



M3M-18 Handheld RF Power Meter
User Manual

Notices

This operating manual is designed to study the device, operating principles, rules of use, maintenance, transportation and storage of power meter M3M-18 (further - the meter).

The manufacturer reserves the right, without notice to the customer, make changes in the design of the meter without affecting its normalized metrological and technical characteristics.

The manual must always be with the meter.

Safety Requirements

Only the qualified personnel who studied the user manual are allowed to operate with the meter.

ATTENTION

THE DETECTION SECTION OF THE METER IS HIGHLY SENSITIVE TO STATIC VOLTAGE (DISCHARGE). BEFORE CONNECTING THE METER TO ANY SOURCE ENSURE THAT ALL DEVICES ARE GROUNDED.

To exclude the operating failures when the meter is powered by the 220V power supply, measurements should be made in the absence of sudden changes in AC voltage.

The insulation between input AC circuit of AC/DC adapter and meter body when it is connected to the AC/DC adapter, endures normal conditions for 1 min impact of 1.5 kV AC voltage without breakdown.

The insulation resistance between the meter body and DC input are less than 20 mOhm, under normal operation conditions.

Environmental Conditions

Normal operation conditions

Operating environment	(25 ±5) °C
Operation relative humidity	80 %
Atmospheric pressure	630 to 800 mm Hg.

The meter can be used in measuring systems and has PC remote control option using the program “Microwave Power Meter”, under the OS Windows® 2000/XP/7/8. The connection interface is USB 2.0.

Environmental conditions

Operating environment	+5 °C to +40 °C
Operation relative humidity	80 % RH for temperature up to 30 non-condensing
Atmospheric pressure	70.0 to 106.7 kPa (537 to 800 mm Hg.)
Vibration	
frequency	10 to 55 Hz
acceleration, max	30 m/s ² (3g)
Single-action mechanical shock	
acceleration, max	300 m/s ² (30g)
pulse duration	6 ms
number of beats in each direction	3
Multiple-action mechanical shock	
beats per minute	10 to 50
acceleration, max	200 m/s ² (20g)
pulse duration	8 ms
number of beats in each direction	1000

Transportation conditions (max)

Operating environment	-25 °C to +55 °C
Operation relative humidity	95 % RH for temperature up to 30 non-condensing
Atmospheric pressure	70.0 to 106.7 kPa (537 to 800 mm Hg.)
Transport vibration	
beats per minute	80 to 120
acceleration, max	30 m/s ² (3g)
total number of beats	4000

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1. Getting Started

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1.1. Description

M3M-18 power meter (figure 1.1) is used to RF and microwave power measurements. With a high accuracy up to ± 0.33 dB, a wide frequency range of 10 MHz to 18 GHz, and measurements range of -60 dBm to +20 dBm, the M3M-18 is a good solution for a wide variant of RF measurement applications - manufacturing and testing, design, tuning and verifying of microwave blocks for electronics, communication, instrumentation, tests.

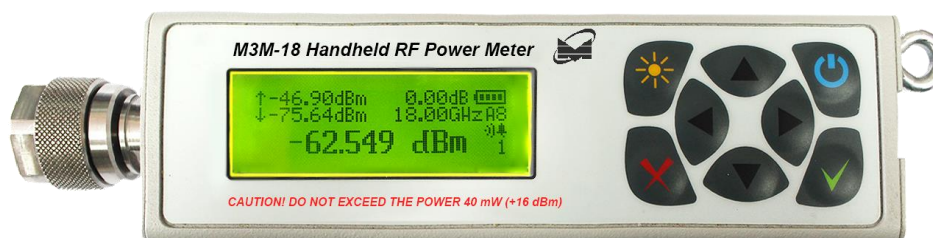


Figure 1.1 – M3M-18 Power Meter main view

1.2. Initial Inspection

Before you begin measurements, you must conduct an external inspection, ensure that there are no mechanical damage of the meter and safety protective seals of company - manufacturer.

Ensure that input coaxial adapter of the meter is not damaged, on the inner surfaces of the connector no signs corrosion, metal shavings, dirt. In case of pollution or the presence of metal shavings - wipe the connector cotton bud dipped in alcohol. In case of damage to the connector or the presence of corrosion, contact the manufacturer.

After transporting the meter under conditions different from working, you have to keep it off in working conditions (climatic factor) for at least 30 minutes.

If the meter does not switch on, recharge the battery.

Supply and delivery set (figure 1.2):

- ✓ Micran M3M-18 Handheld RF Power Meter, 10 MHz to 18 GHz
- ✓ Printed M3M-18 User Manual (English)
- ✓ Certificate of Calibration
- ✓ M3M software and USB driver (USB flash drive)
- ✓ Instrument hard case
- ✓ Power supply, AC adapter, 220 V/50 Hz
- ✓ USB 2.0 interface cable (Standard-A to Type-B), 1.8 meter



Figure 1.2 – Supply and delivery set

1.3. M3M Power Meter Structure and Operation

Meter consists of the next units:

- ✓ Diode detector
- ✓ Analog-to-digital converter unit (ADC)
- ✓ Central processing control unit (CPU)
- ✓ LCD display
- ✓ Keyboard
- ✓ USB interface
- ✓ Battery

Block diagram of the meter shown in figure 1.3.

The work of the meter is based on converting the power of the microwave signal by diode amplitude detector to the DC voltage.

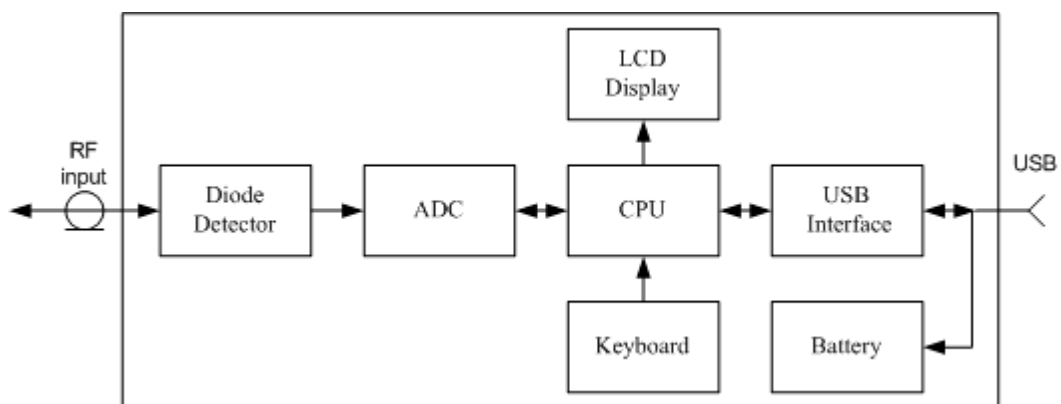


Figure 1.3 – Block diagram of the meter

A voltage proportional to the microwave power supplied to the input of the meter, amplified, digitized, and fed into the processing circuit under control of the central processing control unit. The central processing control unit performs a series of mathematical and service functions, such as processing of measurement results in accordance with the parameters and displayed them on the indicator, frequency correction, storing the results of measurements, the attenuation compensation using an external attenuator, self-diagnostics. Calibration correction is stored in external FLASH-memory and measured data is corrected according the calibration coefficients, which decreased total error.

The meter can be used in manual mode (using main keyboard and LED display) and in remote control mode (operation and readout of the measured values can be performed using the “M3M-18 Handheld RF Power Meter” software on PC). To remote meter with a computer USB interface is used.

Charging the battery is made either from the USB port, or from AC 220 V with the dedicated AC/DC adapter. To retain the parameters, specified in 5, is not recommend to use the AC/DC adapter to perform the measurements during the battery charging (in this case charging is possible from PC USB port). Running time meter while charging from the USB should not exceed 24 hours. The time interval between cycles when operating using the charger or together to PC must be less than 30 minutes.

1.4. Handling Precaution

Only the qualified personnel who studied the user manual and have the skills of test and measurement equipment are allowed to operate with the meter.

ATTENTION

THE DETECTION SECTION OF THE METER IS HIGHLY SENSITIVE TO STATIC VOLTAGE (DISCHARGE). BEFORE CONNECTING THE METER TO THE TESTED DEVICE MUST BE TAKEN ACTIONS TO PREVENT EXPOSURE TO STATIC ELECTRICITY (USE ANTI-STATIC WRIST STRAP, CONNECT THE MONITORING DEVICE AND THE COMPUTER TO THE PROTECTIVE GROUND LINE).

OPENING THE METER BODY FOR MAINTENANCE AND SETTING OPERATIONS SHOULD ONLY BE DONE BY THE MANUFACTURER.

IT IS FORBIDDEN TO BREAK THE SEALS AND CONDUCT A SELF-REPAIR.

NOT ALLOWED TO EXCEED THE POWER LEVEL OF 40 mW (+16 dBm) AT THE INPUT OF THE MICROWAVE METER.

1.5. Power Supply

The battery is charged either via PC USB-port or from AC 220 V with the AC/DC adapter.

To charge the battery via PC USB-port need to connect the meter to the computer using a standard USB 2.0 cable (AB-type).

To charge from the power supply 220V 50 Hz is needed to use the AC/DC adapter, included in delivery set.

The battery status is displayed on the screen of the meter (see figure 2.2.1). When the battery is low, the display shows the message "Warning! Battery is low ". In further work without recharging the meter automatically turns off.

The charging process is accompanied by flashing of the indicator elements. When charging is complete, the flashing stops, displays all the elements of the indicator.

When you turn off the meter during the process of charging, the display shows the message "Battery is charging" (the charging process continues) or "Battery is charged" (the charging process is over). After pressing **ON/OFF** button message is not displayed.

In saving mode operation (paragraph 2.3.11), meter charging doesn't stop when it is turned off automatically.

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2.1. Controls and Indicators



Control of the meter may be manually or remotely from PC, for this purpose on the front panel and on the right side (Figure 2.1.1) provides the appropriate control keys and connectors. The name and basic control functions are shown in Table 2.1.1.



Figure 2.1.1 – Front panel keypad

Table 2.1.1- Name and basic control functions

No	Name	Description
1	RF input	Connector to the signal source.
2	Display	The display shows the value of the input microwave power level in the selected measurement units according to calibration data, as well as additional information about the operation and status of the meter. And the setting that can be set or changed using the keys in the menu mode.
3		Press the MENU button to access the M3M-18 menus. Press MENU once causes the power display (the measurement mode) to be replaced with the menu display (the menu mode). The menu can be navigated with the navigation keys. Press MENU second to exit the menu mode and the display will return to normal mode.
4		The display is backlit to allow visibility in dark environments. Press BACKLIGHT to turn on and off the LCD backlight display. You can change the delay setting using the M3M-18 menus
5		The NAVIGATION KEYS have the functions of shortcut keys (paragraph 2.3, "Selection and installation of measurement parameters and meter settings"). The ◀/▶ or ▲/▼ keypads allow users select different menus in the menu mode.

6		The ENTER button for selecting menu items and confirmation of the entered data.
7		Press ON/OFF button to turn on or turn off the power meter.
8	Stud	Stud strap for wearing the meter on the wrist.
9	USB connector	Jack for connecting the meter to PC or to a charger for charging the battery.

2.2. Modes and Navigation

The meter has 3 modes:

- ✓ The measurement mode;
- ✓ The menu mode;
- ✓ The values mode.

Turning on and turning off the meter is produced by pressing and holding **ON/OFF** until the appearance of display.

2.2.1 The Measurement Mode

When the measurement mode is enabled, the meter automatically switches to the measuring mode. Indicator status in the measurement mode is shown in Figure 2.2.1.

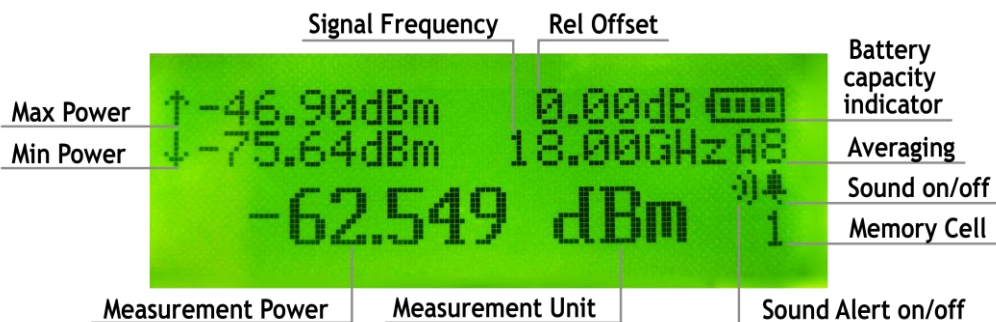


Figure 2.2.1 – Indicator status in the measurement mode

In this mode direct measurement of the power level of the microwave signal received at the RF input. The measurement result can be seen on the screen in measurement mode (figure 2.2.1). If the meter is not connected to a source of microwave oscillations, the screen will display the value of the noise power.

On the indicator in measurement mode are also displayed: battery charge level; sign, indicating that the key sound activated; sign, indicating that the sound notification activated; minimum power value; maximum power value; frequency correction (the frequency of the input signal for the automatic correction of the measurement results according to the calibration table of the meter); attenuation compensation; the degree of averaging; available memory.

In the measurement mode control buttons have the following functions:

Press **ENTER** to go to the relative measurement, press again to return to absolute measurements. Press **MENU** button to the entrance to the menu mode, press again to back to the measurement mode with the cancellation of the input values.

Pressing ◀/▶ or ▲/▼, depending on the settings, provides changing the frequency correction, the degree of averaging, attenuation compensation, measurement units or the number of available memory locations. Functions of these keys are set to " Menu > Device Setup > Keyboard Setting> Up/Down or Left/Right " (paragraph 2.3.16 "Using keyboard shortcuts ").

ATTENTION

WHEN EXCEEDING THE LEVEL OF THE INPUT POWER 21 dBm (125 mW), THE METER WILL START TO BEEP, ACCOMPANIED BY FLASHING THE BACKLIGHT.

2.2.2 Menu Mode

In the menu mode you might select the measurement parameters and installing or setting of the meter. Status of the LCD indicator in the menu mode is shown in Figure 2.2.2. The menu structure is shown in Figure 2.2.3.



Figure 2.2.2 – Indicator status in the menu mode

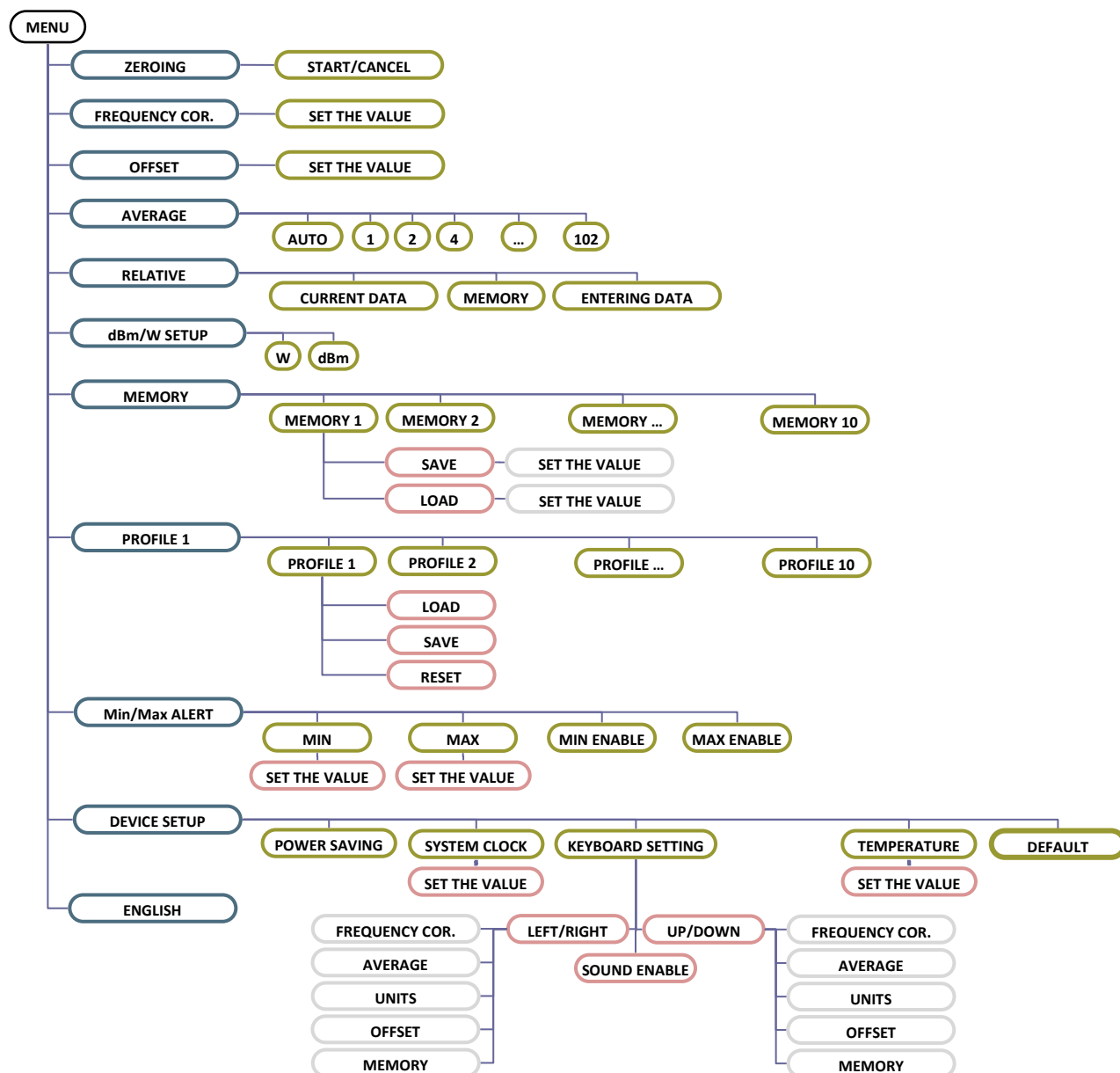


Figure 2.2.3 – Menu map structure

In Menu mode, user can select the parameter setting and measurement of microwave power oscillations. Navigation keys ▲/▼ select different menus. **ENTER** allows users choose the menus. Exit the menu with the confirmation of selection happens when you press the **ENTER**, exit without saving changes by pressing **MENU**. Exit from the menu mode to the measurement mode by pressing **MENU**.

2.2.3 Values Mode

This mode is provided to edit or display the value of the measurement or meter settings. Indicator status in the values mode is shown in Figure 2.2.4

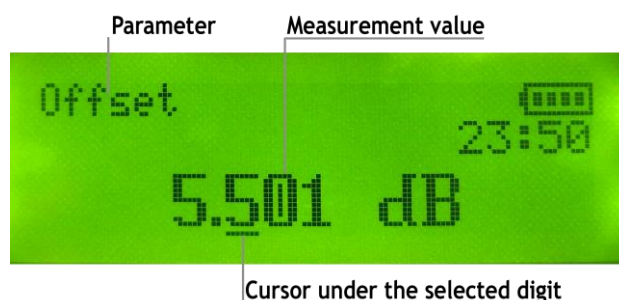


Figure 2.2.4 – Indicator status in the values mode

Changing the measurement value made on categories, under selected category is located the cursor. Selecting a category is done by pressing keys ◀/▶. Change the value of the category is done by pressing the ▲/▼. Changing the measurement value is confirmed by pressing the **ENTER**; cancel the changes - by pressing the **MENU**. In values mode that is designed to display parameter measurements, there is no cursor and you cannot change the value of the parameter.

2.3. Measurement Parameters and Settings

2.3.1 Zeroing

The Zeroing is done to increase the measurement accuracy in the measurement of power levels below -40 dBm (0.1 mW). Zeroing proceeds as follows:

In measurement mode press the **MENU** button to enter the menu. Using ▲/▼ select "Zeroing", press **ENTER**. Zeroing will be done after 30 seconds. Zeroing process is displayed as a percentage of the operation, at the end of the process indicator will show "100%" (Figure 2.3.1). Return to menu is performed by the **MENU** key.



Figure 2.3.1 – Indicator status «Zeroing»

ATTENTION

RESET OPERATION MAY BE CARRIED OUT ONLY WHEN THERE IS NO SIGNAL AT THE RF INPUT OF THE METER.

2.3.2 Frequency Correction

The Frequency correction allows you to provide correction of irregularity of the amplitude-frequency characteristics (AFC) (microwave power converter) by introducing the value of the detector input signal. Thus there is automatic correction of measurement results according to the calibration table of the meter (stored in the internal memory of the meter). The frequency value of the frequency correction set in the range from 0.01 to 18.00 GHz. To set the frequency (which is measured the input power) you must perform the following steps.

Measurement Mode

Changing the value of the frequency is performed using the keys ▲/▼ or ◀/▶, depending on what function were assigned to them. The value of the "Signal Frequency" (figure 2.2.1) should change in the direction of decreasing (increasing) with fixed step. The step value change frequency is set in the item "Menu > Frequency Cor." by setting the cursor under the desired digit value in GHz. Key setting ▲/▼ or ◀/▶ to change the frequency in the measurement mode is in "Menu > Device Setup > Keyboard Setting> Up/Down or Left/Right".

Menu Mode

Using the ▲/▼ to select "Frequency cor." and press **ENTER** (figure 2.3.2). Going to values mode using the keys ▲/▼ or ◀/▶ to enter frequency (GHz) and press **ENTER** to save the changes or press the **MENU** to exit the menu. To go to the measurement mode, press the **MENU**.

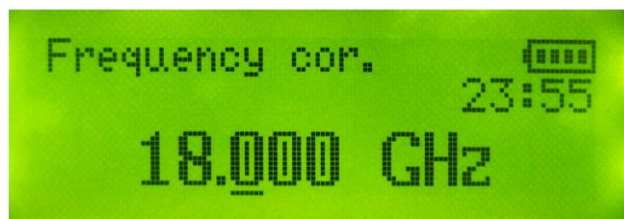


Figure 2.3.2 – Indicator status «Frequency correction»

The entered frequency value in the measurement mode is displayed with an accuracy of two decimal places.

The frequency value of the frequency correction can be set by using shortcut keys (paragraph 2.3.16 "Using keyboard shortcuts").

2.3.3 Attenuation Compensation

The Attenuation compensation allows you to provide the ability to compensate the attenuation, intended to offset the attenuation of external attenuation or gain of the external amplifier. In this case, there is an automatic correction of the measurement result in accordance with the entered value. The external attenuation value of the attenuator is specified in dB from 0 to 99 dB. The gain value of the external amplifier is specified in dB in the range from minus 99 to 0 dB. To set the value, follow these steps.

Measurement Mode

Changing the value is performed using the keys ▲/▼ or ◀/▶, depending on what function were assigned to them. In this case the attenuation value on the indicator (figure 2.3.1) should change in the direction of decreasing (increasing) with fixed step. The step value is set in the menu item "Rel Offset", by setting the cursor under the desired digit number in dB. Key setting ▲/▼ or ◀/▶ changes the attenuation in the measurement mode is in "Menu > Device Setup > Keyboard Setting> Up/Down or Left/Right".

Menu Mode

Using the keys ▲/▼, select "Offset" and press **ENTER**. By pressing ▲/▼ or ◀/▶ set the value (Figure 2.3.4) and press **ENTER** to save the changes or press **MENU** button to exit to the main menu. Press **MENU** to exit in the measurement mode.



Figure 2.3.4 – Indicator status «Frequency correction»

The measurement result is automatically adjusted depending on the entered value.

The value entered in the measurement mode is displayed up to two decimal places.

Attenuation value can be set by using the shortcut keys (paragraph 2.3.16 "Using keyboard shortcuts").

2.3.4 Measurement Units

The measurement units function allows you to provide the ability to display the result in units of W or dBm. Change of measurement units in which to display the measurement result is performed in the following sequence:

In measurement mode press the **MENU** button to enter the menu. Using the keys **▲/▼** select the "dBm/W Setup" and press **ENTER**. Using the keys **▲/▼** selects the measurement unit dBm or W (Figure 2.3.5). Press **ENTER** to save the changes or **MENU** to exit to the main menu. Press **MENU** to exit in the measurement mode.



Figure 2.3.5 – Indicator status «dBm/W Setup»

2.3.5 Relative Measurements

Relative measurement is a measurement that displays the ratio of the current value of the power in watts (W) to the value of the power specified by the user. The results of relative measurements are displayed either in percent (%) or in decibels (dB). The calculation result of the relative measurements in percent is produced by the formula:

$$P_{rel.} = \frac{P_m}{P_{set.}} \times 100, \quad (1)$$

where $P_{rel.}$ – results of relative measurements, %;

$P_{set.}$ – power value that is set by the user and relative to which the calculations are performed, W;

P_m – measured power level, W.

Calculation of relative measurements in decibels based on a formula:

$$P_{rel.} = P_{set.} - P_m, \quad (2)$$

где $P_{rel.}$ – results of relative measurements, dB;

$P_{set.}$ – power value that is set by the user and relative to which the calculations are performed, dBm;

P_m – measured power level, dBm.

The meter has the ability of relative measurements in three modes:

- ✓ relative to the current value of the measured power;
- ✓ relative to the value of the power level from the memory location;
- ✓ relative to the entered value.

Option measurements can be set in "Menu> Relative", using the keys ▲/▼. To confirm the selected mode press the **ENTER** or the **MENU** button to exit to the main menu (Figure 2.3.6). Double-press **MENU** allows to enter the menu mode, and then to the measuring mode.

In the measurement mode function of relative measurements is turned on/off after you press **ENTER**.

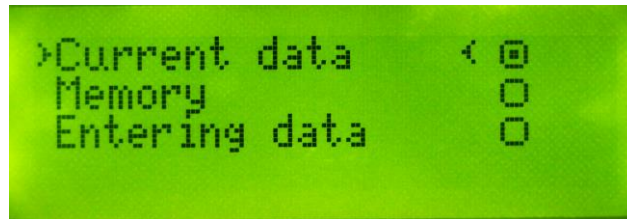


Figure 2.3.6 – Indicator status «Relative measurements»

When you confirm your mode of measurements relative to the current value of the power level, on the display in the measurement mode should be displayed the value close to 0,000 dB (100 % or 1.00+02%) depending on the fluctuations of microwave power input. In percentages, the relative results of the measurements are displayed if the selected units of measure are W. The percentages are displayed in engineering format.

When selecting the measuring mode relative to the value from the memory location, the indicator will display the result of the ratio of the current power level to the value stored in the memory location, the number of which is displayed in the lower right corner of the indicator "Memory Sell" (Figure 2.2.1).

When you select the measurements mode relative to the entered value, the user will be asked to enter a value. To enter the values mode you need press **ENTER** in the measurement mode. Using the keys ▲/▼ or ◀/▶ must be set the power level relative to which will be measured and press **ENTER** to save the value or press the **MENU** to exit the values mode.

2.3.6 Setting the Number of Averages

Analog-to-digital conversion of the signal received at the input of the meter is done by ADC. The ADC values are read by the microcontroller and are summed with the results of previous transformations. After N measurements the cumulative sum of the measured values are normalized to the number of them. On the indicator of the meter displays the average value of the power level calculated by the formula:

$$S_{avg} = \frac{\sum S_i}{2^n}, \quad (3)$$

where $i = 1 \dots N$ – number of measurements;

$N = 2^n$ – number of averaging;

N - order of averaging;

S_i – result of one i-th measurement.

On the indicator average is displayed in the upper right corner as a symbol "A[n]", where "A" means averaging (averaging), n – averaging value. Symbol "AA" means, that the current averaging value 10 or A, in hexadecimal notation. When installing the automatic averaging ("Menu> Averaging> Auto") the degree of averaging n on the display in the measurement mode (Figure 2.2.1) will take values 1,2..,9, A, depending on the power level at the RF input according to the table 2.2.1. Relations between the time of measurements t_{meas} (s) and the number of averagings N depends on term $t_{meas} = N / 128$.



Figure 2.3.7 – Indicator status «Averaging»

NOTE

In remote mode, using PC readout time differs from the time of measurement at the interval.

Changing the number of averages is the following way:

In measurement mode press the **MENU** button to enter the menu. Using the keys **▲/▼**, select the "Averaging", press **ENTER**. By pressing **▲/▼** to select the number of averages N from 1 to 1024 and press **ENTER** to save the changes or press **MENU** button to exit to the main menu. Press **MENU** to exit in the measurement mode.

Recommended number of averages at different power levels shown in Table 2.2.1, which is used in the selected averaging mode "Auto".

Table 2.2.1 – number order of averages in mode «Auto»

The measured level of microwave power, mW (dBm)	Number order of averages N
39.8 to 1 (from +16 to 0)	32
1 to $3.16 \cdot 10^{-2}$ (from 0 to minus 15)	64
$3.16 \cdot 10^{-2}$ to $1 \cdot 10^{-4}$ (from minus 15 to minus 40)	128
$1 \cdot 10^{-4}$ to $1 \cdot 10^{-6}$ (from minus 40 to minus 60)	256

2.3.7 Internal Memory of the Meter

For storing the results of measurements ten memory cells are made. In each memory cell will store the result of measurement, the date and time when the measurement was made.

To see the contents of a memory cell or store the value in the cell is the following way:

In measurement mode press the **MENU** button to enter the menu. Using the keys **▲/▼** select "Memory" and press **ENTER**. Using the keys **▲/▼** select a memory cell from the list, press **ENTER** to select options "Download" or "Save".

When you click "Save" indicator goes into a state shown in Figure 2.3.8, the indicator will show the current value of the power level. Fixation of the value indicator is performed by the keys **◀/▶**. Using the keys **▲/▼** or **◀/▶** you can change the value of the power level, the change is confirmed by pressing **ENTER**. The transition of the indicator to a condition in which the current value is displayed the power level, occurs on double clicking the key **ENTER**. Exit the menu mode by pressing **MENU**.

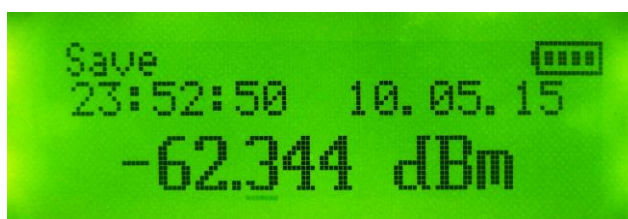


Figure 2.3.8 – Indicator status «Memory contents»

When you click "Download" on the indicator displays a previously saved value of the power level or value of 0.00 dBm or mW 1.000. Exit the menu mode by pressing **MENU**. After the meter reset or alarm reset (reset to factory defaults) the values saved before stored in the memory cell.

It is possible to quickly save the measurement result in any of the ten memory cells: hold down the **ENTER**, press **►**, thus it is necessary by pressing **▲/▼** to select the desired cell from the list and confirm by pressing **ENTER**, and then select from the list the "Save ". After that, the meter enters the values memory cells, where you can change the measured power level. The stored value is confirmed by pressing **ENTER**. Exit the menu mode by pressing **MENU**. The number of stored cell is indicated on the indicator of the meter in the lower right corner. Pressing the keys **◀/▶** or **▲/▼** depending on the settings, changes the number of available memory cells. This function is set to "Menu > Device Setup > Keyboard Setting> Up/Down or Left/Right".

2.3.8 Profiles

To store user settings of the meter there are ten profiles. In each profile you can save the current settings of the meter and, as necessary, to load them.

Saving the current settings

In measurement mode press the **MENU**. Using the **▲/▼** to select "Profiles", press **ENTER**. Then using **▲/▼** select the desired profile, press **ENTER**. Using **▲/▼** select "Save". Then all the current settings of the meter will be saved in the selected profile.

Profile Download

In measurement mode press the **MENU**. Using **▲/▼** select "Profiles", press **ENTER**. Then, using **▲/▼** select the desired profile, press **ENTER**. Using **▲/▼** select "Download". Then restore the saved in the profile settings of the meter.

Profile Reset

In measurement mode press the **MENU**. Using **▲/▼** select "Profiles", press **ENTER**. Then, using **▲/▼** select the desired profile, press **ENTER**. Using **▲/▼** select "Reset". Then all the saved settings in the profile will be reset.

Quick access to the profile editor can be carried out using the keyboard shortcuts (paragraph 2.3.16 "Using keyboard shortcuts").

2.3.9 Accumulation of max/min Values of Microwave (RF) Power

After switching on, the meter stores the maximum and minimum value of the measured power. These values can be used to analyze changes of the RF power level for a certain period of time. The values are displayed in the top left corner of the screen in measurement mode with an accuracy of two decimal places. Press **ENTER** twice to reset the accumulated values for the minimum and maximum required in the measurement mode.

2.3.10 Sound Notification

Sound notification is intended to register the output value of the measured power from a user-specified interval of capacities Setting the measurement range, in which there will be an alert is in "Menu > Sound notification ".

Setting the sound notification in the following order:

In measurement mode press the **MENU** button to enter the menu. Using **▲/▼** select "Min/Max alert" and press **ENTER**. Set the limits of the interval in the "Max" and "Min", respectively. Enter the limit values by using the keys **▲/▼** or **◀/▶**. Press **ENTER** to confirm. Exit the menu mode by pressing **MENU**.

Enabling of measurement limits by setting the appropriate checkboxes by pressing **ENTER** opposite the points "Sound minimum" and "Sound maximum " ("Menu> Min/Max Alert ").

If the measured value goes outside preset limits, you will hear a beep and flashes the backlight.

2.3.11 Using Saving Mode

Saving mode is intended for longer battery life of the meter. To enable saving mode:

In measurement mode press the **MENU** button to enter the menu. Using the keys ▲/▼, select "Device Setup", press **ENTER**. Then use the key ▲/▼ to select "Power Saving". Tick the "Power Saving" by pressing **ENTER**.

Exit the menu mode by pressing "Menu/Cancel".

In economy mode the meter is made off after 15 minutes in the following cases:

- ✓ In the absence of data transmission via USB in remote mode;
- ✓ If within 15 minutes is not pressed any key of meter management.

2.3.12 Temperature

The temperature inside the meter is displayed under the "Temperature". To know the current temperature:

In measurement mode press the **MENU** button to enter the menu. Using the keys ▲/▼ select "Device Setup", press **ENTER**. Then use the keys ▲/▼ to select "Temperature". Press **ENTER**. This mode displays the values of temperature and time. To return to menu mode press **MENU**.

2.3.13 Language

The meter has ability to use symbols menu items and units of measurement in English and Russian languages. To switch from one language to another:

In measurement mode press the **MENU** button to enter the menu. Using the keys ▲/▼, select «English (Англ.)" to switch from Russian to English and "Russian (Рус.)» to switch from English to Russian. In accordance with the selected language is carried out displaying units and names of menu items. Press **ENTER** to save the changes or press **MENU** button to return to the measurement mode. To return to the menu, press **MENU** button.

2.3.14 System Clock

The system clock is used for counting the time and date. To know the current time and date or to change the settings of system clock:

In measurement mode press the **MENU** button to enter the menu. Using keys ▲/▼ select «Device Setup», press **ENTER**, then using keys ▲/▼, select «System Clock» and press «Enter». This mode displays the date and time.

To set a time and date use the keys ▲/▼ and ◀/▶. To confirm, press **ENTER**. To return to menu mode press **MENU**.

NOTE

After alarm reset (reset to factory defaults) of the meter, you need to set the system clock to the current date and time.

2.3.15 Default Setting

To establish the initial settings of the meter, do the following:

In measurement mode press the **MENU** button to enter the menu. Using ▲/▼ select "Device Setup" and press **ENTER**. Then, use ▲/▼ to select "Default Setting" and press **ENTER**. After the reset, the meter automatically switches to the measuring mode.

Default parameters of the meter are shown in Table 2.3.1.

Table 2.3.1 Default parameters of the meter

Parameter	Default value
Measurement units («Menu > dBm/W Setup»)	dBm
Frequency correction («Menu > Average»)	0.10 GHz
Attenuation compensation («Menu > Offset»)	0.00 dB
Averaging («Menu > Average»)	Auto
Relative measurements mode («Menu > Relative»)	Current data
Sound enable («Menu > Device Setup > Keyboard Setting > Sound enable»)	On
Available memory («Menu > Memory»)	1
Power saving («Menu > Device Setup > Power saving»)	On
Language («Menu > English/Russia»)	Rus

2.3.16 Using the Meter Keyboard Shortcuts

There are special shortcuts provided quick accesses to main menu items:

Hold **ENTER** + ▲: Editor "Attenuation compensation (Offset)".

Hold **ENTER** + ►: Saving the measurement results of microwave power in the memory location.

Hold **ENTER** + ▼: Editor "Frequency correction".

Hold **ENTER** + ◀: Profile editor.

Simultaneously pressing the **ENTER** + **MENU** + **ON/OFF**: alarm reset (reset to factory defaults) of the meter. Alarm reset is used if the meter will not respond to keystrokes management.

2.4. Measurement Procedure

Measurements must be carried in the following sequence:

Press and hold **ON/OFF** button until the indication appears. After that hold the meter in the On state for at least 10 seconds. Set the measurement parameters in accordance with paragraph 2.3. If necessary make zeroing. Connect the RF input with signal source.

ATTENTION

ABSOLUTE MAXIMUM RATE OF THE INPUT POWER SHOULD BE NO MORE THAN 16 dBm (40 mW).

Fix the value of the power of the microwave signal that is displayed on the indicator; if necessary store the result into one of the memory cells. Turn off the meter in measurement mode press **ON/OFF** button. Disconnect the meter from the signal source.

Calculate the measurement error δ_m , %, by the equation:

$$\delta_m = \pm \left(\delta_{rel} + 2 * \frac{\sigma_{sdl}}{P_m} * 100 \right), \quad (4)$$

where P_m – measured power level, nW;

σ_{sdl} – the limit of the standard deviation of the random component of measurement error, nW;

δ_{rel} – maximum permissible relative error of measurement, %.

On connecting the meter to the output of the signal source may occurs the error caused by the mismatch of the output source impedance and the input impedance of the meter to the characteristic impedance of the transmission line.

An additional component of the measurement error δ_{PAC} , %, due to mismatch, calculated by the equation:

$$\delta_{PAC} = \pm 2 \cdot \Gamma_{SIGN} \cdot |\Gamma_{MEAS}| \cdot 100, \quad (5)$$

where Γ_{SIGN} – the reflection coefficient of the source output signal;

$|\Gamma_{MEAS}|$ – the factor of the reflection coefficient of the input to the meter.

The factor of the reflection coefficient associated with the voltage standing wave ratio (VSWR) by the equation:

$$\Gamma = \frac{VSWR - 1}{VSWR + 1}. \quad (6)$$

3. PC Remote Control Option

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3.1. Installing USB Driver

The meter connects to the computer via the USB port using the USB cable 2.0 (A-B) included in the delivery set. The meter works correctly on Windows 2000/XP. To work with computers is necessary to install the M3M-18 drivers. If the driver of the meter or the driver for the virtual COM ports from FTDI is already installed on this computer, driver installation not required. To install the drivers, the user must have administrator rights on the PC. Installation is done in the following order:

Connect the meter to the USB port on a computer using a cable USB 2.0 (AB). When connected to a USB port the meter turns on automatically. In a few seconds the computer will report about finding a new device and prompt the user to install the device driver using the "Setup manager" (Figure 3.1 a).

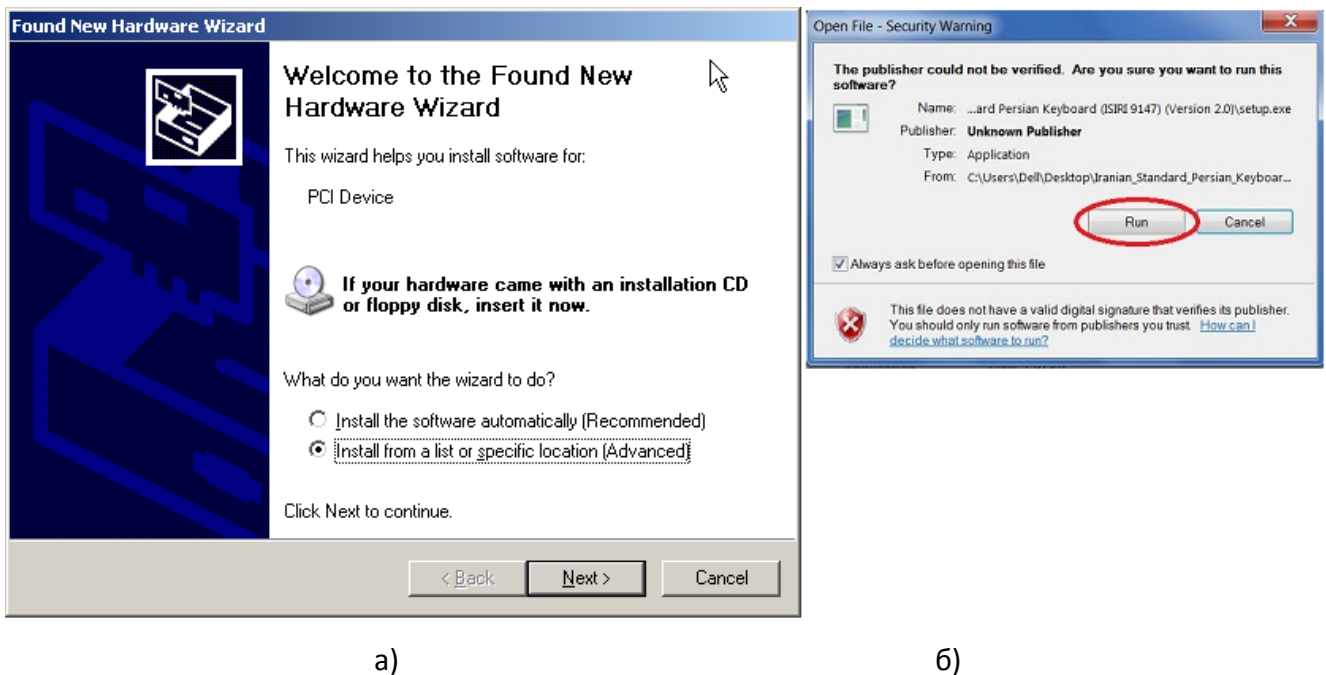


Figure 3.1 – Dialog windows Found New Hardware

NOTE

If "Setup Manager" does not appear, perhaps, the user does not have administrator rights, or the meter driver or driver for virtual COM-port from FTDI already installed on this computer;

Virtual COM-port installation:

After the startup dialog window "Setup Manager", click "Cancel". Open the file «CDM 20600.exe», located on the CD in the folder «FTDI». After a few seconds a window will appear "Security Warning" (figure 3.1, b). After the appearance of the window "Security Warning" click "Run". After a few seconds the computer will report that new hardware is installed and ready to use.

3.2. Description and Operation of the Program "Power Meter"

The program "Power meter" (further - the program) is designed for remote control of the meter.

To run the program need to open the file "Power Meter.exe", located on the CD in the folder «Install».

Operating window shown in Figure 3.2.

The main controls of the program (buttons and menus) and their functions are similar to the menu of the meter in manual mode, except for the following:

«Auto search» – automatic search of meters connected to the PC with the connection parameters definition. The list of COM ports (USB Serial Port) of the computer, which is connected to the meter appears in the list (1). If the meter is not found, the list (1) writes "Device not found";

«Logging» – dialog window "Logging" (see figure 3.3), which establishes the interval between the reading of the measurement result in continuous mode (the checkbox next to "Continuously"), select the log file and the parameters that you want to keep. When placing the checkbox next to "Save file" dialog window appears in which you specify the path and name of the file. The log file is saved in text format with the extension ".txt", which is opened in a text editor. When you click on "Expand" (Figure 3.3 a) appears the field displaying the information recorded in the log file (Figure 3.3 b). In the absence of the checkbox "Logging", the log file will not contain information about the meter. Starting and stopping the logging process is carried out by placing or removing the checkbox "Continuously";

"Status" key - a request for the set measurement parameters;

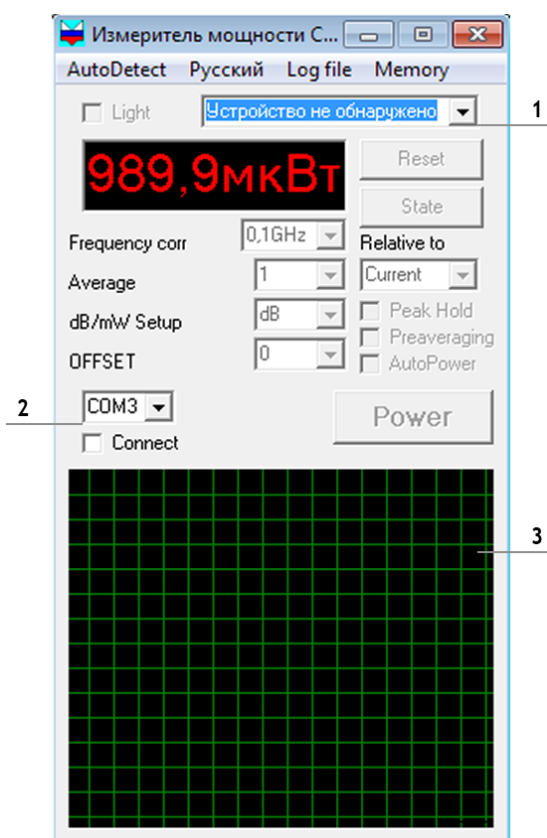


Figure 3.2 – Operating control window of the meter's software

Checkbox "Continuously" - periodic inquiry of measurement results, providing a continuous update of the metered data;

Checkbox «ССП» – enabling the reading of the measured results with pre-averaging, which is necessary to use in averaging more than 32;

"Power" key - a single measurement result request;

Checkbox "Connect" - a connection to the meter. Becomes active after determining the number of COM-port PC and selecting it from the list (2);

Graphic area (3) - graphical display of measurement results.

When the program starts, the control keys are not active. Remote control is active only after the connection between the PC and the meter. In remote mode you can change the settings of the meter manually. To update settings in the main program window, after you change the settings, you must click the "Status".

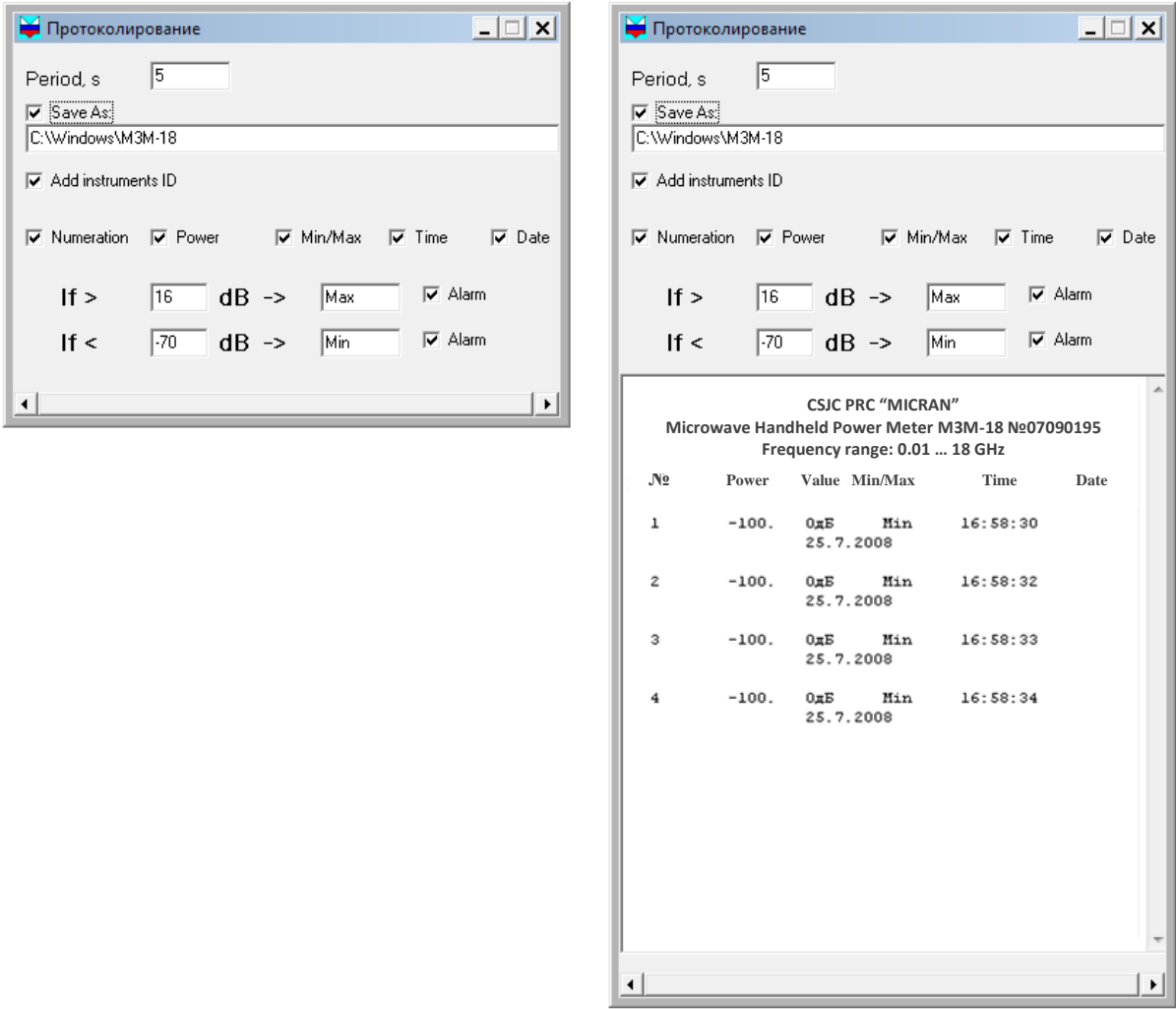


Figure 3.3 - The dialog window "Save to file"

4. List of Presumable Problems and Troubleshooting Recommendations

The list of presumable problems, their causes, and operational recommendations on meter's malfunctions are shown in table 4.4.

Table 4.4 – List of presumable problems, their causes and troubleshooting methods.

Name of problem, external signs of existence	Presumable reason of the problem	Troubleshooting methods
The meter does not turn on	Battery is low	Charge the battery
During operation, the meter stops responding to keystrokes	Program failure	Make the alarm reset (reset to factory defaults) the meter by simultaneously pressing the ENTER + MENU + ON/OFF
During operation, the meter stops responding to keystrokes and alarm reset (reset to factory defaults) does not work	Program failure	Wait until the battery will be discharged and the device turns off. Then charge the battery.
Upon accession to the source of the signal, the meter beeps and the backlight blinking.	Exceeded the absolute maximum rate of input RF power.	Immediately disconnect the meter from the source and make sure that the power source signal is valid for the measuring range.
	Sound limits notification are turned on	Remove the checkboxes next to the items "Min Enable" and "Max Enable" ("Menu> Min/Max Alert")

5. Specifications

Specifications

Frequency range	0.01 to 18 GHz
Power level measurement range	$1 \cdot 10^{-6}$ to 100 mW (-60 to +20 dBm)
Limits of basic relative measurement error without error mismatch with the number of averages N^* , max	$\pm 8.0\%$ (± 0.33 dB)
Limit of permitted standard deviation of the random component of measurement error, max	± 0.025 nW
Limits of additional relative measurement error rejecting ambient temperature from 25 °C for every 10 °C, max	$\pm 2.5\%$ (± 0.1 dB)
Amplitude flatness	0.6
Absolute maximum rate of input power	20 dBm
Instability of measuring data on 15 min operating period with changing the ambient temperature no more than 1°C, P_m – measured power	The greater of: ± 1 unit of account** or $\pm 0.01 \cdot P_m$ W
SWR performance for different frequency band, max	
10 MHz to 12.00 GHz	1.2
12 GHz to 18 GHz	1.2
Output connector type	Type-N (male or female)
Input impedance	50 Ohm
Measurement time, max	N/128 s
Operating mode setting, max	10 s
Duration of continuous operation, min	
from battery with backlight	8 h
from battery without light	16 h
from the AC/DC adapter or PC	24 h
Power supply from AC/DC adapter	
input 50 Hz voltage	(220 \pm 22) V
DC output voltage	(6.0 \pm 0.3) V
charge current, max	500 mA
charging time, max	3 h
Power supply from USB, max	
charge current	125 mA
charging time	8 h
Dimensions, max	
length	177.0 mm
width	48.0 mm
height	32.5 mm
Weight, max	
the meter	0.35 kg
battery charger	0.20 kg
Reliability parameters	
average MTBF	10 000 h
average lifetime of the meter	5 years
average lifetime of the battery	2 years
average storage time	3 years

* At number of averages – N (N=1024 at $P_m \leq -55$ dBm, N=512 at -55 dBm $\leq P_m \leq -50$ dBm, N=256 at -50 dBm $\leq P_m \leq -39$ dBm, N=128 at -39 dBm $\leq P_m \leq -35$ dBm, N=64 at -35 dBm $\leq P_m \leq -33$ dBm, N=16 at -33 dBm $\leq P_m \leq -32$ dBm, N=4 at -32 dBm $\leq P_m \leq -28$ dBm, N=2 at -28 dBm $\leq P_m \leq 20$ dBm).

** 1 unit of account is 0.1 dB for the selected unit "dBm"; 0.1 mW, 0.1 mW or 0.1 nW at selected units "W". Term $\pm 0.01 \cdot P_m$.

6. Manufacturer's (Supplier's) Warranty

The manufacturer guarantees the conformity of the meter presented characteristics provided the customer operating conditions.

Service life is 5 years with the replacement of the batteries, including storage period, 3 years, in the manufacturer's packaging. The battery life is 2 years. Battery replacement is made only by the manufacturer.

Storage warranty period set 18 months from the date of acceptance meter by a Quality Department. The warranty period is 12 months from date of shipment of the meter to the consumer. Warranty life is 3000 hours within the warranty period.

During the warranty period manufacturer undertakes free of charge correct identified defects or replace defective parts, or the whole meter, if it cannot be corrected at the factory.

Claims in case of mechanical damage of the meter and violation of protective seals will not be accepted. During a service life (5 years) on a contractual basis manufacturer performs a paid post-warranty meters repair and service.

7. Storage

Before putting into operation meters should be stored in warehouses in shipping container at ambient temperatures from 0 to + 40 ° C and relative humidity of 80%. Meters without packaging must be kept at an ambient temperature of + 10 to + 35 ° C and relative humidity of 80%.

The storage place should be free of dust, vapors of acids and alkalis, corrosive gases and other substances that may cause corrosion.

Appendix A – Information about the Power Meter

Product name: _____ M3M-18 Power Meter _____

Product designation: _____ M3M-18 Power Meter ЖHKЮ.468161.001 TY _____

Manufacturer: Micran

Release date: « _____ » _____ 20 _____

Serial number: _____

Information about the content of precious materials and non-ferrous metals:

Gold – 0,098 g.

Appendix B – Packing Certificate

Microwave power meter M3M-18 ЖHKЮ.468161. 001 TY

designation

Microwave power meter M3M-18

name

No

serial number

Packed by Micran according to the requirements stated in the design documentation.

job title

signature

full name

date

Appendix C – Approval Certificate

<div>Microwave power meter M3M-18 ЖHKЮ.468161. 001 TY</div> <div>designation</div>	
<div>Microwave power meter M3M-18</div> <div>name</div>	<div>No</div> <div>serial number</div>

Manufactured and accepted in accordance with the mandatory requirements of state standards, current technical documentation and found fit for use.

Chief of Quality Department

PS	<div>signature</div>	<div>full name</div>
	<div>date</div>	
Head of Company	<div>signature</div>	<div>delivery document</div>
PS	<div>date</div>	<div>full name</div>

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