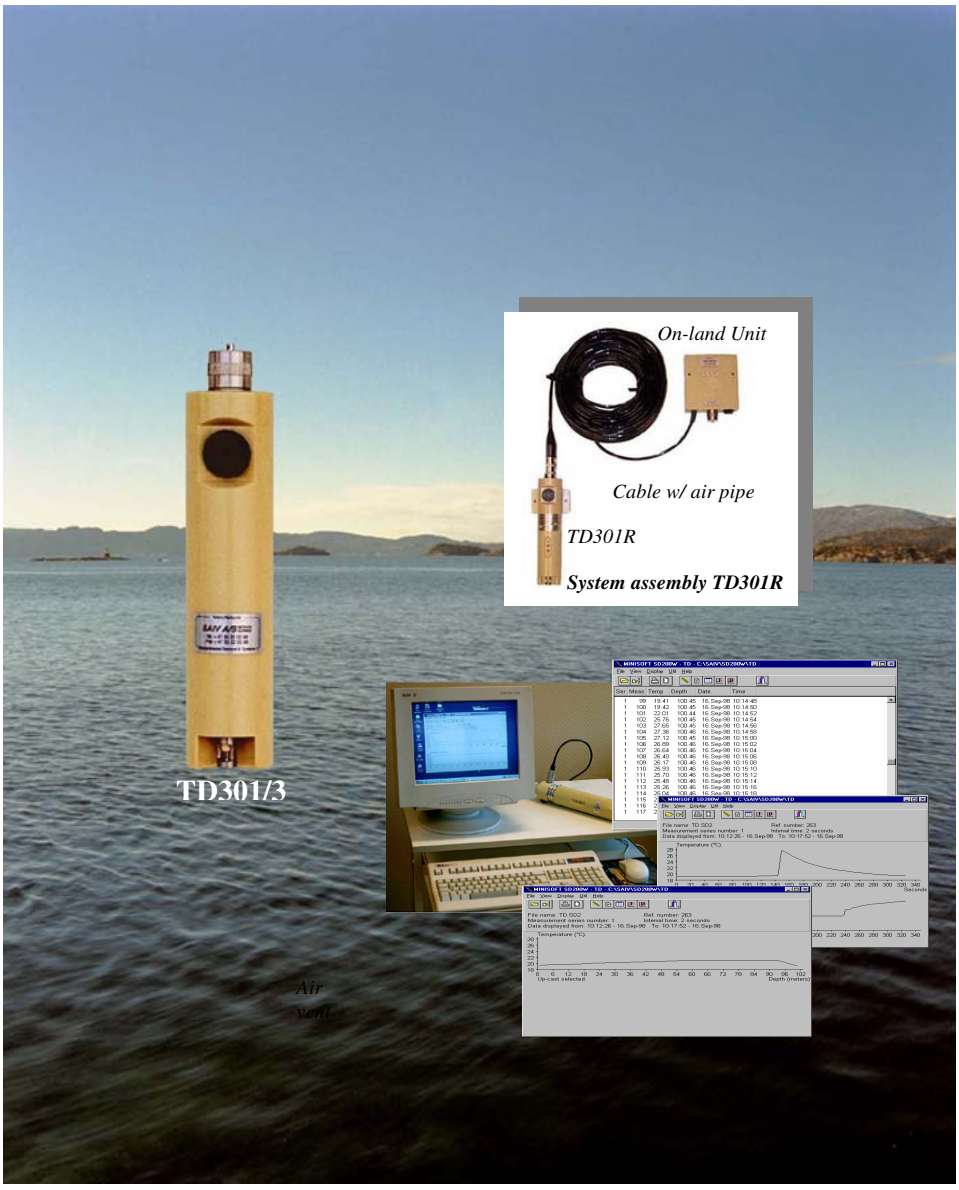
Operating Manual
for
Pressure/depth sensors/recorders
models
TD301 – TD303



Manufacturer:

SAIV A/S

Nygardsviken 1, POB 3513 **Tel : +47 56 11 30 66**
5845 Bergen, Norway **Fax: +47 56 11 30 69**
e-mail: saivas@online.no **web: www.saivas.no**

Distributor:

SAIV01APR2009

Pressure/depth sensors/recorders

models TD301 – TD303

Standard storage/transport packing.

The suitcase contains:

- *TD301/TD303*
- *On/Off Mag-Key (TD301 only)*
- *On-Land Unit (for TD301R only)*
- *PC communication cable*
- *SD200W program*
- *Operating manual*

INTRODUCTION

This manual describes the TD301/3 (absolute type) and TD301R (reference to air pressure via On-Land Unit) and the dedicated data processing program SD200W.
Except for TD303 these instruments have a built in replaceable battery for self contained recording application. All models are also designed for on line operation and can be powered from external source, e.g. AC/DC converter. When external power is applied, the internal battery will automatically not be in use.
Although each chapter contains comprehensive information, it is recommended that the user read the complete manual prior to operating the sensor.

Fig. 1

Figure 1 shows the TD303, this unit is for on-line applications with external power supply.
Typical application is on R.O.V. etc. The unit is supplied with connector with pigtail or with pc-connector and AC/DC converter.

Fig. 2

Figure 2 shows the TD301R with On-Land Unit. This unit provides connector for direct data communication and ventilation to air pressure.
The cable with air pipe is supplied at length relative to the depth range of the TD301R.
The PC cable can be extended to length up to 500 meters.
For remote readout and monitoring, the manufacturer offers several options: Communication Unit CU901, for two-way communication, via Iridium satellite, GPRS with embedded web server, GSM and UHF/VHF.

OPERATING MANUAL
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Contents:

✓ GENERAL DESCRIPTION AND SPECIFICATIONS

The TD301/TD303 are precision instruments measuring temperature and depth (pressure) in the sea, lakes, water reservoirs, groundwater, rivers and on R.O.V. etc. All settings like measuring interval, real time clock etc, are accessed via menu. The programmed settings and calibration coefficients are maintained in nonvolatile eeprom, and will not be changed/lost if power is disconnected. The model TD301 has a built-in replaceable battery for self- contained recording applications. On/Off- switching is by a magnetic key or from keyboard. The model TD303 is for online applications with external power supply and has an extra feature of 5Hz sampling with programable output formats to suit the host unit. All units have a built-in data memory. The modelsTD301 and TD303 have a "ring memory" where the oldest data will be overwritten when memory is full. Data are recorded in physical units and simultaneously transmitted via an RS232 I/O watertight connector for online use. Robustness and complete protection from leakage has been obtained by vacuum molding the electronic and all other components in solid polyurethane.
A comprehensive PC-program is supplied with the units for easy communication, programming and presentation/processing of data.

For remote readout and monitoring, the manufacturer offers several options: Communication Unit CU901, for two-way communication via Iridium satellite, GPRS with embedded web server, GSM and UHF/VHF.
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Designations:
Absolute types: TD301/TD303 , Reference type: TD301R,
Differential types: TD301D/TD303D

SENSOR DESIGN
Robustness and complete protection from leakage has been obtained by vacuum molding the electronic and all other components in solid polyurethane. The pressure transducer element is embedded in the sensor body. A protective cap with a small hole in the centre (pressure port) covers the diaphragm of the pressure transducer. The transducer is a piezoresistive type, which is basically temperature sensitive, but a unique, built-in, algorithm performs a perfect temperature compensation. The water temperature is measured by a thermistor. The model TD301has a built-in replaceable battery for self- contained recording applications. Two magnetically sensitive command switches, START and CONFIRM are placed inside the molded sensor body. The switches are operated by a magnetic key (Mag-Key) supplied with the sensor. The user can control that the sensor is both active and has been correctly programmed by observing two built-in LED lamps. The model TD303 is for on-line applications with external power supply.

MENU-DRIVEN PROGRAMMING

When the sensor is connected to a PC, the user may read out recorded data, change the measuring mode or enter calibration mode etc. according to a displayed menu.
In addition, the menu contains several utility functions, like setting of real time clock, setting integration time, baud rate, erasing of data and display of battery life counter.

OPERATION

The TD301/TD302 and TD303 are normally used for profiling in the sea and lakes, either in recording or on-line configuration. When used as a recorder (TD301) without cable connected, the pressure data from the first measurement in a series is deducted from all the subsequent pressure measurements in that series. Since the first measurement is the air pressure at/near surface level, the subsequent recorded pressure data will be the net water pressure. The recorded air pressure will be shown in the heading for each series together with date, time and recording interval etc. Only the magnetic key (Mag-Key) is necessary for operating the TD301 in the field (switching On/Off).
In on-line configuration on/off switching and setting of air pressure is operated via the key-board.
Recorded data from the individual stations (i.e. data recorded between two successive start and stop-commands) are organised as successive data series in the memory with sensor serial number, stored air pressure, interval and date and time for each new start.

DATA READ-OUT AND PROCESSING

Data recorded in the sensor memory can be transferred to a PC at any time. The sensor can communicate with any standard PC (hyperterminal etc) for setting sensor status and reading of recorded data. However, the use of the MINISOFT SD200W program is recommended. This program combines both communication and data processing functions. The program organises data into PC-files, and provides versatile functions for graphic processing and tabulation of the data. Options for extracting data from chosen depths or temperatures, selecting upcast/downcast etc. are all included in the program.
The MINISOFT SD200W can also generate export files for sonar equipment etc.

CALIBRATION

Calibration Certificate with credentials is supplied with the sensor. The calibration coefficients are maintained in the sensor memory and can be displayed/hard-copied at any time.
Due to the excellent long term stability of transducers and circuitry, the sensor does not have to be re-calibrated for several years. For users needing regular confirmation of the calibration, the factory offers efficient and low cost calibration service.
If owner wants to perform calibration on his own, the manufacturer will provide useful guidance on request.

Specifications for TD301 and TD303

Pressure: *Specify desired depth and type with order*
Ranges: (absolute) 20,50,100,200,500 – 6000 dbar (m)
Ranges: (reference) 10,20,50,100 dbar (m) (TD301R only)*
Resolution: 0.0001 dbar (m)
Accuracy: +/- 0.01% FS
Response time: 0.1 sec

Temperature:
Range: -2 to +40'C
Resolution: 0.001'C
Accuracy: +/- 0.01'C
Response time: < 0.2 sec

Memory: *CMOS SRAM*
Capacity:
TD301/TD303: 44000 data sets of TD (ring memory)

Data output: *RS232 ASCII code. 1200-9600 baud, 1 start, 7 data, 1 stop, even parity or 1 start,8 data, 1 stop, no parity selectable via menu*

Interval:
Programmable: 1 sec to 180 min.
Burst mode: 5 Hz w/programmable data formats

Real time clock: *+/- 2 sec/day*

Integration time: *Programmable: 0 - 100sec*

Material: *Vacuum molded polyurethane and Titanium*

Power supply:
TD301: 2 lithium AA-cells 3.6V
Recommended type:
SAFT LSH 14500
(Sufficient for 1.000.000 data sets)
TD303: External power supply 10 - 30 VDC

Current consumption:
Active: < 10 mA
Quiescent: 60uA

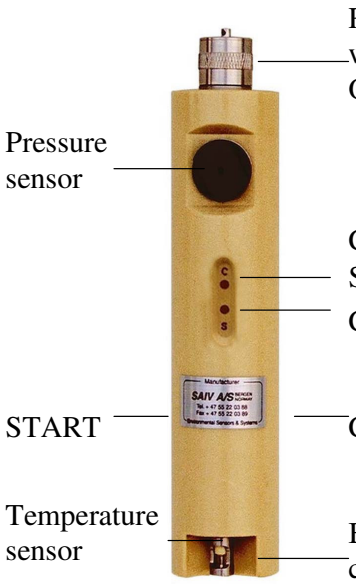
Dimensions:
TD301/TD303: Length 170 mm. Diameter 45 mm

Weight:
TD301/TD303: In air: 0.5 kg. In water: 0.3 kg

Accessories:
common: MiniSoft SD200W program diskette
Operating Manual
TD301/TD302 On/Off magnetic key,
PC communication cable (2,5m)
TD303: Connector and 1.5m pigtail

Warranty: *Two years against faulty materials and workmanship.*

Pressure/depth sensors/recorders models TD301 and TD303 OVERVIEW

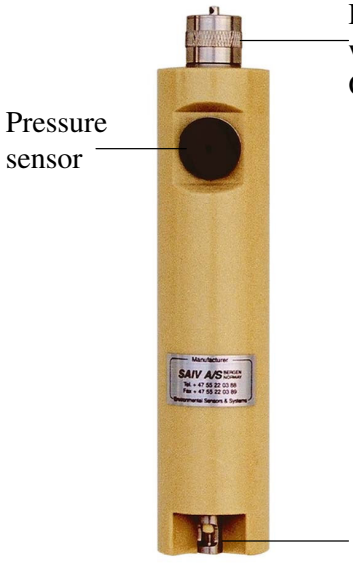


TD301

TD301

Dimensions:	*overall length*	*170 mm*
	diameter	*45 mm*
Weight:	*in air*	*0.5 kg*
	in water	*0.3 kg*
Power supply:	*2 lithium AA-cells 3.6V. Recommended type: SAFT LSH14500*	
Material:	*vacuum molded polyurethane and titanium*	

Note! *When changing battery, remember to connect the PC cable. See Chapter 8. (Maintenance and change of battery)*



TD303

TD303

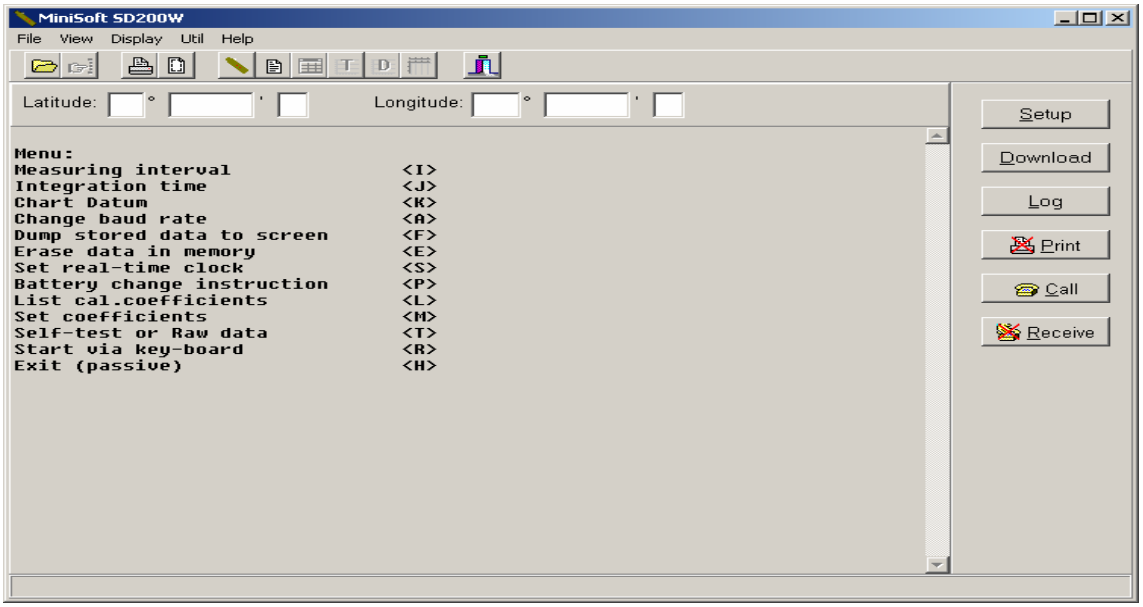
Dimensions:	*overall length*	*170 mm*
	diameter	*45 mm*
Weight:	*in air*	*0.5 kg*
	in water	*0.3 kg*
Power supply:	*External 10 – 30 VDC*	
Material:	*vacuum molded polyurethane and titanium*	

✓ BRIEF FUNCTIONAL DESCRIPTION

- ***Read/change sensor status***
- ***Start measurements***
- ***Stop running measurement***
- ***Memory capacity***
- ***Read recorded data into your PC***
- ***Real time monitoring via cable***

To take full advantage of this chapter, it is recommended that one is familiar with the content of Chapter 5.

Read/change sensor status:
When connected to PC, the sensor may be started/stopped via keyboard by holding <I> (5sec) or manually operated by activating the magnet sensitive switch marked START.
Awake status is indicated by light from the S-lamp. The sensor remembers its latest programming and will show this status on the screen. If that is the desired interval, the sensor is ready for use. Otherwise, do changes according to menu.



The various functions of the menu are self-explanatory. A description of functions is given on page 3.01 (Sensor menu explanation). If the menu is left unused for more than 1 minute, the sensor will turn passive automatically. (as if <H> was pressed)

Start of measurements:
Hold the Mag-Key on START and when the S-lamp starts to flash, confirm start by holding the Mag-Key on CONFIRM. Start is confirmed immediately by a short flash in the C-lamp. The data is now measured and stored at the pre-set interval. The C-lamp flashes (0.5sec) each time a new recording take place.

Continued next page.

Stop a running measurement series:
Stop a running series by holding the Mag-Key on CONFIRM and then on START.
The C-lamp will flash for a few seconds, after which the TD301 enters passive.
For the TD303 hold <I> (5sec).

Memory capacity:
The storage memory is sufficient for 12 hours (TD301/TD303) of continuous recording of TD data at 1 second interval. At longer intervals, multiply by the chosen interval in seconds to find total recording capacity in hours. F.ex. at interval 5 sec: 12x5 = 60 hours TD301 or TD303.
When the memory is full, the oldest data will be over written in TD301/TD303
To erase memory see Chapter 3.

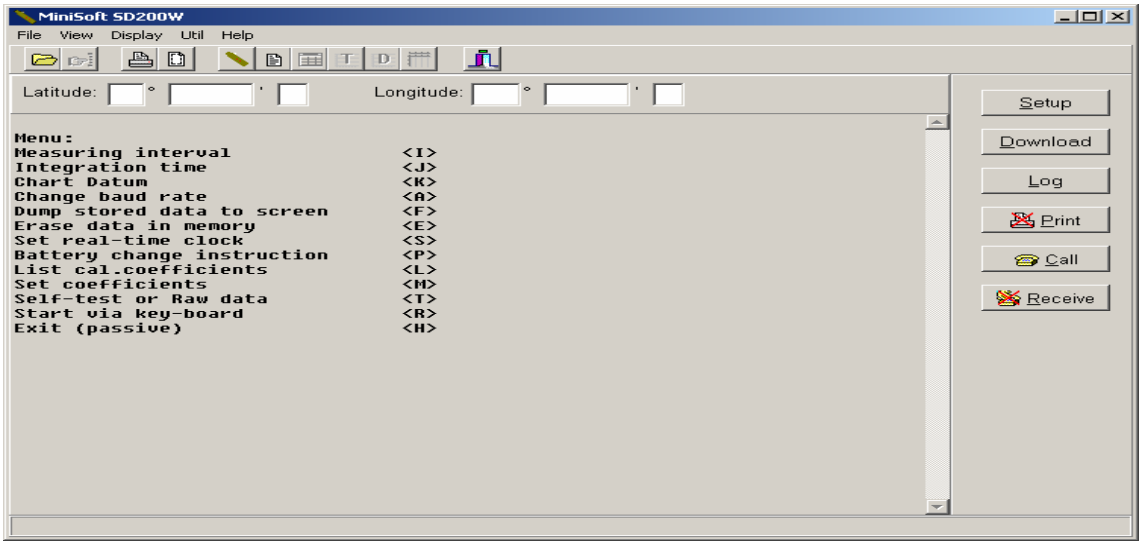
Read recorded data into your PC:
Click **Download.** A sub-window appears, and data from the sensor are downloaded to your computer. When all recorded data have been received, the program requires a filename. The cursor is already in correct position. Just write a filename without extension, f.ex. <myfile>, and click 'OK'. The file will be stored with the extension .sd2 (<myfile.sd2>).
After the sensor has transferred the data, it returns its menu to the PC screen. Wait until the menu is complete, then press <H> to switch the sensor back to passive. Remove the sensor cable.
For detailed information on processing of data see Chapter 5 (MINISOFT SD200W).

Real time monitoring via cable:
The TD301/TD303 can provide on-line data in physical units at baud rates from 1200 to 9600, at the intervals; 1 sec to 180 min.
For further operating details see Chapter 4.

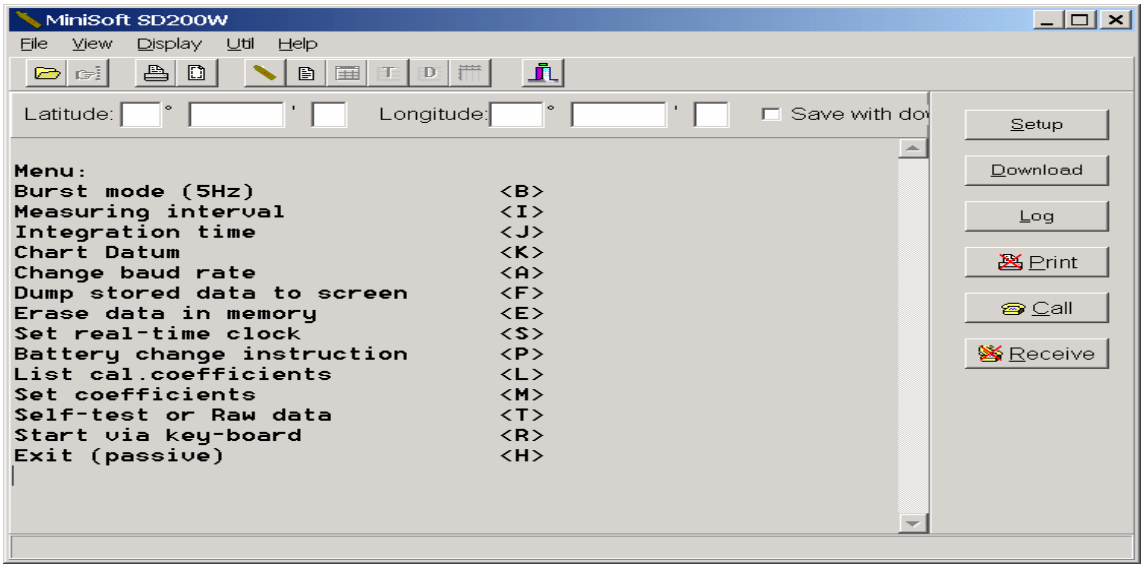
✓ SENSOR MENU EXPLANATION

Connect the TD301/TD303 to your PC with MINISOFT SD200W installed. Wake up the sensor and wait 10 seconds (TD301) or press <M> (TD303). Menu will appear as follows:

Menu TD301



Menu TD303 (Burst mode added)



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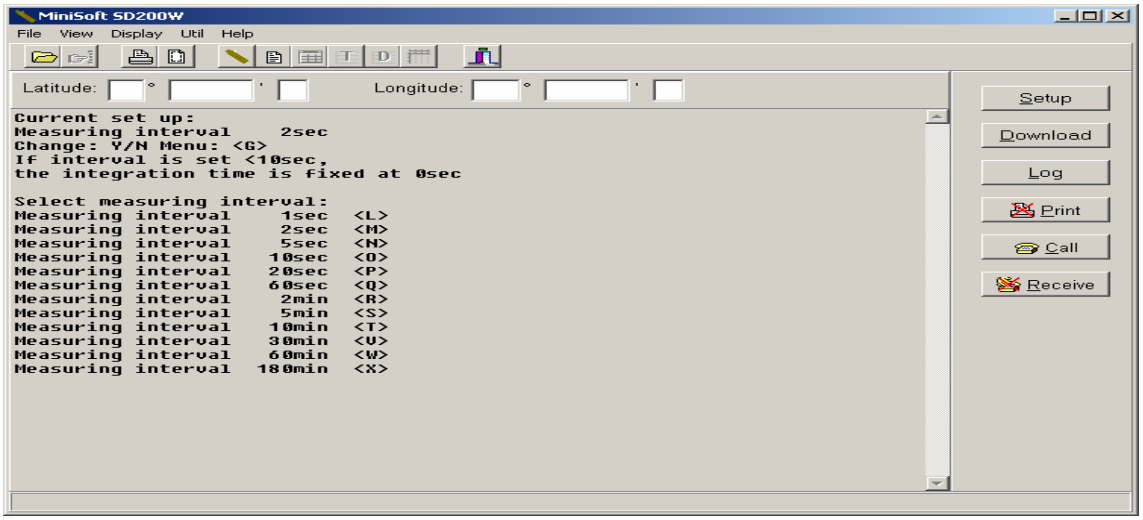
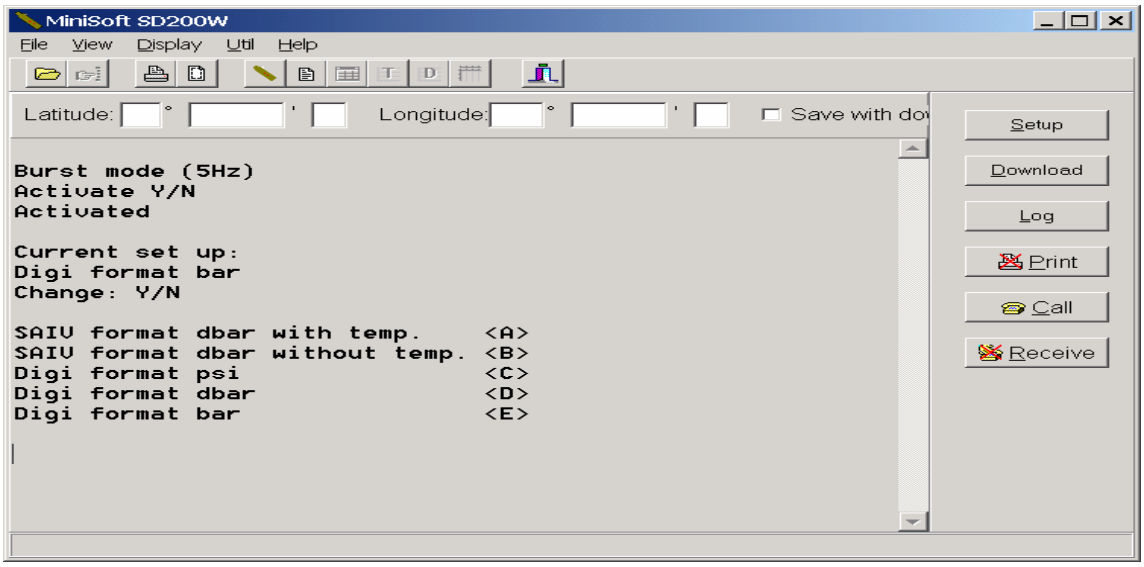
Measuring interval <I>



Select the actual interval by pressing appropriate key.

Burst mode <B> TD303 only (TD301 on request)



In “burst mode” the TD303 runs at 5Hz sampling. In this mode data are not recorded in internal memory, except in”**SAIV format dbar with temp**” a record of pressure and temperature is recorded every 15 seconds.
A choise of 5 output formats are selectable.

Continued next page.

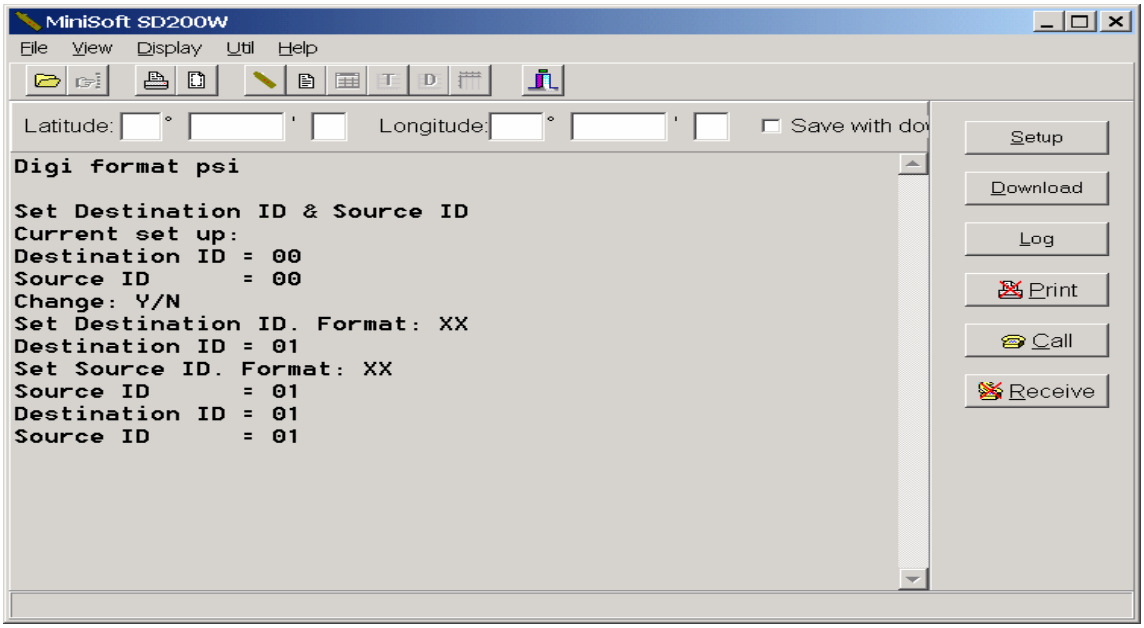
Output formats:

Saiv format dbar with temp.
P 0000.012 (5Hz continously with temp interrupt every 15 second)
N00001 T+10.035 P 0000.011 (every 15 second)
P 0000.011
-
-

Saiv format dbar without temp.
P 0000.012 (5Hz continously)
P 0000.011
-
-

Digi format psi/dbar/bar.
*01010.067 (5Hz continously)
*01010.065
-
-

In Digi format the 2 first digits are ”Destination ID” and the 2 next are “Source ID” (default is 0101)



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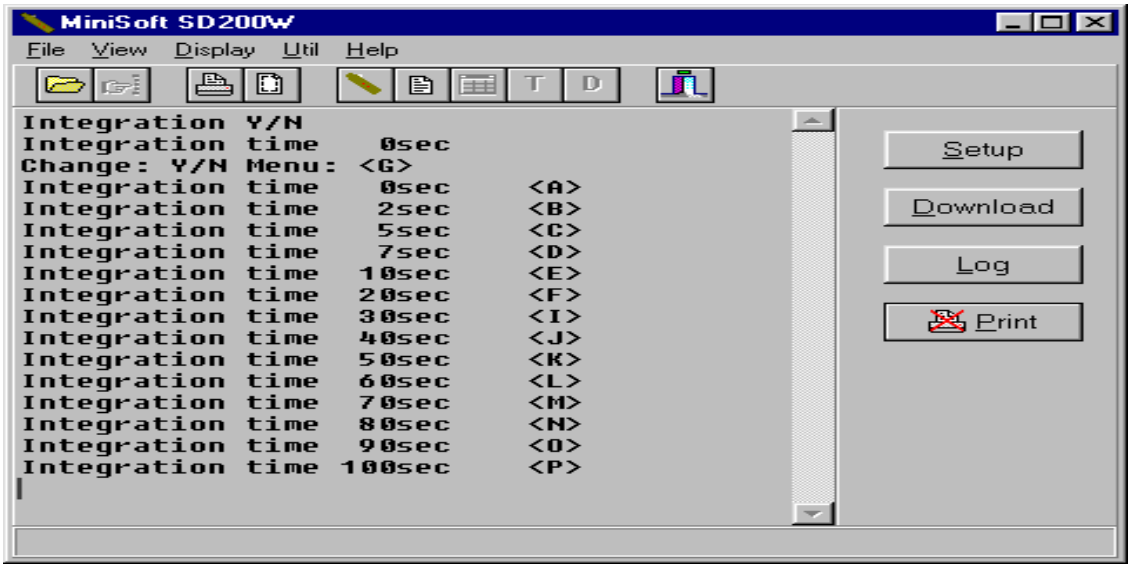
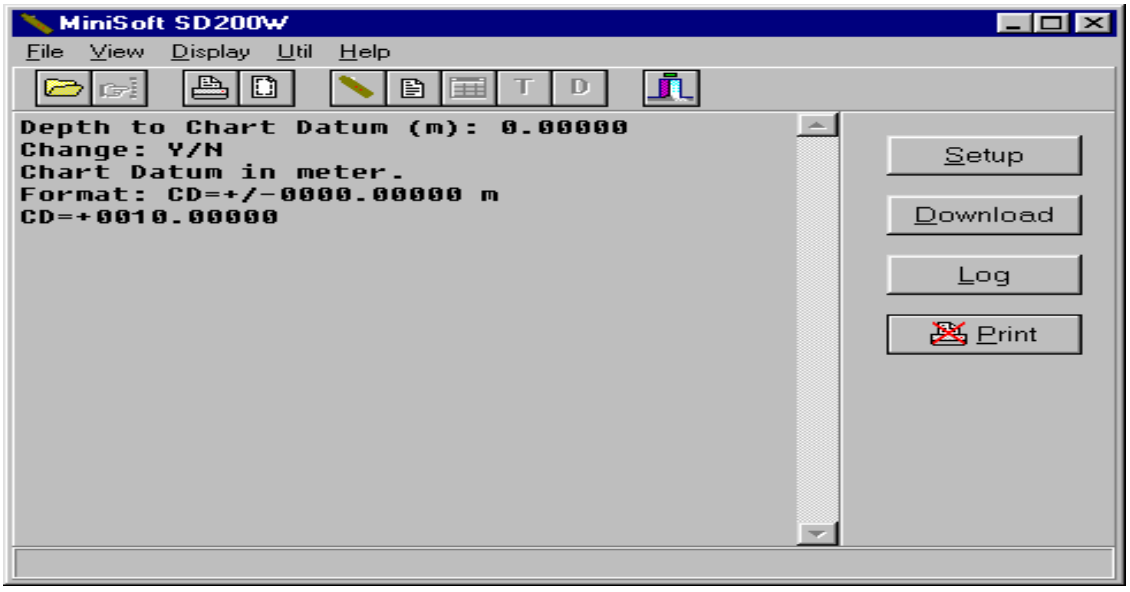
Integration time <J>



Select the actual int. time by pressing appropriate key.

Chart Datum <K>



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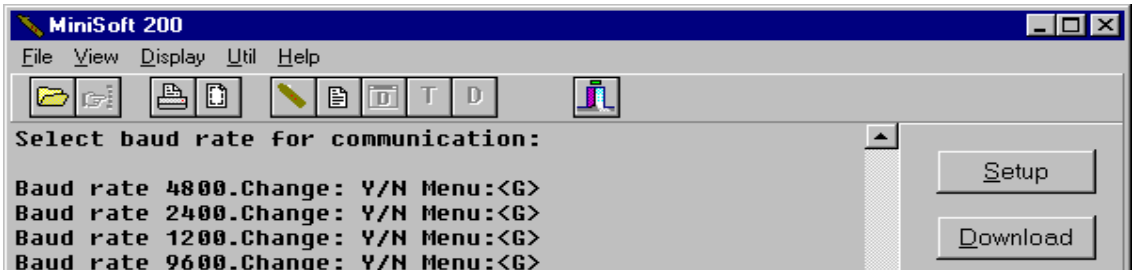
Change baud rate <A>



Note:
A new selected baud rate will be operative only after the sensor is turned passive or a start via key-board is executed. <R>.
Baud rate 4800 is the default rate.

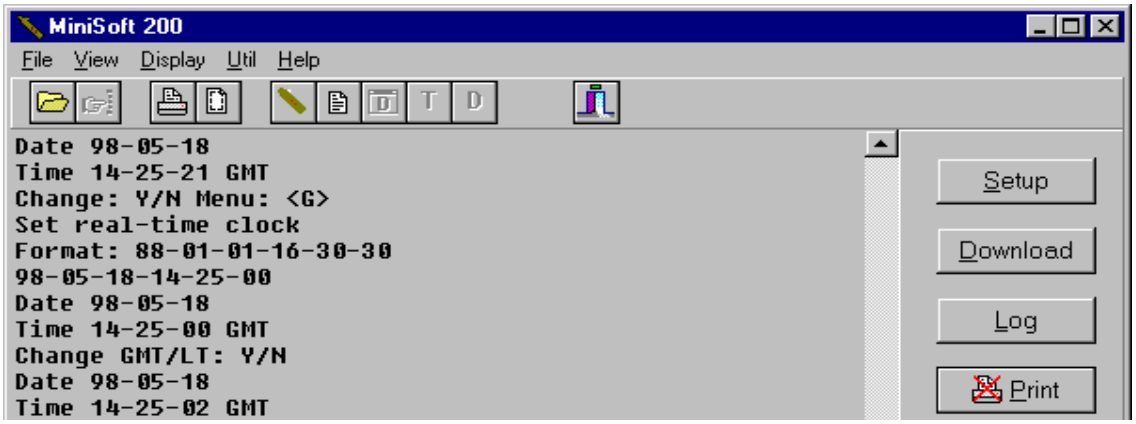
Dump stored data to screen <F>

This command will send a copy of the recorded data to the PC screen.

Erase data in memory <E>

To erase data press <E>.

Set real-time clock <S>



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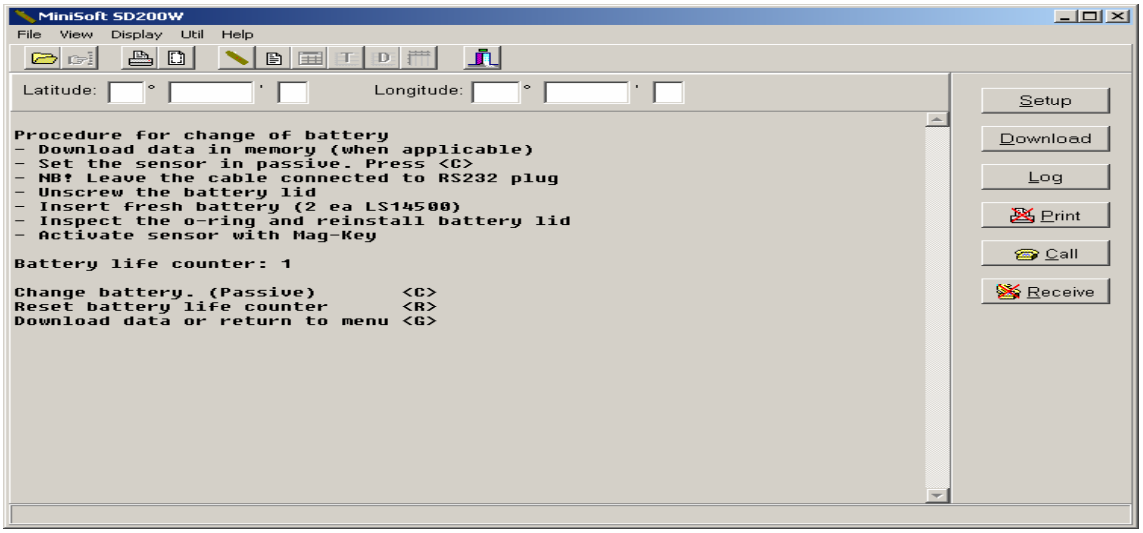
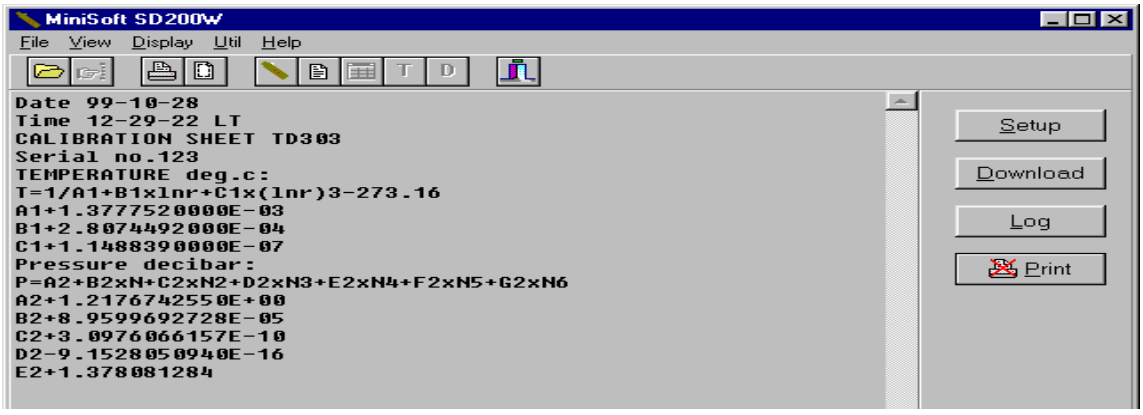
Battery change instruction <P> (TD301)

The battery life counter increments itself by one count each time a measurement is made. By this, a rough estimate of the remaining battery capacity can be obtained. It is recommended to change battery when the counter reach 1.000.000. The battery life counter status is shown by pressing <P>.
When changing battery, press <C> to make the sensor passive. To reactivate after installing fresh battery, use Mag-Key on **START**, return to **Battery change instruction** and reset **Battery life counter** <R>
Note! During battery change procedure the cable should not be disconnected from the sensor.



List cal. coefficients <L>

Press <L> and the coefficients will appear in form of a calibration sheet. (size A4)



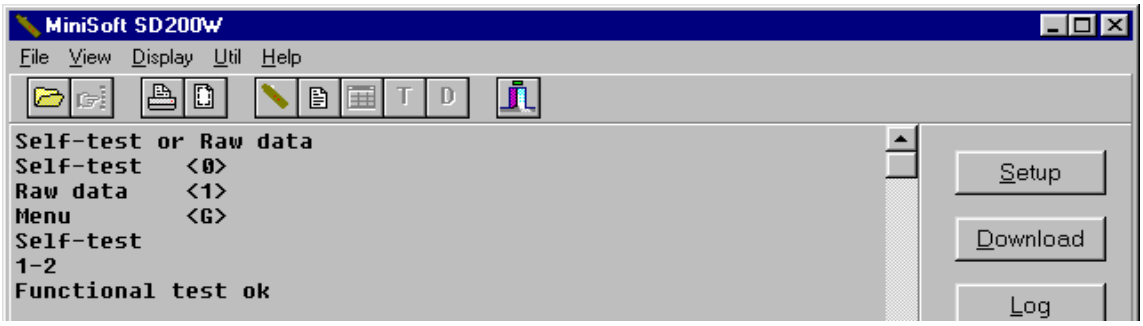
The calibration sheet shows all valid calibration coefficients used by the sensor to calculate the variables in physical units. Keep a copy of the calibration sheet for your own reference. For printout see Chapter 5 (MINISOFT SD200W PROGRAM.)

Continued next page.

If one or several calibration coefficients become faulty, e.g. due to incorrect procedure during change of battery, the sensor will calculate incorrect data. Incorrect coefficients can be corrected. See 'Set coefficients.

Set coefficients <M> (mainly for factory use)
Each of the coefficients in the calibration sheet is presented one by one followed by a 'change Y/N' press <N> to proceed to next coefficient. It is possible to correct a specific coefficient, press <Y> and type the correct coefficient including correct sign. If you make a formal error (a missing sign, missing digits etc).-the sensor will demand a repeated entry.

Self-test or Raw data <T>



Self-test
This is a functional test of the electronic circuitry and components, current consumption, memory addresses and all uP-functions. The test runs in 2 steps and when completed, the result is shown in clear text on the screen.

Raw data
The sensor will present unprocessed digital numbers for each transducer at a fixed interval of 5 seconds. (mainly for factory use.)

Start via key-board <R>
When pressing <R>, all settings made via the menu are latched into the internal memory, and the sensor immediately starts measurements according to selected mode and interval.

Exit (passive) <H>
When pressing <H>, all settings made in the menu are latched into the internal memory, and the sensor turns passive.

Note: The sensor will turn passive if the PC keyboard is left unused for more than one minute.(the sensor will react as if <H> was pressed) To bring up the menu again, simply hold Mag-Key on **START** or hold <I>.

✓ FIELD OPERATION

To prepare the sensor for measurement:

- ***Make sure that the sensor is programmed to wanted mode and time interval.***

The sensor remembers its latest settings, and if no change is wanted, it is ready for use.

If you want **to change the settings**, connect the TD301/TD303 to your PC and activate the MINISOFT SD200W program, see page 2.01. (Read sensor status)
Activate the sensor (Mag-Key on **START** or hold <I>). The sensor status will appear. Wait 10 seconds for sensor menu, and do the wanted changes. F. example:

Press <I> if you want a new measurement interval.
Press <E> if you want to erase memory.
After each executed command the menu will return on the screen.

Once the sensor has been programmed to the desired settings, it is ready for deployment. Only the Mag-Key is necessary for operating the TD301 in the field.
When the first measurement in a series is taken, the pressure data from this measurement is deducted from all the subsequent pressure measurements in that series. Since the first measurement is the air pressure at/near surface level, the subsequent recorded pressure data will be the net water pressure. The recorded air pressure will be shown in the heading for each series together with date, time and recording interval etc.
In on-line configuration on/off switching and setting of air pressure is operated via the key-board.

Profiling with TD301:
Deploy the sensor until the maximum wanted depth has been reached and pull the sensor back to the surface. An 'upcast'/'downcast' speed of < 1.5 ms is recommended.
When the sensor has been brought to the surface, stop it (Mag-Key on CONFIRM).
The C-lamp will flash for a few seconds and then go passive.
The data are recorded as series in the sensor memory. You can continue taking new series from other stations by giving a new start and stop command for each one of them.
Recorded data from the individual stations (i.e. data recorded between two successive starts and stop-commands) are organised as successive data series in the memory with sensor serial number, date and time for each new start. Each set of data is proceeded with a progressive number. The MINISOFT SD200W program will keep track of all series and organise the readout series by series.
When memory of TD301 is full, oldest data will be over written. (Ring memory)

Continued next page.

Real time monitoring via cable
The TD301/TD303 provide on-line data in physical units at baud rates from 1200 to 9600, at the intervals; 1 sec to 180 min.
The model TD303 is designed for on-line use, e.g. ROV etc, and has an extra feature of 5Hz sampling (burst mode) with programable output formats to suit the host unit.

Output format:
Output: RS232 ASCII code 1 start, 7 data, 1 stop, even parity
Output: RS232 ASCII code 1 start, 8 data, 1 stop, none parity

TD301/TD303
TD N00001 T+20.931 P 0010.020

TD303 Burst mode: See output format in chapter 3

Data can be presented on the PC with MINISOFT SD200W and simultaneously recorded in the sensor. The manufacturer will provide cable of needed length on order.
(Max length 1000/500m with baud rate 4800/9600, respectively)

The MINISOFT SD200W contain the facility to accept real time GPS data in NMEA format via an RS232 port on users PC. To activate this function click the 'Display' in the tool bar of the MINISOFT SD200W.

For long term operation of a deployed sensor the manufacturer can provide a special cable for external power. In a fixed deployed position, the operator will not be able to interrupt the TD301 with the Mag-Key. For this reason the sensor can be started/stopped via keyboard by holding <I>.
Be aware that, when the TD301 is started with the cable connected, it will not update the air pressure, but use the latest stored value from latest start without cable.
If you want to update the air pressure, remove the RS232 plug and start a new measurement (see page 2.01), and then connect the plug again after first measurement is completed (C-lamp blinks once).

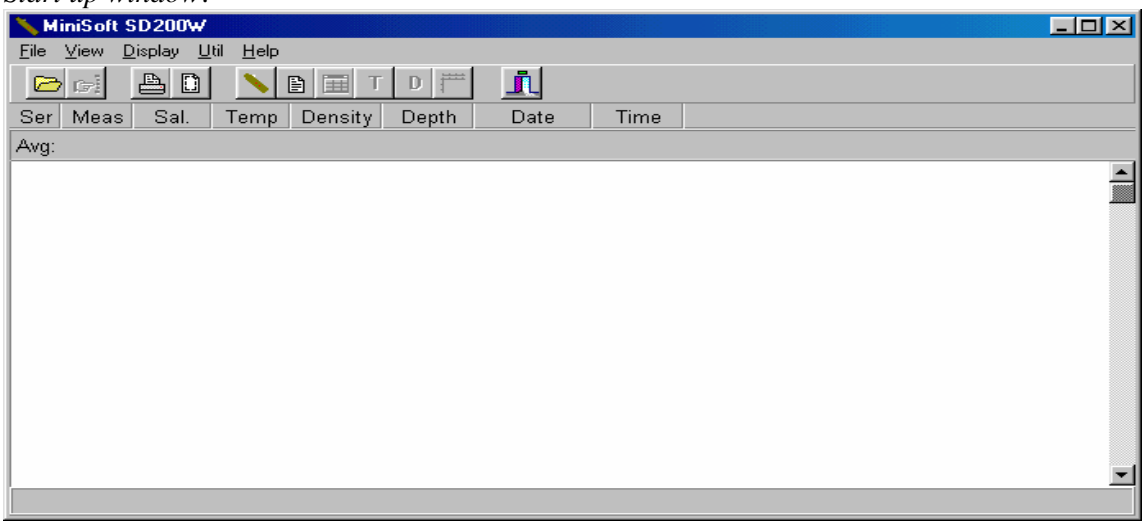
The TD301/TD303 is equipped with an additional feature for manually setting of Air pressure. Simply hold the <I> until submenu appears. This feature is especially made for using the TD301/TD303 on an R.O.V. or on an on-line profiling system.

Remote readout and monitoring
For remote readout and monitoring, the manufacturer offers several options: Communication Unit CU901, for two-way communication via Iridium satellite, GPRS with embedded web server, GSM and UHF/VHF.

✓ MINISOFT SD200W PROGRAM

MINISOFT SD200W is a windows based program for downloading data from SD200/TD300 series of MINI STD/CTD/TD instruments/sensors. This program combines both communication and data processing functions. The program organises the data into PC-files, and provides versatile processing functions for listing and graphical presentation of the data. Options for organising the data versus standard depth(meters/pressure(dbar), selection of upcast/downcast etc. are included in the program.
The program is supplied on CD. File name: SD200W.exe.

Start up window:



Put the mouse pointer on the symbols, and they will explain themselves.

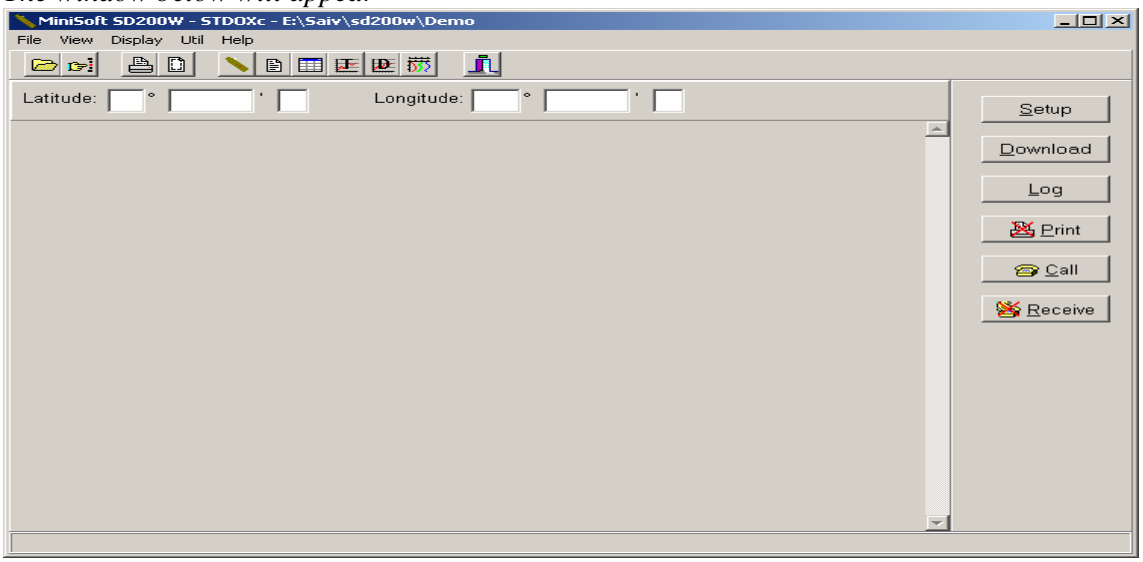
The basic use of SD200W are:

- ***Communication mode (with the sensor).***
- ***Downloading of data.***
- ***Processing of data files.***
- ***Graphs.***
- ***Multigraph***
- ***Multigraph ‘ On- line plot’.***
- ***Real time data via telephone line.***
- ***Export of data files.***

Continued next page.

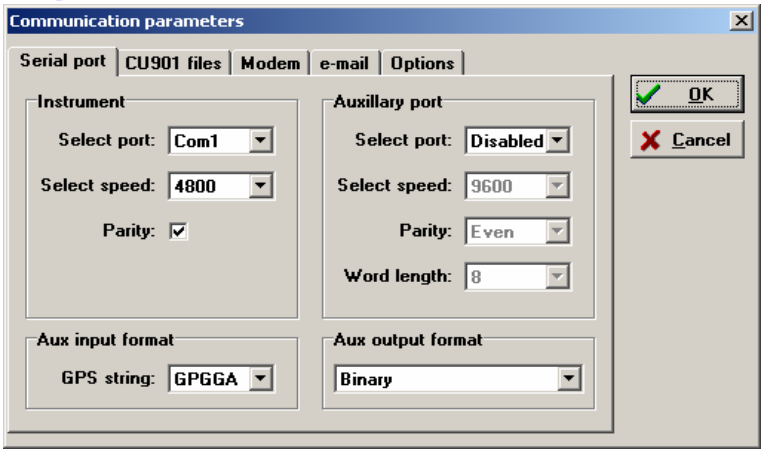
Communication mode: Click the instrument symbol button 

The window below will appear



Connect the TD301/TD303 with its cable to a COM port of your PC.

Setup button.



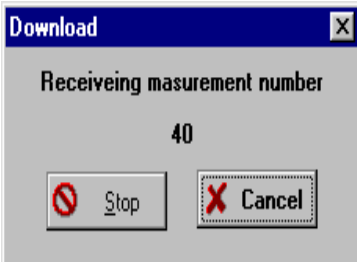
Enter the selected COM port (usually COM1 or COM2). Also control that the baud rate is correct. (Normally baud rate is 4800, but the TD301/3 can be set to 1200/2400/4800/9600). Click 'OK'

Start the TD301 with the Mag-Key, and wait 10 seconds until the sensor menu appear on your screen, (for TD303 hold <I> and press <M> to get the menu). Your PC operates now as a simple terminal and you can communicate directly with the sensor according to its menu. See Chapter 3 (Sensor menu explanation).

Download button

Start the TD301 (Mag-Key), and wait 10 seconds until the sensor menu appear on your screen. (TD303 hold <I> and press <M>).When the menu is completed, click **Download** button.

Continued next page.



A sub window appears, and data from the sensor start to flow to your computer disk. When all recorded data have been received or stop has been activated, the program will ask you to type a filename.
After the sensor has transferred the data, it returns its menu to your PC. Wait until the menu is complete, then press < H > to switch the sensor back to passive.

Log button

If you want to store the real time data in a file, click the **Log** button prior to starting the sensor. Data will be stored and only the record number is shown on the screen. Click the **Close** button to stop storing, and write filename. The extension «.sd2» is automatically added to the given filename. Stop the sensor with the Mag-Key on CONFIRM and than on START. (The C-lamp will flash for a few seconds, after which the TD301 enters passive).

Print button

It is possible to obtain a printout (hard copy) of the calibration coefficients (Calibration sheet). First click the **Print** button (the X will disappear). Then press <L> in the sensor menu. When the calibration sheet is completed, click the **Print** button again.
If you want to view data in real time as they appear from the sensor, start the TD301. When S-lamp starts to flash, confirm start (Mag-Key on CONFIRM). Data are simultaneously shown on the screen and recorded in the sensor memory.

Call & Recive button

These buttons are for communication with, and collection of data from remote stations equipped with telephone,GSM or Iridium satellite terminal/modem. See manual for Communication Unit CU901

Processing of data files.

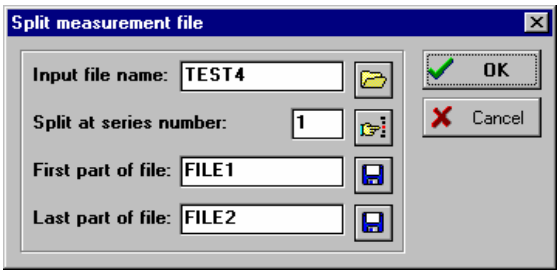
Navigate on A- or C- drive until you find the wanted file name. If your file contains more than one measurement series, select the series you want to process.
In normal use, the TD301/TD303 is started and stopped outside water. Therefore, after starting the sensor and before stopping it, several measurement may have been recorded in the air. The program has already identified all measurements in the actual series and tagged all where the sensor is in the air or the depth is less than a few cm. Now it suggests that you exclude these measurements from the series, and you may just 'OK'. If you want to overrule, then alter the suggested measurement numbers, 'First' and 'Last' boxes.

Split data file.

When you download data into your PC, all data in the sensor memory at the time of readout will be loaded into a common PC file. If the file contains unwanted or duplicated data series, the option enables you to split the file into two new files.

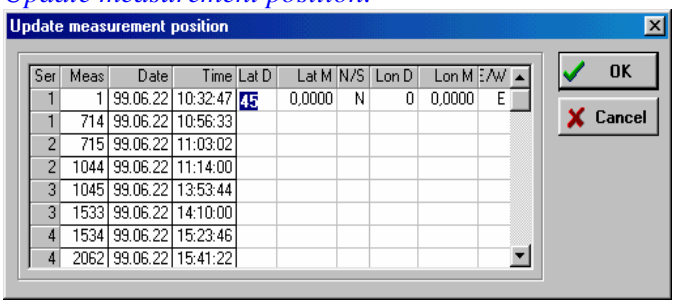
Click **Util** and select **Split data file.**

Continued next page.



- *Click the file button and choose the wanted file.*
- *Type the number of the series to be split.*
- *Click the appropriate button and type new file name 'First- & Last part'.*
- *Click 'OK'*
- *The original file is kept unchanged.*

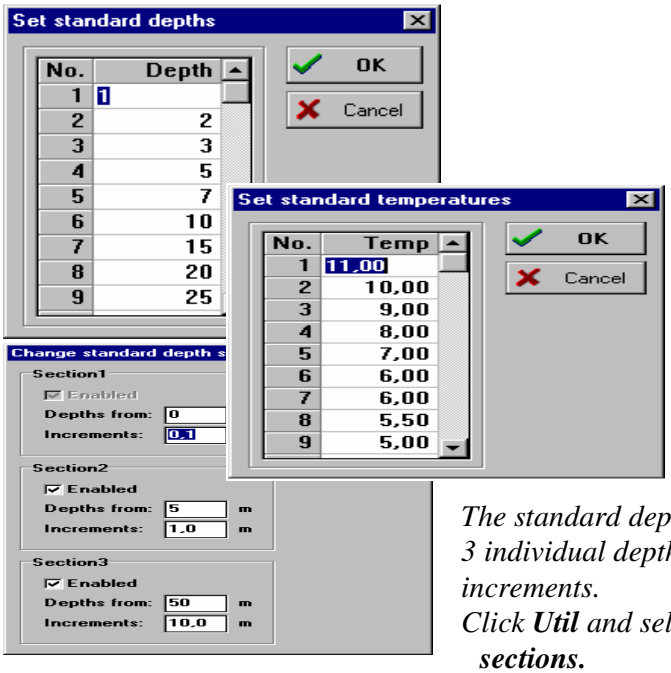
Update measurement position.



To update position in a chosen file; Click **Util** and select **Update measurement position.** Each series will have the position presented in heading of the graph. The position is also used for calculating real depth, see *Pressure or depth*

Change standard depths/temperatures.

The TD301/TD303 measures at specified intervals. To obtain data from selected standard depths/temperatures, the MINISOFT SD200W calculates the most probable standard values by a linear extrapolation between records just above and just below each standard depth/temperature.



The MINISOFT SD200W comes with a set of default standard depths/temperatures. Each selected standard depth/temperature can be confirmed or replaced by alternative values. The selection will be valid until a new change is made.
*Click **Util** and select **Change standard depths** or **Change standard temperature .***

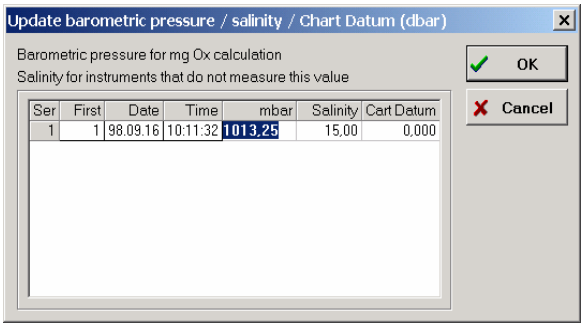
The standard depth can also be selected for up-to 3 individual depth section having different depth increments.
*Click **Util** and select **Change standard depths sections.***

Continued next page

Update barometric pressure/salinity/Chart Datum.

For instruments/sensors that not measure salinity, it is possible to manually set the salinity to obtain correcter density and depth calculation.

Click **Util** symbol and select **Update barometric pressure/salinity/Chart Datum**.



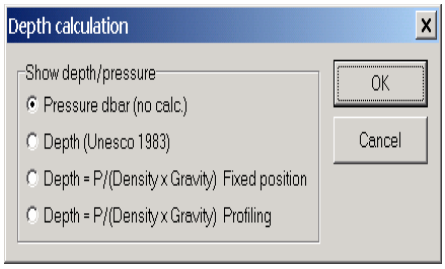
A sub window appear and you may set salinity.

Calculate density for TD instrument.

Click **Display** symbol and select **Calculated density for TD instrument**.

Pressure or Depth.

Whether to present pressure (dbar) or real depth (meters) is selectable. To choose the one or the other, click **Display** and click on **Depth calculation**



The depth in meters is calculated from the measured pressure and temperature, salinity and gravity at the position. The gravity is derived from the latitude. If the position is not known, the program will use nominal gravity 9.80665.

To install latitude se page 5-04 *'Update measurement position'.*

Note:

1) When "Depth (Unesco 1983)" is selected, fixed salinity of 35 ppt is used.
2) When "Depth=P/(Density x Gravity) Fixed position" is selected, the actual density at the measuring point is used.
3) When "Depth=P/(DensityxGravity) Profiling" is selected, the average density of all measurement above is used (weighed profile)

GPS position.

Click the **Display** symbol and select **GPS position** Position will be shown in real time if GPS receiver is connected.

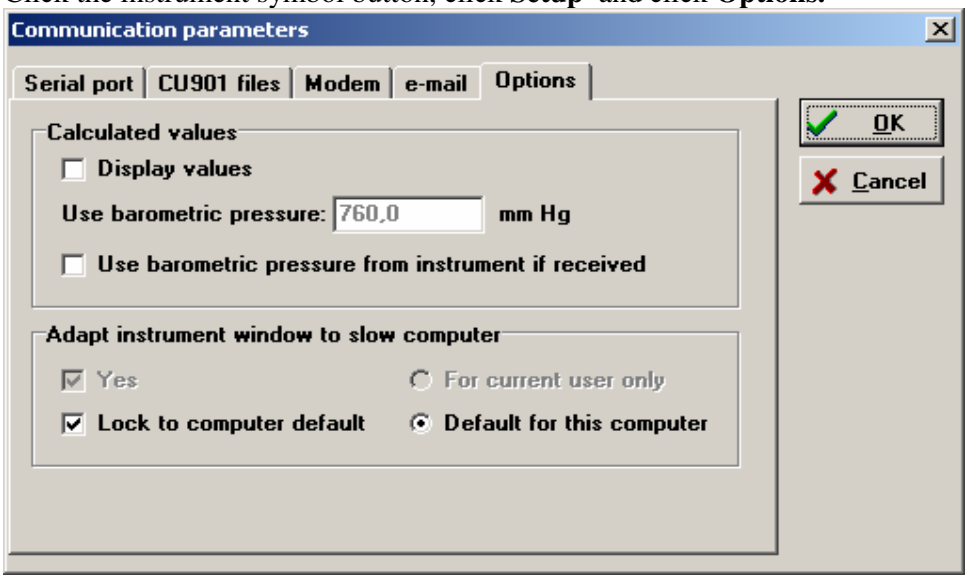
Average values.

Click the **Display** symbol and select **Average** Calculated average values for the chosen series will be shown as heading in 'list file. (**Only selected series)**

Continued next page.

Display of calculated values. (On-line feature)

Click the instrument symbol button, click **Setup** and click **Options.**



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Graphs.

- ***Temperature/time***
- ***Temperature/depth***
- ***Depth/time***
- ***Multigraph***
- ***Multigraph 'On-line plot'***

Recorded data may be presented as a function of time or depth.

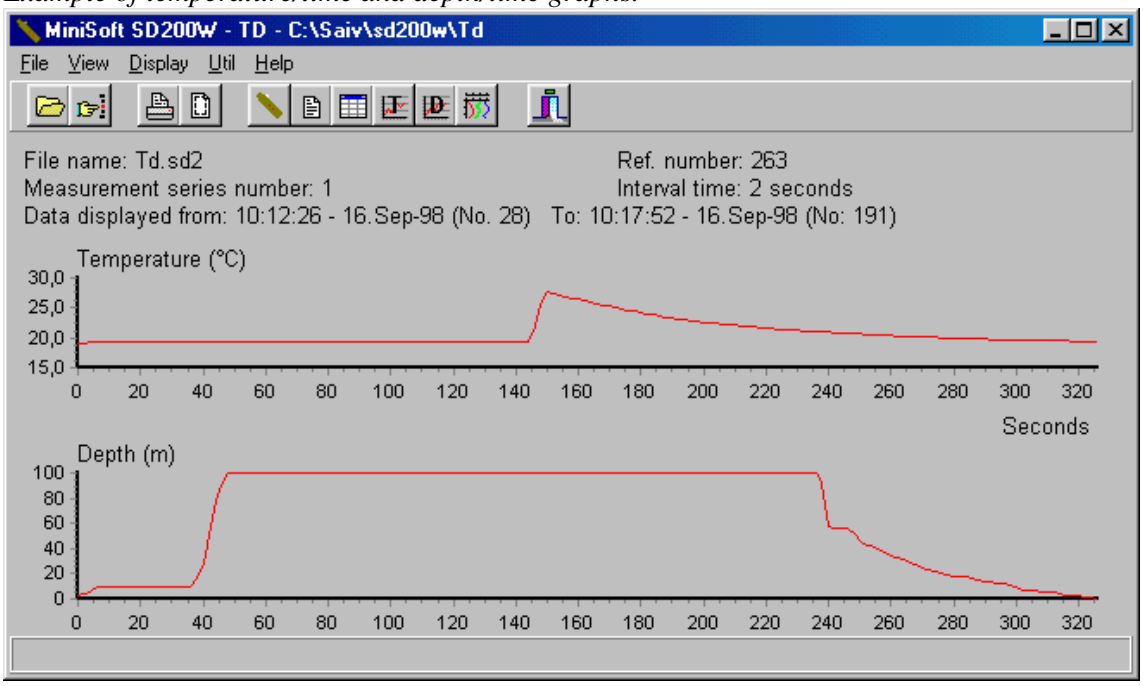
For function of time; click the symbol button: **T**

For function of depth; click the symbol button: **D**

Note 1: You may alternate between different tables and graphic presentations in a fast and simple way by placing the mouse pointer inside a data or graphic window, and click the right mouse button. A list of available presentations appears. Click the presentation you want, and the display will immediately jump to the selected presentation. Make a hard copy of a display at any time via print command.

Note 2: To display the co-ordinates for any point on a graph, place the mouse pointer on the desired point and click the left mouse button twice.

Example of temperature/time and depth/time graphs.



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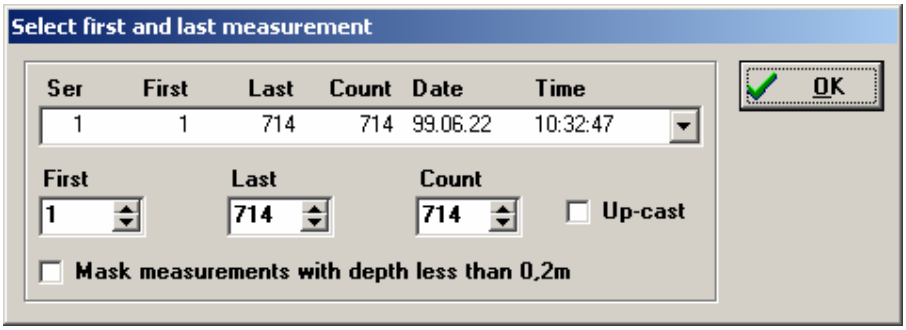
Upcast/Downcast.

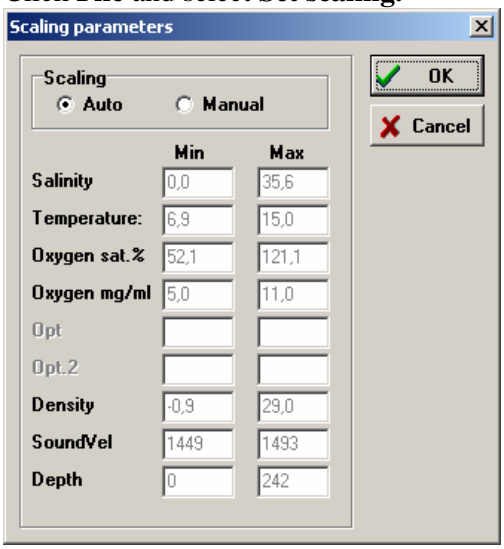
If the selected variables are a function of depth you can select the graphic processing either from surface and down to maximum depth (downcast) or from maximum depth to surface (upcast). If **Up-cast** box is not activated, default is downcast. The selection is shown on the graph.
Click **File** and select **Set range**. Select **Up-cast** and click 'OK'.



Scaling of graphs.

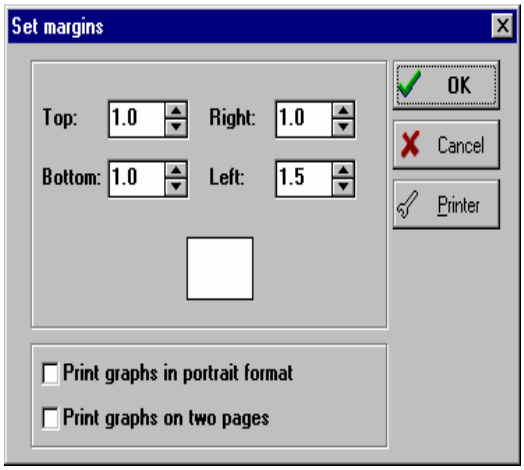
Automatic scaling is standard.
If other scaling is wanted:

Click **File** and select **Set scaling.**



Printout format.

Printout format can be set; standard- or portrait format and presentation on one or two pages.
Click **File** and select **Page setup**.



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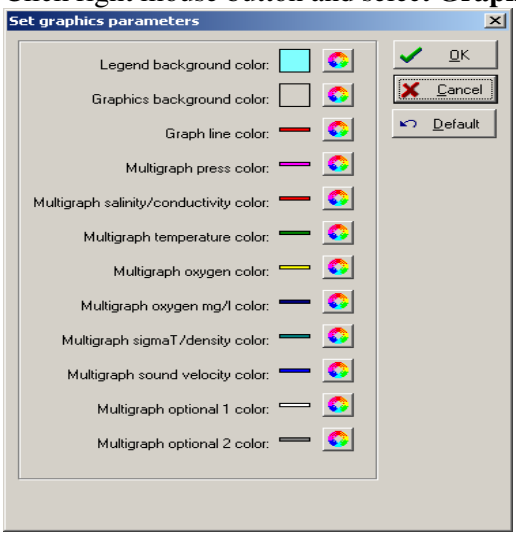
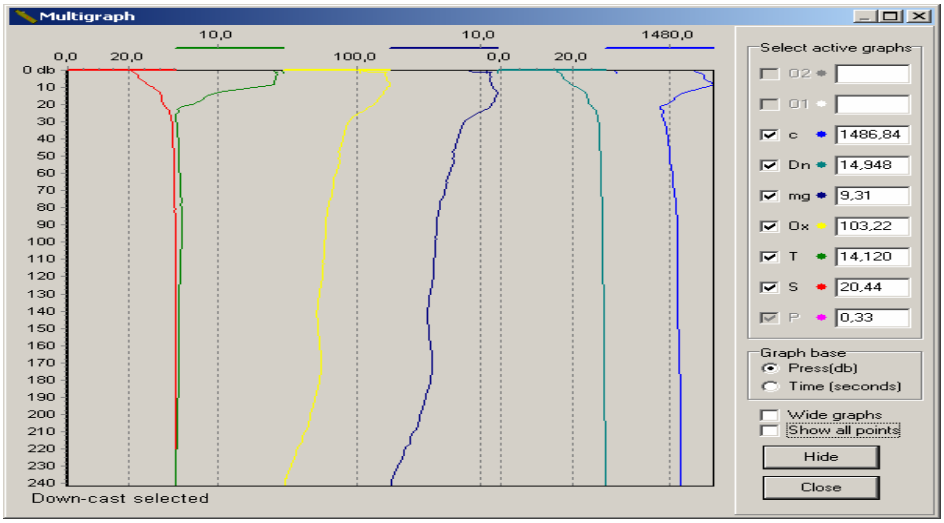
Graph color settings.

If other color is wanted:

Click right mouse button and select **Graph color settings**



Multigraph: Click the multigraph symbol button 



The desired parameters are

activated at the right side of the screen. The last received parameter value is shown in the adjacent box.

Graph base: Select depth or time for the y-axis.

Wide graph: *Activated:* All parameters will use full width of x-axis.

*Deactivated:*Each parameter will have individual x-axis

Continued next page

Zoom in:
Place the mouse pointer in the desired area, press left button and move downwards toward right side and release button. Repeat one or more times to increase resolution.

Zoom out (return to normal):
Use mouse pointer as for 'Zoom in' but move upwards toward left side.

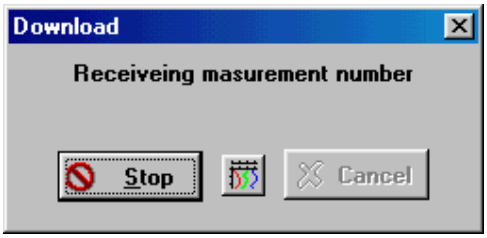
Scroll:
Press right mouse button and use the 'hand' to move the displayed area up/down

Multigraph 'On-line plot':

To activate, press instrument symbol 

Press **Log.**

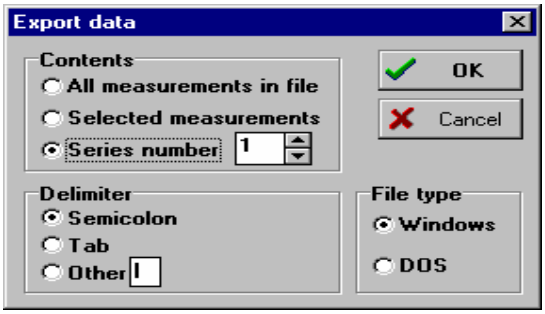
Start the instrument. Following box will appear.



Press the **Multigraph button**
Further options are as described under **Multigraph** above.

Export of data files.

File for Excel and similar



Click **File**
Click **Export** and select **List** the sub menu will appears.

Note: The delimiter setting must be the same in
both exporting and importing programs.

DESCRIPTION OF SENSORS

TEMPERATURE SENSOR
The temperature is measured by a thermistor (Fenwall 112-102 EAJ-B01). The thermistor resistance Rt depends on the temperature according to the equation:

T = 1/(A1+B1x ln(Rt)+C1x (ln(Rt))^3-273.16)
T is temperature in degree C.

Fast response is obtained by mounting the thermistor element in a heat conductive compound inside a silver tip at the top of a stainless steel prong. The prong extends appr. 17mm off the sensor body. The base of the prong is made of material with low heat conductivity. By this combination of material properties a time constant of less than 0.5 s is obtained.

PRESSURE TRANSDUCER
The transducer is based on a piezoresistive element. The element is basically temperature sensitive. A highly accurate temperature compensation is obtained by a built-in advanced algorithm and a set of individually calibrated temperature coefficients.
The transducer measures the absolute pressure (atmospheric pressure plus water pressure) or pressure with reference to air pressure. To obtain recording of net water pressure using absolute pressure type, the actual air pressure can be set manually or the sensor can be started without cable connected. When the first measurement in a series is taken, the pressure data from this measurement is deducted from all the subsequent pressure measurements in that series. Since the first measurement is the air pressure at/near surface level, the subsequent recorded pressure data will be the net water pressure.
A protective cap with a small hole in the centre (pressure port) covers the diaphragm of the transducer.

Note! When the TD301 is started with the cable connected, it will not update the air pressure, but use the latest stored value from latest start without cable. This feature allows remote start/stop of deployed sensor via cable without change of the stored air pressure measurement.

✓ CALIBRATION

TD Calibration Certificate with credentials is supplied with each sensor. See example.
The calibration coefficients is maintained in the sensor in non volatile memory, and can be displayed/hard-copied at any time.
Due to the excellent long term stability of the TD sensors and the electronic circuitry of the TD301/TD303, the sensor does not have to be re-calibrated for several years. However, for users requiring periodic confirmation of calibration, the factory offers an efficient and low cost calibration service. The calibration procedure and the reference equipment used at the factory are described on the Calibration Certificate as shown.
If owner wants to perform calibration on his own, the manufacturer will provide useful guidance on request.

Continued next page.

Calibration Certificate

Certificate no: *127*

Instrument: *Temp. & Depth Recorder TD301* Serial number: *127*

Range*:* *Pressure: 0-100bar* Temperature : *-2 - +40 degr.C*

Calibrated date: Certificate issued date: Env. temp (degr.C):

Calibrated by : ***SAIV A/S*** Customer:

Calibration procedure:
Temperature is calibrated by setting the sensor in three stirred, temperature stabilised calibration baths. Pressure is calibrated by connecting to a reference DWT and successively generate six pressures from 1 bar to FS. Raw temperature and pressure data are recorded and coefficients are calculated from least square equations and stored in the sensor's eeprom. (Coefficients: Pressure: A2,B2,C2,D2,E2,F2,G2. Temperature: A1,B1,C1)

TEMPERATURE degr. C		PRESSURE dbar	
Reading	Reference	Reading	Reference

All calibration coefficients are shown on attached calibration sheet

Working r**eferences:**
Temperature* Falmouth Scientfic Model OTM S-112 S/N 1377-09JUL96
Pressure** Budenberg DWT Model 280L S/N 9050

Traceable references:
Temperature:
Subreference 1:
General Oceanics ATB 1250 temp. bridge serial no 1235
(Working ref. Is controlled by subref.1 four times per year)
(Subref.1 is controlled by subref.2 twice per year)

Subreference 2:
Destilled water tripple point cell at +0.010 degr.C
Phenoxybenzene tripple point cell at +26.868 degr.C

Pressure Subreference:
Pressure reference at FIMAS Coastal Base Calibration Center

Control frequency: Once per year

Calibrated by .....
Signature .....

✓ MAINTENANCE AND CHANGE OF BATTERY

GENERAL

- **After use rinse the sensor with fresh water.**
- **Before leaving the sensor unused, check that the sensor is not still running. If unsure, give a stop command by holding the Mag-Key on CONFIRM and than on START, stop is visualised by the C-lamp flashing for a few seconds.**
- **Check that no water droplets are trapped inside the RS232 connector or cover cap. If necessary rinse with alcohol and let dry prior to mounting the cover cap.**
- **Keep the sensor in its standard case when not in use.**

Spray the sensor with fresh water after use, to avoid that crystallised salt deposits on the sensor surface.
Salt or silt deposit in the pressure port may block the input and thus affect the reading. Check that the pressure port is open, but take care not to harm the membrane inside.
The protective cap can be unscrewed for cleaning.

BATTERY, AND CHANGE OF BATTERY

The TD301 is powered by two AA-size lithium cells nominal voltage 3.6V. In principle all high quality 3.6V lithium cells can be used. However it is mandatory that the cells function equally well in all positions. Lithium cells with liquid electrolyte should be avoided because such cells will only operate well in an upright position.

Recommended battery cell:
TD301: LS 14500, 3.6V SAFT, France

This type of cell is available world wide or can be purchased from SAIV at any time.

The TD301has a **battery life counter** which counts the number of measurements done. In general, appr. half of the battery capacity will be spent to sustain the measurement process. The remaining capacity is spent during readout and programming. After 1.000.000 measurements, change of battery is recommended.
Practically, most customers change battery yearly, unless the counter has reached the mentioned number sooner.

Continued next page

Change of battery

The communication cable supplied with the sensor contains a small lithium cell which will support the internal clock and the memory during battery change.
Note! For safety reasons, we recommend that the data in memory is downloaded to PC prior to change of battery.

Procedure for change of battery:

- Download data in memory (when applicable)
- Set the instrument in passive (See **Battery change instruction** Chapter 3)
- Leave the cable connected to the RS232 plug
- Unscrew the battery cap
- Insert two fresh lithium cells (+ terminal pointing inwards)
- Inspect the O-ring and reinstall battery cap
- Connect the instrument to your PC and reset **Battery life counter**

Note! If power has been interrupted, either due to battery failure or if the above procedure was not correctly followed, the internal clock will revert to default setting and stored data will be lost. All other settings will remain unchanged. After installing fresh battery, the instrument will send the following message to the PC: ***'Battery power has been interrupted. Internal clock can be corrected. Correct clock Y/N'***
Press <Y> and set the clock. If the keyboard is left unused for more than 10 second the sensor will continue and status will appear.
It is advised in such cases to check that all calibration coefficients are unchanged. Compare with your hard copy of the calibration sheet.

O-RING SEALS

The TD301is equipped with two O-ring seals. One on the battery cap, and one on the RS232 connector. It is practical to install new O-ring at the time of changing battery.

TD301 O-rings:
RM0146-24 (Battery cap)
R2050 (RS232 connector)

TD303 O-ring:
R2050 (RS232 connector)

Note of Precaution

An exhausted battery may produce some gas pressure inside a sealed battery compartment.
Although such incidents has not been reported for the SD204 and TD300 – series of instruments, it is a safety precaution to keep this possibility in mind when opening the battery compartment.
Simply aim the battery compartment lid away from your body when opening.
As an extra safety the lid is designed such that the seal is released prior to lid is fully unscrewed.