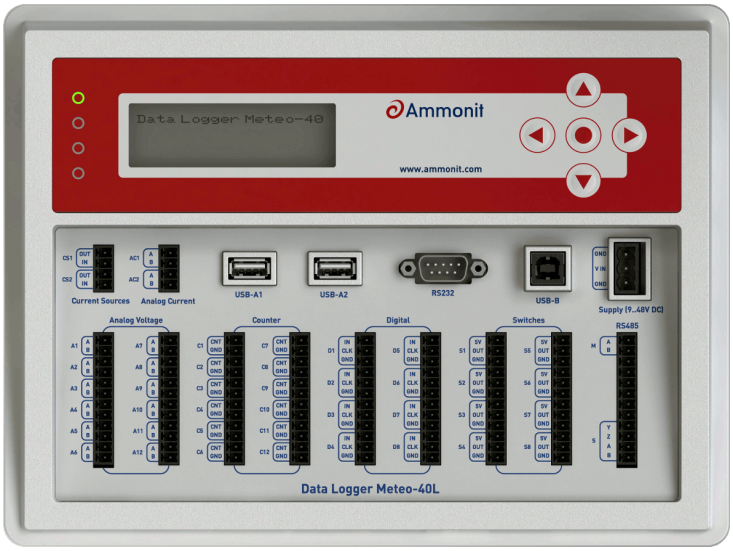
Ammonit

Data Logger Meteo-40 User's Manual



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measuring wind power

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



Caution
In order to ensure that Meteo-40 data loggers work properly, some requirements should be meet.
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 the Ammonit website (`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 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. Please contact us, 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 forecast 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 the manual carefully. Please remember that time spent now setting up the data logger properly, might save you from losing valuable data!

We recommend configuring and testing 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 signal channels: There are up to 12 analog differential voltage inputs, up to 2 analog current inputs. Furthermore Meteo-40 comprises 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 RS485 interface.

In general the Meteo-40 is divided in two main units: A communication unit and a measuring unit. The communication unit offers 3 USB slots to connect a PC, modem, memory stick, a web cam via Ethernet, or WiFi. A standard RS232 slot is also available. This basic concept is depicted in detail in Figure 1.1.

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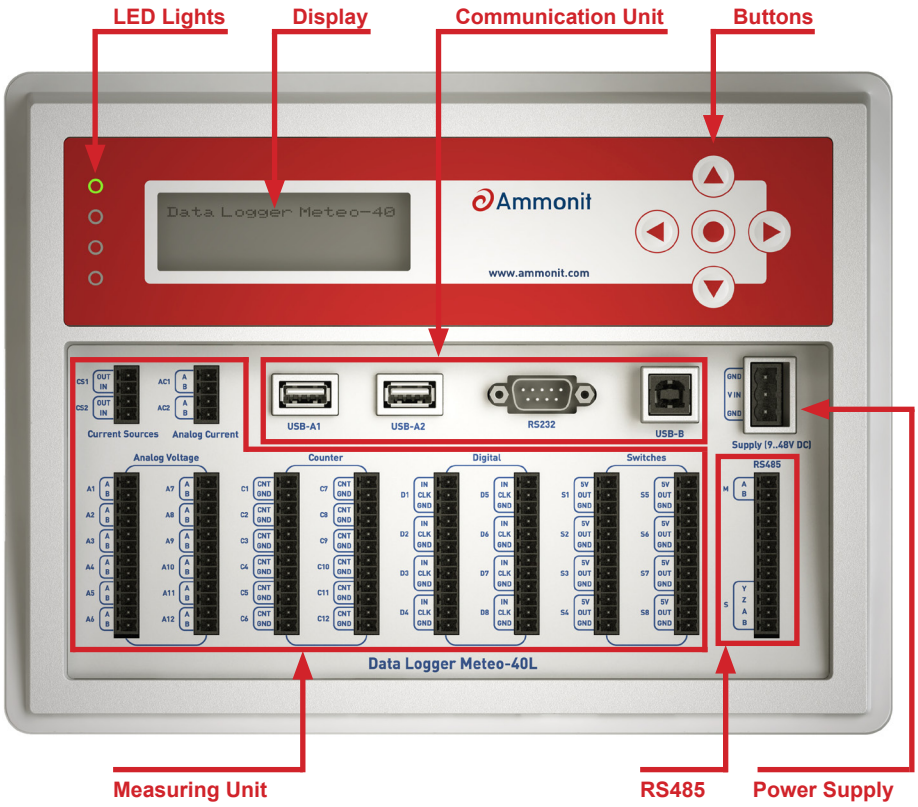


Figure 1.1: Overview of Meteo-40L

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) is shown in Table 1.1.

Feature		Meteo-40S	Meteo-40M	Meteo-40L
Input channels	Counters	4	8	12
	Digital	2	4	8
	Analog (*U*)	4	8	12
	Analog (*I*)	-	1	2
	RS-485	Up to 8 sensors		
Output channels	Switches	2	4	8
	RS-485	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		
	RS-232	1 for serial modem		
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

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

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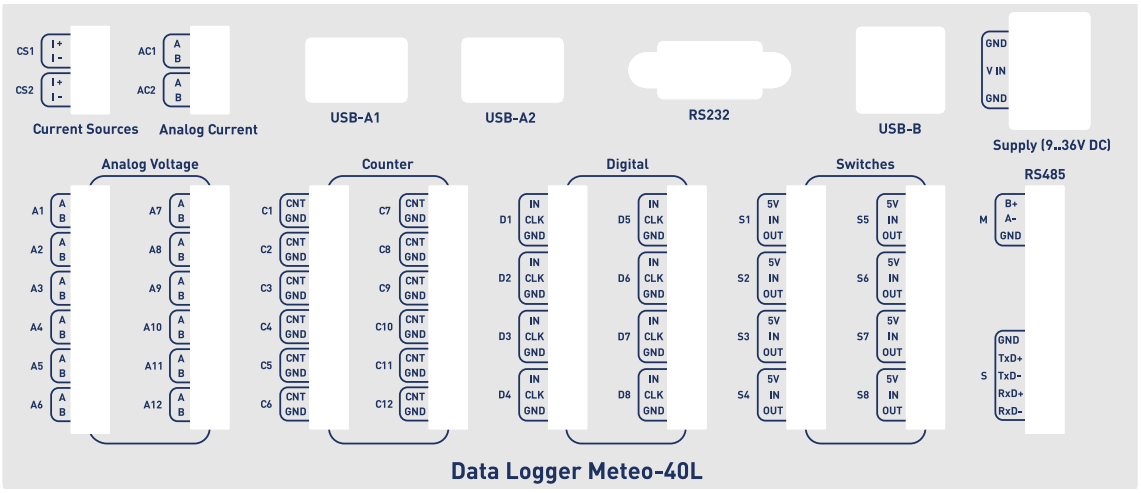


Figure 1.2: Meteo-40L Terminal

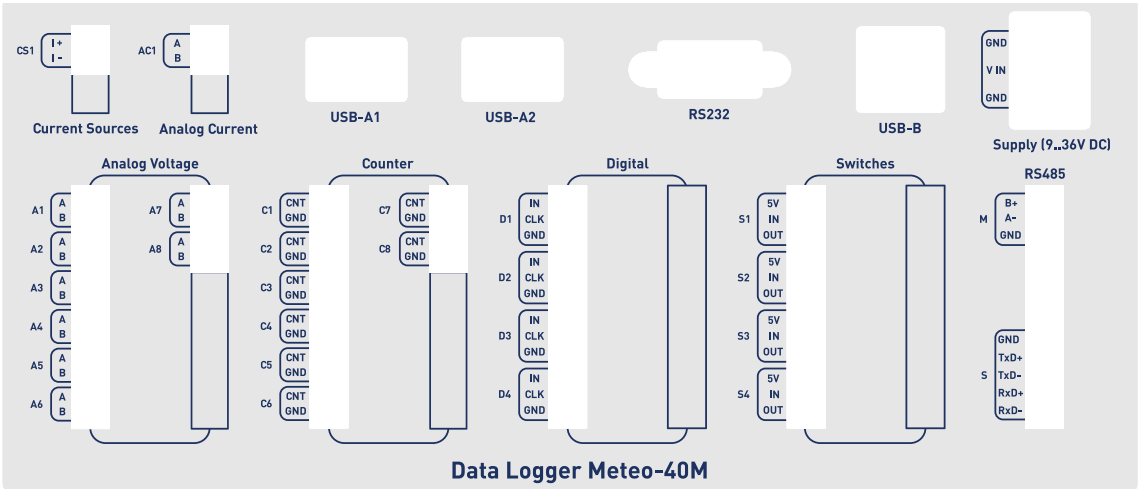


Figure 1.3: Meteo-40M Terminal

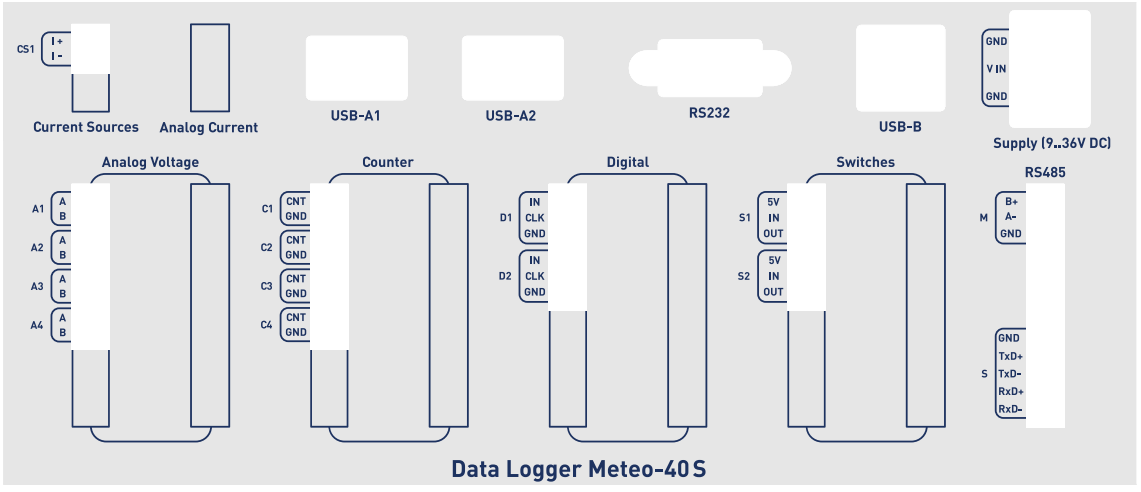


Figure 1.4: Meteo-40S Terminal

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).

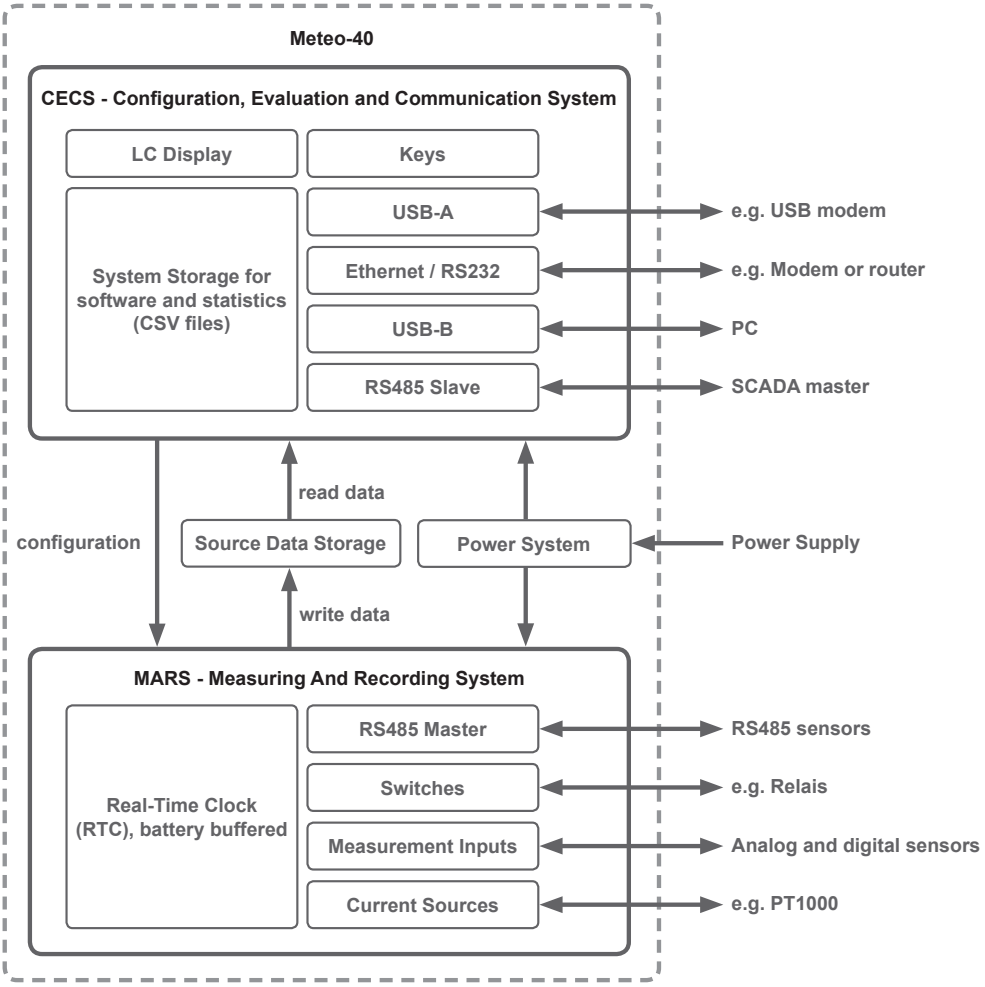


Figure 1.5: Block diagram of Meteo-40

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 and RS-232.

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 the use of 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 for a few seconds until the display turns on. A manual start of CECS is necessary to configure Meteo-40.

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Later on, during a measurement campaign, CECS will be started by MARS according to the configured time schedule, for example to send emails. After scheduled actions have been executed, CECS turns off automatically to lower power consumption.

1.4.1 CECS: Switch on / off behaviour

CECS is configured to run for 20 minutes before it automatically switches 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
Please 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. Meteo-40 offers a *CECS power mode*, which can be configured via web interface (SystemAdministration) or over the display of the data logger. If `CECS power mode` is activated, it will be displayed in the status box (see Section 3.2) in the web interface with the infinity symbol (∞) as well as on the Meteo-40 display with the word `Always`.



Note
The *CECS power mode* is switched off by default.

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



Important
Please note: When CECS is configured to be permanently switched 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 6.4.



Note
For optimal recording of the data, 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 menu System → Administration. 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 connection via Ethernet or USB is required.

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



Note
The Meteo-40 web interface will be 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)	no (only a few settings can be changed)	no	no	-	Using the display (see Section 4.4 and Chapter 9).
USB memory stick	no	no	yes	USB memory stick	Manual data download on pre-configured USB memory stick (see Section 4.2).
LAN	yes	yes (Internet access required)	yes (Data transfer via email, FTP/SCP, AmmonitOR or manual data download via web interface)	USB Ethernet adapter and Ethernet cable	Recommended for initial configuration and software updates (see Section 2.2).
W-LAN	yes	no	yes (Download via web interface)	USB W-LAN stick	Recommended on site for maintenance (see Section 7.6).
Point-to-Point Ethernet	yes	no	yes (Download via web interface)	USB Ethernet adapter and Ethernet cable	PC has to be configured (see Section 2.4).
USB	yes	no	yes (Download via web interface)	USB (A/B) cable	Backup access. Driver file might be required (see Section 2.3).

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Method / Action	Configura-tion	Software Update	Data Download	Required Devices	Comment
Modem access (GSM / Directional Radio / Satellite)	yes	yes (Internet access required)	yes (Data transfer via email, FTP/SCP, AmmonitOR or manual data download via web interface)	Modem	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 7.7)
SCADA over RS485 (Modbus RTU)	no	no	yes (Modbus protocol)	-	Modbus register map has to be configured for data retrieval (see Section 8.1).
SCADA over Ethernet (Modbus TCP/IP)	no	no	yes (Modbus protocol)	-	Modbus register map has to be configured for data retrieval (see Section 8.1).

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Chapter 2

Getting Started with Meteo-40

2.1 Introduction

Before you start working with Meteo-40, the data logger has to be connected 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 is successfully started and 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 enter the web interface it is necessary to establish a TCP/IP connection between Host PC and Meteo-40. The easiest way is to connect the data logger via USB-Ethernet adapter to your local LAN (see Section 2.2). Another option is a point-to-point connection between your PC and Meteo-40 via USB (see Section 2.3) with a standard USB 2.0 A/B cable (the same type of cable is typically used to connect a USB printer to a PC) or via Ethernet (see Section 2.4) with standard Ethernet cable and USB-Ethernet adapter.

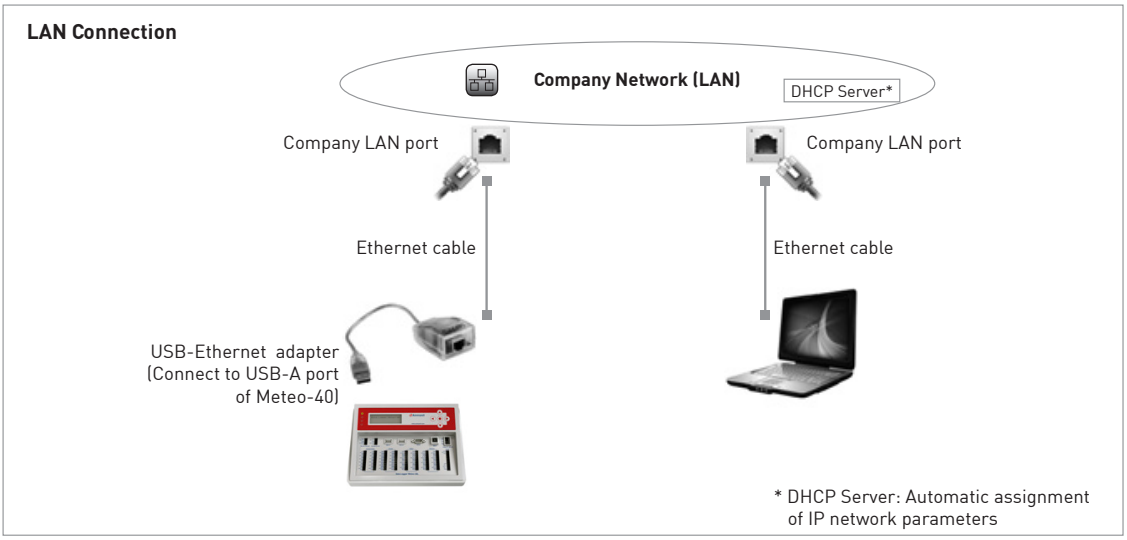


Figure 2.1: Accessing Meteo-40 via LAN (see Section 2.2)

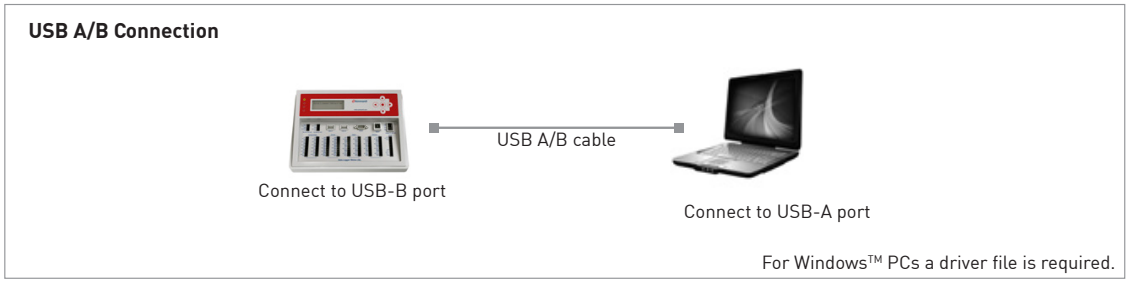


Figure 2.2: Accessing Meteo-40 via USB (see Section 2.3)

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 section Support → Software (`http://www.ammonit.com/support/downloads/214-software#Software`). For further details refer to Section 2.3.

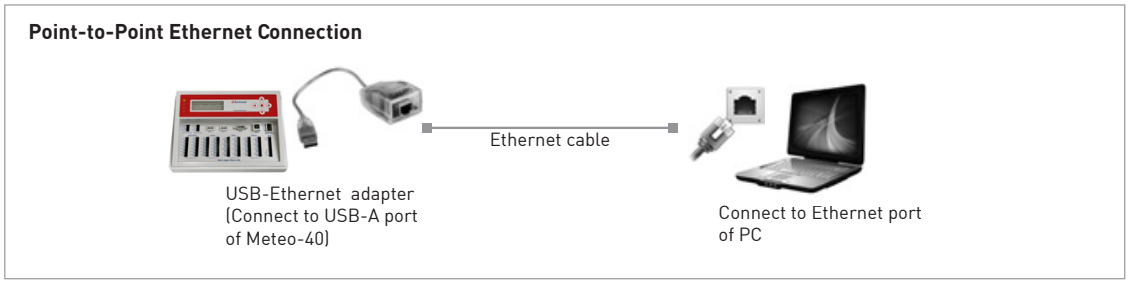


Figure 2.3: Accessing Meteo-40 via Point-to-Point Ethernet Connection (see Section 2.4)

Note
After having configured Meteo-40 for W-LAN, the data logger web interface can be accessed by using a W-LAN stick (see Section 7.6).

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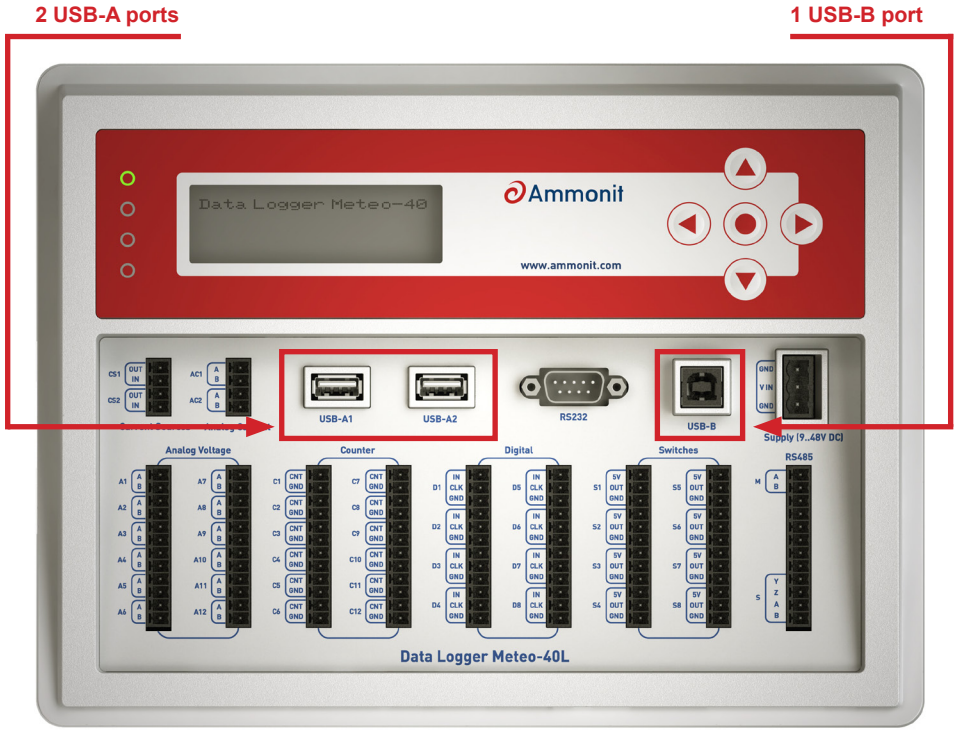


Figure 2.4: USB ports of Meteo-40L

This chapter explains how to connect Meteo-40 with a PC via LAN, point-to-point Ethernet or USB for the initial configuration.

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

2.2 Connecting Meteo-40 via Ethernet to your Local 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, an USB-Ethernet adapter is needed. Connect the USB side of the adapter with the data logger and plug in the Ethernet cable on the other side. If you have only one Ethernet port in your office, use a switch or a hub to have more Ethernet ports available.

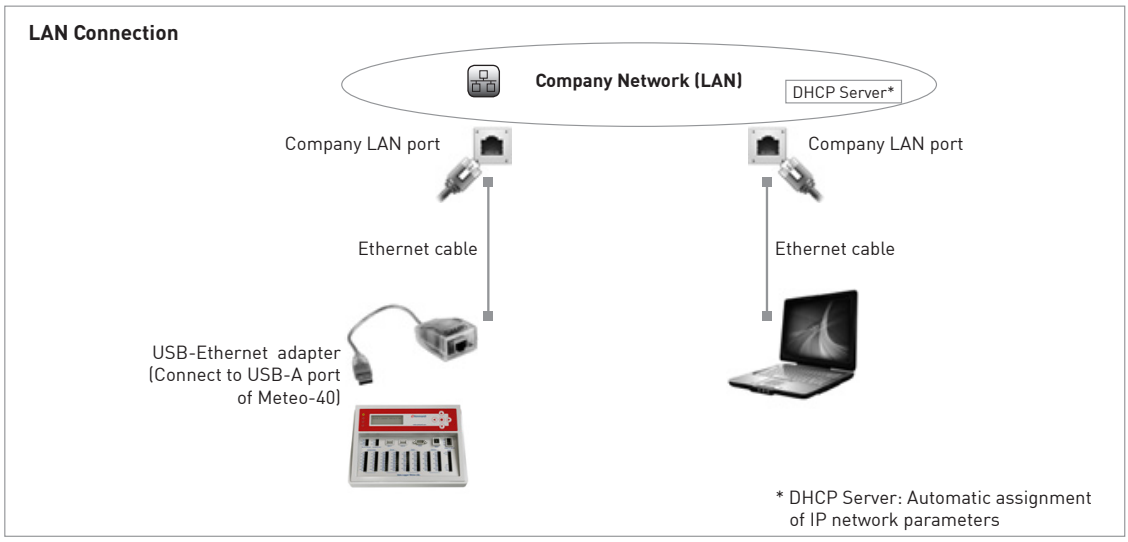


Figure 2.5: Accessing Meteo-40 via LAN

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 → Ethernet menu you can find a connection list which displays all available connections. If `Active` is displayed, the connection was successfully established.

Note
The Meteo-40 display always shows at least one Ethernet connection - even if no device is connected. This Ethernet item refers to a standard USB connection, which will be displayed with `Unavailable`, if no device is connected. So if you connect Meteo-40 via Ethernet to your local LAN, a second Ethernet item will be displayed which is `Active`.

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, you have to start a web browser and enter `https://` and the IP address from the data logger display e.g. https://192.168.12.30.

Tip
Please use Mozilla Firefox (`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*.

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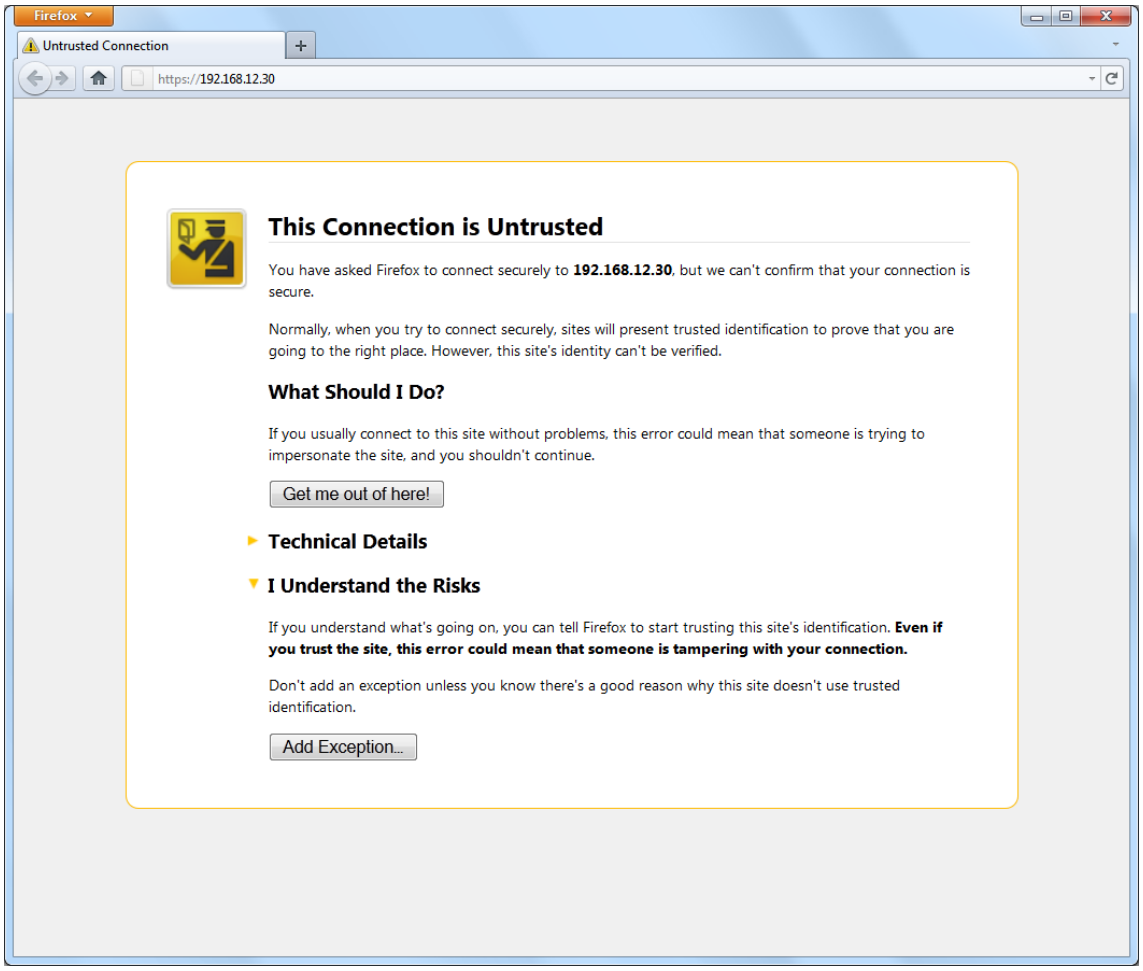


Figure 2.6: Firefox Connection Untrusted alert page

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.

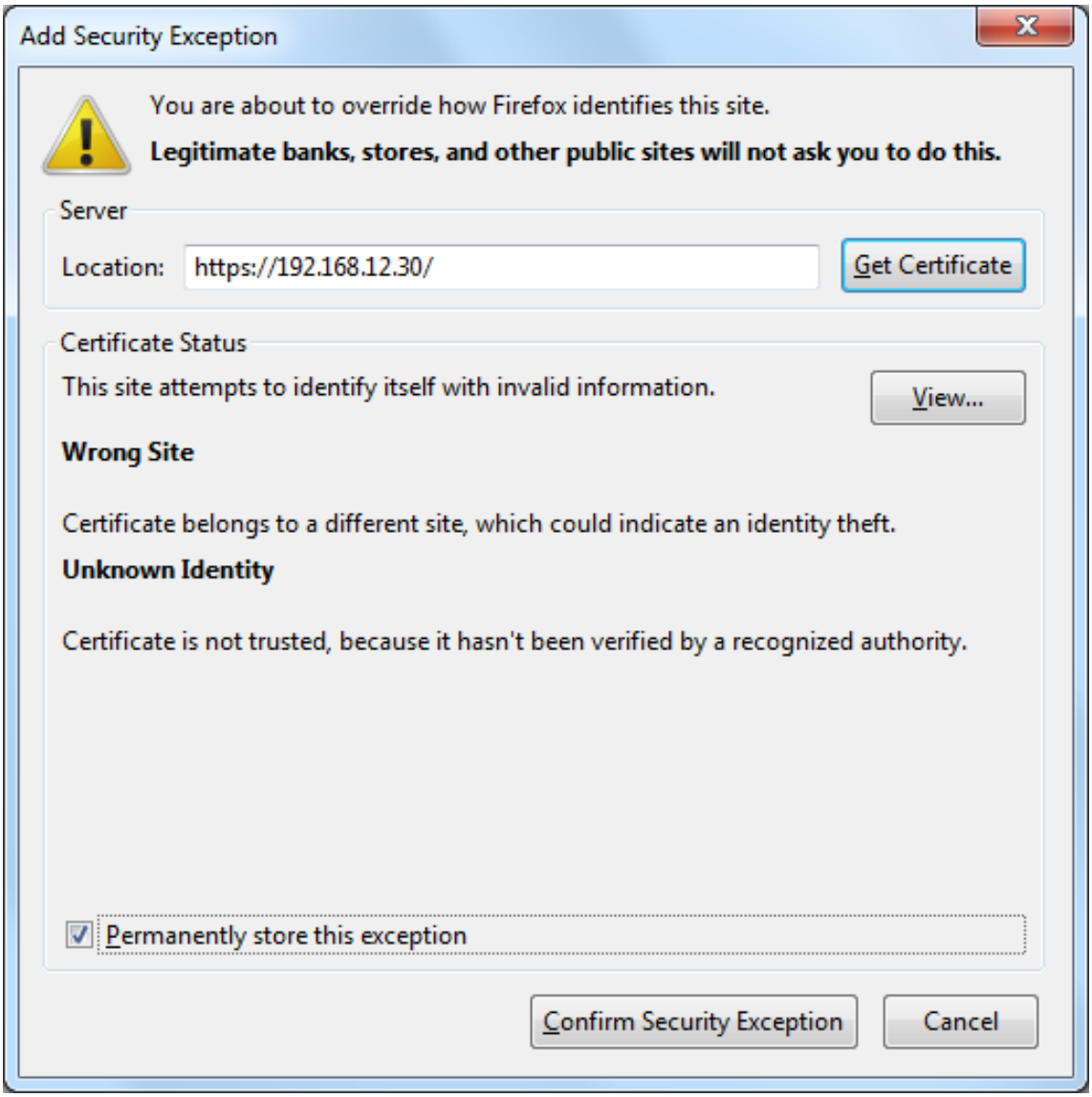


Figure 2.7: Add Security Exception

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 you can verify its validity.

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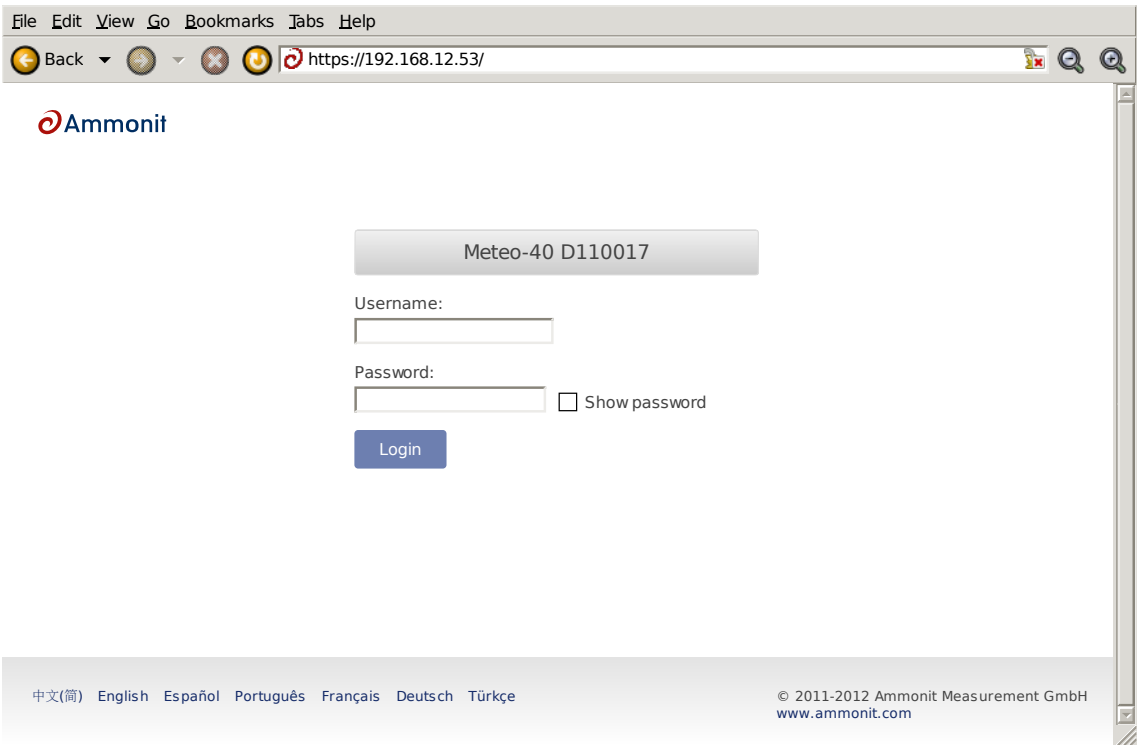


Figure 2.8: Meteo-40 web interface initial screen

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

Please go to Chapter 3 to proceed with the configuration.

2.3 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 this, it should be automatically recognised and installed. If any incompatibility problems occur, please refer to Section 2.3.2. Otherwise proceed to Section 2.3.1.

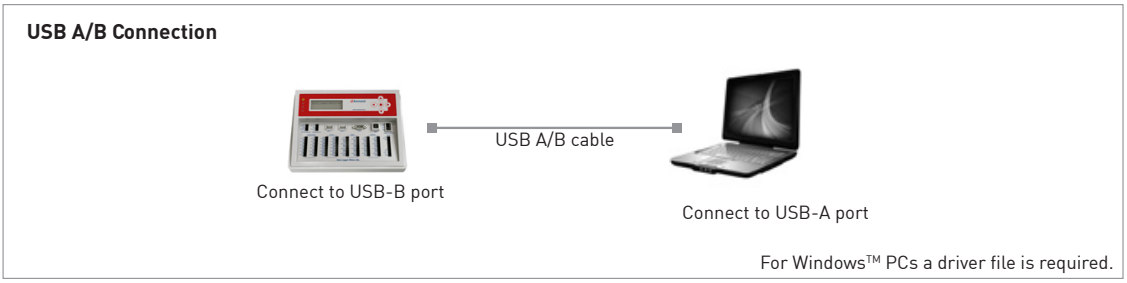


Figure 2.9: Accessing Meteo-40 via USB Connection

2.3.1 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.

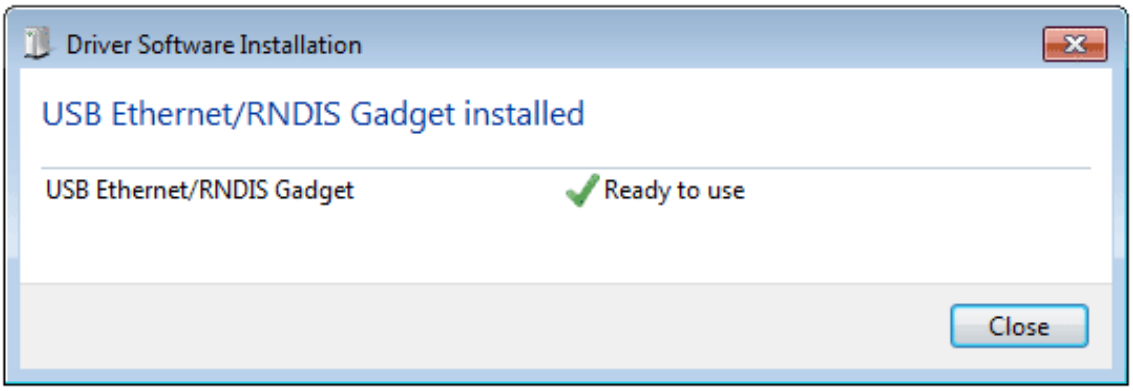


Figure 2.10: Windows Driver Software Installation

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.

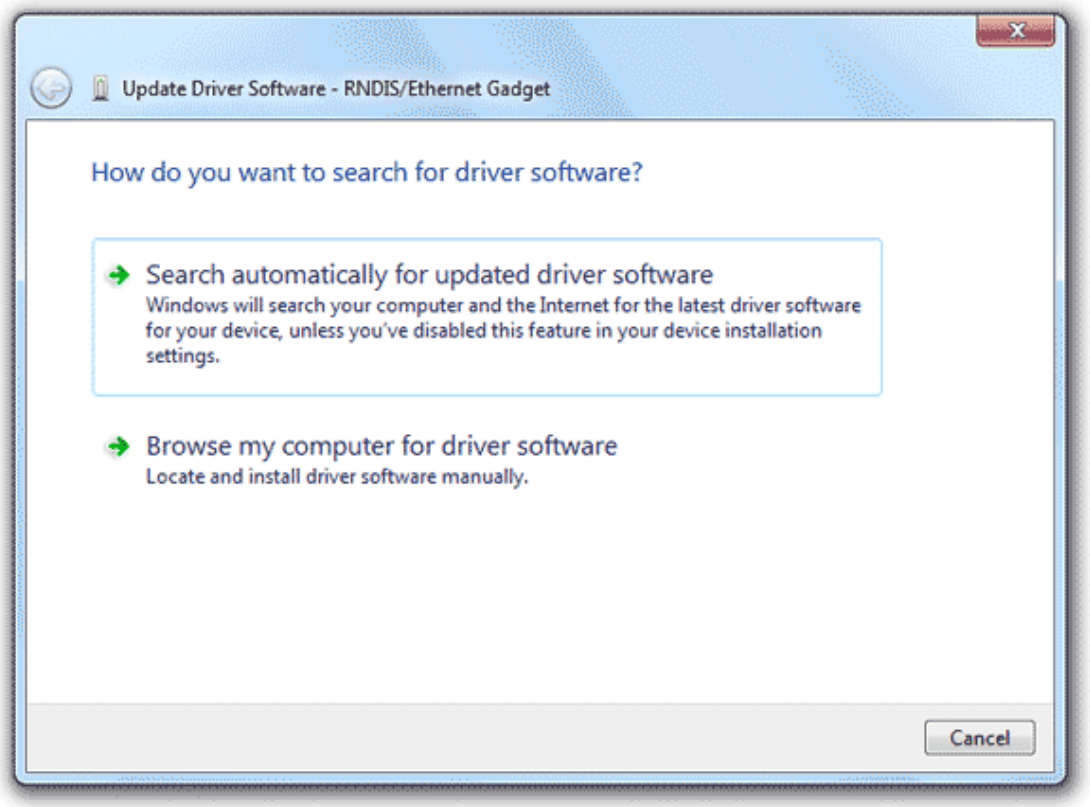


Figure 2.11: Windows Driver Update Installation

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

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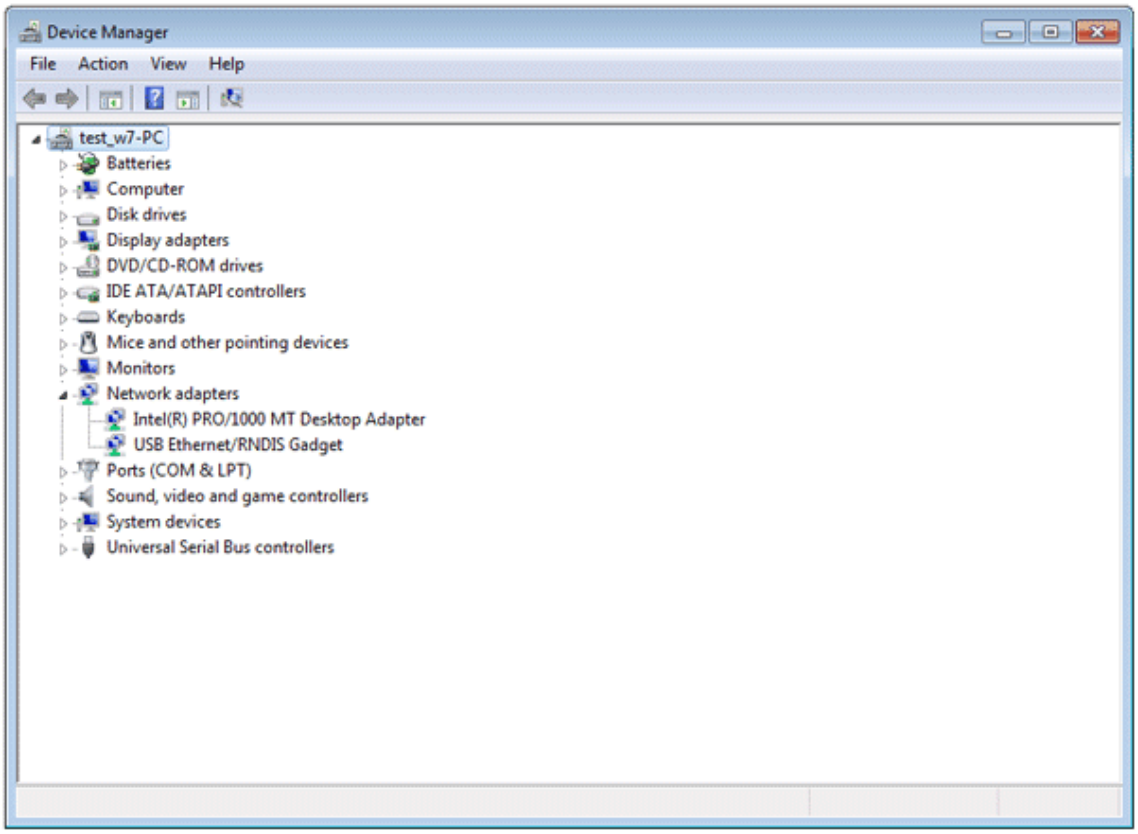


Figure 2.12: Windows Device Manager

The local connection is established. An IP address is automatically assigned to the data logger, which can be found on its display by accessing the USB connection under the menu Communication → Devices → LAN → Ethernet under IP/Netmask. To start using Meteo-40 just 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
Please use Mozilla Firefox (`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 please activate JavaScript and Cookies in our web browser!

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

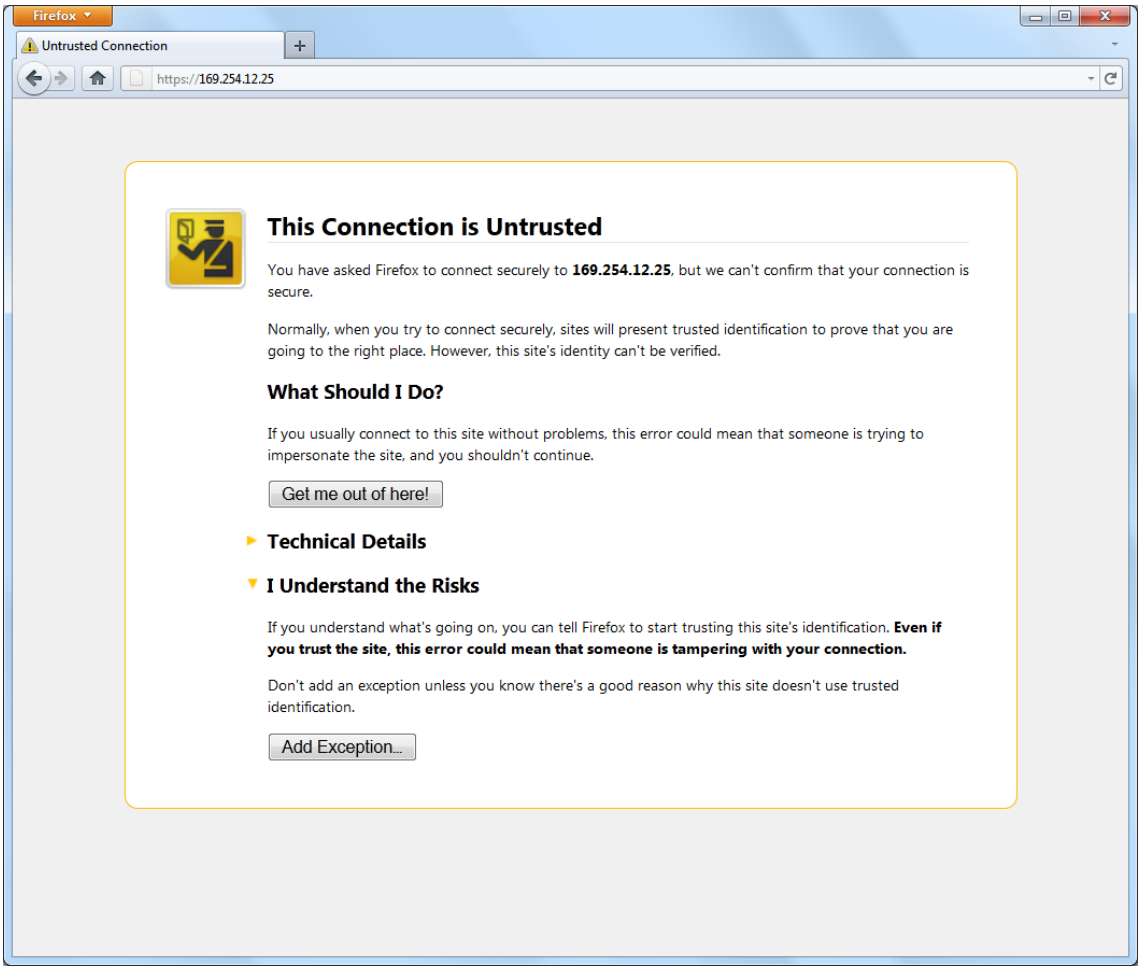


Figure 2.13: Firefox Connection Untrusted alert page

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.

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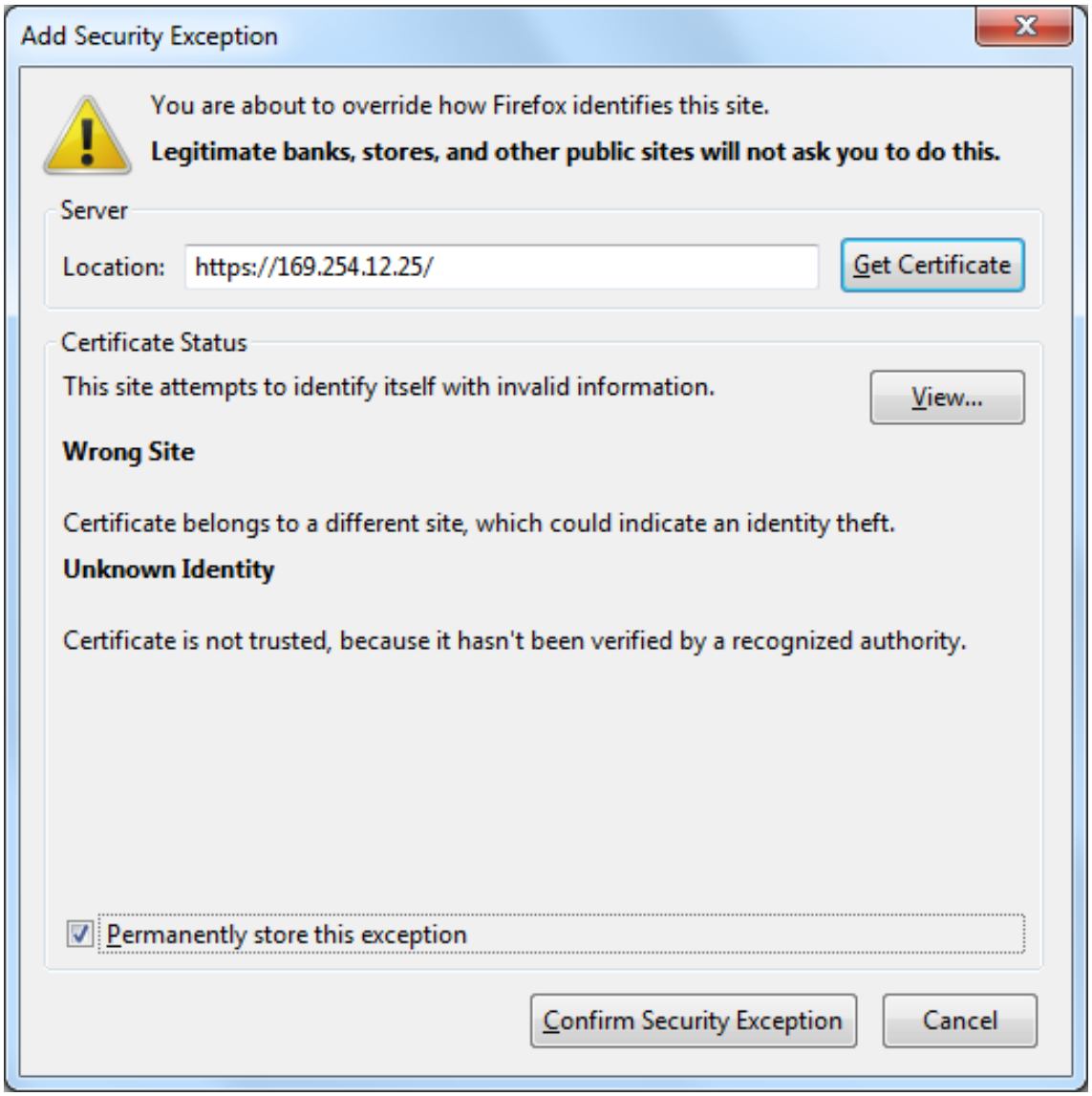


Figure 2.14: Add Security Exception

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 you can verify its validity.

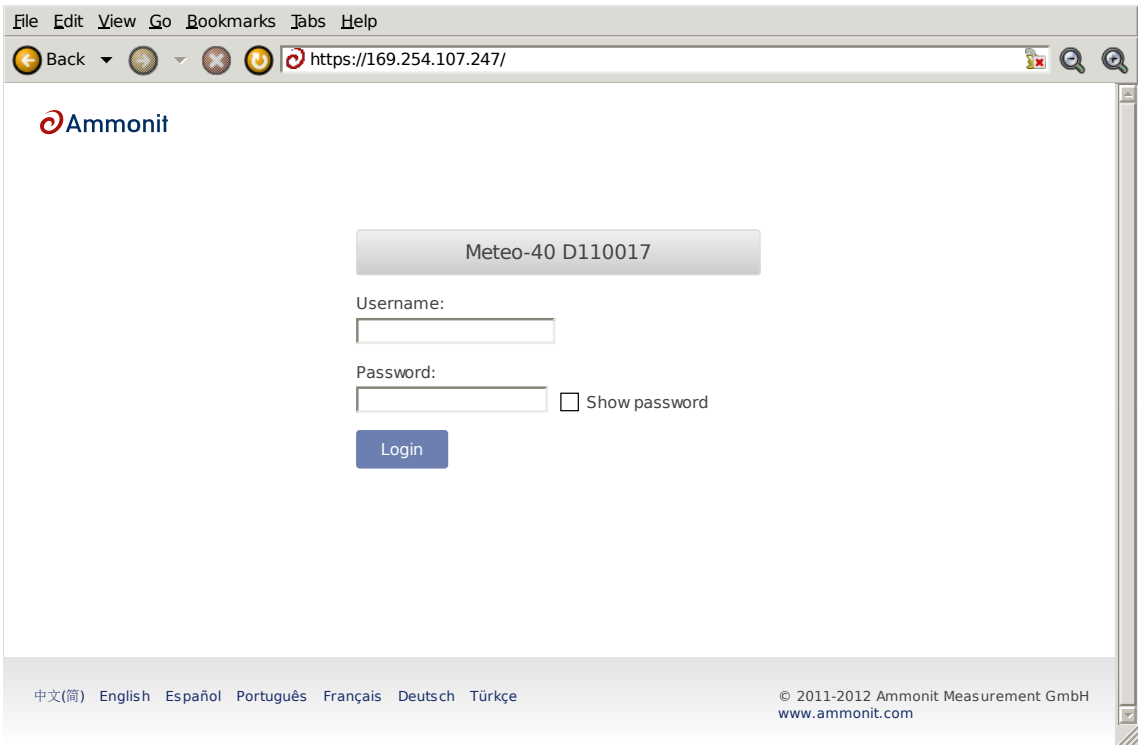


Figure 2.15: Meteo-40 web interface initial screen

2.3.2 Driver Update

When installing Meteo-40 for the first time driver compatibility 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 please 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.

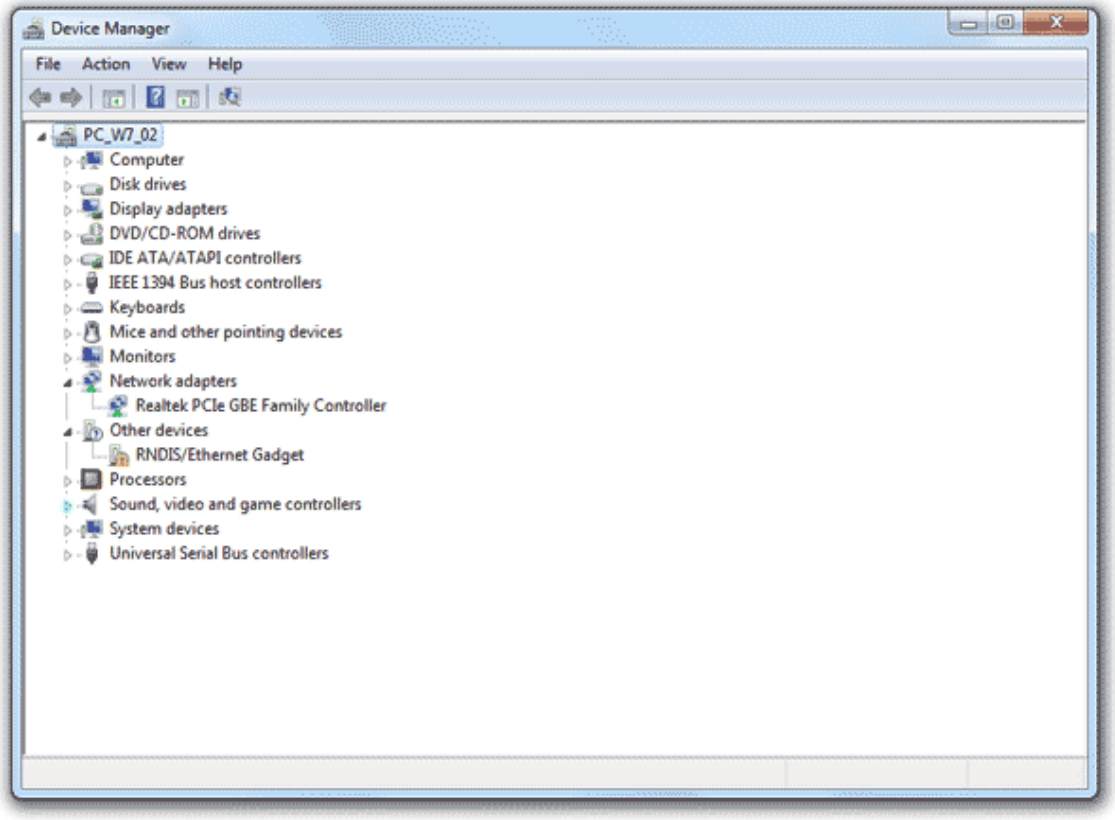


Figure 2.16: New USB Ethernet/RNDIS Gadget in Device Manager

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

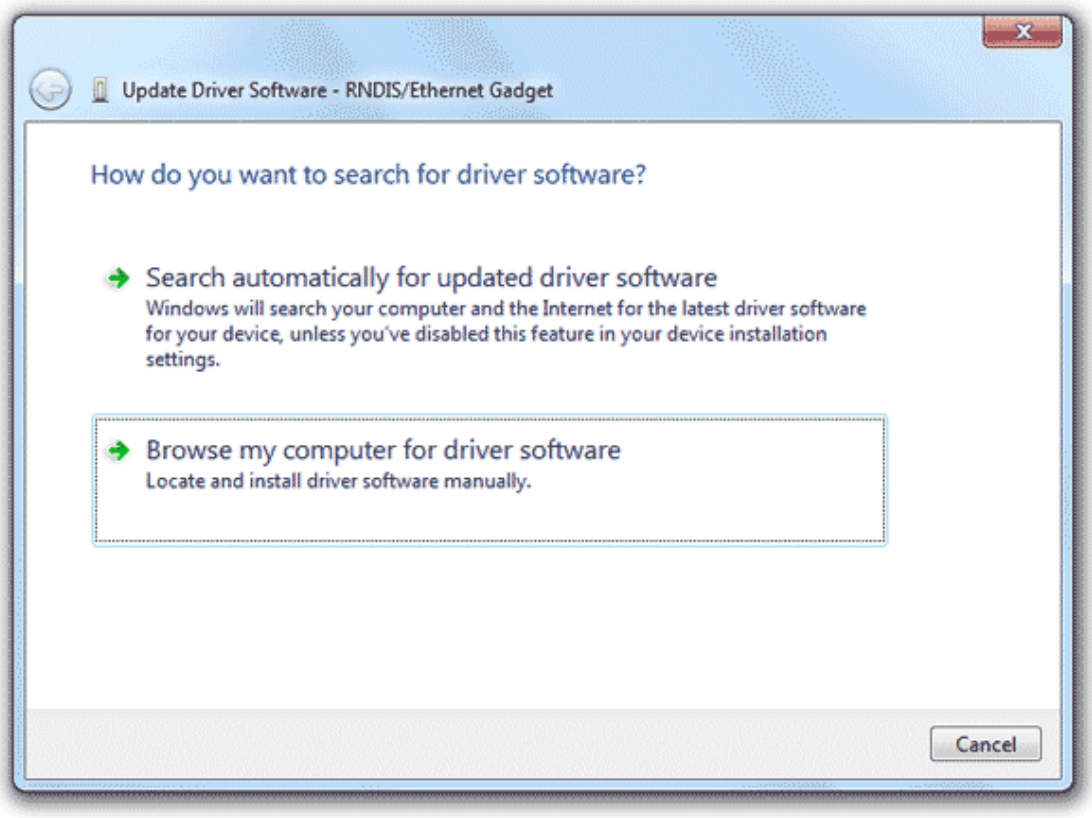


Figure 2.17: Update Driver Software dialog box

Locate and select the Meteo-40.inf file downloaded from Ammonit's website.

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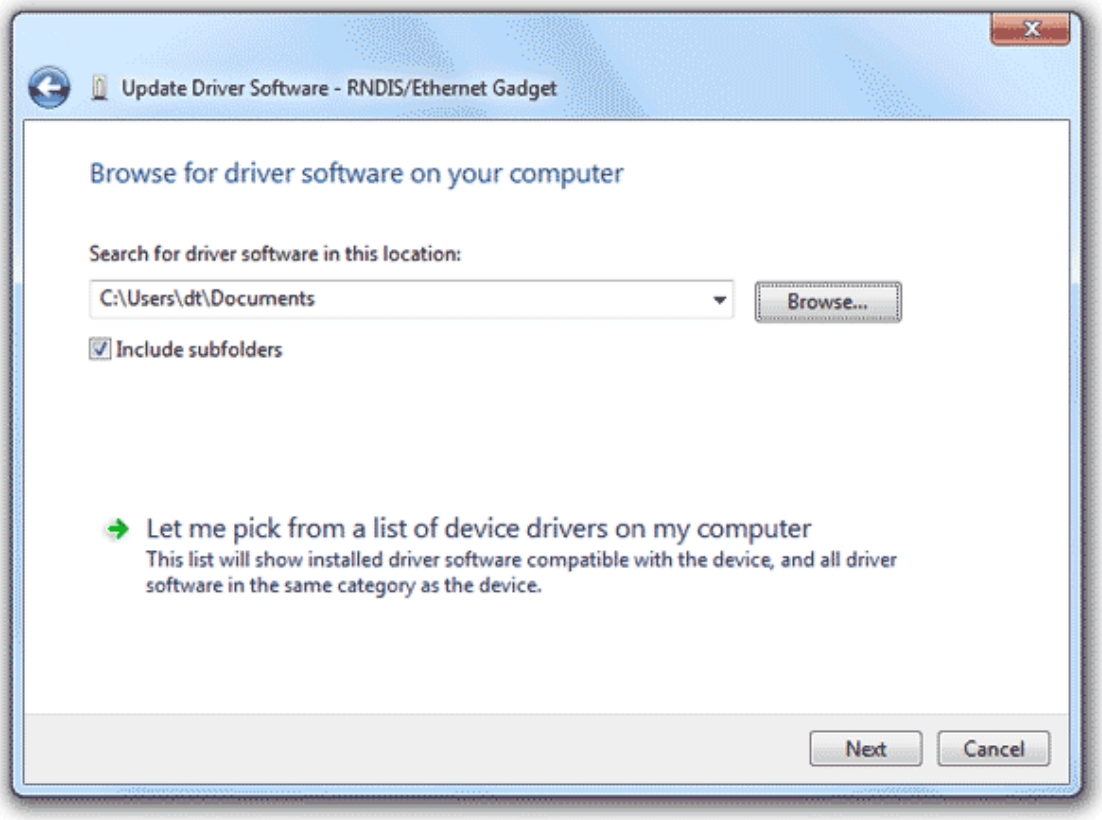


Figure 2.18: Update Driver Software dialog box

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.

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Figure 2.19: Windows Security Advisory

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

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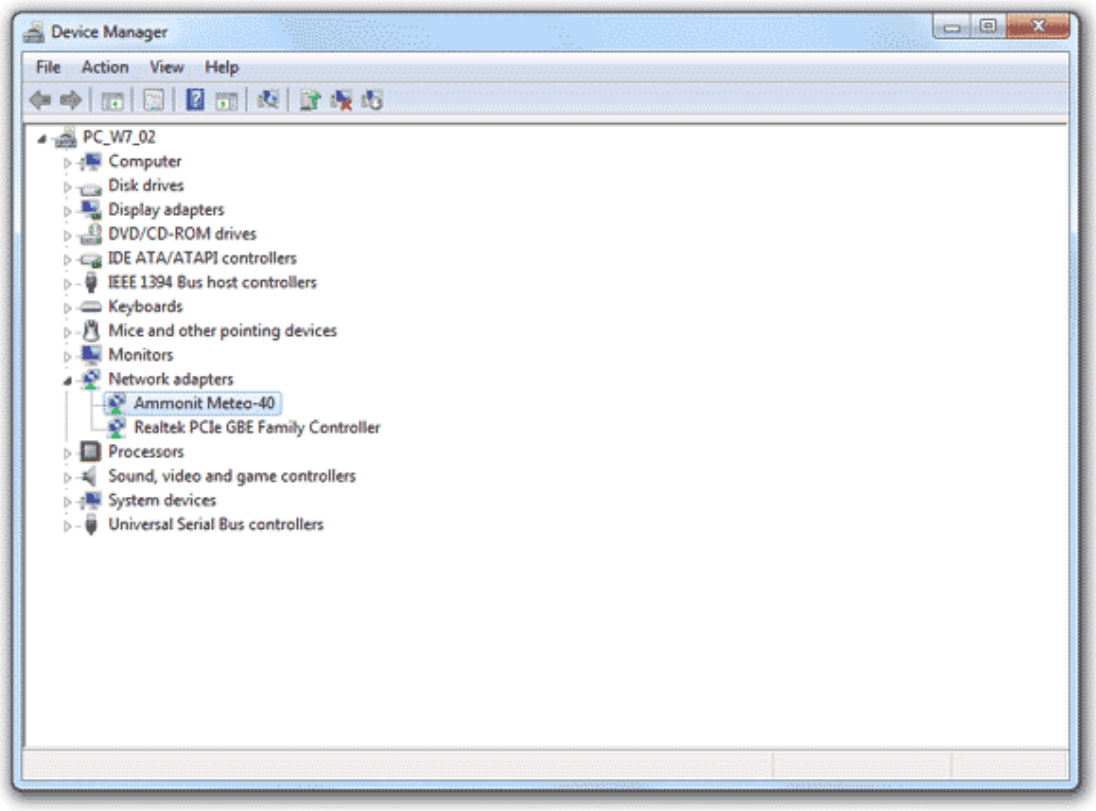


Figure 2.20: Windows Device Manager

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

In order to connect Meteo-40 with your Windows 7™ PC an USB-Ethernet adapter (see Figure 2.1) and a standard Ethernet cable are required. No additional driver file is needed for a direct point-to-point connection via Ethernet.

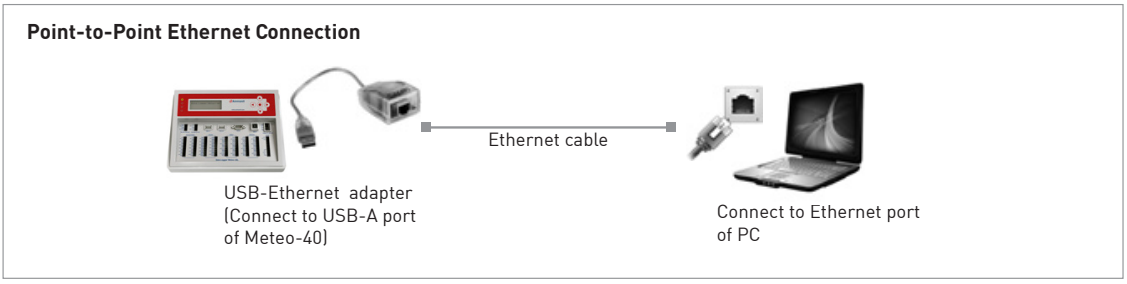


Figure 2.21: Accessing Meteo-40 via Point-to-Point Ethernet Connection

Before you connect the devices, your PC has to be configured to use a static IP address. To do so, open the *Network and Sharing Center* in the *Control Panel* of your computer and click on *LAN Connection* (see Figure 2.22).

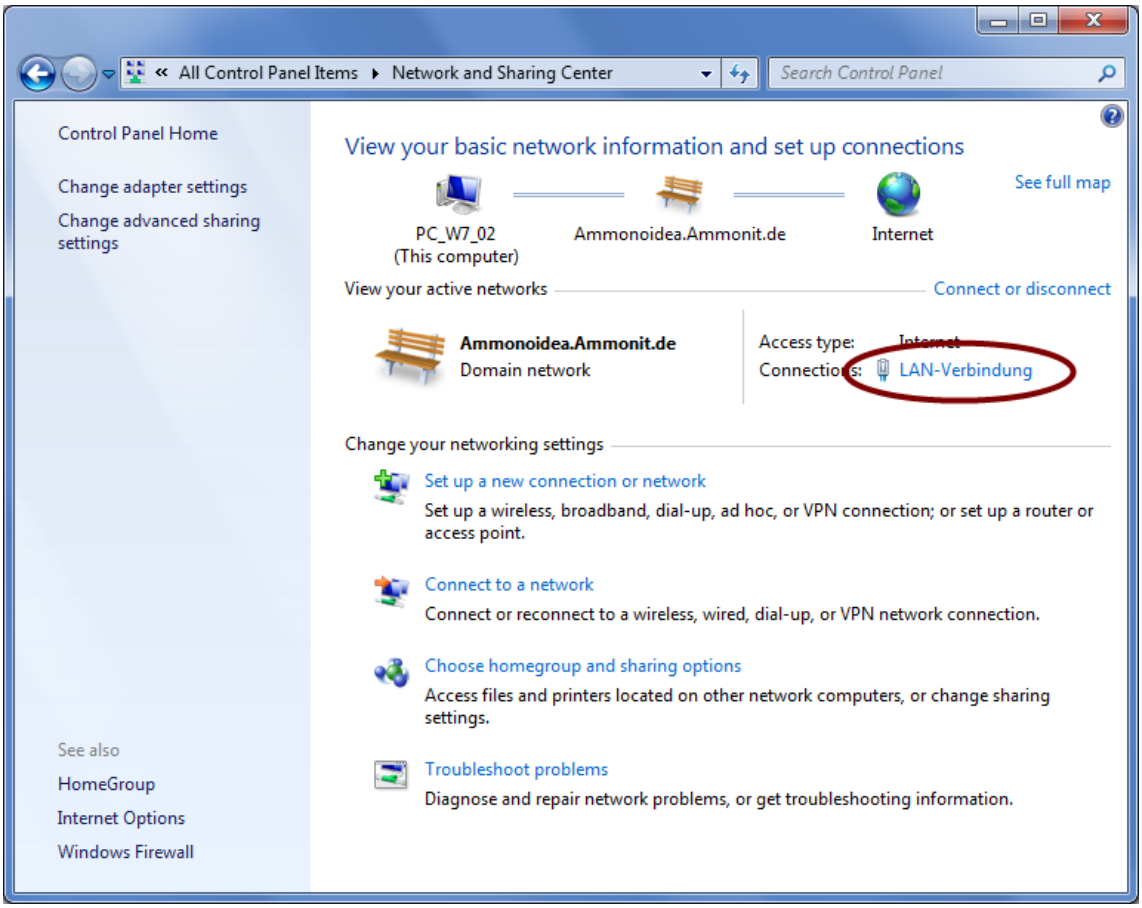


Figure 2.22: Network and Sharing Center of Windows 7™

To configure the LAN connection, click on *Properties* (Figure 2.23) in the LAN Connection Status window.

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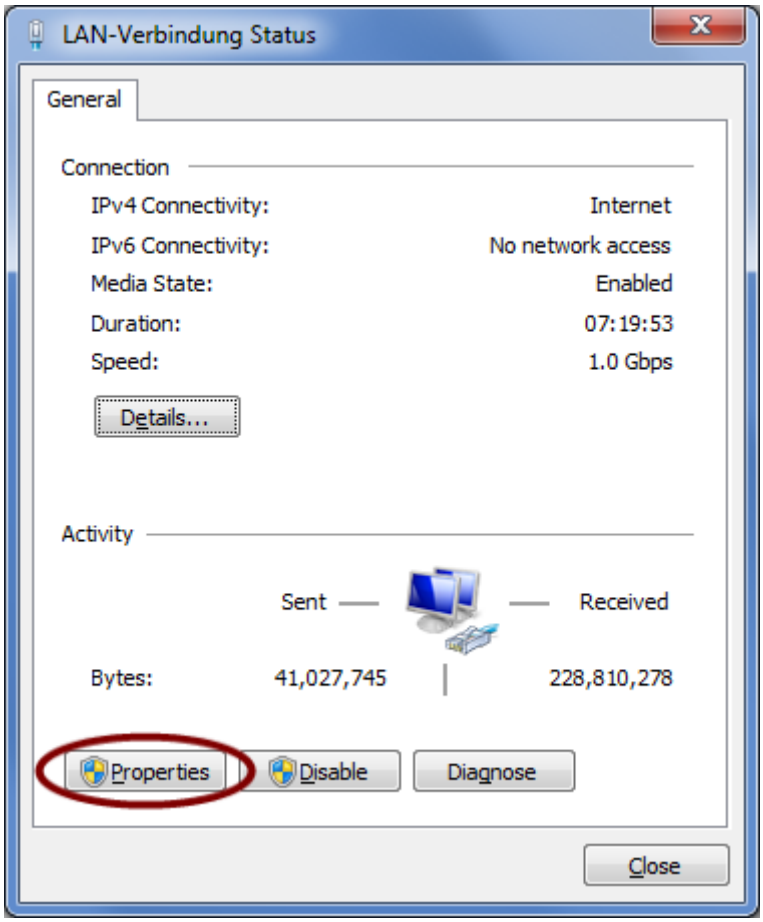


Figure 2.23: LAN Connection Status

Select *Internet Protocol Version 4 (TCP/IPv4)* and open the *Properties* of the Internet protocol as shown in Figure 2.24

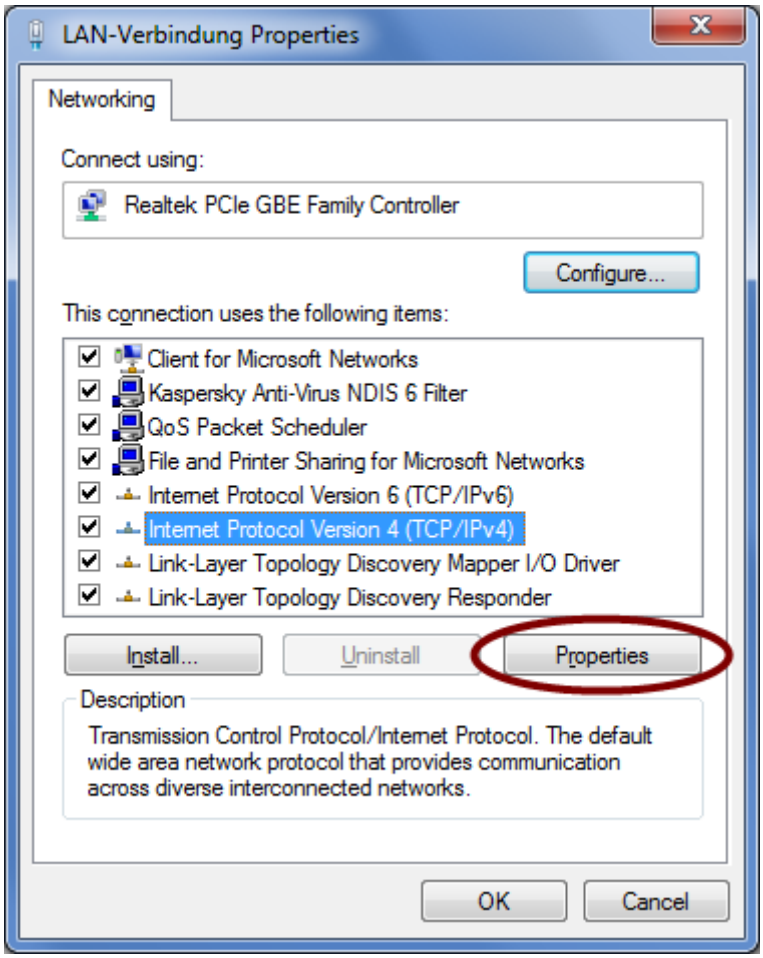


Figure 2.24: Properties of LAN Connection

Choose *Use the following IP address* and enter the following IP address `192.168.40.1` as shown in Figure 2.25. By pressing the TAB button the Subnet mask will be filled automatically. With *OK* you save the configuration.

Important
If you do not have the rights to configure the settings, please ask your system administrator.

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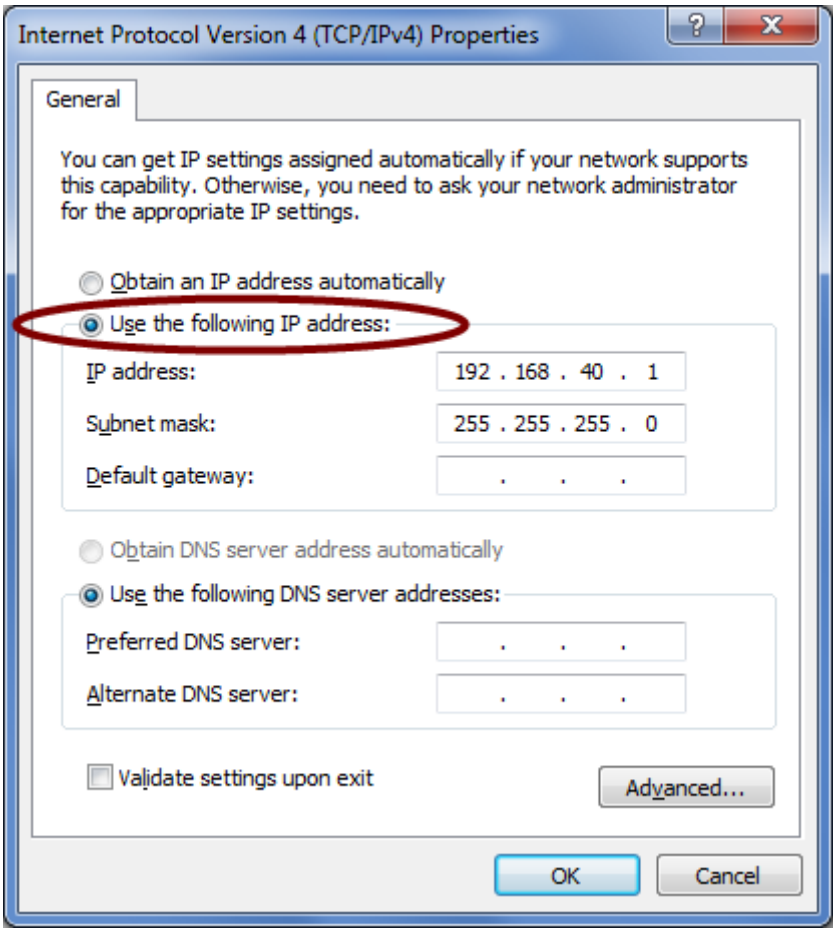


Figure 2.25: Properties of Internet Protocol

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

Now Meteo-40 has to be configured for the point-to-point Ethernet connection. Please open the Communication → Devices → LAN → Ethernet menu and select *Ethernet (Offline)*. Now move to *Use DHCP* and press the right button on the Meteo-40 keyboard until No is displayed as shown in Figure 2.26. *Use DCHP* is configured on Yes by default to support the standard LAN (see Section 2.2) connection via Ethernet.

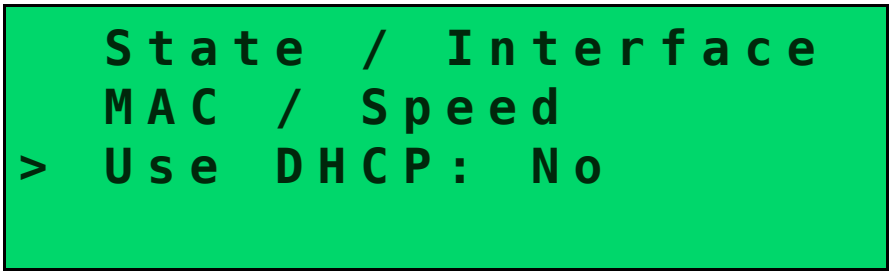


Figure 2.26: Meteo-40 display with deactivated DHCP

Finally open your browser (e.g. Mozilla Firefox) and enter `https://192.168.40.40`, whereas 192.168.40.40 is the preconfigured IP address of each Meteo-40 data logger. Afterwards a confirmation prompt appears. Please click *I Understand the risks* and press *Add Exception* as shown in Figure 2.27.

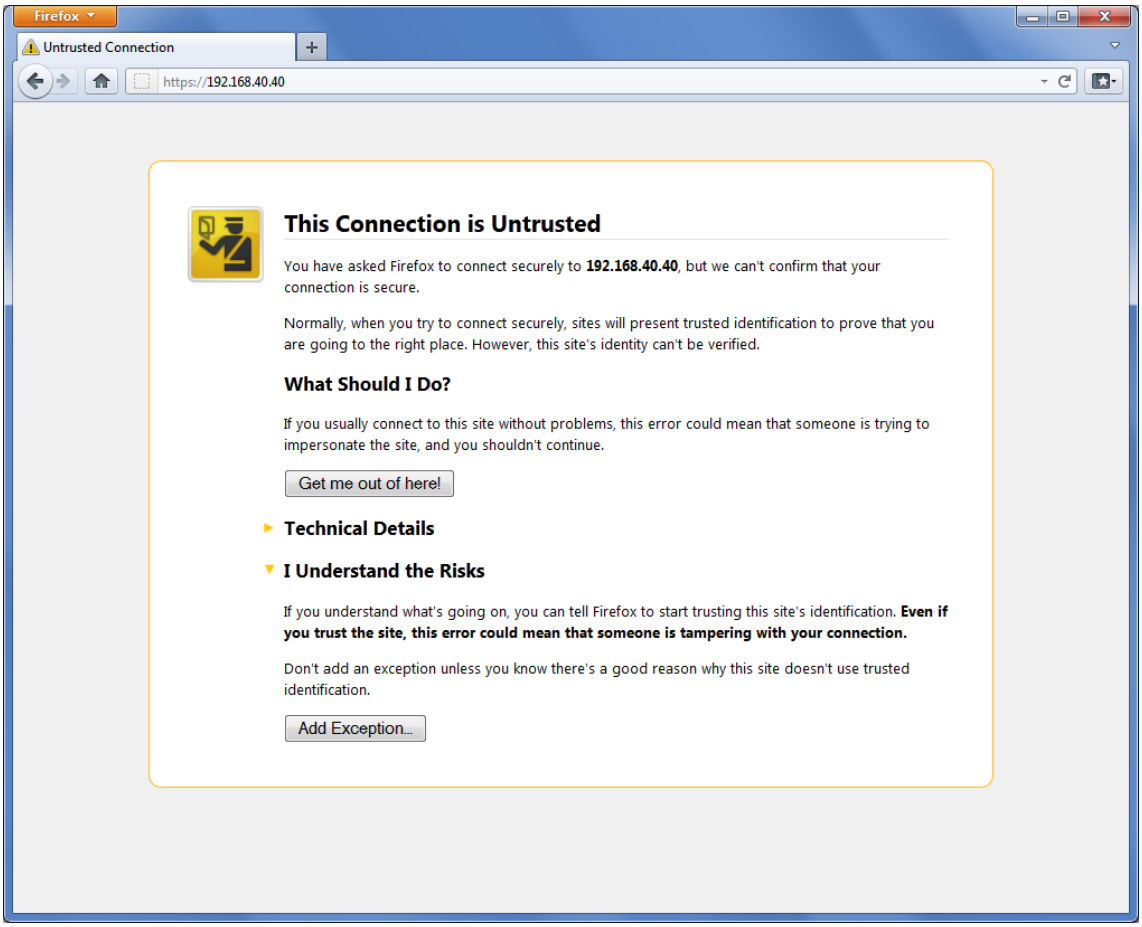


Figure 2.27: Mozilla Firefox Connection Untrusted Alert Page

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.

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Figure 2.28: Add Security Exception

After confirming the certificate the Meteo-40 login page is shown. Please use the login details you received to enter the web interface. To proceed with the configuration go to Chapter 3.

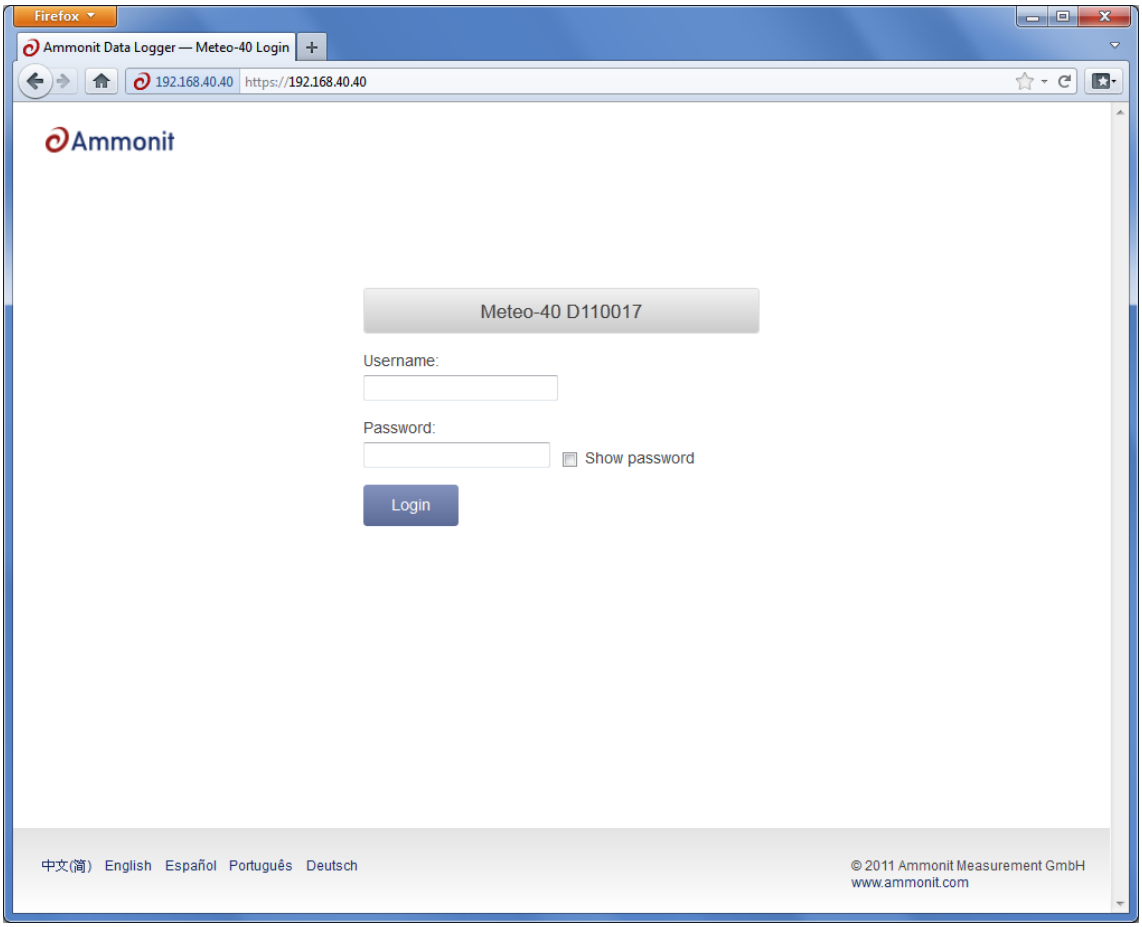


Figure 2.29: Meteo-40 web interface initial screen

Tip
Using this point-to-point connection (without Internet access) the modem connection can be tested, e.g., does the modem send emails.

Note
Please do not forget to reset the LAN configuration on your PC (Internet protocol properties) and to enable DHCP on Meteo-40 (if needed).

2.5 Using Bonjour

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`). It provides automatic resolution of computer host names and the data logger can now be accessed via its serial number. Unfortunately, our tests have revealed that this software causes problems when installed on Windows XP.

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

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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 this time as well and should be accepted as described in Section 2.3.1.

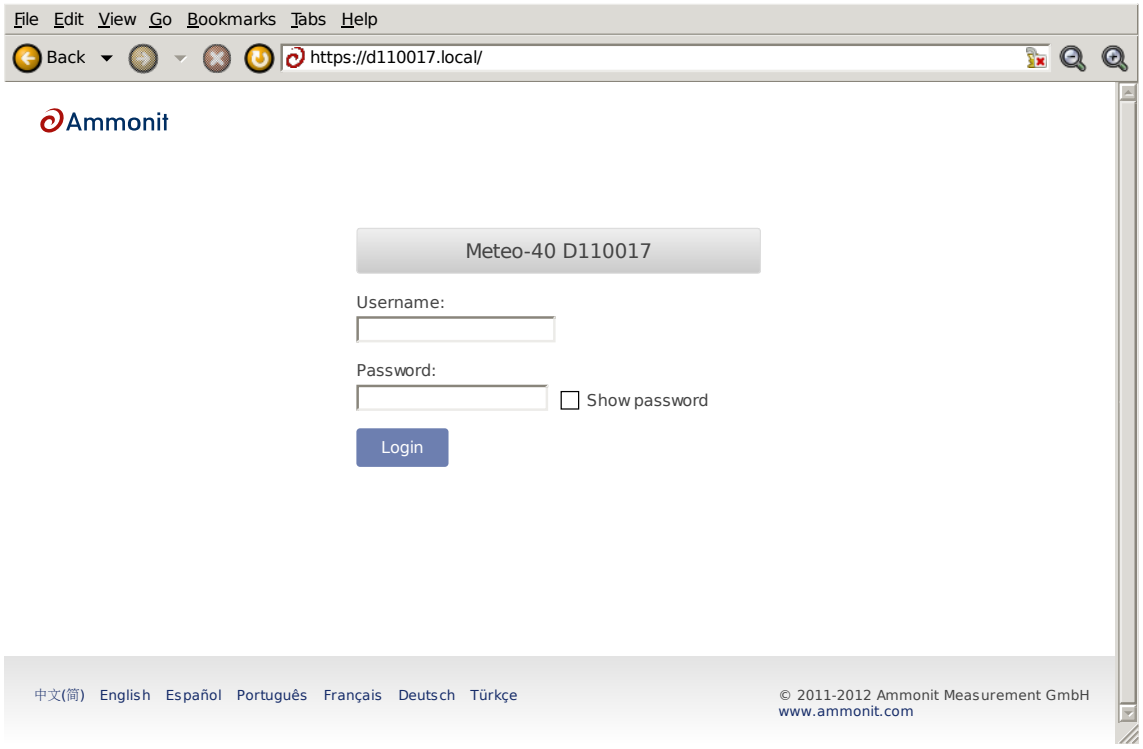


Figure 2.30: Meteo-40 web interface initial screen

2.6 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.

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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`.

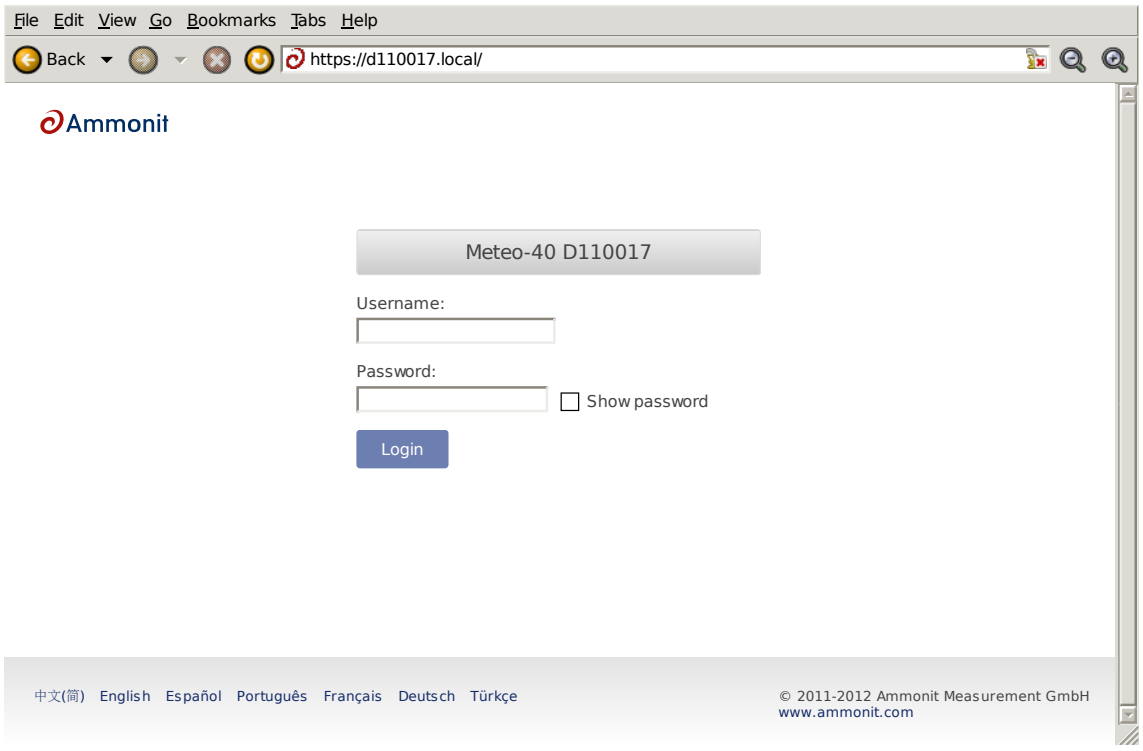


Figure 3.1: Login Screen

The original password for each account is enclosed in the data logger's manual. The passwords are unique for each Meteo-40. All passwords can be changed (Change Passwords:) by the administrator.

Account	Permissions
Guest	• Look at all configuration pages • Look at live data
Viewer	• All of the above • Download measurement data
User	• All of the above • Configure the data logger
Admin	• All of the above • Change the name of the data logger • Upgrade the data logger software

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 please activate JavaScript and Cookies in our web browser!

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

Help Click here to access online help.

Logout Click here to 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
Please be aware that due to security reasons it is not possible to reset the 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 should send the data logger to Ammonit, so that we can restore the original passwords.

3.2 Global Control Elements

After login the Status Box appears in the upper left corner of the screen. It always shows the most important information and control options.

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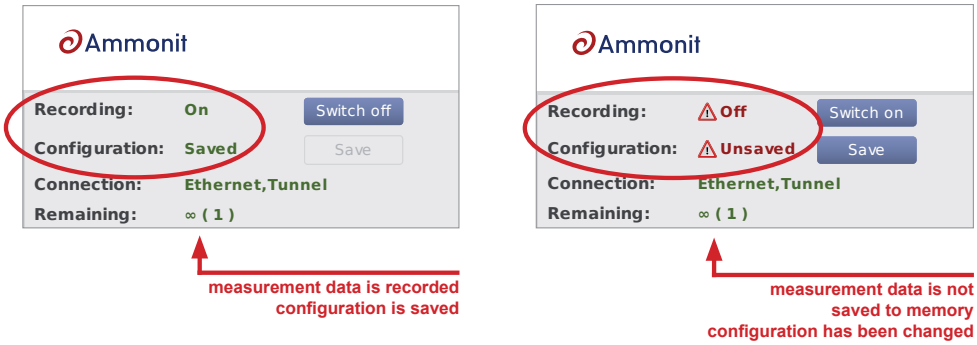


Figure 3.2: Meteo-40 Status Box displaying Status of Recording

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!

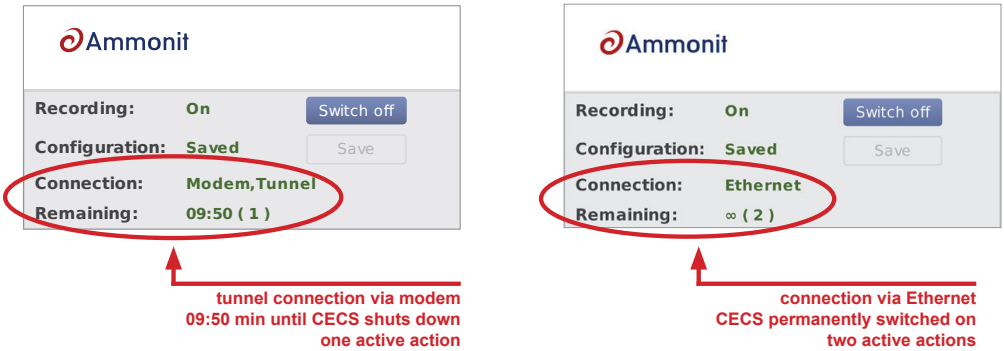


Figure 3.3: Meteo-40 Status Box displaying Connection and Power Mode

The Meteo-40 Status Box displays how you are accessing the data logger (`Connection`), e.g., tunnel connection via modem or using Ethernet without tunnel in the office. Additionally, the web interface informs about the remaining time until shut down or whether CECS is configured to run permanently (`Remaining`). In brakets 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
	Display
	Web Camera
	Switches
	System Log
Measurement	Sensors
	Channels
	Evaluation
Data	Live
	Statistics
	Source
Communication	Schedule
	E-Mail
	Online
	FTP/SCP
	SCADA
	LAN
	WLAN
	Modem

Table 3.2: Menu of the Web Interface

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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.

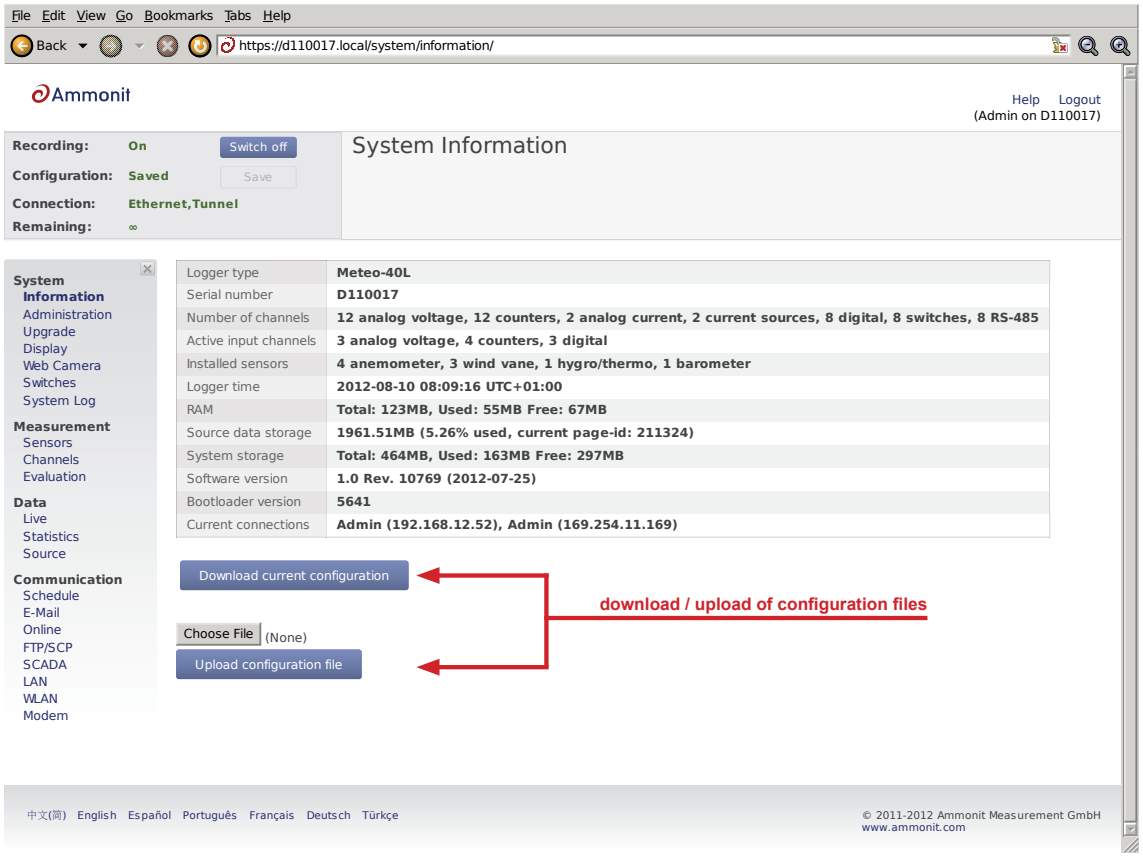


Figure 4.1: System Information Page

Under *Current connections* all current logins are displayed with IP address, e.g., via LAN, W-LAN, 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.

Use *Download Current Configuration* to download the configuration file. The configuration file is an 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.

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`, you cannot change anything here.

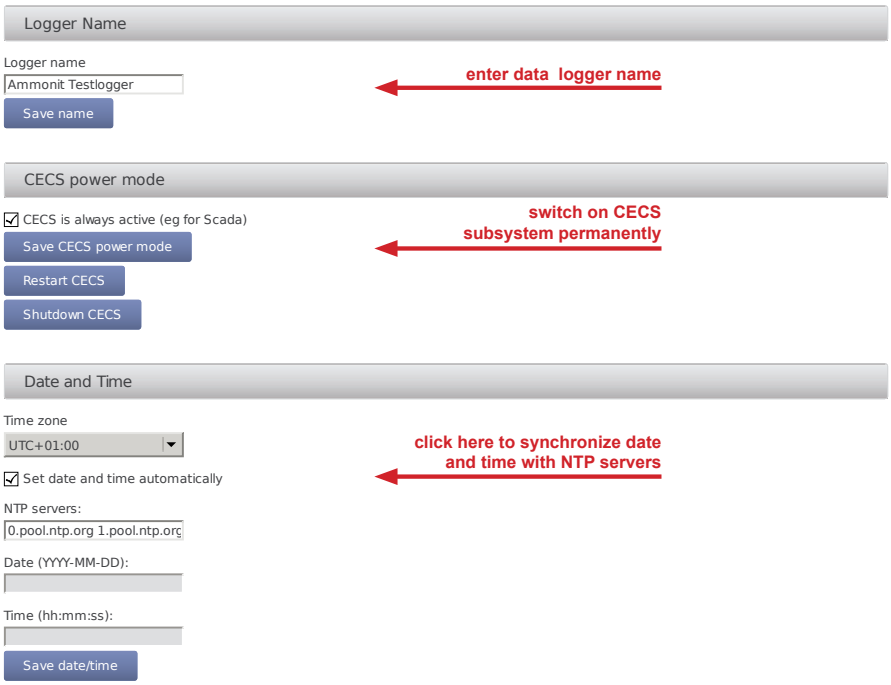


Figure 4.2: System Administration Page (1/2)

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

Note
The data logger serial number is the most important ID to identify the data logger. Use the *Logger Name* to combine the data logger with a site, e.g., Berlin Test Logger.

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CECS Power Mode CECS is configured to run for 20 minutes before it switches off automatically. The *CECS power mode* is switched off by default.

In order to keep CECS running, e.g., for SCADA wind farm monitoring, Meteo-40 offers the *CECS power 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. Before any changes of the CECS mode via display can be made, permissions have to be defined in the web interface (System → Display (see Section 4.4). If *CECS power mode* is activated, it will be displayed in the status box in the web interface with the infinity symbol (∞) as well as on the Meteo-40 display with the word `Always`.



Note
If the power supply for the Meteo-40 is disconnected while CECS is running in the *CECS power mode* CECS will restart automatically after the Meteo-40 is powered again.



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

If the CECS has to be restarted, click on *Restart CECS*.

If you wish to shutdown the CECS, e.g. during remote access, click on *Shutdown CECS*.



Important
The 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.

Date and Time: Time synchronization of the data logger is a primary concern. 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.

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 will be checked while typing the values.

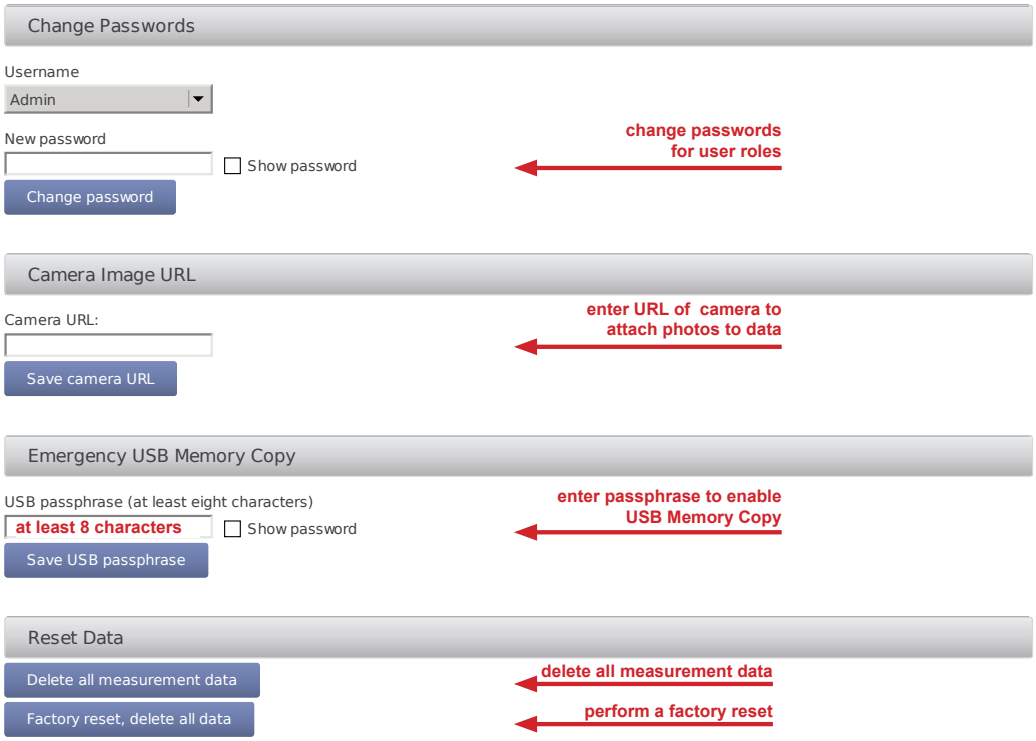


Figure 4.3: System Administration Page (2/2)

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



Important
Please be aware that due to security reasons it is not possible to reset passwords. If you loose a modified `Admin` password, there is no way to recover it, not even for Ammonit. In this case, you have to send the data logger to back to the manufacturer. Only Ammonit is able to restore the original passwords.

Camera Image URL If one or more photos should be taken by an outdoor camera, you have to enter the URL of the photo in the web interface. The URL depend on the installed camera, e.g., http://xxx or https://xxx. In doing so Meteo-40 will attach a photo to the measurement data.



Important
Connect the camera to one of the USB-A ports of Meteo-40. If necessary, use an USB-Ethernet adapter. Please configure both devices, Meteo-40 and camera, for static IP address. In order to configure the camera, use the software delivered with the camera. The static IP address of Meteo-40 can be configured in the Communication → LAN menu (see Section 7.5).



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

Emergency USB Memory Copy Meteo-40 offers the possibility to download created CSV files with measurement data (statistics see Section 6.3) on an USB memory stick which is connected to the data logger. Before you use this function, data logger and USB memory stick have to be configured.

Please create a TXT file named keyfile.txt, which has to be saved on the USB memory stick you use for downloading the CSV files. This TXT file must include the data logger serial number and a password, e.g., D110017=passphrase. The TXT file is necessary to prevent unauthorized data download.

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

The passphrase has to be entered in the field shown in Figure 4.3.

You can use one USB memory stick for several data loggers. To do so, enter line by line the details of the data loggers, e.g., first line D110016=passphrase; second line D110017=passphrase; third line D110018=passphrase.

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

Meteo-40 shows in its display how many CSV files are downloaded. When the download is finished, the data logger menu is shown and the USB memory stick can be disconnected.

Using this function, always all available CSV files are copied to the USB memory stick. All CSV files are compressed to keep the file as small as possible.

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.

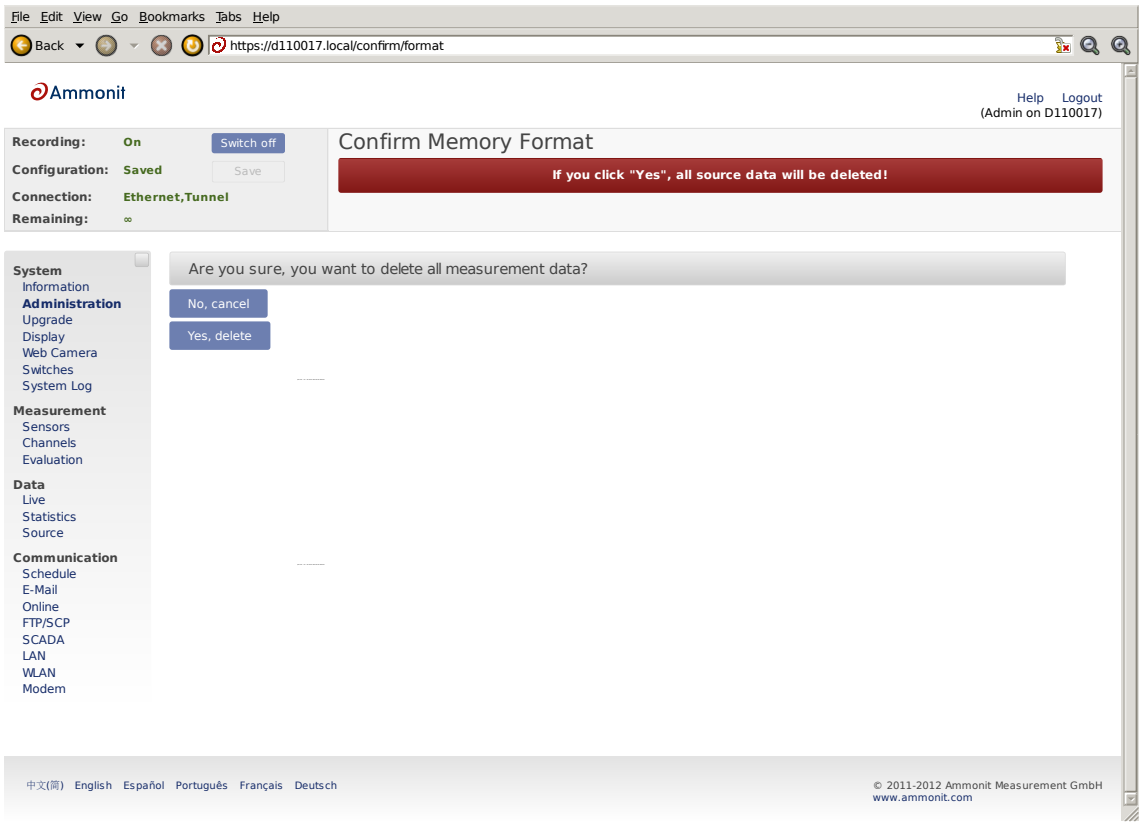


Figure 4.4: Deleting All Measurement Data

Important
Recording stops after deleting measurement data. Start recording by clicking *Switch on* in the status box.

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

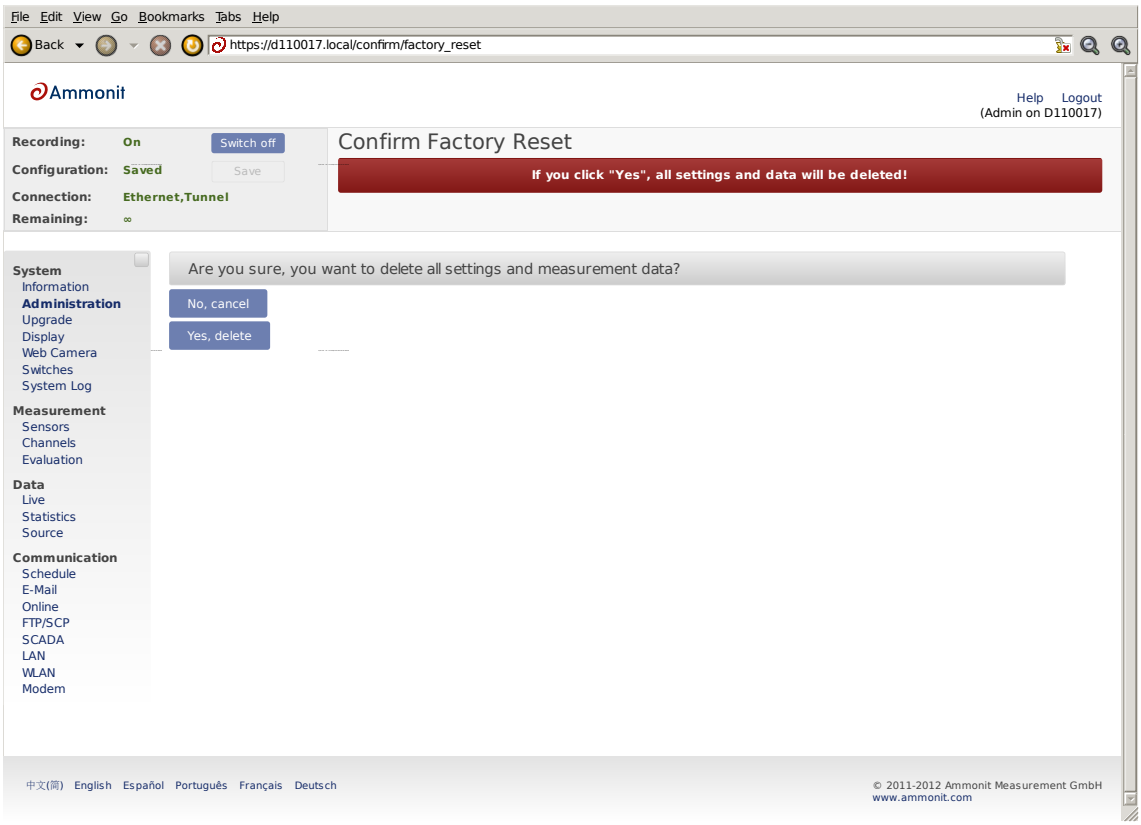


Figure 4.5: Factory Reset

Note
After performing a factory reset, recording stops. Recording can be started after at least one sensor has been configured.

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.

Note
In order to perform a software upgrade, the data logger has to be connected to the Internet via modem or LAN. 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.

Important
You have to be logged in as `Admin` to perform an upgrade.

Update data logger 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.

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Note
The new software itself will not be downloaded and installed. The software version is not changed in this step!

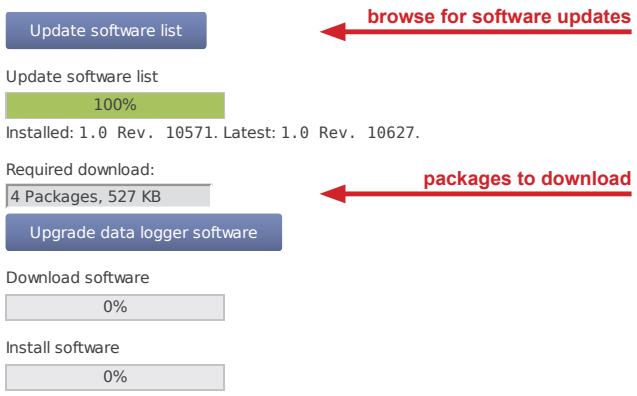


Figure 4.6: System Upgrade

Upgrade Data Logger Software: The software upgrade can easily be performed by pressing the *Upgrade data logger software* button. Now the software packages will be downloaded and installed. After the installation is completed, the 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
Depending on the installed firmware version, the software packages are 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. We recommend refreshing the browser page at least every 10 min to keep the connection.

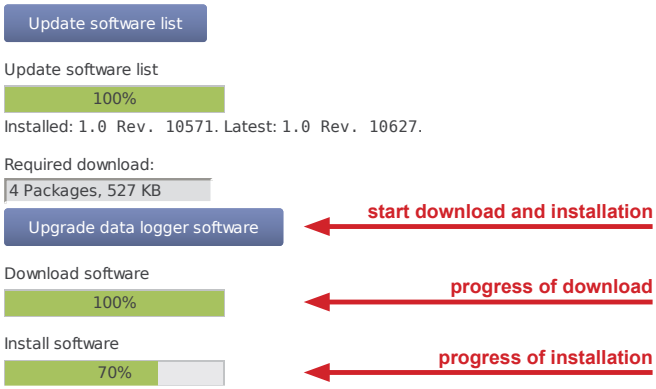


Figure 4.7: System Upgrade

4.4 The Display Page

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

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

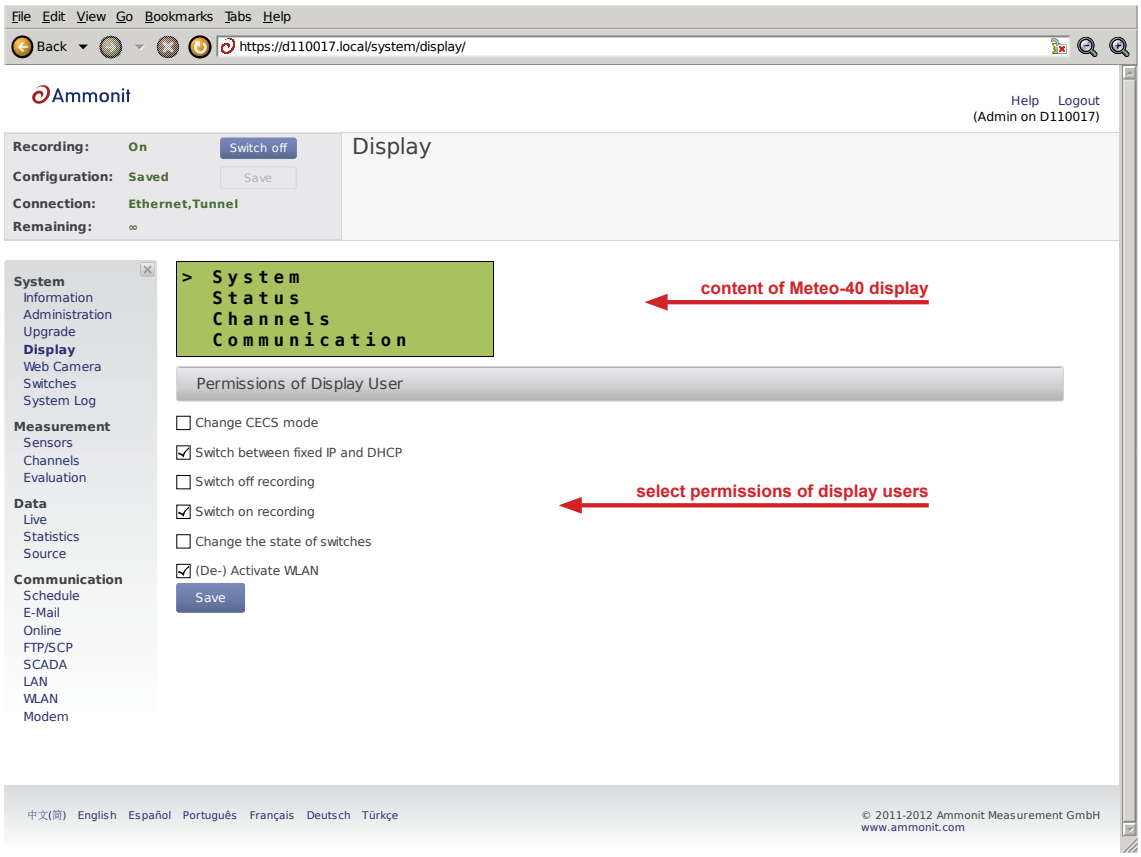


Figure 4.8: Display Page

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

4.5 Using a USB Webcam

It is possible to connect a USB webcam to one of the two USB-A slots of the Meteo-40 data logger.

In the Communication → E-Mail submenu you can choose to attach an image taken by the webcam to an email.

4.6 Configuring Switches

Switches can be used to optimize the power consumption of the measurement system. Most sensors do not need to be supplied with power continuously and can be switched off during the time when no measurement

values are recorded. But it is important to follow the sensors specifications: Most sensors need a rise time to get ready for measurement.

Note
Please refer to Chapter 13 for more information about physically connecting the supply by using a switch.

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

- Switch on/off the modem power supply (optional)
- Toggle on/off the supply of several external devices especially sensors

Note
Please note that a switch selected for a sensor in the `Sensor Helper` or for configuring the modem is not available for further sensor configurations.

To define the switch pretime via web interface for the input channels please refer to Section 5.1.3.

To toggle the power supply via web interface a switch corresponding to the modem has to be selected from the Online Configuration page according to Figure 7.14. The online configuration is located in the Communication → Online menu.

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

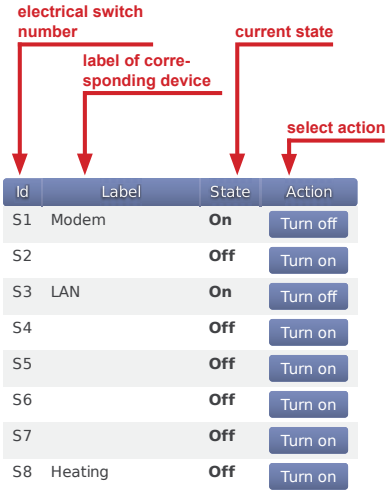


Figure 4.9: Switch Configuration

Heating control The heating control is designed to turn on or off switches according to measured temperature and humidity values. In order to use this function, select a switch as well as a temperature and a humidity sensor from the dropdown list. Only active sensors and free switches are listed.

The heating is switched On, when the temperature is between -10°C ... 2°C and the humidity is higher than 70%. Apart from that the switch is `Off`.

The state of the selected switch is reviewed according to the statistics interval configured in the Communication → SCADA menu, e.g. 10 min. If the above mentioned criterias match, the state of the switch changes automatically.

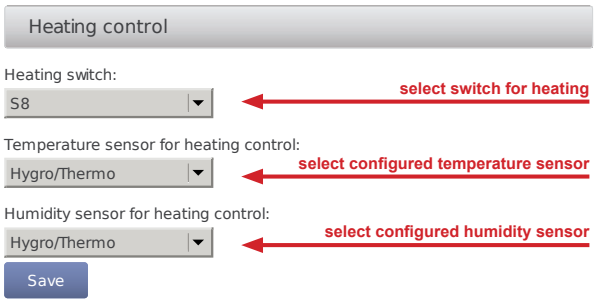


Figure 4.10: Heating Control

4.7 Viewing the System Log

To observe system processes and their functionality as well as potential error occurrences Meteo-40 generates temporary log files.

When CECS is powered on, a new log file is created. By clicking on *Download* it is possible to save the log file as a text file on the connected computer.

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 list of system log entries and the MARS error codes can be important for Ammonit engineers to locate errors in the data logger.



Figure 4.11: System Log Page (Deleting Measurement Errors)

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Chapter 5

Measurement

5.1 Sensor Configuration

5.1.1 Difference between Sensors and Channels

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

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 electrical channels used depends on the kind of sensor and also on the kind of electrical wiring of the sensor. For example, a 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 submenu.

$$v_{\text{wind}} = \text{offset} + \text{slope} \cdot Cx$$

Equation 5.1: Linear Equation

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 must be configured.

5.1.2 Configuring Sensors

In the submenu Measurement → Sensors sensors can be added and basic parameters can be configured by using the *Sensor Helper* (see Section 5.1.3). The result is a list of sensors with main properties. Two

buttons visible on the right side of each row allow a user to *Change* or to *Delete* the sensor configuration. To make changes to an existing configuration, you click on the *Change* button. The *Sensor Helper* opens and is ready for making the necessary changes.

The first column of the sensor definitions overview shows which sensors are active. By ticking off the checkbox you can deactivate a sensor.



Figure 5.1: Sensor Definitions

Below the sensor definitions overview you can find four buttons: *Save*, *Add sensor*, *Undo* and *Delete all sensors*.

Save: After deactivating / activating the checkbox in the first column of the sensor definitions overview you have to save the changed status by clicking on the *Save* button. Furthermore, the activation / deactivation changes the configuration and switches off recording, so the configuration has to be activated and recording has to be switched on in the status box (see Section 3.2.

Add sensor: If you want to add a sensor, click on *Add sensor* to open the *Sensor Helper*.

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.

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



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

5.1.3 Sensor Helper

In order to simplify the configuration of sensors, Meteo-40 offers a *Sensor Helper* in the Measurement → Sensors submenu. The *Sensor Helper* is a wizard which guides you through the sensor configuration. It can be started by clicking on *Add sensor* or *Change*.



Note
The *Sensor Helper* also starts by clicking on *Change* in submenu Measurement → Channels and in submenu Measurement → Evaluation.

The sensor helper provides a list of various sensor types (e.g., anemometer, wind vane, barometric pressure sensor, etc.) with common models. If the sensor is given in the list, the appropriate channel settings for each type are selected automatically as shown in Figure 5.2. Depending on the sensor further settings can be configured, e.g. `Installation Height`, `Label`, `Serial Number`, etc. Additionally, measurement rate, channel as well as switch and switch pretime (if necessary) can be selected or changed.



Note
The sensor helper offers only channels and switches which are not already used for other sensors.

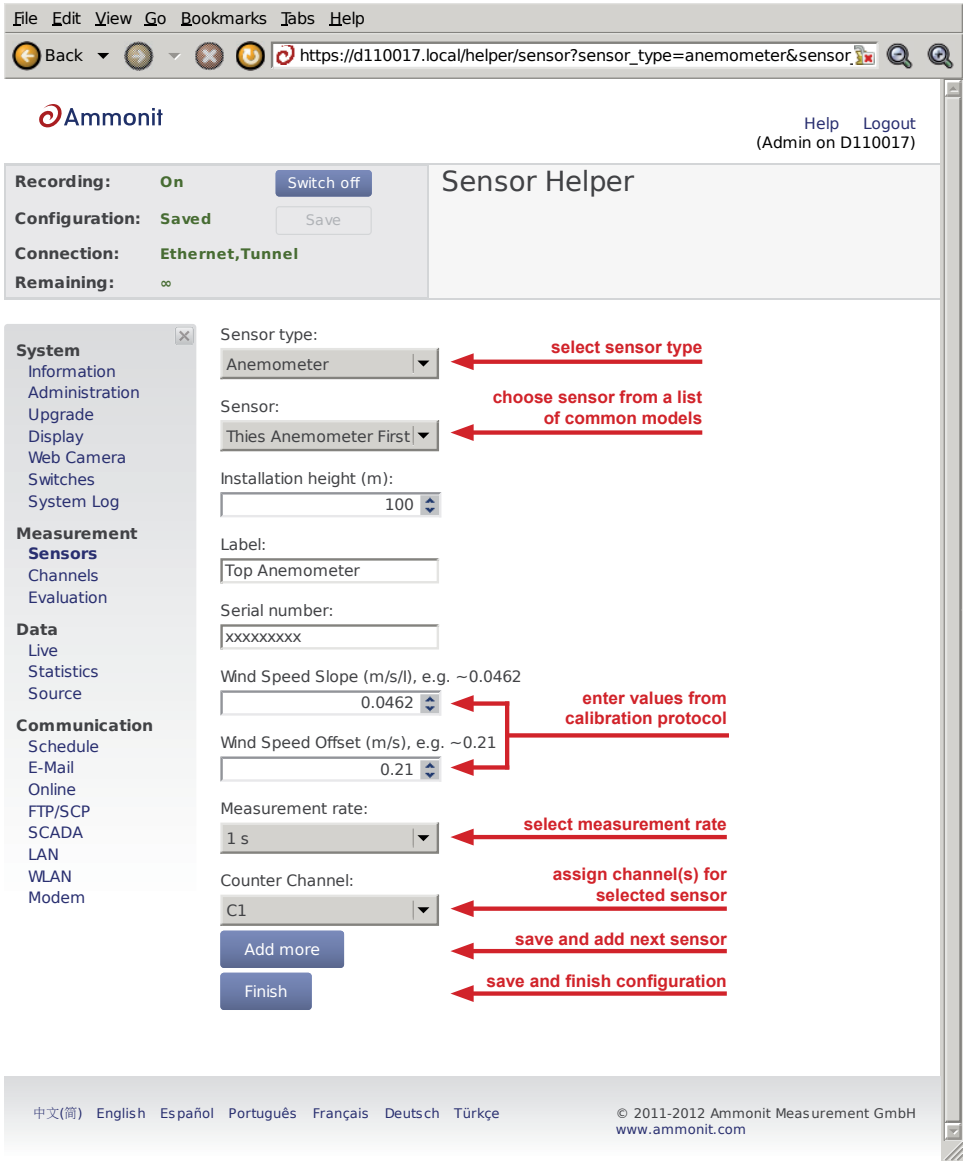


Figure 5.2: Sensor Helper with Sensor Settings

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 values indicated in the calibration protocol of the sensor.

If the desired sensor is not given in the list, it is possible to configure the sensor manually. In this case select *Other Sensor* in the Sensor Helper. Afterwards choose between analog current, analog voltage, counter input or status input.

5.1.4 Typical Cabinet Sets

In order to save time configuring the measurement system, pre-configured typical cabinet sets can be added. By choosing one of the cabinet sets the current configuration will be replaced. Both cabinet sets only differ in the type of wind vanes.

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Standard Cabinet (Digital Wind Vanes): Standard configuration with wind vanes TMR

Legacy Cabinet (Potentiometer Wind Vanes): Configuration with wind vanes POT and one digital wind vane TMR

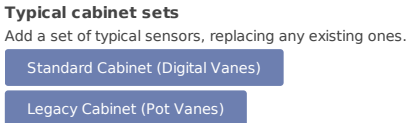


Figure 5.3: Typical Cabinet Sets

5.2 Measurement Channels

In the Measurement → Channels submenu a table is shown which displays all connected channels with details such as label, value, rate, range, protocol and selected switch. In order to modify sensor settings, click on *Change* to start the *Sensor Helper* (see also Section 5.1.3).

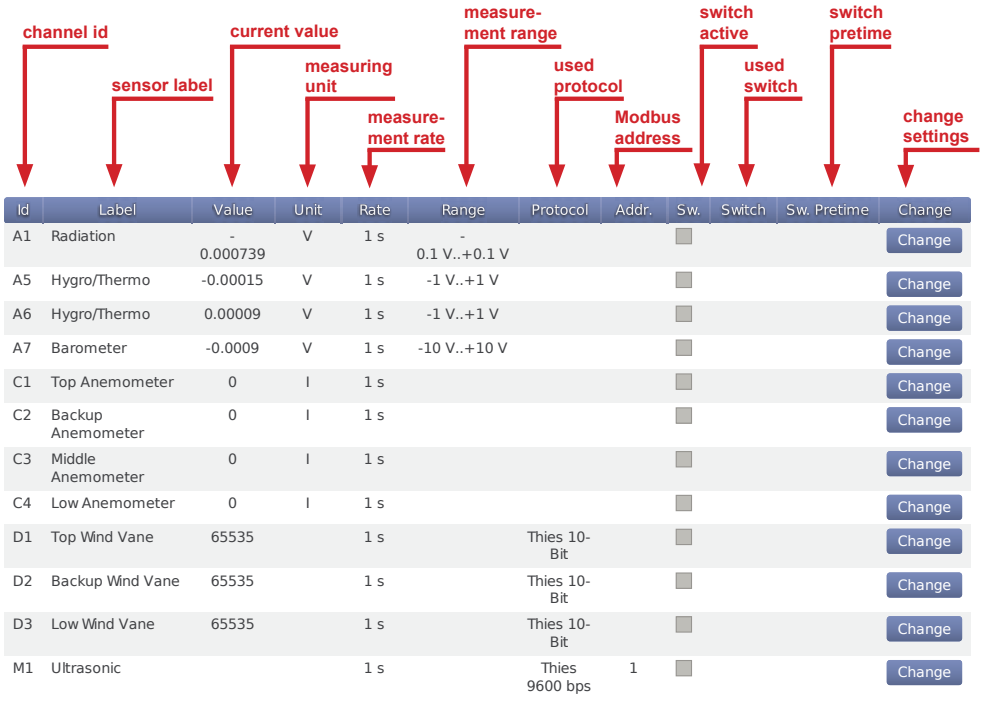
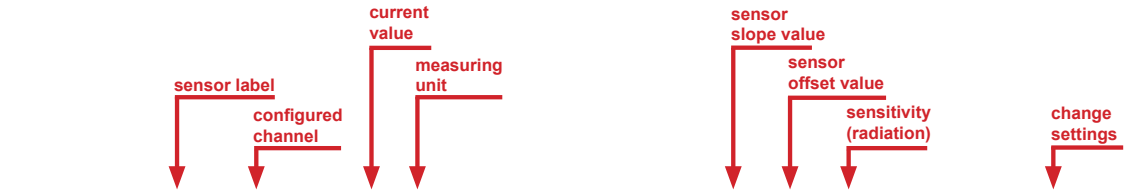


Figure 5.4: Measurement Channels Overview

Note
By clicking on a column headline in the measurement channels overview, you can sort the selected column in ascending or descending order.

5.3 Configuring the Evaluation

In the Measurement → Evaluation submenu the settings for data evaluation are configured. A table displays the configured sensors with their parameters. If the settings should be modified, click on *Change* to start the *Sensor Helper* (see also Section 5.1.3).



Evaluation	Label	Channels	Value	Unit	Quartic Factor	Cubic Factor	Quadratic Factor	Slope	Offset	Sensitivity	Shunt Resistance	Change
Wind Speed	Top Anemometer	C1	0.0000	m/s				1	0			Change
Wind Speed	Backup Anemometer	C2	0.0000	m/s				1	0			Change
Wind Speed	Middle Anemometer	C3	0.0000	m/s				1	0			Change
Wind Speed	Ultrasonic	M1_1	---	m/s								Change
Wind Speed	Low Anemometer	C4	0.0000	m/s				1	0			Change
Wind Direction	Top Wind Vane	D1	---	°				0.3515625	0			Change
Wind Direction	Backup Wind Vane	D2	---	°				0.3515625	0			Change
Wind Direction	Low Wind Vane	D3	---	°				0.3515625	0			Change
Wind Direction	Ultrasonic	M1_2	---	°								Change
Humidity	Hygro/Thermo	A5	-0.0122	%				100	0			Change
Temperature	Ultrasonic	M1_4	---	°C								Change
Temperature	Hygro/Thermo	A6	-29.9908	°C				100	-30			Change
Air Pressure	Barometer	A7	799.9634	mbar				60	800			Change
Global Solar Irradiance	Radiation	A1	-738.5479	W/m²						1		Change

Figure 5.5: Screenshot of the Configuration for the Evaluation



Note
By clicking on a column headline in the evaluation configuration overview you can sort the selected column in ascending or descending order.

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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). Additionally, it is possible to download measurement data (see Section 6.4 and Section 4.2) and configure the statistics which will be saved as CSV file.

6.2 Live Data Page

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

By clicking the *Start* button currently measured values are displayed. In order to stop displaying live data click on *Stop*.

The table shows the total amount of available data. In comparison, the line chart can be customized by choosing sensors and connected channels.



Note
To display live data in a chart, it is necessary to enable JavaScript in your web browser.

6.3 Statistics Data

In order to configure statistics and CSV files, go to the Data → Statistics menu. Here you can:

- define type and interval of the statistics
- decide how often a CSV file should be created.

Click on *Select statistics* under *Configure statistics* to create the statistics, e.g., average, maximum, minimum, standard deviation, count, sum and median. You decide by ticking checkboxes for each evaluator / channel, which value should be calculated. Additionally, Meteo-40 displays internal current and internal voltage in the CSV files.

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Note
Meteo-40 automatically suggests the standard statistics, i.e. the data logger calculates for vectorial values (wind direction) average, standard deviation and count. Additional statistics can be selected manually.



Figure 6.1: Statistics Configuration Page

Press *Save* to finish the configuration of statistical values.

Further details have to be configured to calculate the statistics and to create the CSV file.

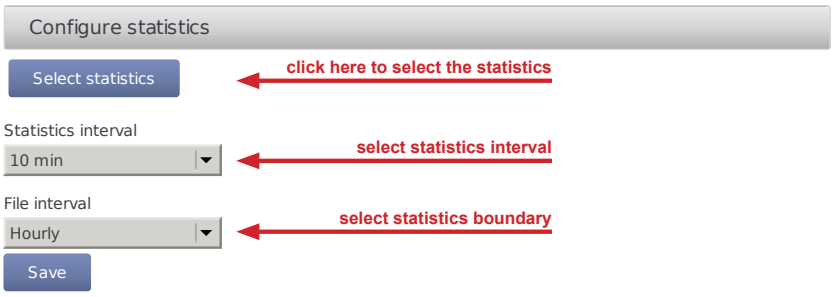


Figure 6.2: Statistics Data Download Page

Statistics Interval: Defines in which interval, statistics will be calculated. All current data that has been collected since the last evaluation will be considered to generate new aggregate data.

File Interval: Determines how often a new aggregate data file in CSV format will be created. Selecting *Hourly* produces one file per hour that includes data from the last hour. *Daily* generates only one file per day, etc.

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If CSV files have been created, all files are listed on the page. A table shows the CSV files with the start and end time of the statistic as well as its file size. Checkboxes indicate whether the file has been sent by email or uploaded using FTP or SCP. The latest file is displayed on top of the list.



Note
All CSV files uploaded to AmmonitOR are marked with a ticked checkbox in the SCP column.

By clicking on the file name, the selected CSV file can immediately be downloaded. If you want to have a detailed look on the source data, click on the arrow in the *Source* column. A new window opens, which shows the available data according to the configured statistics. If, for example, the statistics interval is 10 min and the file interval is hourly, 6 files are available.

To delete a file, click on the *Delete* button on the right side of each row. In order to navigate through all available files, use the arrows under the table. The arrows are marked with Oldest, Back, Forward and Latest. If all CSV files should be deleted in one step, click on *Delete all statistics*.

To create a new CSV file click on *Update* now. Afterwards, Meteo-40 builds a new file with the measurement data that has been gathered since the last CSV file. This function can be important - for example, after changing the evaluation interval.

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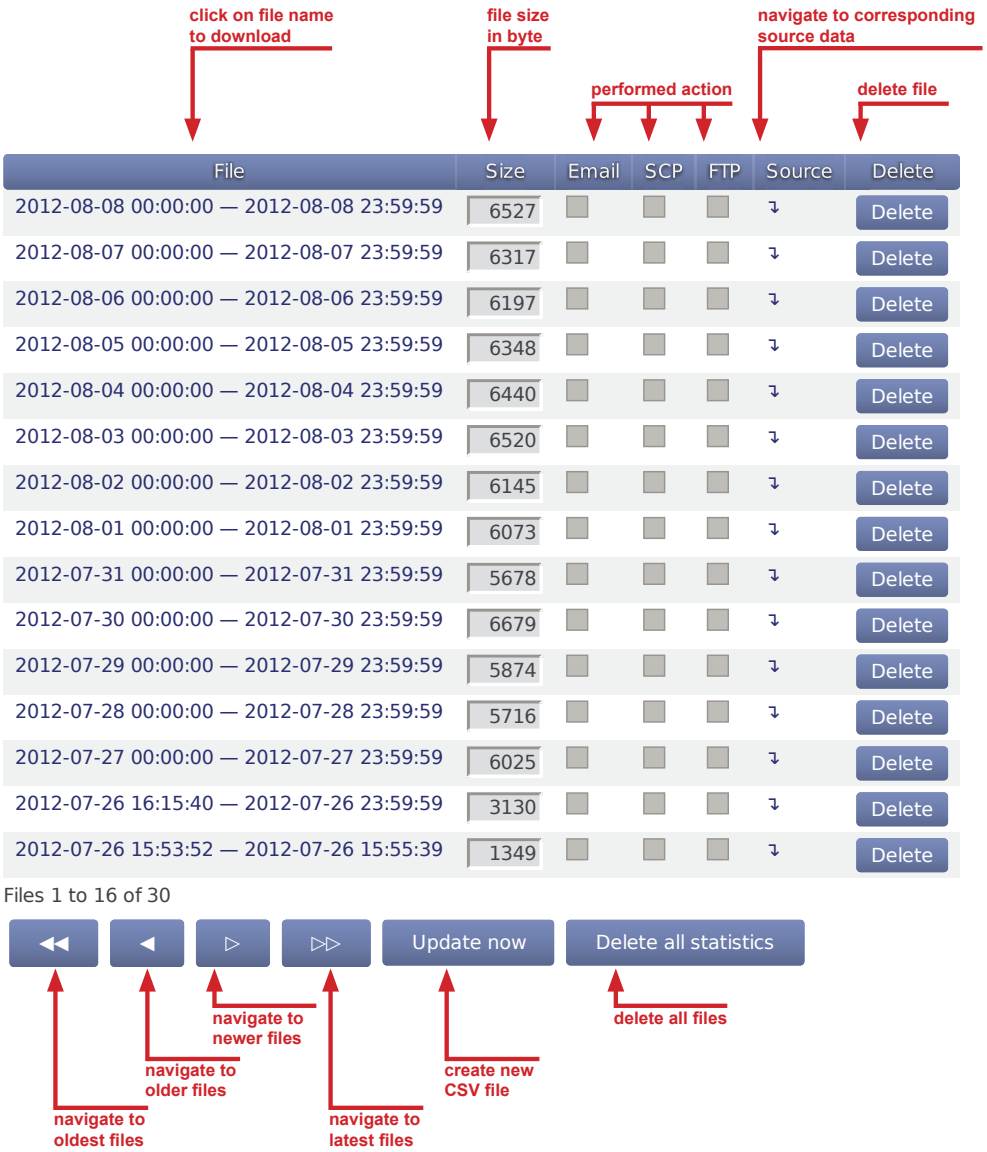


Figure 6.3: Statistics Data Download Page

Note
If you want to download CSV files manually on site, you can use a USB memory stick. For further details see Section 4.2.

6.3.1 The CSV File Format

Meteo-40 stores measurement data in standard Comma-Separated Value 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`). Ini files are described e.g. in Wikipedia (`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.

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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 uncompressed on all operating systems, see e.g. Wikipedia (`http://en.wikipedia.org/wiki/Gzip`) for further details.

6.3.1.1 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.

6.3.1.1.1 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 data/time entry; followed by the evaluator statistics which 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.

Currently, Meteo-40 offers the following statistics: Avg, Min, Max, StdDev, Count, Median, and Sum.

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 logger do not have an influence on the CSV file. In the first column of the CSV file the datetime for each statistic is given. Date and time are similar to ISO-8601 with milliseconds, e.g., `2012-05-31 15:50:00.500`.

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.

6.3.1.1.2 Information part (Ini file format)

The information part contains 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 and type of the data logger; the name which has been assigned by the user; timezone in the format UTC+xx:xx or UTC-xx:xx; as well as the version of the firmware of the data logger
- `[Evaluation]` indicates file_interval and stat_interval (see also Section 6.3).

- [Adjustment]: CS1 and CS2 are the calibration values for the current source of Meteo-40. The values are for informational purpose only.
- [Counters]: The measurement_period for counter channels is indicated in seconds, in general 1s. For this time period the number of pulses is counted.
- [Master]: rate of RS485 is given in s, min or h; baudrate for RS485 without unit.
- [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 which has been entered by the user in the sensor configuration.
  - sensor_type: Indicates the type of the sensor, e.g., anemometer.
  - 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.
  - 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).

6.3.1.2 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 6.4.

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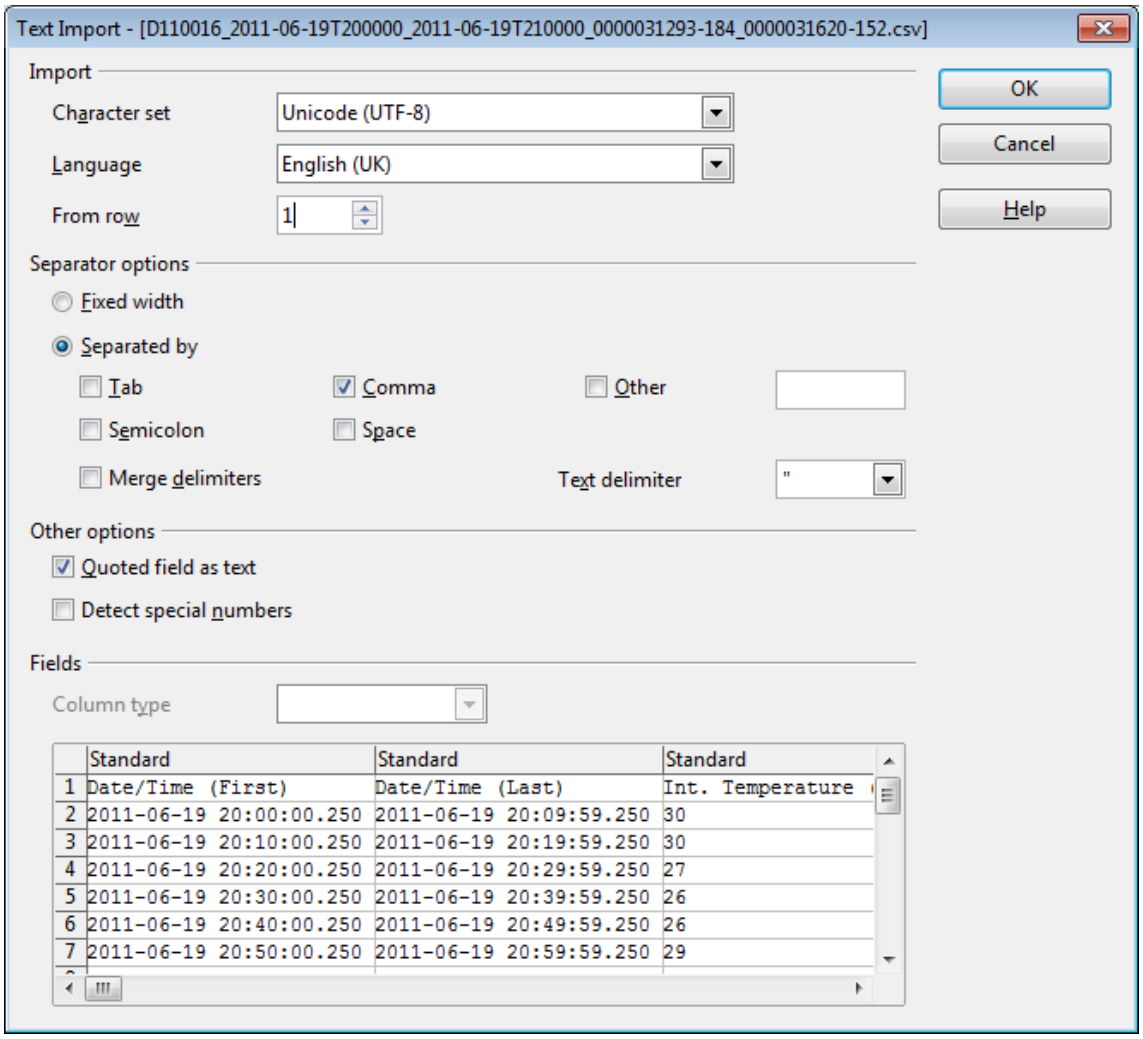


Figure 6.4: Libreoffice CSV-file import settings

6.3.1.3 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
Please save CSV files always in a directory. The described process in Microsoft Excel does not work when you try opening files which are attached to emails.

---

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 please deselect *Use system separators* and use . (dot) as decimal separator and , (comma) as Thousands separator. See figure Figure 6.5.

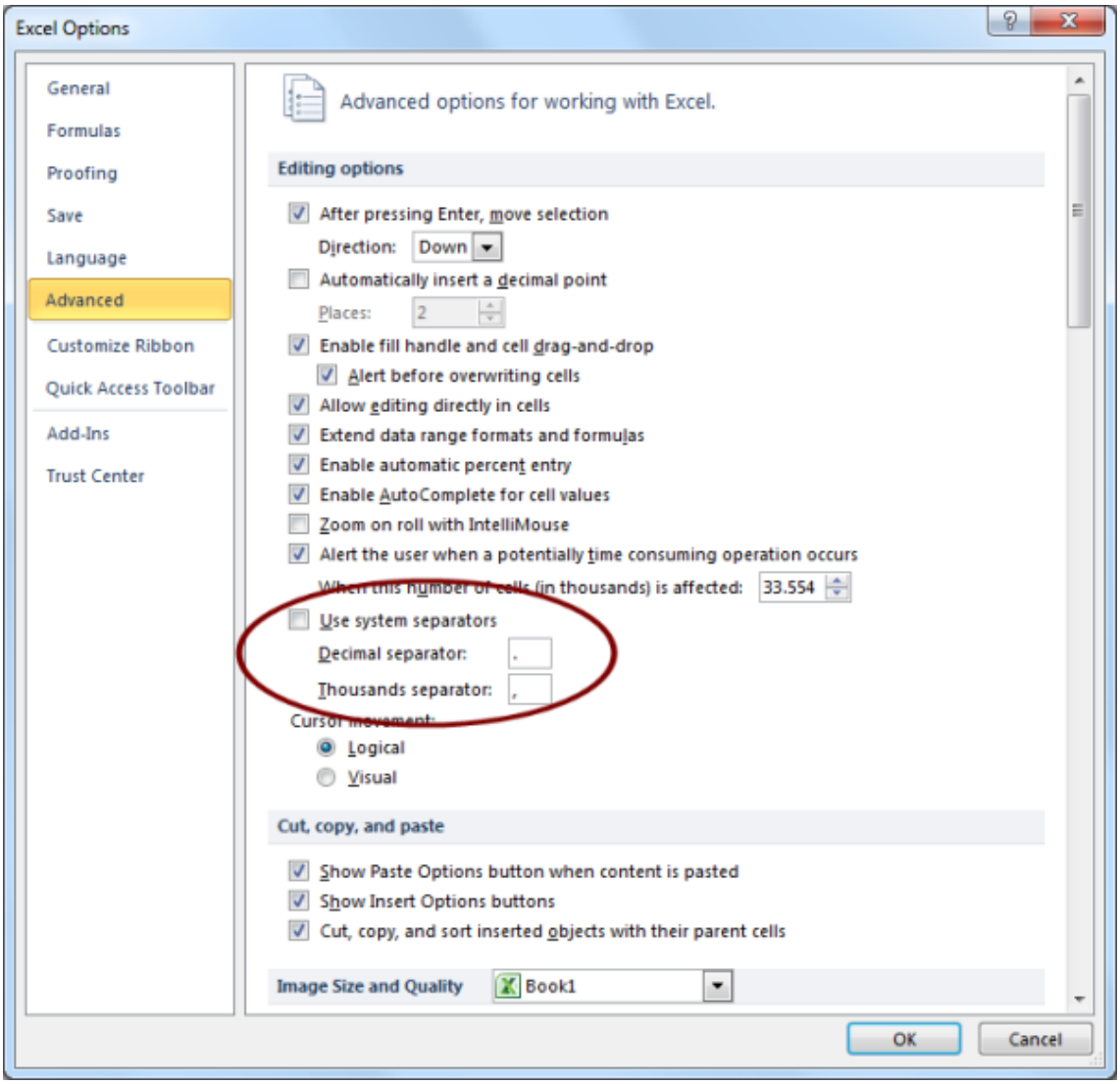


Figure 6.5: Microsoft Excel 2010 CSV Import (1)

2. After setting the options in Microsoft Excel click on the *Data* tab as shown in Figure 6.6. 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. Now follow the instructions in the *Text Import Wizard*.

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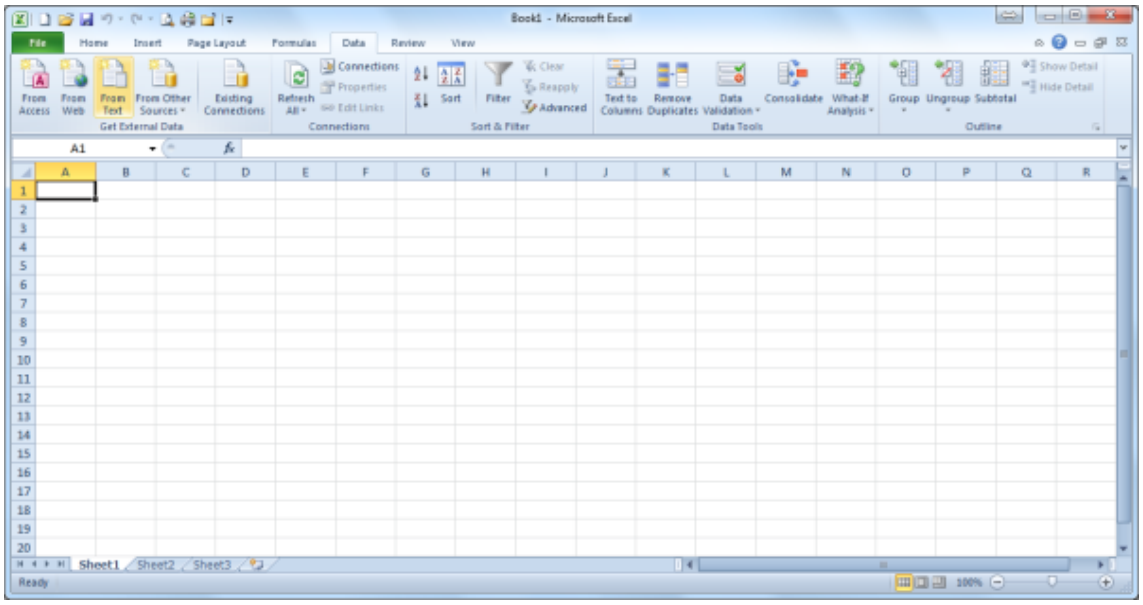


Figure 6.6: Microsoft Excel 2010 CSV Import (2)

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 6.7.

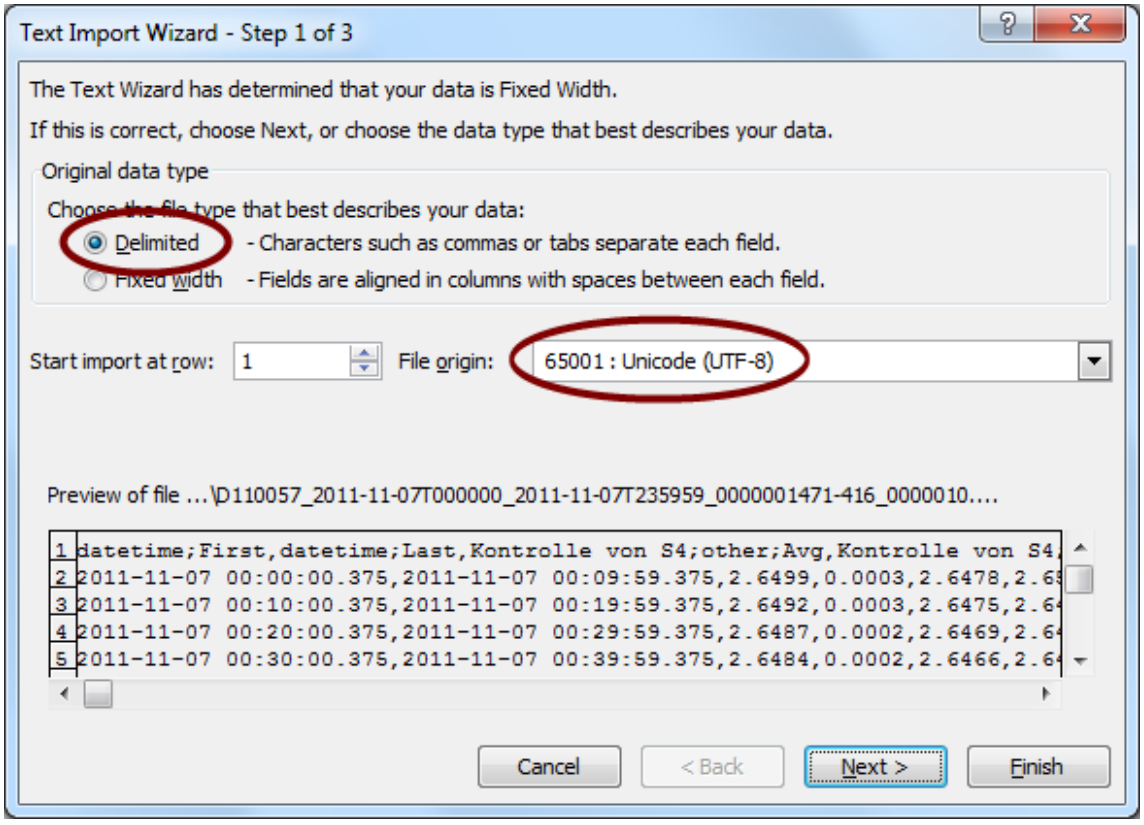


Figure 6.7: Microsoft Excel 2010 CSV Import (3)

4. In next step define *Comma* as delimiter and " as text qualifier as shown in Figure 6.8.

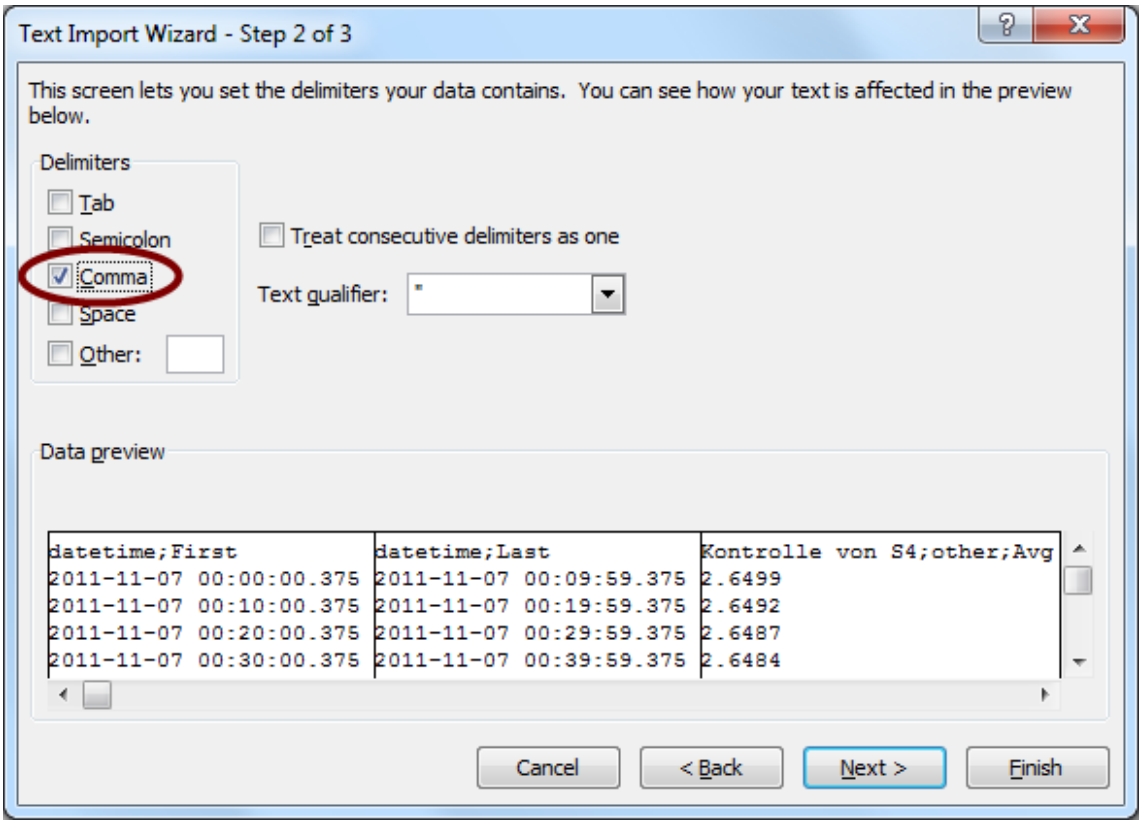


Figure 6.8: Microsoft Excel 2010 CSV Import (4)

5. In the last step of the wizard, select *Text* for the data format columns. See Figure 6.9.

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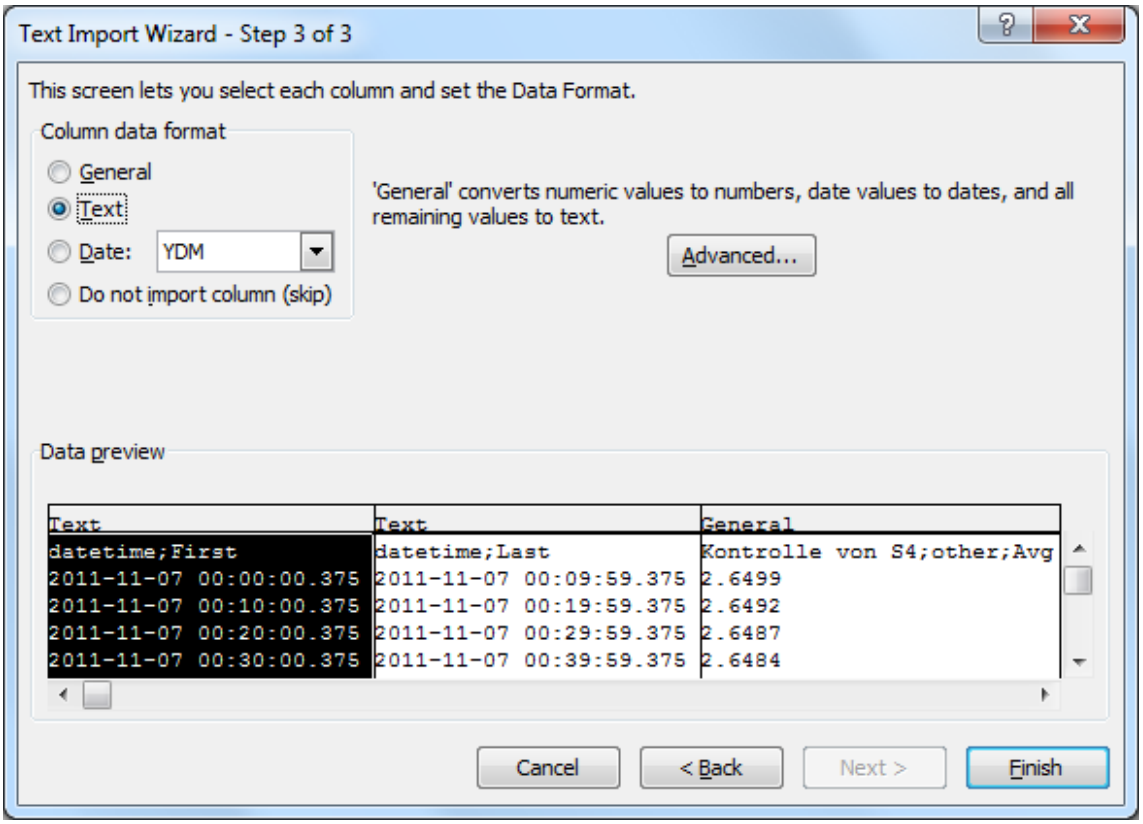


Figure 6.9: Microsoft Excel 2010 CSV Import (5)

6. By clicking on *Finish* the file opens in your selected sheet. See Figure 6.10.

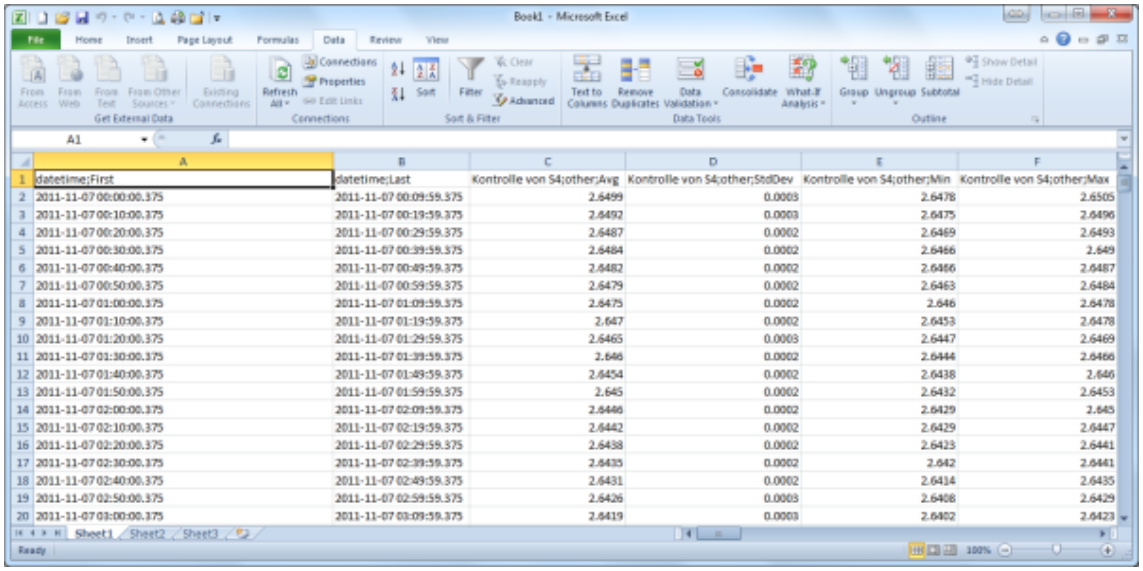


Figure 6.10: Microsoft Excel 2010 CSV Import (6)

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 YYY-MM-DD hh:mm:ss.000 as shown in Figure 6.11.

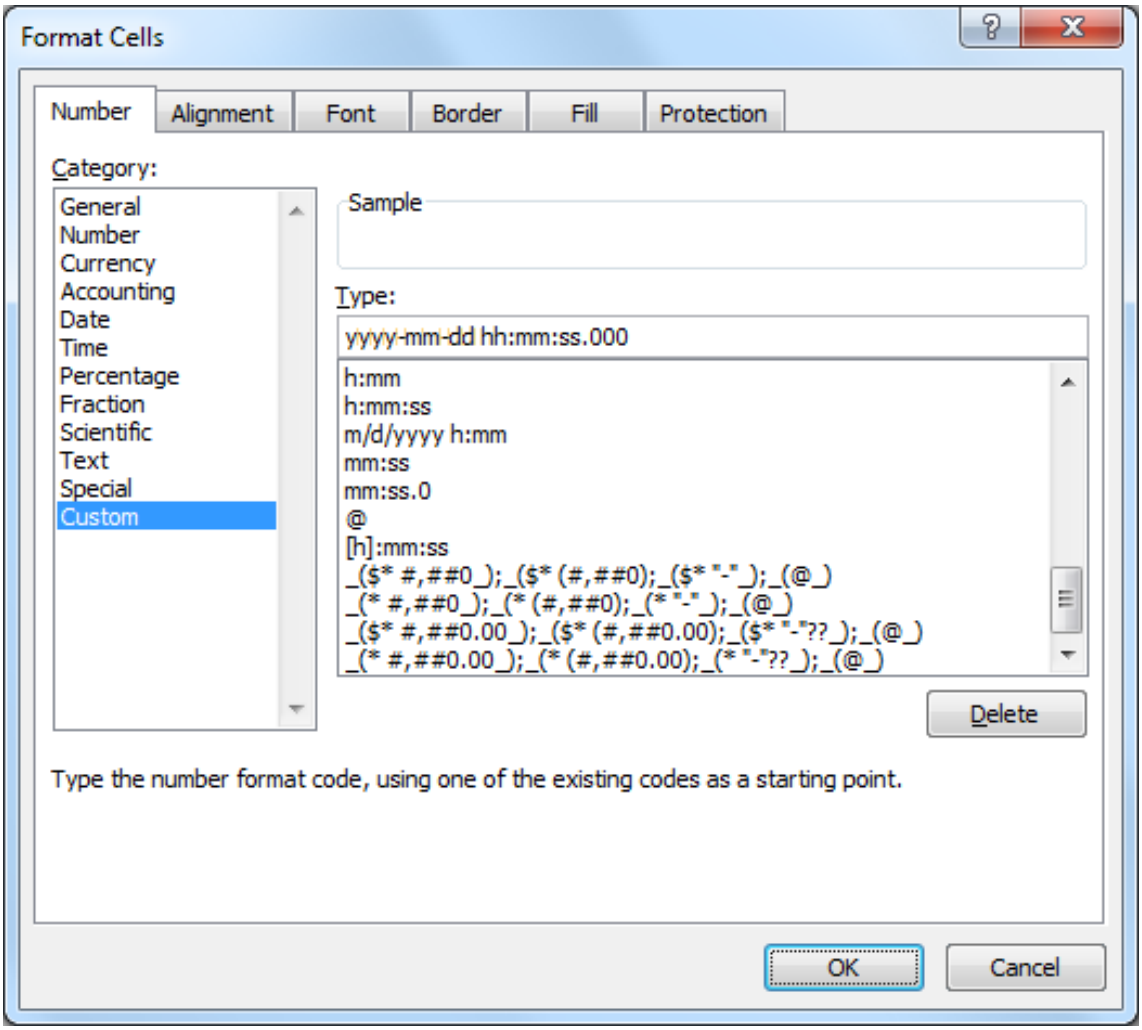


Figure 6.11: Microsoft Excel 2010 Format Cells

6.3.1.4 CSV Import in Microsoft Excel 2003

Importing CSV files in Microsoft Excel 2003 is similar to the import in Microsoft Excel 2010. Before the import can start the CSV file has to be saved locally on a PC.

At first Microsoft Excel has to be launched and the options have to be modified. Open the *Options* window, which can be found in the *Extras* menu. On the tab *International* deselect *Use system separators* and insert . (dot) for decimal separator and , (comma) for Thousands separator. See Figure 6.12.

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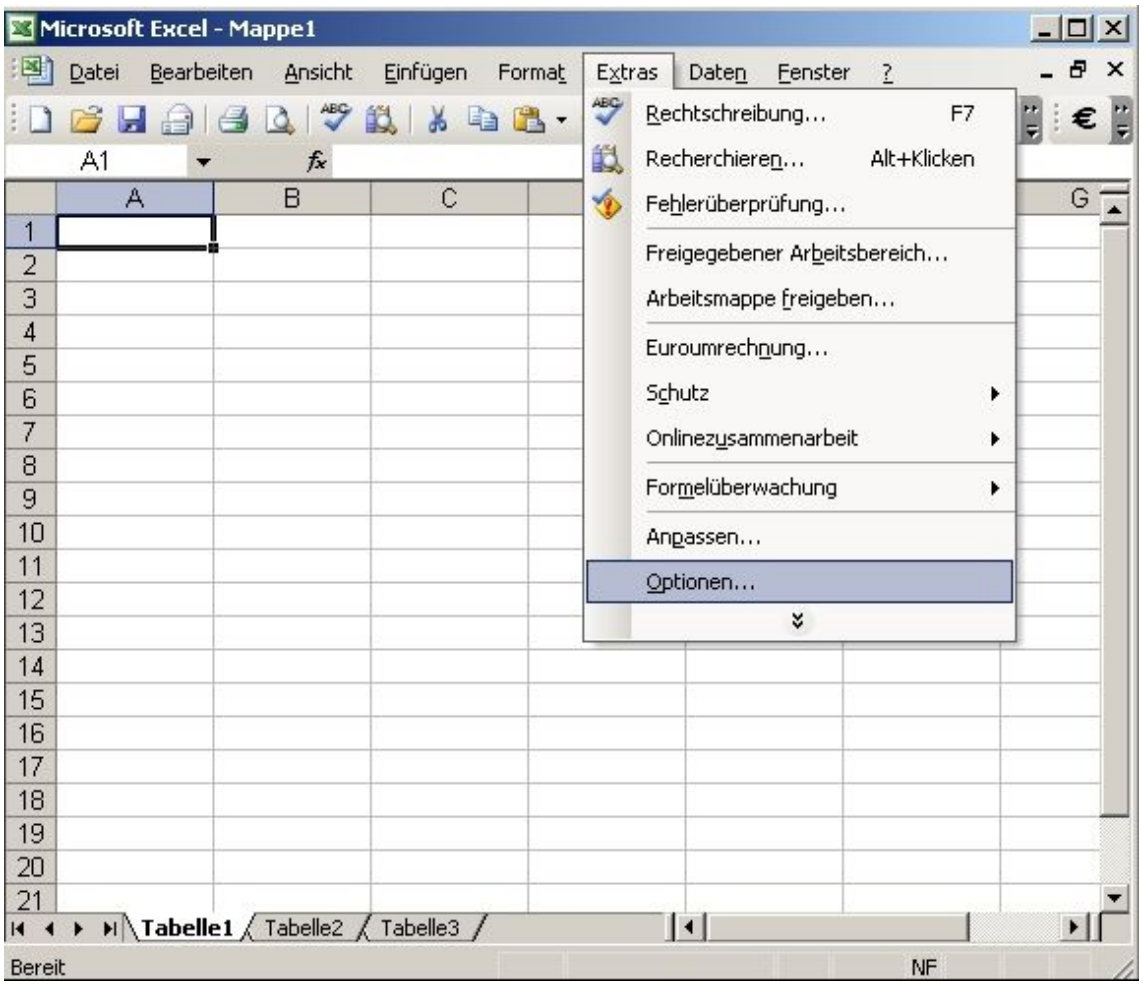


Figure 6.12: Microsoft Excel 2003 Options

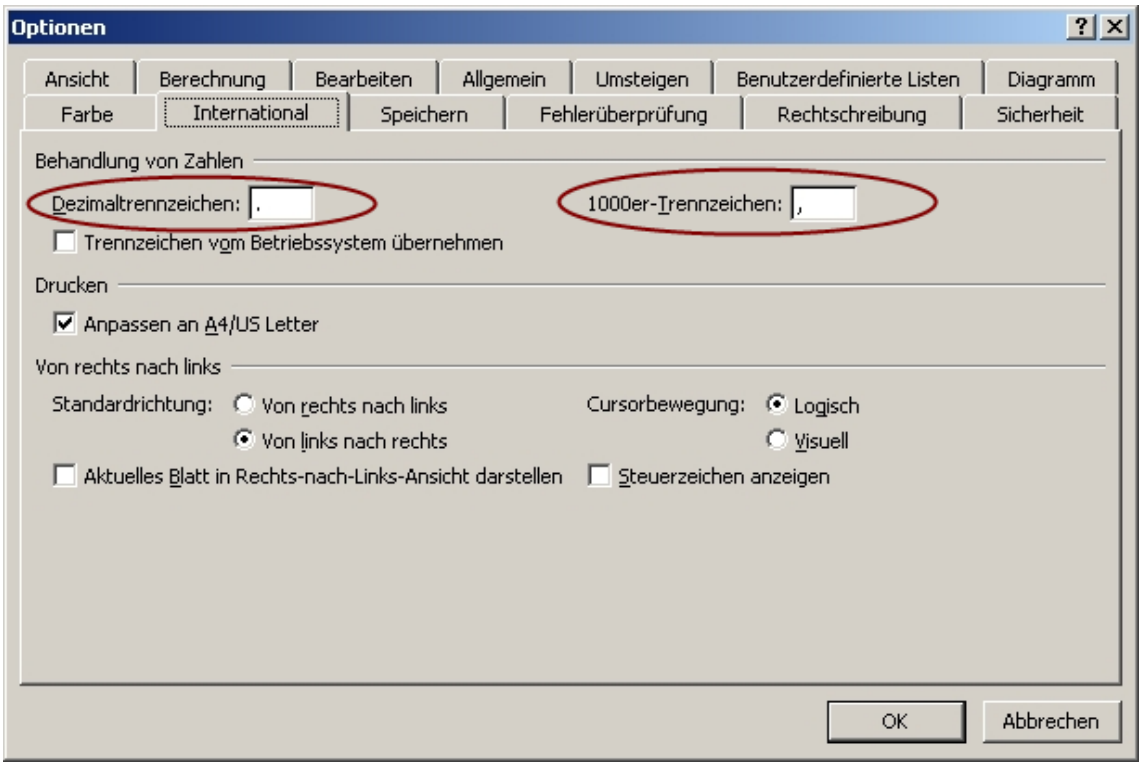


Figure 6.13: Setting Microsoft Excel 2003 Options

After setting the options, open the *Data* menu and go to *Import External Data* and select *Import Data*. Browse for the CSV file and open it. The *Text Import Wizard* starts.

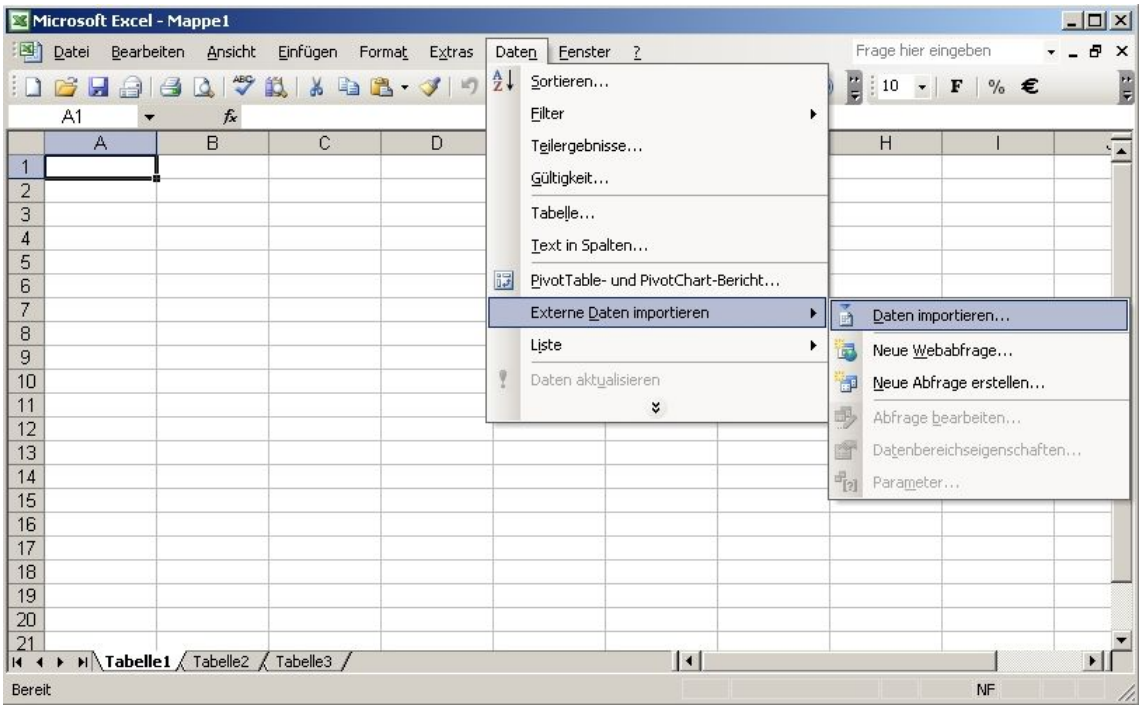


Figure 6.14: Launching the Microsoft Excel 2003 Text Import Wizard

Now follow the instruction of the *Text Import Wizard* as described in Section 6.3.1.3.

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6.4 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.

In order to navigate through the source data use the arrows under the table to move forward and back in the value series. By clicking on the little arrow in the middle the amount of rows displayed in the table will be doubled with each click. Jump to another menu and back to *Source Data* to reset the table to 100 rows (default).

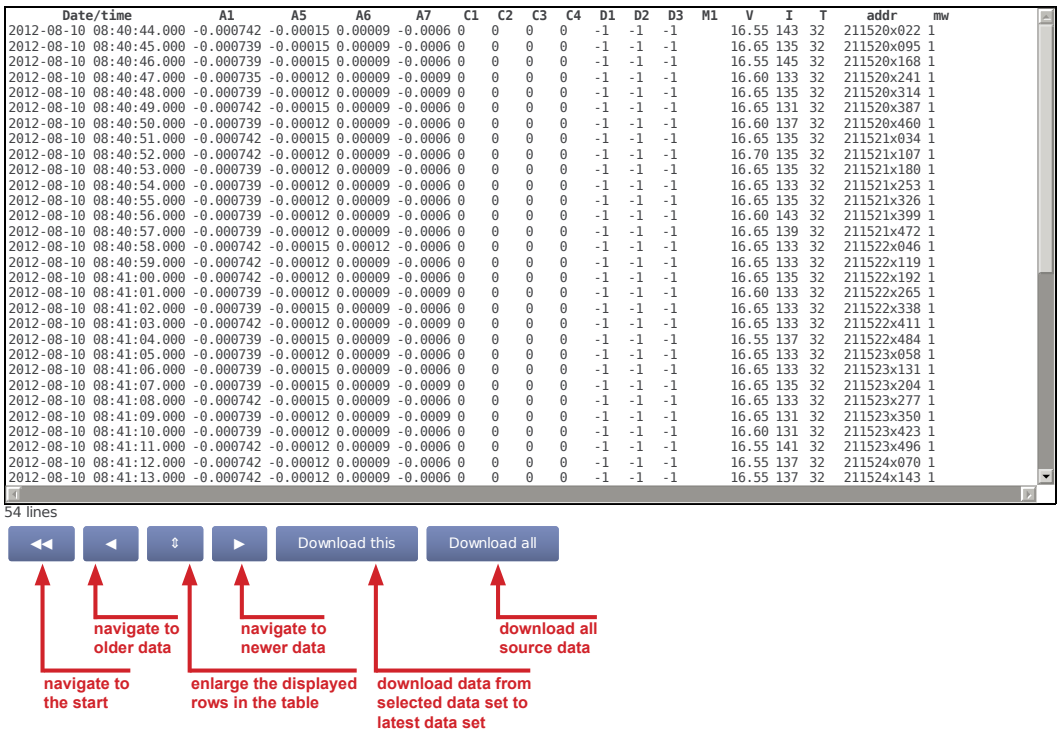


Figure 6.15: Screenshot of Source Data

By using the Download All button, all of the source data that has been recorded so far can be downloaded. The data format is CSV, but in a simpler form than used for evaluation data. As such, the download data volume does not correspond to the volume, used on the data logger storage.

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.

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Chapter 7

Communication

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

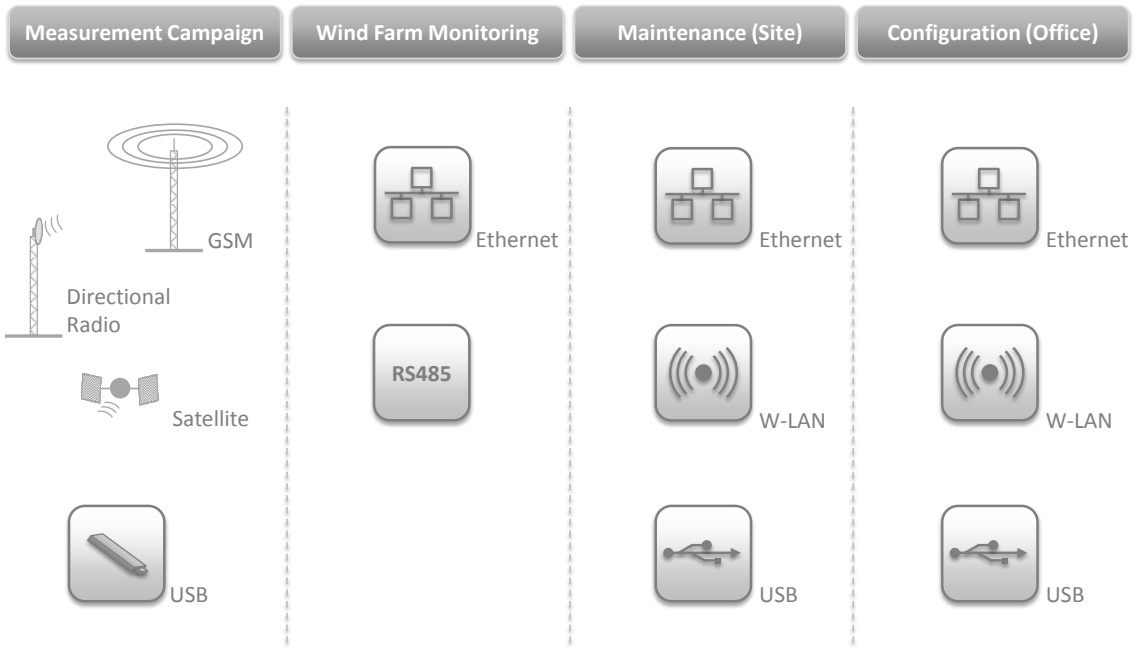


Figure 7.1: Data Transmission with Meteo-40

The Meteo-40 web interface can be accessed by means of an USB-Ethernet adapter in a LAN, using a USB W-LAN stick for W-LAN, as well as using a modem for GSM/GPRS, directional radio or satellite communication or just connecting it to a PC with a standard USB cable. To download measurement data, a pre-configured USB memory stick can be used, as well (see Section 4.2).

After successful connection the device is shown on the data logger display under the menu `Communication`. USB and Ethernet connections are displayed in menu Communication → Devices → LAN → Ethernet; a connected modem in menu Communication → Devices → Modem. W-LAN parameters are displayed in menu Communication → Devices → WLAN.

Note
Although no Ethernet/USB device is connected, Meteo-40 displays one `unavailable` Ethernet 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
- FTP/SCP server upload (also AmmonitOR installation on customer's server)
- AmmonitOR upload (AmmonitOR account is required)
- Direct download via web interface
- Direct download from data logger on USB memory stick

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

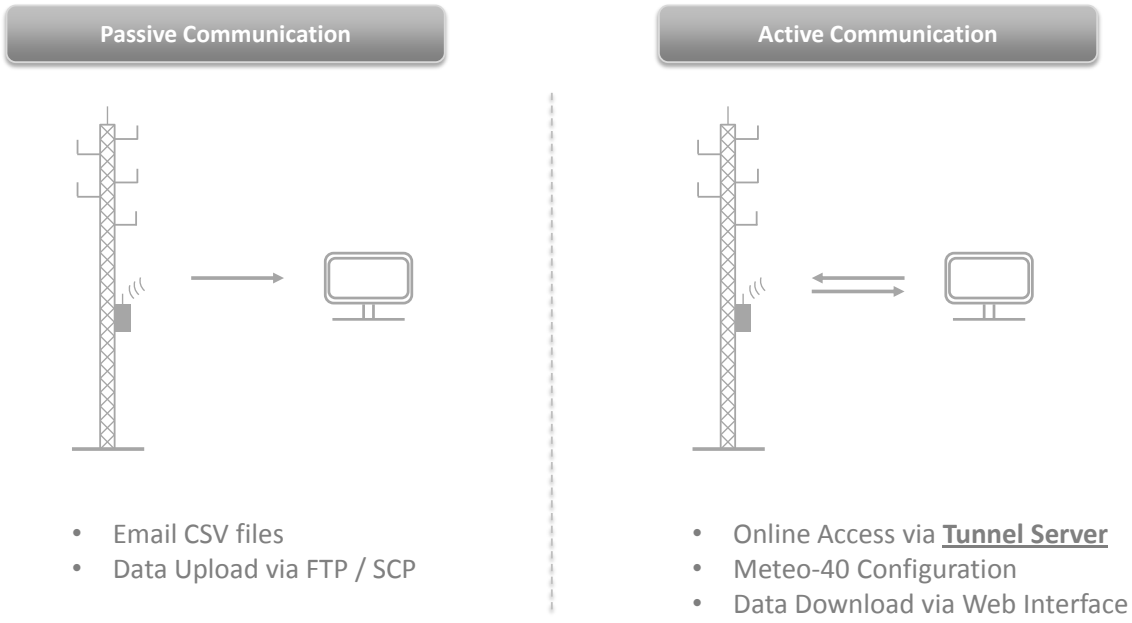


Figure 7.2: Passive vs. Active Communication with Meteo-40

The settings can be easily configured via the Meteo-40 web interface in the Communication → Schedule menu (see also Section 7.1). CSV files are stored on the data logger and can directly be downloaded, automatically be sent via email as well as automatically be uploaded to an SCP/FTP server.

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

We recommend using our online platform *AmmonitOR* to access, manage, monitor and display measurement data. To register and start using *AmmonitOR*, please send an email to support@ammonit.com.

7.1 Configuring the Communication Schedule

Actions are processes that the data logger performs according to the settings in menu Communication → Schedule. Meteo-40 turns on one minute before an action takes place and will stay switched on as long as the action is running. The status box in the web interface informs about the number of running actions.

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Note
If the *CECS power mode* in the System → Administration menu is activated, Meteo-40 does not switch off automatically. Please refer to Section 1.4.1 for further details.

Email An email with the CSV files is sent. If necessary, CSV statistics files are generated automatically before sending email.

FTP/SCP CSV files are sent using FTP or SCP (including AmmonitOR). If necessary, CSV files are generated automatically before transfer.

Online The Meteo-40 web interface can be accessed over the Internet. If configured, a tunnel connection is established.

Only generate CSV If CSV files should not be transfer via email or FTP/SCP, select this option to generate CSV files for the manual download via web interface or on USB memory stick. According to the configured statistics (see Section 6.3), Meteo-40 generates CSV files on the selected days to the scheduled times.

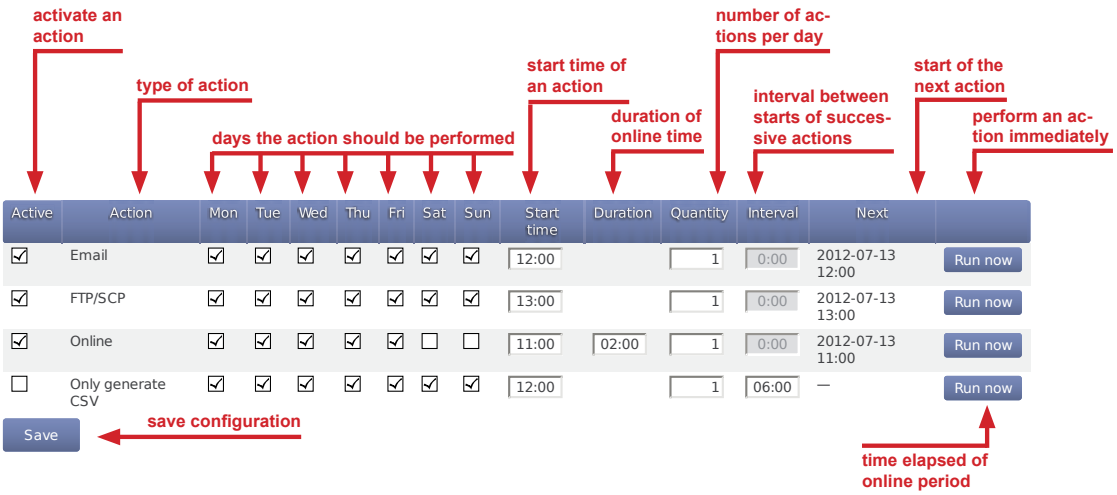


Figure 7.3: Configuring the Schedule

Configuring the schedule includes defining the behaviour 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`).

Weekdays By ticking the checkboxes, you decide on which weekdays an action should be performed.

Start Time: Determines the time of day when the first action should start. If there is no *Start time* defined, Meteo-40 will schedule the first action for `00:00`. (24 hour format: Enter `14:00` when the action should start at 2 p.m.)

The *Start Time* has to be entered according to the following time format: `hh:mm`.

Duration (Only applies for *Online*): Defines the length of time (hh:mm) the data logger is connected to the Internet. The duration begins with every start of an action. (Example: Start time `10:00`, Duration `02:00`, Quantity 3, Interval `04:00` means that the data logger will be online at 10 a.m. For two hours. At 2 p.m. Meteo-40 goes online for two more hours. And finally the data logger is online between 6 and 8 p.m..)

The *Duration* has to be entered according to the following time format: `hh:mm`.

Quantity: Specifies the number of actions that 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 executed at the latest at midnight, even if the user's defined number of actions has not been achieved.

The *Quantity* has to be entered as integer, e.g., 2 or 4.

Interval: Determines 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.

The *Interval* has to be entered according to the following time format: `hh:mm`.

Next: Meteo-40 shows the time when the next action should be performed. Date and time are displayed in the column Next.

By deselecting the checkbox in column *Active* an action can be deactivated, e.g., when an action is temporarily not needed.



Important
In order to perform an action immediately press the button *Run now*.

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

Do not forget to save your modifications in the communication schedule. Without saving the previous values will be reset.

7.2 Configuring Email Parameters

In order to receive measurement data via email, Meteo-40 has to be connected to the Internet (via modem) and you have to configure the settings in menu Communication → Email.



Important
An email can include up to 10 attachments.

Please define `SMTP server`, `username`, `password` and `sender's email address`. Meteo-40 allows entering one or more recipients under `To` and `Cc`. Please use a semicolon (;) to separate the email addresses. According to the settings in the Communication → Schedule menu (see Section 7.1) an email will be sent to the specified account including a CSV file. The CSV file contains the measurement data that has been collected since the last email.

If a web cam is connected to the data logger, an instant picture can be attached that is taken a moment before the email is sent.

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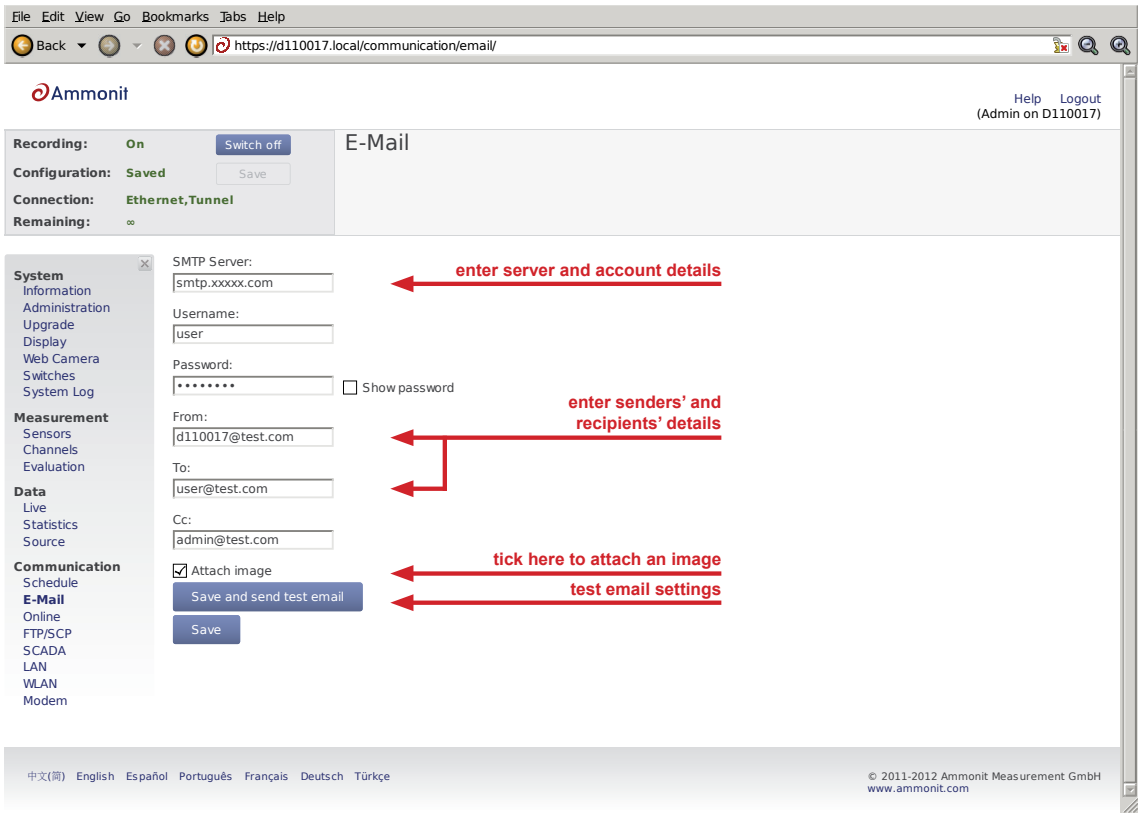


Figure 7.4: Configuring Email Parameters

Important
Do not forget to save 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 must be connected to the Internet via modem, LAN or W-LAN. It is not sufficient to connect Meteo-40 to a PC via USB, because a PC is not necessarily configured as router.

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

7.3 Configuring Online Access

Meteo-40 can only be accessed if it is powered-on and an Internet connection has been established. In order to configure periods for online access, go to menu Communication → Schedule.

Important

Meteo-40 has to be connected to a tunnel server (e.g., Ammonit Tunnel Server see Figure 7.6) to obtain a unique subdomain. This way 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 eavesdropped on by anyone else.

To access Meteo-40 via the Internet a tunnel connection / tunnel server has to be configured in menu Communication → Online. You can select the `Ammonit tunnel`, your own `tunnel` (login and port have to be entered) or no `tunnel`, if you use Meteo-40 for testing purposes in your office.

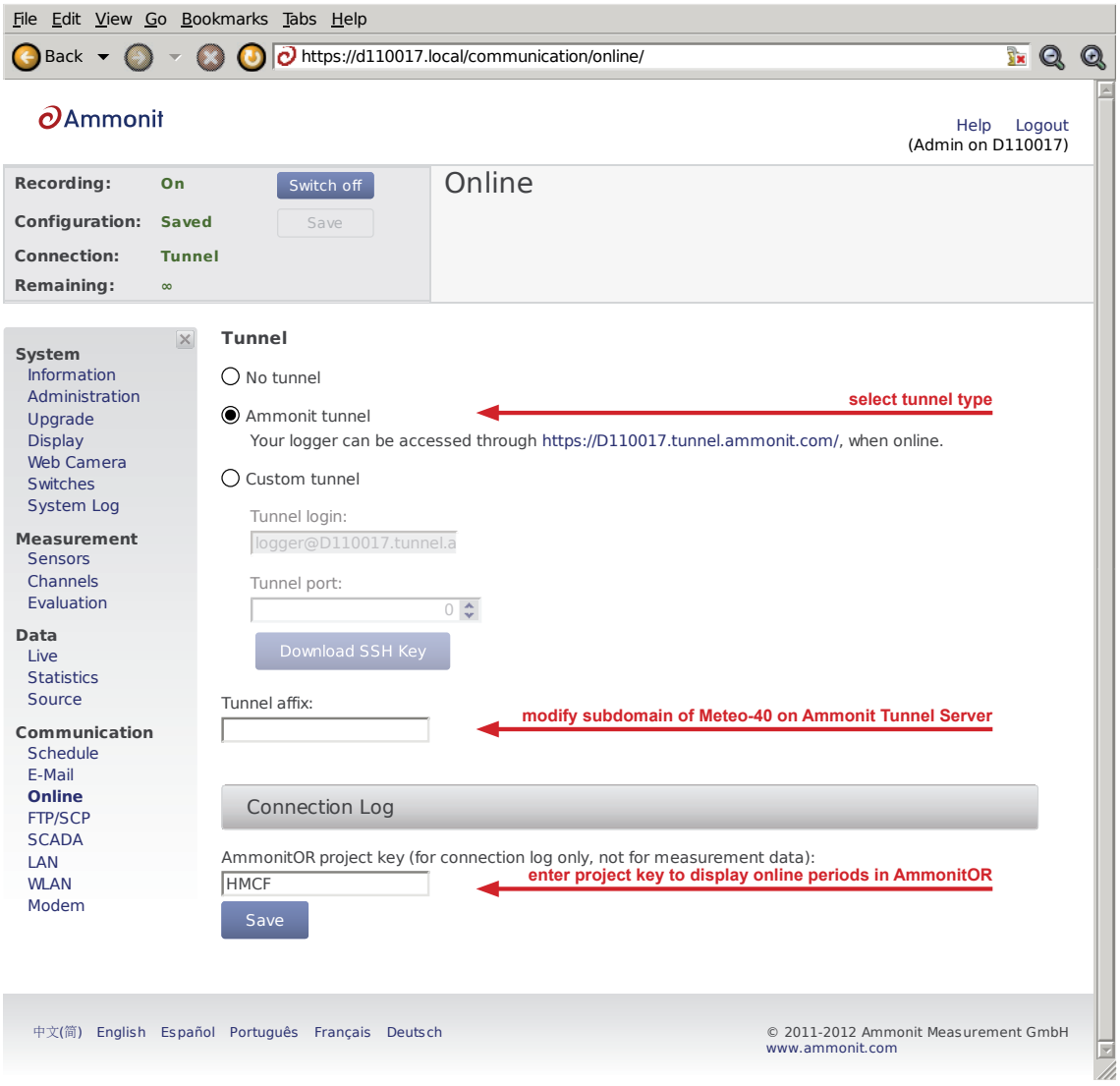


Figure 7.5: Configuring the Online Access

Meteo-40 offers three tunnel options (see Figure 7.5):

No Tunnel: Can be selected, when you use a SIM card with static IP address or when you are directly connected with the data logger via Ethernet or USB.

Ammonit tunnel: By using the Ammonit Tunnel Server (see Figure 7.6) you can access the data logger's web interface by using the displayed link (e.g., https://Dnnnnnn.tunnel.ammonit.com) in menu Communication → Online.

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Custom tunnel: Please enter *Tunnel login* and *Tunnel port*.

Tunnel affix With the *Tunnel affix* you can modify the subdomain of the data logger on the Ammonit tunnel. After saving the *Tunnel affix* the new subdomain is displayed under the Ammonit tunnel options.

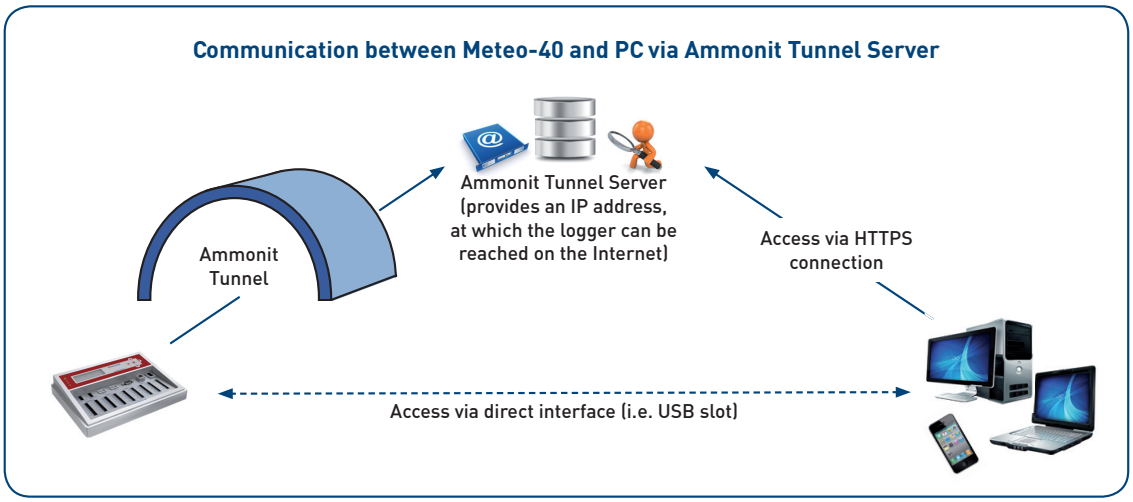


Figure 7.6: Communication between Meteo-40 and PC via Ammonit Tunnel Server

Important
Please note that Meteo-40 can only be accessed via tunnel server, when the data logger is online! The online time is 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 7.7) will be displayed.

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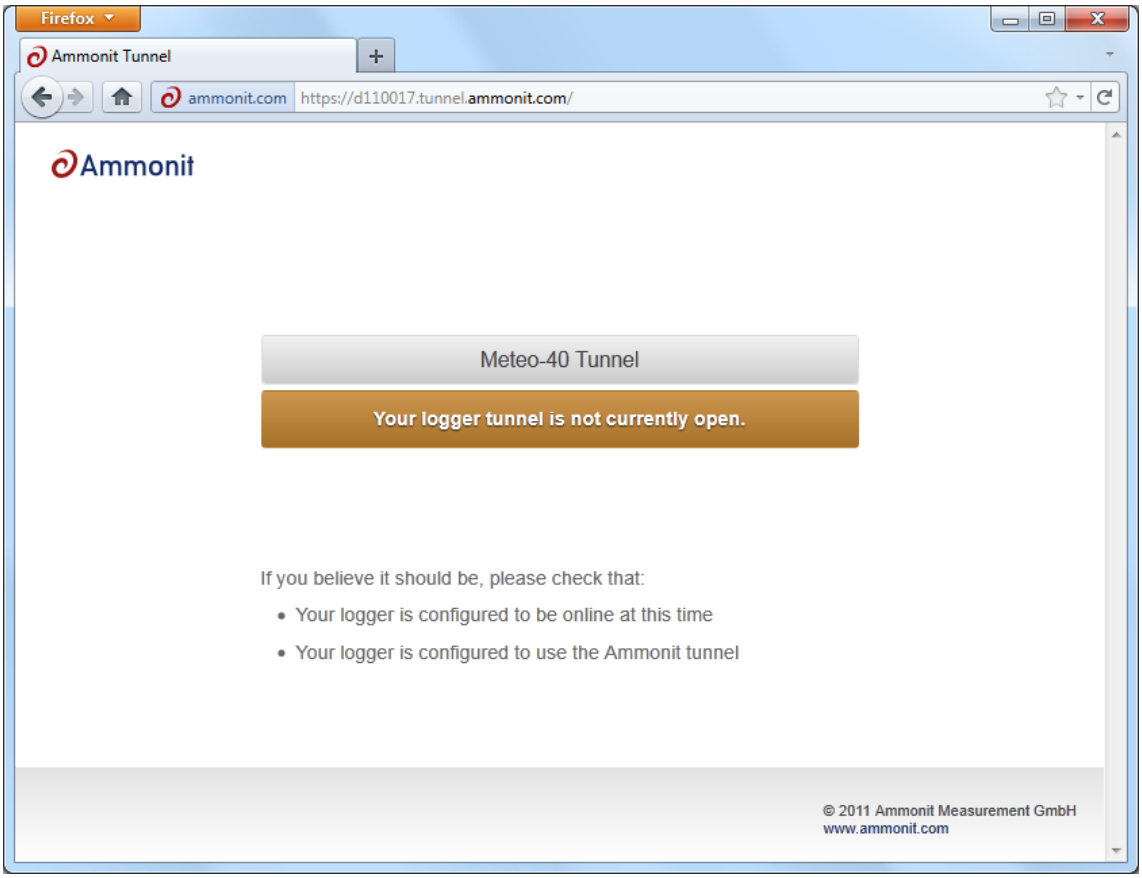


Figure 7.7: Communication via Ammonit Tunnel (closed tunnel)

7.3.1 Connection Log

If you have an AmmonitOR account (on Ammonit server), you can monitor the online times of your Meteo-40. In order to view the connections as shown in Figure 7.8, enter the *Project key*, which is displayed AmmonitOR.

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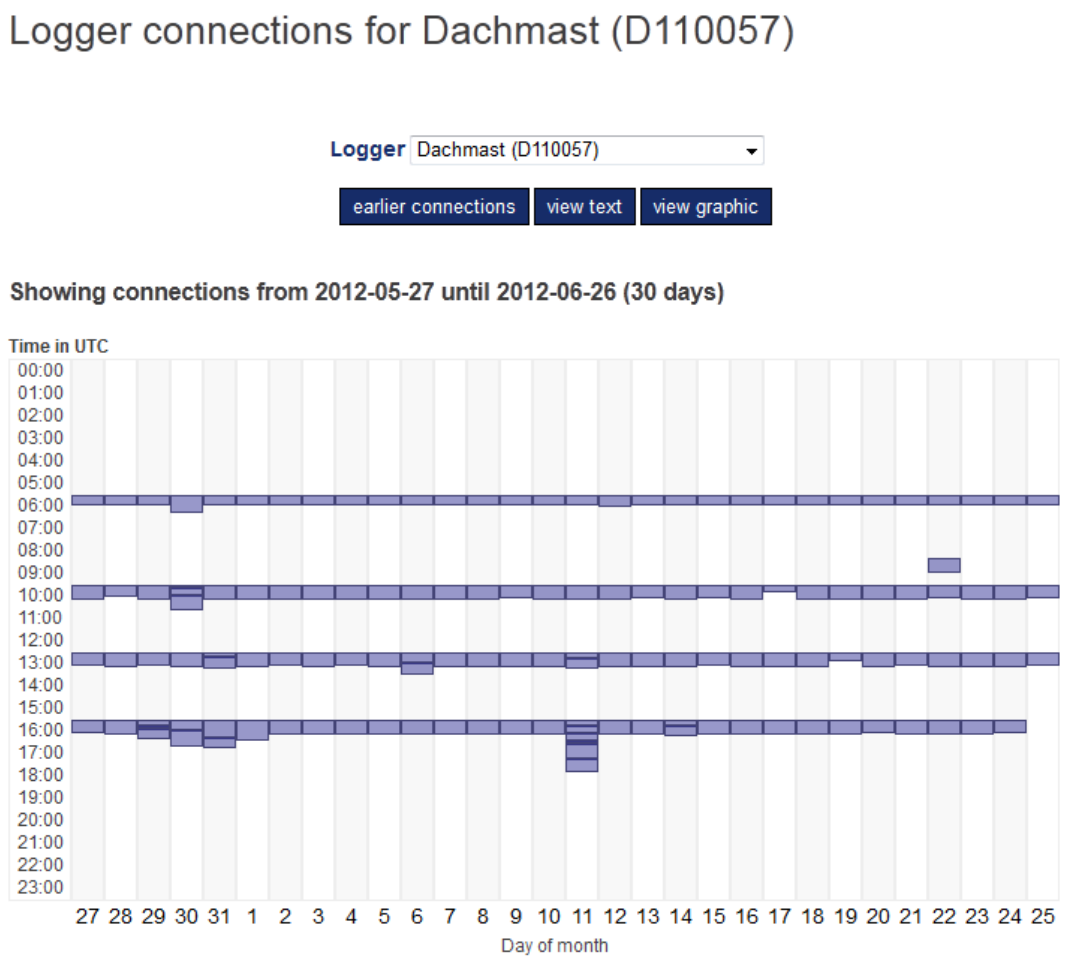


Figure 7.8: Connection Log in AmmonitOR

Note
In order to monitor measurement data in AmmonitOR, AmmonitOR has to be configured in the Communication → FTP/SCP menu. Entering the *AmmonitOR Project key* in Communication → Online menu implies only the monitoring of the connection; no measurement data is sent to AmmonitOR.

7.4 Configuring SCP and FTP Parameters

By using *FTP/SCP* you can upload CSV files to a server of your choice - requirement: Meteo-40 has to be connected to the Internet, e.g., via modem.

The upload comprises all collected CSV files which have been generated since the last performance of this action. If it is the first upload, Meteo-40 uploads all CSV files - no matter how many CSV files have already been generated. The sequence of actions can be configured in menu Communication → Schedule. For further details please refer to Section 7.1.

Meteo-40 offers three methods to upload data that can be configured in menu Communication → FTP/SCP (see also Section 7.3):

AmmonitOR The measurement data will securely be uploaded to the AmmonitOR server. You can conveniently monitor your measurement system, using plots and filters.

Important
If you use an AmmonitOR installation on your server, select *SCP* and enter your server details!

If you select AmmonitOR, an AmmonitOR project key has to be entered. This key can be found in the corresponding AmmonitOR project and is used to upload the data to the selected project.

On the *Statistics Data Download* page in the Data → Statistics menu all CSV files, which have been uploaded to AmmonitOR, are marked with a ticked checkbox in the SCP column. See also Section 6.3.

Note
To use the online platform, an *AmmonitOR* account is needed. Please send an email to support@ammonit.com to register.
In order to work properly with AmmonitOR, please refer to the AmmonitOR manual which can be downloaded from the Ammonit website (`http://www.ammonit.com/products/software/`). See also Figure 7.9.

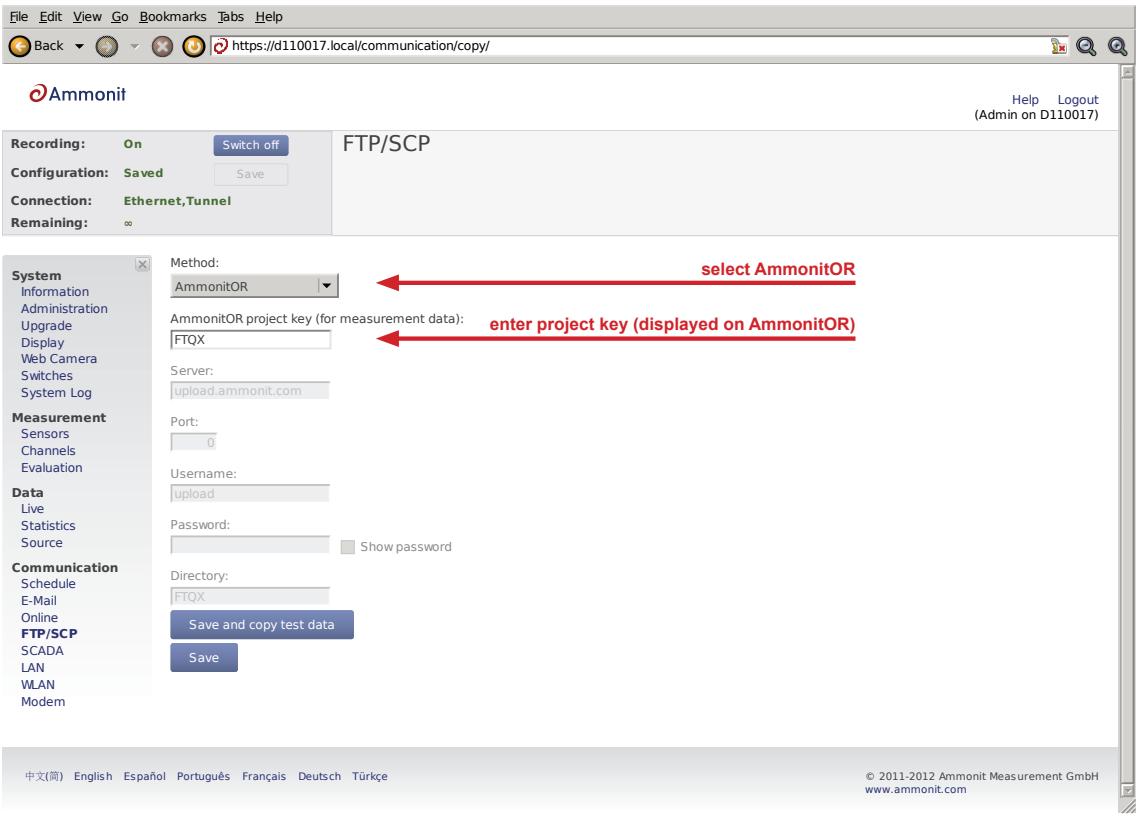


Figure 7.9: Configuring the SCP File Upload to AmmonitOR

SCP The file upload via SCP to your server (your AmmonitOR installation) is encrypted with RSA 2048 bit. Enter server address, username, password and directory to enable the file upload.

Important
If you have an AmmonitOR installation on your server, select the *SCP* method and enter the *AmmonitOR Project key*, displayed in the project on AmmonitOR, in the *Directory*.

On the *Statistics Data Download* page in the Data → Statistics menu all CSV files, which have been uploaded via SCP, are marked with a ticked checkbox in the SCP column. See also Section 6.3.

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FTP Select this option to upload files to your FTP server. Enter server address, username, password and directory to enable the file upload.
On the *Statistics Data Download* page in the Data → Statistics menu all CSV files, which have been uploaded via FTP, are marked with a ticked checkbox in the FTP column. See also Section 6.3.



Note
The file upload via FTP is not encrypted.

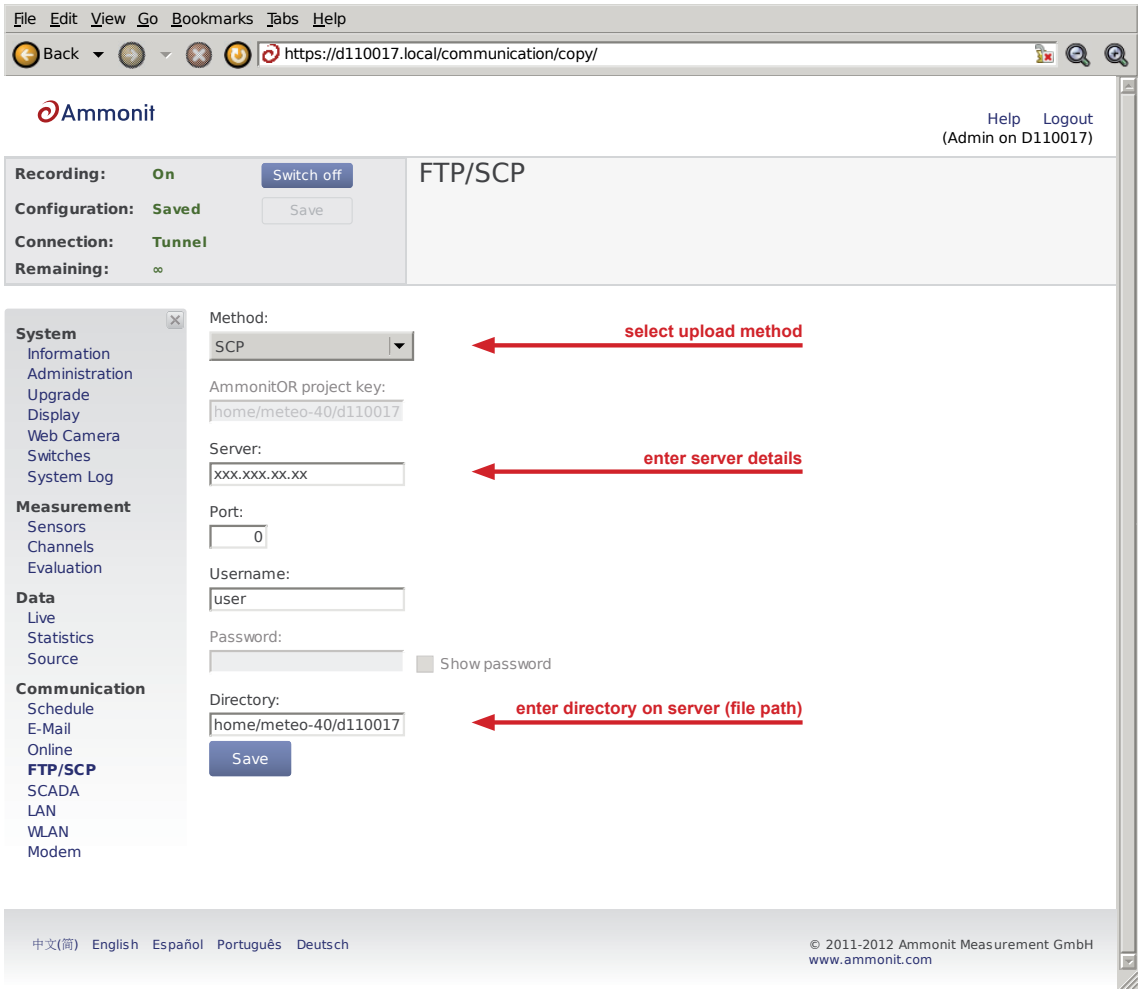


Figure 7.10: Configuring the FTP/SCP Parameters



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



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 you want to share. It is also important to configure Windows™ Firewall by adding an exception for the corresponding port (21 for FTP) and the FileZilla server interface.

7.5 Configuring LAN Parameters

If you want to connect the data logger to a LAN, use an USB Ethernet adapter. By connecting the USB Ethernet adapter to one of the USB-A ports of Meteo-40, the network connection will be automatically recognized. In order to access the web interface, enter the assigned IP address `https://xxx.xxx.xx.xx` in your web browser. The IP address can be found on the data logger display by selecting the corresponding device at the menu Communication → Devices → LAN → Ethernet. Please refer to Section 2.2 and Chapter 3 for more information about the login.

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

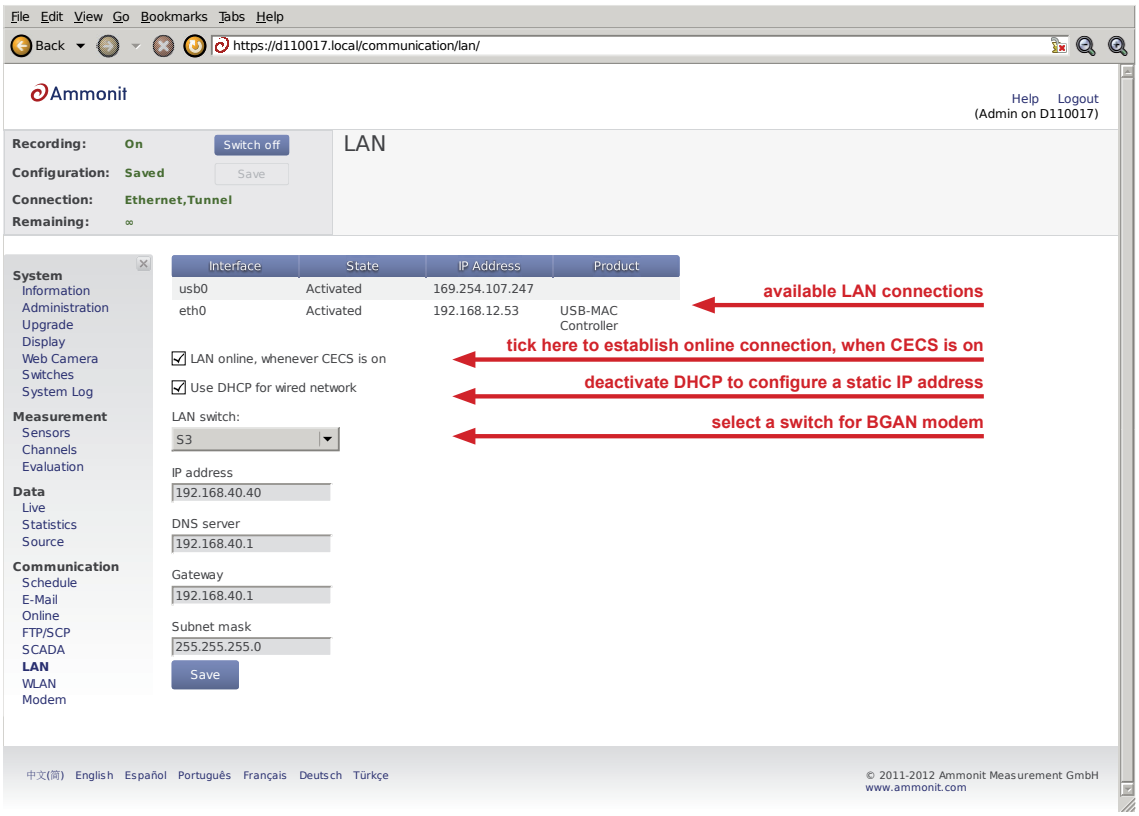


Figure 7.11: Configuring LAN parameters

The checkbox *LAN online, when CECS is on* is active by default. So Meteo-40 is online as soon as the data logger is connected to LAN via Ethernet.

Use DHCP for wired network is active by default. Thus Meteo-40 automatically obtains an IP address from the server. If *Use DHCP for wired network* is active, the fields below are disabled.

Please refer to Chapter 2 for more detailed information about local communication via Ethernet and USB.

7.5.1 Configuring a Static IP address

In order to configure a static IP address, deselect *Use DHCP for wired network* and enter *IP address*, *DNS server*, *Gateway* and *Subnet mask*.

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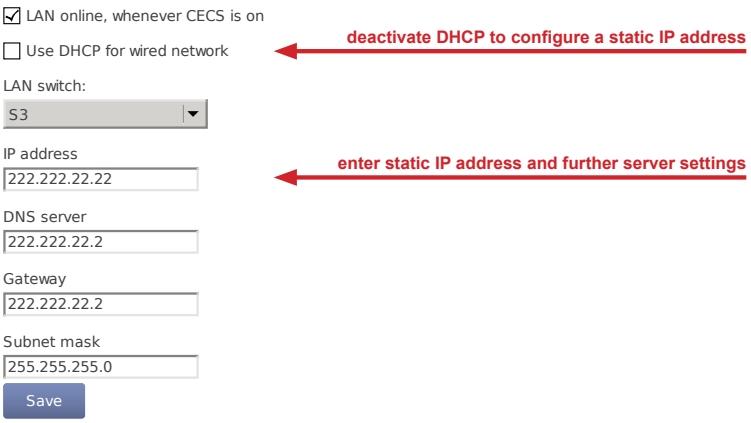


Figure 7.12: Configuring a Static IP Address

7.5.2 Configuring a BGAN Satellite Modem

If you use a BGAN satellite modem for communication, which is connected via Ethernet to Meteo-40, you have to select a *LAN switch* from the dropdown list. Hence prior to a scheduled action, the modem can be supplied via a Meteo-40 switch (see Section 7.5).

In order to configure the BGAN satellite modem, please refer to the software provided by its manufacturer.

7.6 Configuring W-LAN

In order to be more flexible, e.g., to connect your computer with the data logger on site without climbing up the met mast, Meteo-40 supports W-LAN. To use this function, you need a W-LAN USB stick which will be plugged into one of the USB-A ports of Meteo-40.

Before you start using the W-LAN function, Meteo-40 has to be configured. At first connect the data logger via Ethernet or USB with your computer and access the web interface (see Chapter 2). In menu Communication → WLAN the checkbox *Activate W-LAN* has to be ticked. According to your local network Meteo-40 assigns an *IP address* and displays *Netmask*, *Network* as well as *First address* and *Last address* of your network. The entered *Passphrase* should have at least eight characters. Click on *Save* to finish your configuration.

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

Note
Due to security reasons the passphrase for W-LAN access must have at least eight characters.

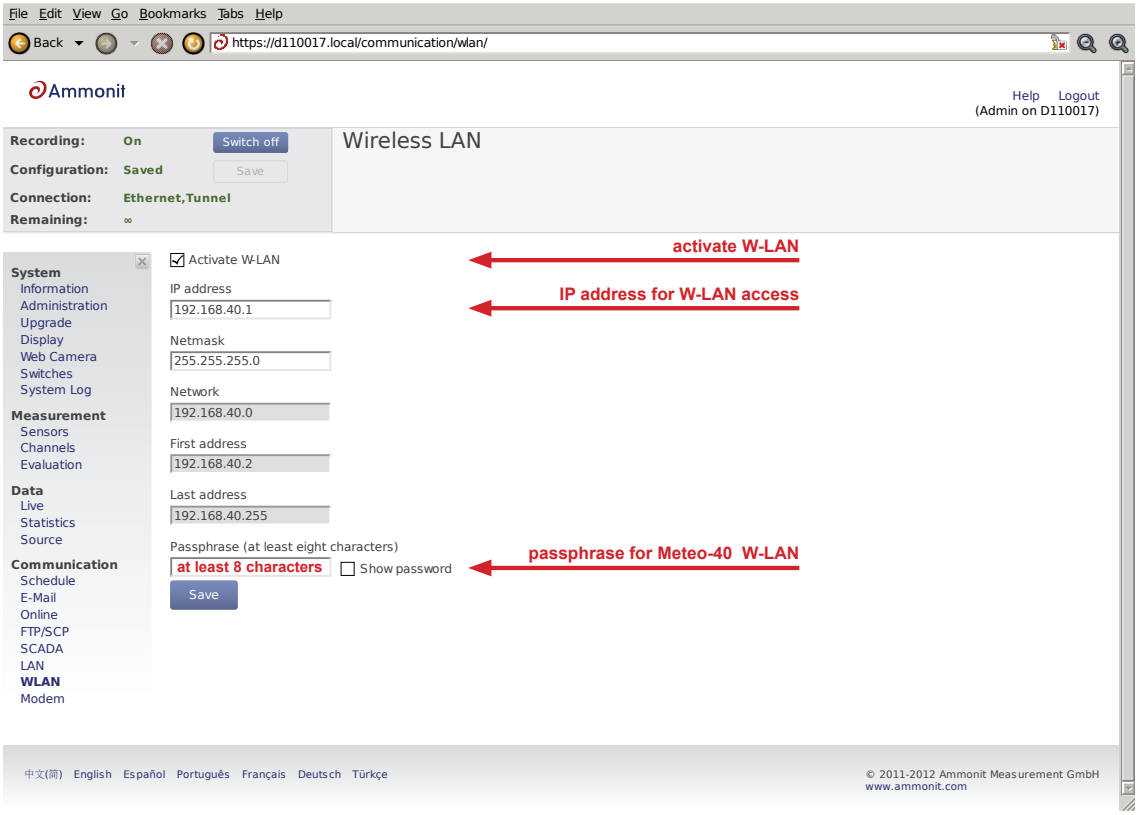


Figure 7.13: Configuring W-LAN Parameters

After having finished the configuration in the Meteo-40 web interface, activate the W-LAN function of your computer and search Meteo-40 among the available W-LANs. You recognize the data logger by its serial number. Establish the W-LAN connection and enter the *Passphrase* you have created before. By entering the IP address, which was displayed before (see Figure 7.13), you can access the Meteo-40 web interface via W-LAN.

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

7.7 Configuring the Modem

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

Note
In order to configure the BGAN satellite modem, use the software provided by the manufacturer.

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

Tip
Please have the PUK code available to create a new SIM card PIN code via the Meteo-40 web interface, if your SIM card has been locked after entering a wrong SIM card PIN code. See also Section 7.7.3.

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

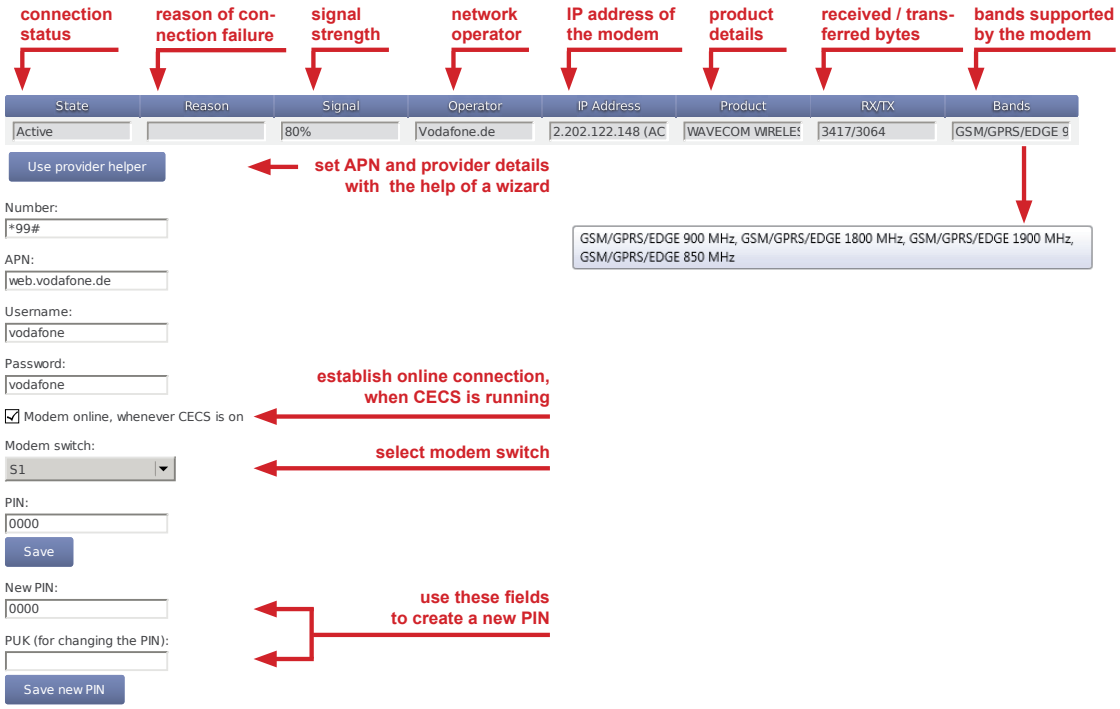


Figure 7.14: Modem Configuration

Now fill in the required information and / or use the *Provider Helper* (see Section 7.7.1):

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 a direct point-to-point connection (TCP/IP connection without GPRS or UMTS), enter the phone number in the corresponding field.

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.

If you do not know the APN of your operator, use our Provider helper to set APN and provider details automatically or ask your provider for the details. See Section 7.7.1.

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

Username will automatically be set by selecting the APN via Provider helper.

Password: Enter the password for the chosen APN.

Password will automatically be set by selecting the APN via Provider helper.

Modem online, then CECS is on The checkbox is activated by default. Thus the modem establishes an online connection as soon as the CECS is switched on (automatically or manually).

If the checkbox is deactivated, the modem is only switched on according to the defined actions in the schedule (see Section 7.1).



Note
Please note that the default setting with activated checkbox increases power consumption - depending on modem type and location of next transmitting mast.

Modem switch: A switch is used to control the power supply of the modem. Please assign a switch for the power supply from the *Modem switch* combo box.



Note
Please note that the switch configured for the modem supply is not available for sensor configuration.



Important
If you use a BGAN satellite modem, you have to assign a switch for the LAN connection in the Communication → LANmenu (see also Section 7.5.2).

PIN: PIN code of the used SIM card is required.

After connecting a modem, it will be shown in the Meteo-40 display in menu Communication → Devices → Modem. 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 7.14) displayed in the web interface in menu Communication → Modem.

By clicking on *Save* you finish the modem configuration. In order to test the modem connection, activate the *Modem permanent online* mode. After successful connection of the modem, the state in the overview changes to `Active` and further connection details will be displayed.

The modem connection can be closed by deactivating the *Modem online, when CECS is on* mode. If no action is running, the modem connection is closed immediately. Or you disconnect the modem from Meteo-40.

7.7.1 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 an APN and click on *Finish* to save your settings. APN, username and password are displayed in the modem configuration. The remaining fields like PIN code and number still have to be filled to finish the modem configuration.

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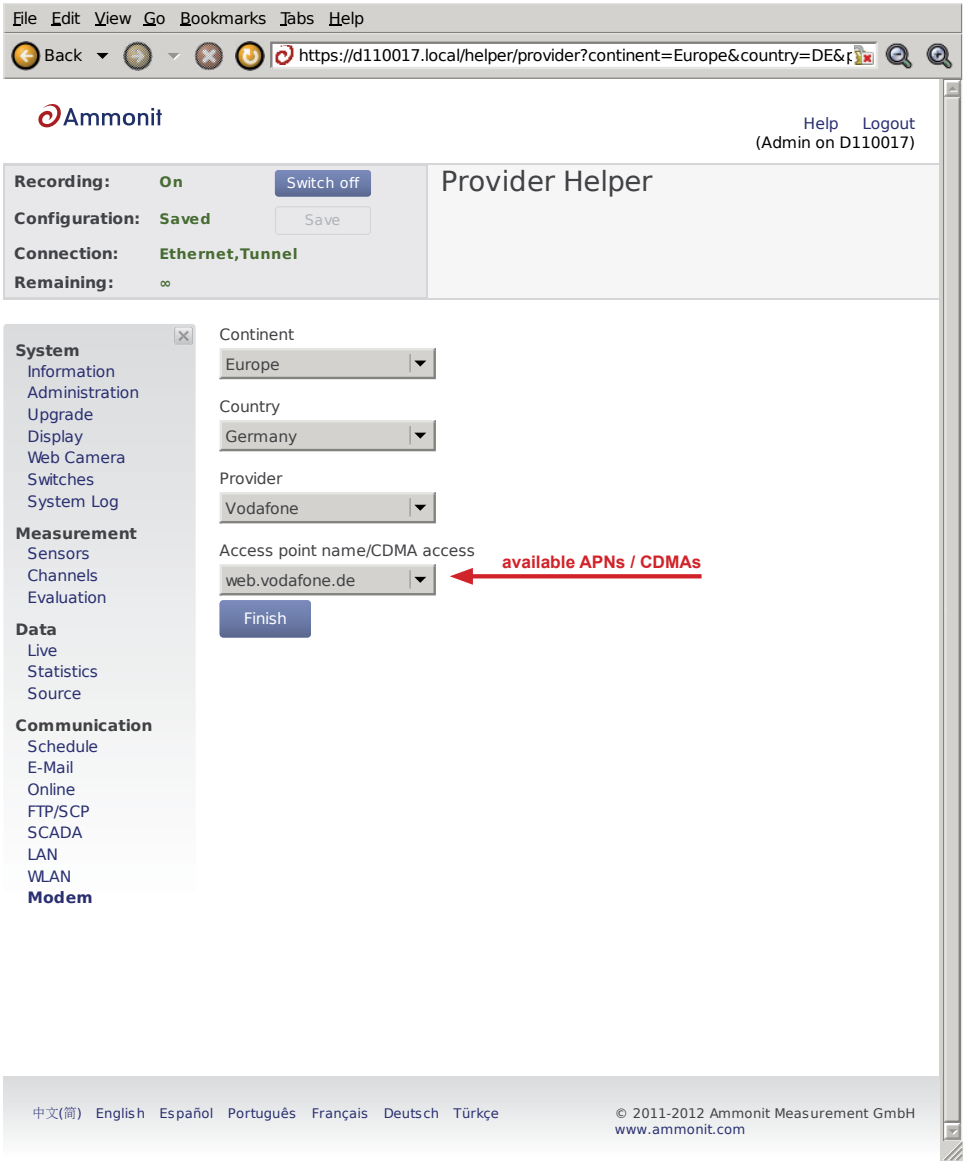


Figure 7.15: Meteo-40 Provider Helper

7.7.1.1 Configuring an Iridium Satellite Modem via Provider Helper

If you use an Iridium satellite modem, please select in the *Provider Helper* for continent `All`. Hence all the other values are preconfigured, i.e., number, username and password.

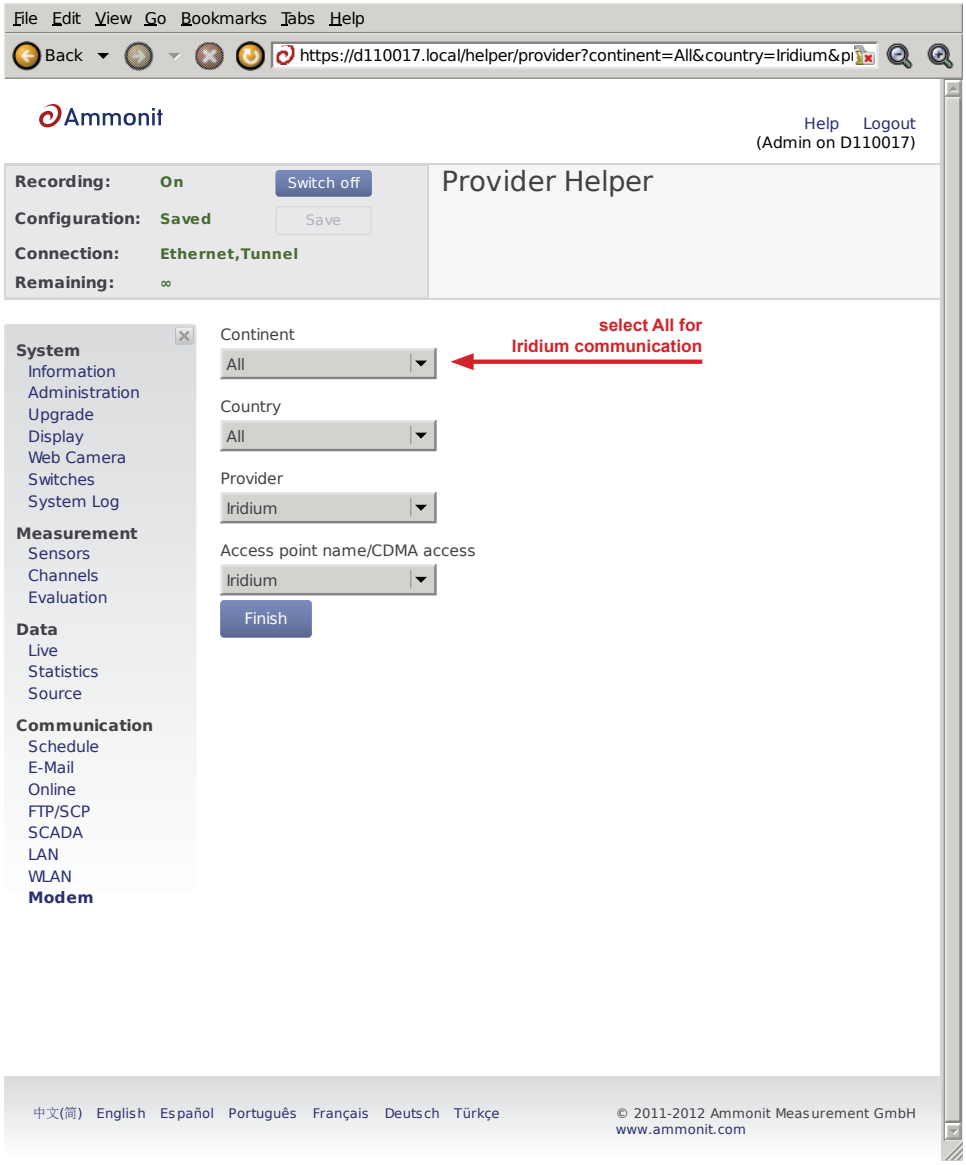


Figure 7.16: Configuring a Iridium Satellite Modem

7.7.2 Two Ways to Establish an Online Connection via Modem

According to the actions scheduled in the Communication → Schedule menu, Meteo-40 has to establish an online connection. To do so, the 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, when CECS is on*:

Modem is online to perform a scheduled action An online connection is established, when it is needed for an action, i.e. sending emails, uploading files or remote access of the web interface according to the schedule (see also Section 7.1).

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

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

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Important
Please note that the default setting with activated checkbox increases power consumption - depending on modem type and location of next transmitting mast.

If the *CECS power mode* (see Section 4.2) is activated, the modem is permanently online.
The mode is independent from the LAN online mode.

7.7.3 Reset PIN Code of Locked SIM Card

If you have entered a wrong PIN code and your SIM card has been locked, you can use a PUK code to create a new PIN code. At the end of the modem configuration you can find the appropriate fields (see Figure 7.14). Click on *Save* to save the new PIN code, which will automatically inserted in the PIN code field for the modem configuration.

7.7.4 Connecting a 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 first configuring the modem in the web interface in menu Communication → Modem before connecting the modem to the data logger.

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.

7.7.5 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 7.21.



Important
It is very important that you 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.

In order 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™, in general no driver file needs to be installed.

After connecting the modem to your PC, go to the *Device Manager* (see Figure 7.17)and open the properties of the modem by double-clicking on the modem.

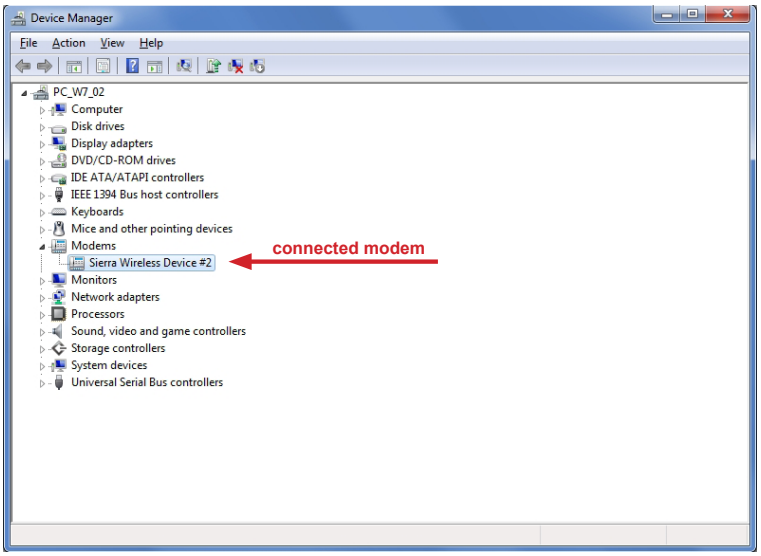


Figure 7.17: Device Manager

Go to the *Modem* tab (see Figure 7.18) to get the name of the *Port*, to which the modem is connected. Change the *Maximum Port Speed* to `57600` `baudrate`. Save your changes.

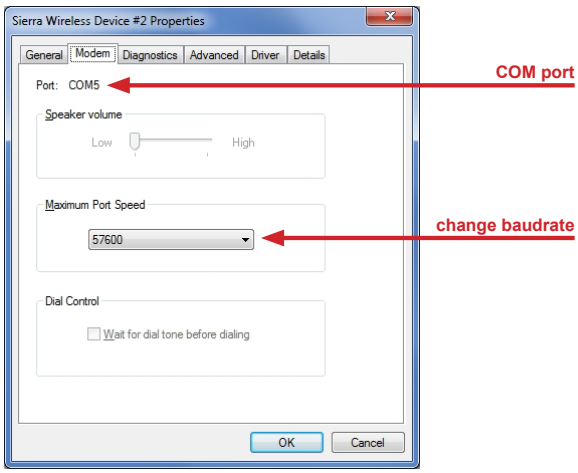


Figure 7.18: Modem Properties

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 name as *Serial line* and `57600` for the *Speed* as shown in Figure 7.19. Open the command window (see Figure 7.20) of the program. In order to test the connection enter `at` and press Enter. If `OK` is shown, the connection is fine and your can change the frequency bands with the above mentioned AT commands.

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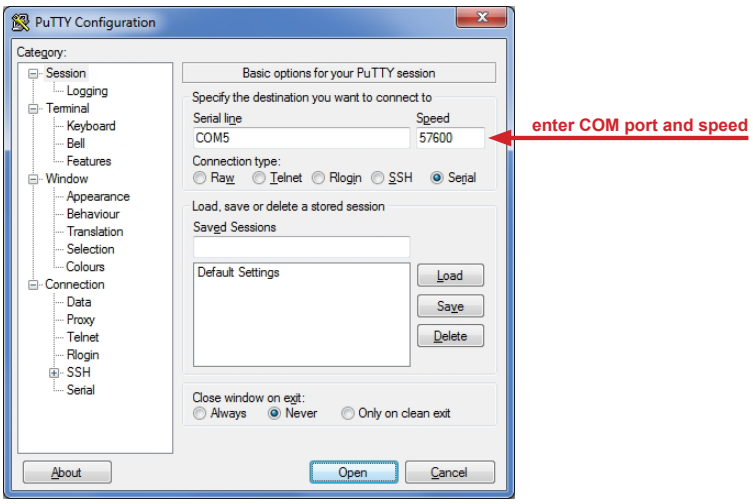


Figure 7.19: PuTTY Configuration



Figure 7.20: PuTTY Command Window

Important
Please restart the modem after modification.

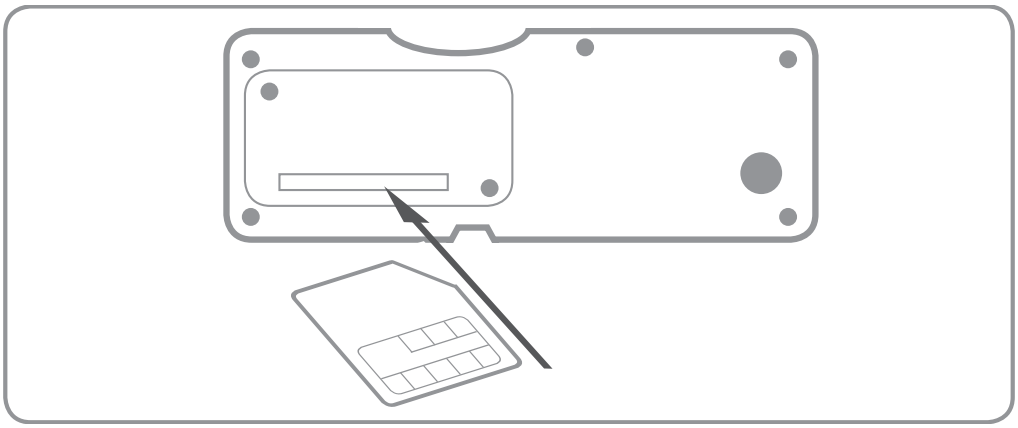


Figure 7.21: Inserting SIM Card into modem Fastback Extend EDGE FXT009

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Chapter 8

SCADA

8.1 Configuring Meteo-40 for SCADA

Meteo-40 can be used to monitor performance and production of wind farms by providing reliable meteorological data. To integrate the data logger in a SCADA system, Meteo-40 supports the standards Modbus TCP/IP and Modbus RTU protocols.

In order to integrate Meteo-40 in your SCADA system, Meteo-40 has to be connected via RS485 S (slave) or Ethernet and the Configuration, Evaluation and Communication System (CECS) has to be permanently switched on. For SCADA operation, Meteo-40 offers the *CECS power mode*, which can be configured via web interface (System → Administration, see Section 4.2) or over the display (Status → CECS, see Section 9.5) of the data logger. If *CECS power mode* is active, it will be displayed in the status box at the web interface with the infinity symbol (∞) as well as on the Meteo-40 display with the word Always. *CECS power mode* is switched off by default.

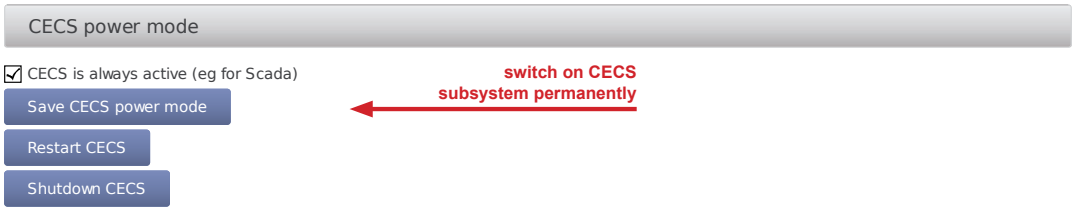


Figure 8.1: Configuring CECS power mode for SCADA

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

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

Note
The CECS is a fully embedded Linux™ computer (see also Section 1.4). Please be aware that Meteo-40 has a higher power consumption when the CECS is switched on.

SCADA parameters can be configured in the Communication → SCADA menu. To activate SCADA for Meteo-40 select the checkbox *Activate SCADA server*.

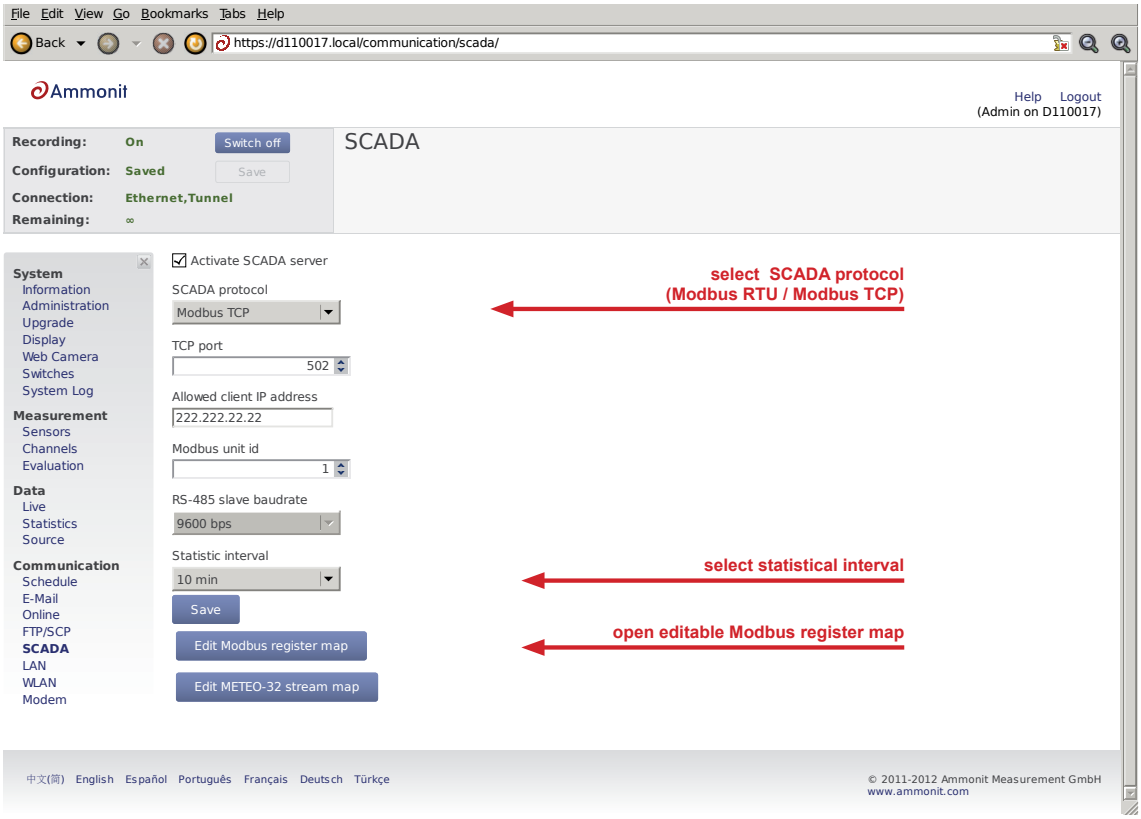


Figure 8.2: Configuring SCADA Parameters

Select a statistics interval to calculate the evaluations.

Important
The statistics interval configured in the Data → Statistics menu is not used for SCADA applications. The statistics interval for SCADA monitoring has to be entered here.

Depending on the SCADA system where Meteo-40 is to be integrated, a protocol for data retrieval must be used:

Modbus RTU over RS485 S (slave) If you are using the Modbus RTU protocol, a *Modbus Unit ID* and a *RS485 baudrate* have to be selected.

Some SCADA clients require a half duplex (2-wire) RS485 interface. To convert the 4-wire RS485 signal into a 2-wire (half duplex) signal, the RPT-485_422-2 industrial grade module can be used (see Section 12.2.3)

Note
Please note, 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 baudrate.

Modbus TCP over Ethernet By selecting Modbus TCP a *TCP port* has to be entered. The default value is 502. As a security measure, if an IP address is entered at field *Allowed client IP address*, only the client with the specified IP address can request data from Meteo-40. The default value is 0.0.0.0, which allows any client accessing the data.

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Note
Make sure your Modbus TCP client is addressing the Modbus-40 SCADA server with the unit ID configured. The default value is 0. The unit identificator is used in Modbus TCP only for routing purpose when addressing a device on a MODBUS+ or MODBUS serial line subnetwork, but the Modbus TCP server is still sensitive to this. For further details see *MODBUS Messaging on TCP/IP Implementation Guide V1.0b* recomendations at The Modbus Organization (`http://www.modbus.org/`).

To connect Meteo-40 to a fiber optic, an industrial media converter 10/100BaseT to 100BaseFX (-40 to 75°C) can be used. The Ethernet interface should be properly configured with a fixed IP address. Refer to Section 7.5 for further details.

METEO-32 Stream Used for streaming Meteo-32 data. A Meteo-32 stream map has to be configured. Refer to Section 8.1.2 for further details.

Save your settings. Otherwise, the configuration is reset to the previous values after moving to another page.

8.1.1 Meteo-40 and Modbus

With its configurable Modbus Register Map, Meteo-40 is designed to operate in most existing SCADA systems. It allows the operator to define at Meteo-40 Modbus server which measurement data are stored and where. Live data of all active channels and switches as well as statistical data can be selected. Data logger's internal values appear at the Modbus registers table under "Int. Voltage (V)", "Int. Curren (mA)" and "Int. Temperature (°C)". A time stamp to the live data ("Live Date/Time") and a different time stamp containing the end time of the evaluation interval for statistical data ("Statistics Date/Time") are also available. Registers addresses must be between 0 and 65535.

Measurement values are represented according to IEEE 754 standard in binary32 format (32-bit single precision binary floating point), stored in two subsequent 16-bit Modbus registers.

Date/time values, i.e. year, month, day, hour, minute, and second, as well as switches state are represented as decimal values, stored in one 16-bit Modbus register each.

Modbus Endianness for SCADA Server According to Modbus Application Protocol V1.1.b, the Modbus protocol is a 'big-Endian' protocol: "Modbus uses a 'big-Endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is 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:

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 8.1: Modbus Endianness for SCADA Server

Modbus register address interpretation 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 use for example Modbus address 30101 to read Modbus input register 100 and modbus addess 40101 to read Modbus holding register 100. To configure the Meteo-40 Modbus register table, the selected data need to be configured with a unique register address between 0 and 65535, independently of the function code that will be used to read it.

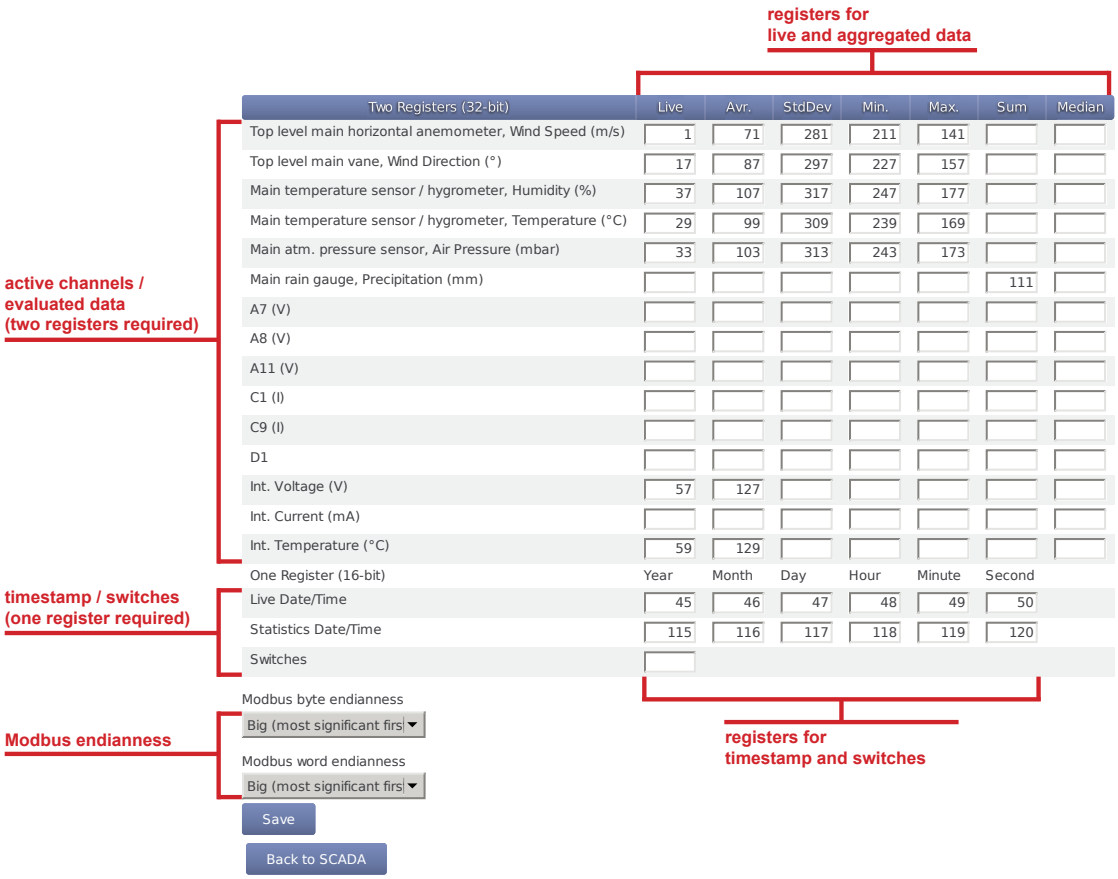


Figure 8.3: SCADA Modbus Register Table

Live data describes instantly measured data of the active channels (An, Cn, Dn, Mn, etc.) and switches (Sn) as well as instantly evaluated data (Top Anemometer Wind Speed (`m/s`), Precipitation (`mm`), etc.).

Aggregated or statistical data: the evaluation interval for statistics calculation and generation of newly aggregated data has to be defined over the Meteo-40 web interface in Communication → SCADA menu. The following statistics are available: average (scalar or vectorial), minimum, maximum, standard deviation, median and sum (for status signals). Statistics can be applied both to channels and to evaluated data.

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`).

8.1.2 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 baudrate* (9600, 19200 or 38400). *TCP port*, *Allowed client IP address* and *Modbus Unit ID* do not have to be filled; the fields are disabled for Meteo-32 streaming. Finally, save your settings by clicking on the *Save* button.

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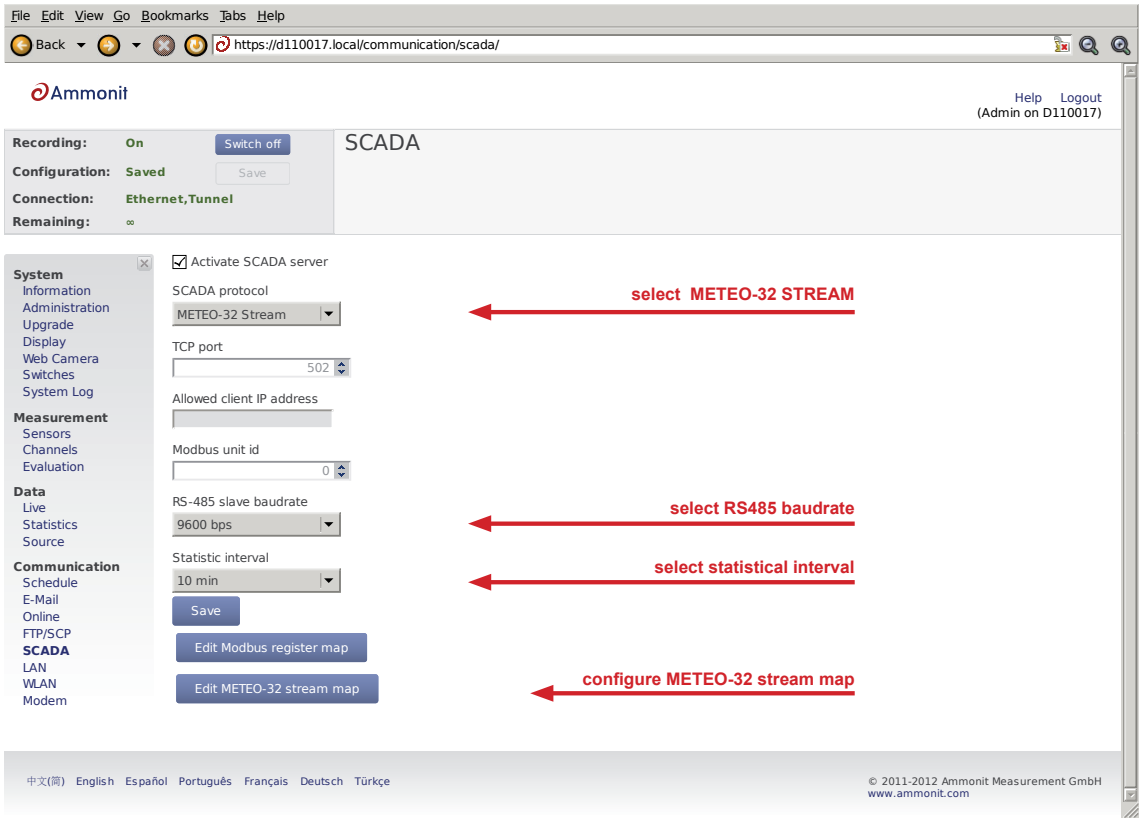


Figure 8.4: Configuring Meteo-40 for Meteo-32 streaming

In order to set up Meteo-40 for Meteo-32 streaming a *Stream Map* has to be configured, which can be opened by clicking on *Edit METEO-32 stream map*. The stream map displays all active channels and evaluated data. To retrieve data, special codes have to entered (unlike Modbus register map!). Refer to Table 8.2 and Table 8.3 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)	u	0.01 m/s	
Ultrasonic (wind direction)	u	degree	
Ultrasonic (vertical wind speed)	u	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/m²	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 8.2: Channel Codes for Meteo-32 Stream Map

Value	Code
Average	a
Standard Deviation	s
Minimum	i
Maximum	x

Table 8.3: Statistic Codes for Meteo-32 Stream Map

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	Live	Avr.	StdDev	Min.	Max.
Top Anemometer, Wind Speed (m/s)	s1	s1a	s1s	s1i	six
Barometer, Air Pressure (mbar)	b1	b1a	b1s	b1i	b1x
Pyranometer, Solar Irradiance Total (W/m²)	u2	u2a	u2s	usi	usx
Pyranometer, Solar Irradiance Diffuse (W/m²)	s2	s2a	s2s	s2i	s2x
Top Wind Vane, Wind Direction (°)	d1	d1a	d1s	d1i	d1x
Pyranometer, Sun Status (%)	s3	s3a	s3s	s3i	s3x
Hygro/Thermo, Humidity (%)	h1	h1a	h1s	h1i	h1x
Hygro/Thermo, Temperature (°C)	t1	t1a	t1s	t1i	t1x
Int. Voltage (V)	vx	vxa	vxs	vxi	vxx
Int. Current (mA)	ic	ica	ics	ici	icx
Int. Temperature (°C)	ti	tia	tis	tii	tix

Figure 8.5: SCADA Meteo-32 Stream Map

Click on *Save* to finish the configuration.

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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 on the right side of 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 memory stick, you can assign permissions to display users. The configuration is done in the System → Display menu (see also Section 4.4).

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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 RS-485 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	Logger	Type Serial Number (Dxxxxxx) Channels
	Version	Software version Bootloader version
	Memory	RAM including % of memory used Source Memory including % of memory used
Time and Date	Clock	Displays date and time
	Set Clock	Sets date and time on Meteo-40 according to NTP server time and *Time Zone* defined in the web interface at 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.

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Submenu Item	Description
Rem. Time	Infty (if CECS power mode is active) Remaining time in mm:ss
Recording	On Off (no recording, e.g. after changing the configuration)
Configuration	Saved Unsaved (the configuration was changed)
CECS	When needed Always (if CECS power mode is active)
Ethernet	Online Offline
Modem	Online Offline
Tunnel	Active Inactive
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 / see 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.

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	0.1V, 0.1-0.3V, 1V, 10V
		Rate	1/8s ... 30s 1min ... 30min 1h
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo40 offers 2, 4 or 8 switches.
		Time	1/8s ... 30s 1min ... 30min 1h

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	1mA, 10mA, 100mA
		Rate	1/8s ... 30s 1min ... 30min 1h
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo40 offers 2, 4 or 8 switches.
		Time	1/8s ... 30s 1min ... 30min 1h

Table 9.5: Menu: Channels/Analog Current

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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	0n or 0ff
		Value	Displays the current value.
	Settings	Rate	1s ... 30s 1min ... 30min 1h
	Switch	State	0n or 0ff
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	1/8s ... 30s 1min ... 30 min 1h

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	0n or 0ff
		Value	Displays the current value
	Settings	Rate	1/8s ... 30s 1min ... 30min 1h
		Type	None Thies10bit Thies8bit Status
	Switch	State	0n or 0ff
		ID	Select the appropriate switch. Depending on the data logger type, Meteo40 offers 2, 4 or 8 switches.
		Time	1/8s ... 30s 1min ... 30min 1h

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.	0n or 0ff

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:
			`Offline`
			`Active`

			Type: indicates connection mode, i.e. GSM
			RX Bytes: displays sum of bytes received
			TX Bytes: displays sum of bytes transferred
	LAN	Ethernet (USB)	State / Interface State: `Active` or `Unavailable` Interface: `usb`
			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 State: `Active` Interface: `eth`
			IP / Netmask: displays IP address and subnet mask
			DNS Servers: displays DNS server addresses
			Routes: displays router or gateway address
			MAC / Speed: displays MAC address of the data logger and transmission rate
			Use DHCP: `Yes` / `No` (can be selected using the keyboard)
	WLAN	`Active` / `Inactive` IP Address	

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Submenu	Submenu Item	Property	Description
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		

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Chapter 10

Sensors

Depending on the data logger type, Meteo-40 offers up to 35 channels. To be more precise Meteo-40 provides inputs for the following measurands:

- Analog Voltage
- Analog Current
- Pulse (Counter)
- Digital (serial and status)
- RS485 (master) to connect various types of sensors.

See also Section 1.3.



Note
If the sensor, you want to connect, is not listed in this manual, refer for technical details and connection plans to the datasheets on our website (www.ammonit.com (`http://www.ammonit.com`)) or contact our sales team (+49-30-6003188-0 or info@ammonit.com).

10.1 Connecting Sensors to Analog Voltage Channels

Meteo-40 comprises differential voltage inputs to eliminate common mode disturbances. Furthermore, differential inputs can be helpful to avoid ground loops.

You can find the analog voltage channels (Ax) on the lower left side of the measuring unit (see Section 1.2). For example, potentiometer wind vanes, barometric pressure sensors, temperature humidity sensors or pyranometers can be connected to analog voltage channels. The available voltage ranges are ±0.1V, ±1V, ±10V and 0.1V to 0.3V. The range 0.1V to 0.3V is intended as a high resolution range for PT1000 temperature sensor. For further electrical details refer to Section 11.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Analog Voltage Channels	4	8	12

Table 10.1: Analog Channels of Meteo-40

10.1.1 Wind Vanes with Potentiometer

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.

Refer to Figure 13.5 for the connection diagram.

In order to determine the wind direction with potentiometric wind vanes, e.g., Thies First Class and Thies Compact, those wind vanes have to be connected to two analog voltage channels (A_x+A_y, e.g., A_1+A_2). A_y indicates the total voltage (U_{Ay}); A_x indicates the partial voltage (U_{Ax}). The following equation shows the calculation of the wind direction (D).

$$D_{[°]} = \frac{U_{Ay[V]}}{U_{Ax[V]}} \cdot 360° + offset_{[°]}$$

Equation 10.1: Calculation of the Wind Direction (D)

The `Offset` [°] has to be filled, when the wind vanes has not been precisely aligned to the North, e.g. when the wind vanes has been aligned to the mast. The offset specifies the angle between North and the point the wind vane has been aligned to.

The `Offset` for each wind vane can be configured in the *Sensor Helper* (see Section 5.1.3).

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 10.2: Parameters for the configuration of potentiometric wind vanes



Important
If potentiometric wind vanes, e.g., Thies First Class (Thies Product ID: 4.3150.00.201), Thies Compact (Thies Product ID: 4.3129.00.712 / 4.31.29.10.712), Vector W200P,Vector W200P/L, NRG #200P, are installed, protection resistors are needed. Ask for the Ammonit 5V external module (Order-No: M83501)! See Section 12.1.



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/`).

10.1.2 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 to include 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 13.7 for the connection diagram.

The output signal (U) from the barometric pressure sensor is proportional to the air pressure (P).

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$$P_{[mbar]} = slope_{[mbar/V]} \cdot U_{[V]} + offset_{[mbar]}$$

Equation 10.2: 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 in the *Sensor Helper* (see Section 5.1.3).

Sensor	Order-No	Slope	Offset
Ammonit AB60	S31100	60 mbar/V	800 mbar
Ammonit AB100	S31200	100 mbar/V	600 mbar
Vaisala PTB110	S32100 for PTB 110.3 S32200 for PTB 110.2 S32300 for PTB 110.1	60 mbar/V	800 mbar

Table 10.3: Parameters for the configuration of barometric pressure 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 6.4). The calculated air pressure value in hPa is saved in the CSV file (see Section 6.3.1.1).

Note
The CSV file 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/`).

10.1.3 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 13.8 for the connection diagram.

The output signal (U) from the temperature sensor is proportional to the temperature (T) in °C.

$$T_{[°C]} = slope_{[°C/V]} \cdot U_{[V]} - offset_{[°C]}$$

Equation 10.3: Calculation of Temperature (T)

The output signal (U) from the humidity sensor is proportional to the humidity (RH) in %.

$$RH_{[\%]} = slope_{[\%/V]} \cdot U_{[V]}$$

Equation 10.4: 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 5.1.3).

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 10.4: 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 6.4). The calculated values for temperature (°C) and humidity (%) are saved in the CSV file (see Section 6.3.1.1).



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/`).

10.1.4 Pyranometers

Pyranometers measure the global 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.

Pyranometers, e.g., CMP series of Kipp & Zonen, have to be connected to analog voltage channels (Ax). Please refer to Figure 13.10 for the connection diagram.

The output signal (U) from the pyranometer is proportional to the global radiation (R) in W/m².

$$R_{[W/m^2]} = slope_{[W/m^2/V]} \cdot U_{[V]}$$

Equation 10.5: Calculation of Solar Radiation (R)

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Slope is an internal parameter of the sensor, which is important to calculate the radiation in W/m². The value is pre-configured in the *Sensor Helper* (see Section 5.1.3).

Sensor	Order-No	Slope	Offset
Kipp & Zonen CMP3	S61100	200000 W/m²/V	0 W/m²
Kipp & Zonen CMP6	S61110	200000 W/m²/V	0 W/m²
Kipp & Zonen CMP11	S61120	100000 W/m²/V	0 W/m²
Hukseflux Pyranometer LP 02	S63100	66666.666 W/m²/V	0 W/m²
Hukseflux Pyranometer SR 1	S63120	66666.666 W/m²/V	0 W/m²

Table 10.5: Parameters for the configuration of pyranometers

Important
If you install calibrated pyranometers, enter the values given in the calibration protocol.
If the value in the calibration protocol is given as Sensitivity, the Slope value has to be calculated.

$$\text{Slope}_{[[W/m^2]/V]} = \frac{1}{\text{Sensitivity}_{[\mu V/[W/m^2]]}} \cdot 10^6$$

Equation 10.6: Calculation of Slope based on Sensitivity

If the Sensitivity is given in µV/[W/m²], it has to be converted to [W/m²]/V for the Slope value.
Thus the result of the formular has to be multiplied by 10^6 (from µV to V).
For Example: If the Sensitivity is 12.09 µV/[W/m²], the calculated Slope is 82712 [W/m²]/V.

Meteo-40 saves all electrically measured values in µV to the source data (Section 6.4). The calculated values for solar radiation are saved in the CSV file (see Section 6.3.1.1).

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/).

10.1.4.1 Pyranometer: Delta-T Sunshine SPN 1

The pyranometer Delta-T Sunshine SPN 1 measures global (total) and diffuse irradiance in W/m². It provides 2 analogue voltage outputs (Ax) for global and diffuse radiation, and 1 digital output (Dx) for sunshine duration.

Solar Irradiance	Slope	Offset
Global Solar Irradiance	1000 W/m²/V	0 W/m²
Diffuse Solar Irradiance	1000 W/m²/V	0 W/m²

Table 10.6: Parameters for the configuration of Delta-T Sunshine SPN1

The order number for Delta-T Sunshine SPN 1 is S65100.



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/`).

10.2 Connecting Sensors to Counter Channels

The counter channels (C) are on the right side of the analog voltage channels (see Section 1.2). For example, anemometers and precipitation sensors can be connected to counter channels. For further electrical details refer to Section 11.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Counter Channels	4	8	12

Table 10.7: Counter Channels of Meteo-40

10.2.1 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 anemometer. 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.

Please refer to the Ammonit website (`http://www.ammonit.com/`) to learn more about anemometer behaviour and accuracy.

Anemometers are connected to counter channels (Cx). Refer to Figure 13.2 for the connection diagram.

The wind speed (V) is determined by the linear function of the frequency output (I):

$$V_{[m/s]} = \text{slope}_{[m]} \cdot I_{[1/s]} + \text{offset}_{[m/s]}$$

Equation 10.7: Calculation of Wind Speed (V)

For wind assessment campaigns is it required to perform an individual MEASNET calibration of each anemometer in a wind tunnel test to achieve optimal accuracy and precision. After calibration use the values for slope and offset according to the calibration protocol.

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Sensor	Order-No
Thies First Class Advanced	S11100 / S11100H
Vector L100 First Class	S14100 / S14100H
Thies Compact	S12100 / S12100H
Windsensor (Risø) P2546A	S16100
Vaisala Anemometer WAA252	S15100H

Table 10.8: 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), you have to implement the Ammonit 5V external module (Order-No. M83501)! See Section 12.1.



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/`).

10.2.2 Precipitation Sensors (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 cm², is conducted through an inflow sieve into a tipping bucket. When the bucket has collected 2 cm² = 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 connected to counter channels (Cx). Please refer to Figure 13.9 for the connection diagram.

The output signal (I) from the sensor is proportional to the precipitation quantity (N).

$$N_{\mu m} = \text{slope}_{[\mu m/\text{pulse}]} \cdot I_{[\text{pulse}]}$$

Equation 10.8: 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 5.1.3).

Sensor	Order-No	Slope	Offset
Thies Precipitation Sensor	S71100H	0.1 mm/I	0 mm
Young Precipitation Sensor	S73100 / S73100H	0.1 mm/I	0 mm

Table 10.9: 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` to the source data (Section 6.4). The calculated values are saved in the CSV file (see Section 6.3.1.1).



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 (Thies Product ID: 5.4032.35.007 / 5.4032.35.008) or Young, you have to implement the Ammonit 5V external module (Order-No. M83501)! See Section 12.1.



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/`).

10.3 Connecting Sensors to Digital Channels

In order to connect for example serial wind vanes Meteo-40 offers up to 8 digital channels (D). The digital channels are in the middle of the measuring unit next to the counter channels (see Section 1.2). For further electrical details refer to Section 11.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Digital Channels	2	4	8

Table 10.10: Digital Channels of Meteo-40

10.3.1 Wind Vanes TMR

Ammonit recommends to install digital wind vanes TMR to determine the wind direction. Wind vanes TMR deliver more precise measurement values than wind vanes POT and are less susceptible to failure 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 10.11: 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.

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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 channels, 4 counter channels and 2 digital channels).

Sensor	Order-No
Thies First Class	S21100H
Thies Compact	S22100 / S22100H

Table 10.12: Parameters for the configuration of wind vanes TMR



Important
If you plan to install wind vane Thies First Class TMR (Thies Product ID: 4.3150.00.001) or Thies Compact TMR (Thies Product ID: 4.3129.70.701 / 4.3129.60.701), you can optionally implement the Ammonit 5V external module (Order-No. M83501)! See Section 12.1.



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/`).

10.3.2 Precipitation Monitors

Precipitation monitors determine the beginning and the end of precipitation and the duration of the period of precipitation. The sensor delivers status output, i.e. precipitation=on or precipitation=off.



Important
If you plan to install precipitation monitor Thies (Thies Product ID: 5.4103.10.000), you have to implement the Ammonit 5V external module (Order-No. M83501)! See Section 12.1.

10.4 Connecting Sensors to Analog Current

The data logger types Meteo-40M and Meteo-40L offer analog current channels. Meteo-40L provides two connectors; Meteo-40M one. Barometric pressure sensors can be connected to these channels that offer a current range of 1mA, 10mA and 100mA. For further electrical details refer to Section 11.2.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Analog Current Channels	-	1	2

Table 10.13: Analog Current Channels of Meteo-40

10.5 Connecting Sensors to RS485 M

All data logger types of Meteo-40 offer a RS485 M (master) slot to connect up to eight smart sensors. For further electrical details refer to Section 11.2.

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.

The following RS485 sensors are supported. Please remember that most RS485 sensors have to be configured before use. This configuration has also be applied when adding the sensors to Meteo40 in the Measurement → Sensors menu.



Important
We recommend an operation baudrate of 19200 Baud or higher to achieve polling each sensor in less than 1/8 s. Please note that the selected baudrate and measurement rate are applied to all RS485 sensors connected to the bus. It is important that each sensor is configured with a unique RS485 address in the bus.

Sensor type	Sensor model	Description	Channels and Evaluated data	Sensor's previous configuration needed
Ultrasonic	Thies Ultrasonic Anemometer 2D	4_382x_xx_xxx, Telegram 3	Mx_1: Wind speed, Mx_2: Wind direction, Mx_3: Acoustic virtual temperature	Baudrate, Address, Half duplex mode, scalar averaging over 1 s
Ultrasonic	Thies Ultrasonic Anemometer 3D	4_3830_xx_xxx, Telegram 3	Mx_1: Wind speed azimut, Mx_2: Wind direction azimut, Mx_3: Wind speed elevation, Mx_4: Acoustic virtual temperature	Baudrate, Address, Half duplex mode, scalar averaging over 1 s
Ultrasonic	NMEA - Thies Ultrasonic Anemometer Compact	Sensors supporting NMEA standard. For example Thies 4_387x_xx_xxx, Telegram 3	Mx_1: Wind direction, Mx_2: Wind speed	NMEA (when needed), Baudrate, Address, Half duplex mode, scalar averaging over 1 s
Ultrasonic	Lufft Ventus V200A	Lufft Ventus 2D Ultrasonic VENTUS-V200A-UMB (Modbus registers 14 and 25)	Mx_1: Wind direction, Mx_2: Wind speed	Baudrate, Address, Modbus protocol, parity none, scalar averaging over 1 s
Ultrasonic	Lufft WS-Series	Lufft Weather station WSx-UMB (Modbus 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 °C (act.), Mx_5: Wind speed fast m/s	Baudrate (38400), Address, Modbus protocol, parity none, scalar averaging over 1 s

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Sensor type	Sensor model	Description	Channels and Evaluated data	Sensor's previous configuration needed
Ultrasonic	Gill Windmaster Pro 3D	Gill Anemome-ter Ultra 3D, Mode 4	Mx_1: Wind direction azimut, Mx_2: Wind speed azimut, Mx_3: Wind speed elevation	Baudrate 38400 (B5), Address (default Q), averaging inactive (G0), sampling rate 20 Hz (P8), Pollar polled (M4), Output format CSV (O1)
Ultrasonic	Gill Wind Observer 2D	Gill Anemome-ter Ultra 2D, Mode 4	Mx_1: Wind direction azimut, Mx_2: Wind speed azimut	Baudrate 38400 (B5), Address (default A), averaging inactive (G0), sampling rate 20 Hz (P8), Pollar polled (M4), Output format CSV (O1)

Sensor type	Sensor model	Description	Channels and Evaluated data	Sensor's previous configuration needed
Power Meter	GD2000 Power Meter	GD2000 Multi-function Power Analyzer (Modbus registers 56 to 63)	Mx_1: Active power, Mx_2: Power factor, Mx_3: Reactive power, Mx_4: Apparent power	Baudrate (19200), Address
Wind Vane	Wind vane Thies First Class RS485	4_3150_x0_400	Mx_1: Wind speed, Mx_2: Wind direction	Baudrate, Address, Half duplex mode
Wind Vane	Thies Wind Vane 8 Bits Parallel via ICP I7051	ICP CON I7051 RS485 Module to connect two Thies 8-bit parallel wind vanes	Mx_1: Wind direction vane DI0 ~ DI7, Mx_2: Wind direction vane DI8 ~ DI15	Same configuration as for Meteo32: Baudrate 38400, Address 6, Checksum disabled, Parity 8N1
Barometric Pressure Sensor	Barometeric Pressure Sensor Thies RS485	3_1157_10_xxx, Telegramm 1	Mx_1: Air pressure, Mx_2: Temperature	Baudrate, Address

Table 10.14: Meteo-40 supported RS485 sensors (others)



Tip
For more information about Thies acoustic virtual temperature see sensor's manual.

10.5.1 Thies Ultrasonic Configuration Options

Before you connect Thies sensors to Meteo-40, they must be configured. Ammonit offers some configuration options on purchase:

Order No: 4.38m0.h2.r00

- 'm' is for sensor model:

7 – US 2D compact
2 – US 2D
3 – US 3D

- 'h' is for heating *:
  0 – standard
  3 – PTC Heating stainless-steal caps
  4 – like 3 plus additionasl chassis heating (42V)

  * for US 3D:
  2 – standard
  4 – extreme conditions
- 'r' is for RS485 configuration:
  3 – Baud rate 9600 (8N1) → for Meteo32
  5 – Baud rate 38400 (8N1) → for Meteo40

Standard settings:

- Half duplex
- 8N1
- Heating on
- Analog outputs 0..10V
- Wind speed scale 0..60m/s

Special settings (have to be included when ordering the device):

- Full duplex
- Heating off
- ADIO special use
- Analog outputs mA
- Analog outputs range 2..10V /4..20mA

10.5.2 Lufft UMB Configuration Tool

Before you connect Lufft sensors to Meteo-40, you have to configure the sensors. Please download and install the software UMB-Config-Tool (`http://www.lufft.com/en/support/downloads/software/?subcategory1=61`) and follow the next steps:

1. Power off 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 connection in menu Edit/Connection settings.
4. In order to configure the sensor, switch all sensors temporarily to UMB protocol in menu Options (follow instructions).
5. Add new sensor in menu Edit/Sensor. Select the appropriate type from the list and ID (default 1). Do not exit this menu, press Configure to access sensor configuration.
6. Load profile from sensor (press button again if it does not respond). Select tab with sensor's type name and configure as described in the upper table.
7. Store profile on sensor to apply the configuration changes to the sensor. Also store profile on disk to keep a copy of sensor's configuration.
8. Close configuration program, disconnect and power off the sensor. Connect the sensor to the logger and power on the sensor.
9. Add the sensor to logger's sensors list in menu Measurement/Sensors, applying the same configuration.

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10.5.3 Gill Wind Configuration Tool

Before Gill sensors are connected to Meteo-40, you have to configure the settings. Please download and install Gill Wind Com (`http://www.gill.co.uk/main/software.html`) and follow the next steps:

Use the Wizard tool to change from the default configuration all parameters specified in the upper table.

1. Do not forget to finally save the configuration report in menu Tools.
2. Close configuration program, disconnect and power off the sensor. Connect the sensor to the logger and power on the sensor.
3. Add the sensor to logger's sensors list in menu Measurement/Sensors, applying the same configuration.



Note
Please notice that any wind magnitude lower than defined by sensor's parameter K (default 0.050 m/s) will have the wind direction omitted.



Important
Please notice that Gill Windmaster sensors do not support connecting more than one unit in a bus.

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Chapter 11

Technical Data

11.1 Specification

Property	Specification
Housing Dimensions	260x194x50mm
Weight	950g
Protection	IP65
Temperature	-40 ... +65°C (operation) -20 ... +65°C (display readable)
Memory	Meteo-40S: 1GB Meteo-40M: 1GB Meteo-40L: 2GB
Date Format	YYYY-MM-DD
Time Format	hh:mm:ss
Clock	Buffered real time clock Accuracy: -40 ... +85°C (±3.5ppm); 0 ... +40°C (±2ppm) 3V Lithium Button Cell CR2032; approx. 180 mAh; operating time >3 years
Power Supply	No internal supply! (see Table 11.6)

Table 11.1: Specification



Important
Meteo-40 has no internal supply battery! External power supply is essential for proper operation. Table 11.6 contains the characteristics of the voltage supply and the current consumption of the data logger.

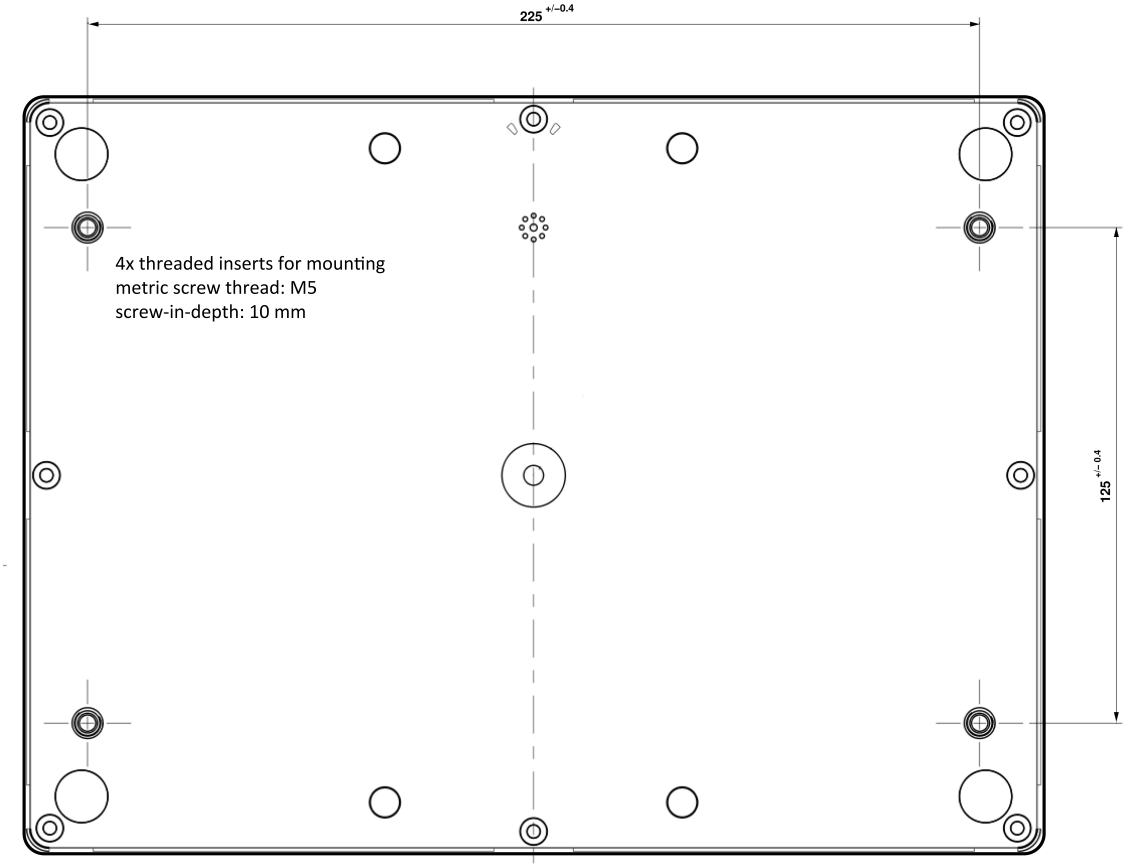


Figure 11.1: Mounting threads dimensions.

11.2 Electrical Characteristics

The values given in the tables Table 11.2 to Table 11.6 contain the specifications of the digital and analog inputs and outputs. The given values are specified for a temperature range of -40 to +65°C.

Note
All inputs and outputs are protected against overvoltage and electrostatic discharge. All voltage outputs of the data logger are fused by an self-resetting electronic fuse. Furthermore, the power supply comprises an inverse-polarity protection.

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Channel	Property	Specification
Analog Voltage (Differential Inputs)	Channels	A1 ... A12 (Meteo-40L) A1 ... A8 (Meteo-40M) A1 ... A4 (Meteo-40S)
	Available Voltage Ranges (DC)	±0.1V, ±1V, ±10V and 0.1V ... 0.3V
	Internal Resolution (Bit)	15 bit (Range: ±0.1V) 16 bit (Range: ±1V) 16 bit (Range: ±10V) 16 bit (Range: 0.1V ...0.3V)
	Internal Resolution (Voltage)	6.1 µV (Range: ±0.1V) 30 µV (Range: ±1V) 300 µV (Range: ±10V) 3.1 µV (Range: 0.1V ...0.3V)
	Input Impedance	1 MΩ
	Input Voltage	min. -12V max. +12V
	Maximum Measurement Frequency	8 Hz
Analog Current (Differential Inputs)	Channels	AC1 ... AC2 (Meteo-40L) AC1 (Meteo-40M)
	Available Current Ranges (DC)	±1mA, ±10mA, ±100mA
	Measurement Error	< 0.5% (Range: ±1mA) < 0.25% (Range: ±10mA) < 0.25% (Range: ±100mA)
	Resolution (Bits)	13 bit (±1mA), 15 bits (±10mA, ±100mA)
	Input Impedance (Shunt)	4.7 Ω
	Maximum Input Current	150 mA
	Maximum Input Voltage	0.75V
Maximum Measurement Frequency	8Hz	
Counter (Non-Differential Inputs)	Channels	C1 ... C12 (Meteo-40L) C1 ... C8 (Meteo-40M) C1 ... C4 (Meteo-40S)
	Frequency Range (TTL-Level)	1Hz ... 25kHz
	Frequency Resolution [1]	0.1 Hz
	Voltage Threshold (f > 1 Hz)	0.22V
	Input Voltage	min. -12V max. +12V
Digital (Serial Input / Output)	Channels	D1 ... D8 (Meteo-40L) D1 ... D4 (Meteo-40M) D1 ... D2 (Meteo-40S)
	Input Voltage Range (High State)	2V ... 25V
	Input Voltage Range (Low State)	-0.5V ... 0.6V
	Input Resistance	≥ 10 kΩ
Switches	Channels	S1 ... S8 (Meteo-40L) S1 ... S4 (Meteo-40M) S1 ... S2 (Meteo-40S)
	Switch Voltage Range	5V ... 28V
	Max. Current Continuous Switch	120 mA
	Peak Switch Current (2 s)	400 mA
	Switch On Resistance	< 350 mΩ
	Switch Off Resistance	> 10 MΩ

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Table 11.2: Electrical specifications of analog and digital inputs

Channel	Property	Specification
Switches	Electrical Channels	S1 ... S8
Digital Clock Output	Electrical Channels	D1 ... D8
	High State	5V
	Low State	0V
	Output Resistance	100 Ω
	Minimal Load Resistance	500 Ω

Table 11.3: Electrical specifications of analog and digital outputs



Important
The switches section of the Meteo-40 comprises 5V outputs to supply periferical devices inside the steel cabinet of the measurement setup. The 5V supply is not intended to supply sensors connected with long cables due to the risk of damage caused by lightning strike.
The 5V outputs provide an electronic current limiter and an overvoltage protection.

Property	Specification
Max. output voltage	5.5 V
Min. output voltage	4.7 V
Max. output current per output terminal	15 mA

Table 11.4: Electrical specifications of the 5V output

Property	Specification
Serial interface port	Male 9-pin RS232 connector for connection to serial modem
Maximal Baudrate	115200 Baud

Table 11.5: Electrical specifications of the RS232 Interface



Important
Meteo-40 has no internal supply battery! External power supply is essential for proper operation. Table 11.6 contains the characteristics of the voltage supply and the current consumption of the data logger.

Power Supply	Property	Specification
Supply Voltage Input (with Reverse Voltage Protection)	Supply Voltage Range	9V (DC) ... 36V (DC)
	Peak Supply Voltage (10 s)	55V (DC)
Current Consumption	Average Current Consumption @ 12V (DC) during measurement	< 30 mA (P < 360 mW)
	Average Current Consumption @ 12V (DC) during communication	< 60 mA (P < 720 mW)
	Average Current Consumption @ 12V (DC) with display illumination	< 500 mA (P < 6 W)

Table 11.6: Electrical specifications of the power supply

[1]The frequency resolution depends on the period time setting. Longer period time setting results in higher resolution.

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Chapter 12

Accessories

12.1 External Module 5V Supply (M83501)

To power sensors requiring 5V for the use with Meteo-40, the external module M83501 can be applied. Ammonit suggests the use of this module for the sensors given in the list below. In general the M83501 module provides different pull-up or pull-down resistors an also a 5V output with active current limit.

1. **Potentiometric wind vanes (1mA): two protection resistors, e.g.:**
   - Wind vane Thies Compact (2k) (Thies Product ID: 4.31.29.00.712 / 4.31.29.10.712) → see Section 10.1.1
   - Wind vane Vector W200P (1k) → see Section 10.1.1
   - Optional: Anemometer NRG #40H (Hall Effect); Anemometer Risø P2546A (Reed switch) → see Section 10.2.1
2. **Potentiometric wind vanes (10mA): two protection resistors, e.g.:**
   - Wind vane Thies First Class (2k) (Thies Product ID: 4.3150.00.212) → see Section 10.1.1
   - Wind vane Vector W200P/L (2k) → see Section 10.1.1
   - Wind vane NRG #200P (10k) → see Section 10.1.1
3. **Counter, switch or open-collector: pull-up resistor (6k8), e.g.:**
   - Precipitation sensor Thies (Thies Product ID: 5.4032.35.007 / 5.4032.35.008) → see Section 10.2.2
   - Precipitation sensor Young → see Section 10.2.2
   - Anemometer NRG #40H (Hall Effect) → see Section 10.2.1
   - Anemometer Risø P2546A (Reed switch) → see Section 10.2.1
   - Anemometer Thies (if open drain output is used) → see Section 10.2.1
4. **Digital input / status: pull-down resistor (10k), e.g.:**
   - Control switch
   - Precipitation monitor Thies (Thies Product ID: 5.4103.10.000) → see Section 10.3.2
5. **Supply: stabilised and actively fused 5V / 110mA output, e.g.:**
   - AC adapter for NRG anemometer
   - Optional: Wind vane Thies First Class TMR (Thies Product ID: 4.3150.00.001); Wind vane Thies Compact TMR (Thies Product ID: 4.3129.70.701 / 4.3129.60.701) → see Section 10.3.1

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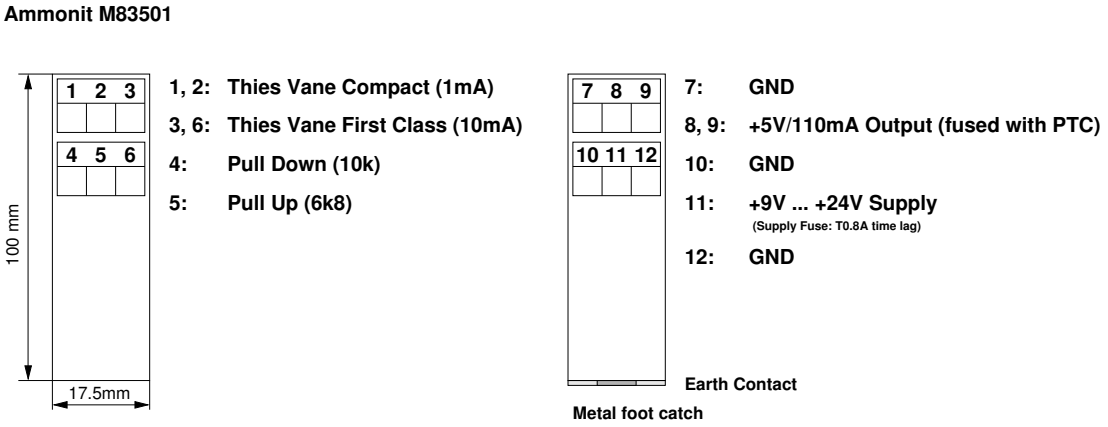


Figure 12.1: 5V External Module: Pin Assignment

Parameter	Pin	Min	Max
Supply voltage DC	11	9V	24V
Output voltage	8, 9	5.0V	5.2V
Output current (ϑ = 25°C)			110mA
Current limit Pin 1 and 2	1, 2		1mA
Current limit Pin 3 and 6	3, 6		10mA
Operating temperature		-40°C	+75°C
Quiescent current		7mA @ 13V	
Ground	7, 10 ,12		
Fuse T0.8a (time lag): 5 x 20mm			

Table 12.1: Electrical Characteristics

- Supply with fuse T0.8A (time lag)
- Housing dimensions (width x height x depth): 17.5 x 100 x 115mm
- Mounting on DIN-rail (35 x 7.5mm)
- Terminal: wire cross section from 0.25 to 1.5mm²

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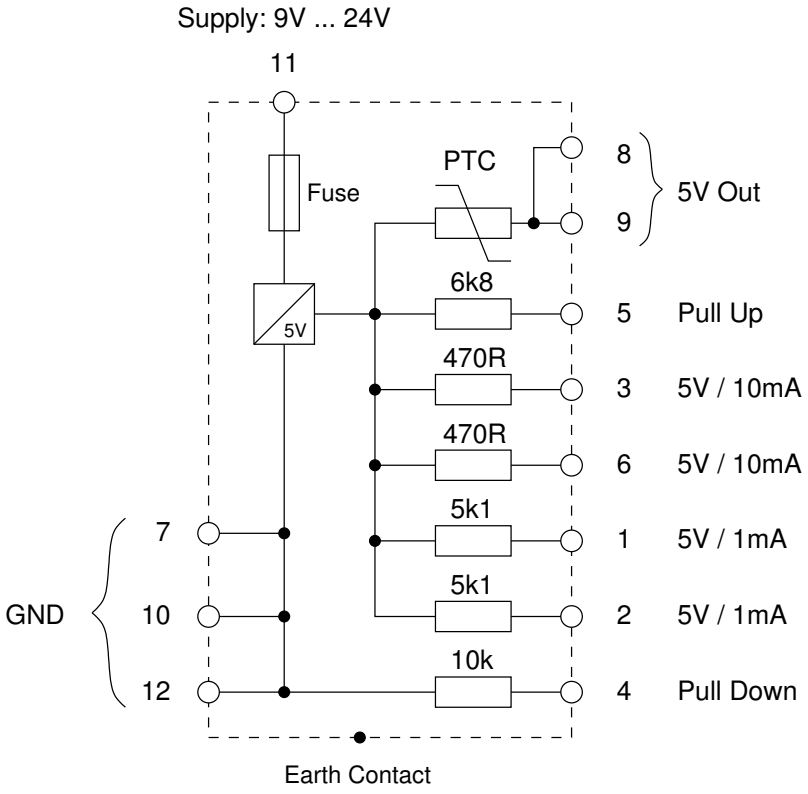


Figure 12.2: 5V External Module: Principle of Operation

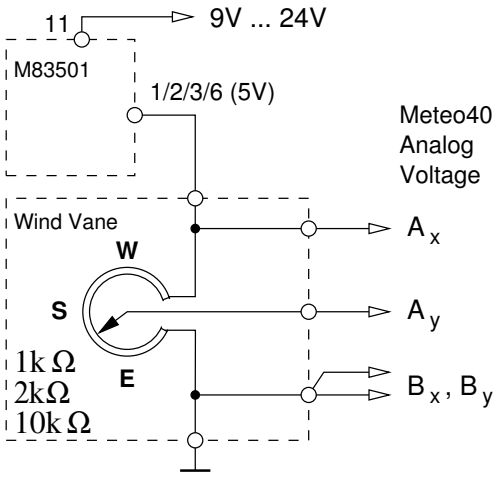


Figure 12.3: 5V External Module: Protection resistor for potentiometric wind vane (2k)

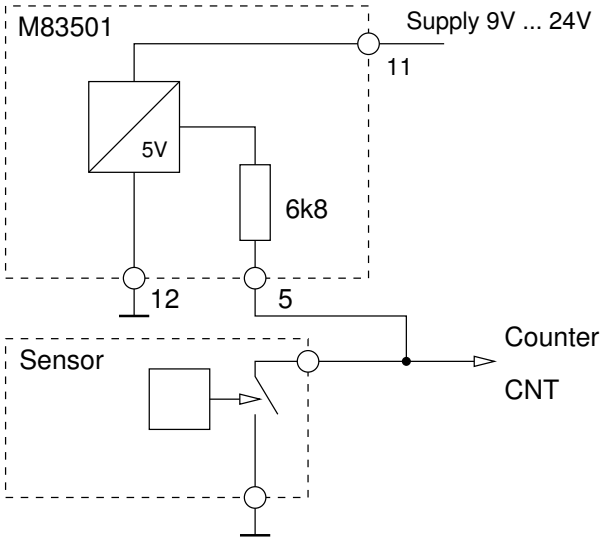


Figure 12.4: 5V External Module: Counter input with pull-up resistor (open collector)

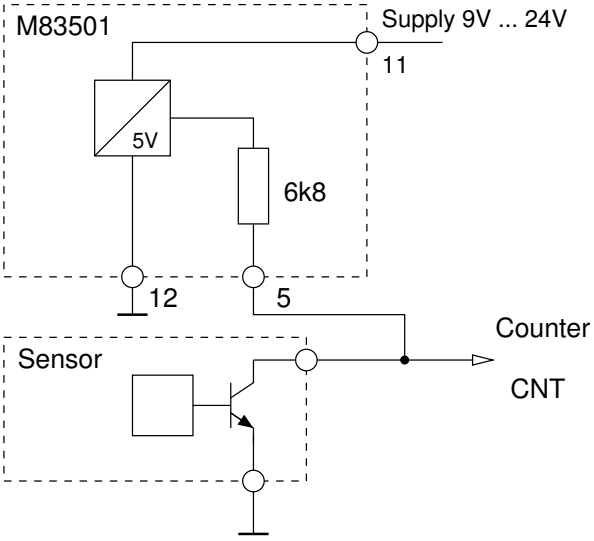


Figure 12.5: 5V External Module: Counter input with pull-up resistor (switch output)

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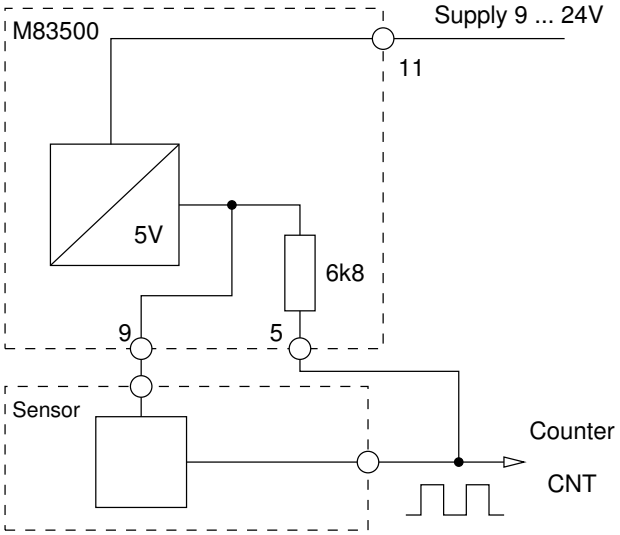


Figure 12.6: 5V External Module: Counter input with pull-up resistor (5V supply for sensor)

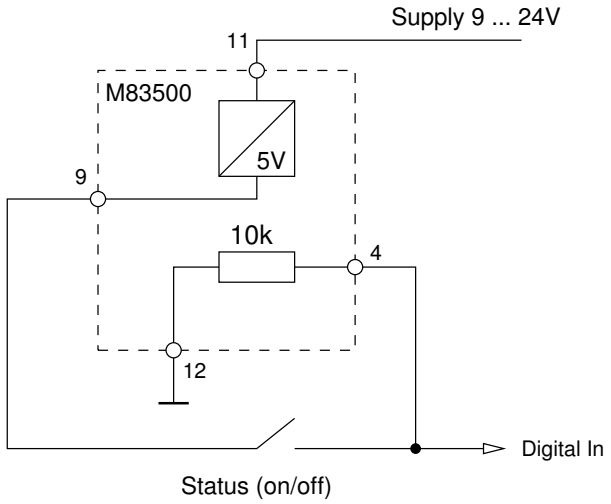


Figure 12.7: 5V External Module: Digital input with pull-down resistor

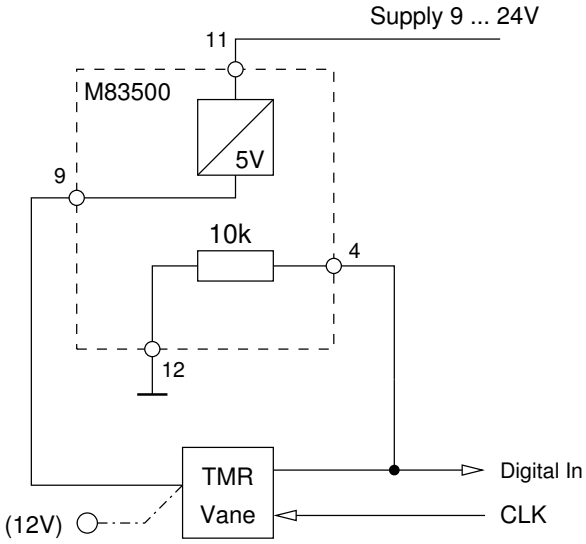


Figure 12.8: 5V External Module: Digital input with pull-down resistor (digital wind vane Thies TMR)

12.2 External Module RS485 (M83550)

- Biasing resistor for RS485 bus (680Ω)(configurable with jumpers)
- RS485 bus termination (120Ω) (switchable with jumpers)
- Over-voltage protection for all RS485 bus lines
- A stabilised and actively fuses 5V / 110mA output for general purposes
- Protected with fuse T0.8A (time-lag)
- Housing dimensions (width x height x depth): 22.5 x 110 x 115mm
- Operating temperature: -40°C ... +75°C

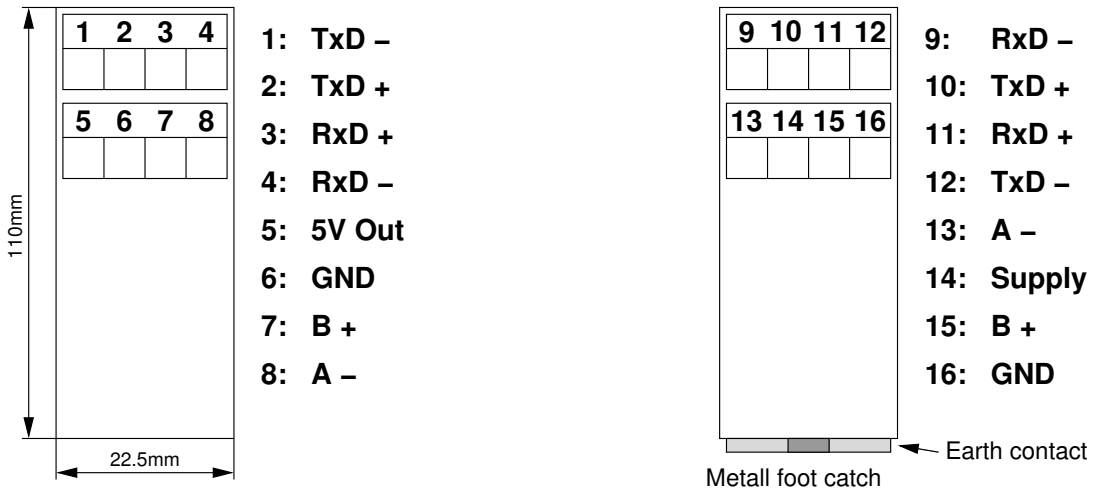


Figure 12.9: RS485 External Module: Pin Assignment

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Parameter	Min	Type	Max
Supply voltage	9V		24V
Quiescent current	7.5mA		18mA
Fuse		T0.5A (time-lag) (5 x 20mm)	
Output voltage	4.9V	5.0V	5.2V
Output current (ϑ = 25°C)			110mA
Bus termination		120Ω	
Biasing resistors		680Ω	

Table 12.2: Electrical Characteristics



Note
For further details about the RS485 external module refer to the data sheet on the Ammonit Website (`http://www.ammonit.com/`).

Jumper	Description	RS485-M (Master)	RS485-S (Slave)
JP1	Pull-up B+	on	
JP2	Termination B+/A-	off	
JP3	Pull-down A-	on	
JP4	Pull-up RxD +		off
JP5	Termination RxD		off
JP6	Pull-down RxD -		off
JP7	Pull-up TxD +		off
JP8	Termination TxD		off
JP9	Pull-down TxD -		off

Table 12.3: Jumper Settings

12.2.1 RS485-M (Master)

Half duplex interface (2-wire)

The purpose of the RS485 external module is to provide a universal interface for different types of RS485 sensors of different manufacturers. In order to have this flexibility, biasing resistors (680Ω) for the B+ line and the A- line are included in the module. Figure 12.10 shows the half duplex RS485 interface with the module working on lines B+ and A-.

To have active biasing resistors, jumpers JP1 and JP3 are set by default.

Additionally a termination resistor of 120Ω may be set via jumper JP2. This is not needed in conjunction with Meteo-40. Therefore, the module is delivered with an open jumper JP2.

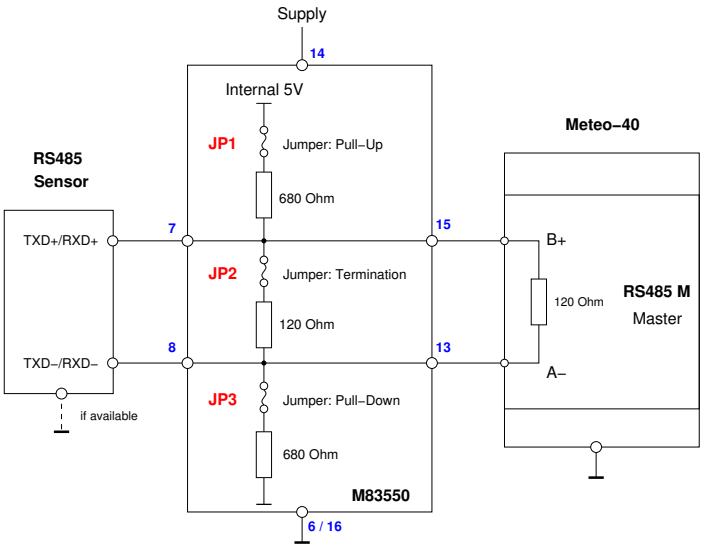


Figure 12.10: RS485 External Module: RS485-M (Master, half duplex interface)

Up to 8 sensors can be connected (see Figure 12.11).

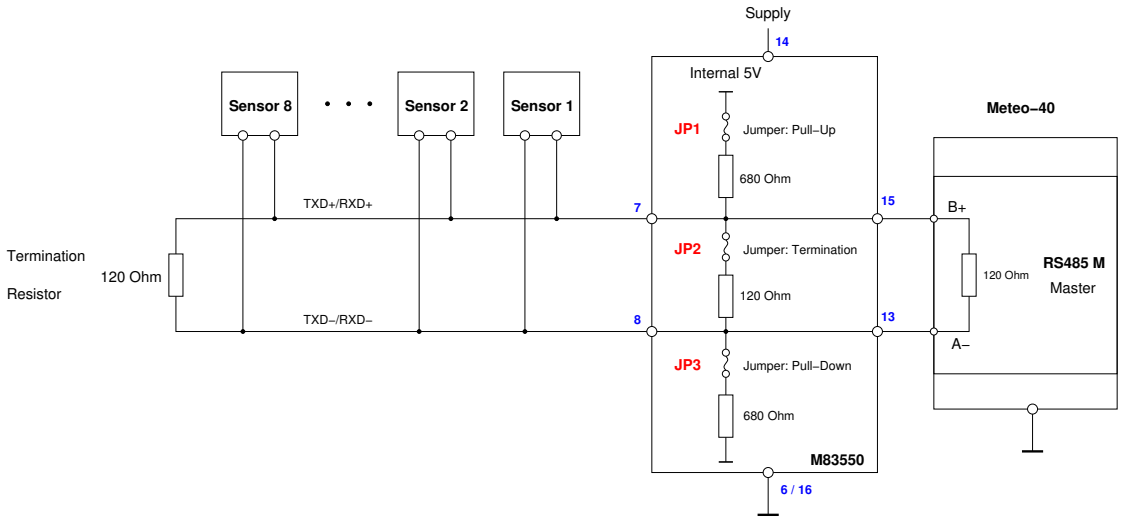


Figure 12.11: RS485 External Module: Example for up to eight RS485 sensors

12.2.2 RS485-S (Slave) - SCADA setup (full duplex)

Full duplex interface (4-wire) - SCADA

Figure 12.12 shows the setup of a SCADA system. The Meteo-40 data logger is connected to the SCADA client via the full duplex interface (Slave).

If biasing on the full duplex (Slave) interface is needed, the jumpers JP4, JP6, JP7 and JP8 have to be set additionally.

Up to eight sensors can be connected to the half duplex interface (Master) of the Meteo-40.

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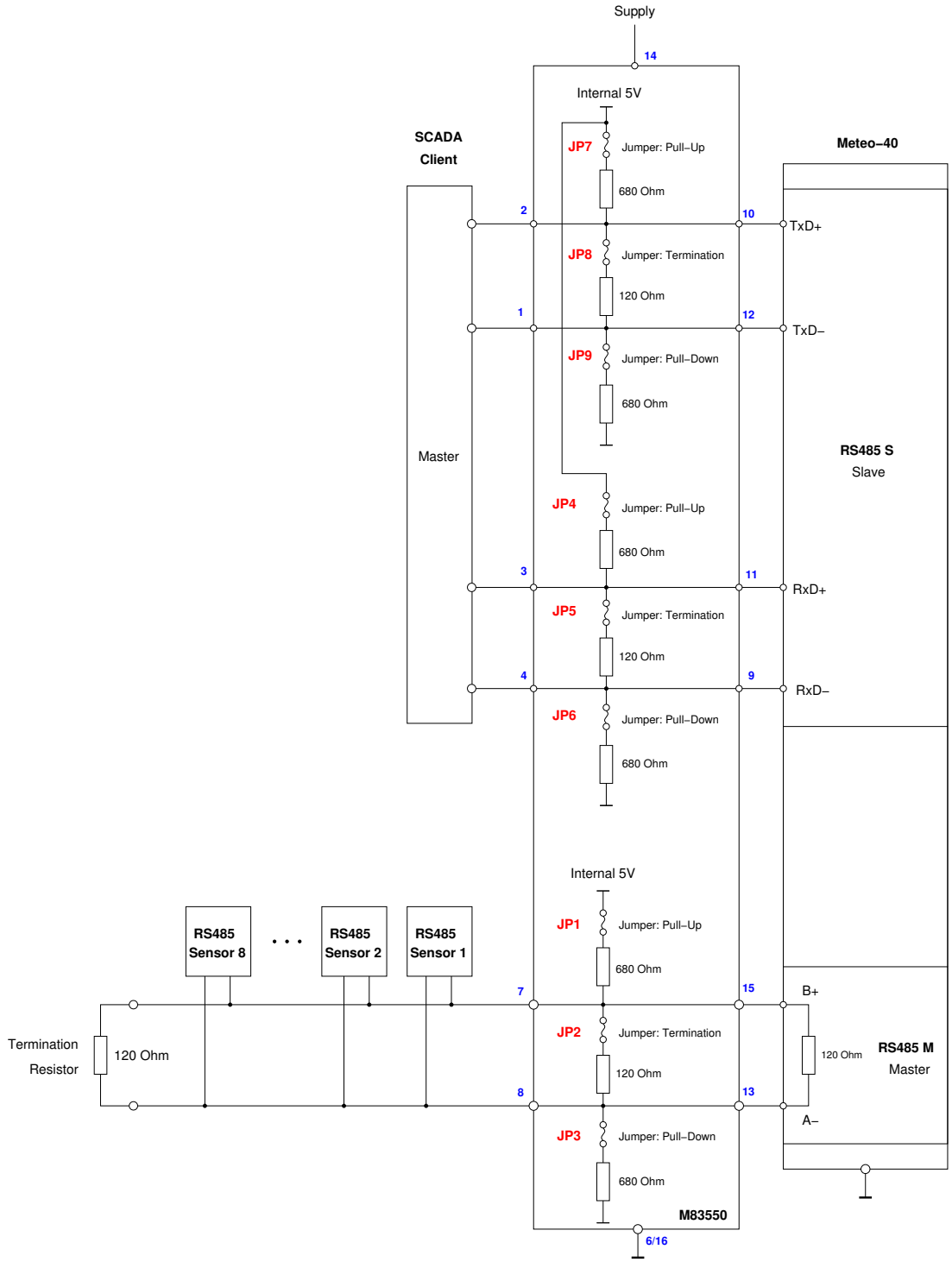


Figure 12.12: RS485 External Module: RS485-S (Slave, full duplex interface)

12.2.3 SCADA Setup (half duplex)

Half duplex (2-wire) SCADA client

Figure 12.13 shows a SCADA setup using a half duplex interface at the SCADA client.

In order to connect the SCADA client to the Meteo-40 slave interface, an additional converter (e.g. Comm-Front RPT-485_422-2) has to be applied.

The converter can be supplied by the 5V output of the module (Pin 5).

The master interface has the same setup as shown in Figure 12.12.

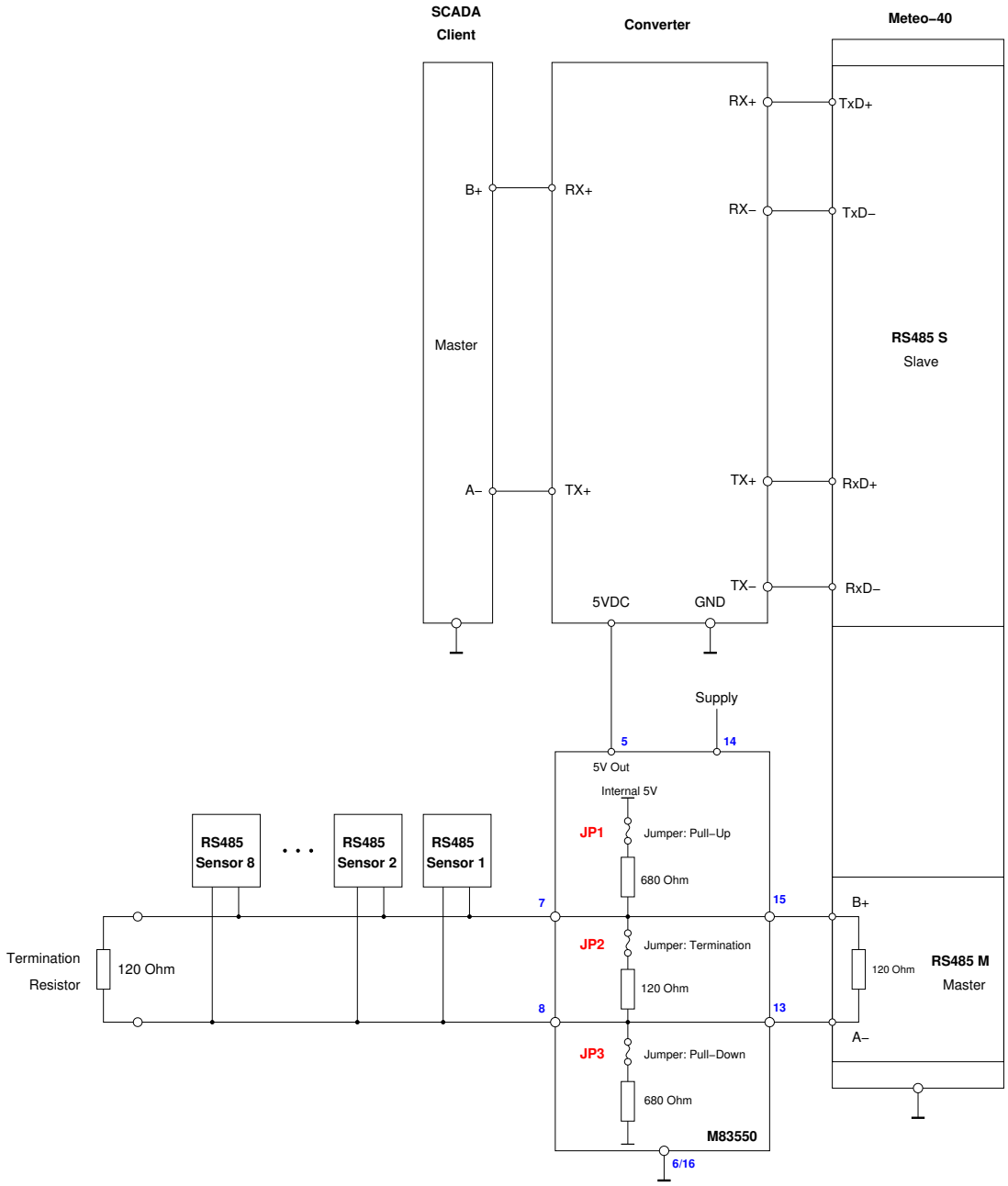


Figure 12.13: RS485 External Module: SCADA setup

When using the Comm-Front RPT-485_422-2 exernal device, its jumpers must be set as follows:

2-wire: 1, 2, 3 ON; 4 OFF
4-wire: 1, 2, 3, 4 OFF

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Chapter 13

Electrical Connection Plans

The following connection plans explain how to connect Meteo-40 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 want to connect, is not listed in this manual, refer for technical details and connection plans to the datasheets on our website (www.ammonit.com (`http://www.ammonit.com`)) or contact our sales team (+49-30-6003188-0 or info@ammonit.com).

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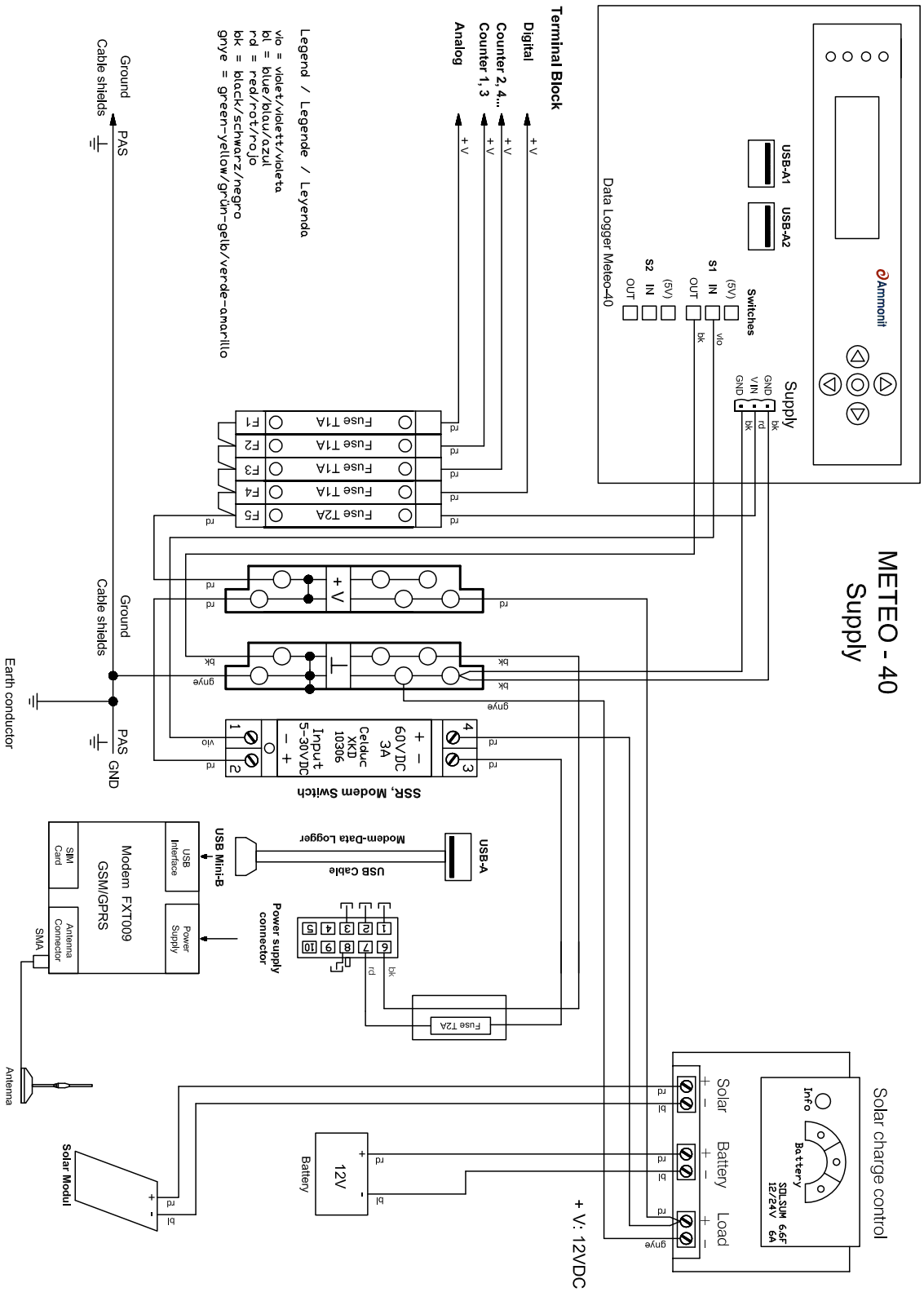


Figure 13.1: Meteo-40 Supply incl. Modem

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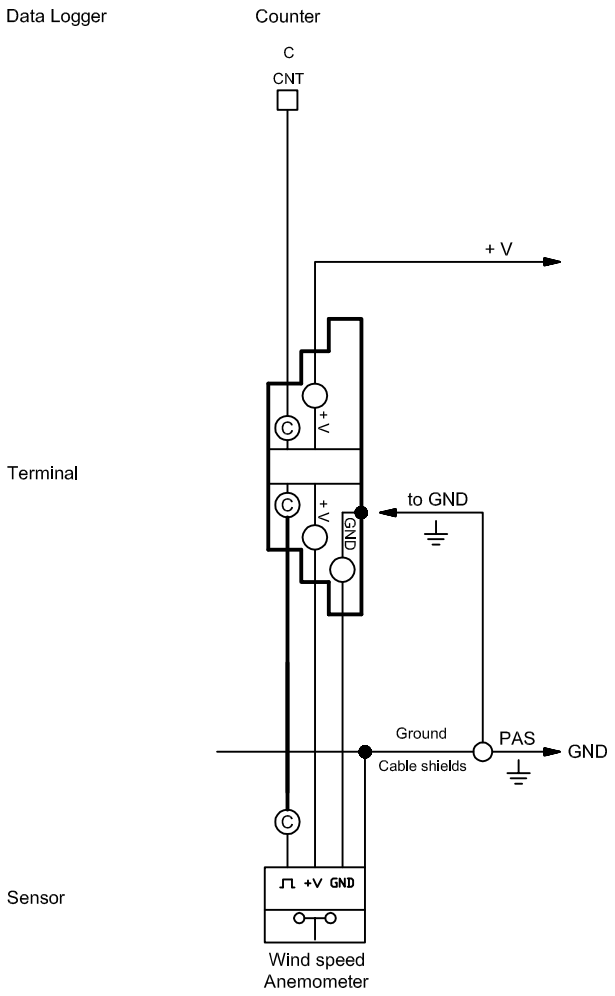


Figure 13.2: Electrical Connection Plan: Anemometer

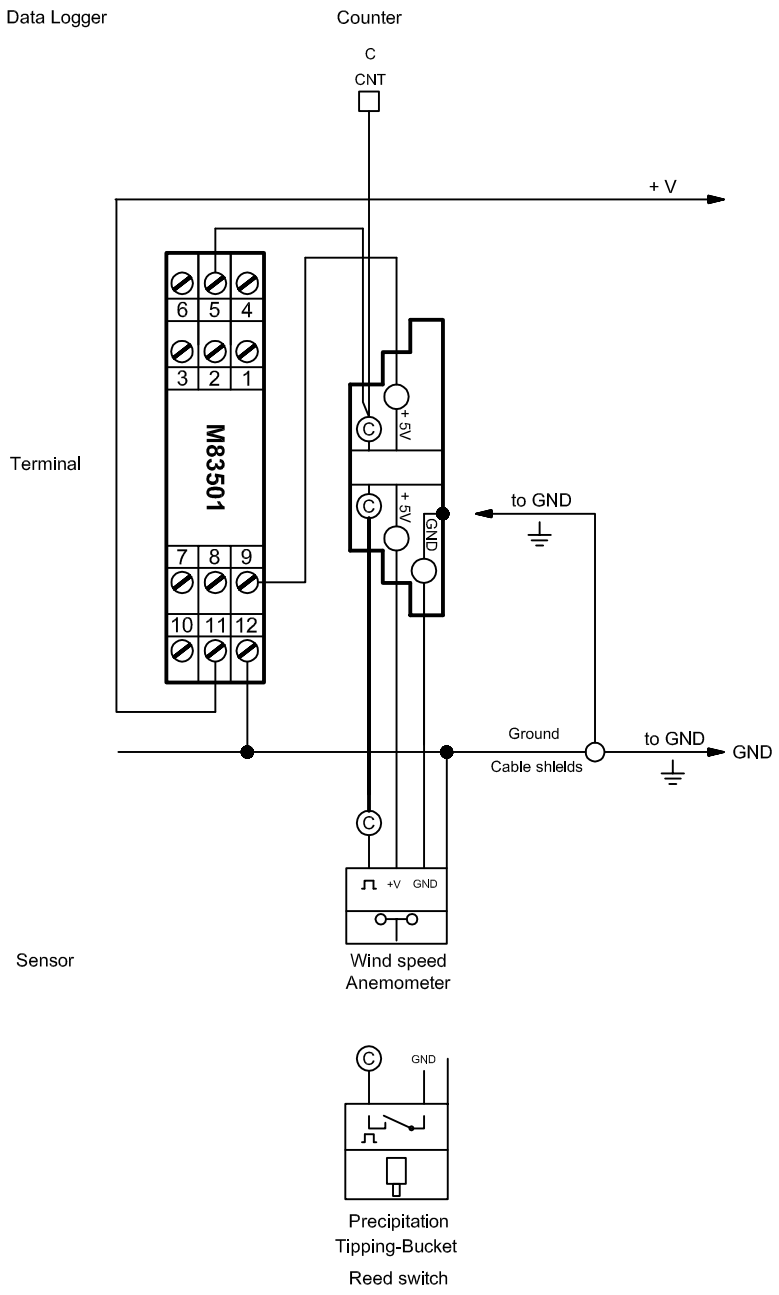


Figure 13.3: Electrical Connection Plan: Anemometer / Precipitation via M83501

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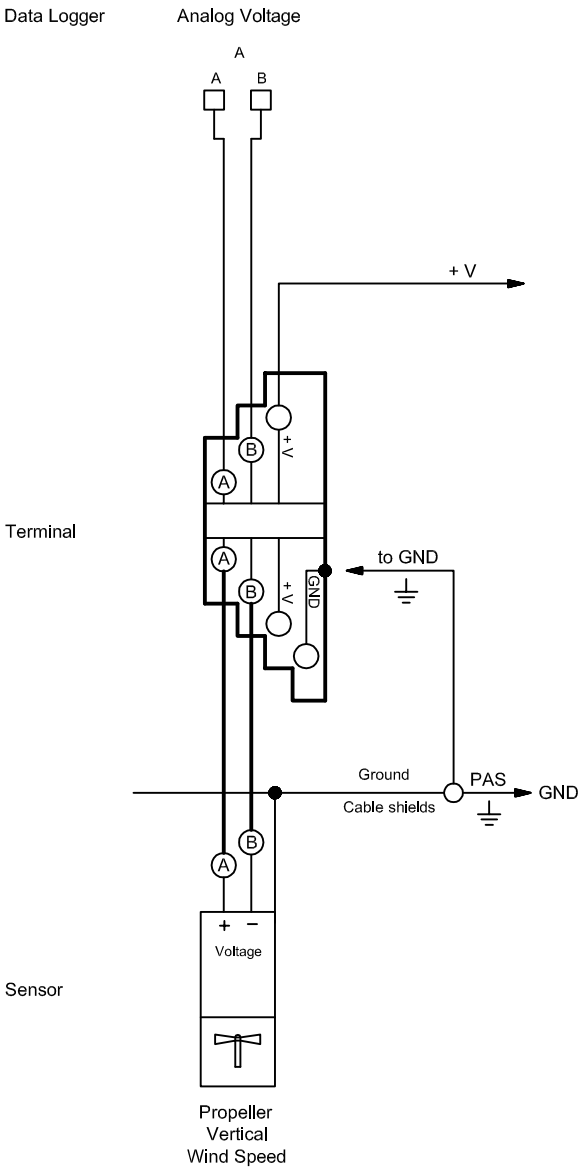


Figure 13.4: Electrical Connection Plan: Propeller Anemometer Gill

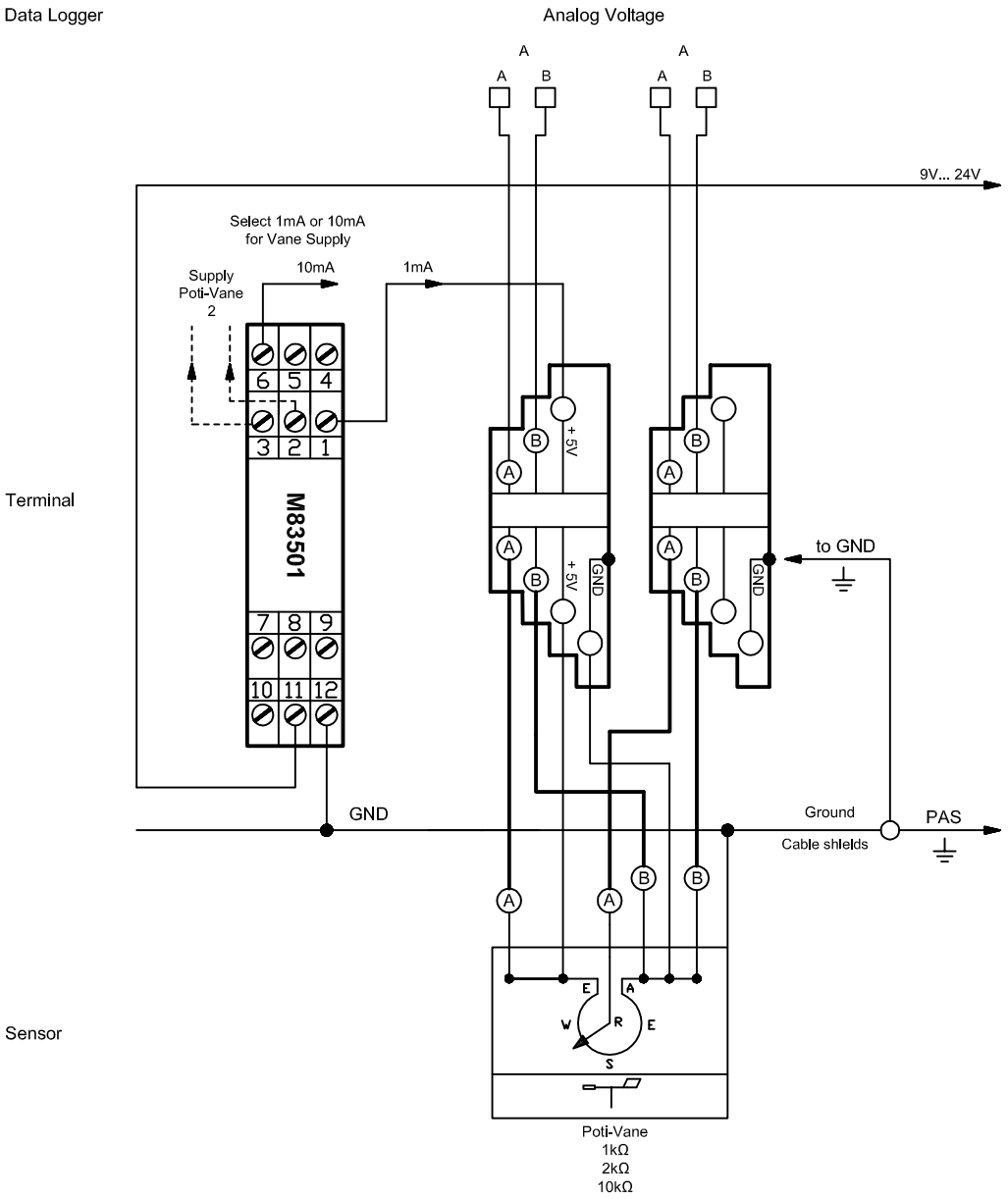


Figure 13.5: Electrical Connection Plan: Wind Vane POT

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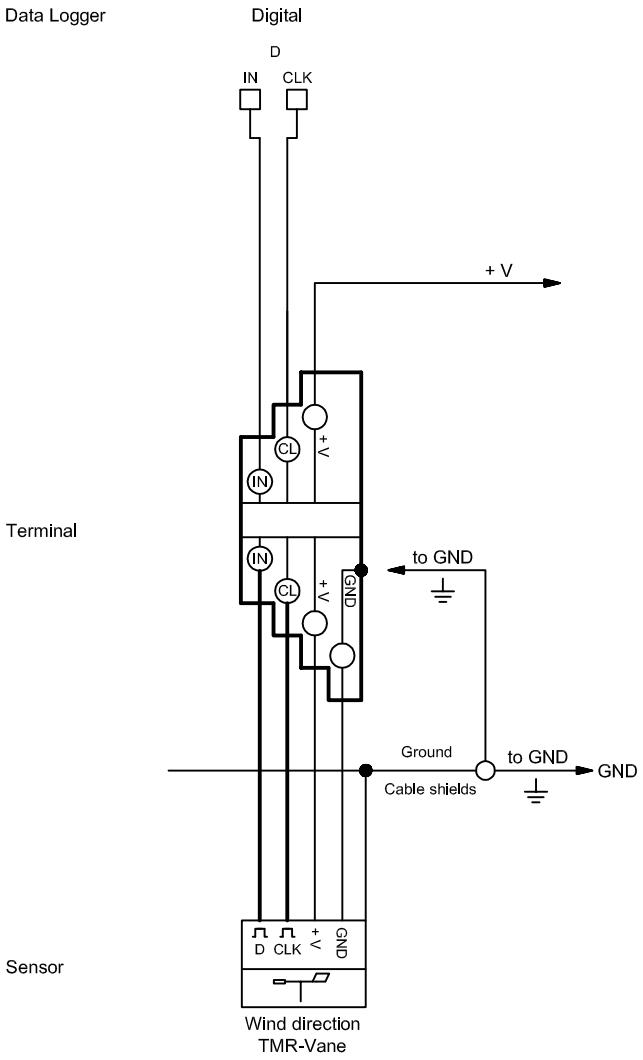


Figure 13.6: Electrical Connection Plan: Wind Vane TMR

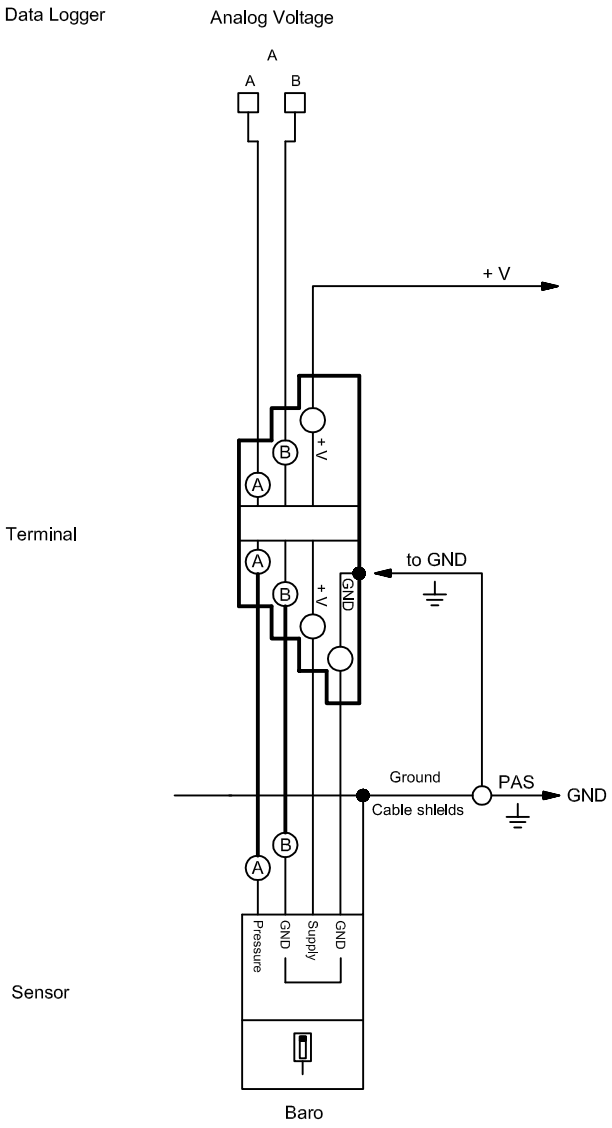


Figure 13.7: Electrical Connection Plan: Barometric Pressure Sensor

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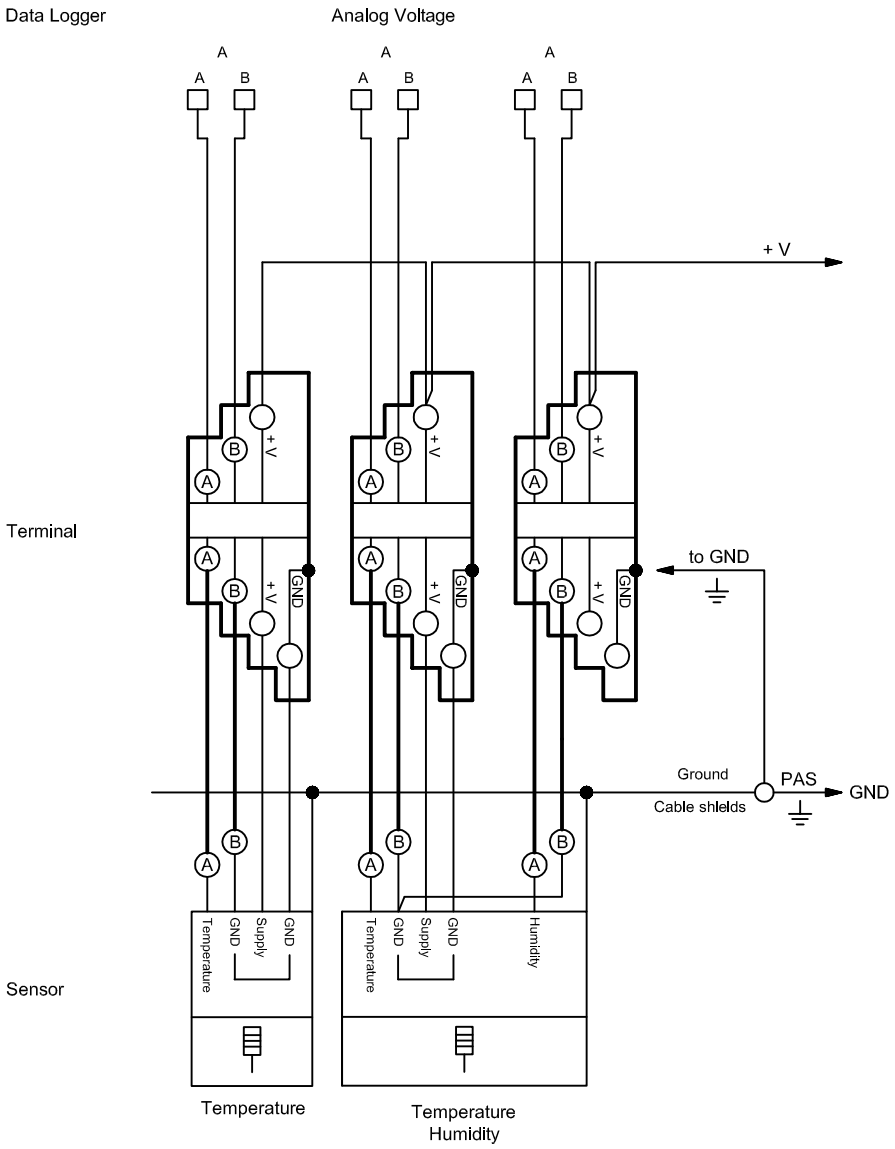


Figure 13.8: Electrical Connection Plan: Temperature Sensor and Temperature Humidity Sensor

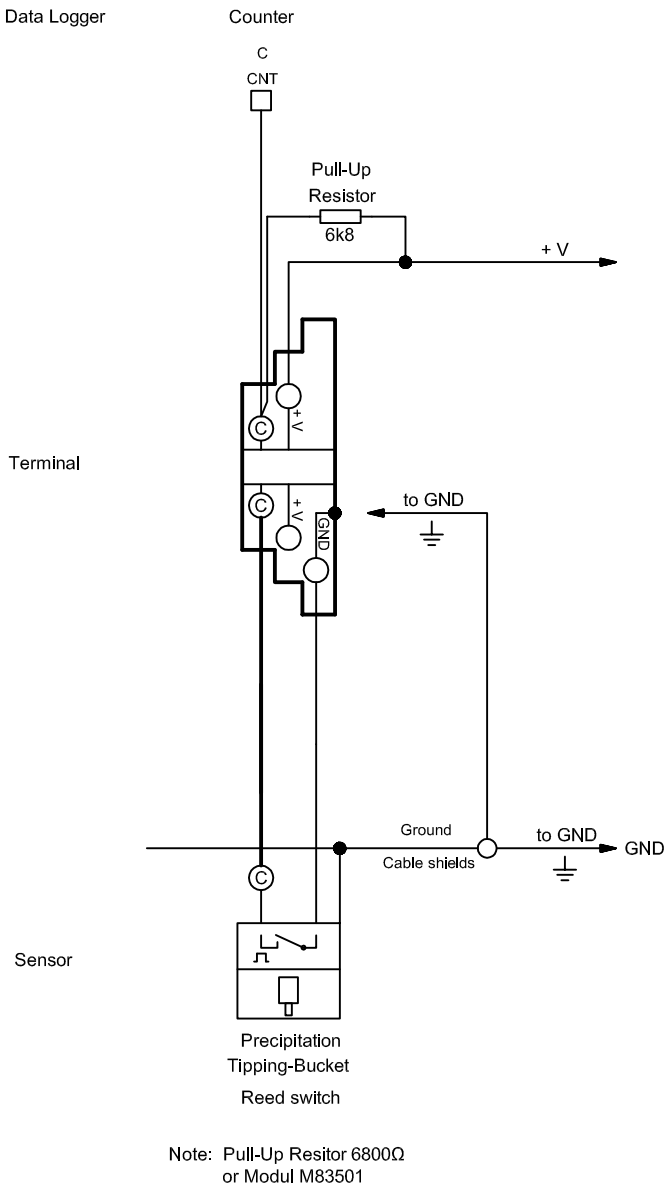


Figure 13.9: Electrical Connection Plan: Precipitation Sensor

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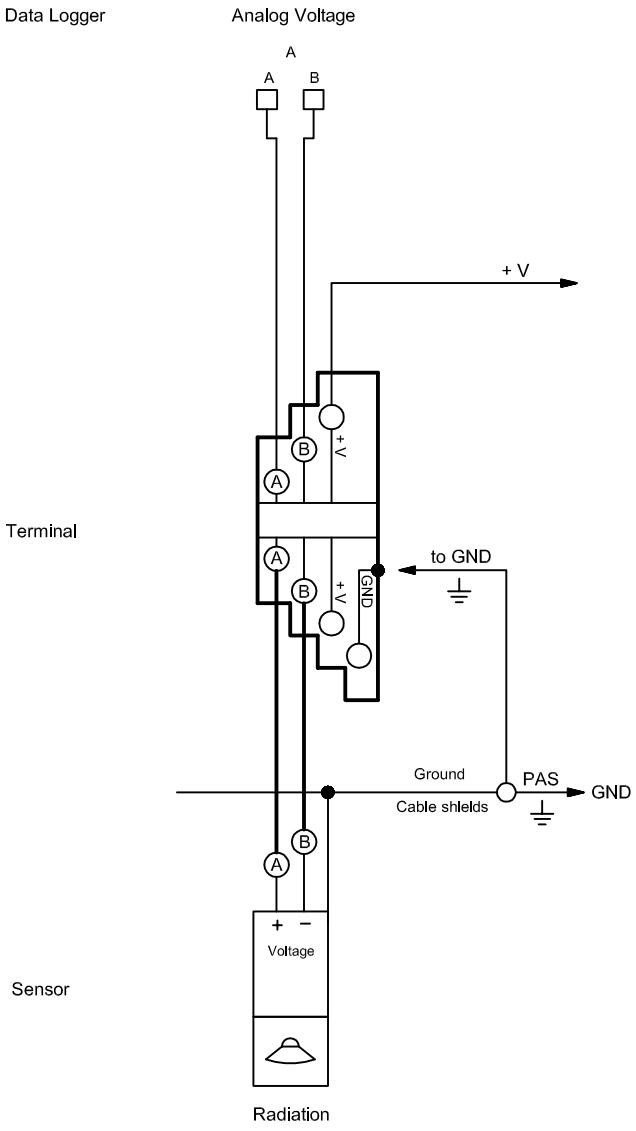


Figure 13.10: Electrical Connection Plan: Pyranometer

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Chapter 14

Cryptographical Software

Ammonit implemented certain standard cryptographical software to protect sensitive measurement data. None of the algorithms are developed by Ammonit. All cryptographical 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 (RS 2048 bit) to AmmonitOR or your own server

In the near future we will encrypt emails, which are sent by the data logger.



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	Algorithms
HTTPS	All access to the user interface of the 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 realised 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: Cryptographical Software

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Chapter 15

Maintenance and Care

In order to ensure that your Meteo-40 data logger works 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-Dxxxxxx.txt in menu System → Information) and the system log (syslog.txt in menu System → System Log) and send both on request to Ammonit.

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°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 the Ammonit website (`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. Please contact us, 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 it, 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.

15.2.1 Grounding of Sensors

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Chapter 16

Frequently Asked Questions

Please find in this chapter a summary of frequently asked questions.

If you do not find the answer to your specific question in this chapter, please 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. 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. See Section 9.1.
The red LED light is turned on. What does it indicate?	It indicates that an error in the measuring operation occured. For details see System → System Log 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 a USB Ethernet adapter available. How can I connect Meteo-40 to the LAN?	As Meteo-40 has no Ethernet port, a USB Ethernet adapter is required. Use the USB Ethernet adapter included in the delivery.
Meteo-40 is connected to the LAN. After entering the IP address of Meteo-40 in my browser, I receive an error message.	• Meteo-40 is switched off. The web interface can only be access when Meteo-40 is switched on, rep. the CECS has to be on. • Make sure, Meteo-40 and your PC are within the same LAN. • A static IP address is configured, which does not exist in your current LAN. Connect the data logger via USB and change the LAN settings. See Section 7.5.
Meteo-40 is connected via USB to a Windows PC and is not recognized.	Download and install the required driver file. See Section 2.3.
Which cable I have 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.

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16.2 Remote Communication

16.2.1 Modem

Question	Answer
After configuring and connecting the modem Sierra Wireless FXT009, the connection cannot be established.	• 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 7.7.5). • Check the power supply of the modem. A small red light indicates that the modem is running. • Make sure that you configured the SIM card's provider details in the provider settings. Use the *Provider helper* (see Section 7.7.1), 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. • 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. • Make sure that you use a SIM card / rate, which supports mobile Internet.
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.	Deselect the checkbox *Modem online, when CECS is on* 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.
How do I connect a BGAN satellite modem?	As BGAN modems are connected via Ethernet, you require an USB Ethernet adapter and you have to assign a *LAN switch* (see Section 7.5). The modem itself has to be configured using the software provided by its manufacturer.

16.2.2 Ammonit Tunnel

Question	Answer
After entering the URL of the tunnel connection, a message is displayed which states that the tunnel is not responding.	• 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 7.1).  **Tip** If you use AmmonitOR to monitor your data logger, you can check when the logger is scheduled to be online. • The data logger is busy, e.g. performing an upgrade, uploading files. Try to access the tunnel connection a few minutes later. • Another user is logged in and is downloading data files. Try to access the tunnel connection a few minutes later.

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Question	Answer
The entered URL seems to be wrong.	A *Tunnel affix* has been entered. Thus the URL has been changed. **Tip** If you use AmmonitOR to monitor your data logger, you can access the Meteo-40 web interface via the displayed URL in our AmmonitOR account.

16.3 Firmware Upgrade

Question	Answer
Do I have to be on site to perform an upgrade?	No, you can start the upgrade via remote access (tunnel connection), e.g., when the data logger is scheduled to be online.
My data logger is not connected to the Internet; how can I perform an upgrade?	In order to perform an upgrade, the data logger has to be connected to the Internet.
Do I have to install all upgrades?	We recommend installing all available upgrades to benefit from new features and to fix recent problems.
During the download process the connection was interrupted? Do I have to restart the download process?	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.
How does the installation process affect the recording of the MARS?	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.

16.4 Data: Transfer and Download

Question	Answer
Which methods are available to transfer data files?	• Upload data files via SCP/FTP connection to a server of your choice or the AmmonitOR installation on your server (see Section 7.4). • Upload data files via SCP to your AmmonitOR account on the Ammonit server (AmmonitOR project key is required, see Section 7.4). • Sent data files to an email account (see Section 7.2). • Manual download of CSV files via the Meteo-40 web interface. • Manual download of CSV files on pre-configured USB memory on site (see Section 4.2).
If no Internet connection is available on site, can I download data files?	Yes, you can download the statistics using a pre-configured USB memory stick. Switch on the data logger and plug in the prepared USB memory stick. All generated CSV files will automatically be saved on the USB memory stick. See also Section 4.2.

Question	Answer
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 6.3.1) and has to be decompressed before you can use it. If you work with Microsoft Excel™, open the file as decribed in Section 6.3.1.3. If you work with LibreOffice or OpenOffice, use the settings decribed in Section 6.3.1.2.
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 Options in menu File. Under Advanced 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 importing data files. In order to import CSV files, click on From Text in menu Data and browse for the CSV file. Follow the instructions of the import wizard. For further details refer to Section 6.3.1.3.
I have an AmmonitOR installation on my server. How can I upload the data files to my server?	Select in the Communication → FTP/SCP menu for method *SCP* and enter the server settings and the project key for the directory.

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?	If the sensor is not given in the list, you can select *Other Sensor* in the *Sensor Helper* and configure channels, slope and offset values, measurement rate etc. manually. If the anemometer you want to install is not listed in the *Sensor Helper*, select *Anemometer* for the sensor type and *Generic Anemometer* for the sensor. The other values have to be configured manually. If the analog wind vane you want to install is not listed in the *Sensor Helper*, select *Wind Vane* for the sensor type and *Generic Analog Wind Vane* for the sensor. The other values have to be configured manually.  **Important** Only for the sensors listed in the *Sensor Helper*, Ammonit assures the correct calculation of the statistics! If you are unsure how to configure an unlisted sensor, contact the Ammonit support team.
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 *Sensor Helper*.

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Question	Answer
I have to configure a pyranometer, but it is only the *Sensitivity* given in the data sheet. Can I enter this parameter for the slope value?	Sensitivity is not equal to the slope value. You have to calculate the slope value using the formula described in Section 10.1.4.

16.5.2 Sensor Connection

Question	Answer
Where can I find a plan to connect a sensor?	• 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 describe in the data sheet you receive for each sensor bought from Ammonit. • If you ordered only the sensors without cables from Ammonit, refer to the data sheet by the sensor's manufacturer. In Chapter 13 is you can find the electrical connection plans for Meteo-40.
I have to install two potentiometric wind vanes, a barometric pressure sensor and a temperature humidity sensor. Which logger model is suitable?	The Meteo-40M model offers 8 analog voltage channels to connect two potentiometric wind vanes, a barometric pressure sensor and a temperature humidity sensor. If digital wind vanes TMR would be installed, which require only one digital channel each, the Meteo-40S model would be suitable, as well. **Note** 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.

16.6 Measurement

Question	Answer
Sensors are configured and connected, but the measurement is not recorded?	• The MARS is turned off. Connect Meteo-40 to the power supply to turn the MARS on. • In the status box *Recording* is swiched off. Click *Switch on* in the Meteo-40 web interface. • The configuration has not been saved after the last modification. Save the configuration and click *Switch on* for recording. After 20 min Meteo-40 automatically starts recording.

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Chapter 17

GNU General Public License

17.1 Preamble

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Chapter 18

Glossary

APN
Access Point Name

CDMA
Code Division Multiple Access

CECS
Configuration, Evaluation, and Communication System

CSV
Comma Separated Values

DHCP
Dynamic Host Configuration Protocol

FTP
File Transfer Protocol

GNU
GNU's Not Unix

GnuPG
GNU Privacy Guard

GPL
General Public License

GPRS
General Packet Radio Service

GSM
Global System for Mobile communications

HTTP
HyperText Transfer Protocol

HTTPS
HTTP Secure

IEEE
Institute of Electrical and Electronics Engineers

IP
Internet Protocol

LAN
Local Area Network

LCD
Liquid Crystal Display

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LED

Light-emitting diode

LGPL

Lesser General Public License

MARS

Measurement And Recording System

NTP

Network Time Protocol

PIN

Personal Identification Number

POT

Potentiometer - Measurement Principle, e.g., Wind vane POT

RNDIS

Remote Network Driver Interface Specification

SCADA

Supervisory Control and Data Acquisition

SCP

Secure Copy Protocol/Program

SIM

Subscriber Identity Module

SMS

Short Message Service

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

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Chapter 19

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