



**Operating Instructions HLG200/210**  
**Issue No.2 July, 1996**

**HLG200/210**

**CRYOGENIC LIMITED**

# OPERATING INSTRUCTIONS

## HLG200/210

### 1. SPECIFICATION

#### 1.1 Probe

Standard probe diameter 2.1mm

Active probe length

- |       |          |          |
|-------|----------|----------|
| (i)   | Type 105 | 550mm )  |
| (ii)  | Type 150 | 1100mm ) |
| (iii) | Type 250 | 1100mm ) |

Overall probe length ) Excluding 28mm top cap  
) length

- |       |          |          |
|-------|----------|----------|
| (i)   | Type 105 | 1050mm ) |
| (ii)  | Type 150 | 1500mm ) |
| (iii) | Type 250 | 1500mm ) |

#### 1.2 Control Unit

Front panel switches      Sample rate switch: MAX-MIN  
Relay control: OFF-AUTO-ON  
Probe select switch: 105 and 150/250  
Illuminated mains ON/OFF

Rear panel connections      Fused mains input  
Probe connector  
Analogue/recorder output (normally set 2V per 1000mm)  
4-20mA available as optional extra  
Control and alarm outputs HLG210 only  
Computer inhibit signal

Fuses                              1 of 20mm x 5mm Anti-surge 250mA -T (220-240 V)  
500mA-T (100-120 V)

Meter                              3.5 digit LED displaying liquid helium depth (mm) at 1mm  
resolution

Accuracy                          +/- 1% FSD +/- 1mm (non-immersed section of sensor element in  
cold gas)

Additional helium consumption (typical values)

<5cc/hour Static  
<10cc/hour Min.rate  
<70cc/hour Max.rate

## **2. GENERAL DESCRIPTION**

The instrument is designed to measure the depth of liquid helium in the storage vessels, cryostats, cryopumps, or wherever an accurate monitor of helium depth is required. It consists of two basic components - a sensor and a control unit. The sensor is housed in a flexible, corrosion-resistant tube and can either be installed permanently in the helium containing vessel, or insert as and when required. The control unit is bench mounted, or can occupy a half standard rack. With dimensions of 88mm high x 196mm wide x 228mm deep, and a weight of 1.1kg, it is easily portable.

Digital readout and analogue/recorder outputs are provided.

A 4-20mA current loop interface is now provided as standard.

In addition, the HLG210 also has an extra back panel socket and circuitry for an adjustable alarm and two control levels. These are set by means of internal adjustment in conjunction with the digital display. Two of the set points drive a 2-pole changeover relay for switching 24 Volts AC at up to 1A. The third point drives an open collector output for purposes such as automatic de\_energisation of two set points, the unit can be used to control an automatic refill system, one level is set to correspond to a full helium reservoir and the other to the low reservoir level. The third point is normally used as an extra low alarm point. The unit can be supplied with an audible alarm as an optional extra.

## **3. PRINCIPLE OF OPERATION**

The sensor consists of a fine wire made from an alloy (NbTi) which has a superconducting transition temperature higher than the boiling point of liquid helium. A small heater wound on the sensor wire is used to ensure that a short section at the top of the wire remains resistive independent of the liquid helium level. The voltage developed across the sensor is then directly proportional to the length of conductor in the helium vapour. This voltage is internally converted to equivalent helium depth and digitally displayed. This operation is pulsed intermittently (see 5.1.2) but there is a continuous digital display.

## **4. PROBES**

The sensor wire are housed in a thin-walled stainless steel tube (overall diameter nominally 2.08mm). Three standard types of probes are available - Types 105, 150 and 250. Special probes, to a different length or external diameter, can be supplied upon request.

### **4.1 Type 105**

This probe is suited for measuring helium depth to a maximum of 550mm and has an overall length of 1050 (excluding top fitting length of 28mm).

### **4.2 Type 150**

This probe is suited for measuring helium depth to a maximum of 1100mm using two identical sections each 550mm long. The overall length of the probe is 1500mm (excluding top fitting length of 28mm). When used with the HLG200 probe gives ranges 0 - 1100mm on '150/250' position, and 0 - 550mm on '105' position.

### **4.3 Type 250**

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This probe is identical in size to the Type 150, but has a single active section of 1100mm and so measures continuously helium depth to a maximum of 1100mm. It is the preferred probe for use with the HLG200/210.

### **N.B.**

Probes must not be activated in vacuum or else the sensor wire will be destroyed. They may, however, be used to measure helium depth in a pumped bath and prove an accurate monitor even for  $T < T_{\lambda}$ .

## **5. CONTROL BOX**

### **5.1 Front Panel**

There are 2 switches on the HLG200 front panel as follows:-

5.1.1 "PROBE" - either 150/250 (0-1100mm), or 105 (0-550mm with 105 or 150 type probes).

5.1.2 "SAMPLE RATE" - MAX.= 3s between pulses MIN.= 120s between pulses

5.1.3 The HLG210 has the following additional switch  
"RELAY" and associated LED  
ON - energises relay and LED  
AUTO - relay turns on when lower level reached and off when higher level reached.  
OFF - de-energises relay and LED

5.1.4 "POWER" ON/OFF (with associated illuminated red neon indicator).

5.1.5 The digital panel meter is a 3.5 digit meter, which displays helium depth from 0 to a maximum of 1999mm with 1mm resolution.

### **5.2 Back Panel**

There are 3 sockets on the back panel as follows:-

5.2.1 "INPUT" - IEC mains input fused socket, the voltage selector for voltages 110, 120, 220 and 240 Volts is located inside the control box.

5.2.2 "PROBE" - A 7-way socket for connection to the probe via the cable provided

5.2.3 "ANALOGUE OUTPUT" - a 3-pin DIN socket for analogue/recorder output. The control unit is supplied complete with plug which can be wired by the operator/user, as required. Pin No.1 is output and Pin No.3 is ground. The output scaling is normally set at 2 Volts per 1000mm. Pin No.2 is used for a 4 - 20mA output if fitted.

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5.2.4 The HLG210 has the following additional 9-way D type socket. Connections are as follows:-

1	N/C1	)
2	C1	)
6	N/O1	) RELAY CONTACTS
7	N/C2	)
8	C2	)
3	N/O2	)
4	+15V (via 100 ohm resistor)	
9	ALARM (open collector, 100mA maximum)	
5	0V	

The relay contacts are not intended for AC line switching. Maximum rated voltage is 24 Volts AC RMS with current rating of 1Amps maximum.

### **5.3 Adjusting 'SET ALARM', 'SET HIGH', 'SET LOW'.**

**CAUTION**- Care should be exercised when carrying out the following procedure as there are DC voltages of up to 65V and AC 240V present within the unit.

- 5.3.1 Remove the mains connector from the rear of the unit. Unscrew one screw from top front panel and the second screw from the top back panel joined by the same extrusion, remove top and side cover. Check that there is no exposed mains wiring before continuing.
- 5.3.2 Connect the mains and switch unit to "ON".
- 5.3.3 On control printed circuit board locate the PCB switch, SW1, and also potentiometers RV1, RV2, and RV3. (a silk screen pattern could be used for easy location of components - drawing provided with this manual)

The PCB mounted switch selects the front panel meter function to display in (mm). The switch position are as follows:-

- 5.3.4 Display "Liquid He level" - set DIP switches to position:
  - 1- towards front panel
  - 2&3 - towards rear panel
- 5.3.5 "Set Alarm" level, all switches towards rear panel, adjust an alarm level by RV3.
- 5.3.6 " Set Low " level, set switch 3 towards front panel and adjust by RV2.
- 5.3.7 " Set High " level, set switch 3&2 towards front panel and adjust by RV3.
- 5.3.8 Reset switches to display "Liquid He Level" (5.3.4) above.
- 5.3.9 Switch "4" is used for enabling an inhibit signal from computer.  
towards rear panel enable.

## **6. FAULT FINDING**

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- 6.1.1 The superconducting wire in the probe has a resistance of approximately 0.170 ohm/mm of active length when at nitrogen temperature, and 0.1688 ohm/min of active length when at about 10K

When the probe resistance is measured in air at room temperature its resistance corresponds to the full active length of the probe.

For type 105: 550mm = 100 ohm  
For type 250: 1100mm = 201 ohm

- 6.1.2 The control unit forces a 2-stage pulse through the superconducting wire and samples the voltage across the wire at a particular time during the current pulse.
- 6.1.3 When a fault is suspected it is necessary to establish if the fault is in the control unit cable or probe.

It should be borne in mind that both probes and the interconnecting cable are susceptible to mechanical damage.

## **6.2 Interconnecting Cable**

- 6.2.1 Check interconnecting cable by checking continuity between the following pins:-

A - A  
B - B  
C - C  
D - D  
E - E  
F - F

## **6.3 Control Unit**

- 6.3.1 Select 'MAX' sample rate, type "250" probe, disconnect the interconnecting cable at the control unit.
- 6.3.2 Short together A,B,D,F - the DPM should read 1100mm.
- 6.3.3 Short together D,F only select type "105" - the DPM should read 0mm.
- 6.3.4 If a more accurate check is deemed necessary on the control unit proceed as follows:-
- 1) Terminate leads from probe socket F and D on one unit terminal of decade resistance box.
  - 2) Terminate leads from probe socket A, B, E, C on the other terminal of the decade resistance box.

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- 3) Now for either 105 or 150/250 ranges the display reading may be checked with a reading of zero obtained for 92.4 ohm (105) or 184.8 ohm (150/250).

As the resistance is decreased the reading will increase to the maximum for the range selected equivalent to a change of 0.168 ohm/mm.

#### **6.4 Probes**

- 6.4.1 For type 105 probes the following resistance's should be measured at the probe connector:-

E-C 2-5 ohm  
E-F 95-105 ohm  
F-D 0.5-4 ohm

- 6.4.2 For type 150 probes the following resistance's should be measured at the probe connector.

E-C 2-5 ohm  
E-F 95-105 ohm  
F-D 0.5-4 ohm

A-B 2-5 ohm  
A-E 95-105 ohm

- 6.4.3 For type 250 probes the following resistance's should be measured at the probe connector.

A-B 2-5 ohm  
A-F 190-210 ohm  
F-D 0.5-4 ohm

- 6.4.4 It is important that there are no short between the active probe connections and the probe outer tube.

#### **7. CALIBRATION OF THE CONTROL UNIT**

- 7.1.1 The control unit is normally calibrated using decade resistance box arrangement described in paragraph 6.3.4.

The exact resistance chosen to correspond to a reading of zero is dependent on the precise conditions of use the probe. The standard correspond to a 10K probe environment rather than the 77K used previously. This corresponds to a probe resistivity of 0.168 ohm/mm of active length giving a resistance of 92.4 ohm for a type 105 probe with 550mm active, length and 184.8 ohm for a type 250 probe with 1100mm active length.

The procedure is as follows:-

- 7.1.2 Select 'MAX' sample rate and '105'. Set the decade box to 92.4 ohm.
- 7.1.3 Adjust RV7 until a small positive reading is obtained on the DPM (approx 20mm). Now adjust RV7 gradually in stages until a reading of 0+1 digit is obtained.

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It is important to wait for the unit to pulse after making any adjustment.

- 7.1.4 Select '150/250' and set the decade box to 184.8 ohm.
- 7.1.5 Now adjust RV6 following the same procedure as in 7.1.3.
- 7.1.6 Set the decade box to 0 ohm (i.e. short together the leads).
- 7.1.7 Adjust RV4 for a reading of 1100mm +/- 1mm
- 7.1.8 Switch to '105' check for a reading of 550mm +/- 1mm.

**7.2 Calibration to a particular probe**

- 7.2.1 As each probe is slightly different it may be found that a particular installation gives an offset when the probe is in an empty but cold dewar.
- 7.2.2 To calibrate the control unit to a particular probe, it is necessary to suspend the active length in cold helium gas to set the zero reading.  
  
For type 105 probes set RV7 as in 7.1.3 above.  
  
For type 250 probes set RV6 as in 7.1.3 above.
- 7.2.3 Full scale is set on 105 or 250 range using RV4, when A,B,C,D,E,F are shorted together.

**8. UNPACKING THE CONTROL UNIT**

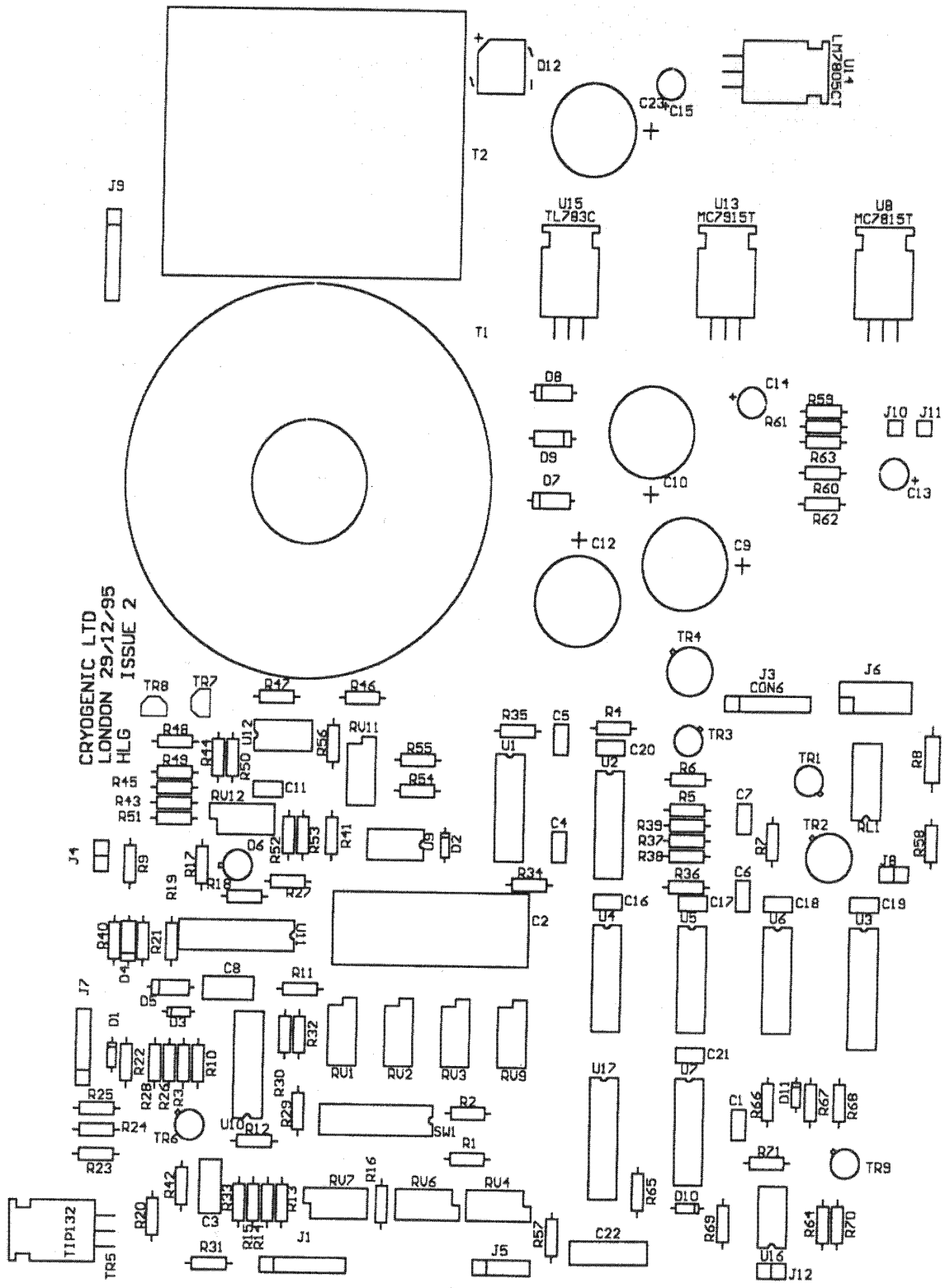
The unit comes complete with mains lead, probe interconnecting lead, analogue output plug, control output plug (HLG210 only), and manual with circuit diagram.

To use, place the probe in the helium container to required depth. Connect interconnecting lead to probe and the other end to the probe output on the control unit. Switch unit 'ON', the power light will illuminate. Select the correct position of the probe switch and the measurement sample rate required (either MAX. or MIN.) and the helium depth can be read off the digital meter.

The warranty is for one year but full service and repairs are always available (see attached Warranty Clause).

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## **STANDARD PRODUCT WARRANTY**

All products manufactured by CRYOGENIC LIMITED are warranted to be free from defects in materials and workmanship for a period of one year after date of despatch. At no expense to the purchaser, CRYOGENIC LIMITED will repair or replace (at our option) any parts which in the sole opinion of CRYOGENIC LIMITED prove to be defective within the scope of this Guarantee. Transportation costs of goods returned to CRYOGENIC LIMITED for repairs will be prepaid by the purchaser. Goods should not be returned without prior consultation with CRYOGENIC LIMITED to decide whether an on-site inspection and possible repair should be made. If the defect is determined to be as a result of misuse, improper repair, unauthorised user modification or abnormal operation conditions, repairs will be invoiced at cost.

This Warranty does not apply to equipment not manufactured by CRYOGENIC LIMITED, for which, the relevant manufacturer's warranty is passed on whenever possible.