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Instructions for Use

021739/02/14

DLN Data Logger

5.1756.00.000

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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
  - Endangering 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 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 under certain conditions, and in rare cases, may also output erroneous measuring values, it is recommended using redundant systems with plausibility checks with **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, arrange for recycling as the packaging materials are designed to be recycled.

Documentation

- © Copyright **Adolf Thies GmbH & Co KG**, Göttingen / Germany
- Although this 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

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1 Device version

Designation	Order number
DLN data logger	5.1756.00.000

Features:

- **DLN data logger** in plastic housing for rail mounting
- Selectable power supply
- Two-line (2x16 characters) liquid-crystal display (LCD)
- 1 LED for functional check of charging circuit
- Option for display and selection of adjustable parameters on the display using 3 buttons or via the RS-232 and USB interface
- 2 counter inputs for precipitation sensors
- 1 PT 100 input for temperature acquisition
- 1 input 0-1 V for the connection of a rel. humidity sensor
- 2 optocoupler outputs for precipitation
- RS-485 interface for connection of a THIES laser precipitation monitor (5.4110.xx.xxx) or output of a data telegram.
- RS-232 interface for commands and data output
- USB interface for commands and data output
- SD card slot for data output / data transport

Scope of supply:

1 DLN data logger 5.1756.00.000

1 set of operating instructions

1 wiring diagram

2 Application / Structure of data logger

The DLN data logger is a complete measuring system for the capture and storage of data measured by two precipitation sensors with pulse outputs and a Pt100 temperature sensor and a humidity sensor. A THIES laser precipitation monitor (5.4110.xx.xxx) can also be connected to the serial COM2 interface. The RS-232 interface COM1 or USB can be used for commands and data output. Output of the data is also possible using a memory card (SD card).

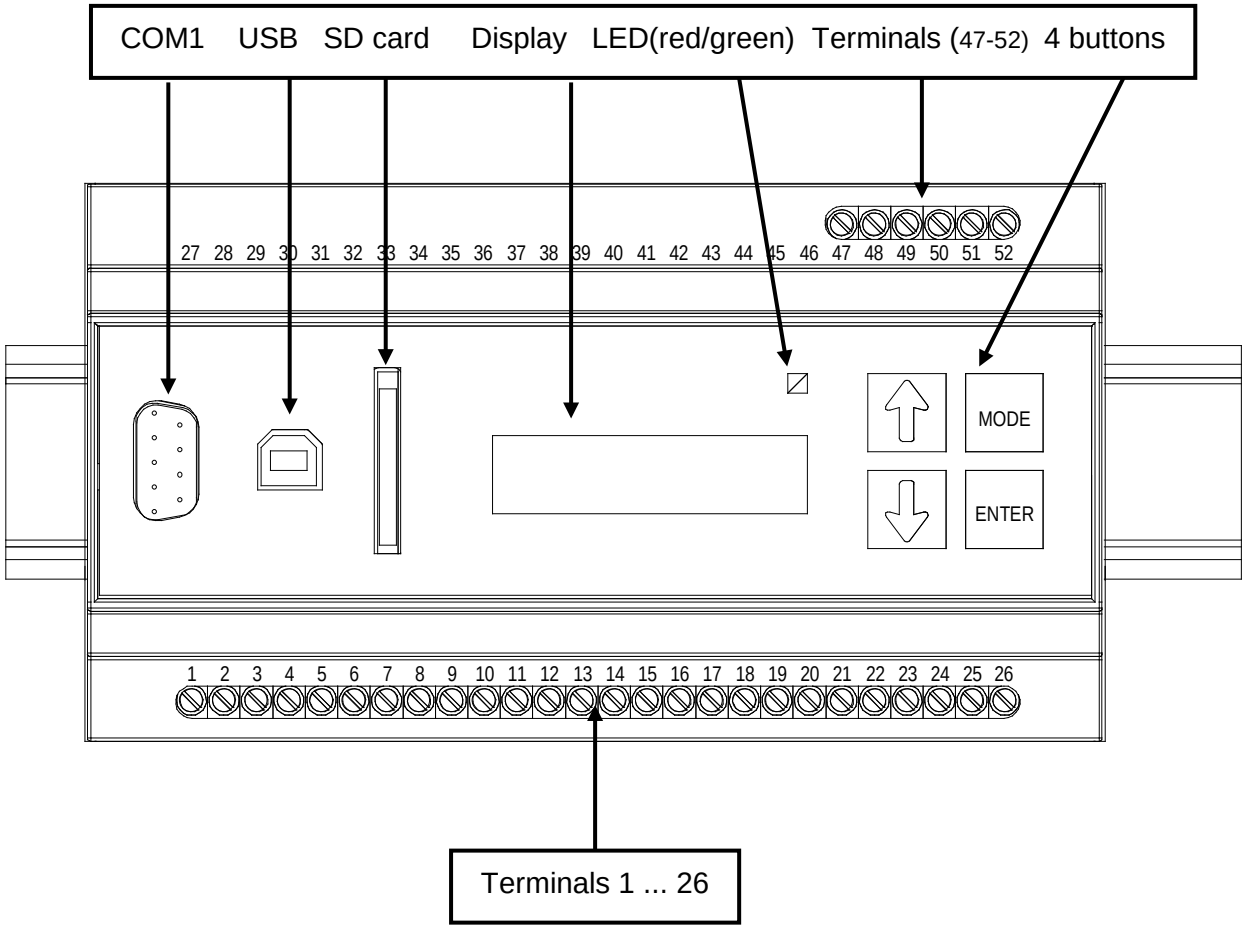


Figure 1: Connections

Figure 2 below shows an overview of all interfaces.

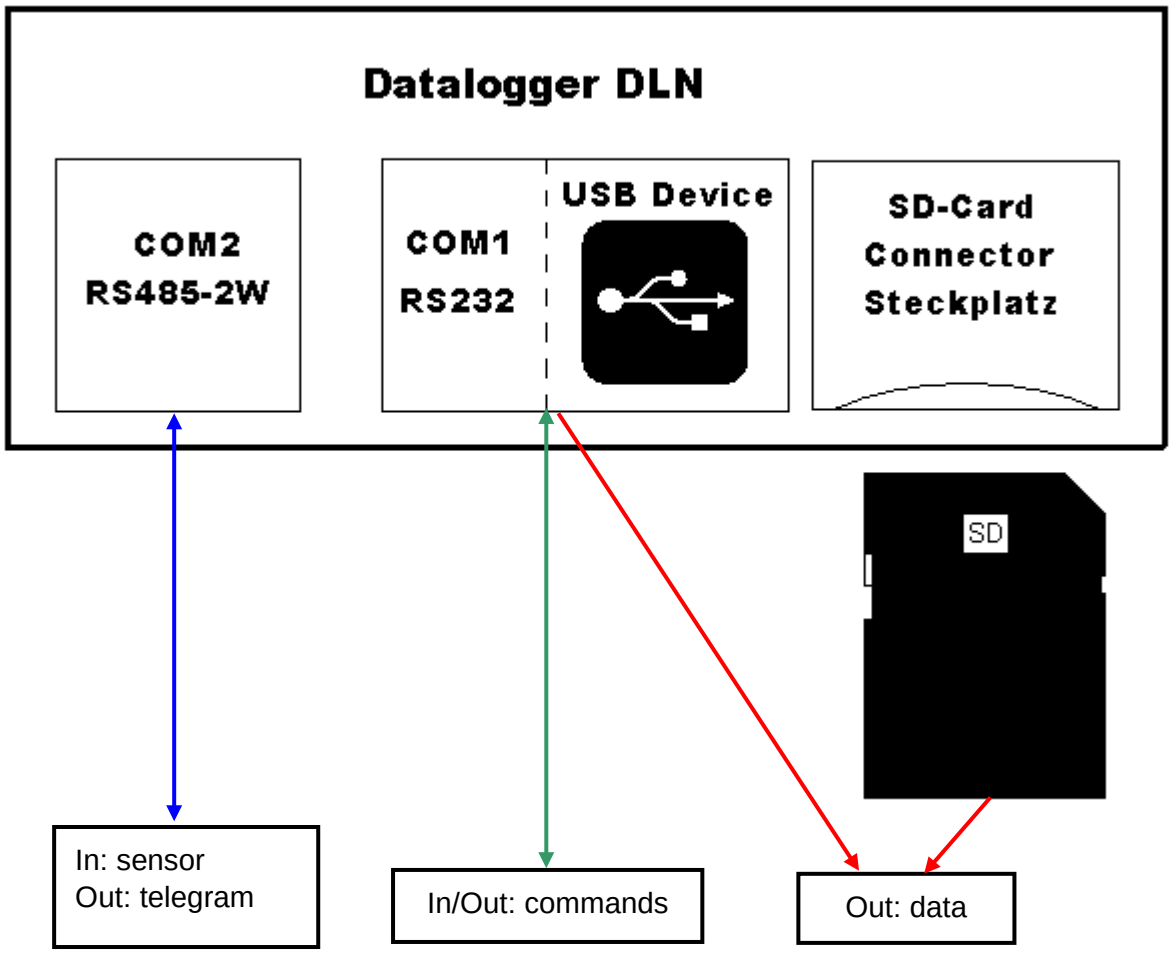


Figure 2: Interfaces of the data logger

This DIN rail-mounted device (9 modules) is designed for installation in distribution switchgear systems with standard 35mm (top-hat) rails, in addition to covers with a 45mm cut-out. Cables are connected using tunnel terminals at the bottom of the device (see **Figure 1**).

The data logger is operated with a 12V rechargeable battery and therefore runs without an external power supply. A rechargeable battery is not included in the scope of supply.

There is also the option to operate the logger with 24 V AC/DC by means of a power supply unit, which, at the same time, may serve for charging the storage-battery.

A capacitor buffers the clock for a couple of hours if the battery is disconnected.

Operation is ensured over a wide temperature range from -30 ° to 60 °C.

The device is simple to operate with three buttons (Mode button not supported) or via the serial Interface COM1 and USB.
The three buttons are referred to below as follows: "<Δ>", "<∇>" and "<ENTER>" (see **Figure 1**).
The device is equipped with a two-line alphanumerical display (LCD).

Sampling of the measured temperature values can be adjusted in a range from one second to 60 minutes. The precipitation pulses are continuously measured.

Data are stored with the date and time according to the storage interval selected (1 to 60 minutes) in a non-volatile flash data memory (4MB) (i.e. data are saved with no power supply). The data memory is designed as a ring buffer. When the ring buffer is full, the oldest data set is next to be overwritten.

The data logger can be switched to maintenance mode to test the sensors or the measuring inputs. The measured values from the sensors are not written to the memory in this mode. This means that values captured in maintenance mode appear on the display as normal but will not be taken into consideration for the calculation of stored values.

The two pulses from the precipitation transmitter can undergo further processing with potential-free via passive optocouplers.

3 Installation

Please note

The device should only be installed and connected by qualified technicians. The general engineering regulations and applicable provisions and standards must be observed.

3.1 Recommendation for selection of site

The device is designed for indoor installation. When used outdoors, an additional external housing the appropriate protection rating is required.

Note

When selecting the installation site, please take note of the operating temperature range and protection rating.

3.2 Mechanical mounting

Mounting the housing:

The data logger is designed for snap-on mounting using a standard 35mm rail (top-hat, TS35). The rail must be at least as long as the width of the housing (157mm, 9 modules).

Mounting on rail:

- If not already available: Fit a 35mm rail with a length of at least 9 modules (157mm) at the installation site.
- Position the device on the rail so that the upper edge of the rail engages in the relevant groove of the device.
- Insert a screwdriver (blade width < 4mm) in the slot of the snap-on clip and pull the clip down. The slot is located in the middle of the housing's lower edge.
- Press the device fully onto the rail.
- Release the snap-on clip. The clip will snap into place behind the rail.
- Jiggle slightly to check whether the housing is firmly secured to the rail.

3.3 Electrical mounting

3.3.1 Cables

To ensure a low-interference measuring system (i.e. EMC-compliant), the data lines and measuring circuits must be shielded and the shielding carefully earthed. This procedure depends on local conditions at the site:

- **Metal housing**: Directly connect shielding to EMC cable glands.
- **Plastic housing or no housing**: Connect shield using suitable rails or a metal mounting plate with clips/clamps (see **Figure 3**). There should be extensive contact between the cable shielding and the clips.

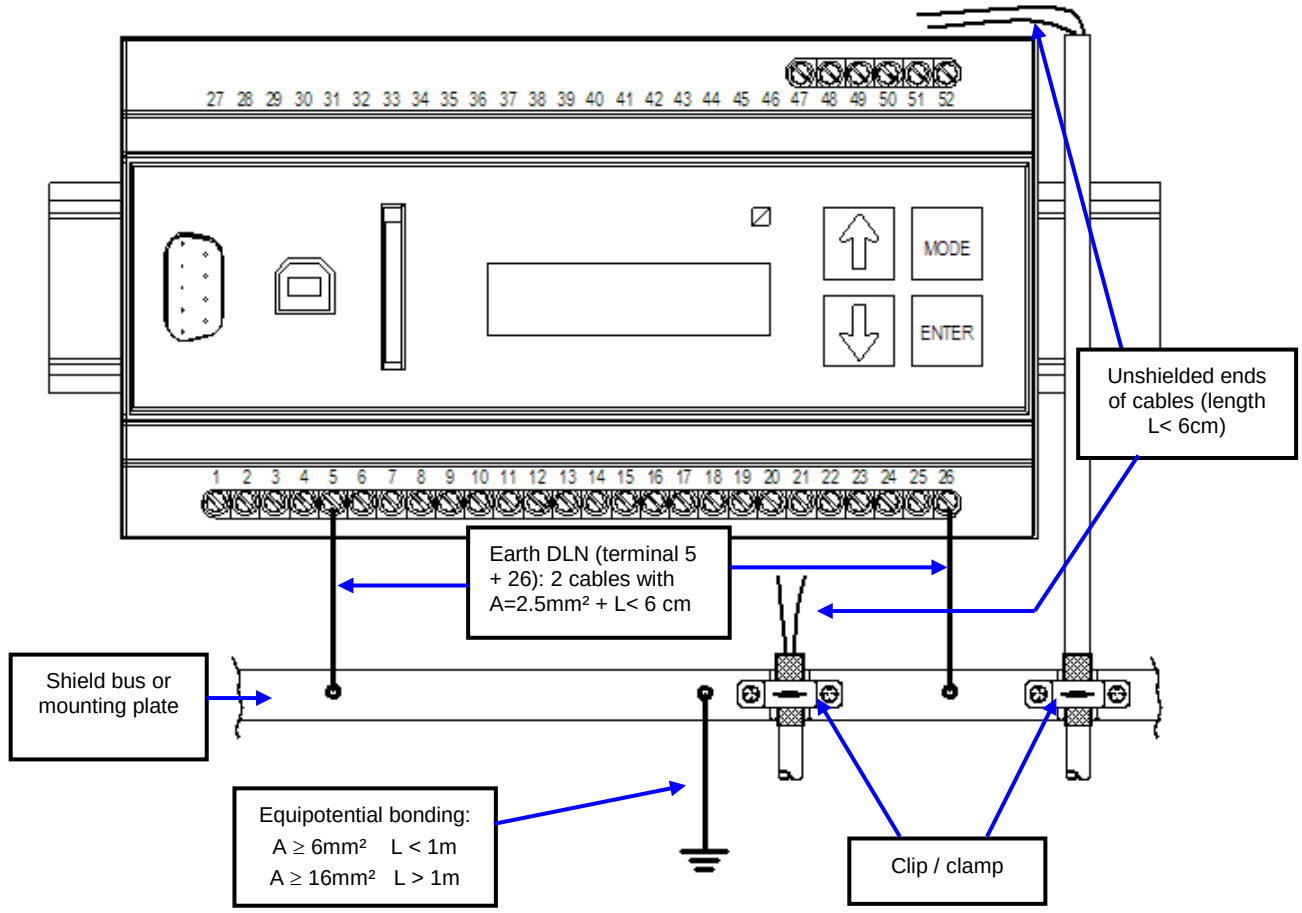


Figure 3: Example of device earthing

The functional earth of the DLN data logger (terminals 5 + 26) should be connected to the earthed shield bus or mounting plate with 2 cables with a core cross-section of 2.5mm² and not exceeding 6cm in length.

For equipotential bonding we recommend using the shortest possible cable (≤1m) with a cross-section of min. 6mm² between the metal housing / shield bus or the mounting plate and protective earth (earthing band or local equipotential bonding strip).

When using the 24VAC power input (terminal 1 + 2), a green LED will light up on the data logger (above display, see **Figure 1**) indicating a functional check of the charging circuit.

Lightning protection:

We recommend installing additional protective elements (so-called coarse protection, e.g. varistors) as well as additional line filters (for 230V main power), in particular if the device is to be used outdoors.

3.3.2 Rechargeable battery

When using the 24VAC-supply input we recommend the use of an optional rechargeable battery (article no. 210375). When connecting the battery please pay attention to the predefined polarity (**red** = **+** , **black** = **-**)!

Replacement or charging is necessary at the latest when the displayed voltage falls below 9.0V. However, avoid allowing the battery to discharge below 11.0 V as no significant capacity is then available. The service life of the rechargeable battery is significantly shortened when operated at less than 10.5 V! The new battery should be "freshly" charged again before installation as it might no longer have maximum capacity due to self-discharge (approx. 3% per month). The stored data are saved when the battery is replaced. The internal clock time is buffered for a couple of hours. Data should be saved before disconnecting the battery. After connection the data logger will start up the bootloader, which then starts the normal firmware after approx. 30 seconds.

Please note:

When changing the rechargeable battery with the power supply switched on, make sure that the red cable does not come into contact with any parts of the housing (risk of short-circuiting).

During installation make sure that all connections are de-energised to rule out any risk to persons and/or equipment!

3.3.3 Solar panel

Electric connection:

The connection of the optional solar panel is to be carried out according the wiring plan (see section **8**). We recommend earthing the panel for protection against lightning strikes.
The integrated 12V solar regulator generates a temperature-controlled voltage for an optimum load of the battery. The maximum power of the panel should not exceed 20 W, otherwise the regulator could be damaged. Due to temperature control the battery should always be kept in the case of the data logger.

Alignment:

- Direction: For optimum performance always align the panel pointing towards the sun at noon (south on the northern hemisphere and vice versa). If necessary, use a compass.
- Angle: The optimum tilt angle (see **Figure 4**) depends on the latitude of the site. If the data logger is to be used all year round, we recommend a tilt angle for optimum winter performance:

  Tilt angle = Latitude + 15°

  (Note: Does not apply to Arctic/Antarctic, maximum tilt angle 90°)

  Example: Berlin (Germany) latitude: 50.3° ---> tilt angle = 50.3° + 15° = 65.3°

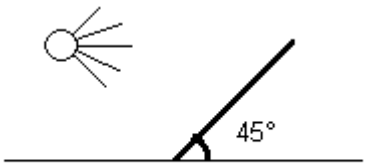


Figure 4: Tilt angle for solar panel (here 45°)

- Casting of a partial shadow due to construction or site, e.g. caused by sensors or traverses, which are installed above the solar panel, should be avoided without fail.

Maintenance:

- Any dirt, snow, leaves etc. on the solar panel reduces the amount of light and decreases the energy yield. Therefore regularly clean the solar panel surface as needed.

3.3.4 Optocoupler outputs

The data logger offers the option of connecting additional instruments to the passive optocoupler outputs with potential-free for both precipitation inputs. **Figure 5** shows the basic circuitry of precipitation channel 1. The second precipitation channel has an equivalent structure. To save power, both outputs are separately configurable (For programming see section **4.1**, Display "18. Opto output"). The optocoupler does not require power when the input is idle (i.e. open).

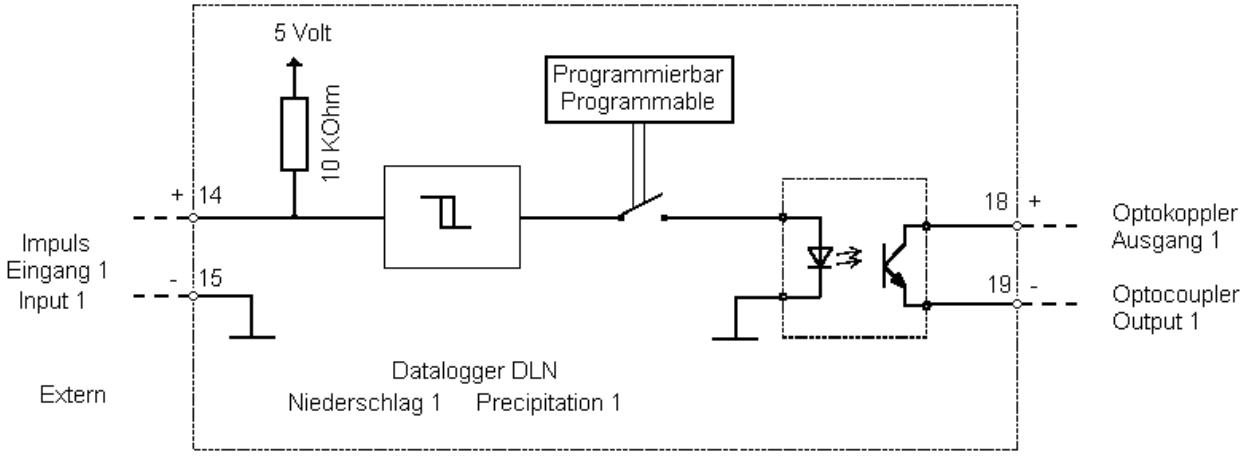


Figure 5: Block diagram: precipitation input 1 / output 1

Figure 6 shows two options for the connection of external devices to both passive outputs (supply Vcc and resistance R to be provided by user):

- Pull-up circuit to terminal 18/19 (output 1).

  Idle high-potential.

- Pull-down circuit to terminal 20/21 (output 2).

  Idle low potential.

The load resistor R should be dimensioned as small as possible (e.g. Vcc=5V, R = 5V/1mA = 5 kΩ). The connecting cables should be shielded and the external receive input provided with EMC filters (not shown in **Figure 6**).

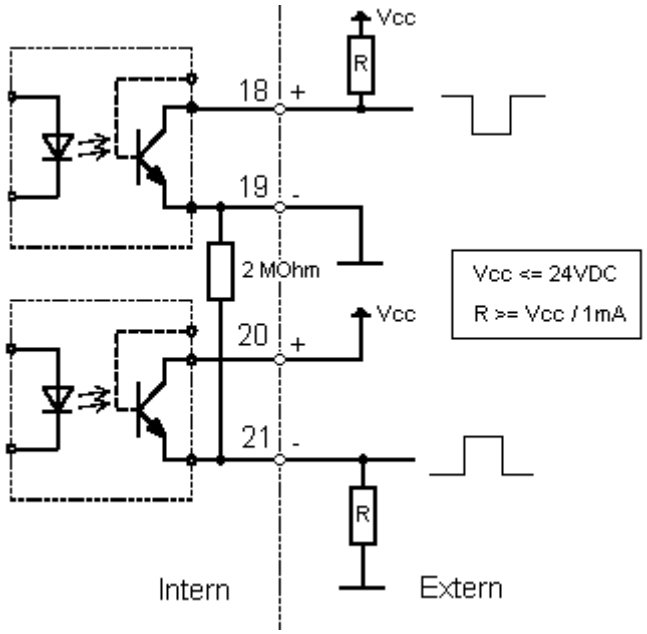


Figure 6: Examples of external circuitry of optocoupler outputs

Note:

Due to the higher energy consumption the optocoupler outputs should only be configured as needed.

4 Operation

When the battery is connected, the data logger will automatically start the bootloader (for loading new firmware) and perform re-initialisation. The bootloader waits 30 seconds and then starts the current firmware automatically. After switching on for the first time, the date and time should be checked.

```
Bootl.NSLOG V1.5
-
```

4.1 Display options

The display is switched on using the "<ENTER>" button (press for max. half a second). The display switches off automatically if no button is pressed for 4 minutes or if no character is transmitted or received via the COM1 serial interface or USB. The display will not however switch off if the COM2 serial interface is configured to output a telegram or to automatically receive sensor data (e.g. LNM).

After switch-on the display will show the name of the station.

If "*" is shown as the first character in the first line, this means that the user has the option of editing this value or of obtaining additional information (see section **4.2**). Pressing the <∇> button moves the user to the next value on the display and the <Δ> button can be used to move back.
If "M" appears as the first character in the second line of the measured sensor values, this indicates maintenance mode (see also Operating mode).

Note:
The display can be read down to a minimum temperature of -20°C. However, for technical reasons the display speed is very slow at low temperatures (approx. 10 seconds at -20 °C!).

SEQUENCE OF DISPLAYED VALUES:

1. Station name / language
2. Date and time
3. Data output

Internal instantaneous values measured by sensors:

4. Sensor 1: Precipitation 1
5. Sensor 2: Precipitation 2
6. Sensor 3: Temperature
7. Sensor 4: Rel. humidity

External measured values received serially:

8. Sensors 5 to 11 (laser precipitation monitor LNM)

9. Sensor configuration
10. Sensor status
11. Function of serial interfaces
12. Sampling rate / storage interval
13. Voltage of rechargeable battery
14. Status of AC supply
15. Status of EEPROM
16. Baud rate of COM1 / SD card
17. Baud rate of COM2
18. Status of counter
19. Opto output
20. Operating mode (normal / maintenance)

Clock accuracy

1. STATION NAME / LANGUAGE:

```
* Station: THIES
DLN       V1.01b
```

STATION NAME:

The station name displayed in the first line is used to distinguish data from several stations. The name (here: "THIES") can be up to 5 characters in length. This name is written to the SD card on readout and output to the serial Interface COM1 and USB with the data. The second line displays the type of device ("DLN)") and the software version ("V1.01b").

> ***Note:***
> *When using THIES's MEVIS software and an SD card for data readout, the last character of the station name should not be a blank.*

Serial command: "XXn" for inputting the station name (see section **6.5**)

LANGUAGE:

When the station name is changed (see section **4.2.1**), the second line switches to language selection for the display output ("Sprache: Deutsch" or "Language: English"), allowing the user to then choose between the two modes.

2. DATE / TIME:

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

Display and selection of logger date and logger time.

Serial commands Date: "DD", "DT", "DM", "DJ" " (see section **6.5**)

Serial commands Time: "ZZ", "ZH", "ZM", "ZS" (see section **6.5**)

3. DATA OUTPUT:

```
* Data output
       ?
```

Start data output (see section **6.1**).

If there is no SD card in the slot of the data logger, output automatically takes place via the serial interface COM1 and USB.

Serial commands: "TS","ts","DS","ds","SS","GS" (see section **6.5**)

MEASURED SENSOR VALUES:

All measured values for display are captured and updated every second.
General error messages (measuring range exceeded or sensor not connected): output is "???.?".

If an internal sensor is not configured, "---.-" is output.
If "M" appears as the first character in the second line of the measured sensor values, this indicates maintenance mode (see also "18. Operating mode").

Serial commands: "mm" or "MM" (see section **6.5**)

4. SENSOR 1 Precipitation 1:

```
*Precipitation 1:
    NNN.N mm I:N
```

Output of the precipitation amount of input 1 fallen on today's date (including

during maintenance mode, total of all precipitation since midnight).

Display and selection of current consumption test (I:0 -> off I:1 -> on).

Serial command: "NT1" (see section **6.5**)

Measuring range: 0 ... 999.9 mm
Resolution: 0.1 mm

5. SENSOR 2 Precipitation 2:

```
*Precipitation 2:
    NNN.N mm I:N
```

Output of the precipitation amount of input 2 fallen on today's date (including

during maintenance mode, total of all precipitation since midnight).

Display and selection of current consumption test (I:0 -> off I:1 -> on).

Serial command: "NT2" (see section **6.5**)

Measuring range: 0 ... 999.9 mm
Resolution: 0.1 mm

6. SENSOR 3 Temperature:

```
Temperature:
   TT.T°C
```

Display of current measured temperature 1.
Measuring range: -40 ... 70 °C
Resolution: 0.1 °C

7. SENSOR 4 Rel. humidity:

```
Rel. humidity:
   NNN.N %
```

Display of current measured relative humidity.
Measuring range: 2.0 ... 100.0% r.H.
Resolution: 0.1% r.H.

Serial sensors:

See below for display of the data from serial sensors with the relevant configuration. The selected configuration is shown in the display "10. Function of serial interfaces". For the description see also section **4.2.5**).

8. SENSOR CONFIGURATION:

```
*Channel config.:
 xxxx channels: YY
```

X = "0"	Sensor deregistered
X = "1"	Sensor registered
YY = 04 to ??	Number of channels

Sensor 1...4

Display of internal measuring channels configured ("1"→ registered). Unconfigured measuring channels ("0") are indicated by dashes (e.g. "---.-") on the display and identified with serial output. The first figure (from the left) stands for the 1st measured sensor value (precipitation 1) and the last for sensor 4 (rel. humidity).

To change the sensor configuration see section **4.2.3**.

Serial command: "KK" (see section **6.5**)

9*. SENSOR STATUS:*

```
 Sensor conn.:
xxxx
```

Sensor 1...4

x = "+" Sensor physically connected
x = "-" Sensor not connected
x = "0" Current consumption test of sensor off
x = "X" Sensor deregistered (see display 7. "Sensor configuration")
x = "?" Sensor not testable

The display indicates whether the relevant sensor is connected. "-" shows that the logger has not identified a sensor on the channel, and "+" it has identified the sensor.
"+" in the display does not necessarily mean that the sensors are functional. It means that the logger has identified the sensor is connected but says nothing about the quality of the measured values.

10. FUNCTION OF SERIAL INTERFACES

```
* COM1: Command
  COM2: Off/Aus
```

The display shows the functional settings of the two serial interfaces COM1 and COM2.

COM1 is permanently set to processing commands.

To minimise current consumption it is necessary to switch off COM2.

Further information about the settings for COM2 can be found in section **4.2.5**.

Serial command: "Cs" (see section **6.5**)

11. SAMPLING RATE / STORAGE INTERVAL:

```
*Sampling: 1 sec
 Storage: 1 min
```

The settings for the sampling rate (line 1) and the storage interval are displayed here (line 2).

Additional information can be found in section **4.2.4**.

Possible settings for the **measuring rate** (only applies to sensors 3 and 4 (temperature and humidity))

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

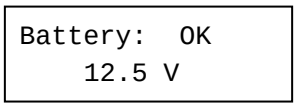
1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 minutes

Possible settings for the **storage rate**:

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

Serial commands: "MT", "ST" (see section **6.5**)

12. VOLTAGE OF RECHARGEABLE BATTERY:



OK : Voltage >11.5 V
!!! Voltage 10.6 ... 11.5 V
Low : Voltage <10.5 V Charge/replace battery!

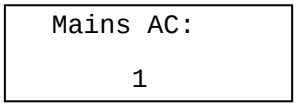
Display of measured battery voltage.

Note:

Avoid allowing the battery to discharge below 10.5 V as no significant capacity is then available, and this will significantly shorten the service life of the battery!

It is recommended replacing or charging the battery when "!!!" appears on the display.

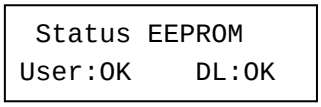
13. STATUS OF AC SUPPLY



Display of the status of the mains power supply (terminals 1 and 2):

- "1": Power supplied from mains (green LED also lights up above display)
- "0": No power supplied from mains

14. STATUS OF EEPROM:



Status of EEPROM memory (used to store parameters for user settings and adjustment values). If "OK" is not displayed here, the device may be faulty.

15. BAUD RATE COM1 / SD card:

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

```
    SD card:
2 TM SD02G 3.2
```

No SD card in slot	SD card in slot of data logger (example: line 2 is specific for each type of SD card)
Display of settings for COM1 Possible settings: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 Bd 8 data bits, parity none (8N1) or 7 data bits, parity even (7E1), 1 stop bit Serial commands: "CC1", "CP1" (see section **6.5**)	Display of "Card Identification Register" (CID) of SD card in slot. The CID data are necessary to distinguish between cards as the adhesive label on the card normally has no significance. Not all available SD cards function with the data logger (see section **6.2** for SD cards tested). Line 2: MID, OID, PNM, PRV of CID

Note:
When using the USB interface, the COM1 settings of the data logger must match those of the remote station (e.g. PC)!

16. BAUD RATE COM2

```
* COM 2:LPM/LNM
     9600 Bd 8N1
```

Display of COM2 settings.

Possible settings as for COM1 (see above).

The first line shows the current functional setting for COM2 (here: "LPM/LNM", for setting see display "10. Function of serial interfaces").

Serial commands: "CC2","CP2" (see section **6.5**)

17. Status of counter

```
Counter 1:NNNNNN
Counter 2:NNNNNN
```

Output of number of pulses measured for both inputs since switching on the device for diagnostic purposes.

18. Opto output

```
*Opto output1:X
 Opto output2:X
```

X = 0: Relevant output off (pulse output blocked)

X = 1: Relevant output on (pulse output released)

Display and configuration of both opto outputs (see also section **3.3.4**).

Serial commands: "OO1","OO2" (see section **6.5**)

19. Operating mode / Clock accuracy

```
*Mode:Normal
 RTC corr: -NN
```

1st line:

Display of mode selected:

"Normal": Normal mode

"Maintenance": Maintenance mode (measured values not written to memory)

Note:

Maintenance mode terminates automatically when the display is switched off!

2nd line:

Output and setting of clock accuracy of data logger (see also section **4.2.6**).

Adjustment range: -31 ... +31 (RTC compensation value)

Serial command: "ZK" (see section **6.5**)

Note:

The RTC compensation value is factory-set.

4.2 Adjustment of parameters

All displayed values output with "*" on the top left can be edited.

To edit a displayed value you only need to press the <ENTER> button, followed by the <∇> button. The value to be edited is then indicated by the flashing cursor. Both buttons can then be released. The <Δ> and <∇> buttons can be used to increase or reduce this value. Once the selected value is correct, press the <ENTER> button again to quit edit mode or to select the next editable value.

4.2.1 Station name

The station name identifies the measuring station. If several data logger are available, each one should be given a different name. All upper-case letters and numbers are permitted here as well as underscore "_" and blank characters.
When editing the station name, the output language is displayed in the second line. You can switch between them as required using the arrow keys.

4.2.2 Date

If a new input for the date is invalid (e.g.: 31.4.00), it will be automatically corrected.

4.2.3 Sensor configuration

To change the sensor configuration, press the <ENTER> and <∇> button simultaneously and then proceed as follows:
The second line is deleted and a question mark output. Then press the <∇> and <Δ> button simultaneously for 10 seconds. The "countdown" is shown on the display. At the end of the "countdown" you can edit values as usual.

4.2.4 Sampling rate / storage interval

The sampling rate specifies the time intervals at which the analogue sensor values are measured by the data logger (temperature and humidity**)**. The sampling rate can be changed during operation without losing previous data. All digital counter inputs (here only precipitation) are measured continuously irrespective of the sampling rate selected.

23 increments are available for adjustment of the sampling rate:

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 storage interval specifies the time interval for storage of the measured values following averaging or addition of these values.

12 increments are available to adjust the mean storage interval:

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

Example: Sampling rate 1 second

Mean storage interval 10 minutes

600 measured values (if available) are used to calculate a mean value, followed by storage.

With "normal" sensors the average value is calculated as an arithmetical mean. The exception here is precipitation (summation).

Note:

When adjusting the sampling rate, it may be necessary to correct the storage interval to an integral multiple!

The storage interval influences the storage period of the mean values (see following **Table 1**).

Storage interval	**Storage period 4 sensors**		**Storage period 11 sensors**	
	Days	Years	Days	Years
1 min	210	0.5	102	0.27
2 min	420	1.1	204	0.5
3 min	631	1.7	307	0.8
4 min	841	2.3	409	1.1
5 min	1052	2.8	512	1.4
6 min	1262	3.4	614	1.6
10 min	2104	5.7	1024	2.8
12 min	2525	6.9	1228	3.3
15 min	3157	8.6	1536	4.2
20 min	4209	11.5	2048	5.6
30 min	6314	17.2	3072	8.4
60 min	12629	34.6	6144	16.8

Table 1: Overview of storage periods with 4 and 11 channels

4.2.5 Function of serial interface COM2

According to **Table 2** below the COM2 interface can be switched off (minimum current consumption) or the output of data telegrams selected or certain serial sensors for receiving data.

These settings can be used to change the number of measured values. In this case the ring buffer is re-initialised.

To change the function using the buttons, proceed as for sensor configuration (see section **4.2.3**).

Please note:

Before changing settings, existing measured data of the data logger should be backed up!

If the number of measuring channels is changed, previous stored values will no longer be available!

The sensor baud rate must match that of the COM2 interface.

The index in the following table shows the values required for programming via COM1 or USB (command "CS", see section **6.5**). COM2 should be switched off to minimise current consumption.

Index	Display text	Priority	Measured values	Function
0	Off/Aus	-	-	COM not used (minimum current consumption)
1	LPM/LNM A	-	7	THIES laser precipitation monitor (see **4.2.5.1**)
2	T-Online	-	-	Telegram instantaneous values (see also section4.2.5.2)
3	T-Online 2	-	-	Telegram instantaneous values 2 (see also section 4.2.5.2)

Table 2: Functions of serial interfaces

4.2.5.1 Sensor THIES LNM

The THIES LNM laser precipitation monitor (5.4110.xx.xxx) can be used with COM2 (RS-485 two-wire, half duplex).

The following settings should be made on the LNM:

- Baud rate 9600Bd 8N1: BR = 5
- Automatic mode telegram output on: TM = 4, 5, 6 or 7
- Half duplex: BD = 1

The data transmitted from the LNM once a minute are automatically received by the data logger. The following 7 values from telegrams 4 to 7 of the LNM are used here:

1. 1min. SYNOP Tab.4680 (No. 12 of telegram)
2. 1min. Intensity [µm/min] (No. 14)
3. Total Precipitation [mm] (No. 17)
4. 1min. Visibility in precipitation [m] (No. 18)
5. 1min. Quality level [%] (No. 20)
6. Inside temperature [°C] (No. 38)
7. Error status (No. 22 to 36)

Special averaging and general information:

Reg. 1.: SYNOP

The numerically highest SYNOP code in the averaging interval is stored.

Exceptions:

- Code "77" (snow grains) is evaluated between Code "51" and "52" (drizzle).
- Error codes "–1", "41" or "42" take priority over all other codes.

Reg. 2.: Intensity

The measured value is converted to µm/min without a decimal point.

Conversion: mm/h = µm/min / 16.667

Resolution: 0.06 mm/h

Reg. 3.: Total precipitation

Mean value memory:
Storage of difference in storage interval (Resolution: 0.1mm)

Extreme value memory:
Storage of the lowest and highest total in the interval. The total is limited to max. 3000.0mm. If the total is greater than the threshold values 3000, 6000 or 9000mm, the relevant values are deducted.

e.g.: LNM total precipitation 3507.16mm -> data logger stores 507.2mm

Reg.4.: Visibility in precipitation

Visibility is limited to max. 30000m.

Reg.7.: Error status

The 15 error status bits are combined into one figure according to the following value system:

Bit 14 (Status laser) to bit 0 (Status controlling power range high)

Restriction of highest possible value to: 32751

e.g.: Status bit laser (bit 14) and Sensor supply (bit 8) set

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

Special extreme value calculation:

Reg.1.: SYNOP

Code "77" (snow grains) is recoded "54" (however, according to Tab.4680 "54" is the code for light freezing drizzle).

It is possible to transmit a command to the sensor using the command "SL2" (see section **6.5**).

4.2.5.2 Telegrams

Telegrams with instantaneous values are transmitted every second.

All telegrams are output with a checksum:

- The checksum is output directly before the <CR> character.
- The start of the checksum is identified with "*".
- Calculation starts with the first character after <STX> (if available). <STX> and "*" do not form part of the calculation. The initial value is zero and the characters are linked with exclusive OR.
- Output of the checksum is hexadecimal with 2 characters.

Telegram Online / Online 2:

Output of all instantaneous values. Sequence of data as on display (see also section **4.1**).

Telegram "Online" corresponds to the response to the command "mmc".

Telegram "Online 2" additionally transmits <STX> at the start and <ETX> at the end.

Note on baud rate:

2400Bd should be used as the minimum baud rate so that all data of the telegram can be output within one second.

4.2.6 Selection of clock accuracy

Clock accuracy is influenced by production-specific tolerances, ageing and the temperature dependency of the clock crystals.
If major deviations in time are noticed, it is possible to compensate for clock errors of the crystal as required (e.g. after the first year of operation).

Formula for mean frequency deviation **due to temperature drift**:

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

Example:
With a mean operating temperature of 5°C a difference in relation to room temperature of approx. 10 minutes per year should be assumed (arithmetic value for 5°C: approx. 7.5 min/a).

Setting values: -31 ... +31 (corresponds to -5.448 s/d ... +10.896 s/d)

Resolution of the negative setting value: -0.1757 s/d

Resolution of the positive setting value: +0.3515 s/d

5 Capture of measured values

To minimise current consumption the display and other circuitry parts are switched off when no button is pressed for 4 minutes or no data communication takes place via COM1 or USB. If COM2 is set to telegram output or automatic receive (e.g. sensor LNM), the display will not be switched off.

If the display is on (display mode), all configured channels are sampled every second.
When the device is solely in measuring mode (display off), the internal analogue measuring channels (temperature and supply voltage) and serial data are measured according to the sampling rate selected (1s to 1 hour) and the remaining digital channels every second.

Storage of the measured values according to the storage interval selected does not take place in maintenance mode.

The following diagram shows the sequence for the capture of measured values:

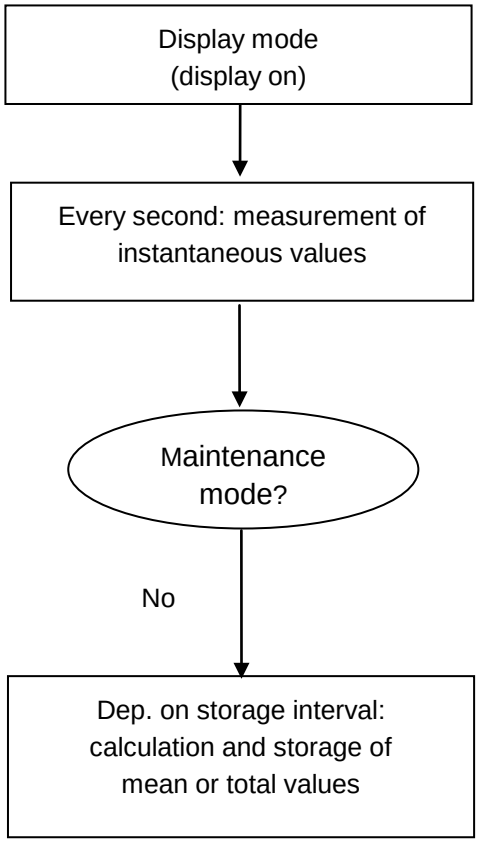


Figure 7: Flow diagram for display mode (display on)

6 Data output

The data logger basically offers three options for data output:

- Serial interface COM1 (RS-232) (see following **Note ***)
- Serial interface USB (see following **Note ***)
- SD card (Secure Digital memory card)

The serial interfaces COM1 and USB allow the data of the data logger to be queried from another computer via a cable. If necessary, the data logger is activated (display on) by the transmission of a character via COM1 or USB, so that switch-on using the "ENTER" button is not required.

The serial data can be output manually or via remote control (for serial commands see section **6.5**).

Note: *

The serial interfaces COM1 and USB should only be used as an alternative, i.e. the simultaneous use of COM1 and USB is not recommended.

The data logger cannot simultaneously receive commands from both interfaces. The data logger generally responds simultaneously via both interfaces.

A terminal program can be used for serial communication (e.g. "terminal" of Windows operating system. See following **Table 3** for general settings for COM1. A terminal program is also used for USB communication (see also section **6.4**). The communication settings of the terminal program (connection to serial interface or USB) and the data logger (COM1) must match.

All data are output as ASCII files (plain text). This means you can also use word processing programs to view, edit and print your data sets. In addition, you can work on files via the ASCII interface using standard software, e.g. spreadsheets, databases, etc.

A firmware upload is also possible via COM1.

Baud / bit per second	**As per COM1 baud rate of data logger**	
Data bits **(*)**	8	7
Parity **(*)**	N (none)	E (even)
Stop bits	1	
Flow control / handshaking	none	

Table 3: Terminal program configuration

(*) : Data logger setting: either 8N1 or 7E1

6.1 Manual data output

With manual data output the entire data memory is output via the COM1 interface or to the SD card (see also section **6.2,** poss. only newer data).

SD card:

1. Set display to:

```
* Daten Ausgabe
        ?
```

2. Insert SD card in slot of data logger.
3. Press <ENTER> button followed by <▼> button until cursor starts to flash.
4. Press <▼> or <▲> button for at least three seconds.
5. Start of output: The first line contains the file name and the second the number of data sets output. The red LED above the display light ups.
6. Abort during output of data: press <ENTER> button.
7. End of output of data: output of "END " in line 2

```
 sssssM00.TXT
 ooo: NNNNNX END
```

File name on SD card (ssss: station name)

ooo: "SD" or "COM1"

NNNNN: number of data sets scanned

8. Remove SD card once output has ended (red LED off):

   Press card to release and then remove.

Serial (COM1):

As above, but without SD card in slot (above items 2 and 8 do not apply).

The data files are stored on the SD card with the following tree structure:

```
D:\                          Root directory (here drive D)
└─── sssss\                  Subdirectory (station name)
     └─ ssssMnn.TXT          Data files (nn: 00..99)
```

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

The data on the SD card are always written to the "00" file. If there is already a "00" file in the subdirectory, the data logger will just try to append the new data. If the "00" file exceeds 10 million characters, this "00" file is renamed a non-existent "01" to "99" file. If renaming is not possible, output is aborted.

Please note:

The data logger does not delete data on the SD card.

The user is responsible for providing an SD card with sufficient memory and deleting old "01" to "99" files.

The write protector tab on the SD card is not used by the data logger.

We urge storing the data on other media.

Do not remove the card during the write operation. Press the "ENTER" button to abort output.

We accept no liability for the loss of data on SD cards.

*Only the SD cards recommended should be used here (see also section **6.2**).*

6.2 Recommended SD cards

To output the SD card's Card Identification Register (CID: MID, OID, PNM, PRV) see section **4.1** (baud rate COM1 / SD card). The CID data are necessary to distinguish cards as the adhesive label on the card normally has no significance.

For a list of tested SD cards (max. capacity 2GB, listed by manufacturer ID) see the following table.

MID: Manufacturer ID OID: OEM/Application ID

PNM: Product name PRV: Product version

Adhesive label	Capacity	Manufacturer	MID	OID	PNM	PRV	Works with data logger
Platinum	2GB	Panasonic	1	__	_____	0.0	YES
Kingston	512MB	Toshiba	2	TM	SD512	1.5	YES
Kingston AgfaPhoto	2GB				SD02G	2.8 3.2 3.8	
SanDisk	512MB	SanDisk	3	SD	SD512	8.0	No
	1GB				SD01G		
	2GB				SD02G		
ATP (industrial)	512MB	???	9	AP	AF_SD	1.0	YES
Platinum	1GB	???	27	SM	UD___	1.0	YES
PNY Technologies extreme memory AgfaPhoto	1GB	???	39	PH	SD01G	2.0	YES
extreme memory	1GB	???	62	H-	FLASH	0.0	YES
extreme memory	2GB	???	136	__	NCARD	1.0	YES

Table 4: SD cards tested

Information about SD cards:

Only use SD cards with positive test results (see above table).

Not all cards are compatible with the data logger.

The SD cards must be formatted to the FAT16 standard (status of SD cards on delivery).

6.3 Connecting cable of serial interface COM1

The serial interface COM1 is designed as a three-wire connection when using RS-232. The send line (TxD) and the receive line (RxD) should be crossed in the cable.

PC/TERMINAL		Cable	Data logger DLx	
Sub-D25 (25-pin)			Sub-D9	
TxD	2	—	2	RxD
RxD	3	—	3	TxD
GND	7	—	5	GND
Both sides Sub-D9 (9-pin)				
RxD	2	X	2	RxD
TxD	3	X	3	TxD
GND	5	—	5	GND

Table 5: COM1 connections with RS-232

6.4 USB

For communication via USB it is necessary to have a VCP driver (virtual COM port) installed on the PC you are using. VCP drivers cause the USB device to appear as an additional COM port on the PC. The user software can then treat the USB device as a standard COM port. The parameters (baud rate, data bits and parity) must match the COM1 setting of the data logger.

The driver is available from FTDI (FT245R): http://www.ftdichip.com/

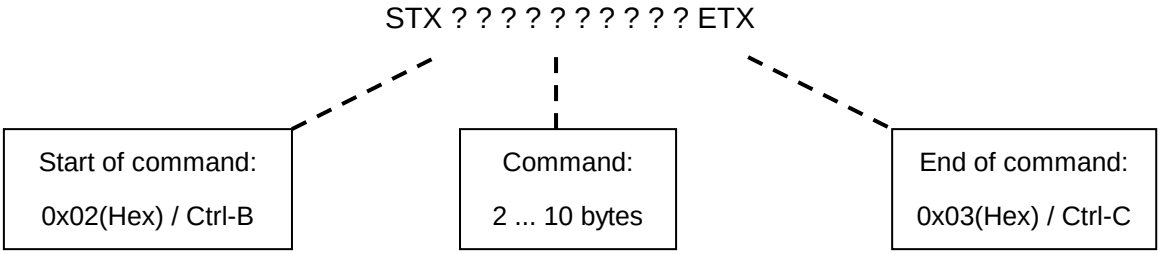
Installation guides for different operating systems are also available for download here.

A standard AB connector cable should be used as the USB cable between the PC and data logger.

6.5 Format of commands

The following commands can be used for the serial interfaces COM1 and USB of the data logger.

The commands consist of 4 to 12 bytes:



Overview of commands:

"HH"	Help: shows list of input commands
"PD"	Switch DLx to Powerdown (display off, measuring mode)
"RS"	Restart data logger: start bootloader
"CC"<n><0..9>	Select baud rate COMn (n=1,2):0:300Bd .. 5:9600Bd .. 9:115.2kBd
"CP"<n><0,1>	Select data bits/parity COMn (n=1,2): 0: 8N1 1: 7E1
"Cs000 "aaa	Select function of COM2 aaa:COM2 Values according to index in **Table 2** Example: STX "Cs000 003"ETX COM2: 3 (-> telegram T-Online 2) See section**4.2.5** for in additional information. **Old data can be deleted!**
"MT"<01s,02s,03s,04s,05s,06s,10s,12s,15s,20s,30s,01m,02m,03m,04m,05m,06m,10m,12m,15m,20m,30m,60m>	Select sampling rate in seconds or minutes
"ST"<01m,02m,03m,04m,05m,06m,10m,12m,15m,20m,30m,60m>	Select storage rate in minutes
"SS"	Output all stored values
"GS"	Entire memory: Only advisable when logger has re-initialised itself so as to save any data not yet overwritten.
"TS"<DdMoYy> "ts"<d><m><y>	Output stored data from one day For description of parameters: see section **6.5.1**
"DS"<DdMoYyHhMi> "ds"<d><m><y><h><m>	Output stored data from a specific time For description of parameters: see section **6.5.1**
"EP"	Output EEPROM data (parameter storage) for servicing
"LL"	Logger status: Output logger date and time, station name, sensor configuration, sensor status, voltage of battery, EEPROM status, mode
"MM"	Output instantaneous measured values with sensor designation (multiple lines)

"mm" "mmc"	Output instantaneous measured values as a one-line data set. Sequence of data as on display. Output as for "mm" command and checksum. For calculation of checksum see section **4.2.5.2**
"DD"	Output data logger date
"DT"<1..31>	Input day: Select day for data logger clock **(*)** Response: Day input, data logger date
"DM"<1..12>	Input month: Select month for data logger clock **(*)** Response: Month input, data logger date
"DJ"<0..99>	Input year: Select year for data logger clock **(*)** Response: Year input, data logger date
"ZZ"	Output data logger time
"ZH"<0..23>	Input hours: Select hour for data logger clock **(*)** Response: Hour input, data logger time
"ZM" <0..59>	Input minutes: Select minute for data logger clock **(*)** Second is set to zero. Response: Minute input, data logger time
"ZS" <0..59>	Input seconds: Select second for data logger clock **(*)** Response: Second input, data logger time
"ZK"a<0..31>	Selection of clock accuracy (a: +,-) (see also section **4.2.6**)
"XX"	Output station name, device type and software version.
"XXn"<AAAAA>	Input station name
"NT"<n>' '<0,1>	Precipitation sensor n (n=1,2) current consumption test (0:off)
"OO"<n>' '<0,1>	Switch optocoupler output n (n=1,2) off (0) or on (1)
"KK"<01..04>' '<0,1>	Select sensor configuration for a sensor <01..04> Sensor number <0,1> 0 -> deregister 1 -> register Example: STX "KK02 1"ETX (register sensor 2)
"SL2"<AAAAAAAAA>	Transparent gateway / bridge command LNM connected to COM2. The command will only be executed if an LNM has been configured to COM2. Function can be used for standard commands with a single-line response. The command <AAAAAAAAA> (up to 9 characters) is transmitted to COM2 and the response is output. CR is automatically added to the command. e.g.: STX"SL200TT00001"ETX -> TT parameter of LNM is set to 1. Note on LNM: Command may destroy minute-based data telegram due to half-duplex operation.
CR LF"?"CR LF	Response to an unknown command or incorrect parameter

Table 6: List of commands

(*): The internal divider of the clock is reset whenever writing to a register. In specific terms, this means that the internal 1/100-second register is reset, so that the change in seconds takes place.

OTHER CHARACTERS WITH SIGNIFANCE:

STX (0x02 Hex)	Start of a command
ETX (0x03 Hex)	End of a command
EOT (0x04 Hex)	Abort memory output with the commands: "SS", "GS", "ts", "ds", "TS", "DS"
XON (0x11 Hex)	Software handshake (continue output)
XOFF (0x13 Hex)	Software handshake (stop output; max. 4 minutes, Otherwise data logger will switch off!)

6.5.1 Parameters for memory commands

Note:
In extreme cases the data logger search may take over two minutes.

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

Dd: day (01..31) Mo: month (01..12) Yy: year (00..99) without century

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

Example: STX"DS0103041200"ETX
Stored data 1.03.2004 12:00 requested.

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) without century

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

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

Example: STX"ds" 29 31 32 40 28 ETX

Stored data 1.03.2004 12:00 requested.

Binary parameter should be input without blanks!

6.6 Data format

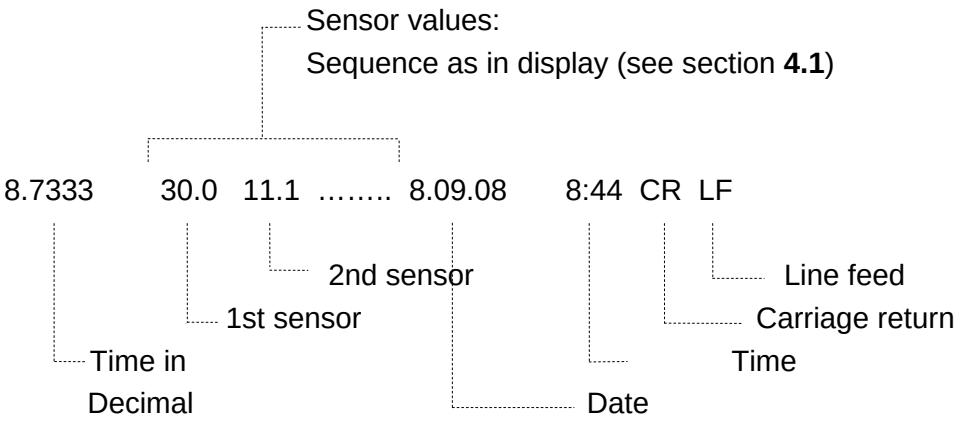
Data are output in one line with a fixed telegram length. The separating character is at least one blank (ASCII 32). Lines end with "CR LF". The decimal point acts as the decimal separator. Incorrect measured values are identified by one or more "?" or "!". Unconfigured internal measuring channels are output with minus signs (e.g. "---.-"). The end of serial data output (COM1 and USB) is identified by an end line (not with output to SD card, see section **6.6.2**).

Note:

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

6.6.1 Data

Data of data line:



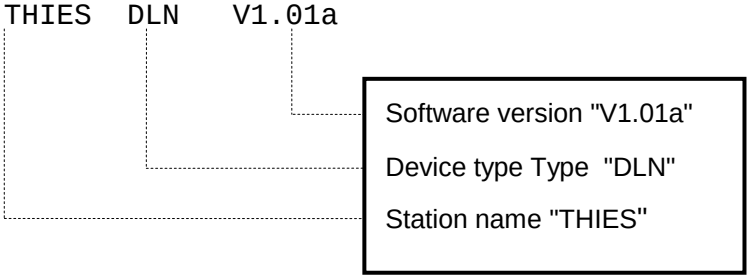
Example:

```
14.9667   0.0   0.0  24.8  53.4 14.10.10 14:58
14.9833   0.0   0.0  24.8  53.3 14.10.10 14:59
15.0000   0.0   0.0  24.7  53.6 14.10.10 15:00
15.0167   0.0   0.0  24.7  53.9 14.10.10 15:01
15.0333   0.0   0.0  23.7  53.8 14.10.10 15:02
15.0500   0.0   0.0  21.5  51.6 14.10.10 15:03
15.0667   0.0   0.0  20.0  51.0 14.10.10 15:04
15.0833   0.0   0.0  18.9  51.5 14.10.10 15:05
15.1000   0.0   0.0  18.5  51.8 14.10.10 15:06
15.1167   0.0   0.0  17.6  51.5 14.10.10 15:07
```

6.6.2 End line

The end line is only output with serial interfaces COM1 and USB.

```
END OF DATA Station: THIES  DLN   V1.01a
```



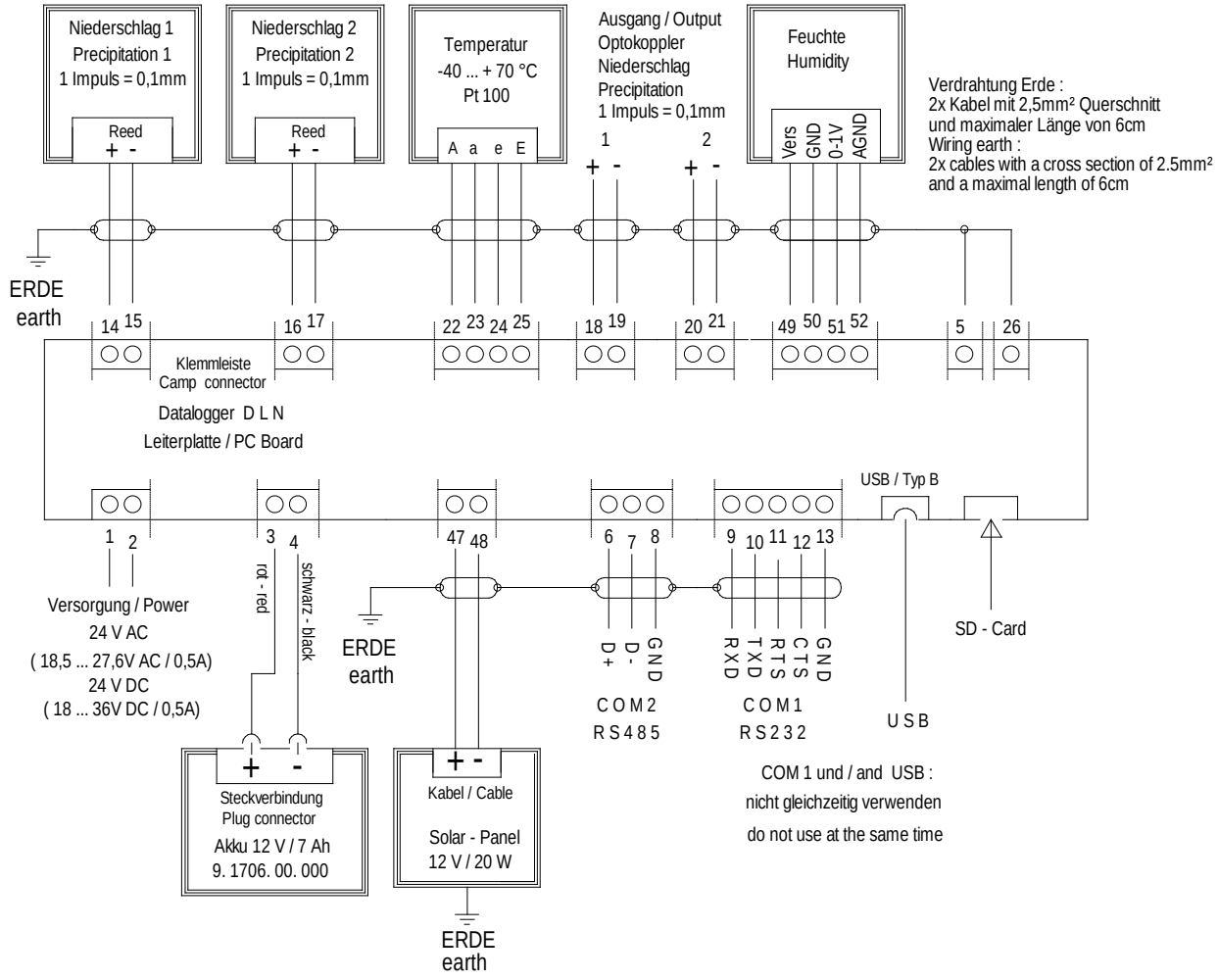
7 Technical data

Housing	Plastic
Type of protection	IP 20
Power supply	
Supply	24VAC (18.5 .... 27.6VAC), 50/60 HZ, 0.5A 24VDC (18 ... 36VDC), 0.5A
Rech. battery *	12VDC, 7Ah (type: lead, closed structure, VRLA)
Solar panel *	Nominal voltage 15-18V (max. 23.5V no-load voltage), max. 20W Output voltage: temperature-controlled for optimal recharging of battery
Mean current consumption Rech. battery 12.5V (COM2 + opto outputs switched off, Pt100 switched on)	Max. 2mA (display mode, display on, without sensors) 0.3mA (measuring mode, display off, sampling rate 1s) 0.1mA (measuring mode, display off, sampling rate 1min)
Operating temperature	-30...+60°C
Temperature display	-20...+60°C (for readoff)
Storage temperature	-40...+85°C
Humidity	max. 100% r.h., non-condensing
Analogue measurement	
A/D converter	16 bit resolution with differential inputs and 50/60Hz suppression
Analogue accuracy	±0.1% of measuring span of sensors, without long-term drift ±0.1°C
Channels	3 1. Supply voltage (0...15V) 2. Temperature Pt100 (-40...70°C) 3. Rel. humidity (0.02 ...1V, 2 ...100% rH) Input impedance: min. 12KΩ Supply: 12VDC nominal (battery), switched (max. 20mA)
Digital measurement	2 channels for number of pulses (e.g. reed contact, tipping bucket f. precip.) Supply: 5V via 10kOhm pull-up (see **Figure 5**) Switching thresholds of Schmitt trigger input circuit: Positive (V_{T+}) : 1.3 ... 2.2V Negative (V_{T-}) : 0.6 ... 1.5V Hysteresis ($V_{T+} - V_{T-}$) : 0.4 ... 1.2V
Digital opto outputs	2 passive optocouplers connectable for further processing of pulses max. 24V max. 1mA (see section **3.3.4**)
Measurement cycle for temperature + humidity	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
Storage interval of data set	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 min
Time basis	Real-time clock with automatic leap-year identification Accuracy adjustable (+10.8 ... –5.4 seconds/day)
Storage capacity	Firmware: 64 KB (flash, uploadable via COM1 with XModem CRC) Data: 4 MB (flash) Parameters: 256 bytes (EEPROM)
Number of data sets	303104 (with 4 sensors) (see also **Table 1**) 147456 (with 10 sensors, LNM to COM2)
Storage time	See section **4.2.4** for further details
Data output	
Serial 1 (COM1) (alternative to USB)	RS-232 Flow control: XON/XOFF handshake
USB	USB 2.0 full speed device, type B connector, type FTDI (FT245R),

(alternative to COM1)	VIRTUAL COM PORT driver: **www.ftdichip.com**
Memory card	SD card up to 2GB. Formatted to FAT16, compatible with Microsoft® Windows® and MS-DOS® Compatibility with all cards available on the market cannot be guaranteed. For types tested see section **6.2**
Free serial interfaces	COM2 for connection of serial sensors or output of data telegrams
Serial 2 (COM2)	RS-485 two-wire (half-duplex) Delay/latency: 20ms
Parameter COM1,COM2	300...115200 baud, 8 data bits and no parity (8N1), 7 data bits and even parity (7E1), 1 stop bit
Operation	3 buttons on device and remote control via COM1 or USB
LCD display	2 lines each with 16 characters (alphanumerical)
Type of mounting	Snap-on mounting 35mm standard DIN EN 60 715 rail, TH35, 9 modules
Type of connection	32 terminals, ∅ max. 2.5mm²
Dimensions	157 x 86 x 58.5 mm (9 modules)

* Rechargeable battery and solar panel not included in delivery

8 Wiring diagram



Note:

EMC-compliant mounting of cables: *see section **3.3.1**.*

Optocoupler outputs: *see section **3.3.4**.*

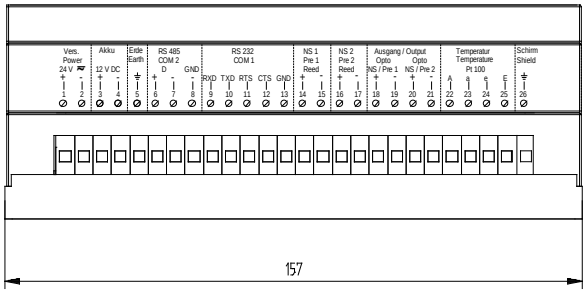
9 Maintenance

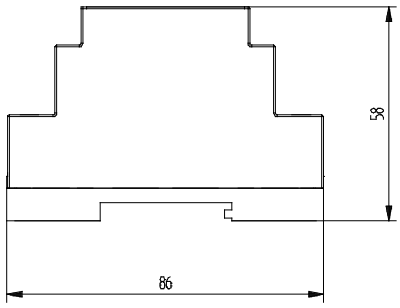
The DLN data logger is maintenance-free.

Cleaning:
To clean the housing a slightly damp cloth should be used without chemical cleaning agents.

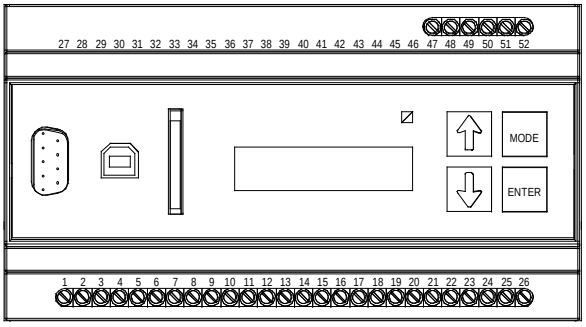
Storage:
The DLN data logger should be stored in a dry room free of dust at a temperatures between -20.. + 50°C. We recommend storing the device in a cardboard box.

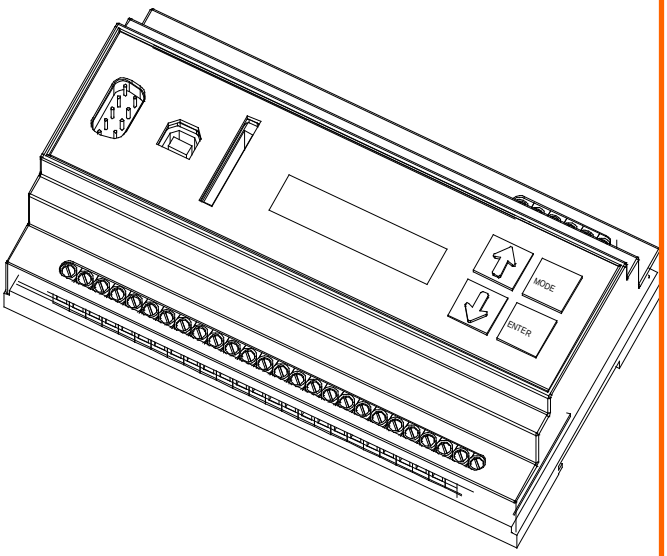
10 Dimension drawing





Snap-on mounting using a standard DIN EN 60 715 rail





11 Accessories

BATTERY 12 V 7 AH Serves for the supply of the DLN, carries out buffering with the solar panel supply	210 375	Nominal power: 12 V, 7 Ah

SD – Card 2 GB Serves for data storing/ data transport	9.2200.00.000	Storing capacity: 2 GB

Protective Housing For outdoor mounting of the DLN. Equipment: - Plastic housing with clear cover - integrated power supply unit - cable gland	9.3293.00.000	Housing: Dimension: 252x162x120mm (LxWxD) Material: Plastic Protection: IP 67 Power supply unit: Primary: 85 V...264V AC, 45...65Hz Secondary: 24V DC; 60 W

Further Accessories on request.

12 EC Declaration of Conformity

Document-No.: 001201 **Month: 10 Year: 15**

Manufacturer: **A D O L F T H I E S G m b H & C o. K G**
Hauptstr. 76
D-37083 Göttingen
Tel.: (0551) 79001-0
Fax: (0551) 79001-65
email: Info@ThiesClima.com

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

Description of Product: **Datalogger DLN, Datalogger DLU**

Article No. **5.1756.00.000** **9.1711.00.000**

specified technical data in the document: **021738/02/14; 021786/10/15**

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

2004/108/EC	DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC
2006/95/EC	DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2006 on the harmonisation of the laws of Member States relating to 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

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: 02.10.2015
Signed for and on behalf of:

Legally binding signature: issuer:

.....
Wolfgang Behrens, General Manager

.....
Joachim Beinhorn, 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.

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