Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.

No. 95-11, Pao-Chung Rd., Hsin-Tien City, Taipei Hsien, Taiwan

GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.

No.69 Lushan Road, Suzhou New District Jiangsu, China.

declare that the below mentioned product

GOM-802

is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Equipment Directive (73/23/EEC).

For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

◎ EMC

EN 61326-1: Electrical equipment for measurement, control and laboratory use — EMC requirements **(1997+A1: 1998)**	
Conducted and Radiated Emission EN 55011: 1998 class B	Electrostatic Discharge IEC 61000-4-2: 1995+A1: 1998
Current Harmonic IEC 61000-3-2: 2000	Radiated Immunity IEC 61000-4-3: 1996+A1: 1998
Voltage Fluctuation IEC 61000-3-3: 1995	Electrical Fast Transients IEC 61000-4-4: 1995
----------	Surge Immunity IEC 61000-4-5: 1995
----------	Conducted Susceptibility IEC 61000-4-6: 1996
----------	Power Frequency Magnetic Field IEC 61000-4-8: 1993
----------	Voltage Dips/ Interrupts IEC 61000-4-11: 1994

◎ **Safety**

Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC
IEC / EN 61010-1: 2001

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SAFETY TERMS AND SYMBOLS

These terms may appear in this manual or on the product:

WARNING. Warning statements identify condition or practices that could result in injury or loss of life.

CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.

WARNING: This equipment is not for measurements performed for CAT II, III and IV.

The following symbols may appear in this manual or on the product:

DANGER High Voltage

ATTENTION refer to Manual

Protective Conductor Terminal

Earth(ground) Terminal

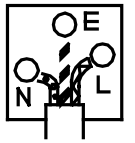
FOR UNITED KINGDOM ONLY

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are colored in accordance with the following code:

Green/ Yellow:	**Earth**
Blue:	**Neutral**
Brown:	**Live (Phase)**



As the colors of the wires in main leads may not correspond with the colors marking identified in your plug/appliance, proceed as follows:

The wire which is colored Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol  **or colored Green or Green & Yellow.**

The wire which is colored Blue must be connected to the terminal which is marked with the letter N or colored Blue or Black.

The wire which is colored Brown must be connected to the terminal marked with the letter L or P or colored Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any mounded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

1. PRODUCT INTRODUCTION

1-1. Description

GOM-802 is a high precision programmable DC Milli-ohm meter suitable for the low resistance measurements of switches, relays, connectors, PCB tracks and variety of other devices. With the easy-to-use features, superior performance, and automatic test interfaces described as below, GOM-802 is obviously a reliable and handy instrument for the low resistance measurements.

Easy-to-use features:

Utilizing the arrow key for setting the percentage of upper and lower limit based on the normal value can make it easier to execute the HI-LO-GO comparator function. Besides, through the Alarm Buzzer setting can indicate the PASS/FAIL status, and all kinds of output status can be indicated through Handler Interface output.

The RELATIVE feature that enables GOM-802 to remove the stray resistance easily, and the 20 sets of Normal/Hi/Lo setting memories can satisfy with different kind of test condition. Also, the last setting will be recalled every time when the GOM-802 is turned on.

Superior Performance:

There are nine measurement ranges from 30mΩ to 3MΩ selected automatically or manually with the constant current between 1μA and 1A, 0.05% high accuracy, 1μΩ resolution and four terminals Kelvin connection to make a reliable and consistent test result.

The flexible choice for a high measurement accuracy at speed of 7 sampling/sec (full scale at 30000) or a less measurement accuracy at speed of 30 sampling/sec (full scale at 3000) can match with the speed requirement of test.

Temperature Compensation (Option):

The optional temperature probe PT-100 can control the measuring resistance to meet the required temperature. When the temperature coefficient and required temperature is keyed in under TC mode, GOM-802 will display the measuring resistance corresponding to the required temperature.

Automatic Test:

For automatic system applications, the GOM-802 provides a handler interface that can indicate the output status on PASS, FAIL, HI, LO, READY, or EOT, and control signal of measurement trigger. An optional RS-232 GPIB is also available for the computer control application.

Application:

- Production testing for contact resistance of switches, relays, connectors, cables and printed circuit boards and other low resistance devices.
- Component testing of resistors, motors, fuses, heating elements.
- Incoming inspection and quality assurance testing.
- Conductivity evaluation for product design.

1-2. Key Feature:

- 30,000 counts.
- Measurement Range: 30mΩ~3MΩ.
- 0.05 high accuracy.
- Hi/Lo comparator and limit percentage setting with 20 memory sets.
- Measurement of REL, Actual and % value.
- Manual or Auto-ranging.
- Continuous or Trigger measurement mode.
- Temperature compensation and measurement.

GOM-802 DC MILLI-OHM METER
USER MANUAL

- Four-wire measurement method.
- Auto-recall last setting on re-power on.
- Diode test.
- Alarm setting for PASS/FAIL test result.
- Sampling rate: 7 or 30 sampling/sec.
- Standard interface: Scan, Handler, optional interface: RS-232 GPIB.

2. SPECIFICATIONS

The specifications are operated under the essential conditions as follows:

- A 1-year calibration cycle.
- An operating temperature of 18 to 28℃ (64.4 to 82.4℉).
- Relative humidity not exceeding 80%.
- Accuracy is expressed as ±(percentage of reading + digits).
- The instrument requires 30 minutes warm-up time to achieve rated accuracy.

1. Resistance Measurement

30000 counts (speed : 7 times/second)

Range	Resolution	Measuring Current	Accuracy	Open-terminal Voltage
30m	1μ	1A approx.	0.1%+6*	3V
300m	10μ	100mA	0.05%+6*	
3	100μ	100mA	0.05%+3	
30	1m	10mA	0.05%+2	
300	10m	1mA	0.05%+2	
3k	100m	100μA	0.05%+2	
30k	1	100μA	0.05%+2	4.8V
300k	10	10μA	0.05%+2	
3Meg	100	1μA	0.05%+2	
3000 counts Accuracy (speed: 30 times/second)		±5 counts **		

*When the instrument is set to 30mΩ or 300mΩ range, the resistance value will be changed while connecting or disconnecting the test lead to the panel due to the different temperature between internal and external of the instrument. Therefore, it must wait 1 minute in order to obtain an accurate value after the test lead is connected or disconnected.

* When use Kelvin clip to resume testing after long time ending, it needs more time to wait for a stable value.

** In high speed mode, first assure that the instrument has been grounded through power cord.

Measurement	Four-terminal method.	
Auto-ranging	Provided.	
Over input range	"OL" indication	
Maximum Applied voltage	30m~3Ω range: 30VpDC Other range: 100VpDC	
Comparator	20 sets of comparator status can be selected.	
Buzzer mode switchable	NON, PASS, FAIL	
2.Temperature Measurement		
Temperature sensor (option)	Platinum resistor. Lead length: 1.5m approx.	
Range	Accuracy Speed: 7 times/second	Accuracy Speed: 30 times/second
-9.9℃ ~ 39.9℃	0.3%+0.5℃	0.3%+2℃
-50.0℃ ~ -10.0℃ 40℃ ~ 100℃	0.3%+1.0℃	0.3%+3℃
3. Temperature Correction Function		
Temperature correction range	0.0℃~40.0℃	
Reference temperature range	0℃~99.9℃	
Thermal coefficient range	±9999 ppm	
Temperature range	Accuracy of temperature compensation for 3930 ppm/Cu wire, speed: 7 times/second.*	
0℃~39.9℃	0.3%+resistance measurement accuracy.	
40℃~100℃	0.6%+resistance measurement accuracy.	

* The temperature coefficiency for the other setting must be calculated individually according to different conditions.

* If the temperature coefficiency or the difference between the environmental temperature and the require temperature exceeds normal operation, after compensation calculation, the variation of the reading value will be tremendous.

4. Interface	
Handler interface	Signal: START TTL input Signal: LOW, HIGH, FAIL, PASS, EOT, READY total 6 TTL outputs. (This function is valid only under the resistance measurement mode and the compare mode is enabled.)
Scanner	Signal: READY, PASS, LOW, HIGH, CLOCK, STRB total 6 TTL outputs. (This function is valid only under the resistance measurement mode and the compare mode is enabled.)
RS-232 GPIB (option)	IEEE488.1-1987, IEEE488.2-1992 and SCPI-1994
5. ENVIRONMENTAL	
Operation Environment	Indoor use, altitude up to 2000m. Ambient Temperature 0℃ to 40℃. Relative Humidity 80% (Maximum). Installation category II Pollution Degree 2
Storage temperature	-10℃ to 70℃.
6. GENERAL	
Power source	AC 100V/120V/220V/230V±10%, 50/60Hz, 27VA, 22W.
Accessories	Test Lead × 1, Instruction manual × 1, Programmable manual × 1 (option), Temperature sensor (option) × 1
Dimension	251(W)×91(H)×291(D) m/m
Weigh	Approx. 3 kg

WARNING：To avoid electrical shock, the power cord protective grounding conductor must be connected to ground.

CAUTION：To avoid damaging the instrument, do not use it in a place where ambient temperature exceeds 40℃.

3. PRECAUTIONS BEFORE OPERATION

3-1.Unpacking the Instrument

The product has been fully inspected and tested before shipping from the factory. Upon receiving the instrument, please unpack and inspect it to check if there is any damage caused during transportation. If any sign of damage is found, notify the bearer and/or the dealer immediately.

3-2.Checking the Line Voltage

The product can be applied by any kind of line voltages shown in the table below. Before connecting the power plug to an AC line outlet, make sure the voltage selector of the rear panel is set to the correct position corresponding to the line voltage. It might be damaged the instrument by connecting to the wrong AC line voltage.

***WARNING.* To avoid electrical shock the power cord protective grounding conductor must be connected to ground.**

AVERISS: Pour éviter les chocs électriques, le fil de terre du cordon secteur doit impérativement être relié à la terre.

When line voltages are changed, replace the required fuses shown as below:

Model	Line voltage	Range	Fuse	Line voltage	Range	Fuse
GOM-802	100V 120V	90-110V 108-132V	TT0.3A 250V	220V 230V	198-242V 216-250V	T0.25A 250V

***WARNING.* To avoid personal injury, disconnect the power cord before removing the fuse holder.**

4. PANEL INTRODUCTION

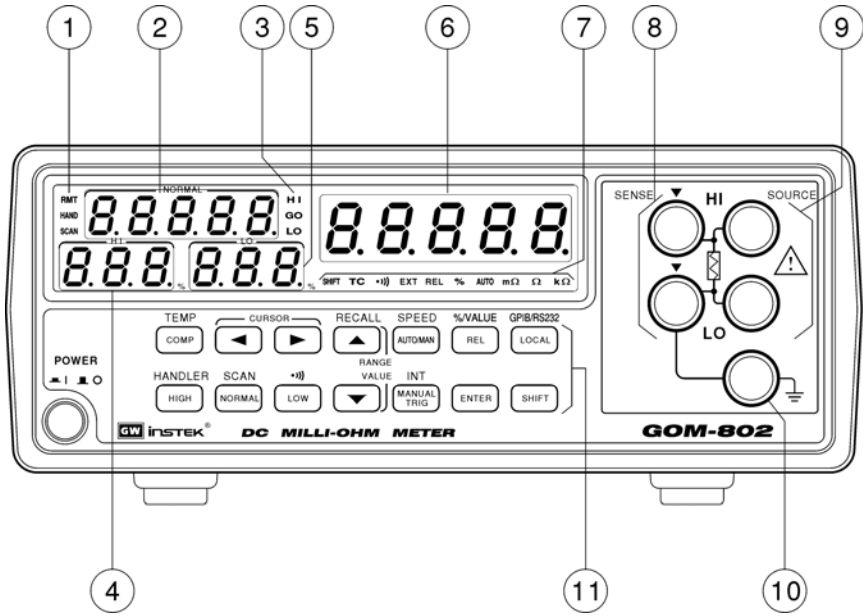


Figure 4-1. Front Panel

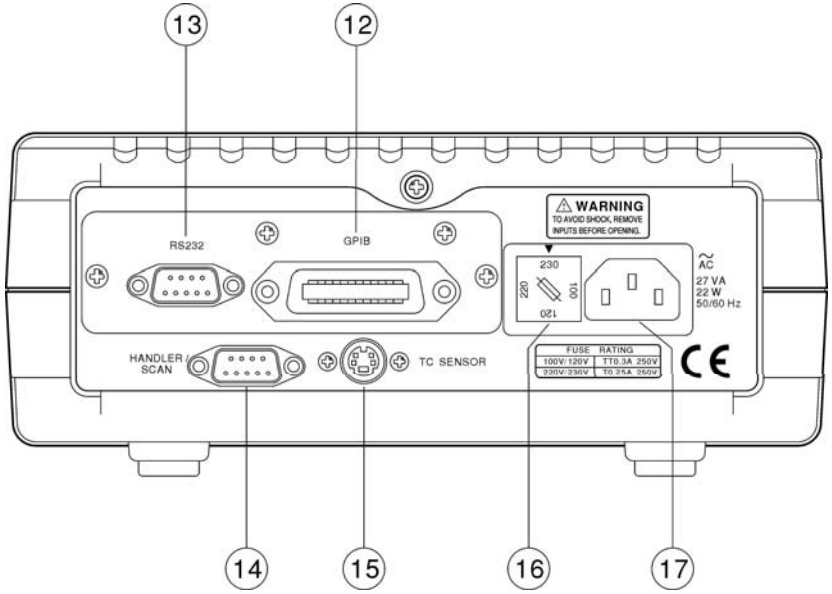


Figure 4-2. Rear Panel

4-1. Front Panel

1. Interface Indicator
2. Normal value displayed area.
3. Comparator indicator.
4. Upper limit percentage display area.
5. Low limit percentage display area.
6. Measurement value displayed area.
7. Functions control indicator.
8. Measurement terminal: Sense HI, Sense LO
9. Current source terminal: Source HI, Source LO.
10. The negative measurement terminal has the same potential as the circuit earth terminal, but can not be replaced by it.
11. Function Control knob.

WARNING: This equipment is not for measurements performed for CAT II, III and IV.

4-2. Rear Panel

12. GPIB Interface terminal.
13. RS232 Interface terminal.
14. Handler and SCAN interface terminal.
15. Temperature compensation probe terminal (TC SENSOR).
16. Line voltage selector and input fuse holder.
17. AC Power-line connector.

5. OPERATION INTRODUCTION

5-1. The [SHIFT] key and function keys

The [SHIFT] button is used to enable the secondary function of certain function keys that with blue symbols printed above. The SHIFT LED will be on after pressed the [SHIFT] button. At this time, only the buttons with blue symbols are workable. To release SHIFT function, press [SHIFT] again.

5-2. Warm up

The instrument requires half-an-hour warm up to achieve rated accuracy.

5-3. Over-range indication

If the input exceeds the full scale of the selected range, the instrument will indicate over-range input by lighting the “OL” message on the display.

5-4. TRIG standby indication

Under the TRIG mode, change the range or power on the instrument, the “————” message will be displayed on the measurement displayed area, now the instrument is in the TRIG standby status. The decimal is represented the range. When proceeding the TRIG measurement, the measurement displayed area will display the present measuring value.

5-5. Input overload protection

The maximum allowable input is shown as table 5-1. Please proceed the measurement accordingly.

Table 5-1:

RANGE	MAXIMUN INPUT
30mΩ, 300mΩ,3Ω	30Vp DC
Other ranges	100Vp DC

WARNING: To avoid shock hazard and/or instrument damage, do not apply input potentials that exceed the input overload limits shown in table 5-1.

5-6. Interface Operation

This instrument equips RS-232 as standard device with a D-SUB 9 PIN SHELL on the rear panel. Besides, the instrument also provides a GPIB option device with a 24 PIN SHELL in blue. The configuration is compliance with IEE488.

For further detailed operation, please refer to the Interface manual.

5-7. Installation and Operation

Operate the GOM-802 in a location with a suitable environment free from dust, direct exposition of sunlight, and strong effect of magnetic fields.

If you have no idea about the resistor value before testing, start from the high resistor value range to the low until the right value can be read out.

GOM-802 DC MILLI-OHM METER
USER MANUAL

6. MEASUREMENT INSTRUCTION

6-1. Resistance measurement

(1) Resistance measurement function

1) Get into resistance measurement function by pressing [SHIFT] and [TEMP] in sequence to select main function mode.
2) Press [▲]or[▼] can switch over the function, and 3 kinds of measurements “ohm”, “℃” and “TC” will be displayed on the panel.
3) Press “ohm” and [ENTER] to get into resistance measurement mode.
4) Use [▲]or[▼] to switch to adequate range or press [AUT/MAN] for Auto range measurement.

(2) Compare function

Compare function:

1) Enable or disable the Compare function by pressing [COMP] button.
2) Make HI, GO, LO judgment shown on the panel indicator according to the setting of the upper and low normal value percentage.
3) When the Compare function is relieved, the setting for % and REL will be relieved too.
   Example:
   Normal value: 100.00
   up limit: 10.0% = up limit value: 110.00
   down limit: 20.0% = down limit value: 80.00

   The indicators of GO, HI, and LO will be lighted up according to the resistance value of DUT:

   109.00 GO indicator lights up

   120.00 HI indicator lights up

   70.00 LO indicator lights up

Normal value setting:

1) Under Compare function, press [NORMAL] button to turn on/off the function of normal value setting.
2) When the normal value setting is enabled, the maximum number displayed on the normal value area will be flashing, adjust the value by using [▲]and [▼], and move the flashing number by using [▶] or [◀], then press [ENTER] to confirm the correct value. The maximum normal value is set at 33000 while the minimum normal value is set at 00000.
3) After setting, the HI, LO, GO judgment is according to the new setting value.
4) If the setting is not saved, once jump out the setting function and re-power on, the setting will be cleared.

High limit percentage setting:

1) Under the compare function, press [HIGH] to turn on/off the up limit percentage setting function, and press [SHIFT] to clear the setting.
2) After setting, the maximum number displayed on the up limit percentage area will be flashing, adjust the value by using [▲]and [▼], and move the flashing number by using [◀] or [▶], then press [ENTER] to confirm the correct value. The maximum up limit percentage value is set at 999 while the minimum up limit percentage value is set at 000.
3) After setting, the HI, LO, GO judgment is according to the new setting value.
4) If the setting is not saved, once leave the setting function and re-power on, the setting will be cleared.

Low limit percentage setting:

1) Under the compare function, press [LOW] to turn on/off the down limit percentage setting function, and press [SHIFT] to clear the setting.
2) After setting, the maximum number displayed on the up/down limit percentage area will be flashing, adjust the value by using [▲]and [▼], and move the flashing number by using [◀] or [▶], then press [ENTER] to confirm the correct value. The maximum down limit percentage value is set at 999 while the minimum down limit percentage value is set at 000.
3) After setting, the HI, LO, GO judgment is according to the new setting value.
4) If the setting is not saved, once leave the setting function and re-power on, the setting will be cleared.

The save function for the compare setting:

1) Under Compare function, set the high and low limit percentage of normal value according to the setting procedure of Normal value, High limit percentage and low limit percentage.
2) Press [SHIFT] and [RECALL] in sequence getting into save and recall function of Compare setting.
3) Switch to save function by pressing [▲] or [▼], and the “SAVE” message will be displayed on the panel, press [ENTER] to confirm the setting, or press [SHIFT] to clear the setting.
4) Among the message “S MXX” displayed on the panel, XX means the number of the storage group from 00 to 19. Use [▲] or [▼], [◀] or [▶] to adjust the save location, then press [ENTER] to replace the previous save location, or press [SHIFT] to clear the setting.

The recall function for the compare setting:

1) Under Compare function, set the high and low limit percentage of normal value according to the setting procedure of Normal value, High limit percentage and low limit percentage.
2) Press [SHIFT] and [RECALL] in sequence getting into save and recall function of Compare setting.
3) Switch to recall function by pressing [▲] or [▼], and the "CALL" message will be displayed on the panel, press [ENTER] to confirm the setting, or press [SHIFT] to clear the setting.
4) Among the message "C MXX" displayed on the panel, XX means the number of the recall group from 00 to 19. Use [▲] or [▼], [◀] or [▶] to adjust the recall location, the panel will display the normal value and the up/down limit percentage of normal value.
5) After recall setting, the HI, LO, GO judgment is according to the new setting value.

The Buzzer function setting:

1) Under the Compare mode, press [SHIFT] and [•))] in sequence getting into buzzer setting. The panel will display the present setting status, the message "NON" means no action, "bP" means the buzzer is activated when the test is pass, and "bF" means the buzzer is activated when the test is failed.
2) Use [▲] or [▼] to select "NON", "bP" or "bF", then [ENTER] to confirm the setting, or press [SHIFT] to clear the setting.
3) The buzzer will be disabled once leave the Compare mode.

Display measurement value percentage:

1) Under the Compare mode, press [SHIFT] and [%/VALUE] in sequence to select resistance value which is based on actual value or normal value to calculate the percentage, and displays it on the panel.

   Normal value: 20.000
   Actual value: 10.000
   Percentage: 050.00%

2) Enable the measurement value percentage calculation, and the auto range function will be annulled.

(3) REL FUNCTION

1) Use this function to do zero adjustment when the test lead or the resistance of the DUT needs to be adjusted.
2) Pre-set a reference value, then every value must minus the reference value before displaying on the panel for the compare judgment.
3) Under the compare mode, enable REL function, the auto-range function will be annulled.
4) After calculation, if the value is negative, the minus symbol and the number will be displayed alternately on the position of MSD (most significant digit) under low converted speed mode (7 times/second), while only the minus symbol will be displayed on the position of MSD under high converted speed mode.

6-2. Temperature measurement

(1) Temperature measurement

1) Connect an optional temperature probe to the rear panel.
2) Press [SHIFT] and [TEMP] in sequence getting into main function selection mode.
3) Press [▲] or [▼] can switch over 3 kinds of functions of "ohm", "℃", and "TC" on the panel.
4) Select " ℃ "and press [ENTER] getting into temperature measurement mode. The measuring value will be displayed on the normal value displayed area.

(2) REL function

Pre-set a reference value, then every value must minus the reference value before displaying on the panel for the compare judgment.

(3) Single range

There is only a single range for the temperature measurement.

6-3. Temperature Compensation Measurement

(1) Temperature compensation measurement mode

1) The adequate resistance value of the DUT can be calculated through the environment temperature, the setting coefficient of temperature of the DUT, and the require observation temperature.
2) Press [SHIFT] and [TEMP] in sequence getting into main function selection mode.
3) Press [▲] or [▼] can switch over 3 kinds of functions of "ohm", "℃", and "TC" on the panel.
4) Select "TC" and press [ENTER] getting into temperature compensation measurement mode.
5) The up limit percentage area display the observation temperature and the setting coefficient of temperature will be displayed on the normal value displayed area.
6) Use [▲] or [▼], [◀] or [▶] to set the require observation temperature and the coefficient of temperature, then press [ENTER] to confirm the setting or press [SHIFT] to clear the setting.

(2) Range selection

Use [▲] or [▼] to switch over the range or set [AUTO/MAN] to auto range mode.

(3) REL function

Pre-set a reference value, then every value must minus the reference value before displaying on the panel for the compare judgment.

6-4. General Function

(1) Converted speed selection

1) Press [SHIFT] and [SPEED] in sequence to switch over the converted speed.
2) Low converted speed: 7 times/second, full scales: 30000.
3) High converted speed: 30 times/second, full scale: 3000.
4) The converted speed function can be applied on the measurement of resistance, temperature, and temperature compensation.

(2) Auto range function

1) Press [AUTO/MAN] to switch over auto range or manual range.
2) Under the Compare mode, switch over the range will annulled the previous setting of % or REL function.
3) The temperature measurement only has a single range.
4) Under external trigger mode, Auto range function is disabled.

(3) Trigger function

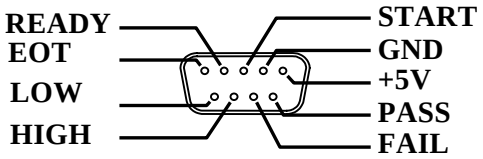
1) Press [MANUAL TRIG] getting into external trigger mode.
2) Each time when the [MANUAL TRIG] button is pressed, the EXT LED will be flashing once and the panel value will be updated again. Press [SHIFT] and [INT] in sequence to leave Trig mode.

3) Under the TRIG mode, change the range or power on the instrument, the "————" message will be displayed on the measurement displayed area, now the instrument is in the TRIG standby status. The decimal is represented the range. When proceeding the TRIG measurement, the measurement-displayed area will display the present measuring value.

(4) Handler interface

The handler interface provides a TTL input (START), 6 TTL outputs, including LOW, HIGH, FAIL, PASS, EOT and READY (This function is valid only under the resistance measurement mode and the compare mode is enabled).

9-PIN D-SHELL (FEMALE)



START: Start trigger and proceed one time measurement, negative edge trigger.

READY: Output "1" to GND, means the measurement is completed and can proceed next trigger.

EOT: Output "1" to GND, means the AD convert procedure is completed, can change the DUT.

LOW: Output "1" to GND, means the judgment of the compare function is low.

HIGH: Output "1" to GND, means the judgment of the compare function is high.

FAIL: Output "1" to GND, means the judgment of the compare function is High or low.

PASS: Output "1" to GND, means the judgment of the compare function is GO.

The output current from all output collector and +5V terminal can not exceed 60mA.

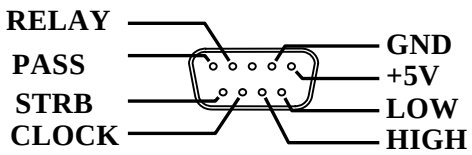
(5) Interface setting

Please refer to the programmable manual.

(6) SCAN interface

1) The scan interface provides 6 TTL outputs, including READY, PASS, LOW, HIGH, FAIL, CLOCK, and STRB.

9-PIN D-SHELL (FEMALE)



RELAY: Control the relay signal, and series signal output.

PASS: Indicate PASS signal, and series signal output.

LOW: Indicate LOW signal, and series signal output.

HIGH: Indicate HIGH signal, and series signal output.

CLOCK: When every group of output signal (including READY, PASS, LOW, HIGH) is ready, a CLOCK signal will be sent out. There are 100 groups of output signals totally.

STRB: After all 100 groups of output signals have been ready, a STRB signal will be sent out.

2) SCAN Operation

① Set to SCAN mode from the resistance measurement mode, first enable the compare function and change the range manually, then press [SHIFT] and [SCAN] in sequence.

② Set sweep count by adjusting [▲] or [▼], [◀] or [▶], the maximum count can be up to number 100. Press [ENTER] to confirm the setting or press [SHIFT] to cancel the setting.

③ Set one count sweep delay time up to 30000 unit maximum or 30 unit minimum (unit: 16.2ms) by adjusting [▲] or [▼], [◀] or [▶], then press [ENTER] to confirm the setting or press [SHIFT] to cancel the setting.

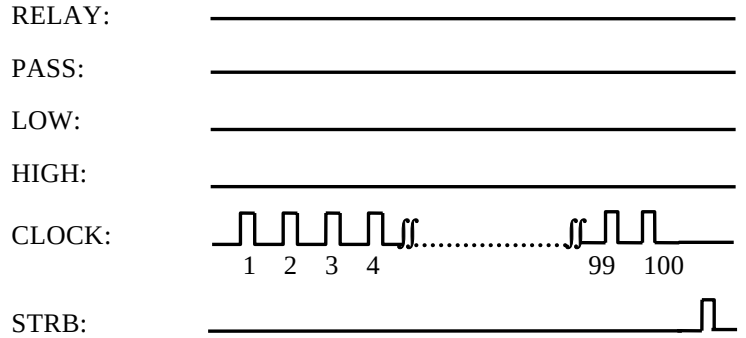
④ When the setting is completed, the message of "READY" will be displayed on the measurement value displayed area. Now the setting of range and up/down limit of the compare function can not be changed. Proceed sweep function by press [MANUAL TRIG], and the result will be output through SCAN interface.

⑤ Press [SHIFT] and [SCAN] in sequence to leave SCAN mode.

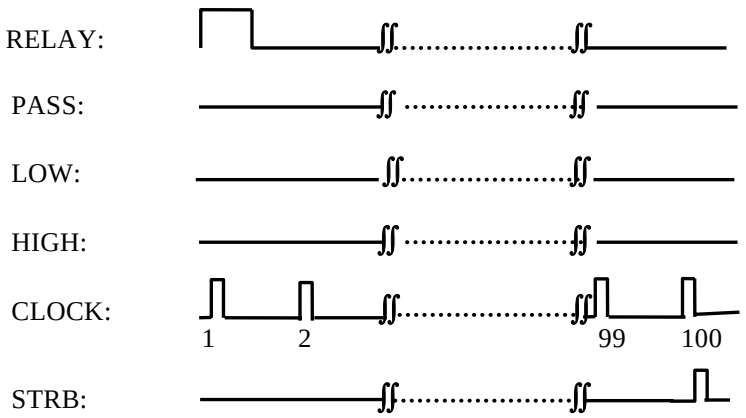
⑥ After sweep, the measurement results can be observed by adjusting [▲] or [▼].

⑦ Please refer to the procedure of SCAN interface output as follows:

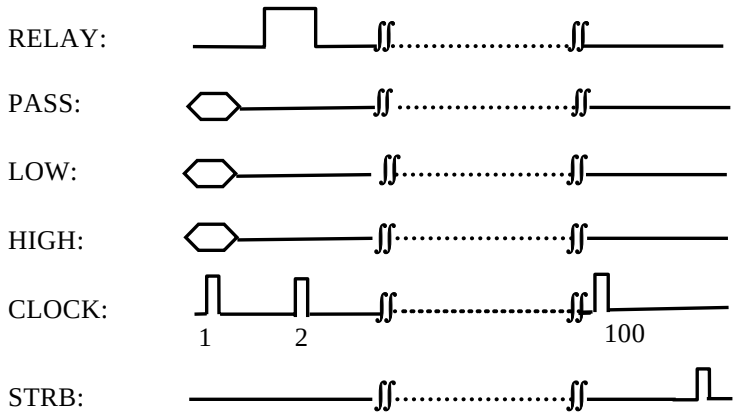
Step 1. After the SCAN setting, the message of "READY" will be displayed on the panel, SCAN interface starts output:



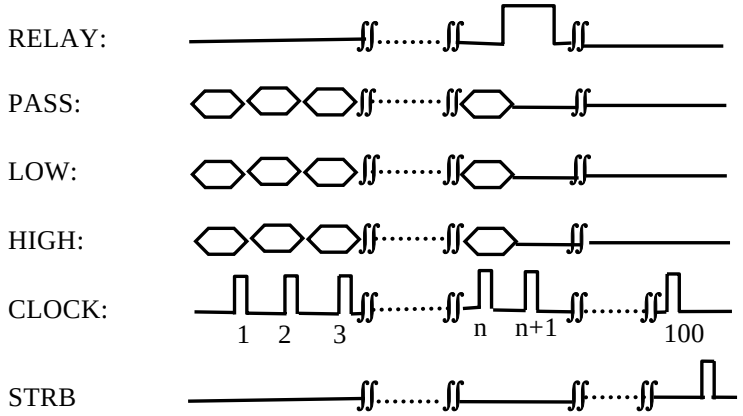
Step 2. Press [MANUAL TRIG] to start scan:



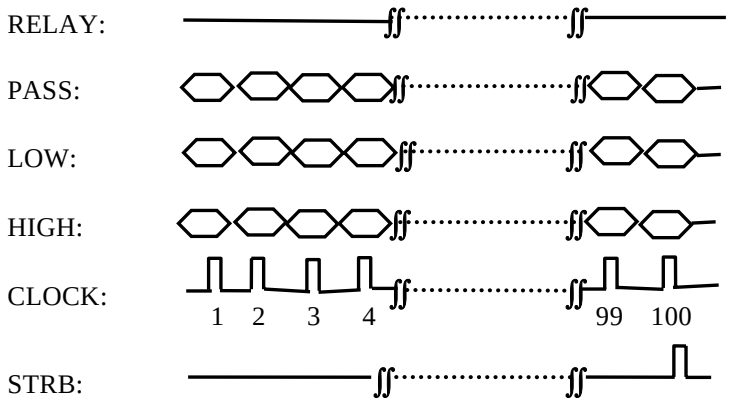
Step 3: Scan channel one, the sweep delay time is up:



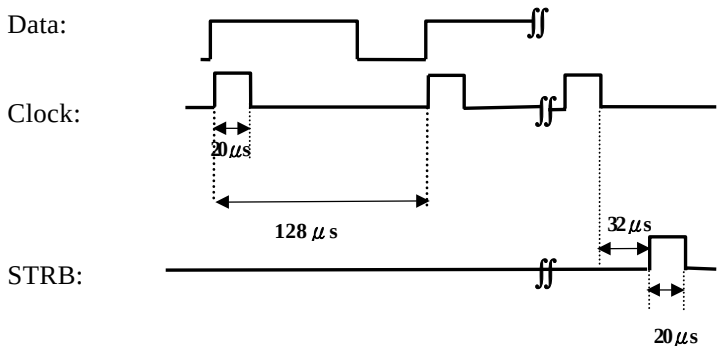
Step 4: Scan channel n, the sweep delay time is up:



Step 5: Scan channel 100, the sweep delay time is up:



⑧ The account of output time for SCAN interface:



7. MEASUREMENT TECHNIQUES

7-1. 4-wire measurement

(1) The 4-wire measurement can eliminate wire resistance and get accurate resistance. Please refer to the wiring method as Figure 7-1.

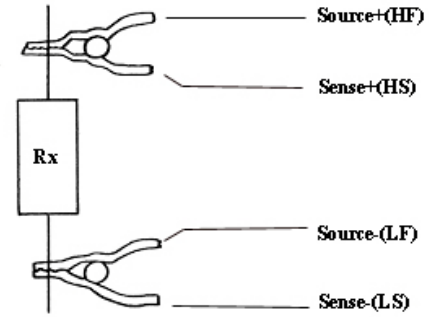


Figure 7-1

Note: 1. Before testing, make sure that the KELVIN clip is well connected with the DUT.
2. The terminals of HF (Source HI), LF (Source LO), HS (Sense HI) and LS (Sense LO) must be connected to front panel terminals properly.

(2) Principle

1) The traditional 2-wire measurement result combines the test lead resistance. Please refer to Figure 7-2 for the measurement result:

$$\frac{V}{I} = r1 + R + r2$$

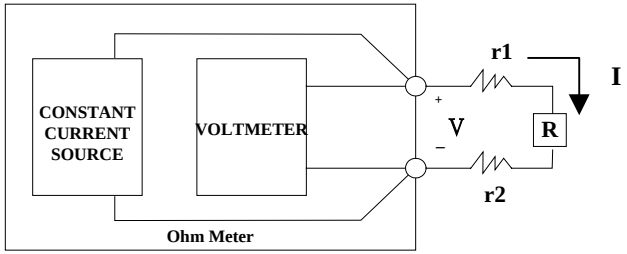


Figure 7-2

2) 4-wire measurement.

The 4-wire measurement takes advantage of the high input resistance characteristic of the voltmeter that there is no voltage-drop on r3 and r4 as no current getting through these resistances. Therefore, the voltmeter can measure the voltage precisely on the resistance.

The measuring result is: $R = \frac{V}{I}$

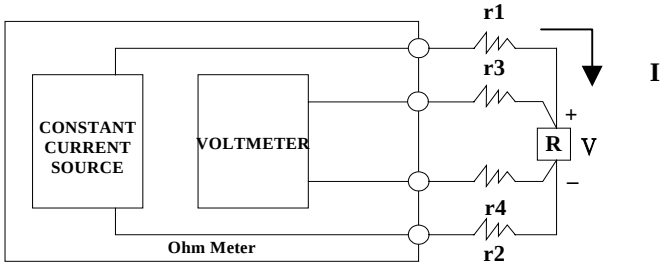


Figure 7-3

(3) Zeroing

The clip of test lead includes Source+ (HF), Source- (LF), Sense+ (HS), Sense- (LS) terminals. Before zeroing test, make sure that the clip of Sense+ is next to Sense- for accurate zeroing test. When the quality of the wire and material can not be guaranteed, use REL function for zeroing adjustment.

7-2. Temperature measurement

(1) Reference temperature

The international Temperature Scale (ITS) is based on the following table 7-1 which was revised in 1990 with seventeen fixed points and corresponding temperatures.

Table 7-1:

Element		Type	Temperature	
			K	℃
(H_2)	Hydrogen	Tripple point	13.8033	-259.3467
(Ne)	Neon		24.5561	-248.5939
(O_2)	Oxygen		54.3584	-218.7916
(Ar)	Argon		83.8058	-189.3442
(Hg)	Mercury	Tripple point	234.325	-38.8344
(H_2O)	Water	Tripple point	273.16	+0.01
(Ga)	Gallium	Melting point	302.9146	29.7646
(In)	Indium	Freezing point	429.7485	156.5985
(Sn)	Tin	Freezing point	505.078	231.928
(Zn)	Zinc		692.677	419.527
(Al)	Aluminum		933.473	660.323
(Ag)	Silver		1234.93	961.78
(Au)	Gold		1337.33	1064.18

Note: 1. Temperature unit:
Thermodynamic temperature: T
Kelvin: K

2. Temperature scale:
Celsius scale: ℃
Rankinescale: ℉
Kelvin: ℉
℃ =5/9 (℉-32)
K = ℃+273.15
℉ = ℉+459.67

(2) Temperature measurement sensor

The common usage for the resistance temperature detectors, RTD, is to convert temperature into electro signal. Please refer to following table 7-2 of its feature:

Table 7-2

	Feature	Description
1.	Accuracy	Higher accuracy
2.	Resolution	0.1~1.0℃ higher resolution
3.	Speed of response	Slower
4.	Self-heating	yes
5.	Long term stability	Good
6.	Output characteristic	Approx. 0.4 ohm/℃, near linear.

(3) Optional Platinum resistance sensor

This kind of temperature probe meets the specification of German DIN43760: 1968, 3-wire measurement.

The relation between temperature and resistance can refer to the description of the Gallendarvan Dusen Equation as follows:

$$\mathbf{R_{RTD}=R_0[1+AT+BT^2+CT^3(T-100)]}$$

Where: R_{RTD} is the calculated resistance of the RTD.
R_0 is the known RTD resistance at 0℃.
T is the temperature in ℃.
A=alpha [I+(delta/100)]
B=-I(alpha)(delta)(Ie-4)
C=-I(alpha)(beta)(Ie-8)

The alpha, beta, and delta values are listed in Table 7-3.

Table 7-3

Type	Standard	Alpha	Beta	Delta	Ω at 0℃
PT-100	ITS90	0.003850	0.10863	1.49990	100Ω

Example—Calculate the resistance of a PT-100 RTD at 100℃(T). The following R_0 (Ωat 0℃), alpha, beta, and delta values are used for the PT-100 RTD:

T=100℃

R_0 (Ωat 0℃)=100Ω

Alpha=0.003850

Beta=0.10863

Delta=1.49990

A, B, and C are calculated according to above value as follows:

A=0.00391

B=5.77e-7

C=4.18e-12

The resistance of the RTD at 100℃(R100) is then calculated as follows:

$R_{100}=R_0[1+AT=BT^2+CT^3(T-100)$

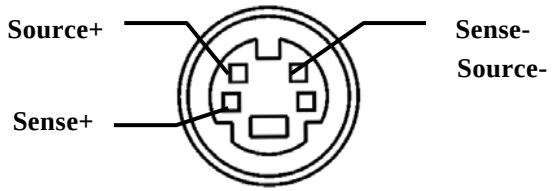
$=100\{1+[(0.00391)(100)]+[(-5.77e-7)(100^2)+[(-4.18E-12)(100^3)(100-100)]]$

$=100[1+0.391+(-0.006)+0]$

$=100(1.385)$

$=138.5\Omega$

(4) Temperature Sensor Terminals



8. MAINTENANCE

Qualified personnel execute the following instructions only. To avoid electrical shock, do not perform any servicing other than the operating instructions unless you are qualified to do so.

8-1. Line fuse replacement

If the fuse blows, the meter would not work. Try to determine and correct the cause of the blown fuse, then replace the fuse with correct rating and type shown as below:

FUSE RATING AND TYPE	
100/120V	TT0.3A 250V
220/230V	T0.25A 250V
F101 on PCB	T6.3A 250V

WARNING: For continued fire protection, replace only with 250V fuse of the specified type and rating, and disconnect the power cord before proceeding fuse replacement.

8-2. Line voltage conversion

The primary winding of the power transformer is tapped to permit operation from 100/120V, or 220/230V AC 50/60Hz line voltage. Conversion from one line voltage to another is done by changing the line voltage selector switch as shown in Figure 4-2. The rear panel identifies the line voltage to which the unit was factory set. To convert to a different line voltage, perform the following procedure:

1) Make sure the power cord is unplugged.
2) Adjust the line voltage selector switch to the desired line voltage position.
3) A change in line voltage may also require a corresponding change of fuse value. Install the correct fuse value as listed on rear panel.

8-3. Cleaning

To keep the instrument clean, wipe the case with a damp cloth and detergent. Do not use abrasives or solvents.