



Przedsiębiorstwo Badawczo-Produkcyjne

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ULTRASONIC GENERATOR UG - S/A

rev. 4.0/03.07.2008

Technical Documentation



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1. Introduction. Warranty conditions

In this documentation there is no service and diagnostic information such as schematic diagrams or diagnostic clues related to UG-S/A. The manufacturer guarantees high quality and reliability of device. In case of any defects resulting from mistakes in the assembling process, during the warranty validity period, customer has the right to request for unpaid repair. All defects should be reported to the manufacturer. Warranty period is extended by number of days needed to repair device, which are counted from delivery to manufacturer to send off day. In case of any failures, repairs are made only by manufacturer, the repairs are free of charge if failures are caused by manufacturer and if warranty period hasn't expired. If failures are caused by user then the repairs are charged. Customer isn't allowed to open and make any changes or repairs in the equipment.

This warranty does not cover any defect caused by an accident, misuse, improper installation or operation, unauthorized repair or maintenance and damage caused by improper supplying device (voltage lower than 180V and higher than 240V).

2. Technical description

2.2 Standard equipment

- Generator module – UG-S/A
- CD with UG-S/A software
- RS 232 cable to connect device with PC
- Power cable
- Connector to attach a load

2.3 Destination

UG-S/A generator is designed to power the ultrasonic ceramic transducers by sinusoidal voltage/current with frequency in range 18 - 22kHz. This frequency is manually adjustable with 1Hz interval or automatically in automatic mode, where device is working in selected frequency range. This range is related to resonant frequency of the transducer. Generator enables measurement of frequency characteristic of the transducer in frequency range 18 - 22kHz, which helps to find optimal work frequency and matching impedance.

1. Frequency of the output signal could be changed in range 18-22kHz with 1Hz maximum resolution. This range depends on device version and it is possible to obtain larger (15-60kHz). Output signal is based on quartz generator.

2. Maximum output power is 500W and it is regulated by change output voltage. This is done by driving power stage by PWM signal. Pulse width is defined as ratio of time t and T . This is shown on the following picture:

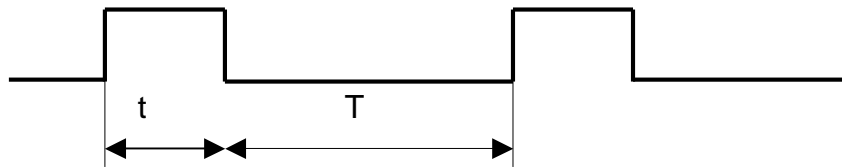


Fig. 1.

$$U_{OUT} = C \cdot \frac{t}{T}$$

Where:

C - corresponds to the maximum output voltage of the selected range

$\frac{t}{T}$ - defined as "pulse width" ranging between 1-100%

Output power:

$$P_{OUT} = \frac{U_{OUT}^2}{R_L}$$

it increases with square of pulse width.

Maximum power occurs for:

$$\frac{t}{T} = 0.5 \quad (PW = 100\%)$$

2.4 Construction

Generator consist of modules connected together by DIN and/or AWP connectors.

- main board
- supply board
- suppressor board
- analog and digital signals controlling board
- PWM board
- filters board
- power stage board
- measurement board
- RS 232 communication control board

2.5 Information plate



 www.optel.pl	Power Ultrasound Generator UG S/A Serial no.: 07.12.rev.4 Date of production.: 03.2008
Ultrasound Frequency: 17 – 50kHz Power Supply: 220-240 VAC/50Hz Power Output: 600W Dimensions: 360 x 340 x 160mm Weight: app. 11 kg Standard: 67/308/Ce	

Fig. 2. Information plate

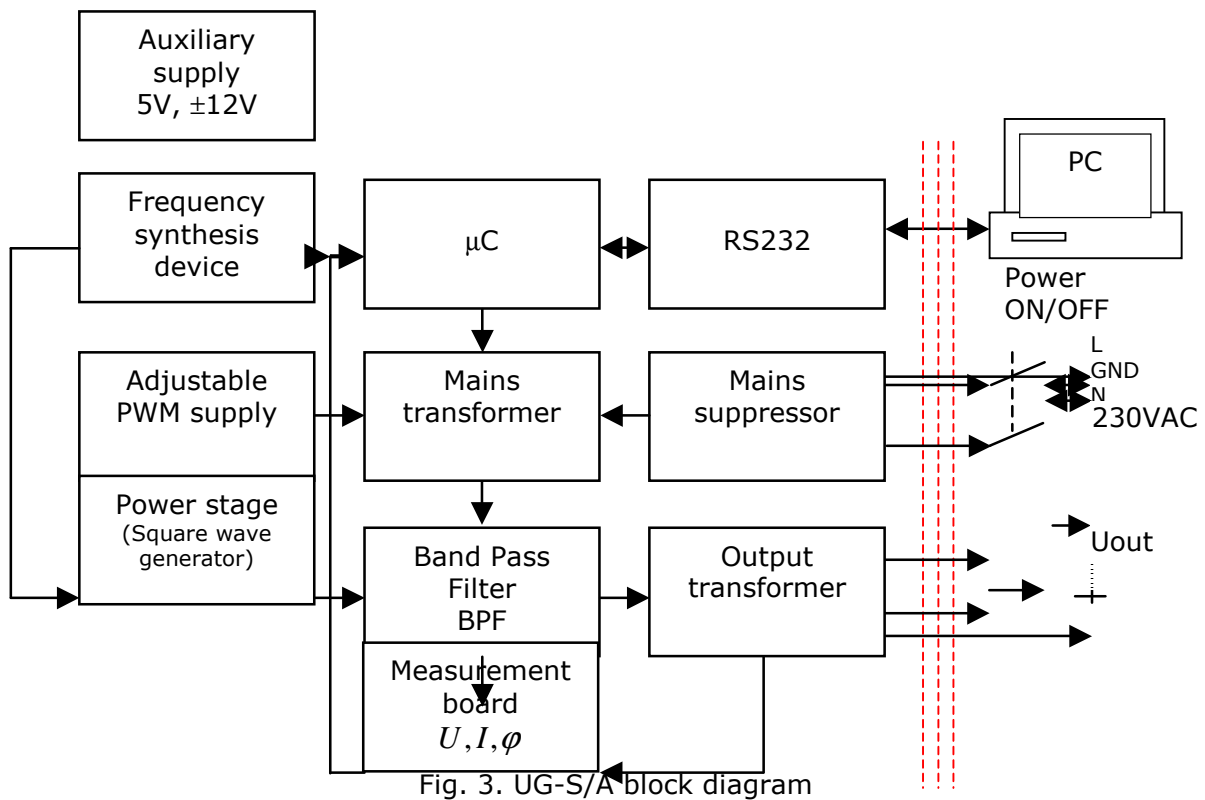
2.6 Technical information

- | | |
|---|-----------------------------|
| • frequency range: | 17 000 - 50 000Hz |
| • frequency setting resolution: | 1Hz or 2Hz |
| • maximum output power: | max 600W |
| • maximum output voltage: | 500V _{sk} |
| • maximum output current: | 4.0 A _{sk} |
| • output voltage shape: | SIN (h max. < 10%) |
| • accuracy of frequency measurement: | ±1Hz |
| • accuracy of voltage measurement: | ±5%, ±5 LSB |
| • accuracy of current measurement: | ±5%, ±5 LSB |
| • accuracy of phase measurement: | ±2° (in range +50/-70°) |
| • accuracy of absolute value of
o impedance measurement: | ±5% (in range 20-400Ω) |
| • four temperature sensors: | PT100 |
| • load impedance (minimum): | 40-300Ω ¹ |
| • supply | 230 VAC / 50Hz |
| • maximum output power: | 600W |
| • PC communication protocol: | RS232 |
| • three parts of load impedance range | |
| • adjustable output voltage in range: | 1%-99% (with 1% resolution) |
| • transformer output | |

- Interzoll Plus desk enclosure 3 HE IZP 36360 (BOPLA)
- enclosure consistent with: IP40 to EN60529

All changeable parameters are adjustable by using digital lines (TTL standard, 5V).

2.7 Block diagram - principle of operation



3. Getting started and using UG-S/A

This device works with any PC computer equipped with RS232 interface or any USB-RS232 adapter, Microsoft Windows operating system (95/98/ME/2000/XP/VISTA) and dedicated software (UG-S/A rev. 2.0) which is distributed with this product.

Content of CD/DVD:



where:

ug_sa.pdf – UG-S/A technical documentation

setup.exe, ug_sa.msi – software installer

DistFile.cab, instmsi.exe, instmsiw.exe, setup.ini – installer files

3.1 Description of connectors and indicators



Fig. 4. Front panel

Enable	- power ON indicator
Output	- output enable indicator
Temperature	- overheat indicator
Power	- power ON/OFF switch
Iout	- diagnostic current output
Uout	- diagnostic voltage output



Fig. 5. Back panel

1. Power connector
2. Glass body fuse 5x20mm 6.3A 250V (quick-acting)
3. RS232 interface - DB9 female
4. Output connector for ultrasound transducer
5. Fan



Do not cover the fans, this may damage the generator!

3.2 Guidelines for user

Before power ON please check:

- accuracy and confidence of connections
- condition of cable insulation
- use only mains socket with fully efficient grounding pin
- to attach load (ultrasonic transducer or model resistance), use only cables with appropriate insulation class

If the device is in operation:

- do not touch /do not short load (ultrasound transducer) connectors
- do not leave working generator without supervision
- signal output must be disabled before changing the load (ultrasound transducer); it must be done in all operating modes (spectrum analyzer, power analyzer, continuous work); switch button F1 in STOP position (the color will change to red) and check if LED indicator ("Output") on front panel is deactivated
- do not change the fuse
- do not disconnect mains cable
- do not disconnect RS232 cable

Before replacing the fuse the generator must be turned off – exit the program (F10), turn off the PC, turn off the device and disconnect mains cable.

Replace the fuse only with identical one (see the description below the fuse socket) (glass body 5x20mm 6.3A 250V (quick-acting)).

WARNING!



FAILURE TO FOLLOW THESE RULES MAY CAUSE SERIOUS INJURY OR DEATH.

The user is responsible for any damages or injuries caused by the improper use of the device.

3.3 Installation and first use

1. Before turning on the PC – connect RS232 cable and screw it down to avoid disconnection during work.
2. Turn on the PC.
3. Install software from included CD/DVD: click on setup.exe to start Wizard installation program and follow the steps.
4. After installation (before first start of UG-S/A) reset your PC
5. Check if the load (ultrasound transducer) is connected properly.
6. Turn on the generator (4th socket on back panel)
7. Start UG-S/A software (UG-S/A.exe)

If the software is properly installed the following files are created as in the example:
 <root> **UG_SA**

analyzer_f
analyzer_m
set
protocol
 ug_sa.exe
 lissa.uir

3.4 Software description

After starting UG-S/A software, main panel appears on the screen. It is shown below:

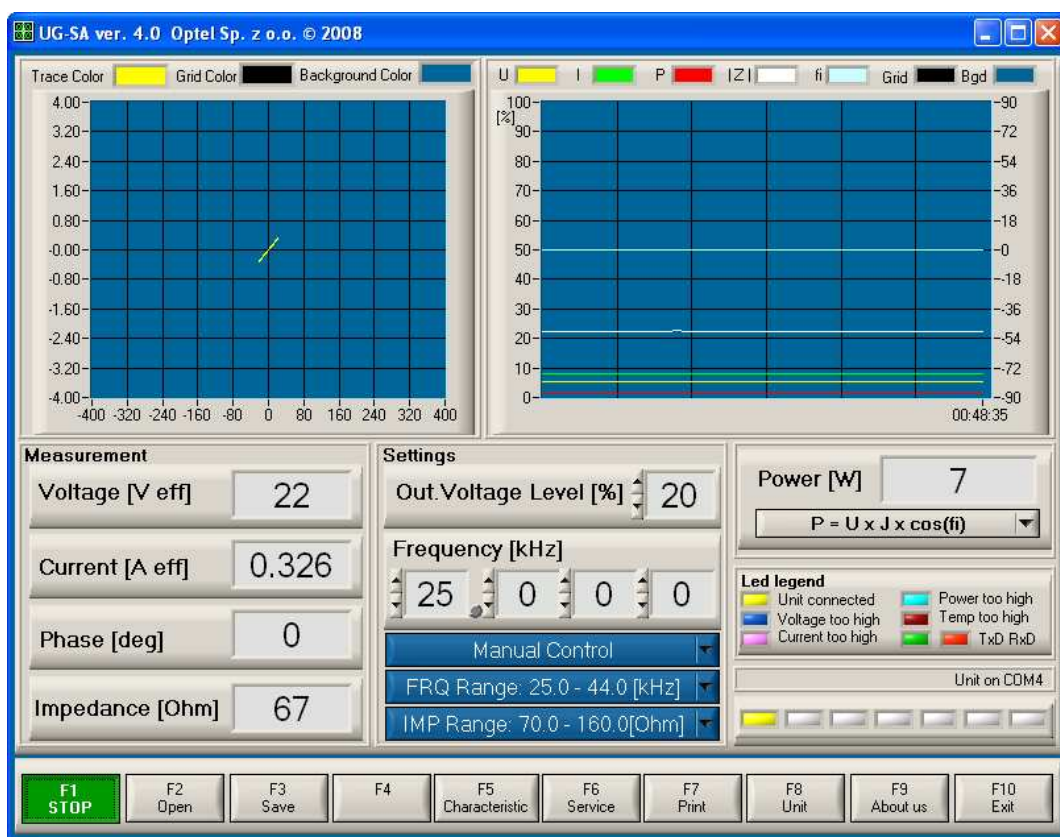


Fig. 6. Main panel.

Main panel consist of following elements:

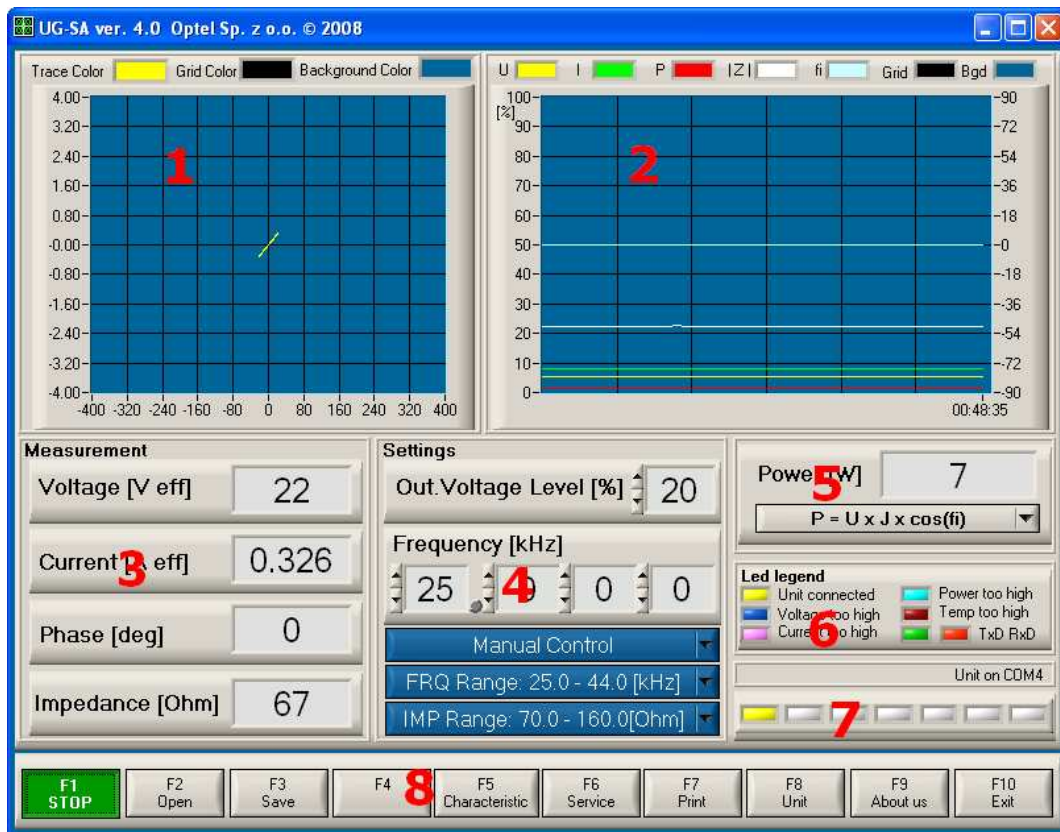


Fig. 7. Main panel

1. Graph of Lissajous curves
2. Voltage, current, power, impedance and phase graph in time domain (default 10 minutes range)
3. Measurements panel
4. Settings panel
5. Power measurement panel
6. Legend of generator condition panel
7. Generator condition panel
8. Function buttons

- **Measurements panel**

This panel shows actual data measured by the generator.

- **Settings panel**

This panel is used to set generation parameters: power and frequency. UG-S/A software allows the generator to work in two modes: automatic or manual frequency setting. In automatic mode the generator automatically adjusts to the resonance frequency of the transducer and keeps it. In manual mode user sets desirable frequency.

- **Generator condition panel**

Below the main panel, is located a status bar of RS232 port where user may found actual status information.

In case of transmission errors, appropriate information will be shown on this panel. If this happens, user should check if generator is on, if the

device and PC are connected properly and if some other applications are using this communication port. After this kind of error occurs, the user should re-detect the device (F8 button and then "Find").

On this panel user also may find indicators:

- Unite connected – the device is detected and is configured properly,
- Voltage too high - voltage exceeded the maximum permitted level,
- Current too high - current exceeded the maximum permitted level,
- Power too high – power exceeded the maximum permitted level,
- Tx line of RS232 active – the PC is sending some data to the generator,
- Rx line of RS232 active - the generator is sending some data to the PC.

• **Function buttons**

There are two ways of using function buttons. User may click on them using the mouse or use function buttons on his keyboard (F1 – F10).

Button	Description	Function
F1	START/STOP	Start acquisition and generation on the output
F2	Open	Load settings from file
F3	Save	Save actual settings to file
F4		
F5	Characteristic	Enter analyzer window
F6	Service	Enter the service panel
F7	Print	Print screen
F8	Unit	Enter the generator connection window
F9	About us	Information about manufacturer
F10	Exit	Exit the program and turn off generator

After start, the software automatically detects the generator. If it is done, the yellow indicator ("Unite connected") on the generator condition panel is lighted. If the generator isn't connected properly or the power is off, the „Characteristic“ function gets blocked. In that case user should re-detect device - "Find" button.

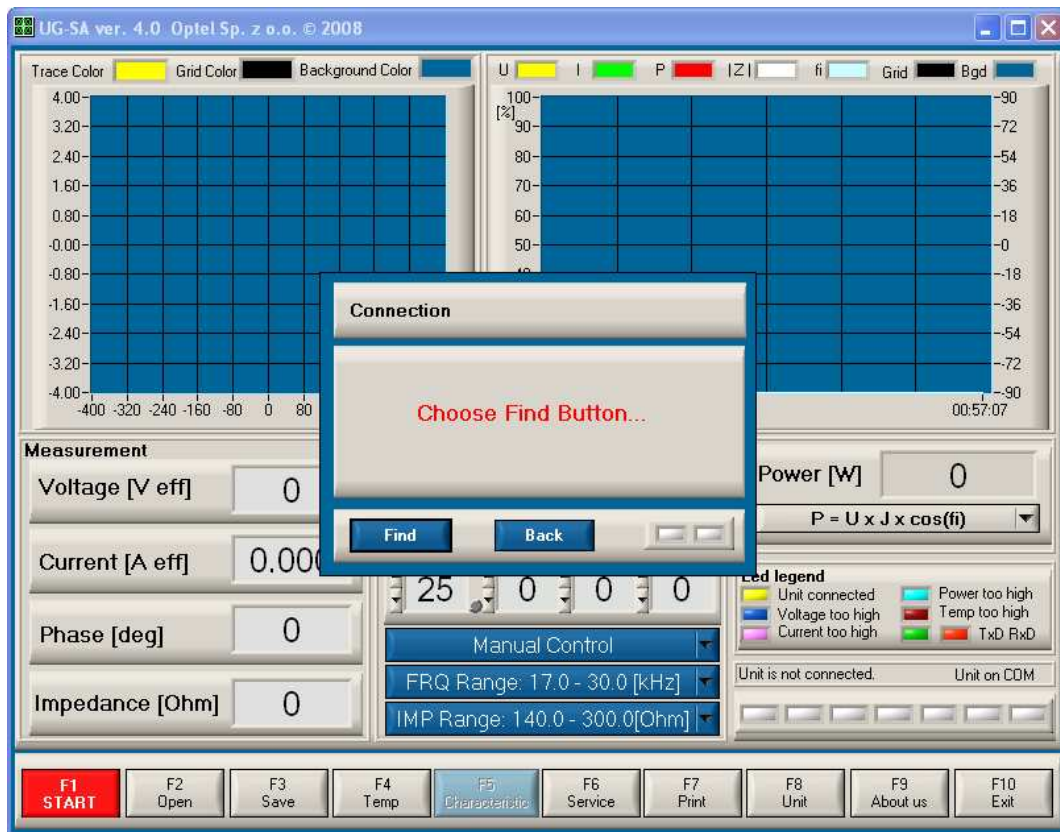


Fig. 8. Main panel – connection with UG-S/A failed.

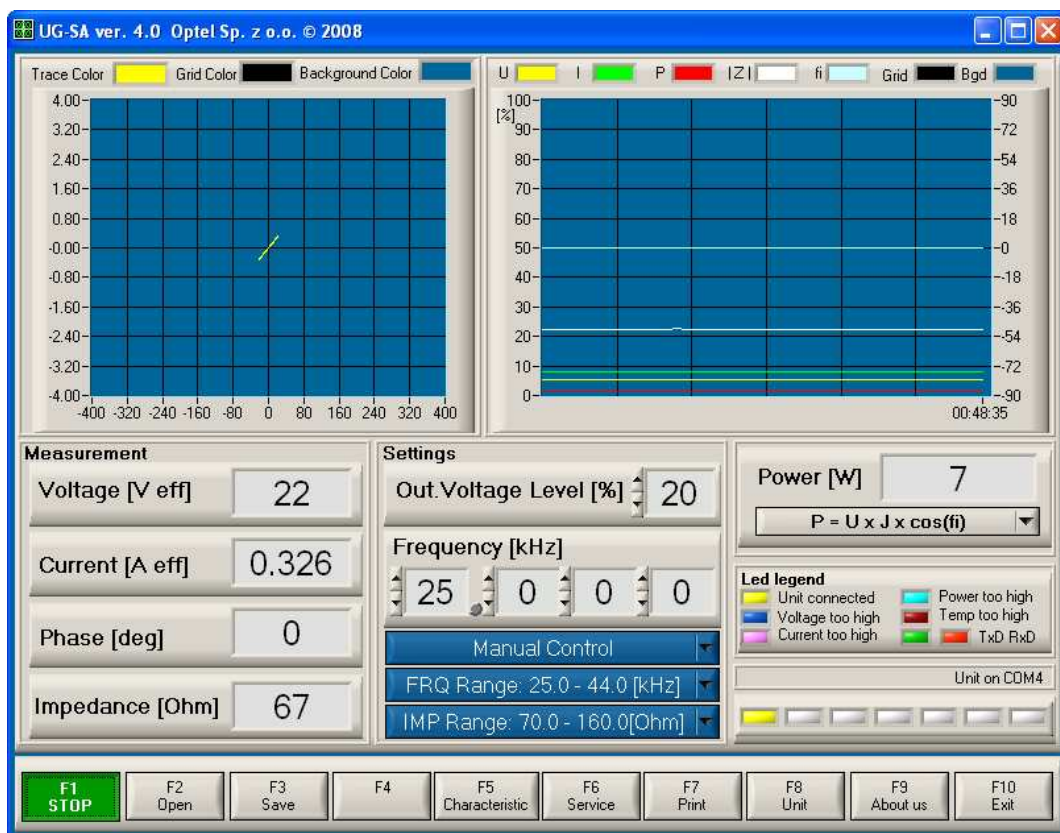


Fig. 9. Main panel – generator works properly

Normal working mode.

- set desirable output voltage level (%) and start frequency
- run the generator by START button (or F1 button)
- during work the user may change voltage and frequency
- if power, voltage or current exceed the maximum permitted level, generator is stopped (as STOP/F1)

Measuring load frequency response.

To measure load frequency response click „Characteristic” (F5) button on main panel. From that time, device works as analyzer.

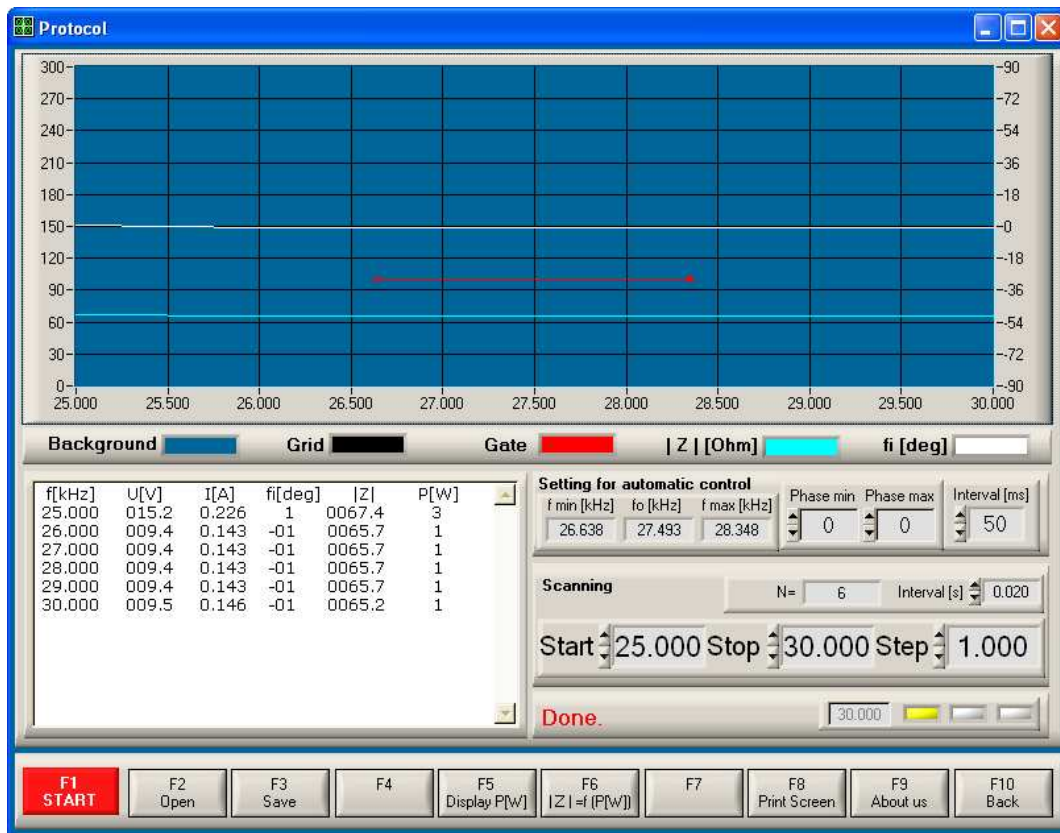


Fig. 10. Characteristic panel

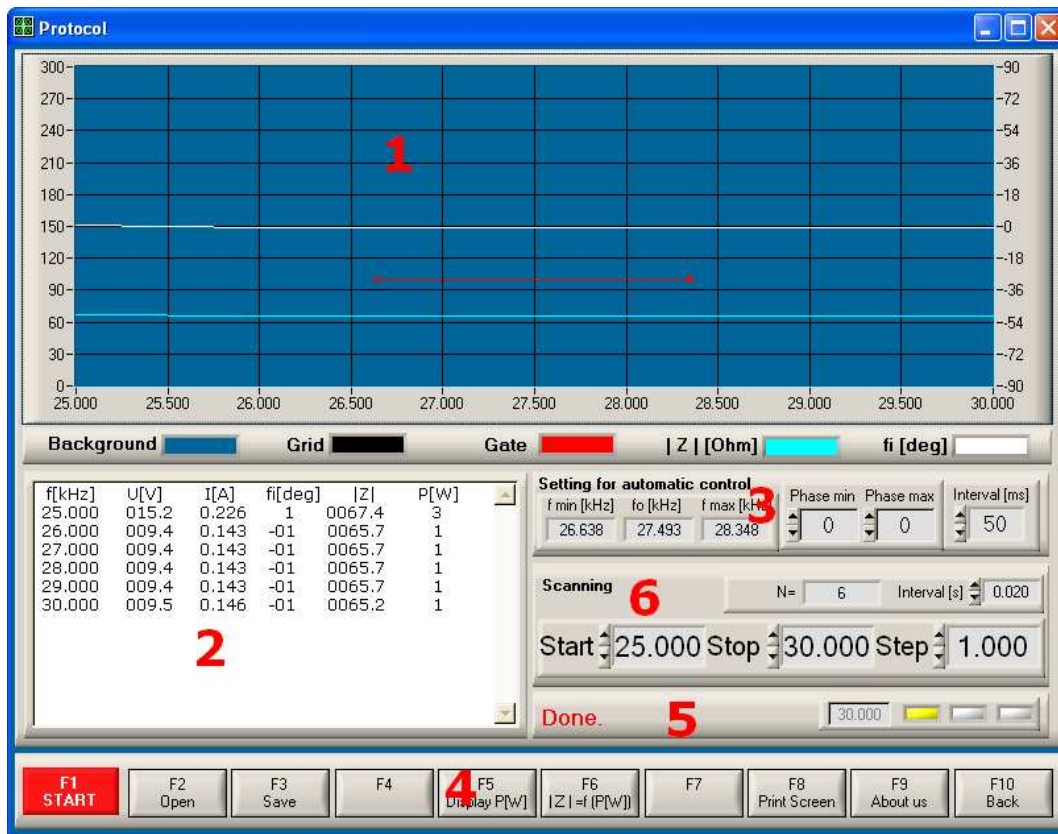


Fig. 11. Analyzer panel – description

1. Graph of impedance and phase in frequency domain
2. Table of measured values: frequency, voltage, current, phase, impedance and power
3. Parameters for automatic mode on main panel
4. Function buttons
5. Generator condition panel
6. Parameters: scanning range, frequency and resolution

Button	Description	Function
F1	START/STOP	Start acquisition and generation on the output - characteristic plotting
F2	Open	Load settings from file
F3	Save	Save actual settings to file
F5	Display P[W]	Power graph in frequency domain
F6	Z =f(P([W]))	Impedance graph in power domain
F8	Print Screen	Print screen
F9	About us	Information about manufacturer
F10	Back	Back to the main panel

If you click START (F1) button for chosen range and frequency with declared interval (s) (6 part), the characteristic measurement starts. On this graph, user may chose (by cursor in white color) limits of frequency range for option „Setting for automatic control“.

„interval” parameter describes time duration between two single steps (frequency changes) of the scan. The smallest value of this parameter is 50 ms.

In the window described as „Setting for automatic control” the user may find values, which are changeable by cursor. They are used in automatic mode (tuning to the resonance). When user set the desirable phase, generator will be trying to change frequency to keep selected phase. Phase could be set to 0, but that choice could be difficult to realize. In this mode generator changes frequency in range selected by cursor.

In the left, on the bottom of the window, there is shown a table with measured values. User could choose any of them by selecting by the cursor.

It is possibility to archive measured data (2nd part): voltage, current, power, impedance and phase. There are creating files in Excels format:

```

phase:          filename____fi.csv
current:        filename____I.csv
power:          filename____P.csv
voltage:        filename____U.csv
impedance:      filename____Z.csv
frequency:      filename____F.csv
  
```

Graph $Z = f(P)$ is available on [F5] Display P[W] panel

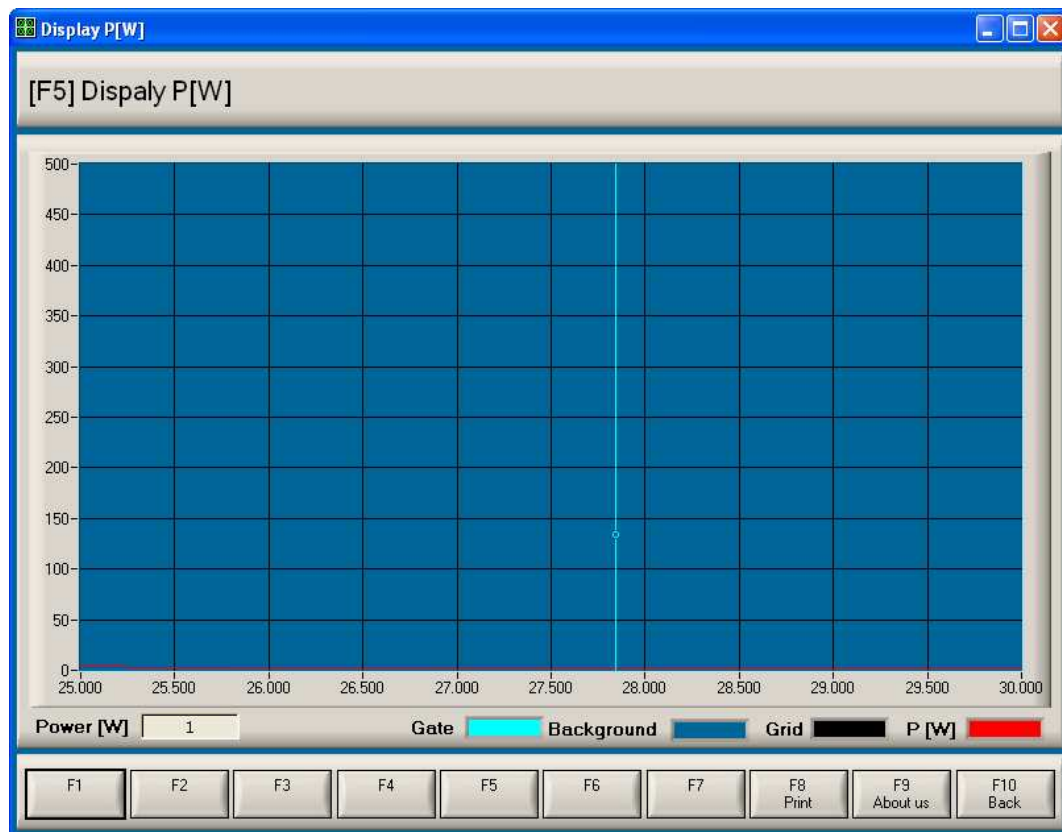


Fig. 12. Power graph in frequency domain

Button	Description	Function
F8	Print	Print screen

F9	About us	Information about manufacturer
F10	Back	Back to the previous panel

In this graph is shown power in frequency domain. By cursor user may read every single point of this graph to get strict values.

Measurement of impedance characteristic in power domain.

The procedure is the same as for the characteristics in frequency domain (paragraph above)

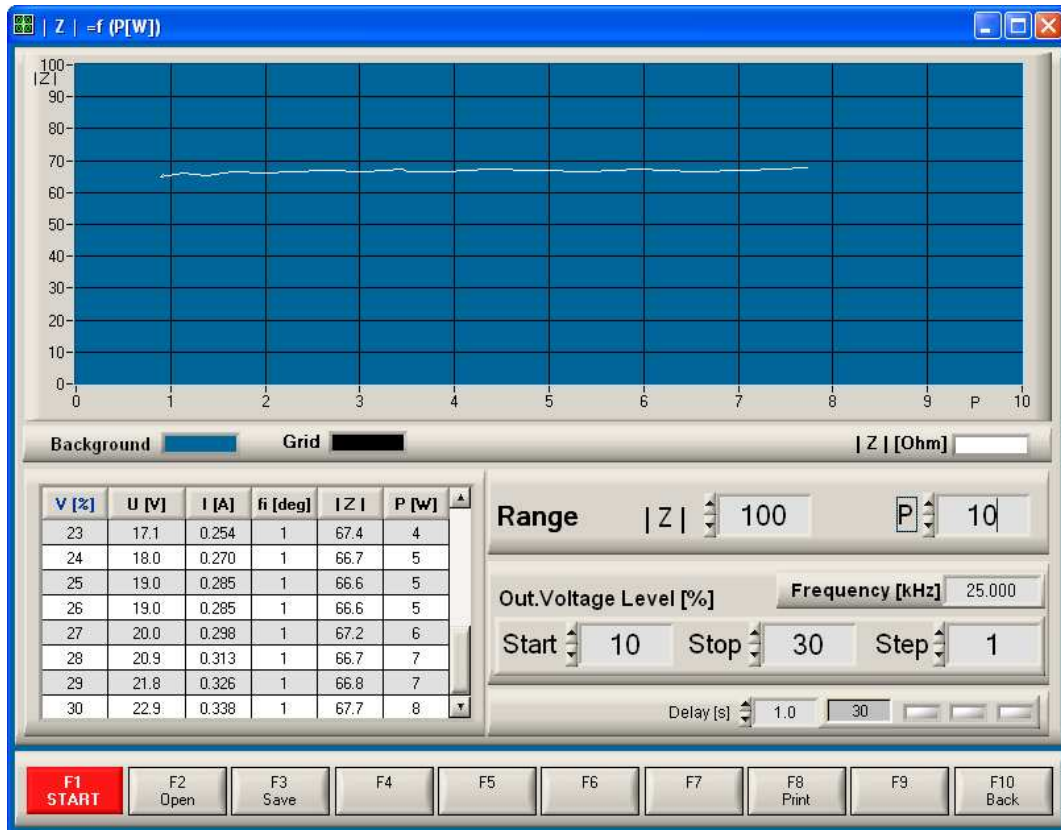


Fig. 13. Panel of impedance graph in Power domain

Characteristic measurement is started by START (F1) button for selected range of output voltage and with selected intervals. After scan started, generator is changing "Out. Voltage Level [%]" with declared step and with declared time intervals (Delay [s]), on the graph there are printed out impedance and power values. In the lower left window is shown table with measured values.

The user may set desirable range of X and Y axes (**Range**).

Also there is possibility to save measured data from the table on hard drive (voltage, current, power, impedance and phase). They are saved as Excel files:

phase: *filename_____fi.csv*
current: *filename_____I.csv*
power: *filename_____P.csv*
voltage: *filename_____U.csv*
impedance: *filename_____Z.csv*
frequency: *filename_____F.csv*

Button	Description	Function
F1	Start/Stop	Start acquisition and generation on the output - characteristic plotting
F2	Open	Load settings and graph from file
F3	Save	Save actual settings and graph to file
F7	Print	Print screen
F9	About us	Information about manufacturer
F10	Back	Back to the previous panel

Additional information.

Clicking on colored windows, user may choose the color of the background, grid or plot.



The company registered in the Companies Register by the Regional Court Wroclaw Fabryczna, 4th Industrial Section of the National Court Register under KRS number 0000124439. NIP: PL8981047033 REGON: 008375538.

The amount of the capital equals 364.500 PLN (three hundred and sixty four thousand and five hundred).