

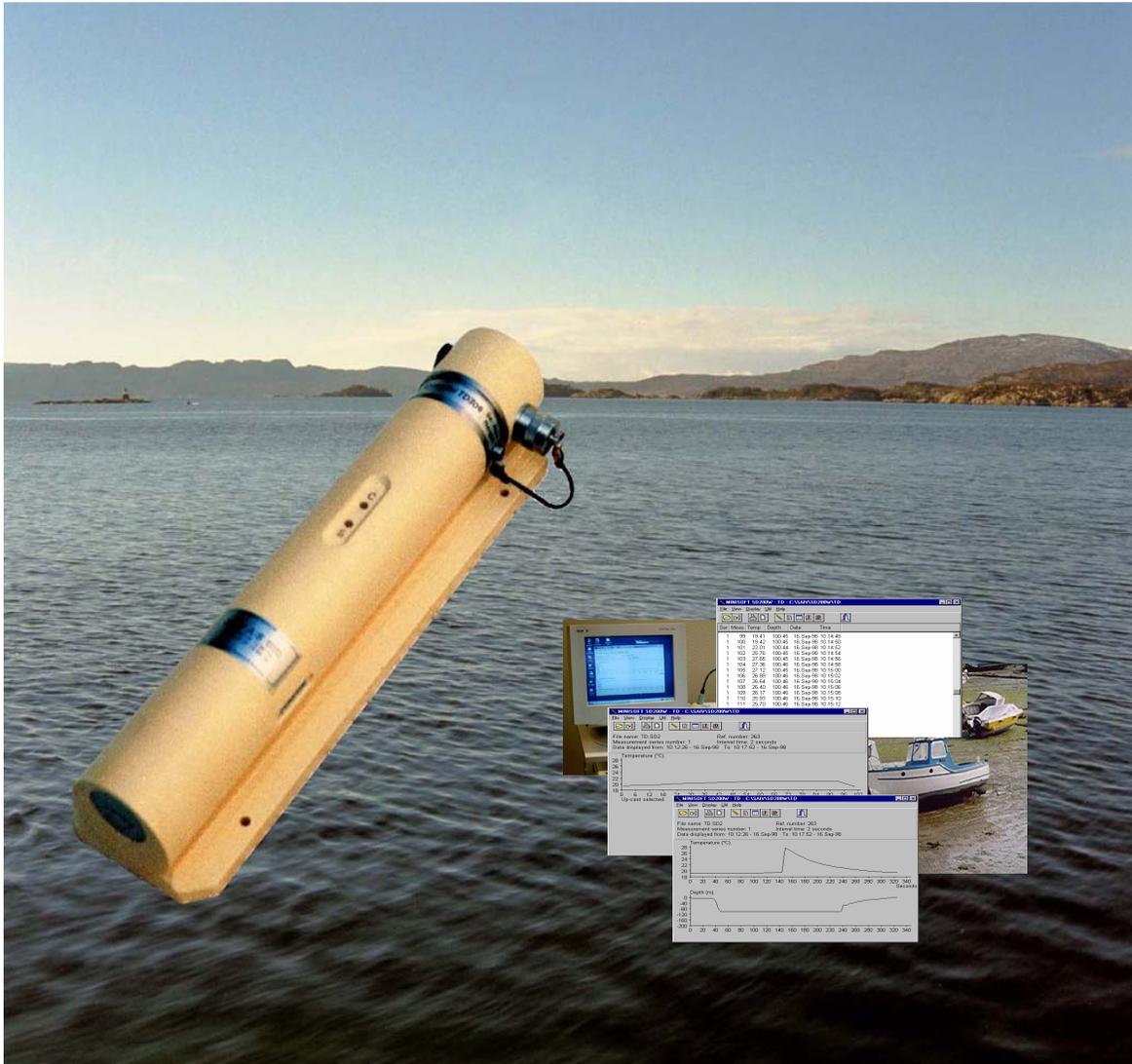
OPERATING MANUAL

for

Tide Recorder - model TD304

with

Optional Sensors



Manufacturer:

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SAIV01JUNE2006

A COMPLETE TIDE-SYSTEM IN A SUITCASE



TD304 in standard packing.

This is all you need to produce professional tide and temperature series on your own PC.

The suitcase contains:

- TD model TD304
- On/Off magnetic key (Mag-Key)
- On-Land Unit (for TD304R only)
- PC communication cable
- SD200W program
- Operating manual

Interfacing of customer specified sensors offered.

INTRODUCTION

This manual describes the TD model TD304 (absolute type)/TD304R (reference to air pressure via ON-Land Unit) and the dedicated data processing program SD200W. These instruments have a built in replaceable battery for self contained recording application. Both 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 instrument.



The figure to the left shows the TD304R with On-Land Unit. The On-Land 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 TD304R. The PC cable can be extended to length up to 500 meters.

For remote data readout and monitoring, the manufacturer offers the new Communication Unit, CU901, for two-way communication via Iridium satellite, GSM and UHF/VHF. The Iridium satellite system has world wide coverage and the subscription is affordable.

OPERATING MANUAL

for

Tide Recorder - model TD304

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GENERAL DESCRIPTION AND SPECIFICATIONS

INTRODUCTION

The TD304 is high precision instruments for recording/monitoring of tide or water level and also temperature. Optional sensors can be added: dissolved oxygen, turbidity and fluorescence.



Data are recorded and transmitted in engineering units via an RS-232 I/O water tight connector. The instrument is Plug and Play compatible with PC's. All settings like measuring interval, integration time, Chart Datum/air pressure etc. are accessed via menu. All the programmed settings and calibration coefficients are maintained in non volatile eeprom, and will not be changed/lost if power is disconnected.

The power consumption is extremely low. In practical operation the battery capacity is sufficient for a year-around operation. Data recorded in the instrument are in physical units and can be copied to a PC and presented immediately after the measurements have been completed (or at any time later).

The TD304 is available with absolute or reference (R) type pressure sensor. The reference type is vented to air pressure through the connector and a cable with internal air pipe. Data from the instrument can also be transferred to PC by cable or remotely via telephone or satellite terminal. Request information from factory. A comprehensive PC-program is supplied with the unit for easy communication, programming and presentation/processing of data.

Designations: TD304: absolute type. TD304R: reference (gauge) type.

INSTRUMENT DESIGN

The TD304 instrument contains permanent sensors for temperature and pressure. The software and the calibration coefficients are maintained in non volatile EEPROM. Data in physical units are recorded in the instrument memory and are simultaneously available at an RS-232 I/O water tight connector. Robustness and complete protection from leakage has been obtained by vacuum molding the electronic and all other components in solid polyurethane. A sealed battery compartment contains two replaceable C-cells. Two command switches, START and CONFIRM, are placed inside the molded instrument body. The command switches are magnetically sensitive and are operated by a magnetic key (Mag-Key) supplied with the instrument. Two built-in control lamps are used for visual checks. By observing the lamps, the user can control that the instrument is both active and has been correctly programmed. The RS-232 connector has pins for connection of optional sensors. If the instrument is used for real time monitoring via cable, the connector also has pin for external power supply. The instrument is equipped with a mooring frame.



MENU-DRIVEN PROGRAMMING

When the TD304 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.

Several measuring modes are available as selective combinations of TD, with/without optional sensors, e.g. oxygen, fluorescence and turbidity.

In addition, the menu contains several functions, like setting of real time clock, baud rate, erasing of data and display of battery life counter.

OPERATION

Once the TD304 has been programmed to the desired measuring mode and interval, it is ready for deployment. Only the magnetic key (Mag-Key) is necessary for operating the instrument 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.

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 instrument serial number, date and time for each new start.

When memory is full, further storage of data is inhibited and the instrument will refuse to start. This is signified by S- and C-lamps flashing alternately, if new start is attempted. In on-line operation the instrument will continue to measure and feed out real time data until cable is disconnected.

DATA READ-OUT AND PROCESSING

Data recorded in the instrument memory can be transferred to a PC at any time. The TD304 can communicate with any standard PC for setting instrument 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.

CALIBRATION

Calibration Certificate with credentials is supplied with the instrument. The calibration coefficients are maintained in the instrument memory and can be displayed/hard-copied at any time.

Due to the excellent long term stability of sensors and circuitry, the instrument 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 Tide Recorder – model TD304

Pressure: Specify desired depth and type with order

Ranges: (absolute) 20,50,100,200,500 m

Ranges: (reference) 10,20,50,100 m

Resolution: 0.0001 dbar (m)

Accuracy: +/- 0.01% FS (0 - 35°C)

Response time: 0.1 sec

Temperature:

Range: -2 to +40°C

Resolution: 0.001°C

Accuracy: +/- 0.01°C

Response time: < 0.2 sec

Dissolved oxygen (optional):

Sensor type: SAIV205

Range: 0 to 20 mg/l

Resolution: 0.01 mg/l

Accuracy: +/- 0.2 mg/l

Fluorescence (optional) Rhodamine/Chlorophyll/CDOM

Sensor type: Seapoint

Range: 2.5, 7.5, 25, 75 ug/l

Selectable-/autorange

Resolution: 0.03 ug/l

Turbidity (optional):

Sensor type: Backscatter

Range: 12.5, 62.5, 250, 750 FTU

Selectable-/autorange

Linearity: < 2%

Real time clock: +/- 2 sec/day

Interval:

Programmable: 1 sec to 180 min.

Integration time: Programmable: 2 – 240 sec
(pressure measurements)

Memory: CMOS SRAM
Capacity: 77000 data sets of TD

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

Power supply: 2 ea 3.6V lithium C-cells
Recommended type: SAFT LSH 14
(Sufficient for 1.500.000 data sets)
External supply if used 10 – 30V

Material: Vacuum molded polyurethane and
Titanium

Dimensions: Length 400 mm. Diameter 60 mm

Weight: In air: 2.5 kg. In water: 1.3 kg.

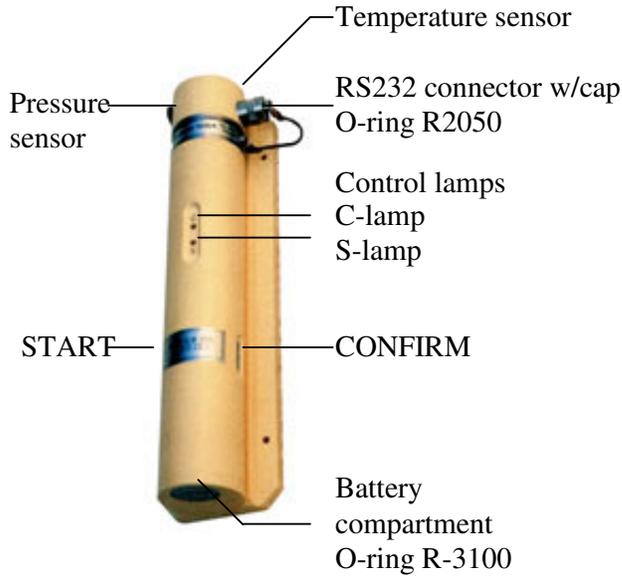
Packing: Suitcase (534x427x157 mm)
Grossweight 5.5 kg

Accessories: On/Off magnetic key,
(included) PC communication cable 2.5m,
MINISOFT SD200W program
Operating manual

TD304R: Cable (15m) with air pipe and
on-land connector unit.

Warranty: Two years against faulty materials
and workmanship

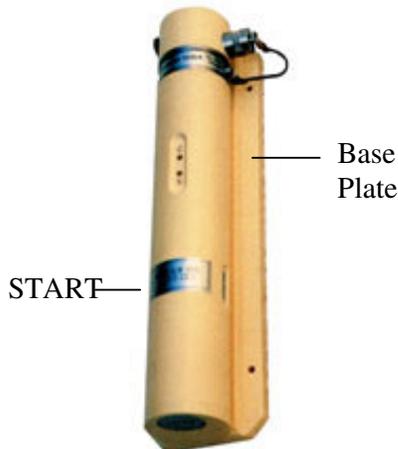
TD model TD304 OVERVIEW



Control lamps side

Dimensions:	overall length 400 mm
	diameter 60 mm
Weight:	in air 2.3 kg
	in water 1.3 kg
Power supply:	2 lithium C-cells 3.6V. Recommended type: SAFT LSH14
Material:	Vacuum molded polyurethane and titanium

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



PC cable



Mag-Key

✓ BRIEF FUNCTIONAL DESCRIPTION

- *Read/change instrument status*
- *Start/stop measurements using the Mag-Key*
- *Memory capacity*
- *Read recorded data into your PC*
- *Real time monitoring via cable*

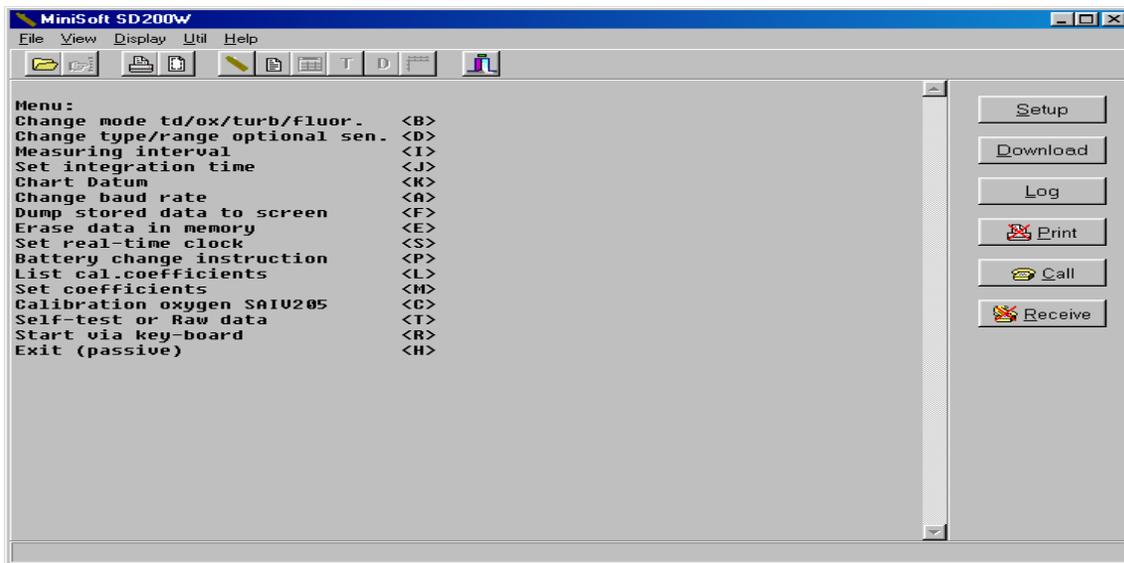


To take full advantage of this chapter, it is recommended that one is familiar with the content of Chapter 5.

Read/change instrument status:

When connected to PC, the instrument 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 instrument remembers its latest programming and will show this status on the screen. If that is the desired measuring mode and interval, the instrument 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 (Instrument menu explanation). If the menu is left unused for more than 1 minute, the instrument will turn passive automatically. (as if <H> was pressed)

Start/stop measurements using the Mag-Key:

Start measurements by a flick of the Mag-Key on START and when the S-lamp starts to flash, confirm start by a flick 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 series by a flick of the Mag-Key on CONFIRM and then on START. The C-lamp will flash for a few seconds, after which the TD304 enters passive.

Memory capacity:

The storage capacity is 77000 sets of TD data, which, for example, is sufficient for 450 days of recording at 10 minutes interval.

When the memory is full, further storage of data is inhibited and the instrument will go to passive. If start is attempted, S- and C-lamps will flash alternately, signifying that memory is full.

To erase memory see Chapter 3.

Read recorded data into your PC:

Click **Download**. A sub-window appears, and data from the TD304 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 instrument has transferred the data, it returns its menu to the PC screen. Wait until the menu is complete, then press <H> to switch the TD304 back to passive. Remove the instrument cable.

For detailed information on processing of data see Chapter 5 (MINISOFT SD200W).

Real time monitoring via cable:

The TD304 provides on-line data in physical units.

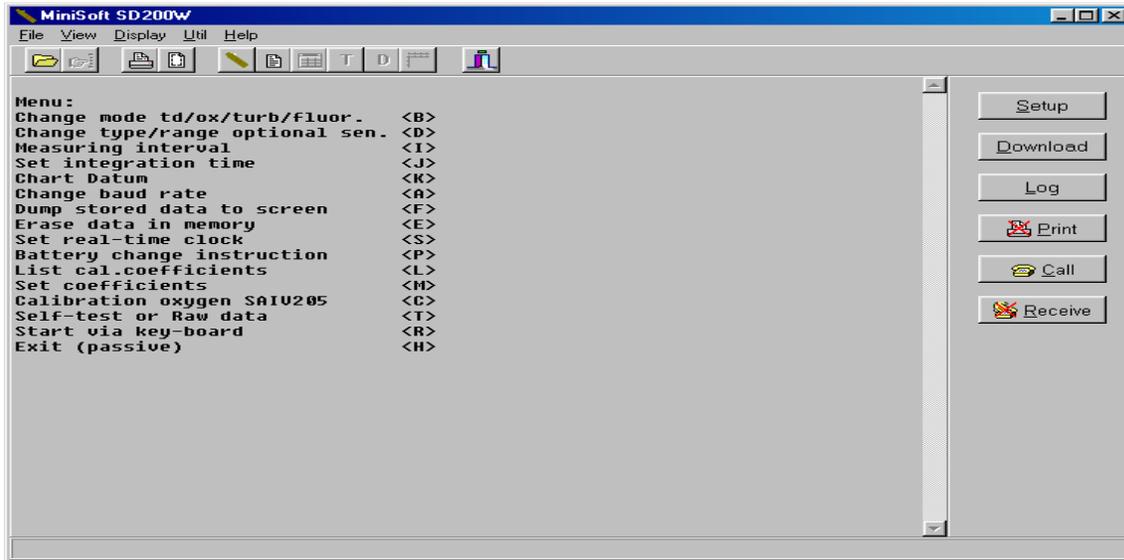
Using TD mode, on-line output will operate with all baud rates (1200 -9600) at any chosen interval.

For further operating details see Chapter 4.

✓ INSTRUMENT MENU EXPLANATION

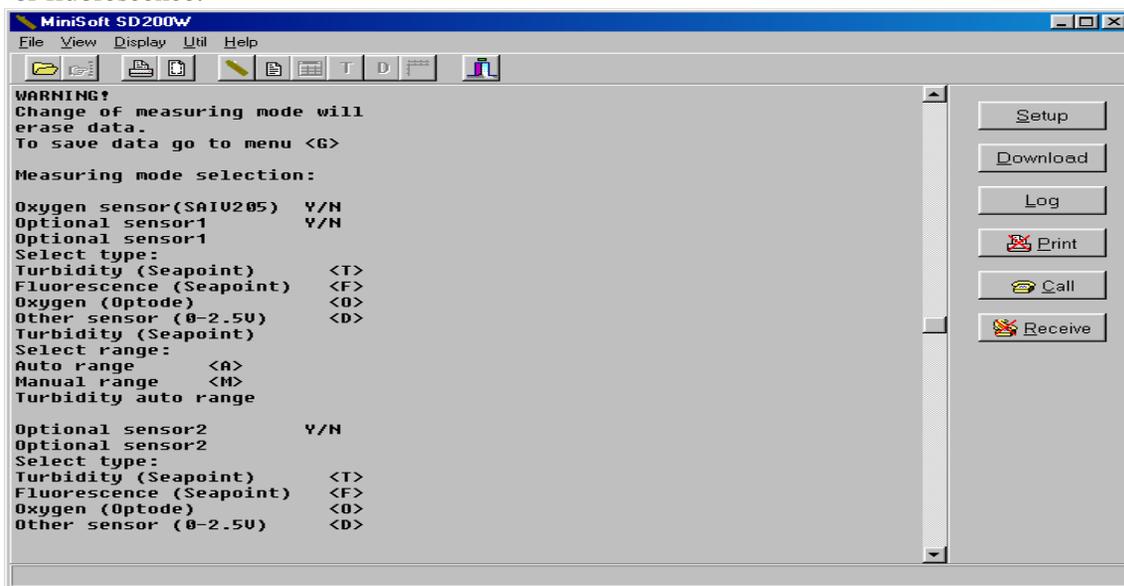


Connect the TD304 to your PC with MINISOFT SD200W installed. Wake up the instrument (hold Mag-Key on **START**) and wait 10 seconds. Menu will appear as follows:



Change mode td/ox/turb/fluor < B >

The basic parameters measured are temperature (t) and pressure (d). Several modes are available as selective combinations of TD with/without optional sensors (when installed) e.g. oxygen, turbidity or fluorescence.

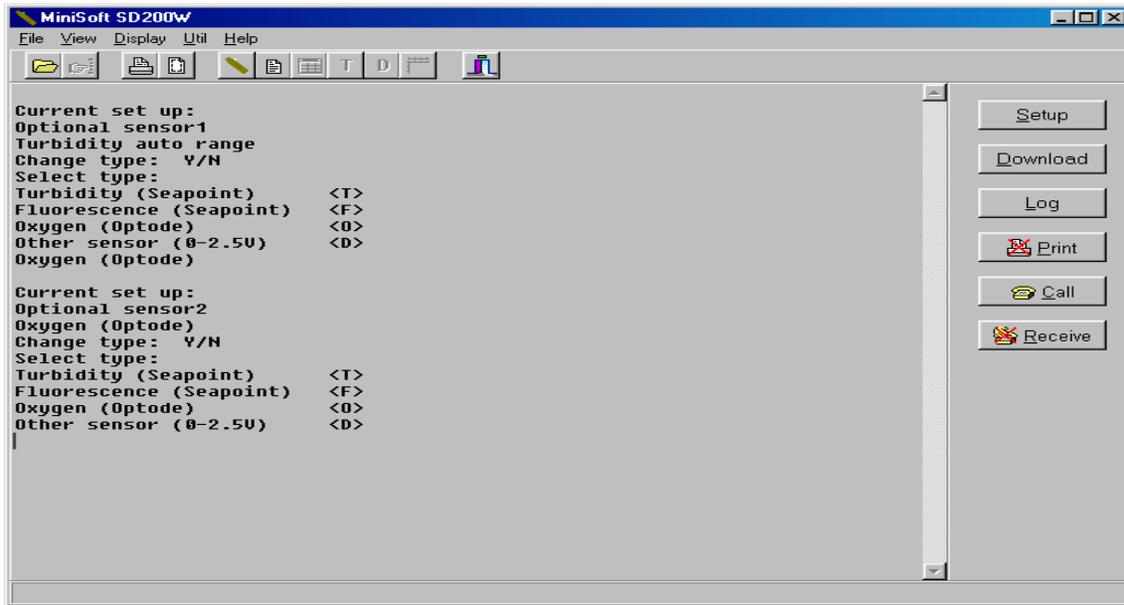


The selected mode will be operative until changed as described.

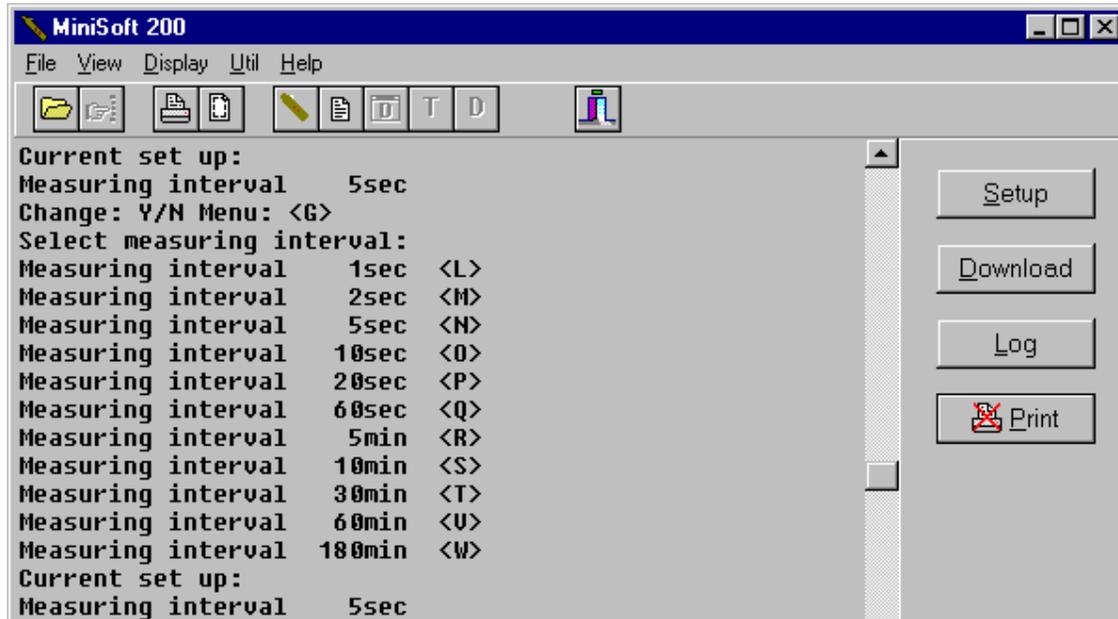
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Change type/range optional sensors <D>

sub menu:

**Measuring interval <I>**

sub menu:

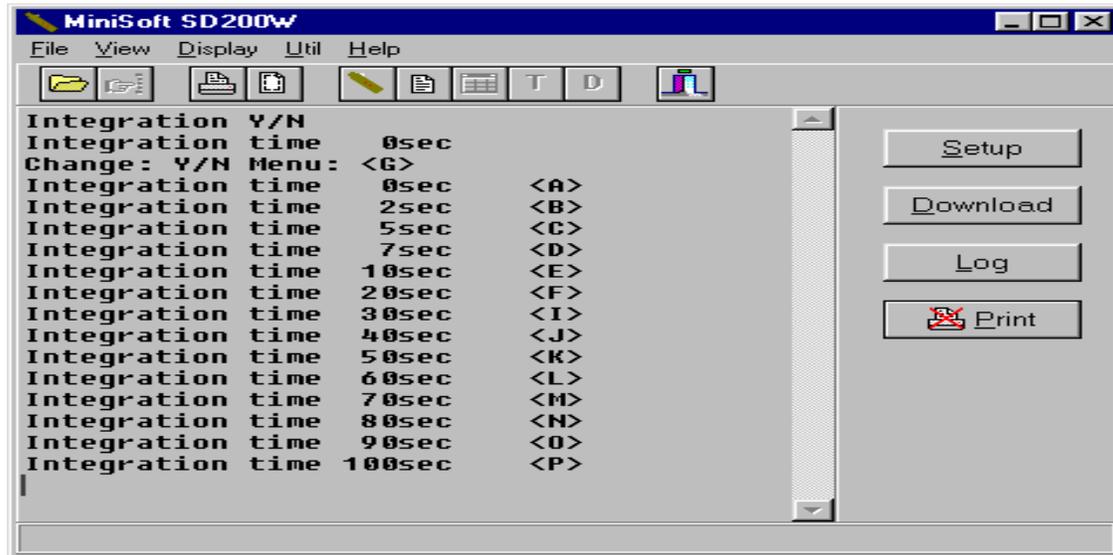


Select the actual interval by pressing appropriate key.

Continued next page.

Set integration time <J>

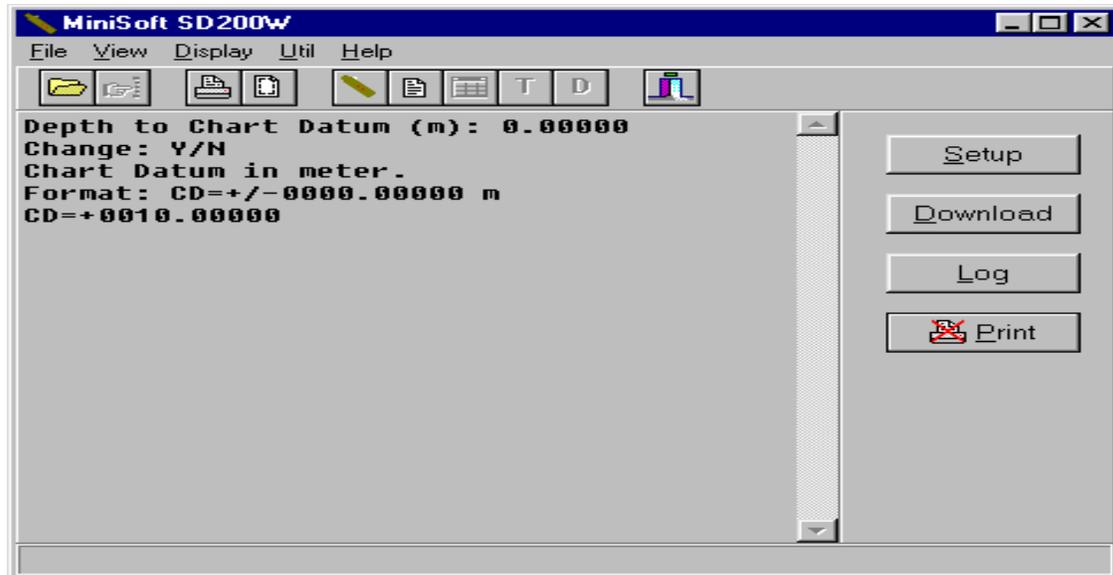
sub menu:



Select the actual int. time by pressing appropriate key.

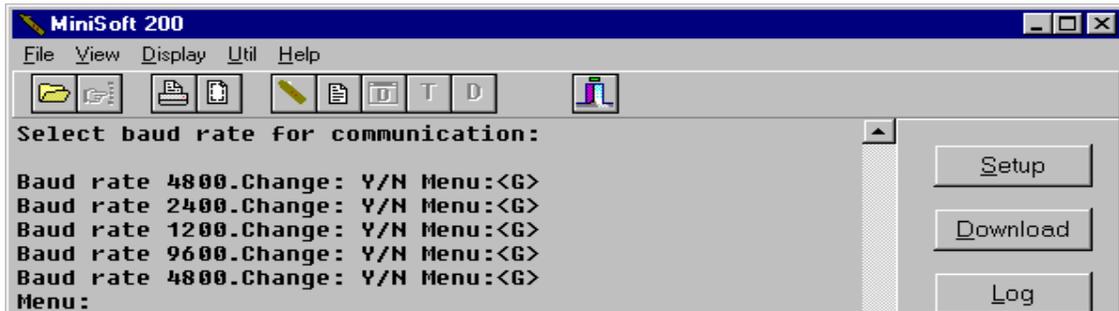
Chart Datum <K>

sub menu:

*Continued next page.*

Select baud rate <A>

sub menu:

**Note!**

A new selected baud rate will be operative only after the instrument 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>

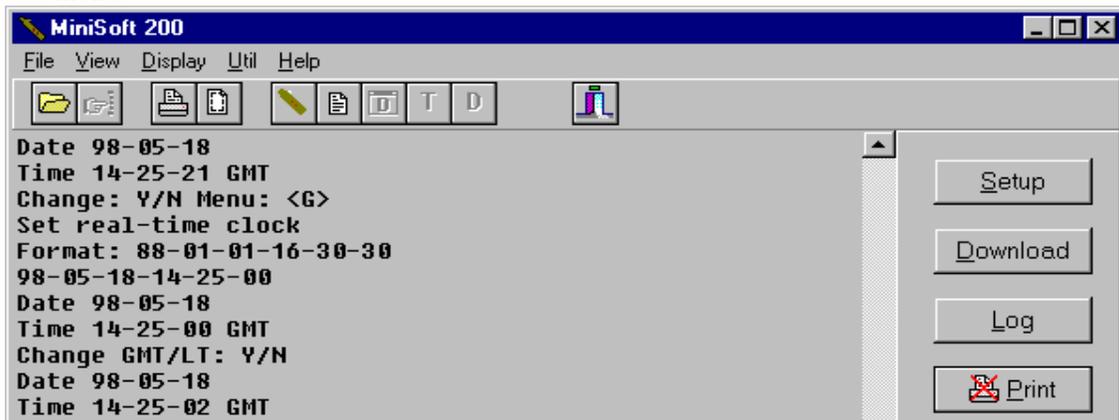
This command will send a copy of the recorded data to the PC screen.

Erase data in memory <E>

To erase data press <E>.

Set real-time clock <S>

sub menu:

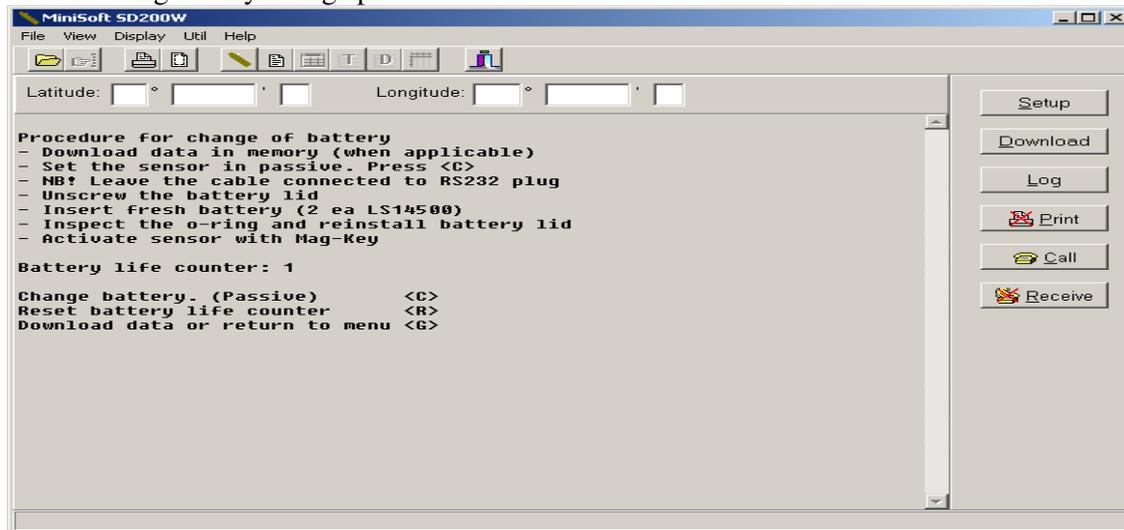


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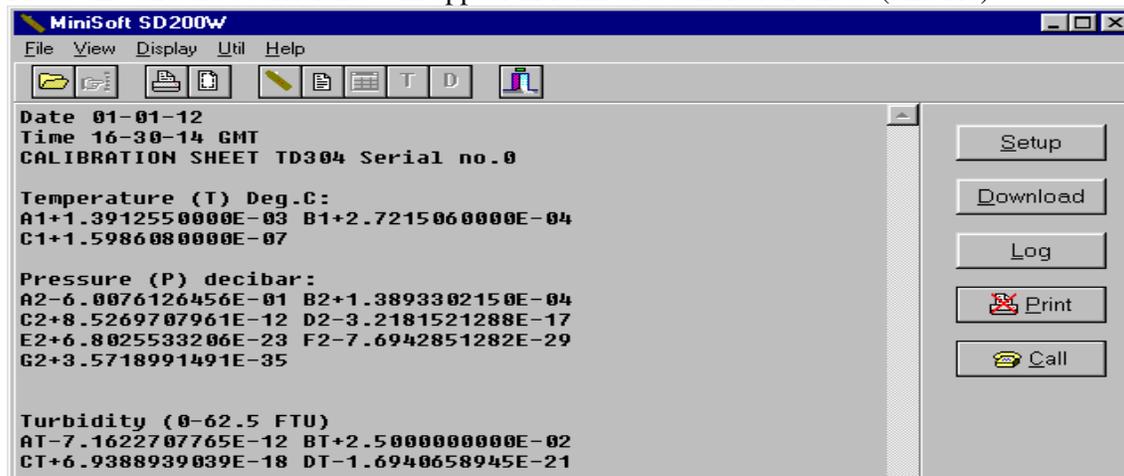
Battery change instruction <P>

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 1.500.000. The battery life counter status is shown by pressing <P>. When changing battery, press <C> to make the instrument 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 instrument.

**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 TD304 to calculate the variables in physical units. Keep a copy of the calibration sheet for your own reference.

Continued next page

For printout see Chapter 5 (MINISOFT SD200W PROGRAM.)

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

Set coefficients <M> (mainly for factory use)

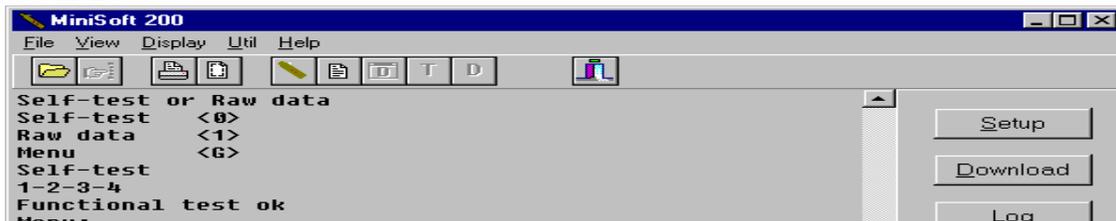
Each of the coefficients in the calibration sheet is presented one by one followed by a 'change Y/N' press <N> to proceed to next coefficient. It is possible to correct a specific coefficient, press <Y> and type the correct coefficient including correct sign. If you make a formal error (a missing sign,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

Calibration oxygen <C>

See Chapter 7 (Calibration) and Chapter 6 (Description of sensors)

Self-test or Raw data <T>

sub menu:



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 4 steps and when completed, the result is shown in clear text on the screen.

Raw data

The instrument will present unprocessed digital numbers for each sensor 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 instrument 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 instrument turns passive.

Note! The instrument will turn passive if the PC keyboard is left unused for more than one minute.(the instrument will act 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 instrument for measurement:

- *Make sure that you have sufficient unused memory.*
- *Make sure that the instrument is programmed to wanted mode and time interval.*

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

If you want **to change the settings**, connect the TD304 to your PC and activate the MINISOFT SD200W program, see page 2.01. (Read instrument status)

Activate the instrument (Mag-Key on **START**). The instrument status will appear. Wait 10 seconds for instrument menu, and do wanted changes. F. example:

- Press if you want to change mode.
- Press <I> if you want a new measurement interval.
- Press <E> if you want to erase memory.
- Press <J> if you want to set/change integration time
- Press <K> if you want to set Chart Datum
- After each executed command the menu will return on the screen.*
- Press <H> to make the new settings valid. (exit)

Once the instrument has been programmed to the desired measuring mode and interval, it is ready for deployment. Only the Mag-Key is necessary for operating the instrument in the field.

For **tide or level** measurements the instruments is placed on a fixed base.

The TD304 is also suitable for **profiling work**. 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.

Deploy the instrument until the maximum wanted depth has been reached and pull the instrument back to the surface. An 'upcast'/'downcast' speed of < 1.5 ms is recommended.

When the instrument has been brought to the surface, stop it (Mag-Key on CONFIRM and then on START). The C-lamp will flash for a few seconds and the TD304 will enter passive.

The data have been recorded as a series in the instrument 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 instrument 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.

Continued next page.

When memory is full, further storage of data is inhibited and the instrument will refuse to start. This is visualised by S- and C-lamps flashing alternately when a new start is attempted. If the instrument is connected to PC, the message '*Memory full*' will appear on the screen.

Real time monitoring via cable

The TD304 provides on-line data in physical units.

Using TD mode, on-line output will operate with all baud rates (1200 -9600) at any chosen interval.

Output format:

Mode Output: RS232 ASCII code 1 start, 7 data, 1 stop, even parity

```
TD                    N00001 T+20.931 P0010.02
TDOX                N00045 T+20.931 P0010.02 OX092.43
TDOT                N00056 T+20.931 P0010.02 OT008.04
TDOXOT             N00065 T+20.931 P0010.02 OX092.43 OT008.04
TDOTOF             N00078 T+20.931 P0010.02 OT008.04 OF007.54
TDOXOTOF          N00108 T+20.931 P0010.02 OX092.43 OT008.04 OF007.54
Carriage return and line feed at end of line.
```

N: measurement number. T: temperature. P: pressure(depth). OX: oxygen.
OT: turbidity /OF: fluorescence/Op: oxygen optode/OS: other sensor.

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

The MINISOFT SD200W contain several facilities e.g. accept real time GPS data in NMEA format via an RS232 port on users PC.

See Chapter 5.

For long term operation of a deployed instrument the manufacturer can provide a special cable with power unit. In a fixed deployed position the TD304 can be started/stopped via keyboard by holding <I>. When the instrument memory is full, the instrument will continue to measure and present data as long as the cable is connected.

Be aware that, when the TD304 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), or simply hold the <I> until submenu appears and then set the Air pressure manually.

Remote readout and monitoring

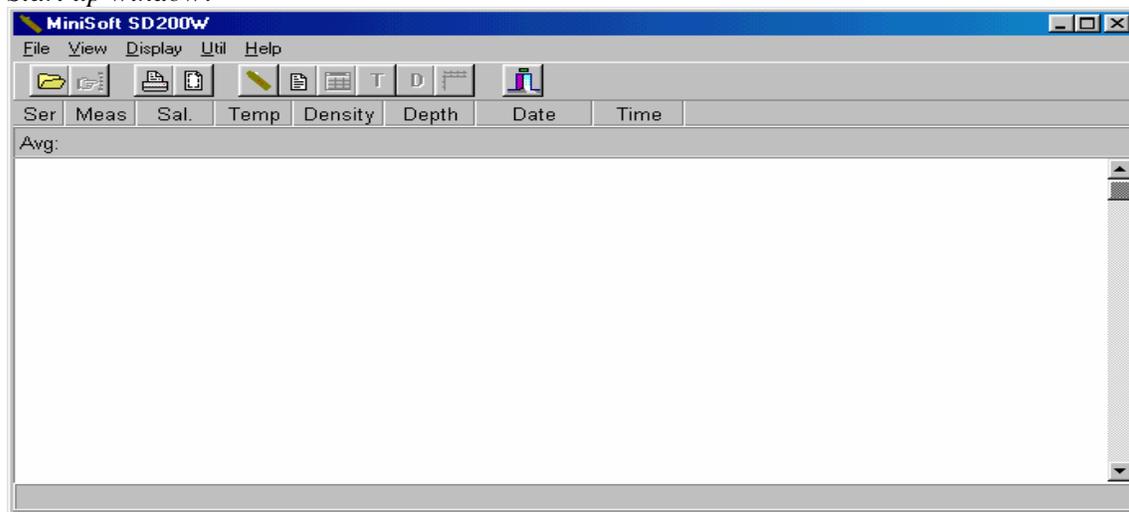
For remote data readout and monitoring, the manufacturer offers the new Communication Unit, CU901, for two-way communication via Iridium satellite, GSM and UHF/VHF. The Iridium satellite system has worldwide coverage and the subscription is affordable.

✓ MINISOFT SD200W PROGRAM



MINISOFT SD200W is a windows based program for downloading data from TD300 series of TD instruments. 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 3.5 diskette. 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:

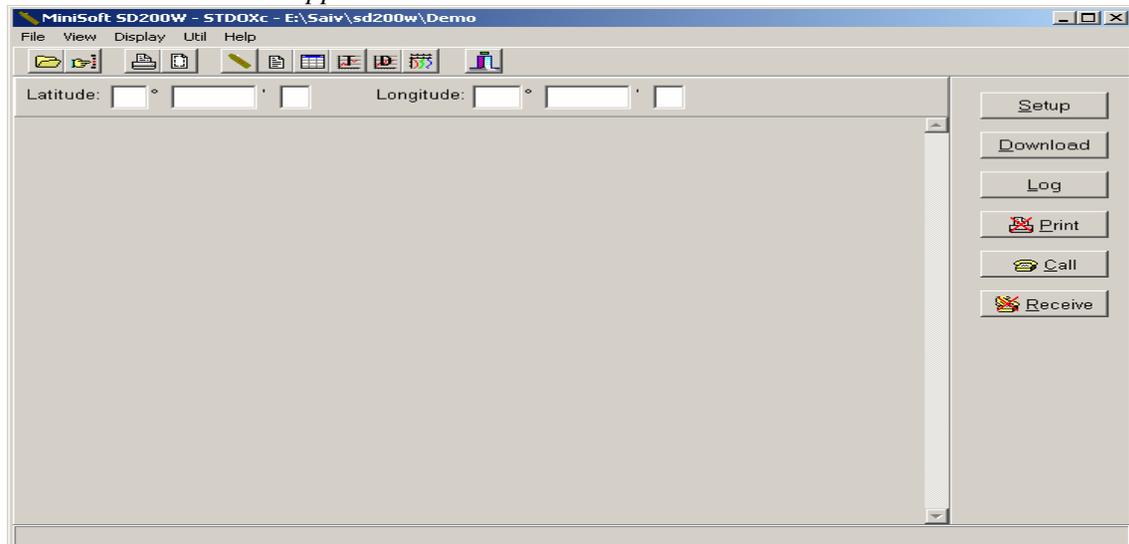
- ***Communication mode (with the instrument).***
- ***Downloading of data.***
- ***Processing of data files.***
- ***Graphs.***
- ***Multigraph***
- ***Multigraph 'On- line plot'.***
- ***Real time data via telephone line.***
- ***Export of data files.***

Continued next page.

Communication mode: Click the instrument symbol button

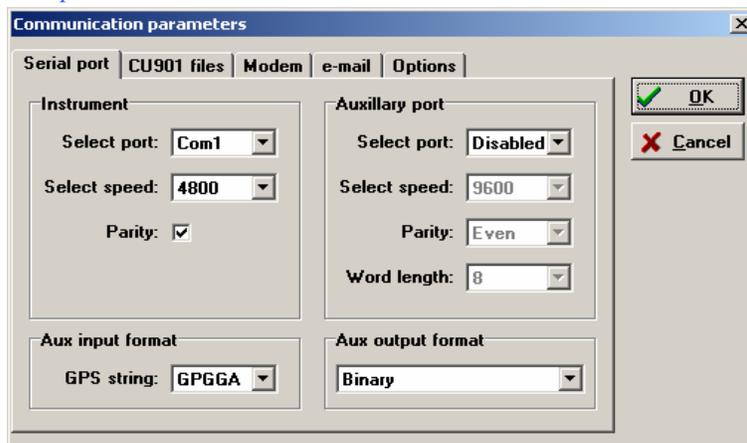


The window below will appear



Connect the TD304 with its cable to a COM port of your PC.

Setup button.



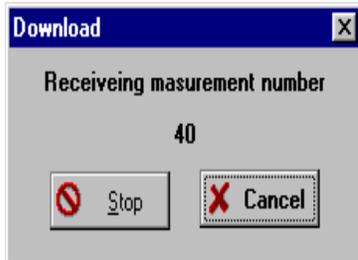
Enter the selected COM port (usually COM1 or COM2). Also control that the baud rate is correct. (Normally baud rate is 4800, but the TD304 can be set to 1200/2400/4800/9600). Click 'OK'

Start the TD304 with the Mag-Key, and wait 10 seconds until the sensor menu appear on your screen. Your PC operates now as a simple terminal and you can communicate directly with the sensor according to its menu. See Chapter 3 (Instrument menu explanation).

Download button

Start the TD304 (Mag-Key), and wait 10 seconds until the instrument menu appear on your screen. When the menu is completed, click **Download** button.

Continued next page.



A sub window appears, and data from the instrument 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 instrument 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 instrument. 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 TD304 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 instrument 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 instrument, start the TD304. When S-lamp starts to flash, confirm start (Mag-Key on CONFIRM). Data are simultaneously shown on the screen and recorded in the instrument 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 TD304 is started and stopped outside water. Therefore, after starting the instrument 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 TD304 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 instrument 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.

Continued next page

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

- 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.

Ser	Meas	Date	Time	Lat D	Lat M	N/S	Lon D	Lon M	E/W
1	1	99.06.22	10:32:47	45	0,0000	N	0	0,0000	E
1	714	99.06.22	10:56:33						
2	715	99.06.22	11:03:02						
2	1044	99.06.22	11:14:00						
3	1045	99.06.22	13:53:44						
3	1533	99.06.22	14:10:00						
4	1534	99.06.22	15:23:46						
4	2062	99.06.22	15:41:22						

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 TD304 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.

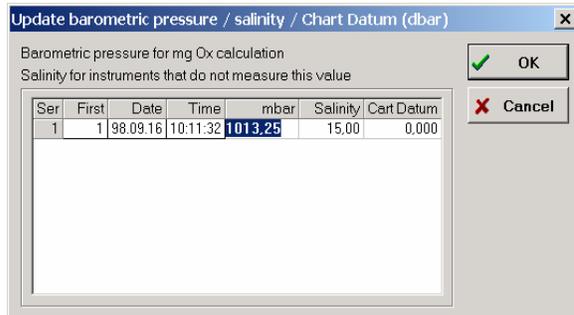
Click **Util** and select **Change standard depths sections**.

Continued next page

Update barometric pressure/salinity/Chart Datum.

For instruments 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**.



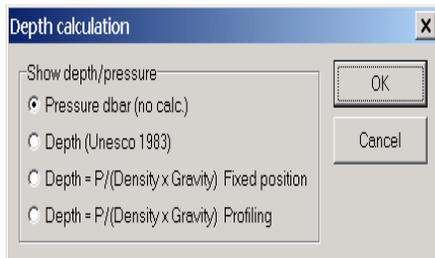
A sub window appear and you may set salinity.

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.

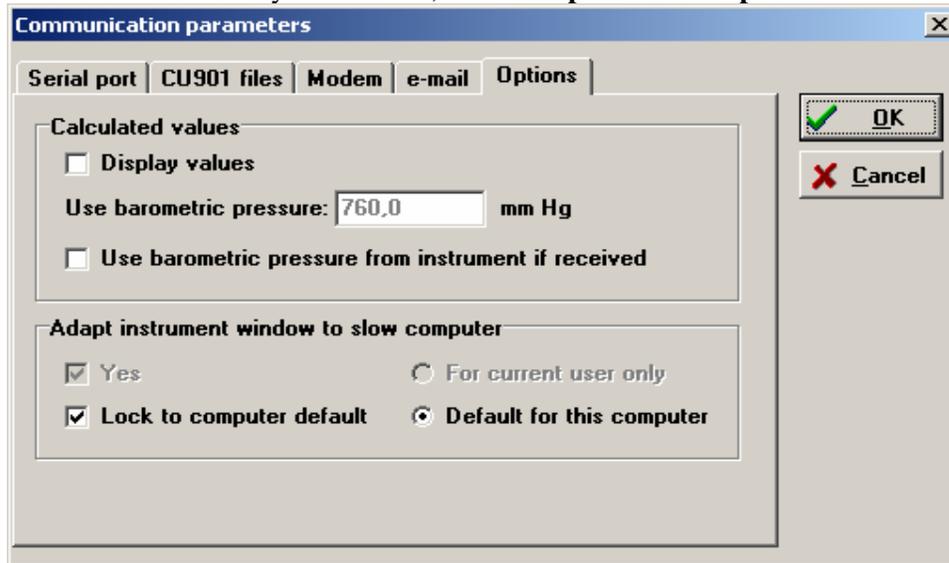
Average values.

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.

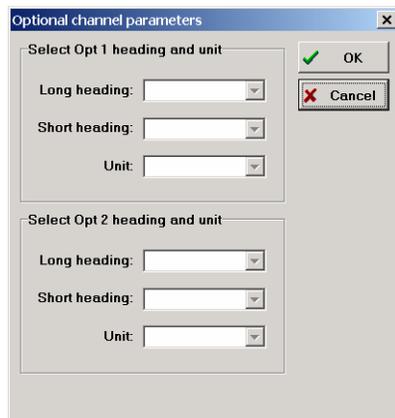
Display of calculated values. (On-line feature)

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

**Optional Sensors.**

Heading and unit for optional channels (only for "Other Sensor")

For the Seapoint- and Aanderaa Optode sensors, the TD304 give heading and unit automatically when these types are used. For other sensor type heading and unit can be set manually.



Click **Util**, select **Set heading and unit for optional channel**.

The "Long heading" will be used in general headings and may be as long as required.

The "Short heading" is for data columns in 'list file' and should be as short as possible to save space (5 characters is recommended)

Continued next page

Graphs.

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

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

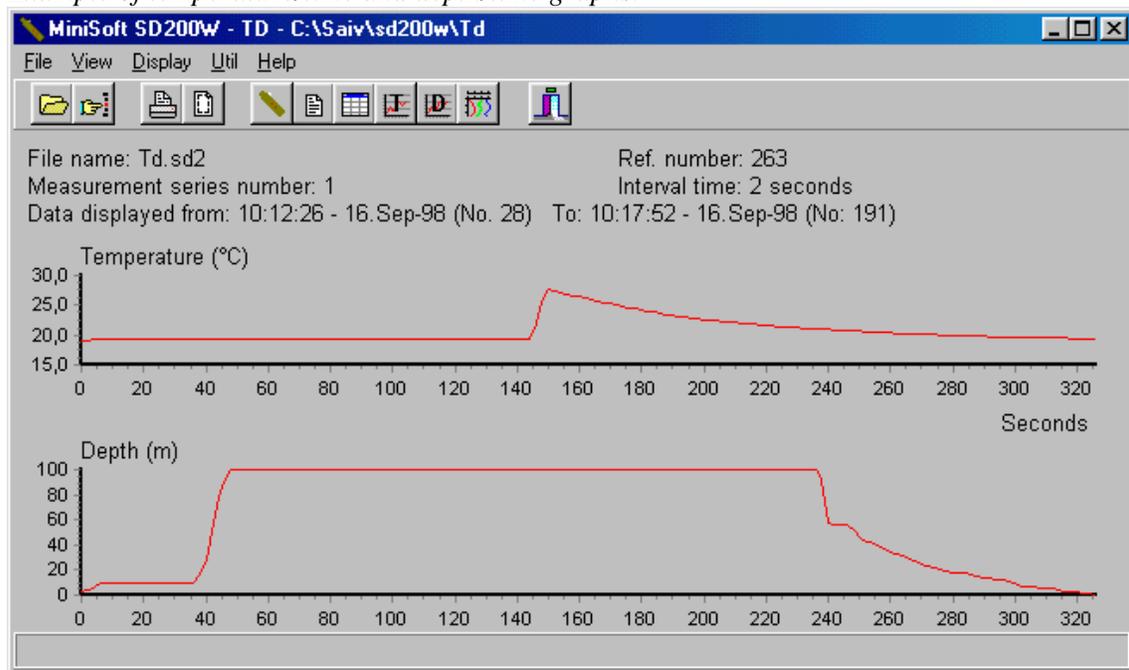
For function of time; click the symbol button: **T**

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.



Continued next page.

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'.

Ser	First	Last	Count	Date	Time
1	1	43	43	89.03.07	11:41:40

First: 2, Last: 42, Count: 41, Up-cast

Scaling of graphs.

Automatic scaling is standard.
If other scaling is wanted:

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

	Min	Max
Salinity	32,3	33,7
Temperature:	4,1	4,9
Oxygen sat. %		
Oxygen mg/ml		
Sigma T	25,6	27,1
SoundVel	1465	1470
Depth	1	84

Printout format.

Printout format can be set; standard- or portrait format and presentation on one or two pages.

Click **File** and select **Page setup**.

Top: 1.0, Right: 1.0, Bottom: 1.0, Left: 1.5

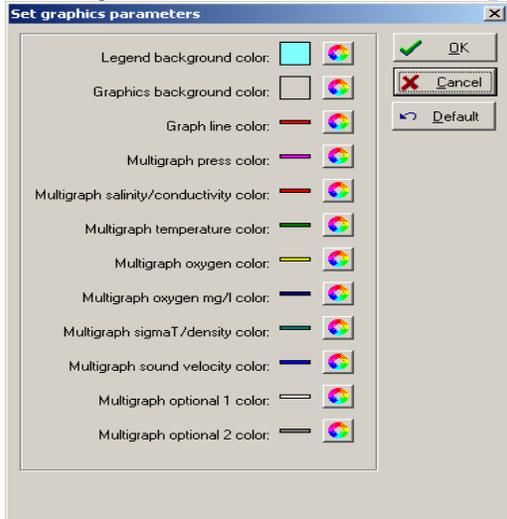
Print graphs in portrait format
 Print graphs on two pages

Continued next page.

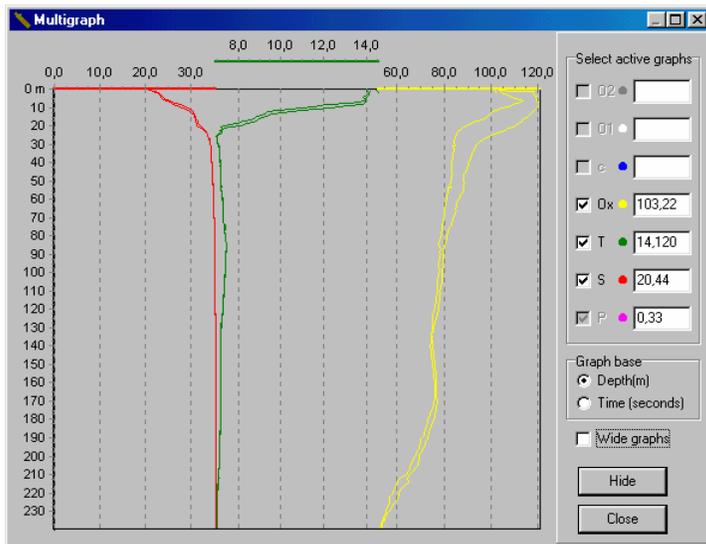
Graph color settings.

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

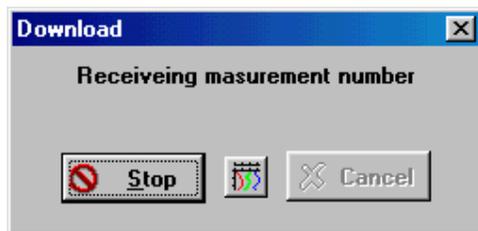
Multigraph 'On-line plot':

To activate, press instrument symbol



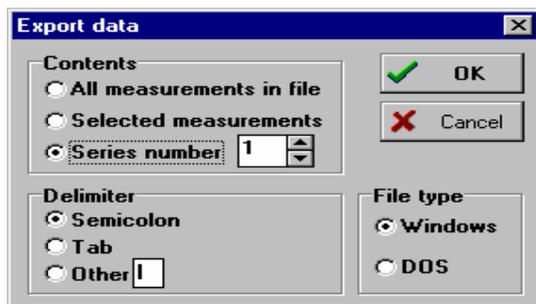
Press **Log**.

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 appear.

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 R_t depends on the temperature according to the equation:

$$T = 1/(A1+B1*\ln(Rt)+C1*(\ln(Rt))^3-273.16)$$

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 instrument 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 SENSOR

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 TD304 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 instrument via cable without change of the stored air pressure measurement.

Continued next page.

OPTIONAL SENSORS

The TD304 has 3 channels available for optional sensors. The one channel is devoted for measurement of dissolved oxygen SAIV205. The two other channels will operate with sensors having 0 – 2.5VDC output signal.

Often required sensors are turbidity and fluorescence. (see below). From serial No 160, the TD304 is also prepared for the Aanderaa Optode .. oxygen sensor

OXYGEN SENSOR SAIV205

This sensor is based on a sensing element from OxyGuard and is furnished with a breathing hole for pressure compensation to water depth down to 2000 meters. The breathing hole should be sealed to avoid evaporation of electrolyte when sensor is not in use. An O-ring on the probe is provided for this.

The sensor uses silver as cathodic material and pure zinc as anodic material. When combined with the supplied electrolyte, the sensor generates a polarisation voltage which attracts dissolved oxygen to the cathode through a membrane.

In operation dissolved oxygen from the water diffuses through the membrane to the cathode. This causes electrons (current) to flow between the anode and the cathode via an external circuit. The output signal is proportional to the oxygen saturation (%).

In order to make the oxygen reading independent of temperature, the instrument measure the membrane temperature and compensates for the effect.

The recorded data represent the degree of saturation in %, The MINISOFT SD200W presents data both in degree saturation and mg/l compensated for pressure.

The oxygen sensor require frequent calibration. To simplify this procedure, the instrument has a built in automatic calibration routine see Chapter 7. (Calibration)

Installation of the oxygen sensor (when supplied separately)

The sensor is connected to the RS232 plug on the instrument and fixed with a securing screw.



First plug in the sensor and tighten the sleeve nut completely. The sensor is now correctly connected and the securing screw can be installed. This screw has an O-ring under the head and should only be tightened lightly to allow some flexibility.

The RS232 output/input of the instrument is extended to the plug on top of the oxygen sensor and the cover cap must be installed on this plug prior to deployment.

Note! Remember to move the O-ring seal on the probe to upper resting position (non sealing) prior to calibration/deployment.

When not in use or during transportation, the O-ring seal should always be in the lower sealing position to avoid leakage/evaporation of electrolyte through the breathing hole.

For change of membrane and electrolyte see Chapter 8 (Maintenance and Change of Battery)

Continued next page.

FLUORESCENCE, TURBIDITY & OTHER SENSORS

Several sensors, available on the market with analog output (0 – 2.5VDC) can be used with the TD304. For ease of operation the manufacturer recommends turbidity- and fluorescence sensors from Seapoint Sensors Inc. and the Aanderaa Oxygen Optode Sensor 3975S.

The Seapoint type sensors have identical, linear voltage output. Range and type selection are set in the TD304 instrument menu. The Seapoint sensors have 4 selectable ranges, for these sensors the TD304 offer a choice of manual- or autorange setting.

A combined attachment- battery unit is supplied from SAIV, the supply voltage to added sensors is governed by the TD304.



Pictures show TD304, equipped with oxygen SAIV205, turbidity and fluorescence sensors, and the instrument placed in transport/storing case with accessories and fluorescence sensor.

OTHER SENSORS

For possible connection of other type of sensors, contact factory for guidance/assistance.

✓ CALIBRATION



TD Calibration Certificate with credentials is supplied with each instrument. See example. The calibration coefficients is maintained in the instrument 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 TD304, the instrument 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.

Calibration of Oxygen Sensor SAIV205 (when installed)

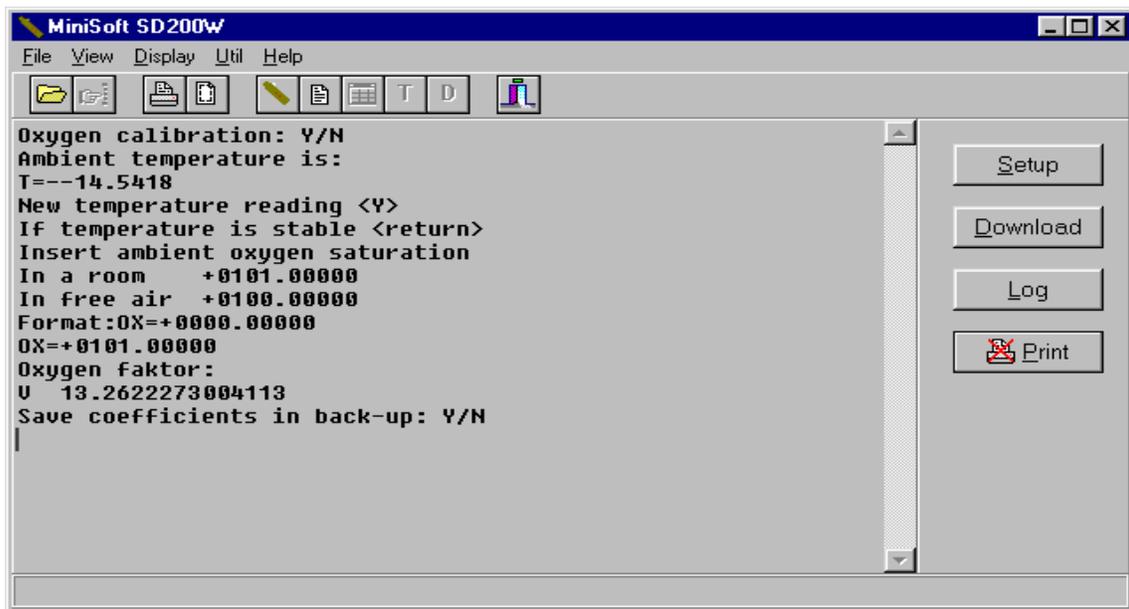
This sensor is based on an electro-chemical process and it is recommended to check the calibration regularly, e.g. daily when in use.

To facilitate this, the TD304 has a built-in automatic calibration routine for this sensor:

Connect the TD304 to the PC. Activate the MINISOFT SD200W program. Start the instrument and wait for the menu to appear on the screen.

Press <C> for 'Calibration oxygen' and select 'Oxygen calibration'.

Press <Y> for 'New temperature reading' and observe that the temperature is stable, i.e. equal to the ambient temperature +/- 0.5 deg.C. Then proceed according to the menu.



About optional sensor see Chapter 6

Continued next page.

Calibration Certificate

Certificate no: **126**

Instrument: *Tide Recorder TD304* Serial number: *126*

Range: *Pressure: 0-10bar Reference* 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

Working references:

Temperature* Falmouth Scientific Model OTM S-112 S/N 1377-09JUL96

Pressure** Budenberg DWT Model 280L S/N 9050

Calibrated by

Signature



MAINTENANCE AND CHANGE OF BATTERY



GENERAL

- After use, rinse the instrument with fresh water.*)
- Before leaving the instrument unused, check that the instrument is not still running. If unsure, give a stop command by holding the Mag-Key on CONFIRM and then 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 instrument in its standard case when not in use.

*))Spray the instrument with fresh water after use, to avoid that crystallised salt deposits on the instrument surface.

Salt or silt deposit in the pressure sensor 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.

MAINTENANCE OF OXYGEN SENSOR

A clean oxygen probe is necessary for reliable reading and calibration. It is therefore important to rinse the probe in fresh water after use. If deposits appear on the membrane, gently wipe the membrane with a piece of soft paper or cloth. If it becomes necessary to disinfect the probe, any standard disinfecting chemical can be used. The probe is made of highly resistant material. Neither the membrane nor the electrolyte need to be changed at regular intervals. The probe is a totally new design and cannot be compared to other meters regarding service.

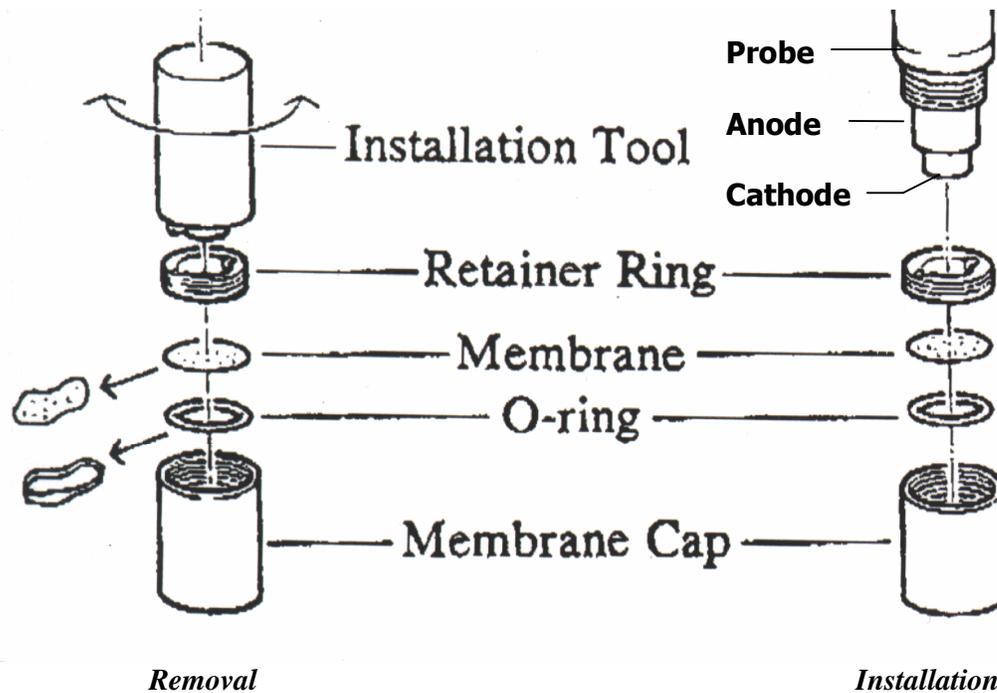
Renovation and changing electrolyte and membrane.

If the membrane has been damaged, or if it is no longer possible to obtain stable reading, the probe needs renovation. Unscrew the membrane cap, hold the probe under a water tap and brush the anode with a stiff brush. **Never** use steel or brass brush! It is only necessary to remove the non-sticking white oxide. Inspect the cathode, and remove possible deposits.

Do not polish the cathode.

- Unscrew the retaining ring in the cap using the special tool. (supplied with the sensor)
- Remove the old membrane and the O-ring.
- Rinse the cap and the retainer ring.
- Dry the parts properly.
- Put in a new O-ring into the bottom of the cap.

Continued next page.



- Put a membrane on top of the O-ring.
- Replace the retainer ring and tighten it down firmly but not too hard.
If the membrane wrinkles it has not been placed correctly in the cap. Start all over.
- Fill new electrolyte in the membrane cap. (3/4 full)
- Hold the cap upright and slowly screw it onto the probe. Excess electrolyte will dribble out. Tighten firmly by hand. Do not use tool.
Leave the sensor to stabilise for a couple of hours to enable the membrane stretch and bend in with the cathode.
Calibrate according to procedure as described in Chapter 7.

BATTERY, AND CHANGE OF BATTERY

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 TD304 – 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.

The TD304 is powered by two C-size lithium cells, each with nominal voltage 3.6V. In principle all high quality 3.6V lithium cells can be used. However it is mandatory that the

Continued next page.

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 cells:

LSH14 3.6V SAFT, France

BCX 72 C, 3.6V Electrochem, USA

Both type of cells are available world wide. The SAFT type can be purchased from SAIV at any time.

The instrument has a **battery life counter** which counts the number of measurements done. In general, approximately half of the battery capacity will be spent to sustain the measurement process, while the remaining capacity is spent during readout and programming. When battery life counter reach 1.500.000, change of battery is recommended.

Practically, most customers change battery yearly, unless the counter has reached the mentioned number sooner.

The instrument checks the battery voltage continuously, and if the voltage drops below 5V, it will give the message: '**LOW BATTERY**' and then halt operation. This ensures that remaining battery capacity is saved to retain recorded data in the memory. If start is attempted, S- and C-lamps will flash alternately, signifying that battery is low. If cable is connected the message appears on the PC screen.

Note! In practical use a '*low battery*' situation may occur in the field where the ambient temperature is relative low. When the instrument is back in the laboratory, the battery voltage may increase due to higher temperature and the instrument will allow new start. This may deceive the operator, and the instrument will 'remember' that '*low battery*' occurred. The instrument will refuse to start, (S- and C-lamps will flash alternately) even if the battery has gained voltage due to increased ambient temperature. If connected to PC the following message will appear:

!!Warning!!

Low battery detected.

Remember to reset 'battery life counter' after installing fresh battery.

Change of battery

The communication cable supplied with the instrument 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**

Continued next page.

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 instrument 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

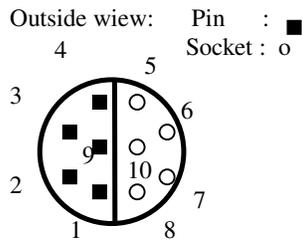
The TD304 is equipped with two O-ring seals. One on the battery cap, and one on the RS232 connector. It is practical to install new O-ring at the time of changing battery.

O-rings: R-3100 (Battery cap)
R2050 (RS232 connector)

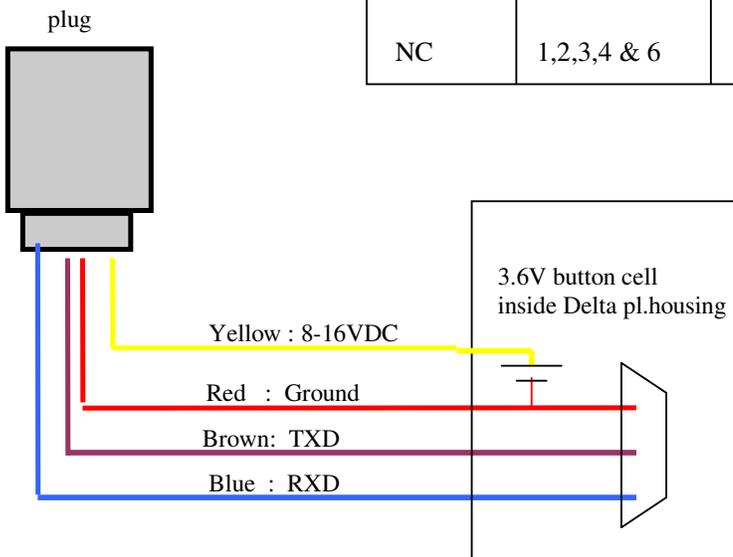
Appendix



Wiring of PC cable with 9 pins Delta plug and button cell for SD204/TD301/TD304



SD204 plug			9 Pins Delta plug	
Signal	Pin	Color	Pin	Color
TXD →	8	Brown	2	Brown
RXD ←	7	Blue	3	Blue
Ext.Power	10	Yellow		button cell for support during battery change
Gnd/0V	5+9	Red	5	Red
NC	1,2,3,4 & 6		1-4-6	Shorted
			7-8	Shorted



9 pins Delta plug
Female