

# UNITEST®



## Instruction Manual Cat.No. 9050

# UNITEST MACHINEmaster

## Machinery and Appliance Tester





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## References marked on instrument or in instruction manual :

⚠ Warning of a potential danger, comply with instruction manual.

📖 Reference. Please use utmost attention.

⚠ Caution! Dangerous voltage, danger of electrical shock.

☐ Continuous double or reinforced insulation complying with category II IEC 60536.

CE Conformity symbol, confirms respect of valid directives. EMV directive (89/336/EEG) including standards EN 61326, EN 50081-1 and EN 50082-1 are fulfilled. Low voltage directive (73/23/EEG) including standard EN 61010-1 is also fulfilled.

⚠ **The instruction manual contains information and references, required for safe operation and maintenance of instrument. Prior to using the instrument, the user is kindly requested to thoroughly read the instruction manual and comply with it in all sections.**

⚠ Failure to read the instruction manual or to comply with the warnings and references contained herein can result in serious personal injury or instrument damage.

### 1.0 General / Introduction

You have acquired a high quality measurement instrument by Ch. BEHA GmbH, allowing you to carry out reproducible measurement over a very long time period. Ch. BEHA GmbH is a member of the world-wide operating BEHA group with its head office in Glottertal/Schwarzwald, which also houses the technological centre. The BEHA group is one of the leading companies for Test and Measurement Instruments. The UNITEST MACHINEmaster is a handy test instrument to carry out measurements in compliance with EN 60204/ IEC 60204 and DIN VDE 0701 / DIN VDE 0701/0702.

### 1.1 Product description

The UNITEST MACHINEmaster is characterised by the following features:

- Test instrument for acceptance and documentation of electrical equipment of machines, control panels and systems, and instruments in compliance with EN 60204/IEC 60204 and DIN VDE 0701/0702.
- Measurements of earth conductor voltage drop, insulation resistance and residual voltage
- Additional measurement of loop resistance
- All measurements in compliance with DIN VDE 0701 /0702
- Test current  $\pm 200$  mA and 10A AC
- Earth conductor resistance in compliance with DIN VDE 0701, Part 1 ( $\pm 200$  mA)
- Insulation resistance
- Substitute leakage current, earth conductor current, differential current
- Measurement of instruments which cannot be disconnected from mains (e.g. PC) in compliance with DIN VDE 0701/0702
- Built-in data memory for approx. 1800 values
- Limit value individually adjustable for each measurement
- With evaluation of measurement results PASS/FAIL
- RS 232 interface
- Recording (Data Logger) for approx. 8000 measurement values

### 1.2 Possible Measurements with the UNITEST MACHINEmaster

Measurement function:	Respective Regulation:
Current consumption ( $I_L$ )	-
Mains voltage ( $V_{L-N}$ )	-
Power (P)	-
Voltage (V)	-
Frequency (f)	-
Loop impedance ( $Z_L$ )	IEC 60204, IEC 60364
Short-circuit current to be expected ( $I_K$ )	DIN VDE 0100
Residual current ( $V_{RES}$ )	IEC 60204
Insulation resistance ( $R_{INS}$ )	IEC 60204
PE voltage drop ( $V_{PE}$ 10A AC)	IEC 60204
PE resistance ( $R_{PE}$ 10A AC)	DIN VDE 0701/0702 Part 1
PE resistance ( $R_{PE} \pm 200$ mA)	DIN VDE 0701/0702 Part 1
Substitute leakage current ( $I_{PE SubS}$ )	DIN VDE 0701/0702
Leakage current during operation ( $I_A$ ), or contact current ( $I_B$ )	DIN VDE 0701/0702
Differential current ( $I_{\Delta}$ )	DIN VDE 0701/0702
EARTH conductor current ( $I_{PE}$ )	DIN VDE 0701/0702

### 1.3 Scope of Supply

- 1 pc UNITEST MACHINEmaster
- 1 pc Test lead COMMANDER 1
- 1 pc. Test lead COMMANDER 2
- 1 pc. Schuko mains connection lead 3x1,5 mm<sup>2</sup> 250V/16A (connection lead in compliance with EN 60320)
- 2 pcs Alligator clamps
- 4 pcs Safety test probes
- 1 pc Carrying case
- 1 pc Instruction manual

### 2.0 Transport and Storage

Please keep the original packaging for later transport, e.g. for calibration. Any transport damage due to faulty packaging will be excluded from warranty claims.

In order to avoid instrument damage, we recommend that accumulators are removed when not using the instrument over a certain period of time. However, should the instrument be contaminated by leaking battery cells, you are kindly requested to return it to the factory for cleaning and inspection.

Instruments must be stored in dry and closed areas. In the case of an instrument being transported in extreme temperatures, a recovery time of at least 2 hours is required prior to instrument operation.

### 3.0 Safety Measures

The UNITEST MACHINEmaster has been built and tested in compliance with the valid safety regulations and left the factory in safe and perfect condition. In order to maintain this condition and to ensure safe instrument operation, the user must pay attention to the references and warnings contained within this instruction manual.

- ⚠ The respective accident prevention regulations established by the professional associations for electrical systems and equipment have to be strictly met for all tasks.
- ⚠ Only use correctly wired and fully functional earthed mains sockets for instrument supply! If any doubts exist regarding function or safety of mains sockets, the user has to proceed with socket test in compliance with DIN VDE 0100 Part 610.
- ⚠ The instrument may only be connected to input voltage as indicated on the type shield. If the measurement instrument displays, PE and an interval sound, the earth conductor is not orderly connected and no measurements may be carried out.

⚠ In order to avoid electrical shock, the valid safety and regulations regarding excessive contact voltage are to be respected when working with voltages exceeding 120V (60V) DC or 50V (25V)rms AC. The values in brackets are valid for limited ranges (such as medical and agricultural applications)

⚠ Measurements in dangerous proximity of electrical systems are only to be carried out in accordance with the instructions of a responsible electrical specialist, and never alone.

⚠ Perform a visual inspection of the test instrument and the connection leads used prior to any use. Ensure that the test instrument and the test leads used are in perfect condition. The test instrument must not be used if one or several functions fail or if the instrument does not appear to be ready for operation.

⚠ If the operator's safety is no longer ensured, the instrument is to be put out of service and not used. The safety is no longer ensured, if the instrument:

- shows obvious damages
- does not carry out the desired measurements
- has been stored for too long under unfavourable conditions
- has been subjected to mechanical stress during transport.

⚠ The instrument may only be used within the operation and measurement range data as specified within the technical data section.

☞ Avoid any heating up of the instrument by direct sunlight to ensure perfect functioning and a long instrument life. The cooling slots on instrument rear may never be covered to ensure perfect air circulation!

⚠ The opening of the instrument, e.g. for fuse replacement, may only be carried out by an authorised service technician. Prior to opening the instrument, ensure that it is switched off and disconnected from all current circuits.

### 3.1 Appropriate Usage

- ⚠ The instrument may only be used under those conditions and for those purposes having originated its conception. For this reason, the safety references (section 3), the technical data including environmental conditions (section 13) and the usage in dry environments have to be complied with.
- ⚠ The operational safety is no longer ensured when modifying or changing the instrument.
- ✎ Any maintenance and calibration operations may only be carried out by our factory service technicians!
- ⚠ An extremely high electromagnetic field can impair the measurement instrument function



## 4.0 Instrument Description

### 4.1 Operation and Display Elements

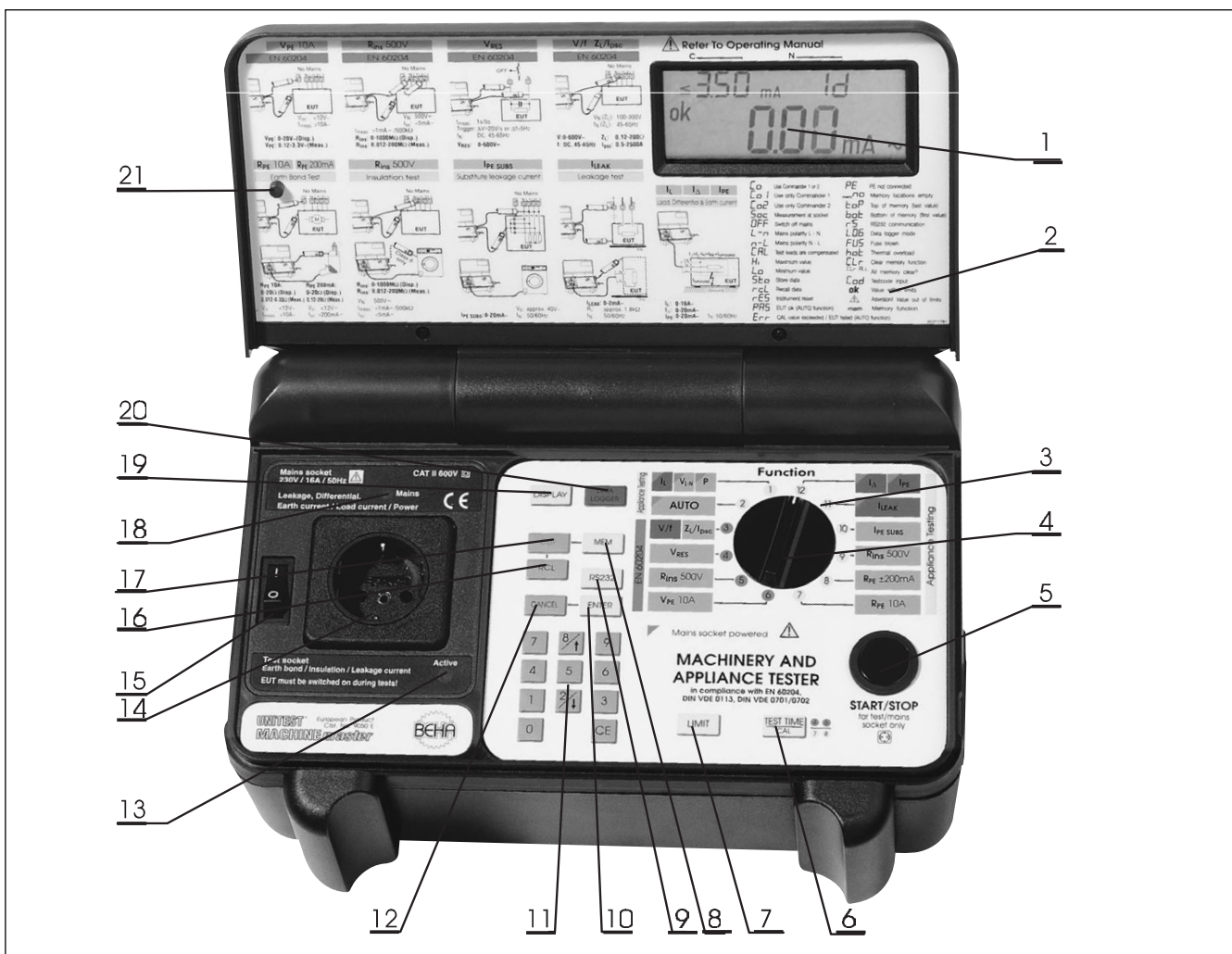


Fig.2.1 Front Panel

#### Explanation of individual operation/display elements

- 1 LCD.
- 2 Cover sticker with brief instructions
- 3 Function number (to detect which function the measurement result saved has to be assigned to)
- 4 Switch Measurement Function
- 5 Key START/STOP, measurements carried out via test/mains socket (14) may be started and stopped by pressing this key.
- 6 Key TEST TIME / CAL is used for:  
setting the measurement time for following both functions:
  - $V_{PE}$  10A from 1 to 20s
  - $V_{RES}$  1 or 5s
 - or compensation of test lead resistance of customer specified test leads or measurement accessories for the following functions:
  - $R_{PE}$  10A (also valid for function  $V_{PE}$  10A)
  - $R_{PE} \pm 200mA$
- 7 Key LIMIT VALUE is used to select limit value for following functions:
  - $V_{PE}$  10A
  - $R_{PE}$  10A
  - $R_{PE}$  200mA
  - $R_{INS}$
  - $I_{PE}$  SUBS
  - $I_{Leak}$
  - $Z_L/I_{PSC}$
 Adjustable limit values, please refer to section 4.9.1.
- 8 Key MEM is used to memorise displayed values.
- 9 Key RS232 is used to transfer memorised values to PC or external serial printer.
- 10 Key ENTER has the following functions:
  - Selection of customer / UUT number
  - Selection of test codes for AUTO function
  - Selection of fuse nominal current / characteristics for limit value input in function  $Z_L$



- 11 Numerical keyboard (0...9, CE)
  - to enter test codes, customer and UUT numbers.
  - key CE is used to correct number entries.
  - keys 8/↑ and 2/↓ are used to select values in loop impedance function (ZI), and to call memorised values.
- 12 Key CANCEL is used to exit one of the following functions: save, call, transfer, clear, and record (Data Logger).
- 13 Lamp ACTIVE indicates that a measurement is presently carried out at test/mains socket
- 14 Test/mains socket
- 15 Switch ON/OFF. This switch is automatically switched off, when closing the instrument cover.
- 16 Key RCL is used to call memorised measurement values.
- 17 Key CLR is used to partially or fully clear memorised measurement values.
- 18 Lamp Mains indicates that mains voltage (230V/max. 16A/50Hz) is present at test/mains socket.
- 19 Key DISPLAY, is used to:
  - switch between differential and ground conductor current display within function IΔ/I<sub>PE</sub>.
  - verify entered date
  - switch between memory location/function code and measurement values when calling memorised values.
  - switch between displayed values within function record (Data Logger).
- 20 Key DATA LOGGER is used to activate RECORD function (Data Logger)
- 21 Power-Off pin activates the ON/OFF switch (15) when closing the instrument cover.

## 4.2 Connections

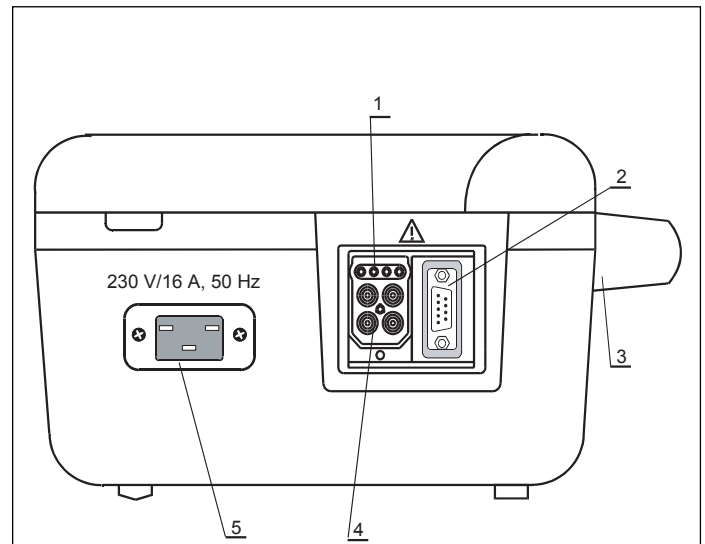


Fig.2.2. Connections

### Explanation of individual instrument connections:

- 1 COMMANDER 1 and 2 (control lines)
- 2 Connection for serial interface RS232 (9-pole)
- 3 Instrument handle
- 4 COMMANDER 1 and 2 (measurement connections)
- 5 Mains connection 230V/16A, 50Hz

⚠ Only use the original test leads supplied and appropriate safety measurement accessories!

⚠ The maximum admissible voltage between the measurement connections sockets is to 600V AC/DC! The maximum admissible voltage of the measurement connection sockets towards ground amounts to 600V AC/DC!

## 4.3 Accessories Supplied

- COMMANDER 1 for measurement in compliance with DIN VDE 0701/0702

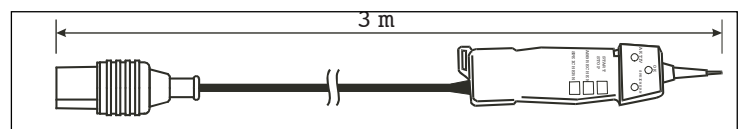


Fig. 2.3 COMMANDER 1

- COMMANDER 2, for measurements in compliance with EN 60204/IEC 60204 and DIN VDE 0701/0702

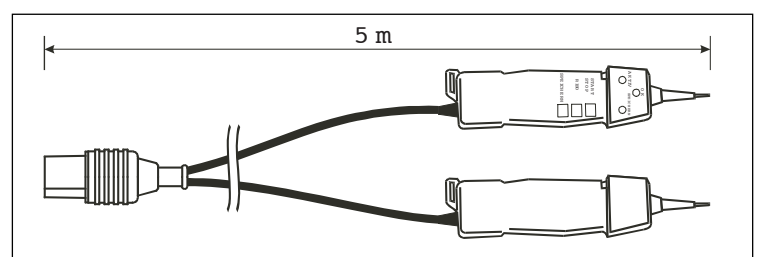


Fig 2.4 COMMANDER 2

## **5.0 General Information regarding the Performance of Measurements**

- ⚠ The test instrument may not be used for measurements in electrical systems!
- ⚠ The maximum admissible mains input voltage is 230V  $\pm 10\%$ , 50Hz.
- ⚠ The test instrument may only be connected to a correctly wired shockproof mains socket. This socket may be protected by maximum 16 A!
- ⚠ The maximum output current of the mains socket is to 16 A! The test instrument may not be used for permanent measurements.
- ⚠ Prior to any use, check the perfect functioning of test instrument and test leads.
- ⚠ The test leads and test probes may only be touched at the handles provided. Never directly touch the test probes.
- ⚠ The measurement connection sockets may not be connected to an external voltage exceeding 600 V AC or DC to avoid instrument damage. The maximum admissible voltage of the measurement connection sockets towards ground amounts to 600 V AC/DC!
- 👉 Mains bias and compensation procedures because of test load can impair the measurement results when measuring the loop impedance. Therefore, several tests should be performed and compared. In order to obtain a reproducible and reliable test result, it is advised to switch off all loads or to disconnect them from the mains.
- 👉 Measurements have to be carried out in compliance with the respectively valid standards and regulations.

## **6 MEASUREMENTS in compliance with EN 60204 / IEC 60204**

### **6.0 General Information regarding Measurements in compliance with EN 60204 / IEC 60204**

Prior to instrument commissioning or during repeat tests, the safety of electrical and electronic equipment has to be checked and documented by carrying out appropriate tests. All tests required are described in the standard EN 60204 / IEC 60204.

If the electrical equipment is connected to the machine, the following tests have to be carried out:

- Continuity of the protective bonding circuit.
- Insulation resistance (as destruction-free preliminary test to high voltage test)
- Voltage test (Flash test)
- Protection against residual voltages

Here, the machine equipment starts at mains connection point and ends at the furthest instrument point. According to EN 60204 / IEC 60204 the following are considered as machines, e.g.:

- Metal processing and working machines
- Rubber and plastic machines
- Assembly machines
- Conveying technology
- Food machines
- Print, paper and cardboard machines
- Test and measurement instruments
- Packaging Machines
- Leather, simulated leather and shoe machines
- Washing plants
- Construction and building material machines
- Compressors
- Pumps Mining and rock crushing machines
- Cooling and air conditioning systems
- Heating and venting units
- Elevators
- Pig iron working machines
- Leisure Centres
- Movable machines (e.g. agriculture and forestry)
- Vehicles for human transport
- Textile machines
- Transportable machines
- Household machines
- Etc.

The UNITEST MACHINEmaster is equipped with a built-in data memory and a serial interface. The optional software allows documentation of measurement values on the PC.

Voltage testing is carried out by using model UNITEST 0113 High Voltage Tester, Cat. No. 9030.

**Individual Descriptions of Testing:**

- Continuity of the protective bonding circuit.

Earth conductor test at a test current of 10 A / 50 Hz, displaying the voltage drop (see section 6.1) or loop impedance measurement (see section 6.2)

Limit Values:

- 3.3 V at 1.0 mm<sup>2</sup>
- 2.6 V at 1.5 mm<sup>2</sup>
- 1.9 V at 2.5 mm<sup>2</sup>
- 1.4 V at 4.0 mm<sup>2</sup>
- 1.0 V at > 6 mm<sup>2</sup>

- **Insulation resistance** at test voltage of 500 V and a limit value of 1 MΩ (see section 6.3)
- **Voltage test at 1000 V** or 1500 V AC (500 VA) for minimum 1 s
- **Protection against residual voltages**, 1 s or 5 s after switching-off, voltage must be below 60 V (see section 6.4).

⚠ Measurements in dangerous proximity of electrical systems are only to be carried out in accordance with the instructions of a responsible electrical specialist, and never alone.

⚠ Only touch test leads and test probes at handles provided. Direct touching of test probes has to be strictly avoided.

**6.1 Earth Conductor Voltage Drop  $V_{PE}$  10A complying to EN 60204 / IEC 60204**

**Measurement Function 6**

To check continuous connection of earth conductor system, the measurement has to be carried out at a test current of minimum 10 A in compliance with EN 60204 / IEC 60204.  
For limit values, please refer to table 1:

$V_{PE}$ max.	PE Conductor cross- section
3.3V	1.0mm <sup>2</sup>
2.6V	1.5mm <sup>2</sup>
1.9V	2.5mm <sup>2</sup>
1.4V	4.0mm <sup>2</sup>
1.0V	≥6.0mm <sup>2</sup>

Table 1

⚠ **Prior to any earth conductor voltage drop measurement, ensure that UUT has been disconnected from mains and that no voltage is present. Failure to comply with this warning can lead to serious corporal injuries or instrument damage.**

⚠ Impedances of supplementary operational current circuits switched in parallel or transient currents may have influences to the measurement results.

**How to carry out the measurement?**

The measurement may only be carried out by using COMMANDER 2.

**STEP 1**

- Connect UNITEST MACHINEmaster mains cable to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on measurement instrument and turn switch "Measurement Function" to position  $V_{PE}$  10A (6). The following is displayed:

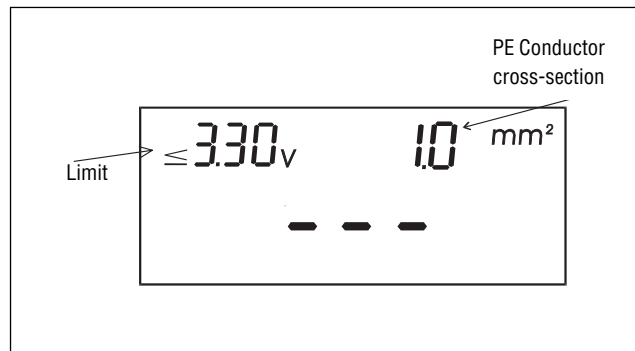


Fig.6.1

If the test leads have been compensated, **CAL** is displayed after having set the switch "Measurement Function" to  $R_{PE}$  10 A. Also refer to "Compensating Test Leads" in section 7.3.1.

### STEP 2

- Select limit value for voltage drop with reference to conductor cross-section applied, by using the key "LIMIT" (see table 1).
- Set respective measurement time (1s to 20s) by using key TEST TIME/CAL.

### STEP 3

- Connect COMMANDER 2 test probes (use measurement accessories, if required) to UUT, as shown in Fig. 6.2:

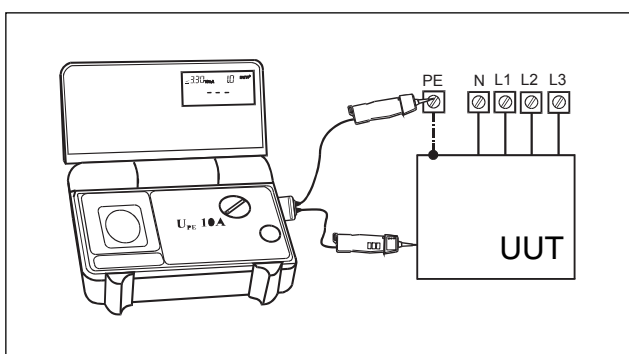


Fig.6.2

### STEP 4

- Briefly press key START/STOP at COMMANDER 2, the ACTIVE lamp is illuminated. Measurement running time is indicated on the LCD. Upon completion of measurement, the last measured value is displayed:

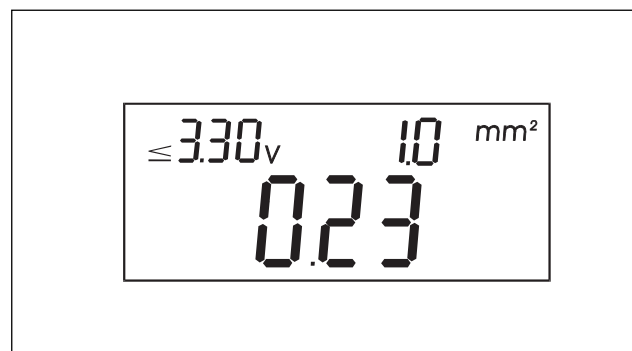


Fig.6.3

OK is displayed, if the limit value has been fulfilled, otherwise, the symbol  $\Delta$  is displayed and a long acoustic signal is audible.

- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" at COMMANDER 2 or key „MEM“ at UNITEST MACHINE-master (for further information, see section 9.2 "Saving Measurement Results").

### NOTE!

- **OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.**
- **Set limit values are maintained even after having switching off the instrument.**
- **During this function  $V_{PE}$  measurement values, measurement time as well as limit value are memorised.**
- **Message 002 is displayed, connect COMMANDER 2.**
- **Prior to measurement of earth conductor voltage drop, remove UUT from current circuit.**
- **If the voltage present at test probes exceeds 30 V when starting the measurement, the voltage is displayed and the measurement will not be carried out.**
- **The test leads have to be compensated when using additional measurement accessories (see 7.3.1).**

## 6.2 Voltage V/Frequency f and Loop Impedance $Z_L$ / Prospektive Short-circuit Current $I_{PSC}$ , according to EN 60204 / IEX 60204

### Measurement Function 3

⚠ Mains bias and compensation procedures because of test load can impair the measurement results when measuring loop impedance. Therefore, several tests should be performed and compared. In order to obtain a reproducible and reliable test result, it is advised to switch off all loads or to disconnect them from the mains.

### How to carry out V/f measurements?

⚠ The measurement can only be carried out by using COMMANDER 2.

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on the instrument and set the switch Measurement Function to position 3 (V/f,  $Z_L/I_{PSC}$ ). ACTIVE lamp of COMMANDER 2 starts lighting and indicates that measurement is running at COMMANDER 2.

The following is displayed:

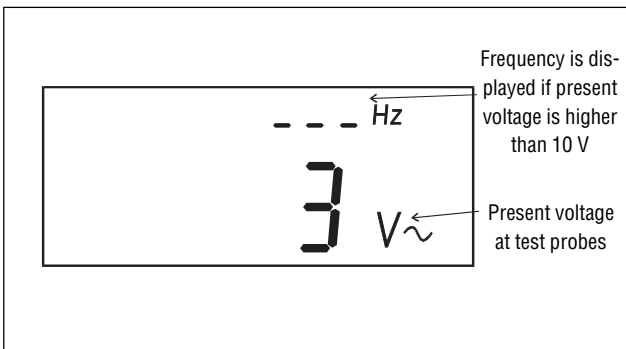


Fig. 6.4

#### STEP 2

- Connect test probes of COMMANDER 2 to UUT (use measurement accessories, if required) as shown in Figure 6.5. Voltage value V and frequency value f are continuously displayed without key pressing. (Figure 6.6):

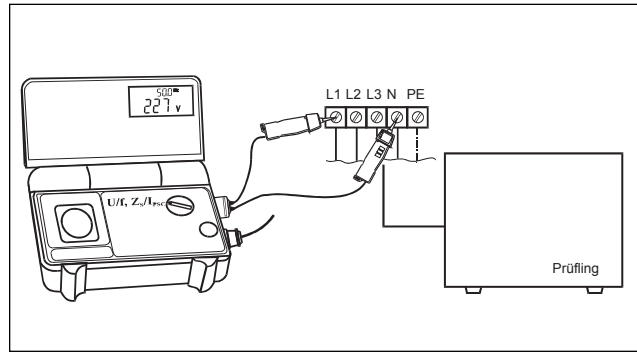


Fig.6.5

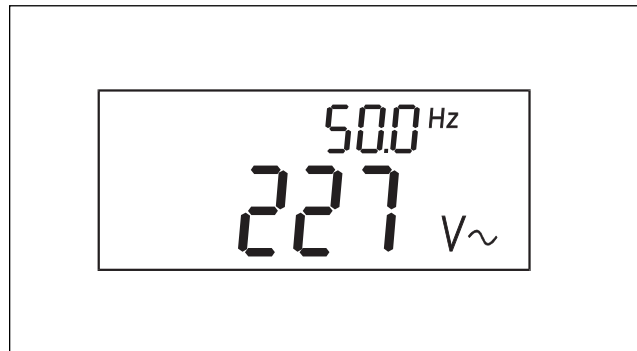


Fig. 6.6

#### NOTE!

- If the voltage displayed falls below 10V, "--- Hz" is displayed instead of the actual frequency.
- The high-resistance input (approx. 40 MΩ) enables voltage display even for one-pole connection. This display, however, is incorrect. To guarantee that no voltage is present, voltage testers complying with EN 61243-3 have to be used (e.g. UNITEST 2000 alpha, Cat.No. 6741).
- Frequency is only displayed between 45 and 65 Hz, otherwise "oL" is displayed.
- UNITEST MACHINEmaster can display DC and AC voltages. For DC voltage display, refer to Figure 6.7

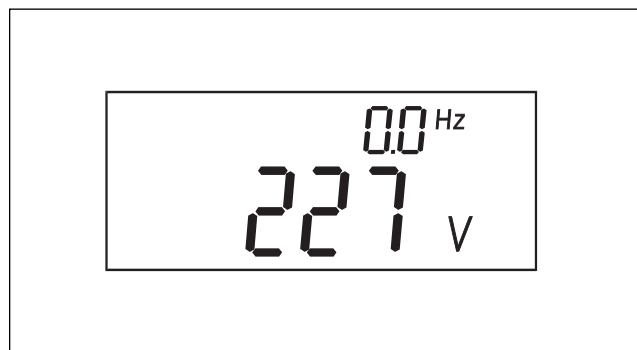


Fig. 6.7

- If COMMANDER 1 or no COMMANDER is connected, the following message is displayed: C02. If this is the case, connect COMMANDER 2.

- The measurement result V/f cannot be saved.

### How to carry out the $Z_L/I_{PSC}$ measurement?

After having installed UUT and the electrical connections being complete, including the connection to the power supply, the earth conductor continuity can be verified by means of a loop impedance measurement in compliance with DIN VDE 0113/EN 60204. The measurement can be used for machines with earth conductor loops not exceeding approximately 30 m, otherwise a voltage drop measurement can be carried out at PE conductor (see 6.1).

- ☞ The loop impedance measurement can only be carried out by using COMMANDER 2.

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on the instrument and set switch Measurement Function to position 3 (V/f,  $Z_L/I_{PSC}$ ). ACTIVE lamp of COMMANDER 2 starts lighting.

#### STEP 2

- Check limit value set for loop impedance  $Z_L$  by pressing LIMIT VALUE key.  
The following is displayed:

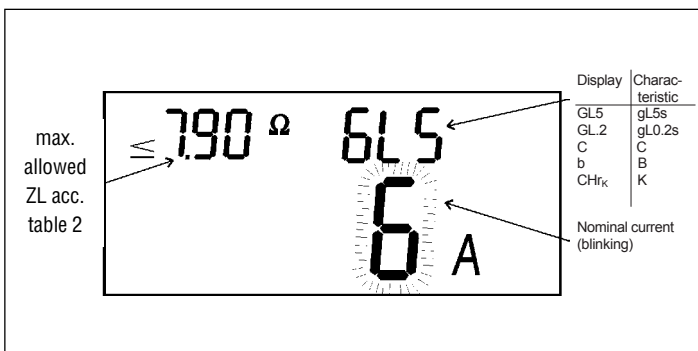


Fig.6.8

Keys 8/↑ and 2/↓ are used for nominal current setting of excessive current protection device (see table 1)  
Key "ENTRY" is used to switch between nominal current and characteristic.

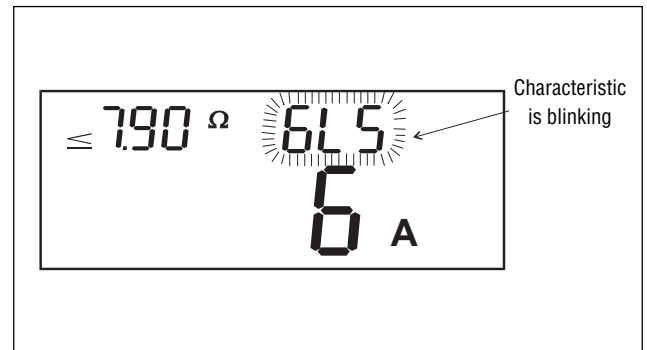


Fig. 6.9

Press key "CANCEL" to terminate limit value entry.

$V_{\text{mains}} = 230 \text{ V} / 50 \text{ Hz}$	Fuses at Low Voltage according to DIN VDE 0636 with gL Characteristic				Protection Switch and Overload Protection Devices with: Characteristic B, C and K					
$I_n$ A	gL		gL 0,2 s		B		C		K	
	$I_a(5 \text{ S})$ A	$Z_L(5 \text{ S})$ $\Omega$	$I_A(0,2 \text{ s})$ A	$Z_L(0,2 \text{ s})$ $\Omega$	$I_A=5I_n$ A	$Z_L(\leq 0,2 \text{ s})$ $\Omega$	$I_a=10I_n$ A	$Z_L(0,2 \text{ s})$ $\Omega$	$I_a=15I_n$ A	$Z_L(0,2 \text{ s})$ $\Omega$
2	9.21	23.9	20	11.0	10	22	20	11	30	7.3
4	19.2	11.5	40	5.5	20	11	40	5.5	60	3.7
6	28	7.9	60	3.7	30	7.3	60	3.65	90	2.4
10	47	4.7	100	2.2	50	4.4	100	2.2	150	1.5
16	72	3.1	148	1.5	80	2.8	160	1.4	240	0.9
20	88	2.5	191	1.2	100	2.2	200	1.1	300	0.7
25	120	1.8	270	0.8	125	1.8	250	0.9	375	0.6
32	156	1.4	332	0.7	160	1.4	320	0.7	480	0.5
35	173	1.3	367	0.6	175	1.3	350	0.65	525	0.4
40	200	1.1	410	0.5	200	1.1	400	0.55	600	0.37
50	260	0.8	578	0.4	250	0.9	500	0.45	750	0.29
63	351	0.6	750	0.3	315	0.7	630	0.35	945	0.23
80	452	0.5	—	—	—	—	—	—	—	—
100	573	0.4	—	—	—	—	—	—	—	—
125	751	0.3	—	—	—	—	—	—	—	—
160	995	0.2	—	—	—	—	—	—	—	—

Table 2.  
Max. admissible  $Z_L$  Impedance and Short-circuit Currents from EN 60364-6-61

### STEP 3

- Connect COMMANDER 2 test probes to UUT (use measurement accessories, if required) (see Fig. 6.10). The measurement result for  $V/f$  will be displayed.

**If frequency is not within the frequency of 45...65 Hz, no loop measurement may be started, the instrument shows "FR".**

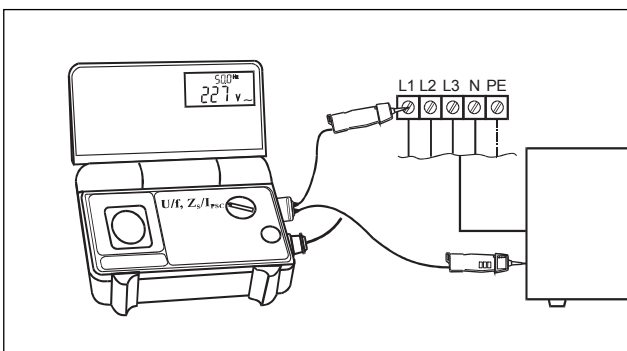


Fig. 6.10

### STEP 4

- Start measurement via key "START/STOP" at COMMANDER 2. The measurement result is displayed as follows:

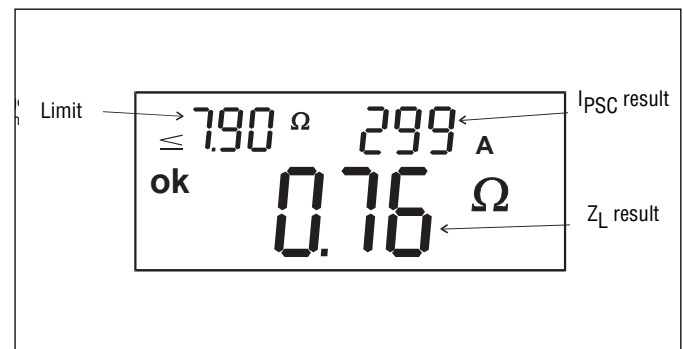


Fig. 6.11

OK is displayed if the  $Z_L$  result is below the admissible value, otherwise, the symbol  $\Delta$  is displayed. .

- Memorise the measurement result displayed by pressing key **SAVE** at COMMANDER 2 or at UNITEST MACHINEmaster (for further information, please refer to section 9.2. "Saving Measurement Results").



#### NOTE !

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.
- Set limit values are maintained even after having switching off the instrument.
- During this function, measurement values  $Z_L/I_{PSC}$  as well as limit value  $Z_L \text{ max.}$  are memorised.
- Measurements can only be carried out, if a voltage between 100 V and 300 V AC is present at test probes, otherwise, only the voltage is displayed and  $Z_L/I_{PSC}$  measurement is not carried out.
- In case message  $\square\square2$  is displayed, connect COMMANDER 2 or start measurement at COMMANDER 2.

### 6.3 Insulation Resistance $R_{INS}$ in compliance with EN 60204 / IEC 60204

#### Measurement Function 5

- ⚠ The UUT/machinery must be disconnected from the mains during the insulation test, and it must be ensured that all loads of the machinery under test are switched on. Failure to respect these references can lead to instrument damage.
- ⚠ The UUT/the machinery under test may not be touched during the measurement, danger of electrical shock!
- ⚠ **Insulation measurement causes charging of capacitive UUTs. Upon termination of measurement, the UNITEST MACHINEmaster automatically discharges UUT. When interrupting the measurement, a dangerous voltage may remain at UUT. If a dangerous voltage has been detected by means of measurement function 3 (V/f), the UUT has to be discharged by using a high-ohm resistance (not via short-circuit!).**

#### How to carry out the measurement ?

The measurement may only be carried out by using COMMANDER 2.

##### STEP 1

- Connect UNITEST MACHINEmaster mains cable to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on measurement instrument, and set switch Measurement Function to position  $R_{INS}$  500V (5). The following is displayed:

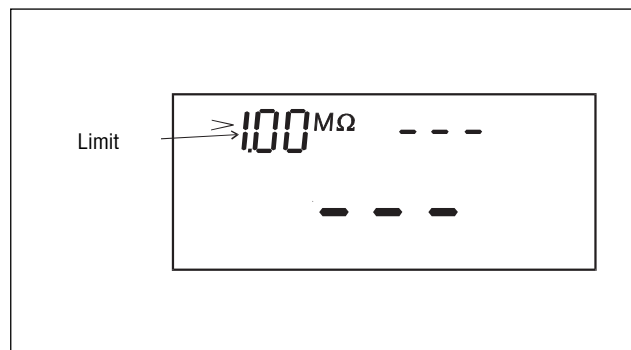


Fig.6.12

##### STEP 2

- The limit value of insulation resistance is set to 1 MΩ according to EN 60204 / IEC 60204 and cannot be modified.

##### STEP 3

- Connect COMMANDER 2 test probes (or measurement accessories, if required) to UUT, see Figure 6.13:

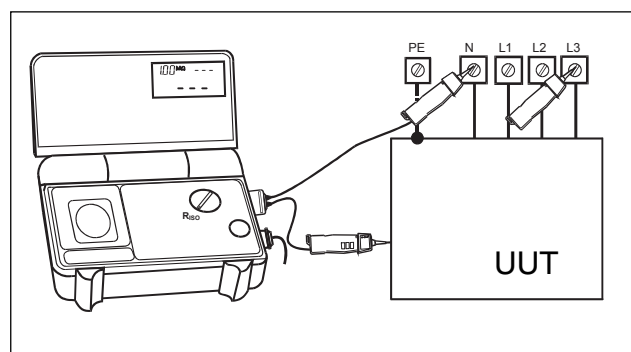


Fig.6.13

#### STEP 4

- Press "START/STOP" at COMMANDER 2 and keep pressed until stabilisation of measurement result displayed. The COMMANDER 2 ACTIVE lamp is illuminated and indicates the active measurement. Release key, UUT is automatically discharged. The following measurement result is displayed (Fig.6.14):

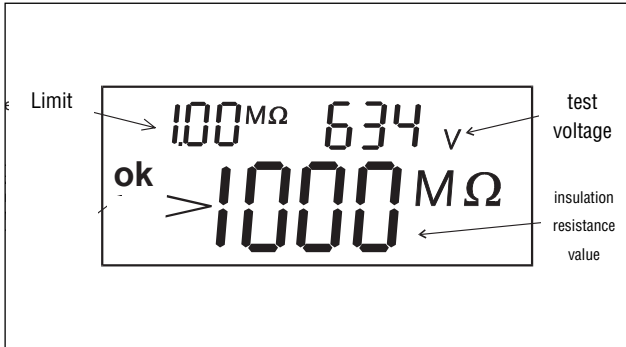


Fig. 6.14

OK is displayed when limit value has been fulfilled, otherwise the symbol  $\Delta$  is displayed.

- Memorise the measurement result displayed, if desired. For this purpose, press key "MEM" at COMMANDER 2 or at UNITEST MACHINEmaster (for further information, see section 9.2 "Saving Measurement Results").

#### NOTE!

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.**
- Set limit values are maintained even after having switching off the instrument.**
- During this function RINS measurement values as well as limit value are memorised.**
- In case message Co2 is displayed, connect COMMANDER 2 or start measurement at COMMANDER 2.**
- Prior to measurement of insulation resistance, remove UUT from current circuit.**
- If the voltage present at test probes exceeds 50 V when starting the measurement, the voltage is displayed and the measurement will not be carried out**
- Do not touch UUT during testing !**
- Only remove commander leads from UUT upon termination of measurement to ensure perfect discharge.**
- UUT discharge is carried out automatically upon completion of measurement!**

## 6.4 Residual Voltage $V_{RES}$

### Measurement Function 4

Definition of Residual Voltage (Fig. 6.15):

Residual voltages are defined as voltages still present after having switched off an instrument or a machine. This voltage may be caused, e.g. by capacitors or generator after-running. In compliance with EN 60204/IEC 60204, residual voltages for fixed installations have to be discharged within 5 s down to  $\leq 60$  V, for instruments with plug connections, the discharge time amounts to 1 s. The built-in measurement function of UNITEST MACHINEmaster  $V_{RES}$  (4) may be used to proof or measure discharge.

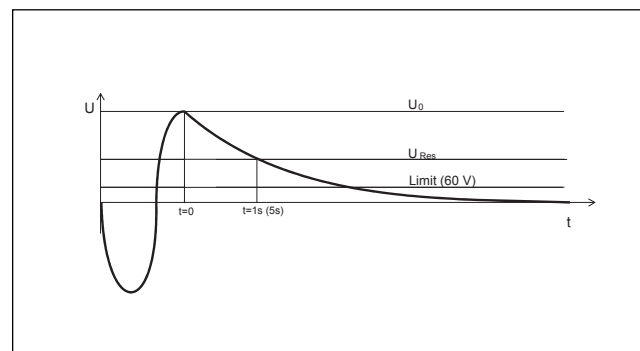
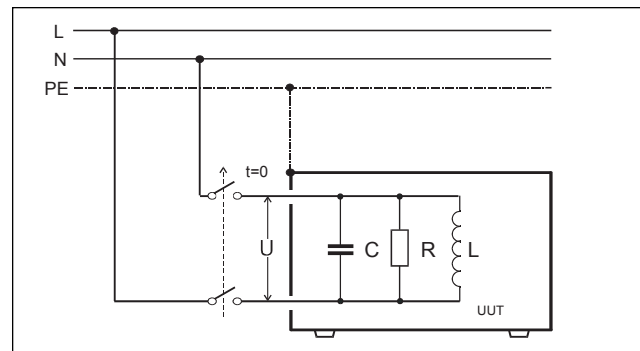


Fig.6.15

Fig 6.16 Possible Voltage Diagram after Switching-off Mains Voltage

- $V_0$  Voltage present at UUT at time  $t=0$  (directly after switch-off)
- $V_{RES}$  Voltage 1s (or 5s) present at UUT after having switched off the mains voltage.

## How to carry out the measurement?

The measurement may only be carried out by using COMMANDER 2.

### STEP 1

- Connect UNITEST MACHINEmaster mains cable to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on measurement instrument and turn switch "Measurement Function" to position  $V_{RES}$  (4). The following is displayed:

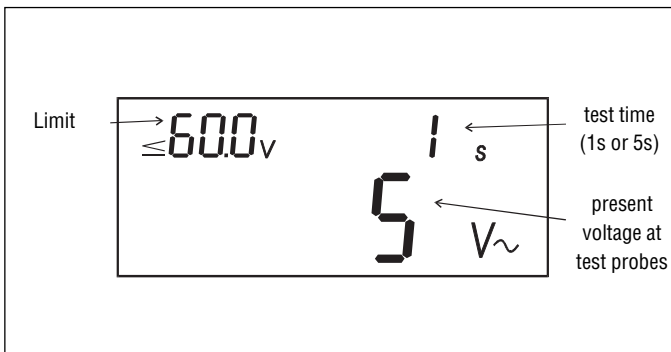


Fig.6.17

### STEP 2

- Check set measurement time and modify, if required, by pressing key "TEST TIME/CAL". The value may be set to either 1s (for UUTs with plug-on connection) or to 5s (for fixed UUT).

### STEP 3

- Connect COMMANDER 2 test probes (use measurement accessories, if required) to UUT, as shown in Fig. 6.18:

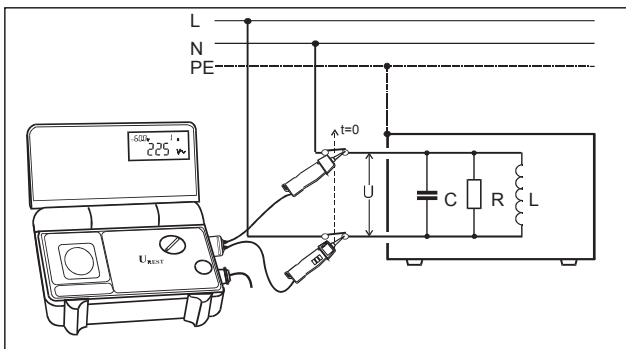


Fig.6.18

☞ Voltage present is displayed without key pressing.

### STEP 4

- Press START/STOP key at COMMANDER 2 "OFF" starts blinking on the LCD. Simultaneously Commander 2 "ACTIVE" lamp is illuminated and indicates that the instrument is ready for operation. To start measurement, UUT has to be switched off or mains voltage of UUT has to be interrupted.

### STEP 5

- Interrupt mains voltage. Residual voltage measurement is automatically generated, either by voltage modification ( $\Delta V > 20V/s$ ) or by frequency modification ( $\Delta f > 5Hz$ ). Value of voltage present at test probes is displayed. After elapsed measurement time, the voltage still present is recorded and compared with the limit value.

When exceeding the limit value,  $\Delta$  is displayed, an acoustic signal is audible. Measurement results below 60 V are evaluated by symbol ok.

- Measurement result save. For this purpose, press key "SAVE" on COMMANDER 2 or at UNITEST MACHINEmaster (for further information, see section 6.2 "Saving Measurement Results").
- Press key "START/STOP" at UNITEST MACHINEmaster. The measurement instrument returns to initial mode (STEP 1).

### NOTE!

- **OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.**
- **Set limit values are maintained even after having switching off the instrument.**
- **During this function  $V_{RES}$  measurement values as well as limit value are memorised.**
- **If message  $\square 02$  is displayed, connect COMMANDER 2 or start measurement at COMMANDER 2.**

## **7.0 General Information for Performing Appliance Tests in Compliance with DIN VDE 0701/0702**

The accident prevention prescriptions regarding electrical systems and equipment of the "Berufsgenossenschaft" [German employer's liability insurance association] defines the time frame for testing electrical instruments:

- Prior to first initial use as well as after modification, maintenance and prior to re-operation as well as in defined TIME INTERVALS.
- For portable appliances this TIME INTERVAL generally amounts to 6 months (3 months for building sites).

Depending on the intensity of use, the time interval should be kept flexible, provided that the instrument safety is always ensured. The maintenance interval for building sites can be extended to maximum 12 months, for indoor use to maximum 24 months.

The DIN VDE regulation of the DIN VDE 0701 and DIN VDE 0701/0702 range defines test sequence and limit values.

### **7.1 Explanation of Technical Terms**

#### **Leakage Current:**

The leakage current is defined as the current flowing from a UUT via the insulation. This can be either via the casing, or via touchable and conductible parts, or via the PE, or via additional earth connections (e.g. antenna connection, water connection) of a UUT.

#### **Touching Current:**

A current measurement of touchable and conductible parts of a UUT towards earth, limit value in compliance with DIN VDE 0701/0702 is 0.5 mA. The measurement can be carried out either directly or in compliance with the differential current procedure.

The contact current measurement is carried out for instruments of protection class II equipped with touchable and conductible parts, or for instruments of protection class I equipped with touchable and conductible parts not being connected to the PE. The measurement must be carried out for both mains plug positions, in case the mains plug is reversible.

#### **Differential Current:**

According to DIN VDE 0701/0702, this is a measurement procedure to determine the protective conductor or the contact current. This is determined by a cumulative current measurement including all active conductors (L1-L2-L3-N) of a UUT. With this procedure, the total UUT leakage current can be measured. The measurement must be applied if the UUT is equipped with an additional earth connection or cannot be installed instead from earth. This measurement procedure is used for the UNITEST MACHINEmaster.

#### **Substitute Leakage Current:**

According to DIN VDE 0701 it is an alternative measurement procedure to determine the protective conductor or contact current. In accordance with DIN VDE 0702, this measurement is considered as a substitute for insulation measurement. It can be applied if instruments equipped with heating elements of protection class I do not meet the insulation values requested. This measurement procedure determines the leakage current being deviated via the protective conductor or a touchable part without including the mains voltage.

#### **Insulation Measurement:**

A measurement of the insulation resistance between active parts (L1-L2-L3-N) and the protective earth conductor (PE) within a system, an instrument or a machinery. Here, a test voltage of 500 V DC is used in compliance with DIN VDE 0701/0702.

The limit values differ; please refer to the practical references.

#### **Testing the Presence of Voltage:**

Also called leakage current in operation and is determined by a current measurement for touchable and conductible UUT parts towards earth in compliance with DIN VDE 0701 Part 240. The limit value according to DIN VDE 0701 Part 240 amounts to 0.25 mA. This measurement is similar to the contact current measurement.

#### **Protection Class I:**

Instruments of protection class I are instruments with basic insulation between active (live) parts and the casing. For structural reasons, the metal casing or metal casing parts must be connected to the protective earth conductor. Instruments belonging to protection class I are equipped with a shockproof connection mains plug.

#### **Protection Class II:**

Instruments of protection class II are equipped with a continuously reinforced or additional insulation between the active (live) parts and the casing. However, such instruments may contain touchable, metallic parts. Instruments belonging to protection class II are equipped with a mains plug without shockproof connection facility.

### Protection Class III:

Instruments of protection class III are exclusively destined for connecting to SELV [safety extra low voltage] current circuits, or to circuits being only supplied by an internal current source with PELV (protective low voltage).

### Protective Earth Conductor Current:

This is a part of the UUT leakage current being returned within the protective earth conductor (PE). The limit value according to DIN VDE 0701/0702 amounts to 3.5 mA. The protective earth conductor current is determined either by a direct current measurement within the UUT protective conductor or by the differential current procedure. The direct measurement can be applied if the UUT is not equipped with additional earth connection or can be installed as stand-alone. The measurement has to be carried out for both mains plug positions, in case the mains plug is reversible. According to DIN VDE 0701:2000-09, the protective earth current measurement represents an additional measurement for insulation capacity for instruments belonging to protection class I.

According to DIN VDE 0702, we are dealing with a substitute measurement for insulation measurement for instruments belonging to protection class I for which the insulation measurement cannot or may not be carried out.

### Protective Earth Conductor Resistance:

This is the protective earth conductor (PE) resistance starting from the mains connection point (earthing contact of mains plug) to all touchable, metallic UUT casing parts which should be connected to the protective earth conductor. During the protective conductor measurement, the connecting line has to be moved across the whole length in sections. This measurement can only be carried out for instruments belonging to protection class I.

### Visual Inspection:

Emphasis has to be laid on the electrical safety of the instruments parts to ensure that they do not show any damage. The following features have to be considered in particular:

- Casing, protective covers
- Connection leads and plugs
- Condition of insulations
- Strain relief, protection against buckling, and conductor installation
- Signs of overload or inappropriate use
- Inadmissible interventions or modifications
- User accessible fuse holders or fuse inserts
- Cooling openings and air filters, Protective covers, Overpressure valves, Fixtures, Contamination or corrosion presenting security impediments
- Labelling for safety reasons

### 7.1.2 Performing Tests in Compliance with DIN VDE 0701 Part 1 (edition 2000-09)

DIN VDE 0701 defines the electrical safety requirements for electrical appliances. Here, tests and limit values for overhauled or modified instruments are indicated. The appropriate use must not present a danger for the user or the environment after repair or modification.

#### The test sequence is as follows:

- 1.) Visual inspection
  - 2.) PE conductor test (for appliances of protection class I)  
The limit value is 0.3  $\Omega$  for appliances with connection leads up to 5m, increased by 0.1  $\Omega$  for every further 7.5 m, up to a max. 1.0  $\Omega$ .
  - 3.) Insulation resistance measurement (if applicable).  
The limit value is  
1M $\Omega$  for appliances of protection class I  
2M $\Omega$  for appliances of protection class II  
0,25M $\Omega$  for appliances of protection class III  
0,3M $\Omega$  for instruments of protection class I with heating elements
  - 4a.) Measurement of the PE conductor current (for instruments belonging to protection class I)  
The limit value is 3.5 mA  
The protective earth conductor current may be measured either directly via the substitute leakage current method, or via the differential current method.
  - 4b.) Measurement of the touching current (for instruments belonging to protection class II)  
The limit value is 0.5 mA  
The contact current may be measured either directly via the substitute leakage current method, or via the differential current method.
- ☞ This measurement must also be carried out for instruments belonging to protection class I, which are equipped with touchable, conductible parts.
- 5.) Functional Test
  - 6.) Test of labelling

### 7.1.3 Carrying out Tests in compliance with DIN VDE 0702 Part 1 (edition 1995-11)

DIN VDE 0702 defines test procedures and limit values for repeat tests. The repeat test is defined as a test carried out in determined time intervals with the objective to prove electrical safety for electrical instruments. It must be ensured that the protection is effective against direct or indirect contact. DIN VDE 0702 is valid for electrical instruments, which can be separated from the electrical system by a plug-in device.

#### The test sequence is as follows:

- 1.) Visual inspection
  - 2.) PE resistance measurement (for appliances of protection class I)  
The limit value is  $0.3\Omega$  for appliances with connection leads up to 5m, increased by  $0.1\Omega$  for every further 7.5m.
  - 3.) Insulation resistance measurement  
The limit value is  
 $0.5M\Omega$  for appliances of protection class I  
 $2M\Omega$  for appliances of protection class II  
 $0.25M\Omega$  for appliances of protection class III
  - 4.) Measurement of the substitute leakage current  
The limit value is  
7 mA for appliances of protection class I with heating capacity  $\leq 6\text{ k}\Omega$   
15 mA for instruments belonging to protection class I with heating capacity  $>6\text{ k}\Omega$
- ☞ For appliances of protection class I, equipped with heating elements for which the insulation resistance requested is not met, a substitute leakage current measurement has to be performed.

- 5.) Measurement of the protective conductor current (for appliances of protection class I)

The limit value is 3.5 mA

- ☞ This is a substitute measurement to the insulation measurement for appliances of protection class I.

- 6.) Measurement of the contact current (for instruments belonging to protection class II)

The limit value is 0.5 mA

- ☞ This is a substitute measurement to the insulation measurement for appliances of protection class II, or for appliances class I with touchable, conductible parts.

## 7.2 PE Resistance $R_{PE} \pm 200mA$ or 10A in compliance with DIN VDE 0701, Part 1 / DIN VDE 0702 Part 1

### Measurement Function 8 and 7

For appliances of Protection class I, the low-ohm continuity of earth conductor between earth contact of mains plug and touchable metal parts, having to be connected to earth conductor in compliance with DIN VDE 0701/0702, has to be verified.

#### 7.2.1 Compensation of Test Leads (if desired)

Resistance of COMMANDERS supplied, except additional alligator clamps, test probes or any further measurement accessories, has been compensated by the factory, prior to delivery. For this purpose, a renewed compensation is not required. However, should additional accessories be used, the compensation has to be carried out as follows:

##### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect required COMMANDER to UNITEST MACHINEmaster, switch on the instrument and set switch "Measurement Function" to position  $R_{PE} \pm 200mA$  or  $R_{PE} 10A$ .

##### STEP 2

- Press key "TEST TIME/CAL". The following is displayed.

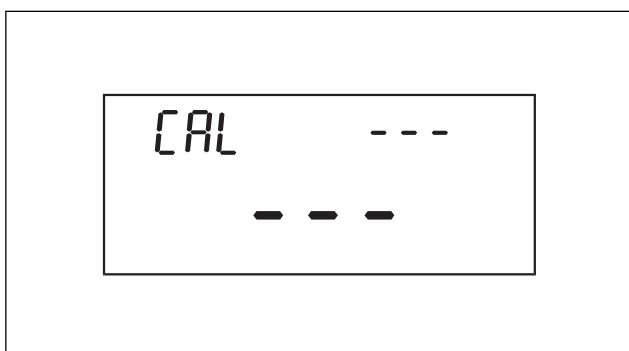


Fig.7.1

- Connect additional measurement accessories (test probe, alligator clamp or test leads) to COMMANDER, short-circuit test probes as shown in Figure 7.2.

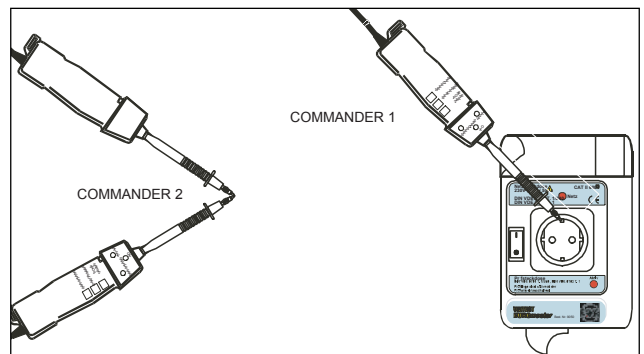


Fig.7.2

##### STEP 3

- Briefly press key START/STOP of COMMANDER. The COMMANDER 2 ACTIVE lamp is illuminated and indicates active measurement. Measurement accessories resistance is displayed
- The following result is displayed (Fig. 7.3):

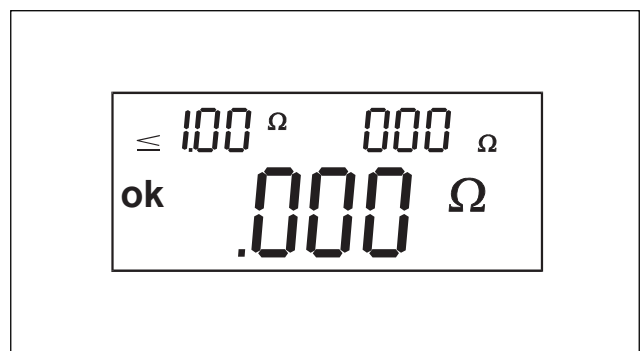


Fig. 7.3 Test lead compensation, function 8

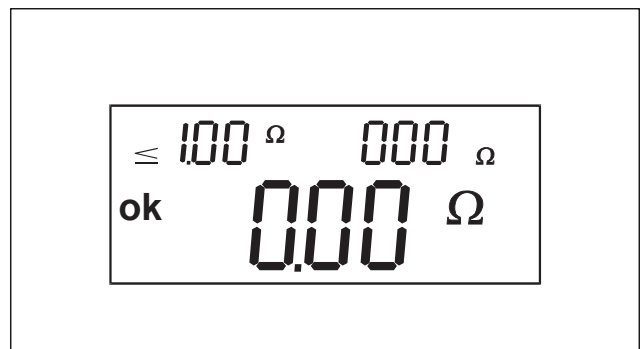


Fig. 7.4 Test lead compensation, function 7

Measurement accessory resistance has thus been compensated and the instrument is ready for operation. For any subsequent measurements, the compensated value obtained is deducted from the measurement value.



#### NOTE!

- **OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.**
- **Set limit values are maintained even after having switched off the instrument.**
- **The maximum resistance to be compensated is to 5Ω. If a larger resistance is displayed after measurement, no compensation is carried out, and ERR is briefly displayed. Thereafter, CLR is displayed to indicate that the compensated value has been cleared. This procedure is also used to clear a memorised compensation. For this purpose, press key "TESTTIME/CAL" and start measuring with open test probes.**  
**A perfect contact has to be ensured during compensation. Otherwise further errors may occur during measurements.**

#### How to carry out the measurement?

The measurement may be carried out either by means of COMMANDER 1 in conjunction with Test/Mains Socket or COMMANDER 2.

⚠ Prior to any earth conductor resistance measurement, ensure that UUT has been disconnected from mains and that no voltage is present. Failure to comply with this warning can lead to serious personal injuries or instrument damage.

#### 7.2.2 Measurement of PE Resistance at Fixed installed appliances

##### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on the instrument and set switch Measurement Function to position RPE ±200mA or RPE 10A. The following is displayed:

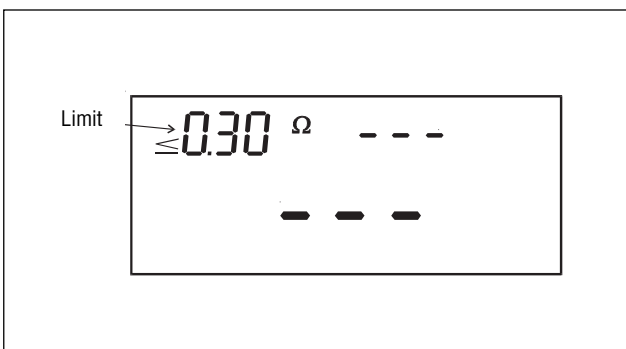


Fig 7.5

In case test leads have been compensated CAL is displayed after having set the switch Measurement Function to RPE ±200mA (also refer to "Compensation of Test Leads", section 7.2.1).

##### STEP 2

- Select desired limit via key LIMIT, which may be set to either 0.3Ω, 1Ω or in function 7 (RPE 10A) additional..

⚠ Under no circumstance may, the resistance value exceed 0.3 Ω. This value is valid for fixed connection lines up to a length of 5 m. For fixed connection lines exceeding 5 m, this value is increased by respectively 0.1 Ω for each further 8.5 m connection length. According to DIN VDE 0701, the maximum admissible protective earth conductor resistance is 1Ω.

##### STEP 3

- Connect test probes of COMMANDER 2 (with measurement accessories, if required) to UUT, as shown in figure 7.6:

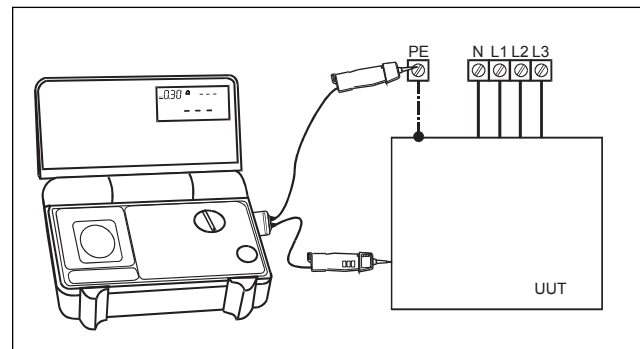


Fig.7.6

#### STEP 4

- Briefly press key START/STOP at COMMANDER 2. ACTIVE lamp at COMMANDER 2 is illuminated and indicates active measurement. Release the key. The last measurement value is displayed:

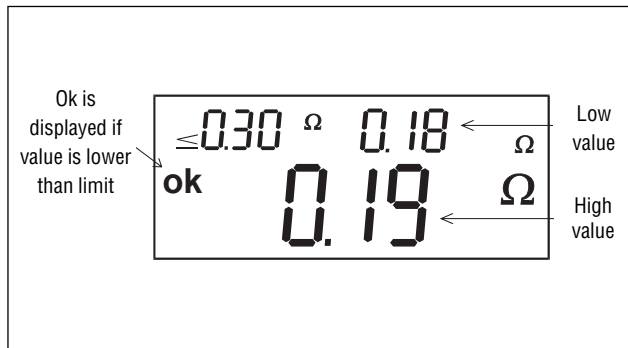


Fig.7.7

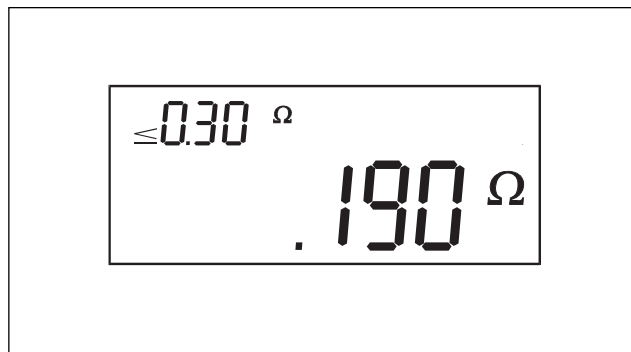


Fig.7.8

- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" at COMMANDER 2 or at UNITEST MACHINEmaster (for further information, see section 9.2 "Saving Measurement Results").

☞ Due to the fact that the PE resistance is measured a current of +200 mA and -200 mA, two measurement values are generated and displayed. The higher value is always indicated on the larger LCD.

If the measurement values differ considerably,  $\pm(10\% + 2 \text{ Digit})$ , the UNITEST MACHINEmaster displays the warning symbol, even if both measurement values are within the pre-set limit value. This can be applied for trouble-shooting in systems to detect corroded transition resistance (thermal voltages, semiconductor effects...)

#### NOTE!

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.
- Set limit values are maintained even after having switched off the instrument.
- During this function  $R_{PE}$  measurement values as well as limit value are memorised.
- In case message  $\text{E0}$  is displayed, connect COMMANDER 2 or start measurement at COMMANDER 2.
- Prior to measurement of PE resistance, remove UUT from current circuit.
- If the voltage present at test probes exceeds 30 V when starting the measurement, the voltage is displayed and the measurement will not be carried out.
- Please ensure compensation of test leads when using additional measurement accessories.

#### 7.2.3 Measurement of PE Resistance at Portable appliances

##### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 1 to UNITEST MACHINEmaster, switch on the instrument and set switch Measurement Function to position  $R_{PE} \pm 200\text{mA}$  or  $R_{PE} 10\text{A}$ .

☞ In case the test leads have been compensated, CAL is displayed after having set switch Measurement Function to  $R_{PE} \pm 200\text{mA}$  (also refer to "Compensation of Test Leads" in section 7.2.1).

##### STEP 2

- Select desired limit by means of key LIMIT, possible settings are:  $0.3\Omega$ ,  $1\Omega$  or in function 7 ( $P_{RE} 10\text{A}$ ) additional  $19.9\Omega$  (no limit value).
- ☞ Under no circumstance may, the resistance value exceed  $0.3\Omega$ . This value is valid for fixed connection lines up to a length of 5 m. For fixed connection lines exceeding 5 m, this value is increased by respectively  $0.1\Omega$  for each further 7.5 m connection length.

### STEP 3

- Connect test probes of COMMANDER 1 (with measurement accessories, if required) to UUT, as shown in figure 7.9:

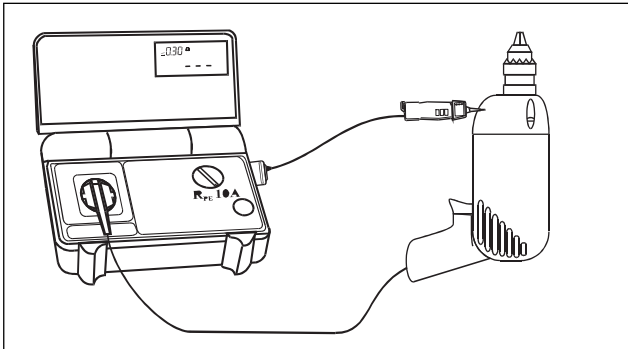


Fig.7.9

### STEP 4

- Briefly press START/STOP at COMMANDER 1. ACTIVE lamp at COMMANDER 1 is illuminated and indicates active measurement.
- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" at COMMANDER 1 or at UNITEST MACHINEmaster (for further information, see section 9.2 "Saving Measurement Results").

### NOTE!

- **OK lamp at COMMANDER 1 has the same function as symbol indicated on the LCD.**
- **Set limit values are maintained even after having switched off the instrument.**
- **During this function  $R_{PE}$  measurement values as well as limit value are memorised.**
- **If message  $\square$  is displayed, connect COMMANDER 1 or start measurement at COMMANDER 1.**
- **Prior to measurement of PE resistance, remove UUT from current circuit.**
- **If the voltage present at test probes exceeds 30 V when starting the measurement, the voltage is displayed and the measurement will not be carried out.**
- **Please ensure compensation of test leads when using additional measurement accessories.**

## 7.2.4 Measurement of PE Resistance

**at appliances which may not be disconnected from Mains (e.g. PC)**

### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on instrument and set switch Measurement Function to position  $R_{PE} \pm 200 \text{ mA}$  or  $R_{PE} 10 \text{ A}$ . The following is displayed (Fig. 7.10):

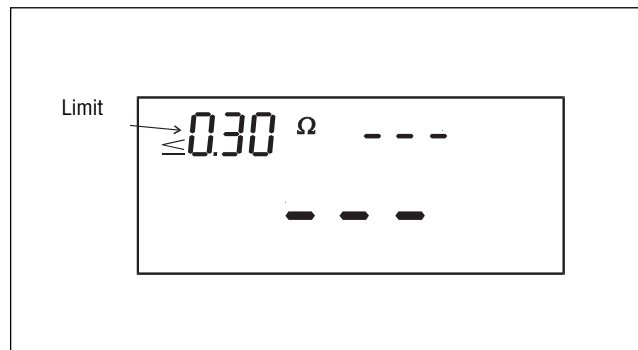


Fig. 7.10

If the test leads have been compensated,  $\square$  is displayed after having set switch Measurement Function (also refer to "Compensation of Test Leads" in section 7.2.1).

### STEP 2

- Select desired limit by means of key LIMIT, possible settings are:  $0.3 \Omega$ ,  $1 \Omega$  or function 7 ( $R_{PE} 10 \text{ A}$ ) additional.
- **Under no circumstance, may the resistance value exceed  $0.3 \Omega$ . This value is valid for fixed connection lines up to a length of 5 m. For fixed connection lines exceeding 5 m, this value is increased by respectively  $0.1 \Omega$  for each further 7.5 m connection length. According to DIN VDE 0701, the maximum admissible protective earth conductor resistance is  $1 \Omega$ .**

### STEP 3

- Connect test probes of COMMANDER 2 (with measurement accessories, if required) to UUT, as shown in figure 7.10a:

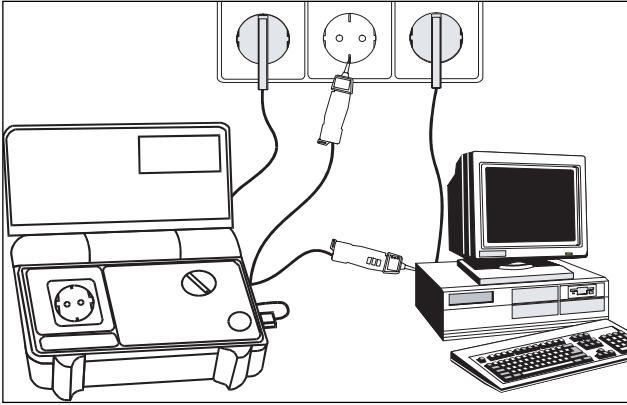


Fig. 7.10a

#### STEP 4

- Briefly press key START/STOP at COMMANDER 2. ACTIVE lamp at COMMANDER 2 is illuminated. Release the key, the last measurement value is displayed:

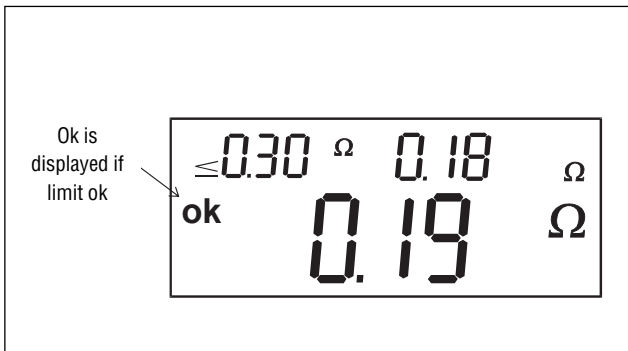


Fig. 7.11

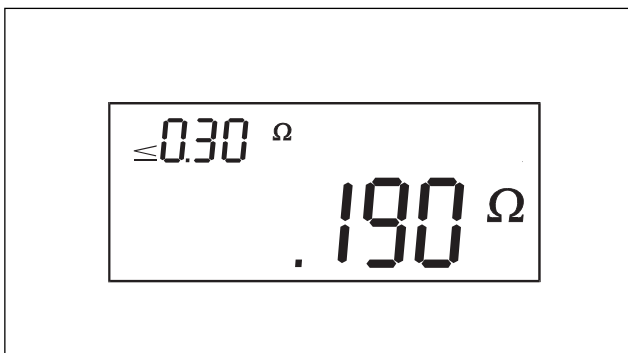


Fig. 7.11

- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" at COMMANDER 2 or at UNITEST MACHINEmaster (for further information, see section 9.2 "Saving Measurement Results").

#### NOTE!

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.
- Set limit values are maintained even after having switched off the instrument.
- During this function  $R_{PE}$  measurement values as well as limit value are memorised.
- In case message  $\triangle$  is displayed, connect COMMANDER 2 or start measurement at COMMANDER 2.
- Prior to measurement of PE resistance, remove UUT from current circuit.
- If the voltage present at test probes exceeds 30 V when starting the measurement, the voltage is displayed and the measurement will not be carried out.
- Please ensure compensation of test leads when using additional measurement accessories.

## 7.4 Insulation Resistance $R_{INS}$ in compliance with DIN VDE 0701/0702 Part 1

### Measurement Function 9

#### How to carry out the measurement?

The measurement can be carried out as follows:

1. Between short-circuited L/N connections and PE connection of mains plug of a portable appliance (protection class I).
  2. Between short-circuited L/N connection of mains plug and touchable, conductive parts of a UUT (protection class II).
  3. Between two points of fixed installed appliance.
- ☞ After the DIN VDE 0701/0702 measurement, all test objects must be switched on during the  $R_{INS}$  test.

#### 7.4.1 Portable Appliances of Class I

##### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Switch on UNITEST MACHINEmaster and set switch Measurement Function to position  $R_{INS}$  500V (9). The following is displayed:

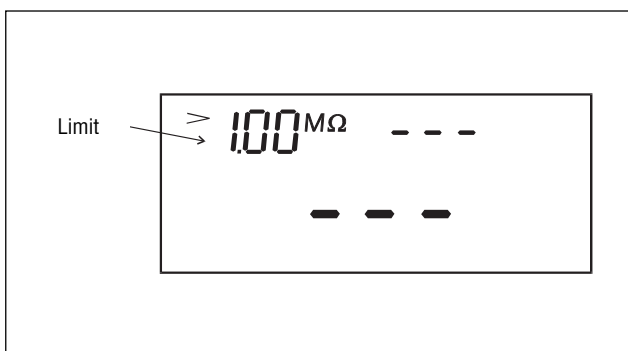


Fig.7.13

##### STEP 2

- Select desired limit of 0,5 MΩ as insulation resistance by using key LIMIT. Possible settings are: 0.25 MΩ, 0.5 MΩ, 1 MΩ or 2 MΩ.

##### STEP 3

- Connect UUT to test / mains socket of UNITEST MACHINEmaster, as shown in Fig. 7.14. Switch on UUT:

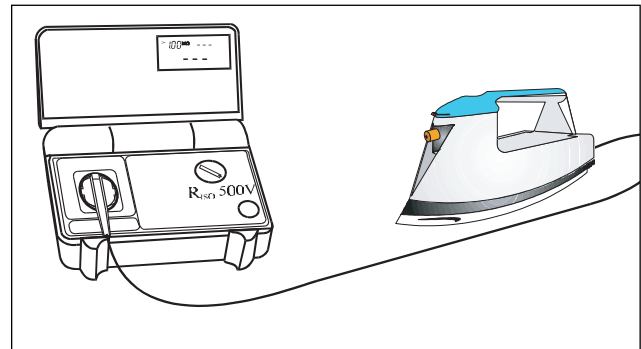


Fig.7.19.

##### STEP 4

- Keep key START/STOP at UNITEST MACHINEmaster pressed until stabilisation of displayed measurement result. ACTIVE lamp at test / mains socket is illuminated and indicates active measurement. Release the key. UUT is automatically discharged.

The following measurement result is displayed:

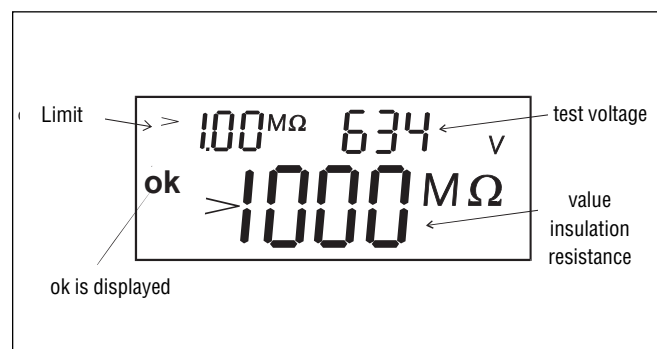


Fig.7.15.

- Memorise the measurement result displayed, if desired. For this purpose, press key SAVE (for further information, see section 9.2 "Saving Measurement Results").

### 7.4.2 Portable Appliances of Class II

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 1 to UNITEST MACHINEmaster, switch on measurement appliance, set switch Measurement Function to position  $R_{INS}$  500V (9). See Fig. 7.13.

#### STEP 2

- Select desired limit of  $2M\Omega$  as insulation resistance by means of key LIMIT. Possible settings are:  $0.25 M\Omega$ ,  $0.5 M\Omega$ ,  $1 M\Omega$  or  $2 M\Omega$ .

#### STEP 3

- Connect UUT to test / mains socket of UNITEST MACHINEmaster. Switch on UUT. Scan all touchable, conductible parts by means of COMMANDER 1 (see Fig. 7.16).

- ☞ If required, wrap casing by using a conductible foil (e.g. aluminium foil).

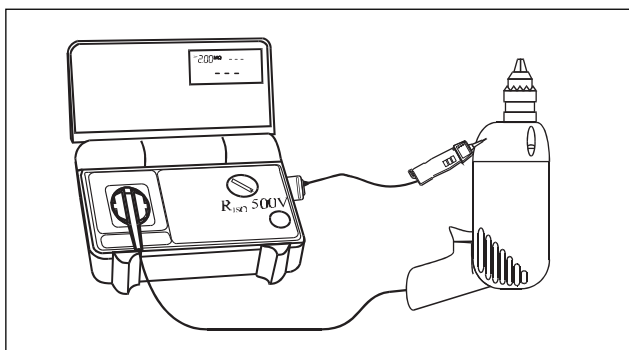


Fig.7.16

#### STEP 4

- Keep key START/STOP at COMMANDER 1 pressed until stabilisation of measurement result displayed. ACTIVE lamp on the appliance and on COMMANDER 1 starts lighting and indicates active measurement. The last measurement value is displayed, see Fig. 7.15.
- Memorise the measurement result, if desired. For this purpose, press key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, (for further information, see section 9.2 "Saving Measurement Results").

### 7.4.3 Fixed installed Appliances

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on appliance and set switch Measurement Function to position  $R_{INS}$  500 V (9). See Figure 7.13.

#### STEP 2

- Select desired limit of insulation resistance by means of key LIMIT. Possible settings are:  $0.25 M\Omega$ ,  $0.5 M\Omega$ ,  $1 M\Omega$  or  $2 M\Omega$ .

#### STEP 3

- Connect test probes of COMMANDER 2 (use measurement accessories, if required) to UUT and switch on UUT, see Fig. 7.17.

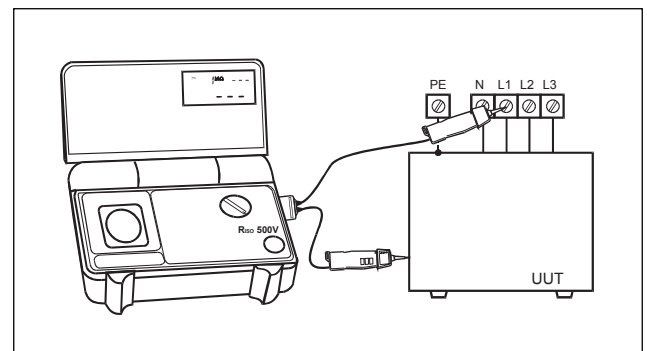


Fig.7.17

#### STEP 4

- Keep key START/STOP at COMMANDER 2 pressed until stabilisation of measurement result displayed. ACTIVE lamps on appliance and on COMMANDER 2 start lighting and indicate active measurement. Last measurement value is displayed, see Fig. 7.15.
- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" at COMMANDER 1 or at UNITEST MACHINEmaster (for further information, see section 9.2 "Saving Measurement Results").

#### NOTE!

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.
- Set limit values are maintained even after having switched off the appliance.
- During this function  $R_{INS}$  measurement values as well as limit value are memorised.
- If message  $C_{02}$  is displayed, connect COMMANDER 2 or start measurement at COMMANDER 2.
- Prior to measurement of insulation resistance, remove UUT from current circuit.
- If the voltage present at test probes exceeds 50 V when starting the measurement, the voltage is displayed and the measurement will not be carried out
- Do not touch UUT during measurement !
- Only remove Commander leads from UUT after completion of measurement to guarantee discharge.
- UUT discharge is carried out automatically after termination of measurement!
- According to DIN VDE 0701/0702, UUTs have to be switched ON during  $R_{INS}$  measurement !

## 7.5 Substitute Leakage Current $I_{PE}$ subs in compliance with DIN VDE 0701/0702

### Measurement Function 10

#### How to carry out the measurement?

Possibility to carry out the measurement for fixed appliances via COMMANDER 2 or for portable appliances via test / mains socket at UNITEST MACHINEmaster.

⚠ According to DIN VDE 0701/ DIN VDE 0702, UUTs have to be switched ON during this type of measurement.

#### 7.5.1 Fixed installed Appliances

##### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on measurement appliance and set switch Measurement Function to position  $I_{PE}$  SUBS, the following is displayed:

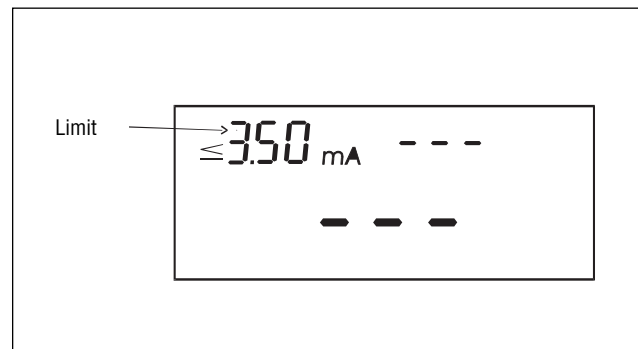


Fig.7.18

##### STEP 2

- Set desired limit by means of key LIMIT. Possible settings are: 0.5, 3.5, 7 or 15mA.



### STEP 3

Connect test probes of COMMANDER 2 (measurement accessories, if required) to UUT as shown in Figure 7.19. Switch on UUT:

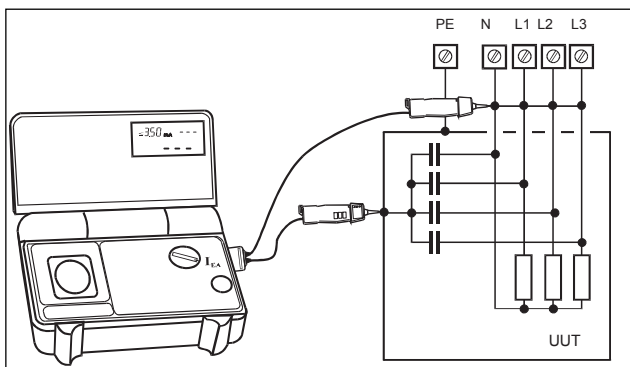


Fig.7.19

### STEP 4

- Press key START/STOP at COMMANDER 2. ACTIVE lamp at Commander is illuminated. The measurement remains active until renewed pressing of key START/STOP.

### STEP 5

- To terminate measurement, press key START/STOP again. The measurement result is indicated as shown:

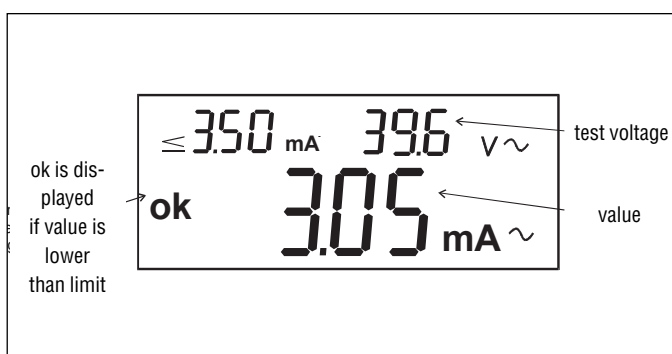


Fig. 7.20

- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" at COMMANDER 2 or at measurement appliance (for further information, see section 9.2 "Saving Measurement Results"). Possibility to memorise measurement result even during active measurement, if desired.

## 7.5.2 Portable Appliances

### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket. Switch on measurement appliance. Set switch Measurement Function to position I<sub>PE</sub> SUBS. (See Fig. 7.18).

### STEP 2

- Set desired limit by means of key LIMIT. Possible settings are: 0.5, 3.5, 7 or 15 mA.

### STEP 3

- Connect UUT to test / mains socket of UNITEST MACHINEmaster (see Fig. 7.21). Switch on UUT.

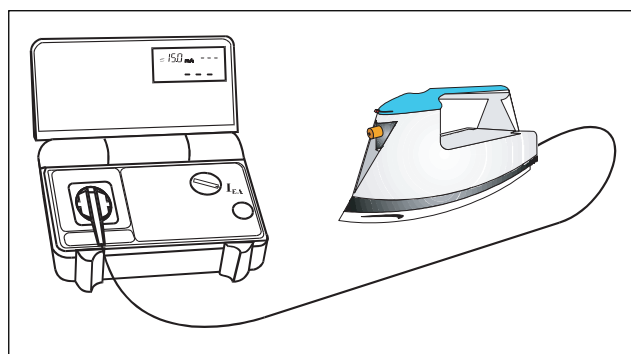


Fig.7.21

### STEP 4

- Press key START/STOP at UNITEST MACHINEmaster. Measurement is started, ACTIVE lamp is illuminated and indicates active measurement.

### STEP 5

- To terminate measurement, press START/STOP key again. The result is displayed as shown in Fig. 7.20.

- Memorise the measurement result displayed, if desired, during or after completion of measurement. For this purpose, press key "SAVE" at UNITEST MACHINEmaster. (See section 9.2 "Saving Measurement Results").

### NOTES!

- According to DIN VDE 0702 (issue 11-1995), the measurement value displayed corresponds to the leakage current which would be generated by a UUT at a mains voltage of 230 V +6%. The measurement value is calculated.

## 7.6 Leakage Current / Contact Current $I_{Leak}$ according to DIN VDE 0701/0702, Part 1 , DIN VDE 0701, Part 240

### Function 11

#### 7.6.1 Leakage Current $I_{Leak}$ according to DIN VDE 0701, Part 240

Part 240 within DIN VDE 0701 refers to safety of data processing appliances and office machines (IT appliances, information technology). It includes the verification that following parts are not live: touchable, conductible parts of double-insulated appliances, or parts of appliances belonging to protection class I which are not connected to the PE conductor. This is verified by means of a current measurement on those conductible parts of the UUT and the PE contact of mains socket of test appliance. The current measured during this procedure may not exceed 0.25mA.

The correct measurement requires a polarity reversing of mains plug causing an interruption of operation. Polarity reversing of mains plug is carried out by means of the UNITEST MACHINEmaster by pressing of key START/STOP.

In order to avoid any data loss, this measurement should only be carried out on data processing appliances after contacting the operator or owner.

#### Definition of Leakage Current

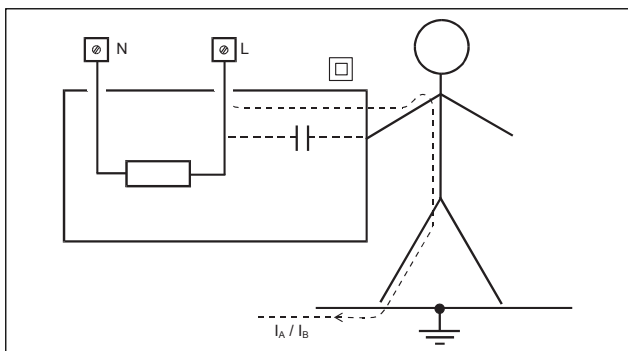


Fig. 7.22

Leakage Current/Contact Current is defined as the current flowing from a touchable, conductible appliance part through the human body towards the earth.

⚠ UUT is put into service during this test, e.g. the appliance will be supplied with mains voltage. For this purpose, switch on UUT. UUTs driven by motors or equipped with heating units may present a danger for the person testing (comply with UUT instruction manual!).

#### How to carry out the measurement?

The measurement may be carried out by using COMMANDER 1 in conjunction with test/mains socket at UNITEST MACHINEmaster (portable appliances) or by using COMMANDER 2 (fixed appliances).

##### 7.6.1.1 Portable Appliance

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.

#### STEP 2

- Connect COMMANDER 1 to UNITEST MACHINEmaster, switch on measurement appliance and set switch Measurement Function to position  $I_{LEAK}$  (measurement function 11). The following is displayed:

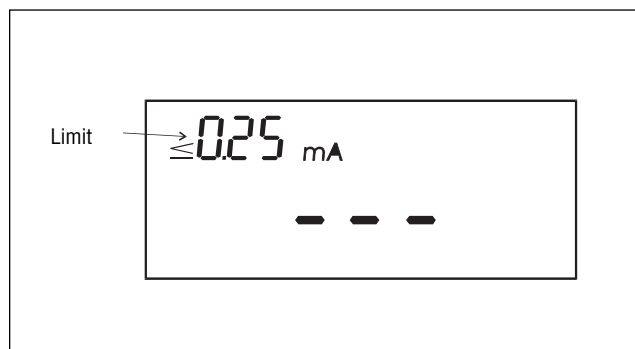


Fig. 7.23

#### STEP 3

- Set desired limit by means of key LIMIT. According to DIN VDE 0701 Part 240, the value may not exceed 0.25 A.

#### STEP 4

- Insert UUT into test / mains socket of UNITEST MACHINEmaster.

#### STEP 5

- Press key START/STOP at COMMANDER 1. ACTIVE lamps at UNITEST MACHINEmaster and at COMMANDER 1 are illuminated. Simultaneously, lamp Mains is lighting, indicating presence of test voltage at Test / Mains Socket.

The following is displayed :

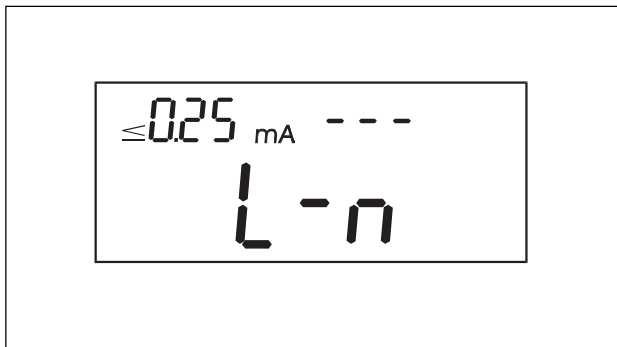


Fig. 7.24

- LCD indicates phase position at left connection of Test Mains Socket, i.e. indicating the position of phase polarity. L and N connection assignment may be opposite (depending on mains cable connection of UNITEST MACHINEmaster). Display of measurement value after approx. 1 s (Fig.7.26).

#### STEP 6

- Scan all touchable, conductible UUT parts by means of COMMANDER 1 (Fig. 7.25).

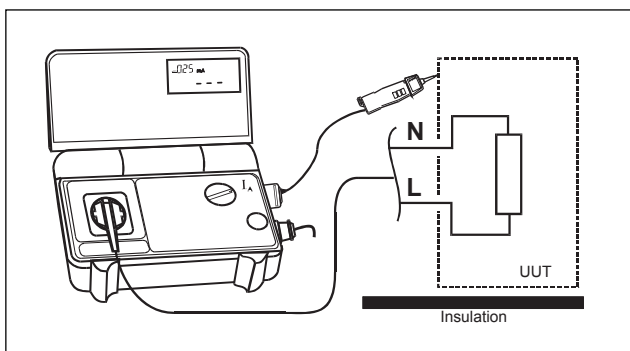


Fig. 7.25

- The following is indicated in the UNITEST MACHINE-master display:

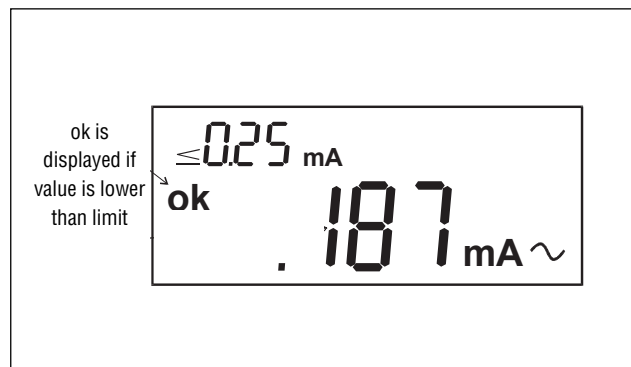


Fig. 7.26

#### STEP 7

- Press key START/STOP again to terminate measurement. The last measured value is displayed.
- Memorise the displayed value by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. Further possibility to memorise during active measurement (see section 9.2 "Saving Measurement Results").

#### STEP 8

- Press key START/STOP to repeat measurement at reversed phase polarity. For this purpose, the connection of L and N are automatically reversed. Phase polarity indication and measurement display are carried out as shown in Figures 7.24 and 7.26.

#### STEP 9

- Press key START/STOP again to terminate measurement. Last measurement value is displayed.
- Memorise the displayed value during or after completion of measurement by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. (see section 9.2 "Saving Measurement Results").

### 7.6.1.2 Fixed installed appliances

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on measurement appliance and set switch Measurement Function to position  $I_{LEAK}$ , (measurement function 11). The following is displayed (Fig. 7.23):

#### STEP 3

- Set desired limit by means of key LIMIT. According to DIN VDE 0701 Part 240, the value may not exceed 0.25 A.

#### STEP 4

- Connect UUT to Commander 2 (see Fig. 7.24).

⚠ It is important to observe that passive test probe of Commander 2 (without keys) is connected to earth, otherwise measurement results could occur.

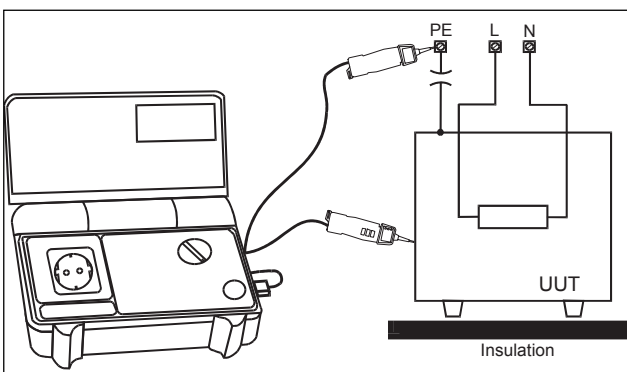


Fig.7.27

#### STEP 5

- Press START/STOP key at COMMANDER 2. ACTIVE lamp at COMMANDER 2 is lighting, indicating active measurement.

#### STEP 6

- Press key START/STOP again to terminate measurement. Last measured value is displayed.
- Memorise the displayed value by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. Further possibility to memorise during active measurement (see section 9.2 "Saving Measurement Results").

#### NOTE !

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.
- Set limit values are maintained even after having switched off the appliance.
- Message  $\text{Co2}$  is displayed, connect COMMANDER 2
- If the voltage present at UUT equals or exceeds 50 V, an acoustic warning signal will be audible.

### 7.6.2 Contact Current $I_{LEAK}$ according to DIN VDE 0701/0702, Part 1

For appliances of protection class II equipped with touchable, conductible parts, generating doubts regarding insulation resistance measurement, e.g. information technology appliances and other electronic units, the measurement may be carried out in compliance with the differential current procedure, according to DIN VDE 0701/0702 Part 1.

#### 7.6.2.1 Portable appliances

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.

#### STEP 2

- Connect COMMANDER 1 to UNITEST MACHINEmaster, switch on measurement appliance and set switch Measurement Function to position  $I_{LEAK}$ , (measurement function 11). The following is displayed:

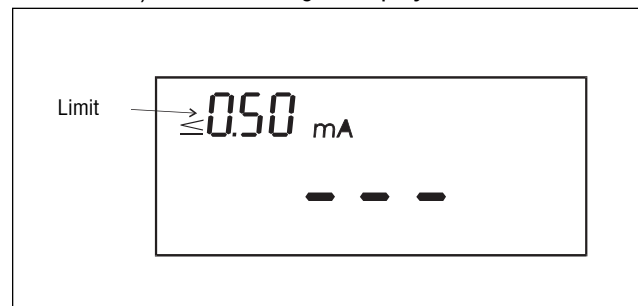


Fig. 7.28

#### STEP 3

- Set desired limit by means of key LIMIT. According to DIN VDE 0701/0702 Part 1, the measurement value may not exceed 0.50 mA.

#### STEP 4

- Insert UUT into test / mains socket of UNITEST MACHINEmaster.

### STEP 5

- Press key START/STOP at COMMANDER 1, ACTIVE lamps at UNITEST MACHINEmaster and COMMANDER 1 are illuminated. Simultaneously, lamp Mains is lighting, indicating presence of mains voltage at Test / Mains Socket.

The following is displayed:

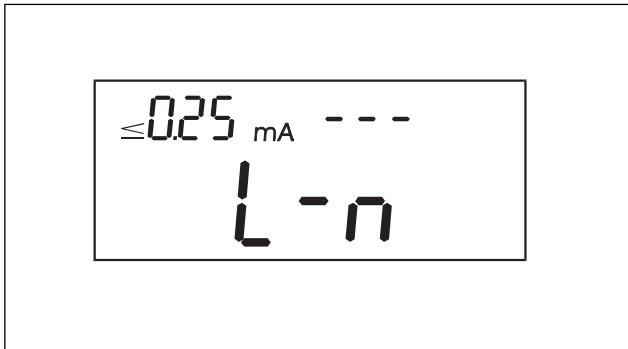


Fig. 7.29

- LCD indicates phase position at left connection of Test Mains Socket, i.e. indicating the position of phase polarity. L and N connection assignment may be opposite (depending on mains cable connection of UNITEST MACHINEmaster). Display of measurement value after approx. 1 s (Fig. 7.31).

### STEP 6

- Scan all touchable, conductible UUT parts by means of COMMANDER 1 (Fig. 7.30).

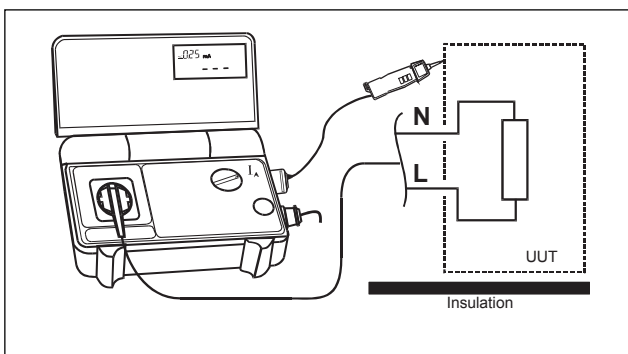


Fig.7.30

- The following is indicated in the UNITEST MACHINE-master display:

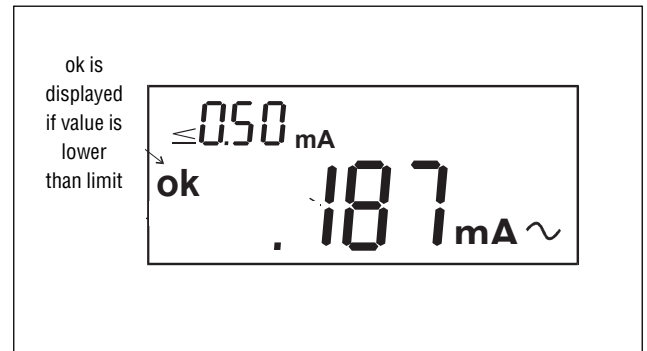


Fig. 7.31

### STEP 7

- Press key START/STOP again to terminate measurement. The last measured value is displayed.
- Memorise the displayed value by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. Further possibility to memorise during active measurement (see section 9.2 "Saving Measurement Results").

### STEP 8

- Press key START/STOP to repeat measurement at reversed phase polarity. For this purpose the connection of L and N polarities are automatically reversed. Phase polarity indication and measurement display are carried out as shown in Figures 7.29 and 7.31.

### STEP 9

- Press key START/STOP again to terminate measurement. Last measurement value is displayed.
- Memorise the displayed value during or after completion of measurement by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. (see section 9.2 "Saving Measurement Results").

### 7.6.2.2 Fixed installed appliances

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.

#### STEP 2

- Connect COMMANDER 2 to UNITEST MACHINEmaster, switch on measurement appliance and set switch Measurement Function to position  $I_{Leak}$  (measurement function 11). The following is displayed (Fig. 7.29).

#### STEP 3

- Set desired limit by means of key LIMIT. According to DIN VDE 0701/0702 Part 1, the value may not exceed 0.50 mA.

#### STEP 4

- Connect UUT to Commander 2 (see Fig. 7.32).

It is important to observe that passive test probe of Commander 2 (without keys) is connected to earth, otherwise false measurement results could occur.

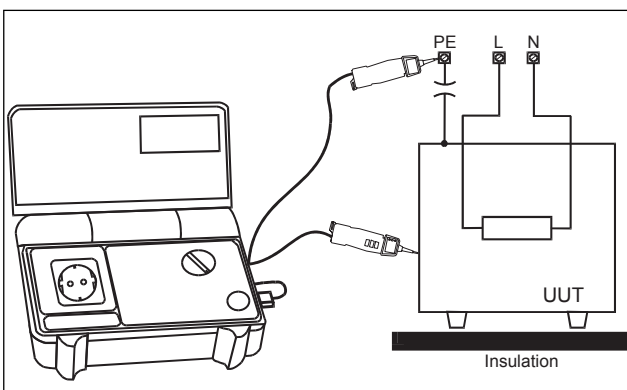


Fig.7.32

#### STEP 5

- Press START/STOP key at COMMANDER 2. ACTIVE lamp at COMMANDER 2 is lighting, indicating active measurement.

#### STEP 6

- Press key START/STOP again to terminate measurement. Last measured value is displayed.
- Memorise the displayed value by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. Further possibility to memorise during active measurement (see section 9.2 "Saving Measurement Results").

#### NOTE !

- OK lamp at COMMANDER 2 has the same function as symbol indicated on the LCD.
- Set limit values are maintained even after having switched off the appliance.
- If message  $\text{CO}_2$  is displayed, connect COMMANDER 2
- If the voltage present at UUT equals or exceeds 50 V, an acoustic warning signal will be audible.

### 7.6.2.3 Appliances which may not be separated from Mains (e.g. PC)

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.

#### STEP 2

- Connect COMMANDER 1 to UNITEST MACHINEmaster, switch on measurement appliance and set switch Measurement Function to position  $I_{LEAK}$  (measurement function 11). The following is displayed:

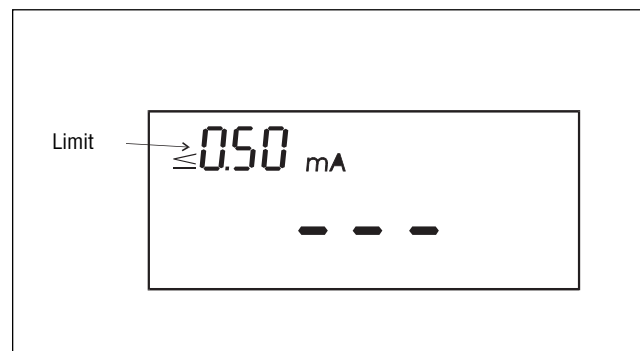


Fig.7.33

#### STEP 3

- Set desired limit by means of key LIMIT. According to DIN VDE 0701/0702 Part 1, the value may not exceed 0.50 mA.

#### STEP 4

- Press key START/STOP at COMMANDER 1, ACTIVE lamps at UNITEST MACHINEmaster and COMMANDER 1 are illuminated. Simultaneously, lamp Mains is lighting, indicating presence of mains voltage at Test Mains Socket.

The following is displayed:

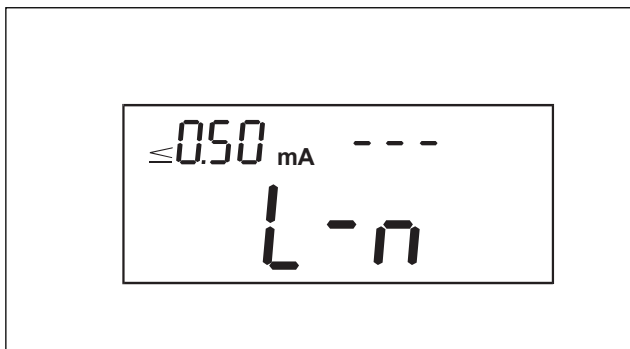


Fig.7.34

- LCD indicates phase position at left connection of Test Mains Socket, i.e. indicating the position of phase polarity. L and N connection assignment may be opposite (depending on mains cable connection of UNITEST MACHINEmaster). Display of measurement value after approx. 1 s (Fig.7.31).

#### STEP 5

- Scan all touchable, conductible UUT parts by means of COMMANDER 1 (Fig. 7.35).

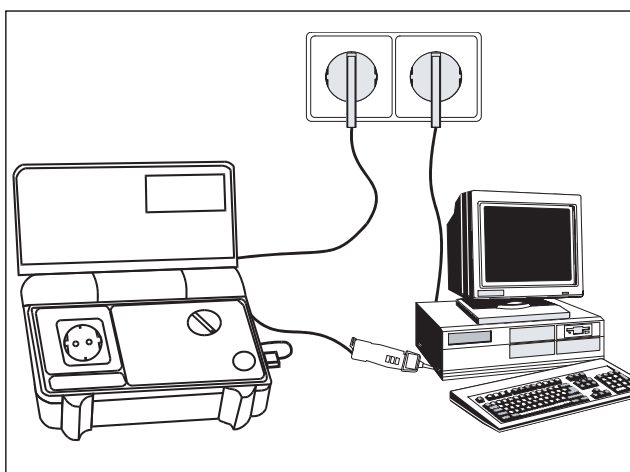


Fig. 7.35

- The following is indicated in the UNITEST MACHINE-master display:

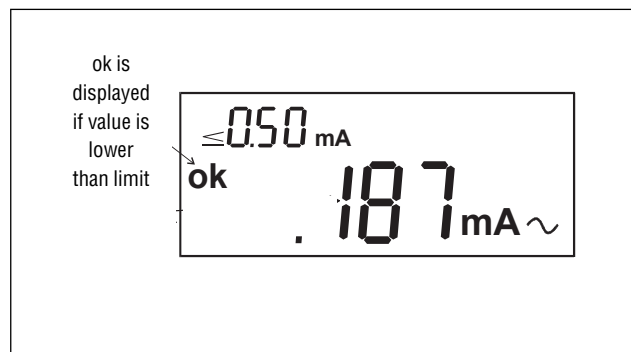


Fig.7.36

#### STEP 6

- Press key START/STOP again to terminate measurement. The last measured value is displayed.
- Memorise the displayed value by pressing key SAVE at COMMANDER 1 or at UNITEST MACHINEmaster, if desired. Further possibility to memorise during active measurement (see section 9.2 "Saving Measurement Results").



## 7.7 Differential Current $I_{\Delta}$ and Earth Conductor Current $I_{PE}$ according to DIN VDE 0701/0702, Part 1

### Measurement Function 12

Appliances of protection class I for which there is no guarantee that all parts carrying mains voltage are tested during insulation resistance measurement or where insulation resistance measurement may not be carried out due to other reasons, the measurement may be carried out in compliance with the differential current procedure, according to DIN VDE 0701/0702, Part 1.

**During differential current measurement the UUT must not be insulated to earth.**

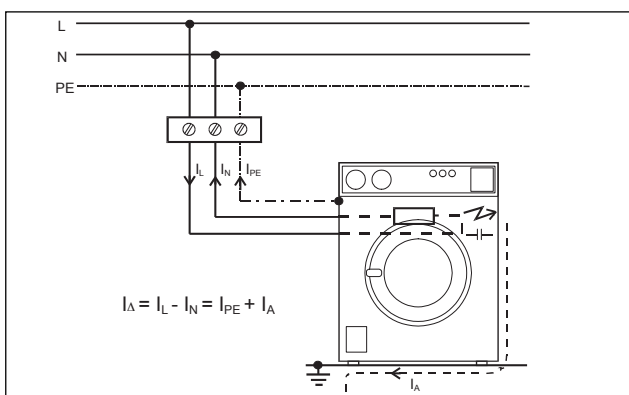


Fig.7.37

**⚠ UUT is put into service during this test, e.g. the appliance will be supplied with mains voltage. For this purpose, switch on UUT. UUTs driven by motors or equipped with heating units may present a danger for the person testing (comply with UUT instruction manual!).**

### How to carry out the measurement?

This test may only be carried out by using test / mains socket of UNITEST MACHINEmaster.

### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Switch on measurement appliance and set switch Measurement Function to position  $I_{\Delta}$ ,  $I_{PE}$  (12). The following is displayed:

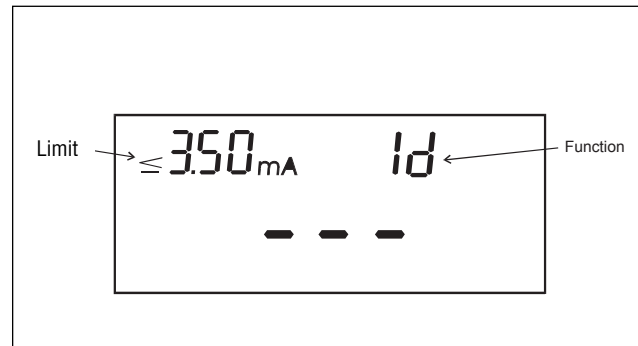


Fig.7.38

### STEP 2

- Connect UUT to test / mains socket (Fig.7.39):

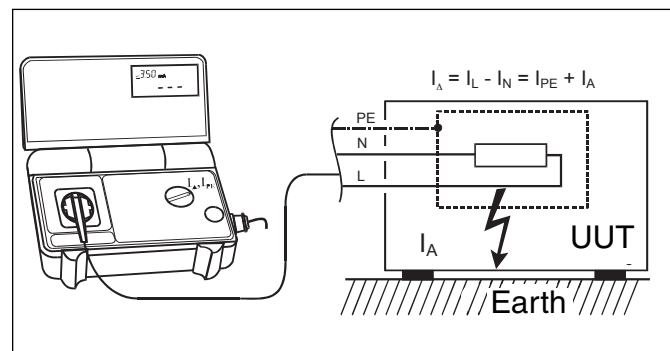


Fig.7.39

### STEP 3

- Differential current measurement  $I_{\Delta}$  ( $I_{\Delta}$  is displayed) or earth conductor current measurement  $I_{PE}$  ( $I_{PE}$  is displayed). Select by means of key DISPLAY.

#### STEP 4

- Press key START/STOP at UNITEST MACHINEmaster, ACTIVE lamp is illuminated. Simultaneously, lamp Mains is lighting, indicating presence of mains voltage at Test / Mains Socket. Brief indication of the following display.

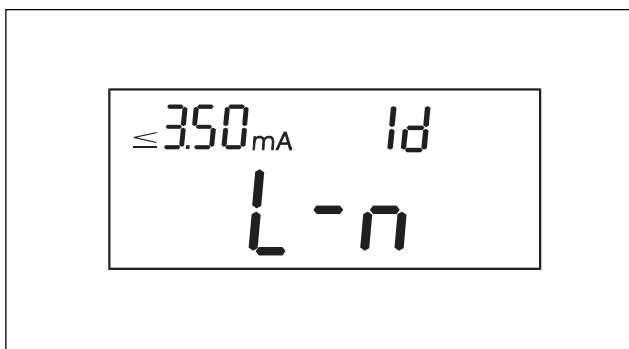


Fig.7.40

- LCD indicates phase position at left connection of Test Mains Socket, i.e. indicating the position of phase polarity. L and N connection assignment may be opposite (depending on mains cable connection of UNITEST MACHINEmaster). Display of measurement value after approx. 1 s.

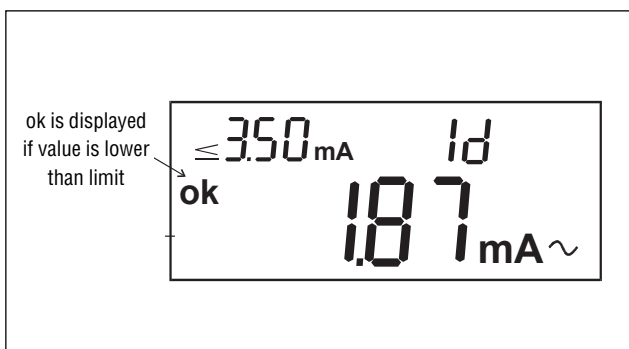


Fig.7.41

#### STEP 5

- Press key START/STOP again to terminate measurement. The last measured value is displayed.
- Memorise the displayed value by pressing key SAVE at UNITEST MACHINEmaster, if desired. Further possibility to memorise during active measurement (see section 9.2 "Saving Measurement Results").

#### STEP 6

- Press key START/STOP to repeat measurement at reversed phase polarity by automatically reversing the polarity of L - N connection. Display of phase position and measurement values are carried out as shown in Figures 4.45 and 4.46.

#### STEP 7

- To terminate measurement, press again key START/STOP. The last measurement value is displayed.
- Memorise the measurement result displayed, if desired, during or after completion of measurement. For this purpose, press key "SAVE" at UNITEST MACHINEmaster (see section 9.2 "Saving Measurement Results").

## 7.8 Load Current ( $I_L$ ), Load Voltage ( $V_{L-N}$ ) and Power (P) according to DIN VDE 0701/0702 Measurement Function 1

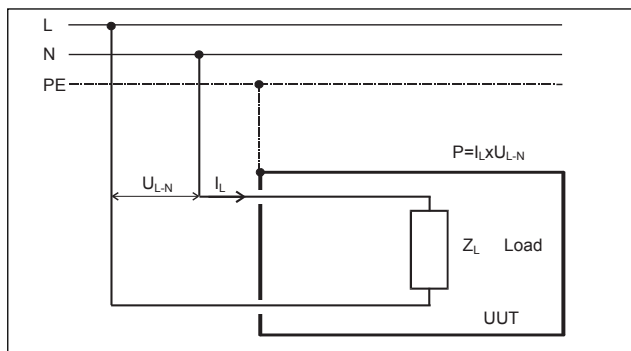


Fig.7.42 Basic Circuit Diagram for Measurement of  $I_L$ ,  $V_{L-N}$  and P

**⚠ UUT is put into service during this test, e.g. the appliance will be supplied with mains voltage. For this purpose, switch on UUT. UUTs driven by motors or equipped with heating units, or other danger sources may present a danger for the person testing (comply with UUT instruction manual!).**

### How to carry out the measurement?

The measurement may only be carried out by using the test/mains socket of UNITEST MACHINEmaster.

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket. Switch on measurement appliance and set switch Measurement Function to position 1 ( $I_L$ ,  $V_{L-N}$ , P). The following is displayed:

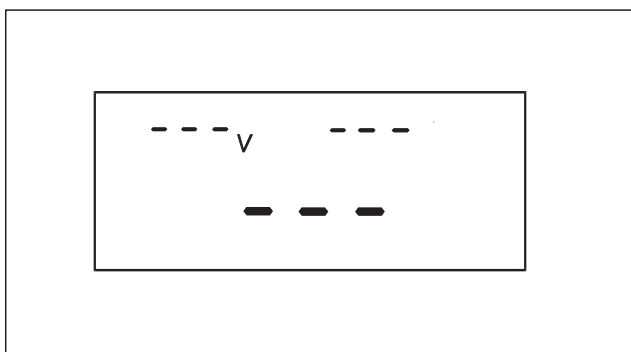


Fig.7.43

#### STEP 2

- Connect UUT to test / mains socket, see Figure 7.45:

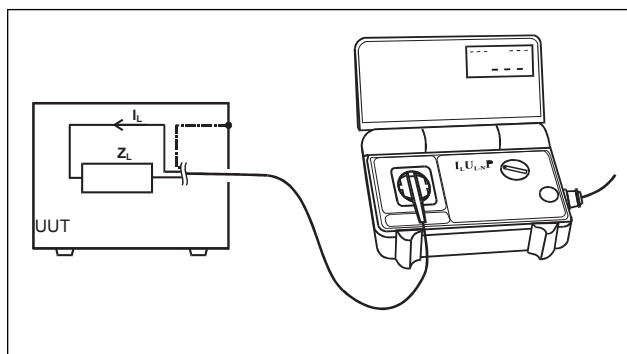


Fig. 7.44

#### STEP 3

- Press key "START/STOP". ACTIVE lamp is illuminated indicating active measurement at test / mains socket. Simultaneously, lamp Mains is lighting, indicating presence of mains voltage at Test / Mains Socket.

The following is displayed:

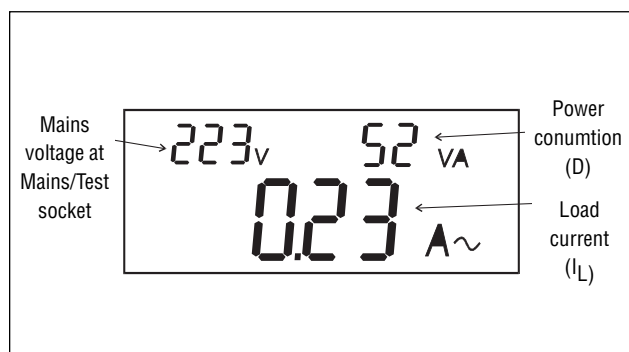


Fig.7.45

$I_L$  RMS value of load current  
 $U_{L-N}$  RMS value of mains voltage

The apparent power ( $S = U \times I$ ) in VA taken via the built-in mains socket is measured.

The measurement remains active until further pressing of key START/STOP.

#### STEP 4

- Press key START/STOP again to terminate measurement. The last measured values are displayed.
- Memorise the measurement result displayed, if desired. For this purpose, press key "SAVE" appliance (for further information, see section 9.2 "Saving Measurement Results"). Possibility to memorise measurement result even during active measurement, if desired.

⚠ Please ensure that no UUTs are connected with a power consumption exceeding 3.7 kVA (230V, 16A) in rush current above 40A !

Fuse protection of UUTs within the function  $I_L/V_{L-N}/N$  is carried out via the power supply system. The UNITEST MACHINEmaster is equipped with an additional protection against short circuit or overload. Therefore, ensure that UNITEST MACHINEmaster is only connected to an correctly fused mains socket at 230V/16A.

⚠ The test / mains socket is not appropriate for continuous supply of UUTs but only to carry out measurements !

#### Note

- Any current values displayed exceeding 16A are marked with the symbol ⚠, indicating excessive current. Immediately interrupt measurement !

## 7.9 AUTO Function

### Measurement Function 2

Function AUTO may be used to carry out different measurements for one UUT in compliance with DIN VDE 0701/0702. The measurements to be carried out and the respective limit values are set by means of a test code prior to testing. The test procedure is then mostly automatic.

It is possible to enter the test code manually or by means of a barcode reader.

### 7.9.1 Application of AUTO Function

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket and plug in the appropriate COMMANDER to be selected for the respective measurement.
- Switch on UNITEST MACHINEmaster, set function switch to position AUTO (2). The following is displayed :

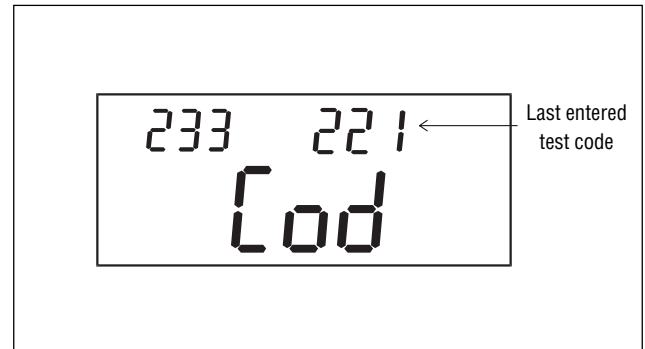


Fig.7.46

#### STEP 2

- Enter desired test code via keyboard, as described below, or use barcode reader (see section 7.9.2).

Use key CE in case the total test code has to be cleared.

Press key ENTER, the first (left) number starts blinking.

Subsequently enter all 6 numbers of test code by means of numerical keyboard (please refer to Table 3, Page 41).

Key ENTER may be used to correct numbers already entered. For this purpose, press key ENTER several times, until desired numeral is blinking. The desired number may be modified by using the numerical keyboard.

⚠ For some test code numbers, not all values (0...9) may be entered as they are invalid (refer to table 3). Entering an invalid number is impossible. An acoustic signal is audible.

⚠ Under certain, unintentional circumstances data may be lost or modified during electronic saving. CH. BEHA will not be held liable for financial and other loss being caused by data loss, wrong handling or any other reason.

⚠ We recommend you to save and transmit the measurement results daily your computer. In case of incidentals outer influences you can lose saved measurement sof the instrument.

Num. Pos. no.	Value	Function Number	Measurement Function	Limit value	Accessory to be used	Application Examples
1	0	–	no R <sub>PE</sub> -Measurement	–	–	
	1	8	R <sub>PE</sub> ±200 mA	0.3 Ω	COMMANDER 2	fixed. inst. UUTs
	2	8	R <sub>PE</sub> ±200 mA	0.3 Ω	Commander 1 Test/mains socket	portable UUTs
	3	8	R <sub>PE</sub> ±200 mA	1 Ω	COMMANDER 2	fixed. inst. UUTs
	4	8	R <sub>PE</sub> ±200 mA	1 Ω	Commander 1 Test/mains socket	portable UUTs
	5	7	R <sub>PE</sub> 10 A	0.3 Ω	COMMANDER 2	fixed. inst. UUTs
	6	7	R <sub>PE</sub> 10 A	0.3 Ω	Commander 1 Test/mains socket	portable UUTs
	7	7	R <sub>PE</sub> 10 A	1 Ω	COMMANDER 2	fixed. inst. UUTs
	8	7	R <sub>PE</sub> 10 A	1 Ω	Commander 1 Test/mains socket	portable UUTs
	9	7	R <sub>PE</sub> 10 A	19.9 Ω	Commander 1 Test/mains socket	Extension lead
2	0	–	no R <sub>INS</sub> measurement	–	–	
	1	9	R <sub>INS</sub> (CLIII)	0.25 MΩ	COMMANDER 2	fixed. inst. UUTs
	2	9	R <sub>INS</sub> (CLI)	0.5 MΩ	COMMANDER 2	fixed. inst. UUTs
	3	9	R <sub>INS</sub> (CLI)	0.5 MΩ	Commander 1 Test/mains socket	portable UUTs
	4	9	R <sub>INS</sub> (CLI)	0.5 MΩ	Test/mains socket	portable UUTs
	5	9	R <sub>INS</sub> (CLI)	1 MΩ	Commander 1 Test/mains socket	portable UUTs
	6	9	R <sub>INS</sub> (CLII)	2 MΩ	COMMANDER 2	fixed. inst. UUTs
	7	9	R <sub>INS</sub> (CLII)	2 MΩ	Commander 1 Test/mains socket	portable UUTs
3	0	–	no I <sub>PE</sub> SUBS Measurement	–	–	
	1	10	I <sub>EA</sub>	7.0 mA	COMMANDER 2	fixed. inst. UUTs
	2	10	I <sub>EA</sub> (CLI)	7.0 mA	Test/mains socket	portable UUTs
	3	10	I <sub>EA</sub>	15.0 mA	COMMANDER 2	fixed. inst. UUTs
	4	10	I <sub>EA</sub> (IC Spare measurement)	0.5 mA	COMMANDER 2	fixed. inst. UUTs
	5	10	I <sub>EA</sub> (IC Spare measurement)	0.5 mA	Test/mains socket	portable UUTs
	6	10	I <sub>EA</sub> (IC Spare measurement)	3.5 mA	COMMANDER 2	fixed. inst. UUTs
	7	10	I <sub>EA</sub> (IC Spare measurement)	3.5 mA	Test/mains socket	portable UUTs
4	0	–	no I <sub>LEAK</sub> measurement	–	–	
	1	11	I <sub>LEAK</sub>	0.25 mA	COMMANDER 2	fixed. inst. UUTs
	2	11	I <sub>LEAK</sub>	0.25 mA	Commander 1 Test/mains socket	portable UUTs
	3	11	I <sub>LEAK</sub>	0.5 mA	COMMANDER 2	fixed. inst. UUTs
	4	11	I <sub>LEAK</sub>	0.5 mA	Commander 1 Test/mains socket	portable UUTs
5	0	–	no I <sub>D</sub> /I <sub>PE</sub> measurement	–	–	
	1	12	I <sub>D</sub>	3.5 mA	Test/mains socket	portable UUTs
	2	12	I <sub>PE</sub>	3.5 mA	Test/mains socket	portable UUTs
6	0	–	no I <sub>L</sub> /U <sub>L</sub> -N/P measurement	–	–	
	1	1	I <sub>L</sub> /U <sub>L</sub> -N/P	–	Test/mains socket	portable UUTs

### STEP 3

- If applicable, connect UUT mains plug to test/mains socket of UNITEST MACHINEmaster. Connect test probe(s) of COMMANDER used to UUT (see Fig.7.47)

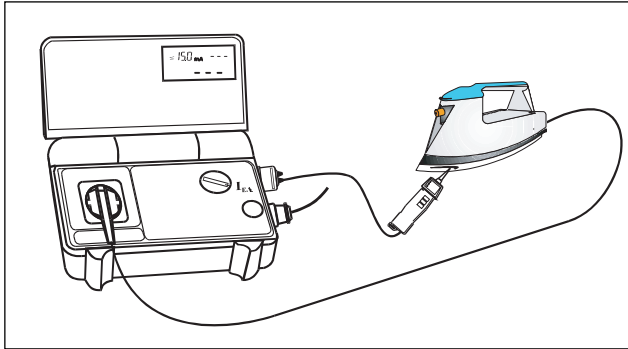


Fig.7.47

### STEP 4

- Press key START/STOP at COMMANDER used or at appliance to start measurement. The function number for the first measurement to be carried out is briefly indicated (see example in Fig. 4.53). Then, the measurement is carried out. The following is displayed (Fig.7.48).

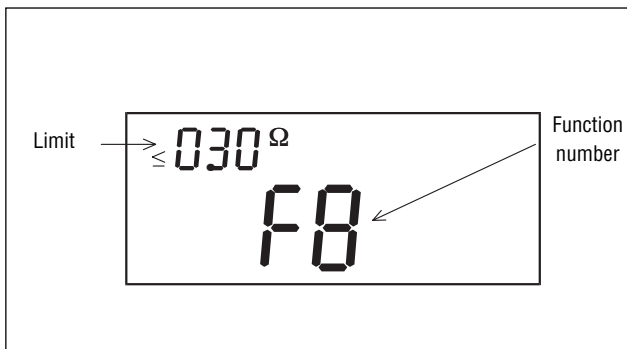


Fig.7.48

- Measurements for  $R_{PE}$  (measurement function 7/8),  $R_{INS}$  (measurement function 9) and  $I_{PE\ SUBS}$  (measurement function 10) are automatically started after confirmation with the respective key START/STOP and are then again stopped.
- Measurements for  $I_{LEAK}$  (measurement function 11),  $I_{\Delta}/I_{PE}$  (measurement function 12) and  $I_L/V_{L-N/P}$  (measurement function 1) are started after confirmation with the respective key START/STOP and are only stopped after repeated pressing of key START/STOP. This allows for longer test periods.

- After completed measurement or if pressing the wrong key START/STOP, the function number of the subsequent measurement and the number of the COMMANDER ( $C01/C02$ ) required or the mains socket (StE) are displayed in turns.

- The last displayed value is taken as measurement result for each completed measurement (storage in buffer). However, should the operator wish to save a measurement value prior to measurement time completion during measurements with longer test periods (in measurement functions  $I_{LEAK}$ ,  $I_{\Delta}/I_{PE}$ , and  $I_L/V_{L-N/P}$ ), this may be carried out manually by pressing key SAVE at COMMANDER or key MEM at measurement appliance.

PRS is displayed if all test results are within the limits.

ERR is displayed as soon as one value is not within the limits.

- **Immediately after failure the limit within one of both measurement functions  $R_{PE}$  or  $R_{INS}$ , the AUTO function is interrupted and ERR is displayed.**

### STEP 4

- If desired, all measurement results buffered during AUTO function can be saved by pressing key „SAVE“ (see section 9.2 "Saving Measurement Results"). All measurement results could be recalled after having been saved. Please refer to section 9.3 "recalling Saved Measurement Results" for recalling procedure.

#### Notes!

- If the limit for functions  $R_{PE}$  or  $R_{INS}$  are not respected, the AUTO function is interrupted. When saving such a measurement, "-- -- --" is saved for all measurements not having been carried out (this is indicated when recalling or printing memorised measurement results).
- Press key CANCEL at appliance or COMMANDER, or turn switch measurement function to interrupt AUTO function.
- Explanations of possible messages, see section 10.1.
- Measurements that have been interrupted by the user cannot be memorised !
- For each measurement during which mains voltage is applied at test/mains socket, three acoustic warning signals are audible prior to measurement.
- For measurement functions  $I_{LEAK}$  (measurement function 11),  $I_{\Delta}/I_{PE}$  (measurement function 12), respectively, two measurements are carried out with reversed socket polarity (L-N). I.e., two measurement results are memorised.

### 7.9.2 Using the Barcode Pen/Scanner

To avoid manual entry of test code, manual recalling or clearing of memorised data during measurement result saving, it is recommended to use a barcode pen / scanner.

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket and plug the respectively required COMMANDER to carry out measurement.
- Switch on UNITEST MACHINEmaster, set function switch to position **AUTO** (2). The following is displayed.

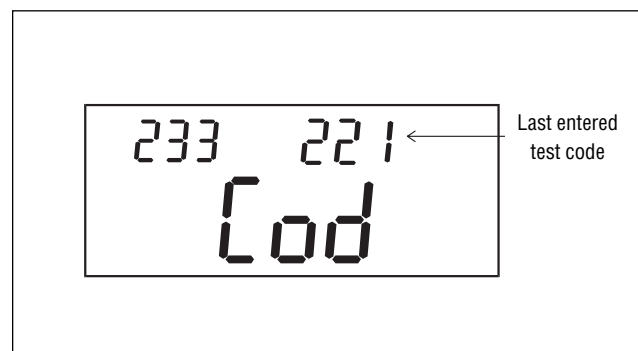


Fig. 7.49

#### STEP 2

- Press key ENTER, first (left) numeral starts blinking.

#### STEP 3

- Connect barcode pen / scanner, via respective adapter, to RS232 port of UNITEST MACHINEmaster.

#### Barcode Pen

Move barcode pen across the barcode to be read. Make sure that the movement is carried out at constant speed (not too slow) across the middle of the barcode. During this procedure, ensure that barcode pen is held slightly inclined. If the test code is not indicated by the UNITEST MACHINEmaster immediately after the reading of barcode label, the user is requested to repeat the procedure. The barcode pen is capable of reading all barcodes. With respect to the UNITEST MACHINEmaster, exclusively "Code 39" (Code 3 of 9) without test number is used.

## Barcode Scanner

Connect barcode scanner to power unit enclosed in the supply package. Hold scanner above barcode and press the key, if required. If the test code is not indicated by the UNITEST MACHINEmaster immediately after the reading of barcode label, the user is requested to repeat the procedure.

The barcode scanner is capable of reading all barcodes. With respect to the UNITEST MACHINEmaster, exclusively "Code 39" (Code 3 of 9) without test number is used.

### Barcode Examples



Fig.7.50 Barcode Examples of Portable appliances, Class I

### STEP 3

- Thereafter, measurements may be carried out by means of the AUTO function, as described for manual entry in section 7.9.1.

## 8.0 Monitoring by using Function DATA LOGGER

### Functions 1,3,11,12

The function DATA LOGGER is appropriate to use for monitoring a measurement value over a longer time period. It is possible to memorise 8000 measurement data.

### Which functions may be recorded ?

- Load current  $I_L$  (Measurement Function 1)
- Voltage  $V$  (Measurement Function 3)
- Leakage Current Contact Current  $I_{LEAK}$  (Measurement Function 11)
- Differential Current  $I_{\Delta}$  (Measurement Function 12)
- Earth Conductor Current IPE (Measurement Function 12)

☞ All memorised data has to be cleared prior to executing the function DATA LOGGER.

### How to activate the function ?

#### Example Load Current $I_L$ (1)

#### STEP 1

- Connect mains cable of UNITEST MACHINEmaster to an operational mains socket.
- Set switch Measurement Function to desired range.

#### STEP 2

- Connect UNITEST MACHINEmaster to UUT and start desired measurement, as described within the respective measurement function.

Press key DATA LOGGER. Should there be data left in the memory, the following is displayed:

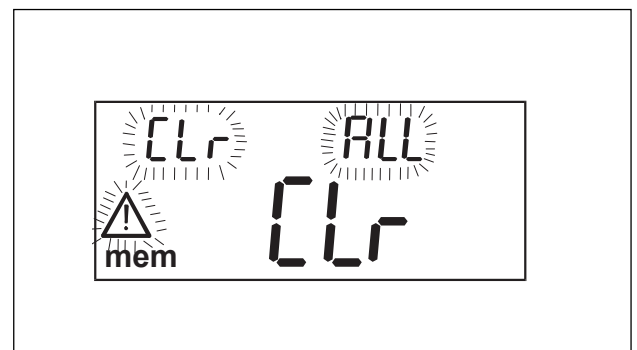


Fig. 8.1



### STEP 3

- Clear memory by confirming with key CLEAR. The following is displayed:

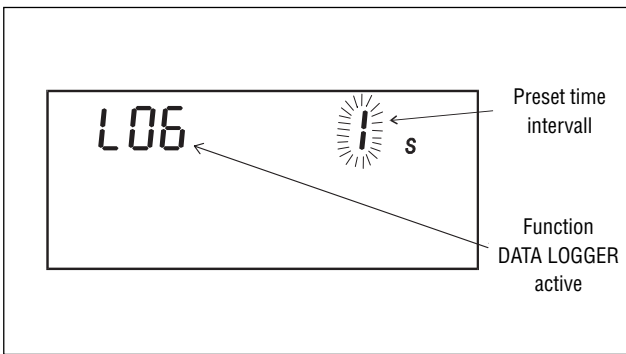


Fig.8.2

- Enter interval between measurements for function RECORD by means of numerical keyboard. All values between 1s and 99s may be entered. Key CE is used to clear any faulty entry.

### STEP 4

- Press key RECORD again, to start RECORD function. Now the values are recorded.

The following is displayed:

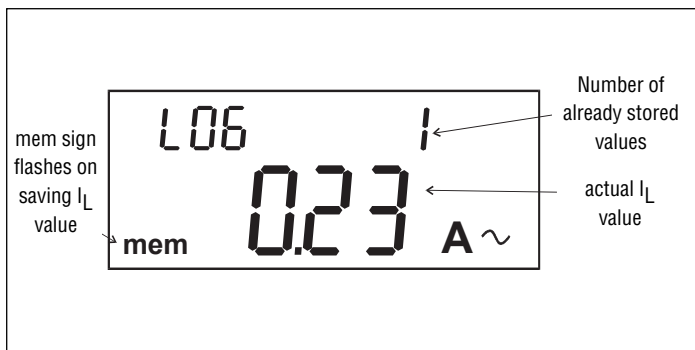


Fig.8.3

### STEP 5

- Press key START/STOP or key CANCEL at UNITEST MACHINEmaster, to terminate recording. The following is displayed:

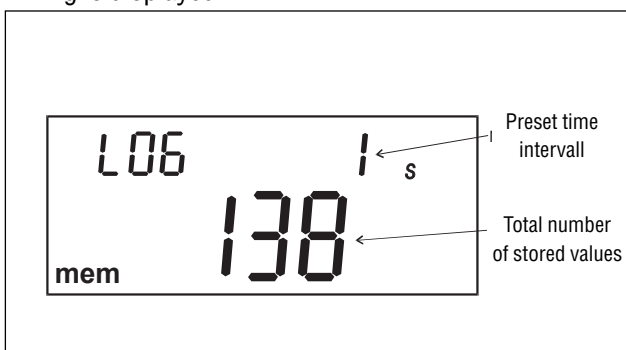


Fig.8.4

- Press key DISPLAY to display the lowest value (minimum value) during RECORD function (LO is displayed on the right, upper corner of LCD).
- Press key DISPLAY again to display the highest value (maximum value during DATA LOGGER function. (HI is displayed).

### NOTES!

- Upon completion of DATA LOGGER function, all measurement values are memorised automatically!
- If the internal memory is full prior to terminating function DATA LOGGER; this function is automatically terminated. The following is displayed (Fig. 8.5). Example for 8000 measurement values at an interval of 1 s.

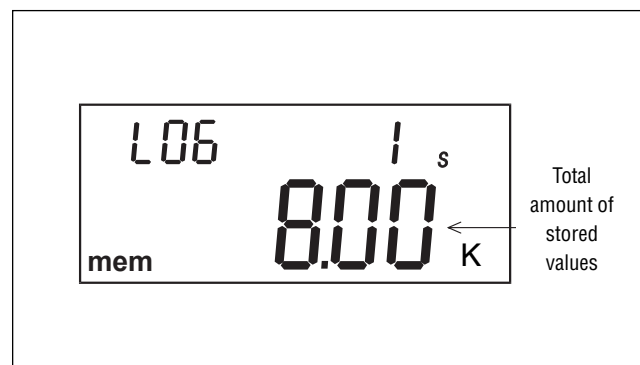


Fig. 8.5

- If the amount of recorded measurement values exceeds 999 during measurement function DATA LOGGER, the amount of values displayed is only maintained in steps of 10, in the right, upper corner of the LCD (see Fig. 8.6). Example: Display 1.05k corresponds to 1050 measurement values.

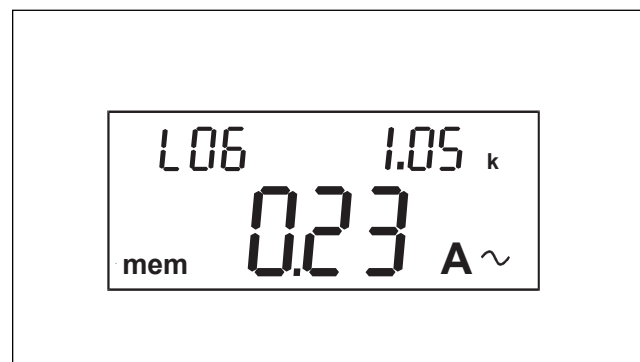


Fig. 8.6

## 9 Further Functions

### 9.0 List of possible Limit Values

Function	Function number	Limit	Standard
$Z_L$	3	<b>0,23...23.9 <math>\Omega</math></b> (s.Tab.1 page 17)	IEC 60204:1997 DIN VDE 0100-610
$V_{RES}$	4	$\leq$ <b>60 V in 1 s</b> $\leq$ 60 V in 5 s	DIN VDE 0113
$R_{INS}$ 500 V	5	<b>&gt; 1 M<math>\Omega</math></b>	IEC 60204/ EN 60204
$U_{PE}$ 10 A	6	$\leq$ <b>3.3 V (1mm<sup>2</sup>)</b> $\leq$ 2.6 V (1.5mm <sup>2</sup> ) $\leq$ 1.9 V (2.5mm <sup>2</sup> ) $\leq$ 1.4 V (4.0mm <sup>2</sup> ) $\leq$ 1.0 V ( $\geq$ 6.0mm <sup>2</sup> )	IEC 60204/ EN 60204
$R_{PE}$ 10 A	7	$\leq$ <b>1 <math>\Omega</math></b> $\leq$ 0.3 $\Omega$	DIN VDE 0701-260
$R_{PE} \pm 200$ mA	8	$\leq$ <b>1 <math>\Omega</math></b> $\leq$ 0.3 $\Omega$	DIN VDE 0701-1 DIN VDE 0702-1
$R_{INS}$ 500 V	9	<b>&gt; 0.25 M<math>\Omega</math></b> > 0.5 M $\Omega$ > 2 M $\Omega$	DIN VDE 0701-1 and DIN VDE 0702-1
$I_{PE SUBS}$	10	0,5 mA 3,5 mA $\leq$ <b>7 mA</b> $\leq$ 15 mA	DIN VDE 0701-1/0702-1
$I_{LEAK}$	11	$\leq$ <b>0.25 mA</b> $\leq$ 0.5 mA	DIN VDE 0701-240 DIN VDE 0702-1
$I_{\Delta}, I_{PE}$	12	$\leq$ <b>3.5 mA</b>	DIN VDE 0702-1

Table 4

#### NOTES!

- If there are several limits possible for one function, possibility to select this value by means of key LIMIT at UNITEST MACHINEmaster.
- If limit value is not exceeded, the symbol  $\triangle$  is displayed.
- The values printed in bold characters are default values or after an appliance reset (reset function, please refer to section 9.1).

9.1 Carrying out the Reset Function

Should an appliance error occur, carry out the reset procedure as follows:

STEP 1

- Switch off appliance.

STEP 2

- Press key CLEAR and keep pressed, repeat appliance switch on. 50F X.X is briefly displayed thus indicating the version of internal firmware. Then, CLr ALL is displayed. All memory addresses are now cleared. RES is displayed. Now the reset function is complete.

STEP 3

- Release key CLEAR. The measurement function is displayed. Now, the appliance is ready for further measurements.

The following actions are carried out during reset function run.

- **Bold printed Limits** are set (see Table 4).
- The memory is cleared.
- Test lead compensation for additional measurement accessories for functions R<sub>PE</sub> 10A, V<sub>PE</sub> 10A and R<sub>PE</sub> ± 200mA is cleared.
- **Measurement time** in function U<sub>RES</sub> is set to 1s.
- **Measurement time** in function V<sub>PE</sub> is set to 10s.
- **Customer number** and UUT number are set to 001.
- Measurement function number 12 is set to I<sub>Δ</sub> (differential current measurement).
- **Measurement interval** for function **DATA LOGGER** is set to 1s.
- Test Code is cleared.

9.2 Saving Measurement Results

Any displayed measurement result, except display of Voltage V and Frequency f (3) may be saved, recalled, and sent to an external printer or transferred to a personal computer. Not only the measurement value but also additional information such as limit and test voltage / test current are memorised, as well as function number (C...customer number, N...UUT number) (see Fig. 9.1).

C (customer number)		N (UUT number)	
001	000	001	Result 1 Result 2 Result 3
001	000	002	Result 1 Result 2 Result 3
001	000	003	Result 1 Result 2 Result 3
⋮			
002	000	001	Result 1 Result 2 Result 3
002	000	002	Result 1 Result 2 Result 3
002	000	003	Result 1 Result 2 Result 3
⋮			
003	000	001	Result 1 Result 2 Result 3
003	000	002	Result 1 Result 2 Result 3
003	000	003	Result 1 Result 2 Result 3
⋮			

Fig.9.1.

Every memorised value bears a date (day, month, year). Regarding the entry of date, please refer to section 9.2.1.

### 9.2.1 Date Entry

After first pressing of key **SAVE** following switch-on of UNITEST MACHINEmaster, **dRE** is briefly displayed. The following is displayed:

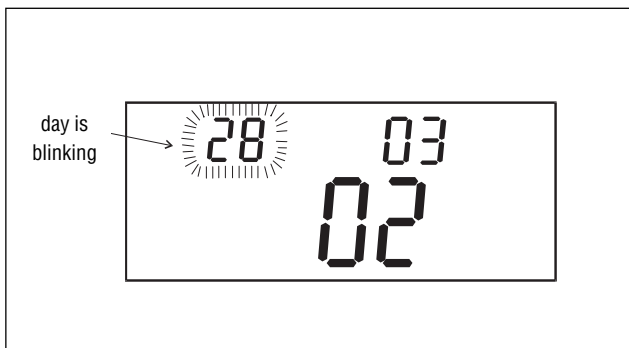


Fig.9.2

#### STEP 1

- Enter day via numerical keyboard.
- Press key **ENTER** to confirm day entered  
→ month display starts blinking.

#### STEP 2

- Enter month via numerical keyboard.
- Press key **ENTER** to confirm month entered  
→ year display starts blinking.

#### STEP 3

- Enter year via numerical keyboard.

Press key **ENTER** to confirm year entered  
→ Customer / UUT Number appears (see section 9.2.3).

#### NOTES!

- Possibility to use key **CE** in order to clear any faulty entry.
- If date displayed is correct, is possible to directly confirm by using key **MEM**.
- Should the data entered have to be verified, key **DISPLAY** has to be used. For this purpose, change measurement function by means of rotary switch. The data display is now possible for all measurement functions except **IΔ/I<sub>PE</sub>** (function 12).
- If a wrong date ( 1 > DD > 31 ) or a wrong month ( 1 > MM > 12 ) have been entered, date entry will not be accepted after pressing key **ENTER** or key **MEM**. The incorrect value starts blinking again.
- The date has to be updated after each switch-on of the UNITEST MACHINEmaster. The last entered date is memorised.

### 9.2.2 Saving Measurement Results

A measurement has been carried out and the measurement result is displayed. The UNITEST MACHINEmaster offers the facility to assign the measurements performed to a certain customer and UUT. This is possible via the alignment of a 3-digit customer number and a 6-digit UUT number.

#### STEP 1

Press the **MEM** key of the appliance or the key „SAVE“ on COMMANDER once to enter the 3-digit customer number. The following is displayed:

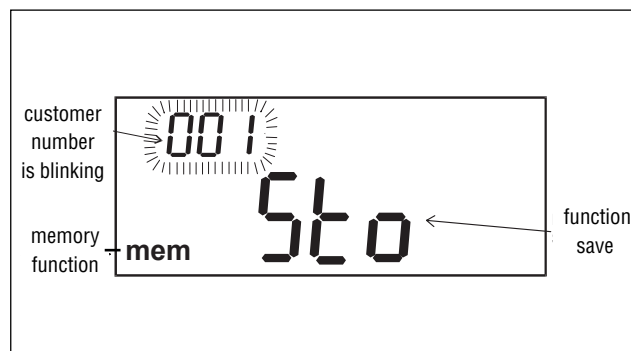


Fig. 9.3

#### STEP 2

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The 'CE' key is used to clear faulty entries.

### STEP 3

- Press the **ENTER** key to confirm the **Customer Number**. Now, the **UUT Number** is displayed.

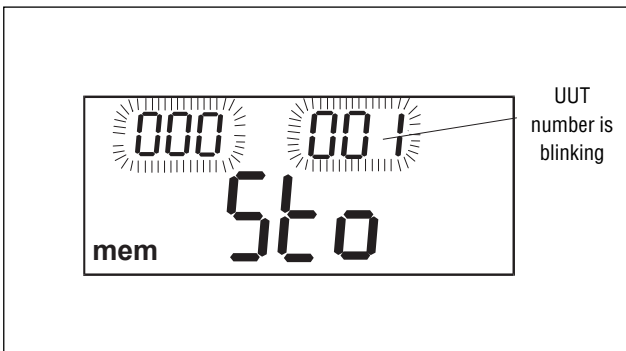


Fig. 9.4

### STEP 4

- Enter the respective **UUT Number** via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

### STEP 5

- Press the „MEM“ key of the appliance or the key „SAVE“ on the respective **COMMANDER** again to terminate the saving procedure. The result is saved and displayed. The procedure is completed once a double signal sound is audible.

### 9.2.3 Pre-setting and Testing of Customer and UUT Number

If further measurement results are to be memorised within the same customer / UUT number, and to avoid entry during memorisation procedure, it is recommended to set both numbers prior to measurement as follows:

#### STEP 1

- Turn switch **Measurement Function** to clear any results displayed.

Pre-setting and Verification of Customer and UUT Number

#### STEP 2

- Press the **MEM** key of the appliance or the key **SAVE** on the **COMMANDER** once to enter the 3-digit customer number. The customer number is displayed according to Fig. 9.3.

### STEP 3

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The 'CE' key is used to clear incorrect entries.

### STEP 4

- Press the **ENTER** key to confirm the **Customer Number**. Now, the **UUT Number** is displayed according to Fig. 9.4.

### STEP 5

- Enter the respective **UUT Number** via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

### STEP 6

- Press the **MEM** key of the appliance or the key **SAVE** on the **COMMANDER** again to terminate the saving procedure. The result is saved and displayed. The procedure is completed once a double signal sound is audible.

UNITEST MACHINEmaster possesses approx. 1800 memory addresses for the function DATA LOGGER.

### NOTES!

- Possibility to use key **CE** in order to clear any incorrect entry.
- Proposed **Customer or UUT Numbers** after having pressed the key „MEM“ or „SAVE“ (see Fig. 9.2) correspond to the values having been last used within function **SAVE**, and are independent from the other functions. (**RECALL**, **RS232**, **CLEAR**).
- Key **CANCEL** may be used to quit function **SAVE** without memorisation.
- To further process memorised measurement data by using Software **UNITEST es control0113** (Cat. No. 1253), the entry of **Customer and UUT Numbers** have to be carefully chosen.
- In case on the **LCD** of the **MACHINEmaster** appears 'top', the memory of the appliance is filled up. It is not possible to save further measuring data. Please transfer data to **PC** and clear memory.

### 9.3 Recalling Saved Measurement Values

Saved measurement values including customer and UUT numbers as well as function number can be verified, i.e. be recalled onto the LCD.

#### How to recall measurement results saved?

##### STEP 1

- Press the **CANCEL** key or turn the **Function switch** to terminate any active functions.

##### STEP 2

- Press the **RCL** key to enter the **Customer** and **UUT Number**. The following is displayed:

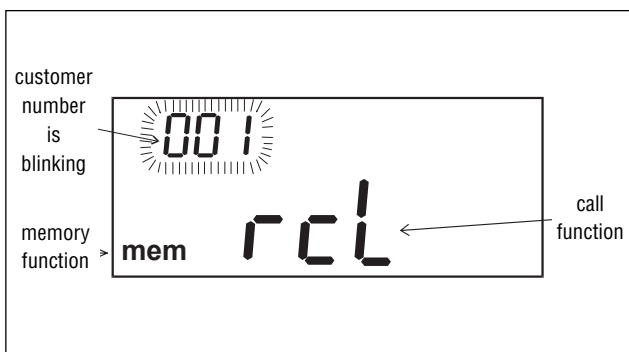


Fig. 9.5

##### STEP 3

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The 'CE' key is used to clear incorrect entries.

##### STEP 4

- Press the **ENTER** key to confirm the **Customer Number**. Now, the UUT Number is displayed.

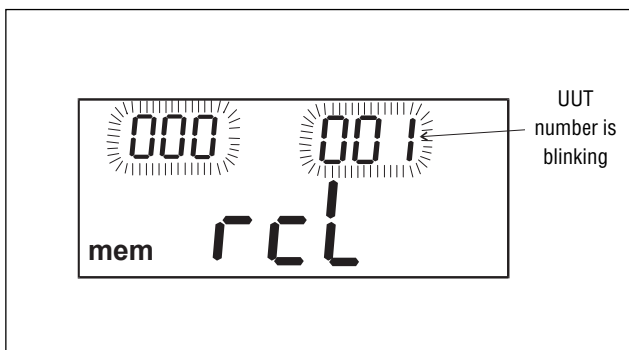


Fig. 9.6

##### STEP 5

- Enter the respective **UUT Number** via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

##### STEP 6

- Press the **RCL** key again to confirm the previously entered customer and UUT number. The following is briefly displayed (please refer to Fig. 9.7 Example for Differential Current Measurement):

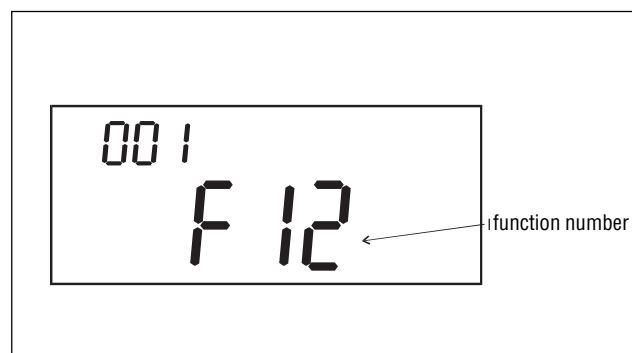


Fig. 9.7

The last memorised result for the selected customer/UUT number is displayed as follows (Fig. 9.8 Example for Differential Current Measurement):

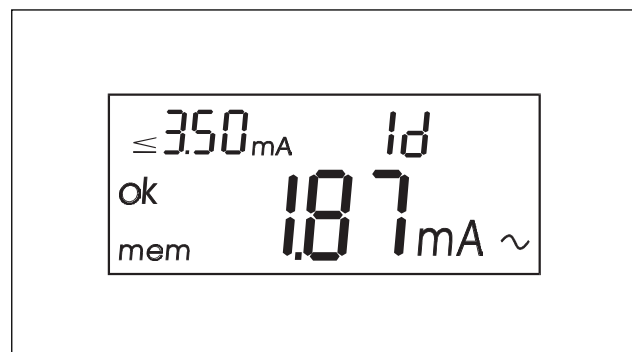


Fig. 9.8

- The **2/↓** and **8/↑** keys are used to display further results having been saved under the same customer/UUT number.
- The **DISPLAY** key is used to switch between the saved measurement values and the measurement function / customer / UUT number, i.e. between Fig. 9.7 and Fig. 9.8.

**STEP 7**

- Press the CANCEL key to exit the RCL function.

**NOTES!**

- It is possible to press key CE to clear any incorrect entry of Customer / UUT Numbers.
- Pre-set values for Customer / UUT Numbers after having pressed key CALL (see Fig. 7.6) correspond to the respectively last entry and are independent from the other functions (RS232, CLEAR).
- If results of the AUTO function are displayed, **Aut** is briefly indicated prior to the display of the individual measurement value.
- If "top" is indicated on the LCD when pressing key **8/↑**, the measurement value displayed represents the last memorised result entered with the respective Customer / UUT Number.
- If "bot" is indicated on the LCD when pressing key **2/↓**, we are dealing with the first result memorised.

9.4 Printout of Measurement Values via RS232

Interface

Measurement values memorised may be transferred to a personal computer for further processing. For data transfer to a PC, a respective software is required being able to activate the PC interface.  
 A special software for measurement value transfer, for easy establishment of a test report, and for administration of customers and systems, is available as UNITEST es control 0113 (Cat. No. 1253).

There are four different possibilities to transfer memorised measurement values:

All Measurement Values	9.4.1
Only Measurement Values within a certain Customer Number	9.4.2
Only Measurement Values within a certain UUT Number	9.4.3
Only Measurement Values within a certain Customer / UUT Number	9.4.4

9.4.1 Transfer All Measurement Values

All memorised measurement values are to be transferred.  
Memory Structure:

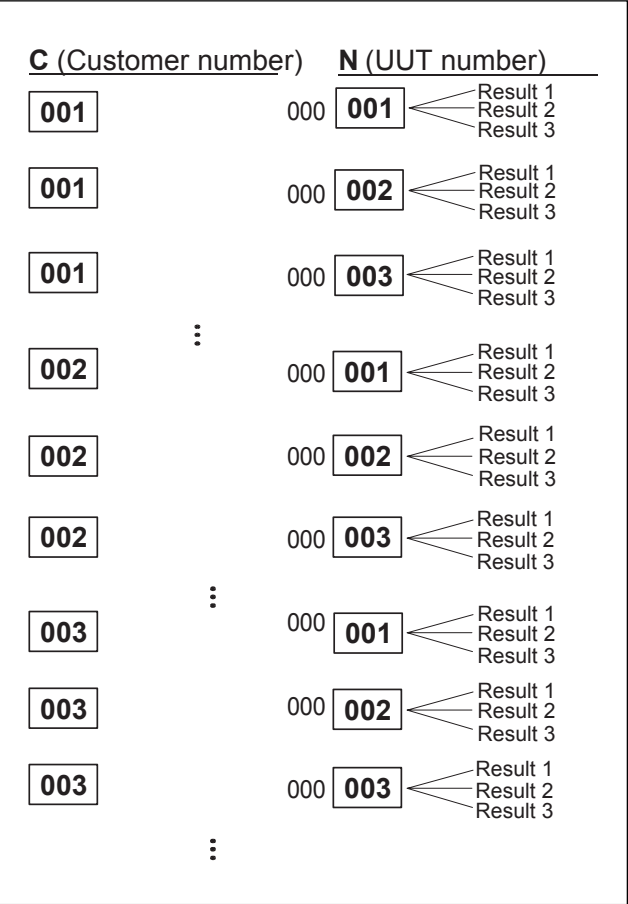


Fig.9.9

Version 1:

STEP 1

- Press key **CANCEL** or turn switch Measurement Function to interrupt possible active functions.

STEP 2

- Press key **RS 232** and keep pressed for approx. 2s until the following is displayed:

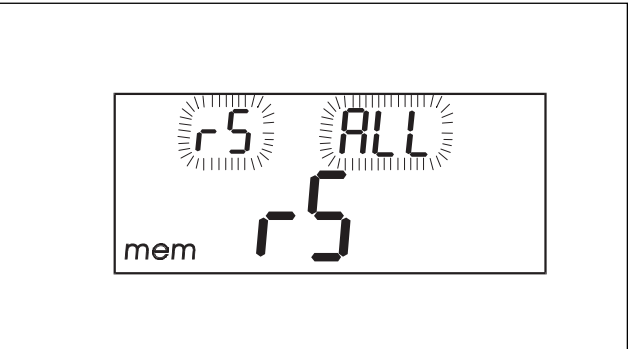


Fig. 9.10

STEP 3

- Press key **RS 232** again. All memorised measurement values are transferred. The following is displayed .

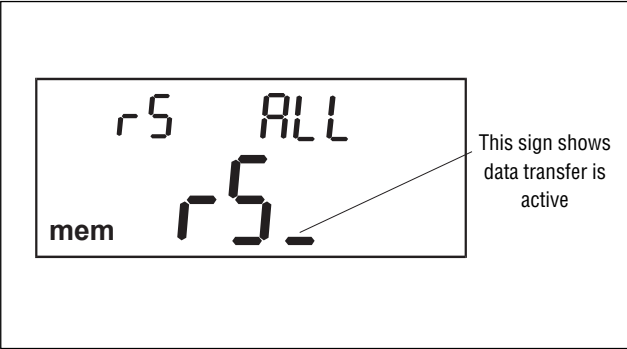


Fig. 9.11

Version 2:

STEP 1

- Press key **CANCEL** or turn switch **Measurement Function** to interrupt possible active functions.

STEP 2

- Press key **RS 232**. The following is displayed:

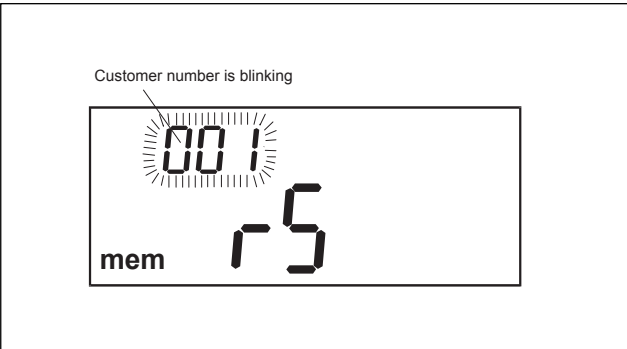


Fig.9.12

STEP 3

- Press key **CE** to clear UUT Number displayed. "-" is displayed.



#### STEP 4

- Press key **ENTER** to select Customer Number:

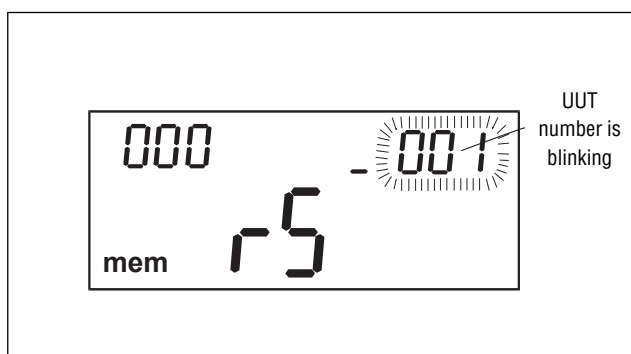


Fig.9.13

#### STEP 5

- Press key **CE** to clear Customer Number displayed. "-" is displayed.

#### STEP 6

- Press key **RS 232** again to start transfer. The following is displayed:

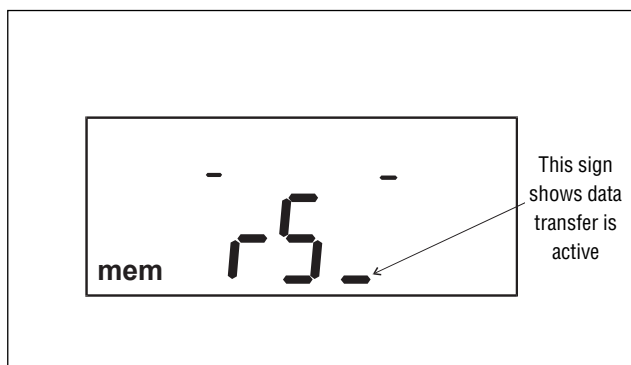


Fig.9.14

After transfer of all memorised data, the pre-set measurement function is displayed again.

#### Example of a Transfer Report :

CH. BEHA GmbH		
UNITEST MACHINEmaster		
9050E 2.0 No.10116 12345		
-----		
DATE: _____		
TESTER: _____		
PLACE: _____		
REMARK: _____		
-----		
TOTAL: 14		
-----		
C:001 N:000001 10-05-02		
-----		
Zl	=	0.56 Ohm
Ipsc	=	405 A
Lim	:	23.9 Ohm
-----		
C:001 N:000002 10-05-02		
-----		
Vres	=	100 V
t	=	1 s
Lim	:	60.0 V
-----		
C:001 N:000003 10-05-02		
-----		
Rins	=	11.08 MOhm
Vins	=	641 V
Lim	:	1.00 MOhm
-----		
Vpe	=	1.55 V
t	:	3 s
Lim	:	3.30 V
-----		
C:002 N:000001 10-05-02		
-----		
Rpe	=	.280 Ohm -
Lim	:	0.30 Ohm
-----		
C:002 N:000002 10-05-02		
-----		
Rpe+	=	0.42 Ohm -
Rpe-	=	0.43 Ohm
Lim	:	0.30 Ohm
-----		
Rins	=	10.77 MOhm-
Vins	=	643 V
Lim	:	1.00 MOhm
-----		
Ileak	=	.063 mA -
Lim	:	0.50 mA
-----		
C:002 N:000003 10-05-02		
-----		
Id	=	0.47 mA -
Lim	:	3.50 mA
Id	=	0.03 mA -
Lim	:	3.50 mA
-----		
C:002 N:000004 10-05-02		
-----		
Rpe	=	.436 Ohm -
Lim	:	0.30 Ohm
-----		
Id	=	0.75 mA -
Lim	:	3.50 mA
Id	=	0.02 mA -
Lim	:	3.50 mA
-----		
C:003 N:000001 10-05-02		
-----		
Il	=	7.99 A -
Vl-n	=	218 V
P	=	1746 VA
-----		
END OF DATA		

### 9.4.2 Transfer of Measurement Values selected by Customer Number

Only measurement values are to be transferred having been memorised within a certain Customer Number (C), despite UUT Number.

C (Customer number)	N (UUT number)	
001	000 001	Result 1 Result 2 Result 3
001	000 002	Result 1 Result 2 Result 3
001	000 003	Result 1 Result 2 Result 3
⋮		
002	000 001	Result 1 Result 2 Result 3
002	000 002	Result 1 Result 2 Result 3
002	000 003	Result 1 Result 2 Result 3
⋮		
003	000 001	Result 1 Result 2 Result 3
003	000 002	Result 1 Result 2 Result 3
003	000 003	Result 1 Result 2 Result 3
⋮		

Fig.9.16

### Transfer of Measurement Values selected by Customer Number

#### STEP 1

- Press the **CANCEL** key or turn the **Function switch** to terminate any active functions.

#### STEP 2

- Press the RS 232 key to display the **Customer** and **UUT Number**. The following is displayed:

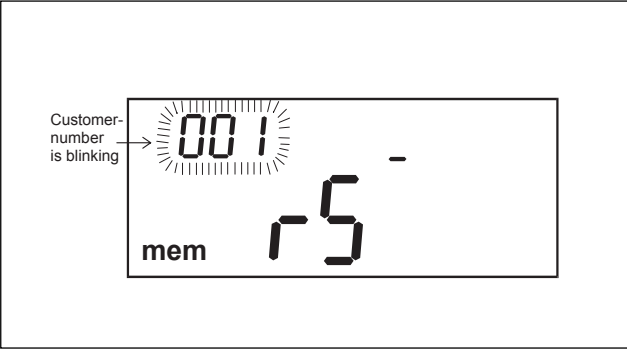


Fig. 9.17

#### STEP 3

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The ‘CE’ key is used to clear incorrect entries.

#### STEP 4

- Press the **ENTER** key to confirm the **Customer Number**. Now, the **UUT Number** is displayed.

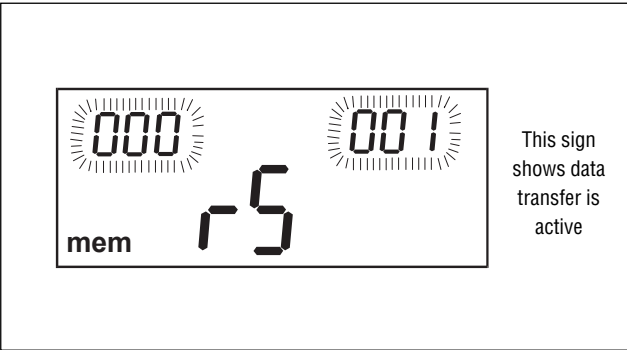


Fig. 9.18

#### STEP 5

- Press the **CE** key to clear the UUT Number.

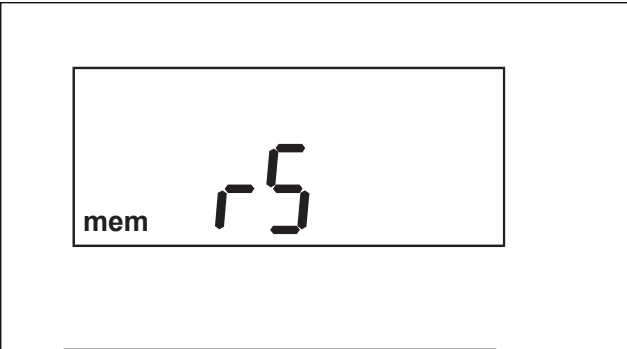


Fig. 9.19

STEP 6

- Press the **RS 232** key again to start data transfer.

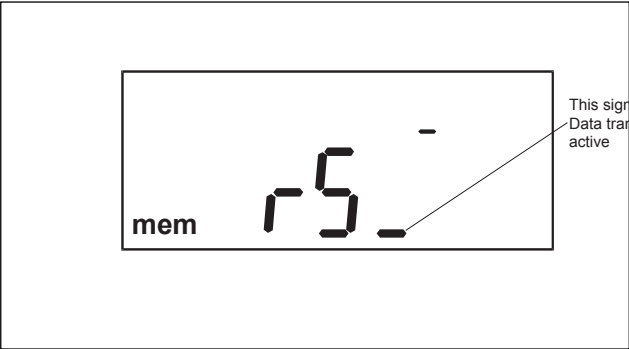


Fig. 9.20

After the transfer of all data saved the set measurement function and the last measurement value are displayed again.

9.4.3 Transfer Measurement Values selected by UUT Number

Only measurement values are to be transferred having been memorised within a certain **UUT Number** (N), despite Customer Number.

C (Customer number)	N (UUT number)	
001	000 001	Result 1 Result 2 Result 3
001	000 002	Result 1 Result 2 Result 3
001	000 003	Result 1 Result 2 Result 3
⋮		
002	000 001	Result 1 Result 2 Result 3
002	000 002	Result 1 Result 2 Result 3
002	000 003	Result 1 Result 2 Result 3
⋮		
003	000 001	Result 1 Result 2 Result 3
003	000 002	Result 1 Result 2 Result 3
003	000 003	Result 1 Result 2 Result 3
⋮		

Fig. 9.21

STEP 1

- Press the **CANCEL** key or turn the Function switch to terminate any active functions.

STEP 2

- Press the **RS 232** key to display the Customer and UUT Number. Please refer to Fig. 9.17.

STEP 3

- Press the **CE** key to clear the Customer Number, '-' is now displayed

STEP 4

- Press the **ENTER** key to display the **UUT Number**.

STEP 5

- Enter the respective UUT Number via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

STEP 6

- Press the **RS 232** key again to start data transfer.

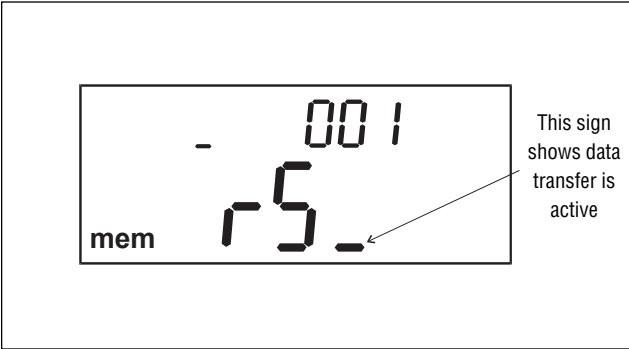


Fig. 9.22

After the transfer of all data saved the set measurement function and the last measurement value are displayed again.

### 9.4.4 Transfer of Measurement Values selected by Customer and UUT Number

Only measurement values are to be transferred having been memorised within a certain **Customer/UUT Number** (C and N).

C (Customer number)	N (UUT number)
001	000 001
001	000 002
001	000 003
⋮	
002	000 001
002	000 002
002	000 003
⋮	
003	000 001
003	000 002
003	000 003

Fig. 9.23

Transfer of Measurement Values selected by Customer and UUT Number

#### STEP 1

- Press the **CANCEL** key or turn the **Function switch** to terminate any active functions.

#### STEP 2

- Press the **RS 232** key to enter the **Customer** and **UUT Number**. The following is displayed:

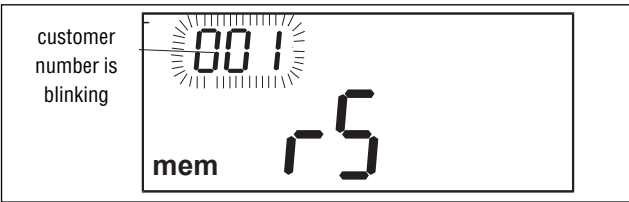


Fig. 9.24

#### STEP 3

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The 'CE' key is used to clear incorrect entries.

#### STEP 4

- Press the **ENTER** key to confirm the **Customer Number**. Now, the **UUT Number** is displayed.

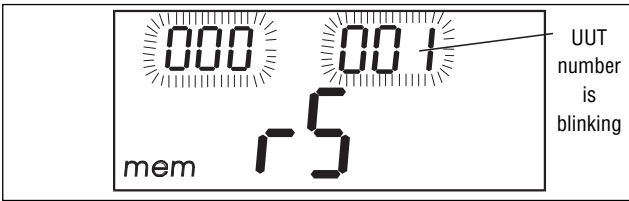


Fig. 9.25

#### STEP 5

- Enter the respective **UUT Number** via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

#### STEP 6

- Press the **RS 232** key again to confirm the customer and UUT number previously entered and to start data transfer. The following is displayed.

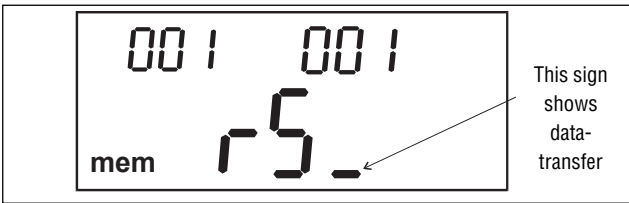


Fig. 9.26

After the transfer of all data saved the set measurement function and the last measurement value are displayed again.

9.5 Clearing Memorised Measurement Values

Memorised measurement values may be cleared completely or partially.

There are four different possibilities to clear memorised measurement values:

- All Measurement Values 9.5.1
- Measurement Values within a certain Customer Number 9.5.2
- Measurement Values within a certain UUT Number 9.5.3
- Measurement Values within a certain Customer /UUT Number 9.5.4

9.5.1 Clearing All Measurement Values

All memorised measurement values are to be cleared.  
Memory Structure:

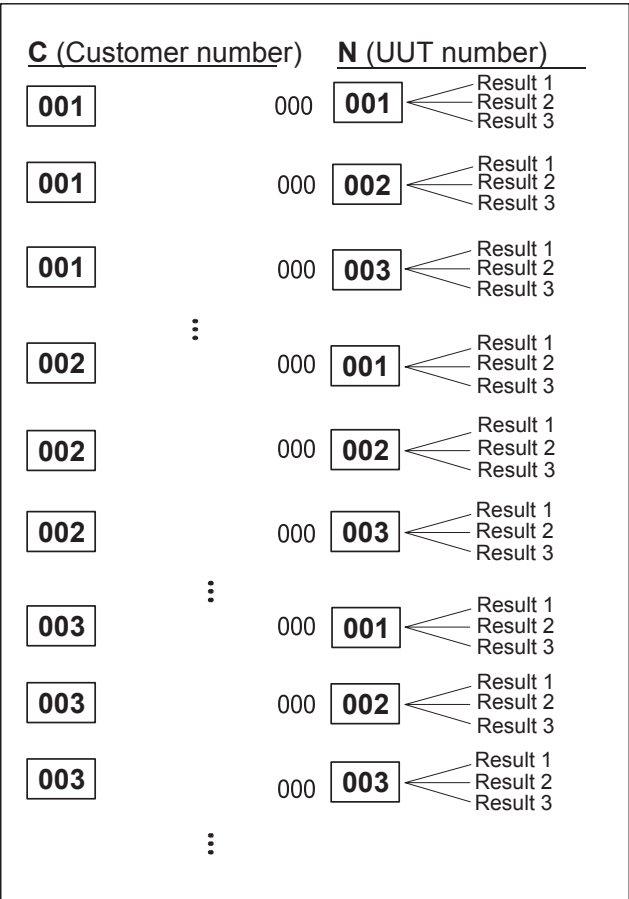


Fig. 9.27

Version 1:

STEP 1

- Press key **CANCEL** or turn switch **Measurement Function** to interrupt possible active functions.

STEP 2

- Press key **CLR** during approx. 2 s. until the following display appears:

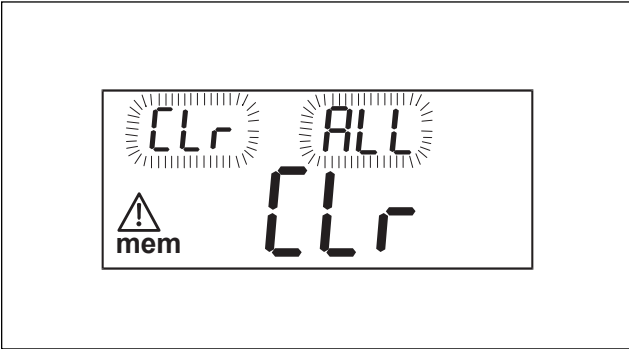


Fig. 9.28

STEP 3

- Press again key **CLR**. All memorised measurement values are cleared. To interrupt this function, press key **CANCEL** or turn switch **Measurement Function**.

After having cleared all memorised data, the pre-set measurement function is displayed again.

Version 2:

STEP 1

- Press key **CANCEL** or turn switch **Measurement Function** to interrupt possible active functions.

STEP 2

- Press key **CLR**. The following is displayed:

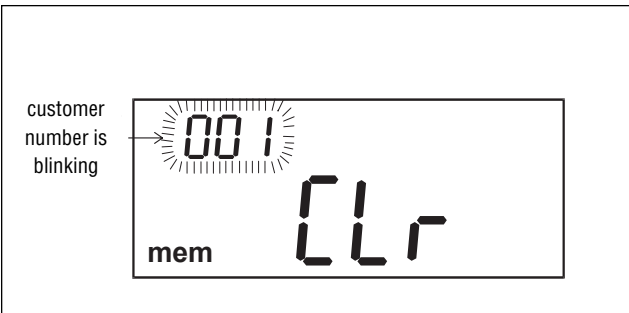


Fig. 9.29

**STEP 3**

- Press key **CE** to clear displayed Customer Number. "-" is displayed.

**STEP 4**

- Press key **ENTER** to select **UUT Number**:

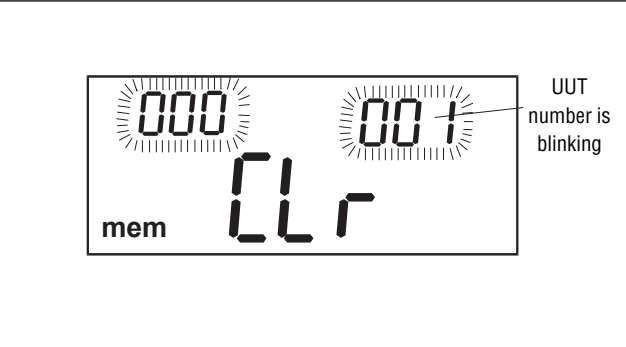


Fig. 9.30

**STEP 5**

- Press key **CE** to delete UUT Number displayed. "-" is displayed.

**STEP 6**

- Press again key **CLR** to start clearing procedure. A further safety question will be asked to avoid any involuntary clearing of data. The following is displayed:

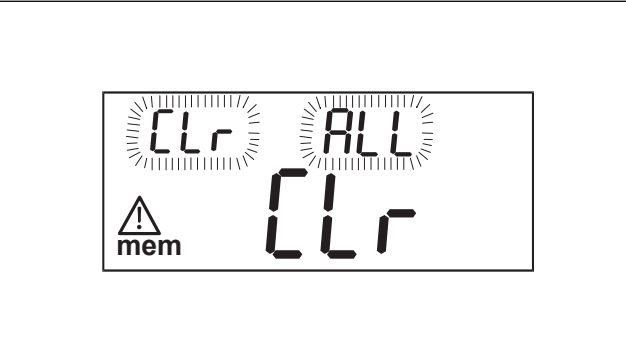


Fig. 9.31

**STEP 7**

- Press key **CLR** again. To interrupt this function, press key **CANCEL** or turn rotary switch **Measurement Function**.

After having cleared all memorised data, the pre-set measurement function is displayed again.

**9.5.2 Clearing Measurement Values selected by Customer Number**

Only measurement values are to be cleared having been memorised within a certain **Customer Number (C)** despite UUT Number.

C (Customer number)	N (UUT number)	
001	000 001	Result 1 Result 2 Result 3
001	000 002	Result 1 Result 2 Result 3
001	000 003	Result 1 Result 2 Result 3
⋮		
002	000 001	Result 1 Result 2 Result 3
002	000 002	Result 1 Result 2 Result 3
002	000 003	Result 1 Result 2 Result 3
⋮		
003	000 001	Result 1 Result 2 Result 3
003	000 002	Result 1 Result 2 Result 3
003	000 003	Result 1 Result 2 Result 3

Fig. 9.32

**STEP 1**

- Press the **CANCEL** key or turn the **Function switch** to terminate any active functions.

**STEP 2**

- Press the **CLR** key to display the **Customer** and **UUT Number**. The following is displayed:

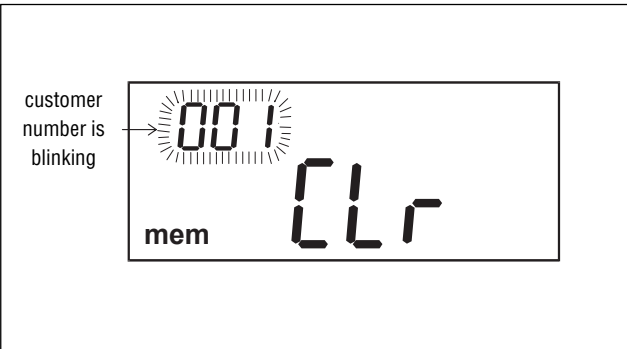


Fig. 9.33

### STEP 3

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The 'CE' key is used to clear faulty entries.

### STEP 4

- Press the **ENTER** key to confirm the **Customer Number**. Now, the UUT Number is displayed.

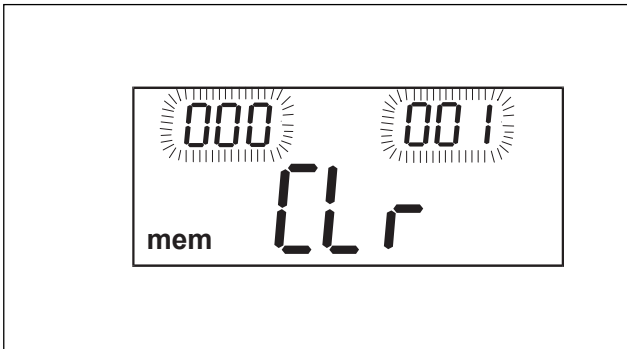


Fig. 9.34

### STEP 5

- Press the **CE** key to clear the **UUT Number**.

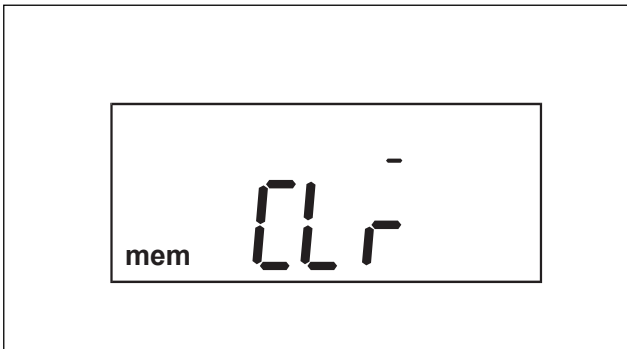


Fig. 9.35

### STEP 6

- Press the **CLR** key. A repeated safety command is displayed to avoid involuntary clearing. Please press the **CANCEL** to cancel this function or turn the **Function switch**.

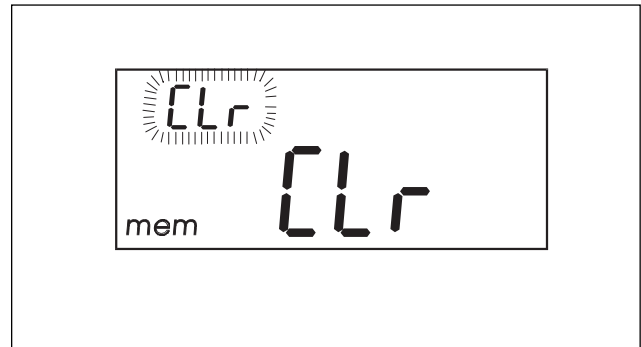


Fig. 9.36

### STEP 7

- Press the **CLR** key again to confirm the clearing procedure.

After the transfer of all data saved the set measurement function and the last measurement value are displayed again.

9.5.3

Clearing Measurement Values selected by UUT Number

Only measurement values are to be cleared having been memorised within a certain UUT Number (N), despite Customer Number.

C (Customer number)	N (UUT number)	
001	000 001	Result 1 Result 2 Result 3
001	000 002	Result 1 Result 2 Result 3
001	000 003	Result 1 Result 2 Result 3
⋮		
002	000 001	Result 1 Result 2 Result 3
002	000 002	Result 1 Result 2 Result 3
002	000 003	Result 1 Result 2 Result 3
⋮		
003	000 001	Result 1 Result 2 Result 3
003	000 002	Result 1 Result 2 Result 3
003	000 003	Result 1 Result 2 Result 3
⋮		

Fig. 9.37

- STEP 1

  - Press the **CANCEL** key or turn the **Function switch** to terminate any active functions.
- STEP 2

  - Press the **CLR** key to display Customer and UUT Number.

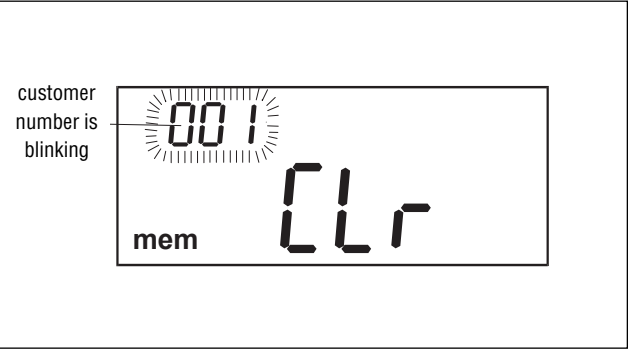


Fig. 9.38

- STEP 3

  - Press the **CE** key to clear the **Customer Number**, '-' is now displayed.
- STEP 4

  - Press the **ENTER** key to display the **UUT Number**.
- STEP 5

  - Enter the respective **UUT Number** via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

- STEP 6

  - Press the **CLR** key. A repeated safety command is displayed to avoid involuntary clearing. Please press the **CANCEL** key to cancel this function or turn the **Function switch**.

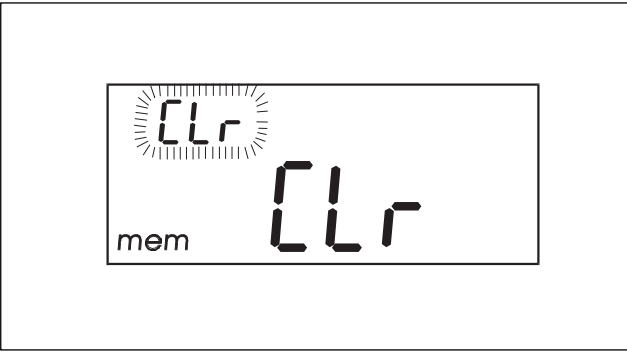


Fig. 9.39

- STEP 7

  - Press the **CLR** key again to confirm the clearing procedure.

After the transfer of all data saved the set measurement function and the last measurement value are displayed again.



9.5.4 Clear Measurement Values selected by Customer and UUT Number

Only measurement values are to be cleared having been memorised within a certain **Customer / UUT Number** (C and N).

C (Customer number)	N (UUT number)	
001	000 001	Result 1 Result 2 Result 3
001	000 002	Result 1 Result 2 Result 3
001	000 003	Result 1 Result 2 Result 3
⋮		
002	000 001	Result 1 Result 2 Result 3
002	000 002	Result 1 Result 2 Result 3
002	000 003	Result 1 Result 2 Result 3
⋮		
003	000 001	Result 1 Result 2 Result 3
003	000 002	Result 1 Result 2 Result 3
003	000 003	Result 1 Result 2 Result 3
⋮		

Fig. 9.40

STEP 1

- Press the **CANCEL** key or turn the **Function switch** to terminate any active functions.

STEP 2

- Press the **CLR** key to display Customer and UUT Number. The following is displayed:

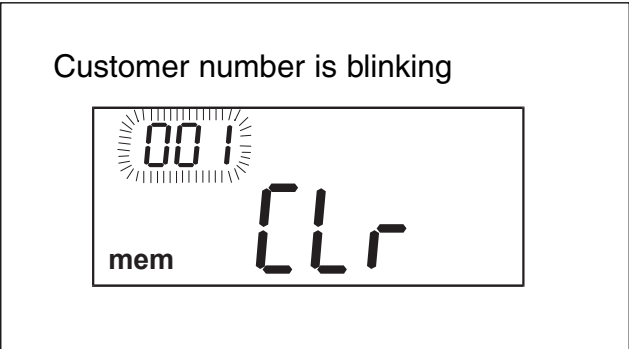


Fig. 9.41

STEP 3

- Enter the respective **Customer Number** using the numerical keypad (11). The customer number consists of three digits and must have a value between 001 and 999. There is no need to enter the leading zeros, i.e. the digit Zero 0 in first position (e.g. 053). The 'CE' key is used to clear incorrect entries.

STEP 4

- Press the **ENTER** key to confirm the **Customer Number**. Now, the **UUT Number** is displayed.

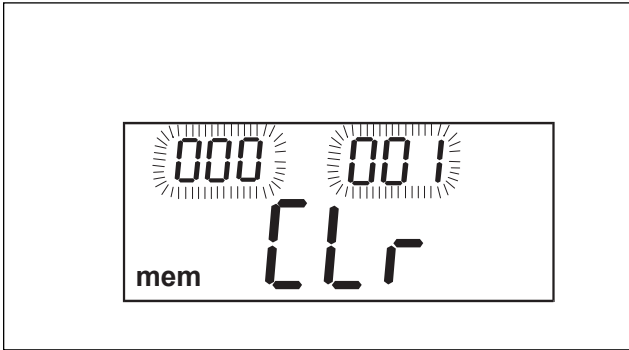


Fig. 9.42

STEP 5

- Enter the respective **UUT Number** via the numerical keypad (11). The number consists of six digits and must have a value between 000 001 and 999 999. There is no need to enter the leading zeros (e.g. 001 234). The **ENTER** key is used to switch between UUT and customer number.

STEP 6

- Press the **CLR** key. A repeated safety command is displayed to avoid involuntary clearing. Please press the **CANCEL** key to cancel this function or turn the **Function switch**.

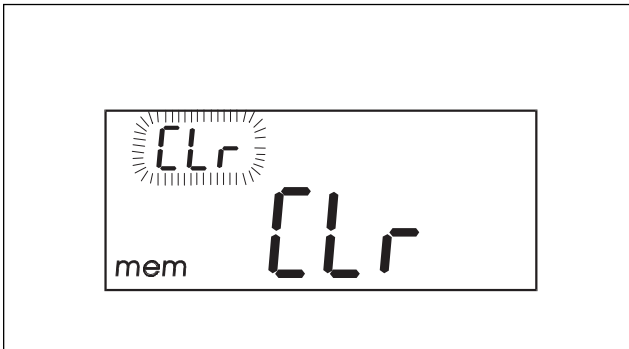


Fig. 9.43

#### STEP 7

- Press the **CLR** key again to confirm the clearing procedure.

After the transfer of all data saved the set measurement function and the last measurement value are displayed again.

### 9.6 Using the Barcode Pen / Scanner

To avoid manual entry of test code, manual recalling or clearing of memorised data during measurement result saving, it is possible to use a Barcode Pen / Scanner. Only the Barcode Pen/Scanner specified in section 4.9.2 can be used.

#### 9.6.1 Connecting a Barcode Pen/Scanner

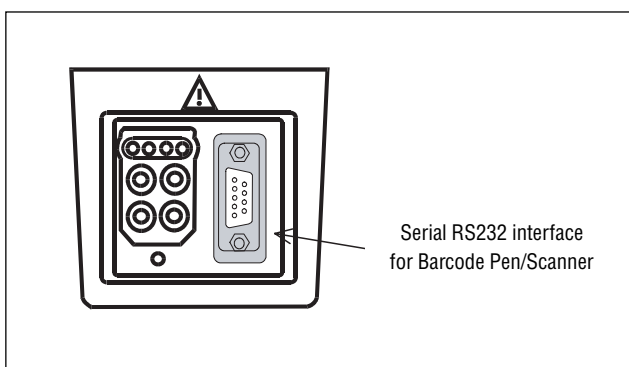


Fig.9.44

#### 9.6.2 Using a Barcode Pen/Scanner during Saving of Measurement Results

##### STEP 1

- Connect Barcode Pen/Scanner with appropriate adapter to RS 232 interface of UNITEST MACHINE-master.

##### STEP 2

- To carry out a measurement to be saved, please refer to procedure in sections 3 to 4.

##### STEP 3

- Press key **MEM** to enter UUT Number.

##### STEP 4

- Reading the barcode instead of manual entry. For this purpose, use the Barcode Pen/Scanner in conjunction with the instruction manual supplied. The Barcode Pen/Scanner sends the code read to the UNITEST MACHINE-master. The last 6 digits are evaluated. The code is briefly displayed and the memorisation procedure is carried out automatically.

#### 9.6.3 Using a Barcode Pen/Scanner during Calling of Memorised Measurement Results

##### STEP 1

- Press key **CANCEL** or turn switch **Measurement Function** to interrupt possible active functions.

##### STEP 2

- Press key **RCL** to select **UUT Number** (see Fig. 9.45).

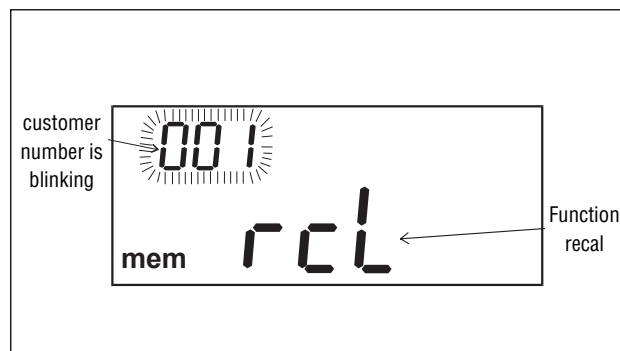


Fig. 9.45

##### STEP 3

- To read a barcode for the measurement to be recalled, use the Barcode Pen/Scanner in compliance with the instruction manual supplied. The Barcode Pen/Scanner sends the code read to the UNITEST MACHINE-master. The measurement value called is indicated on the display.

#### 9.6.4 Using a Barcode Pen/Scanner to Clear Memorised Measurement Results.

##### STEP 1

- Press key **CANCEL** or turn switch **Measurement Function** to interrupt possible active functions.

##### STEP 2

- Press key **CLR** to select **UUT Number** (see Fig. 6.47).

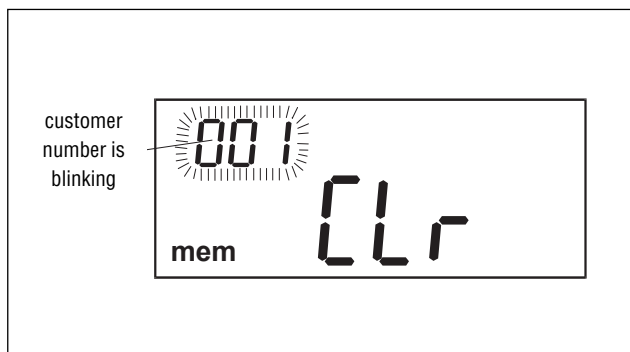


Fig. 9.46

##### STEP 3

- To read a barcode for the measurement to be cleared, please use the Barcode Pen/Scanner in compliance with the instruction manual supplied. The Barcode Pen/Scanner sends the code read to the UNITEST MACHINEmaster.

##### STEP 4

- Press again key **CLR** to delete the measurement value.

#### 9.6.5 Using a Barcode Pen/Scanner for AUTO Function

Described in section 7.9 AUTO Function.

## 10. Messages

### 10.1 Messages in the Display

During operation, various messages may appear on the display of UNITEST MACHINEmaster. The following meanings can be classified:

<b>Co</b>	Use COMMANDER 1 or COMMANDER 2.
<b>Co 1</b>	Use COMMANDER 1.
<b>Co 2</b>	Use COMMANDER 2.
<b>StE</b>	Measurements at test/mains socket.
<b>OFF</b>	Switch off mains voltage or UUT.
<b>L-n</b>	Phase polarity at test/mains socket (phase on the left).
<b>n-L</b>	Phase polarity at test/mains socket (phase on the right).
<b>CR L</b>	Test lead is compensated (valid for additional accessories).
<b>CR L</b>	Appliance is ready to compensate additional measurement leads.
<b>Hi</b>	Display of maximum value within function RECORD.
<b>Lo</b>	Display of minimum value within function RECORD.
<b>SPE</b>	Appliance presently in function SAVE.
<b>Rbr</b>	Appliance presently in function CALL.
<b>rES</b>	Active appliance reset.
<b>⚠ PE</b>	PE connection of appliance missing. Attention ! Danger of live
<b>MEM no</b>	Data memory empty.
<b>top</b>	Last saved measurement result is displayed, or memory of appliance is full.
<b>bot</b>	First saved measurement result is displayed.
<b>rS</b>	RS232 communication output of measurement values via interface.
<b>LOG</b>	Appliance presently in function RECORD (Data Logger)
<b>rS</b>	Frequency outside specified range, at loop impedance measurement
<b>FUS</b>	Fuse defect, see section 9.2.
<b>hot</b>	Appliance overheated (function: VPE 10A or RPE 10A).
<b>CLr</b>	Appliance presently in function CLEAR memory.
<b>CLr ALL</b>	Clear total memory.
<b>Cod</b>	Entry of test code within AUTO function.
<b>ok</b>	Displayed measurement value within pre-set limit.
<b>⚠</b>	Displayed measurement value outside pre-set limit
<b>"</b>	Or displayed current IL in function IL/UL-N/P exceeds 16A, or input voltage outside admissible range.
<b>MEM</b>	Memory function.
<b>OL</b>	Overflow display (measurement result outside display range).
<b>PRs</b>	UUT ok, i.e. all values measured during AUTO function are within limit values.
<b>ERR</b>	Faulty UUT (function AUTO) or maximum value for test lead compensation has been exceeded (see sections 4.2.1 and 4.3.1).

## 10.2 Acoustic Messages

Different acoustic signals with the following signification can be generated by the UNITEST MACHINEmaster:

Short signal sound (-)

- Key confirmation sound
- Turning the rotary switch
- Appliance switch-on
- Exceeding the safety voltage level within function U/f, Z<sub>L</sub>/I<sub>PSC</sub> (3).

Short/longer signal sound (- —)

- Function not yet complete

Short/short signal sound (- —)

- Function such as saving, printing, or clearing complete

Long signal sound (———)

- Input voltage exceeds allowable range

Continuous interval sound (- - - ...)

- PE connection of UNITEST MACHINEmaster not correctly earth
- Test probes connected are in contact with dangerous voltages in functions I<sub>PE</sub> SUBS or I<sub>LEAK</sub>.

Longer signal sound (—)

- Final result after termination of pre-set measurement time in functions V<sub>RES</sub> and V<sub>PE</sub>10A are outside limits.

## 11.0 Maintenance

When using the appliance in compliance with the instruction manual, no special maintenance is required.

- ☎ Should operational problems occur during daily use, our consulting service (phone +49 (0) 7684/8009-429) will be at your disposal, free of charge. For any queries regarding the appliance, please always quote product description and serial number, both marked on the type shield label on appliance rear.

If functional errors occur after expiration of warranty, our after sales service will repair your appliance without delay.

### 11.1 Cleaning

If the appliance is dirty after daily usage, it is advised to clean it by using damp cloth and a mild household detergent.

- ⚠ Prior to cleaning, ensure that appliance is switched off and disconnected from external voltage supply and any other appliances connected (such as UUT, control appliances, etc.).

- ⚠ Never use acid detergents or dissolvants for cleaning.

- ☎ After cleaning, the appliance may not be used until complete dried.

### 12.0 Internal Fuses

The measurement inputs of the appliance are protected by fuses, described in section 11 Technical Data. When using the appliance in compliance with the instruction manual, these fuses will not blow.

- ⚠ **However, should the fuses blow, the measurement appliance has to be returned to the factory for repair.**

### 13.0 Technical Data

Technical data indicated refer to 23°C ±5°C. max. 70% rel. Humidity, mains voltage 230V, 50/60 Hz

#### 13.1. Load Current (IL) . Measurement Function 1

Measurement Range (A)	Resolution (A)	Accuracy
0...16.00	0.01	±(5% rdg. + 3 D)

Display Range: .....0.00...19.99A

Measurement Principle:.....Current transformer

If measurement value of 16 A is exceeded, the warning symbol is displayed.

#### 13.2. Mains Voltage (VL-N) . Measurement Function 1

Measurement Range (V)	Resolution (V)	Accuracy
207.....244	1	±(5% rdg. + 3 D)

Mains voltage at built-in mains socket is measured.

#### 13.3. Power (P) . Measurement Function 1

Measurement Range (VA)*	Resolution (VA)	Accuracy
0....1999	1	±(5% rdg. + 3 D)
2.00 k....3.90 k	10	

\* Automatic Range

Display Range: .....0....4.87kVA

Apparent power taken via built-in mains socket is measured (  $S = V \times I$  ) in VA

#### 13.4. Voltage (V) . Measurement Function 3

Measurement Range (V)	Resolution (V)	Accuracy
0.....600	1	±(5% rdg. + 3 D)

Frequency Range: .....DC (0Hz) . 45-65Hz

Internal Resistance: .....approx. 40MΩ

#### 13.5. Frequency (f) . Measurement Function 3

Measurement Range (Hz)	Resolution (Hz)	Accuracy
45.0.....65.0	0.1	±(0.1% rdg. + 3 D)

#### 13.6. Loop Impedance (ZL) . Measurement Function 3. According to IEC 60204 / EN 60204

Measurement Range (Ω)*	Resolution (Ω)	Accuracy
0.12.....19.99	0.01	±(5 % rdg. + 3 D)
20.0.....199.9	0.1	

\* Automatic Range

Display Range: .....0.00.....199.9 Ω

Frequency Range: .....45...65 Hz

Measurement Time:.....10 ms

Test Current: .....approx. 23 A at 230 V (RL approx. 10 Ω)

### 13.7. Prospective Short Circuit Current (IPSC) . Measurement Function 3

Measurement Range (A)	Resolution (A)	Accuracy
0.5.....199.9	0.1	Refer to Accuracy of Loop Impedance and Voltage measured
200.....1999	1	
2.00k.....2.50k	10	

Display Range: .....0.5 A.....30.0 kA  
Voltage Range .....100...300 V  
Frequency Range: .....45...65 Hz  
Measurement Time:.....10 ms  
Test Current: .....Approx.. 20 A (RL approx. 10  $\Omega$ )

Calculation basis for prospective short circuit current displayed:

for VL-PE = 115V ( $\pm 10\%$ ) :  $I_{psc} = 115V/Z_L$   
for VL-PE = 230V ( $\pm 10\%$ ) :  $I_{psc} = 230V/Z_L$   
for all other mains voltages :  $I_{psc} = V_{L-PE}/Z_L$   
( $Z_L$  represents loop impedance measured)

### 13.8. Residual Voltage (VRES) . Measurement Function 4. According to IEC 60204 / EN 60204

Measurement Range (V)	Resolution (V)	Accuracy
0.....600	1	$\pm(5\% \text{ rdg.} + 3 \text{ D})$

Limit Value: ..... $\leq 60V$  (fixed pre-setting)  
Discharge Time:.....1 s or 5 s (selectable)  
Frequency Range: .....DC (0 Hz) 45...65 Hz  
Internal Resistance: .....approx. 40 M $\Omega$

### 13.9. Insulation Resistance ( $R_{INS}$ ) .

Measurement Function 5 and 9. According to IEC 60204 / EN 60204, DIN VDE 0701/0702

Measurement Range (M $\Omega$ ) *	Resolution (M $\Omega$ )	Accuracy
0.012.....1.999	0.001	$\pm(5\% \text{ rdg.} + 3 \text{ D})$
2.00.....19.99	0.01	
20.0.....199.9	0.1	
**200.....1000	1	$\pm(10\% \text{ rdg.})$

\* Automatic Range

\*\* No or only limited usage for capacitive loads

Nominal Test Voltage: .....500V DC  
Open Voltage: .....<750V DC  
Test Voltage: .....>500V DC (for nominal load of 500 k $\Omega$ )  
Short Circuit Current: .....<5mA DC  
After the measurement, UUT is automatically discharged.

### 13.10. PE Voltage Drop ( $V_{PE 10A}$ ) . Measurement Function 6. According to IEC 60204 / EN 60204

Measurement Range (V)	Resolution (V)	Accuracy
0.12.....3.30	0.01	$\pm(5\% \text{ rdg.} + 10 \text{ D})$

Display Range: .....0.00.....19.99 V  
Test Current: .....>10 A / 50 Hz (for RPE <330 m $\Omega$  and VMainsvoltage >207 V)  
Test Voltage: .....<12V AC  
Max. Value to be compensated: ..0.1  $\Omega$   
Operating Time: ..... see diagram 1 in section 13.11.

### 13.11. PE Resistance ( $R_{PE}$ 10A) . Measurement Function 7. According to DIN VDE 0701/0702

Measurement Range ( $\Omega$ ) *	Resolution ( $\Omega$ )	Accuracy
0.012.....0.999	0.001	
1.00.....9.99	0.01	$\pm(5\% \text{ rdg.} + 10 \text{ D})$
10.0.....19.9	0.1	

\* Automatic Range

Test Current: .....>10A / 50 Hz (at  $R_{PE} < 330 \text{ m}\Omega$  and  $V_{Mains} > 207 \text{ V}$ )

Test Voltage: .....<12V AC

Max. Value to be compensated: ..0.1  $\Omega$

Operating Time: ..... see diagram 1

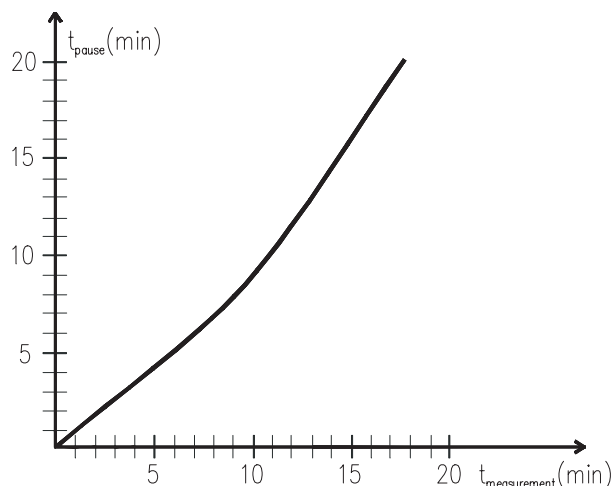


Diagram 1:

Allowable Operating Time and Breaks for Measurement Functions 6 and 7

### 13.12. PE Resistance ( $R_{PE} \pm 200 \text{ mA}$ ) . Measurement Function 8, According to DIN VDE 0701/0702

Measurement Range ( $\Omega$ )	Resolution ( $\Omega$ )	Accuracy
0.12.....19.99	0.01	$\pm(5\% \text{ rdg.} + 3 \text{ D})$

Test Current: .....>200mA DC (at 2 $\Omega$ )

Test Voltage: .....approx. 12 V DC

Max. Value to be compensated: ..5  $\Omega$

Automatic Reversing of Polarity of Test Voltage

### 13.13. Substitute Leakage Current ( $I_{PE \text{ SUBS}}$ ) . Measurement Function. According to DIN VDE 0701 /0702

Measurement Range (mA)	Resolution (mA)	Accuracy
0.....19.99	0.01	$\pm(5\% \text{ rdg.} + 3 \text{ D})$

Test Voltage: .....< 50V AC

Test Current: .....< 30mA AC

Display Test Voltage (V) *	Resolution (VA)	Accuracy
0....49.9	0.1	$\pm(5\% \text{ rdg.} + 3 \text{ D})$
50.....600	1	

\* Automatic Range

Displayed measurement value for IPE SUBS is referred to a mains voltage of 230 V+6%, according to DIN VDE 0702.



**13.14. Leakage Current according to DIN VDE 0701 Part 240 /  
touching Current ( $I_A/I_B$ ) DIN VDE 0701/0702, Measurement Function 11**

Measurement Range (mA)	Resolution (mA)	Accuracy
0....1.999	0.001	±(5% rdg. + 3 D)

Internal Resistance: .....approx 1.8kΩ

**13.15. Differential Current ( $I_\Delta$ ) / Earth Conductor Current ( $I_{PE}$ ) . Measurement Function 12.  
According to DIN VDE 0701/0702**

Measurement Range (mA)	Resolution (mA)	Accuracy
0.03.....19.99	0.01	±(5% rdg. + 3 D)

Measurement Principle: Current transformer

**An additional zero error of ca. 0.25 mA may be caused by UUT load current.**

**13.16. General**

Power Supply: .....Mains Voltage 230 V, ±10 %,16 A, 50 Hz

Current Consumption: .....max. 1 A / 230 VA (without active test/mains socket)

Display: .....LCD with symbols

Interface: .....RS-232. (electrically isolated)

Parameter:.....9600 Baud. 1 Start Bit. 8 Data Bits. 1 Stop Bit. XON/XOFF-Handshake

Internal Memory

(Measurement Values): .....approx. 1800 measurement Values

Internal Memory

(RECORD/Data Logger): .....approx. 8000 measurement Values

Overload Protection: .....

Fuse F1: .....20 A quick-blow / 600 V 30 kA (10 x 38 mm)

.....(for Functions  $V_{PE}$  10 A and  $R_{PE}$  10 A)

Fuse F2:

.....0.315 A medium slow / 250 V (5x20 mm)

.....(for function  $R_{PE}$  ±200 mA)

Dimensions (total): .....305 x 130 x 270 mm ( W x H x D )

Weight (without accessories): .....approx. 5 kg

Protection Class: .....II (double insulation)

Overvoltage Class: .....CAT II / 600 V

.....CAT III / 300 V

Pollution Degree: .....2

According to: .....EN 61557, IEC61557, DIN VDE 0413

.....IEC 61010, EN 61010, DIN VDE 0411

.....DIN VDE 0404

Protection Degree: .....IP 40

Reference Temperature Range: .. 23°C ±5°. max. 70% rel. humidity.

Operating Temperature Range: ..0...+40°C. max 85% rel. humidity

Storage Temperature Range: .....-10...+40° C. max 90 % rel. humidity +40...+60 °C. max 80 % rel. humidity

Absolute Altitude: .....up to 2000 m

Test Voltages acc. to IEC 61010: **3.7 kV AC / 1 min.** between short circuited test probes of COMMANDER 2 and all accessible metal parts.

**2.8 kV AC / 1 min** between short circuited mains connection (L. N. PE) and all accessible metal parts.

## **24 month Warranty**

UNITEST appliances are subject to strict quality control. However, should the appliance function improperly during daily use, you are protected by our 24 months warranty (valid only with invoice).

We will repair free of charge any defects in workmanship or material, provided the appliance is returned unopened and untampered with, i.e. with undamaged warranty label.

Any damage due to dropping or incorrect handling are not covered by the warranty.

If the appliance shows failure following expiration of warranty, our service department can offer you a quick and economical repair.

# Qualitätszertifikat • Certificate of Quality

## Certificat de Qualité • Certificado de calidad



Die BEHA-Gruppe bestätigt hiermit, dass das erworbene Produkt gemäß den festgelegten Beha-Prüfanweisungen während des Fertigungsprozesses kalibriert wurde. Alle innerhalb der Beha-Gruppe durchgeführten, qualitätsrelevanten Tätigkeiten und Prozesse werden permanent durch ein Qualitätsmanagement-System nach ISO 9000 überwacht.

Die BEHA-Gruppe bestätigt weiterhin, dass die während der Kalibrierung verwendeten Prüfeinrichtungen und Instrumente einer permanenten Prüfmittelüberwachung unterliegen. Die Prüfmittel und Instrumente werden in festgelegten Abständen mit Normalen kalibriert, deren Kalibrierung auf nationale und internationale Standards rückführbar ist.



The BEHA Group confirms herein that the unit you have purchased has been calibrated, during the manufacturing process, in compliance with the test procedures defined by BEHA. All BEHA procedures and quality controls are monitored on a permanent basis in compliance with the ISO 9000 Quality Management Standards.

In addition, the BEHA Group confirms that all test equipment and instruments used during the calibration process are subject to constant control. All test equipment and instruments used are calibrated at determined intervals, using reference equipment which has also been calibrated in compliance with (and traceable to) the calibration standards of national and international laboratories.



Le groupe BEHA déclare que l'appareil auquel ce document fait référence a été calibré au cours de sa fabrication selon les procédures de contrôle définies par BEHA. Toutes ces procédures et contrôles de qualité sont régis par le système de gestion ISO 9000.

Le groupe BEHA déclare par ailleurs que les équipements de contrôle et les instruments utilisés au cours du processus de calibrage sont eux-mêmes soumis à un contrôle technique permanent.

Ces mêmes équipements de contrôle sont calibrés régulièrement à l'aide d'appareils de référence calibrés selon les directives et normes en vigueur dans les laboratoires de recherche nationaux et internationaux.



El grupo BEHA declara que el producto adquirido ha sido calibrado durante la producción de acuerdo a las instrucciones de test BEHA. Todos los procesos y actividades llevados a cabo dentro del grupo BEHA en relación con la calidad del producto son supervisados permanentemente por el sistema ISO 9000 de control de calidad.

Adicionalmente, el grupo BEHA constata que los equipos e instrumentos de prueba utilizados para la calibración también son sometidos a un permanente control. Estos equipos e instrumentos de prueba son a su vez calibrados en intervalos regulares valiéndose de equipos de referencia calibrados de acuerdo a directivas de laboratorios nacionales e internacionales.



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Reg. No. 3335  
Quality Management System  
ISO 9001



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I.S. / ISO 9002 / EN 29002  
Quality Management System

### IQ NET

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