# P04-KNX-GPS

## Weather Station

Item number 71230


elsner elektronik

## Installation and Adjustment

Installation, inspection, commissioning and troubleshooting of the device must only be carried out by a competent electrician.

This manual is amended periodically and will be brought into line with new software releases. The change status (software version and date) can be found in the contents footer. If you have a device with a later software version, please check **www.elsner-elektronik.de** in the menu area "Service" to find out whether a more up-to-date version of the manual is available.

## Clarification of signs used in this manual

Safety advice.

Safety advice for working on electrical connections, components, etc.

**DANGER!** ... indicates an immediately hazardous situation which will lead to death or severe injuries if it is not avoided.

**WARNING!** ... indicates a potentially hazardous situation which may lead to death or severe injuries if it is not avoided.

**CAUTION!** ... indicates a potentially hazardous situation which may lead to trivial or minor injuries if it is not avoided.


**ATTENTION!** ... indicates a situation which may lead to damage to property if it is not avoided.

ETS In the ETS tables, the parameter default settings are marked by underlining.

# 1. Description

The **Weather Station P04-KNX-GPS** for the KNX building bus system measures temperature, wind speed and brightness. It recognises precipitation and receives the GPS signal for time and location.

The compact housing of the **P04-KNX-GPS** accommodates the sensors, evaluation circuits and bus-coupling electronics.

***Functions:***

- **Brightness measurement**
- **GPS receiver**, outputting the current time and location coordinates
- **Wind measurement**: The wind strength is measured electronically and thus noiselessly and reliably, even during hail, snow and sub-zero temperatures. Even turbulent air and rising winds in the vicinity of the device are recorded
- **Precipitation detection**: The sensor surface is heated, so that only drops and flakes are recognised as precipitation, but not mist or dew. When the rain or snow stops, the sensor is soon dry again and the precipitation warning ends
- **Temperature measurement**

Configuration is made using the KNX software ETS. The **product file** can be downloaded from the Elsner Elektronik website on **www.elsner-elektronik.de** in the "Service" menu.

### 1.0.1. Deliverables

- Sensor
- Connection cable approx. 10 m, with plug and connecting terminals
- Surface-mounted junction box (IP 55, not weatherproof)
- Worm-thread clamp Ø 40-60 mm
- 4×50 mm stainless steel roundhead screws and 6×30 mm dowels for wall mounting. Use fixing materials that are suitable for the base!
- Fix mounting with installation accessories

## 1.1. Technical specification

***Weather Station:***

| | |
|---|---|
| Housing | Plastic |
| Colour | White / Translucent |
| Assembly | Surface mount |
| Protection category | IP 44 |
| Dimensions | approx. 62 × 75 × 155 (W × H × D, mm) |
| Connection cable | 4-wire (bus +/-, auxiliary voltage +/-),<br>diameter approx. 5 mm |
| Weight | Weather station with mounting approx. 90 g,<br>total weight with accessories approx. 280 g |
| Ambient temperature | Operation -30…+50°C, storage -30…+70°C |

| | |
|---|---|
| Auxiliary supply | 20...32 V DC.<br>An appropriate power supply unit can be purchased from Elsner Elektronik. |
| Auxiliary current | at 24V DC: max. 90 mA |
| Bus current | max. 10 mA |
| Data output | KNX +/- |
| BCU type | Integrated microcontroller |
| PEI type | 0 |
| Group addresses | max. 2000 |
| Assignments | max. 2000 |
| Communication objects | 28 |
| Temperature sensor: | |
| Measurement range | -30°C ... +50°C |
| Resolution | 0.1°C |
| Wind sensor: | |
| Measurement range | 0 m/s ... 35 m/s |
| Resolution | 0.1 m/s |
| Accuracy | ±15% of the measurement value when incoming flow is 45°...315°<br>(Frontal incoming flow corresponds to 180°) |
| Brightness sensor: | |
| Measurement range | 0 lux ... 150,000 lux |
| Resolution | 1 lux up to 300 lux<br>2 lux up to 1000 lux<br>25 lux up to 150.000 lux |
| Accuracy | ±15% of the measurement value at 30 lux ... 30,000 lux |

***Mounting arm Fix:***

| | |
|---|---|
| Colour | powder-coated white RAL 9003 |
| Total lenght | approx. 430 mm |
| Weight | approx. 190 g |

The product conforms with the provisions of EU directives.

# 2. Installation and start-up

## 2.1. Installation notes

Installation, testing, operational start-up and troubleshooting should only be performed by an electrician.

**CAUTION!**
**Live voltage!**
There are unprotected live components inside the device.
- National legal regulations are to be followed.
- Ensure that all lines to be assembled are free of voltage and take precautions against accidental switching on.
- Do not use the device if it is damaged.
- Take the device or system out of service and secure it against unintentional use, if it can be assumed, that risk-free operation is no longer guaranteed.

The device is only to be used for its intended purpose. Any improper modification or failure to follow the operating instructions voids any and all warranty and guarantee claims.

After unpacking the device, check it immediately for possible mechanical damage. If it has been damaged in transport, inform the supplier immediately.

The device may only be used as a fixed-site installation; that means only when assembled and after conclusion of all installation and operational start-up tasks and only in the surroundings designated for it.

Elsner Elektronik is not liable for any changes in norms and standards which may occur after publication of these operating instructions.

## 2.2. Installation location

Select an installation position on the building where the sensors can measure wind, rain and sunshine without hindrance. No structural elements should be mounted above the weather station, from which water could continue to drop on the precipitation sensor even after it has stopped raining or snowing. The weather station should not be shaded by structures or, for example, trees.

At least 60 cm of clearance must be left around the device. This facilitates correct wind speed measurement without eddies. At the same time, this prevents spray (raindrops hitting the device) or snow (snow penetration) from impairing the measurement. The wind sensor must not come into contact with water. The distance also prevents birds from biting the sensor.

The mounting position must be selected so that the sensors for rain and wind cannot be touched by persons.

Please ensure that the extended awning does not cast shade on the device, and does not protect the device against wind.

Temperature measurements can also be distorted by external influences such as warming or cooling of the building structure on which the sensor is mounted. Temperature variations from such sources of interference must be corrected in the ETS in order to ensure the specified accuracy of the sensor (temperature offset).

Magnetic fields, transmitters and interference fields from electrical consumers (e.g. fluorescent lamps, neon signs, switch mode power supplies etc.) can block or interfere with the reception of the GPS signal.

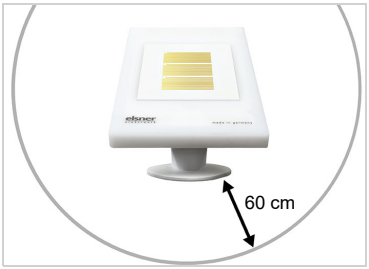



*Fig. 1*
*There must be at least 60 cm clearance to other elements (structures, construction parts, etc.) below, to the sides and in front of the device.*

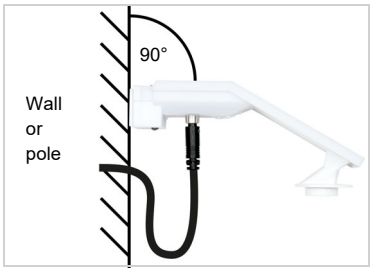



*Fig. 2*
*The device must be attached to a vertical wall (or a pole).*

*Place the supply line in a loop before leading it into the wall or junction box. This will allow rain to drip off and not drain into the wall or box.*


*Fig. 3*
*The device must be mounted in the horizontal (transverse) direction.*

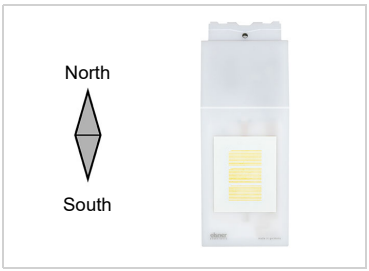



*Fig. 4*
*For installation in the northern hemisphere, the device must be aligned to face south.*

*For installation in the southern hemisphere, the device must be aligned to face north.*

## 2.3. Position of the sensors

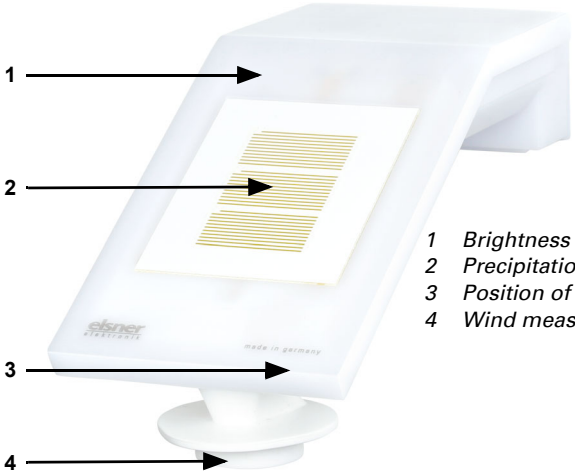



*Fig. 5*

*1 Brightness sensor*
*2 Precipitation sensor (area with tracks)*
*3 Position of temperature sensor*
*4 Wind measuring element*

**ATTENTION!**
Sensitive wind sensor.
- Remove the protective transport sticker after installation.
- Do not touch the sensor on the wind measuring element (on bottom, recessed).

### 2.3.1. Measurement direction of the brightness sensor

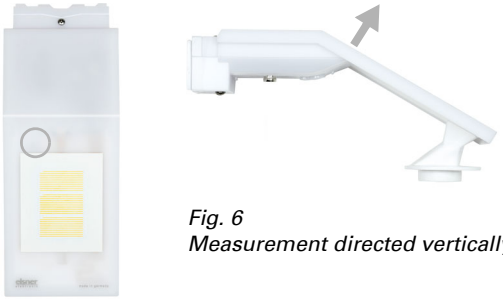


*Fig. 6*
*Measurement directed vertically to the device surface*

# 2.4. Installing the weather station

## 2.4.1. Attach mount

First, assemble the mount for wall/pole mounting. Release the screw joint of the mount with a cross-headed screwdriver.

***Wall installation***

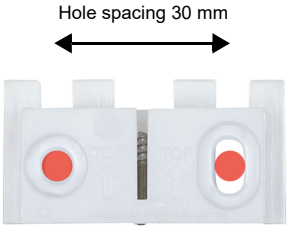



*Fig. 7 Front view*

Use two screws to attach the mount to the wall. Use the fastening material (dowels, screws) that is suitable for the base.

Make sure that the arrows are pointing upward.

***Pole installation***

The device is installed on the pole with the enclosed clamp.

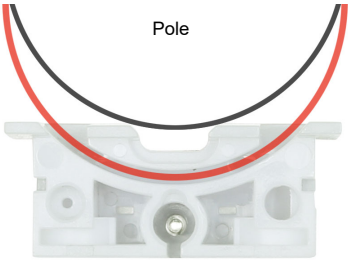



*Fig. 8 Bottom view*

Insert the clamp in the mount through the recess. Tighten the clamp on the pole.

Make sure that the arrows are pointing upward.

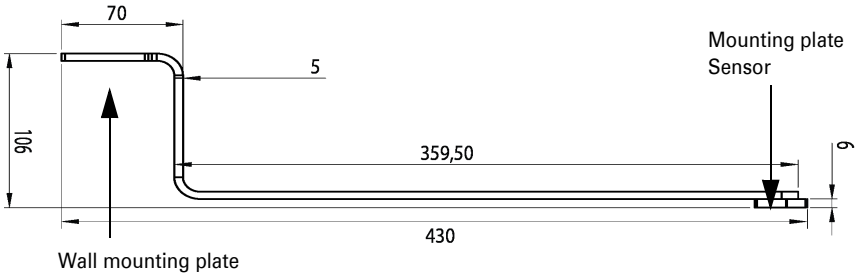
## 2.4.2. Assembly with Mounting Arm Fix

With the Mounting Arm Fix, the weather station can be flexibly mounted on the wall.

Only use suitable fixing material (screws, dowels) to fix the wall installation plate and make sure that the subsurface is stable.

***Dimensions Fix:***

*Fig. 9*




***Wall mounting plate Fix:***

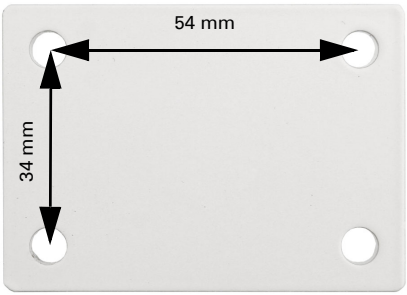



*Fig. 10*
*Hole diameter 6.2 mm*

***Affix sensor mounting plate:***

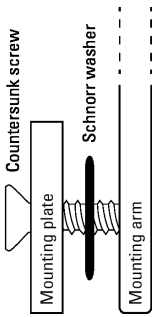
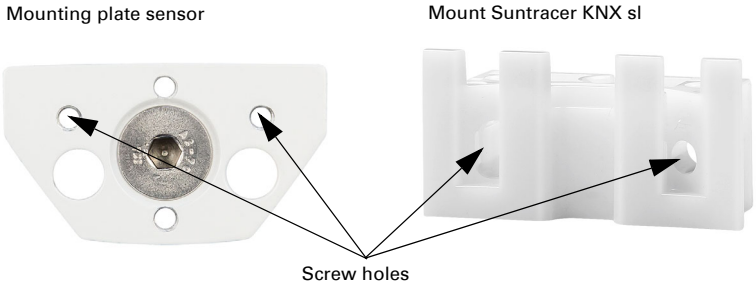



*Fig. 11*
*(Schema sequence screw fastening)*

*Screw the sensor mounting plate onto the boom with the countersunk screw DIN 7991 M8x10. Place the Schnorr tooth lock washers between the mounting plate and the boom*

*Fig. 12*
*For mounting use the cylinder head screws DIN 912 M4x25 and place the DIN 125 washers under the screw heads.*

*Fig. 13*




***Installation examples:***

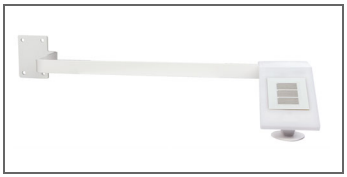
*Fig. 14*

*Sensor offset upwards.*

*Fig. 15*

*Sensor offset downwards.*

*Fig. 16*



*Sensor offset to the right (or the left).*

## 2.4.3. Attaching and connecting the device


*Fig. 17*

1. Slide the device onto the mounting from above.
2. Tighten the screw of the mount to secure the device.
3. Screw the M8 connectors of the connection cable onto the connection socket on the bottom side of the device.

Connect the loose end of the connection cable to KNX bus and auxiliary voltage. Use the connection sockets and clips included for this purpose.

| *KNX bus:* | *Auxiliary votage:* |
|---|---|
| *+ red*<br>*- black* | *+ yellow*<br>*- white* |

## 2.5. Instructions for assembly and initial start-up

Remove all transport protection stickers present after installation.

The wind measurement value and thus also all wind switching outputs cannot be output until 35 seconds after the power is turned on.

After the auxiliary voltage has been applied, the device will enter an initialisation phase lasting a few seconds. During this phase no information can be received or sent via the bus.

# 3. Addressing the equipment

The equipment is delivered ex works with the bus address 15.15.255. You program a different address in the ETS by overwriting the address 15.15.255 or teach the device using the programming button.

The programming button can be reached through the opening on the underside of the housing; it is recessed by approx. 15 mm. Use a thin object to reach the key, e. g. a 1.5 mm² wire.

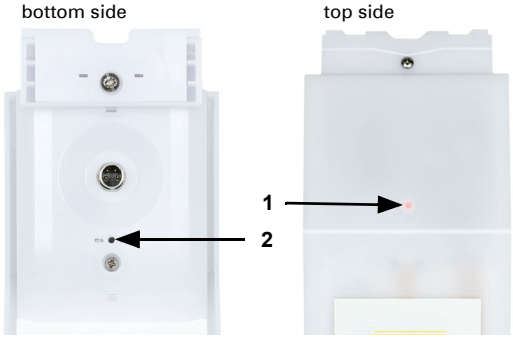



*Fig. 18*
*1 Programming LED (under the semi-transparent lid)*
*2 Programming button for teaching the device*

# 4. Maintenance

**WARNING!**
**Risk of injury caused by components moved automatically!**
The automatic control can start system components and place people in danger (e.g. moving windows/awnings if a rain/wind alarm has been triggered while cleaning).
- Always isolate the device from the mains for servicing and cleaning.

The device must regularly be checked for dirt twice a year and cleaned if necessary. In case of severe dirt, the sensor may not work properly anymore.

**ATTENTION**
The device can be damaged if water penetrates the housing.
- Do not clean with high pressure cleaners or steam jets.

# 5. Transfer protocol

***Units:***

*Temperatures in degrees Celsius*
*Brightness in Lux*
*Wind in metres per second*

## 5.1. List of all communications objects

***Abbreviation flags:***

*C Communication*
*R Read*
*W Write*
*T Transmit*
*U Update*

| No | Text | Function | Flags | DPT type | Size |
|---|---|---|---|---|---|
| 1 | Software version | Output | R-CT | [217.1] DPT_Version | 2 Bytes |
| 24 | GPS malfunction (0 : OK \| 1: NOK) | Output | R-CT | [1.2] DPT_Bool | 1 Bit |
| 25 | Date / time | Input / Output | RWCT | [19.1] DPT_DateTime | 8 Bytes |
| 26 | Date | Input / Output | RWCT | [11.1] DPT_Date | 3 Bytes |
| 27 | Time | Input / Output | RWCT | [10.1] DPT_TimeOfDay | 3 Bytes |
| 28 | Date and time query | Input | -WC- | [1.017] DPT_Trigger | 1 Bit |
| 30 | Location: Northern latitude [°] | Output | R-CT | [14.7] DPT_Value_AngleDeg | 4 Bytes |
| 31 | Location: Eastern longitude [°] | Output | R-CT | [14.7] DPT_Value_AngleDeg | 4 Bytes |
| 34 | Rain: Switching output | Output | R-CT | [1.1] DPT_Switch | 1 Bit |
| 35 | Rain: Switching output with fixed delays | Output | R-CT | [1.1] DPT_Switch | 1 Bit |
| 36 | Rain: Switching delay to rain | Input | -WC- | [7,005] DPT_TimePeriodSec | 2 Bytes |
| 37 | Rain: Switching delay to no rain | Input | -WC- | [7,005] DPT_TimePeriodSec | 2 Bytes |
| 41 | Temperature sensor: Malfunction | Output | R-CT | [1.1] DPT_Switch | 1 Bit |
| 42 | Temperature sensor: External measurement | Input | -WCT | [9.1] DPT_Value_Temp | 2 Bytes |
| 43 | Temperature sensor: Measurement value | Output | R-CT | [9.1] DPT_Value_Temp | 2 Bytes |

| No | Text | Function | Flags | DPT type | Size |
|---|---|---|---|---|---|
| 44 | Temperature sensor: Total measurement | Output | R-CT | [9.1] DPT_-Value_Temp | 2 Bytes |
| 45 | Temperature sensor: Min./Max. measurement query | Input | -WC- | [1.017] DPT_Trigger | 1 Bit |
| 46 | Temperature sensor: Minimum measurement | Output | R-CT | [9.1] DPT_-Value_Temp | 2 Bytes |
| 47 | Temperature sensor: Maximum measurement | Output | R-CT | [9.1] DPT_-Value_Temp | 2 Bytes |
| 48 | Temperature sensor: Min./Max. measurement reset | Input | -WC- | [1.017] DPT_Trigger | 1 Bit |
| 95 | Brightness sensor measurement | Output | R-CT | [9.4] DPT_-Value_Lux | 2 Bytes |
| 271 | Wind sensor: Malfunction | Output | R-CT | [1.1] DPT_Switch | 1 Bit |
| 272 | Wind sensor: Measurement [m/s] | Output | R-CT | [9.5] DPT_-Value_Wsp | 2 Bytes |
| 273 | Wind sensor: Measurement [Beaufort] | Output | R-CT | [20.014] DPT_Beaufort_Wind_-Force_Scale | 1 Byte |
| 274 | Wind sensor: Max. query measurement | Input | -WC- | [1.017] DPT_Trigger | 1 Bit |
| 275 | Wind sensor: Maximum measurement [m/s] | Output | R-CT | [9.5] DPT_-Value_Wsp | 2 Bytes |
| 276 | Wind sensor: Maximum measurement [Beaufort] | Output | R-CT | [20.014] DPT_Beaufort_Wind_-Force_Scale | 1 Byte |
| 277 | Wind sensor: Max. reset measurement | Input | -WC- | [1.017] DPT_Trigger | 1 Bit |

# 6. Parameter setting

### 6.0.1. Behaviour on power failure/power restoration

***Behaviour on bus or auxiliary power failure***

The device sends nothing.

***Behaviour on bus or auxiliary voltage restoration and following programming or reset***

The device sends all measurement values as well as switching and status outputs according to their send pattern set in the parameters with the delays established in the "General settings" parameter block. The "Software version" communications object is sent once after 5 seconds.

### 6.0.2. Malfunction objects

Malfunction objects are sent after every reset and, additionally, after changes (i.e. at the beginning and end of a malfunction).

## 6.1. General settings

Set basic characteristics of data transfer.

| Transmission delay after reset/restoration of bus for: | |
|---|---|
| Measured values | 5 ... 300 seconds |
| Maximum telegram quota | 1 • 2 • 5 • 10 • 20 • 50 Telegrams per sec. |

## 6.2. GPS

Set whether the time and date are to be sent as separate objects or as one common object. Specify whether the time and date are to be set by the GPS signal or objects.

If time and date are **set by the GPS-Signal**, the data is available as soon as a valid GPS signal is received.

If time and date are **set by two objects**, then only a maximum of 10 seconds may elapse between receiving the date and receiving the time Furthermore, a change of date may not occur between receiving both objects. The objects must be received by the device on the same day.

The device has an integrated real-time clock. Therefore, time keeps on running internally and can be sent to the bus, even when no GPS coverage is available or no time object has been received for some time. The internal clock can show a time drift of up to ±6 seconds per day.

| | |
|---|---|
| Object type date and time | • two separate objects<br>• a common object |
| Date and time will be set by | • GPS signal and not sent<br>• GPS signal and sent periodically<br>• GPS signal and sent on request<br>• GPS signal and sent on request + periodically<br>• object(s) and not sent |
| Send cycle<br>*(if sent periodically)* | 5 s ... 2 h; 1 min |

Set what happens in the event of a GPS malfunction. Please note, that after return of auxiliary voltage, it can take up to 10 minutes before the GPS signal is received.

| | |
|---|---|
| If there is no reception, GPS fault is ... recognised after the last reception | 20 min • 30 min • 1 h • 1.5 h • 2 h |

| | |
|---|---|
| GPS fault object sends<br>(1: malfunction\| 0: no malfunction) | • never<br>• on change<br>• on change to 1<br>• on change to 0<br>• on change and periodically<br>• on change to 1 and periodically<br>• on change to 0 and periodically |
| Send cycle<br>*(if sent periodically)* | 5 s ... 2 h; 10 s |

## 6.3. Location

The **location** is received via GPS or entered manually (selection of the nearest town or by entering coordinates). Also when using the GPS signal coordinates can be entered manually for the initial commissioning. This data is used as long as no GPS reception exists. For this you select the option "Input (only valid until the first GPS reception)".

| | | |
|---|---|---|
| Location is determined by | • input<br>• input (only valid until the first GPS reception)<br>• GPS reception | |
| Location input using<br>*(if input selected)* | • Town<br>• Coordinates | |
| Country<br>*(if input by town is selected)* | • Belgium<br>• Denmark<br>• Germany<br>• France<br>• Great Britain<br>• Italy | • Liechtenstein<br>• Luxembourg<br>• Netherlands<br>• Austria<br>• Switzerland<br>• USA |
| Town<br>*(if input by town is selected)* | 6 towns in Belgium<br>1 town in Denmark<br>48 towns in Germany; Stuttgart<br>23 towns in France<br>4 towns in Great Britain<br>10 towns in Italy<br>1 town in Liechtenstein<br>1 town in Luxembourg<br>2 towns in the Netherlands<br>4 towns in Austria<br>4 towns in Switzerland<br>2 towns in the USA | |
| E. longitude [degrees, -180...+180]<br>*(if input by coordinates is selected)* | 9<br>[negative values mean "western longitude"] | |
| E. longitude [minutes, -59...+59]<br>*(if input by coordinates is selected)* | 10<br>[negative values mean "western longitude"] | |

| | |
|---|---|
| Northern latitude [Degrees, -90…+90]<br>*(if input by coordinates is selected)* | 48<br>[negative values mean "southern latitude"] |
| Northern latitude [minutes, -59…+59]<br>*(if input by coordinates is selected)* | 46<br>[negative values mean "southern latitude"] |

In order to be able to output the **local time**, the time zone (difference to world time (Coordinated Universal Time)) and the summer time rules must be defined. Specify the hours and minutes after winter time (standard time).

| | |
|---|---|
| Time zone (relative to GMT): | |
| Prefix | • positive (+)<br>• negative (-) |
| Hours | 0 ... 13; 1 |
| Minutes | 0 ... 59; 0 |
| Summertime rule | • Europe<br>• USA<br>• user-defined<br>• none |
| All the following times are to be entered as winter time = standard time | |
| Start of Summer Time: | |
| on | • Monday ... Sunday<br>• Date |
| From (day)<br>*(for Europe or USA summer time rules)*<br>(Day)<br>*(For user defined summer time rules)* | 1 ... 31; 25 |
| (Month) | 1 ... 12; 3 |
| (Hour) | 0 ... 23; 2 |
| (minutes) | 0 ... 59 |
| End of Summer Time: | |
| on | • Monday ... Sunday<br>• Date |
| From (day)<br>*(for Europe or USA summer time rules)*<br>(Day)<br>*(For user defined summer time rules)* | 1 ... 31; 25 |
| (Month) | 1 ... 12; 10 |
| (hour) | 0 ... 23; 2 |
| (minutes) | 0 ... 59 |
| Time shift: | |
| hours | -12 ... 12; 1 |
| minutes | 0 ... 59 |

The standard coordinates can be transmitted from the device to the bus and thus be used in other applications, no matter whether they have been received via GPS or specified manually.

| | |
|---|---|
| Send coordinates | • never<br>• periodically<br>• on change<br>• on change and periodically |
| on change of | 0.5° • 1° • 2° • 5° • 10° |
| Send cycle | 5 s ... 2 h; 5 min |

## 6.4. Rain

Activate the rain sensor in order to use objects and switch outputs.

| | |
|---|---|
| Use rain sensor | No • **Yes** |

Set, in which cases delay times received are to be kept per object. The parameter is only taken into consideration if the setting by object is activated further down. Please note that the setting "After power restoration and programming" should not be used for the initial start-up, as the factory settings are always used until the first call (setting via objects is ignored).

| Maintain the | |
|---|---|
| delays received via communication objects | • never<br>• after power restoration<br>• after power restoration and programming |
| | |

Select whether the special rain output is to be used with fixed switching delay. This switching output has no delay on rain recognition and 5 minutes delay after it is dry again.

| | |
|---|---|
| Use rain output with fixed switching delay | No • Yes |

Set the delay times. If the delays are defined using objects, then the times set here are only valid up to the first call.

| | |
|---|---|
| Delays can be set via objects (in seconds) | No • Yes |
| Delay on rain | none • 1 s ... • 2 h |
| Delay on no rain (after drying of the sensor) | 5 min • 1 h... • 2 h |

Define the send pattern for the rain switch output and specify the object value for the event of rain.

| | |
|---|---|
| Switching output sends | • on change<br>• on change to rain<br>• on change to no rain<br>• on change and periodically<br>• on change to rain and periodically<br>• on change to no rain and periodically |
| Send cycle<br>*(if sent periodically)* | 5 s ... 2 h; 10 s |
| Object value(s) with rain | 0 • 1 |

## 6.5. Temperature measurement value

First of all set whether the temperature sensor malfunction object is to be used and correct, if necessary, the output of the measurement value by specifying an offset (e.g. in order to compensate malfunction sources).

| | |
|---|---|
| Use malfunction object | No • Yes |
| Offset in 0.1°C | -50... 50; 0 |

Then set the mixed value calculation if desired.

| | |
|---|---|
| Use external reading | No • Yes |
| Ext. Reading proportion of the total reading<br>*(if external reading is to be used)* | 5% • 10% • 15% • ... • 50% • ... • 95% • 100% |
| All following settings refer to the total measured value | |

Specify the send pattern for the total measured value.

| | |
|---|---|
| Send pattern | • never<br>• periodically<br>• on change<br>• on change and periodically |
| on change of<br>*(if sent on change)* | 0.1°C • 0.2°C • 0.5°C • 1.0°C • 2.0°C • 5.0°C |
| Send cycle<br>*(if sent periodically)* | 5 s ... 2 h; 10 s |

Select whether the minimum and maximum value should be used.

| | |
|---|---|
| Use minimum and maximum value | No • Yes |

## 6.6. Brightness measurement value

Set the send pattern for the measured brightness.

| | |
|---|---|
| Send pattern | • never<br>• periodically<br>• on change<br>• on change and periodically |
| at and above change in %<br>*(if sent on change)* | 1 ... 100; 20 |
| Send cycle<br>*(if sent periodically)* | 5 s ... 2 h |

## 6.7. Wind measurement

If necessary, activate the wind malfunction object. Specify whether the measurement should also be output in Beaufort.

| | |
|---|---|
| Use malfunction object | No • Yes |
| Measured value additionally output in the Beaufort scale | No • Yes |

Define the send pattern and, if necessary, activate the maximum value (this value is not retained after a reset).

| | |
|---|---|
| Send pattern | • never<br>• periodically<br>• on change<br>• on change and periodically |
| on change of<br>*(if sent on change)* | 2% • 5% • 10% • 25% • 50% |
| Send cycle<br>*(if sent periodically)* | 5 s ... 2 h; 10 s |
| Use maximum value | No • Yes |

### Beaufort scale

| Beaufort | Meaning |
|---|---|
| 0 | Calm |
| 1 | Light air |
| 2 | Light breeze |
| 3 | Gentle breeze |
| 4 | Moderate breeze |

| Beaufort | Meaning |
|---|---|
| 5 | Fresh breeze |
| 6 | Strong breeze |
| 7 | High wind |
| 8 | Gale |
| 9 | Severe gale |
| 10 | Storm |
| 11 | Violent storm |
| 12 | Hurricane |

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