

Ultrasonic Doppler digiTDS

Digital Transcranial Doppler Spectrograph

User Manual



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1. APPLICATION

Digital Transcranial Doppler digiTDS It is an instrument for Diagnostics and non-invasive ultrasonic assessment of blood flow in intracranial and peripheral vessels.



The device can be operated only by trained and qualified personnel. Diagnosis and therapy using a study based on digiTDS are reserved to the competence of the doctor.

1.1 The phenomenon of Doppler effect Doppler signal Spectrum

Doppler methods are divided into methods of continuous wave and pulsed method for flow measurement in the continuous wave we are in around the area seen by ultrasound beam while using a pulse-only on the selected depth.

In the measurement of the speed of blood flow Doppler frequency effect we distributed wavelength on blood cells. Distributed frequency f_o differs from that of the wave frequency from f_n for a small value called Doppler shift f_d :

$$f_o = f_n \pm f_d$$

Doppler shift or the frequency f_d is proportional to the speed of the moving blood cells:

$$f_d = \frac{2 v f_n}{c} \cos \Theta$$

where Θ is the angle between the direction of the ultrasonic wave and blood flow velocity vector, c indicates the speed of propagation of ultrasonic wave in the medium (the speed of ultrasound in the blood is 1570 m/s).

In the particular case when flow takes place along the beam direction, angle θ is equal to 0° , $\cos 0^\circ$ is equal to 1 and the speed component in equal to Doppler effect is simply equal to the v . But when the blood flow is perpendicular to the beam angle θ is equal to 90° , $\cos 90^\circ$ is equal to 0, in which case we can't see the phenomenon of the Doppler effect.

The correct evaluation of the angle called Doppler angle has a very significant impact on the accuracy of the measurement of the frequency f_d , and so as a result, the calculation of the speed measured blood flow. As larger is the angle between the velocity vector and an ultrasonic beam, the more critical is its measurement. The deviation of $\pm 5^\circ$ from the angle of 60° causes 15% error in measuring the frequency of dopplerowskiej, while for the angle $0^\circ = \theta$ same variance changes the result of a pomijalną the value of 0.5%. If the angle θ is unknown the result of the measurement is given in units of frequency (hertz [Hz] or kilohertz [kHz]). For example, we will calculate the frequency of the dopplerowską corresponding to the blood flow in common carotid artery;

Emitter frequency	$f_n = 8 \text{ MHz}$
Ultrasound velocity	
In blood	$c = 1570 \text{ m/s}$
Systolic flow velocity	$v = 60 \text{ cm/s}$
Diastolic flow velocity	$v = 35 \text{ cm/s}$
angle θ	$\theta = 60^\circ, \cos 60^\circ = 1/2$
diastole:	$f_d = 2 f_n v \cos \theta / c = 3057 \text{ Hz}$
systole:	$f_d = 2 f_n v \cos \theta / c = 1783 \text{ Hz}$

As can be seen from the given example, the measured Doppler frequency range lies in the acoustic frequency band. This allows you to not only electronic measurement of Doppler frequency, but also audible Doppler signal assessment.

1.2. Choice of the ultrasound frequency

Ultrasonic wave rozchodząca in the tissues is damping. Wave amplitude decreases with the depth of penetration. In soft tissues the damping factor increases linearly

(approximately) with frequency. It is assumed that, on average, for the soft tissue of the damping factor is 0.3 to 0.4 dB at 1 cm. The damping factor is given for frequencies equal to 1 MHz for frequencies for example. 8 MHz attenuation will increase eight times compared with the wave with a frequency of 1 MHz, and doubled compared with the frequency of 4 MHz. frequency Doubling reduces practically doubled the range of research. The seemingly obvious simple application to use small frequency. However, the resolution of ultrasonograficzna, as well as ultrasonic dispersion energy on blood cells and Doppler shift of różną frequency and hence the selection of the appropriate frequency of ultrasound is a compromise between the scope of testing and sensitivity, especially in the Doppler studies of slow flows. Na

Intracranial vessels lie at a depth of 4 to 9 cm. Emitted ultrasonic waves to the inside of the head by a strongly absorbing bone of the skull. For anatomical conditions optimal ultrasonic frequency applied in intracranial applications is in range from 1.5 MHz to 2.5 MHz.

1.3CW mode

In a study of peripheral arteries usually flow in which ultrasonic wave is given and received in a continuous manner. Hence the name-continuous wave sensor (called continuous wave Doppler hot water). Continuous wave method was used in peripheral vascular examination set shallow under the skin. The result of the measurement is affected because the movement of blood in the area seen by the entire beam of ultrasound. If it has a few blood vessels is the result of the measurement is proportional to the average flow rate for all "as seen" blood. For peripheral vascular examination used are generally high frequencies from 4 MHz to 10 MHz and with small diameters 2-10 mm. This enables the generation of narrow wedge. The ultrasonic beam is narrower the better resolution of the transverse and is easier to distinguish the flow in blood vessels located close to each other.

Dopplerowska method is very easy to apply to qualitative, osłuchowej, diagnosis of lesions in arteries and veins. An experienced operator on the basis of the respective sounds, their height's "Doppler" intensity, phases, etc. can assess the overall condition of the vessels and even locate large narrowing or obstruction.

1.4. PW mode

In the case of deeper areas, and especially in the przezczaszkowych studies use rather pulse waves (pulse wave Of Doppler). Thanks to this we can make measurements of flow at selected depths by eliminating the effects of Doppler shift in the blood and possibly switch located under the desired area.

Piezoelectric transducer sends pulses of high frequency f_n about duration and repetition frequency $f_p = 1/T_p$ (T_p is sometimes the repetition of impulses). Ultrasonic wave is partially reflected and dispersed in the tissues and echo back to the transducer during breaks between transmitting impulses of t_p . In the receiver are processed only echoes reflected from the deep, covered the gate of the próbkującą during the t_3 delayed relative to the pulse of the time t_2 . The flow in blood vessels not covered by a link shall not affect the measurement result. The duration of the gate depends on the application. Przezczaszkowych research is about 1 microsecond pulse duration, but from 8 to 16 microseconds. This corresponds to the length of the measuring area from about 6 to 12 mm.

Transverse resolution depends on the first approximately the diameter of the sensor. If it is required the production of narrow wedge should be used as in the optics of the lens "focal plane arrays" ultrasonic field. They differ from optical lenses, while in optics focusing effect is obtained through the lens of the convex, the ultrasonic waves at a point are usually concave lenses.

Measuring volume depends on the length of the measurement area and the width of the beam. Beam width varies with the distance from the transducer. For nieogniskowanych heads in the width of the beam is approximately constant in the middle and then grows-the beam becomes diverges for Cone. Point bundles are the narrowest in the fire and there's also a volume measurement is possible. In the outbreak, the measuring volume is thus the shape slightly przewężonego of the cylinder with a diameter equal to the width of the beam and the height corresponding to the length of the broadcast the ultrasonic pulses. In intracranial measurements beam width in the outbreak is about 4 mm and the length of the "cylindr" is approximately 10 mm. So you can take it with a typical volume of measurements in the study przezczaszkowych is a little over 100 mm³.

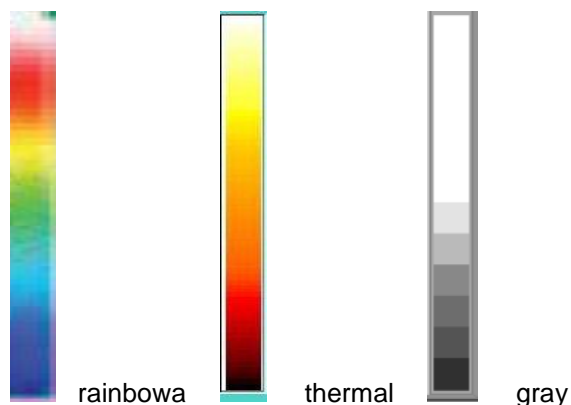
1.5. Doppler ultrasound spectrum

As a result of scattering ultrasound on one drobinie moving with a speed V_1 , we get a signal on one frequency dopplerowskiej f_{d1} . Blood cells in the blood vessel are moving at different speeds; soon as possible in the middle of the vessel, slower near the sides. Each blood cel is therefore the source of ultrasonic wave frequency of different distributed dopplerj. The sum of the individual waves distributed and then received by the ultrasonic transducer is characterized by so a frequency spectrum in the range of $f_d = 0$ for blood at the walls of the $f_d = f_{max}$ for blood cells flowing in the middle of the vessel. Presentation of the spectrum in the form of discrete bands spaced along the x axis of the corresponding frequency is used generally in technical issues. In the study of blood flow variable should be taken into account at the time of the nature of the Doppler signal. For this reason, the most commonly used is a presentation of "three-dimensional", in which the horizontal axis is the time, we show on the vertical axis the frequency while the third dimension-the amplitude or power of the Doppler signal-is presented in multi-stage grayscale. The higher the signal strength of the brighter lights point on the screen; This means that more blood flows from the specified speed v for parabolic flow profile is the uniform distribution of brightness over the entire frequency range. For a flattened profile distributed signal energy is focused around the maximum frequency spectrum, while turbulent flow outweighs the lower frequencies. In the first case there is a lightening of the spectra of the boundary around his hold, while in the second around the low frequencies, and even negative frequencies indicating turbulences.

In the spektrogramach movement of flat profile (for vessels such as large arteries of the lower extremities) dominate the higher frequencies close to the maximum frequency. We see a similar effect in common carotid artery in the early phase of contraction. In the spectrum of the disappearing then lower component frequencies-this area is assumed to be called "systolic window".

If your TDS you selected 256 points the Fourier transform then it means that the range of the measured frequency is divided into 256 discrete values. Because the number of points does not change so the distance between them (resolution in frequency) varies depending on the selected range. And so, for example, in the range from -3kHz to + 3kHz is equal to ~ 25 Hz in the range from -6kHz to + 6kHz ~ 50 Hz and in the range from -12kHz to + 12kHz ~ 100 Hz.

The power of the Doppler signal is presented in color scale or gray from the black "no signal Doppler to white color corresponding to the signal of dopplerowskiemu with the highest intensity. If you follow colour-scale logging, it's in a standard execution uses thermal scale, in which an increase in signal power corresponds to the colour change from dark red to bright yellow or scale a bit similar to a rainbow, in which dark blue points correspond to the minimum signal strength and by green, yellow, red to white to indicate successively more.



Pict. gray and color scales FFT

1.6 TM -Color

In digital Dopplerze collected, collected and processed are the following sample signal after each package pulse. It is therefore available in the device information from various depths along the ultrasonic beam. It used to work on multi-goal. It is possible to speed registration flow in more than one goal for one of ultrasonic probes. Another advantage of such a system, the presentation is known for her flow methods called ultrasonography TM (Time Motion). In several gates (depths) is evaluated the flow velocity, then coded in colour scale conventionally red for the influx and blue for low tide. Different color intensity corresponds to a different speed. The vertical dimension presented the course of TM corresponds to another depth along the beam horizontal travel the next time sampla.. TM presentation allows you to more easily locate. Refer the probe so that the ultrasonic beam covered dish (dish) blood vessels. Then watching the mileage you can select TM (depth) goals, in which we record the Doppler signal.



Pict TM colors

2. Transcranial procedures

The bone of the skull dampens the ultrasonic wave very strongly and place the application we call head ultrasonic windows.

The study of the Middle cerebral artery, anterior cerebral artery, posterior cerebral artery, the artery connecting the rear-head shall be applied in the area of the temporal bone. The optimal place is moving the head between the upper part of the ear and bow. The easiest way to perform a measurement in a few steps: find the strongest signal (Middle cerebral artery or internal jugular, depth test 50-60 mm), while keeping the direction to flow after the head temple for finding bone is thinnest, bending the head and changing the depth of research and register flow in subsequent episodes.

Study of vertebral arteries, Basilar Artery, the artery connecting the rear-head shall be applied in the vicinity of the great hole just below the base of the skull. Study of the ophthalmic artery and siphon the carotid artery runs through the eyeball in the direction of the channel. Measurements by the eyeball always applies the minimum radiated power of ultrasound.



Prior to the test by the eyeball device set up for a maximum of 10% of the ultrasonic power and, as far as possible, use less power.

3.. Peripheral vessels

An ultrasonic probe is placed over the examined blood vessel. The probe or skin at the site of the examination should be covered with ultrasonic gel in such a way as to ensure good acoustic coupling

The ultrasonic probe is placed over the examined artery at such an angle to the vessel that the acoustic signal is as loud as possible. Usually the angle is between 45o and 60o. It's recommended avoiding simultaneous flow measurement in different vessels. That will result averaging different flow curves. In such a case the probe angle or insonation direction should be changed.

Signals from healthy lower limb arteries usually have three distinguished phases, one after the other: the one louder and of a higher frequency, and two, more silent and of a lower frequency. The first sound is reminiscent of a strong wind blowing; the other two reminiscent of a noise of smaller intensity in those arteries with a smaller degree of occlusion, while in arteries of a greater degree of occlusion (over 50%) the second phase fades and only the first phase, corresponding to heart contraction, is audible. A single-phase signal usually has a high frequency and is similar to wheezing. At, or immediately downstream of, the occlusion, the sound is composite. It consists of high frequencies, corresponding to the acceleration of flooding by occlusion with a superimposed booming tone, usually associated with disturbances of the flow upstream of the occlusion. In carotid arteries where flow resistances are much less than in lower limb arteries, after the first phase usually a continuous Doppler “noise” is audible, corresponding to the continuous flow in the diastolic phase. In atheromatously modified blood vessels signal frequency diminishes, the diastolic phase fades, diminishes or completely fades.

The most important is to listen Doppler sounds – localize vessels and recognize the blood flow character.

The assessment of the blood flow direction is especially important in vertebral arteries (in steal syndrome), in ophthalmic artery branches (in internal carotid artery occlusion) and in internal and external carotid arteries (in common carotid artery occlusion).

The examination also allows the localisation of embolisms in the large arteries of the lower and upper limbs, such as the femoral, popliteal artery, the crus arteries, and the subclavian, brachial, and ulnar arteries among others. A characteristic “plop” sound is produced by the deflexion of blood from an embolism. The signal fades downstream of the embolism.

4. Effects of ultrasound and possible biological effects

Amplitude ultrasound wave divergent in the reduction such as soft tissue decreases with distance. Suppression resulting in the loss of energy is related to the absorption or scattering of the wave. Absorption is the process in which it lost some of the energy is converted to heat. Dissipation is to change the direction of the wave, and as a result, part of the radiation may return as echoes, giving a contribution to the recorded spectrum. Center absorbs energy ultrasound wave by turning it on. The temperature will continue to increase as long as the rate of heat absorption is greater than the speed of his dissipation.

Excessive temperature increase may have adverse effects on mammals. The observed biological effects depend on many factors, such as exposure time, the nature of the treated tissue, cell hyperplasia and the potential for regeneration. For the range of temperature increase observed biological effects, except in the case of prolonged exposure. The expected temperature rise is much larger than soft tissue.

The cavitation effect can last for only fractions of a second. Oscillations of gas bodies are a nonlinear process, and are in General from a temporary peak in size so that even small changes of sound pressure may cause large oscillations. There are such conditions to be taken into consideration both the thermal effect and cavitation. Both of these phenomena can interfere with each other. It is possible however, instance of a strong thermal effect associated with absorption without cavitation phenomena współistniejącego, as well as the emergence of the phenomenon of cavitation in medium-amplitude level, where there is no thermal effect.

The principle of limiting the power - ALARA rule

ALARA as low as reasonable achievable is the abbreviation for the set of rules to be applied in the diagnosis of ultrasound Diagnostics for diagnostic information at the lowest possible ultrasonic wave output parameters.

The width of the gate pulse time corresponds to 10 mm 13 msec. Increase the duration of broadcast increases the width of the goals but also increase power output signal. To compensate for the change in power, Doppler systems is that automatically adjusts the amplitude of the signal, so that the output was constant.

The scale is related to the PRF (pulse repetition frequency), increase the value PRF causes an increase in signal strength, because it grows to fill the signal. the number of pulses generated in a given period of time. In this case also the amplitude is doing so in order to compensate for the increase in the PRF.



Please observe the following rules:

To minimize the emission of ultrasound, the device should always be set lower power, while the large gain.

Must be limited to the minimum necessary the time of direct contact of the probe with the patient.

Power level should reduce to a minimum, at which you can get sufficient diagnostic information.

It is necessary to ensure the minimum exposure time bone on ultrasonic radiation, due to the gradual increase in temperature.

For security, you should limit the increase to the specified size. It is specifically indicated in the study by the eye where the maximum intensity is limited to the $I_{stpa} = 17\text{mW/cm}^2$

5. Measurements

5.1.. AVERAGE velocity AND MAXIMUM velocity

In the classical method measuring function as a secondary indicator. On the reliability of measurement of influence: experience, precision, care and examining. Anatomical considerations are also an important factor hindering the determination of Doppler angle and thus the correct values for the enumeration. It is understood that the results designated with an accuracy of the order of 10-20% are meaningful and useful. A higher value results in digital case studies by the same person in order to compare for example. for the assessment of the course of treatment. Automatically measuring results always require critical verification by performing the test.

Flow meter allows the registration of average speed and maximum. Average speed, energy integration method, corresponds to the average change in the frequency of dopplerowskiej. Clinical value of this parameter is significant. With the same diameter of the blood vessel, you can, in fact, assess the flow and as a result, the blood supply to the organ. Measurement of mean value can be exact in the case of large changes in the

vessel causing turbulent flow. Measured in this case, the average speed is usually less than the actual fact manifest turbulence in the flow of components with low frequencies. Especially in such cases, a very useful turns out to be a measurement of the maximum speed of the flow. Designating the Doppler spectrum boundary algorithm applied allows an assessment of the maximum frequency dopplerowskiej corresponding to the flow rate of the blood streams in the central part of the blood vessel. The impact of the turbulence in narrowing is noticeable..

Timing temporary average speed and instantaneous speed is displayed on the monitor screen in the form of lighter runs on spectrum. If the test is carried out under a well known for dopplerowskim we can change the frequency of dopplerowską on the flow velocity by modifying and confirming the selected angle value. The system automatically suggests a value of 0 (for probe 2 MHz CPU for intracranial vascular studies and 60 (for continuous wave probes for peripheral vascular).

The computer system automatically sets the average value (duty cycle) average instantaneous flow velocities v_{av} , v_p and peak diastolic v_d average speed and instantaneous peak flow speed v_{max} . These figures are displayed on the screen and can be adjusted manually using the cursor. Digital value should be viewed critically, remembering that they are designated properly when the boundaries of the average speed and the maximum image correctly process the spectrum.

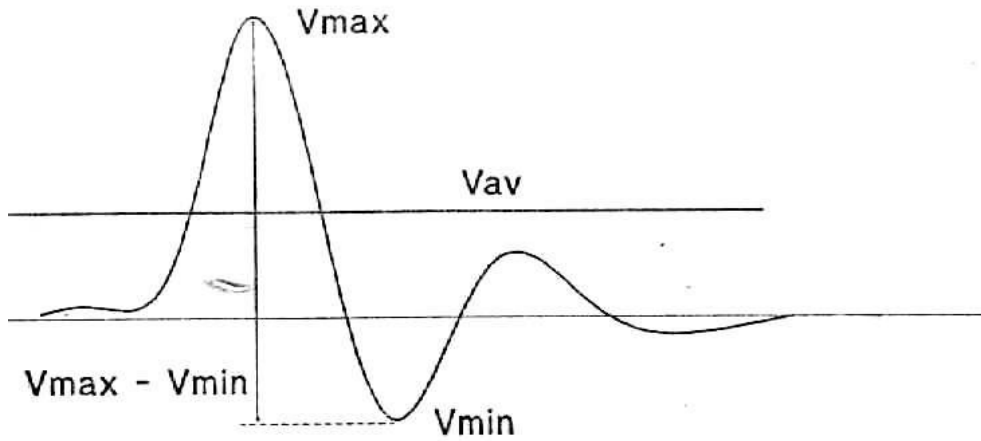
The proper test conditions require assessment of the conduct of the vessel in relation to the registration of the Doppler signal spectrum of readable, probes and a good representation of the speed envelope.

5.2 INDICES

Doppler test results depend on the shape of the spectrum of the measured signals, the geometry of the blood vessel, the shape of the ultrasonic beam and the angle under which the ultrasonic beam is tilted to a blood vessel. The impact of these factors on the correct interpretation of the results of the impact on the lookout for ways kppk parameterization. On the one hand, the indexes were introduced which were designed to assign certain dimensionless numbers characteristic features of movement related to his syncopated and possibly friction problems. On the other hand, the research focused on the analysis of the specific timing.

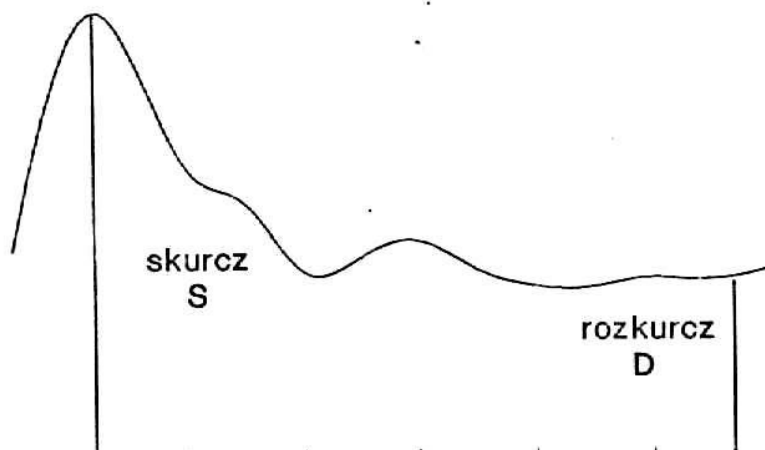
PI.

$$PI = \frac{V_{\max} - V_{\min}}{V_{av}} = \frac{f_{d \max} - f_{d \min}}{f_{av}}$$



RI Pourcelota

$$RI = \frac{S - D}{S}$$

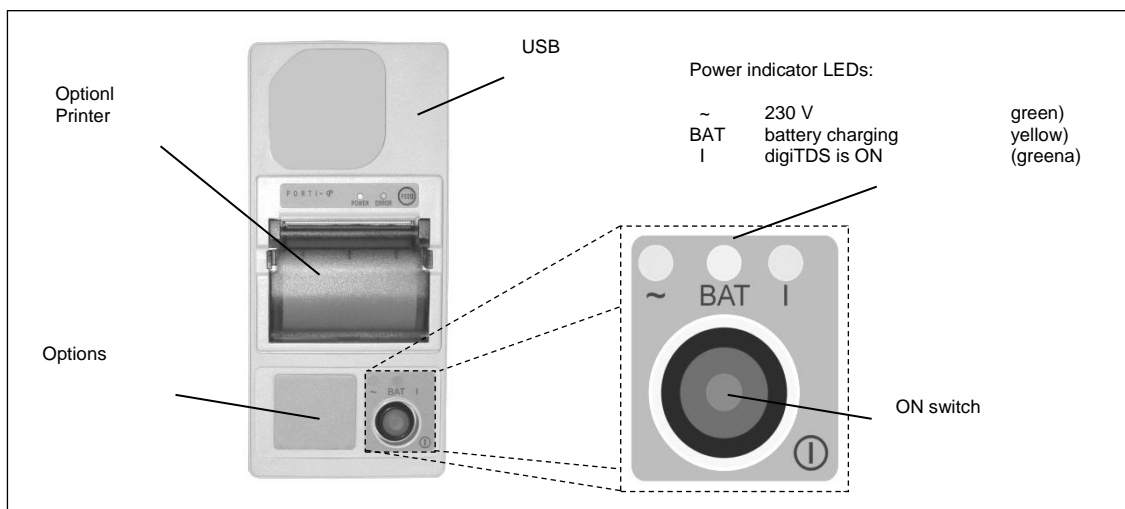


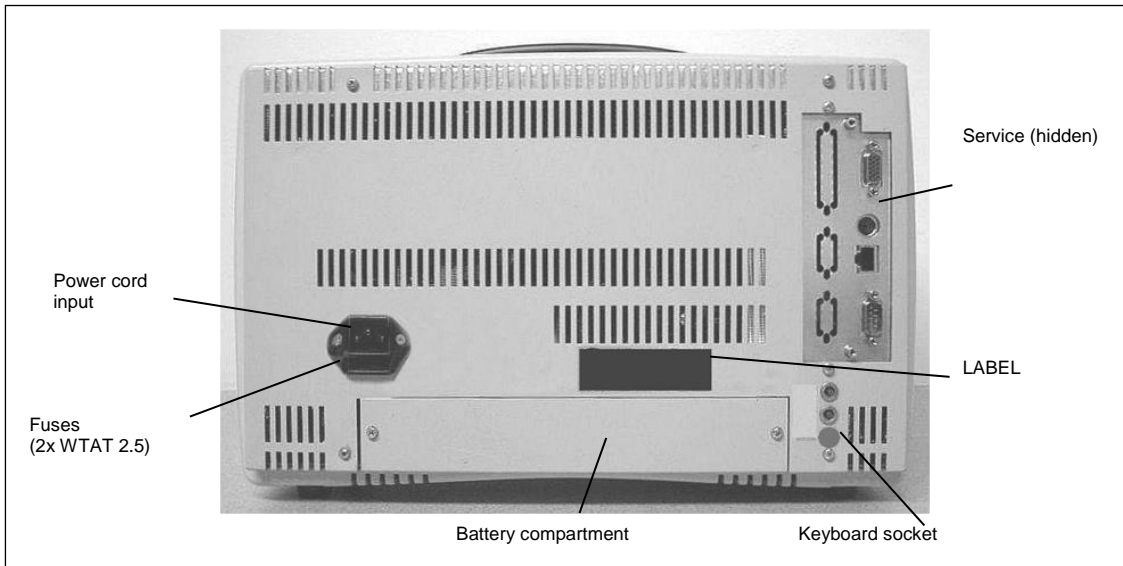
6. Proceeding.



Before use please read the instructions for use, check the completeness and condition of the device. Mechanical damage, water damage and similar device control require vulnerability. It is unacceptable to use the damaged power cord.

The building is compact camera, combining mobility with the convenience of use. A leading camera built-in is a large, 12.1 "TFT LCD screen providing a very clear picture with high resolution and touch function of monitoring and control. In the hollow, located on the right side of the front plate, are placed the connector used to connect the heads and stereo headphones. The connector heads have pads signal lamp and luminous colours featured probe activity for easier identification of the channel. On the right side are placed: the power switch indicator lights, and the thermal printer on the lateral right wall is built green button is used to start the camera and lights indicate power state.





Power cord socket with double fuse socket are located on the back of the device..

Warning: If the device has a built-in rechargeable battery type NiMH batteries, which, after use should be scrapped in accordance with the provisions in force for equipment containing dangerous materials

Note: If you do not use for longer than 14 days, you must connect the device periodically to current to recharge the battery.

Setting up

The device has a built-in inside the power supply that allows medical 230 voltage supply safety. Option alternating current (AC) and the built-in rechargeable batteries. Under normal operating conditions the power is taken from the hospital's power grid 230 VAC in this time are loaded the batteries so that they are in constant readiness to take over the power of the camera in the case of the disappearance of the main power supply or where it is necessary the use of the camera during the movement of the patient.

The digiTDS switchin on to work is done by pressing the Green switch, which is located on the right side of the device. The green lamp lights labeled "~" located on the switch. Shining yellow lamps, marked "BAT", indicates battery charging status.


UWAGA: The socket to which the power cable is connected must be fitted with a

protective earth pin. Make sure that the electrical installation ensures an adequate level of protection for devices and protection class I.

Plugging transducers



If the camera stayed in an environment whose climatic conditions much different from normal, working conditions should be acclimatised to the returning process engine, leaving it without any of transport packaging for a period of min. 12 hours.

Connect the probe (probe) to the sockets on the front. Socket probes (ultrasonic heads) are marked with the symbol  and possibly the letter "A" or "B" respectively for the two channels. The probe connectors require conservation direction (orientation) when connecting-make it top marks on the socket and the plug on the upper side. It is equipped with a safety latch connector against accidental disconnection and may only be disconnected by pulling behind the black plug housing.



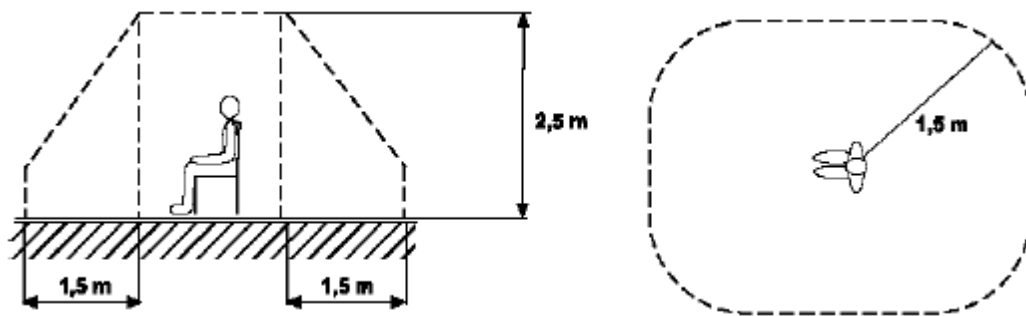
Unacceptable to the severance of the probes by pulling for their cables.

USB socket located on the side wall is designed to connect additional devices (mouse, keyboard), memory (memory stick, external drive). Note that this socket has a standard single-load capacity. While at the same time you want to connect several peripheral devices by passive HUB should be taken into account given by their manufacturers specifications, to total demand not exceeding 0, 5A. The USB socket is completely insulated,



In the case of connecting to USB active devices that are not medical devices, it must be ensured that they fall outside of the patient environment.

An example of the determination of the patient's environment shown in the following figure

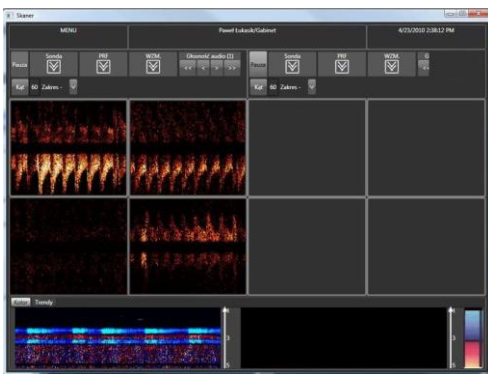
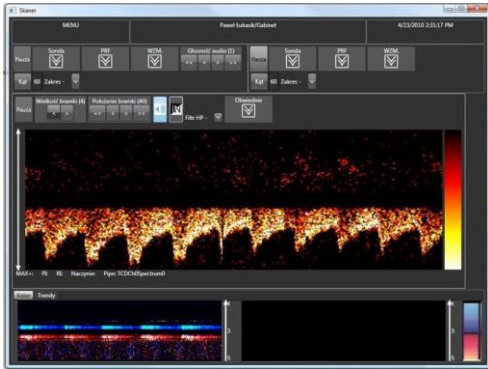
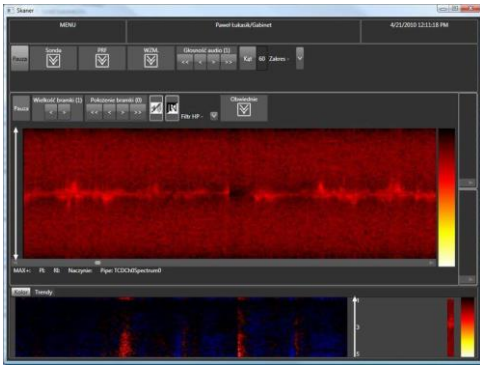


The user interface uses the device settings similar to a personal computer PC and Windows operating system, but is unacceptable to install any programs on your device and use the system as a personal computer. This can lead to impairment of the fundamental functions of the digiTDS.

Controls

An essential element for the user to affect the functioning of the apparatus (support) is a touch screen. Its functioning can be nearly duplicated by the mouse type. Pointing to the box and the window the user activates them develops the check boxes or buttons, indicates and approves the choice. In addition, the camera can be equipped with a keyboard is a desktop to the remote control. In addition to staging and approval fields indicated, it provides direct access to selected functions, settings and adjustment.

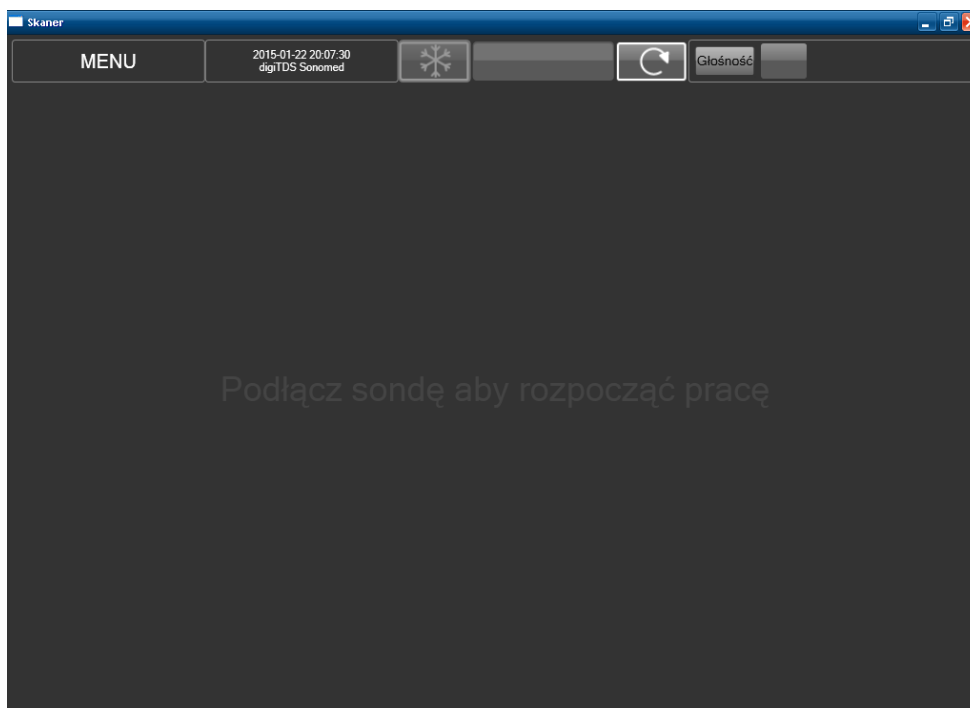
The appearance and configuration of the screen are associated with the currently implemented by the function. Here are a few examples of configurations for different screen modes and ways to present data (Fig.). In the remainder of the manual explains in detail the support for user interface and run the individual operating modes.



Windows configurations sample..

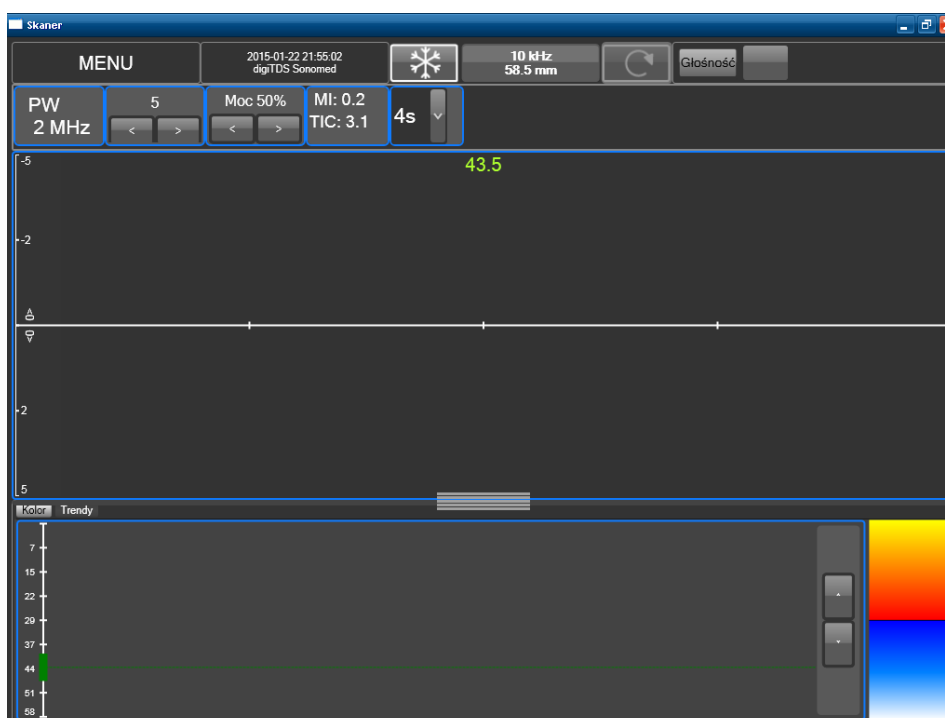
7.2 Interfejs użytkownika

For the user with the vehicle primarily used 12 " LCD display with touch screen. Through the drop-down menu and function buttons the user enters the desired parameters and accepts the election. When you turn on the device, the display is shown the main screen as shown in the following figure.



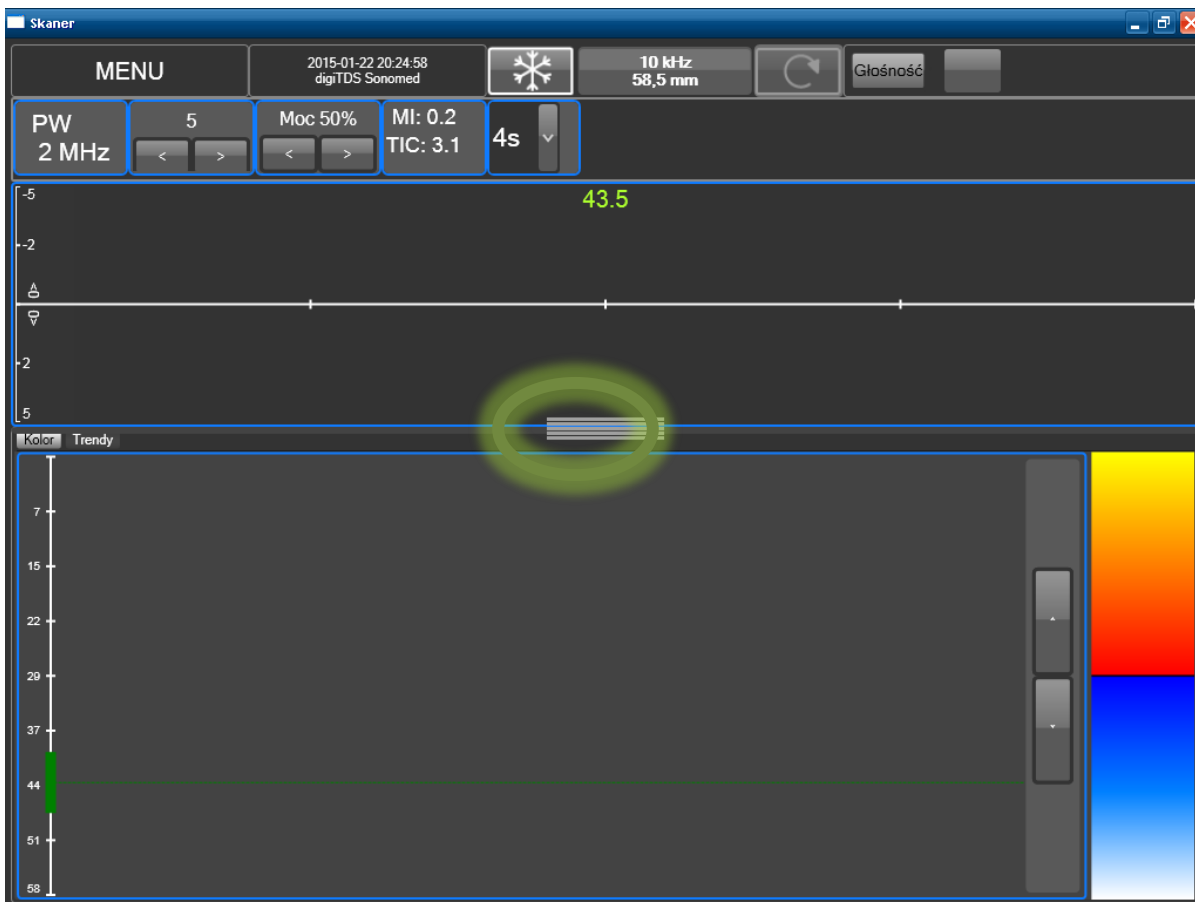
To get started, connect the ultrasound probe into the socket (channel 0-blue) or B (channel 1-yellow).

Below is the screen after connecting the device to the socket of the device and ultrasonic probes (



The screen is divided into so that the presentation of the spectrum was the largest, central area called the next Window. Below the window of the spectrum is the window color, which depending on the color of the tab/window displays Trends (one for each channel) or long-term indicators of selected parameters.

The ratio of the height of the window to the spectrum of color is adjustable by the user by clicking the 'przeciągnięcie' to the desired location on the edge of the mark that divides both areas



After double clicking around the zero line of the window, there is a detailed menu bar around the Windows and the horizontal axes:-timeline that corresponds to the range of types, and vertical-reflecting depth. The following

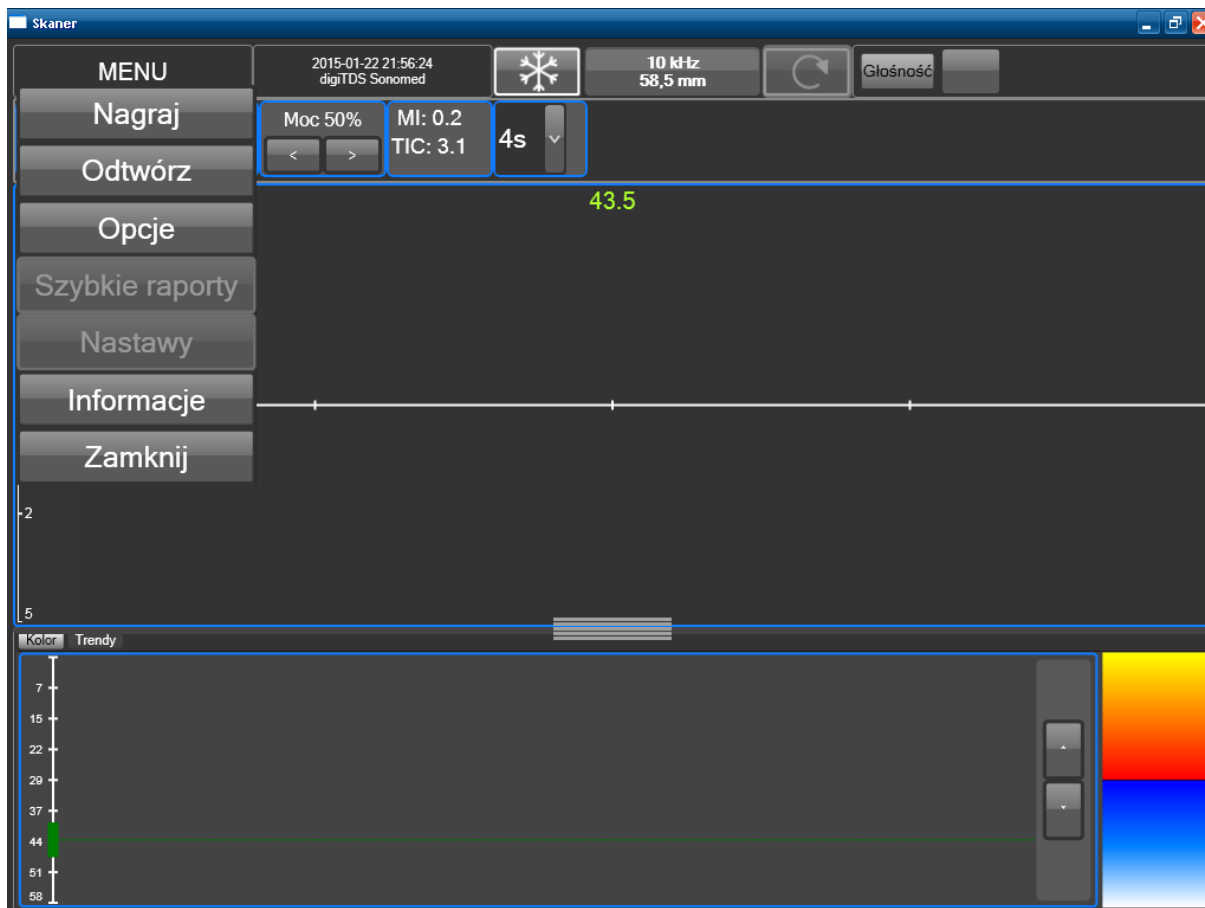
The image shows a software interface for a USG probe. The interface is divided into several sections:

- Top Menu Bar:** Contains buttons for 'MENU', 'Gain', 'Moc', 'Podstawa czasu', 'Freeze', 'PRF', 'Cineloop', 'Głośność', and 'suwak regulacji Głośności'.
- Central Display:** Shows a color scale from -1 m/s to 1 m/s. A green vertical line is positioned at 49.5. The display is labeled 'obszar okna Spektrum' and 'obszar okna Kolor'.
- Bottom Control Panel:** Contains various parameters and buttons:
 - PW 2 MHz:** Labeled 'aktualnie podłączona głowica USG'.
 - SV (9):** Labeled 'Sample Volume - objętość pomiarowa'.
 - 4 kHz 150 mm:** Labeled 'Polożenie bramki - głębokość pomiarowa'.
 - 4s:** Labeled 'zmiana położenia linii zerowej'.
 - MI: 0.0, TIC: 0.0:** Labeled 'MENU lista rozwijana'.
 - 100 Hz:** Labeled 'obwódnie'.
 - Kąt 45:** Labeled 'zmiana skalowania'.
 - 49.5:** Labeled 'zmiana skalowania'.
 - PI: 0.00, RI: 0.00, Naczynie: 0:** Labeled 'obszar okna Kolor'.

illustration shows a view of the LCD screen when you turn on the specific options for Spectrum Window channel A (blue).

Menu Bar

In the upper-left corner of the MENU is displayed when you click the drop-down list of commands to choose from

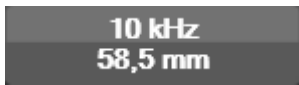


- :
- Record-recording raw data from the buffer of the device.
- Play function to load raw data into the buffer of the device
- options-opens the Options window application/system
- Rapid reports – opens the quick print the currently visible data.
- Settings-opens a window so you can select and a selection of personalized user settings.
- Information-opens a window with information about the device,
- close** the shutdown function

:



Freeze a button that is used to stop and play the course in the the spectrum and the corresponding presentation (in the color). Next to the button (white) and inactive (gray).



#kHz – #mm - PRF -pulse repetition frequency selection button broadcasting (only in pulse mode), and the maximum range of the test (in mm.).

Currently, there are two modes of PRF: automatic (button PRF is white) and the value PRF changes automatically due to the extreme just scored dopplerowskiej and the mode in which you manually lock the value PRF (PRF when a button is black).

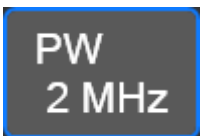


Cineloop a button that is used to start and stop the Cineloop mode data presentation . Next to the button (white) and inactive (gray).



The volume slider. The upper icon shows the slider during normal operation, the icon in the (white) when sound is muted.

In the next place are the parameters such as:



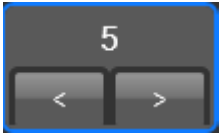
ULTRASOUND probe button to enable and disable the ultrasonic probes. The device can be equipped with two ultrasonic probe that can operate simultaneously, or be run separately. Connect the probes to the channel indicated by respective color.. This color is permanently assigned to a particular channel



and corresponds to the color of the window frames on the display screen and the backlight color Sockets probes if the Freeze is active. Connection of a given number of probes determines the specific resource possible configuration of the device. The primary mode of action is to use one of the probe, the registration of the spectrum in a single window and the display of the window. The most common application work is dual-channel monitoring (bilateral). In the dopplerowskiej monitoring is understood as a long-term, IE. more than a few minutes observing or recording blood flow signals.



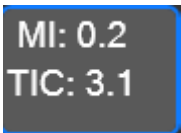
The device is not equipped with supervisory functions vital functions or alarms and is not intended to monitor patients!



Gain button with adjustable in the range of 0 to 9 can be used to change the value of the strengthening of the receiver. The greater the value, the bigger the boost. Initial value: 5



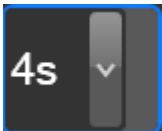
Power button with adjustable maximum power rating of the transmitter in the range 5 to 200%. Smart above 100% are signaled the advent of the red frame around the button. Initial value: 50%



MI – mechanical index

TIC – thermal index

The indexes are calculated on the basis of the current tune associated with the emitted power of the ultrasonic head. the power of the transmitter, the length of the gate transmitter and PRF..



Time base Select horizontal axis of time, IE. the number of seconds corresponding to the full width of the screen.

single selection drop-down list of parameters

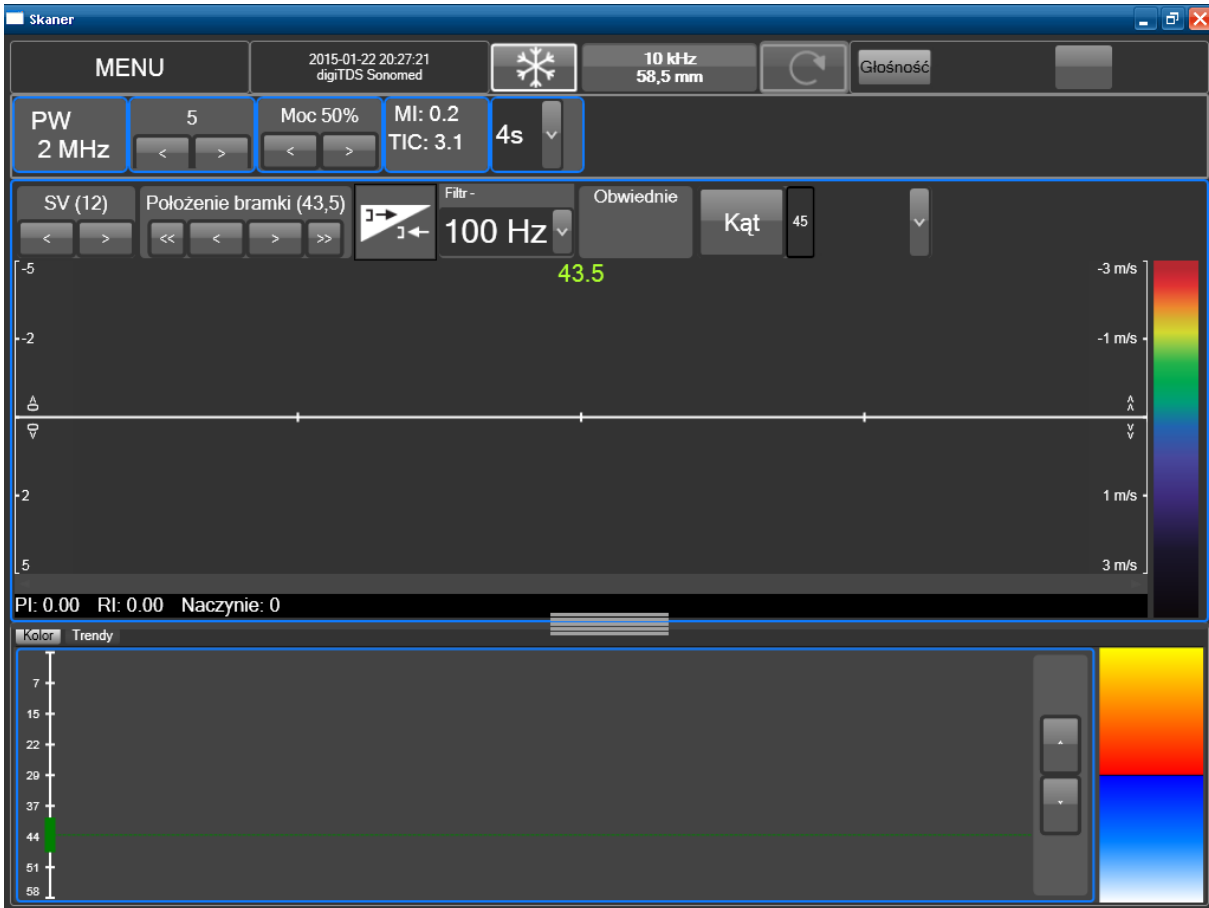


Visible in the central part of the screen (Window spectrum) Green digit displays the current value of the position of the gate-the depth of the initial expressed in mm, which are collected data displayed in the range of.



Detailed menu bar

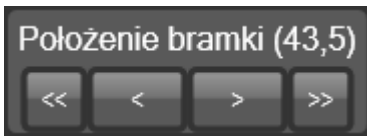
When I double click in the window area of the spectrum appears a detailed menu bar around the window, figure below



In this window, the following buttons become visible:



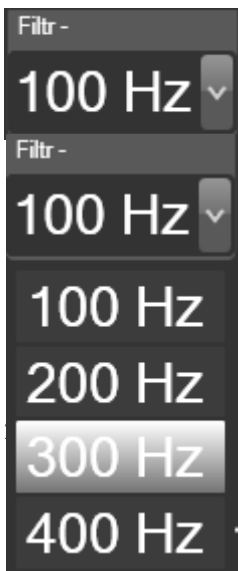
Sample Volume volume volume control button using the volumetric changes in the length of the goals expressed in mm active Button Inbox only during testing in pulsed mode (PW Doppler). Initial value: 12.



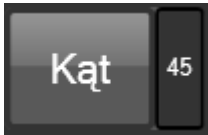
The position of the gate button with adjustable depth from which the received signal is presented in the spectrum. The value is expressed in mm. Initial value: 43,5.



Invert button to reverse the direction of speed on the vertical scale. The default presentation of the record influx of (positive frequency/speed) over the axle.



Filtr HPP Press the arrow next to the filter cut-off frequency list expands • limiter between. WallFilter. By frequency selection the user affect the characteristics applied to filter data. The choice of higher values allows you to filter the signal registered reduce the impact of strong signals from the blood vessel wall movement and slow flowing of blood.



Angle button to adjust the angle of the tests (Doppler angle) by clicking it multiple times until the desired value of 0, 15, 30, 45, 60, 75 or Required. the angle is used for automatic conversion of frequency Doppler signal recorded on the speed of the blood flow. The default value of the angle is 60°.



If you speak with the diagnosis of speeds the flow of blood it must ensure that the correct setting of the angle. We must also be aware that having an effect on the results of the digital angle value is the result of knowledge of Anatomy and the user by way of application of the probe.

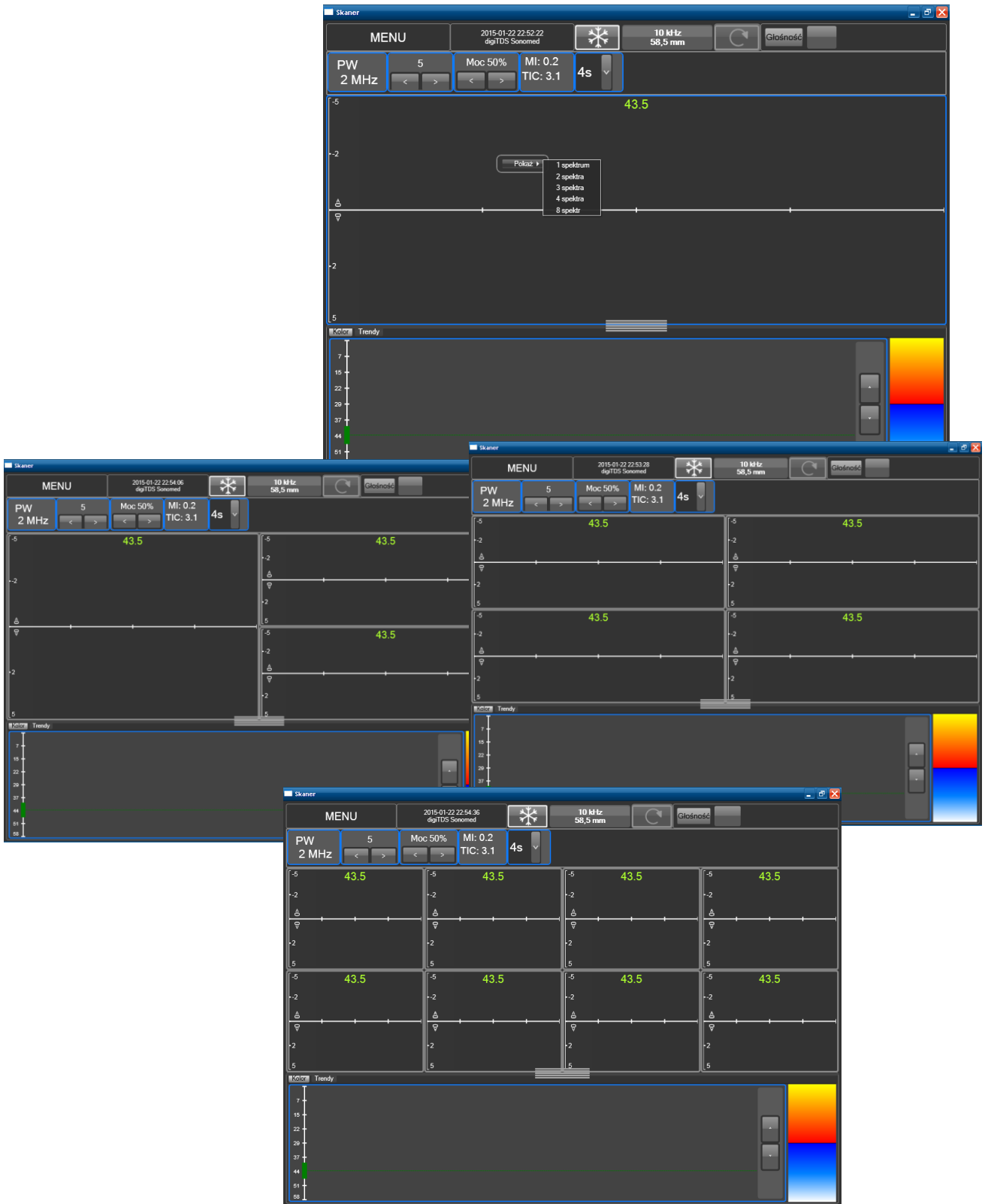


The scale and speed of movement. Negative values indicate movement of the head and positive in the flow towards the head. Moving zero line is done with the help of visible markers on the left (click on the top tag moves to the top of the zero line, while lower down). With the help of the arrows visible on the right side it is possible to zoom in (by clicking the arrow located above the zero line) and out (by clicking the arrows located below the zero line) presented the course in the area of the window.



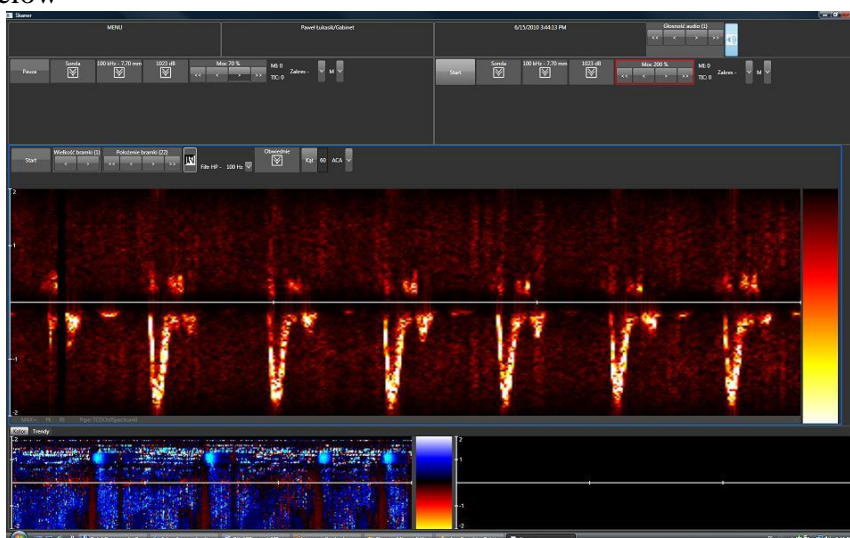
Multigate mode

Multigate work requires dividing the Spectrum window area to a number corresponding to the number of depth from which you want to view the data. This is done by clicking the right mouse button in the window area of the spectrum. Will then show and when you hover the mouse pointer on it developed a list of the available number of possible to display Windows (range). This is usually 1, 2, 3, 4, or 8 boxes (range) that can be displayed at the same time

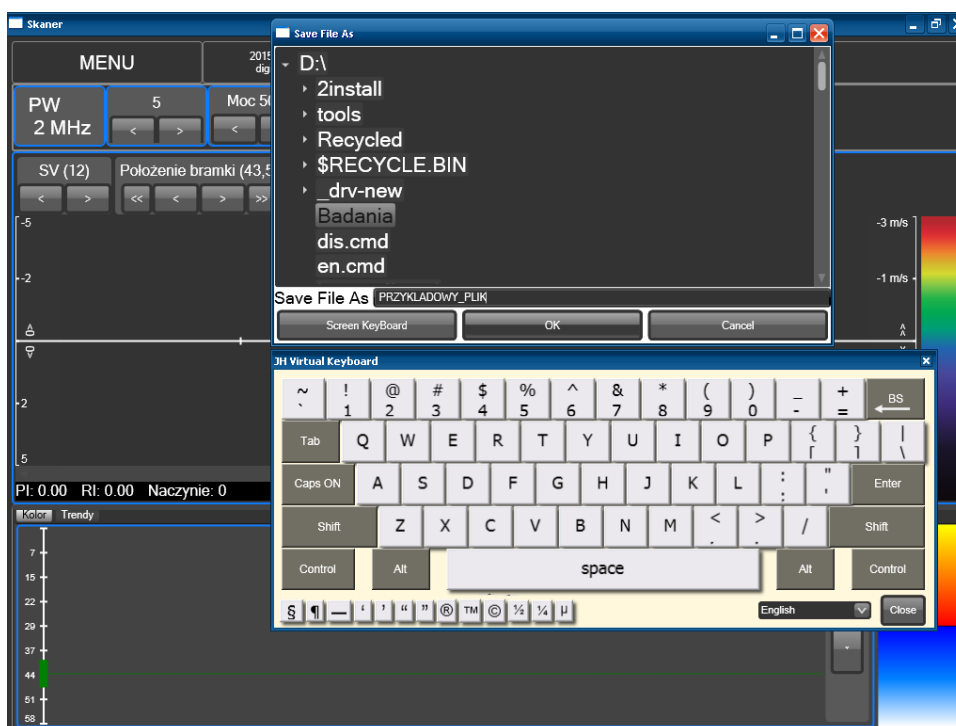


In the case of multigate work specific parameters as position, whether the Sample Volume and are available to be set individually for each window spectrum.


An example of the screen during the test flow using single ultrasonic probes one shown in the figure below



- 1) The camera allows you to record sustainable portion of the test (max. 30 the last seconds) to a file. To do this: stop the Freeze button acquisition. From the drop-down list MENU, choose burn. Select the write path by double clicking on the name of the disk and the folder in which you want to save the file, for example. -drive D:\, the directory test. Call the on-screen keyboard by clicking on-screen Keyboard located below a field to enter the name of the file. Enter the desired file name (here PRZYKLADOWY_PLIK) and confirm OK button located below the field to enter the name of the file.



Turn off the digiTDS after use, in order to disable the camera: a soft, dry cloth to remove the remnants of the gel with the ULTRASOUND head-to prevent its drying it on the head. From the drop-down list MENU, choose close. The question of whether to disable the application and answer in the affirmative. When you close the application and return to Windows, turn off your computer by clicking on the lower fly-out menu bar Start-> turn off computer ...-Disable >.

Working with the headphones in the case of conduct research in a noisy environment, which could distract the operations or impede the diagnosis can be to the device to connect stereo headphones. The inclusion of the headphones automatically mutes the speakers. Headphone Jack (jack 3, 5 mm) is located at the front of the device, on the right side and is indicated by the symbol 

Conditions of storage and transport:

temperature	-10 , 50° C,
humidity	< 90 %,
preassure	500,1060 hPa

Environmental conditions

- The device should be operated within the range of environment temperature from 10°C to 45°C by relative humidity not exceeding 85% and atmospheric pressure 70-106 kPa.

digiTDS is not intended to operate in presence of anesthetic gases.

It is recommended that the device be operated at room temperature with moderate humidity. Mechanical shock is to be avoided, and special precautions are needed with the ultrasonic probe since it can get damaged when hit by a hard surface. The probe can be cleaned by means of a soft tissue, dampened with water or alcohol (70% isopropanol). The mild disinfection liquids only are recommended. When the probe

requires sterilization only cold processes are allowed (gas, plasma). Do not soak connectors.

- Manufacturer's recommendations concerning EMC

You should reckon with limited resistance to electromagnetic interference engine and avoid working near their sources (e.g. next to a cell phone or diaterm) – more detailed information about the electromagnetic compatibility is given below in the instructions. Basic research is always obtained from the acoustic signal Doppler blood flow. If accompanied by additional signals from interferences and their elimination is not possible at that time recorded mileage and digital values must ignore.

Electromagnetic compatibility recommendations

Electromagnetic emissions


Guidance and manufacturer's declaration – electromagnetic emissions		
DOPPLER device are intended for use in the electromagnetic environment specified below. The customer or the user of DOPPLER device should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment – guidance
RF emissions CISPR 11	Group 1	DOPPLER device use RF energy only for their internal functions. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The DOPPLER device are suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Electromagnetic immunity

Guidance and manufacturer's declaration – electromagnetic immunity			
DOPPLER device are intended for use in the electromagnetic environment specified below. The customer or the user of DOPPLER device should assure that it is used in such environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be At least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains Power quality should be that of typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differentia mode ±2 kV common mode	±1 kV differentia mode ±2 kV common mode	Mains Power quality should be that of typical commercial or hospital environment.
Voltage dips, short interruption and voltage variations on Power supply input lines IEC 61000-4-11	< 5% U_T (>95% dip in U_T) for dla 0,5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles < 5% U_T (>95% dip in U_T) for 5 sec	< 5% U_T (>95% dip in U_T) for dla 0,5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles < 5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of typical commercial or hospital environment. If the user of DOPPLER device requires continued operation during power mains interruptions, it is recommended that DOPPLER device are powered from an uninterruptible power supply or a battery.
Power frequency (50/60Hz) magnetic fields IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the a.c. mains voltage priori to application of the test level.			

Guidance and manufacturer's declaration – electromagnetic immunity

DOPPLER device are intended for use in the electromagnetic environment specified below. The customer or the user of DOPPLER device should assure that it is used in such environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 V	Portable and mobile RF communications equipment should be used no closer to any part of the DOPPLER device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.17 \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz do 2,5 GHz	10 V/m	$d = 0.35 \sqrt{P}$ 80MHz to 800MHz $d = 0.7 \sqrt{P}$ 800MHz to 2,5GHz where P is the maximum output power rating of the transmitter in watts (W) manufacturer and d is the recommended separation distance in meters (m). ^b Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^c should be less than the compliance level in each level frequency range. ^d Interferences may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1 At 80 MHz and 800 MHz, the higher frequency ranges applied.

NOTE 2 These guidelines May not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

- a** The ISM (industrial, medical and scientific) bands between 150kHz and 80MHz are 6,765MHz to 6.795MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.
- b** The compliance level in the ISM frequency bands between 150kHz and 80MHz and in the frequency range between 80MHz and 2.5GHz intend to reduce the likelihood of mobile and portable communication equipment causing interference if they are brought inadvertently to the patient's environment. Therefore, an additional factor of 10/3 is used to calculate the advisable distance of separation for transmitters in these frequency ranges.
- C** The field intensities established by the fixed transmitters, such as base radio stations, telephones (cell phone/wireless) mobile land radio transmitters, amateur radio transmitters, AM and FM radio and TV transmission cannot be forecast theoretically with any accuracy. In order to evaluate the electromagnetic environment due to fixed RF transmitters, it is advisable to execute an electromagnetic inspection of the site. If the measure of the field intensity on the site where the DOPPLER device are used exceeds the level of RF compliance used above, DOPPLER device should be observed to check if the operation is normal. If abnormal performance is observed, additional procedures may be required, such as reorienting or repositioning DOPPLER series monitors.
- D** Above the range 150kHz thru 80MHz, the field intensity should be less than 10V/m.

Recommended separation distances between portable and mobile RF communication equipment and DOPPLER device			
DOPPLER device are intended for use in an electromagnetic environment in which RF perturbations radiated are controlled. The customer or user of the DOPPLER device can help to prevent electromagnetic interference by maintaining a minimum distance between the mobile and portable RF communication equipment (transmitters) and DOPPLER device as recommended below, according to the maximum output power of the communication equipment.			
Rated maximum output power of transmitter [W]	Distance of separation according to the frequency of the transmitter [m]		
	150 kHz to 80 MHz outside ISM bands	80 MHz thru 800 MHz	800 MHz thru 2.5 GHz
	$d = 1.17 \sqrt{P}$	$d = 0.35 \sqrt{P}$	$d = 0.7 \sqrt{P}$ 800MHz to 2,5GHz
0,01	0.117	0,035	0.07
0,1	0.37	0.12	0,23
1	1.17	0.35	0.7
10	3.7	1.11	2,3
100	11,7	3.5	7
<p>For transmitters with a nominal maximum output power not listed above, the advisable distance of separation d in meters (m) can be determined by using the equation applicable to the frequency of the transmitter, where P is the nominal maximum output power of the transmitter in watts (W) according to the manufacturer of the transmitter.</p> <p>NOTE 1: At 80MHz and 800MHz, the distance of separation for the highest frequency range is applied.</p> <p>NOTE 2: In the ISM (industrial, medical and scientific) frequency bands between 150kHz and 80MHz there are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.</p> <p>NOTE 3: An additional factor of 10/3 is used to calculate the advisable distance of separation for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80MHz to 2.5GHz to reduce the likelihood of interference that the mobile/portable communication equipment could cause if taken inadvertently to areas of patients.</p> <p>NOTE 4: These directives may not be applicable in every situation. Electromagnetic transmission is affected by the absorption and reflection of structures, objects and people.</p>			

THE OPERATING CONDITIONS

It is advisable to get the device worked at room temperature with moderate humidity. Mechanical shocks must be avoided. Caution requires ultrasonic probe, which can be destroyed on impact with a hard surface.

It is recommended to use only certified ultrasound gel – CE marked. Do not remove the remnants of ultrasound gel by scrub off. The probe can be cleaned with a cotton swab or soft cloth moistened with water or a mild disinfectant. You can use isopropanol 70% soaked pads. Excluded are all hot disinfection processes. Do not soak connectors. If you need to sterilize the probe gas or plasma sterilization is permitted. The housing and device clean with a wet cloth softly wipe screen. It is not, however, allowed ingress of any liquids inside the enclosure.



The manufacturer recommends that you make the services.

The manufacturer recommends that you make the services. They should be carried out in the third, fifth, seventh, eighth and ninth of the year from the date of purchase. Life-time of the instrument the manufacturer specifies for 10 years.

Repairs to the device

In case of damage or of any queries whatsoever, concerning the correct operation of the device, please contact service. Don't open the casing – there are no elements inside designed to be operated by user.

Short specifications

- Standard ultrasonic frequency 2; (4); 8; options (1); 16 MHz
- Screen XGA 12,1 inch with touch
- Power supply 230 V \pm 10% 50 Hz
- Power (average): < 55 VA
- Dimensions 380 x 270 x 190 mm
- Weight (average) ~ 5,5 kg
- Safety: I, BF

Basic completion

- Ultrasonic Transducers (PW2, CPW4, CPW8 and optional)
- Console
- network cable
- User Manual
- declaration of conformity