



SOFTSAL

**A Data Management Package For
The Guidline AUTOSAL**

Version 3.1

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CONTENTS

1 GENERAL INTRODUCTION	4
2 INSTALLATION	5
2.1 System Contents	5
2.2 System Requirements	6
2.2.1 Computer Requirements	6
2.2.2 Salinometer Requirements	6
2.3 Connecting The Autosal.....	6
2.4 Installing The Software	6
2.4.1 Making A Working Copy.....	6
2.4.1.1 Hard Disk Procedure	7
2.5 Command Line Syntax	7
3 SALINOMETER DATA ACQUISITION	8
3.1 General Principles	8
3.2 Starting AUTOSAL Data Acquisition	9
3.3 Using The Menu System	10
3.4 The Configuration Menu	12
3.4.1 Allowed Standard-Deviation	12
3.4.2 PractSalScale.....	13
3.5 The Standardizing Menu.....	13
3.5.1 K15-Value	14
3.5.2 Stability	14
3.5.3 Rs-Trim	16
3.5.4 Substandard.....	16
3.6 The Measuring Menu.....	17
3.6.1 Data-File-Header.....	17
3.6.2 Selection Of Box Number	18
3.6.3 Automatic Measurement.....	19
3.6.4 Selection Of Printer Protocol	20
3.6.5 Manual Measurement.....	22
3.6.6 Measurement Of Control Datasets	24
3.7 Special Case And Error Handling.....	27
3.7.1 Measured Value Too Small	27
3.7.2 Identical Box-/Bottle-No.	28
3.7.3 Single Measurement Out Of Allowed Standard-Deviation	29
3.7.4 Consecutive Mean Out Of Allowed Standard-Deviation	30
3.7.5 No Rs Trim Possible.....	31
3.7.6 Parameter Check Before Appending To Data File	32
3.7.7 No Data From AUTOSAL	33
3.7.8 Suppression Too High	34
3.7.9 STANDBY During Measuring	35
3.7.10 Measurement Out Of PSS 78 Limits.....	36
4 POSTPROCESSING	37
4.1 General Principles	37

4.2 Starting Autosol Data Postprocessing	38
4.3 Operating The Postprocessing.....	38
5 THE FILE SYSTEM.....	43
5.1 General Principles	43
5.2 The ASI.CFG File	43
5.3 The Raw Data File	44
5.4 The Corrected Data File.....	44
6 INDEX.....	45
7 LIST OF FIGURES.....	47
8 PROBLEM REPORT FORM	48
9 SOFTSAL PRODUCT REGISTRATION FORM	50

1 GENERAL INTRODUCTION

The **SOFTSAL** package is a comfortable add on for AUTOSAL users who want to acquire salinity data from the salinometer by personal computer. The system has a menu user interface where you configure the acquisition, e.g. selection of allowed standard deviations, restriction to Practical Salinity Scale 1978, standardizing the salinometer and starting the measuring process, selection of on-line printer output and data file.

During main operations you sit in front of the salinometer as usual, taking sample bottles, switching to STANDBY, flushing the cell, pumping in the sample, selecting the appropriate BOTTLE NUMBER, switching to READ. During these operations the PC receives specific information on what you are doing. In READ MODE the PC receives conductivity data and calculates corresponding salinity, these values are displayed in large digits on the screen, so you can follow the procedure. If sufficient data for calculating the mean salinity have been transferred, the PC beeps to inform you to take further samples. So salinometry is unchanged in operations but you don't have to take care of your data.

The system checks for data quality (standard deviations, freak value elimination, sufficient flushing of the cell), inconsistent input (double occurrence of bottle numbers within same box) or instability of electronics (monitors the transferred value of the cell equivalent network which is switched instead of the cell to the electronics during STANDBY).

If you don't want the software to decide on your data, you may switch off the automatism and decide which 2 Rt should be used for calculation of salinity by pressing down the DATALOG push-button

Besides **data acquisition** there is a second part within the package, that is the **data postprocessing**. If you have generated control data sets during measuring by taking samples of well known salinity, e.g. sample from standard water ampoules or from prepared substandards, you can eliminate zero order drift of the salinometer.

For further processing of the data you may use your own algorithms, we have documented the file system and the data formats. Retrieval and postprocessing is simplified, for all data are in ASCII.

With the **SOFTSAL** data management packages comes the necessary hardware, that are cables, connectors and an optoisolated interface box for connecting the BCD port of the AUTOSAL with a PC COM port.

On the distribution diskette there is a demo program (ASIDEMO.EXE) which is a full version for training and information purposes. This program works without an AUTOSAL connected and without the necessary interface hardware. Within the menu screen there is a window with the operational elements of an AUTOSAL. Play with this version to get some experience before serious work. If you like the **SOFTSAL** package you may copy the demo version and give it to your colleagues.

If you have any comments on the product (improvements, wishes or problems), please use the problem report form at the end of the guide.

2 INSTALLATION

2.1 System Contents

SOFTSAL package consists of **HARDWARE COMPONENTS**, the **SOFTSAL DISKETTE** and the **SOFTSAL USER'S GUIDE**.

HARDWARE COMPONENTS:	Serial Interface Box	The box converts the parallel AUTOSAL BCD data to a serial bitstream and isolates the hardware of the PC from the AUTOSAL electrically for security and crosstalk attenuation reasons.
	Cable from Interface Box to Autosal	50 pol. ribbon cable with Sub-D connectors.
	Cable from Interface Box to PC	Standard cable with 9 pol. Sub-D connectors.
SOFTSAL DISKETTE:	README.DOC	A text file that contains information not yet in the manual.
	ASI.EXE	The SOFTSAL Data Acquisition Program.
	TEST.DAT	Example file containing the acquired salinity data. Here a demonstration data set.
	ASIPP.EXE	The SOFTSAL Postprocessing Program.
	TEST.COR	Example file containing salinity data after postprocessing. Here data from the demonstration set TEST.DAT.
	ASIDEMO.EXE	SOFTSAL Data Acquisition Demo Program. Does not need the hardware and an AUTOSAL.
	ASICTRL.EXE	Connection test program.

2.2 System Requirements

2.2.1 Computer Requirements

SOFTSAL runs on IBM Personal Computers running PC-DOS; or a PC compatible running Microsoft Corporation's MS-DOS operating system, version 3.1 or later.

A monochrome or colour monitor.

One 3 1/2 inch diskette drive.

At least 200K of free computer memory.

A serial interface according to EIA 232.

2.2.2 Salinometer Requirements

A Guildline AUTOSAL MODEL 8400x with BCD Interface Option.

2.3 Connecting The Autosal

The connection from the PC to the AUTOSAL is done via the optoisolated Interface Box. The box is connected to the AUTOSAL by a separate 50-wire extension cable and to the PC by a standard serial cable with 9 pol. Sub-D connectors.

2.4 Installing The Software

2.4.1 Making A Working Copy

As a convenience to authorised users, The **SOFTSAL** diskette is not copy protected. It can be copied using standard DOS copying commands. We ask you not to distribute copies of the software to unauthorised users. But you may distribute the demo program ASIDEMO.EXE.

As a safeguard against the loss, damage, or erasure of the **SOFTSAL** diskette, you should make a working copy of the diskette before using **SOFTSAL**. If the working copy is made on a diskette, the diskette must have a label bearing the following copyright notice:

SOFTSAL
Copyright 1996 by SiS Sensoren Instrumente Systeme GmbH
All rights reserved

In addition to the copyright notice, it is a good idea to put the version number of **SOFTSAL** on the diskette label. The version number is on the master **SOFTSAL** diskette and is displayed when **SOFTSAL** starts. When reporting problems with **SOFTSAL**, be sure to include the version number on the Problem Report Form printed at the end of this guide.

Before making a working copy, we recommend write protecting the **SOFTSAL** diskette. A 3 1/2 inch diskette is write protected by moving the write-protect slide so the window is open. See your computer manual for details.

2.4.1.1 Hard Disk Procedure

If your computer has a diskette drive for drive A and a hard disk drive for drive C, you can make a working copy of **SOFTSAL** on the hard disk as follows:

Turn on and boot the computer in the ordinary way from the hard disk or a DOS diskette in drive A.

Insert the **SOFTSAL** diskette in drive A.

Switch to drive C by entering the DOS command

C:

Make a new subdirectory named **SOFTSAL** by entering the DOS command

MD **SOFTSAL**

Change to the **SOFTSAL** subdirectory by entering the DOS command

CD **SOFTSAL**

Copy the files from the **SOFTSAL** diskette to the **SOFTSAL** subdirectory by entering the DOS command

COPY A:*.*

After all the files have been transferred to the hard disk and the DOS prompt is redisplayed, remove the **SOFTSAL** diskette from drive A.

Before you work with the system please read the readme.doc file which contains information not yet in the guide.

2.5 Command Line Syntax

Usage: ASI [/M] [/Cx] [/?] [/H]
 ASICTRL [/M] [/Cx] [/?] [/H]

Command Line Parameter:

M Monochrome Display Mode
Cx Serial interface COM port selection (1 to 4, default is COM 1)
?,H Help Screen for command line parameter

Note : It is only one time necessary to start the program with a /C option, because the setting will be stored in the ASI.CFG file and then used by default.

3 SALINOMETER DATA ACQUISITION

3.1 General Principles

The Data Acquisition part of **SOFTSAL** comes in two versions, one is the working version ASI and the other is the demo version ASIDEMO. ASIDEMO has exactly the same features as the working version but without the need for the additional hardware and the AUTOSAL. The demo version simulates an AUTOSAL and displays the operational elements of the salinometer in a Demo Status subwindow within the screen of a working version.

We advice for training purposes to use the demo version at first.

The needed operational elements of an AUTOSAL to work with **SOFTSAL** are:

<u>AUTOSAL</u>	<u>SOFTSAL DEMO EQUIVALENT</u>
STANDBY	F1
READ	F2
DATALOG	F3
BOTTLE NO	↑ BOTTLE NO INCREASING ↓ BOTTLE NO DECREASING
2RT DISPLAY	SMALL DISPLAY AREA AT THE BOTTOM OF DEMOSTATUS WINDOW PRESS F4 FOR INPUT TO THAT DISPLAY, CONFIRM BY <ENTER>

In the following we will use the AUTOSAL nomenclature if we refer to an operational element, if you are playing with the demo you have to translate.

3.2 Starting the AUTOSAL Data Acquisition

Once a working copy of **SOFTSAL** has been made as described in section 2.3.3 you start the data acquisition as follows:

Turn on your computer and boot in the ordinary way, then change to the AUTOSAL directory.

Enter the DOS command

ASI for full version
ASIDEMO for demo version

and the initial **SOFTSAL** Data Acquisition Screen is displayed.

NOTE: If this does not start the **SOFTSAL** Data Acquisition you have to change the directory to **SOFTSAL** or set the appropriate PATH. For details study your computer manual.

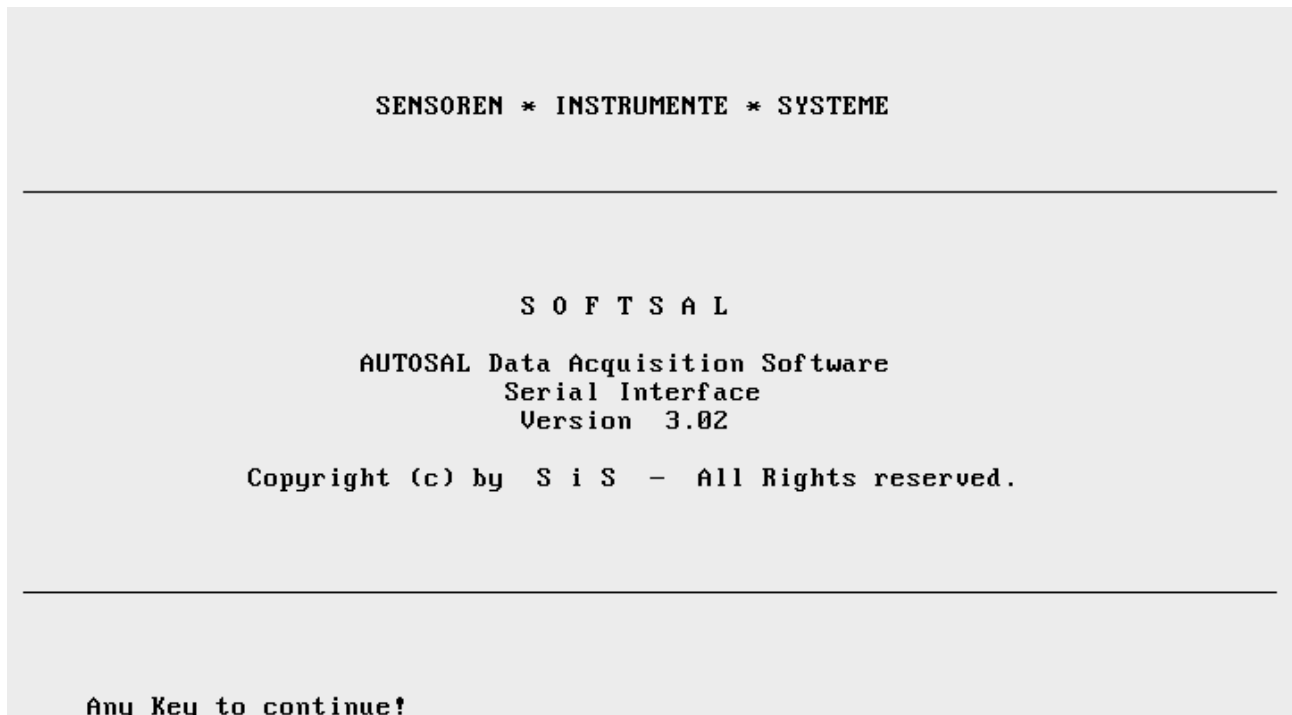


Figure 3.1 Initial Screen Of Data Acquisition

You are requested to switch the salinometer to STANDBY for reading the bath temperature. You should work with the Salinometer only if the same bath temperature is selected as during last standardization. Secondly the control digits from the in STANDBY - instead of the cell - switched equivalent network are transferred to the Data Acquisition System. These digits have to be unchanged in a certain tolerance band from the digits seen after Standardization, otherwise there is a change in Rs trim or a drift in the electronic. In all these cases you have to standardize the salinometer.

The next two figures show the corresponding screens. Normally when you start the system for the first time you will see these screens for the system doesn't know your specific salinometer.

Please switch to STANDBY
for reading bathtemperature!

No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt
								Bath: °C	Std:

Figure 3.2a Control Of Bath Temperature and STANDBY Digits

Bath-Temp. or Control-Digits
differ from last Standardiza-
tion. Re-standardize AUTOSAL!
Press any key!

No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt
								Bath: 21°C	Std:

Figure 3.2b Message For Necessary Re-Standardizing

3.3 Using The Menu System

By pressing any key we come to the menu system. The system forces you to restandardize because of the above mentioned discrepancies.

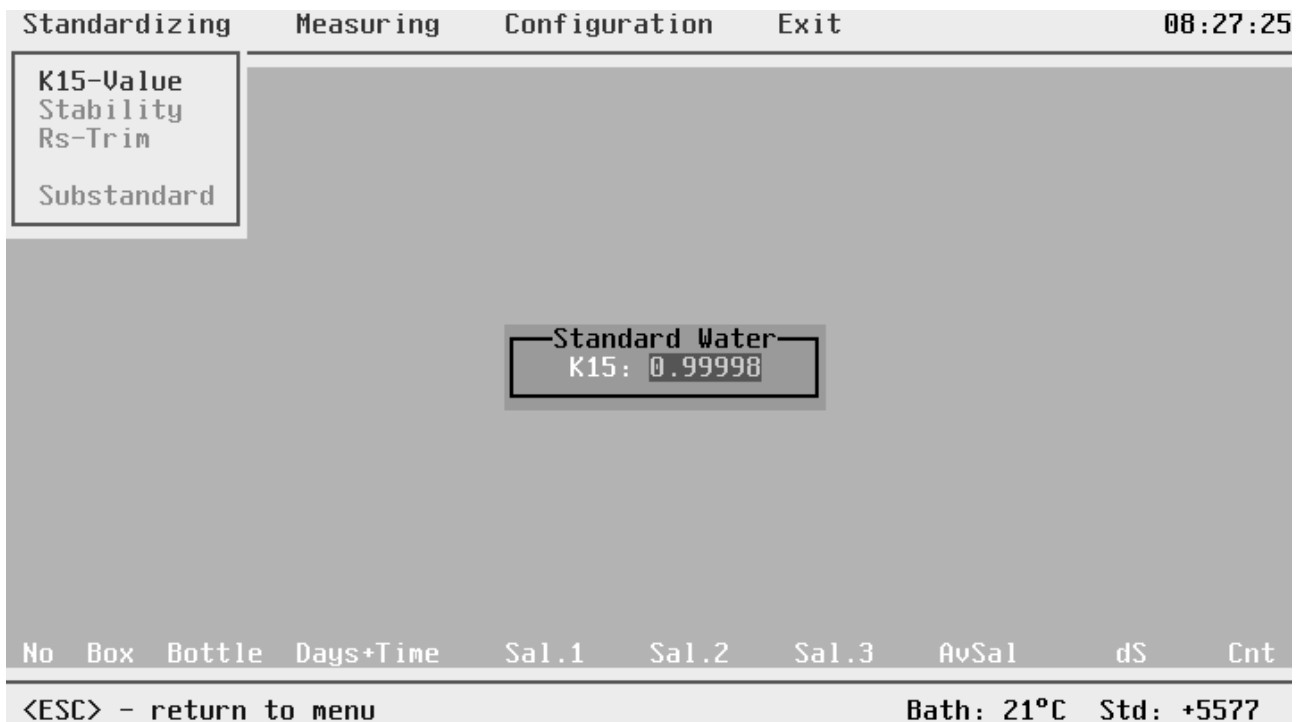


Figure 3.3 Main Menu

On top of the screen you see the main menu row - Standardizing, Measuring, Configuration and Exit. Standardize is selected and the standardizing submenu is visible with K15-Value selected. The upper right corner shows the time, the bottom line is the status line. Here you always see information according to the selected menu item, in this status you see some explanations of the item K15 selected. By cursors you move through the menu system, but because the standardizing procedure is definitely fixed only highlighted items are selectable. You always have one choice, that is to interrupt the actual procedure by pressing <ESC>.

Please interrupt by <ESC> for we want to make a quick tour through the menu system before we go into details.

By cursor right or left you can select the main menu items. Go to Measuring for instance. The status line shows Data Acquisition. You open the submenu of the main menu items by pressing <ENTER>, a window opens and you are asked to fill in an MS-DOS Filename, default is the last used file. For the first time the default is FILENAME. The extension is fixed to DAT because all acquired salinity data are stored in *.DAT files. Confirm all entries by <ENTER> so you come to the most important window of the system where in big letters you see S1, S2 and S3. Fill in 0001 for Box-No and confirm by <ENTER>. A further longish window appears telling you to switch the AUTOSAL to STANDBY, flush and fill the cell and switch to READ, please do that (preferable in the demo version). You see the calculated salinity from incoming 2 Rt's. After a certain time you hear a beep and once more do the above procedure, a second beep and you will have a fixed value for S2. Try a third time and you will get a fixed S3, shortly after the beep you will hear another one and the bottom line of the window shows a dataset.

Return to menu by <ESC> and select Configuration. Slowly confirm for four times so you get to all subwindows of configuring Allowed S-Dev. and return to Allowed S-Dev. Now go down by cursor to PractSalScale and confirm by <ENTER>, in the status line you get some help.

Return to the menu and select Standardizing, try to go through the whole procedure by consideration of the helps in menu and status line. We hope you have got to the bottom and have a certain feeling about the using of the menu. In the next sections we will show you the usage of the system in detail and the principles behind it; so we start with the Configuration Menu because that is the logical way for a novice.

3.4 The Configuration Menu

After selection of the Configuration Menu, go down to the submenu by <ENTER>. You now have the choice between Allowed S-Dev and PractSalScale.

3.4.1 Allowed Standard-Deviation

Select Allowed S-Dev, the status line shows "Limits for Data Acquisition", confirm by pressing <ENTER>. The Standard-Deviation window opens.

You have to fill in two values, one for single measurements and one for 3 consecutive measurements.

A single measurement leads to a mean value of a unique subsample in the cell. A subsample is a filling of the cell from your sample bottle. The Standard-Deviation for a single measurement is the calculated deviation from ten readings of a subsample. This deviation has to be less/equal the here preset Standard-Deviation for single measurements. If within the first ten transmitted values this criterion is fulfilled, the mean value is the salinity of the single measurement. If the criterion is not true, the calculated standard deviation (greater than preset Standard-Deviation) is doubled, all of the ten values out of a window of +/- two times around the mean value are cancelled. These cancelled values are defined as freak values and are omitted from the 10 values and replaced by new readings. The checking procedure begins again (mean value determination, standard deviation determination, checking the limit criterion, omitting freak values). If within 10 trials you get no deviation beyond the preset value, you will get an error message during measurement: Measurement out of allowed standard-deviation for single measurements. Press any key!

If some trials always lead to that message, your AUTOSAL give too noisy readings or the preset value is too small. The deviation is given in salinity units so you may decide according to your precision needs, to the specific capability of your AUTOSAL or the actual noisy environment (e.g. laboratory, or on board of ship). The best selection needs some experience with salinometry and the **SOFTSAL** system. We have preselected the Standard deviation for single measurements to 0.0015, which is normally far too large.

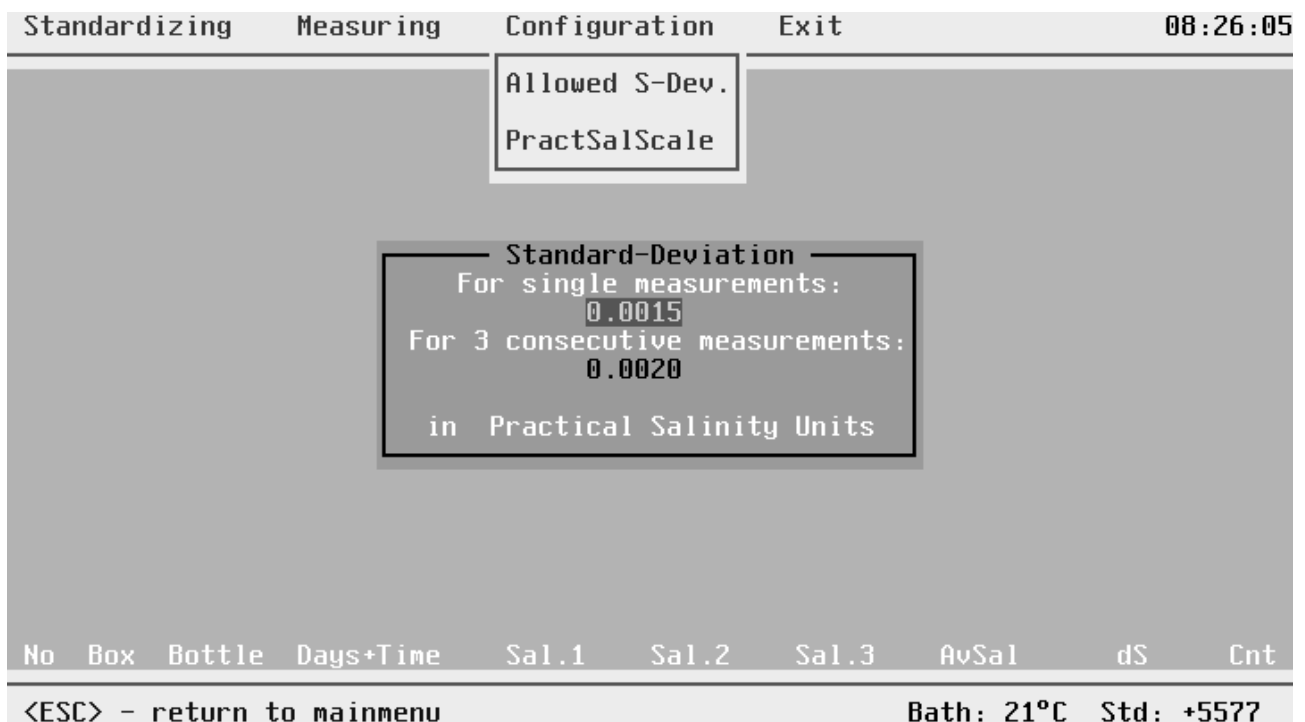


Figure 3.4 Configure Standard-Deviation Window

After you have got one single measurement, the system requests for at least two more subsample of your sample bottle. If after three consecutive single measurements the standard deviation of these is beyond the here preselected value, the mean value - called AvSal - is determined and you may go to the next sample bottle. If three consecutive single measurements don't have a deviation beyond the limit, the first one of the three is cancelled, the second becomes the actual first and the third becomes the actual second one. You have to flush and pump in a further subsample, this will become the actual third one. The system calculates the standard deviation again and checks for the limit criterion, if fulfilled, the mean value of these three consecutive single measurements is the salinity of the sample, if not fulfilled, the system asks for more subsamples. If after 10 consecutive single measurements the criterion has not been fulfilled the system displays an error message: **10 consecutive measurements out of allowed std.-dev. . Please flush more carefully. Press any key.** The most often reason will be drift of salinity between consecutive single measurements due to insufficient flushing, especially if the preceding bottle had a considerable different salinity. Another reason can be the too small preselected Standard-Deviation for 3 consecutive measurements. We have selected 0.0020 here, that is large enough for the beginning. Normally the value is larger than that for single measurements. With some experience you will find "your" limit value.

Please fill in "your" test limits (each time confirmed by <ENTER>), you come to the preceding window and select PractSalScale by cursor down followed by <ENTER>.

The deviation parameters are stored in an ASCII file named ASI.CFG .

3.4.2 PractSalScale

For determination of salinity the system uses the measured Rt of the AUTOSAL and the temperature of the thermostat tank according to Practical Salinity Scale 1978. These algorithms have limits at 2 and 42 PSU. If you select PSS78-Limits: ON, the system is restricted to the range of 2 to 42 PSU. If you switch to OFF, PSS78 is used even outside the range. The normal selection is ON, because most samples are within the range.

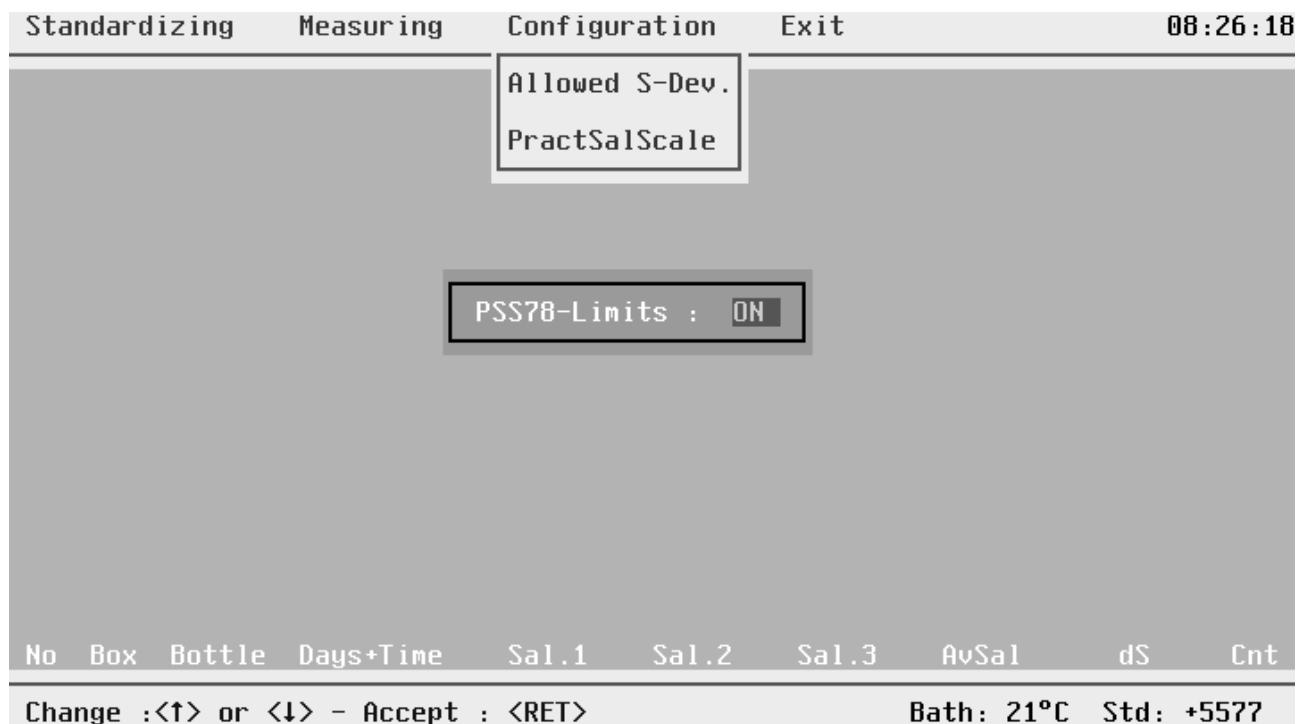


Figure 3.5 PractSalScale Submenu

3.5 The Standardizing Menu

The Standardizing submenu contains K15 Value, Stability, Rs-Trim and Substandard menuitems. Besides the correct selection of deviation limits, the thorough adjustment of the Rs trim and if selected, the exact determination of the substandard are the main preconditions for quality data. This is the reason why we have given a fixed procedure within the Standardizing Menu. The system tells you what to do next and you have no other choice except leaving the menu by <ESC>. Before standardizing please consult your AUTOSAL Technical Manual for the standardizing procedure.

3.5.1 K15-Value

The K15 value is the conductivity ratio of a seawater sample and an aqueous solution of 32,4356 g KCl per kg at 15 °C and at standard atmospheric pressure. If K15 is 1, the seawater has by definition a salinity of 35. A seawater with salinity about 35 is called a standard seawater. Standard seawater is commercially available (e.g. SiS Sensoren Instrumente Systeme GmbH) in vials with labelled K15.

You can use any kind of seawater the K15 value is known of, because the system calculates the corresponding $2 \cdot R_t$ value. Without this system you normally use standard seawater of K15 very near 1, so without significant error you could use $2 \cdot R_t = 2 \cdot K15$. But with seawater of differing K15 the error of that procedure becomes far above the accuracy of an AUTOSAL, you have to use the exact formulas from K15 to R_t . This is done by the **SOFTSAL** system. So if the salinity range of your interest is different from 35 (e.g. Baltic) you can use standard water of K15 value other than 1 (for commercial distribution of such standard waters please contact SiS Sensoren Instrumente Systeme GmbH).

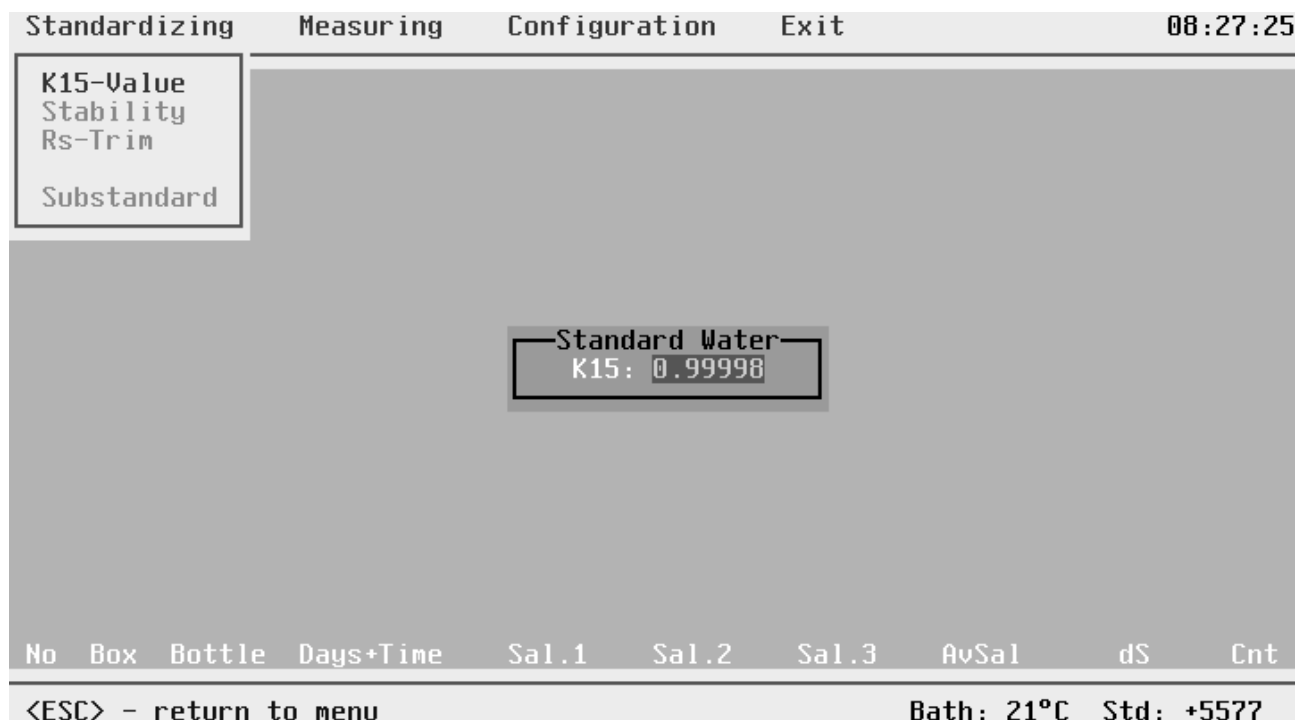


Figure 3.6 K15-Value Submenu

Select the K15 menuitem and confirm by <ENTER>, a small window for the input of K15 is opened. Filling in the K15 of the standard water you are going to use and confirming by <ENTER>, you come to the next menuitem.

3.5.2 Stability

Prepare the standard vial and the Autosal as described in the STANDARDIZE PROCEDURE in the technical manual of your salinometer.

Now the stability of your salinometer is examined, for standardizing is useful only if your instrument is stable.

Confirm the selected K15 value by <ENTER> and a new window opens, which is similar to the menu Measuring. We will roughly describe the procedure of measuring here, for more details we refer to paragraph 3.6.3.

In the lower part of the window you are told what to do next. You leave the keyboard and take a seat in front of the AUTOSAL, all the following is done from here. The computer will be now controlled by the salinometer. The stability control is to secure getting a stable reading of your standard water sample within the from Configuration preselected limits.

For the salinometer is not standardized up to now the displayed salinity values on the screen are not the true salinity of your sample. It's only secured that the displayed values don't show drift between flushing.

A drift is for example to be seen, if the cell had been filled with distilled water (salinity = 0) during the preheating phase of the salinometer bath and now during standardizing is not sufficiently preflushed.

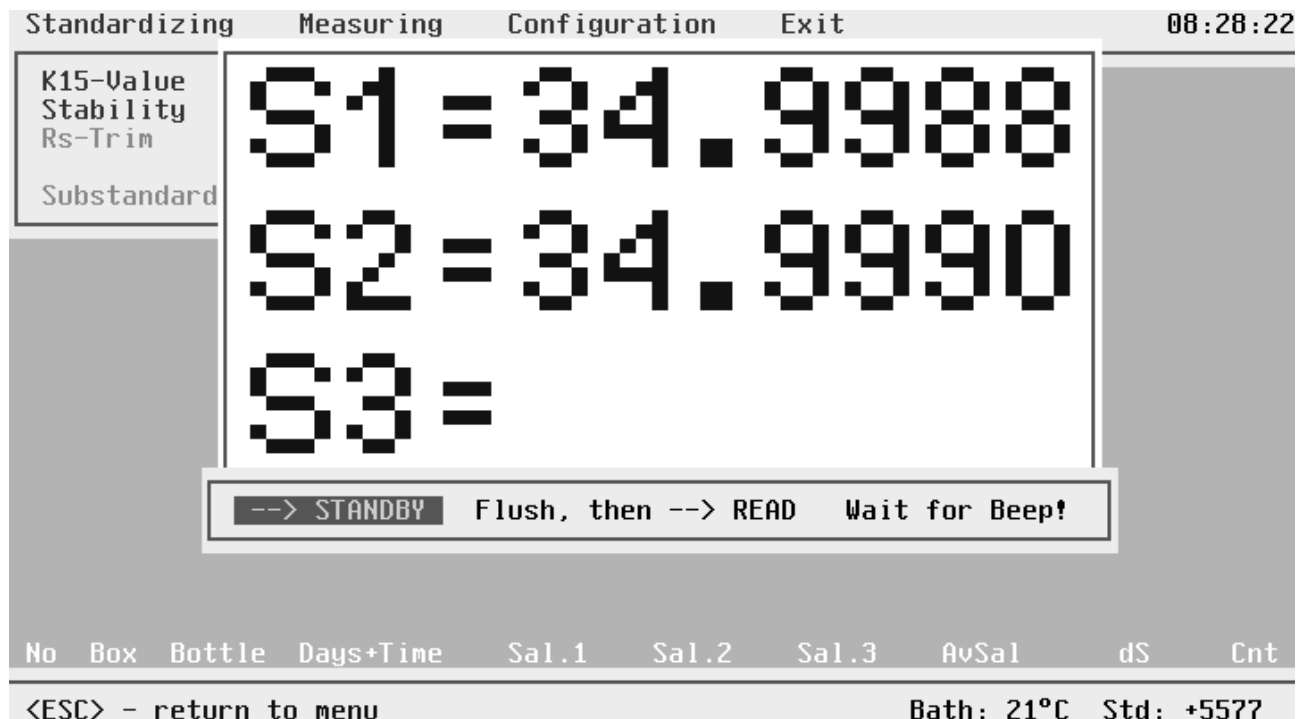


Figure 3.7 Stability Control

Switch the salinometer to STANDBY and flush the cell, then switch to READ. You see the from incoming Rt values calculated salinities, after the system has got a first single measurement it beeps to tell you to flush in the next subsample and switch to READ afterwards, the system beeps again and requests the next subsample. The above figure 3.7 shows the screen at this moment.

During the measuring process you have all the possibilities as in normal measuring samples and as well all the possible error messages. After sufficient subsamples you will get three consecutive measurements within the in configuration preselected standard deviation. That is the end of stability control and the system automatically switches to Rs-Trim.

3.5.3 Rs-Trim

Within this menupart an instruction window is opened. First you are asked to switch to READ, the screen shows the corresponding $2 \cdot R_t$ value which should be displayed with the standard water of given K15. Next you should trim the Rs helipot of the AUTOSAL to show the demanded $2 \cdot R_t$ on it's display.

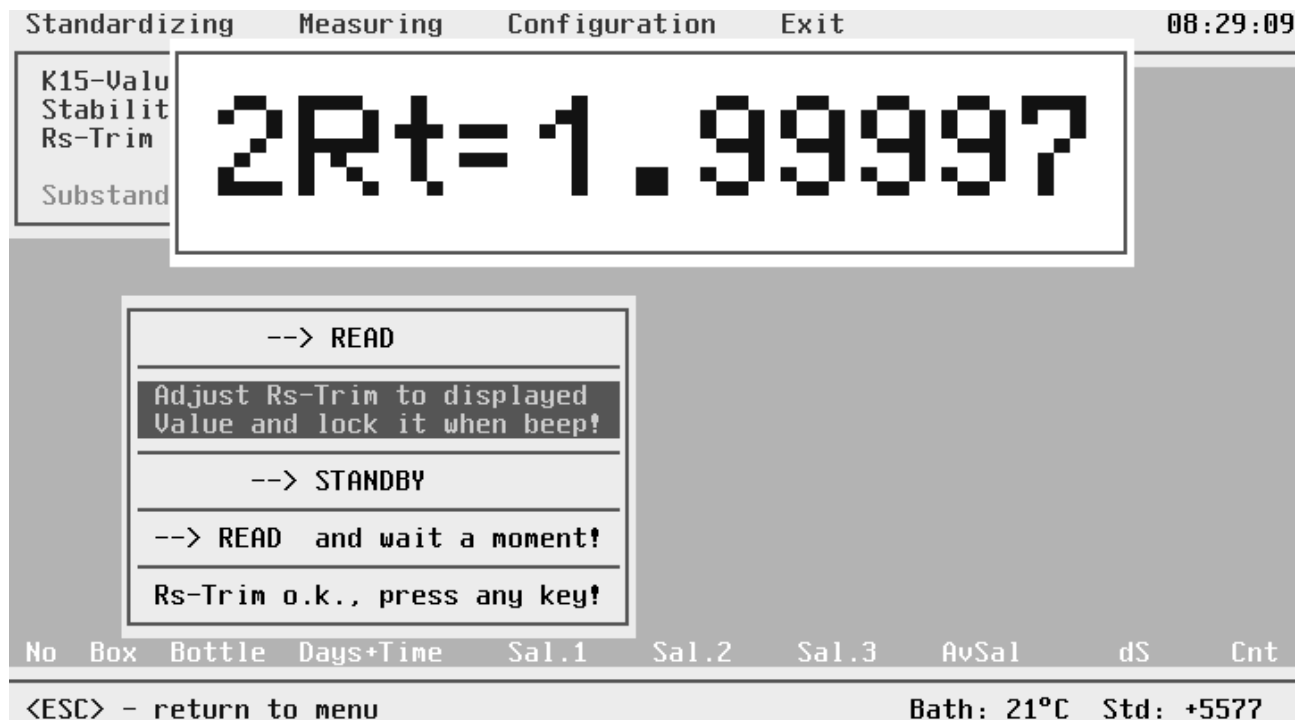


Figure 3.8 Rs-Trim

If you manage to adjust to the accurate value you hear a beep and the systems asks you to lock the Rs-Trim. After switching to STANDBY, the system reads the display from the AUTOSAL. The two leading digits are the bath temperature, the remaining digits represent the "conductivity ratio" of a cell equivalent circuit which is switched to the electronics during STANDBY instead of the cell. This value is written to the last row behind Std: and will be from now on controlled every time at programstart to see whether the Rs-Trim has been changed since the last standardisation.

If you now switch back to READ again the system controls whether the $2 \cdot R_t$ value is unchanged by the locking of the trim. In that case after pressing any key, you come to the Substandard menuitem.

3.5.4 Substandard

It's a good practice to take - while recording a lot of datasets over a period of several days - from time to time control datasets in order to control the accuracy of the AUTOSAL and even to correct for zero order drift of the AUTOSAL (see POSTPROCESSING). For this controlling you may use standard water vials (expensive but best method) or you have prepared a substandard. If you want to use the substandard method, you now, immediately after standardizing, have to determine the salinity of your substandard.

Confirm Substandard by <ENTER> and a measuring window opens comparable to that one you have seen during Stability Control. Please try to get three consecutive single measurements. If you succeed, your system two times beeps and opens another small window with the calculated salinity of your substandard.

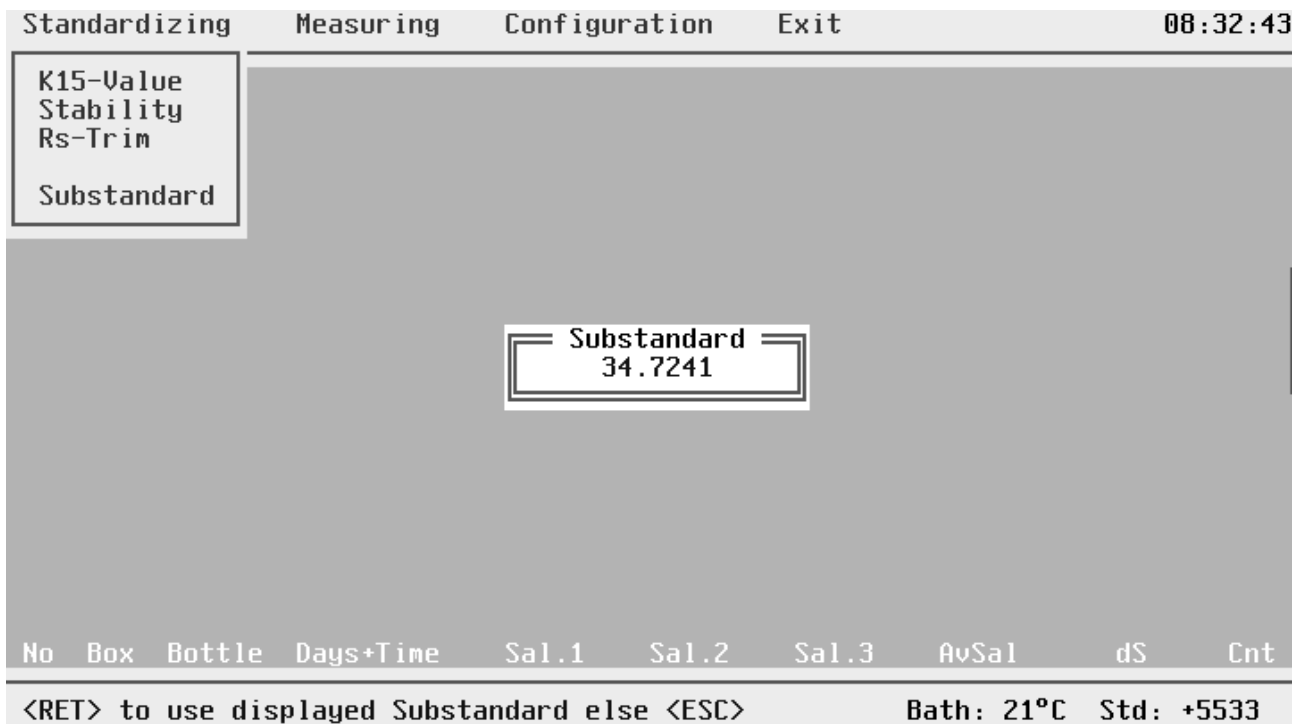


Figure 3.9 Substandard

If you want to use this value from now on up to the next necessary standardization, press <ENTER> else press <ESC> and try again or leave to main menu.

All data from the standardizing procedure are stored in an ASCII file called ASI.CFG

3.6 The Measuring Menu

The Measuring Menu is the central menu part of the system, and in practice, you will work here most of the time. There are two methods for measuring, the automatic and the manual one. After specifying a Data-File-Header, all further work will be done at the AUTOSAL.

Choose Measuring and confirm by <ENTER> to open the Data-File-Header Form.

3.6.1 Data-File-Header

First you have to specify the Data File Name where you want the data to be recorded. The file extension for salinity data is DAT, which you can't fill in, it is given by the system. You have to confirm by <ENTER> and come to the second part of the header. Some information already has been filled in even if your DAT file has been created just before.

The system has filled in the information for Last Standardizing, the salinity of an eventually defined Substandard (if none is defined, salinity is set to zero), Bath Temperature, Standard Control Digits, Date of first Dataset and Datasets in File, if any datasets in the file exist, there will be a further message displayed: **File already exists. Data will be appended.** If data already existing, the system checks before appending is allowed whether the system parameters in the existing header are equal to the actual ones, which are stored in the ASI.CFG file. If there is a discrepancy an error message is displayed. For details we refer to paragraph 3.7.6.

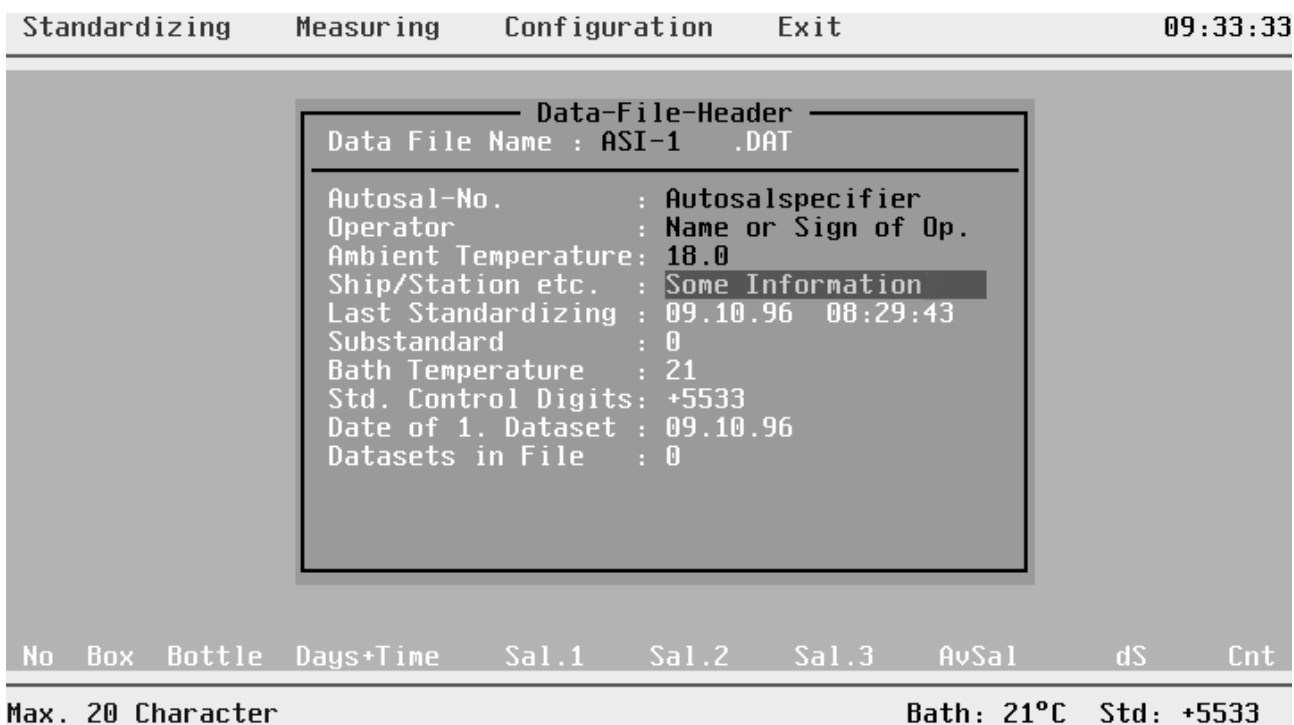


Figure 3.10 Data-File-Header

3.6.2 Selection Of Box Number

If you go further on by <ENTER> you come to the Measuring Window with large letters for the three consecutive single measurements. Within this window you see a small subwindow where you have to fill in the box number your next sample bottles come from. Fill in the box number and confirm by <ENTER>.

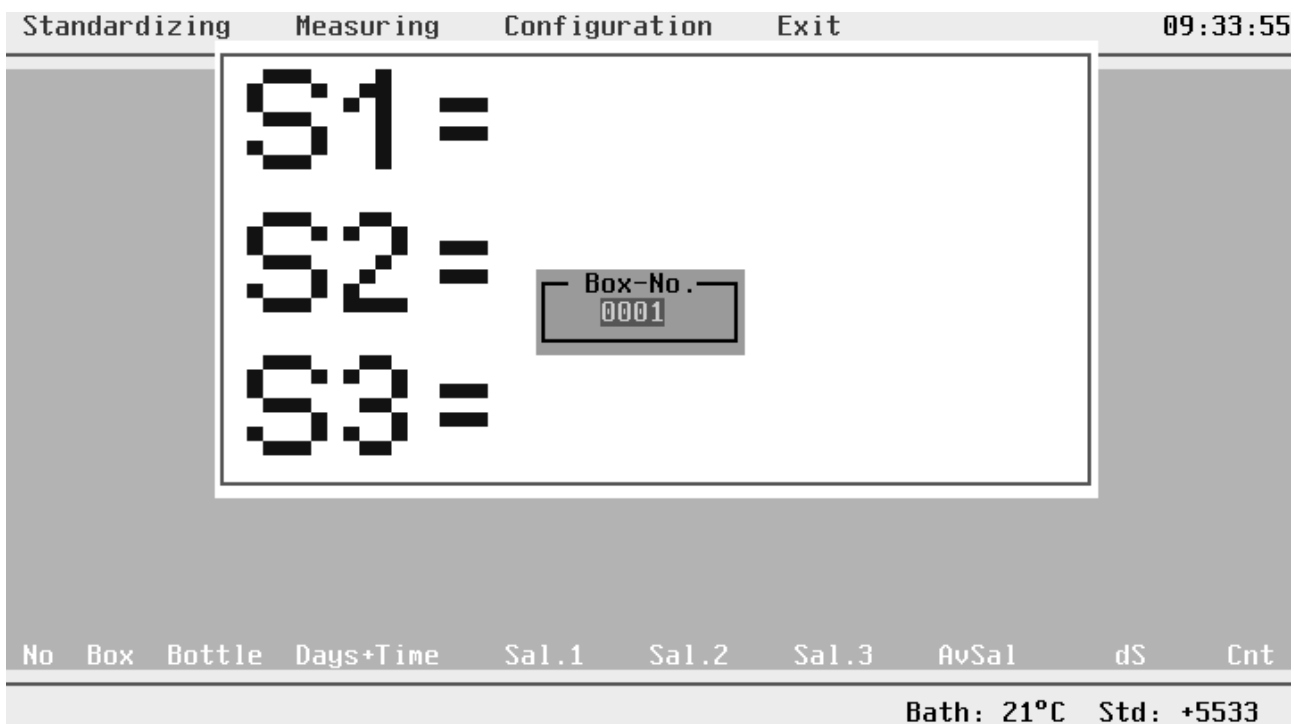


Figure 3.11 Selection of Box Number

3.6.3 Automatic Measurement

An Instruction Window is opened where you see how to proceed. Now you can leave the keyboard as long as you take bottles out of the same box. You are asked to switch the salinometer to STANDBY, sufficiently flush and fill the cell. Before you switch to READ please adjust the right bottle number by the THUMB WHEEL SWITCH of the AUTOSAL. Now switch to READ. Normally you see incoming values for S1, these values are calculated from the transmitted $2 \cdot R_t$ data. The instruction window shows "Wait for beep!". You hear the beep when a single measurement is terminated (for definition of single measurement please see paragraph 3.4.1 Allowed Standard-Deviation). After beeping, switch to STANDBY and fill the cell with the next subsample and proceed as before. Not before three subsamples you get a final salinity value which is the mean value of three consecutive single measurements within the preselected standard variation.

If the first three don't lead to a consecutive mean within the limits, the first is cleared and the other jump one row up. You have to try with another subsample up to three consecutive single measurements within the limits.

If you have got the consecutive mean the measuring windows clears up and at the bottom you see your first dataset. The columns are the consecutive No of the dataset, the Box and Bottle Nos as identifier of the specific sample, next are Days + Time (these are needed for POSTPROCESSING, for details see the corresponding paragraph), the first Single Measurement S1, the second Single Measurement S2, the third Single Measurement S3, the mean value of the three consecutive single measurements AvSal, the standard deviation of AvSal dS, and finally the Count of needed single measurements for AvSal.

As soon as a dataset is acquired, it is immediately written to the data file specified in the header.

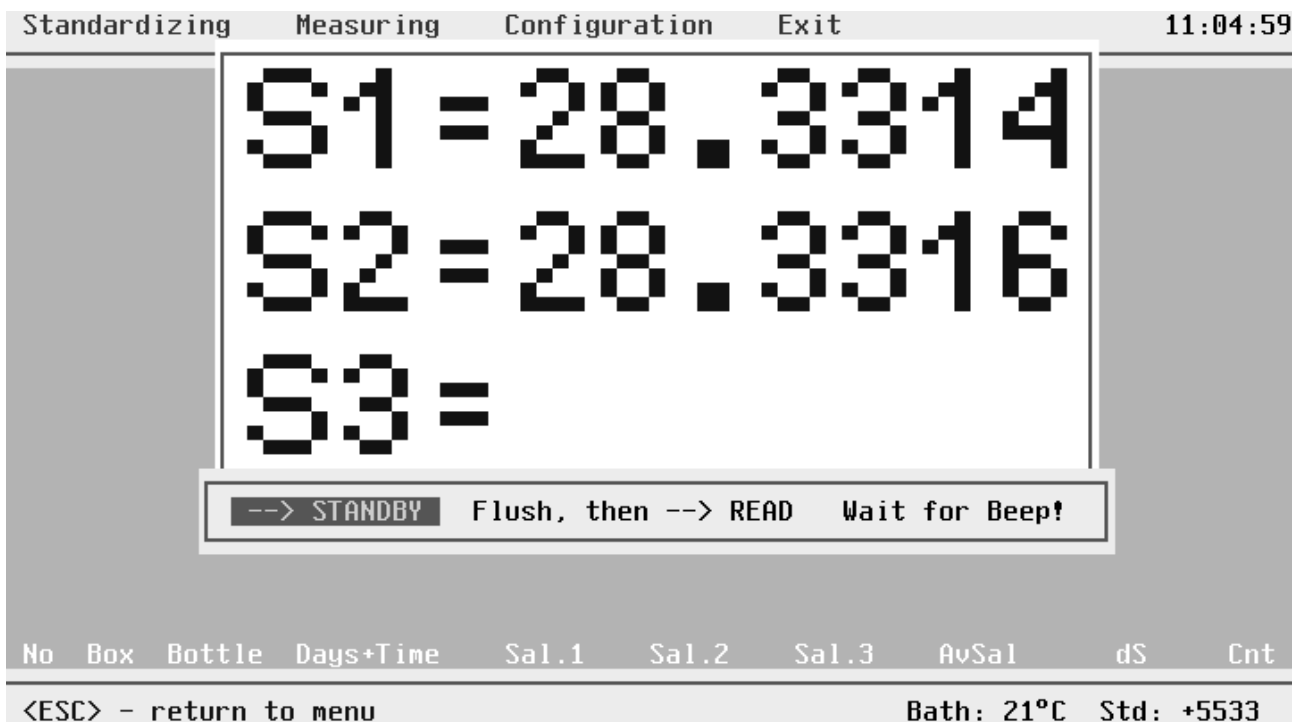


Figure 3.12 The Measuring Window

The next sample bottle may be salinometered. Please switch to STANDBY, adjust the right bottle number, the box number if you switched to a new box and/or select on line printer protocol. These choices are available at STANDBY before the beginning of a new dataset and are shown in the last row, the status line.

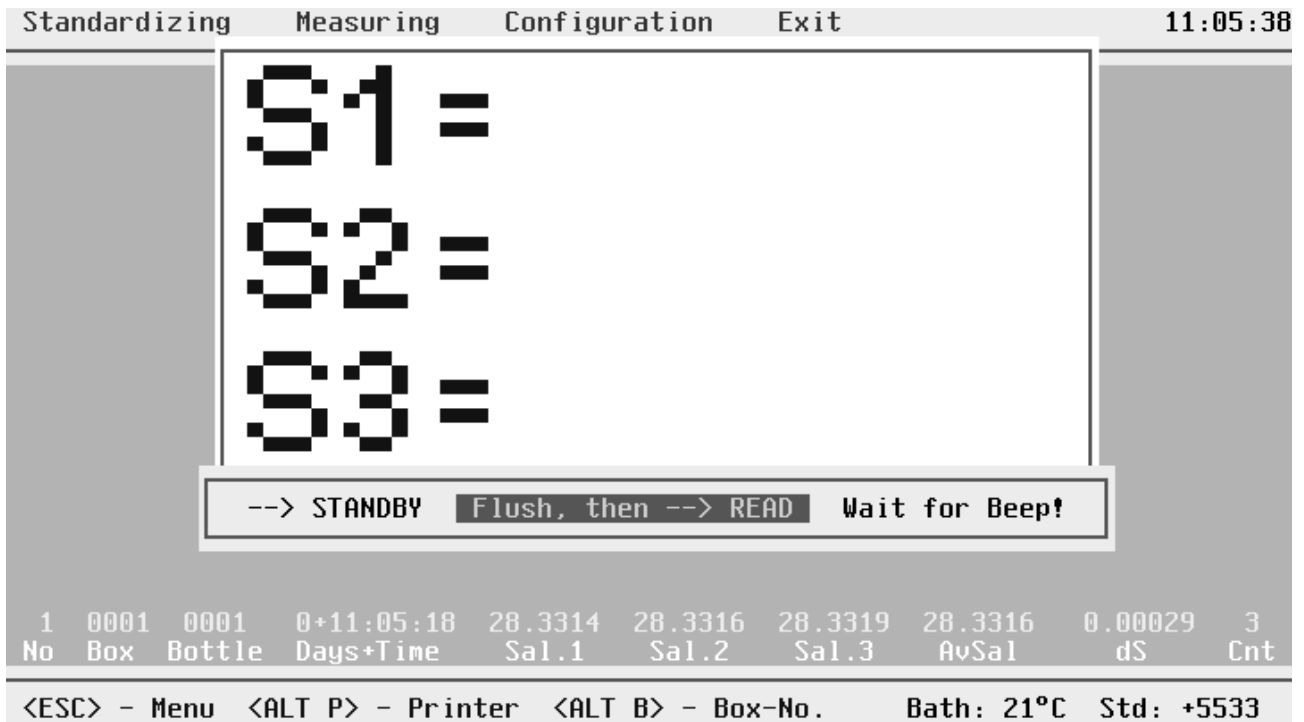


Figure 3.13 Possible Selections for a New Data Set

3.6.4 Selection Of Printer Protocol

Selection of a Printer is possible every time you have switched to STANDBY and just in before measuring the first subsample. In this situation you see the screen of figure 3.13. Select printing by pressing down <ALT P>. A subwindow opens where you can toggle Printer Protocol ON or OFF by cursor up or down. Try Printer Protocol ON.

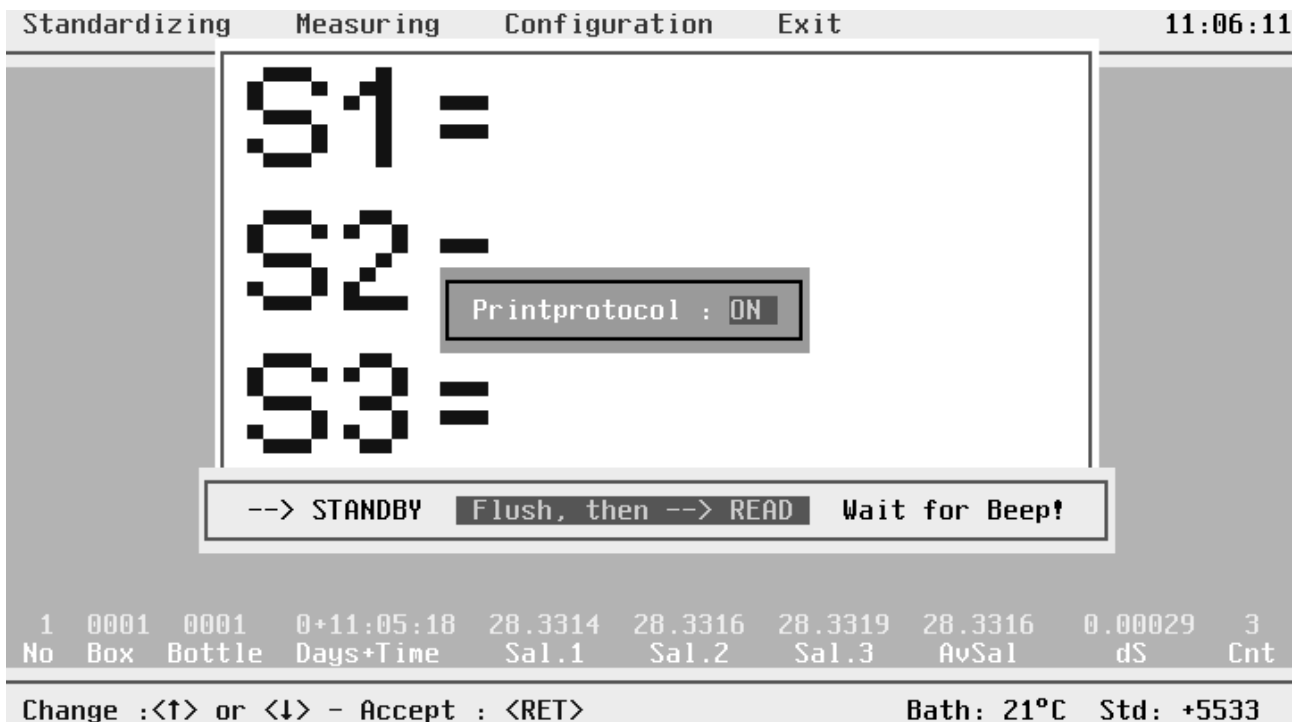


Figure 3.14 Selection of Printer Protocol

From now on each new complete dataset is send to printer without delay. So there is a protocol even if a systems crash has occurred.

The first part is the header filled in before measurement and the second part is the continuous data protocol from selection of Printer Protocol ON.

```
*****
*                               S I S - SOFTSAL - Data                               *
*****
* AUTOSAL-No.: Autosalspecifier           Operator: Name or Sign of Op.           *
* Last Std.: 09.10.96 08:29:43           Actual Date: 09.10.96                   *
* Bathtemp.: 21 C                         Std.-control-digits: +5533             *
* Ambient Temp.: 18.0 C                     Ship: Some information                 *
* Name of Data File: ASI-1 .DAT                                                    *
* Allowed Std.-Dev.(single Meas.) : 0.0015 Practical Salinity Units             *
* Allowed Std.-Dev.(3 cons. Meas.): 0.0020 Practical Salinity Units             *
*****
```

No.	Box	Bottle	Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt
2	0001	0002	11:11:43	28.3338	28.3335	28.3337	28.3337	0.00019	3
3	0001	0003	11:12:44	28.3340	28.3342	28.3337	28.3340	0.00029	3
4	0001	0004	11:13:33	28.3329	28.3333	28.3333	28.3331	0.00022	3
5	0001	0005	11:14:37	34.5177	34.5181	34.5179	34.5179	0.00020	4
6	0001	0006	11:15:40	34.1322	34.1302	34.1304	34.1310	0.00108	4
7	0001	0007	11:16:18	34.1285	34.1277	34.1279	34.1280	0.00041	3
8	0001	0008	11:17:03	30.2485	30.2490	30.2496	30.2490	0.00058	3
9	0001	0009	11:17:37	30.2491	30.2481	30.2483	30.2485	0.00052	3
10	0001	0010	11:18:31	30.2492	30.2498	30.2504	30.2498	0.00058	3

Figure 3.15 Printer Protocol

3.6.5 Manual Measurement

Manual measurement is preferable or even necessary if:

you have extreme fluctuations due to noisy environment

you want to decide which 2*Rt values should be used

the sample is too small for three consecutive measurements

During automatic measurement the status line shows "<DATA LOG> - manually measuring". This selection is possible during all three consecutive single measurements.

If the user has selected manual measurement by DATALOG, the systems beeps, all values in the measuring window are cleared, and the instruction row beyond the big measurement window is replaced by a new instruction window which guides the user through the following options of manual measurement:

Switch to READ and (as often as you like) press DATA LOG: Single Measurement

Switch to STANDBY and (after flushing!) switch back to READ: Next Position

Switch to STANDBY and then press DATA LOG: Next Sample
(and new measuring window)

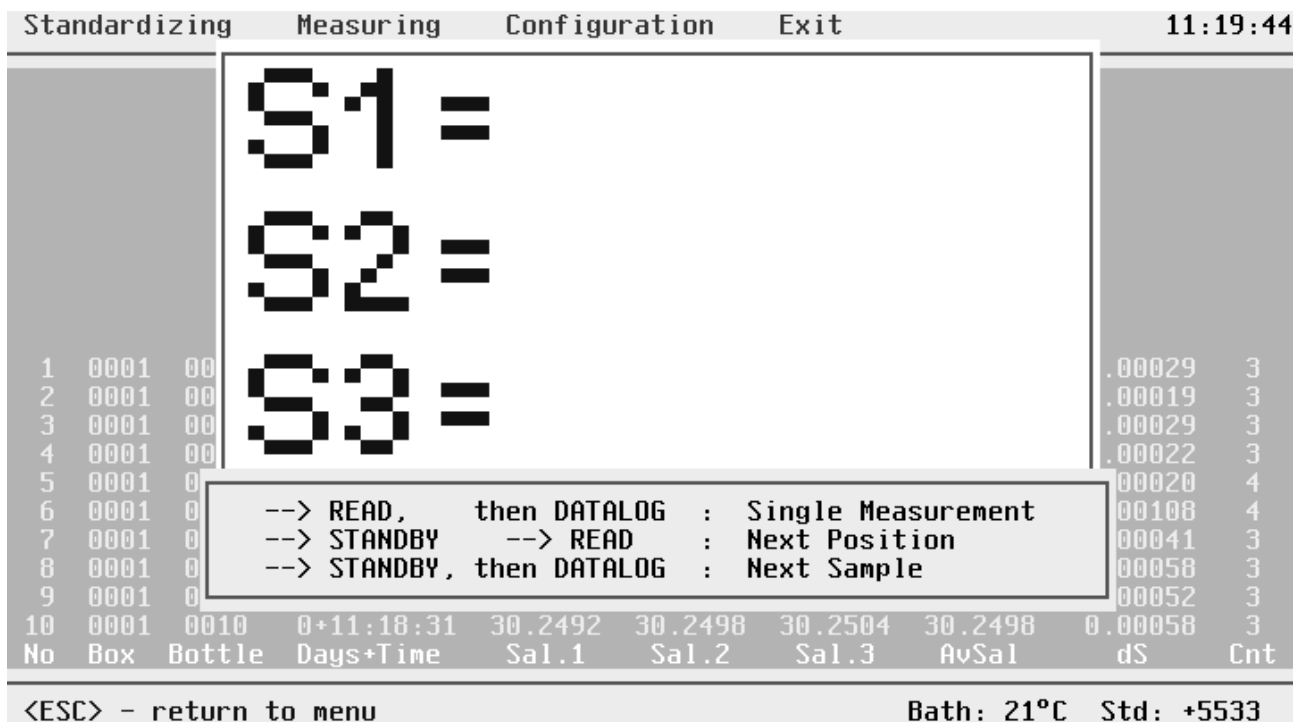


Figure 3.16 Start Screen Manual Measurement

If the user performs one of these actions, a beep is the acoustic confirmation of a selected action. So the user can concentrate on the operation of the AUTOSAL.

During manual measurement all limitations from automatism are removed, e.g. here is no inspection of deviations of salinity from preselected limits, the single measurement is no mean of 10 incoming readings. The measured Rt is calculated to salinity and directly displayed as representant of S1, S2 or S3 respectively.

Standardizing			Measuring				Configuration		Exit		11:24:47	
			S1 =									
			S2 =									
1	0001	00									.00029	3
2	0001	00									.00019	3
3	0001	00									.00029	3
4	0001	00									.00022	3
5	0001	00									.00020	4
6	0001	00									.00108	4
7	0001	0									.00041	3
8	0001	0									.00058	3
9	0001	0									.00052	3
10	0001	0010	0+11:18:31	30.2492	30.2498	30.2504	30.2498	0.00058	3			
11	0001	0011	0+11:22:23	28.2337	28.2345	28.2352	28.2345	0.00076	0			
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0			
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt			
<ESC> - Menu			<ALT P> - Printer			<ALT B> - Box-No.		Bath: 21°C		Std: +5533		

Figure 3.18 Complete Data Sets From Manual Measurements

3.6.6 Measurement Of Control Datasets

It's a good practice to take - while getting one dataset after the other - from time to time control datasets in order to control the accuracy of the AUTOSAL and even to correct for zero order drift of the AUTOSAL (see POSTPROCESSING). For this controlling you may use standard water vials (expensive but best method) or you have prepared a substandard.

You tell the system to make a control dataset by selecting BOTTLE NO. "0". Switch to STANDBY, flush in your standard water or substandard and switch to READ. The next figure shows the appearing screen.

You are asked to tell which kind of control sample you use, either standard water (confirm by <ALT S>) or substandard water (confirm by <ALT U>).

If you selected standard water, you are asked to fill in the K15 value of the vial. After confirmation by <ENTER> all possible methods of sample measurement are available, select one and proceed up to the end, so you will get a control dataset based on standard water.

If you use substandard water, you see the salinity of the substandard you have determined just after the last standardizing of your salinometer. Confirm by <ENTER> to use this substandard water and measure the "actual" salinity of the substandard.

The field dS is no more standard deviation of AvSal - as for normal samples- but is the difference between the measured salinity and the true salinity, e.g.:

$$\text{True Salinity} = \text{Measured Salinity (AvSal)} + \text{Difference (dS)}$$

The difference value dS is the actual correction of zero order drift of the AUTOSAL. The consecutive control datasets are used for correction of zero order drift at times of your samples. This is done by the POSTPROCESSING.

Standardizing			Measuring			Configuration			Exit		06:38:52	
			S1 =									
			S2 -									
			S3			Bottle No. 0 to generate Control Dataset by using :						
						Standardwater : <ALT S>						
						Substandardwater: <ALT U>						
			--> STANDBY			Flush, then --> READ			Wait for beep!			
1	0001	00								.00029	3	
2	0001	00								.00019	3	
3	0001	00								.00029	3	
4	0001	00								.00022	3	
5	0001	00								.00020	4	
6	0001	00								.00108	4	
7	0001	0								.00041	3	
8	0001	0								.00058	3	
9	0001	0								.00052	3	
10	0001	0010	0+11:18:31	30.2492	30.2498	30.2504	30.2498	0.00058	3			
11	0001	0011	0+11:22:23	28.2337	28.2345	28.2352	28.2345	0.00076	0			
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0			
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt			
For normal Dataset change Bottle No.-> <RET>								Bath: 21°C Std: +5533				

Figure 3.19 Entrance Screen For Generation Of Control Dataset

Standardizing			Measuring			Configuration			Exit		06:39:17	
			S1 =									
			S2 -									
			S3			Bottle No. 0 to gen Standard Water t by K15: 0.99998 Sta S> Substandardwater: <ALT U>						
			--> STANDBY			Flush, then --> READ			Wait for beep!			
1	0001	00								.00029	3	
2	0001	00								.00019	3	
3	0001	00								.00029	3	
4	0001	00								.00022	3	
5	0001	00								.00020	4	
6	0001	00								.00108	4	
7	0001	0								.00041	3	
8	0001	0								.00058	3	
9	0001	0								.00052	3	
10	0001	0010	0+11:18:31	30.2492	30.2498	30.2504	30.2498	0.00058	3			
11	0001	0011	0+11:22:23	28.2337	28.2345	28.2352	28.2345	0.00076	0			
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0			
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt			
<ESC> - return to menu								Bath: 21°C Std: +5533				

Figure 3.20 Using Standard Water For Control

Standardizing			Measuring				Configuration		Exit		06:40:44		
			<div style="border: 1px solid black; padding: 5px;"> <p>S1 =</p> <p>S2 =</p> <p>S3 =</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> Bottle No. 0 to gen Substandard et by 34.7241 Sta S> Substandardwater: <ALT U> </div> </div>										
1	0001	00								.00029	3		
2	0001	00								.00019	3		
3	0001	00								.00029	3		
4	0001	00								.00022	3		
5	0001	00								.00020	4		
6	0001	00								.00108	4		
7	0001	00								.00041	3		
8	0001	0								.00058	3		
9	0001	0	<div style="border: 1px solid black; padding: 2px;"> --> STANDBY Flush, then --> READ Wait for beep! </div>									.00052	3
10	0001	0								.00058	3		
11	0001	0011	0+11:22:23	28.2337	28.2345	28.2352	28.2345	0.00076	0				
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0				
13	0001	0000	1+06:40:07	34.9990	34.9986	34.9992	34.9990	0.00054	3				
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt				
<RET> to use displayed Substandard else <ESC>								Bath: 21°C		Std: +5533			

Figure 3.21 Using Substandard Water For Control

The next figure shows the generated datasets for both methods.

Standardizing			Measuring				Configuration		Exit		06:43:29		
			<div style="border: 1px solid black; padding: 5px;"> <p>S1 =</p> <p>S2 =</p> <p>S3 =</p> </div>										
1	0001	00								.00029	3		
2	0001	00								.00019	3		
3	0001	00								.00029	3		
4	0001	00								.00022	3		
5	0001	00								.00020	4		
6	0001	00								.00108	4		
7	0001	00								.00041	3		
8	0001	00								.00058	3		
9	0001	0								.00052	3		
10	0001	0	<div style="border: 1px solid black; padding: 2px;"> --> STANDBY Flush, then --> READ Wait for Beep! </div>									.00058	3
11	0001	0						.00076	0				
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0				
13	0001	0000	1+06:40:07	34.9990	34.9986	34.9992	34.9990	0.00054	3				
14	0001	0000	1+06:43:11	34.7239	34.7243	34.7247	34.7243	-0.00019	4				
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt				
<ESC> - return to menu								Bath: 21°C		Std: +5533			

Figure 3.22 Possible Control Datasets From Both Methods

The identification for control datasets is BOTTLE NO. "0000". Sample No. 13 is due to standard water, the K15 was 0.99998, so by definition the true salinity is 34.9992. The system has evaluated a salinity of assail = 34.9990. Here that difference is 0.0026.

In case of substandard water, as with sample No. 14 the AvSal is 34.7243 and the difference to the true salinity of the substandard water is -.00019.

3.7 Special Case And Error Handling

3.7.1 Measured Value Too Small

The warning "Measured value too small. Switch to READ (if FUNCTION SWITCH at ZERO) or check your sample!" is displayed, if the measured 2 Rt value is less than 0.00006.

Standardizing		Measuring		Configuration				Exit		07:59:05
			S1 =							
1	0001	00	S2 =					.00029	3	
2	0001	00	Measured Value too small Switch to READ or Check your sample!					.00019	3	
3	0001	00						.00029	3	
4	0001	00	S3 =					.00022	3	
5	0001	00						.00020	4	
6	0001	00						.00108	4	
7	0001	00						.00041	3	
8	0001	00						.00058	3	
9	0001	0						.00052	3	
10	0001	0	--> STANDBY	Flush, then	--> READ	Wait for beep!		.00058	3	
11	0001	0						.00076	0	
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0	
13	0001	0000	1+06:40:07	34.9990	34.9986	34.9992	34.9990	0.00054	3	
14	0001	0000	1+06:43:11	34.7239	34.7243	34.7247	34.7243	-0.00019	4	
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt	
<DATA LOG> - manually measuring							Bath: 21°C	Std: +5533		

Figure 3.23 Measured Value Too Small

Most often in this case, it will be that inadvertently you have switched the FUNCTION SWITCH via READ to the ZERO position. These two positions can't be discriminated by the BCD interface.

The message could further come from bubbles in the cell or distilled water from longer standby times. The message disappears at once if a value above the ZERO limit is detected.

3.7.2 Identical Box-/Bottle-No.

At the beginning of the evaluation of a new dataset there is a reading of the selected BOTTLE NO. from the AUTOSAL THUMB WHEEL SWITCH. The System compares this actual Bottle- No. in consideration with the actual Box-No. with all other existing Box-/Bottle-No. combinations of the actual DAT file.

If the combination is existing the message "Bottle/box-no.-combination already exists in this file. <ALT I> - ignore this fact and acquire a dataset; <ALT B> - select new box-no.; <RET> - once more read BOTTLE-NO. (after new adjustment of THUMB WHEEL SWITCH)."

Standardizing		Measuring		Configuration			Exit		08:02:49		
			S1 =								
1	0001	00	S2 -					.00029	3		
2	0001	00	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Bottle/Box-No.-Combination already exists in this File. <ALT I> - Ignore and Measure <ALT B> - New Box-No. <RET> - Retry </div>					.00019	3		
3	0001	00							.00029	3	
4	0001	00							.00022	3	
5	0001	00							.00020	4	
6	0001	00							.00108	4	
7	0001	00							.00041	3	
8	0001	00							.00058	3	
9	0001	0							.00052	3	
10	0001	0							.00058	3	
11	0001	0		--> STANDBY	Flush, then -->	READ	Wait for beep!		.00076	0	
12	0001	0012	0+11:24:36	28.2354	0.0000	0.0000	28.2354	0.00000	0		
13	0001	0000	1+06:40:07	34.9990	34.9986	34.9992	34.9990	0.00054	3		
14	0001	0000	1+06:43:11	34.7239	34.7243	34.7247	34.7243	-0.00019	4		
No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt		
								Bath: 21°C	Std: +5533		

Figure 3.24 Identical Box-/Bottle-No.

3.7.3 Single Measurement Out Of Allowed Standard-Deviation

The message "Measurement out of allowed standard-deviation for single measurements. Press any key!" is displayed if the following conditions are true:

1. Ten single measurements (salinity) have been evaluated.
2. Ten times these single measurements have been examined for freak values and these have been replaced by new readings.
3. The tenths single measurement isn't within the deviation limits.

After pressing of any key the systems restarts from beginning of the actual process. For details of ideas behind, please refer to section 3.4.1 Allowed Standard-Deviations.



Figure 3.25 Single Measurement Out Of Allowed Standard-Deviation

3.7.4 Consecutive Mean Out Of Allowed Standard-Deviation

The Message "10 consecutive measurements out of allowed std.-dev.. Please flush more carefully! Press any key!" is displayed if the following conditions are true:

1. Ten consecutive single measurements are valid.
2. The last three measurements are out of limits for standard-deviation for consecutive measurements.

Most probable is a drift between consecutive measurements due to insufficient flushing in between, especially if there is a considerable change in salinity of the actual sample in comparison with the preceding one. Another reason might be a too small preselected deviation limit. For details of ideas behind, please refer to section 3.4.1 Allowed Standard-Deviations.

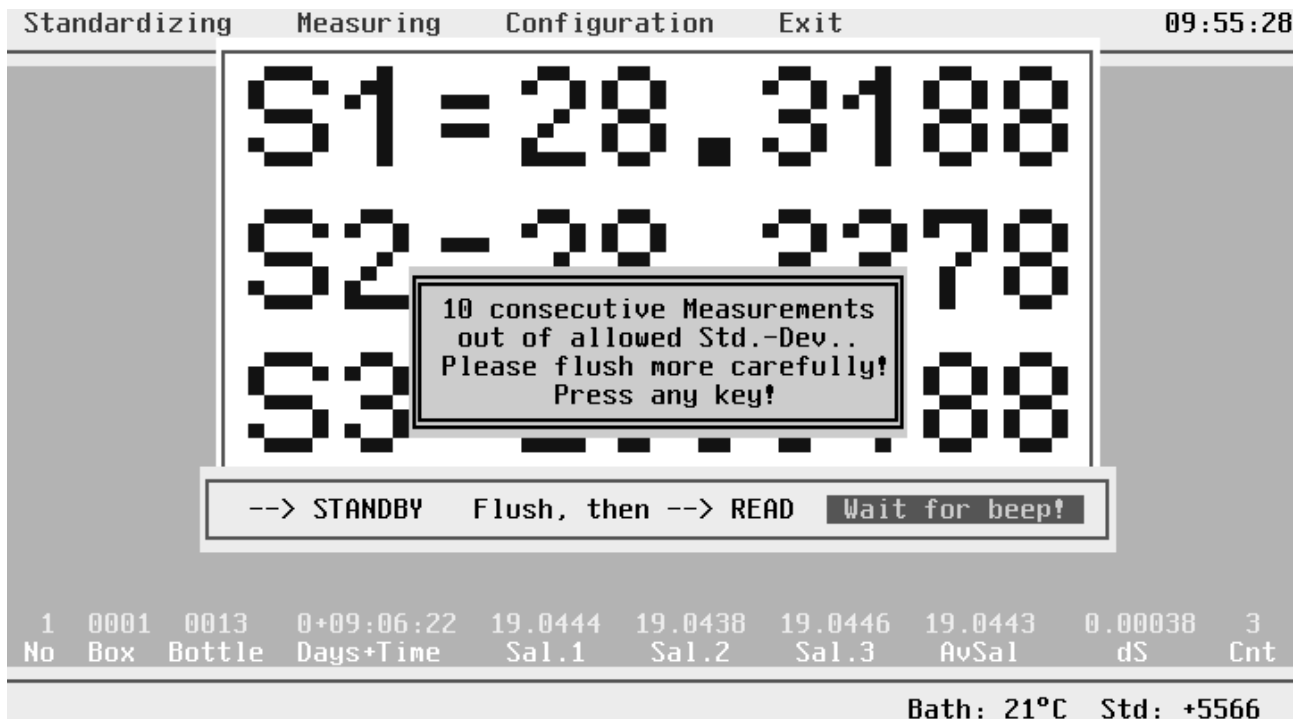


Figure 3.26 Consecutive Mean Out Of Allowed Standard-Deviation

3.7.5 No Rs Trim Possible

If during the Rs trimming process the system has tried more than fifty times to get readings from the AUTOSAL with deviations in given limits without success, the message "Allowed standard-deviation too small or not enough discipline by trimming Rs. Press any key!" is displayed. After pressing any key you are back in the standardizing menu and may restart Rs-Trim by <ENTER>

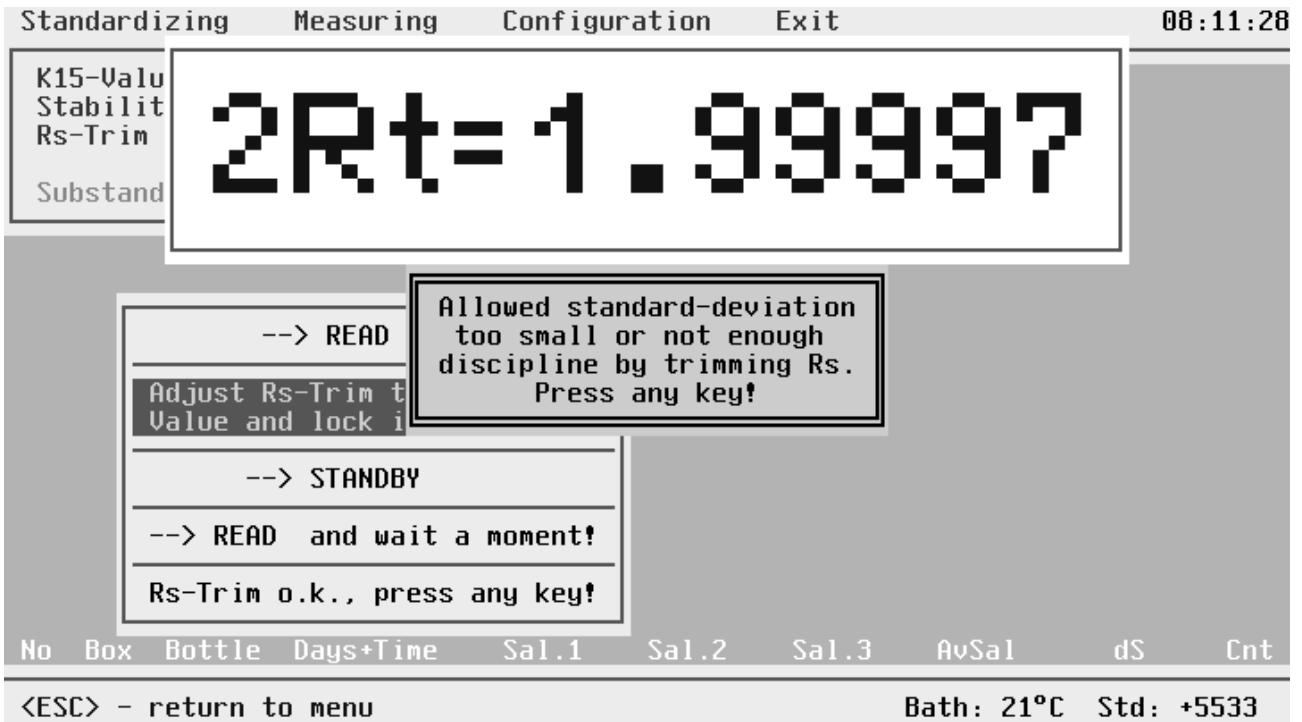


Figure 3.27 No Rs Trim Possible

3.7.6 Parameter Check Before Appending To Data File

If in Measuring you fill in a Data File Name which is already existing, you can append new data to that file under certain conditions. It has to be obvious that the settings of the AUTOSAL are unchanged. Therefore, the system checks up the Bath Temperature, the Standard-Control-Digits and the eventually existing Substandard. If there are any deviations, the system shows the comparison of Actual- and File-Data and denies appending. By any key you come back to filling in a Data-File-Name (an new one this time!).

Standardizing Measuring Configuration Exit 08:59:47

Data-File-Header

Data File Name : ASI-1 .DAT

Autosal-No. :
 Operator :
 Ambient Temperature:
 Shi
 Las

Parameter	File Data	Actual
Bathtemp	: 21	21
Std-Control	: +5533	+5566
Substandard	: 34.7241	0

Press any Key

No	Box	Bottle	Days+Time	Sal.1	Sal.2	Sal.3	AvSal	dS	Cnt
Actual Parameter differ from File Data							Bath: 21°C	Std: +5566	

Figure 3.28 Parameter Check Before Appending

3.7.7 No Data From AUTOSAL

If the system doesn't receive data, the message "AUTOSAL not correctly connected or defect. Press any key!" is displayed. By any key you get back to the operating system layer.

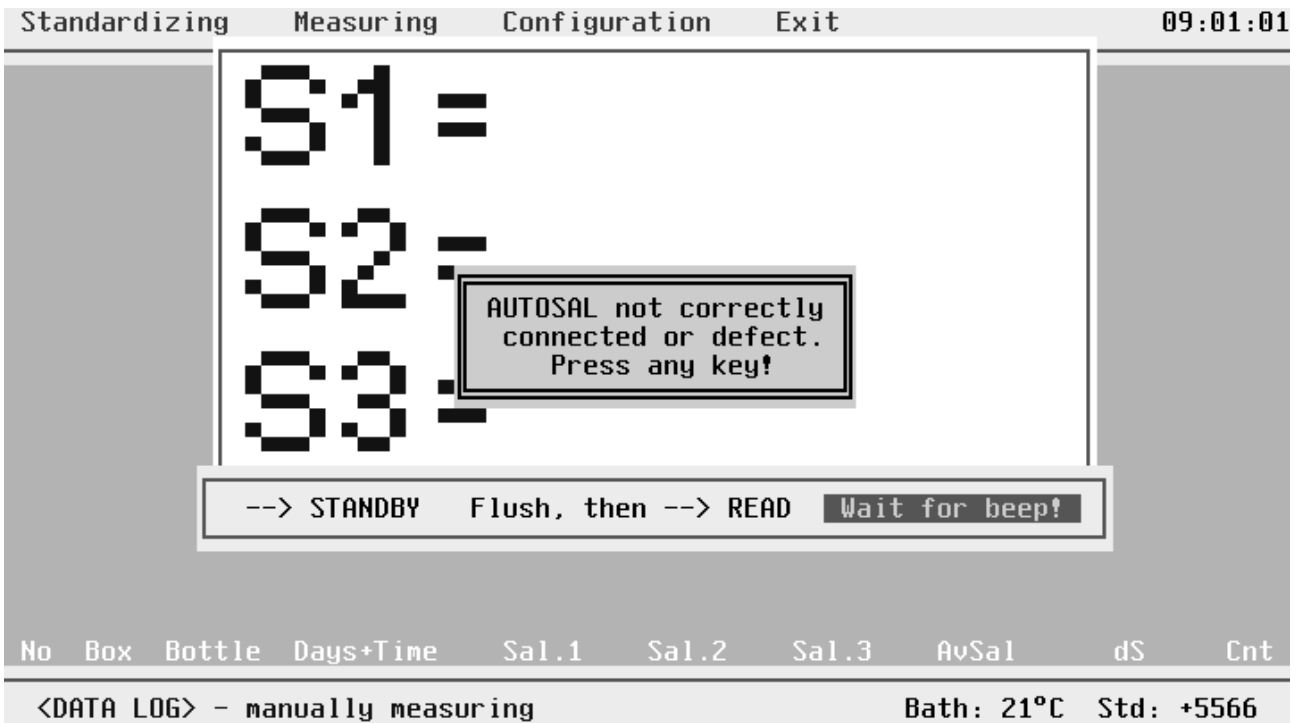


Figure 3.29 No Data From AUTOSAL

3.7.8 Suppression Too High

For correct operation of the AUTOSAL, you have to preselect the first two digits of the 2*Rt value by the 23 position SUPPRESSION SWITCH until the last four digits of the display stop flashing and show a positive reading.

If by mistake you switched to too high suppression the reading will become negative. Guildline recommends to work with positive readings, therefore the **SOFTSAL** doesn't support negative readings.

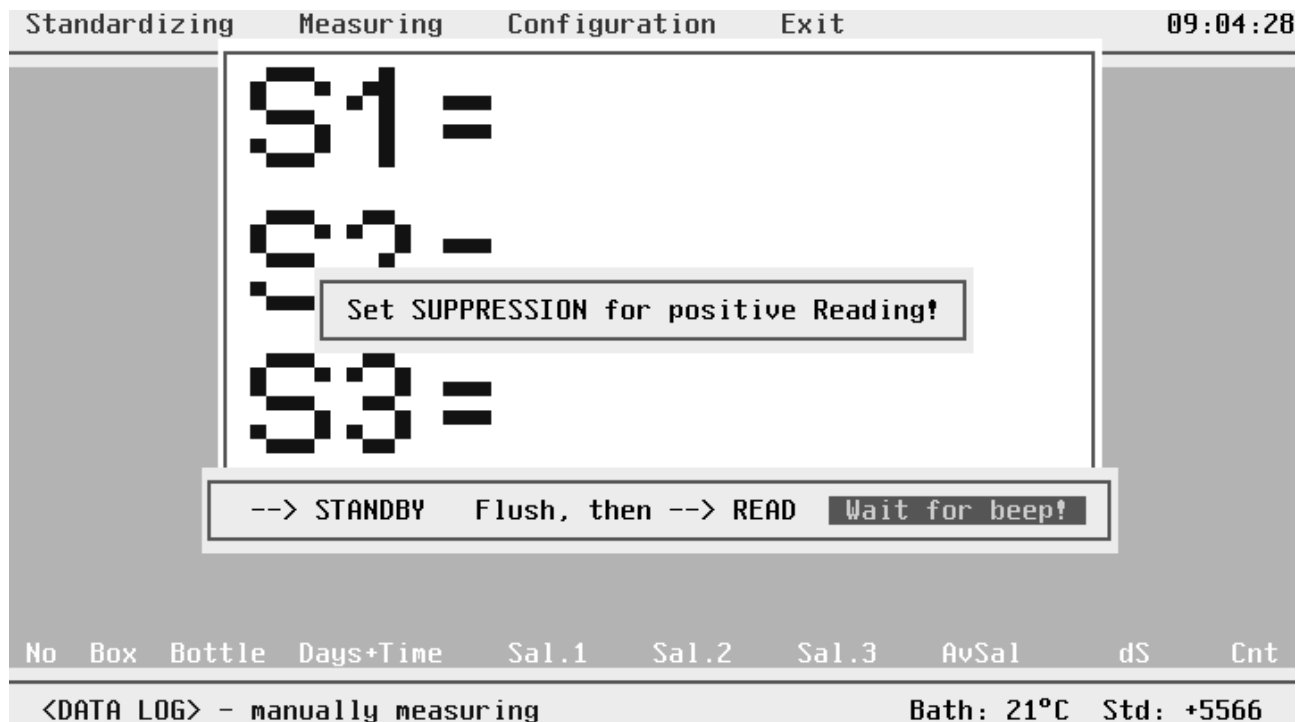


Figure 3.30 Suppression Too High

3.7.9 STANDBY During Measuring

If you inadvertently switch from READ to STANDBY during measuring, the message "Don't switch to STANDBY while Measuring! --> READ" is displayed. After switching back to READ, the actual measurement is cancelled and that single measurement process is restarted.

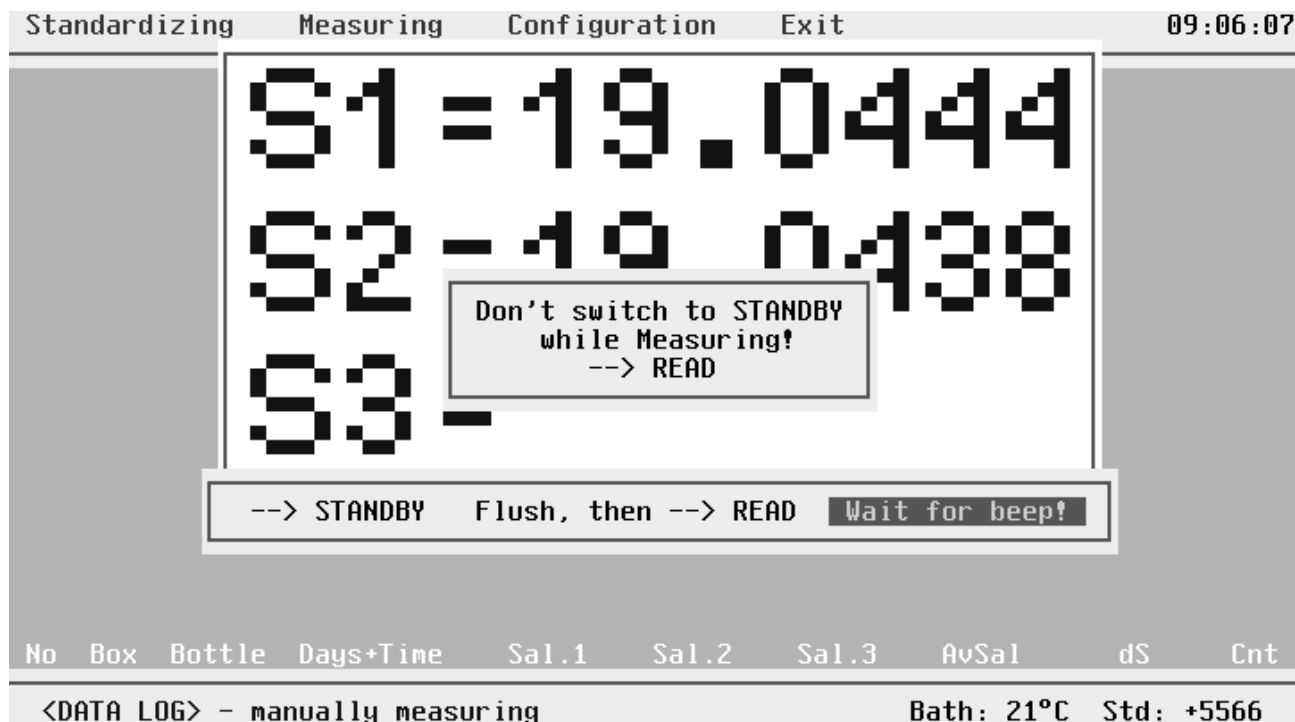


Figure 3.31 STANDBY During Measuring

3.7.10 Measurement Out Of PSS 78 Limits

If in Configuration you have set limits of PSS78 "ON", the calculated salinity is checked according to that constrains. If salinity is outside limits, a message is displayed.

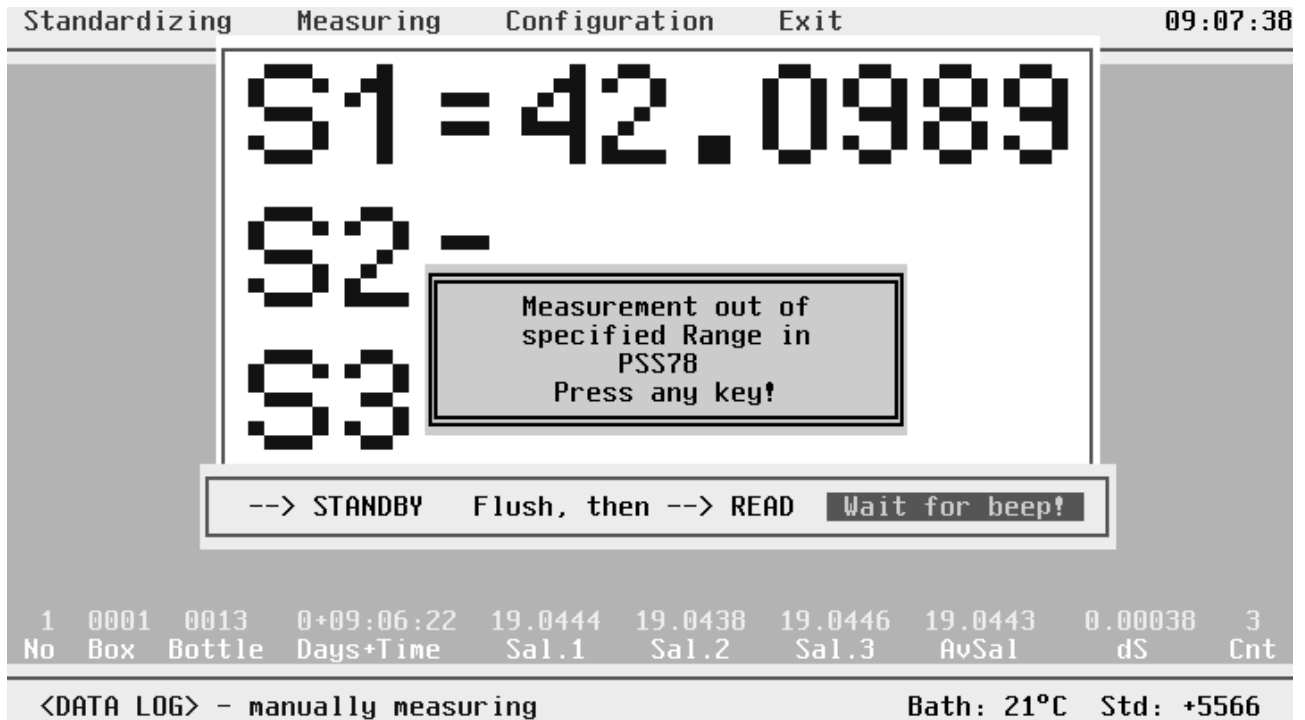


Figure 3.32 Out Of PSS78 Limits

4 POSTPROCESSING

4.1 General Principles

If you have generated control data sets during measuring by taking samples of well known salinity, e.g. sample from standard water ampoules or from prepared substandards, you can eliminate zero order drift of the salinometer.

By the control sets you know the deviation of the measured values (substandard- or standard water) from the real values which are known from initial standardization or from the K15. These deviations are known at the times of measurement and are called zero order or offset drift.

For you only control the salinometer near one point you can't evaluate correction terms of higher order, for zero and first order you had to use two different control waters for evaluation of offset drift and slope drift.

So by control sets you know the offset drift of the salinometer at the specific time of the controlling, this time is filled in the Days+Time field in the dataset. Days are counted from the last standardizing as the reference where the offset had been zero by definition. The offset term is filled in the dS field of the control set.

The aim of the AUTOSAL Data Postprocessing is to interpolate the offset drift between the known points of the control sets and to correct the measured salinity values of the samples according to the actual offset (approximated by interpolation).

4.2 Starting Autosal Data Postprocessing

The postprocessing is done outside the AUTOSAL Data Acquisition Software. You have to leave that program by EXIT and start the AUTOSAL Data Post Processing Software by typing

ASIPP

If this does not start the **SOFTSAL** Data Postprocessing you have to change the directory to **SOFTSAL** or set the appropriate PATH. For details study your computer manual.

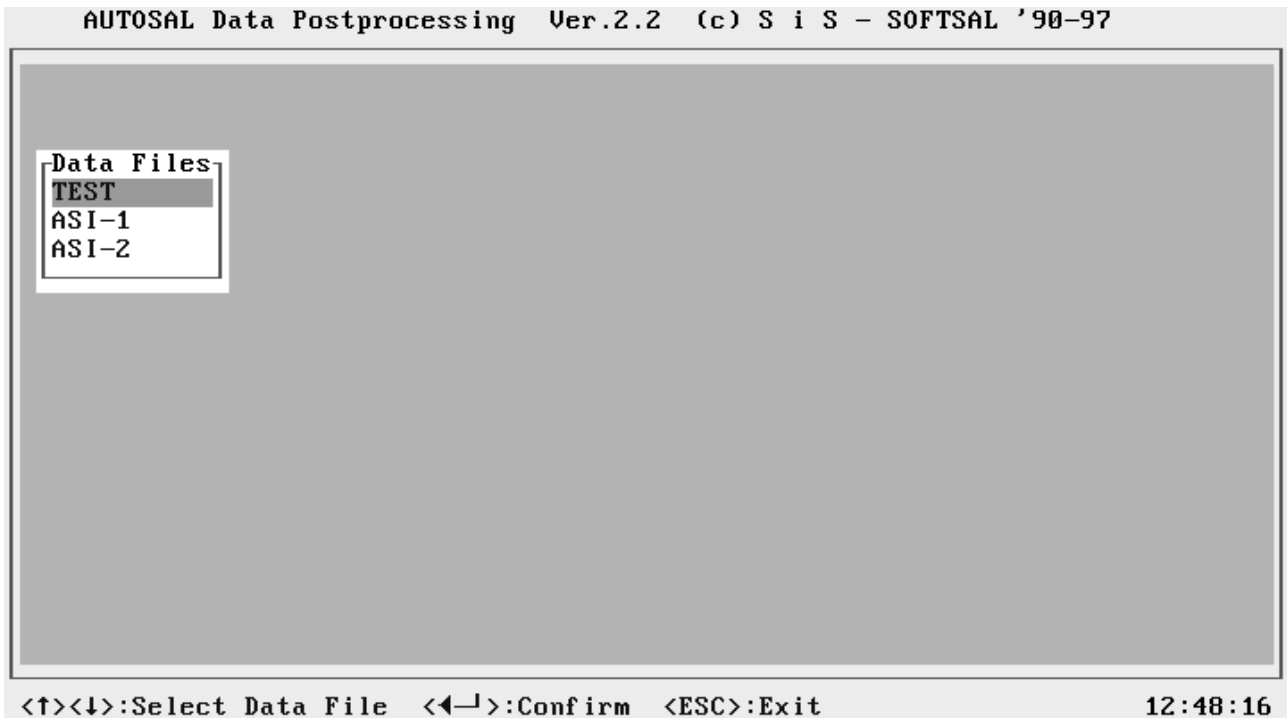


Figure 4.1 Initial Screen Of Data Postprocessing

4.3 Operating The Postprocessing

A small window is opened where you see a list of all existing data files (files with the extension DAT). Select by cursor up or down the appropriate file, we select TEST, which is a dummy file to show the operation of the postprocessing.

Next you get the data file header (Fig. 4.2) of the selected file with information about the contents. By using <ESC> you will close this window and go back to the initial file selection window to choose a different file.

```

AUTOSAL Data Postprocessing Ver.2.2 (c) S i S - SOFTSAL '90-97
TEST
----- Data File Header -----
Autosal-No.      : 8400A 220-1
Operator         : Maassen
Ambient Temperature: 18.0
Ship/Station etc. : Poseidon 92/ 33
Last Standardizing : 05.01.90  10:00:00
Substandard      : 0
Bath Temperature : 21
Std. Control Digits: +0001
Date of 1. Dataset : 06.01.90
Datasets in File  : 192

<←-|>:Continue  <ESC>:Exit
12:48:21

```

Figure 4.2 Data File Header of selected File

Confirm by <ENTER> and you come to the next screen, which shows all the control datasets of the data file and some auxiliary information.

```

AUTOSAL Data Postprocessing Ver.2.2 (c) S i S - SOFTSAL '90-97
TEST
-----
No  Box  Bottle  Days+Time  AvSal  dS  Cnt  delta S/h
4  0001  0000  1+10:00:00  35.0024  -0.00240  3  -1.000e-004
8  0001  0000  1+12:00:00  35.0026  -0.00260  3  -1.000e-004
12 0001  0000  1+14:00:00  35.0028  -0.00280  3  -1.000e-004
16 0001  0000  1+16:00:00  35.0030  -0.00300  3  -1.000e-004
20 0001  0000  2+10:00:00  35.0048  -0.00480  3  -1.000e-004
24 0001  0000  2+12:00:00  35.0050  -0.00500  3  -1.000e-004
28 0001  0000  2+14:00:00  35.0052  -0.00520  3  -1.000e-004
32 0001  0000  2+16:00:00  35.0054  -0.00540  3  -1.000e-004
36 0001  0000  3+10:00:00  35.0072  -0.00720  3  -1.000e-004
40 0001  0000  3+12:00:00  35.0074  -0.00740  3  -1.000e-004
44 0001  0000  3+14:00:00  35.0076  -0.00760  3  -1.000e-004
48 0001  0000  3+16:00:00  35.0078  -0.00780  3  -1.000e-004
52 0001  0000  4+10:00:00  34.9898  +0.01020  3  1.000e-003
56 0001  0000  4+12:00:00  35.0104  -0.01040  3  -1.030e-002
60 0001  0000  4+14:00:00  35.0106  -0.01060  3  -1.000e-004
64 0001  0000  4+16:00:00  35.0108  -0.01080  3  -1.000e-004
68 0002  0000  5+10:00:00  35.0126  -0.01260  3  -1.000e-004
72 0002  0000  5+12:00:00  35.0128  -0.01280  3  -1.000e-004
76 0002  0000  5+14:00:00  35.0130  -0.01300  3  -1.000e-004
80 0002  0000  5+16:00:00  35.0132  -0.01320  3  -1.000e-004

<↑><↓>:Select Data  <←-|>:(Un)Mark  <ALT><G>:Start  <ESC>:Exit
12:37:36

```

Figure 4.3 Control Data Sets

Days+Time is referred to the last standardization of the AUTOSAL, AvSal is the measured Salinity of the control water, dS is the actual deviation of the measured salinity to the reference salinity (either substandard evaluated during standardization or evaluated from K15), delta S / h is the slope of the polygon straight line connecting adjacent dS points over time (difference between actual time of control set and time of last standardization). These polygon straight lines interpolate the drift of the AUTOSAL between two control points.

Between the control points lie the measured salinities at specified times. These salinities are corrected by the at the specified times evaluated actual drift. The corrected salinity called Sal is the uncorrected AvSal plus the actual drift delta S:

$$\text{Sal} = \text{AvSal} + \text{delta S}$$

These calculations are started if you press <ALT><G>. The result is a file with the original name of the uncorrected data file but with the file extension changed to COR, in our case TEST.COR.

You may now select the next data file for postprocessing. We will now leave the Data Postprocessing by pressing <ALT><X> and discuss the results of the postprocessing of the data file TEST.DAT. This is done at DOS level.

DataSets from TEST.DAT corrected by S I S PostProcessing

```
Autosal-No.      : 8400A 220-1
Operator         : Maassen
Ambient Temperature: 18.0
Ship/Station etc. : Poseidon 92/ 33
Last Standardizing : 05.01.90 10:00:00
Substandard      : 0
Bath Temperature : 21
Std. Control Digits: +0001
Date of 1. Dataset : 06.01.90
Datasets in File  : 192
```

No	Box	Bottle	Days+Time	AvSal	dS	Cnt	delta S	Sal
1	0001	0001	1+08:30:00	30.0000	0.00000	3	-2.250e-003	29.9978
2	0001	0002	1+09:00:00	30.0000	0.00000	3	-2.300e-003	29.9977
3	0001	0003	1+09:30:00	30.0000	0.00000	3	-2.350e-003	29.9977
4	0001	0000	1+10:00:00	35.0024	-0.00240	3	-1.000e-004 / h	
5	0001	0004	1+10:30:00	30.0000	0.00000	3	-2.450e-003	29.9976
6	0001	0005	1+11:00:00	30.0000	0.00000	3	-2.500e-003	29.9975
7	0001	0005	1+11:30:00	30.0000	0.00000	3	-2.550e-003	29.9975

Figure 4.4 The Corrected Data Set TEST.COR

The first row of the file specifies the raw data file and indicates that it has been corrected by the postprocessing. Following is the header of the data file, defined during measuring.

The main part is the data set. Line by line you see the data sets with corrected salinity Sal. The sample values are combined to blocks, separated you see the control data sets.

The AUTOSAL had been standardized at 05.01.90 10:00:00 o'clock. The first control data set is of 06.01.90 10:00:00 o'clock, so Days is 1 and Time is 10:00:00 o'clock. The time difference to the time of last standardization is 24 hours, the deviation of the AUTOSAL is dS = -0,0024, so the slope of the first polygon straight line is -1.000e-004. The time differences of the first, second and third sample are 22.5 h, 23 h and 23.5 h respectively, so the corresponding deviations delta S are $22.5 * (-1e-4) = -2.250e-003$, $23 * (-1e-4) = -2.300e-003$ and $23.5 * (-1e-4) = -2.350e-003$ respectively. The resulting "true" salinities are calculated by $\text{Sal} = \text{AvSal} + \text{delta S}$.

Now lets have a look to the data sets around No 52

No	Box	Bottle	Days+Time	AvSal	dS	Cnt	delta S	Sal
47	0001	0037	3+15:30:00	30.0000	0.00000	3	-7.750e-003	29.9923
48	0001	0000	3+16:00:00	35.0078	-0.00780	3	-1.000e-004 / h	
49	0001	0038	4+08:30:00	30.0000	0.00000	3	8.700e-003	30.0087
50	0001	0039	4+09:00:00	30.0000	0.00000	3	9.200e-003	30.0092
51	0001	0040	4+09:30:00	30.0000	0.00000	3	9.700e-003	30.0097
52	0001	0000	4+10:00:00	34.9898	+0.01020	3	1.000e-003 / h	
53	0001	0041	4+10:30:00	30.0000	0.00000	3	5.050e-003	30.0051
54	0001	0042	4+11:00:00	30.0000	0.00000	3	-1.000e-004	29.9999
55	0001	0043	4+11:30:00	30.0000	0.00000	3	-5.250e-003	29.9948
56	0001	0000	4+12:00:00	35.0104	-0.01040	3	-1.030e-002 / h	
57	0001	0044	4+12:30:00	30.0000	0.00000	3	-1.045e-002	29.9896

Figure 4.5 Correction With Faulty Control Set

Up to now the deviations of the control sets had been negative. The control set No 52 has positive deviation, positive slope and is one magnitude larger than the previous one. The next control set has negative deviation again and corresponds to the mainly monotonous drift history of the AUTOSAL. Now the slope of the polygon part between 52 and 56 is extremely large, because between the two control sets are only 2 hours. You may examine the resulting salinities Sal for the involved samples in order to see the principles behind.

We decide the data set No 52 to be faulty and will not use it for corrections. So we switch back to the AUTOSAL Data Postprocessing and select the file TEST.

AUTOSAL Data Postprocessing Ver.2.2 (c) S i S - SOFTSAL '90-97								
TEST								
No	Box	Bottle	Days+Time	AvSal	dS	Cnt	delta S/h	
4	0001	0000	1+10:00:00	35.0024	-0.00240	3	-1.000e-004	
8	0001	0000	1+12:00:00	35.0026	-0.00260	3	-1.000e-004	
12	0001	0000	1+14:00:00	35.0028	-0.00280	3	-1.000e-004	
16	0001	0000	1+16:00:00	35.0030	-0.00300	3	-1.000e-004	
20	0001	0000	2+10:00:00	35.0048	-0.00480	3	-1.000e-004	
24	0001	0000	2+12:00:00	35.0050	-0.00500	3	-1.000e-004	
28	0001	0000	2+14:00:00	35.0052	-0.00520	3	-1.000e-004	
32	0001	0000	2+16:00:00	35.0054	-0.00540	3	-1.000e-004	
36	0001	0000	3+10:00:00	35.0072	-0.00720	3	-1.000e-004	
40	0001	0000	3+12:00:00	35.0074	-0.00740	3	-1.000e-004	
44	0001	0000	3+14:00:00	35.0076	-0.00760	3	-1.000e-004	
48	0001	0000	3+16:00:00	35.0078	-0.00780	3	-1.000e-004	
52	0001	0000	4+10:00:00	34.9898	+0.01020	3	1.000e-003	* N U *
56	0001	0000	4+12:00:00	35.0104	-0.01040	3	-1.300e-004	
60	0001	0000	4+14:00:00	35.0106	-0.01060	3	-1.000e-004	
64	0001	0000	4+16:00:00	35.0108	-0.01080	3	-1.000e-004	
68	0002	0000	5+10:00:00	35.0126	-0.01260	3	-1.000e-004	
72	0002	0000	5+12:00:00	35.0128	-0.01280	3	-1.000e-004	
76	0002	0000	5+14:00:00	35.0130	-0.01300	3	-1.000e-004	
80	0002	0000	5+16:00:00	35.0132	-0.01320	3	-1.000e-004	

<↑><↓>:Select Data <←|>:(Un)Mark <ALT><G>:Start <ESC>:Exit 12:38:16

Figure 4.6 Inactivation Of Control Data

We realise the remarkable set No 52 here as well, because the slope of the drift is exactly linear apart from just that set. The collection of all control sets with displayed drift slope has the meaning to make an estimation of the quality of the control data possible and to give some tools to inactivate eventual freak values.

We select the control dat set No 52 by cursor down 12 times and unmark this dataset by <ENTER>. The data set is now labelled by * N U * which means "not used". In this mode <ENTER> is a toggle, if you want to reactivate the data, set press ENTER again. But now let's process the data file without usage of the faulty control set by typing <ALT><G>. We now leave the Data Postprocessing by pressing <ALT><X> and discuss the results of the postprocessing of the data file TEST.DAT at DOS level.

No	Box	Bottle	Days+Time	AvSal	dS	Cnt	delta S	Sal
47	0001	0037	3+15:30:00	30.0000	0.00000	3	-7.750e-003	29.9923
48	0001	0000	3+16:00:00	35.0078	-0.00780	3	-1.000e-004 / h	
49	0001	0038	4+08:30:00	30.0000	0.00000	3	-9.945e-003	29.9901
50	0001	0039	4+09:00:00	30.0000	0.00000	3	-1.001e-002	29.9900
51	0001	0040	4+09:30:00	30.0000	0.00000	3	-1.008e-002	29.9899
52	0001	0000	4+10:00:00	34.9898	+0.01020	3	1.000e-003 / h *N U*	
53	0001	0041	4+10:30:00	30.0000	0.00000	3	-1.021e-002	29.9898
54	0001	0042	4+11:00:00	30.0000	0.00000	3	-1.027e-002	29.9897
55	0001	0043	4+11:30:00	30.0000	0.00000	3	-1.034e-002	29.9897
56	0001	0000	4+12:00:00	35.0104	-0.01040	3	-1.300e-004 / h	
57	0001	0044	4+12:30:00	30.0000	0.00000	3	-1.045e-002	29.9896

Figure 4.7 The Newly Corrected Data Set TEST.COR

In the file TEST.COR the inactivated control set is marked by * N U * as well and had not been used for postprocessing. The drift of The AUTOSAL is now monotonous and negative. That looks more plausible.

It is not always that simple to decide whether a control set is faulty, you need some experience with your AUTOSAL to decide between drift effects and faulty measurements.

5 THE FILE SYSTEM

5.1 General Principles

The system uses the files ASI.EXE and ASIPP.EXE as executable files. The first is the **SOFTSAL** Data Acquisition and the second is the **SOFTSAL** Data Postprocessing program, a third is the ASIDEMO.EXE file which is a demo of the **SOFTSAL** Data Acquisition program running without the hardware needed for the full version. The *.EXE files must be accessible from your actual directory, so install the appropriate PATH.

During operating the **SOFTSAL**, the system will write files to the actual directory. These are the ASI.CFG file, the *.DAT file and the *.COR file.

The ASI.CFG holds the actual configuration parameters of the system, the *.DAT file holds the acquired raw data and *.COR the corrected data. These files are ASCII files and can be read by PRINT or TYPE from DOS level or by every text processing system.

5.2 The ASI.CFG File

The ASI.CFG file is an ASCII file written by the system during operation of **SOFTSAL** to the actual directory. The figure shows an example.

```
EXAMPLE.DAT      [name of last used raw data file]
0.0005           [deviation parameter for single measurement]
0.0007           [deviation parameter for consecutive measurement]
14.01.90  12:46:29 [date of last standardization  time of last standardization]
29.9972          [value of substandard determined during standardization]
24              [bathtemperature of AUTOSAL during standardization]
+6269           [Std - Control digits during standardization]
1               [last choosen serial port - default is 1]
```

Figure 5.1 ASI.CFG File

The first character of each row is a space, the last is a carriage return/ line feed. The field length is as shown. Date and time is separated by two spaces. The field length for substandard is 7 including the decimal point.

The data file name is that one at last used and that will be proposed if you start measurement again, you may change this field in the measurement header and consequently the new data file name will be written to the ASI.CFG file and next time you start measuring again will be the proposal of the system.

The next two fields specify the deviation parameters selected during configuration. These may be altered during a measuring session within one data file.

The last four rows specify the parameters gathered during standardization of the AUTOSAL. If these parameters have been changed, it is not longer possible to append data to the here specified raw data file, and you will get a warning message as explained in paragraph 3.7.6.

If you use the **SOFTSAL** system with different AUTOSALS you have to use different ASI.CFG files. We advise to use different diskettes or different subdirectories in this case. Before starting the system, make the corresponding directory the actual one, for ASI.CFG is read from or written to the actual directory.

5.3 The Raw Data File

The raw data file is written during Measuring to the actual directory. The figure shows the EXAMPLE.DAT file, it's an ASCII file.

```

Autosal-No.      : 344
Operator         : MAASSEN
Ambient Temperature: 22.0
Ship/Station etc. : OMEGA 12/32.3
Last Standardizing : 14.01.90 12:46:29
Substandard      : 29.9972
Bath Temperature : 24
Std. Control Digits: +6269
Date of 1. Dataset : 14.01.90
Datasets in File : 7
No  Box  Bottle  Days+Time  Sal.1  Sal.2  Sal.3  AvSal  dS  Cnt
 1  0001  0001  0+12:56:49 36.6304 36.6300 36.6299 36.6301 0.00030 3
 2  0001  0002  0+13:03:08 36.8563 36.8564 36.8562 36.8563 0.00007 3
 3  0001  0002  0+13:04:57 36.8566 0.0000 0.0000 36.8566 0.00000 0
 4  0001  0003  0+13:10:08 36.0029 36.0030 36.0037 36.0032 0.00041 3
 5  0001  0004  0+13:13:50 35.0854 35.0852 35.0853 35.0853 0.00009 3
 6  0001  0007  0+13:17:45 34.0051 34.0049 34.0051 34.0050 0.00012 3
 7  0001  0000  0+13:26:52 29.9958 29.9966 29.9973 29.9966 0.00061 4

```

Figure 5.2 Raw Data File EXAMPLE.DAT

The first character of each row is a space, the last is a carriage return/ line feed. The field length is as shown.

5.4 The Corrected Data File

The corrected data file is the output of the **SOFTSAL** Postprocessing program. The next figure shows the corrected data file from the EXAMPLE file.

```

DataSets from EXAMPLE.DAT corrected by S I S PostProcessing

Autosal-No.      : 344
Operator         : MAASSEN
Ambient Temperature: 22.0
Ship/Station etc. : OMEGA 12/32.3
Last Standardizing : 14.01.90 12:46:29
Substandard      : 29.9972
Bath Temperature : 24
Std. Control Digits: +6269
Date of 1. Dataset : 14.01.90
Datasets in File : 7
No  Box  Bottle  Days+Time  AvSal  dS  Cnt  delta S  Sal
 1  0001  0001  0+12:56:49 36.6301 0.00030 3  1.561e-004 36.6303
 2  0001  0002  0+13:03:08 36.8563 0.00007 3  2.515e-004 36.8566
 3  0001  0002  0+13:04:57 36.8566 0.00000 0  2.789e-004 36.8569
 4  0001  0003  0+13:10:08 36.0032 0.00041 3  3.572e-004 36.0036
 5  0001  0004  0+13:13:50 35.0853 0.00009 3  4.131e-004 35.0857
 6  0001  0007  0+13:17:45 34.0050 0.00012 3  4.723e-004 34.0055
 7  0001  0000  0+13:26:52 29.9966 0.00061 4  9.063e-004 / h

```

Figure 5.3 Corrected Data File EXAMPLE.COR

The first character of each row is a space, the last is a carriage return/ line feed. The field length is as shown.

ALT P	20
ASI	5; 7; 8; 9; 13; 43; 50
ASI.CFG	13; 17; 43
ASI.EXE	43
ASIDEMO	4; 5; 6; 8; 9; 43
ASIDEMO.EXE	4; 6; 43
ASIPP.EXE	5; 43
automatic	17; 22; 23
automatisms	4; 22
BCD interface	4; 27
bottle	4; 12; 13; 19
BOTTLE NUMBER	4
box	4; 5; 6; 18; 19; 28
COM port	7
command line	7
consecutive measurements	12; 13; 22; 30
control data	4; 16; 24; 26; 37; 39; 40; 41
control dataset	16; 24; 26; 39
control datasets	16; 24; 26; 39
control points	39; 40
copyright	6
corrected data	43; 44
count field	23
DAT	5; 11; 17; 28; 38; 40; 42; 43; 44
data acquisition	4; 9
data postprocessing	38
DATALOG	4; 8; 22
Days+Time	37; 39; 40; 41; 42; 44
DemoStatus	8
drift	4; 9; 13; 15; 16; 24; 30; 37; 39; 40; 41; 42
error message	12; 13; 15; 17
file system	4
flush	11; 13; 15; 19; 23; 24; 30
freak value	4; 12; 29; 41
freak values	12; 29; 41
hard disk	7
instability	4
instruction window	16; 19; 22
insufficient flushing	13; 30
junction box	4
K15	11; 14; 15; 16; 24; 26
K15 value	14; 15; 24
manual	6; 9; 15; 17; 22; 23; 38
manual measurement	22
measured salinity	24; 37; 39
measuring	4; 15; 16; 17; 19; 20; 22; 35; 37; 40; 43
menu	4; 10; 11; 14; 15; 16; 17; 31
monochrome	6
noisy environment	22
offset	37
PATH	9; 38; 43
POSTPROCESSING	16; 24; 37
precision	12

precision needs	12
printer protocol	19
problem report form	4
PSS78	13; 36
raw data	40; 43; 44
READ	4; 8; 11; 15; 16; 19; 22; 23; 24; 27; 35
restandardize	10
Rs Trim	14; 31
single measurements	12; 13; 16; 18; 19; 22; 23; 29; 30
slope	37; 39; 40; 41
SOFTSAL diskette	6; 7
stability	15
stability control	15
standard seawater	14
standard water	4; 37
standardize	9; 11
STANDBY	4; 8; 9; 10; 11; 15; 16; 19; 20; 22; 23; 24; 35
start	9; 11; 31; 38; 43
status line	11; 12; 19; 22
submenu	11; 12; 14; 16
subsample	12; 15; 19; 20
substandard	14; 16; 24; 37; 39; 43
suppression	34
TEST.DAT	5; 40; 42
THUMB WHEEL SWITCH	19; 28
training	4; 8
true salinity	26
value too small	27
working copy	6; 7; 9
zero order drift	4; 16; 24; 37

7 LIST OF FIGURES

Figure 3.1 Initial Screen Of Data Acquisition	9
Figure 3.2a Control Of Bathtemperature and STANDBY Digits	10
Figure 3.2b Message For Necessary Re-Standardizing	10
Figure 3.3 Main Menu	11
Figure 3.4 Configure Standard-Deviation Window	12
Figure 3.5 PractSalScale Submenu	13
Figure 3.6 K15-Value Submenu	14
Figure 3.7 Stability Control	15
Figure 3.8 Rs-Trim	16
Figure 3.9 Substandard	17
Figure 3.10 Data-File-Header	18
Figure 3.11 Selection of Box Number	18
Figure 3.12 The Measuring Window	19
Figure 3.13 Possible Selections Before New Data Set	20
Figure 3.14 Selection of Printer Protocol	20
Figure 3.15 Printer Protocol	21
Figure 3.16 Start Screen Manual Measurement	22
Figure 3.17 Three Consecutive Single Measurements In Manual Measuring Mode	23
Figure 3.18 Complete Data Sets From Manual Measurements	24
Figure 3.19 Entrance Screen For Generation Of Control Dataset	25
Figure 3.20 Using Standard Water For Control	25
Figure 3.21 Using Substandard Water For Control	26
Figure 3.22 Possible Control Datasets From Both Methods	26
Figure 3.23 Measured Value Too Small	27
Figure 3.24 Identical Box-/Bottle-No	28
Figure 3.25 Single Measurement Out Of Allowed Standard-Deviation	29
Figure 3.26 Consecutive Mean Out Of Allowed Standard-Deviation	30
Figure 3.27 No Rs Trim Possible	31
Figure 3.28 Parameter Check Before Appending	32
Figure 3.29 No Data From AUTOSAL	33
Figure 3.30 Suppression Too High	34
Figure 3.31 STANDBY During Measuring	35
Figure 3.32 Out Of PSS78 Limits	36
Figure 4.1 Initial Screen Of Data Postprocessing	38
Figure 4.2 Data File Header of selected File	39
Figure 4.3 Control Data Sets	39
Figure 4.4 The Corrected Data Set TEST.COR	40
Figure 4.5 Correction With Faulty Control Set	41
Figure 4.6 Inactivation Of Control Data	41
Figure 4.7 The Newly Corrected Data Set TEST.COR	42
Figure 5.1 ASI.CFG File	43
Figure 5.2 Raw Data File EXAMPLE.DAT	44
Figure 5.3 Corrected Data File EXAMPLE.COR	44

8 PROBLEM REPORT FORM

If you encounter a software bug, deficiency, or documentation error in the **SOFTSAL** System please make a photocopy of this page, fill out the form and send it to **SiS Sensoren Instrumente Systeme GmbH, Mühlenkoppel 12, D 24222 Schwentinental, GERMANY**. We will try to resolve the problem and provide you with a correction.

Name _____ Phone _____

Company/ Institution _____

Division/ Department _____

Street _____

City _____ State _____ Zip _____

Country _____ Date _____

Computer name _____ Memory (kilobytes) _____

Peripherals _____ Diskette size _____

Serial No. of AUTOSAL _____ Type of AUTOSAL _____

Version number displayed on initial **Data Acquisition** screen _____

Version number displayed on initial **Data Postprocessing** screen _____

Version number displayed on initial **Data Acquisition** screen (Demo Version) _____

Describe the problem and how to reproduce it (attach listing if applicable), and give your diagnosis if any:

9 SOFTSAL PRODUCT REGISTRATION FORM

Please fill out this registration form or a copy of it and return it to **SiS Sensoren Instrumente Systeme GmbH, Mühlenkoppel 12, D 24222 Schwentinental, GERMANY** within 30 days of receipt. As a registered licensee, you will get one year software upgrades free of charge. Please print or type:

Name _____ Phone _____

Company/ Institution _____

Division/ Department _____

Street _____

City _____ State _____ Zip _____

Country _____ Date _____

Purchase Date _____ 5 1/4 3 1/2

Version ASI _____ Version DEMO _____ Version ASIPP _____

Purchase From _____

Comments _____

