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I N T R O M E T

ITM – 525

PCB copper thickness gauge

O P E R A T I N G M A N U A L

PRINCIPLE OF OPERATION

Please read this Operating Manual carefully before start operation. The instrument includes tiny probes which must be handled with care. The manufacturer keeps no responsibility for any damage occurred due to wrong operation.

The INTROMET ITM-525 instrument is designed for accurate non-destructive measurement of the copper thickness in plated through holes and copper foil on laminate. It consists of electronic unit (Fig.1, 2) and probes (Fig. 3, 4).
Eddy current probes (US pat. 5,600,240) designed for measurement in through holes. They are used for etched or unethed PCBs, as well as for tin-lead soldered PCBs. The eddy current probe tips are acid-protected with special coating and can measure wet PCB.
To measure copper thickness on laminate four-point electrical resistance method CSP probe can be used.

Eddy current probes are detachable, consisting of a probe holder and replaceable cartridge of certain size. To measure copper thickness in the hole, the tip of the cartridge must be inserted into the hole up to stop.

The instrument must be properly calibrated before getting start. Calibration units and foils are applied for this purpose. Calibration settings are stored in the instrument memory. User can apply his own standards and store the calibration settings in the instrument memory.

PCB parameters, measuring mode, print-out settings, etc. can be set with the instrument keypad.

Measured data can be stored in instrument memory to be processed afterwards. Readings and statistics taken can be displayed, downloaded to computer for printing out.

Precautions

The tips of probes may be easily damaged if wrong operated. Please follow advices mentioned below to extend probe life:

- *use the tip protective cap when the probe is not in use*
- *insert the probe tip into the hole loosely and at right angles to the PCB*
- *do not apply force trying to insert tip into the hole*
- *carefully use cartridges because their tiny tips can be damaged mechanically.*
- *keep probe tips clean and dry*
- *keep cartridges away from strong magnetic field.*

CONTENTS

APPLICATION

The ITM-525 is applied to measure copper thickness in plated through holes (PTH) of PCB and copper thickness on laminate.

1.1. Applicable PCB

- Single or double cladded, multilayer
- Non-etched, etched
- Without or with tin or tin-lead coating

PCB Thickness:

- From 0.5 mm to 6.0 mm

Hole Diameter:

- From 0.45 mm to 2 mm

1.2. Measuring Range and Resolution (copper in PTH)

Measuring Range:

- From 5 μm to 60 μm

Resolution:

- 0.1 μm

1.3. Measuring Range and Resolution (copper on laminate)

Measuring Range:

- From 15 μm to 80 μm

Resolution:

- 0.1 μm

FEATURES

- In-process measurement is possible
- Only one-side access to the holes is required
- No limitations on PCB size
- No need for electric contact with plating
- Reveals cracks in PTH coating
- acid-protected probe tips
- measures as small hole as 0.45 mm
- Measures thickness in μm or mils
- Two calibration modes
- Automatic zero setting
- Storing 15 000 measurements
- Statistical analysis
- USB interface
- Measurement on laminate requires no cleaning surface

CONTENT OF THE ITM-525 SET

1.4. Content

The list of probes, parts and accessories available is as follows.

- INTROMET ITM-525 electronic unit in leather pouch
- Cartridge holder
- Cartridge EP-30 for holes 0.8 to 2 mm
- Cartridge EP-25 for holes 0.6 to 0.8 mm
- Probe EP-20 for holes 0.45 to 0.6 mm

- Probe shortened EP-30S for holes 0,8 to 2,0 mm)
- Probe shortened EP-25S for holes 0,6 to 0,8 mm
- Calibration unit EP25/30
- Reference standard RS-52-1 for EP-30
- Reference standard RS-52-2 for EP-25
- Reference Standard & calibration unit RS-52-3 for EP-20
- Probe Guide
- CSP copper surface probe
- CSP calibration foils
- USBA-USBB cable
- Plug-in type AC adapter
- 2 rechargeable AA batteries
- Carrying Case
- Operating Manual

POWER SUPPLY

ITM-525 is power supplied with two AA rechargeable batteries.
Continues working time - 10 hours.
"BAT LOW" displayed when batteries are low. The instrument is turned off automatically. To charge batteries connect AC adapter and choose one of modes from the instrument menu: Fast Charge / Normal Charge / Slow Charge. Charging time is 2 / 4 / 14 hours correspondingly. It is possible to use normal batteries (non-rechargeable). In this case choose the No Charge mode to avoid accidental charge.
Following AC adapter is applied to recharge the batteries:

AC input:	110-240 V / 50-60 Hz
DC output:	9V, 500 mA
Outer pole:	“-“

OPERATION CONTROLS AND DISPLAYS

ITM-525 has graphic LCD display and membrane keypad (Fig. 1).
Batteries compartment is from the rear (Fig. 2).
USB, probe, and AC connectors are located in the up.

Probe with cartridge installed is presented on Fig. 3, CSP probe – on Fig. 4.

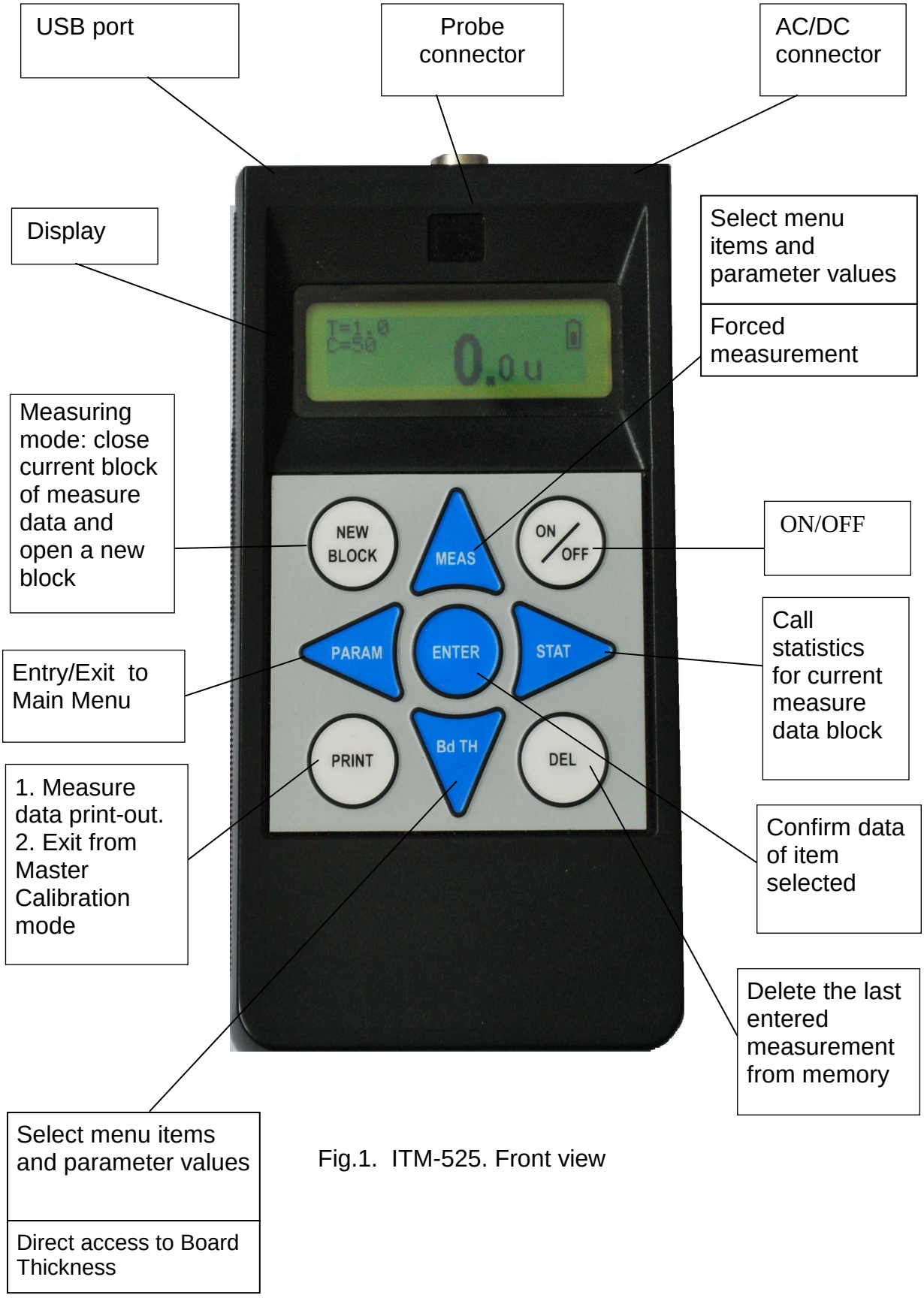


Fig.1. ITM-525. Front view

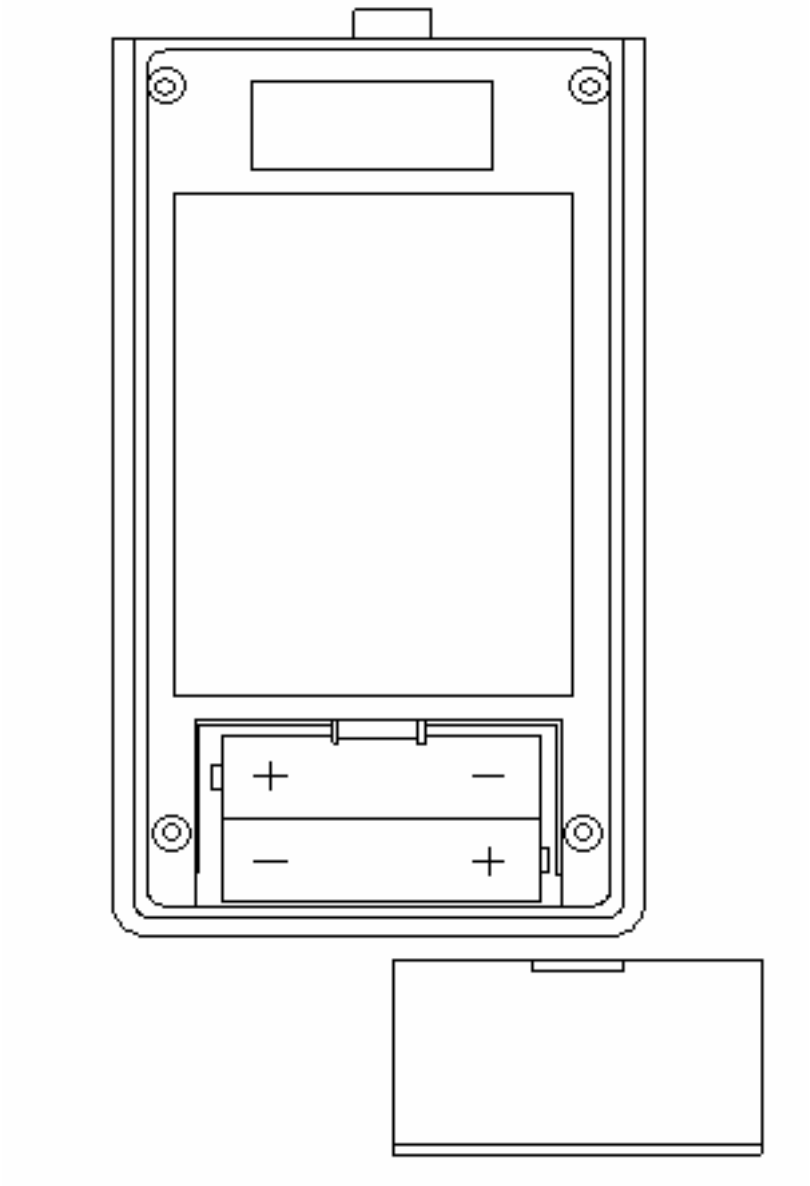


Fig.2. ITM-525. Rear view. Cover of battery compartment is open

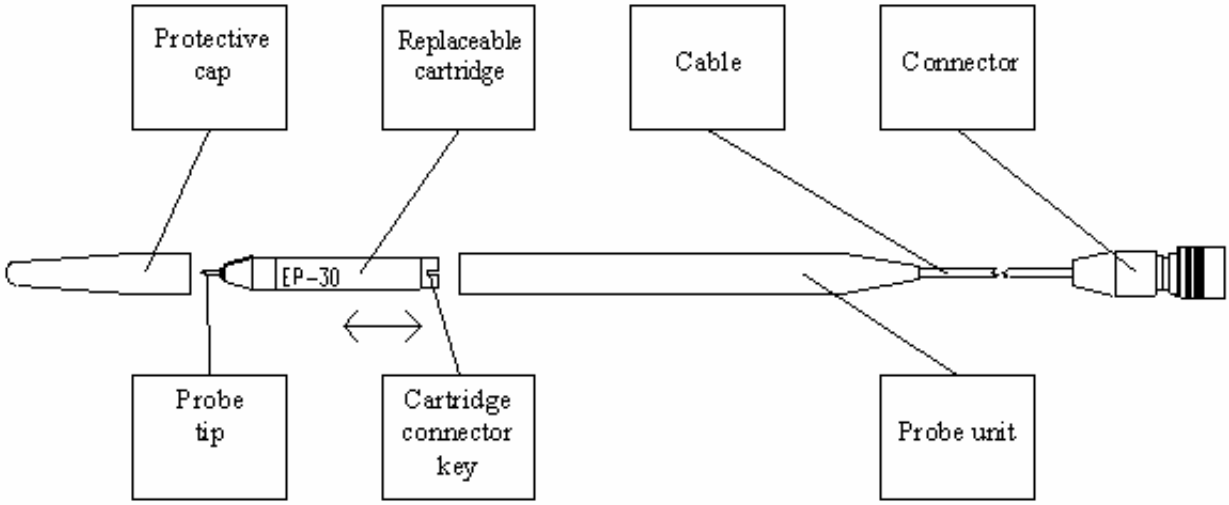


Fig. 3. Probe unit with replaceable cartridge

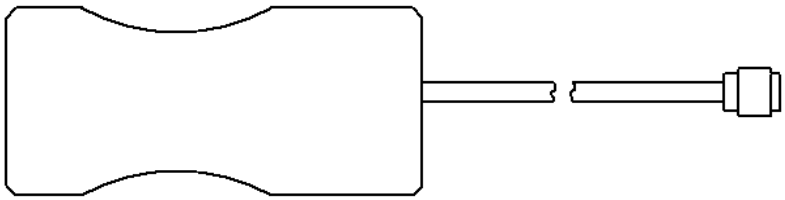


Fig. 4. CSP probe

FACTORS, WHICH EFFECT READINGS

There are factors, which effect readings of ITM-525.

The main factors are as following:

1.5. Linear dimensions

Following parameters effect readings: PCB thickness, hole diameter, copper cladding thickness on PCB and dimensions of inner copper traces in case of multilayer PCB.

The **PCB thickness** influence is eliminated by entering board thickness actual value via the keyboard before measuring. Board core thickness variations within a tolerance limit of 10% result in copper thickness reading variations of approx. 3%, regardless of the copper cladding thickness.

The hole 0.8 mm to 2.0 mm diameter variation causes an additional error of the readings taken with "EP-30" probe, not more than (1...2) μm. The measure error for (0.45-0.6) mm and (0.6-0.8) mm hole diameters are still less.

The measurement reliability can be improved by instrument calibration applying standards with known copper thickness in the through-holes. The copper thickness in the standard PTH may be determined, for instance, through the metallographic cross-section technique. However, the actual errors of standard certification should be properly taken into account.

The effects of **copper cladding thickness** as well as the dimensions of **contact pads, outer and inner** (for multilayer PCB), **copper traces** of etched PCB are usually negligible for commonly produced PCB. However, the copper thickness reading for the hole without contact pads around it may be significantly less than the real value. In this case, measure result may be corrected through multiplying the reading by an experimentally defined correcting coefficient. The correction is not necessary if the contact pad diameter is greater than twice the hole diameter, according to IEC 326-3.

1.6. Electric conductivity

The electric conductivity of electroplated or electrolyze deposited copper depends basically on the plating bath conditions and chemistry.

The copper electric conductivity in the most applicable plating processes equals approx. (50 ± 3) MS/m or (86 ± 5,3)% IACS. The value of 50.0 MS/m is taken as the base one for the preliminary calibration of the instrument.

Note
1 MS/m = 10^6 S/m = 10^6 1/(Ohm · m);
100% IACS = 59.5 MS/m - electric conductivity of pure copper (20° C)
1 MS/m = 1.72% IACS;
1% IACS = 0.58 MS/m

If the copper electric conductivity at the User's site differs significantly from the base value of 50.0 MS/m and is definitely known, User can change the conductivity value via the keyboard (Direct method, Chap. 9.2.4.1).

If the actual value of the electric conductivity is unknown, it can be entered through the Indirect method (see Chap. 9.2.4.2) applying the standards with known copper thickness produced at the User's.

1.7. Tin - Lead alloy coating

Due to the electric conductivity of tin-lead alloy is much lower than of the copper conductivity, a 10 μ thickness Sn-Pb layer results in an increase in the copper thickness measurement of approx. 10% when the copper thickness is approx. 25 μm. This effect decreases with increasing of copper plating thickness.

That is why the tin-lead coating influence can be stated as a negligible one.

1.8. Temperature

The copper electric conductivity is temperature dependent. The higher the temperature, the lower the electric conductivity. Assuming the electroplated copper has the same temperature coefficient as the pure copper, a 10°C change in temperature will result in the 4% change of conductivity, which should be taken into consideration during calibration.

Example:

- Temperature of the standard at time of calibration : 25°C
- Temperature of the board under test : 30°C
- Change of conductivity : -2%

As the base value 50.0 MS/m of the electric conductivity is considered for base calibration, User enters 49 MS/m value for Direct method correction (see Chap. 9.2.4.1).

For Indirect correction (see Chap. 9.2.4.2) User can apply the standard board with the same temperature as the board under test.

RECOMMENDATIONS

To make sure the instrument readings are correct compare the readings taken with the results of measurements in the same holes by another technique, e.g., by microscope when the cross-section method is applied. This comparison can be useful when User starts instrument application.

If readings differ from the measure results of an arbitrary method both systematically and significantly, it is possible that the actual electric conductivity value differs significantly from the base value of 50.0 MS/m. In this case User can apply Direct or Indirect methods of reading correction through entering the actual value of conductivity. Setting lower conductivity you increase readings and vice versa.

In any case, be careful in evaluating the standard reliability and measurement errors of an arbitrary method, e.g. of a cross-section method. These above mentioned errors may be significantly more in value than the errors of the ITM-525.

START UP

Plug appropriate cartridge to the cartridge holder and connect the probe to the electronic unit. Remove protective cap.

Turn the instrument on and calibrate it if requested. Calibration is recommended each time before getting start. The ITM-525 stores default BASE SETTINGS:

- calibration characteristic - Base;
- copper plating thickness indication - in μm;
- board thickness - 1.6 mm;
- copper electric conductivity - 50.0 MS/m;
- measure data is stored;
- out of tolerance measured copper thickness sound and visual alarm is on;
- lower limit of copper thickness in the hole - 15.0 μm;
- upper limit of copper thickness in the hole - 35.0 μm.

Settings can be changed (excepting "measure data is stored") through the Main Menu of the instrument and held on for the next measurement sessions.

Recommendation:

Application of CSP does not require cleaning the copper surface prior to measurement. However for better results degreasing is recommended. This can be done effectively with eraser.

MEASURING OPERATION

"Measuring" is the main mode of the instrument operation. The instrument is ready to measure just after been turned on.

Two modes of measuring are available:

1. Auto start measuring mode.
2. Free-running display mode.

In the Auto start measuring mode a measurement is taken automatically at the moment when the probe tip is inserted into a hole. The reading appears on the main display and is stored in the instrument memory.

In Free-running display mode measurements are performed continuously in the cycle of 1 S and display. Measurements are not stored in the instrument memory.

To get reading of copper thickness in through hole the tip of probe is to be inserted in the hole under test for 1-2 seconds.

To get reading on the surface of laminate CSP probe is to be put on the surface tightly, so 4 pins of the probe get contact copper surface reliably. Reading appears automatically.

1.9. Measure data storage

When measurements are performed in the Auto Start measuring mode sequences of measurements are integrated in BLOCKS in the instrument memory. Month, date, hour and minute of the BLOCK creation form its initial name. Later User can change a block name for any desired(Chap. 11.2.). Data blocks can be called out for display, printing and removal from the instrument memory by their names. The block created during the current measuring session, is named ACTIVE. When measuring session has been completed and "**NEW BLOCK**" key pressed, the current block is closed (becomes non-active) and a new data block opens and becomes ACTIVE. If the "**NEW BLOCK**" key not pressed after measuring session, the current block stays ACTIVE.

Thus, after the instrument is turned on, the ACTIVE BLOCK is the one which was current before turning off.

All the measurement data blocks are combined into 8 FILES with initial names: APPL0 ... APPL7. File names can be changed for desired too (Chap. 9.2.2).

Each file has one block as an ACTIVE one.

The instrument has two groups of preliminary settings.

1. Actual for all the data files - global settings:
- built-in clock (Chap. 9.1.1)
- measure system unit (Chap. 9.1.2)
- sound and visual alarm on/off (Chap. 9.1.3)
- backlight on/off (Chap. 9.1.4)
- print-out parameters (Chap. 9.1.5).

2. Actual for the individual file only - file settings:
- board thickness (Chap. 9.2.3)
- copper electric conductivity σ (Chap. 9.2.4)
- copper plating thickness tolerance limits: upper and lower (Chap. 9.2.5).

According to the above mentioned, measure data can be stored in different files according to the calibration parameters: board thickness, copper conductivity σ and plating tolerance limits.

Measure data can be removed from the instrument memory in the following ways:

- the last measurement taken in the ACTIVE block through pressing "**DEL**" key in the measuring mode (see Chap. 8.3);

- an individual measurement in the open block through pressing "**DEL**" in "BLOCK/VEIW" mode (see Chap. 11.3);

- an individual block separately in the selected file through command "BLOCK/Deleting" (see Chap. 11.5);

- all the blocks of the selected file simultaneously through command "FILE/Clear" (see Chap. 9.2.7).

1.10. Control through Main Menu

The instrument operates under the control of the special software embedded in the instrument program memory. Software provides User to control the instrument

operation, to make various parameter settings via keyboard. The structure of the program is presented in Fig. 5.

The program is built as a system of menus and submenus of the different levels. These menu items are presented on the main display during the instrument operation.

Main Menu (Top level).

Items: FILE, CAL, BLOCK and SETUP form the Main Menu.

The items of the Main Menu present menus of the second level which are lists of commands and submenus.

To enter the Main Menu from Measuring mode, press “**PARAM**” key.

To select the item required User moves through the Main Menu using "↑" and "↓" “Arrow” keys. The list of items can be scrolled through like a “closed ribbon”. This movement is indicated on the main display through changing item names displayed. To entry the item required, select the item and confirm the selection by pressing “**ENTER**” key.

To return from the Main Menu into Measuring mode, press “**PARAM**” key again.

Menus (Second level).

Items of the second level are arranged in the lists of submenus and groups of commands according to the item of Main Menu as a heading.

To select the item of the menus, enter the proper item of Main Menu and select the required item of the second level applying vertical arrow keys ↑ and ↓.

To confirm the item selection press “**ENTER**” key.

To exit from menu to Main Menu press “**PARAM**” key.

Submenus and commands.

Submenus and commands are the items of the second level menus. By selecting these items User can set up various parameters: PCB parameters, tolerance limits, alarms, clock and so on, look through the measure data stored in memory or delete some measure data from the memory if needed.

Inside submenus vertical arrow keys “↑” and “↓” are used

- to scroll the file/ block lists of contents;
- to change parameter values up and down.

In the submenus when one of the items in the row on display is highlighted via “negative picture”, the keys “**PARAM**” and “**STAT**” change their meaning to the horizontal arrows “←” and “→”. These horizontal “arrow” keys are used for selecting items inside the submenus only.

To exit from submenu press “**ENTER**” key.

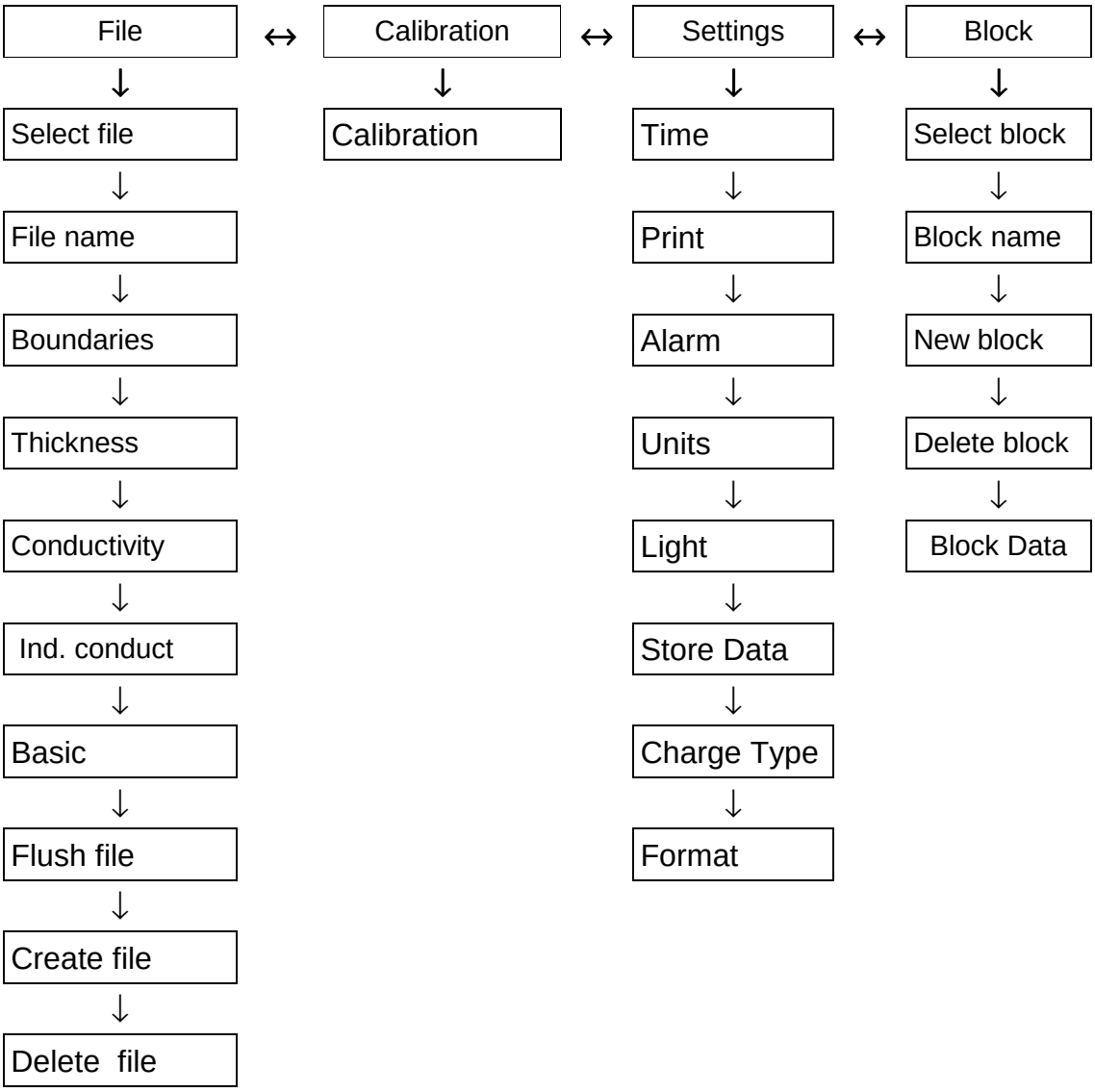


Fig. 5 Structure of Main Menu.

1.11. Measuring in Auto Start Mode

In this mode a current measurement is taken at the moment when the probe tip is inserted into a hole up to the stop. The instrument indicates the measurement by a short-time sound, displays the reading and holds it till next measurement. The measure data is stored in the ACTIVE block of the current file.

Functions available through key pressing:

"**NEW BLOCK**" - close the current block and open a new one which becomes ACTIVE;

"**PARAM**" - entry into Main Menu;

"**PRINT**" - transfer the measured data of the ACTIVE block to computer via USB port;

"**MEAS**" - force the measurement when copper plating thickness in a hole is very low: 2...5 μ (measurement auto start may not work). Press the key holding probe tip in the hole;

"**Bd TH**" - entry directly into "Board thickness" item of Main menu;

"**STAT**" - display statistics of the ACTIVE block data;

"**DEL**" - delete the measurement performed the last in order.

In the Auto Start Mode a measurement is taken in the manner as it is illustrated in the following example:

> **Attention**
> Please, make sure there is free space under the board, so the probe tip when inserted into the hole down to the stop could protrude through the hole by 1...1.5 mm on the board opposite side

KEY	DISPLAY	OPERATION
1. ON/OFF	Self calibration	Turn on the instrument. Probe tip is in air. "Self calibration" indicates for 10 seconds.
2.	**Def. File 1** C=50.0MS/mT=1.50 mm Min:15.0μ Max:35.0μ	Instrument is ready to measure.
3.	T=1.5 C=50 **25**.3μ(*)	Insert probe tip into the hole under test. Sound signal indicates the measurement is taken and reading appears on display. Measurement is stored in active block of a current file
4.	T=1.5 C=50 **25**.3μ(*)	Take probe tip out of the hole. Display holds the reading
5.		Repeat Operations 3, 4 for another hole to be tested (***)

> NOTE
> To delete the last-in-order measurement, press "**DEL**" key. Erroneous reading disappears from display and memory.
> The last measurement of the block cannot be deleted. For this measurement removal use "BLOCK/Deleting" routine

6. DEL	T=1.5 C=50 **35**.3 μ(*)	Press "**DEL**" key to delete measurement taken the last in order
7.	T=1.5 C=50 **0**.0 μ	Erroneous measurement disappears from display.

NOTE
For ACTIVE block statistics calling, press "**STAT**" key. Active block statistics display

8. STAT	Data Amount N= 9		Number of measurements in block displays
9. ↑	Average 26.2 µ		Average value of block measurements displays
10. ↑	Minimum 49.1 µ		Minimum value of block measurements displays
11. ↑	Maximum 25.6 µ		Maximum value of block measurements displays
12. ↑	Range 1.0 µ		Range value of block measurements displays
13. ↑	Deviation 0.3 µ		Standard deviation of block measurements displays
14. ↑	Coeff.Var. 0.69 %		Coefficient of variation of block measurements displays
15. ↑	CP 24.005		Coefficient CP displays
16. ↑	CR 0.042		Coefficient CR displays
17. ↑	CPK -14.068		Coefficient CPK displays
18. Param	T=1.5 C=50 **0**.0 µ		Return to measuring mode. Instrument is ready to measure

NOTE
For transferring the active block data via USB-port press "**PRINT**" key

19. PRINT	PRINTING ...		Measure data is being transferred out. After transferring completed, string "PRINTING" disappears from display

NOTE
To hold the current block still active do not press "**NEW BLOCK**" key, (e.g. for next measurement storage)

20. NEW BLOCK	Block created		Active block is closed. A new block is created.
21.	T=1.5 C=50		New block is active.

0.0 μ

(*) All the values are for illustration only.

(**) When turned on for the first time, the instrument stores the base calibration characteristic and the base PCB parameters: copper special conductivity σ=50 MS/m and board thickness- 1.6 mm (see Chap.10 and Chap. 9). Current file name "APPL 7" displays.

Attention
The instrument is turned off automatically in 4 minutes after the last measurement or key pressing. Signal sounds before turn-off

1.12. Measuring with Free-running display

In the Free-running display mode measurements are executed continuously in the cycle of approx. 1 S and the readings display. The readings are not stored in the instrument memory in opposite to the Auto Start mode.

While measuring, actual are the settings, which are preliminary, set in the current file.

> NOTE
> When copper plating in a hole is very low or probe tip is out of a hole, "AIR" displays and measurement is not taken. To force the measurement, press "**MEAS**" arrow key, holding probe tip in the hole under test

Functions available through pressing keys: "**PARAM**" - entry into Main Menu.

This mode is convenient, particularly, for plating defect detection.

The probe is sensitive to axis rotation. This is beneficial to detect short circular cracks in copper deposit, which cause fluctuations in the instrument readings while the probe rotates. To perform this operation effectively User can apply the Desktop Stand DPS-3 (see Chap. 3.2).

Measuring with Free-running display is executed in the following manner:

KEY	DISPLAY	OPERATION
1. ON/OFF	Self calibration 	Turn the instrument on
2. ENTER	**Def. File 1** C=50.0MS/mT=1.50 mm Min:15.0µ Max:35.0µ 	Instrument is ready to measure.
3.	T=1.5 C=50 **25**.3µ(*) 	Insert probe tip in the hole under test down to stop. Reading displays. Signal sounds when measurement taken
4. ENTER	T=1.5 C=50 **25**.3µ(*) 	Take probe tip out of hole. The instrument is on Free-running display mode

(*) Values are for illustration only.

> NOTE
> When probe tip inserted, measurements are taken continuously in cycle of 1 s. If a measurement is accidentally taken while the probe tip is moving out of hole under test, it may cause the reading sufficiently different from the actual copper thickness value. That's why; take readings executed only when probe tip is inserted down to the stop

PRELIMINARY SETTING

The instrument is supplied with the default parameter settings made at the Manufacturer's. When any settings are to be changed, User can easily do the changes required through the proper items of the Main Menu.

It is important to remember there are **two groups of settings** in the instrument:

1. **Global settings** - actual for all the instrument measurements and all the data files in the instrument memory - are changed through "SETUP" item of Main Menu:

PARAMETER		DEFAULT VALUE
- built-in clock	(Chap. 9.1.1)	Greenwich Mean
- measure unit system	(Chap. 9.1.2)	Metric
- sound alarm turning on/off	(Chap. 9.1.3)	On
- backlight delay	(Chap. 9.1.4)	Off
- print-out parameters	(Chap. 9.1.5)	All On

2. **File settings** - actual for the individual data file only - are changed through "FILE" menu of the Main Menu:

PARAMETER		DEFAULT VALUE
- file name	(Chap. 9.2.2)	Default File
- PCB thickness	(Chap. 9.2.3)	1.6 mm
- copper electric conductivity σ	(Chap. 9.2.4)	50 MS/m
- copper plating thickness tolerance limits: lower and upper	(Chap. 9.2.5)	15µ ÷ 35µ

Before the measurements are performed check up the preliminary settings and set the proper values for parameters if needed

1.13. Global settings

Such settings are actual for all the measurements the instrument makes, stores and displays and provide the convenience of the instrument usage. They work in all the files of the instrument memory.

1.13.1. Clock setting

The instrument has a built-in clock with automatic correction for leap-years. The measure data blocks in the memory are distinguished by the initially. Date and time of the measurements taken are presented in the print-out listing.

The instrument is supplied with the built-in clock set according to Greenwich Mean time.

Date and time are corrected accurate to 1 S through “SETUP/Clock” item of the Main Menu in the following manner:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ↑ / ↓	Settings	Select "Settings” menu
3. ENTER	Settings → Print	Entry to "Settings" menu
4. ↑ / ↓	Settings → Time	Select “Time” item
5. ENTER	6-Aug-2 (*) 16:23:45	Entry to “Time” submenu. Date is highlighted and ready for correction initially
6. ←/→	6-Aug-2 (*) 16:23:45	Select one of items of submenu for correction. Selected item is highlighted through inverse picture
7. ↑ / ↓	6-Aug-2 (*) 16:44:45	Correct the item value. Repeat operations 6, 7 for other items if needed
8. ENTER	Settings → Time	Corrected values stored. Return to "Settings" Menu.
9. PARAM	Settings	Return to Main Menu
10. PARAM	T=1.5 C=50 **0**.0 μ	Exit from the Main Menu. Instrument is ready to measure with new clock settings

(*) Time setting values are for illustration only.

1.13.2. Measure unit system setting

The instrument is capable to display the readings for the copper thickness either in metric (μm) or in Imperial units (mils).

1 mil = 0.001 inch = 25.4 μm

If metric system chosen, copper electric conductivity σ is presented in MS/m and when Imperial system is in use, σ displays in %% IACS.

Convenient measure unit system selection is executed through the "SETUP/Unit" item of Main Menu in the following manner:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ↑ / ↓	Settings	Select "Settings" menu
3. ENTER	Settings → Print	Entry to "Settings" menu
4. ↑ / ↓	Settings → Units	Select “Units” item
5. ENTER	Metric	Entry to “Units” submenu. Date is highlighted and ready for correction initially
6. . ↑ / ↓	English	Select Imperial units (mils)
7. ENTER	Settings → Units	Return to "Settings" Menu.
8. PARAM	Settings	Return to Main Menu
10. PARAM	T=1.5 C=50 **0**.0 m	Exit from the Main Menu. Instrument is ready to measure with new clock settings

1.13.3. Turning on/off the sound and visual alarm

The indication of the situation when the reading is out of the tolerance limits can be turned on/off through “Settings|Alarm” item of the Main Menu for User’s convenience.

If sound and visual alarm is turned on, a picture of the bell displays in the left lower corner of the main display in the Measuring Mode.

A specific signal sounds and special symbols display when a reading is out of the tolerance limits which can be set preliminary.

When the copper thickness in a hole under test is less than the lower limit the “TL” characters display in the upper left corner of the main display.

When the copper thickness in a hole under test is over than the upper limit the “TH” characters display in the upper left corner of the main display.

Turning on the sound and visual alarm is executed in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ↑ / ↓	Settings	Select "Settings” menu
3. ENTER	Settings → Print	Entry to "Settings" menu
4. ↑ / ↓	Settings → Alarm	Select “Alarm” item
5. ENTER	On	Entry to “Alarm” submenu.
6. . ↑ / ↓	Off	Sound and visual alarm is turned off.
7. ENTER	Settings → Alarm	Corrected values stored. Return to "Settings" Menu.
8. PARAM	Settings	Return to Main Menu
10. PARAM	T=1.5 C=50 **0**.0 µ	Exit from the Main Menu. Instrument is ready to measure with new clock settings

If needed to turn the alarm on, repeat the operations 1...8 in the same way once more.

NOTE
Alarm system is off if there is completely no copper plating in the hole

1.13.4. Display illumination setting

Display illumination can be set Off or On or Auto. When set Auto the display is illuminated for a short time to save power.

Setting is executed through the “Setting|Backlight” of the Main menu in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ↑ / ↓	Settings	Select "Settings” menu
3. ENTER	Settings → Print	Entry to "Settings" menu
4. ↑ / ↓	Settings → Light	Select “Light” item
5. ENTER	On	Entry to “Light” submenu.
6. . ↑ / ↓	Auto	Auto mode is turned on.
7. ENTER	Settings → Light	Corrected values stored. Return to "Settings" Menu.
8. PARAM	Settings	Return to Main Menu
9. PARAM	T=1.5 C=50 **0**.0 µ	Exit from the Main Menu. Instrument is ready to measure with Auto mode of backlighting

1.13.5. Downloading setting

Measured data can be downloaded to computer with help of USB interface and printed out after that.

To make possible downloading data to a computer set device connection as follows.

1. Connect the instrument to a computer with USB cable included into delivery set. Being connected with the instrument, computer generates COM port, which number is needed for downloading.
2. To know the COM port number click Start/Control panel/System/System properties/Hardware. Find the COM port number in the line Ports (COM & LPT).

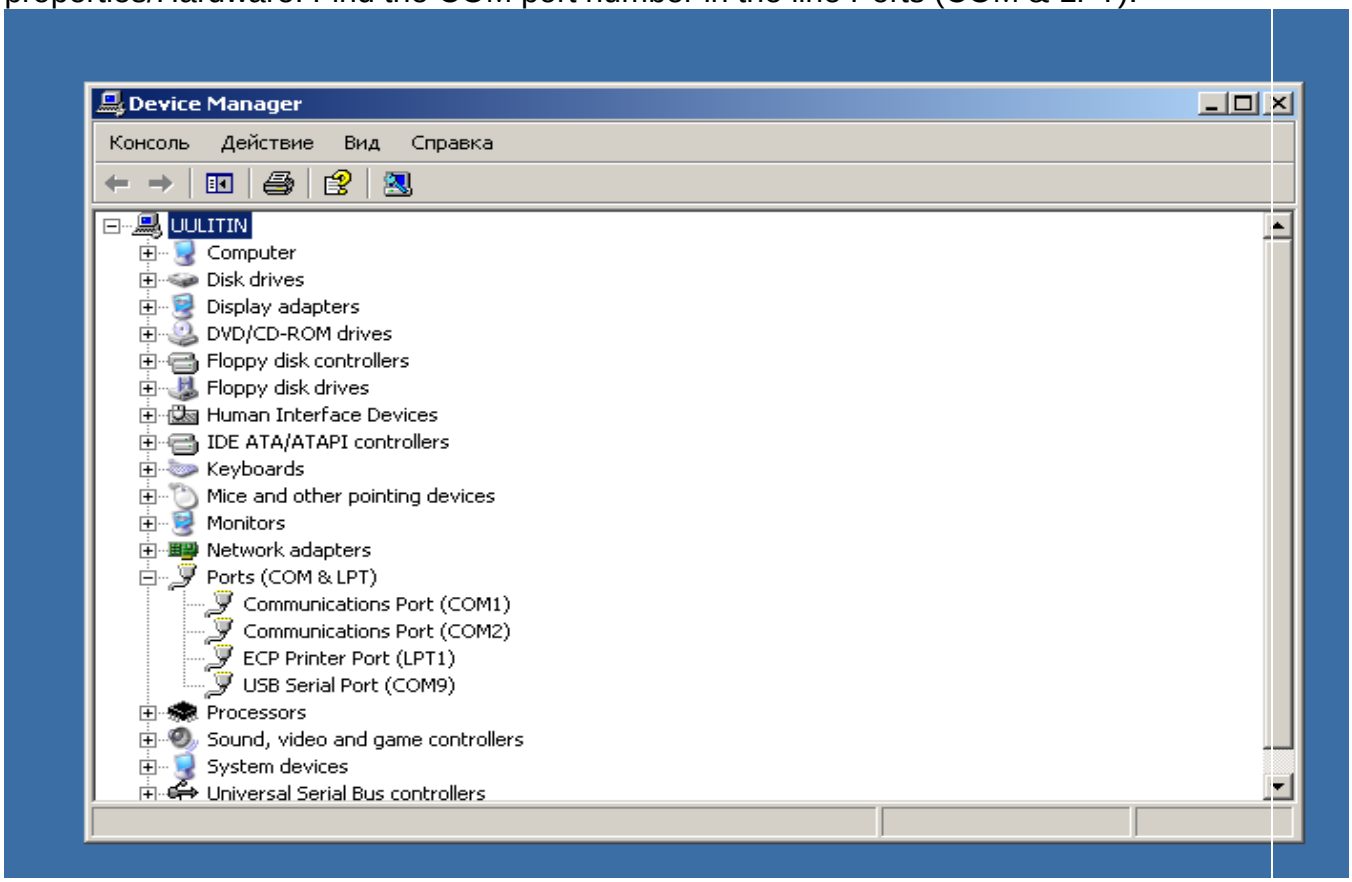


Fig. 6

3. Turn the instrument on and run Hyperterminal as following Start/Programs/Accessories/Communications/Hyperterminal.

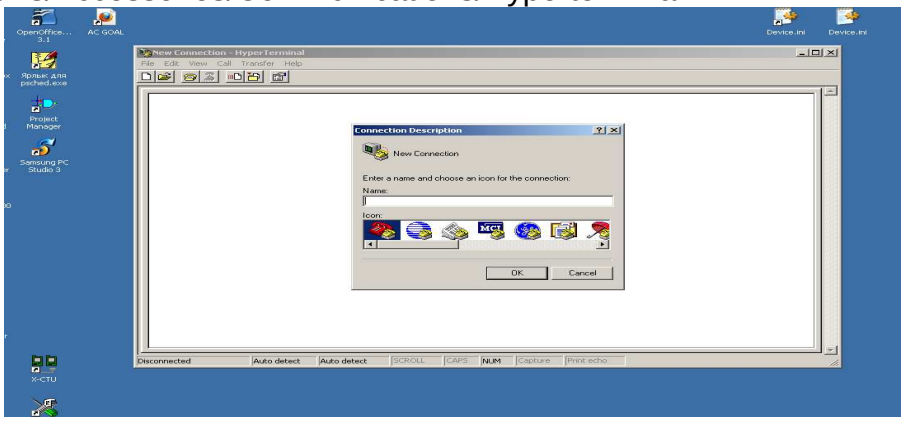


Fig. 7

4. Put the name of the file into the window New Connection. Data will be downloaded into the file under this name. Click OK. Put the COM port number (see 15.2) and click OK. Set 115200 bouds.

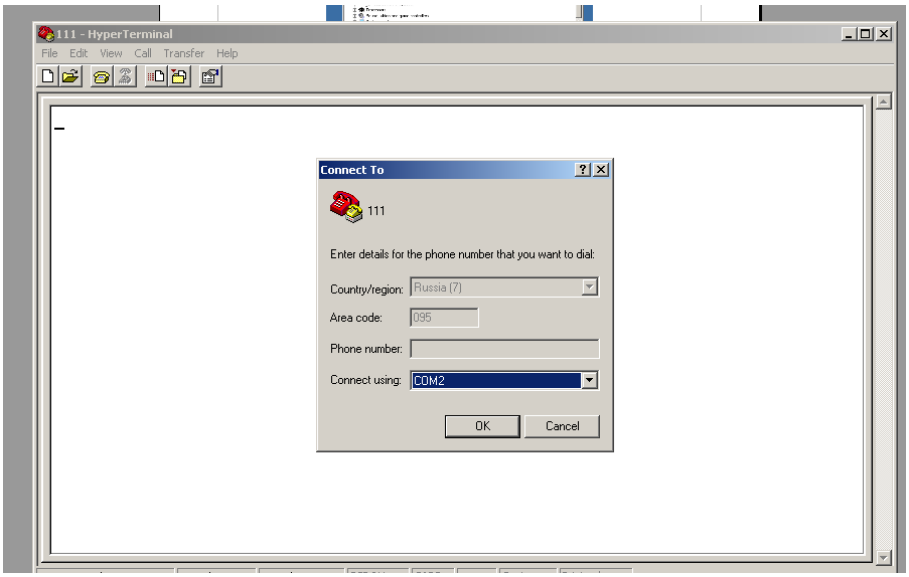


Fig. 8

5. Press PRINT on the instrument keypad to download data.

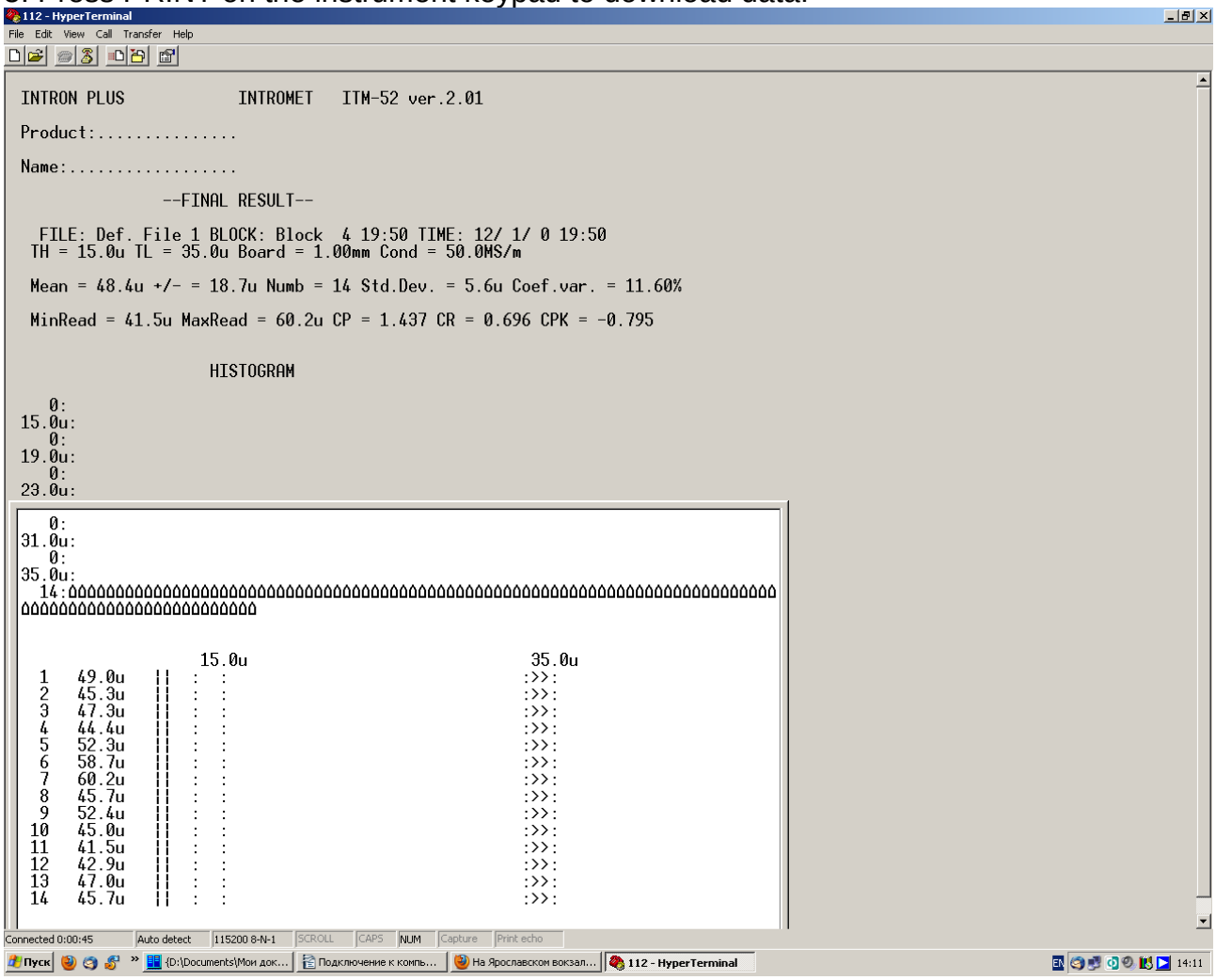


Fig. 9

Depending on preset values the following parameters may be downloaded

1. The title (always printed)
- Manufacturer name: INTRON PLUS
- the instrument type: INTROMET ITM-525
- name of file (number)
- block name (date and time block created)
- upper tolerance limit value
- lower tolerance limit value
- PCB thickness
- conductivity of copper plating

2. Block measure data in digital format:
Parameters: Table on

3. Block measure data in graphical format:
Parameters: Graph on

4. Statistics for block measure data:
Parameters: Statistics on

5. Histogram for block measure data;
Parameters: Histogram on

Setting the proper parameters "ON" or "OFF" User defines the contents of measure data print-out listing.

Below come examples of listings in following formats:

1 - Histogram off; Statistics off; Graph off; Table on
2 - Histogram off; stt: off; Graph on; Table on
3 - Histogram on; Statistics on; Graph off; Table off.

Example 1 (*)

Measure data block print-out in digital format :
Parameters: Histogram off; Statistics off; Graph off; Table on.

INTRON PLUS INTROMET ITM-525

Product: . . . . . .
Name: . . . . . .
--FINAL RESULT--
FILE: Def. File 8 BLOCK: 06/23/09 15:11
TH = 35.0 µ TL = 15.0 µ Board = 1.60 mm Cond = 50.0 M

11.0 µ 15.4 µ 15.4 µ 27.2 µ 27.4 µ 27.2 µ 43.1µ 43.3 µ 66.1 µ

NOTE:
- FINAL RESULT- : type of printing
APPL 7 : file name containing the block 04/11/09 18:31

Example 2 Measure data block print-out in graphical format:
Parameters: Histogram off; Statistics off; Graph: off; Table on.

INTRON PLUS INTROMET ITM-525

Product:.....
Name:.....
--FINAL RESULT--
File: Def. File 4 BLOCK: 06/28/09 12:02
TH = 32.0 µ TL = 12.0 µ Board = 1.60 mm Cond = 50.0 M

```
                          12.0µ                                  32.0µ
  1      03.1µ     ||     :<<:                                     : : 03.1µ
  2      09.3µ     ||     :<<:                                     : : 09.3µ
  3      09.2µ     ||     :<<:                                     : : 09.2µ
  4      14.1µ     ||     :  :   *                                 : : 14.1µ
  5      14.1µ     ||     :  :   *                                 : : 14.1µ
  6      18.9µ     ||     :  :                  *                  : : 18.9µ
  7      18.8µ     ||     :  :                 *                   : : 18.8µ
  8      18.8µ     ||     :  :                 *                   : : 18.8µ
  9      30.2µ     ||     :  :                          *          : : 30.2µ
 10      29.5µ     ||     :  :                         *           : : 29.5µ
```

NOTE
12.0 µ - lower tolerance limit value
32.0 µ - upper tolerance limit value
<<: - measurement is below the lower limit
:>> - measurement is over the upper limit.

Example 3 Measure data block print-out with histogram and statistics:
Parameters: Histogram on; Statistics on; Graph: off; Table off

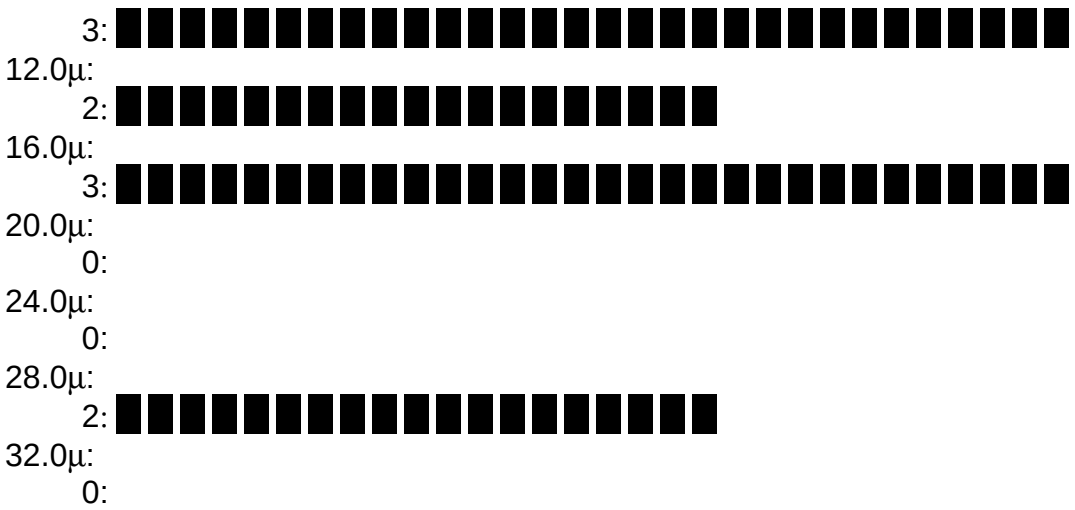
INTRON PLUS INTROMET ITM-525

Product:.....

Name:.....

--FINAL RESULT--
File: Def. File 3 BLOCK: 06/28/09 12:02
TH = 32.0µ TL = 12.0µ Board = 1.60 mm Cond = 50.0M
Mean = 16.6µ +/- = 27.1µ N = 10 Std.Dev. = 08.6µ Coeff.Var. = 51.8% Min. Read = 03.1µ Max. Read = 30.2µ CP = 00.38 CR = 02.60 CPK = 00.17

HISTOGRAM



2: **; 3: *****	- Histogram column graphical image with interval quantity presented
Mean	- Copper thickness mean value in µ (see Chap. 13)
+/-	- the range of measurements in µ
N	- number of measurements in the current block
Std.Dev.	- Standard deviation of measuring series (see Chap. 13)
Coeff.Var.	- Coefficient of variation (COV) (see Chap. 13)
Min. Read.	- Minimum value of block measurements in µ
Max. Read.	- Maximum value of block measurements in µ
CP, CR, CPK	- coefficients CP, CR, CPK accordingly

Block measure data downloading parameter setting is executed through the “Setting| Print” of the Main Menu in the following manner:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ↑ / ↓	Settings		Select “Settings” menu
3. ENTER	Settings → Print		Entry in “Settings” menu
4. ENTER	Print → Histogram		Entry in “Print” submenu.
5. ENTER	On		Entry to "Histogram " item. Histogram is on
6.↑ / ↓	Off		Histogram is on.
7. ENTER	Print → Histogram		Histogram off confirmed Items “Statistics”, “Table” and ”Graph” may be selected by ↑ / ↓ keys.
8. PARAM	Settings → Print		New print settings stored. Return to “Settings” menu
9. PARAM	Settings		Return to Main Menu
10. PARAM	T=1.5 C=50 0.0 µ		Exit from Main Menu. Instrument is ready to print out

(*) The chosen item name is for illustration only.

1.13.6. Data storing

The instrument has an ability to turn on/off automatic data storing in auto start measuring mode.
Setting the data storing mode is executed through the “Setting|Store Data” of the Main menu in the manner illustrated in the following example

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu

2. ↑ / ↓	Settings		Select “Settings” menu
3. ENTER	Settings → Print		Entry in “Settings” menu
4. ENTER	Settings → Store Data		Select in “Store Data” item
5. ENTER	On		Entry to "Store Data" item. Data storing is on
6.↑ / ↓	Off		Data storing is off
7. ENTER	Settings → Store Data		Return to “Settings” menu. Data storing off confirmed
8. PARAM	Settings		Return to Main Menu
9. PARAM	T=1.5 C=50 0.0 µ		Exit from Main Menu. Instrument is to measurements

1.13.7. Charge type

There are four charge modes available:
Fast Charge
Normal Charge – full charge for 4 hours
Slow Charge – full charge for 14 hours
No Charge – recommended when use non-rechargeable batteries.

Setting acceptable charge type is executed through the “Setting|Charge type” of the Main menu in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ↑ / ↓	Settings	Select “Settings” menu
3. ENTER	Settings → Print	Entry in “Settings” menu
4. ↑ / ↓	Settings → Charge type	Select in “Charge type” menu
5. ENTER	NoCharge	Entry to "Charge type" menu. “NoCharge” item is selected
6. ↑ / ↓	Fast Charge	“Fast Charge” item is selected
7. ↑ / ↓	Normal Charge	“Normal Charge” item is selected
8. ↑ / ↓	Slow Charge	“Slow Charge” item is selected
9. ENTER	Settings → Charge type	“Slow Charge” mode is confirmed Return to “Settings” menu
10. PARAM	Settings	Return to Main Menu
11. PARAM	T=1.5 C=50 0.0 µ	Exit from Main Menu. Instrument is to measurements

1.14. File settings

File setting group of parameters contains the parameters which present directly the features of PCBs themselves and PCB manufacturing process: board thickness, copper special electric conductivity and tolerance limits on copper plating thickness. So, User can store the measurements taken in the different files carrying the settings in accordance with the thickness of boards under test, plating process features and tolerance requirements on copper plating thickness.

Over the above, entering the actual values for board thickness and copper conductivity σ improves the reliability of the instrument measurements.

1.14.1. Definite file selection

As each file has its specific file settings so before measuring or file setting User is to call the file where measurements are to be stored or file settings be entered. The definite file calling out is executed through “FILE/Select” item of the Main Menu in the following manner:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ENTER	File → Select file	Entry in “File” menu
3. ENTER	Def. File 2 C=50.0MS/mT=1.50mm Min:15.0µ Max:35.0µ	Entry in “File/Select” submenu. Current file name and its main parameters display
4. ↑ / ↓	APPL 1 (*) C=50.0MS/mT=1.50mm Min:15.0µ Max:35.0µ	Select the file required
5. ENTER	File → Select file	Required file selected. Return to “File” menu
6. PARAM	File	Return to Main Menu
7. PARAM	T=1.5 C=50 0.0 µ	Exit from Main Menu. The instrument is ready to store measurements in a new selected file

(*) Values are for illustration only.

1.14.2. File name setting

Initial file names Def. File 0...7 may be changed for any desired through "File/Name" item of the Main Menu in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File 	Entry into Main Menu
2. ENTER	File → Select file 	Entry into “File” menu
3. ↓	File → File name 	Select "File|Name" item
4. ENTER	File name: Def. File 2 	Entry into "Name" item. Current file name displays. First position of name is highlighted
5. ↑ / ↓	File name: Cef. File 2 	Set a new character on the first position
6. →	File name: Cef. File 2 	Choose another position to be changed
7. ↑ / ↓	File name: Cff. File 2 	Repeat operations 5 and 6 for all other positions to be changed. Current position is highlighted
8. ENTER	Name changed 	New file name stored
9.	File → File name 	Return to File|Name item
10. PARAM	File 	Return to File Menu. Instrument is ready to measure in the file with a new name
11. PARAM	T=1.5 C=50 **0**.0 μ 	Instrument is ready to measure in the file with a new name

(*) Names are for illustration only.

1.14.3. Board thickness value setting

Board thickness value is entered through "File/Board" item of the Main Menu in the manner illustrated in the following example:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ENTER	FILE → Select file		Entry into “File” menu
3. ↑ / ↓	FILE → Thickness		Select "File|Thickness" item
4. ENTER	Board thickness: 01.6 mm (*)		Entry into "Thickness" submenu. Current board thickness value displays
5.→	Board thickness: 01.6 mm (*)		Digit to be changed highlights
6. ↑ / ↓	Board thickness: 01.5 mm (*)		Set a new board thickness value
7. ENTER	Stored		New board thickness value stored.
8.	FILE → Thickness		Return to “File” menu
9. PARAM	File		Return to Main Menu. The instrument is ready to measure with a new board thickness setting
10. PARAM	T=1.5 C=50 **0.**0 µ		The instrument is ready to measure with a new board thickness setting

(*) Values are for illustration only.

NOTE
You can enter "File|Thickness" item of the Main Menu directly from measure mode by pressing "Bd/Th" key

1.14.4. Copper electric conductivity σ value setting

If the electric conductivity of copper σ in PTH differs from the base value of 50.0 MS/m (86% IACS) significantly, the actual conductivity value is to be entered before measuring. It can be done through Direct or Indirect methods (see Chap. 6.2) through the “FILE” item of the Main Menu.

1.14.4.1. *Electric conductivity value setting. The Direct method*

The Direct method proposes entering the value of the conductivity σ directly. The electric conductivity σ correction through Direct method is executed through “FILE/ Cond” item of Main Menu in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ENTER	FILE → Select file	Entry in “File” menu
3. ↑ / ↓	FILE → Conductivity	Select "File|Conductivity" item. Current conductivity σ value displays (in MS/m or %% IACS)
4. ENTER	Conductivity: 50.MS/m (*)	Entry to "File|Conductivity" item. Current conductivity σ value displays
5.→	Conductivity : 50.MS/m (*)	Digit to be changed highlights
6. ↑ / ↓	Conductivity: 51.MS/m (*)	Set a new conductivity value
7. ENTER	Stored	New conductivity value stored
8.	File → Conductivity	Return to “File” menu
9. PARAM	File	Return to Main Menu
10. PARAM	T=1.5 C=50 0.0μ	The instrument is ready to measure with a new copper electric conductivity σ

(*) Conductivity values are for illustration only.

1.14.4.2. *Electric conductivity σ value setting. The Indirect method*

The Indirect method proposes of the actual electric conductivity σ value correction through the measurements made in the standard holes with the known copper plating thickness.

The electric conductivity σ correction through the Indirect method is executed through “File|Indir.Cond” item of the Main Menu in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ENTER	File → Select file	Entry into “File” menu
3. ↑ / ↓	File → Indir. Cond	Select "File| Indir. Cond” item
4. ENTER	Cal. Points	Entry to " Cal. points" submenu.
5.	Cal. Points	Insert probe tip into the hole with known copper thickness. Instrument makes measurement. Take probe tip out of the hole
6.	Cal. Points	Repeat measurements in the hole 4 more times
7.	Cal. points 31.2μ(*)	Mean value of the measurements displays
8.→	Cal. points 3 1.2μ(*)	Digit to be changed highlights
9. ↑ / ↓	Cal. points 32.2μ(*)	Set the known value of the copper thickness in the standard hole
10. ENTER	File → Cond Ind	Copper electric conductivity σ value corrected. Return to "File" menu
11. PARAM	File	Return to Main Menu
12. PARAM	T=1.5 C=50 0.0 μ	Instrument is ready to measure with electric conductivity σ equal to copper conductivity in the hole

(*) Copper thickness values are for illustration only.

1.14.5. Copper thickness tolerance limit setting

The upper and lower limits on the copper plating thickness in PTH are entered for tolerance control. If the required limit values entered and the current measurement is out of tolerance, the instrument will indicate this situation through sound alarm.

The sound and visual alarm may be turn off though “SETUP/Alarm” item of Main menu.

Setting of the copper thickness tolerance limits is executed in the manner illustrated in the following example:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ENTER	File → Select file	Entry into “File” menu
3. ↑ / ↓	File → Boundaries	Select "Boundaries" submenu
4. ENTER	Boundaries →Minimum	Entry to "Boundaries|Minimum " submenu.
5. ENTER	Min. boundary: 15.0 µ	Current lower limit displays
6.→	Min. boundary: 15.0 µ	Digit to be changed highlights
7. ↑ / ↓	Min. boundary: 16.0 µ	Set a new upper limit value
8. ENTER	Stored	New limit values stored.
9.	File → Boundaries	Return to "Boundaries" submenu
10. ENTER	Boundaries →Minimum	Entry to "Boundaries|Minimum " submenu.
11. ↑ / ↓	Boundaries →Maximum	Entry to "Boundaries|Maximum" submenu Execute p.p. 5-8 to set new upper tolerance limit.
12. ENTER	File → Boundaries	Return to “File” Menu
13. PARAM	File	Retirn to Main Menu.
14. PARAM	T=1.5 C=50 **0**.0 µ	The instrument is ready to measure with new tolerance limits

(*) Tolerance limit values are for illustration only.

1.14.6. Return to the default file settings

All the file parameters can returned to the default base values through “FILE/Default” item of the Main Menu:

- PCB thickness 1.6 mm
- copper special electric conductivity σ 50 MS/m
- copper plating thickness tolerance limits: upper 15μ
  lower 35μ.

Return to the default file setting is executed in the following manner:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ENTER	FILE: → Select file		Entry into “File” menu
3. ↑ / ↓	File → Basic		Select “Basic settings" command
4. ENTER	Stored		Confirm “Basic setting" command through pressing “**ENTER**” key. Basic file settings are entered in the instrument memory
5.	File → Basic		Default file settings stored. Return to “File” menu
6. PARAM	File		Return to Main Menu
7. PARAM	T=1.5 C=50 0.0 μ		Exit from Main Menu. The instrument is ready to measure with default file settings

(*) Number of file is for illustration only.

1.14.7. File measure data removal

Selected file can be cleared (all blocks of the file are deleted) through “FILE/Clear” item of Main Menu. After the deleting, a new active file is created in the file.

Clear file procedure is executed in the following manner:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ENTER	File → Select file		Entry into “File” menu
3. ↑ / ↓	FILE: → Delete file		Select "Delete file" command
4. ENTER	File deleted		Confirm “Delete file" command through pressing “**ENTER**” key. All blocks of the file are deleting. A new active block is created
5.	File → Delete file		After deleting return to “File” menu
6. PARAM	File		Return to Main Menu
7. PARAM	T=1.5 C=50 0.0µ		Exit from Main Menu. The instrument is ready to measure with default file settings

1.14.8. File flushing

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ENTER	File → Select file		Entry into “File” menu
3. ↑ / ↓	FILE: → Flush file		Select "Flush file" command
4. ENTER	Def. File 2 (*) File erased		Confirm “Delete file" command through pressing “**ENTER**” key. All blocks of the file are deleting. A new active block is created
5.	File → Flush file		After deleting return to “File” menu
6. PARAM	File		Return to Main Menu
7. PARAM	T=1.5 C=50 0.0µ		Exit from Main Menu. The instrument is ready to measure with default file settings

(*) File name s for illustration only.

1.14.9. Creation of new file

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ENTER	File → Select file		Entry into “File” menu
3. ↑ / ↓	FILE: → Create file		Select "Create file" command
4. ENTER	Def. File 7 (*) File created		Confirm “Create file" command through pressing “**ENTER**” key. All blocks of the file are deleting. A new active block is created
5.	File → Create file		After deleting return to “File” menu
6. PARAM	File		Return to Main Menu
7. PARAM	T=1.5 C=50 0.0µ		Exit from Main Menu. The instrument is ready to measure with default file settings

CALIBRATION

1.15. Calibration modes

The INTROMET is ready to measure just after been turned on by pressing "**ON/OFF**" key. When the probe unit with cartridge is connected and the probe tip is in air, the instrument performs the zero setting. The instrument stores the calibration values set during the last session.

To receive the correct measurements a calibration procedure should be made each time if one of the influencing factors described in Chap. 6: PCB geometry, copper electric conductivity, temperature and so on change significantly.

To make sure the instrument is in order and ready to measure User can insert the probe tip into the proper hole of the supplied reference standard RS-52-1 and compare the reading with the data marked on the standard. For probe "EP-25" use reference standard RS-52-2 and for probe EP-20 use reference standard RS-52-3.

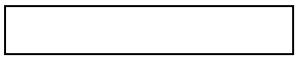
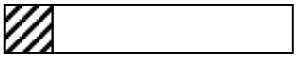
Two calibration techniques are available:
- Base calibration;
- Master calibration.

1.16. Base calibration

Base calibration is performed in two points : the "air" point and the "Cu-infinity" point applying the supplied calibration unit. This technique is used as a usual method covering the most practical tasks. Base calibration characteristic is stored in the instrument memory.

Base two points calibration is executed through “CAL” item of Main Menu in the following manner:

KEY	DISPLAY	OPERATION
1. ON/OFF	Self Calibration	Turn on the instrument. Probe tip is in air
2.	Def. File 8	Current file name indicated
	C=50.0MS/m T=1.50 mm	Current values of file settings indicated In lower part of display
	Min: 15.0 μ Max: 35.0 μ	
3. PARAM	File	Entry into Main Menu
4. ↑ / ↓	Calibration	Select item "Calibration". Note, that calibration mode appears automatically on display after a probe for through holes is connected instead of SP-100 probe or vice versa.

5. ENTER	CALIBRATION 	A long-time sound signal indicates the entry into "Calibration" program
6.	CALIBRATION 	Insert the probe tip into the hole from the proper side of the calibration unit or Calibration Standard for Extra Small probe

NOTE
"EP-30" cartridge is inserted into the hole marked "EP-30" and
"EP-25" cartridge - into the hole marked "EP-25"
"EP-20" probe - into the Calibration unit RS-52-3.

		A short-time sound indicates the measurement is stored. Instrument is waiting for another probe tip insertion. Take the probe tip out of the calibration hole
7.	CALIBRATION 	Repeat Operation 5 four more times until all rectangle became shaded
8.	Calibration	Calibration is completed. Return to Main Menu
9. PARAM	T=1.5 C=50 0.0 μ 	Exit from the Main Menu. The instrument is ready to measure

(*) Number of file is for illustration only.

1.17. Master calibration

Master calibration is a three or more points calibration based on the known copper thickness standards produced by the User. This calibration is required only when there is any doubt on the instrument readings. In any other case it is not necessary since the Base calibration characteristic is stored constantly in the instrument memory.

WARNING

Master calibration should be performed by only an experienced user of the instrument. The more points are used for Master calibration – the more accurate are readings

Before Master calibration performance enter the board thickness value (see Chap. 10.2) and the electric conductivity σ value (see Chap. 10.3.1) for the standard board made at the User's.

The Master calibration routine based on the standards made at the User's is executed in the following manner:

KEY	DISPLAY	OPERATION
1. ON/OFF		Turn off the instrument (if it was on)
2. DEL + ON/OFF	PARAM for calibr ENTER for return NEW for clear	Holding "**DEL**" key pressed, press "**ON/OFF**" key. Probe tip is in air.
3. PARAM	Point 1 0.0 μ	Insert probe tip into the first hole of the standard. A short signal sounds. Measurement performed
4.	Point 1 14.9 μ (*)	Insert probe tip into the hole with known copper thickness until filling of the white bar. Ordinal number of measurement and current measure result display

NOTE
If measurement is taken improperly, User can delete the last measurement by pressing "**DEL**" key. In this case, current measure result disappears from display

5.	Point 1 14.7 μ (*) 15.1μ(*)	Mean value of the serial measurements for current hole displays in lower string
6. ↑ / ↓	Point 1 14.7 μ (*) 16.4μ(*)	Correct the actual copper thickness value in the current hole
7. ENTER	Point 2 0.0 μ	The first calibration point is entered

8.		Repeat Operations 4...7 for other (3 or more) holes with known copper thickness
9. MEAS		New calibration characteristic entered. Instrument restarts

(*) The copper thickness values and quantity of measurements are for illustration only.

NOTE
If Master Calibration has been completed and the instrument is turned on for the next time, the last entered Master Calibration is actual but not the Base calibration.

1.18. Return to Base calibration

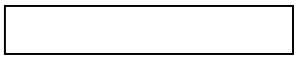
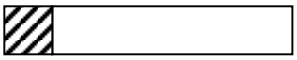
Attention
To return to the base calibration characteristic the instrument is to be turned off while being in the “Master Calibration” mode

The return routine is executed in the following manner:

KEY	DISPLAY	OPERATION
1. ON/OFF		Turn off the instrument (if it was on)
2.DEL + ON/OFF	PARAM for calibr ENTER for return NEW for clear	Holding "**PARAM**" key pressed, press "**ON/OFF**" key. Hold "**PARAM**" key until "MASTER" appears on the display. Entry to "Master Calibration" routine
3.		Press “**NEW BLOCK**” key. Instrument restarts and returns back to Base calibration characteristic.

1.19. Calibration with CSP

To calibrate the gauge with CSP only calibration foil 50 μm included in the set should be used. Calibration foils 18 and 35 μm are used for reference to insure proper function.

KEY	DISPLAY	OPERATION
1. ON/OFF	Self Calibration	Turn on the instrument. Probe CSP is connected.
2.	Def. File 8 C=50.0MS/m T=1.50 mm Min: 15.0 μ Max: 35.0 μ	Current file name indicated Current values of file settings indicated In lower part of display
3. PARAM	File	Entry into Main Menu
4. ↑ / ↓	Calibration	Select item "Calibration ". Note, that calibration mode appears automatically on display after CSP is connected instead of a probe for through holes or vice versa.
5. ENTER	CALIBRATION 	A long-time sound signal indicates the entry into "Calibration" program
6.	CALIBRATION 	Put CSP probe on the surface tightly, so 4 pins of the probe get contact copper surface reliably. Remember to use only 50 mkm copper calibration foil.
7.	CALIBRATION 	Repeat Operation 6 four times until all rectangle becomes shaded
8.	Calibration	Calibration is completed. Return to Main Menu.
9. PARAM	T=1.5 C=50 0.0 μ 	The instrument is ready to measure.

(*) Number of file is for illustration only.

MEASURE DATA PROCESSING

Measure data stored in the instrument memory is available for processing. The data may be displayed, deleted, downloaded to a computer. Statistics parameters of the measure data blocks may be displayed. These functions are available directly during the measuring session for the ACTIVE block and whenever through “BLOCK” item of Main Menu.

1.20. Block data selection

The data block is to be selected before processing. The measurements are grouped in BLOCKS according to the time of their performance. The data block is selected through the name which initially contains the date and time when the block was created.

Definite block is selected through “BLOCK/Select” item of Main Menu in the manner illustrated in the following example:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ↑ / ↓	Block		Select “Block” menu
3. ENTER	Block → Select block		Entry in “Block” menu
4. ENTER	Block: 6 10:22(*)		Entry in “Bock|Select” item. Active block creation date, hours and minutes display
5. ↑ / ↓	Block: 6 9:44(*)		Select the block required
6. ENTER	Block → Select block		The required block selected. Return to “Block” menu
7. PARAM	Block		Return to Main Menu
8. PARAM	T=1.5 C=50 **0**.0µ		The instrument is ready to measurements

(*) Block names are for illustration only.

Staying in “BLOCK” menu User can display a individual measurement and statistics of the block opened.

1.21. Block name setting

Initial block name can be changed for any desired through “BLOCK/Name” item of Main menu in the following manner:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ↑ / ↓	Block		Select “Block” menu
3. ENTER	Block → Select block		Entry in “Block” menu
4. ↑ / ↓	Block → Block name		Choose “Block|Name” item
5. ENTER	Block name Block 6 10:22(*)		Entry in “Block|Name” item. Current block name displays. The first position of name is highlighted
6. ←/→	Block name Block 6 10:22(*)		Choose another position to be changed
7, ←/→	Block name Block 7 10:22(*)		Set a new character for the position to be changed
8.	Block name Block 7 11:34(*)		Repeat operations 6 and 7 for all other positions to be changed. Current position is highlighted
9. ENTER	Name Changed		A new name of the block is stored.
10.	Block → Block name		Return to “Block” menu
11. PARAM	Block		A new name of the block is stored. Return to Main Menu
12. PARAM	T=1.5 C=50 **0**.0µ		The instrument is ready to measurements

(*) Block names are for illustration only.

1.22. Block data display

The individual measurements in the selected block are displayed through “Block|Block Data” item of Main menu in the following manner:

KEY	DISPLAY	OPERATION
1. PARAM	File	Entry into Main Menu
2. ↑ / ↓	Block	Select “Block” menu
3. ENTER	Block → Select Block	Entry in “Block” menu
4. ↑ / ↓	Block → Block Data	Choose “Block Data” item
5. ENTER	N=3(*) point=4.29 m	Entry in “Block| Data” item. Last measurement (N3) is indicated

Attention
To delete any measurement in block, press the "**DEL**" key. The very last measurement of the block cannot be deleted. For this measurement removal use “BLOCK/Deleting” routine

6. ↑ / ↓	N=1(*) point=4.35 m	Choose another measurement to be displated
7. PARAM	Block → Block Data	Return to “Block” menu
8. PARAM	Block	Return to Main Menu
9. PARAM	T=1.5 C=50 **0**.0µ	The instrument is ready to measurements

(*) Values and measurement numbers are for illustration only.

NOTE
After a single measurement removal, the next measurement takes the order number of the removed one. The same number stays on display. When the last-in-order measurement of the block removed the order number of the next measurement decreases

1.23. Block data statistics display

Statistics of data block can be displayed through pressing "**STAT**" key while being in the "BLOCK" item of the Main Menu.

Block to be displayed: active block of the current file (as a default) or selected through "BLOCK/Select".

Statistics of block measure data display is executed in the following manner:

1.	Blk: 06/19 08:20(*) → Select		Entry "Block" item of the Main Menu
2. STAT	NUM	006	Number of block measurements display
3. ↓	MEAN	31.0 μ	Mean value of block measurements display
4. ↓	StdDev	05.2 μ	Standard deviation of block measurements display
5. ↓	MIN	20.1μ	Minimum value of block measurements display
6. ↓	MAX	29.0 μ	Maximum of block measurements display
7. ↓	RANG	8.9 μ	Variation range (MAX-MIN) of block measurements display
8. ↓	CP	00.34	Coefficient CP display
9. ↓	CR	00.12	Coefficient CR display
10. ↓	CPK	01.34	Coefficient CPK display
11. ENTER	Blk: 06/19 08:20(*) → Select		Return to "BLOCK" menu
12. PARAM	BLOCK		Return to Main Menu
13. PARAM	T=1.5 C=50 **0**.0μ		Exit from Main Menu

(*) Values are for illustration only.

1.24. Block data removal

A whole block of the current file may be removed from the instrument memory through “File|Deleting” item of the Main Menu. When the last block of the selected file is removed a new block is created and becomes ACTIVE.

The individual block removal routine is executed in the following manner:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ↑ / ↓	Block		Select “Block” menu
3. ENTER	Block → Select block		Entry in “Block” menu
4. ↑ / ↓	Block → Delete block		Select “Delete block” item.
5. ENTER	Block deleted		Active the block is deleted
6. ENTER	Blk: 06/19 08:20(*) → Select		The required block selected. Return to “BLOCK” menu
7.	Block → Delete block		Automatic return to “Block” menu
8. PARAM	Block		Return to Main Menu
9. PARAM	T=1.5 C=50 **0**.0µ		Instrument is ready to measure

Attention

The above routine causes the deletion of the block from preliminary selected file. To delete a block from another file you need to select the given file beforehand, according to Chap. 8.1.

1.25. Create block

New block creation realizes through “Block|Block Data” item of Main menu in the following manner:

KEY	DISPLAY		OPERATION
1. PARAM	File		Entry into Main Menu
2. ↑ / ↓	Block		Select “Block” menu
3. ENTER	Block → Select block		Entry in “Block” menu
4. ↑ / ↓	Block → New block		Select “Delete block” item.
5. ENTER	Block 7 12: 6(*) Block created		Active the block is deleted
6.	Block → New block		Automatic return to “Block” menu
7. PARAM	Block		Return to Main Menu
8. PARAM	T=1.5 C=50 **0**.0 µ		Instrument is ready to measure

(*) New block name

> **Attention**
> New block creation is possible through the key “NEW BLOCK”. New block opens and previous closes by pressing this key in measurement mode.

STATISTICAL TERMS

1.26. Mean value

The MEAN value is the sum of all measurements of a series divided by the number of measurements:

$$MEAN = \frac{(T_1+T_2+...+T_n)}{N} = \frac{\sum_{n=1}^{N} T_n}{N}$$

where: T_n = individual measurement
N = number of measurements

1.27. MIN, MAX and Range

Minimum (MIN) and Maximum (MAX) are the extreme values of a measurement series. The difference between minimum and maximum is called the RANGE (RANG).

1.28. Standard Deviation

The standard deviation is a measure for the spread of a measurement series. The square root of the result is the STANDARD DEVIATION :

$$Std.Dev. = \frac{\sqrt{(T-T_1)^2+(T-T_2)^2+...+(T-T_n)^2}}{(N-1)}$$

where: T = mean value
T_n = individual value
N = number of measurements

1.29. Coefficient of Variation (COV)

The coefficient of variation is the standard deviation from the mean value in percent. The COV is sometimes also referred to as the relative standard deviation:

$$Coeff.Var. = \frac{Std.Dev}{T} \times 100\%$$

1.30. Capability statistics coefficients

1.30.1. Coefficient CP

$$CP = \frac{T}{6s}$$

where: Standard Deviation of results $\sigma = \sqrt{\frac{\sum_{i=1}^{n} (\overline{X} - X_n)^2}{n-1}}$

T= (Upper specification limit) - (Lower specification limit)

1.30.2. Coefficient CR

CR = 1 / CP

1.30.3. Coefficient CPK

$$CPK_1 = \frac{(\text{Upper specification limit}) - (\text{Mean})}{3\sigma}$$

$$CPK_2 = \frac{(\text{Mean}) - (\text{Lower specification limit})}{3\sigma}$$

If $CPK_2 < CPK_1$, then $CPK = CPK_2$.
If $CPK_1 < CPK_2$, then $CPK = CPK_1$.

HAND-HELD PROBE GUIDE OPERATION

1. Put the movable part of the guide up to the stop and hold it in this position (see Fig. 10).

2. Release the fastening nut on the movable part by 2...3 turns counter-clockwise.

3. Insert the probe unit into the guide to place the probe tip extending outward the plane of the guide supports.

4. Turn the fastening nut clockwise up to the stop.

5. Allow the movable part move down until it bears up against the immovable part of the guide. The cone part of the probe unit is to expand outward the plane of supports.

6. While measuring, hold the guide with probe fastened perpendicular to the PCB plate. Insert the probe tip into the hole under test down to stop. The movable part goes up for 5...10 mm. Avoid the hole inside surface touch with the probe tip. Place the guide bearing up against the board plate with all three supports.

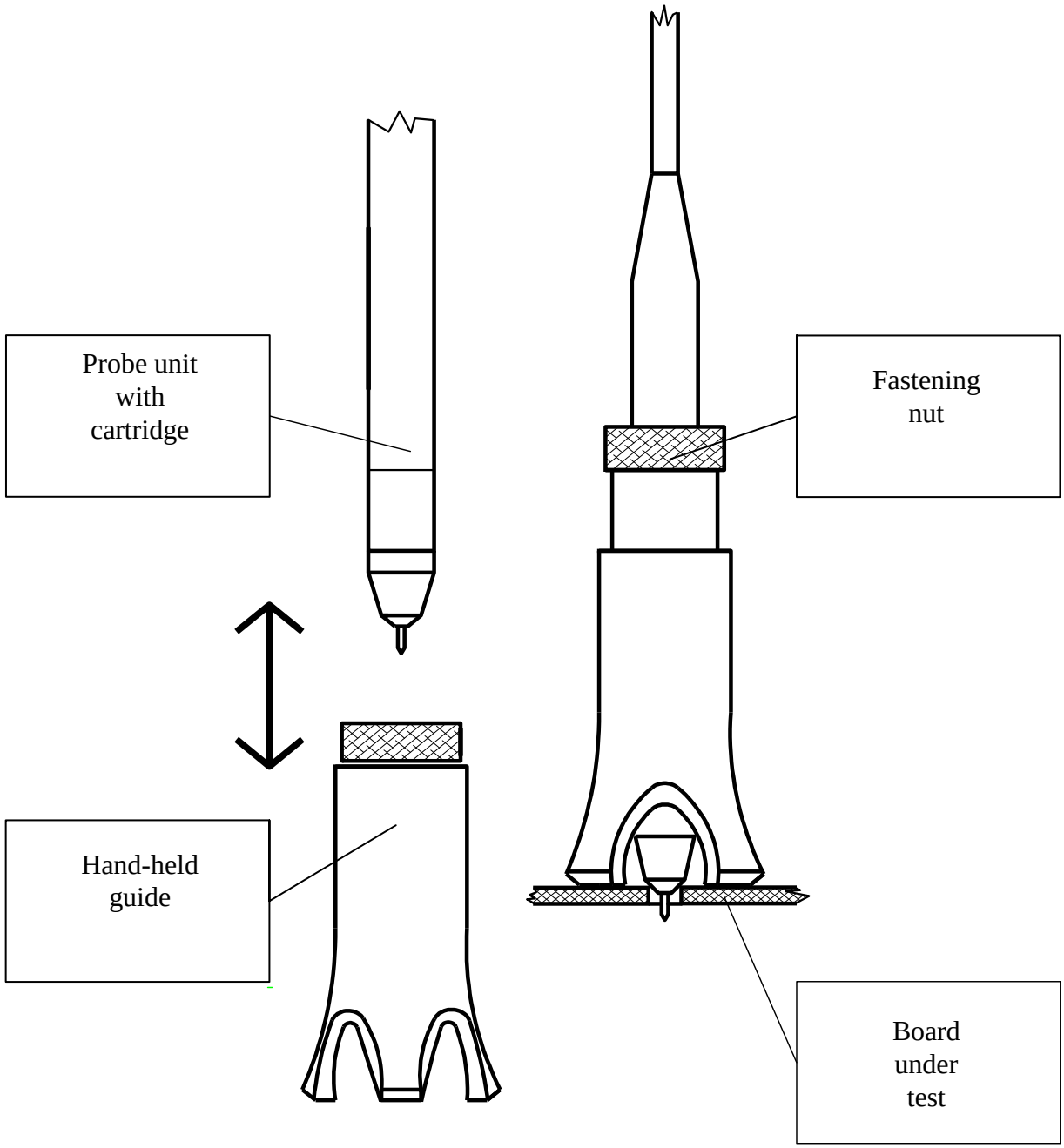


Fig. 10. Hand-held guide application

CARTRIDGE REPLACEMENT

To remove the probe cartridge from the probe unit (see Fig. 3):

- hold the probe cartridge firmly in one hand;
- hold the cartridge holder close to the upper part by the other hand;
- pull the cartridge in the direction of the probe tip without twisting.

To plug the probe cartridge in the cartridge holder:

- insert the cartridge into the cartridge holder down to stop;
- rotate the cartridge to align the connector keys;
- plug in the cartridge with slight effort.

Note: calibration is required each time after cartridge is changed.

BATTERIES REPLACEMENT

To replace batteries turn the instrument off. If replaced with non-rechargeable batteries, choose No Charge mode.

ERRORS

DISPLAY	ERROR AND REASON	OPERATION
ERR 001	Measure result < 0. 1. Forced measurement in air or very low Cu 2. Improper calibration: Base or Master 3. Incorrect file settings: conductivity or board thickness	Press "**ENTER**". Zero result display. Press "**DEL**". Check up the unit operation with RS reference standard. If not recovered: - turn off the unit; turn it on and repeat the calibration properly - enter correct file settings.
ERR 002	Data memory destroyed. All files clear. Return to base parameters 1. Breakdown in power supply: low voltage or while battery change	Execute the calibration properly. Enter correct file and global settings
ERR 003	Data memory is overloaded.	Turn off the unit; turn it on again and delete some blocks unneeded
ERR 004	Master calibration execution error 1. Less then 3 points entered 2. Incorrect measure data entered	Repeat Master calibration properly. Enter 3 or more calibration points.
ERR 005	"Air" calibration error	Turn off the unit and turn it on again. If not recovered , replace the cartridge. If not recovered, contact Manufacturer
ERR 006	Self test not passed. Unit failure	Turn off the unit and turn it on again. If not recovered , contact Manufacturer.

MEASURE DATA STORAGE STRUCTURE

FILE 0 PCB Parameter settings	FILE 1 PCB Parameter settings		FILE 7 PCB Parameter settings
Block 1	Block 1		Block 1(*)
Block 2	Block 2		
Block 3 Date and time of creation Measurement 1 Measurement 2 ..... Measurement n	Block 3(*)		
Block 4			
.....			
Block m(*)			

(*) Active blocks

(**) While turned on for the first time, the instrument will store measurement data into FILE 0 (Block 1) with base parameter settings:

- board thickness - 1.6 mm;
- electric conductivity - 50 MS/m;
- upper tolerance limit - 35.0 μm;
- lower tolerance limit - 15.0 μm.

TROUBLE SHOOTING

Malfunctions	Reason
No display	- Instrument is not turned on - Instrument is turned off automatically - Batteries discharged
Instrument turned off automatically	- No measurement or key pressed for the last 4 minutes. Turn on the instrument - Batteries discharged. Charge the batteries - Occasional electrostatic discharge. Turn on the instrument again
"BAT LOW" display	- Batteries need to be recharged
Instrument doesn't measure	- Copper plating thickness insufficient or sufficient plating defects. Press "**MEAS**" key - Probe out of order. Change for the proper one
Erroneous measurement	- Incorrect board parameter settings: board thickness, electric conductivity, improper probe is used - Calibration error. Repeat calibration - Probe not inserted up to the stop
Unexpected characters display	- Program break-down. Contact our local representative

SPECIFICATIONS

Model:	INTROMET ITM-525
Board thickness:	0.5 mm - 6.0 mm
Ambient temperature:	+5° C...+40° C
Data storage:	8 files for up to 15000 measurements
Measuring range:	5 μm... 60 μm
Resolution:	0.1 μm
Power supply:	Two rechargeable batteries of AA size

DELIVERY LIST

- Electronic unit in leather pouch S/N _____ _ pc.
- Cartridge EP-30 _ pc.
- Cartridge EP-25 _ pc.
- Probe EP-20 _ pc.
- Copper surface probe CSP _ pc.
- Cartridge holder _ pc.
- Calibration unit EP25/30 _ pc.
- Reference Standard RS-52-1 for EP-30 _ pc.
- Reference Standard RS-52-2 for EP-25 _ pc.
- Reference Standard & calibration unit RS-52-3 for EP-20 _ pc.
- Calibration foils for CSP _ pc.
- Probe Guide _ pc.
- USB cable _ pc.
- Plug-in type AC adapter _ pc.
- Rechargeable battery _ pc.
- Carrying Case _ pc.
- Operating Manual _ pc.

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