out.

d. Reduce the resistor decade box until the LN_2 light comes on, slowly increase the resistor decade box in 10 ohm steps until pressing the LN_2 button makes the light go out. Record the voltage a TP1 for use in step f.

e. Remove the resistor decade box from the Model 1786 LN_2 DET input BNC. Connect the LN probe to the LN_2 DET input BNC.

f. Adjust RV3 until the voltage at TP1 is +0.5 volts above the reading in step d.

g. Press the LN_2 button, the light should go out.

h. Repeat Step 4.3.4 to ensure that the unit is functional.

Section 5

THEORY OF OPERATION

5.1 MODEL 1786 LN_2 MONITOR

5.1.1 NORMAL OPERATION

In the following circuit description the terms logic "1" and logic "0" are used to describe the voltage level at the outputs and inputs of the various integrated circuits. A logic "1" is defined as +2.4 volts to +5 volts and a logic "0" is defined as 0 to +0.8 volts, both referenced to ground.

Q8 is a constant current source, the current being adjustable with RV3. The output current generates a bias voltage across the LN_2 detector, forcing Q6 to be cut off. With Q6 cut off, Q5 is also cut off setting A4 pin 9 to a logic "1". At system turn on, pressing the LN_2 switch (S2a) sets A4 pin 10 to a logic "1". The resultant logic "0" at A4 pin 8 cuts Q3 off and forces Q4 on. Transistors Q3 and Q4 are constant current sources used to generate the delayed high voltage turn off function. The constant current generated by Q4 forces the 250 μF capacitor to charge to approximately -14 volts cutting off FET Q2 and setting A3 pin 5 to a logic "1". Since A3 pin 5 and 6 are high, A4 pin 3 is set low. Setting A3 pin 1 to a logic "0" activating the high voltage cutout relay for normal operation. With A4 pin 8 at a logic "0", A4 pin 11 is set to a logic "1" disabling both the LN_2 LEVEL Lamp and buzzer.

5.1.2 LOW LN_2 OPERATION

If the LN_2 level drops, exposing the LN_2 sensor, its resistance will decrease lowering the sensor bias voltage, forcing Q6 to saturate. Q5 will turn on setting A4 pin 8 to a logic "1" and A4 pin 11 to a logic "0". A4a and b will latch up inhibiting A4c until the low LN_2 level is corrected and the system is reset. Since A1 pins 1, 2 and 6 are at logic "0", the buzzer and LN_2 lamp will be activated. With A4 pin 8 set to logic "1", transistor Q4 will cut off and transistor Q3 will turn on. Transistor Q3 is a constant current source which discharges the 250 μF capacitor to ground. The discharging time is approximately 20 minutes, after which Q2 is turned on setting A3 pin 5 to a logic "0", activating the high voltage cutout relay.

When the LN_2 has been replenished and switch S2 is pressed, A4a and b will be reset, enabling A4 pin 10 setting the system back to normal operation. Switch S1 will disable the buzzer and high voltage relay cutout.

In the event of a missing or open LN_2 detector, the voltage drop across the 1.8 k ohm resistor, in the LN_2 detector biasing network, will approach zero volts; turning on Q7. Q7 will turn on Q6 forcing the system to initiate a low LN_2 alarm.