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Operating Instructions

021616/09/10-AB1003811

DATALOGGER DL16 PRO

9.172x.0x.000

Firmware version: V 0.94

9.1720.00.000

9.1721.00.000 (example)

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Operating Instructions

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- 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.

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1 Device Characteristics

- 8Mbyte data memory
- WINDOWS-compatible file system
- Archiving of measured data for up to 365 days
- Data retention for up to 20 years
- 16 programmable multifunction channels, thereof:
- Up to 8 channels with „Thies serial-synchronous interface“
- Up to 8 digital in-/output
- Up to 6 counters with 32 bit depth
- Up to 16 PT100 inputs
- Up to 16 power inputs
- Up to 16 voltage inputs
- 24 bit ADC with minimum input noise
- Fully bipolar inputs with high common-mode input voltage range (+-15V vs ground)
- Thus no galvanic isolation of the sensor supply with DC/DC converters necessary.
- High common-mode rejection (stat. typ. 100dB, dyn. > 120dB with filtering at 50Hz)
- Freely programmable configuration of the channels, for ex. measuring ranges 40mV to 25V full scale
- Any mathematical linking of all channels
- 2 electrically isolated channels for power measurement (0...1A AC/DC, 0...10A AC/DC)
- 6 serial interfaces (RS232, RS422, RS485)
- Optionally: accurate pressure sensor onboard (measuring range: 300...1100hPa)
- Battery-backed, accurate, temperature-compensated real-time-clock
- Calculation of True Solar Time (TST)
- Freely programmable sensor supply (3V, 5V, 12V)
- 4 freely programmable potential-free heavy-power-disconnectors (60V DC, 48V AC, 10A)
- USB Interface
- Ethernet Interface
- SD-card slot
- Modem support
- Connection for DCF77 receiver
- Connection for solar panel, solar controller onboard
- Protocols: TELNET, FTP, http
- Integrated WEB-Server
- Simple operation using rotary switch and 4-line alphanumerical LC-display
- Freely programmable outputs for the LC-display

- Freely programmable WEB pages
- Commands and parameters are freely programmable
- Firmware Upload via RS232, USB, FTP or SD card
- Download of measuring values via RS232, MODEM, TELNET, FTP or SD card

2 Device Version

Designation	Article No.	Equipment
Datalogger DL16	**9.1720.0x.000**	• Stainless steel case with: • Datalogger • Transformer • Switched-mode power supply • Rechargeable battery • Terminal blocks
Datalogger DL16	**9.1721.0x.000**	• Stainless steel case (big) with: • Datalogger • Transformer • Switched-mode power supply • Rechargeable battery • Terminal blocks Further additional user-specific installations such as: • Overvoltage protection • Power bar • et cetera

DL16 configuration see chapter 10

Scope of supply: 1 x DL16 Datalogger

1 x set of operating instructions

1 x Description for the configuration of the DL16

1 x Wiring diagram

1 x CD with setup and configuration

3 Application

The DL16 Datalogger is a universally configurable measuring system designed for high-precision acquisition and storage of the following measured quantities:

- 16 multifunctional channels (PT100, current, voltage, frequency, serial synchronous)
- 2 heavy-current measurement inputs (0…1A / 0…10A)
- 6 serial interfaces (2 RS232 + 2 RS485 or 4 RS485), with four for external sensors and two for PC and modem communication. When using the RS485 interface, bus mode e.g. of ULTRASONIC anemometers is possible.

- Mathematical linking of individual channels via integrated functions

4 electrically isolated, freely configurable High-current-switches are provided for switching DC or AC voltage. This for example allows heating to be switched as a function of temperature.

The device is operated with a rechargeable battery and can also function without a 230V mains supply for short periods of up to 1 day without any additional source of energy.
To prevent battery discharge the acquisition of measured values is switched off if the voltage level falls below 11.5V.

During the starting process of the data logger, after battery voltage has been applied or in case of a reset, the boot loader is started first. This programme also monitors the battery voltage. The boot loader will stop execution of the programme, when the battery voltage is lower than 12.0V. This condition will be signalled by lighting and/or flashing of all red LEDs on the PCB.

The robust, lockable case is dust and hose-proof (IP65). It is made of stainless steel to protect the device from electromagnetic fields. In addition, operation is guaranteed in a temperature range from -30°C to 60°C.

The device is simple to operate using either a rotary switch or one of the following interfaces:

- USB
- Ethernet
- Modem (analog or ISDN)

The device is equipped with a 4-line alphanumerical LC display (4 x 20 characters).

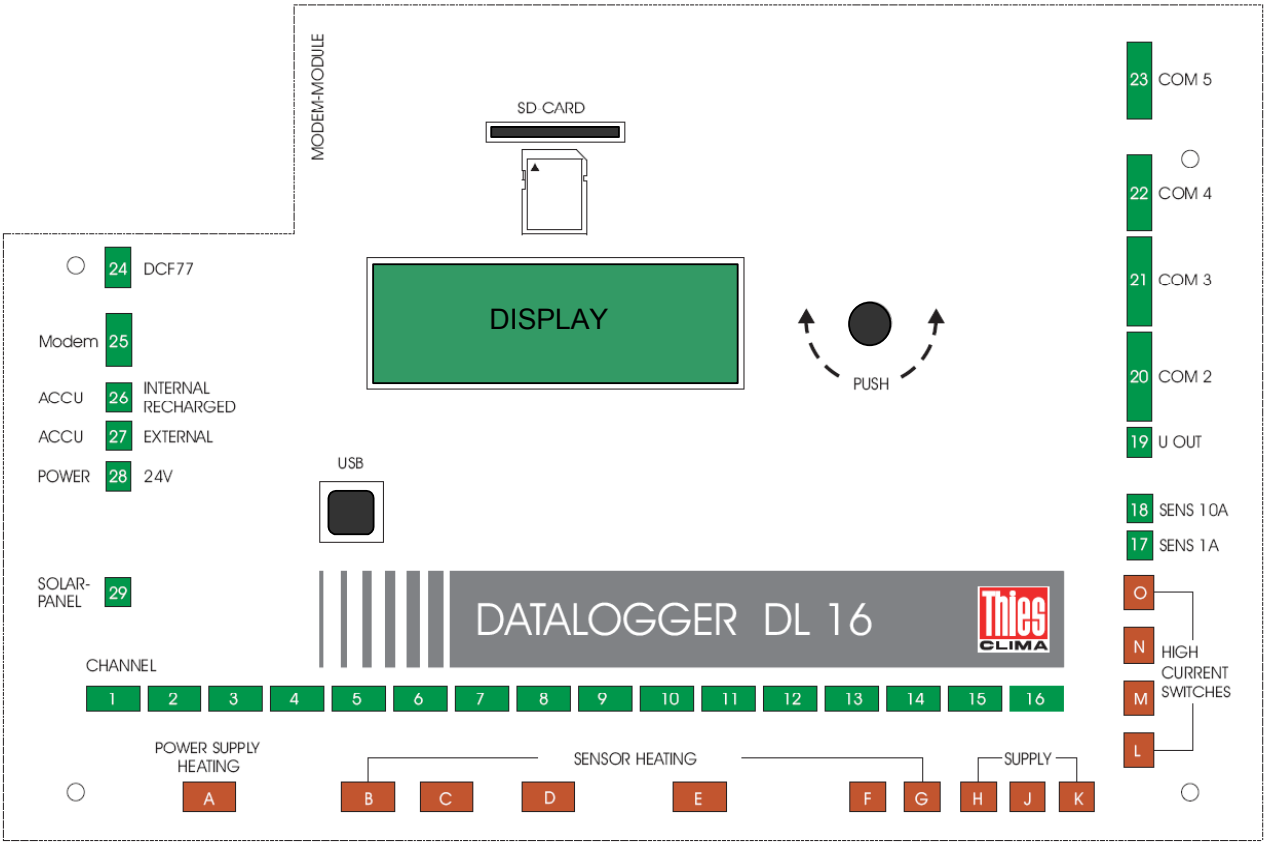

Figure 1: Front view

A real-time operating system runs on the DL16 Datalogger in conjunction with a file system. The measured data are initially written to a 64kbyte RAM disk and if necessary, stored on the 8Mbyte internal FLASH drive. The FLASH drive files always take the form of day log files. Data are managed as a ring buffer, i.e. if the FLASH memory is full, the oldest data are deleted first. The file name is made up of the year, month and day, e.g. 20090301. Besides the two internal drives there is also a slot for an SD card, which is used to export data or write new firmware and bootloaders to the Datalogger. Please take care that the applied SD card must be formatted by a FAT-16 file system.

Data readout is possible via the following interfaces:

- USB
- Ethernet (Telnet, FTP)
- MODEM
- SD card

The integrated real-time clock and RAM memory are battery-backed. This means that the time and data on the RAMDISK are saved even if the supply voltage is switched off.

The datalogger DL16 supports the time formats UTC (Universal Time Coordinated) and TST (True Solar Time). Switching over between the formats is possible.

The automatic synchronization of the time (UTC) is possible, when a DCF77 receiver or a GPS module is connected.

The Datalogger can be switched to maintenance mode to test the sensors or the measurement inputs. In this mode the values measured by the sensors are not transmitted to the archive, but shown on the display as usual.

The data logger will automatically deactivate the maintenance mode after 20 minutes. This prevents accidental failure of the user to reset the maintenance mode.

4 Structure of Datalogger

4.1 Connections of the 9.1720.00.000

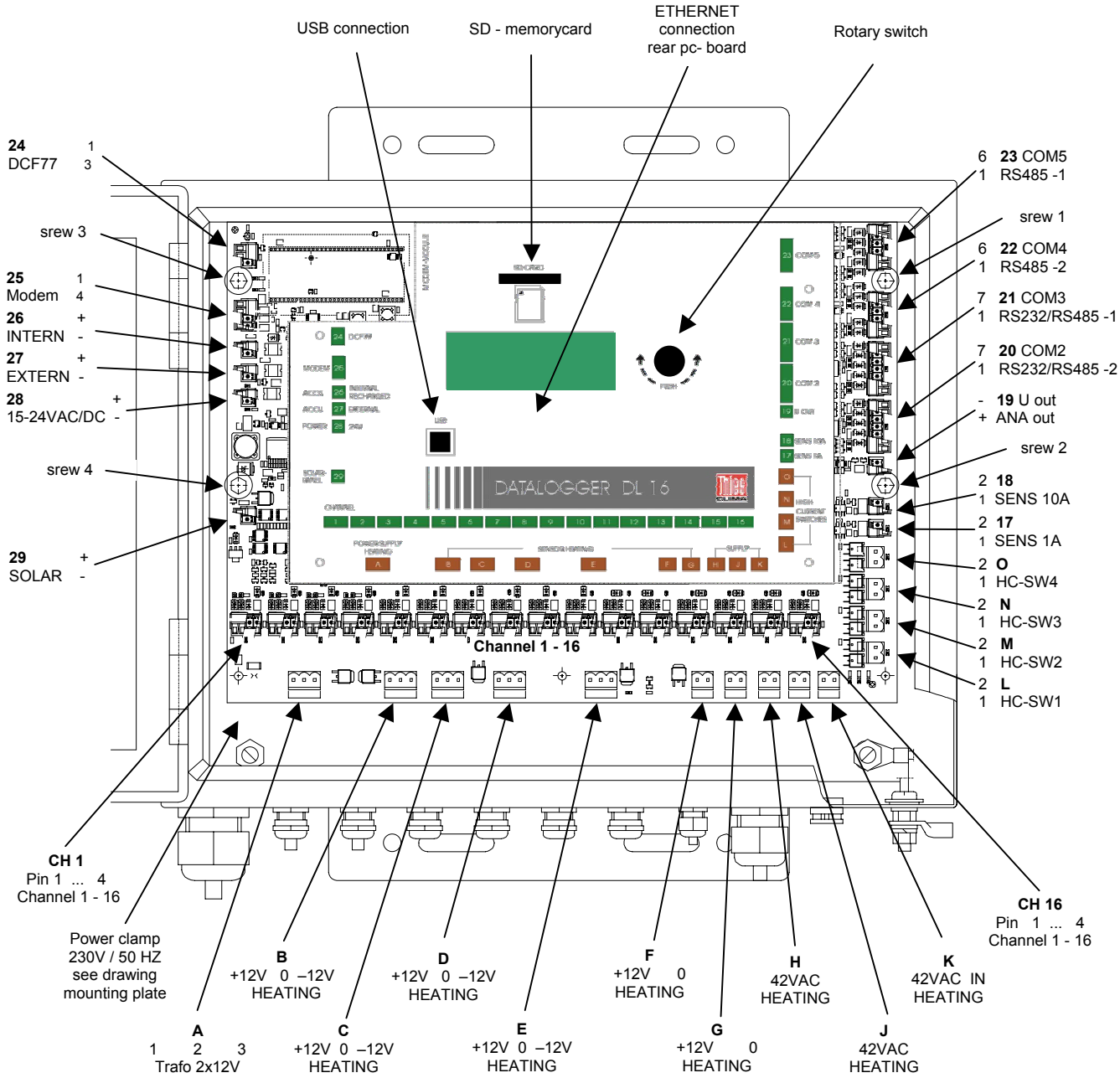

Figure 2: Connections

Each channel and each interface of the DL16 is equipped with a red Channel LED. These are located on the top of the DL16 PCB, below and to the right of the plugs of the respective channels. Above the plugs for the channels 1 – 4 there are jumpers (1 jumper for each channel). By plugging a jumper a 10kOhm pull-up resistance can be activated.

It is possible to move the unit consisting of the front panel and DL16 PCB out of the way to service the components housed under the DL16 PCB if the four screws are released (screw 1 ... screw 4 as shown in Fig. 2). In this state the front panel / PCB unit is no longer fixed in place.

Caution:

The supply voltage of the Datalogger must be switched off without fail before performing maintenance.

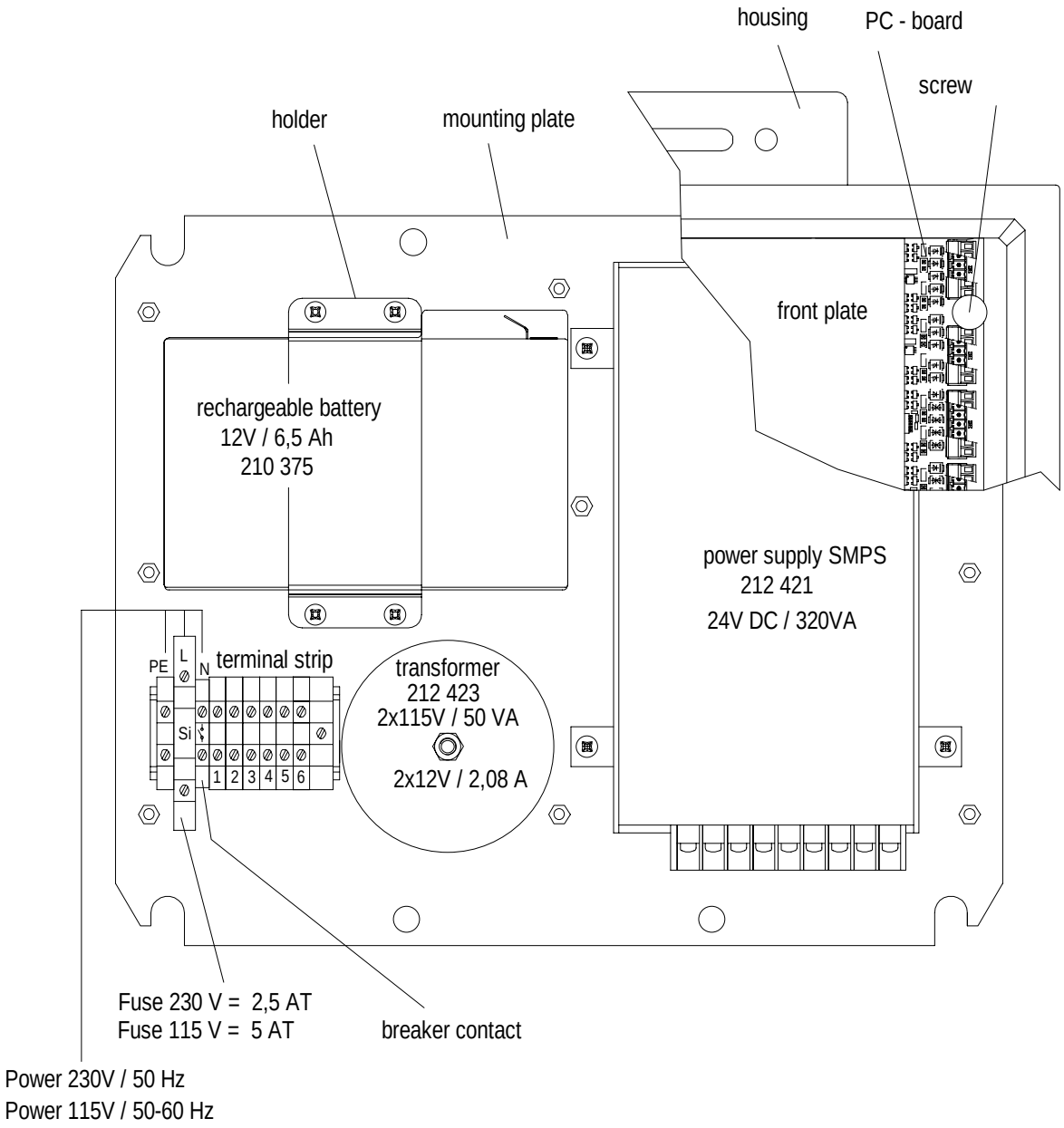

Figure 3: Components below the PCB of the DL16

The following components can be found under the PCB of the DL16:

- 12V lead gel rechargeable battery
- Transformer (2x115V, 2x12V, 50VA or 115V, 2x12V, 50VA)
- Power supply unit (SMPS) (100..240VAC, 24DC, 320W)
- Terminal strip (clamp connector) (clamps 1 to 6 to connect transformer and SMPS)

Supply of the Datalogger with mains voltage (L / N / PE) has to be provided for on the left part of the terminal strip, marked L, N and PE (Netz/Mains).
The sensors are directly connected to the DL16 PCB.

All terminal strips (clamp connectors) and plug connectors fitted (directly to the DL16) are listed in Chapter 12 "Wiring diagram".

4.2 Connections of the DL16 9.1721.00.000 (Exemple, equipment acc. to order)

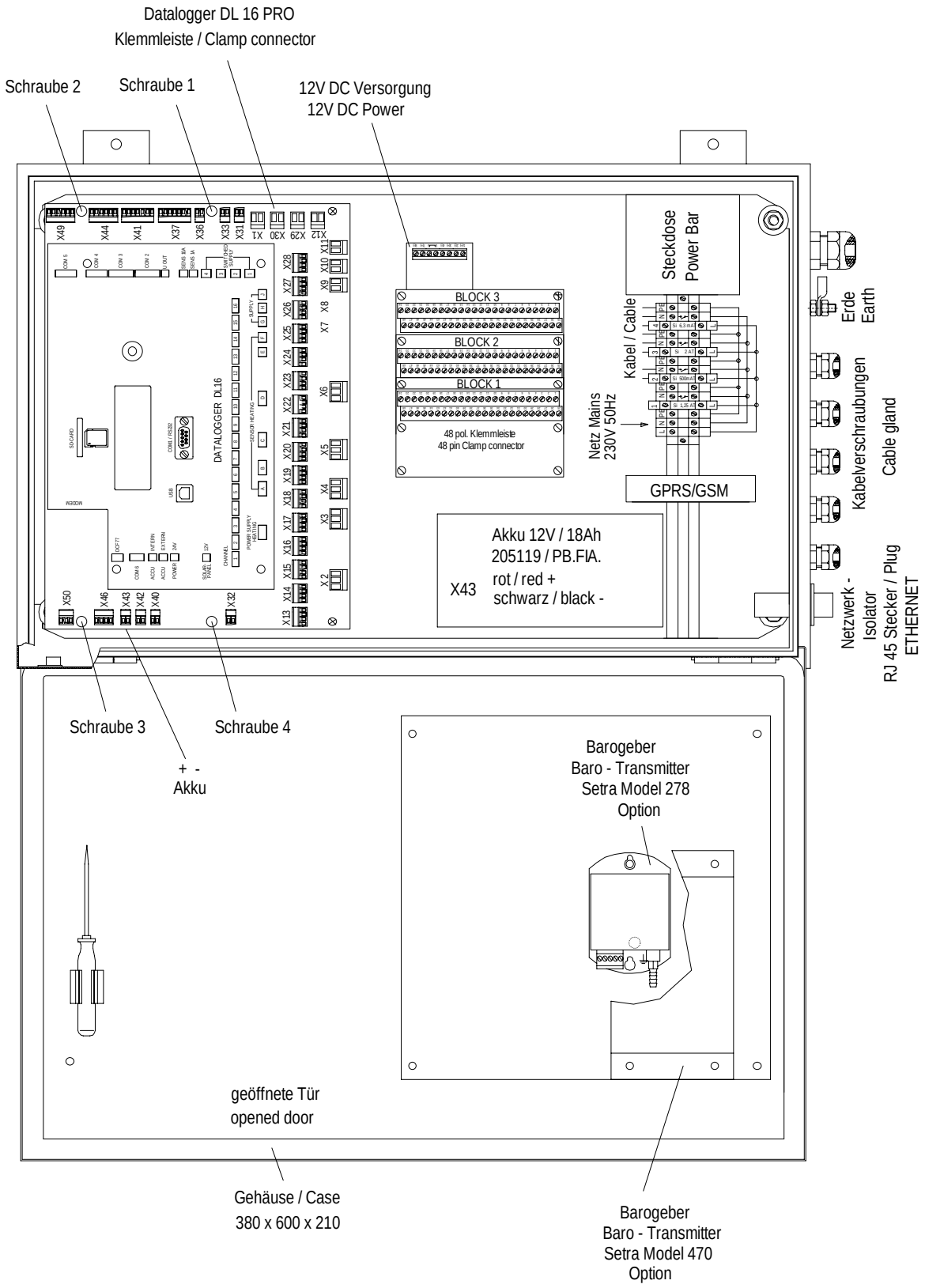

Figure 4: Connections

Each channel and each interface of the DL 16 has a red channel LED. These are arranged on the upper side of the DL 16 pc-board, below and right-hand beside the plug of each channel.

The following components can be found under the PCB of the DL16:

- 12V lead gel rechargeable battery
- transformer (2x115V, 2x12V, 50VA or 115V, 2x12V, 50VA)
- power supply unit (SMPS) (100..240VAC, 24DC, 320W)
- terminal strip (clamp connector) (clamps 5 to 12 to connect transformer and SMPS)

It is possible to move the unit consisting of the front panel and DL16 PCB out of the way to service the components housed under the DL16 PCB if the four screws are released (screw 1 ... screw 4 as shown in Fig. 2). In this state the front panel / PCB unit is no longer fixed in place.

Caution:

The supply voltage of the Datalogger must be switched off without fail before performing maintenance.

The Datalogger should be supplied with mains voltage (L / N / PE) at the terminal strip (clamp connector) labelled L, N and PE (Netz / Mains) positioned on the right.
The sensors are directly connected to the DL16 PCB or the three 48-pin terminal strips (clamp connectors) (BLOCK1...BLOCK3).
A SETRA278 pressure module can either be fitted under PCB BLOCK3 or on the mounting plate (Setra B 470) in the door. Under PCB BLOCK3 there is also a PCB with terminal strip (clamp connector) for a 12V power supply.

All terminal strips (clamp connectors) and plug connectors fitted (directly to the DL16) are listed in Chapter 12 "Wiring diagram".

4.3 Power connections

The DL16 Datalogger is equipped with 4 power connections:

- Rechargeable battery, internal (12V, 7Ah lead gel)
- External 12V supply, e.g. external rechargeable battery
- 24V AC/DC, external (or 230V or 115V with power supply unit / transformer)
- Connection of an external solar panel up to 22V no-load voltage

When a solar panel or 24V AC/DC is used, the internal battery will be charged.

For the start of the Datalogger-DL16, an internal battery voltage of >12V is required. Should this voltage be lower than that, the starting process will be stopped and all red light-emitting diodes on the DL16 PCB will light up and/or flash.

In the event that the voltage of the internal battery falls below 11.5V during operation, data logging will be stopped and an entry into the file “syslog.txt“ will be made (e.g. “08.01.00 00:22:42 Internal battery power less than 11.5V. Measurement stopped“).

Additionally, the following dialogue will be shown on the display:

```
Internal battery
Power < 11.5V
Measurement stopped
```

As soon as the battery voltage exceeds 11.8V again, data logging will be continued and an entry into the file “syslog.txt“ will be made (e.g. “08.01.00 00:44:49 Internal battery power OK. Measurement started“).

4.4 Analogue and digital inputs/outputs

The table shows the analogue and digital inputs and outputs offered by the DL16 Datalogger and their possible configuration.

Channel	Function [R,U,I]	Alternative function 1 [I]	Alternative function 2 [U]	Alternative function 3 [U]	Alternative function 4 [Ω]	Alternative function 5	Alternative function 6	Alternative function 7
CH1[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	Counter/ frequency 32bit[4]	-	-
CH2[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	Counter/ frequency 32bit[4]	-	-
CH3[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	Counter/ frequency 32bit[4]	-	-
CH4[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	Counter/ frequency 32bit[4]	-	-
CH5[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	Counter/ frequency 32bit
CH6[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	Counter/ frequency 32bit
CH7[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	-
CH8[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	-
CH9[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	-
CH10[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	-
CH11[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	-
CH12[2]	PT100	0...20mA	0...10V	0...100mV	Resistance	Digital I/O	Thies serial-synchronous	-
CH13[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	-	-	-
CH14[1]	PT100	0..20mA	0...10V	0...100mV	Resistance	-	-	-
CH15[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	-	-	-
CH16[1]	PT100	0...20mA	0...10V	0...100mV	Resistance	-	-	-
U OUT[3]	0...10V	-	-	-		-	-	-
SENS 10A[1]	0...10A	-	-	-		-	-	-
SENS 1A[1]	0...1A	-	-	-		-	-	-

Table 1: Channel configuration matrix of standard IO

[1]: Input
[2]: Input or output (dep. on function selected)
[3]: Output
[4]: Jumper for pull-up resistance (10kOhm between pin 2 and pin 4)

Note:
With the present device the functions of the individual channels are already configured. The channel configuration is described under 10.1.

4.5 Digital interfaces

The table shows the digital interfaces offered by the DL16.

Interface	Function	Alternative function 1	Alternative function 2	Description
USB	USB to RS232	-	-	Communication with the Datalogger
COM2	RS232	RS485 full duplex	RS485 half duplex	Communication of the Datalogger with external devices/sensors
COM3	RS232	RS485 full duplex	RS485 half duplex	Communication of the Datalogger with external devices/sensors
COM4	RS485 full duplex	RS485 half duplex	-	Communication of the Datalogger with external devices/sensors
COM5	RS485 full duplex	RS485 half duplex	-	Communication of the Datalogger with external devices/sensors
COM6[1]	RS232	RS485 full duplex	RS485 half duplex	Output of instantaneous values or communication of the Datalogger with external devices/sensors
Ethernet	Telnet	-	-	Communication with the Datalogger
Modem[1]	Analogue	ISDN	-	Communication with the Datalogger
SD card	SD card	-	-	Pick-up of measured values and/or firmware update

Table 2: Channel configuration matrix of serial interfaces

[1]: Function defined by the module used.

The plug connector for the Ethernet interface on the lower part of the DL16 PCB includes 2 LEDs.

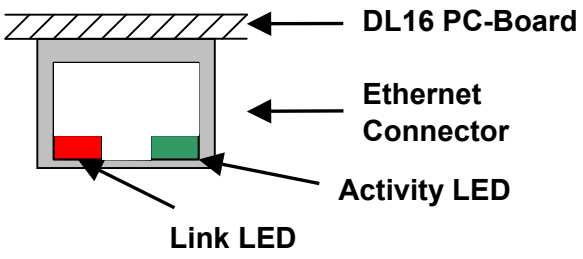

Figure 5: Status LED Ethernet Connector

When data traffic takes place on the Ethernet interface, the Activity LED will light up green. The Link LED will never light up.

It must be pointed out for the RS485 mode of the interfaces COM2, COM3 and COM5 that the DL16 does not change into receive mode after transmission of a command. That means that the driver keeps active still for a certain time period. This period depends on the set baud rate and is given in the following table.

Baud rate	Time [ms]
300	33,33
600	16,77
1200	8,33
2400	4,16
4800	2,08
9600	1,041
19200	0,520
38400	0,260
57600	0,130
115200	0,086

Table 3: Switch-over delay transmitting to receiving (COM2, COM3, COM5)

Remark:
A serial instrument in RS485 half-duplex mode at COM2, COM3 or COM5 has to wait a defined time period after receipt before changing into transmission mode and sending a reply.

At the interfaces COM2 to COM5 the connection of an external modem is possible. The operation of the modem is subject to the following limitation:

- A project download is not possible
- The modem is not supported by the boot loader (no firmware update by X-modem, file transfer possible)

Other functions, such as file transfer, and the online mode via the configuration program, as well as the execution of commands are possible also with this modem communication.

4.3.1 Optional Communication Module

An analogue- , ISDN or GSM modem can be used optionally. Here, the modem is inserted in the 64-pole receptacle top left on the DL 16 pc-board. In this case, the serial interface COM6 is not available.

For the communication via modem 6 time slices can be set in the configuration. A time slice indicates the period when the modem is active. Each time slice is defined by a start- and end time.

If both times are identical the respective time slice is deactivated. In the standard configuration only one time slice is activated. (00:00:00 to 23:59:00).

The datalogger DL 16 checks the conditions for each time slice in the measurement cycle. A condition is met when the current time is within the period of the time slice during the verification. That means , with a measurement cycle of 2 minutes and a time slice from 23:59:00 to 00:00:00, the condition for this time slice would never be met. Thus, the modem is permanently deactivated.

Via a characteristic the supply of the modem can be switched to „on“, off“ or „time slice“. If the characteristic is set to “on”, and the Datalogger is externally supplied by 24 V AC/DC the modem is permanently activated. In case the external supply for the DL 16 is missing, the activation of the modem occurs at the set time slices.

4.5.1.1 GSM Modem (optional, order-no. 9.1703.60.000)

Inserting the SIM card

- switch off logger
- Pivot the unit front plate and DL16 pc-board upwards or resp. Forward.
- Insert the SIM card by means of a small pincer.
  The sloped side of the SIM card must indicated to top left
  (see Fehler! Verweisquelle konnte nicht gefunden werden.)
- start logger

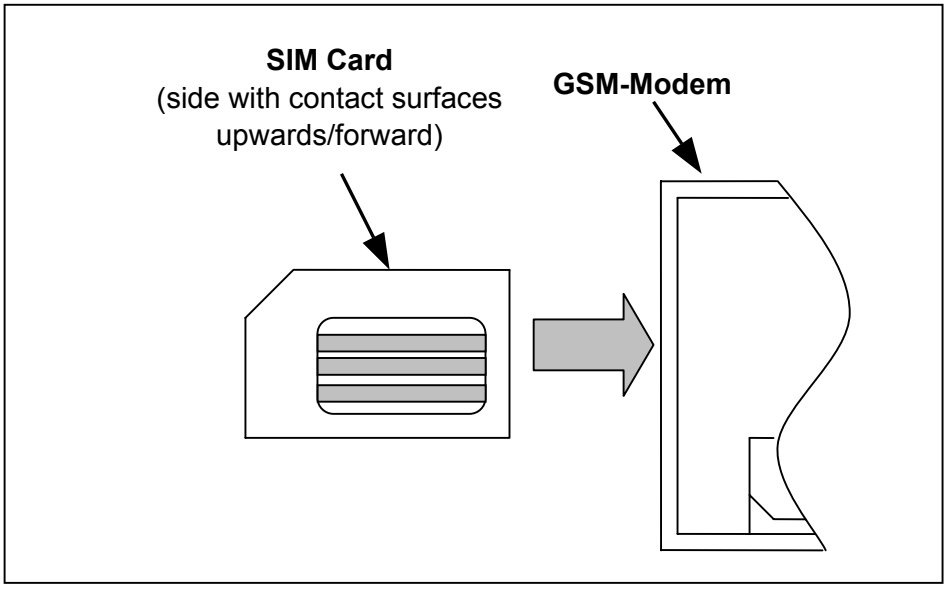

Figure 6: Insert SIM card

The GMS LED (yellow) left hand beside the receptacle shows the following states:

- no GMS modem available (LED off)
- GSM modem available, but no SIM card inserted (LED shines permanently)
- GSM modem available, SIM card inserted, and modem logged in (LED blinks)

The **Figure 7** shows a GSM modem with inserted SIM card.

Each night, the datalogger DL 16 switches off the modem at 24:00:00 for 10 seconds (switching off the supply voltage). Thus, a possible error status of the modem is cancelled.

The modem can be dialled externally. All commands for control and data query are available via the modem interface.

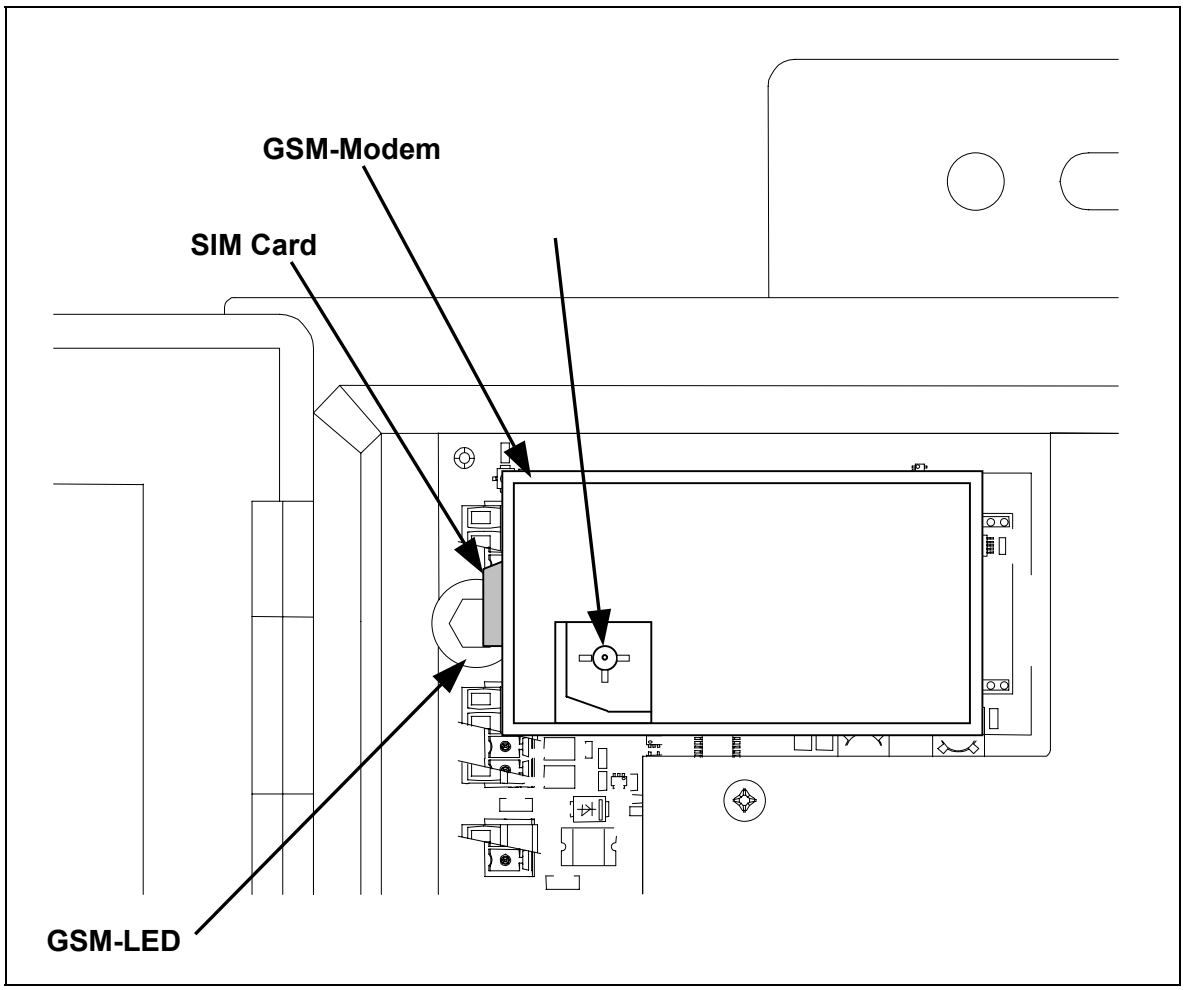

Figure 7: GSM modem

4.6 Sensor supply

With the DL16 Datalogger it is possible to connect a supply voltage to the channels CH1 to CH16 and with the interfaces COM2 to COM5. This voltage can be individually configured for each of the 16 channels and 4 interfaces and provides for the following voltage values:

- 3.3V
- 5V
- 12V

The voltage sources are short-circuit-proof, current-limited and switch off with any overvoltage.

Current limiting is designed on a block basis for 4 channels each, i.e. the 4 channels together must not exceed the specified current consumption, or the supply to this block will be switched off.

The correlation between the channels and block-by-block power limiting is given in **table 18** .

Note:
Supply to a block will be switched off in case of excess current. Any switch-off of the supply due to overcurrent will be recorded in the file "syslog.txt". The file „syslog.txt" is located in the drive „ser:0:" and can be read with FTP, for example.

4.7 Channel Configuration

In order to change the configuration of the channels of the DL 16 during operation it can be displayed in a dialogue. The channel configuration is structured into 2 blocks.

Block	Indication in the Display	Description
1	011011111111--11	- 16 digits acc. to the 16 analogue E/A - left-hand digit is channel 1 - right-hand digit is channel 16 - possible values of a digit: 1: channel is activated 0: channel is deactivated -: channel is not configured P: Power fail
2	111111	- 6 digits acc. to the 4 serial interfaces and the 2 high-power inputs - left-hand digit is channel COM2 - 4 digit from left is channel COM5 - 5 digit from left is channel Sens1A - right-hand digit is channel Sens10A - possible values of a digit: 1: channel is activated 0: channel is deactivated -: channel is not configured P: Power fail

Table 4: Channel configuration

Configured channels can be switched off and on again („0“ or „1“) by the user in the channel configuration. Non-configured channels („-“) cannot be activated.

For changing the channel configuration the user has to switch over into the edit mode. According to the position of the block cursor the respective channel LED is activated, here.

```
111-01111111----
```

If the deactivation of the sensor supply voltage occurs (see chapt. 4.4) for ex., as an effect of a short-circuit, the datalogger DL 16 tries, then, to detect the defective sensor, and the following dialogue appears in the display.

```
    Power fail
12V   Chn1..Chn4
  P---------------
       Close
```

The dialogue shows the deactivated supply block, the supply voltage for the deactivated block, and the channel configuration. The „P“ within the channel configuration marks the channel for which the power fail condition was detected (here channel 1). The dialogue can be closed without modifications at the channel configuration with „close“.

4.8 Potential-free High-current-switches

The DL16 Datalogger is equipped with 4 potential-free High-current-switches (SW1…SW4), which offer flexible control.

4.9 DCF77

A DCF77 active antenna can be connected using a separate plug-in connector. The Datalogger automatically detects when a DCF77 antenna is connected. Clock synchronisation takes place once a day at 3 am.

4.10 Baro Transmitter Module 3.1157.20.000 [1)]

The baro transmitter module 3.1157.20.000 is a component of the DL 16. It can be activated via the software, and be incorporated in the configuration. The pressure sensor has an internal heating control, which is automatically active when the logger is supplied with AC voltage. With deactivated AC voltage, i.e. the logger is supplied only via battery, the heating control is switched off. The accuracy of the air pressure is given in the technical data.

[1)] activatable as optional feature

4.11 Status of Datalogger

The DL 16 status is displayed by 3 colored LED. These are arranged down right on the DL 16 pc-board (see **Figure 8**).

With normal operation the green LED blinks in measuring cycle. In addition to the green LED also a blue diode blinks every second. In case that after a project upload, or after a restart with a new project only the blue LED blinks, and not the green one, the archive construction has changed, and the datalogger has stopped the measurements. In this case the archive data files must be read out, and be destroyed. The destroying of the archives is carried out by the command <CTRL B>REMOVE_ARCHIVES<CTRLC>. Afterwards, the datalogger must be restarted. After running the command "REMOVE_ARCHIVES" all measuring values are irrevocably destroyed.

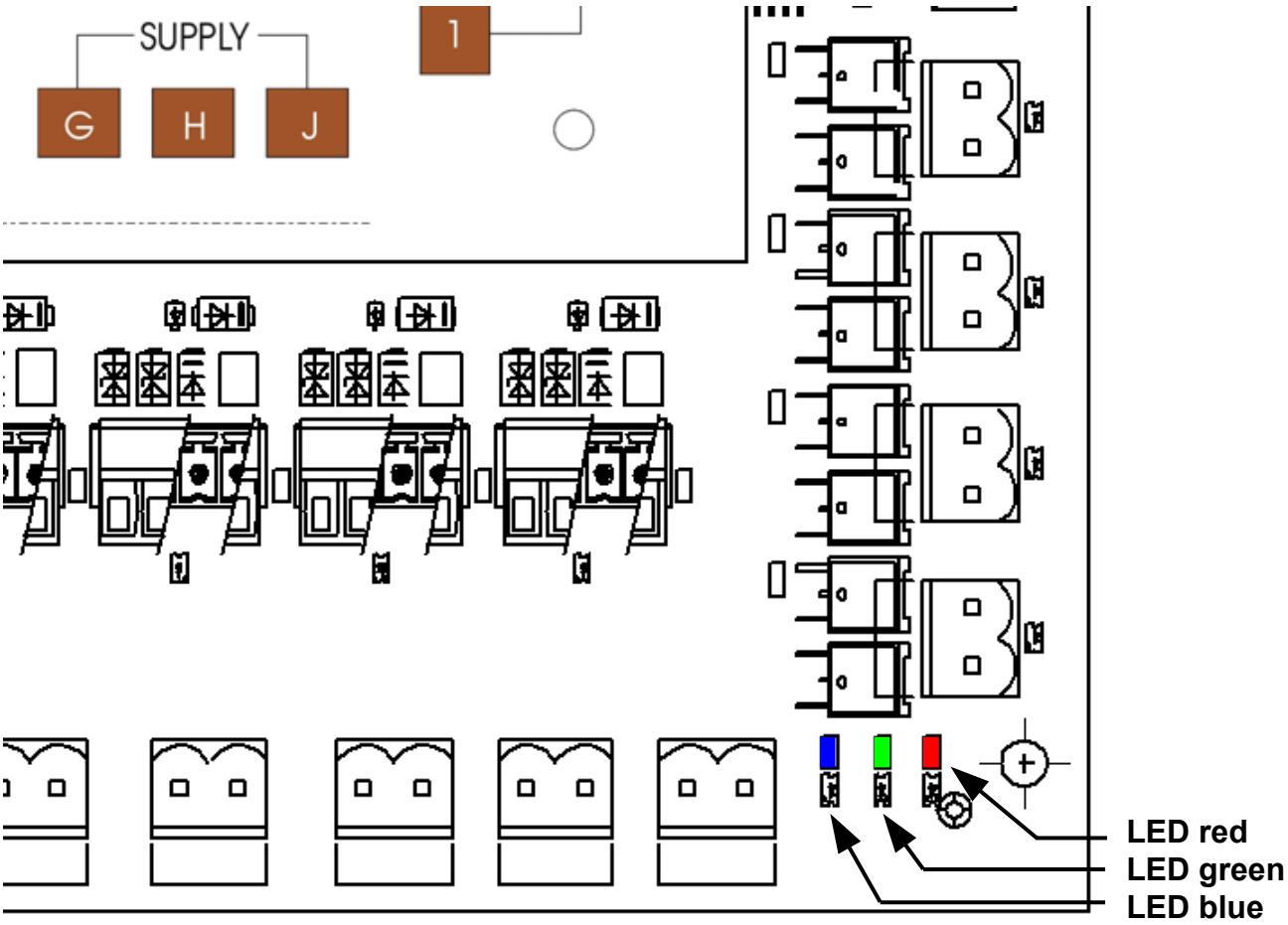

Figure 8: Status LED

Remark:

After running the command "REMOVE_ARCHIVES" all measuring values are irrevocably destroyed!

4.12 Maintenance Mode

For maintenance of datalogger DL 16, and the connected sensors the DL16 can be switched into the operating state “maintenance mode“. The activating and deactivating of the „maintenance mode“ is carried out via an interface by means of a command or by the turnkey (dialogue in the display).

In the display the activated maintenance mode is indicated by an “$” as first character in the fourth line.

All mean value buffers, included in the datalogger configuration (each mean value module contains a mean value buffer), are completely deleted when the maintenance mode is switched on or off. When the maintenance mode is activated all newly incoming measuring values are marked with the status “maintenance mode/ sensor deactivated”. That means: also the values stored in the archive within this time period, get this status. Thus is guaranteed that on a later analysis of the filed measuring values no data are evaluated which are marked by the maintenance mode.

The status of the instantaneous values (raw values), however, will not change.

4.13 Power - Down Mode

The datalogger supports an operating state, the power-down-mode, which is used to reduce the power consumption of the system dramatically . This mode is possible only with a measurement cycle > 10 seconds, and can be activated only in the configuration.

In the power-down-mode the DL 16 is turned into a power saving state (sleeping mode) between the measurements. Depending on the configuration, also the sensor supply can be connected individually for each channel. In order that the sensors, connected to the DL 16, are ready for operation at the moment of measurement, it is possible to set, individually for each channel, a point of time shortly before measurement when the sensor supply shall be re-activated. This setting is possible only in the configuration.

When the DL 16 is in the power-down-mode the display is permanently switched off.

The datalogger can be activated by the following events from the power-down-mode:

- Applying the turnkey
- Inserting an SD card
- Receipt of a character via USB

After the activation the display is switched on, and the sensor supply is started. The datalogger continues the measurements at an increased measurement cycle. Thus, the display indicates permanently up-to-date measuring values for the user. This modified measurement cycle has no effect on the averaging- and storing intervals.

If no other event occurs for at least 20 seconds the datalogger returns into the power-down-mode.

Remark:

When the power-down-mode is activated in the datalogger DL16 the Ethernet interface is switched off, and no Telnet-, FTP- and WEB-server is available!

5 Installation

5.1 9.1720.00.000: Dimensions, drilling pattern, cable glands

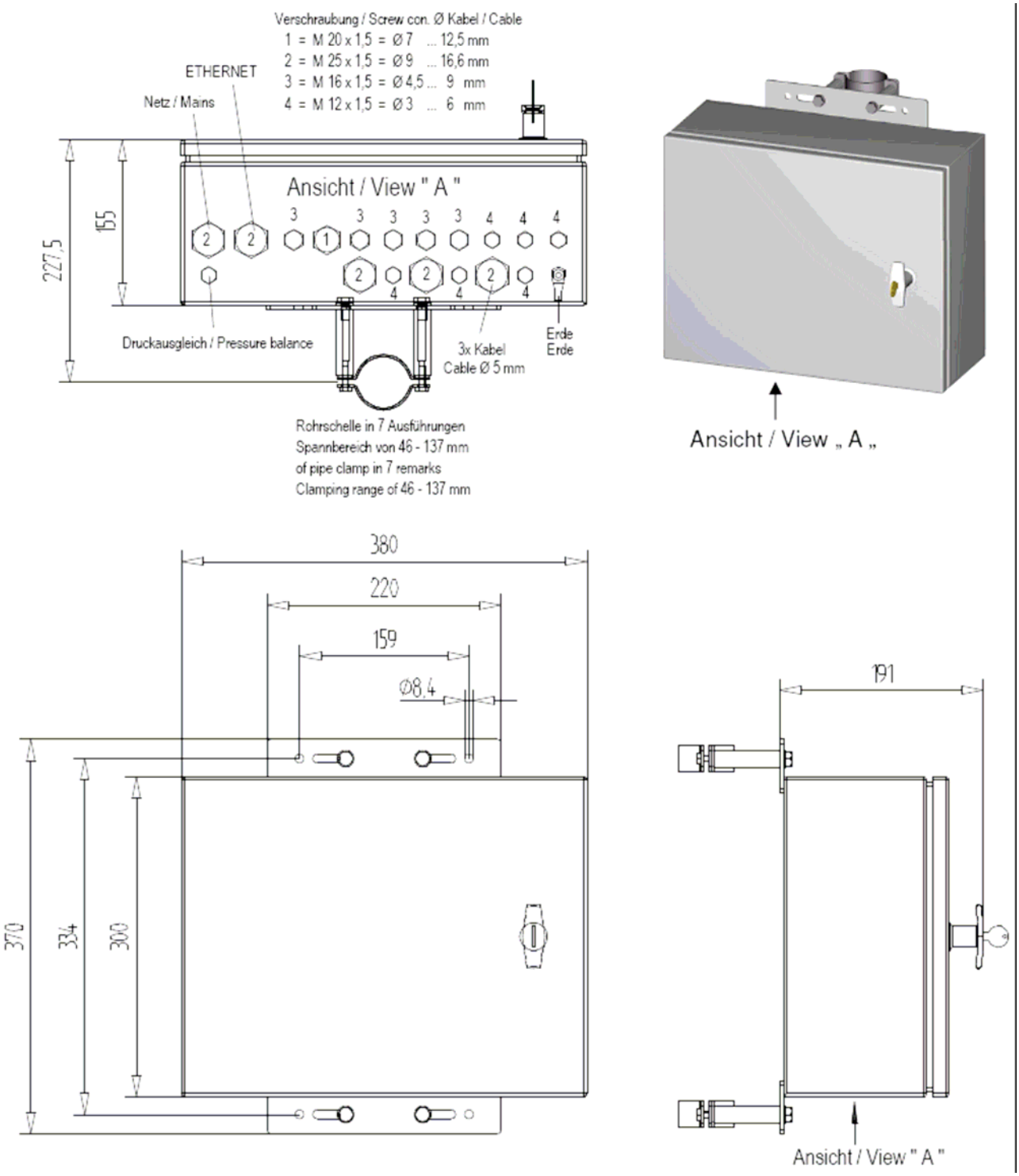

Figure 9: Dimension drawing 9.1720.00.000

Note:
The DL16 should be installed with the cable glands pointing downwards to prevent the ingress of water.

5.2 9.1721.00.000: Dimensions, drilling pattern, cable glands

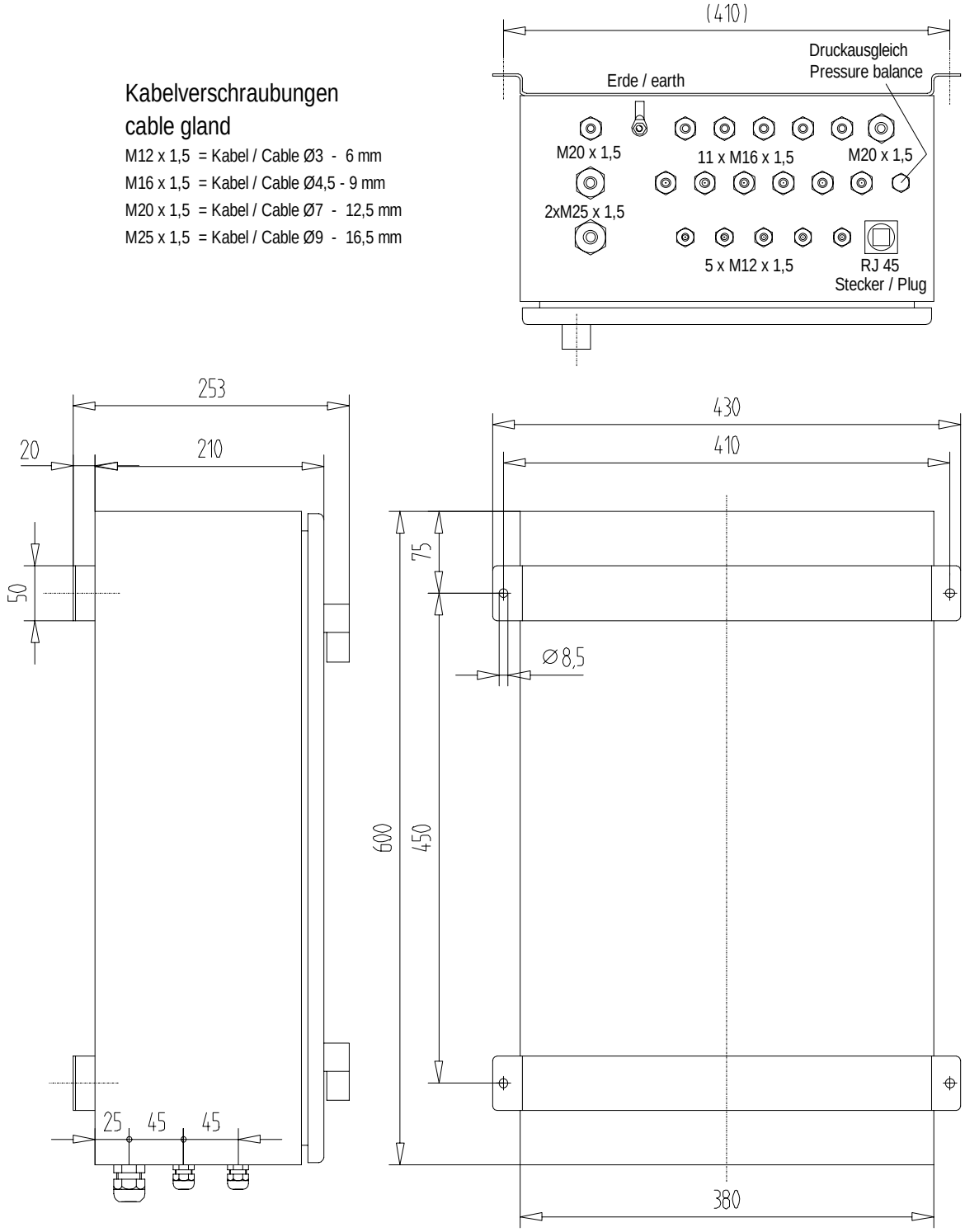

Figure 10: Dimension drawing 9.1721.00.000

Note:
The DL16 should be installed with the cable glands pointing downwards to prevent the ingress of water.

5.3 Cable glands

The sensor cables and the mains power supply line are routed to the supply terminals through the relevant glands; see also diagram of connections and wiring diagram. They are then connected to the appropriate screw terminals.

To ensure EMC-compatible installation, the braided shield of the cables should be connected to the contact spring of the cable gland, depending on the version (see Fehler! Verweisquelle konnte nicht gefunden werden.).
The wiring diagram can be found in Chapter 11.

Version

1. Standard contact
- Cut back outer sheath and shield
- Make a round cut in the outer sheath at approx. 15 mm but do not remove
- Insert cable through the gland
- Remove outer sheath
- Pull back cable to make the connection between the cable shield and contact spring
- Close ... job completed!

2. Fine cables without inner sheath
- Cut back outer sheath
- Pull back braided screen approx.15 - 20 mm over outer sheath
- Insert cable in gland until connection is made between the cable shield and contact spring
- Close ... job completed!

3. Routing cable shield to another connection
- Expose approx.10 mm of braided screen
- Insert cable through gland until connection is made between the cable shield and contact spring
- Close ... job completed!

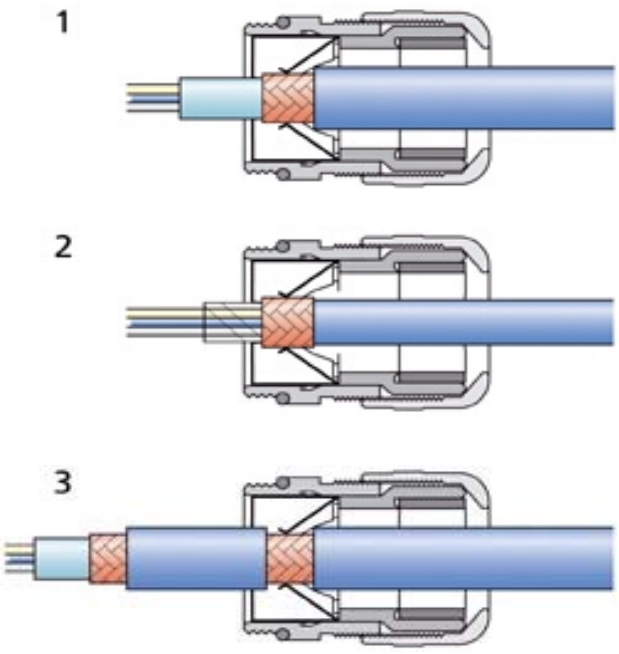

Figure 11: Shield cables with cable gland

5.4 Internal rechargeable battery

The rechargeable battery must always be connected, observing the specified polarity without fail (red -> + , black -> -)!

Note:
*Before replacing the rechargeable battery, the Datalogger should be switched off and disconnected from the 230V power supply. Section **9.2** describes how to switch off the Datalogger.*

5.5 External 24V AC/DC power supply

The internal battery is automatically charged whenever the external 24V AC/DC (Connection POWER 24V”) power supply is used. The rechargeable battery needs to be replaced at the latest when the battery voltage displayed falls below 11.5 V with the 24V AC/DC supply switched off. The data already stored will be saved during replacement.

Note:
No measurements will be made if the battery voltage is less than 11.5V!

Note:
The boot loader in the Datalogger DL16 will not start the firmware, when the battery voltage is below 12.0V! This condition will be signalled by lighting and/or flashing of all red LEDs on the PCB!

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

5.6 Mains connection

When the system is supplied via the 230V-supply or 115V-supply, one green light-emitting diode each will be illuminated on the Datalogger DL16 below and above clamp connector X40 (terminal “POWER 24V“). When the LEDs are off although the 230V-supply / 115V-supply has been connected, check the Fuse of the terminal strip on the input side.

5.7 Solar panel

The solar panel is connected using the SOLAR PANEL plug connector (X32). The charge controller integrated in the Datalogger monitors charging of the internal battery. It is not permitted to use the solar panel without the internal battery.

At locations in the northern hemisphere the module should be aligned to the south. For critical wintertime operation (little sunshine) we recommend an elevation angle adjusted according to the location (approx. 45° for Spain). Under no circumstances should any partial shadow be cast by the structure or location, e.g. by sensors or crosspieces fitted over the module. In addition, the surface of the solar panel should be cleaned if necessary (removal of snow, leaves).

When the solar panel is connected, a green LED lights up under plug connector X32.

Note:
The integrated charge controller is designed for a solar panel with a no-load voltage of 22V and a nominal voltage of 17V.

Note:
When no solar panel has been connected, input X32 has to be wired with a 4.7kOhm resistor.

5.8 DCF active antenna (9.1760.00.000)

In general terms make sure that the antenna is placed in an optimum position. It should be aligned horizontally and crosswise to the direction of the transmitter (located near Frankfurt/M., N 50° 01’, E 09° 00’). The antenna should be positioned at least 1 metre from sources of interference such as power lines and 20cm from metal structures.

6 System Start

The order in which supply voltages are applied is shown below.

- Internal battery (terminal “ACCU INTERN”)
- External voltage supply 24V AC/DC (terminal “POWER 24V”)
- External battery (terminal “ACCU EXTERN”)
- Solar panel (terminal “SOLAR PANEL”)

In order to prevent that the DL16 looses data in the event of a sudden mains failure or that the internal FLASH-drive is damaged, always connect a battery (terminal “ACCU INTERN”). Upon application of a supply voltage of >12V (ACCU INTERN), the Datalogger starts. In this process, the micro controller in the DL16 will first initiate the boot loader (refer to Chapter 8).

```
THIES DL16
Bootloader V0.42
Wait for ‚x’: 15
COM TELNET
```

Subsequently, the boot loader will start the actual firm ware (refer to Chapter 9).

```
THIES DL16
Bootloader V0.42
Starting firmware
```

Once the firmware has been started, the configuration will be the first to be loaded. This is located in the internal FLASH-drive in the form of a binary file.

```
      DL16
  Loading project
 Read configuration
   from file
```

Following that, all modules and sensors specified by the configuration will be initialised.

```
      DL16
  Loading project
 Init object list
 System
```

Note:
The boot loader in the DL16 will not start the firmware, when the battery voltage is below 12.0V! This condition will be signalled by lighting and/or flashing of all red LEDs on the PCB!

7 General Functions

The DL16 Datalogger embodies a new concept for THIES's Datalogger series. In this logger the firmware and configuration are separate. The firmware is comparable with the operating system of a PC. This means that the user is free to configure the function to be performed by the firmware, with this thus corresponding to the drivers and programs in a PC.

Example: The DL16 has six different COM interfaces which only have a function once configured. Configuration allows the driver and function to be specified.

Configuration is carried out using a separate configuration tool. It is possible to configure the following functions:

- function of all IO (analogue, digital, serial)
- averaging methods
- mathematical linking of measured values
- archive structure
- structure of export data records (readout of archives)
- structure and content of dialogues
- allocation of passwords
- commands of serial interface and Help texts
- complete configuration and content of WEB pages
- configuration of Ethernet

The function of individual components may be repeated within a configuration, e.g. averaging. Other functions are specified for all Dataloggers, e.g. function of USB.

The present device is completely configured to the requirements.

7.1 Predefined functions

Regardless of the configuration the following functions are available with every datalogger:

- Communication via USB
- Command HH

The USB interface is reserved as communication interface. It is used for the communication of the datalogger with configuration tool and terminal. In the pre-selection the set baud rate is 115200Baud 8N1. The configuration can overwrite this setting.

The command HH (help) is not changeable by the configuration, and serves for querying the commands supported by the datalogger in the current configuration.

Remark:

The command HH is used to query all available commands online via a configured interface . The output of the commands occurs with a brief description, and the optional parameters.

7.2 Calculation of mean values

For data processing it is advisable to average the measured values over a specific period of time prior to storage. Various averaging methods are available here. The standard averaging method is sliding averaging, which takes the arithmetical average of the measured values over a specific period. Vectorial or scalar averaging is used for wind speed and direction.

The measurement interval of a mean value is always

(86400 modulo (mean value period))+sampling interval … (86400 modulo (mean value period))+mean value period …

The related measurement will be archived with the time stamp (86400 modulo(mean value period))+mean value period.

With a sampling period of 10 minutes and a sampling rate of 1 sec., data for the following intervals will be recorded:

Data interval	Time stamp of data
00:00:01 ... 00:10:00	00:10:00
00:10:01 ... 00:20:00	00:20:00
...	
23:50:01 ... 00:00:00	00:00:00

7.2.1 Arithmetical averaging

The standard averaging method is arithmetical averaging in a ring buffer. The averaging time is adjustable within limits. The mean value is the total of valid measured values divided by the number of valid measured values during the averaging time period selected. An error will be output if the number of measured values is 20% below the maximum number of possible inputs. If the time difference between the first and last measured value is greater than the averaging time period selected, the oldest measured value will be deleted.

$$X = \frac{1}{N}\sum_{i=0}^{N-1}(x_i)$$

7.2.2 Mean value wind speed

When a pulse transmitter is used to determine wind speed, an internal hardware counter registers every pulse. The hardware counter is read according to the sampling rate, and the data subjected to further processing in the Datalogger. Linking with the wind direction is performed.

In the present configuration vectorial calculation is used to obtain the mean value for the wind speed, i.e. the wind direction pertaining to the wind speed value is included in this calculation.

Calculation of wind speed using vectorial averaging:

$$x_i = v_i * \sin(Wd_i)$$

$$y_i = v_i * \cos(Wd_i)$$

$$V = \sqrt{\left[\frac{1}{N}\sum_{i=0}^{N-1}(x_i)\right]^2 + \left[\frac{1}{N}\sum_{i=0}^{N-1}(y_i)\right]^2}$$

Calculation of wind speed using scalar averaging:

$$V = \frac{1}{N}\sum_{i=0}^{N-1}(v_i)$$

7.2.3 Mean value wind direction

The mean value can be calculated for the wind direction in two ways: scalar and vectorial. With vectorial averaging the wind speed is included in averaging. With scalar averaging the wind direction is calculated without taking account of the wind speed.

Calculation of wind direction using vectorial averaging:

$$x_i = v_i * \sin(Wd_i)$$

$$y_i = v_i * \cos(Wd_i)$$

$$Wd = \arctan\left[\frac{\sum_{i=0}^{N-1} x_i}{\sum_{i=0}^{N-1} y_i}\right]$$

Calculation of wind direction using scalar averaging:

$$x_i = \sin(WD_i)$$

$$y_i = \cos(WD_i)$$

$$Wd = \arctan\left[\frac{\sum_{i=0}^{N-1} x_i}{\sum_{i=0}^{N-1} y_i}\right]$$

7.3 True Solar Time

The True Solar Time (abbr. TST) is depending on the longitude of the datalogger position and the day of the year. The calculation of the TST, implemented in the DL16, is given in the following:

$$TST = Time\_UTC - 4min/degree * L_e + E_t$$

Time_UTC : Time of the DL16 (UTC)
L_e: Longitude [degree] [west: positive east: negative]
E_t: correction peak position of the sun [min]

$$\begin{aligned} E_t &= (0,000075 + 0,001868 \cos\Gamma - 0,032077 \sin\Gamma \\ &\quad -0,014615 \cos 2\Gamma - 0,04089 \sin 2\Gamma)(229,18) \end{aligned}$$

$$\Gamma = \frac{2\pi(d_n - 1)}{365}$$

d_n: day of the year

Remark:
If the setting "Use true solar time" is set to "FALSE", or is not configured, UTC is used for True Solar Time.

7.4 Data structure of internal drives

As described above, the Datalogger is equipped with two internal drives:

- RAM disk (data carrier designation: “ram:0”)
- FLASH disk (data carrier designation: “ser:0“)

The RAM disc has approx. 800 kbyte, and is used to buffer the measuring values. Thus, the write cycles of the internal FLASH disc are minimized. It is tried to store the current day’s data file on the RAM disc. After the day’s change-over the file of the previous day is stored on the flash disc. If the memory requirements of a day’s data file exceeds the provided space the data are stored also on the flash disc.

The FLASH disk is 8Mbyte in size and is used to store the measured values, as well as the configuration and system files. A directory named WEB contains all files for Internet presentation. The measured values are stored in day log files in separate subdirectories. The names of the subdirectories are specified by the configuration:

The additional files for the system and configuration are as follows:

- config.bin contains the configuration in binary format
- system.ini file in Windows INI format containing parameters for Ethernet and modem
- syslog.txt contains Datalogger status signals
- syslog.old is generated if syslog.txt exceeds 8kbyte.

The file "syslog.txt" is used to log status signals during initialisation and general outputs. The MAC address set for the Datalogger is also output here.

An example of the content of this file is shown below:

```
02.02.09 09:33:55 DL16 boot
02.02.09 09:33:55 Stop Scheduling
02.02.09 09:33:55 Clear configuration
02.02.09 09:33:55 Read configuration from file.
02.02.09 09:33:55 Read end
02.02.09 09:33:55 Initialize configuration
02.02.09 09:34:06 Valid MAC-Address: 00-24-AD-00-00-04
02.02.09 09:34:10 Initialization OK
02.02.09 09:34:10 Start processing
```

If the size of the "syslog.txt" file reaches 8kbyte, its contents will be copied to the file "syslog.old“. Here the contents of the "syslog.old" file will be deleted beforehand, i.e. the file is always 8kbyte in size. After copying the contents of the "syslog.txt" file are deleted.

7.5 Storage of measured values (Archives)

The datalogger acquires the measuring values in sampling interval, which is set offline during configuration. The measuring values are saved in archives, while the archive name represents a directory on the drive„ser:0:“ The time interval of the measuring values in the archive is constant, and is indicated as saving interval. If the saving interval of an archive changes, all averaging intervals of the measuring values included in this archive are automatically adjusted. According to the specific datalogger configuration this dependency can be suspended. However, if the averaging interval of an archive-measuring-value is modified, the saving interval of the archive does not change.

The storing time of the archives in the DL16 can be queried by the command „get logger status“. The output is carried out in days, and is adjusted automatically to the set storing interval.

The measured values are stored in day log files. This means that if recording lasts *n* days, the relevant directories of the archives will contain *n* day log files. The name of a day log file is made up of the year (4 positions), the month (2 positions), the day (2 positions) and the file extension "BIN".

An example of a directory/file view for a DL16 is shown below.

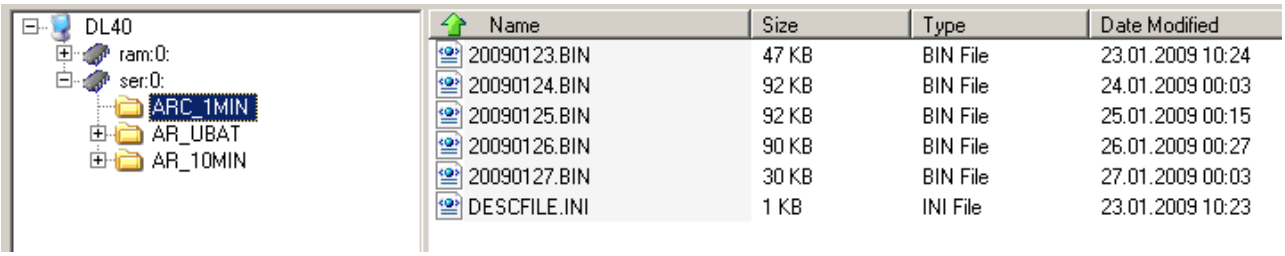

Figure 12: Directory/file view

Binary filing is used to store the measured values in the day log files to save memory space. This means that the data cannot be viewed with a text editor.

Every archive includes a description file 'DESCFILE.INI' so the data of the binary file can be interpreted by software. This contains a description of the binary data structure.

Every measured value in a day log file is allocated to a status byte that shows the status of the measured value. The status in this byte is coded bytewise, that means there a 8 different conditions. The conditions can also be combined with each others by setting the respective bits.

The table gives the allocation between bit position of the status bytes and their signification.

Bit Position in the status byte	Character in the meas. value (ASCII presentation)	Signification
Status byte = 0 (no bit set)	Display of measuring value	Measuring value is valid
0	-	Sensor is deactivated in the sensor configuration
1	-	Datalogger is in maintenance mode
2	%	Timeout (for ex. digitalization takes too long)
3	!	Value is out of valid range
4	@	Difference between 2 consecutive values is too far.
5	#	Filling level of the averaging buffer is too low.
6	?	Error depending on measurement type (for ex. ADC

		overflow)
7	?	Error depending on measurement type (for ex. cable break)

Table 5: Status values and their ASCII characters

With data output the measured values are output in plain text (ASCII form) without specifying the status byte. The status is directly encoded in the measured value, i.e. the positions of the measured value are filled with the character corresponding to the specific state (see previous table). If several conditions (bits) are selected in the status byte, the character for the status with the lowest bit position (highest priority) is used for filling up.

If for example a value is output with 3 positions !!!, a range error is involved.

This may for instance be the case if the air pressure is output with 3 positions but assumes a value of ≥1000hPa.

7.6 Export of archive to SD-card

The data logger saves the measured values in archives on the internal drive. Via the SD-card interface, the user on site may also export all archives to a SD-memory card.

Remark:
The datalogger DL 16 supports only SD cards with FAT-16 file system!

For this purpose, the SC-card will be inserted into the corresponding slot of the Datalogger DL16 and then the dialogue with the information on the data carrier will be confirmed.

Subsequently, the following dialogue will appear on the display:

```
Copy data to SD-card
    Export Text
   Export binary
       Cancel
```

The user may chose between exportation in text format or binary format. Exit from the dialogue without performing an export is possible by selecting Cancel.

The data logger will create a directory with the station names on the SD-card. This directory is used as target for all outputs during export.

The option for exports in text format depends on the configuration of the Datalogger DL16; this will be set up with a separate configuration tool.

7.6.1 Text format

When the user selects export in text format, the period for the export must be indicated. In the table below, selectable time spans (periods) are shown.

Period	Description
Newest	Only the latest data, which have not been recorded yet in text format on the SC-card, will be exported.
1 day[1]	Data for the current day will be exported.
2 days[1]	Data for the current day and the previous day will be exported.
3 days[1]	Data for the current day and the previous two days will be exported.
1 week[1]	Data for the current week will be exported.
2 weeks[1]	Data for the current week and the previous week will be exported.
3 weeks[1]	Data for the current week and the previous two weeks will be exported.
1 month[1]	Data for the current month will be exported.
2 months[1]	Data for the current month and the previous month will be exported.
3 months[1]	Data for the current month and the previous two months will be exported.

Table 6: Time spans for exports in text format

[1]: All relevant data will be exported. A verification, whether the data are already contained in the SD-card either completely or in part, will not take place.

On the display, the option for selecting the time span appears in the third line.

```
   Select export
     time span
     Newest
Cancel        Export
```

Once the item „Export“ has been selected, the data logger will start with the output of the measured values from the configured archives. During the process of exportation, the Datalogger DL16 will indicate status information on the display.

```
  Exporting data
  AR_READ_Av
  27.06.09 10:30:00
     Cancel
```

By selecting the item “Cancel “, the exportation of data can be terminated.
In case of exportation in text format, the measured values from the archives will be recorded in separate text files, according to the respective configuration. The names of these text files have the following format:

DL16_tii.TXT

In these, the first 5 characters (‚DL16_’) and the file suffix (‘TXT’) will always be identical. The character 't’ represents a letter which will be introduced on the occasion of the configuration. Under ‚ii’, the DL16 automatically assigns a 2-digit index. The following 2 file names serve as examples for this nomenclature.

- DL16_M00.TXT (file contained mean values)
- DL16_E00.TXT (file contained extreme values)

In the event that the size of a file exceeds 1MByte, a new file will be created and its index incremented (e.g. DL16_M01.TXT).

The format, in which measured values will be saved in the files, depends on the configuration. When the export process has ended, a dialogue to this effect will appear.

```
Copy data finished
You can now remove
   Your SD-card
        OK
```

7.6.2 Binary format

When the user selects export in binary format, export will start automatically. During this process, all archive, configuration and LOG-files located in the internal drive “ser:0“ will be copied. During the process of exportation, the DL16 will indicate status information on the display.

```
   Exporting data

    20090630.BIN
      Cancel
```

By selecting the item „Cancel “, the exportation of data can be terminated.

When the export process has ended, a dialogue to this effect will appear.

```
Copy data finished
You can now remove
   Your SD-card
        OK
```

7.7 Communication via FTP

An FTP server is implemented in the Datalogger. This allows the user to establish a connection via Ethernet to exchange data with the Datalogger, so offering direct access to files and directories on the FLASH drive "ser:0:" in the Datalogger. Only the data of the FLASH drive are visible via FTP. The data of the current day's file (RAM disc) are not available via FTP.

Enter the IP address of the DL16 Datalogger for read access to the Datalogger.

The figure shows the process involved in Windows Explorer.

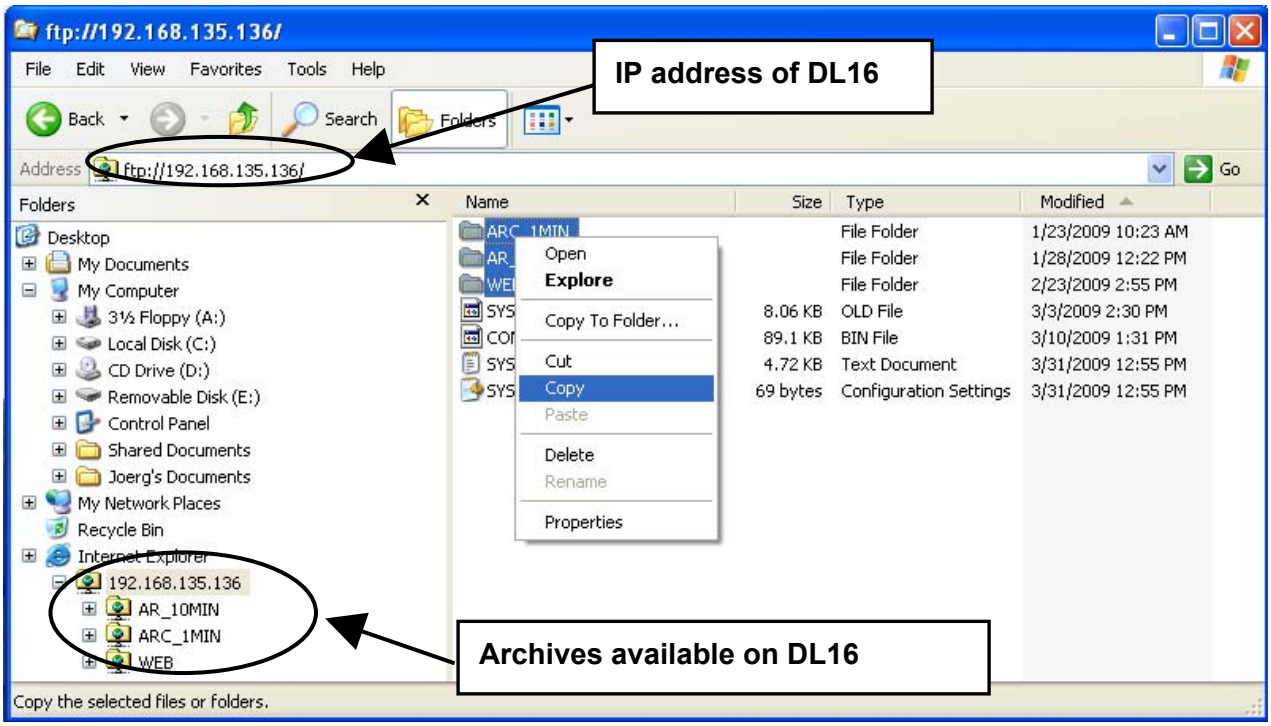

Figure 13: FTP communication

If write access to the DL16 Datalogger is also required, the user and password must be specified as well as the IP address. The following figure shows the process involved in Windows Explorer. The inputs for the user and password in Internet Explorer are as follows:

ftp:“user“:“PASSWORD“@“IP address“

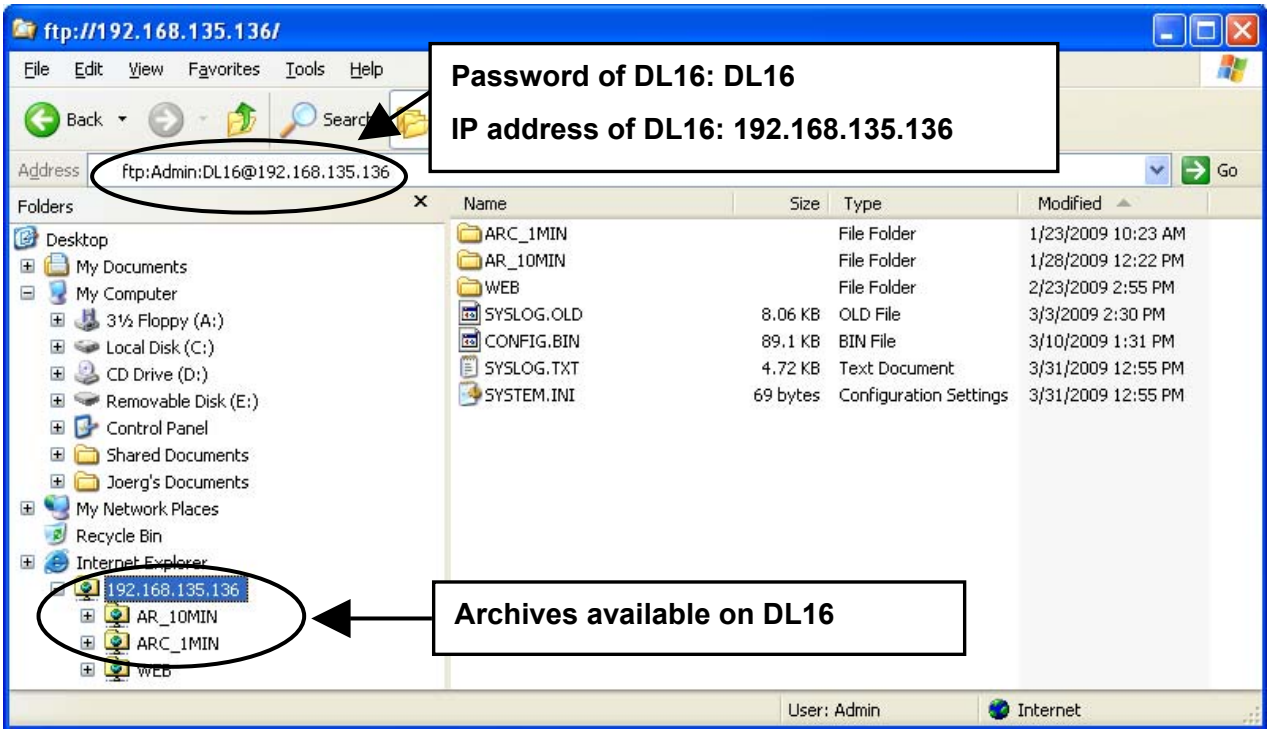

Figure 14: FTP communication with password

"DL16", the FTP password here, is set by the configuration program or the command "FTPPW" (default: DL16).

Remark:

When the power-down-mode is activated in the datalogger DL16 the Ethernet interface is switched off, and no Telnet-, FTP- and WEB-server is available!

7.7.1 Firmware upload via FTP

It is possible to realize a firmware upload via FTP. For this, the file DL16FIRM.HEX must be copied onto the root directory, and afterwards the logger has to be re-started. Before copying the data it must be guaranteed that there is sufficient space for storing the file DL16 FIRM.HEX. For loading the firmware please proceed as follows:

1. Read-out the archive data by MEVIS or another appropriate program.
2. Delete the data files with the ending BIN in the subdirectories of the archives.
3. Copy the data file DL16FIRM.HEX on the logger by FTP.
4. Open a Telnet connection, and restart the logger via the command <CTLRB>RS 1 >CTRLC>.
5. The firmware Is now loaded, and the data file DL16FIRM.HEX is automatically deleted.

7.8 Communication via Telnet

The DL16 provides for communication via a Telnet connection. In this case the IP address of the Datalogger and Port 23 has to be set in a terminal program. The selections are shown below for HyperTerminal (Windows).

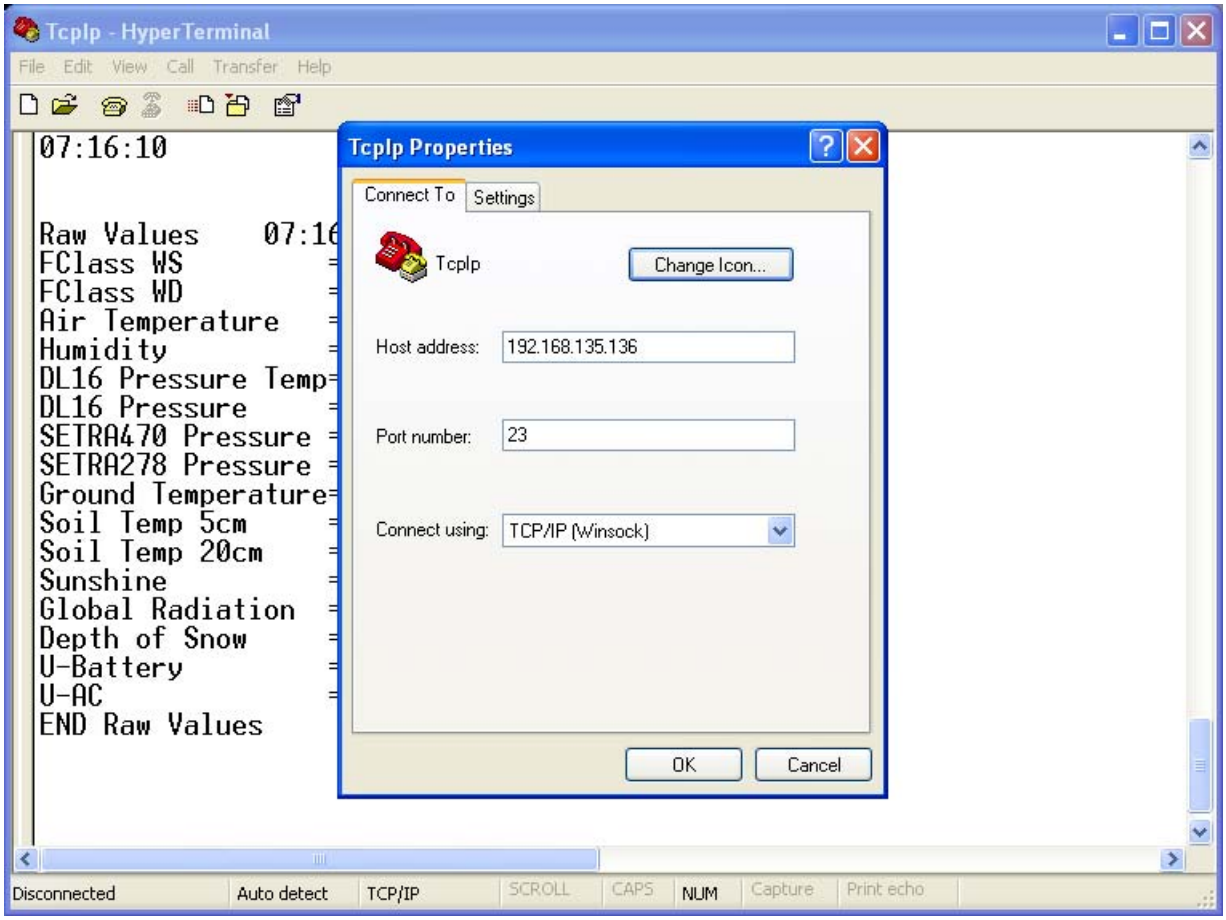

Figure 15: Telnet communication

The command <CTRL B>hh<CTRL C> can be input to test the connection. The Datalogger responds by outputting the Help texts.

Remark:

When the power-down-mode is activated in the datalogger DL16 the Ethernet interface is switched off, and no Telnet-, FTP- and WEB-server is available!

7.9 Communication - serial (USB serial)

The DL16 provides for communication via a USB serial port. If the USB connection is used, the program "CDM 2.04.16.exe" has to be first run from the CD. The program installs the drivers for the USB serial interface. If the Datalogger is now connected to the serial port, the PC will set up a new serial interface which must be used for communication. The baud rate with the Datalogger is 115200baud, 8N1.

The settings for HyperTerminal (Windows) are shown below.

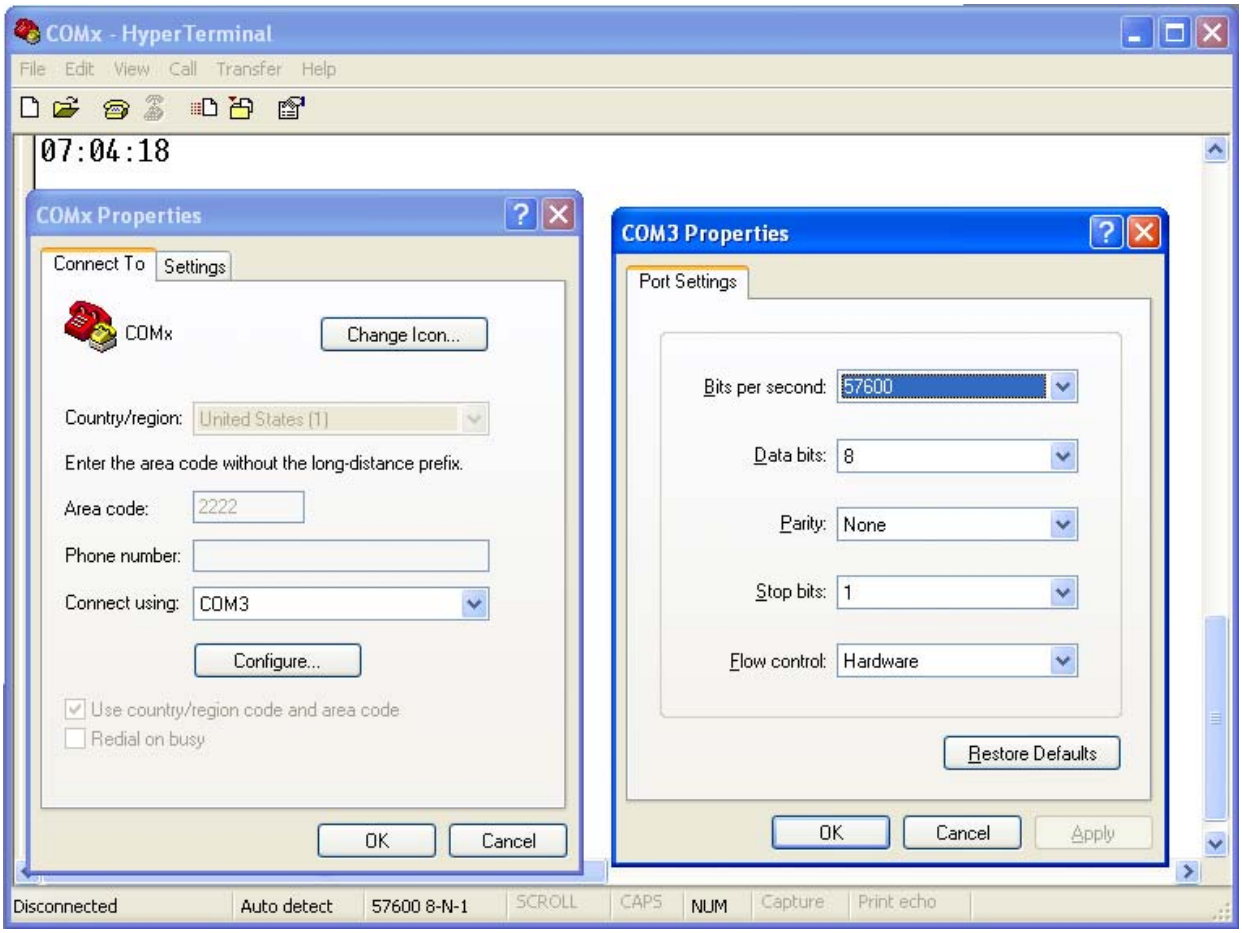

Figure 16: Serial communication

7.10 Operation

As soon as the (internal) battery is connected, the data logger will start automatically. If the voltage of the internal battery is lower than 12.0V, the data logger will terminate the starting process and all red light emitting diodes on the PCB will flash or light up.

Check time and date, when the device is switched on for the first time.

Note:
If the voltage of the internal battery is lower than 12.0V during the starting process, all red LEDs on the PCB will flash or light up. In this condition, the starting process will be stopped!

7.11 Rotary switch and display

The display consists of 4 lines each with 20 characters. The content of the display, i.e. the 4x20 characters, creates a dialogue. The texts and measured values which can be displayed in a dialogue are freely configurable. A special Windows programme will be used for this purpose (configuration tool).

Any number of dialogues can be configured (only depending on the RAM memory available to the DL16 Datalogger). It is possible to page through dialogues by turning the rotary switch to the left or right. If the user turns this switch several times to the left, the first dialogue can be accessed, and several times to the right, the last dialogue.

If "*" is displayed as the first character in a dialogue in the top left-hand corner, this indicates inputs can be edited. Press the rotary switch to access selection mode, which is shown by underscoring. The user can now switch between the editable inputs by turning the rotary switch. The dialogue element active in each case is shown by underscoring. Once an entry has been selected, it is possible to switch to edit mode by pressing the rotary switch again. This mode is indicated by a flashing block cursor, which appears at the first position of the value to be edited. Turn the rotary switch to edit the value or the first position of the value. If the rotary switch is pressed again, the block cursor will move to the next position, which can then be edited by turning the switch. After editing the final position, end edit mode and save the configuration.

```
Please wait while
saving settings.
```

The configuration with the edited value is saved. The time required to store the configuration depends on the size of the project and may take several seconds.

To abort editing, turn the switch while holding down. This process will terminate edit mode for the current dialogue element.

Note:
Turning the switch while pressing it is equivalent to the ESCAPE functionality in PCs.

The user returns to selection mode once the message is displayed. To quit selection mode, select "*" on the top left of the dialogue and press the rotary switch once.
If "$" appears as the first character in the fourth line, this indicates maintenance mode.

As soon as the rotary switch is activated, the white backlight will be automatically switched on for 1 minute by the DL16.

Note:
The display can be read down to a minimum temperature of –20°C. For technical reasons the display speed is slower with low temperatures (approx. 10 seconds at –20 °C!).

7.12 Passwords

All accesses to the data logger may be assigned to different access levels. For this purpose, 5 passwords are provided, which may be divided into the following 3 groups:

- passwords for the commands (command line), the display and the WEB-pages
- password for FTP-communication
- password for the up-/download of the configuration

7.12.1 Passwords for commands, display and WEB

4 password levels are available for the user:

- No password required (lowest level)
- Password level 0
- Password level 1
- Pass word level 2 (highest level)

Levels 0…2 have been assigned passwords. Setting the password of level x allows access to all functions of lower password levels. When e.g. the password of level 2 has been set, then all locked functions of levels 0 and 1 will also be unlocked.

For the commands (command line), it is possible to establish 2 passwords. The first for reading and the second for writing access. The password is set with the command „command line password”.

Depending on the respective password of the 3 passwords, sub-dialogues may be shown or hidden on the display. Via a password input field, the user may set the password, thus showing or hiding a button. The display button may then be selected and confirmed with the rotary switch. When sub-dialogues have been allocated to the button, only the first one of these dialogues will be displayed.

For the design of the WEB-pages, the option exists to enter a specific password for each individual page (password level 0..2). When the user accesses a password-protected WEB-page

via an internet browser, he will have to log in into the Datalogger. The user name for login will be „user“ (this cannot be changed) and the password will be the preset password.

Configuration of commands, dialogues, WEB-pages and the related password levels will be carried out with a separate configuration tool and will depend on the respective project.

7.12.2 Password for FTP

In the Datalogger DL16, a FTP-Server has been implemented, through which the user may exchange data with the DL16. A password will only be required for writing access. This password will be preset during configuration and may be modified via a command (command line) or via the display.

7.12.3 Password for up and download

The up- and download of the configuration may be secured by password. This serves to prevent accidental overwriting of the configuration in the data logger.

7.12.4 Default passwords

When the configuration is set up with the separate configuration tool, the passwords will be preset. Depending on the configuration, the user may modify these passwords in the course of operation.

The following table shows the preset passwords.

Group	Level	Preset password
Passwords for the commands (command line), the display and the WEB-pages	Level 0	00000000
	Level 1	00000001
	Level 2	00000002
Password for FTP-communication	-[1]	DL16
Password for the up-/download of the configuration	-[1]	-[2]

[1] Only one password exists (1 level)
[2] No password preset

Table 7: Preset passwords

8 Bootloader

When the DL16 Datalogger starts, the bootloader will first run. The function of the bootloader is to load new firmware or a new bootloader to the system.

The bootloader can load files from the following sources:

- serial via USB in X-Modem format
- serial via TELNET in X-Modem-Format
- as a file from the SD card
- as a file from the internal FLASH drive.

The boot loader supports programming of the boot loader and the firmware. When using the SC-card, the file name for the boot loader will be DL16Boot.hex and for the firmware it will be DL16Firm.hex. When a binary configuration file CONFIG.BIN exists on the SC-card, it may also be loaded with the boot loader.

8.1 X-Modem CRC

When no SD-card with a firmware has been inserted, the boot loader for the serial interfaces will automatically be executed. It will issue to following information message:

```
THIES DL16
Bootloader Vx.xx
Wait for ‚x’: 15
COM TELNET
```

The figure after ":" is decremented once a second down to 0, i.e. the DL16 Datalogger waits 15s for new firmware. The 4th line lists the possible serial interfaces available for loading the firmware. Here the firmware (Intel-Hex format) has to be transmitted using the X-MODEM protocol.

The X-Modem bootloader always starts with a baud rate of 115200baud 8N1. The following message will appear on a connected terminal program:

DL16 X-Modem bootloader

Version: V0.34

Insert x to start

After 'x" is entered, the bootloader outputs the characters 'C", one every second. This character acts as the starting sequence for the X-Modem protocol. The file can now be transmitted in the terminal program. The protocol used here is X-Modem CRC.

8.2 Firmware on SD card

If an SD card is in the slot provided during start-up and contains a file DL16Firm.hex, the bootloader will output the following message:

```
THIES DL16
Bootloader Vx.xx
Firmware on SD-card
Press Button to load
```

Press the rotary button to start programming the new firmware. If the rotary switch is not pressed within 15s, the bootloader will be automatically run for the serial interfaces.

After the firmware has been programmed or after a period of 15s, the bootloader starts the actual firmware:

```
THIES DL16
Bootloader Vx.xx
Starting firmware
```

8.3 Firmware on internal FLASH drive

If the file DL16Firm.hex is already available on the internal FLASH drive when the bootloader starts up, this file will be automatically loaded with start-up of the bootloader. This is the recommended procedure with remote control. FTP or the configuration tool can be used to first copy the file 'DL16Firm.hex' to the Datalogger and then start up the system. The bootloader will then automatically load the file from the internal DataFlash.

8.4 Programming bootloader

Like the firmware, it is also possible to reprogram the bootloader. The procedures are identical to those described under **8.1** and **8.2**. The file name for the bootloader is DL16Boot.hex.

If the configuration file 'CONFIG.BIN' is available on the SD card, this will be automatically copied to the internal FLASH drive. The Datalogger starts automatically with this configuration.

Here, please note that a configuration always includes only the standard values for the constants of the measuring value transmitters. That means, that in case of configuration updates the constants, which are already set, can be overwritten by standard values.

Remark:

After the update of configuration (‚CONFIG.BIN’) the individual constants of the measuring value transmitters have to be checked necessarily, and to be re-set, where required !

9 Start-up of firmware

Once the bootloader has finished, the firmware will start and load the existing configuration. Loading may take up to 2 minutes depending on the size of the configuration. The following message appears on the display:

```
      DL16
Loading project
Read configuration
   from file
```

Loading is followed by initialisation of the connected devices and internal drivers. The status is shown in the display.

```
      DL16
Init object list
Please wait...
```

The Datalogger is fully functional after successful initialisation.

9.1 Special cases with project start

If the Datalogger did not boot properly the last time, the following message will appear on start-up of the firmware:

```
Last boot failed
Start with last
project again?
Yes   No
```

If the dialogue is acknowledged with 'Yes', the existing configuration will be loaded again. If 'No' is selected, the Datalogger will start without reading the configuration. Caution!!! In this case the Ethernet is not initialised.

If only remote access is possible with the Datalogger, it is possible to delete the file "ERROR.TXT" and restart the Datalogger. In this case the configuration will be loaded on restarting.

If there is no configuration on the Datalogger, i.e. the file 'CONFIG.BIN' is not available, the DL16 will output the following message when the firmware starts:

```
    THIES DL16
  No configuration
   file exists
```

9.2 Switch off Datalogger and reset

To disconnect the Datalogger from the voltage supply, it first has to be switched off. To do so, press the rotary control switch for approx. 10 seconds. Measuring will cease during this period and the data will be written from the internal RAM to the FLASH. This will be followed by a message stating that the Datalogger can now be disconnected from the power supply:

```
DL16 shutting down
You can now turn
Off power supply
```

If the switch is held down for another 5 seconds, a dialogue will appear for restarting the Datalogger.

```
  Restart Logger ?

    Yes        No
```

If the switch is released when this dialogue appears, the Datalogger will restart.

If the response to the dialogue is 'No', the rotary switch should be turned before releasing. The dialogue will remain active. 'No' can now be selected. If the rotary switch is pressed again, the dialogue will be deleted, and the Datalogger starts acquisition of the measured values.

Note:
The Datalogger must be switched off without fail before disconnecting the battery voltage. Disconnecting the battery voltage without switching off the Datalogger beforehand may damage the internal FLASH drive.

9.3 Start-up without configuration

If the current configuration is not to be loaded to the DL16 Datalogger when it is started up, the rotary switch should be held down after running the bootloader. The Datalogger starts without reading the configuration and outputs the following message stated below to the display.

The rotary switch must be pressed when the text "Starting Firmware" appears in the display. Hold down the rotary switch until the following message appears in the display.

```
     THIES DL16
 Read configuration
       aborted
```

When Ethernet has been configured, the FTP-service will be available after start-up.

10 Configuration for Order „AB100 3811“

The DL16 Datalogger is supplied with a default configuration. This configuration specifies the behaviour of the measurement inputs, the texts shown in the display, the control commands, the WEB pages displayed and the structure of the archives.
To make fundamental changes to the configuration a corresponding program is required. Some parameters can be amended via the display.

The following measured quantities are implemented for this measuring station:

- Command Interpreter (1 x RS232 115200Baud 8N1)
- Air temperature (1 x PT100)
- Wind direction (3 x THIES 4.3150.X0.000)
- Wind velocity (6 x THIES 4.3351.X0.000)

10.1 Configuration of sensors

The DL16 Datalogger is prepared for the connection of different sensors. The sensors can be directly connected without prior modification.

10.2 Channel assignment

The datalogger DL 16 is delivered with a pre-defined configuration. The configuration of the in- and outputs of the instrument available, as well as the setting of the baud rate and the telegram frame for the MEVIS interface are given in the following table.

DL16 connector socket	IO - Type	Sensor	Type of measurement
CH1	Frequency	THIES 4.3351.X0.000 (6)	Wind velocity 1
CH2	Frequency	THIES 4.3351.X0.000 (5)	Wind velocity 2
CH3	Frequency	THIES 4.3351.X0.000 (4)	Wind velocity 3
CH4	Frequency	THIES 4.3351.X0.000 (3)	Wind velocity 4
CH5	Frequency	THIES 4.3351.X0.000 (2)	Wind velocity 5
CH6	Frequency	THIES 4.3351.X0.000 (1)	Wind velocity 6
CH7	THIES serial	THIES 4.3150.X0.000 (3)	Wind direction 1 THIES serial
CH8	THIES serial	THIES 4.3150.X0.000 (2)	Wind direction 2 THIES serial
CH9	THIES serial	THIES 4.3150.X0.000 (1)	Wind direction 3 THIES serial
CH10	not used	-	-
CH11	not used	-	-
CH12	not used	-	-
CH13	PT100 (1)	-	Air temperature
CH14	not used	-	-
CH15	not used	-	-
CH16	not used	-	-

COM2	not used	-	-
COM3	RS232 115200Baud 8N1 (1)	-	Command Interpreter
COM4	not used	-	-
COM5	not used	-	-
COM6	not used	-	-
1A	not used	-	-
10A	not used	-	-

Table 8: Configured Channels

10.3 Acquisition of measured values

The acquisition of the analogue inputs is done in a period type of 1 seconds.

These values are called raw values, and serve as basis for further calculations of mean- and extreme values.

Averaging method and averaging period for the calculation of the mean values are given in the following table.

Measuring value	Calculation	Averaging time	Time interval Min/Max	Minimum filling level for valid data
AV USolar	Gliding mean value	10min	10min	30%
AV UBat	Gliding mean value	10min	10min	30%
AV UAC	Gliding mean value	10min	10min	30%
Lufttemperatur	Gliding mean value	10min	10min	30%
Wind velocity 1 Wind direction 1	Wind velocity and Wind direction with standard deviation Wind velocity scalar Wind direction scalar	10min	10min	30%
Wind velocity 2 Wind direction 1	Wind velocity and Wind direction with standard deviation Wind velocity scalar Wind direction scalar	10min	10min	30%
Wind velocity 3 Wind direction 2	Wind velocity and Wind direction with standard deviation Wind velocity scalar Wind direction scalar	10min	10min	30%
Wind velocity 4 Wind direction 2	Wind velocity and Wind direction with standard deviation Wind velocity scalar Wind direction scalar	10min	10min	30%
Wind velocity 5 Wind direction 3	Wind velocity and Wind direction with standard deviation Wind velocity scalar Wind direction scalar	10min	10min	30%

Wind velocity 6 Wind direction 3	Wind velocity and Wind direction with standard deviation Wind velocity scalar Wind direction scalar	10min	10min	30%

Table 9: Measured values configured and their corresponding mean periods

The averaging- and extreme value intervals are adapted according to the storing interval of the archives, i.e. when the archive times change the appropriate averaging- and extreme value intervals change automatically. The memory cycle is not affected.

10.4 Adjustment of parameters

Dialogues which show "*" on the top left contain editable inputs.

Chapter **0** describes how to edit/amend parameters and inputs.

Station name

The station name is used to identify the measuring station. If there is more than one datalogger in a metrological network, each one should be given a different name. All ASCII characters which can be shown in the display may be used here.

The station name is shown in the main dialogue as the first editable entry.

Date and Time

The date and time are shown in the main dialogue and can be set there.

10.5 Remote Maintenance

Interrogation and parameterization of the Datalogger is also possible via remote maintenance parallel with operation using the display. Serial interfaces USB and TELNET are available for this purpose. All commands have the same format for control:

<STX>Command Parameter<ETX>

STX: start of text character

ETX: end of text character

Command: any configured command

Parameter: optional

Specifying a parameter is optional, i.e. there are commands without any parameter (read only), and commands which can be called up with or without parameters. In the latter case it is possible to query the set value without specifying the parameter. Specifying a parameter on the other hand will reset it.

Changing of the parameters is carried out temporarily, i.e. they get lost when restarting the DL16. In order to save changes permanently, the configuration must be stored by command STR.

This table shows all available commands:

Designation	Command	Description
DL16 System commands		
Command ArchID	<STX>ArchID<Para><ETX>	Query der Archiv-ID

Command CLPW	<STX>CLPW<Para><ETX>	Select/query of command line pass word
Command DD	<STX>DD<Para><ETX>	Select/query of the date
Command DJ	<STX>DJ<Para><ETX>	Select the current year
Command DM	<STX>DM<Para><ETX>	Select the current month
Command DT	<STX>DT<Para><ETX>	Select the current day
Command LL	<STX>LL<Para><ETX>	Query of DL16 status
Command ll	<STX>ll<Para><ETX>	Query of DL16 status
Command MAIN	<STX>MAIN<Para><ETX>	Select/query of maintenance mode
Command PWL0	<STX>PWL0<Para><ETX>	Select/query of the pass word
Command RS	<STX>RS<Para><ETX>	Carry out reset
Command STAT_NAME	<STX>STAT_NAME<Para><ETX>	Select/query of station name
Command STR	<STX>STR<Para><ETX>	Storing of configuration
Command VER	<STX>VER<ETX>	Query of SW version
Command ZH	<STX>ZH<Para><ETX>	Select the current hout
Command ZM	<STX>ZM<Para><ETX>	Select the current minute
Command ZZ	<STX>ZZ<Para><ETX>	Select/query of time
DCF77 Commands		
Command DCF77_INFO	<STX>DCF77_INFO<ETX>	Query of DCF77 status information
Command DCF77_ST	<STX>DCF77_ST<Para><ETX>	Select/query of moment of synchronization
Commands for Querying Measuring Values		
Command mm	<STX>mm<ETX>	Query of current raw values
Command MM	<STX>MM<ETX>	Query of current raw values
Commands relating to the Mean Value Archiv		
Command ds_cfg	<STX>ds_cfg<ETX>	Output of configuration for the mean value archive
Command ds_esc	<STX>ds_esc<ETX>	Abort output of measuring values from mean value archive
Command ds_iso	<STX> ds_iso<Para><ETX>	Query of measuring values form mean value archive
Command ds	<STX> ds<Para><ETX>	Query of measuring values form mean value archive
Commands relating to Extreme Value Archive		
Command de_cfg	<STX>de_cfg<ETX>	Output of configuration for the extreme value archive
Command de_esc	<STX>de_esc<ETX>	Abort output of measuring values from the extreme value archive
Command de_iso	<STX> de_iso<Para><ETX>	Query of measuring values from the extreme value archive
Command de	<STX> de<Para><ETX>	Query of measuring values from the extreme value archive
Commands for Settings		
Command AR_AV_SI	<STX>AR_AV_SI<Para><ETX>	Select/query the storing cycle (mean value archive)
Command AR_EX_SI	<STX>AR_EX_SI<Para><ETX>	Select/query of storing cycle (mean

		value archive)
Command COM3_BR	<STX>COM3_BR<Para><ETX>	Select/query of baud rate for the serial interface COM3
Command COM3_DF	<STX>COM3_DF<Para><ETX>	Select/query of the data format for the serial interface COM3
Command FC_WD1_O	<STX>FC_WD1_O<Para><ETX>	Select/query of offset for the wind direction transmitter 1 (CH7)
Command FC_WD2_O	<STX>FC_WD2_O<Para><ETX>	Select/query of offset for the wind direction transmitter 2 (CH8)
Command FC_WD3_O	<STX>FC_WD3_O<Para><ETX>	Select/query of offset for the wind direction transmitter 3 (CH9)
Command FC_WS_1_AVT	<STX>FC_WS_1_AVT<Para><ETX>	Select/query of averaging method for the wind transmitter 1 (CH1)
Command FC_WS_2_AVT	<STX>FC_WS_2_AVT<Para><ETX>	Select/query of averaging method for the wind transmitter 2 (CH2)
Command FC_WS_3_AVT	<STX>FC_WS_3_AVT<Para><ETX>	Select/query of averaging method for the wind transmitter 3 (CH3)
Command FC_WS_4_AVT	<STX>FC_WS_4_AVT<Para><ETX>	Select/query of averaging method for the wind transmitter 4 (CH4)
Command FC_WS_5_AVT	<STX>FC_WS_5_AVT<Para><ETX>	Select/query of averaging method for the wind transmitter 5 (CH5)
Command FC_WS_6_AVT	<STX>FC_WS_6_AVT<Para><ETX>	Select/query of averaging method for the wind transmitter 6 (CH6)
Command GSM_TS1_Off	<STX>GSM_TS1_Off<Para><ETX>	Select/query of turn off time for the time slot 1 (GSM modem)
Command GSM_TS1_On	<STX>GSM_TS1_On<Para><ETX>	Select/query of turn on time for the time slot 1 (GSM Modem)
Command GSM_TS2_Off	<STX>GSM_TS2_Off<Para><ETX>	Select/query of turn off time for the time slot 2 (GSM modem)
Command GSM_TS2_On	<STX>GSM_TS2_On<Para><ETX>	Select/query of turn on time for the time slot 2 (GSM modem)
Command GSM_TS3_Off	<STX>GSM_TS3_Off<Para><ETX>	Select/query of turn off time for the time slot 3 (GSM modem)
Command GSM_TS3_On	<STX>GSM_TS3_On<Para><ETX>	Select/query of turn on time for the time slot 3 (GSM modem)
Command GSM_TS4_Off	<STX>GSM_TS4_Off<Para><ETX>	Select/query of turn off time for the time slot 4 (GSM modem)
Command GSM_TS4_On	<STX>GSM_TS4_On<Para><ETX>	Select/query of turn on time for the time slot 4 (GSM modem)
Command GSM_TS5_Off	<STX>GSM_TS5_Off<Para><ETX>	Select/query of turn off time for the time slot 5 (GSM modem)
Command GSM_TS5_On	<STX>GSM_TS5_On<Para><ETX>	Select/query of turn on time for the time slot 5 (GSM modem)
Command GSM_TS6_Off	<STX>GSM_TS6_Off<Para><ETX>	Select/query of turn off time for the time slot 6 (GSM modem)
Command GSM_TS6_On	<STX>GSM_TS6_On<Para><ETX>	Select/query of turn on time for the time slot 6 (GSM modem)
Command GSM_TS7_Off	<STX>GSM_TS7_Off<Para><ETX>	Select/query of turn off time for the time slot 7 (GSM modem)

Command GSM_TS7_On	<STX>GSM_TS7_On<Para><ETX>	Select/query of turn on time for the time slot 7 (GSM modem)
Command GSM_TS8_Off	<STX>GSM_TS8_Off<Para><ETX>	Select/query of turn off time for the time slot 8 (GSM modem)
Command GSM_TS8_On	<STX>GSM_TS8_On<Para><ETX>	Select/query of turn on time for the time slot 8 (GSM modem)
Command GSM_TS9_Off	<STX>GSM_TS9_Off<Para><ETX>	Select/query of turn off time for the time slot 9 (GSM modem)
Command GSM_TS9_On	<STX>GSM_TS9_On<Para><ETX>	Select/query of turn on time for the time slot 9 (GSM modem)
Command GSM_TS10_Off	<STX>GSM_TS10_Off<Para><ETX>	Select/query of turn off time for the time slot 10 (GSM modem)
Command GSM_TS10_On	<STX>GSM_TS10_On<Para><ETX>	Select/query of turn on time for the time slot 10 (GSM modem)
Command GSM_TS11_Off	<STX>GSM_TS11_Off<Para><ETX>	Select/query of turn off time for the time slot 11 (GSM modem)
Command GSM_TS11_On	<STX>GSM_TS11_On<Para><ETX>	Select/query of turn on time for the time slot 11 (GSM modem)
Command GSM_TS12_Off	<STX>GSM_TS12_Off<Para><ETX>	Select/query of turn off time for the time slot 12 (GSM modem)
Command GSM_TS12_On	<STX>GSM_TS12_On<Para><ETX>	Select/query of turn on time for the time slot 12 (GSM modem)
Command GSM_TS13_Off	<STX>GSM_TS13_Off<Para><ETX>	Select/query of turn off time for the time slot 13 (GSM modem)
Command GSM_TS13_On	<STX>GSM_TS13_On<Para><ETX>	Select/query of turn on time for the time slot 13 (GSM modem)
Command GSM_TS14_Off	<STX>GSM_TS14_Off<Para><ETX>	Select/query of turn off time for the time slot 14 (GSM modem)
Command GSM_TS14_On	<STX>GSM_TS14_On<Para><ETX>	Select/query of turn on time for the time slot 14 (GSM modem)
Command GSM_TS15_Off	<STX>GSM_TS15_Off<Para><ETX>	Select/query of turn off time for the time slot 15 (GSM modem)
Command GSM_TS15_On	<STX>GSM_TS15_On<Para><ETX>	Select/query of turn on time for the time slot 15 (GSM modem)
Command GSM_TS16_Off	<STX>GSM_TS16_Off<Para><ETX>	Select/query of turn off time for the time slot 16 (GSM modem)
Command GSM_TS16_On	<STX>GSM_TS16_On<Para><ETX>	Select/query of turn on time for the time slot 16 (GSM modem)
Command GSM_TS17_Off	<STX>GSM_TS17_Off<Para><ETX>	Select/query of turn off time for the time slot 17 (GSM modem)
Command GSM_TS17_On	<STX>GSM_TS17_On<Para><ETX>	Select/query of turn on time for the time slot 17 (GSM modem)
Command GSM_TS18_Off	<STX>GSM_TS18_Off<Para><ETX>	Select/query of turn off time for the time slot 18 (GSM modem)
Command GSM_TS18_On	<STX>GSM_TS18_On<Para><ETX>	Select/query of turn on time for the time slot 18 (GSM modem)
Command GSM_TS19_Off	<STX>GSM_TS19_Off<Para><ETX>	Select/query of turn off time for the time slot 19 (GSM modem)
Command	<STX>GSM_TS19_On<Para><ETX>	Select/query of turn on time for the

GSM_TS19_On		time slot 19 (GSM modem)
Command GSM_TS20_Off	<STX>GSM_TS20_Off<Para><ETX>	Select/query of turn off time for the time slot 20 (GSM modem)
Command GSM_TS20_On	<STX>GSM_TS20_On<Para><ETX>	Select/query of turn on time for the time slot 20 (GSM modem)
Command GSM_TS21_Off	<STX>GSM_TS21_Off<Para><ETX>	Select/query of turn off time for the time slot 21 (GSM modem)
Command GSM_TS21_On	<STX>GSM_TS21_On<Para><ETX>	Select/query of turn on time for the time slot 21 (GSM modem)
Command GSM_TS22_Off	<STX>GSM_TS22_Off<Para><ETX>	Select/query of turn off time for the time slot 22 (GSM modem)
Command GSM_TS22_On	<STX>GSM_TS22_On<Para><ETX>	Select/query of turn on time for the time slot 22 (GSM modem)
Command GSM_TS23_Off	<STX>GSM_TS23_Off<Para><ETX>	Select/query of turn off time for the time slot 23 (GSM modem)
Command GSM_TS23_On	<STX>GSM_TS23_On<Para><ETX>	Select/query of turn on time for the time slot 23 (GSM modem)
Command GSM_TS24_Off	<STX>GSM_TS24_Off<Para><ETX>	Select/query of turn off time for the time slot 24 (GSM modem)
Command GSM_TS24_On	<STX>GSM_TS24_On<Para><ETX>	Select/query of turn on time for the time slot 24 (GSM modem)
Command DCF77_Summer	<STX>DCF77_Summer<Para><ETX>	Select/query offset for DCF77 summer time
Command DCF77_Winter	<STX>DCF77_Winter<Para><ETX>	Select/query of offset for DCF77 winter time
Command KK	<STX>KK<Para><ETX>	Select/query of channel configuration
Command KK_MISC	<STX>KK_MISC<Para><ETX>	Select/query of channel configuration
Command PWFTP	<STX> PWFTP<Para><ETX>	Select/query of FTP pass word

Table 10: Commands for remote control

DL16 System commands

Command: **ArchID**

Parameter: -

Description: The command queries the archive ID.

Example: *<STX>*ArchID*<ETX>*
22

Command: **CLPW**

Parameter: xxxxxxxx x: password consisting of 8 characters

Description: The command sets the password, indicated as „xxxxxxxx“, consisting of 8 characters.

The commands AR_AV_SI, AR_EX_SI, COM3_BR, COM3_DF, DCF77_Summer, DCF77_Winter, FC_WD1_O, FC_WD2_O, FC_WD3_O, FC_WS_1_AVT, FC_WS_2_AVT, FC_WS_3_AVT, FC_WS_4_AVT, FC_WS_5_AVT, FC_WS_6_AVT, GSM_TS1_On, GSM_TS1_Off, GSM_TS2_On, GSM_TS2_Off, GSM_TS3_On, GSM_TS3_Off, GSM_TS4_On, GSM_TS4_Off, GSM_TS5_On, GSM_TS5_Off, GSM_TS6_On, GSM_TS6_Off, GSM_TS7_On, GSM_TS7_Off,

GSM_TS8_On, GSM_TS8_Off, GSM_TS9_On, GSM_TS9_Off, GSM_TS10_On, GSM_TS10_Off, GSM_TS11_On, GSM_TS11_Off, GSM_TS12_On, GSM_TS12_Off, GSM_TS13_On, GSM_TS13_Off, GSM_TS14_On, GSM_TS14_Off, GSM_TS15_On, GSM_TS15_Off, GSM_TS16_On, GSM_TS16_Off, GSM_TS17_On, GSM_TS17_Off, GSM_TS18_On, GSM_TS18_Off, GSM_TS19_On, GSM_TS19_Off, GSM_TS20_On, GSM_TS20_Off, GSM_TS21_On, GSM_TS21_Off, GSM_TS22_On, GSM_TS22_Off, GSM_TS23_On, GSM_TS23_Off, GSM_TS24_On, GSM_TS24_Off, KK, KK_MISC und STAT_NAME can be written only by entering the password (Reading of the set parameter is done without password)
For the commands PWFTP and PWL0 the password has to be entered for writing and reading.

The default password is 00000000

Example: <*STX*>CLPW 00000000<*ETX*>
Pass word OK

Command: **DD**
Parameter: xx.yy.zz xx: day
yy: month
zz: year
Description: The command sets the date specified with "xx.yy.zz". If no parameter is specified, the current date is read.
Example: <*STX*>DD<*ETX*>
22.06.09

Command: **DJ**
Parameter: xx xx: year
Description: The command sets the year specified with „xx“.
Example: <*STX*>DJ 09<*ETX*>

Command: **DM**
Parameter: xx xx: month
Description: The command sets the month specified with„xx“ .
Example: <*STX*>DM 06<*ETX*>

Command: **DT**
Parameter: xx xx: day
Description: The command sets the day specified with„xx“.
Example: <*STX*>DT 22<*ETX*>

Command: **LL**
Parameter: -
Description: The command queries the status of the DL16.
Example: <*STX*>LL<*ETX*>

Command: **ll**

Parameter: -

Description: The command queries the status of the DL16.

Example: <*STX*>ll<*ETX*>

Command: **MAIN**

Parameter: x x=0: maintenance mode off
x=1: maintenance mode on

Description: The command activates or de-activates the maintenance mode of the datalogger. If no parameter is specified, the current status is read (on/off)

Example: <STX>MAIN<ETX>
0 (Off)

Command: **PWL0**

Parameter: xxxxxxxx x: password consisting of 8 characters

Description: The command replaces the password indicated as „xxxxxxxx“ (max. 8 characters).
If no parameter is specified, the current password is read. The password has to be entered for writing and reading.
(➔command CLPW).
The default password is 00000000

Example: <*STX*>PWL0 00000000<*ETX*>
Password OK

Command: **RS**

Parameter: x x: 0=no reset, 1=reset

Description: If the stated parameter equals „1“ a reset of the DL16 is triggered.

Example: <STX>RS 1<ETX>

DL16 X-modem bootloader
Version: V0.36Suspend waiting
Loading firmware

Command: **STAT_NAME**

Parameter: x x: Station name (max. 8 characters)

Description: The command sets the station name specified with „x“. If no parameter is specified, the current station name is read.

Example: <STX>STAT_NAME<ETX>
DL16

Command: **STR**

Parameter: x x: 0=no storing, 1=storing

Description: The command is used to store the configuration.

Example: <STX>STR 1<ETX>
OK

Command: **VER**
Parameter: -
Description: The command is used to query the SW version of the datalogger.
Example: <STX>VER<ETX>
0.49

Command: **ZH**
Parameter: xx xx: hour
Description: The command sets the hour specified with „xx“.
Example: <*STX*>ZH 11<*ETX*>

Command: **ZM**
Parameter: xx xx: Minute
Description: The command sets the minute specified with „xx“.
Example: <*STX*>ZM 10<*ETX*>

Command: **ZZ**
Parameter: xx:yy:zz xx: hours
yy: minutes
zz: seconds
Description: The command sets the time specified with „xx:yy:zz“. If no parameter is specified, the current time is read.
Example: <STX>TIME<ETX>
12:43:50

DCF77 Commands

Command: **DCF77_INFO**

Parameter: -

Description: The command is used to query the current information of the DCF77 module.

Example: <STX>DCF77_INFO<ETX>
Actual DCF77 data: __.__.__ __:__
Last synchronization time: 29.01.09 11:07
Signal quality: 86

Command: **DCF77_ST**

Parameter: x x: time in hours

Description: This command is used to set or respectively query the hour for the synchronization by the DCF77-signal. If the value is 3, that means that the synchronization is carried out at the third hour of the day, thus at 03:00 o’clock

Example: <STX>DCF77_ST<ETX>
3h

Commands for Querying Measuring Values

Command: **mm**
Parameter: -
Description: The command is used to query the current instantaneous/raw values of the available sensors. All measuring values are arranged in one line, separated by a space character. The measuring values are preceded with date and time. The sequence of values within the line is identical with the command „MM“.
Example: `<STX>mm<ETX>`

Pos.	Length	Example	Description	Sensor
1	7	xx.xxxx	Mevis compatible time	DL16
8	1	<SPACE>		
9	5	###.#	Solar voltage	DL16
14	1	<SPACE>		
15	5	###.#	Batterie voltage	DL16
20	1	<SPACE>		
21	5	###.#	AC voltage	DL16
26	1	<SPACE>		
27	4	##.#	Wind velocity 1	Wind transmitter FirstClass (CH1)
31	1	<SPACE>		
32	3	###	Wind direction 1	Wind direction transmitter FirstClass (CH7)
35	1	<SPACE>		
36	5	###.#	Standard deviation wind velocity 1	Wind transmitter FirstClass (CH1)
41	1	<SPACE>		
42	5	###.#	Standard deviation wind direction 1	Wind direction transmitter FirstClass (CH7)
47	1	<SPACE>		
48	4	##.#	Wind velocity 2	Wind transmitter FirstClass (CH2)
52	1	<SPACE>		
53	5	###.#	Standard deviation wind velocity 2	Wind transmitter FirstClass (CH2)
58	1	<SPACE>		
59	4	##.#	Wind velocity 3	Wind transmitter FirstClass (CH3)
63	1	<SPACE>		
64	3	###	Wind direction 2	Wind direction transmitter FirstClass (CH8)
67	1	<SPACE>		
68	5	###.#	Standard deviation wind velocity. 3	Wind transmitter FirstClass (CH3)
73	1	<SPACE>		
74	5	###.#	Standard deviation wind direction 2	Wind direction transmitter FirstClass (CH8)
79	1	<SPACE>		
80	4	##.#	Wind valocity 4	Wind transmitter FirstClass (CH4)
84	1	<SPACE>		
85	5	###.#	Standard deviation wind direction 4	Wind transmitter FirstClass (CH4)
90	1	<SPACE>		

91	4	##.#	Wind velocity 5	Wind transmitter FirstClass (CH5)
95	1	<SPACE>		
96	3	###	Wind direction 3	Wind direction transmitter FirstClass (CH9)
99	1	<SPACE>		
100	5	###.#	Standard deviation wind velocity 5	Wind transmitter FirstClass (CH5)
105	1	<SPACE>		
106	5	###.#	Standard deviation wind direction 3	Wind direction transmitter FirstClass (CH9)
111	1	<SPACE>		
112	4	##.#	Wind velocity 6	Wind transmitter FirstClass (CH6)
116	1	<SPACE>		
117	5	###.#	Standard deviation wind velocity 6	Wind transmitter FirstClass (CH6)
122	1	<SPACE>		
123	5	###.#	Air temperature	Temperature transmitter (CH13)
128	1	<SPACE>		
129	8	aa:bb:cc	aa: day, bb: month, cc: year	
137	1	<SPACE>		
138	8	aa:bb:cc	aa: hour, bb: minute, cc: sekunde	
146	2	<CR><LF>		

Table 11: Dataline instantaneous values

Command: **MM**

Parameter: -

Description: The command is used to query the current instantaneous/raw values of the available sensors. All measuring values are arranged in separate lines, with a preceded, describing text. A headline „instantaneous values“ as well as a time stamp is output before the measuring values. After the measuring values an „END“ is output as end identification.

Example: `<STX>MM<ETX>`

```
     Instantaneous Measuring Values :
    --------------------------------
Date / time: 30.09.10 13:24:26
Usolar              :  0.0V
Ubat                : 12.4V
UAC                 :  0.0V
Windspeed 1         : 0.0m/s
Winddirection 1     :???deg
Std. Dev. Windsp. 1:???.?m/s
Std. Dev. Winddi. 1:???.?deg.
Windspeed2          : 0.0m/s
Std. Dev. Windsp. 2:???.?m/s
Windspeed 3         : 0.0m/s
Winddirection 3     :???deg
Std. Dev. Windsp. 3:???.?m/s
Std. Dev. Winddi. 2:???.?deg.
Windspeed 4         : 0.0m/s
Std. Dev. Windsp. 4:???.?m/s
Windspeed 5         : 0.0m/s
Winddirection 3     :???deg
Std. Dev. Windsp. 5:???.?m/s
Std. Dev. Winddi. 3:???.?deg.
Windspeed 6         : 0.0m/s
Std. Dev. Windsp. 6:???.?m/s
Air temperature     :???.?degC
```

END

Commands relating to the Mean Value Archiv

Command: **ds_cfg**

Parameter: -

Description: This command is used to read out the configuration of the mean value archive.

Command: **ds_esc**

Parameter: -

Description: The command is used to abort the reading procedure of the mean value archive. The reading is started with the commands ds and ds_iso.

Example: <STX>ds_esc<ETX>
Reader job not active

Command: **ds_iso**

Parameter: xx-xx-xx yy:yy aa-aa-aa bb:bb:bb

xx-xx-xx: Indication of start date
yy:yy: Indication of start time
aa-aa-aa: Indication of end date
bb:bb:bb: Indication of end time

Description: The command is used to read the mean value archive from the start time to the end time. If no parameter is specified, the entire archive is read out.
The following example shows only the order. The reply of the DL16 with the archive data is identical with the reply of command „ds“, and is exemplarily presented subsequent to table 12.

Example: <STX>ds_iso 09-06-22 10:34 09-06-22 11:34<ETX>

Command: **ds**

Parameter: DMYHMI

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)
MI: Minute in binary +28 (28…77)

Description: This command is used to read out the mean value archive from start time up to now. If no parameter is specified the entire archive is read out.
The following example shows only the order. The reply of the DL16 with the archive data is identical with the reply of command „ds_iso“, and is exemplarily presented subsequently to table 12.

Example: <STX>ds2"%'J<ETX>

The data are output in one line with a fixed telegram length. A semicolon is used as the separator between the different values. The lines end with "CR LF". All values are output with a fixed width, with blank characters appearing instead of leading zeros . The decimal point acts as the decimal

separator. If the status of a value is not OK (bad value), the relevant status is written directly to the formatted value in the form of ASCII characters. For encoding status values see Chapter **7.5**

This means that a value which is output as follows

##.#

indicates that the averaging buffer was not sufficiently filled for calculation of this value; see **7.2**.

DATA LINE Mean Value Archive:

Pos.	Length	Example	Description	Sensor
1	7	xx.xxxx	Mevis compatible time	DL16
8	1	<SPACE>		
9	5	###.#	Solar voltage	DL16
14	1	<SPACE>		
15	5	###.#	Batterie voltage	DL16
20	1	<SPACE>		
21	5	###.#	AC voltage	DL16
26	1	<SPACE>		
27	4	##.#	Wind velocity 1	Wind transmitter FirstClass (CH1)
31	1	<SPACE>		
32	3	###	Wind direction 1	Wind direction transmitter FirstClass (CH7)
35	1	<SPACE>		
36	5	###.#	Standard deviation wind velocity 1	Wind transmitter FirstClass (CH1)
41	1	<SPACE>		
42	5	###.#	Standard deviation wind direction 1	Wind direction transmitter FirstClass (CH7)
47	1	<SPACE>		
48	4	##.#	Wind velocity 2	Wind transmitter FirstClass (CH2)
52	1	<SPACE>		
53	5	###.#	Standard deviation wind velocity 2	Wind transmitter FirstClass (CH2)
58	1	<SPACE>		
59	4	##.#	Wind velocity 3	Wind transmitter FirstClass (CH3)
63	1	<SPACE>		
64	3	###	Wind direction 2	Wind direction transmitter FirstClass (CH8)
67	1	<SPACE>		
68	5	###.#	Standard deviation wind velocity. 3	Wind transmitter FirstClass (CH3)
73	1	<SPACE>		
74	5	###.#	Standard deviation wind direction 2	Wind direction transmitter FirstClass (CH8)
79	1	<SPACE>		
80	4	##.#	Wind valocity 4	Wind transmitter FirstClass (CH4)
84	1	<SPACE>		
85	5	###.#	Standard deviation wind direction 4	Wind transmitter FirstClass (CH4)
90	1	<SPACE>		
91	4	##.#	Wind velocity 5	Wind transmitter FirstClass (CH5)
95	1	<SPACE>		
96	3	###	Wind direction 3	Wind direction transmitter FirstClass (CH9)
99	1	<SPACE>		
100	5	###.#	Standard deviation wind velocity 5	Wind transmitter FirstClass (CH5)
105	1	<SPACE>		
106	5	###.#	Standard deviation wind direction 3	Wind direction transmitter FirstClass (CH9)

111	1	<SPACE>		
112	4	##.#	Wind velocity 6	Wind transmitter FirstClass (CH6)
116	1	<SPACE>		
117	5	###.#	Standard deviation wind velocity 6	Wind transmitter FirstClass (CH6)
122	1	<SPACE>		
123	5	###.#	Air temperature	Temperature transmitter (CH13)
128	1	<SPACE>		
129	8	aa:bb:cc	aa: day, bb: month, cc: year	
137	1	<SPACE>		
138	8	aa:bb:cc	aa: hour, bb: minute, cc: sekunde	
146	2	<CR><LF>		

Table 12: Output format mean value archive

Commands relating to Extreme Value Archive

Command: **de_cfg**

Parameter: -

Description: This command is used to read out the configuration of the extreme value archive.

Command: **de_esc**

Parameter: -

Description: The command is used to abort the reading procedure of the extreme value archive. The reading is started with the commands de and de_iso.

Example: <STX>de_esc<ETX>
Reader job not active

Command: **de_iso**

Parameter: xx-xx-xx yy:yy aa-aa-aa bb:bb:bb

xx-xx-xx: Indication of start date
yy:yy: Indication of start time
aa-aa-aa: Indication of end date
bb:bb:bb: Indication of end time

Description: The command is used to read the extreme value archive from the start time to the end time. If no parameter is specified, the entire archive is read out.
The following example shows only the order. The reply of the DL16 with the archive data is identical with the reply of command „de“, and is exemplarily presented subsequently to table 13.

Example: `<STX>de_iso 09-06-22 13:45 09-06-22 14:45<ETX>`

Command: **de**

Parameter: DMYHMI

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)
MI: minute in binary +28 (28…77)

Description: This command is used to read out the extreme value archive from start time up to now. If no parameter is specified the entire archive is read out.
The following example shows only the order. The reply of the DL16 with the archive data is identical with the reply of command „de_iso“, and is exemplarily presented subsequently to table 13.

Example: `<STX>de2"%)I<ETX>`

The data are output in one line with a fixed telegram length. A space is used as the separator between the different values. The lines end with "CR LF". All values are output with a fixed width, with blank characters appearing instead of leading zeros . The decimal point acts as the decimal separator. If the status of a value is not OK (bad value), the relevant status is written directly to the formatted value in the form of ASCII characters. For encoding status values see Chapter**7.5**

This means that a value which is output as follows

##.#

indicates that the averaging buffer was not sufficiently filled for calculation of this value; see **7.2**

DATA LINE Extreme Value Archive:

Pos.	Length	Example	Description	Sensor
1	7	xx.xxxx	Mevis compatible time	DL16
8	1	<SPACE>		
9	11	###.# 16:58	USolar MIN	DL16
20	1	<SPACE>		
21	11	###.# 16:58	USolar MAX	DL16
32	1	<SPACE>		
33	11	###.# 16:58	UBat MIN	DL16
44	1	<SPACE>		
45	11	###.# 16:58	UBat var MAX	DL16
56	1	<SPACE>		
57	11	###.# 16:58	UAC var MIN	DL16
68	1	<SPACE>		
69	11	###.# 16:58	UAC var MAX	DL16
80	1	<SPACE>		
81	11	###.# 16:58	Wind velocity 1 MIN	Wind transmitter FirstClass (CH1)
92	1	<SPACE>		
93	11	###.# 16:58	Wind velocity (gust) 1 MAX	Wind transmitter FirstClass (CH1)
104	1	<SPACE>		
105	11	###.# 16:58	Wind direction 1 MIN	Wind direction transmitter FirstClass (CH7)
116	1	<SPACE>		
117	11	###.# 16:58	Wind direction (gust) 1 MAX	Wind direction transmitter FirstClass (CH7)
128	1	<SPACE>		
129	11	###.# 16:58	Wind velocity 2 MIN	Wind transmitter FirstClass (CH2)
140	1	<SPACE>		
141	11	###.# 16:58	Wind velocity (gust) 2 MAX	Wind transmitter FirstClass (CH2)
152	1	<SPACE>		

153	11	###.# 16:58	Wind velocity 3 MIN	Wind transmitter FirstClass (CH3)
164	1	<SPACE>		
165	11	###.# 16:58	Wind velocity (gust) 3 MAX	Wind transmitter FirstClass (CH3)
176	1	<SPACE>		
177	11	###.# 16:58	Wind direction 2 MIN	Wind direction transmitter FirstClass (CH8)
188	1	<SPACE>		
189	11	###.# 16:58	Wind direction (gust) 2 MAX	Wind direction transmitter FirstClass (CH8)
200	1	<SPACE>		
201	11	###.# 16:58	Wind velocity 4 MIN	Wind transmitter FirstClass (CH4)
212	1	<SPACE>		
213	11	###.# 16:58	Wind velocity (gust) 4 MAX	Wind transmitter FirstClass (CH4)
224	1	<SPACE>		
225	11	###.# 16:58	Wind velocity 5 MIN	Wind transmitter FirstClass (CH5)
236	1	<SPACE>		
237	11	###.# 16:58	Wind velocity (gust) 5 MAX	Wind transmitter FirstClass (CH5)
248	1	<SPACE>		
249	11	###.# 16:58	Wind direction 3 MIN	Wind direction transmitter FirstClass (CH9)
260	1	<SPACE>		
261	11	###.# 16:58	Wind direction (gust) 3 MAX	Wind direction transmitter FirstClass (CH9)
272	1	<SPACE>		
273	11	###.# 16:58	Wind velocity 6 MIN	Wind transmitter FirstClass (CH6)
284	1	<SPACE>		
285	11	###.# 16:58	Wind velocity (gust) 6 MAX	Wind transmitter FirstClass (CH6)
296	1	<SPACE>		
297	11	###.# 16:58	Air temperature MIN	Temperature transmitter (CH13)
308	1	<SPACE>		
309	11	###.# 16:58	Air temperature MAX	Temperature transmitter (CH13)
320	1	<SPACE>		
321	8	aa:bb:cc	aa: day, bb: month, cc: year	
329	1	<SPACE>		
330	5	aa:bb	aa: hour, bb: minute	
335	2	<CR><LF>		

Table 13: Output format extreme value archive

Commands for Settings

Command: **AR_AV_SI**

Parameter: x

x=1s: Storing cycle 1 Second
x=2s: Storing cycle 2 Seconds
x=3s: Storing cycle 3 Seconds
x=4s: Storing cycle 4 Seconds
x=5s: Storing cycle 5 Seconds
x=6s: Storing cycle 6 Seconds
x=10s: Storing cycle 10 Seconds
x=12s: Storing cycle 12 Seconds

x=15s: Storing cycle 15 Seconds
x=20s: Storing cycle 20 Seconds
x=30s: Storing cycle 30 Seconds
x=1m: Storing cycle 1 Minute
x=2m: Storing cycle 2 Minutes
x=3m: Storing cycle 3 Minutes
x=4m: Storing cycle 4 Minutes
x=5m: Storing cycle 5 Minutes
x=6m: Storing cycle 6 Minutes
x=10m: Storing cycle 10 Minutes
x=12m: Storing cycle 12 Minutes
x=15m: Storing cycle 15 Minutes
x=20m: Storing cycle 20 Minutes
x=30m: Storing cycle 30 Minutes
x=1h: Storing cycle 1 Hour
x=2h: Storing cycle 2 Hours
x=3h: Storing cycle 3 Hours
x=6h: Storing cycle 6 Hours
x=12h: Storing cycle 12 Hours
x=1d: Storing cycle 1 Tag

Description: The command is used to set the storing cycle for the mean value archive. If no parameter is specified the storing cycle currently set is read.

Example: <STX>AR_AV_SI<ETX>
10m (10 minutes)

Command: **AR_EX_SI**

Parameter: x see command „AR_AV_SI“

Description: The command is used to set the storing cycle for the extreme value archive. If no parameter is specified the storing cycle currently set is read.

Example: <STX>AR_EX_SI<ETX>
10m (10 minutes)

Command: **COM3_BR**

Parameter: x
x=1200: 1200Baud
x=2400: 2400Baud
x=4800: 4800 Baud
x=9600: 9600Baud
x=19200: 19200Baud
x=38400: 38400Baud
x=57600: 57600Baud
x=115200: 115200Baud

Description: The command is used to set the baud rate for COM3. If no parameter is specified the set value is queried.

Example: <STX>COM3_BR<ETX>
9600 (9600)

Command: **COM3_DF**

Parameter: x 8N1=8 data bits, no parity, 1 stop bit
7E1=7 data bits, even parity, 1 stop bit
7O1=7 data bits, uneven parity, 1 stop bit
7O2=7 data bits, uneven parity, 2 stop bits
8O1=8 data bits, uneven parity, 1 stop bit
8O2=8 data bits, uneven parity, 2 stop bits
8N2=8 data bits, even parity, 2 stop bits

Description: The command is used to set the format for COM3. If no parameter is specified the set value is queried.

Example: <STX>COM3_DF<ETX>
8N1 (8N1)

Command: **DCF77_Summer**

Parameter: x x=offset between summer time and UTC in hours
(summer time + x = UTC)

Description: This command is used to set the offset between DCF77 summer time and UTC. If no parameter is specified the set value is queried..

Example: <STX>DCF77_Summer<ETX>
-02h

Command: **DCF77_Winter**

Parameter: x x= offset between winter time and UTC in hours
(Winter time + x = UTC)

Description: This command is used to set the offset between DCF77 winter time and UTC. If no parameter is specified the set value is queried.

Example: <STX>DCF77_Winter<ETX>
-01h

Command: **FC_WD1_O**

Parameter: x x=Offset for the wind direction in in °

Description: The command is used for setting the offset for the wind direction transmitter1. Herewith, a correction of the measuring values with erroneous north alignment is possible. If no parameter is specified the set value is queried.

Example: <STX>FC_WD1_O<ETX>
+0.00

Command: **FC_WD2_O**

Parameter: x x=Offset for the wind direction in in °

Description: The command is used for setting the offset for the wind direction transmitter2. Herewith, a correction of the measuring values with erroneous north alignment is possible. If no parameter is specified the set value is queried.

Example: <STX>FC_WD2_O<ETX>
+0.00

Command: **FC_WD3_O**

Parameter: x x=Offset for the wind direction in in °

Description: The command is used for setting the offset for the wind direction transmitter3. Herewith, a correction of the measuring values with erroneous north alignment is possible. If no parameter is specified the set value is queried.

Example: <STX>FC_WD3_O<ETX>
+0.00

Command: **FC_WS_1_AVT**

Parameter: x x=WS vect WD vect : WS vectorial WD vectorial
x=WS scal WD scal : WS scalar WD scalar
x=WS vect WD scal : WS vectorial WD scalar
x=WS scal WD vect : WS scalar WD vectorial

Description: This command is used to set the averaging method for the wind transmitter 1. The averaging module is linked to the wind direction transmitter 1. If no parameter is specified the set value is queried.

Example: <STX>FC_WS_1_AVT<ETX>
WS scal WD scal (WS scal WD scal)

Command: **FC_WS_2_AVT**

Parameter: x see command „FC_WS_1_AVT“

Description: This command is used to set the averaging method for the wind transmitter 2. The averaging module is linked to the wind direction transmitter 1. If no parameter is specified the set value is queried.

Example: <STX>FC_WS_2_AVT<ETX>
WS scal WD scal (WS scal WD scal)

Command: **FC_WS_3_AVT**

Parameter: x see command „FC_WS_1_AVT“

Description: This command is used to set the averaging method for the wind transmitter 3. The averaging module is linked to the wind direction transmitter 2. If no parameter is specified the set value is queried..

Example: <STX>FC_WS_3_AVT<ETX>
WS scal WD scal (WS scal WD scal)

Command: **FC_WS_4_AVT**

Parameter: x see command „FC_WS_1_AVT“

Description: This command is used to set the averaging method for the wind transmitter 4. The averaging module is linked to the wind direction transmitter 2. If no parameter is specified the set value is queried..

Example: <STX>FC_WS_4_AVT<ETX>
WS scal WD scal (WS scal WD scal)

Command: **FC_WS_5_AVT**
Parameter: x see command „FC_WS_1_AVT“

Description: This command is used to set the averaging method for the wind transmitter 5. The averaging module is linked to the wind direction transmitter 3. If no parameter is specified the set value is queried..

Example: <STX>FC_WS_5_AVT<ETX>
WS scal WD scal (WS scal WD scal)

Command: **FC_WS_6_AVT**
Parameter: x see command „FC_WS_1_AVT“

Description: This command is used to set the averaging method for the wind transmitter 6. The averaging module is linked to the wind direction transmitter 3. If no parameter is specified the set value is queried..

Example: <STX>FC_WS_6_AVT<ETX>
WS scal WD scal (WS scal WD scal)

Command: **GSM_TS1_Off**
Parameter: x x=hh:mm:ss : time (hh: hour, mm: minute, ss: second)

Description: The command is used to set the turn-off time for the 1. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.

Example: <STX>GSM_TS1_Off<ETX>
00:00:05

Command: **GSM_TS1_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 1. time slice of the GSM modem. If no parameter is specified the parameter currently set is read

Example: <STX>GSM_TS1_On<ETX>
00:00:00

Command: **GSM_TS2_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 2. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.

Example: <STX>GSM_TS2_Off<ETX>
00:00:05

Command: **GSM_TS2_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 2. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.

Example: <STX>GSM_TS2_On<ETX>
00:00:00

Command: **GSM_TS3_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 3. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS3_Off<ETX>
00:00:05

Command: **GSM_TS3_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 3. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS3_On<ETX>
00:00:00

Command: **GSM_TS4_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 4. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS4_Off<ETX>
00:00:05

Command: **GSM_TS4_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 4. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS4_On<ETX>
00:00:00

Command: **GSM_TS5_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 5. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS5_Off<ETX>
00:00:05

Command: **GSM_TS5_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 5. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS5_On<ETX>
00:00:00

Command: **GSM_TS6_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 6. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS6_Off<ETX>
00:00:05

Command: **GSM_TS6_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 6. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Command: <STX>GSM_TS6_On<ETX>
00:00:00

Command: **GSM_TS7_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 7. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS7_Off<ETX>
00:00:05

Command: **GSM_TS7_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 7. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS7_On<ETX>
00:00:00

Command: **GSM_TS8_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 8. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS8_Off<ETX>
00:00:05

Command: **GSM_TS8_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 8. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS8_On<ETX>
00:00:00

Command: **GSM_TS9_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 9. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS9_Off<ETX>
00:00:05

Command: **GSM_TS9_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 9. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS9_On<ETX>
00:00:00

Command: **GSM_TS10_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 10. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS10_Off<ETX>
00:00:05

Command: **GSM_TS10_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 10. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS10_On<ETX>
00:00:00

Command: **GSM_TS11_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 11. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS11_Off<ETX>
00:00:05

Command: **GSM_TS11_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 11. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS11_On<ETX>
00:00:00

Command: **GSM_TS12_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 12. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS12_Off<ETX>
00:00:05

Command: **GSM_TS12_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 12. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS12_On<ETX>
00:00:00

Command: **GSM_TS13_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 13. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS13_Off<ETX>
00:00:05

Command: **GSM_TS13_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 13. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS13_On<ETX>
00:00:00

Command: **GSM_TS14_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 14. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS14_Off<ETX>
00:00:05

Command: **GSM_TS14_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 14. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS14_On<ETX>
00:00:00

Command: **GSM_TS15_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 15. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS15_Off<ETX>
00:00:05

Command: **GSM_TS15_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 15. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS15_On<ETX>
00:00:00

Command: **GSM_TS16_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 16. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS16_Off<ETX>
00:00:05

Command: **GSM_TS16_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 16. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS16_On<ETX>
00:00:00

Command: **GSM_TS17_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 17. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS17_Off<ETX>
00:00:05

Command: **GSM_TS17_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 17. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS17_On<ETX>
00:00:00

Command: **GSM_TS18_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 18. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS18_Off<ETX>
00:00:05

Command: **GSM_TS18_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 18. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS18_On<ETX>
00:00:00

Command: **GSM_TS19_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 19. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS19_Off<ETX>
00:00:05

Command: **GSM_TS19_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 19. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS19_On<ETX>
00:00:00

Command: **GSM_TS20_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 20. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS20_Off<ETX>
00:00:05

Command: **GSM_TS20_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 20. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS20_On<ETX>
00:00:00

Command: **GSM_TS21_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 21. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS21_Off<ETX>
00:00:05

Command: **GSM_TS21_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 21. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS21_On<ETX>
00:00:00

Command: **GSM_TS22_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 22. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example <STX>GSM_TS22_Off<ETX>
00:00:05

Command: **GSM_TS22_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 22. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS22_On<ETX>
00:00:00

Command: **GSM_TS23_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 23. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS23_Off<ETX>
00:00:05

Command: **GSM_TS23_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 23. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example <STX>GSM_TS23_On<ETX>
00:00:00

Command: **GSM_TS24_Off**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-off time for the 24. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS24_Off<ETX>
00:00:05

Command: **GSM_TS24_On**
Parameter: x see command „GSM_TS1_Off“
Description: The command is used to set the turn-on time for the 24. time slice of the GSM modem. If no parameter is specified the parameter currently set is read.
Example: <STX>GSM_TS24_On<ETX>
00:00:00

Command: **KK**
Parameter: xxxxxxxxxxxxxxxx CH1…CH16
x=0: channel activated
x=1: channel de-activated
x=-: channel not configured
Description: The command sets the channel configuration for the channels CH1 to CH16. Here, the respective channel is activated by ’1’, and de-activated by’0’. If no parameter is specified the current channel configuration is read. A not-configured channel is here marked by a ‚-’.
Example: <STX>KK<ETX>
1111111111111111

Remark:
A not-configured channel cannot be switched on or off!

Command: **KK_MISC**
Parameter: xxxxxx COM5…COM2 SENS1A SENS10A
x=0: channel activated
x=1: channel de-activated
x=-: channel not configured
Description: The command sets the channel configuration for the channels COM5 to COM2 and both the high current channels SENS1A and SENS10A. Here, the respective channel is activated by ’1’, and de-activated by’0’. If no parameter is specified the current channel configuration is read. A not-configured channel is here marked by a ‚-’.
Example: <STX>KK_MISC<ETX>
--1---

Remark:
A not-configured channel cannot be switched on or off!

Command:	**PWFTP**
Parameter:	x x: password
Description:	This command is used to set or respectively read the FTP password (w/o parameter). In both cases the command line password with the command „CLPW“ is to be set before.
Example:	<STX>PWFTP<ETX> DL16

11 Technical Data

Case	Stainless steel
Type of protection	IP 65
Dimension	see chapter 5
Weight	6 kg
Power supply	
Internal rechargeable battery	12V 7Ah (lead gel) When the Datalogger is started, the battery voltage has to be >12.0V. During operation, measuring with be interrupted when the battery voltage is <11.5V.
Back-up battery	3.6V lithium cell, 0.56Ah (only for S-RAM and RTC, soldered onto PCB)
Transformer (built into case)	2x115V AC (230V AC) primary 2 x 12V AC 50W secondary (Datalogger)
Switched-mode power supply (built into case)	100...240V AC primary 24V DC 320W secondary (sensor supply, sensor heating)
Solar panel, external	22V no-load voltage, 17V nominal voltage, arbitrary power The following solar panel of the company Thies can be used: 9.1258.20.000 Solar panel 12V/20-24W) 9.1708.00.000 Solar panel 12 V/5,5 W 9.1708.00.020 Solar panel 12 V/ 23 W 9.1708.00.051 Solar panel 12 V/ 51 W
Power consumption	approx. 90 mA @ 12V (without sensors, backlight off)approx. 115 mA @ 12V (with sensors, backlight on) Sleepmode: approx. 3.5mA @ 12V (without sensors, display- background lighting out)
Power consumption modem	GSM modem GSM modus: ca. 350mA (modem is logged in to the GSM power supply) Sending burst: max. 1,7A Receiving burst: ca. 75mA
Operating temperature	-30...+60°C
Display temperature	-20...+60°C
Storage temperature	-40...+70°C
Humidity	Max. 100 % r. h., non-condensing
Analogue measured values	
A/D converter	24bit (with 50Hz or 60Hz suppression)
Measuring accuracy	± 0.01% of measuring range (-40°...+70°C)
Noise suppression	Typ. 100dB at 50Hz
Input voltage	Fully bipolar inputs with typ. 20V common-mode input voltage range
Multifunctional channels	16 multifunctional channels
	Up to 16 x temperature Pt100 (accuracy ± 0.1K, -40°...70°C)
	Up to 16 x voltages input (0...+10V, input impedance 200kΩ, accuracy ± 0.035%, from –40°…+70°C temperature response ±3.5ppm/K) Adjusting range: ± 15V to logger ground in 10 V measuring range
	Up to 16 x millivolt input (0...100mV, input impedance 200kΩ, accuracy ± 0.015%, from –40°…+70°C temperature response ± 1.5ppm/K) Adjusting range: ± 2,5V to logger ground in 100mV measuring range
	Up to 16 x powerinput (0..20mA, measuring resistance 200Ω, accuracy ± 0.035% @ –40°…+70°C temperature response ±10ppm/K

	Adjusting range: ± 15V to logger ground in 20mV measuring range)
	Up to 8 x interface “THIES serial synchronous”
	Up to 8 x digital outputs 0V...5V
Inputs	1 heavy-power measuring channel 0...1A DC/AC, Internal resistance 0,2Ohm, rms- accuracy 0.01A, max. 48V DC / AC *
	1 heavy-power measuring channel 0...10A DC/AC, Internal resistance 0,02Ohm, rms- accuracy 0.1A, max. 48V DC / AC *
Outputs	
	4 x heavy-power disconnectors max. 60V DC/AC and max 10 A each
	serial Synchronous
	Digital input (input impedance: 100kohm)
	Digital output (output impedance: 50ohm power-limited to 40 mA)
Measuring cycle	1 second
Storage cycle	1min and 10min
Time basis	Real-time clock with automatic leap-year identification, battery-backed
	Accuracy:± 3.5ppm = ± 0.3s / 24h in the range from -40°C…+85°C
	Automatic time synchronisation with DCF77 antenna 9.1760.00.000
	and/or GPS module
Data format, internal	32bit float
Storage allocation	
Firmware	Approx. 500kbyte FLASH (exchange possible via bootloader, see Chapter 5.2)
Data memory	8MB Flash as Windows-compatible FAT-16 drive
Max. depth of archives	209 days storage
SD card slot	Firmware upload, data output
	SD card interface, format: FAT-16
USB serial	Firmware upload, control of DL16 and data output
	Virtual COM interface via USB, transmission length 5 m
	Protocol: RTS/CTS handshake,
	115200 baud, 8 data bits, no parity, 1 stop bit (8N1)
Ethernet interface	Firmware upload, control of DL16, data output, WEB, FTP, TELNET,
	Speed : 10Mbit
Operation	1 rotary switch on device. Remote operation via serial interfaces (COM1, USB) or Ethernet (Telnet)
LCD display	4 lines each with 20 characters (alphanumerical)
Baro transmitter module [2)] 3.1157.20.000	The DL16 has an internal barometer which is activated via the software, and can be incorporated in the configuration.
Thermostat On[1]	Integrated sensor heating keeps temperature of pressure sensor at a constant value of 50°C Precision: ± 0.3hPa, measuring range: 300…1100hPa
Thermostat Off [1]	Integrated sensor heating has been switched off Typ. precision: ± 1.5hPa, measuring range: 300…1100hPa

Table 14: Technical data

[1]: The thermostat is activated automatically when the DL16 is supplied by 24V AC/DC via the connection „POWER 24V“.When the DL 16 is supplied only by an internal battery, the thermostat is switched off.

[2)] Optional range of features

*: in the range from –40°C…+70°C

Channel / interface	Supply	Minimum value current limiting		
		Us=3.3V	Us=5V	Us=12V
CH1	Pin1: GND Pin4: +Us	250mA	250mA	800mA
CH2	Pin1: GND Pin4: +Us			
CH3	Pin1: GND Pin4: +Us			
CH4	Pin1: GND Pin4: +Us			
CH5	Pin1: GND Pin4: +Us	250mA	250mA	800mA
CH6	Pin1: GND Pin4: +Us			
CH7	Pin1: GND Pin4: +Us			
CH8	Pin1: GND Pin4: +Us			
CH9	Pin1: GND Pin4: +Us	250mA	250mA	800mA
CH10	Pin1: GND Pin4: +Us			
CH11	Pin1: GND Pin4: +Us			
CH12	Pin1: GND Pin4: +Us			
CH13	Pin1: GND Pin4: +Us	250mA	250mA	800mA
CH14	Pin1: GND Pin4: +Us			
CH15	Pin1: GND Pin4: +Us			
CH16	Pin1: GND Pin4: +Us			
COM2	Pin1: GND Pin7: +Us	400mA	800mA	800mA
COM3	Pin1: GND Pin7: +Us			
COM4	Pin1: GND Pin6: +Us			
COM5	Pin1: GND Pin6: +Us			

Table 15: Sensor supply

The maximal current per channel is 140mA @ 20°C

12 Wiring diagram

The wiring diagram is among the attachments included in delivery.
(see chapter **2**).

13 EC Declaration of Conformity

Document-No.: **001260** Month: 07 Year: 09

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

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Description of Product: **DATALOGGER DL16 PRO**

Article No. **9.1720.00.000** **9.1721.00.000**

specified technical data in the document: **021610/07/09; 021615/07/09**

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)

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

Reference number	Specification
IEC 61000-6-2: 2005	Electromagnetic compatibility Immunity for industrial environment
IEC 61000-6-3: 2006	Electromagnetic compatibility Emission standard for residential, commercial and light industrial environments
IEC 61010-1: 2001	Safety requirements for electrical equipment for measurement, control and laboratory use. Part 1: General requirements

Place: Göttingen Date: 16.07.2009

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.

Annex 1 Description file for Archive Data

Each archive in the datalogger DL 16 contains a description file named ‚DESCFILE.INI' (see **Storage of measured values (Archives)**).

The construction of this file corresponds to that one of an initialization file, as in the operating system Windows, for example. The names of the sections are numbered consecutively, starting with 1 in ascending order, thus stating the sequence of the measuring values in the binary daily file This group of measuring values is called dataset.

Each section describes the characteristic of a measuring value. The possible keys within a section are given in the following table.

Key	Value	Description
Name	xxx	The description for the measuring value (max. 64 characters)
ClassID	24	The data type for the measuring value is float (float value)
	33	The data type for the measuring value is float extreme (float value with time stamp/extreme value)
	25	The data type for the measuring value is text (string with length „size").
ObjectID	xxx	The object ID for the measuring value on (internal use).
Offset	xxx	Offset of the measuring value within the binary daily file (in byte).
Size	xxx	Size or respectively length of the measuring value within the binary daily file (in byte).
LinkID	xxx	The key indicates the link ID, which is comprehensively valid over all archives of a datalogger. The link-ID indicates the data source of the measuring values, for ex. the US2D (source for wind velocity/-direction, gust, standard deviation).That means the mean value and the related extreme values of a measuring unit have the same link ID.
UnitID	0..19	The unit ID indicates the unit for the measuring values.
	0	Unknown unit
	1	Unit: m/s
	2	Unit: grad
	3	Unit: °C
	4	Unit: %
	5	Unit: hPa
	6	Unit: W/m^2
	7	Unit: Lux
	8	Unit: kLux
	9	Unit: mm
	10	Unit: m
	11	Unit: km
	12	Unit: l
	13	Unit: s
	14	Unit: min
	15	Unit: h
	16	Unit: mV
	17	Unit: V
	18	Unit: mA
	19	Unit: A
	20	Unit: J
	21	Unit: ppm/Vol
	22	Unit: ja/nein
TypeID	0..32	The type ID indicates the measuring value type.
	0	Unknown data type
	1	Wind velocity
	2	Wind direction
	3	Temperature
	4	Air humidity
	5	Humidity

	6	Air pressure
	7	Radiation
	8	Brightness
	9	Visibility
	10	Snow height
	11	Precipitation
	12	Time period
	13	Impulses
	14	Voltage
	15	Power
	16	Resistance
	17	Percent value
	18	Counter reading
	19	Energy
	20	Status
	21	Check sum
	22	Sunshine (logical value)
	23	Drops
	24	Synop 4680
	25	Synop 4677
	26	Metar 4678
	27	Precipitation intensity
	28	Radar reflectivity
	29	Diameter
	30	Evaporation
	31	Logical value
	32	NWS Code
ExtremID[1]	1..3	The extreme-ID indicates, whether the extreme value is a minimum, a maximum or a standard deviation.
	1	Minimum value
	2	Maximum value
	3	Standard deviation
PairRef[2]	xxx	The Pair-Ref contains the section names of the linked measuring value. Describes the current section for ex. a wind direction (typeID=2), then the Pair-Ref is the section name for the linked wind velocity. In return, the Pair-Ref of the wind velocity is the section name of the related wind direction .

Table 16: Keys within the description file

[1]: Key is optional, i.e. only for measuring values with the ClassID 33
[2]: Key is optional, i.e. only for linked measuring values (for ex. wind velocity/wind direction)

The binary daily file may contain any number of datasets.

Daily file (for ex. 20100623.BIN)				
Time stamp 1	Data set 1	…	Time stamp n	Dataset n

Here, each dataset is preceded with a time stamp of data type integer.

Time stamp (32Bit integer)			
LSB			MSB
Byte n	Byte n+1	Byte n+2	Byte n+3

Date and time are coded in the time stamp as follow:.

Bit	Significat.
0..5	Second
6..11	Minute
12..16	hour
17..21	day
22..25	month
26..31	year

The measuring values included in the dataset might be from data type Float, FloatExtrem or Text (see key ClassID in table 10)). Depending on the data type the bytes in the daily file must be interpreted as follows:

Data Type Float				
Status	Float (32Bit)			
	LSB			MSB
Byte n	Byte n+1	Byte n+2	Byte n+3	Byte n+4

Data type FloatExtrem								
Status	Float (32Bit)				Time stamp (32Bit)			
	LSB			MSB	LSB			MSB
Byte n	Byte n+1	Byte n+2	Byte n+3	Byte n+4	Byte n+5	Byte n+6	Byte n+7	Byte n+8

Data Type Text				
Status	Text			
	1. character			Last character
Byte n	Byte n+1	Byte n+2	…	Byte n+Size

The status byte is bitwise coded (see **Table 5: Status values and their ASCII characters**).

If the construction of at least one archive in the datalogger DL 16 changes, the value for the key “version” in the section “archive” is incremented within the INI-file “System.ini” by one. The value of this key is read by means of the command “ArchID”.

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