PHYWE
excellence in science

CT Scanner control unit

13922.95
13922.99

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Operating instructions

CE The unit complies with the corresponding EC guidelines.

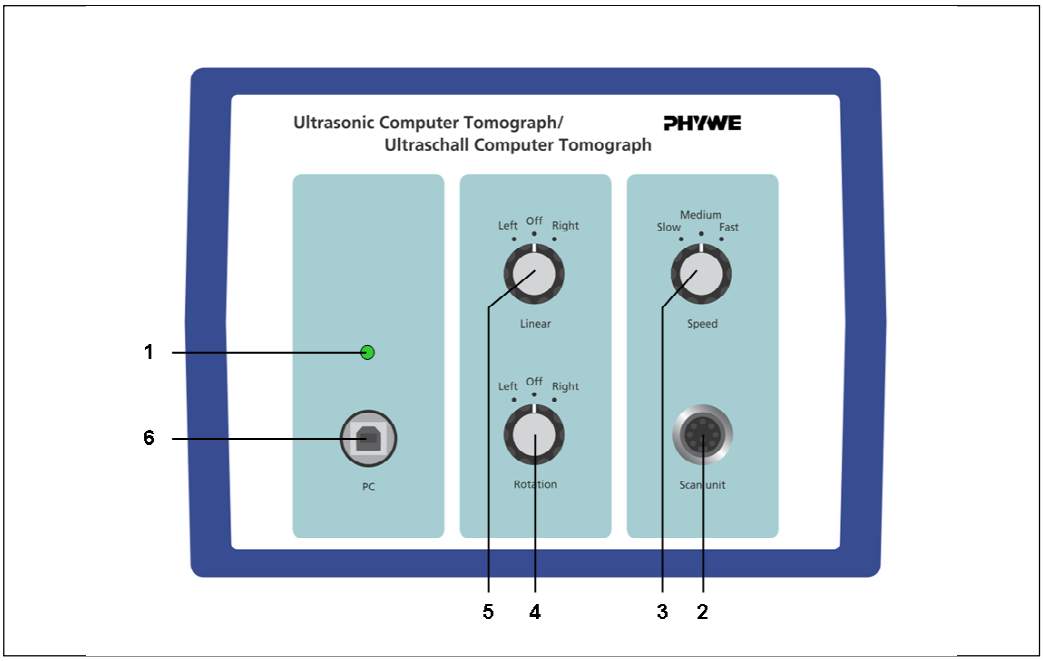


Fig. 1: 13922.95 CT Scanner control unit

CONTENTS

1 SAFETY PRECAUTIONS

- Read these and also the echoscope (13921.95) operating instructions carefully and completely before putting the instrument into operation. This protects and avoids damage to the instrument.
- Only use the instrument for the purpose for which it is intended.
- The instrument is intended for use in dry rooms in which there is no risk of explosion.
- Prior to application of the mains voltage, ensure that the protective earth lead of the power supply is properly connected to the earth lead of the mains. The mains plug is only to be plugged into a mains socket that has an earth lead. Do not cancel the protective effect by use of an extension cable that does not have an earth lead.
- Ensure that the mains voltage given on the type plate of the power supply matches that of your mains supply.
- Set up the experimental arrangement so that the power supply or mains plug of the instrument are freely accessible. Do not cover up the ventilation slots of the experimental arrangement.
- Only use the experimental set-up for the intended purpose.
- Do not open the experimental set-up.
- Do not connect to the instrument any other devices than those intended for use with it.
- Caution: Separate the instrument from the mains before disconnecting, exchanging or removing any cable connections!

2 PURPOSE AND CHARACTERISTICS

Computerised tomography is an important method to investigate inner structures. It is not only used in medical diagnostics but also for material testing. The principles of tomography imaging are independent of the measuring method. Beside the well known X-ray or NMR (nucleus magnetic resonance) procedures also other measurement techniques like positron emission tomography or ultrasonic tomography are used. The CT-scanner is composed of a stepper controlled rotational axis and a linear axis. Due to this two dimensional displacement, the sample or the measuring probes can be place in defined positions, necessary to realise CT-scans, B-scans and sound field measurement.

3 FUNCTIONAL AND OPERATING ELEMENTS

A CT scanner control unit

1. *on/off LED*
2. *scanner control cable plug*
3. *manual speed selection switch*
4. *rotation acting switch (left/right)*
5. *shifting acting switch (left/right)*
6. *USB Plug*

B CT scanner mechanics

7. *clip on probe holder*
8. *CT sample dummy*
9. *water tank*
10. *UT probe flange*
11. *scanner control cable connector*
12. *sample and probe holder flange*
13. *fixing screw : manual Z axis adjust*

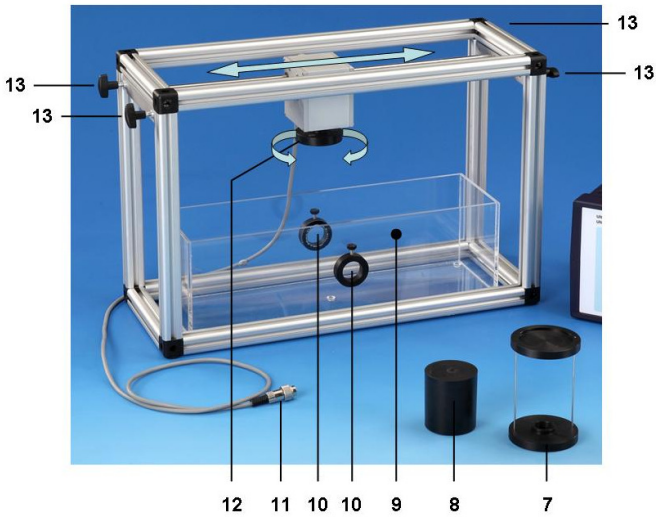


Fig. 2: CT Scanner mechanics

4 NOTES ON OPERATION

In connection with the echoscope unit, the CT-control & scanner unit built a very versatile scanner which can be used for computer tomography, B-scans and sound field measurements.

CT-scanner configuration: The scanner has a sample holder [12] for the test object [8]. This sample holder will rotate, driven by a stepper motor. A second stepper can realize a linear shift with a local resolution < 10 µm. The sample will dip into a water filled tank [9]. On the outside of this tank two ultrasonic probes are localized in opposition [10]. During the measurement the holder will be moved perpendicularly to the measurement axis, after each linear scan, the sample will be rotated corresponding to the ct-algorithm. The whole holder can be moved vertically [13], to adjust the position of the cross section.

B-scans and sound field measurement mode: The scanner enables a series of experiments to illustrate the generation of cross section images. Therefore an ultrasonic probe (1, 2 or 4 MHz) is attached to the probe holder [7]. The sample object (i.e. test block or breast dummy) is placed in the bath and then scanned with assistance of the scanner control unit. The scanner can be controlled manually or with the delivered **measure Ultra Echo** Software. The recorded B-scans are free of motion artefacts and have a high local resolution. The quality can be improved by increasing the measurement time.

5 HANDLING

5.1 Power on

Ensure that the mains voltage given on the type plate of the power supply matches that of your mains supply.

As the scanner is composed of two moving parts, check first that the rotation knob [4] and the linear knob [5] are in “off” position.

Connect the scanner to the control unit and the control unit to the main and switch it on. The power switch is on the rear. LED [1] must light on.

5.2 Manual control

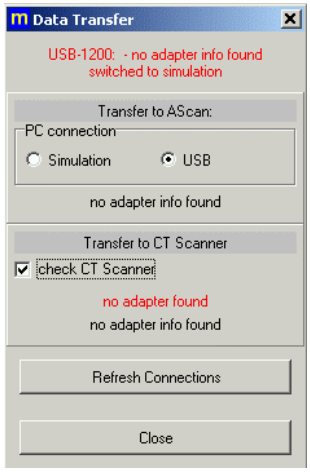
Manually you can shift or rotate the sample and probe holder flange at steady speed. First of all select the speed using the rotation knob [3]. To rotate the sample, switch the knob [4] left or right. To shift the sample, switch the knob [5] left or right.

5.3 Software settings

The software **measure Ultra Echo** records, displays and evaluates the data transferred from the echoscope and also controls the CT-scanner

5.3.1 Menu: Options

Data Transfer



measure Ultra Echo Software can control the echoscope (13921.95) and the CT scanner control unit through an USB port or works in simulation mode. The respective setup can be entered in the ***“Data Transfer”*** window. To access select in the menu ***Options*** the item ***Data Transfer.***

The program will check the connection and when it is successful the result will be displayed in green letters. When there is no connection, the software displays an error message in red letters, indicating the probable reason. In this case the program switches automatically to the simulation mode.

In simulation mode the computer generates data. This mode is used for software demonstration, no measurements were done. The program will stay in simulation mode until the next successful data transfer check.

Note: The program saves the data transfer selection, and retrieves this selection at the next software start. Be aware: the software also remembers the simulation mode; a note will be displayed during software start-up.

If “check CT scanner” is selected, the connection to the scanner will be checked. Only activate this function if the CT scanner is linked and powered on.

When no connection could be established, it is recommended to go on step by step:

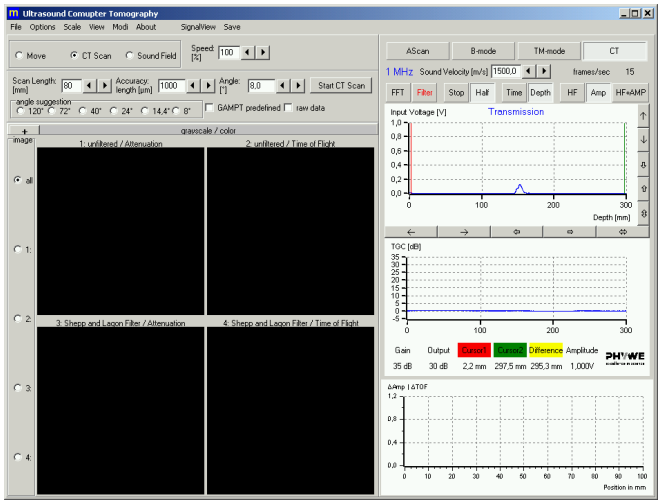
- first switch off the devices, take off all data cables.
- connect device and switch on, refresh connection
- when there is a scanner do the same steps with it

5.3.2 CT mode

In addition to the diagrams, the software offers different evaluation and filter functions. When no device is connected, an offline simulation mode will be activated automatically.

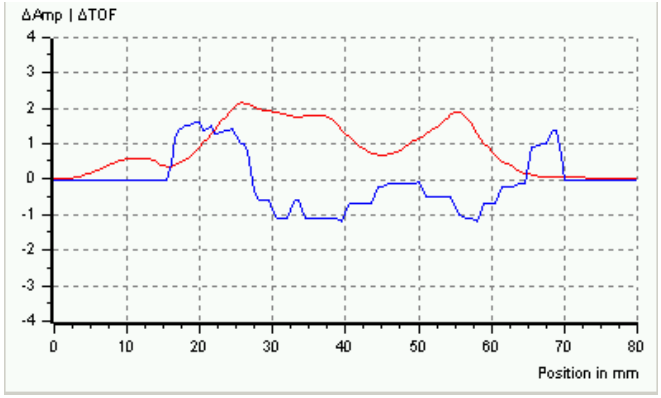
After starting the software, the system measures in A-scan mode. Beside A-scan mode, the other measuring modes are: manual B-scan mode, Time Motion mode and optional mechanical CT mode (requires the CT scanner accessories ref. 13922.99) (See also ***Modi menu***).

Select CT mode.



The structure of the screen is similar to the B-Mode and TM-Mode. On the right side is the down scaled A-scan screen. For all parameter settings of A-scan screen refer to the manual of the echoscope (13921.95)

Below, an additional diagram indicates the variation of amplitude signal (red) and time of flight (blue) during the measurement in function of the X axis position.

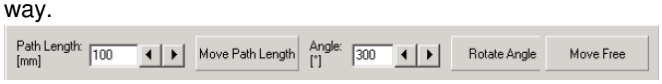


Select between ***Move***, ***CT Scan*** and ***Sound Field*** mode. A specific display appears. For all modes, select ***Direction*** and ***Speed*** to control the movement of the scanner (speed is given in percent, whereas 100% is the maximal possible speed).

To get a steady motion, the scanner doesn't stop at each measure point. When the scanner reaches the next measure position the data will measured "on the fly". When the speed is too high for the selected accuracy, it could be that the scanner reaches the next position before the computer finished processing data of the last one. In this case the values are interpolated. For warning the actual position is displayed in red letters. (Deactivating or hiding the signal view in the down scaled main screen save computer calculation time. This function can be helpful for older or slower computers, see menu ***SignalView*** in 13921.95 manual).

a) Move Mode

In the "Move" mode, the sledge of CT scanner can be positioned. By pressing "Move Free" the sledge moves into the selected direction until the button is pressed again. Selecting "Move Path Length" the sledge will slide by the value given in the input field, the button Rotate Angle works in the same way.

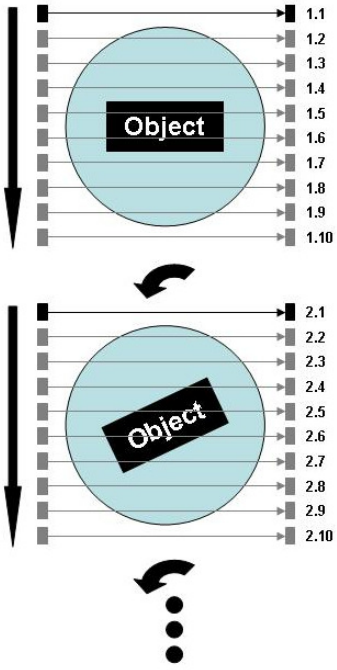


b) Sound Field Scan Mode

Starting from the actual position, the sledge moves over a distance defined by the "Scan Length" in steps of selected "Accuracy". The amplitude signal (red) and time of flight (blue) are displayed in the diagram in function off the position. With "Save Scan" the values can be exported into a text file (ASCII-file).

By using a hydrophone, this mode can be used to measure the sound field of an ultrasonic transducer in lateral or vertical direction.

c) CT Scan Mode



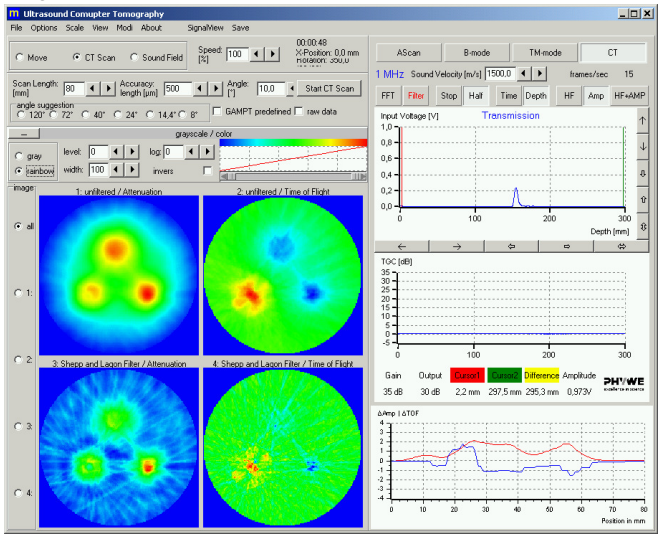
The ultrasound CT-scanner is composed of an emitter and a receiver. We can measure the attenuated intensity only on a one dimensional axis. That's why for each angle position we have to measure the intensity in several positions by translating the measurement axis over the whole sample width. The "*scan length*" is at minimum the sample width (the whole objet must pass through the measurement field), and the distance between two positions is entered in the "*accuracy*" field. The number of points per scan is given by "*scan length / accuracy*". After each linear scan the object is rotated by the "*angle*" field value and a new linear scan is performed. The scans will be repeated until 360° is reached or overstepped. "Start CT Scan" starts the measurement. In this system, the object moves and the transducer-receiver assembly is fixed.

Note: It is possible to work with active TGC settings in CT-measurement mode, but this can cause unpredictable results. The used CT-algorithm cannot handle different amplifications during a measurement. It is highly recommended to deactivate TGC during CT-measurements.

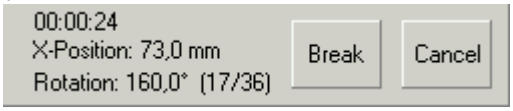
Measurement procedure

The start position of a measurement is always in the middle

of the object. When the values for Scan Length, Angle and Accuracy are adjusted and the measurement is started acting “Start CT Scan”, the software asks to move the scanner to the centre object position. If it was not done previously, the user can adjust de position using the front panel knobs at the scanner control unit. After positioning, the scanner moves by scan length/2 to the first scan start position and begins scanning.



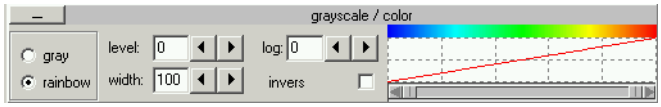
The signal amplitude and time of flight in function of position are displayed in the Δamp/ΔTOF diagram for each scan. The actual position is shown as a vertical line. At the same time the position, angle and duration of measurement are displayed as values in the upper screen part. With the button “Break / Continue” a measurement can be interrupted, “Cancel” stops the measurement.



When a linear scan at one angle value is finished, the measured data will be converted into gray scale values (or rainbow colour) and will be included into the images on left side. This procedure is repeated after each linear scan, so that image builds up step by step.

Four images are displayed. The upper two show attenuation and time of flight unfiltered. The lower two represent the same results but mathematically filtered to enhance the contours. Starting from the basic image, the image quality is increased. The attenuation and time of flight image show complementary information about the inner structure of the measured object.

All four or only one selected image can be displayed. Clicking on “+” above the images, opens the colour scaling box. In this toolbox you can select between colour and gray scale and change the amplitude levels attributed to the colour to enhance the colour distribution.



If the measurement is finished the images can be saved using the menu item “File” -> “Save Images” or the whole form can be printed with “File” -> “Print Form”.

Beside the “Start CT Scan” button, you can select raw data. When this function is activated, during the next measurement the .Amp- und .TOF- data (see diagram right down) will be stored. These data serve as base for image calculation with the CT- algorithm.

After the measurement, the images will be saved with menu “File” -> “Save Images”. Also raw data will be saved into ASCII-files using similar names like the image names. In the ASCII files each row corresponds to a CT scan line.

Recommended parameters for CT sample dummy [8] measurements:

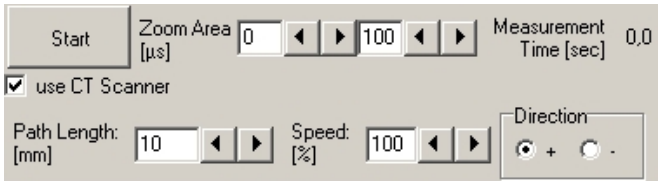
frequency: 1 MHz
path length: 80 mm,
accuracy: 500 µm
angle : <=15°

5.3.3 B-mode

After software start, the system measures in A-scan mode. Beside A-scan mode, the other measuring modes are: manual B-scan mode, Time Motion mode and optional mechanical CT mode (requires the CT scanner accessories ref. 13922.99) (See also ***Modi menu***).

Select B-mode.

For Parameters settings refer to the Ultrasonic echoscope (13921.95) manual. For scanner settings select “use CT Scanner”



Introduce “Path Length”, ""Speed” in % f maximum speed and choose the direction.

Start measurement.

6 TECHNICAL SPECIFICATIONS

This high-quality instrument fulfils all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark.

Computer port: control unit via USB
Scan path: max. 350mm
Lateral accuracy: 1mm
Angle accuracy: 1°

7 SCOPE OF DELIVERY

The CT Scanner (13922-95) is only sold in the set:

13922.99 Ultrasonic computer tomography

Scope of supply:

CT scanner
CT control unit
Water tank
CT sample dummy
Probe holder

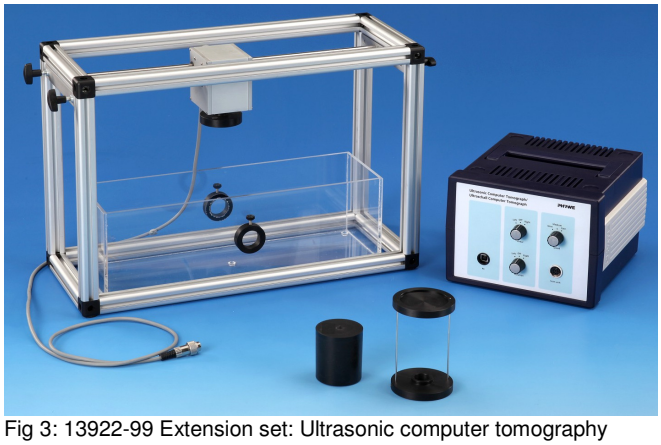


Fig 3: 13922-99 Extension set: Ultrasonic computer tomography

8 ACCESSORIES

13921.99	**Basic set: Ultrasonic echography**
13921.01	**Extension set: Non destructive testing**
13921.02	**Ultrasonic probe 4 MHz**
13921.03	**Extension set: Shear waves**
13921.04	**Extension set: Ultrasonic diagnostics**
13921.05	**Ultrasonic probe 2 MHz**

9 NOTES ON THE GUARANTEE

We guarantee the instrument supplied by us for a period of 24 months within the EU, or for 12 months outside of the EU. Excepted from the guarantee are damages that result from disregarding the Operating Instructions, from improper handling of the instrument or from natural wear.

The manufacturer can only be held responsible for the function and technical safety characteristics of the instrument, when maintenance, repairs and alterations to the instrument are only carried out by the manufacturer or by personnel who have been explicitly authorized by him to do so.

10 WASTE DISPOSAL

The packaging consists predominately of environmentally compatible materials that can be passed on for disposal by the local recycling service.

Should you no longer require this product, do not dispose of it with the household refuse.

Please return it to the address below for proper waste disposal..

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