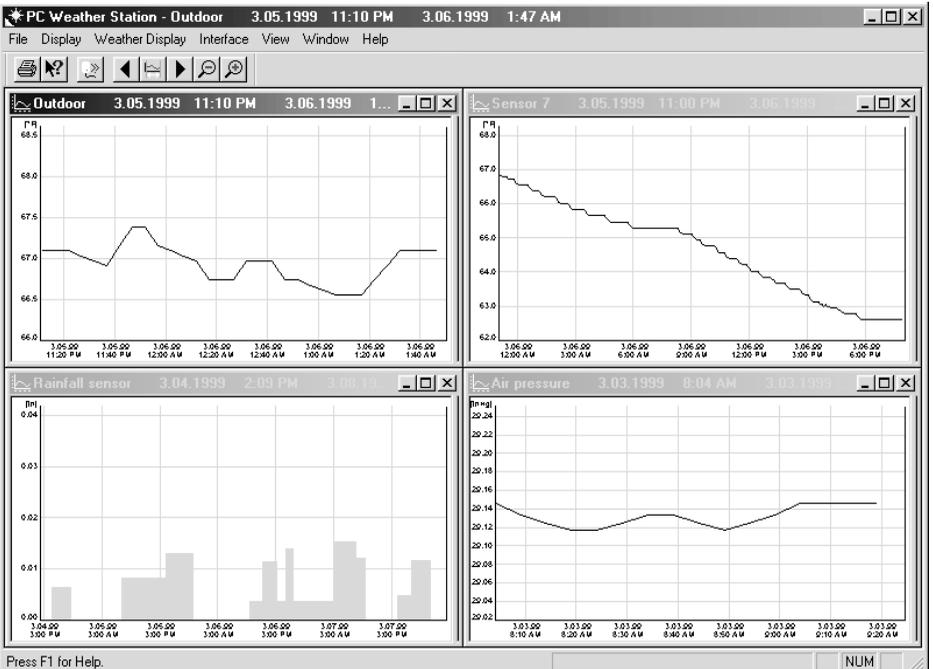


# PC Radio Weather Station



**Operating and Evaluation Software  
for Windows 95/98/NT**

# Contents

Preface .....	4
Explanation of Terms .....	5
<b>Chapter 1 Introduction</b>	
General Information .....	8
System Requirements .....	9
Installation .....	10
Main Window .....	11
Control .....	13
<b>Chapter 2 Commissioning</b>	
Preparations .....	16
Preparing the PC Interface .....	17
Commissioning Measured Value Transmitter .....	18
Indoor radio sensor with air pressure .....	18
Wind radio sensor .....	18
Rainfall measuring system .....	19
Addressing the radio sensors .....	20
Indoor radio sensor without air pressure .....	21
Indoor/Outdoor temperature sensor .....	21
Outdoor radio sensor .....	21
Storing the Solar-Powered Outdoor Sensors .....	22
Commissioning the Software .....	22
<b>Chapter 3 File</b>	
Weather Data File .....	26
Export .....	26
Print .....	26
Print Preview .....	27
Printer Setup .....	27
Sensor Name .....	27
Specifications .....	28
Floating average .....	29
Maximum difference .....	29
Rainfall measured value compensation .....	29
Exit .....	30
<b>Chapter 4 Display</b>	
Temperature/Humidity .....	32
Rainfall .....	33
Wind Force and Direction .....	33
Air pressure .....	33
All Sensors .....	33
Sensor Management .....	34
Weather Display .....	34
Toolbar .....	34
Status bar .....	35

## Chapter 5 Weather Display

Always on Top .....	38
No Header .....	38
External Sensor .....	38
Rainfall Display .....	38
Delete Total Rainfall .....	38

## Chapter 6 Interface

Read Now .....	40
Read Automatically .....	40
Interface Status .....	40

## Properties

Initialize .....	41
Interface .....	42
RS232 Multiplexer .....	42

## Chapter 7 View

Period .....	44
Period Forwards .....	44
Period Backwards .....	44
Zoom Out Period .....	44
Zoom In Period .....	44
Adapt Periods .....	45
Font .....	45
Settings .....	46

## Chapter 8 Window

Cascading .....	48
Tiled Horizontally .....	48
Tiled Vertically .....	48
Arrange Icons .....	48
Close All .....	48

## Chapter 9 Buttons

Toolbar .....	50
---------------	----

## Appendix

Appendix A Changing the Batteries .....	51
Appendix B Special Terms .....	52
Appendix C Eliminating Faults .....	53
Appendix D Range .....	55
Appendix E Technical Data .....	56
Appendix F Weather File Data Format .....	57
Appendix G Data Transfer Protocol (Version 2.0) .....	60

# Preface

Observation of weather data is not only of global significance but may also be of local interest. This can range from simply displaying the current weather data to long-term observation and analysis of recorded data and even to responses to dropping below or exceeding defined values. When used together with the operating and evaluation software, the radio weather station can be implemented for all these options.

In this way, the area of use of the radio weather station ranges from private requirements up to industrial and commercial use, e.g. agricultural and forestry industries, boat and ship captains, waterways industries and open-air event organizers. Apart from measuring the indoor temperature and relative humidity, up to 15 sensors can be connected for more temperature and humidity measurements. In addition, sensors are also available for registering air pressure, rainfall, wind direction and wind speed.

The radio controlled sensors have a range of up to 330 ft in the open, enabling an extremely flexible installation. Power supply for the sensors is provided by means of an integrated solar cell module. A battery bridges periods of darkness and little sunlight caused by bad weather. This battery is then recharged during periods of light. In this way, maintenance of the sensors is not generally required. All the sensors connected are automatically detected by the weather station and can be implemented immediately.

While the PC radio weather station is recording all the weather data, the data can be read out and analyzed by means of the operating and evaluation software. To do this, all the measured value data from the sensors is automatically transmitted to the radio interface and stored there. The radio interface is connected to a free serial interface. The data can then be transferred to the PC by using the software.

The radio weather station thus enables easy, comprehensive observation and analysis of the weather data and responses to various weather conditions.

# Explanation of Terms

In order to better understand the following descriptions, some of the more typical terms used by Windows, and which also appear in this manual, are explained briefly here.

**Left mouse button** The left mouse button is pressed (clicked) to select an element on the screen or to activate a function.

**Right mouse button** The right mouse button is often pressed (clicked) inside windows to call in a menu providing short-cuts to activate functions.

**Double click** A double click refers to pressing the left mouse button twice in succession, quickly. Double clicking is used, for example, to quickly select and activate entries in lists without having to use a separate button.

**Buttons** Buttons are framed areas, normally labeled, which activate the corresponding function when clicked, e.g. "Read", "Print" or "Help". Buttons can be activated with the mouse or keyboard.

**Input field** An input field enables characters to be entered. Depending on the type of input field, all characters can be entered or possibly only digits.

**Marking field** A marking field enables a function to be switched on or off. The current state is indicated by a cross or tick.

**Selection field** This operating element enables the selection of various settings. The selection fields are set out in related groups, whereby on one field can be active. The one currently active is indicated by a dot in a circle.

**Toolbar** The toolbar is an area containing icons representing various buttons which can be used to work quickly. These icons can only be activated by using the mouse.

**Status bar** The bottom area of a window is called the status bar. It contains general information e.g. information on the buttons. The status bar also displays a measured value in numeric form together with the date and time.

In order to enable extremely easy operation of the program, the buttons are always located on the right side or at the bottom edge of the window. When selecting or entering data, observe the functions of the following buttons.

**Ok** After activating this button, the current window is closed. The entries and settings made are **stored**.

**Cancel** After activating this button, the current window is closed. However, the entries and settings made are **not stored**.

**Close** After activating this button, the current window is closed. The entries and settings made are **automatically stored**.

# **Chapter 1**

## **Introduction**

# General Information

The radio weather station represents a highly sophisticated, easy to use, universal weather measuring system which can record, evaluate and display the data from up to 16 external radio sensors for temperature and humidity, a sensor for wind and another for rainfall.

When connected to a PC via the PC radio interface, the operating and evaluation software can be used to record the weather data. The measured values can be stored any interval between 1 and 60 minutes (1 hour). To enable analysis, it is simply necessary to transfer the data stored in the radio interface to the PC at regular intervals. This can be done, for example, according to the selected interval each day or once a week. The constant connection of the weather station to the PC also enables a continuous display of the weather data recorded.

The required period can be selected for which the weather data should be analyzed (day, week, month, year). The output data only relates to the previously selected number of sensors (9 or 16).

The weather data can be displayed in the form of a diagram and in a table. In addition, the minimum and maximum values are also displayed in respect of the selected period.

If required, the measured values can be displayed in separate window adapted to the weather station display.

# System Requirements

The operating and evaluation software can basically be run on any PC using Windows 95/98 or Windows NT. However, to enable fast processing, it is recommended implementing at least a 486 DX with a frequency of 66 MHz.

When Windows 95/98 is used, the PC should have at least 16 Mbyte RAM to ensure processing can be completed quickly. If Windows NT is used, the PC should have at least 32 Mbyte working memory because the operating system is more comprehensive.

Any printer set up under Windows can be used for printing purposes. The connection of an ink-jet or laser printer allows professional printouts to be made.

# Installation

The operating and evaluation software for the weather station is installed by activating the "Install" installation program provided on the program disk. This can be done, for example, by using the "Run" command in the Windows 95/98/NT Start menu.

The required target directory can be selected during the installation process. By default, the software is installed in the directory "c:\Program Files\PC Weather Station". After confirming all entries, the program files are set up in the selected directory. Finally, a program group called "PC Weather Station" is created together with links to the program. This means that the software can then be called in quickly at any time.

# Main Window

The main window of the operating and evaluation software consists of a menu bar, toolbar and status bar as well as one or more diagrams which represent the individual measured values in graphical form.

The toolbar contains several buttons which enable the most important functions to be activated quickly by using the mouse.

The status bar, located at the bottom of the main window, provides information on the buttons, menu options and help functions.

The central area of the main window displays sub-windows for all the measured values selected, according to the periods specified, in graphical and tabular form.

By simply clicking on the left mouse button inside the graphic, the time represented by the mouse position when clicked is shifted to the middle of the window and the window content in the time axis is zoomed by a factor of 2.

The time period displayed can be moved to the left or right by simply clicking the mouse to the left or right of the graphic, respectively.

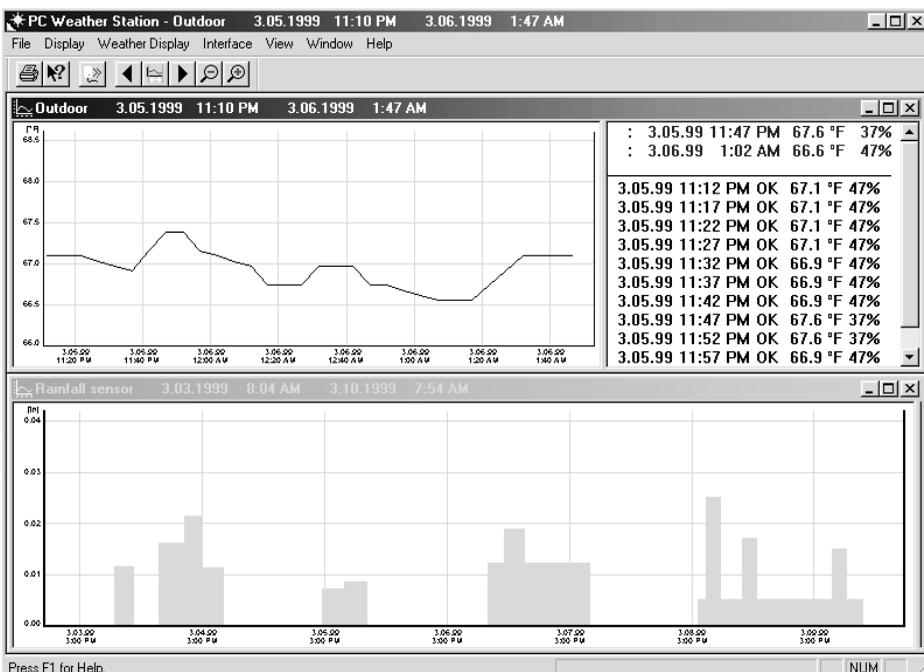


Figure: Operating and evaluation software, main window

## **File**

This menu can be used to call in the weather data files, print the various graphics, assign sensor names and export the measured values. The menu also provides the option of exiting from the program.

## **Display**

This menu is used to select the required measured value transmitters whose values should be displayed graphically (e.g. rainfall quantity, air pressure, etc.), or the simultaneous display of all the sensor data. In addition, the measured values can also be displayed in a weather display similar to that on the weather station LCD.

The toolbar and status bar can be made visible or invisible as required.

## **Weather Display**

This menu is used to select the various displays in the weather display and to delete the total rainfall value.

## **Interface**

This can be used to read weather data manually or automatically in a specified time matrix. It is possible to define that the PC interface be read out automatically each time the program is started.

## **View**

This menu is used to select the period for which the weather data available should be displayed and all the parameters for the graphic representation .

## **Windows**

This menu is used to define whether several windows should be displayed cascading, tiled horizontally or vertically. It is also possible to close all the windows simultaneously.

## **Help**

This menu contains the options Help Topics, Help and About. The Help Topics and Help options are provided to access online help to specific subjects and About provides information on the program version.

# Control

The operating and evaluation software can be controlled by using the mouse and keyboard. The "Enter" and "Esc" keys have a special significance in respect of user input and selection.

<b>Key</b>	<b>Function</b>	<b>Description</b>
Enter	Ok	Store input / Confirm selection
Esc	Cancel	Discard input / Reject selection

A range of function keys and key combinations are available in the main window with which to activate the most important functions quickly. In most cases, it prevents having to switch from using the mouse to the keyboard and vice versa.

<b>Key</b>	<b>Function</b>
F1	Help
F4	Weather display
F5	Read now
F8	Cascade windows
Alt+F8	Tile windows
F9	Period forwards
Alt+F9	Adapt all periods
F10	Zoom out period
F11	Zoom in period
F12	Period backwards
Alt+F12	Settings
Strg+E	Export
Strg+P	Print
Alt+D	File
Alt+A	Display
Alt+I	Interface
Alt+S	View
Alt+F	Windows
Alt+W	Weather display



# **Chapter 2**

## **Commissioning**

# Preparations

This section describes the working steps and settings necessary in order to start the sensors and weather station as well as the operating and evaluation software.

The outdoor sensors for measuring wind speed, rainfall, outdoor temperature and relative humidity are equipped with a solar cell for power supply and a lithium backup battery for periods of darkness and bad weather.

To protect the valuable batteries from total discharge during a longer period of storage without the solar cell being exposed to light, (e.g. storage in its packing), the power supply for initial operation is activated by a small magnet which must be inserted from the outside. Therefore, the magnet belonging to the respective sensor should be inserted just before the sensor is installed outside.

**In order to ensure the unique assignment of sensors in the PC interface, the PC interface should only be put into operation after the sensors have all been running for ten minutes.**

Particular attention should be paid to this because the sensors operate in a test mode for up to ten minutes after the operating power is applied (inserting the magnets in the outdoor sensors or inserting the batteries in the indoor sensors). During the test phase, data is transferred in a 4-second cycle instead of a 3-minute cycle.

The outdoor temperature and relative humidity sensors must be assigned unique addresses to ensure differentiation.

## **Inserting the magnets in the outdoor sensors**

In the case of the outdoor radio sensor for temperature and relative humidity, the magnet to activate the system is inserted in a opening designed for the purpose in the housing cover.

Activating the wind transmitter is also performed by inserting a small magnet in the opening provided. The magnet holder is located above the retaining tube (opposite the solar cell).

To insert the magnet in the rainfall measuring system, the upper section of the casing must be separated from the lower section by pressing it and turning it counterclockwise. The housing cover of the funnel integrated in the electronics casing is equipped with a clip-in holder for the small, round magnet. After pressing the magnet into the holder, the rainfall measuring system starts to transmit.

# Preparing the PC Interface

Preparation of the PC interface consists purely of inserting two AA alkaline batteries in the battery compartment on the rear side of the unit.

**Only use high quality alkali-manganese batteries. The PC interface cannot be operated without batteries.**

**The PC interface should only be put into operation after all the connected sensors have been in operation for more than ten minutes!**

During the initialization phase, no communication may be established between the PC and PC interface. In order not to affect the sensor initialisation. The PC and, more specifically the monitor, should remain switched off, because after inserting the batteries, the PC interface immediately to search for the sensors. This initialisation phase takes 6 minutes.

The initialization phase begins immediately and takes 6 minutes. During this period, the interface searches for all sensor transmitters and defines a small time window for each sensor received; the window being used later to activate the receiver. If synchronization between the transmitter and PC interface is lost as a result of temporary radio path interference, the interface scans for all the sensor transmitters every 17 hours. During this period, any sensors added are registered by the system.

In this way, new sensors are automatically integrated into the system.

Communication between the PC and interface should only be established 6 minutes after inserting the batteries.

To simplify commissioning, simply put the base station (interface) in the vicinity of the sensors. This ensures the error-free transmission of data from the sensors in the first step.

The data from the installed sensors is stored in the PC interface at an interval, which can be set, between 2 minutes and 1 hour.

# Commissioning Measured Value Transmitter

The weather station sensor concept is based on two groups of sensors. The basic requirement to operate the weather station is the indoor radio sensor with barometric atmospheric pressure. This sensor transmits a fixed data telegram which defines the display of the temperature and relative humidity in the display area for indoor values. Therefore, the sensor need not be addressed by the user and is immediately ready for use.

The radio rainfall measuring system and wind radio sensor have fixed addresses and belong to this group since their measured values also have a fixed location in the system.

The second group of sensors is comprised of all the other temperature/humidity sensors which can transmit up to 16 different temperature/humidity values. Each of these sensors can be assigned an individual name in the software (e.g. location of the sensor). In this case, each respective sensor must be allocated a unique address which simultaneously defines its position in the polling sequence. Observe the relevant notes on addressing in respect of these three types.

## **Indoor radio sensor with air pressure**

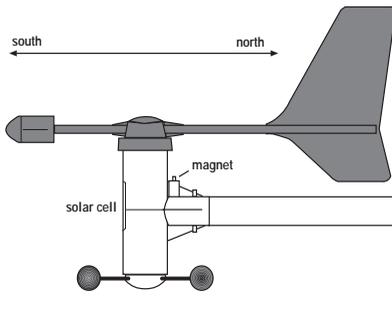
The indoor radio sensor with air pressure requires 2 round cell batteries in order to operate. It contains temperature, humidity and air pressure sensors. The data from it always appears in the indoor display window of the weather display. It measures the indoor temperature, humidity and air pressure and is the basic requirement for displaying the air pressure, pressure tendency and pressure history.

To insert the batteries, open the battery compartment on the rear side of the housing. Read the information on polarity in the battery compartment and insert the batteries accordingly. Then close the compartment. The sensor can then be brought to its installation site. Note that this sensor is not designed for use outdoors or in rooms with high humidity. The sensor is operational directly after inserting the batteries.

## **Wind radio sensor**

The wind radio sensor compiles both wind speed and direction at the installation site. It is supplied with power from a solar cell with a backup battery for periods of darkness. It is assigned a fixed address which the user cannot manipulate.

It can be installed on a mast or at the top of a wall. The important factor for the installation site is that the solar cell in the sensor housing faces south and is in an exposed space, i.e. the wind must be able to approach the sensor from all sides.



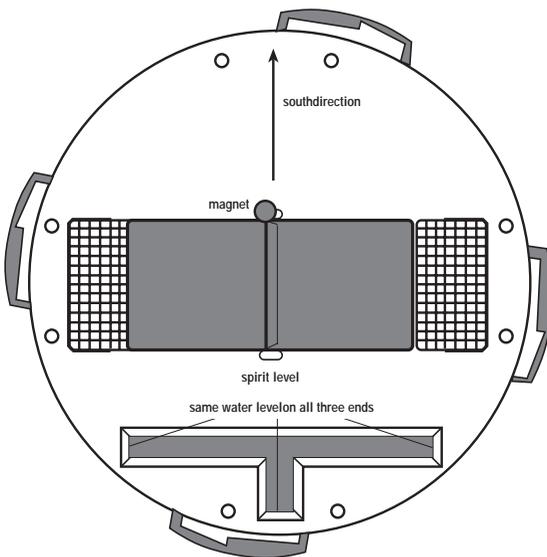
**Example of wind radio sensor installation on a mast**

Accurate alignment of the sensor, pointing the solar cell due south, is an essential factor because it represents the reference point for measuring the wind direction.

It must be assembled absolutely vertically in the retaining tube in order to receive accurate measurements.

Screw the retaining tube and sensor tight, ensuring a firm fit of all the components.

In its basic setting, the wind sensor is in an exact North - South direction (solar cell facing south) to ensure an accurate north reference point for the evaluation electronics.



**Aligning the WS-2010-16, using the spirit level and position of the transmitter magnets**

### **Rainfall measuring system**

The rainfall measuring system is also solar powered and is provided with a fixed address which cannot be manipulated by the user.

The solar cell must be accurately aligned to face south.

The rainfall measuring system must be positioned on an absolutely horizontal surface and fixed by means of screws inserted in the holes in the base of the housing. Remove the upper section beforehand by pressing it and turning clockwise. There is a recess in the lower section which, when filled with water, provides a perfectly horizontal alignment without any other resources required.

Fill the recess with a little water and then align the lower part of the housing according to the spirit level principle. After marking the installation position exactly, drain off the water. Ensure the solar cell faces south. The short side of the integrated spirit level must point north.

To enable good transmission (wide range), it is better not to set the rainfall transmitter directly on the ground. Installing it approx. 3,3 ft above ground level produces the best results and protects the system from dirt (especially the solar cells).

After screwing the lower section to the base, replace the upper section as follows:

In the middle of the counter rocker for rainfall on the lower section at the side is a bar magnet which triggers the electronic counting pulses.

The upper section of the housing must be mounted so that the solar cell is also on the same side as magnet, meaning that the electronics part is directly opposite and the three retaining latches fit exactly in the locks on the lower section. Then turn the upper section counterclockwise a little until it snaps into the locks in the lower section and remove tape that secures rocker.

The rainfall sensor is then ready for operation. As a test, pour a little water in the funnel very slowly. The recorded amount is later converted and displayed on the PC interface in inches, liter/m<sup>2</sup> or mm.

### Addressing the radio sensors

The outdoor sensor concept enables the use of up to 8 sensors simultaneously whose data appears at the top right of the display in the area for outdoor values. Each sensor in the system must be assigned an address which enables the receiver to integrate the data within the complete system without any interference. At the factory, each radio sensor outdoor radio sensor with solar cell is defined as Sensor 1 and the other sensor types as Sensor 2. The programmable assignment is illustrated

Indoor Sensor	Outdoor Sensor	Jumper		Indoor Sensor	Outdoor Sensor
		1	0		
16	8	JP1	A0	4	12
		JP2	A1		
		JP3	A2		
15	7	JP1	A0	3	11
		JP2	A1		
		JP3	A2		
14	6	JP1	A0	2	10
		JP2	A1		
		JP3	A2		
13	5	JP1	A0	1	9
		JP2	A1		
		JP3	A2		

in the diagram.

The addressing can be performed by the user by setting the jumpers on the component side of the sensor board. First of all, unscrew the protective cover from the sensor housing and then open the housing sensor housing by removing the screws on the rear side. In the case of the other sensor types, only the rear panel needs to be removed.

Then set the jumpers according to the addressing table.

### **Indoor radio sensor without air pressure**

The indoor radio sensor without air pressure corresponds to the indoor sensor with air pressure with regard to operation and function. However, it only contains a temperature and humidity sensor, but no air pressure sensor. This sensor can be freely addressed and assigned a name. The address can be defined as required according to the previous paragraph.

This sensor is well suited for use in indoor areas, such as a garage, cellar or even attic, because it is battery operated and continues to function in the dark.

### **Indoor/Outdoor temperature sensor**

The indoor/outdoor temperature sensor requires the insertion of 2 round cell batteries in order to operate. The electronically remote, encapsulated temperature sensor connected to a 4,95 ft long connection line enables it to measure the temperature in garden ponds or ground areas, etc.

This sensor can also be freely addressed.

The splashproof electronics housing can be installed or set down at the required location and the temperature sensor placed in or on the required object. The sensor only supplies temperature data, not humidity data.

### **Outdoor radio sensor with solar power supply**

The outdoor radio sensor enables the transmission of temperature and humidity values related to the site of its installation.

This sensor can also be freely addressed. At the factory, all solar powered outdoor sensors are defined as Sensor 1. However, individual addressing is possible.

The sensor should be installed on the North or West side because temperature information in meteorological terms always relates to 'shaded areas'. It can also be installed at other sites, as required. It is only necessary to ensure that the solar cell which provides the sensor with power is always exposed to light. The sensor should not be located near obstacles, such as leaves, which cast shadows and interfere with the power supply from the solar cell.

A good installation site, for example, is underneath a roof overhang.

The sensor is designed for installation on a mast or wall and should be mounted as follows: Mount the sensor wall bracket either exactly vertical on a wall using four screws or on a mast using the holding clamp.

Insert the sensor in the wall bracket and screw the parts together using the screws supplied.

The protective cover should be at the top and the solar cell exposed to light.

During periods of darkness or bad weather with little or no sunlight, power is provided to the sensor by an internal, solar buffered, backup battery system.

# Storing the Solar-Powered Outdoor Sensors

The outdoor sensors receive their operating power supply from a solar cell. Energy is also stored in a integrated battery which assumes power supply during periods of darkness and bad light.

If such a sensor remains out of operation for a longer period and receives no light, there is no risk to the internal battery if the magnets, inserted to activate the operating voltage, are removed. The sensor can thus remain stored, e.g. in its packing, for several years.

Following a longer period in storage, it is recommended to recharge the integrated battery before starting the system up. To do this, expose the solar cell, which is connected to the battery system even when deactivated, to sunlight for several hours.

## Commissioning the Software

After activating the operating and evaluation software, the interface is connected to the COM port intended. The standard setting is connection to the 1st serial interface (COM 1). If necessary, select a different interface by selecting the menu "Interface", submenu "Properties" and option "Interface".

The standard version of the weather station (PC interface) can support up to 16 temperature/humidity sensors which are automatically detected when the addresses are set correctly. Detecting the number of sensors simultaneously determines the number of measured values which can be stored in the radio interface. The memory should be read out when full at the latest so that no data is lost. When 16 sensors are used, the memory requirements are increased correspondingly so that fewer values can be stored in the same time period.

The number of measured values which can be stored is also affected by the **Interval** selected. The interval, i.e. the time period at which the weather data is recorded, can be set between 1 minute and 60 minutes. The standard setting is recording every 5 minutes.

The following table indicates the connection between the number of sensors supported, the selected interval and the maximum storage period, without measured values being lost. Each dataset requires 56 or 30 bytes. The radio interface has a memory capacity of 32 kbyte.

Sensors	Interval (minutes)	Maximum storage period (days)
9	5	3.5
9	10	7
16	15	5
16	30	10.5

The number of sensors to be supported can be modified using menu "Interface", submenu "Properties", option "Initialize".

**Note:**

If these settings are changed, the radio interface is re-initialized. All the weather data stored up to then is lost. In addition, the radio interface cannot send any data to the PC for approx. 6 minutes because the weather station (radio interface) because automatically scans for all the available sensors during this period.

In order to display the correct **air pressure**, the height of the installation site above sea level (NN) must be specified, in ft, in the weather station and software. To do this, activate the "File" menu, "Specifications" option and enter the absolute height above 0 in the corresponding input field.

The **rainfall measuring system** leaves the factory with a very high degree of accuracy so that no adjustment is normally necessary. However, adjustment is possible in individual cases where extreme precision is necessary for professional requirements. The entry is made in the "Specifications" option in the "Rainfall per collector"



# Chapter 3

## File

# Weather Data File

This function serves to open stored weather data files and create new ones in which data in the PC interface can be stored. This means it is possible, for example, to create a weather data file for each month and the data to be displayed in graphical and tabular form as and when desired.

## Export

After selecting this function, a window opens in which to select the period related to which data should be exported and the sensor data required. The selection of predefined periods enables particularly fast processing. In addition, any target file can be specified for the data to be exported.

### Separators

In order to separate individual data (date, time, measured value), several export formats require the entry of a special separator character which ensures the data is read in correctly by other programs. The semicolon (;) is frequently used.

**Export Weather Station Data**

Weather Data Available  
from 2.23.2000 12:13 PM to 2.24.2000 1:53 PM

Period for Export  
from 2.23.2000 1:53 PM to 2.24.2000 1:53 PM  
Predefined periods: Last 24 hours, Last hour, Last 3 hours, Last 6 hours, **Last 12 hours**, Last 24 hours, Last 3 days, Last 7 days, Last 30 days, All

Target file  
PC\_WETTER.EXP

Settings  
Separator: ;

Sensor Data for Export  
 Sensor 1  Sensor 9  
 Sensor 2  Sensor 10  
 Sensor 3  Sensor 11  
 Sensor 4  Sensor 12  
 Sensor 5  Sensor 13  
 Sensor 6  Sensor 14  
 Sensor 7  Sensor 15  
 Sensor 8  
 Indoor sensor  
 Wind sensor  
 Rainfall sensor

Select None  
Select All

OK  
Cancel  
Help

## Print

In order that the developments of weather data can be analyzed over a longer period of time independently of the PC, it is recommended to print out the rele-

vant information. It is particularly useful to make a monthly printout of all the required measured values. The graphic is printed according to the settings defined in the printer setup.

Before activating the option, call in the "Printer Setup" function to define the printer on which the weather graphics should be printed.

Printout in table form is not possible, at present. However, the data export function (see above) can be used here. Export the data as described in "Export", e.g. in an Excel file, and print a table from Excel.

## Print Preview

This option displays the entire page as it will appear on the printed page according to the parameters defined in "Printer Setup"

## Printer Setup

This menu option is used to select the printer to be used for a printout. In addition, the specific printer properties can be defined for the printout, e.g. the paper size and print quality.

## Sensor Name

Sensor Names	
Sensor 1	Kitchen
Sensor 2	Bathroom
Sensor 3	Garage
Sensor 4	Outdoor
Sensor 5	Sensor 5
Sensor 6	Sensor 6
Sensor 7	Sensor 7
Sensor 8	Sensor 8
Indoor Sensor	Indoor sensor
Wind Sensor	Wind sensor
Rainfall Sensor	Rainfall sensor
Sensor 9	Sensor 9
Sensor 10	Sensor 10
Sensor 11	Sensor 11
Sensor 12	Sensor 12
Sensor 13	Sensor 13
Sensor 14	Sensor 14
Sensor 15	Sensor 15

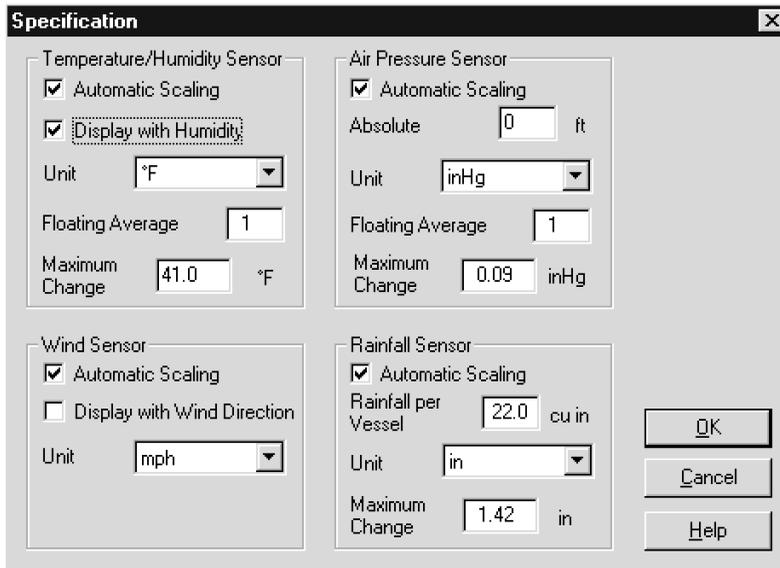
Close

Help

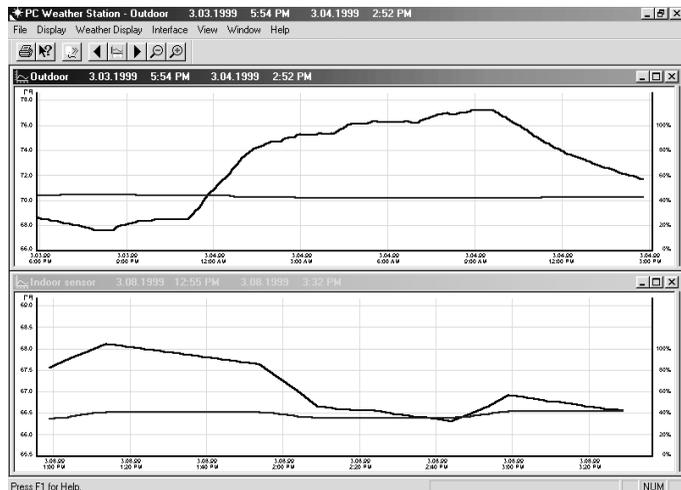
After selecting this option, a window opens in which each sensor is provided with an input field in which to describe the sensor. Enter the name of the respective

installation site of the sensors, for example. The descriptive name also appears when the corresponding "sensor window" is opened (graphic and values table).

## Specifications



The "Specifications" menu can be used to select the measurement units for all the sensors. The units °C and °F are available for temperature sensors, km/h, m/s, knots and mph for wind speed, l/m<sup>2</sup>, mm and in for rainfall, and hPa, mmHg and inHg for atmospheric pressure. This menu can also be used for the accurate adjustment of the rainfall measurement transmitter and height adjustment for the air pressure.



Automatic scaling can be selected for graphical representations for all sensor types.

### **Floating average**

A filter function is available with which to even out brief fluctuations in the measured values or exceptional measured values in the graphics representing the temperature/humidity and air pressure diagrams. In this case, a definable number of measured values is used to establish a floating average.

If, for example, a floating average of 10 is entered in the input field provided, a measured value is formed from the average of the current measurement plus the 10 previous and 10 following measured values. Thus, the average value is determined from 21 measured values.

The diagram on Page 28 illustrates the same temperature/humidity progression without a floating average and with a floating average of 20.

The original measure values are not changed by the evening out and the evened out signal sequence is not stored.

### **Maximum difference**

This input field is available for the temperature/humidity sensors, air pressure sensor and rainfall sensor. It is used to define the maximum permissible difference between two measured value transmissions, in which case larger differences are rejected .

### **Rainfall measured value transmitter compensation**

The rainfall measuring system leaves the factory in an accurate condition, so that adjustment is not normally necessary and the calibration factor already set can be used. Compensation is only necessary in the cases where extreme accuracy is required for professional purposes.

Before compensating the rainfall measured value transmitter, the accumulated rainfall total shown in the weather display must be reset to zero.

Then pour exactly one liter of water very slowly into the funnel of the rainfall measuring transmitter, within any period.

**Caution! Pouring too quickly falsifies the measuring results. Pour the water so slowly that no water remains in the funnel at any time.**

Since the diameter of the funnel is 5,118 in, i.e. has a surface area of 20,57 in<sup>2</sup> the setpoint value of 1 quart (U.S.) water poured in must produce a rainfall total of 2,81 in.

After all the water has funneled through, wait approx. 10 minutes and then read out the PC interface. After calling in the weather display, the actual value appears and should read 2,81 in.

The ratio of setpoint value to actual value defines the calibration factor. However, since a calibration factor has already been entered earlier, or the predefined value of 22.6 cu in per collector movement exists, this must be taken into account in the calculation.

The new calibration factor is calculated by the following equation:

$$\text{New calibration factor} = \frac{\text{Setpoint value (e.g. 2,81 in)} \times \text{old calibration factor}}{\text{Actual value (display value after filling the water)}}$$

The old calibration factor (i.e. currently valid value) is displayed in the "Rainfall per collector" input field. This input field must then be used to enter the new calibration factor, if necessary.

## Exit

This menu option is used to exit from the PC weather station software.

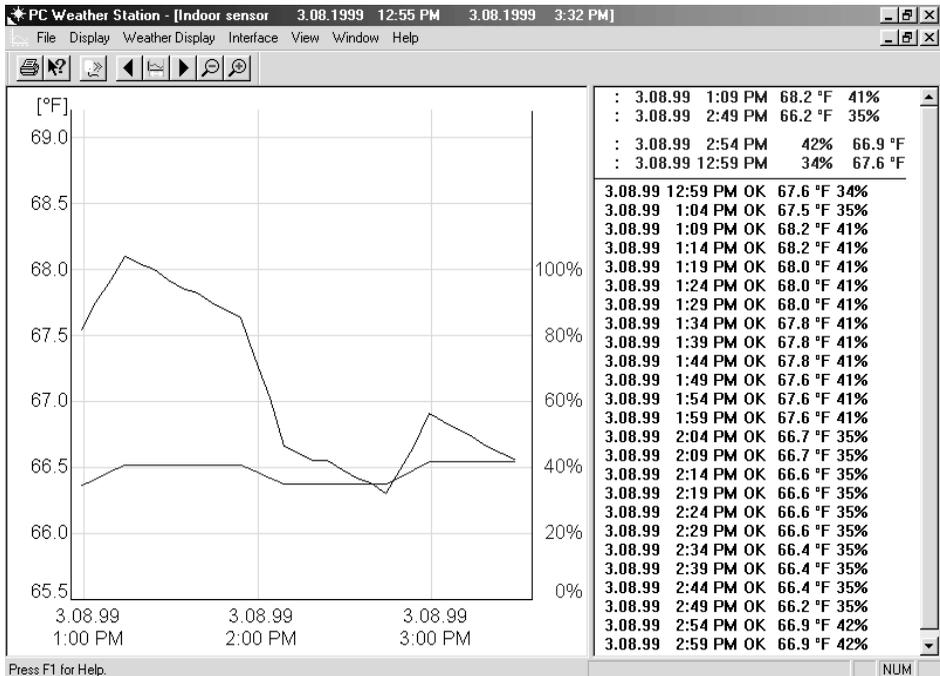
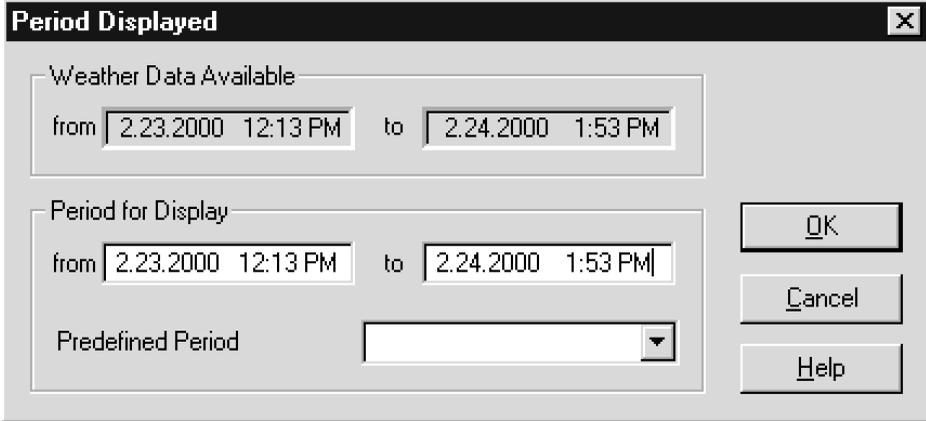
# **Chapter 4**

## **Display**

# Temperature/Humidity

Menu to select the display of a chosen temperature/humidity sensor. After selecting the corresponding sensor, the window for the display representation period appears.

The graphical and tabular output of the weather data can be provide for different period of time. This enables the observation of both general, long-term weather



developments as well as detailed characteristics concerning individual days. The upper part of the window, under "available weather data", indicates the period for which data is available regarding the relevant sensor. The period to be displayed can be entered in the input fields arranged below it. Eight predefined periods are provided as options, ranging from the last hour to the last 30 days. In addition, a graphic representing the entire data recording period can be automatically displayed.

After selecting the period for display, the corresponding graphics window appears on the screen containing a graphic representing the measured values available. Practically any number of measured value windows can be displayed simultaneously, either overlapping, tiled or cascaded. The size of the windows can be changed as with all Windows programs.

In order to observe the recorded weather data more closely, a "split screen" function is also available with which displays the same data in a table form. The table of values in the window can be drawn out from right to left and scroll bars are provided to search for measured values within the list.

The minimum and maximum values which have occurred within the period displayed are indicated at the top of the table together with the time and date of their occurrence.

It is possible to enlarge the display of each individual measured value window to full screen size.

## **Rainfall**

The window containing measured values concerning rainfall is displayed on the screen. A values table can also be opened using the mouse. The information at the top of the screen relates to hourly and daily rainfall values instead of minimum and maximum values.

## **Wind Force and Direction**

The weather data recorded by the wind measurement transmitter is displayed in a window on the screen. In the case of extreme values, the top part of the values table also indicates the prevailing wind direction, with fluctuation range, at the moment the data was recorded.

The wind speed can also be displayed as a full screen graphic.

## **Air Pressure**

This function displays the barometric air pressure in graphical and tabular form together with the related minimum and maximum values.

## **All Sensors**

All the currently available measured value windows are displayed simultaneously.

# Sensor Management

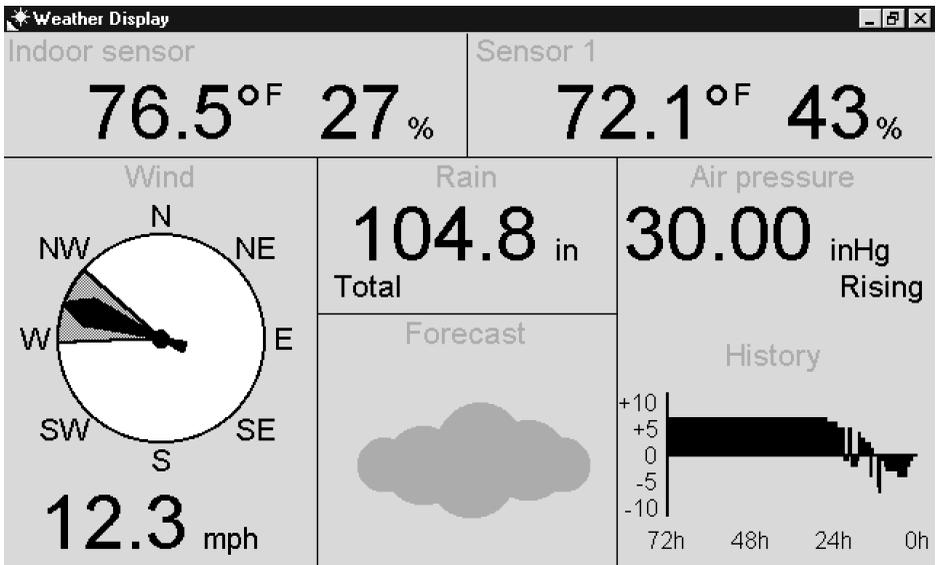
After activating this menu option, a window opens which contains a list of all the sensors used by the PC weather station. Any of the sensors can be activated manually by clicking the respective selection field with a tick. In the same way, this window can be used to deactivate sensors no longer required.

# Weather Display

When the weather data is being recorded, the measured values can be displayed in a window representing the weather station parallel to the graphical display. When this function is selected, the display window can be activated or deactivated.

By pressing the right-hand mouse button inside the display, the window characteristics can be modified.

The window settings are automatically stored so that when the window is activated again, it appears with the same characteristics and in the same position.



# Toolbar

Use this command to activate and deactivate the buttons in the toolbar. The toolbar should normally be activated to enable quick access to the respective functions using the mouse. By deactivating the toolbar, however, the diagram displayed can be enlarged.

## Status Bar

This option is used to visualize or hide the status bar, located at the bottom edge of the main window. The status bar contains information regarding the functions in the toolbar, help, etc. By deactivating the status bar, the diagram displayed can be enlarged.

A particular feature is the numeric measured value display inside the status bar with date and time. The information relates to the measured value at current cursor position within the graphic (e.g.: temperature and humidity) with the date and time recorded.



# **Chapter 5**

## **Weather Display**

## Always on Top

If the weather display window should be permanently in the foreground, it is indicated by a tick in this selection field.

## No Header

This selection field is used to activate and deactivate the weather display header.

## External Sensor

This menu is used to select the required temperature/humidity sensor to be displayed in the right-hand display area of the weather display. Up to 8 sensors can be displayed in the right-hand display area. The sensors actually used can be selected.

## Rainfall Display

This menu is used to define whether the total rainfall, rainfall over the past hour (every hour on the half hour) or rainfall over the last day (recorded for 24 hrs starting from 7.30 a.m.) should appear in the weather display.

The times and time periods comply to international standards implemented by professional weather services.

## Delete Total Rainfall

The accumulated total rainfall value is deleted by selecting this menu option. After activating the menu option, a confirmation request appears as to whether the rainfall total really should be deleted. Deletion occurs after confirming the request with "Yes".

# **Chapter 6**

## **Interface**

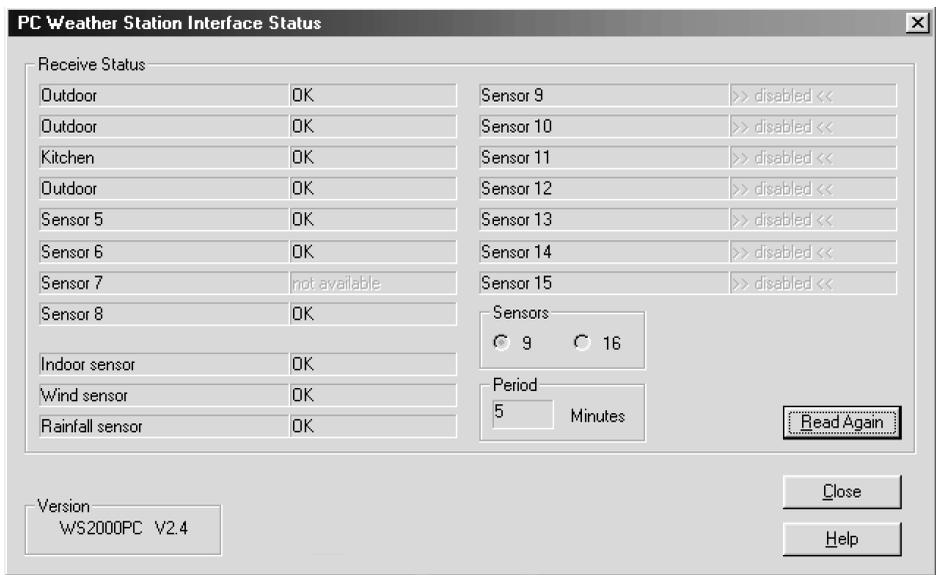
# Read Now

All the data records stored in the PC interface are read out and saved in the current weather data file. After the data transfer, the content of the 32 kb PC interface memory is automatically deleted.

# Read Automatically

This option enables the automatic reading out of data in the PC radio interface each time the program is started and after a freely configurable interval. The PC radio interface memory is automatically cleared after being read out.

# Interface Status



After activating this menu option, a dialog box appears indicating the status of all the sensors.

The status window of the PC weather station interface displays the number of sensors supported, the set time interval for storing the measured values and the current receive status of the individual sensors. One-off reception failures which occur in sensors are considered normal and are usually caused by 2 sensors in the same time window. By setting transmission intervals of different lengths for the individual sensors ensures the receiving capability of the failed sensor is recovered before its next transmission.

Longer receive failures may occur when the sensor concerned is at a critical distance or the radio transmission is disturbed by other equipment.

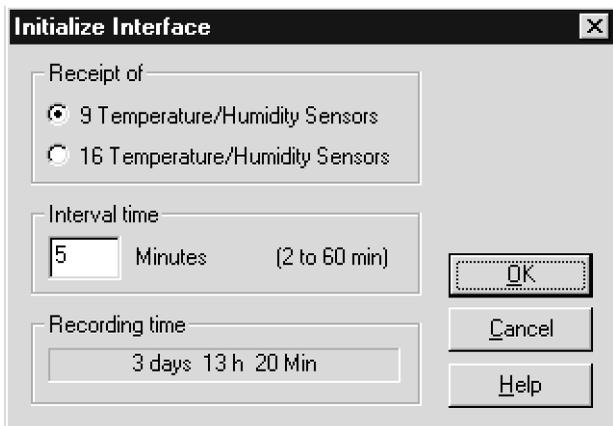
# Properties

## Initialize

The "Initialize interface" window can be used to define the interval period for saving the measured values in the PC interface and the number of temperature/humidity sensors supported (9 or 16). Intervals between 1 minute and 1 hour can be set for saving the measured values. The default interval period is 5 minutes. The maximum number of measured values which can be saved is not only dependent on the interval but also on the number of sensors connected (9 or 16). With a storage interval of 10 minutes and 9 temperature/humidity sensors, the recording time exceeds one week. If the memory is full, the respectively oldest data is overwritten according to the principles of the ring memory. The stored data should, therefore, be read out from the PC and into the required file in good time, according to the set interval.

The following table illustrates the connection between the number of sensors supported, the selected interval and the maximum storage period. Each dataset requires 30 or 56 bytes.

Sensors	Interval (minutes)	Maximum storage period (days)
9	5	3.5
9	10	7
16	15	5
16	30	10.5



### Note:

The interval and number of sensors involved should be selected when the weather station is commissioned and not subsequently adjusted, if possible, because all data in the radio interface is lost following modification! Therefore, before the interval or number of sensors connected can be changed, a confirmation request appears.

If in doubt, read out the weather data available before initiating changes.

In the case of changes made later, e.g. through disassembling the system, the changes should be made at the beginning of a new saving period.

## Interface

This submenu enables the selection of a serial interface to which the radio interface should be connected. The default setting for the connection is the first serial interface (COM 1). The interface parameters (9600 baud, 8 data bits, 2 stop bits and even parity) are automatically set by the operating and evaluation software. After confirming the selection, the radio interface is searched for on the selected interface. If the radio interface is not found, a corresponding message is issued.

## RS232 Multiplexer

As with the PC radio interface, several other units also operate with the computer via the serial RS232 port. Since most computers, however, only have 2 or even 1 serial ports, the implementation of an RS 232 multiplexer is advantageous enabling the operation of up to 6 external units on one serial COM port. By cascading several multiplexers, it is possible to provide up to 36 serial ports for each PC COM port.

If an RS232 multiplexer is available, the interface address is selected via this menu option.

# Chapter 7

## View

## Period

On activating this menu command, the "Period Display" window opens up. This window is used to define the period for which the weather station data should be displayed. For quick selection, up to 8 predefined periods are available which can be selected simply by clicking the mouse.

**Period Display** [X]

Weather Data Available

from 2.23.2000 12:13 PM to 2.24.2000 1:53 PM

Period for Display

from 2.24.2000 1:53 AM to 2.24.2000 1:53 PM

Predefined Period: Last 12 hours

OK  
Cancel  
Help

## Period Forwards

If only a section of a period is displayed in the graphic, this function can be used to shift the area displayed on the screen forwards to display a later time period.

## Period Backwards

If only a section of a period is displayed in the graphic, this function can be used to shift the area displayed on the screen backwards to display an earlier time period.

## Zoom Out Period

This function increases the period represented by the graphic and the values table up to a maximum of the total period which can be displayed.

## Zoom In Period

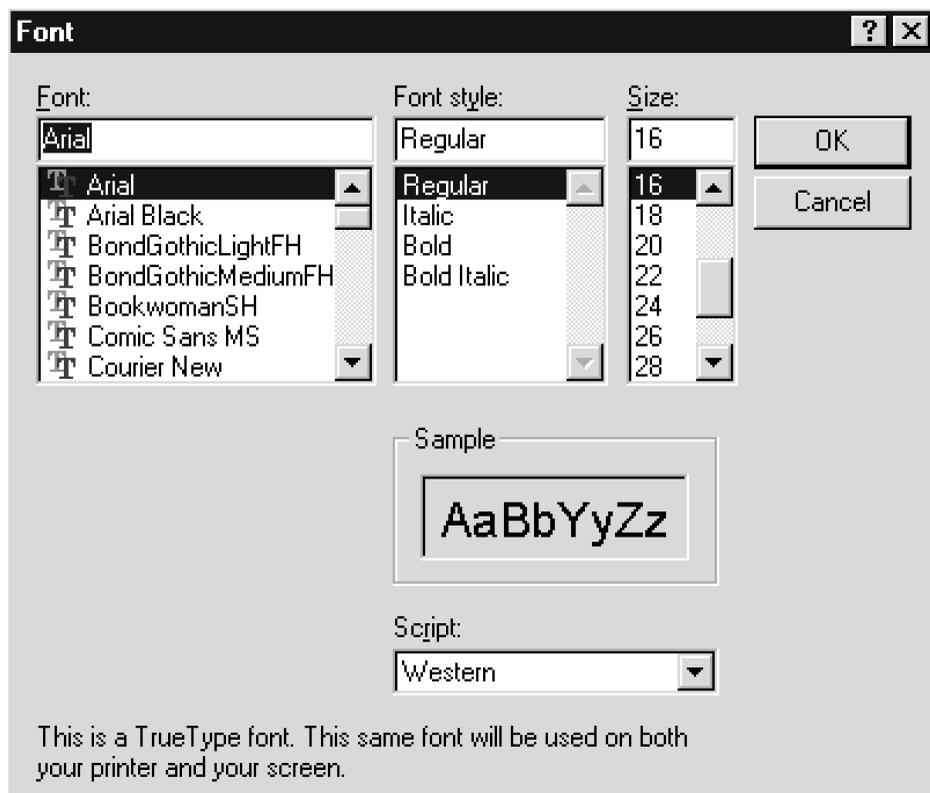
This function reduces the period represented by the graphic and the values table.

## Adapt Periods

When several graphic windows are being displayed with various scaling factors for the time axis, this function causes an automatic adaptation of the graphics to the time axis in the currently selected window. All the graphics displayed on the screen are then represented for to the same time period.

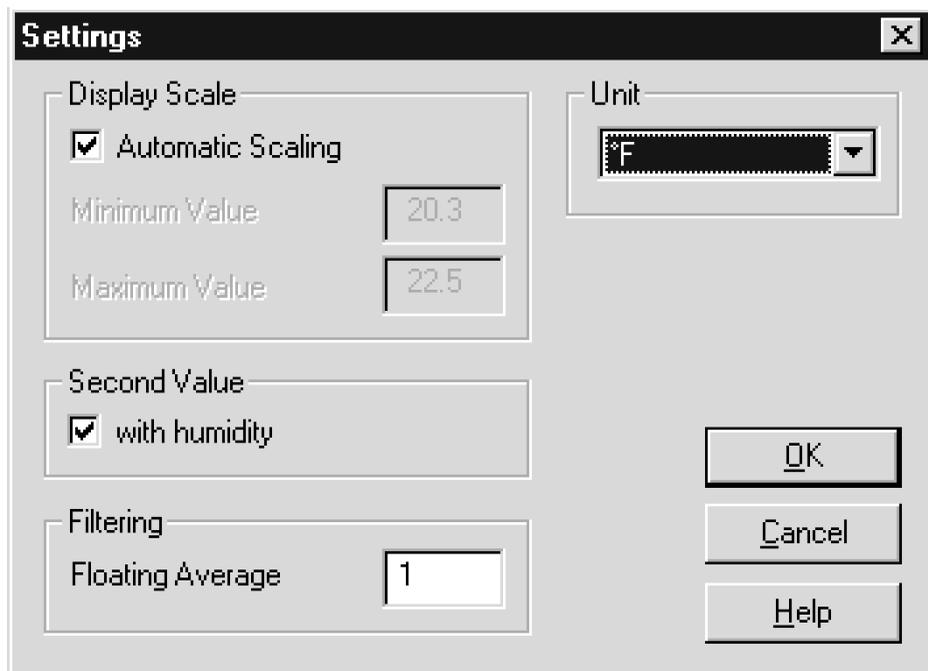
## Font

After activating this menu command, a window opens in which to modify the font, font style and font size. The font defined is then used for the screen display and printout.



## Settings

The "Settings" menu command can be used to modify the scale of the screen window currently open. Apart from the freely selectable minimum and maximum values, automatic adaptation of the scaling to the minimum and maximum values of the period represented is also possible. In the case of a temperature/humidity sensor, it is possible to select the relative humidity to be displayed as the second value. In addition, the unit of measurement can be change here in respect of the currently active window (e.g. °C or °F for the temperature sensor).



The screenshot shows a "Settings" dialog box with a title bar containing a close button (X). The dialog is organized into several sections:

- Display Scale:** Contains a checked checkbox for "Automatic Scaling". Below it are two input fields: "Minimum Value" with the value "20.3" and "Maximum Value" with the value "22.5".
- Unit:** A dropdown menu currently displaying "F".
- Second Value:** A section containing a checked checkbox for "with humidity".
- Filtering:** A section containing an input field for "Floating Average" with the value "1".

On the right side of the dialog, there are three buttons: "OK", "Cancel", and "Help".

# **Chapter 8**

# **Windows**

## **Cascading**

Use this command to arrange the open windows overlapping each other on the screen.

## **Tile Horizontally**

Use this command to arrange the up to 3 open windows tiled beside each other on the screen. Other measured value windows are then cascaded.

## **Tile Vertically**

Use this command to arrange the up to 3 open windows tiled vertically. Other measured value windows are then positioned beside them.

## **Arrange Icons**

Use this command to arrange the windows, minimized to icons, at the bottom of the main window.

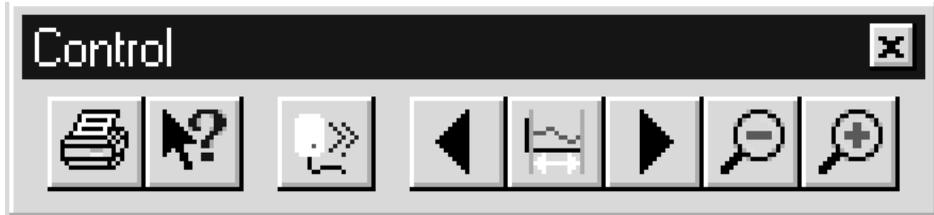
## **Close All**

Use this command to close all the measured value windows.

# Chapter 9

## Buttons

# Toolbar



The buttons in the toolbar can be used to activate the following functions quickly using the mouse:

- |                                |   |
|--------------------------------|---|
| <b>Print:</b>                  | Prints the active document                                  |
| <b>Context-sensitive help:</b> | Displays information on the button, menu or window clicked  |
| <b>Read out data:</b>          | Reads out the weather data from the interface immediately   |
| <b>Period backwards:</b>       | Shifts the period displayed back in time                    |
| <b>Define period:</b>          | Defines the start and end time (date, time) for the display |
| <b>Period forwards:</b>        | Shifts the period displayed forwards in time                |
| <b>Zoom out period:</b>        | Enlarges the period displayed                               |
| <b>Zoom in period:</b>         | Reduces the period displayed                                |

# Appendix A Changing the Batteries

## **Radio sensors with battery operation**

All the batteries in these sensors have a working life of up to 3 years (alkali batteries). They must be replaced when the display of the corresponding sensor does not appear for over 24 hours and no other general, longer term interference in the transmission path needs to be taken into account. This can generally be determined if data transmission from other sensors located nearby is not displayed either (refer to Appendix C "Faults").

The batteries are changed by opening the battery compartment on the rear of the sensor housing, removing the used batteries and inserting two new round cell batteries of the type AA Alkaline, ensuring correct polarity according to the markings on the compartment cover. The sensor is operational again after replacing the cover. The data from the sensor should reappear in the display after the PC interface has completed its sensor polling cycle (refer to Appendix C "Eliminating Faults").

## **PC radio interface**

If communication between the PC interface and PC no longer operates properly or data is not received from several sensors, it indicates that the batteries in the PC interface are empty.

The batteries can be replaced by opening the battery compartment on the rear side of the interface housing, removing the used batteries and inserting two new round cell batteries of the type AA Alkaline, ensuring correct polarity according to the markings on the compartment cover.

**Other system components do not require changing the batteries because they are powered by solar cells. Integrated batteries provide power during periods of darkness or bad light.**

**Used batteries should not be disposed of in normal household waste! Dispose of them at your local special waste depot or return them to your dealer.**

## Appendix B Special Terms

**Air pressure history** - storage and graphical display of the air pressure over the last 72 hours. This can be used to determine conclusions related to the general weather development. The graphical representation appears in the weather display.

**Air pressure tendency** - calculates the weather development over the last hour.

**Weather tendency** - weather forecast display via weather symbols, calculated from the speed at which the air pressure is rising or falling.

# Appendix C Eliminating Faults

If transmission is not received from a sensor for 36 hours, its value disappears from the display. At regular intervals (17 hours) the PC interface polls all the sensors during a six minute period in case synchronization between sensor and PC interface has been temporarily affected by transmission path interference. Transmission occurs in a very short period of time. After this period any faulty reception should have been cleared.

***Possible faults which prevent correct display of transmitted measured value data include:***

## **Undefined values after starting up**

Ensure that the PC interface is only started up 10 minutes after the last radio sensor was started up in order to receive defined data immediately and guarantee the correct assignment of the data telegrams to the display positions.

## **No reception - distance between transmitter and receiver is too great**

Reduce the distance between transmitter and receiver.

## **Repeater for Increasing the Range**

Buildings which reduce ranges can be compensated for by means of a special repeater designed for the weather station. The battery powered repeater, equipped with transmitter and receiver receives the data from the required sensors and transfers them on with only a minimum delay. The repeater is housed in a waterproof casing and is suitable for installation both indoors and out. Several repeaters can be cascaded to overcome greater distances.

## **No reception - interfering material between transmitter and receiver (thick walls, concrete,...)**

Find a new location for the transmitter or receiver. Also refer to Appendix D ("Range").

## **Batteries of transmitter or receiver empty**

Change batteries.

## **Transmitter superimposed by source of interference**

(radio, headphones, loudspeakers)

Eliminate the source of the interference or find a new location for the transmitter. If no data is received for 36 hours, the associated measuring point is deactivated so that no more measured data is displayed because the system assumes that the sensor no longer exists. No more attempts are made to receive data in order to save battery power. Every 17 hours the receiver automatically starts a resynchronization, whereby sensors which have not been received for over 36 hours are deactivated.

**A newly added radio sensor (e.g. following a change of batteries) is automatically accepted by the system and the related data is displayed.**

Faults are often restricted to limited periods (radio communication) or can be easily eliminated. If a unit, e.g. radio headphones, remote babysitter, etc is operated your house or a neighbor's at 433 MHz, the period of activity is normally limited. Most of these units can be changed to an interference-free frequency. Such measures can normally eliminate faults effectively.

**Radio sensor interferes with other units in 433 MHz range**

The transmissions from radio sensors can cause short-term interference on units operating on the same channel (every 3 minutes for approx. 200 ms). This interference is negligible. If possible, change the channel on the unit experiencing interference.

**Recharging batteries in the outdoor sensors**

The vanadium-lithium battery integrated in the outdoor sensors is capable of covering power requirements during periods of darkness for several months so that, under normal conditions, no recharging is necessary.

However, if the battery is discharged following a long period in storage in darkness, recharge it by exposing the solar cell to sunlight for several hours, without the activating magnets being inserted.

# Appendix D Range

Under optimum conditions, the open field range is 330 ft, i.e. when there is 'visual' contact between the transmitter and receiver. Walls and reinforced concrete constructions can be passed through, but they do affect the range correspondingly. A reduced range may be due to the following reasons:

- High frequency interference of all types.
- Buildings of all types and vegetation.
- Especially in the case of the wind sensor, metal roofs or roof insulation with foil sealed glass wool can reduce the range.
- Transmitter and receiver clearance from conductive surfaces or objects which affect radiation characteristic and thus the range (including human bodies and the ground).
- Broadband interference in built-up areas may reach levels which lessen the entire signal-to-noise ratio, thus reducing the range.
- Units with neighboring operating frequencies may affect the receiver.
- Poorly screened PCs may affect the receiver and reduce the frequency.

## Appendix E Technical Data

The following table provides an overview of the technical data of the weather station.

Measuring interval, outdoor sensor .....	3 min
Measuring interval, indoor sensor .....	3 min
Transmission frequency .....	433.92 MHz
Range in open space .....	Max. 330 ft
<b>Temperature range, indoors</b> .....	+ 32 °F to + 158 °F (0.0 °C to +70 °C)
<b>Temperature range, outdoors</b> .....	- 22 °F to + 158 °F (-30.0 °C to +70 °C)
Resolution .....	0,1 °F (0.1 °C)
Accuracy .....	± 2 °F (±1 °C)
<b>Measuring range, rel. humidity</b> .....	20 % - 95 %
Resolution .....	1%
Accuracy .....	8%
<b>Measuring range, air pressure</b> .....	23,62 to 32,48 in Hg (800 to 1100 hPa)
Resolution .....	0,03 in Hg (1 hPa)
Accuracy .....	± 0,03 in Hg (±1 hPa)
<b>Rainfall</b> .....	0 to 393 in (0 to 9999 mm)
Resolution .....	< 0,02 in (< 0,5 mm)
Accuracy .....	2% ± 0,04 in (2% ±1 mm)
<b>Wind speed</b> .....	0 - 124 mph (0 - 200 km/h)
Resolution .....	0,1 mph (0.1 km/h)
Accuracy .....	3% ± 0,6 mph (3% ±1 km/h)
<b>Wind direction</b>	
Numeric resolution .....	5 degrees
Power supply .....	2 round cells (alkaline)
Dimensions (W x H x D) .....	3,94 x 2,76 x 0,94 in (100 x 70 x 24 mm)

# Appendix F Weather File Data Format

The information below is comprised of extracts from the C++ source program in order to make the structure of the weather data file more clear.

The weather data file is a sequential file in which all the data received is stored in succession in one dataset of constant size (WSPC\_DATEN).

At the start of the file is a 4-byte integer, containing flags which indicate the presence of sensors.

This is followed by consecutive datasets as received from the interface.

## Dataset structure

```
typedef struct
{
    time_t zeit;
    WSPC_TEMP_FEUCHTE t_f[8];           // 8 temperature/humidity sensors
    WSPC_T_F_DRUCK   t_f_d[8];         // 8 temp./humidity/pressure sensors
    WSPC_WIND        wind;             // Wind sensor
    WSPC_REGEN       regen;            // Rainfall sensor
} WSPC_DATEN;                          // Dataset structure

#pragma pack(1)                          // All following data is byte-aligned
typedef struct
{
    short temp;
    unsigned char feuchte;
    unsigned char flag;
} WSPC_TEMP_FEUCHTE;                    // Structure to record data from external sensors

typedef struct
{
    short druck;
    short temp;
    unsigned char feuchte;
    unsigned char flag;
} WSPC_T_F_DRUCK;                       // Structure to record data from external sensors
                                         // with pressure
```

```
typedef struct
{
    short staerke;
    short richtung;
    unsigned char breite;
    unsigned char flag;
} WSPC_WIND;           // Structure to record data from wind sensor
```

```
typedef struct
{
    short zaehler;
    unsigned char flag;
} WSPC_REGEN;         // Structure to record data from rain sensor
```

```
#pragma pack()       // All following data is again 4-byte aligned
```

# Radio Interface Memory

32 kbyte as a ring memory

## Command Overview

- '1' : Request dataset
- '2' : Select next dataset
- '3' : Activate 9 temperature sensors
- '4' : Activate 16 temperature sensors
- '5' : Request status
- '6' : Set interval time

# Appendix G Data Transfer Protocol (Version 2.0)

## Activate Data Transfer

- In normal state, the PC weather station is inactive and does not react to V24 signals.
- To activate it, set the RTS line  $< -9$  V and the DTR line to  $> 9$  V.
- The PC weather station activates its interface following a High-Low side of a pulse on the DTR line.
- After the PC weather station has started and stabilized its main oscillator (approx. 30 ms), it transfers a "ETX" character to confirm that it is ready to receive.
- Data transfer can then begin.
- The PC weather station is reactivated as soon as the DTR line is reset to 'High' or if no valid start command (SOH) is received for 0.5 s.
- Data exchange via the V24 has priority over receipt from a sensor. Therefore, the receipt of data should occur at greater intervals.
- Datasets are, therefore, only deleted from the PC following an explicit request. By comparing the block numbers transferred in the data set, the PC can determine whether the next dataset has actually been selected.
- Each value stored is assigned a flag which indicates whether the value is new or represents the previous value received.
- The PC weather station can either receive either 8 temperature/humidity sensors + 1 indoor sensor with pressure or 15 temperature/humidity sensors + 1 indoor sensor with pressure.

After changing the operating mode, all the stored datasets are deleted from the radio interface and all the sensors re-identified. During this period of approx. 6 minutes there must be no communication with the interface.

# Interval and Storage Period

a) All 16 sensors

Interval	Storage period
10 min.	85 1/4 hr. (3 1/2 days)
15 min.	128 hr. (5 1/4 days)
30 mn.	256 hr. (10 1/2 days)
1 hour	512 hr. (21 1/4 days)

b) With 8 sensors

Interval	Storage period
10 min.	170 1/2 hr. (7 days)
15 min.	256 hr. (10 1/2 days)
30 min.	512 hr. (21 1/4 days)
1 hour	1024 hr. (42 1/2 days)

# Data Format

Data frames:

<STX><length> [message] <checksum><ETX>  
1 1 n 1 1

Data transmission: 9600 baud, even parity, 8 bit, 2 stop

<STX> is issued as the start character and <ETX> as the end character

All characters between the start and end are processed so that no <STX> nor <ETX> are contained.

<STX>	becomes character string:	<ENQ> <DC2>
<ETX>	becomes character string:	<ENQ> <DC3>
<ENQ>	becomes character string:	<ENQ> <NAK>

- After receiving a data packet, processing must be interrupted before the length and checksum can be checked.
- The length indicates the number of characters in the message.
- The checksum is the negative 8-bit sum of bytes from <STX> up to the last character in the message. If all the characters (from STX to the checksum) are added and then 255 is subtracted, it must result in 0.

In the case of faulty data reception, the radio interface issues the message <NAK>.

<STX> <01h> <NAK> <0E8h> <ETX>

Note:

In the following description of the individual commands, only the actual message is indicated as the reply. The data structure must be added.

# Request Dataset

<SOH> '1' (-sum) <EOT>

1 1 1 1

Response from weather station: (34/60 Bytes)

1. Data available

(Block no.) (Time) (Data)

2 2 n

Block no.: Number of the block in the memory (no relation to time. Serves to control dataset registered twice.)

Time: Age of the dataset in minutes up to the current time.

Data: 30 (9 sensors) or 56 (16 sensors) bytes

2. No data available: <DLE>

# Dataset

The dataset consists of 30 or 56 bytes, each byte containing two digits.  
In the following, bits 0-3 are referred to as "L" and bits 4-7 as "H".

Temp 1	L2, H1, L1	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 1	L3, H2	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 2	H4, L4, H3	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 2	H5, L5	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 3	L7, H6, L6	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 3	L8, H7	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 4	H9, L9, H8	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 4	H10, L10	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 5	L12, H11, L11	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 5	L13, H12	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 6	H14, L14, H13	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 6	H15, L15	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 7	L17, H16, L16	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 7	L18, H17	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Temp 8	H19, L19, H18	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 8	H20, L20	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Rainfall	H22, L22, H21, L21	(L22,H21,L21 = binary counter status) (Bit 3 of H22 is the new flag)
Wind sp.	H24, L24, H23, L23	BCD (hundreds, tens, units, tenths) (Bit 3 of H22 is the new flag)
Wind dir.	L26, H25, L25	BCD (hundreds, tens, units)
Pressure_I	H27, L27, H26	BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp I	L29, H28, L28	BCD (tens, units, tenths) (Bit 3 of tens is sign)
HumidityI	L30, H29	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
>>>> Pressure 9 is not supported		
Temp 9	H31, L31, H30	BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 9	H32, L32	Binary (Hi, Lo) (Bit 3 of Hi is the new flag)

Pressure_10	L34, H33, L33 BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp 10	H35, L35, H34 BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 10	H36, L36 Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Pressure_11	L38, H37, L37 BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp 11	H39, L39, H38 BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 11	H40, L40 Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Pressure_12	L42, H41, L41 BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp 12	H43, L43, H42 BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 12	H44, L44 Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Pressure_13	L46, H45, L45 BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp 13	H47, L47, H46 BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 13	H48, L48 Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Pressure_14	L50, H49, L49 BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp 14	H51, L51, H50 BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 14	H52, L52 Binary (Hi, Lo) (Bit 3 of Hi is the new flag)
Pressure_15	L54, H53, L53 BCD (hundreds, tens, units) (absolute pressure - 200 hPa)
Temp 15	H55, L55, H54 BCD (tens, units, tenths) (Bit 3 of tens is sign)
Humidity 15	H56, L56 Binary (Hi, Lo) (Bit 3 of Hi is the new flag)

## Select Next Dataset

<SOH> '2' (-Sum) <EOT>  
1 1 1 1

Response from weather station: (1 Byte)

1. Next dataset available : <ACK>
2. No dataset available: <DLE>

## Set 9 Sensors

<SOH> '3' (-sum) <EOT>  
1 1 1 1

Response from weather station: (1 byte)  
<ACK>

## Set 16 Sensors

<SOH> '4' (-sum) <EOT>  
1 1 1 1

Response from weather station: (1 byte)  
<ACK>

## Set Interval Time

<SOH> '6' (time in minutes)(-sum) <EOT>  
1 1 1 1 1

Response from weather station: (1 Byte)  
<ACK>

Note:

Permissible values for the interval lie within the range from 1 to 60 minutes.

# Poll Status

<SOH> '5' (-sum) <EOT>

1 1 1 1

**Response from weather station: (21 byte)**

(Status)

## Dataset status

B1	Status of temp. sensor 1	
B2	Status of temp. sensor 2	
B3	Status of temp. sensor 3	
B4	Status of temp. sensor 4	
B5	Status of temp. sensor 5	
B6	Status of temp. sensor 6	
B7	Status of temp. sensor 7	
B8	Status of temp. sensor 8	
B9	Status of rainfall sensor	
B10	Status of wind sensor	
B11	Status of indoor sensor	
B12	Status of temp. sensor 9	
B13	Status of temp. sensor 10	
B14	Status of temp. sensor 11	
B15	Status of temp. sensor 12	
B16	Status of temp. sensor 13	
B17	Status of temp. sensor 14	
B18	Status of temp. sensor 15	
B19	Interval times in min.	
B20	Bit 0 : not used	
	Bit 1 : 0 ‡ without HF	1 ‡ with HF
	Bit 2 : 0 ‡ 8 sensors	1 ‡ 16 sensors
	Bit 3 : not used	
B21	Version number	

Sensor status:

n < 16 ‡ not available

n = 16 ‡ OK

n 17 .. 255 ‡ number of receive errors +16