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Linux is a registered trademark of Linus Torvalds. Mozilla Firefox is a registered trademark of the Mozilla Foundation. Windows and Internet Explorer are registered trademarks of Microsoft Corp.

The Meteo-40 includes free software developed by third parties, including software code subject to the GNU General Public License ( GPL). See Chapter 16.7 to view the terms of this license.

To access the source code distributed under the terms of the GPL or the LGPL used in Meteo-40, contact Ammonit.

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### Caution

In order to ensure that Meteo-40 data loggers work properly, some requirements should be met.

The data logger can be affected by extreme temperature and humidity conditions. Meteo-40 is designed to operate properly at temperatures between -40 °C and +65 °C in non-condensing environments. The display is readable between -20 °C and +70 °C.



On site the data logger has to be installed in a robust and weatherproof cabinet (see also at [www.ammonit.com](http://www.ammonit.com) (<http://www.ammonit.com/>)). The cabinet protects Meteo-40 against weather and condensation damage, theft and vandalism. If humidity tolerance is exceeded and moisture penetrates, the electronics of Meteo-40 can be damaged. Users are responsible for effective humidity control.

Handle Meteo-40 with care, do not drop the device, and avoid mechanical shocks and vibrations to prevent the electronics from being damaged. Do not try to open or break the Meteo-40 housing or any of the slots. Avoid permanent pressure on the data logger.

To ensure that Meteo-40 operates properly, install only equipment, e.g., sensors, adapters and cables, which is undamaged and approved by Ammonit. Contact Ammonit, if any questions occur.

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# Chapter 1

## Introduction

### 1.1 Opening Remarks

Meteo-40 data loggers from Ammonit are professional measuring devices, which record meteorological details in order to calculate the wind energy potential of a site. The data loggers can be used flexibly and are well-suited for a wide range of applications. The implemented standards of measurement evaluation and data security meet the requirements of professional specialists. However, you conveniently configure sensors, statistics and the communication via the user-friendly web interface.

Before installation read this manual carefully. Remember that time spent now setting up the data logger properly, might save you from losing valuable data!

We recommend to configure and to test sensors and communication before the measuring equipment is installed on the mast.

We hope you find this manual clear and easy to understand. If you have any comments or suggestions, please let us know.

### 1.2 Overview of Meteo-40

Depending on the model, Meteo-40 offers up to 34 measurement channels: There are up to 12 analog differential voltage inputs, up to 2 analog current inputs. Furthermore, Meteo-40 has up to 12 counter inputs and up to 8 digital channels.

In addition, Meteo-40 is able to support up to 8 smart sensors via the RS485 interface.

In general, Meteo-40 is divided into two main units: A communication unit and a measuring unit. The communication unit offers 3 USB slots to connect a PC, modem, web camera, or flash drive, and 1 Ethernet slot to connect a camera or router. Additionally, the Meteo-40 can be connected to the network via Ethernet.

**Note**

Meteo-40 Revision C offers a standard RS232 slot. Meteo-40 Revision D is equipped with an Ethernet slot. The production of Meteo-40 Revision C stopped in October 2012.

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The basic concept is shown in detail in Figure 1.1.

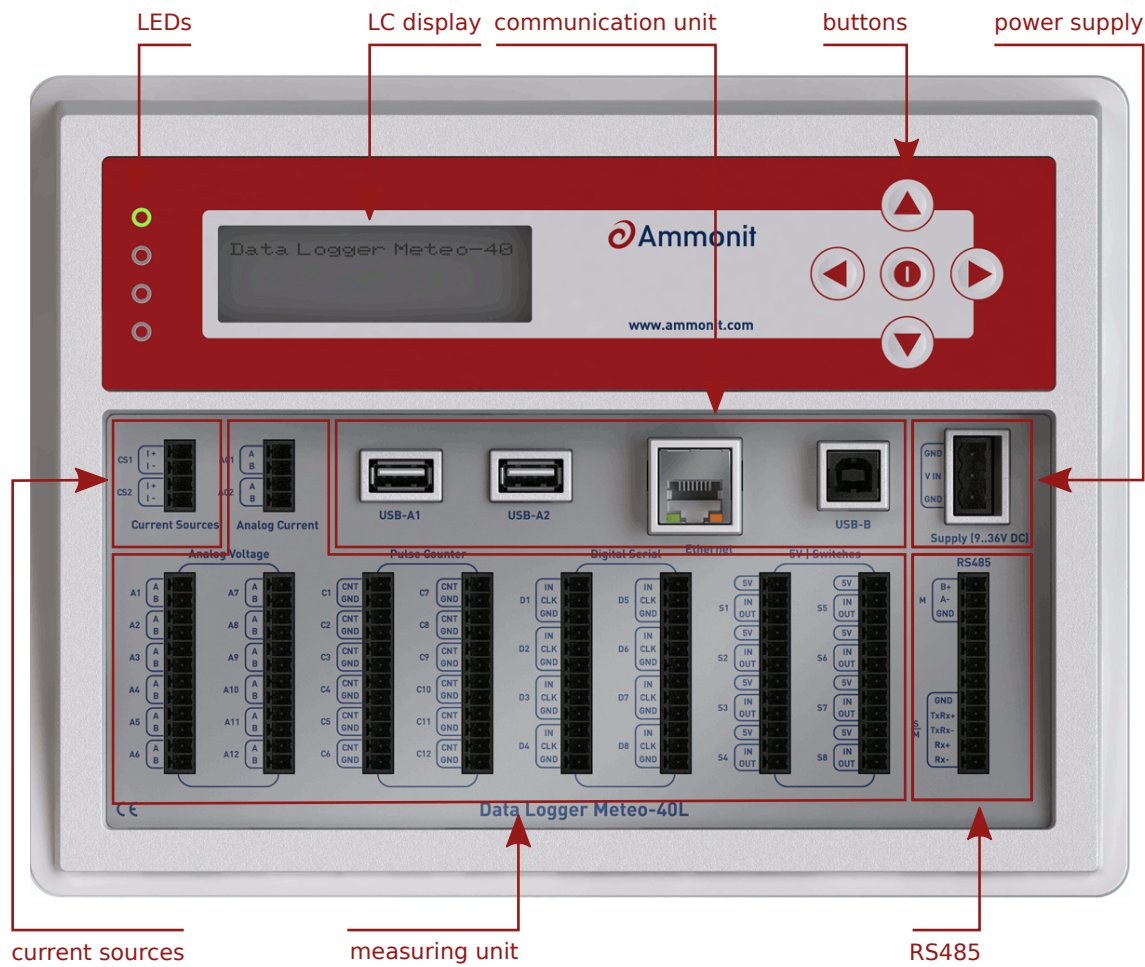


Figure 1.1: Overview of Meteo-40L

### 1.3 Meteo-40 Series

The Meteo-40 series differs mainly in the number of input and output channels and in the measurement data storage capacity. Some basic information about the different models (Meteo-40S, Meteo-40M and Meteo-40L) are shown in Table 1.1.

Feature		Meteo-40S	Meteo-40M	Meteo-40L
Input channels	Counters	4	8	12
	Periods	0	2	4
	Digital	2	4	8
	Analog ( U )	4	8	12
	Analog ( I )	1	1	2
	RS485	Up to 8 sensors		
Output channels	Switches	2	4	8
	Constant Current	1	1	2
	RS485	1 for SCADA		
Memory Size	Source Data	1 GByte	2 GByte	2 GByte
	CSV Data	> 50 MByte		
Connectivity	USB	2 USB host, 1 USB device		
	Ethernet	1 for router, LAN		
Display and keys		LC display with backlight (4 lines each with 20 characters), five keys		
Power supply		9 - 36 V (DC)		

Table 1.1: Meteo-40 feature overview



**Note**

The predecessor of the current Meteo-40 Revision D, Revision C, is equipped with a standards RS232 slot instead of the Ethernet slot.

Find below an overview of the terminals. The white areas indicate available connectors.

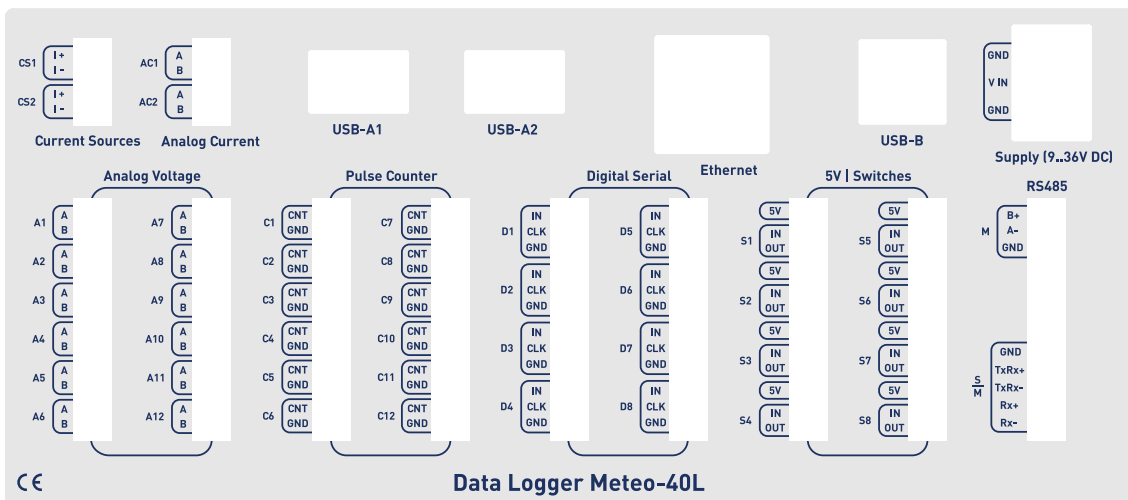


Figure 1.2: Meteo-40L Terminal

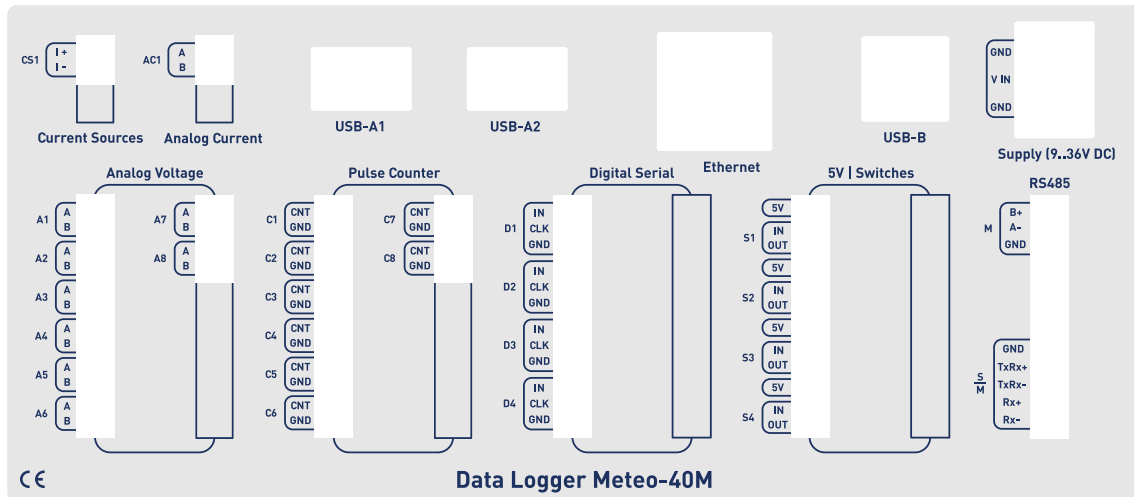


Figure 1.3: Meteo-40M Terminal

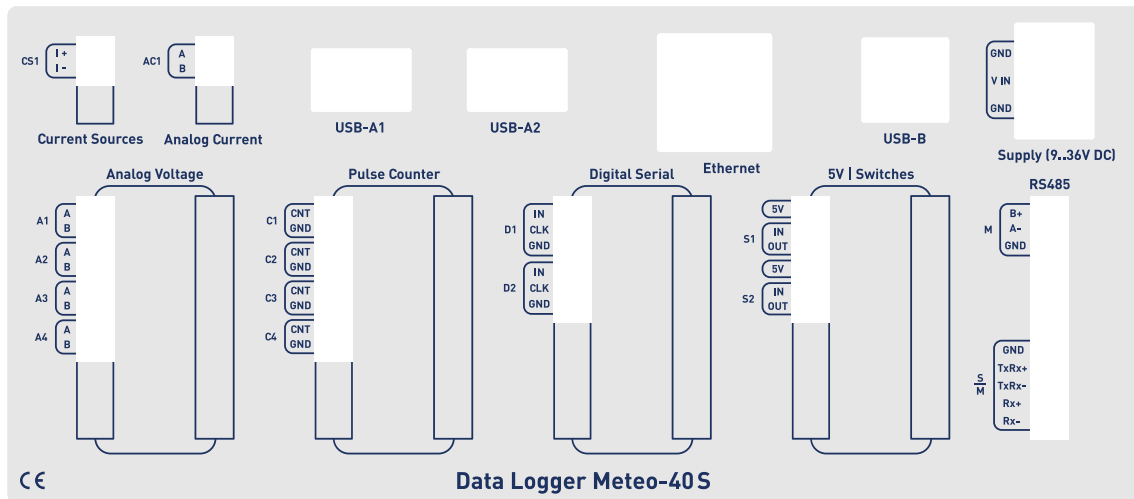


Figure 1.4: Meteo-40S Terminal

## 1.4 The Two Systems of Meteo-40

Meteo-40 consists of two basic systems: the *Measurement And Recording System*( MARS) and the *Configuration, Evaluation and Communication System*( CECS).

For measuring and recording data, only MARS is needed. MARS is designed to work with minimal power consumption. It controls the analog data logger hardware, measurement channels and data storage. It has no access to the display or to the devices that could be connected via USB or Ethernet (RS232 for Meteo-40 Revision C).

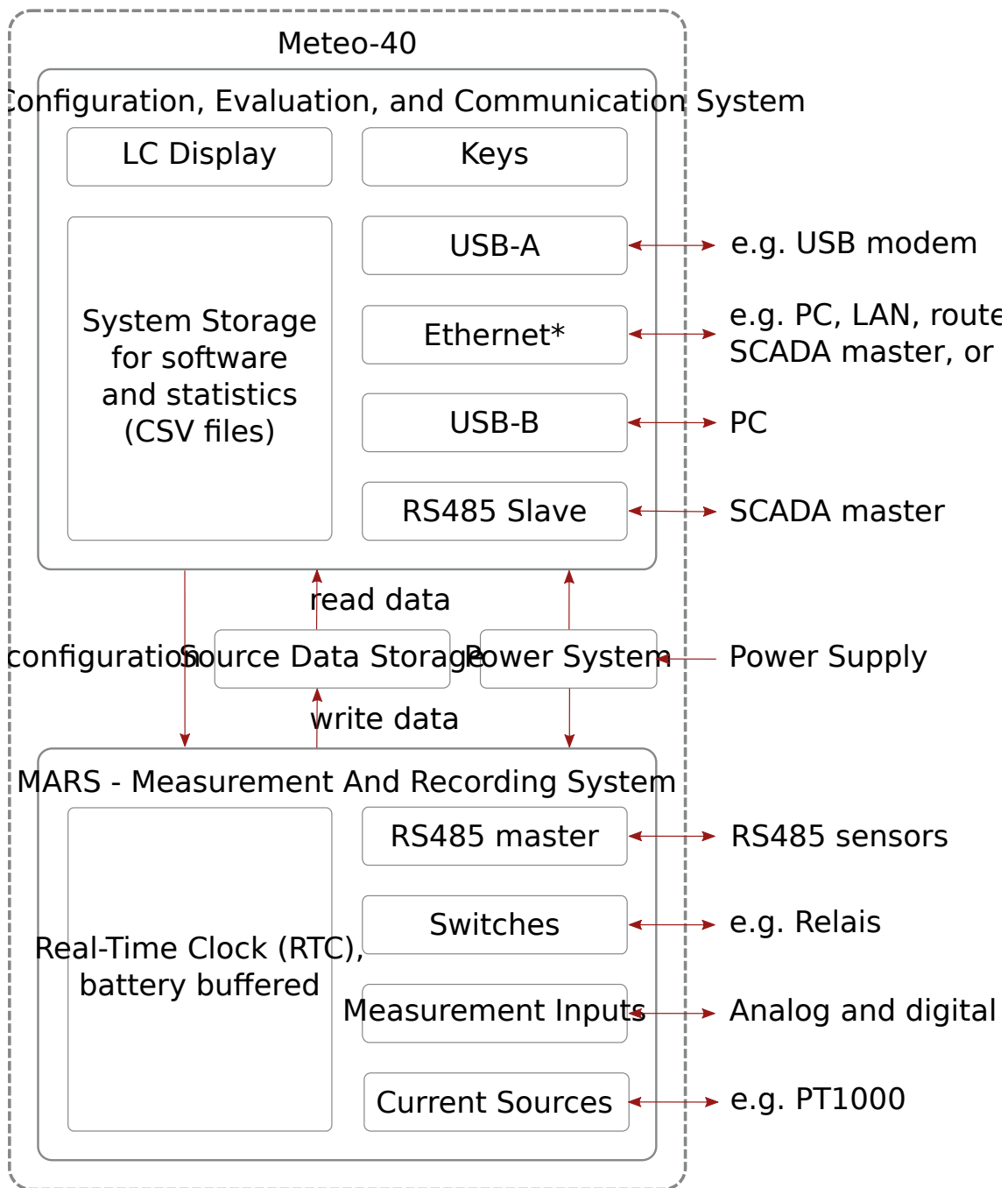
In order to use connected devices and to operate the display or the web interface, CECS has to be started. CECS is a fully operational embedded Linux™ computer. Starting it, allows using Meteo-40's features, but increases power consumption.

To save power during a measurement campaign, CECS is usually powered down and only MARS is running. MARS starts, when the power connector is plugged in.

The booting process of the MARS software is indicated by the illumination of the two lower LEDs (red and yellow). Both LEDs will turn off, when the MARS is started successfully.

CECS can be started either manually or automatically. To manually start CECS, press the middle button of the keyboard and hold it until the display turns on. A manual start of CECS is necessary for the initial configuration of Meteo-40.

Later on, during a measurement campaign, CECS will be started by MARS according to the configured time schedule, e.g., to upload measurement data. After the scheduled actions have been executed, CECS turns off automatically to reduce power consumption.



\*RS232 on older Meteo-40

Figure 1.5: Block diagram of Meteo-40

---

## 1.4.1 CECS: Switch on / off behavior

CECS is configured to run for 20 minutes, before it automatically turns off. When the time is expired and an action is still running, e.g., sending an email, the system will wait until the action is finished and will switch off afterwards. The remaining time is displayed in the **status box**(see Section 3.2) of the Meteo-40 web interface.



### Note

With every user action, e.g., click in the web interface or pressing a button on the keyboard, the remaining time will be reset to 20 minutes.

---

For **SCADA** operation, CECS has to run permanently. This is possible by means of the *CECS always active* mode. If **CECS always active** mode is selected, it will be displayed in the **status box**(see Section 3.2) in the web interface with the infinity symbol ( $\infty$ ) as well as on the Meteo-40 **display** with the word **Always**.



### Note

The *CECS always active* mode is not selected by default. If the SCADA server is activated, the **CECS always active** mode is automatically set.

---

If power supply is disconnected and the data logger shuts down while CECS was running in the *CECS always active* mode, it will start automatically as soon as power is available again.



### Important

When CECS is configured to be permanently on, you cannot manually shut down the system by pressing the middle button on the data logger.

---

## 1.5 Data Storage

CECS and MARS both have access to the common measurement data storage (shared source data memory). It is possible to view or download the source data via the web interface, see Section 6.7.



### Note

For optimal data recording, it is recommended to format the data storage before starting a new measurement campaign. Formatting is a very fast process, which only takes a few milliseconds and can be performed via the web interface under the System → Administration menu. For further details see Section 4.2.

---

## 1.6 User Interfaces

There are two ways to control and configure the data logger: via web interface or by using the buttons of Meteo-40. The second method is only intended for checking and testing, since this control menu does not provide as many possibilities to configure Meteo-40. However, the web interface offers all available configuration options and is recommended for the configuration of the device. To use the web interface a TCP/IP or USB connection is required.

Thanks to its web interface, Meteo-40 can also be operated via Internet with mobile devices, i.e., smartphone, tablet PC.



**Important**

The Meteo-40 web interface is accessed via HTTPS connection, which uses high-grade encryption (AES-256, 256 bit). This connection cannot be decrypted using today's technologies.

## 1.7 Communication Methods and Required Devices

Depending on the project, Meteo-40 offers various methods for communication and data retrieval. All available methods are commonly used as well as easy to handle and to configure. In order to set up the connection to Meteo-40, devices like Ethernet cable or modem are necessary as shown in the following table.

Method / Action	Configuration	Software Update	Data Download	Required Devices	Comment
Meteo-40 (stand-alone)	available	no	no	-	Using the display (see Section 4.4.1 and Chapter 9).
USB flash drive (connected to data logger)	required	yes (see Section 4.3.3)	yes	USB flash drive	Manual data download on pre-configured USB flash drive (see Section 4.2).
LAN (data logger connected to LAN)	available	yes (Internet access required)	yes (Data transfer via email, SCP/FTP/S-FTP, AmmonitOR or manual data download via web interface)	Ethernet cable	Recommended for initial configuration and software updates (see Section 2.3).
W-LAN (PC, laptop etc. connected to data logger's W-LAN)	required	no	yes (Download via web interface)	USB W-LAN stick	Recommended on site for maintenance (see Section 7.8).
Point-to-Point Ethernet (data logger connected to PC)	required	no	yes (Download via web interface)	Ethernet cable	PC has to be configured (see Section 2.4).
USB (data logger connected to PC)	no	no	yes (Download via web interface)	USB (A/B) cable	Backup access. Driver file might be required (see Section 2.5).
USB (data logger connected to smartphone)	available	yes, tethering function of the smartphone needs to be activated	yes (Download via web interface)	USB cable of the smartphone (accessory)	Convenient for remote servicing or software upgrades, when no modem is installed.

Method / Action	Configuration	Software Update	Data Download	Required Devices	Comment
Modem access (data logger connected to modem, e.g., GPRS/GSM, directional radio, satellite)	required	yes (Internet access required)	yes (Data transfer via email, SCP/FTP/S-FTP, AmmonitOR or manual data download via web interface)	Modem and accessory cable	Thanks to the tunnel server design a standard SIM card can be used in a GSM modem. The tunnel server manages IP addresses. SIM card with static IP address is not necessary. (see Section 7.9)
SCADA over RS485 (Modbus RTU)	required	no	yes (Modbus protocol)	-	Modbus register map has to be configured for data retrieval (see Section 8.1).
SCADA over Ethernet (Modbus TCP/IP)	required	no	yes (Modbus protocol)	-	Modbus register map has to be configured for data retrieval (see Section 8.1).



**Note**

If you are working with a Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the data logger to your LAN. The production of Meteo-40 Revision C stopped in October 2012.

## Chapter 2

# Getting Started with Meteo-40

### 2.1 Introduction

Before you start working with Meteo-40, connect the data logger to the power supply. In the moment Meteo-40 is connected to the power supply, the lower LED lights turn on and indicate that the [Measurement And Recording System \( MARS\)](#) is booting. Both LEDs turn off, when MARS has successfully started and is running. To access the web interface, the second system [Configuration, Evaluation and Communication System \( CECS\)](#) has to be started. Press the middle button of Meteo-40's keyboard and hold it until the display turns on (see [Section 1.4](#)).

In order to access the web interface, it is necessary to establish a TCP/IP connection between Host PC and Meteo-40. There are multiple ways to create this connection:

1. If you connect the data logger to your LAN using an Ethernet cable (see [Section 2.3](#)) and DHCP method, any other device in the lan (e.g. your PC) will have access to the web interface of the data logger, as long as the CECS is running.

## LAN connection between Data Logger and PC

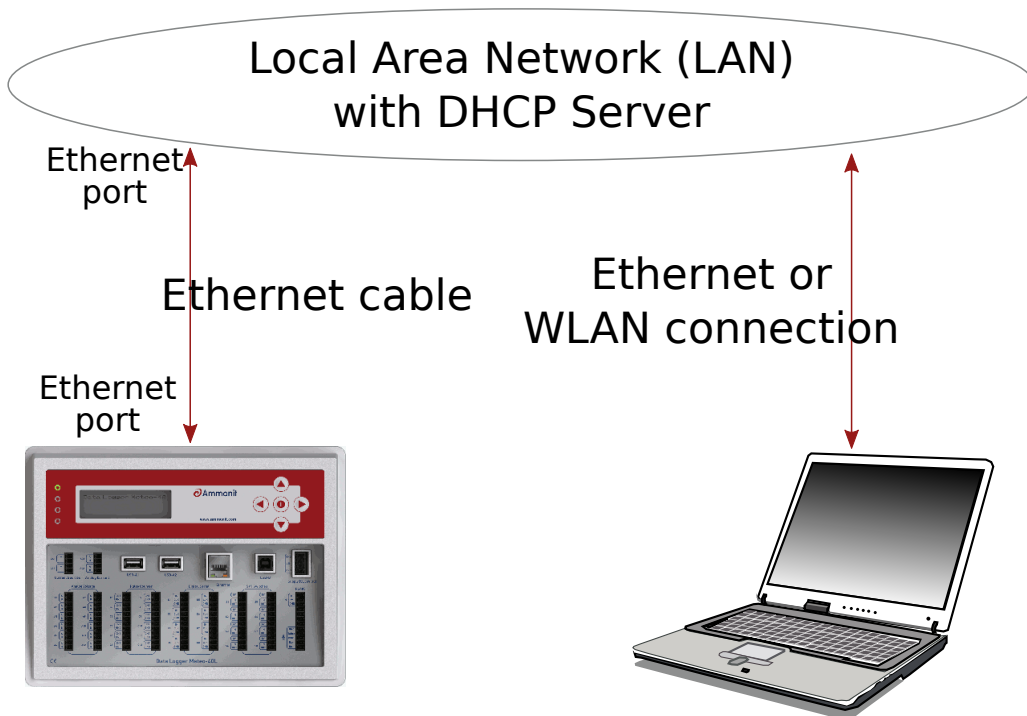


Figure 2.1: Accessing Meteo-40 via LAN (see Section 2.3)

2. A direct, point-to-point connection using an Ethernet cable (see Section 2.4), either with the link-local method or with static IP addresses. The link-local method is recommended.

## to-point Ethernet connection between Data Logger

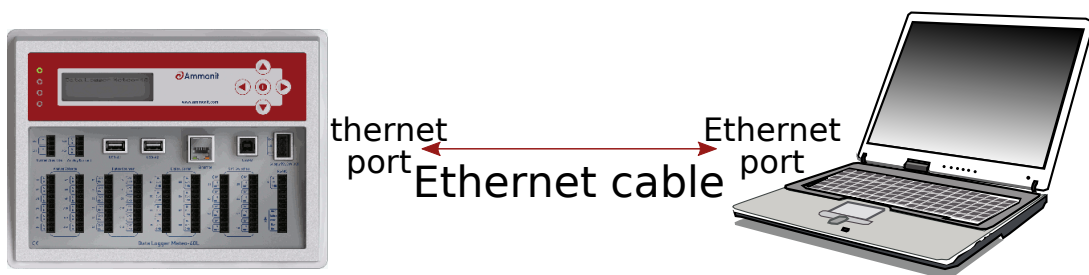


Figure 2.2: Accessing Meteo-40 via Point-to-Point Ethernet Connection (see Section 2.4)

3. A direct, point-to-point connection using a standard USB 2.0 A/B cable, (see Section 2.5). The same type of cable is typically used to connect a USB printer to a PC.

## Connection between Data Logger and PC or Mobile I

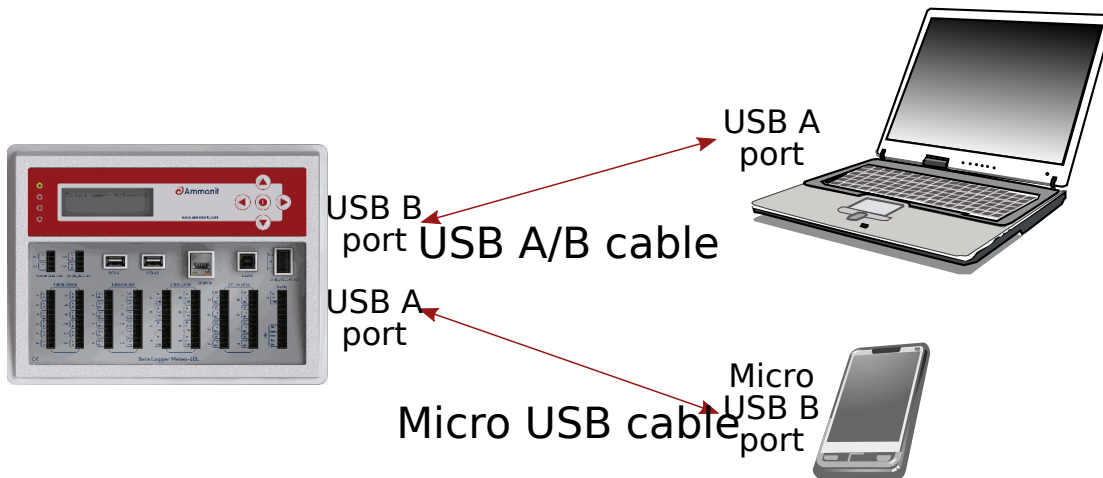


Figure 2.3: Accessing Meteo-40 via USB-B(see Section 2.5)



### Important

If you establish a connection via USB, a driver file might be needed for Windows PCs. The driver file can be downloaded from the Ammonit website in the [Customer Support+Support Documents](#) → [Software](#) (<http://www.ammonit.com/>) section. For further details refer to Section 2.5.



### Note

If you are working with Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the data logger to your LAN or via Ethernet to your PC (Point-to-Point). The production of Meteo-40 Revision C stopped in October 2012.



### Note

After having configured Meteo-40 for W-LAN, the data logger web interface can be accessed by using a W-LAN USB device (see Section 7.8).

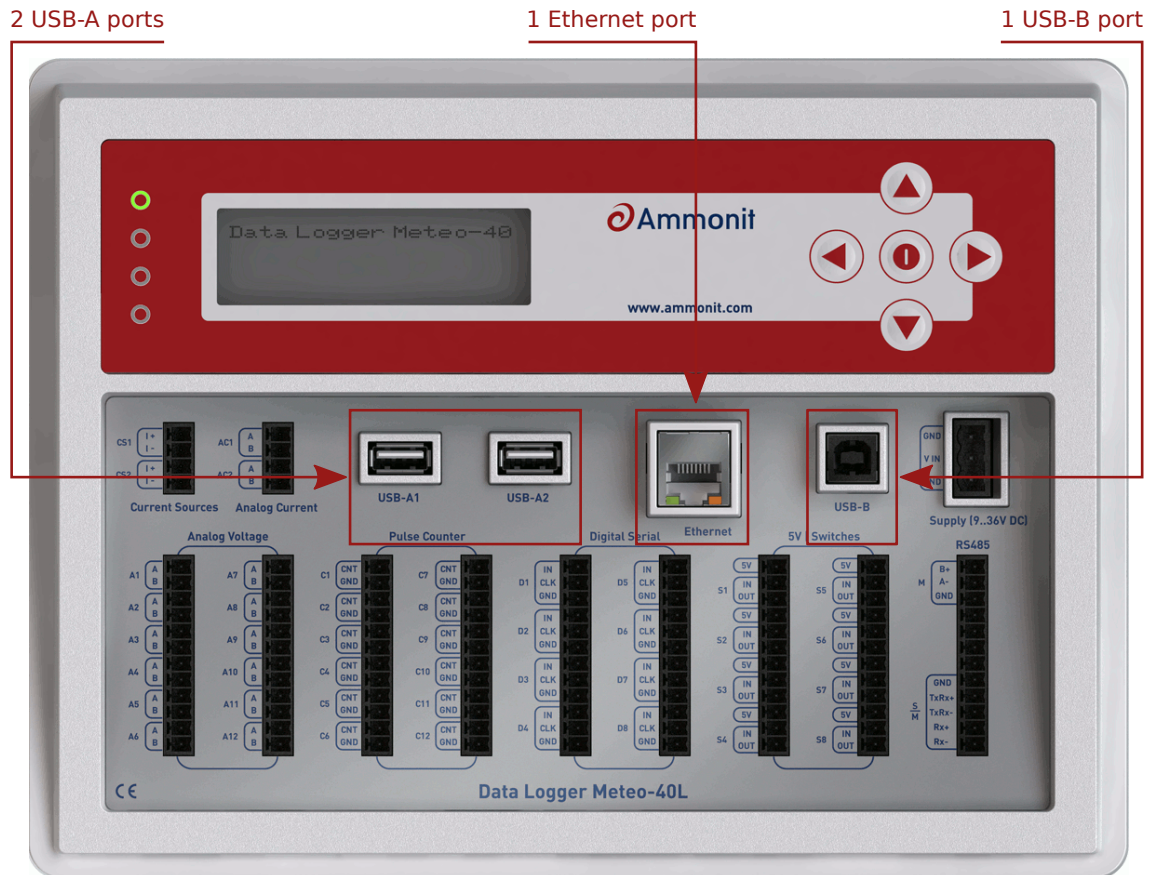


Figure 2.4: Ethernet / USB ports of Meteo-40L



**Tip**

We recommend connecting Meteo-40 via Ethernet to your LAN. It is the easiest method, no additional driver file is needed and updates can be performed immediately.

## 2.2 Using Bonjour™ on Windows™

For Windows Vista™ and later versions, this procedure can be simplified by installing the software [Bonjour Print Services for Windows from Apple](http://support.apple.com/kb/DL999) (<http://support.apple.com/kb/DL999>). It provides automatic resolution of computer host names and the data logger can be accessed via its serial number. Unfortunately, our tests have revealed that this software can cause problems when installed on Windows XP.



**Warning**

Do not use Bonjour with Windows XP™, as it might cause communication problems!

After the installation of Bonjour Print Services just type the serial number as follows in your web browser `https://Dnnnnnn.local` with `Dnnnnnn` as your data loggers serial number. The untrusted connection alert page will appear and should be accepted as described in Section 2.5.1.

URL: <http://d171234.local/>



Meteo-40 D171234

Username:

Password:  
  Show password

Login

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Figure 2.5: Meteo-40 web interface initial screen

## 2.3 Connecting Meteo-40 via Ethernet to your LAN

In order to connect Meteo-40 with your PC via Ethernet, both devices have to be connected to your local network. Your computer should be connected via LAN or W-LAN to your network. To connect Meteo-40 to the network, a standard Ethernet cable is needed. If you have only one Ethernet port in your office, use a switch or a hub to multiply the available Ethernet ports. See Figure 2.1.



### Note

If you are working with Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the data logger to the LAN. Connect the USB side of the adapter to the data logger and plug in the Ethernet cable on the other side. The production of Meteo-40 Revision C stopped in October 2012.

To see that Meteo-40 has been connected successfully, use the buttons on the data logger to navigate through the menu. In the Communication → Devices → LAN menu you can find a list of connections, which displays all available connections. If `eth Activated` is displayed, the connection has been successfully established.

By opening this menu item (click on the right button of the data logger keyboard), you can browse for the connection properties such as IP address, which was automatically assigned to the data logger by DHCP server. To access the web interface, start your web browser. Enter `https://` and the IP address shown in the data logger display, e.g., `https://192.168.12.30`.



### Tip

We recommend using [Mozilla Firefox](http://www.mozilla.com/) (<http://www.mozilla.com/>) as your web browser to access Meteo-40. Other modern web browsers, including mobile web browsers, should work as well, but are not systematically tested by Ammonit.

After entering the address in your web browser, a confirmation prompt may appear. Click *I understand the risks* and press *Add Exception*.

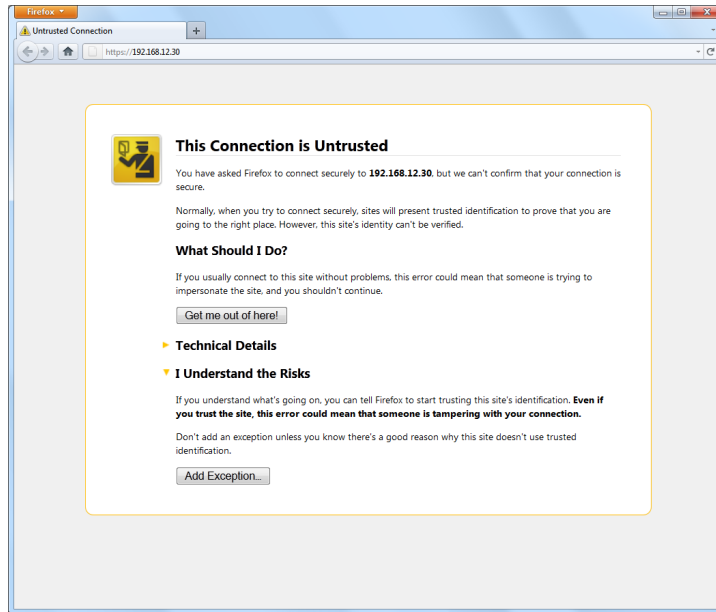


Figure 2.6: Firefox Connection Untrusted alert page

In the next step download the certificate by clicking on *Get Certificate* and *Confirm Security Exception* to access the Meteo-40 web interface. In order to save the exception *Permanently store this exception* should be checked.

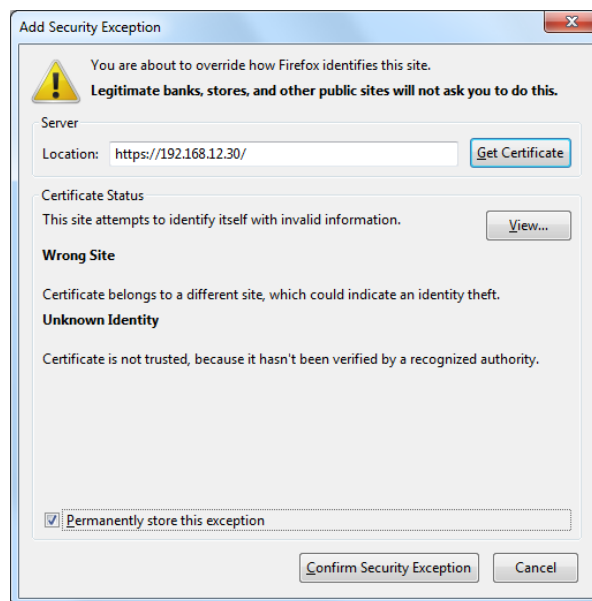


Figure 2.7: Add Security Exception



### Important

In order to prevent misuse of the certificate, Ammonit deliberately did not store the security certificate on each data logger. After downloading the certificate, its validity can be verified.



URL: <https://192.168.43.21/>



Meteo-40 D171234

Username:

Password:  
  Show password

Login

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Figure 2.8: Meteo-40 web interface initial screen



#### Important

In order to use all functions of the web interface, activate JavaScript and Cookies in your web browser!

Go to Chapter 3 to proceed with the configuration.

## 2.4 Connecting Meteo-40 to your Windows 7™, Windows 10™ PC via point-to-point Ethernet connection

In order to connect Meteo-40 with your Windows 7™ PC, an Ethernet cable is required. No additional driver file is needed for a direct point-to-point connection via Ethernet. See Figure 2.2.



#### Note

If you are working with Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the data logger via point-to-point Ethernet connection to your PC. Connect the USB side of the adapter to the data logger and plug in the Ethernet cable on the other side. The production of Meteo-40 Revision C stopped in 2012.

Before you connect the devices, Meteo-40 has to be configured to use either a *link-local* connection or a *static IP address*. The former is much easier to use, because it does not involve any manual configuration of the PC, if it has the standard configuration of obtaining an IP address automatically.

### 2.4.1 Using link-local connection

To use a link-local address, you have to make sure your PC is configured to obtain an IP address automatically. In most cases, this is already be the case.

In the next step Meteo-40 has to be configured for the link-local Ethernet connection. Open the Communication → Devices → LAN → Ethernet menu and select *Ethernet (Offline)*. Move to *Method* and press the right button on the Meteo-40 keyboard until *Link-local* is displayed as shown in Figure 2.9. *DHCP* is configured by default to support the standard LAN (see Section 2.3) connection via Ethernet.

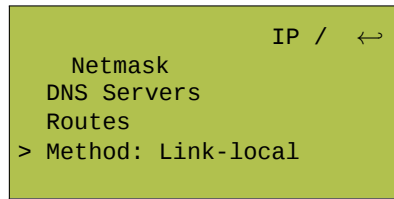


Figure 2.9: Meteo-40 display with activated link-local connection

Open your browser, e.g., Mozilla Firefox. When you are using a Mac or a Linux computer, or when you have installed Bonjour on a Windows PC, you can just enter `https://Dnnnnnn.local` in the URL field of your web browser.

Otherwise, look up the IP number in the menu and enter the number as follows `https://169.254.nnn.nnn` as URL. For *link-local* connection, IP addresses start always with `169.254.`, while the remaining numbers are random and change every time.

## 2.4.2 Using static IP address

To use a static IP address, you need to configure your PC and Meteo-40. To configure the PC, open the *Network and Sharing Center* in the *Control Panel* of your computer and click on *LAN Connection*(see Figure 2.10). In most cases, the link-local connection Section 2.4.1 is preferable.

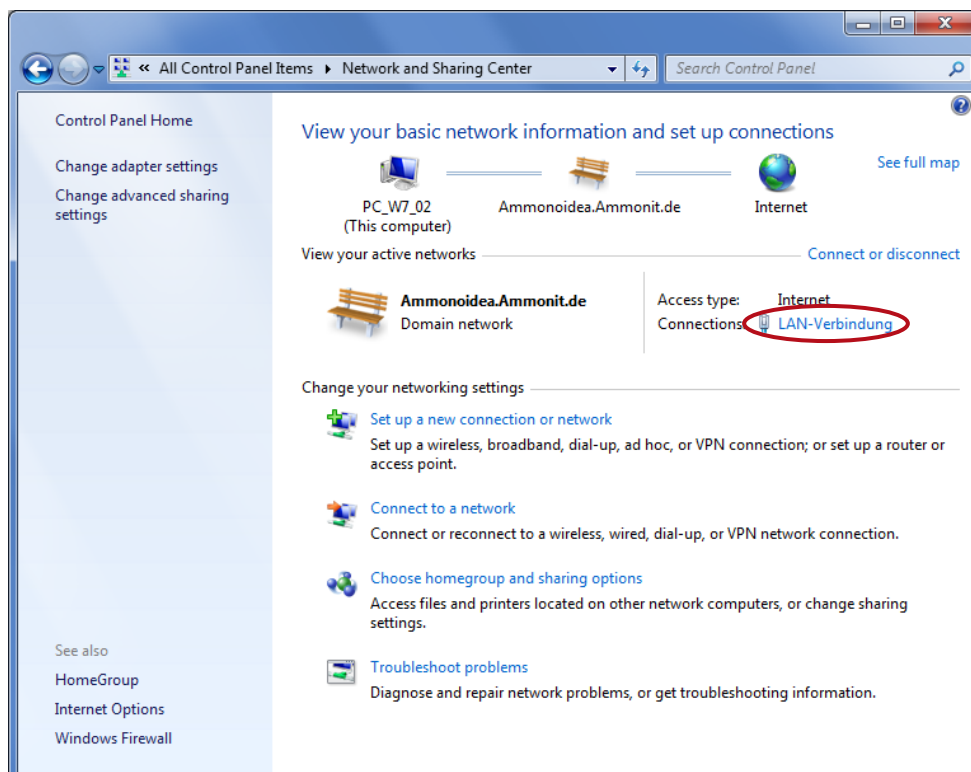


Figure 2.10: Network and Sharing Center of Windows 7™

To configure the LAN connection, click on *Properties*( Figure 2.11) in the LAN Connection Status window.

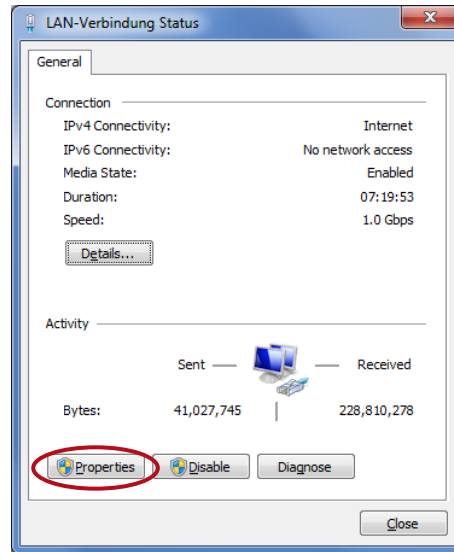


Figure 2.11: LAN Connection Status

Select *Internet Protocol Version 4 (TCP/IPv4)* and open the *Properties* of the Internet protocol as shown in Figure 2.12

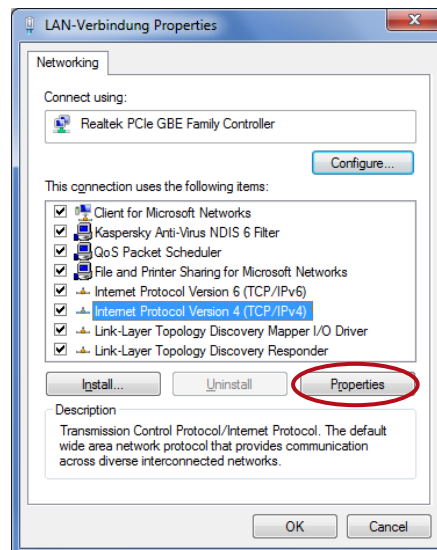


Figure 2.12: Properties of LAN Connection

Choose *Use the following IP address* and enter the following IP address 192 . 168 . 40 . 1 as shown in Figure 2.13. By pressing the TAB button the Subnet mask will be filled automatically. Save the configuration with OK.

**Important**

If you do not have the rights to configure the settings, contact your system administrator.

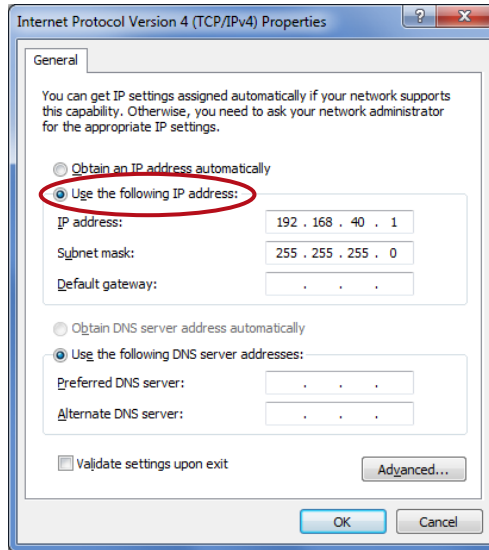


Figure 2.13: Properties of Internet Protocol

After having configured the LAN connection, connect your PC with Meteo-40 using a standard Ethernet cable. Switch on Meteo-40 by pressing the middle button of the keyboard.

In the next step Meteo-40 has to be configured for the static IP point-to-point Ethernet connection. Open the Communication → Devices → LAN → Ethernet menu and select *Ethernet (Offline)*. Move to *Method* and press the right button on the Meteo-40 keyboard until *Static IP* is displayed.

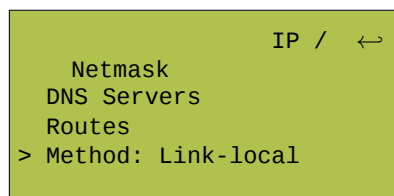


Figure 2.14: Meteo-40 display with activated link-local connection

Open your browser, e.g., Mozilla Firefox. When you are using a Mac or a Linux computer, or when you have installed Bonjour on a Windows PC, you can just enter `https://Dnnnnnn.local` in the URL field of your web browser.

Otherwise, just enter `https://192.168.40.40`, where 192.168.40.40 is the preconfigured IP address of each Meteo-40 data logger.

Afterwards a confirmation prompt appears. Click *I understand the risks* and press *Add Exception* as shown in Figure 2.15.

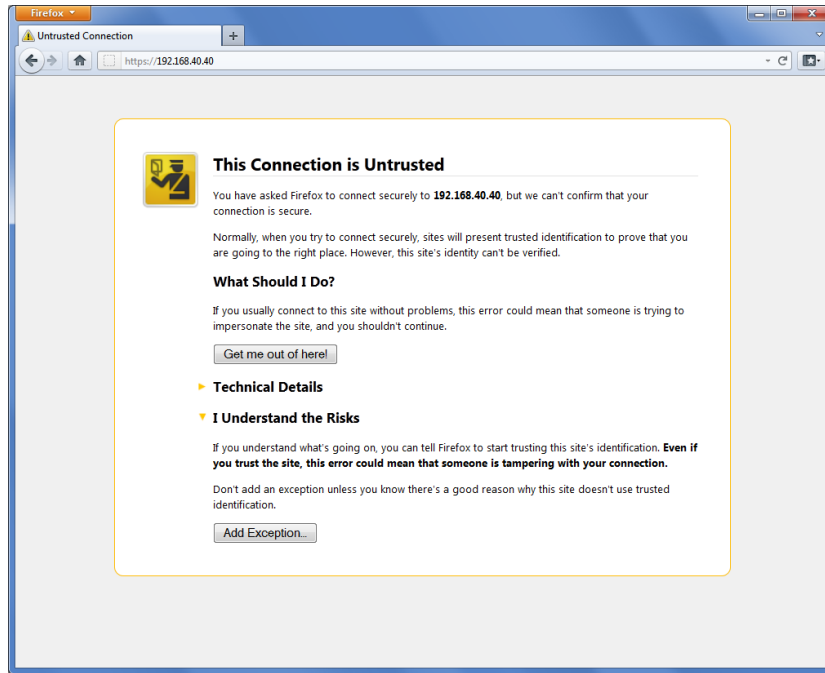


Figure 2.15: Mozilla Firefox Connection Untrusted Alert Page

In the next step download the certificate by clicking on *Get Certificate* and *Confirm Security Exception* to access the Meteo-40 web interface. In order to save the exception, *Permanently store this exception* should be checked.

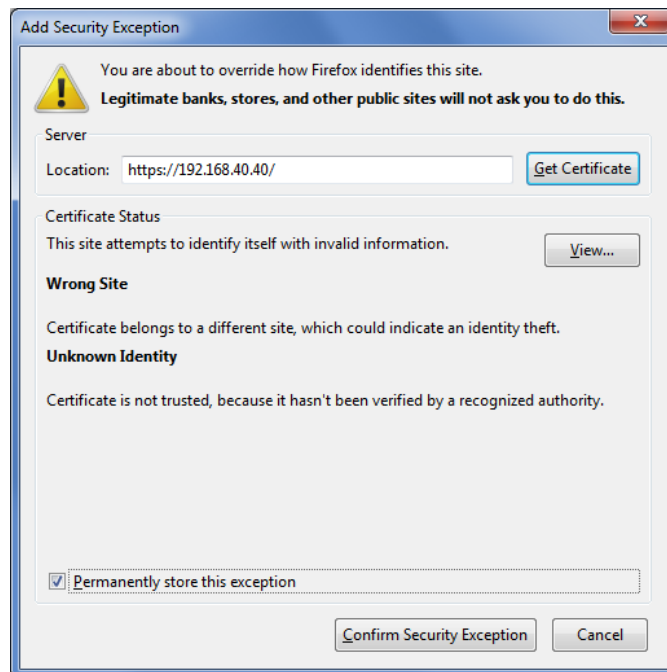


Figure 2.16: Add Security Exception

After confirming the certificate, the Meteo-40 login page is shown. Use your login details (Meteo-40 certificate) to enter the web interface. To proceed with the configuration, go to Chapter 3.

URL: https://192.168.40.40/



Meteo-40 D171234

Username:

Password:  
  Show password

---

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Figure 2.17: Meteo-40 web interface initial screen



**Tip**

By using this point-to-point connection (without Internet access), the modem connection can be tested, e.g., sending emails via modem.



**Note**

Do not forget resetting the LAN configuration on your PC (Internet protocol properties) and enabling DHCP on Meteo-40 (if needed).

## 2.5 Connecting Meteo-40 with your Windows 7™, Windows Vista™ or Windows XP™ PC via USB

Meteo-40 requires a standard RNDIS USB driver from Microsoft™ Corporation. With the driver, it should be automatically recognized and installed. If any incompatibility problems occur, refer to Section 2.5.2. Otherwise proceed to Section 2.5.1.



**Tip**

You can also connect Meteo-40 to your tablet PC or smartphone by using a micro USB cable as shown in Figure 2.3. In doing so, you can easily connect to the data logger for maintenance reasons in the field or for performing updates using the tethering function of your mobile device (see also Section 4.3.1).

### 2.5.1 Standard RNDIS USB Driver

Start Meteo-40 and connect the USB-B side of the cable to the data logger and the USB-A to the computer. Windows will find the new hardware and will automatically search for appropriate software. After a few seconds the USB Ethernet/ RNDIS Gadget is installed and ready to use.

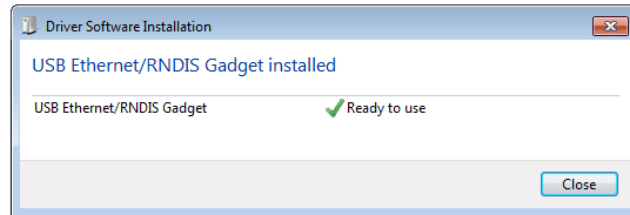


Figure 2.18: Windows Driver Software Installation

If the installation does not start automatically, open the Device Manager, right click on the device, select *Update Drivers* and *Search automatically for updated driver software*. Access to the Internet is required for this step.

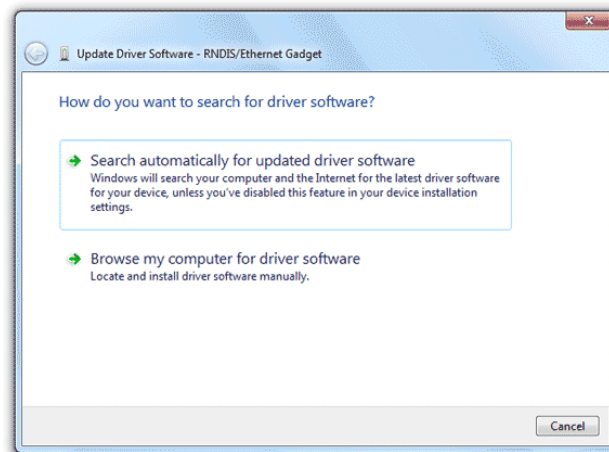


Figure 2.19: Windows Driver Update Installation

Once the software installation is completed, a new RNDIS/Ethernet Gadget device will appear on the Network adapters list in the Device Manager.

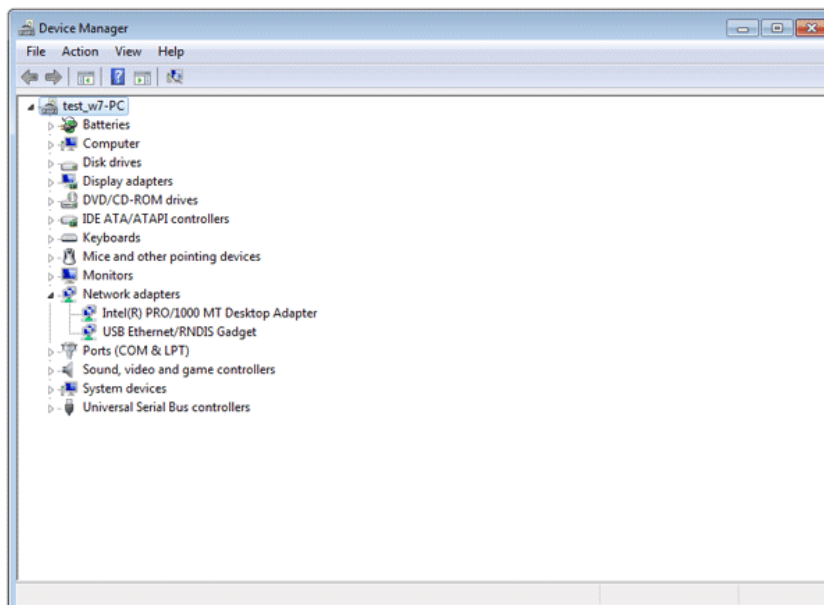


Figure 2.20: Windows Device Manager

---

The local connection is established. An IP address is automatically assigned to the data logger, which can be found on its display in the menu Communication → Devices → LAN → USB under IP/Netmask. To start using Meteo-40, type the address in your web browser, e.g., `https://169.254.12.25/`. The address always starts with 169.254, the remaining part is random.



**Tip**

We recommend using [Mozilla Firefox](http://www.mozilla.com/) (<http://www.mozilla.com/>) as your web browser to access Meteo-40. Other modern web browsers, including mobile web browsers, should work as well, but are not systematically tested by Ammonit.

---



**Important**

In order to use all functions of the web interface, activate JavaScript and Cookies in your web browser!

---

After entering the address in your web browser, a confirmation prompt may appear. Click *I understand the risks* and press *Add Exception*.

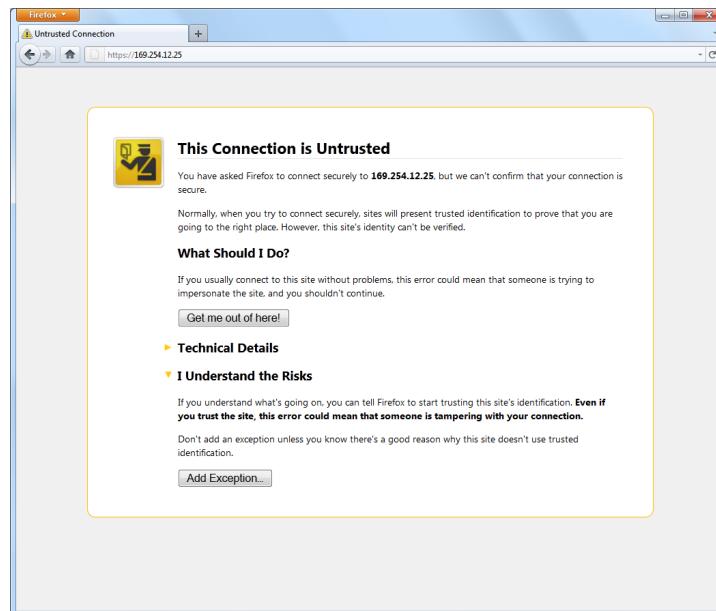


Figure 2.21: Firefox Connection Untrusted alert page

In the next step download the certificate by clicking on *Get Certificate* and *Confirm Security Exception* to access the Meteo-40 web interface. In order to save the exception, *Permanently store this exception* should be checked.



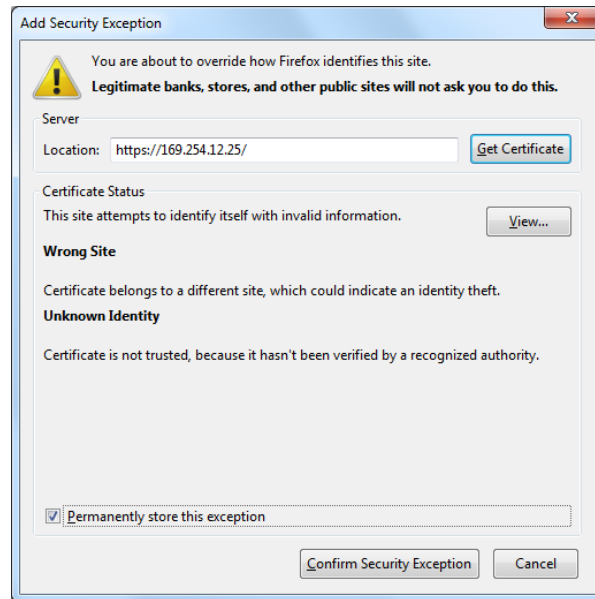


Figure 2.22: Add Security Exception

**Important**

In order to prevent misuse of the certificate, Ammonit deliberately did not store the security certificate on each data logger. After downloading the certificate, its validity can be verified.

URL: <https://169.254.43.21/>



Meteo-40 D171234

Username:

Password:  
  Show password

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Figure 2.23: Meteo-40 web interface initial screen

## 2.5.2 Driver Update

When installing Meteo-40 for the first time, driver incompatibility problems may occur. A new RNDIS/Ethernet Gadget device should appear in the Device Manager under Network Adapters, but a warning sign (⚠) indicates that the hardware driver software was not correctly installed.

In this case download the driver file from the Ammonit website. Therefore, go to <http://www.ammonit.com/>, open the *Support* page and browse to the software section under *Downloads*. After downloading the Meteo-40 driver file, extract the ZIP file and save the *Meteo-40.inf* file on your PC.

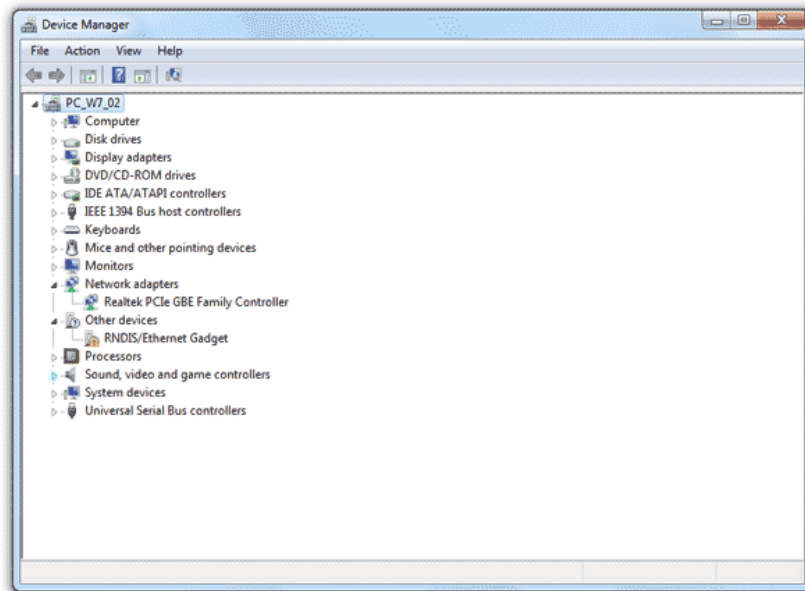


Figure 2.24: New USB Ethernet/ RNDIS Gadget in Device Manager

Right click on the device and select *Update Driver Software...*. An update wizard opens. Click on *Browse my computer for driver software*.

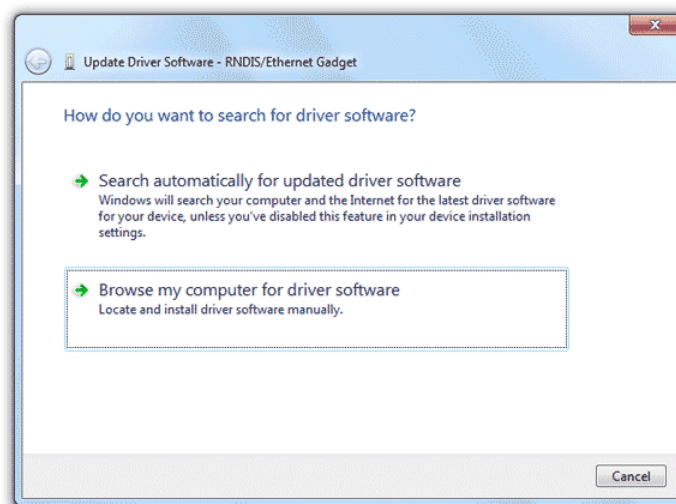


Figure 2.25: Update Driver Software dialog box

Locate and select the *Meteo-40.inf* file, which has been downloaded from the Ammonit website to your PC.

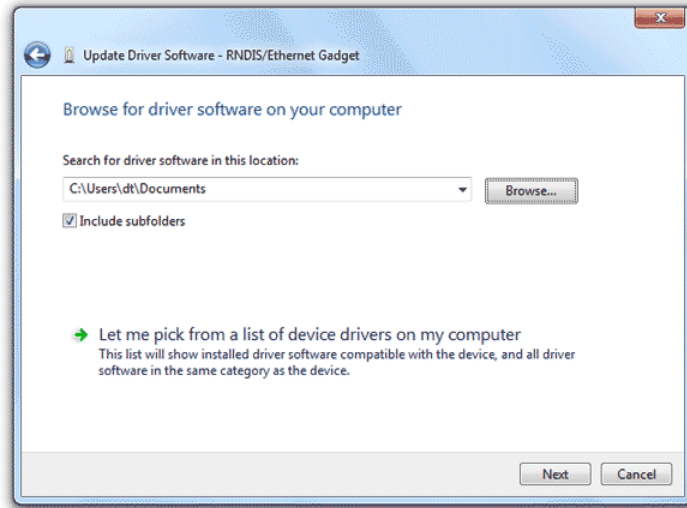


Figure 2.26: Update Driver Software dialog box

**Note**

During the installation of the drivers, Windows may show a warning message: "Windows can't verify the publisher of this driver software". If this happens, select "Install this driver software anyway" to complete the installation.

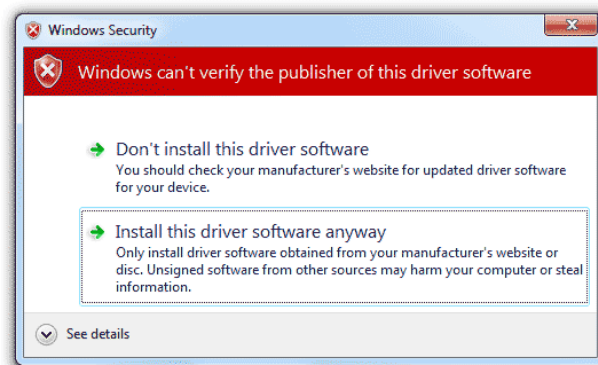



Figure 2.27: Windows Security Advisory

The driver software for Meteo-40 should now be correctly installed. The warning sign () should have gone and the name of the device in the Hardware Manager should have changed from RNDIS/Ethernet Gadget to *Ammonit Meteo-40*.

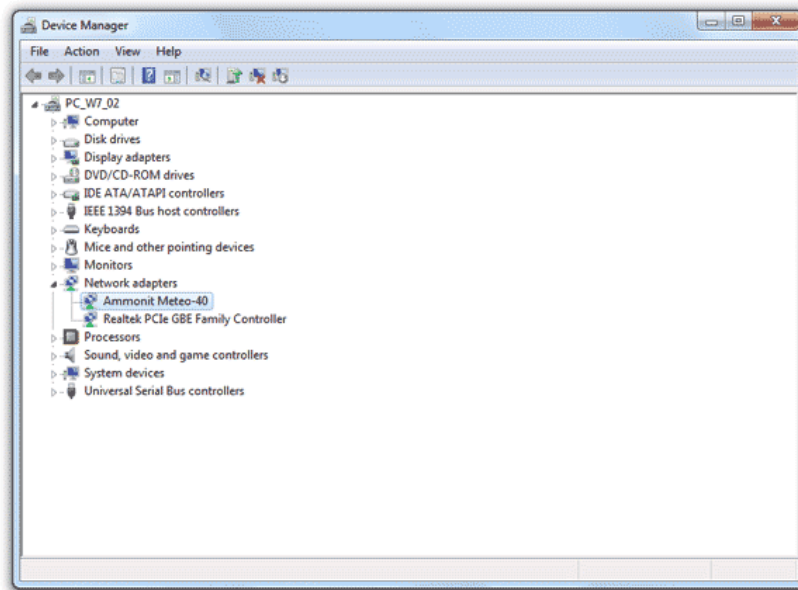


Figure 2.28: Windows Device Manager

## 2.6 Connecting Meteo-40 to your Windows 8™ PC via USB

In order to connect Meteo-40 to a Windows 8™ PC, some PC settings have to be modified. Unlike its predecessor Windows 7, Windows 8 strictly enforces a driver signature check - verifying the signatures with its own local database. If your PC is not configured to install unsigned driver files, the installation of Meteo-40 will fail. The problem can be solved by disabling a checkbox in the PC settings in a few steps:

1. Open the *PC settings* in the *Charms* bar for example by pressing the "Windows" key + "C" on the keyboard. Click on *General*.

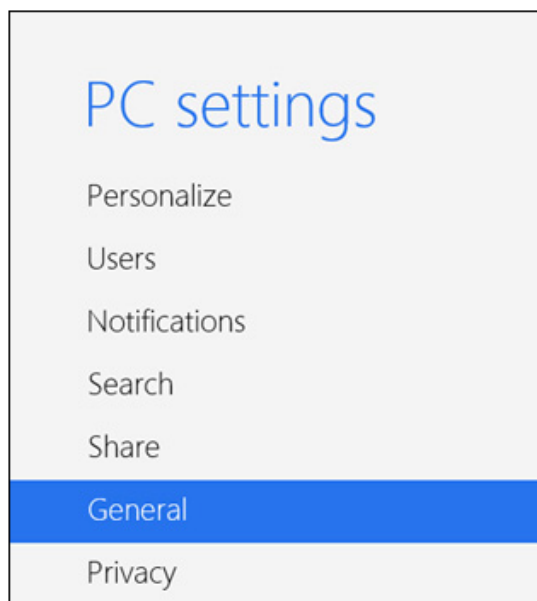


Figure 2.29: Windows 8 PC settings (1)

2. Select *Advanced startup* and click on *Restart now*.

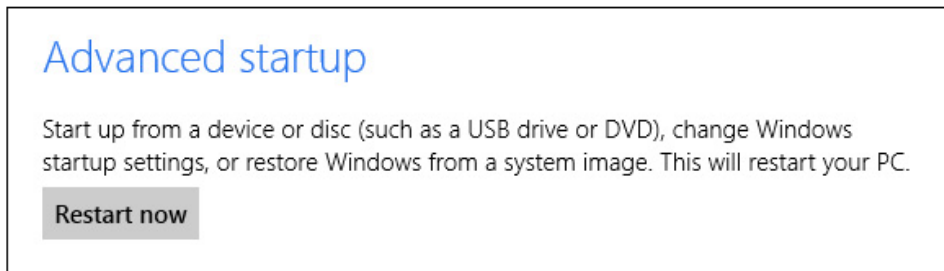


Figure 2.30: Windows 8 PC settings (2)

3. Go to *Troubleshoot* and click on *Advanced options*. Select *Startup Settings*.

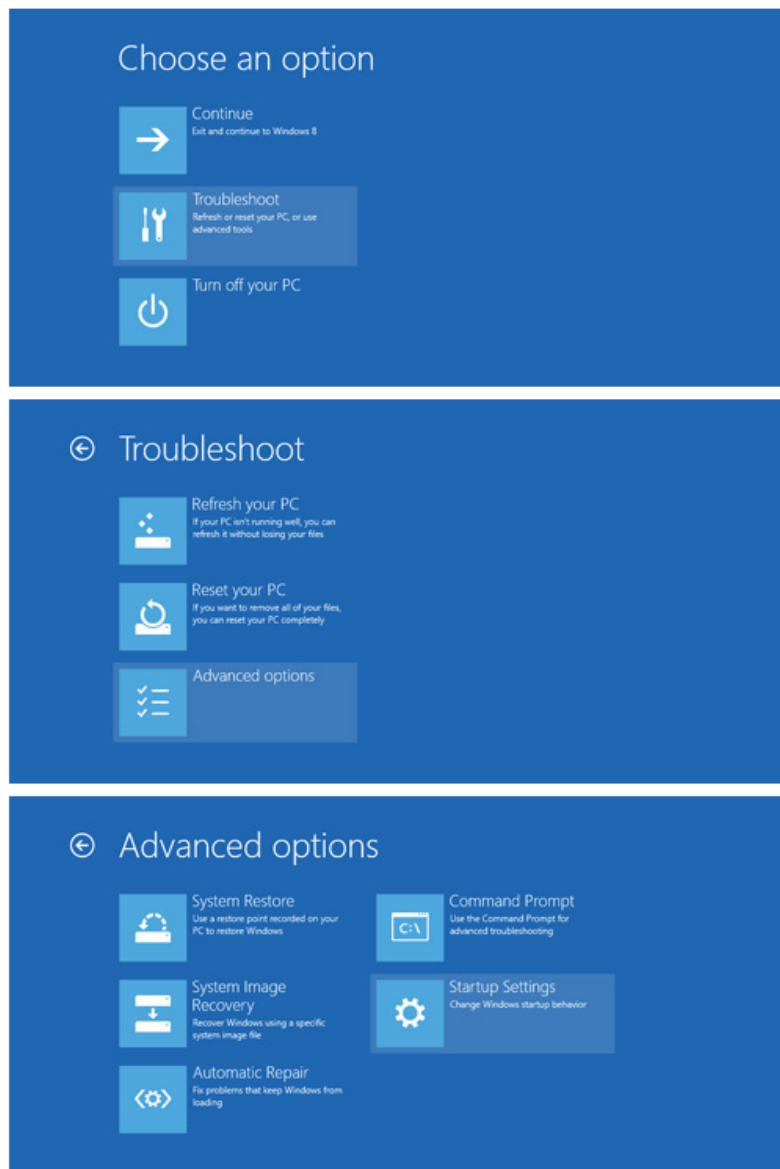


Figure 2.31: Windows 8 PC settings (3)

- 
4. The Windows Startup Settings are displayed. The first option is *Disable driver signature enforcement*. In order to disable this feature, click on *Restart*. After reboot, press *F7* to modify the settings. Thereafter the Meteo-40 driver file should be installed properly.



Figure 2.32: Windows 8 PC settings (4)

After having configured the settings of your Windows 8™ PC, the Meteo-40 driver file has to be installed. To do so, follow the instructions in Section 2.5.2.

## 2.7 Using Meteo-40 with Linux

Recommended is any up-to-date Linux distribution with installed [Network Manager](http://projects.gnome.org/NetworkManager/) (at least version 0.8), such as Debian 6.0, Ubuntu 10.04 or later. Configure the RNDIS/Ethernet Gadget to use link-local and connect the Meteo-40 with the PC. You should be able to access the Meteo-40 with your web browser now.

## Chapter 3

# Login at Meteo-40

### 3.1 Login Options

Once you access the login page of the data logger over the web interface, you may log into one of four accounts, which have different access rights: Guest, Viewer, User or Admin.

URL: <http://d171234.local/>



Meteo-40 D171234

Username:

Password:  
  Show password

Login

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Figure 3.1: Login Screen

The original access password for each account is enclosed in the data logger's delivery. The passwords are unique for each Meteo-40. All passwords can be changed (see [Change Access Passwords](#): in Section 4.2) by the Admin user.



#### Warning

Be careful if you change the password for the Admin account. A forgotten Admin password cannot be recovered. The data logger must be returned to Ammonit to restore the original password.

Account	Permissions
Guest	<ul style="list-style-type: none"> <li>• Look at all configuration pages</li> <li>• Look at live data</li> </ul>
Viewer	<ul style="list-style-type: none"> <li>• All of the above</li> <li>• Download measurement data</li> </ul>
User	<ul style="list-style-type: none"> <li>• All of the above</li> <li>• Configure the data logger</li> <li>• Change (but not see) communication and encryption passwords</li> </ul>
Admin	<ul style="list-style-type: none"> <li>• All of the above</li> <li>• Change the name of the data logger</li> <li>• Upgrade the data logger software</li> <li>• Change all users access passwords</li> </ul>

Table 3.1: Accounts and permissions

The Meteo-40 web interface is available in seven languages: Chinese, English, French, German, Portuguese, Spanish, and Turkish.



**Important**

In order to use all functions of the web interface, activate JavaScript and Cookies in our web browser!

After login, two links are shown in the upper right corner:

**Help** Access online help.

**Logout** Close the session, when access to the data logger is no longer needed.

Under these links the account you are logged into ( Guest, Viewer, User or Admin) is shown, followed by the serial number of the data logger.



**Warning**

Be aware that due to security reasons it is not possible to reset the access passwords. Furthermore, if you change the Admin password and forget it, there is no way to recover it, not even for Ammonit. In this case, you have to send the data logger to Ammonit, so that we can restore the original passwords.

## 3.2 Global Control Elements

A Status Box is shown in the upper left corner of the Meteo-40 web interface. It always shows the most important information and control options.



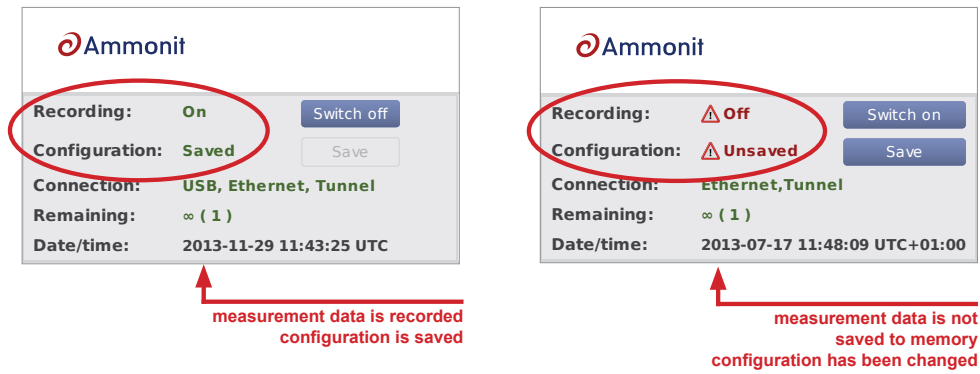


Figure 3.2: Meteo-40 Status Box displaying Status of Recording

The Status Box displays whether Meteo-40 is recording data and whether the current configuration is saved. You can switch on or off recording here and save the configuration after having made any changes.



**Note**

If you switch Recording on, the Configuration will be saved automatically, because recording cannot work without a saved configuration.



**Important**

If you switch Recording off, no measurement data will be saved to memory. The measurement is still going on and you will be able to see live data, but you cannot generate CSV files and you will not be able to access measured data afterwards!

If Configuration is not saved, you have changed the configuration and the changed configuration is active. You must save the configuration to use the new configuration permanently. If you do not save the configuration, your settings will be lost after disconnecting the power supply!

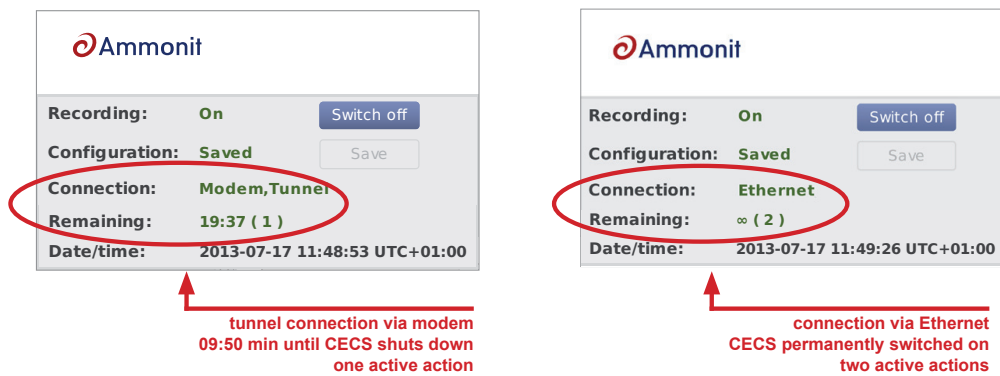


Figure 3.3: Meteo-40 Status Box displaying Connection and Power Mode

The Meteo-40 Status Box displays the current established connections ( Connection), e.g., tunnel connection via modem or using Ethernet without tunnel in the office. The available connection modes are USB, Ethernet and Modem. If the data logger is available through the tunnel, it will be shown as Tunnel in the connections list. The current preferred connection for the Internet access is written in capital letters.

Additionally, the web interface informs about the remaining time until shut down or whether CECS is configured to run permanently ( Remaining). In brackets the number of running actions are displayed, e.g., online access or upload of CSV file.

### 3.3 Menu of the Web Interface

The menu of the Meteo-40 web interface consists of four main menu items: *System*, *Measurement*, *Evaluation* and *Communication*. Each menu item is explained in the following chapters (See Chapter 4 to Chapter 7).

Menu	Submenu Item
System	Information
	Administration
	Upgrade
	Device
	Camera
	Switches
	Logbook
Measurement	Sensors
	Channels
	Evaluation
Data	Live
	Statistics
	Gusts
Source	
Communication	Schedule
	Online
	AmmonitOR
	Email
	SCP/FTP/SFTP
	SCADA
	LAN
	WLAN
Modem	

Table 3.2: Menu of the Web Interface

## Chapter 4

# System Configuration

### 4.1 System Information

This page gives an overview of important system properties, such as data logger type, serial number, available memory, software versions and number of channels.

<b>Recording:</b> <span style="color: red;">▲ Off</span> <input type="button" value="Switch on"/>	<h2>System Information</h2>
<b>Configuration:</b> <span style="color: green;">Saved</span> <input type="button" value="Save"/>	
<b>Connection:</b> <span style="color: green;">ETHERNET, Tunnel</span>	
<b>Remaining:</b> ∞	
<b>Date/time:</b> 2017-05-11 15:05:04 UTC+01:00	

- Meteo-40**
- System Information**
- Administration
- Upgrade
- Device
- Camera
- Switches
- Logbook
- Measurement**
- Sensors
- Channels
- Evaluation
- Data**
- Live
- Statistics
- Gusts
- Source
- Communication**
- Schedule
- Online
- AmmonitOR
- Email
- FTP/SCP
- SCADA
- LAN
- WLAN
- Modem

Data logger type	<b>Meteo-40L</b>
Serial number	<b>D171234</b>
Number of channels	<b>12 analog voltage, 12 counters, 2 analog current, 2 current sources, 8 digital, 8 switches, 8 RS-485, 4 period measurement</b>
Active input channels	<b>None</b>
Installed sensors	<b>None</b>
Data logger location	<b>52.50176, 13.43479 @ 36.5m</b>
RAM	<b>Total: 123MiB, Used: 34MiB Free: 89MiB</b>
Source data storage	<b>1961.51MiB (52.20% used, current page-id: 2097152)</b>
System storage	<b>Total: 461MiB, Used: 104MiB Free: 358MiB, Type: MT29F4G08ABBD4HC[7,0]</b>
Uptime	<b>CECS: 1 day, 10:17:36; MARS: 11 days, 10:20:54</b>
Software version	<b>1.6.4 (2017-05-05)</b>
Bootloader version	<b>5641</b>
Production date	<b>2017-01-02 10:11:12</b>
AmmonitOR	<b>EWNP</b>
SCADA	<b>Modbus TCP</b>
Current connections	<b>Admin (127.0.0.1)</b>

No file selected

Figure 4.1: System Information Page

Under *Current connections* all current logins are displayed with IP address, e.g., via LAN, W-LAN (WiFi), USB or tunnel. If a connection has been established via tunnel (see also Section 7.3), the letter T after the IP address indicates the tunnel.

*Source data storage* shows the amount of memory which is already in use for storing source data. Please note, that more than 100 % are possible. A value beyond 100 % means that the data logger is overwriting the oldest source data by storing new data.

Use *Download Current Configuration* to download the configuration file. The configuration file is an INI file ([http://en.wikipedia.org/wiki/INI\\_file](http://en.wikipedia.org/wiki/INI_file)), which is a widely-used file format. This file contains configuration settings related to modem, Ethernet, server upload, email, data evaluation, SCADA as well as activated channels and sensors. By saving a configuration file, the configuration can quickly be uploaded and effectively applied to other data loggers. The file name is config-Dnnnnnn.txt with Dnnnnnn as the serial number of the data logger.

**Warning**

Be careful with uploading a changed INI file to the data logger. Inconsistencies can lead to malfunctions of the data logger.

We strongly advice not to change manually any entry in the configuration file.

---

## 4.2 System Administration

This page contains different administration aspects of the data logger. Only users logged in as Admin can access the complete functionality of this section. If you are logged in as User, Viewer or Guest, changes in the System → Administration menu are not possible.

**Data Logger Name:** By giving each Meteo-40 a name, the data loggers can be identified easier. The name appears in the source data files header, on AmmonitOR (<http://or.ammonit.com/>) and in the config.txt file.

The screenshot shows a web interface for setting a data logger name. At the top, there is a grey header bar with the text 'Data Logger Name'. Below this, the label 'Data logger name' is positioned above a text input field. The input field contains the text 'Meteo-40 Site 1'. Below the input field is a blue button with the text 'Save name'.

Figure 4.2: Assigning a Data Logger Name

**Note**

The data logger serial number is the most important ID to identify the data logger. Use the *Data Logger Name* to give the data logger a custom name, e.g. Meteo-40 Site 1.

---

**CECS Power Mode** The standard operation mode keeps CECS running for 20 minutes. Each user interaction resets the remaining time before automatic shutdown to 20 min. The *CECS always active* mode is not selected by default.

In order to keep CECS permanently running, e.g., for SCADA wind farm monitoring, Meteo-40 offers the *CECS always active* mode. This mode prevents the automatic shutdown of CECS. It can be configured via web interface (System → Administration) or by using the display (Status → CECS) of the data logger. To do any changes of the CECS mode via display, permissions have to be defined in the web interface (System → Display (see Section 4.4.1)). If the *CECS always active* mode is selected, it will be displayed in the *status box* of the web interface with the infinity symbol (∞) as well as on Meteo-40 display with the word Always.

Figure 4.3: Configuring the *CECS always active* Power Mode



**Note**

If the power supply for Meteo-40 is disconnected while CECS is running in the *CECS always active* mode, CECS will restart automatically as soon as Meteo-40 is powered again.

To ensure reliability of Meteo-40 function, it is highly recommended, that the CECS is rebooted regularly. In cases, where CECS is always on, e. e.g. for SCADA, Meteo-40 has an automatic reboot function. The default behavior of Meteo-40 is to reboot just before the start of the week, i.e. every Sunday five minutes before midnight. Alternatively, you can choose to reboot every day five minutes before midnight, or never.

To restart the CECS, click on *Restart CECS*.

To shutdown the CECS, e.g., during remote access, click on *Shutdown CECS*.



**Important**

When CECS is configured to be permanently active, you cannot shut down the system, neither by pressing the middle button on the data logger nor using the *Shutdown CECS* button at the web interface. You can still restart the CECS with the *Restart CECS* button.



**Important**

MARS(for measuring and recording) continues without stopping during the restart. You will not loose any measurement data unless the recording is explicitly switched off or the power supply has been disconnected. For further details about the systems refer to Section 1.4.

You can start the CECS by applying a voltage peak to the selected digital channel. The voltage peak can be triggered over a cable / switch close to the ground. If this is prepared during the first installation, you might prevent further climbing up the met mast during maintenance work.

Once the CECS is on, the communication can be established remotely by any of the previously installed and foreseen methods (Modem, a previously connected Ethernet cable or WLAN). The CECS will automatically turn off after 20 min, if no action on the data logger is performed.

The voltage peak must last at least one second (see also Section 12.2.5). The digital channel has to be selected from the list of available digital channels in the *Power CECS on digital status signal* dropdown list. This change on data logger's configuration will stop the measurement for some seconds, until it is automatically or manually restarted (see Section 3.2).

**Date and Time, Location:** Time synchronization of the data logger is a primary concern. Four synchronisation methods are available: GPS, NTP, SCADA and Manually.

In order to synchronize date and time automatically to NTP servers, select *Set data and time automatically*. Additionally the time zone has to be set.

**Warning**

It is not recommended to perform time zone changes during the measurement campaign. This could lead to duplicated measurement intervals and eventually data loss. We recommend to process the data later in AmmonitOR (<http://or.ammonit.com/>).

Optionally, you can also choose to *Set date, time and location using GPS*. The GPS device must provide a sentence following the GPRMC NMEA standard (e.g. PHS8-P modem).

To synchronise date and time over SCADA see Section 8.2.2.

If date and time should be set manually, enter date (date format YYYY-MM-DD) and time (time format hh:mm:ss) in the appropriate fields. Date and time format are validated while typing the values.

Date and Time, Location

Time zone  
 ← select the local timezone

Set date, time, and location using GPS ← set date, time, and location using GPS

Set date and time using NTP (Internet) ← synchronize date and time with NTP servers

NTP servers:

Set date and time using SCADA ← set date and time via SCADA

Date (YYYY-MM-DD):

Time (hh:mm:ss):

Latitude (decimal):  
 ← enter the location manually

Longitude (decimal):

Altitude (meters):

← download KML file to view location in Google Earth™ or Marble

Figure 4.4: Configuring Date, Time and Location of the Data Logger

In order to view the data logger location in GIS programs or Google Earth™, you can set the data logger location (not altitude) either automatically via a GPS device, or manually by entering latitude, longitude, and altitude in the appropriate fields. Enter latitude and longitude in the decimal format ( dd.dddddd°), not in degrees and minutes ( dd°mm.mmmm', like GPS) nor in degrees, minutes, and seconds ( dd°mm'ss.ss").

After downloading the KML file, you can open the file in Google Earth™.

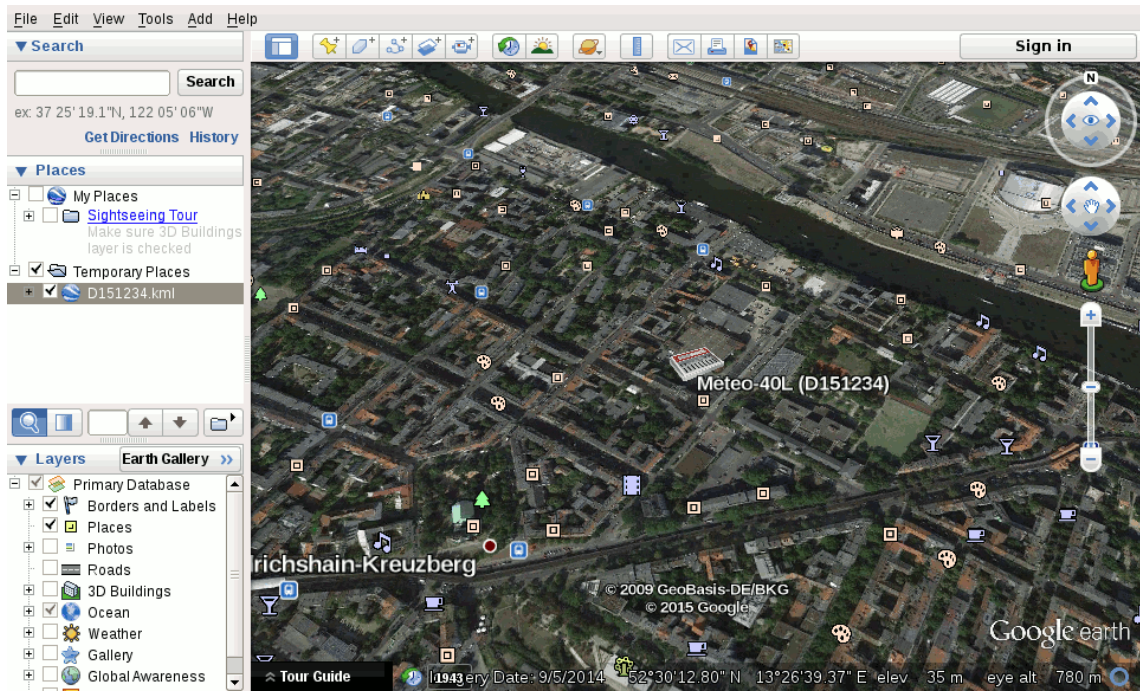


Figure 4.5: Data Logger Location displayed in Google Earth™

**Change Access Passwords:** User access passwords can be changed here. To do so, select a user name (role) from the drop-down list and enter the new password.

Change Passwords

Username  
Admin

New password   Show password

Change password

Figure 4.6: Changing Access Passwords





**Warning**

Be aware that due to security reasons it is not possible to reset passwords. If you lose a modified Admin password, there is no way to recover it, not even for Ammonit. In this case, return the data logger to Ammonit. Only Ammonit is able to restore the original passwords.



**Note**

Only the first eight characters of the password are significant, i.e., Ammonit\_1 and Ammonit\_2 would be treated the same. Eight characters give the choice of at least 10<sup>41</sup> variations.

**Signing and Encryption** Files sent by Meteo-40, such as CSV data or logbook files, can optionally be digitally signed or encrypted using GnuPG. The signature guarantees, that the files have been really produced by a specific data logger and have not been altered. The encryption ensures, that nobody can see the contents of the files without the right password.

Figure 4.7: Signing and Encryption

For additional security, the user Admin can set the option Force Encryption. If this option is set, users other than Admin have only restricted access to measurement data:

- CSV files can only be downloaded in encrypted form.
- CSV files can only be copied to USB flash drive in encrypted form.
- Live data can be seen only for 2 minutes on the web interface, but still unlimited on the LC display.
- Source data cannot be downloaded nor copied to USB flash drive.
- Data transfer settings (AmmonitOR, Email, SCP/FTP/SFTP, SCADA) cannot be changed.



**Note**

The signature for a CSV file refers to the canonical, uncompressed CSV file. Before version 1.4.2, the signature referred to the compressed CSV file as sent by the data logger, however.



**Note**

If the Meteo-40 data logger has been produced before 2014-08, the digital signature is not available, only encryption (since firmware version 1.0.1). Please contact Ammonit, if digital signature is required on a previously purchased data logger.

**Allow Manufacturer Administration** In some cases it is necessary that Ammonit developers have access to your data logger to check configurations or to modify any settings. The mode is only used for maintenance purposes. Activate the manufacturer administration mode to allow Ammonit developers accessing your data logger.

By default the manufacturer administration mode is inactive.

If the manufacturer administration mode is activated, you can start the manufacturer tunnel communication with the 'Start' button.

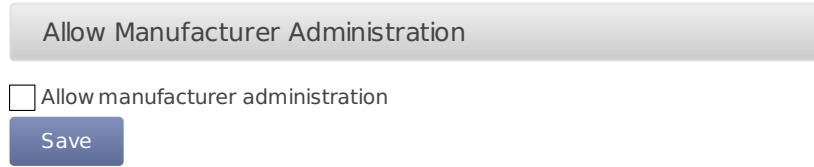


Figure 4.8: Allow Manufacturer Administration



**Important**

Without your permission, Ammonit will never access any of your data loggers!

**Reset Data:** In order to delete all measurement data in one step, click on *Delete all measurement data*. The user will be asked to approve a confirmation prompt.

URL: <http://d171234.local/confirm/format>

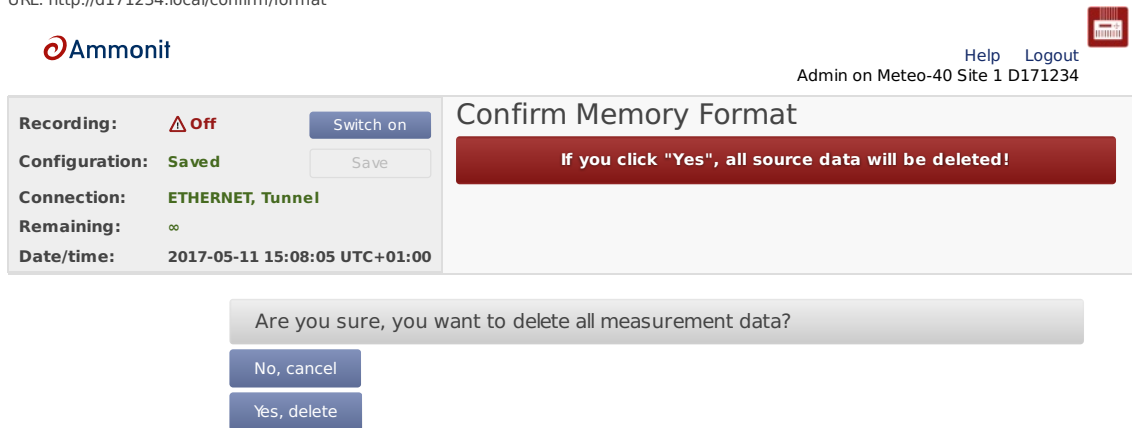


Figure 4.9: Deleting All Measurement Data



**Important**

Recording stops after deleting measurement data. Start recording by clicking *Switch on* in the [status box](#) of the web interface.

In order to delete all configurations, passwords and measurement data, click on *Factory reset, delete all data*. The data logger will be set back to the condition at delivery. The user will be asked to approve a confirmation prompt before the reset is performed.

URL: http://d171234.local/confirm/factory\_reset

Ammonit

Help Logout  
Admin on Meteo-40 Site 1 D171234

Recording: ▲ Off

Configuration: Saved

Connection: ETHERNET, Tunnel

Remaining: ∞

Date/time: 2017-05-11 15:08:17 UTC+01:00

### Confirm Factory Reset

If you click "Yes", all settings and data will be deleted!

Are you sure, you want to delete all settings and measurement data?

Figure 4.10: Factory Reset

**Note**

After performing a factory reset, recording stops. Recording can be started after at least one sensor has been configured. The data reset is logged in the Meteo-40 logbook.

**Scanning disk for errors** Used to scan the file systems of the data logger. Perform the scan only on demand of Ammonit. For further details, ask the Ammonit developers.

## 4.3 Upgrade Data Logger Software

The development of Meteo-40 is in constant process. Ammonit is continually adding new features to the data logger according to user needs.

**Important**

In order to perform a software upgrade, the data logger has to be connected to the Internet, e.g., via modem or LAN or using the tethering function of a mobile phone ( Section 4.3.1). It is not sufficient to connect Meteo-40 to a PC over USB, because a PC is not necessarily configured to work as a router. You have to be logged in as Admin to perform an upgrade. If you do not have an Internet connection, you may upgrade the data logger offline, using a USB flash drive. See Section 4.3.3 for details.

**Update software list:** In this step the data logger browses for updates and displays the number of available software packages. Below the progress bar the currently installed version is displayed; the latest version describes the available upgrade.

**Note**

The new software itself will not be downloaded and installed after clicking on *Update software list*. The software version is not changed in this step!

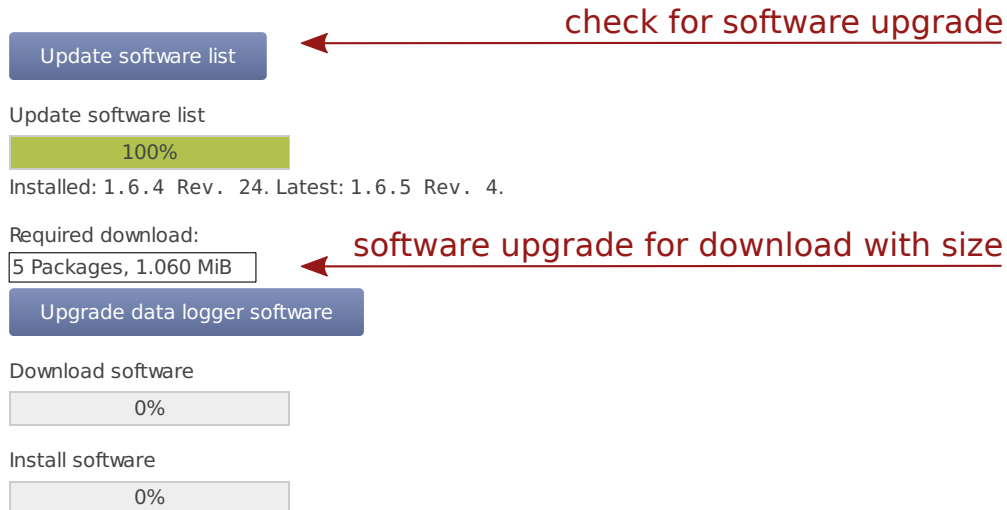


Figure 4.11: System Upgrade

**Upgrade data logger software:** The software upgrade can easily be performed by pressing the *Upgrade data logger software* button. The software packages will be downloaded and installed. After the installation is completed, CECS is restarted.



**Note**

In older firmware versions the data logger has to be restarted after the upgrade. Press the *Restart data logger* button.



**Important**

Before upgrading the data logger via modem, make sure that the corresponding switch is configured correctly in the Communication → Modem menu of the data logger web interface.

Depending on the installed firmware version, the software packages needed for the upgrade can be large. So the download and installation process can take some time depending on the speed of your Internet connection.

In rare cases the progress bar in the Meteo-40 web interface may seem to have stopped. Wait! If the progress bar does not move for a certain time, we recommend restarting the upgrade process. Do not disconnect the power supply or reboot the system during the whole upgrade process.

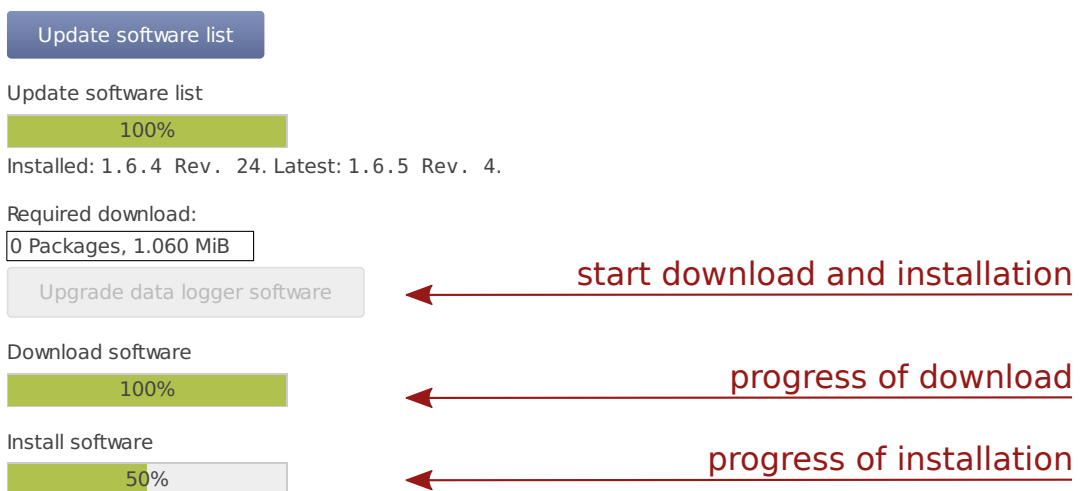


Figure 4.12: System Upgrade

### 4.3.1 Upgrade using a Smartphone

The Meteo-40 data logger can only be upgraded when it is connected to the Internet.

By connecting your smartphone to the data logger, you can set up an Internet connection via the tethering function of the smartphone.

Connect your smartphone to your Meteo-40 data logger via USB (USB-A slot of the data logger and micro USB slot of the smartphone). Make sure, that the data logger has no Ethernet LAN connection during the procedure, i.e. in doubt just unplug the Ethernet cable from the data logger. Open the settings for *Tethering and portable hotspot* of the smartphone operating system (see Figure 4.14) and activate USB tethering.



#### Important

Before starting the upgrade via tethering, make sure that *Use DHCP for wired network* is selected in the Communication → LAN menu of the Meteo-40 web interface. Additionally, make sure *Connect to Internet via USB modem only* is not selected in the Communication → LAN menu of the Meteo-40 web interface.



Figure 4.13: Settings for Firmware Upgrade via Tethering

Browse at Meteo-40 display for the IP address using the keys (Communication → Devices → LAN → USB (Activated) → IP settings). Enter the data logger's IP address in your smartphone browser, login and perform the upgrade.

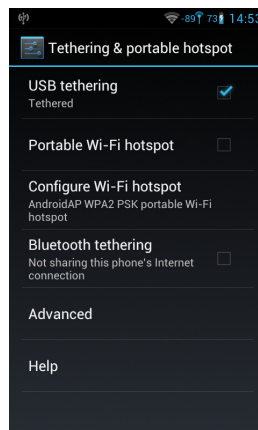


Figure 4.14: Tethering Settings of an Android™ smartphone



#### Tip

The tethering function can also be very useful for remote servicing.

### 4.3.2 Software Upgrade Behind a Firewall

For most firewalls, that allow outgoing HTTPS and HTTP traffic, no special configuration is needed. Only in some very restrictive environments, you may need to configure your firewall for the Meteo-40 software upgrade or ask your

---

network administrator to do so. If Meteo-40 is in a separated subnet, you may also need to specify a Gateway in the LAN settings of the data logger.

Meteo-40 needs to connect the server `archive.ammonit.com` via HTTPS(port 443, since version 1.5) or HTTP(port 80, before version 1.5) as outbound connection to perform a software upgrade. Make sure, that these connections are allowed. There is no need for Meteo-40 to connect any other servers, use any other protocols or use any kind of inbound connections.

### 4.3.3 Offline Upgrade using USB Flash Drive



#### Warning

Note, that this method is *not* the preferred software upgrade method. If possible, please use the online upgrade method.

Make sure, you have saved all your data and your configuration before performing an offline upgrade.

---

#### 4.3.3.1 Prepare the Offline Upgrade

1. Make sure, that all relevant data from data logger is saved: Configuration file, CSV files, and, if necessary, source data.
2. Make sure, the data logger has version 1.6 or higher. Older versions of the data logger software do not support offline upgrade.
3. Make sure, the software version you like to upgrade to is actually newer than the software version already installed on the data logger. Downgrades are not supported. Always use the latest offline update image from Ammonit, because errors of older versions might be fixed!
4. You need to get a download link from Ammonit, which leads you to a *zip archive*, `Meteo-40_ version.zip`. Download and unpack this zip archive on your PC. You will need the `meteo-40.bin`.
5. You need a prepared USB flash drive of at least 1 GiB capacity. The flash drive must formatted as FAT32. The file `meteo-40.bin` must be placed in the top-level of the flash drive, not in a directory. You will get the file on request from Ammonit.

#### 4.3.3.2 Performing the Offline Upgrade

1. Switch off the CECS of the data logger. In doubt, remove the power supply.
2. Plug the prepared USB flash drive into one of the two USB-A slots of the Meteo-40.
3. If necessary, reconnect the power supply of the data logger. Switch on the CECS.
4. You will see the following text on the LC display:

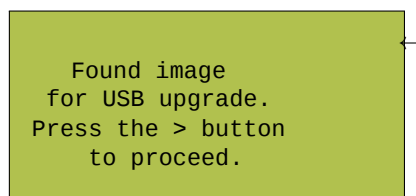


Figure 4.15: Press the right arrow button

You have to press the right arrow button within ten seconds, otherwise the boot process continues normally and no upgrade will be performed.

5. For around half a minute, the following message appears:

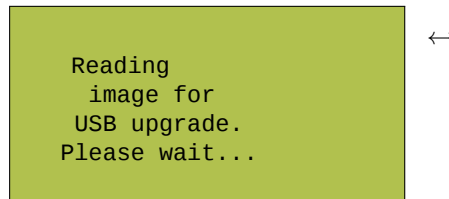


Figure 4.16: Reading the image



**Warning**

After that step interrupting the process, unplugging the USB flash drive, or a power failure can lead to a non-functional data logger!

6. The complete process takes around eight minutes, until the following message appears:

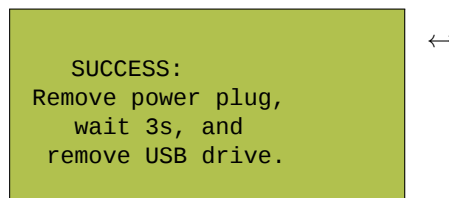


Figure 4.17: Successful upgrade

which should be performed accordingly: Remove the power supply of the data logger, wait at least three seconds, remove the USB flash drive, and re-enable the power supply of the data logger.

## 4.4 The Device Page

### 4.4.1 Display Access

The display page shows, what can be seen on the LCD.

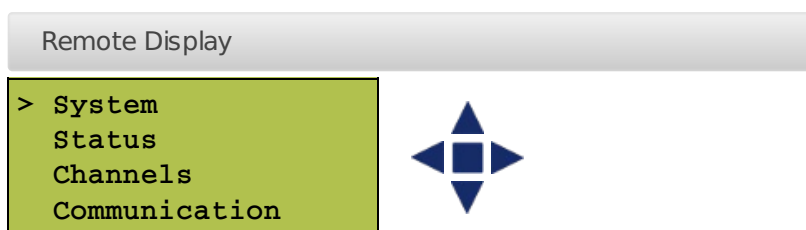


Figure 4.18: Remote Display

In order to give users without access to the web interface the chance of configuring the data logger, some permissions for display users can be selected, e.g., switch on recording or (de-)activate W-LAN.

If the corresponding permission *Run an action* is set, you can also start the execution of an action over the display menu Communication → Schedule. Select one of the actions and press the right button to start it.

---

**Display Settings**

**Permissions of Display User**

- Change CECS mode
- Switch between DHCP, static IP, and link-local
- Switch off recording
- Switch on recording
- Change the state of switches
- (De-) Activate WLAN
- Run an action, e.g. go online

**Other Settings**

- Activate display backlight

Figure 4.19: Display Settings



**Note**

To view the display in the web interface, it is advised to enable JavaScript in your web browser.

---

#### 4.4.2 Connected USB Devices

Also on the device page, you can find a list of the USB devices, that are currently connected to the data logger and recognized by it, e.g. a modem, a flash drive, or a camera.



**Note**

The list of devices is not updated automatically. You have to reload the page to see any changes.

---

#### 4.4.3 USB Flash Drive Copy

Meteo-40 offers the possibility to download created CSV statistics files with measurement data (statistics see Section 6.3), the source data in CSV format, and/or the logbook in CSV format to an USB flash drive. The USB flash drive must be connected to the data logger. Before you use this function, data logger and USB flash drive have to be configured.



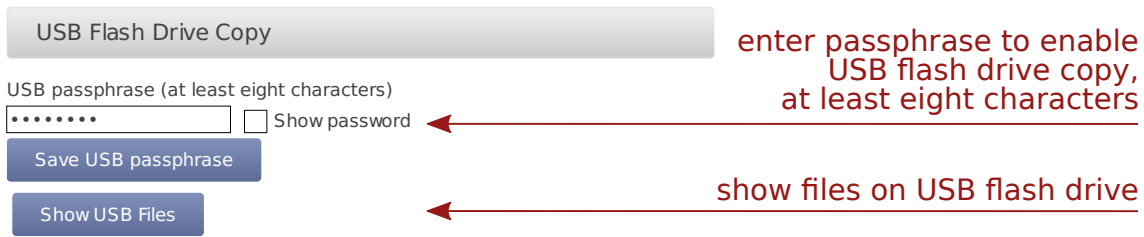


Figure 4.20: Configuring the USB Flash Drive Copy

**Important**

A file system like FAT32, NTFS, ext4, ext3, or ext2 is required on USB flash drive.

In order to format the USB flash drive with FAT32 on your Windows™ PC, connect the USB stick to the PC. Open the Windows™ Explorer. Right-click on the USB flash drive shown under *Computer*. Click on *Format...* and select FAT32 as *File system*. Start the formatting process.

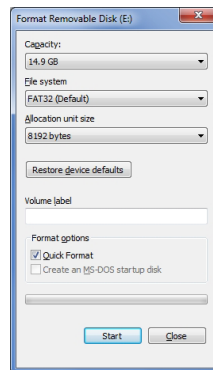


Figure 4.21: Formatting the USB flash drive ( Windows™ PC)

Create a file named `keyfile.txt`, which has to be saved on the USB flash drive used to download CSV files (statistics and/or source data). This INI file must include the data logger serial number and a password in a the INI file format. The INI file is necessary to prevent unauthorized data download. Example:

```
[D123456]
password = yoursecretpassword
statistics = all
```

**Note**

The passphrase for the USB stick must have at least 8 characters!

The passphrase has to be entered in the field shown in Figure 4.20.

It is possible to use one USB flash drive for several data loggers. To do so, in the `keyfile.txt` the details of the data loggers have to be entered section by section, e.g.,

---

```
[D123456]
password = passwordone
statistics = since 2016-01-01
gustdata = since 2016-01-01
config = save
logbook = all
```

```
[D234567]
password = passwordtwo
statistics = newest 10
config = save
sourcedata = all
```

```
[D345678]
password = passwordthree
statistics = month 2016-01
config = save
sourcedata = day 2016-01-07
```

The following entries are possible:

**password** Mandatory, must have at least eight characters

**statistics** One of the time period values, see below. Copies the primary statistics files.

**secondary** One of the time period values, see below. Copies the secondary statistics files.

**tertiary** One of the time period values, see below. Copies the tertiary statistics files.

**config** Value save to copy the configuration file. Other values are not yet implemented.

**logbook** One of the time period values, see below.

**gustdata** One of the time period values, see below.

**sourcedata** One of the time period values, see below.



**Warning**

Copying source data may take a very long time, even some hours.

---

The time period values are:

**all** Copy all files of this type.

**since DATE** Copy files of this type since and including DATE in format YYYY-MM-DD.

**until DATE** Copy files of this type until and including DATE in format YYYY-MM-DD.

**month DATE** Copy files of this type in the month of DATE in format YYYY-MM.

**day DATE** Copy files of this type at the day of DATE in format YYYY-MM-DD.

**newest NUMBER** Copy newest files of this type, max. NUMBER.

**oldest NUMBER** Copy oldest files of this type, max. NUMBER.

Meteo-40 has to be switched on for download. If the USB flash drive is configured correctly, it will be recognized by the data logger. If the passphrase, entered in the web interface and in the `keyfile.txt` does not match, data download is not possible.

Meteo-40 shows in its display the number of downloaded files. When the download is finished, the data logger menu is shown and the USB flash drive can be disconnected.

By using this function, always all available files are copied to the USB flash drive. All data files are compressed to keep them as small as possible.



**Note**

If encryption and/or digital signature is switched on for the data logger, copying to the USB flash drive behaves accordingly, i.e. data will be encrypted and/or signed.

If the Force Encryption option is enabled, copying source data to USB flash drive is prohibited.

---

#### 4.4.4 Access to USB Drive Files

### 4.5 Using a Camera

You can take pictures with Meteo-40 and send the image to AmmonitOR, as an email attachment, copy it to an SCP/FTP/SFTP file server or copy it to a permanently connected USB flash drive. Each of these options must be individually configured. See the respective checkboxes in the Communication → AmmonitOR, Communication → Email, and Communication → SCP/FTP/SFTP submenus.

You can either use a USB webcam plugged into one of the two USB-A slots or an Ethernet connected camera by HTTP/HTTPS.

URL: <http://d171234.local/system/camera/>

The screenshot displays the Ammonit web interface for the camera configuration. At the top, the URL is <http://d171234.local/system/camera/>. The page features the Ammonit logo and navigation links for Help and Logout. The main content area is titled "Camera" and includes a control panel with the following settings:

- Recording:** Off (with a warning triangle icon) and a "Switch on" button.
- Configuration:** Saved and a "Save" button.
- Connection:** ETHERNET, Tunnel
- Remaining:** ∞
- Date/time:** 2017-05-11 15:36:54 UTC+01:00

A sidebar on the left lists navigation options under "Meteo-40": System (Information, Administration, Upgrade, Device), Camera (Switches, Logbook), Measurement (Sensors, Channels, Evaluation), Data (Live, Statistics, Gusts, Source), and Communication (Schedule, Online, AmmonitOR, Email, FTP/SCP, SCADA, LAN, WLAN, Modem).

The main content area shows a "Current Camera Image" section with a live video feed of a weather station tower against a clear sky. Below the image is a "Camera Image Settings" section containing:

- Camera Image URL:
- Copy Camera Image to USB Drive
- A "Save camera settings" button.

At the bottom of the page, there is a language selection menu (中文(简), English, Español, Português, Français, Deutsch, Türkçe) and a copyright notice: © 2011-2017 Ammonit Measurement GmbH www.ammonit.com.

Figure 4.22: Camera Image

**Note**

If the camera should be used for monitoring purposes, a steady power supply has to be connected.

---

### 4.5.1 Camera Configuration

To take one or more photos with an outdoor camera, just enter the URL of the photo in the web interface. The URL depends on the installed camera, e.g., `http:// nn.nn.nn.nn/` or `https:// nn.nn.nn.nn/`. Mobotix M25M camera image URL typically is `http://10.13.0.197/record/current.jpg`.

Camera Image Settings

Camera Image URL:

Copy Camera Image to USB Drive

Save camera settings

enter URL of camera to attach photos to data

copy camera image to USB flash drive, if present

Figure 4.23: Attaching Camera Images

If you connect the camera via Ethernet, it is recommended to use static IP addresses. You must configure both the camera and Meteo-40, each with a different address in the same network. E.g. `10.13.0.197` for the camera and `10.13.0.200` for the data logger. In this case, the netmask would be `255.0.0.0`. DNS server and gateway are not relevant here.

The static IP address of Meteo-40 can be configured in the Communication → LAN menu (see Section 7.7). In order to configure the IP address of the camera use the software delivered with it.

To minimize the energy consumption, the Ethernet port is not always active but is automatically activated only when needed, i.e. when the image has to be acquired and shared by means of one of the methods (AmmonitOR, email or SCP/FTP). This means, you might not see an image on accessing the System → Camera menu (see Section 4.5) menu. You will know if the Ethernet interface is active because it will appear at the connections list in the [status box](#) of the web interface.

If you want the Ethernet port to be always active despite the higher power consumption, you can configure it in Communication → LAN menu (see Section 7.7).

In order to reduce the data traffic when a camera is sending pictures frequently, we can restringe the modem tunnel communication to the scheduled online times. The option Prevent implicit tunnel activation in menu Communication → Online must be active. The option Modem online whenever CECS is on (recommended) must not be active.

**Important**

If a USB modem is connected to Meteo-40 and Ethernet is used for the camera, it is necessary to select Connect to Internet via USB modem only in the Communication → LAN menu.

---

## 4.6 Configuring Switches

Switches can be used to control and optimize the power consumption of the measurement system. External devices connected to Meteo-40, such as modem, camera or heating can be controlled via the data logger. Meteo-40 will close

(turn on) the configured switch when the corresponding device is needed, e.g., to send data via the modem connection, and open it again (turn off) when not needed.

In a solar power plant, a switch can be used to orient the solar trackers for protection of the payloads in case of high wind.

Meteo-40L data logger provides eight switches intended for the following tasks:

- Control the modem power supply (recommended). See Section 7.9 for GSM and Section 7.7 for satellite.
- Control camera power supply. See Section 7.7.
- Toggle sensor's power supply in case the polling rate is very low. See Switch Pre time in Section 5.1.2 and follow sensor specifications.
- Control *one selected switch* according to the configured measurements and thresholds Section 4.6.1.

A switch can only fulfill one of the duties. It can either be shared between several sensors or used to control modem's power supply or at the Switch Manager.

To manually toggle one or more of the switches individually, go to the System → Switches menu.

Switches			
Id	Label	State	Action
S1	Modem	Off	Turn on
S2	Heating	Off	Turn on
S3		Off	Turn on
S4		Off	Turn on
S5		Off	Turn on
S6		Off	Turn on
S7		Off	Turn on
S8		Off	Turn on

Figure 4.24: Switch Configuration



#### Warning

We highly recommend configuring a switch for the modem in the Communication → Modem menu. If the modem is switched manually via the System → Switches menu, you risk the shutdown of the modem after rebooting the data logger or after problems with the power supply.

In Meteo-40 firmware version higher than 1.0 Rev.13915 switch S1 is set by default for the modem. In case the switch is not used for the modem, it can be deselected.

**Note**

Refer to Chapter 13 for more information about physically connecting the supply using a switch.

---

### 4.6.1 Switch manager

The Switch manager is designed to automatically toggle *one of the switches* depending on the configured conditions. It is commonly used for sensor's heating control. *Only one switch* can be selected.

In order to use this function, select a switch as well as one or more switching conditions. The available switching conditions are temperature range, minimum humidity, minimum voltage, minimum windspeed and two time frames. If more than one condition is configured, the switch will only be closed (i.e. On) when all conditions are fulfilled. If only one time frame is needed, the duration of the second time frame duration must be set to 00:00. If the inverted logic is selected, the switch will remain closed as long as the conditions are not fulfilled. Only configured sensors and free switches are listed.

The state of the selected switch is reviewed according to the values calculated at the end of the configured statistics interval for SCADA, Switch manager and snapshots in the Data → Statistics menu. The default statistics interval is 10 min. The average value is used for temperature, humidity and voltage whereas the maximum is used for wind speed.

**Note**

If the state of the selected switch was manually changed, it will be overwritten by the switch manager at the end of the statistics interval.

---

**Important**

It is necessary to keep the *CECS always on* if the switch manager is deployed. The state of the switch can only be closed (i.e. On) when *CECS* is running, i.e., to perform an action (see Section 7.2) or if *CECS* is configured to be *Always on* (see Section 4.2). On *CECS* shut down, the selected switch is opened (turned Off).

---

### Switch Manager

Managed switch  
S2

Invert switch behaviour

Label  
Heating

**Switching Conditions**

Temperature  
Int. Temperature (Tempe

Minimum temperature (°C)  
-30

Maximum temperature (°C)  
30

Humidity  
None

Minimum humidity (%)  
70

Voltage  
Supply voltage measure

Minimum voltage (V)  
0

Wind speed  
Anemometer (Wind Spei

Minimum wind speed (m/s)  
20

**Time Frames**

Use timer

First time frame start (hh:mm)  
09:00

Duration (hh:mm)  
0:45

Second time frame start (hh:mm)  
09:50

Duration (hh:mm)  
00:00

Figure 4.25: Switch Manager

If the sensor heating should be supplied by an external power supply via relay, check the connection plan Figure 13.17.

---

## 4.7 Using the Logbook

Events, which are not related to measurement data, are listed in the logbook. The logbook displays for example all user logins and the user's IP address. A calendar is shown with a monthly overview. Green highlighted boxes indicate days with logbook entries. By clicking on the day, the entries are displayed. Click on the arrows shown above the calendar to go to the previous or next month.

It is also possible to add entries to the logbook, e.g., to record replacements of sensors or any maintenance work that is important for data interpretation. Record messages by clicking on *Log a message*. A short text message can be edit.

Logbook entries of a day can be downloaded by clicking on the *Download* button.

The screenshot shows a web interface for a logbook. At the top, there are navigation links for years (2016, 2017) and months (01-12). Below this is a calendar for June 2015 (2015-06). The calendar shows days from 1 to 30, with the 30th highlighted in a green box. Below the calendar are two tabs: 'Date/Time' and 'Message'. Underneath are five buttons: 'Log a message', 'Download', 'Download month', 'Download year', and 'Download all'. Below these buttons is a section titled 'Measurement and Recording Errors'. Under this section, the text 'RS485\_TIMEOUT' is visible. At the bottom of this section is a button labeled 'Reset measurement errors'.

Figure 4.26: Logbook

MARS errors are indicated by the red LED(second from bottom). A detailed list containing error codes is reported below *Measurement and Recording Errors*. By clicking on *Reset Measurement Errors* the list of errors can be deleted.



### Note

The MARS error codes can be important for Ammonit engineers to locate errors in the data logger.

---

### 4.7.1 Logbook Events

The following actions or events are logged to the logbook:

- User note to logbook
- Log in of a user and failed login attempt
- Factory reset
- Memory format
- Setting date and time via GPS, NTP, [EKO sun tracker](#), SCADA or Admin (manually)
- Setting location via GPS or [EKO sun tracker](#)
- Copying data to USB flash drive
- Software upgrade
- Password reset by manufacturer
- CECS start/stop



- [Actions execution](#)
- [Actions initiated by a short message \( SMS\)](#)
- [RS485-M Serial Console](#)



## Chapter 5

# Measurement

### 5.1 Sensor Configuration

In the Measurement → Sensors menu, sensors can be added and basic parameters can be configured by using the *Sensor Helper* (see Section 5.1.2). After having configured the sensors, two buttons are available for each sensor: *Delete* and *Change*. These allow a user to delete or change an existing sensor with help of the *Sensor Helper*.

Label	Type	Model	Height	Serial No.	Rate	Channels	Change	Delete
Top Anemometer	Anemometer	Thies Anemometer First Class Advanced	120		1 s	C1	Change	Delete
Backup Anemometer	Anemometer	Thies Anemometer First Class Advanced	118		1 s	C2	Change	Delete
Middle Anemometer	Anemometer	Thies Anemometer First Class Advanced	60		1 s	C3	Change	Delete
Low Anemometer	Anemometer	Thies Anemometer First Class Advanced	10		1 s	C4	Change	Delete
Top Wind Vane	Wind Vane	Thies Wind Vane 10 Bits Serial Synchron	120		1 s	D1	Change	Delete
Backup Wind Vane	Wind Vane	Thies Wind Vane 10 Bits Serial Synchron	118		1 s	D2	Change	Delete
Low Wind Vane	Wind Vane	Thies Wind Vane 10 Bits Serial Synchron	60		1 s	D3	Change	Delete
Hygro/Thermo @10.0m	Hygro/Thermo	Galltec Hygro-Thermo Active KP	10		1 s	A1, A2	Change	Delete
Barometer @10.0m	Barometer	Barometric Pressure Sensor AB60	10		1 s	A3	Change	Delete

Add sensor  
 Undo  
 Delete all sensors  
 RS485-M serial console

Figure 5.1: Sensor Definitions

Below the sensor definitions overview you can find four buttons: *Add sensor*, *Undo*, *Delete all sensors* and *RS485-M serial console*.

**Add sensor:** Opens the *Sensor Helper* to configure a new sensor.

**Undo:** Click on this button to undo your last action.

**Delete all sensors** If all sensors should be deleted, e.g., after a completed measurement campaign, you can click on *Delete all sensors* to remove all sensors from the configuration in one step.

**RS485-M serial console** Occasionally send a command to a sensor connected to the RS485 Master port. This can be useful for debugging communication problems or to change sensor's configuration (see Section 5.1.4).



**Note**

By clicking on a column headline in the sensor definitions overview, you can sort the selected column in ascending or descending order.



**Important**

For some estimations related to solar sensors, the GPS location of the measurement station has to be added in the System → Administration menu (see also Section 4.2).

**Warning**

Adding or deleting a sensor, switches off recording. The new configuration is unsaved! By clicking on *Switch on*, recording will be activated and the configuration will be saved automatically in one step.

### 5.1.1 Difference between Sensors, Channels, and Evaluations

To have a better understanding of the sensor management, it is important to know the difference between sensors, channels, and evaluations.

In general, a sensor is an electro-mechanical device, which records physical values. The physical values are transformed into an electrical value by the sensor. For example, wind speed can be transformed into a frequency. To map these electrical values on the corresponding physical values, an evaluation process has to be performed.

A sensor may be connected to more than one electrical channel of Meteo-40. The number of used electrical channels depends on the kind of sensor and also on the kind of electrical wiring of the sensor. For example, wind vane POT (potentiometer) may use the two analog channels A1 and A2. Another example is the pyranometer Delta-T SN1 that emits two analog voltage signals and one digital status signal. The two analog output signals have to be connected to two analog voltage channels and the digital status signal has to be connected to one digital input.

The evaluation process of the measured values is done by the software of the Meteo-40 data logger. Both pieces of data are saved: the measured physical value at every channel and the evaluated value. Some typical formulas are displayed below.

Most anemometers deliver a rectangle pulse output signal with a frequency proportional to the instant speed. Connecting it to a counter input (i.e., C1 to C12), its frequency will be measured. For the evaluation of wind speed a linear formula will be applied using slope and offset values given in the configuration of the Measurement → Sensors menu.

$$v_{\text{wind}} = \begin{cases} \text{slope} \cdot Cx + \text{offset} & : Cx > 0 \\ 0 & : Cx = 0 \end{cases}$$

Equation 5.1: Linear Equation for Wind Speed

A counter value of 0 will always result in 0, i.e. the offset is ignored in this case.

The output signal of many pyranometers is an analog voltage. To measure and record this signal, the output of the pyranometer should be connected to an analog voltage input (i.e., A1 to A12). To interpret the value of the apparent solar radiation, the measured value is internally divided by the specific sensitivity of this sensor. In this case sensitivity has to be configured.

### 5.1.2 Sensor Helper

In order to simplify the configuration of sensors, Meteo-40 provides a *Sensor Helper* in the Measurement → Sensors menu. The *Sensor Helper* is a wizard, which guides you through the sensor configuration. It will appear when you attempt to *Add sensor* or *Change* a sensor, a channel or an evaluation.

You must select of the available sensor types (e.g., anemometer, wind vane, barometric pressure sensor, solar sensor, etc.) and the supported models. If the sensor appears in the list, the appropriate channel settings will be automatically selected as shown in Figure 5.2. Depending on the sensor, further settings can be configured by the user, e.g., Slope, Offset, Sensitivity, etc. Additionally, measurement rate, channel as well as switch and switch pretime (if necessary) can be selected or changed.

**Important**

If the sensor doesn't appear in the list of preconfigured sensor, you can always use a generic sensor from the *Other Sensor* list.

**Note**

Only channels and switches which are not already used by other sensors are available.

---

Sensor type  
Anemometer ▼

Sensor  
Thies Anemometer First ▼

Installation height (m)  
120 ▼

Label  
Top Anemometer

Serial number

Wind Speed Slope (m/s/l)  
0.0462 ▼

Wind Speed Offset (m/s)  
0.21 ▼

Measurement rate  
1 s ▼

Counter Channel  
C1 ▼

Add more

Finish

Figure 5.2: Sensor Helper with Sensor Settings

**Important**

For many sensors, slope and offset values are pre-configured according to the manufacturer's information. Carefully check the values. If calibrated sensors are installed, use the slope and offset resp. sensitivity values indicated in the calibration protocol of the sensor.

---

### 5.1.3 Order of Sensors and Evaluations

The order of sensors and evaluations in the web interface and the LC display is always consistent.

Sensors are ordered by

1. sensor type (anemometers, wind vanes, thermo/hygro sensors, barometers, precipitation sensors, solar sensors, ultrasonics, power meters, other sensors),
2. height (from highest to lowest),
3. and finally the textual label (alphabetically).

Evaluations are ordered by

1. evaluation type (wind speed, wind direction, humidity, temperature, differential temperature, air pressure, air density, etc.)
2. height of the corresponding sensor (from highest to lowest),
3. and finally the textual label (alphabetically).

### 5.1.4 RS485 Master Serial Console

During the installation process or in case of communication problems, it can be useful to send a special command to a connected RS485 sensor.



Send Request over RS485-M

Protocol:

Modbus address

Modbus start register (0..65535)

Modbus register quantity (1..20)

Modbus function code

Command:

Latest Response:  
 Not available

**RS-485 master general configuration**

RS-485 speed:

RS-485 data format:

Figure 5.3: RS485-M Serial Console

First of all, the RS485 Master general serial settings must be set matching sensor's configuration. These settings affect not only the serial console but any other RS485 sensor configured.

If Modbus protocol is selected, the telegram will be internally composed, according to the selected address, start register (PDU addressing, first reference is 0), register quantity and function code, and shown in the command box. If ASCII protocol is selected, the command must be typed by the user in the command box. The following escape sequences representations are recognized for the ASCII commands:

Escape Sequence	Symbol
<CR>	\x0d
<LF>	\x0a
<STX>	\x02
<ETX>	\x03

Table 5.1: ASCII escape sequences for RS485-M serial console

The communication will be reflected in the logbook including a timestamp. Example of ASCII communication: "RS485-M Request: '01TR00003<CR>', Response: '<STX>000.1 096 +24.6 M 0E\*1D<CR><ETX>'". Example of Modbus communication: "RS485-M Request: '0104277400063aa6', Response: '01040c41375c2942c0000041e800006d3d'".

**Note**

The RS485-M serial console is only available for Admin.

## 5.2 Measurement Channels

In the Measurement → Channels menu a table is shown, which displays all connected channels with details such as label, value, rate, range, protocol and selected switch. To modify sensor settings, click on *Change* to start the *Sensor Helper*(see also Section 5.1.2).

ID	Label	Value	Unit	Rate	Range	Protocol	Addr.	SW	Switch	Sw. Pretime	Change
A1	Hygro/Thermo @10.0m	4.832	V	1 s	-10 V..+10 V			<input type="checkbox"/>			<a href="#">Change</a>
A2	Hygro/Thermo @10.0m	0.39140	V	1 s	-1 V..+1 V			<input type="checkbox"/>			<a href="#">Change</a>
A3	Barometer @10.0m	5.2776	V	1 s	-10 V..+10 V			<input type="checkbox"/>			<a href="#">Change</a>
C1	Top Anemometer	23	I	1 s				<input type="checkbox"/>			<a href="#">Change</a>
C2	Backup Anemometer	17	I	1 s				<input type="checkbox"/>			<a href="#">Change</a>
C3	Midsize Anemometer	0	I	1 s				<input type="checkbox"/>			<a href="#">Change</a>
C4	Low Anemometer	0	I	1 s				<input type="checkbox"/>			<a href="#">Change</a>
D1	Top Wind Vane			1 s		Thies 10-Bit		<input type="checkbox"/>			<a href="#">Change</a>
D2	Backup Wind Vane			1 s		Thies 10-Bit		<input type="checkbox"/>			<a href="#">Change</a>
D3	Low Wind Vane			1 s		Thies 10-Bit		<input type="checkbox"/>			<a href="#">Change</a>

[Digital test](#)

Figure 5.4: Measurement Channels Overview

**Note**

Click on a column headline in the measurement channels overview to sort the selected column in ascending or descending order.

## 5.3 Configuring the Evaluation

In the Measurement → Evaluation menu the settings for data evaluation are shown. A table displays the configured sensors with their measured and estimated values. The order of evaluations is explained in Section 5.1.3. If the settings should be modified, click on *Change* to start the *Sensor Helper*(see also Section 5.1.2).

Label	Evaluation	Origin	Value	Unit	Slope	Offset	Clip	Change
Top Anemometer	Wind Speed	C1	21.300	m/s	0.0462	0.21		Change
Backup Anemometer	Wind Speed	C2	20.100	m/s	0.0462	0.21		Change
Middle Anemometer	Wind Speed	C3	0.0000	m/s	0.0462	0.21		Change
Low Anemometer	Wind Speed	C4	0.0000	m/s	0.0462	0.21		Change
Top Wind Vane	Wind Direction	D1	0.0000	°	0.3515625	0		Change
Backup Wind Vane	Wind Direction	D2	0.0000	°	0.3515625	0		Change
Low Wind Vane	Wind Direction	D3	0.0000	°	0.3515625	0		Change
Hygro/Thermo @10.0m	Humidity	A1	81.261	%	100	0	100	Change
Hygro/Thermo @10.0m	Temperature	A2	34.140	°C	100	-30		Change
Barometer @10.0m	Air Pressure	A3	960.654	hPa	60	800		Change

Add evaluation

Figure 5.5: Screenshot of the Configuration for the Evaluation

In addition to the automatically generated evaluations, it is possible to apply formulas to the measured values or even combine evaluations. The new evaluations can be added in the *Evaluation Helper* by clicking on *Add evaluation*. See Section 5.3.1.

**Note**

Click on a column headline in the evaluation configuration overview to sort the selected column in ascending or descending order.

### 5.3.1 Evaluation Helper

The *Evaluation Helper* introduces a higher flexibility to Meteo-40 sensors configuration. A part from the automatically configured evaluations which appear when you add a sensor, this tool allows you to generate new evaluations, combining the existing by means of a formula. The standard statistics will be available for this new evaluation and will be included in the CSV statistics file. The *Evaluation Helper* also provides some special statistics like the covariance, kurtosis, turbulence intensity or Obukhov length. To use this feature, click *Add evaluation* in the Measurement → Evaluation menu. The *Evaluation Helper* will guide you through the configuration process. After choosing a formula from the list, the corresponding parameters will be shown for selection.

**Important**

Only the measured values are saved by default to the CSV statistics file. Estimated values are for information purposes. In order to include estimated values in the CSV statistics file, select the values over the statistics selection interface in the Data → Statistics menu under *Select statistics* (see also Section 6.3.1).

---

### 5.3.1.1 Addition

Addition of two or three previously configured evaluations.

$$A = B + C$$

Equation 5.2: Addition of two elements

$$A = B + C + D$$

Equation 5.3: Addition of three elements

### 5.3.1.2 Albedo

Surface albedo is defined as the ratio of irradiance reflected to the irradiance received by a surface. It is dimensionless and measured on a scale from 0 (corresponding to a black body that absorbs all incident radiation) to 1 (corresponding to a body that reflects all incident radiation).

$$\text{Albedo} = \frac{\text{ReflectedIrradiance}}{\text{GlobalIrradiance}}$$

Equation 5.4: Albedo

### 5.3.1.3 Ampere meter

Based on the Ohm's law, you can use the Ampere meter formula to transform the measured voltage to the corresponding current, after introducing the value of the shunt resistor used. This formula can be used with any existing voltage evaluation (e.g. if you previously configured a Gantner A3.1 module).

$$I = \frac{V}{R}$$

Equation 5.5: Ohm's law

(where I is the current through the conductor in units of amperes, V is the voltage measured across the conductor in units of volts, and R is the resistance of the conductor in units of ohms)

### 5.3.1.4 Density of moist air

According to IEC 61400-12-1 it is required to measure air density, which is calculated from air temperature and air pressure. Air density has a significant influence on the wind energy calculation. See calculation of wind energy in Section 10.1.

At high temperatures measuring relative air humidity is recommended according to IEC 61400-12-1. In order to calculate density of moist air, Meteo-40 offers two options: with or without relative humidity.

If air density should be calculated without humidity, choose only a temperature and a barometric pressure sensor from the list in the *Evaluation Helper*. Meteo-40 calculates air density for evaluation with original 1-sec measurement data according to the following formula:

$$\rho = \frac{p}{R_0 \cdot T}$$

Equation 5.6: Calculation of Density [ $\rho$ ] of Dry Air

(where  $p$  is the air pressure,  $T$  the air temperature and  $R_0$  the gas constant of dry air 287,05[J/kgK])

If relative humidity should be considered for air density calculation, choose also a humidity sensor from the list in the *Evaluation Helper*. With selected humidity sensor, Meteo-40 calculates density of moist air for evaluation with original 1-sec measurement data according to the following formula:

$$\rho = \frac{1}{T} \left( \frac{p}{R_0} - RH \cdot p_{H_2O} \left( \frac{1}{R_0} - \frac{1}{R_{H_2O}} \right) \right)$$

Equation 5.7: Calculation of Density [ $\rho$ ] of Moist Air

(where  $T$  is the air temperature,  $p$  the air pressure,  $R_0$  the gas constant of dry air 287,05[J/kgK],  $R_{H_2O}$  the gas constant of water vapour 461,5[J/kgK],  $p_{H_2O}$  the vapor pressure,  $RH$  the relative humidity)

Formula:  
Density of moist air  
kg/m<sup>3</sup>

Temperature  
Hygro/Thermo @20.0m

Air Pressure  
Barometer

Humidity  
Hygro/Thermo @20.0m

Label:  
Density of Moist Air

Save

Delete

select formula

select temperature sensor

select barometric pressure sensor

select humidity sensor (for complex calculation)

Figure 5.6: Evaluation for Air Density

### 5.3.1.5 Dew point

The dew point is the temperature to which air must be cooled to become saturated with water vapor. If the temperature ( $T$ ) and relative humidity ( $f$ ) are measured, it is possible to calculate the *Dew point* configuring it in the *Evaluation Helper*. The following formula is applied.

$$T_D = (f/100)^{1/8} \times (112 + 0.9 \times T) + 0.1 \times T - 112$$

Equation 5.8: Calculation of the dew point

(where  $T$  is the measured temperature and  $f$  is the measured relative humidity)

### 5.3.1.6 Differential temperature

By selecting *Differential temperature* in the *Evaluation Helper*, the difference between two temperature measurements can be recorded every second. Choose two temperature sensors from the list for theta 1 and theta 2. According to the following equation the difference is calculated.

$$\Delta\vartheta_{[K]} = \vartheta1_{[^{\circ}C]} - \vartheta2_{[^{\circ}C]}$$

Equation 5.9: Calculation of the Temperature Difference [ $\Delta\theta$ ]

Formula:  
 Differential temperature  
 $\vartheta1 - \vartheta2$

Temperature  $\vartheta1$   
 Hygro/Thermo 1

Temperature  $\vartheta2$   
 Hygro/Thermo 2

Label:  
 Differential Temperature

Save  
 Delete

Figure 5.7: Evaluation for Differential Temperature

### 5.3.1.7 Division

Division of two previously configured evaluations.

$$A = \frac{B}{C}$$

Equation 5.10: Division

### 5.3.1.8 Pyrgeometer incoming long wave irradiance Ein

Incoming long wave irradiance received from the atmosphere. Pyrgeometer equation by Albrecht and Cox.

$$E_{in} = E_{net} + \sigma \times T^4$$

Equation 5.11: Pyrgeometer incoming long wave irradiance

(where  $E_{in}$  is the long-wave irradiance received from the atmosphere [ $W/m^2$ ],  $E_{net}$  is the net irradiance at sensor surface [ $W/m^2$ ],  $\sigma$  is the Stefan–Boltzmann constant  $5.670374419 \times 10^{-8}$  [ $W/(m^2 \cdot K^4)$ ] and  $T$  is the Absolute temperature of pyrgeometer detector [ $K$ ])

### 5.3.1.9 Inflow angle

Angle off the horizontal plane at which the wind flow comes into the sensor.

$$\varphi = \arctan(V_z / V_h)$$

Equation 5.12: Calculation of the inflow angle

(where  $V_z$  is the vertical wind speed and  $V_h$  is the horizontal wind speed)

### 5.3.1.10 Linear equation

The linear equation can be used with any existing evaluation in order to apply an slope and offset. It can also be used to provide a dimensionless measurement (e.g. from a previously configured *Other sensor*) with a unit and an evaluation type for better interpretation.

$$A = \text{Slope} \cdot B + \text{Offset}$$

Equation 5.13: Linear equation

### 5.3.1.11 Multiplication

Multiplication of two previously configured evaluations.

$$A = B \cdot C$$

Equation 5.14: Multiplication

### 5.3.1.12 Obukhov length

The Obukhov Length can be useful for turbulences analysis and is typically associated with a 3D ultrasonic sensor. To add this evaluation, the measurement of wind speed, wind direction, vertical wind speed and virtual temperature at one height are needed.

$$L = u_*^3 / (K \times g / \text{avg}(T) \times \sigma(V_z, T))$$

Equation 5.15: Calculation of the Obukhov Length

(where  $u_*$  is the friction velocity [m/s],  $g$  the gravitational acceleration 9.81[m/s<sup>2</sup>],  $\sigma(V_z, T)$  the covariance of vertical wind speed and virtual temperature and  $K$  the von Kármán constant 0,41)

### 5.3.1.13 Obukhov stability parameter

Dimensionless stability parameter given by the normalized measuring height above ground  $z$  with the Obukhov length  $L$ . Can be useful for turbulences analysis and is typically associated with a 3D ultrasonic sensor. To add this evaluation, the measurement of wind speed, wind direction, vertical wind speed and virtual temperature at one height are needed.

$$\zeta = z / L$$

Equation 5.16: Calculation of the Obukhov stability parameter

(where  $z$  is the height above ground and  $L$  is te Obukhov length as in Section 5.3.1.12)

### 5.3.1.14 Sensible heat flux

Sensible heat flux measured with the eddy covariance method. In meteorology, the conductive heat flux from the Earth's surface to the atmosphere.

$$Q_H = \rho \times C_p \times \sigma(V_z, T)$$

Equation 5.17: Calculation of the sensible heat flux

(where  $\rho$  is the air density 1.2[kg/m<sup>3</sup>],  $C_p$  the specific heat with constant pressure 1004.67[J/K/kg] and  $\sigma(V_z, T)$  the covariance between the vertical wind speed and the temperature)

---

### 5.3.1.15 Solar zenith angle

The solar zenith angle is the angle between the zenith and the centre of the Sun's disc. It is calculated from the configured latitude and longitude and the time in the moment of the calculation.

### 5.3.1.16 Total apparent power

Apparent power is the product of the rms (root mean square) values of voltage and current. It is taken into account when designing and operating power systems.

$$S_{[VA]} = U_{1[V]} \cdot I_{1[A]} + U_{2[V]} \cdot I_{2[A]} + U_{3[V]} \cdot I_{3[A]}$$

Equation 5.18: Calculation of total apparent power [S].



## Chapter 6

# Data Evaluation

### 6.1 Introduction

As soon as *Recording* in the status box (see Section 3.2) is switched on, Meteo-40 records and stores measurement data. In order to check current data, the web interface offers the possibility to have a closed look at live data (see Section 6.2). In the Data menu, measurement data can be downloaded (see Section 6.7 and Section 4.2) and statistics can be configured, which will be saved as CSV file.

### 6.2 Live Data Page

This page displays the currently measured data. The data is presented in a table and in a line chart.

Click on *Start* to display currently measured values. *Stop* ends displaying data. The table shows the total amount of available data. In comparison, the line chart can be customized by choosing sensors and connected channels.

**Note**

Enable JavaScript in your web browser to display live data in a chart.

---

### 6.3 Statistic Data Files

In the Data → Statistics menu CSV files with statistics are listed and can be downloaded. Meteo-40 shows a calendar with available statistics. Click on a month to highlight days with available CSV files. To navigate through the calendar, click on a month or use the arrows to move one month ahead or back. Click on a highlighted day to list all CSV files, which have been generated for this day.

To view the available CSV files for a whole month, click on *Show month*; for a complete year, click on *Show year*. You can jump between the years and months by clicking on a month resp. year in the calendar.

All CSV files for the selected period are listed in a table, the file name refers to the time interval covered. For each file, a link to download the corresponding signature, its size in bytes, the methods through which the file has been shared and a link to visualize the matching source data are available. To display the source data corresponding to a file, click on the arrow in the *Source* column.

Below the list of CSV files it is indicated how many statistics CSV files are currently visible, from the available files in the data logger, e.g., 1 of 53 files.

If CSV files have been uploaded to an AmmonitOR project, sent per Email or copied to a configured SCP/FTP server, it will be tagged by a checkmark in the corresponding box.

To manually download or delete one or more files, select them and Click *Download selected* or *Delete selected* respectively. For the download, the CSV files will be compressed in one ZIP file. If you want a certain file to be sent or copied again, you can also mark the selected files as not sent with the option *Mark as not sent*



**Important**

Deleting CSV statistic files does not delete the corresponding source data, statistic files can be generated again as long as the matching source data are still in the *Source data storage*.

To immediately generate statistic files from the available source data, click on *Generate now*. Meteo-40 will generate new files for the configured *file interval*, containing a line with the calculated statistics for each *statistics interval*. For the standard configuration of daily file interval and ten minutes statistics interval, there will be 144 lines.

If *Generate partial files* is selected, not only the files for a complete *file interval* will be generated but also a file with the residuary data until the moment of the generation. This setting is only recommended for testing purposes.

Statistics calendar

Show month Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Select	File	Sig	Size	AmmonitOR	Email	Copy	Check	Source
<input checked="" type="checkbox"/>	2017-05-10 00:00:00	↓	36626	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	✓	↓
<input type="checkbox"/>	2017-05-11 00:00:00							

1 of 333 files

Download selected Generate now Delete selected

Mark all as not sent Try to fix possibly inconsistent files

Figure 6.1: Downloading Statistics

### 6.3.1 Configuring Statistics and CSV files

In order to configure statistics and CSV files, go to the Data → Statistics menu. You can define content and interval of the statistics.

Meteo-40 automatically suggests the standard statistics for each evaluation and channel. Additional statistics can be selected manually.

Click on *Select statistics* in the *Configure statistics* section to create the statistics, e.g., average, maximum, minimum, standard deviation, count, sum and median. Tick checkboxes to include evaluators / channels in the statistics. Remove checkboxes to exclude evaluators / channels. Additionally, Meteo-40 displays internal current and internal voltage in the CSV files.

Configure statistics

Select statistics

Statistics interval for files

10 min ▼

File interval

Daily ▼

Generate partial files

Statistics interval for SCADA, Switch manager and snapshots

2 s ▼

SCADA Summary interval

Every five minutes ▼

Secondary files

Tertiary files

Save

Figure 6.2: Configuring the Statistics

The options are:

**Select statistics** Select individual statistics for every evaluator and channel. See Figure 6.4.

**Statistics interval for files** Defines over which time interval statistics are calculated, generating a new line in the CSV file. All current data that has been collected since the last generated file is considered to generate new aggregate data. Several intervals are available from 1/4 s to 1 h.

**File interval** Determines, how often a new aggregate data file in CSV format has to be created. Selecting *Hourly*, produces one file per hour that includes data from the last hour. *Daily* generates only one file per day, etc. Several intervals are available from every 5 minutes to weekly. The file interval is also applied to Gust data files.

**Generate partial files** Generate CSV files up to the current moment, even if the file interval has not yet finished.

**Statistics interval for SCADA, Switch manager and snapshots** Defines over which time interval statistics are calculated. The calculation occurs at the end of the interval and the data are available over SCADA, applied to Switch manager or sent/copied as a snapshot. All current data from that period is considered to generate new aggregate data. Several intervals are available from 1/4 s to 1 h.

**SCADA Summary interval** Applied only to the Summary statistic of the SCADA Modbus server. Typically used to obtain a daily summary of sun status or precipitation measurements.

**Secondary Files** Supplementary statistics files can be generated with a different interval for the statistics calculation. Secondary statistics can be configured here. See Section 6.4.

**Tertiary Files** A further supplementary statistics interval can be configured here. See Section 6.4.



**Warning**

Be careful with setting the *statistics interval* and the *file interval*! Low values for the *statistics interval* lead to huge statistics files, which you might need to remove manually once in a while. Low values for the *file interval* lead to many small CSV files, which might be hard to handle.

---

For solar-related evaluations Meteo-40 estimates certain values in addition to the measured values, i.e., estimated sun status, estimated direct normal irradiation. In order to create the estimated values, the GPS location of the measurement station has to be entered in the System → Administration menu. By default the estimated values are not included in the CSV file. If required, select the values for the statistics.

Meteo-40 uses vectorial calculations for wind direction, i.e., vectorial average, direction maximum, direction minimum, and vectorial standard deviation (Yamartino method). Hence, the calculated minimum value for the wind direction can be higher than the maximum in case of wind from northern directions.

$$d = \text{atan2} \left( \sum_{i=1}^n \sin(\vartheta_i), \sum_{i=1}^n \cos(\vartheta_i) \right)$$

Equation 6.1: Calculation of wind direction average

The equation for the average wind direction  $d$  is given by Equation 6.1. If  $d$  is less than zero,  $2\pi$  is added.

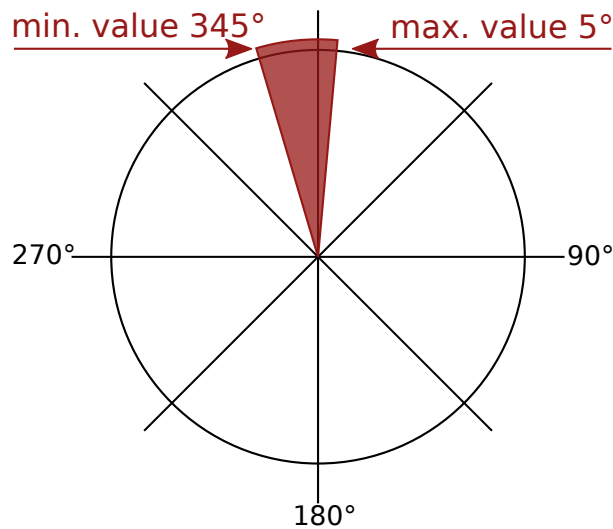


Figure 6.3: Vectorial Calculation for the Wind Direction

Evaluator/Channel	Avg	Max	Min	SDv	Cnt	Sum	Med	Val
Int. Voltage (Analog Voltage)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Int. Current (Analog Current)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Int. Temperature (Temperature)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					

Save

Back to statistics

Figure 6.4: Statistics Configuration Page

Press Save to finish the configuration of statistical values.

### 6.3.2 Maintenance Options

Under *Maintenace* we provide some options for trouble-shooting in case of CSV files generation problems.

Automatic system storage clean-up tasks are performed on CECS start in order to preserve the correct operation of the system. If more than 20000 CSV files are present on startup, all CSV files which can be identified as shared (via AmmonitOR, Email, SCP/FTP or USB flash-drive copy) are automatically deleted. You can also force the deletion of all already shared files by pressing the *Delete sent statistics* button.

Previous to generating a new CSV file the state of the storage is checked as well. If the available storage was insufficient or the number of CSV files was greater than 20000, the oldest CSV files which have already been shared are deleted.

**Important**

If none of the listed sharing options is used (AmmonitOR, Email, SCP/FTP or USB flash-drive copy), the data logger will not remove any existing files. This can lead to not generating any new files in case of memory shortage or even to a system malfunction in case of very large amount of files (over 40000). For this use case, you can choose to allow the deletion of the oldest files in order to free space by activating the option *Automatically delete oldest files if needed*.

---

The *Fix checked files* button will inspect all existing files, search for known incidences and regenerate the files if needed. This option is only available if the data logger detects any suspicious files. CSV files which have been replaced with an empty file as described in *Delete sent statistics* will be marked as suspicious.

## 6.4 Secondary and Tertiary Statistics Files

Sometimes it is necessary, to have additional statistics on top of the standard. E.g. with a different statistics interval or a different selection of values. You can activate the supplementary generation of statistics files with two different configurations. The files will be listed in a similar table as the main statistic files (see Figure 6.5 and Figure 6.6). If the files are generated, they will be automatically sent per Email or AmmonitOR additionally to the main statistic files.

**Warning**

Beware, that having more CSV files

1. is more work for the data logger, more time and energy is consumed
  2. fills the memory of the data logger faster
  3. more bandwidth for sending is used
- 

### 6.4.1 Secondary Statistics Files

Select *Generate additional files with secondary interval* to activate the generation of the secondary files. You can configure a *statistics interval* different from the main statistics interval. To select the statistics which will be calculated and included in the secondary files, click on *Select statistics*.

Secondary statistics files calendar

Show month Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Select	File	Sig	Size	AmmonitOR	Email	Copy	Source
<input type="checkbox"/>	2017-05-10 00:00:00	↓	113	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	↓
	2017-05-11 00:00:00						

1 of 333 files

Download selected Generate now Delete selected

Generate additional files with secondary interval

Select statistics

Secondary statistics interval

1 h

Save

Figure 6.5: Secondary Statistics Page

## 6.4.2 Tertiary Statistics Files

Select *Generate additional files with tertiary interval* to activate the generation of the tertiary files. You can configure an *statistics interval* different from the main and the secondary statistics interval. To select the statistics which will be calculated and included in the secondary files, click on *Select statistics*.

Tertiary statistics files calendar

Show month Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Select	File	Sig	Size	AmmonitOR	Email	Copy	Source
<input type="checkbox"/>	2017-05-10 00:00:00	↕	113	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	↕
	2017-05-11 00:00:00						

1 of 333 files

Download selected Generate now Delete selected

Generate additional files with tertiary interval

Select statistics

Tertiary statistics interval

1 h

Save

Figure 6.6: Tertiary Statistics Page

## 6.5 Gust Data Files

Detecting extreme wind events or gusts can be interesting to compare different geographical terrains or to estimate wind turbines load. Meteo-40 offers the possibility to genere extra CSV files including the sensible measurement values with the highest available measurement rate. To generate gusts data files you must activate this option in menu Data → Gusts.

One gusts CSV file will be generated per day (or the configured *file interval* in Data → Statistics menu) including all wind gusts of that period. If no gust was registered during the period, an empty file is generated. Empty files will not be visible in the *Gust data files calendar* but will be listed beneath.

To be considered a gust, the selected *trigger evaluation* must exceed the configured threshold value a minimum number of consecutive repetitons (*minimum repetitions* parameter) and not more than the selected *maximum repetitions*. The gust as well as the previous and posterior number of seconds specified by *time overhang* parameter are included in the gusts CSV file (see .

Gust data files calendar

Show month Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Select	File	Sig	Size	AmmonitOR	Email	Copy	Source
<input type="checkbox"/>	2017-05-07 00:00:00		0				↓
<input type="checkbox"/>	2017-05-08 00:00:00						

1 of 333 files

Download selected Generate now Delete selected

Figure 6.7: Gust Data Calendar

Not every existing measurement is related to gusts analysis. The relevant evaluations must be selected. Press the *Select evaluations* button to access the evaluations selection site and select which evaluations must be included in gusts CSV files.

Evaluator	Include
Anemometer (Wind Speed)	<input checked="" type="checkbox"/>
Wind Vane (Wind Direction)	<input type="checkbox"/>
Hygro/Thermo (Humidity)	<input checked="" type="checkbox"/>
Hygro/Thermo (Temperature)	<input type="checkbox"/>

Save

Back to gust data

Figure 6.8: Gust Evaluations Selection



**Important**

If the gusts data generation is activated in a running project, all existing source data will be analyzed and gusts CSV files will be generated. This process could take several hours.

## 6.6 The CSV File Format

Meteo-40 stores measurement data in standard Comma-Separated Value (CSV) format with appended information in ini file format. The CSV file is documented in RFC 4180 (<http://tools.ietf.org/html/rfc4180>) and well



explained, e.g., in Wikipedia ([http://en.wikipedia.org/wiki/Comma-separated\\_values](http://en.wikipedia.org/wiki/Comma-separated_values)). Ini files are described, e.g., in Wikipedia ([http://en.wikipedia.org/wiki/INI\\_file](http://en.wikipedia.org/wiki/INI_file)) as well. CSV files can easily be read by many programs and software tools, as is the ini file format.

**Note**

In almost all cases, the CSV files created by Meteo-40 are compressed using GNU gzip (<http://www.gzip.org/>) with the typical file extension .gz. gzip compressed files can be decompressed on all operating systems, see, e.g., Wikipedia (<http://en.wikipedia.org/wiki/Gzip>) for further details.

---

## 6.6.1 Ammonit Meteo-40 specific details

The measurement data files of the Meteo-40 use the , (comma) as field separator, "(double quote) for embedding commas in textual strings and UTF-8 as character set.

The statistics files generated by Meteo-40 data loggers are structured in two parts, the data in standard CSV format and additional information in so-called ini file format. Both parts are separated by one empty line.

### 6.6.1.1 Data part (CSV format)

The CSV part starts with a header line. This line is a comma-separated list of the statistics for each active channel and evaluator. The first item of the list is the date/time entry.

The date and time value shows the start time of the statistics interval. Date and time format are similar to ISO-8601, e.g., 2014-07-17 15:50:00. The date and time values are always the local time of the data logger. The timezone is stated in the second part of the file.

The evaluator statistics have the form `Sensor;Evaluation;Statistic` (e.g., `Anemometer;wind_speed;Avg` or `WindVane10bit;wind_direction;Count`). Thereafter, the channel statistics are displayed in the form `Channel;Statistic` (e.g., `A2;Avg` or `C1;StdDev`).

The statistics can individually be selected per sensor in the Data → Statistics menu (see Figure 6.4).

According to the configured statistics interval, Meteo-40 calculates the statistics. Each time period is represented in a line of the CSV file. The values are generally decimal numbers, using a point ( . ) as decimal mark.

Language settings of the data logger do not have an influence on the CSV file.

The following evaluation types are available:

---

wind\_speed: Wind Speed,  
wind\_direction: Wind Direction,  
humidity: Humidity,  
temperature: Temperature,  
temperature\_differential: Differential Temperature,  
air\_pressure: Air Pressure,  
air\_density: Air Density,  
solar\_irradiance: Global Horizontal Irradiance,  
solar\_irradiance\_diffuse: Diffuse Horizontal Irradiance,  
solar\_irradiance\_direct: DNI·cosθ,  
solar\_DNI: Direct Normal Irradiance (DNI),  
solar\_irradiance\_direct\_sw: Estimated DNI,  
solar\_DNIcos\_sw: Estimated DNI·cosθ,  
sun\_status: Sun Status,  
sun\_status\_sw: Estimated Sun Status,  
precipitation: Precipitation,  
precipitation\_intensity: Precipitation Intensity,  
precipitation\_status: Precipitation Status,  
precipitation\_sum: Precipitation Sum,  
wind\_speed\_vert: Vertical Wind Speed,  
counter: Counter,  
voltage: Analog Voltage,  
current: Analog Current,  
status: Status,  
active\_power: Active Power,  
power\_factor: Power Factor,  
reactive\_power: Reactive Power,  
apparent\_power: Apparent Power,  
obukhov\_length: Obukhov Length,  
dir\_max\_speed: Direction at max. Speed,  
brightness\_max: Brightness max. Value,  
brightness\_direction: Direction of Brightness,  
frequency: Frequency,  
inclination\_angle: Angle of Inclination,  
vibration\_frequency: Vibration Frequency,  
vibration\_amplitude: Vibration Amplitude,  
other: Other Evaluation,  
any: Any Evaluation

The following statistics are available:

Avg: Average,  
Max: Maximum,  
Min: Minimum,  
StdDev: Standard deviation,  
Count: Count of valid values,  
Sum: Summary,  
Med: Median,  
Val: First valid value

### 6.6.1.2 Information part (Ini file format)

The information part contains data logger information as well as sensor details like installation height, slope and offset values, as well as unit and sensor name.

The information part is included in every file. It can be found below the statistical data. The overall format of the configuration is the following:

```
[Section 1]
key1=value
key2=value
```

[Section 2]  
key1=value

All section names, keys and values are case-sensitive and may contain unicode characters in UTF-8 encoding. While sections and values may contain spaces; keys will not. Each section is unique; each key is unique within its section. Neither the order of sections nor the order of entries within the sections are significant or guaranteed.

- [System]: Serial number in the format `serial=D123456` and type of the data logger in the format `type=Meteo-40L` the assigned name; timezone in the format `timezone=UTC+01:00`(the offset can be positive or negative or be missing, which indicates UTC); the location in decimal degrees and altitude in meters: `latitude=0.0 longitude=0.0 altitude=0.0` as well as the software version and important system settings, e.g., `cecs_power_permanent=true`.
- [Summary] comprises the date and time when the CSV file has been created, the used source data storage and the summary over the file time interval for configured precipitation, precipitation intensity, status and sun status evaluations.
- [Evaluation] indicates `file_interval` and `stat_interval`(see also Section 6.3).

The `file_interval`, usually daily, can have the following values:

```
fiveminutes
tenminutes
fifteenminutes
twentyminutes
thirtyminutes
hourly
twohours
threehours
fourhours
sixhours
twelvehours
daily
weekly
```

The `stat_interval`, usually 10 min, can have the following values:

```
1 s
2 s
3 s
5 s
10 s
20 s
30 s
1 min
2 min
5 min
10 min
15 min
20 min
30 min
1 h
```

- [Adjustment]: CS1 and CS2 are the calibration values for the current source of Meteo-40. The values are for informational purpose only.
- [Master]: The rate of RS485 is given in s, min or h; `serial_setting` for RS485 includes speed without unit, as well as data format in conventional notation (e.g., 9600 8N1).
- [Sensor; Evaluator]
  - `statistic`: List of statistics, which are calculated for the sensor, e.g., average, min, max.
  - `unit`: Unit for the data, e.g., m/s.
  - `sensor_label`: Name, which has been entered by the user in the sensor configuration.
  - `sensor_height`: Installation height in meters, which has been entered by the user in the sensor configuration.
  - `sensor_type`: Indicates the type of the sensor, e.g., anemometer. The following values are possible:

- 
- anemometer: Anemometer,
  - wind\_vane: Wind Vane,
  - hygro\_thermo: Humidity / Temperature Sensor,
  - barometer: Barometric Pressure Sensor,
  - precipitation: Precipitation Sensor,
  - pyranometer: Solar Sensor,
  - ultrasonic: Ultrasonic Anemometer,
  - power\_meter: Power Meter,
  - other: Other Sensor
- sensor\_model: The model of the sensor, e.g., Thies First Class Advanced.
  - formula: The type of formula used to convert the electrical values, e.g., linear.
  - formula\_params: Parameters, which are referenced to in the formula, including related channels and evaluator parameters, e.g., A5 A6 var\_offset var\_slope. Values of the parameters are displayed in the lines below the formula parameters, e.g., var\_offset, var\_slope, var\_period, var\_sensitivity.
- [Channel]
    - statistic: List of statistics, which are calculated for the channel/sensor. For each statistic a column is displayed in the upper part of the CSV file.
    - unit: Unit of the calculated data. This is the SI unit for the type of quantity, however the unit for barometric pressure might be either hPa or mbar, and the temperature unit is °C or K for differential temperature.
    - rate: Configured rate for the channel with unit (not applicable for Master channels).
    - range: Configured range for analog voltage channels (Ax) with unit.
    - protocol: Protocol, which is used for digital channels (Dx).

## 6.6.2 CSV import in LibreOffice or OpenOffice



### Tip

Use LibreOffice (<http://www.libreoffice.org/>) Calc or OpenOffice.org (<http://www.openoffice.org>) Calc. These are free, professional spreadsheet programs to process your CSV files.

---

The recommended settings to import the CSV file are shown in Figure 6.9.

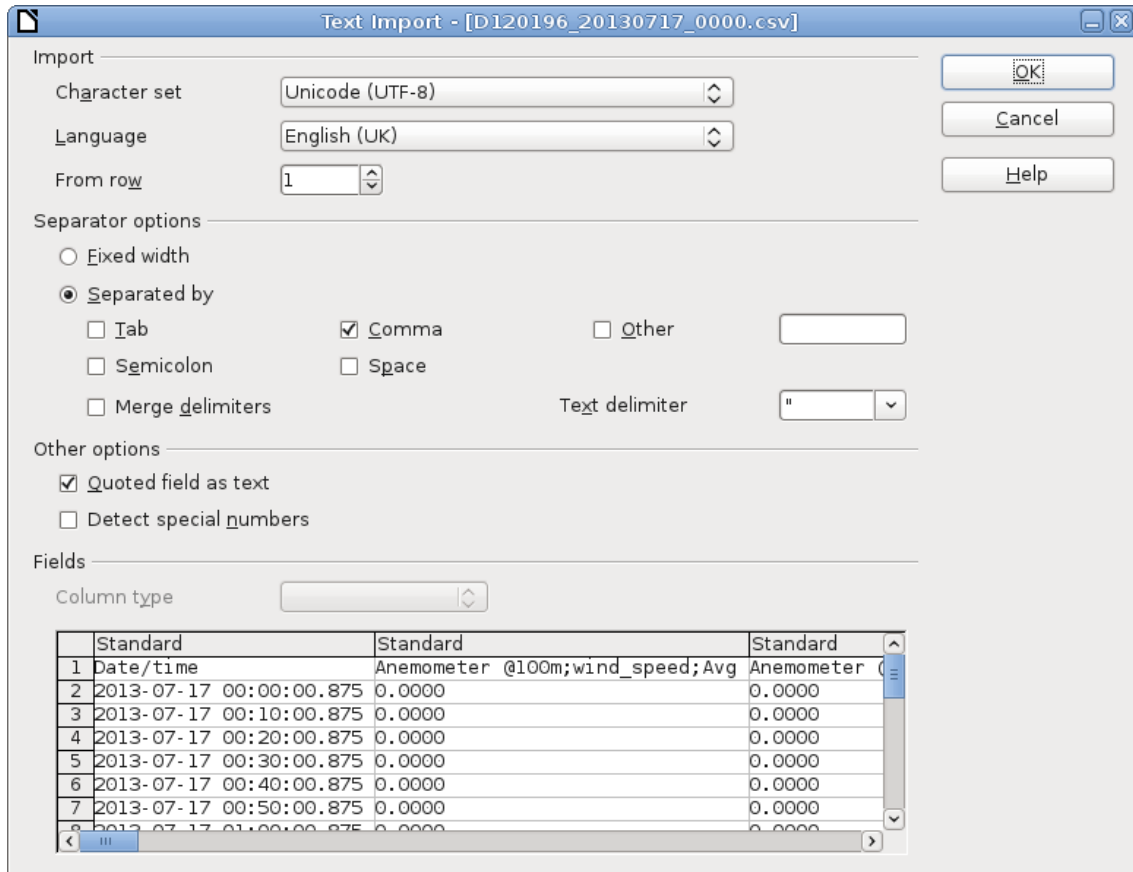


Figure 6.9: LibreOffice CSV-file import settings

### 6.6.3 CSV Import in Microsoft Excel 2010™

Depending on the version of Microsoft Excel™ the procedure can be slightly different. In general, we recommend using the import assistant of Microsoft Excel™.



#### Note

Save CSV files always in a directory. The described process in Microsoft Excel™ does not work, when files are opened via your email program.

1. Launch Microsoft Excel™ and open the *Options* window, which can be found in the *File* menu. Open the *Advanced* menu. In the *Editing options* section deselect *Use system separators* and use *.* (dot) as decimal separator and *,* (comma) as Thousands separator. See figure Figure 6.10.

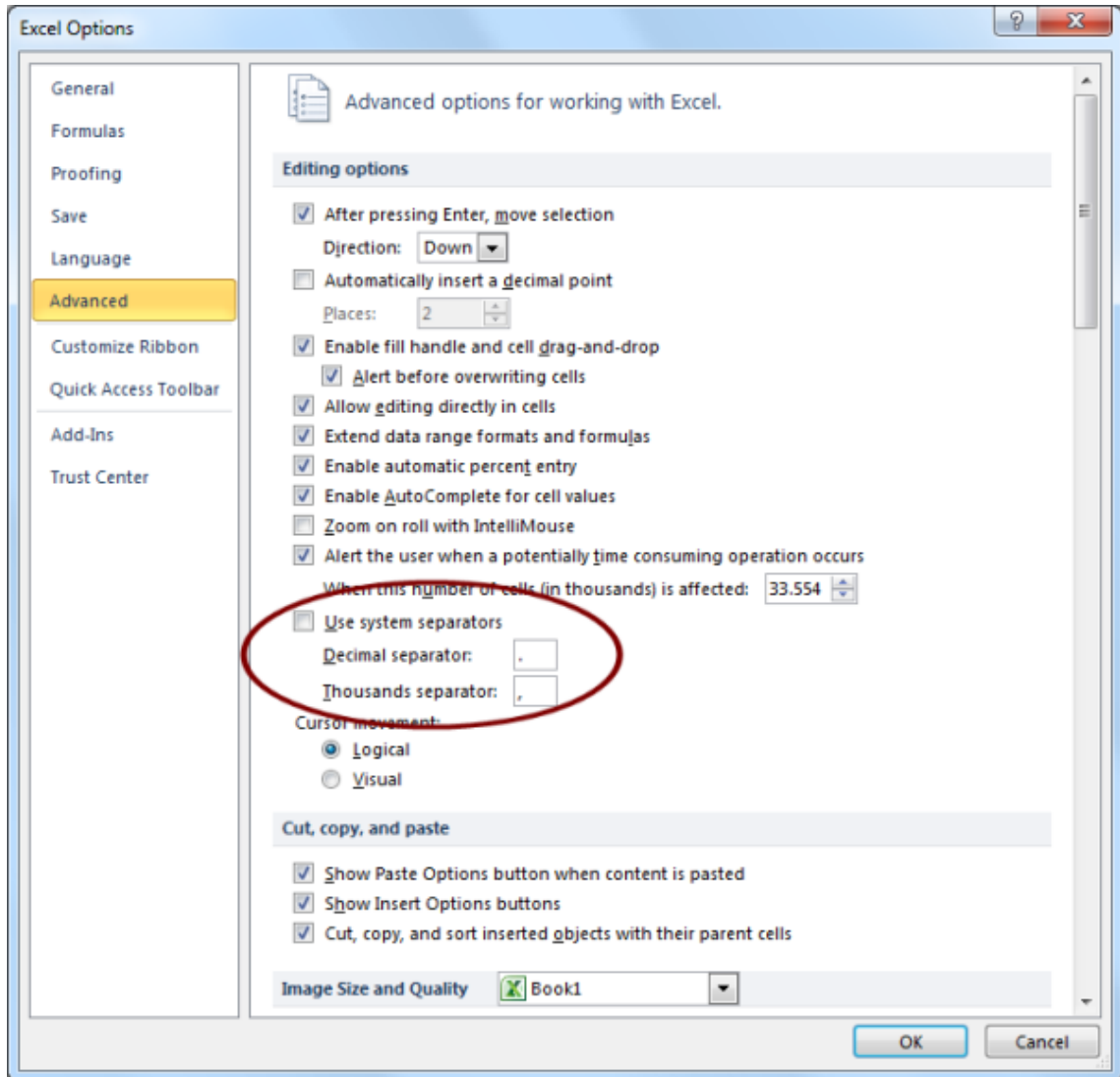


Figure 6.10: Microsoft Excel 2010™ CSV Import (1)

2. After setting the options, click on the *Data* tab as shown in Figure 6.11. In order to import the CSV file, click on *From Text* in the group *Get External Data*, locate and double-click the file you want to import. Follow the instructions in the *Text Import Wizard*.

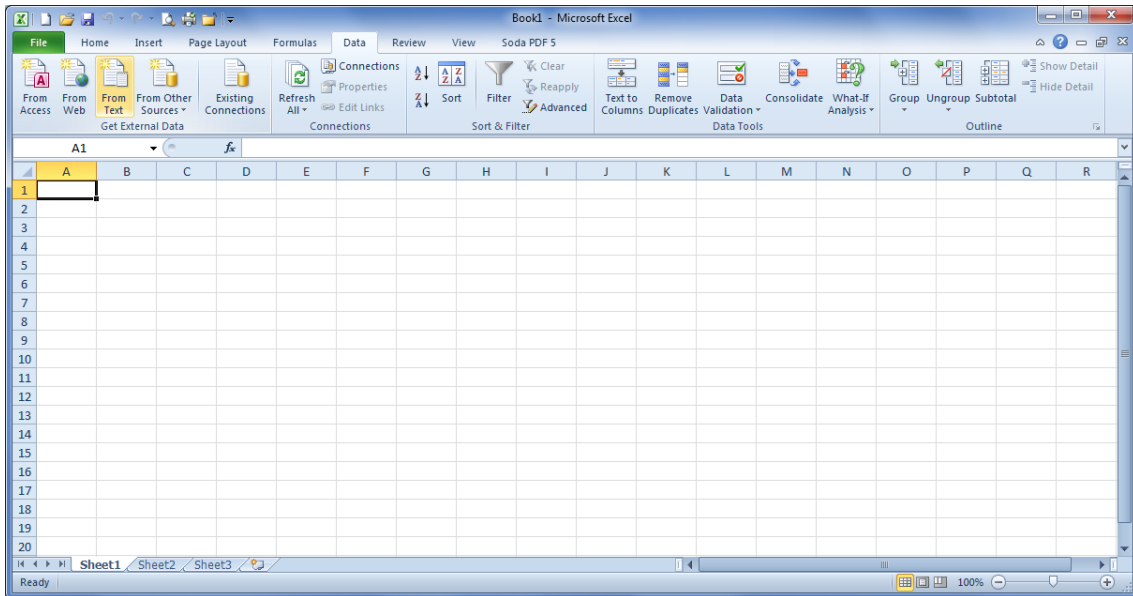


Figure 6.11: Microsoft Excel 2010™ CSV Import (2)

3. In the first step of the wizard choose *Delimited* as *Original data type* and select *Unicode (UTF-8)* for the file origin. See Figure 6.12.

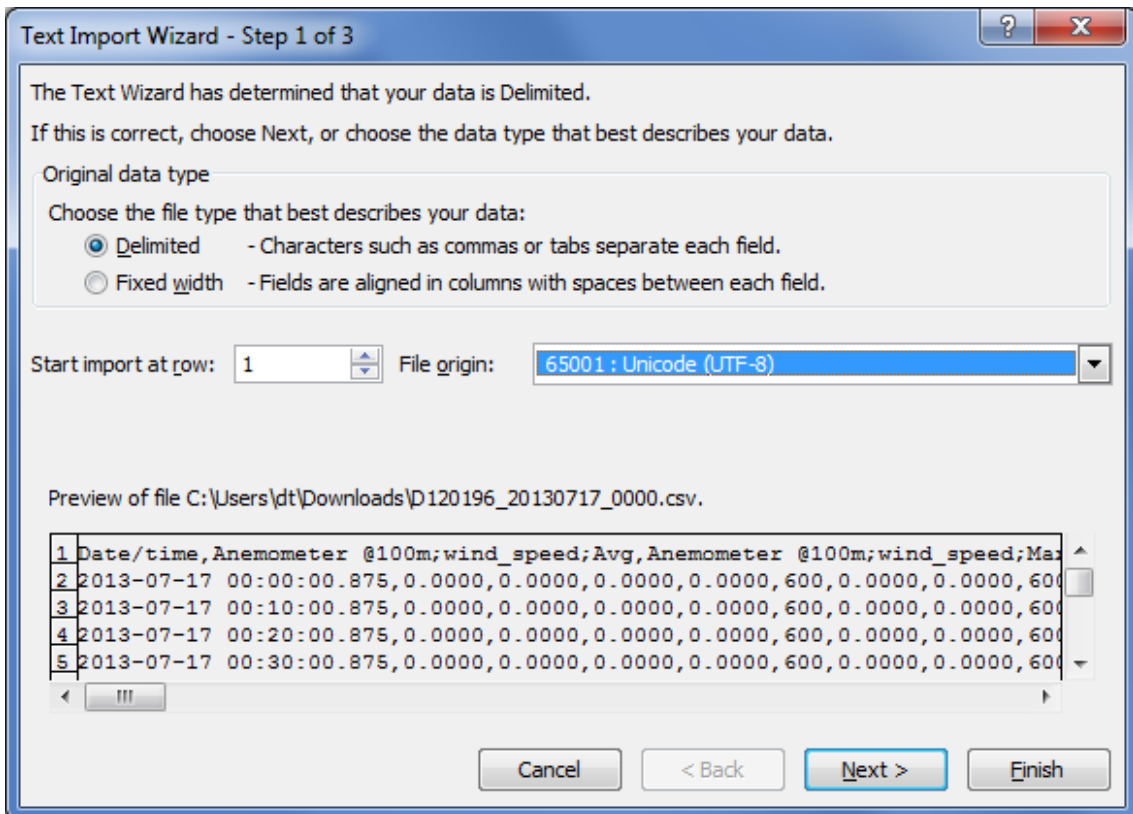


Figure 6.12: Microsoft Excel 2010™ CSV Import (3)

4. In next step define *Comma* as delimiter and *"* as text qualifier as shown in Figure 6.13.

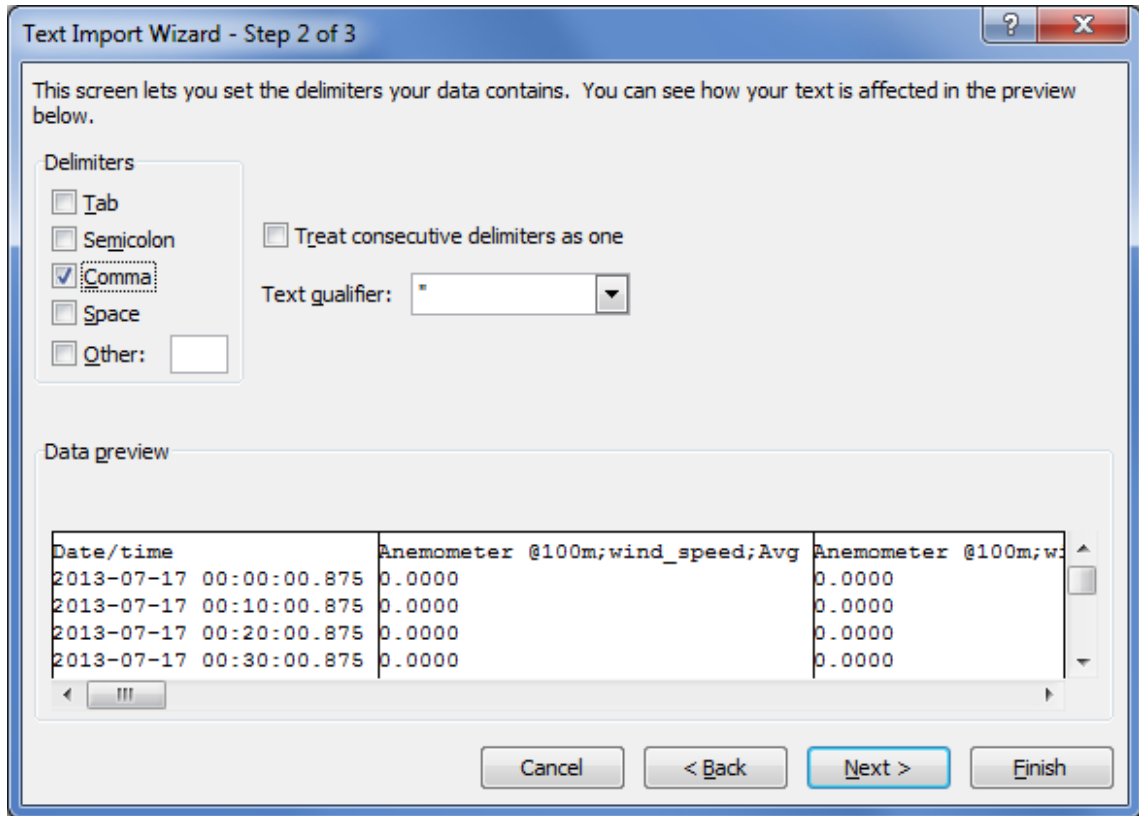


Figure 6.13: Microsoft Excel 2010™ CSV Import (4)

5. In the last step of the wizard, select *Text* for the data format columns. See Figure 6.14.



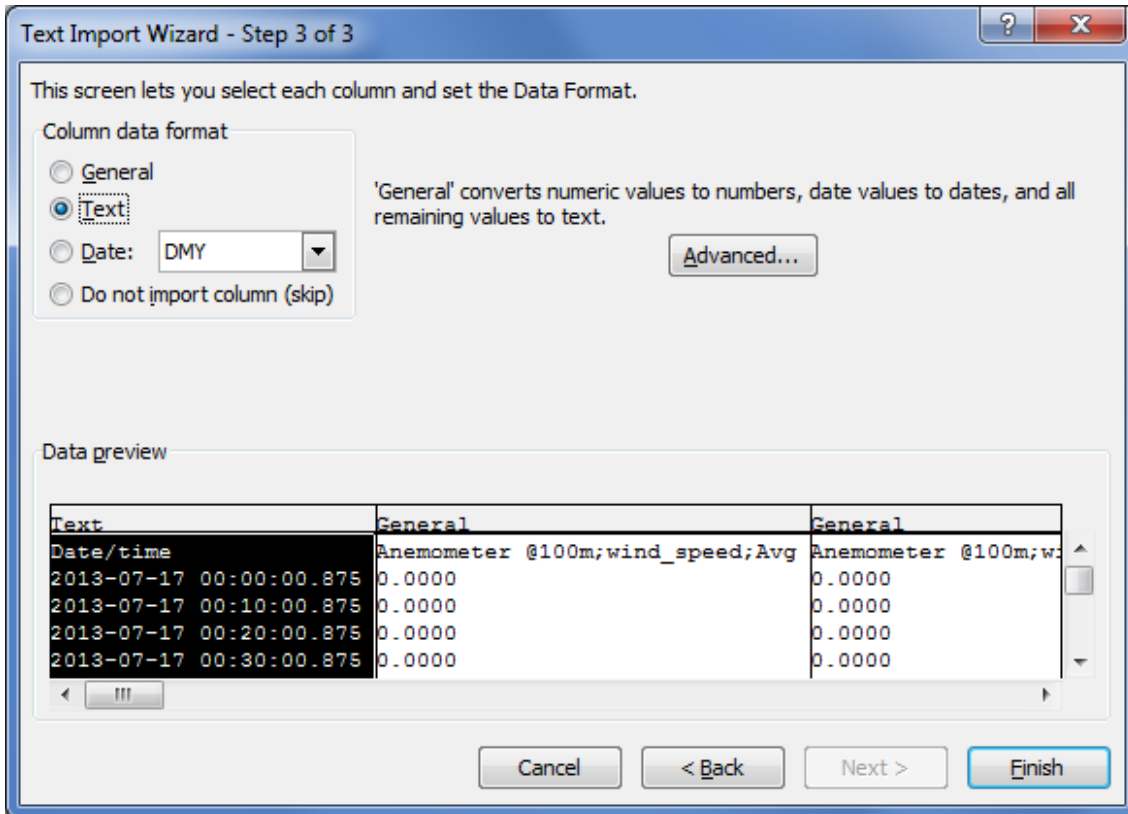


Figure 6.14: Microsoft Excel 2010™ CSV Import (5)

6. By clicking on *Finish* the file opens in your selected sheet. See Figure 6.15.

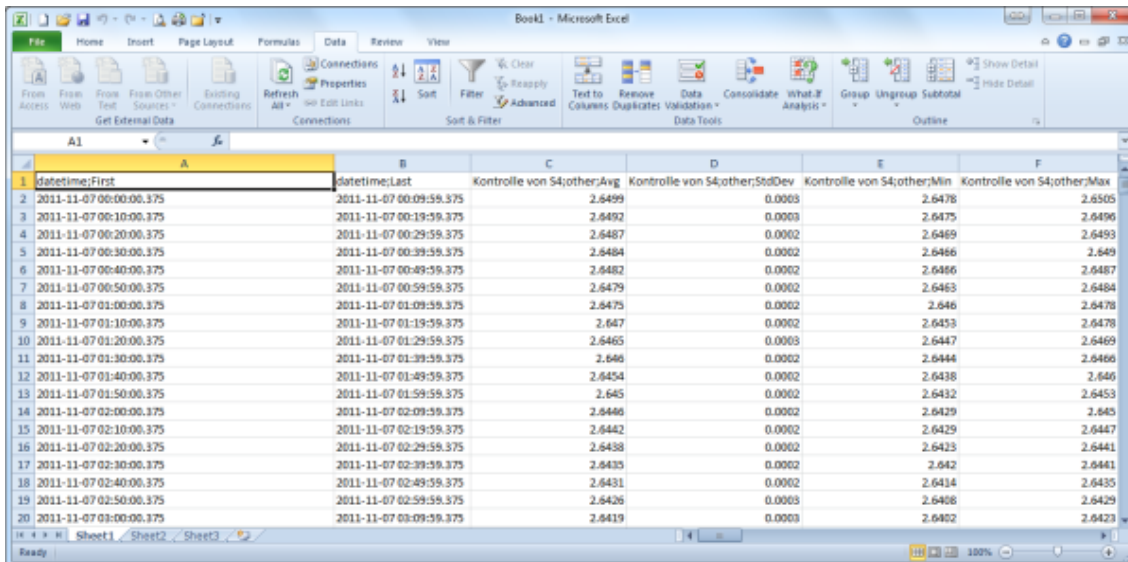


Figure 6.15: Microsoft Excel 2010™ CSV Import (6)

7. In order to change the cell format of the date and time columns from text to date time format, highlight the column(s) and open *Format Cells* in the *Numbers* group on the *Home* tab. Select *Custom* and enter *YYYY-MM-DD hh:mm:ss.000* as shown in Figure 6.16.

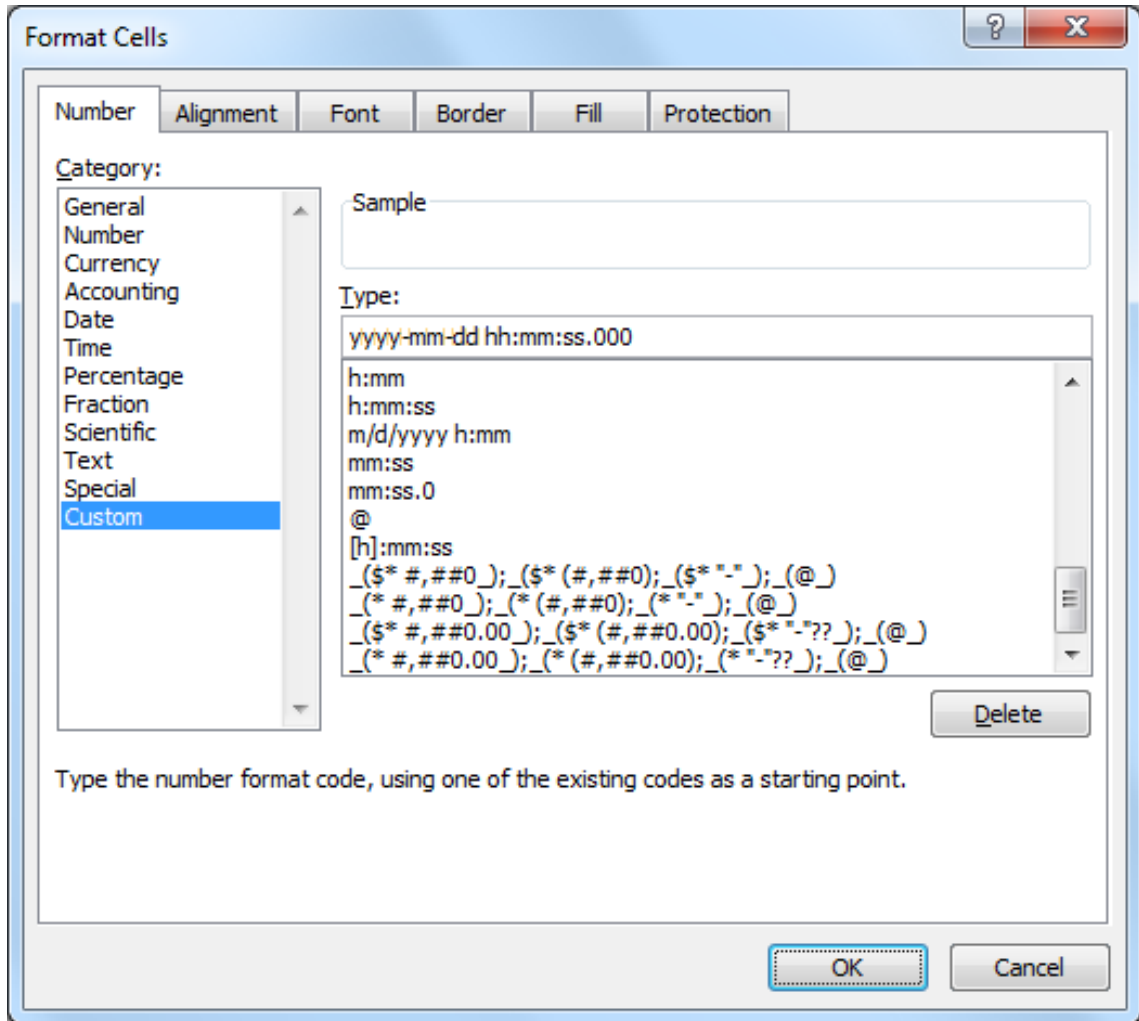


Figure 6.16: Microsoft Excel 2010™ Format Cells

## 6.7 Access to Source Data

Source data contains all electrically measured values neither interpreted nor with any statistical evaluation applied. If source data is available and the used sensors are known, it is possible to re-evaluate a complete measurement campaign.



### Important

Source data is only recorded, when recording is switched on!

The source data storage is organized as a ring buffer, which means that the oldest data will be overwritten, when the storage is filled entirely. For compactness reasons data is saved in a binary format and cannot be read directly. However, you can view or download data.

To view or download source data, go to the Data → Source menu. Meteo-40 displays all months and related days, on which source data is available. As shown in Figure 6.17, select month, day and time period to display related source data in the table below.

2016
07 08 09 10 11 12

2017 01 02 03 04 05

◀ **2017-05** ▶

Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

HH:MM HH:MM HH:MM HH:MM HH:MM HH:MM

Date and Time	A1	A2	A3	C1	C2	C3	C4	D1	D2	D3	sw	V	I	T	addr
2017-05-11 12:25:00.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x000
2017-05-11 12:25:01.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x001
2017-05-11 12:25:02.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x002
2017-05-11 12:25:03.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x003
2017-05-11 12:25:04.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x004
2017-05-11 12:25:05.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x005
2017-05-11 12:25:06.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x006
2017-05-11 12:25:07.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x007
2017-05-11 12:25:08.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x008
2017-05-11 12:25:09.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x009
2017-05-11 12:25:10.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x010
2017-05-11 12:25:11.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x011
2017-05-11 12:25:12.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x012
2017-05-11 12:25:13.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x013
2017-05-11 12:25:14.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x014
2017-05-11 12:25:15.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x015
2017-05-11 12:25:16.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x016
2017-05-11 12:25:17.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x017
2017-05-11 12:25:18.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x018
2017-05-11 12:25:19.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x019
2017-05-11 12:25:20.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x020
2017-05-11 12:25:21.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x021
2017-05-11 12:25:22.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x022
2017-05-11 12:25:23.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x023
2017-05-11 12:25:24.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x024
2017-05-11 12:25:25.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x025
2017-05-11 12:25:26.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x026
2017-05-11 12:25:27.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x027
2017-05-11 12:25:28.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x028
2017-05-11 12:25:29.000	0.1	0.2	0.3	0.1	0.2	0.3	0.4	0.1	0.2	0.3	01h	12.00	125	30	50000x029

600 lines

Source Data Only

Evaluated Data Only

Source and Evaluated Data

Download ten minutes

Download hour

Download day

Download week

Figure 6.17: Screenshot of the Source Data Page

The displayed source data can be downloaded as CSV file by clicking on the buttons below the table.

**Download ten minutes** Click to download a CSV file with source data of the selected 10min-period.

**Download hour** Click to download source data of the selected hour, i.e., source data of one table row. The source data in the downloaded CSV file starts with 00:00 min and ends with 59:59 min.

**Download day** Click to download source data of the selected day, i.e., the source data of the whole day from 00:00:00 to 23:59:59. If source data of the current day should be downloaded, the CSV file includes all data up to the download moment.



**Warning**

The volume of downloaded source data can be huge, e.g., a filled 2 GB memory can lead to a 10 GB CSV file.



# Chapter 7

## Communication

### 7.1 Introduction

Depending on the usage of Meteo-40, several communication methods are available:

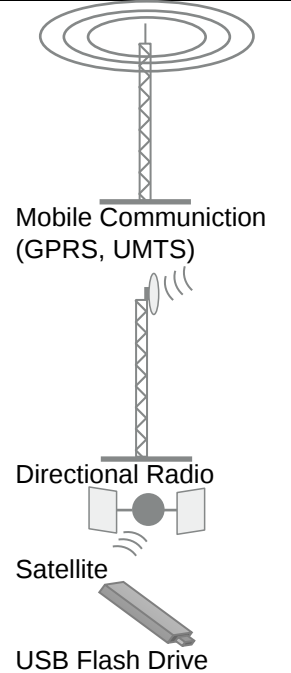
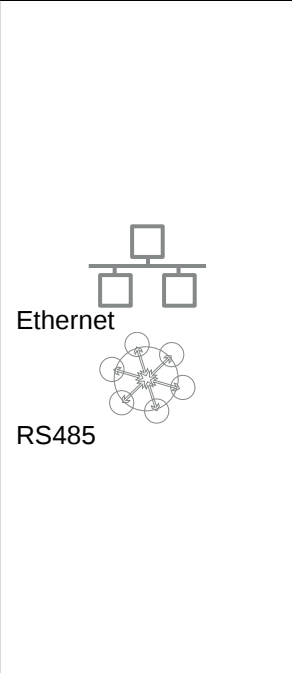
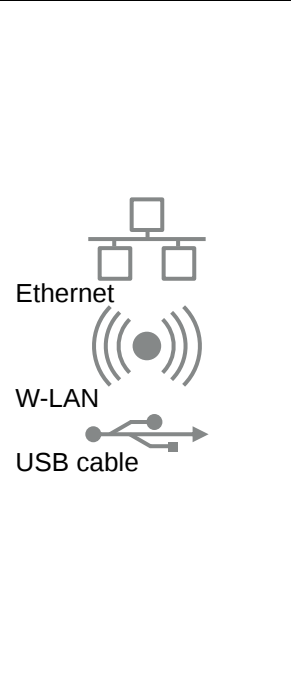
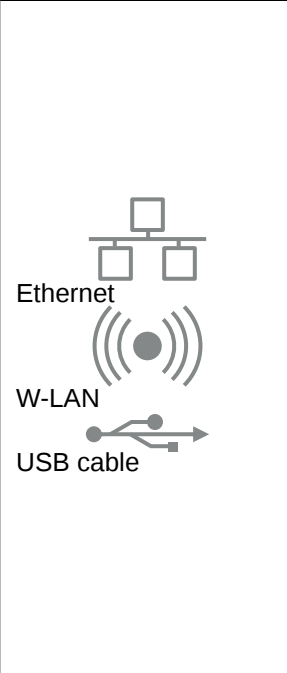
Measurement Campaign	Power Plant Monitoring	Maintenance (Site)	Configuration (Office)
 <p>Mobile Communication (GPRS, UMTS)</p> <p>Directional Radio</p> <p>Satellite</p> <p>USB Flash Drive</p>	 <p>Ethernet</p> <p>RS485</p>	 <p>Ethernet</p> <p>W-LAN</p> <p>USB cable</p>	 <p>Ethernet</p> <p>W-LAN</p> <p>USB cable</p>

Table 7.1: Data Transmission with Meteo-40

The Meteo-40 web interface can be accessed via:

- LAN
- W-LAN(WiFi) using a USB WiFi stick
- Modem for GSM/ GPRS, directional radio or satellite connection
- USB



**Tip**

To download measurement data without accessing the Meteo-40 web interface, a pre-configured USB flash drive can be used (see Section 4.2).

If Meteo-40 has been connected successfully to one of the above mentioned devices or networks, it is shown on the data logger **display** under the menu **Communication**. USB and Ethernet connections are displayed in menu **Communication** → **Devices** → **LAN**; a connected modem in menu **Communication** → **Devices** → **Modem**. W-LAN (WiFi) parameters are displayed in menu **Communication** → **Devices** → **WLAN**.



**Note**

Although no USB device is connected, Meteo-40 displays one **unavailable** USB connection, which refers to the USB-B slot. As soon as you connect Meteo-40 via USB with your computer the displayed connection will change to **active**.

Once the connection has been established, further settings can be configured via the web interface. There are different ways to collect data from Meteo-40:

- Email
- SCP/FTP/SFTP server upload
- AmmonitOR upload (also AmmonitOR installation on customer's server)(AmmonitOR account is required)
- Direct download via web interface
- Direct download from data logger on USB flash drive

Data transmission between Meteo-40 and PC can be automatic (one-way) or interactive (two-way). Automatic communication means that Meteo-40 sends CSV files by email or uploads data via SCP/FTP/SFTP. Once the actions have been configured, no further interaction is needed. Active communication implies an action by the user, e.g., accessing the web interface while Meteo-40 is online. If a modem is used, you can access Meteo-40 via a **tunnel server**.

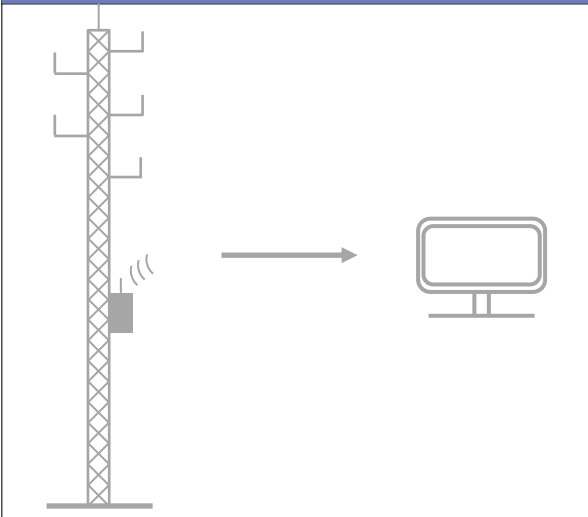
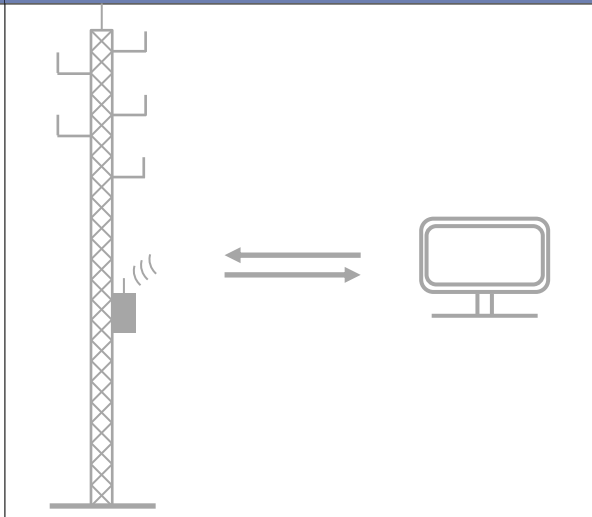
Automatic Communication	Interactive Communication
	
<ul style="list-style-type: none"><li>• Data Upload to AmmonitOR</li><li>• Email CSV and other files</li><li>• Data Upload via SCP, FTP, or SFTP</li></ul>	<ul style="list-style-type: none"><li>• Online Access via Tunnel Server</li><li>• Meteo-40 Configuration</li><li>• Data Download via Web Interface</li></ul>

Table 7.2: Automatic vs. Interactive Communication with Meteo-40

The settings for data transmission or online access can easily be configured via the Meteo-40 web interface in the **Communication** → **Schedule** menu (see also Section 7.2). **CSV files**, which include measurement data, are stored on

the data logger and can be downloaded directly from the data logger, sent automatically via email to an address of your choice as well as CSV files can be uploaded automatically to an SCP/FTP/SFTP server of your choice.

In order to configure the settings for each communication method, use the menu items: *Online*, *AmmonitOR*, *Email*, *SCP/FTP/SFTP*, *LAN*, *W-LAN* and *Modem*.



**Tip**

We recommend using our online platform *AmmonitOR* to manage and monitor measurement data. To register and start using *AmmonitOR*, go to the *AmmonitOR* login page (<https://or.ammonit.com/access/login/>).

Port	Direction	Configurable	Usage
21/tcp (FTP)	outgoing	yes	file transfer from Meteo-40 to file server
4040/tcp	outgoing	no	secure tunnel for Meteo-40 web interface
4041/tcp	outgoing	no	secure file transfer from Meteo-40 to file server, e.g. AmmonitOR
25/tcp (SMTP)	outgoing	yes	email transfer from Meteo-40 to mail server
123/tcp+udp (NTP)	outgoing	no	network time protocol to set time and date
443/tcp (HTTPS)	incoming	no	secure Meteo-40 web interface
465/tcp (SSMTP)	outgoing	yes	secure email transfer from Meteo-40 to mail server
502/tcp (Modbus)	incoming	no	Meteo-40 SCADA service

Table 7.3: Ports used by Meteo-40

## 7.2 Configuring the Communication Schedule

Actions are processes, which the data logger performs according to the settings in the Communication → Schedule menu. You select which action should be performed at which time and how often or how long during a day.

Meteo-40 turns on one minute before an action takes place and stays switched on as long as the action is running. The *status box* in the web interface informs about the number of running actions.



**Note**

If *CECS is always active* has been selected in the CECS power mode section of the System → Administration menu, Meteo-40 does not switch off automatically. Refer to Section 1.4.1 for further details.

Configuring the schedule includes defining the communication behavior during a day and selecting on which weekdays an action should be performed. Each action starts performing at its *Start Time* and will be repeated according to the defined *Interval* until the number of actions (*Quantity*) is achieved or a new day begins (00:00).

**Online** Indicates the periods, at which the Meteo-40 web interface can be accessed over the Internet. If configured, a tunnel connection is established.



**Note**

Be carefully selecting the online intervals of the data logger. Connection costs can be very high depending on the communication method. In most cases up to three online intervals of 20 minutes are sufficient.

**AmmonitOR** Indicates, when and how often CSV files should be uploaded to an AmmonitOR account.

**Email** Indicates, when and how often emails with attached CSV file(s) should be sent. If necessary, CSV files are generated automatically before emails are sent.

**SCP/FTP/SFTP** Indicates, when and how often CSV file(s) should be uploaded to a configured server using SCP, FTP or SFTP. If necessary, CSV files are generated automatically before upload.

**Only generate CSV** Indicates, when and how often CSV files should be generated without sending or uploading them. Select this option to generate CSV files for the manual download via web interface or on USB flash drive. According to the configured statistics (see Section 6.3), Meteo-40 generates CSV files on the selected days at the scheduled times.

Action	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Start time	Duration	Quantity	Interval	Next	
Online	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12:00	00:20	1	0:00	2017-05-12 15:48	Run now
AmmonitOR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12:00		1	0:00	2017-05-12 15:48	Run now
Email	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12:00		1	0:00	2017-05-12 15:48	Run now
FTP/SCP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12:00		1	0:00	2017-05-12 15:48	Run now
Only generate CSV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12:00		1	0:00	2017-05-12 15:48	Run now

Save

Figure 7.1: Configuring the Schedule

**Weekdays** Select the weekdays, on which the action should be performed.

**Start Time:** Determine, when the first action should start. If no *Start time* is defined, Meteo-40 will schedule the first action for 00:00.

Enter the *Start Time* according to the 24-hour format: hh:mm. Enter 14:00, when the action should start at 14:00 hrs.

**Duration (Only applies for Online):** Enter the length of time (hh:mm), which the data logger should be connected to the Internet. The duration begins with every start of an action.

Example: Start time 11:00, Duration 00:20, Quantity 2, Interval 03:00 means that the data logger will be online at 11:00 hrs for 20 minutes. At 14:00 hrs Meteo-40 is online again for 20 min.

Enter the *Duration* according to the following time format: hh:mm.

**Quantity:** Enter the number of actions, which should be performed during a day. Once a weekday has been selected to perform the action, the *Quantity* is set to 1. After changing the *Quantity* to a number higher than 1, an *Interval* can be entered. The last action will be performed at the latest at midnight, even if the user's defined number of actions has not been achieved.

Enter the *Quantity* as integer, e.g., 2, 3, 4.

**Interval:** Determine the time between the starts of two successive actions. The *Interval* can be entered once the *Quantity* of an action was set to a higher number than 1. Entering 01:00 means that the action will be performed hourly; entering 24:00 means that there is only one action per day possible.

Enter the *Interval* according to the following time format: hh:mm.

**Next:** Displays, when the next action is scheduled indicating date and start time.



**Note**

Actions running just before midnight may be interrupted by the automatic CECS reboot. See Section 4.2 for details.

---

For immediate action, click *Run now*. You can also start an action over the display menu (see Section 4.4.1).

While Meteo-40 is online, the time elapsed is shown in the last column as percentage value. Otherwise, the *Run now* button can be clicked to connect Meteo-40 immediately to the Internet.

**Note**

Consider the time settings for sending emails and uploading CSV files via SCP/FTP/SFTP. During night hours the battery's energy might be too low to send or upload large files.

---

Do not forget saving your modifications. Without saving the previous values will be reset.

**Tip**

In order to save or reduce connection costs, we recommend carefully setting the online periods of the data logger in the schedule. In most cases it is sufficient to configure not more than three time slots of 20 minutes for Internet activity.

---

## 7.3 Configuring Online Access

The Meteo-40 web interface can only be accessed remotely, when the data logger is powered-on and an Internet connection has been established. Periods for online access can be configured in the Communication → Schedule menu.

**Important**

Meteo-40 can be connected to a tunnel server (e.g., Ammonit Tunnel Server; see Figure 7.2) to obtain a unique subdomain. Thus the GSM modem can be equipped with a standard SIM card with dynamic IP address. The tunnel server manages the subdomains. Users access the Meteo-40 web interface (when online) by entering its subdomain, e.g., `https:// subdomain . tunnel . ammonit . com`. Additionally, the tunnel between data logger and server is encrypted and therefore cannot be accessed by unauthorized users.

---

A tunnel connection / tunnel server can be configured in the Communication → Online menu. You can choose between the Ammonit tunnel, your own tunnel or no tunnel, if you use Meteo-40 for testing purposes in your office.

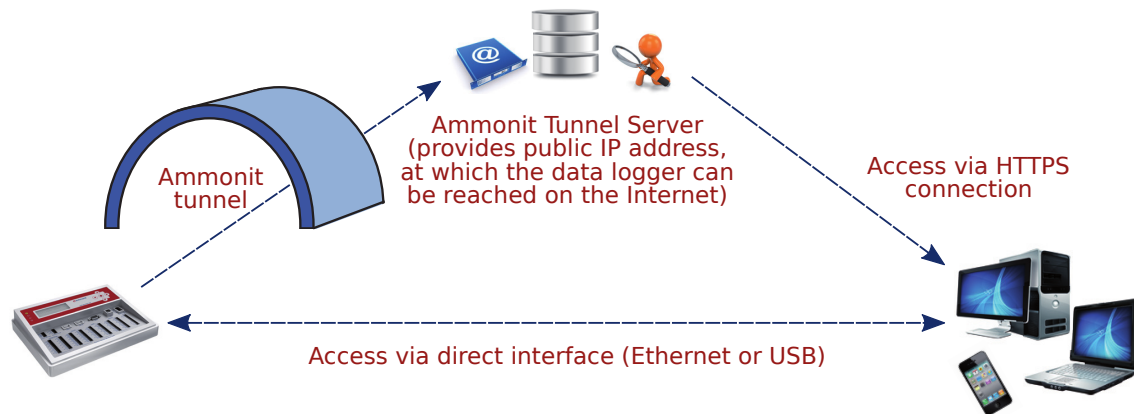


Figure 7.2: Communication between Meteo-40 and PC via Ammonit Tunnel Server



**Note**

If you use a SIM card with static IP address, a tunnel connection is not necessarily needed. The tunnel connection can be configured additionally, since it is established faster than the connection via static IP address. The Ammonit tunnel server caches images and history of the last sessions.

Tunnel

Tunnel server  
Ammonit tunnel

Tunnel login  
logger@D171234.tunnel

Tunnel port  
4040

Download SSH key

Link to tunnel

Tunnel access code (highly recommended)  
secret-phrase

Prevent implicit tunnel activation (only recommended for satellite communication)

Save Tunnel Config

Figure 7.3: Configuring the Online Access

Meteo-40 offers three tunnel options (see Figure 7.3) in the Communication → Online menu:

**No tunnel:** Select this option, when you use a SIM card with static IP address or when you are connected directly to the data logger via LAN (Ethernet) or USB.

**Ammonit tunnel:** Select the Ammonit Tunnel Server (see Figure 7.2) to access the data logger's web interface via an Ammonit tunnel domain link `https://Dnnnnnn.tunnel.ammonit.com`.

**Custom tunnel:** Enter *Tunnel login* and *Tunnel port* of your own tunnel server. Your server has to authenticate the Meteo-40 data logger. Download the SSH key of the data logger for authentication. Contact your system administrator for further details.

**Download SSH Key** *Download SSH Key* is only necessary, if you use your own tunnel server or an AmmonitOR installation. The SSH public key is used to authenticate the data logger at your server.

**Link to tunnel** In order to get the URL to access your Meteo-40 data logger via Ammonit tunnel, click on *Link to tunnel*.

**Tunnel access code** By using a *Tunnel access code*, you prevent unauthorized Internet traffic from reaching the data logger. This traffic might slow down your connection and increase Internet costs. For the tunnel access code, you can use upper and lower case letters, number, and the underscore. Other symbols are not allowed.

**Tip**

By entering a tunnel access code, connection costs can be saved. The login page of the data logger is not visible for unauthorized users. Thus the URL of the data logger cannot easily be spammed or attacked.

**Note**

Compared with the *Tunnel affix* (available in older Meteo-40 firmware versions), the *Tunnel access code* does not change the URL of your data logger in the tunnel. It remains <https://dnnnnnn.tunnel.ammonit.com/>.

Once the *Tunnel access code* has been entered in your browser, it is saved as cookie on your PC. The *Tunnel access code* has only be entered again on your PC after the cookie has been deleted.

**Tip**

By using the Ammonit Tunnel server with *Tunnel Access Code*, you can boost your connection to your data logger. The Ammonit Tunnel server recognizes the IP address of your data logger in the field. In some cases the IP address is accessible from outside (routable IP address of the installed SIM card). However, in this case you can directly access your data logger via its IP address. There is no need to use the circuit via the Ammonit Tunnel server in Germany. The Ammonit Tunnel server still manages the connection. Thus you access the web interface of the data logger via a simple URL: <https://dnnnnnn-direct.tunnel.ammonit.com>. This feature works with all Ammonit Meteo-40 data loggers, no matter which firmware version is installed.

In order to access the data logger via tunnel, the URL of the data logger has to be entered in your browser, i.e., <https://dnnnnnn.tunnel.ammonit.com/>. On your first access via tunnel you have to enter the *Tunnel access code*, see Figure 7.4.

URL: <https://D151234.tunnel.ammonit.com/>



Ammonit Meteo-40 Tunnel

Please enter your access code

The tunnel access code or affix must be configured on your data logger under Communication/Online. If no access code is configured, try Ammonit.

The tunnel access code prevents unauthorized access to the login page of the data logger.

Figure 7.4: Entering the Tunnel Access Code

**Prevent implicit tunnel activation** The data traffic can be reduced by selecting this checkbox. The feature is especially designed for satellite communication. By activating the checkbox, the tunnel is only established according to the configured schedule (see Section 7.2). Other tunnel activations are prevented.



#### Important

Meteo-40 can only be accessed via tunnel server, when the data logger is online! The online periods are configured in the Communication → Schedule menu.

If Meteo-40 is configured for the Ammonit Tunnel Server and your data logger is currently not online, the following page (see fig Figure 7.5) will be displayed.

URL: <https://D151234.tunnel.ammonit.com/>

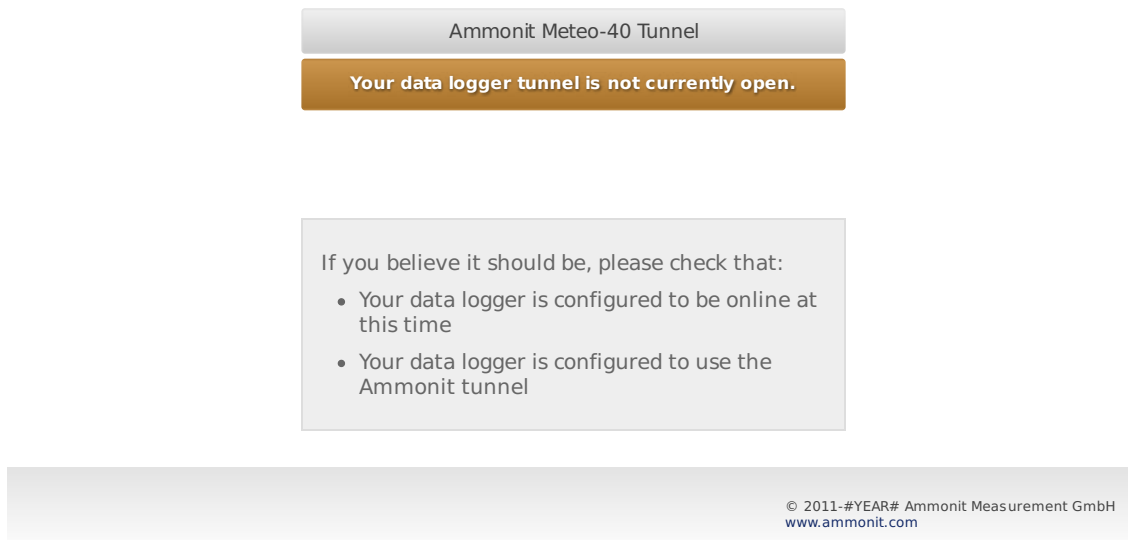


Figure 7.5: Communication via Ammonit Tunnel (closed tunnel)

**Remove tunnel identification** Public key cryptography is used at Meteo-40 to identify the tunnel server in order to prevent man-in-the-middle attacks. During the installation, Ammonit includes the ssh host fingerprint of the official tunnel server in the known hosts list of every data logger, to make possible the use of the tunnel service. If you are using a custom tunnel server, the new fingerprint will be added to the data logger known hosts list on the first access to your tunnel server. If the tunnel server ssh host key changes due to a server relaunch you must delete the old tunnel host identification in order to allow the connection.

## 7.4 Configuration for using AmmonitOR

In the Communication → AmmonitOR the AmmonitOR server can be selected, and one can configure which kind of data is send to AmmonitOR.

If Meteo-40 user Admin set the option Force Encryption, the parameters cannot be changed by user User.

**Note**

If you do not have an AmmonitOR account yet, go to the [AmmonitOR login page \(https://or.ammonit.com/access/login/\)](https://or.ammonit.com/access/login/) or click on *Link to AmmonitOR* to register. Further details about AmmonitOR and a user manual can be found on [www.ammonit.com \(http://www.ammonit.com\)](http://www.ammonit.com).

---

**AmmonitOR server** Select your preferred AmmonitOR server: Ammonit-hosted installation or your own AmmonitOR server.

If you use the Ammonit-hosted installation, server details are filled automatically. If you use your own installation, enter the necessary server details. Your local AmmonitOR server has to authenticate each data logger. To do so, see Section 7.4.1.

**AmmonitOR project key** Enter the *Project key* of your related AmmonitOR project. The *Project key* is displayed in the project overview of your AmmonitOR project. It consists of four to six uppercase letters. You can connect more than one data logger to an AmmonitOR project. To do so, use the *Project key* for all project-related data loggers.

**Server, Port, Username** Name or IP address of your AmmonitOR server, TCP port, and username for upload. These values are automatically set correctly for the Ammonit hosted server.

**Start date** Files older than this date will not be transmitted to AmmonitOR.

AmmonitOR server  
Ammonit AmmonitOR ▼

AmmonitOR project key  
EWNP

Server  
upload.ammonit.com

Port  
4041

Username  
upload

Start date (YYYY-MM-DD)  
\_\_\_\_\_

Send CSV files

Send logbook data  
Yes ▼

Send configuration file

Send camera image

Send data snapshot

Send gust data files

Send secondary CSV files

Send tertiary CSV files

Reset send status

Save and copy test data

Save

Link to AmmonitOR

Download SSH key

Figure 7.6: AmmonitOR Settings

---

Decide, which data should be monitored in AmmonitOR:

AmmonitOR send options

**CSV files** Select this, if you want to send all measurement data to AmmonitOR.

If you do not want your measurement data sent to AmmonitOR, deselect this switch.

**Logbook data** Whether to send logbook entries. Select No to never send them, Yes to send them always on the next day, or Immediately to send them with every scheduled email.

**Configuration file** Select this option, to send the data logger configuration file to AmmonitOR. Passwords and the modem PIN will be stripped of the configuration file for security reasons.

**Camera image** Select this option, to send camera images to AmmonitOR. The camera image is taken at the moment of the sending to AmmonitOR.

**Data snapshot** Select this option, to send data snapshots to AmmonitOR. The data snapshot consists of the measurements just in the moment of sending to AmmonitOR.

---



**Note**

This feature is still considered experimental and might not always work.

---

**Gust data, secondary, and tertiary CSV files** Select this option, to send gust data, secondary, or tertiary CSV files to AmmonitOR.

---



**Note**

This files are only stored on AmmonitOR, but not yet interpreted in any way.

---

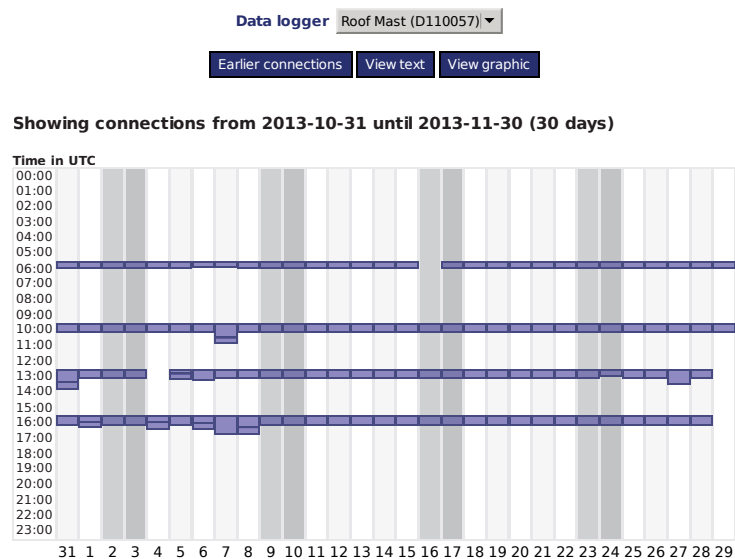


Figure 7.7: Connection Log in AmmonitOR

**Reset send status** With this function, Meteo-40 forgets about ever sending files to AmmonitOR. Any files will be sent again.

**Save and copy test data** This function sends a test file to AmmonitOR. This is useful to check the connection and settings, such as the project key.

**Save** Save the current settings.

**Link to AmmonitOR** Click on *Link to AmmonitOR* to set up a new AmmonitOR account.



**Download SSH Key** Applies only, when you use a local AmmonitOR installation (not the Ammonit-hosted installation). Your AmmonitOR server has to authenticate each Meteo-40 data logger. To do so, download the SSH key and see Section 7.4.1 and AmmonitOR user manual on the [Ammonit website \(http://www.ammonit.com/en/ammonit-customer-login\)](http://www.ammonit.com/en/ammonit-customer-login).

### 7.4.1 Authenticating Meteo-40 at your local AmmonitOR installation

If data files should be uploaded to a local AmmonitOR installation, the local AmmonitOR server has to authenticate each Meteo-40 data logger. To do so, download the *SSH key* from each Meteo-40 data logger. The *SSH key* can be downloaded in the Communication → AmmonitOR menu. Copy the *SSH key* on your local AmmonitOR server.

Open the AmmonitOR administration web interface (admin rights are necessary) and enter the *SSH key* in the Base → SSH keys menu of AmmonitOR. For further details see AmmonitOR manual, which can be downloaded from the [Ammonit website \(http://www.ammonit.com/en/ammonit-customer-login\)](http://www.ammonit.com/en/ammonit-customer-login). After adding the key, the file upload can be configured.

## 7.5 Configuring Email Parameters

In order to receive data via email from the data logger, Meteo-40 has to be connected to the Internet (e.g., via modem) and an email account has to be configured in the Communication → Email menu.



#### Important

Do not use your personal email account for data logger emails. We recommend setting up a separate account. Anyone logged in as either Admin or User on the data logger can access username and password, and consequently the related email account.



#### Tip

It is possible to use email addresses from free service providers, e.g., Yahoo, Gmail, to send data files from Meteo-40.

---

Enter server and account details:

**SMTP server** Enter SMTP server address, e.g., `smtp.mail.provider.com`. SMTP (Simple Mail Transfer Protocol) is a standard protocol used to send emails. SMTP server details can be found in our email account data or contact your email service provider.

**SMTP port** Enter the SMTP port, e.g., 25 or 465, later servers often use 587. The port number can be found in the SMTP server details or contact your email service provider.

**SMTP username** Enter the username, which is used to access your email account. Often the username is the same as the email address.

**SMTP password** Enter the password, which is used to access your email account.

**From** Enter the sender's email address, which is often also the username of the email account.

**To** Enter the email address of the recipient. If more than one email address should be entered, use a semicolon (;) to separate the email addresses.

**Cc** If required, enter the recipient(s), who should receive the email in copy. If more than one email address should be entered, use a semicolon (;) to separate the email addresses.

**POP server (for POP-before-SMTP authorization)** Only required for SMTP servers using POP-before-SMTP or SMTP-after-POP authentication.

**Start date (YYYY-MM-DD)** Indicates which data files should be sent via email. No older files than indicated with the *Start date* will be sent.

Enter the start date in ISO-8601 format: YYYY-MM-DD (e.g., 2016-01-31)

---

All other send options are explained in the AmmonitOR section, [AmmonitOR send options](#).

According to the settings in the Communication → Schedule menu (see Section 7.2), an email is sent to the specified account including one or more CSV files. An email includes all CSV files, generated since the last email has been sent.



**Note**

An email can include up to 10 attachments. If more files are to be transmitted, multiple emails are send.

---

SMTP server

SMTP port (e.g. 25, 465, or 587)

SMTP username

SMTP password  
  Show password

From

To

Cc

POP server (for POP-before-SMTP authorisation)

Start date (YYYY-MM-DD)

Maximal number of attachments

Send CSV files

Send logbook data

Send configuration file

Send camera image

Send data snapshot

Send gust data files

Send secondary CSV files

Send tertiary CSV files

Figure 7.8: Configuring Email Parameters

---

In certain cases it might be necessary to reset the status of the data files sent via email. The data files can be resend, e.g., to another email address or if old files have gone lost. Press *Reset send status* to set the send status of CSV files listed in the Data → Statistics menu to zero. The entered *Start date* indicates the data files, which should be reset for email transfer.



#### Important

Do not forget saving the settings. By clicking the button `Save` and `send test email`, the configuration can be checked.

---



#### Note

In order to test the email function, the data logger has to be connected to the Internet via modem, LAN or W-LAN (WiFi). It is not sufficient to connect Meteo-40 to a PC via USB, because a PC is not necessarily configured as router. If your smartphone is designed for tethering, you can connect your smartphone and configure it as router to test the email function of the data logger.

---

On the *Statistics Data Download* page in the Data → Statistics menu all CSV files, which have been sent via email, have a checkmark. See also Section 6.3.

## 7.5.1 Signing and Encrypting Emails and Attachments

Digital signature and encryption are very complex topics. By digitally signing an email or a file, its authenticity can be verified. A valid digital signature indicates that the email / file has been created by a known sender, e.g., your Meteo-40 data logger (authentication), and the email has not been manipulated on its way to the receiver (integrity). By using encryption, you can encode emails and attachments in a way that third parties cannot read the file, only authorized parties are allowed to open and read the files. A password is required to decrypt emails and files.

Read this section carefully and follow our description step by step to avoid any misunderstandings. For further details about digital signature and encryption, refer to Chapter 14.

Meteo-40 integrates GnuPG, which is a free software to sign and encrypt data files. GnuPG is based on the international standard OpenPGP. Refer to [Wikipedia](http://en.wikipedia.org/wiki/GNU_Privacy_Guard) ([http://en.wikipedia.org/wiki/GNU\\_Privacy\\_Guard](http://en.wikipedia.org/wiki/GNU_Privacy_Guard)) or [GnuPG website](http://gnupg.org/) (<http://gnupg.org/>) for further details.

In the Communication → Email menu emails and attachments can be signed or signed and encrypted using GnuPG.

**Unsigned and unencrypted** If emails should be sent neither with digital signature nor password protected, select this option.

**Sign data (GnuPG)** Select this option to digitally sign CSV and logbook files sent via email. The CSV and logbook files sent by Meteo-40 are signed with a unique digital key. A certificate, indicating the digital signature, is attached to the email for each CSV and logbook file. The attachments can, however, be opened and saved without restriction.

As soon as a signed file is modified, the certificate is invalid.

In order to verify the certificate, download the `Public` key, displayed in the Meteo-40 web interface and import the key into your local verification software, e.g., Gpg4win (see Section 7.5.1.1).

**Sign and encrypt data (GnuPG)** Select this option to sign (as above) and encrypt CSV and logbook files sent via email. Enter an *Encryption password*, which is required to decrypt the file on the recipient's side.

In addition to the digital signature Meteo-40 can encrypt CSV and logbook attachments with a `Private` key. The encrypted files can only be opened by authorized persons with the *Encryption password*. To do so, additional software is required. See e.g. Section 7.5.1.1.

To decrypt the data, download the `Public` key by clicking on the button in the Meteo-40 web interface. Import the `Public` key into your encryption software (see below). The displayed `Fingerprint` is used to authenticate the `Public` key.

### 7.5.1.1 Working with Gpg4win to Decrypt and Verify Files on Windows™ PCs

In order to open and read files, which have been encrypted by Meteo-40, additional software is necessary. We recommend installing GPG4win (GNU Privacy Guard for Windows). Gpg4win enables users to encrypt, decrypt, sign and verify emails and attachments as well as files in a directory. The software includes the following components:

- GnuPG: encryption tool
- Kleopatra: certificate manager for OpenPGP
- GpgOL: add-in for Microsoft Outlook 2003/2007/2010/2013™ for email encryption
- GpgEx: plug-in for Microsoft Explorer™ for file encryption
- Gpg4win Compendium: documentation for beginners and advanced users

Go to the [GPG4win website \(http://gpg4win.de/download\)](http://gpg4win.de/download) and download the current software version. Install the software with the above mentioned components.



#### Note

If you work with Microsoft Outlook™, the program has to be restarted to implement the GpgOL add-in as separate ribbon. For decryption via the GpgOL add-in, go to Section 7.5.1.5.

Before working with Gpg4win, the software has to be configured. Download the `Public` key from the Meteo-40 web interface, as shown in Figure 4.7.



#### Important

Each Meteo-40 data logger has its own unique public key. If you work with different Meteo-40 data loggers, you have to import the public key of each Meteo-40. One user's private key is sufficient to certify the public keys (as shown in Figure 7.11).

Import the `Public` key in Gpg4win via right-mouse click in the Windows Explorer™. A message is displayed after successfully importing the key.

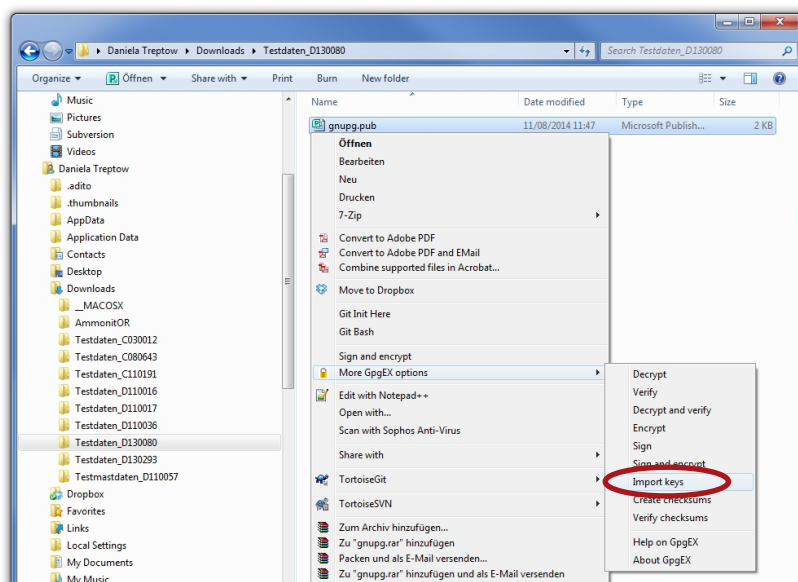


Figure 7.9: Importing the Public key into Gpg4win

Open the Kleopatra software. The `Public` key is listed under *Other Certificates*.

The `Public` key of the Meteo-40 data logger has to be certified by your own key. If a user's private key has already been generated, skip the following task and go on with Figure 7.11.

If no user's private key exists, create a new certificate via the `File` → `New Certificate` menu. Select `Create a personal OpenPGP key pair` and enter the required details. Click `Create key` and enter a high quality password. Your key should have been successfully created.

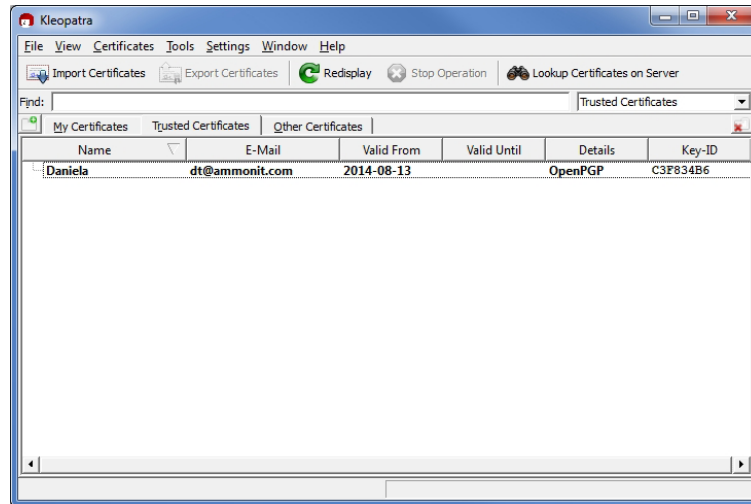


Figure 7.10: Creating the private key

The `Public` key of Meteo-40 has to be certified. Go to `Other Certificates` and select Meteo-40's key. Open the context menu via right-mouse click and select `Certify Certificate`.

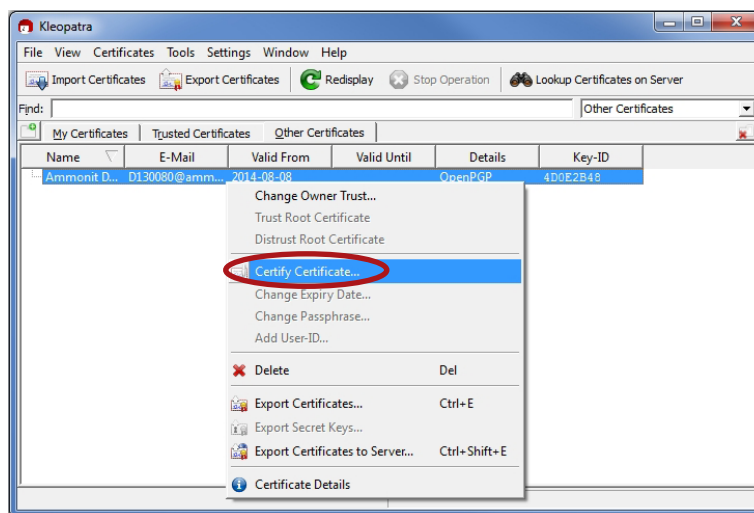


Figure 7.11: Certifying the Public key

Before trusting the certificate, check the displayed `Fingerprint` with the `Fingerprint` shown in the Meteo-40 web interface (see Figure 4.7).

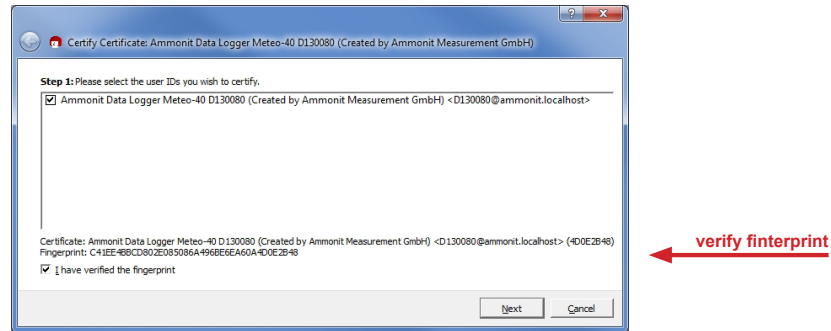


Figure 7.12: Verifying the Fingerprint

Verify the certificate and enter the password for the Private key. The password is used to unlock the Private key for the OpenPGP certificate. Finally both certificates are displayed under *Trusted Certificates*.

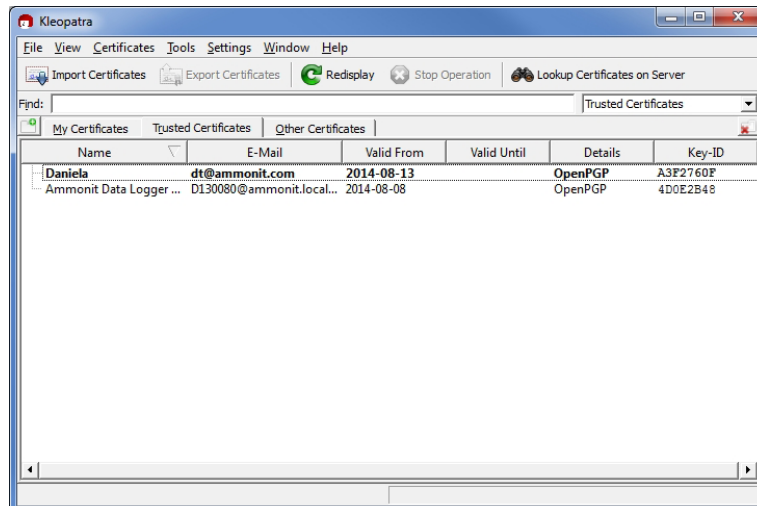


Figure 7.13: Trusted Certificates

### 7.5.1.2 Verifying digital signatures in the Windows Explorer™

If *Sign data (GnuPG)* has been selected, each CSV and logbook file sent by Meteo-40 comes with a detached signature file, i.e., a separate signature file (.sig) is attached to the email. The signature file has the same name as the CSV or logbook file - ending on .sig.

Download and certify the Public key of Meteo-40 as described in Section 7.5.1.1.

Download both related files to your directory. Choose the data or logbook file, which should be verified. Open the context menu with a right-mouse click on the .csv, .gz, .log or .sig file and select *Verify*.

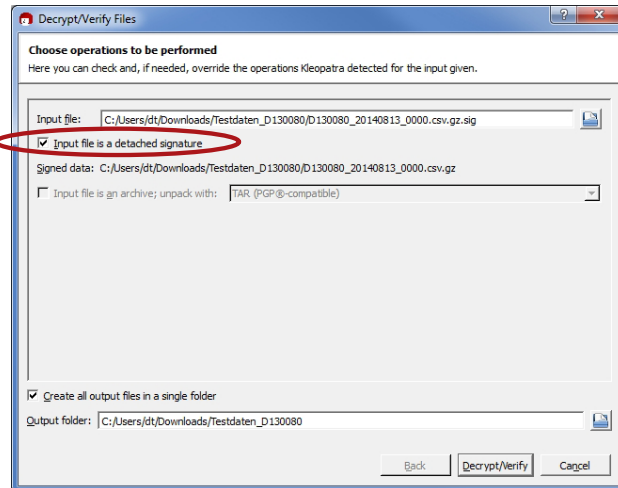


Figure 7.14: Verifying signed files

Make sure that *Input file is a detached signature* is selected. Both related files should be listed, with the signature ending on *.sig* in the *Input file* field. Select *Decrypt/Verify*. After verification the Kleopatra software indicates the validity of the signature.

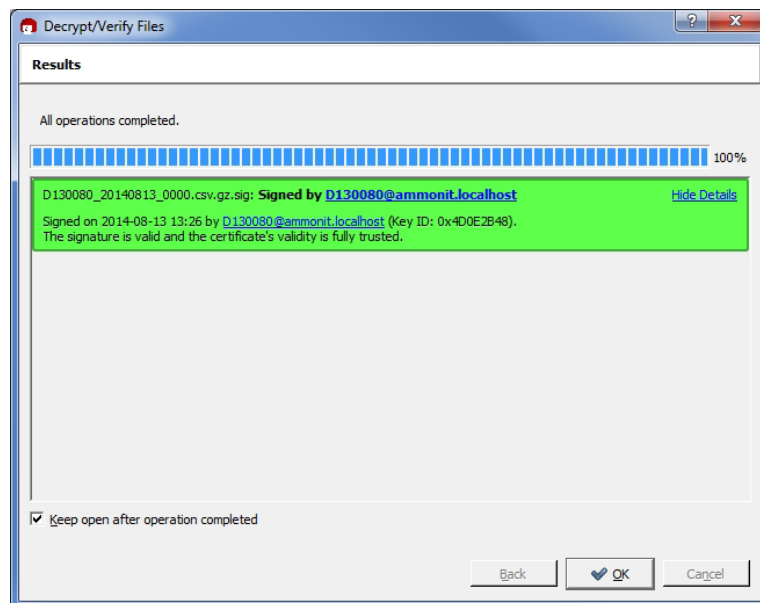


Figure 7.15: Successfully verified signature

### 7.5.1.3 Verifying digital signatures in Microsoft Outlook™

If *Sign data (GnuPG)* has been selected, each CSV and logbook file sent by Meteo-40 comes with a detached signature file, i.e., a separate signature file (.sig) is attached to the email. The signature file has the same name as the CSV or logbook file - ending on *.sig*.

Download and certify the *Public* key of Meteo-40 as described in Section 7.5.1.1.

Open the email and select the file, which should be verified (ending on *.csv.gz* or *.log*). Click on *Save and decrypt* in the *Attachments* ribbon of Microsoft Outlook™.



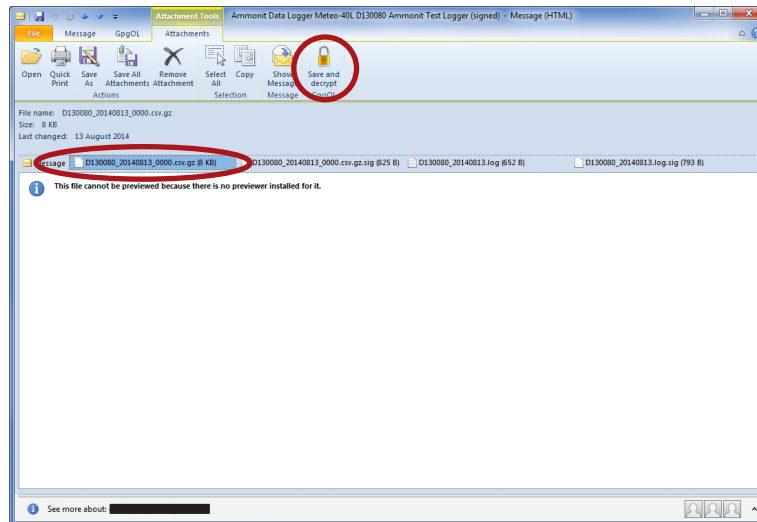


Figure 7.16: Verifying files in Microsoft Outlook™

Make sure that *Input file is a detached signature* is selected. Both related files should be listed, with the signature ending on .sig in the *Input file* field. Select *Decrypt/Verify*.

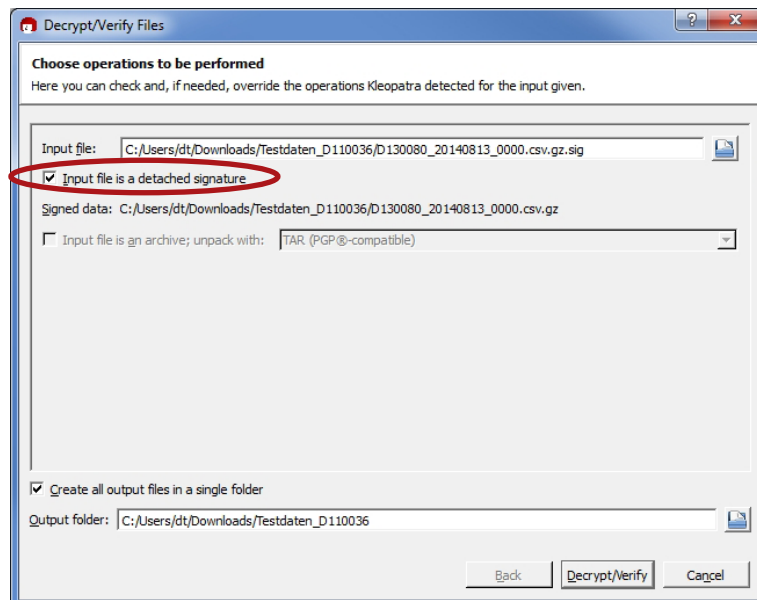


Figure 7.17: Verifying signatures in Microsoft Outlook™

After verification the Kleopatra software indicates the validity of the signature.

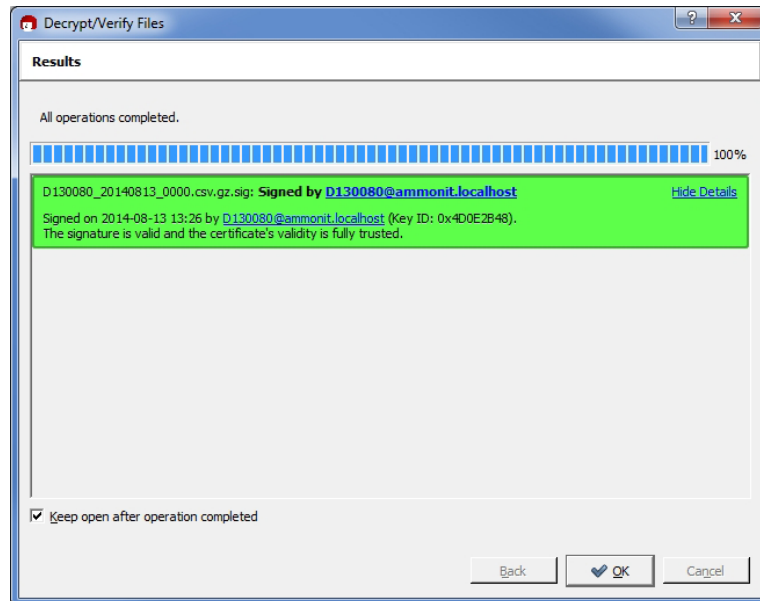


Figure 7.18: Successful validation of the signature

**Note**

If test emails sent by Meteo-40 have been signed, a separate signature file is attached, e.g., Meteo-40.txt.sig. To verify the signature, open the email and select both related attachments, e.g., Meteo-40.txt and Meteo-40.txt.sig. Choose *Save and decrypt* in the *Attachments* ribbon of Microsoft Outlook™. Both files are listed in the Kleopatra software: Input file and Signed data (see Figure 7.19). Select *Decrypt/Verify* to validate the signature.

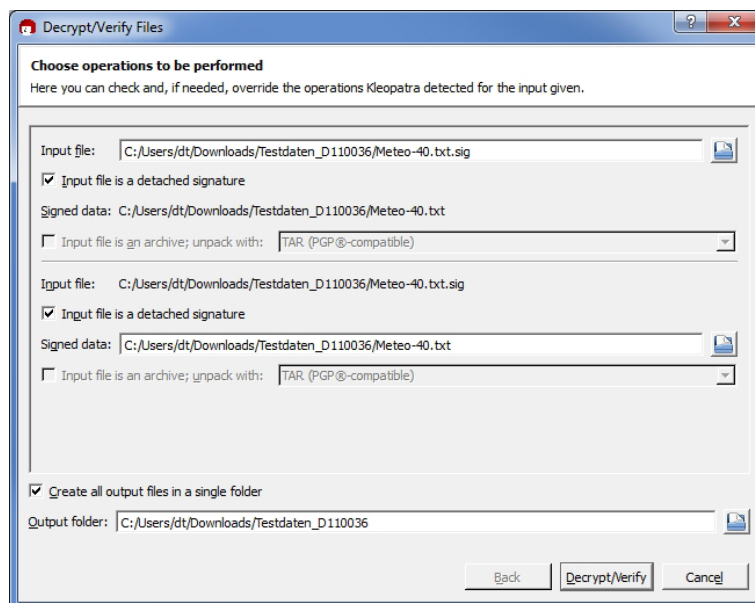


Figure 7.19: Verifying signed test mails

**7.5.1.4 Decrypting files in the Windows Explorer™**

Download and certify the Public key of Meteo-40 as described in Section 7.5.1.1.

Encrypted files can be decrypted in the Windows Explorer™. Right click on the file and select *Decrypt and verify*.

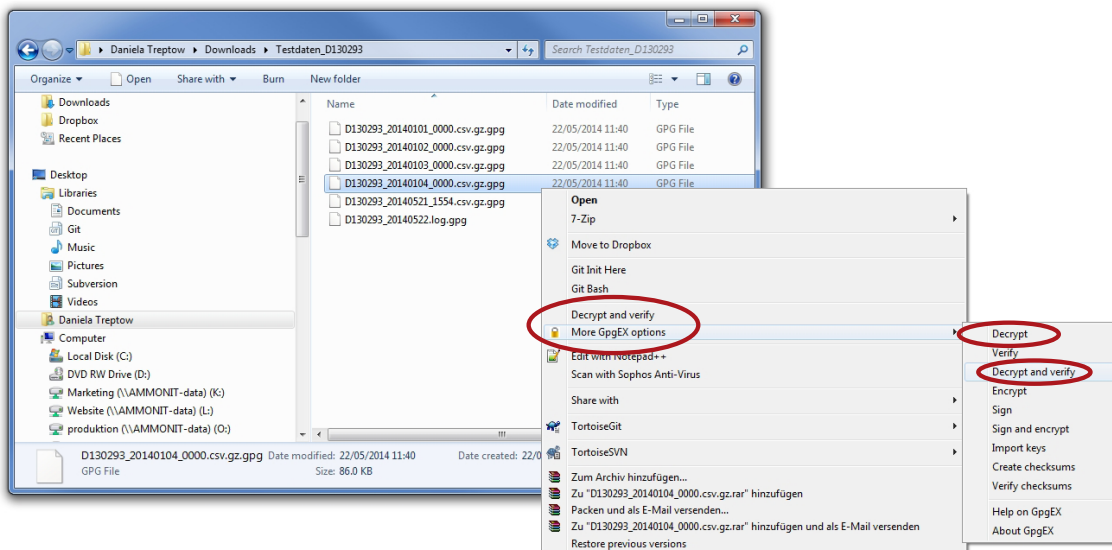


Figure 7.20: Decrypting files via the GpgEx plug-in for Windows Explorer™

Start the decryption process by clicking *Decrypt and verify*.

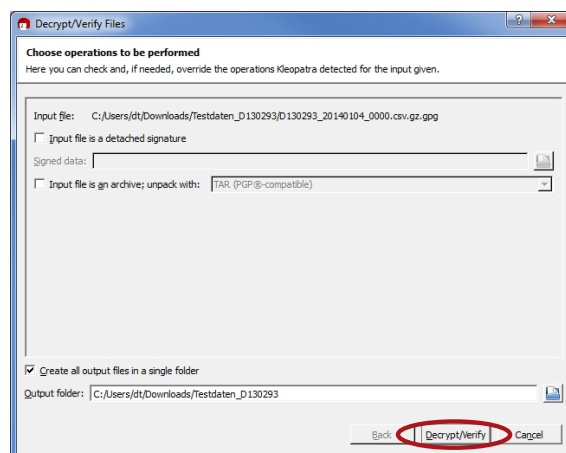


Figure 7.21: Decryption via Kleopatra Software

For decryption enter the password, which you entered for encryption in the Meteo-40 web interface in the System → Administration menu.

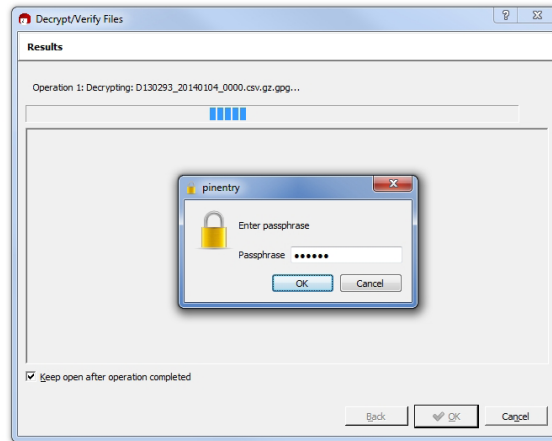


Figure 7.22: Password Prompt for Decryption

After successful decryption the file is displayed in the initial folder or the one selected in the decryption process.

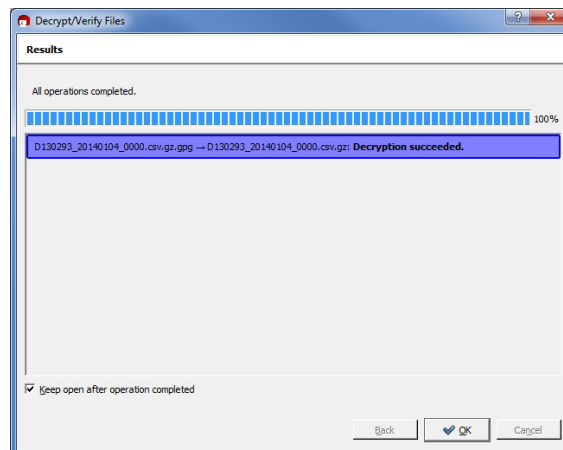


Figure 7.23: Successful File Decryption

### 7.5.1.5 Decrypting files in Microsoft Outlook™

After installing Gpg4win a new ribbon *GpgOL* should be shown in your Outlook™ application. Follow our step by step guide to decrypt encoded data files sent by your Meteo-40 data logger.

Download and certify the `Public` key of Meteo-40 as described in Section 7.5.1.1.

Open the email item and go to the *Attachments* ribbon (Click on one of the attached files). Click on *Save and decrypt* in the *Attachments* ribbon.

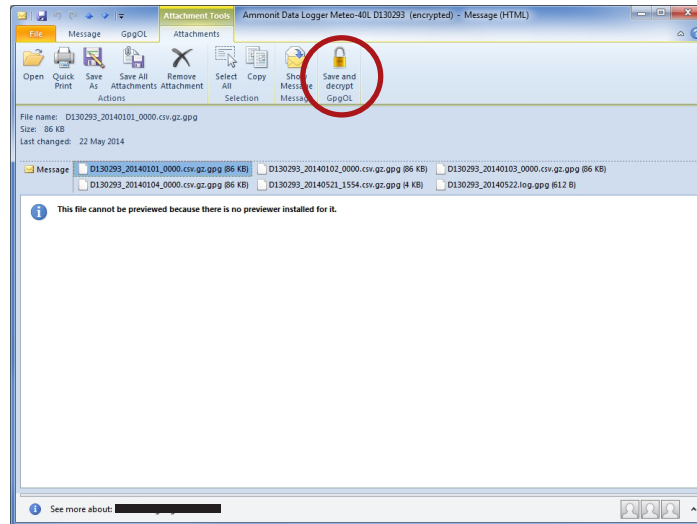


Figure 7.24: GpgOL add-in in Microsoft Outlook™

Select the folder, in which the files should be saved and start the decryption process by clicking on *Decrypt/Verify* in the Kleopatra software. For decryption, enter the passphrase that you configured for encryption in the Communication → Email menu of the Meteo-40 web interface. See also Section 7.5.1.4.

Both encoded and decrypted data files should be successfully saved in the selected folder.



#### Note

In order to verify signed and encrypted test emails sent by Meteo-40, open the email and select *Decrypt* in the *GpgOL* ribbon of Microsoft Outlook™. Enter the password, which has been set for *Encryption* in the Meteo-40 web interface at the System → Administration menu.

## 7.6 Configuring SCP, FTP and SFTP Parameters

By using *SCP/FTP/SFTP* you can upload [CSV files](#) to a server of your choice. To do so, Meteo-40 has to be connected to the Internet, e.g., via modem.

The CSV file upload can be configured in the Communication → *SCP/FTP/SFTP* menu. Meteo-40 offers two methods to upload data:

If Meteo-40 user `Admin` set the option *Force Encryption*, the parameters cannot be changed by user `User`.

**SCP** Select this option to upload files via SCP to your server. The connection is encrypted with RSA 2048 bit. Enter server address, port, username and directory to enable the file upload. Contact your system administrator for the server details.

SCP works only, if you add the data loggers public SSH key to the `authorized_keys` file on the server. SCP with login name and password is not supported. In doubt, ask your server administrator.

All files uploaded via SCP have a checkmark in the SCP column in the Data → Statistics menu. See also Section 6.3.

**FTP** Select this option to upload files to your FTP server. Enter server address, username, password and directory to enable the file upload. Contact your system administrator for the server details.

All files uploaded via FTP have a checkmark in the FTP column in the Data → Statistics menu. See also Section 6.3.



#### Note

FTP transfer always uses *passive mode*, not *active mode*.



**Warning**

The file upload via FTP is not encrypted.

---

**SFTP** SFTP or Secure FTP is similar to SCP. In principal, the same facts apply.

The screenshot shows a configuration form with the following fields and options:

- Method: SCP (dropdown menu)
- Server: [text input field]
- Port: [text input field]
- Username: [text input field]
- Password: [password input field] with a "Show password" checkbox to its right.
- Directory: [text input field]
- Start date (YYYY-MM-DD): [text input field]
- Send CSV files:  (checked)
- Send logbook data: Yes (dropdown menu)
- Send configuration file:  (checked)
- Send camera image:  (unchecked)
- Send data snapshot:  (unchecked)
- Send gust data files:  (unchecked)
- Send secondary CSV files:  (unchecked)
- Send tertiary CSV files:  (unchecked)
- Buttons: "Reset send status", "Save and copy test data", "Download SSH key", and "Save".

Figure 7.25: Configuring the SCP/FTP/SFTP Parameters

By entering a *Start date*, you can configure which files should be uploaded. No older files than the indicated *Start date* will be uploaded.

All other send options are explained in the AmmonitOR section, [AmmonitOR send options](#).

**Important**

Save your configuration. The entered values are reset after moving to another page.

---

Each upload includes all collected CSV files, which have been generated since the last file upload. If it is the first upload, Meteo-40 uploads all CSV files - no matter, how many CSV files have been generated. The sequence of actions can be configured in the Communication → Schedule menu. For further details refer to Section 7.2

**Tip**

If you are using Windows™, you might try the FileZilla (<http://filezilla-project.org>) FTP server. After downloading and installing the software, you have to add a new user. Enter the appropriate fields and select the folder, which should be shared. It is also important to configure Windows™ Firewall by adding an exception for the corresponding port (21 for FTP) and the FileZilla server interface.

---

**Warning**

Make sure to download FileZilla only from its official website or other trusted sources. Malicious versions have been released, that might copy private information to unauthorized parties.

---

## 7.7 Configuring LAN Parameters

**Important**

Restart the data logger or disconnect the Ethernet cable for some seconds to apply new network settings.

---

Meteo-40 data loggers can be connected to your LAN using a standard Ethernet cable. The network connection will be automatically recognized. In order to access the Meteo-40 web interface, enter the assigned IP address `https://nn.nn.nn.nn/` in your web browser. The IP address can be found on the data logger display by selecting the corresponding device at the Communication → Devices → LAN → Ethernet. Refer to Section 2.3 and Chapter 3 for more information about the login.

**Note**

If you are working with Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the data logger to your LAN. The production of Meteo-40 Revision C stopped in October 2012.

---

A table in the Communication → LAN menu displays, which devices are connected, e.g., USB and / or Ethernet with its state, IP address and product (if available).

Screenshot of the Configuration of LAN parameters

Figure 7.26: Configuring LAN parameters

**LAN online, whenever CECS is on** The checkbox is selected by default. Thus after connecting Meteo-40 to LAN via Ethernet, the data logger goes online as soon as the CECS subsystem is switched on.

---

**Use DHCP, static IP, or link-local** By default, Meteo-40 automatically obtains an IP address from a DHCP server. DHCP is active in most of the networks. If *Use DHCP for wired network* is active, the fields below are disabled. For most SCADA applications, the data logger has to be configured with a fix IP address. Thus the use of DHCP server has to be deactivated. See Section 7.7.1 for more information.

---



**Note**

For upgrading the Meteo-40 firmware via the tethering function of your smartphone, the method has to be set to DHCP. See also Section 4.3.1.

---

The `link-local` method is useful for connecting a PC with Meteo-40 directly using an Ethernet cable. This connection will not have an influence over the USB modem communication and can be used for testing the former.

**Connect to Internet via USB modem only (recommended e.g. for SCADA)** Select this checkbox to set the USB modem connection as preferred Internet connection. This checkbox is not selected by default.

This function is only recommended, when Ethernet port is used and USB-modem connections are preferred for the Internet connection, e.g., in SCADA applications or connecting a camera to the Ethernet port.

By choosing a *LAN switch* you can supply your router or modem, e.g., BGAN satellite modem. For further details about BGAN modems refer to Section 7.9.7.

### 7.7.1 Configuring a Static IP address in a LAN

In order to configure a static IP address in a LAN, go to the Communication → LAN menu and select *Static IP*. Enter the details for *IP address*, *DNS server*, *Gateway* and *Subnet mask*.

If the data logger has to be available from other subnets, e.g., if the SCADA Master is located in another network segment, it is possible to add additional subnets. The previously configured gateway will also be used for this subnets. A list of IP numbers and subnet prefixes can be entered in *Additional subnets* field. Use a semicolon (;) to separate the IP addresses, e.g., 192.168.13.0/24;192.168.14.0/24

Screenshot of the Configuration of static IP address

Figure 7.27: Configuring a Static IP Address in a LAN

---



**Note**

If you are working with a SIM card with static IP address, it is not necessary to change the LAN settings. Refer to Section 7.9.3.

---

## 7.8 Configuring W-LAN

For local wireless access to the data logger, you can connect a W-LAN (WiFi) USB stick to Meteo-40. Meteo-40 will create a wireless access point (hotspot) and you can connect to this network and access the data logger web interface.

Before using the W-LAN function, Meteo-40 has to be configured. Go to the Communication → WLAN menu and select the checkbox *Activate W-LAN*. According to the configured *IP address* and *Netmask*, the available IP addresses range is shown.



**Important**

Note down or copy the assigned IP address, as you need this IP address to access the Meteo-40 web interface via W-LAN!

---



Data loggers produced after 2017-05-12 have a default passphrase. The original WLAN passphrase is enclosed in the data logger's delivery. The passphrases are unique for each Meteo-40. If you prefer to change this, you must enter a *Passphrase* consisting of at least eight characters. Click on Save to finish your configuration.

Figure 7.28: Configuring W-LAN Parameters

After successfully configuring the Meteo-40, the new wireless access point must appear among the available wireless networks at your computer. The new W-LAN name is the serial number of the data logger (Dnnnnnn). Select the W-LAN and enter the *Passphrase*.

Open your browser and enter the configured IP address (see Figure 7.28).



**Note**

If you are already connected to a W-LAN, a second W-LAN connection could cause problems.

## 7.9 Configuring the Modem

Meteo-40 can be connected to the Internet via modem to perform scheduled actions. UMTS/GSM/GPRS modems, or BGAN satellite modems can be configured. UMTS/GSM/GPRS modems are configured via the Meteo-40 web interface in the Communication → Modem menu.



**Note**

Depending on the SIM card used in the modem, a different APN (Access Point Name) has to be entered for proper communication. If you use a SIM card with dynamic IP address, you can easily configure the modem via our provider helper, see Section 7.9.1. If you use a SIM card with static IP address, an individual APN might be necessary. Ask your provider for the correct APN. See also Section 7.9.3.

In order to configure a BGAN satellite modem, refer to Section 7.9.7.



**Important**

We recommend configuring the modem in the web interface before connecting the modem to the data logger.



**Tip**

If your SIM card gets lock for some reason, e.g., entering a wrong PIN code, remember the PUK code to create a new SIM card PIN code via the Meteo-40 web interface. See also Section 7.9.5.

On the upper part of the configuration page, the properties of the connected modem are displayed, e.g., signal strength, operator, IP address and supported bands. If there is no modem connected, the fields are empty.

State	Reason	Signal	Operator	IP Address	Product	RX/TX	Bands
Activated		85%	o2 - de	10.53.108.67 (USB3)	Cinterion PHS8-P REVISION 03.001	5084/5198	GSM/GPRS/EDGE 900 MHz, GSM/GPRS/EDGE 1800 MHz, GSM/GPRS/EDGE 1900 MHz, GSM/GPRS/EDGE 850 MHz, WCDMA 2100 MHz (Class I), WCDMA 3GPP UMTS 800 MHz (Class VI), WCDMA 3GPP UMTS 850 MHz (Class V), WCDMA 3GPP UMTS 900 MHz (Class VIII), WCDMA 3GPP UMTS 1900 MHz (Class II)

Use provider helper

Number: \*99#

APN: internet

Username:

Password:

Modem online, whenever CECS is on (recommended)

Modem switch (typically S1): S1

PIN:

Save

New PIN:

PUK (for changing the PIN):

Save new PIN

SMS

set APN and provider details with the help of a wizard

establish online connection, whenever CECS is running

select modem switch

use these fields to change the SIM PIN or set a new one

Figure 7.29: Modem Configuration

In the upper part of the screen, the current modem and connection properties are displayed:

**State** Connection status

**Reason** Reason of connection failure

**Signal** Signal strength  
**Operator** Mobile network operator  
**IP Address** IP address of modem  
**Product** Product details  
**RX/TX** Received/transmitted bytes  
**Bands** Radio bands supported by the modem

Use the *Provider Helper*(see Section 7.9.1) to complete the required information or enter the details manually:

**Number:** Depending on your provider, the phone number of the GPRS/ UMTS or satellite service has to be entered, e.g., \*99#.

If you are using point-to-point protocol ( PPP, TCP/IP connection without GPRS or UMTS), enter the phone number in the relevant field. In this case, the APN is not important, but username and password probably are, depending on your provider.

In case of doubt contact your provider.

**APN (Access Point Name):** Enter the APN of the GPRS/ UMTS network, which can be requested from the provider or can be found in the Internet. CDMA does not require an APN.

Use the [Provider helper](#) to set APN and provider details automatically. Check the details with your provider. See Section 7.9.1.



#### Important

If you are using a SIM card with static IP address, the APN is different from the one offered in the *Provider helper*. Ask your provider for the exact APN. See also Section 7.9.3.

**Username:** Enter the username for the APN, if applicable.

The username will automatically be set by selecting the APN via the [Provider helper](#).

**Password:** Enter the password for the chosen APN.

Password is automatically set after selecting the APN via [Provider helper](#).

**Modem online, whenever CECS is on** The checkbox is selected by default. Thus the modem establishes an online connection as soon as CECS is switched on (automatically or manually). See also Section 7.9.4.

If the checkbox is deselected, the modem only turns on according to the defined actions in the schedule (see Section 7.2).



#### Note

The default setting with activated checkbox *Modem online, whenever CECS is on* can increase power consumption - depending on modem type and location of the next transmitting mast.



#### Tip

By deactivating the checkbox *Modem online, whenever CECS is on*, connection costs can be saved. The modem will only be switched on according to the scheduled actions. A running CECS system for maintenance purposes does not switch the modem.

**Modem switch:** A switch can be selected for automatic control of modem power supply at the *Modem switch* combo box (see Section 4.6). An external relai will be controlled by the switch (see also Figure 13.1 for electrical connection plans). The modem will be power cycled as needed to prevent possible modem hangups.



#### Important

If the modem is connected via relay to the data logger, a switch must be configured. Without selecting a switch for the modem, it will not be power cycled on data logger restart, e.g. after installing an upgrade or at the end of an action requiring communication. The assigned switch has to be saved to the data logger configuration. We highly recommend the usage of a modem switch, the modem may otherwise misbehave.

In Meteo-40 firmware version higher than 1.0 Rev.13915 switch S1 is set by default for the modem. If a different switch is used to control the modem relai, it must be accordingly selected. If the switch is not used for the modem, it can be deselected.

**Note**

The switch configured for the modem supply is not available for sensor configuration.

---

**Important**

If you use a BGAN satellite modem, a switch for the LAN connection has to be assigned in the Communication → LAN menu (see also Section 7.9.7).

---

**PIN:** Enter the PIN code of the used SIM card.

**New PIN:** This field is used, if you like or have to change the PIN. To use it, you need also to enter the PUK below.

**PUK** The PUK PIN Unlock Key (or Personal Unblocking Code, PUC) is used to activate the new PIN above.

**SMS** Click here to configure short message functions. See Section 7.9.2.

After connecting a modem, Meteo-40 shows certain modem properties in its display in the Communication → Devices → Modem menu. Use the right keyboard button to navigate to the modem properties. Additionally, you can see the properties such as state, signal strength and bands in the table (see Figure 7.29) displayed in the web interface in the Communication → Modem menu.

Apply the configuration by clicking on *Save*. We recommend testing the modem connection. Therefore, activate the checkbox *Modem online, whenever CECS is on*. The state of the modem should change to *Active*, when the modem has been configured successfully.

Close the modem connection by deactivating the *Modem online, whenever CECS is on* mode. If no action is running, the modem connection is closed after 20 minutes from the last user interaction.

The connection will instantly be closed, when CECS is shut down in the System → Administration menu or when the modem is manually disconnected from Meteo-40.

**Important**

If you close the modem connection while accessing the data logger over the modem, you will instantly lose the communication with the data logger and you will not be able to access it until the next scheduled online action ( Communication → Schedule).

---

Resetting the SIM PIN over the Meteo-40 web interface is only possible, when the SIM card has been locked after using a wrong PIN. SIM PUK and new PIN are required to unlock the SIM card.

## 7.9.1 Using the Provider Helper

In order to support users configuring modem settings, Meteo-40 offers a provider wizard, which can be started by clicking on *Use provider helper*. After choosing continent and country, the wizard shows available providers and APNs. Select the relevant APN and click on *Finish* to set APN, username and password in the modem configuration.

**Note**

The *Provider helper* is designed for SIM cards with dynamic IP address. For SIM cards with static IP address, refer to your provider to get the details for the modem configuration. See also Section 7.9.3.

---

The *Provider helper* does not fill in the number field. Enter number and PIN code manually to finish the modem configuration.

Continent  
Europe

Country  
Germany

Provider  
O2

Access point name/CDMA access **available Access Point Names**

internet (o2 MMS)

Finish

Figure 7.30: Meteo-40 Provider Helper

## 7.9.2 Short Message Service

In order to configure the Short Message Service (SMS), go to the Communication → Modem menu and select SMS.



### Important

The Short Message Service on Meteo-40 data loggers can only be used in connection with a PHS8-P modem. Other modems offered by Ammonit do not support this feature.

Enable short message service

Receiver number  
+493060031880

SMSC  
+491760000443

SMS password:  
.....  Show password

Save and send test message

Save

Figure 7.31: Settings for Short Message Service

The parameters are:

**Enable short message service** Tick the checkbox to enable the SMS function of Meteo-40.

**Receiver number** This number is currently only used for sending test messages, i.e. one should enter the telephone number of a mobile phone. The number is not used for other SMS functions of Meteo-40.

**SMSC** The SMSC (Short message service center) has to be configured for some mobile telephony providers and SIMs, for others it is not necessary. In case of doubt, ask your mobile telephony provider.

**SMS password** Enter a password to use the SMS function. Without password the service is not possible. Use at least eight characters for the password (numbers and letters are allowed).

---

### 7.9.2.1 Sending a Short Message

If the SMS feature is activated and a password has been entered, a message can be sent to the telephone number linked with the SIM in the modem. The content must be *password command* where *password* is the configured SMS password and *command* is an SMS command. Be careful typing the password respecting upper and lower cases.

Command	Description
info or just i, like <i>information</i>	Meteo-40 replys to the short message with its serial number, software version, internal voltage, internal current, and internal temperature in that moment, and the current recording pointer, as well as state of switches, modem, and Ethernet.
online or just o, like <i>online</i>	Meteo-40 tries to get online immediately and replys the same details as <i>information</i> .
s N + or s N -, like <i>switch N on/off</i> ( N corresponds to the switch number)	Meteo-40 turns on or off the specified switch and replys the same details as <i>information</i> . E.g.: s1+ to switch on S1 s2- to switch off S2.

Table 7.4: Short Message Commands



#### Note

If you are unsure about the telephone number of the SIM or whether SMS sending works, try the Save and send test message function.

---

### 7.9.3 Working with Static IP SIM cards

If a SIM card with static IP address is used, refer to the configuration details given by your provider to complete the fields in the Communication → Modem menu. The APN for SIM cards with static IP address is different than for SIM cards with dynamic IP address. The *Provider helper* is designed for SIM cards with dynamic IP address.

### 7.9.4 Two Ways to Establish an Online Connection via Modem



#### Note

For testing the USB modem communication you can use a link-local connection over **USB** or **LAN** simultaneously. This connection will not have an influence over the usb modem communication.

---

According to the actions scheduled in the Communication → Schedule menu, Meteo-40 has to establish an online connection. To do so, CECS of Meteo-40 has to be switched on (see also Section 1.4). Meteo-40 offers two possibilities to set up or control the online connection via modem using the checkbox *Modem online, whenever CECS is on*:

**Modem is online to perform a scheduled action (checkbox inactive)** An online connection is established, when it is needed for an action, i.e., sending emails, uploading files or remote access according to the schedule (see also Section 7.2).

**Modem is online, when CECS is running - independent of scheduled actions (checkbox is active; default)** An online connection via modem is established as soon as CECS(see also Section 1.4) of Meteo-40 is activated, either manually or according to the schedule in the Communication → Schedule menu. The connection is closed, when CECS is switched off.

By default the *Modem online, whenever CECS is on* checkbox is activated and the modem always goes online, when CECS is running.

**Important**

The default setting with activated checkbox can increase power consumption - depending on modem type and location of next transmitting mast.

---

We recommended deactivating this option, if the *CECS always active* mode (see Section 4.2) is selected. With activated *CECS always active* mode, the modem will stay permanently online, despite the scheduled online actions.

The mode is independent from the [LAN online mode](#).

## 7.9.5 Reset PIN Code of Locked SIM Card

If a wrong PIN code has been entered and the SIM card has been locked, use its PUK code to create a new PIN code. On the bottom of the modem configuration page you can find the appropriate fields (see Figure 7.29). Click on **Save** to apply the new PIN code, which will automatically be copied in the PIN code field for the modem configuration.

## 7.9.6 Connecting a GSM/GPRS Modem to Meteo-40

We recommend testing the modem connection before final installation in the field.

**Important**

In order to avoid PIN conflicts, we recommend configuring the modem before the modem is connected to Meteo-40.

---

Before connecting the modem to Meteo-40 insert the SIM card into the modem. Afterwards the modem can be provided with power and connected to the data logger. If the modem has been successfully recognized, Meteo-40 shows the connection in its display **Communication → Devices → Modem**.

### 7.9.6.1 Information on Modem Sierra Wireless Airline Fastback Extend EDGE FXT009

If you are using the modem Sierra Wireless AirLine Fastback Extend EDGE FXT009, slide the SIM card into the modem as shown in Figure 7.32.

**Important**

It is very important to lock the SIM card slot after inserting the SIM card into the modem. If the SIM card is not properly placed, connection problems may occur.

---

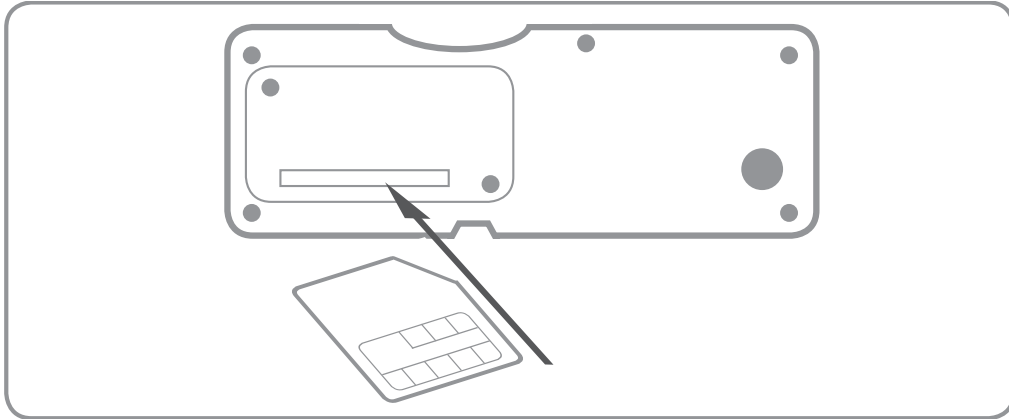


Figure 7.32: Inserting SIM Card into modem Fastback Extend EDGE FXT009

To customize the frequency bands of the modem, connect the modem directly to your computer via USB. If you are using a Windows™ PC and the modem is not displayed in the *Device Manager* under *Modem*, you require a driver file, which can be downloaded from the *Sierra Wireless* (<http://www.sierrawireless.com/>) website. On Linux™ PCs, in general no driver file needs to be installed.

After connecting the modem to your PC, go to the *Device Manager* (see Figure 7.33) and open the properties of the modem by double-clicking on the modem.

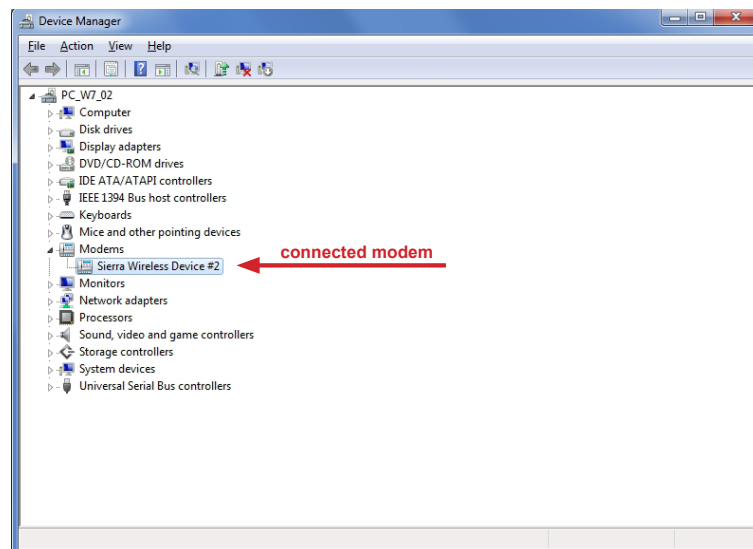


Figure 7.33: Device Manager

Go to the *Modem* tab (see Figure 7.34) to get the name of the *COM Port*, to which the modem is connected, e.g., COM5. Change the *Maximum Port Speed* to 57600 baud rate. Save the changes.



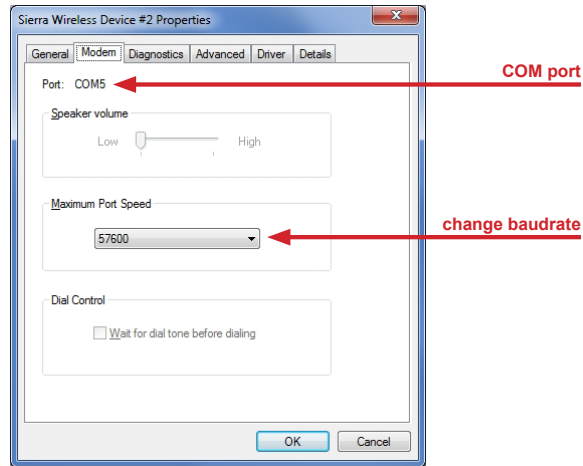


Figure 7.34: Modem Properties

To switch from one supported band to another, you can configure your modem with the help of AT commands.

AT+WMBS=5 (to switch to 850/1900 MHz)  
 AT+WMBS=4 (to switch to 900/1800 MHz)  
 AT+WMBS=7 (to switch to 850/900/1800/1900 MHz)

In order to customize the frequency bands, a standard terminal program like *PuTTY* (<http://www.putty.org/>) can be used. Open the program and enter the port number as *Serial line* and 57600 for the *Speed* as shown in Figure 7.35. Open the command window (see Figure 7.36) of the terminal program. In order to test the connection, enter "at" and press Enter. If OK is shown, the connection is fine and you can change the frequency bands with the above mentioned AT commands.



### Warning

Make sure to download PuTTY only from its official website or other trusted sources. Malicious versions have been released, that might copy private information to unauthorized parties.

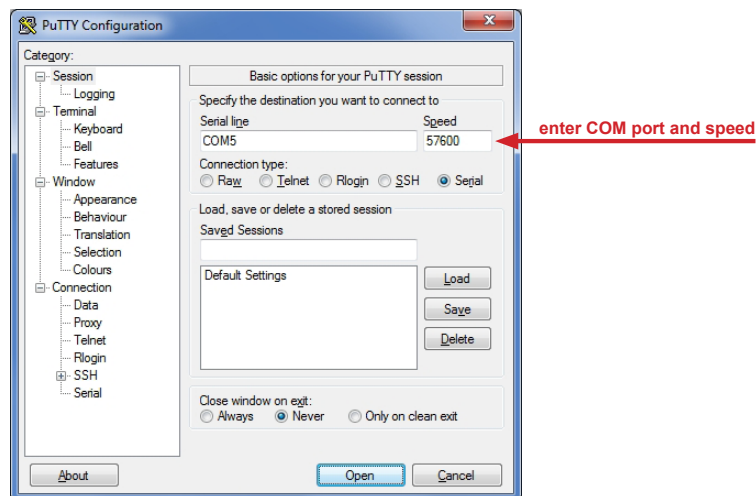


Figure 7.35: PuTTY Configuration

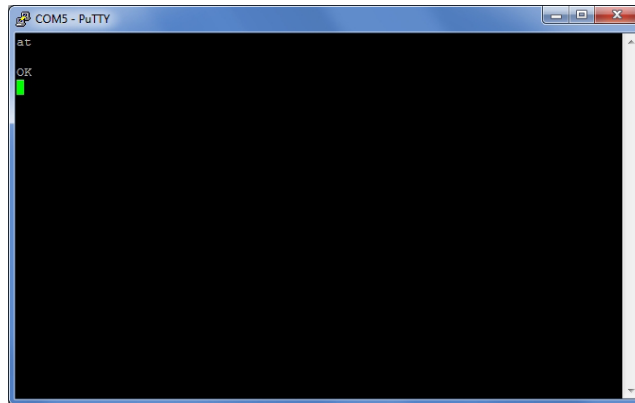


Figure 7.36: PuTTY Command Window



**Important**

Restart the modem after modification.

---

## 7.9.7 Connecting a BGAN Satellite Modem to Meteo-40

### 7.9.7.1 Pointing the terminal to the satellite

It is recommended to test the connectivity outdoors because pointing through a window introduces a slight drop in signal strength. Most units have audible and visual pointing indicators. The terminal first needs to acquire GPS, which may take a long time. Some units will then display pointing information to help with the orientation of the antenna. Line-of-sight to the satellite is required for connectivity.

### 7.9.7.2 Configuring Meteo-40 with BGAN Satellite Modem



**Important**

BGAN modems are not configured using the modem page, but in the LAN page, as shown in Figure 7.26.

---

BGAN satellite modems are connected via Ethernet to Meteo-40. If you are working with Meteo-40 Revision C with RS232 slot, you have to use an USB Ethernet adapter to connect the satellite modem to your data logger.

Configure DHCP to automatically assign an IP address to data logger Ethernet port and modem. Both Meteo-40 and modem must be configured to use DHCP.

Use the software provided by its manufacturer to configure the BGAN satellite modem.

In order to supply the modem, select a *LAN switch* from the dropdown list in the Communication → LAN menu. Hence prior to the scheduled actions, the modem can be supplied via the Meteo-40 switch (see Section 7.7). For testing, the checkbox *LAN online, whenever CECS is on* may be switched on. So the modem goes online as soon as CECS has been switched on. After testing, this setting should be switched off to prevent excessive traffic.

For testing the satellite modem, go to the Communication → Schedule menu and press *Run now* for the online action. Go to the Communication → Online menu and copy the Ammonit tunnel address of the data logger, e.g., <https://dnnnnnn.tunnel.ammonit.com>. Disconnect the data logger from your PC and / or LAN. After entering the copied address in your browser, you should be able to log into the Meteo-40 web interface.

### 7.9.7.3 Recommended Settings for Satellite Connections

URL: https://D151234.local/communication/lan/

The screenshot shows the Ammonit web interface. At the top left, the URL is https://D151234.local/communication/lan/. The Ammonit logo is in the top left, and 'Help Logout Admin on D171234' is in the top right. On the left side, there is a sidebar with recording status (Off), configuration (Saved), connection (ETHERNET, Tunnel), remaining time (∞), and date/time (2017-05-11 14:54:40 UTC). The main content area is titled 'LAN' and contains a list of ten orange boxes with the following text:

- Please turn off 'CECS is always active'
- Please activate AmmonitOR with a valid project key
- Please use AmmonitOR for data transfer
- Please configure a tunnel access code
- Please prevent implicit tunnel activation
- Please use mode for reduced user interface interactions
- Please configure not more than three online times of max. one hour combined
- Please turn off 'LAN online, whenever CECS is on'
- Please do not use EMail for data transfer
- Please use daily CSV files with 10 minute statistics interval

Below the LAN settings, there is a table showing interface status:

Interface	State	IP Address	Product
usb0	Unavailable	169.254.12.34	
eth0	Activated	192.168.12.34	

Below the table, there are several configuration options:

- LAN online, whenever CECS is on
- IP address allocation method: DHCP (dropdown)
- Connect to internet via USB modem only (recommended e.g. for SCADA and Ethernet camera)
- LAN switch (typically S1): S2 (dropdown)
- IP address: 192.168.40.40 (input field)
- DNS server: 192.168.40.1 (input field)
- Gateway: 192.168.40.1 (input field)
- Subnet mask: 192.168.40.1 (input field)
- Additional subnets: (input field)
- Save (button)
- Check optimal BGAN settings (button)

Figure 7.37: Check BGAN optimal settings

Use the Check optimal BGAN settings button to verify if all recommended settings are properly configured.

1. We strongly recommend sending data *only to AmmonitOR*, but not by email. The data transfer to AmmonitOR consumes less bandwidth than email (see Section 7.2 and Section 7.4).
2. Use only few tunnel connections, e.g. twice or thrice a week for twenty minutes (see Section 7.2).
3. Use a tunnel access code to prevent unauthorized access to the data loggers login page (see Figure 7.3) which can generate data traffic.
4. Only for software versions before 1.7.7: To reduce data traffic when using the web user interface, you may want to reduce user interface interactions (see Figure 7.3).
5. Prevent implicit tunnel activation, only recommended for satellite communication (see Figure 7.3).
6. Do not set the check on *LAN online, whenever CECS is on*(see Section 7.7).

- 
7. Be sure to generate not too huge or too many CSV files by keeping the default of one file per day with 10 minutes statistics interval (see Section 6.3). Avoid gust data files, which may get large, depending on configuration and wind conditions.

## 7.10 Troubleshooting

Some mobile service providers and also firewalls in corporate networks restrict the communication of mobile devices to certain ports. The communication of the Meteo-40 data logger might also be affected. There are different incidents, e.g., the tunnel connection does not work, but Rx/Tx traffic is possible or the tunnel is accessible, but sending emails does not work. Reasons for this are often blocked ports by the communication service provider or the firewall or broken DNS.

### 7.10.1 How to perform the test for tunnel and AmmonitOR

In the web user interface, just save the online/tunnel parameters or AmmonitOR settings. In this moment the data logger checks the connection and presents the result.

Alternatively, you can do the check from the LC display. Go to Communication (Figure 7.38). Then select Communication Check (Figure 7.39). This will take some time. After some seconds, you can see the results (Figure 7.40).

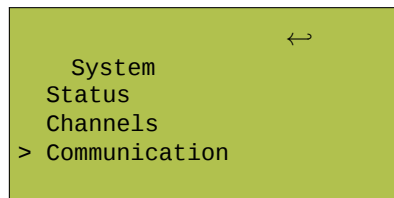


Figure 7.38: Select "Communication"

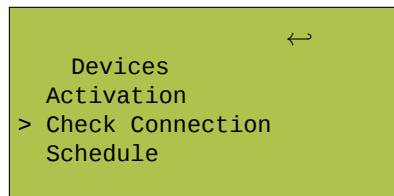


Figure 7.39: Select "Check Connection"

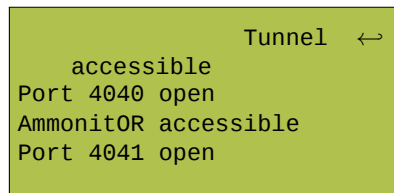


Figure 7.40: View results of check

If one of the servers is not accessible or a port is blocked, please contact your network administrator or mobile service provider.

## Chapter 8

# SCADA

### 8.1 Configuring Meteo-40 for SCADA

Meteo-40 SCADA Server can be used to monitor performance and production of wind farms by providing reliable meteorological data. Meteo-40 data loggers support the standard protocols Modbus TCP/IP over Ethernet as well as Modbus RTU over RS485 (Slave).

SCADA parameters can be configured in the Communication → SCADA menu. In order to activate SCADA for Meteo-40, select the checkbox *Activate SCADA server*.

---

Activate SCADA server

SCADA protocol  
Modbus TCP

TCP port  
502

Allowed client IP address

Modbus unit id  
1

RS-485 slave speed  
19200 bps

RS-485 slave data format  
8N1

Save

Edit Modbus register map

Edit METEO-32 stream map

Figure 8.1: Configuring SCADA Parameters

Depending on the SCADA system in which Meteo-40 is integrated, a protocol for data retrieval has to be chosen:

**Modbus TCP over Ethernet** If you use Modbus TCP, a *TCP port* has to be entered. The default value is 502. If *Allow global access* is selected, the scada server will be accessible over every available TCP connection (e.g. Ethernet, Modem, USB-B), otherwise it will only be available over the Ethernet connection. By entering an IP address in field *Allowed client IP address*, the access to the data can be restricted to a single IP. Only the client with the specified IP address can request data from Meteo-40. If the field is left empty or filled with value 0.0.0.0, any client is allowed to access the data. You can also introduce a list of IP addresses separated by a semicolon (;), e.g., 192.168.13.5;192.168.14.6.

**Note**

In most SCADA systems, the Ethernet interface should be configured properly with a static IP address. Refer to Section 7.7 for further details.

**Important**

If a USB modem is connected to Meteo-40 and Ethernet is used for SCADA, it is necessary to select **Connect to Internet via USB modem onlY** in the **Communication → LAN** menu.

In order to connect Meteo-40 to a fiber optic, an industrial media converter 10/100BaseT to 100BaseFX (-40–75 °C) can be used.

Make sure that your Modbus TCP client is addressing the *Meteo-40 SCADA server* with the proper *Modbus unit ID* configured here. The default value is 1.

Modbus TCP uses the unit identifier for routing purposes in case of addressing a device on a MODBUS or MODBUS+ serial line subnetwork. The Modbus TCP server is still sensitive for this parameter. For further details see *MODBUS Messaging on TCP/IP Implementation Guide V1.0b* recommendations at [The Modbus Organization \(http://www.modbus.org/\)](http://www.modbus.org/).

**Modbus RTU over RS485 S (slave)** If you are using the Modbus RTU protocol, *Modbus Unit ID* and *RS485 serial settings* (speed and data format) have to be selected.

**Note**

Some SCADA clients require a half-duplex (2-wire) RS485 interface. In order to convert the 4-wire RS485 signal delivered by Meteo-40 Revision C data loggers into a 2-wire (half duplex) signal, an accessory module has to be implemented. Refer to the separate data sheet provided by Ammonit. For further details contact Ammonit.

The production of Meteo-40 Revision C stopped in October 2012.

The accessory module is not necessary for Meteo-40 Revision D data loggers (with Ethernet port).

If you are using more than one Meteo-40 data logger in your SCADA system, each data logger requires a unique Modbus Unit ID and all data loggers have to use the same RS485 serial settings (speed and data format).

**Meteo-32 Stream** Used for streaming Meteo-32 data. A Meteo-32 stream map has to be configured. Refer to Section 8.4 for further details.

Save your settings. Otherwise, the configuration is reset to the previous values after moving to another page.

### 8.1.1 CECS power mode

**Important**

To use Meteo-40 SCADA server, the CECS must remain permanently on ( *CECS always active mode*) Figure 8.2( **System → Administration**). This mode is automatically set when the SCADA server is activated in the **Communication → SCADA**. You can only switch it off again after deactivating the SCADA server.

The *CECS always active* mode can be configured manually via the web interface (see Section 4.2) or over the display ( **Status → CECS**, see Section 9.5) of the data logger.

If *CECS always active* mode is selected, it will be displayed in the **status box** of the web interface with the infinity symbol (∞) as well as on the Meteo-40 **display** with the word **Always**.

Figure 8.2: Configuring CECS always active mode for SCADA

If power supply is disconnected and the data logger shuts down while CECS was running in the *CECS always active* mode, it will restart automatically as soon as power is available again.



**Note**

When CECS is configured to be permanently active, you cannot manually shut down the system by pressing the middle button on the data logger.



**Important**

CECS is a fully embedded Linux™ computer (see also Section 1.4). Be aware that the power consumption of Meteo-40 is higher, when CECS is switched on.

### 8.1.2 Statistics selection

It is possible to request both live data and statistics over SCADA (see [available statistics](#)). The *time interval* over which the SCADA statistics will be calculated can be modified in menu Data → Statistics menu (see also Section 6.3.1).



**Important**

The same statistics interval is used for SCADA, the *Switch manager* and the *data snapshots*.

*Summary* statistic is normally used to calculate the summary over a complete day. It is available for precipitation, precipitation intensity, status and sun status evaluations. The SCADA summary interval defaults to daily and can be changed in Data → Statistics menu.

The Modbus register map in the Meteo-40 web interface only shows the selected statistics from the Data → Statistics menu. Go to the Data → Statistics menu and select the required data. See also Section 6.3.1.



## 8.2 Meteo-40 and Modbus

The configurable Modbus Register Map allows Meteo-40 to operate in most existing SCADA systems. The user must determine which measurement values should be available for the SCADA Master and configure a unique register number for each measurement (PDU addressing, first reference is 0). Two separate data blocks are available for input and holding registers. For more information about the supported function codes see the public function code definition from the Modbus application protocol specification [The Modbus Organization \(http://www.modbus.org/\)](http://www.modbus.org/).

All registers in range 0 to 65535 not selected to hold a measurement will contain the hexadecimal value FFFFh. If the register is selected but no valid measurement is present, the invalid value corresponding to the configured data type is written (see Table 8.1).

Data Type	Invalid Value
short (16-bit integer)	7FFFh
ushort (16-bit unsigned integer)	FFFFh
long (32-bit integer)	7FFFFFFFh
ulong (32-bit unsigned integer)	FFFFFFFFh
IEEE 754 (32-bit single precision binary floating point)	7FC00000h
Unix Time	00000000h

Table 8.1: Modbus Invalid values

live data
aggregated data

live data
aggregated data

Input Registers											
Measurements	Live	Avg	Max	Min	SDv	Sum	Med	Val	Summary	Type	Factor
Anemometer, Wind Speed (m/s)	<input type="text" value="2"/>	<input type="text" value="102"/>	<input type="text" value="104"/>	<input type="text" value="106"/>	<input type="text" value="108"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
Wind Vane, Wind Direction (°)	<input type="text" value="4"/>	<input type="text" value="112"/>			<input type="text" value="118"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
Hygro/Thermo, Humidity (%)	<input type="text" value="6"/>	<input type="text" value="122"/>	<input type="text" value="124"/>	<input type="text" value="126"/>	<input type="text" value="128"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
Hygro/Thermo, Temperature (°C)	<input type="text" value="8"/>	<input type="text" value="132"/>	<input type="text" value="134"/>	<input type="text" value="136"/>	<input type="text" value="138"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
A1 (V)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
A2 (V)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
A3 (V)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
A4 (V)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>					float (IEEE754 32-bit)	<input type="text" value="1"/>
C1 (I)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>			float (IEEE754 32-bit)	<input type="text" value="1"/>
Int. Voltage (V)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>						float (IEEE754 32-bit)	<input type="text" value="1"/>
Int. Current (mA)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>						float (IEEE754 32-bit)	<input type="text" value="1"/>
Int. Temperature (°C)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>						float (IEEE754 32-bit)	<input type="text" value="1"/>
Switches	<input type="text"/>									ushort (16-bit)	
Year    Month    Day    Hour    Minute    Second											
Date/Time Live	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				ushort (16-bit)	
Date/Time Statistics	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				ushort (16-bit)	
Date/Time Summary	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>				ushort (16-bit)	
Live    Start    End											
Unix Time	<input type="text" value="0"/>	<input type="text" value="100"/>	<input type="text"/>							ulong (32-bit)	
Unix Time Summary		<input type="text"/>	<input type="text"/>							ulong (32-bit)	

**Holding Registers**

Write measurements to holding registers

Set date/time

Set switches state

**Stored Data Request**

Retrieved unix time

First input register for retrieved data

**Modbus Endianness**

Byte endianness:  ▼

Word endianness:  ▼

Figure 8.3: SCADA Modbus Register Table

**Column Measurements** Name of the evaluation, channel, or measurand. For every measurand either two or four registers are used, depending on the data type selected (see Table 8.2).

Name of date, time, and switches fields. Every single value needs one register, with the exception of the UNIX time (seconds since 1970-01-01 00:00:00 GMT), which needs two registers.

**Columns statistics ( Live, Avg, ... Med)** In these fields, the modbus register number where each measurement

value will be contained must be introduced.

**Type** For each evaluation or channel, a data type can be selected, e.g., `float`, (see Table 8.2).

**Factor** For each evaluation or channel, a scale factor can be selected, e.g., `float`, (see Table 8.2).

**Live data** Describes instantly measured data of the active channels (*A n*, *AC n*, *C n*, *D n*, *M n*, *P n*) and switches (*S n*) as well as instantly evaluated data (Top Anemometer Wind Speed ( m/s), Precipitation ( mm), etc.). All live data values, including Live Date/Time and Live Unix Time, are written in the Modbus store with an atomic operation. This guarantees that the time-stamps, in case configured, match the measurement values.

**Aggregated / statistical data** Statistics can be applied to channels and to evaluated data. All statistics data values, including Statistics Date/Time and Start-End Unix Time, are written in the Modbus store with an atomic operation. This guarantees that the time-stamps, in case configured, match the measurement values

The SCADA interval for statistics calculation (*'Statistics interval for SCADA, Switch manager and snapshots'*) defaults to 10 minutes and can be configured in the Data → Statistics menu. This interval is applied for standard statistics: average (*Avg*), maximum (*Max*), minimum (*Min*), standard deviation (*SDv*), sum (*Sum*, only for status signals), median (*Med*) and value (*Val*). For the Summary statistic, *'SCADA summary interval'* is applied, which defaults to daily. The summary statistic is calculated as a simple moving statistic at the end of every SCADA interval for statistics calculation (i.e. 10 minutes with the default configuration).



**Important**

Only measurements selected in menu Data → Statistics (see Figure 6.4) are available here for retrieval.

---

In order to configure the Modbus slave address of the data logger for serial subnetworks, go to the Communication → SCADA menu. For further details about Modbus see: [www.modbus.org](http://www.modbus.org) (<http://www.modbus.org>).

Option	Description
Measurements Data Type and Scale Factor	<p>Date/time values, i.e., year, month, day, hour, minute, and second, as well as state of the switches are represented as unsigned short values, stored in one 16-bit Modbus register each. Data type and scale factor do not apply to these values.</p> <p>For the measurement value representation, data type and scale factor have to be selected. Data types short, ushort, long and ulong represent a measurement value as an integer and store it in one or respectively two subsequent 16-bit registers. To achieve higher resolution on the representation or a wider range of values represented with a lower resolution, the original measured value can be divided by a scale factor before storing it into the registers as an integer. The default data type is IEEE 754 standard in binary32 format (32-bit single precision binary floating point), being values stored in two subsequent 16-bit Modbus registers. In this last case, scale factor 1 is recommended. See also Equation 8.1.</p>
Modbus Endianness for SCADA Server	<p>According to the Modbus Application Protocol Specification V1.1.b, Modbus is a 'big-Endian' protocol: "Modbus uses a 'big-Endian' representation for addresses and data items. If a numerical quantity larger than a single byte is transmitted, the most significant byte will be sent first." Meteo-40 endianness can be configured by the user via web interface and is set by default to 'big-endian' byte order and 'big-endian' registers order representation (high byte first, high word first). For example for value -4.395978e-11, the representation would be: Table 8.3</p>
Modbus register address interpretation	<p>For historical reasons, some devices use a starting offset to refer to Modbus register addresses, depending on the function code used to read the data. That means, a Modbus client may represent for example Modbus input register 100 with address 30101 and Modbus holding register 100 with address 40101.</p> <p>Meteo-40 does not use this representation. The same measurement values are available as input and as holding register. Only the register address, unique for each measurement that will be retrieved and in range 0 to 65535, must be introduced at the Modbus register table. For the previous example, only 100 should be introduced at the corresponding text box of the register table. The Modbus Master can read the data as holding or as input register.</p>
Modbus Device Identification	<p>Some additional information relative to the physical and functional descriptor of the device is available with function code 43 (see Table 8.4).</p>

Table 8.2: Optional Available Information and configuration

$$\text{Value}_{\text{SCADA}} = \frac{\text{Value}_{\text{Original}}}{\text{Scalefactor}}$$

Equation 8.1: Scale Factor

Representation	Byte Endianness	Word Endianness
AE41 5650	Big (high byte first)	Big (high word first)
5650 AE41	Big (high byte first)	Little (low word first)
41AE 5056	Little (low byte first)	Big (high word first)
5056 41AE	Little (low byte first)	Little (low word first)

Table 8.3: Modbus Endianness for SCADA Server

Object Id	Description	Type
0x00	VendorName: 'Ammonit Measurement GmbH'	ASCII String
0x01	ProductCode: Data logger serial number (e.g. 'D151234')	ASCII String
0x03	VendorURL: 'http://ammonit.com/'	ASCII String
0x04	ProductName: Data logger name (see Section 4.2)	ASCII String
0x05	ModelName: Data logger type (e.g. 'Meteo-40L')	ASCII String

Table 8.4: Modbus Device Identification

## 8.2.1 Input Registers

Input registers contain the measurement values configured by the user. Meteo-40 SCADA server instantly writes measured values in the Live registers and the calculated statistics after each interval in the aggregated data registers. These data can be read with modbus function code 04. Register addresses must be between 0 and 65535. The following values can be accessed in modbus registers, if so configured in the table:

Live and statistical data of all active channels  
 Data logger internal values (Int. Voltage (V), Int. Current (mA) and Int. Temperature (°C))  
 Switches state  
 Unix Time (for live data and start/end of current statistics interval)  
 Live data time stamp (Live Date/Time)  
 Last second of the evaluated interval for statistical data (Statistics Date/Time)

## 8.2.2 Holding Registers

Holding registers can be both read or written. If Write measurements to holding registers is selected, the measurement values from the Input registers table will be also written in the same register numbers from the Holding registers table. They can be read with function code 03.



### Note

To prevent holding registers from being overwritten by the measurements, the holding and input registers ranges cannot overlap if Write measurements to holding registers is selected. This means, you cannot configure a holding register between two input registers. It is recommended to use a complete different range e.g. 0 to 999 for the input registers and 1000 to 2000 for the holding registers.

Holding registers can be written by the SCADA client in order to achieve any of the following implemented functionalities.

**Date/Time synchronization** To synchronise data logger date and time over Modbus, configure the start holding register number for the date/time value (Set Date/Time). By means of a single modbus frame and function code 16 (write multiple registers), year, month, day, hour, minute and second must be written in six subsequent registers, starting at the previously configured register (16-bit unsigned short values).

A successful synchronization will be logged in the [logbook](#)



### Important

It is necessary to allow date and time synchronization over SCADA in Section 4.2.

**Set switches state** If a register number is configured in *Set switches state*, it is possible to set the current state of the switches. You can use modbus function code 6 (write single register) to control the state of all 8 switches with one telegram or function code 5 (write single coil) to set the state of only one switch.

In the first case, you must write into the configured register the integer representing the state of all switches. Each bit determines the state of one switch: "0" for open, "1" for closed switch.

In the second case the configured register is the first address and corresponds to S1. To change the state of switch 'n' (Sn) you must write the coil address

Switch number	S8	S7	S6	S5	S4	S3	S2	S1
Bit Position	7	6	5	4	3	2	1	0

Table 8.5: Set switches state

**Stored Data Request** To request stored data using Modbus, the holding register for the retrieved unix time and the first input register for the retrieved data must be configured. Scale factor and data type configuration from the input registers table will be applied.

*Retrieved Unix Time* contains the register number where the timestamp of the required period must be written. With a single Modbus telegram and function code 16 (write multiple registers), the timestamp must be written as a 32-bit unsigned long in two subsequent holding registers. The statistic values of the first interval starting after the required timestamp is returned.

*First input register for retrieved data* contains the number of the first register where the requested stored data will be available. This offset will be added to the number in the input registers table and the corresponding measurement value will be available there.

All values from the *Stored Data Retrieval* range are written in the Modbus store with an atomic operation. This guarantees that the time-stamps, in case configured, match the measurement values read from the store.

E.g. *Retrieved Unix Time* = 3000, *First input register for retrieved data* = 4000, *Unix Time Start* = 100, *Anemometer Wind Speed Avg* = 102. To retrieve the data from 2016-1-27 15:00:00 the corresponding Unix Timestamp (1453903200) should be written in holding registers 3000 and 3001. After writing the timestamp, the Unix Time at the beginning of the requested interval will be available at register 4000 + 100 = 4100 and the average wind speed for the requested interval will be available at register 4000 + 102 = 4102.



**Note**

In case that no valid measurement values were available for the requested period, the first available period will be returned. It is highly recommended to verify the unix timestamp of the returned data.

### 8.3 Cascading two Meteo-40 Data Loggers using RS485

An easy way to cascade two or more Meteo-40 data loggers to get more measurement channels, is to use one Meteo-40 as RS485 SCADA master, and up to four Meteo-40 as RS485 slaves. All data loggers have to be connected as an RS485 bus.

Please be aware of the following characteristics of the RS485 cascading:

- Due to the additional communication involved, there is a delay on the cascaded channels, between 1 and 2 seconds. For most applications, where only 10 minute average data is relevant, this should not be a problem.
- The CECS of the slave or slaves must be always active, leading to a higher energy consumption.
- The slave or slaves do not necessarily have a connection to the Internet. If there is no additional modem or a router, the data loggers cannot be accessed from remote nor can receive software updates easily.
- The master can only read up to 20 Modbus registers per slave in one read instruction. Instead of using four Meteo-40 slaves, one can also configure the same Meteo-40 up to four times to read different register sets. This allows reading up to 80 Modbus registers from one slave.
- Care has to be taken, that master and slave configuration fit exactly.

### 8.3.1 Configuration of the slave or slaves

The Meteo-40 slave or slaves need to be configured as a SCADA device with Modbus RTU protocol and a unique Modbus unit identifier. Note, that if you need to share more than 20 registers with the master, Meteo-40 will need more than one read requests. Meteo-40 can perform until 8 read requests per second, of 20 registers each. The CECS must be always active.

### 8.3.2 Configuration of the master

At the master side, every slave has to be added as a RS485 sensor ( Other Sensor/ Modbus RTU), introducing slave's unit identifier as RS-485 address. If you need to request more than 20 registers from one slave, you must do this configuring two different sensors with the same slave unit identifier. After selecting the corresponding data type, the resulting evaluations must show the same measurement value as at the slave. For each of the measurement values you should configure a custom evaluation using a linear equation in order to confer it the known unit and data type (see [Evaluation Helper](#)).

## 8.4 Replacing Meteo-32 Data Loggers used for SCADA

To ensure compatibility with Ammonit Meteo-32 data loggers, Meteo-40 offers serial streaming via RS485 S (slave) port. So Meteo-40 can easily replace operating Meteo-32 data loggers in SCADA systems.

After activating Meteo-40 for SCADA in menu Communication → SCADA, select *Meteo-32 Stream* as SCADA protocol and the required *RS485 serial settings* (baud rate and data format). Save the settings.

Activate SCADA server  
 SCADA protocol  
 METEO-32 Stream  
 TCP port  
 502  
 Allowed client IP address  
 Modbus unit id  
 1  
 RS-485 slave speed  
 115200 bps  
 RS-485 slave data format  
 8N1  
 Save  
 Edit Modbus register map  
 Edit METEO-32 stream map

select METEO-32 stream protocol  
 select RS485 baudrate  
 select statistics interval  
 configure METEO-32 stream map

Figure 8.4: Configuring Meteo-40 for Meteo-32 streaming

In order to set up Meteo-40 for Meteo-32 streaming, configure the *Stream Map*. Open it via *Edit Meteo-32 stream map*. The stream map displays all active channels and evaluated data. For data retrieval, special codes have to be entered (unlike Modbus register map!). Refer to [Table 8.6](#) and [Table 8.7](#) as well as the example in [Figure 8.5](#).

Sensor	Code	Unit	Example
Anemometer	s	0.1 m/s	Anemometer 1 = s1 Anemometer 2 = s2
Wind Vane	d	degree	Wind Vane 1 = d1 Wind Vane 2 = d2
Ultrasonic (horizontal wind speed)	u1	0.01 m/s	
Ultrasonic (wind direction)	u2	degree	
Ultrasonic (vertical wind speed)	u3	0.01 m/s	
Humidity	h	% Frel	Humidity 1 = h1 Humidity 2 = h2
Temperature	t	0.1 K	Temperature 1 = t1 Temperature 2 = t2
Air Pressure	b	hPa	Barometric Pressure Sensor 1 = b1 Barometric Pressure Sensor 2 = b2
Pyranometer	r	W/m <sup>2</sup>	Pyranometer 1 = r1 Pyranometer 2 = r2
Precipitation	p	0.1 mm/min	
Analog Voltage	v	0.1 mV	Analog Voltage 1 = v1 Analog Voltage 2 = v2
Counter Input	c	0.1 Hz	Counter Input 1 = c1 Counter Input 2 = c2
Status Input	i	% on	Status Input 1 = i1 Status Input 2 = i2
Int. Temperature	ti	°C + 40	ti
Int. Voltage	vx	V	vx
Int. Current	ic	mA	ic

Table 8.6: Channel Codes for Meteo-32 Stream Map

Value	Code
Average	a
Standard Deviation	s
Minimum	i
Maximum	x

Table 8.7: Statistic Codes for Meteo-32 Stream Map



	Live	Avg	Max	Min	SDv
Backup Anemometer, Wind Speed	<input type="text" value="s4"/>	<input type="text" value="s4a"/>	<input type="text" value="s4x"/>	<input type="text" value="s4i"/>	<input type="text" value="s4s"/>
Low Anemometer, Wind Speed	<input type="text" value="s3"/>	<input type="text" value="s3a"/>	<input type="text" value="s3x"/>	<input type="text" value="s3i"/>	<input type="text" value="s3s"/>
Middle Anemometer, Wind Speed	<input type="text" value="s2"/>	<input type="text" value="s2a"/>	<input type="text" value="s2x"/>	<input type="text" value="s2i"/>	<input type="text" value="s2s"/>
Top Anemometer, Wind Speed	<input type="text" value="s1"/>	<input type="text" value="s1a"/>	<input type="text" value="s1x"/>	<input type="text" value="s1i"/>	<input type="text" value="s1s"/>
Backup Wind Vane, Wind Direction	<input type="text" value="d3"/>	<input type="text" value="d3a"/>	<input type="text" value="d3x"/>	<input type="text" value="d3i"/>	<input type="text" value="d3s"/>
Low Wind Vane, Wind Direction	<input type="text" value="d2"/>	<input type="text" value="d2a"/>	<input type="text" value="d2x"/>	<input type="text" value="d2i"/>	<input type="text" value="d2s"/>
Top Wind Vane, Wind Direction	<input type="text" value="d1"/>	<input type="text" value="d1a"/>	<input type="text" value="d1x"/>	<input type="text" value="d1i"/>	<input type="text" value="d1s"/>
Hygro/Thermo, Humidity	<input type="text" value="h1"/>	<input type="text" value="h1a"/>	<input type="text" value="h1x"/>	<input type="text" value="h1i"/>	<input type="text" value="h1s"/>
Hygro/Thermo, Temperature	<input type="text" value="t1"/>	<input type="text" value="t1a"/>	<input type="text" value="t1x"/>	<input type="text" value="t1i"/>	<input type="text" value="t1s"/>
Int. Voltage (V)	<input type="text" value="vx"/>	<input type="text" value="vxa"/>	<input type="text" value="vxx"/>	<input type="text" value="vxi"/>	
Int. Current (mA)	<input type="text" value="ic"/>	<input type="text" value="ica"/>	<input type="text" value="icx"/>	<input type="text" value="ici"/>	
Int. Temperature (°C)	<input type="text" value="ti"/>	<input type="text" value="tia"/>	<input type="text" value=""/>	<input type="text" value=""/>	

Figure 8.5: SCADA Meteo-32 Stream Map

Click on Save to finish the configuration.



## Chapter 9

# Using the Display

The LC display of Meteo-40 with background light is able to show 4 lines, each with 20 characters. In order to navigate through the menu or to perform an action, use the buttons next to the display.



Figure 9.1: Use of the Meteo-40 buttons

1. Press this button for a few seconds to switch Meteo-40 ( CECS) on or off.
2. Navigate into a submenu or perform an action.
3. Scroll down in the menu list.
4. Leave the submenu, return to the previous menu.
5. Scroll up in the menu list.



### Note

After connecting Meteo-40 to the power supply, the two lower LED lights (red and yellow) turn on for a few seconds. When the LED lights turn off, Meteo-40 is ready and can be switched on.

## 9.1 Assigning Permissions to Display Users

In order to avoid that settings are accidentally modified by a display user, e.g., when measurement data is downloaded on a USB flash drive, you can assign permissions to display users. The configuration can be changed in the System → Display menu (see also Section 4.4.1).

## 9.2 LED Lights

Meteo-40 has four LED lights next to its display. The two upper LED lights have not yet been assigned a function. The two lower LED lights (red and yellow) turn on, when Meteo-40 is connected to a power supply and turn off as soon as Meteo-40 is ready to be switched on. However, the lower LED lights show:

**Red (third from the top)** Indicates errors in measuring operation. For details see the error list in the display System → Errors → Error List.

**Yellow (lower LED light)** Indicates that RS485 sensors are connected. According to the Modbus protocol the LED light blinks, when a measurement is made.

## 9.3 Navigating through the Display Menu

The display menu of Meteo-40 includes four main menu items and several submenu items. The main menu items are *System*, *Status*, *Channel* and *Communication*.

In order to jump into a submenu or to perform an action, press the right button. To return to the previous menu, use the left button. By pressing the upper or the lower button, you can navigate up and down the menu list. For further details see Figure 9.1.

## 9.4 Menu: System

Submenu	Submenu Item	Description
Information	Data Logger	<ul style="list-style-type: none"> <li>Type</li> <li>Serial Number (Dnnnnnn)</li> <li>Channels</li> </ul>
	Version	<ul style="list-style-type: none"> <li>Software version</li> <li>Bootloader version</li> </ul>
	Memory	<ul style="list-style-type: none"> <li>RAM including % of memory used</li> <li>Source Memory including % of memory used. Note, that the value can go beyond 100%, because the memory is organized as ring buffer.</li> </ul>
Time and Date	Clock	Displays date and time, incl. time zone
	Set Clock	Sets date and time on Meteo-40 according to NTP server time and <i>Time Zone</i> defined in the web interface in menu System → Administration
Errors	Error List	Displays the error list
	Clear List	Clears the error list

Table 9.1: Menu: System

## 9.5 Menu: Status

The Status menu includes the information shown in the status box of the Meteo-40 web interface (see Section 3.2 also). In order to switch recording on / off or to save the configuration, press the right navigation button next to the display.

Submenu Item	Description
Rem. Time	<ul style="list-style-type: none"> <li>• Infty = Infinity (if CECS always active is selected)</li> <li>• Remaining time in mm:ss</li> </ul>
Recording	<ul style="list-style-type: none"> <li>• On</li> <li>• Off (no recording, e.g., after changing the configuration)</li> </ul>
Configuration	<ul style="list-style-type: none"> <li>• Saved</li> <li>• Unsaved (changes have been made)</li> </ul>
CECS	<ul style="list-style-type: none"> <li>• When needed</li> <li>• Always (if CECS always active is selected)</li> </ul>
Ethernet	<ul style="list-style-type: none"> <li>• Online</li> <li>• Offline</li> </ul>
Modem	<ul style="list-style-type: none"> <li>• Online</li> <li>• Offline</li> </ul>
Tunnel	<ul style="list-style-type: none"> <li>• Active</li> <li>• Inactive</li> </ul>
Jobs	Number of currently running actions

Table 9.2: Menu: Status

## 9.6 Menu: Channels

The menu channels contains seven submenus: Evaluations, Analog Voltage, Analog Current, Counter, Digital Lines, Switches and Internal. In order to set or display the values, press the right button until the required value appears in the display.

Submenu	Property
Evaluations	Displays current values of the evaluation, e.g., wind speed, wind direction, temperature etc. The order of evaluations is explained in Section 5.1.3.

Table 9.3: Menu: Channels/Evaluations

Submenu	Submenu Item	Property	Range of Values
Analog A1 (Depending on the data logger type, Meteo-40 offers 4, 8 or 12 analog voltage channels)	Measurement	State	On or Off
		Value	Displays the current value
	Settings	Range	0.1 V, 0.1–0.3 V, 1 V, 10 V
		Rate	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>

Table 9.4: Menu: Channels/Analog Voltage

Submenu	Submenu Item	Property	Range of Values
Analog AC1 (Depending on the data logger type, Meteo-40 offers none, 1 or 2 analog current input channels.)	Measurement	State	On or Off
		Value	Displays the current value
	Settings	Range	1 mA, 10 mA, 100 mA
		Rate	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>

Table 9.5: Menu: Channels/Analog Current

Submenu	Submenu Item	Property	Range of Values
Counter C1 (Depending on the data logger type, Meteo-40 offers 4,8 or 12 counters.)	Measurement	State	On or Off
		Value	Displays the current value.
	Settings	Rate	<ul style="list-style-type: none"> <li>• 1 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>

Table 9.6: Menu: Channels/Counter

Submenu	Submenu Item	Property	Range of Values
Digital D1 (Depending on the data logger type, Meteo-40 offers 2,4 or 8 digital channels.)	Measurement	State	On or Off
		Value	Displays the current value
	Settings	Rate	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>
		Type	<ul style="list-style-type: none"> <li>• None</li> <li>• Thies10bit</li> <li>• Thies8bit</li> <li>• Status</li> </ul>
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> <li>• 1/8 s–30 s</li> <li>• 1 min–30 min</li> <li>• 1 h</li> </ul>
	ClockPin	CLK 5 V	Press the right button to force the clock pin to 5 V for 10 seconds.
		CLK 0 V	Press the right button to force the clock pin to 0 V for 10 seconds.

Table 9.7: Menu: Channels/Digital Lines

Submenu	Range of Values
S1 (Displays a list of switches. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.	On or Off

Table 9.8: Menu: Channels/Switches

Submenu	Property
Voltage	Displays the current value
Current	Displays the current value
Temperature	Displays the current value

Table 9.9: Menu: Channels/Internal

## 9.7 Menu: Communication

Submenu	Submenu Item	Property	Description		
Devices	Modem	Product Name (only when a modem is connected)	Quality: displays signal strength		
			Status: <ul style="list-style-type: none"> <li>• Offline</li> <li>• Active</li> </ul>		
			Type: indicates connection mode, i.e., GSM		
			RX Bytes: displays sum of bytes received		
			TX Bytes: displays sum of bytes transferred		
	LAN	USB		State / Interface <ul style="list-style-type: none"> <li>• State: Active</li> <li>• or Unavailable</li> <li>• Interface: usb</li> </ul>	
				IP / Netmask: displays IP address and subnet mask	
				Routes: displays router or gateway address	
				MAC / Speed: displays MAC address of the data logger and the transmission rate	
		Ethernet (network connection)			State / Interface <ul style="list-style-type: none"> <li>• State: Active</li> <li>• Interface: eth</li> </ul>
					IP / Netmask: displays IP address and subnet mask
					DNS Servers: displays DNS server addresses
					Routes: displays router or gateway address



Submenu	Submenu Item	Property	Description
			MAC / Speed: displays MAC address of the data logger and transmission rate Method: DHCP/ Fixed IP/ Link-local (can be selected using the keyboard)
	WLAN	<ul style="list-style-type: none"> <li>• Restart</li> <li>• Active/ Inactive</li> <li>• IP Address</li> </ul>	The WLAN connection can be restarted using the display.
Activation	Modem: When needed or Permanent (can be selected using the keyboard)		
	LAN: When needed or Permanent (can be selected using the keyboard)		
	WLAN: Active or Not active		
Check Connection			Checks the connection to Tunnel and AmmonitOR servers, see Section 7.10.1.
Schedule	Online	<ul style="list-style-type: none"> <li>• Online</li> </ul>	Perform the respective actions immediately, by pressing the right button. The configuration for the actions has to be done beforehand. The dash ( - ) is visible, if the action is not active at the moment, otherwise it show runs or done.
	AmmonitOR	<ul style="list-style-type: none"> <li>• AmmonitOR</li> <li>• AmmonitOR Test</li> </ul>	
	Email	<ul style="list-style-type: none"> <li>• Email</li> <li>• Email Test</li> </ul>	
	Copy	<ul style="list-style-type: none"> <li>• Copy</li> <li>• Copy Test</li> </ul>	
	Generate CSV	<ul style="list-style-type: none"> <li>• Gen. CSV</li> </ul>	
	SMS	<ul style="list-style-type: none"> <li>• SMS Test</li> </ul>	



## Chapter 10

# Sensors

Meteo-40 data loggers are designed for installation in wind and solar measurement campaigns. Thus the data logger is compatible with all relevant sensor types. Depending on the data logger type a different number of sensors can be connected to analog voltage, pulse/counter, digital/serial/status as well as analog current, current source and RS485 channels. See also Chapter 11 and Section 1.3.

Depending on the measurement campaign different sensors are required. Find below a list of measurement instruments for wind measurement and solar measurement purposes as well as a list of other meteorological sensors and different measurement devices.

**Note**

If the sensor, you want to connect, is not listed in this manual, refer for technical details and connection plans to the data sheets on the Ammonit website (<http://www.ammonit.com>) or contact our sales team (+49-30-6003188-0 or [info@ammonit.com](mailto:info@ammonit.com)).

### 10.1 Sensors for Wind Resource Assessment and Wind Farm Monitoring

In order to evaluate the wind conditions at a specific location, various measurements for wind resource assessment are required. According to IEC 61400-12-1 horizontal wind speed, wind direction as well as air density have to be measured. Wind energy is calculated as follows:

$$P = 1/2\rho \cdot A \cdot v^3$$

Equation 10.1: Calculation of Wind Energy [P]

(where A is the area;  $\rho$  is the air density,  $\rho = p / (R \cdot T)$ , being p the air pressure, T the air temperature and R the gas constant; v is the wind speed)

Therefore, wind speed (v) is the most important parameter, as wind energy (P) is proportional to the cube of wind speed.  $\Delta 1\%$  wind speed  $\approx \Delta 3\%$  wind energy

The following sensors are crucial for wind site assessment:


Sensor	Description	Link
Anemometer (wind speed)	<ul style="list-style-type: none"> <li>• Most important parameter for wind measurement</li> <li>• Wind energy is proportional to the cube of wind speed</li> <li>• Install calibrated cup anemometers or calibrated ultrasonic anemometers</li> <li>• Heated sensors are recommended for measurements in cold climates</li> </ul> <hr/> <p> <b>Note</b> Vertical wind speed measurement for turbulence and wind turbine load analysis with 3D ultrasonic or propeller anemometer.</p> <hr/>	<a href="#">Section 10.6(Anemometers)</a> <a href="#">Section 10.8(Ultrasonics)</a> <a href="#">Section 10.6.2(Propeller Anemometer)</a>
Wind vane (wind direction)	<ul style="list-style-type: none"> <li>• Important parameter for wind farm micrositing</li> <li>• Ultrasonic anemometers also determine the wind direction</li> </ul>	<a href="#">Section 10.7(Wind vanes)</a> <a href="#">Section 10.8(Ultrasonics)</a>
Temperature / Humidity sensor	<ul style="list-style-type: none"> <li>• Important parameters for air density calculation</li> <li>• Wind energy is linear proportional to the inverse of air temperature in K</li> <li>• Measurement of relative humidity recommended at high temperatures acc. to IEC</li> <li>• Combined air temperature and relative humidity sensors available</li> </ul>	<a href="#">Section 10.10</a>
Barometric pressure sensor	<ul style="list-style-type: none"> <li>• Important parameter for air density calculation</li> <li>• Wind energy is linear proportional to air pressure</li> </ul>	<a href="#">Section 10.11</a>
Ultrasonic anemometer	<ul style="list-style-type: none"> <li>• Evaluate horizontal wind speed and direction; 3D ultrasonics measure vertical wind speed for turbulence analysis</li> <li>• Recommended for measurements in cold climates, as ultrasonic anemometers do not have moving parts and can be fully heated</li> </ul>	<a href="#">Section 10.8</a>

Table 10.1: Sensors for Wind Measurement

## 10.2 Sensors for Solar Resource Assessment

Certain solar measurements are necessary to design profitable solar power plants. Refer to the [Ammonit website \(http://www.ammonit.com\)](http://www.ammonit.com) to learn more about solar measurement systems. Depending on application (e.g., PV, CSP, CPV) and size of the solar power plant different measurements are crucial.

Insolation combines Direct Normal Irradiation (DNI) and Diffuse Horizontal Irradiance (DHI). Both are linked according to the formula for Global Horizontal Irradiation (GHI):

$$GHI_{[W/m^2]} = DHI_{[W/m^2]} + DNI_{[W/m^2]} \cdot \cos(\theta)$$

Equation 10.2: Calculation of Global Horizontal Irradiation

(where  $\theta$  is the solar zenith angle)

On a sunny day the insolation is 100 % GHI, 20 % DNI and 80 % DNI·cos( $\theta$ ).

Sensor	Description	Link
Pyranometer	<ul style="list-style-type: none"> <li>Measures GHI (Global Horizontal Irradiation), if installed horizontally</li> <li>Measures GTI (Global Tilted Irradiation), if installed tilted as PV panel</li> <li>Measures DHI (Diffuse Horizontal Irradiation), if shaded by a shadow ball or shadow ring (installation on sun tracker)</li> </ul>	Section <a href="#">10.12.1</a>
Pyrheliometer	<ul style="list-style-type: none"> <li>Measures DNI (Direct Normal Irradiation) and has to be installed on a sun tracker to follow the position of the sun on the sky</li> </ul>	Section <a href="#">10.12.3</a>
Sunshine Duration sensor	<ul style="list-style-type: none"> <li>Indicates the sunshine status as defined by WMO (sunshine = direct irradiation exceeds the level of 120 W/m<sup>2</sup>)</li> </ul>	Section <a href="#">10.12.4</a>
Solar Tracker	<ul style="list-style-type: none"> <li>Capable to orient a payload towards the sun. Can be combined with different solar sensors to measure solar radiation global, direct and diffuse components.</li> </ul>	Section <a href="#">10.12.5</a>
Soiling Measurement	<ul style="list-style-type: none"> <li>Soiling and Irradiance Measurement Systems collect critical data for evaluating PV array performance.</li> </ul>	Section <a href="#">10.19</a>

Table 10.2: Sensors for Solar Measurement

Besides measuring the solar conditions at the site of the planned solar power plant, some additional measurements might be necessary to design the solar power plant, i.e., wind speed, wind direction, air temperature, relative humidity as well as air pressure (see Table [10.1](#)). In some cases soiling detectors and precipitation sensors are required.

### 10.3 Other Sensors for Meteorological Purposes

There are several sensors, which are not mandatory for wind and solar resource assessment, but provide important parameters for ground construction and other influential conditions, e.g., precipitation sensors.

Sensor	Description	Link
Precipitation Rain Gauge	<ul style="list-style-type: none"> <li>Measures the amount of precipitation (rain gauge)</li> </ul>	Section <a href="#">10.13</a>
Laser Precipitation Monitor	<ul style="list-style-type: none"> <li>Calculates SYNOP code (Surface Synoptic Observations)</li> <li>Measures intensity of total precipitation</li> <li>Measures intensity of liquid precipitation</li> <li>Measures intensity of solid precipitation</li> <li>Calculates the amount of precipitation</li> </ul>	Section <a href="#">10.13.2</a>

Table 10.3: Sensors for Meteorological Purposes

## 10.4 Devices for Electrical Measurements

Meteo-40 can be used to connect power meters, multifunction transducers or other electrical measurement devices, e.g., for power curve measurement.

Device	Description	Link
Multifunction Transducer	<ul style="list-style-type: none"> <li>Also power meters or measuring transducers</li> <li>Measure average phase voltage, current, real and reactive power</li> </ul>	Section <a href="#">10.14</a>

Table 10.4: Electrical Measurement Devices

## 10.5 Research Applications

Meteo-40 is also used for research applications. A large and always growing list of formulas, developed and tested in collaboration with specialists, is included in the *Evaluation Helper*. For a complete list of the available formulas see Section [5.3.1](#). Thanks to the *Evaluation Helper*, it is possible to apply a linear formula to a live measured data for later calculation of the standard statistics on this value. Most formulas combine different measurements and constants, like the air density, the covariance or a plain addition. Some special statistics related to turbulences analysis like Obukhov length or turbulence intensity can also be configured. The resulting value will be included in the statistics files.

In some research projects, a higher measurement rate can be needed. Over the RS485 Master ( [RS485-M](#)) port, Meteo-40 offers the possibility to record data from one RS485 sensor with a maximum polling rate of 8 Hz. If more than one RS485 sensor is connected to RS485-M, a maximum polling rate of 1 Hz is available. For the analogue voltage channels Ax, analogue current ACx and digital channels Dx, the highest measurement rate is 8 Hz. Whereas for counter channels Cx and period measurement Px the maximum is 1 Hz.

## 10.6 Anemometers

Anemometers measure the horizontal wind speed (velocity). This parameter is crucial for any wind site assessment. Cup anemometers are the general standard type of anemometers. They are robust and resistant to turbulence and skew winds caused by masts and traverses. Each anemometer should be individually calibrated and equipped with a certified calibration report according to international standards (e.g., MEASNET). At least two anemometers have to be installed on a met mast. Most anemometers can be equipped with electronically regulated heating.

Refer to the Ammonit website (<http://www.ammonit.com/>) to learn more about anemometer behavior and accuracy.

The wind speed ( $v$ ) is determined by the linear function of the frequency (impulse) output ( $I$ ):

$$v_{[m/s]} = \begin{cases} \text{slope}_{[m]} \cdot I_{[1/s]} + \text{offset}_{[m/s]} & : I > 0 \\ 0 & : I = 0 \end{cases}$$

Equation 10.3: Calculation of Wind Speed ( $v$ )

A counter value of 0 will always result in 0, i.e., the offset is ignored in this case.

For wind assessment campaigns it is required to perform an individual MEASNET calibration of each anemometer in a wind tunnel to achieve optimal accuracy. After calibration, use the values for slope and offset according to the calibration protocol.

Anemometers are connected to counter channels (Cx). Refer to Figure 13.11 for the connection diagram. Further details about counter channels can be found in Section 11.2 and Section 12.2.

Anemometers can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.2).

Sensor	Order-No	Description
Thies Anemometer FCA X vibration extended - Modbus	S11200 / S11200H	See Section 10.6.1
Thies Anemometer FCA X one-step calibration - Modbus		See Section 10.6.1
Thies Anemometer FCA X inclination extended - Modbus	S11200 / S11200H	See Section 10.6.1
Thies Anemometer FCA X - Modbus	S11200 / S11200H	See Section 10.6.1
Thies Anemometer FCA X - ASCII	S11200 / S11200H	See Section 10.6.1
Thies Anemometer First Class Advanced	S11100/S11100H	
Thies Anemometer First Class	P6100H/P6100	
Thies Anemometer Compact	S12100H	
Thies Anemometer Classic	P6121H	
Anemometer Vento First Class		
Vector L100 First Class	S14100/S14100H	
Risø P2546A	S16100	
Vaisala Anemometer WAA 252	S15100H	
Young Propeller Anemometer Model 27106T	S17100	See Section 10.6.2
NRG #40 Anemometer	S18200C	
NRG #40 Anemometer linear	S18200C	Pure linear formula
Second Wind C3		
Lambrecht Wind Professional 14522		
Young Wind Monitor	S17200	
Met One 014 mini		
Generic Anemometer		
Generic Anemometer linear		Pure linear formula for NRG anemometers
Generic Anemometer PM		

Table 10.5: Overview Anemometers

**Important**

If you plan to install anemometer NRG #40H (Hall Effect), anemometer Risø P2546A (Reed switch), anemometer Thies (if open drain is used), an external circuitry is needed. This can be solved by an external resistor or - more elegant - using an external module by Ammonit. The external modules allow adaption for many different types of sensors and provide stabilized and ripple-free voltage supply for the sensors. Refer to the data sheet and contact Ammonit for further details.

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**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website \(http://www.ammonit.com/\)](http://www.ammonit.com/).

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Meteo-40 saves all electrically measured values to the source data (see Section 6.7). The calculated wind speed in m/s is saved to the CSV file (see Section 6.6.1).

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**Note**

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

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## 10.6.1 Thies First Class Advanced X

The anemometer Thies First Class Advanced X is a cups anemometer that can be connected to the RS485-M port and offers a list of aggregated informations like vibration frequency, inclination, corrected and uncorrected wind speed. Thanks to the digital communication over the RS485 bus, this supplementary information can synchronously be requested by Meteo-40.

The corrected wind speed (EC 61400-12-1 Edition 2.0 compliant) is the result of correcting the influence of the atmospheric pressure on the measured wind speed. Meteo-40 will acquire the measurement values of the lower table every second, including measured frequency, corrected and uncorrected wind speed and 3-axis vibration frequencies.

If a Modbus RTU implementation is used ('Thies FCA X - Modbus', 'Thies Anemometer FCA X vibration extended - Modbus' or 'Thies Anemometer FCA X inclination extended - Modbus'), the sensor will be uniquely identified on every CECS start by requesting its hardware ID, which will be written in the configuration file. The calibration table, applied to the measured frequency resulting on the uncorrected wind speed at the second position of the table, is requested and saved eitherways in the configuration file. If any changes are detected in either the hardware ID or the calibration table, it is reflected in the [logbook](#), including the time stamp when the calibration was performed and the number of the calibration certificate.

**Important**

Due to the inherent time required in master/slave protocols like Modbus or Thies ASCII protocol, if you want to connect more than four RS485 sensors to the [RS485-M](#) bus and request the measurement value every second, it is not possible to request a long list of measurement data. Modbus protocol is optimizing the amount of data transmitted and you must use the plain version ('Thies FCA X - Modbus') in this case.

---



Model	Channel (Protocol)	Measurement Data	Modbus Reg.
Thies FCA X vibration extended - Modbus	RS485-M (Modbus RTU)	Wind speed corrected depending on the air pressure and calibration table (m/s) Wind speed calculated with current calibration table (m/s) Frequency (Hz) Absolute atmospheric pressure (hPa) Status byte Vibration frequency X (Hz) Vibration amplitude X (mg) Vibration frequency Y (Hz) Vibration amplitude Y (mg) Vibration frequency Z (Hz) Vibration amplitude Z (mg)	35013 35049 35049 35021 35025 35037 35039 35041 35043 35045 35047
Thies FCA X one-step calibration - Modbus	RS485-M (Modbus RTU)	Wind speed calculated from measured frequency (m/s) Housing interior temperature (°C) Absolute atmospheric pressure (hPa) Status byte Vibration frequency X (Hz) Vibration amplitude X (mg) Vibration frequency Y (Hz) Vibration amplitude Y (mg) Vibration frequency Z (Hz) Vibration amplitude Z (mg)	35049 35019 35021 35025 35037 35039 35041 35043 35045 35047
Thies FCA X inclination extended - Modbus	RS485-M (Modbus RTU)	Wind speed corrected depending on the air pressure and calibration table (m/s) Wind speed calculated with current calibration table (m/s) Frequency (Hz) Housing interior temperature (°C) Absolute atmospheric pressure (hPa) Status byte Inclination angle $\theta$ (°) Inclination angle $\rho$ (°) Inclination angle $\varphi$ (°)	35013 35049 35049 35019 35021 35025 35031 35033 35035
Thies FCA X - Modbus	RS485-M (Modbus RTU)	Wind speed corrected depending on the air pressure and calibration table (m/s) Housing interior temperature (°C) Absolute atmospheric pressure (hPa) Status byte	35013 35019 35021 35025
Thies FCA X - ASCII	RS485-M (Thies)	Wind speed calculated with current calibration table (m/s) Wind speed calculated with standard curve (m/s) Wind speed corrected depending on the air pressure and calibration table (m/s)	Telegram 2
Generic Anemometer	Counter	Wind speed corrected/calculated (m/s)	

**Note**

Amplitude vibration unit ist mg, where  $1g=9,81m/s^2$ .

## 10.6.2 Propeller Anemometer Young

The Propeller Anemometer measures horizontal and vertical wind speed. However, it is not classified according to MEASNET and IEC. The anemometer is widely used to measure vertical wind speed to analyse turbulences and the wind load of a turbine.

The anemometer uses a transducer, which converts linearly the rotational speed into DC voltage levels. Connect the sensor to the analog voltage channels (Ax) of your Meteo-40 data logger.

The anemometer can easily be configured in the Meteo-40 web interface via the *Sensor Helper*(see Section 5.1.2).

Sensor	Order-No
Propeller Anemometer Young 27106T	S17100

Table 10.7: Overview Propeller Anemometer

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website \(http://www.ammonit.com/\)](http://www.ammonit.com/).

Meteo-40 stores all electrically measured values to the source data (see Section 6.7). The calculated wind speed in m/s is saved to the CSV file (see Section 6.6.1).

**Note**

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

## 10.7 Wind Vanes

Wind vanes indicate the horizontal wind direction. The evaluation of the wind direction enables the best possible positioning of wind turbines. It is essential that a wind vane covers an entire 360° degree radius - without north gap.

Meteo-40 data loggers are capable of using different types of wind vanes: Digital Wind Vanes and Analog (potentiometric) Wind Vanes. The Meteo-40 data logger comprises digital interfaces to connect several Digital Wind Vanes.

In addition to Digital Wind Vanes Meteo-40 data loggers are capable to make use of classical Analog Wind Vanes using a potentiometer. Ammonit suggests to use a five wire setup with two analog voltage channels to eliminate measurement errors caused by cable length and voltage drops in the supply voltage of the wind vane.

Furthermore, wind direction can also be recorded using wind vanes with data transmission via [RS485-M](#) bus.

### 10.7.1 Digital Wind Vanes TMR

Ammonit recommends installing digital wind vanes TMR to determine the wind direction. Wind vanes TMR deliver higher precision and are less susceptible to mechanical wear because of their solid state design. Ammonit offers wind vane Thies First Class TMR 10-bit serial-synchron and wind vane Thies Compact TMR 10-bit serial-synchron.

Wind Vane	Accuracy
Thies Compact TMR	± 1°
Thies Compact POT	± 2°
Thies First Class TMR	± 0.5°
Thies First Class POT	± 1°

Table 10.8: Comparison of Wind Vane Accuracy

Each wind vane TMR requires one digital channel, whereas potentiometer wind vanes require two analog voltage channels each. By installing wind vanes TMR instead of wind vanes POT, analog voltage channels are available for other analog sensors, e.g., barometric pressure sensor, temperature or humidity sensors.

**Tip**

Considering a measurement system with wind vanes TMR a smaller Meteo-40 model with less channels can be sufficient - for example Meteo-40S with 10 channels (4 analog voltage, 4 counter and 2 digital channels).

Wind vanes TMR are connected to digital channels (Dx). Refer to Figure 13.13 for the connection diagram. Further details about digital channels can be found in Section 11.3 and Section 12.2.

Wind vanes can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.2).

Sensor	Order-No
Thies First Class	S21100H
Thies Compact	S22100 / S22100H

Table 10.9: Overview Wind vanes TMR

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

### 10.7.2 Wind Vanes with Potentiometer

To determine the wind direction with a potentiometer wind vane, e.g., Thies First Class and Thies Compact, Ammonit recommends to use a five wire connection between data logger and wind vane. This five wire connection eliminates voltage drops across the connection cables and also eliminates the negative impact of voltage drops in the sensor's supply. Select the Generic Analog Wind Vane sensor type to connect any wind vane using this equation with the voltage range -10 V–+10 V.

The five wire connection method makes use of two consecutive analog voltage channels of the Meteo-40 data logger:  $A_n$ ,  $A_{n+1}$ .  $A_n$  records the total voltage of the potentiometer (voltage between vane supply and Ground),  $A_{n+1}$  measures the voltage between wiper and Ground. The following equation shows the calculation of the wind direction (D).

$$D_{[^\circ]} = \frac{U_{A_{n+1}[V]}}{U_{A_n[V]}} \cdot 360^\circ + \text{offset}_{[^\circ]}$$

Equation 10.4: Calculation of the Wind Direction (D)

The *Offset*[°] must be filled when the wind vane has not been precisely aligned to the north, e.g., when the wind vane has been aligned to the mast. The offset specifies the angle between the North and the point the wind vane has been aligned to.

---

The Offset for each wind vane is configured in the *Sensor Helper*( see Section 5.1.2) of the Meteo-40 web interface.

Refer to Figure 13.7 for the connection diagram. Further details about analog voltage channels can be found in Section 11.1 and Section 12.2

Sensor	Order-No	Offset
Thies First Class	S21200H	0° (if aligned to the North)
Thies Compact	S22200 / S22200H	0° (if aligned to the North)

Table 10.10: Parameters for the configuration of potentiometric wind vanes



**Important**

If potentiometric wind vanes, e.g., Thies First Class, Thies Compact, Vector W200P, Vector W200P/L, NRG #200P additional resistors for current limitation have to be used in the wiring setup. Contact Ammonit regarding further details about the accessory module!



**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website \(http://www.ammonit.com/\)](http://www.ammonit.com/).

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Meteo-40 stores all electrically measured values to the source data ( Section 6.7). The calculated wind direction in ° (degree) is saved to the CSV file (see Section 6.6.1).



**Note**

The CSV file contains the electrical values according to the chosen statistical interval for all active measurement channels.

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### 10.7.3 Wind Vanes connected to RS485-M

Certain wind vanes have an RS485 interface. Meteo-40 data loggers are capable to address up to eight smart sensors on the [RS485-M](#) bus.



**Important**

If you intend to connect more than one sensor via RS485-M, all connected sensors must use the same protocol and serial settings. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all rs485-connected sensors has to be configured to half duplex. See Section 11.6.

---

Wind vanes can easily be configured in the Meteo-40 web interface via the *Sensor Helper*(see Section 5.1.2). See Table 10.11 for the configuration of RS485 wind vanes.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Wind Vane TMR RS485	Thies	Telegram 3	Mx_1: Wind direction	Serial settings, Address, Half duplex mode
Thies Wind Vane First Class RS485	Thies	Telegram 3	Mx_1: Wind speed Mx_2: Wind direction	Serial settings, Address, Half duplex mode
Thies Wind Vane 8-bit parallel via ICP DAS I7051	DCON	RS485 module to connect two Thies 8-bit parallel wind vanes	Mx_1: Wind direction vane DI: 0–7 Mx_2: Wind direction vane DI: 8–15	Same configuration as for Meteo-32 (Serial settings: 38400 8N1, Address: 6, Checksum: disabled)

Table 10.11: Configuration of RS485 Wind Vanes

Meteo-40 stores all measured values to the source data ( Section 6.7). The wind direction in ° (degree) is saved to the CSV file (see Section 6.6.1).

## 10.8 Ultrasonic Anemometers

Ultrasonic anemometers must be connected to the RS485-M port (see Section 11.6). 2D ultrasonic anemometers measure horizontal wind speed, wind direction and acoustic virtual temperature. 3D ultrasonic anemometers also measure the vertical wind velocity, which is important for turbulence and wind load calculations.



### Important

If you intend to connect more than one sensor via RS485-M, all connected sensors must use the same protocol and serial settings. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all rs485-connected sensors has to be configured to half duplex. See Section 11.6.

The following ultrasonic anemometers are included in the Meteo-40 sensor helper for easy configuration. More Modbus sensors can be configured as Other sensor.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies 2D Anemometer	Thies	Telegram 3	Mx_1: Wind speed Mx_2: Wind direction Mx_3: Acoustic virtual temperature	serial settings, address, half duplex mode, scalar averaging over 1 s
Thies 3D Anemometer	Thies	Telegram 3	Mx_1: Wind speed azimuth Mx_2: Wind direction azimuth Mx_3: Wind speed elevation Mx_4: Acoustic virtual temperature	serial settings, address, half duplex mode, scalar averaging over 1 s
NMEA - Thies Compact Anemometer	NMEA	Telegram 3	Mx_1: Wind direction Mx_2: Wind speed	serial settings, address, NMEA protocol, half duplex mode, scalar averaging over 1 s

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Lufft 2D VENTUS-V200A-UMB	Modbus RTU	input registers 14 and 25	Mx_1: Wind direction Mx_2: Wind speed	serial settings, address, Modbus RTU protocol, parity none
Gill Wind Master (Pro) 3D Anemometer	Gill	Mode 4	Mx_1: Wind direction azimuth Mx_2: Wind speed azimuth Mx_3: Wind speed elevation Mx_4: Sonic temperature (if activated)	serial settings (B5: 38400 bps, 8N1), address (default Q), averaging inactive (G0), sampling rate 20 Hz (P8), polar polled (M4), output format CSV (O1), Sonic temperature activated (A3)
Gill Wind Observer / WindSonic 2D Anemometer	Gill	Mode 4	Mx_1: Wind direction azimuth Mx_2: Wind speed azimuth Mx_3: Sonic temperature (if activated)	serial settings (B5: 38400 bps, F1: default 8N1), address (default A), averaging inactive (G0), sampling rate 20 Hz (P8), polar polled (M4), output format CSV (O1), Sonic temperature optionally activated (A2)
Vaisala WMT700 NMEA MWV	NMEA	WMT700 NMEA MWV Data Message	Mx_1: Wind direction Mx_2: Wind speed	autoSend = 0 (automatic messages disabled), com2_protocol = 11 (WMT700 NMEA profile for serial port COM2 MWV protocol), com2_interf = 0 (RS-485 interface for serial port COM2), com2_delay = 10, wndUnit = 0 (m/s wind speed unit), address = WI (Weather Instruments), device identifier = II

### 10.8.1 NMEA MWV V 2.0

Supported NMEA telegram: \$WIMWV,<dir>,<ref>,<spd>,<uni>,<sta>\*<chk><CR><LF>

- <dir>: Wind direction xxx.x
- <ref>: Reference R = relative
- <spd>: wind speed xxx.x
- <uni>: Wind speed unit M = m/s
- <sta>: Status A = valid
- <chk>: Checksum (8-bit XOR, excluding \$ and \*)
- <CR>: Carriage return code, ASCII 0DH
- <LF>: Line feed code, ASCII 0AH

### 10.8.2 Thies Ultrasonic Configuration Options

Before connecting any Thies sensor to the RS485-M port, it has to be configured. Three Thies ultrasonic types are available: 2D compact, 2D and 3D. You can use the Thies Device Utility software to configure your sensors ( Thies Device Utility software (<https://www.thiesclima.com/en/Products/Accessories-Software/?art=216>)).

Ammonit recommends configuring Thies ultrasonic sensors as follows:

Required settings

- Half duplex for transmission mode
- Unique ID for each sensor connected to the bus

- Heating ON/OFF

Further Thies-specific settings

- Voltage threshold for heating suppression: 17 V (HC=17)
- Serial settings: 38400 bps, 8N1 (data format)
- Average mode: scalar-averaged velocity and vectorial-averaged angle (AM=2)

**Tip**

For more information about Thies acoustic virtual temperature, see sensor's manual.

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### 10.8.3 Lufft UMB Configuration Tool

Before connecting any Lufft sensor to Meteo-40, it has to be configured. Download and install the software **UMB-Config-Tool** (<https://www.lufft.com/de-de/produkte/download-de/software-umb-config-tool>) and follow the next steps:

1. Power on the sensor.
2. Connect sensor's A-, B+ to your computer using RS485 to USB or RS232 adapter.
3. Start *Config-Software-UMB* and setup the connection in the Edit → Connection settings menu.
4. In order to configure the sensor, switch all sensors temporarily to UMB protocol in the *Options* menu (follow instructions).
5. Add the new sensor in the Edit → Sensor menu. Select the appropriate type from the list and ID (default 1). Do not exit this menu, press *Configure* to access the sensor configuration.
6. Load the profile from the sensor (press the button again, if it does not respond). Select the tab with sensor type name and configure as described in the table above (see Section 10.8).
7. Store profile on sensor to apply the configuration changes to the sensor. Save the profile also to your disk to keep a copy of the sensor configuration.
8. Close the configuration program, disconnect and power off the sensor. Connect the sensor to the data logger and power on the sensor.
9. Add the sensor to the sensor list of the data logger in the Measurement → Sensors menu, applying the same configuration.

### 10.8.4 Gill Wind Configuration Tool

Before connecting any Gill sensor to Meteo-40, it must be configured accordingly.

1. Download and install *Gill Wind Com* (<http://www.gill.co.uk/main/software.html>).
2. Use the Wizard tool to change from the default configuration all parameters specified in the upper table (see Section 10.8).
3. Use a different address for each unit connected to the RS485-M. It is recommended that letters A to F, K, M, N, and P are not used since they can appear in a data string and might result in erroneous poll responses.
4. Do not forget to save the configuration report in the *Tools* menu.
5. Close the configuration program, disconnect and power off the sensor. Connect the sensor to the data logger and power on the sensor.
6. Add the sensor to Meteo-40 sensors list in the Measurement → Sensors menu, applying the same configuration.

**Note**

Any wind magnitude lower than defined by sensor's parameter K (default 0.050 m/s) will omit the wind direction.

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**Important**

Gill Wind Master sensors with firmware v7.01 can be networked with other Wind Master units on a 2-wire RS485 bus. Units with older versions cannot be networked.

## 10.9 Weather and Environmental Integrated Monitoring Stations

Weather and environmental stations are capable of measuring a large amount of atmospheric conditions in only one device. To acquire this data the preferred connection is RS485. These sensors can be connected to the RS485-M port (see Section 11.6).

**Important**

If you intend to connect more than one sensor via RS485-M, all connected sensors must use the same protocol and serial settings. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all RS485-connected sensors has to be configured to half duplex. See Section 11.6.

The following weather and environmental stations are included in the Meteo-40 sensor helper for easy configuration. More Modbus sensors can be configured as Other sensor.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Clima Sensor US	Thies	Telegram 6	Mx_1: Wind speed Mx_2: Wind direction Mx_3: Temperature Mx_4: Humidity Mx_5: Air pressure Mx_6: Brightness max. value Mx_7: Direction of brightness Mx_8: Precipitation status Mx_9: Precipitation intensity Mx_10: Precipitation sum Mx_11: SYNOP	BR=384, DM=0, DT=0, TT=0, RD=5
Thies Clima Sensor US VDTHP	Thies	Telegram 2	Mx_1: Wind speed Mx_2: Wind direction Mx_3: Temperature Mx_4: Humidity Mx_5: Air pressure	BR=384, DM=0, DT=0, TT=0, RD=5
Lufft Weather station WS	Modbus RTU	input registers 10, 14, 22, 31 and 47	Mx_1: Relative humidity (act.) Mx_2: Rel. air pressure (act.) Mx_3: Wind direction fast Mx_4: Air temperature (act.) Mx_5: Wind speed fast	serial settings (38400 bps), address, Modbus RTU protocol, parity none



Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Lufft Weather station WS 502	Modbus RTU	input registers 10, 14, 22, 27, 31 and 47	Mx_1: Relative humidity (act.) Mx_2: Rel. air pressure (act.) Mx_3: Wind direction fast Mx_4: Global radiation (act.) Mx_5: Air temperature (act.) Mx_6: Wind speed fast	serial settings (38400 bps), address, Modbus RTU protocol, parity none
Lufft Weather station WS 300	Modbus RTU	input registers 10, 14 and 31	Mx_1: Relative humidity (act.) Mx_2: Rel. air pressure (act.) Mx_3: Air temperature (act.)	serial settings (38400 bps), address, Modbus RTU protocol, parity none
Gill MaxiMet GMX600	Modbus RTU	registers 2 to 20	Mx_1: Wind direction Mx_2: Wind speed Mx_3: Wind direction corrected Mx_4: Air pressure Mx_5: Humidity Mx_6: Temperature Mx_7: Dew point Mx_8: Precipitation sum Mx_9: Precipitation intensity	serial settings, address
TWS100 integrated dust monitoring sensor	Modbus RTU	registers 1 to 14	Mx_1: Wind direction Mx_2: Wind speed Mx_3: Temperature Mx_4: Humidity Mx_5: Air pressure Mx_6: Precipitation sum Mx_7: Global irradiance Mx_8: UV Index Mx_9: Noise Mx_10: Particulate Matter PM <sub>10</sub> Mx_11: Particulate Matter PM <sub>2.5</sub>	averaging interval 1s, serial settings, address

## 10.10 Temperature Humidity Sensors

Temperature sensors measure the air temperature, while humidity sensors measure the air humidity. Both sensors are often applied in combination to reduce cost.

Temperature humidity sensors, e.g., Galltec Active KP, Galltec Active TP, have to be connected to analog voltage channels (Ax). Refer to Figure 13.4 for the connection diagram.

The output signal (U) from the temperature sensor is proportional to the temperature (T) in °C.

$$T_{[^{\circ}\text{C}]} = \text{slope}_{[^{\circ}\text{C}/\text{V}]} \cdot U_{[\text{V}]} + \text{offset}_{[^{\circ}\text{C}]}$$

Equation 10.5: Calculation of Temperature (T)

The output signal (U) from the humidity sensor is proportional to the humidity (RH) in %.

$$RH_{[\%]} = \text{slope}_{[\%/V]} \cdot U_{[V]}$$

Equation 10.6: Calculation of Humidity (RH)

Slope and Offset are internal parameters of the sensor, which are important to calculate temperature (T) in °C and humidity (RH) in %. Both values are pre-configured in the *Sensor Helper*(see Section 5.1.2).



**Note**

For more flexibility, when connecting the combined Galltec temperature and humidity sensor to Meteo-40, two different Galltec Active KP sensors are listed in the *Sensor Helper*(see Section 5.1.2). Two analog channels are needed and thus the order of the signals to be connected is selectable. "Galltec Thermo-Hygro Active KP" assigns the first analog channel to temperature and the second to humidity. As opposite, "Galltec Hygro-Thermo Active KP" assigns the first channel to humidity and the second to temperature.

Sensor	Order-No	Slope	Offset
Galltec Active KP (Temperature + Humidity)	S52100	100 %/V (Humidity) 100 °C/V (Temperature)	0 % (Humidity) -30 °C(Temperature)
Galltec Active TP (Temperature)	S42100	100 °C/V	-30 °C

Table 10.12: Parameters for the configuration of temperature humidity sensors



**Important**

If you install calibrated sensors, enter the values given in the calibration protocol.

Meteo-40 saves all electrically measured values in V to the source data ( Section 6.7). The calculated values for temperature (°C) and humidity (%) are saved to the CSV file (see Section 6.6.1).



**Note**

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.



**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the *Ammonit website* (<http://www.ammonit.com/>).

### 10.10.1 Resistance Temperature Detectors (RTD) / Pt100 / Pt1000

RTDs measure the temperature by correlating the resistance of the RTD element with temperature. Those sensors provide high accuracy and repeatability; the sensors are suitable for precision applications. RTDs use electrical resistance and require a power source to operate.

Platinum Resistance Thermometers (Pt100 / Pt1000) are classified according to DIN EN 60751 - see tolerance classes below.

Tolerance Class	Tolerance in K
Class B1/3 DIN	$\pm(0.10 \text{ K} + 0.0017 \times [t])$
Class A	$\pm(0.15 \text{ K} + 0.002 \times [t])$
Class B	$\pm(0.30 \text{ K} + 0.005 \times [t])$
Class 0.5	$\pm(0.50 \text{ K} + 0.006 \times [t])$

Table 10.13: Tolerance Classes - Platinum Resistance Thermometers (Pt100)

Pt100 / Pt1000 sensors have to be connected to the analog voltage channel and the current source of Meteo-40 data loggers. The sensors can easily be configured via the *Sensor Helper* (see Section 5.1.2) in the Meteo-40 web interface.

Meteo-40 saves all electrically measured values in V to the source data (Section 6.7). The calculated value for temperature (°C) is saved to the CSV file (see Section 6.6.1).

**Note**

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.

### 10.10.2 Temperature Humidity Sensors connected to RS485-M

Some available temperature humidity sensors have to be connected to the RS485-M bus of the Meteo-40 data logger. The sensors can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.2).

**Important**

If you intend to connect more than one sensor via RS485-M, all connected sensors must use the same protocol and serial settings. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all rs485-connected sensors has to be configured to half duplex. See Section 11.6.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Galltec Thermo/Hygro KPC.MS	Modbus RTU	registers 0, 1, 3, 4	Mx_1: Temperature Mx_2: Humidity	Fixed serial settings (19200 8N1)
Campbell Hygro/Thermo CS215	SDI-12	D0	Mx_1: Temperature Mx_2: Humidity	External module needed (address, 19200 8N1, 120Ω termination). See SDI-12.

Table 10.14: Data request for RS485 Temperature Humidity Sensors

Meteo-40 saves all measured values to the source data (Section 6.7). The values for temperature (°C) and humidity (%) are saved to the CSV file (see Section 6.6.1).

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## 10.11 Barometric Pressure Sensors

Barometric pressure sensors measure the air pressure. Air pressure and air temperature should be evaluated for an accurate wind site assessment. It is recommended including an air pressure sensor as part of a measuring system.

Barometric pressure sensors, e.g., AB60, AB100 and Vaisala PTB110, have to be connected to analog voltage channels (Ax). Refer to Figure 13.3 for the connection diagram.

The output signal (U) from the barometric pressure sensor is proportional to the air pressure (P).

$$P_{[\text{mbar}]} = \text{slope}_{[\text{mbar/V}]} \cdot U_{[\text{V}]} + \text{offset}_{[\text{mbar}]}$$

Equation 10.7: Calculation of Air Pressure (P)

Slope and Offset are internal parameters of the sensor, which are important to calculate the air pressure in hPa. Both values are pre-configured for sensors listed in the library of the *Sensor Helper*(see Section 5.1.2).

Sensor	Order-No	Slope	Offset
Ammonit AB60	S31100	60 mbar/V	800 mbar
Ammonit AB100	S31200	100 mbar/V	600 mbar
Vaisala PTB110.1	S32300	120 mbar/V	500 mbar
Vaisala PTB110.2	S32200	100_mbar/V	600_mbar
Vaisala PTB110.3	S32100	60 mbar/V	800 mbar

Table 10.15: Parameters for the configuration of barometric pressure sensors

PTB 110.1: pressure range 500..110hPa, output signal 0..5V

PTB 110.2: pressure range 600..110hPa, output signal 0..5V

PTB 110.3: pressure range 800..110hPa, output signal 0..5V



### Important

If you install calibrated sensors, enter the values given in the calibration protocol.

---

Meteo-40 saves all electrically measured values in V to the source data ( Section 6.7). The calculated air pressure value in mbar is saved to the CSV file (see Section 6.6.1).



### Note

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

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### Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the Ammonit website (<http://www.ammonit.com/>).

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### 10.11.1 Barometric Pressure Sensors connected to RS485-M

Certain barometric pressure sensors have to be connected to the RS485-M bus of the Meteo-40 data logger. The sensors can easily be configured in the Meteo-40 web interface via the *Sensor Helper*(see Section 5.1.2).



#### Important

If you intend to connect more than one sensor via RS485-M, all connected sensors must use the same protocol and serial settings. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all rs485-connected sensors has to be configured to half duplex. See Section 11.6.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Baro Transmitter	Thies	Telegramm 1	Mx_1: Air pressure Mx_2: Temperature	serial settings, address

Table 10.16: Data request for RS485 Barometric Pressure Sensors

Meteo-40 saves all measured values to the source data ( Section 6.7). The air pressure value in hPa is saved to the CSV file (see Section 6.6.1).

## 10.12 Solar Sensors

### 10.12.1 Pyranometers

Pyranometers measure the global horizontal radiation. They are also used as reference instruments thanks to their measurement precision. The use of this sensor is crucial for measurements with solar-powered applications.

Meteo-40 indicates for pyranometers the global horizontal irradiation (GHI).

Pyranometers, e.g., MS series of EKO Instruments or CMP series of Kipp & Zonen, have to be connected to analog voltage channels (*Ax*). Refer to Figure 13.2 for the connection diagram.

The output signal (*U*) from the pyranometer is proportional to the solar irradiance (*E*) in  $W/m^2$ .

$$E_{[W/m^2]} = \frac{U_{[\mu V]}}{\text{Sensitivity}_{[\mu V/[W/m^2] ]}}$$

Equation 10.8: Calculation of Solar Irradiance (*E*)

*Sensitivity* is an internal parameter of the sensor, which is important to calculate the radiation in  $W/m^2$ . The value is given in the calibration certificate of the sensor.



#### Note

Some EKO pyranometers allow the internal configuration of the sensitivity value. In that case, you must introduce a sensitivity of  $1 \mu V/[W/m^2]$  at the sensor helper.

Sensor	Order-No
CMP 3	S61100
CMP 6	S61110
CMP 10	S61130
CMP 11	S61120
EKO ML-01	S64350
EKO MS-40	S64111
EKO MS-57	S64211
EKO MS-60M ( RS485)	S64160
EKO MS-80A	S64150
EKO MS-80A over shunt	S64150 and S82402
EKO MS-80M ( RS485)	S64160
EKO MS-202	
EKO MS-802	S64120
EKO MS-410	S64130
EKO MS-602	S64110
Kipp & Zonen CMP11	S61120
Kipp & Zonen CMP6	S61110
Kipp & Zonen CMP3	S61100
Kipp & Zonen SMP10 ( RS485)	S61430 / S61420
Hukseflux Pyranometer LP 02	S63100
Hukseflux Pyranometer SR 11	S63120
Hukseflux Pyranometer SR30 ( RS485)	
SP Lite2	S61180
Silicon Irradiance Sensor MT 0-1V	S68310 / S68320 / S68330
Silicon Irradiance Sensor MT 0-10V	S68100
Silicon Irradiance Sensor MT 4-20mA	S68110 / S68210
Silicon Irradiance Sensor SiS-13TC-T	S68250
Li-Cor LI-200SZ	
ISET Solar Radiation Sensor	
Datasol MET Reference Cell ( RS485)	

Table 10.17: Pyranometers

Meteo-40 saves all electrically measured values in V to the source data ( Section 6.7). The calculated values for solar radiation are saved in W/m<sup>2</sup> to the CSV file (see Section 6.6.1).



**Note**

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.



**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the Ammonit website (<http://www.ammonit.com/>).

### 10.12.2 Delta-T Sunshine SPN1

The pyranometer Delta-T Sunshine SPN1 measures global horizontal and diffuse irradiation in W/m<sup>2</sup>. It provides 2 analogue voltage outputs (Ax) for global and diffuse irradiation, and 1 digital output (Dx) for sunshine duration.

Additionally, Meteo-40 estimates the direct normal irradiation based on the values of global horizontal and diffuse irradiation according to the general formula: Global Horizontal Irradiation = Diffuse Horizontal Irradiation + Direct Normal Irradiation  $\cdot \cos(\theta)$ , where  $\theta$  is the solar zenith angle

The order number for Delta-T Sunshine SPN1 is S65100.



#### Important

In order to estimate direct normal irradiation (DNI) and sun status, latitude and longitude of the measurement station have to be entered in the System → Administration menu (see also Section 4.2).

If any estimated values should be included in the CSV statistics file, the values have to be selected in the Data → Statistics menu under *Select statistics* (see also Section 6.3.1).



#### Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

### 10.12.3 Pyrheliometers

Pyrheliometers are used to measure the direct irradiance emitted by the sun in a 5 degree angle. The sensors have to be connected to the analog voltage channels (Ax) of Meteo-40.

The output signal (U) from the pyrheliometer is proportional to the solar irradiance (E) in W/m<sup>2</sup>.

$$E_{[W/m^2]} = \frac{U_{[\mu V]}}{\text{Sensitivity}_{[\mu V/[W/m^2] ]}}$$

Equation 10.9: Calculation of Direct Solar Irradiation (E)

Sensitivity is an internal parameter of the sensor, which is important to calculate the irradiation in W/m<sup>2</sup>. The value is given in the calibration certificate of the sensor.

The direct normal irradiation is the basic measurement from pyrheliometers. Additionally, Meteo-40 estimates DNI  $\cdot \cos(\theta)$  and sun status based on the recorded values for direct normal irradiation. Sun status is calculated as defined by WMO (sun status is 1 if direct normal irradiation exceeds the level of 120 W/m<sup>2</sup>, else 0). In order to estimate sun status and DNI  $\cdot \cos(\theta)$ , latitude and longitude of the measurement station must be entered in the System → Administration menu (see also Section 4.2).

These sensors often include with built-in Pt100 sensor and a thermistor. The Pt100 sensor can be connected to a current source (see Section 11.5) of Meteo-40.

If the built-in Pt100 sensor should be connected to Meteo-40, pyrheliometer and Pt100 sensor have to be configured separately in the *Sensor Helper*: Pyrheliometer via sensor type *Solar Sensors* and Pt100 via sensor type *Hygro/Thermo*.



#### Important

Do not connect the thermistor to Meteo-40!

Sensor	Order-No
EKO MS-56	S64210
Kipp & Zonen CPH1	S62210

Table 10.18: Pyrheliometers

**Important**

In order to estimate sun status and direct normal irradiation [ $DNI \cdot \cos(\theta)$ ], latitude and longitude of the measurement station must be entered in the System → Administration menu (see also Section 4.2). If any estimated values should be included in the CSV statistics file, the values have to be selected in the Data → Statistics menu under *Select statistics* (see also Section 6.3.1).

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the Ammonit website (<http://www.ammonit.com/>).

## 10.12.4 Sunshine Duration Sensors

Sunshine duration sensors indicate the sunshine status as defined by the WMO (sunshine = irradiation exceeds the level of  $120 \text{ W/m}^2$ ). The sensor measures the irradiation and switches the output voltage high or low to indicate sunny or not sunny conditions.

Sunshine duration sensors, e.g., Kipp & Zonen CSD 3, have to be connected to analog voltage channels (Ax). If direct irradiation should be measured, connect this output also to another analog voltage channel (Ax). Refer to Figure 13.2 for the connection diagram.

The output signal (V) indicates sunshine or no sunshine. Additionally, the calculated direct irradiation can be measured. The output signal (mV) for direct irradiation is proportional to the direct irradiation ( $\text{W/m}^2$ ).

$$E_{[\text{W/m}^2]} = \frac{U_{[\mu\text{V}]}}{\text{Sensitivity}_{[\mu\text{V}/[\text{W/m}^2]']}}$$

Equation 10.10: Calculation of Solar Irradiation (E)

Sensitivity is an internal parameter of the sensor, which is important to calculate the radiation in  $\text{W/m}^2$ . The value is given in the calibration certificate of the sensor.

Meteo-40 saves all electrically measured values in V to the source data (Section 6.7). The calculated values for direct irradiation are saved in  $\text{W/m}^2$  to the CSV file (see Section 6.6.1).

Sensor	Order-No
Kipp & Zonen CSD 3	S61910

Table 10.19: Sunshine Duration Sensors

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the Ammonit website (<http://www.ammonit.com/>).

Meteo-40 saves all electrically measured values to the source data (Section 6.7). The calculated direct irradiation in  $\text{W/m}^2$  and the current sun status are saved to the CSV file (see Section 6.6.1).

**Note**

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.



### 10.12.5 Solar Trackers

EKO Instruments high precision STR Sun Tracker provide high tracking reliability, enhanced functionality with fully automated set up procedure through a built in GPS receiver. The compact sun trackers are suited to support all kinds of measurement sensors to measure Global, Diffuse and Direct Radiation.

EKO Sun Trackers must be connected to RS485-M port by means of an RS232 to RS485 adapter .

Date, time and location are acquired from the sensor by means of commands TM and LO. If the data logger values are significantly different, Meteo-40 will get automatically synchronized and the changes will be logged in the [logbook](#). This synchronization happens in two cases: when configuring the sensor and on every CECS reboot. If you want to trigger the synchronisation routine, you can access the configured EKO Sun Tracker for editing and save it again without changing the configuration.

According to the configured polling rate, which is 1 s per default, the calculated angle according to the GPS information and the current angle are requested and recorded.



#### Important

Make sure that no other method to synchronize date and time is active ( Section 4.2).

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
EKO Sun Tracker	EKO	Commands MR and CR	M1_1: Azimuth calculated (CR) M1_2: Altitude calculated (CR) M2_1: Azimuth (MR) M2_2: Altitude (MR)	serial settings

Table 10.20: Data request for RS485 Sun Tracker

### 10.12.6 Rotating Shadowband Irradiometer

Measure Global, Diffuse and Direct Radiation from two LiCor sensors as well as the temperature. The average values from both sensors are also calculated.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
CSPS RSI	Modbus RTU	Registers 0 to 20	M1_1: Global Horizontal Irradiance (GHI) M1_2: Difuse Horizontal Irradiance (DHI) M1_3: Direct Normal Irradiance (DNI) M1_4: Temperature M1_5: GHI LiCor 1 M1_6: DHI LiCor 1 M1_7: DNI LiCor 1 M1_8: GHI LiCor 2 M1_9: DHI LiCor 2 M1_10: DNI LiCor 2	Serial settings

Table 10.21: Configuration of RS485 CSPS RSI

### 10.12.7 Reference Cell

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration	
Datasol MET Reference Cell	Modbus RTU	registers 96 to 108	Mx_1: Solar irradiance Avg. (W/m <sup>2</sup> ) Mx_2: Solar irradiance 1 (W/m <sup>2</sup> ) Mx_3: Solar irradiance 2 (W/m <sup>2</sup> ) Mx_4: Wind Speed (m/s) Mx_5: Temperature Air (°C) Mx_6: Temperature Panel (°C)	Serial settings, address	

Table 10.22: Configuration details for RS485 Reference Cell

### 10.12.8 RS485 communication specifications

Some pyranometers can or must be connected to the RS485-M port. For EKO pyranometers, it is also possible to use the M-Box RS485 Modbus RTU adapter and connect analog pyranometers to the RS485-M bus. If more than one sensor is connected to the RS485-M bus, they must be configured with a unique Modbus ID and they must all share the same protocol and serial settings (see Section 11.6).

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
EKO MS-60M	Modbus RTU	registers 19 to 24	M1_1: Measuring Voltage (mv) M1_2: Global Irradiance (W/m <sup>2</sup> ) M1_3: Internal Temperature (°C)	serial settings (9600, 8N2)
EKO MS-80M	Modbus RTU	registers 19 to 24	M1_1: Measuring Voltage (mv) M1_2: Global Irradiance (W/m <sup>2</sup> ) M1_3: Internal Temperature (°C)	serial settings (9600, 8N2)
EKO M-Box	Modbus RTU	registers 19 to 24	M1_1: Measuring Voltage (mv) M1_2: Global Irradiance (W/m <sup>2</sup> ) M1_3: Internal Temperature (°C)	serial settings (9600, 8N2)
EKO SMP10	Modbus RTU	registers 5 to 10	M1_1: Solar Irradiance (W/m <sup>2</sup> ) M1_2: Solar Irradiance Long (W/m <sup>2</sup> ) M1_3: Temperature (°C)	serial settings (19200, 8E1)
Datasol MET Reference Cell	Modbus RTU	registers 96 to 108	M1_1: Solar Irradiance Average (W/m <sup>2</sup> ) M1_2: Solar Irradiance 1 (W/m <sup>2</sup> ) M1_3: Solar Irradiance 2 (W/m <sup>2</sup> ) M1_4: Wind Speed (m/s) M1_3: Temperature Air (°C) M1_3: Temperature Panel (°C)	serial settings
Hukseflux SR30	Modbus RTU	registers 2 to 6	M1_1: Irradiance(temperature compensated signal)(W/m <sup>2</sup> ) M1_2: Irradiance(temperature uncompensated signal)(W/m <sup>2</sup> ) M1_3: Sensor body temperature (°C)	serial settings (19200, 8E2)

Table 10.23: Data request for RS485 pyranometer

## 10.13 Precipitation Sensors

### 10.13.1 Rain Gauge

Precipitation sensors are designed to measure the quantity and intensity of precipitation striking the earth's surface. Precipitation is best measured with a tipping bucket device. Precipitation, collected over a surface of 200 cm<sup>2</sup>, is con-

ducted through an inflow sieve into a tipping bucket. When the bucket has collected 2 cm<sup>3</sup> = 0.1 mm of precipitation, it tips over. This measurement principle is based on the “Guide to Meteorological Instruments No 8, WMO”. Precipitation sensors are typically applied for meteorological assessments.

Precipitation sensors, e.g., Young precipitation sensor, have to be connected to counter channels (Cx). Refer to Figure 13.12 for the connection diagram.

The output signal (I) from the sensor is proportional to the precipitation quantity (N).

$$N_{\mu\text{m}} = \text{slope}_{[\mu\text{m}/\text{pulse}]} \cdot I_{[\text{pulse}]}$$

Equation 10.11: Calculation of Precipitation Quantity (N)

Slope is an internal parameter of the sensor, which is important to calculate the precipitation quantity according to the measurement rate set in the sensor configuration. The value is pre-configured in the *Sensor Helper* (see Section 5.1.2).

Sensor	Order-No	Slope	Offset
Thies Precipitation Sensor	S71100H	0.1 mm/l	0 mm
Young Precipitation Sensor	S73100 / S73100H	0.1 mm/l	0 mm

Table 10.24: Parameters for the configuration of precipitation sensors



**Important**

If you install calibrated sensors, enter the values given in the calibration protocol.

Meteo-40 saves all electrically measured values in Pulse [I] to the source data (Section 6.7). The calculated values are saved to the CSV file (see Section 6.6.1).



**Note**

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.



**Important**

If you plan to install precipitation sensor Thies or Young, you have to implement an accessory module! Refer to the data sheet and contact Ammonit for further details.



**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website \(http://www.ammonit.com/\)](http://www.ammonit.com/).

### 10.13.2 Laser Precipitation Monitors

Laser precipitation monitors measure various precipitation details, i.e., intensity of total, liquid and solid precipitation as well as the precipitation amount and the SYNOP parameter.

Thies Laser Precipitation Monitor (LPM) sensor performs a new calculation every minute, after the first 5 minutes of operation. Meteo-40 requests data with a 1 s rate in order to guarantee a valid measurement per minute with a working sensor.

Thies LPM has to be connected to RS485-M port.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Laser Precipitation Monitor	Thies	Telegram 8	Mx_1: SYNOP Mx_2: Intensity total precipitation Mx_3: Intensity liquid precipitation Mx_4: Intensity solid precipitation Mx_5: Precipitation amount	Serial settings, address, half duplex mode, no automatic telegram sending

Table 10.25: Configuration of RS485 Laser Precipitation Monitor Sensors



**Note**

SYNOP (surface synoptic observations) is a numerical code used for reporting weather observations, also called FM-12 by the World Meteorological Organization. Refer to Thies LPM sensor's manual for more information.

## 10.14 Multifunction Transducer, Power Meters and other Electrical Measurement Devices

Meteo-40 can be used to connect power meters, multifunction transducers or other electrical measurement devices, e.g., for power curve measurement. The devices are connected to the RS485-M of Meteo-40 (see Section 11.6).

Model	Protocol	Description	Channels and Evaluated data	Sensor's previous configuration needed	
Sineax CAM (see Section 10.14.1)	Modbus RTU	Actual values (registers 40100, 40118 to 40122, 40134 to 40142)	Mx_1: Average phase Voltage U Mx_2: Current I1 Mx_3: Current I2 Mx_4: Current I3 Mx_5: Real Power P1 Mx_6: Real Power P2 Mx_7: Real Power P3 Mx_8: Total Real Power P Mx_9: Total Reactive Power Q	Serial settings, address	

Model	Protocol	Description	Channels and Evaluated data	Sensor's previous configuration needed	
Iskra MT540 (see Iskra manuals download ( <a href="http://www.iskrasistem.si/download/manuals/">http://www.iskrasistem.si/download/manuals/</a> ))	Modbus RTU	Normalized actual values (registers 804, 809 to 811, 816 to 819, 823)	Mx_1: Average phase Voltage U Mx_2: Current I1 Mx_3: Current I2 Mx_4: Current I3 Mx_5: Real Power P1 Mx_6: Real Power P2 Mx_7: Real Power P3 Mx_8: Total Real Power P Mx_9: Total Reactive Power Q	Serial settings, address	
GD2000 Multi-function Power Analyzer	Modbus RTU	registers 56 to 63	Mx_1: Active power Mx_2: Power factor Mx_3: Reactive power Mx_4: Apparent power	Serial settings (19200 bps), address	

### 10.14.1 Sineax CAM Measuring Unit

Sineax CAM is a universal measuring unit for heavy current variables. Actual measurements for average phase voltage, current, real and reactive power are requested from this sensor. For more information refer to Gossen Metrawatt Sineax CAM documentation (<http://www.gossenmetrawatt.com/english/produkte/sineaxcam.htm#>).

## 10.15 Remote Sensing

### 10.15.1 ZephIR 300 Lidar

Meteo-40 can acquire ZephIR 300 live and averaged wind data measurements and include them in the measurement CSV files or share them over SCADA. You can select 'ZephIR 300' for averaged data or 'ZephIR 300 Live' for live data from the sensors list under 'Other Sensor'.

Before adding a ZephIR 300 to the list, it must be powered and connected to Meteo-40's RS485-M port. The configured heights will be automatically requested and for each height, a RS485 channel (M1 to M8) will be configured. If both live and averaged data are requested, a maximum of 4 heights can be configured at ZephIR 300.



#### Note

For more information about how to electrically connect ZephIR 300 and Meteo-40 please contact us.



#### Important

Measurement polling interval for averaged data is 1 minute per default. To ensure a valid measurement per interval it must always be lower than the statistics time interval (see Section 6.3).

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
ZephIR 300	Modbus RTU	Averaged wind data per height	Mx_1: Reference Mx_2: Wind Speed Mx_3: Vertical Wind Speed Mx_4: Wind Direction Mx_5: Temperature Mx_6: Air Pressure Mx_7: Humidity Mx_8: Wind Speed Max Mx_9: TI	Serial settings, address
ZephIR 300 Live	Modbus RTU	Averaged wind data per height	Mx_1: Reference Mx_2: Wind Speed Mx_3: Vertical Wind Speed Mx_4: Wind Direction Mx_5: Temperature Mx_6: Air Pressure Mx_7: Humidity	Serial settings, address

Table 10.26: Requested values

## 10.16 Bats Detection

### 10.16.1 Song Meter SM3BAT

It is possible to connect the Wildlife Acustics Song Meter SM3BAT to the RS485-M interface. This allows a real time monitoring of bat passes and pulses, as well as of the status of the SM3BAT flash memory card and power supply.



#### Note

An external RS232 to RS485 adapter is required.

Model	Protocol	Description	Channels / Evaluated Data
SM3BAT	ASCII	(compatible with Thies)	Mx_1: Internal Voltage (V) Mx_2: Internal Temperature (°C) Mx_3: Flash memory level (%) Mx_4: Bat passes Mic0 Mx_5: Bat pulses Mic0 Mx_6: Bat passes Mic1 Mx_7: Bat pulses Mic1

Table 10.27: Requested values

*Scheduling:* The SM3BAT can be programmed to monitor during specific periods of the day, and “sleep” during other parts of the day to conserve power. When the SM3BAT is sleeping, it will not respond to Meteo-40 messages. Thus, the SM3BAT needs to be programmed when to be monitoring for bats e.g. 24 hours or just at night, etc.

*Recording:* The SM3BAT normally records the ultrasonic echolocation audio data on up to 4 SDHC or SDXC flash cards. Full spectrum recordings can typically consume 1-2GB of card space per night depending on bat activity. The flash cards will eventually fill up. Normally, the SM3BAT would shut down if it is no longer able to make recordings.

---

However, for this application, it is desirable to continue monitoring, updating bat counters, and responding to requests. If the interface to Meteo-40 is detected, then the SM3BAT will continue monitoring for bats even if the flash cards are full, but no new bat activity data will be recorded. This condition is indicated by the flash card 100% full indication in the response messages.

*Bat Activity:* Echolocating bats typically produce individual ultrasonic “pulses” continuously while they fly for navigation, avoiding obstacles, and hunting for food. The frequencies, bandwidth and duration of pulses varies from species to species and with the functional needs of the bat at the time (e.g. many bats will increase bandwidth and decrease duration as they close in on prey). The SM3BAT can be configured to recognize pulses that may be tuned to specific bats in a given area. This includes specifying the minimum and maximum frequencies and minimum and maximum durations of a pulse. These parameters can be tuned to recognize echolocating bats while avoiding false positives from other ultrasonic noise sources such as wind, rain, and insects. The optimum parameters will depend on the specific bats and insects likely occurring in a given area. A “bat pass” refers to a series of pulses recorded as a bat flies by the microphone. Additional parameters in SM3BAT help define what a bat pass is including the maximum trigger duration and the maximum time between pulses (the trigger window). A bat pass begins with the first detected pulse, and ends when either no pulses have been detected after the maximum time between pulses has occurred, or when the maximum trigger duration has been reached. SM3BAT will not count a bat pass unless it contains at least two pulses. In this way, the SM3BAT can count passes and pulses detected on an ongoing basis and report these counts to the customer equipment.

## 10.17 Lightning Detector

### 10.17.1 SG1000 Lightning Detector



**Note**

This sensor can only be connected to data loggers produced after 2017-06, which can register the digital signal period (see Section 11.2).

---

The SkyScan SG1000 lightning detector can detect the presence of lightning/thunderstorm activity occurring within 64 km of your location. It detects the characteristic electromagnetic emissions from individual lightning strokes and uses patented technology to determine the distance to the detected stroke. The distances are indicated in four ranges: 0-5 km; 5-13 km; 13-32 km; and 32-64 km. This allows you to track the approach of dangerous storm activity.



**Note**

More than one range can be detected simultaneously.

---

SG1000 may also identify certain types of especially strong storms. These storms can produce dangerous winds, heavy rains or tornadoes. When SG1000 detects lightning patterns indicating the presence of these storms, it activates the Severe thunderstorm alarm.

Four digital signals with complementary information are supplied by this lightning detector: Alarm, Error, Battery power and Baseline (see Table 10.28).



Signal	Description
0-5km	Distance range 0-5 km
5-13km	Distance range 5-13 km
13-32km	Distance range 13-32 km
32-64km	Distance range 32-64 km
Severe	Severe thunderstorm alarm
Alarm	Lightning activity has moved within range
Error	There is a system error that needs to be addressed (error code is indicated by the status LED on the unit)
Battery power	Mains power has been interrupted and system is operating on battery backup
Baseline	Ensures that there is activity on the digital output (i.e. can be used as a heartbeat to confirm system is up-and-running)

Table 10.28: SG1000 status signals

**Important**

If the period of the digital output signal of the sensor is changed, it is necessary to configure the measurement rate at Meteo-40 accordingly. The period of the digital output signal can be set to a value between 2.0 and 4.8 seconds, being the default value 2.0. The measurement rate configured at the data logger for this sensor must be at least twice as long as the period duration of the digital output, in order to guarantee that a complete period is caught. The default measurement rate is 5 seconds.

## 10.18 Soil Water Content

Measuring the water content, electrical conductivity (EC), and temperature of soil is a main topic for any agricultural project. Meteo-40 supports several volumetric water content (VWC) sensors, connected to an analog channel or to the RS485-M interface.

Sensor
Decagon EC-20, EC-10, EC-5 Soil Moisture Sensors

Table 10.29: Soil Moisture Sensors

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Campbell Reflectometer CS650	SDI-12	DO	Mx_1: Volumetric water content Mx_2: Electrical conductivity	External module needed (address, 19200 8N1, 120Ω termination). See SDI-12.

Table 10.30: RS485 Soil Water Content Sensors

## 10.19 Soiling Measurement

Soiling is the accumulation of dust, dirt and other contaminants on the surfaces of PV modules. The amount of dust is extremely dependent on the location of the PV power plant, e.g., desert valley with sand storms. In absence of significant rain events or regular cleaning, production losses due to soiling effects increase. Measuring soiling effects provides important details about the PV power plant production, e.g., how much dust can be on the modules before any problem occurs and how does the dust affect transparency and efficiency of the modules.

### 10.19.1 Atonometrics RDE300

Soiling and Irradiance Measurement Systems with the Atonometrics RDE300 Series measurement and control unit collect critical data for evaluating PV array performance. The systems can be used at operating PV power plants and pre-construction site survey locations.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Atonometrics RDE300	Modbus RTU		M1_1: Global Irradiance PV1 M1_2: Analog Current PV1 M1_3: Temperature PV1 M1_4: Active Power PV1 M2_1: Global Irradiance PV2 M2_2: Analog Current PV2 M2_3: Temperature PV2 M2_4: Active Power PV2 M2_5: Soiling Ratio M2_6: Soiling Ratio Isc M2_7: Soiling Ratio Pmax M3_1: Event Code M4_1: Status Fluid M5_1: Status Pump	Serial settings, address

Table 10.31: Data request for RDE300 RS485 Soiling Measurement

### 10.19.2 Ammonit Soiling Measurement Kit SD2100

The Ammonit soiling measurement kit compares the estimated plane-of-array solar (POA) irradiance of a naturally-soiled PV module with a clean reference PV module. The measurement station determines the short-circuit current output as well as the module surface temperature from the backside of each PV module. Based on these measurements the POA irradiance can be determined for each module.

$$G = \frac{G_0 \cdot I_{sc} \cdot (1 - TK_{Isc} \cdot (T - T_0))}{I_{sc0}}$$

Equation 10.12: Calculation of POA Irradiation

Where G : POA irradiance reaching the solar cells, G<sub>0</sub> : reference condition irradiance, I<sub>sc</sub> : measured short circuit current, I<sub>sc0</sub> : short circuit current at reference condition, T : measured surface temperature, T<sub>0</sub> : surface temperature at reference condition, TK I<sub>sc</sub> : temperature coefficient of short circuit current.

Two standard metrics for the effects of soiling on energy production are available at the *Evaluation Helper* (see Section 5.3.1). The Soiling Ratio I<sub>sc</sub> index (SR I<sub>sc</sub>), which equals 1 when both modules are clean, and the Soiling Loss Index (SLI), expressed as a percentage.

$$RS_{Isc} = \frac{I_{SC_{Soiled}}}{I_{SC0} \cdot (1 + TK_{Isc} \cdot (T_{Soiled} - T_0)) \cdot \frac{G}{G_0}}$$

Equation 10.13: Calculation of SR Isc

Where G is the POA irradiance from the clean module, Isc Soiled is the measured short-circuit current of the soiled module and T Soiled is the measured temperature of the soiled module.

$$SLI = \left(1 - \frac{G_{Clean}}{G_{Soiled}}\right) \cdot 100$$

Equation 10.14: Calculation of SLI

Where G Clean : POA irradiance of the clean PV module and G Soiled : POA irradiance of the reference PV module.

The Ammonit soiling measurement kit includes the following components: Ammonit I-U Conversion Box, Surface Temperature Sensor and a 30 W Photovoltaic (PV) Module.

Configure an Ampere meter from the sensors list for each of the I-U Conversion Boxes. In order to achieve best match to the output voltage, the appropriate voltage range must be selected. If you are using CM8281, with a shunt resistor of 50 mΩ, you must select the ±1.0 V range.

### 10.19.3 Kipp & Zonen DustIQ

The DustIQ is an instrument meant to measure and report the transmission loss (TL) and soiling ratio (SR) caused by light being blocked and reflected and subsequently not getting through the glass of the panel due to soiling of the panel.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Kipp & Zonen DustIQ	Modbus RTU		M1_1: Soiling Ratio 1 M1_2: Transmission Loss 1 M1_3: Soiling Ratio 2 M1_4: Transmission Loss 2	Serial settings, address

Table 10.32: Data request for DustIQ RS485 Soiling Measurement

## 10.20 Other RS485 Sensors

In addition to meteorological sensors, further RS485-compatible sensors or devices can be connected to the RS485-M bus (see Section 11.6). The following list includes some sensors and their configuration.

## 10.20.1 RS485 Multiplexer

Sensor type	Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Multi Channel Voltage Module	Gantner e.bloxx A1	Modbus RTU	registers 17 to 32	Mx_1: Analog Voltage AI1 Mx_2: Analog Voltage AI2 Mx_3: Analog Voltage AI3 Mx_4: Analog Voltage AI4 Mx_5: Analog Voltage AI5 Mx_6: Analog Voltage AI6 Mx_7: Analog Voltage AI7 Mx_8: Analog Voltage AI8	Serial settings, address, protocol, channels definition
Multi Channel Voltage Module	Gantner e.bloxx A3-1	Modbus RTU	registers 17 to 26	Mx_1: Analog Voltage 1 Mx_2: Analog Voltage 2 Mx_3: Analog Voltage 3 Mx_4: Analog Voltage 4 Mx_5: Digital status	Serial settings, address, protocol, channels definition
Multi Channel Digital Module	Gantner e.bloxx D1-1	Modbus RTU	registers 0 to 7	Mx_1: Digital status 1 Mx_2: Digital status 2 Mx_3: Digital status 3 Mx_4: Digital status 4 Mx_5: Digital status 5 Mx_6: Digital status 6 Mx_7: Digital status 7 Mx_8: Digital status 8	Serial settings, address, protocol, channels definition

Table 10.33: Configuration details for other RS485 Sensors / Devices

## 10.20.2 Configuring generic Modbus RTU sensors

It is possible to connect up to 8 Modbus RTU sensors to RS485-M port (see Section 11.6). They can be combined with other Modbus RTU sensors implemented in Meteo-40 like Lufft sensors, but not with other protocols like Thies or Gill.

Sensor type:

Sensor:

Installation height (m):

Label:

Serial number:

Evaluation type:

Unit

RS-485 Channel:

RS-485 address (0..247)

Data Type:

Word Endianness:

Modbus start register (0..65535)

Modbus register quantity (1..20)

Modbus function code (3..4)

**RS-485 master general configuration**

RS-485 speed:

RS-485 data format:

Measurement rate:

Figure 10.1: Generic Modbus RTU sensor configuration

The maximum quantity of consecutive registers that can be read from each sensor is 20. It is necessary to specify the first register (PDU addressing, first reference is 0) and the amount of registers. The function code is selectable between '03' (read holding registers) and '04' (read input registers).

Read registers will be evaluated according to the selected data type (see Table 10.34). If a 32-bit data type is selected, each two registers will be merged. For each registers pair (if 32-bit data type selected) or each individual register (if 16-bit data type selected), an evaluation is generated. E.g. reading 10 registers on RS485 channel M1 will generate 10 evaluations if a 16-bit data type is selected (M1\_1 to M1\_10) and 5 evaluations if a 32-bit data type is selected (M1\_1 to M1\_5).

The resulting evaluations have no unit or evaluation type. You can create a new evaluation on top of each original evaluation by means of the [linear equation](#) from the *Evaluation Helper*(see Section 5.3.1). Finally, it is necessary to properly select the evaluations to be included in the CSV statistics files in the Data → Statistics(see Figure 6.4).

Data Type	Description
short (16-bit)	16-bit integer
ushort (16-bit)	16-bit unsigned integer
long (32-bit)	32-bit integer
ulong (32-bit)	32-bit unsigned integer
float (IEEE754 32-bit)	32-bit single precision binary floating point
32-bit unsigned (8-bit exp)	8-bit signed decade exponent, 24-bit uint
32-bit signed (8-bit exp)	8-bit signed decade exponent, 24-bit signed int

Table 10.34: Data types available

## Chapter 11

# Channels

In the previous chapter, various sensors have been described, which can be connected to Meteo-40. The sensors have to be connected to the corresponding channel. Depending on the data logger type, Meteo-40 offers up to 35 channels. Meteo-40 provides connectors for the following measurands and signals:

- Analog Voltage (DC)
- Analog Current (DC)
- Pulse Counter / Period
- Digital / Serial / Status
- RS485-M (master)

Furthermore, the data logger Meteo-40 provides up to two high precision Current Sources to supply passive sensors.

See also Section 1.3.

### 11.1 Connecting Sensors to Analog Voltage Channels

Meteo-40 is equipped with up to 12 differential voltage inputs, depending on the logger's type. Generally, there are two benefits from differential inputs:

1. Reduced impact of perturbances and interferences on the signal lines,
2. Helps to avoid ground loops.

You can find the analog voltage channels (Ax, Bx) on the lower left side of the measuring unit (see Section 1.2). For example, analog wind vanes, barometric pressure sensors or pyranometers with analog voltage output can be connected to analog voltage channels of Meteo-40.

The analog voltage ranges comprise the following voltage ranges:

- $\pm 0.1$  V,
- $\pm 1$  V,
- $\pm 10$  V,
- 0.1 V to 0.3 V.

**Note:** The voltage range 0.1 V to 0.3 V is a high resolution range, especially designed for use with passive Pt1000 temperature sensors in conjunction with the current sources of Meteo-40.

For further electrical details refer to Section 12.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Analog Voltage Channels	4	8	12

Table 11.1: Analog Channels of Meteo-40

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## 11.2 Connecting Sensors to Counter / Period Channels

The counter channels (C) are located next to the analog voltage channels (see Section 1.2). For example, anemometers and precipitation sensors can be connected to counter channels. For electrical details refer to Section 12.2.

With data loggers produced since 2017-06, one can use the counter channels C5, C6, C11, and C12 as period measurement channels (P). This is useful for low frequency signals. The channel names are P1 to P4, respectively.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Counter Channels	4	8	12
Period measurements	0	2	4

Table 11.2: Counter / Period Channels of Meteo-40

### 11.2.1 Period measurement

Meteo-40 data loggers produced after 2017-06 can detect rising and falling edges of a signal connected to P channels. Three different measurement options are implemented: period, pulse width and duty cycle. These can be configured as Other Sensor in the Sensor Helper (see Section 5.1.2). If you want to use the period measurement to connect an anemometer, you must select the Generic Anemometer PM from the list of sensors.

For the period-related measurements, the first two or three edges in the measurement interval are registered. No averaging is applied for a measurement interval.



#### Important

The measurement rate must be at least twice as long as the period of the measured signal. If the measurement rate is too short, there might not be enough edges per measurement interval.

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**Period:** The Period is the duration of time of one cycle in a repeating event, so the Period is the reciprocal of the frequency. For the Period measurement, a total of three edges is needed.

**Pulse Width:** The Pulse Width or pulse duration is the time between a rising and a falling edge. At least one rising and one falling edge are needed for this measurement.

**Duty Cycle:** The Duty Cycle is the percentage of the ratio of the pulse width to the total period of the waveform. In this case, at least three edges are needed for the measurement.

Period, Pulse Width and Duty Cycle are illustrated in Figure Figure 11.1.



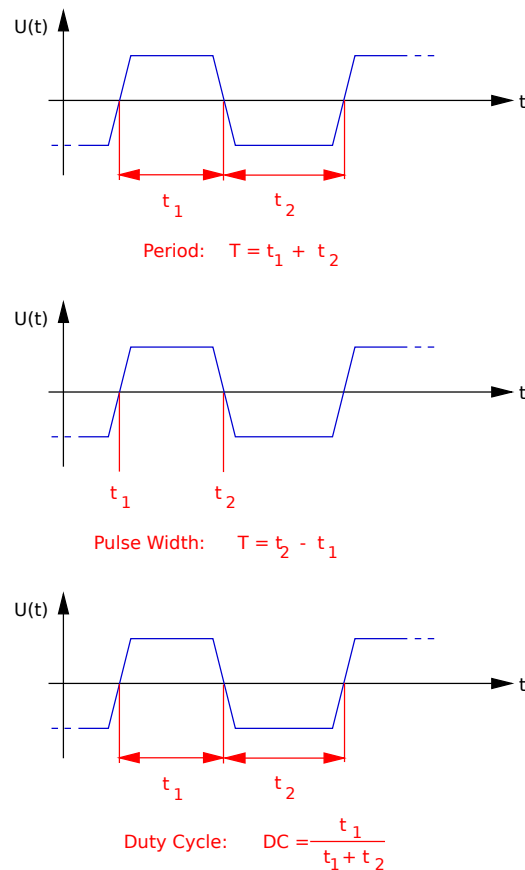


Figure 11.1: Illustration of Period, Pulse Width and Duty Cycle.

## 11.3 Connecting Sensors to Digital Channels

To use digital serial wind vanes Meteo-40 comprises up to eight Digital Channels (D). These Digital Channels are located in the middle of the connection panel of the data logger. For further electrical details refer to Section 12.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Digital Channels	2	4	8

Table 11.3: Digital Channels of Meteo-40

### 11.3.1 Functionality Check of Clock Output

To set up a proper digital connection between the sensor and Meteo-40 it is sometimes necessary to verify the functionality of the Digital Clock Output. The Digital Clock Output sends a short data sequence to the sensor, the sensor should respond with a data sequence on the IN line of the serial interface.

To request data from the sensor the Digital Clock Output must provide voltage levels that can be detected (understood) by the sensor. To simply test the functionality of the Digital Clock Output with a Multimeter, Meteo-40 provides a software driven test procedure. To perform the CLK-Line Output Test do the following:

- Disconnect the sensor from the data logger.
- Connect the data logger to the PC to configure it via web interface.

- Login into the data logger and follow the links Measurement → Channels
- Press the "Digital test" button below the sensor list.
- A tabular showing the Digital Channels available on this logger appears. The right columns of the table contain two buttons: "5 V" and "0 V" corresponding to each channel.

Channel	CLK 5 V	CLK 0 V
D1	5 V	0 V
D2	5 V	0 V
D3	5 V	0 V
D4	5 V	0 V
D5	5 V	0 V
D6	5 V	0 V
D7	5 V	0 V
D8	5 V	0 V

Figure 11.2: Configuration Menu for CLK-Line Test in Meteo-40.

- Connect the multi meter between CLK output and GND of the Digital Channel you intend to check.
- **First step:** Press the button "5 V" to switch on the DC voltage of the Clock Output. There must be a voltage between 4 V and 5.6 V present at the Clock Output.
- **Second Step:** Add a resistor of 1 kΩ–1.2 kΩ in parallel to the multi meter (see figure Figure 11.3). Press the button "5 V" to switch on the DC voltage of the Clock Output. The voltage at the Clock Output *must not drop below 3 volts*.

**Notes:**

- The DC voltage output can be toggled between High- and Low-level via the two buttons "5 V" and "0 V"
- The test has limited timespan: After pressing the "Digital test" button and choosing the DC voltage level, the voltage level will remain only 10 seconds. To repeat the test, the button "5 V" has to be pressed again.

**Test Result:** If the voltage level drops below 3 volts, the CLK output of the data logger could be defective.

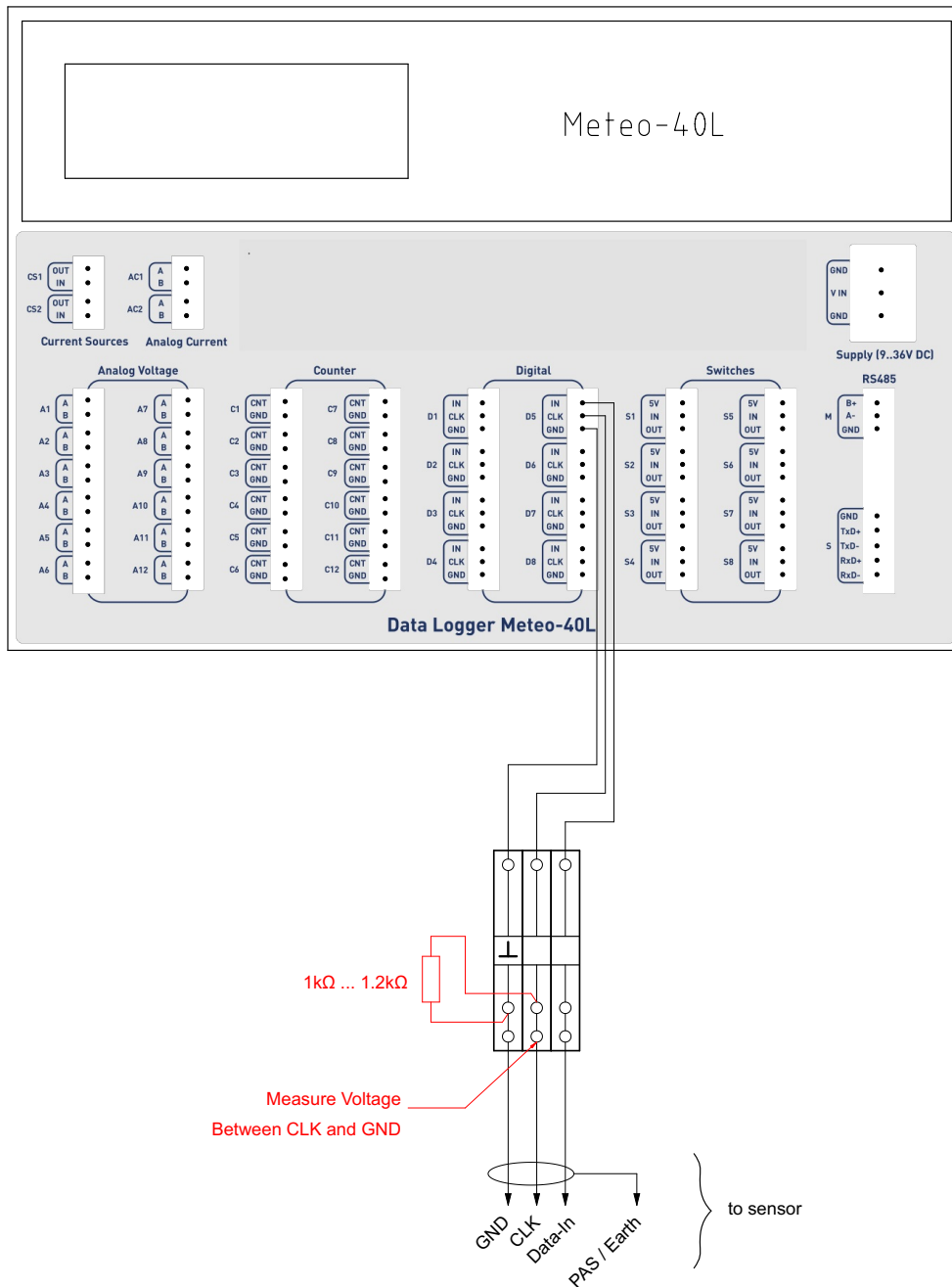


Figure 11.3: Setup for CLK-Line test of Serial Interface.

## 11.4 Connecting Sensors to Analog Current Channels

Meteo-40 data loggers offer analog current measurement channels: Meteo-40L provides two channels; Meteo-40M and Meteo-40S one each.

---

Barometric pressure sensors with current output can be connected to these channels. The current measurement channels offer current ranges of 1 mA, 10 mA and 100 mA which can be configured via web interface.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Analog Current Channels	1	1	2

Table 11.4: Analog Current Channels of Meteo-40

## 11.5 Connecting Sensors to Current Source

The current source (CS) is located on the left of the communication unit next to the analog current channels (see Section 1.2). Meteo-40 data loggers are equipped with one or two current sources, depending on the logger's type. The goal of these current sources is to supply passive temperature sensors (PT100 or PT1000).

Single Pt100 and Pt1000 sensors as well as Pt100 sensors, which are for example implemented inside pyrheliometers can be connected to the current source of Meteo-40. For electrical details refer to Section 12.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Current Source Channels	1	1	2

Table 11.5: Current Source Channels of Meteo-40



### Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the Ammonit website (<http://www.ammonit.com/>).

---

## 11.6 Connecting Sensors to RS485-M

All data logger types of Meteo-40 offer an RS485-M (master) slot for bus connection of up to eight sensors with RS485 interface. For further electrical details refer to Section 12.2.

When adding an RS485 sensor in the Measurement → Sensors menu, a (selectable) channel name between M1 and M8 is assigned to the sensor. Subindexes, e.g., M1\_1, M1\_2, are created for measured data and evaluations. In the Measurement → Evaluation menu the evaluations are displayed. Both measured values and evaluated data are included in the CSV files and can be seen in the Data → Live menu.

Most RS485 sensors have to be configured before use. The same configuration must be applied, when adding the sensors to Meteo-40 in the Measurement → Sensors menu.



### Important

Only sensors using the same protocol and serial settings can share the RS485 bus. It is necessary to configure each sensor with a unique RS485 address in the bus.

---



### Important

If 4 or less RS485 sensors are connected, the RS485-M receiver remains enabled for 165 ms. With more than 4 sensors, the receiver enabled time decreases to 40 ms. The sensor response delay and the response transmission itself should happen within this period.

---

### 11.6.1 SDI-12 sensors

SDI-12 is a standard communications protocol which provides a means to transfer measurements taken by an intelligent sensor to a data recorder. A subset of the SDI-12 protocol is implemented on Meteo-40. By means of an external hardware, the RS485-M interface can be used to connect SDI-12 sensors. If more than one SDI-12 is connected, the external adapters must be configured with different RS485 addresses. The supported SDI-12 sensors can be found in section [Sensors](#).

## 11.7 Using the Switches

Each Meteo-40 data logger comprises switches to switch different kinds of loads on and off. The number of switches depends on the type of the logger (S, M or L). The switch is internally realized with a P-channel MOSFET. The loads can be sensors as well as relays (electro-mechanical or solid state). Each switches section consists of three terminals: 5 V output, Input (In) and Output (Out).

**Input terminal:** This is the input of the voltage to be switched. Note: Input voltage must be positive with respect to ground (GND).

**Output terminal:** Output of the switch.

**5 V Output terminal:** The 5 V output can be used as a control voltage for external devices. Furthermore, it can be used as input voltage for the switches.

The following two figures show example circuits to make clear the use of the 5 V and the switches terminals.

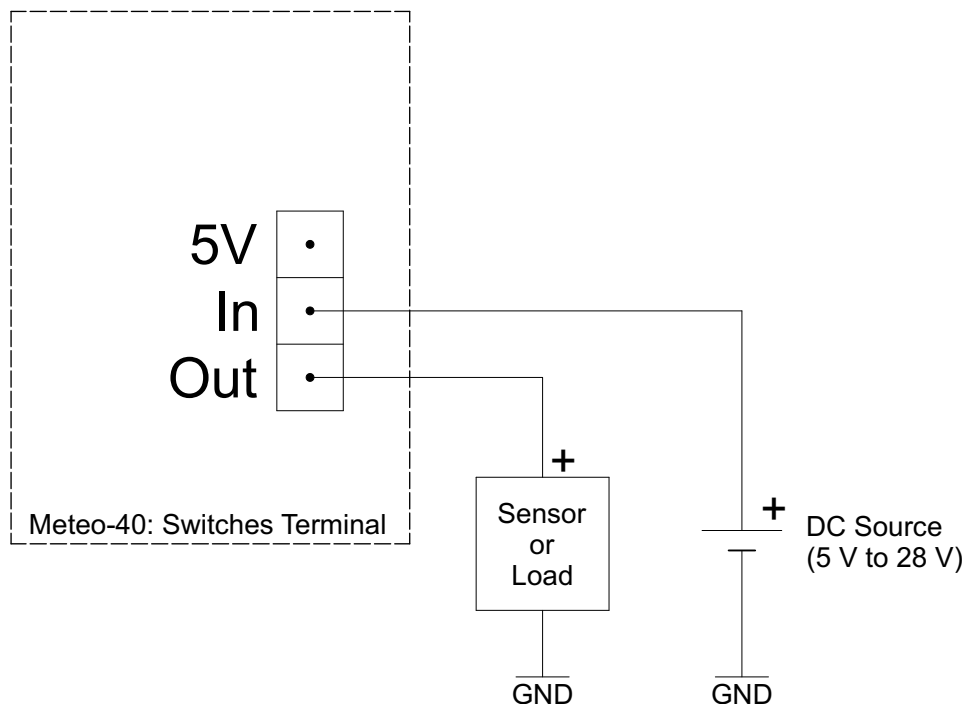


Figure 11.4: Use switches to supply sensors.

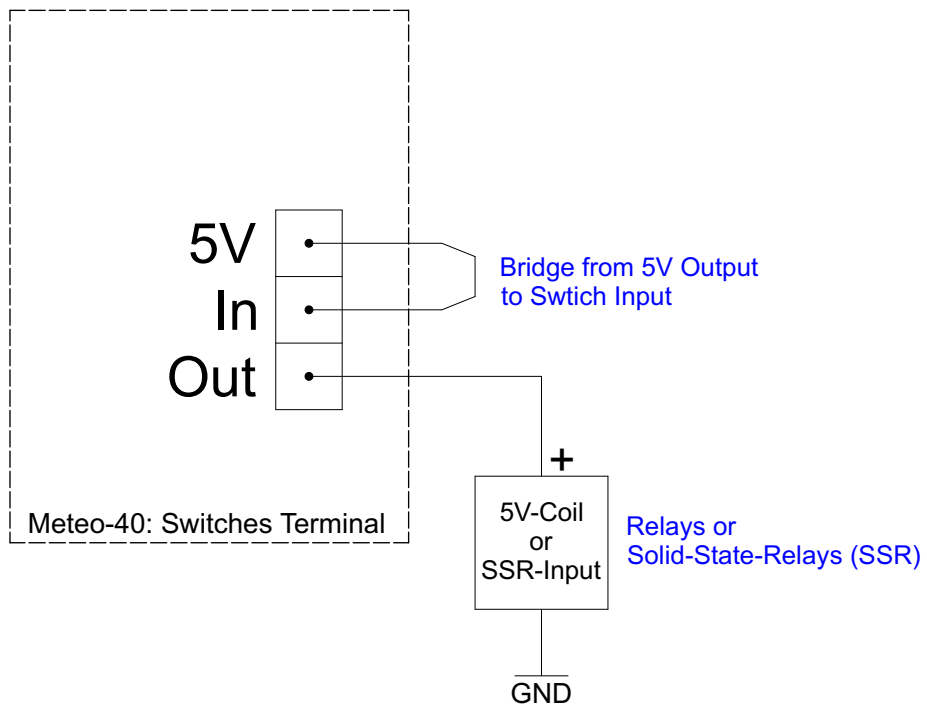


Figure 11.5: Use switches and 5 V for external relays control.

## Chapter 12

# Technical Data

### 12.1 Specification

Property	Specification
Housing Dimensions	260 × 194 × 50 [mm]
Weight	950 g
Protection	IP65
Temperature	-40–+65 °C (operation) -20–+65 °C (display readable)
Memory	Meteo-40S: 1 GB Meteo-40M: 2 GB Meteo-40L: 2 GB
Date Format	YYYY-MM-DD
Time Format	hh:mm:ss
Clock	Buffered real time clock Accuracy: -40–+85 °C (±3.5 ppm); 0–+40 °C (±2 ppm) 3 V Lithium Button Cell CR2032; approx. 180 mAh; operating time >3 years
Power Supply	No internal supply! (see Section 12.2.13)



#### Important

Meteo-40 has no internal supply battery! External power supply is essential for proper operation. Section 12.2.13 contains the characteristics of the voltage supply and the current consumption of the data logger.

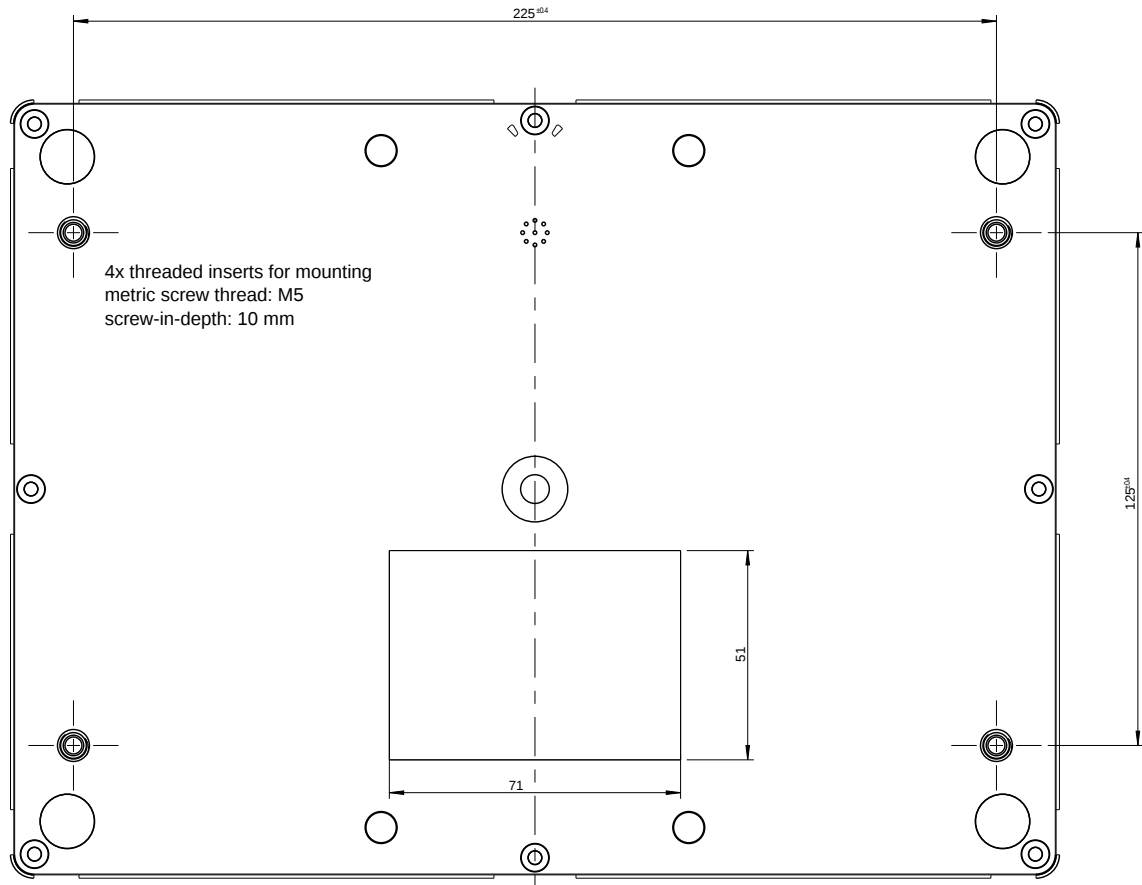


Figure 12.1: Mounting threads dimensions.

## 12.2 Electrical Characteristics

The values given in the following tables Table 12.1 to Table 12.12 contain the specifications of the digital and analog inputs and outputs. The given values are specified for a temperature range of -40– +65 °C.



### Note

All inputs and outputs are protected against overvoltage and electrostatic discharge using suppressor diodes. All voltage outputs of the data logger are fused by an self-resetting electronic fuse. Additionally, the power supply comprises an reverse-polarity protection diode.



### 12.2.1 Electrical Specifications of Analog Voltage Channels / Differential Inputs

Property	Specification
Number of Channels per Data Logger Type	12 @ Meteo-40L (A1–A12) 8 @ Meteo-40M (A1–A8) 4 @ Meteo-40S (A1–A4)
Available Voltage Ranges (DC)	±0.1 V ±1 V ±10 V 0.1 V–0.3 V
Internal Resolution (Bit)	15 bit (Range: ±0.1 V) 16 bit (Range: ±1 V) 16 bit (Range: ±10 V) 16 bit (Range: 0.1 V–0.3 V)
Internal Resolution (Voltage)	6.1 µV (Range: ±0.1 V) 30 µV (Range: ±1 V) 300 µV (Range: ±10 V) 3.1 µV (Range: 0.1 V–0.3 V)
Measurement Accuracy (Voltage)	≤ 50 µV (Range: ±0.1 V) ≤ 150 µV (Range: ±1 V) ≤ 1 mV (Range: ±10 V) ≤ 50 µV (Range: 0.1 V–0.3 V)
Input Impedance	1 MΩ
Input Voltage	min. -12 V max. +12 V
Maximum Measurement Frequency	4 Hz

Table 12.1: Electrical Specifications of Analog Voltage Channels / Differential Inputs

### 12.2.2 Electrical Specifications of Analog Current Channels / Differential Inputs

Property	Specification
Number of Channels per Data Logger Type	2 @ Meteo-40L (AC1–AC2) 1 @ Meteo-40M (AC1) 1 @ Meteo-40S (AC1)
Available Current Ranges (DC)	±1 mA ±10 mA ±100 mA
Measurement Accuracy (DC)	≤ 5µA (Range: ±1 mA) ≤ 30µA (Range: ±10 mA) ≤ 300µA (Range: ±100 mA)
Resolution (Bit)	13 bit (Range: ±1 mA) 15 bit (Range: ±10 mA) 15 bit (Range: ±10 mA)
Input Impedance (Shunt)	4.7 Ω
Maximum Input Current	150 mA
Maximum Input Voltage	0.75 V
Maximum Measurement Frequency	4 Hz

Table 12.2: Electrical Specifications of Analog Current Channels / Differential Inputs

### 12.2.3 Electrical Specifications of Internal Measurements

Meteo-40 comprises measurement of *Internal Supply Voltage* and *Internal Current* of the data logger. These measurement values can be used for remote verification of the functionality of the data logger and are written to the source data and the CSV data files respectively.

**Important Notes:**

- Internal Supply Voltage and Internal Current are recorded with 12 bit resolution only,
- Internal Supply Voltage is measured directly behind a reverse polarity protection diode. This means: The measured value is approximately 0.35 volt lower than the supply voltage at the logger's supply terminals.

### 12.2.4 Electrical Specifications of Counter Channels / Non-Differential Inputs

The counter counts impulses within a defined measurement timespan. This measurement timespan is derived from a precise timer signal with a precision of  $\pm 5$  ppm in the temperature range  $-40$ – $+65$  °C. Note: An impulse is the sequence of two consecutive changes of logical states (0 1 0 or 1 0 1). If the second state change of one impulse does not fit into the defined measurement timespan this impuls is not taken into account in this timespan.

In case of a measurement timespan of one second the count of impulses is (nearly) equal to frequency (Unit: Hz).

Property	Specification
Number of Channels per Data Logger Type	12 @ Meteo-40L (C1–C12) 8 @ Meteo-40M (C1–C8) 4 @ Meteo-40S (C1–C4)
Frequency Range (TTL-Level)	1 Hz–25 kHz
Frequency Resolution <sup>1</sup>	0.1 Hz
Voltage Threshold ( $f > 1$ Hz)	0.22 V
Input Voltage	min. -12 V max. +12 V
Period Measurement (Non-Differential Inputs)	Channels P1 (C5), P2 (C6), P3 (C11), P4 (C12)

Table 12.3: Electrical Specifications of Counter Channels / Non-Differential Inputs

### 12.2.5 Electrical Specifications of Digital Channels (Serial Input / Output)

Property	Specification
Number of Channels per Data Logger Type	8 @ Meteo-40L (D1–D8) 4 @ Meteo-40M (D1–D4) 2 @ Meteo-40S (D1–D2)
Input Voltage Range (High State)	2 V–25 V
Input Voltage Range (Low State)	-0.5 V–0.6 V
Input Resistance	$\geq 10$ k $\Omega$

Table 12.4: Electrical Specifications of Digital Channels (Serial Input / Output)

<sup>1</sup>The frequency resolution depends on the period time setting. Longer period time setting results in higher resolution.

### 12.2.6 Electrical Specifications for Digital Clock Output

Property	Specification
Number of Channels per Data Logger Type	8 @ Meteo-40L (D1–D8) 4 @ Meteo-40M (D1–D4) 2 @ Meteo-40S (D1–D2)
High State	5 V
Low State	0 V
Output Resistance	100 $\Omega$
Minimal Load Resistance	500 $\Omega$

Table 12.5: Electrical Specifications for Digital Clock Output

### 12.2.7 Electrical Specifications for Analog Current Source

Property	Specification
Number of Channels per Data Logger Type	2 @ Meteo-40L (CS1–CS8) 1 @ Meteo-40M (CS1) 1 @ Meteo-40S (CS1)
Nominal Current	200 $\mu$ A
Tolerances	< 0.5 %

Table 12.6: Electrical Specifications for Analog Current Source

### 12.2.8 Electrical Specifications for Switches

Property	Specification
Number of Channels per Data Logger Type	8 @ Meteo-40L (S1–S8) 4 @ Meteo-40M (S1–S4) 2 @ Meteo-40S (S1–S2)
Switch Voltage Range	5 V–28 V
Max. Current Continuous Switch	120 mA
Peak Switch Current (2 s)	400 mA
Switch On Resistance	< 350 m $\Omega$
Switch Off Resistance	> 10 M $\Omega$

Table 12.7: Electrical Specifications for Switches



#### Important

The switches section of the Meteo-40 comprises 5 V outputs to supply peripheral devices inside the steel cabinet of the measurement setup. The 5 V supply is not intended to supply sensors connected with long cables due to the risk of damage caused by lightning strike.

The 5 V outputs provide an electronic current limiter and an overvoltage protection.

---

### 12.2.9 Electrical Specifications of the 5 V Output

Property	Specification
Max. output voltage	5.5 V
Min. output voltage	4.7 V
Max. output current per output terminal	15 mA

Table 12.8: Electrical Specification of the 5 V Output

### 12.2.10 Electrical Specifications of the RS485 Interface

Property	Specification
Supply Voltage RS485 A, B	5 V
Termination Resistor (Bus Termination)	120 $\Omega$
Maximal Transmission Rate	1 MB/s

Table 12.9: Electrical Specification of the RS485 Interface



**Note**

Biasing of RS485 interface via external module M83570.

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### 12.2.11 Electrical Specification of the Ethernet Interface



**Important**

The Ethernet interface is only available on Meteo-40 Revision D.

---

Property	Specification
Ethernet port (Meteo-40 Revision D)	100 Mbit/s (100BASE-TX)

Table 12.10: Electrical Specification of the Ethernet Interface

### 12.2.12 Electrical Specification of the RS232 Interface



**Important**

The RS232 interface is only available on Meteo-40 Revision C. The production of Meteo-40 Revision C stopped in October 2012.

---

Property	Specification
Serial interface port (Meteo-40 Revision C)	Male 9-pin RS232 connector for connection to serial modem
Maximal Baudrate	115200 Baud

Table 12.11: Electrical Specification of the RS232 Interface

### 12.2.13 Electrical Specification of the Power Supply



#### Important

Meteo-40 has no internal supply battery! External power supply is essential for proper operation.

Power Supply	Property	Specification
Supply Voltage Input (with Reverse Voltage Protection)	Supply Voltage Range	9 V (DC)–36 V (DC)
	Peak Supply Voltage (10 s)	55 V (DC)
Current Consumption	Average Current Consumption @ 12 V (DC) during measurement	$\leq 30 \text{ mA}$ ( $P < 360 \text{ mW}$ )
	Average Current Consumption @ 12 V (DC) during communication	$\leq 70 \text{ mA}$ ( $P \leq 840 \text{ mW}$ ) for Meteo-40 Revision D $\leq 60 \text{ mA}$ ( $P < 720 \text{ mW}$ ) for Meteo-40 Revision C
	Average Current Consumption @ 12 V (DC) with display illumination	175 mA ( $P \leq 2.1 \text{ W}$ ) for Meteo-40 Revision D $< 500 \text{ mA}$ ( $P < 6 \text{ W}$ ) for Meteo-40 Revision C

Table 12.12: Electrical Specification of the Power Supply



# Chapter 13

## Electrical Connection Plans

The following connection plans explain how Meteo-40 is connected with power supply, sensors and other periphery.



**Note**

Since Meteo-40 is designed to be very flexible, various sensors can be connected to the data logger. If the sensor you intend to connect, is not listed in this manual, refer for technical details and connection plans shown on the data sheets on our website ([www.ammonit.com](http://www.ammonit.com) (<http://www.ammonit.com>)) or contact our sales team (+49-30-6003188-0 or [sales@ammonit.com](mailto:sales@ammonit.com)).

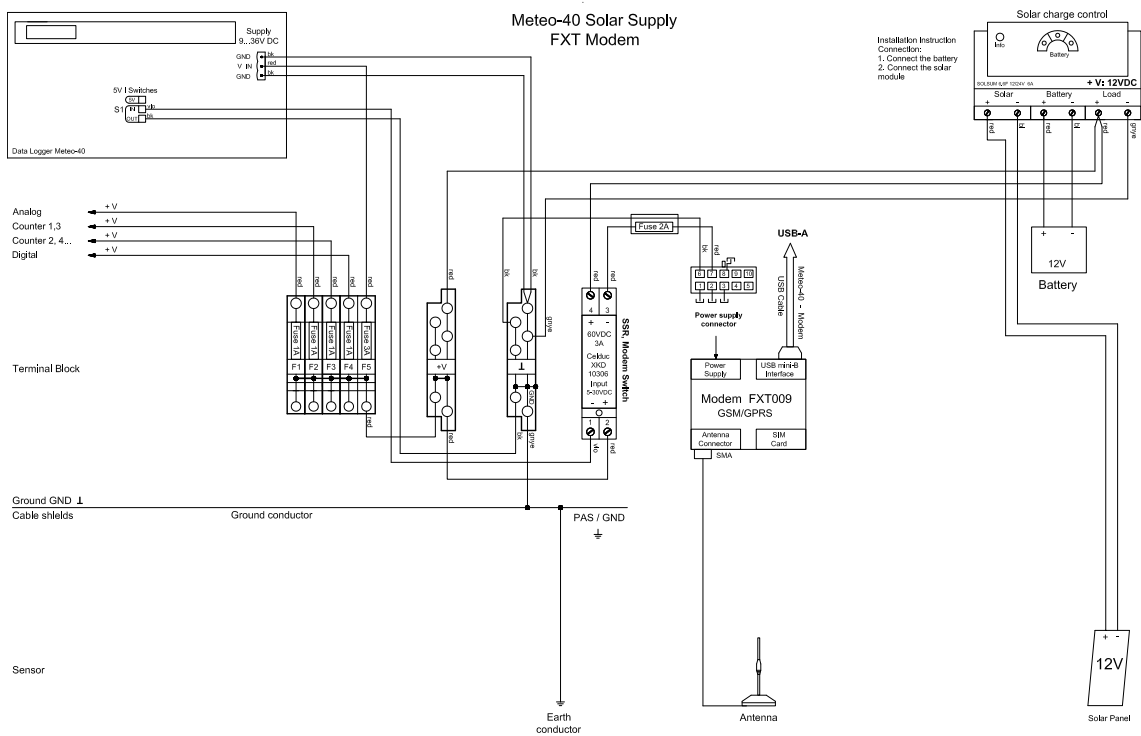


Figure 13.1: Meteo-40 Supply incl. Modem

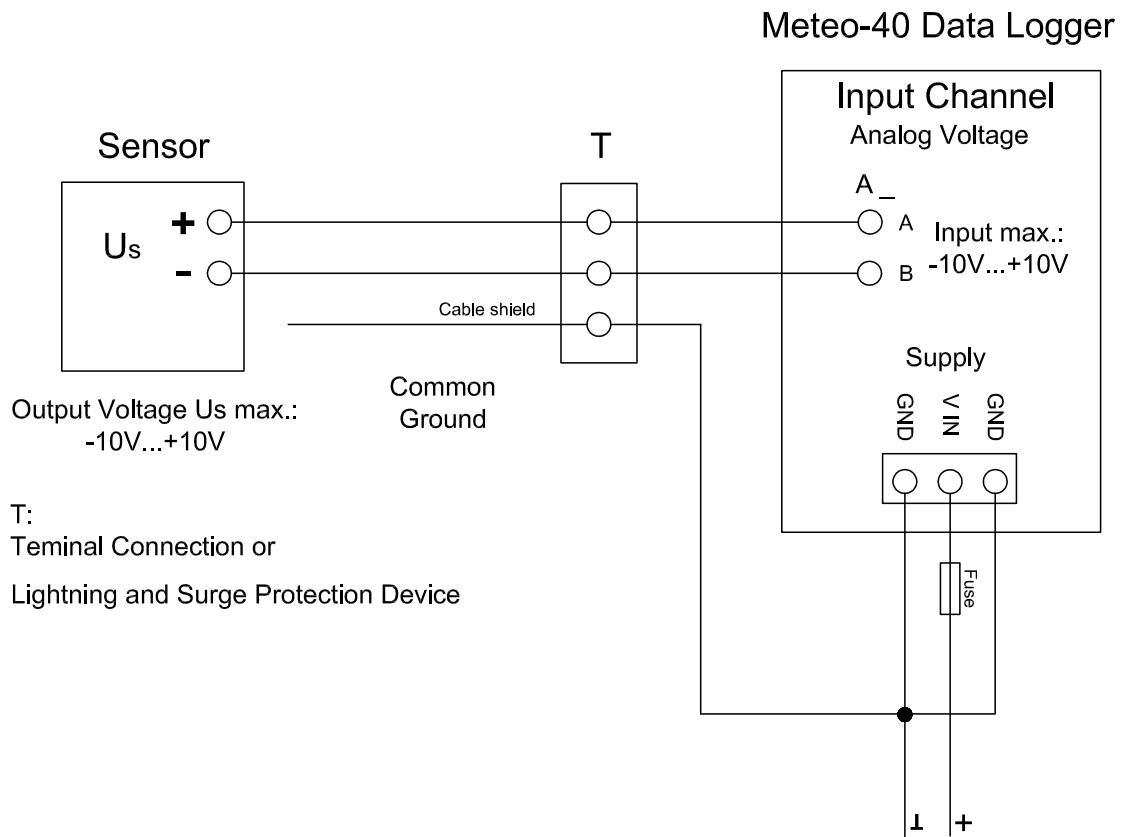


Figure 13.2: Electrical Connection Plan: Analog Voltage (Pyranometer)

Floating voltage source (pyranometer) is connected via terminal or OVP to the differential analog voltage channels.



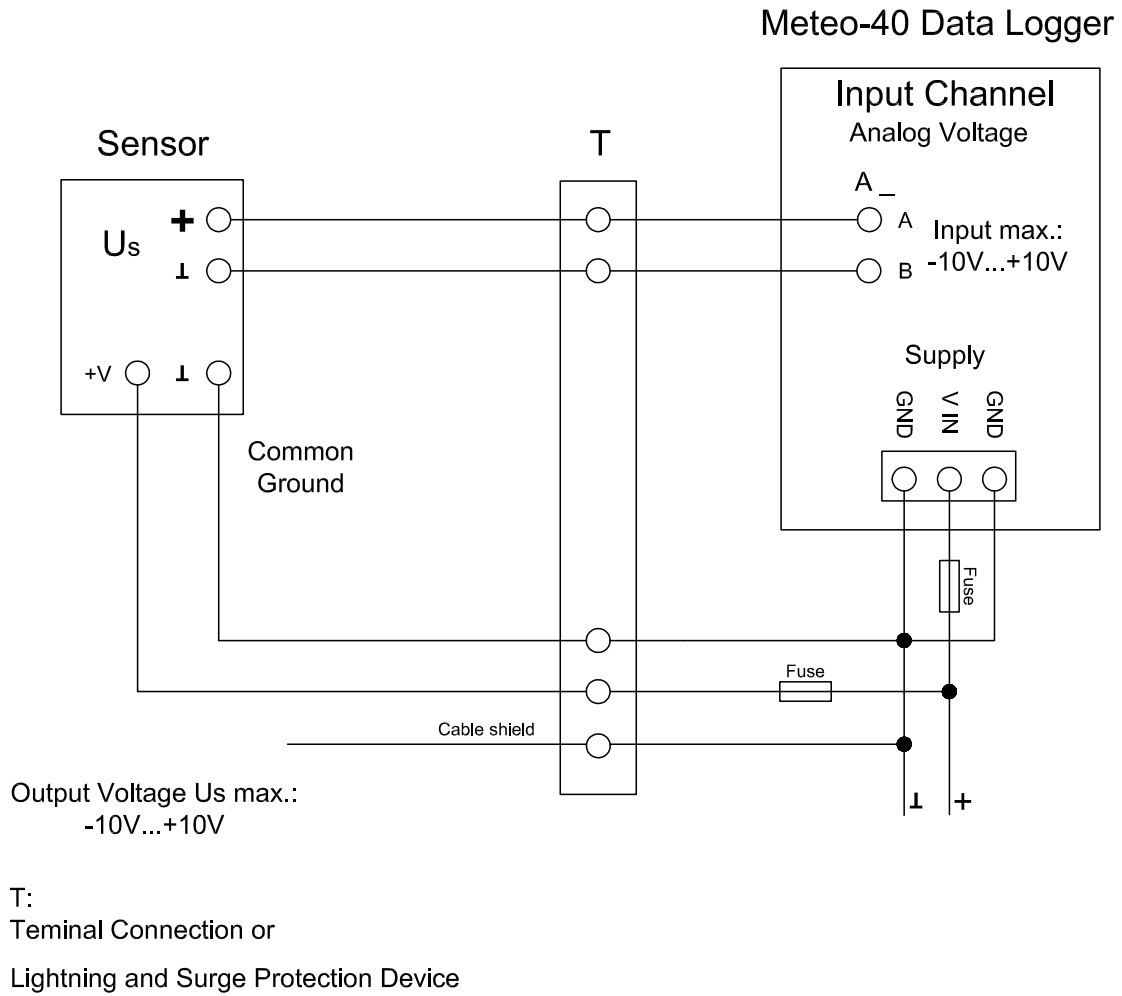


Figure 13.3: Electrical Connection Plan: Analog Voltage (Temperature / Barometric Pressure Sensor)

The temperature and/or barometric pressure sensor is connected via terminal or OVP to the differential analog voltage channels. To avoid ground loops, it is not recommended connecting the B terminal of the analog voltage input directly to common ground.

## Meteo-40 Data Logger

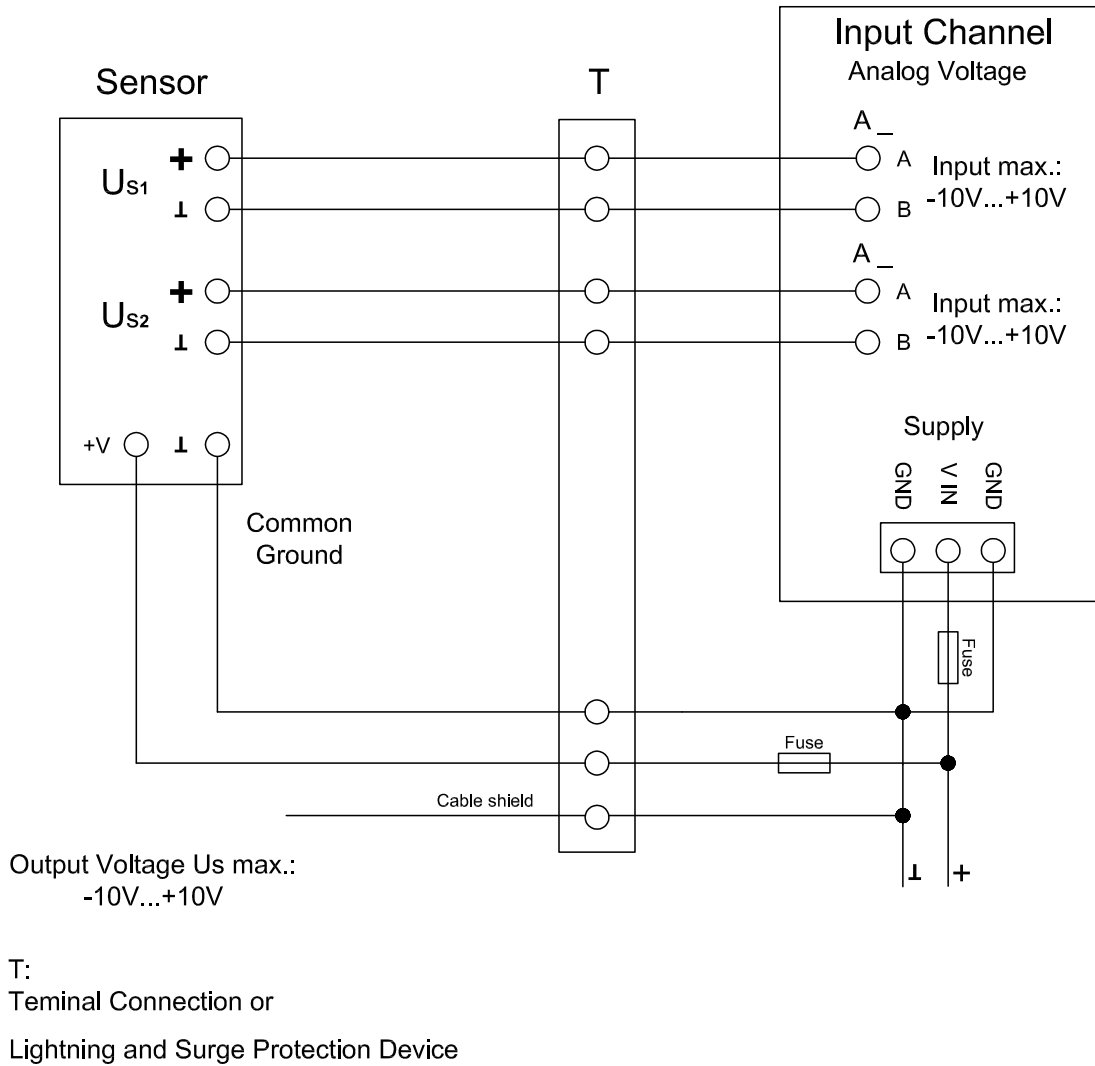


Figure 13.4: Electrical Connection Plan: Analog Voltage (Temperature + Humidity Sensor)

Voltage sources (temperature and humidity sensor) are connected via terminal or OVP to the differential analog voltage channels. To avoid ground loops, it is not recommended connecting the B terminal of the analog voltage input directly to common ground.

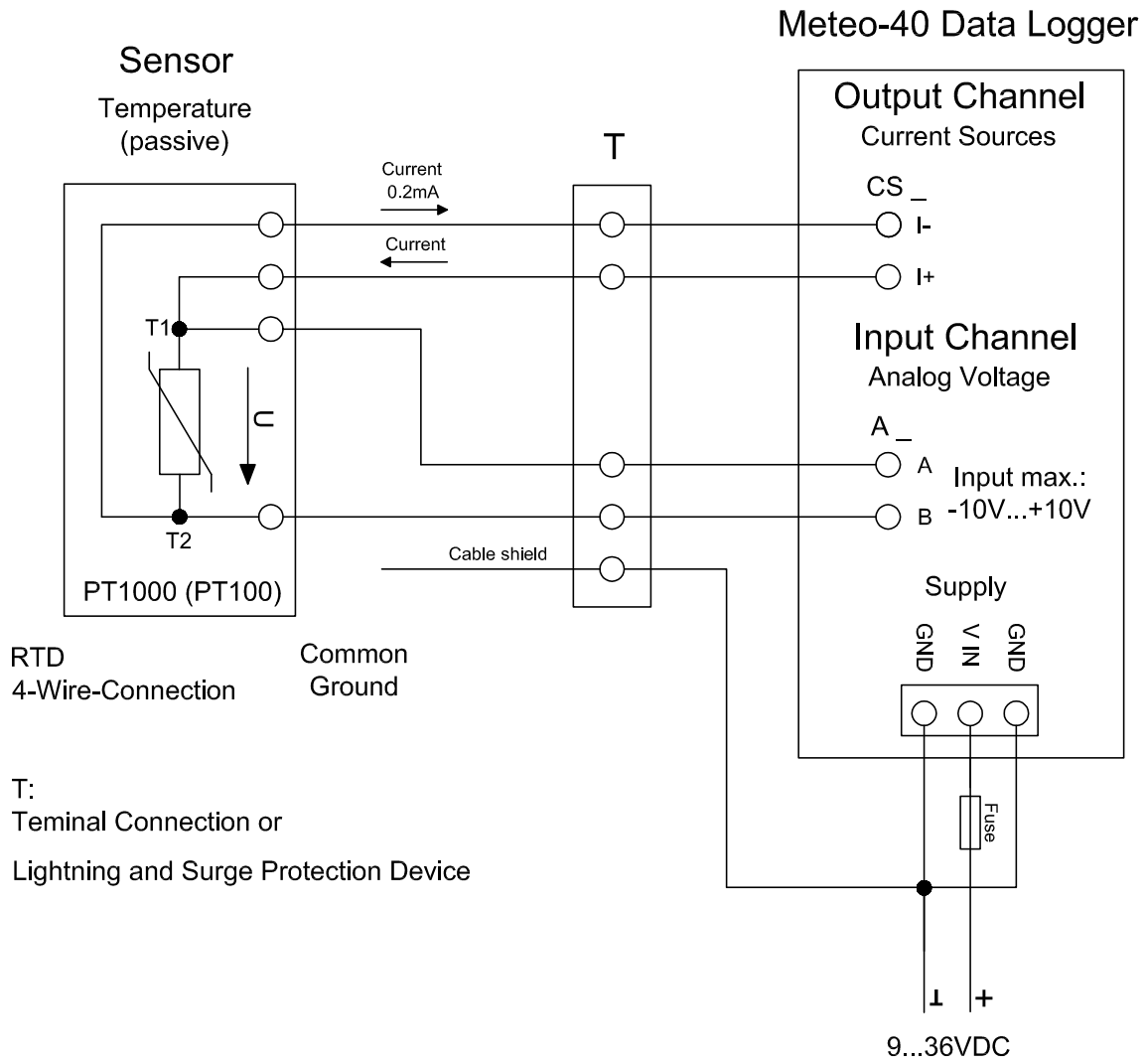


Figure 13.5: Electrical Connection Plan: Analog Voltage / Current Source (4-wire-connection; Pt1000)

Analog Current Source (CS) of Meteo-40 is applied to feed a Pt100/Pt1000 temperature sensor. The sensor is connected via terminal or OVP to the differential analog voltage channel. 4-wire measurement is recommended to avoid voltage errors due to the resistance of feed line.

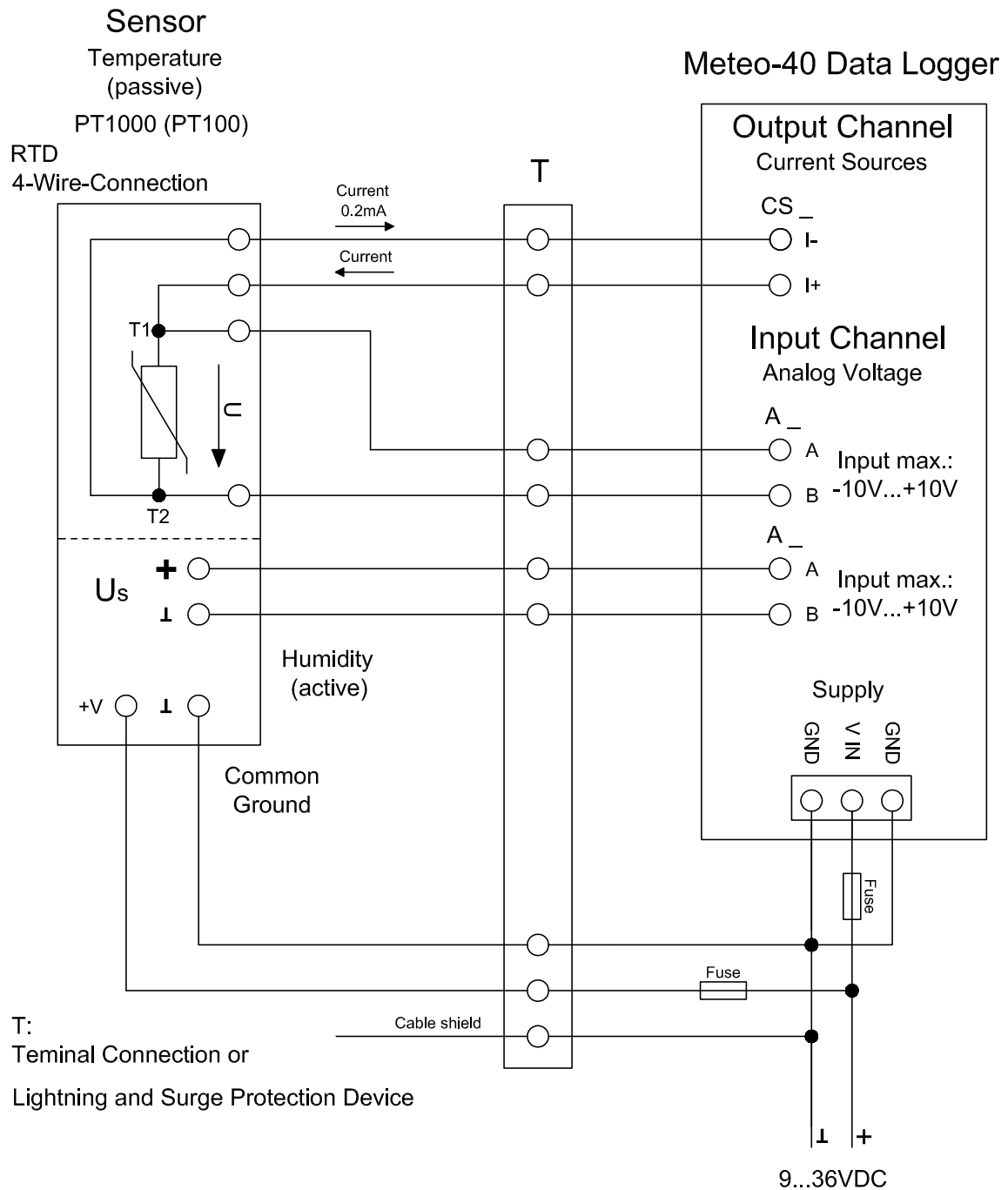


Figure 13.6: Electrical Connection Plan: Analog Voltage / Current Source (4-wire-connection; Pt1000 + Humidity)

Analog Current Source (CS) of Meteo-40 supplies the Pt100/Pt1000 temperature sensor. The active humidity sensor may be fed by the same supply as the data logger. Both sensor outputs are connected via terminal or OVP to individual differential analog voltage channels.

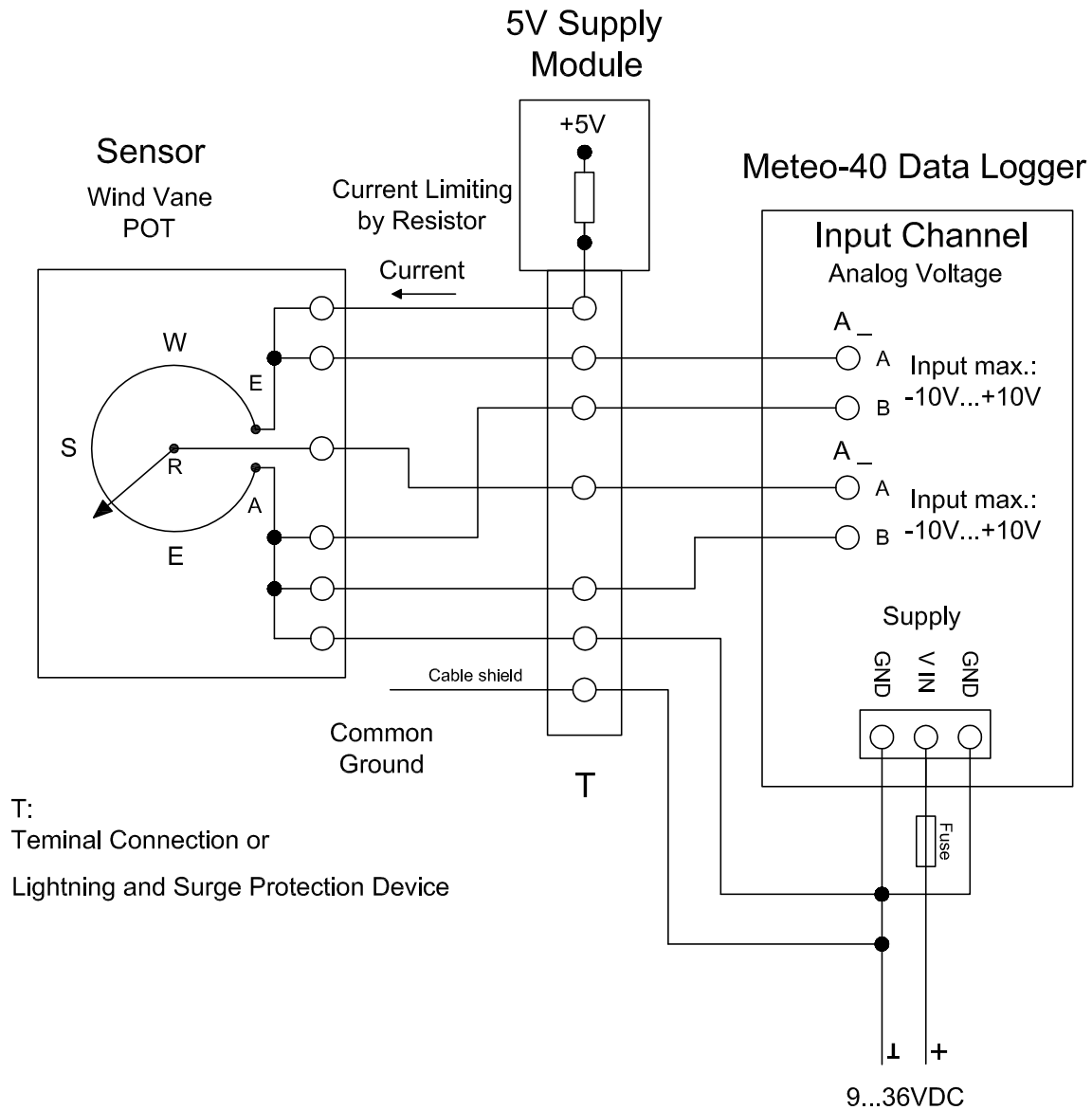


Figure 13.7: Electrical Connection Plan: Analog Voltage (Potentiometric Wind Vane)

The figure above shows the 5-wire connection of a potentiometric wind vane. The intention of this configuration is to avoid voltage drops on the measurement lines caused by wire resistance. The first analog voltage channel measures the voltage across the whole potentiometer while the second channel measures the voltage between wiper and ground. The configuration is supplied via current limiting resistor by a 5 V supply. All lines to the wind vane are connected via terminal or OVP.

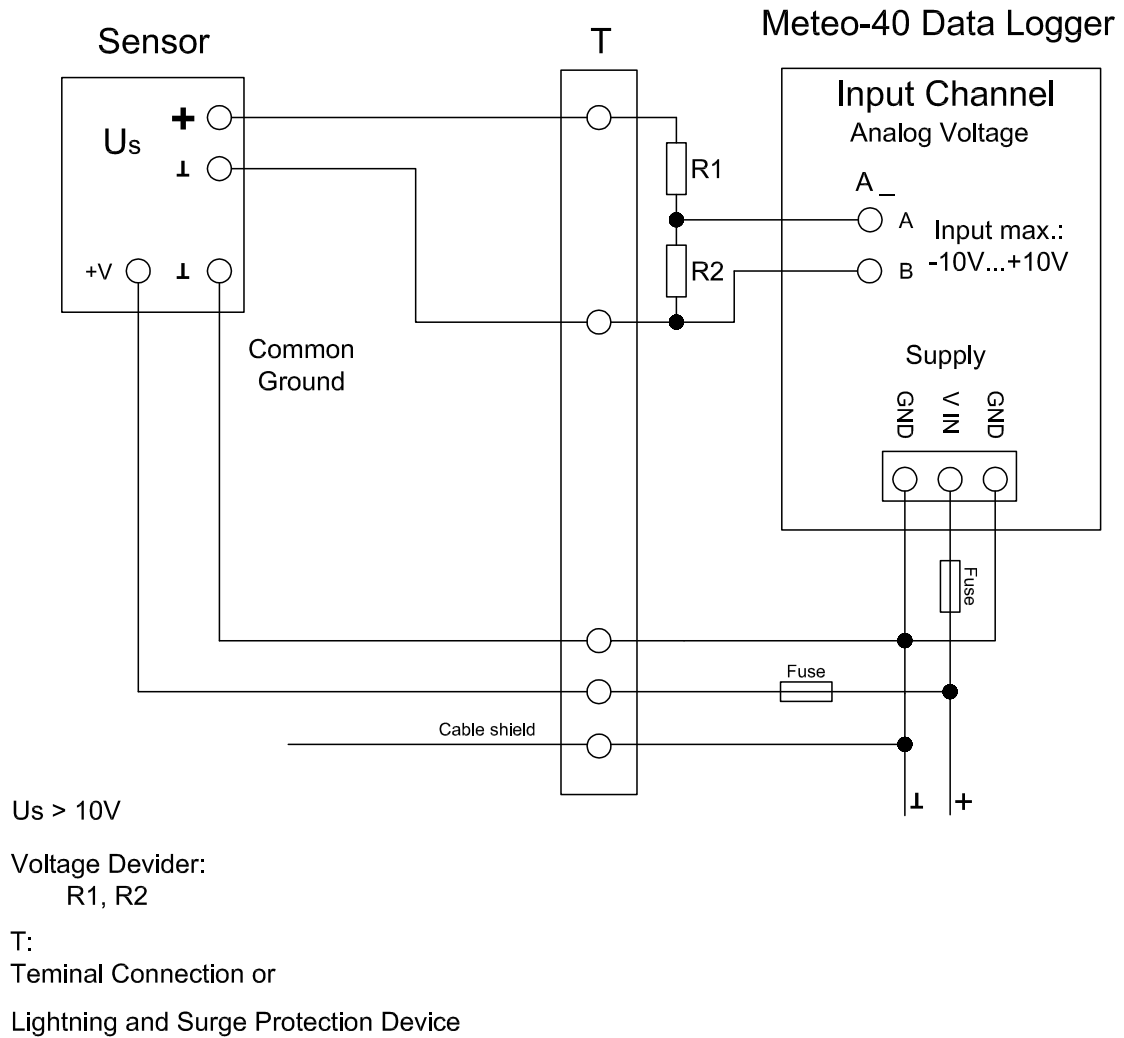


Figure 13.8: Electrical Connection Plan: Analog Voltage with Voltage Divider (R1, R2)

The Meteo-40 data logger is designed to measure analog DC voltages from -10 V–10 V. This is sufficient for most meteorological sensors. If voltages higher than +10 V occur, the voltage at the analog voltage inputs must be shared by a voltage divider. Note that R2 is in parallel to the input impedance of the analog voltage channel (1 M $\Omega$ ).

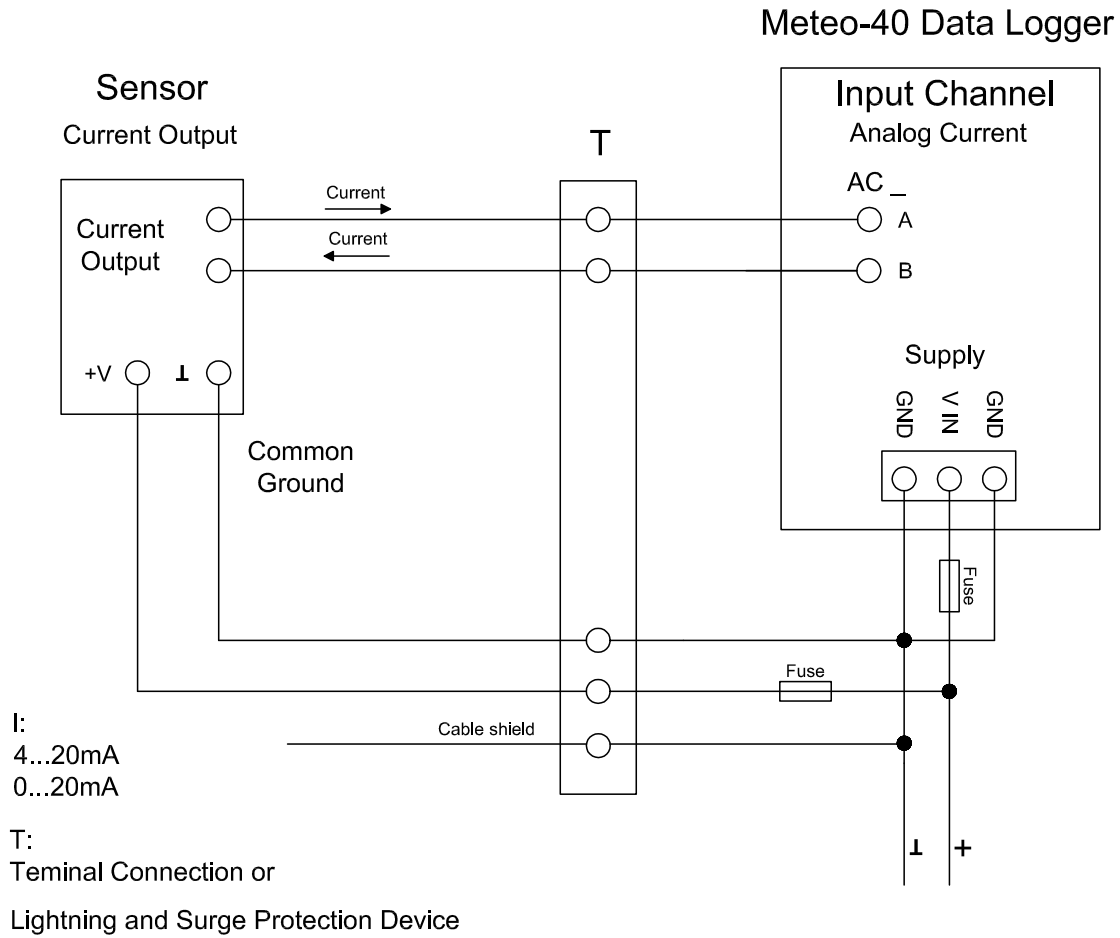
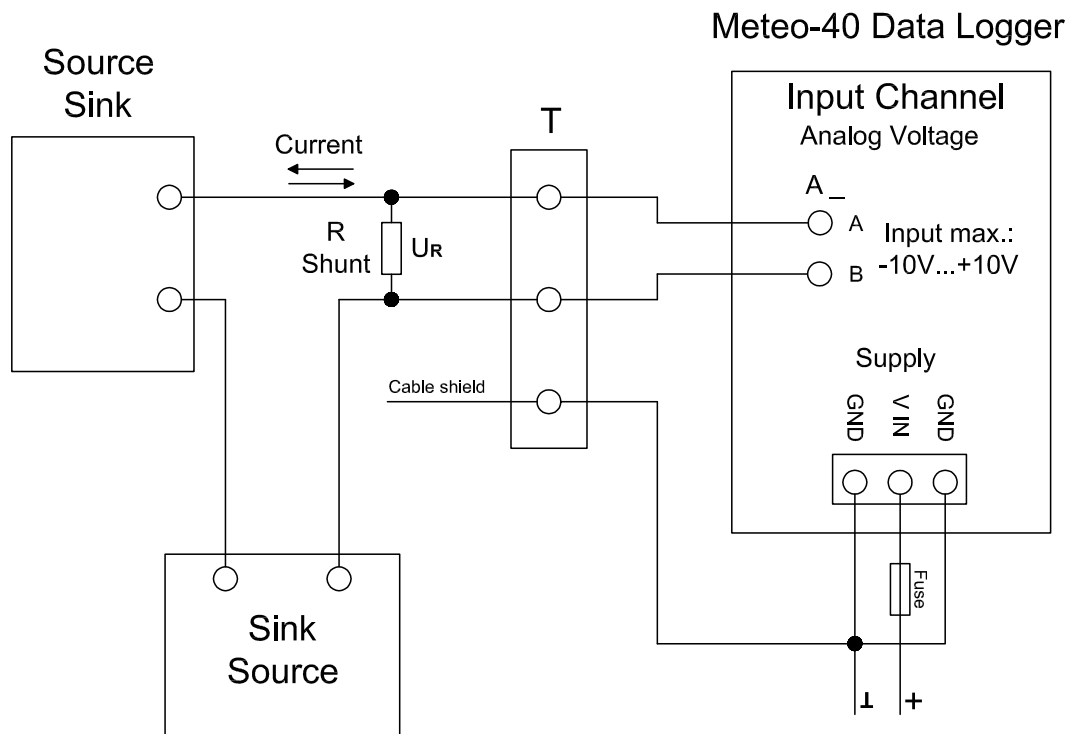


Figure 13.9: Electrical Connection Plan: Analog Current (2-wire-connection), active

Meteo-40 comprises analog current measurement inputs (AC) to measure DC currents up to 100 mA. Many meteorological sensors provide analog current outputs with 0–20 mA or 4–20 mA. The positive signal line has to be connected to the A input. The negative line (or signal ground) has to be connected to the B input of the analog current input. The figure above depicts the recommended setup using connections via terminal or OVP to the data logger.



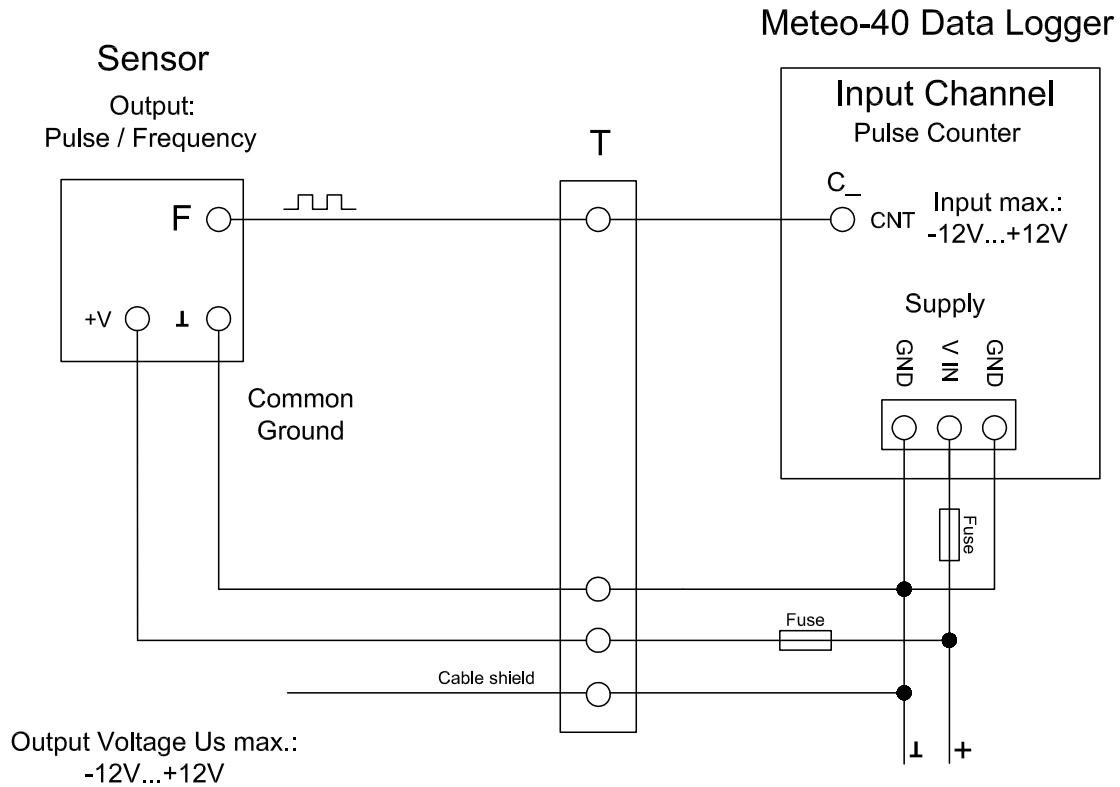
Output Voltage  $U_R$  max.:  
-10V...+10V

T:  
Terminal Connection or  
Lightning and Surge Protection Device

Figure 13.10: Electrical Connection Plan: Analog Voltage with Shunt

The Meteo-40 data logger can measure DC currents up to 100 mA on its analog current inputs. This is sufficient for most meteorological sensors. If currents higher than 100 mA are to be measured, a shunt can be used in conjunction with the analog voltage inputs.





T:  
Terminal Connection or  
Lightning and Surge Protection Device

Figure 13.11: Electrical Connection Plan: Pulse Counter (Anemometer)

Meteo-40 comprises several impulse counter inputs (CNT). In most cases they are used for anemometer setup. The signal output of the sensor has to be connected to the CNT input of the data logger. To avoid floating signals common ground is used for the negative line of counter connection. The figure above depicts the recommended setup using connections via terminal or OVP to the data logger.

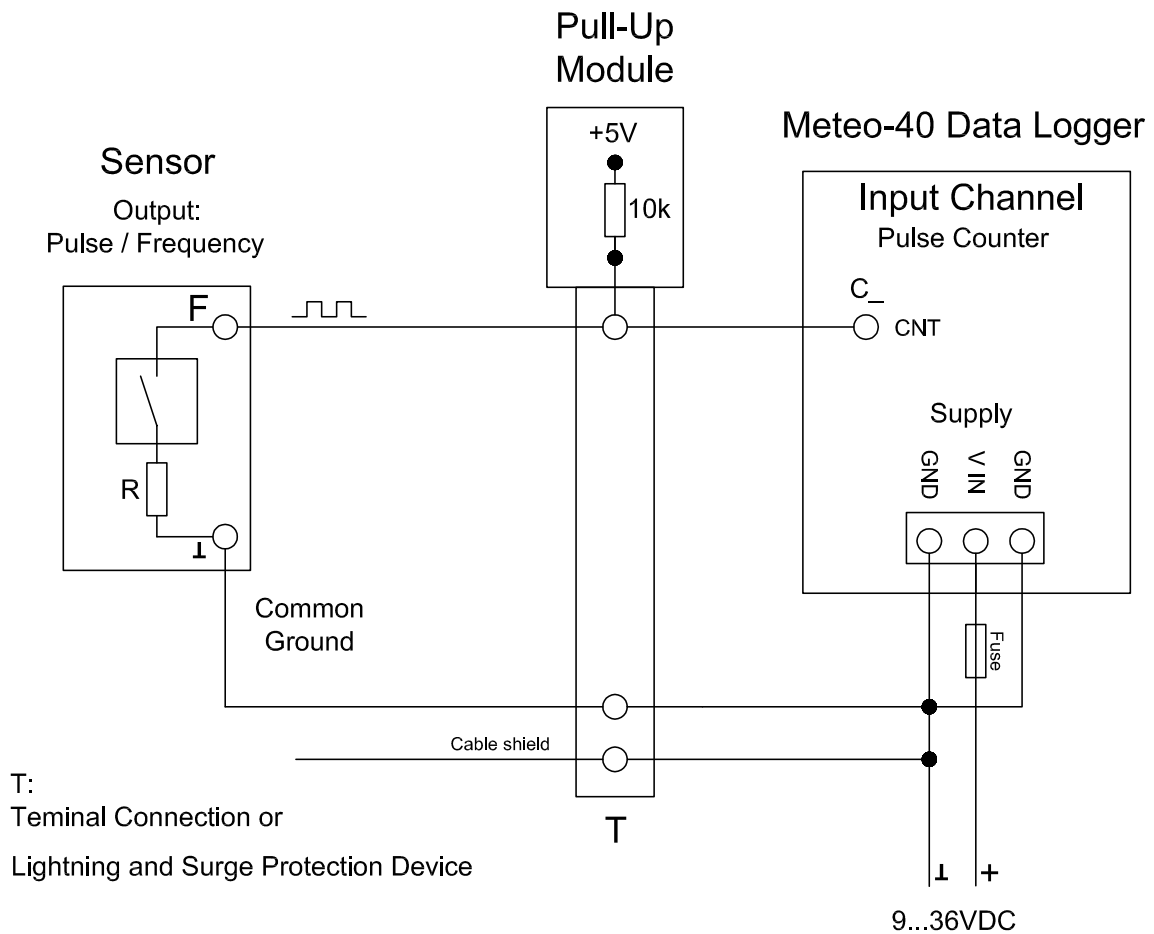
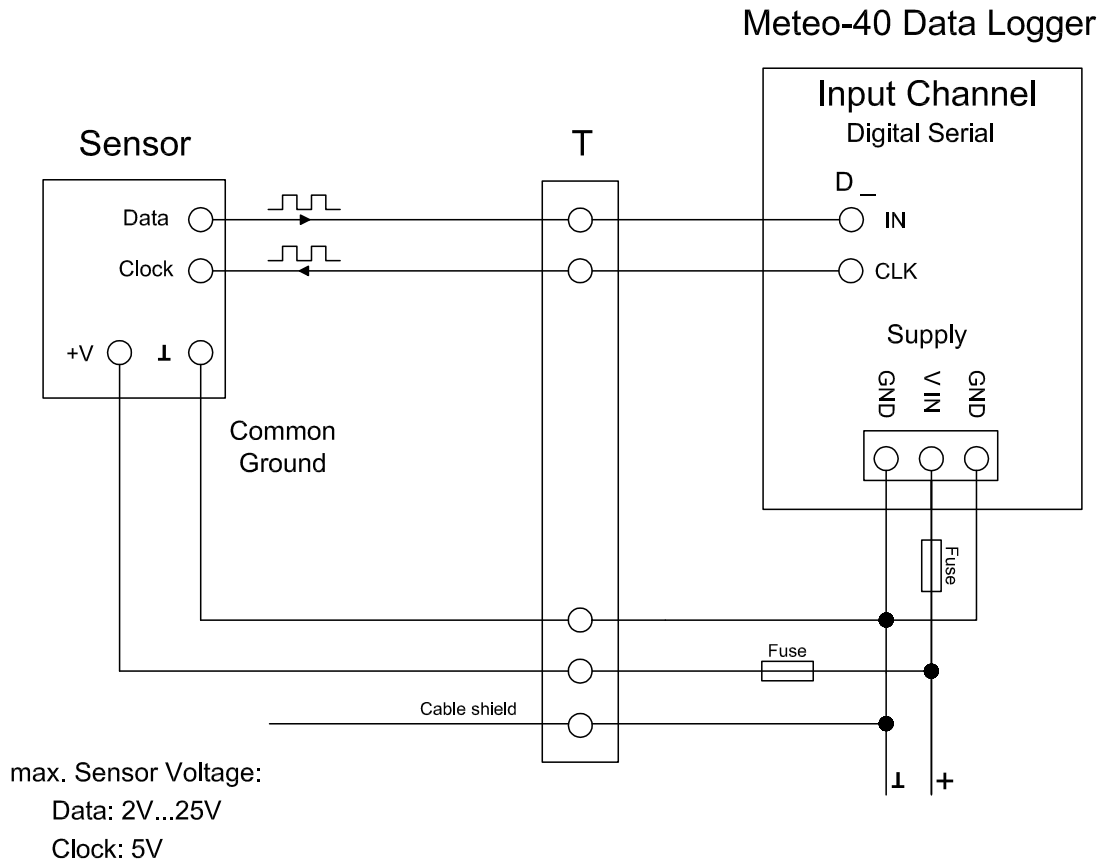


Figure 13.12: Electrical Connection Plan: Pulse Counter with Pull-up Module for Precipitation Measurement

The counter inputs of the Meteo-40 data logger can be used for precipitation sensors. Most precipitation sensors comprise open collector outputs or use a switching reed contact. In both cases an additional pull-up resistor has to be applied. This pull-up resistor is tied to a 5 V supply to feed the sensor's output. The module M83570 by Ammonit comprises several configurable pull-up resistors and an internal 5 V supply. M83570 can easily be integrated in the setup of a steel cabinet. The figure above shows the recommended setup using connections via terminal or OVP to the data logger.



T:  
Terminal Connection or  
Lightning and Surge Protection Device

Figure 13.13: Electrical Connection Plan: Digital Serial for Serial Wind Vane (Thies TMR)

The Digital Serial inputs of Meteo-40 data loggers are designed to connect sensors using serial communication. The data logger sends a clock burst to the sensor via the CLK line. The response of the sensor is sent back to the data input line (IN) of the Digital Serial panel. It is essential that sensor and data logger use the same common ground. The figure above shows the recommended setup using connections via terminal or OVP to the data logger.

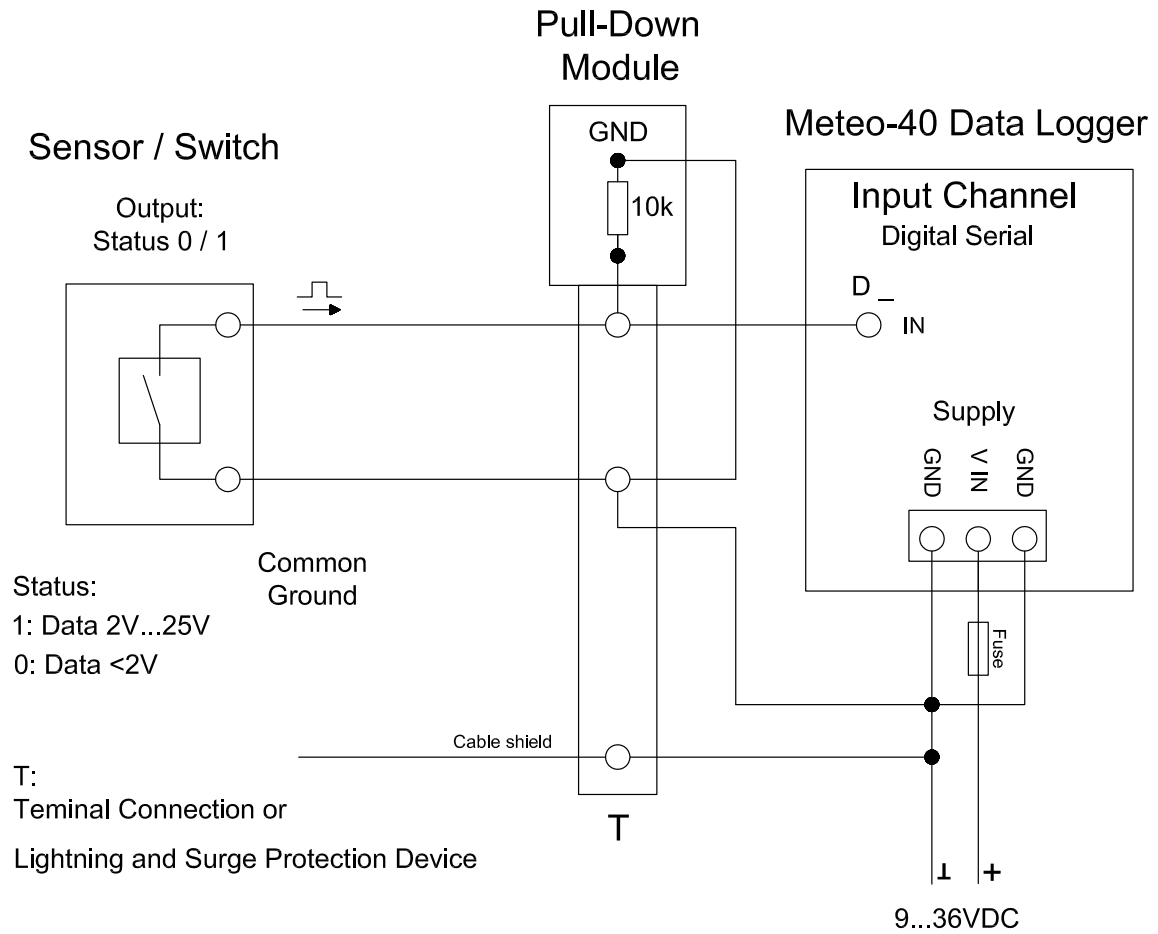


Figure 13.14: Electrical Connection Plan: Status with Pull-down Module

In some cases an additional pull-down resistor may be required to equalise the electrical potential on the status signal lines. This may be necessary to reduce perturbation caused by floating lines. The potential equalization can be realized by an external resistor to GND or an external module M83570 provided by Ammonit. This external module comprises pull down resistors for several signal lines.

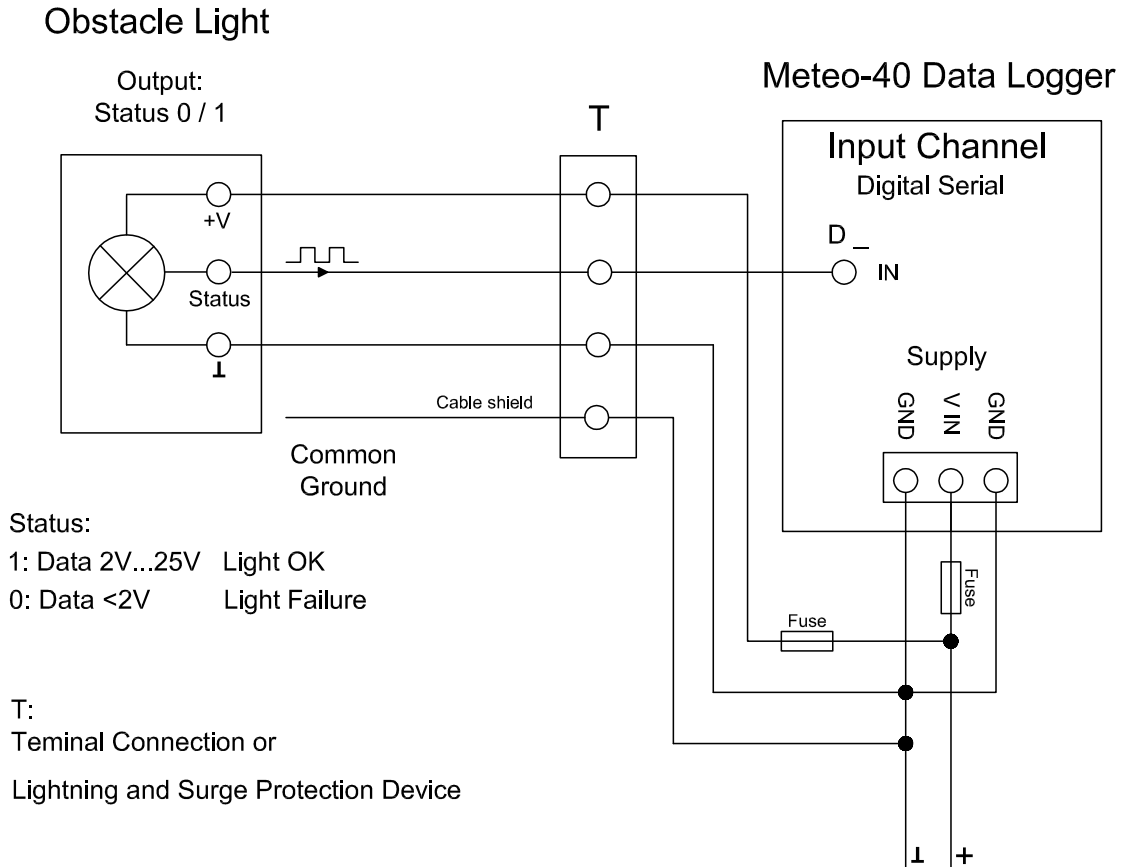


Figure 13.15: Electrical Connection Plan: Status for Obstacle Light

Many obstacle lights provide a diagnosis port to indicate malfunction. This diagnosis port can be connected to the IN port of the Serial Digital panel. For a detailed description of the electrical characteristics of the interfaces see table in Section 12.2.5. The figure above shows the recommended setup using connections via terminal or OVP to the data logger.

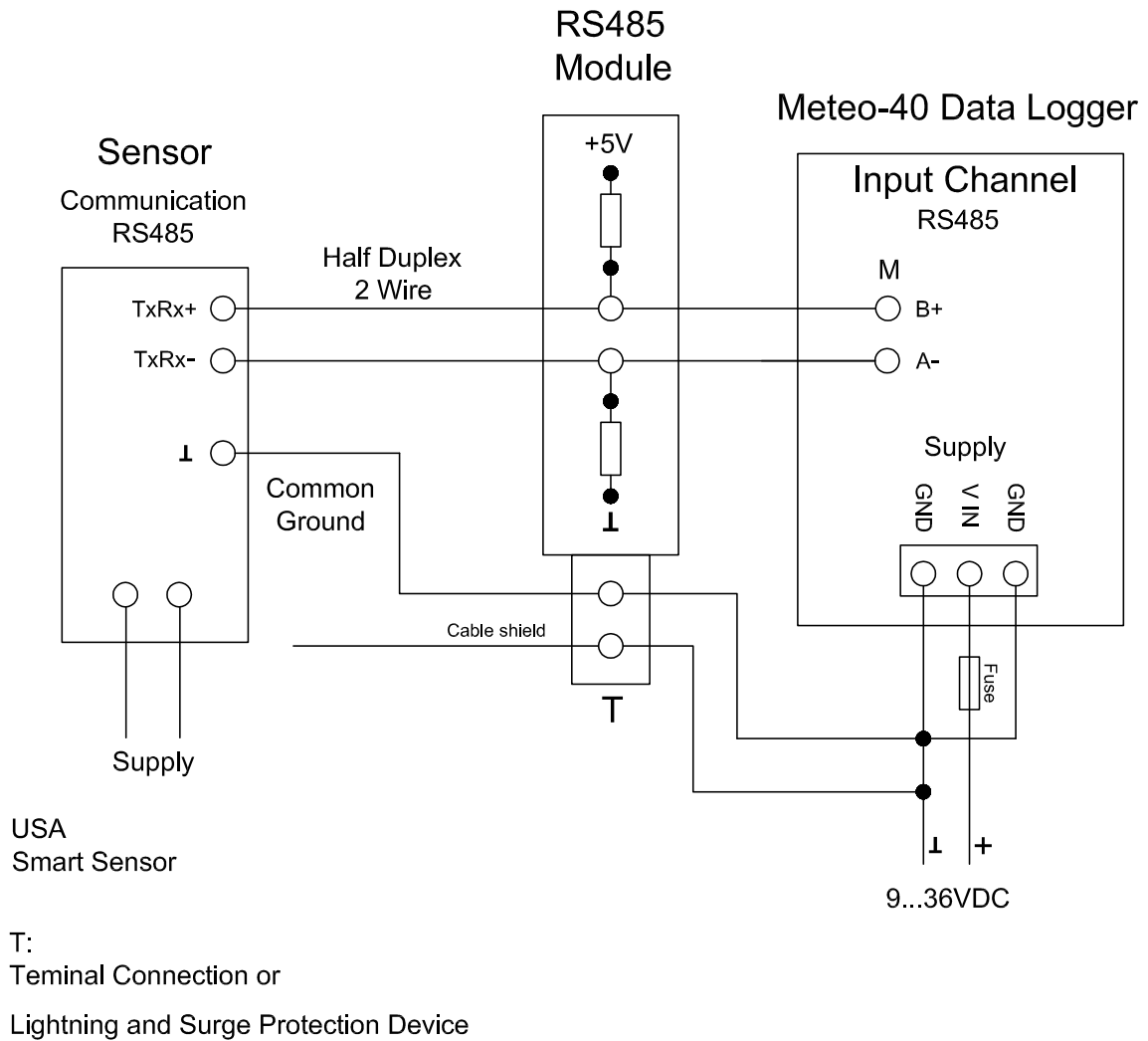


Figure 13.16: Electrical Connection Plan: RS485 with RS485 Module

In case of RS485 bus communication an additional biasing may be required. This can be done with the configuration shown above. Ammonit provides the external Module M83570 which comprises a configurable circuit for biasing purposes. The M83570 module contains an internal voltage supply providing 5 V for biasing the RS485 bus lines.

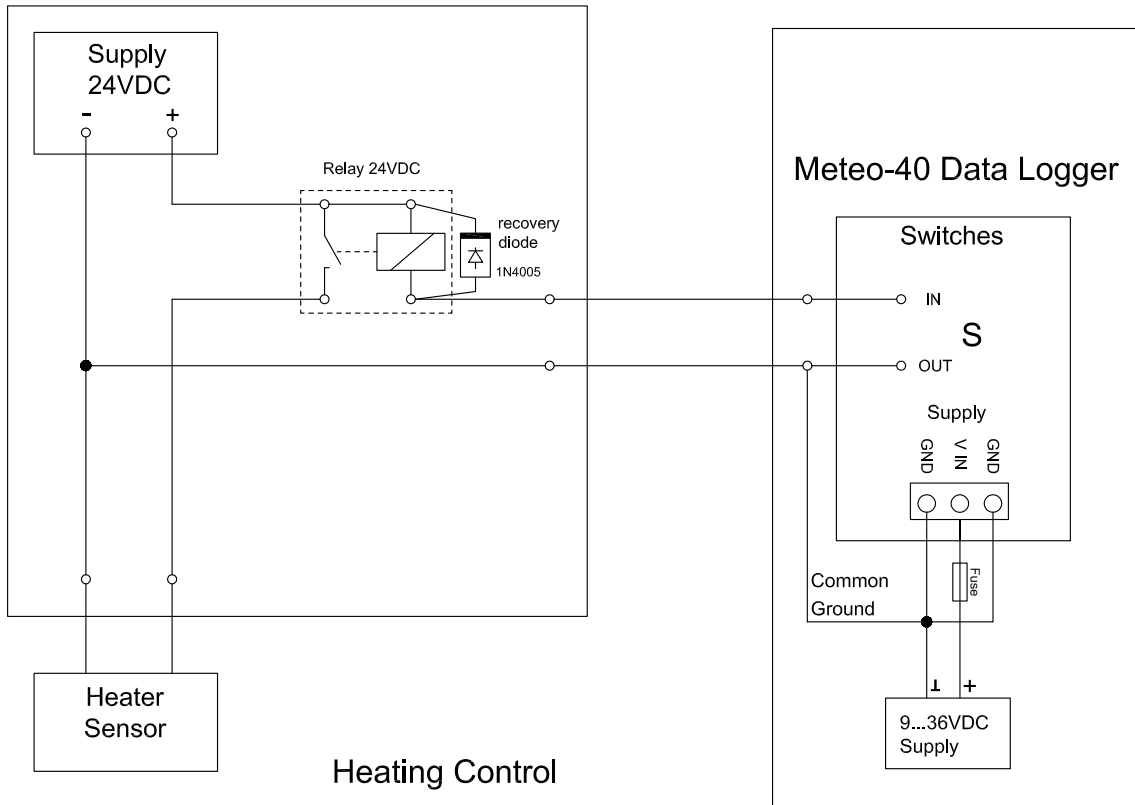


Figure 13.17: Electrical Connection Plan: Switch external Sensor Heating via Meteo-40 Switch Manager

The configuration above displays the connection of an external sensor heating switched by the Meteo-40 heating control.





## Chapter 14

# Cryptographic Software

Ammonit implemented certain standard cryptographic software to protect sensitive measurement data. None of the algorithms are developed by Ammonit. All cryptographic software used on Meteo-40 is free software. Its source code is available for everybody to study and check for security problems.

Currently the following is encrypted:

- Access to Meteo-40 via web interface over HTTPS with high-grade encryption (AES-256, 256 bit keys)
- All data sent and received via the Meteo-40 web interface, e.g., data download
- Data upload via SCP (RSA 2048 bit) to AmmonitOR or your own server
- Emails and attached CSV files sent by Meteo-40 (optional)



### Note

There is no encryption, when data is uploaded via FTP to a server. Moreover, the data stored on Meteo-40 is not encrypted. But only computer specialists with inside knowledge could be able to access the data.

Software or Protocol	Description	Supported Algorithms
HTTPS	All access to the user interface of the data logger is done via HTTPS, a combination of HTTP with SSL/ TLS, as implemented in OpenSSL.	AES, Blowfish, Camellia, SEED, CAST-128, DES, IDEA, RC2, RC4, RC5, Triple DES, GOST 28147-89, MD5, MD2, SHA-1, SHA-2, RIPEMD-160, MDC-2, GOST R 34.11-94, RSA, DSA, Diffie–Hellman key exchange, Elliptic curve, GOST R 34.10-2001
SSH	The connection to the Ammonit tunnel server (or any tunnel server of your choice) is performed with an SSH reverse tunnel.	3DES, Blowfish, CAST128, Arcfour, AES, RSA
GnuPG	GnuPG is used to digitally sign and encrypt measurement data.	CAST5, Camellia, Triple DES, AES, Blowfish, Twofish, ElGamal, RSA RIPEMD-160, MD5, SHA-1, SHA-2, Tiger, DSA, RSA

Table 14.1: Cryptographic Software



## Chapter 15

# Maintenance and Care

In order to ensure that Meteo-40 data loggers work properly, it is important that you maintain and handle the device with care.



### Important

If an error occurs and the Ammonit support team needs to be contacted, download the configuration file ( `config-Dnnnnnn.txt` in menu System → Information) and send it with the error description to the Ammonit Support [support@ammonit.com](mailto:support@ammonit.com).

## 15.1 Operation and Storage

The data logger can be affected by extreme temperature and humidity conditions. Meteo-40 is designed to operate properly at temperatures between -40–+65 °C in non-condensing environments. The display is readable between -20–+70 °C.

On site the data logger has to be installed in a robust and weatherproof cabinet (see also at [www.ammonit.com](http://www.ammonit.com) (<http://www.ammonit.com/>)). The cabinet protects the data logger against weather and condensation damage, theft and vandalism. If humidity tolerance is exceeded and moisture penetrates, the electronics of Meteo-40 can be damaged. Users are responsible for effective humidity control.

Handle Meteo-40 with care, do not drop it, and avoid mechanical shocks and vibrations to prevent the electronics from being damaged. Do not open or break the Meteo-40 housing or any of the slots. Avoid permanent pressure on the data logger.

To ensure that Meteo-40 operates properly, install only equipment, e.g., sensors, adapters and cables, which is undamaged and approved by Ammonit. Contact Ammonit, if any questions occur.

## 15.2 Overvoltage / Lightning Protection

Ammonit offers lightning and overvoltage protection devices for DC and AC low-voltage supplies of components and measuring systems, ensuring protection of data and signal lines and power cables. The surge protection cable clamp is installed in the steel cabinet instead of a regular unprotected cable clamp. We offer several types of surge protection devices, differing in number of pins and voltage levels. Although the installation of overvoltage protection devices is not mandatory, we highly recommend installing them, as unprotected lightning can lead to a total breakdown of the entire measuring system. Overvoltage protection is strongly advised at freestanding measuring stations or when aircraft obstacle lights are applied.



## Chapter 16

# Frequently Asked Questions

Find in this chapter a summary of frequently asked questions.


If you do not find the answer to your specific question in this chapter, contact the Ammonit support team.

### 16.1 Local Communication

Question	Answer
The Meteo-40 display does not show anything.	The display is switched off. Press the middle button of your data logger and hold it until the display turns on. The display of Meteo-40 is only illuminated, when CECS is running. During MARS operation, the display is switched of. Refer to Chapter 9. The ambient temperature is below -20 °C. The crystals of the LCD got stuck.
I cannot configure Meteo-40 using the buttons.	You do not have permission to configure the data logger with the buttons on the Meteo-40 housing. See Section 9.1.
The red LED light is turned on. What does it indicate?	It indicates that an error in the measuring operation occurred. For details see System → Logbook in the web interface or System → Errors → Error List in the display menu.
The yellow LED light blinks. What does it indicate?	It indicates that at least one RS485 sensor is connected. According to the Modbus protocol, the yellow LED light blinks, when a measurement is taken.
I do not have an USB Ethernet adapter available. How can I connect Meteo-40 Revision C to the LAN?	As Meteo-40 Revision C has no Ethernet port, an USB Ethernet adapter is required. Use the USB Ethernet adapter included in the delivery. Meteo-40 Revision D data loggers are equipped with Ethernet port and can be connected directly to the LAN - without any accessories.
Meteo-40 is connected to the LAN. After entering the IP address of Meteo-40 in my browser, I receive an error message.	Check the three following possibilities: <ul style="list-style-type: none"> <li>• Meteo-40 is switched off. The web interface can only be accessed, when Meteo-40 is switched on, rep. the CECS has to be on. See Section 1.4.</li> <li>• Make sure, Meteo-40 and your PC are within the same LAN.</li> <li>• A static IP address is configured, which does not exist in your current LAN. If you have the permission, you can activate DHCP in the display of Meteo-40. Go to the Communication → Devices → LAN → eth menu and set <i>Use DHCP</i> to Yes(see Section 9.1. Or connect the data logger via USB and change the LAN settings. See Section 7.7.</li> </ul>
Meteo-40 is connected via USB to a Windows PC and is not recognized.	Download and install the required driver file. See Section 2.5.
Which cable I have to use to connect Meteo-40 to my PC?	Use a standards USB-A+B cable, the same cable used to connect printers or other devices. Note that you might require a driver file for Meteo-40 (see above).


## 16.2 Remote Communication

### 16.2.1 Modem

Question	Answer
<p>After configuring and connecting the Sierra Wireless FXT009 modem, the connection cannot be established.</p>	<ul style="list-style-type: none"> <li>• Make sure the SIM card is not broken. The SIM card should be inserted properly and the SIM card slot of the modem has to be locked (see Section 7.9.6.1).</li> <li>• Check the power supply of the modem. A small red light indicates that the modem is running.</li> <li>• Make sure that you configured the SIM card's provider details in the provider settings. Use the <i>Provider helper</i>(see Section 7.9.1), if you are unsure. If your provider is not given in the list, ask your provider for the details, i.e., APN, username and password. We recommend doublechecking the provider details.</li> <li>• Make sure that the used SIM card has not been locked by entering a wrong PIN code. You can create a new PIN code via the Meteo-40 web interface; the PUK code is required.</li> <li>• Make sure that you use a SIM card / rate, which supports mobile Internet.</li> </ul>
<p>An Internet connection is always established, when I switch on the CECS of Meteo-40. The modem should only be online, when data has to be sent.</p>	<p>Deselect the checkbox <i>Modem online, when CECS is on</i> in the Communication → Modem menu. Thus the modem only establishes an online connection, when an action (e.g., upload data, email data or online availability) is scheduled.</p>
<p>I cannot connect to the data logger via modem?</p>	<ul style="list-style-type: none"> <li>• Make sure the modem is switched on and running to perform the scheduled actions. Did you configure a switch to toggle the modem? If the modem is connected via relay to the data logger, a switch has to be configured in the Communication → Modem menu of the data logger. In Meteo-40 firmware version 1.0 Rev. 13915 and higher S1 is set by default in the modem configuration. It is not sufficient to toggle the switch manually, as it is not saved to the data logger configuration. After rebooting the data logger or after power supply interruptions, the modem will not start again. It remains switched off. See also Section 7.9.</li> <li>• If the modem is configured properly and you do not receive any measurement data, it could be a problem with the modem. Are the frequency bands configured correctly? Refer to Section 7.9.6.1. We also recommend upgrading the data logger firmware regularly as we continuously improve the software.</li> <li>• If you receive measurement data, the signal might be too weak to set up the Internet connection to access the data logger. In this case refer to Section 16.2.2.</li> </ul> <hr/> <p> <b>Tip</b> We recommend testing the modem functions before installation in the field, i.e., sending emails, uploading files and accessing the web interface via modem connection.</p> <hr/>

Question	Answer
How do I connect a BGAN satellite modem?	<p>BGAN satellite modems are connected via Ethernet cable to Meteo-40. If you are working with Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the modem.</p> <p>In order to supply the satellite modem, a <i>LAN switch</i> has to be assigned in the Communication → LAN menu. Make sure that the checkbox <i>LAN online, whenever CECS is on</i> is not selected. Hence, the modem goes online only when needed. The modem itself has to be configured using the software provided by its manufacturer. For further details refer to Section 7.9.7 and especially to Section 7.9.7.3.</p>

## 16.2.2 Ammonit Tunnel

Question	Answer
After entering the URL of the tunnel connection, a message is displayed which indicates that the tunnel is not responding.	<ul style="list-style-type: none"> <li>Your data logger is (currently) not connected to the Internet. The data logger has not been configured to be online for this time. Meteo-40 establishes an Internet connection for the periods configured in the schedule (see Section 7.2).</li> </ul> <hr/> <div style="display: flex; align-items: center;">  <div> <p><b>Tip</b></p> <p>If you use AmmonitOR to monitor your data logger, you can check, when the data logger is scheduled to be online.</p> </div> </div> <hr/> <ul style="list-style-type: none"> <li>The data logger is busy, e.g., performing an upgrade, uploading files. Try to access the tunnel connection a few minutes later.</li> <li>Another user is logged in and is downloading data files. Try to access the tunnel connection a few minutes later.</li> </ul>
The entered URL seems to be wrong.	<p>Make sure that the URL has the form <code>https://Dnnnnnn.tunnel.ammonit.com/</code>, where Dnnnnnn must be replaced with the serial number of the data logger without spaces or hyphens.</p> <p>If a tunnel affix has been entered in the Meteo-40 web interface (Meteo-40 firmware version older than 1.0 Rev. 13645), enter the URL of the data logger without tunnel affix:  <code>https://Dnnnn.tunnel.ammonit.com</code> (Dnnnnnn represents the serial number of the data logger). The tunnel affix has to be entered for the tunnel access code. If you lost your tunnel affix or tunnel access code, call the Ammonit support team.</p>

Question	Answer
<p>The data logger is sending / uploading data, but I cannot connect to the data logger via tunnel.</p>	<p>The tunnel connection seems to be not stable enough. The issue can be solved as follows:</p> <ul style="list-style-type: none"> <li>• The GPRS connection might be very weak. Switch to GSM. Ask your provider for the dial-in number (P-to-P). The dial-in <i>Number</i> has to be configured in the Meteo-40 web interface in the Communication → Modem menu. An <i>APN</i> does not have to be entered. See also Section 7.9.</li> <li>• The signal might be very weak. Replace the installed antenna with a <i>Yagi</i> directional antenna. The <i>Yagi</i> antenna can be aligned to a near transmitting station to receive a better signal. For further details see <a href="http://en.wikipedia.org/wiki/Yagi-Uda_antenna">Wikipedia</a> (<a href="http://en.wikipedia.org/wiki/Yagi-Uda_antenna">http://en.wikipedia.org/wiki/Yagi-Uda_antenna</a>).</li> <li>• Instead of using a standard SIM card with dynamic IP address, insert a SIM card with public IP address into the modem. The data logger can be accessed via its public IP address and/or via the domain provided by the tunnel server, if configured. See also Section 7.3. If your data logger is registered in AmmonitOR, you can find its public IP address in the Data Loggers → Connections menu. Go with the mouse pointer on a displayed connection in the <i>graphic view</i> or look up the IP address in the <i>text view</i>.</li> </ul>

## 16.3 Firmware Upgrade

Question	Answer
<p>Do I have to be on site to perform an upgrade?</p>	<p>No, you can start the upgrade via remote access (tunnel connection), e.g., when the data logger is scheduled to be online. Nevertheless we recommend upgrading the data logger in the office to avoid any unexpected difficulties.</p>
<p>My data logger is not connected to the Internet; how can I perform an upgrade?</p>	<p>In order to perform an upgrade, the data logger has to be connected to the Internet. By connecting your smartphone to the data logger, you can set up an Internet connection via the tethering function of the smartphone. Connect your smartphone to your Meteo-40 data logger via USB (USB-A slot of the data logger and micro USB slot of the smartphone). Open the settings for <i>Tethering and portable hotspot</i> of the smartphone operating system (see Figure 4.14). Activate USB tethering. Browse for the IP address of your Meteo-40 data logger using the keys ( Communication → Devices → LAN → USB (Activated) → IP settings). Enter the data logger's IP address in your smartphone browser, login and perform the upgrade.</p>
<p>Do I have to install all upgrades?</p>	<p>We recommend installing all available upgrades to benefit from new features and to fix recent problems. Ammonit regularly informs Meteo-40 users about available upgrades by email.</p>
<p>During the download process the connection was interrupted? Do I have to restart the download process?</p>	<p>The downloaded software packages are stored on the data logger. Start the upgrade process again to continue the download and installation process. Once downloaded packages do not have to be downloaded again.</p>
<p>How does the installation process affect the recording of the MARS?</p>	<p>If the MARS is not affected by the upgrade, the recording continues without any interruption. If the MARS will be upgraded, the recording stops for approx. 30s and continues afterwards.</p>


## 16.4 Data: Transfer and Download




Question	Answer
Which methods are available to transfer data files?	<ul style="list-style-type: none"> <li>• Upload data files via SCP/FTP/SFTP connection to a server of your choice or the AmmonitOR installation on your server (see Section 7.6).</li> <li>• Upload data files to your AmmonitOR account on the Ammonit server (AmmonitOR project key is required, see Section 7.6).</li> <li>• Sent data files to an email account (see Section 7.5).</li> <li>• Manual download of CSV files via the Meteo-40 web interface.</li> <li>• Manual download of CSV files on pre-configured USB flash drive on site (see Section 4.4.3).</li> </ul>
If no Internet connection is available on site, can I download data files?	Yes, you can download the statistics and/or the source data using a pre-configured USB flash drive. Switch on the data logger (CECS) and plug in the prepared USB flash drive. All generated CSV files will automatically be saved on the USB flash drive. See also Section 4.2. You can also connect to the data logger via USB or W-LAN on site and download the CSV files on your PC.
What happens to data files, which could not be sent / uploaded according to the schedule time, e.g., because of connection problems?	Files, which have not been sent according to the scheduled time, will be sent or uploaded at the next scheduled action.
I receive data files with the file type csv.gz? How do I handle these files?	The file is compressed using GNU gzip (See Section 6.6) and has to be decompressed before you can use it. If you work with Microsoft Excel™, open the file as described in Section 6.6.3. If you work with LibreOffice or OpenOffice, use the settings described in Section 6.6.2.
How can I open CSV files generated by Meteo-40 with Microsoft Excel?	In order to open CSV files with Microsoft Excel, the settings have to be adapted. Launch Microsoft Excel and open the <i>Options</i> in menu <i>File</i> . Under <i>Advanced</i> the decimal and thousands separators are defined. Adapt the settings for Meteo-40 CSV files as follows, if necessary. Decimal separator has to be a dot (.); thousands separator has to be a comma (,). If necessary, deselect the function Use system separators. CSV files generated by Meteo-40 data loggers use the comma (,) as field separator, double quote (") for embedding commas in textual strings and UTF-8 as character set. These details have to be considered, when data files are imported. In order to import CSV files, click on <i>From Text</i> on the <i>Data</i> tab and browse for the CSV file. Follow the instructions of the import wizard. For further details refer to Section 6.6.3.
I have an AmmonitOR installation on my own server. How can I upload the data files to it?	Select in the Communication → AmmonitOR menu of your Meteo-40 data logger for <i>AmmonitOR server</i> the value <i>Custom AmmonitOR</i> and below under <i>server</i> the name or IP address of your server.

## 16.5 Sensor: Configuration and Connection

### 16.5.1 Sensor Configuration

Question	Answer
The sensor, which I have to install, is not given in the sensor list. How do I configure the sensor?	<p>If the sensor is not given in the list, you can select <i>Other Sensor</i> in the <i>Sensor Helper</i> and configure channels, slope and offset values, measurement rate etc. manually.</p> <p>If the anemometer you want to install is not listed in the <i>Sensor Helper</i>, select <i>Anemometer</i> for the sensor type and <i>Generic Anemometer</i> for the sensor. The other values have to be configured manually.</p> <p>If the analog wind vane you want to install is not listed in the <i>Sensor Helper</i>, select <i>Wind Vane</i> for the sensor type and <i>Generic Analog Wind Vane</i> for the sensor. The other values have to be configured manually.</p> <hr/> <p> <b>Important</b> Only for the sensors listed in the <i>Sensor Helper</i>, Ammonit assures the correct calculation of the statistics!</p> <hr/> <p>If you are unsure how to configure an unlisted sensor, contact the Ammonit support team.</p>
I have a calibrated sensor. Where do I enter the calibration values?	For each configured sensor you can modify the slope and offset values in the <i>Sensor Helper</i> .
My configured pyranometer SPN1 does not display any estimated value?	In order to estimate DNI and sun status, you have to enter the geographic coordinates of the measurement station, i.e., latitude and longitude. Both coordinates are important to get the zenith angle of the sun at the site. Enter latitude and longitude in the System → Administration menu of your Meteo-40 data logger.
How many switches can be controlled by the switch manager?	The switch manager can control exactly one switch.

## 16.5.2 Sensor Connection

Question	Answer
Where can I find a plan to connect a sensor?	<ul style="list-style-type: none"> <li>If you ordered the measurement system including steel cabinet and cables from Ammonit, connection plans can be found in the steel cabinet. Additionally, the sensor connection with Ammonit cables is described in the data sheet, which you received for each sensor bought from Ammonit.</li> <li>If you ordered only the sensors without cables from Ammonit, refer to the data sheet by the sensor's manufacturer. In Chapter 13 you can find the electrical connection plans for Meteo-40.</li> </ul>
I have to install two potentiometric wind vanes, a barometric pressure sensor and a temperature humidity sensor - all connected to analog voltage channels. Which data logger model is suitable?	<p>The Meteo-40M model offers 8 analog voltage channels to connect two potentiometric wind vanes, a barometric pressure sensor and a temperature humidity sensor.</p> <p>If digital wind vanes TMR would be installed, which require only one digital channel each, the Meteo-40S model would be suitable, as well.</p> <hr/> <p> <b>Note</b> Digital wind vanes TMR are more precise than potentiometric wind vanes. Additionally, digital wind vanes TMR are subject to less mechanical wear than potentiometer wind vanes thanks to their solid state design. Wind vanes TMR do not have moving parts, except the bearings. Thus digital wind vanes TMR are more reliable and less susceptible to failure.</p> <hr/>

## 16.6 Measurement

Question	Answer
Sensors are configured and connected, but the measurement is not recorded?	<p>Check the following options:</p> <ul style="list-style-type: none"> <li>• It seems that the power supply during measurement was not sufficient or has stopped. Thus MARS is turned off. Connect Meteo-40 to a reliable power supply to operate MARS on.</li> <li>• In the status box <i>Recording</i> is switched off. Click <i>Switch on</i> in the Meteo-40 web interface.</li> <li>• The configuration has not been saved after the last modification. Save the configuration and click <i>Switch on</i> for recording.</li> </ul>
Where can I find the meteorological data in m/s or °C?	<p>The current value of each evaluation is displayed in the Measurement → Evaluation menu in the Meteo-40 web interface. Additionally, you can display live data in the Data → Live menu of the data logger. In the CSV files you can find the evaluated meteorological data according to the settings you made in the Data → Statistics menu. Furthermore, if you work with AmmonitOR, you can monitor the meteorological data in your AmmonitOR project, e.g., in various plots for selectable periods.</p>
Where can I find the original electrical measurement data?	<p>The current electrical value of each channel is displayed in the Measurement → Channels menu of the Meteo-40 web interface. Additionally, you can see the electrical values of all channels in the Data → Source menu. In the source file, which can be downloaded in the Data → Statistics menu of the data logger, you can see all electrical values of all channels for a selected period.</p>

## 16.7 Errors and Messages

Question	Answer
After saving a configuration or starting an action, an <i>Internal error</i> occurred and is displayed in the web interface?	<p>Internal errors could have various reasons. Not always a serious error occurred, e.g., due to a short connection time out, an operation could have been interrupted. Try the following actions to solve the problem:</p> <ul style="list-style-type: none"> <li>• Go to another page and perform the action again.</li> <li>• Restart the data logger and perform the action again.</li> </ul>
The red LED light is turned on. What does it indicate?	<p>It indicates that an error in the measuring operation occurred. For details see System → Logbook in the web interface or System → Errors → Error List in the display menu.</p>

### Important



If you should notice any error on your data logger or in the web interface, we kindly ask you to inform us as soon as possible. The Meteo-40 data logger is a very complex system, so unfortunately it can happen that errors occur. In order to avoid any disruption of the data logger operation, we need on your assistance. In case of an error, please note down what have been done on the data logger before the error occurred, which system components are used, e.g., GSM modem or satellite modem, and which system configuration is active.



# Release Notes

## 1.7.29 (2022-08-31)

- Fix the display of the installed copy of the manual.

## 1.7.28 (2022-08-30)

- Prevent loss of system configuration when settings are changed.
- If the "Delete all measurement data" process is interrupted, it will now be resumed.
- Allow changing sensor model when only one requires a calibration table.
- Ensure sensor helper loads for unknown sensor models.

## 1.7.27 (2021-07-26)

- Improved robustness against RS485 data corruption for ASCII protocols.
- Improved memory usage for CSV generation with RS485 sensors.
- Fix endianness for Galltec Thermo-Hygro KPC MS.
- Fix Luft WS 502 implementation.
- Fix DHI formula in Evaluation helper.
- Fix table sorting on clicking the header in the sensor list and other pages.
- Fix statistics calculation for 'Thies FCA X - ASCII' and 'Vaisala WMT700 NMEA'.



### Warning

You must delete and regenerate older files to correctly perform the statistics calculation.

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## 1.7.26 (2021-04-21)

- Introduce a timeout for SCP communication.
- Fix graphical issue in the web interface in Chrom(ium) versions 87 and up.
- Fix rounding problem for negative values.

## 1.7.25 (2020-12-08)

- Make switch pre-time available for most sensors, again.

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## 1.7.24 (2020-11-06)

- Enhanced startup system storage clean-up function for very large amount of CSV files
- New IDS-20 Icing measurement system from Sommer Messtechnik

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### Note

Newly ordered data loggers get a completely new software release, Meteo-40 plus Version 2.0.0 or better, which has the following benefits:



1. supports modems with LTE (4G)
2. runs on the latest Linux version
3. supports TLS 1.1, 1.2, and 1.3
4. has a new user management
5. the tunnel is replaced with AmmonitConnect

For further Information, please contact our sales team.

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## 1.7.23 (2020-09-30)

- Fix high count statistic for potentiometric wind vanes when combined with several RS485 sensors
- Add Lufft WS 502 with solar irradiance
- Add Lufft WS 300
- New Thies FCA X anemometer implementation for one-step calibration
- Enhance performance for very large amount of CSV files

## 1.7.22 (2020-07-08)

- Fix EE071 Hygro-Thermo over RS485 implementation
- Add body temperature value to the values read by Hukseflux pyranometer SR30, fix the solar irradiance values

## 1.7.21 (2020-01-23)

- New Hukseflux pyranometer SR30 implemented

## 1.7.20 (2019-11-27)

- New incoming long wave radiation Ein for pyrgeometers
- Fix generate statistics if secondary statistics active and evaluations from Evaluation Helper configured
- New DustIQ sensor implemented
- Fix problem with resetting tunnel name to tunnel.ammonit.com in some cases

## 1.7.19 (2019-08-19)

- Add maintenance option to automatically delete oldest files in case of system storage shortage
- Register if CSV statistics files were copied to USB flash-drive
- Fix connect more than one Meteo-40 Modbus RTU slaves (SCADA) to the same RS485 bus

- Add option to allow global access to SCADA server

**Warning**

If you use SCADA over USB-Modem you must allow global access!

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- More than one client IP addresses allowed for SCADA Modbus TCP
- Fix user interface for set date/time over NTP
- Fix save and send test email action
- New dew point formula in evaluation helper
- Fix start recording over LCD
- Increase reliability of SCADA stored data request and summary statistic

### 1.7.18 (2019-05-03)

- New solar sensors pyranometer MS-40, pyrliometer MS-57 and pyrgeometer MS-202
- Connection of pyranometer MS-80A over shunt available
- Fix TWS100 parser
- New Plane of Array irradiance formula in evaluation helper (replaces effective irradiance)
- New Soiling Ratio Isc index formula in evaluation helper (replaces Soiling Ratio)

**Warning**

If you had already configured Soiling Ratio evaluations, you will have to configure them again!

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- Fix Soiling Loss Index formula in evaluation helper

### 1.7.17 (2019-02-07)

- New sensors type Weather Station in Sensor Helper
- New TWS100 integrated dust monitoring station
- New Thies Hygro-Thermo compact over RS485
- New NRG 200M Wind Vane with configurable slope
- New Ampere meter in sensors list for easier configuration of the I-U Conversion Box
- New Ampere meter formula in Evaluation Helper for Gantner modules used with Ammonit Soiling Kit
- Separated save and send/copy test file for Communication Email/AmmonitOR/Copy
- Fix double email, broken in 1.7.12
- Thies barometer can be connected to counter input
- Thies FCA X automatic request can be deactivated
- Remove CMA 11 albedometer from list, can still be configured as two CMP 11
- Fix Pyranometer Li-Cor LI-200SZ formula (broken in 1.7.16)

### 1.7.16 (2018-11-09)

- New formula for albedo in Evaluation Helper
- New CMA 11 albedometer
- New formula for diffuse horizontal radiation (DHI) in Evaluation Helper
- Thies FCA X wind speed available with Thies protocol
- Thies FCA X - Modbus RTU plain version for connecting more than four sensors to RS485-M
- Thies FCA X inclination extended version over Modbus RTU
- Fix out of range values in Thies 10-bit protocol for Dx channels
- Fix evaluations missing in snapshots

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- Fix Silicon Irradiance Sensor SiS-13TC-T irradiance formula
  - Fix SCADA Modbus Register Map field order for Date/Time
  - Fix request hardware ID from Thies anemometer FCA X
  - Fix configure other sensors if no switch available
  - Fix RS485 Modbus RTU sensors signed long values parser
  - Fix parser for SMP10 over RS485-M
  - Fix pyranometer solar irradiance negative values for newly configured sensors
  - New Pyranometer MS-80A in sensor helper
  - New EE071 Humidity and Temperature Probe in sensor helper

### **1.7.15 (2018-07-17)**

- Fix Secure FTP
- Change in CSV files header for internal temperature 'T' to 'T;Avg'
- New sensor EKO MS-60M RS485 pyranometer
- New sensor EKO M-Box RS485 Modbus RTU adapter for pyranometer
- Don't send snapshot if not explicitly configured
- Fix automatic system storage clean-up for already sent CSV statistics files (see Section 6.3)

### **1.7.14 (2018-04-12)**

- New sensor EKO MS-80M RS485 pyranometer
- New sensor EKO ML-01 pyranometer
- New EC-10 Decagon soil moisture sensor
- Add RS485 8 Hz measurement for one sensor
- Add Secure FTP as method to transfer files, additional to SCP and FTP, SCP is still the recommended method
- Do not show or log complete login IP address, for data protection
- Fix RS485 sensors telegram freezes

### **1.7.13 (2018-03-19)**

- New Thies Clima US VDTHP
- Fix SDI-12 (broken in 1.7.12)
- Fix save SCP (broken in 1.7.12)
- Fix Meteo-32 stream map

### **1.7.12 (2018-03-15)**

- New download SCADA Modbus registers table as CSV available
- New Gill MaxiMet GMX600 weather station
- New ultrasonic flow meter KUF2000
- New Hygro/Thermo CS215 over SDI-12
- Fix period measurement
- Allow empty Gateway and DNS server for LAN configuration
- Allow use of Switch Manager only with timer
- Support two microphones for SM3BAT
- Performance enhancement for actions if CSV files not required, e.g. send camera images
- Automatically activate period channels on Meteo-40 M and Meteo-40 L
- Add purely linear formula for NRG and Generic anemometers



### 1.7.11 (2017-12-15)

- New Vaisala WMT700 NMEA MWV
- New Datasol MET Reference Cell
- Fix SMP10 pyranometer Modbus registers
- Improve email layout
- Minor error connections

### 1.7.10 (2017-11-14)

- Meteo-32 stream map includes ZephIR Live data
- Enhance CSV files generation reliability
- Switch manager supports timer with two user-defined timeframes
- Support 2nd, 3rd, and 4th statistical moment (variance, skewness, kurtosis)
- Fix statistics interval value written in secondary and tertiary CSV files
- Add system storage level to data snapshots

### 1.7.9 (2017-09-19)

- New lightning detector SkyScan SG1000
- New Duty Cycle and Pulse Width measurement
- Fix some problems when UI not in English
- Fix files selection when "start date" parameter used
- Fix switch manager label not shown in switches table
- New Song Meter SM3Bat Detector
- User interface usability enhancements
- Allow delete empty Gust data files
- New refresh camera image button
- Increased MARS stability

### 1.7.8 (2017-08-21)

- Fix CSV file generation, which broke in 1.7.7 in some cases
- More updates of UI translation

### 1.7.7 (2017-08-18)

- Fix SDI-12 allowed address range
- Fix Modbus RTU sensors configuration migration
- Fix recording off after upgrade
- Update of UI translation
- Add internal V, I and T to Evaluation Helper
- Fix source data access for certain RS485 serial settings
- Fix internal voltage and temperature available in Switch Manager
- Always reduce online traffic when logged in, not only for satellite connections
- Fix USB flash drive source data download
- Deactivate Gusts files generation if no trigger evaluation configured

---

## 1.7.6 (2017-07-25)

- New Reflectometer CS650 over SDI-12
- New Wind Direction Potentiometric formula in Evaluation Helper
- Fix delete evaluations from evaluation helper
- Fix compressed files download as Viewer
- Selection of individual files for redundant send/copy possible with 'Mark as not sent'
- Fix invalidate CSV files
- Replace "formula\_params" with "params" key in CSV files footer
- Fix data logger name encoding error in SCP
- Allow fine-grained sending of CSV files



### Warning

If you already have secondary and/or tertiary CSV files configured, you must explicitly switch on sending to AmmonitOR, by email, or to a file server now!

---

- Additional RS485 master speed: 1200 bps
- Sign all data by default
- Support signing and encryption of log and config files for server copy and USB flash drive copy
- The comma (",") is not allowed in the data logger name anymore
- Fix ZephIR evaluations for more than one height
- Effectively turn USB modem switch off, even if no USB modem is connected
- Set switch state over display is per default available
- Manufacturer administration can be manually started over UI
- Newly produced data loggers have individual UI certificates

## 1.7.4, 1.7.5 (2017-06-12)

- Fix possible LCD freeze after reboot

## 1.7.3 (2017-06-09)

- Fix LCD backlight switching

## 1.7.2 (2017-06-07)

- Fix data logger name encoding error in snapshots and test email
- New ZephIR Live data
- New Gill Wind Master M3
- Fix evaluation type for Gantner modules

## 1.7.1 (2017-05-15)

- Fix active channels when adding evaluation with evaluation helper

## 1.7 (2017-05-12)

- Support secondary and tertiary CSV statistics files
- New data types with 8-bit exponent selectable for modbus sensors
- New Atonometrics RDE300
- Evaluation type and unit can be configured for all sensors of type 'Other Sensor'
- Enhanced performance for SCADA stored data request
- Fix evaluations using GPS location
- Provide default WLAN passphrase for newly produced data loggers
- Fix wrong time-stamp in CSV files if summary statistic configured
- New formulas in Evaluation Helper
- Fix live data evaluation for Thies Clima sensor
- New Gill Wind Master 3D Ultrasonic XYZ coordinates
- Support period measurement on counter channels C5, C6, C11, and C12 for newly produced Meteo-40, available as P1, P2, P3, and P4
- Fix switches state shown in display

### 1.6.3 (2017-02-28)

- Fix ultrasonic sensors wind speed linear formula



#### Warning

In case you are using ultrasonic sensors and version 1.6.2, you must delete and regenerate all files generated with this version!

---

- Fix SCADA stored data request

### 1.6.2 (2017-02-14)

- Allow deletion of multiple selected statistics files
- Fix a problem with source data memory overuse if a switch is associated to a sensor
- Fix missing latitude and longitude in CSV and admin page when using GPS
- Add date and time of last GPS fix in CSV statistics file as `gps_fix`
- Use function code 4 for Iskra MT540 input registers
- Fix SCADA Modbus write to holding registers selection
- Switch manager supports inverted logic
- Increased robustness for RS485 Thies communication
- RS485 serial console representation enhancements
- New Thies 3D Ultrasonic XYZ coordinates

### 1.6.1 (2016-12-20)

- New RS485 Master serial console
- New RS485 sensor SMP10 pyranometer
- Record status byte for Thies Ultrasonic 2D and 3D
- Fixed send statistics CSV per email if Gust data active
- Include SCADA status in Information site
- New set one switch over SCADA using Modbus write single coil
- Fixed set switches OFF over SCADA
- Fixed request stored data over SCADA
- Fixed sending of snapshot data to AmmonitOR, broken in 1.6
- Fixed unexpected tunnel connection if SMS active

- Fix tunnel connection fails on action execution if another action running
- New solar zenith angle in evaluation helper
- Allow Mosbus RTU broadcast address '0' for sensors
- Slope for ultrasonic sensors wind direction available
- Fix SiS-13TC-T sensor irradiance not available
- Default connection (Ethernet/Modem) is shown in capital letters (uppercase)
- Add support for Met One 014mini anemometer

## 1.6 (2016-11-14)

- Optionally create gust data files
- Include internal voltage and temperature in Switch Manager lists
- Add data snapshot to email and server copy
- Add slope and offset for 3D ultrasonic sensors vertical wind speed
- Update provider helper with current mobile providers and APNs
- Fix custom evaluations: allow any input evaluation and not only evaluations of type "other"
- Data logger is prepared for later upgrades via USB flash memory
- Fix easy cleanup for SCADA registers tables
- Increase backlight time for Meteo-40 Revision D from 5 s to 15 s, and allow Admin to deactivate display backlight
- Custom evaluations are ordered in CSV between regular evaluations and channels
- Optionally copy camera image to a USB flash drive when sending
- Allow Admin and User to view and download data logger files on USB flash drive
- Use hPa instead of mbar for newly configured pressure sensors
- Fix SCADA stored data request timestamp: use unix time and not logger local time
- New summary statistics available over SCADA
- New set switches state over SCADA
- Allow users starting actions via display (requires setting the permission first)
- New covariance evaluation
- New generic thermo-hygro 5 V -20–80 °C / 10 V
- Maximum and minimum statistics available for internal temperature
- Statistics for internal channels can be selected
- New sensor MESA WSWD Sonic
- Add source data download of complete week
- Add function to invalidate all statistics CSV files, that have been sent before
- Write in SCADA server holding registers optimized
- When setting time, check whether files from later dates exist
- Fix close tunnel connection if CECS always on

## 1.5.10 (2016-08-01)

- Fix a harmless, but annoying error message when saving the configuration
- User interface: fix related to config file download
- User interface: minor performance improvement
- Force Encryption now also blocks changes on Email and SCADA, and limits live data to about 2 minutes
- New evaluations: Sensible Heat Flux, Turbulence Intensity, Obukkhov stability parameter and Inflow angle

## 1.5.9 (2016-07-06)

- Add function to easily regenerate possibly inconsistent CSV files
- Make action handling more reliable
- Solve problem with switch "Prevent implicit tunnel activation (only recommended for satellite communication)". The tunnel connection was not disabled after "Action online"
- Fix wrong date/time stamps in CSV, in cases when first channel had invalid data
- Add option to reduce online traffic when logged in, e.g. for satellite connections

- SCADA server write in Modbus store is now an atomic operation
- New generic Hygro/Thermo sensor -20–80 °C
- New Silicon Irradiance Sensor SiS-13TC-T
- Fix SCADA modbus acknowledge writing holding registers
- Fix SCADA interval for stored data request
- Pyranometer Li-Cor LI-200SZ must be connected to analogue channel
- Fix a problem with signatures for newly produced Meteo-40
- Enhanced EKO Sun Tracker date, time and location synchronization
- Logbook more verbose, i.e. messages about CECS status and actions
- Minor UI improvements, e.g. faster web service and data logger icon
- Fix a problem with CECS mode not possible to change from LC display
- Fix a problem with time setting occasionally not working
- Fix CMP10 solar sensor

### 1.5.8 (2016-04-14)

- UI: show CECS and MARS uptime
- Fix false handling of missing digital (TMR) wind vane data



#### Warning

In case you have wrong CSV files, generated from version 1.5 to 1.5.7, you have to remove them and regenerate!

- Rename *Heating Manager* to *Switch Manager*
- Add switch management by means of wind speed for solar power plants
- Fix precipitation scale factor for Meteo-32 Streaming livedata
- Fix change switch state with switch manager
- Add easy cleanup for SCADA registers tables
- Fix Obukov-length CSV header for AmmonitOR
- Fix source data download
- Fix Silicon irradiance sensor default slope

### 1.5.7 (2016-03-07)

- Fix automatic CECS reboot method

### 1.5.6 (2016-02-24)

- Add evaluated data to source data view in web interface and to USB flash copy
- Add evaluation type and unit to linear equation
- Fix ZephIR 300 endianness and statistics
- Provide access to stored data over SCADA
- Fix ultrasonic wind speed scale factor for Meteo-32 Streaming livedata



#### Warning

In case you are using Meteo-32 Streaming to read wind speed values from ultrasonic sensors, you might need to correct the scale factor at the SCADA master!

- Fix generation of partial CSV files
- Minor bug fixes in CSV files generation
- Fix action 'Only generate CSV'
- Use '---' for invalid value in CSV

---

## 1.5.5 (2016-01-14)

- Fix statistics when using different measurement rates for counters and digitals
- Fix generic windvane evaluation

## 1.5.4 (2016-01-13)

- Fix statistics when using different measurement rates are used



### Warning

In case you have wrong CSV files, generated from version 1.5 to 1.5.3, you have to remove them and re-generate!

---

- Fix data snapshots to AmmonitOR
- Add hint for BGAN users on LAN page
- Add PT100 variant of Galltec Thermo-Hygro Passive CP
- More flexible ways of copying files to USB flash drive by date
- New ZephIR certified averaged data
- Fix CSV File generation with Thies Clima Sensor US

## 1.5.3 (2015-12-07)

- Fix problem with action colliding with midnight reboot
- Remove standard cabinets from user interface

## 1.5.2 (2015-12-03)

- New Apogee pyranometer PYR-PA, PYR-SA
- Fix RS485 polling rate for Thies Laser Precipitation Monitor
- Add self test for digital clock output
- More flexible automatic CECS reboot function



### Note

If you use SCADA or are using Meteo-40 in 24/7 mode, check the setting *Automatic CECS reboot* option on the administration page after upgrade!

---

## 1.5.1 (2015-11-26)

- Fix a precision error in release 1.5 for digital wind vanes

## 1.5 (2015-11-25)

- Add support for sensors:

- EKO Sun Tracker
  - CMP 10 Pyranometer
  - Inclinometer 2-axis SCA121 Level Developments
  - Vento anemometer
  - Galltec Thermo-Hygro with two 4–20 mA
  - ISET Solar Radiation Sensor
  - Generic Thermo/Hygro sensors with voltage outputs
  - Pyranometer Li-Cor LI-200SZ
  - New status evaluation in Evaluations Helper
  - New direction at maximum speed evaluation in Evaluation Helper
  - Fix active power and obukhov length in evaluation in Evaluation Helper
  - Fix application of positive and negative slope and offset to Young Propeller Anemometer
- 



#### Note

If you have different slope values for upwind and downwind, it is necessary to regenerate the CSV files! The slope for downwind will be automatically set to a negative value by the data logger.

---

- Support for SMTPS in addition to STARTTLS for more Email security options
- Device Identification available over SCADA
- Set date and time over SCADA Modbus communication
- CSV stability improvements
- Support tilt angle and cardinal direction for SPN1
- Improve evaluation view and start messages in LC display
- Fix a communication issue, when no AmmonitOR project key is set
- Improve GPS reliability
- Future upgrades will use HTTPS instead of HTTP, enhancing security
- Fix configuring digital channel to power on CECS

### 1.4.3 (2015-08-18)

- Fixed a CSV generation error

### 1.4.2 (2015-08-04)

- Digital signatures refer to uncompressed CSV as canonical, not the compressed files - this might influence your work flow
- Fixed a problem with delayed GPS time
- GPS location no longer changes configuration
- Support for Temperature Sensors 4–20 mA, -30–70 °C and -40–60 °C

### 1.4.1 (2015-07-23)

- Fix for download of encrypted data in web interface

## 1.4 (2015-07-16)

- Data encryption supported for USB flash drive copy and download
- Support for CSPS RSI sensor
- New linear equation, active power and wind direction formulas in Evaluation Helper
- Heating manager control by means of voltage measurement allowed

- 
- Configurable word endianness for RS485 Modbus Sensors
  - Include solar radiation summary in CSV files
  - User interface change: New device page with display and USB flash drive settings
  - User interface change: Encryption and signature now under Administration
  - Add a Force Encryption option
  - Connection check in web interface and via LC display
  - Fix CSV generation with numerous RS485 errors
  - Fix Young Wind Monitor missing wind direction evaluation

### **1.3.4 (2015-05-11)**

- New HMP155 active and passive sensors
- Fix tunnel connectivity, when reconfiguring
- Reduce SCADA Modbus server response time to 40 ms
- Old CSV files get removed on CECS reboot when not enough memory left

### **1.3.3 (2015-03-31)**

- Allow custom clipping for humidity sensors
- Fixed a problem with encryption when private key is not available
- Fixed a problem with sending pictures via FTP
- Enhanced RS485 sensors support
- Fixed a problem with preventing sending of CSV files to AmmonitOR or file server
- Removed unused tilt angle from sensor helper
- Fixed UI air density configuration
- Fixed a SCADA performance issue

### **1.3.2 (2015-02-16)**

- Fixed a problem with deleting source data memory

### **1.3.1 (2015-02-06)**

- Fixed a problem with display showing "Please wait" for a long time
- Fixed a problem with Thies Precipitation Monitor

### **1.3 (2015-02-04)**

- Fixed a CSV generation error in cases where measurement has been stopped for a day by the user
- Data snapshot and camera image can be sent to AmmonitOR now, data snapshot is still experimental
- UI: show modem quality bar in LC display and web UI
- UI: warn about missing WLAN passphrase
- UI: don't show Gantner modules as unknown in LC display
- Add Thies Precipitation Monitor
- Obukhov length possible with 3D ultrasonics
- Enhance memory security esp. for SCADA
- Thies Clima Sensor uses wind direction offset for brightness direction
- Fixed a problem with SCP sending when data logger name contained non-ASCII characters



## 1.2.4 (2014-11-12)

- Added support for Thies Clima Sensor US
- Fix wind speed evaluation for Lufft WS

## 1.2.3 (2014-11-05)

- Enhance memory security

## 1.2.2 (2014-10-20)

- Fixed a problem with the SCADA function: In some cases the values were not readable
- Fixed a problem with the camera function for data logger with non-ASCII characters in their name
- Fixed a problem with the display of values for some RS485 modules

## 1.2.1 (2014-09-22)

- Counter measurement fix: When the clock is set, e.g. by NTP or GPS, under some conditions, the counter value can be wrong. This affected mainly the maximal values
- Minor UI fixes

## 1.2 (2014-09-08)

- Modem PHS8 is supported
- Experimental support for SMS
- Complete configuration can be sent to AmmonitOR or via email or FTP/SCP

**Note**

If you don't want to have the configuration file sent to AmmonitOR or via email or FTP/SCP, you have to switch this off in the respective menu.

- New scale factor and data type selection for SCADA measurement values
- New Unix Time available over SCADA
- Easier connection between PC and data logger using link-local connection
- Fixed a problem with CSV generation
- Fixed providing sum statistic over SCADA

## 1.1 (2014-08-14)

- Digital signature available for newly produced data loggers. Contact Ammonit, if this feature is required on a previously purchased device
- The heating manager can make use of an optional voltage as additional heating condition, while the humidity has been made optional
- The USB flash drive function is activated with a default password for newly produced data loggers
- Factory reset and source data deletion is logged in the logbook
- Setting of date/time by GPS, NTP, or manually is logged into logbook
- Setting the date via GPS is supported, updating the altitude by GPS is not done anymore

- 
- An error in the counters calculation for periods  $\neq 1$  s has been fixed
  - Minor user interface changes
  - Fixed a problem sending images via e-mail
  - Use new algorithm for wind direction maximum and minimum
  - Show DHCP state also for Tethering connection
  - New Thies Laser Precipitation Sensor
  - Memory sizes are indicated in MiB
  - Error condition recognition for Gill Wind Master

### 1.0.1 (2014-06-10)

- Enhanced Modbus RTU SCADA server performance
- New page for AmmonitOR related configuration
- Allow sending data to both AmmonitOR and an FTP/SCP server
- New density of moist air evaluation
- Fix CSV generation with temperature differential evaluations
- Correction for Galltec Thermo-Hygro Passive CP
- Allow date limit for file transfer (start date) and reset of send status
- Improved check when sending test email
- Add experimental support for email encryption
- Fix NMEA RS485 telegram parser
- Enhance modem communication in respect to disconnection
- Enhance clock accuracy
- Enhance memory protection
- Fix Young Monitor and Tech Sun channel order
- Fix erroneous recursive CSV file generation

### 1.0 Rev. 14683 (2013-12-19)

- Support for temperature difference evaluation
- More WLAN chips are supported: Atheros AR9271, Ralink rt2800, Ralink rt73
- Enhanced UI for accessing source data
- Minor error corrections, e.g.
  - in respect to USB flash drive,
  - solar evaluations in the LC display,
  - use of non-ASCII characters in email password and data logger name
  - correction of WAV252 and MT32
  - optimization of SCADA streaming mode

### 1.0 Rev. 14324 (2013-11-08)



#### Note

There are some minor, but incompatible changes in this software version. Please check carefully, if one of the changes might affect you.

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- New sensors: FarData wind vane, Teknam Thermo-Hygro, Teknam barometric pressure sensor
- Enhanced special mode for Meteo-32 wind vane compatibility: No dedicated configuration of Meteo-32 sensors necessary; standard configuration and connection according to manual
- Milliseconds in date/time field of statistics file ( . csv) removed; importing software might be configured, if necessary
- Switching of CECS status via status input signal, see Administration.
- Format of the keyfile.txt changed to INI file format; copying of source data to logbook possible
- Minor user interface changes

- Speed up and improved robustness of source data download
- Speed up some solar evaluations
- Enhanced RS485-Sensors error recognition and response
- Configurable slope and offset for RS485 ultrasonics horizontal wind speed
- Fix RS485-Sensors count statistic when more than one sensor connected

## **1.0 Rev. 13947 (2013-09-23)**

- New sensors: Tech-Sen thermo-hygro, Tech-Sen barometric pressure sensor
- Correction for status evaluation
- Minor user interface changes

## **1.0 Rev. 13863 (2013-09-12)**

- New sensors: Setra barometric pressure sensor Model 276 and 278; compatibility for first and second Meteo-32 wind vane
- Optimized tunnel traffic
- USB connection displayed in status box; data logger name shown in upper right corner

## **1.0 Rev. 13749 (2013-09-04)**

- New sensors: Pyranometer SP Lite 2, Gantner e.bloxx A1
- Re-enabled reboot at midnight, with exception for SCADA-enabled data loggers
- Enhanced flash memory detection

## **1.0 Rev. 13645 (2013-08-23)**

- New sensors: Hygro-thermo Galltec KPC MS, passive hygro-thermo Galltec CP, Gantner e.bloxx A3-1 and d.bloxx D1-1, wind vane Vaisala WAV252, Thies precipitation intensity
- Support of virtual temperature for Gill wind observer 2D
- Better presentation of switches states in live data
- Better estimation of sun status for SPN1
- User interface enhancements for SCADA
- Logbook for registering events
- POP-before-SMTP/SMTP-after-POP supported by email function
- Better support for USB flash drives
- Replacement of tunnel affix by tunnel access code
- Download multiple CSV file as ZIP archive
- Solved wrong statistics selection (scalar/vector)

## **1.0 Rev. 13187 (2013-07-01)**

- Communication enhancements, esp. for satellite modems
- Increased memory protection
- Support for Sineax Cam Power Meter, e.g. for PCM
- Heating manager problem on configuring boundaries corrected
- Enhancements in web interface: Statistics calendar
- Optional time synchronization via GPS

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## **1.0 Rev. 12696 (2013-05-16)**

- Heating manager: Temperature and humidity configurable
- Support for ISKRA Power Meter, e.g. for PCM
- Wind direction offset for ultrasonic sensors added
- Timing enhancement for RS485 sensors
- Additional route for LAN possible, e.g. for SCADA
- Solved sporadic connection failure with modem
- Possible wrong timezone corrected, when setting the time manually
- Enhancements in web interface for smart phones and small devices

## **1.0 Rev. 12454 (2013-04-24)**

- Timeout problem for serial (RS485) SCADA connections corrected

## **1.0 Rev. 11982 (2013-01-22)**

- Set default display contrast
- Error for Lufft RS485 sensor corrected
- Automatic reboot at midnight removed
- RS485 serial settings allowed
- Further performance enhancements for SCADA

## **1.0 Rev. 11900 (2012-12-19)**

- Possible source data corruption problem after second overrun (e.g. after two years) corrected; upgrade must happen before second overrun
- Implementation of new "generic" ModBus RTU sensor
- Supported temperature measurement using Pt1000 or Pt100 for data loggers with built-in Ethernet interface
- Evaluating of virtual temperature for Gill Windmaster Pro 3D, if configured like Thies ultrasonics 2D/3D
- Minor user interface corrections

## **1.0 Rev. 11669 (2012-11-19)**

- Documentation of heating manager
- Performance enhancements for SCADA
- Support of data logger with built-in Ethernet interface

## **1.0 Rev. 11587 (2012-11-05)**

- New feature: Simple heating manager
- Corrected data actualization problem in SCADA
- Internet Explorer 8™ and Chrome™ supported

## 1.0 Rev. 11317 (2012-10-08)

- Parallel working of SCADA and modem possible
- UI with virtual display keys
- Enhanced factory reset

## 1.0 Rev. 11236 (2012-09-21)

- Email sending problem corrected
- GPS enhancements
- Changes in network shown live in display

## 1.0 Rev. 11181 (2012-09-11)

- CSV files with round time slices
- Serial modems work, even if not permanently on
- Measurement frequency ¼s removed
- Problem with displaying negative power for pyranometers corrected
- Emergency password reset method available by means of Ammonit support for new data loggers
- Configuration of longitude, latitude, and altitude, support of KML (e.g. Google Earth™)
- USB GPS devices supported
- Enhanced user manual

## 1.0 Rev. 11031 (2012-08-27)

- Min and max for wind direction available
- Error when saving sensors corrected
- Measurement interruption when upgrading corrected
- Measurement range for NRG hygro/thermo sensor corrected
- Order of hygro/thermo for Galltec sensor corrected
- Corrected error for ICP-CON wind vane module
- Enhanced user manual
- Detection of under-voltage situation (brown-out) implemented
- Configuration of CSD3 optionally with only one voltage channel
- Thies wind vane classic with one analog channel supported
- SCADA endianness configurable
- Overall stability enhancements

## 1.0 Rev. 10769 (2012-07-25)

- More robust CSV creation
- Gill Windmaster supported
- Power meter GD2000 supported
- Virtual temperature Thies ultrasonics 2D/3D evaluated
- Turkish language in user interface supported
- User interface problem with Internet Explorer™ corrected

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## **1.0 Rev. 10627 (2012-07-12)**

- Average values for SCADA supported
- Gill Wind Obversver is supported
- PINs and passwords not visible in the downloaded configuration anymore
- Problems with uploading older configuration files solved
- CECS mode is saved in the configuration file
- New functions to remove all statistics files, all sensors, and for factory reset
- Switches in the display shown
- Minor changes for upgrade function

## **1.0 Rev. 10474 (2012-06-29)**

- Fixing of an potential data corruption error introduced with the last version

## **1.0 Rev. 10244 (2012-06-15)**

- Problem with switching of the CECS corrected
- Enhanced solar sensors
- AmmonitOR connection log supplied with data logger time and time zone
- Documentation corrections

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## Chapter 17

# Glossary

**APN**

Access Point Name

**CDMA**

Code Division Multiple Access

**CECS**

Configuration, Evaluation, and Communication System

**CPV**

Concentrated Photovoltaics

**CSP**

Concentrated Solar Power

**CSV**

Comma Separated Values

**DHCP**

Dynamic Host Configuration Protocol

**DHI**

Diffuse Horizontal Irradiation

**DNI**

Direct Normal Irradiation

**DNS**

Domain Name System

**FTP**

File Transfer Protocol

**GHI**

Global Horizontal Irradiation

**GIS**

Geographic Information System

**GNU**

GNU's Not Unix

**GnuPG**

GNU Privacy Guard

**GPL**

General Public License

**GPRS**

General Packet Radio Service

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<b>GPS</b>	Global Positioning System
<b>GSM</b>	Global System for Mobile communications
<b>GTI</b>	Global Tilted Irradiation
<b>HTTP</b>	HyperText Transfer Protocol
<b>HTTPS</b>	HTTP Secure
<b>IEEE</b>	Institute of Electrical and Electronics Engineers
<b>IP</b>	Internet Protocol
<b>LAN</b>	Local Area Network
<b>LCD</b>	Liquid Crystal Display
<b>LED</b>	Light-emitting diode
<b>LGPL</b>	Lesser General Public License
<b>MARS</b>	Measurement And Recording System
<b>NTP</b>	Network Time Protocol
<b>OVP</b>	Overvoltage Protection
<b>PIN</b>	Personal Identification Number
<b>POT</b>	Potentiometer - Measurement principle, e.g., Wind vane POT
<b>PPP</b>	Point-to-point protocol
<b>PUK</b>	PIN Unlock Key (or Personal Unblocking Code, PUC)
<b>PV</b>	Photovoltaic
<b>RNDIS</b>	Remote Network Driver Interface Specification
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>SCP</b>	Secure Copy Protocol/Program
<b>SFTP</b>	Secure FTP
<b>SIM</b>	Subscriber Identity Module
<b>SMS</b>	Short Message Service

**SMSC**

Short Message Service Center

**SSH**

Secure Shell

**SSL**

Secure Sockets Layer

**TCP/IP**

Transmission Control Protocol/Internet Protocol

**TLS**

Transport Layer Security

**TMR**

Tunnel Magneto Resistance - Measurement principle, e.g. Wind vane TMR

**UMTS**

Universal Mobile Telecommunications System

**USB**

Universal Serial Bus

**W-LAN**

Wireless Local Area Network

**WMO**

World Meteorological Organization

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# Chapter 18

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