Datalogger DLx-MET

Instruction for Use

9.1756.x0.x0x

9.1757.10.x00

From start of software version V1.18

Dok. No. 021579/04/21

THE WORLD OF WEATHER DATA

Safety Instructions

- Before operating with or at the device/product, read through the operating instructions.
  This manual contains instructions which should be followed on mounting, start-up, and operation.
  A non-observance might cause:
  - failure of important functions
  - endangerment of persons by electrical or mechanical effect
  - damage to objects
- Mounting, electrical connection and wiring of the device/product must be carried out only by a qualified technician who is familiar with and observes the engineering regulations, provisions and standards applicable in each case.
- Repairs and maintenance may only be carried out by trained staff or **Adolf Thies GmbH & Co. KG**. Only components and spare parts supplied and/or recommended by **Adolf Thies GmbH & Co. KG** should be used for repairs.
- Electrical devices/products must be mounted and wired only in a voltage-free state.
- **Adolf Thies GmbH & Co KG** guarantees proper functioning of the device/products provided that no modifications have been made to the mechanics, electronics or software, and that the following points are observed:
- All information, warnings and instructions for use included in these operating instructions must be taken into account and observed as this is essential to ensure trouble-free operation and a safe condition of the measuring system / device / product.
- The device / product is designed for a specific application as described in these operating instructions.
- The device / product should be operated with the accessories and consumables supplied and/or recommended by **Adolf Thies GmbH & Co KG.**
- Recommendation: As it is possible that each measuring system / device / product may, under certain conditions, and in rare cases, may also output erroneous measuring values, it is recommended using redundant systems with plausibility checks for **security-relevant applications**.

Environment

- As a longstanding manufacturer of sensors Adolf Thies GmbH & Co KG is committed to the objectives of environmental protection and is therefore willing to take back all supplied products governed by the provisions of "*ElektroG*" (German Electrical and Electronic Equipment Act) and to perform environmentally compatible disposal and recycling. We are prepared to take back all Thies products concerned free of charge if returned to Thies by our customers carriage-paid.

- Make sure you retain packaging for storage or transport of products. Should packaging however no longer be required, please arrange for recycling as the packaging materials are designed to be recycled.

Documentation

- © Copyright **Adolf Thies GmbH & Co KG**, Göttingen / Germany
- Although these operating instruction has been drawn up with due care, **Adolf Thies GmbH & Co KG** can accept no liability whatsoever for any technical and typographical errors or omissions in this document that might remain.
- We can accept no liability whatsoever for any losses arising from the information contained in this document.
- Subject to modification in terms of content.
- The device / product should not be passed on without the/these operating instructions.

Contents

Figure

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1 Models

Order-No.	Sensor-Interface	Transformer	Case version
9.1756.00.000	no	230V AC/100 VA	B
9.1756.10.000			A
9.1756.00.100	yes		B
9.1756.10.100			A
9.1756.00.001	no	230V AC/260 VA	B
9.1756.10.001			A
9.1757.10.000	no	115V AC/100 VA	A
9.1757.10.100	yes		A

Scope of supply: 1 x Datalogger DLx-MET.

1 x Instruction for use.

1 x Wiring diagram

2 Application / Construction of the Datalogger

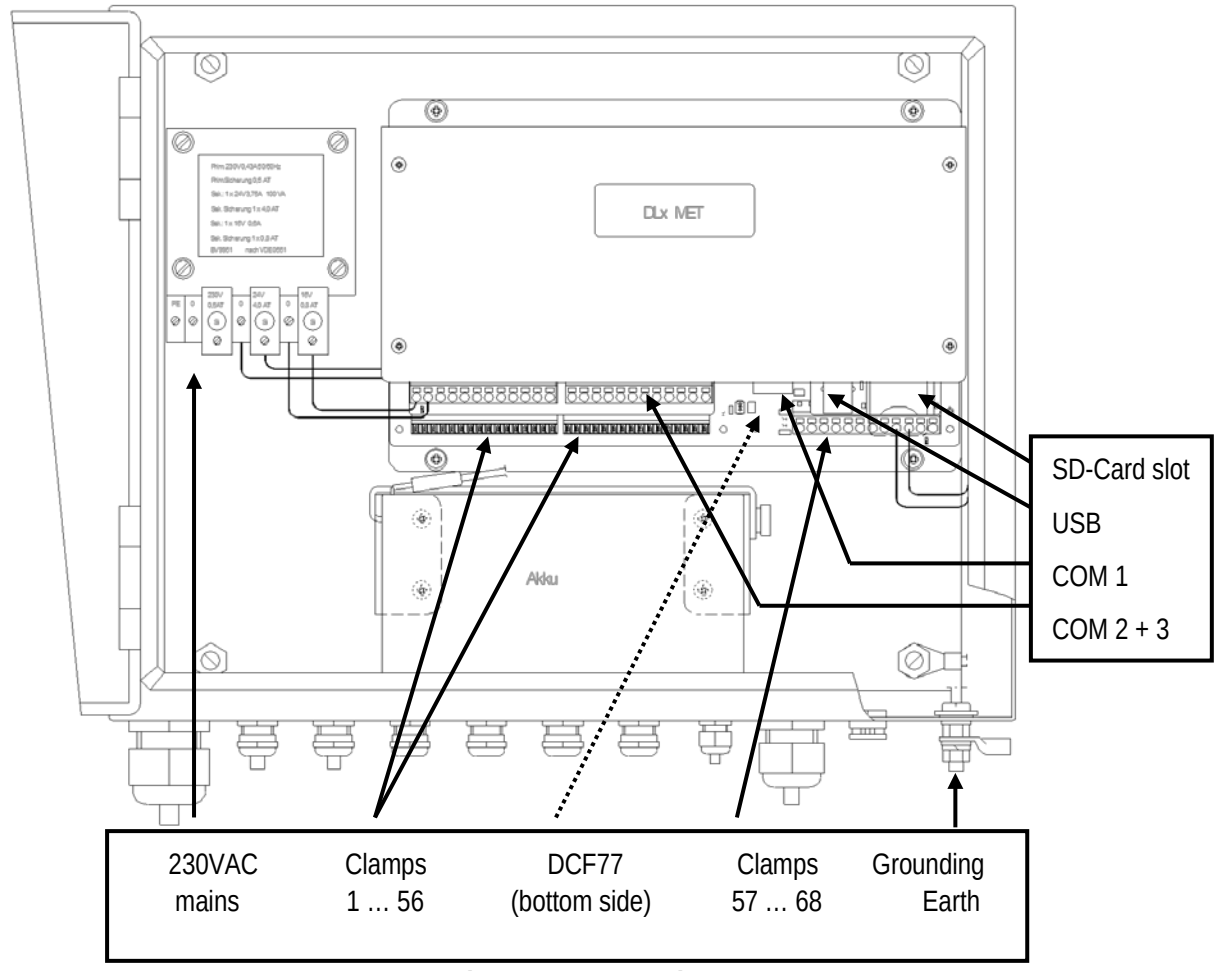


Figure 1: Connections

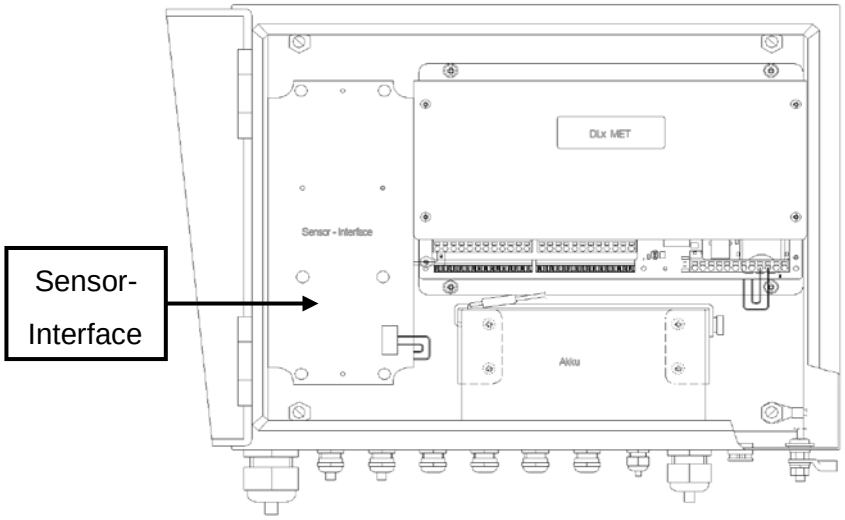


Figure 2: Assembly with Sensor-Interface (9.175x.x0.100)

The Datalogger DLx-MET is a complete measurement system serving for the acquisition and storing of at minimum 10 meteorological parameters (e.g. temperature or radiation). Additionally in the version 9.175x.x0.100 a so-called Sensor-Interface (SIF, see **Figure 2: Assembly with Sensor-Interface (9.175x.x0.100)** printed circuit board with several measuring channels is connected to the serial interface COM2. Optional measuring of other parameters or special sensors with serial output can be done by connecting the so-called Sensor-Interface or a serial sensor to the serial interface COM2 or COM3 (RS485 2W, 2-Wire, half-duplex). The serial interfaces COM1 (used for commands and data output) and COM2 are adjustable from operation mode RS232 to RS485-4W (4-Wire, full-duplex). The USB interface is compatible with COM1. See below **Figure 3** for a overview of all interfaces.

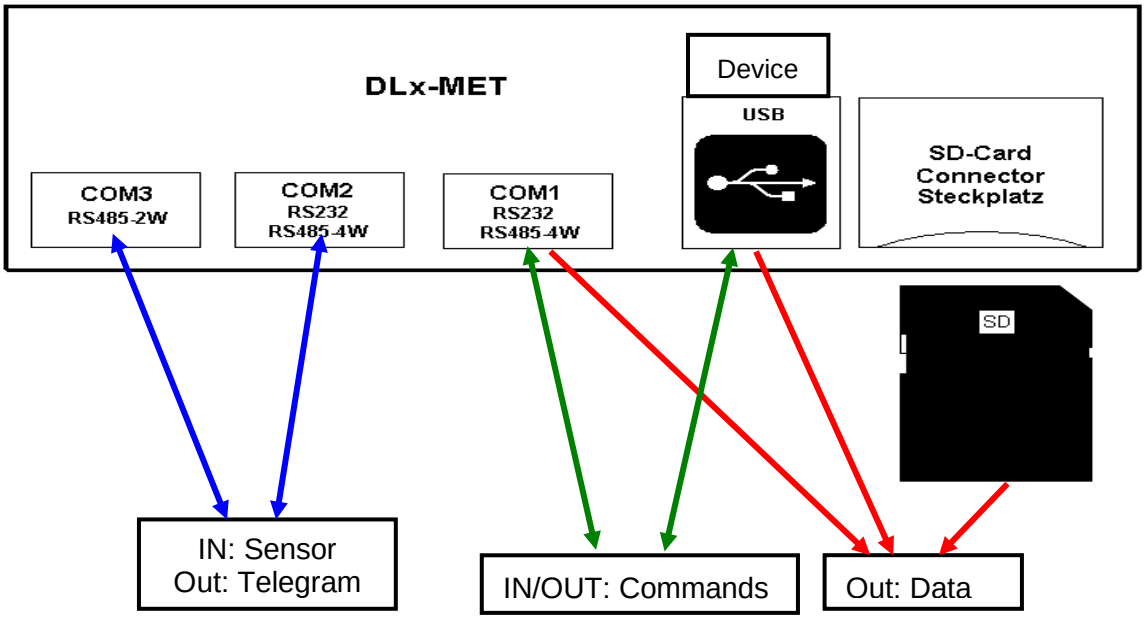


Figure 3: Interfaces of the Datalogger

The instrument is battery-operated (12 V), thus allowing it to be set up according to model and sensor equipment at site without any mains supply for some hours or even days (applies not for sensors measured by the Sensor-Interface). The exchangeable storage battery is situated in the data logger case. With an optional 12 V solar panel it is possible to load the battery.

A switched sensor excitation with a nominal voltage of 11 V is available to minimize the consumption (see chap. **2.1.11**). The turn-on time is selectable between 1 and 30 seconds.

Additionally a mains power supply (230 VAC or 115 VAC) can be used, which also supplies (24 VAC) the heating of sensors and the Sensor-Interface (apply only for 9.1756.x0.**1**00). In this case the battery serves for bridging in case of power failure.

The **Figure 5: Block diagram supply**

shows the supply possibilities.

In order to protect the accumulator against discharging the measurement of the sensors is interrupted in case the voltage is below 10,5 V (thus the current consumption is minimized). Then, the voltage is measured every 5 minutes; when it is higher than 11,0 V the normal measuring routine is continued.

An integrated lithium battery buffers the contents of the data memory and the clock operation when no other power supply is available. This means that the saved values and the time are not lost even when there is no additional power supply.

The housing can be locked, is impermeable to jet-water (IP65), and is a very stable construction. For shielding against electromagnetic fields the housing is made of stainless steel. In addition, operation is guaranteed for temperatures ranging from – 30 °C to 60 °C.

The instrument can be easily operated either by means of three keys, via serial interface COM1 or via USB. The three keys are referred to in the following as"<Δ>", "<∇>"ON, and "<ENTER>" (see **Figure 4: Front view**

A three-line, alphanumeric liquid crystal display (LCD) serves as indicating instrument.

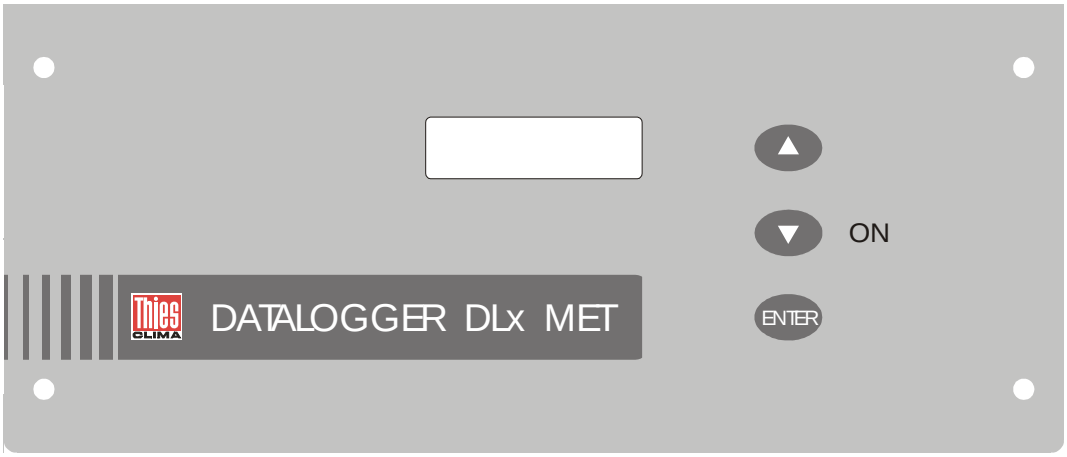


Figure 4: Front view

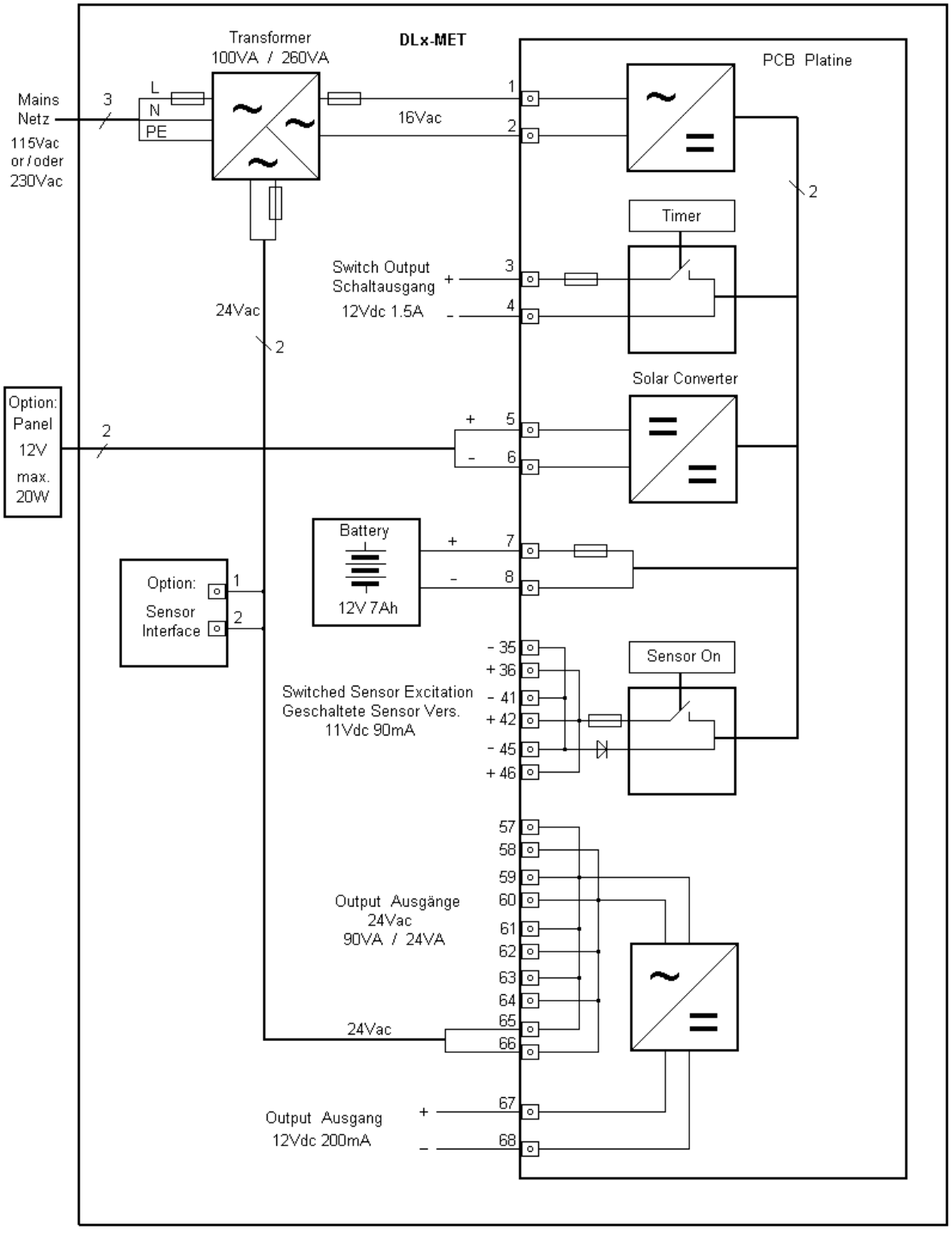


Figure 5: Block diagram supply

The scanning of the measuring values is selectable in the range from 1 second to 60 minutes. For each of the 10 internal sensors the scanning, and further processing can be switched on or off separately.

The optional sensors connected to the Sensor-Interface are processed if the datalogger receives a telegram over the serial interface COM2 (apply only for 9.175x.x0.**1**00).

The measuring values are stored in a memory (CMOS-RAM) with a storing rate of 1 to 60 minutes for mean values and 1 minute to 6 hours for extreme values. The memories are organized as so-called ring memory with a capacity of 1.4 MB (mean) and 0.5 MB (extreme). If the capacity of the ring memory is exhausted, the next step is to overwrite the oldest record. The reading-out of the data can be carried out via the serial interface COM1, USB or via a Secure Digital Memory Card (SD Card, see **chapter 5.2** for working types).

There is a so-called switch output available for the supply of an optional GSM-modem; by means of this contact output the modem can be supplied at up to 6 selectable times a day.

It is possible to synchronize the internal time automatically by means of a separately connectable DCF77-receiver module (reception range up to 2000 km around Frankfurt(Main)/Germany).

For checking the sensors or the measuring inputs the datalogger can be turned into the maintenance-mode. While this mode is active the measuring values of all the sensors cannot get into the memory. I.e. values detected during the maintenance-mode are displayed, however, are not taken into consideration for the calculation of mean- or extreme values.

2.1 Mounting

The datalogger is designed for wall-mounting or installation on a mast.

For proper protection against lightning strikes we strongly recommend to connect a preferably short cable (≤ 1 m) with a cross section greater than 6 mm² between the case (see **Figure 1: Connections**

Grounding Earth) and the mast (if used) with an earth terminal (e.g. grounding bound or main equipotential bonding conductor). This connection is also necessary when mains (230 VAC) is connected to the datalogger.

It exists two case variants:

- 9.175x.**1**0.x00x (case version A)
- 9.1756.**0**0.x00x (case version B)

For the mast-installation of case version A seven different pipe clips with a diameter from 46 to

137 mm are available. For mast-installation with case version B see **chapter 2.1.2**

2.1.1 Wall-Mounting

For mounting on a wall or likewise use the 4 mounting holes:

- diameter 10 mm, see **Figure 6: Dimension illustration of the case version B (9.1756.00.x0x) (in mm)**
- diameter 8.4 mm, see **Figure 7: Dimension illustration of the case version A (9.175x.10.x0x) (in mm)**

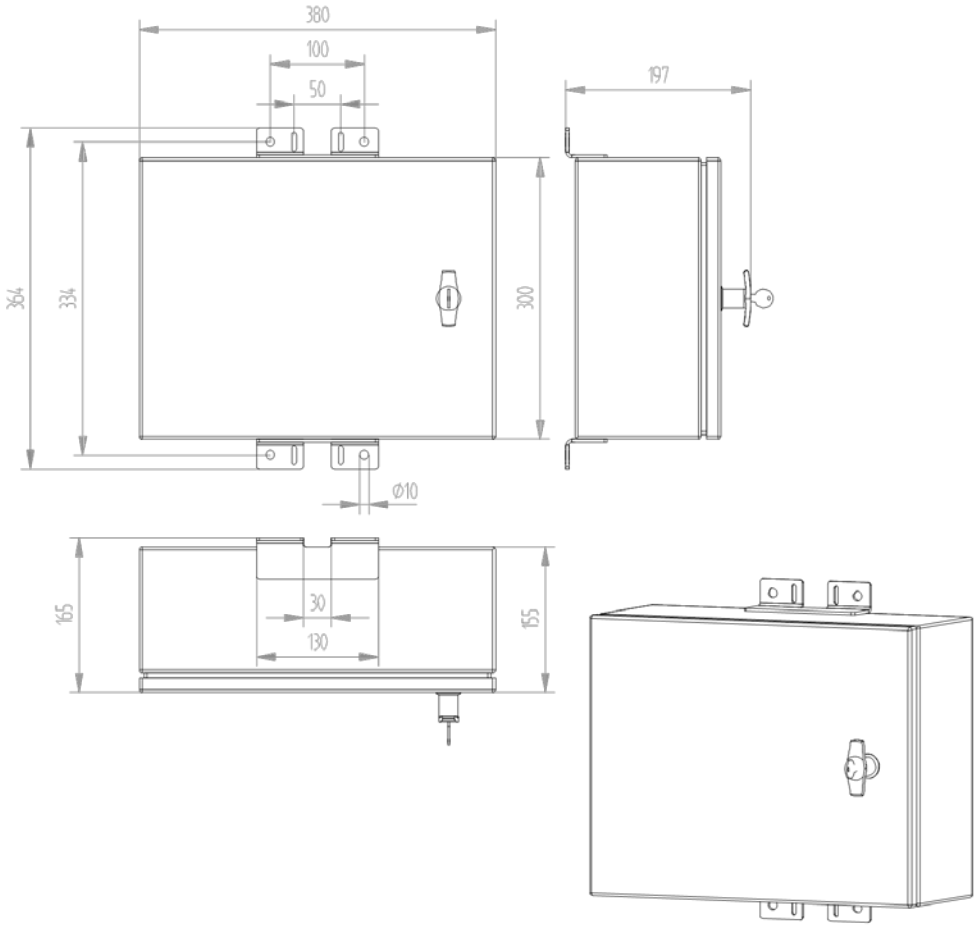


Figure 6: Dimension illustration of the case version B (9.1756.00.x0x) (in mm)

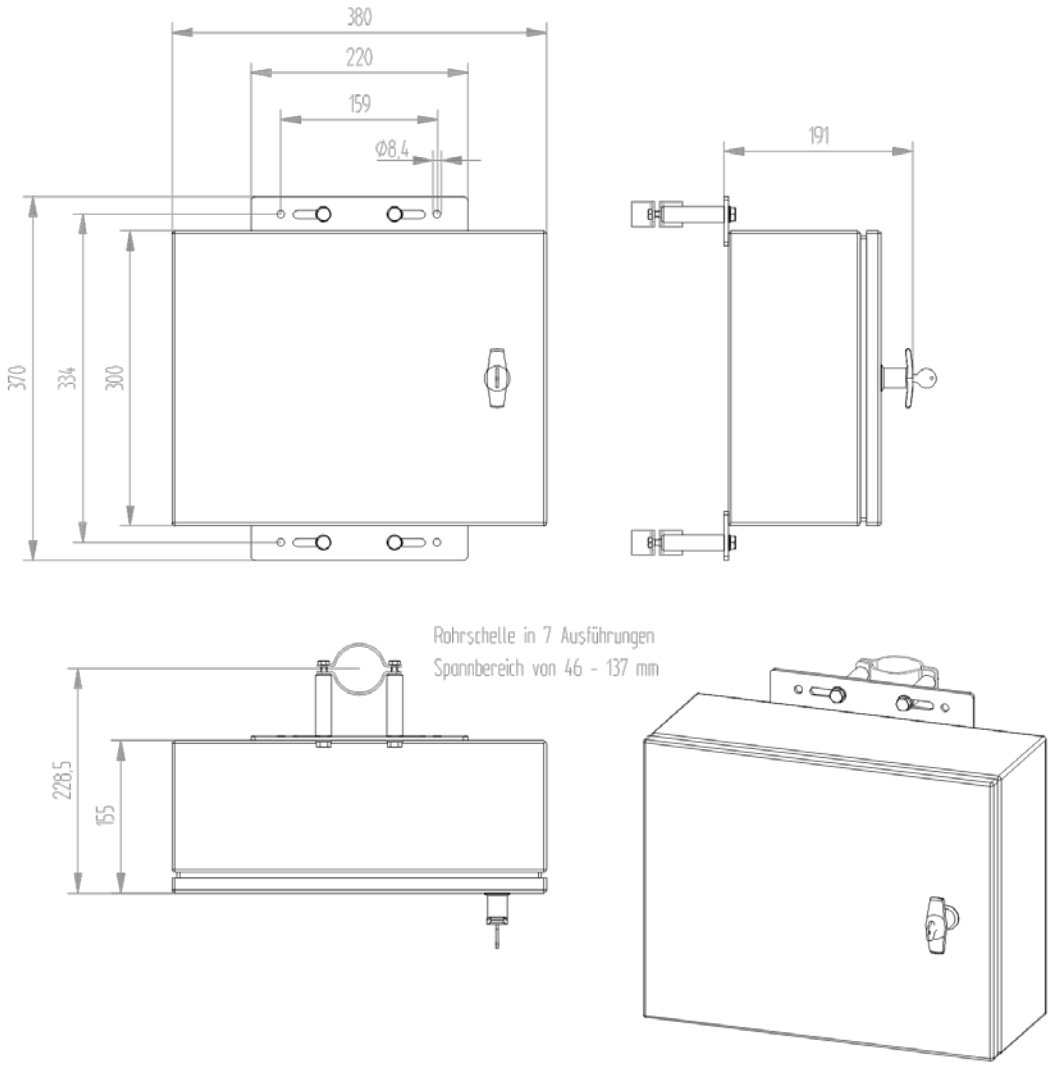


Figure 7: Dimension illustration of the case version A (9.175x.10.x0x) (in mm)

2.1.2 Mast-Installation for Case Version B

The following instructions are only valid for case version B (9.1756.**0**0.x0x).

1. Cut two piece in the requested length of the guy rope (1 meter) according to table (see **Table 1: Length of guy rope**
2. Insert the strap into the housing from the screw head side, and bend a projection of 20 mm over the ridge (see **Figure 8: Strap Housing**
3. Put the free end of the prepared clamp around the mast and the mounting angle, and screw it on (see **Figure 9: Mast with guy rope**
4. Two straps are provided for the datalogger.

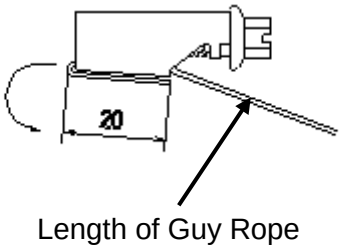


Figure 8: Strap Housing

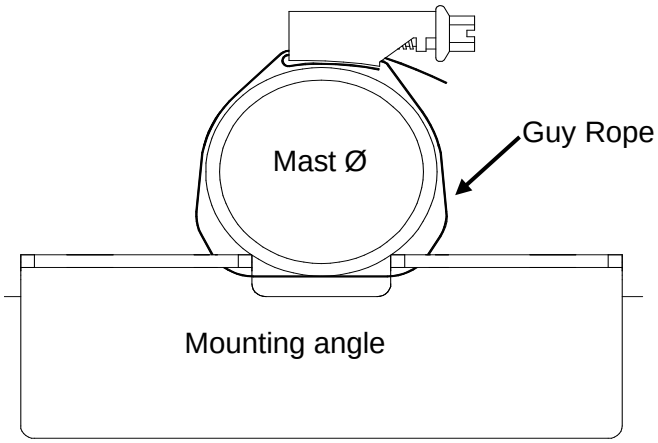


Figure 9: Mast with guy rope

Mast Ø	Length of Guy Rope
48 mm / 1.9 inch	250 mm / 10 inch
60 mm / 2.4 inch	310 mm / 12.2 inch
80 mm / 3.2 inch	370 mm / 14.6 inch
90 mm / 3.5 inch	400 mm / 15.8 inch
102 mm / 4 inch	440 mm / 17.3 inch

Table 1: Length of guy rope

2.1.3 Cable Gland

In order to carry out an EMC-compatible installation the cable screen (excepted the supply cable, which is normally not shielded) is to be connected to the contact spring of the screwed cable gland (see **Figure 10**). For wiring plan ref. to **chapter 7.**

1. With the Standard Contacting

- Strip back the outer sheath and screen (shielding)
- Make a round cut in the outer sheath approx. 15mm along but do not remove the sheath
- Guide the cable through the cable gland
- Pull off the outer sheath
- Pull back the cable until the connection is made between the cable screen and contact spring
- Turn shut… and it is ready for use!

2. With thin Wires without an Inner Sheath

- Strip back the outer sheath
- Pull back the screen braid approx. 15 - 20mm over the outer sheath
- Insert the cables into the cable gland until the contact is made between the cable screen and contact spring
- Turn shut ….and it is ready for use!

3. When Routing the Cable Screen to another Connection

- Expose the screen braid approx. 10mm
- Guide the cable through the cable gland until the connection is made between the cable screen and contact spring- Turn shut…and it is ready for use!

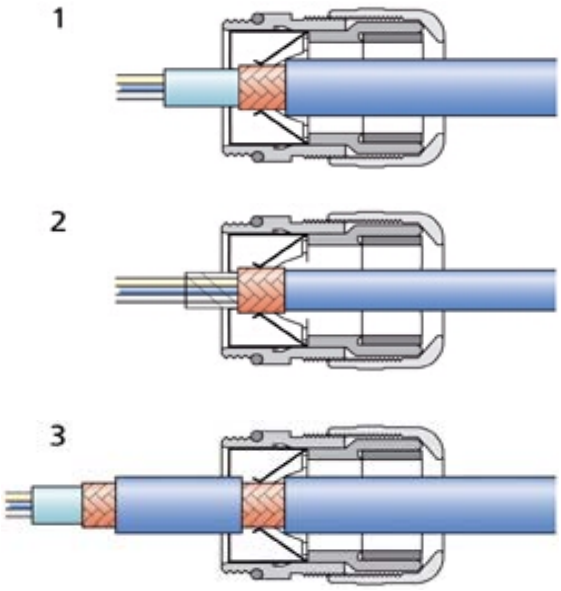


Figure 10: Screen cable connection to the cable gland

2.1.4 Accumulator

The accumulator or battery is to be connected always. It is absolutely necessary to pay attention to the specified polarity (**red** -> **+** ,**black** -> **-**)!

Remark:

When changing the accumulator, or with active power- or solar-supply please take care that the red cable is not in contact with the housing parts (danger of short-cut)

During the installation please take care that all connections are voltage-free, and that people and/or instruments are not endangered!

When replacing the accumulator with active power supply please take care that the red cable has no contact with any part of the housing (danger of short-circuit).
A replacing or loading is necessary at the latest when the indicated accumulator voltage decreases below 9.0V. However, a discharge of the accumulator below 11,0V should be avoided, as no considerable capacity is available any more. With operation below 10,5V the life time of the accumulator is reduced considerably! The new accumulator should be newly charged before mounting, because, possibly, it might not have its maximum capacity due to self-discharge (approx. 3% per month). The stored data are being secured during the replacement. Before disconnecting the accumulator, the data should be saved. Without accumulator no measurements are being carried out.

Note:

The built-in rechargeable battery (accu) is a consumable, which must be replaced at regular intervals.
The service life depends in particular on the operating temperature, the charging end voltage and the discharge current!

2.1.5 Mains Supply

Safety Notes if using mains supply:

Attention! High Voltage Mortal Danger!

The instrument must be mounted and wired only by qualified personnel, who knows and observes the generalities of techniques, and applicable regulations and norms.

Please keep in mind the local safety instructions.

Before carrying out any installation or service isolate unit from the mains supply!

The connection between the case and the earth terminal has to be done according to the details in **chapter 2.1.** When a Sensor-Interface (SIF, see **Figure 2**) board is installed (9.175x.x0.100), it is necessary to swing open it to connect the 230V-power supply to the transformer or to check the fuses (see **Figure 1**). When the both screws at the head of the SIF-board are removed you can turn the board.

When the 230V (115V) -power supply cable is installed, and connected, a red LED is active at the datalogger between clamps 1 and 2 for the function control of the charging connection. In case this LED does not light, the fuses of the 230VAC (115VAC) -input and the 16VAC-output of the transformer should be checked.

Additionally a red LED lights up between clamp 67 and 68 for control the 24VAC supply (normally used for heating of sensors). In case of malfunction check the fuses 230VAC (115VAC) and 24VAC.

Remark for 9.1756.x0.001:

The 26Vac output has no fuse, but a 135°C thermal trip switch which breaks the primary supply.

2.1.6 Solar Panel

Electric Connection:

The connection of the optional solar panel is to be carried out according the wiring plan
(see **chapter 7**). We recommend to earth the panel for protection against lightning strikes.
The integrated 12V solar regulator generates a temperature-controlled voltage for a optimum load of the battery. Due to the temperature-controlling the battery should be always in the case of the datalogger.

Alignment:

- Direction: Always align the panel pointing to the sun at noon (south on the northern hemisphere and vice versa) for an optimum performance. If necessary, refer to a compass.

- Angle: The optimum tilt angle (angle between the horizontal plane and the solar panel, (see **Figure 11: Tilt angle for solar panel (here 45°)**
- depends on the latitude of the site. If the datalogger is to be used all the year round, we recommend a tilt angle for optimum winter performance:

  Tilt Angle = Latitude + 15° (apply not for Arctic/Antarctic region, maximum tilt angle 90°)

  Example: Berlin (Germany) Latitude: 50.3° ---> Tilt Angle = 50.3° + 15° = 65.3°

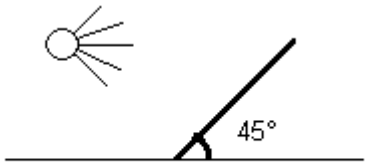


Figure 11: Tilt angle for solar panel (here 45°)

- Nearby obstacles (trees, sensors etc.) should not block the sun at the panel.

Maintenance:

- Dirt, snow, leaves etc. on the panel reduces the amount of light and decreases the energy yield. Therefore regularly clean the glass of the panel depending on the vicinity.

2.1.7 DCF-Active Antenna (9.1760.00.000)

For installation of the optional DCF-Active Antenna (9.1760.00.000) it is necessary to notice the following:

Generally, please take care that the position of the antenna is optimal. It should be aligned horizontally to, and across the direction of the transmitter (situated near Frankfurt/M., N 50° 01', E 09° 00'). The antenna should have a minimum distance of 1m from sources of interference such as power lines, and a 20 cm-distance from metal obstacles. For other information on the alignment of the antenna ref. to **chapter 3.2.7**.

2.1.8 Remove Front Plate

For changing or checking of the jumpers for the digital input (ref. to **chapter 2.1.9**) or for the resistors of the serial interfaces (ref. to **chapter 2.1.10**) the front plate (see **Figure 4: Front view**

has to be removed.

First remove the 4 recessed head screws of the front plate. Then move the plate carefully because otherwise the ribbon cable for the three keys can be damaged.

Before you tighten the screws check the 3 keys of the front plate. When the keys are not working anymore you had to insert the ribbon cable into the 4-pin connector of the printed circuit board.

2.1.9 Setting Digital Input

The digital input „Event/Length of time" (Sensor 10) can be configured for two possibilities with the Jumper P2:

Jumper position	Logic *	Inverse Level	Miscellaneous
2	3.3 V(5 V TTL)	No	Pull-up resistor 100 kΩ to 3.3 V
3	1 V	Yes **	Input resistor > 1 kΩ

Table 2: Jumper for digital input

* The corresponding switching levels are listed in the technical data (see **chapter 6**)

** Note that with jumper in position 3 the logic level is reversed by the electronic.

The jumper P2 is situated 2 cm above clamp 13 (see **Figure 12: Jumper for Digital Input**

To change or check the position it is necessary to remove the front plate (ref. to **chapter 2.1.8**).

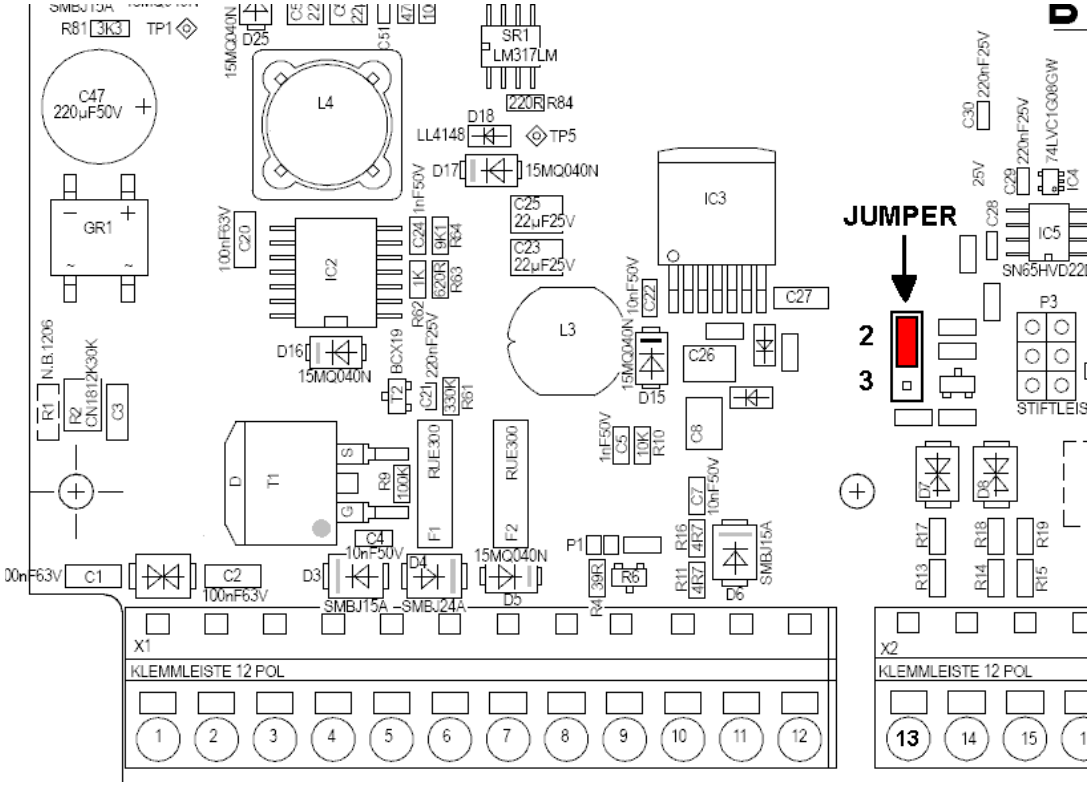


Figure 12: Jumper for Digital Input

2.1.10 Setting Resistors Serial Interfaces

There are three multi-pin connectors for the serial interfaces when used in RS485 mode. To get the lowest current consumption and no negative impacts when COM1(P5) or COM2(P4) are in the RS232 mode all respective jumpers must be open. COM1 and COM2 are adjustable by firmware between RS232 and RS485 (ref. to **chapter 3.1** Baud rate setting). COM3 is always in the operation mode RS485-2w (half-duplex).

To change or check the position of the jumpers it is necessary to remove the front plate (ref. to chap. **2.1.8**). **Figure 13: Jumper for serial interfaces**

show the position of the multi-pin connectors:

COM1:	10-pin connecter P5	(above the 9 pin D-plug)
COM2:	10-pin connecter P4	(above clamp 20)
COM3:	6-pin connector P3	(above clamp 15)

Termination	COM1(P5) COM2(P4)	COM3(P3)
1000 Ω pull-down resistor	J7-8 connected	J3-4 connected
1000 Ω pull-up resistor	J9-10 connected	J5-6 connected
220 Ω termination resistor	J5-6 connected	J1-2 connected
T+/T- connected to R+/R- for 2 wire operation (RS485-2w) (Remark: mode not available)	J1-2 and J3-4 connected	----------

Table 3: Serial Port RS485 termination selection

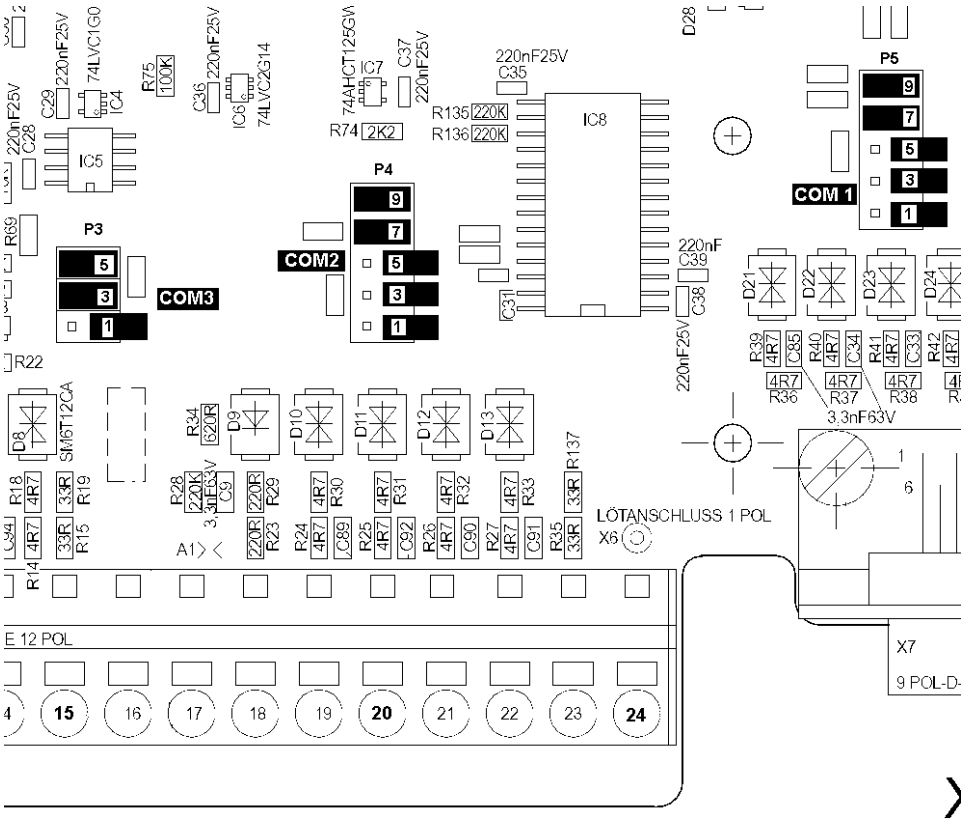


Figure 13: Jumper for serial interfaces

2.1.11 Switched Sensor Excitation

To minimize the current consumption exists a simultaneous switched sensor excitation (11V nominal) (see **Figure 5: Block diagram supply**

which is supplied to 3 clamp pairs:

- clamp 36/35
- clamp 42/41
- clamp 46/45

The turn-on time before the time of measurement can be selected from 1 to 30 seconds in defined levels (serial command „VT“ or with the keys).

Remark:

The maximum current at the 3 clamp pairs should not exceed a total of 90 mA!

3 Operation

When the accumulator is connected, the datalogger starts automatically with the so-called Bootloader (uploads new Firmware), and re-initialises itself. The Bootloader waits 30 seconds and start the actual firmware automatically. After the first activation, time and date should be controlled.

```
DLx Met
Bootloader V1.2

-
```

3.1 Display Options

The display is switched on through the button <∇> (press half a second at the most). The display deactivates itself automatically, if – for 4 minutes – no button was pressed or no signal was sent or received via the serial interfaces COM1 or USB. No deactivation of the display occurs if the serial interface COM2 or COM3 are configured for telegram-output or for automatic receive of data (e.g. LPM sensor).

After the unit has been switched on the station name appears on the display.

The character "*" as first character of the first line signifies for the user that it is possible to edit this value or to get more information (ref. **chapter 3.2**). By pressing the <∇>-button you reach the next indicated value, and get back respectively through button <∆>.
„M“ as first character of the second line with the sensor measuring values shows the maintenance operation (see operation mode).

Remark:

The display can be read off up to a minimum temperature of –20°C . For technology reasons, the time until the value appears on the display, is rather long with low temperatures (approx. 10 seconds at –20°C!).

SEQUENCE OF DISPLAY VALUES:

1. Station name/Language/Turn-on time
2. Date and time of datalogger
3. Data output

Internal sensor measured instantaneous values:

4. Sensor 1: Wind speed
5. Sensor 2: Wind direction
6. Sensor 3: Temperature 1
7. Sensor 4: rel. Humidity
8. Sensor 5: Precipitation
9. Sensor 6: Air pressure
10. Sensor 7: Radiation
11. Sensor 8: Temperature 2
12. Sensor 9: 20 mA Input
13. Sensor 10: Event / Length of time

External sensor serial received values, if configured:

14. Sensor 11 to ??

14. Sensor configuration
15. Sensor connection
16. Serial interfaces mode
17. Measuring cycle/storing cycle
18. Voltage of the accumulator/Status of power supply
19. DCF77 receiving control
20. DCF77 synchronisation
21. Switch output-timer
22. A/D-Converter State
23. State EEPROM
24. Baud rate COM1/SD-Card
25. Baud rate COM2
26. Baud rate COM3
27. Operation Mode (Normal/Maintenance)

    Output format (DLxMet/TDL14)

    Clock drift

1. STATION NAME / LANGUAGE / TURN-ON TIME:

```
* Station: THIES
DLx(Met) V1.03a

USB:0    02s DE
```

Station name:

The station name serves to distinguish the data from several stations. The name (here: "THIES") can comprise up to 5 characters. On the readout, this name is output on the SD card or respectively, along with the data via the serial interfaces COM1 and USB. The instrument type(„DLx(Met)“) and the software version („V1.03a“) are mentioned in the second line. The third line shows if a USB-connection is detected (USB:1) or not (USB:0) and the “DE” indicate a German(Deutsch)/English firmware version.

Remark:

In case of using the THIES software MEVIS and getting the data with a SD-Card, the last character of the station name may be not a space.

Serial command: “XXn” for input of the station name (ref. to **chapter 5.5**)

Language:

When changing the station name (ref. to **chapter 3.2.1**) the second line turns to the language selection for the display output („Language :English“ or „Sprache : Deutsch“); selecting between both modes is possible, then.

Turn-on time:

The turn-on time of the switched sensor excitation (see **chapter 2.1.11**) is showed in the middle of the third line (here “02 s”).

Setting options: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 seconds

Serial command: “VT” (ref. to **chapter 5.5**)

2. DATE/TIME:

```
*Date: 01.01.08
 Time: 13:00:00
```

Display of date and time of the logger.

Serial commands date: “DD”, “DT”, “DM”, “DJ” (ref. to **chapter 5.5**)

Serial commands time: “ZZ”, “ZH”, “ZM”, “ZS” (ref. to **chapter 5.5**)

3. DATA OUTPUT:

```
* Data Output
      ?
```

Starting the data output (ref. to **chapter 5.1**)
If there is no SD-Card in the slot of the datalogger, the output is carried out automatically via the serial interface COM1.

Serial commands: “TS”,”ts”,”DS”,”ds”,”TE”,”te”,”DE”,”de”,”SS”,”GS”,”EE” (ref. to **chapter 5.5**)

SENSOR MEASURED VALUES:

For display, all measuring values are detected, and updated every second.
General error message (exceeding of measuring range or sensor not connected) is the output of „???.?“.
If a internal sensor is not configured (switched off) „---.-„ is output.
„M“ as first character of the second line with the sensor measuring values shows the maintenance operation (see operation mode).

Serial commands: “mm” or “MM” (ref. to **chapter 5.5**)

4. SENSOR 1 Wind speed:

```
* Windspeed:
   NN.N m/s
Classic_1    I:N
```

Line 2: Display of the instantaneously measured wind speed.

Line 3: Display and input type of THIES sensor Wind-Transmitter “Compact 1”, Wind-Transmitter “Classic 1” or “Classic 2”, Wind transmitter “First Class” or ““Compact 2” and current flow test of sensor (I:0 -> off I:1 -> on)

Serial commands: “WV” and “WW” (ref. to **chapter 5.5**)

Measuring range: 0.5 ... 50.0 m/s (Compact 1: characteristic 821Hz -> 65m/s)
0.3 … 50.0 m/s (Classic 1: characteristic 1042Hz -> 50m/s)
0.3 … 50.0 m/s (Classic 2: characteristic 754Hz -> 75m/s)
0.3 … 75.0 m/s (First Class)
0.0 ... 60.0 m/s (Compact 2: characteristic 821,73Hz -> 60m/s)

Resolution: 0.1 m/s

5. SENSOR 2 Wind direction:

```
* Winddirection:
    NNN °

    5-/8-Bit
```

Line 2: Display of the instantaneously measured wind direction.

Line 3: Display and input type of sensor (5-/8-Bit syn.ser. or 10-Bit syn.ser.)

Serial command: “WD” (ref. to **chapter 5.5**)

	5-Bit sensor:	8-Bit sensor:	10-Bit sensor:
Measuring range:	0 ... 349°	0 … 357°	0 … 359°
Resolution:	<= 12°	<= 3°	1°

6. SENSOR 3 Temperature 1:

```
Temperature 1:
   NNN.N °C
```

Display of the instantaneously measured temperature1.
Measuring range: -40 ... 70°C
Resolution: 0.1°C

7. SENSOR 4 relative Humidity:

```
Rel.Humidity :
   NNN.N %
```

Display of the instantaneously measured rel. Humidity.
Measuring range: 0.2 ... 100% r.H.°C
Resolution: 0.1 % r.H.

8. SENSOR 5 Precipitation:

```
* Precipitation:
    NNN.N mm

    0.X      I:N
```

Line 2: Display of the amount of precipitation which has fallen during the current day. The sum of all precipitation since midnight, including the during the maintenance mode.

Line 3: Display and input of the resolution of the sensor (0.1 -> 0.1mm, 0.2 -> 0.2mm) and current flow test of sensor (I:0 -> off I:1 -> on).

Serial commands: “NS” and “NT" (ref. to **chapter 5.5**)

Measuring range: 0 ... 999.9mm

Resolution: 0.1 / 0.2mm

9. SENSOR 6 Air pressure:

```
* Air pressure :
    NNNN.N hPa
Min:NNN Max:NNNN
```

Line 2: Display of the instantaneously measured air pressure

Line 3: Display and input option for the measuring range of the air pressure sensor*

Serial commands: “LM” and “LN" (ref. to **chapter 5.5**)

Measuring range: (500-900)* ... (700-1200)* hPa
Resolution: 0.1hPa

Remarks:

Measuring range adjustable (see Line 3)

Adjusted Min-value need to be smaller than the Max-value

10. SENSOR 7 Radiation:

```
* Radiation  :
    NNNN.N W/sm

  NN.NNNN uV/W
```

Line 2: Display of the instantaneously measured global radiation.

Line 3: Display and input of the radiation constant [µV/W]

Serial command: “SK1” (ref. to **chapter 5.5**)

Measuring range: 0 ... >1428W/m^2
Resolution : <1W/m^2

11. SENSOR 8 Temperature 2:

```
Temperature 2:
   NNN.N °C
```

Display of the instantaneously measured temperature 2.
Measuring range: -40 ... 70°C
Resolution: 0.1°C

12. SENSOR 9 20mA Input:

```
20mA Input:
   NNN.N %
```

Display of the instantaneously measured 20mA Input.
Measuring range: 0 ... 100%
Resolution: 0.1%

13. SENSOR 10 Event/Length of time:

```
* Event/Length :
     NNN.N

    Event    L:N
```

Line 2: Display of the instantaneously measured digital state input:

- Mode Event: Level active (-> 1)/non-active (-> 0)
- Mode Length: Length of time in minutes during the current day

Line 3: Display and input of the mode of the digital state input (Event or Length) and the active logic (L:0 -> low active logic, L:1 -> high active logic)

Measuring range: 0,1 (Mode: Event) or 0 …. 9999min (Mode : Length)

Resolution: 6 seconds (Mode : Length)

Serial command: “LS” and “LT” (ref. to **chapter 5.5**)

Remark:

*To setting up or check the logic level (3.3 V or 1 V) see **chapter 2.1.9**.*

Serial sensors:

From here will displayed the data of serial sensors if configured (e.g. Sensor-interface or Sonic-wind sensor). The set configuration is given in the display **"**16.Serial Interfaces Mode". Please refer to **chapter 3.2.5** for additional information.

14. SENSOR CONFIGURATION:

```
*Channel config:
xxxxx xxxxx
 Channels: 10+YY
```

x = "0" Sensor switched off
x = "1" Sensor switched on

YY= 00 to ??: Number of external channels

Sensor 1...10

Display of the configured internal measuring channel („1"→ switched on). Measuring channels which are not configured („0"→ switched off) are marked by bars (for ex. „---.-") in the display and in the data output.
The first digit (from the left side) means the 1. measuring value of the sensor (wind speed) the last one means sensor 10 (state/length).

For more information to change the sensor configuration ref. to **chapter 3.2.3**

Serial command: "KK" (ref. to **chapter 5.5**)

15. SENSOR CONNECTION:

```
 Sensor connec.:
xxxxx xxxxx
```

x = "+" Sensor connected
x = "-" Sensor not connected

x = "0" Current flow test of sensor off

x = "X" Sensor not configured (see 14. sensor configuration)

Sensor 1…10 x = "?" Sensor not testable

This display shows whether a internal sensor is connected. A "-" means, that the datalogger not detect the sensor, and the "+" stand for vice versa. A "+" means not mandatory that the sensor is working respectively a good quality of the measurement.

16. SERIAL INTERFACES MODE:

```
* COM1: Command
  COM2: Sonic  R
  COM3: SIF002
```

The display shows the settings of the three serial interfaces COM1 till COM3.

The COM1 interface is fix adjusted to operate the commands.

To get the lowest power consumption it is necessary to switch COM2 and COM3 off.

For more information to change the serial interface mode for COM2 and COM3 ref. to

chapter 3.2.5

Serial command: “Cs” (ref. to **chapter 5.5**)

17. MEASURING CYCLE/STORING CYCLE:

```
*Meas.Cyc. 1 sec
 Memory C. 1 min
 ExtremeC. 1 h
```

The display shows the setting of the measuring cycle (line 1), the mean-value- (line 2) and the extreme-value-storing cycle (line 3). Refer to **chapter 3.2.4** for additional explanation.

Setting options **measuring cycle** (applies only for the 10 internal sensors connected directly to the datalogger):

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 seconds and

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 minutes

Setting options **mean storing cycle**:

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 and 60 minutes

Setting options **extreme storing cycle**:

1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 minutes and

1, 2, 3, 4, 6 hours

Serial commands: “MT”, “ST”, “ET” (ref. to chap.**5.5**)

18. VOLTAGE OF THE ACCUMULATOR/Status of Power Supply :

```
Accumulator:  OK
  12.5 V
Mains AC: 1
```

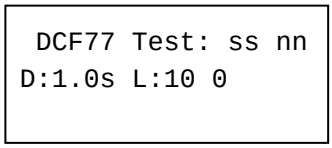
OK : voltage >11.5 V
!!! voltage 10.6 ... 11.5 V
Low : voltage <10.5 V loading/replacing of the accumulator !
Display of the measured voltage of the accumulator.

Line 3 displays the state of power supply (1: mains voltage present, 0: no mains voltage).

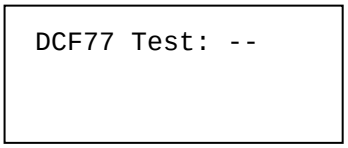
Remark:

Analogue measurements at a recorded voltage of below 9 V are not accurate!
*A discharge of the accumulator below 10,5 V should be avoided, as, firstly, no considerable capacity is available any more, and secondly the life time of the accumulator is reduced considerably ! Please replace or charge the accumulator, if "!!!" is displayed. In order to protect the accumulator against further discharge the query of the sensors is interrupted at a voltage of 10.5 V; thus the current consumption is minimized. Then, the voltage is checked every 5 minutes; when it is higher than 11,0 V the normal measuring routine is continued (ref. to **chapter 4**).*

19. DCF77 RECEIVING CONTROL:



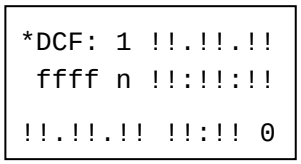
DCF-antenna on



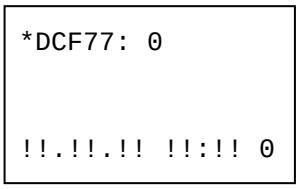
DCF-antenna off

For more information refer to **chapter 3.2.7**.

20. DCF77 SYNCHRONISATION



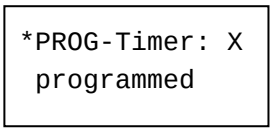
DCF-antenna on



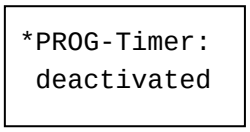
DCF-antenna off

For more information refer to **chapter 3.2.8**.

21. SWITCH OUTPUT TIMER:



X= 1,2,3,4,5,6



Display of the programmed timers for the connection of a consumer load (for ex. GSM-Modem, refer to **chapter 3.2.6**).

Serial command: “FS” (ref. to **chapter 5.5**)

22. A/D-Converter State:

```
A/D: OK
```

State for service purposes only:

OK	(A/D converter in order)
Err	(A/D converter defect)

23. STATE EEPROM:

```
 Estado EEPROM
Usuario:OK DL:OK
```

State of the EEPROM memory (parameter memory for user-settings and calibration values). In case “OK” is not displayed here, the instrument might be defect.

24. BAUD RATE (COM1)/SD-Card:

```
*   COM 1:Command
     9600 Bd 8N1

     RS232
```

No SD-Card in the slot

Display of the settings of COM1

Setting options:
300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 Bd

8 data bits, no (none) parity or 7 data bits, even parity, 1 stop bit, RS232 or RS485-4Wire

Serial commands: “CC1”, “CP1”, “CR1”
(ref. to **chapter 5.5**)

```
   SD-Card:
 2 TM SD02G 3.2

xxxxxxxx 04.2008
```

SD-Card in the slot of the datalogger
(Example, line 2 and 3 are specific for each SD-Card)

Display of the so-called “Card Identification Register”(CID) of the SD-Card in the slot. The data of the CID is necessary to differ the cards, since the label on the card is normally of no relevance. Unfortunately not all available SD-Cards works with the datalogger (see **chapter 5.2** for tested SD-Cards).

Line 2 : MID, OID, PNM, PRV of the CID

Line 3 : Product serial number (x) and manufacturing
date (month and year)

25. BAUD RATE (COM2)

```
*   COM 2:SIF001
     9600 Bd 8N1
     RS232
```

Display of the settings of the serial interface COM2.
Setting options are the same like COM1 (see above).

In the first line the actual setting of the mode is displayed (here “SIF001”, see display 16: SERIAL INTERFACES MODE for adjustment).

Serial commands: “CC2”, “CP2”, ”CR2” (ref. to **chapter 5.5**)

26. BAUD RATE (COM3)

```
*   COM 3:Off/Aus
    9600 Bd 8N1
    485-2Wire
```

Display of the settings of the serial interface COM3.
Setting options are the same like COM1 and COM3 (see above) except for the fixed serial operation mode (always RS485-2Wire, half-duplex operation).

In the first line the actual setting of the mode is displayed (here switched “Off/Aus”, see display 16: SERIAL INTERFACES MODE for adjustment).

Serial commands: “CC3”, “CP3”, (ref. to **chapter 5.5**)

27. OPERATION MODE / OUTPUT FORMAT / CLOCK DRIFT:

```
*Mode: Normal
 Output: DlxMet
 RTC Cor: -NN
```

1. Line

Display of the selected mode:
„Normal“: normal mode
„Maintenance “: Maintenance mode (Measuring values are not stored in the memory)

Remark:

The maintenance mode is stopped automatically when the display is switched off!

---

2. Line

Display of the output format for mean and extreme values as well as single-line instantaneous values (command “mm”/”mmc”), (ref. to **chapter 5.6.4)**:

“DLxMet”: Data output of the internal channels in the sequence as in the display.

“TDL14”: Data output of the internal channels in the order and number (14 instead of 10) according to Datalogger TDL14.

Serial command: “OF” (ref. to **chapter 5.5**)

3. Line

Output and setting of the datalogger clock drift (ref. to **chapter 3.2.9**).

Setting range: -31 … +31 (RTC correction value)

Serial command: “ZK” (ref. to **chapter 5.5**)

Remark:

The RTC correction value is factory-set on the first delivery.

3.2 Changing Parameters

All display values which are output with a "*" to top left can be changed.

In order to be able to edit the displayed value, first simply press the <ENTER>-key and then the <∇>-key. The value to be changed is then indicated by the flashing cursor. Now you can release both keys. With the <Δ> key the value can be raised, or decreased with the. <∇> key. If the set value is o.k., simply press the <ENTER>-key again in order to leave the edit mode or to proceed to the next changeable value.

3.2.1 Station Name

Station name identifies the measuring station. If several dataloggers are in use, then each logger should be given a different name. All letters and digits can be set as well as the underlining "_" and the space key.
When the station name is changed in the second line the output language is displayed, and can be selected through the arrow key.

3.2.2 Date

If an invalid date is entered (for example.: 31.4.00), it is corrected automatically.

3.2.3 Sensor Configuration

For changing the sensor configuration, it is necessary – after pressing the <ENTER>- and <∇> -key at the same time – to proceed as follows:
The second line is cancelled, and an interrogation mark is output. Afterwards, press the <∇>- and <Δ> -key at the same time for 10 seconds. The „countdown“ is shown on the display. After the „countdown“ has finished you can change the values as usual.

3.2.4 Measurement/Store Cycle

The **measurement cycle** indicates the time intervals at which the analogue sensor values are measured by the datalogger and the serial sensors (e.g. sensor-interface SIF) are requested. The measurement cycle can be changed during operation without the preceding data being lost. All digital inputs (wind speed, wind direction (every second) and precipitation) are continuously measured independently from the measured value set.

There are 23 different measurement intervals available:

seconds: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30

minutes: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

The **mean storing cycle** indicates time interval for storing the measuring values. For this, the measuring values are averaged, or accumulated.

The memory cycle is selectable in 12 steps.

Minutes : 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Example: meas. cycle
1 second

mean storing cycle 10 minutes

A mean value is calculated from 600 measuring values, and stored. The calculation of the mean value is carried out as arithmetic mean with „normal“ sensors. Exceptions are the wind direction (vectorial mean), and precipitation (formation of sums).

Remark:

When adjusting the measuring cycle the cycles of mean value memory and extreme value possibly have to be corrected to an integral multiple!

The mean storing cycle influences the storing time period of the mean values (see following **Table 4: Summary over memory time periods with 10 channels** for 9.1756.x0.000 without additional serial sensors (10 channels))

The **extreme storing value** cycle gives the time point when the extreme values are saved.

The extreme storing value cycle is selectable in 16 steps:

Minutes: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30

Hours: 1, 2, 3, 4, 6

The extreme value cycle influences the extreme value time period (see following **Table 4** for 10 channels).

The storage period is the period of time until the old data are overwritten. The datalogger has two ring memories. Both time periods depend on the number of measured channels.

Additionally the time period of the mean value memory depends on the mean storing cycle set. The time period of the extreme value memory depends similarly on the extreme storing value cycle set.

For other number of channels you can use the following formulas.

[ ]: means rounding down to integer

Calculation of quantity of mean ring memory dataset:

Quantity (Mean) = [32768 / (5 + 2 * Channels)] * 47

Calculation of quantity of extreme ring memory dataset:

Quantity (Extreme) = [32768 / (5 + 8 * Channels)] * 16

Example with 20 channels:

Quantity(Mean) = [32768 / (5 + 2 * 20)] * 47 = 34216 data set

Quantity(Extreme) = [32768 / (5 + 8 * 20)] * 16 = 3168 data set

That denote in this case the mean time period is 23.76 days (= 34216/1440) when the mean storing cycle is 1 minute.

Mean storing cycle Extreme storing cycle	Mean value time period [day]	Extreme value time period [day]
1 min	42	4
2 min	85	8
3 min	128	12
4 min	171	17
5 min	213	21
6 min	256	25
10 min	427	42
12 min	513	51
15 min	641	64
20 min	855	85
30 min	1282	128
1 h	2565	256
2 h		513
3 h		770
4 h		1026
6 h		1540

Table 4: Summary over memory time periods with 10 channels

3.2.5 Adjust Serial Interfaces Mode

According to following **Table 5** COM2 and COM3 can be switched off (lowest power consumption) or adjusted for the input of serial sensors and output of telegrams. It is not possible to set both serial interfaces to the same priority (e.g. COM2 to SIF001 and COM3 to SIF002). With this settings the number of channels can be changed and in this case the ring memories (mean and extreme) are new initialised.

To start the setting with the keys the procedure like sensor configuration (ref. to **chapter 3.2.3**) has to be done.

Remarks:

Before change this settings save the measuring data of the logger!

In case of changing the number of channels the old mean and extreme data is no more available!

The baud rate and mode (RS232 or RS485) parameters of a sensor must be same as the corresponding serial port of the datalogger (COM2 or COM3).

If more than one sensor is selected, the order of the sensor values in the display and memories is done according the priority in the following table. The sensor with the lowest priority value is output first. E.g. when Sonic (priority 1) and SIF(priority 3) are set, the values from the Sonic are given out before the data of the SIF.

The index of the table below shows the values needed for programming via the serial interface COM1 or USB (command “Cs”, ref. to **chapter 5.5**). With the command “CH” the content of the table can be requested. To get the lowest power consumption it is necessary to switch COM2 and COM3 off.

Index	Display text	Priority	Channel	Function
0	Off/Aus	-	-	COM not used (lowest power consumption)
1	Sonic R	1	3	THIES Windsensor SONIC-2D (ref. to **chapter 3.2.5.1**)
2	LPM/LNM A	2	7	THIES Laser Precipitation Monitor (ref. **3.2.5.3**)
3	T-WindLED	-	-	Telegram WindLED (ref. to **chapter 3.2.5.4**)
4	T-Online	-	-	Telegram Instantaneous values 1 (ref. **3.2.5.4**)
5	T-Online 2	-	-	Telegram Instantaneous values 2 (ref. **3.2.5.4**)
6	SIF001	3	6	THIES Sensor Interface 001 (ref. to **chapter 3.2.5.2**)
7	SIF002	3	9	THIES Sensor Interface 002 (ref. to **chapter 3.2.5.2**)
8	Sonic3D2R	4	6	THIES Windsensor SONIC-3D telegram 2 (ref. to **chapter 3.2.5.5**)
9	Sonic3D5R	4	5	THIES Windsensor SONIC-3D telegram 5 (ref. to **chapter 3.2.5.5**)
10	SIF0003	3	9	THIES Sensor Interface 003 (ref. to **chapter 3.2.5.2**)
11	SIF0004	3	9	THIES Sensor Interface 004 (ref. to **chapter 3.2.5.2**)
12	T-OnlWiIn	-	-	Telegram Instantaneous values 3 + WindLED (Internal) (ref. to **chapter 3.2.5.4**)
13	T-OnlWiS2	-	-	Telegram Instantaneous values 3 + WindLED (Sonic2D) (ref. to **chapter 3.2.5.4**)
14	SIF0005	3	9	THIES Sensor Interface 005 (ref. to **chapter 3.2.5.2**)
15	Clima US	5	10	THIES Clima Sensor US (ref. to **chapter 3.2.5.6**)

Table 5: Serial Interface Modes

3.2.5.1 Sensor THIES SONIC-2D

The following THIES SONIC-2D sensors are connectable to the datalogger on COM2 (RS485-4Wire, full-duplex) or COM3 (RS485-2Wire, half-duplex):

- "Ultrasonic Anemometer 2D" with software version 3.09 and higher (4.382x.xx.xxx)
- "Ultrasonic Anemometer 2D compact" with software version 1.2 and higher (4.3871.xx.xxx)

The settings below has to be done:

- ID = 0
- Baudrate 9600 Bd 8N1

  4.382x.xx.xxx: BR = 5, command "00BR00005"

  4.3871.xx.xxx: BR = 96 and BP = 8
- automatic output off: TT = 0
- full-duplex : DM = 2 (or 1) or half-duplex: DM = 0 and RD = 20
- Remark for 4.3871.xx.xxx: storage of changed parameter with "00KY0"

Preset THIES SONIC versions working with this datalogger:

- Full-duplex (COM2): 4.3820.00.300, 4.3820.30.300
- Half-duplex(COM3): 4.3820.01.301, 4.3820.31.301

The data of the SONIC-2D are requested with the command "00TR00002" (VDT-telegram: Wind speed, wind direction, acoustic-virtual temperature). With the command "SO2"(ref. to **chapter 5.5**) it is possible to send a command to the sensor.

3.2.5.2 Sensor-Interface SIF

In the case of model 9.175x.x0.**1**00 is a so-called sensor-interface SIF build in and is connected to COM2 (9600 Bd 8N1, RS232 mode) of the datalogger. Available are different SIF which separate between number and type of channels. The data are requested with the command "mm". The command "SI2" (ref. to **chapter 5.5**) can be used to send a command to the SIF.

Types:

SIF001, 6 channels: Radiation 2 + 3, Direct-radiation 1 + 2, Temperature 3 + 4

SIF002, 9 channels: 10 V-input, 1V-Input 1 + 2, 20 mA-Input 2 + 3 + 4, Temperature 3 + 4 + 5

SIF003, 9 channels:10 V-input 1 + 2, Radiation 2 + 3, 20 mA-Input 2 + 3, Temperature 3 + 4 + 5

SIF004, 9 channels: 10 V-input 1 + 2, Radiation 2 + 3, 4-20 mA-Input 2, 20 mA-Input 3, Temperature 3 + 4 + 5

SIF005, 9 channels: 10 V-input, 1V-Input 1 + 2, 4-20 mA-Input 2 + 3 (Wind speed 0…60m/s, wind direction), 20 mA-Input 4, Temperature 3 + 4 + 5

3.2.5.3 Sensor THIES LPM

The THIES Laser Precipitation Monitor LPM (5.4110.xx.xxx) sensor is connectable to the datalogger on COM2 (RS485-4Wire, full-duplex) or COM3 (RS485-2Wire, half-duplex).

The settings below has to be done:

- Baud rate 9600 Bd 8N1: BR = 5
- automatic telegram output on: TM = 4, 5, 6 or 7
- full-duplex : BD = 0 or half-duplex: BD = 1

The every minute from LPM send telegram is received automatically by the datalogger.

The datalogger uses the 7 values below from the telegram 4 to 7 of the LPM:

1. 1 min. SYNOP Tab.4680 (Nr. 12 of the telegram)
2. 1 min Intensity [µm/min] (Nr. 14)
3. Precipitation amount [mm] (Nr. 17)
4. 1 min. Visibility in precipitation [m] (Nr. 18)
5. 1 min. Measuring quality [%] (Nr. 20)
6. Interior temperature [°C] (Nr. 38)
7. State (error and warning) (Nr. 22 up to 36)

Specific mean value calculation and common hints:

for 1.: SYNOP

The highest SYNOP-Code in the mean value interval is to be saved.

Exceptional cases:

- Code „77“ (snow grains) will be evaluated between code „51“ and „52“ (drizzle)
- Error codes „–1“, „41“ or „42“ have priority over all other codes.

for 2.: Intensity

The measurement value is calculated to µm/min without decimal point.

Conversion: mm/h = µm/min/16.667

Resolution: 0.06 mm/h

for 3.: Precipitation amount

Mean memory:
The difference in the storing interval will be saved (resolution: 0.1 mm)

Extreme memory:
The lowest and the highest amount in the interval is saved.

The amount is limited to 3000.0 mm. If the amount exceeds the threshold values 3000, 6000 or 9000 mm the according values are subtracted

Example: LPM-amount 3507.16 mm -> datalogger stores 507.2 mm

for 4.: Visibility in precipitation

The visibility is limited to 30000 m.

for 7.: State (error and warning)

The 15 error and warning status bits will be combined to one number depending on their bit value below:

Bit 14(Status Laser) to Bit 0 (Status Control output laser power)

Limitation: 32751

Example: Status Laser (Bit 14) and Status Sensor supply (Bit 8) are set.

State = $2^{14} + 2^{8} = 16384 + 256 = 16640$

Specific extreme value calculation:

for 1.: SYNOP

The code „77“ (snow grains) is changed to „54“ (but „54“ means according Tab.4680 code light freezing drizzle).

With the command “SL2” (ref. to **chapter 5.5**) it is possible to send a command to the LPM.

3.2.5.4 Telegrams

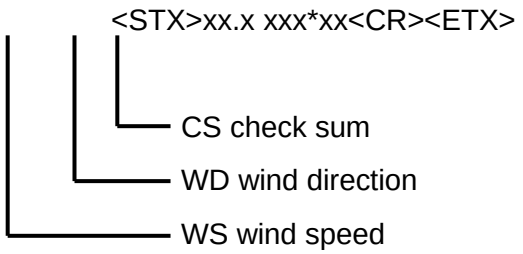
The telegrams with instantaneous values are send every second by the datalogger.

All telegrams are output with a check sum:

- output of the check sum direct for the <CR>-symbol.
- start of the check sum is marked with a „*“.
- calculation of the check sum starts after the <STX>-symbol (if available). <STX> and “*” are not part of the calculation.
- check sum is formed by exclusive-or function (starting with 0).
- 8 bit check sum result is output with two characters (high and low nibble) with a value range from 0 to F (hexadecimal).

Telegram WindLED:

Standard Thies telegram for the exchange of wind data (e.g. used by Wind Indicator LED 4.3222.xx.xxx). The wind data of sensor 1 and 2 are send.



Telegram Instantaneous values 1 / Instantaneous values 2:

Output of all instantaneous data. Order of the data is like in the display (ref. to. **chapter 3.1**)

Telegram „Online“ is the same like the answer of the command „mmc“.

Telegram „Online 2“ starts additional with <STX> and sends a <ETX> at the end.

Telegram T-OnlWiIn / T-OnlWiS2:

Output of all instantaneous data and the telegram WindLED.

The telegram for the instantaneous data is equivalent to the answer of the command “mmc”, but instead of the decimal time the string “DLXMET_” is given out.

With the adjustment “T-OnlWiIn” accordingly the WindLED telegram (see above) is sended.

In contrast with the setting “T-OnlWiS2” the data of a Sonic2D is sended with the WindLED telegram. Example:

```
DLXMET_  5.4 240  -1.4 ???.?   0.0 ????.?    2.3  24.6   0.0    0.0  0.1
291  22.0 12.05.09 11:03:03*13<CRLF><STX> 0.1 291*15<CR><ETX>
```

Remark for baud rate:

We recommend to use a least a baud rate of 2400 Bd, so that all data can be output within a second.

3.2.5.5 Sensor THIES SONIC-3D

The THIES SONIC-3D (4.3830.xx.xxx, software 3.10 and higher) anemometer is connectable to the datalogger on COM2 (RS485-4Wire, full-duplex) or COM3 (RS485-2Wire, half-duplex).

The settings below has to be done:

- ID = 0
- Baudrate 9600 Bd 8N1: BR = 5, command “00BR00005”
- automatic output off (TT = 0)
- full-duplex : DM = 2 (or 1) or half-duplex: DM = 0 und RD = 20

The data of the SONIC-3D are requested with the command (subject to setting of serial interface)

“00TR2” (telegram 2)

or

“00TR5” (telegram 5)

The data of the telegram will be saved not averaged in the mean memory, thus the data is not changed by the datalogger.

If necessary the setting of the averaging time (command „AV“ of the sensor), the averaging method (command „AM“) and the unit of the wind speed (command „OS“) are to be set by the user. The datalogger does not change sensor settings.

With the command “SD2” (ref. to chap. **5.5**) it is possible to send a command to the sensor.

3.2.5.6 Sensor THIES CLIMA US

The THIES CLIMA SENSOR US (4.920x.xx.xxx) sensor is connectable to the datalogger on COM2 (RS485-4Wire, full-duplex) or COM3 (RS485-2Wire, half-duplex).

The sensor settings below has to be done:

- CI=0 (Thies command interpreter)
- ID=0
- BR=96 + BP=8 (Baudrate 9600Bd 8N1)
- DM=0 + RD=20 or DM=2(half- or full-duplex depending on connection to datalogger)
- TT=0 (no automatic telegram)
- DT=0 (short telegram)
- BO=0 or BO=1 (calculation brightness)
- OS=0 (recommended: unit wind speed m/s)
- HH=1 (recommended: Verbose Mode off)
- Remark: storage of changed parameter with “00KY0” or “00CS1”

The data of the sensor are requested with the command “00TR6” (telegram 6).

The datalogger uses the 10 values below from the telegram:

1. Wind speed (unit depends on command “OS”)
2. Wind direction
3. Temperature
4. relative Humidity
5. Air pressure
6. Brightness (calculation depends on command ”BO”)
7. Direction of brightness
8. Precipitation Intensity [µm/min]
9. Precipitation amount
10. SYNOP

Specific mean value calculation and common hints:

for 8.: Precipitation Intensity

The measurement value is calculated to µm/min without decimal point.

Conversion: mm/h = µm/min/16.667

Resolution: 0.06 mm/h

for 9.: Precipitation amount

Mean memory:
The difference in the storing interval will be saved (resolution: 0.1 mm)

Extreme memory:
The lowest and the highest amount in the interval is saved.

for 10.: SYNOP

The highest SYNOP-Code in the mean value interval is to be saved.

With the command “SC2” (ref. to **chapter 5.5**) it is possible to send a command to the sensor.

3.2.6 Switch Output Timer

The so called switch output can be programmed in two modes:

- 5 daily On-Timers for short power-on-time (Timer 1 to 5)
- 1 daily Off-Timer for short interrupting time (Timer 6)

The time period is selectable from 5 to 31 minutes. For setting via a serial interface refer to chap. See **5.5** (command “FS”).

On-Timers:

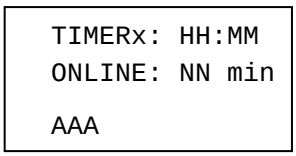
The On-Timers activate up to 5 daily time slots for an externally connected GSM-modem. By setting small time slots (for ex. 5 min) the average current consumption of the modem per day (operating current approx. 200 mA) can be kept down.
During a data transmission via a timer-controlled modem, the remaining power-on-time is fixed on 5 min, thus a re-logging-in in case of a failure is guaranteed within this period. When the datalogger is always on (Display on, e.g. telegram output or automatic receive of serial data), the output will be never switch off.

Off-Timer:

The switch output is always on, except during the programmed time period. E.g with this function a Modem can be daily restartet automatically. The setting of the period to1 select the “Always-On”-mode.

Selection with the Display:

In the edit mode all timers can be set in turn.
Selectable are the daily starting time (“HH:MM”), and the minimum power-on-period (“NN”, Timer 1 to 5) respectively interrupting time (“NN”, Timer 6). If the Off-Timer 6 is programmed, all the On-Timers will be deactivated automatically.



x = 1,2,3,4,5,6	HH: 0…23	MM: 0…59
x = 1…5:	x = 6:	
NN = 0, 5…31	0, 1*, 5…31	
AAA = “ON”	“OFF”	

„HH:MM“ indicates the starting time of the respective timer slot in the format hour:min.

The period is selectable in minute-increments from 5 to 31. When the period is set to 0, the respective timer is deactivated.

***= “Always-On”-mode (Timer 6) : selection with setting the period “NN” to 1 (starting time “HH:MM” is then irrelevant).

Remark:

Only timer 1 is activated even if the discharge-protection for the accumulator is active (voltage <= 11.0 V).

3.2.7 DCF77 Receiving Control

```
 DCF77 Test: ss nn
D:1.0s L:10 0
```

DCF-antenna on

```
DCF77 Test: --
```

DCF-antenna off

This display serves for controlling and setting of the DCF77-antenna.

„ss“: indicates the seconds (0-60, with overflow „??“), after the minute mark has been identified

„nn“: cycle counter (0-99) of the received second marks.

„D:D.Ds“: time difference of the second marks in seconds (ideal: 1.0s, except for the second 60 (minute mark): 2.0 s)

„L:NN B“: length of the second marks in 10ms(NN).

B indicates the binary decoding (L= 6..13 [10 ms] -> „0“, L= 16...23 [10 ms] -> „1“, other lengths are output with “?”)

After this output has been activated, the following values appear for example:

```
DCF77 Test: ??
2 D:1.0s L:19 1
```

The minute mark has not yet been identified („??“). The 2. second mark received has a length of 190 (19*10) ms.
The length of the second mark (optimal: L=10 resp. L=20, the length is shorter with weak reception) is well suited for the optimal alignment of the antenna.

After the minute mark has been recognized (D:2.0 s und L: 7...13 [10 ms]) „ss“ is output and is raised every second up to a maximum of 60. When the reception is correct, “ss” and “nn” run almost synchronously. A difference of more than 1 means, that error pulses or not enough pulses have been received; thus a decoding of the DCF77 time information is impossible.

```
 DCF77 Test: 32
32 D:1.0s L:08 0
```

Remark:

If the reception is very weak in the daytime, the antenna should be aligned at night (broader reach). Never try to align the antenna during sunrise or sunset (site of transmitter and receiver/data logger) !
Possibly, there are several alignments (neither horizontal!) allowing a reception (reflections).
The transmitter can be inactive for several hours (thunderstorm close to the sender).

3.2.8 DCF77 Synchronization

```
*DCF: 1 !!.!!.!!
 ffff n !!:!!:!!

!!.!!.!! !!:!! 0
```

DCF-antenna on

```
*DCF77: 0


!!.!!.!! !!:!! 0
```

DCF-antenna off

This display serves for switching on and off the DCF-antenna, indicates the last time of synchronization (third line) and the manual start of synchronization.

When the DCF-antenna is active, it tries to receive a time telegram at night from 01:30 h (max. 10 minutes) because of the better reception. This time telegram is sent during standard time as CET (“Central European Time”, CET=UTC+1 h), and during daylight saving time as CEST (“Central European Summer Time”, CEST=UTC+2 h). This time telegram is converted in UTC, and the internal clock is synchronized.

In the edit mode the antenna can be activated and deactivated. Additionally in the third line the last synchronised DCF77-Time is given out:

```
*DCF: 1

30.04.09 03:33 s
```

s = 0 CET/standard time

s = 1 CEST/daylight saving time

With active DCF-antenna, and sufficient reception, when you wait approx. 2 minutes or longer, the DCF time telegram is displayed, and the internal clock is synchronized (provided that no error occurs).

Example: Reception of a time telegram (year not yet received)

```
*DCF: 1  30.04.!!
 ffff n  09:06:52
```

ffff = Error display in the hexadecimal (0 means “no

n = 0...9 display of the received second pulses

When the minute mark has been received, the seconds are set to zero
Second 28: reception minute
Second 35: reception hour
Second 41: reception day
Second 49: reception month
Second 57: reception year

3.2.9 Setting the Clock Drift

The clock drift results from the conditional manufacturing tolerance, the ageing and temperature dependency of the used quartz crystal.

In case of larger deviations in time the clock drift error of the quartz crystal might be compensated (for ex. after the first operating year), if required.

Formula for the mean frequency deviation by **temperature drift** :

$$\Delta f/f = -0.036 \text{ ppm} * (\text{temperature} - 25°C)^2$$

Example:
With a mean working temperature of 5°C the difference compared to room temperature is approximately 10 minutes per year (calculation for 5°C: ca. 7.5 min/a).

Setting range:	-31 … +31	(equates to –5.448 s/d … +10.896 s/d)
Resolution negative:	-0.1757 s/d	
Resolution positive:	+0.3515 s/d	

4 Measuring Value Acquisition

For reasons of current consumption the display, and other control parts are switched off in case that for 4 minutes no button has been pressed, or no data communication over COM1 or USB has been proceeded. No deactivation of the display occurs if the serial interface COM2 or COM3 are configured for telegram-output or for automatic receive of data (e.g. LPM sensor).
When the display is on (display mode) all configured internal channels are scanned every second.
In the pure measuring mode (display off) the configured analogue measuring channels are measured, depending on the set measuring cycle (1 second to 1 hour). The digital measuring channels are measured every second.
The following figures will make clear the process of the measuring value acquisition:

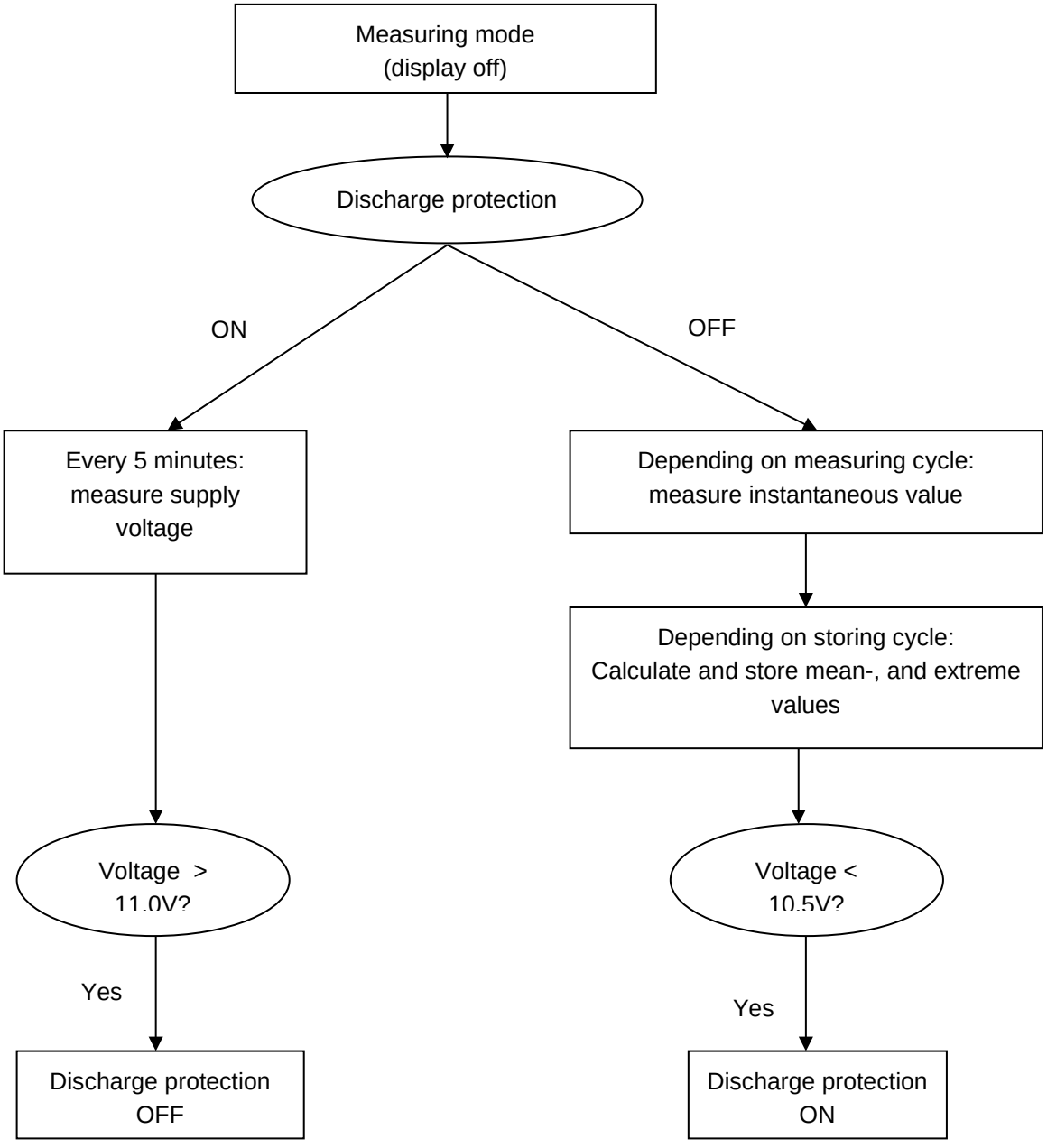


Figure 14: Flow diagram in the measuring mode (display off)

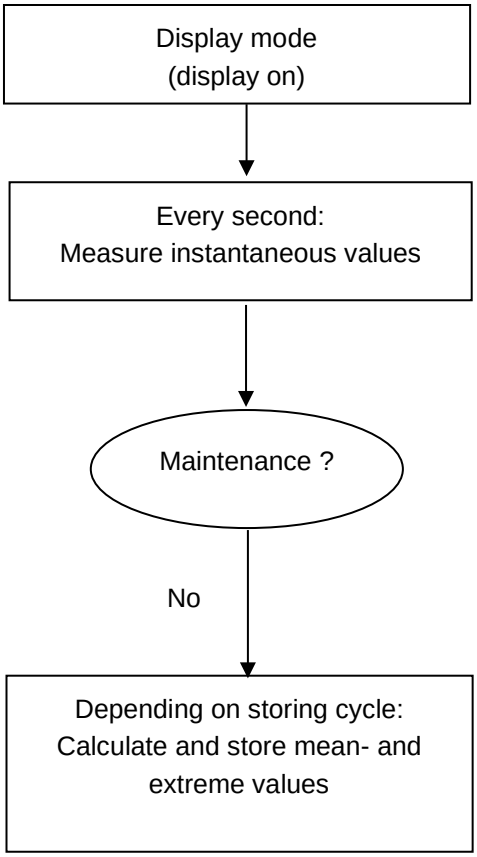


Figure 15: Flow diagram in the display mode (display on)

5 Data Output

On principle, there are three interfaces existing at the data logger for the data output:

- serial interface COM1 (RS232/RS485)
- serial interface USB
- SD-Card (Secure Digital memory Card)

With the serial interfaces COM1 and USB it is possible to query the data of the data logger via a cable from another computer. Via the both serial interfaces it is possible to wake-up the datalogger (Display on) with sending a byte, therefore it is not necessary to wake-up with the "<▽>"ON -key.

The serial data output can be carried out manually (not USB) or by remote-control (ref. to **chapter 5.5** for commands).

For the reading out of data you can use a usual terminal program (e.g. “Terminal” of WINDOWS, general settings for COM1 see following **Table 6**). For communication via USB also a terminal program can be used, but here a configuration is not necessary (except COM-port, ref. to **chapter 5.4**)

The transmitted data are output as ASCII-files (clear text). Thus, you are in a position, to see your data records with word processors, as well, to process them and to print them out. Herewith, you are also in a position to follow up your data via the ASCII-interface with standard-software such as spread sheet, data bases etc.

Furthermore it is possible to upload a firmware over COM1.

Baud / Bits per second	**just like baud rate COM1 of the data logger**	
Data bits (*)	8	7
Parity (*)	none	even
Stop bit	1	
Flow control / Handshaking	none	

Table 6: Terminal Program Configuration COM1

(*): possible settings: 8N1 or 7E1

5.1 Data Output Manually

With the manually data output the complete ring memory (mean or extreme) will be given out on serial port COM1 or on a SD-Card (ref. to **chapter 5.2**).

SD-Card:

1. Set the display to

```
* Data Output
      ?
```

2. Push and snap in the SD-Card into the slot of the datalogger.
3. First press <ENTER> and then <▼> -button, until the cursor is flashing.
4. Press <▼> - or <▲> -button for at least 3 seconds.
5. Select mean or extreme value memory:

```
* Data Output
    X-data
```

X: “M” Mean value: <▼>

X: “E” Extreme value: <▲>

6. Start output: Press <ENTER>
7. To cancel or end data output: Press <ENTER>
8. Finish of output: Output „ END “ on display (line 2)

```
* Data Output
Y ooo: NNNNN END
ssssY00.TXT
```

Y: “M” (mean) or “E” (extreme)

ooo: “SD” or “COM1”

NNNNN: number of scanned data records

Line 3: Filename on SD-Card (ssss: station name)

9. Remove the card when the output is ready:
   Push the Card until it releases, then pull it out (so called ejector type Push-In/Push- Out).

Serial (COM1):

As above but without SD-card in socket (number 2 and 9 do not apply).

Additional information's for the using of SD-Cards:

The data files are stored on the SD-Card in the following tree structure:

`D:\`	Root-Directory (here drive D)
`└── sssss\`	Subdirectory (Station name)
`├── sssssMnn.TXT`	Mean memory files (nn: 00..99)
`└── sssssEnn.TXT`	Extreme memory files (nn: 00..99)

Example station "MET23": `"D:\MET23\MET23M00.TXT"`

The data on a SD-Card is always written into the "00"-file. If a "00"-file is present in the subdirectory the datalogger tries to append only the new data. Whenever the "00"-file is greater then ten million bytes, the "00"-file is renamed to a not existing "01"- to "99"-file. Unless the renaming is possible, the output of the data will be broken off.

Remarks:

The data logger do not delete any data on the SD-Card.

The user is responsible to use a SD-Card with enough free memory and the deleting of the old "01"- to "99"-files.

The write-protect tab of the SD-Card is not used by the data logger.

We strongly recommend to backup the data on alternative media.
Do not eject the card while writing the data. Press the "ENTER"-Key for breaking the output.

Liability is excluded for loss of data.

*Refer to **chapter 5.2** for recommended SD-Cards.*

5.2 Recommendations on SD-CARD

To display the so-called “Card Identification Register”(CID: MID, OID, PNM, PRV) of the SD-Card refer to **chapter 3.1** (Baud rate COM1/SD-Card). The data of the CID is necessary to differ the cards, since the label on the card is normally of no relevance.

List of tested SD-Cards (maximum size 2GB, sorted by manufacturer ID) see following table.

MID: Manufacturer ID OID: OEM/Application ID

PNM: Product name PRV: Product version

Label	Size	Manufacturer	MID	OID	PNM	PRV	Work with Datalogger
Platinum	2GB	Panasonic	1	__	_____	0.0	JA
Kingston	512MB	Toshiba	2	TM	SD512	1.5	JA
Kingston AgfaPhoto	2GB				SD02G	2.8 3.2 3.8	
					SA02G	0.9	
SanDisk	512MB	SanDisk	3	SD	SD512	8.0	nein
	1GB				SD01G		
	2GB				SD02G		
ATP (industrial)	512MB	???	9	AP	AF_SD	1.0	JA
Platinum	1GB	???	18	GT		1.0	JA
Platinum	1GB	Samsung	27	SM	UD___	1.0	JA
PNY Technologies extreme memory AgfaPhoto	1GB	???	39	PH	SD01G	2.0	JA
	2GB				SD02G	3.0	
extreme memory	1GB	???	62	H-	FLASH	0.0	JA
Platinum	2GB	???	111	__	SMI__	0.0	JA
Transcend	2GB	???	116	J‘	SDC	1.0	JA
extreme memory	2GB	???	136	__	NCARD	1.0	JA

Table 7: Tested SD-Cards

Remarks on SD-Card:

Use only positive tested SD-Cards. Refer to the above list.

Not all cards are compatible with the datalogger.

The SD-Cards must be preformatted with the standard “FAT16”-format (deliverer condition of the SD-Card).

5.3 Connecting RS232 CABLE OF COM1

The serial interface COM1 in RS232 mode is designed as “three-wire”-connection. The transmission line (TxD) and the receiving line (RxD) are to be crossed in the cable.

PC/TERMINAL		cable	Datalogger DLx	
Sub-D25 (25 pins)			Sub- D9	
TxD	2	——	2	RxD
RxD	3	——	3	TxD
Ground	7	——	5	Ground
Both sides Sub-D9 (9 pins)				
RxD	2	X	2	RxD
TxD	3	X	3	TxD
Ground	5	——	5	Ground

Table 8: Connections COM1 for RS232

5.4 USB

For the communication via USB it is required to have a VCP (Virtual COM Port) driver on the used PC. Virtual COM port drivers cause the USB device to appear as an additional COM port available to the PC. Application software can access the USB device in the same way as it would access a standard COM port.

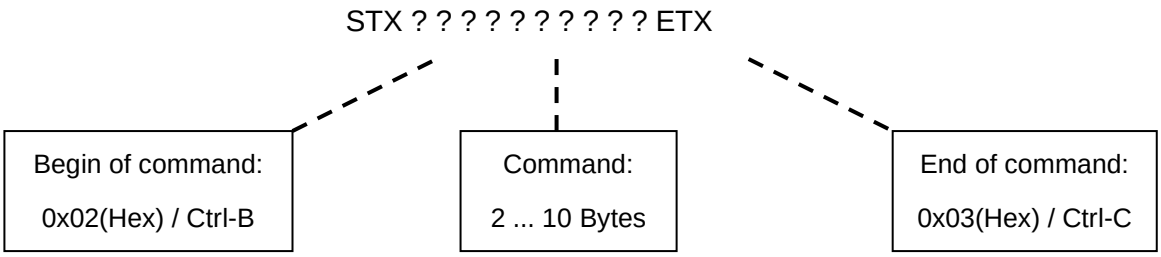
The driver is available from FTDI (FT245R): http://www.ftdichip.com/
In addition installation guides for several operating systems can be downloaded from there.

The USB cable between PC and datalogger is a common so-called AB-plug-cable.

5.5 Format of the Commands

The following commands operate with the serial interfaces COM1 and USB of the datalogger.

The commands are 4 to 12 bytes long:



LIST OF THE COMMANDS:

"HH"	Help: indicates the list of entering commands.
“PD“	Turn Datalogger into “power down” (display off, Measuring-Mode).
“RS”	Reset of the Datalogger. Start of Bootloader.
„CC”<n><0..9>	Set baud rate COM n (n = 1,2,3) 0:300 Bd …5:9600 Bd … 9:115200 Bd
„CP“<n><0,1>	Set data bits and parity COM n (n = 1,2,3) 0: 8N1 1: 7E1
„CR“<n><0,1>	Set operation mode COM n (n = 1,2) 0: RS232 1: RS485-4w
“Cs000 ”aaa’ ‘bbb	Configure sensor or telegram for COM2 and COM3 aaa:COM2 bbb:COM3 values according to index in **Table 5: Serial Interface Modes** Example: STX “Cs000 008 001”ETX COM2: 8 (-> SIF002) COM3: 1 (-> SONIC) Ref. to chap.**3.2.5** for additional remarks. **Old data can be deleted!**
“CH”	Output of setting possibilities for COM2 and COM3
„MT“<01s,02s,03s,04s,05s,06s,10s,12s,15s,20s,30s,01m,02m,03m,04m,05m,06m,10m,12m,15m,20m,30m,60m>	Set measuring cycle in seconds or minutes.
„ST“<01m,02m,03m,04m,05m,06m,10m,12m,15m,20m,30m,60m>	Set mean storing cycle in minutes.
„ET“<01m,02m,03m,04m,05m,06m,10m,12m,15m,20m,30m,01h,02h,03h,04h,06h>	Set extreme storing cycle in minutes and hours.
„SS“	Output of all stored mean values.
„GS“	Complete mean memory: Reasonable only, when the logger has re-initialised itself, in order to save data which have not been overwritten.
“EE”	Output of all stored extreme values.
"TS"<DdMoYy> “ts”<d><m><y>	Stored mean data of one day Description of parameters: ref. to **chapter 5.5.1**

„DS“<DdMoYyHhMi> “ds”<d><m><y><h><m>	Output of stored mean data from a specific time Description of parameters: ref. to **chapter 5.5.1**
"TE"<DdMoYy> “te”<d><m><y>	Stored extreme data of one day Description of parameters: ref. to **chapter 5.5.1**
„DE“<DdMoYyHhMi> “de” ”<d><m><y><h><m>	Output of stored extreme data from a specific time Description of parameters: refer to **chapter 5.5.1**
"EP"	Output of EEPROM-data (parameter memory) for service purposes.
"LL"	Logger status: Output station name, date and time, state of the AD-transducer, sensor configuration, measuring and storing rates, voltage of the accumulator, state of power supply, radiation constant, EEPROM-status, operation mode, contact output-Timer, last DCF-synchronisation time and appropriate logger time.
"MM"	Instant. measuring values: output with sensor identification (multiline).
"mm" “mmc”	Instantaneous measuring values: output as single-line data record (sequence of data: refer to **chapter 5.6.4**) Output like “mm”-command and check sum. Calculation of check sum refer to **chapter 3.2.5.4**.
"DD"	Output Logger-date.
"DT"<1..31>	Entering day: Setting of day for the logger-clock **(*)** Response: entered day, logger date.
"DM"<1..12>	Entering month: setting of month for the logger-clock **(*)** Response: entered month, logger date.
"DJ"<0..99>	Entering year: setting of year for logger-clock **(*)** Response: entered year, logger date.
"ZZ"	Output logger-time.
"ZH"<0..23>	Entering hour: entering of hour for the logger-clock **(*)** Response: entered hour, logger-time.
"ZM" <0..59>	Entering minute: entering of minute for the logger-clock **(*)**. The second is set to zero. Response: entered minute, logger-time.
„ZS“ <0..59>	Entering second: setting of second for the logger-clock. **(*)** Response: entered second, logger time.
„ZK“a<0..31>	Enter correction of logger-clock drift (a: +,-) (refer to **chapter 3.2.9)**.
"XX"	Output of the station name, instrument type, and software-version.
„XXn“<AAAAA>	Enter station name.
„LM“<500..900>	Enter of the lower measuring range in hPa of the air pressure sensor.
„LN“<700..1200>	Enter of the higher measuring range in hPa of the air pressure sensor.
“WV”<0..5>	Wind speed sensor type (0:COMx, 1:Compact1, 2:Classic1, 3:FirstClass, 4:Classic2, 5:Compact2).
“WW”<0,1>	Wind speed sensor current flow test (0:Off).
“WD”<0..2>	Wind direction sensor type (0:COMx, 1:5-/8-Bit, 2:10-Bit).

„NS“<1,2>	Precipitation sensor type resolution (0.1mm/0.2mm).
“NT“<0,1>	Precipitation sensor current flow test (0:Off).
„LS“<0,1>	Digital input mode: Event(0) or Length(1).
„LT“<0,1>	Digital input logic: active logic low (0) or active logic high (1).
„SK“<n>’ ’<NN.NNNN>	Enter radiation constant n (n=1…5). Example: STX „SK1 12.42“ ETX (set constant 1 to 12.42).
“KK“<01..10>’ ’<0,1>	Entering sensor configuration of a internal sensor <01..10> sensor number <0,1> 0 -> switch off 1 -> switch on Example: STX “KK02 1“ ETX (switch on sensor 2)
“FF“	Output of all switch-output timers.
“FS“<1..6><HH><MM><LL>	Setting of a switch output-timer (refer to **chapter 3.2.6**): **(**)** <1..6> timer number (1…5: On, 6: Off), <HH> starting hour, <MM> starting minute, <LL> time period in minutes(0, 5 …31) Ex.: STX “FS2083005“ ETX (timer 2, start at 08:30 h, period: 5 min)
“OF”<0,1>	Setting of the output format: DLxMet (0) or TDL14(1) (refer to **chapter 5.6.4**).
„VT“<01s,02s,03s,04s,05s,06s, 10s,12s,15s,20s,30s>	Setting of the turn-on time of the switched sensor excitation in seconds (see **chapter 2.1.11**).
“SI2”<AAAAAAA>	Transparent Gateway/Bridge command to Sensor-Interface SIF (9.175x.x0.**1**00) Operation only if SIF configured for COM2 or COM3. The command <AAAAAAA> (up to 7 signs) is send to COM2 or COM3 and the answer is given back. STX and ETX is added automatically. Example: STX “SI2HH” ETX -> Help (HH) from Sensor-Interface
“SO2”<AAAAAAAAA> “SL2”<AAAAAAAAA> “SD2”<AAAAAAAAA> “SC2”<AAAAAAAAA>	Transparent Gateway/Bridge command to SONIC-2D(“SO2”), SONIC-3D(“SD2”), LPM (“SL2”) or Clima Sensor US(“SC2”) connected to COM2 or COM3. Works only for commands with a single-line answer and if SONIC respectively LPM is configured to COM2 or COM3. The command <AAAAAAAAA> (up to 9 signs) is send to COM2 or COM3 and the answer is given back. CR is added automatically. Example: STX”SO200TT00000”ETX -> TT parameter of the SONIC-2D is set to 0 Remark LPM: When using half-duplex mode the command can destroy information of the every minute automatically send data telegram.
CR LF"?"CR LF	Response in case of unknown command or erroneous parameter.

Table 9: List of commands

(*): The internal divider of the clock will be reset by each write into the register. That means, the internal 1/100 second-register is reset and therefore the change of the second is manipulated.

(**): In the case of a On-Timer (1…5) is programmed (LL: >=5), automatically the Off-Timer (6) is switched off and vice versa.

ADDITIONAL CHARACTERS AND THEIR MEANING:

STX (0x02 Hex)	Start of command
ETX (0x03 Hex)	End of command
EOT (0x04 Hex)	End of memory data output by the commands: "SS", "GS", “EE”, "ts", "ds", “TS”, “DS”, ”, "te", "de", “TE”, “DE”
XON (0x11 Hex)	Software-Handshake (continue output)
XOFF (0x13 Hex)	Software-Handshake (stop output; max. 4 minutes, otherwise the logger turns itself off!)

5.5.1 Parameter for Memory Commands

Remark:

Time duration for searching mean data can be up to several seconds.

ASCII parameters (2 bytes per parameter, commands “TS”, “DS”, “TE”, DE”) :

Dd: day (01..31) Mo: month (01..12) Yy: year (00..99) w/o century

Hh: hour (00..23) Mi: minute (00..59)

Example: STX“DS0103041200“ETX
Mean data from 1.03.2004 12:00 are required.

Binary parameters (1 byte per parameter, commands “ts”, ”ds”, “te”, “de”):

d : day in binary + 28 (29..59)

m : month in binary + 28 (29..40)

y : year in binary + 28 (28..127) w/o century

h : hour in binary + 28 (28..52)

m : minute in binary + 28 (28..77)

Example: STX“ds“ 29 31 32 40 28 ETX

Mean data from 1.03.2004 12 :00 are required.

Binary parameters have to enter without spaces!

5.6 Data Format

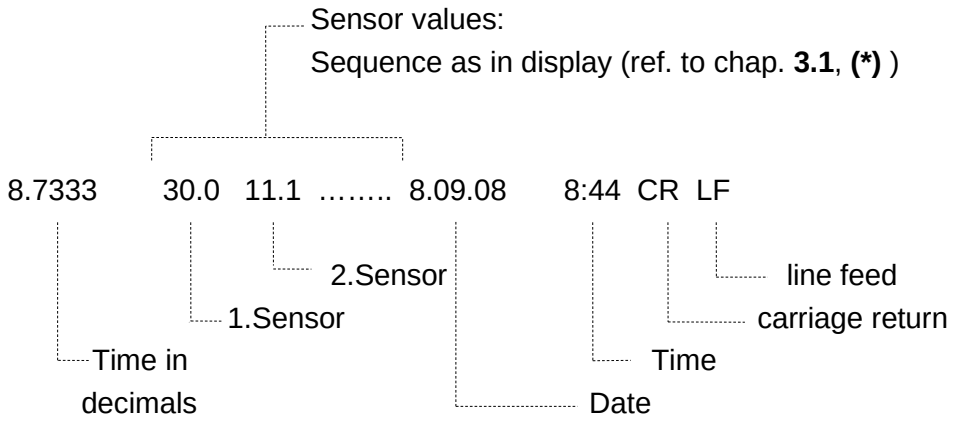
The data are output in tabular form with fixed telegram length. Separator is at least one space (ASCII 32). Lines are concluded with "CR LF". Decimal separator is the point. Erroneous values are marked by one or several "?" respectively “!”. Non-configured internal channels are marked by one or more “-“. The end of the serial (COM1 and USB) data output is identified with the End Line (not on SD-Card, ref. to **chapter 5.6.3**)

Remark:

The date and time in the data line refers to the end of the measurement.

5.6.1 Mean Data

Data Line Mean Data:



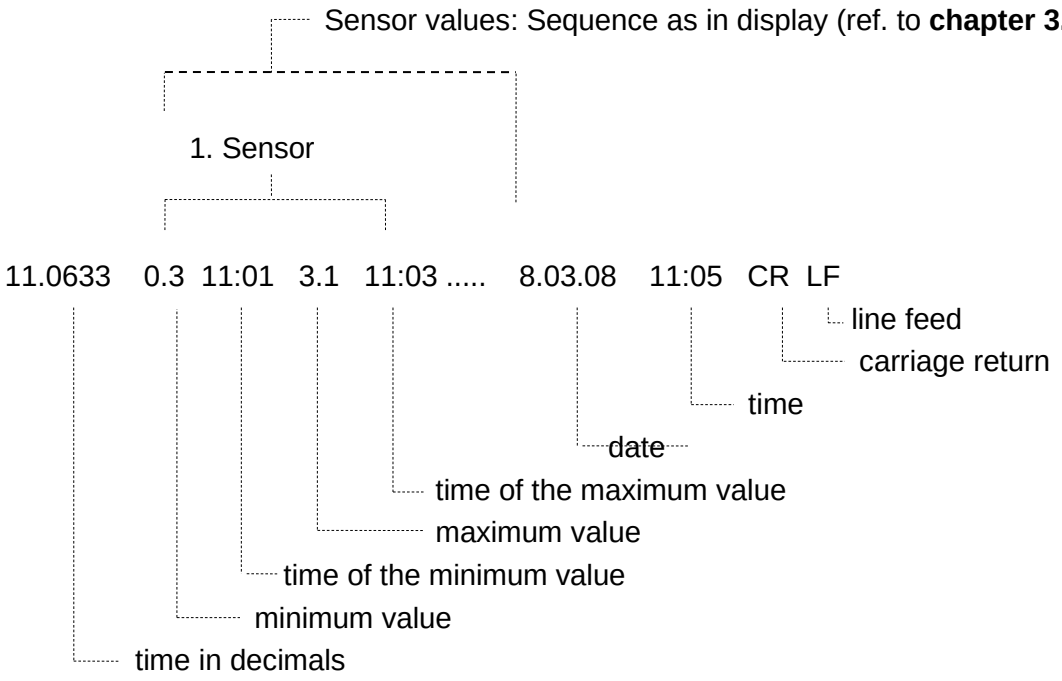
Examples (9.175x.x0.**1**00, Sensor-Interface with 6 additionally sensors):

```
15.0667 57.5 329  -1.5 ???.?   0.0 ????.? 1033.2  24.4   0.0    1.0
0.0    1.1    1.2    1.0  -5.0  51.6 27.10.08 15:04

15.0833 57.5 329  -1.5 ???.?   0.0 ????.? 1033.2  24.4   0.0    1.0
0.0    1.0    1.2    0.8  -5.0  51.6 27.10.08 15:05

15.1000 57.5 329  -1.5 ???.?   0.0 ????.? 1033.2  24.6   0.0    1.0
0.0    0.9    1.1    0.7  -5.0  51.6 27.10.08 15:06

15.1167 57.5 329  -1.5 ???.?   0.0 ????.? 1033.2  24.6   0.0    1.0
0.0    1.1    1.2    1.0  -5.0  51.6 27.10.08 15:07
```

(*) : Does only apply when output format is switched to “DLxMet”, ref. to **chapter 5.6.4** .

5.6.2 Extreme Data

Data Line Extreme Data:



Remark:

Special case wind direction: The minimum value is always marked with "?", and the maximum value is the direction at the highest gust (maximum) of wind speed.

Examples (9.175x.x0.**1**00, Sensor-Interface SIF001 with 6 additionally sensors):

```
13.0000 57.5 12:51 57.6 12:51 ??? 00:01 329 12:51  -1.5 12:51  -1.4
12:51 ???.? 13:19 ???.? 13:19   0.0 12:51   0.0 12:51 ????.? 15:01
????.? 15:01 1033.0 12:51 1033.5 12:51  24.5 13:00  24.7 12:51   0.0
12:51   0.0 12:51    1.0 12:51    1.0 12:51    0.0 12:51    0.8
12:55    0.0 12:56    2.0 12:51    0.2 12:56    2.1 12:52    0.0
12:52 2.3 12:52  -5.0 12:51  -5.0 12:51  51.6 12:51  51.6 12:51
27.10.08 13:00
```

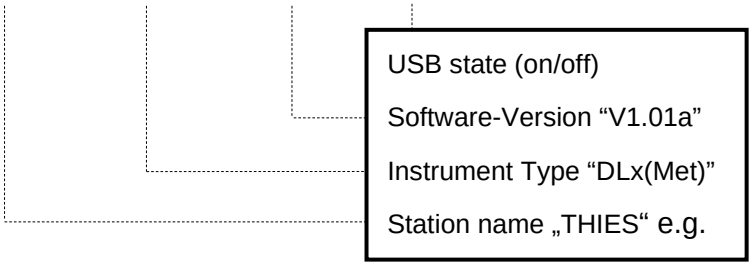
```
13.1667 57.5 13:01 57.6 13:01 ??? 00:01 329 13:01  -1.5 13:01  -1.4
13:01 ???.? 13:19 ???.? 13:19   0.0 13:01   0.0 13:01 ????.? 15:01
????.? 15:01 1033.0 13:01 1033.5 13:01  24.3 13:09  24.5 13:01   0.0
13:01   0.0 13:01    1.0 13:01    1.0 13:01    0.0 13:01    0.3
13:04    0.0 13:02    2.1 13:08    0.0 13:07    2.2 13:09    0.0
13:02 2.0 13:10  -5.0 13:01  -5.0 13:01  51.6 13:01  51.6 13:01
27.10.08 13:10
```

(*) : Does only apply when output format is switched to "DLxMet", ref. to **chapter 5.6.4** .

5.6.3 End Line

End line is only output by the serial interfaces COM1 and USB.

```
END OF DATA Station: THIES  DLx(Met) V1.01a USB: 0
```



5.6.4 Output Format TDL14

The output format for mean and extreme data as well as single-line instantaneous values (command “mm”/”mmc”) is adjustable between „DLxMet“ (order of the internal channels as in the display) and „TDL14“ (order and number (14 instead of 10) according to data logger TDL14). The setting can be done manually with the display (“Operation mode/Output format”(**chapter 3.1**) or with the serial command „OF“(**chapter 5.5**).

The following table shows the order with the setting “TDL14“:

Number TDL14	Number DLxMet	Sensor name
1	1	Wind speed
2	2	Wind direction
3	3	Temperature 1
4	4	rel. Humidity
5	6	Air pressure
6	7	Radiation
7	5	Precipitation sum
8	10	Event **(*)**
9	9	20mA-Input
10	8	Temperature 2
11	---	Not configured
12	---	Not configured
13	10	Length of time **(*)**
14	---	Not configured

Table 10: Order of Output Format “TDL14”

(*) : Usage depending on the setting of the internal channel 10

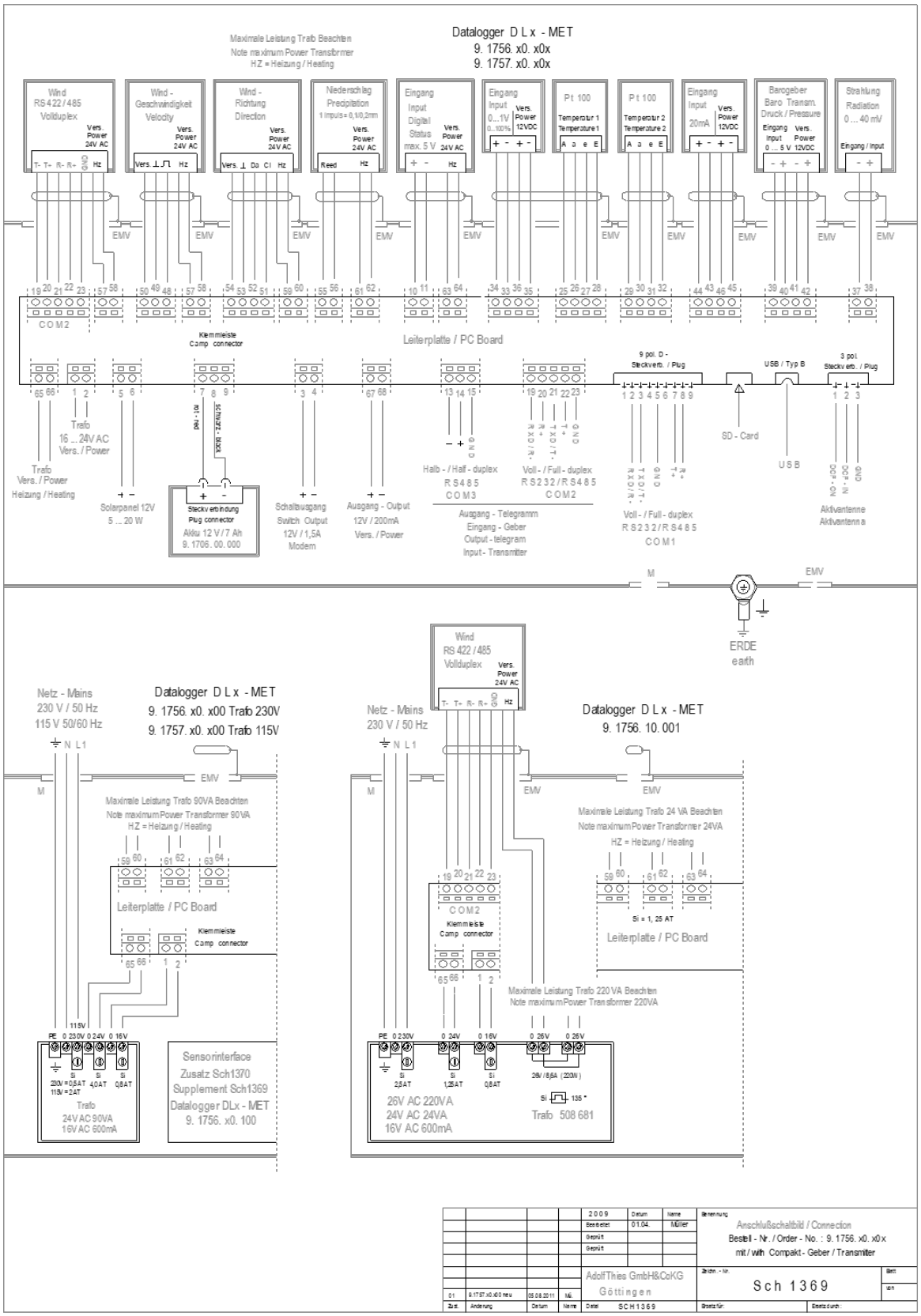
6 Technical Data

Housing	stainless steel
Protection class	IP 65
Power supply	
Battery	12V 7 Ah (lead acid valve regulated VRLA), voltage is monitored
Solar panel	12V 20 W max
Switched sensor excitation	11V 90 mA max.
Switched Output	12V 1.5A max. (e.g. for supplying a GSM-Modem)
Buffer-battery	3V 0.56Ah, buffering data memory and real time clock.
Mains operation	monitoring status of mains(On/Off) **Out all versions:** 12Vdc 200 mA, powered by 24Vac output (e.g. permanent supply for fan)
	91756.x0.x00: In: 230Vac 100 VA 0.5A 50/60Hz Out: 24Vac 90VA (e.g. heating of sensors) 16Vac 10VA (data logger and sensors)
	9.1756.x0.001: In: 230Vac 260VA 1.25A 50/60Hz 135°C thermal trip switch Out: 26Vac 220VA (e.g. heating of sensors) 24Vac 24VA 16Vac 10VA (datalogger and sensors)
	91756.x0.x00: In: 115Vac 100 VA 0.9A 50/60Hz Out: 24Vac 90VA (e.g. heating of sensors) 16Vac 10 VA (datalogger and sensors)
Power consumption battery (COM2 and COM3 switch off)	approx. 12mA (Display active without Sensors) max. 1mA (Display off)
Temperature range	-30...+60°C
Temperature Display	-20...+60°C (for reading)
Storage Temperature	40...+85°C
Humidity	up to 100% RH, non-condensing
Analogue Measurement	
A/D-Converter	24 Bit theoretical resolution with fully differential inputs
Accuracy analogue	±0,1% of measuring span of the sensors, without long term drift
Internal Channels	6 1 Voltage for radiation sensor (0...40 mV) 1 Voltage for humidity (0...1 V) 1 Voltage for air pressure (0…5 V) 1 Current (0…20 mA) 2 Temperature Pt100 (-40...70°C)
Input resistance internal channels	0…40mV 100 kΩ 0…1V 100 kΩ 0…5V 200 kΩ 0...20mA 120 Ω
Factory calibration 40mV-Input series resistance	100 Ω

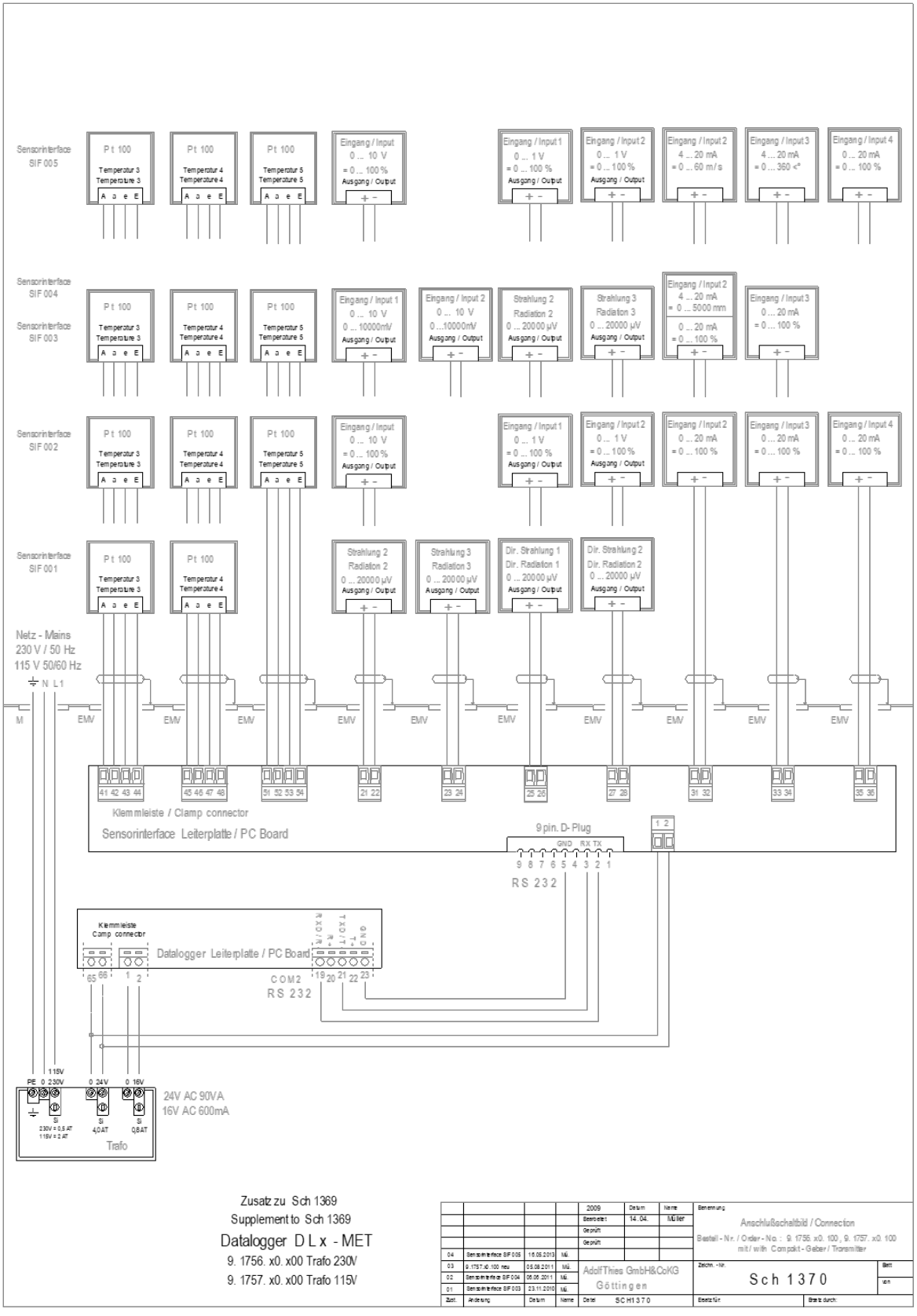
Additional analogue channels (applies for 9.1756.x0.100)	
Sensor-Interface SIF001	6 (4x Voltage for Radiation (20mV), 2x Temperature Pt 100)
Sensor-Interface SIF002	9 (10V, 2 x 1V, 3 x 20mA, 3 x Temperature Pt 100)
Sensor-Interface SIF003	9 (2 x 10V, 2x Voltage for Radiation (20mV), 2 x 20mA, 3 x Temperature Pt 100)
Sensor-Interface SIF004	9 (2 x 10V, 2x Voltage for Radiation (20mV), 4-20mA, 20mA 3 x Temperature Pt 100)
Digital Measurement	
Channels	4
	synchronous-serial (wind direction: THIES 5, 8 or 10 bit)
	16 bit counter (wind speed, THIES: Wind-transmitter compact 1 4.3519.x0.x00 Wind-transmitter classic 1 4.3303.22.007 Wind-transmitter classic 2 4.3303.22.018 Wind-transmitter first class 4.3351.x0.000 Wind-transmitter compact 2 4.3619.x0.x00
	8 bit counter (precipitation: resolution 0.1 or 0.2 mm)
	Event / Length of time 3.3V(5 V-TTL)-logic (max. level 5V, pull-up 100 kΩ to 3.3V, low level: <0.9V, high level: >1.9V) or 1V-Logic (switch level: 0.58V ±0.1V)
Measurement cycle	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 s 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 min
Memory cycle	
Mean values	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 min
Extreme values	as mean values, 2 h, 3 h, 4 h and 6 h are additionally adjustable
Time base	Real time clock with automatic leap year identification. Clock drift settable (+10.7 … -5.4 seconds per day) Automatic time synchronisation with optional DCF77-antenna (9.1760.00.000)
Memory capacity	Flash: 128 KB(Firmware, Upload able COM1 XModem-CRC) RAM: 2 MB (Data) EEPROM: 256 Bytes (Parameter)
Number of data records	
Mean values	61570 (with 10 sensors)
Extreme values	6160 (with 10 sensors)
Memory period	refer to chap. **3.2.4** for more information
Data output	
Serial 1 (COM1)	RS232 or RS485 full-duplex adjustable Flow control: XON/XOFF-Handshake
USB	USB 2.0 full speed device, Type B connector, Type FTDI (FT245R), VIRTUAL COM PORT driver**:** **www.ftdichip.com**
Memory Card	SD-Card, Types (up to 2GB), formatted on PC with FAT16, compatible to Microsoft® Windows® and MS-DOS® Compatibility to all commercially available cards cannot be guaranteed for tested cards ref. to chap. **5.2**
Free serial interfaces	COM2 and COM3 for connection of sensor-interface or serial sensors or output of telegrams
Serial 2 (COM2)	RS232 or RS485 full-duplex adjustable
Serial 3 (COM3)	RS485 half-duplex

	Response delay/latency: 20ms
Parameter COM1, COM2, COM3	300...115200 Baud, 8 data bits and no parity (8N1), 7 data bits and even parity (7E1), 1 stop bit
Resistors RS485 (COM1, COM2, COM3)	Adjustable to 220 Ω termination and 1000 Ω pull-up and -down
Operating	3 keys on the instrument and remote control operation via COM1 or USB
LCD-Display	3 row with 16 character (alphanumeric)

7 Wiring Plan



Additional wiring plan for Sensor-Interface SIF (at 1756.x0.100):



8 EC-Declaration of Conformity

Document-No.: 0001251 **Month: 04 Year: 21**

Manufacturer: **A D O L F T H I E S G m b H & C o. K G**

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email: Info@ThiesClima.com

This declaration of conformity is issued under the sole responsibility of the manufacturer

Description of Product: **DATALOGGER DLx**

Article No.	**9.1755.00.005**	**9.1755.00.013**	**9.1755.01.013**	**9.1755.01.913**
	9.1755.10.005	**9.1755.10.008**	**9.1755.15.000**	
	9.1756.00.000	**9.1756.00.001**	**9.1756.00.100**	**9.1756.10.000**
	9.1756.10.001	**9.1756.10.100**	**9.1756.00.000P**	**9.1756.00.001P**
	9.1756.00.100P	**9.1756.10.000P**	**9.1756.10.001P**	**9.1756.10.100P**
	9.1757.10.000	**9.1757.10.100**	**509953**	

The indicated products correspond to the essential requirement of the following European Directives and Regulations:

2014/30/EU	DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
2014/35/EU	DIRECTIVE 2014/35/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
552/2004/EC	Regulation (EC) No 552/2004 of the European Parliament and the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)
2011/65/EU	DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
2012/19/EU	DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE)

The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:

EN 61000-6-2	Electromagnetic compatibility Immunity for industrial environment
EN 61000-6-3	Electromagnetic compatibility Emission standard for residential, commercial and light industrial environments
EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements
EN 50581	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Place: Göttingen Date: 20.04.2021
Signed for and on behalf of:

Legally binding signature:

Dr. Christoph Peper, General Manager

issuer:

ppa. Jörg Petereit, Development Manager

This declaration certificates the compliance with the mentioned directives, however does not include any warranty of characteristics.
Please pay attention to the security advises of the provided instructions for use.

Please contact us for your system requirements.
We advise you gladly.

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