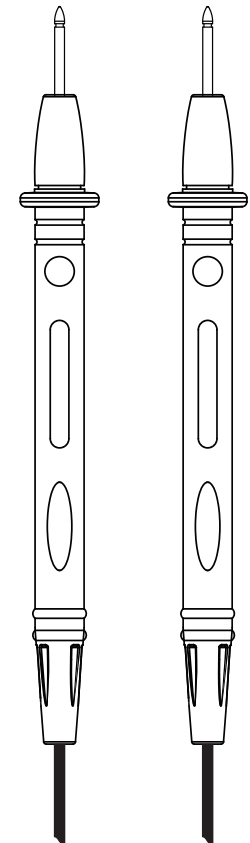
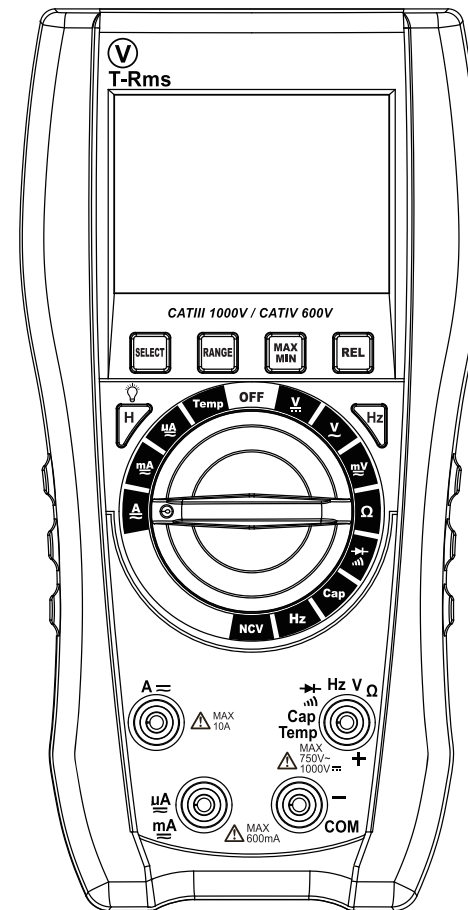




LCD MULTI METER

ITEM NO.:AR020087



I. INTRODUCTION

This is a low power consumption, high accuracy and stable hand held 3 6/7 digits (6000 counts) multimeter; with special designed IC to support true RMS measurement. It performs measurements of DC voltage/ current, true RMS AC voltage/current, resistance, capacitance, frequency, diode, continuity, temperature and non-contact voltage sensing.


II. SAFETY

The multimeter was designed in compliance with IEC/EN safety requirements, please read the safety instruction before any operation.

1. Please check the insulation, conductivity, and connection of the multimeter and test probe before any measurement.
2. Please do not perform any measurements exceeding the specified limitation, otherwise it may damage the instrument and endanger the user.
3. Please operate the instrument with caution to avoid the hazards when measuring the voltage over 60V DC and 40V AC.
4. Please make sure right function has been selected before any measurement.
5. Please disconnect the test probe from the testing point before switching the function.
6. Do not measure the voltage when test probe is connecting with the current measurement terminal.
7. Do not modify the circuit of the multimeter, otherwise it may damage and endanger the user.
8. Do not perform measurement in wet environment.
9. Do not perform measurement in the presence of explosive gas and combustible or in dusty environment.
10. Do not take any measurement whenever anomalous conditions occur such as deformation, break, leakage and blind display ... etc.

III. SPECIFICATION

1. GENERAL SPECIFICATION

Display:	LCD
Maximum Resolution:	6000, 3 6/7 digits (Frequency and Capacitance is 9999)
Range:	Auto / Manual
Data Refresh Rate:	3 times / sec
Low Power Indication:	when  appears
Working Temperature:	0 ~ 50°C (32 ~ 122°F)
Storage Temperature:	-10 ~ 60°C (14 ~ 140°F)
Humidity:	< 80% RH
Power Source:	9V 6F22 Battery
Rating:	AC 0 ~ 750V DC 0 ~ 1000V AC 0 ~ 10A DC 0 ~ 10A Ω 0 ~ 60M TEM -200°C ~ 1300°C (-328 ~ 2372°F) CAP 0 ~ 9.999mF Hz 0 ~ 9.999MHz
CAT Category:	CAT IV 600V CAT III 1000V
Certificated & Approved:	EMC: EN 61326-1, EN 61326-2-2 GS: EN 61010-1, EN 61010-031, EN 61010-2-030, EN 61010-2-033
Pollution Degree:	2

(1)

2. ACCURACY

2.1 DC Voltage (DCV)

2.1.1 DCmV

Range	Accuracy	Resolution
60.00mV	±1%±2digits	0.01mV
600.0mV		0.1mV

2.1.2 DCV

Range	Accuracy	Resolution
6.000V	±1%±2digits	1mV
60.00V		10mV
600.0V		100mV
1000V		1V

2.2 True RMS AC Voltage (ACV)

2.2.1 ACmV

Range	Accuracy	Resolution
60.00mV	±1%±2digits	0.01mV
600.0mV		0.1mV

2.2.2 ACV

Range	Accuracy	Resolution
6.000V	±1%±2digits	1mV
60.00V		10mV
600.0V		100mV
750V		1V

2.3 Capacitance (F)

Range	Accuracy	Resolution
9.999nF	± (2%+10)	0.001nF
99.99nF	± (1%+3)	0.01nF
999.9nF		0.1nF
9.999uF	± (1.5%+3)	1nF
99.99uF		10nF
999.9uF	± (2%+3)	100nF
9.999mF	± (3%+3)	1muF



2.4 Resistance (Ω)

Range	Accuracy	Resolution
600.0Ω	±1%±3digits	0.1Ω
6.000k		1Ω
60.00k	±1%±1digits	10Ω
600.0k		100Ω
6.000M		1kΩ
60.00M		10kΩ

(2)

CAUTION: For measurement of range 600Ω, please short the two probes to obtain the resistance between two probes prior to the measurement. User will need to subtract this value in order to get a more accurate reading during the measurement.

2.5 Diode and Continuity

Range	Display Value
	Diode forward voltage drop: 0 ~ 1.5V
	Buzzer will buzz when the resistance between two points is < 50 ohm. "OL" will be displayed when the resistance between two points is > 600 ohm.

2.6 Frequency

Peak Voltage for frequency measurement is ±600mV.

Range	Accuracy	Resolution
9.999Hz	±1%±3digits	0.001Hz
99.99Hz		0.01Hz
999.9Hz		0.1Hz
9.999KHz		1Hz
99.99KHz		10Hz
999.9KHz		100Hz
9.999MHz		1KHz

2.7 Temperature

Range	Accuracy	Resolution
-200°C~399°C (-328°F~750°F)	±2%±3digits	1°C (1°F)
400°C~1300°C (752°F~2372°F)	±2%±5digits	1°C (1°F)

CAUTION: The table indicates the maximum reading range of the meter, user has to select corresponding K-type thermocouple for different temperature measurement.

2.8 DC Current

Range	Accuracy	Resolution
600.0uA	±1.5%±6digits	0.1uA
6000uA		1uA
60.00mA		10uA
600.0mA		100uA
10.00A	±2%±10digits	10mA

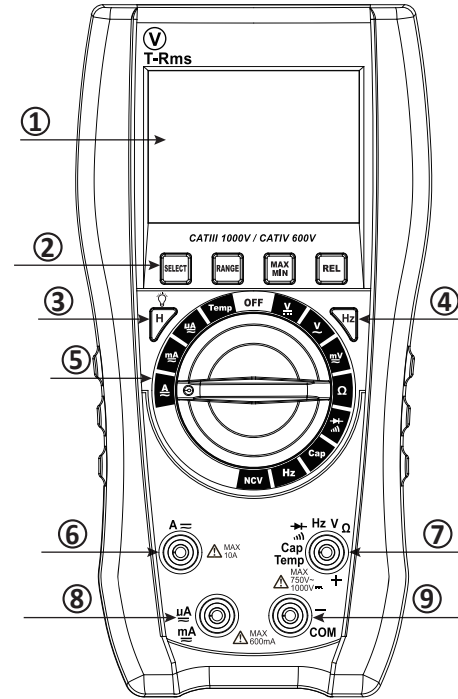
CAUTION: Do not measure maximum current 10A for more than 10 seconds!

2.9 AC Current

Range	Accuracy	Resolution
600.0uA	±1%±6digits	0.1uA
6000uA		1uA
60.00mA		10uA
600.0mA		100uA
10.00A	±2%±6digits	10mA

CAUTION: Do not measure maximum current 10A for more than 10 seconds!

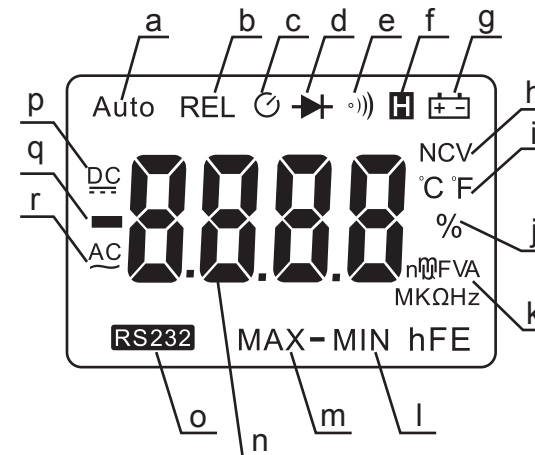
IV. OPERATION



- ① LCD Display
- ② Function Switches
- ③ Short press for value holding
Long press for background light
- ④ Hz
- ⑤ Rotation Switch for Measured Function
- ⑥ 10A Current Measured Terminal
- ⑦ Measured Terminal of Voltage, Resistance, Capacitance, Frequency, Temperature, Continuity and Diode
- ⑧ <600mA Current Measured Terminal
- ⑨ Common Ground Terminal

1. PANEL DESCRIPTION

① LCD Display: Measured value and unit display.



- a. Auto Range
- b. Relative Value Measurement
- c. Auto Power-off
- d. Diode Measurement
- e. Continuity Measurement
- f. HOLD
- g. Low Battery Power Indication
- h. Non-Contact Voltage Sensing
- i. Temperature Units
- j. Duty Cycle Unit
- k. Other Units
- l. Minimum Indication
- m. Maximum Indication
- n. Measured Value
- o. Bluetooth on/off flag
(This only works for 7117A)
- p. DC Indication
- q. Negative Polarity Indication
- r. AC Indication

② Function Switches

(2-1) SELECT

- Switch between DCmV / ACmV at \overline{mV} measurement.
- Switch between diode / continuity measurement at $\overline{\text{diode}}$ measurement.
- Change the temperature unit at temperature measurement.
- Switch between DC / AC current at $\overline{\mu A}$, \overline{mA} and \overline{A} measurement.
- Cancel the **Auto Shut Down** function by pressing and hold the switch, then turn on the power; the buzzer will buzz.

(2-2) RANGE

Switch between Auto / Manual range. The initial condition will be **AUTO** range. Press this switch will be able to define the range manually. Press and hold this switch for more than 2 seconds will return to **AUTO** range. This switch only works for $\overline{\mu A}$, \overline{mA} , \overline{A} , \overline{V} , \overline{V} and $\overline{\Omega}$ measurements.

(2-3) REL

Press this switch to activate the **Relative Value Measurement**; the range will switch from **AUTO** to **MANUAL**. This function works for voltage, current, and resistance.

When the REL button is pressed, **REL** appears on the screen, the measuring range will be fixed, and the reading on the LCD (reference value) will be initialized as 0.

In this mode, **REL (current reading) = input value - reference value**.

For instance, if the stored value is 20.0V and the present measurement value is 22.0V, the reading would be 2.0V.

If a new measured value is equal to the initialized value, then the reading will be 0.0V.

- REL measurement only works for Manual range.
- Press REL again will deactivate the function when REL is activated.
- Press REL when meter is under HOLD condition will deactivate HOLD, and the value will be the reference value.
- Press RANGE, REL, or rotate the measurement switch will cancel the REL measurement (REL will disappear from the LCD).
- Press and hold REL for more than 2 seconds, the meter will enter Bluetooth transmission mode, and RS232 will appear on LCD (This only works for 7117A).

(2-4) MAX/MIN

- Press **MAX/MIN** once will enter maximum mode, **MAX** will appear on LCD. The reading will stay at maximum value that has been measured. Press **MAX/MIN** second time will enter minimum mode, **MIN** will appear on LCD. The minimum value that has been measured will be displayed. Press **MAX/MIN** third time, **MAX-MIN** will appear on LCD, and meter will display difference between maximum and minimum value. Keep pressing **MAX/MIN** will repeat the order.
- REL**, **HOLD** and **SELECT** will not function after enter MAX/MIN mode. Press **RANGE** will leave MAX/MIN mode.
- Press and hold **MAX/MIN** for more than 2 seconds will leave the MAX/MIN mode.

③ HOLD

- Press this switch will hold the value that shows on LCD. When it is activated, **H** will be displayed on LCD. Press **HOLD** again will deactivate it.
- Press **RANGE**, **MAX/MIN**, **REL**, or rotate the measurement switch will deactivate the **HOLD** condition.
- Press **HOLD** for more than 2 seconds will switch on the background light; repeating the procedure will switch off the background light. The background light will switch off automatically after 30 seconds.

④ Hz

This switch works for AC Voltage, Current measurement and Frequency measurement. Pressing this switch will change between frequency and duty cycle measurement.

⑤ Rotation Switch for Measured Function

Rotate this switch to change the measured function.

⑥ 10A Current Measured Terminal.

⑦ Measurement Terminal of Voltage, Resistance, Capacitance, Frequency, Temperature, Continuity and Diode.

⑧ <600mA Current Measured Terminal.

⑨ Common Ground Terminal (COM).

2. DC VOLTAGE MEASUREMENT

2.1 Plug the black probe with ⑨ **COM** terminal, and red probe with ⑦ terminal.

2.2 Rotate the switch to \overline{V} .

2.3 The initial range will be auto range, **AUTO** and **DC** will be displayed. User can press **RANGE** to change the range of 6.000V, 60.00V, 600.0V and 1000V manually.

2.4 Rotate the switch to \overline{mV} , then press **SELECT** to select DC measurement (**DC** will be displayed).

2.5 The initial range will be auto range, user can press **RANGE** to change the range of 60.00mV or 600.0mV manually.

2.6 Contact the probes with the testing point, the polarity of the red probe will be displayed on the LCD.

⚠ CAUTION:

- If **OL** is displayed during measurement, it means the measured voltage is higher than specific range. Please increase the range level.
- Do not measure voltage higher than 1000V DC; otherwise the meter may be damaged.
- Avoid the direct contact with human body during the high voltage measurement.

3. AC VOLTAGE MEASUREMENT

3.1 Plug the black probe with ⑨ **COM** terminal, and red probe with ⑦ terminal.

3.2 Rotate the switch to \overline{V} .

3.3 The initial range will be auto range, **AUTO** and **AC** will be displayed. User can press **RANGE** to change the range of 6.000V, 60.00V, 600.0V, and 750V manually.

3.4 Rotating the switch to \overline{mV} , then press **SELECT** to select AC measurement (**AC** will be displayed).

3.5 The initial range will be auto range, user can press **RANGE** to change the range of 60.00mV, 600.0mV manually.

3.6 Contact the probes with the testing point, the polarity of the red probe will be displayed on the LCD.

⚠ CAUTION:

- If **OL** is displayed during measurement, it means the measured voltage is higher than specific range. Please increase the range level.
- Do not measure voltage higher than 750V AC; otherwise the meter may be damaged.
- Avoid the direct contact with human body during the high voltage measurement.

4. RESISTANCE MEASUREMENT

4.1 Plug the black probe with ⑨ **COM** terminal, and red probe with ⑦ terminal.

4.2 Rotate the switch to $\overline{\Omega}$, then contact the probes with the testing points.

4.3 Press **RANGE** to select the range.

⚠ CAUTION:

- If user does not have any idea of measured resistance during the Manual range, please start from the highest range.
- If **OL** is displayed during measurement, it means the measured resistance is higher than specific range. Please increase the range level.

- It will take few seconds for the reading to be stable when user measures resistance higher than 1M ohm.
- **OL** will be displayed when measured an open circuit.
- Please make sure all voltage has cut off and all capacitor has been discharged before any measurement.
- Do not feed any voltage into the probes during the resistance measurement.

5. DIODE / CONTINUITY MEASUREMENT

- 5.1 Plug the black probe with **COM** terminal, and red probe with **7** terminal.
- 5.2 Rotate the switch to **diode symbol**, then contact the probes with the testing points.
- 5.3 To perform diode measurement, please press **SELECT** unit **diode symbol** displayed on the LCD.
- 5.4 Forward measurement: When contact the red probe with anode and black probe with cathode, the voltage value will be displayed on LCD.
- 5.5 Reverse measurement: When contact the red probe with cathode and black probe with anode, the **OL** will be displayed on LCD.
- 5.6 Complete measurement of diode includes both forward and reverse measurement. If any direction is not as above described, it means the diode may be damaged.
- 5.7 To perform continuity measurement, please press **SELECT** unit **bell symbol** is displayed on the LCD.
- 5.8 Contact the probes with two sides of the circuit. If the resistance is smaller than 50 ohm, the buzzer will buzz.

⚠ CAUTION:

- Do not feed any voltage into the probes during the continuity measurement.

6. CAPACITANCE MEASUREMENT

- 6.1 Plug the black probe with **COM** terminal, and red probe with **7** terminal.
- 6.2 Rotate the switch to **Cap** measurement.
- 6.3 Contact the capacitor with the testing probe, and the measured value will be displayed on the LCD.
- 6.4 To measure the 9.999mf capacitor, the meter needs about 30 seconds to get a stable reading.

7. FREQUENCY MEASUREMENT

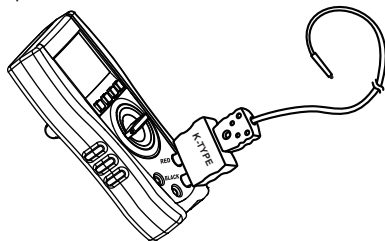
- 7.1 Plug the black probe with **COM** terminal, and red probe with **7** terminal.
- 7.2 Rotate the measurement switch to **Hz**, connecting the two probe or the shielded wire with the signal source or the load of the source.
- 7.3 Press **Hz** to switch between Frequency / Duty Cycle and the measured signal frequency or the duty cycle value will be display on LCD.

⚠ CAUTION:

- Frequency measurement only works at auto ranging.
- Please use shielded wire to measure the small signal in noisy environment.

8. TEMPERATURE MEASUREMENT

- 8.1 Rotate the switch to **Temp**.
- 8.2 Connect the K-type thermocouple with the meter to perform the measurement.
- 8.3 Change temperature unit by pressing **SELECT**.
- 8.4 Temperature measurement needs the transfer connector and K-type thermocouple.
The connection shows as below figure:



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9. NON-CONTACT VOLTAGE SENSING

- 9.1 Rotate the switch to **NCV**, and **EF** will be displayed on the LCD
- 9.2 Approach the sensor to the target (sensor is locate on which **V** is printed on the instrument).
- 9.3 If the meter senses the voltage, “-“ will be displayed on the LCD. The more closer to the voltage source, the more “-“ will appear on the LCD.
- 9.4 The voltage sensing range is 80 ~ 1000VAC.

10. DC CURRENT MEASUREMENT

- 10.1 Plug the black probe with **COM** terminal, and red probe with **uA**, **mA**, or **A** terminal (the maximum current is 6000uA for uA measurement, the maximum current is 600mA for mA measurement, and the maximum current is 10A for measurement).
- 10.2 Rotating the switch to (**uA mA A**), then press **SELECT** to select DC measurement (**DC** will be displayed).
- 10.3 Connect two probes with the testing points in serial; LCD will display the polarity of red probe.

⚠ CAUTION:

- If user has no idea of the measured current range, please start the measurement from the highest range, and then decrease the range base on the measurement.
- If **OL** appears, it means the measured current is higher than range, please increase the range.
- Maximum input current is 600mA or 10A (depends on different terminal), over the current may damage the meter.

11. AC CURRENT MEASUREMENT

- 11.1 Plug the black probe with **COM** terminal, and red probe with **uA**, **mA**, or **A** terminal (the maximum current is 6000uA for uA terminal, the maximum current is 600mA for mA terminal, and the maximum current is 10A for A terminal).
- 11.2 Rotating the switch to (**uA mA A**), then press **SELECT** to select AC measurement (**AC** will be displayed).
- 11.3 Connect two probes with the testing points in serial; LCD will display the polarity of red probe.

⚠ CAUTION:

- If user has no idea of the measured current range, please start the measurement from the highest range, and then decrease the range base on the measurement.
- If **OL** appears, it means the measured current is higher than range, please increase the range.
- Maximum input current is 600mA or 10A (depends on different terminal), over the current may damage the meter.

12. AUTO SHUT DOWN


- 12.1 Meter will power off automatically after 15 minutes. To restart the meter, please press any switch.
- 12.2 Press and hold **SELECT** button and then turn on the power will deactivate the **Auto Shut Down** function.

V. MAINTENANCE

⚠ CAUTION

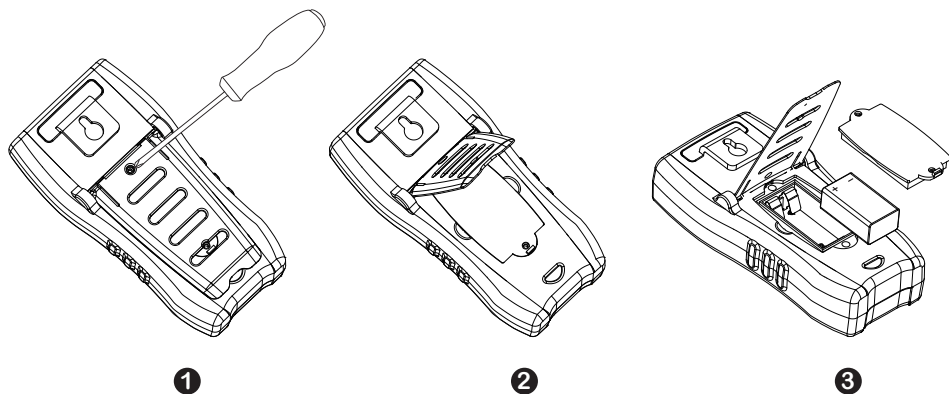
- This is a meter with precise design, please do not modify the circuit.
- Keep away from water, dust and fall down.
- Do not operate and store the meter in high temperature, high moisture, flammable, explosive and strong magnetic environment.
- Do not use abrasive, alcohol and solvent to clean the meter.
- Take off the battery if meter is going to store for a long period.

(8)

- Change the battery when  appears on LCD.
- Do not measure voltage higher than 1000V DC or 750V AC.
- Do not measure any voltage during current, resistance, diode, continuity, temperature and non-contact voltage sensing measurement.
- Do not use the meter if the battery or battery cover is not properly installed.
- Please move testing probes away from the testing point and switch off the meter during the battery replacement.
- Please use the original testing probes.
- Please recycle the battery by following the local regulation.



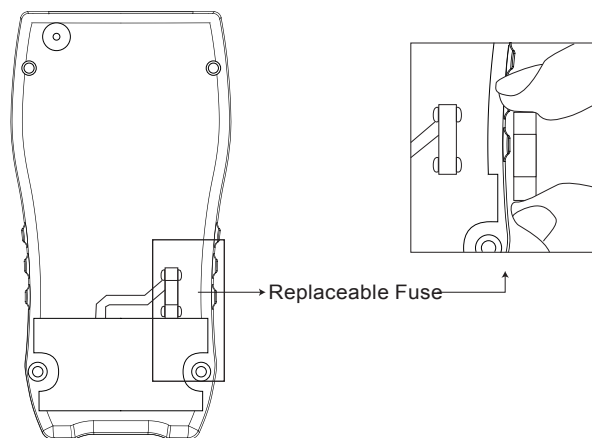
1. BATTERY REPLACEMENT



2. FUSE REPLACEMENT

The instrument uses one 10A/250V fuse. Please follow the instruction to replace the fuse:

- (1) Switch off the power and remove the probes.
- (2) Remove the protective cases and four screws on the back of the instrument and open the back cover. Please see following figure of fuse position and use the same type fuse.
- (3) Reinstall the back cover to its position, screw it completely and restore the protective case.
- (4) Please recycle the fuse by following the local regulation.




(9)

3. APPENDIX







If the meter cannot work properly, please try following solution.

If it doesn't help, please contact with the dealer or service center.

PHENOMENON	SOLUTION
No display	1. Check if the battery is properly installed. 2. Change the battery.
 appears on LCD	Change the battery.
Value is not accurate	Change the battery.

- * This manual is subject to change without notice.
- * The content of this manual is considered correct; if the user find any errors, omissions, etc., please contact the manufacturer.
- * The company does not assume any accidents and hazards caused by incorrect operation of the user.
- * The functions described in this manual do not serve as a reason for the use of the product for special purposes.

VI. SAFETY SYMBOLS

SYMBOL	DESCRIPTION
CAT III	Category III is for measurements performed in the building installation.
CAT IV	Category IV is for measurements performed at the source of the low-voltage installation.
	<ul style="list-style-type: none"> • Do not dispose electrical appliances as unsorted municipal waste, use separate collection facilities. • Contact your local government for information regarding the collection systems available. • If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the ground water and get into the food chain, damaging your health and well-being. • When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposal at least for free of charge.
	WARNING. RISK OF DANGER
	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.
	AC (Alternating Current)
	DC (Direct Current)
	Both direct and alternating current

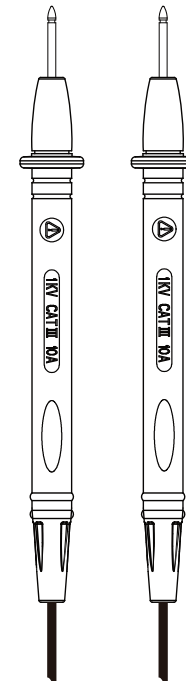
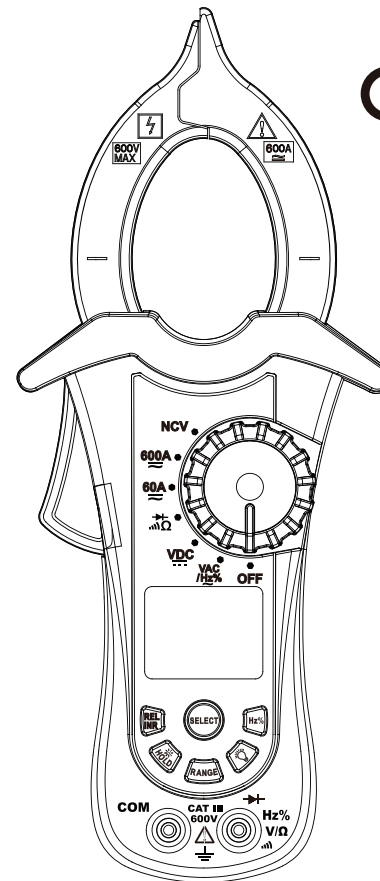
(10)



JONNESWAY®

600A DIGITAL CLAMP METER

ITEM NO.: AR020093



GB INSTRUCTION MANUAL ----- 1~10

DE GEBRAUCHSANLEITUNG --- 11~20

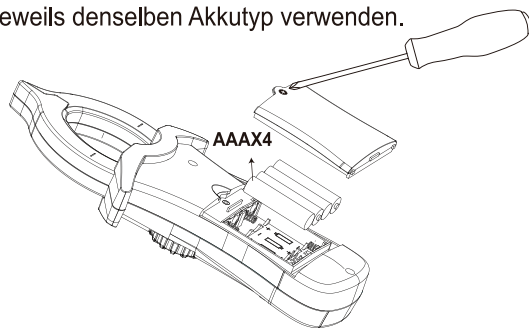
IX. INSTANDHALTUNG

Bei Nichtgebrauch des Instruments muss der Schalter in die "off"-Position (aus) rotiert werden. Bei einem längeren Nichtgebrauch den Akku herausnehmen.

X. AUSWECHSELN DES AKKUS

Als Stromquelle dieses Instruments werden 4 x AAA-Akkus verwendet. Die Anleitung zum Auswechseln des Akkus befolgen:

- (1) Die Stromzufuhr abschalten und die Sonden entfernen.
- (2) Das Akkufach ist auf der Rückseite des Instruments. Zum Öffnen des Akkufachs die Schrauben mit einem Schraubenzieher lockern und den Akku unter Beachtung der Polaritätsrichtungen auswechseln. Jeweils denselben Akkutyp verwenden.
- (3) Das Akkufach einsetzen und vollständig festschrauben.
- (4) Lassen Sie den Akku nach örtlichen Bestimmungen wiederverwerten.



Symbole	Beschreibung
CAT III	Die Messkategorie II ist zum Testen und Messen der Stromkreise bestimmt, die direkt an die Nutzungspunkte angeschlossen sind (Steckdosen und ähnliche Dosen) der Niederspannungs-Netzinstallation angeschlossen sind.
	<ul style="list-style-type: none"> • Elektrische Geräte gehören nicht in den unsortierten Hausmüll. Bringen Sie diese an dafür bestimmte Sondermüllstellen.. • Wenden Sie sich hinsichtlich der vorhandenen Sondermüllsammelstellen an Ihre örtliche Umweltschutzbehörde. • Bei einer Entsorgung von elektrischen Geräten in Abfalldeponien oder Mülldeponien können gefährliche Substanzen in das Grundwasser und in die Nahrungsmittelkette gelangen, wodurch die Gesundheit gefährdet wird. • Beim Ersetzen der alten Geräte mit neuen ist der Händler gesetzlich verpflichtet, Ihr altes Gerät zur Entsorgung kostenlos entgegenzunehmen.
	WARNUNG. GEFÄHRDUNG DER BETRIEBSSICHERHEIT
	WARNUNG: GEFÄHRLICHE SPANNUNG. Stromschlagrisiko.
	AC (Wechselstrom)
	DC (Gleichstrom)
	Sowohl Gleich- als auch Wechselstrom



I. INTRODUCTION

This is a low power consumption, high accuracy and stable hand held clamp meter. The digit is 3 1/2 (2000 counts) for 7128A and 3 6/7 (6000 counts) for 7128B/C. It performs measurements of DC voltage/current, AC voltage/current, resistance, frequency, diode, continuity and non-contact voltage sensing. The meter will switch to sleeping mode after 15 minutes without any operation, please press "SELECT" button to wake up or switch off the power to restart the meter.

II. CAUTION

- (1) Please change the battery when is shown on LCD.
- (2) To prevent the electric arc damage the contacting point of the switch, please do not rotate the switch during high power measurement.
- (3) Make sure the switch is in the right position during the AC and DC voltage measurement.
- (4) Make sure all circuit power is off during resistance and diode measurement.
- (5) If " - " appears on the left of measured value during DC voltage measurement, it means the polarity of testing probe is reversed. In general, it means red probe is contacting with negative.
- (6) Do not disassemble the device.
- (7) Use only current probes, test leads, and adapters supplied with the product.
- (8) For better accuracy, do not rotating the function switch during the measurement. If the user needs to switch the function, please release the clamp from the measured object, and then rotating the switch.

III. GENERAL SPECIFICATION

Display: LCD

Maximum Resolution: 2000, 3 1/2 digits (AR020093A)
6000, 3 6/7 digits (AR020093, AR020093B)

Range: Auto / Manual

Data Refresh Rate: 3 times / sec

Low Power Indication: when appear

Working Temperature: 0 ~ 50 °C (32 ~ 122 °F)

Storage Temperature: -10 ~ 60 °C (14 ~ 140 °F)

Humidity: < 80 %RH

Power: 1.5V AAA X4 Battery

CAT Category: CAT III 600V

Safety: EMC: EN 61326-1, EN 61326-2-2

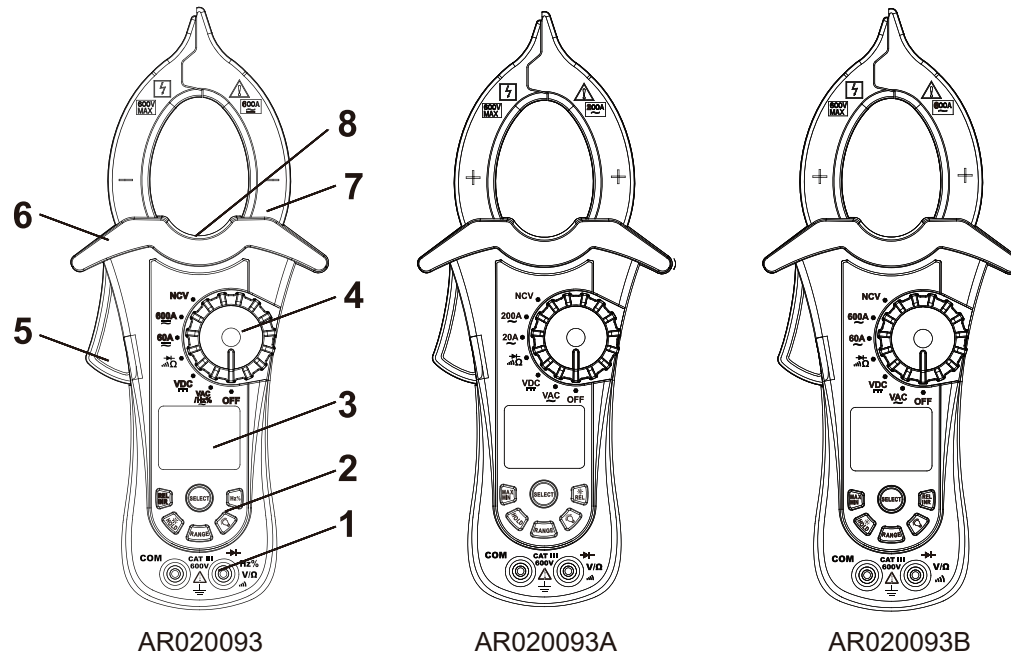
GS: EN 61010-1, EN 61010-031, EN 61010-2-030,
EN 61010-2-032, EN 61010-2-033

Pollution Degree: 2

Rating:	AC	0 ~ 600VAC
	DC	0 ~ 600VDC
	AC	0 ~ 200A (AR020093A)
		0 ~ 600A (AR020093, AR020093B)
	DC	0 ~ 600A (AR020093)
	Ω	0 ~ 20M (AR020093A)
		0 ~ 60M (AR020093, AR020093B)
	Hz	0 ~ 9.999MHz (AR020093)

IV. PRODUCT DESCRIPTION

- (1) Testing Probe Inserting Terminal
- (2) Function Switches
- (3) LCD Display
- (4) Measurement Rotation Switches
- (5) Clamp Trigger
- (6) Protection Wall
- (7) Clamp: Do not clamp both live and neutral wire at the same time during measurement, please clamp one of them only.
- (8) Illumination



(2)

AR020093



Funktion	Bereich	Auflösung	Genauigkeit
DC-Spannung: 0~600V DC	600 mV	0.1 mV	±1.5%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC-Spannung: 0~600V AC	600 mV	0.1 mV	±2%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC-Strom: 0~60A	60A	0.01A	±2.5%±8 digits
AC-Strom: 0~600A	600A	0.1A	±2.5%±5 digits
AC Frequency: 0~9.999M Hz	9.999MHz	0.1Hz	±2%±5 digits
AC Duty Cycle: 1%- 99%	99%	0.1%	±2%±5 digits
DC Current: 0~60A	60A	0.01A	±2.5%±8 digits
DC Current: 0~600A	600A	0.1A	±2.5%±8 digits
Widerstand: 0~60M Ω	600 Ω	0.1 Ω	±1%±3 digits
	6k Ω	0.001k Ω	±1%±3 digits
	60k Ω	0.01k Ω	±1%±3 digits
	600k Ω	0.1k Ω	±1%±3 digits
	6M Ω	0.001M Ω	±2%±3 digits
	60M Ω	0.01M Ω	±2%±3 digits
Diode und Durchgang ➔ 🔔	Anzeige		
	Dioden-Flussspannung: 0-3V		
	Bei einem Summen des Summers beträgt der Widerstand <50 Ohm		

AR020093B


Funktion	Bereich	Auflösung	Genauigkeit
DC-Spannung: 0~600V DC	600 mV	0.1 mV	±1.5%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC-Spannung: 0~600V AC	600 mV	0.1 mV	±2%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC-Strom: 0~60A	60A	0.01A	±2.5%±8 digits
AC-Strom: 0~600A	600A	0.1A	±2.5%±5 digits
Widerstand: 0~60M Ω	600 Ω	0.1 Ω	±1%±3 digits
	6k Ω	0.001k Ω	±1%±3 digits
	60k Ω	0.01k Ω	±1%±3 digits
	600k Ω	0.1k Ω	±1%±3 digits
	6M Ω	0.001M Ω	±2%±3 digits
	60M Ω	0.01M Ω	±2%±3 digits
Diode und Durchgang ➔ 🔔	Anzeige		
	Dioden-Flussspannung: 0-3V		
	Bei einem Summen des Summers beträgt der Widerstand <50 Ohm		

(19)

A. AC-SPANNUNGSMESSUNG



- (1) Den Schalter auf die $\frac{VAC}{Hz\%}$ Messung drehen, und der Drücken  Schlüssel.
- (2) Die rote Sonde in die V-Klemme und die schwarze Sonde in die COM-Klemme einstecken. Die Sonde an den Testpunkt anschließen, wonach der Spannungswert in der LCD-Anzeige erscheint.
- (3) Drücken Sie , um zwischen Frequenz / Tastverhältnis zu wechseln und die gemessene Signalfrequenz oder der Betriebszykluswert wird auf LCD angezeigt.

B. AC-STROMMESSUNG

- (1) Die Prüfsonde vom Instrument entfernen und den Schalter auf die Strommessung rotieren. Mit der Messung ab 600A beginnen $\underline{600A}$, wenn der Messwert ungewiss ist.
- (2) Den Trigger zum Öffnen der Klemme schieben und danach das Messgerät an die spannungsführende oder an die neutrale Leitung klemmen (die Klemme nicht gleichzeitig an beide Leitungen klemmen).
- (3) Zum Sicherstellen der Genauigkeit muss sichergestellt werden, dass die Leitung in der Mitte der und senkrecht zur Klemme ist.
- (4) Den Trigger loslassen, damit die Klemme einen geschlossenen Kreis bildet.
- (5) Drücken  Schlüssel
- (6) Der Wert wird auf der LCD-Anzeige angezeigt.



VIII. SPEZIFIKATIONEN

AR020093A

Funktion	Bereich	Auflösung	Genauigkeit
DC-Spannung: 0~600V DC	200 mV	0,1 mV	±1.5%±3 digits
	2V	1 mV	
	20V	10 mV	
	200V	100 mV	
	600V	1V	
AC-Spannung: 0~600V AC	200 mV	0,1 mV	±2%±3 digits
	2V	1 mV	
	20V	10 mV	
	200V	100 mV	
	600V	1V	
AC-Strom: 0~20A	20A	10mA	±2.5%±8 digits
AC-Stromt: 0~200A	200A	1A	±2.5%±5 digits
Widerstand: 0~20MΩ	200Ω	0.1Ω	±1%±3 digits
	2kΩ	1Ω	±1%±3 digits
	20kΩ	10Ω	±1%±3 digits
	200kΩ	100Ω	±1%±3 digits
	2MΩ	1kΩ	±2%±3 digits
	20MΩ	10kΩ	±2%±3 digits
Diode und Durchgang  	Anzeige		
	Dioden-Flussspannung: 0-3V		
	Bei einem Summen des Summers beträgt der Widerstand <50 Ohm		

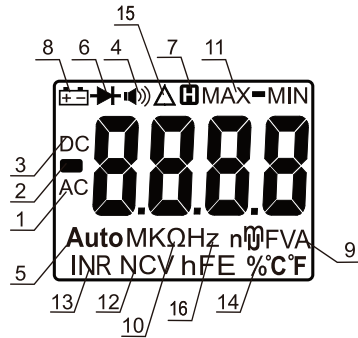
V. PANEL DESCRIPTION

- (1) **HOLD**: Press this switch to hold the value shown on LCD. Press any switch will deactivate the hold condition.
- (2) **REL/INR**: Press this switch to activate the "Relative Value Measurement"; the range will switch from "Auto" to "Manual". This function works for voltage, current, and resistance. When the REL button is pressed, Δ appears on the display, the measuring range will be fixed, and the reading on the LCD (reference value) will be initialized as 0.
In this mode, REL Δ (current reading) = input value - reference value.
For instance, if the stored value is 20.0V and the present measurement value is 22.0V, the reading would be 2.0V. If a new measurement value is equal to the initialized value, then the reading will be 0.0V.

Press REL/INR for more than 2 seconds to activate or deactivate the "Inrush Current Measurement". Repeated measurement is available by short press in this mode. (AR020093, AR020093B)
- (3) **RANGE**: Switch between Auto and Manual range. The initial condition will be AUTO range. Press the switch will be able to define the range manually. In manual range, the range will jump from low to high and repeat the cycle when user presses the switch. Press and hold this switch for more than 2 seconds will return to "AUTO" range.
- (4) **SELECT**: Press this button to change the function of the measurement. User can also press this button to awake the device during the sleeping mode. If user wants to switch off the function of sleeping mode, user needs to press and hold this button when its power is off, and switch on the power at the same time. If the sleeping mode is switched off, the device will tweet 5 times every 15 minutes. The device will resume the function of sleeping mode if the device is restarted. The device will tweet 5 times 1 minutes before the device enter the sleeping mode. The device will have a long tweeting before the device enter the sleeping mode.
- (5) **MAX/MIN**: Display maximum and minimum history value. (AR020093A, AR020093B)
- (6) **Hz**: Switch between frequency and duty cycle during frequency measurement. Switch between frequency, duty cycle, and voltage / current measurement during AC Voltage / Current measurement. (AR020093)
- (7)  is illumination switch. Press and hold this switch will switch on the light.
- (8) Press  for more than 2 seconds will switch on the background light; repeat the procedure will switch off the background light. The background light will also switch off automatically after 30 seconds

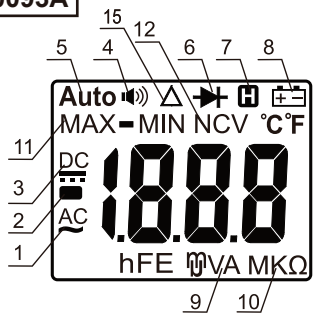
VI. LCD DESCRIPTION

AR020093, AR020093B



- (1) AC Voltage Indication
- (2) DC Polarity Indication
- (3) DC Voltage Indication
- (4) Continuity Test Indication
- (5) Auto Range
- (6) Diode Test Indication
- (7) Hold Function
- (8) Low Battery Power Indication
- (9) Voltage and Current Unit
- (10) Resistance Unit
- (11) Max/Min Indication
- (12) Non-Contact Voltage Sensing
- (13) Inrush Current Indication
- (14) Duty Cycle Indication (AR020093)
- (15) Relative Value Measurement Indication
- (16) Frequency Unit (AR020093)

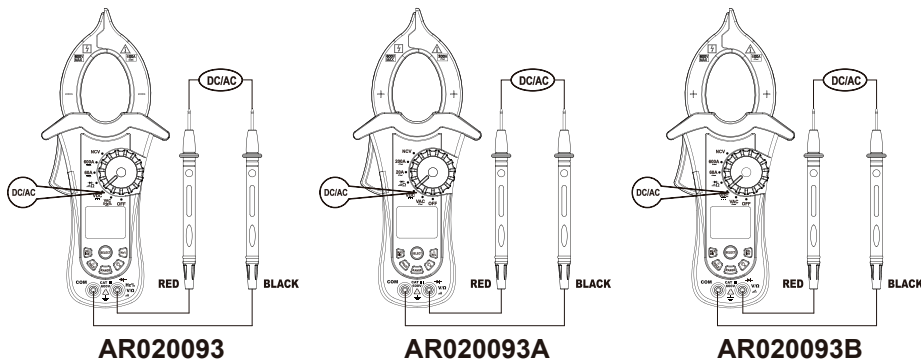
AR020093A



- (AR020093A, AR020093B)
- (12) Non-Contact Voltage Sensing
- (13) Inrush Current Indication
- (14) Duty Cycle Indication (AR020093)
- (15) Relative Value Measurement Indication
- (16) Frequency Unit (AR020093)

VII. OPERATION

1. AC / DC VOLTAGE MEASUREMENT V_{AC} / V_{DC}

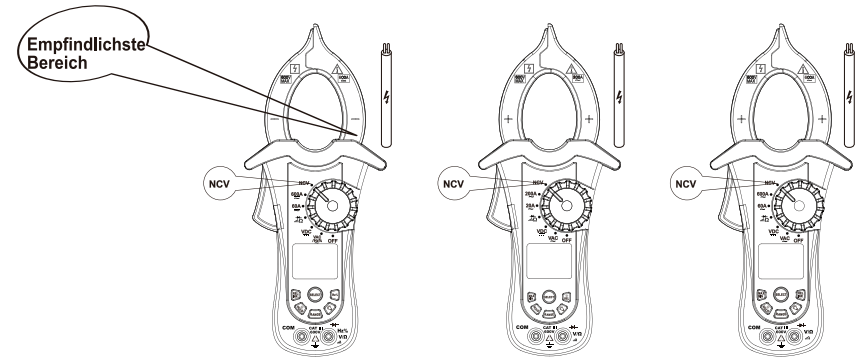


- (1) Rotate the switch to DCV or ACV according to the demand of measurement.
- (2) Plug the red probe in V terminal and black probe in COM terminal. Connect the probe with testing point and voltage value will be displayed on LCD.

(4)

- (2) Die rote Sonde an die V-Klemme und die schwarze Probe an die COM-Klemme anschließen.
- (3) Zum Wählen der \rightarrow -Funktion auf den "Select"-Schalter (wählen) drücken.
- (4) Die rote Sonde an den Positivpol der Diode und die schwarze Sonde an den Negativpol der Diode anschließen.
- (5) Der Fluss-Durchgangsspannungswert der gemessenen Diode erscheint in der LCD-Anzeige.
- (6) Zum Wählen der Durchgangsmessung auf den "Select"-Schalter (wählen) drücken. Das Instrument summt, wenn ein geringerer Widerstand als 50 Ω C gemessen wird.

6. SPANNUNGSABTASTUNG NCV



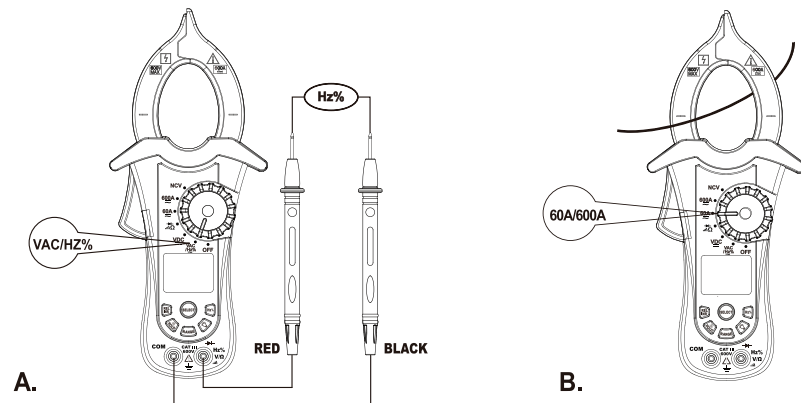
AR020093

AR020093A

AR020093B

- (1) Den Schalter auf die NCV-Messung rotieren.
- (2) Wenn Sie sich der rechten Seite der Klemme dem Kabel nähern und die Spannung erkannt wurde, twittert der Summer. Wenn keine Spannung anliegt, kein Summertweeten. (AR020093A)
Wenn Sie sich der rechten Seite der Klemme dem Kabel nähern und die Spannung erkannt wurde, twittert der Summer und auf dem LCD wird "----" angezeigt. Wenn keine Spannung anliegt, erscheint auf dem LCD "EF" und es ertönt kein Summertweeten. (AR020093, AR020093B)

7. FFREQUENZ / Tastverhältnis MESSUNG (nur AR020093) $Hz\%$



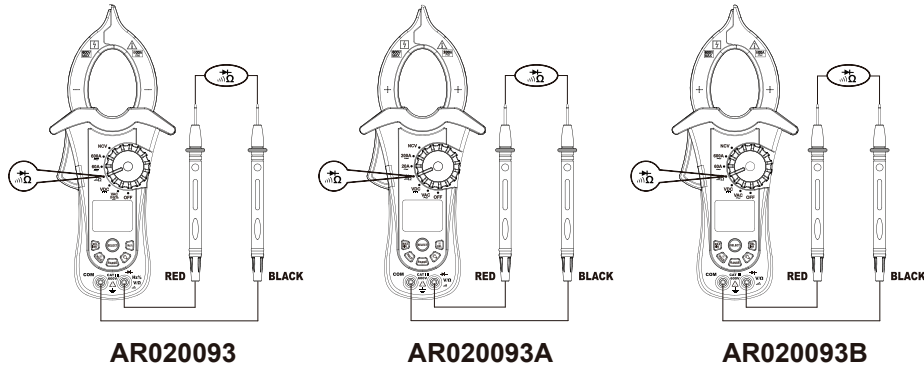
A.

B.

(17)

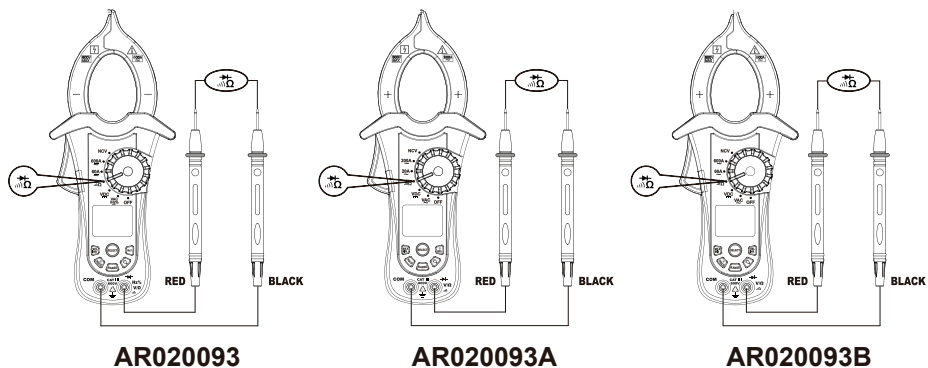
- (2) Den Trigger zum Öffnen der Klemme schieben und danach das Messgerät an die spannungsführende oder an die neutrale Leitung klemmen (die Klemme nicht gleichzeitig an beide Leitungen klemmen).
- (3) Zum Sicherstellen der Genauigkeit muss sichergestellt werden, dass die Leitung in der Mitte der und senkrecht zur Klemme ist.
- (4) Den Trigger loslassen, damit die Klemme einen geschlossenen Kreis bildet.
- (5) Den Wert in der LCD-Anzeige ablesen.
- (6) Bei einem Wählen des richtigen Bereichs wird der gemessene Wert genauer sein.

4. WIDERSTANDSMESSUNG



- (1) Zur Vermeidung eines Stromschlags muss sichergestellt werden, dass vor der Messung die Stromzufuhr abgeschaltet und der Kondensator entladet sind. Die Spannung und der Strom dürfen mit dieser Funktion nicht gemessen werden.
- (2) Die rote Sonde an die V-Klemme und die schwarze Probe an die COM-Klemme anschließen.
- (3) Die Sonde an den Testpunkt anschließen, wonach der Widerstandswert in der LCD-Anzeige erscheint.

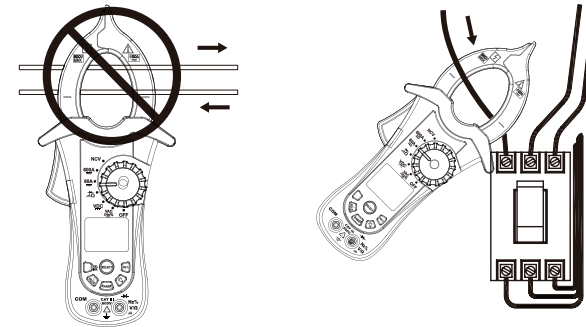
5. DIODEN- UND DURCHGANGSPRÜFUNG



- (1) Zur Vermeidung eines Stromschlags muss sichergestellt werden, dass vor der Messung die Stromzufuhr abgeschaltet und der Kondensator entladet sind. Die Spannung und der Strom dürfen mit dieser Funktion nicht gemessen werden.

2. AC CURRENT MEASUREMENT

AR020093 $\underline{60A} / \underline{600A}$ AR020093A $\underline{20A} / \underline{200A}$ AR020093B $\underline{60A} / \underline{600A}$

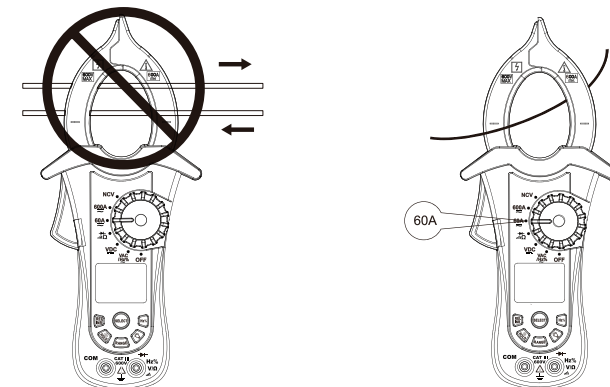


CORRECT

- (1) Remove the testing probe from instrument. Start the measurement from larger range if the measured value is uncertain.
- (2) Push the trigger to open the clamp, then clamp the meter on live wire or neutral wire. (Do not clamp on both wire at the same time.)
- (3) To ensure the accuracy, make sure the wire is in the center of the clamp and it is perpendicular to the clamp.
- (4) Release the trigger, and so the clamp forms a closed loop.
- (5) Read the value from LCD.
- (6) The more accurate value will be obtained if proper range is selected.
- (7) Long press INR switch will activate or deactivate the Inrush Current measurement. Repeated measurement is available by short press in this mode.

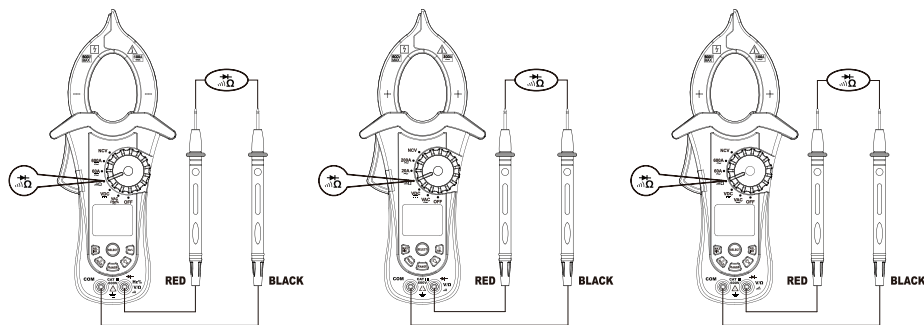
CAUTION: For better accuracy, do not rotating the function switch during the measurement. If the user needs to switch the function, please release the clamp from the measured object, and then rotating the switch.

3. DC CURRENT MEASUREMENT (AR020093) $\underline{60A} / \underline{600A}$



- (1) Remove the testing probe from instrument and rotate the switch to current measurement. Start the measurement from 600A range **600A** if the measured value is uncertain.
- (2) Push the trigger to open the clamp, then clamp the meter on live wire or neutral wire. (Do not clamp on both wire at the same time.)
- (3) To ensure the accuracy, make sure the wire is in the center of the clamp and it is perpendicular to the clamp.
- (4) Release the trigger, and so the clamp forms a closed loop.
- (5) Read the value from LCD.
- (6) The more accurate value will be obtained if proper range is selected.

4. RESISTANCE MEASUREMENT Ω



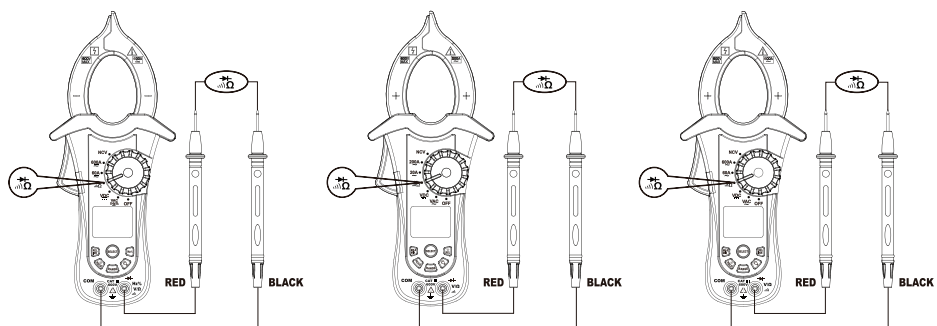
AR020039

AR020039A

AR020039B

- (1) To prevent the electric shock, make sure all power is off and capacitor is discharged before this measurement. Do not measure voltage and current with this function.
- (2) Plug red probe in V terminal and black probe in COM terminal.
- (3) Connect the probe with testing point and resistance value will be displayed on LCD.

5. DIODE AND CONTINUITY MEASUREMENT \rightarrow



AR020039

AR020039A

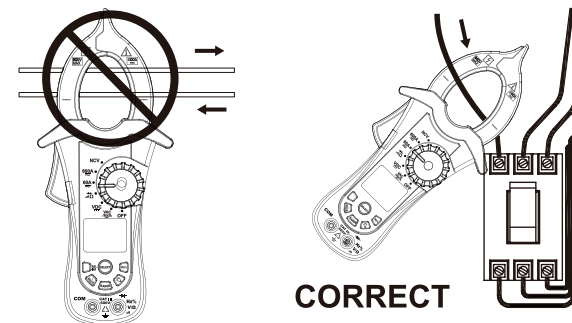
AR020039B

- (1) To prevent the electric shock, make sure all power is off and capacitor is discharged before this measurement. Do not measure voltage and current with this function.
- (2) Plug red probe in V terminal and black probe in COM terminal.
- (3) Press "Select" switch to select \rightarrow function.

(6)

2. AC-STROMMESSUNG

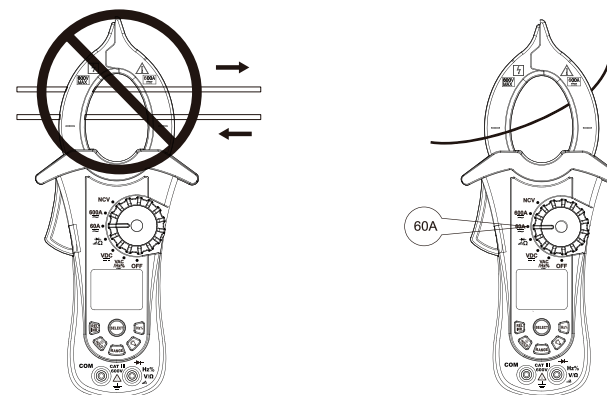
AR020093 **60A / 600A** AR020093A **20A / 200A** AR020093B **60A / 600A**



- (1) Die Prüfsonde vom Instrument entfernen. Die Messung im größeren Bereich beginnen, wenn der Messwert ungewiss ist.
- (2) Den Trigger zum Öffnen der Klemme schieben und danach das Messgerät an die spannungsführende oder an die neutrale Leitung klemmen (die Klemme nicht gleichzeitig an beide Leitungen klemmen).
- (3) Zum Sicherstellen der Genauigkeit muss sichergestellt werden, dass die Leitung in der Mitte der und senkrecht zur Klemme ist.
- (4) Den Trigger loslassen, damit die Klemme einen geschlossenen Kreis bildet.
- (5) Den Wert in der LCD-Anzeige ablesen.
- (6) Bei einem Wählen des richtigen Bereichs wird der gemessene Wert genauer sein.
- (7) Lange auf den INR-Schalter drücken, um die Messung des Einschaltstroms zu aktivieren oder zu deaktivieren. Die Wiederholung der Messung erfolgt durch kurzes Drücken in diesem Modus.

VORSICHT: Drehen Sie den Funktionsschalter während der Messung nicht, um eine bessere Genauigkeit zu erzielen. Wenn der Benutzer die Funktion umschalten muss, lösen Sie bitte die Klemme vom Messobjekt und drehen Sie den Schalter.

3. DC-STROMMESSUNG (AR020093) **60A / 600A**

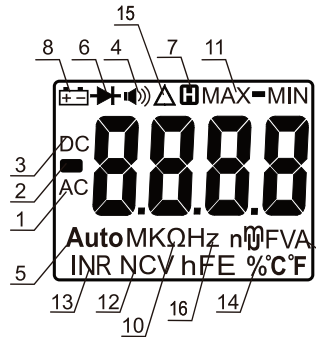


- (1) Die Prüfsonde vom Instrument entfernen und den Schalter auf die Strommessung rotieren. Mit der Messung ab 600A beginnen **600A**, wenn der Messwert ungewiss ist.

(15)

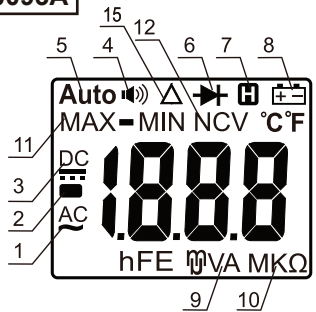
VI. LCD-BESCHREIBUNG

AR020093, AR020093B



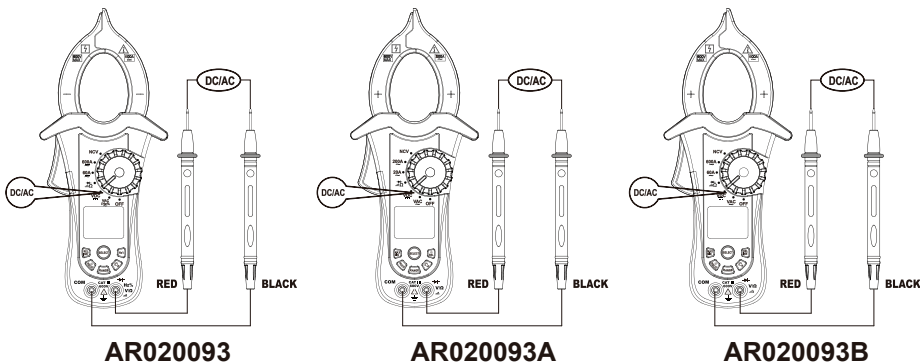
- (1) AC-Spannungsanzeige
- (2) DC-Polaritätskennzeichen
- (3) DC-Spannungsanzeige
- (4) Anzeige der Durchgangsprüfung
- (5) Auto-Bereich (autom.)
- (6) Anzeige der Diodenprüfung
- (7) Haltefunktion
- (8) Anzeige der niedrigen Akkuladung
- (9) Spannungs- und Stromeinheit
- (10) Widerstandseinheit
- (10) Widerstandseinheit
- (12) Berührungsfreie Spannungsabtastung
- (13) Anzeige des Einschaltstroms (AR020093A, AR020093B)
- (14) Anzeige der Einschaltdauer (AR020093)
- (15) Anzeige der relativen Messung
- (16) Frequenzeinheit (AR020093)

AR020093A



VII. BETRIEB

1. AC-/DC-SPANNUNGSMESSUNG V_{AC} / V_{DC}

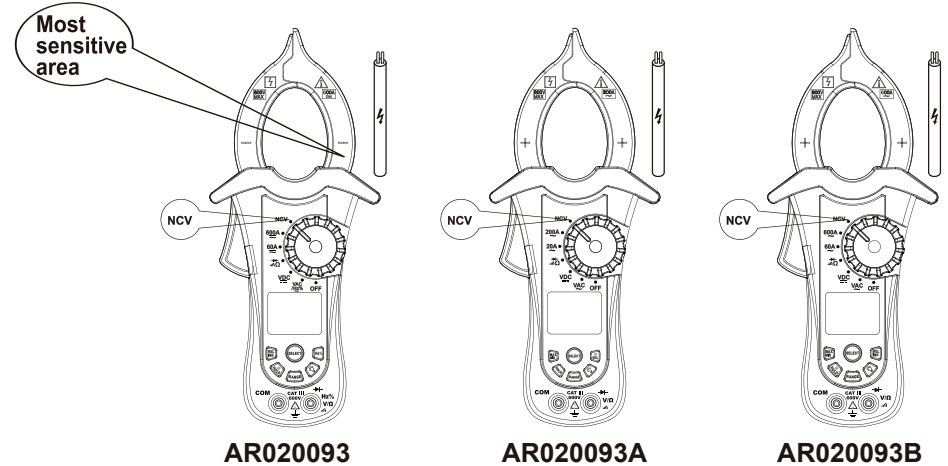


- (1) Den Schalter je nach Messungsanforderung auf DCV oder ACV rotieren.
- (2) Die rote Sonde in die V-Klemme und die schwarze Sonde in die COM-Klemme einstecken. Die Sonde an den Testpunkt anschließen, wonach der Spannungswert in der LCD-Anzeige erscheint.

(14)

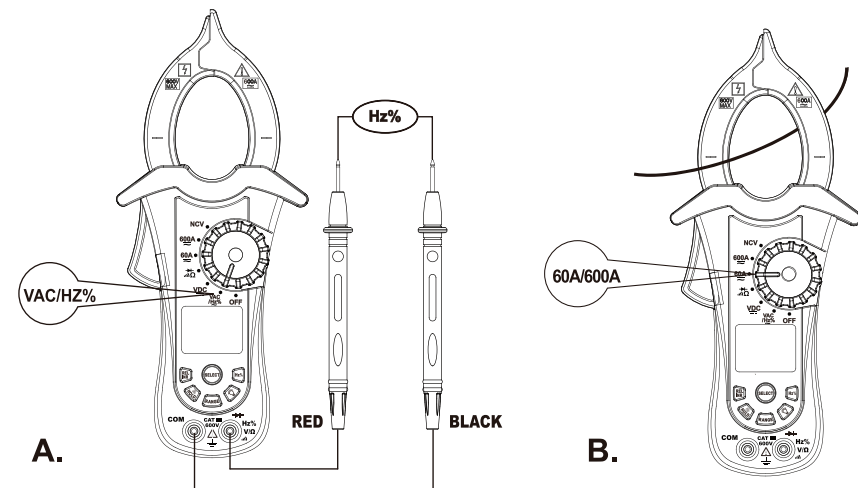
- (4) Make red probe connected to positive of diode and black probe connected to negative of diode.
- (5) Forward continuity voltage value of measured diode will be displayed on LCD.
- (6) Press "Select" switch to select continuity measurement. The instrument will buzz when measured resistance is smaller than 50Ω .

6. VOLTAGE SENSE NCV





- (1) Rotate the switch to NCV measurement.
- (2) Approaching the right side of the clamp to the wire, if the voltage has been detected, the buzzer will tweet. If there is no voltage, no buzzer tweeting. Approaching the right side of the clamp to the wire, if the voltage has been detected, the buzzer will tweet, and "----" will appear on the LCD. If there is no voltage, "EF" will appear on LCD and no buzzer tweeting.

7. Frequency/ Duty Cycle Measurement (nur AR020093) $Hz\%$




(7)

A. AC VOLTAGE MEASUREMENT



- Rotating the switch to **VAC** position, and press  button.
- Plug the red probe to V terminal, and black to COM terminal, and connecting the probes with the testing target in parallel; the measured value will be shown on the display.
- Press  button to switch between Frequency / Duty Cycle and the measured signal frequency or the duty cycle value will be display on LCD.



B. AC CURRENT MEASUREMENT

- Remove the testing probe from instrument and rotate the switch to current measurement. Start the measurement from 600A range **600A** if the measured value is uncertain.
- Push the trigger to open the clamp, then clamp the meter on live wire or neutral wire. (Do not clamp on both wire at the same time.)
- To ensure the accuracy, make sure the wire is in the center of the clamp and it is perpendicular to the clamp.
- Release the trigger, and so the clamp forms a closed loop.
- Press the  button.
- The value will be displayed on LCD.

VIII. SPECIFICATION

AR020049A

Function	Range	Resolution	Accuracy
DC Voltage: 0~600V DC	200 mV	0.1 mV	±1.5%±3 digits
	2V	1 mV	
	20V	10 mV	
	200V	100 mV	
	600V	1V	
AC Voltage: 0~600V AC	200 mV	0.1 mV	±2%±3 digits
	2V	1 mV	
	20V	10 mV	
	200V	100 mV	
	600V	1V	
AC Current: 0~20A	20A	10mA	±2.5%±8 digits
AC Current: 0~200A	200A	1A	±2.5%±5 digits
Resistance: 0~20MΩ	200Ω	0.1Ω	±1%±3 digits
	2kΩ	1Ω	±1%±3 digits
	20kΩ	10Ω	±1%±3 digits
	200kΩ	100Ω	±1%±3 digits
	2MΩ	1kΩ	±2%±3 digits
	20MΩ	10kΩ	±2%±3 digits
Diode and Continuity  	Display		
	Diode forward voltage 0~3V		
	Buzzer is buzzing, resistance is <50 ohm		

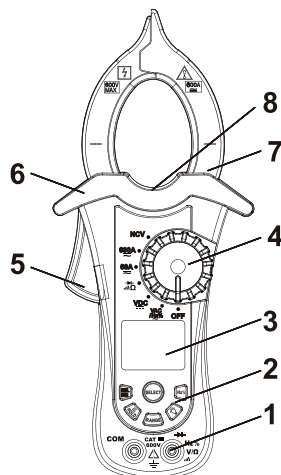
- HALTEN:** Auf diese Taste drücken, um den in der LCD-Anzeige gezeigten Wert zu halten. Auf eine beliebige Taste drücken, um die Haltezustand zu deaktivieren.
- REL:** Auf diese Taste drücken, um die "Relative Messung" zu aktivieren. Der Bereich wechselt von "Auto" (autom.) auf "Manual" (manuell). Diese Funktion ist für die Messung der Spannung, des Stroms und des Widerstands bestimmt. Nach dem Aktivieren der Funktion dient der Strommesswert als Bezugswert. Der angezeigte Wert zeigt den Unterschied zwischen der Strommessung und der nächsten Messung an. Erneut auf diese Taste drücken, um die Funktion zu deaktivieren.
- RANGE (Bereich):** Zum Umschalten zwischen dem Auto-Bereich (autom.) und dem Manual-Bereich (manuell). Der Ausgangszustand ist auf den AUTO-Bereich (autom.) voreingestellt. Durch Drücken auf die Taste wird der Manual-Bereich (manuell) eingestellt. Im Manual-Bereich (manuell) wird der Bereich von niedrig auf hoch umgeschaltet und wiederholt diesen Zyklus, wenn der Nutzer auf die Taste drückt. Auf diesen Schalter und diesen länger als 2 Sekunden gedrückt halten, um den "AUTO"-Bereich (autom.) wiederherzustellen.
- SELECT (wählen):** Drücken Sie diese Taste, um die Funktion der Messung zu ändern. Der Benutzer kann diese Taste auch drücken, um das Gerät während des Schlafmodus zu wecken. Wenn der Benutzer die Funktion des Schlafmodus ausschalten möchte, muss der Benutzer diese Taste drücken und halten, wenn der Strom ausgeschaltet ist, und gleichzeitig die Stromversorgung einschalten. Wenn der Schlafmodus ausgeschaltet ist, twittert das Gerät 5 Mal alle 15 Minuten. Das Gerät setzt die Funktion des Schlafmodus fort, wenn das Gerät neu gestartet wird. Das Gerät twittert 5 mal 1 Minuten, bevor das Gerät in den Schlafmodus wechselt. Das Gerät wird lange twittern, bevor das Gerät in den Schlafmodus wechselt.
- MAX/MIN (max./min.):** Anzeige des maximalen und minimalen Historie-Werts (AR020093A, AR020093B)
- Hz:** Umschalten zwischen der Frequenz- und Einschaltdauer-Messung während der Frequenzmessung. Umschalten zwischen der Frequenz-, Einschaltdauer- und der Spannungs-/Strommessung während der AC-Spannungs-/AC-Strommessung (AR020093)
-  ist der Beleuchtungsschalter. Auf diesen Schalter drücken und diesen gedrückt halten, um die Beleuchtung einzuschalten.
- Länger als 2 Sekunden auf  drücken, um die Hintergrundbeleuchtung einzuschalten. Diesen Vorgang wiederholen, um die Hintergrundbeleuchtung abzuschalten. Die Hintergrundbeleuchtung wird nach 30 Sekunden ebenfalls automatisch abgeschaltet.
- Länger als 2 Sekunden auf INR drücken, um die "Messung des Einschaltstroms" zu aktivieren oder zu deaktivieren. Die wiederholte Messung kann durch kurzes Drücken in diesem Modus erfolgen (AR020093, AR020093B)

Bemessungsspannung:

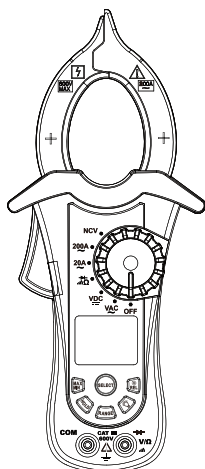
AC	0 ~ 600VAC
DC	0 ~ 600VDC
AC	0 ~ 200A (AR020093A)
	0 ~ 600A (AR020093, AR020093B)
DC	0 ~ 600A (AR020093)
Ω	0 ~ 20M (AR020093A)
	0 ~ 60M (AR020093, AR020093B)
Hz	0 ~ 9.999MHz (AR020093)

IV. BESCHREIBUNG DES PRODUKTS

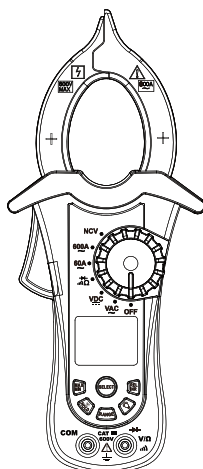
- (1) Prüfsonden-Einsetzklemme
- (2) Funktionsschalter
- (3) LCD-Anzeige
- (4) Rotationsschalter für die Messung
- (5) Klemmentrigger
- (6) Schutzwand
- (7) Klemme: Während der Messung darf die Klemme nicht gleichzeitig an die spannungsführende und neutrale Leitung geklemmt werden. Jeweils nur eine dieser Leitungen klemmen.
- (8) Beleuchtung



AR020093



AR020093A



AR020093B

(12)

AR020093

Function	Range	Resolution	Accuracy
DC Voltage: 0~600V DC	600 mV	0.1 mV	±1.5%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC Voltage: 0~600V AC	600 mV	0.1 mV	±2%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC Current: 0~60A	60A	0.01A	±2.5%±8 digits
AC Current: 0~600A	600A	0.1A	±2.5%±5 digits
AC Frequency: 0~9.999M Hz	9.999MHz	0.1Hz	±2%±5 digits
AC Duty Cycle: 1%- 99%	99%	0.1%	±2%±5 digits
DC Current: 0~60A	60A	0.01A	±2.5%±8 digits
DC Current: 0~600A	600A	0.1A	±2.5%±8 digits
Resistance: 0~60M Ω	600 Ω	0.1 Ω	±1%±3 digits
	6k Ω	0.001k Ω	±1%±3 digits
	60k Ω	0.01k Ω	±1%±3 digits
	600k Ω	0.1k Ω	±1%±3 digits
	6M Ω	0.001M Ω	±2%±3 digits
	60M Ω	0.01M Ω	±2%±3 digits
Diode and Continuity ➔ 🔔	Display		
	Diode forward voltage 0~3V		
	Buzzer is buzzing, resistance is <50 ohm		

AR020093B

Function	Range	Resolution	Accuracy
DC Voltage: 0~600V DC	600 mV	0.1 mV	±1.5%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC Voltage: 0~600V AC	600 mV	0.1 mV	±2%±3 digits
	6V	0.001 V	
	60V	0.01V	
	600V	0.1 V	
AC Current: 0~60A	60A	0.01A	±2.5%±8 digits
AC Current: 0~600A	600A	0.1A	±2.5%±5 digits
Resistance: 0~60M Ω	600 Ω	0.1 Ω	±1%±3 digits
	6k Ω	0.001k Ω	±1%±3 digits
	60k Ω	0.01k Ω	±1%±3 digits
	600k Ω	0.1k Ω	±1%±3 digits
	6M Ω	0.001M Ω	±2%±3 digits
	60M Ω	0.01M Ω	±2%±3 digits
Diode and Continuity ➔ 🔔	Display		
	Diode forward voltage 0~3V		
	Buzzer is buzzing, resistance is <50 ohm		


(9)

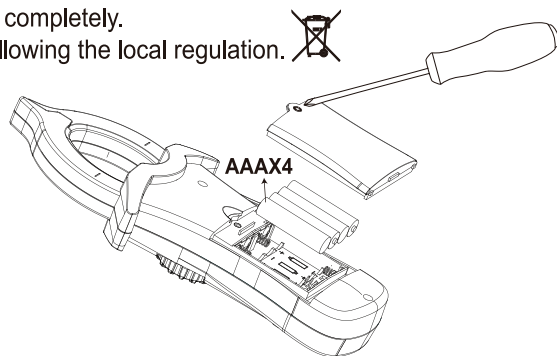
IX. MAINTENANCE

When instrument is not in use, please rotate to "off" position. Remove batteries for long term storage.







X. BATTERY REPLACEMENT

The power source of this instrument is 4 x AAA batteries. Please follow the instruction to replace the battery:

- (1) Switch off the power and remove the probes.
- (2) The battery case is at the back of instrument. To open battery case, please unscrew it by screwdriver and replace the battery according to polarity indication. Please use the same type batteries.
- (3) Install battery case and screw it completely.
- (4) Please recycle the battery by following the local regulation. 



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
Symbol	Description
CAT III	Measurement Category III is applicable to test and measuring circuits connected to the directly part of the building's low-voltage MAINS installation.
	<ul style="list-style-type: none"> • Do not dispose electrical appliances as unsorted municipal waste, use separate collection facilities. • Contact your local government for information regarding the collection systems available. • If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the ground water and get into food chain, damaging your health and well-being. • When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposal at least for free of charge.
	WARNING. RISK OF DANGER.
	WARNING. HAZARDOUS VOLTAGE. RISK OF ELECTRIC SHOCK.
	AC (Alternating Current)
	DC (Direct Current)
	Both direct and alternating current




I. EINFÜHRUNG

Dies ist eine stabile Handstrommesszange mit einem niedrigen Stromverbrauch und einer hohen Genauigkeit. Die Ziffer ist 3-1/2 (2000 Zählungen) für 7128A und 3-6/7 (6000 Zählungen) für 7128B/C. Für die Messung der DC-Spannung/des AC-Stroms, der AC-Spannung/des AC-Stroms, des Widerstands, der Frequenz, der Diode, des Durchgangs und der berührungsfreien Spannungsabtastung. Das Messgerät wechselt nach 15 Minuten ohne Bedienung in den Ruhemodus. Bitte drücken Sie die Taste „SELECT“, um aufzuwachen oder schalten Sie die Stromversorgung aus, um das Messgerät neu zu starten.

II. VORSICHTSMASSNAHMEN

- (1) Den Akku auswechseln, wenn  in der Anzeige erscheint.
- (2) Um einen Schaden durch einen Lichtbogen an der Kontaktstelle des Schalters zu vermeiden, darf der Schalter während einer Hochleistungsmessung nicht rotiert werden.
- (3) Sicherstellen, dass der Schalter während der AC- und DC-Spannungsmessung in der richtigen Position ist.
- (4) Sicherstellen, dass alle Stromkreise während der Widerstands- und Diodenmessung abgeschaltet sind.
- (5) Falls "–" links neben dem Messwert während der DC-Spannungsmessung erscheint, bedeutet dies, dass die Polarität des Prüfsonde verkehrt ist. Allgemein weist dies darauf hin, dass die rote Sonde mit dem Negativpol in Kontakt ist.
- (6) Das Gerät nicht auseinandernehmen.
- (7) Nur die Stromtastknöpfe, Messleitungen und Adapter verwenden, die mit dem Produkt geliefert wurden (Artikel-Nr. SS-3521C).
- (8) Drehen Sie den Funktionsschalter während der Messung nicht, um eine bessere Genauigkeit zu erzielen. Wenn der Benutzer die Funktion umschalten muss, lösen Sie bitte die Klemme vom Messobjekt und drehen Sie den Schalter.

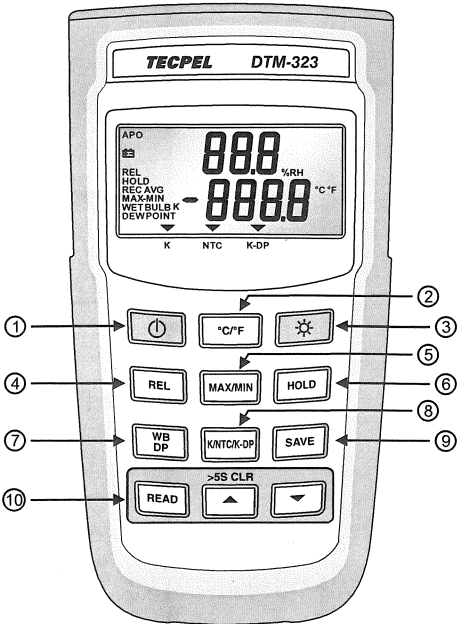
III. ALLGEMEINE SPEZIFIKATIONEN

Anzeige: LCD
 Maximale Auflösung: 2000, 3-1/2 Ziffern (AR020093A)
 6000, 3-6/7 Ziffern (AR020093, AR020093B)
 Bereich: Autom/Manuell
 Datenerneuerungsrate: 3 Male/Sek.
 Anzeige einer niedrigen Ladung: bei Erscheinen von 
 Zul. Betriebstemperatur: 0 - 50°C (32 - 122°F)
 Zul. Aufbewahrungstemperatur: -10 - 60°C (14 - 140°F)
 Zul. Feuchtigkeit: < 80% RH
 Stromquelle: 1.5V AAA X4 -Akku
 CAT-Kategorie: CAT III 600V
 Sicherheitsrichtlinie: EMC: EN 61326-1, EN 61326-2-2
 GS: EN 61010-1, EN 61010-031, EN 61010-2-030,
 EN 61010-2-032, EN 61010-2-033
 Verschmutzungsgrad: 2

OPERATOR'S MANUAL

HYGRO THERMOMETER

TECPEL DTM-323



Do not immerse the hygrometer sensor head into liquids since this causes permanent damage to the sensor.

SPECIFICATIONS

ELECTRICAL

Temperature Scale: Celsius or Fahrenheit user-selectable.

Measurement Range:

K-TYPE -50°C to 1000°C, (-50°F to 1832°F)

Resolution: 0.1°C or 0.2°F

Accuracy: Accuracy is specified for operating temperatures over the range of 18°C to 28°C (64°F to 82°F), for 1 year, not including thermocouple error.

±(0.1% rdg + 1°C) on -50°C to 1000°C

±(0.1% rdg + 2°F) on -50°F to 1832°F

±(0.05% rdg + 1.4°F) -58°F to -328°F

Sensor: Thermistor temperature sensor

Range: 0°C to 60°C, (32°F to 140°F)

Resolution: 0.1°C/°F

Accuracy:

±2°C on 0°C to 10°C

±0.5°C on 10°C to 45°C

±2°C on 45°C to 60°C

±4°F on 32°F to 50°F

±1°F on 50°F to 113°F

±4°F on 113°F to 140°F

RELATIVE HUMIDITY

Sensor: Capacitive Humidity Sensor

Range: 0% to 100% RH

Accuracy:

±2.5% at 25°C(77°F), 10% to 90% RH

±5% at 25°C(77°F), 0% to 10% RH, 90% to 100% RH

Sensor Response Time for 90% of Total Range: 60sec typical.

Sensor Hysteresis(excursion of 10% to 90% to 10% RH): ±1%RH typical.

Temperature Coefficient:

0.1 times the applicable accuracy specification per °C from 0°C to 18°C and 28°C to 50°C (32°F to 64°F and 82°F to 122°F).

Input Protection:

24V dc or 24V ac rms maximum input voltage on any combination of input pins.

Input Connector: Accepts standard miniature thermocouple connectors (flat blades spaced 7.9mm, center to center).

GENERAL

Display: 5 digit liquid crystal display (LCD).

Overload: "----" or "OL" is display.

Battery: 1.5V x 4 PCS (SIZE AAA) UM-4 R03.

Battery Life: 200 hours typical with carbon zinc battery.

Reading Rate: 1 time per second.

Auto power off: 15 minutes, press power key to resume operation.

Dimensions: 160mm(H) x 83mm(W) x 38mm(D)

Weight: Approx. 230g including batteries.

Supplied Wire: 4 feet type "K" thermocouple bead wire

(Teflon tape insulated). Maximum insulation temperature 260°C (500°F). Wire accuracy ±2.2°C or ±0.75% of reading (whichever is greater) from 0°C to 800°C.

ENVIRONMENTAL

Ambient Operating Ranges:

0°C to 50°C (32°F to 122°F) <80% R.H.

Storage Temperature:

-20°C to 60°C (-4°F to 140°F) <70% R.H.

OPERATING INSTRUCTIONS

1. "⏻" Power Switch

The "⏻" key turns the thermometer on or off. In the SET mode cannot be powered off. Exit SET mode to power off.

APO function mode

Press "⏻" power key for more than 4 seconds to disable the auto-power function. The display will show "APO OFF".

2. "°C/°F" Selecting the Temperature Scale

Readings are displayed in either degrees Celsius(°C) or degrees Fahrenheit(°F). When the thermometer is turned on, it is set to the temperature scale that was in use when the thermometer was last turned off. To change the temperature scale, press the "°C/°F" key.

3. "☀" Button

Press the "☀" key to trigger on the backlight function, press the "☀" key again to cancel the backlight function. The backlight will switch-off automatically after 30 seconds.

4. "REL" Button

Press the "REL" key to enter Relative mode, zero the display, and store the displayed Reading as a reference value and annunciator REL is displayed. Press "REL" key again to exit the relative mode. In this mode, press "HOLD" key to stop reading, all values are frozen, press "HOLD" key again to restart reading.

5. "MAX/MIN" Button

Press "MIN/MAX" key to enter the MIN/MAX recording mode and REC shows on the display. The beeper emits a tone when a new minimum or maximum measurement is recorded. Press "MIN/MAX" key again to cycle through the current readings:

MAX: The highest measurement recorded.

MIN: The lowest measurement recorded.

MAX-MIN: The difference of the highest and the lowest measurement.

AVG: The average values of the measurements.

Press "MIN/MAX" key over two seconds to exit the function. In this mode, press "HOLD" key to stop recording, all values are frozen, press "HOLD" key again to restart recording. In this mode, the APO function and other keys are disabled, excluding "HOLD" and Back-light keys. Press and hold down the "MAX/MIN" key for more than 2 seconds to exit the MAX/MIN function.

6. "HOLD" Button

Press the "HOLD" key to enter the data hold mode, the "HOLD" annunciator is displayed at the center-left of display. When data hold mode is selected, the meter held the present readings and stops all further measurements. Press the "HOLD" key again to cancel data hold mode, causing meter to resume taking measurements.

7. "WB/DP" Button

In the NTC data Mode, the Meter displays ambient temperature when first turned on. To display wet bulb(WB) temperature, press "WB/DP" key once. Press the "WB/DP" again to switch to dew point(DP) temperature. Press "WB/DP" a third time returns the Meter to ambient temperature.

8. "K/NTC/K-DP" Button

Press the "K/NTC/K-DP" key, the meter can cycle through "K-TYPE", "NTC", "K-DP".

※ K-DP = K-TYPE temperature minutes Dew point temperature.

9. "SAVE" Button

The save function stores the %RH, K-TYPE, NTC, Wet bulb, Dew point data in a nonvolatile memory. Press the "SAVE" key to save the current data, the word SAVE is displayed to indicate the data are saved. The build in memory can store up to 256 data.

10. "READ", "▲", "▼" Button

To recall the readings from memory, press "READ" key. To check the memorized data just to press "▲" or "▼" until the desired memorized data is displayed. To return the meter to normal operation, press "READ" key again.

※ CLR SAVE DATA:

Pressing the "▲" key for more than 5 seconds to clears all the saved data in memory. And lower display show "Clr" about 2 second.

OPERATOR MAINTENANCE

WARNING

To avoid possible electrical shock, disconnect the thermocouple connectors from the thermometer before removing the cover.

Battery Replacement

1. Power is supplied by 4pcs 1.5V (SIZE AAA) UM-4 R03.
2. The "🔋" appears on the LCD display when replacement is needed. To replace battery remove screw from back of meter and lift off the battery cover.
3. Remove the battery from battery contacts and replace.
4. When not use for long time remove battery.
5. Don't keep in place with high Temp, or high humidity.

Cleaning

Periodically wipe the case with a damp cloth and detergent, do not use abrasives or solvents.

*Software operation manual is on the software disk.

INTRODUCTION

The instrument hereafter referred to as "the Meter" is a battery powered meter that measures relative humidity and temperature. Through a few easy to use controls, the Meter displays three different temperature points of the air surrounding the meter's sensor: ambient, wet bulb, and dew point.

SAFETY INFORMATION

WARNING

To avoid electrical shock, do not use this instrument when working voltages at the measurement surface over 24V AC or DC.

WARNING

To avoid damage or burns, do not make temperature measurement in microwave ovens.

CAUTION

Repeated sharp flexing can break the thermocouple leads. To prolong lead life, avoid sharp bends in the leads, especially near the connector.

AVM-713 Mini Anemometer Operating Instruction

1. Introduction

AVM-713 is a stable, safe, reliable mini digital anemometer, widely used in mining, electric, iron and steel, petrochemical, energy-saving, navigation, fan manufacturing, exhaust ventilation, sporting and many more industries. This operating manual includes relevant safety information and warnings. Please read this manual carefully and observe all the cautions strictly.

Warning:
Before using the product, please read the operation safety rules carefully.

2. Out of the Box

Open the packing box and take out the meter. Please check carefully if any items below are missing or damaged.

1. Main unit ----- 1
2. Blister----- 1
3. Operating manual----- 1

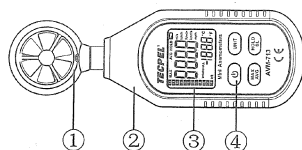
3. Operation Safety

1. Please check the meter and the accessories before using and beware of any damage or abnormal phenomenon. If you find the case is damaged or the LCD shows nothing, or you consider that the meter could not work properly anymore, please stop using it.
2. Observe the operating instructions while measuring.
3. Do not open the meter at will or change internal wiring to avoid damages to the meter.
4. When the LCD displays "OL", replace the battery timely. Remove the battery if the meter is not used for a long time.
5. Do not store or use the meter in high temperature, high humidity, flammable, combustible, or strong electromagnetic environment.
6. Please use soft cloth and neutral detergent to clean the case for maintenance. Do not use grinding agent and solvent to avoid case corrosion and damaging the meter.

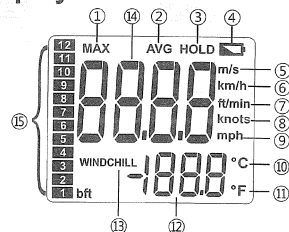
Warning:
Based on the principle of magnetic induction wind speed measurement, the product may be subject to interference under strong battery radiation condition. Please stay from those conditions as far as possible.

4. Product Outlook

1	Vane	2	Meter
3	LCD display	4	Function keys



5. Display Interface



1	Maximum measurement	2	Average value
3	Data hold	4	Low battery
5	m/s	6	km/h
7	ft/min	8	Knots
9	Mph	10	Celsius
11	Fahrenheit	12	Temperature value
13	Wind chill notification	14	Wind speed value
15	Beaufort scale		

6. Key functions and setup

1. ON/OFF:

Short press once to start up; short press again to power off.

Note: Product's auto power off feature can be disabled: Press and hold "HOLD" and then press "ON/OFF" key to enable/disable auto power off, LCD will display "APO OFF" to indicate status.

2. UNIT: Unit conversion key:

Short press this key and the wind speed value cycles m/s, km/h, ft/min, knots, and mph. Long press this key and the temperature unit changes between °C and °F.

3. MAX/AVG:

Pressing this key can select maximum, average and normal value measurement; select maximum and the meter will always show the maximum reading; select average and the meter will always show the average reading.

4. HOLD/BL:

HOLD: Short press this key once to hold the measurement; short press this key again to exit data hold and continue normal measurement.

BL: Long press this key to turn on backlight; long press this key again to turn off backlight.

7. Technical Specification

1. Wind Speed and Temperature

Function	Range	Resolution	Accuracy	Description
Wind Speed	0-30m/s (as standard)	0.1m/s	±(5%rdg+0.5)	
	1.4~108 Km/h (refer only)		±(5%rdg+15dgt)	
	0.7~58 Knots (refer only)		±(5%rdg+10dgt)	
	0.8~67 mph (refer only)		±(5%rdg+10dgt)	
	78~5905 ft/min (refer only)		±(5%rdg+180dgt)	
Temperature	-10~50°C	0.1°C	±2°C	
	14~122°F	0.2°F	±4°F	
Beaufort Wind Scale	0~12	1	±1	Only for reference
Sampling Rate			0.5s	Sampling rate is twice per second.
Overload Indication			OL	Shows "OL"
MAX/AVG			MAX/AVG	Shows "MAX/AVG"
Data Hold			HOLD	Shows "HOLD"
Backlight			BL	Manually turn on or off
Auto Power off			5mins	Automatically power off after 5mins without operating
Low Battery			3.0~3.5V	Shows low battery prompt when power is 3.0~3.5V
Wind Chill Notification			WIND CHILL	Wind speed with 5m/s and Temperature under 0°C will be display "WIND CHILL"

2. General Type

- a. LCD display: 4-bit LCD display. The displayed maximum is 9999.
- b. Overload indication: When the wind speed is over 45m/s or the temperature is lower than -10°C or higher than 50°C, "OL" will be displayed.
- c. Low battery display: Prompt "OL". The new battery should be replaced in time.
- d. Sampling rate: 2/s
- e. Sensor type: Magnetic induction type wind speed sensor and NTC negative temperature coefficient sensor.
- f. When the temperature is lower than 0°C and the wind speed is over 5m/s, the meter shows "WINDCHILL".
- g. Impact strength: Can withstand the impact of landing from 1 meter's height.
- h. Power requirement: 1.5V batteries (AAA) ×3
- i. Product size: 160×50×28mm
- j. Weight: 118g

3. Environment Specification

- a. Indoor use
- b. Altitude height: 2000m
- c. Pollution level: 2
- d. Working temperature and humidity:
0°C~40°C (not greater than 80%RH)
40°C~50°C (not greater than 45%RH)
- e. Storage temperature and humidity:
-20°C~60°C (not greater than 75%RH)

4. Electrical Specifications

- a. Accuracy: Wind speed: ±5%rdg + 0.5 Temperature: ±2°C
- b. Environment temperature: 23°C±5°C
- c. Environment humidity: ≤80%RH

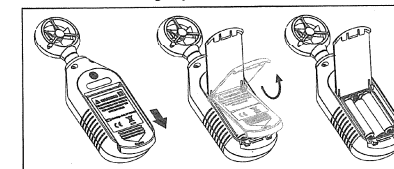
5. General Maintenance

Warning: please do not open the meter case to avoid affecting device accuracy or damage to the meter.

- a. Maintenance and service of the meter should be accomplished by professional personnel or designated maintenance department.
- b. Clean the case by dry cloth periodically, detergent with abrasive or solvent composition shall not be used.

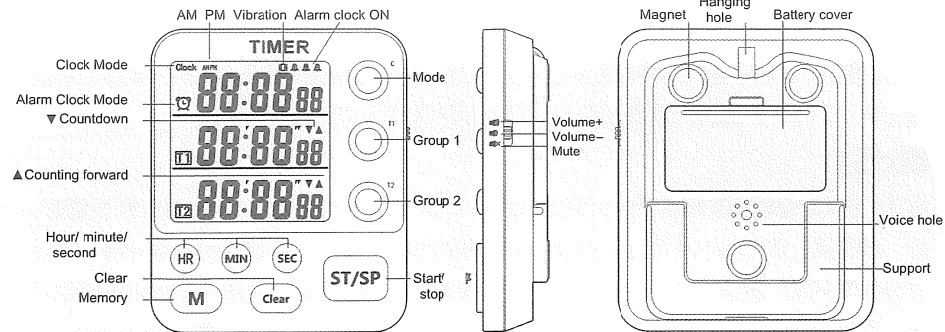
6. Battery Installation and Replacement

- a. The meter uses 3 pieces of AAA 1.5V batteries. Please see figure below for steps of battery installation and replacement.
- b. Turn the panel down, push the battery cover open in the direction of the arrow, lift the cover and remove the batteries; install new batteries in accordance of polarity indications.
- c. Please use batteries of same type instead of improper ones.
- d. Close the cover tightly after installing new batteries.



Multi-Functional Alarm Clock Timer (319)

Picture



Definitions of Buttons

- C**----- Press this button to switch the clock, Alarm Clock 1, Alarm Clock 2 and Alarm Clock 3; and press down and hold this button to enter the settings of the clock or alarm clock.
- T1/T2**----- Used to select and control Group 1 and 2 timers.
- HR**----- Used to set the "hour" value (press and hold the button for 0.5 seconds to quickly increase the value).
- MIN**----- Used to set the "minute" value (press and hold the button for 0.5 seconds to quickly increase the value).
- SEC**----- Used to set the "second" value (press and hold the button for 0.5 seconds to quickly increase the value).
- M**----- Memory button (press and hold the button for 2 seconds and wait for the corresponding group flashing and then set the hour/ minute/ second of the memory time).
- Clear**----- Reset/ Zero clearing (press and hold the button to close the display and enter the standby state).
- ST/SP**----- Start/ Stop.
- HR+ MIN**----- Press HR and MIN buttons at the same time to enable/ disable vibration function.

Standby

Press down and hold the "Clear" button for about 2 seconds to turn off the display and enter the standby state. Press any key to wake it up.

Enabling Vibration

Press HR and MIN buttons at the same time to enable/ disable vibration function.

Control of Prompt Tone

Turn the toggle switch on the side of the product to the corresponding position to control the volume of the prompt tone or turn off the prompt tone.

🔊: Volume+ 🔊: Volume- 🔇: Mute

Clock Settings

Press C button to switch to the clock mode (the clock icon is displayed in the upper right corner of the screen); press and hold down the C button for about 2 seconds and the value will flash to enter the clock setting. Press HR, MIN and SEC buttons to set the hour, minute and second, respectively. After completing the settings, press C button to save the settings, and press and hold down ST/SP button to switch the 12/ 24 -hour system.

Alarm Clock Settings

Continuously press C button to switch Alarm Clock 1, 2 and 3. After selecting the desired alarm clock, press and hold down the C button for about 2 seconds until the value flashes. Press HR, MIN and SEC buttons to set the hour, minute and second, respectively. After completing the settings, press C button to save the settings, and press the ST/SP button to enable or disable the alarm clock.

* One-minute alarm prompt: one "di" prompt tone per second within the first 20 seconds, two "di" prompt tones per second within the 21th-30th seconds, three "di" prompt tones per second within the 31th-50th seconds, four "di" prompt tones per second within the 51th -60th seconds. Press any key during the prompt to end the alarm.

Countdown Settings

Press T1 or T2 button to switch to Timer T1 or T2 that you want to use. Press HR, MIN and SEC buttons to set the hour, minute and second, respectively; press the Clear button to clear the value. After setting the time, press ST/SP button to start the countdown; at the moment, the countdown ▼ flashes; if you press the button again to pause the countdown and the countdown ▼ stops flashing, but you can press the button a third time to continue the countdown. When the timer counts down to zero, a counting forward ▲ will appear and flash, then the time starts from zero, the prompt tone will ring for one minute (when the prompt tone is enabled), and the corresponding prompt light will also flash for one minute. Press the ST/SP button to immediately return to the time preset before countdown. Press the Clear button to clear the value, and press the button again to return to the last set value.

Setting Memory Time

You may have to use a countdown time over and over again, therefore, you can set this time to memory time so that you can quickly and easily use the countdown time over and over again. The setting method for the memory time is shown as follows:

Press T1 or T2 button to switch to the memory time T1 or T2 you want to set. If the countdown time is stopped, you can press and hold the M button until the value flashes. Press HR, MIN and SEC buttons to set the hour, minute and second, respectively. After completing the settings of the memory time, press C button to save the settings.

* Whenever you want to use this memory time, you can press the M button in the stop state of the timer to call out the memory time you set.

Setting Stopwatch(Counting Forward)

Press T1 or T2 button to switch to the desired timer T1 or T2. Press ST/SP button to enable the stopwatch under the state of value cleared. You can press ST/SP button to pause or continue the time-keeping.

* The precision of the timing unit is hundredth of a second and second within one hour, and second after more than one hour. The maximum timing is 99 hours, 59 minutes and 59 seconds.

How to Place This Product

You can attach a rope to the clasp and hang the timer on a wall or anywhere else you can hang it.

You can open the support to place the product on the table.

The product can be adsorbed on the surface of iron objects such as refrigerator.

How to Replace Battery

When the battery is in low level, the display will be dark or not clear. Replace the battery in time in dark flash.

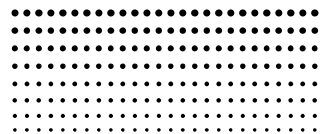
Warm Prompt

If the product will be not used for a long time, please take out the battery to avoid battery leakage, thus causing damage to the machine.



fx-115ES fx-991ES

User's Guide



CASIO
http://world.casio.com/edu/

RCA502160-001V01

Handling Precautions

- Be sure to press the **ON** key before using the calculator for the first time.
- Even if the calculator is operating normally, replace the battery at least once every three years.

A dead battery can leak, causing damage to and malfunction of the calculator. Never leave a dead battery in the calculator.

- The battery that comes with this unit discharges slightly during shipment and storage. Because of this, it may require replacement sooner than the normal expected battery life.
- Low battery power can cause memory contents to become corrupted or lost completely. Always keep written records of all important data.
- Avoid use and storage of the calculator in areas subjected to temperature extremes.

- Very low temperatures can cause slow display response, total failure of the display, and shortening of battery life. Also avoid leaving the calculator in direct sunlight, near a window, near a heater or anywhere else it might be exposed to very high temperatures. Heat can cause discoloration or deformation of the calculator's case, and damage to internal circuitry.
- Avoid use and storage of the calculator in areas subjected to large amounts of humidity and dust.

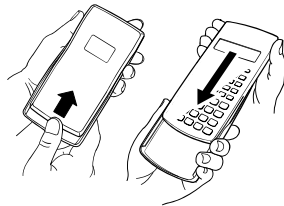
- Take care never to leave the calculator where it might be splashed by water or exposed to large amounts of humidity or dust. Such conditions can damage internal circuitry.
- Never drop the calculator or otherwise subject it to strong impact.
- Never twist or bend the calculator.
- Avoid carrying the calculator in the pocket of your trousers or other tight-fitting clothing where it might be subjected to twisting or bending.
- Never try to take the calculator apart.
- Never press the keys of the calculator with a ballpoint pen or other pointed object.
- Use a soft, dry cloth to clean the exterior of the calculator.

If the calculator becomes very dirty, wipe it off with a cloth moistened in a weak solution of water and a mild neutral household detergent. Wring out all excess liquid before wiping the calculator. Never use thinner, benzene or other volatile agents to clean the calculator. Doing so can remove printed markings and can damage the case.

Before Using the Calculator

Removing the Hard Case

Before using the calculator, slide its hard case downwards to remove it, and then affix the hard case to the back of the calculator as shown in the illustration below.

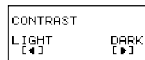


Turning Power On and Off

- Press **ON** to turn on the calculator.
- Press **OFF** to turn off the calculator.

Adjusting Display Contrast

Press **MODE**(**SETUP**) **6** (**◀CONT▶**) This displays the contrast adjustment screen. Use **◀** and **▶** to adjust display contrast. After the setting is the way you want, press **ON**.



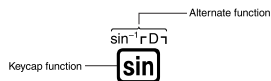
- You can also adjust contrast using **◀** and **▶** while the mode menu (which appears when you press **MODE**) is on the display.

Important!

- If adjusting display contrast does not improve display readability, it probably means that battery power is low. Replace the battery.

About this Manual

- The **[MATH]** mark indicates an example that uses Math format, while the **[LINE]** mark indicates Linear format. For details about input/output formats, see "Specifying the Input/Output Format".
- Keypad markings indicate what a key inputs or what function it performs. Example: **[1]**, **[2]**, **[3]**, **[4]**, **[5]**, **[6]**, etc.
- Pressing the **[F1]** or **[F2]** key followed by a second key performs the alternate function of the second key. The alternate function is indicated by the text printed above the key.



- The following shows what the different colors of the alternate function key text mean.

If key marking text is this color:	It means this:
Yellow	Press [F1] and then the key to access the applicable function.
Red	Press [F2] and then the key to input the applicable variable, constant, or symbol.
Purple (or enclosed in purple brackets)	Enter the CmplX Mode to access the function.
Green (or enclosed in green brackets)	Enter the BASE-N Mode to access the function.

- The following shows an example of how an alternate function operation is represented in this User's Guide.

Example: **[sin^-1]** **[1]** **[)]** **[=]**
Indicates the function that is accessed by the key operation (**[sin^-1]**) before it. Note that this is not part of the actual key operation you perform.

- The following shows an example of how a key operation to select an on-screen menu item is represented in this User's Guide.

Example: **[F1]**(**SETUP**)
Indicates the menu item that is selected by the number key operation (**[F1]**) before it. Note that this is not part of the actual key operation you perform.



- The cursor key is marked with four arrows, indicating direction, as shown in the illustration nearby. In this User's Guide, cursor key operation is indicated as **▲**, **▼**, **◀**, and **▶**.
- The displays and illustrations (such as key markings) shown in this User's Guide and the separate Appendix are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.
- In no event shall CASIO Computer Co., Ltd. be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of the purchase or use of this product and items that come with it. Moreover, CASIO Computer Co., Ltd. shall not be liable for any claim of any kind whatsoever by any other party arising out of the use of this product and the items that come with it.

Using the Separate Appendix

Whenever you see the symbol **[Appendix]** in this manual, it means you should refer to the separate Appendix. Example numbers (like "<#021>") in this User's Guide refer to the corresponding example number in the Appendix. Specify the angle unit in accordance with the marks in the Appendix: **[Deg]**: Specify Degree for the angle unit. **[Rad]**: Specify Radian for the angle unit.

Initializing the Calculator

Perform the following procedure when you want to initialize the calculator and return the calculation mode and setup to their initial default settings. Note that this operation also clears all data currently in calculator memory.

[F1] **[2]** (CLR) **[F1]** **[3]** (All) **[=]** (Yes)

- For information about calculation modes and setup settings, see "Calculation Modes and Calculator Setup".
- For information about memory, see "Using Calculator Memory".

Important!

- For a very complex calculation or some other type of calculation that takes a long time to execute, the display may show only the above indicators (without any value) while it performs the calculation internally.

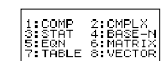
Calculation Modes and Calculator Setup

Calculation Modes

When you want to perform this type of operation:	Select this mode:
General calculations	COMP
Complex number calculations	CMPLX
Statistical and regression calculations	STAT
Calculations involving specific number systems (binary, octal, decimal, hexadecimal)	BASE-N
Equation solution	EQN
Matrix calculations	MATRIX
Generation of a number table based on an expression	TABLE
Vector calculations	VECTOR

Specifying the Calculation Mode

(1) Press **MODE** to display the mode menu.



(2) Press the number key that corresponds to the mode you want to select.

- To select the CMPLX Mode, for example, press **[2]**.

Configuring the Calculator Setup

Pressing **MODE**(**SETUP**) displays the setup menu, which you can use to control how the calculations are executed and displayed. The setup menu has two screens, which you can jump between using **◀** and **▶**.



Safety Precautions

Be sure to read the following safety precautions before using this calculator. Keep this manual handy for later reference.

Caution

This symbol is used to indicate information that can result in personal injury or material damage if ignored.

Battery

- After removing the battery from the calculator, put it in a safe place where it will not get into the hands of small children and accidentally swallowed.
- Keep batteries out of the reach of small children. If accidentally swallowed, consult with a physician immediately.
- Never charge the battery, try to take the battery apart, or allow the battery to become shorted. Never expose the battery to direct heat or dispose of it by incineration.
- Improperly using a battery can cause it to leak and damage nearby items, and can create the risk of fire and personal injury.
- Always make sure that the battery's positive (+) and negative (-) ends are facing correctly when you load it into the calculator.
- Use only the type of battery specified for this calculator in this manual.

Disposing of the Calculator

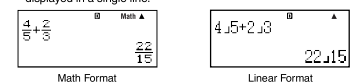
- Never dispose of the calculator by burning it. Doing so can cause certain components to suddenly burst, creating the risk of fire and personal injury.

- See "Adjusting Display Contrast" for information about how to use "◀CONT▶".

Specifying the Input/Output Format

For this input/output format:	Perform this key operation:
Math	[MODE] [MODE] [1] (MthIO)
Linear	[MODE] [MODE] [2] (LineIO)

- Math format causes fractions, irrational numbers, and other expressions to be displayed as they are written on paper.
- Linear format causes fractions and other expressions to be displayed in a single line.



Specifying the Default Angle Unit

To specify this as the default angle unit:	Perform this key operation:
Degrees	[MODE] [MODE] [3] (Deg)
Radians	[MODE] [MODE] [4] (Rad)
Grads	[MODE] [MODE] [5] (Gra)

$90^\circ = \frac{\pi}{2}$ radians = 100 grads

Specifying the Number of Display Digits

To specify this:	Perform this key operation:
Number of Decimal Places	[MODE] [MODE] [6] (Fix) [0] - [9]
Number of Significant Digits	[MODE] [MODE] [7] (Sci) [0] - [9]
Exponential Display Range	[MODE] [MODE] [8] (Norm) [1] (Norm1) or [2] (Norm2)

Calculation Result Display Examples

- Fix: The value you specify (from 0 to 9) controls the number of decimal places for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed. Example: $100 \div 7 = 14.286$ (Fix2) 14.29 (Fix3)
- Sci: The value you specify (from 1 to 10) controls the number of significant digits for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed. Example: $1 \div 7 = 1.4286 \times 10^{-1}$ (Sci5) 1.429×10^{-1} (Sci4)

Rounding Function (Rnd)

This function rounds the value or the result of the expression in the function's argument to the number of significant digits specified by the number of display digits setting.

Display Digits Setting: Norm1 or Norm2
The mantissa is rounded to 10 digits.

Display Digits Setting: Fix or Sci
The value is rounded to the specified number of digits.

Example: $200 \div 7 \times 14 = 400$

LINE $200 \div 7 \times 14$ \Rightarrow 400

(Specifies three decimal places.)

FIX $200 \div 7 \times 14$ \Rightarrow 400.000

(Calculation is performed internally using 15 digits.)

$200 \div 7$ \Rightarrow 28.571

ANS $\times 14$ \Rightarrow 400.000

The following performs the same calculation with rounding.

$200 \div 7$ \Rightarrow 28.571

(Round the value to the specified number of digits.)

RND (Ans) \Rightarrow 28.571

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(Check rounded result.)

ANS $\times 14$ \Rightarrow 399.994

Practical Examples

Appendix

<#042> $\int_0^1 (\sin X + \cos X)^2 dX = \pi$ (n/l: Not specified)

<#043> Confirm that the two sides of the following equation are equal:

$$e = \sum_{n=0}^{\infty} \frac{1}{n!}$$

Transforming Displayed Values

You can use the procedures in this section to transform a displayed value to engineering notation, or to transform between standard form and decimal form.

Using Engineering Notation

A simple key operation transforms a displayed value to engineering notation.

Appendix

<#044> Transform the value 1,234 to engineering notation, shifting the decimal point to the right.

<#045> Transform the value 123 to engineering notation, shifting the decimal point to the left.

Using S-D Transformation

You can use S-D transformation to transform a value between its decimal (D) form and its standard (S) form (fraction, π).

Formats Supported for S-D Transformation

S-D transformation can be used to transform a displayed decimal calculation result to one of the forms described below. Performing S-D transformation again converts back to the original decimal value.

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Note

When you transform from decimal form to standard form, the calculator automatically decides the standard form to use. You cannot specify the standard form.

Fracton: The current fraction display format setting determines whether the result is an improper fraction or mixed fraction.

π : The following are the π forms that are supported.

This is true only in the case of Math format.

$n\pi$ (n is an integer)

$\frac{d}{c}\pi$ or $a\frac{b}{c}\pi$ (depending on fraction display format)

(depending on fraction display format)

Transformation to a fractional π form is limited to inverse trigonometric function results and values that are normally expressed in radians.

After obtaining a calculation result in $\sqrt{\quad}$ form, you can convert it to decimal form by pressing the \square key. When the original calculation result is in decimal form, it cannot be converted to $\sqrt{\quad}$ form.

Examples of S-D Transformation

Note that S-D transformation can take some time to perform.

Example: Fraction \rightarrow Decimal

MATH $\frac{1}{3}$ \Rightarrow 0.3333333333

Each press of the \square key toggles between the two forms.

$\frac{1}{3}$ \Rightarrow 0.3333333333

Appendix

<#046> π Fraction \rightarrow Decimal

<#047> $\sqrt{\quad}$ \rightarrow Decimal

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Complex Number Calculations (CPLX)

Your calculator can perform the following complex number calculations.

- Addition, subtraction, multiplication, division
- Argument and absolute value calculations
- Reciprocal, square and cube calculations
- Conjugate complex number calculations

All calculations in this section are performed in the CPLX Mode (\square).

Appendix <#048> $(1 + 3i) + (2i) = \frac{3}{2} - \frac{1}{2}i$

Inputting Complex Numbers

In the CPLX Mode, the \square key changes function to become an imaginary number i input key. In this section, the \square key is referred to as the i key. Use the i key when inputting a complex number of the format $a + bi$. The key operation below shows how to input $2 + 3i$, for example.

$2 + 3i$

You can also input complex numbers using polar coordinate format ($r \angle \theta$). The key operation below shows how to input $5 \angle 30$, for example.

$5 \angle 30$

The angle unit for argument θ input and result display is the calculator's default angle unit.

Calculation Result Display Format

Your calculator can display complex number calculation results in rectangular coordinate or polar coordinate format. You can select the coordinate format by configuring the calculator's setup. For more information, see "Specifying the Complex Number Display Format".

Examples of Calculation Results Using Rectangular Coordinate Format ($a + bi$)

Example 1: $2 \times (\sqrt{3} + i) = 2\sqrt{3} + 2i = 3.464101615 + 2i$

$2 \times (\sqrt{3} + i) \Rightarrow 2\sqrt{3} + 2i$

E-42

With Linear format, the real part and imaginary part are shown in two different lines.

Example 2: $\sqrt{2} \angle 45 = 1 + i$

$\sqrt{2} \angle 45 \Rightarrow 1 + i$

Examples of Calculation Results Using Polar Coordinate Format ($r \angle \theta$)

Example 1: $2 \times (\sqrt{3} + i) = 2\sqrt{3} + 2i = 4 \angle 30$

$2 \times (\sqrt{3} + i) \Rightarrow 4 \angle 30$

With Linear format, the absolute value and argument are shown in two different lines.

Example 2: $1 + i = \sqrt{2} \angle 45$

$1 + i \Rightarrow \sqrt{2} \angle 45$

Argument θ is output in the range of $-180 < \theta \leq 180$.

Specifying the Calculation Result Display Format

You can override complex number display settings and specify the format that should be used to display calculation results.

- To specify rectangular coordinate format for the calculation result, perform the following key operation at the end of the calculation. \square (CPLX) \square (R) \square (a+bi)
- To specify polar coordinate format for the calculation result, perform the following key operation at the end of the calculation. \square (CPLX) \square (P) \square (r \angle θ)

Appendix <#049> $1 + i = \sqrt{2} \angle 45 = 1.414213562 \angle 45$

Conjugate Complex Number (Conj)

You can use the following operation to obtain a conjugate complex number.

\square (CPLX) \square (Conj)

Appendix

<#050> Determine the conjugate of the complex number $2 + 3i$.

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Absolute Value and Argument (Abs, arg)

You can use the following procedure to obtain the absolute value ($|Z|$) and argument (\arg) on the Gaussian plane for a complex number of the format $Z = a + bi$.

\square (Abs); \square (Arg) (CPLX) \square (arg)

Appendix

<#051> Obtain the absolute value and argument of $2 + 2i$.

*1 Absolute Value *2 Argument

Statistical Calculation (STAT)

All calculations in this section are performed in the STAT Mode (\square).

Selecting a Statistical Calculation Type

In the STAT Mode, display the statistical calculation type selection screen.

Statistical Calculation Types

Key	Menu Item	Statistical Calculation
\square (1)	1-VAR	Single-variable
\square (2)	A+BX	Linear regression
\square (3)	$_+CX^2$	Quadratic regression
\square (4)	In X	Logarithmic regression
\square (5)	e^X	e exponential regression
\square (6)	A \cdot B \cdot X	ab exponential regression
\square (7)	A \cdot X \cdot B	Power regression
\square (8)	1/X	Inverse regression

Inputting Sample Data

Displaying the STAT Editor Screen

The STAT editor screen appears after you enter the STAT Mode from another mode. Use the STAT menu to select a statistical calculation type. To display the STAT editor screen from another STAT Mode screen, press \square (STAT) \square (Data).

STAT Editor Screen

There are two STAT editor screen formats, depending on the type of statistical calculation you selected.

Single-variable Statistics | Paired-variable Statistics

The first line of the STAT editor screen shows the value for the first sample or the values for their first pair of samples.

FREQ (Frequency) Column

If you turn on the Statistical Display item on the calculator's setup screen, a column labeled "FREQ" will also be included on the STAT editor screen.

You can use the FREQ column to specify the frequency (the number of times the same sample appears in the group of data) of each sample value.

Rules for Inputting Sample Data on the STAT Editor Screen

- Data you input is inserted into the cell where the cursor is located. Use the cursor keys to move the cursor between cells.

STAT Editor Screen with cursor

The values and expressions you can input on the STAT editor screen are the same as those you can input in the COMP Mode with Linear format.

Pressing \square while inputting data clears your current input. After inputting a value, press \square . This registers the value and displays up to six of its digits in the currently selected cell.

Example: To input the value 123.45 in cell X1

(Move the cursor to cell X1.)

Inputting 123.45 into cell X1

Registering a value causes the cursor to move down one cell.

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STAT Editor Screen Input Precautions

The number of lines in STAT editor screen (the number of sample data values you can input) depends on the type of statistical data you selected, and on the Statistical Display setting of the calculator's setup screen.

Statistical Display	OFF (No FREQ column)		ON (FREQ column)	
	Single-variable	80 lines	40 lines	40 lines
Paired-variable	40 lines	26 lines		

The following types of input are not allowed on the STAT editor screen.

- \square , \square , \square (M-) operations
- Assignment to variables (STO)

Precautions Concerning Sample Data Storage

Sample data you input is deleted automatically whenever you change to another mode from the STAT Mode or change the Statistical Display setting (which causes the FREQ column to be shown or hidden) on the calculator's setup screen.

Editing Sample Data

Replacing the Data in a Cell

(1) On the STAT editor screen, move the cursor to the cell you want to edit.

(2) Input the new data value or expression, and then press \square .

Important!

Note that you must totally replace the existing data of the cell with new input. You cannot edit parts of the existing data.

Deleting a Line

(1) On the STAT editor screen, move the cursor to the line you want to delete.

(2) Press \square .

Inserting a Line

(1) On the STAT editor screen, move the cursor to the line that will be under the line you want to insert.

(2) Press \square (STAT) \square (Edit).

(3) Press \square (Ins).

Important!

Note that the insert operation will not work if the maximum number of lines allowed for the STAT editor screen are already used.

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Deleting All STAT Editor Contents

(1) Press \square (STAT) \square (Edit).

(2) Press \square (Del-A).

This clears all of the sample data on the STAT editor screen.

Note

Note that you can perform the procedures under "Inserting a Line" and "Deleting All STAT Editor Contents" only when the STAT editor screen is on the display.

STAT Calculation Screen

The STAT calculation screen is for performing statistical calculations with the data you input with the STAT editor screen. Pressing the \square key while the STAT editor screen is displayed switches to the STAT calculation screen.

The STAT calculation screen also uses Linear format, regardless of the current input/output format setting on the calculator's setup screen.

Using the STAT Menu

While the STAT editor screen or STAT calculation screen is on the display, press \square (STAT) to display the STAT menu.

The content to the STAT menu depends on whether the currently selected statistical operation type uses a single variable or paired variables.

Single-variable Statistics | Paired-variable Statistics

STAT Menu Items

Common Items

Select this menu item:	When you want to do this:
\square (1) Type	Display the statistical calculation type selection screen
\square (2) Data	Display the STAT editor screen
\square (3) Edit	Display the Edit sub-menu for editing STAT editor screen contents
\square (4) Sum	Display the Sum sub-menu of commands for calculating sums
\square (5) Var	Display the Var sub-menu of commands for calculating the mean, standard deviation, etc.
\square (6) MinMax	Display the MinMax sub-menu of commands for obtaining maximum and minimum values

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Single-variable Menu Item

Select this menu item:	When you want to do this:
\square (7) Distr	Display the Distr sub-menu of commands for normal distribution calculations * For more information, see "Distr Sub-menu".

Paired-variable Menu Item

Select this menu item:	When you want to do this:
\square (7) Reg	Display the Reg sub-menu of commands for regression calculations * For details see "Commands when Linear Regression Calculation (A+BX) Is Selected" and "Commands when Quadratic Regression Calculation ($_+CX^2$) Is Selected".

Single-variable (1-VAR) Statistical Calculation Commands

The following are the commands that appear on the sub-menu that appear when you select \square (Sum), \square (Var), \square (MinMax), or \square (Distr) on the STAT menu while a single-variable statistical calculation type is selected.

See **Appendix** <#052> for information about the calculation formula used for each command.

Sum Sub-menu (\square (STAT) \square (Sum))

Select this menu item:	When you want to obtain this:
\square (1) Σx^2	Sum of squares of the sample data
\square (2) Σx	Sum of the sample data

Var Sub-menu (\square (STAT) \square (Var))

Select this menu item:	When you want to obtain this:
\square (1) n	Number of samples
\square (2) \bar{x}	Mean of the sample data
\square (3) σ_n	Population standard deviation
\square (4) σ_{n-1}	Sample standard deviation

MinMax Sub-menu (\square (STAT) \square (MinMax))

Select this menu item:	When you want to obtain this:
\square (1) minX	Minimum value
\square (2) maxX	Maximum value

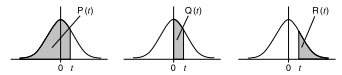
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Distr Sub-menu (2nd) (STAT) (7) (Distr)

1) P(2) C(3) R(4) ▶
 This menu can be used to calculate the probability of standard normal distribution. Normalized variate t is calculated with the expression shown below, using the mean value (\bar{x}) and population standard deviation value ($\sigma_{\bar{x}}$) obtained from the data input on the STAT editor screen.

Standard Normal Distribution



$$X \gg t = \frac{X - \bar{x}}{\sigma_{\bar{x}}}$$

- Appendix** Single-variable Statistical Calculation
- <#053> Select single-variable (1-VAR) and input the following data: (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) (FREQ: ON)
 - <#054> Edit the data to the following, using insert and delete: (0, 1, 2, 3, 4, 5, 6, 7, 9, 10) (FREQ: ON)
 - <#055> Edit the FREQ data to the following: (1, 2, 1, 2, 2, 2, 3, 4, 2, 1) (FREQ: ON)
 - Examples <#056> through <#059> all use the same data as Example <#055>.
 - <#056> Calculate sum of squares of the sample data and sum of the sample data.
 - <#057> Calculate number of samples, mean, and population standard deviation.
 - <#058> Calculate minimum value and maximum value.
 - <#059> Performing standard normal distribution approximation on the input sample data (from Example <#053>) produces the probabilities shown below. Distribution probability that is a value less than the normalized variate when the sample value is 3 (P value for normalized variate when $X = 3$) Distribution probability that is a value greater than the normalized variate when the sample value is 7 (R value for normalized variate when $X = 7$)

Commands when Linear Regression Calculation (A+BX) Is Selected

With linear regression, regression is performed in accordance with the following model equation.

$$y = A + BX$$

The following are the commands that appear on the sub-menus that appear when you select (1) (Sum), (2) (Var), (3) (MinMax), or (7) (Reg) on the STAT menu while linear regression is selected as the statistical calculation type.

See **Appendix** <#060> for information about the calculation formula used for each command.

Sum Sub-menu (2nd) (STAT) (4) (Sum)

Select this menu item:	When you want to obtain this:
(1) Σx^2	Sum of squares of the X-data
(2) Σx	Sum of the X-data
(3) Σy^2	Sum of squares of the Y-data
(4) Σy	Sum of the Y-data
(5) Σxy	Sum of products of the X-data and Y-data
(6) Σx^3	Sum of cubes of the X-data
(7) Σx^2y	Sum of (X-data squares \times Y-data)
(8) Σx^4	Sum of biquadrate of the X-data

Var Sub-menu (2nd) (STAT) (5) (Var)

Select this menu item:	When you want to obtain this:
(1) n	Number of samples
(2) \bar{x}	Mean of the X-data
(3) $\sigma_{\bar{x}}$	Population standard deviation of the X-data
(4) $\sigma_{\bar{x}-1}$	Sample standard deviation of the X-data
(5) \bar{y}	Mean of the Y-data
(6) $\sigma_{\bar{y}}$	Population standard deviation of the Y-data
(7) $\sigma_{\bar{y}-1}$	Sample standard deviation of the Y-data

MinMax Sub-menu (2nd) (STAT) (6) (MinMax)

Select this menu item:	When you want to obtain this:
(1) minX	Minimum value of the X-data
(2) maxX	Maximum value of the X-data
(3) minY	Minimum value of the Y-data
(4) maxY	Maximum value of the Y-data

Reg Sub-menu (2nd) (STAT) (7) (Reg)

Select this menu item:	When you want to obtain this:
(1) A	Regression coefficient constant term A
(2) B	Regression coefficient B
(3) r	Correlation coefficient r
(4) \hat{x}	Estimated value of x
(5) \hat{y}	Estimated value of y

Appendix Linear Regression Calculation: <#061> to <#064>

- Examples <#062> through <#064> all use the data input in Example <#061>.
- *1 Estimated Value ($y = -3 \rightarrow \hat{x} = ?$)
- *2 Estimated Value ($x = 2 \rightarrow \hat{y} = ?$)

Commands when Quadratic Regression Calculation (+CX²) Is Selected

With quadratic regression, regression is performed in accordance with the following model equation.

$$y = A + BX + CX^2$$

See **Appendix** <#065> for information about the calculation formula used for each command.

Reg Sub-menu (2nd) (STAT) (7) (Reg)

Select this menu item:	When you want to obtain this:
(1) A	Regression coefficient constant term A
(2) B	Linear coefficient B of the regression coefficients
(3) C	Quadratic coefficient C of the regression coefficients
(4) $\hat{x}1$	Estimated value of x1
(5) $\hat{x}2$	Estimated value of x2
(6) \hat{y}	Estimated value of y

• Sum sub-menu (sums), Var sub-menu (number of samples, mean, standard deviation), and MinMax sub-menu (maximum value, minimum value) operations are the same those for linear regression calculations.

Appendix Quadratic Regression Calculation: <#066> to <#068>

- Examples <#066> through <#068> all use the data input in Example <#061>.

Comments for Other Types of Regression

For details about the calculation formula of the command included in each regression type, refer to the indicated calculation formulas (**Appendix** <#069> to <#073>).

Statistical Calculation Type	Model Equation	Calculation Formula
Logarithmic Regression (ln X)	$y = A + B \ln X$	<#069>
c Exponential Regression (e^X)	$y = Ae^{cX}$	<#070>
ab Exponential Regression (A \times B ^X)	$y = AB^X$	<#071>
Power Regression (A \times X ^B)	$y = AX^B$	<#072>
Inverse Regression (1/X)	$y = A + \frac{B}{X}$	<#073>

Appendix Comparison of Regression Curves

- The following example uses the data input in Example <#061>.
- <#074> Compare the correlation coefficient for logarithmic, e exponential, ab exponential, power, and inverse regression. (FREQ: OFF)

Appendix Other Types of Regression Calculation: <#075> to <#079>

Command Usage Tips

- The commands included in the Reg sub-menu can take a long time to execute in logarithmic, e exponential, ab exponential, or power regression calculation when there are a large number of data samples.

Base- n Calculations (BASE-N)

The BASE-N Mode lets you perform arithmetic calculations, negative value calculations, and logical operations with binary, octal, decimal, and hexadecimal values.

All calculations in this section are performed in the BASE-N Mode (2nd) (4).

Number Base Setting and Value Input

Use the keys listed below to specify the number base. The key markings used in this section are the ones that are above each key, on the right.

Key	Number Base	Screen Indicator
(2nd)	Decimal	Dec
(2nd)	Hexadecimal	Hex
(2nd)	Binary	Bin
(2nd)	Octal	Oct

- The current number base setting is indicated in the second line of the display.
- The initial default number base setting when you enter the BASE-N Mode is always decimal (DEC).

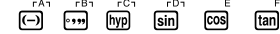
Inputting Values

In the BASE-N Mode, you can input values using the currently selected number base.

- A Syntax ERROR occurs if you input values that are not allowed for the currently selected number base (such as inputting 2 while binary is selected).
- You cannot input fractional values or exponential values in the BASE-N Mode. If a calculation produces a fractional value, the decimal part is cut off.

Inputting Hexadecimal Values

Use the keys shown below to input the alphabetic letters (A, B, C, D, E, F) required for hexadecimal values.



Base	Range
Binary	Positive: 0000000000000000 $\leq x \leq 0111111111111111$ Negative: 1000000000000000 $\leq x \leq 1111111111111111$
Octal	Positive: 000000000000 $\leq x \leq 177777777777$ Negative: 200000000000 $\leq x \leq 377777777777$
Decimal	-2147483648 $\leq x \leq 2147483647$
Hexadecimal	Positive: 0000000000 $\leq x \leq 7FFFFFFF$ Negative: 8000000000 $\leq x \leq FFFFFFFF$

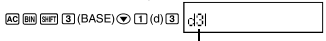
- The allowable calculation range is narrower from binary (16 bits) than it is for the other number systems (32 bits).
- A Math ERROR occurs when a calculation result is outside the applicable range for the number system being used.

Specifying the Base during Input

The BASE-N Mode lets you override the current default number base setting and input a particular value using a different base. When inputting the value, press (2nd) (BASE) (2) to display page two of the BASE menu, and then press the number key that corresponds to the base you want to specify.

Press this key:	To specify this number base:
(2nd) (d)	Decimal (Base 10)
(2nd) (h)	Hexadecimal (Base 16)
(2nd) (b)	Binary (Base 2)
(2nd) (o)	Octal (Base 8)

The key operation below shows how to input a value of 3 using the decimal number base, for example.



The value you input here is decimal number base.

- Appendix**
- <#080> Calculate $1_2 + 1_2$ in binary.
 - <#081> Calculate $7_8 + 1_8$ in octal.
 - <#082> Calculate $1F_{16} + 1_{16}$ in hexadecimal.
 - <#083> Convert the decimal value 30_{10} to binary, octal, and hexadecimal.
 - <#084> Transform the result of $5_{10} + 5_{10}$ to binary.

Negative Number Calculations and Logical Operations

To input a negative number calculation or logical operation command, press (2nd) (3) (BASE) to display page one of the BASE menu, and then press the number key that corresponds to the command you want to specify.

Press this key:	When you want to input this:
(2nd) (and)	Logical operator "and" (logical product), which returns the result of a bitwise AND
(2nd) (or)	Logical operator "or" (logical sum), which returns the result of a bitwise OR
(2nd) (xor)	Logical operator "xor" (exclusive logical sum), which returns the result of a bitwise XOR
(2nd) (xnor)	Logical operator "xnor" (exclusive negative logical sum), which returns the result of a bitwise XNOR

Press this key:	When you want to input this:
(2nd) (Not)	"Not" function, which returns the result of a bitwise complement
(2nd) (Neg)	"Neg" function, which returns the result of a two's complement

• Negative binary, octal, and hexadecimal values are produced by taking the binary two's complement and then returning the result to the original number base. With the decimal number base, negative values are displayed with a minus sign.

Appendix

Examples <#085> through <#090> show examples of calculations with negative binary values and examples of logical operations. Before starting each calculation, be sure to press (2nd) (BASE) first.

Equation Calculations (EQN)

All calculations in this section are performed in the EQN Mode (2nd) (5).

Equation Types

An equation type menu appears when you press (2nd) (5) (EQN) and enter the EQN Mode.

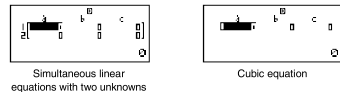
Key	Menu Item	Equation Type
(1)	$a_1X + b_1Y = c_1$	Simultaneous Linear Equations with Two Unknowns
(2)	$a_1X + b_1Y + c_1Z = d_1$	Simultaneous Linear Equations with Three Unknowns
(3)	$aX^2 + bX + c = 0$	Quadratic Equation
(4)	$aX^3 + bX^2 + cX + d = 0$	Cubic Equation

Changing the Current Equation Type Setting

Press (2nd) (5) (EQN) to re-enter the EQN Mode. This clears all current EQN Mode input and displays the equation type menu described above.

Inputting Coefficients

Use the coefficient editor screen to input the coefficients of an equation. The coefficient editor screen shows input cells for each of the coefficients required by the currently selected equation type.



Rules for Inputting and Editing Coefficients

- Data you input is inserted into the cell where the cursor is located. When you register input into a cell, the cursor moves to the next cell to the right.
- When simultaneous linear equations with three unknowns or cubic equation is selected as the equation type, the d column will not be visible on the display when the coefficient editor screen is first displayed. The d column will become visible when you move the cursor to it, which causes the screen to shift.
- The values and expressions you can input on the coefficient editor screen are the same as those you can input in the COMP Mode with Linear format.
- Pressing (2nd) while inputting data clears your current input.
- After inputting data, press (2nd). This registers the value and displays up to six of its digits in the currently selected cell.
- To change the contents of a cell, use the cursor keys to move the cursor to the cell and then input the new data.

Initializing All Coefficients to Zero

You can clear all coefficients to zero by pressing the (2nd) key while inputting values on the coefficient editor screen.

Coefficient Editor Screen Input Precautions

Coefficient editor screen precautions are basically the same as those for the STAT editor screen. The only difference is that the first STAT editor screen precaution does not apply in the case of the coefficient editor screen. For details, see "STAT Editor Screen Input Precautions".

Solution Display

After inputting and registering values on the coefficient editor screen, press (2nd) to display the solution(s) for the equation.

- Each press of (2nd) displays the next solution, if there is one. Pressing (2nd) while the final solution is displayed returns to the coefficient editor screen.

- In the case of simultaneous linear equations, you can use (2nd) and (2nd) to switch the display between the solutions for X and Y (and Z).
- When there are multiple solutions for a quadratic or cubic equation, you can use the (2nd) and (2nd) keys to scroll the display between X1, X2, and X3. The actual number of solutions depends on the equation.
- Pressing (2nd) while a solution is displayed will return to the coefficient editor screen.
- The display format of solutions is in accordance with the input/output format and complex number display format settings of the calculator's setup screen.
- Note that you cannot transform values to engineering notation while an equation solution is displayed.

Appendix Equation Calculation: <#091> to <#095>

Matrix Calculations (MATRIX)

You can save matrices under the names "MatA", "MatB", and "MatC" in matrix memory. Matrix calculation results are stored in a special Matrix Answer Memory named "MatAns".

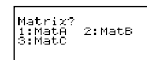
All calculations in this section are performed in the MATRIX Mode (2nd) (6).

Creating and Managing a Matrix

Creating a Matrix and Storing It in Matrix Memory

(1) In the MATRIX Mode, press (2nd) (4) (MATRIX) (1) (Dim).

- This displays the matrix selection screen.

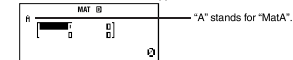


- Note that the matrix selection screen also appears whenever you enter the MATRIX Mode.
- (2) Press a number key (1, 2, or 3) to specify the name of the matrix you want to select.
- This displays a screen for configuring dimension settings.



(3) Press a number key (1) through (6) to specify the matrix dimension you want to use.

- Pressing a number key to specify the matrix dimension causes the matrix editor screen to appear.



- "A" stands for "MatA".
- (4) Use the matrix editor screen to input each of the elements into the matrix.
- Input is subject to the same rules as those that govern the coefficient editor screen in the EQN Mode. For more information, see "Rules for Inputting and Editing Coefficients".
- If you want to create another matrix, repeat this procedure from step (1).

Copying the Contents of One Matrix to Another Matrix

- (1) Use the matrix editor screen to display the matrix you want to copy, or display the Matrix Answer Memory screen.
- If you want to copy Matrix A, for example, press (2nd) (4) (MATRIX) (2) (Data) (1) (MatA).
- (2) Press (2nd) (5) (STO).
- This causes the "STO" indicator to appear on the display.
- (3) Specify the destination of the copy operation.

To specify this destination:	Press this key:
Matrix A	(2nd) (MatA)
Matrix B	(2nd) (MatB)
Matrix C	(2nd) (MatC)

• Pressing (2nd) (MatB) copies the matrix to Matrix B, and displays the matrix editor screen for Matrix B.

Performing Matrix Calculations

Pressing (2nd) while the matrix selection screen or matrix editor screen is on the display switches to the matrix calculation screen.

Matrix Answer Memory Screen

The Matrix Answer Memory (MatAns) screen shows the results of matrix calculations.



- You cannot edit the contents of a cell.
- To switch to the matrix calculation screen, press **[2]**.
- While the MatAns screen is on the display, you can press an arithmetic operator key (like **[+]**, **[-]**, **[*]**, **[/]**) and use the screen contents in a subsequent calculation, just as with Answer Memory contents. For more information, see "Using Answer Memory to Perform a Series of Calculations".

Matrix Menu Items

The following are the menu items on the matrix menu that appears when you press **[2]** **[1]** (MATRIX).

Select this menu item:	When you want to do this:
[1] Dim	Select a matrix (MatA, MatB, MatC) and specify its dimension.
[2] Data	Select a matrix (MatA, MatB, MatC) and display its data on the matrix editor screen.
[3] MatA	Input "MatA"
[4] MatB	Input "MatB"
[5] MatC	Input "MatC"
[6] MatAns	Input "MatAns"
[7] det	Input the "det" function for obtaining the determinant
[8] Trn	Input the "Trn" function for obtaining a transposed data in Matrix

Appendix

<#096> Input MatA = $\begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$, MatC = $\begin{bmatrix} 1 & 0 & -1 \\ 0 & -1 & 1 \end{bmatrix}$.

<#097> Copy MatA = $\begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$ to MatB and edit the contents

of MatB to MatB = $\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$.

- The following examples use the matrices input in Examples <#096> and <#097> (MatA, MatB, MatC).
- <#098> MatA + MatB (Adding Two Matrices)
- <#099> MatA × MatB (Matrix Scalar Multiplication)
- <#100> 3 × MatA (Matrix Scalar Multiplication)
- <#101> Obtain the determinant of Matrix A (det(MatA)).
- <#102> Obtain the transposition of Matrix C (Trn(MatC)).
- <#103> Obtain the inverse matrix of Matrix A (MatA⁻¹).
- Use the **[2]** key to input "1". Note that you cannot use **[2]** for this input.

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<#104> Obtain the absolute value (Abs(MatB)) of each element of Matrix B.

- Use **[2]** **[2]** (Abs).
- <#105> Determine the square (MatA²) or cube (MatA³) of Matrix A.
- Use **[2]** to specify squaring, and **[2]** **[3]** to specify cubing. Note that you cannot use **[2]** for this input.

Generating a Number Table from a Function (TABLE)

All calculations in this section are performed in the TABLE Mode **[2]** **[7]**.

Configuring a Number Table Generation Function

The procedure below configures the number table generation function with the following settings.

Function: $f(x) = x^2 + \frac{1}{2}$

Start Value: 1, End Value: 5, Step Value: 1

[LINE]

(1) Press **[2]** **[7]** (TABLE).

$f(x)=x^2 + \frac{1}{2}$

(2) Input the function.

$f(x)=x^2 + \frac{1}{2}$

(3) After making sure the function is the way you want, press **[2]**. This displays the start value input screen.

Start?

Indicates the initial default start value of 1.

If the initial value is not 1, press **[1]** to specify the initial start value for this example.

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(4) After specifying the start value, press **[2]**. This displays the end value input screen.

End?

Indicates the initial default end value of 5.

Specify the end value.

(5) After specifying the end value, press **[2]**.

This displays the step value input screen.

Step?

Indicates the initial default step value of 1.

Specify the step value.

For details about specifying the start, end, and step values, see "Start, End, and Step Value Rules".

(6) After specifying the step value, press **[2]**.

$f(x)$

Pressing the **[2]** key returns to the function editor screen.

Supported Function Types

- Except for the X variable, other variables (A, B, C, D, Y) and independent memory (M) are all treated as values (the current variable assigned to the variable or stored in independent memory).
- Only variable X can be used as the variable of a function.
- The derivative (d/dx), integration (∫), coordinate conversion (Pol, Rec), and sum (Σ) functions cannot be used for a number table generation function.
- Note that the number table generation operation causes the contents of variable X to be changed.

Start, End, and Step Value Rules

- Linear format is always used for value input.
- You can specify either values or calculation expressions (which must produce a numeric result) for Start, End, and Step.
- Specifying an End value that is less than the Start value causes an error, so the number table is not generated.
- The specified Start, End, and Step values should produce a maximum of 30 X-values for the number table being generated. Executing a number generation table using a Start, End, and Step value combination that produces more than 30 X-values causes an error.

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Note

- Certain functions and Start, End, Step value combinations can cause number table generation to take a long time.

Number Table Screen

The number table screen shows X-values calculated using the specified Start, End, and Step values, as well as the values obtained when each X-value is substituted in the function f(x).

- Note that you can use the number table screen for viewing values only. Table contents cannot be edited.
- Pressing the **[2]** key returns to the function editor screen.

TABLE Mode Precautions

Note that changing the input/output format settings (Math format or Linear format) on the calculator's setup screen while in the TABLE Mode clears the number table generation function.

Vector Calculations (VECTOR)

You can save vectors under the names "VectA", "VectB", and "VectC" in vector memory. Vector calculation results are stored in a special Vector Answer Memory named "VectAns".

All calculations in this section are performed in the VECTOR Mode **[2]** **[8]**.

Creating and Managing a Vector

Creating a VECTOR and Saving It in VECTOR Memory

- In the VECTOR Mode, press **[2]** **[8]** (VECTOR) **[1]** (Dim).
 - This displays a vector selection screen.
 - Note that the vector selection screen also appears whenever you enter the VECTOR Mode.
- Press a number key (**[1]**, **[2]**, or **[3]**) to specify the name of the vector you want to select.
 - This displays a screen for configuring dimension settings.
- Press a number key (**[1]** or **[2]**) to specify the vector dimension you want to use.
 - You can select either 3-dimension (**[1]**) or 2-dimension (**[2]**).
 - Pressing a number key to specify the dimension displays the vector editor screen.

"A" stands for "VectA".

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<#106> Store VectA = (1, 2) and VectB = (2, -1, 2).
<#107> Copy VectA = (1, 2) to VectB and then edit Vector B to VectB = (3, 4).

- The following examples use the vectors input in Examples <#106> and <#107> (VectA, VectB, VectC).
- <#108> VectA + VectB (Vector Addition)
- <#109> 3 × VectA (Vector Scalar Multiplication)
- <#110> VectA × VectB (Vector Dot Product)
- <#111> VectA × VectB (Vector Cross Product)
- <#112> Obtain the absolute values of VectC.
- <#113> Determine the size of the angle (angle unit: Deg) formed by vectors A = (-1, 0, 1) and B = (1, 2, 0), and one of the size 1 vectors perpendicular to both A and B.

*1 $\cos \theta = \frac{(A \cdot B)}{|A| |B|}$, which becomes $\theta = \cos^{-1} \left(\frac{(A \cdot B)}{|A| |B|} \right)$

*2 Size 1 vector perpendicular to both A and B = $\frac{(A \times B)}{|A \times B|}$

Scientific Constants

Your calculator comes with 40 built-in constants that are commonly used in scientific calculations. You can use the scientific constants in any calculation mode except for BASE-N.

- To recall a scientific constant, press **[2]** **[7]** (CONST). This displays the scientific constant menu. Input the two-digit number that corresponds to the constant you want to recall. When you recall a constant, its unique symbol appears on the display.
- The following are all of the built-in scientific constants.

- proton mass; 02: neutron mass; 03: electron mass; 04: muon mass; 05: Bohr radius; 06: Planck constant; 07: nuclear magneton; 08: Bohr magneton; 09: Planck constant, rationalized; 10: fine-structure constant; 11: classical electron radius; 12: Compton wavelength; 13: proton gyromagnetic ratio; 14: proton Compton wavelength; 15: neutron Compton wavelength; 16: Rydberg constant; 17: atomic mass unit; 18: proton magnetic moment; 19: electron magnetic moment; 20: neutron magnetic moment; 21: muon magnetic moment; 22: Faraday constant; 23: elementary charge; 24: Avogadro constant; 25: Boltzmann constant; 26: molar volume of ideal gas; 27: molar gas constant; 28: speed of light in vacuum; 29: first radiation constant; 30: second radiation constant; 31: Stefan-Boltzmann constant; 32: electric constant; 33: magnetic constant; 34: magnetic flux quantum; 35: standard acceleration of gravity; 36: conductance quantum; 37: characteristic impedance of vacuum; 38: Celsius temperature; 39: Newtonian constant of gravitation; 40: standard atmosphere

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- The values are based on ISO Standards (1992) and CODATA Recommended Values (1998). For details, see **[Appendix <#114>]**.

[Appendix <#115> and <#116>]
Perform all of these examples in the COMP Mode **[2]** **[1]**.

Metric Conversion

The calculator's built-in metric conversion commands make it simple to convert values from one unit to another. You can use the metric conversion commands in any calculation mode except for BASE-N and TABLE.

To recall a metric conversion command, press **[2]** **[8]** (CONV). This displays the metric conversion command menu. Input the two-digit number that corresponds to the metric conversion you want to recall. See **[Appendix <#117>]** for a list of all the metric conversion commands and conversion formulas.

- Conversion formula data is based on the "NIST Special Publication 811 (1995)".
- *"cal" uses the NIST value at 15°C.

[Appendix <#118> to <#120>]

Perform all of these examples in the COMP Mode **[2]** **[1]**.

Technical Information

Calculation Priority Sequence

The calculator performs calculations according to a calculation priority sequence.

- Basically, calculations are performed from left to right.
- Expressions within parentheses have the highest priority.

The following shows the priority sequence for each individual command.

- Function with parentheses: Pol, Rec
- ∫, d/dx, Σ
- PI, OI, RI
- sin, cos, tan, sin⁻¹, cos⁻¹, tan⁻¹, sinh, cosh, tanh, sinh⁻¹, cosh⁻¹, tanh⁻¹
- log, ln, e^x, 10^x, √, 3√, arg, Abs, Conj, Not, Neg, det, Trn, Rnd
- Functions preceded by values, powers, power roots: x², x³, xⁿ, x^{1/x}, x^{1/y}, 1/x, 1/y, 1/x^y, 1/y^x
Normalized variate: ▶ f
Percent: %

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- Fractions: a^b/c
- Prefix symbol: (-) (negative sign)
- d, h, s (base n symbol)
- Metric conversion commands: cm, m, mm, μm
- Statistical estimated value calculation: \bar{x} , \bar{y} , \bar{z} , \bar{s}_x , \bar{s}_y , \bar{s}_z
- Permutations, combinations: nPr, nCr
- Complex polar form symbol: ∠
- Dot product: • (Dot)
- Multiplication and division: ×, ÷
- Multiplication where sign is omitted: Multiplication sign omitted immediately before π, variables, scientific constants (2π, 5π, πA, 3πp, 2l, etc.), functions with parentheses (2[√], (3), Abs(30), etc.)
- Addition and subtraction: +, -
- Logical AND; and
- Logical OR, XOR, XNOR; or, xor, xnor

If a calculation contains a negative value, you may need to enclose the negative value in parentheses if you want to square the value -2, for example, you need to input (-2)². This is because x² is a function preceded by a value (Priority 2, above), whose priority is greater than the negative sign, which is a prefix symbol (Priority 4).

Example:
[2] **[2]** **[2]** **[2]** $-2^2 = -4$
[2] **[2]** **[2]** **[2]** $(-2)^2 = 4$
Multiplication and division, and multiplication where the sign is omitted are the same priority (Priority 8), so these operations are performed from left to right when both types are mixed in the same calculation. Enclosing an operation within parentheses causes it to be performed first, so the use of parentheses can result in different calculation results.

Example:
[2] **[2]** **[2]** **[2]** $1 + 2 = \frac{1}{2}$
[2] **[2]** **[2]** **[2]** $1 + (2) = \frac{1}{2}$

Stack Limitations

This calculator uses memory areas called stacks to temporarily store lower calculation priority sequence values, commands, and functions. The numeric stack has 10 levels and the command stack has 14 levels, as shown in the illustration below.

$2 \times ((3 + 4) \times (5 + 4) + 3) + 5 + 8 =$

Numeric Stack
① 2 ② 4 ③ 5 ④ 3 ⑤ 8
⑥ 4 ⑦ 4 ⑧ 4 ⑨ 4 ⑩ 4

Command Stack
① (② × ③ (④ (⑤ (⑥ (⑦ (⑧ (⑨ (⑩ (⑪ (⑫ (⑬ (⑭ (

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A Stack ERROR occurs when the calculation you are performing causes the capacity of either stack to be exceeded.

Stack Issues to Keep in Mind for Each Mode

- In the CMPLX Mode, each input value uses two levels of the numeric stack, regardless of whether the input value is a real number or a complex number. This means that the numeric stack effectively has only five levels in the CMPLX Mode.
- The MATRIX Mode uses its own matrix stack, which is used in combination with the general-purpose numeric stack. The matrix stack has three levels. Performing a calculation that involves a matrix causes one level of the matrix stack to be used for storage of the result. Squaring, cubing, or inverting a matrix also uses one level of the matrix stack.
- The VECTOR Mode uses its own vector stack, which is used in combination with the general-purpose numeric stack. The vector stack has five levels. Vector stack usage follows the same rules as the matrix stack, described above.

Calculation Ranges, Number of Digits, and Precision

The calculation range, number of digits used for internal calculation, and calculation precision depends on the type of calculation you are performing.

Calculation Range	Number of Digits for Internal Calculation	Precision
$\pm 1 \times 10^{-99}$ to $\pm 9.999999999 \times 10^{99}$ or 0	15 digits	In general, ±1 at the 10th digit for a single calculation. Precision for exponential display is ±1 at the least significant digit. Errors are cumulative in the case of consecutive calculations.

Function Calculation Input Ranges and Precision

Functions	Input Range
sinx	DEG 0 ≤ x ≤ 9 × 10 ⁹ RAD 0 ≤ x ≤ 157079632.7
cosx	DEG 0 ≤ x ≤ 1 × 10 ¹⁰
	DEG 0 ≤ x ≤ 9 × 10 ⁹
	RAD 0 ≤ x ≤ 157079632.7
tanx	DEG Same as sinx, except when x = (2n-1)π/90.
	RAD Same as sinx, except when x = (2n-1) × π/2.
	GRA Same as sinx, except when x = (2n-1) × 100.
sin ⁻¹ x	0 ≤ x ≤ 1
cos ⁻¹ x	0 ≤ x ≤ 1
tan ⁻¹ x	0 ≤ x ≤ 9.999999999 × 10 ⁹⁹
sinhx	0 ≤ x ≤ 2
coshx	0 ≤ x ≤ 230.2586092
sinh ⁻¹ x	0 ≤ x ≤ 4.999999999 × 10 ⁹⁹
cosh ⁻¹ x	1 ≤ x ≤ 4.999999999 × 10 ⁹⁹

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- Use the vector editor screen to input each element.
 - Input is subject to the same rules as those that govern the coefficient editor screen in the EQN Mode. For more information, see "Rules for Inputting and Editing Coefficients".
 - If you want to create another vector, repeat this procedure from step (1).

Copying the Contents of One Vector to Another Vector

You can copy the contents of Vector Answer Memory (VectAns) or of a vector in vector memory to another vector in vector memory. The vector copy operation is basically the same as the matrix copy operation. See "Copying the Contents of One Matrix to Another Matrix" for more information.

Performing Vector Calculations

To perform a vector calculation, display the vector calculation screen by pressing the **[2]** key.

Vector Answer Memory Screen

The Vector Answer Memory screen shows the result of the last vector calculation.

[VectA] **[VectB]** **[VectC]** **[VectAns]**
Stands for "VectAns".

- You cannot edit the contents of a cell.
- To switch to the vector calculation screen, press **[2]**.

Vector Menu Items

The following are the menu items on the vector menu that appears when you press **[2]** **[8]** (VECTOR).

Select this menu item:	When you want to do this:
[1] Dim	Select a vector (VectA, VectB, VectC) and specify its dimension
[2] Data	Select a vector (VectA, VectB, VectC) and display its data on the vector editor screen
[3] VectA	Input "VectA"
[4] VectB	Input "VectB"
[5] VectC	Input "VectC"
[6] VectAns	Input "VectAns"
[7] Dot	Input the "*" command for obtaining the dot product of a vector

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Functions	Input Range
tan ⁻¹ x	0 ≤ x ≤ 9.999999999 × 10 ⁹⁹
tan ⁻¹ x	0 ≤ x ≤ 9.999999999 × 10 ⁻¹
log ₁₀ x	0 < x ≤ 9.999999999 × 10 ⁹⁹
10 ^x	-9.999999999 × 10 ⁹⁹ ≤ x ≤ 99.99999999
e ^x	-9.999999999 × 10 ⁹⁹ ≤ x ≤ 230.2586092
√x	0 ≤ x < 1 × 10 ¹⁰
x ²	x ≤ 1 × 10 ⁹⁹
1/x	x ≤ 1 × 10 ¹⁰⁰ , x ≠ 0
3√x	x ≤ 1 × 10 ¹⁰⁰
x!	0 ≤ x ≤ 69 (x is an integer)
nPr	0 ≤ n < 1 × 10 ¹⁰ , 0 ≤ r ≤ n (n, r are integers) 1 ≤ n(n-1) < 1 × 10 ¹⁰⁰
nCr	0 ≤ n < 1 × 10 ¹⁰ , 0 ≤ r ≤ n (n, r are integers) 1 ≤ n!/(n-r)! < 1 × 10 ¹⁰⁰ or 1 ≤ n!/(n-r)! < 1 × 10 ¹⁰⁰
Pol(x, y)	0 ≤ r ≤ 9.999999999 × 10 ⁹⁹ √x ² + y ² ≤ 9.999999999 × 10 ⁹⁹
Rec(r, θ)	0 ≤ r ≤ 9.999999999 × 10 ⁹⁹ θ: Same as sinx
e ^{ix}	x ≤ 1 × 10 ¹⁰⁰ 0 ≤ b, c
1/e ^{ix}	x ≤ 1 × 10 ¹⁰⁰
Decimal ↔ Sexagesimal Conversions	0:00:00 ≤ x ≤ 99999999.9999
10 ^x	x ≤ 0, -1 × 10 ¹⁰⁰ < y < 100
x ^y	x > 0; y = n, $\frac{m}{2^{21}}$ (m, n are integers) However, -1 × 10 ¹⁰⁰ < y < 100
√y	y ≥ 0; x = 0, -1 × 10 ¹⁰⁰ < 1/x < 100 y ≥ 0; x = 0
x ^y	y > 0; x = 2n+1, $\frac{2m+1}{2^{21}}$ (m ≠ 0; n are integers) However, -1 × 10 ¹⁰⁰ < 1/x < 100
a ^{b/c}	Total of integer, numerator, and denominator must be 10 digits or less (including display marks).

- Precision is basically the same as that described under "Calculation Range and Precision" above.
- √(x²), x^{√y}, 3√x², x^{1/y}, nPr, nCr type function requests require consecutive internal calculation, which can cause accumulation of errors that occur with each calculation.
- Error is cumulative and tends to be large in the vicinity of a function's singular point and inflection point.

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■ Error Messages

The calculator will display an error message when a result exceeds the calculation range, when you attempt an illegal input, or whenever any other similar problem occurs.

When an error message appears...

The following are general operations you can use when any error message appears.

- Pressing \leftarrow or \rightarrow displays to the calculation expression editing screen you were using before the error message appeared, with the cursor located at the position of the error. For more information, see "Displaying the Location of an Error".
- Pressing AC clears the calculation expression you input before the error message appeared. You can then re-input and re-execute the calculation, if you want. Note that in this case, the original calculation will not be retained in calculation history memory.

Math ERROR

• Cause

- The intermediate or final result of the calculation you are performing exceeds the allowable calculation range.
- Your input exceeds the allowable input range (particularly when using functions).
- The calculation you are performing contains an illegal mathematical operation (such as division by zero).

• Action

- Check the input values, reduce the number of digits, and try again.
- When using independent memory or a variable as the argument of a function, make sure that the memory or variable value is within the allowable range for the function.

Stack ERROR

• Cause

- The calculation you are performing has caused the capacity of the numeric stack or the command stack to be exceeded.
- The calculation you are performing has caused the capacity of the matrix stack to be exceeded.
- The calculation you are performing has caused the capacity of the vector stack to be exceeded.

• Action

- Simplify the calculation expression so it does not exceed the capacity of the stack.
- Try splitting the calculation into two or more parts.

Syntax ERROR

• Cause

- There is a problem with the format of the calculation you are performing.

• Action

- Make necessary corrections.

Argument ERROR

• Cause

- There is a problem with the argument of the calculation you are performing.

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• Action

- Make necessary corrections.

Dimension ERROR (MATRIX and VECTOR Modes only)

• Cause

- The matrix or vector you are trying to use in a calculation was input without specifying its dimension.
- You are trying to perform a calculation with matrices or vectors whose dimensions do not allow that type of calculation.

• Action

- Specify the dimension of the matrix or vector and then perform the calculation again.
- Check the dimensions specified for the matrices or vectors to see if they are compatible with the calculation.

Variable ERROR (SOLVE feature only)

• Cause

- You did not specify a solution variable, and there is no X variable in the equation you input.
- The solution variable that you specified is not included in the equation you input.

• Action

- The equation you input must include an X variable when you do not specify the solution variable.
- Specify a variable that is included in the equation you input as the solution variable.

Can't Solve Error (SOLVE feature only)

• Cause

- The calculator could not obtain a solution.

• Action

- Check for errors in the equation that you input.
- Input a value for the solution variable that is close to the expected solution and try again.

Insufficient MEM Error

• Cause

- There is not enough memory to perform your calculation.

• Action

- Narrow the table calculation range by changing the Start, End, and Step values, and try again.

Time Out Error

• Cause

- The current differential or integration calculation ends without the ending condition being fulfilled.

• Action

- Try increasing the *tol* value. Note that this also decreases solution precision.

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■ Before assuming malfunction of the calculator...

Perform the following steps whenever an error occurs during a calculation or when calculation results are not what you expected. If one step does not correct the problem, move on to the next step. Note that you should make separate copies of important data before performing these steps.

- (1) Check the calculation expression to make sure that it does not contain any errors.
- (2) Make sure that you are using the correct mode for the type of calculation you are trying to perform.
- (3) If the above steps do not correct your problem, press the MODE key. This will cause the calculator to perform a routine that checks whether calculation functions are operating correctly. If the calculator discovers any abnormality, it automatically initializes the calculation mode and clears memory contents. For details about initialized settings, see "Initializing the Calculation Mode and Other Settings" under "Calculation Modes and Calculator Setup".
- (4) Initialize all modes and settings by performing the following operation: MODE (CLR) (MODE) (Setup) (YES).

Reference

■ Power Requirements and Battery Replacement

Your calculator uses a TWO WAY POWER system that combines a solar cell with G13 type button battery (LR44).

Normally, calculators equipped with a solar cell alone can operate only when relatively bright light is present. The TWO WAY POWER system, however, lets you continue to use the calculator as long as there is enough light to read the display.

Replacing the Battery

Dim display figures when available lighting is dim or failure of anything to appear on the display immediately when you turn on the calculator indicates that button battery power is low. Note that you will not be able to use the calculator if its button battery is dead. When any of these symptoms occur, replace the button battery. Even if the calculator is operating normally, replace the battery at least once every three years.

Important!

- Removing the button battery from the calculator causes independent memory contents and values assigned to variables to be cleared.

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- (1) Press OFF (OFF) to turn off the calculator.

- To ensure that you do not accidentally turn on power while replacing the battery, slide the hard case onto the front of the calculator.

- (2) On the back of the calculator, remove the screw and the battery cover.

- (3) Remove the old battery.

- (4) Wipe a new battery with a dry cloth, and then load it into the calculator with its positive (+) side facing upwards (so you can see it).

- (5) Replace the battery cover and secure it in place with its screw.

- (6) Perform the following key operation:

MODE (OFF) (YES) (CLR) (ALL) (YES).

- Make sure you perform the above key operation. Do not skip it.

Auto Power Off

Your calculator will turn off automatically if you do not perform any operation for about six minutes. If this happens, press the ON key to turn the calculator back on.

Specifications

Power Requirements:

Solar Cell: Built into the front of the calculator

Button Battery: G13 Type (LR44) × 1

Battery Life: Approximately 3 years (Based on one hour of operation per day.)

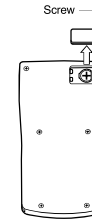
Operating Temperature: 0°C to 40°C

Dimensions: 12.2 (H) × 80 (W) × 161 (D) mm

1/2" (H) × 3 1/8" (W) × 6 5/16" (D)

Approximate Weight: 105g (3.7 oz) including the battery

Bundled Items: Hard Case



CASIO®

CASIO COMPUTER CO., LTD.
6-2, Hon-machi 1-chome
Shibuya-ku, Tokyo 151-8543, Japan

SA0411-B Printed in China

E-72

Operating Instructions

CORDLESS (HAMMER) DRILL DRIVER

MODEL
T76503158
T76703158
T76703258



WARNING
AVERTISSEMENT



ALWAYS READ INSTRUCTIONS BEFORE USING POWER TOOLS
Pour réduire les risques de blessures, l'utilisateur doit lire le manuel d'instruction



ALWAYS WEAR SAFETY



WEAR HEARING 92.0d B



AVOID PROLONGED EXPOSURE TO VIBRATION 4.23m/s²

General Power Tool Safety Warnings

WARNING

Read all safety warnings and all instructions. Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury. **Save all warnings and instructions for future reference!** The term "power tool" in the warnings refers to your mains-operated (corded) power tool or battery-operated (cordless) power tool.

1. Work area safety

- Keep work area clean and well lit.** Cluttered or dark areas invite accidents.
- Do not operate power tools in explosive atmospheres, such as in the presence of flammable liquids, gases or dust.** Power tools create sparks which may ignite the dust or fumes.
- Keep children and bystanders away while operating a power tool.** Distractions can cause you to lose control.

2. Electrical safety

- Power tool plugs must match the outlet. Never modify the plug in any way. Do not use any adapter plugs with earthed (grounded) power tools.** Unmodified plugs and matching outlets will reduce risk of electric shock.
- Avoid body contact with earthed or grounded surfaces, such as pipes, radiators, ranges and refrigerators.** There is an increased risk of electric shock if your body is earthed or grounded.
- Do not expose power tools to rain or wet conditions.** Water entering a power tool will increase the risk of electric shock.
- Do not abuse the cord. Never use the cord for carrying, pulling or unplugging the power tool. Keep cord away from heat, oil, sharp edges or moving parts.** Damaged or entangled cords increase the risk of electric shock.
- When operating a power tool outdoors, use an extension cord suitable for outdoor use.** Use of a cord suitable for outdoor use reduces the risk of electric shock.
- If operating a power tool in a damp location is unavoidable, use a residual current device (RCD) protected supply.** Use of an RCD reduces the risk of electric shock.
- Hold power tool by insulated gripping surfaces, when performing an operation where the fastener may contact hidden wiring or its own cord.** Fasteners contacting a "live" wire may make exposed metal parts of the power tool "live" and could give the operator an electric shock.

3. Personal safety

- Stay alert, watch what you are doing and use common sense when operating a power tool. Do not use a power tool while you are tired or under the influence of drugs, alcohol or medication.** A moment of inattention while operating power tools may result in serious personal injury.
- Use personal protective equipment. Always wear eye protection.** Protective equipment such as dust mask, non-skid safety shoes, hard hat, or hearing protection used for appropriate conditions will reduce personal injuries.
- Prevent unintentional starting. Ensure the switch is in the off-position before connecting to power source and/or battery pack, picking up or carrying the tool.** Carrying power tools with your finger on the switch or energizing power tools that have the switch on invites accidents.
- Remove any adjusting key or wrench before turning the power tool on.**

A wrench or a key left attached to a rotating part of the power tool may result in personal injury.

- e. **Do not overreach. Keep proper footing and balance at all times.** This enables better control of the power tool in unexpected situations.
 - f. **Dress properly. Do not wear loose clothing or jewelers. Keep your hair, clothing and gloves away from moving parts.** Loose clothes, jewelers or long hair can be caught in moving parts.
 - g. **If devices are provided for the connection of dust extraction and collection facilities, ensure these are connected and properly used.** Use of dust collection can reduce dust related hazards.
- 4. Power tool use and care**
- a. **Do not force the power tool. Use the correct power tool for your application.** The correct power tool will do the job better and safer at the rate for which it was designed.
 - b. **Do not use the power tool if the switch does not turn it on and off.** Any power tool that cannot be controlled with the switch is dangerous and must be repaired.
 - c. **Disconnect the plug from the power source and/or the battery pack from the power tool before making any adjustments, changing accessories, or storing power tools.** Such preventive safety measures reduce the risk of starting the power tool accidentally.
 - d. **Store idle power tools out of the reach of children and do not allow persons unfamiliar with the power tool or these instructions to operate the power tool.** Power tools are dangerous in the hands of untrained users.
 - e. **Maintain power tools. Check for misalignment or binding of moving parts, breakage of parts and any other condition that may affect the power tool's operation. If damaged, have the power tool repaired before use.** Many accidents are caused by poorly maintained power tools.
 - f. **Keep cutting tools sharp and clean.** Properly maintained cutting tools with sharp cutting edges are less likely to bind and are easier to control.
 - g. **Use the power tool, accessories and tool bits etc. in accordance with these instructions, taking into account the working conditions and the work to be performed.** Use of the power tool for operations different from those intended could result in a hazardous situation.
- 5. Battery tool use and care**
- a. **Recharge only with the charger specified by the manufacturer.** A charger that is suitable for one type of battery pack may create a risk of fire when used with another battery pack.
 - b. **Use power tools only with specifically designated battery packs.** Use of any other battery packs may create a risk of injury and fire.
 - c. **When battery pack is not in use, keep it away from other metal objects, like paper clips, coins, keys, nails, screws or other small metal objects that can make a connection from one terminal to another.** Shorting the battery terminals together may cause burns or a fire.
 - d. **Under abusive conditions, liquid may be ejected from the battery; avoid contact. If contact accidentally occurs, flush with water. If liquid contacts eyes, additionally seek medical help.** Liquid ejected from the battery may cause irritation or burns.
- 6. Service**
- a. **Have your power tool serviced by a qualified repair person using only identical replacement parts.** This will ensure that the safety of the power tool is maintained.

Product Safety Instructions

WARNING

1. To ensure the designed operational integrity of power tools, do not remove installed cover or screws.
2. Use your tool at lower input than specified on the nameplate, otherwise, the finish may be spoiled and working efficiency reduced by motor overload.
3. Do not wipe plastic parts with solvent. Solvents such as gasoline, thinner, benzene, carbon tetrachloride, alcohol, ammonia and oil containing chloric annex may damage and crack plastic parts. Do not wipe them with such solvent. Wipe plastic parts with a soft cloth lightly dampened with soap water.
4. Use clamps or other practical way to secure and support the work piece to a stable platform. Holding the work by hand or against your body is unstable and may lead to a loss of control.
5. Use only accessories that are recommended by the manufacturer for your model. Accessories that may be suitable for one tool may create a risk of injury when used on another tool.

Important Safety Instructions For Charger & Battery Pack

WARNING




1. Caution : To reduce risk of injury, charge only specific type rechargeable battery packs. Other types of battery packs may burst causing personal injury and damage.
2. Before using charger, read all instructions and cautionary markings on battery packs and chargers.
3. Do not expose charger to rain or snow.
4. To reduce the risk of damage to electric plug and cord, pull by plug rather than cord when disconnecting charger.
5. Use of an attachment not recommended or sold by the charger manufacture may result in a risk of fire, electric shock, or injury to persons.
6. Make sure cord is located so that it will not be stepped on, tripped on, tripped over, or otherwise subjected damage or stress.
7. Do not operate charger with damaged cord or plug. Replace them immediately.
8. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damage in any way, take it to qualified center.
9. To reduce risk of electric shock, unplug charger from outlet before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.
10. Do not disassemble charger or battery pack, take it to a qualified service center while repair is required. Incorrect reassembling may result in a risk of electric shock or fire.

Additional Safety Rules For Charger & Battery Pack

WARNING

1. Do not charge battery pack when temperature is below 0°C (32°F) or above 40°C (104°F).
2. Do not attempt to use a set-up transformer, an engine generator or DC power receptacle.
3. Do not allow anything to cover or clog the charger vents.
4. Always cover the battery pack terminals with the battery pack cover when the battery pack is not used.
5. Do not short the battery pack.
6. Do not touch the terminals with any conductive material.
7. Avoid storing battery pack in a container with other metal objects such as nails, coins, etc.
8. Do not expose battery pack to water or rain, A battery pack short can use large current flow, overheating, possible burns and even a breakdown.
9. Do not store the machine and battery pack in locations where the temperature may reach or exceed 50°C (122°F)
10. Do not incinerate the battery pack even if it is severely damaged or completely worn out. The battery pack can explode in a fire.
11. Be careful not drop, shake or strike battery pack.
12. Do not charge inside a box or container of any kind. The battery pack must be placed in a well ventilated area during charging.
13. Do not leave batteries unused for extended period of time. Recharge the battery every 3~6 months and bring Li-Ion battery to 40~80% charge level before storage.
14. Li-Ion batteries are sensitive to high temperature and should be kept in a cool, dry and out of direct light exposure. Ideal temperature for operation and storage is below 25°C (77°F).
15. For extension of the battery lifetime, the lithium-ion battery is designed with the protection function to stop the output.
In the case of described below, when using this product, even if you are pulling the switch, the motor may stop.
This is not malfunction but the result of protection function.
 - When the battery power remaining runs out, the motor stops.
 - If the tool is overloaded, the motor may stop.
In this case, release the switch of tool and eliminate causes of overloading.
After that you can use it again.
 - If the battery is overheated under overload work, the battery power may stop.
In this case stop using the battery and let the battery cool. After that you can use it again.
16. This product is designed with low voltage protection, which prevents the tool from over discharging and prolongs battery's lifespan.

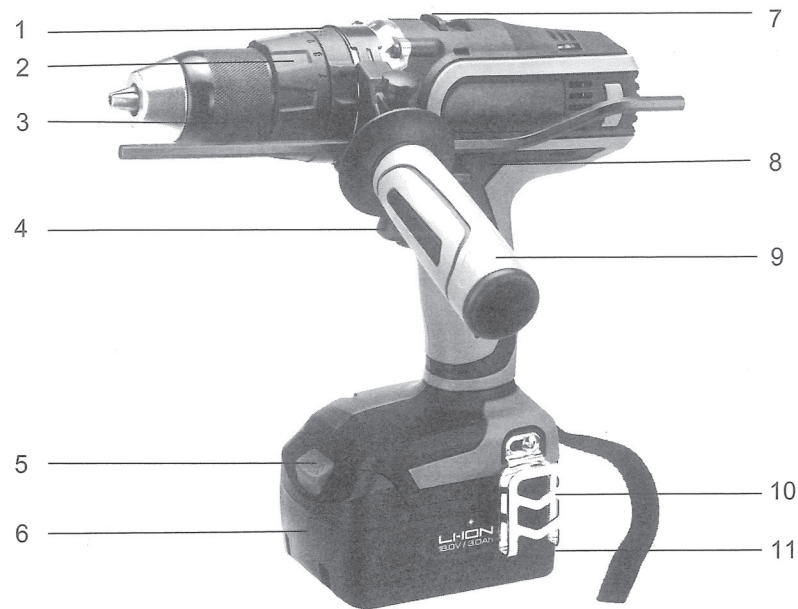
Specific Safety Rules and/or Symbols

- | | |
|--|--|
|  -----Recycle |  -----Class II Tool |
|  -----Do Not Throw In Garbage | V-----Volts |
| a.c.-----Alternating Current | Hz-----Hertz |
| W-----Watts | kg-----Kilograms |
| mm-----Millimeter | d.c. ----Direct Current |
| kg-cm--Kilograms - Centimeter | ft-lb----Foot-Pound |
| /min-----Revolutions or Reciprocations Per Minute | |

Specifications

Model No	T76703158	T76703258	T76503158
Voltage	18 V d.c.		
No-Load Speed	L : 0~460r.p.m./min H : 0~1600r.p.m./min	L : 0~360r.p.m./min H : 0~1320r.p.m./min	L : 0~460r.p.m./min H : 0~1600r.p.m./min
Max Tightening Torque	612kg-cm/ 60N-m / 44.3ft-lb	785kg-cm/ 80N-m / 58.8ft-lb	612kg-cm/ 60N-m / 44.3ft-lb
Hammer	No	No	Yes
Clutch	15 Sections+1 Drill		
Chuck Capacity	1/2" (13mm)		
Tool Weight	1.66kg	1.66kg	1.95kg
Battery Weight	0.65kg		
Charging Time	60-70 Minutes Auto Cut-off		

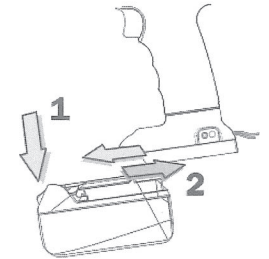
View the Major Components



1	Function Adjustment Ring
2	Torque Adjustment Ring
3	Keyless Chuck
4	Main Switch
5	Battery Knob
6	Battery Pack
7	High / Low Speed Rod
8	Forward/Reverse Rod
9	Handle
10	Hook
11	Fuel Gauge (Optional)

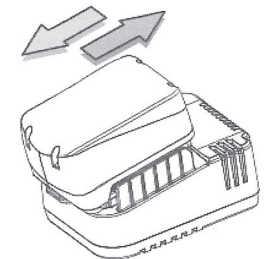
Operating Instructions (Slide-In) Installing or Removing Battery Pack

1. Always switch off the machine before insertion or removal of the battery pack.
2. To remove the battery pack, push the button on the battery pack and pull the tool unit from the battery pack in the direction.
3. To insert the battery pack, align the tool unit slides with the battery pack sliding groove and push the tool unit into place.
The tool unit can be slide into battery pack in two directions.
4. Do not force the battery pack in sliding it into tool unit. If the battery pack does not slide in easily, it is not being inserted correctly.

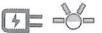

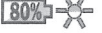





Charging the Battery Pack

1. Connect the plug to the charger before charging.
2. Plug the fast charger into the power source.
3. Slide the battery pack into the charger as the arrow direction shown on the charger.
4. Push the battery pack into place and make sure the red light on the charger is "ON". The battery pack is now starting the charging cycle.
5. After finish the charging cycle, the light will turn into green. The battery pack is now ready for use.
6. Your new battery pack is not charged. You need to charge it before use.
7. If you try to charge a battery pack from a just-operated machine, sometimes the charging light will not come on. If this occurs, let the battery pack cool for a while then re-insert it and try to charge again.
8. When you charge a new battery pack or a battery pack which has not been used for a long period, it may not accept a full charge. This is a normal condition and does not indicate a problem. You can recharge the battery pack fully after discharging it completely a couple of times.
9. Unplug the charger from the power source after finish the charge.
10. Please remove the battery from the unplugged charger for storage.







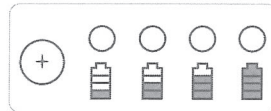
The LED Light on the Charger

-  Power On (Green light flashes slowly)
-  Battery Low (Red light stays illuminated)
-  Battery charged 80% (Green light flashes rapidly)
-  Battery charged 100% (Green light stays illuminated)
-  Battery Pack temperature is too hot or too cold (Red light flashes slowly)
-  Battery Pack malfunction (Red and Green lights stay illuminated)

Battery Pack LED Indication Function(Optional)

The Battery Pack has a "SW" button and 4-step green LEDs for indicating remaining capacity status. The fuel gauge green LED will indicate when the "SW" button is momentarily pressed.

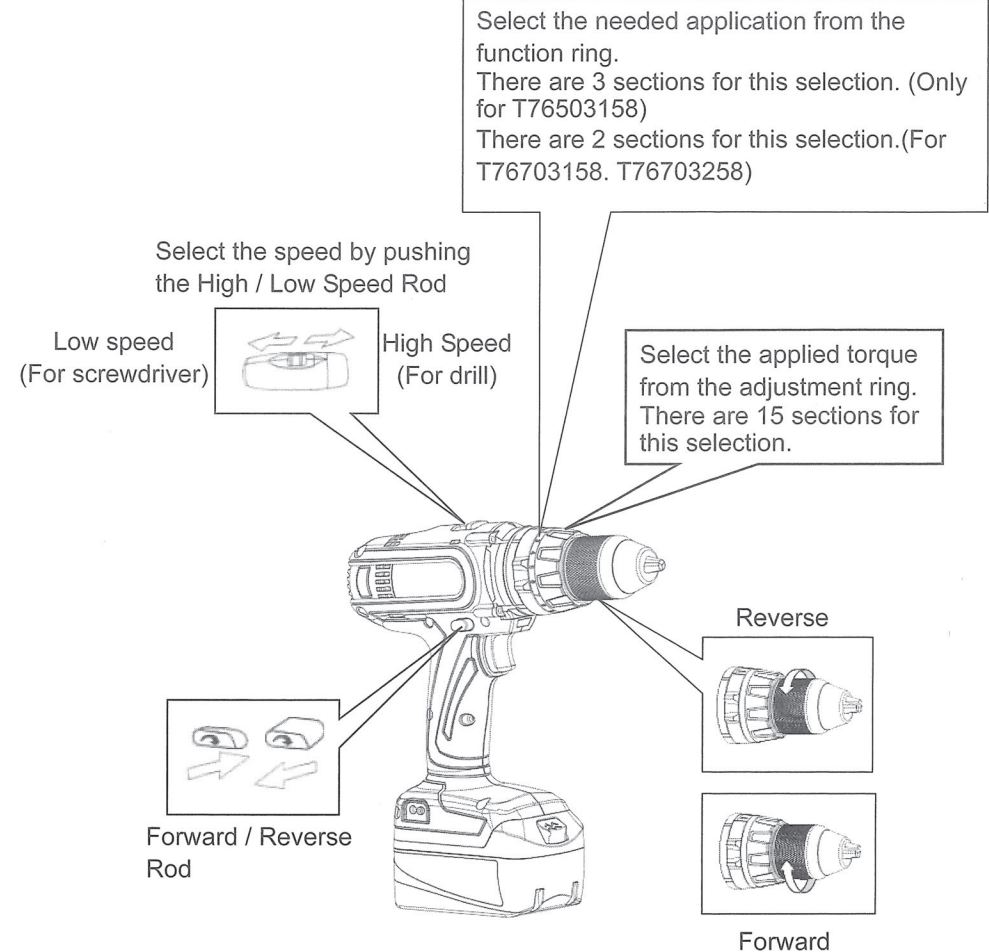
Remaining Capacity LED Indication	RC Status
LED 1 (green)	 0%- 25%
LED 1, 2 (green)	 26%-50%
LED 1, 2, 3 (green)	 51%-75%
LED 1, 2, 3, 4 (green)	 76%-100%



⚠ WARNING

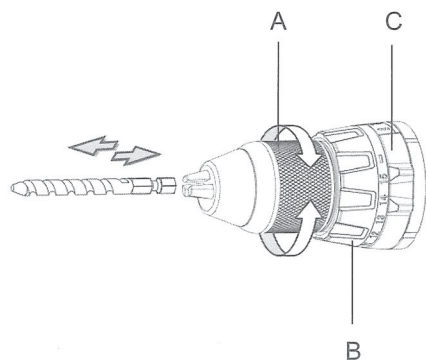
1. Charger is plugged into a 100-240V a.c outlet only.
2. If the battery pack is too hot or too cold, the charger will not fast charge the battery pack and the red Indicator light is "blinking". When the battery pack temperature returns to between 0°C(32°F) and 50°C(122°F), The charger will automatically begin charging.
3. If both red and green indicator lights are "ON" the battery pack either does not comply or is defective. Please contact your retailer.
4. Do not charge the battery pack in the rain, snow or high temperature environment.
5. Do not charge battery pack when environment temperature is below 0°C (32°F) or above 40°C(104°F)
6. While charge the cool battery pack (below 0°C) in the warm indoor, keep the battery pack in the room for one hour to warm up before starting the battery pack.
7. Remove the plug after finishing the charge.
8. The charger should be cooled at least one hour after continue charging three times.
9. Do not use generator for charging the battery pack.

Tool Operation



1. How to insert and remove bit

To remove a bit from the keyless chuck, hold the "B" part firmly by one hand and turn the "A" part by counterclockwise.



2. Forward/Reverse selection button

Select the forward or reverse direction of the tool by pushing the button.

3. High/Low speed selection

Use the "High" for drilling application.

Use the "Low" for screwdriver application.

4. Select the applied torque

Select the [torque icon], use the 15 sections adjustment ring to select the right torque for your application.

5. Drill model: ("C")

Select the function ring to the [drill icon] sign for the maximum torque position if you would like to make a drill.

6. Hammer model: ("C")

(Only for T76503158) Select the function ring to the [hammer icon] for concrete applications.

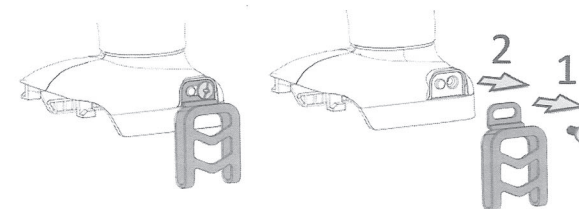
Installing Or Removing Hook

1. Installing Hook :

Use Phillips or slotted bit size bit and tighten in clockwise.

2. Removing Hook :

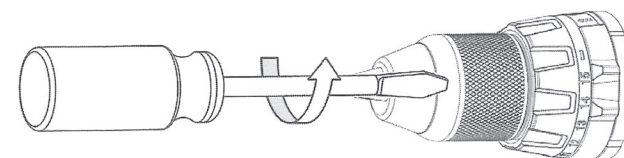
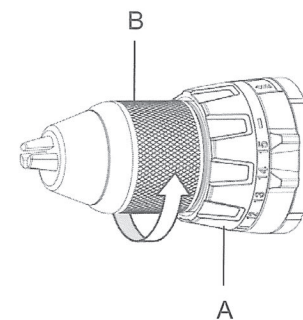
Use Phillips or slotted bit size bit to loosen the hook.



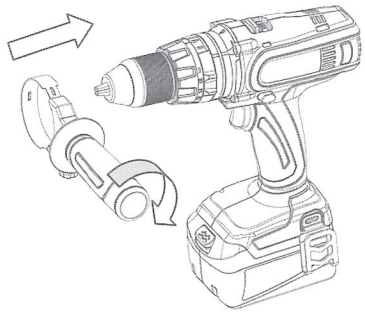
How to replace a keyless chuck

1. Hold "A" firmly and turn "B" part counterclockwise until the chuck is fully open.

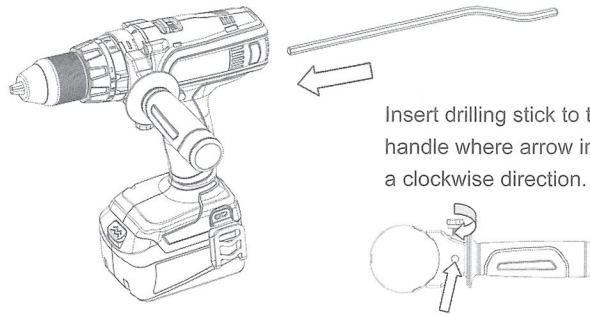
2. Release the left-hand screw inside the chuck.



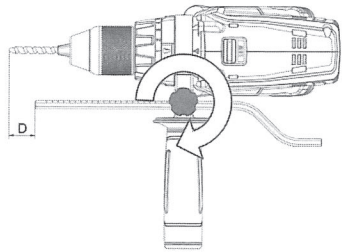
Installing Or Removing Handle



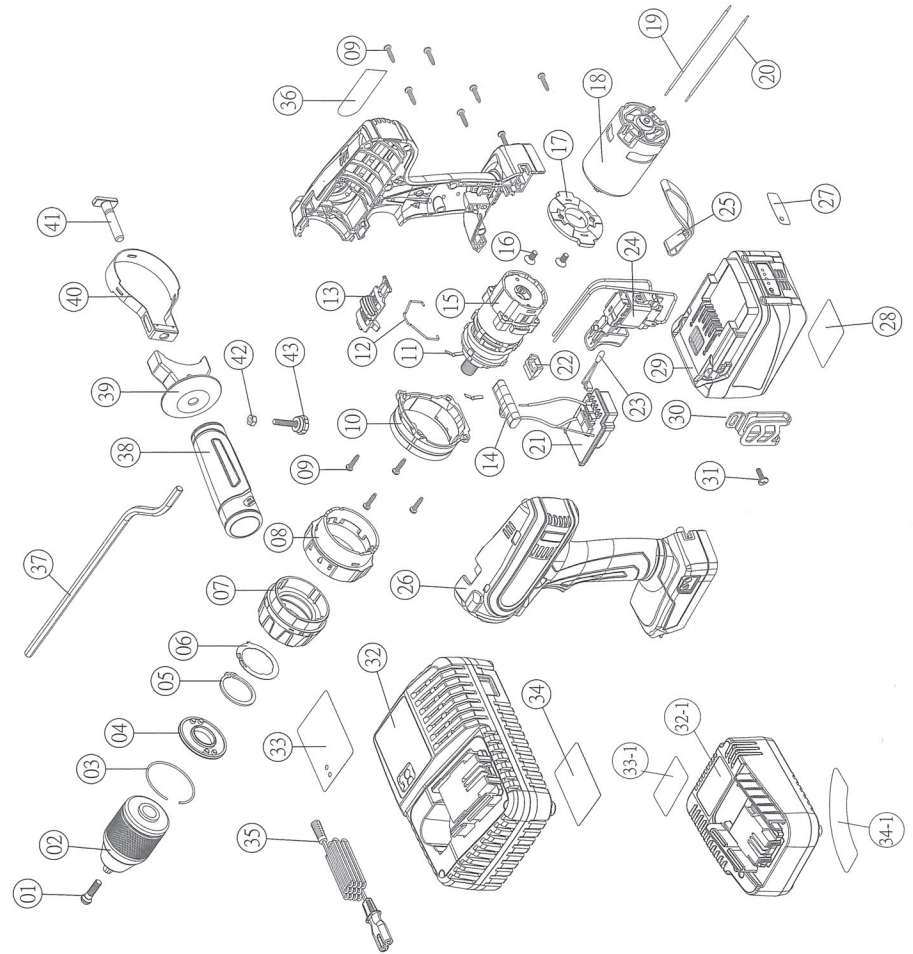
Loose handle in a anti-clockwise direction first then put it through the drill, tighten it in a clockwise direction.



Insert drilling stick to the back of the side handle where arrow indicated then tighten in a clockwise direction.



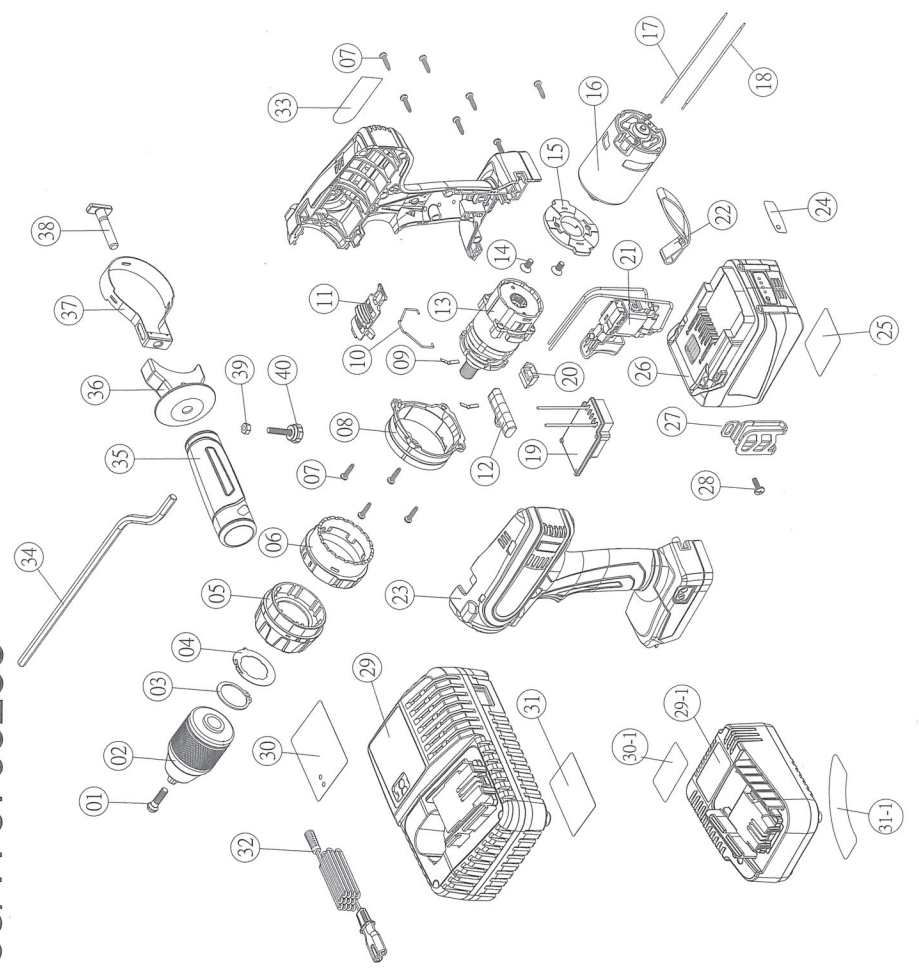
D is an estimated depth, this is adjustable according to users' needs. Make sure stick is tighten before use.



MODEL : T76503158

NO.	PARTS NAME	Q
01	CHUCK SCREW	1
02	KEYLESS CHUCK	1
03	SPRING RING	1
04	WASHER ASSY	1
05	SNAP RING	1
06	SHELL FRAGMENT	1
07	TORQUE RING	1
08	FUNCTION ADJUST RING	1
09	SCREW	12
10	FRONT COVER ASSY	1
11	SHELL FRAGMENT	2
12	SPEED CHANGE SPRING	1
13	HIGH/LOW SPEED ROD ASSY	1
14	FORWARD/REVERSE ROD	1
15	GEAR BOX ASSY	1
16	SCREW	2
17	MOTOR CONNECTOR	1
18	MOTOR ASSY	1
19	MOTOR WIRE	1
20	MOTOR WIRE	1
21	DISCHARGE PROTECTOR	1
22	LED ASSY	1
23	THERMAL SENSOR	1
24	MAIN SWITCH	1
25	BELT	1
26	HOUSING-L&R ASSY	1
27	FUEL GAUGE LABEL	1
28	BATTERY LABEL	1
29	BATTERY PACK	1
30	HOOK	1
31	SCREW	1
32	CHARGER	1
32-1	MINI CHARGER(OPTIONAL)	1
33	CHARGER UPPER LABEL	1
33-1	MINI CHARGER UPPER LABEL (OPTIONAL)	1
34	CHARGER LOWER LABEL	1
34-1	MINI CHARGER LOWER LABEL (OPTIONAL)	1
35	POWER CORD	1
36	HOUSING LABEL-R	1
37	ADJUST DEPTH BAR	1
38	HANDLE	1
39	FIXED HANDLE CONNECTOR	1
40	FIXED HANDLE RING	1
41	SCREW	1
42	EXAGONAL NUT	1

MODEL : T76703158/T76703258



NO.	PARTS NAME	Q
1	SCREW	1
2	KEYLESS CHUCK	1
3	C RING	1
4	SHELL FRAGMENT	1
5	TORQUE RING	1
6	FUNCTION ADJUST RING	1
7	SCREW	12
8	FRONT COVER ASSY	1
9	SHELL FRAGMENT	2
10	SPEED CHANGE SPRING	1
11	HIGH/LOW SPEED ROD ASSY	1
12	FORWARD/REVERSE ROD	1
13	GEAR BOX ASSY	1
14	SCREW	2
15	MOTOR CONNECTOR	1
16	MOTOR	1
17	MOTOR WIRE-RED	1
18	MOTOR WIRE-BLOCK	1
19	DISCHARGE PROTECTOR	1
20	LED ASSY	1
21	MAIN SWITCH	1
22	BELT	1
23	HOUSING-L&R	1
24	FUEL GAUGE LABEL	1
25	BATTERY LABEL	1
26	BATTERY PACK	1
27	HOOK	1
28	SCREW	1
29	CHARGER	1
29-1	MINI CHARGER (OPTIONAL)	1
30	CHARGER UPPER LABEL	1
30-1	MINI CHARGER UPPER LABEL (OPTIONAL)	1
31	CHARGER LOWER LABEL	1
31-1	MINI CHARGER LOWER LABEL (OPTIONAL)	1
32	POWER CORD	1
33	HOUSING LABEL-R	1
34	ADJUST DEPTH BAR	1
35	HANDLE	1
36	FIXED HANDLE CONNECTOR	1
37	FIXED HANDLE RING	1
38	SCREW	1
39	NUT	1
40	SCREW	1



testo 549 - testo 550 . Digital manifold

Instruction manual



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2 Safety and the environment

2.1. About this document

Use

- > Please read this documentation through carefully and familiarize yourself with the product before putting it to use. Pay particular attention to the safety instructions and warning advice in order to prevent injuries and damage to the products.
- > Keep this document to hand so that you can refer to it when necessary.
- > Hand this documentation on to any subsequent users of the product.

Symbols and writing standards

Representation	Explanation
	Warning advice, risk level according to the signal word: Warning! Serious physical injury may occur. Caution! Slight physical injury or damage to the equipment may occur. > Implement the specified precautionary measures.
	Note: Basic or further information.
Menu	Elements of the instrument, the instrument display or the program interface.
[OK]	Control keys of the instrument or buttons of the program interface.

2.2. Ensure safety

- > Do not operate the instrument if there are signs of damage at the housing, mains unit or feed lines.
- > Do not perform contact measurements on non-insulated, live parts.
- > Do not store the product together with solvents. Do not use any desiccants.

- > Carry out only the maintenance and repair work on this instrument that is described in the documentation. Follow the prescribed steps exactly. Use only original spare parts from Testo.
- > Dangers may also arise from the systems being measured or the measuring environment: Note the safety regulations valid in your area when performing the measurements.
- > If the measuring instrument falls or another comparable mechanical load occurs, the pipe sections of the refrigerant hoses may break. The valve positioners may also be damaged, whereby further damage to the interior of the measuring instrument may occur that cannot be identified from the outside. The refrigerant hoses must therefore be replaced with new, undamaged refrigerant hoses every time the measuring instrument falls or following any other comparable mechanical load. Send the measuring instrument to Testo Customer Service for a technical check for your own safety.
- > Make sure that your refrigeration system is properly earthed, as otherwise the measuring instrument might get damaged.

2.3. Protecting the environment

- > Dispose of faulty rechargeable batteries/spent batteries in accordance with the valid legal specifications.
- > At the end of its useful life, send the product to the separate collection for electric and electronic devices (observe local regulations) or return the product to Testo for disposal.
- > Refrigerant gases can harm the environment. Please note the applicable environmental regulations.

3 Specifications

3.1. Use

testo 549 and testo 550 are digital manifolds for maintenance and service work on refrigeration systems and heat pumps. They may only be used by qualified authorized personnel.

The functions of the testo 549 and testo 550 mean they can replace mechanical manifolds, thermometers and pressure/temperature charts. Pressures and temperatures can be applied, adapted, tested and monitored.

testo 549 and testo 550 are compatible with most non-corrosive refrigerants, water and glycol. testo 549 and testo 550 are not compatible with refrigerants containing ammonia.

The instruments must not be used in explosive environments!

3.2. Technical data

Characteristic	Values
Parameters	Pressure: kPa / MPa / bar / psi Temperature: °C/°F/K
Sensor	Pressure: 2 x pressure sensor, temperature: 2 x NTC
Meas. cycle	0,5 s
Measurement channels	Quantity: 4
Interfaces	Pressure connections: 3 x 7/16" UNF NTC measurement
Measuring ranges	HP/LP pressure measuring range: -100 to 6000 kPa / -0.1 to 6 Mpa / -1 to 60 bar (rel) / -14.7 to 870 psi Temperature measuring range: -50 to +150 °C / -58 to 302°F Vacuum measuring range (rel): -1 to 0 bar / -14.7 to 0 psi
Overload	65 bar, 6500 kPa, 6,5 Mpa, 940 psi
Resolution	Pressure resolution: 0.01 bar/0.1 psi/ 1 kPa/0.001 MPa Temperature resolution: 0.1 °C/0.1 °F
Accuracy (nominal temperature 22 °C/71.6 °F)	Pressure: ±0,5 % of full scale (±1 digit) Temperature (-40...150°C): ±0.5 °C (±1 digit) / 0,9°F (±1 Digit)
No. of refrigerants	60

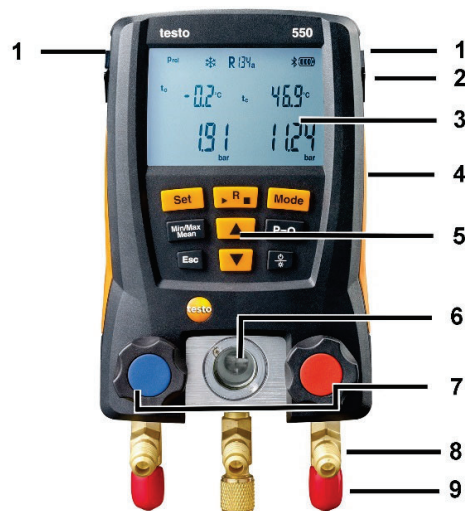
Characteristic	Values		
Selectable refrigerants in the instrument	R114	R407C	R444B
	R12	R407F	R448A
	R123	R407H	R449A
	R1233zd	R408A	R450A
	R1234yf	R409A	R452A
	R1234ze	R410A	R452B
	R124	R414B	R453a
	R125	R416A	R454A
	R13	R420A	R454B
	R134a	R421A	R454C
	R22	R421B	R455A
	R23	R422B	R458A
	R290	R422C	R500
	R32	R422D	R502
	R401A	R424A	R503
	R401B	R427A	R507
	R402A	R434A	R513A
	R402B	R437A	R600a
	R404A	R438A	R718 (H2O)
	R407A	R442A	R744 (CO2)
Refrigerants that can be updated via testo Service (only testo 549)	R11	R227	R417A
	FX80	R236fa	R417B
	I12A	R245fa	R417C
	R1150	R401C	R422A
	R1270	R406A	R426A
	R13B1	R407B	R508A
	R14	R407D	R508B
	R142B	R41	R600
	R152a	R411A	RIS89
	R161	R412A	SP22
	R170	R413A	

Characteristic	Values		
Refrigerants that can be updated via testo Service (only testo 550)	R11	R227	R417A
	FX80	R236fa	R417B
	I12A	R245fa	R417C
	R1150	R401C	R422A
	R1270	R406A	R426A
	R13B1	R407B	R508A
	R14	R407D	R508B
	R142B	R41	R600
	R152a	R411A	RIS89
	R161	R412A	SP22
	R170	R413A	
Measurable media	Measurable media: All media that are stored in the testo 549 and testo 550 Not measurable: Ammonia (R717) and other refrigerants which contain ammonia		
Ambient conditions	Operating temperature: -20 to 50 °C/ -4 to 122 °F Storage temperature: -20 to 60 °C/ -4 to 140 °F		
Housing	Material: ABS/PA/TPU Dimensions: 265 x 135 x 75 mm Weight: approx. 1000 g (without batteries)		
IP class	42		
Power supply	Current source: Rechargeable batteries/batteries 4x 1.5 V, type AA/mignon/LR6 Battery life: approx. 250h (display light off, Bluetooth off)		
Display	Type: Illuminated LCD Response time: 0.5 s		
Directives, standards and tests	EU Directive: 2014/30/EU i You can find the EU declaration of conformity on the Testo homepage www.testo.com under the product-specific downloads.		

4 Product description

4.1. Overview

Display and control elements



- 1 Mini-DIN probe socket for NTC temperature probe, with socket cover
- 2 Foldable suspension device (on rear)
- 3 Display. Instrument status icons:

Icon	Significance
	Battery capacity
	Bluetooth®, (see Switching Bluetooth® on and off (testo 550), page 14)
	Select measuring mode (see Selecting the measuring mode, page 15)

- 4 Battery compartment. It is not possible to charge rechargeable batteries in the instrument!

5 Control keys:

Key	Function
[Set]	Set units
[R, ►, ■]	Select refrigerant/ Start/stop / Tightness test
[Mode]	Switching measuring mode
[Min/Max/Mean]	Display min./max./mean values
[▲]	Up key: Change display view
[P=0]	Pressure zeroing
Esc	Switches to the measurement/home view
[▼]	Down key: Change display view
	Switching the instrument on/off Switch the display illumination on/off.

- 6 Sight glass for refrigerant flow
- 7 2 x valve positioner
- 8 3 x hose parkers for refrigerant hoses
- 9 3 x connections 7/16" UNF, brass
Left/right: Low pressure/high pressure, for refrigerant hoses with quick connect fitting, passage can be locked via valve positioner. Centre: for refrigerant bottles, for example, with sealing cap.
- 10 On the back below the battery compartment cover, mini-USB connection for firmware update.

5 First steps

Inserting batteries/rechargeable batteries

1. Fold out the suspension device and open the battery compartment (clip lock).
2. Insert batteries (included in delivery) or rechargeable batteries (4x 1.5 V, type AA/Mignon/LR6) in the battery compartment. Observe the polarity!
3. Close the battery compartment.
 - After inserting the batteries, the instrument switches on automatically and goes into the settings menu.

i When not in use for long period: Remove batteries/rechargeable batteries.

Performing settings

1. Press **[Set]** repeatedly,
 2. Press **[▲]** or **[▼]** to select the unit/parameter.
- The settings will be accepted once the last selection has been made.

Key functions

Representation	Explanation
[▲] or [▼]	Change parameter, select unit
[Set]	Select units/parameters

Adjustable parameters

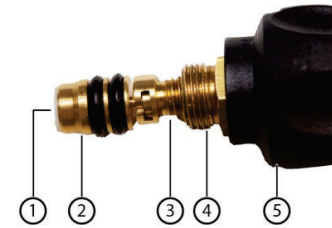
Representation	Explanation
°C, °F	Set temperature unit.
bar, kPa, MPa, psi	Set unit of pressure.
Pabs, Prel or psig	Depending on the selected unit of pressure: Switch between absolute and relative pressure display.
14.7 psi 1.013 bar (Pamb)	Set current absolute pressure
🔥 / ❄️ / 🔥❄️	Select measuring mode
AUTO OFF	Automatic switch-off time, instrument switches off after 30 minutes if no temperature probe is connected and there is no pressure apart from ambient pressure.
T_{fac}	Temperature compensation factor, icon is shown on the display if the function is disabled.

- Settings will be applied following the final selection.

Operating valve positioner

The digital manifold acts like a conventional two-way manifold with regard to the refrigerant path: The passages are opened by opening the valves. The adjacent pressure is measured with valves closed as well as with them open.

- > Open valve: Turn valve positioner anticlockwise.
- > Close valve: Turn valve positioner clockwise.

**⚠️ WARNING**

Valve positioner tightened too tightly.

- Damage to the PTFE seal (1).
- Mechanical deformation of the valve piston (2) leading to the PTFE seal (1) falling out.
- Damage to the thread of the threaded spindle (3) and the valve screw (4).
- Broken valve knob (5).

Tighten the valve positioner only hand-tight. Do not use any tools to tighten the valve positioner.

6 Using the product

6.1. Preparing for measurement

6.1.1. Switching the instrument on

- > Press **[🔘]**.

Zeroing the pressure sensors

Zero the pressure sensors before every measurement.

- ✓ There must be ambient pressure at all connections. >.
- > Press for 3 seconds key **[P=0]** and execute zeroing.

6.1.2. Connecting the temperature sensor



Sensors must be connected before the measuring instrument is switched on, so that they are recognised by the instrument.

Surface temperature sensor

An NTC temperature sensor (accessory) must be connected for measuring the pipe temperature and for automatic calculation of superheating and subcooling.

Deactivating the surface compensation factor for insertion and air temperature sensor

A surface compensation factor has been set in the measuring instrument to reduce the measuring errors in the main field of applications. This reduces measuring errors when using surface temperature sensors.

If the measuring instrument testo 550 is used in combination with insertion or air temperature sensors (accessories), this factor must be deactivated:

1. Press **[Set]** repeatedly until **T_{fac}** is displayed.
 2. Press **[▲]** or **[▼]** to set **T_{fac}** to Off.
 3. Press **[Set]** to continue through the settings menu until the measurement/home view is displayed.
- **T_{fac}** is shown on the display if **T_{fac}** is disabled.

Connecting the refrigerant hoses

i Before each measurement check whether the refrigerant hoses are in flawless condition.

- ✓ The valve actuators are closed.
1. Connect the refrigerant hoses for low-pressure side (blue) and high-pressure side (red) to the measuring instrument.
 2. Connect the refrigerant hoses to the system.

WARNING

The measuring instrument dropping down or any other comparable mechanical load can cause breakage of the pipe pieces in the refrigerant hoses. The valve actuators may also suffer damage, which in turn could result in further damage inside the measuring instrument, which may not be detectable from outside.

- > For your own safety you should return the measuring instrument to the Testo Service for technical inspection.
- > You should therefore always replace the refrigerant hoses with new ones after the measuring instrument has dropped down or after any comparable mechanical loading.

Setting the refrigerant

1. Press **[R, ►, ■]**.
 - This opens the refrigerant menu and the currently selected refrigerant flashes.
2. Setting the refrigerant:

Key functions

Representation	Explanation
[▲] or [▼]	Changing the refrigerant
[R, ►, ■]	Confirm the setting and exit the refrigerant menu.

Available refrigerants

Representation	Explanation
R...	Refrigerant number of refrigerant acc. to ISO 817
---	no refrigerant selected.

Example: Setting refrigerant R401B

1. Press **[▲]** or **[▼]** several times, until **R401B** flashes.
2. Press **[R, ►, ■]** to confirm the setting.

Quitting the refrigerant selection

- > Press **[R, ►, ■]** or automatically after 30 s, if no other key has been pressed.

6.1.3. Switching Bluetooth® on and off (testo 550)




i In order to be able to establish a connection via Bluetooth, you need a tablet or smartphone with the Testo app **Refrigeration** already installed on it.



You can get the App for iOS instruments in the App Store or for Android instruments in the Play Store.

Information about compatibility can be found in the relevant app store.




- Press **[▲]** and **[▼]** simultaneously and hold down for 3 seconds.
- Once the Bluetooth icon is shown on the display, Bluetooth is switched on.

Display	Explanation
 flashes	There is no Bluetooth connection, or a potential connection is being searched for.
 is permanently displayed	There is a Bluetooth connection.
 is not displayed	Bluetooth is disabled.

- Press **[▲]** and **[▼]** simultaneously and hold down for 3 seconds.
- Once the Bluetooth icon is no longer shown on the display, Bluetooth is switched off.

6.1.4. Selecting the measuring mode

- Press **[Set]** several times.
- Select function with **[▲]** or **[▼]**.
- Save setting: press **[Set]**.
- Measuring mode is displayed.

Display	Mode	Function
	Refrigeration system	Normal functionality of the digital manifold
	Heat pump	Normal functionality of the digital manifold
	Automatic mode	If the automatic mode is activated, the testo 549 und testo 550 digital manifold automatically changes the display of the high and low pressure. This automatic change occurs when the pressure on the low-pressure side is 1 bar higher than the pressure on the high-pressure side. During the change, Load (2 s) is shown in the display. This mode is especially suited to air conditioning systems which cool and heat.

6.2. Performing the measurement

WARNING

Risk of injury caused by refrigerant that is at high pressure, hot, cold, or poisonous!

- > Wear safety goggles and protective gloves.
- > Before pressurizing the measuring instrument: Always fasten the measuring instrument at the suspension device in order to prevent it from falling (risk of breakage)
- > Check if the refrigerant hoses are intact and connected correctly before each measurement. Do not use a tool to connect the hoses. Only tighten the hoses by hand (max. torque 5.0 Nm/3.7 ft*lb).
- > Maintain permissible measuring range (0 to 60 bar). Pay particular attention with systems with refrigerant R744, as these are often operated with higher pressures.

Measuring

- Pressurize the measuring instrument.
- Read off readings.

i With zeotropic refrigerants, the evaporation temperature t_{Ev} is displayed after the complete evaporation/the condensation temperature $t_{\text{c/Co}}$ is displayed after the complete condensation.

The measured temperature must be assigned to the superheating or the subcooling side ($t_{\text{oh}} \leftrightarrow t_{\text{cu}}$). Depending on this assignment, $t_{\text{oh}}/T1$ or $\Delta t_{\text{oh}}/\text{SH}$ or $t_{\text{cu}}/T2$ or $\Delta t_{\text{cu}}/\text{SC}$ is shown depending on the selected display.

- Reading and display illumination flash:
 - 1 bar before reaching the critical pressure of the refrigerant,
 - upon exceeding the max. permissible pressure of 60 bar.

Key functions

- > **[▲]** or **[▼]**: Change the reading display.

Possible display combinations:

Evaporation pressure
Refrigerant evaporation
temperature t_{Ev}

Condensation pressure
Refrigerant condensation
temperature $t_{\text{c/Co}}$

or (only with connected temperature probe)

Evaporation pressure Measured temperature $t_{oh}/T1$	Condensation pressure Measured temperature $t_{cu}/T2$
--	---

or (only with connected temperature probe)

Evaporation pressure Superheating $\Delta t_{oh}/SH.$	Condensation pressure Subcooling $\Delta t_{cu}/SC$
--	--

With two connected NTC probes, Δt is also shown.

- > **[Mean/Min/Max]**: Record readings, display min./max. readings, mean values (since switching on).

Tightness test/pressure drop test

i Systems can be tested for tightness with the temperature-compensated tightness test. The system pressure and the ambient temperature are measured over a defined period for this. A temperature probe can be connected that measures the ambient temperature for this (recommendation: NTC air probe, art. no. 0613 1712). Information about the temperature-compensated differential pressure and about the temperature at the beginning/end of the test exists as a result. If no temperature probe is connected, the tightness test can be performed without temperature compensation.

1. Press **[Mode]** (leakage test view).
 - Leakage test view is opened. **ΔP** is displayed.
2. Start the leakage test: Press **[R, ►, ■]**.
3. End the leakage test: Press **[R, ►, ■]**.
 - Result is displayed.
4. Confirm message: Press **[Mode]**.

7 Maintaining the product

Cleaning the instrument

i Do not use any aggressive cleaning agents or solvents! Mild household cleaning agents and soap suds may be used.

- > If the housing of the instrument is dirty, clean it with a damp cloth.

Keeping connections clean

- > Keep screw connections clean and free of grease and other deposits, clean with a moist cloth as required.

Removing oil residues

- > Carefully blow out oil residues in valve block using compressed air.

Ensuring the measuring accuracy

- Testo Customer Service would be glad to further assist you if you so wish.
- > Check instrument regularly for leaks (recommended: annually). Keep to the permissible pressure range!
 - > Calibrate instrument regularly (recommended: annually).

Changing batteries/rechargeable batteries


- ✓ Instrument is switched off.



1. Fold out the suspension device, loosen the clip and remove the cover of the battery compartment.
2. Remove empty batteries/rechargeable batteries and insert new batteries/rechargeable batteries (4x 1.5 V, type AA, Mignon, LR6) in the battery compartment. Observe the polarity!
3. Set on and close cover of the battery compartment (clip must engage).
4. Switch the instrument on.

8 Tips and assistance

8.1. Questions and answers

Question	Possible causes/solution
 flashes	Batteries are almost empty. > Change batteries.
The instrument switches off automatically.	Residual capacity of the batteries is too low. > Change batteries.
uuuu lights up instead of the parameter display	The permissible measuring range has been undershot. > Keep to the permitted measuring range.
oooo lights up instead of the parameter display	The permissible measuring range has been exceeded. > Keep to the permitted measuring range.

8.2. Measurement parameters

Name		Description
bar, °C	psi, °F	
Δtoh	SH	Superheating, evaporation pressure
Δtcu	SC	Subcooling, condensation pressure
to	Ev	Refrigerant evaporation temperature
tc	Co	Refrigerant condensation temperature
toh	T1	Measured temperature, evaporation
tcu	T2	Measured temperature, condensation

8.3. Error reports

Question	Possible causes/solution
---- lights up instead of the temperature value display (T1/T2 or toh/tcu)	Sensor or cable faulty > Please contact your dealer or Testo Customer Service
---- lights up instead of the display of the value for superheating/subcooling (SH/SC or Δtoh/Δtcu)	- There is no superheating/subcooling. - No theoretical condensation or evaporation temperature can be calculated based on the pressure measured.
EEP FAIL displayed	Electronics faulty > Please contact your dealer or Testo Customer Service

8.4. Accessories and spare parts

Description	Article no.
Clamp probe for temperature measurement at pipes (1,5m cable length)	0613 5505
Clamp probe for temperature measurement at pipes (5m cable length)	0613 5506
Pipe wrap probe with Velcro tape for pipe diameters of up to max. 75 mm, Tmax. +75 °C, NTC	0613 4611
Watertight NTC surface probe	0613 1912
Precise, robust NTC air probe	0613 1712
Transport case for measuring instrument, probe and hoses	0516 0012







For a complete list of all accessories and spare parts, please refer to the product catalogues and brochures or look up our website at: www.testo.com


If you have any questions, please contact your dealer or Testo Customer Service. The contact details can be found on the back of this document or on the Internet at www.testo.com/service-contact.

9 Declarations

Product	Testo 550
Mat.-No.	0560 1550
Date	09.02.2018

i The use of the wireless module is subject to the regulations and stipulations of the respective country of use, and the module may only be used in countries for which a country certification has been granted. The user and every owner has the obligation to adhere to these regulations and prerequisites for use, and acknowledges that the re-sale, export, import etc. in particular in countries without wireless permits, is his responsibility.

Country	Comments
Australia	 E 1561
Brazil	 <p>03226-16-04701</p> <p>Este equipamento opera em caráter secundário, isto é, não tem direito a proteção contra interferência prejudicial, mesmo de estações do mesmo tipo, e não pode causar interferência a sistemas operando em caráter primário.</p>
Canada	Product IC ID: 12231A-05631550 see IC Warnings
Europe + EFTA	  The EU Declaration of Conformity can be found on the homepage www.testo.com under the product EU countries: Belgium (BE), Bulgaria (BG), Denmark (DK), Germany (DE), Estonia (EE), Finland (FI), France (FR), Greece (GR), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Sweden (SE), Slovakia (SK), Slovenia (SI), Spain (ES), Czech Republic (CZ), Hungary (HU), United Kingdom (GB), Republic of Cyprus (CY). EFTA countries: Iceland, Liechtenstein, Norway, Switzerland
Hongkong	Authorized
Japan	  201-150148 see Japan Information

Korea	 MSIP-CMM-Toi-550 see KCC Warning																
Russia	Authorized																
South Africa	ICASA: TA-2016/1203																
Turkey	Authorized																
USA	Product FCC ID: 2ACVD056001550 FCC Warnings																
Bluetooth SIG Listing	<table border="1"> <thead> <tr> <th>Feature</th> <th>Values</th> </tr> </thead> <tbody> <tr> <td>Bluetooth Range</td> <td>< 20 m (free field)</td> </tr> <tr> <td>Bluetooth type</td> <td>L Series BLE module (08 May 2013) based on TI CC254X chip</td> </tr> <tr> <td>Qualified Design ID</td> <td>B016552</td> </tr> <tr> <td>Bluetooth radio class</td> <td>Class 3</td> </tr> <tr> <td>Bluetooth company</td> <td>LSD Science & Technology Co., Ltd</td> </tr> <tr> <td>RF Band</td> <td>2402-2480MHz</td> </tr> <tr> <td>Output power</td> <td>0 dBm</td> </tr> </tbody> </table>	Feature	Values	Bluetooth Range	< 20 m (free field)	Bluetooth type	L Series BLE module (08 May 2013) based on TI CC254X chip	Qualified Design ID	B016552	Bluetooth radio class	Class 3	Bluetooth company	LSD Science & Technology Co., Ltd	RF Band	2402-2480MHz	Output power	0 dBm
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IC Warnings

This instrument complies with Part 15C of the FCC Rules and Industry Canada RSS-210 (revision 8). Commissioning is subject to the following two conditions:

- (1) This instrument must not cause any harmful interference and
- (2) this instrument must be able to cope with interference, even if this has undesirable effects on operation.

Cet appareil satisfait à la partie 15C des directives FCC et au standard Industrie Canada RSS-210 (révision 8). Sa mise en service est soumise aux deux conditions suivantes :

- (1) cet appareil ne doit causer aucune interférence dangereuse et
- (2) cet appareil doit supporter toute interférence, y compris des interférences qui provoquerait des opérations indésirables.

FCC Warnings

Information from the FCC (Federal Communications Commission)

For your own safety

Shielded cables should be used for a composite interface. This is to ensure continued protection against radio frequency interference.

FCC warning statement

This equipment has been tested and found to comply with the limits for a Class C digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Shielded interface cable must be used in order to comply with the emission limits.

Warning

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

KCC Warning

해당 무선 설비는 운용 중 전파혼신 가능성이 있음

Japan Information

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。



Testo 552 - Digital Vacuum Gauge with Bluetooth

Instruction manual



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1 Safety and waste disposal

1.1 About this document

- The instruction manual is an integral part of the instrument.
- Keep this document throughout the entire operating life of the instrument.
- Always use the complete original instruction manual.
- Please read this instruction manual through carefully and familiarise yourself with the product before putting it to use.
- Pay particular attention to the safety instructions and warning advice in order to prevent injury and damage to the product.

1.2 Safety

General safety instructions

- Only operate this instrument in the proper manner, for its intended purpose and within the parameters specified in the technical data.
- Do not apply any force to open the instrument.
- Do not operate the instrument if there are signs of damage at the housing, mains unit or connected cables.
- Always comply with the locally valid safety regulations when carrying out measurements. Dangers may also arise from objects to be measured or the measuring environment.
- Do not store the product together with solvents.
- Do not use any desiccants.
- Only perform maintenance and repair work on this instrument that is described in this documentation. Follow the prescribed steps exactly.
- Use only original spare parts from Testo.
- Make sure that your refrigeration system is properly earthed, as otherwise the measuring instrument might get damaged.
- Use with A2L refrigerants

Testo measuring instruments (as of July 2020) can be used in compliance with the prescribed laws, standards, directives and safety regulations for refrigeration systems and refrigerants as well as regulations of the manufacturers of refrigerants of safety group A2L as per ISO 817.

Regional standardization and interpretation must always be observed.

For example, DIN EN 378-Part 1-4 applies to the scope of the EN standards.

During maintenance work, the employer must ensure that a hazardous explosive atmosphere is prevented (see also TRBS1112, TRBS2152 VDMA 24020-3).

A hazardous and potentially explosive atmosphere must be anticipated during maintenance and repair work on refrigeration systems with flammable refrigerants (e.g. those of category A2L and A3).



Maintenance, repairs, removal of refrigerants and commissioning of systems may only be carried out by qualified personnel.

Batteries

- Improper use of batteries may cause the batteries to be destroyed, or lead to injury due to current surges, fire or escaping chemicals.
- Only use the batteries supplied in accordance with the instructions in the instruction manual.
- Do not short-circuit the batteries.
- Do not take the batteries apart and do not modify them.
- Do not expose the batteries to heavy impacts, water, fire or temperatures in excess of 60 °C.
- Do not store the batteries in the proximity of metal objects.
- Do not use any leaky or damaged batteries.
- In the event of contact with battery acid: rinse affected areas thoroughly with water, and if necessary consult a doctor.
- Take batteries out of the instrument immediately if they are not functioning properly or if they show signs of overheating.
- Remove all batteries from the instrument if it is to remain unused for a longer period.

Warnings

Always pay attention to any information denoted by the following warnings. Implement the precautionary measures specified!

Display	Explanation
 WARNING	Indicates possible serious injury.
 CAUTION	Indicates possible minor injury.
ATTENTION	Indicates possible damage to equipment.

1.3 Waste disposal

- Dispose of faulty rechargeable batteries and spent batteries in accordance with the valid legal specifications.
- At the end of its useful life, dispose of the instrument via separate collection for electro- and electronic devices. Please observe local regulations concerning waste disposal. Or alternatively return the product to Testo for disposal.

2 General technical data

Feature	Values
Vacuum measuring range	0 to 26.66 mbar / 0 to 20,000 microns
Sensor overload (relative)	5 bar / 72 psi
Vacuum resolution	1 micron (from 0 to 1,000 microns) 10 microns (from 1,000 to 2,000 microns) 100 microns (from 2,000 to 5,000 microns) 500 microns (from 5,000 to 10,000 microns) 5,000 microns (from 10,000 to 20,000 microns)
Vacuum accuracy	±(10% of m.v. +10 microns) (100 to 1,000 microns)
Operating temperature	-10 to 50 °C / 14 to 122 °F
Storage temperature	-20 to 50 °C / -4 to 122 °F
Temperature measuring range	-10 to 50 °C / 14 to 122 °F
Temperature resolution	0.1 °C / 0.1 °F
Battery life	50 h (without background illumination and Bluetooth)
Protection class	IP 42
Parameter	mmHG, Torr, mbar, hPa, micron, inH ₂ O, inHg, Pa
Measuring cycle	0.5 sec
Sensor	1× Pirani sensor
Connections	- 2× 7/16" UNF - 1× MiniDIN (t570)

Setting values alarm treshold

Unit	Setting range	Resolution
mbar / hPa	0 - 7,5	0,05
micron	0 - 7500	50

2.1 Bluetooth module



The use of the wireless module is subject to the regulations and stipulations of the respective country of use, and the module may only be used in each case in countries for which a country certification has been granted.

The user and every owner undertake to adhere to these regulations and prerequisites for use, and acknowledge that the re-sale, export, import, etc. in particular in, to or from countries without wireless permits, is their responsibility.

Feature	Value
Bluetooth	Range 20 m (free field) (Varies depending on the capability of the mobile terminal device used.)
Bluetooth type	LSD Science & Technology Co., Ltd L series BLE module (08 May 2013) based on TI CC254X chip
Qualified Design ID	D030430
Bluetooth radio class	Class 3
Bluetooth company	10274

3 Description of the instrument

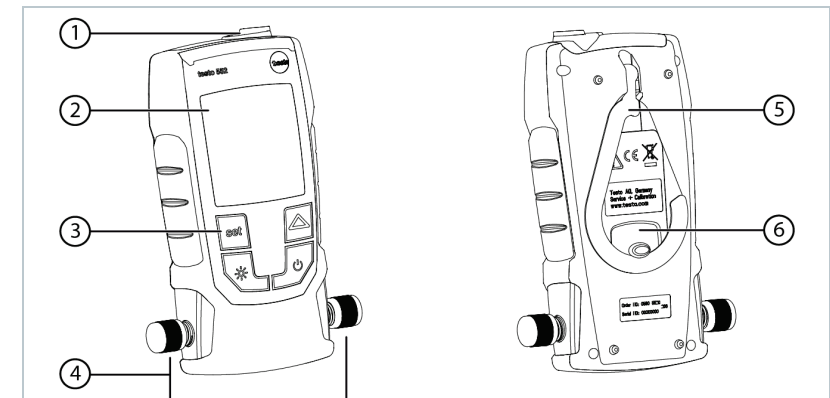
3.1 Use

The testo 552 is a digital vacuum gauge for the precise measurement of extremely small pressures in the vacuum range. This allows you to monitor the evacuation (usually during commissioning) of refrigeration systems and heat pumps.

With the testo 552, you can therefore measure the current pressure in a refrigeration system, and thus gather information about the degree of dehumidification and the removal of foreign matter (oils, foreign gases, etc.).

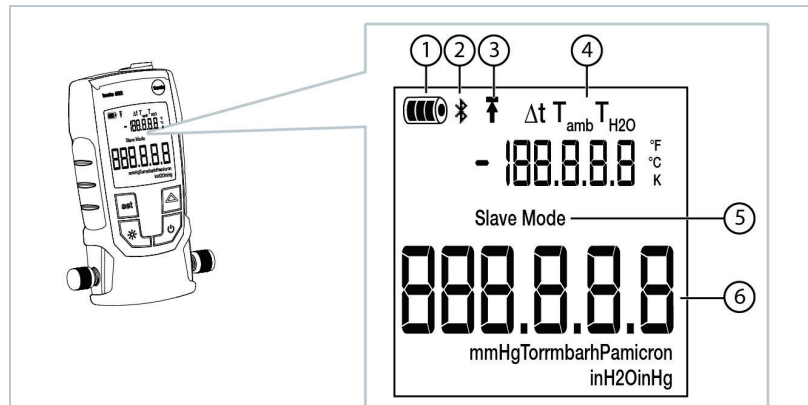
A vacuum gauge is always used in conjunction with a vacuum pump (generates the vacuum). A manifold (analogue or digital) is also often used in order to obtain controlled access to the refrigeration system.

3.2 Instrument overview



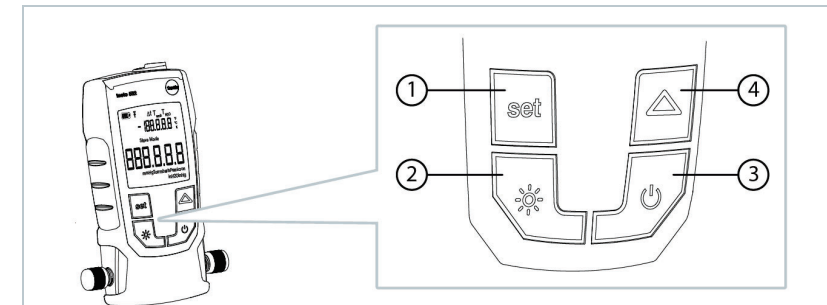
Element	Function
1 MiniDIN probe socket	Cable connection for connecting to the testo 570.
2 Display	Displays instrument status icons, measuring units and measuring values.
3 Control keys	Instrument operation.
4 Connections 7/16" UNF, brass	Connection of refrigerant hoses, vacuum pump, manifolds, etc..
5 Hook	Suspension device
6 Battery compartment	Contains two AA batteries.

3.3 Displays overview



Element	Function
1 Icon [🔋]	Displays the remaining battery capacity. 🔋 >75% 🔋 >50% 🔋 >25% 🔋 <10%
2 Icon [📶]	Bluetooth® appears when Bluetooth has been activated on the instrument.
3 Icon [⬆️]	An alarm threshold is set.
4 Temperature display	- selected, currently measured temperature - Measurement parameter: T_{H_2O} = evaporation temperature of water T_{amb} = ambient temperature Δt = temperature difference between evaporation temperature of water and ambient temperature - unit set (°C, °F)
5 Slave Mode	Appears when the testo 552 is connected to the testo 570 via a connecting cable and the testo 570 is in Evacuation mode.
6 Pressure display	Displays the currently measured pressure, the measurement parameter and the unit set (mmHG, Torr, mbar, hPa, micron, inH2O, inHg).

3.4 Control keys overview



Element	Function
1 set	- Switches to the settings. - Switches between the set-up options. (This function is disabled, when connected to the App with BT)
2 ☀️	Switches the display illumination on or off.
3 ⏻	Switches the instrument on or off.
4 ▲	- Switches between the temperature displays. - Navigates in the Set menu.
5 set + ▲	Switches Bluetooth® on or off (press and hold down for 3 sec.)

3.5 Connection options overview



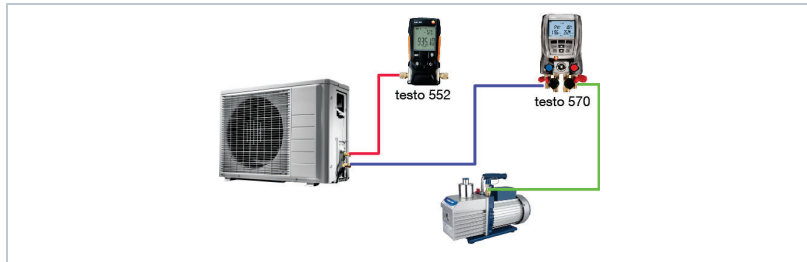
In regard to the following connection options, the testo 570 is used to represent any manifold and can use the testo 552 as a probe via a MiniDIN connecting cable (see Option 2).

Option 1 (recommended)



The testo 552 is connected at the point that is furthest from the vacuum pump. This ensures that a sufficiently deep vacuum is generated throughout the system in order to remove any moisture or foreign gases that may be present.

3 Description of the instrument



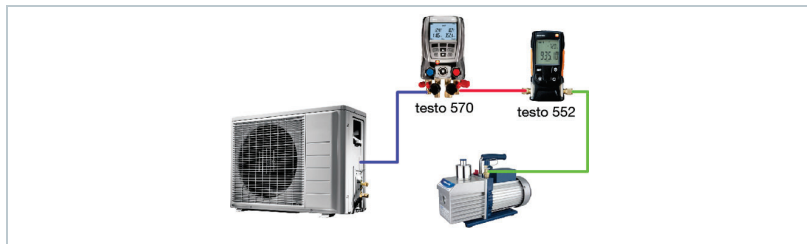
Option 2



Option 3

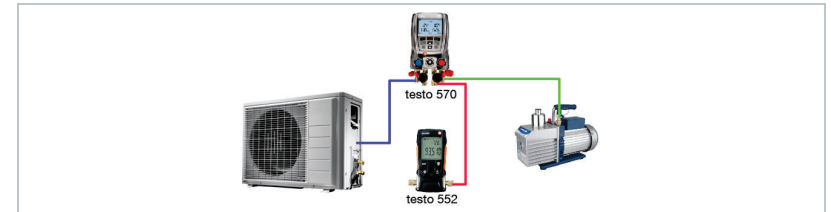


Option 4



3 Description of the instrument

Option 5



4 Operation


4.1 Connecting

i Always use refrigerant hoses that are specifically intended for evacuations.

- 1 - Remove sealing caps.
- Connect the testo 552 to the circuit.




4.2 Switching instrument on and off

- 1 - Press .
 - ▶ The instrument switches on or off.
- ▶ The instrument displays 000000 when ambient pressure is applied to the connections. The display indicates the applied pressure value once the applied pressure is within the measuring range. (0 to 20,000 microns).



4.3 Switching background illumination on and off

- 1 - Switch the instrument on.
- Press .
- ▶ The background illumination switches on or off.



4.4 Setting units and AutoOff

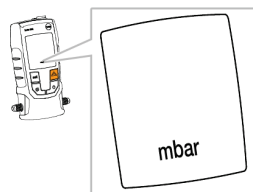
i The set-up menu must always be completely navigated through, even if only one parameter needs to be changed.

- 1 - Switch the instrument on.
- 2 - Press **set** to change settings.



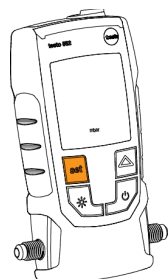
4 Operation

- 3 - Press Δ to set the pressure unit required.

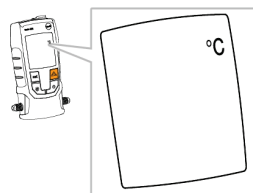


- 4 - Press **set**.

- ▶ The unit is set.
- ▶ The display shows the temperature unit.



- 5 - Press Δ to set the temperature unit required.



- 6 - Press **set**.

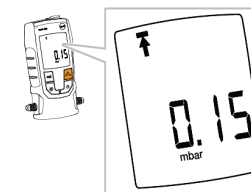
- ▶ The temperature unit is set.
- ▶ The display shows the setting for the alarm threshold.



Adjusting the alarm threshold causes an alarm to be triggered when the set value is exceeded.

4 Operation

- 7 - Press Δ to set the alarm threshold.



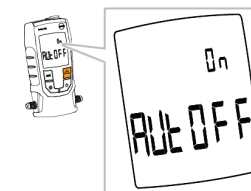
- 8 - Press **set**.

- ▶ The alarm threshold is set.
- ▶ The display shows the AutoOff setting.



If AutoOff is activated, the instrument switches off after 15 minutes when ambient pressure is applied to the sensor.

- 9 - Press Δ to switch AutoOff on or off.



- 10 - Press **set**.

- ▶ All settings are stored.
- ▶ The display changes to the measuring mode.



- ▶ The instrument can now be used.



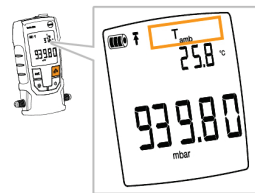
4.5 Displaying temperature values

- 1 - Press **Δ** to change the temperature measurement parameter.



- ▶ The temperature measurement parameter switches between TH2O, Tamb and **Δ**t.

i **Δ**t is displayed in K for °C, and in °F for °F.



4.6 Establishing a Bluetooth® connection

i You need a tablet or smartphone with the Testo Smart Probes App already installed on it to be able to establish a Bluetooth connection.

You can get the App for iOS instruments in the App Store or for Android instruments in the Play Store.

Compatibility:

Requires iOS 8.3 or later / Android 4.3 or later

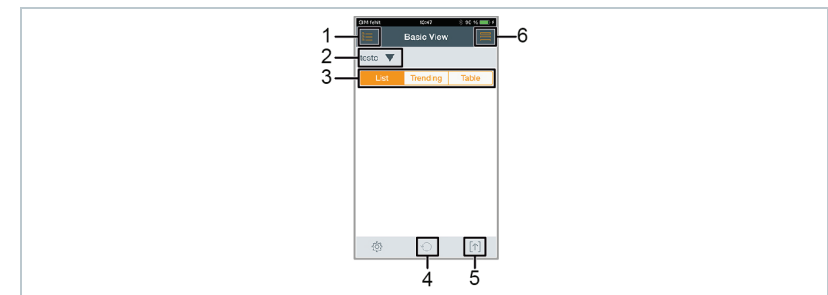
Requires Bluetooth 4.0



- 1 - Press **set** and **Δ** simultaneously and hold down for 3 seconds.
 - ▶ - When the Bluetooth icon is shown on the display, Bluetooth is switched on.
 - Once the APP is opened, the instrument will be connected automatically if it is within range. The instrument does not have to be connected to the smartphone / tablet beforehand via settings.
- 2 - Press **set** and **Δ** simultaneously and hold down for 3 seconds.
 - ▶ - When the Bluetooth icon is no longer shown on the display, Bluetooth is switched off.

Display	Explanation
flashes	There is no Bluetooth® connection, or a potential connection is being searched for.
is permanently displayed	There is a Bluetooth® connection
is not displayed	Bluetooth® is disabled.



4.7 Overview of operating controls




1. Choice of applications.
2. Display of connected testo 552.
3. Switch between the views (list, graphic diagram, table).
4. Restarts the measuring value recording in graph and table format.
5. Export the readings.
6. Options menu.


4.8 App options

4.8.1 Set “Language”


- 1 | - Tap  -> Settings -> Language
 - ▶ A selection list is displayed.
- 2 | - Tap the required language.
 - ▶ The selected language receives a green check mark.
- 3 | - Tap  several times until the measurement view is displayed.
 - ▶ The language has been changed.


4.8.2 Display Tutorial

 The Tutorial guides you through the first steps when operating the testo Smart Probes App.


- 1 | - Tap  -> Tutorial
 - ▶ The Tutorial is displayed. In Tutorial, swipe to display the next page.
- 2 | - Tap X to close the Tutorial.



4.8.3 Display testo website

 An internet connection is required to display the testo website.

- 1 | - Tap  -> About/Link -> Testo
 - ▶ The page www.testo-international.com is displayed.



4.8.4 Display App Info

 In App Info you can find the version number of the installed App.

- 1 | - Tap  -> About/Link -> Info
 - ▶ The App’s version number is displayed, as well as the ID.
- 2 | - Tap  several times until the measurement view is displayed.



4.9 List, graphic diagram and table view

The available readings can be displayed in different ways in the various views.


- List view
Displays the readings transmitted by the testo 552 in the form of a list. Readings from all connected testo 552 are displayed here.
- Graphic diagram view
The graphical progression of up to four different readings can be displayed. Tap on a reading above the diagram to select the readings to be displayed.
- Table view
In the Table view, all readings are displayed in sequence according to date and time. The different readings from the individual testo 552 can be selected by pressing  .

4.10 Exporting readings



4.10.1 Excel (CSV) Export

- 1 | - Press .
 - ▶ A selection of export options appears.
- 2 | - Press Export Excel (CSV).
 - ▶ A list of readings is displayed.
- 3 | - Press .
 - ▶ A selection of sending/export options appears.
- 4 | - Select your required sending/export options.

4.10.2 PDF Export

- 1 - Press .
- ▶ A selection of export options appears.
- 2 - Press Export PDF.
- ▶ A PDF is created and saved on your mobile terminal device (Android only) or sent via e-mail (iOS and Android).
- 3 - Press Done to exit the detailed view.

4.10.3 Exporting a graph

- 1 - Press .
- ▶ A selection of export options appears.
- 2 - Press Export Graph.
- ▶ An image file of the trend display is created.
- 3 - Press .
- ▶ A selection of sending/export options is displayed.
- 4 - Tap on the sending/export option you need

4.11 Operating as a probe on the testo 570

The testo 552 has no save or transmission function of its own.

By connecting the testo 552 to the testo 570, the data is transferred to the testo 570. From there the data can be saved or managed via the EasyKool software.



In combination with the testo 570, the testo 552 can be used as a high precision vacuum probe, if connected to the front of the testo 570 using the connection cable 0554 5520. The firmware version 1.09 or later must be installed for this.

Before connecting both instruments, the testo 552 must be switched on and the same pressure unit must be set on both instruments.

The testo 570 will only connect to the testo 552 once the Evacuation mode has been activated. When used as a probe, the testo 552 cannot be operated, all keys are deactivated.

In order to be able to use the readings from the testo 552 via the testo 570 in the EasyKool software, you need EasyKool software version 4.0 or later.

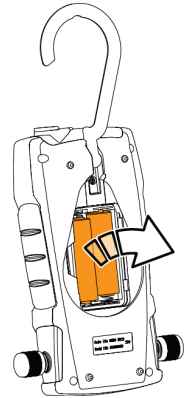
- 1 - Connect the connecting cable to the MiniDIN probe socket of the testo 552.
- 2 - Connect the connecting cable to the front-end MiniDIN probe socket of the testo 570.
- 3 - On the testo 570 set Evacuation mode.
 - ▶ The testo 552 switches to Slave mode.
 - ▶ The keys of the testo 552 are deactivated.
 - ▶ The readings are transmitted to the testo 570.
- 4 - Remove the connecting cable.
 - ▶ The testo 552 exits Slave mode.



5 Maintenance

5.1 Changing batteries

- 1 - Switch the instrument off.
- 2 - Flip hook up.
- 3 - Open the battery compartment.
- 4 - Remove batteries.
- 5 - Insert new batteries, observing the indications inside the battery compartment.
- 6 - Close the battery compartment.
- 7 - Fold hook down.



Cleaning the instrument



Contaminants such as oil may impair the accuracy of the vacuum sensor. Complete the following steps to clean the sensor.

CAUTION

Carrying out cleaning with the instrument switched on may result in damage to the sensor!

- Before cleaning, switch the instrument off!

CAUTION

Damage to the sensor due to sharp objects!

- Do not insert any sharp objects into the connections!

- 1 - Switch the instrument off.
- 2 - Put a few drops of rubbing alcohol into one of the two connections.
- 3 - Seal the opening by placing your finger on it or screw on the sealing caps.
 - Shake the instrument briefly.

- 4 - Remove all the alcohol from the instrument.
- 5 - Repeat this process at least twice.
- 6 - Leave the instrument to dry for at least 1 hour. To dry the sensor faster, you can connect the probe directly to a vacuum pump and draw vacuum.

6 Tips and assistance

6.1 Questions and answers

Question	Possible cause / solution
Readings are incorrect.	<ul style="list-style-type: none"> - Check that the testo 552 is connected properly. - Connect the testo 552 directly to the vacuum pump in order to check the values. - Check that all hoses are leak-tight. - Clean the sensor as described in the Cleaning the instrument section.
Instrument displays oooooo	The applied pressure is outside the specified measuring range. (0 to 20,000 microns).
Err0	- No connection between sensor and instrument, send instrument in to Testo Customer Service.
Err1	- No calibration possible, send instrument in to Testo Customer Service.
Err2	- Temperature outside the measuring range, adjust temperature value.
Err3	- Temperature outside the measuring range, adjust temperature value.
Err4	- Sensor broken, send instrument in to Testo Customer Service.
Err5	- Sensor's electrical circuit interrupted, send instrument in to Testo Customer Service.


If we have not been able to answer your question, please contact your dealer or Testo Customer Service. You will find contact details on the back of this document or on the website www.testo.com/service-contact

6.2 Accessories and spare parts







Description	Item no.
Connecting cable for testo 552	0554 5520

7 EC Declaration of Conformity



Product	testo 552
Mat.-No.	0560 5522
Issued	31.08.2021

 The use of the wireless module is subject to the regulations and stipulations of the respective country of use, and the module may only be used in countries for which a country certification has been granted. The user and every owner has the obligation to adhere to these regulations and prerequisites for use, and acknowledges that the re-sale, export, import etc. in particular in countries without wireless permits, is his responsibility.

7 EC Declaration of Conformity

Country	Comments
Australia	 E1561
Brazil	 Agência Nacional de Telecomunicações 03231-16-04701 Este equipamento opera em caráter secundário, isto é, não tem direito a proteção contra interferência prejudicial, mesmo de estações do mesmo tipo, e não pode causar interferência a sistemas operando em caráter primário.
Canada	Product IC: 12231A-05605522 see IC Warnings
Europe + EFTA	  The EU Declaration of Conformity can be found on the testo homepage www.testo.com under the product specific downloads. EU countries: Belgium (BE), Bulgaria (BG), Denmark (DK), Germany (DE), Estonia (EE), Finland (FI), France (FR), Greece (GR), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Sweden (SE), Slovakia (SK), Slovenia (SI), Spain (ES), Czech Republic (CZ), Hungary (HU), Republic of Cyprus (CY). EFTA countries: Iceland, Liechtenstein, Norway, Switzerland
Japan	 R 204-640004 see Japan Information
Korea	 MSIP-CRM-Toi-552 see KCC Warning
Malaysia	Authorized
South Africa	ICASA ID: TA-2016/1706
Turkey	Authorized
UAE	TRA number: ER79893/20

7 EC Declaration of Conformity

United Kingdom (GB)	  The UK Declaration of Conformity can be found on the testo homepage www.testo.com under the product specific downloads.																
USA	Product FCC ID: 2ACVD05605522 see FCC Warnings																
Bluetooth SIG Listing	<table border="1"> <thead> <tr> <th>Feature</th> <th>Values</th> </tr> </thead> <tbody> <tr> <td>Bluetooth Range</td> <td>< 20 m (free field)</td> </tr> <tr> <td>Bluetooth type</td> <td>L Series BLE module (08 May 2013) based on TI CC254X chip</td> </tr> <tr> <td>Qualified Design ID</td> <td>B016552</td> </tr> <tr> <td>Bluetooth radio class</td> <td>Class 3</td> </tr> <tr> <td>Bluetooth company</td> <td>LSD Science & Technology Co., Ltd</td> </tr> <tr> <td>RF Band</td> <td>2402-2480MHz</td> </tr> <tr> <td>Output power</td> <td>0 dBm</td> </tr> </tbody> </table>	Feature	Values	Bluetooth Range	< 20 m (free field)	Bluetooth type	L Series BLE module (08 May 2013) based on TI CC254X chip	Qualified Design ID	B016552	Bluetooth radio class	Class 3	Bluetooth company	LSD Science & Technology Co., Ltd	RF Band	2402-2480MHz	Output power	0 dBm
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FCC Warnings

Information from the FCC (Federal Communications Commission)

For your own safety

Shielded cables should be used for a composite interface. This is to ensure continued protection against radio frequency interference.

FCC warning statement

This equipment has been tested and found to comply with the limits for a Class C digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Shielded interface cable must be used in order to comply with the emission limits.

7 EC Declaration of Conformity

Warning

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

IC Warnings

This instrument complies with Part 15C of the FCC Rules and Industry Canada RSS-210 (revision 8). Commissioning is subject to the following two conditions:

- (1) This instrument must not cause any harmful interference and
- (2) this instrument must be able to cope with interference, even if this has undesirable effects on operation.

Cet appareil satisfait à la partie 15C des directives FCC et au standard Industrie Canada RSS-210 (révision 8). Sa mise en service est soumise aux deux conditions suivantes :

- (1) cet appareil ne doit causer aucune interférence dangereuse et
- (2) cet appareil doit supporter toute interférence, y compris des interférences qui provoqueraient des opérations indésirables.

KCC Warning

해당 무선 설비는 운용 중 전파혼신 가능성이 있음.

Japan Information

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。





testo 316-3 · Leakage detector for refrigerants

Instruction manual



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2 Safety and the environment



2.1. About this document

Use

- > Please read this documentation through carefully and familiarize yourself with the product before putting it to use. Pay particular attention to the safety instructions and warning advice in order to prevent injuries and damage to the products.
- > Keep this document to hand so that you can refer to it when necessary.
- > Hand this documentation on to any subsequent users of the product.

Warnings

Always pay attention to information that is marked by the following warnings with warning pictograms. Implement the specified precautionary measures.

Representation	Explanation
 WARNING	Indicates potential serious injuries
 CAUTION	indicates potential minor injuries
NOTICE	indicates circumstances that may lead to damage to the products

2.2. Ensure safety

- > Only operate the product properly, for its intended purpose and within the parameters specified in the technical data. Do not use any force.
- > Dangers may also arise from the systems being measured or the measuring environment: Note the safety regulations valid in your area when performing the measurements.
- > Do not perform contact measurements on non-insulated, live parts.
- > Do not store the product together with solvents. Do not use any desiccants.

- > Carry out only the maintenance and repair work on this instrument that is described in the documentation. Follow the prescribed steps exactly. Use only original spare parts from Testo.
- > Temperatures given on probes/sensors relate only to the measuring range of the sensors. Do not expose handles and feed lines to any temperatures in excess of 70 °C unless they are expressly permitted for higher temperatures.

2.3. Protecting the environment

- > Dispose of faulty rechargeable batteries/spent batteries in accordance with the valid legal specifications.
- > At the end of its useful life, send the product to the separate collection for electric and electronic devices (observe local regulations) or return the product to Testo for disposal.
- > Dispose of faulty rechargeable batteries/spent batteries in accordance with the valid legal specifications.

3 Specifications

3.1. Use

The testo 316-3 is a leakage detector for fast and reliable leak detection in refrigeration systems and heat pumps. Gas concentrations are indicated both visually and audibly.

i The testo 316-3 is not protective equipment! Do not use the testo 316-3 as a monitoring instrument for personal safety.

3.2. Technical data

Feature	Values
Sensor	Electrochemical sensor with heated diode

Feature	Values
Detectable refrigerants	All HFCs, HCFCs and CFCs e.g. FX80, I12A, R11, R114, R12, R123, R1234yf, R1234ze, R124, R125, R12a, R13, R134a, R13B1, R14, R142b, R161, R22, R227, R23, R236fa, R245fa, R32, R401A, R401B, R401C, R402B, R403B, R404A, R406A, R407A, R407B, R407C, R407D, R407F, R408A, R409A, R410A, R411A, R412A, R413A, R414B, R416A, R417A, R417B, R417C, R420A, R421A, R421B, R422A, R422B, R422C, R422D, R424A, R426A, R427A, R434A, R437A, R438A, R448A, R449A, R452A, R500, R502, R503, R507, R508A, R508B, R1233zd, R450A, R455A, R513A, R407H, R444B, R452B, R453a, R454A, R454B, R454C, R458A, SP22
Response threshold	<4 g/a / <0.15 oz/a
Sensor service life	80-100 hours (equates to approx. 1 year of normal usage)
Warm-up period (switching instrument on – ready to measure)	Approx. 20 s
Power supply	Alkaline Batteries (2xD)
Battery life	16 hours
Storage/transportation conditions	0 to 50 °C / 32 to 122 °F
Operating conditions	-18 to 50 °C / -0 to 122 °F 20 % - 80 %RH, non-condensing
Minimum Response / Detection Time	< 1 second
Recovery Time for 50 g/yr exposure	12 seconds
Calibration Frequency	Check annually with Calibration Standard

Feature	Values
Weight	Approx. 400 g (incl. batteries)
Dimensions (L x W x H)	Housing: approx. 270 x 65 x 65 mm Length of flexible sensor shaft including sensor head: approx. 285 mm
EC Directives	2014/30/EC
Standards	EN14624:2012

4 Product description

4.1. Overview



5 First steps

5.1. Commissioning

Installing the sensor

1. Unscrew the protective cap (1) from the sensor head (counter-clockwise).
2. Take the sensor (2) out of its protective film packaging.
3. Carefully push the three sensor wires into the sockets in the sensor head, until they are no longer visible.



NOTICE

Malfunction due to damaged sensor wires!

> Do not damage sensor wires.

4. Put the protective cap on the sensor and tighten by turning in a clockwise direction.

Insert batteries

1. Using a screwdriver, push down the locking clip on top of the handle.



2. Slide the top part of the handle down.
3. Insert two mono (D) type batteries. Observe the polarity!



4. Slide the top part of the handle back on.

Switch on

⚠ WARNING

Danger of explosion!

- > The instrument must not be used in environments where flammable gases are present.
- > Press [⏏] briefly.
- **PWR** LED lights up and all yellow gas concentration indicator LEDs start to flash one after another.
- The sensor is heated up.
- The instrument is ready to use once the gas concentration indicator LEDs have gone off and one beep per second can be heard.

Switch off

- > Press and hold down [⏏].

6 Using the product

6.1. Performing settings

Setting the sensitivity

There are two sensitivity levels: **HI** (high, default) and **LO** (low).

The **LO** level is 8x less sensitive than the **HI** setting. At high refrigerant gas concentrations, set the sensitivity to **LO**.

- > Press [⏏] briefly to set the sensitivity to **LO**.
- > Press [⏏] again to revert to the **HI** level.

6.2. Finding leaks

NOTICE

Sensor destruction due to desorbing substances (e.g. oils)!

- > Do not operate the instrument in contaminated environments.

1. Move the leakage detector to the site where the leak is suspected.

i Leak detection can only be carried out correctly if the probe is guided directly over the leak.

2. Guide the probe head over the surface to be tested at a maximum distance of 6 mm and a rate of 2.5 to 5 cm per second.

- If the instrument detects a leak, the yellow gas concentration indicator LEDs light up and the instrument starts to beep rapidly. The larger the leak, the more segments light up.

3. Move instrument away from the leak briefly.

- > In the case of high refrigerant concentrations: before going back to the leak, set the sensitivity to **LO**.

4. Guide the probe head back to the leak in order to precisely locate the site.

- > Set the sensitivity back to **HI** as soon as the leak has been precisely located.

7 Maintaining the product

Cleaning the instrument

- > If the housing of the instrument is dirty, clean it with a damp cloth.

Do not use any aggressive cleaning agents or solvents! Weak household cleaning agents and soap suds may be used.

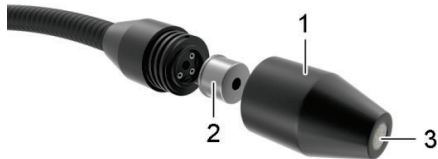
Replacing the sensor

The electrochemical sensor has a service life of approximately 100 operating hours. Once this time is up, or if you suspect that some leaks have not been detected, the sensor must be replaced.

CAUTION**Risk of burns due to hot sensor head!**

> Before removing the protective cap: switch instrument off and let the sensor head cool down.

1. Unscrew the protective cap (1) from the sensor head (anti-clockwise).
2. Remove defective sensor.
3. Take the new sensor (2) out of its protective film packaging.
4. Carefully push the three sensor wires into the sockets in the sensor head, until they are no longer visible.

**NOTICE****Malfunction due to damaged sensor wires!**

> Do not damage sensor wires.

5. Put the protective cap on the sensor head and tighten by turning in a clockwise direction.

Replacing the filter

The filter must be replaced if it is clogged with water or oil or if it appears to be dirty.

CAUTION**Risk of burns due to hot sensor head!**

> Before removing the protective cap: switch instrument off and let the sensor head cool down.

1. Unscrew the protective cap (1) from the sensor head (anti-clockwise).
2. Push the spent filter (3) out of the protective cap using a paper clip or something similar.
3. Insert the new filter into the protective cap.
4. Put the protective cap on the sensor head and tighten by turning in a clockwise direction.

Changing batteries

i Once **PWR** starts to flash, this indicates that the battery has enough power left for approximately one hour.

1. Using a screwdriver, push down the locking clip on top of the handle.



2. Slide the top part of the handle down.
3. Remove the spent batteries.
4. Insert two mono (D) type batteries. Observe the polarity!



5. Slide the top part of the handle back on.

8 Tips and assistance**8.1. Questions and answers**

Question	Possible causes	Possible solution
All gas concentration indicator segments are lit up, audible signal is off	Sensor is missing or is no longer fully functional	> Change sensor.

Question	Possible causes	Possible solution
At the smallest of movements, the instrument signals a leak	<ul style="list-style-type: none"> • Sensor wires are kinked. • Sensor has been exposed to a high degree of humidity for too long. 	<ul style="list-style-type: none"> > Remove sensor and examine wires. If necessary, straighten wires with pincers. > Switch the instrument on and wait until the alarm switches off (duration: up to 20 minutes).
Instrument is not very sensitive, seems to ignore leaks or does not detect some types of refrigerant.	Sensor has reached the end of its service life.	> Change sensor.
Instrument cannot be switched on.	Batteries are depleted.	> Change batteries.

If we have not been able to answer your question, please contact your local dealer or the Testo Customer Service. Contact details can be found on the internet at www.testo.com/service-contact

8.2. Accessories and spare parts

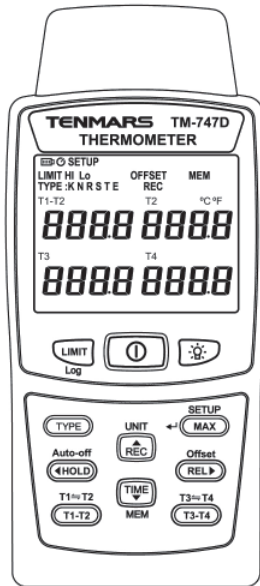
Description	Item no.
Replacement sensor	0554 2610
Replacement filter	0554 2611

For other accessories and spare parts, please refer to the product catalogues and brochures or look up on the internet at www.testo.com



TENMARS

TM-747/747D 4-Channel Thermometer User's Manual



HB2TM7470000

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TENMARS

1 Introduction

TM-747X series thermometers are K /J/ T / E/ R / S/ N type thermocouple thermometers.

2 Accessories

- 1 Meter
- 1 User manual
- 6 1.5V AAA Carbon zinc battery
- 1 Carrying case
- 1 9V AC to DC adaptor (TM-747D)
- 1 USB cable (TM-747D)
- 1 Installation disk (TM-747D)

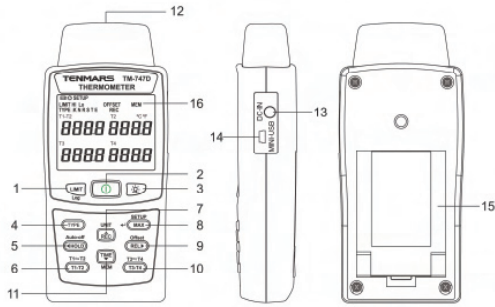
3 Safety Precaution

	Note! Please refer to this manual. Improper use may damage the meter and its components.
	Complies with European Directive.

- Do not operate in environments with flammable gas or humid environments.
- Operating altitude: up to 2000M.
- Operating environment: Indoor use; Pollution degree 2.
- Clean with soft cloth when dirty, such as glasses cloth. Do not clean with chemicals and other solvents.
- ✧ **Class B** – Equipment for use in all establishments other than domestic.
- ✧ **Group 1** – RF energy generated is needed for internal functioning.

TENMARS

4 Meter Description



1. Alarm setup button / Auto record button (TM-747D)
2. Power button
3. Backlight button
4. K / J / T / E / R / S / N type switching/manually record button.
5. Hold button / Auto-shutdown button
6. Interchange button for "T1 - T2" vs. "T1 & T2"
7. Unit °C / °F / K switch button
8. Maximum value, Minimum value, Average value, elapsed time / Setup button
9. Relative value / offset value button
10. Interchange button for "T3 - T4" vs. "T3 & T4"
11. Time button / Read button
12. Thermocouple input terminal T1/T2 T3/T4
13. External power DC 9V input
14. USB data output jack
15. Battery cover and tilt stand
16. LCD display

- With DC-IN connected, appears on the screen.
- Without heat-sensing wire connected, **UL** will appear on the screen.

TENMARS

5 Operation

5.1 Power on or off

Press button · turn on or turn off.

5.2 Turn on backlight

press button to turn on or turn off the backlight.

* The backlight will automatically turn off after being lit for 15 seconds.

5.3 Alarm on or off

press to turn "on" or "off" the alarm, followed by "LIMIT" appears on the LCD.

This LCD shows the status "on" or "off" of the alarm function. It is possible to set the upper and lower limit of the temperature range by yourself. When the temperature reading exceeds the range, the buzzer will alarm until the temperature back to the range or the alarm function turned off.

(For the limit range setup, please enter 5.17 Setup Function)

TENMARS

5.4 Auto Recording

Press and hold for ≥ 2 seconds to enable or disable the auto-recording function "LOG" (TM747D)

The LCD display will first show the number of logs for REC/MEM START mode and then switch back to temperature mode after 1 second.



The auto-recording is such if the current number is 3, it will be increased to X by 1 at each pressing. (the number of logs in TM-747D is up to 16800)

* Execute "LOG" to disable the auto-shutdown function. For recording for a long time, please connect the meter to an external power supply.

5.5 Thermocouple Type Selection (TYPE):

Press to enable selection of different thermocouple types in a full cycle.



5.6 Manual Record

Press , followed by "REC" appears on the LCD, the log number of records will increase by +1 at each time, and one log will be recorded.

The manual records are up to 200 logs.



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5.7 Unit Switch for °C, °F and K

Press and hold for ≥ 2 seconds to switch the unit: Celsius (°C), Fahrenheit (°F), or Kelvin (K).

5.8 Data Hold

Press to enable or disable the data hold function.

5.9 Disable Auto Power Off Function

Press and hold for 2 seconds to enable or disable the auto power off function.

5.10 Relative Value Measurement

Press to enter the relative: Just use one thermocouple, the difference between two temperatures can be measured.

For example, measure the first temperature as 25°C, and then press to show 0°C on the LCD. Again, measure the second temperature. If the second temperature is measured as 30°C, the LCD will show the difference value 5°C (30-25=5°C).

Again, press to disable the function.



The left shows the relative value, right shows the temperature value being measured.

press the / and hold to switch the display between "T1 & T2" and "T3 & T4".

TENMARS

5.11 Offset Value

The user can set the offset value to compensate for the error due to the working thermocouple wire.

Press **Offset** and hold for ≥ 2 seconds to set the offset value in OFFSET mode.

b. Press **REC** or **TIME** to increase or decrease the offset value by the scale of 0.1°C , $^{\circ}\text{F}$, or K. The setting range is $\pm 5^{\circ}\text{C}$, $\pm 5\text{K}$, or $\pm 9^{\circ}\text{F}$.

*If to set offset value of another channels, press **T1-T2** and **T3-T4** to switch and select between "T1

& T2" and "T3 & T4" for adjustment. Press **SETUP** **MAX** to save the setting value and exit the setting mode.

*If the value updated to be 0.1, "OFFSET" will continuously appear on the LCD. "OFFSET" will not disappear unless it is corrected back to 0.0.



6

TENMARS

5.12 Change Display of T1-T2 vs. T1 & T2

● Press **T1-T2** to enable or disable T1 - T2 .

The value shown on the left shows the difference of T1 - T2, and the one shown on the right is the T1 value which is measured presently.



● Press and hold **T1-T2** for ≥ 2 seconds for the position change of T1 and T2.

5.13 Change Display of of T3-T4 vs. T3 & T4

● Press **T3-T4** to show the value of T3 - T4.

Again, press **T3-T4** to disable the function.

The value shown on the left presents the difference of T3-T4, the one shown on the right is the temperature measured through T3 channel.



● Press and hold **T3-T4** for 2 seconds for the position change of T4 and T3 on the right.

7

TENMARS

5.14 Time Display

Press **TIME** for < 1 second to switch the three date-time modes: Year/Month/Day \rightarrow Hour/Minute:Second \rightarrow Cyclic display each term by second.



5.15 Read Record

Press **MEM** and hold for ≥ 2 seconds to read the records in "MEM" mode while LCD displays MEM CALL.

Press **REC** or **TIME** to read the previous or next record.

The three items of time, number of logs and temperature data are displayed on the LCD and are auto-displayed cyclic by second.



*It is used in the "MEM CALL" mode. Press **MAX** to exit this mode.

8

TENMARS

5.16 Maximum /Minimum/ Average Value

Press **MAX** repeatedly to select maximum, minimum and average value of measure data.

When MAX, MIN, and AVG are displayed at the same time, it represents the elapsed time of the measurement, and the present temperature T1 / T3.



5.17 Setup

Press **SETUP** **MAX** and hold for ≥ 2 seconds for SETUP: Step1 - Step4

Step1. High/Low limit Value setting for alarm function (Limit):

Select Setup mode to the upper and lower limit of T1, T2, T3 and T4 (Setup Limit Hi - Lo).

Press **HOLD** to select and set the range (Hi & Lo) of T1, T2, T3, T4.

Press **REL** to select the position to be modified. The position will be indicated to the next one by each press.

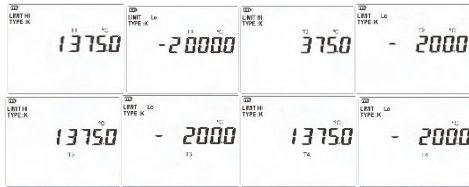
Press **REC** or **TIME** to set the plus-minus sign and temperature.

The setting of the upper and the lower limits are based on the TYPE range measured; it may auto-identify whether it exceeds the limit. (The Setup function will fail if it exceeds the TYPE range which is set by the user.)

Press **SETUP** **MAX** to save the settings and proceed to Step 2.

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Step2. Set Record Intervals: (TM747D)

Press **HOLD** or **REL** to select hour, minute, and second. Press **REC** or **TIME** to adjust the record interval.



Press **SETUP** **MAX** to save the settings and proceed to Step 3.

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Step3. Time Setting:

Press **HOLD** or **REL** to select the year, month, day, hour, minute, and second.

Press **REC** or **TIME** adjust the time. Press and hold the button to enable speedy adjustment.



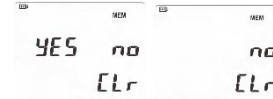
Press **SETUP** **MAX** to save the settings and proceed to Step 4.

Step4. Clear the record in the memory:

Press **HOLD** to clear, "YES" will flash.

Press **REL** to keep, "NO" will flash.

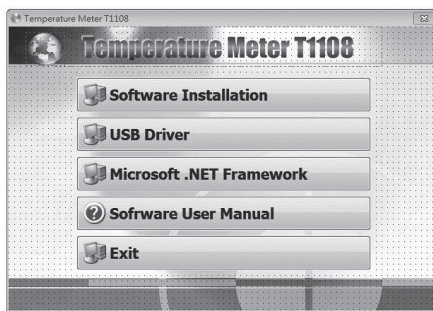
* Press **SETUP** **MAX** to save the settings, and complete all settings.



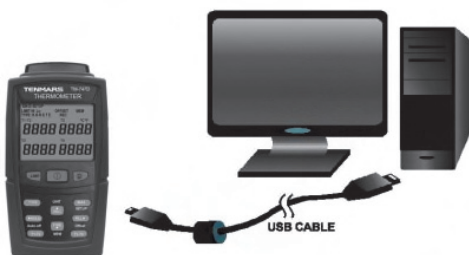
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6 Software Installation (TM-747D)

- Supported operating systems: XP/Windows7/Windows 8.1/Windows10
- Place the CD included with this meter into the CD/DVD-ROM drive of the PC to connect to and install the desktop program:

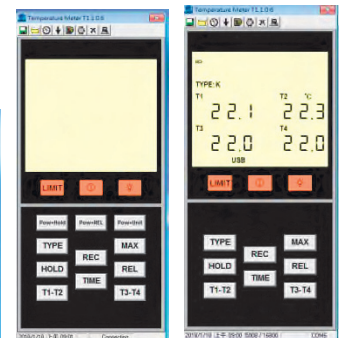


- As the desktop application installed completely, remove the disc from the CD/DVD ROM drive.
- Connect the USB cable included with this meter to the PC, as shown in the figure below.



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- Execute the PC desktop software program: Double-click the left mouse button on the desktop program (Thermometer Meter) to execute the desktop program.



With USB cable connected to the PC, **USB** appears on the screen (TM-747D).

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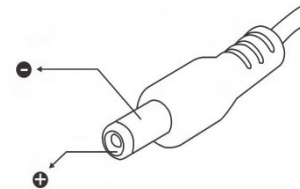
7 General Specifications

- Display: 4-channel and 4-digit LCD
- Unit: °C / °F / K
- Data hold (HOLD)
- Auto ranging
- Back light
- Auto power (default 15 min) and disable auto power off
- Maximum/minimum/mean value/measurement elapsed time
- Alarm function
- Overload display: "OL"
- Input limit: Maximum input 24V DC or AC
- Datalogging capacity 16,800 records. (TM-747D)
- Save interval: 1 second~24 hours.
- Low battery detection 
- Battery: 1.5V×6 (LR03 SIZE AAA 1.5V).
- Battery life: Approximately 100 hours.
- Operation temperature and humidity: 0°C to 50°C (32°F to 122°F), < 80%RH
- Storage temperature and humidity: 0°C to 50°C, relative humidity under 80%.
- Weight: Approximately 330 grams
- Dimensions: 168 (L) x 73 (W) x 35 (H) mm

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- The backlight will be continuously on if the meter is connected to the external power supply.
- **AC to DC Adaptor**
External AC 100~240V to DC 9V/0.5A adaptor. (Please pay attention to the polarity)
Voltage: DC9V(9.0 ~ 15.0 VDC MAX)
Current: $\geq 1000\text{mA}$
Plug: The pin in the center connects to the positive electrode and the outer case is negative electrode
Diameter: 5.5mm; internal diameter: 2.1mm.



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8 Electrical Specifications:


Accuracy is specified for ambient temperatures between 18 to 28°C (64 to 82°F).

Range	TYPE-K : -200°C to +1372°C (-328°F to +2501°F) TYPE-J : -210°C to +1200°C (-346°F to +2192°F) TYPE-T : -250°C to +400°C (-418°F to +752°F) TYPE-E : -210°C to +1000°C (-346°F to +1832°F) TYPE-R / S : 0°C to +1767°C (+32°F to +3212°F) TYPE-N : -150°C to +1300°C (-238°F to +2372°F)	
Resolution	0.1	K / J / T / E / N $\leq 1000^\circ\text{C}$
	1	R / S K / J / T / E / N $\geq 1000^\circ\text{C}$
Accuracy	K/J/E/T/N Type:	
	$\pm(0.05\% \text{ rdg} + 0.7^\circ\text{C} / 1^\circ\text{F})$	
	R/S Type:	
Temperature coefficient	$\pm(0.05\% \text{ rdg} + 2^\circ\text{C} / 4^\circ\text{F})$	
	0.05% \pm 0.07°C of reading/ °C (0.06°F/ °F) outside +18°C to 28°C (+64°F to +82°F) specified range	
Temperature scale	ITS-90	
The above specifications do not include accuracy of thermocouple.		

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9 Maintenance or Repair

1. When the "  " symbol is displayed on the LCD, it means that there is insufficient power; please change the battery immediately in order to ensure its accuracy.
2. Do not place the meter in locations that have high temperature, humidity or that are exposed to direct sunlight.
3. Remember to turn off the power after usage; remove the battery if not used for a long period of time in order to prevent battery leakage and causing damages to internal components.
4. When the instrument failure, only by the authorized service provider or return the original repair.

10 Battery Replacement

1. Turn off the power.
2. Open the frame and battery cover at the back of the meter, remove the batteries.
3. Please insert a new AAA battery according to the polarities.
4. Put the battery cover and frame back in place.

11 End of Life Disposal



Note: This symbol indicates that the meter and its accessories must be separated and processed properly.

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**Professional Electrical and
Environment Test & Measurement
Instruments:**

LED light meter, Temperature & Humidity
meter, Infrared Thermometer, Sound level
meter, Light meter, EMF meter, UV Light
meter, RF meter, Hot wire Anemometer, Co
meter, Anemometer, Lan cable tester, Co2
meter, Solar power meter, Radiation meter,
Clamp meter, Multimeter, Phase Rotation
test, Digital Insulation tester

**Our products of high quality are
selling well all over the world**

**TENMARS ELECTRONICS CO., LTD.
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Taipei City, Taiwan
E-mail: service@tenmars.com
<http://www.tenmars.com>**

Insulation Tester

MODEL TES-1600

- 2000M Ω /1000V, 200M Ω /500V, 200M Ω /250V
- Power lock for 3 minutes (Auto power off)
- Auto-Zero adjustment
- Data-Hold-Function



TES-1600

Specifications for TES-1600

AC Voltage

Range: 750V
Resolution: 1V
Accuracy: 0.8% rdg + 3 dgts
Input Impedance: 10M Ω
Overload Protection: 1100VDC & 800VAC

MEG OHMS

Range: 200M Ω /250V, 200M Ω /500V, 2000M Ω /1000V
Resolution: 0.1M Ω
Accuracy: 3% rdg + 3 dgts
Terminal Voltage: 250V ~ 1000V +/- 10%
Output short circuit current:

0.4mA/0.9mA/1.7mA max

Operating/Storage Condition

0°C to 40°C < 80% R.H.
-10°C to 60°C < 70% R. H.

OHMS

Range: 200 Ω
Resolution: 0.1 Ω
Accuracy: 1% rdg + 2 dgts
Max open circuit voltage: 3.3V
Overload protection: 500V DC/AC
Continuity Beeper
Resolution: 0.1 Ω
Operation resistance: < 100 Ω
Max open circuit voltage: 3.3V
Overload protection: 500V DC/AC
Power Source: 6pcs "AA" 1.5V batteries
Display: 3 1/2 digit, 0.65" LCD
Sampling Rate: 2.5 times/sec
Auto-Zero adjustment
Size & Weight: 165mm(L)x100mm(W)x57mm(H) & 500g
Accessories:
Carrying Case, Test Lead, Battery & Instruction Manual

輝奇氣體有限公司

HUEI CHYI GAS CO., LTD.

Hand Carry Wheeled Welding System Manual

車輪式手提小型切斷、熔接加熱器使用說明

1. Slowly turn on the oxygen cylinder valve, observing the high pressure gauge (280kg/m²) to ensure the inflow of oxygen has increased (the pointer should move up). Turn the regulator valve clockwise until the pointer of the low pressure gauge (28kg/m²) is at the 3kg level.

先將氧氣瓶閥打開，目測氧氣調整器上的高壓錶【280kg】是否有氣，然後將旋鈕順時鐘方向旋轉，目測低壓錶【28kg】指針調至 3kg 位置。

2. Slowly turn on the Acetylene cylinder valve, observing the high pressure gauge (28kg/m²) to ensure the inflow of acetylene has increased (the pointer should move up). Turn the regulator valve clockwise until the pointer of the low pressure gauge (4kg/m²) is at the 0.5Kg level.

再將乙炔燃氣瓶閥打開，目測乙炔燃氣調整器上的高壓錶【28kg】是否有氣，然後將旋鈕順時鐘方向旋轉，目測低壓錶【4kg】指針調至 0.5kg 位置後，再將氧氣、乙炔燃氣針閥同時打開。

3. Slowly turn on the torch fuel valve, which is located at the end of the torch next to the red hose. Light the flame. The torch oxygen valve, next to the handle, needs to be twisted and adjusted until a blue flame is achieved.

將熔接加熱器後端紅色膠管前的旋鈕微開點燃火焰，再將【手把】下端的加熱氧氣，旋鈕微開慢慢反覆調配，火燄至藍色即可使用。

4.1 When finished, shut down the fuel then oxygen, and always bleed lines to ensure nothing stays in the hose to extend the lifespan of it.

使用完畢後務必先將膠管內氣體燒完或放掉，已確保膠管使用之延長。

4.2 The oxygen and acetylene cylinder valves must be turned off to prevent leakage and achieve safety.

另將氧氣、乙炔燃氣瓶閥鎖緊。【防止漏氣、以策安全】

phone : (02)2651-6988/(02)2785-6343 Fax : (02)2783-8009

BX-FBS- 050AT Operation Manual

KEY FUNCTIONS

1. ON/OFF: Turn unit ON of OFF.
2. CLEAR: a) Exit the CHARGE or RECOVERY operation
b) Clear the input value.
3. ▲: Press this key to increase one while under the input value state.
4. ▼: Press this key to decrease one while under the input value state.
5. UNIT/SHIFT: a) To switch the (kg->lb->lboz->oz->g) as unit selected.
b) To move from one digit to the next when under the input value state.
c) Pause or continue CHARGE or RECOVER action.
6. TARE/ENTER: a) To Zero out the weight applied on the platform.
b) When under the input value state, it is the function of ENTER key.
7. CHARGE: To start CHARGE mode.
8. RECOVERY/ESCAPE: a) To start RECOVERY mode.
b) While under input value state, press this key to exit.
c) Press and hold for 3 seconds to enter the setting mode for the empty weight of the tank and total weight of the tank (empty tank weight + refrigerant amount).

OPERATION

1. CHARGE mode:

- 1-1 Connect to AC 110V power supply, with no weight on platform, press ON/OFF, LCD reads 0.000 kg, place tank on platform, LCD reads weight.
- 1-2 Press CHARGE, read out of previous input value appears. To set a new charging weight by using UNIT/SHIFT, ▲ and ▼ buttons.
- 1-3 Press TARE/ENTER and the display reads "GOOD" and start charging, the weight unit on LCD flashes.
- 1-4 When the desired amount minus 30 g (-30 g) is reached, buzzer pre-alarms for 5 seconds, PULSE function activates, every 6 seconds will open solenoid valve for 0.3 second, to keep weight and pressure stable. When the desired amount is reached, LCD reads cycle of <GOOD->initial weight-> charging weight-> remaining weight>, buzzer sounds rapidly (Bi~Bi~Bi) for 30 seconds then stops.
- 1-5 It will alarm in one sound for 30 seconds and stop charging if no change in weight on the platform for 4 minutes, and the display reads (done -> initial weight -> charging weight -> remaining weight).
- 1-6 Press any button (except for ON/OFF), LCD reads "out" and go back to weighing mode.

2. RECOVERY mode (Empty tank weight and full tank weight must be set in advance):

- 2-1 Press ON/OFF, LCD reads 0.000 kg, place tank on platform, LCD reads weight.
- 2-2 Press RECOVERY/ESCAPE, LCD reads RECO, press TARE/ENTER to start recovery, the weight unit on LCD flashes.
- 2-3 When reaching the weight of "empty tank weight + 80.00% of refrigerant amount weight", buzzer pre-alarms for 5 seconds, when reaching the weight of "empty tank weight + 90.00% of refrigerant amount weight", operation finished, LCD reads cycle of <Full->initial weight-> recovery weight-> finished weight>, buzzer sounds rapidly (Bi~Bi~Bi) for 30 seconds then stops.
- 2-4 It will alarm in one sound for 30 seconds and stop charging if no change in weight on the platform for 4 minutes, and the display reads (done -> initial weight -> recovery weight -> finished weight).
- 2-5 Press any button (except for ON/OFF), LCD reads "out" and go back to weighing mode.

EX: Empty tank weight=8.500 kg

Total tank weight (empty tank weight+ refrigerant volume weight)=20.500 kg

Refrigerant volume weight = 20.500 kg – 8.500 kg = 12.000 kg

Empty tank weight + 80% of refrigerant volume weight = 8.500 kg + (12.000 kg * 80%) = 18.100 kg

Empty tank weight + 90% of refrigerant volume weight = 8.500 kg + (12.000 kg * 90%) = 19.300 kg

3. Set empty tank weight and full tank weight

3-1 Turn scale on with platform empty, LCD reads 0.000 kg, press and hold down RECOVERY/ESCAPE for 3 seconds, LCD reads E-tAn then 0.000 kg.

3-2 Use UNIT/SHIFT, ▲ and ▼ buttons to input empty tank weight.

EX: Empty tank weight = 8.500 kg

LCD displays 0.000 kg, press UNIT twice and display 0.000 kg, press ▲ for 5 times and display 0.500 kg, press UNIT and display 0.500 kg, press ▲ for 8 times and display 8.500 kg.

3-3 Press TARE/ENTER to save the empty tank weight, LCD reads CAPA then 0.000 kg. Use UNIT/SHIFT, ▲ and ▼ buttons to input full tank weight. Press TARE/ENTER to save full tank weight.

EX: Full tank weight (empty tank weight + refrigerant weight) = 20.500 kg

LCD displays 0.000 kg, press UNIT twice and display 0.000 kg, press ▲ for 5 times and then display 0.500 kg, press UNIT twice and display 00.500 kg, press ▲ twice and display 20.500 kg. Press TARE/ENTER to save full tank weight.