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

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

Caution

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

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



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

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

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

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Contents

1	Introduction	1
1.1	Opening Remarks	1
1.2	Overview of Meteo-40	1
1.3	Meteo-40 Series	2
1.4	The Two Systems of Meteo-40	4
1.4.1	CECS: Switch on / off behavior	6
1.5	Data Storage	6
1.6	User Interfaces	6
1.7	Communication Methods and Required Devices	7
2	Getting Started with Meteo-40	9
2.1	Introduction	9
2.2	Using Bonjour™ on Windows™	12
2.3	Connecting Meteo-40 via Ethernet to your LAN	13
2.4	Connecting Meteo-40 to your Windows 7™ PC via point-to-point Ethernet connection	15
2.4.1	Using link-local connection	15
2.4.2	Using static IP address	16
2.5	Connecting Meteo-40 with your Windows 7™, Windows Vista™ or Windows XP™ PC via USB	20
2.5.1	Standard RNDIS USB Driver	20
2.5.2	Driver Update	23
2.6	Connecting Meteo-40 to your Windows 8™ PC via USB	26
2.7	Using Meteo-40 with Linux	28
3	Login at Meteo-40	29
3.1	Login Options	29
3.2	Global Control Elements	30
3.3	Menu of the Web Interface	32
4	System Configuration	33
4.1	System Information	33
4.2	System Administration	35
4.3	Upgrade Data Logger Software	41
4.3.1	Upgrading Meteo-40 using a Smartphone	43

4.3.2	Software Upgrade Behind a Firewall	44
4.3.3	Offline Upgrade using USB Flash Drive	44
4.3.3.1	Prepare the Offline Upgrade	44
4.3.3.2	Performing the Offline Upgrade	45
4.4	The Device Page	45
4.4.1	Display Access	45
4.4.2	Connected USB Devices	46
4.4.3	USB Flash Drive Copy	47
4.4.4	Access to USB Drive Files	49
4.5	Using a Camera	49
4.6	Configuring Switches	51
4.6.1	Switch manager	52
4.7	Using the Logbook	53
4.7.1	Logbook Events	54
5	Measurement	55
5.1	Sensor Configuration	55
5.1.1	Difference between Sensors, Channels, and Evaluations	55
5.1.2	Configuring Sensors	55
5.1.3	Order of Sensors and Evaluations	57
5.1.4	Sensor Helper	57
5.1.5	RS485 Master Serial Console	58
5.2	Measurement Channels	60
5.3	Configuring the Evaluation	60
5.3.1	Evaluation Helper	61
5.3.1.1	Linear equation	61
5.3.1.2	Differential temperature	62
5.3.1.3	Density of moist air	62
5.3.1.4	Obukhov length	63
5.3.1.5	Obukhov stability parameter	63
5.3.1.6	Sensible heat flux	64
5.3.1.7	Inflow angle	64
6	Data Evaluation	65
6.1	Introduction	65
6.2	Live Data Page	65
6.3	Statistic Data Files	65
6.3.1	Configuring Statistics and CSV files	66
6.4	Secondary and Tertiary Statistics Files	68
6.4.1	Secondary Statistics Files	69
6.4.2	Tertiary Statistics Files	70
6.5	Gust Data Files	70

6.6	The CSV File Format	71
6.6.1	Ammonit Meteo-40 specific details	72
6.6.1.1	Data part (CSV format)	72
6.6.1.2	Information part (Ini file format)	74
6.6.2	CSV import in LibreOffice or OpenOffice	75
6.6.3	CSV Import in Microsoft Excel 2010™	76
6.7	Access to Source Data	81
7	Communication	83
7.1	Introduction	83
7.2	Configuring the Communication Schedule	85
7.3	Configuring Online Access	87
7.4	Configuration for using AmmonitOR	91
7.4.1	Authenticating Meteo-40 at your local AmmonitOR installation	93
7.5	Configuring Email Parameters	93
7.5.1	Signing and Encrypting Emails and Attachments	95
7.5.1.1	Working with Gpg4win to Decrypt and Verify Files on Windows™ PCs	96
7.5.1.2	Verifying digital signatures in the Windows Explorer™	99
7.5.1.3	Verifying digital signatures in Microsoft Outlook™	100
7.5.1.4	Decrypting files in the Windows Explorer™	102
7.5.1.5	Decrypting files in Microsoft Outlook™	104
7.6	Configuring FTP and SCP Parameters	105
7.7	Configuring LAN Parameters	106
7.7.1	Configuring a Static IP address in a LAN	107
7.8	Configuring W-LAN	108
7.9	Configuring the Modem	109
7.9.1	Using the Provider Helper	112
7.9.2	Short Message Service	113
7.9.2.1	Sending a Short Message	114
7.9.3	Working with Static IP SIM cards	114
7.9.4	Two Ways to Establish an Online Connection via Modem	114
7.9.5	Reset PIN Code of Locked SIM Card	115
7.9.6	Connecting a GSM/GPRS Modem to Meteo-40	115
7.9.6.1	Information on Modem Sierra Wireless Airline Fastback Extend EDGE FXT009	115
7.9.7	Connecting a BGAN Satellite Modem to Meteo-40	118
7.9.7.1	Pointing the terminal to the satellite	118
7.9.7.2	Configuring Meteo-40 with BGAN Satellite Modem	118
7.9.7.3	Recommended Settings for Satellite Connections	119
7.10	Troubleshooting	120
7.10.1	How to perform the test for tunnel and AmmonitOR	120

8	SCADA	121
8.1	Configuring Meteo-40 for SCADA	121
8.1.1	CECS power mode	122
8.1.2	Statistics selection	123
8.2	Meteo-40 and Modbus	124
8.2.1	Input Registers	127
8.2.2	Holding Registers	127
8.3	Cascading two Meteo-40 Data Loggers using RS485	129
8.3.1	Configuration of the slave or slaves	129
8.3.2	Configuration of the master	129
8.4	Replacing Meteo-32 Data Loggers used for SCADA	129
9	Using the Display	133
9.1	Assigning Permissions to Display Users	133
9.2	LED Lights	134
9.3	Navigating through the Display Menu	134
9.4	Menu: System	134
9.5	Menu: Status	135
9.6	Menu: Channels	135
9.7	Menu: Communication	138
10	Sensors	141
10.1	Sensors for Wind Resource Assessment and Wind Farm Monitoring	141
10.2	Sensors for Solar Resource Assessment	142
10.3	Other Sensors for Meteorological Purposes	143
10.4	Devices for Electrical Measurements	144
10.5	Anemometers	144
10.5.1	Propeller Anemometer Young	145
10.6	Wind Vanes	146
10.6.1	Digital Wind Vanes TMR	146
10.6.2	Wind Vanes with Potentiometer	147
10.6.3	Wind Vanes connected to RS485 bus	148
10.7	Ultrasonic Anemometers	148
10.7.1	NMEA V 2.0	149
10.7.2	Thies Ultrasonic Configuration Options	150
10.7.3	Lufft UMB Configuration Tool	150
10.7.4	Gill Wind Configuration Tool	151
10.8	Temperature Humidity Sensors	151
10.8.1	Resistance Temperature Detectors (RTD) / Pt100 / Pt1000	152
10.8.2	Temperature Humidity Sensors connected to RS485 bus	153
10.9	Barometric Pressure Sensors	153
10.9.1	Barometric Pressure Sensors connected to RS485 bus	154

10.10	Pyranometers	154
10.10.1	Pyranometer: Delta-T Sunshine SPN 1	155
10.11	Pyrheliometers	156
10.12	Sunshine Duration Sensors	157
10.13	Solar Trackers	157
10.14	Soiling Measurement	158
10.15	Rotating Shadowband Irradiometer	159
10.16	Precipitation Sensors (Rain Gauge)	159
10.17	Laser Precipitation Monitors	160
10.18	Other Sensors / Devices compatible with Meteo-40 RS485 bus	161
10.18.1	Configuring generic Modbus RTU sensors	161
10.19	Multifunction Transducer, Power Meters and other Electrical Measurement Devices	163
10.19.1	Sineax CAM Measuring Unit	163
10.20	Remote Sensing	164
10.20.1	ZephIR 300 Lidar	164
11	Channels	165
11.1	Connecting Sensors to Analog Voltage Channels	165
11.2	Connecting Sensors to Counter Channels	166
11.3	Connecting Sensors to Digital Channels	166
11.3.1	Functionality Check of Clock Output	166
11.4	Connecting Sensors to Analog Current Channels	168
11.5	Connecting Sensors to Current Source	169
11.6	Connecting Sensors to RS485 M	169
12	Technical Data	171
12.1	Specification	171
12.2	Electrical Characteristics	172
12.2.1	Electrical Specifications of Analog Voltage Channels / Differential Inputs	173
12.2.2	Electrical Specifications of Analog Current Channels / Differential Inputs	173
12.2.3	Electrical Specifications of Counter Channels / Non-Differential Inputs	174
12.2.4	Electrical Specifications of Digital Channels (Serial Input / Output)	174
12.2.5	Electrical Specifications for Digital Clock Output	174
12.2.6	Electrical Specifications for Analog Current Source	175
12.2.7	Electrical Specifications for Switches	175
12.2.8	Electrical Specifications of the 5V Output	175
12.2.9	Electrical Specifications of the RS485 Interface	175
12.2.10	Electrical Specification of the Ethernet Interface	176
12.2.11	Electrical Specification of the RS232 Interface	176
12.2.12	Electrical Specification of the Power Supply	176
13	Electrical Connection Plans	179

14	Cryptographic Software	197
15	Maintenance and Care	199
15.1	Operation and Storage	199
15.2	Overvoltage / Lightning Protection	199
16	Frequently Asked Questions	201
16.1	Local Communication	201
16.2	Remote Communication	202
16.2.1	Modem	202
16.2.2	Ammonit Tunnel	203
16.3	Firmware Upgrade	204
16.4	Data: Transfer and Download	204
16.5	Sensor: Configuration and Connection	205
16.5.1	Sensor Configuration	205
16.5.2	Sensor Connection	206
16.6	Measurement	206
16.7	Errors and Messages	207
	Release Notes	209
1.7.6	(2017-07-25)	209
1.7.4, 1.7.5	(2017-06-12)	209
1.7.3	(2017-06-09)	209
1.7.2	(2017-06-07)	209
1.7.1	(2017-05-15)	210
1.7	(2017-05-12)	210
1.6.3	(2017-02-28)	210
1.6.2	(2017-02-14)	210
1.6.1	(2016-12-20)	210
1.6	(2016-11-14)	211
1.5.10	(2016-08-01)	211
1.5.9	(2016-07-06)	212
1.5.8	(2016-04-14)	212
1.5.7	(2016-03-07)	212
1.5.6	(2016-02-24)	212
1.5.5	(2016-01-14)	213
1.5.4	(2016-01-13)	213
1.5.3	(2015-12-07)	213
1.5.2	(2015-12-03)	213
1.5.1	(2015-11-26)	214
1.5	(2015-11-25)	214
1.4.3	(2015-08-18)	214

1.4.2 (2015-08-04)	214
1.4.1 (2015-07-23)	214
1.4 (2015-07-16)	215
1.3.4 (2015-05-11)	215
1.3.3 (2015-03-31)	215
1.3.2 (2015-02-16)	215
1.3.1 (2015-02-06)	215
1.3 (2015-02-04)	215
1.2.4 (2014-11-12)	216
1.2.3 (2014-11-05)	216
1.2.2 (2014-10-20)	216
1.2.1 (2014-09-22)	216
1.2 (2014-09-08)	216
1.1 (2014-08-14)	217
1.0.1 (2014-06-10)	217
1.0 Rev. 14683 (2013-12-19)	217
1.0 Rev. 14324 (2013-11-08)	218
1.0 Rev. 13947 (2013-09-23)	218
1.0 Rev. 13863 (2013-09-12)	218
1.0 Rev. 13749 (2013-09-04)	218
1.0 Rev. 13645 (2013-08-23)	218
1.0 Rev. 13187 (2013-07-01)	219
1.0 Rev. 12696 (2013-05-16)	219
1.0 Rev. 12454 (2013-04-24)	219
1.0 Rev. 11982 (2013-01-22)	219
1.0 Rev. 11900 (2012-12-19)	219
1.0 Rev. 11669 (2012-11-19)	220
1.0 Rev. 11587 (2012-11-05)	220
1.0 Rev. 11317 (2012-10-08)	220
1.0 Rev. 11236 (2012-09-21)	220
1.0 Rev. 11181 (2012-09-11)	220
1.0 Rev. 11031 (2012-08-27)	220
1.0 Rev. 10769 (2012-07-25)	221
1.0 Rev. 10627 (2012-07-12)	221
1.0 Rev. 10474 (2012-06-29)	221
1.0 Rev. 10244 (2012-06-15)	221

GNU General Public License	223
Preamble	223
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION	223
Section 0	223
Section 1	224
Section 2	224
Section 3	224
Section 4	225
Section 5	225
Section 6	225
Section 7	225
Section 8	226
Section 9	226
Section 10	226
NO WARRANTY Section 11	226
Section 12	226
How to Apply These Terms to Your New Programs	227
17 Glossary	229
18 Index	232

List of Figures

1.1	Overview of Meteo-40L	2
1.2	Meteo-40L Terminal	3
1.3	Meteo-40M Terminal	4
1.4	Meteo-40S Terminal	4
1.5	Block diagram of Meteo-40	5
2.1	Accessing Meteo-40 via LAN (see Section 2.3)	10
2.2	Accessing Meteo-40 via Point-to-Point Ethernet Connection (see Section 2.4)	10
2.3	Accessing Meteo-40 via USB-B (see Section 2.5)	11
2.4	Ethernet / USB ports of Meteo-40L	12
2.5	Meteo-40 web interface initial screen	13
2.6	Firefox Connection Untrusted alert page	14
2.7	Add Security Exception	14
2.8	Meteo-40 web interface initial screen	15
2.9	Meteo-40 display with activated link-local connection	16
2.10	Network and Sharing Center of Windows 7™	16
2.11	LAN Connection Status	17
2.12	Properties of LAN Connection	17
2.13	Properties of Internet Protocol	18
2.14	Meteo-40 display with activated link-local connection	18
2.15	Mozilla Firefox Connection Untrusted Alert Page	19
2.16	Add Security Exception	19
2.17	Meteo-40 web interface initial screen	20
2.18	Windows Driver Software Installation	21
2.19	Windows Driver Update Installation	21
2.20	Windows Device Manager	21
2.21	Firefox Connection Untrusted alert page	22
2.22	Add Security Exception	23
2.23	Meteo-40 web interface initial screen	23
2.24	New USB Ethernet/RNDIS Gadget in Device Manager	24
2.25	Update Driver Software dialog box	24
2.26	Update Driver Software dialog box	25

2.27	Windows Security Advisory	25
2.28	Windows Device Manager	26
2.29	Windows 8 PC settings (1)	26
2.30	Windows 8 PC settings (2)	27
2.31	Windows 8 PC settings (3)	27
2.32	Windows 8 PC settings (4)	28
3.1	Login Screen	29
3.2	Meteo-40 Status Box displaying Status of Recording	31
3.3	Meteo-40 Status Box displaying Connection and Power Mode	31
4.1	System Information Page	34
4.2	Assigning a Data Logger Name	35
4.3	Configuring the <i>CECS always active</i> Power Mode	36
4.4	Configuring Date, Time and Location of the Data Logger	37
4.5	Data Logger Location displayed in Google Earth™	38
4.6	Changing Passwords	38
4.7	Signing and Encryption	39
4.8	Allow Manufacturer Administration	40
4.9	Deleting All Measurement Data	40
4.10	Factory Reset	41
4.11	System Upgrade	42
4.12	System Upgrade	43
4.13	Settings for Firmware Upgrade via Tethering	43
4.14	Tethering Settings of an Android™ smartphone	44
4.15	Press the right arrow button	45
4.16	Reading the image	45
4.17	Successful upgrade	45
4.18	Remote Display	46
4.19	Display Settings	46
4.20	Configuring the USB Flash Drive Copy	47
4.21	Formatting the USB flash drive (Windows™ PC)	47
4.22	Camera Image	50
4.23	Attaching Camera Images	51
4.24	Switch Configuration	52
4.25	Switch Manager	53
4.26	Logbook	54
5.1	Sensor Definitions	56
5.2	Sensor Helper with Sensor Settings	58
5.3	RS485-M Serial Console	59
5.4	Measurement Channels Overview	60

5.5	Screenshot of the Configuration for the Evaluation	61
5.6	Evaluation for Differential Temperature	62
5.7	Evaluation for Air Density	63
6.1	Downloading Statistics	66
6.2	Configuring the Statistics	67
6.3	Vectorial Calculation for the Wind Direction	68
6.4	Statistics Configuration Page	68
6.5	Secondary Statistics Page	69
6.6	Tertiary Statistics Page	70
6.7	Gust Data Calendar	71
6.8	Gust Evaluations Selection	71
6.9	LibreOffice CSV-file import settings	76
6.10	Microsoft Excel 2010™ CSV Import (1)	77
6.11	Microsoft Excel 2010™ CSV Import (2)	78
6.12	Microsoft Excel 2010™ CSV Import (3)	78
6.13	Microsoft Excel 2010™ CSV Import (4)	79
6.14	Microsoft Excel 2010™ CSV Import (5)	80
6.15	Microsoft Excel 2010™ CSV Import (6)	80
6.16	Microsoft Excel 2010™ Format Cells	81
6.17	Screenshot of the Source Data Page	82
7.1	Configuring the Schedule	86
7.2	Communication between Meteo-40 and PC via Ammonit Tunnel Server	88
7.3	Configuring the Online Access	88
7.4	Entering the Tunnel Access Code	90
7.5	Communication via Ammonit Tunnel (closed tunnel)	91
7.6	AmmonitOR Settings	92
7.7	Connection Log in AmmonitOR	93
7.8	Configuring Email Parameters	95
7.9	Importing the Public key into Gpg4win	97
7.10	Creating the private key	97
7.11	Certifying the Public key	98
7.12	Verifying the Fingerprint	98
7.13	Trusted Certificates	99
7.14	Verifying signed files	99
7.15	Successfully verified signature	100
7.16	Verifying files in Microsoft Outlook™	100
7.17	Verifying signatures in Microsoft Outlook™	101
7.18	Successful validation of the signature	101
7.19	Verifying signed test mails	102
7.20	Decrypting files via the GpgEx plug-in for Windows Explorer™	102

7.21	Decryption via Kleopatra Software	103
7.22	Password Prompt for Decryption	103
7.23	Successful File Decryption	104
7.24	GgpOL add-in in Microsoft Outlook™	104
7.25	Configuring the FTP/SCP Parameters	105
7.26	Configuring LAN parameters	107
7.27	Configuring a Static IP Address in a LAN	108
7.28	Configuring W-LAN Parameters	109
7.29	Modem Configuration	110
7.30	Meteo-40 Provider Helper	113
7.31	Settings for Short Message Service	113
7.32	Inserting SIM Card into modem Fastback Extend EDGE FXT009	116
7.33	Device Manager	116
7.34	Modem Properties	117
7.35	PuTTY Configuration	117
7.36	PuTTY Command Window	118
7.37	Check BGAN optimal settings	119
7.38	Select "Communication"	120
7.39	Select "Check Connection"	120
7.40	View results of check	120
8.1	Configuring SCADA Parameters	121
8.2	Configuring CECS always active mode for SCADA	123
8.3	SCADA Modbus Register Table	125
8.4	Configuring Meteo-40 for Meteo-32 streaming	130
8.5	SCADA Meteo-32 Stream Map	132
9.1	Use of the Meteo-40 buttons	133
10.1	Generic Modbus RTU sensor configuration	162
11.1	Configuration Menu for CLK-Line Test in Meteo-40.	167
11.2	Setup for CLK-Line test of Serial Interface.	168
12.1	Mounting threads dimensions.	172
13.1	Meteo-40 Supply incl. Modem	179
13.2	Electrical Connection Plan: Analog Voltage (Pyranometer)	180
13.3	Electrical Connection Plan: Analog Voltage (Temperature / Barometric Pressure Sensor)	181
13.4	Electrical Connection Plan: Analog Voltage (Temperature + Humidity Sensor)	182
13.5	Electrical Connection Plan: Analog Voltage / Current Source (4-wire-connection; Pt1000)	183
13.6	Electrical Connection Plan: Analog Voltage / Current Source (4-wire-connection; Pt1000 + Humidity)	184
13.7	Electrical Connection Plan: Analog Voltage (Potentiometric Wind Vane)	185

13.8	Electrical Connection Plan: Analog Voltage with Voltage Divider (2xR)	186
13.9	Electrical Connection Plan: Analog Current (2-wire-connection), active	187
13.10	Electrical Connection Plan: Analog Voltage with Shunt	188
13.11	Electrical Connection Plan: Pulse Counter (Anemometer)	189
13.12	Electrical Connection Plan: Pulse Counter with Pull-up Module for Precipitation Measurement	190
13.13	Electrical Connection Plan: Digital Serial for Serial Wind Vane (Thies TMR)	191
13.14	Electrical Connection Plan: Status with Pull-down Module	192
13.15	Electrical Connection Plan: Status for Obstacle Light	193
13.16	Electrical Connection Plan: RS485 with RS485 Module	194
13.17	Electrical Connection Plan: Switch external Sensor Heating via Meteo-40 Switch Manager	195

List of Tables

1.1	Meteo-40 feature overview	3
3.1	Accounts and permissions	30
3.2	Menu of the Web Interface	32
5.1	ASCII escape sequences for RS485-M serial console	59
7.1	Data Transmission with Meteo-40	83
7.2	Automatic vs. Interactive Communication with Meteo-40	84
7.3	Ports used by Meteo-40	85
7.4	Short Message Commands	114
8.1	Modbus Invalid values	124
8.2	Optional Available Information and configuration	126
8.3	Modbus Endianness for SCADA Server	127
8.4	Modbus Device Identification	127
8.5	Set switches state	128
8.6	Channel Codes for Meteo-32 Stream Map	131
8.7	Statistic Codes for Meteo-32 Stream Map	131
9.1	Menu: System	134
9.2	Menu: Status	135
9.3	Menu: Channels/Evaluations	135
9.4	Menu: Channels/Analog Voltage	136
9.5	Menu: Channels/Analog Current	136
9.6	Menu: Channels/Counter	137
9.7	Menu: Channels/Digital Lines	137
9.8	Menu: Channels/Switches	138
9.9	Menu: Channels/Internal	138
10.1	Sensors for Wind Measurement	142
10.2	Sensors for Solar Measurement	143
10.3	Sensors for Meteorological Purposes	144
10.4	Electrical Measurement Devices	144

10.5	Overview Anemometers	145
10.6	Overview Propeller Anemometer	145
10.7	Comparison of Wind Vane Accuracy	146
10.8	Overview Wind vanes TMR	146
10.9	Parameters for the configuration of potentiometric wind vanes	147
10.10	Configuration of RS485 Wind Vanes	148
10.11	Parameters for the configuration of temperature humidity sensors	152
10.12	Tolerance Classes - Platinum Resistance Thermometers (Pt100)	153
10.13	Data request for RS485 Temperature Humidity Sensors	153
10.14	Parameters for the configuration of barometric pressure sensors	154
10.15	Data request for RS485 Barometric Pressure Sensors	154
10.16	Pyranometers	155
10.17	Pyrheliometers	156
10.18	Sunshine Duration Sensors	157
10.19	Data request for RS485 Sun Tracker	158
10.20	Data request for RS485 Soiling Measurement	158
10.21	Configuration of RS485 CSPS RSI	159
10.22	Parameters for the configuration of precipitation sensors	159
10.23	Configuration of RS485 Laser Precipitation Monitor Sensors	160
10.24	Configuration details for other RS485 Sensors / Devices	161
10.25	Requested values	164
11.1	Analog Channels of Meteo-40	165
11.2	Counter Channels of Meteo-40	166
11.3	Digital Channels of Meteo-40	166
11.4	Analog Current Channels of Meteo-40	169
11.5	Current Source Channels of Meteo-40	169
12.1	Electrical Specifications of Analog Voltage Channels / Differential Inputs	173
12.2	Electrical Specifications of Analog Current Channels / Differential Inputs	173
12.3	Electrical Specifications of Counter Channels / Non-Differential Inputs	174
12.4	Electrical Specifications of Digital Channels (Serial Input / Output)	174
12.5	Electrical Specifications for Digital Clock Output	174
12.6	Electrical Specifications for Analog Current Source	175
12.7	Electrical Specifications for Switches	175
12.8	Electrical Specification of the 5V Output	175
12.9	Electrical Specification of the RS485 Interface	175
12.10	Electrical Specification of the Ethernet Interface	176
12.11	Electrical Specification of the RS232 Interface	176
12.12	Electrical Specification of the Power Supply	177
14.1	Cryptographic Software	197

Chapter 1

Introduction

1.1 Opening Remarks

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

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

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

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

1.2 Overview of Meteo-40

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

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

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

**Note**

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

The basic concept is shown in detail in Figure 1.1.

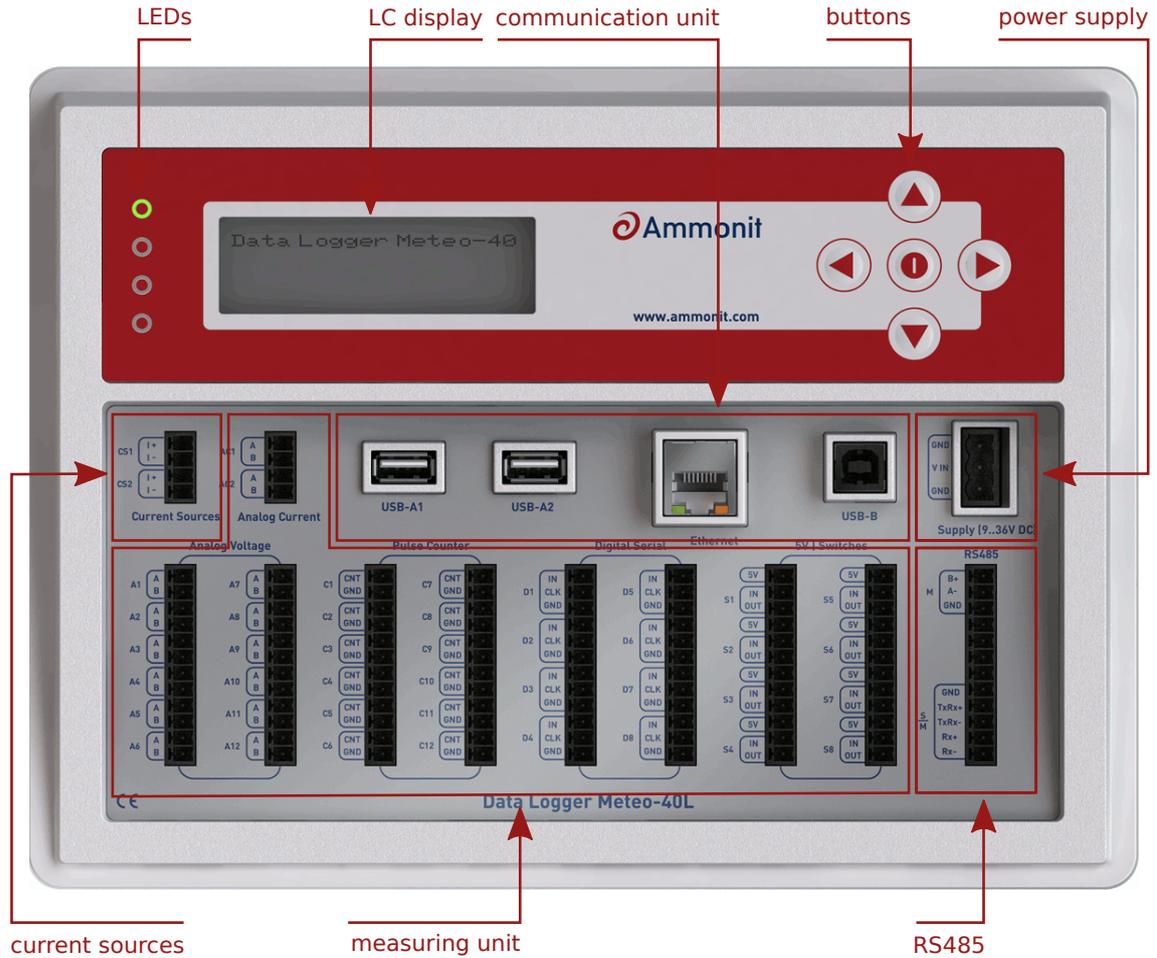


Figure 1.1: Overview of Meteo-40L

1.3 Meteo-40 Series

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

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

Table 1.1: Meteo-40 feature overview



Note

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

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

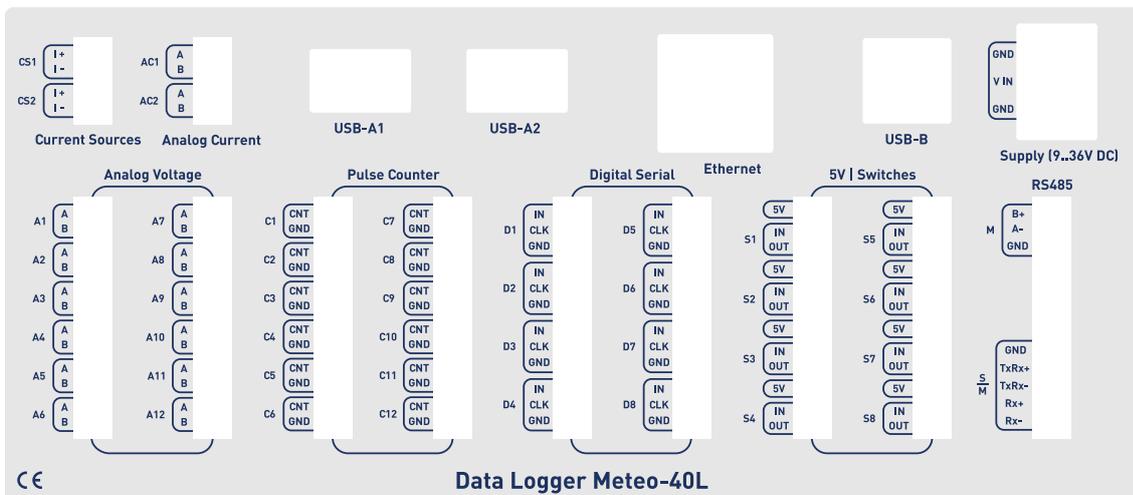


Figure 1.2: Meteo-40L Terminal

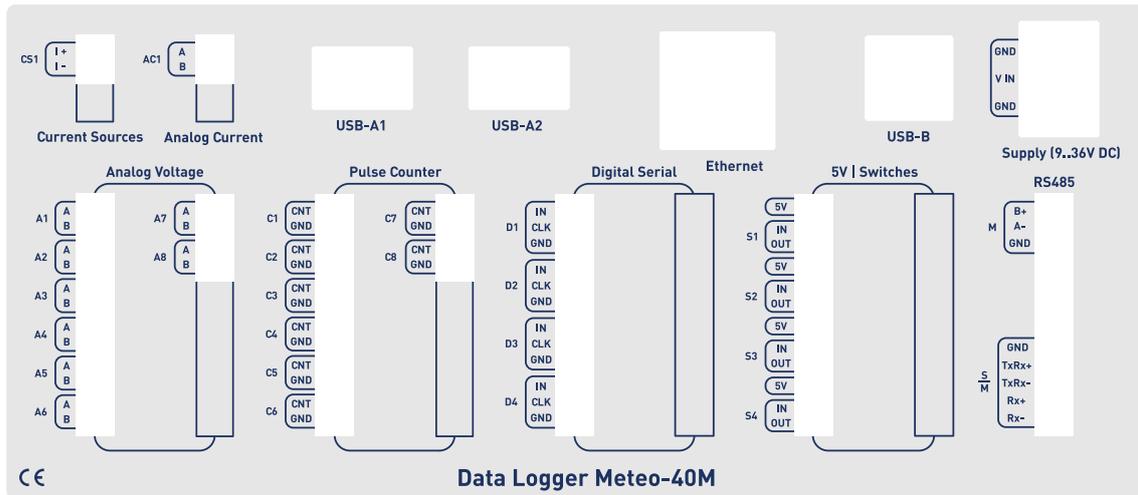


Figure 1.3: Meteo-40M Terminal

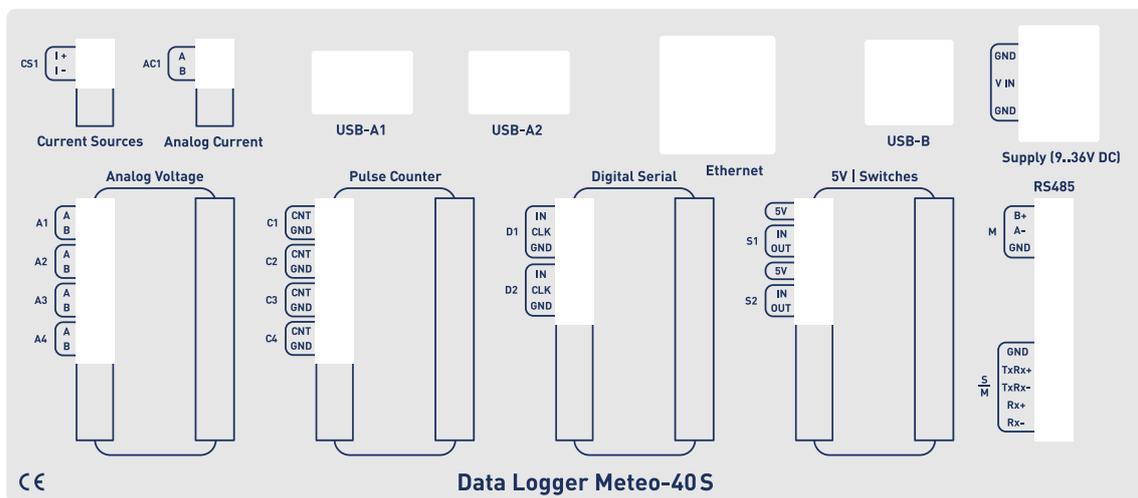


Figure 1.4: Meteo-40S Terminal

1.4 The Two Systems of Meteo-40

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

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

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

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

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

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

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

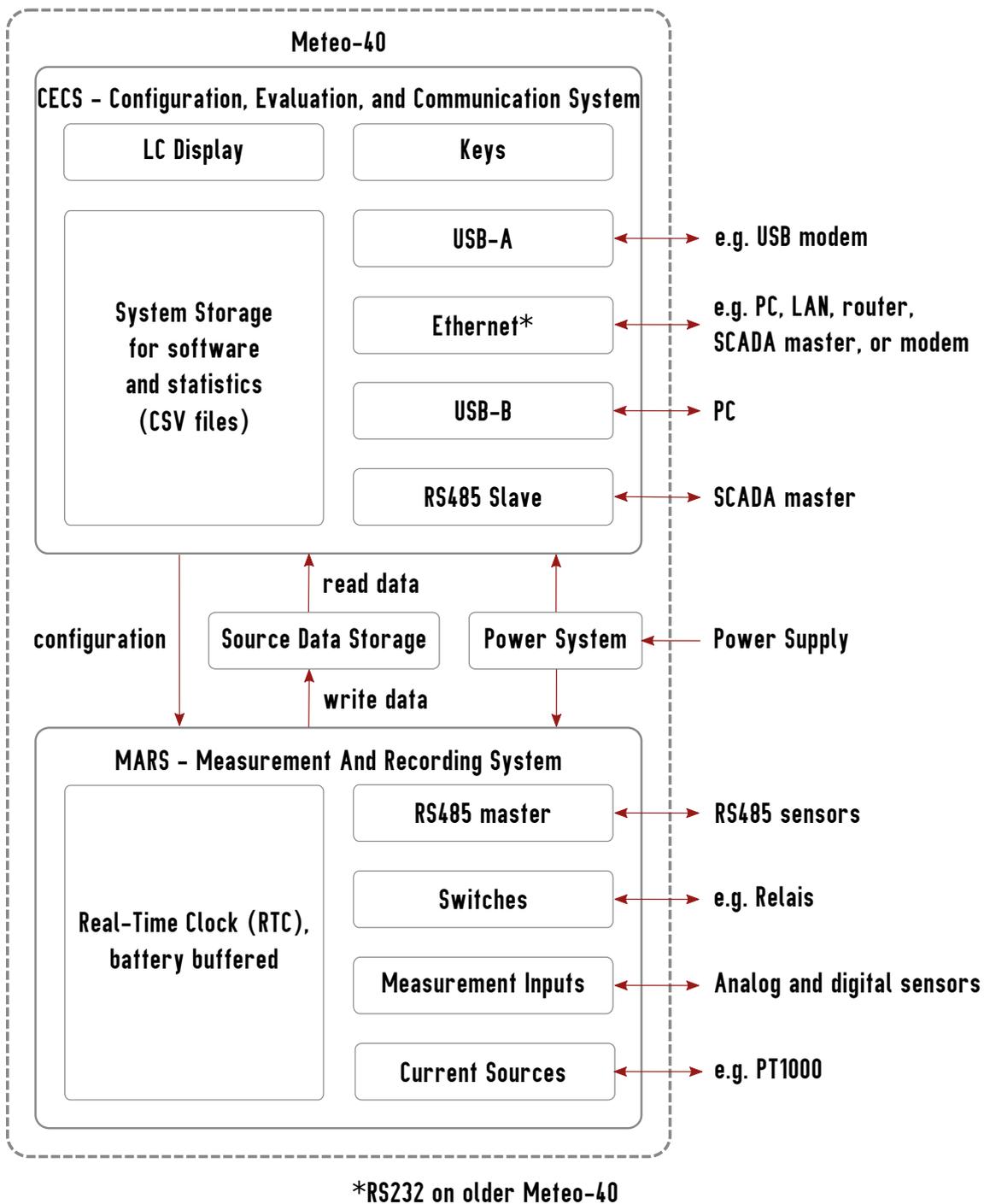


Figure 1.5: Block diagram of Meteo-40

1.4.1 CECS: Switch on / off behavior

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



Note

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

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



Note

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

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



Important

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

1.5 Data Storage

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



Note

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

1.6 User Interfaces

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

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

**Important**

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

1.7 Communication Methods and Required Devices

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

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

Method / Action	Configura-tion	Software Update	Data Download	Required Devices	Comment
Modem access (data logger connected to modem, e.g., GPRS/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 and accessory cable	Thanks to the tunnel server design a standard SIM card can be used in a GSM modem. The tunnel server manages IP addresses. SIM card with static IP address is not necessary. (see Section 7.9)
SCADA over RS485 (Modbus RTU)	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).



Note

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

Chapter 2

Getting Started with Meteo-40

2.1 Introduction

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

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

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

LAN connection between Data Logger and PC

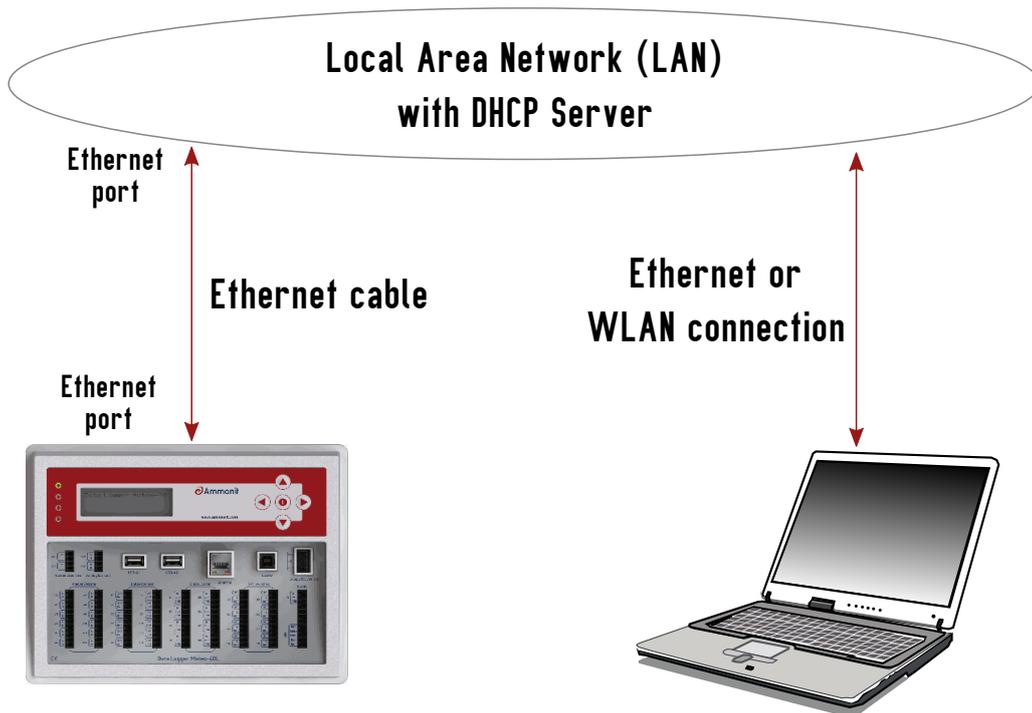


Figure 2.1: Accessing Meteo-40 via LAN (see Section 2.3)

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

Point-to-point Ethernet connection between Data Logger and PC

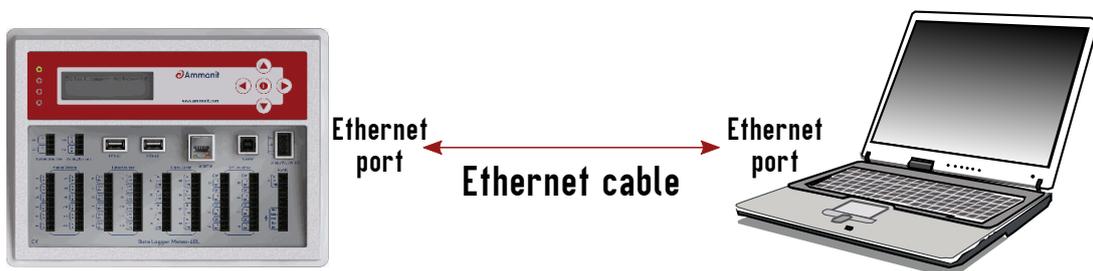


Figure 2.2: Accessing Meteo-40 via Point-to-Point Ethernet Connection (see Section 2.4)

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

USB Connection between Data Logger and PC or Mobile Phone

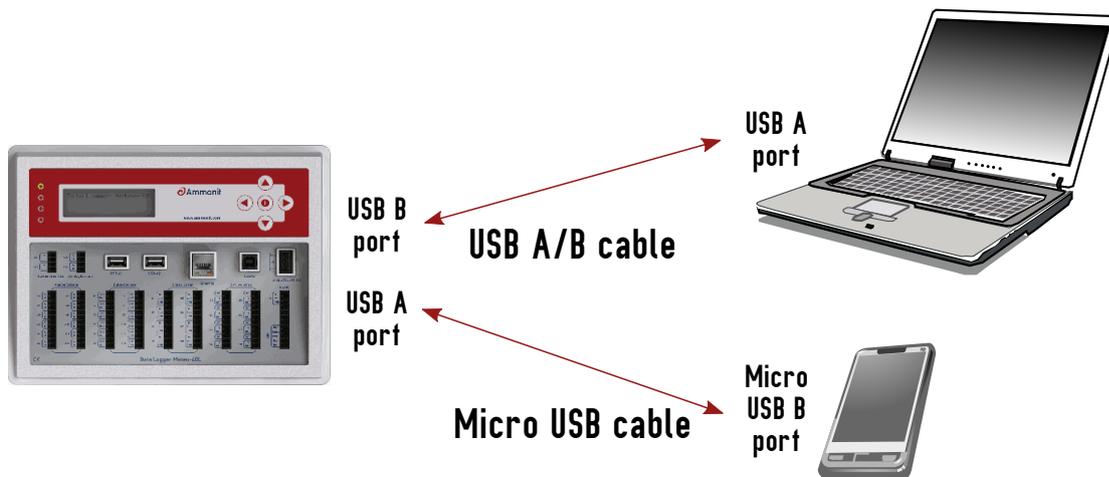


Figure 2.3: Accessing Meteo-40 via USB-B (see Section 2.5)



Important

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



Note

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



Note

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

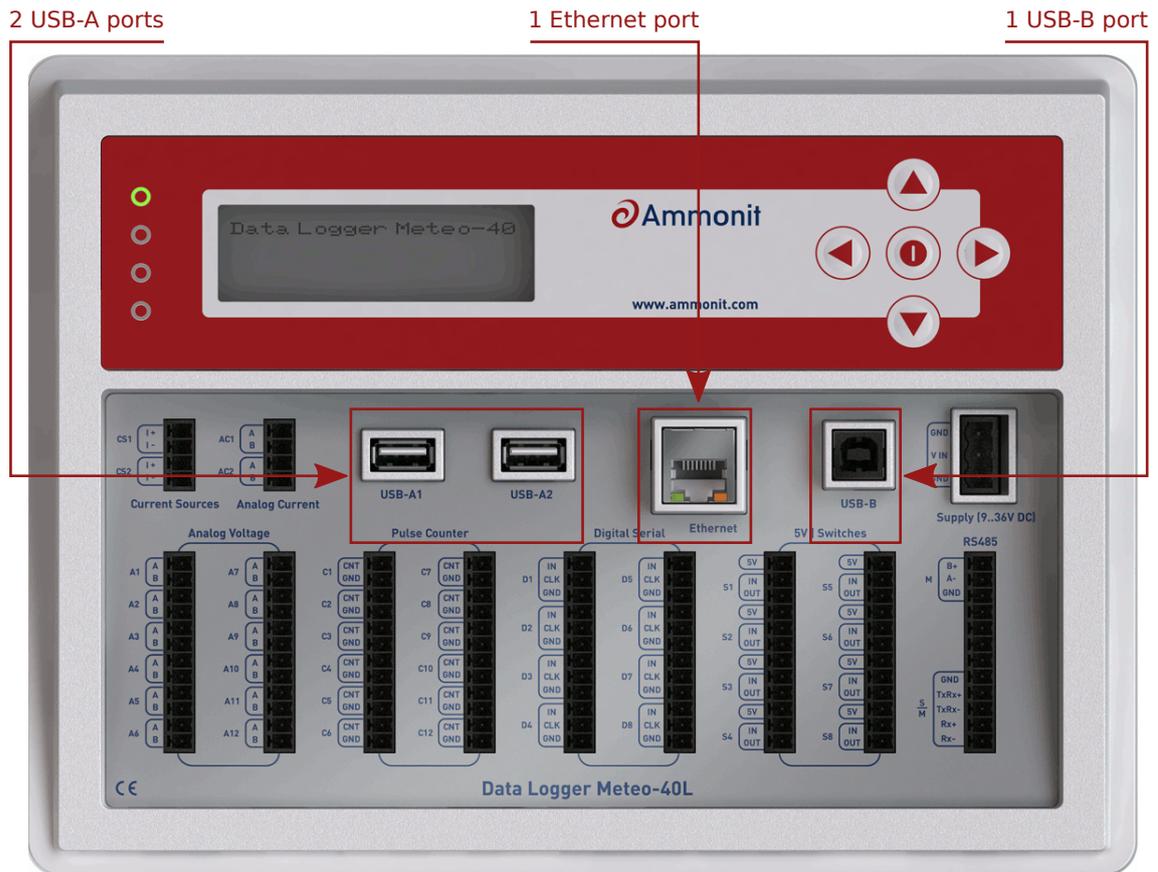


Figure 2.4: Ethernet / USB ports of Meteo-40L



Tip

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

2.2 Using Bonjour™ on Windows™

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



Warning

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

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

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



Meteo-40 D171234

Username:

Password:
 Show password

Login

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Figure 2.5: Meteo-40 web interface initial screen

2.3 Connecting Meteo-40 via Ethernet to your LAN

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



Note

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

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

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



Tip

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

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

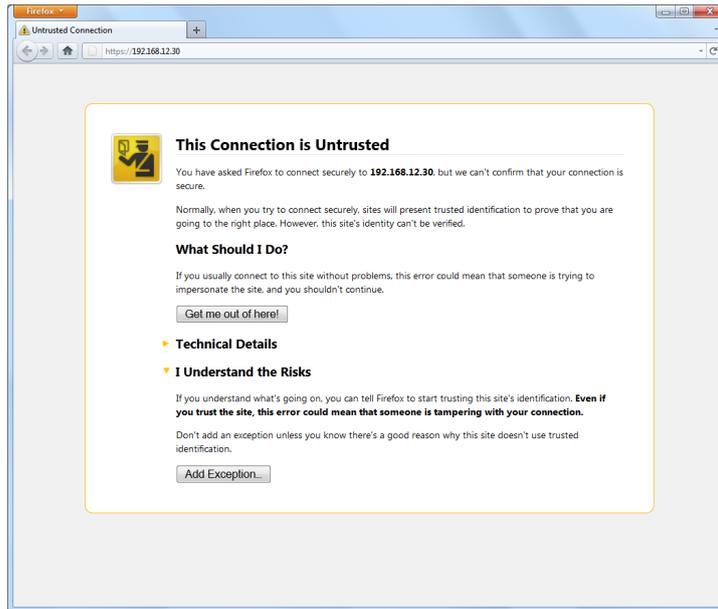


Figure 2.6: Firefox Connection Untrusted alert page

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



Figure 2.7: Add Security Exception



Important

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

URL: <https://192.168.43.21/>



Meteo-40 D171234

Username:

Password:
 Show password

Login

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Figure 2.8: Meteo-40 web interface initial screen



Important

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

Go to [Chapter 3](#) to proceed with the configuration.

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

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



Note

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

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

2.4.1 Using link-local connection

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

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

```
IP / Netmask
DNS Servers
Routes
> Method: Link-local
```

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

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

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

2.4.2 Using static IP address

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

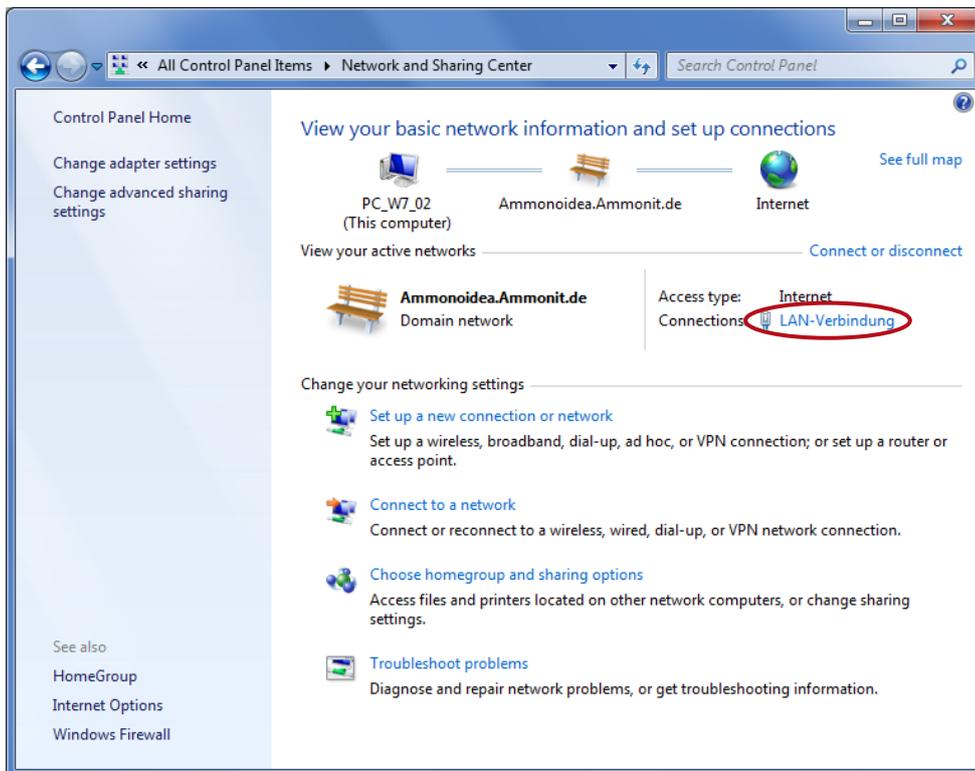


Figure 2.10: Network and Sharing Center of Windows 7™

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

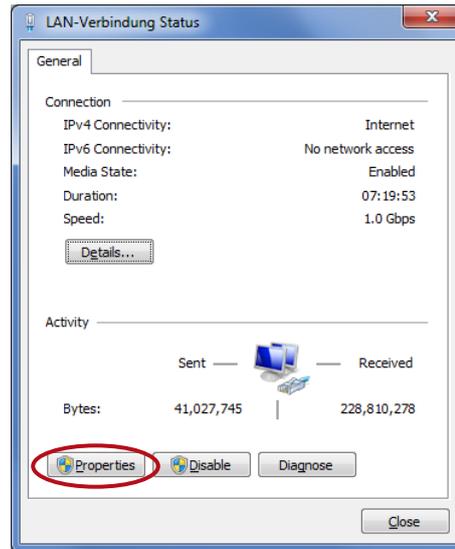


Figure 2.11: LAN Connection Status

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

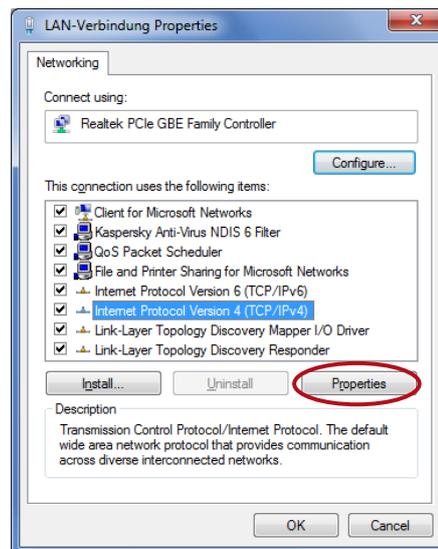


Figure 2.12: Properties of LAN Connection

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

**Important**

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

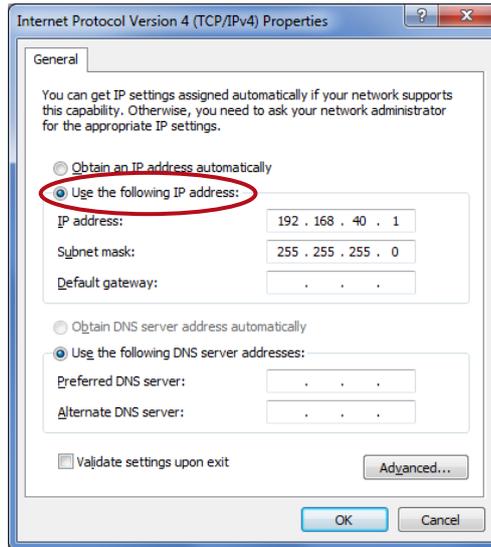


Figure 2.13: Properties of Internet Protocol

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

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

```
IP / Netmask
DNS Servers
Routes
> Method: Link-local
```

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

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

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

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

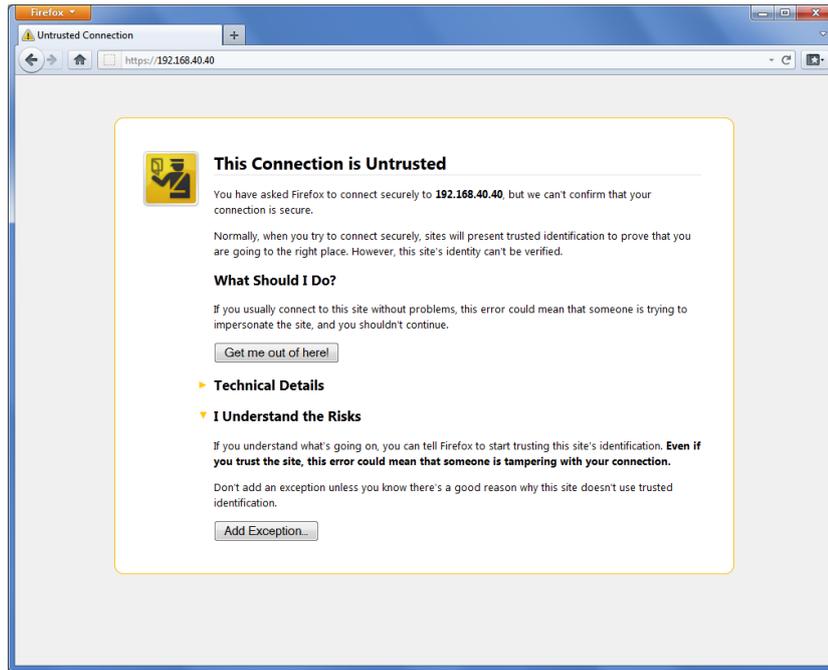


Figure 2.15: Mozilla Firefox Connection Untrusted Alert Page

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

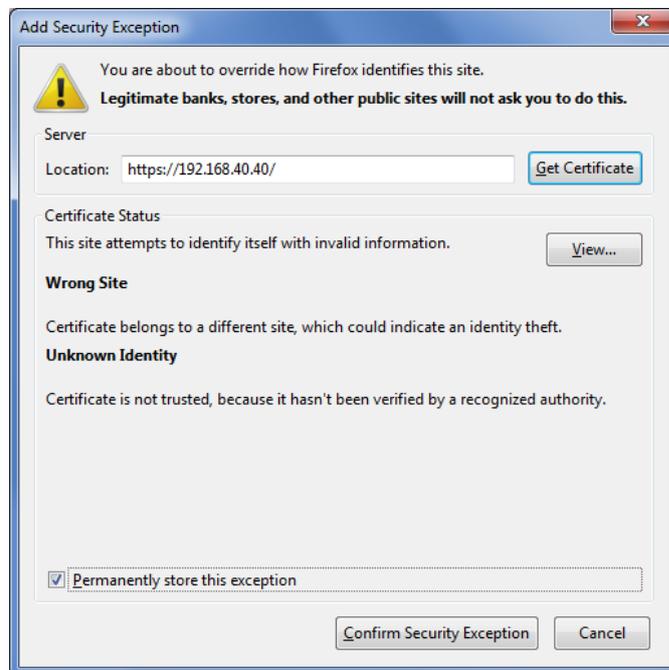


Figure 2.16: Add Security Exception

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

URL: https://192.168.40.40/



Meteo-40 D171234

Username:

Password:
 Show password

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Figure 2.17: Meteo-40 web interface initial screen



Tip

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



Note

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

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

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



Tip

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

2.5.1 Standard RNDIS USB Driver

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

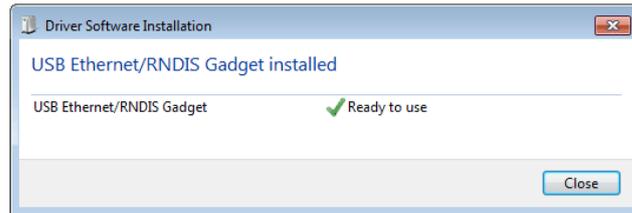


Figure 2.18: Windows Driver Software Installation

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

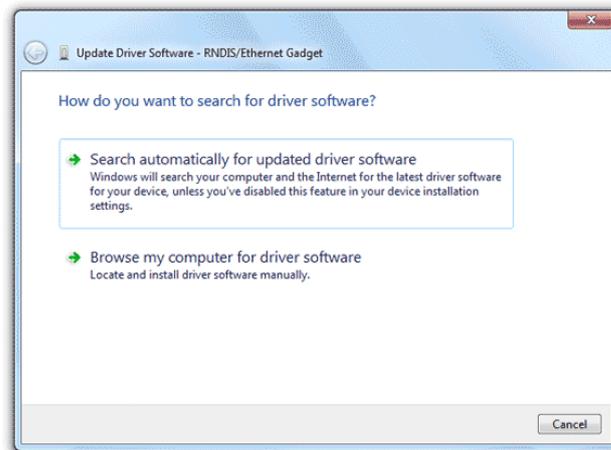


Figure 2.19: Windows Driver Update Installation

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

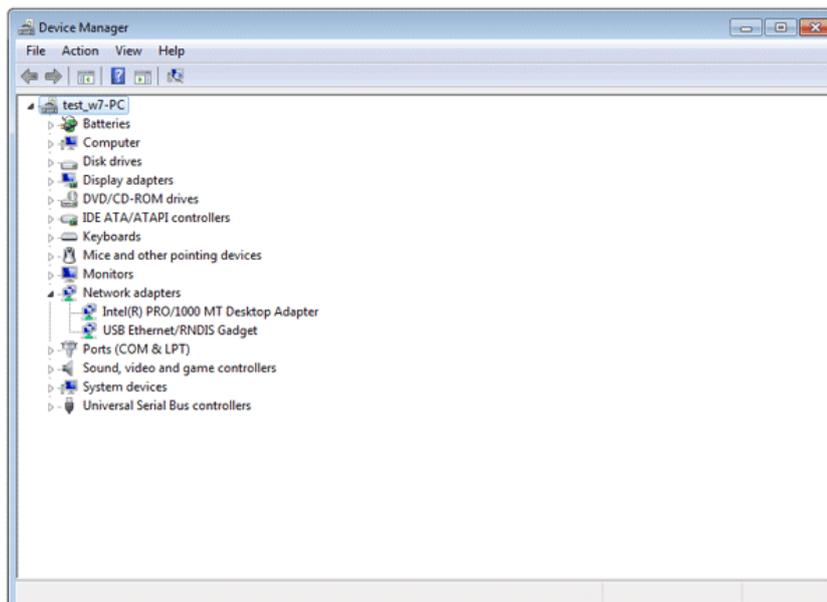


Figure 2.20: Windows Device Manager

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



Tip

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



Important

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

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

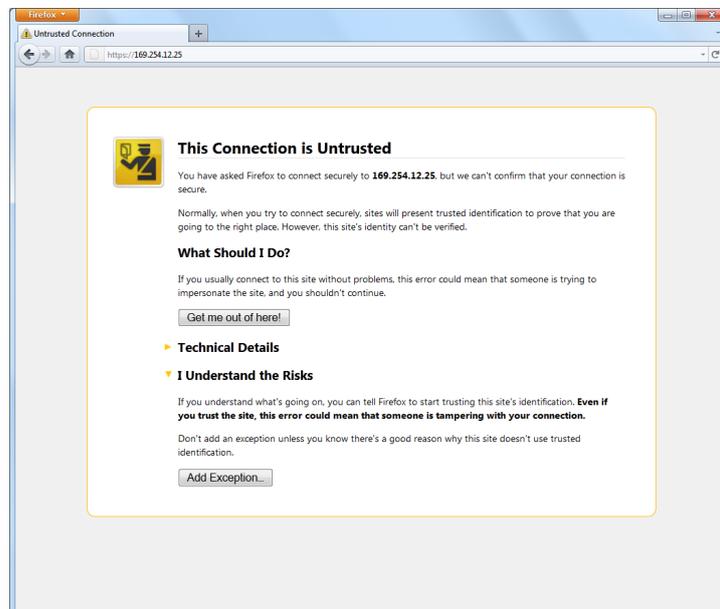


Figure 2.21: Firefox Connection Untrusted alert page

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



Figure 2.22: Add Security Exception

**Important**

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

URL: <https://169.254.43.21/>



Meteo-40 D171234

Username:

Password:
 Show password

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Figure 2.23: Meteo-40 web interface initial screen

2.5.2 Driver Update

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

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

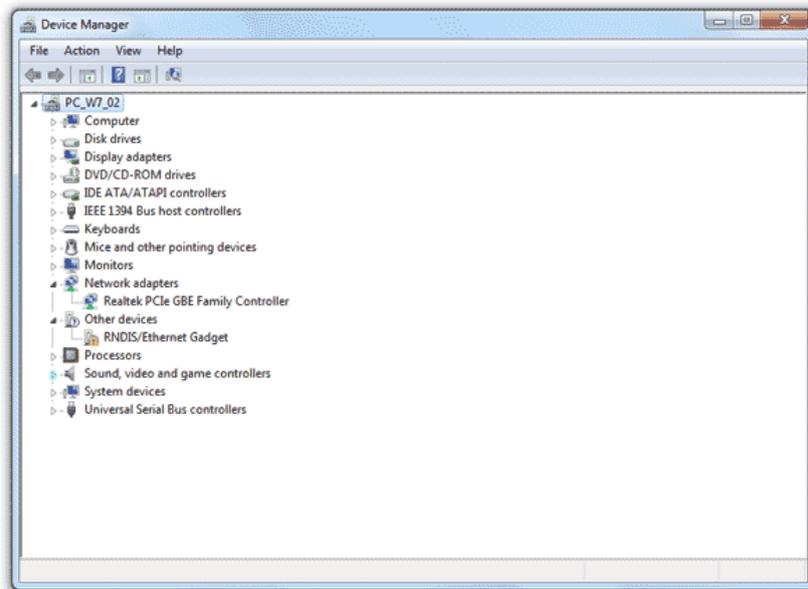


Figure 2.24: New USB Ethernet/RNDIS Gadget in Device Manager

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

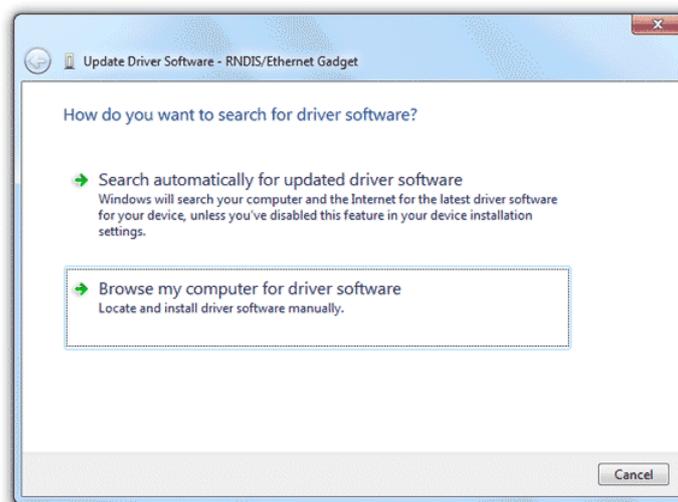


Figure 2.25: Update Driver Software dialog box

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

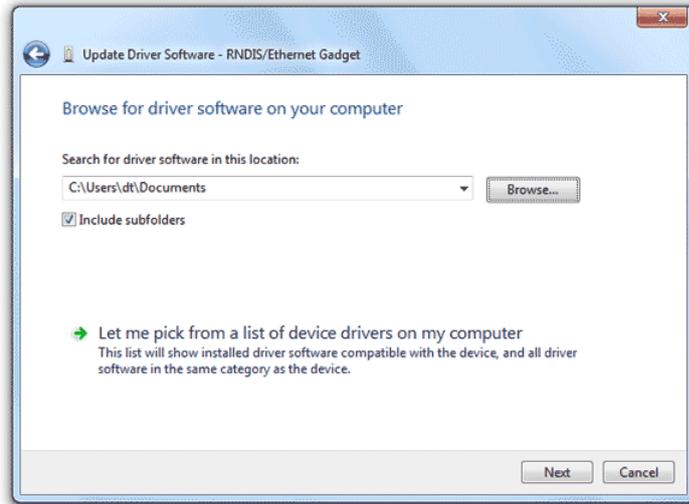


Figure 2.26: Update Driver Software dialog box

**Note**

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

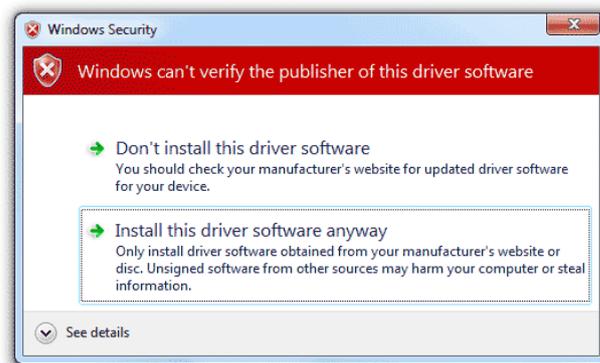


Figure 2.27: Windows Security Advisory

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

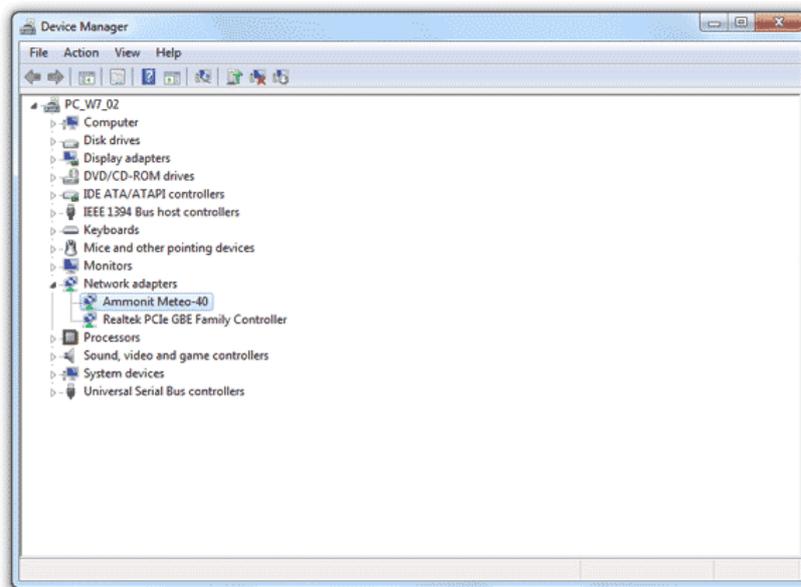


Figure 2.28: Windows Device Manager

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

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

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

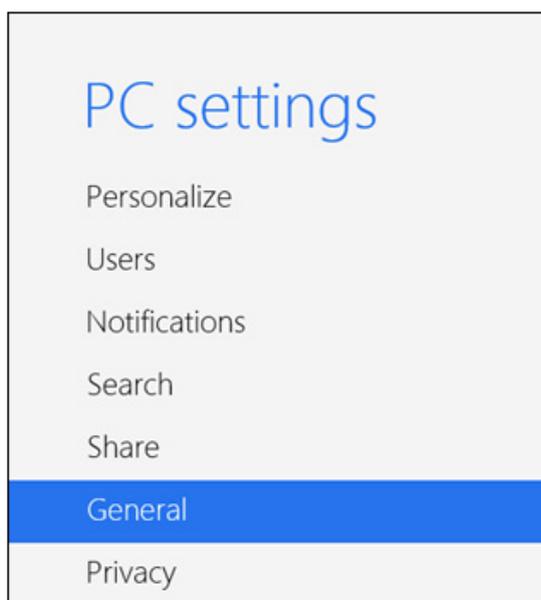


Figure 2.29: Windows 8 PC settings (1)

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

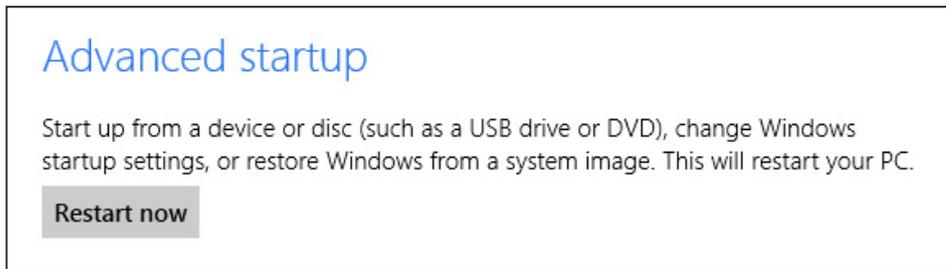


Figure 2.30: Windows 8 PC settings (2)

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

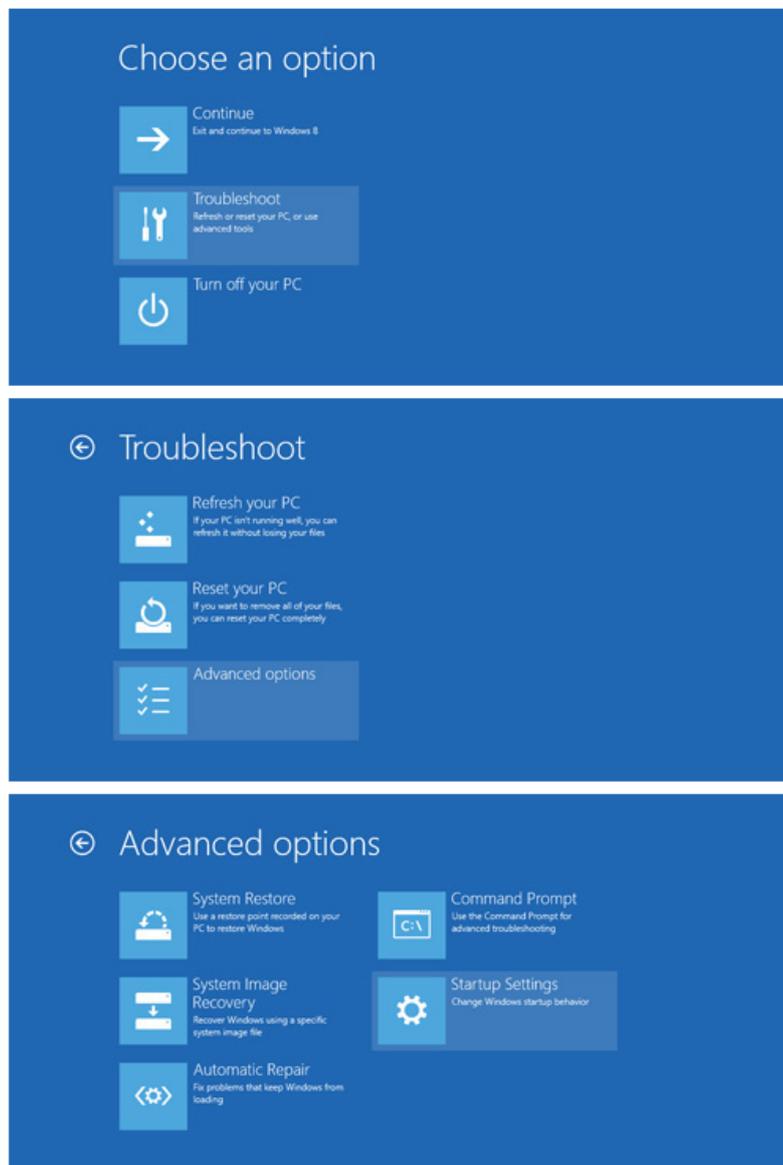


Figure 2.31: Windows 8 PC settings (3)

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

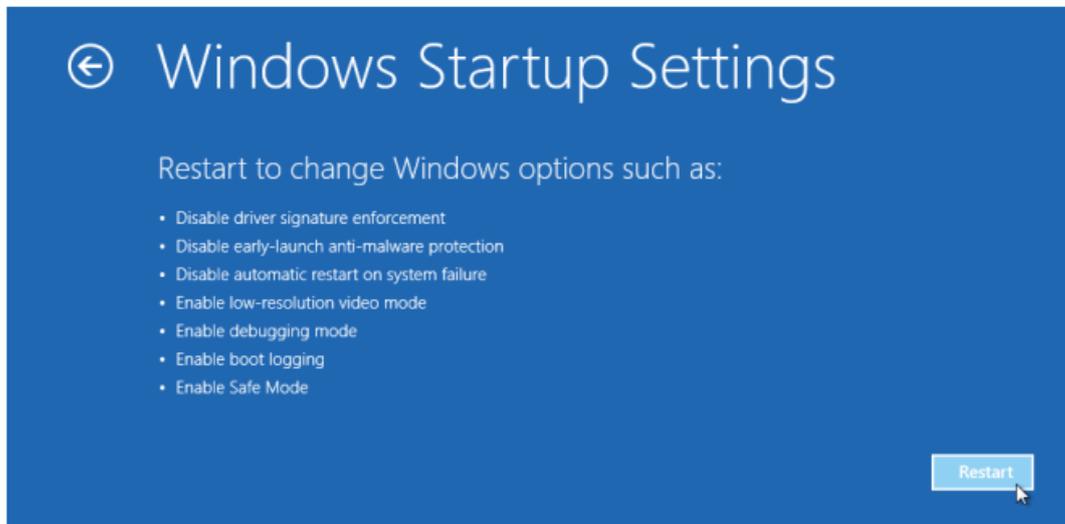


Figure 2.32: Windows 8 PC settings (4)

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

2.7 Using Meteo-40 with Linux

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

Chapter 3

Login at Meteo-40

3.1 Login Options

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

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



Meteo-40 D171234

Username:

Password:
 Show password

Login

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Figure 3.1: Login Screen

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



Warning

Be careful with changing the password for the Admin account. A forgotten Admin password cannot be recovered. The data logger has to be returned to Ammonit to restore the original password.

Account	Permissions
Guest	<ul style="list-style-type: none"> • Look at all configuration pages • Look at live data
Viewer	<ul style="list-style-type: none"> • All of the above • Download measurement data
User	<ul style="list-style-type: none"> • All of the above • Configure the data logger
Admin	<ul style="list-style-type: none"> • 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, activate JavaScript and Cookies in our web browser!

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

Help Access online help.

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

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



Warning

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

3.2 Global Control Elements

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

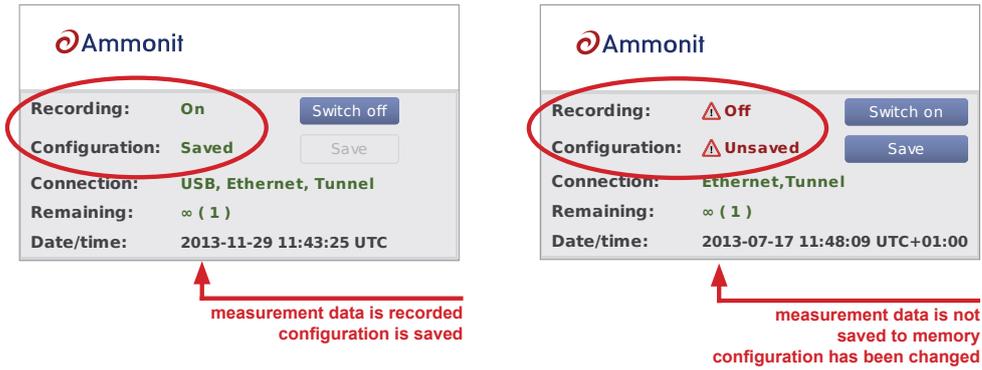


Figure 3.2: Meteo-40 Status Box displaying Status of Recording

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



Note

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



Important

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

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

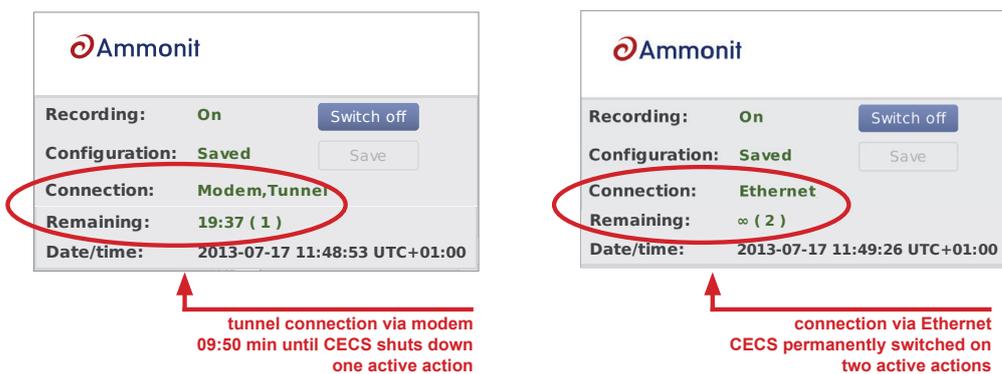


Figure 3.3: Meteo-40 Status Box displaying Connection and Power Mode

The Meteo-40 Status Box displays, in which way the data logger is accessed (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 brackets the number of running actions are displayed, e.g., online access or upload of CSV file.

3.3 Menu of the Web Interface

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

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

Table 3.2: Menu of the Web Interface

Chapter 4

System Configuration

4.1 System Information

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



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

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

Data logger type	Meteo-40L
Serial number	D171234
Number of channels	12 analog voltage, 12 counters, 2 analog current, 2 current sources, 8 digital, 8 switches, 8 RS-485, 4 period measurement
Active input channels	None
Installed sensors	None
Data logger location	52.50176, 13.43479 @ 36.5m
RAM	Total: 123MiB, Used: 34MiB Free: 89MiB
Source data storage	1961.51MiB (52.20% used, current page-id: 2097152)
System storage	Total: 461MiB, Used: 104MiB Free: 358MiB, Type: MT29F4G08ABDDAHC[7,0]
Uptime	CECS: 1 day, 10:17:36; MARS: 11 days, 10:20:54
Software version	1.6.4 (2017-05-05)
Bootloader version	5641
Production date	2017-01-02 10:11:12
AmmonitOR	EWNP
SCADA	Modbus TCP
Current connections	Admin (127.0.0.1)

No file selected

Figure 4.1: System Information Page

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

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

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

**Warning**

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

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

4.2 System Administration

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

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

Data Logger Name

Data logger name

Meteo-40 Site 1

Save name

Figure 4.2: Assigning a Data Logger Name

**Note**

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

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

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

CECS Power Mode

Restart CECS

Shutdown CECS

CECS is always active (only recommended for SCADA and laboratory use)

Automatic CECS reboot

Weekly

Save CECS power mode

Power CECS on digital status signal

None

Save channel

switch on CECS permanently

choose automatic reboot interval

select digital channel for manual CECS start with voltage peak

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



Note

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

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

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

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



Important

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



Important

MARS (for measuring and recording) continues without stopping during the restart. You will not lose 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.

By applying a voltage peak for at least one second to the selected digital channel, CECS can be turned on. This might be useful to prevent climbing up the met mast to switch on the data logger during maintenance work. The CECS will automatically turn off after 20 min, when no action on the data logger is performed. The voltage peak can be triggered by a cable / switch close to the ground (see also Section 12.2.4).

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

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

Optionally, you can also choose to *Set date, time and location using GPS*.

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

Date and Time, Location

Time zone
 UTC+01:00 (Germany, S) ← select the local timezone

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

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

NTP servers:
 0.pool.ntp.org 1.pool.ntp.org

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

Date (YYYY-MM-DD):

Time (hh:mm:ss):

Latitude (decimal):
 52.50176 ← enter the location manually

Longitude (decimal):
 13.43479

Altitude (meters):
 36.5

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

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

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

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

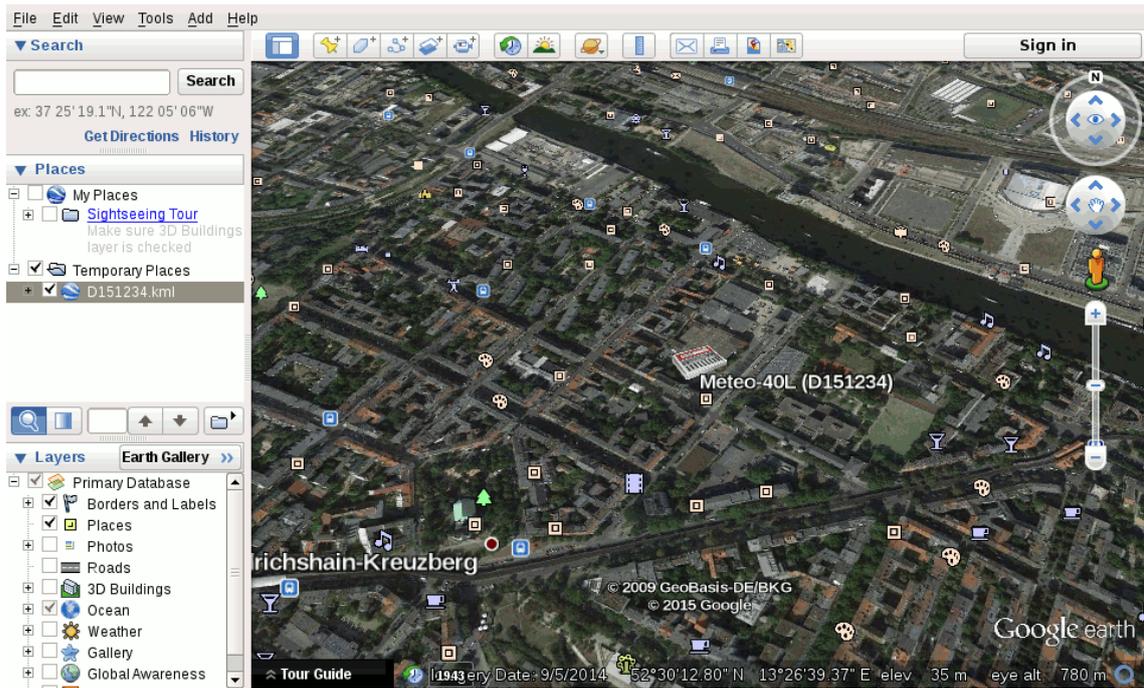


Figure 4.5: Data Logger Location displayed in Google Earth™

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

Change Passwords

Username

New password
 Show password

Figure 4.6: Changing Passwords



Warning

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, return the data logger to Ammonit. Only Ammonit is able to restore the original passwords.



Note

Only the first eight characters of the password are significant, i.e., Ammonit_1 and Ammonit_2 would be treated the same. Eight characters give the choice of at least 10⁴⁰ variations.

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

Figure 4.7: Signing and Encryption

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

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



Note

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



Note

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

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

By default the Manufacturer Administration mode is inactive.

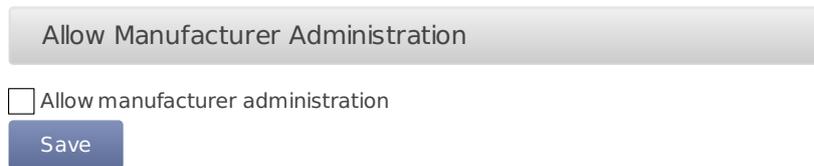


Figure 4.8: Allow Manufacturer Administration



Important

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

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

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

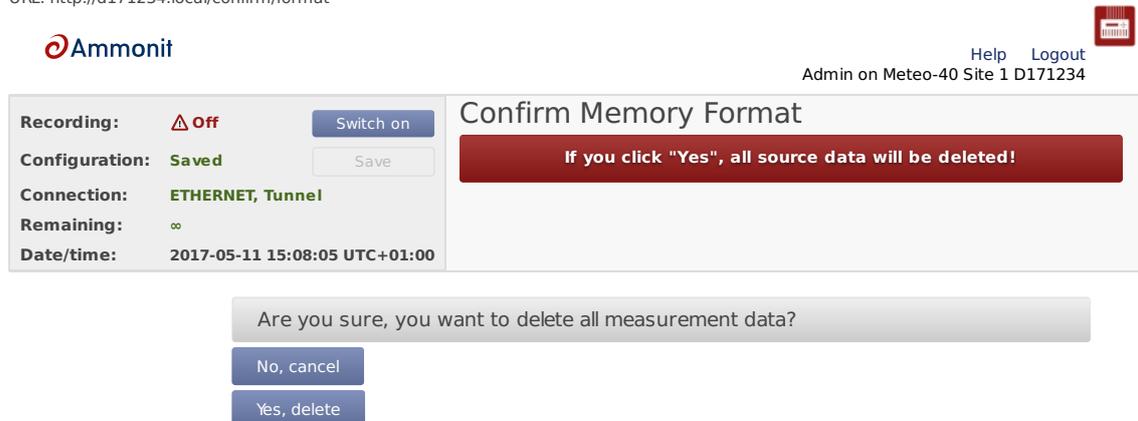


Figure 4.9: Deleting All Measurement Data



Important

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

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

URL: http://d171234.local/confirm/factory_reset

Ammonit

Help Logout
Admin on Meteo-40 Site 1 D171234

Recording: ▲ Off

Configuration: Saved

Connection: ETHERNET, Tunnel

Remaining: ∞

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

Confirm Factory Reset

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

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

Figure 4.10: Factory Reset

**Note**

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

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

4.3 Upgrade Data Logger Software

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

Important

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

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

**Note**

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

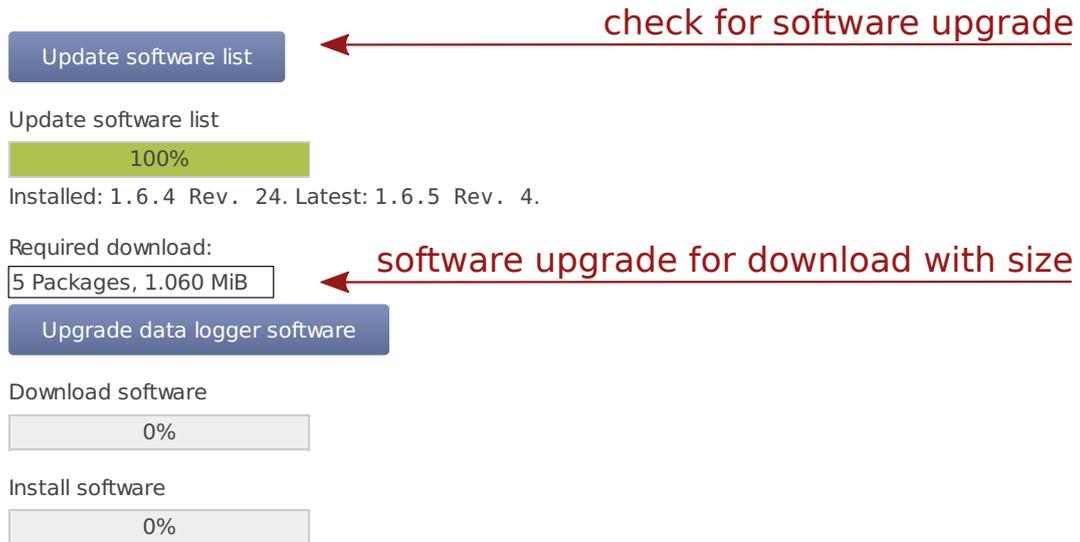


Figure 4.11: System Upgrade

Upgrade data logger software: The software upgrade can easily be performed by pressing the *Upgrade data logger software* button. The software packages will be downloaded and installed.

After the installation is completed, CECS is restarted.



Note

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



Important

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

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

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



Figure 4.12: System Upgrade

4.3.1 Upgrading Meteo-40 using a Smartphone

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

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

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



Important

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



Figure 4.13: Settings for Firmware Upgrade via Tethering

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

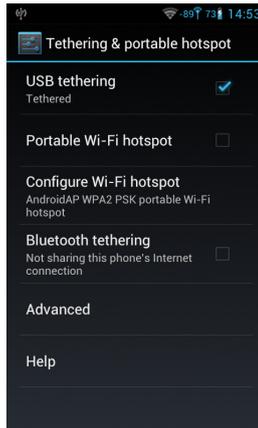


Figure 4.14: Tethering Settings of an Android™ smartphone



Tip

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

4.3.2 Software Upgrade Behind a Firewall

For most firewalls, that allow outgoing HTTPS and HTTP traffic, no special configuration is needed. Only in some very restrictive environments, you may need to configure your firewall for the Meteo-40 software upgrade or ask your network administrator to do so. If Meteo-40 is in a separated subnet, you may also need to specify a Gateway in the LAN settings of the data logger.

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

4.3.3 Offline Upgrade using USB Flash Drive



Warning

Note, that this method is *not* the preferred software upgrade method. If possible, please use the online upgrade method. Make sure, you have saved all your data and your configuration before performing an offline upgrade.

4.3.3.1 Prepare the Offline Upgrade

1. Make sure, the data logger has version 1.6 or higher. Older versions of the data logger software do not support offline upgrade.
2. Make sure, the software version you like to upgrade to is actually newer than the software version already installed on the data logger. Downgrades are not supported. Always use the latest offline update image from Ammonit, because errors of older versions might be fixed!
3. You need a prepared USB flash drive of at least 512 MiB capacity. The flash drive must be formatted as FAT32. The file `meteo-40.bin` must be placed in the top-level of the flash drive, not in a directory. You will get the file on request from Ammonit.

4.3.3.2 Performing the Offline Upgrade

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

```
Found image
for USB upgrade.
Press the > button
to proceed.
```

Figure 4.15: Press the right arrow button

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

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

```
Reading
image for
USB upgrade.
Please wait...
```

Figure 4.16: Reading the image



Warning

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

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

```
SUCCESS:
Remove power plug,
wait 3s, and
remove USB drive.
```

Figure 4.17: Successful upgrade

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

4.4 The Device Page

4.4.1 Display Access

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

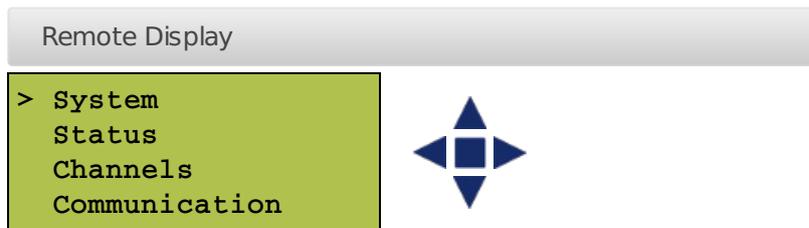


Figure 4.18: Remote Display

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

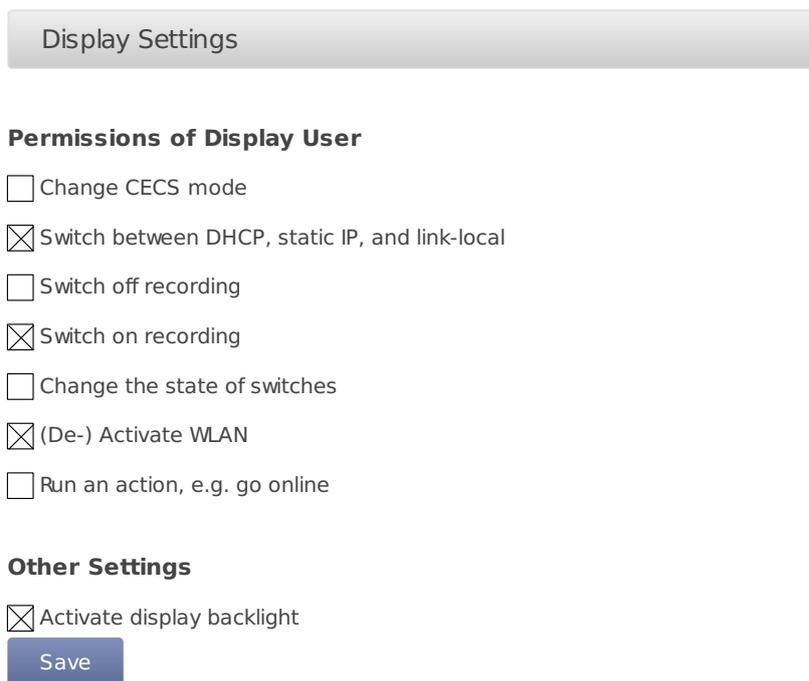


Figure 4.19: Display Settings



Note

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

4.4.2 Connected USB Devices

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



Note

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

4.4.3 USB Flash Drive Copy

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

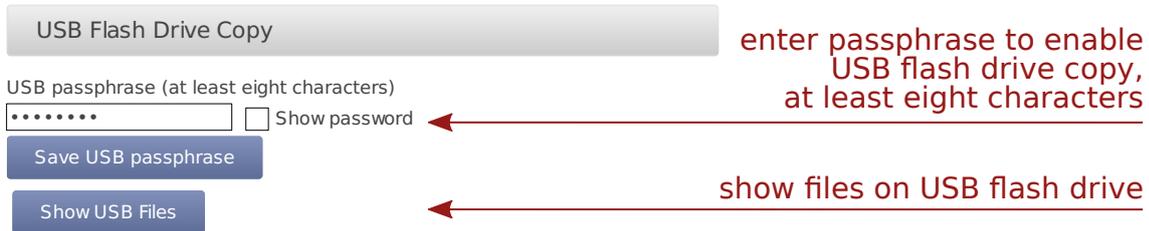


Figure 4.20: Configuring the USB Flash Drive Copy



Important

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

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

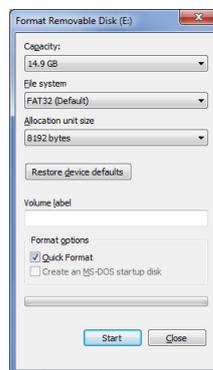


Figure 4.21: Formatting the USB flash drive (Windows™ PC)

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

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



Note

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

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

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

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

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

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

The following entries are possible:

- password** Mandatory, must have at least eight characters
- statistics** One of the time period values, see below. Copies the primary statistics files.
- secondary** One of the time period values, see below. Copies the secondary statistics files.
- tertiary** One of the time period values, see below. Copies the tertiary statistics files.
- config** Value save to copy the configuration file. Other values are not yet implemented.
- logbook** One of the time period values, see below.
- gustdata** One of the time period values, see below.
- sourcedata** One of the time period values, see below.



Warning

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

The time period values are:

- all** Copy all files of this type.
- since DATE** Copy files of this type since and including DATE in format YYYY-MM-DD.
- until DATE** Copy files of this type until and including DATE in format YYYY-MM-DD.
- month DATE** Copy files of this type in the month of DATE in format YYYY-MM.
- day DATE** Copy files of this type at the day of DATE in format YYYY-MM-DD.
- newest NUMBER** Copy newest files of this type, max. NUMBER.
- oldest NUMBER** Copy oldest files of this type, max. NUMBER.

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

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

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

**Note**

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

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

4.4.4 Access to USB Drive Files

4.5 Using a Camera

It is possible to connect either a USB webcam to one of the two USB-A slots of the Meteo-40 data logger or to access an Ethernet connected camera by HTTP/HTTPS.

You can send the image to AmmonitOR, as an email attachment, or copy it to an FTP/SCP file server. See the respective checkboxes in the Communication → AmmonitOR, Communication → Email, and Communication → FTP/SCP submenus.

Recording: ▲ Off Switch on	<h2>Camera</h2>
Configuration: Saved Save	
Connection: ETHERNET, Tunnel	
Remaining: ∞	
Date/time: 2017-05-11 15:36:54 UTC+01:00	

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

Current Camera Image



Camera Image Settings

Camera Image URL:

 Copy Camera Image to USB Drive
Save camera settings

Figure 4.22: Camera Image

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

In general, it is recommended to use a static IP address for both the camera and Meteo-40. You need to configure both data logger and camera to two different addresses in the same network, e.g. `10.13.0.197` for the camera and `10.13.0.200` for the data logger. In this case, the netmask would be `255.0.0.0`. DNS and servers and gateways are not relevant here.

For example, a Mobotix M25M camera image URL typically is `http://10.13.0.197/record/current.jpg`.



Figure 4.23: Attaching Camera Images

**Important**

If you connect the camera via Ethernet, configure both devices, Meteo-40 and camera, with a 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 7.7).

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

**Note**

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

4.6 Configuring Switches

Switches can be used to control and optimize the power consumption of the measurement system. External devices connected to Meteo-40, such as modem, camera or heating can be controlled via the data logger. Meteo-40 will close (turn on) the configured switch when the corresponding device is needed, e.g., to send data via the modem connection, and open it again (turn off) when not needed.

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

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

- Control the modem power supply (recommended). See Section 7.9 for GSM and Section 7.7 for satellite.
- Control camera power supply. See Section 7.7.
- Toggle sensor's power supply in case the polling rate is very low. See Switch Pre time in Section 5.1.4 and follow sensor specifications.
- Control of the selected switch according to the configured measurements and thresholds Section 4.6.1.

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

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

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

Figure 4.24: Switch Configuration



Warning

We highly recommend configuring a switch for the modem in the Communication → Modem menu. If the modem is switched manually via the System → Switches menu, you risk the shutdown of the modem after rebooting the data logger or after problems with the power supply. In Meteo-40 firmware version higher than 1.0 Rev.13915 switch S1 is set by default for the modem. In case the switch is not used for the modem, it can be deselected.



Note

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

4.6.1 Switch manager

The Switch manager is designed to automatically toggle a switch depending on measured temperature, humidity, voltage and/or wind speed values. It is commonly used for sensor's heating control. In order to use this function, select a switch as well as one or more switching conditions. Only configured sensors and free switches are listed. If more than one condition is configured, the switch will only be closed (i.e. On) when all conditions are fulfilled. If the inverted logic is selected, the switch will remain closed as long as the conditions are not fulfilled.

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



Important

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

Switch Manager

Managed switch
None

Invert switch behaviour

Label:
Switch Manager

Temperature
None

Minimum temperature (°C)
-10

Maximum temperature (°C)
2

Humidity
None

Minimum humidity (%)
70

Voltage
None

Minimum voltage (V)
0

Wind speed
None

Minimum wind speed (m/s)
20

Save

Figure 4.25: Switch Manager

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

4.7 Using the Logbook

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

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

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

The screenshot shows a logbook interface. At the top, there are navigation options for years (2016, 2017) and months (05, 06, 07, 08, 09, 10, 11, 12). Below this is a calendar for June 2015, with the date 30 highlighted. Under the calendar, there are two tabs: 'Date/Time' and 'Message'. Below the tabs are five buttons: 'Log a message', 'Download', 'Download month', 'Download year', and 'Download all'. The main content area is titled 'Measurement and Recording Errors' and contains the text 'RS485_TIMEOUT'. Below this text is a button labeled 'Reset measurement errors'.

Figure 4.26: Logbook

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



Note

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

4.7.1 Logbook Events

The following actions or events are logged to the logbook:

- User note to logbook
- Log in of a user and failed login attempt
- Factory reset
- Memory format
- Setting date and time via GPS, NTP, [EKO sun tracker](#), SCADA or Admin (manually)
- Setting location via GPS or [EKO sun tracker](#)
- Copying data to USB flash drive
- Software upgrade
- Password reset by manufacturer
- CECS start/stop
- [Actions](#) execution
- Actions initiated by a short message (SMS)
- RS485-M Serial Console

Chapter 5

Measurement

5.1 Sensor Configuration

5.1.1 Difference between Sensors, Channels, and Evaluations

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

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

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

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

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

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

Equation 5.1: Linear Equation for Wind Speed

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

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

5.1.2 Configuring Sensors

In the Measurement → Sensors menu, sensors can be added and basic parameters can be configured by using the *Sensor Helper* (see Section 5.1.4). At the resulting list of sensors, two buttons are visible on the right side of each row:

Delete and *Change*. These allow a user to delete the sensor or to change the existing configuration with the *Sensor Helper*.

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

Add sensor

Undo

Delete all sensors

RS485-M serial console

← add sensor with sensor helper

← delete all sensors in one step

Figure 5.1: Sensor Definitions

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

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

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

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

RS485-M serial console Occasionally send a command to a sensor connected to the RS485 Master port. This can be useful for debugging communication problems or to change sensor's configuration (see Section 5.1.5).



Note

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

**Important**

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

**Warning**

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

5.1.3 Order of Sensors and Evaluations

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

Sensors are ordered by

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

Evaluations are ordered by

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

5.1.4 Sensor Helper

In order to simplify the configuration of sensors, Meteo-40 offers a *Sensor Helper* in the Measurement → Sensors menu. 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 menu Measurement → Channels and in menu Measurement → Evaluation.

The sensor helper provides a list of various sensor types (e.g., anemometer, wind vane, barometric pressure sensor, solar 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., Slope, Offset, Sensitivity, 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 used for other sensors.

Sensor type: Anemometer ← select sensor type

Sensor: Thies Anemometer First ← choose sensor from a list of common models

Installation height (m): 100

Label: Top Anemometer

Serial number: xxxxxxxx

Wind Speed Slope (m/s/l), e.g. ~0.0462: 0.0462 ← enter values from calibration protocol

Wind Speed Offset (m/s), e.g. ~0.21: 0.21 ← enter values from calibration protocol

Measurement rate: 1 s ← select measurement rate

Counter Channel: C1 ← assign channel(s) for selected sensor

Add more

Finish

Figure 5.2: Sensor Helper with Sensor Settings



Important

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

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.

5.1.5 RS485 Master Serial Console

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

Send Request over RS485-M

Protocol:

Modbus address

Modbus start register (0..65535)

Modbus register quantity (1..20)

Modbus function code

Command:

Latest Response:
 Not available

RS-485 master general configuration

RS-485 speed:

RS-485 data format:

Figure 5.3: RS485-M Serial Console

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

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

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

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

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



Note

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

5.2 Measurement Channels

In the Measurement → Channels menu a table is shown, which displays all connected channels with details such as label, value, rate, range, protocol and selected switch. To modify sensor settings, click on *Change* to start the *Sensor Helper* (see also Section 5.1.4).

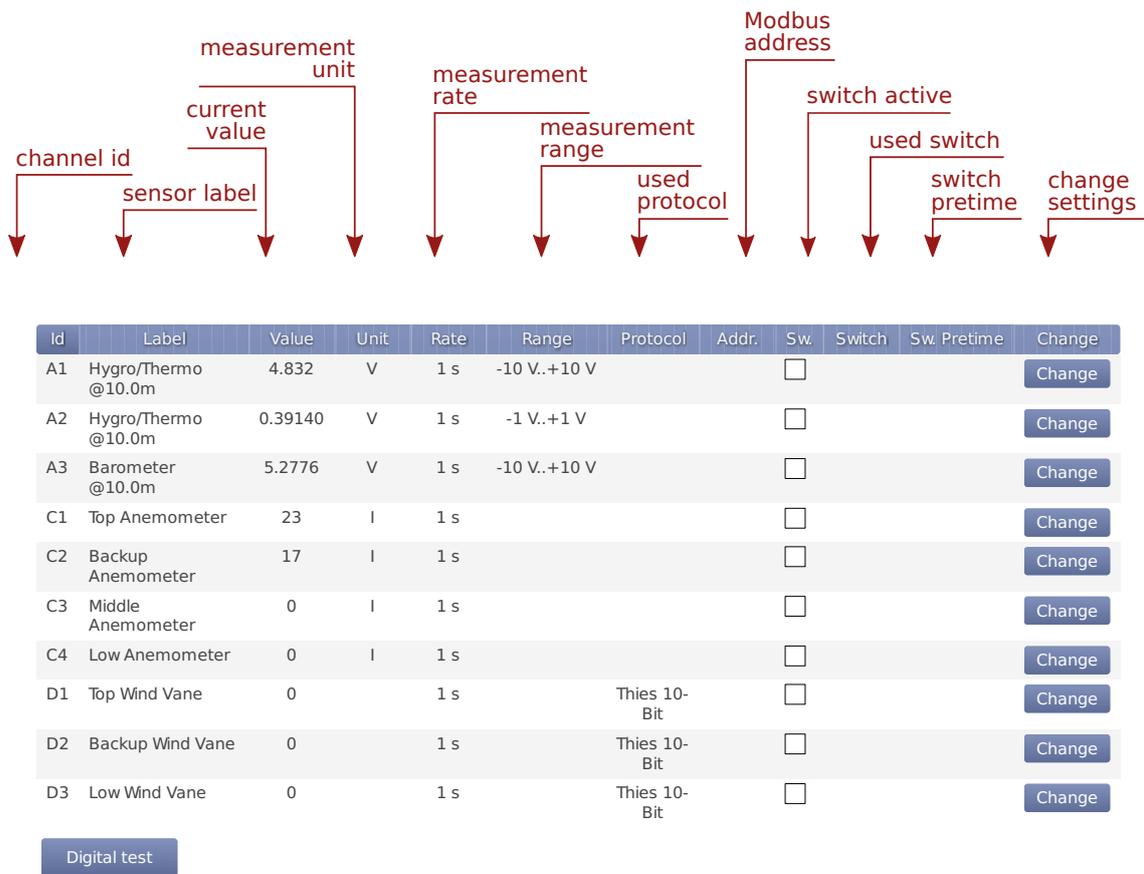


Figure 5.4: Measurement Channels Overview



Note

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

5.3 Configuring the Evaluation

In the Measurement → Evaluation menu the settings for data evaluation are shown. A table displays the configured sensors with their measured and estimated values. The order of evaluations is explained in Section 5.1.3. If the settings should be modified, click on *Change* to start the *Sensor Helper* (see also Section 5.1.4).

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

Add evaluation

Figure 5.5: Screenshot of the Configuration for the Evaluation

In order to combine evaluations, new evaluations can be added in the *Evaluation Helper* by clicking on *Add evaluation*. See Section 5.3.1.

**Important**

Only the measured values are saved by default to the CSV statistics file. Estimated values are for information purposes. In order to save estimated values to the CSV statistics file, select the values in the Data → Statistics.

**Note**

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

5.3.1 Evaluation Helper

In order to add evaluations, which combine already configured evaluations, click *Add evaluation* in the Measurement → Evaluation menu. Select from a list of formulas, e.g., linear equation, differential temperature, density of moist air.

5.3.1.1 Linear equation

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



Note

The original evaluation can be removed from the CSV files if so configured in Figure 6.4.

5.3.1.2 Differential temperature

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

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

Equation 5.2: Calculation of the Temperature Difference [$\Delta\theta$]

Formula:
Differential temperature
theta 1 - theta 2

Temperature theta 1
Hygro/Thermo 1

Temperature theta 2
Hygro/Thermo 2

Label:
Differential Temperature

Save
Delete

Figure 5.6: Evaluation for Differential Temperature

5.3.1.3 Density of moist air

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

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

If air density should be calculated without humidity, choose only a temperature and a barometric pressure sensor from the list in the *Evaluation Helper* (see Section 5.3.1). Meteo-40 calculates air density for evaluation with original 1-sec measurement data according to the following formula:

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

Equation 5.3: Calculation of Density [ρ] of Dry Air

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

If relative humidity should be considered for air density calculation, choose also a humidity sensor from the list in the *Evaluation Helper* (see Section 5.3.1). With selected humidity sensor, Meteo-40 calculates density of moist air for evaluation with original 1-sec measurement data according to the following formula:

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

Equation 5.4: Calculation of Density [ρ] of Moist Air

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

Formula:
Density of moist air
kg/m³

Temperature
Hygro/Thermo @20.0m

Air Pressure
Barometer

Humidity
Hygro/Thermo @20.0m

Label:
Density of Moist Air

Save

Delete

Figure 5.7: Evaluation for Air Density

5.3.1.4 Obukhov length

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

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

Equation 5.5: Calculation of the Obukhov Length

(where u_* is the friction velocity [m/s], g the gravitational acceleration 9.81[m/s²], $\sigma(V_z, T)$ the covariance of vertical wind speed and virtual temperature and K the von Kármán constant 0,41)

5.3.1.5 Obukhov stability parameter

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

$$\zeta = z / L$$

Equation 5.6: Calculation of the Obukhov stability parameter

(where z is the height above ground and L is the Obukhov length as in Section 5.3.1.4)

5.3.1.6 Sensible heat flux

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

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

Equation 5.7: Calculation of the sensible heat flux

(where ρ is the air density 1.2[kg/m³], C_p the specific heat with constant pressure 1004.67[J/K/kg] and $\sigma(V_z, T)$ the covariance between the vertical wind speed and the temperature)

5.3.1.7 Inflow angle

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

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

Equation 5.8: Calculation of the inflow angle

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

Chapter 6

Data Evaluation

6.1 Introduction

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

6.2 Live Data Page

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

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

**Note**

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

6.3 Statistic Data Files

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

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

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

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

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

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



Important

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

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

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

Under *Maintenance* we provide some options for trouble-shooting in case of CSV files generation problems. *Delete sent statistics* will replace all existing CSV files which have already been shared in any of the ways (AmmonitOR, Email or SCP/FTP) with an empty file in order to create more space in the system storage. This process is also automatically performed on CECS reboot if the available system storage is too low for the normal operation of the system. *Try to fix possibly inconsistent files* will check all existing files, search for known incidences and regenerate the files if needed. This option is only available if the data logger detects any suspicious files.

Statistics calendar

Show month Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

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

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

1 of 333 files

Download selected Generate now Delete selected

Mark all as not sent Try to fix possibly inconsistent files

Figure 6.1: Downloading Statistics

6.3.1 Configuring Statistics and CSV files

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

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

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

The screenshot shows a web interface for configuring statistics. At the top is a grey header with the text 'Configure statistics'. Below it is a blue button labeled 'Select statistics'. The main area contains several configuration options:

- 'Statistics interval for files' with a dropdown menu set to '10 min'.
- 'File interval' with a dropdown menu set to 'Daily'.
- An unchecked checkbox labeled 'Generate partial files'.
- 'Statistics interval for SCADA, Switch manager and snapshots' with a dropdown menu set to '2 s'.
- 'SCADA Summary interval' with a dropdown menu set to 'Every five minutes'.
- Three blue buttons stacked vertically: 'Secondary files', 'Tertiary files', and 'Save'.

Figure 6.2: Configuring the Statistics

The options are:

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

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

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

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

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

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

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

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



Warning

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

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

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

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

Equation 6.1: Calculation of wind direction average

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

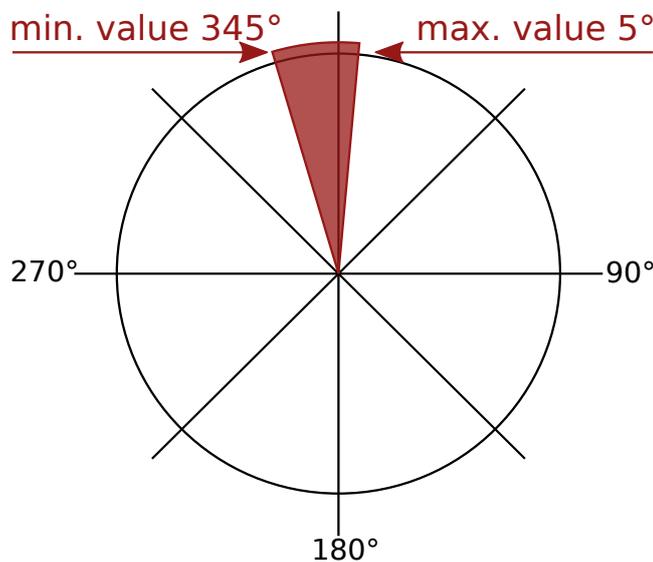


Figure 6.3: Vectorial Calculation for the Wind Direction

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

Save

Back to statistics

Figure 6.4: Statistics Configuration Page

Press Save to finish the configuration of statistical values.

6.4 Secondary and Tertiary Statistics Files

Sometimes it is necessary, to have additional statistics on top of the standard. E.g. with a different statistics interval or a different selection of values. You can activate the supplementary generation of statistics files with two different

configurations. The files will be listed in a similar table as the main statistic files (see Figure 6.5 and Figure 6.6). If the files are generated, they will be automatically sent per Email or AmmonitOR additionally to the main statistic files.



Warning

Beware, that having more CSV files

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

6.4.1 Secondary Statistics Files

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

Secondary statistics files calendar

Show month
Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

◀
2017-05
▶

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

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

1 of 333 files

Download selected
Generate now
Delete selected

Generate additional files with secondary interval

Select statistics

Secondary statistics interval

1 h ▼

Save

Figure 6.5: Secondary Statistics Page

6.4.2 Tertiary Statistics Files

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

Tertiary statistics files calendar

Show month Show year

2016 06 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

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

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

1 of 333 files

Download selected Generate now Delete selected

Generate additional files with tertiary interval

Select statistics

Tertiary statistics interval

1 h

Save

Figure 6.6: Tertiary Statistics Page

6.5 Gust Data Files

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

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

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

Gust data files calendar

2016 06 07 08 09 10 11 12
 2017 01 02 03 04 05

2017-05

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

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

1 of 333 files

Figure 6.7: Gust Data Calendar

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

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

Figure 6.8: Gust Evaluations Selection



Important

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

6.6 The CSV File Format

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

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



Note

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

6.6.1 Ammonit Meteo-40 specific details

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

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

6.6.1.1 Data part (CSV format)

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

wind_speed: Wind Speed,
 wind_direction: Wind Direction,
 humidity: Humidity,
 temperature: Temperature,
 temperature_differential: Differential Temperature,
 air_pressure: Air Pressure,
 air_density: Air Density,
 solar_irradiance: Global Horizontal Irradiance,
 solar_irradiance_diffuse: Diffuse Horizontal Irradiance,
 solar_irradiance_direct: DNI-cos θ ,
 solar_DNI: Direct Normal Irradiance (DNI),
 solar_irradiance_direct_sw: Estimated DNI,
 solar_DNIcos_sw: Estimated DNI-cos θ ,
 sun_status: Sun Status,
 sun_status_sw: Estimated Sun Status,
 precipitation: Precipitation,
 precipitation_intensity: Precipitation Intensity,
 precipitation_status: Precipitation Status,
 precipitation_sum: Precipitation Sum,
 wind_speed_vert: Vertical Wind Speed,
 counter: Counter,
 voltage: Analog Voltage,
 current: Analog Current,
 status: Status,
 active_power: Active Power,
 power_factor: Power Factor,
 reactive_power: Reactive Power,
 apparent_power: Apparent Power,
 obukhov_length: Obukhov Length,
 dir_max_speed: Direction at max. Speed,
 brightness_max: Brightness max. Value,
 brightness_direction: Direction of Brightness,
 frequency: Frequency,
 inclination_angle: Angle of Inclination,
 vibration_frequency: Vibration Frequency,
 vibration_amplitude: Vibration Amplitude,
 other: Other Evaluation,
 any: Any Evaluation

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

Meteo-40 offers the following statistics:

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

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

Language settings of the data logger do not have an influence on the CSV file. In the first column of the CSV file the date and time for each statistic is given. The date and time is the start time of the statistics interval. Date and time format are similar to ISO-8601, e.g., 2014-07-17 15:50:00.

The date and time values are always the local time of the data logger. The timezone is stated in the second part of the file.

6.6.1.2 Information part (Ini file format)

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

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

```
[Section 1]
key1=value
key2=value
[Section 2]
key1=value
```

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

- [System]: Serial number in the format

```
serial=D123456
```

and type of the data logger in the format

```
type=Meteo-40L
```

the assigned name; timezone in the format

```
timezone=UTC+01:00
```

(the offset can be positive or negative or be missing, which indicates UTC); the location in decimal degrees and altitude in meters:

```
latitude=0.0 longitude=0.0 altitude=0.0
```

as well as the software version and important system settings, e.g., `cecs_power_permanent=true`.

- [Summary] comprises the date and time when the CSV file has been created, the used source data storage and the summary over the file time interval for configured precipitation, precipitation intensity, status and sun status evaluations.
- [Evaluation] indicates `file_interval` and `stat_interval` (see also Section 6.3).

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

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

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

- 1 s
 - 2 s
 - 3 s
 - 5 s
 - 10 s
 - 20 s
 - 30 s
 - 1 min
 - 2 min
 - 5 min
 - 10 min
 - 15 min
 - 20 min
 - 30 min
 - 1 h
- [Adjustment]: CS1 and CS2 are the calibration values for the current source of Meteo-40. The values are for informational purpose only.
 - [Master]: The rate of RS485 is given in s, min or h; serial_setting for RS485 includes speed without unit, as well as data format in conventional notation (e.g., 9600 8N1).
 - [Sensor; Evaluator]
 - statistic: List of statistics, which are calculated for the sensor, e.g., average, min, max.
 - unit: Unit for the data, e.g., m/s.
 - sensor_label: Name, which has been entered by the user in the sensor configuration.
 - sensor_height: Installation height in meters, which has been entered by the user in the sensor configuration.
 - sensor_type: Indicates the type of the sensor, e.g., anemometer. The following values are possible:
 - anemometer: Anemometer,
 - wind_vane: Wind Vane,
 - hygro_thermo: Humidity / Temperature Sensor,
 - barometer: Barometric Pressure Sensor,
 - precipitation: Precipitation Sensor,
 - pyranometer: Solar Sensor,
 - ultrasonic: Ultrasonic Anemometer,
 - power_meter: Power Meter,
 - other: Other Sensor
 - sensor_model: The model of the sensor, e.g., Thies First Class Advanced.
 - formula: The type of formula used to convert the electrical values, e.g., linear.
 - formula_params: Parameters, which are referenced to in the formula, including related channels and evaluator parameters, e.g., A5 A6 var_offset var_slope. Values of the parameters are displayed in the lines below the formula parameters, e.g., var_offset, var_slope, var_period, var_sensitivity.
 - [Channel]
 - statistic: List of statistics, which are calculated for the channel/sensor. For each statistic a column is displayed in the upper part of the CSV file.
 - unit: Unit of the calculated data. This is the SI unit for the type of quantity, however the unit for barometric pressure might be either hPa or mbar, and the temperature unit is °C or K for differential temperature.
 - rate: Configured rate for the channel with unit (not applicable for Master channels).
 - range: Configured range for analog voltage channels (Ax) with unit.
 - protocol: Protocol, which is used for digital channels (Dx).

6.6.2 CSV import in LibreOffice or OpenOffice



Tip

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

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

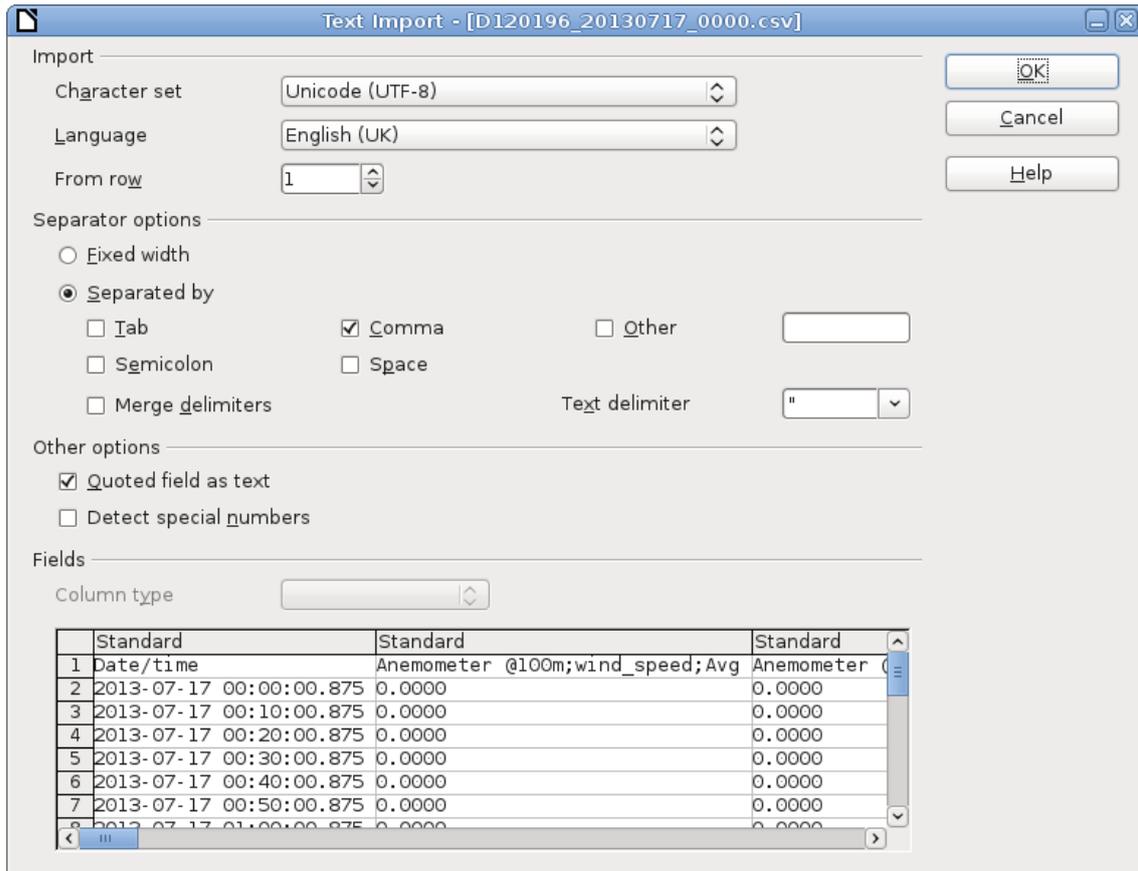


Figure 6.9: LibreOffice CSV-file import settings

6.6.3 CSV Import in Microsoft Excel 2010™

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



Note

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

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

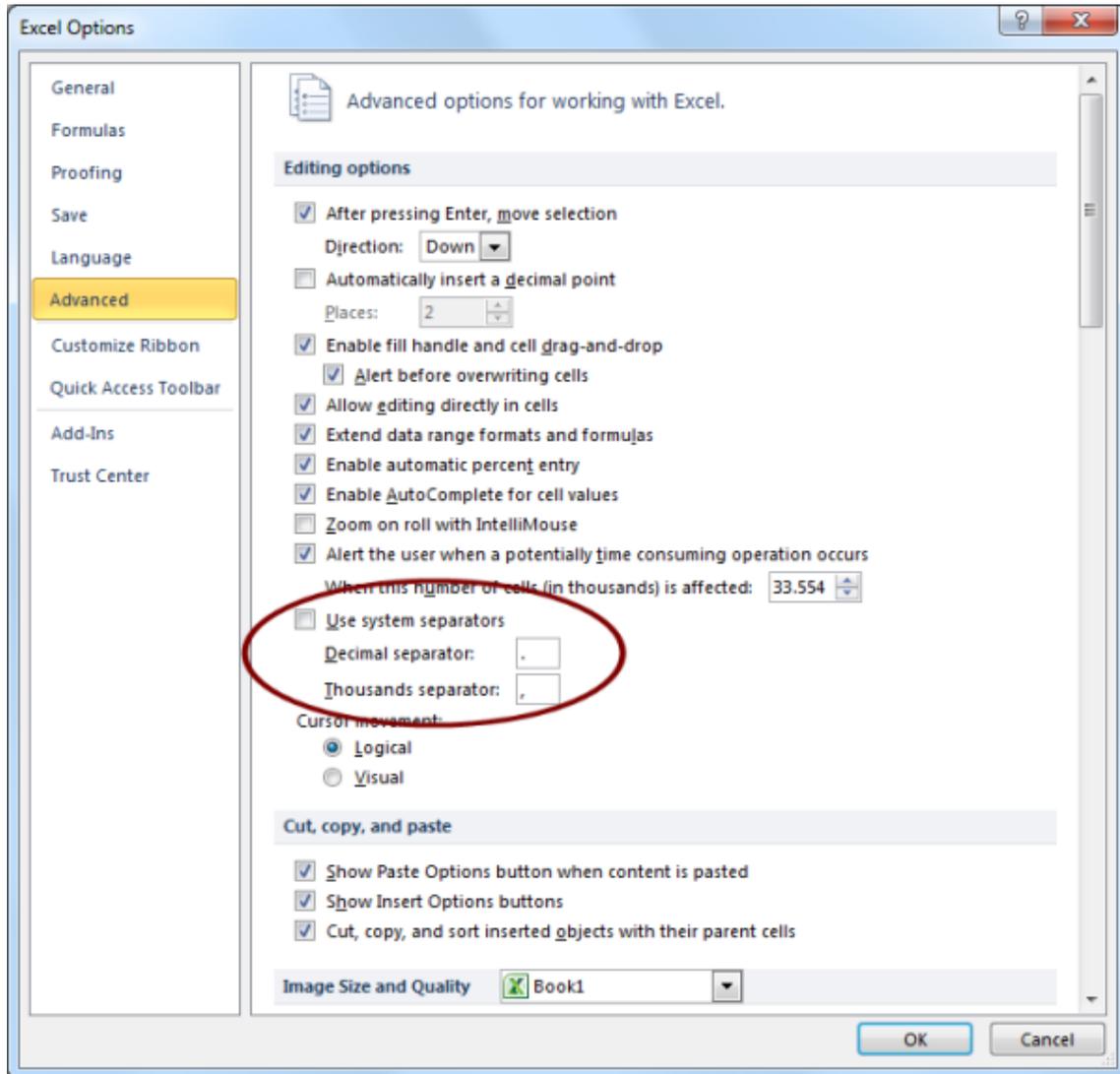


Figure 6.10: Microsoft Excel 2010™ CSV Import (1)

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

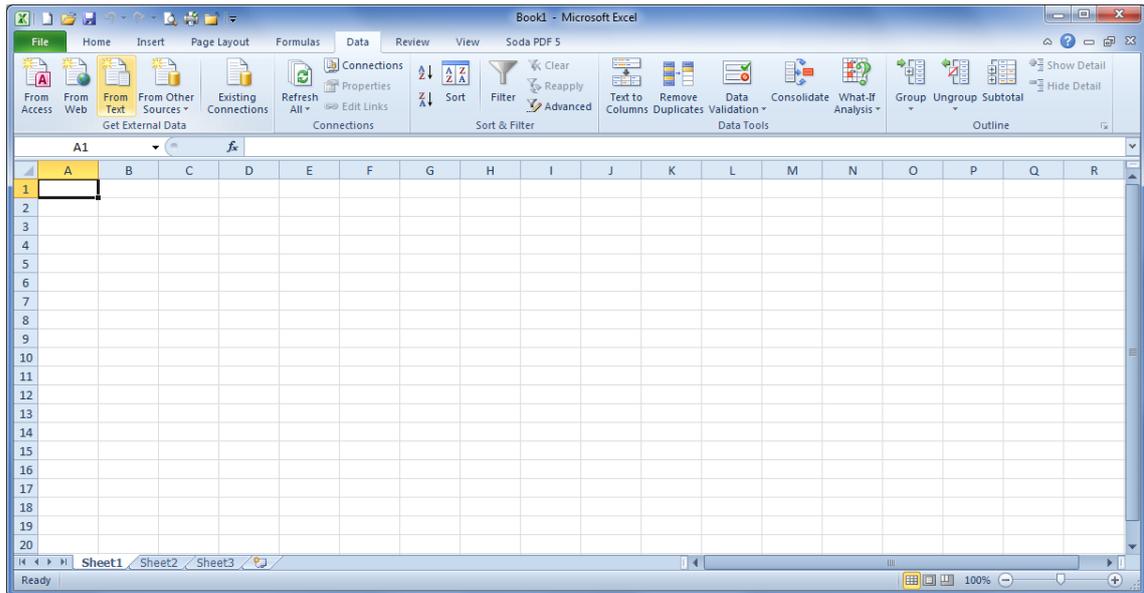


Figure 6.11: Microsoft Excel 2010™ CSV Import (2)

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

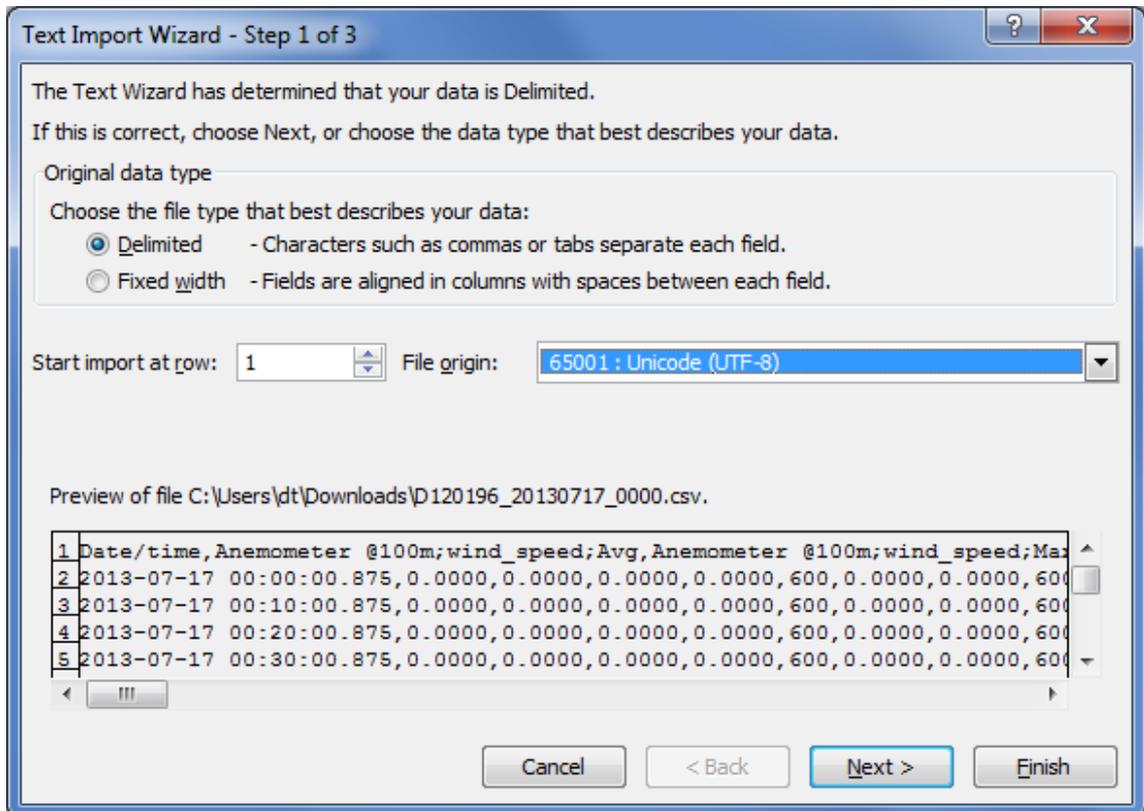


Figure 6.12: Microsoft Excel 2010™ CSV Import (3)

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

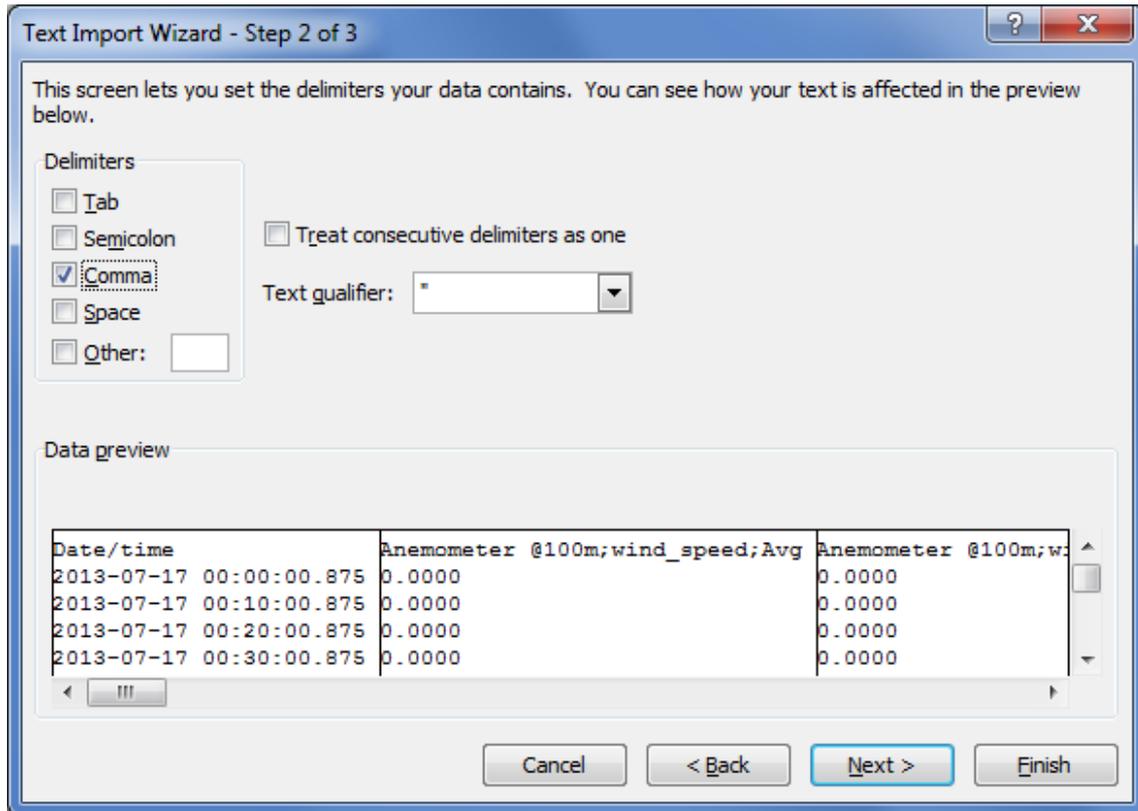


Figure 6.13: Microsoft Excel 2010™ CSV Import (4)

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

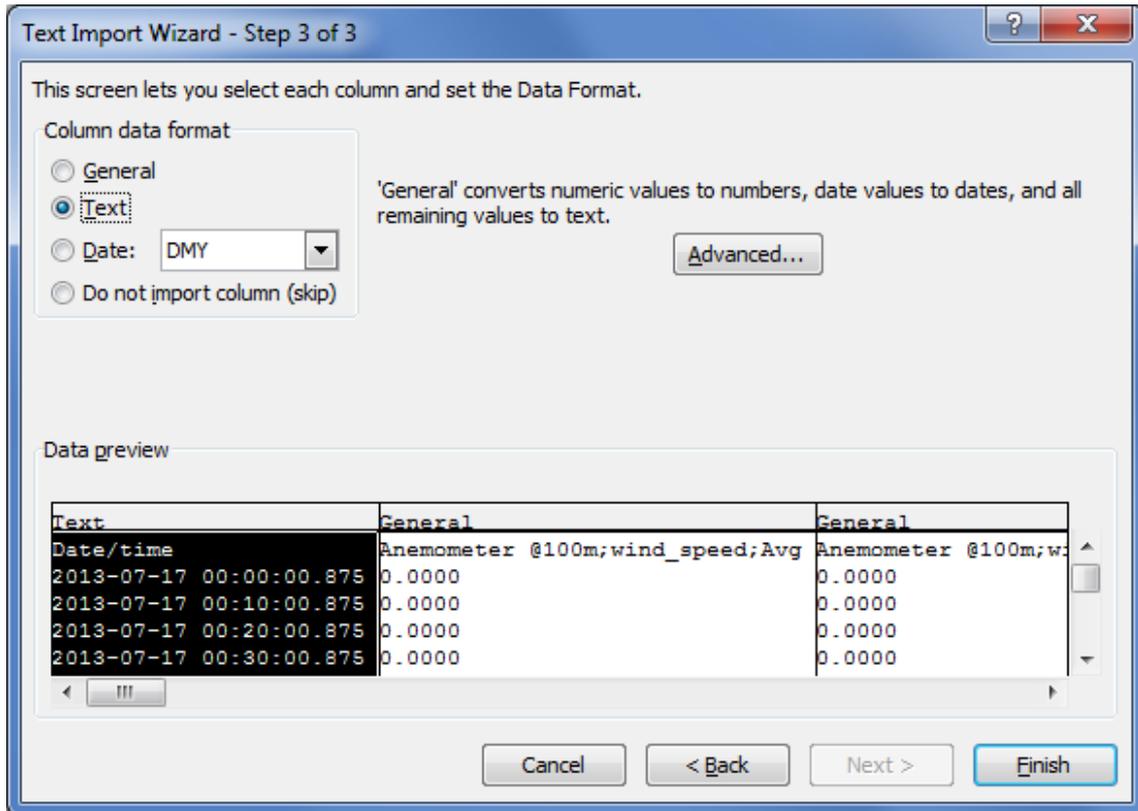


Figure 6.14: Microsoft Excel 2010™ CSV Import (5)

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

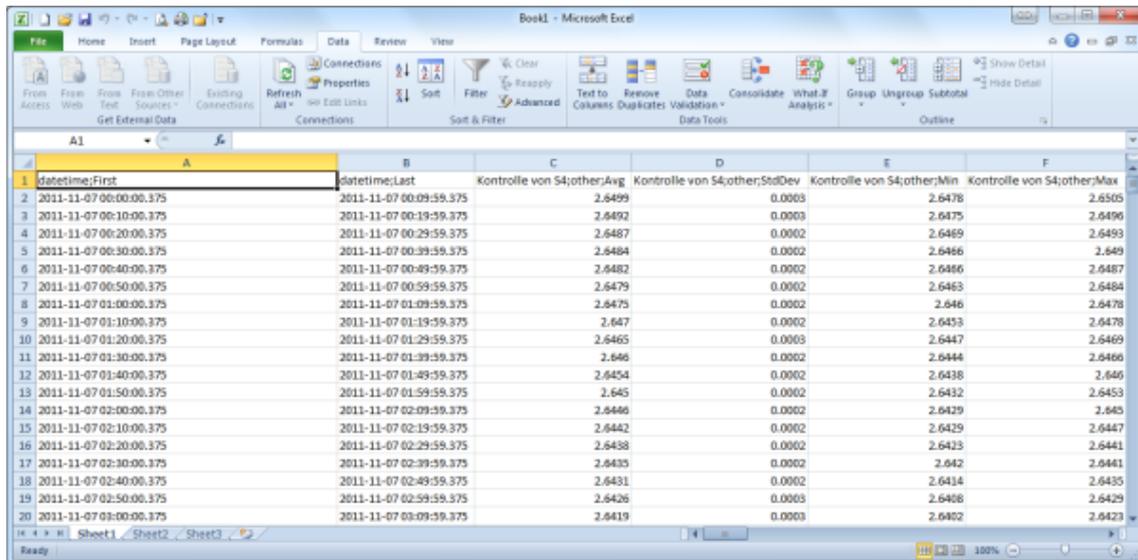


Figure 6.15: Microsoft Excel 2010™ CSV Import (6)

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

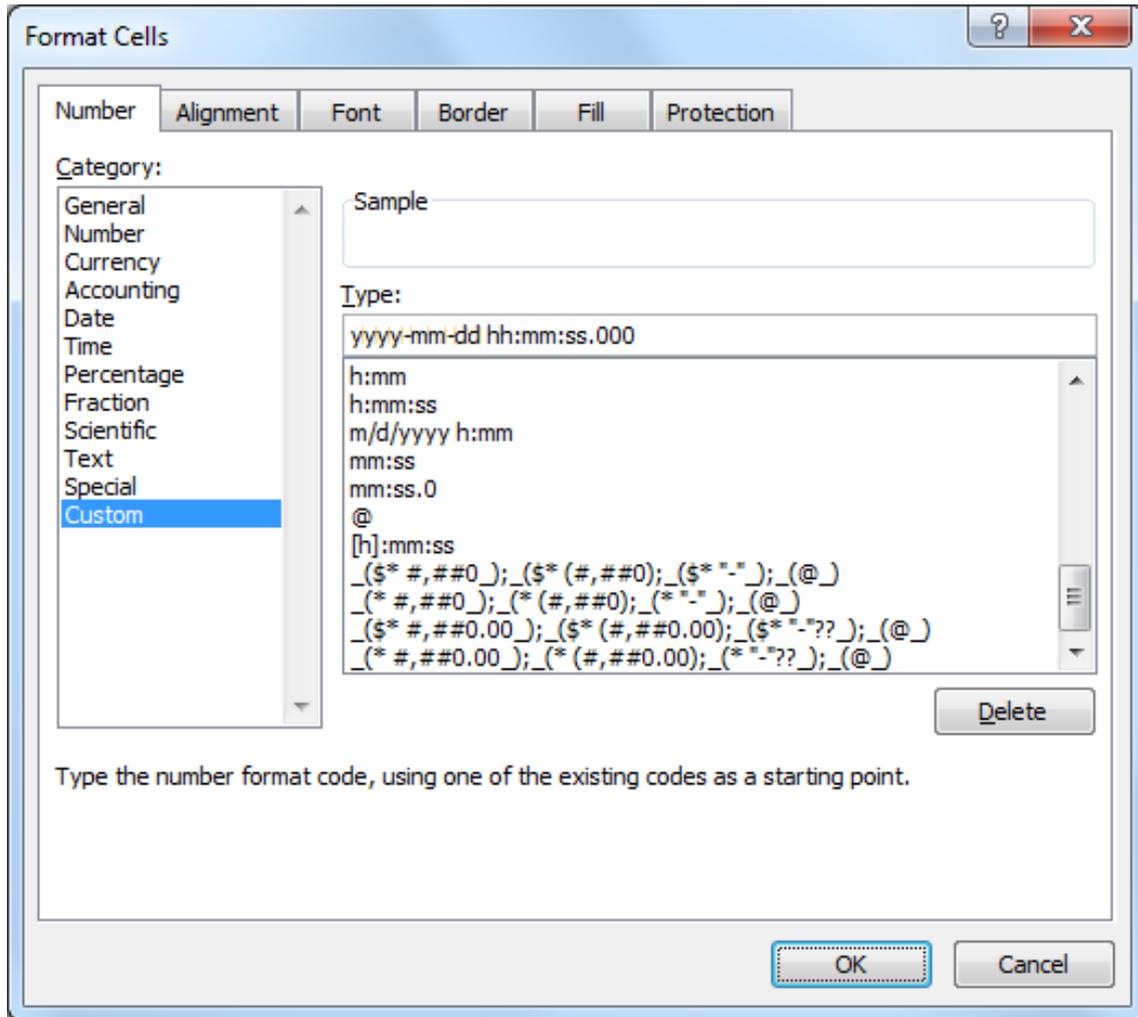


Figure 6.16: Microsoft Excel 2010™ Format Cells

6.7 Access to Source Data

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



Important

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

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

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

2016 07 08 09 10 11 12

2017 01 02 03 04 05

2017-05

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

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

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

600 lines

Source Data Only Evaluated Data Only Source and Evaluated Data Download ten minutes

Download hour Download day Download week

Figure 6.17: Screenshot of the Source Data Page

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

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

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

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



Warning

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

Chapter 7

Communication

7.1 Introduction

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

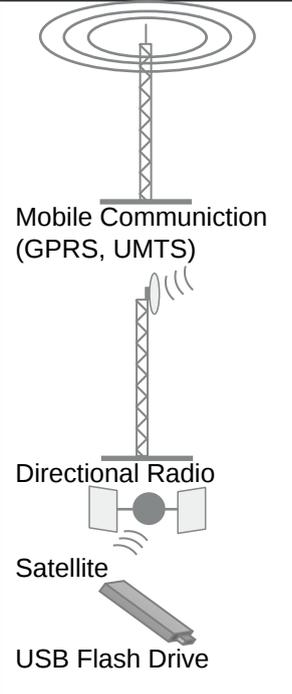
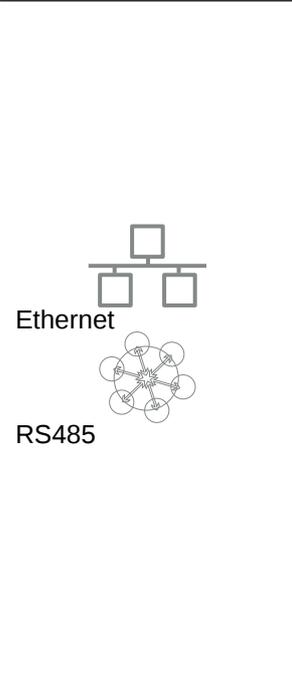
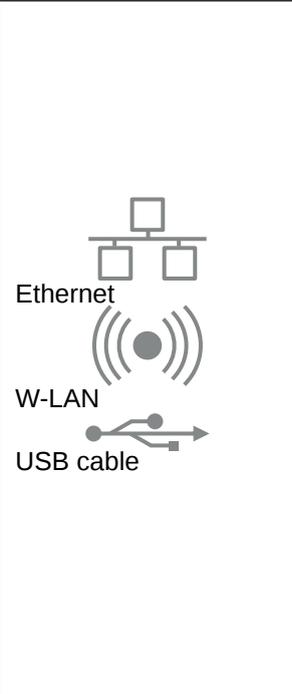
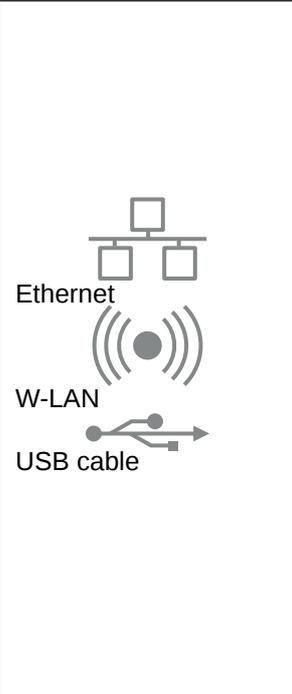
Measurement Campaign	Power Plant Monitoring	Maintenance (Site)	Configuration (Office)
 <p>Mobile Communication (GPRS, UMTS)</p> <p>Directional Radio</p> <p>Satellite</p> <p>USB Flash Drive</p>	 <p>Ethernet</p> <p>RS485</p>	 <p>Ethernet</p> <p>W-LAN</p> <p>USB cable</p>	 <p>Ethernet</p> <p>W-LAN</p> 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

Table 7.1: Data Transmission with Meteo-40

The Meteo-40 web interface can be accessed via:

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

**Tip**

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

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

**Note**

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

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

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

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

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

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

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

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

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



Tip

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

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

Table 7.3: Ports used by Meteo-40

7.2 Configuring the Communication Schedule

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

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



Note

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

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

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



Note

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

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

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

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

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

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

Figure 7.1: Configuring the Schedule

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

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

Enter the *Start Time* according to the 24-hour format: hh:mm. Enter 14:00, when the action should start at 2 p.m..

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

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

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

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

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

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

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

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

**Note**

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

For immediate action, click *Run now*.

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

**Note**

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

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

**Tip**

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

7.3 Configuring Online Access

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

**Important**

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

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

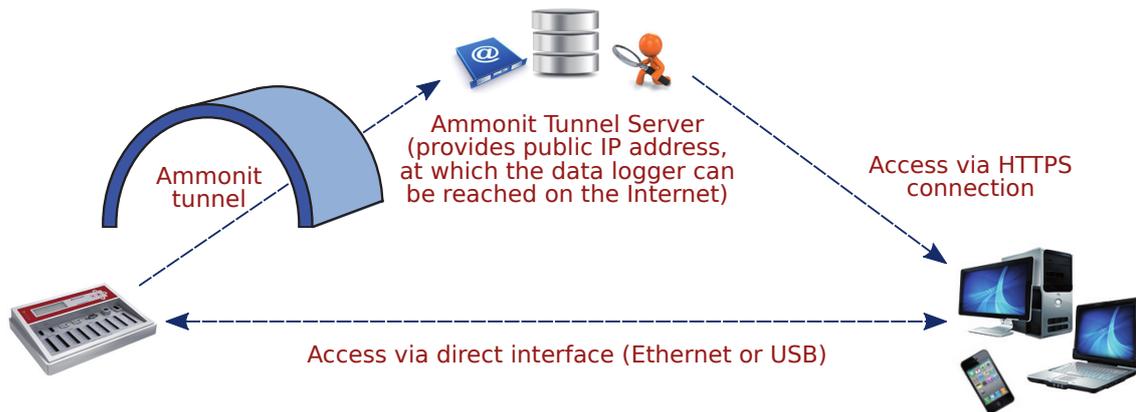


Figure 7.2: Communication between Meteo-40 and PC via Ammonit Tunnel Server



Note

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

The screenshot shows the 'Tunnel' configuration page. It includes a dropdown menu for 'Select tunnel server' (set to 'Ammonit tunnel'), a 'Tunnel login' field (containing 'logger@D130293.tunnel.a'), and a 'Tunnel port' field (set to '0'). There are buttons for 'Download SSH Key', 'Link to tunnel', and 'Save Tunnel Config'. A checkbox is labeled 'Prevent implicit tunnel activation (only recommended for satellite communication)'. Red arrows point to these elements with the following annotations: 'select your preferred tunnel server' (pointing to the dropdown), 'download SSH key for your own tunnel or AmmonitOR installation' (pointing to the 'Download SSH Key' button), 'click to enter the Meteo-40 webinterface via tunnel connection' (pointing to the 'Link to tunnel' button), 'prevent unauthorized internet traffic from reaching the data logger' (pointing to the 'Tunnel access code' field), and 'activate to avoid blind tunnel activation' (pointing to the checkbox).

Figure 7.3: Configuring the Online Access

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

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

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

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

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

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

Tunnel access code By using a *Tunnel access code*, you prevent unauthorized Internet traffic from reaching the data logger. This traffic might slow down your connection and increase Internet costs.

**Tip**

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

**Note**

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

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

**Tip**

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

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



Ammonit Meteo-40 Tunnel

Please enter your access code

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

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

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www.ammonit.com

Figure 7.4: Entering the Tunnel Access Code

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



Important

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

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

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

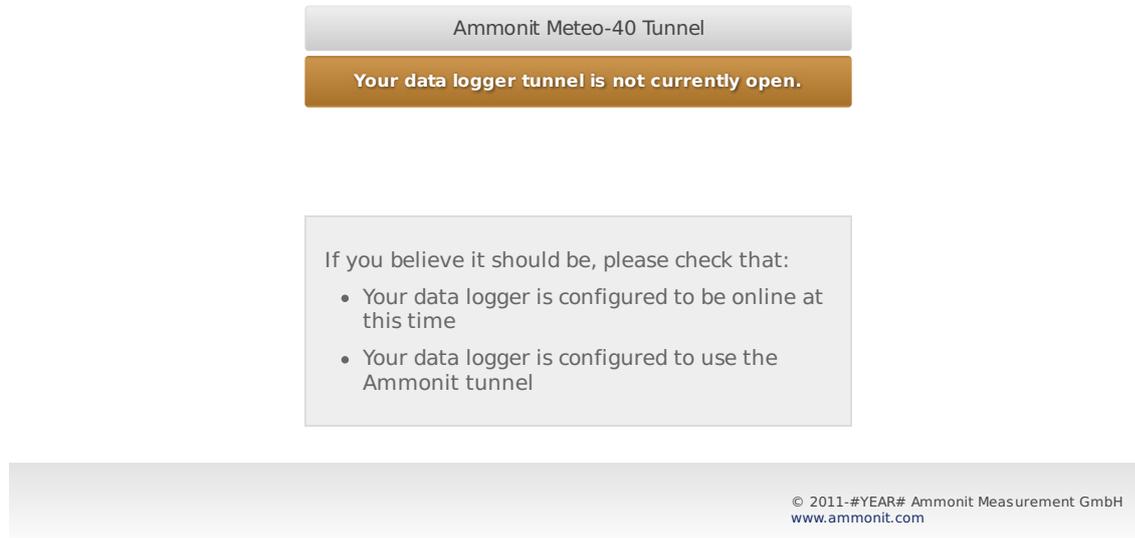


Figure 7.5: Communication via Ammonit Tunnel (closed tunnel)

7.4 Configuration for using AmmonitOR

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

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



Note

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

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

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

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

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

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

Select AmmonitOR server:
 select your preferred AmmonitOR server

AmmonitOR project key
 enter project key of the related AmmonitOR project

Server:

Port:

Username:

Start date (YYYY-MM-DD):

Send CSV files

Send logbook data
 select which details should be transferred to AmmonitOR

Send configuration file link to related AmmonitOR project

Send camera image

Send data snapshot

Send gust data files

download SSH key for custom tunnel or custom AmmonitOR installation

Figure 7.6: AmmonitOR Settings

Decide, which data should be monitored in AmmonitOR:

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

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

Logbook data Select this option, to send logbook entries to AmmonitOR.

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

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

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



Note

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

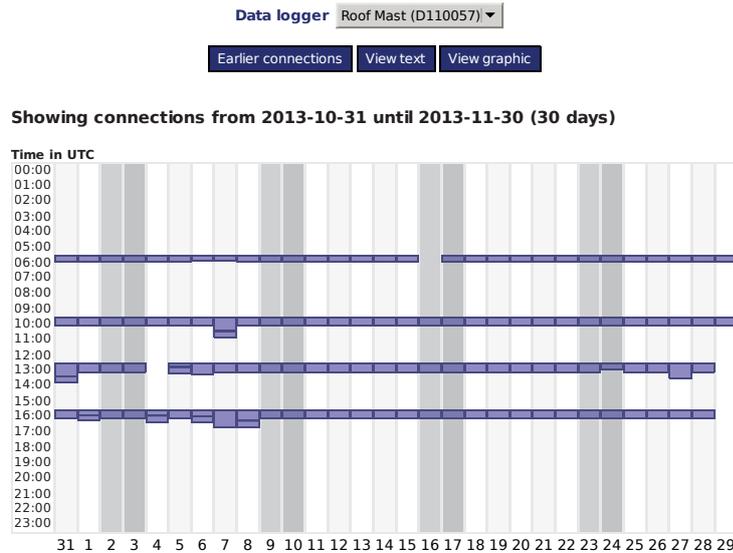


Figure 7.7: Connection Log in AmmonitOR

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

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

Save Save the current settings.

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

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

7.4.1 Authenticating Meteo-40 at your local AmmonitOR installation

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

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

7.5 Configuring Email Parameters

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



Important

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

**Tip**

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

Enter server and account details:

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

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

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

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

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

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

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

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

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

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

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

Send configuration file Whether to send the configuration file. The file will be sent once, and after configuration changes with the next email scheduled.

Send camera image If a camera is connected to the data logger, an instant picture can be attached, which is taken a moment before the email is sent.

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

**Note**

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

SMTP server:
 ← **enter details of your mail server**

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

SMTP username:
 ← **enter email account details**

SMTP password:
 Show password

From:

To:
 ← **enter recipient details**

Cc:

POP server (for POP-before-SMTP authorisation):

Start date (YYYY-MM-DD):

Attach image ← **tick here to attach an image**

Figure 7.8: Configuring Email Parameters

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

**Important**

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

**Note**

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

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

7.5.1 Signing and Encrypting Emails and Attachments

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

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

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

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

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

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

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

In order to verify the certificate, download the `Public` key, displayed in the Meteo-40 web interface and import the key into your local verification software, e.g., Gnp4win (see Section 7.5.1.1).

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

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

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

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

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

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

Go to the [GPG4WiN website](http://gpg4win.de/download) (<http://gpg4win.de/download>) and download the current software version. Install the software with the above mentioned components.



Note

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

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



Important

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

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

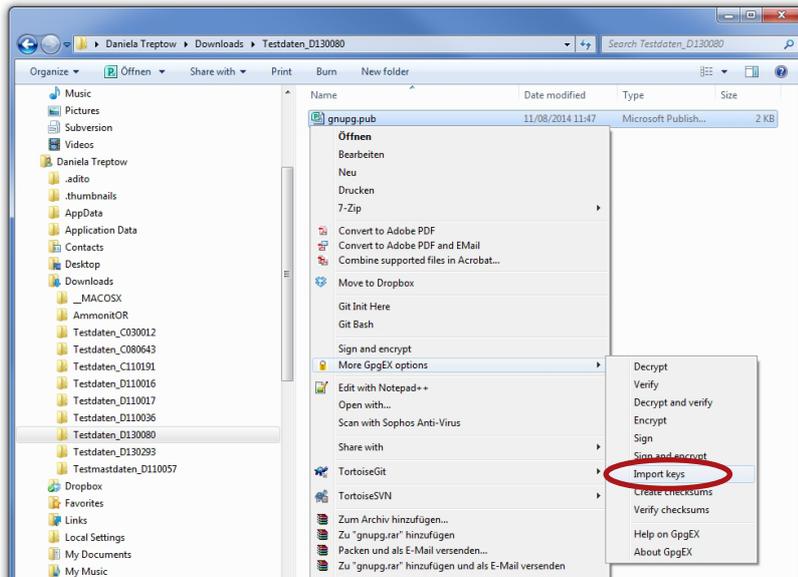


Figure 7.9: Importing the Public key into Gpg4win

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

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

If not user's private key is existing, create a new certificate via the File → New Certificate menu. Select *Create a personal OpenPGP key pair* and enter the required details. Click *Create key* and enter a high quality password. Your key should have been successfully created.

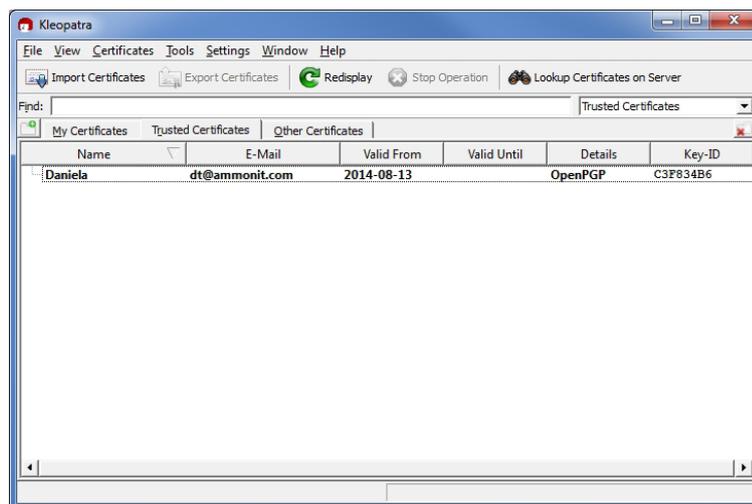


Figure 7.10: Creating the private key

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



Figure 7.11: Certifying the Public key

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

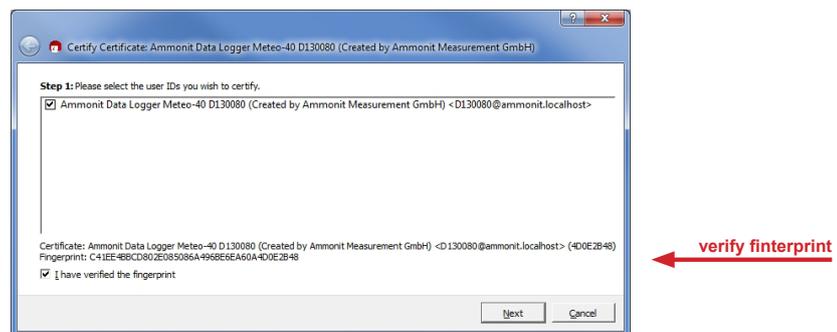


Figure 7.12: Verifying the Fingerprint

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

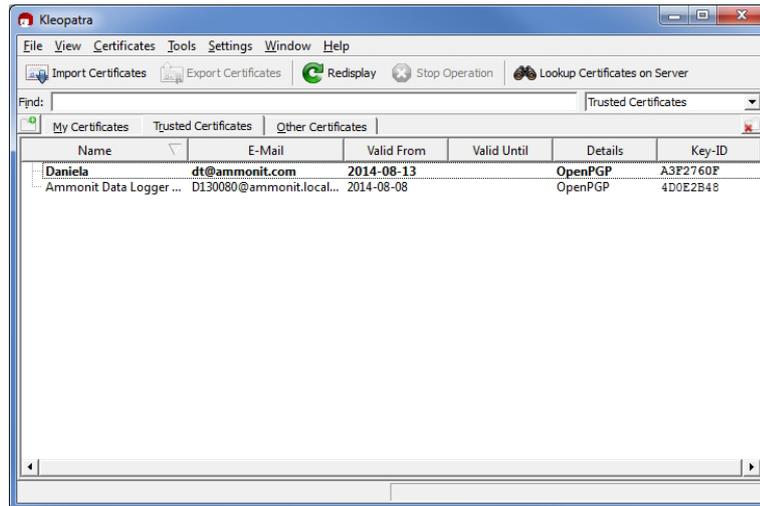


Figure 7.13: Trusted Certificates

7.5.1.2 Verifying digital signatures in the Windows Explorer™

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

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

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

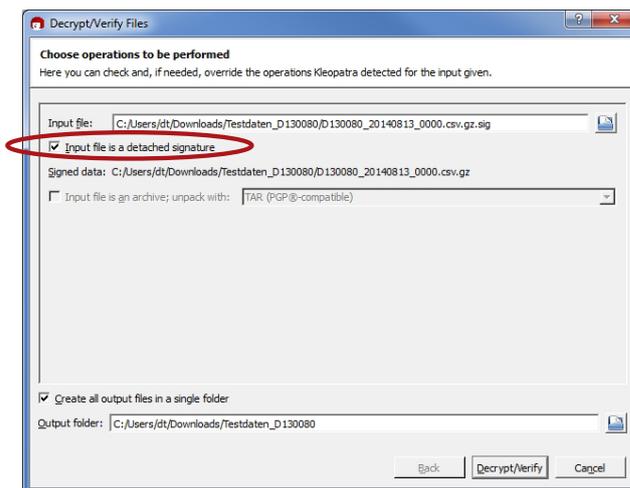


Figure 7.14: Verifying signed files

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

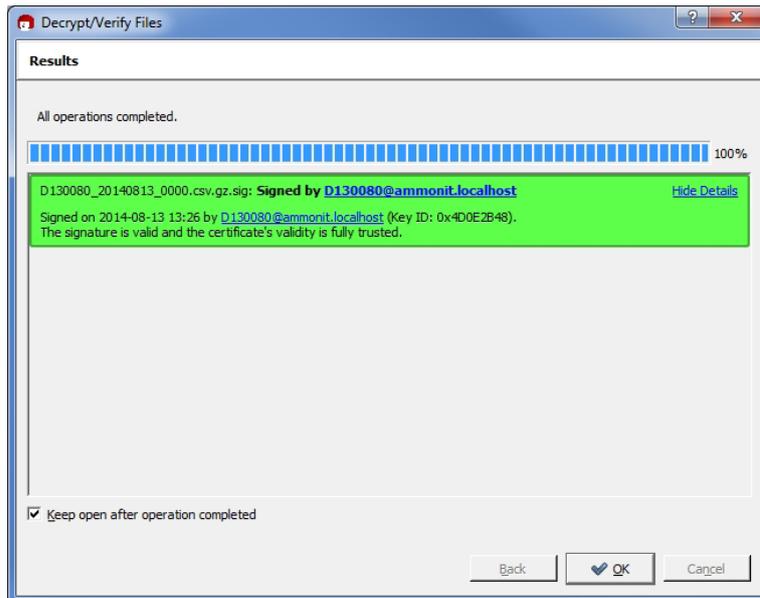


Figure 7.15: Successfully verified signature

7.5.1.3 Verifying digital signatures in Microsoft Outlook™

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

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

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

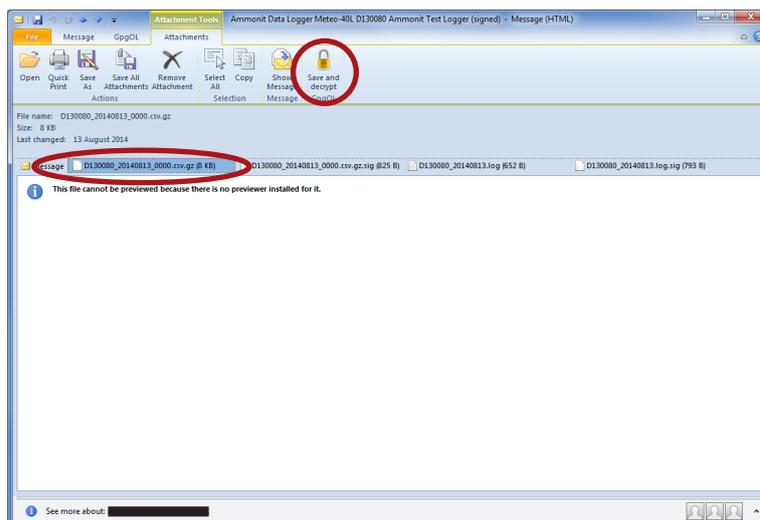


Figure 7.16: Verifying files in Microsoft Outlook™

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

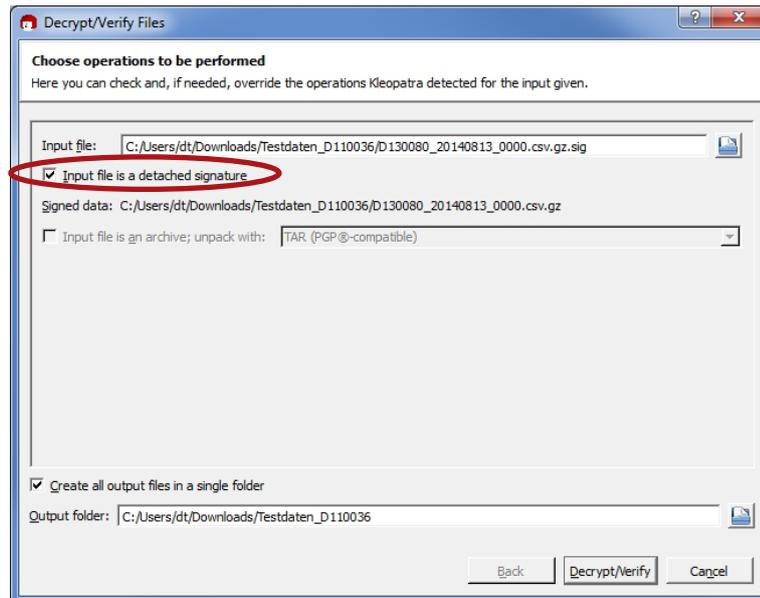


Figure 7.17: Verifying signatures in Microsoft Outlook™

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

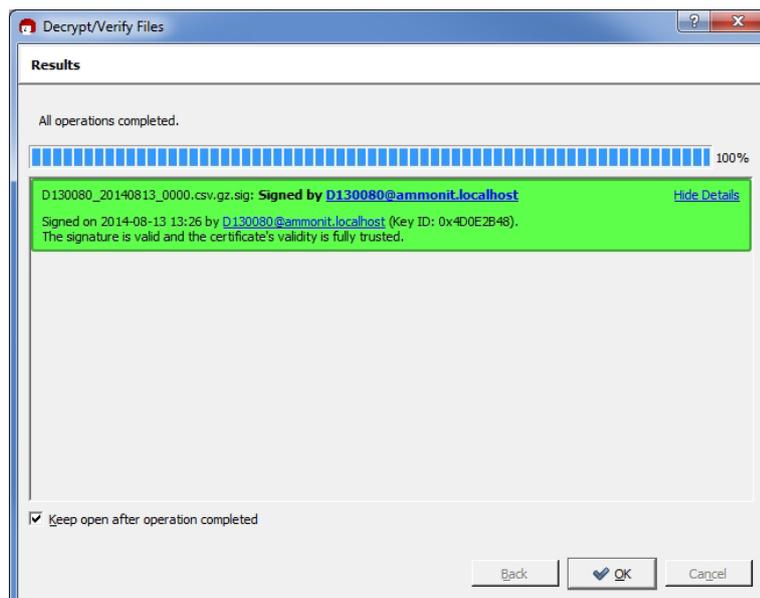


Figure 7.18: Successful validation of the signature

Note

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

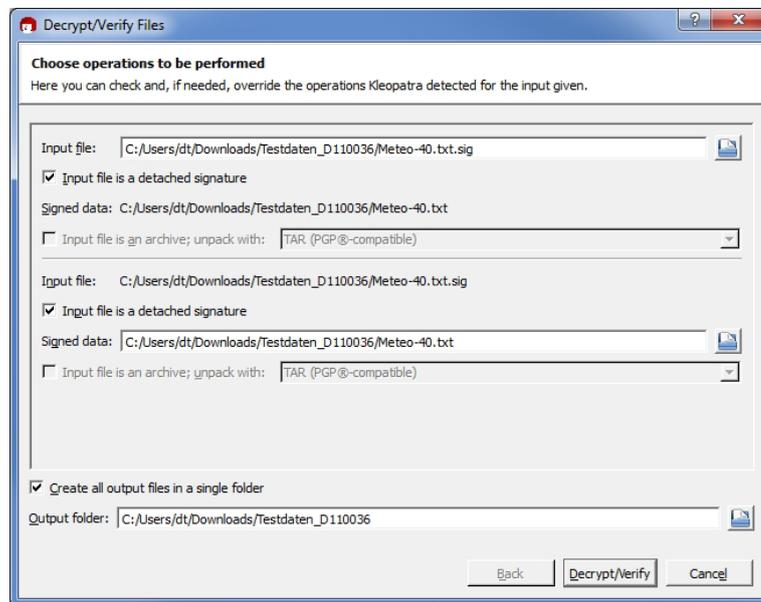


Figure 7.19: Verifying signed test mails

7.5.1.4 Decrypting files in the Windows Explorer™

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

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

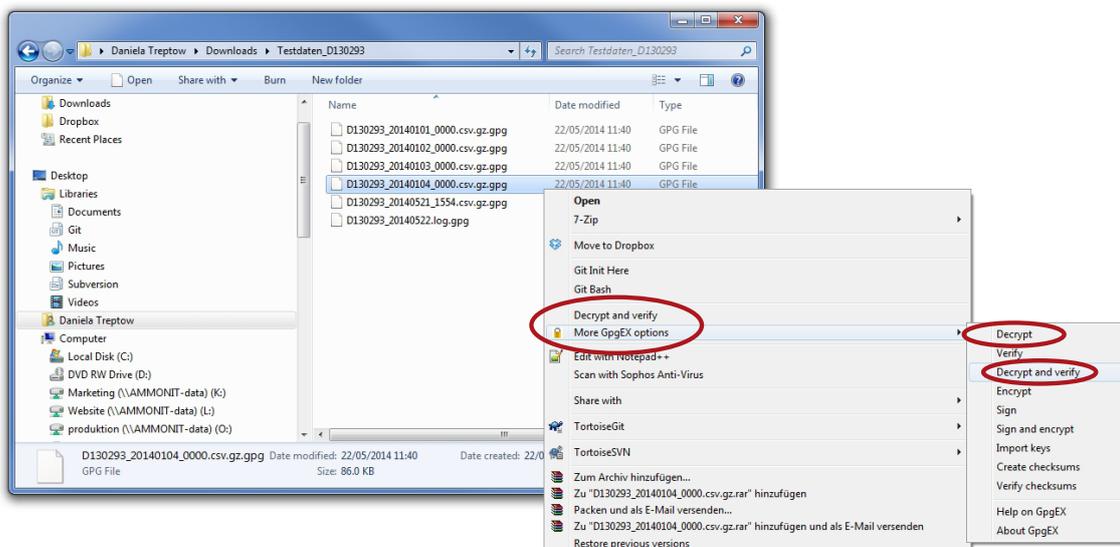


Figure 7.20: Decrypting files via the GpgEX plug-in for Windows Explorer™

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

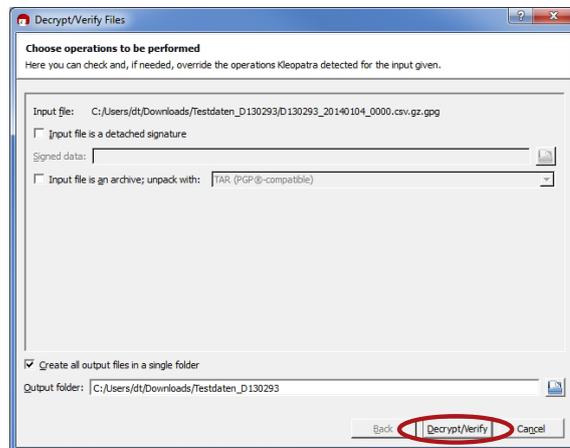


Figure 7.21: Decryption via Kleopatra Software

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

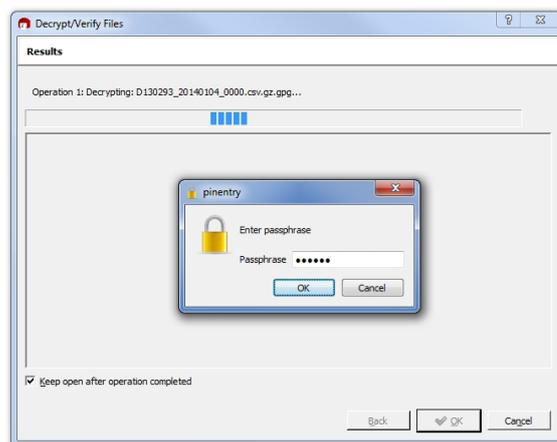


Figure 7.22: Password Prompt for Decryption

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

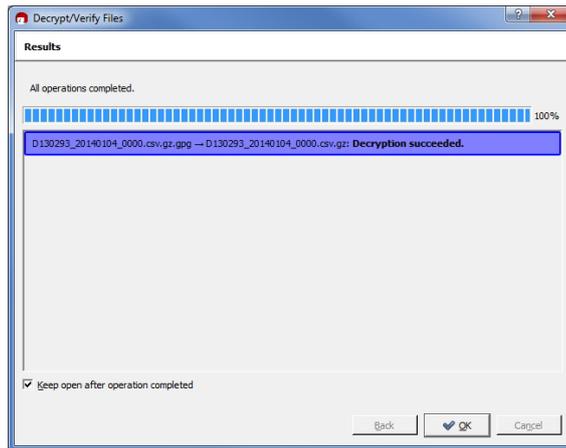


Figure 7.23: Successful File Decryption

7.5.1.5 Decrypting files in Microsoft Outlook™

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

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

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

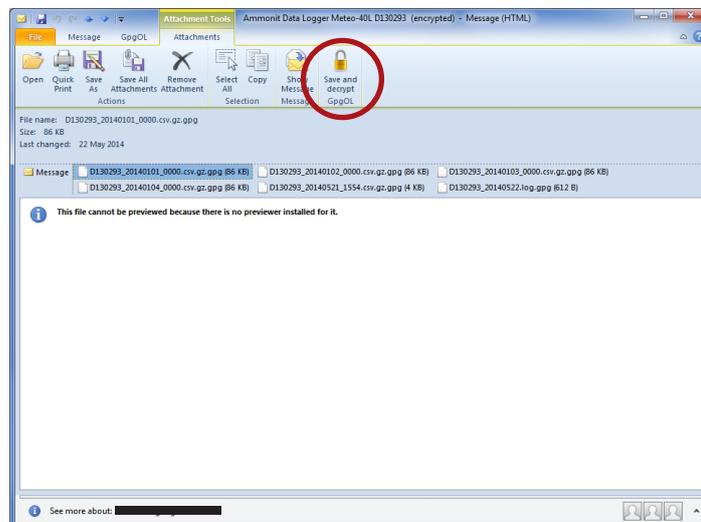


Figure 7.24: GpgOL add-in in Microsoft Outlook™

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

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



Note

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

7.6 Configuring FTP and SCP Parameters

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

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

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

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

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

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

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



Note

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



Warning

The file upload via FTP is not encrypted.

The screenshot shows a configuration form for FTP/SCP parameters. The fields and buttons are as follows:

- Method:** A dropdown menu with 'SCP' selected. A red arrow points to it with the text 'select upload method'.
- Server:** A text input field containing 'xxx.xxx.xx.xx'.
- Port:** A text input field containing '21'.
- Username:** A text input field containing 'user'.
- Password:** A password input field with a 'Show password' checkbox.
- Directory:** A text input field containing 'home/meteo40/d130080'. A red arrow points to it with the text 'enter directory on server (file path)'.
- Start date (YYYY-MM-DD):** An empty text input field.
- Buttons:**
 - 'Reset send status' button.
 - 'Save and copy test data' button. A red arrow points to it with the text 'test file upload'.
 - 'Save' button.

Figure 7.25: Configuring the FTP/SCP Parameters

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



Important

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

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



Tip

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



Warning

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

7.7 Configuring LAN Parameters



Important

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

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



Note

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

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

Interface	State	IP Address	Product
usb0	Unavailable	169.254.12.34	
eth0	Activated	192.168.12.34	

LAN online, whenever CECS is on

IP address allocation method:

Connect to internet via USB modem only (recommended e.g. for SCADA and Ethernet camera)

LAN switch (typically S1):

IP address

DNS server

Gateway

Subnet mask

Additional subnets

available LAN connections

establish internet connection, when CECS is on

select DHCP, static IP address, or link-local connection

select modem for internet connection

select a switch, e.g. for BGAN modem

Figure 7.26: Configuring LAN parameters

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

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

**Note**

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

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

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

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

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

7.7.1 Configuring a Static IP address in a LAN

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

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

Interface	State	IP Address	Product
usb0	Unavailable	169.254.12.34	
eth0	Activated	192.168.12.34	

LAN online, whenever CECS is on

IP address allocation method:
 ← select fixed IP for a static IP address

Connect to internet via USB modem only (recommended e.g. for SCADA and Ethernet camera)

LAN switch (typically S1):

IP address
 ← enter static IP address and further IP settings

DNS server

Gateway

Subnet mask

Additional subnets

Figure 7.27: Configuring a Static IP Address in a LAN



Note

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

7.8 Configuring W-LAN

Meteo-40 supports W-LAN (WiFi) for more flexibility on site. To set up a W-LAN, a W-LAN USB stick has to be connected to the Meteo-40.

Before using the W-LAN function, Meteo-40 has to be configured. Go to the Communication → WLAN menu and select the checkbox *Activate W-LAN*. According to your local network Meteo-40 assigns an *IP address* and displays *Netmask*, *Network* as well as *First address* and *Last address* of your network. Later on you access the Meteo-40 web interface under the assigned IP address.

Enter a *Passphrase* consisting of at least eight characters. Click on *Save* to finish your configuration.



Important

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

**Note**

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

Activate W-LAN
 IP address: 192.168.40.1
 Netmask: 255.255.255.0
 Network: 192.168.40.0
 First address: 192.168.40.2
 Last address: 192.168.40.255
 Passphrase (at least eight characters): **at least 8 characters** Show password

Figure 7.28: Configuring W-LAN Parameters

After having finished the configuration in the Meteo-40 web interface, activate the W-LAN function of your computer. Search Meteo-40 among the available W-LANs. The established W-LAN is shown with the serial number of the data logger. Select the W-LAN and enter the *Passphrase*, which has been entered in the Meteo-40 web interface.

Open your browser and enter the IP address, which has been displayed in the Meteo-40 web interface (see Figure 7.28).

**Note**

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

7.9 Configuring the Modem

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

**Note**

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

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

**Important**

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



Tip

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

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

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

Use provider helper

Number: *99#

APN: internet

Username:

Password:

Modem online, whenever CECS is on (recommended)

Modem switch (typically S1): S1

PIN:

Save

New PIN:

PUK (for changing the PIN):

Save new PIN

SMS

Annotations:

- connection status
- reason of connection failure
- signal strength
- network operator
- IP address of modem
- product details
- received/transmitted bytes
- modem supported bands
- set APN and provider details with the help of a wizard
- establish online connection, whenever CECS is running
- select modem switch
- use these fields to change the SIM PIN or set a new one

Figure 7.29: Modem Configuration

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

State Connection status

Reason Reason of connection failure

Signal Signal strength

Operator Mobile network operator

IP Address IP address of modem

Product Product details

RX/TX Received/transmitted bytes

Bands Radio bands supported by the modem

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

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

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

In case of doubt contact your provider.

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

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



Important

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

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

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

Password: Enter the password for the chosen APN.

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

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

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



Note

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



Tip

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

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

**Important**

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

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

**Note**

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

**Important**

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

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

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

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

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

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

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

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

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

**Important**

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

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

7.9.1 Using the Provider Helper

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

**Note**

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

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

Continent

Country

Provider

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

Figure 7.30: Meteo-40 Provider Helper

7.9.2 Short Message Service

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

**Important**

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

Enable short message service

Receiver number

SMSC

SMS password:
 Show password

Figure 7.31: Settings for Short Message Service

The parameters are:

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

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

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

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

7.9.2.1 Sending a Short Message

If the SMS feature is activated and a password has been entered, a message can be sent to the telephone number linked with the SIM in the modem. The content must be

```
password  
command
```

where *password* is the configured SMS password and *command* is an SMS command. Be careful typing the password respecting upper and lower cases.

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

Table 7.4: Short Message Commands



Note

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

7.9.3 Working with Static IP SIM cards

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

7.9.4 Two Ways to Establish an Online Connection via Modem



Note

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

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

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

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

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

**Important**

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

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

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

7.9.5 Reset PIN Code of Locked SIM Card

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

7.9.6 Connecting a GSM/GPRS Modem to Meteo-40

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

**Important**

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

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

7.9.6.1 Information on Modem Sierra Wireless Airline Fastback Extend EDGE FXT009

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

**Important**

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

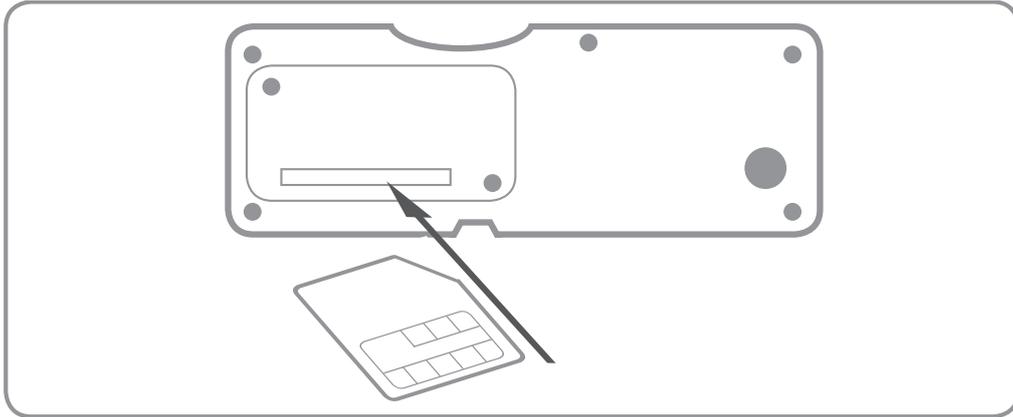


Figure 7.32: Inserting SIM Card into modem Fastback Extend EDGE FXT009

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

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

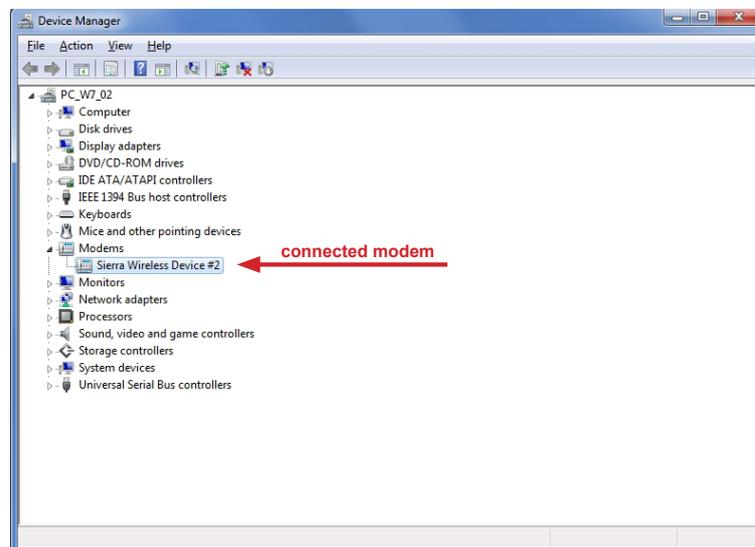


Figure 7.33: Device Manager

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

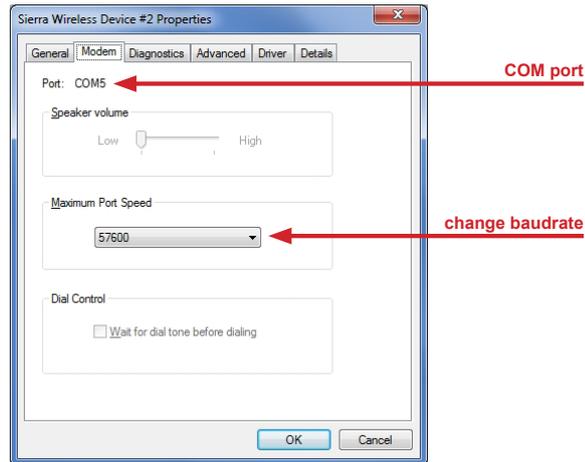


Figure 7.34: Modem Properties

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

AT+WMB5=5 (to switch to 850/1900 MHz)
 AT+WMB5=4 (to switch to 900/1800 MHz)
 AT+WMB5=7 (to switch to 850/900/1800/1900 MHz)

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



Warning

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

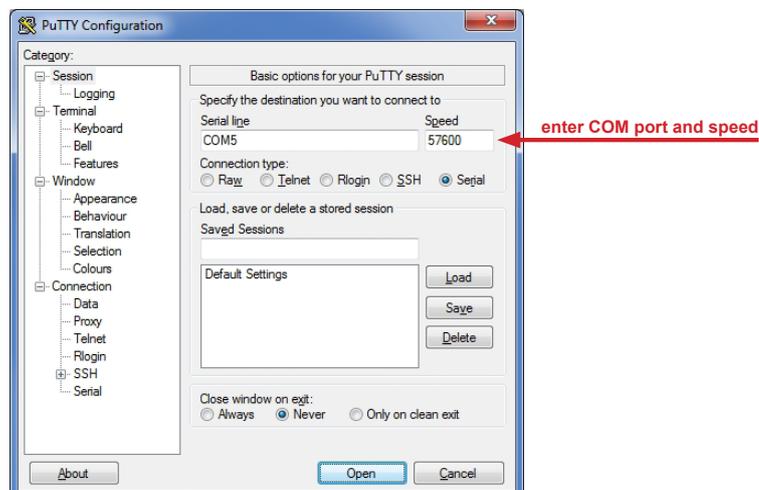


Figure 7.35: PuTTY Configuration

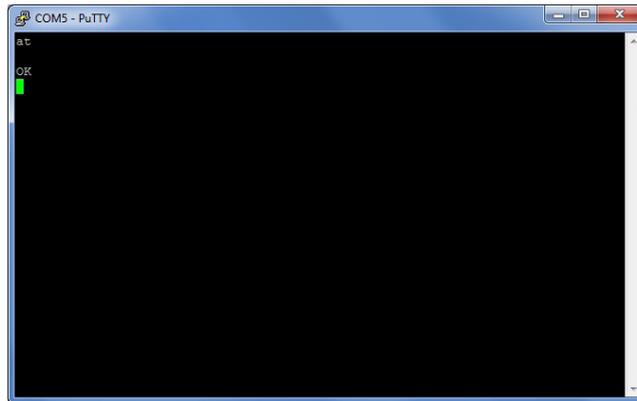


Figure 7.36: PuTTY Command Window



Important

Restart the modem after modification.

7.9.7 Connecting a BGAN Satellite Modem to Meteo-40

7.9.7.1 Pointing the terminal to the satellite

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

7.9.7.2 Configuring Meteo-40 with BGAN Satellite Modem



Important

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

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

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

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

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

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

7.9.7.3 Recommended Settings for Satellite Connections

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

The screenshot shows the Ammonit web interface. On the left, there are status indicators: Recording is Off (with a 'Switch on' button), Configuration is Saved (with a 'Save' button), Connection is ETHERNET, Tunnel, Remaining is ∞, and Date/time is 2017-05-11 14:54:40 UTC. On the right, under the 'LAN' heading, there is a list of ten orange boxes with the following text: 'Please turn off 'CECS is always active'', 'Please activate AmmonitOR with a valid project key', 'Please use AmmonitOR for data transfer', 'Please configure a tunnel access code', 'Please prevent implicit tunnel activation', 'Please use mode for reduced user interface interactions', 'Please configure not more than three online times of max. one hour combined', 'Please turn off 'LAN online, whenever CECS is on'', 'Please do not use EMail for data transfer', and 'Please use daily CSV files with 10 minute statistics interval'. Below this, there is a table with columns 'Interface', 'State', 'IP Address', and 'Product'. The table contains two rows: 'usb0' with state 'Unavailable' and IP '169.254.12.34', and 'eth0' with state 'Activated' and IP '192.168.12.34'. Below the table are several configuration options: a checked checkbox for 'LAN online, whenever CECS is on', a dropdown for 'IP address allocation method' set to 'DHCP', an unchecked checkbox for 'Connect to internet via USB modem only (recommended e.g. for SCADA and Ethernet camera)', a dropdown for 'LAN switch (typically S1)' set to 'S2', and input fields for 'IP address' (192.168.40.40), 'DNS server' (192.168.40.1), 'Gateway' (192.168.40.1), and 'Subnet mask' (192.168.40.1). There is also an empty input field for 'Additional subnets' and two buttons: 'Save' and 'Check optimal BGAN settings'.

Interface	State	IP Address	Product
usb0	Unavailable	169.254.12.34	
eth0	Activated	192.168.12.34	

Figure 7.37: Check BGAN optimal settings

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

1. We strongly recommend sending data *only to AmmonitOR*, but not by email. The data transfer to AmmonitOR consumes less bandwidth than email (see Section 7.2 and Section 7.4).
2. Use only few tunnel connections, e.g. twice or thrice a week for twenty minutes (see Section 7.2).
3. Use a tunnel access code to prevent unauthorized access to the data loggers login page (see Figure 7.3) which can generate data traffic.
4. To reduce data traffic when using the web user interface, you may want to reduce user interface interactions (see Figure 7.3).
5. Prevent implicit tunnel activation, only recommended for satellite communication (see Figure 7.3).
6. Do not set the check on *LAN online, whenever CECS is on* (see Section 7.7).

-
7. Be sure to generate not too huge or too many CSV files by keeping the default of one file per day with 10 minutes statistics interval (see Section 6.3). Avoid gust data files, which may get large, depending on configuration and wind conditions.

7.10 Troubleshooting

Some mobile service providers and also firewalls in corporate networks restrict the communication of mobile devices to certain ports. The communication of the Meteo-40 data logger might also be affected. There are different incidents, e.g., the tunnel connection does not work, but Rx/Tx traffic is possible or the tunnel is accessible, but sending emails does not work. Reasons for this are often blocked ports by the communication service provider or the firewall or broken DNS.

7.10.1 How to perform the test for tunnel and AmmonitOR

In the web user interface, just save the online/tunnel parameters or AmmonitOR settings. In this moment the data logger checks the connection and presents the result.

Alternatively, you can do the check from the LC display. Go to Communication (Figure 7.38). Then select Communication Check (Figure 7.39). This will take some time. After some seconds, you can see the results (Figure 7.40).

```
System
Status
Channels
> Communication
```

Figure 7.38: Select "Communication"

```
Devices
Activation
> Check Connection
Schedule
```

Figure 7.39: Select "Check Connection"

```
Tunnel accessible
Port 4040 open
AmmonitOR accessible
Port 4041 open
```

Figure 7.40: View results of check

If one of the servers is not accessible or a port is blocked, please contact your network administrator or mobile service provider.

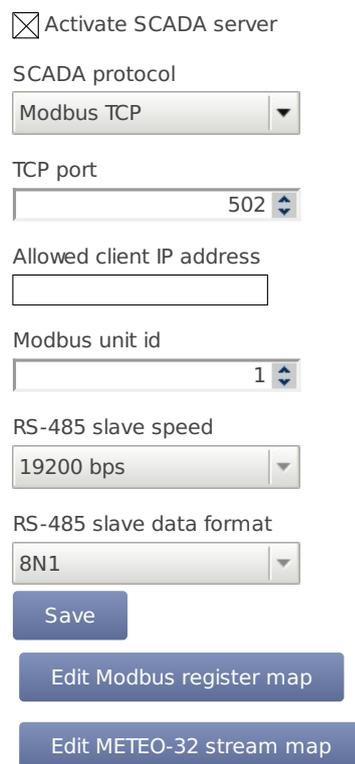
Chapter 8

SCADA

8.1 Configuring Meteo-40 for SCADA

Meteo-40 SCADA Server can be used to monitor performance and production of wind farms by providing reliable meteorological data. Meteo-40 data loggers support the standard protocols Modbus TCP/IP over Ethernet as well as Modbus RTU over RS485 (Slave).

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



Activate SCADA server

SCADA protocol
Modbus TCP

TCP port
502

Allowed client IP address

Modbus unit id
1

RS-485 slave speed
19200 bps

RS-485 slave data format
8N1

Save

Edit Modbus register map

Edit METEO-32 stream map

Figure 8.1: Configuring SCADA Parameters

Depending on the SCADA system in which Meteo-40 is integrated, a protocol for data retrieval has to be chosen:

Modbus TCP over Ethernet If you use Modbus TCP, a *TCP port* has to be entered. The default value is 502. By entering an IP address in field *Allowed client IP address*, the access to the data can be restricted to a single IP.

Only the client with the specified IP address can request data from Meteo-40. If the field is left empty or filled with value 0.0.0.0, any client is allowed to access the data.



Note

In most SCADA systems, the Ethernet interface should be configured properly with a static IP address. Refer to Section 7.7 for further details.

In order to connect Meteo-40 to a fiber optic, an industrial media converter 10/100BaseT to 100BaseFX (-40 ... 75°C) can be used.

Make sure that your Modbus TCP client is addressing the *Meteo-40 SCADA server* with the proper *Modbus unit ID* configured here. The default value is 1.

Modbus TCP uses the unit identifier for routing purposes in case of addressing a device on a MODBUS or MODBUS+ serial line subnetwork. The Modbus TCP server is still sensitive for this parameter. For further details see *MODBUS Messaging on TCP/IP Implementation Guide V1.0b* recommendations at [The Modbus Organization](http://www.modbus.org/) (<http://www.modbus.org/>).

Modbus RTU over RS485 S (slave) If you are using the Modbus RTU protocol, *Modbus Unit ID* and *RS485 serial settings* (speed and data format) have to be selected.



Note

Some SCADA clients require a half-duplex (2-wire) RS485 interface. In order to convert the 4-wire RS485 signal delivered by Meteo-40 Revision C data loggers into a 2-wire (half duplex) signal, an accessory module has to be implemented. Refer to the separate data sheet provided by Ammonit. For further details contact Ammonit.

The production of Meteo-40 Revision C stopped in October 2012.

The accessory module is not necessary for Meteo-40 Revision D data loggers (with Ethernet port).

If you are using more than one Meteo-40 data logger in your SCADA system, each data logger requires a unique Modbus Unit ID and all data loggers have to use the same RS485 serial settings (speed and data format).

Meteo-32 Stream Used for streaming Meteo-32 data. A Meteo-32 stream map has to be configured. Refer to Section 8.4 for further details.

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

8.1.1 CECS power mode



Important

To use Meteo-40 SCADA server, the CECS must remain permanently on (*CECS always active mode*) Figure 8.2 (System → Administration. This mode is automatically set when the SCADA server is activated in the Communication → SCADA. You can only switch it off again after deactivating the SCADA server.

The *CECS always active* mode can be configured manually via the web interface (see Section 4.2) or over the display (Status → CECS, see Section 9.5) of the data logger.

If *CECS always active* mode is selected, it will be displayed in the **status box** of the web interface with the infinity symbol (∞) as well as on the Meteo-40 **display** with the word **Always**.

The screenshot shows the 'CECS Power Mode' configuration page. At the top is a grey header 'CECS Power Mode'. Below it are three buttons: 'Restart CECS', 'Shutdown CECS', and 'Save CECS power mode'. A checkbox is labeled 'CECS is always active (only recommended for SCADA and laboratory use)'. Below that is a section 'Automatic CECS reboot' with a dropdown menu set to 'Weekly'. At the bottom is a section 'Power CECS on digital status signal' with a dropdown menu set to 'None' and a 'Save channel' button. Red arrows point from text annotations to the checkbox, the 'Weekly' dropdown, and the 'None' dropdown.

Annotations:

- switch on CECS permanently (points to the checkbox)
- choose automatic reboot interval (points to the 'Weekly' dropdown)
- select digital channel for manual CECS start with voltage peak (points to the 'None' dropdown)

Figure 8.2: Configuring CECS always active mode for SCADA

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



Note

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



Important

CECS is a fully embedded Linux™ computer (see also Section 1.4). Be aware that the power consumption of Meteo-40 is higher, when CECS is switched on.

8.1.2 Statistics selection

It is possible to request both live data and statistics over SCADA (see [available statistics](#)). For the statistics to be calculated, a time interval must be selected in Data → Statistics menu.



Important

The *time interval* over which the SCADA statistics will be calculated can be modified (see also Section 6.3.1). This interval is used as well for the *Switch manager* and the *data snapshots*

Summary statistic is normally used to calculate the summary over a complete day. It is available for precipitation, precipitation intensity, status and sun status evaluations. The SCADA summary interval can also be changed in Data → Statistics menu.

The Modbus register map in the Meteo-40 web interface only shows the selected statistics from the Data → Statistics menu. Go to the Data → Statistics menu and select the required data. See also Section 6.3.1.

8.2 Meteo-40 and Modbus

The configurable Modbus Register Map allows Meteo-40 to operate in most existing SCADA systems. The user must determine which measurement values should be available for the SCADA Master and configure a unique register number for each measurement (PDU addressing, first reference is 0). Two separate data blocks are available for input and holding registers. For more information about the supported function codes see the public function code definition from the Modbus application protocol specification [The Modbus Organization \(http://www.modbus.org/\)](http://www.modbus.org/).

All registers in range 0 to 65535 not selected to hold a measurement will contain the hexadecimal value FFFFh. If the register is selected but no valid measurement is present, the invalid value corresponding to the configured data type is written (see Table 8.1).

Data Type	Invalid Value
short (16-bit integer)	7FFFh
ushort (16-bit unsigned integer)	FFFFh
long (32-bit integer)	7FFFFFFFh
ulong (32-bit unsigned integer)	FFFFFFFFh
IEEE 754 (32-bit single precision binary floating point)	7FC00000h
Unix Time	00000000h

Table 8.1: Modbus Invalid values

live data
aggregated data

Input Registers	Live	Avg	Max	Min	SDv	Sum	Med	Val	Summary	Type	Factor																																																									
Anemometer, Wind Speed (m/s)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
Wind Vane, Wind Direction (°)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
Hygro/Thermo, Humidity (%)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
Hygro/Thermo, Temperature (°C)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
A1 (V)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
A2 (V)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
A3 (V)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
A4 (V)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
C1 (I)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
Int. Voltage (V)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
Int. Current (mA)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
Int. Temperature (°C)	<input type="checkbox"/>	float (IEEE754 32-bit)	<input type="text" value="1"/>																																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Year</th> <th>Month</th> <th>Day</th> <th>Hour</th> <th>Minute</th> <th>Second</th> <th></th> </tr> </thead> <tbody> <tr> <td>Date/Time Live</td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td>ushort (16-bit)</td> </tr> <tr> <td>Date/Time Statistics</td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td>ushort (16-bit)</td> </tr> <tr> <td>Date/Time Summary</td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td>ushort (16-bit)</td> </tr> <tr> <td>Switches Live</td> <td><input type="text"/></td> <td colspan="5"></td> <td>ushort (16-bit)</td> </tr> <tr> <td>Unix Time</td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td colspan="3"></td> <td>ulong (32-bit)</td> </tr> <tr> <td>Unix Time Summary</td> <td colspan="2"><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td colspan="3"></td> <td>ulong (32-bit)</td> </tr> </tbody> </table>													Year	Month	Day	Hour	Minute	Second		Date/Time Live	<input type="text"/>	ushort (16-bit)	Date/Time Statistics	<input type="text"/>	ushort (16-bit)	Date/Time Summary	<input type="text"/>	ushort (16-bit)	Switches Live	<input type="text"/>						ushort (16-bit)	Unix Time	<input type="text"/>	<input type="text"/>	<input type="text"/>				ulong (32-bit)	Unix Time Summary	<input type="text"/>		<input type="text"/>	<input type="text"/>				ulong (32-bit)															
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Unix Time Summary	<input type="text"/>		<input type="text"/>	<input type="text"/>				ulong (32-bit)																																																												

Holding Registers

Write measurements to holding registers

Set date/time

Set switches state

Stored Data Request

Retrieved unix time

First input register for retrieved data

Modbus Endianness

Byte endianness:

Word endianness:

Figure 8.3: SCADA Modbus Register Table

Column Measurements Name of the evaluation, channel, or measurand. For every measurand either two or four registers are used, depending on the configurable data type (see Table 8.2).

Name of date, time, and switches fields. Every single value needs one register, with the exception of the UNIX time (seconds since 1970-01-01 00:00:00 GMT), which needs two registers.

Columns statistics (Live, Avg, ... Med) Here are the fields for the actual registers.

Type For each evaluation or channel, a data type can be selected, e.g., float, (see Table 8.2).

Factor For each evaluation or channel, a scale factor can be selected, e.g., ffloat, (see Table 8.2).

Live data Describes instantly measured data of the active channels (An , ACn , Cn , Dn , Mn , Pn) and switches (Sn) as well as instantly evaluated data (Top Anemometer Wind Speed (m/s), Precipitation (mm), etc.). All live data values, including Live Date/Time and Live Unix Time, are written in the Modbus store with an atomic operation. This guarantees that the time-stamps, in case configured, match the measurement values.

Aggregated / statistical data The evaluation interval for statistics calculation and generation of newly aggregated data has to be defined via the Meteo-40 web interface in the Communication → SCADA menu. The following statistics are available: average, maximum, minimum, standard deviation, sum (for status signals) and median. Statistics can be applied to channels and to evaluated data. All statistics data values, including Statistics Date/Time and Start-End Unix Time, are written in the Modbus store with an atomic operation. This guarantees that the time-stamps, in case configured, match the measurement values.

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>).

Option	Description
Measurements Data Type and Scale Factor	Date/time values, i.e., year, month, day, hour, minute, and second, as well as state of the switches are represented as unsigned short values, stored in one 16-bit Modbus register each. Data type and scale factor do not apply to these values. For the measurement value representation, data type and scale factor have to be selected. Data types short, ushort, long and ulong represent a measurement value as an integer and store it in one or respectively two subsequent 16-bit registers. To achieve higher resolution on the representation or a wider range of values represented with a lower resolution, the original measured value can be divided by a scale factor before storing it into the registers as an integer. The default data type is IEEE 754 standard in binary32 format (32-bit single precision binary floating point), being values stored in two subsequent 16-bit Modbus registers. In this last case, scale factor 1 is recommended. See also Equation 8.1.
Modbus Endianness for SCADA Server	According to the Modbus Application Protocol Specification V1.1.b, Modbus is a 'big-Endian' protocol: "Modbus uses a 'big-Endian' representation for addresses and data items. If a numerical quantity larger than a single byte is transmitted, the most significant byte will be sent first." Meteo-40 endianness can be configured by the user via web interface and is set by default to 'big-endian' byte order and 'big-endian' registers order representation (high byte first, high word first). For example for value -4.395978e-11, the representation would be: Table 8.3
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 represent for example Modbus input register 100 with address 30101 and Modbus holding register 100 with address 40101. Meteo-40 does not use this representation. The same measurement values are available as input and as holding register. Only the register address, unique for each measurement that will be retrieved and in range 0 to 65535, must be introduced at the Modbus register table. For the previous example, only 100 should be introduced at the corresponding text box of the register table. The Modbus Master can read the data as holding or as input register.
Modbus Device Identification	Some additional information relative to the physical and functional description of the device is available with function code 43 (see Table 8.4).

Table 8.2: Optional Available Information and configuration

$$\text{Value}_{\text{SCADA}} = \frac{\text{Value}_{\text{Original}}}{\text{Scalefactor}}$$

Equation 8.1: Scale Factor

Representation	Byte Endianness	Word Endianness
AE41 5650	Big (high byte first)	Big (high word first)
5650 AE41	Big (high byte first)	Little (low word first)
41AE 5056	Little (low byte first)	Big (high word first)
5056 41AE	Little (low byte first)	Little (low word first)

Table 8.3: Modbus Endianness for SCADA Server

Object Id	Description	Type
0x00	VendorName: 'Ammonit Measurement GmbH'	ASCII String
0x01	ProductCode: Data logger serial number (e.g. 'D151234')	ASCII String
0x03	VendorURL: 'http://ammonit.com/'	ASCII String
0x04	ProductName: Data logger name (see Section 4.2)	ASCII String
0x05	ModelName: Data logger type (e.g. 'Meteo-40L')	ASCII String

Table 8.4: Modbus Device Identification

8.2.1 Input Registers

Input registers contain the measurement values configured by the user. Meteo-40 SCADA server instantly writes measured values in the Live registers and the calculated statistics after each interval in the aggregated data registers. These data can be read with modbus function code 04. Register addresses must be between 0 and 65535. The following values can be accessed in modbus registers, if so configured in the table:

Live and statistical data of all active channels
 Data logger internal values (Int.Voltage (V), Int.Current (mA) and Int.Temperature (°C))
 Switches state
 Unix Time (for live data and start/end of current statistics interval)
 Live data time stamp (Live Date/Time)
 Last time of the evaluation interval for statistical data (Statistics Date/Time)



Important

Only measurements selected in menu Data → Statistics (see also Section 6.3.1) are available here for retrieval.

8.2.2 Holding Registers

Holding registers can be both read or written. If Write measurements to holding registers is selected, the measurement values from the Input registers table will be also written in the same register numbers from the Holding registers table. They can be read with function code 03.

**Note**

To prevent holding registers from being overwritten by the measurements, the holding and input registers ranges cannot overlap if write measurements to holding registers is selected. This means, you cannot configure a holding register between two input registers. It is recommended to use a complete different range e.g. 0 to 999 for the input registers and 1000 to 2000 for the holding registers.

Holding registers can be written by the SCADA client in order to achieve any of the following implemented functionalities.

Date/Time synchronization To synchronise data logger date and time over Modbus, configure the start holding register number for the date/time value (*Set Date/Time*). By means of a single modbus frame and function code 16 (write multiple registers), year, month, day, hour, minute and second must be written in six subsequent registers, starting at the previously configured register (16-bit unsigned short values).

A successful synchronization will be logged in the [logbook](#)

**Important**

It is necessary to allow date and time synchronization over SCADA in Section 4.2.

Set switches state If a register number is configured in *Set switches state*, it is possible to set the current state of the switches. You can use modbus function code 6 (write single register) to control the state of all 8 switches with one telegram or function code 5 (write single coil) to set the state of only one switch.

In the first case, you must write into the configured register the integer representing the state of all switches. Each bit determines the state of one switch: "0" for open, "1" for closed switch.

In the second case the configured register is the first address and corresponds to S1. To change the state of switch 'n' (Sn) you must write the coil address

Switch number	S8	S7	S6	S5	S4	S3	S2	S1
Bit Position	7	6	5	4	3	2	1	0

Table 8.5: Set switches state

Stored Data Request To request stored data using Modbus, the holding register for the retrieved unix time and the first input register for the retrieved data must be configured. Scale factor and data type configuration from the input registers table will be applied.

Retrieved Unix Time contains the register number where the timestamp of the required period must be written. With a single Modbus telegram and function code 16 (write multiple registers), the timestamp must be written as a 32-bit unsigned long in two subsequent holding registers. The statistic values of the first interval starting after the required timestamp is returned.

First input register for retrieved data contains the number of the first register where the requested stored data will be available. This offset will be added to the number in the input registers table and the corresponding measurement value will be available there.

All values from the *Stored Data Retrieval* range are written in the Modbus store with an atomic operation. This guarantees that the time-stamps, in case configured, match the measurement values read from the store.

E.g. *Retrieved Unix Time* = 3000, *First input register for retrieved data* = 4000, *Unix Time Start* = 100, *Anemometer Wind Speed Avg* = 102. To retrieve the data from 2016-1-27 15:00:00 the corresponding Unix Timestamp (1453903200) should be written in holding registers 3000 and 3001. After writing the timestamp, the Unix Time at the beginning of the requested interval will be available at register 4000 + 100 = 4100 and the average wind speed for the requested interval will be available at register 4000 + 102 = 4102.

**Note**

In case that no valid measurement values were available for the requested period, the first available period will be returned. It is highly recommended to verify the unix timestamp of the returned data.

8.3 Cascading two Meteo-40 Data Loggers using RS485

An easy way to cascade two or more Meteo-40 data loggers to get more measurement channels, is to use one Meteo-40 as RS485 SCADA master, and up to four Meteo-40 as RS485 slaves. All data loggers have to be connected as an RS485 bus.

Please be aware of the following characteristics of the RS485 cascading:

- Due to the additional communication involved, there is a delay on the cascaded channels, between 1 and 2 seconds. For most applications, where only 10 minute average data is relevant, this should not be a problem.
- The CECS of the slave or slaves must be always active, leading to a higher energy consumption.
- The slave or slaves have not necessarily a connection to the Internet. If there is no additional modem or a router, the data loggers cannot be accessed from remote nor can receive software updates easily.
- The master can only read up to 20 Modbus registers per slave at a time. Instead of using four Meteo-40 slaves, one can also configure the same Meteo-40 up to four times to read different register sets. This allows reading up to 80 Modbus of one slave.
- Care has to be taken, that master and slave configuration fit exactly.

8.3.1 Configuration of the slave or slaves

The Meteo-40 slave or slaves need to be configured as a SCADA device with Modbus RTU protocol and a unique Modbus unit identifier. Note, that no more 20 registers should be configured. The CECS must be always active.

8.3.2 Configuration of the master

At the master side, every slave has to be added as a RS485 sensor (Other Sensor/Modbus RTU), introducing slave's unit identifier as RS-485 address. For all up to 20 registers one should configure a custom evaluation using a linear equation (see [Evaluation Helper](#)).

8.4 Replacing Meteo-32 Data Loggers used for SCADA

To ensure compatibility with Ammonit Meteo-32 data loggers, Meteo-40 offers serial streaming via RS485 S (slave) port. So Meteo-40 can easily replace operating Meteo-32 data loggers in SCADA systems.

After activating Meteo-40 for SCADA in menu Communication → SCADA, select *Meteo-32 Stream* as SCADA protocol and the required *RS485 serial settings* (baud rate and data format). Save the settings.

Activate SCADA server

SCADA protocol
METEO-32 Stream

TCP port
502

Allowed client IP address

Modbus unit id
1

RS-485 slave speed
9600 bps

RS-485 slave data format
8N1

Save

Edit Modbus register map

Edit METEO-32 stream map

← select METEO-32 stream protocol

← select RS485 baudrate

← select statistics interval

← configure METEO-32 stream map

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

In order to set up Meteo-40 for Meteo-32 streaming, configure the *Stream Map*. Open it via *Edit Meteo-32 stream map*. The stream map displays all active channels and evaluated data. For data retrieval, special codes have to be entered (unlike Modbus register map!). Refer to Table 8.6 and Table 8.7 as well as the example in Figure 8.5.

Sensor	Code	Unit	Example
Anemometer	s	0.1 m/s	Anemometer 1 = s1 Anemometer 2 = s2
Wind Vane	d	degree	Wind Vane 1 = d1 Wind Vane 2 = d2
Ultrasonic (horizontal wind speed)	u1	0.01 m/s	
Ultrasonic (wind direction)	u2	degree	
Ultrasonic (vertical wind speed)	u3	0.01 m/s	
Humidity	h	% Frel	Humidity 1 = h1 Humidity 2 = h2
Temperature	t	0.1 K	Temperature 1 = t1 Temperature 2 = t2
Air Pressure	b	hPa	Barometric Pressure Sensor 1 = b1 Barometric Pressure Sensor 2 = b2
Pyranometer	r	W/m ²	Pyranometer 1 = r1 Pyranometer 2 = r2
Precipitation	p	0.1 mm/min	
Analog Voltage	v	0.1 mV	Analog Voltage 1 = v1 Analog Voltage 2 = v2
Counter Input	c	0.1 Hz	Counter Input 1 = c1 Counter Input 2 = c2
Status Input	i	% on	Status Input 1 = i1 Status Input 2 = i2
Int. Temperature	ti	°C + 40	ti
Int. Voltage	vx	V	vx
Int. Current	ic	mA	ic

Table 8.6: Channel Codes for Meteo-32 Stream Map

Value	Code
Average	a
Standard Deviation	s
Minimum	i
Maximum	x

Table 8.7: Statistic Codes for Meteo-32 Stream Map

	Live	Avg	Max	Min	SDv
Backup Anemometer, Wind Speed	<input type="checkbox"/>				
Low Anemometer, Wind Speed	<input type="checkbox"/>				
Middle Anemometer, Wind Speed	<input type="checkbox"/>				
Top Anemometer, Wind Speed	<input type="checkbox"/>				
Backup Wind Vane, Wind Direction	<input type="checkbox"/>				
Low Wind Vane, Wind Direction	<input type="checkbox"/>				
Top Wind Vane, Wind Direction	<input type="checkbox"/>				
Hygro/Thermo, Humidity	<input type="checkbox"/>				
Hygro/Thermo, Temperature	<input type="checkbox"/>				
Int. Voltage (V)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Int. Current (mA)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Int. Temperature (°C)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 8.5: SCADA Meteo-32 Stream Map

Click on Save to finish the configuration.

Chapter 9

Using the Display

The LC display of Meteo-40 with background light is able to show 4 lines, each with 20 characters. In order to navigate through the menu or to perform an action, use the buttons next to the display.



Figure 9.1: Use of the Meteo-40 buttons

1. Press this button for a few seconds to switch Meteo-40 (CECS) on or off.
2. Navigate into a submenu or perform an action.
3. Scroll down in the menu list.
4. Leave the submenu, return to the previous menu.
5. Scroll up in the menu list.



Note

After connecting Meteo-40 to the power supply, the two lower LED lights (red and yellow) turn on for a few seconds. When the LED lights turn off, Meteo-40 is ready and can be switched on.

9.1 Assigning Permissions to Display Users

In order to avoid that settings are accidentally modified by a display user, e.g., when measurement data is downloaded on a USB flash drive, you can assign permissions to display users. The configuration can be changed in the System → Display menu (see also Section 4.4.1).

9.2 LED Lights

Meteo-40 has four LED lights next to its display. The two upper LED lights have not yet been assigned a function. The two lower LED lights (red and yellow) turn on, when Meteo-40 is connected to a power supply and turn off as soon as Meteo-40 is ready to be switched on. However, the lower LED lights show:

Red (third from the top) Indicates errors in measuring operation. For details see the error list in the display System → Errors → Error List.

Yellow (lower LED light) Indicates that RS485 sensors are connected. According to the Modbus protocol the LED light blinks, when a measurement is made.

9.3 Navigating through the Display Menu

The display menu of Meteo-40 includes four main menu items and several submenu items. The main menu items are *System*, *Status*, *Channel* and *Communication*.

In order to jump into a submenu or to perform an action, press the right button. To return to the previous menu, use the left button. By pressing the upper or the lower button, you can navigate up and down the menu list. For further details see Figure 9.1.

9.4 Menu: System

Submenu	Submenu Item	Description
Information	Data Logger	<ul style="list-style-type: none"> Type Serial Number (Dnnnnnn) Channels
	Version	<ul style="list-style-type: none"> Software version Bootloader version
	Memory	<ul style="list-style-type: none"> RAM including % of memory used Source Memory including % of memory used. Note, that the value can go beyond 100%, because the memory is organized as ring buffer.
Time and Date	Clock	Displays date and time, incl. time zone
	Set Clock	Sets date and time on Meteo-40 according to NTP server time and <i>Time Zone</i> defined in the web interface in menu System → Administration
Errors	Error List	Displays the error list
	Clear List	Clears the error list

Table 9.1: Menu: System

9.5 Menu: Status

The Status menu includes the information shown in the status box of the Meteo-40 web interface (see Section 3.2 also). In order to switch recording on / off or to save the configuration, press the right navigation button next to the display.

Submenu Item	Description
Rem. Time	<ul style="list-style-type: none"> • Infty = Infinity (if CECS always active is selected) • Remaining time in mm:ss
Recording	<ul style="list-style-type: none"> • On • Off (no recording, e.g., after changing the configuration)
Configuration	<ul style="list-style-type: none"> • Saved • Unsaved (changes have been made)
CECS	<ul style="list-style-type: none"> • When needed • Always (if CECS always active is selected)
Ethernet	<ul style="list-style-type: none"> • Online • Offline
Modem	<ul style="list-style-type: none"> • Online • Offline
Tunnel	<ul style="list-style-type: none"> • 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 or display the values, press the right button until the required value appears in the display.

Submenu	Property
Evaluations	Displays current values of the evaluation, e.g., wind speed, wind direction, temperature etc. The order of evaluations is explained in Section 5.1.3.

Table 9.3: Menu: Channels/Evaluations

Submenu	Submenu Item	Property	Range of Values
Analog A1 (Depending on the data logger type, Meteo-40 offers 4, 8 or 12 analog voltage channels)	Measurement	State	On or Off
		Value	Displays the current value
	Settings	Range	0.1V, 0.1-0.3V, 1V, 10V
		Rate	<ul style="list-style-type: none"> • 1/8s ... 30s • 1min ... 30min • 1h
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 1/8s ... 30s • 1min ... 30min • 1h
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> • 1/8s ... 30s • 1min ... 30min • 1h

Table 9.5: Menu: Channels/Analog Current

Submenu	Submenu Item	Property	Range of Values
Counter C1 (Depending on the data logger type, Meteo-40 offers 4,8 or 12 counters.)	Measurement	State	On or Off
		Value	Displays the current value.
	Settings	Rate	<ul style="list-style-type: none"> • 1s ... 30s • 1min ... 30min • 1h
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> • 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	On or Off
		Value	Displays the current value
	Settings	Rate	<ul style="list-style-type: none"> • 1/8s ... 30s • 1min ... 30min • 1h
		Type	<ul style="list-style-type: none"> • None • Thies10bit • Thies8bit • Status
	Switch	State	On or Off
		ID	Select the appropriate switch. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.
		Time	<ul style="list-style-type: none"> • 1/8s ... 30s • 1min ... 30min • 1h
	ClockPin	CLK 5V	Press the right button to force the clock pin to 5V for 10 seconds.
		CLK 0V	Press the right button to force the clock pin to 0V for 10 seconds.

Table 9.7: Menu: Channels/Digital Lines

Submenu	Range of Values
S1 (Displays a list of switches. Depending on the data logger type, Meteo-40 offers 2, 4 or 8 switches.	On or Off

Table 9.8: Menu: Channels/Switches

Submenu	Property
Voltage	Displays the current value
Current	Displays the current value
Temperature	Displays the current value

Table 9.9: Menu: Channels/Internal

9.7 Menu: Communication

Submenu	Submenu Item	Property	Description		
Devices	Modem	Product Name (only when a modem is connected)	Quality: displays signal strength		
			Status: <ul style="list-style-type: none"> • Offline • Active 		
			Type: indicates connection mode, i.e., GSM		
			RX Bytes: displays sum of bytes received		
			TX Bytes: displays sum of bytes transferred		
			State / Interface <ul style="list-style-type: none"> • State: Active • or Unavailable • Interface: usb 		
	LAN	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	
				State / Interface <ul style="list-style-type: none"> • State: Active • Interface: eth 	
		Ethernet (network connection)			IP / Netmask: displays IP address and subnet mask
					DNS Servers: displays DNS server addresses
					Routes: displays router or gateway address

Submenu	Submenu Item	Property	Description
			MAC / Speed: displays MAC address of the data logger and transmission rate
			Method: DHCP / Fixed IP / Link-local (can be selected using the keyboard)
	WLAN	<ul style="list-style-type: none"> • Restart • Active / Inactive • IP Address 	The WLAN connection can be restarted using the display.
Activation	Modem: When needed or Permanent (can be selected using the keyboard)		
	LAN: When needed or Permanent (can be selected using the keyboard)		
	WLAN: Active or Not active		
Check Connection			Checks the connection to Tunnel and AmmonitOR servers, see Section 7.10.1.
Schedule	Online	<ul style="list-style-type: none"> • Online 	Perform the respective actions immediately, by pressing the right button. The configuration for the actions has to be done beforehand. The dash (-) is visible, if the action is not active at the moment, otherwise it show runs or done.
	AmmonitOR	<ul style="list-style-type: none"> • AmmonitOR • AmmonitOR Test 	
	Email	<ul style="list-style-type: none"> • Email • Email Test 	
	Copy	<ul style="list-style-type: none"> • Copy • Copy Test 	
	Generate CSV	<ul style="list-style-type: none"> • Gen . CSV 	
	SMS	<ul style="list-style-type: none"> • SMS Test 	

Chapter 10

Sensors

Meteo-40 data loggers are designed for installation in wind and solar measurement campaigns. Thus the data logger is compatible with all relevant sensor types. Depending in the data logger type a different number of sensors can be connected to analog voltage, pulse/counter, digital/serial/status as well as analog current, current source and RS485 channels. See also Chapter 11 and Section 1.3.

Depending on the measurement campaign different sensors are required. Find below a list of measurement instruments for wind measurement and solar measurement purposes as well as a list of other meteorological sensors and different measurement devices.

**Note**

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

10.1 Sensors for Wind Resource Assessment and Wind Farm Monitoring

In order to evaluate the wind conditions at a specific location, various measurements for wind resource assessment are required. According to IEC 61400-12-1 horizontal wind speed, wind direction as well as air density have to be measured. Wind energy is calculated as follows:

$$P = 1/2\rho \cdot A \cdot v^3$$

Equation 10.1: Calculation of Wind Energy [P]

(where A is the area; ρ is the air density, $\rho = p / (R \cdot T)$, being p the air pressure, T the air temperature and R the gas constant; v is the wind speed)

Therefore, wind speed (v) is the most important parameter, as wind energy (P) is proportional to the cube of wind speed. $\Delta 1\%$ wind speed $\approx \Delta 3\%$ wind energy

The following sensors are crucial for wind site assessment:

Sensor	Description	Link
Anemometer (wind speed)	<ul style="list-style-type: none"> • Most important parameter for wind measurement • Wind energy is proportional to the cube of wind speed • Install calibrated cup anemometers or calibrated ultrasonic anemometers • Heated sensors are recommended for measurements in cold climates <hr/> <p> Note Vertical wind speed measurement for turbulence and wind turbine load analysis with 3D ultrasonic or propeller anemometer.</p> <hr/>	<p>Section 10.5 (Anemometers) Section 10.7 (Ultrasonics) Section 10.5.1 (Propeller Anemometer)</p>
Wind vane (wind direction)	<ul style="list-style-type: none"> • Important parameter for wind farm micro-siting • Ultrasonic anemometers also determine the wind direction 	<p>Section 10.6 (Wind vanes) Section 10.7 (Ultrasonics)</p>
Temperature / Humidity sensor	<ul style="list-style-type: none"> • Important parameters for air density calculation • Wind energy is linear proportional to the inverse of air temperature in K • Measurement of relative humidity recommended at high temperatures acc. to IEC • Combined air temperature and relative humidity sensors available 	<p>Section 10.8</p>
Barometric pressure sensor	<ul style="list-style-type: none"> • Important parameter for air density calculation • Wind energy is linear proportional to air pressure 	<p>Section 10.9</p>
Ultrasonic anemometer	<ul style="list-style-type: none"> • Evaluate horizontal wind speed and direction; 3D ultrasonics measure vertical wind speed for turbulence analysis • Recommended for measurements in cold climates, as ultrasonic anemometers do not have moving parts and can be fully heated 	<p>Section 10.7</p>

Table 10.1: Sensors for Wind Measurement

10.2 Sensors for Solar Resource Assessment

Certain solar measurements are necessary to design profitable solar power plants. Refer to the [Ammonit website \(http://www.ammonit.com\)](http://www.ammonit.com) to learn more about solar measurement systems. Depending on application (e.g., PV, CSP, CPV) and size of the solar power plant different measurements are crucial.

Insolation combines Direct Normal Irradiation (DNI) and Diffuse Horizontal Irradiance (DHI). Both are linked according to the formula for Global Horizontal Irradiation (GHI):

$$GHI_{[W/m^2]} = DHI_{[W/m^2]} + DNI_{[W/m^2]} \cdot \cos(\theta)$$

Equation 10.2: Calculation of Global Horizontal Irradiation

(where θ is the solar zenith angle)

On a sunny day the insolation is 100% GHI, 20% DNI and 80% $DNI \cdot \cos(\theta)$.

Sensor	Description	Link
Pyranometer	<ul style="list-style-type: none"> Measures GHI (Global Horizontal Irradiation), if installed horizontally Measures GTI (Global Tilted Irradiation), if installed tilted as PV panel Measures DHI (Diffuse Horizontal Irradiation), if shaded by a shadow ball or shadow ring (installation on sun tracker) 	Section 10.10
Pyrheliometer	<ul style="list-style-type: none"> Measures DNI (Direct Normal Irradiation) and has to be installed on a sun tracker to follow the position of the sun on the sky 	Section 10.11
Sunshine Duration sensor	<ul style="list-style-type: none"> Indicates the sunshine status as defined by WMO (sunshine = direct irradiation exceeds the level of 120 W/m²) 	Section 10.12
Solar Tracker	<ul style="list-style-type: none"> Capable to orient a payload towards the sun. Can be combined with different solar sensors to measure solar radiation global, direct and diffuse components. 	Section 10.13
Soiling Measurement	<ul style="list-style-type: none"> Soiling and Irradiance Measurement Systems collect critical data for evaluating PV array performance. 	Section 10.14

Table 10.2: Sensors for Solar Measurement

Besides measuring the solar conditions at the site of the planned solar power plant, some additional measurements might be necessary to design the solar power plant, i.e., wind speed, wind direction, air temperature, relative humidity as well as air pressure (see Table 10.1). In some cases soiling detectors and precipitation sensors are required.

10.3 Other Sensors for Meteorological Purposes

There are several sensors, which are not mandatory for wind and solar resource assessment, but provide important parameters for ground construction and other influential conditions, e.g., precipitation sensors.

Sensor	Description	Link
Precipitation Rain Gauge	<ul style="list-style-type: none"> Measures the amount of precipitation (rain gauge) 	Section 10.16
Laser Precipitation Monitor	<ul style="list-style-type: none"> Calculates SYNOP code (Surface Synoptic Observations) Measures intensity of total precipitation Measures intensity of liquid precipitation Measures intensity of solid precipitation Calculates the amount of precipitation 	Section 10.17

Table 10.3: Sensors for Meteorological Purposes

10.4 Devices for Electrical Measurements

Meteo-40 can be used to connect power meters, multifunction transducers or other electrical measurement devices, e.g., for power curve measurement.

Device	Description	Link
Multifunction Transducer	<ul style="list-style-type: none"> Also power meters or measuring transducers Measure average phase voltage, current, real and reactive power 	Section 10.19

Table 10.4: Electrical Measurement Devices

10.5 Anemometers

Anemometers measure the horizontal wind speed (velocity). This parameter is crucial for any wind site assessment. Cup anemometers are the general standard type of anemometers. They are robust and resistant to turbulence and skew winds caused by masts and traverses. Each anemometer should be individually calibrated and equipped with a certified calibration report according to international standards (e.g., MEASNET). At least two anemometers have to be installed on a met mast. Most anemometers can be equipped with electronically regulated heating.

Refer to the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>) to learn more about anemometer behavior and accuracy.

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

$$v_{[m/s]} = \begin{cases} \text{slope}_{[m]} \cdot I_{[1/s]} + \text{offset}_{[m/s]} & : I > 0 \\ 0 & : I = 0 \end{cases}$$

Equation 10.3: Calculation of Wind Speed (v)

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

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

Anemometers are connected to counter channels (Cx). Refer to Figure 13.11 for the connection diagram. Further details about counter channels can be found in Section 11.2 and Section 12.2.

Anemometers can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.4).

Sensor	Order-No
Thies First Class Advanced	S11100 / S11100H
Vector L100 First Class	S14100 / S14100H
Thies Compact	S12100 / S12100H
Windsensor (Risø) P2546A-OPR	S16100C
Vaisala Anemometer WAA252	S15100H

Table 10.5: Overview Anemometers



Important

If you plan to install anemometer NRG #40H (Hall Effect), anemometer Risø P2546A (Reed switch), anemometer Thies (if open drain is used), an accessory module is needed! Refer to the data sheet and contact Ammonit for further details.



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

Meteo-40 saves all electrically measured values to the source data (Section 6.7). The calculated wind speed in m/s is saved to the CSV file (see Section 6.6.1).



Note

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

10.5.1 Propeller Anemometer Young

The Propeller Anemometer measures horizontal and vertical wind speed. However, it is not classified according to MEASNET and IEC. The anemometer is widely used to measure vertical wind speed to analyse turbulences and the wind load of a turbine.

The anemometer uses a transducer, which converts propeller rotation to a DC voltage that is linearly proportional to air velocity. Connect the sensor to the analog voltage channels (Ax) of your Meteo-40 data logger.

The anemometer can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.4).

Sensor	Order-No
Propeller Anemometer Young 27106T	S17100

Table 10.6: Overview Propeller Anemometer



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

Meteo-40 saves all electrically measured values to the source data (Section 6.7). The calculated wind speed in m/s is saved to the CSV file (see Section 6.6.1).



Note

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

10.6 Wind Vanes

Wind vanes indicate the horizontal wind direction. The evaluation of the wind direction enables the best possible positioning of wind turbines. It is essential that a wind vane covers an entire 360° degree radius - without north gap.

There are different wind vane types available. Ammonit recommends installing digital wind vanes due to their accuracy and easy connection to the Meteo-40 data logger. Additionally, wind vanes with potentiometer, which are connected to analog voltage channels, and wind vanes, which are connected to a RS485 bus are compatible with Meteo-40 data loggers.

10.6.1 Digital Wind Vanes TMR

Ammonit recommends installing 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 10.7: Comparison of Wind Vane Accuracy

Each wind vane TMR requires one digital channel, whereas potentiometer wind vanes require two analog voltage channels each. By installing wind vanes TMR instead of wind vanes POT, analog voltage channels are available for other analog sensors, e.g., barometric pressure sensor, temperature or humidity sensors.



Tip

Considering a measurement system with wind vanes TMR a smaller Meteo-40 model with less channels can be sufficient - for example Meteo-40S with 10 channels (4 analog voltage, 4 counter and 2 digital channels).

Wind vanes TMR are connected to digital channels (Dx). Refer to Figure 13.13 for the connection diagram. Further details about digital channels can be found in Section 11.3 and Section 12.2.

Wind vanes can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.4).

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

Table 10.8: Overview Wind vanes TMR

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.6.2 Wind Vanes with Potentiometer

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

$$D[^{\circ}] = \frac{U_{Ax[V]}}{U_{Ay[V]}} \cdot 360^{\circ} + \text{offset}[^{\circ}]$$

Equation 10.4: Calculation of the Wind Direction (D)

The Offset [$^{\circ}$] must be filled when the wind vane has not been precisely aligned to the north, e.g., when the wind vane has been aligned to the mast. The offset specifies the angle between the North and the point the wind vane has been aligned to.

The Offset for each wind vane is configured in the *Sensor Helper* (see Section 5.1.4) of the Meteo-40 web interface.

Refer to Figure 13.7 for the connection diagram. Further details about analog voltage channels can be found in Section 11.1 and Section 12.2

Sensor	Order-No	Offset
Thies First Class	S21200H	0° (if aligned to the North)
Thies Compact	S22200 / S22200H	0° (if aligned to the North)

Table 10.9: Parameters for the configuration of potentiometric wind vanes

**Important**

If potentiometric wind vanes, e.g., Thies First Class, Thies Compact, Vector W200P, Vector W200P/L, NRG #200P, are installed, protection resistors are needed. Contact Ammonit regarding further details about the accessory module!

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

Meteo-40 saves all electrically measured values to the source data (Section 6.7). The calculated wind direction in $^{\circ}$ (degree) is saved to the CSV file (see Section 6.6.1).

**Note**

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

10.6.3 Wind Vanes connected to RS485 bus

There are certain wind vanes, which can be connected to the RS485 bus of the Meteo-40 data logger. Up to 8 smart sensors can be connected to the RS485 bus of Meteo-40.

Wind vanes can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.4). See Table 10.10 for the configuration of RS485 wind vanes.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies First Class	Thies		Mx_1: Wind speed, Mx_2: Wind direction	Serial settings, Address, Half duplex mode
Thies Wind Vane 8-bit parallel via ICP DAS I7051	DCON	RS485 module to connect two Thies 8-bit parallel wind vanes	Mx_1: Wind direction vane DI: 0..7, Mx_2: Wind direction vane DI: 8..15	Same configuration as for Meteo-32 (Serial settings: 38400 8N1, Address: 6, Checksum: disabled)

Table 10.10: Configuration of RS485 Wind Vanes

Meteo-40 saves all measured values to the source data (Section 6.7). The wind direction in ° (degree) is saved to the CSV file (see Section 6.6.1).

10.7 Ultrasonic Anemometers

Ultrasonic anemometers are devices, which measure horizontal wind speed, wind direction as well as acoustic virtual temperature. 3D sensors also measure the vertical wind velocity, which is important for turbulence and wind load calculations.



Important

If more than one ultrasonic anemometer should be connected via RS485, all connected sensors have to use the same protocol. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all rs485-connected sensors has to be configured to half duplex.

Ultrasonic anemometers are connected to the RS485 bus of Meteo-40. The following ultrasonic anemometers are compatible with Meteo-40 data loggers:

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies 2D Anemometer	Thies	Telegram 3	Mx_1: Wind speed, Mx_2: Wind direction, Mx_3: Acoustic virtual temperature	serial settings, address, half duplex mode, scalar averaging over 1 s
Thies 3D Anemometer	Thies	Telegram 3	Mx_1: Wind speed azimuth, Mx_2: Wind direction azimuth, Mx_3: Wind speed elevation, Mx_4: Acoustic virtual temperature	serial settings, address, half duplex mode, scalar averaging over 1 s

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Clima Sensor US	Thies	Telegram 6	Mx_1: Wind speed, Mx_2: Wind direction, Mx_3: Temperature, Mx_4: Humidity Mx_5: Air pressure, Mx_6: Brightness max. value, Mx_7: Direction of brightness, Mx_8: Precipitation status, Mx_9: Precipitation intensity, Mx_10: Precipitation sum, Mx_11: SYNOP	serial settings, address, half duplex mode, no date and timestamp
NMEA - Thies Compact Anemometer	NMEA	Sensors supporting NMEA V2.0 standard. I.e. Thies, Telegram 3	Mx_1: Wind direction, Mx_2: Wind speed	serial settings, address, NMEA protocol, half duplex mode, scalar averaging over 1 s
Lufft 2D VENTUS-V200A-UMB	Modbus	registers 14 and 25	Mx_1: Wind direction, Mx_2: Wind speed	serial settings, address, Modbus protocol, parity none, scalar averaging over 1 s
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	serial settings (38400 bps), address, Modbus protocol, parity none, scalar averaging over 1 s
Gill Windmaster Pro 3D Anemometer	Gill	Mode 4	Mx_1: Wind direction azimuth, Mx_2: Wind speed azimuth, Mx_3: Wind speed elevation, Mx_4: Sonic temperature (if activated)	serial settings (B5: 38400 bps, 8N1), address (default Q), averaging inactive (G0), sampling rate 20 Hz (P8), polar polled (M4), output format CSV (O1), Sonic temperature activated (A3)
Gill Wind Observer 2D Anemometer	Gill	Mode 4	Mx_1: Wind direction azimuth, Mx_2: Wind speed azimuth, Mx_3: Sonic temperature (if activated)	serial settings (B5: 38400 bps, F1: default 8N1), address (default A), averaging inactive (G0), sampling rate 20 Hz (P8), polar polled (M4), output format CSV (O1), Sonic temperature activated (A2)

10.7.1 NMEA V 2.0

Supported NMEA telegram: \$WIMWV,<dir>,<ref>,<spd>,<uni>,<sta>*<chk><CR><LF>

- <dir>: Wind direction xxx.x
- <ref>: Reference R = relative
- <spd>: wind speed xxx.x
- <uni>: Wind speed unit is Kilometers per hour
- <sta>: Status A = valid
- <chk>: Checksum (8-bit XOR, excluding \$ and *)

-
- <CR>: Carriage return code, ASCII 0DH
 - <LF>: Line feed code, ASCII 0AH

Telegram must have 29 bytes.

10.7.2 Thies Ultrasonic Configuration Options

Before connecting any Thies sensor to Meteo-40, the sensor has to be configured. Three ultrasonic types are available: 2D compact, 2D and 3D.

Ammonit recommends configuring Thies ultrasonic sensors as follows:

Required settings

- Half duplex for transmission mode
- Unique ID for each sensor connected to the bus
- Heating ON/OFF

Further Thies-specific settings

- Voltage threshold for heating suppression: 17 V (HC=17)
- Serial settings: 38400 bps, 8N1 (data format)
- Average mode: scalar-averaged velocity and vectorial-averaged angle (AM=2)



Important

If more than one ultrasonic anemometer should be connected via RS485, all connected sensors have to use the same protocol. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all RS485-connected sensors has to be configured to half duplex.



Tip

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

10.7.3 Lufft UMB Configuration Tool

Before connecting any Lufft sensor to Meteo-40, it has to be configured. Download and install the software [UMB-Config-Tool](http://www.lufft.com/en/support/downloads/software/?subcategory1=61) (<http://www.lufft.com/en/support/downloads/software/?subcategory1=61>) and follow the next steps:

1. Power on the sensor.
2. Connect sensor's A-, B+ to your computer using RS485 to USB or RS232 adapter.
3. Start *Config-Software-UMB* and setup the connection in the Edit → Connection settings menu.
4. In order to configure the sensor, switch all sensors temporarily to UMB protocol in the *Options* menu (follow instructions).
5. Add the new sensor in the Edit → Sensor menu. Select the appropriate type from the list and ID (default 1). Do not exit this menu, press *Configure* to access the sensor configuration.
6. Load the profile from the sensor (press the button again, if it does not respond). Select the tab with sensor type name and configure as described in the table above (see Section 10.7).
7. Store profile on sensor to apply the configuration changes to the sensor. Save the profile also to your disk to keep a copy of the sensor configuration.
8. Close the configuration program, disconnect and power off the sensor. Connect the sensor to the data logger and power on the sensor.

9. Add the sensor to the sensor list of the data logger in the Measurement → Sensors menu, applying the same configuration.



Important

If more than one ultrasonic anemometer should be connected via RS485, all connected sensors have to use the same protocol. Additionally, each ultrasonic sensor has to use a unique ID (*RS485 address*), which has to be configured for the sensor. The transmission mode for all RS485-connected sensors has to be configured to half duplex.

10.7.4 Gill Wind Configuration Tool

Before connecting any Gill sensor to Meteo-40, configure the settings. Download and install [Gill Wind Com](http://www.gill.co.uk/main/software.html) (<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 (see Section 10.7).

1. Do not forget to save the configuration report in the *Tools* menu.
2. Close the configuration program, disconnect and power off the sensor. Connect the sensor to the data logger and power on the sensor.
3. Add the sensor to the Meteo-40 sensors list in the Measurement → Sensors menu, applying the same configuration.



Note

Any wind magnitude lower than defined by sensor's parameter K (default 0.050 m/s) will omit the wind direction.



Important

Gill Windmaster sensors are not designed to connect more than one unit to a bus.

10.8 Temperature Humidity Sensors

Temperature sensors measure the air temperature, while humidity sensors measure the air humidity. Both sensors are often applied in combination to reduce cost.

Temperature humidity sensors, e.g., Galltec Active KP, Galltec Active TP, have to be connected to analog voltage channels (Ax). Refer to Figure 13.4 for the connection diagram.

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

$$T_{[^\circ\text{C}]} = \text{slope}_{[^\circ\text{C}/\text{V}]} \cdot U_{[\text{V}]} + \text{offset}_{[^\circ\text{C}]}$$

Equation 10.5: Calculation of Temperature (T)

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

$$RH_{[\%]} = \text{slope}_{[\%/V]} \cdot U_{[V]}$$

Equation 10.6: Calculation of Humidity (RH)

Slope and Offset are internal parameters of the sensor, which are important to calculate temperature (T) in °C and humidity (RH) in %. Both values are pre-configured in the *Sensor Helper* (see Section 5.1.4).



Note

For more flexibility, when connecting the combined Galltec temperature and humidity sensor to Meteo-40, two different Galltec Active KP sensors are listed in the *Sensor Helper* (see Section 5.1.4). Two analog channels are needed and thus the order of the signals to be connected is selectable. "Galltec Thermo-Hygro Active KP" assigns the first analog channel to temperature and the second to humidity. As opposite, "Galltec Hygro-Thermo Active KP" assigns the first channel to humidity and the second to temperature.

Sensor	Order-No	Slope	Offset
Galltec Active KP (Temperature + Humidity)	S52100	100%/V (Humidity) 100°C/V (Temperature)	0% (Humidity) -30°C(Temperature)
Galltec Active TP (Temperature)	S42100	100°C/V	-30°C

Table 10.11: Parameters for the configuration of temperature humidity sensors



Important

If you install calibrated sensors, enter the values given in the calibration protocol.

Meteo-40 saves all electrically measured values in V to the source data (Section 6.7). The calculated values for temperature (°C) and humidity (%) are saved to the CSV file (see Section 6.6.1).



Note

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.8.1 Resistance Temperature Detectors (RTD) / Pt100 / Pt1000

RTDs measure the temperature by correlating the resistance of the RTD element with temperature. Those sensors provide high accuracy and repeatability; the sensors are suitable for precision applications. RTDs use electrical resistance and require a power source to operate.

Platinum Resistance Thermometers (Pt100 / Pt1000) are classified according to DIN EN 60751 - see tolerance classes below.

Tolerance Class	Tolerance in K
Class B1/3 DIN	$\pm(0.10K+0.0017 \times [t])$
Class A	$\pm(0.15K+0.002 \times [t])$
Class B	$\pm(0.30K+0.005 \times [t])$
Class 0.5	$\pm(0.50K+0.006 \times [t])$

Table 10.12: Tolerance Classes - Platinum Resistance Thermometers (Pt100)

Pt100 / Pt1000 sensors have to be connected to the analog voltage channel and the current source of Meteo-40 data loggers. The sensors can easily be configured via the *Sensor Helper* (see Section 5.1.4) in the Meteo-40 web interface.

Meteo-40 saves all electrically measured values in V to the source data (Section 6.7). The calculated value for temperature (°C) is saved to the CSV file (see Section 6.6.1).

**Note**

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.

10.8.2 Temperature Humidity Sensors connected to RS485 bus

There are certain temperature humidity sensors available, which have to be connected to the RS485 bus of the Meteo-40 data logger. The sensors can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.4).

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Galltec Thermo/Hygro KPC.MS	Modbus	registers 0, 1, 3, 4	Mx_1: Temperature Mx_2: Humidity	Fixed serial settings (19200 8N1)

Table 10.13: Data request for RS485 Temperature Humidity Sensors

Meteo-40 saves all measured values to the source data (Section 6.7). The values for temperature (°C) and humidity (%) are saved to the CSV file (see Section 6.6.1).

10.9 Barometric Pressure Sensors

Barometric pressure sensors measure the air pressure. Air pressure and air temperature should be evaluated for an accurate wind site assessment. It is recommended including an air pressure sensor as part of a measuring system.

Barometric pressure sensors, e.g., AB60, AB100 and Vaisala PTB110, have to be connected to analog voltage channels (Ax). Refer to Figure 13.3 for the connection diagram.

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

$$P_{[\text{mbar}]} = \text{slope}_{[\text{mbar/V}]} \cdot U_{[\text{V}]} + \text{offset}_{[\text{mbar}]}$$

Equation 10.7: Calculation of Air Pressure (P)

Slope and Offset are internal parameters of the sensor, which are important to calculate the air pressure in hPa. Both values are pre-configured for sensors listed in the library of the *Sensor Helper* (see Section 5.1.4).

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 10.14: 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 6.7). The calculated air pressure value in mbar is saved to the CSV file (see Section 6.6.1).



Note

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.9.1 Barometric Pressure Sensors connected to RS485 bus

Certain barometric pressure sensors have to be connected to the RS485 bus of the Meteo-40 data logger. The sensors can easily be configured in the Meteo-40 web interface via the *Sensor Helper* (see Section 5.1.4).

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Baro Transmitter	Thies	Telegramm 1	Mx_1: Air pressure, Mx_2: Temperature	serial settings, address

Table 10.15: Data request for RS485 Barometric Pressure Sensors

Meteo-40 saves all measured values to the source data (Section 6.7). The air pressure value in hPa is saved to the CSV file (see Section 6.6.1).

10.10 Pyranometers

Pyranometers measure the global horizontal radiation. They are also used as reference instruments thanks to their measurement precision. The use of this sensor is crucial for measurements with solar-powered applications.

Meteo-40 indicates for pyranometers the global horizontal irradiation (GHI).

Pyranometers, e.g., MS series of EKO Instruments or CMP series of Kipp & Zonen, have to be connected to analog voltage channels (Ax). Refer to Figure 13.2 for the connection diagram.

The output signal (U) from the pyranometer is proportional to the solar irradiance (E) in W/m².

$$E_{[W/m^2]} = \frac{U_{[\mu V]}}{\text{Sensitivity}_{[\mu V/[W/m^2]']}}$$

Equation 10.8: Calculation of Solar Irradiance (E)

Sensitivity is an internal parameter of the sensor, which is important to calculate the radiation in W/m². The value is given in the calibration certificate of the sensor.

Sensor	Order-No
EKO MS-802	S64120
EKO MS-410	S64130
EKO MS-602	S64110
Kipp & Zonen CMP11	S61120
Kipp & Zonen CMP6	S61110
Kipp & Zonen CMP3	S61100
Hukseflux Pyranometer LP 02	S63100
Hukseflux Pyranometer SR 1	S63120

Table 10.16: Pyranometers

Meteo-40 saves all electrically measured values in V to the source data (Section 6.7). The calculated values for solar radiation are saved in W/m² to the CSV file (see Section 6.6.1).



Note

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.10.1 Pyranometer: Delta-T Sunshine SPN 1

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

Additionally, Meteo-40 estimates the direct normal irradiation based on the values of global horizontal and diffuse irradiation according to the general formula: Global Horizontal Irradiation = Diffuse Horizontal Irradiation + Direct Normal Irradiation · cos(θ), where θ is the solar zenith angle

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



Important

In order to estimate direct normal irradiation (DNI) and sun status, latitude and longitude of the measurement station have to be entered in the System → Administration menu (see also Section 4.2).

If any estimated values should be included in the CSV statistics file, the values have to be selected in the Data → Statistics menu under *Select statistics* (see also Section 6.3.1).

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.11 Pyrheliometers

Pyrheliometers are used to measure the direct irradiance emitted by the sun in a 5 degree angle. The sensors have to be connected to the analog voltage channels (Ax) of Meteo-40.

The output signal (U) from the pyrheliometer is proportional to the solar irradiance (E) in W/m².

$$E_{[W/m^2]} = \frac{U_{[\mu V]}}{\text{Sensitivity}_{[\mu V/[W/m^2]']}}$$

Equation 10.9: Calculation of Direct Solar Irradiation (E)

Sensitivity is an internal parameter of the sensor, which is important to calculate the irradiation in W/m². The value is given in the calibration certificate of the sensor.

Meteo-40 indicates for pyrheliometers direct normal irradiation. Additionally, the data logger estimates DNI · cos(θ) and sun status based on the recorded values for direct normal irradiation. In order to estimate sun status and DNI · cos(θ), latitude and longitude of the measurement station have to be entered in the System → Administration menu (see also Section 4.2)

The sensor often comes with built-in Pt100 sensor and thermistor. The Pt100 sensor can be connected to the current source (see Section 11.5) of Meteo-40.

If the built-in Pt100 sensor should be connected to Meteo-40, pyrheliometer and Pt100 sensor have to be configured separately in the *Sensor Helper: Pyrheliometer* via sensor type *Solar Sensors* and Pt100 via sensor type *Hydro/Thermo*.

**Important**

Do not connect the thermistor to Meteo-40!

Sensor	Order-No
EKO MS-56	S64210
Kipp & Zonen CPH1	S62210

Table 10.17: Pyrheliometers

**Important**

In order to estimate sun status and direct normal irradiation [DNI · cos(θ)], latitude and longitude of the measurement station have to be entered in the System → Administration menu (see also Section 4.2). If any estimated values should be included in the CSV statistics file, the values have to be selected in the Data → Statistics menu under *Select statistics* (see also Section 6.3.1).

**Note**

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.12 Sunshine Duration Sensors

Sunshine duration sensors indicate the sunshine status as defined by the WMO (sunshine = irradiation exceeds the level of 120 W/m²). The sensor measures the irradiation and switches the output voltage high or low to indicate sunny or not sunny conditions.

Sunshine duration sensors, e.g., Kipp & Zonen CSD 3, have to be connected to analog voltage channels (Ax). If direct irradiation should be measured, connect this output also to another analog voltage channel (Ax). Refer to Figure 13.2 for the connection diagram.

The output signal (V) indicates sunshine or no sunshine. Additionally, the calculated direct irradiation can be measured. The output signal (mV) for direct irradiation is proportional to the direct irradiation (W/m²).

$$E_{[W/m^2]} = \frac{U_{[\mu V]}}{\text{Sensitivity}_{[\mu V/[W/m^2]']}}$$

Equation 10.10: Calculation of Solar Irradiation (E)

Sensitivity is an internal parameter of the sensor, which is important to calculate the radiation in W/m². The value is given in the calibration certificate of the sensor.

Meteo-40 saves all electrically measured values in V to the source data (Section 6.7). The calculated values for direct irradiation are saved in W/m² to the CSV file (see Section 6.6.1).

Sensor	Order-No
Kipp & Zonen CSD 3	S61910

Table 10.18: Sunshine Duration Sensors



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

Meteo-40 saves all electrically measured values to the source data (Section 6.7). The calculated direct irradiation in W/m² and the current sun status are saved to the CSV file (see Section 6.6.1).



Note

The CSV file contains for all active channels the electrical values according to the chosen statistical interval.

10.13 Solar Trackers

EKO Instruments high precision STR Sun Tracker provide high tracking reliability, enhanced functionality with fully automated set up procedure through a built in GPS receiver. The compact sun trackers are suited to support all kinds of measurement sensors to measure Global, Diffuse and Direct Radiation.

EKO Sun Trackers must be connected to RS485-M port by means of an RS232 to RS485 adapter.

Date, time and location are acquired from the sensor by means of commands TM and LO. If the data logger values are significantly different, Meteo-40 will get automatically synchronized and the changes will be logged in the [logbook](#). This synchronization happens in two cases: when configuring the sensor and on every CECS reboot. If you want to

trigger the synchronisation routine, you can access the configured EKO Sun Tracker for editing and save it again without changing the configuration.

According to the configured polling rate, which is 1 s per default, the calculated angle according to the GPS information and the current angle are requested and recorded.



Important

Make sure that no other method to synchronize date and time is active (Section 4.2).

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
EKO Sun Tracker	EKO	Commands MR and CR	M1_1: Azimuth calculated (CR), M1_2: Altitude calculated (CR), M2_1: Azimuth (MR), M2_2: Altitude (MR)	serial settings

Table 10.19: Data request for RS485 Sun Tracker

10.14 Soiling Measurement

Soiling and Irradiance Measurement Systems with the Atonometrics RDE300 Series measurement and control unit collect critical data for evaluating PV array performance. The systems can be used at operating PV power plants and pre-construction site survey locations.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Atonometrics RDE300	Modbus RTU		M1_1: Global Irradiance PV1, M1_2: Analog Current PV1, M1_3: Temperature PV1, M1_4: Active Power PV1, M2_1: Global Irradiance PV2, M2_2: Analog Current PV2, M2_3: Temperature PV2, M2_4: Active Power PV2, M2_5: Soiling Ratio, M2_6: Soiling Ratio Isc, M2_7: Soiling Ratio Pmax, M3_1: Event Code, M4_1: Status Fluid, M5_1: Status Pump	Serial settings, address

Table 10.20: Data request for RS485 Soiling Measurement

10.15 Rotating Shadowband Irradiometer

Measure Global, Diffuse and Direct Radiation from two LiCor sensors as well as the temperature. The average values from both sensors are also calculated.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
CSPS RSI	CSPS		M1_1: Global Horizontal Irradiance (GHI), M1_2: Difuse Horizontal Irradiance (DHI), M1_3: Direct Normal Irradiance (DNI), M1_4: Temperature, M1_5: GHI LiCor 1, M1_6: DHI LiCor 1, M1_7: DNI LiCor 1, M1_8: GHI LiCor 2, M1_9: DHI LiCor 2, M1_10: DNI LiCor 2	Serial settings

Table 10.21: Configuration of RS485 CSPS RSI

10.16 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 cm³ = 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). Refer to Figure 13.12 for the connection diagram.

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

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

Equation 10.11: Calculation of Precipitation Quantity (N)

Slope is an internal parameter of the sensor, which is important to calculate the precipitation quantity according to the measurement rate set in the sensor configuration. The value is pre-configured in the *Sensor Helper* (see Section 5.1.4).

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

Table 10.22: Parameters for the configuration of precipitation sensors



Important

If you install calibrated sensors, enter the values given in the calibration protocol.

Meteo-40 saves all electrically measured values in Pulse [I] to the source data (Section 6.7). The calculated values are saved to the CSV file (see Section 6.6.1).



Note

The CSV file also contains for all active channels the electrical values according to the chosen statistical interval.



Important

If you plan to install precipitation sensor Thies or Young, you have to implement an accessory module! Refer to the data sheet and contact Ammonit for further details.



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

10.17 Laser Precipitation Monitors

Laser precipitation monitors measure various precipitation details, i.e., intensity of total, liquid and solid precipitation as well as the precipitation amount and the SYNOP parameter.

Thies Laser Precipitation Monitor (LPM) sensor performs a new calculation every minute, after the first 5 minutes of operation. Meteo-40 requests data with a 1s-rate in order to guarantee a valid measurement per minute with a working sensor.

Thies LPM has to be connected to RS485-M port.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Thies Laser Precipitation Monitor	Thies	Telegram 8	Mx_1: SYNOP, Mx_2: Intensity total precipitation, Mx_3: Intensity liquid precipitation, Mx_4: Intensity solid precipitation, Mx_5: Precipitation amount	Serial settings, address, half duplex mode, no automatic telegram sending

Table 10.23: Configuration of RS485 Laser Precipitation Monitor Sensors



Note

SYNOP (surface synoptic observations) is a numerical code used for reporting weather observations, also called FM-12 by the World Meteorological Organization. Refer to Thies LPM sensor's manual for more information.

10.18 Other Sensors / Devices compatible with Meteo-40 RS485 bus

In addition to meteorological sensors, further RS485-compatible sensors or devices can be connected to the Meteo-40 RS485 bus. The following list includes some sensors and their configuration.

Sensor type	Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
Multi Channel Voltage Module	Gantner e.bloxx A1	Modbus	registers 17 to 32	Mx_1: Analog Voltage AI1, Mx_2: Analog Voltage AI2, Mx_3: Analog Voltage AI3, Mx_4: Analog Voltage AI4, Mx_5: Analog Voltage AI5, Mx_6: Analog Voltage AI6, Mx_7: Analog Voltage AI7, Mx_8: Analog Voltage AI8	Serial settings, address, protocol, channels definition
Multi Channel Voltage Module	Gantner e.bloxx A3-1	Modbus	registers 17 to 26	Mx_1: Analog Voltage 1, Mx_2: Analog Voltage 2, Mx_3: Analog Voltage 3, Mx_4: Analog Voltage 4, Mx_5: Digital status	Serial settings, address, protocol, channels definition
Multi Channel Digital Module	Gantner e.bloxx D1-1	Modbus	registers 0 to 7	Mx_1: Digital status 1, Mx_2: Digital status 2, Mx_3: Digital status 3, Mx_4: Digital status 4, Mx_5: Digital status 5, Mx_6: Digital status 6, Mx_7: Digital status 7, Mx_8: Digital status 8	Serial settings, address, protocol, channels definition

Table 10.24: Configuration details for other RS485 Sensors / Devices

10.18.1 Configuring generic Modbus RTU sensors

It is possible to connect up to 8 Modbus RTU sensors to RS485-M port. They can be combined with other Modbus RTU sensors implemented in Meteo-40 like Luft sensors, but not with other protocols like Thies or Gill.

Sensor type:

Sensor:

Installation height (m):

Label:

Serial number:

Evaluation type:

Unit

RS-485 Channel:

RS-485 address (0..247)

Data Type:

Word Endianness:

Modbus start register (0..65535)

Modbus register quantity (1..20)

Modbus function code (3..4)

RS-485 master general configuration

RS-485 speed:

RS-485 data format:

Measurement rate:

Figure 10.1: Generic Modbus RTU sensor configuration

The maximum quantity of consecutive registers that can be read from each sensor is 20. It is necessary to specify the first register (PDU addressing, first reference is 0) and the amount of registers. The function code is selectable between '03' (read holding registers) and '04' (read input registers).

Read registers will be evaluated according to the selected data type. If a 32-bit data type is selected, each two registers will be merged. For each registers pair (if 32-bit data type selected) or each individual register (if 16-bit data type selected), an evaluation is generated. E.g. reading 10 registers on RS485 channel M1 will generate 10 evaluations if a 16-bit data type is selected (M1_1 to M1_10) and 5 evaluations if a 32-bit data type is selected (M1_1 to M1_5).

The resulting evaluations have no unit or evaluation type. You can create a new evaluation on top of each original evaluation by means of the [linear equation](#) from the Evaluation Helper (see Section 5.3.1). Finally, it is necessary to properly select the evaluations to be included in the CSV statistics files in the Data → Statistics (see Figure 6.4).

10.19 Multifunction Transducer, Power Meters and other Electrical Measurement Devices

Meteo-40 can be used to connect power meters, multifunction transducers or other electrical measurement devices, e.g., for power curve measurement. The devices are connected to the RS485 bus of Meteo-40.

Sensor type	Model	Protocol	Description	Channels and Evaluated data	Sensor's previous configuration needed
Power Meter	Sineax CAM (see Section 10.19.1)	Modbus	Actual values (registers 40100, 40118 to 40122, 40134 to 40142)	Mx_1: Average phase Voltage U, Mx_2: Current I1, Mx_3: Current I2, Mx_4: Current I3, Mx_5: Real Power P1, Mx_6: Real Power P2, Mx_7: Real Power P3, Mx_8: Total Real Power P, Mx_9: Total Reactive Power Q	Serial settings, address
Power Meter	Iskra MT540 (see Iskra manuals download (http://www.iskrasistemi.si/download/manuals/))	Modbus	Normalized actual values (registers 804, 809 to 811, 816 to 819, 823)	Mx_1: Average phase Voltage U, Mx_2: Current I1, Mx_3: Current I2, Mx_4: Current I3, Mx_5: Real Power P1, Mx_6: Real Power P2, Mx_7: Real Power P3, Mx_8: Total Real Power P, Mx_9: Total Reactive Power Q	Serial settings, address
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	Serial settings (19200 bps), address

10.19.1 Sineax CAM Measuring Unit

Sineax CAM is a universal measuring unit for heavy current variables. Actual measurements for average phase voltage, current, real and reactive power are requested from this sensor. For more information refer to [Gossen Metrawatt Sineax CAM documentation](#) (<http://www.gossenmetrawatt.com/english/produkte/sineaxcam.htm#>).

10.20 Remote Sensing

10.20.1 ZephIR 300 Lidar

Meteo-40 can acquire ZephIR 300 averaged wind data registers and include them in the measurement CSV files or share them over SCADA. You can select ZephIR 300 from the sensors list under 'Other Sensor'.

Before adding it to the list, the ZephIR 300 must be powered and connected to Meteo-40's RS485-M port. The configured heights will be automatically requested and for each height, a RS485 channel (M1 to M8) will be configured.



Note

For more information about how to electrically connect ZephIR 300 and Meteo-40 please contact us.



Important

Measurement polling interval is 1 minute per default. It must always be lower than the statistics time interval (see Section 6.3) in order to ensure a valid measurement per interval.

Model	Protocol	Description	Channels / Evaluated Data	Required Configuration
ZephIR 300	Modbus	Averaged wind data per height	Mx_1: Reference, Mx_2: Wind Speed, Mx_3: Vertical Wind Speed, Mx_4: Wind Direction, Mx_5: Temperature, Mx_6: Air Pressure, Mx_7: Humidity, Mx_8: Wind Speed Max, Mx_9: TI	Serial settings, address

Table 10.25: Requested values

Chapter 11

Channels

In the previous chapter, various sensors have been described, which can be connected to Meteo-40. The sensors have to be connected to the corresponding channel. Depending on the data logger type, Meteo-40 offers up to 35 channels. Meteo-40 provides connectors for the following measurands and signals:

- Analog Voltage (DC)
- Analog Current (DC)
- Pulse / Counter (Period)
- Digital / Serial / Status
- RS485 (master) to connect various types of sensors.

Furthermore, the data logger Meteo-40 provides up to two high precision Current Sources to supply passive sensors.

See also Section 1.3.

11.1 Connecting Sensors to Analog Voltage Channels

Meteo-40 is equipped with up to 12 differential voltage inputs, depending on the logger's type. Generally, there are two benefits from differential inputs:

1. Reduced impact of perturbances and interferences on the signal lines,
2. Helps to avoid ground loops.

You can find the analog voltage channels (Ax, Bx) on the lower left side of the measuring unit (see Section 1.2). For example, analog wind vanes, barometric pressure sensors or pyranometers with analog voltage output can be connected to analog voltage channels of Meteo-40.

The analog voltage ranges comprise the following voltage ranges:

- $\pm 0.1V$,
- $\pm 1V$,
- $\pm 10V$,
- 0.1V to 0.3V.

Note: The voltage range 0.1V to 0.3V is a high resolution range, especially designed for use with passive Pt1000 temperature sensors in conjunction with the current sources of Meteo-40.

For further electrical details refer to Section 12.2.

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

Table 11.1: Analog Channels of Meteo-40

11.2 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 electrical details refer to Section 12.2.

With data loggers produced since 2017-06, one can use the counter channels C5, C6, C11, and C12 as period measurement channels. This is useful for low frequency signals. The channel names are P1 to P4, respectively.

Channel	Meteo-40S	Meteo-40M	Meteo-40L
Counter Channels	4	8	12
Period measurements	0	2	4

Table 11.2: Counter Channels of Meteo-40

11.3 Connecting Sensors to Digital Channels

To use digital serial wind vanes Meteo-40 comprises up to eight Digital Channels (D). These Digital Channels are located in the middle of the connection panel of the data logger. For further electrical details refer to Section 12.2.

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

Table 11.3: Digital Channels of Meteo-40

11.3.1 Functionality Check of Clock Output

To set up a proper digital connection between the sensor and Meteo-40 it is sometimes necessary to verify the functionality of the Digital Clock Output. The Digital Clock Output sends a short data sequence to the sensor, the sensor should respond with a data sequence on the IN line of the serial interface.

To request data from the sensor the Digital Clock Output must provide voltage levels that can be detected (understood) by the sensor. To simply test the functionality of the Digital Clock Output with a Multimeter Meteo-40 has implemented a software driven test procedure. To perform the CLK-Line Output Test do the following:

- Disconnect the sensor from the data logger.
- Connect the data logger to the PC to configure it via web interface.
- Login into the data logger and follow the links Measurement → Channels
- Press the button "Digital test below the sensor list. "
- A tabular showing the Digital Channels available on this logger occurs. The right columns of the table contains two buttons: "5V" and "0V" corresponding to the each channel.



Figure 11.1: Configuration Menu for CLK-Line Test in Meteo-40.

- Connect the multi meter between CLK output and GND of the Digital Channel you intend to check.
- **First step:** Press the button "5V" to switch on the DC voltage of the Clock Output. There must be a voltage between 4V and 5.6V present at the Clock Output.
- **Second Step:** Add a resistor of 1kΩ ... 1.2kΩ in parallel to the multi meter (see figureFigure 11.2). Press the button "5V" to switch on the DC voltage of the Clock Output. The voltage at the Clock Output *must not drop below 3 volts*.

Notes:

- The DC voltage output can be toggled between High- and Low-level via the two buttons "5V" and "0V"
- The test has limited timespan: After pressing the button "Digital test" and choosing the the DC voltage level the voltage level disappears after 10 seconds. To redo the test the button "5V" has to be pressed again.

Test Result: If the voltage level drops below 3 volts the CLK output of the data logger seems to be defective.

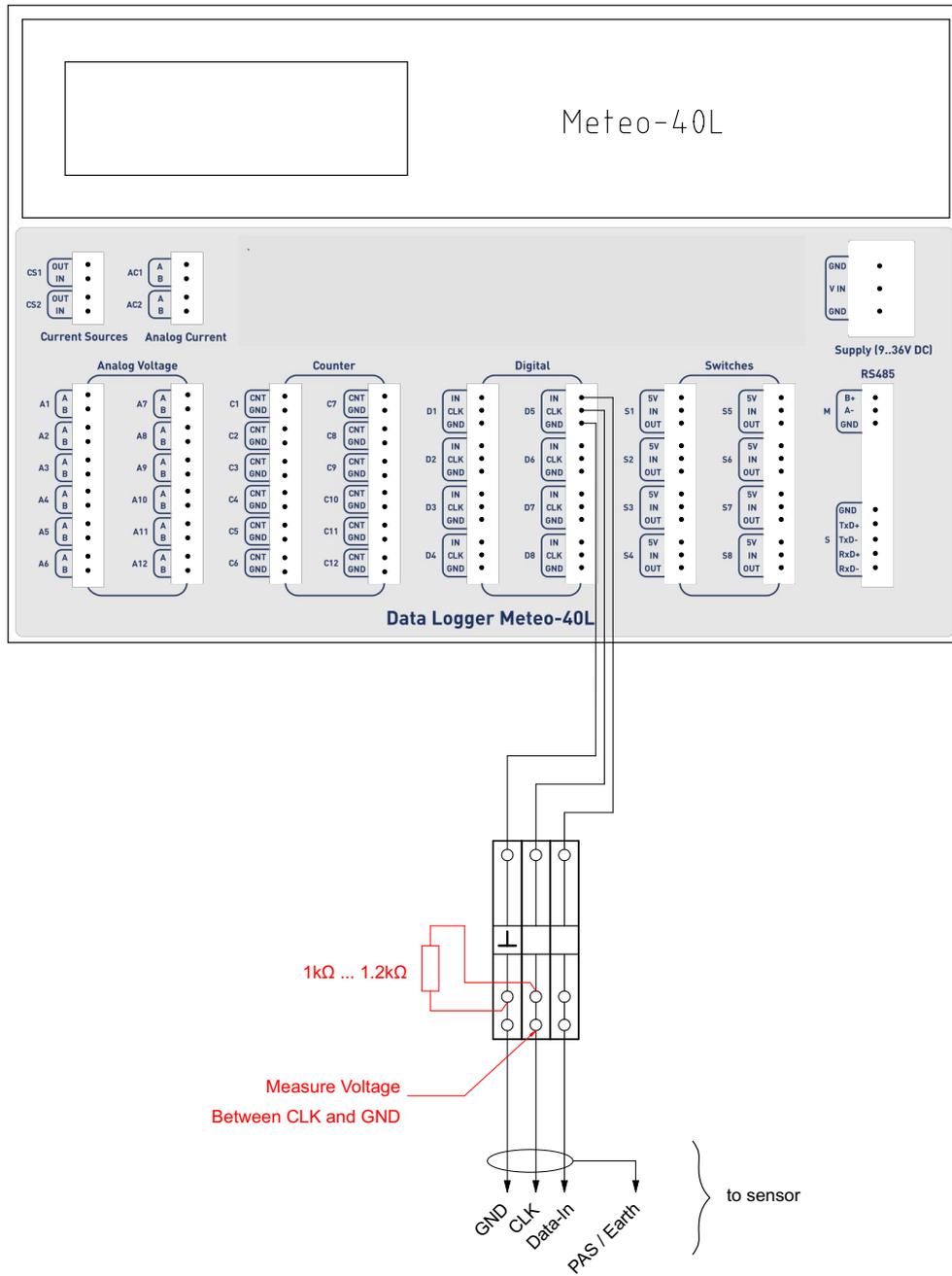


Figure 11.2: Setup for CLK-Line test of Serial Interface.

11.4 Connecting Sensors to Analog Current Channels

Meteo-40 data loggers offer analog current measurement channels: Meteo-40L provides two channels; Meteo-40M and Meteo-40S one each.

Barometric pressure sensors with current output can be connected to these channels. The current measurement channels offer current ranges of 1mA, 10mA and 100mA which can be configured via web interface.

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

Table 11.4: Analog Current Channels of Meteo-40

11.5 Connecting Sensors to Current Source

The current source (CS) is located on the left of the communication unit next to the analog current channels (see Section 1.2). Meteo-40 data loggers are equipped with one or two current sources, depending on the logger's type. The goal of these current sources is to supply passive temperature sensors (PT100 or PT1000).

Single Pt100 and Pt1000 sensors as well as Pt100 sensors, which are for example implemented inside pyrheliometers can be connected to the current source of Meteo-40. For electrical details refer to Section 12.2.

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

Table 11.5: Current Source Channels of Meteo-40



Note

For technical details and electrical characteristics of sensors, refer to the data sheets, which can be downloaded from the [Ammonit website](http://www.ammonit.com/) (<http://www.ammonit.com/>).

11.6 Connecting Sensors to RS485 M

All data logger types of Meteo-40 offer an RS485M (master) slot for bus connection of up to eight sensors with RS485 interface. For further electrical details refer to Section 12.2.

When adding an RS485 sensor in the Measurement → Sensors menu, a (selectable) channel name between M1 and M8 is assigned to the sensor. Subindexes, e.g., M1_1, M1_2, are created for measured data and evaluations. In the Measurement → Evaluation menu the evaluations are displayed. Both measured values and evaluated data are included in the CSV files and can be seen in the Data → Live menu.

Most RS485 sensors have to be configured before use. The same configuration must be applied, when adding the sensors to Meteo-40 in the Measurement → Sensors menu.



Important

Only sensors using the same protocol and serial settings can share the RS485 bus. It is important to configure each sensor with a unique RS485 address in the bus.



Important

If 4 or less RS485 sensors are connected, the RS485 M receiver remains enabled for 165 ms. With more than 4 sensors, the receiver enabled time decreases to 40 ms. The sensor response delay and the response transmission itself should happen within this period.

Chapter 12

Technical Data

12.1 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: 2GB Meteo-40L: 2GB
Date Format	YYYY-MM-DD
Time Format	hh:mm:ss
Clock	Buffered real time clock Accuracy: -40 ... +85°C (± 3.5 ppm); 0 ... +40°C (± 2 ppm) 3V Lithium Button Cell CR2032; approx. 180 mAh; operating time >3 years
Power Supply	No internal supply! (see Section 12.2.12)



Important

Meteo-40 has no internal supply battery! External power supply is essential for proper operation. Section 12.2.12 contains the characteristics of the voltage supply and the current consumption of the data logger.

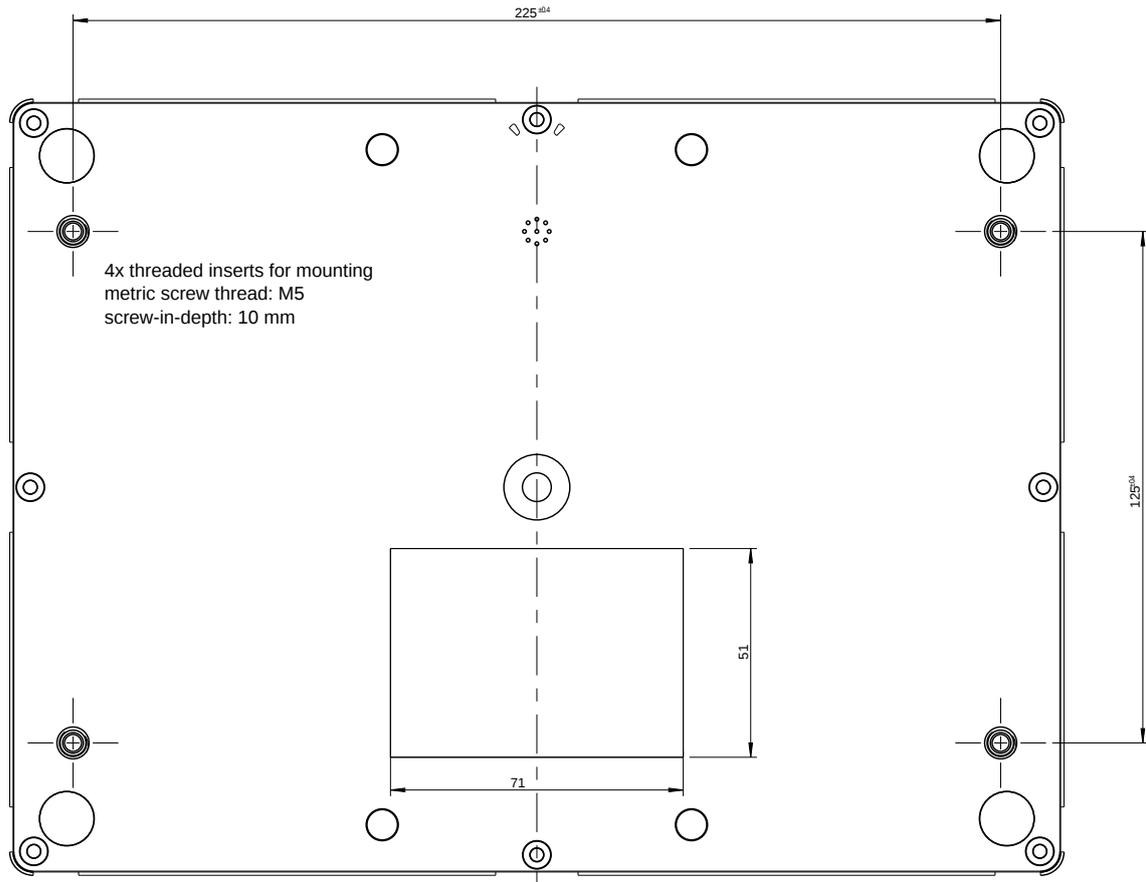


Figure 12.1: Mounting threads dimensions.

12.2 Electrical Characteristics

The values given in the following tables Table 12.1 to Table 12.12 contain the specifications of the digital and analog inputs and outputs. The given values are specified for a temperature range of -40 ... +65 °C.



Note

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

12.2.1 Electrical Specifications of Analog Voltage Channels / Differential Inputs

Property	Specification
Number of Channels per Data Logger Type	12 @ Meteo-40L (A1 ... A12) 8 @ Meteo-40M (A1 ... A8) 4 @ Meteo-40S (A1 ... A4)
Available Voltage Ranges (DC)	±0.1V ±1V ±10V 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)
Measurement Accuracy (Voltage)	≤ 50µV (Range: ±0.1V) ≤ 150µV (Range: ±1V) ≤ 1mV (Range: ±10V) ≤ 50µV (Range: 0.1V ... 0.3V)
Input Impedance	1 MΩ
Input Voltage	min. -12V max. +12V
Maximum Measurement Frequency	8 Hz

Table 12.1: Electrical Specifications of Analog Voltage Channels / Differential Inputs

12.2.2 Electrical Specifications of Analog Current Channels / Differential Inputs

Property	Specification
Number of Channels per Data Logger Type	2 @ Meteo-40L (AC1 ... AC2) 1 @ Meteo-40M (AC1) 1 @ Meteo-40S (AC1)
Available Current Ranges (DC)	±1mA ±10mA ±100mA
Measurement Accuracy (DC)	≤ 5µA (Range: ±1mA) ≤ 30µA (Range: ±10mA) ≤ 300µA (Range: ±100mA)
Resolution (Bits)	13 bit (Range: ±1mA) 15 bits (Range: ±10mA) 15 bits (Range: ±10mA)
Input Impedance (Shunt)	4.7 Ω
Maximum Input Current	150 mA
Maximum Input Voltage	0.75V
Maximum Measurement Frequency	8Hz

Table 12.2: Electrical Specifications of Analog Current Channels / Differential Inputs

12.2.3 Electrical Specifications of Counter Channels / Non-Differential Inputs

Property	Specification
Number of Channels per Data Logger Type	12 @ Meteo-40L (C1 ... C12) 8 @ Meteo-40M (C1 ... C8) 4 @ Meteo-40S (C1 ... C4)
Frequency Range (TTL-Level)	1Hz ... 25kHz
Frequency Resolution ¹	0.1 Hz
Voltage Threshold (f > 1 Hz)	0.22V
Input Voltage	min. -12V max. +12V
Period Measurement (Non-Differential Inputs)	Channels P1 (C5), P2 (C6), P3 (C11), P4 (C12)

Table 12.3: Electrical Specifications of Counter Channels / Non-Differential Inputs

12.2.4 Electrical Specifications of Digital Channels (Serial Input / Output)

Property	Specification
Number of Channels per Data Logger Type	8 @ Meteo-40L (D1 ... D8) 4 @ Meteo-40M (D1 ... D4) 2 @ Meteo-40S (D1 ... D2)
Input Voltage Range (High State)	2V ... 25V
Input Voltage Range (Low State)	-0.5V ... 0.6V
Input Resistance	≥ 10 kΩ

Table 12.4: Electrical Specifications of Digital Channels (Serial Input / Output)

12.2.5 Electrical Specifications for Digital Clock Output

Property	Specification
Number of Channels per Data Logger Type	8 @ Meteo-40L (D1 ... D8) 4 @ Meteo-40M (D1 ... D4) 2 @ Meteo-40S (D1 ... D2)
High State	5V
Low State	0V
Output Resistance	100 Ω
Minimal Load Resistance	500 Ω

Table 12.5: Electrical Specifications for Digital Clock Output

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

12.2.6 Electrical Specifications for Analog Current Source

Property	Specification
Number of Channels per Data Logger Type	2 @ Meteo-40L (CS1 ... CS8) 1 @ Meteo-40M (CS1) 1 @ Meteo-40S (CS1)
Nominal Current	200 μ A
Tolerances	< 0.5 %

Table 12.6: Electrical Specifications for Analog Current Source

12.2.7 Electrical Specifications for Switches

Property	Specification
Number of Channels per Data Logger Type	8 @ Meteo-40L (S1 ... S8) 4 @ Meteo-40M (S1 ... S4) 2 @ Meteo-40S (S1 ... S2)
Switch Voltage Range	5V ... 28V
Max. Current Continuous Switch	120 mA
Peak Switch Current (2 s)	400 mA
Switch On Resistance	< 350 m Ω
Switch Off Resistance	> 10 M Ω

Table 12.7: Electrical Specifications for Switches



Important

The switches section of the Meteo-40 comprises 5V outputs to supply peripheral 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.

12.2.8 Electrical Specifications of the 5V Output

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

Table 12.8: Electrical Specification of the 5V Output

12.2.9 Electrical Specifications of the RS485 Interface

Property	Specification
Supply Voltage RS485 A, B	5V
Termination Resistor (Bus Termination)	120 Ω
Maximal Transmission Rate	1 MB/s

Table 12.9: Electrical Specification of the RS485 Interface

**Note**

Biasing of RS485 interface via external module M83550.

12.2.10 Electrical Specification of the Ethernet Interface

**Important**

The Ethernet interface is only available on Meteo-40 Revision D.

Property	Specification
Ethernet port (Meteo-40 Revision D)	100Mbit/s (100BASE-TX)

Table 12.10: Electrical Specification of the Ethernet Interface

12.2.11 Electrical Specification of the RS232 Interface

**Important**

The RS232 interface is only available on Meteo-40 Revision C. The production of Meteo-40 Revision C stopped in October 2012.

Property	Specification
Serial interface port (Meteo-40 Revision C)	Male 9-pin RS232 connector for connection to serial modem
Maximal Baudrate	115200 Baud

Table 12.11: Electrical Specification of the RS232 Interface

12.2.12 Electrical Specification of the Power Supply

**Important**

Meteo-40 has no internal supply battery! External power supply is essential for proper operation.

Power Supply	Property	Specification
Supply Voltage Input (with Reverse Voltage Protection)	Supply Voltage Range	9V (DC) ... 36V (DC)
	Peak Supply Voltage (10 s)	55V (DC)
Current Consumption	Average Current Consumption @ 12V (DC) during measurement	$\leq 30 \text{ mA}$ ($P < 360 \text{ mW}$)
	Average Current Consumption @ 12V (DC) during communication	$\leq 70 \text{ mA}$ ($P \leq 840 \text{ mW}$) for Meteo-40 Revision D $\leq 60 \text{ mA}$ ($P < 720 \text{ mW}$) for Meteo-40 Revision C
	Average Current Consumption @ 12V (DC) with display illumination	175 mA ($P \leq 2.1 \text{ W}$) for Meteo-40 Revision D $< 500 \text{ mA}$ ($P < 6 \text{ W}$) for Meteo-40 Revision C

Table 12.12: Electrical Specification of the Power Supply

Chapter 13

Electrical Connection Plans

The following connection plans explain how Meteo-40 is connected with power supply, sensors and other periphery.



Note

Since Meteo-40 is designed to be very flexible, various sensors can be connected to the data logger. If the sensor, you want to connect, is not listed in this manual, refer for technical details and connection plans shown on the data sheets on our website (www.ammonit.com (<http://www.ammonit.com>)) or contact our sales team (+49-30-6003188-0 or sales@ammonit.com).

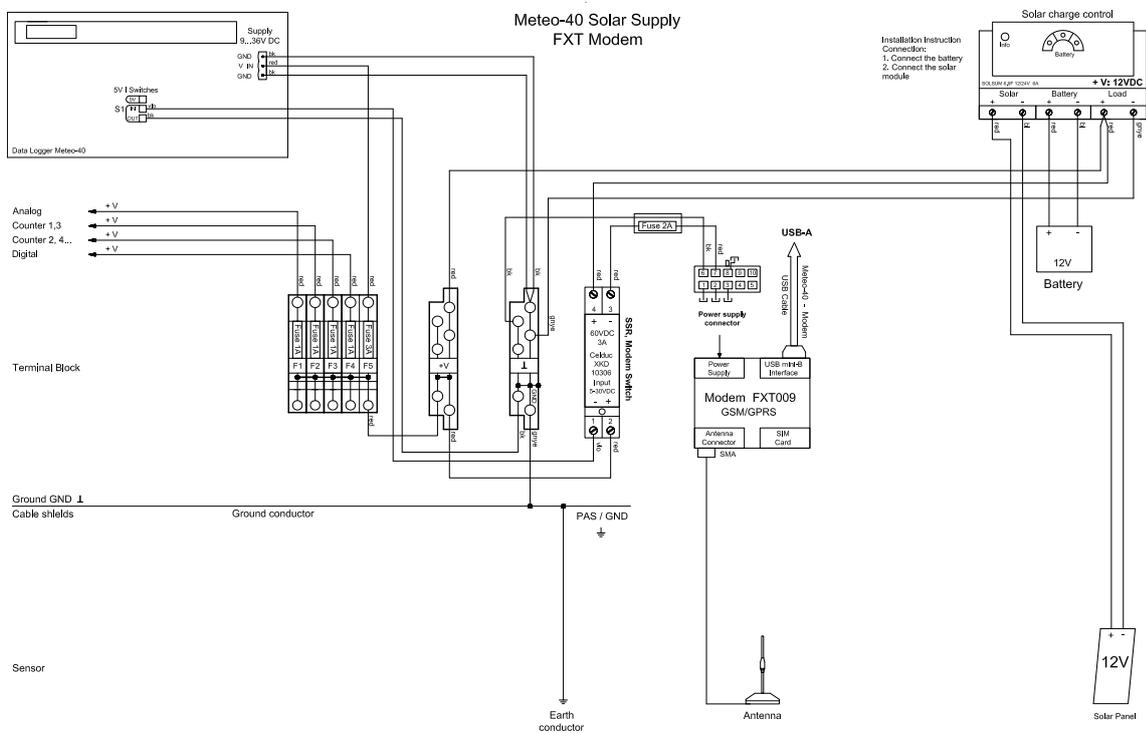


Figure 13.1: Meteo-40 Supply incl. Modem

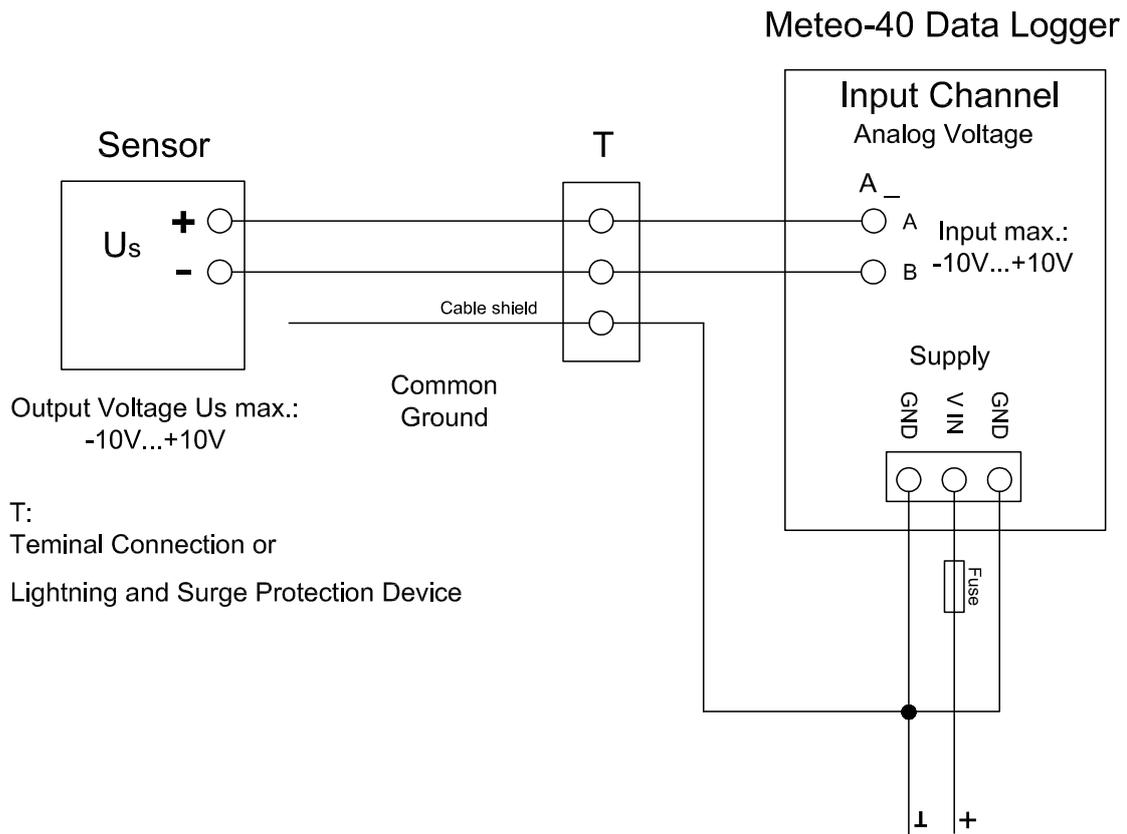


Figure 13.2: Electrical Connection Plan: Analog Voltage (Pyranometer)

Floating voltage source (pyranometer) is connected via terminal or OVP to the differential analog voltage channels.

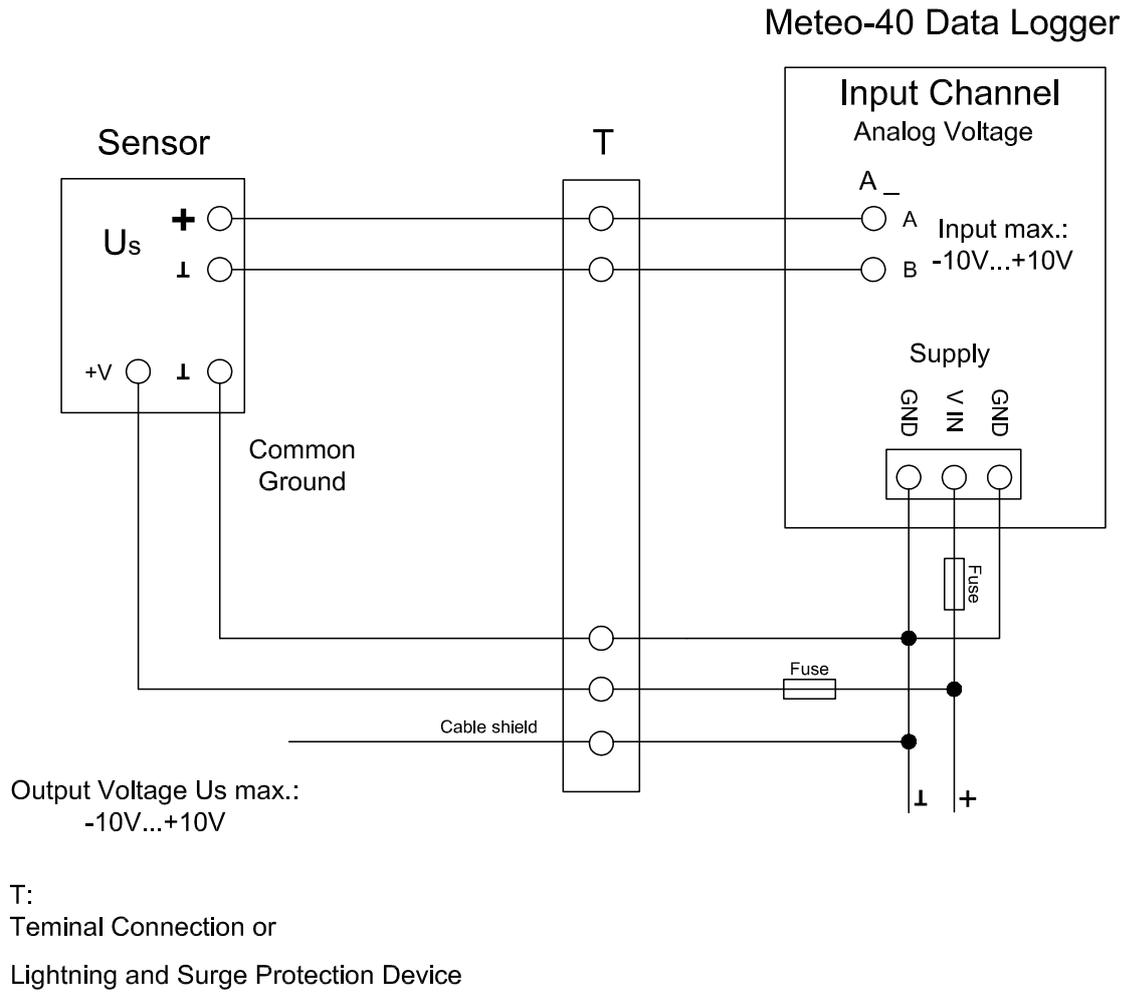


Figure 13.3: Electrical Connection Plan: Analog Voltage (Temperature / Barometric Pressure Sensor)

The temperature and/or barometric pressure sensor is connected via terminal or OVP to the differential analog voltage channels. To avoid ground loops, it is not recommended connecting the B terminal of the analog voltage input directly to common ground.

Meteo-40 Data Logger

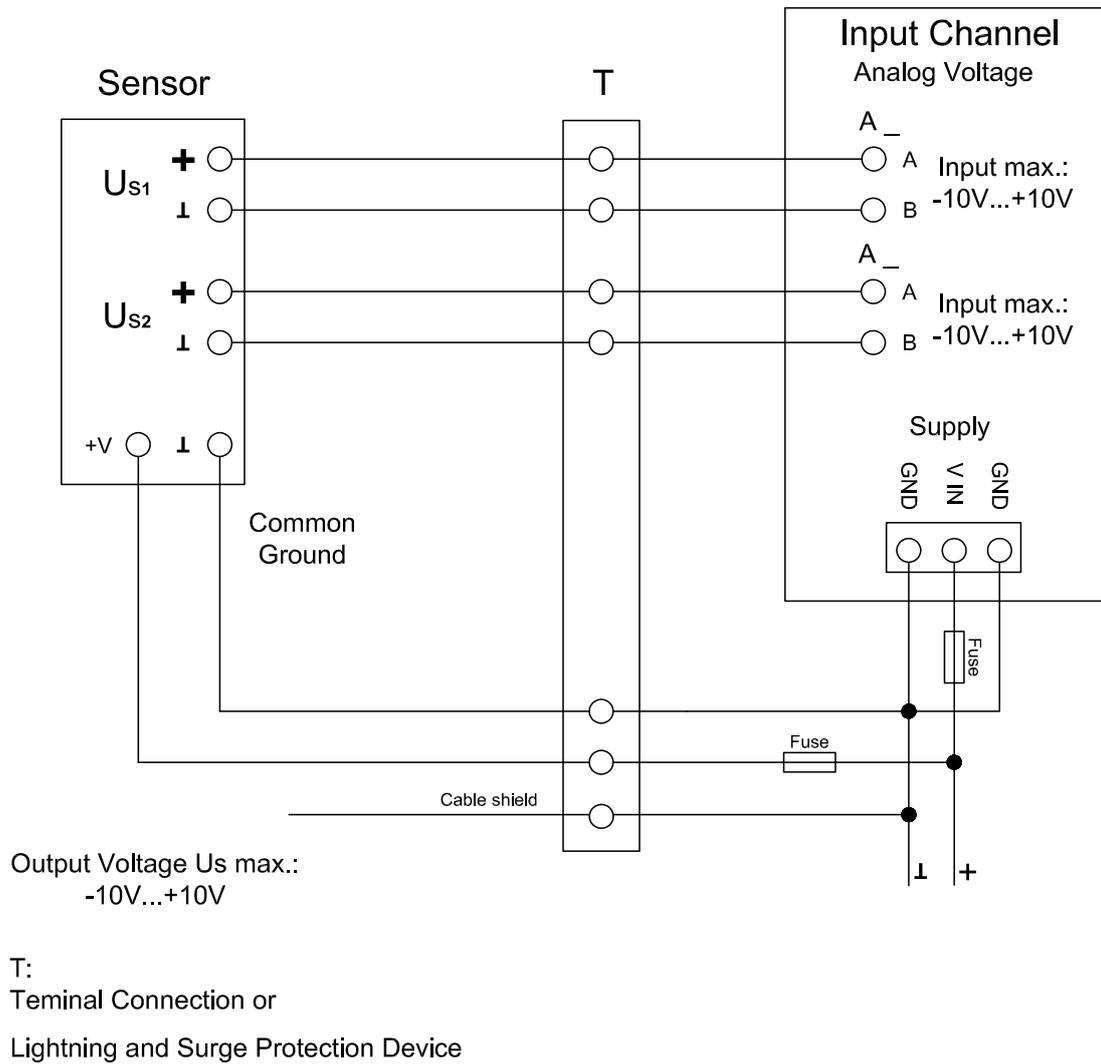


Figure 13.4: Electrical Connection Plan: Analog Voltage (Temperature + Humidity Sensor)

Voltage sources (temperature and humidity sensor) are connected via terminal or OVP to the differential analog voltage channels. To avoid ground loops, it is not recommended connecting the B terminal of the analog voltage input directly to common ground.

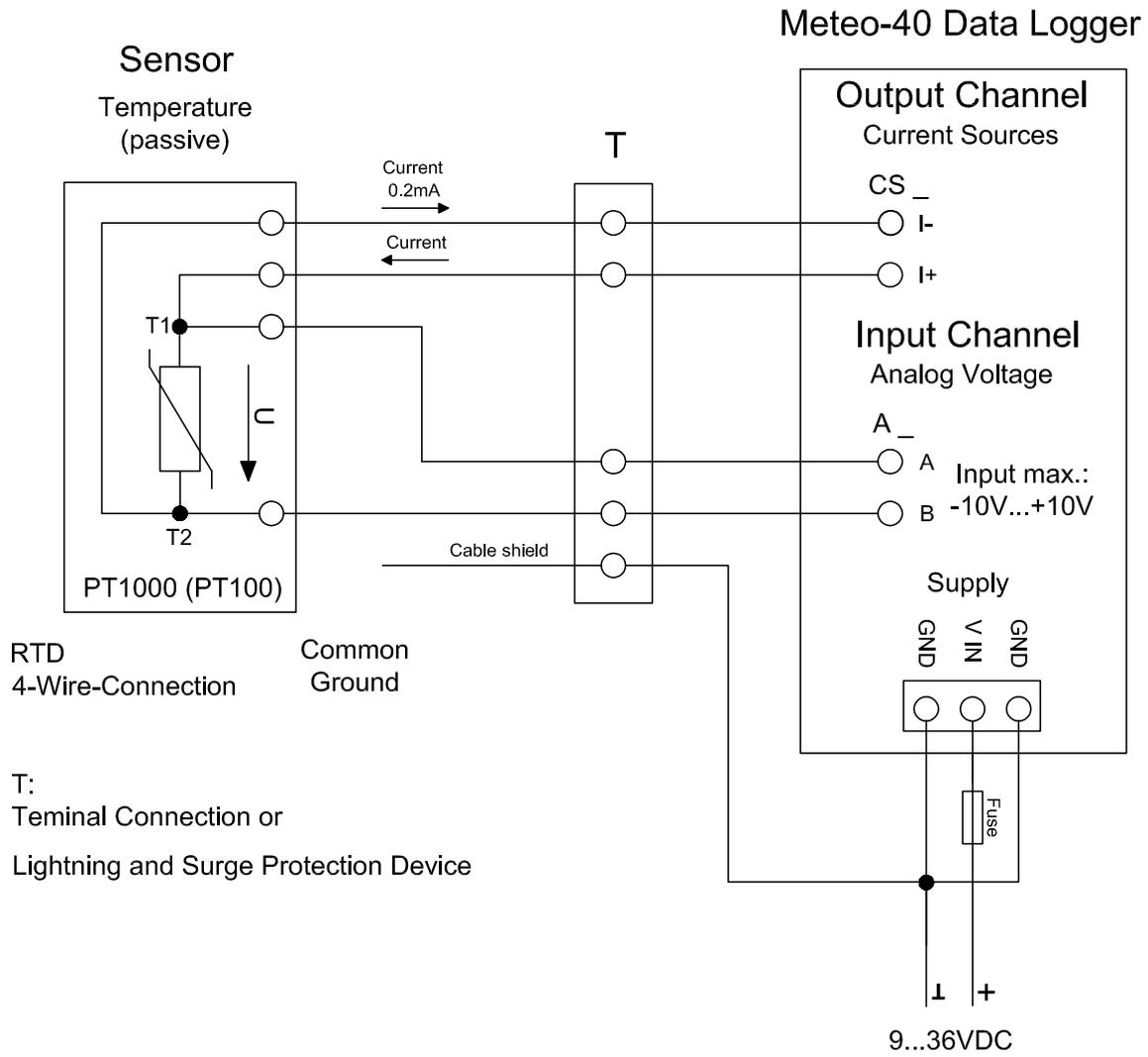


Figure 13.5: Electrical Connection Plan: Analog Voltage / Current Source (4-wire-connection; Pt1000)

Analog Current Source (CS) of Meteo-40 is applied to feed a Pt100/Pt1000 temperature sensor. The sensor is connected via terminal or OVP to the differential analog voltage channel. 4-wire measurement is recommended to avoid voltage errors due to the resistance of feed line.

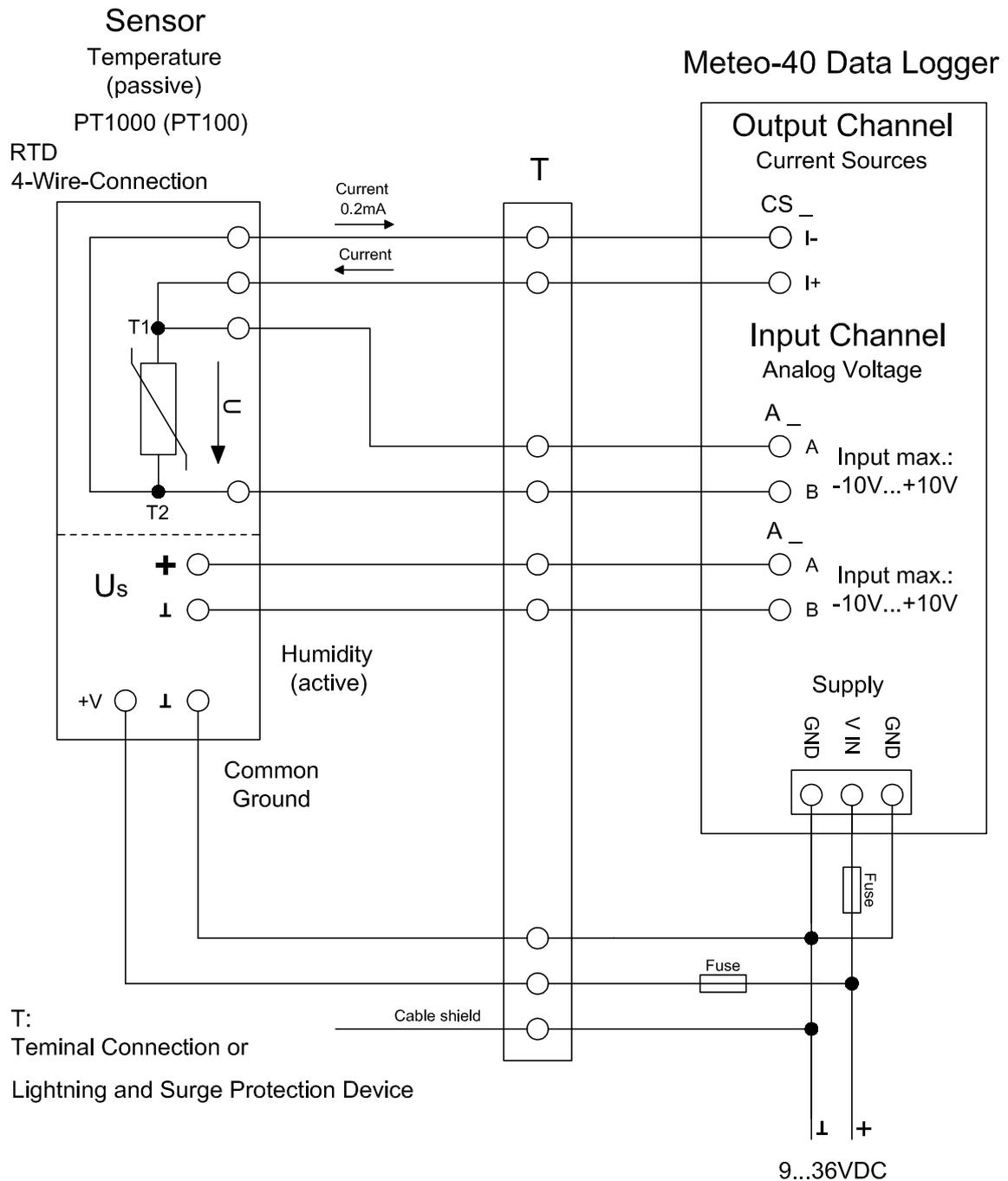
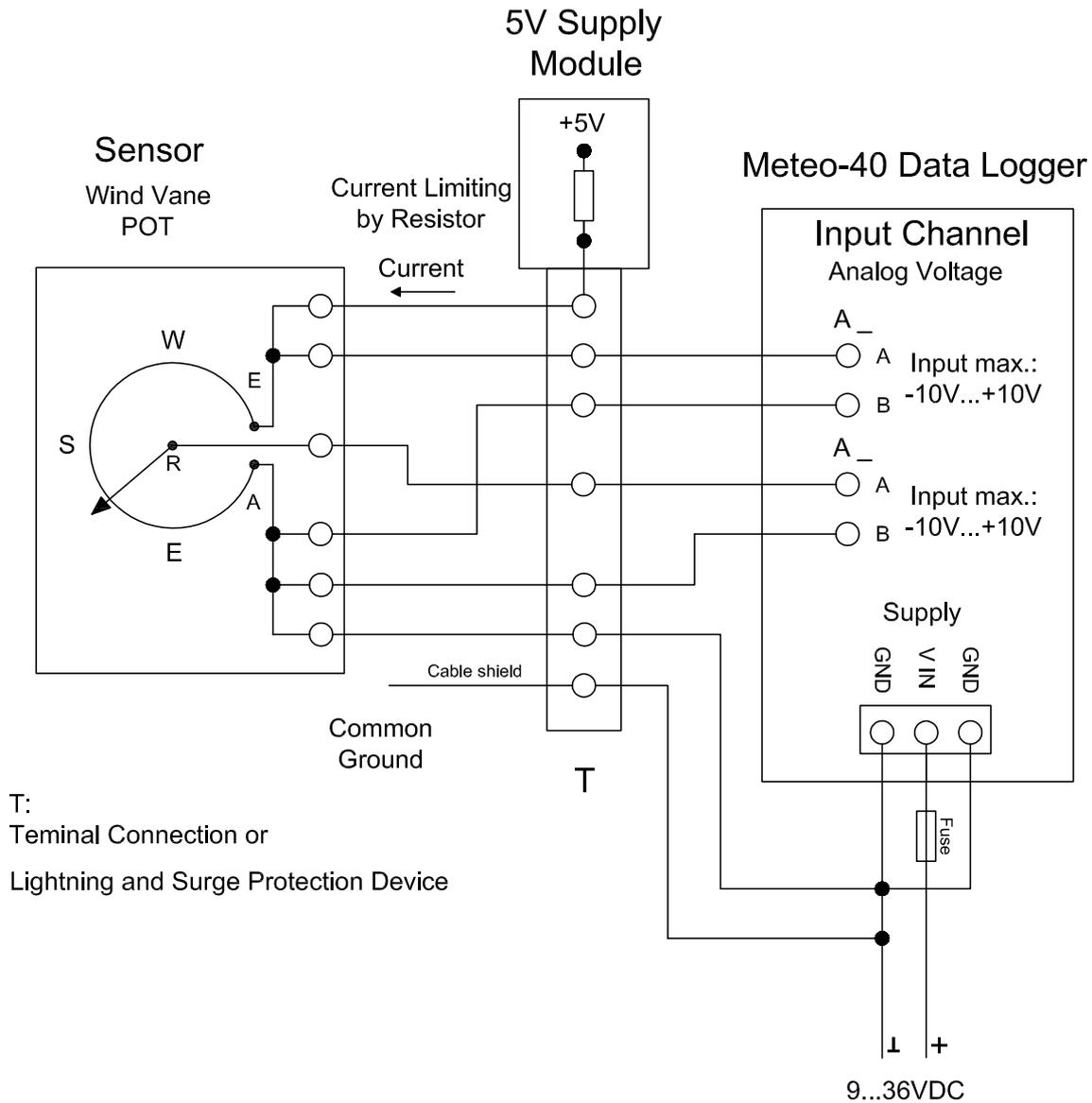


Figure 13.6: Electrical Connection Plan: Analog Voltage / Current Source (4-wire-connection; Pt1000 + Humidity)

Analog Current Source (CS) of Meteo-40 supplies the Pt100/Pt1000 temperature sensor. The active humidity sensor may be fed by the same supply as the data logger. Both sensor outputs are connected via terminal or OVP to individual differential analog voltage channels.



T:
Terminal Connection or
Lightning and Surge Protection Device

Figure 13.7: Electrical Connection Plan: Analog Voltage (Potentiometric Wind Vane)

The figure above shows the 5-wire connection of a potentiometric wind vane. The intention of this configuration is to avoid voltage drops on the measurement lines caused by wire resistance. The first analog voltage channel measures the voltage across the whole potentiometer while the second channel measures the voltage between wiper and ground. The configuration is supplied via current limiting resistor by a 5V supply. All lines to the wind vane are connected via terminal or OVP.

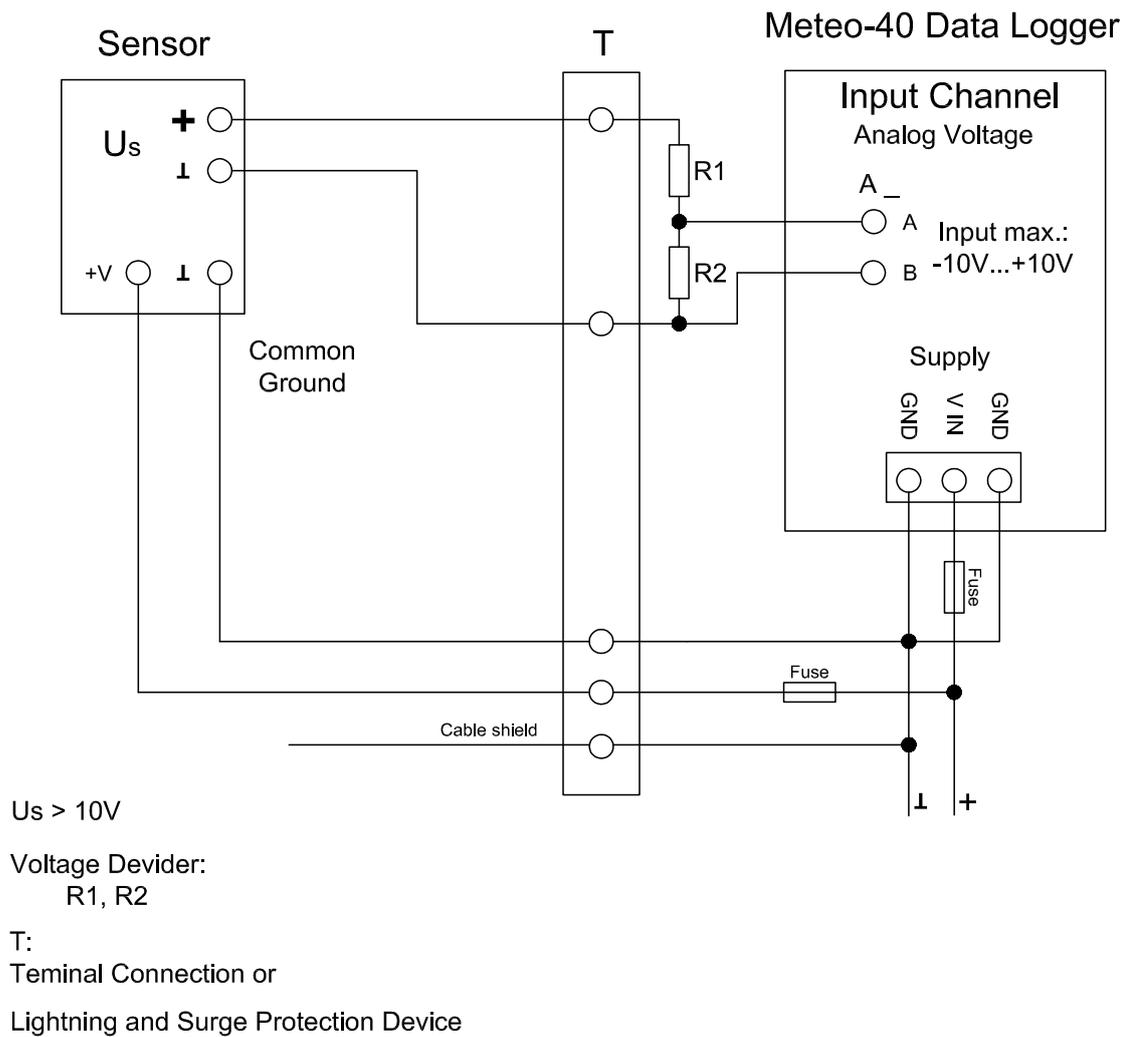


Figure 13.8: Electrical Connection Plan: Analog Voltage with Voltage Divider (2xR)

The Meteo-40 data logger is designed to measure analog DC voltages from -10V ... 10V. This is sufficient for most meteorological sensors. If voltages higher than +10V occur, the voltage at the analog voltage inputs must be shared by a voltage divider. Note that R2 is in parallel to the input impedance of the analog voltage channel (1M Ω).

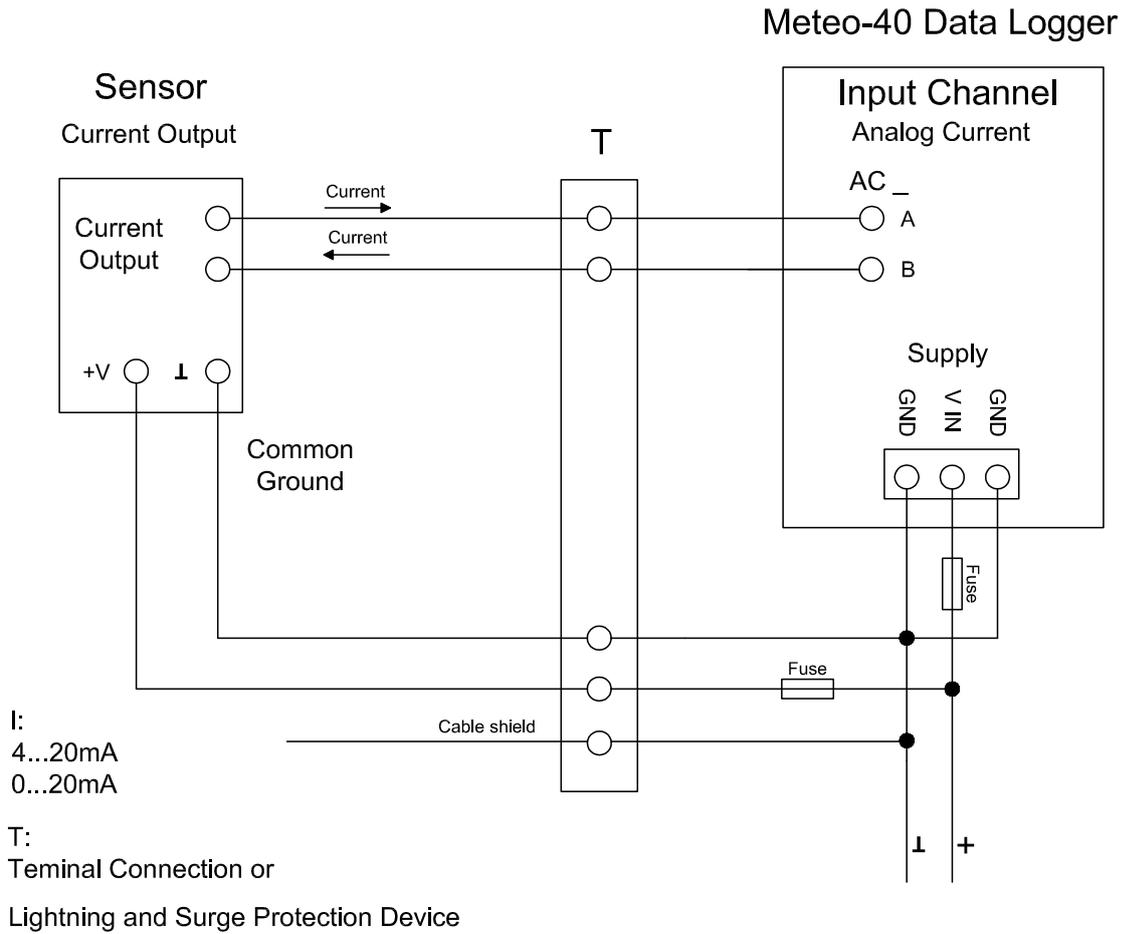
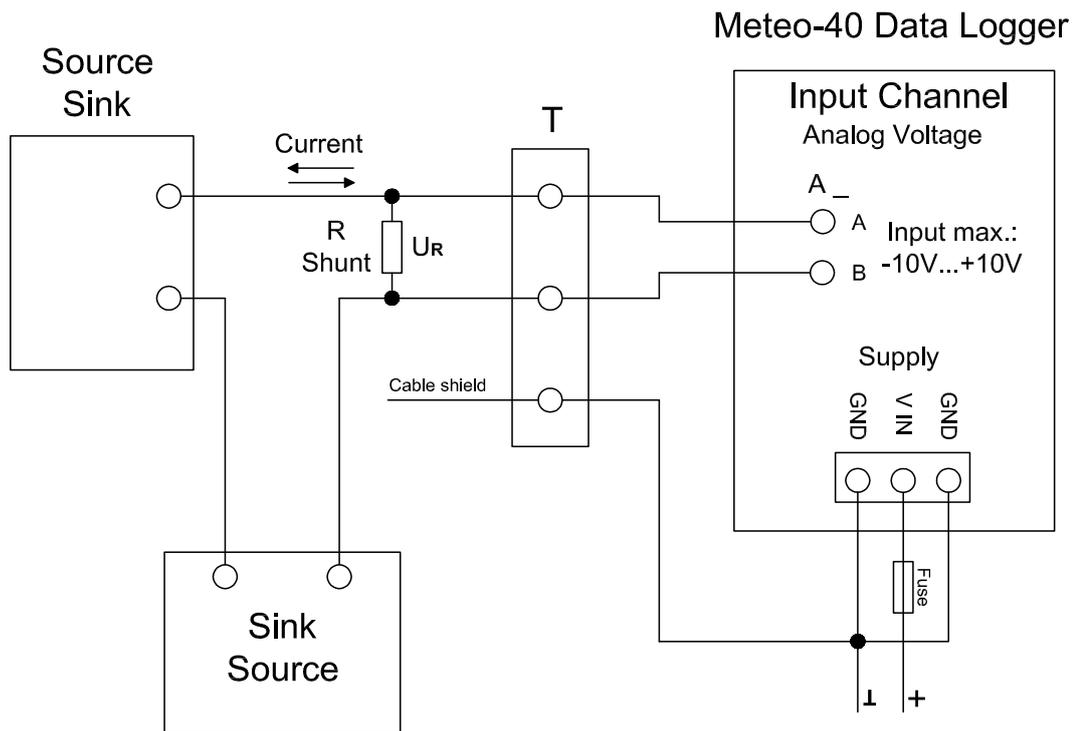


Figure 13.9: Electrical Connection Plan: Analog Current (2-wire-connection), active

Meteo-40 comprises analog current measurement inputs (AC) to measure DC currents up to 100mA. Many meteorological sensors provide analog current outputs with 0...20mA or 4...20mA. The positive signal line has to be connected to the A input. The negative line (or signal ground) has to be connected to the B input of the analog current input. The figure above depicts the recommended setup using connections via terminal or OVP to the data logger.



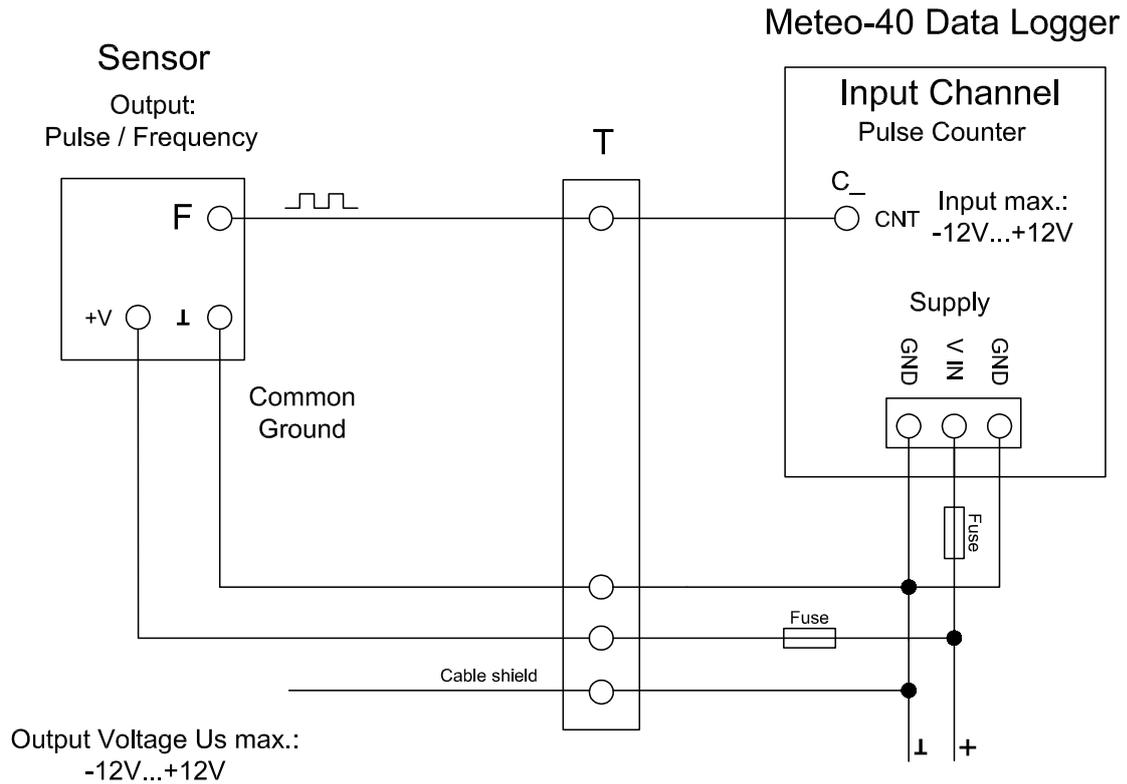
Output Voltage U_R max.:
-10V...+10V

T:
Terminal Connection or
Lightning and Surge Protection Device

Figure 13.10: Electrical Connection Plan: Analog Voltage with Shunt

Max. voltage between sensor and data logger 70 V DC!!!

The Meteo-40 data logger can measure DC currents up to 100mA on its analog current inputs. This is sufficient for most meteorological sensors. If currents higher than 100mA are to be measured, a shunt can be used in conjunction with the analog voltage inputs.



T:
 Terminal Connection or
 Lightning and Surge Protection Device

Figure 13.11: Electrical Connection Plan: Pulse Counter (Anemometer)

Meteo-40 comprises several impulse counter inputs (CNT). In most cases they are used for anemometer setup. The signal output of the sensor has to be connected to the CNT input of the data logger. In most cases the common ground is used for the negative line of counter connection. The figure above depicts the recommended setup using connections via terminal or OVP to the data logger.

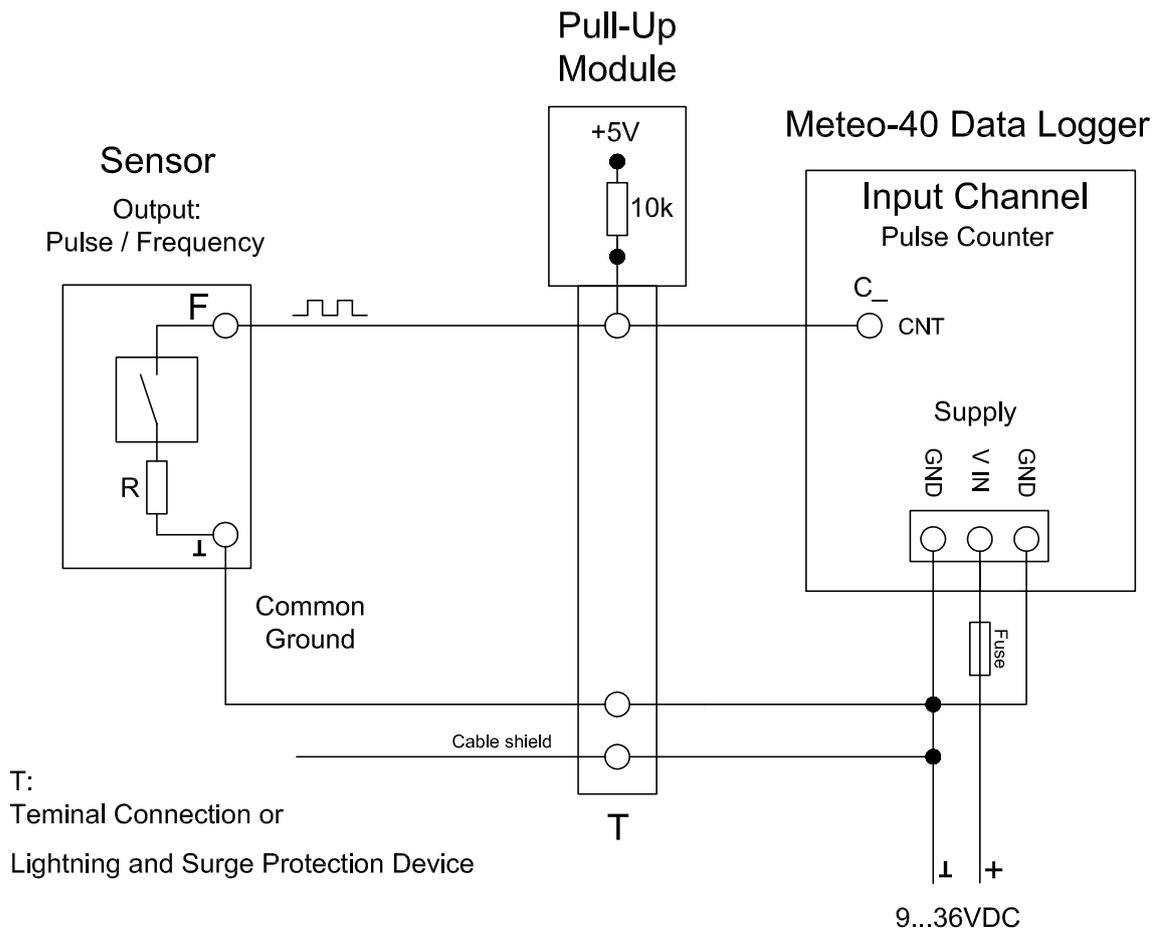
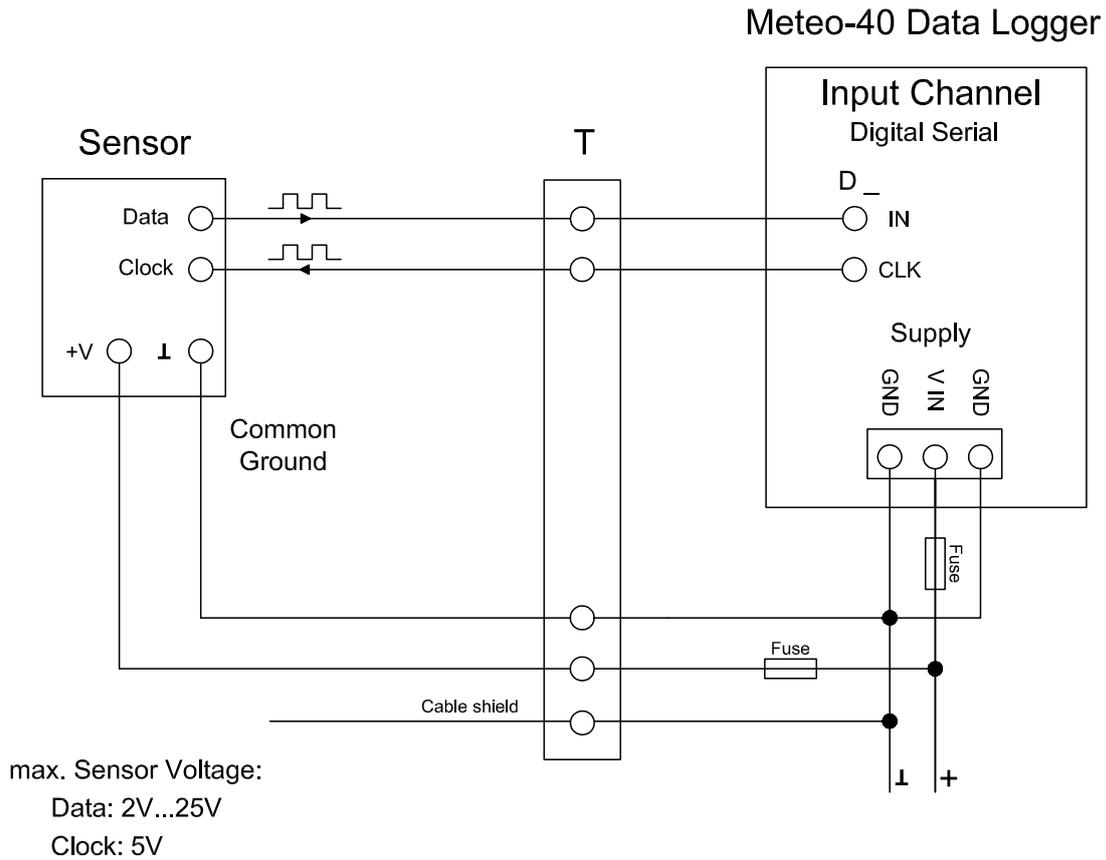


Figure 13.12: Electrical Connection Plan: Pulse Counter with Pull-up Module for Precipitation Measurement

The counter inputs of the Meteo-40 data logger can be used for precipitation sensors. Most precipitation sensors comprise open collector outputs or use a switching reed contact. In both cases an additional pull-up resistor has to be applied. This pull-up resistor is tied to a 5V supply to feed the sensor's output. The module M83510 by Ammonit comprises a pull-up resistor and a 5V supply and can easily be integrated in the setup of a steel cabinet. The figure above shows the recommended setup using connections via terminal or OVP to the data logger.



T:
Terminal Connection or
Lightning and Surge Protection Device

Figure 13.13: Electrical Connection Plan: Digital Serial for Serial Wind Vane (Thies TMR)

The Digital Serial inputs of Meteo-40 data loggers are designed to connect sensors using serial communication. The data logger sends a clock burst to the sensor via the CLK line. The response of the sensor is sent back to the data input line (IN) of the Digital Serial panel. It is essential that sensor and data logger use the same common ground. The figure above shows the recommended setup using connections via terminal or OVP to the data logger.

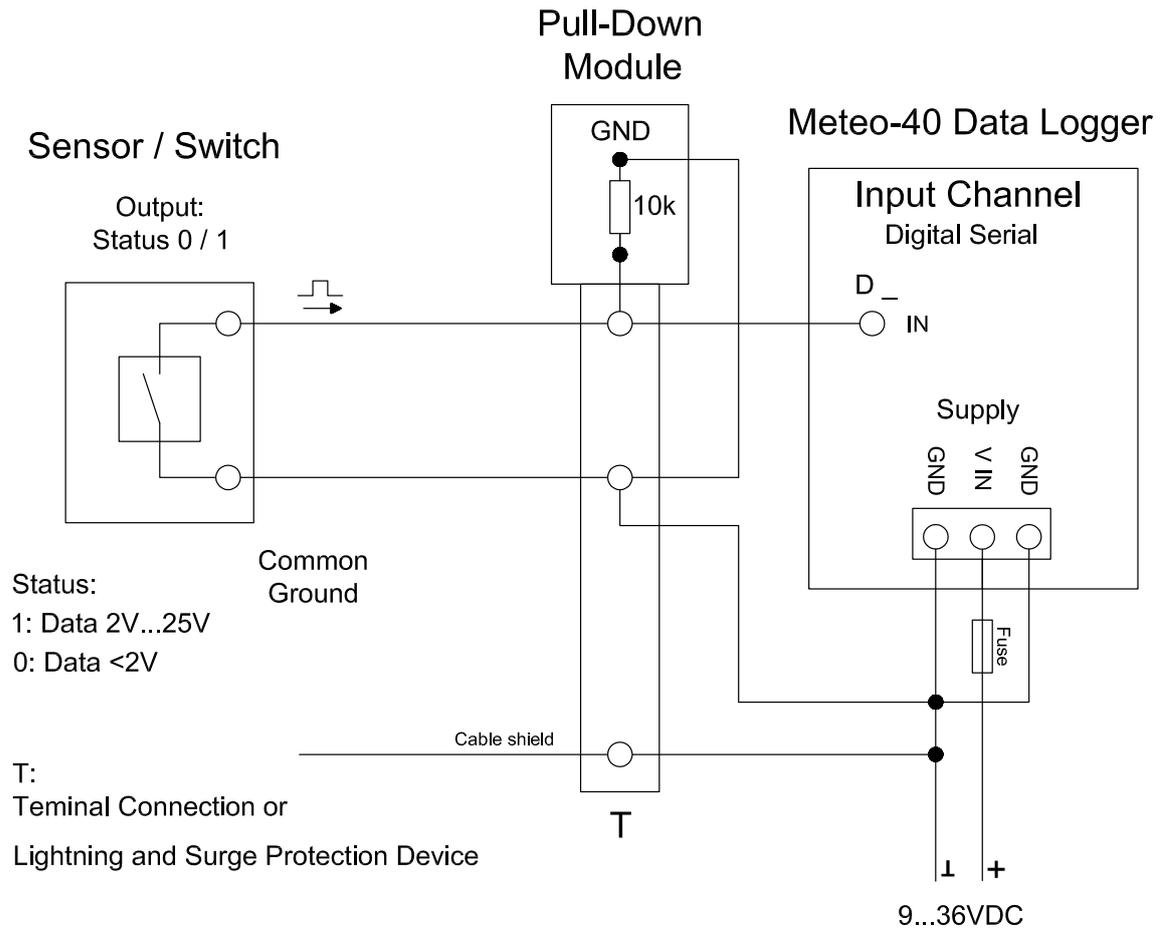


Figure 13.14: Electrical Connection Plan: Status with Pull-down Module

In some cases an additional pull-down resistor may be required to equalise the electrical potential on the status signal lines. This may be necessary to reduce perturbation caused by floating lines. The potential equalization can be realized by an external resistor to GND or an external module provided by Ammonit. This external module comprises several pull down resistors for several signal lines.

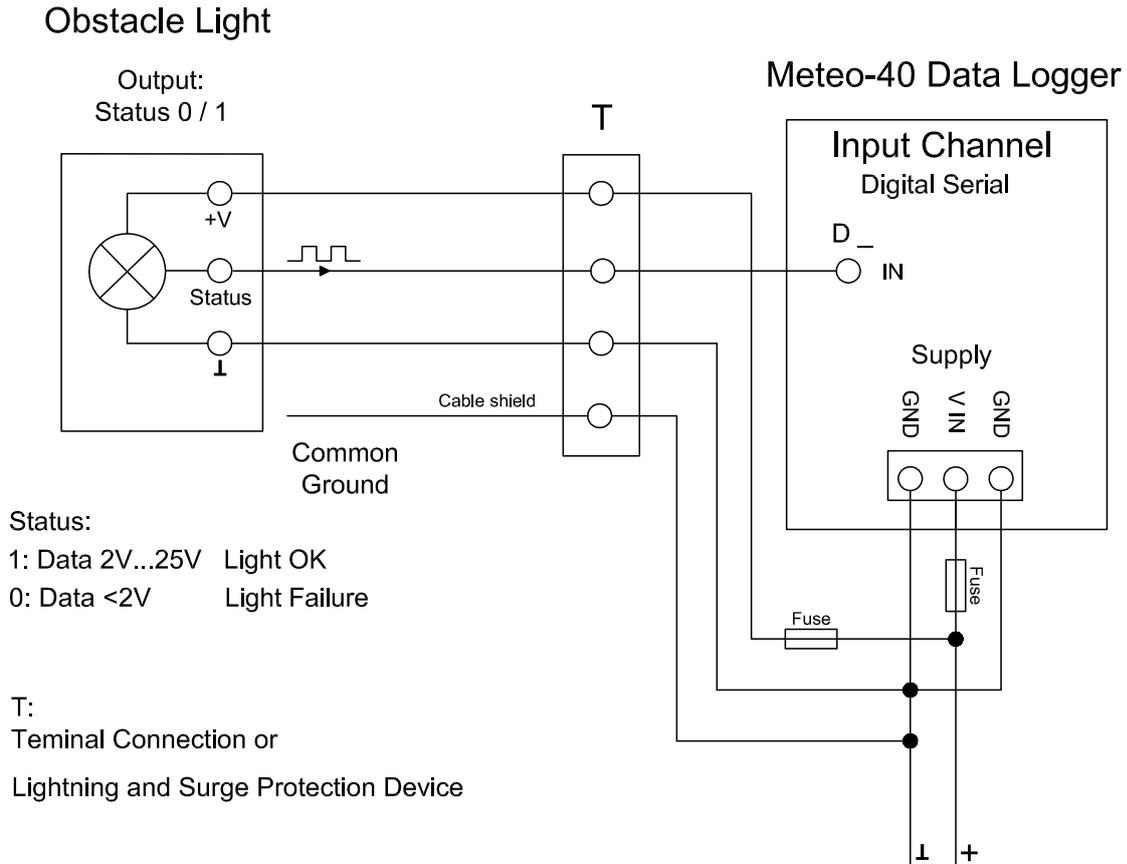


Figure 13.15: Electrical Connection Plan: Status for Obstacle Light

Many obstacle lights provide a diagnosis port to indicate malfunction. This diagnosis port can be connected to the IN port of the Serial Digital panel. For a detailed description of the electrical characteristics of the interfaces see table in Section 12.2.4. The figure above shows the recommended setup using connections via terminal or OVP to the data logger.

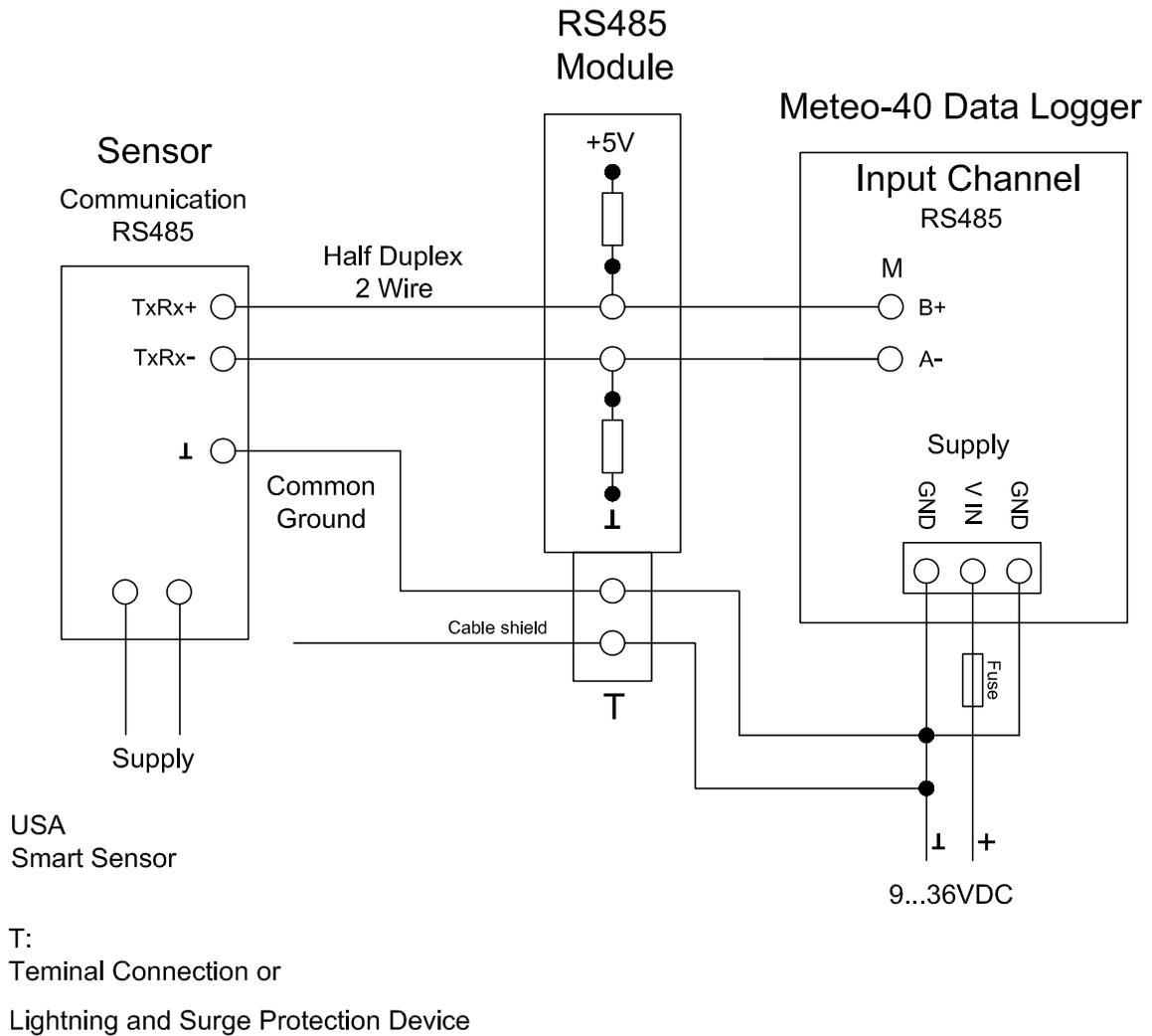


Figure 13.16: Electrical Connection Plan: RS485 with RS485 Module

If RS485 communication is used an additional biasing may be required. This is done with the configuration shown above. Ammonit provides a special RS485 module for biasing purposes. The RS485 module contains an internal voltage supply providing 5V for biasing the RS485 bus lines.

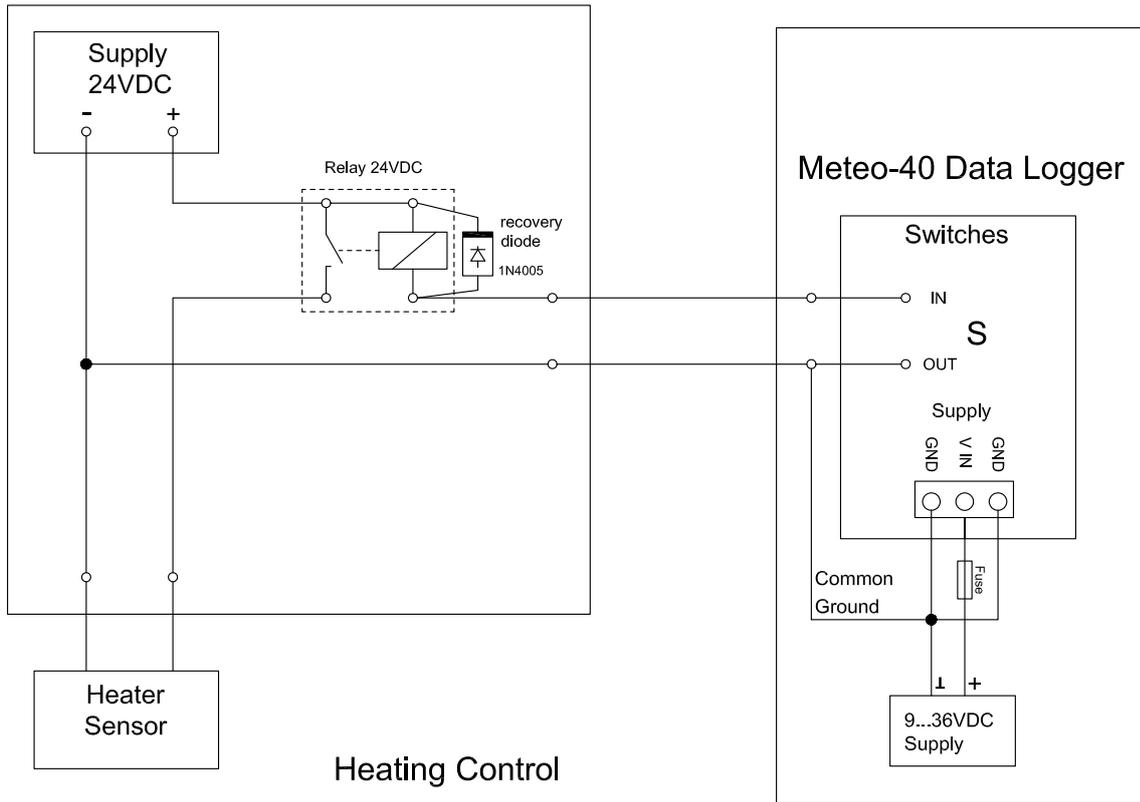


Figure 13.17: Electrical Connection Plan: Switch external Sensor Heating via Meteo-40 Switch Manager

The configuration above displays the connection of an external sensor heating switched by the Meteo-40 heating control.

Chapter 14

Cryptographic Software

Ammonit implemented certain standard cryptographic software to protect sensitive measurement data. None of the algorithms are developed by Ammonit. All cryptographic software used on Meteo-40 is free software. Its source code is available for everybody to study and check for security problems.

Currently the following is encrypted:

- Access to Meteo-40 via web interface over HTTPS with high-grade encryption (AES-256, 256 bit keys)
- All data sent and received via the Meteo-40 web interface, e.g., data download
- Data upload via SCP (RSA 2048 bit) to AmmonitOR or your own server
- Emails and attached CSV files sent by Meteo-40 (optional)



Note

There is no encryption, when data is uploaded via FTP to a server. Moreover, the data stored on Meteo-40 is not encrypted. But only computer specialists with inside knowledge could be able to access the data.

Software or Protocol	Description	Supported Algorithms
HTTPS	All access to the user interface of the data logger is done via HTTPS, a combination of HTTP with SSL/TLS, as implemented in OpenSSL.	AES, Blowfish, Camellia, SEED, CAST-128, DES, IDEA, RC2, RC4, RC5, Triple DES, GOST 28147-89, MD5, MD2, SHA-1, SHA-2, RIPEMD-160, MDC-2, GOST R 34.11-94, RSA, DSA, Diffie–Hellman key exchange, Elliptic curve, GOST R 34.10-2001
SSH	The connection to the Ammonit tunnel server (or any tunnel server of your choice) is performed with an SSH reverse tunnel.	3DES, Blowfish, CAST128, Arcfour, AES, RSA
GnuPG	GnuPG is used to digitally sign and encrypt measurement data.	CAST5, Camellia, Triple DES, AES, Blowfish, Twofish, ElGamal, RSA RIPEMD-160, MD5, SHA-1, SHA-2, Tiger, DSA, RSA

Table 14.1: Cryptographic Software

Chapter 15

Maintenance and Care

In order to ensure that Meteo-40 data loggers work properly, it is important that you maintain and handle the device with care.



Important

If an error occurs and the Ammonit support team needs to be contacted, download the configuration file (config-Dnnnnnn.txt in menu System → Information) and send it with the error description to the Ammonit Support support@ammonit.com.

15.1 Operation and Storage

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

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

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

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

15.2 Overvoltage / Lightning Protection

Ammonit offers lightning and overvoltage protection devices for DC and AC low-voltage supplies of components and measuring systems, ensuring protection of data and signal lines and power cables. The surge protection cable clamp is installed in the steel cabinet instead of a regular unprotected cable clamp. We offer several types of surge protection devices, differing in number of pins and voltage levels. Although the installation of overvoltage protection devices is not mandatory, we highly recommend installing them, as unprotected lightning can lead to a total breakdown of the entire measuring system. Overvoltage protection is strongly advised at freestanding measuring stations or when aircraft obstacle lights are applied.

Chapter 16

Frequently Asked Questions

Find in this chapter a summary of frequently asked questions.

If you do not find the answer to your specific question in this chapter, contact the Ammonit support team.

16.1 Local Communication

Question	Answer
The Meteo-40 display does not show anything.	The display is switched off. Press the middle button of your data logger and hold it until the display turns on. The display of Meteo-40 is only illuminated, when CECS is running. During MARS operation, the display is switched of. Refer to Chapter 9. The ambient temperature is below -20°C. The crystals of the LCD got stuck.
I cannot configure Meteo-40 using the buttons.	You do not have permission to configure the data logger with the buttons on the Meteo-40 housing. See Section 9.1.
The red LED light is turned on. What does it indicate?	It indicates that an error in the measuring operation occurred. For details see System → Logbook in the web interface or System → Errors → Error List in the display menu.
The yellow LED light blinks. What does it indicate?	It indicates that at least one RS485 sensor is connected. According to the Modbus protocol, the yellow LED light blinks, when a measurement is taken.
I do not have an USB Ethernet adapter available. How can I connect Meteo-40 Revision C to the LAN?	As Meteo-40 Revision C has no Ethernet port, an USB Ethernet adapter is required. Use the USB Ethernet adapter included in the delivery. Meteo-40 Revision D data loggers are equipped with Ethernet port and can be connected directly to the LAN - without any accessories.
Meteo-40 is connected to the LAN. After entering the IP address of Meteo-40 in my browser, I receive an error message.	Check the three following possibilities: <ul style="list-style-type: none"> • Meteo-40 is switched off. The web interface can only be accessed, when Meteo-40 is switched on, rep. the CECS has to be on. See Section 1.4. • 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. If you have the permission, you can activate DHCP in the display of Meteo-40. Go to the Communication → Devices → LAN → eth menu and set <i>Use DHCP</i> to Yes (see Section 9.1. Or connect the data logger via USB and change the LAN settings. See Section 7.7.
Meteo-40 is connected via USB to a Windows PC and is not recognized.	Download and install the required driver file. See Section 2.5.
Which cable I have to use to connect Meteo-40 to my PC?	Use a standards USB-A+B cable, the same cable used to connect printers or other devices. Note that you might require a driver file for Meteo-40 (see above).

16.2 Remote Communication

16.2.1 Modem

Question	Answer
<p>After configuring and connecting the Sierra Wireless FXT009 modem, the connection cannot be established.</p>	<ul style="list-style-type: none"> • Make sure the SIM card is not broken. The SIM card should be inserted properly and the SIM card slot of the modem has to be locked (see Section 7.9.6.1). • 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 <i>Provider helper</i> (see Section 7.9.1), if you are unsure. If your provider is not given in the list, ask your provider for the details, i.e., APN, username and password. We recommend doublechecking the provider details. • 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.
<p>An Internet connection is always established, when I switch on the CECS of Meteo-40. The modem should only be online, when data has to be sent.</p>	<p>Deselect the checkbox <i>Modem online, when CECS is on</i> in the Communication → Modem menu. Thus the modem only establishes an online connection, when an action (e.g., upload data, email data or online availability) is scheduled.</p>
<p>I cannot connect to the data logger via modem?</p>	<ul style="list-style-type: none"> • Make sure the modem is switched on and running to perform the scheduled actions. Did you configure a switch to toggle the modem? If the modem is connected via relay to the data logger, a switch has to be configured in the Communication → Modem menu of the data logger. In Meteo-40 firmware version 1.0 Rev. 13915 and higher S1 is set by default in the modem configuration. It is not sufficient to toggle the switch manually, as it is not saved to the data logger configuration. After rebooting the data logger or after power supply interruptions, the modem will not start again. It remains switched off. See also Section 7.9. • If the modem is configured properly and you do not receive any measurement data, it could be a problem with the modem. Are the frequency bands configured correctly? Refer to Section 7.9.6.1. We also recommend upgrading the data logger firmware regularly as we continuously improve the software. • If you receive measurement data, the signal might be too weak to set up the Internet connection to access the data logger. In this case refer to Section 16.2.2. <hr/> <div style="display: flex; align-items: center;">  <p>Tip We recommend testing the modem functions before installation in the field, i.e., sending emails, uploading files and accessing the web interface via modem connection.</p> </div> <hr/>

Question	Answer
How do I connect a BGAN satellite modem?	<p>BGAN satellite modems are connected via Ethernet cable to Meteo-40. If you are working with Meteo-40 Revision C with RS232 slot, you need an USB Ethernet adapter to connect the modem.</p> <p>In order to supply the satellite modem, a <i>LAN switch</i> has to be assigned in the Communication → LAN menu. Make sure that the checkbox <i>LAN online, whenever CECS is on</i> is not selected. Hence, the modem goes online only when needed. The modem itself has to be configured using the software provided by its manufacturer. For further details refer to Section 7.9.7 and especially to Section 7.9.7.3.</p>

16.2.2 Ammonit Tunnel

Question	Answer
After entering the URL of the tunnel connection, a message is displayed which indicates that the tunnel is not responding.	<ul style="list-style-type: none"> • Your data logger is (currently) not connected to the Internet. The data logger has not been configured to be online for this time. Meteo-40 establishes an Internet connection for the periods configured in the schedule (see Section 7.2). <hr/> <div style="display: flex; align-items: center;">  <p>Tip If you use AmmonitOR to monitor your data logger, you can check, when the data logger is scheduled to be online.</p> </div> <hr/> <ul style="list-style-type: none"> • 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.
The entered URL seems to be wrong.	<p>Make sure that the URL has the form <code>https://Dnnnnnn.tunnel.ammonit.com/</code>, where Dnnnnnn must be replaced with the serial number of the data logger without spaces or hyphens.</p> <p>If a tunnel affix has been entered in the Meteo-40 web interface (Meteo-40 firmware version older than 1.0 Rev. 13645), enter the URL of the data logger without tunnel affix: <code>https://Dnnnn.tunnel.ammonit.com</code> (Dnnnnnn represents the serial number of the data logger). The tunnel affix has to be entered for the tunnel access code. If you lost your tunnel affix or tunnel access code, call the Ammonit support team.</p>

Question	Answer
<p>The data logger is sending / uploading data, but I cannot connect to the data logger via tunnel.</p>	<p>The tunnel connection seems to be not stable enough. The issue can be solved as follows:</p> <ul style="list-style-type: none"> • The GPRS connection might be very weak. Switch to GSM. Ask your provider for the dial-in number (P-to-P). The dial-in <i>Number</i> has to be configured in the Meteo-40 web interface in the Communication → Modem menu. An <i>APN</i> does not have to be entered. See also Section 7.9. • The signal might be very weak. Replace the installed antenna with a <i>Yagi</i> directional antenna. The <i>Yagi</i> antenna can be aligned to a near transmitting station to receive a better signal. For further details see Wikipedia (http://en.wikipedia.org/wiki/Yagi-Uda_antenna). • Instead of using a standard SIM card with dynamic IP address, insert a SIM card with public IP address into the modem. The data logger can be accessed via its public IP address and/or via the domain provided by the tunnel server, if configured. See also Section 7.3. If your data logger is registered in AmmonitOR, you can find its public IP address in the Data Loggers → Connections menu. Go with the mouse pointer on a displayed connection in the <i>graphic view</i> or look up the IP address in the <i>text view</i>.

16.3 Firmware Upgrade

Question	Answer
<p>Do I have to be on site to perform an upgrade?</p>	<p>No, you can start the upgrade via remote access (tunnel connection), e.g., when the data logger is scheduled to be online. Nevertheless we recommend upgrading the data logger in the office to avoid any unexpected difficulties.</p>
<p>My data logger is not connected to the Internet; how can I perform an upgrade?</p>	<p>In order to perform an upgrade, the data logger has to be connected to the Internet. By connecting your smartphone to the data logger, you can set up an Internet connection via the tethering function of the smartphone. Connect your smartphone to your Meteo-40 data logger via USB (USB-A slot of the data logger and micro USB slot of the smartphone). Open the settings for <i>Tethering and portable hotspot</i> of the smartphone operating system (see Figure 4.14). Activate USB tethering. Browse for the IP address of your Meteo-40 data logger using the keys (Communication → Devices → LAN → USB (Activated) → IP settings). Enter the data logger's IP address in your smartphone browser, login and perform the upgrade.</p>
<p>Do I have to install all upgrades?</p>	<p>We recommend installing all available upgrades to benefit from new features and to fix recent problems. Ammonit regularly informs Meteo-40 users about available upgrades by email.</p>
<p>During the download process the connection was interrupted? Do I have to restart the download process?</p>	<p>The downloaded software packages are stored on the data logger. Start the upgrade process again to continue the download and installation process. Once downloaded packages do not have to be downloaded again.</p>
<p>How does the installation process affect the recording of the MARS?</p>	<p>If the MARS is not affected by the upgrade, the recording continues without any interruption. If the MARS will be upgraded, the recording stops for approx. 30s and continues afterwards.</p>

16.4 Data: Transfer and Download

Question	Answer
Which methods are available to transfer data files?	<ul style="list-style-type: none"> • Upload data files via SCP/FTP connection to a server of your choice or the AmmonitOR installation on your server (see Section 7.6). • Upload data files to your AmmonitOR account on the Ammonit server (AmmonitOR project key is required, see Section 7.6). • Sent data files to an email account (see Section 7.5). • Manual download of CSV files via the Meteo-40 web interface. • Manual download of CSV files on pre-configured USB flash drive on site (see Section 4.4.3).
If no Internet connection is available on site, can I download data files?	Yes, you can download the statistics and/or the source data using a pre-configured USB flash drive. Switch on the data logger (CECS) and plug in the prepared USB flash drive. All generated CSV files will automatically be saved on the USB flash drive. See also Section 4.2. You can also connect to the data logger via USB or W-LAN on site and download the CSV files on your PC.
What happens to data files, which could not be sent / uploaded according to the schedule time, e.g., because of connection problems?	Files, which have not been sent according to the scheduled time, will be sent or uploaded at the next scheduled action.
I receive data files with the file type csv.gz? How do I handle these files?	The file is compressed using GNU gzip (See Section 6.6) and has to be decompressed before you can use it. If you work with Microsoft Excel™, open the file as described in Section 6.6.3. If you work with LibreOffice or OpenOffice, use the settings described in Section 6.6.2.
How can I open CSV files generated by Meteo-40 with Microsoft Excel?	In order to open CSV files with Microsoft Excel, the settings have to be adapted. Launch Microsoft Excel and open the <i>Options</i> in menu <i>File</i> . Under <i>Advanced</i> the decimal and thousands separators are defined. Adapt the settings for Meteo-40 CSV files as follows, if necessary. Decimal separator has to be a dot (.); thousands separator has to be a comma (,). If necessary, deselect the function Use system separators. CSV files generated by Meteo-40 data loggers use the comma (,) as field separator, double quote (") for embedding commas in textual strings and UTF-8 as character set. These details have to be considered, when data files are imported. In order to import CSV files, click on <i>From Text</i> on the <i>Data</i> tab and browse for the CSV file. Follow the instructions of the import wizard. For further details refer to Section 6.6.3.
I have an AmmonitOR installation on my own server. How can I upload the data files to it?	Select in the Communication → AmmonitOR menu of your Meteo-40 data logger for <i>AmmonitOR server</i> the value <i>Custom AmmonitOR</i> and below under <i>server</i> the name or IP address of your server.

16.5 Sensor: Configuration and Connection

16.5.1 Sensor Configuration

Question	Answer
<p>The sensor, which I have to install, is not given in the sensor list. How do I configure the sensor?</p>	<p>If the sensor is not given in the list, you can select <i>Other Sensor</i> in the <i>Sensor Helper</i> and configure channels, slope and offset values, measurement rate etc. manually.</p> <p>If the anemometer you want to install is not listed in the <i>Sensor Helper</i>, select <i>Anemometer</i> for the sensor type and <i>Generic Anemometer</i> for the sensor. The other values have to be configured manually.</p> <p>If the analog wind vane you want to install is not listed in the <i>Sensor Helper</i>, select <i>Wind Vane</i> for the sensor type and <i>Generic Analog Wind Vane</i> for the sensor. The other values have to be configured manually.</p> <hr/> <p> Important Only for the sensors listed in the <i>Sensor Helper</i>, Ammonit assures the correct calculation of the statistics!</p> <hr/> <p>If you are unsure how to configure an unlisted sensor, contact the Ammonit support team.</p>
<p>I have a calibrated sensor. Where do I enter the calibration values?</p>	<p>For each configured sensor you can modify the slope and offset values in the <i>Sensor Helper</i>.</p>
<p>My configured pyranometer SPN1 does not display any estimated value?</p>	<p>In order to estimate DNI and sun status, you have to enter the geographic coordinates of the measurement station, i.e., latitude and longitude. Both coordinates are important to get the zenith angle of the sun at the site. Enter latitude and longitude in the System → Administration menu of your Meteo-40 data logger.</p>

16.5.2 Sensor Connection

Question	Answer
<p>Where can I find a plan to connect a sensor?</p>	<ul style="list-style-type: none"> • If you ordered the measurement system including steel cabinet and cables from Ammonit, connection plans can be found in the steel cabinet. Additionally, the sensor connection with Ammonit cables is described in the data sheet, which you received for each sensor bought from Ammonit. • If you ordered only the sensors without cables from Ammonit, refer to the data sheet by the sensor's manufacturer. In Chapter 13 you can find the electrical connection plans for Meteo-40.
<p>I have to install two potentiometric wind vanes, a barometric pressure sensor and a temperature humidity sensor - all connected to analog voltage channels. Which data logger model is suitable?</p>	<p>The Meteo-40M model offers 8 analog voltage channels to connect two potentiometric wind vanes, a barometric pressure sensor and a temperature humidity sensor.</p> <p>If digital wind vanes TMR would be installed, which require only one digital channel each, the Meteo-40S model would be suitable, as well.</p> <hr/> <p> 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.</p> <hr/>

16.6 Measurement

Question	Answer
Sensors are configured and connected, but the measurement is not recorded?	<p>Check the following options:</p> <ul style="list-style-type: none"> • It seems that the power supply during measurement was not sufficient or has stopped. Thus MARS is turned off. Connect Meteo-40 to a reliable power supply to operate MARS on. • In the status box <i>Recording</i> is switched off. Click <i>Switch on</i> in the Meteo-40 web interface. • The configuration has not been saved after the last modification. Save the configuration and click <i>Switch on</i> for recording.
Where can I find the meteorological data in m/s or °C?	<p>The current value of each evaluation is displayed in the Measurement → Evaluation menu in the Meteo-40 web interface. Additionally, you can display live data in the Data → Live menu of the data logger. In the CSV files you can find the evaluated meteorological data according to the settings you made in the Data → Statistics menu. Furthermore, if you work with AmmonitOR, you can monitor the meteorological data in your AmmonitOR project, e.g., in various plots for selectable periods.</p>
Where can I find the original electrical measurement data?	<p>The current electrical value of each channel is displayed in the Measurement → Channels menu of the Meteo-40 web interface. Additionally, you can see the electrical values of all channels in the Data → Source menu. In the source file, which can be downloaded in the Data → Statistics menu of the data logger, you can see all electrical values of all channels for a selected period.</p>

16.7 Errors and Messages

Question	Answer
After saving a configuration or starting an action, an <i>Internal error</i> occurred and is displayed in the web interface?	<p>Internal errors could have various reasons. Not always a serious error occurred, e.g., due to a short connection time out, an operation could have been interrupted. Try the following actions to solve the problem:</p> <ul style="list-style-type: none"> • Go to another page and perform the action again. • Restart the data logger and perform the action again.
The red LED light is turned on. What does it indicate?	<p>It indicates that an error in the measuring operation occurred. For details see System → Logbook in the web interface or System → Errors → Error List in the display menu.</p>

Important



If you should notice any error on your data logger or in the web interface, we kindly ask you to inform us as soon as possible. The Meteo-40 data logger is a very complex system, so unfortunately it can happen that errors occur. In order to avoid any disruption of the data logger operation, we need on your assistance. In case of an error, please note down what have been done on the data logger before the error occurred, which system components are used, e.g., GSM modem or satellite modem, and which system configuration is active.

Release Notes

1.7.6 (2017-07-25)

- New Reflectometer CS650 over SDI-12
- New Wind Direction Potentiometric formula in Evaluation Helper
- Fix delete evaluations from evaluation helper
- Fix compressed files download as Viewer
- Selection of individual files for redundant send/copy possible with 'Mark as not sent'
- Fix invalidate CSV files
- Replace "formula_params" with "params" key in CSV files footer
- Fix data logger name encoding error in SCP
- Allow fine-grained sending of CSV files



Warning

If you already have secondary and/or tertiary CSV files configured, you must explicitly switch on sending to AmmonitOR, by email, or to a file server now!

- Additional RS485 master speed: 1200 bps
- Sign all data by default
- Support signing and encryption of log and config files for server copy and USB flash drive copy
- The comma (",") is not allowed in the data logger name anymore
- Fix ZephIR evaluations for more than one height
- Effectively turn USB modem switch off, even if no USB modem is connected
- Set switch state over display is per default available
- Manufacturer administration can be manually started over UI
- Newly produced data loggers have individual UI certificates

1.7.4, 1.7.5 (2017-06-12)

- Fix possible LCD freeze after reboot

1.7.3 (2017-06-09)

- Fix LCD backlight switching

1.7.2 (2017-06-07)

- Fix data logger name encoding error in snapshots and test email
- New ZephIR Live data
- New Gill Wind Master M3
- Fix evaluation type for Gantner modules

1.7.1 (2017-05-15)

- Fix active channels when adding evaluation with evaluation helper

1.7 (2017-05-12)

- Support secondary and tertiary CSV statistics files
- New data types with 8-bit exponent selectable for modbus sensors
- New Atonometrics RDE300
- Evaluation type and unit can be configured for all sensors of type 'Other Sensor'
- Enhanced performance for SCADA stored data request
- Fix evaluations using GPS location
- Provide default WLAN passphrase for newly produced data loggers
- Fix wrong time-stamp in CSV files if summary statistic configured
- New formulas in Evaluation Helper
- Fix live data evaluation for Thies Clima sensor
- New Gill Wind Master 3D Ultrasonic XYZ coordinates
- Support period measurement on counter channels C5, C6, C11, and C12 for newly produced Meteo-40, available as P1, P2, P3, and P4
- Fix switches state shown in display

1.6.3 (2017-02-28)

- Fix ultrasonic sensors wind speed linear formula



Warning

In case you are using ultrasonic sensors and version 1.6.2, you must delete and regenerate all files generated with this version!

- Fix SCADA stored data request

1.6.2 (2017-02-14)

- Allow deletion of multiple selected statistics files
- Fix a problem with source data memory overuse if a switch is associated to a sensor
- Fix missing latitude and longitude in CSV and admin page when using GPS
- Add date and time of last GPS fix in CSV statistics file as `gps_fix`
- Use function code 4 for Iskra MT540 input registers
- Fix SCADA Modbus write to holding registers selection
- Switch manager supports inverted logic
- Increased robustness for RS485 Thies communication
- RS485 serial console representation enhancements
- New Thies 3D Ultrasonic XYZ coordinates

1.6.1 (2016-12-20)

- New RS485 Master serial console
- New RS485 sensor SMP10 pyranometer
- Record status byte for Thies Ultrasonic 2D and 3D

- Fixed send statistics CSV per email if Gust data active
- Include SCADA status in Information site
- New set one switch over SCADA using Modbus write single coil
- Fixed set switches OFF over SCADA
- Fixed request stored data over SCADA
- Fixed sending of snapshot data to AmmonitOR, broken in 1.6
- Fixed unexpected tunnel connection if SMS active
- Fix tunnel connection fails on action execution if another action running
- New solar zenith angle in evaluation helper
- Allow Mosbus RTU broadcast address '0' for sensors
- Slope for ultrasonic sensors wind direction available
- Fix SiS-13TC-T sensor irradiance not available
- Default connection (Ethernet/Modem) is shown in capital letters (uppercase)
- Add support for Met One 014mini anemometer

1.6 (2016-11-14)

- Optionally create gust data files
- Include internal voltage and temperature in Switch Manager lists
- Add data snapshot to email and server copy
- Add slope and offset for 3D ultrasonic sensors vertical wind speed
- Update provider helper with current mobile providers and APNs
- Fix custom evaluations: allow any input evaluation and not only evaluations of type "other"
- Data logger is prepared for later upgrades via USB flash memory
- Fix easy cleanup for SCADA registers tables
- Increase backlight time for Meteo-40 Revision D from 5 s to 15 s, and allow Admin to deactivate display backlight
- Custom evaluations are ordered in CSV between regular evaluations and channels
- Optionally copy camera image to a USB flash drive when sending
- Allow Admin and User to view and download data logger files on USB flash drive
- Use hPa instead of mbar for newly configured pressure sensors
- Fix SCADA stored data request timestamp: use unix time and not logger local time
- New summary statistics available over SCADA
- New set switches state over SCADA
- Allow users starting actions via display (requires setting the permission first)
- New covariance evaluation
- New generic thermo-hygro 5V -20..80°C / 10V
- Maximum and minimum statistics available for internal temperature
- Statistics for internal channels can be selected
- New sensor MESA WSWD Sonic
- Add source data download of complete week
- Add function to invalidate all statistics CSV files, that have been sent before
- Write in SCADA server holding registers optimized
- When setting time, check whether files from later dates exist
- Fix close tunnel connection if CECS always on

1.5.10 (2016-08-01)

- Fix a harmless, but annoying error message when saving the configuration
- User interface: fix related to config file download
- User interface: minor performance improvement
- Force Encryption now also blocks changes on Email and SCADA, and limits live data to about 2 minutes
- New evaluations: Sensible Heat Flux, Turbulence Intensity, Obukkhov stability parameter and Inflow angle

1.5.9 (2016-07-06)

- Add function to easily regenerate possibly inconsistent CSV files
- Make action handling more reliable.
- Solve problem with switch "Prevent implicit tunnel activation (only recommended for satellite communication)". The tunnel connection was not disabled after "Action online"
- Fix wrong date/time stamps in CSV, in cases when first channel had invalid data
- Add option to reduce online traffic when logged in, e.g. for satellite connections
- SCADA server write in Modbus store is now an atomic operation
- New generic Hygro/Thermo sensor -20..80°C
- New Silicon Irradiance Sensor SiS-13TC-T
- Fix SCADA modbus acknowledge writing holding registers
- Fix SCADA interval for stored data request
- Pyranometer Li-Cor LI-200SZ must be connected to analogue channel
- Fix a problem with signatures for newly produced Meteo-40
- Enhanced EKO Sun Tracker date, time and location synchronization
- Logbook more verbose, i.e. messages about CECS status and actions
- Minor UI improvements, e.g. faster web service and data logger icon
- Fix a problem with CECS mode not possible to change from LC display
- Fix a problem with time setting occasionally not working
- Fix CMP10 solar sensor

1.5.8 (2016-04-14)

- UI: show CECS and MARS uptime
- Fix false handling of missing digital (TMR) wind vane data



Warning

In case you have wrong CSV files, generated from version 1.5 to 1.5.7, you have to remove them and regenerate!

- Rename *Heating Manager* to *Switch Manager*
- Add switch management by means of wind speed for solar power plants
- Fix precipitation scale factor for Meteo-32 Streaming livedata
- Fix change switch state with switch manager
- Add easy cleanup for SCADA registers tables
- Fix Obukov-length CSV header for AmmonitOR
- Fix source data download
- Fix Silicon irradiance sensor default slope

1.5.7 (2016-03-07)

- Fix automatic CECS reboot method

1.5.6 (2016-02-24)

- Add evaluated data to source data view in web interface and to USB flash copy
- Add evaluation type and unit to linear equation
- Fix ZephIR 300 endianness and statistics
- Provide access to stored data over SCADA
- Fix ultrasonic wind speed scale factor for Meteo-32 Streaming livedata

**Warning**

In case you are using Meteo-32 Streaming to read wind speed values from ultrasonic sensors, you might need to correct the scale factor at the SCADA master!

- Fix generation of partial CSV files
- Minor bug fixes in CSV files generation
- Fix action 'Only generate CSV'
- Use '---' for invalid value in CSV

1.5.5 (2016-01-14)

- Fix statistics when using different measurement rates for counters and digitals
- Fix generic windvane evaluation

1.5.4 (2016-01-13)

- Fix statistics when using different measurement rates are used
-

**Warning**

In case you have wrong CSV files, generated from version 1.5 to 1.5.3, you have to remove them and re-generate!

- Fix data snapshots to AmmonitOR
- Add hint for BGAN users on LAN page
- Add PT100 variant of Galltec Thermo-Hygro Passive CP
- More flexible ways of copying files to USB flash drive by date
- New ZephIR certified averaged data
- Fix CSV File generation with Thies Clima Sensor US

1.5.3 (2015-12-07)

- Fix problem with action colliding with midnight reboot
- Remove standard cabinets from user interface

1.5.2 (2015-12-03)

- New Apogee pyranometer PYR-PA, PYR-SA
 - Fix RS485 polling rate for Thies Laser Precipitation Monitor
 - Add self test for digital clock output
 - More flexible automatic CECS reboot function
-

**Note**

If you use SCADA or are using Meteo-40 in 24/7 mode, check the setting *Automatic CECS reboot* option on the administration page after upgrade!

1.5.1 (2015-11-26)

- Fix a precision error in release 1.5 for digital wind vanes

1.5 (2015-11-25)

- Add support for sensors:
 - EKO Sun Tracker
 - CMP 10 Pyranometer
 - Inclinometer 2-axis SCA121 Level Developments
 - Vento anemometer
 - Galltec Thermo-Hygro with two 4..20 mA
 - ISET Solar Radiation Sensor
 - Generic Thermo/Hygro sensors with voltage outputs
 - Pyranometer Li-Cor LI-200SZ
- New status evaluation in Evaluations Helper
- New direction at maximum speed evaluation in Evaluations Helper
- Fix active power and obukhov length in evaluation in Evaluations Helper
- Fix application of positive and negative slope and offset to Young Propeller Anemometer



Note

If you have different slope values for upwind and downwind, it is necessary to regenerate the CSV files! The slope for downwind will be automatically set to a negative value by the data logger.

- Support for SMTPS in addition to STARTTLS for more Email security options
- Device Identification available over SCADA
- Set date and time over SCADA Modbus communication
- CSV stability improvements
- Support tilt angle and cardinal direction for SPN-1
- Improve evaluation view and start messages in LC display
- Fix a communication issue, when no AmmonitOR project key is set
- Improve GPS reliability
- Future upgrades will use HTTPS instead of HTTP, enhancing security
- Fix configuring digital channel to power on CECS

1.4.3 (2015-08-18)

- Fixed a CSV generation error

1.4.2 (2015-08-04)

- Digital signatures refer to uncompressed CSV as canonical, not the compressed files - this might influence your work flow
- Fixed a problem with delayed GPS time
- GPS location no longer changes configuration
- Support for Temperature Sensors 4..20mA, -30..70°C and -40..60°C

1.4.1 (2015-07-23)

- Fix for download of encrypted data in web interface

1.4 (2015-07-16)

- Data encryption supported for USB flash drive copy and download
- Support for CSPA RSI sensor
- New linear equation, active power and wind direction formulas in Evaluation Helper
- Heating manager control by means of voltage measurement allowed
- Configurable word endianness for RS485 Modbus Sensors
- Include solar radiation summary in CSV files
- User interface change: New device page with display and USB flash drive settings
- User interface change: Encryption and signature now under Administration
- Add a Force Encryption option
- Connection check in web interface and via LC display
- Fix CSV generation with numerous RS485 errors
- Fix Young Wind Monitor missing wind direction evaluation

1.3.4 (2015-05-11)

- New HMP155 active and passive sensors
- Fix tunnel connectivity, when reconfiguring
- Reduce SCADA Modbus server response time to 40 ms
- Old CSV files get removed on CECS reboot when not enough memory left

1.3.3 (2015-03-31)

- Allow custom clipping for humidity sensors
- Fixed a problem with encryption when private key is not available
- Fixed a problem with sending pictures via FTP
- Enhanced RS485 sensors support
- Fixed a problem with preventing sending of CSV files to AmmonitOR or file server
- Removed unused tilt angle from sensor helper
- Fixed UI air density configuration
- Fixed a SCADA performance issue

1.3.2 (2015-02-16)

- Fixed a problem with deleting source data memory

1.3.1 (2015-02-06)

- Fixed a problem with display showing "Please wait" for a long time
- Fixed a problem with Thies Precipitation Monitor

1.3 (2015-02-04)

- Fixed a CSV generation error in cases where measurement has been stopped for a day by the user
- Data snapshot and camera image can be sent to AmmonitOR now, data snapshot is still experimental
- UI: show modem quality bar in LC display and web UI
- UI: warn about missing WLAN passphrase

-
- UI: don't show Gantner modules as unknown in LC display
 - Add Thies Precipitation Monitor
 - Obukhov length possible with 3D ultrasonics
 - Enhance memory security esp. for SCADA
 - Thies Clima Sensor uses wind direction offset for brightness direction
 - Fixed a problem with SCP sending when data logger name contained non-ASCII characters

1.2.4 (2014-11-12)

- Added support for Thies Clima Sensor US
- Fix wind speed evaluation for Lufft WS

1.2.3 (2014-11-05)

- Enhance memory security

1.2.2 (2014-10-20)

- Fixed a problem with the SCADA function: In some cases the values were not readable
- Fixed a problem with the camera function for data logger with non-ASCII characters in their name
- Fixed a problem with the display of values for some RS485 modules

1.2.1 (2014-09-22)

- Counter measurement fix: When the clock is set, e.g. by NTP or GPS, under some conditions, the counter value can be wrong. This affected mainly the maximal values
- Minor UI fixes

1.2 (2014-09-08)

- Modem PHS8 is supported
- Experimental support for SMS
- Complete configuration can be sent to AmmonitOR or via email or FTP/SCP



Note

If you don't want to have the configuration file sent to AmmonitOR or via email or FTP/SCP, you have to switch this off in the respective menu.

- New scale factor and data type selection for SCADA measurement values
- New Unix Time available over SCADA
- Easier connection between PC and data logger using link-local connection
- Fixed a problem with CSV generation
- Fixed providing sum statistic over SCADA

1.1 (2014-08-14)

- Digital signature available for newly produced data loggers. Contact Ammonit, if this feature is required on a previously purchased device
- The heating manager can make use of an optional voltage as additional heating condition, while the humidity has been made optional
- The USB flash drive function is activated with a default password for newly produced data loggers
- Factory reset and source data deletion is logged in the logbook
- Setting of date/time by GPS, NTP, or manually is logged into logbook
- Setting the date via GPS is supported, updating the altitude by GPS is not done anymore
- An error in the counters calculation for periods $\neq 1$ s has been fixed
- Minor user interface changes
- Fixed a problem sending images via e-mail
- Use new algorithm for wind direction maximum and minimum
- Show DHCP state also for Tethering connection
- New Thies Laser Precipitation Sensor
- Memory sizes are indicated in MiB
- Error condition recognition for Gill Wind Master

1.0.1 (2014-06-10)

- Enhanced Modbus RTU SCADA server performance
- New page for AmmonitOR related configuration
- Allow sending data to both AmmonitOR and an FTP/SCP server
- New density of moist air evaluation
- Fix CSV generation with temperature differential evaluations
- Correction for Galltec Thermo-Hygro Passive CP
- Allow date limit for file transfer (start date) and reset of send status
- Improved check when sending test email
- Add experimental support for email encryption
- Fix NMEA RS485 telegram parser
- Enhance modem communication in respect to disconnection
- Enhance clock accuracy
- Enhance memory protection
- Fix Young Monitor and Tech Sun channel order
- Fix erroneous recursive CSV file generation

1.0 Rev. 14683 (2013-12-19)

- Support for temperature difference evaluation
- More WLAN chips are supported: Atheros AR9271, Ralink rt2800, Ralink rt73
- Enhanced UI for accessing source data
- Minor error corrections, e.g.
 - in respect to USB flash drive,
 - solar evaluations in the LC display,
 - use of non-ASCII characters in email password and data logger name
 - correction of WAV252 and MT32
 - optimization of SCADA streaming mode

1.0 Rev. 14324 (2013-11-08)



Note

There are some minor, but incompatible changes in this software version. Please check carefully, if one of the changes might affect you.

- New sensors: FarData wind vane, Teknam Thermo-Hygro, Teknam barometric pressure sensor
- Enhanced special mode for Meteo-32 wind vane compatibility: No dedicated configuration of Meteo-32 sensors necessary; standard configuration and connection according to manual
- Milliseconds in date/time field of statistics file (.csv) removed; importing software might be configured, if necessary
- Switching of CECS status via status input signal, see Administration.
- Format of the `keyfile.txt` changed to INI file format; copying of source data to logbook possible
- Minor user interface changes
- Speed up and improved robustness of source data download
- Speed up some solar evaluations
- Enhanced RS485-Sensors error recognition and response
- Configurable slope and offset for RS485 ultrasonics horizontal wind speed
- Fix RS485-Sensors count statistic when more than one sensor connected

1.0 Rev. 13947 (2013-09-23)

- New sensors: Tech-Sen thermo-hygro, Tech-Sen barometric pressure sensor
- Correction for status evaluation
- Minor user interface changes

1.0 Rev. 13863 (2013-09-12)

- New sensors: Setra barometric pressure sensor Model 276 and 278; compatibility for first and second Meteo-32 wind vane
- Optimized tunnel traffic
- USB connection displayed in status box; data logger name shown in upper right corner

1.0 Rev. 13749 (2013-09-04)

- New sensors: Pyranometer SP Lite 2, Gantner e.bloxx A1
- Re-enabled reboot at midnight, with exception for SCADA-enabled data loggers
- Enhanced flash memory detection

1.0 Rev. 13645 (2013-08-23)

- New sensors: Hygro-thermo Galltec KPC MS, passive hygro-thermo Galltec CP, Gantner e.bloxx A3-1 and d.bloxx D1-1, wind vane Vaisala WAV252, Thies precipitation intensity
- Support of virtual temperature for Gill wind observer 2D
- Better presentation of switches states in live data
- Better estimation of sun status for SPN1
- User interface enhancements for SCADA
- Logbook for registering events
- POP-before-SMTP/SMTP-after-POP supported by email function

- Better support for USB flash drives
- Replacement of tunnel affix by tunnel access code
- Download multiple CSV file as ZIP archive
- Solved wrong statistics selection (scalar/vector)

1.0 Rev. 13187 (2013-07-01)

- Communication enhancements, esp. for satellite modems
- Increased memory protection
- Support for Sineax Cam Power Meter, e.g. for PCM
- Heating manager problem on configuring boundaries corrected
- Enhancements in web interface: Statistics calendar
- Optional time synchronization via GPS

1.0 Rev. 12696 (2013-05-16)

- Heating manager: Temperature and humidity configurable
- Support for ISKRA Power Meter, e.g. for PCM
- Wind direction offset for ultrasonic sensors added
- Timing enhancement for RS485 sensors
- Additional route for LAN possible, e.g. for SCADA
- Solved sporadic connection failure with modem
- Possible wrong timezone corrected, when setting the time manually
- Enhancements in web interface for smart phones and small devices

1.0 Rev. 12454 (2013-04-24)

- Timeout problem for serial (RS485) SCADA connections corrected

1.0 Rev. 11982 (2013-01-22)

- Set default display contrast
- Error for Lufft RS485 sensor corrected
- Automatic reboot at midnight removed
- RS485 serial settings allowed
- Further performance enhancements for SCADA

1.0 Rev. 11900 (2012-12-19)

- Possible source data corruption problem after second overrun (e.g. after two years) corrected; upgrade must happen before second overrun
- Implementation of new "generic" ModBus RTU sensor
- Supported temperature measurement using Pt1000 or Pt100 for data loggers with built-in Ethernet interface
- Evaluating of virtual temperature for Gill Windmaster Pro 3D, if configured like Thies ultrasonics 2D/3D
- Minor user interface corrections

1.0 Rev. 11669 (2012-11-19)

- Documentation of heating manager
- Performance enhancements for SCADA
- Support of data logger with built-in Ethernet interface

1.0 Rev. 11587 (2012-11-05)

- New feature: Simple heating manager
- Corrected data actualization problem in SCADA
- Internet Explorer 8™ and Chrome™ supported

1.0 Rev. 11317 (2012-10-08)

- Parallel working of SCADA and modem possible
- UI with virtual display keys
- Enhanced factory reset

1.0 Rev. 11236 (2012-09-21)

- Email sending problem corrected
- GPS enhancements
- Changes in network shown live in display

1.0 Rev. 11181 (2012-09-11)

- CSV files with round time slices
- Serial modems work, even if not permanently on
- Measurement frequency 1/8s removed
- Problem with displaying negative power for pyranometers corrected
- Emergency password reset method available by means of Ammonit support for new data loggers
- Configuration of longitude, latitude, and altitude, support of KML (e.g. Google Earth™)
- USB GPS devices supported
- Enhanced user manual

1.0 Rev. 11031 (2012-08-27)

- Min and max for wind direction available
- Error when saving sensors corrected
- Measurement interruption when upgrading corrected
- Measurement range for NRG hygro/thermo sensor corrected
- Order of hygro/thermo for Galltec sensor corrected
- Corrected error for ICP-CON wind vane module
- Enhanced user manual
- Detection of under-voltage situation (brown-out) implemented
- Configuration of CSD3 optionally with only one voltage channel
- Thies wind vane classic with one analog channel supported
- SCADA endianness configurable
- Overall stability enhancements

1.0 Rev. 10769 (2012-07-25)

- More robust CSV creation
- Gill Windmaster supported
- Power meter GD2000 supported
- Virtual temperature Thies ultrasonics 2D/3D evaluated
- Turkish language in user interface supported
- User interface problem with Internet Explorer™ corrected

1.0 Rev. 10627 (2012-07-12)

- Average values for SCADA supported
- Gill Wind Obversver is supported
- PINs and passwords not visible in the downloaded configuration anymore
- Problems with uploading older configuration files solved
- CECS mode is saved in the configuration file
- New functions to remove all statistics files, all sensors, and for factory reset
- Switches in the display shown
- Minor changes for upgrade function

1.0 Rev. 10474 (2012-06-29)

- Fixing of an potential data corruption error introduced with the last version

1.0 Rev. 10244 (2012-06-15)

- Problem with switching of the CECS corrected
- Enhanced solar sensors
- AmmonitOR connection log supplied with data logger time and time zone
- Documentation corrections

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Chapter 17

Glossary

APN

Access Point Name

CDMA

Code Division Multiple Access

CECS

Configuration, Evaluation, and Communication System

CPV

Concentrated Photovoltaics

CSP

Concentrated Solar Power

CSV

Comma Separated Values

DHCP

Dynamic Host Configuration Protocol

DHI

Diffuse Horizontal Irradiation

DNI

Direct Normal Irradiation

DNS

Domain Name System

FTP

File Transfer Protocol

GHI

Global Horizontal Irradiation

GIS

Geographic Information System

GNU

GNU's Not Unix

GnuPG

GNU Privacy Guard

GPL

General Public License

GPRS

General Packet Radio Service

GPS	Global Positioning System
GSM	Global System for Mobile communications
GTI	Global Tilted Irradiation
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
LED	Light-emitting diode
LGPL	Lesser General Public License
MARS	Measurement And Recording System
NTP	Network Time Protocol
OVP	Overvoltage Protection
PIN	Personal Identification Number
POT	Potentiometer - Measurement principle, e.g., Wind vane POT
PPP	Point-to-point protocol
PUK	PIN Unlock Key (or Personal Unblocking Code, PUC)
PV	Photovoltaic
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
SMSC	Short Message Service Center

SSH

Secure Shell

SSL

Secure Sockets Layer

TCP/IP

Transmission Control Protocol/Internet Protocol

TLS

Transport Layer Security

TMR

Tunnel Magneto Resistance - Measurement principle, e.g. Wind vane TMR

UMTS

Universal Mobile Telecommunications System

USB

Universal Serial Bus

W-LAN

Wireless Local Area Network

WMO

World Meteorological Organization

Chapter 18

Index

A

Access Point Name, 109
Access Rights, 29, 133
 Admin, 29
 Guest, 29
 User, 29
 Viewer, 29
Accessing Meteo-40
 Ethernet, 9, 15
 LAN, 9, 13
 USB, 9, 20
Admin, 29
AES, 197
Air density evaluation, 62
Ammonit Tunnel Server, 87
AmmonitOR, 83, 87, 91
Analog Current, 168
Analog Voltage, 165
Anemometers, 55, 144
APN, 109

B

Barometric Pressure Sensors, 153
BGAN, 118, 119
Bonjour Print Services, 12

C

Camera, 49
Cascading, 129
CECS, 4, 6, 35, 121, 135
Change Passwords, 35
Channels, 60
 Analog Current, 135, 168
 Analog Voltage, 135
 Counter, 135, 166
 Digital, 135, 166
 Period Measurement, 166
 RS485, 169
 Status, 135, 166
Communication
 Ethernet, 9, 15, 138
 LAN, 9, 13, 83, 138
 Modem, 83, 109, 138
 Satellite Modem, 83, 109, 118
 Recommended Settings, 119
 USB, 9, 20, 83, 138
 W-LAN, 83, 108, 138

Communication Configuration, 85
Communication Methods, 7
Communication Schedule, 85
Configuration
 Access Point Name, 112
 Email Parameters, 93
 LAN, 106
 Modem, 109
 Online Access, 87
 W-LAN, 108
Configuration File, 33
 Download, 33
 Format, 33
 Upload, 33
Configuration Status, 30
Connection Plans, 179
Connection Status, 30
Cookie, 15, 22
Counter Channels, 166
Cryptographic Software, 197
CSV File, 65, 71, 75, 76

D

Data Evaluation, 60, 65
Data Logger Name, 35
Data Retrieval
 LAN, 7
 Modbus RTU, 7
 Modbus TPC/IP, 7
 Modem, 7
 USB, 7
 W-LAN, 7
Data Storage, 6
Data Transmission, 83
Debian, 28
Delete Measurement Data, 35, 41
DHCP, 9, 13, 15, 106
Differential temperature evaluation, 62
Digital Channels, 166
Digital Wind Vanes, 146, 148
Display, 45, 133
Driver, 20
 Update, 23
Dynamic IP Address, 87, 106, 109, 112

E

Electrical Characteristics, 172

- Email, 83, 93
- Email Attachments, 93
- Encryption, 197
 - Force Encryption, 39
- Error List, 134
- Ethernet, 138
- Evaluation, 60

- F**
- Factory Reset, 35, 41
- FAQ, 201
- File Interval, 65, 67
- File Upload, 83
 - FTP, 105
 - SCP, 105
- FileZilla
 - FTP server, 106
- FTP, 83, 105
 - active mode, 105
 - passive mode, 105
- FXT009, 115

- G**
- Generic Modbus RTU sensors, 161
- Generic Sensors
 - Modbus RTU, 161
- Gill Ultrasonic Sensors, 151
- Global Control Elements, 30
- GnuPG, 197
- GPS, 35
- Guest, 29
- Gust Data, 70

- H**
- HTTPS, 197
- Humidity Sensors, 151

- I**
- IEEE 754, 126
- Import CSV Files, 75, 76
- Inflow angle evaluation, 64
- INI File, 33
- Ini File, 71
- Input Channels, 2
- Internet Explorer, ii
- IP Address, 106, 138

- J**
- JavaScript, 15

- L**
- LAN, 7, 13, 83, 106, 138
- Laser Precipitation Monitors, 160
- LED Lights, 134
- LibreOffice Calc, 75
- Linear equation, 61
- link-local, 15
- Linux, ii, 4, 28
- Live Data, 65
- Location, 35
- Logbook, 53
- Login, 29

- Lufft Ultrasonic Sensors, 150

- M**
- Maintenance, 199
- MARS, 4
- Measurement Values, 60
- Memory, 2, 134
- Menu
 - Display, 134
 - Web Interface, 32
- Meteo-32 Stream Map, 130
- Microsoft Excel 2010, 76, 81
- Modbus, 124
- Modbus Register Map, 124
- Modbus RTU, 7, 121
- Modbus TCP/IP, 7, 121
- Modem, 7, 83, 109, 135, 138, 179
 - FXT009, 115
- Mozilla Firefox, ii, 13, 22

- N**
- NTP Server, 35

- O**
- Obukhov length evaluation, 63
- Obukhov stability parameter evaluation, 63
- Online Period, 87
- OpenOffice Calc, 75
- OpenSSL, 197
- Output Channels, 2
- Overvoltage Protection, 199

- P**
- Period Measurement, 166
- Photos, 93
- Point-to-Point Ethernet Connection, 15
- POP Server, 93
- Potentiometric Wind Vanes, 147
- Power Meters
 - RS485 Sensors, 163
- Power Supply, 2
- Precipitation Sensors, 159
- Provider Helper, 112
- Pyranometers, 55, 154

- R**
- Rain Gauge, 159
- Recording, 30, 135
- Register Map, 121
- Release Notes, 209
- Restart Data Logger, 41
- RNDIS USB Driver, 20
- Rotating Shadowband Irradiometer, 159
- RS485, 169
 - Wind Vanes, 148
- RS485 Master Serial Console, 58
- RS485 S, 121
- RSA, 197

- S**
- SCADA, 6, 7, 121
 - Configuration, 121

- Meteo-32 Stream Map, 130
- SCP, 83, 105, 197
- Security
 - Force Encryption, 39
- Sensible heat flux evaluation, 64
- Sensitivity, 154
- Sensor Configuration, 55
- Sensor Helper, 55, 57
- Sensor Settings, 57, 58
- Sensors, 55
 - Anemometers, 55, 144
 - Barometric Pressure Sensors, 153
 - Humidity Sensors, 151
 - Laser Precipitation Monitors, 160
 - Modbus RTU Sensors, 161
 - Precipitation Sensors, 159
 - Pyranometers, 154, 155
 - Rotating Shadowband Irradiometer, 159
 - RS485 Sensors, 163
 - Soiling Measurement, 158
 - Solar Trackers, 157
 - Temperature Sensors, 151
 - Ultrasonic Sensors, 149–151
 - Wind Vanes, 55, 146, 147
 - ZephIR 300, 164
- SHA, 197
- Sierra Wireless, 115
- SIM Card, 87, 115
- Sineax CAM Measuring Unit, 163
- SMTP Server, 93
- Soiling Measurement, 158
- Solar Trackers, 157
- Source Data, 81
- SSH, 197
- Static IP Address, 87, 106, 107, 109, 114
- Statistics, 65
 - Configuration, 65
- Statistics Interval, 65, 67
- Status (Channel), 166
- Status Box, 30, 135
- Storage Size, 2, 134
- Stream Map, 129
- Subdomain, 87
- Switch, 51
 - Configuration, 51
 - Switch Manager, 51
- Switch Manager, 51
- System
 - CECS, 4, 121
 - MARS, 4
- System Administration, 35
- System Information, 33

T

- Technical Data, 171
- Temperature Humidity Sensors, 151
- Temperature Sensors, 151
- Tethering, 7
- Thies Ultrasonic Sensors, 150
- Tunnel, 83
- Tunnel Server, 87

U

- Ubuntu, 28
- Ultrasonics, 169
 - Gill Sensors, 151
 - Lufft Sensors, 150
 - Thies Sensors, 150
- Upgrade Data Logger Software, 41
- USB, 7, 20, 83, 138
- USB Flash Drive, 46
- User, 29
- User Interface, 6

V

- Viewer, 29

W

- W-LAN, 7, 83, 108, 138
- Web Interface Menu, 32
- Webcam, 49
- WiFi, 108
- Wind Vanes, 55, 146, 147
 - Digital, 146, 148
 - Potentiometer, 147
 - RS485, 148
 - TMR, 146
- Windows, ii, 12, 15, 20

Z

- ZephIR 300, 164