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HiDop 300

**CW Pocket Doppler with
Spectral Analysis**

Operating Instructions



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1. Warnings, general advice

IMPORTANT ADVICE:

Before starting to use your HiDop 300, please carefully read the present operating instructions and get familiar with the use, the applications and functions of the device and of its accessories.

WARNING:

Do not use the HiDop 300 in the presence of flammable gases such as anaesthetics.

WARNING:

The HiDop 300 is not suitable for sterilization and is not to be used in sterile fields without additional measures.

WARNING:

The HiDop 300 may only be operated with AC/DC - converters which comply with the medical safety regulations (as per EN 60601-1 / IEC 601-1 standards).

WARNING:

The HiDop 300 may only be operated with thermal printers, which are authorized by MTB.

WARNING:

The HiDop 300 may only be connected with analog chart recorders (e.g. ECG recorder), which comply with the medical safety regulations (as per EN 60601-1 / IEC 601-1 standard).

WARNING:

The HiDop 300 may only be connected with IBM compatible computers, which comply with the electric safety regulations (as per IEC 950 standard).

ADVICE:

- Ultrasonic devices and probes shall only be operated by respectively trained personal.

ADVICE:

Ultrasound devices and probes contain high precision and delicate, sensitive electro-mechanical and electronic components and are to be handled in accordance with the required caution.

Main care with ultrasound devices and probes is to be taken mainly with regard:

- not to be dropped
- not to be exposed to mechanical forces
- not to be immersed into liquids
- not to be put in contact with solvents
- not to be exposed to extreme cold (less than 0° C or 32° F) or to extreme heat (over 60° C or 140° F)

Further, ultrasound probes:

- must be cleaned and disinfected after each use by the means as suggested in the operating instructions
- must be checked in a regular manner for damages

2. Introduction

Thank you for your decision to use a MTB HiDop 300. The HiDop 300 is a battery powered, bi-directional CW-Doppler device of latest generation. In spite of its reduced size, it includes many features, which up to now were available only with large size and more expensive devices.

The application of most modern technologies was basic for the development of this product of high quality standard.

The HiDop 300 may be used for vascular diagnosis as well as for fetal heart rate detection.

Spectral analysis (Fast Fourier Transform, FFT) for vascular applications and an optimised auto -correlation-function (ACF) for fetal heart rate detection are central points of the HiDop 300 signal processing.

Graphic information is displayed on a black/white LCD-display. You have the choice to display the sonogram or one of two bi-directional blood flow velocity waveforms.

The fetal heart rate is displayed numerically as well as in graphic manner by means of a slow moving trend waveform.

The acoustic Doppler signals are reproduced by an internal loudspeaker. The bi-directional acoustic Doppler signals may be reproduced by using a stereo headset.

A hardcopy of velocity waveforms may be obtained by using a single channel or a 2-channel chart recorder.

An optional serial interface is provided for the connection of a thermal printer or IBM compatible computer. From this interface, the sonogram as well as the velocity waveforms and the trend waveform of fetal heart rate may be reproduced.

Stationary operation is possible with a suitable AC/DC - converter.

3. Assigned clinical applications

3.1. Vascular applications

With the HiDop 300 Doppler device a multitude of vascular examinations are feasible: the recording of sonograms and velocity waveforms for the assessment of stenosis, blood pressure measurements and the assessment of venous insufficiencies.

Depending on the location of the blood vessels to be checked, the examination is performed with a probe of 4 MHz or 8 MHz.

3.2. Obstetric applications

For obstetric applications the fetal heart rate may be displayed numerically and graphically from the 26th week of gestation.

From about the 9th week of gestation the Doppler signals from the fetal beating heart may be obtained as acoustic signals. This makes possible the assessment of fetal heart activities in the early stage of pregnancy. Furthermore, multiple pregnancies may be discovered.

For obstetric applications the 2 MHz probe only may be used.

4. Product description

4.1. Description of device

The HiDop 300 is a bi-directional CW Doppler device with spectral analysis. The main unit includes the controls, the signal processing, the loudspeaker, the graphic LCD-display, the battery compartment, input/output sockets and the transducer cable.

One of three different CW probes (2MHz, 4MHz and 8MHz) may be plugged to the transducer cable.

The referring frequency of probe is printed on each subject casing.

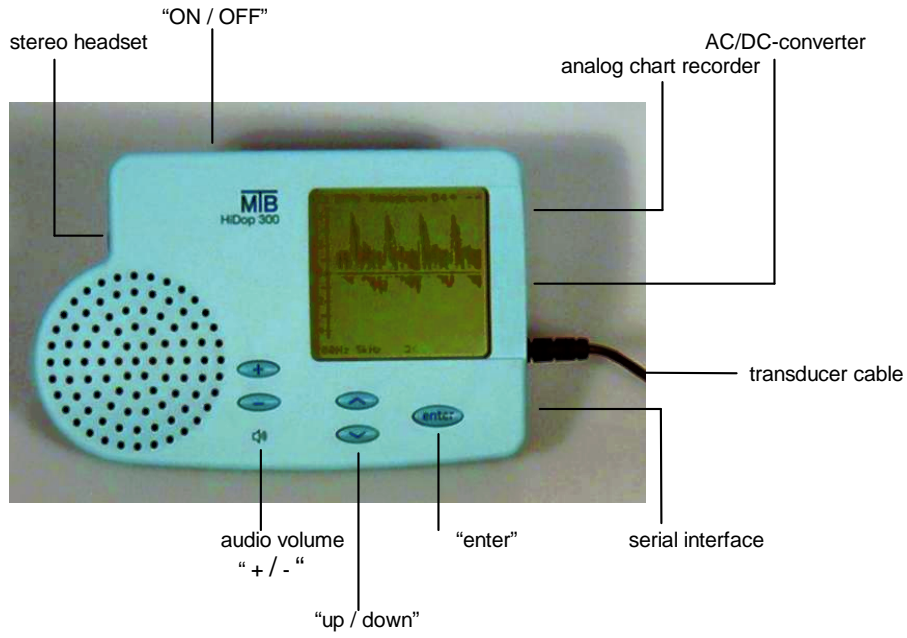
The device automatically recognizes the probes by a digital code and switches to the corresponding mode of operation.

4.2. Identification

For identification, a label with the serial number of your HiDop 300 is fixed inside the battery compartment. Further, various data such as the serial number, the software version and different parameters of the device are stored electronically and permanently and may be called up, if required, by the authorized after sales service.

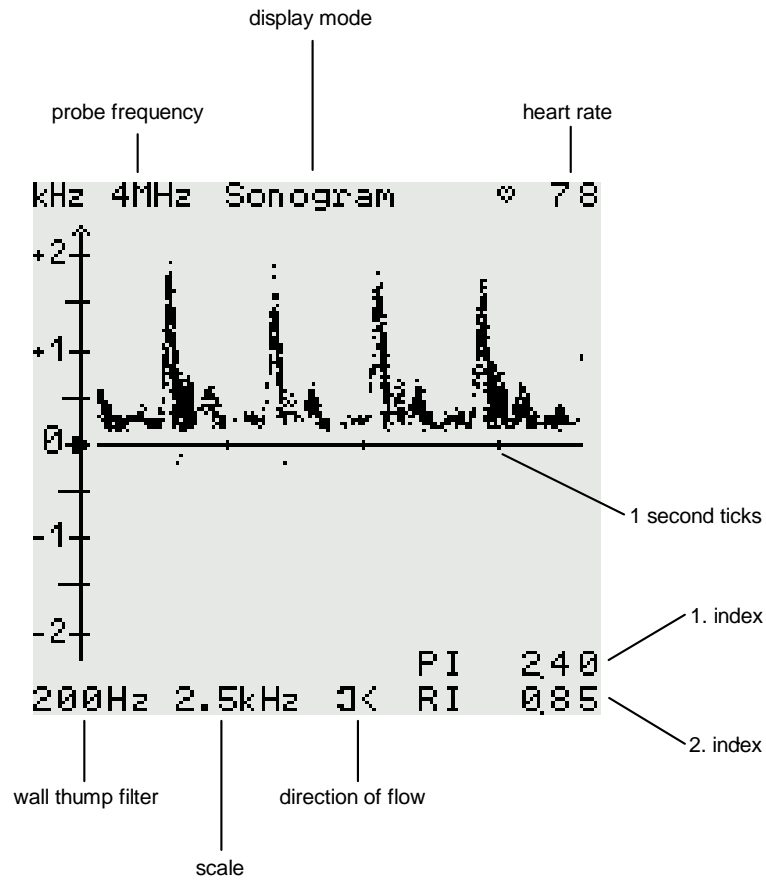
3 labels are positioned on the bottom of the device casing. They contain information about the manufacturer, the type and classification of the device, the CE-mark and safety warnings.

4.3. Controls



4.4. Data display

The following information is shown on the graphic display when operating in real time mode (4MHz and 8 MHz probes only):



5. Preparing the HiDop 300 for use

5.1 Inserting the batteries

The battery compartment is to be found on the bottom of the device casing. The cover of the compartment may be opened without a tool by hand, using one finger only.

Insert four 1.5V alkaline batteries (AM3/LR6/AA) with polarity as indicated in the compartment. Put the cover of the battery compartment back in its position and safely lock it

In case the batteries are inserted incorrectly (wrong polarity) the device will not work, but no damage will result.

The flashing battery symbol on the display indicates that the batteries should be replaced in the near future. You still may use the device for a short while, but do not forget to replace the old batteries at first opportunity.

5.2 Connecting a probe

Choose a probe fitting your application and plug it to the transducer cable. Now your HiDop 300 is ready for use.

6. Operating the HiDop 300

6.1 Switching on

Press and release the “on/off”-key to put the device on. The HiDop 300 automatically recognizes the connected probe and loads the appropriate settings. If no probe is connected or if the probe is incorrectly connected, the display will indicate “NO PROBE”. Please check the probe and its plug-in connection.

After having connected the probe correctly, an alternating test pattern appears on the display for about two seconds. This allows for a functional test of display and memory. If the pattern shows defects, please contact your local dealer.

After this test, the labels “HiDop 300” and “MTB” as well as the frequency of the connected probe and the version of the software will appear for about 3 seconds on the display.

After that your HiDop 300 is in the “real time” mode. The display shows a system of coordinates and information about the settings of the device.

To switch off the device press and release the “on/off”-key again.

An “Auto-shut-off” function switches the device off if it is not used for 3 minutes (if no Doppler signals present).

6.2 Switching on with loading of stored settings

One of three different settings may be loaded when switching the device on:

1. If you switch on the device only by pressing and releasing the “on/off“-key, the settings, which have been active at the last operation, will be loaded. This refers specifically to all types of probes.
2. If you switch on the device keeping the “+“-key pressed down when pressing and releasing the “on/off“-key, the user settings (settings which have been stored by the user in the menu) will be loaded. The “+“-key must be kept pushed down until the device gets operative.
3. If you switch on the device keeping the “-“-key pressed down when pressing and releasing the “on/off“-key, the factory settings will be loaded. The “-“-key must be kept pushed down until the device gets operative.

6.3. Changing the settings of the device

When putting your HiDop 300 to work for the first time, the settings as pre-set by the manufacturer will be loaded. According to the requirements these settings may be changed. To do so, press the “enter”-key (with the device being in on condition). A vertical icon bar appears on the right edge of the display. The icon “Menu” is pre-selected. By pressing the “enter”-key again, the menu appears. The display shows the following graphic:

Graphic of menu



	Menu	
	Sweep	4s
	DispMode	Sonogram
	Scale	5 kHz
	Wallfilter	200 Hz
	Smoothing	6 Hz
	Brightness	50 %
	Contrast	++ / --
	Index1	—
	Index2	⏏
	Options	⏏
	Language	English
	*Display Data	Mode

The cursor on the left edge of the display is positioned at “DispMode” and may be moved to any desired up or down position using the “^”- or “v”-key. The selected menu item may be activated with the “enter”-key. By doing so, the cursor changes from “•” to “>”. Now the available settings appear in a box at right hand. With the “^”-key or the “v”-key the desired settings may be chosen and activated by pressing the “enter”-key. By doing so, the cursor on the left edge of the display changes from “>” to “<”. With the “^”- or the “v”-key further items of the menu may be selected.

If all parameters are set according to your requirements, you may switch back the device into its operating mode by pressing the “enter”-key. Now the device is ready for operation with the settings chosen by the user.

The possibilities of all parameter settings are detailed below:

Sweep: The sweep may be chosen as 2, 4 or 8 seconds per width of display.

Please notice, that a combination of 2 seconds/display width with a scale setting of ± 2.5 kHz it *not* feasible.

DispMode: The following modes of display may be chosen: the sonogram, the maximum/minimum frequency waveform, given as two separated waveforms (f_{max} / f_{min}) and the maximum /minimum frequency waveform given as one added up waveform ($f_{max}+f_{min}$).

Scale: The frequency scale may be chosen as ± 2.5 kHz-, ± 5 kHz- or ± 10 kHz scale.

Please notice, that a combination of ± 2.5 kHz with a sweep setting of 2 seconds/display width is *not* feasible.

- Wall-filter: To reduce the interference originated by severe wall movements of blood vessels, wall thump filters (high-pass filters) are included in the signal processing. The cut-off frequency may be chosen as 100 Hz, 200 Hz or 400 Hz.
Please notice that these filters affect not only the signals produced by wall movements but also the signals produced by slowly flowing blood.
- Smoothing: Both frequency waveforms “fmax / fmin” as well as “fmax + fmin” may be smoothed out by low-pass filters. Cut-off frequencies of these filters may be chosen as 6 Hz (venous filter), 16 Hz (arterial filter) or >25 Hz (no filter).
Please notice that the use of these filters may change the shape of waveforms. For instance the use of a 6 Hz-filter may flatten the steep ascent of arterial pulses.
- Brightness: The brightness of the sonogram (the inverted blackening) may be adjusted. Settings from 30% to 95% are possible. 30% corresponds to the lowest possible brightness (maximum blackening), 95% corresponds to the highest brightness (minimum blackening).
- Contrast: If necessary the contrast of the LCD-display may be adjusted. By pressing the “^”-key or the “v”-key the contrast is increased, respectively decreased step by step.

Index 1: The HiDop 300 computes four Doppler indices, whilst two at most may be shown simultaneously on the display:

the Resistance Index "RI"
the Pulsatility Index "PI"
the mean frequency "Mean"
the systolic/diastolic ratio "S/D"

The theory and the fundamental principles of the calculation of these indices may be found in the relevant literature.

Index 1 may be chosen either as no index or as one of the four indices listed above.

Index 2: The procedures are analogous to those of "Index 1".
"Index 2" may be chosen either as no index or as one of the four indices listed above.

Please notice that whilst "fmax + fmin" is displayed, the calculation of indices is not possible. Therefore the choice of indices is not available when "fmax + fmin" is active.

Option: Under this item of the menu manufacturer settings may be loaded (default) and user settings may be stored (save param). Furthermore, a calibration waveform may be printed out with a chart recorder (cal).

Language: All text used in the HiDop 300 is stored in several languages. A list with the available languages appears in the box at right hand.

* On this line a short reference is given for all menu items.

6.4. Working with the Icon bar

Frequently used functions may be called by using icons. The icon bar appears by pressing the “enter”-key. If there is no activity within 8 seconds, the icon bar disappears by itself. Select an icon by using the “v” or “^”-key and activate it by pressing the “enter”-key.

The following icons are available:

- “PC” -icon
- “printer” -icon
- “Menu” -icon
- “delete icon bar” -icon
- “flow direction” -icon
- “brightness +” -icon
- “brightness -” -icon
- “?” -icon

In the “freeze“ mode two additional icons are available:

- “scroll right” -icon
- “scroll left” -icon

Simultaneously only five icons can be shown on the display. With the “v”-key the icon bar can be shifted upwards and with the “^”-key it can be shifted downwards.

The different icons and their functions are explained below:

“PC”-icon: If your device includes the option “PC interface”, you can transfer Doppler data in real time to your PC using this icon. If your device does not include this option, the message “not available” will appear on the lower edge of the display when activating this icon.

“printer”-icon: If your device includes the option thermal printer, you can print out sonograms and velocity waveforms using this icon. If your device does not include this option, the message “not available” will appear on the lower edge of the display when activating this icon.

“Menu”-icon: This icon becomes active when the “enter”-key is pressed. It allows an immediate access to the menu.

“delete icon”-icon: If you want the icon bar to disappear before the standard 8 seconds have passed, this icon may be selected and activated with the “enter”-key.

“direction of flow”-icon: By selecting this icon (activating by pressing the “enter”-key), the direction of flow, shown on the display, is inverted.

“brightness +”-icon: Selecting this icon allows to adjust the brightness of the sonogram. Each time you press the “enter”-key the brightness will be *increased* by 5%.

“brightness -”-icon: Selecting this icon allows to adjust the brightness of the sonogram. Each time you press the “enter”-key the brightness will be *decreased* by 5%.

“?”-icon: Selecting this icon (activating by pressing the “enter”-key) shows a short reference of the key functions. To quit this reference, press the “enter” key again.

“scroll right”-icon In the “freeze” mode the display can be scrolled right selecting this icon (activating by pressing the “enter”-key). Every time you press the “enter”-key the data will be scrolled by about 1/8 of the display width.

“scroll left”-icon In the “freeze” mode the display can be scrolled left selecting this icon (activating by pressing the “enter”-key). Every time you press the “enter”-key the data will be scrolled by about 1/8 of the display width.

6.5. Temporary storage

The Hidop 300 continuously stores data in a temporary circular buffer. The size of this buffer is 4 displays. For identification, the stored data corresponding to the 4 displays is named D1 ... D4, with D4 representing the data, which have been collected last. The end of the recorded data is marked with a vertical dotted line.

Important notice: **Switching the device off or disconnecting the ultrasound probe will clear the temporary buffer and all stored data will be lost.**

6.6. Freezing the display (“freeze”)

By pressing the “^”-key, the “real-time” mode may be set into “freeze” mode at any time.

By pressing the “^”-key once more, the device returns to operate in the “real-time” mode again.

In the “freeze” mode, “real-time” operation is restricted: Doppler signals are audible but no “real-time” data is shown on the display (as the display is used to reproduce the stored data).

6.6.1. Scrolling the display in the “freeze” mode

In the “freeze” mode you can scroll the stored data to view any part of it. Press the “enter”-key and select the “scroll right” or “scroll left” icon using the “^”-key or the “v”-key. By pressing the “enter”-key the entire stored data may be shifted step by step (8 steps / display) to the right or to the left. The reading D1 ... D4 appears on the upper right edge of the display, indicating which display is shown at present time.

6.6.2. Printing in the “freeze“ mode (option)

After having chosen the most interesting sequence of data using the scroll function, you can make a hardcopy of the display using your thermal printer. Select the “printer”-icon and activate it by pressing the “enter”-key. The contents of the display will be printed on your thermal printer.

Sonograms will be reproduced in high quality with 12 different levels of brightness.

During printer operation, the “printer”-icon will be crossed through. Selecting the crossed through “printer”-icon and activating it by pressing the “enter”-key will stop the printer operation immediately.

If the above option is not available on your device, the message “not available” will appear on the lower edge of the display when activating the “printer”-icon.

Important notice: **During printer operation do not switch off the device and do not disconnect the ultrasound probe.**

WARNING:

The HiDop 300 may only be operated with thermal printers, which are authorized by MTB.

6.6.3. Data transfer to PC in the “freeze” mode (option)

After having chosen the most interesting sequence of data using the scroll function, you can transfer it to your PC.

Select the “PC”-icon and activate it by pressing the “enter”-key. The contents of the display will be transferred to your PC.

4 bits of Doppler data will be transferred to the PC allowing to reproduce the sonograms in 16 different colors.

During data transfer, the “PC”-icon will be crossed through. Selecting the crossed through “PC”-icon and activating it by pressing the “enter”-key will stop the data transfer immediately.

If the above option is not available on your device, the message “not available” will appear on the lower edge of the display when activating the “PC”-icon.

Important notice: During data transfer do not switch off the device and do not disconnect the ultrasound probe.

WARNING:

The HiDop 300 may only be connected with IBM compatible computers, which comply with the electric safety regulations (as per IEC 950 standard).

6.6.4. Replay mode

Instead of scrolling the stored data manually, you can use the replay function to reproduce the stored data continuously.

With the device being in the "freeze" mode first press the "v"-key to switch to the replay mode and then press the "^"-key to start the replay. The contents of the 4 displays will continuously be reproduced.

The reading D1 ... D4 appears on the upper right edge of the display, indicating which display is shown at present time.

To stop the replay at any position, press the "^"-key.

To switch back to "real-time" mode, press the "v"-key.

During replay, "real-time" operation is not possible. The device operates with reduced audio volume and no data can be displayed (as the display is used to reproduce the stored data).

6.7. Printing in "real time" mode (option)

Sonograms and velocity waveforms can be printed continuously in "real time" using your thermal printer.

When operating in "real time" mode, select the "printer"-icon and activate it by pressing the "enter"-key. Doppler data (either sonograms or velocity waveforms) will be printed continuously.

During printer operation, the "printer"-icon will be crossed through.

Selecting the crossed through "printer"-icon and activating it by pressing the "enter"-key will stop the printer operation immediately.

Due to the limited amount of data that can be processed by the printer the quality of the sonograms is lower than in the "freeze" mode. Only 4 levels of brightness can be reproduced and spatial resolution is lower.

If the above option is not available on your device, the message "not available" will appear on the lower edge of the display when activating the "printer"-icon.

WARNING:

The HiDop 300 may only be operated with thermal printers, which are authorized by MTB.

6.8. Data transfer to PC in “real time” mode (option)

Doppler data can be transferred continuously to your PC using this HiDop 300 option together with the PC software offered by MTB.

When operating in “real time” mode, select the “PC”-icon and activate it by pressing the “enter”-key. Doppler data will be transferred continuously to your PC.

During data transfer, the “PC”-icon“ will be crossed through. Selecting the crossed through “PC”-icon and activating it by pressing the “enter”-key will stop the data transfer immediately.

If the above option is not available on your device, the message “not available” will appear on the lower edge of the display when activating the “PC”-icon.

We refer you to the description of the PC software for more information.

WARNING:

The HiDop 300 may only be connected with IBM compatible computers, which comply with the electric safety regulations (as per IEC 950 standard).

6.9. Recording of velocity waveforms using a chart recorder

Velocity waveforms can be printed continuously using a chart recorder (for instance an ECG recorder).

When operating in the "real time" mode, the chosen velocity waveform (DispMode) is sent continuously to the analog chart recorder output. For calibration of your chart recorder select the item "options" in the menu, select "calibrate" and activate the calibration process by pressing the "enter"-key.

A 3 level calibration waveform (for positive and negative velocities each) will be sent to the analog chart recorder output. The levels of the calibration waveform represent Doppler frequencies of 2.5kHz, 5kHz, 7.5kHz and -2.5kHz, -5kHz, -7.5kHz.

The analog chart recorder output is always active and cannot be turned off.

WARNING:

The HiDop 300 may only be connected with analog chart recorders (e.g. ECG recorders), which comply with the medical safety regulations (as per EN 60601-1 / IEC 601-1 standard).

7. Obstetric applications

When working with the 2 MHz probe for fetal heart rate detection, some of the above explained functions are different.

The menu just includes the following items:

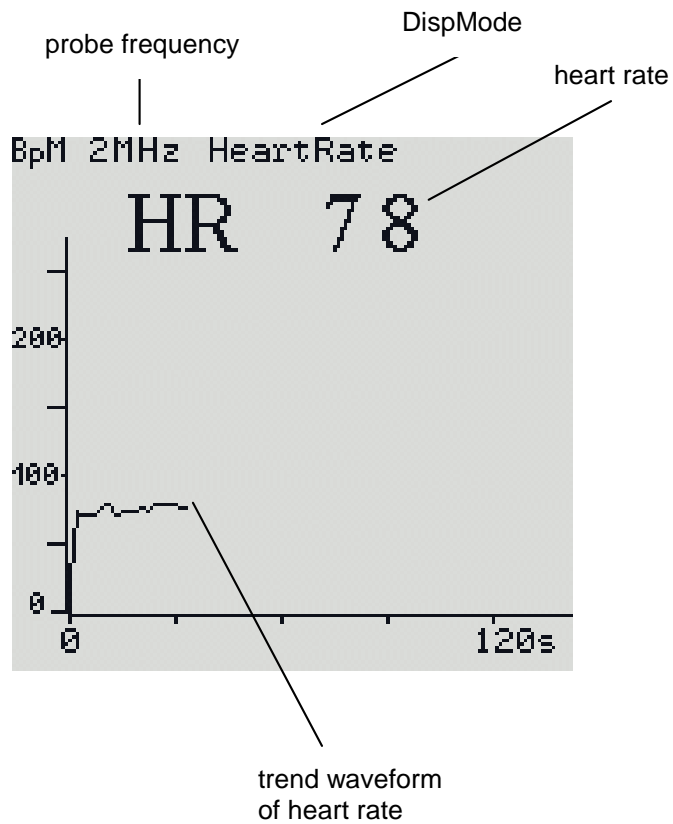
Graphic of menu

Menu	
•	Sweep 60s
	Contrast ++ / --
	Options —
	Language English
	◇
	◇
	*x-Scale Time Deflection

Items or parameters that are different from the menu of the vascular application are explained below:

Sweep: The sweep may be chosen as 60, 120 or 240 seconds per width of display.

In the “real time” mode the display shows the following information:



The present heart rate is displayed numerically. In addition a trend waveform shows the measured heart rate over 60s, 120s or 240s. “freeze”, “scroll” and “replay” functions are analogous to the vascular mode. The same applies to the printing function (in “freeze” mode and in “real-time” mode).

WARNING:

To compute the correct heart rate, the HiDop 300 requires a minimum signal quality. If the probe is positioned so that only weak Doppler signals can be received, a correct computing may not always be possible. Reposition the probe until the signal quality is good.

ADVICE:

If the displayed value of the heart rate lies outside the range for normal fetal heart rates, check the heart rate by listening to the audio Doppler signals.

8. Accessories

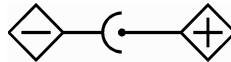
8.1 Operating with an AC/DC-converter

MTB offers an AC/DC-converter, which is suitable to supply the HiDop 300 from the mains. This converter has an output of 7.5 V DC for a maximum 6 W loading power. It complies with EN 60601-1/IEC 601-1 standard.

WARNING:

The HiDop 300 may only be operated with AC/DC – converters, which comply with the medical safety regulations (as per EN 60601-1 / IEC 601-1 standards).

A Ø 5.5mm/2.1mm plug fits the socket of the HiDop 300. The polarity is as follows:



8.2 Connecting a thermal printer (option)

MTB offers a thermal printer and an interface cable, which are compatible with the HiDop 300. The driver software included in the HiDop 300 is made for this specific printer only.

WARNING:

The HiDop 300 may only be operated with thermal printers, which are authorized by MTB.

To prepare your thermal printer for use, first make the necessary modifications in the printer settings:

Data input:	serial
Baud rate:	38400 bps
Bit length:	8 bit
Parity:	none
Stop bit:	1 bit
Data control:	Xon/Xoff

After that, plug the interface cable to the printer and to serial interface socket of the HiDop 300.
Switch on the printer.

8.3 Connecting an IBM-compatible computer (option)

The HiDop 300 includes a serial interface (RS 232) by which Doppler data may be transferred in real-time to the PC. The Baud rate of this interface is 115200 bps.

MTB offers an interface cable connecting your HiDop 300 to the PC.

The description of the PC software includes all necessary information (including minimum requirements that your PC must meet) to transfer Doppler data from the HiDop 300 to the PC.

WARNING:

The HiDop 300 may only be connected with IBM compatible computers, which comply with the electric safety regulations (as per IEC 950 standard).

8.4 Connecting an analog chart recorder

The HiDop 300 includes an analog output, for connecting an analog chart recorder (either single channel or 2 channel recorder, for instance ECG-recorder). Velocity waveforms (no sonograms) may be reproduced on this device.

Ø 3.5mm stereo plugs will fit the output socket of the HiDop 300. Bi-directional velocity waveform signals are available as separate signals on the two contacts of the stereo socket.

Signal level is 200mV / kHz of frequency.

The necessary connection cable may be specific for each type of chart recorder. Please contact your supplier for more information.

WARNING:

The HiDop 300 may only be connected with analog chart recorders (e.g. ECG recorders), which comply with the medical safety regulations (as per EN 60601-1 / IEC 601-1 standard).

8.5 Connecting a stereo headset

The HiDop 300 includes an output for connecting a stereo headset. Audio Doppler signals are available in stereo, separated by flow direction, on this output.

Connecting the headset mutes the internal loudspeaker

The impedance of the headset is 8 Ohms.

Ø 3.5mm stereo plugs will fit the output socket of the HiDop 300.

WARNING:

Devices directly supplied from the mains, which do not comply with the medical safety requirements (as per EN 60601-1 / IEC 601-1 standard), for instance active loudspeakers, must not be connected to the headset output.

9. Care and maintenance

Always wipe off excess gel after use. Use a mild disinfectant cleaner. Use a soft cloth to clean probes and device.

Advice: **Never use solvents when cleaning your device and/or its probes.**

Check your device and its probes in a regular manner for damages. If you discover any damages, fissures, deformations or similar, contact your supplier for advice and service.

10. Technical data

Bi-directional CW ultrasound Doppler

Available probes:	CW 2 MHz CW 4 MHz CW 8 MHz
Identification of probes:	automatic with digital code
Power source:	4 alkaline batteries, 1.5 V (AM3/LR6/AA)
Power consumption:	< 200 mA
Battery life:	minimum 6 hours
AC/DC-converter:	7.5V DC, 800mA
Digitizing of signals:	2-channel 16 Bit A/D converter
Signal processing:	By means of a digital signal processor (DSP)
Display:	graphic b/w LCD display
Audio:	internal speaker 500 mW, mono stereo headset, 8 Ohms
Outputs:	analog output for chart recorder
Interfaces:	serial interface to thermal printer serial interface (RS232) to PC
Controls:	5 keys for the control of all parameters
Size of casing:	170 x 110 x 50 mm
Size of probe:	Diameter of shaft: 14 mm Length of probes: 110 mm
Weight:	450 gr (batteries included)