

Manual

MWS 9-5

Microprocessor-Weather Station

(Version 1.4 and later)



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MWS 9-5 Microprocessor Weather Station

1 Caution

1.1 Intended Use

REINHARDT-Weather stations and sensors are exclusively built for stationary operation on a fixed 1" pipe for automatically collecting climatic parameters outside.

Any use other than described above may cause damage of the product or lead to other dangers.

Do not mount the weather station in reach of children and pets.

Carefully read the complete operating manual. It contains important information about the installation and operation.

1.2 Safety Regulations



The instruments are manufactured according to modern technical standards and can be operated without danger when used as directed.

Damage caused by non-observance of this operating manual can lead to forfeiture of warranty. We shall not assume any liability for subsequent damage.



We shall not assume any liability for damage of items or persons caused by improper handling or non-observance of the safety instructions! In such cases any guarantee claims shall become null and void.

Dear customer, the following safety and hazard notices not only serve the protection of your health but also the protection of the appliance. Please read the following points carefully.



The supply voltage is converted by isolated transformers into voltages of maximum 24VDC. Please do only use the supplied power supply units.



The weather station includes pointed and sharp-edged parts (i.e. windvane and edges of the sensor's housing), which may cause injuries when handled without care.



Do not leave the packaging material lying around. These parts are dangerous toys in the hands of children.

Handle the product with care. Blows or impact, or dropping it even from a small height will damage it.

1.3 Mounting

The weather station is mounted on a 1" water-pipe. This pipe must be fixed very well to stand high wind speeds above 200 km/h when the weather station is mounted.

The weather station is to be fixed well onto the 1" pipe with the pipe clip or the screws. The stability of the weather station on the pipe must be established. Really check this after mounting the weather station!



Insects and dirt may jam the precipitation- and the windsensors! Due to this circumstances please mount the weather station on a place you easy can reach for maintenance purposes for the station can not be guaranteed to be absolutely maintenance free!!

You also find advice for mounting the weather station on your weatherCD.

MWS 9-5 Weather Station has been designed for measuring the most important weather parameters such as temperature, humidity, barometric pressure, wind direction and wind speed, rain (precipitation) and solar energy. All parameters can be displayed graphically, digitally or as an „instrument“. There is also statistics and a history-function.

2 Setting up the MWS 9-5 Weather Station

2.1 Installation of Hardware

Setting up the weather station is easy:

Mount the weather station on a 1" pipe. Orient the North-marker to the North and clamp MWS9-5 in place (Please use the wall clamp enclosed.). Take care that the pipe is mounted as perpendicularly as possible, otherwise the windvane will not work properly and will preferably rotate in one direction.

NOTE

Very Important !

The wind vanes of the MWS 9-5 weather station are very sensitive sensory equipment which can easily be destroyed by mechanical influence.

Therefore do keep the packing of your weather station. Whenever you want to ship your weather station later, this packing guarantees that the weather station is not damaged in transport !! Time and again we have noticed that the units are damaged by wrong packing. This is very annoying for the customer because he has to pay for all costs that may arise.

Please ask for a quotation of an original packing if it is no longer available to you (see last page).

The weather station must be set up at a place which is exposed to the weather (wind and sunshine), because otherwise wind direction, wind speed and solar radiation cannot be measured correctly. (Please see the "Directions of Deutscher Wetterdienst").

Connect the enclosed cable as follows:

Connect the 9pole connector to a free serial interface of your PC (COM1 or COM2 under the Windows-version COM3 or COM4 as well), with 32-bit versions COM1..16).

Plug the power supply into a power outlet 230V / 50Hz.

2.1.1 Warning!!



Never leave the POWER-connector connected to the weather station, if you have not connected the power supply, because then the internal backup batteries, which grant up to 2 hours operation in case of power failure, will be discharged.

If the POWER-connector is plugged in for a long time to the MWS 9-5 without input voltage the internal s will be damaged due to permanent discharge!!



Note on Security

Please note that you must in any case use the power supplies which we have provided or which are technically identical with your MWS 9-5 weather station. Nominal value must be between 10 V and 24 V DC voltage; it must be possible to apply at least 100 mA (with optional heating element another 15 or 24 V DC 1.5 A). Please note also that all the power supplies we provide are only made for use in dry rooms.

The (optional) GPS-receiver is connected next to the 8-way POWER / Data-connector.

The other two sockets are free for additional sensors and for an (optional) heating. The additional sensors can be voltage supplied by the weather station or they can have their own supply. Output voltage of the additional sensors must not exceed +4V; with sensors with pulse output, a TTL-signal is required which may have frequencies from 0..40 kHz (Please contact us if you need other measuring ranges). (Also see "Additional-Sensor").

When you have set up the hardware, you install the software and start the unit.



IMPORTANT !

When removing any additional cables from the weather station, please don't forget to protect the socket with the cap and don't leave the socket open. Otherways the contacts of the socket will start corroding and be damaged within a short period of time!

Also don't forget to protect the plug of the cable from moisture by covering it when removing the weather station for calibration i.e. In this case also remove the wall adaptor of the power supply to ensure that no voltage is applied to the contacts of the weather station's plug when it is not used! Otherways the plug will start corroding due to moisture and the cable has to be replaced within a short period of time.

2.1.2 Overvoltage protection

The MWS 9-5 contains an integrated overvoltage protection (Suppressordiodes) at it's supply- and data wires.

The power line is protected by a SMCJ26CA-diode. This diode breaks through at voltages above 31VDC and is able to carry up to 1500W for a few milli seconds.



CAUTION: If you connect voltages above 30VDC permanently to the power jack, this diode will be destroyed within a few seconds!

The data lines are protected by SMBJ15CA-diodes able to carry transients up to 600W.

Also the housing made of high quality steel is connected to system ground.

This protection is suitable for protecting the station from damage due to overvoltage at close lightning strikes.

For protection of the connected peripherals (computer, camera, i.e.) the customer has to take further precautions (line protection, opto couplers, i.e.).



But please note that this protection is ineffective in case of direct lightning strike due to extremely high energy of lightning!

Currents of up to 200.000A can cause voltages up to 20.000V on the housing which leads to flashovers onto the internal electronic components and it's destruction.

2.2 Software Installation

Insert the WeatherCD into your CD-drive.

You need an HTML-capable browser (Netscape, Internet-Explorer or else).

If Autostart is activated, the CD starts on its own, if not, you execute START.HTM in the CD root directory. (If you want to install the software packages directly, you will find the paths for the single installations in the install.html file.)

Now you follow the instructions of the WeatherCD.

NOTE

The software installations of the 16bit-versions neither change the registry nor any INI-files of your WINDOWS-system. The 32-bit versions create the HKEY_CURRENT_USER\Software\Reinhardt GmbH\Wetter\... key in the registry which is only created when running and is not deleted when the software is de-installed.

Please note the instructions given on the CD for mounting the MWS 9-5.

Then the weather station can be used 20 seconds after it is plugged in.

2.3 Start the Software

Start the software by double-clicking on the program icon (with the DOS-version, you enter "START").

Select the interface (COM1..COM4), everything else should be left at default-settings. Then the weather software starts.

An error message should appear on screen which tells you that the time of the MWS 9-5-clock is not correct. After every start, the software checks the clock of MWS 9-5 and compares it to your computer clock. If they differ more than 10 minutes, the programs asks if the MWS 9-5-clock is to be set. Needless to say, the clock of the connected PC must give the correct time, as MWS 9-5 is set to the PC-clock.

Choose „YES“ for setting the clock of MWS 9-5.

Since software version 3.11b the clock is automatically set by the software at starting up!

If your MWS 9-5 holds a GPS-receiver, it provides MWS 9-5 with the correct time, the coordinates and the number of available satellites.

The software should run for at least one memory interval so that at least one data file is stored on the hard disk. This is important for reading out the datalogger later. (If there is no data file on the hard disk, the datalogger cannot be read out as the software does not find a start date.)

If the software is not started, there might be a faulty data file on the hard disk or not enough free memory. This causes an abort.

If the software finds a faulty data file, there is an error message. Abort with „j“ then and delete the faulty file. Please avoid editing the data files of MWS9-5 (extension .MWS). Many editors cannot handle files of this size. Even a little change of these files can result in that the data can no longer be interpreted!

(For more details on the software components see the manuals for the respective software).

The manual for the latest software you'll find [here](#).

3 Technical details

The standard datalogger of MWS 9-5 can store data of about 26 days, 6 hours and 5 minutes (7561 data records). These specifications refer to a memory interval of 5 minutes and the 13 sensors set by default. Shorter memory intervals and more sensors reduce the period of time which is covered with the datalogger, larger intervals and less sensors extend it.

The small Excel-file `\Software\MWS 5M - Speicherkapazität\Speicher MWS 5M.xls` on the WeatherCD helps you to find out the exact memory which is required.



Please note that no data are written into the logger while reading data from it!

3.1 In Case of Power Failure

The datalogger of MWS 9-5 is made up of EEPROMS which preserve the data even after a power failure. In case of power failure, MWS 9-5 keeps on running as usual for up to 2 hours and storing data in its datalogger because of the in-built backup batteries (3x NiMH). If additional sensors are connected, they reduce this run time because more power is required. A connected GPS-receiver and the heating do not run on if the power supply fails. For an operation in case of power failure it is necessary that the POWER / Data connector of MWS 9-5 remains plugged-in.

NOTE



If the power failure takes too long and the backup batteries are discharged, MWS 9-5 loses the time and data are only stored into the datalogger, after the clock is reset when power has returned or if a GPS-receiver sets the clock automatically.

If you unplug the MWS 9-5 power connector, the clock is deleted.

When power returns, the internal backup batteries are recharged within a few hours.

NOTE

It the MWS 9-5 power connector is unplugged, the microprocessor interpretes this as an irregular abortion!!

MWS 9-5 then loses the time and only stores data into the datalogger after the clock is reset.

If the Power Supply is unplugged and the POWER / Data connector is plugged-in, MWS 9-5 behaves as if there were a power failure and, because of the backup batteries, keeps on running as usual for up to 2 hours. It is therefore possible to e.g. move or transport MWS 9-5 without losing data or without interrupting the recording, if this takes only a short time.

Missing data are indicated by measure values of -99999 in the datafile. The software then recognizes in the values of -99999 that data are missing and creates a gap in the graphical displays.

You may also set MWS 9-5 in such a way that it writes into the datalogger in the set memory interval as soon as operating voltage is applied. Then the datalogger contains data with the wrong time and cannot be read out by the delivered software. You will need your own application then !

3.2 Maintenance

Because of its elaborated sensors, MWS 9-5 almost needs no maintenance. The dripping hole of the rain collector may be clogged by insects, leaves etc. In this case, the display of rain remains unchanged even if it is raining. You just have to carefully clean the rain collector.

The display of rain may also stop if the the rain bucket is stuck by insects below the funnel. Loosen the three clamps fixing the funnel on the station and **carefully** remove the funnel. Remove spider webs etc. from the rain bucket then. Check the mobility of the bucket and then re-fix the funnel with the three clamps.

Also the windsensors may get jammed by insects or dirt.

So please mount the weather station easy to access in need of maintenance!

In any case do not open the housing. Otherwise, delicate components inside the weather station might be destroyed.

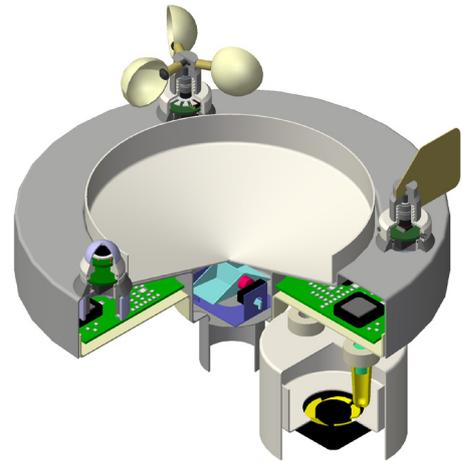


NOTE

Our warranty ends if there is any intervention into hardware or software from your side.

3.3 The sensors

MWS 9-5 weather station has been developed for stationary use under normal climatic conditions (temperate zone). Use under extreme conditions such as e.g. on board of a ship, mobile use on a measuring vehicle etc. has not been tested. It is therefore not recommended to set up the MWS 9-5 weather station where it is exposed to salt or salt water (e.g. directly at the coast etc.).



3.3.1 Temperature Sensor

Temperature measurement is based on a PT100.

The resulting measured value is further linearised by the software. By standard, the temperature sensor is mounted on the lower side of the weather station and is ventilated so that it reacts very fast to temperature changes and avoids a buildup of heat. Unit [°C]

Range: from -40 °C to + 50 °C, measuring accuracy ± 0.3 °C, (display also possible in °Fahrenheit or Kelvin)

CAUTION: Compared to temperature measurements in big shielded cabins the values can be higher when the sun is shining. If the temperature measurements must correlate with the measurements in big shielded cabins you should measure temperature with an additional temperature sensor placed in the shadow or in a big shielded cabin!

3.3.2 Humidity Sensor

is a fast responding capacitive sensor (monolithic) which is based on a dielectric with variable humidity (capacitance). In proportion to humidity the electronics create a signal with changing frequency which is evaluated by the microprocessor. The sensor is also mounted on the lower side of the weather station. There is a protective cover of Gore-Tex above the sensor so that it does not become polluted or destroyed by dust or insects.

Our humidity sensor can be used in a temperature range between -40 °C to + 50 °C. It is linearized to an accuracy of 2 %. The humidity sensor is fully immersible. Unit [%]

Range: from 10 to 100 %, accuracy ± 2 %, display also as dewpoint measurement in °C or °F.

NOTE

This sensor is very responsive to static charge and air pollution (dust, aggressive gases, but also salt). Please note that under unfavourable conditions (i.e. microbic stress caused by moulds, bacteria) this sensor ages faster than under normal conditions.

The producer of this sensor specifies a typical drift of +1.5%RF..2%RF per annum under normal conditions. It should therefore be calibrated or checked every 2 years.

3.3.2 Pressure Sensor

is a monolithic, laser-trimmed sensor for absolute pressure which is linearized to 5 hPa for the whole temperature range, i.e., the barometer is temperature compensated. Another temperature linearisation reduces the deviation to less than 2 hPa over the whole temperature range. The measuring signal is elaborated by an instrumental amplifier. The sensor can be used in the temperature range of -40 °C to + 60 °C.

Measuring range: from 600 hPa to 1100 hPa with ± 0.8 hPa accuracy; display can be reduced to 0 m above sea level (input of the local altitude in [m], display also in mm mercury column or Inch mercury column).

This sensor can be used at altitudes from 50m below zero up to altitudes of 3000m. Other altitudes are possible on request.

This sensor can be transported by air cargo!

The formula for reduction of pressure to 0m sea level used in this sensor is:

Barometer = absolute pressure * ((temperature [K] + 0.0065 * altitude) / temperature [K])⁵ * SQRT (SQRT ((temperature [K] + 0.0065 * altitude) / temperature [K])

If you want to use different formulas for reduction of pressure to sea level you may add a desired formula into the Reinhardt weather software to perform.

Unit [hPa]

3.3.4 Solar Sensor

This is a pyranometer which absorbs radiation between 305 and 2800 nm. The temperature of a black and a reflecting element is subtracted and linearised by the software. The measuring sensors are two semi-conductor sensors.

The values are edited in W/m².

The measured value reaches 90 % of its final value after about 90 seconds.

Unit [W/m²]

Range: from 0 to 1300 W/m² with ±40 W/m² accuracy.

3.3.5 Wind Speed Sensor

is an anemometer with magnetic scanning. Wind speed is measured contactless using a Hall sensor (V1.2 and later) or a Reed-contact. A peak detector holds every gust and hands it on to the measuring software. An average value for the respective memory interval is determined.

Range: in km/h from 0 to 200 km/h with ± 2.5 km/h measuring accuracy, (display also in m/s, miles/h, Knot or Beaufort), breakaway speed lower than 0.8 m/s.

As we have a very comfortable, 3-fold way of measuring wind speed with current wind speed (WG), average wind speed (WD) and gust (WS), you can adapt your wind measurement to your very needs. Please note that dependent on the current winds, the 3 different methods of measuring wind speed can result in very differing graphs: When measuring WG, only a current value is written in the selected measuring interval, when measuring WD and WS, there is continuous evaluation and the whole measuring period is monitored. Unit [km/h]

3.3.6 Wind Direction Sensor

Versions up to 1.1:

There is a weather vane with an endless precision potentiometer of 10 kOhms and a rotation angle of 360 ° for measuring wind direction. Wind direction is given in °, with 90° being East, 180° being South, 270° being West and 0 ° being North.

Range: in 360 °, measuring accuracy 5 °, breakaway speed < 0.8 m/s, hysteresis < 8°.

Please note, that in North direction (changing from 360° to 0°) wrong values may occur! This is caused by switching from maximum to minimum value of winddirection. To get highly accurate winddirection measurement, you should use the sensor with the identifier WV (main winddirection). This sensor is averaged over a storage interval so that these rare faulty values don't lead to wrong measurement.

Output is performed as WR (current winddirection) and WV (main wind direction within a storage interval). The value WR always has got a value between 0 and 359.9°. WV only has got values between 0 and 359.9° if WG > 0. If WG = 0, WV has got a value of -99997, which means, that no valid value for the main winddirection is available. This is clear for when windspeed = 0 no main winddirection can be calculated. Unit [°]

With Version 1.2 the potentiometer was replaced by a precision magnetical encoder without dead angle in the north direction. (since 2009)

3.3.7 Rain / Precipitation Sensor

A self-emptying bucket is tilted by the collected rain. All the water that has been collected on the normed area of 200 cm² is led through a funnel to the bucket. The bucket tilts whenever a certain quantity of water has been collected. The tilting creates pulses which are counted. Out of the pulses, the software calculates the rain that has fallen per m² since the last reset (RE). The current intensity of rain (RD) is also found and displayed. This value is set to 0 each time after storing into the datalogger. Unit [mm] / [l/m²]

Range: from 0 to 5000 ltr/m²,
measuring accuracy ± 0.2 ltr/m²

CAUTION: High windspeeds can cause a display of rainvalues also when it is not raining! This is caused by swirls penetrating into the plugholes of the rainsensor and tipping over the bucket. Another reason for unexplainably rain values can be a vibration of the mast caused by storm, which leads to tipping over of the bucket too.

3.3.8 UV-Sensor (Option)

measures ultraviolet radiation in the range of 320-395 nm. Maximum sensitivity is about 330nm (UV-A).

3.3.9 Light Intensity Sensor (Lux-Sensor) (Option)

measures light intensity in Lux. Measuring range is from 370nm..680nm.

3.3.10 Additional Sensor

Sensors of any kind can be integrated as additional sensors. The information signal must be applied as voltage in the range between 0 V and + 4.095 V or it has to be adapted to MWS 9-5. Negative or higher voltages must be avoided in any case.

The sensor signal is then linearized by software.

As an option the additional inputs can also deal with frequencies with TTL-level in the range from 0...40kHz. In case of need please contact us for further information.

We offer an additional sensor for measuring soil or water temperature.

Pin 8 of the connector for additional sensor leads the output voltage of the PSU which supplies the weather station and can power the additional sensor. Unit [mV]

NOTE

If current consumption of the additional sensors plus current consumption of the weather station exceeding the maximum current of the PSU, we cannot grant that MWS 9-5 weather station works properly !!!

If they need higher currents, the sensors must have an external power supply and its ground has to be connected to the MWS 9-5-ground (Pin 1 of the connector socket). You can call for adjustment instructions of the additional inputs at any time.

3.4 Accuracy Sensors

Temperature:	$\pm 0,3 \text{ }^{\circ}\text{C}$
Humidity:	$\pm 2.0 \%$ (at $10^{\circ}\text{C}..35^{\circ}\text{C}$)
Solar energy:	$\pm 40 \text{ W/m}^2$
Pressure:	$\pm 0.8 \text{ hPa}$ (at $0^{\circ}\text{C}..50^{\circ}\text{C}$), otherwise $\pm 2 \text{ hPa}$
Rain/precipitation:	$\pm 0.2 \text{ mm}$
Wind direction:	$\pm 5^{\circ}$ (at $5^{\circ}\text{C}..50^{\circ}\text{C}$), Hysteresis $< 8^{\circ}$
Breakaway speed:	ca. 0.8 m/s (at $5^{\circ}\text{C}..50^{\circ}\text{C}$)
Wind speed:	$\pm 2.5 \text{ km/h}$ (at $5^{\circ}\text{C}..50^{\circ}\text{C}$)
Breakaway speed:	$< 0.8 \text{ m/s}$ (at $5^{\circ}\text{C}..50^{\circ}\text{C}$)
UV-sensor	$\pm 10\%$ of final value
Light sensor:	$\pm 8\%$ of final value
Additional sensor:	$\pm 1 \%$ of final value (at $0^{\circ}\text{C}..50^{\circ}\text{C}$)

3.4.1 Measuring Ranges

Temperature:	from -40° to $+50^{\circ}$, 0.1° resolution
Relative humidity:	from 10 to 100 %, 0.1% resolution
Dewpoint:	from -40° to $+50^{\circ}$, 0.1° resolution (calculated from temperature and humidity)
Barometric pressure:	from 950 hPa to 1050 hPa in 0.1 hPa resolution
Absolute pressure :	from 600 hPa to 1100hPa in 0.1 hPa resolution
Solar energy:	from 0 to 1300 W/m^2 with 1 W/m^2 resolution (Spectral range 305..2800nm)
Precipitation:	from 0 to 5000 mm with 0.1 mm resolution
Wind direction:	0 to $359,9^{\circ}$, resolution 0.1°
Wind speed:	in km/h from 0 to 200 km/h with 0.1 km/h resolution
Additional inputs:	0- 4.095 V analog or $0..40 \text{ kHz}$ digital
UV :	from 0 to 50000 mW/m^2 (Spectral range 320..395nm)
Light intensity:	from 0 to 150000 Lux (Spectral range 370..680nm)

3.5 Adjustment of Additional Sensors

You will find the adjustment value pairs of your weather station in the MWS9_M.XXX, with XXX a three-digit number.

Additional sensor A has got identification ZA, additional sensor B identification ZB. The pairs of values of ZA start with !L5, those of ZB with !L7 and those of ZC with !L9.

By default we have adjusted the additional inputs ZA and ZB in mV and ZC in kHz.

Now you connect the additional sensor to the resp. socket.

Start a terminal-programm (e.g. Windows-Terminal) and configure as follows: 9600 Baud, 8bit, no parity, 1 Stopbit.

Under Windows-terminal, menu "Settings" - "Terminal-Settings" you turn on CR->CR/LF when transmitting (This creates a #13#10 by pressing the Enter-key.).

You now change into the adjustment mode of the weather station. All sensors will be output with your raw values.

Here you can find out which raw value is created by your additional sensor at a respective analog value. Expose a temperature sensor to 0°C, wait until the sensor has adapted to this temperature and then you see the respective voltage of the sensor. You proceed with e.g. 25°C etc.

Note these pairs of values and replace the respective lines in the adjustment file. It is most important that the first pair of values (e.g. !L5,1,F...) must contain the lowest raw value and the last pair of values must contain the highest raw value.

At least 3 pairs of values must be determined per sensor (e.g. !L5,1F,... to L5,3,W..).

All pairs of values which are not needed must contain raw value 65535!!

After you have determined the necessary adjustment values and entered them in the adjustment file, you can transmit the changed file to MWS 9-5 as follows:

Start program WS_CFG.EXE, set the interface parameters and select the name of your adjustment file. Now the new adjustment data are transmitted.

Do never change the pairs of values of the other sensors as this would lead to wrong measurements of your weather station.

You will find the necessary parameters for controlling the weather station via Terminal-Program in the technical appendix under Control Parameters.

3.6 Power Supply

8-28 VDC, ca. 150 mA, standard equipment

A voltage supply is also possible with voltages from 4.0..8.0 VDC.

CAUTION: The internal backup batteries are not charged in this case!!

Dimensions

Size: Outer diameter 260 mm, height 240 mm
Weight: ca. 1.5 kg

The housing must be mounted centrally on a 1" pipe. Standard cabling is 10 m - longer cabling on request.

3.7 Data Format

The data format of the transmitted data looks like this:

15:24:32, 15.09.03, TE22.09, SO233.32, DR952.25, WR78.91, FE35.58, RE2.01, WG0.00, WS4.11, WD494.29, WC22.09, WV80.79,

Every 2 seconds, MWS 9-5 transmits a data record which starts with time and date. Separated by comma, the single measured values with sensor identification come in the following order:

Temperature (TE), solar energy (SO), barometer (DR), wind direction (WR), humidity (FE), rain/precipitation (RE), wind speed (WG), gust (WS), wind average value (WD), windchill (WC), prevalent wind direction (WV).

The datastring ends with <CR><LF>, since firmware 2.16 each datastring which is written in the internal logger includes an additional ASCII #31 in front of <CR><LF> for data-synchronisation with the software.

The order of the sensors may be changed by changing the positions of the sensors in the datastring (!Kxx), see appendix.

By default, the data are transmitted with 9600BAUD, 8bit, no parity and 1 stopbit.

(For evaluation with your own software, you can set several output modi - see appendix).

On harddisk, a data file is created every month with a format which is similar to that of the transmitted data. The data files receive the extension .MWS

Example :

The filename of the November file 2005 is 11_05.MWS (16bit software versions) and 11_2005.MWS (32bit software versions).

In case of missing data (cause by power fail, etc.) the software writes data with measuring values of -99999 to ensure integrity of the time axis. The software construes these values (-99999) as missing data and creates measurement gaps in the graphical displays.

NOTE

The 32bit versions can read the 16bit-files, but not vice versa!!

3.8 System requirements

3.8.1 System requirements (16bit-Versions)

The MWS 9-5-software needs a computer with at least 486 processor and 4MB RAM (2MB of which must be free (XMS)).

Runs with WIN3x.

You need a free COM-Port (COM1 or COM2, with Windows-versions COM3 or COM4 as well).

If you use COM3 or COM4, please note that it is only possible to switch interrupts for COM3 and COM4 with special interface boards! If you do not have such a board, there will be problems if you use devices at the same time on COM2 and COM4 or COM1 and COM3, because the interfaces use the same interrupts by default.

COM3 and COM4 are only available with the WINDOWS-version!

We recommend a mouse (MS-compatible).

If you use a computer without serial port a RS232 to USB converter, TCP/IP Converter or WLAN modules are available to connect your weather station.

3.8.2 System requirements (32bit-Versions)

At least a computer mit Pentium1 / 200 processor and 32MB RAM.

Runs with WIN98 SE and later.

3.8.3 System Requirements for DOS-Versions

- MS-DOS Vers. 4.0 and later
- HIMEM.SYS Driver in CONFIG.SYS
- FILES = 30 Entry in CONFIG.SYS (at least 30)
- if possible, noEMM386.EXE; if absolutely necessary with extension call RAM (DEVICE = EMM386.EXE RAM in CONFIG.SYS)
- Minimum 1.6MB free XMS-memory

3.8.3.1 SMARTDRIVE

If you have installed SMARTDRIVE, you must limit its memory demand by changing the respective line in AUTOEXEC.BAT:

```
C:\DOS\SMARTDRV.EXE /X... change into  
C:\DOS\SMARTDRV.EXE 1500 /X...
```

Limitation to 1500kB is recommended with 4MB main memory; if there are 8MB and more, a limitation to 4 MB will be sufficient.

If the memory for SMARTDRV is not limited MWS 9-5-software may abort under certain circumstances with the error message RAM full and the computer may crash.

4 Connections and pin assignments

4.1 Cables

4.1.1 Power / Data Cable

Allocation of the Connection Cable for MWS 9-5 (**for version 1.4 and later**).

<u>8 way connector (MWS 9-5-connection)</u>	←————→	<u>9-way interface connector</u>
Pin 1 (GND)		Pin 5 (GND)
Pin 2 (GND), connects to GND when plug is inserted (for batterie buffer)		
Pin 3 (RXD-MWS9-5)		Pin 3 (TXD-PC)
Pin 4 (TXD-MWS9-5)		Pin 2 (RXD-PC)
Pin 5 (VCC 18VDC)		
Pin 6		
Pin 7		

Connect Pin 1 and 2

Connect Pin 4 and 6

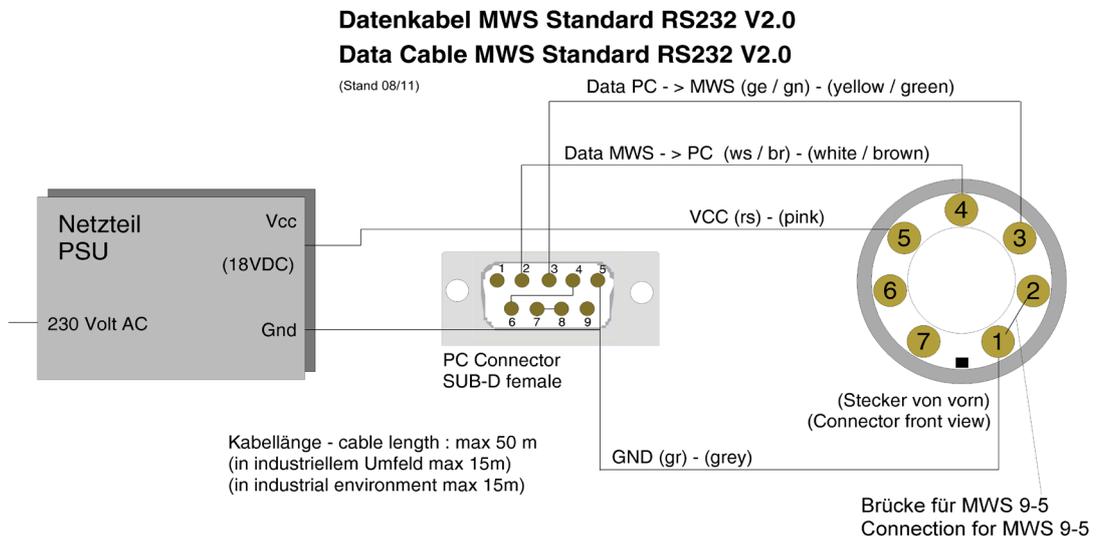
Connect Pin 7 and 8

The data cable can be lengthened to up to 50 m under optimum conditions and with suited cable (not in industrial environment!!)

In case you lengthen the data cable, please take care that the bridges in the connector at the computer must be wired.

(Connect Pin 4 to Pin6 and Pin7 to Pin8).

4.1.1.1 Connection Diagram Standard Data Cable



4.1.2 Allocation of the Connection Cable for MWS9-5 Heating Device

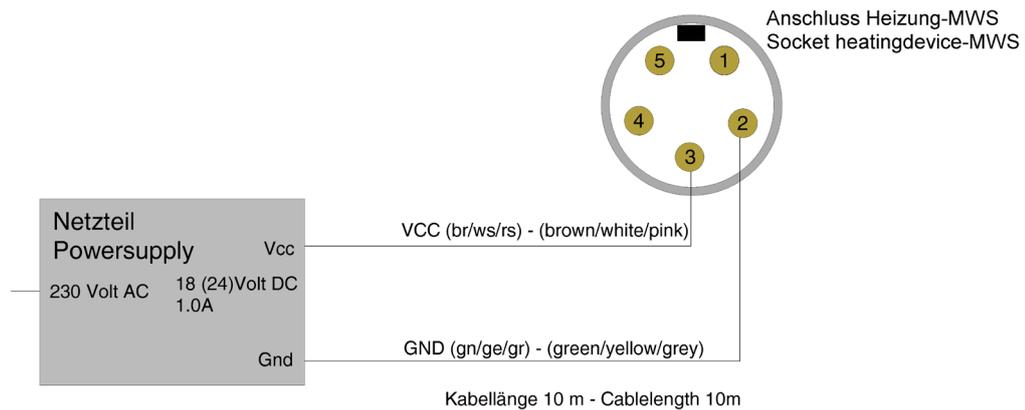
5 way connector (MWS 9-5-connection)	Power Supply for Heating Element (24V / 1A)
Pin 1	
Pin 2 (GND Heating)	←—————→ GND
Pin 3 (VCC Heating)	←—————→ VCC
Pin 4	
Pin 5	

The cable (10m) must not be lengthened as it may happen that there is not enough power for the heating device when it device is working.

4.1.2.1 Connection Diagram Cable with Heating Device

MWS Anschlusskabel für Heizung - Connectioncable for Heatingdevice

(alle Ansichten auf die Lötseite - all views onto solder side)



4.1.3 Allocation of the Connection Cable for MWS9-5 with RS422 / 485 Interface:

8-way connector (MWS9-5-connection)	Output RS422 (free wire endings)
Pin 1 (GND) ←————→	and Power Supply (power supply unit)
Pin 2 (GND) ←————→	to GND power supply unit (grey wire)
Pin 3 (R+-MWS9-5) ←————→	connect to Pin1
Pin 4 (T+-MWS9-5) ←————→	yellow wire (T+ PC)
Pin 5 (VCC 18VDC) ←————→	white wire (R+ PC)
Pin 6 (R--MWS9-5) ←————→	(to Power supply unit VCC - pink wire)
Pin 7 (T--MWS9-5) ←————→	green wire (T- PC)
Pin 8 free	brown wire (R- PC)

connect Pin 1 and 2 !

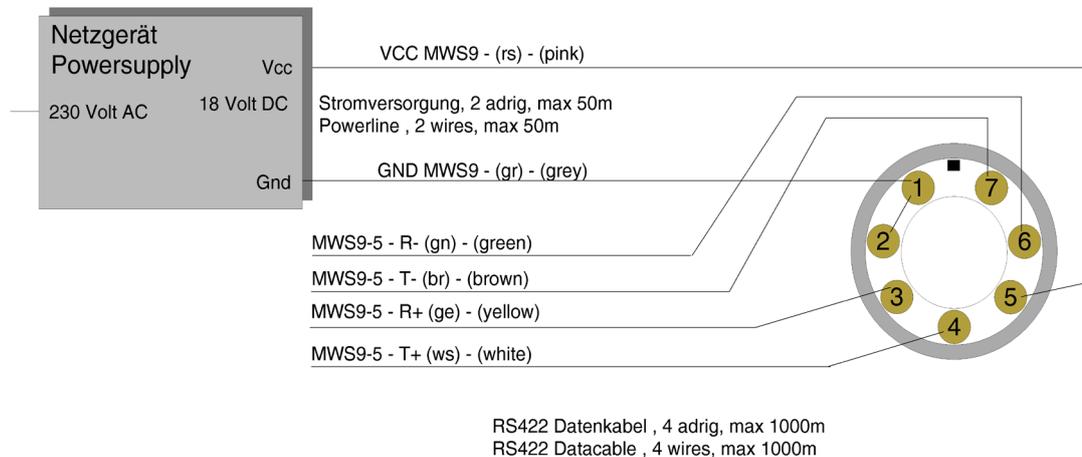
The data cable can be lengthened to up to 1,000 m, the cable of the power supply to up to 50m.

4.1.3.1 Connection Diagram MWS 9-5 with RS422 / 485 Interface

MWS Datenkabel RS422 - MWS Datacable RS422

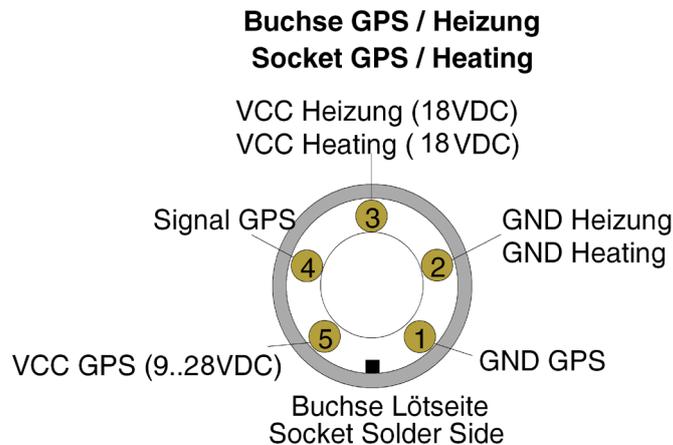
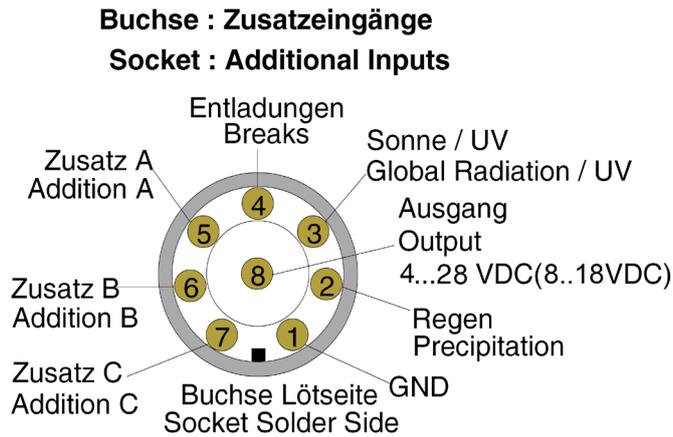
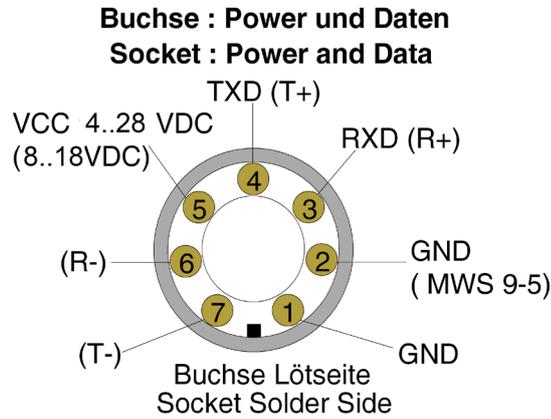
(Stand 08/11)

(alle Ansichten auf die Lötseite - all views onto solder side)



4.2 Pin assignments

4.2.1 Allocation of the Remaining MWS 9-5 Connections



5 Excerpts from the Directions of DWD for Automatic Weather Stations

....

2.2 Regulations for Installation

2.2.1 Demands on Location

When you choose a place for the weather station, there must be no impediments, its horizon must be free. Soil and plants must be representative for its surroundings.

For measuring wind it is compulsory that there are no obstacles. Measuring the duration of sunshine especially is based on a free horizon.

When transmitting stations such as directional radio or installations for air traffic control are near, there must be additional shielding.

...

All preventive measures will prove useless if radio medium frequency transmitters are around.

2.2.2 Measuring field

The measuring field ought to be 10 x 10m, but at least 6 x 6m...

3. Sensors

3.1 Measuring air temperature 200cm

By standard, air temperature is measured 2m above ground...

In order to keep radiation errors as low as possible, air temperature ought to be measured in a weather hut...

3.4 Measuring relative air humidity 200cm

By standard, relative air humidity is measured 2m above ground...

3.5 Measuring precipitation 100cm

...

The collecting area is 200cm². The Hornersche Wippe (see-saw) tilts when it is filled with 2cm², i.e. 0.1 mm precipitation.

3.7 Measuring windspeed

A cup anemometer is used for measuring wind speed. Its rotational speed is proportional to the horizontal wind speed.

3.8 Measuring wind direction

A wind vane with a perpendicular rotary shaft is used for measuring wind direction. Its orientation in the wind results from the pressure difference on both sides of the vane.

By standard wind direction and wind speed is measured 10m above ground.

6 Trouble Shooting

If the weather station is placed and mounted as described, there should be no problems in recording data.

When having problems with data transmission, you may decrease the Baud-rate or shorten the cable. You should use low capacitive cable when using cable length over 15m (RS232).

Using the weatherstation in industrial environment can cause big problems in data transmission or even storing in the logger, when disturbance scatters into the cable. In this case you should use shielded cable or use RS422 Interface.

If the sensor has got any kind of malfunction (i.e. no windvalues, no rain measurement,...), you've got the possibility to reset the Sensor without plugging off the cable. The command for resetting the Sensor is !*. The Sensor then stops triggering the watchdog and a complete reset is performed after 1.6 seconds. The Sensor now will startup in the same way like the cable is plugged in the first time. For this the clock needs to be set again!

If there are unexplainably rain values like described in the description of the precipitation sensor above, you should mount a shield against wind swirls at the bottom of the weather station to avoid unintentional tipping over of the bucket. Also take care that the mast cannot vibrate when it is stormy!

(Further hints on the weather CD under FAQs.)

6.1 Fault Protocol File (16 bit versions)

Important in case of fault

Whenever you restart the software, all versions of the weather software later than V1.06 create a protocol file of the data transmissions between PC and weather station. With DOS-versions this file is called DIAGNOSE.LOG, with WINDOWS-versions DIAG_WS.LOG.

This file can help you, so do save it **in any case**, as it is overwritten whenever you restart the software.

Please see the files .DOC or .DOK too. You will find important new information on the MWS 9-5-software which is not yet in this manual.

6.2 Protocol-files (32 bit versions)

6.2.1 Log-file in case of error (ErrLog.txt)

Softwareversions for sensors without logger same or newer than V2.26 write a log-file (**ErrLog.txt**) in case of errors (dataerrors or transmission problems), in which the timepoint and kind of the error is stored. Older versions displayed an error-message like **!p** or **data error**, which was displayed permanently until the user clicked it away. This caused the problem that no further data were written for the time the message was visible although the error did not exist any longer. In version same or newer V2.26 also an error message appears, but this message is deleted automatically when the error is removed. In this case an entry is written into the log-file.

6.2.2 Logfile when starting up (log.dat)

When the software for weatherstations and sensors with logger is started, the communications between the computer and the weatherstation is stored in a log-file (**log.dat**). With this file you may get important hints in case of problems.

Caution! This log-file is overwritten each time, when the software is restarted. To keep this file, store it in another place or rename it.

6.3 RS422/RS485 port

Using RS422/RS485 needs special treatment:

After applying power to the weather station or after power fail the TX-wire of the weather station is disabled (set to TRI-state) due to safety reasons, this means that the weather station sends NO data.

To enable the weather station, you need to transmit a ? (ASCII 63) to the weather station. Only then the weather station begins to send data.

When using the enclosed REINHARDT software this will be performed automatically!

Otherways you may use the tool ENA422.EXE which allows to send a string to the weather station over the COM-port.

To do this, at first the COM-port settings need to be set with the tool „MWS5MSET.EXE“, for writing the INI-file „WS_CFG.INI“ for the COM-port.

Then you can send the required ? to the weather station with „ENA422 P-?“ .

CAUTION:

Firmware versions from 2.17 or later activate the COM-port immediately!

Thus with RS422 data will be sent without enabling of the COM-port.

With RS485 the port also is active immediately after power is applied, but of course no data will be visible on the data lines for with RS485 data are only sent on request.

Initialisation of the weather station and memory check are performed as well, like with all other COM-port configurations, but you won't see any data on the COM-port for the output is TRI-state!

While initialisation, which will need up to 2 minutes, the weather station will not accept any command!

To send a command to a weather station with RS485, you always must insert the device address of the weather station between the ! or the ? and the command, otherways the weather station won't accept the command! Default address of weatherstations with RS485 is 1.

The command for reading the latest datastring is ?1U (opposite to ?U with all other COM-port configurations)!

7 Options

7.1 Available displays

7.1.1 Meteograph

Precision analog display with high grade stepping motors.

For indoor use only.

7.1.2 DKA1

LED mini display for alternating of up to 9 values. 13 mm digit size.

For indoor use only.

7.1.3 DMMK

Small digital meteo display for displaying 10 parameters simultaneously with digit size 13 mm.
Available for wall mounting or placing on a table.

For indoor use only.

8 Technical appendix

8.1 Control Parameters for calibrating an additional sensor

PLEASE NOTE:

<#13> stands for ASCII-character 13, i.e. CARRIAGE RETURN.

The command can also be closed with <#13><#10> (<CARRIAGE RETURN> - <LINE FEED>, i.e. <CR><LF>).

Changing from measured value output and adjustment mode (voltage output):

!' 'W' <#13>

Transmitting the linearisation data:

!' 'L' <SENSORNUMBER> ';' <INDEX : 1..6> ';' 'F'
<VOLTAGE(mV)> <#13>

!' 'L' <SENSORNUMBER> ';' <INDEX : 1..6> ';' 'W'
<ANALOGVALUE> <#13>

E.g.: You measure 3054 V at 24.5 °C for additional sensor A in the 3rd position of your adjustment table, it will look like this :

!L5,3,F3054 <#13>

!L5,3,W24.5 <#13>

8.2 Controlling the Microprocessor

8.2.1 Input parameters of the MWS9-5-microprocessor

Reset (Versions same or newer than 2.28):

!' '*' <#13>

Changing the BAUD-Rate:

!' 'B' <X> <#13> ; 0 < X < 8 :

BAUD-Rate for X = 0 : 300
1 : 600
2 : 1200
3 : 2400
4 : 4800
5 : 9600 (Default)
6 : 19200
7 : 38400
8 : 76800

NOTE:

After voltage is applied, the sensor ALWAYS is set to 9600 BAUD. If the Baud-rate has been changed by mistake, you can set the sensor to its correct baud-rate during the RAM-test (.....) .

Continue the output after an interruption

!' 'C' <#13>

Input-flags for control (e.g. immediate store), !Fx, 0 <= x <= 255

- Bit 7 - DEBUG_OUTPUT (In reading out RAM, it also edits @ -
Note : Not in the Page mode)
- Bit 6 - Output of device address (DA) with <CR><LF> in front of every data record
- Bit 5 - Resets the lightning-input once every day (Version 2.24 and later)
- Bit 4 - Connection of serial Reinhardt-sensors to the GPS-input (Version 2.24 and later)
This sensor must send a "&" in front of the dataset
If this sensor contains clock and date, the second character of clock must be a "%"
Clock and date must be send in this order with no other sensors in between.
The first 5 values of these sensors are taken over into the internal sensors
20-24(GPS...) up to max. 61 characters overall length. CAUTION!
For storing the settings the sensor has to be restarted with the command !* (reset).
The GPS_ONLINE-bit is not set before restart to control the switching of the
'GPS-Sensor'
- Bit 3 - ALTERNATIVE SENSORS (Version 2.13 and later)
(outputs alternative sensors (valuePort A and GPS-satellites) instead of the Standard-
sensors in position 31 (PW-FAIL WD) and 32 (PW-Fail)
(29) LEAF MOISTURE -> ERROR_FLAGS:***
- Output of the error-register (=ER at !?)
(30) PW_FAIL_WD -> DIG_INPUT:
- Digital value of Port A
(31) PW_FAIL -> GPS_SAT:
- Number of detected GPS-satellites
- Bit 2 - De-activates internal GPS-determination of local altitude
- Bit 1 - Does not take local altitude from the GPS-receiver
- Bit 0 - Immediate Store - Stores immediately after plugging in inspite of incorrect time

Example :

- !' F0' <#13> ; Writes into the datalogger only after the clock is set
' F1' <#13> ; Writes into the datalogger at once (incorrect time)
' F10' <#13> ; Does not take local altitude from the GPS and outputs alternative sensors

Changing from measured value output and adjustment mode (output of frequency):

"! 'W' <#13>

Fading in/out single sensors (All available sensors are listed on a following page.)

"! 'KX,A0' <#13> ; Sensor with output number X is not edited

"! 'KX,A1' <#13> ; Sensor output number X is edited

Sensor attenuation for turn sensor on / off

"! 'KX,M0' <#13> ; Sensor with output number X is not attenuated

"! 'KX,M1' <#13> ; Sensor output number X is attenuated

Transmitting linearisation data:

!' 'L' <SENSORNUMBER> ',' <INDEX : 1..6>','
'F' <VOLTAGE(mV)> <#13>

!' 'L' <SENSORNUMBER> ',' <INDEX : 1..6>','
'W' <ANALOGVALUE> <#13>

Setting the general averaging size

!' 'MX' <#13> ; 1 <= X <= 255 ; X = 0 : averaging off

Setting local altitude for correct display of barometric pressure

!' 'O' <LOCALALTITUDE(m)> <#13>

Resetting windpeak and average wind

(only if storage interval is set to 0 (deactivated))

!' 'P' <#13>

Setting the compression quality

!' 'QX' <#13>; 2 <= X <= 255 ;
 X = 0 : highest compression, (1 complete set/ day)
 X = 1 : every record is complete (compression off)
 X = 2 : every 2nd record is complete
 X = 3 : every 3rd record is complete ...

Resetting the rain/precipitation measurement

!' 'R' <X> <#13> X means every hour on the hour for rain reset, if storage interval > 0
 '!' 'R' <#13> Resets rain to 0, if storage interval = 0



Turning on / off the interface (Protocol-Select)

NOTE: These settings are very complicated and sensitive.

In case of wrong operation, the sensor can be obstructed irreparably.

!' 'SX' <#13> Suppresses the data output to the interface
X is the decimal value of the following binary list for the various protocols.

Binary list of the protocol-parameter for X.

X (binary) =

xxxxxx00b : RS232 - MWS 9-5 transmits a data record every 2 sec
 xxxxxx01b : RS422 - MWS 9-5 transmits a data record every 2 sec
 xxxxxx10b : RS485 - MWS 9-5 is addressed and transmits on request
 xxxxxx11b : not available
 xxxxx1xxb : MWS 9-5 transmits on request only (RS232 + RS422)
 xxxx1xxx b : MWS 9-5 transmits when writing on datalogger and on request
 xxx0xxxxb : Output in ASCII-format and German date
 xxx1xxxxb : Output in ASCII-format and American date
 xx1xxxxxb : Output in compressed format

By combination (addition) of single binary values, you can combine the parameters.

Example for MWS9-5 with RS422 transmits on request only :

X for RS422 (binary) = xxxxxx01

X for transmits on request (binary) = xxxxx1xx

adds --> = xxxxx101 --> Decimal = 5 --> !S5<#10>

CAUTION: With RS485 after the ! or ? always the device address must be inserted! Other ways the command won't be accepted! (Standard@ = 1)

Set time and date:

!" 'U' <TIME DATE in format HHMMSSDDMMYY> <#13>

Example: !U092030100501#13 sets the clock to 9 o'clock 20min and 30sec on 10.5.01

If a GSM900-Module is connected with the weather station also the clock of the GSM900-Module will be set with this command!

!" 'u' <ZEIT DATUM im Format HHMMSSDDMMYY> <#13>

If a GSM900-Module is connected with the weather station only the clock of the weather station will be set, the clock of the GSM900-Module will not be changed with this command by using a lower "u"!

Switch fan off:

!" 'X0' <#10>

Since board version 2.61 (April 2010) and Micro-version 2.39 (July 2006)

Switch fan on (default):

!" 'X1' <#10>

Since board version 2.61 (April 2010) and Micro-version 2.39 (July 2006)

Set memory interval for the RAM:

!" 'Z' <INTERVAL in 10 seconds steps> <#13>

or

!" 'ZD' <INTERVAL in 2 seconds steps> <#13>

Example: !Z1#13 stores a data file every 10 seconds
!Z3#13 results in storing a data file every 30 seconds
!ZD5#13 every 10 seconds
!ZD1#13 every 2 seconds
!Z12#13 every 2 minutes ...etc
(Maximum Z249 = 41 minutes 30 seconds)
!Z0#13 no storage

Time zone with GPS-reception (deviation from UTC-time):

!" 'ZZ' <full hours> <#13>

8.2.2 Querying parameters of the Microprocessor

Call the current data file:

'?' 'U' <#13>

Read out stored data from address 00H and following

'?' 'Y' <#13>

Read out stored data at a certain time:

'?' 'D' <TIME DATE in Format HHMMSSDDMMYY> <#13>

CAUTION: All firmware version inclusive 2.39 cancel the search of data in the logger when a full hour is reached. Also sending data out of the logger is cancel at each full hour. This problem is caused by searching a GPS receiver at the GPS input each hour. This problem was solved with firmware version 2.40. Also see the FAQs to the 32bit software on the "WETTER CD"

Call all the stored data:

'?' 'D' '000000000000' <#13>

Interrupt the data output :

<#13>

Continue the data output after the moment of interrupt:

!' 'C' <#13>

Call linearisation data, sensor configuration and system information:

!' '?' <#13>

Since μ P Version 2.39 the command !? can be combined with a sensor-number, i.e.:

!' '?0' <#13>

Only the info about the main configuration will be sent.

!' '?1' <#13>

Only the info about the configuration of the sensors will be sent.

!' '?2' <#13>

Only the info about the sensor 2 (temperature) will be sent.

...and so on.

8.2.3 Order of the MWS5M Sensors

<i>Output - #</i>	<i>Sensor - #</i>	<i>Ident</i>	<i>Sensor</i>	<i>default</i>	<i>unit</i>
1	1	---	Time	on	hh:mm:ss
2	0	---	Date	on	dd.mm.yy
3	2	TE	Temperature	on	[°C]
4	3	SO	Global radiation	on	[W/m ²]
5	4	DR	Pressure	on	[hPa]
6	5	ZA	Addition1	off	[mV]
7	6	SX	Global radiation external	off	[W/m ²]
8	7	ZB	Addition2	off	[mV]
9	8	WR	Wind direction	on	[°]
10	9	ZC	Addition3	off	[mV]
11	10	FE	Humidity	on	[%]
12	11	RE	Rain	on	[mm] / [l/m ²]
13	12	RD	Rain per storage interval	on	[mm] / [l/m ²]
14	13	WG	Wind speed	on	[km/h]
15	14	WS	Wind peak	on	[km/h]
16	15	WD	Average wind	on	[km/h]
17	16	GE	Lightning	off	
18	17	WC	Windchill	on	[°C]
19	18	WV	Prevailing wind direction	on	[°]
20	19	GH	GPS Local altitude	off	[m]
21	20	GX	GPS X-coordinate	off	
22	21	---	GPS X-coordinate	off	
23	22	GY	GPS Y-coordinate	off	
24	23	---	GPS Y-coordinate	off	
25	24	GV	GPS speed	off	
26	25	TK	Internal temperature (0..255)	off	
27	26	TR	Internal reference voltage	off	
28	27	VI	Operating voltage	off	[V]
29	28	UH	Voltage heating control	off	
30	29	BF	Leaf moisture	off	
31	30	PW	PF Watchdog or PortA	off	
32	31	PV	PF voltage reg. or GPS satellites	off	

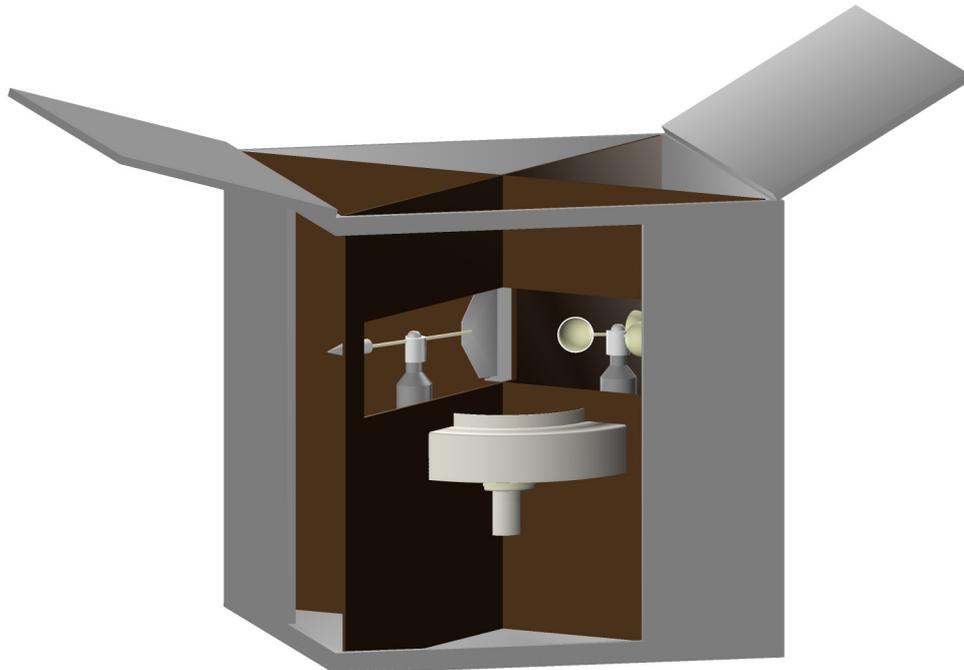
There are other identifiers for additional sensors:

RT : Rain detector
 WU : Clouds base
 WK : Cloud detector
 WT : Temperature sensor of cloud detector
 TD : Internal temperature of pressure sensor
 UV : UV radiation in mW/m²
 LX : Light intensity in lux
 FA : Speed of fan
 BA : Temperature soilsensor 140 at + 30cm
 BB : Temperature soilsensor 140 at + 5cm
 BC : Temperature soilsensor 140 at - 5cm
 BD : Temperature soilsensor 140 at - 50cm
 BE : Temperature soilsensor 140 at - 100cm

9 Packing MWS 9-5 properly

In case you want to ship your MWS 9-5, you must use the original packing. This packing was especially designed for MWS 9-5. It is the best protection against damage or destruction during transport. In this packing it will not even be damaged if it falls from 1 m height onto a stone floor.

Do not fill the packing with polystyrene flakes. They could damage the wind vanes when the package is closed as there might be high pressure.



10 Exchange Connectors

In case you have to replace connectors, please contact:

Fa. Adam, Tel: ++49 (0)8131 - 2808 51

The connectors belong to Series 711.

Below you will find the order numbers:

5way connector (Heating / GPS) : **99-0095-102-05**

7way connector (Voltage supply and data connection) : **99-0475-102-07**

8way connector (additional sensors) : **99-0479-102-08**

Of course, you can order the connectors from REINHARDT.

I&OE / Specifications subject to change without prior notice !

06/23