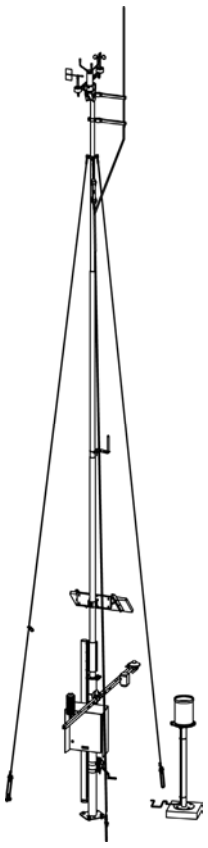
VAISALA

USER'S GUIDE

Vaisala Automatic Weather Station AWS330



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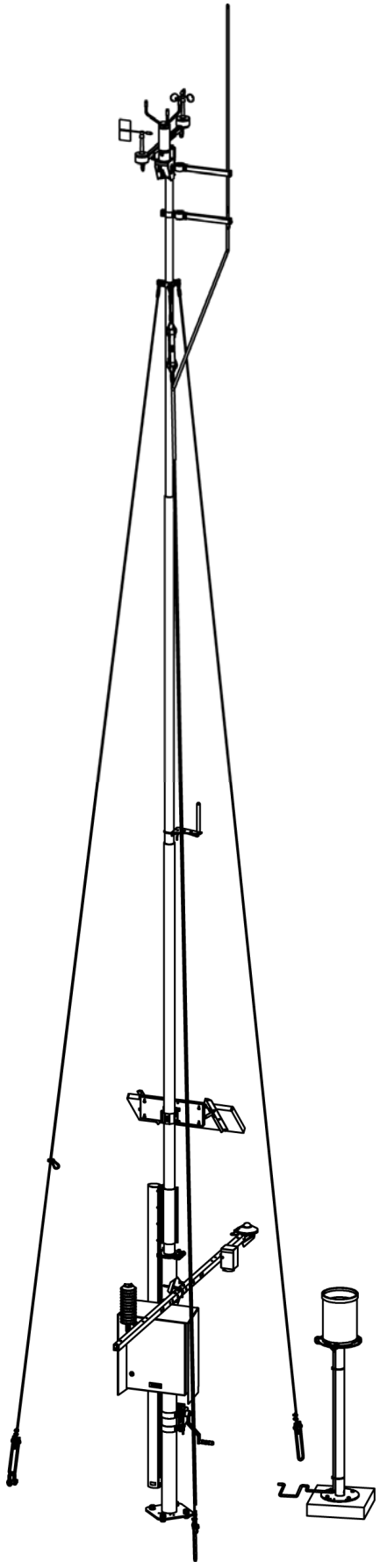

Table of Contents

CHAPTER 4

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and AWS330.

About This Manual

NOTE	Your weather station delivery may include separate instructions for the individual sensors. For your convenience, refer to **this manual** for all information on AWS330.

This manual provides information for installing, operating, and maintaining Vaisala Automatic Weather Station AWS330.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and AWS330.
- Chapter 2, Product Overview, introduces the features, advantages, and the product nomenclature.
- Chapter 3, Functional Description, describes the operating principles of AWS330.
- Chapter 4, Installation, provides you with information that is intended to help you install AWS330.
- Chapter 5, Software Configuration and Operation, contains information on operating AWS Client software and introduces optional Local Display QMD202.
- Chapter 6, Maintenance, provides information that is needed in the basic maintenance of AWS330.
- Chapter 7, Troubleshooting, describes common problems, their probable causes and remedies, and provides contact information for technical support.
- Chapter 8, Technical Data, provides the technical data of AWS330.

- Appendix A, Wiring Diagrams
- Appendix B, Calculation Formulas
- Appendix C, Example Messages
- Appendix D, Sensor Status Values

Version Information

Table 1 Manual Revisions

Manual Code	Description
M211296EN-A	First version of this manual.

Related Manuals

The related manuals are contained on your installation CD. It is recommended that you refer to this User's Guide as your primary source of information on AWS330.

Documentation Conventions

Throughout the manual, important safety considerations are highlighted as follows:

WARNING	Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION	Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE	Note highlights important information on using the product.

Product-Related Safety Precautions

The Vaisala Automatic Weather Station AWS330 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING All electrical installations must be carried by licensed experts as governed by local and state authorities, legislation, and regulations.

WARNING Failure to provide proper grounding may result in personnel injury or death from electrical shock and may severely damage equipment.

WARNING Lightning protection is required to prevent personnel injury and equipment damage due to direct lightning strikes and lightning-induced current surges.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. It is possible to damage the product, however, by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench.
- When an ESD workbench is not available, ground yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either of the above precautions, touch a conductive part of the equipment chassis with your other hand before touching ESD sensitive components.
- Always hold component boards by the edges and avoid touching the component contacts.

Recycling

Recycle all applicable material.

Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

Regulatory Compliances

The Vaisala Automatic Weather Station AWS330 complies with the following EU directives:

- Low Voltage Directive (2006/95/EC)
- EMC-Directive (2004/108/EC)

CE N17728

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Warranty

For certain products Vaisala normally gives a limited one-year warranty. Visit our Internet pages for more information and our standard warranty terms and conditions: www.vaisala.com/services/warranty.html.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature.

Introduction to AWS330

Vaisala Automatic Weather Station AWS330 is a WMO-compliant, standard weather station with a set selection of sensors. It highlights the experience of Vaisala as automatic weather station designer and manufacturer by combining the high-quality, field-proven reliability of Vaisala automatic weather stations with ease of use and durable design.

Automatic weather stations automatically measure, process and store meteorological data for demanding professional use, from meteorological and scientific research to synoptic observations. All measurements and calculations follow WMO guidelines. While operating as standalone units, compatible Vaisala weather stations can also be connected to form observation networks.

Vaisala Automatic Weather Station AWS330 requires only a minimal amount of maintenance and can be depended on to perform effectively in all weather conditions and climates. The modular design of the station allows easy integration of additional sensors even after the initial purchase and permits quick replacement of individual components, reducing downtime and overall operating cost.

By using the optional Observation Display software, data can be saved onto a PC and presented in visual format.

Vaisala offers a variety of services related to AWS330, including site survey, installation, high-quality sensor calibration (including ISO/IEC 17025-accredited) calibration, and extended warranty. Contact Vaisala for more details and an up-to-date listing of the current offering; see section Vaisala Service Centers on page 234.

Figure 1 on page 17 presents Vaisala Automatic Weather Station AWS330.

The following numbers refer to Figure 1 on page 17:

1 = Ultrasonic Wind Sensor WMT703
2 = Mechanical Wind Sensor Set WA15
3 = Lightning rod
4 = Guy wire
5 = GSM/GPRS antenna
6 = Mast
7 = Air Temperature and Relative Humidity Probe HMP155 and Radiation Shield DTR503A
8 = Solar Panel SOLAR33
9 = Enclosure
10 = Sensor support
11 = Snow Depth Sensor IRU-9429
12 = Pyranometer CMP6
13 = Rain gauge RG13(H)
14 = Winch

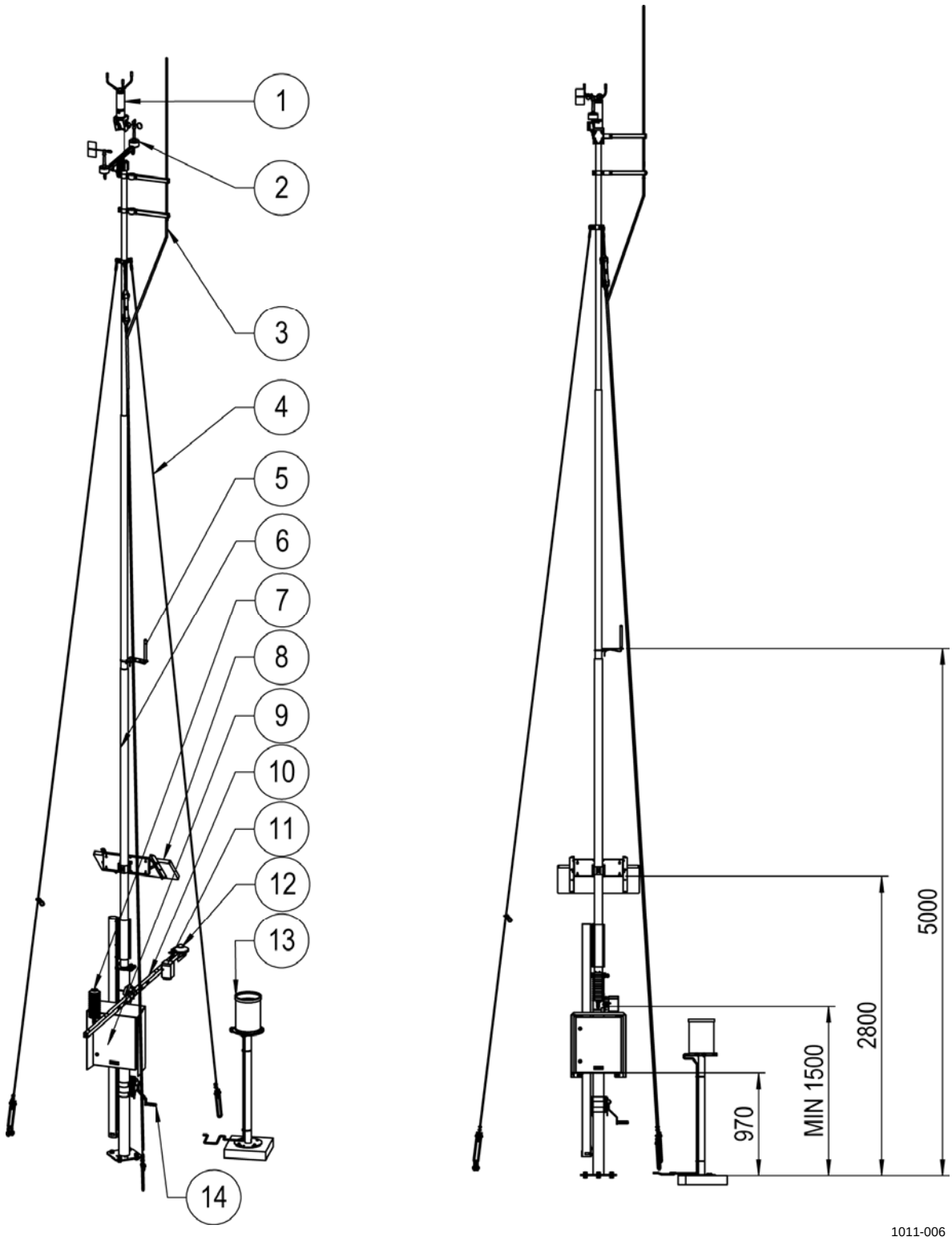


Figure 1 Complete AWS330 System and Dimensions

Ultrasonic Wind Sensor WMT703 and Mechanical Wind Sensor Set WA15 (numbers 1 and 2 in Figure 1 above) are used as alternatives to each other for measuring wind speed and direction. In addition, AWS330 can feature one or two QMT110 soil temperature sensors.

Product Nomenclature

Table 2 Vaisala Automatic Weather Station AWS330 Nomenclature

Code	Common Name
DKP210	Mast
DKP12SUP	Sensor support
HMP155	Air temperature and relative humidity probe
DTR503A	Radiation shield for HMP155
RG13(H)	Rain gauge (with heating)
RGSTAND1140	Rain gauge stand
QML201C	Data logger
BARO-1	Pressure sensor housed inside QML data logger
WMT703	Ultrasonic wind sensor
IRU-9429	Snow Depth Sensor
WA15 - WAA151 - WAV151 - WAC151	Mechanical Wind Sensor Set WA15 Cup anemometer Wind vane Cross arm
QMT110	Soil temperature sensor
CMP6	Pyranometer
AWS Client	Terminal software for service connection between PC and data logger
QMD202	Local LCD display (optional)
SOLAR33	Solar panel

CHAPTER 3

FUNCTIONAL DESCRIPTION

This section describes the operating principles of AWS330.

Operating Principles

Sensors are measured by AWS330 system as:

- Voltage or resistance input converted to measurement value by analog to digital conversion. For example, Pt100 temperature.
- Discrete pulse input converted to measurement value by counter. For example, Rain Gauge RG13(H).
- Frequency converted to measurement value by frequency (counter/time) measurement. For example, Anemometer WAA15 (wind speed).
- Intelligent sensors providing observation values as messages through serial link. For example, WMT703 wind measurement.

Measurements are quality-checked against set limits to produce observation values.

Observation values are processed further to produce statistical and derived values.

Statistical and derived values are used to compose observation and alarms messages.

Messages are passed through communication devices to Observation Display or data collection system.

Figure 2 below illustrates the general AWS330 application functionality with full sensor configuration.

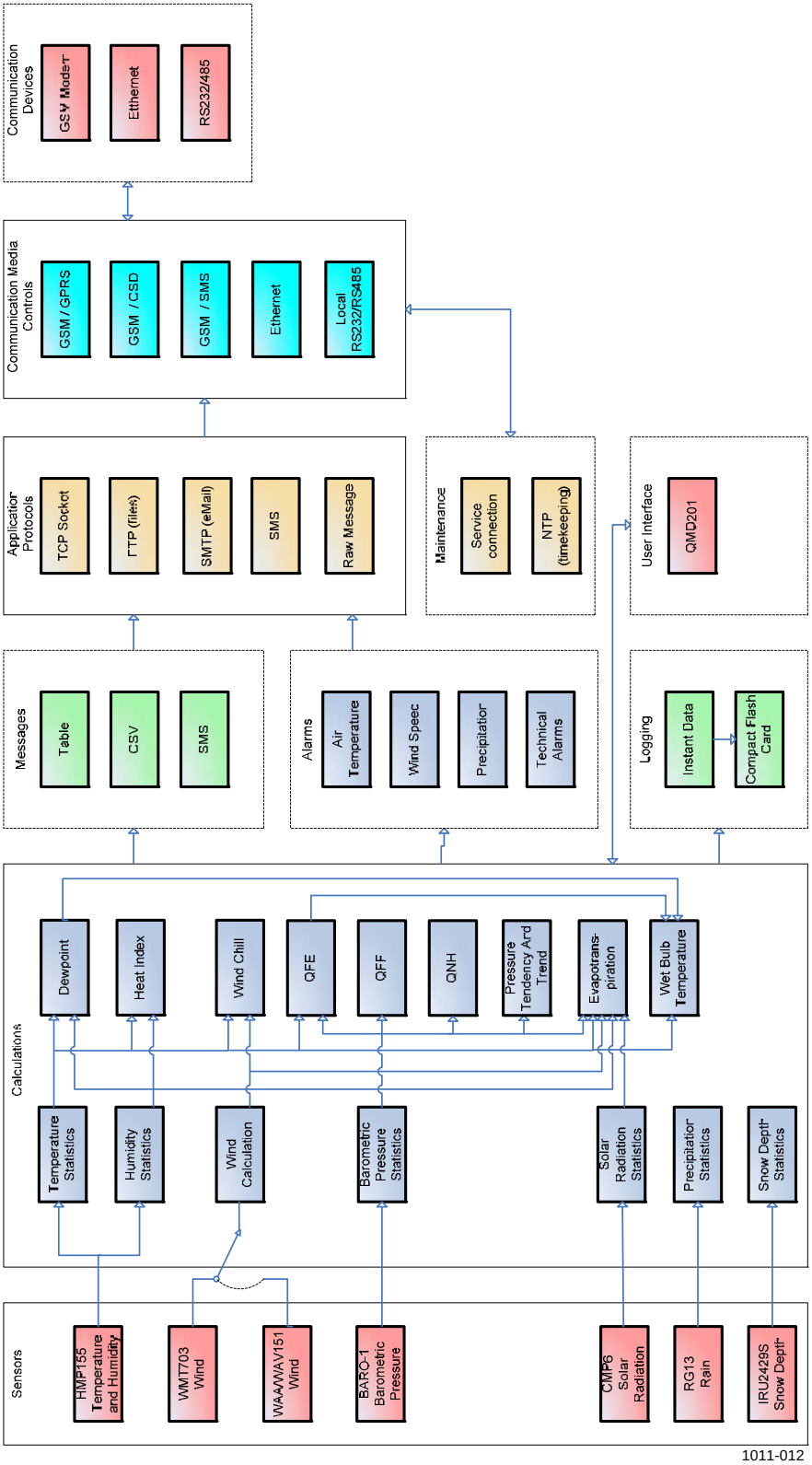


Figure 2 Functional Diagram of AWS330 Application

Sensor Reading

Reading frequencies for AWS330 sensors are listed in Table 3 below.

Table 3 Sensor Reading Frequencies

Sensor	Output	Frequency (s)
HMP155	Temperature	10
HMP155	Humidity	10
BARO-1	Barometric pressure	10
WMT703	Wind speed	1
WMT703	Wind direction	1
WAV15/WAA15	Wind speed	1
WAV15/WAA15	Wind direction	1
RG13	Rainfall	60 (1
CMP6	Solar radiation	10
QMT110	Soil temperature	10
IRU9429	Snow height	60

(1 AWS330 registers all contact closures, but updates the output each 60 seconds.

Observation Values

Depending on the selected sensor configuration, the AWS330 system produces various statistical and derived meteorological outputs.

The following tables list outputs by category.

Values with 1 minute or shorter period are regarded as instant values, that is, they are averaged from several samples. These values are used further to calculate statistical values for longer periods.

Air Temperature and Relative Humidity

Table 4 Products for Air Temperature and Relative Humidity

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Dry bulb temperature	°C	Average	1 min	10 s	TAAVG1M
Dry bulb temperature	°C	Average	1 hour	1 hour	TAAVG1H
Dry bulb temperature	°C	Average	1 day	1 day	TAAVG1D
Dry bulb temperature	°C	Minimum	18:00–06:00	24 hours	TAMIN1D
Dry bulb temperature	°C	Maximum	06:00–18:00	24 hours	TAMAX1D
Relative humidity	%	Average	1 min	10 s	RHAVG1M
Relative humidity	%	Average	1 hour	1 hour	RHAVG1H
Dewpoint (1	°C	Average	1 min	1 min	DPAVG1M
Dewpoint (1	°C	Average	1 hour	1 hour	DPAVG1H
Wet bulb temperature (1	°C	Average	1 min	1 min	TBAVG1M
Wet bulb temperature (1	°C	Average	1 hour	1 hour	TBAVG1H
Heat index (1	°C	Average	1 min	1 min	HIAVG1M
Wind chill (1	°C	Average	1 min	1 min	WCHAVG1M

(1 See Appendix B on page 273 for calculation formula.

Atmospheric Pressure/Vapor Pressure

Table 5 Products for Atmospheric Pressure

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Atmospheric pressure	hPa	Average	1 min	10 sec	PAAVG1M [1]
QFE pressure	hPa	Average	1 min	1 min	QFEAVG1M
QFE pressure	hPa	Average	1 hour	1 hour	QFEAVG1H
QFE pressure	hPa	Minimum	1 hour	1 hour	QFEMIN1H
QFE pressure	hPa	Maximum	1 hour	1 hour	QFEMAX1H
QFE pressure	hPa	Average	1 day	1 day	QFEAVG1D
QFE pressure	hPa	Minimum	1 day	1 day	QFEMIN1D
QFE pressure	hPa	Maximum	1 day	1 day	QFEMAX1D
QFF pressure	hPa	Average	1 min	1 min	QFFAVG1M
QFF pressure	hPa	Average	1 hour	1 hour	QFFAVG1H
QFF pressure	hPa	Minimum	1 hour	1 hour	QFFMIN1H
QFF pressure	hPa	Maximum	1 hour	1 hour	QFFMAX1H
QFF pressure	hPa	Average	1 day	1 day	QFFAVG1D
QFF pressure	hPa	Minimum	1 day	1 day	QFFMIN1D
QFF pressure	hPa	Maximum	1 day	1 day	QFFMAX1D
QNH pressure	hPa	Average	1 min	1 min	QNHAVG1M
QNH pressure	hPa	Average	1 hour	1 hour	QNHAVG1H
QNH pressure	hPa	Minimum	1 hour	1 hour	QNHMIN1H
QNH pressure	hPa	Maximum	1 hour	1 hour	QNHMAX1H
QNH pressure	hPa	Average	1 day	1 day	QNHAVG1D
QNH pressure	hPa	Minimum	1 day	1 day	QNHMIN1D
QNH pressure	hPa	Maximum	1 day	1 day	QNHMAX1D
Pressured trend	hPa/3h	n/a	3 hour	1 min	PTREND3H
Pressured tendency [2]	code	n/a	3 hour	1 min	PTEND3H
Water vapor pressure	hPa	Average	1 hour	1 hour	VPAVG1H

[1] Not directly reported; use QFEAVG1M instead.
[2] Pressure tendency codes; WMO code table 0200.

Pre-Requisite	Code	Meaning
Atmospheric pressure now higher than 3 hours ago.	0	Increasing, then decreasing
	1	Increasing, then steady, or increasing, then increasing more slowly.
	2	Increasing steadily or unsteadily.
	3	Decreasing or steady, then increasing; or increasing, then increasing more rapidly.
Atmospheric pressure now same as 3 hours ago.	0	Increasing, then decreasing.
	4	Steady.
	5	Decreasing then increasing.
Atmospheric pressure now lower than 3 hours ago.	5	Decreasing, then increasing.
	6	Decreasing, then steady, or decreasing, then decreasing more slowly.
	7	Decreasing steadily or unsteadily.
	8	Steady or increasing, then decreasing; or decreasing, then decreasing more rapidly.

See section QFE/QFF Pressure on page 278 for pressure calculation formulas.

Wind

The wind calculation method is scalar. See section Wind Calculation Formulas on page 280 for wind calculation formulas.

Table 6 Products for Wind

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Direction	degrees	Average	3 s	1 sec	WD
Speed	m/s	Average	3 s	1 sec	WS
Direction	degrees	Average	2 min	15 sec	WDAVG2M
Direction	degrees	Minimum	2 min	15 sec	WDMIN2M
Direction	degrees	Maximum	2 min	15 sec	WDMAX2M
Speed	m/s	Average	2 min	15 sec	WSAVG2M
Speed	m/s	Minimum	2 min	15 sec	WSMIN2M
Speed	m/s	Maximum	2 min	15 sec	WSMAX2M
Direction	degrees	Average	10 min	15 sec	WDAVG10M
Direction	degrees	Minimum	10 min	15 sec	WDMIN10M
Direction	degrees	Maximum	10 min	15 sec	WDMAX10M
Speed	m/s	Average	10 min	15 sec	WSAVG10M
Speed	m/s	Minimum	10 min	15 sec	WSMIN10M
Speed	m/s	Maximum	10 min	15 sec	WSMAX10M
Direction of max speed	Degrees	n/a	10 min	15 sec	WDWSMAX10M

Precipitation

Table 7 Products for Precipitation

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Rain accumulation	mm	Sum	1 min	1 min	PRSUM1M
Rain accumulation	mm	Sum	10 min	10 min	PRSUM10M
Rain accumulation	mm	Sum	30 min	30 min	PRSUM30M
Rain accumulation	mm	Sum	1 hour	1 hour	PRSUM1H
Rain accumulation	mm	Sum	3 hour	3 hour	PRSUM3H
Rain accumulation	mm	Sum	6 hour	6 hour	PRSUM6H
Rain accumulation	mm	Sum	12 hour	12 hour	PRSUM12H
Rain accumulation	mm	Sum	1 day	1 day	PRSUM1D
Rain intensity	mm / h	n/a	1 min	1 min	PRFSUM1H
Snow depth	cm	Average	1 hour	1 hour	SNAVG1H

Soil/Water Temperature

Table 8 Products for Soil/Water Temperature

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Soil/water temperature 1	°C	Average	10 min	10 min	TS1AVG10M
Soil/water temperature 1	°C	Average	1 hour	1 hour	TS1AVG1H
Soil/water temperature 1	°C	Minimum	1 hour	1 hour	TS1MIN1H
Soil/water temperature 1	°C	Maximum	1 hour	1 hour	TS1MAX1H
Soil/water temperature 1	°C	Average	1 day	1 day	TS1AVG1D
Soil/water temperature 1	°C	Minimum	1 day	1 day	TS1MIN1D
Soil/water temperature 1	°C	Maximum	1 day	1 day	TS1MAX1D
Soil/water temperature 2	°C	Average	10 min	10 min	TS2AVG10M
Soil/water temperature 2	°C	Minimum	1 hour	1 hour	TS2MIN1H
Soil/water temperature 2	°C	Maximum	1 hour	1 hour	TS2MAX1H
Soil/water temperature 2	°C	Average	1 hour	1 hour	TS2AVG1H
Soil/water temperature 2	°C	Average	1 day	1 day	TS2AVG1D
Soil/water temperature 2	°C	Minimum	1 day	1 day	TS2MIN1D
Soil/water temperature 2	°C	Maximum	1 day	1 day	TS2MAX1D

Solar Radiation/Sunshine

Table 9 Products for Solar Radiation

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Solar radiation	W/m^2	Average	1 min	10 s	GIRRAVG1M
Solar radiation	W/m^2	Average	1 hour	1 hour	GIRRAVG1H
Solar radiation	W/m^2	Average	1 day	1 day	GIRRAVG1D
Sunshine duration [1]	min	Sum	1 day	1 day	SDUR1D

[1] See section Sunshine Duration on page 282 for sunshine duration formula.

Evapotranspiration

Table 10 Products for Evapotranspiration

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Evapotranspiration	mm/day	n/a	1 day	1 day	EVAP1D

See section Evapotranspiration on page 285 for evapotranspiration formula.

System Status

Table 11 System Status Indicator

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
System uptime	min	Sum	n/a	1 min	UPTIME
Data logger status	n/a	n/a	n/a	n/a	STATUS
Power supply voltage	VDC	n/a	n/a	1 min	EXTDC

Alarms

AWS330 system can be enabled to send alarm messages based on selected observation values and technical alarms based on system and sensor status.

The following alarm sources and limits are available:

Table 12 Alarm Sources and Types

Monitored Value	Unit	Alarm Type
Air temperature instant	°C	High limit
Air temperature instant	°C	Low limit
Wind speed max 10 min	m/s	High limit
Precipitation sum 1 hour	mm	High limit
Data logger temperature	°C	High limit
Data logger temperature	°C	Low limit
Data logger supply voltage	VDC	Low limit

In addition, all sensor failures are reported as alarms.

Message Formats

Observation Messages

Observation messages are fixed, and always contain all observations and calculation outputs, regardless if individual sensors are present or not. Observation values and results derived from missing sensors are presented by one or more slash '/' characters in place of the value.

CSV

CSV message consists of header and tag/value pairs separated by semicolons. The actual message does not contain linefeeds; the description is split into two lines for readability.

(S:<StationName>;D:<YYMMDD>;T:<hhmmss>;
<ObsTag1>:ObsValue1>; … <ObsTagN:ObsValueN>)

where

<StationName>	=	Name of the observation site
<YYMMDD>	=	Message date UTC; for example, 101126
<hhmmss>	=	Message time UTC; for example, 085300
<ObsTag1>	=	Name for observation value
<ObsValue1:>	=	Observation value
;	=	Separator character between fields
:	=	Separator character between tag and value

Example header:

S:Testfield1;D:101126;T:055300

Example tag/value pair with trailing separator:

TAAVG1M:-0.3;

Tags for observation values are listed in section Observation Values on page 22.

Missing observation values are replaced with one or more slash '/' characters.

Example of a full CSV Message is shown on page 289.

Table

Table message is a message in readable format with instant values and sensor status values.

The following values are displayed in the table message:

Table 13 Table Message Values

Row Label/Column	Instant	Average	Status [1]
Station name	Station name		
Date	Date time UTC		
Internal temperature [°C]	Logger internal temperature		
DC supply voltage [V]	Logger DC supply voltage		
Temperature [°C]	HMP155 air temperature	1 min average temperature	HMP155 air temperature status
Relative humidity [%]	HMP155 relative humidity	1 min average relative humidity	HMP155 relative humidity status
Wind direction [deg]	3 sec average wind direction	10 min average wind direction	WMT700 status Not available for WAV15 (99)
Wind speed [m/s]	3 sec average wind direction	10 min average wind speed	WMT700 status Not available for WAA15 (99)
Precipitation [mm],[mm/h]	1 min cumulative precipitation from rain gauge	Precipitation intensity calculated over 10 minutes	Rain gauge status
Snow depth [mm],[cm]	Sensor IRU 9429 reading	Snow height	IRU 9429 status
Soil temperature 1 [°C]	QMT102 soil temperature	1 min average soil temperature	QMT102 status
Soil temperature 2 [°C]	QMT102 soil temperature	1 min average soil temperature	QMT102 status

[1] See Appendix D, Sensor Status Values, on page 293.

Missing observation values are replaced with one or more slash '/' characters.

See example Table Message on page 290.

SMS

SMS message is a very short message containing only the basic observations. The message size is limited to 160 characters to fit into a single SMS. Value tags are also different from CSV message tags.

SMS message contains the following values:

Table 14 SMS Message Values

Reported Parameter	Unit	Statistic	Period	Interval	Message Tag
Station name	n/a	n/a	n/a	n/a	S
Message time	UTC	n/a	n/a	n/a	DT
Air temperature	°C	Average	1 min	1 min	TA
Relative humidity	%	Average	1 min	1 min	RH
Dewpoint temperature	°C	Average	1 min	1 min	DP
Liquid precipitation	mm	Sum	1 hour	1 hour	PR
Wind direction	Deg	Average	10 min	15 sec	WD
Wind speed	m/s	Average	10 min	15 sec	WS
Global radiation	W/m2	Average	1 hour	1 hour	SR
Soil water temperature 1	°C	Average	1 min	1 min	TS1
Soil water temperature 2	°C	Average	1 min	1 min	TS2
Snow height	cm	Average	1 hour	1 hour	SH

Message is formatted as:

S:<Station Name>;DT:<Timestamp>;<Tag1>:<Value1>;…<TagN:ValueN>

where

<Station Name>	=	Name of the observation site
<Timestamp>	=	Message UTC timestamp formatted as YYMMDD hhmmss
<Tag1>	=	Observation value tag
<Value1>	=	Observation value
;	=	Separator character between fields
:	=	Separator character between tag and value

Example tag/value pair with trailing separator:

TA:-10.3;

Missing observation values are replaced with a single slash '/' character.

See example SMS Message on page 290.

Alarm Messages

Alarms are sent using plain text messages formatted in similar manner as observation message CSV. The actual message does not contain linefeeds; the description below is split into two lines for readability.

(S:<StationName>;D:<YYMMDD>;T:<hhmmss>;
ALARM:<Alarm reason>;<ValueTag>:<Value>)

where

<StationName>	=	Name of the observation site
<YYMMDD>	=	Message date UTC, for example 101126
<hhmmss>	=	Message time UTC, for example 085300
<Alarm reason>	=	Short description of the source
<ValueTag>	=	Message tag for the alarming value (optional)
<Value>	=	Value of the alarming variable (optional)
;	=	Separator character between fields
:	=	Separator character between tag and value

Example alarm message:

(S:AWS330;D:101129;T:091500;ALARM:Windspeed;WSMAX10M:30.0)

Table 15 Sensor Alarms

Monitored Sensor	Message
HMP155/Temperature	Air temperature sensor failure
HMP155/Relative humidity	Humidity sensor failure
BARO-1	Barometric pressure sensor failure
WMT703/Wind direction	Wind direction sensor failure
WMT703/Wind speed	Wind speed sensor failure
WAV15/WAA15	N/A. Sensor failure is not detectable by AWS330
RG13	N/A. Sensor failure is not detectable by AWS330
CMP6	Solar radiation sensor failure
QMT110	Soil temperature 1/2 sensor failure
IRU9429	Snow height sensor failure

Example sensor alarm message:

(S:AWS330;D:101209;T:091600;ALARM:Humidity sensor failure)

Sensor failure alarms can be sent as above or as an attachment to table message. For an example, see section Table Message with Alarm List on page 291.

CHAPTER 4

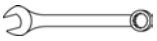
INSTALLATION

This chapter provides you with information that is intended to help you install AWS330.

NOTE	The individual sensors may come with their own instructions. However, refer to **this manual** for all installation instructions.

NOTE	The delivery includes accessories, such as nuts and bolts, that can be used in other installations than mast installation. Not all have to be used.

Necessary Equipment

- Allen keys 
- Wrenches  or adjustable wrench 
- Crosshead screwdriver  and slothead screwdriver 
- Compass
- Spirit level 
- Laptop PC with AWS Client
- Percussion drill (foundation work)
- Hammer 
- Insulated tools (solar panel)
- Safety helmet
- Rubber gloves

Requirements for Software Configuration

Table 16 below lists the items and information that are required before configuring the AWS330 system.

Table 16 Items/Information Required Prior to Configuration

Pre-requisite	Item/Information	Source
All sites	Unique site name	User-provided
Barometric pressure measurement and QFF/QNH values in use.	Observation site altitude from mean sea level.	Map services, GPS receiver (1
Solar radiation sensor and sunshine duration calculation in use	Observation site WGS84 coordinates	GPS receiver, map services
GSM telemetry in use	GSM SIM card and PIN number	Cellular network operator (2
GPRS telemetry in use	GPRS access point name	Cellular network operator
GPRS telemetry in use and access point requires credentials (optional)	GPRS access point credentials	Cellular network operator
GPRS or Ethernet telemetry with fixed IP addressing in use	IP settings - Address - Network mask - Gateway address - DNS address(es)	Network operator
GPRS or Ethernet telemetry with eMail transfer in use	eMail settings - Server name or address - User credentials (optional)	Network operator
GPRS or Ethernet telemetry with FTP transfer in use	FTP settings - Server name or address - User credentials (optional)	Network operator
GSM SMS telemetry in use	SMS central number (optional)	Network operator

1) All GPS receivers do not provide altitude information that is accurate for all purposes. Consult the receiver manual for altitude accuracy information.

2) If possible, also obtain the unlock code PUK in case the SIM card becomes accidentally locked.

Selecting Location

Ambient Measurements

Finding a suitable site for the weather station is important for getting representative ambient measurements. The site should represent the general area of interest. For further information, refer to the local recommendations and WMO Guide to Meteorological Instruments and Methods of Observation, WMO-No. 8.

Allow sufficient clearance especially for the wind sensors. The mast should not be located next to a building or any other object that might affect the airflow.

Avoid the following installation sites to ensure correct measurements: rooftops, sides of buildings, shaded areas, steep slopes, heat sources, swamps, high vegetation, and places that might hold water after rains.

In general, there should be at least 150 m of open area to all directions from the mast. The minimum distance between the mast and obstacles is ten times the height of an obstacle. Refer to Figure 3 below.

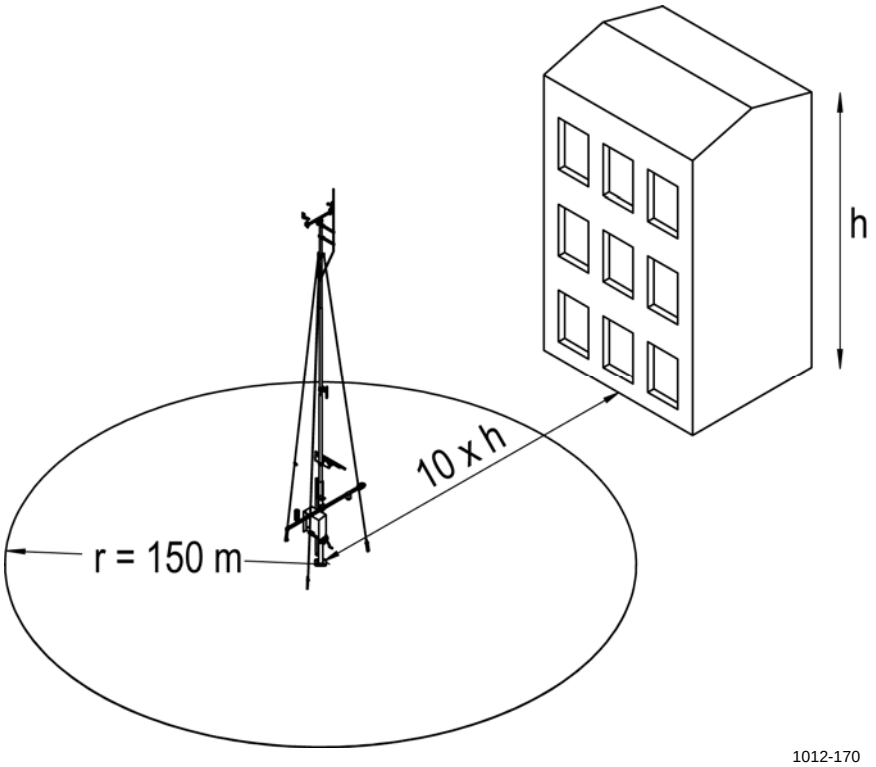


Figure 3 Recommended Mast Location in Open Area

Tilt Direction of the Mast

Also note the tilting direction of the mast. When installed in the northern hemisphere, the mast tilts to the **west**. There should be a clear area up to 9 m on the west side of the mast. The area should be free of obstacles preventing the mast from being erected and tilted.

Soil Evaluation for the Mast

Always evaluate the soil to determine the appropriate type of the foundation required. When designing the foundation, the local construction companies must be consulted to find out about the soil and frost conditions in your area. When the soil is frost-susceptible, make sure to always use proper insulation.

CAUTION	For the mast base installation, the soil bearing capacity has to exceed 45 kPa (940 pounds-force/sq. foot).

Site Preparation

Power Supply and Communication Lines

Before assembling the mast, the power supply and communication lines must be available. The primary AC power service must comply with the National Electrical Code (NEC) or equivalent specifications for grounding the primary power service entrance. The AC (mains) power must be continuous, 110–230 V/50 Hz, and without spikes and blackouts. If the AC (mains) voltage is fluctuating more than the given tolerance allows, the AC (mains) voltage stabilizers are recommended.

WARNING All electrical installations must be carried by licensed experts as governed by local and state authorities, legislation, and regulations.

The following applies to all field cabling:

- Use armored field cables.
- Cables must be suitable for underground use.
- Check the cable core diameter according to maximum allowable drop.
- Route the cables through conduits to the equipment.
- Check cable conduit diameters or use additional termination boxes.
- Ground the cable shield at both ends.
- Use spike and overvoltage protection devices at both ends of field cables.

Always make a detailed cabling and wiring plan. Data transmission lines from the outdoor sites to indoor devices have to be prepared carefully. Also the power supply for the equipment used needs to be planned carefully.

It is recommended that you use a conduit to protect the cables that connect the indoor components to the outdoor components from damage and moisture. Also traffic, standing water, and the twist and stress caused by the connectors will damage the cables.

Equipment Grounding and Lightning Protection

WARNING Consult the local electricity professionals for the local grounding requirements. The customer is responsible for supplying grounding cables, rods, clamps, power cables, long distance signal cables, and conduits for cables.

With mast installations, **equipment grounding and lightning protection must be done separately**. The main principles are as follows:

- Proper equipment grounding is required for personnel safety and for equipment protection. A piece of equipment is grounded by connecting its metal structures and electrical equipment to an external buried ground rod. Individual site requirements may dictate changes in the procedures described in this manual. Changes are permissible as long as protection equivalent to the original requirements is provided for the system.

WARNING Failure to provide proper grounding may result in personnel injury or death from electrical shock and may severely damage the equipment.

WARNING Lightning protection is required to prevent personnel injury and equipment damage due to direct lightning strikes and lightning-induced current surges.

- The materials used in the manufacture of the grounding systems must be chosen to prevent them from forming an electrolytic couple. It is recommended that you use copper (Cu).

- The equipment grounding system and lightning protection grounding system should be located as far as possible from each other. The minimum recommended distance is 5 m (16 ft.). Due to this, the lightning rod grounding cable is routed down from the top of the mast via the guy wire which is isolated from the mast construction; refer to number 2 in Figure 4 below. The equipment grounding should be done near the mast block as illustrated in the figure.

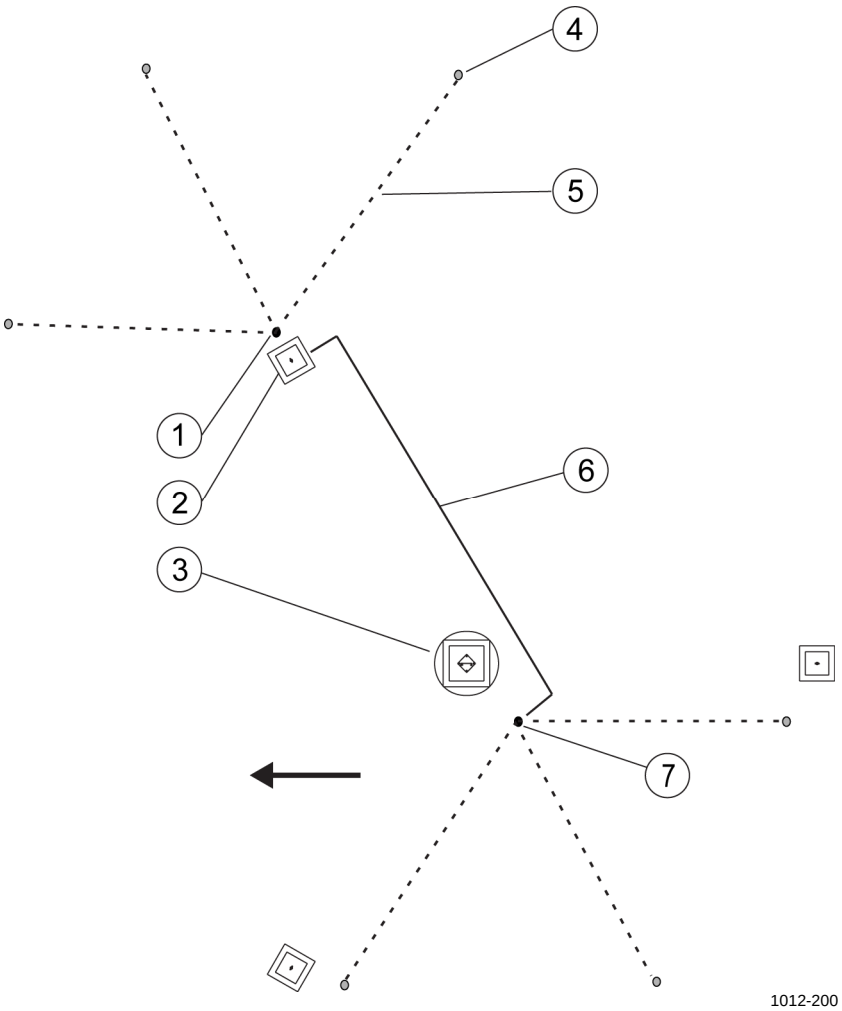


Figure 4 Location of the Grounding Rods and an Optional Grid, Arrow Points to Mast Tilt Direction

The following numbers refer to Figure 4 above:

1 = Lightning protection grounding rod
2 = Guy wire block of the isolated guy wire 3
3 = Mast block
4 = Optional grounding rod
5 = Optional connecting cable
6 = 5-meter minimum distance between the rods
7 = Equipment grounding rod

- The recommended grounding resistance is 10 Ω or less for both the grounding of lighting protection rod and for the equipment grounding. Soil conditions (sand, rocks, and so on) and the ground resistance measurement determine the design and construction of the grounding system. Buried ground rods and/or buried wire can be used for the ground network. The type and combination used depend on soil conditions (ease of installation) and on the value of measured ground resistance (the most effective way of reducing resistance to the required value of 10 Ω or less). Measurements of the earth resistance must be made at least 48 hours after rainfall.
- The connection between ground rods and the equipment frames and copper cables should be made with appropriate compression lugs, bolts, nuts, and lock washers.

Table 17 Examples of Soil Resistivities, Ohm-Meters

Soil Type	Median	Variation
Topsoil, loam	26	1 ... 50
Inorganic clays of high plasticity	33	10 ... 55
Silty or clayey fine sands with slight plasticity	55	30 ... 80
Fine sandy or silty clays, silty clays, clean clays	190	80 ... 300
Silty sands, poorly graded sand-silt mixtures	300	100 ... 500
Well-graded gravel, gravel sand mixtures	800	600 ... 1 000

Due to the above reasons and soil variations, the grounding accessories must be supplied locally.

Foundation

Soil and Frost Conditions

When designing the foundation, the local construction companies must be consulted to find out about the soil and frost conditions in your area. When the soil is frost-susceptible, make sure that you always use proper insulation.

Orientation of the Mast

Refer to Figure 5 on page 40 for the orientation of the mast. The concrete blocks for guy wires have to be placed so that the pole mast can be tilted west (east in the southern hemisphere) by releasing only the detachable guy wire 1; see Figure 5 on page 40.

To ease the orientation of the mast, the two-headed arrow is cut on the orientation plate. "N" should face north and "S" should face south to ensure the aiming of the weather station devices to the correct position.

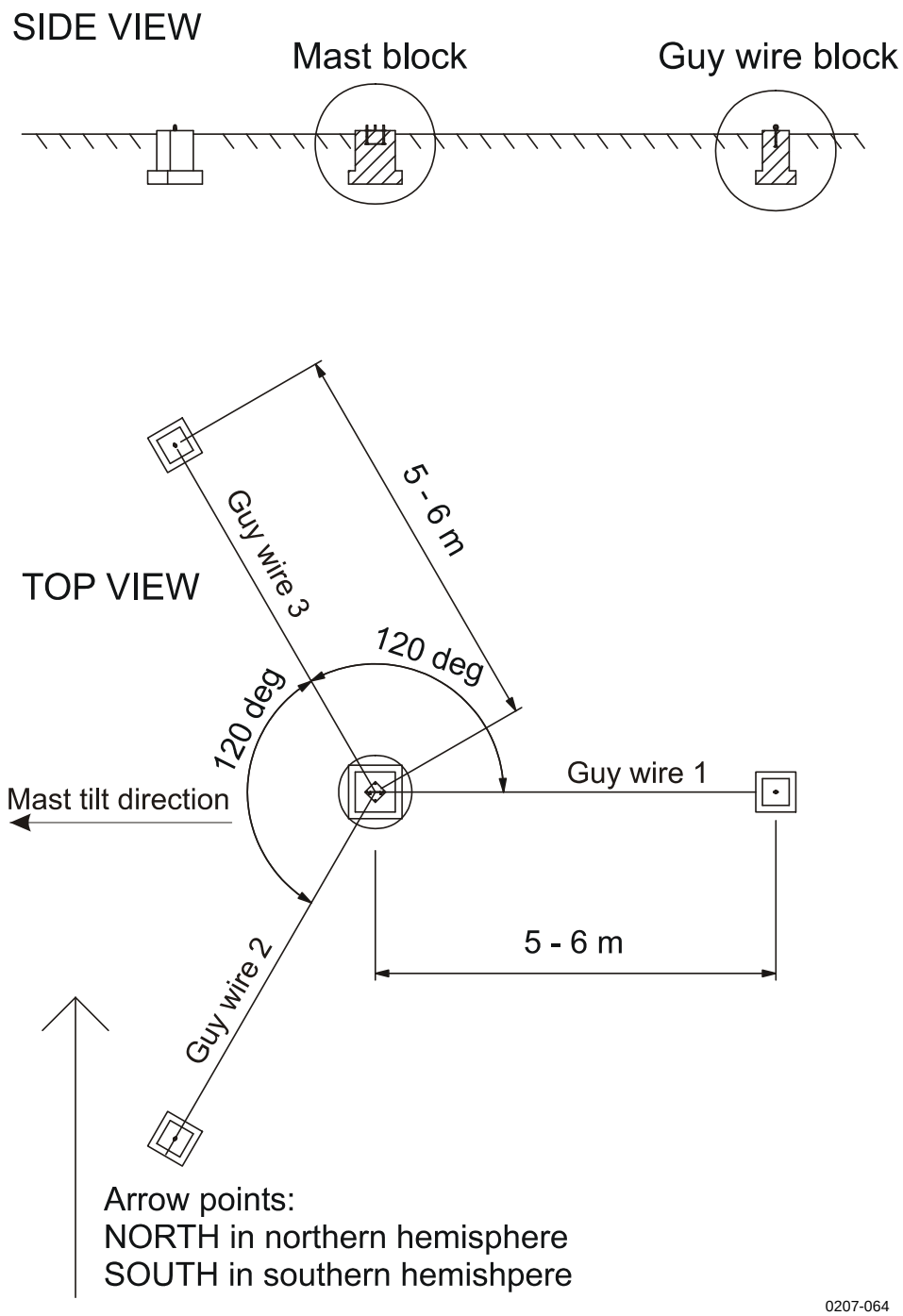


Figure 5 Mast DKP210 Orientation

Concrete Foundations

DKP210 can be mounted on a new or an existing concrete block. The pole mast is fixed to the concrete block with foundation bolts.

NOTE	The minimum weight of the main mast block is 400 kg (882 lb.).

When constructing a new concrete block, fasten the foundation bolt assembly simultaneously with the concrete pour. If there is an existing concrete foundation, you have to drill the holes for the foundation bolts. In both cases, use the delivered orientation plate for the correct placing of the foundation bolts. For the protection of the cables, it is recommended that you install a cable conduit, which has a minimum diameter of 70 mm (2.76 in.). See Figure 6 below.

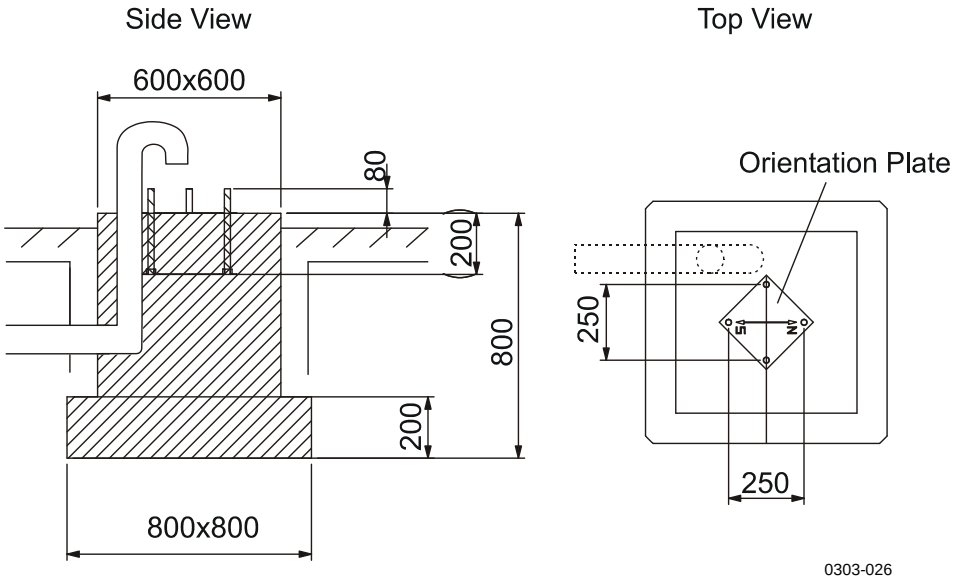


Figure 6 Main Mast Block and Orientation Plate (Dimensions in mm)

Concrete block dimensions for the guy wires are presented in Figure 7 below.

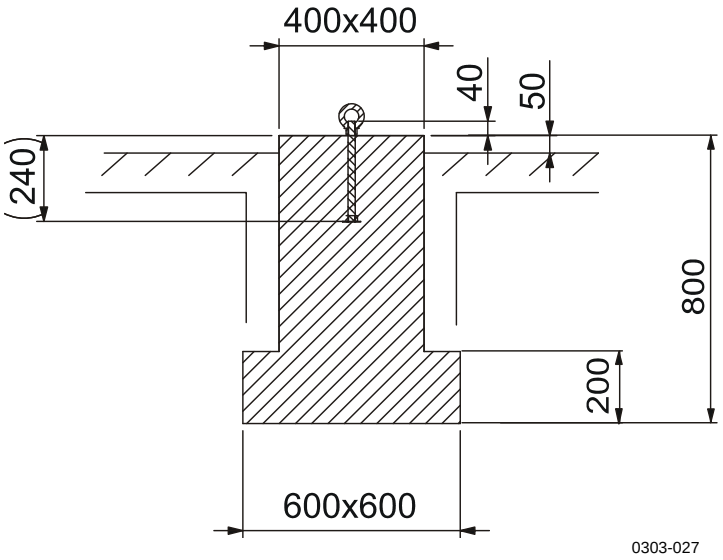


Figure 7 Concrete Block for Guy Wire (Dimensions in mm)

Making a New Concrete Block

1. Make a cast mould with steel reinforcements according to the design shown in Figure 8 below. Use 12 mm deformed steel. In addition to the reinforcement, you need to add two additional horizontal bar layers. The distance between the layers should be approximately 200 mm. Note that you can make the guy wire blocks in a similar way, but the reinforcement horizontal bar length should be 300 mm instead of 400 mm presented in the figure.

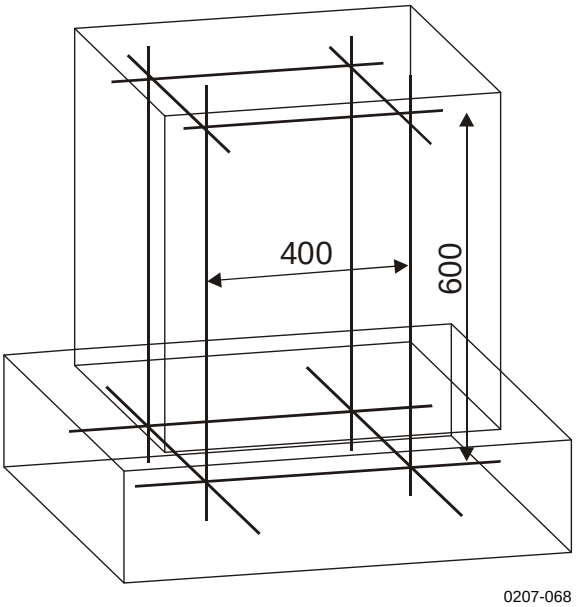


Figure 8 Reinforcement for the Concrete Blocks

2. If necessary, place the cable duct tubes into the casting mould prior to casting. The recommended inner diameter of the duct tube is 70 mm (2.76 in.).
3. Place the steel reinforcement into the casting mould.
4. Screw the foundation bolts (number 1 in Figure 9 below) to the nuts (6) which are fixed to the square metal plate (3).

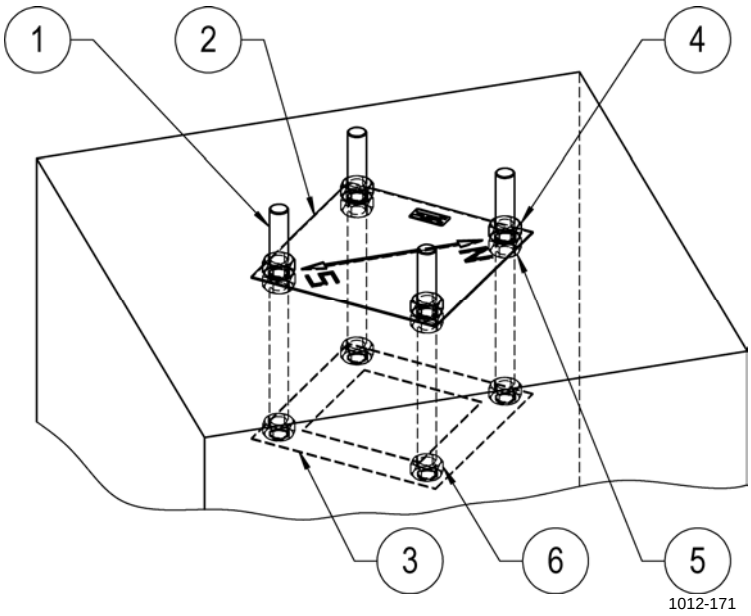


Figure 9 Foundation Assembly for the Mast Base

5. Fix the orientation plate (2) to the upper ends of the foundation bolts (1) with eight nuts (4 and 5), see Figure 9 above. The top of the bolt should be approximately 80 mm above the orientation plate, refer to Figure 6 on page 41.

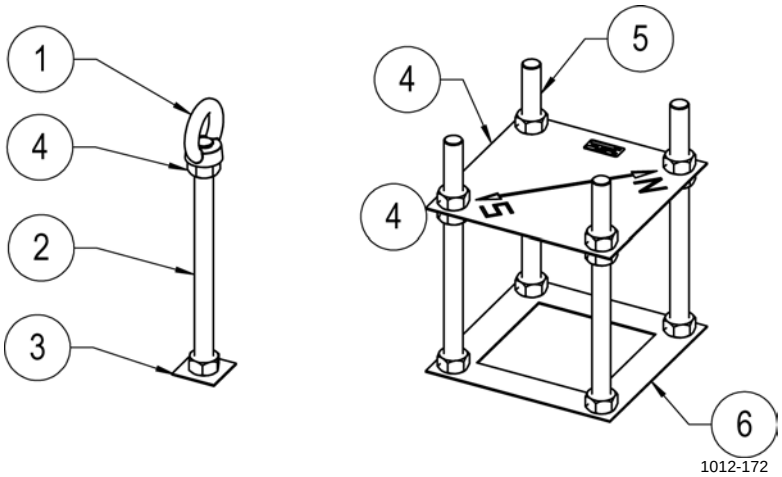


Figure 10 Foundation Assemblies for a New Concrete Block

6. Install the foundation assembly into the mould so that the foundation bolt threads stand above the surface, see Figure 6 on page 41. The orientation plate (number 4 in Figure 10 above)

should be at the same height as the top of the finalized concrete block. Protect the threads of the bolts above the orientation plate, for example, by taping them. Also check the correct alignment of the foundation assembly with the orientation plate. "N" should face north and "S" should face south.

7. For the guy wires, fix the foundation bolt (number 2 in Figure 10 on page 43) to the plate with a nut (3). Fix the eye nut (1) to the other end of the foundation bolt. Level the assembly so that the top of the bolt will be 40 mm above the concrete in the finalized block. The eye nut will then be one centimeter above the finalized concrete block.
8. Pour in the concrete. Finish the concrete block.

Using an Existing Concrete Block

1. Drill holes with a diameter of 25 mm into the concrete block using the orientation plate as a guide. Make sure that the depth of the holes is 240 mm (±5 mm).

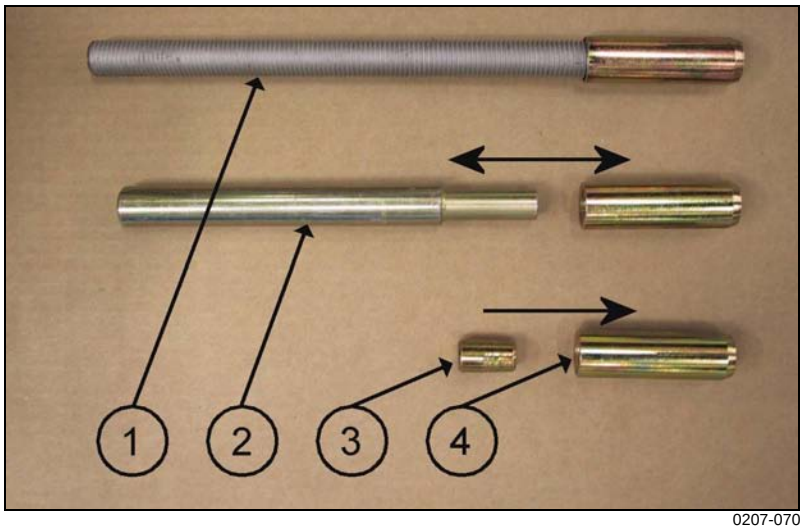


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Figure 11 Accessories for Existing Concrete Block Installation

2. First, install the key piece (number 3 in Figure 11 above) correctly inside the wedge bolt (4). The narrow end should point to the direction of the lower arrow shown in Figure 11 above. Assemble the wedge bolts into the holes. There are four bolts for the mast base and one bolt for each of the guy wire blocks.
3. Hammer the wedge bolts (4) down using the provided bar (2).
4. Screw the foundation bolts (1) to the wedge bolts and tighten the screws properly.
5. Fill the remaining space of the holes with a suitable compound.
6. Start erecting the mast after the compound is dry.

Mechanical Installation Procedure

Reserve at least a full day for the mechanical installation, especially if you do not have previous experience with weather stations.

CAUTION	Wear a safety helmet when installing the mast. Preferably do not install the mast alone.

The mechanical installation consists of the following phases:

1. Installing Mast DKP210 as described on page 46.
2. Installing Ultrasonic Wind Sensor WMT70 as described on page 62 or Installing Mechanical Wind Sensor Set WA15 as described on page 70.
3. Installing GSM/GPRS Antenna as described on page 72.
4. Installing Solar Panel as described on page 73.
5. Erecting Mast DKP210 as described on page 56.
6. Installing Sensor Support as described on page 77.
7. Installing Air Temperature and Relative Humidity Probe HMP155 as described on page 80.
8. Installing Snow Depth Sensor IRU-9429 as described on page 85.
9. Installing Pyranometer CMP6 as described on page 82.
10. Installing Soil Temperature Sensor QMT110 as described on page 86.
11. Installing Rain Gauge RG13(H) as described on page 87.
12. Installing Enclosure as described on page 90, comprising the following phases:
    a. Installing Enclosure to the Mast as described on page 91 or Installing Enclosure to the Wall as described on page 93.
    b. Grounding the Enclosure as described on page 94.
    c. Installing Backup Batteries as described on page 94
    d. Preparing GSM/GPRS Modem as described on page 96
13. Connecting Sensor Cables as described on page 97.
14. Powering Up the System as described on page 99.

After the mechanical installation, AWS330 is configured with a laptop PC and AWS Client software as described in Chapter 5, Software Configuration and Operation, on page 101.

Installing Mast DKP210

DKP210 is a 10-meter tiltable mast. The mast is designed to withstand high wind conditions, up to 50 m/s of maximum wind speed, with a standard set of guy wires. The plate of the pedestal tube is made of stainless steel with a powder coating resistant to corrosion. The material of the lifting rod and mast tubes is anodized aluminum.

CAUTION	Do not install the mast when wind speed is over 7 m/s.

NOTE	Wind sensors WMT703 and WA15 positioned on top of the mast require exact bearings (north, south). Take time to position the mast correctly, as instructed here, and verify the directions carefully. This will make correct aligning of the wind sensors significantly easier.

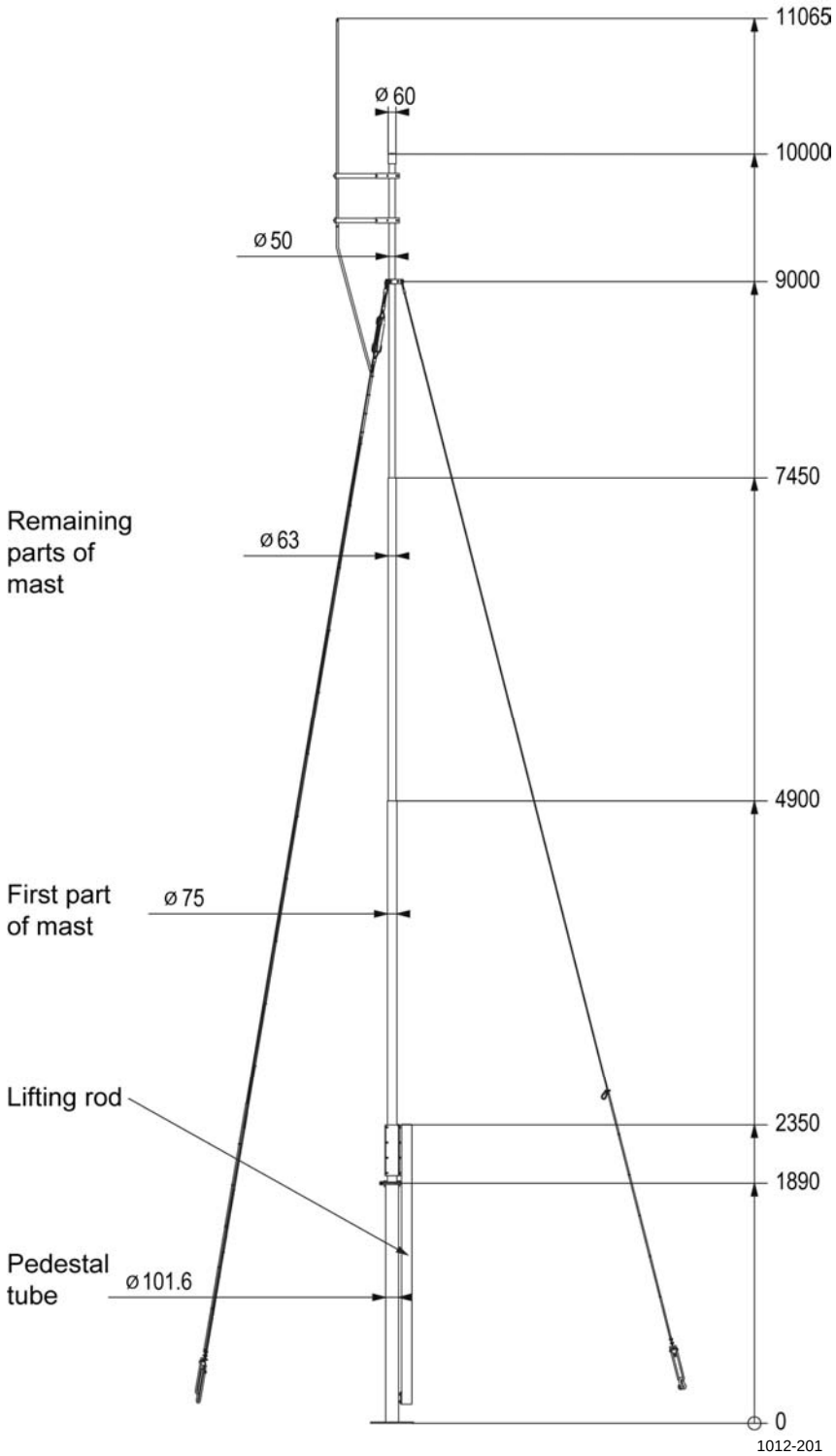

Figure 12 DKP210 Mast Dimensions (in mm)

Tools Required for Mast Installation

You need a set of Allen keys, two wrenches (17 and 30 mm), a spirit level, a compass, and a big hammer.

Mast Installation Procedure

To assemble the mast, follow the work order below:

1. Attach the 2-meter-high pedestal tube to the concrete foundation.
2. Lift the first part of the mast to the upper end of the pedestal tube and assemble the hinge axle.
3. Attach the lifting rod to the clamp preinstalled to the first part of the mast.
4. Assemble the remaining parts of the mast.
5. Lift the upper end of the mast on the tilting support and secure the tilting support to the mast using the provided strap.
6. Attach the guy wires to the uppermost part of the mast.
7. Assemble the rod holders to the lightning rod and attach the assembly to the mast.
8. Attach the winch and route the winch wire to the appropriate guides.
9. Attach the jacketed copper grounding wire to the isolated guy wire 3 with the cable ties.
10. Erect the mast with the winch and secure the hinge with the bolts.
11. Connect the guy wires with fasteners to their foundations and mark them with the cable shrouds.
12. Tilt the mast down by opening the detachable guy wire 1 to verify that the installation is secure.
13. Install any other devices that will be installed to the tiltable part of the mast and attach the cables to the mast with cable ties.
14. Erect the mast with the winch and secure the hinge with the bolts.
15. Remove the winch and assemble the devices to the pedestal tube.

For detailed instructions, refer to the following sections.

Installing the Pedestal Tube

1. Turn the pedestal tube so that the plate lug (number 5 in Figure 13 below) faces **south** in the northern hemisphere and north in the southern hemisphere. The plate lug is for attaching the guide for the winch wire.
2. Place the washers and then the spring washers onto the previously installed nuts. Lift the pedestal tube through the bolts onto the washers.
3. Install the nuts with the washers and spring washers to the foundation bolts.
4. Level the pedestal tube to vertical with the nuts that are under the plate. For adjusting the level, use the appropriate wrench (30 mm) and the spirit level to check that the pedestal tube is vertical.
5. Finally, tighten the bolts with the appropriate wrenches.

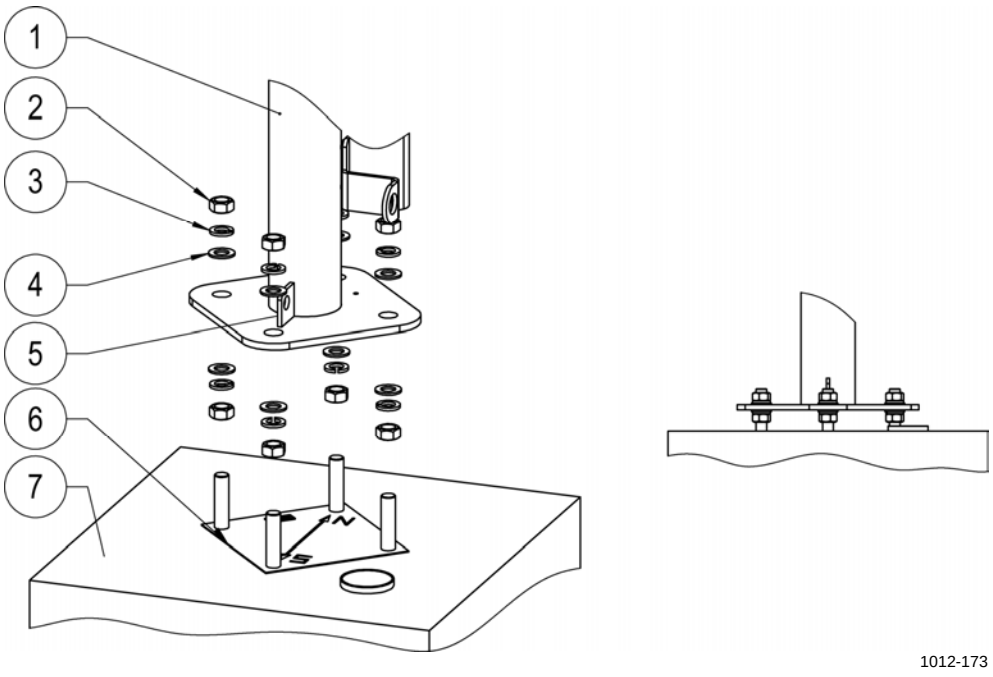

Figure 13 Pedestal Tube Attachment

The following numbers refer to Figure 13 above:

1 = Pole mast
2 = Nut M20 DIN934, 8 pcs; use wrench 30 mm
3 = Spring washer B20 DIN127, 8 pcs
4 = Washer A20 DIN125, 8 pcs
5 = Plate lug
6 = Guide plate, META-0501
7 = Foundation

Connecting the First Part of the Mast to the Pedestal Tube

To connect the first part of the mast to the pedestal tube, install the axle for the hinge. Take the axle (number 3 in Figure 14 below) from the plastic bag labeled "Hinge Set".

1. Thread the Allen bolt (4) with the washers to one end of the axle.
2. Lift the first part of the mast (1) end on the hinge and install the axle.
3. Thread the Allen bolt (4) with the washers to the other end of the axle and tighten both ends with an Allen key.

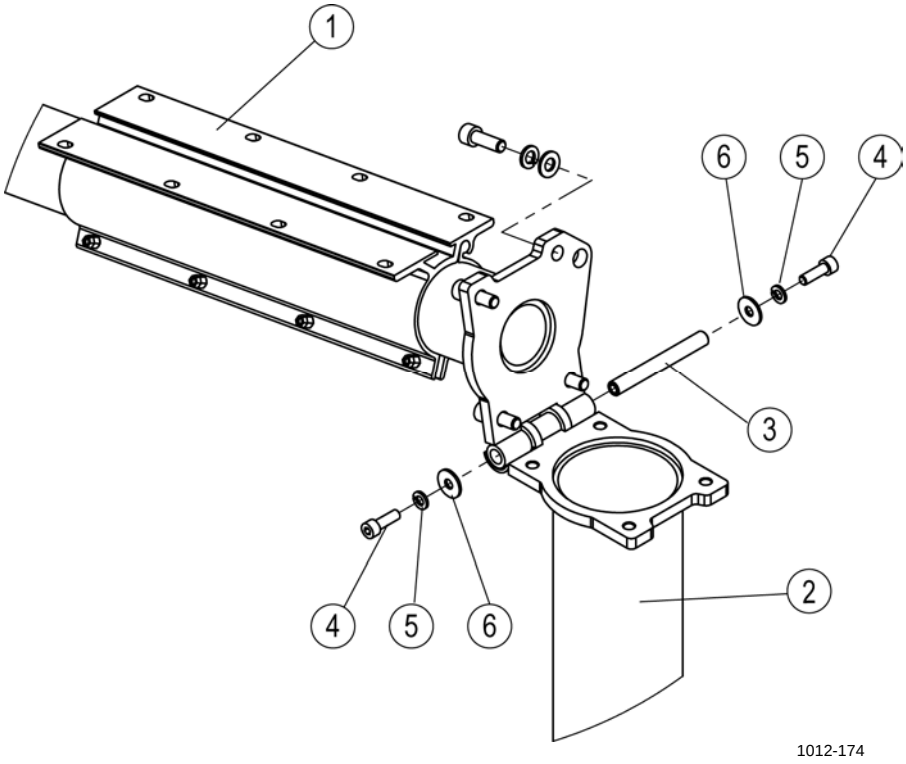

Figure 14 Hinge Axle Installation

The following numbers refer to Figure 14 above:

1 = First part of the mast
2 = Pedestal tube
3 = Axle for hinge
4 = Allen bolt M8x25 DIN912 A4, 2 pcs; use Allen key 6 mm
5 = Spring washer B8 DIN127 A4, 2 pcs
6 = Washer A8.4 DIN9021 A4, 2 pcs

Connecting the Lifting Rod to the Mast

The delivery contains the lifting rod that is used, with the winch, to erect and tilt the upper parts of the mast. The clamps are preinstalled at the factory to the pedestal tube and to the first part of the mast. The clamp on the lifting rod has hooks and taps to ease the installation. The stainless steel bolts are included in the "Lifting Rod Assembly Set". To attach the lifting rod to the first part of the mast:

1. Place the lifting rod (number 3 in Figure 15 below) to the first part of the mast (4).
2. Make sure that both taps on the clamp go into the railing and the hooks at the end of the clamp go firmly around the opposite clamp.
3. Install the Allen bolts with the washers and tighten them with an Allen key (6 mm).

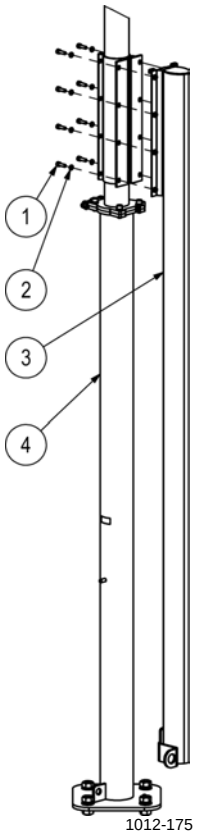

Figure 15 Lifting Rod Installation

The following numbers refer to Figure 15 above:

1 = Allen bolt M8x25 DIN912 A4, 8 pcs; use Allen key 6 mm
2 = Spring washer B8 DIN127 A4, 8 pcs
3 = Lifting rod
4 = First part of the mast

Assembling the Remaining Parts of the Mast

The remaining parts of the mast have an O-ring (number 1 in Figure 16 below) installed on the mast part. Just slide the parts of the mast together to connect them. You need to rotate either of the parts to align the groove (2) on the upper part and the ridge (3) inside the lower part.

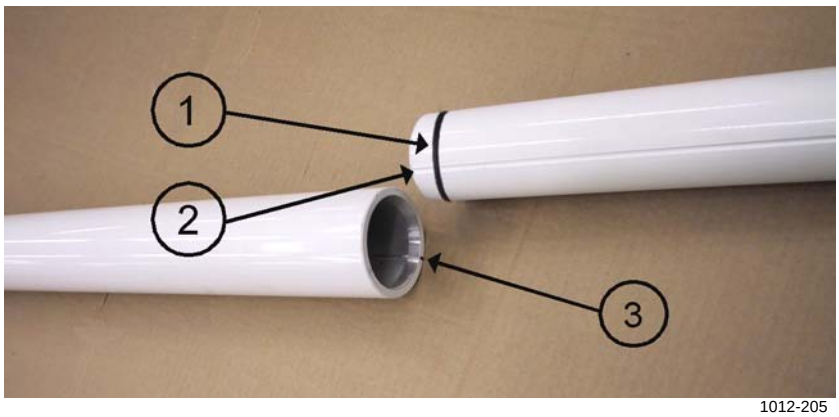

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Figure 16 Alignment of Remaining Parts of the Mast

Connecting the Guy Wires to the Mast

1. Install the clamps (numbers 1 in Figure 17 below) with the washers and Allen bolts (4, 5) around the narrowing of the mast (2), 1 m from the top.
2. Aim the clamps assembly so that the snap hook (7) of detachable guy wire 1 (6) points **upward** when the mast is tilted.
3. Tighten the Allen bolts.

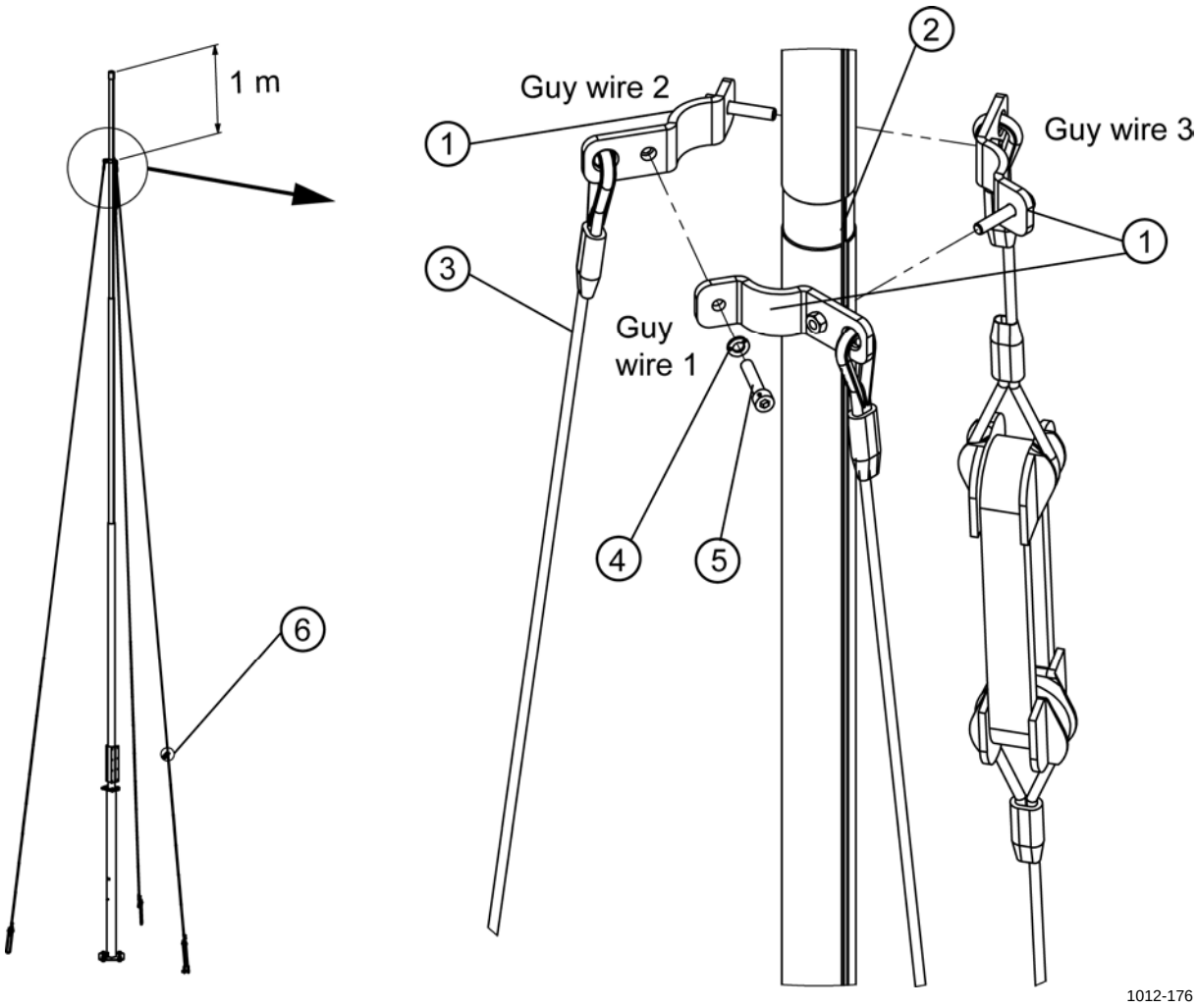

Figure 17 Connecting Guy Wires to the Mast

The following numbers refer to Figure 17 above:

1 = Clamps
2 = Narrowing of the mast
3 = Guy wire
4 = Washer B8 DIN127 A4, 3 pcs
5 = Allen bolt M8x40 DIN912, 3 pcs; use Allen key 6 mm
6 = Guy wire 1 with the snap hook

Installing the Lightning Rod

To install the lightning rod, proceed as follows:

1. Slide the lightning rod (number 1 in Figure 18 on page 55) to the holes in the lightning rod holders (2) and attach the rod to the holders using the fastening plates (6).
2. Attach the lighting rod holders to the mast so that they point to the same direction as the isolated guy wire 3 (number 8 in Figure 18 on page 55; see also Figure 4 on page 37).
3. Before erecting the mast, attach the grounding cable to the isolated guy wire 3 with cable ties (9), starting below the isolation block.

NOTE Leave some extra cable between the lightning rod and the wire clip on the guy wire to ensure that the guy wire does not pull the lightning rod downward.

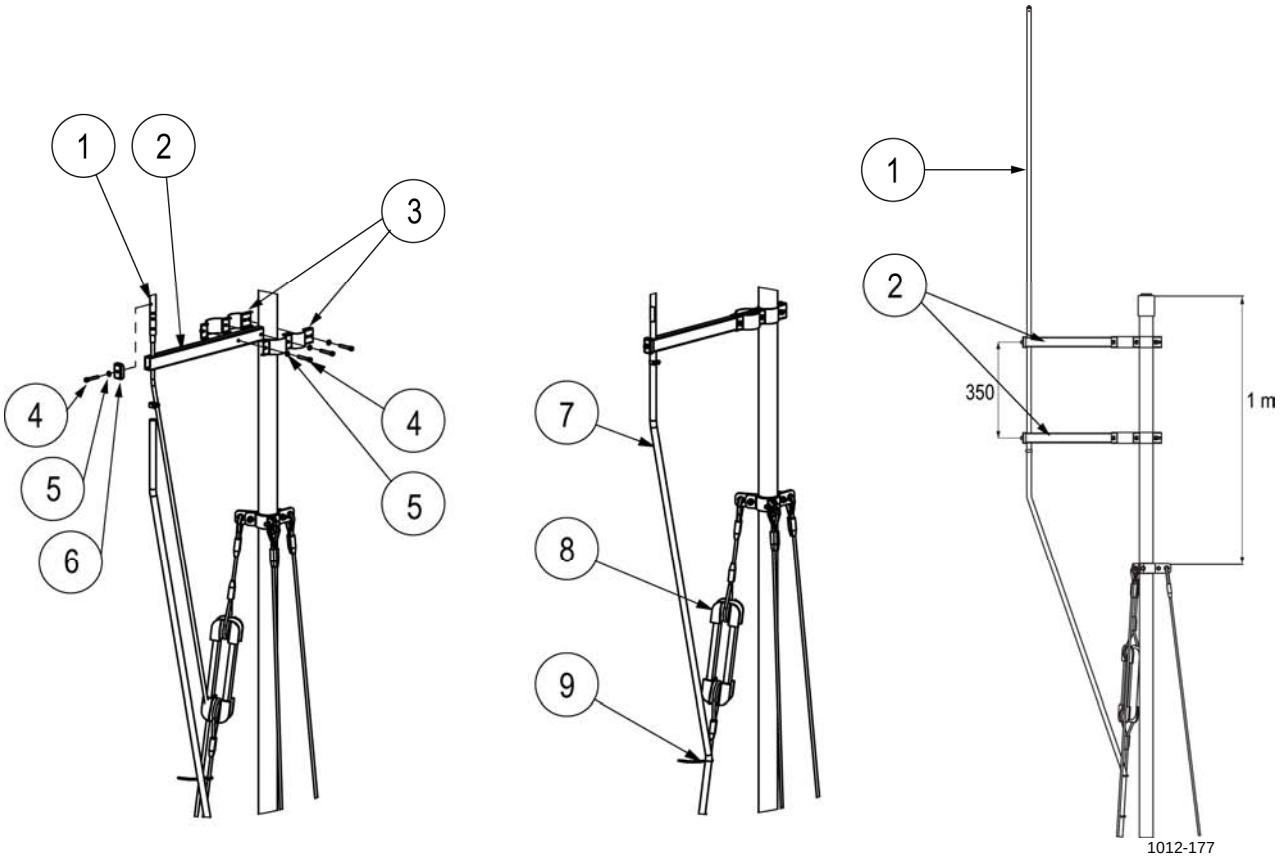

Figure 18 Lightning Rod Installation

The following numbers refer to Figure 18 above:

1 = Lightning rod
2 = Lightning rod holder, 2 pcs
3 = Mounting clamp, 4 pcs
4 = Allen bolt M6x40 DIN912 A4, 7 pcs; use Allen key 5 mm
5 = Spring washer B6 DIN127 A4, 7 pcs
6 = Fastening plate
7 = Grounding cable
8 = Isolated guy wire 3
9 = Cable tie

NOTE	At this point, it is highly advisable to erect the mast to ensure that the installation is secure and the guy wires are firmly attached and of correct length. After you have carefully verified the installation, tilt the mast again and start installing sensors and accessories (wind sensors, GSM/GPRS antenna, and solar panel).

Erecting Mast DKP210

Before erecting the mast, check that all the parts are firmly attached. Check that the top fastener is secure on the upper end of the mast.

Installing and Using the Winch

It is recommended that you use the easy-to-install winch for erecting the mast. After use, the winch should be removed and stored to a dry place.

1. Attach the handle (number 2 in Figure 19 below) to the winch.

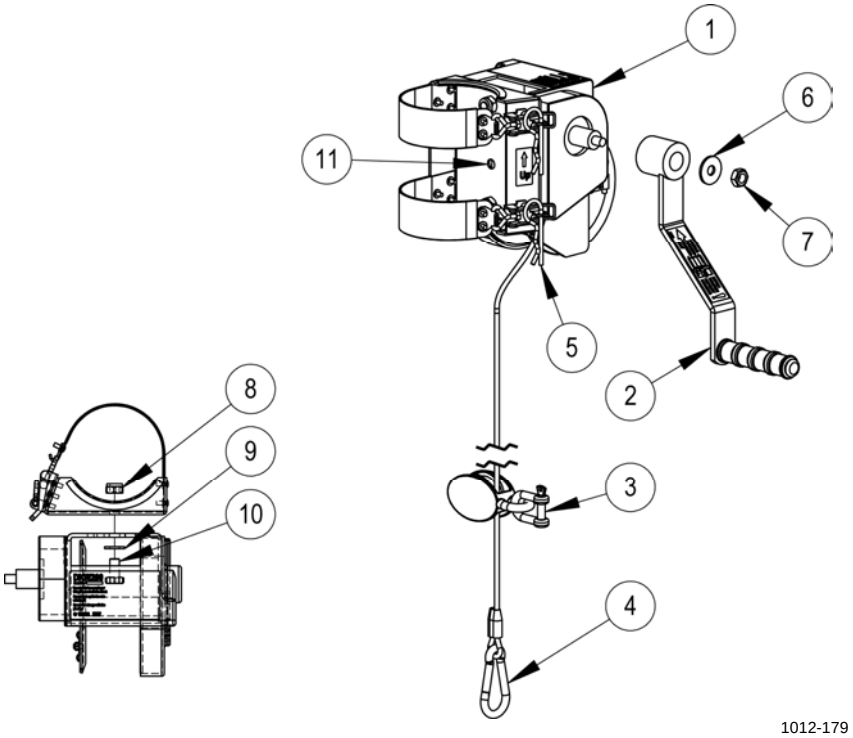

Figure 19 Assembling Winch

The following numbers refer to Figure 19 above:

1 = Winch
2 = Winch handle
3 = Shackle; attach to the lowest part of the mast.
4 = Snap hook; attach to lifting rod
5 = Keen pin, 2 pcs
6 = Washer A10.5 DIN9021 A4
7 = Nut M10 DIN984 A4; use wrench 17 mm
8 = Nut M10 DIN985 A4, 2 pcs; use wrench 17 mm
9 = Washer A10 DIN125 A4, 2 pcs
10 = Bolt A10 DINM10x20 DIN933 A4, 2 pcs; use wrench 17 mm
11 = Alignment hole for mast installation

2. Install the winch toward the pedestal tube so that the tap (number 3 in Figure 20 below) on the tube goes to the hole (2) on the winch. Make sure that the plastic cover on the winch faces up.

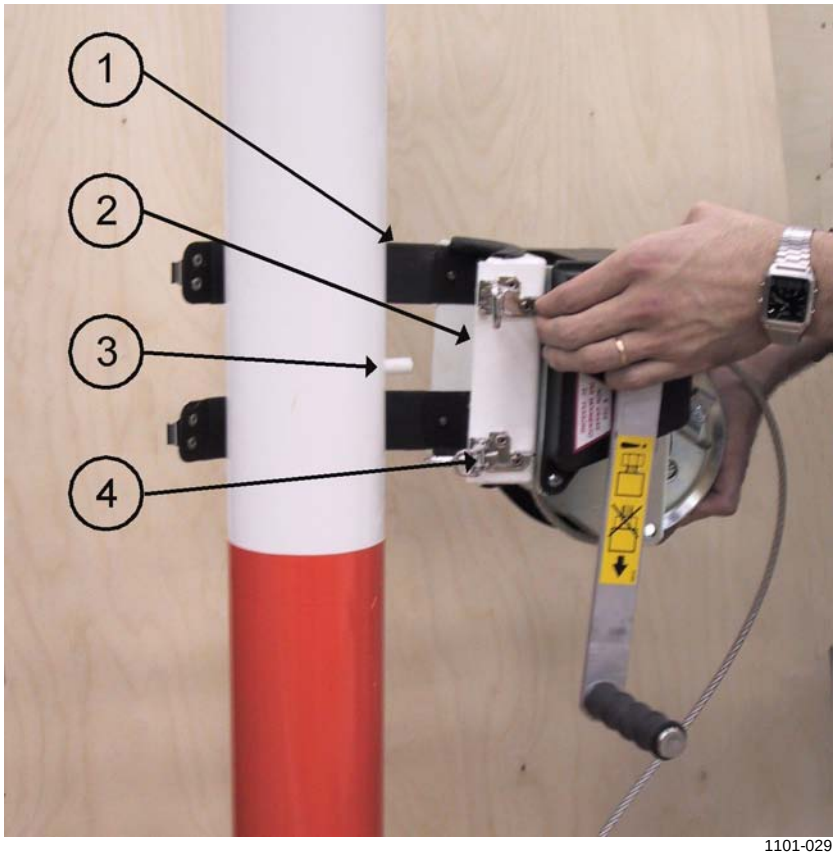

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Figure 20 Winch Installation

3. Wrap the clamps (1) around the tube to the clamp assemblies (4) and attach them.
4. Finally, secure the clamps with the provided pin clips as shown in Figure 21 below.

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Figure 21 Securing Clamp of the Winch

5. Attach the cable bearer to the plate lug (number 5 in Figure 13 on page 49) of the pedestal plate. Make sure that the free wire end points toward the end of the lifting rod (see correct positioning of the cable bearer in Figure 22 below).
6. Clip the hook of the guy wire to the plate lug of the lifting rod.
7. Take a good grasp on the handle and turn it clockwise to tighten the wire and lift the mast slightly. The winch is equipped with a friction break and thus, it stops automatically when you release the handle.
8. Remove the tilting support and erect the mast.

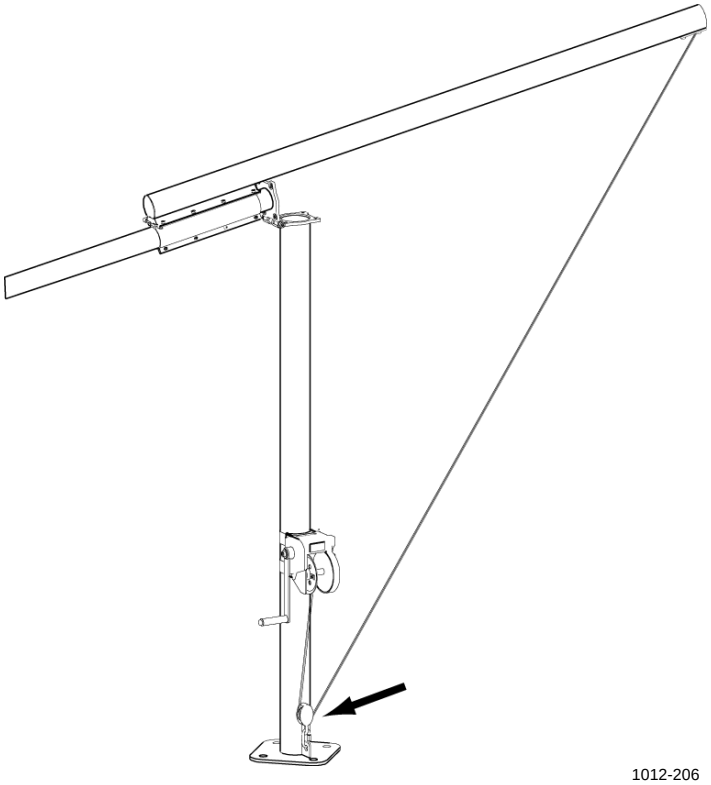


Figure 22 Winch Installed, Cable Bearer Marked with Arrow

WARNING	Make sure that there are no people under the mast when the mast is being erected.

WARNING	When erecting the mast with the winch, avoid touching the wire with bare hands. Do not try to guide the wire.

WARNING	Always wear gloves when using the winch. Do not touch the gears of the winch.

Securing the Hinge

After erecting the mast, secure the hinge with the provided accessories as illustrated in Figure 23 below. Refer also to Figure 14 on page 50.

NOTE	Always assemble the washers (number 3 in Figure 23 below) under the spring washers (2) to prevent the paint from being damaged.

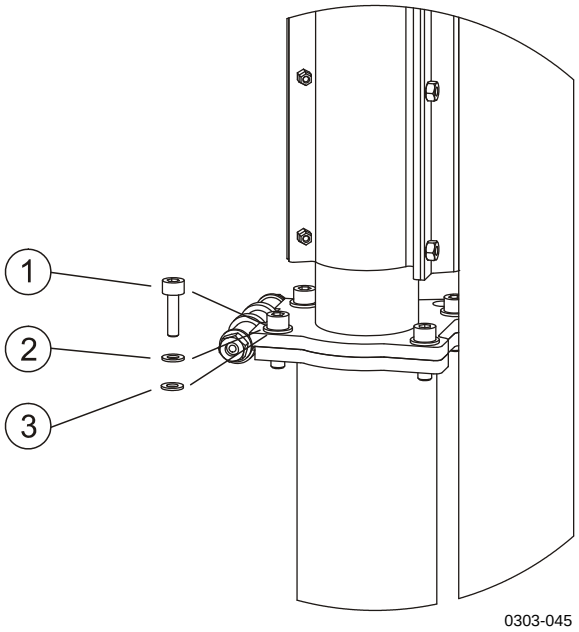


Figure 23 Bolts and Washers for Securing the Hinge

The following numbers refer to Figure 23 above:

1 = Allen bolt M10x30 DIN912 A4, 4 pcs; use Allen key 8 mm
2 = Spring washer B10 DIN127 A4, 4 pcs
3 = Washer A10.5 DIN125 A4, 4 pcs

Connecting the Guy Wires to the Concrete Blocks

1. For the guy wires 2 and 3, connect the U-bolt (number 4 in Figure 24 on page 61) to the eye nut (5) installed on the concrete block. Slide the strap (3) onto the U-bolt and thread the nuts.
2. For the guy wire 1, connect the U-bolt to the eye nut with an additional bow shackle to enable easy releasing of the wire. The strap is used the same way as with the guy wires 2 and 3.
3. Guide the guy wire through the strap (3) around the wedge (9) and back through the strap. Pull the loose wire through the strap and secure it with wire clips.
4. After assembling the wire clips properly, tension the guy wire by tightening the nuts to slide the strap until the initial tension of the guy wires is sufficient.

NOTE	When tensioning the guy wires, make sure that the mast remains straight and that all the guy wires are equally tensioned.

5. Finally, place the black and yellow cable shrouds around the guy wires. There is one package of shrouds for each wire. Place the extra guy wire inside the cable shrouds.

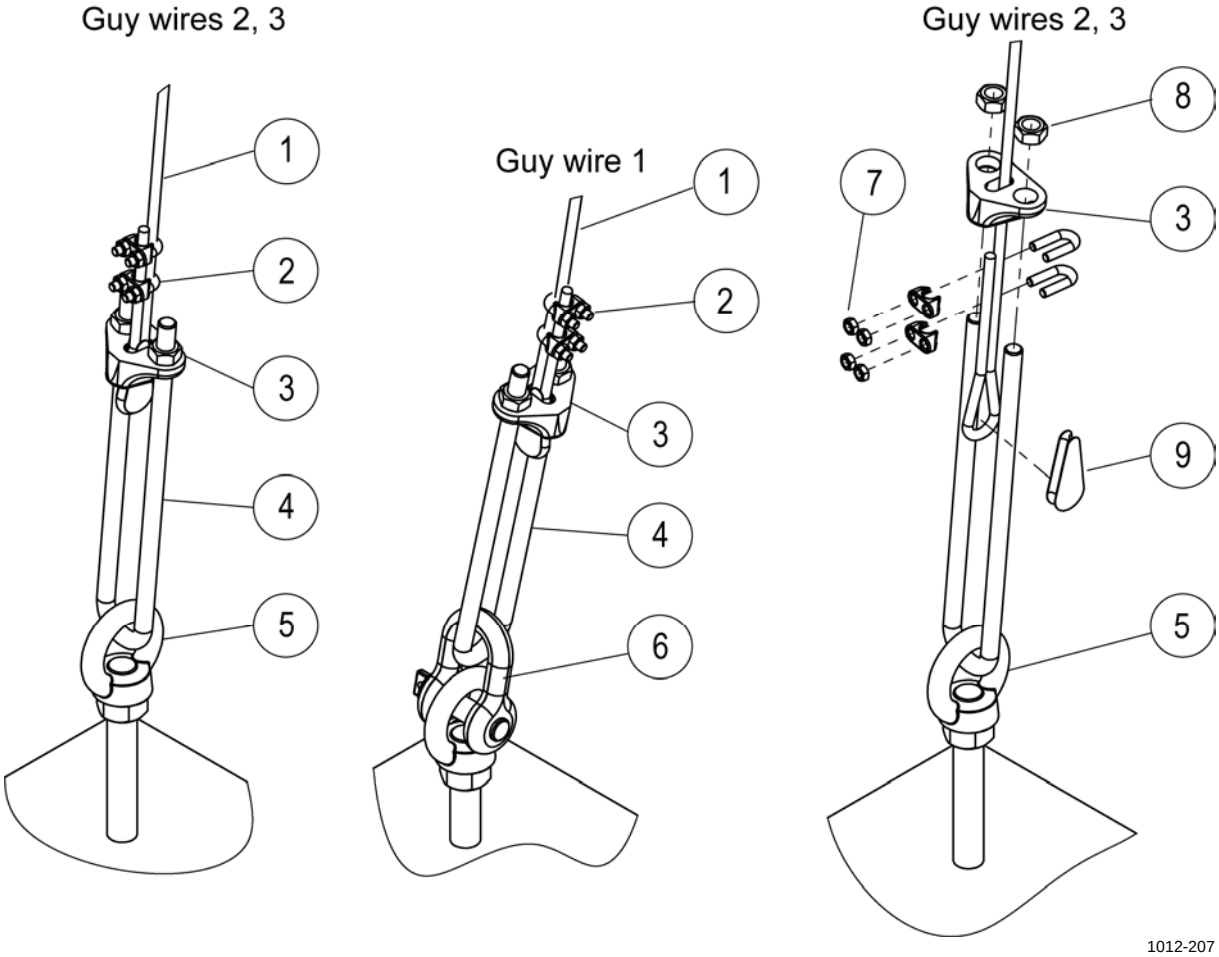


Figure 24 Connecting Guy Wires to Concrete Blocks

The following numbers refer to Figure 24 above:

1 = Guy wire
2 = Wire clip
3 = Strap
4 = U-bolt
5 = Eye nut
6 = Additional bow shackle
7 = Nut M6 DIN934; use wrench 10 mm
8 = Nut M12 DIN934; use wrench 19 mm
9 = Wedge

Installing Ultrasonic Wind Sensor WMT703

Ultrasonic Wind Sensor WMT703 measures wind speed and direction. WMT703 is installed on top of the mast with the FIX70 mounting kit.

The sensor is shipped in a custom cardboard container with plastic transportation dampers. When unpacking WMT703, remove only the damper that protects the sensor body. Do not remove the damper that protects the array.

CAUTION Do not remove the transportation damper that protects the array until you have installed WMT703.

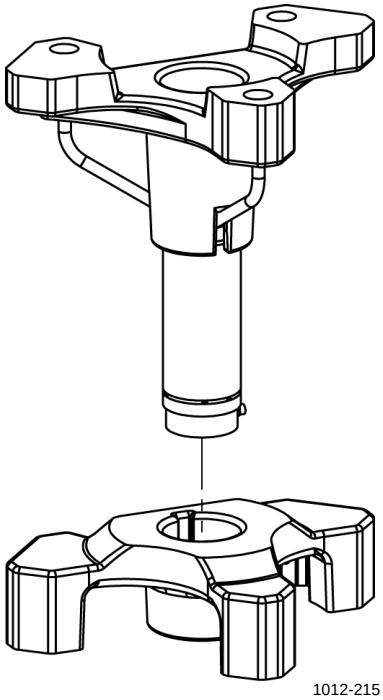


Figure 25 Removing WMT703 Transportation Damper

NOTE Save the container and all the packaging materials for future transporting or shipping.

CAUTION When handling WMT703, do not rotate, pull, strike, bend, scrape, or touch the transducers with sharp objects. Any impact on the wind sensor array damages the device.

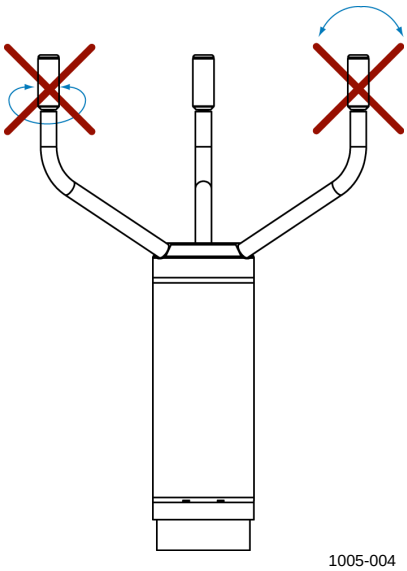


Figure 26 WMT703 Sensor Handling

WARNING A lightning rod must be installed above the wind sensor; see section Equipment Grounding and Lightning Protection on page 36.

WARNING Do not install WMT703 when there is a risk of thunderstorm or lightning activity in the area.

Mounting WMT703

To mount WMT703 on the mast, proceed as follows:

1. Attach the mast adapters (numbers 2, 4, and 5 in Figure 27 on page 65, both sides) to the FIX70 mounting kit (1).
2. Install the FIX70 mounting kit to the mast (11) with the U-bolts (7). Do not tighten the U-bolts (7, 8, 9) too much at this stage because you still need to rotate the bracket to align WMT703 (6) after the installation.
3. Connect the cable to the wind sensor. Tighten the connector by rotating the connector by hand clockwise, see Figure 28 on page 66.
4. Hold the wind sensor (6) from its body and slide the sensor into the FIX70 mounting kit (1). Turn the sensor so that the fixing screw (10) slides into the appropriate slot. Turn the sensor until the fixing screw reaches the far end of the slot. Tighten the fixing screw.

CAUTION	Do not remove the transportation damper that protects the array before aligning the sensor. Do not touch the array when handling WMT703.

5. Remove the transportation damper protecting the array and store it for future use.
6. Align WMT703 as instructed in section Aligning Ultrasonic Wind Sensor WMT703 on page 67.
7. Secure the sensor cable to the mast with cable ties.
8. Connect the sensor cable to the **WMT70 Data** and **WMT70 Power** connectors on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

See also section Installation Tips for Aligning Wind Sensors on page 69.

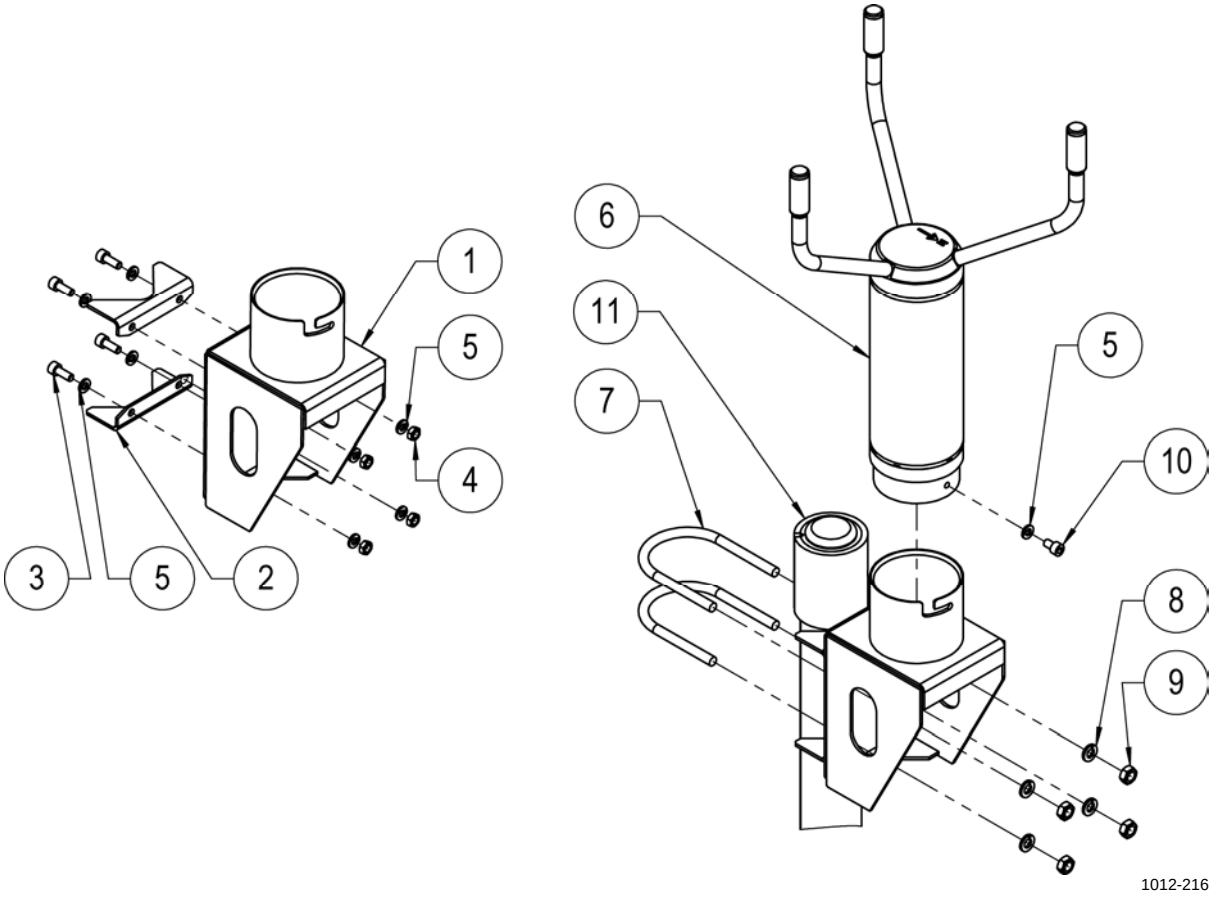


Figure 27 Installing Ultrasonic Wind Sensor WMT703

The following numbers refer to Figure 27 above:

1 = FIX70 mounting kit
2 = Mast adapter for FIX70 mounting kit
3 = Screw M6x16 DIN912 A4, 4 pcs; Allen key 5 mm
4 = Nut M6 DIN934 A4, 4 pcs; use wrench 10 mm
5 = Spring washer B6 DIN127 A4, 9 pcs
6 = Ultrasonic Wind Sensor WMT703
7 = U-bolt
8 = Spring washer B8 DIN127 A4, 4 pcs
9 = Nut M8 DIN934 A4, 4 pcs; use wrench 13 mm
10 = Fixing screw M6x10 DIN912 A4, 1 pcs; use Allen key 5 mm
11 = Mast

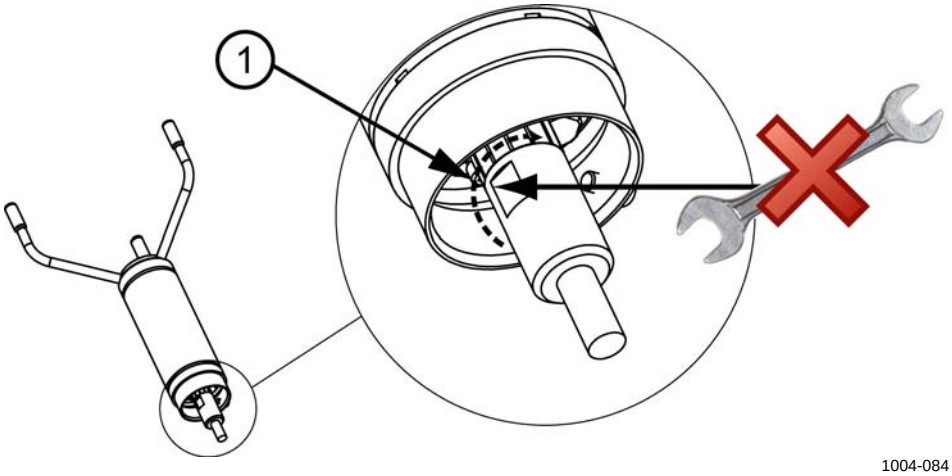


Figure 28 Tightening the Connector

The following number refers to Figure 28 above:

1 = Tighten the connector by rotating the ribbed part of the connector by hand. **Do not use tools.**

NOTE	Verify that the connector is properly tightened to avoid water leakage and damage to the sensor. If water leaks into the connector, the warranty for WMT703 is voided.

Checklist for Connection Cables

Take the following issues into account when installing WMT703:

- Routing of the cables depends on the mounting option selected for WMT703. When mounting to a mast, the cable can be routed either outside or inside the mast, depending on the mast type and other equipment (for instance, lightning rods) installed to the mast.
- Make sure that the cable is properly attached to the mast or cross arm before starting the installation. Otherwise, it may slip and fall down during the installation.
- It is important to attach the cable properly to avoid strain to the connector. Too much strain may cause the cable to fall off, damage the cable or connector, or make the cable or connector susceptible to water leakage. The recommended minimum bending radius for the cable is 70 mm.

WARNING	Make sure that you connect only de-energized wires.

WARNING Using a long cable between different units (sensors, transmitters, power supplies, and displays) can cause a lethal surge voltage if a lightning strike occurs in the vicinity. Always apply proper grounding procedures and follow the requirements of the local Electrical Code.

Aligning Ultrasonic Wind Sensor WMT703

WMT703 is permanently marked with the letter N and a north arrow. WMT703 needs to be aligned in such a way that this arrow points to the north. Misaligning WMT703 causes a wind direction offset error in the measurement results, as shown in Figure 30 on page 68.

To align WMT703, proceed as follows:

1. Determine whether the array of WMT703 is correctly aligned with a compass or other similar method.
2. If the alignment is not correct, readjust the orientation: rotate the FIX70 mounting kit so that the north arrow and the north transducer point to the north in the measurement location. Do not remove WMT703 from the mounting kit during the alignment process. Tighten the bolts of the FIX70 mounting kit.

Figure 29 below and Figure 30 on page 68 show the correct alignment and the measurement error caused by misalignment of WMT703.

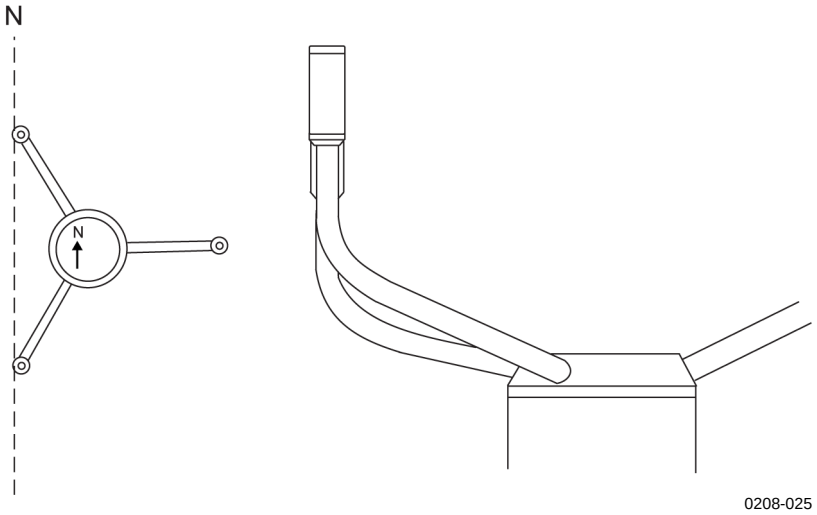


Figure 29 Correctly Aligned WMT703

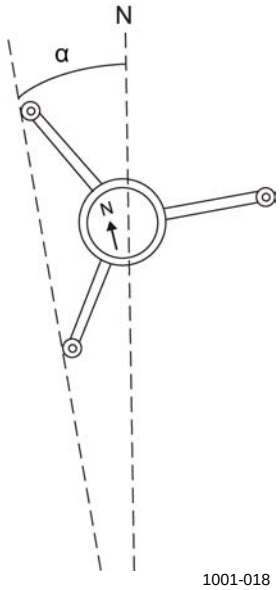


Figure 30 Incorrectly Aligned WMT703 and the Resulting Offset Error

N = The correct direction for true north
a = The wind direction offset error caused by the misalignment of WMT703

Installation Tips for Aligning Wind Sensors

If you have successfully installed Mast DKP210 so that it tilts exactly toward west (in the northern hemisphere), you can align the wind sensor correctly using a regular spirit level.

1. Tilt the mast (number 1 in Figure 31 below) and set it resting on the tilting support (2).
2. Set the spirit level (4) on the WAC151 sensor arm (or on the two lower transducer arms if installing Ultrasonic Wind Sensor WMT703).
3. Check the level that the sensor assembly so that it is exactly horizontal. Tighten the sensor support arm (or the FIX70 mounting kit if installing WMT703) to the mast.
4. Lift the mast, and the wind sensor is aligned correctly toward north.

If you have not succeeded in installing the mast so that it tilts exactly to the west, but it tilts, for example, 5° toward south-west, you can correct the declination by applying the difference angle 5° to the horizontal level. Use the appropriate angle meter to set the correct declination.

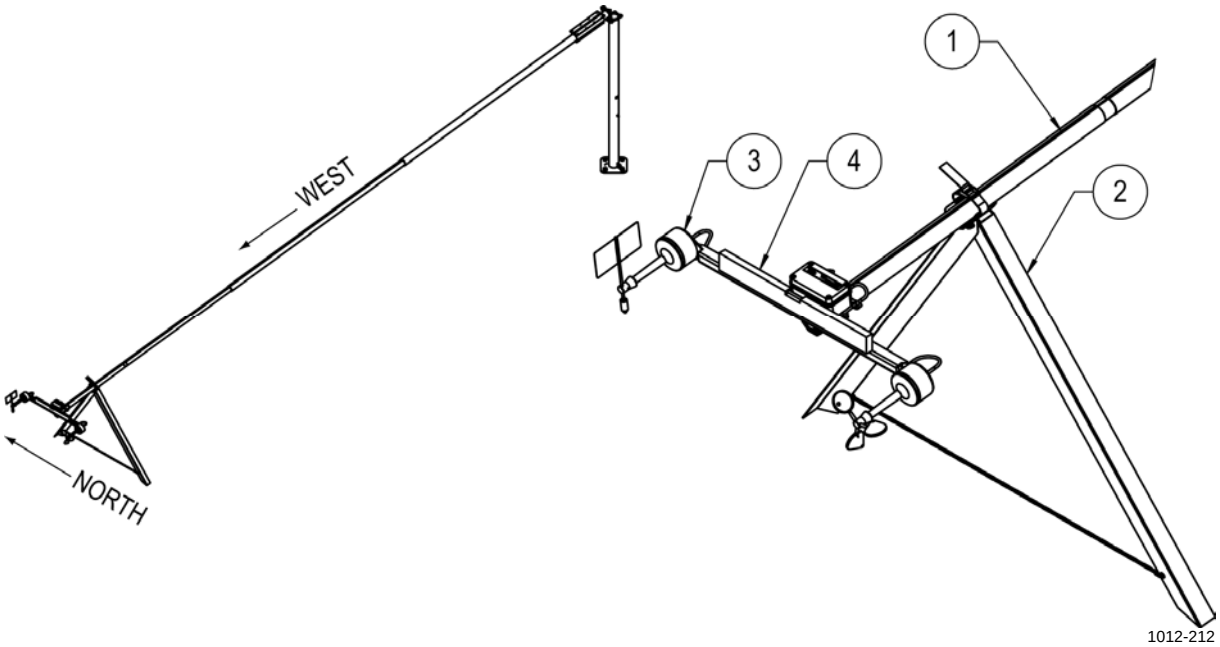


Figure 31 Installing Wind Sensors

The following numbers refer to Figure 31 above:

1 = Mast
2 = Tilting support
3 = Instrument (WA15)
4 = Spirit level

Installing Mechanical Wind Sensor Set WA15

Mechanical Wind Sensor Set WA15 consists of a Vaisala Anemometer WAA151, a Vaisala Wind Vane WAV151, a cross arm WAC151, a junction box, and cabling.

Install WA15 as follows:

1. Attach the cross arm to the top of a pole mast with the mounting clamp. Check that vane end of the cross arm is pointing **north** as shown in Figure 31 on page 69.
2. Mount the sensors onto the cross arm as shown in Figure 32 on page 71.
3. Bind the cables to the mast with cable ties.

WARNING Using a long cable between different units (sensors, transmitters, power supplies, and displays) can cause a lethal surge voltage if a lightning strike occurs in the vicinity. Always ground the mast equipment case close to the mast with a short, low-resistance cable.

4. Connect the sensor cables DRW222446 and DRW222447 to the **WIND1** and **WIND2** connectors on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

See also section Installation Tips for Aligning Wind Sensors on page 69.

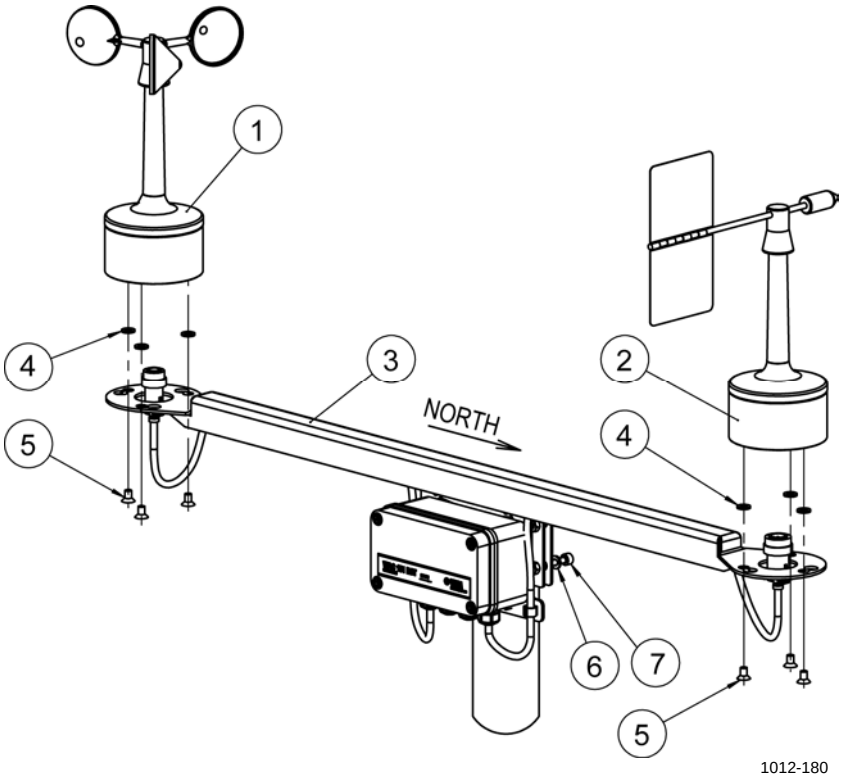


Figure 32 Mechanical Wind Sensor Set WA15 Installation

The following numbers refer to Figure 32 above:

1 = Anemometer WAA151
2 = Wind Vane WAV151
3 = Cross arm WAC151
4 = Washer anti-loss A6.4 PE LD, 6 pcs
5 = Screw M6x16 DIN7992 A4, 6 pcs; use Allen key 4 mm (preinstalled)
6 = Washer A6.4 DIN127 A4, 4 pcs (pre-installed)
7 = Screw M6x25 DIN912 A4, 4 pcs; use Allen key 5 mm (preinstalled)

Installing GSM/GPRS Antenna

To install the GSM/GPRS modem, you need to mount the antenna to the mast and insert the SIM card into the modem (see section Preparing GSM/GPRS Modem on page 96).

The GSM/GPRS antenna is an omnidirectional antenna. The antenna provides high gain, enabling better signal at installation sites where long distances to the base station or the terrain cause uncertain connections. In addition to giving a stable connection, a strong signal also reduces the power consumption of the station. The antenna cable is high-quality coaxial cable.

1. Install the GSM/GPRS antenna to the mast at the height of approximately 5 meters. Check that the antenna cable reaches its connector well and that there is some loose cable.
2. Bind the cables to the mast with cable ties.
3. Connect the antenna cable to the **GSM Antenna** connector on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

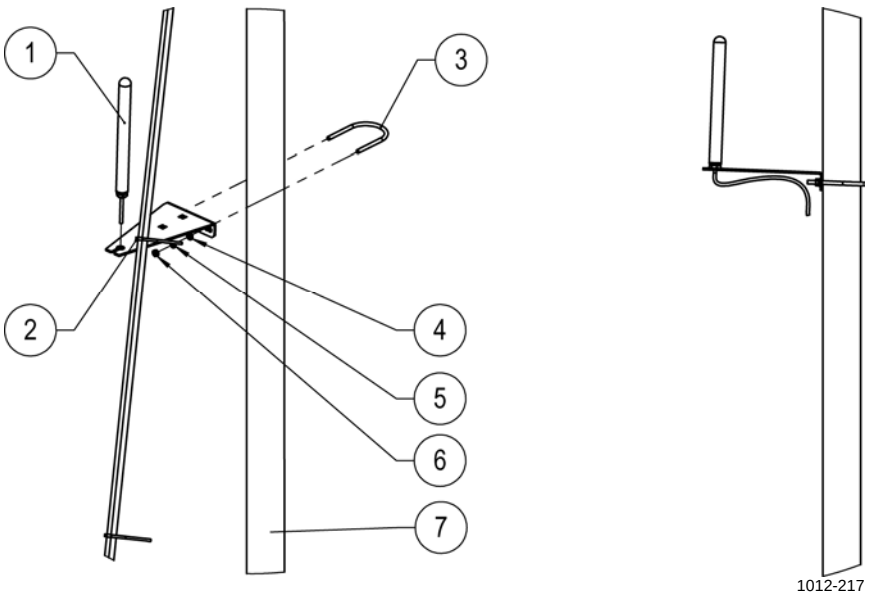


Figure 33 GSM/GPRS Antenna Installation

The following numbers refer to Figure 33 above:

1 = GSM/GPRS antenna
2 = Fastening plate
3 = U-bolt
4 = Washer A6.4 DIN125
5 = Spring washer B6 DIN127
6 = Nut M6 DIN934
7 = Mast DKP210

Installing Solar Panel SOLAR33

Solar Panel SOLAR33 is a custom-designed module incorporating high-power efficiency and quality. The 33 W panel contains 36 polycrystalline silicon cells. The SOLAR33 modules are lightweight and have high power and a robust construction.

The cells are protected from dirt, moisture and mechanical impact using a tempered, low-iron glass front. The solar circuit is laminated using EVA (Ethylene Vinyl Acetate) between tempered glass and a durable, multi-layered polymer back sheet for superior moisture resistance.

WARNING Photovoltaic modules generate direct current (DC) when exposed to sunlight or other sources of light. Although single modules produce low voltage and current, shocks and burns can still result from contact with module output wiring.

CAUTION Handle the solar panel with care: impact on the front or rear surface can damage the module. Do not bend the panel.

CAUTION When working with the panel, use properly insulated tools and wear rubber gloves.

NOTE The rays of the sun should be perpendicular to the panel. In other words, sunlight should hit the panel at a 90° angle.

NOTE Do not concentrate light on the panel in an attempt to increase its power output.

Install the solar panel as follows:

1. Mount the panel to the mast using the provided brackets. Face the panel **south** (true south, not magnetic) on the northern hemisphere and north on the southern hemisphere. The recommended installation height is roughly 4 m from the ground level. Secure the bolts firmly.
2. Adjust the tilting of the solar panel by loosening the adjusting screws. Be careful not to damage the power cable during the tilting. Remember to tighten the screws in the end. Finding the correct angle, shown in Figure 35 on page 76:
   a. The panel is tilted toward the sun. The further you are from the equator, the more vertical the panel.
   b. Maximize the annual energy output by installing the panel at an angle recommended in Table 18 on page 76. In some installations, it may be effective to adjust the tilt seasonally. At most latitudes, performance can be improved during summer by using an angle smaller than the table's recommendation. Conversely, a larger angle can improve winter performance.
3. Guide the solar panel cable down the mast, keeping it away from the grounding cable. Secure the cable with cable ties.

Do not connect the solar panel cable to the enclosure until the mechanical installation of AWS330 is complete, the backup batteries are connected, and the weather station is ready for powering; see instructions in section Powering Up the System on page 99.

CAUTION	Do not connect Solar Panel SOLAR33 before the mechanical installation of the entire AWS330 is complete.

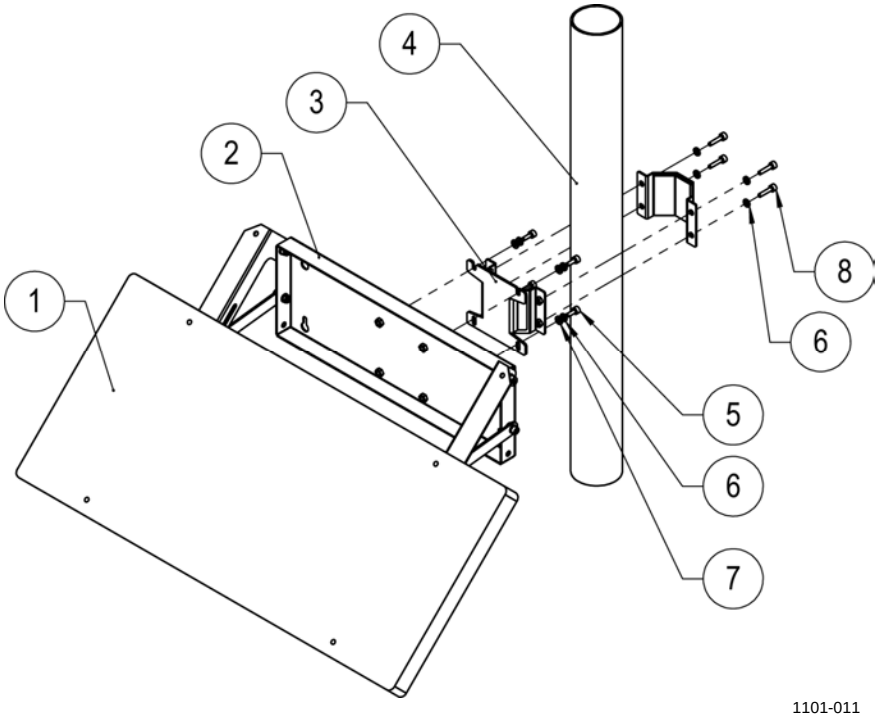


Figure 34 Installing Solar Panel SOLAR33

The following numbers refer to Figure 34 above:

1 = Solar panel
2 = Frame for solar panel
3 = Bracket APPK-SET75
4 = Pole mast
5 = Screw M6x20 DIN912 A4, 4 pcs; use Allen key 5 mm
6 = Spring washer B6 DIN127 A4, 8 pcs
7 = Washer A6 DIN 125 A4, 4 pcs
8 = Screw M6x25 DIN912 A4, 4 pcs; use Allen key 5 mm

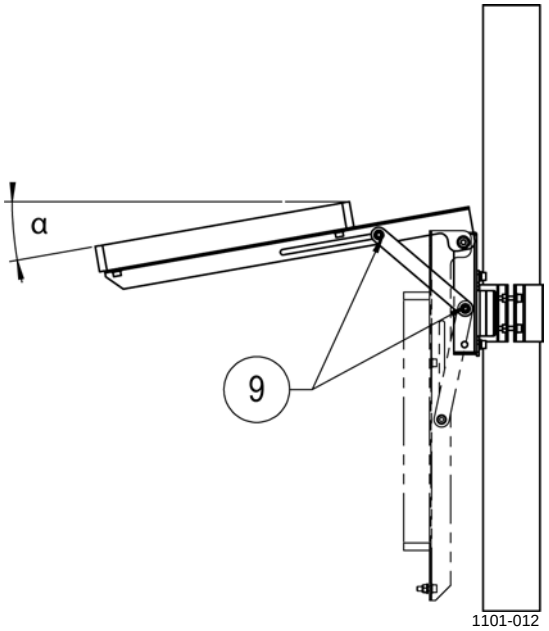


Figure 35 Adjusting Solar Panel SOLAR33 Tilting Angle

The following letter and number refer to Figure 35 above:

α = Tilting angle
9 = Adjusting screws; use Allen key 5 mm and wrench 10 mm

Table 18 Recommended Tilt Angle for Solar Panel

Latitude of Site	Tilt Angle
0 ...10°	20°
10 ... 50°	Add 10° to local latitude
>50°	60°

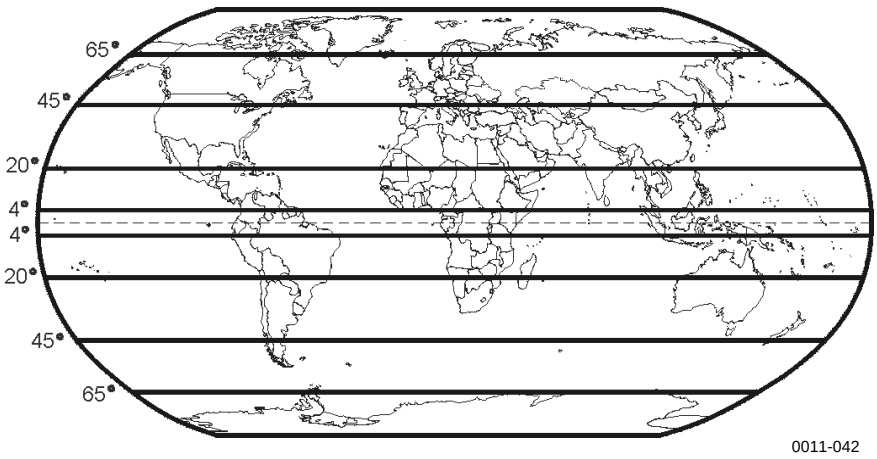


Figure 36 Map of Latitudes

Installing Sensor Support

Sensor support is mounted on the mast and serves for mounting several sensors. In AWS330, a suitable installation height to the mast is 1.8 meters.

Install the sensor support as follows:

1. Mount the sensor support to the mast using a U-bolt (number 2 in Figure 37 below) and the mounting plate (6).
2. Use a spirit level to verify that the arm is level.

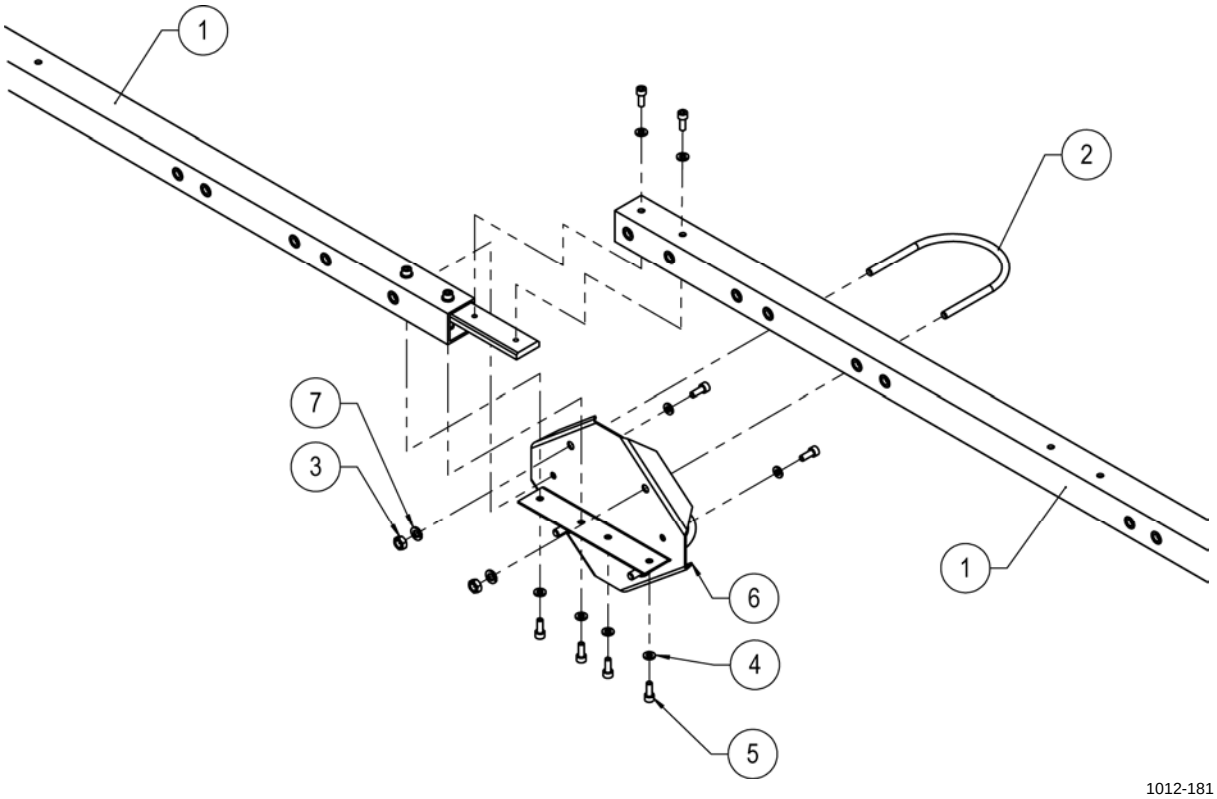


Figure 37 Mounting Sensor Support

The following numbers refer to Figure 37 above:

1 = Sensor support
2 = U-bolt
3 = Nut M8 DIN934 A4, 4 pcs
4 = Washer A6.4 DIN125 A4, 10 pcs
5 = Screw M6x16 DIN912 A4, 10 pcs; use Allen key 5 mm
6 = Mounting plate
7 = Spring washer B8 DIN127 A4, 4 pcs

NOTE	The sensor support package includes a bag of tools, screws, and other useful equipment that you can use for mounting the sensors onto the sensor support. Keep the bag for later use.

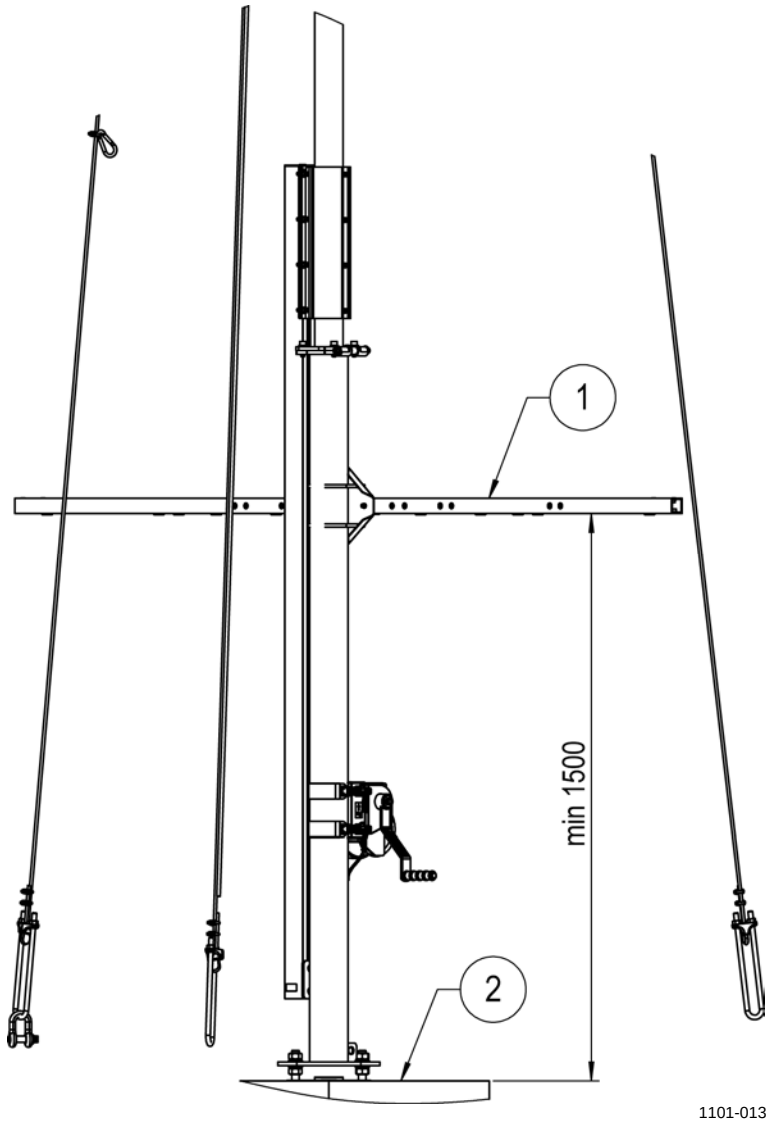


Figure 38 Sensor Support Mounted on Mast

The following numbers refer to Figure 38 above:

1 = Sensor support
2 = Foundation

When mounting only half the sensor support:

1. Mount the sensor support to the mast using a U-bolt (number 2 in Figure 39 below) and the mounting plate (6).
2. Use a spirit level to verify that the arm is level.

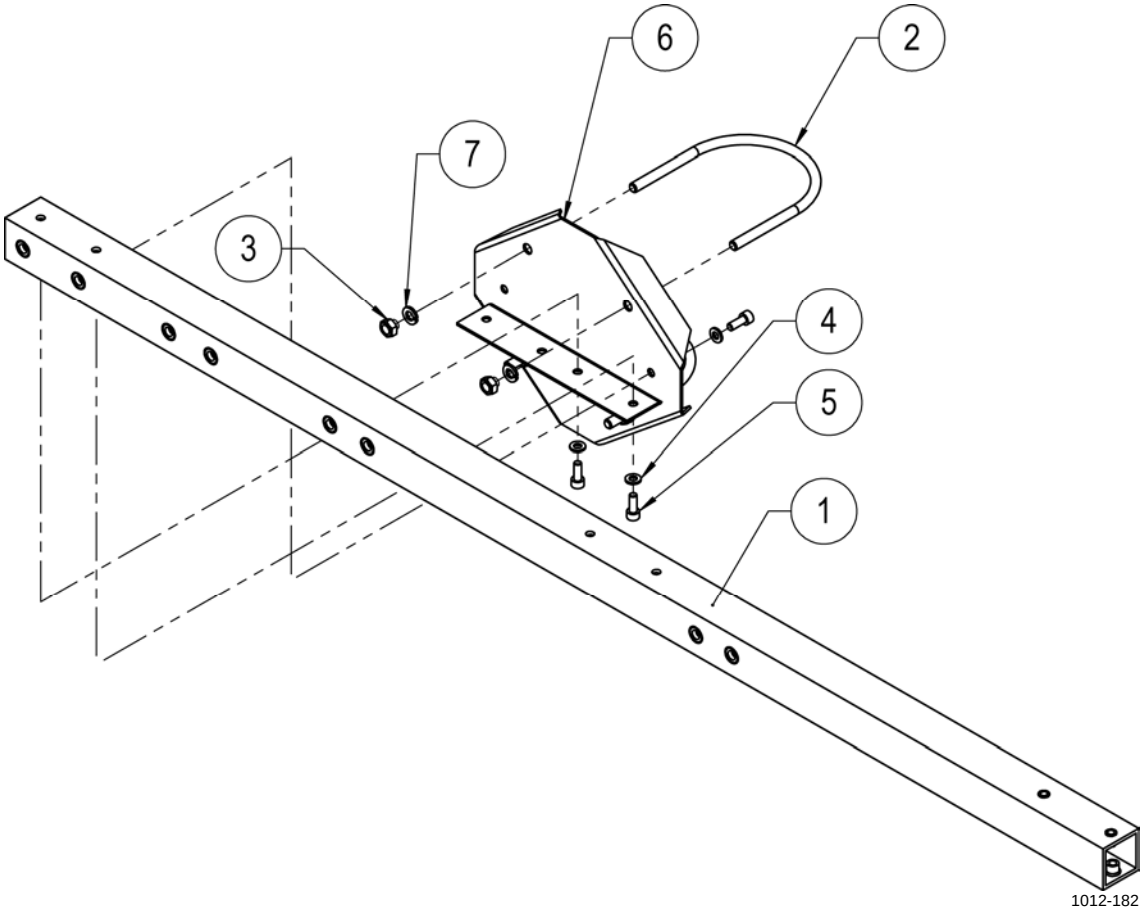


Figure 39 Mounting Half Sensor Support

The following numbers refer to Figure 39 above:

1 = Sensor support
2 = U-bolt
3 = Nut M8 DIN934 A4, 4 pcs
4 = Washer A6.4 DIN125 A4, 3 pcs
5 = Screw M6x16 DIN912 A4, 3 pcs; use Allen key 5 mm
6 = Mounting plate
7 = Spring washer B8 DIN127 A4, 4 pcs

Installing Air Temperature and Relative Humidity Probe HMP155

It is recommended that you install the HMP155 probe and Radiation Shield DTR503A onto a sensor support for WMO-compliant measurement results.

NOTE	The radiation shield is important in protecting the sensor from direct sunlight, and must always be used.

1. Install the radiation shield DTR503A (number 2 in Figure 40 on page 81) onto the sensor support.
2. Remove the protecting cover from the HMP155 probe. Loosen the fastening ring of the sensor with your fingers and put the sensor inside the radiation shield. Tighten the fastening ring without using excessive force.
3. Lead the sensor cable along the sensor support and attach it with cable ties.
4. Connect the sensor cable to the **Temp. / Hum.** connector on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

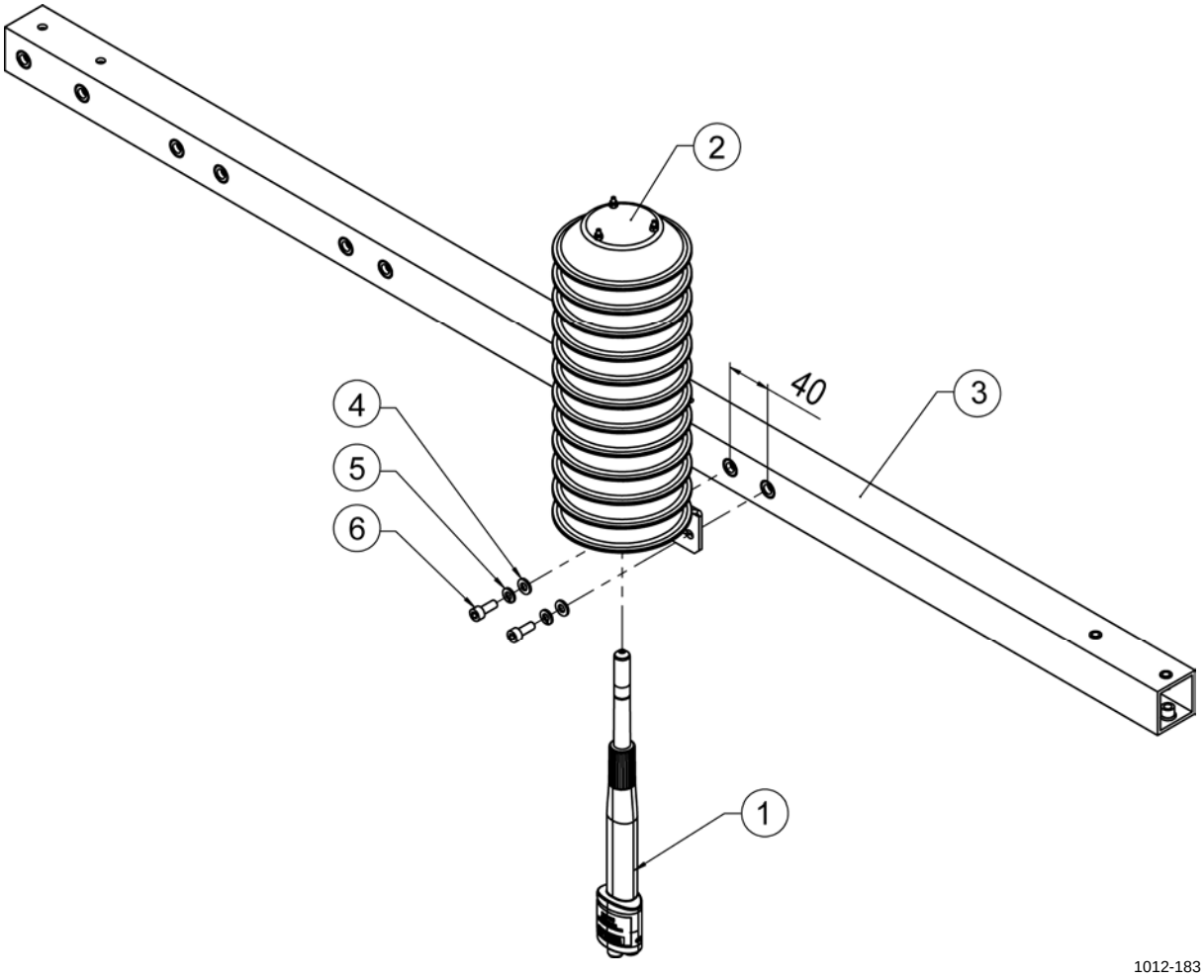


Figure 40 Installing HMP155 into Radiation Shield

The following numbers refer to Figure 40 above:

1 = HMP155 probe
2 = Radiation shield DTR503A
3 = Sensor support
4 = Washer A6.4 DIN125 A4, 2 pcs
5 = Washer B6 DIN127 A4, 2 pcs
6 = Screw M6x16 DIN912 A4, 2 pcs; use Allen key 5 mm

Installing Pyranometer CMP6

Pyranometer CMP6 is installed on a mounting plate for thermal isolation.

1. Install the mounting plate (number 2 in Figure 41 on page 83) onto the sensor support (1).
2. Prepare the sensor (3):
   a. Carefully remove the plastic cover of the sensor by pressing the clips on the cover.
   b. Attach the cable to the sensor and push the plastic cover back into place.

NOTE	Be careful not to drop the sensor when you remove the cover. The cover is attached tightly.

3. Attach the sensor onto the mounting plate[1)] on the sensor support. Place the pyranometer on the mounting plate so that the leveling screws (8) and the leg set in the small drillings on the mounting plate. Two long screws (6) and two nylon insulators (7) are provided for fixing the sensor on the mounting plate. The pyranometer should first be secured lightly with the screws to allow leveling.
4. Level the sensor by turning the leveling screws (8). Use the screw nearest to the spirit level first. When the sensor is straight according to the spirit level, the thermopile is horizontal within 0.05 °. This causes a maximum azimuthal variation of ±0.5% at a solar elevation of 10 °.

NOTE	Correct leveling of the sensor is essential for obtaining accurate measurements. Use the spirit level on the CMP6 to level the sensor.

5. Secure the pyranometer tightly with the two screws (6). Ensure that the pyranometer maintains its leveled position.
6. Route the sensor cable along the sensor support and secure it with cable ties.
7. Connect the sensor cable to the **Sol. Rad.** connector on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

[1)] Temperature fluctuations of the pyranometer body can produce offset signals. Thus, the sensor is thermally isolated from its fixtures using non-conducting materials.

NOTE Keep the original solar radiation sensor packaging for later shipments. Although all sensors are weatherproof and suitable for harsh ambient conditions, they do partially consist of delicate mechanical parts. It is recommended that you use the original shipment packaging in order to safely transport the equipment to the measurement site.

NOTE The drying cartridge of the pyranometer might need to be changed at times. See maintenance instructions of the sensor in section Pyranometer CMP6 on page 181.

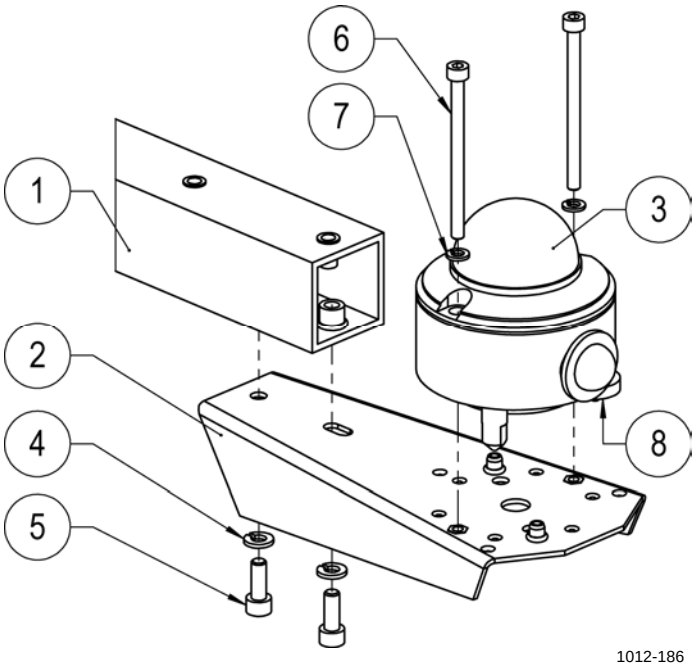


Figure 41 Installing Pyranometer CMP6

The following numbers refer to Figure 41 above:

1 = Sensor support
2 = Mounting plate KZFIXPLATE
3 = Pyranometer CMP6
4 = Washer B6 DIN127 A4, 2 pcs
5 = Screw M6x16 DIN912 A4, 2pcs; use Allen key 5 mm
6 = Screw M5, found in sensor package, 2 pcs, slot-head; use slothead screwdriver
7 = Nylon rings, found in sensor package, 2 pcs
8 = Leveling screw

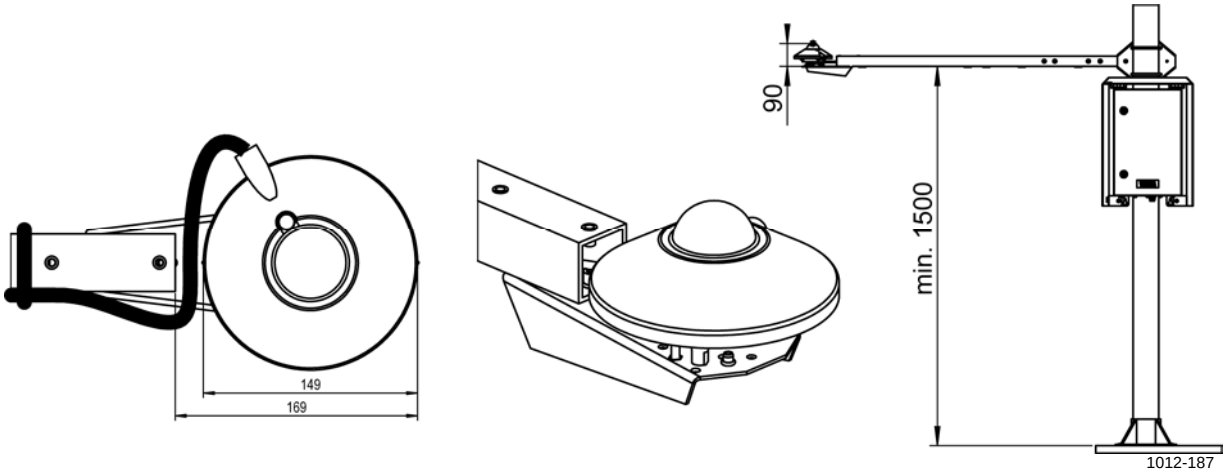


Figure 42 Pyranometer CMP6 Dimensions, Pyranometer CMP6 Installed

Installing Snow Depth Sensor IRU-9429

Snow Depth Sensor IRU-9429 is installed on the sensor support.

1. Attach the installation plate (number 5 in Figure 43 below) to the sensor support.
2. Place the sensor (4) through the installation plate and fasten with the hose clamp (6). Use the screw that comes with the clamp and tighten with wrench 10 mm.
3. Attach the sensor cover (4) to its place using the screws (7).
4. Bind the cable to sensor arm with cable ties.
5. Connect the sensor cable to the **SNOW DEPTH** connector on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

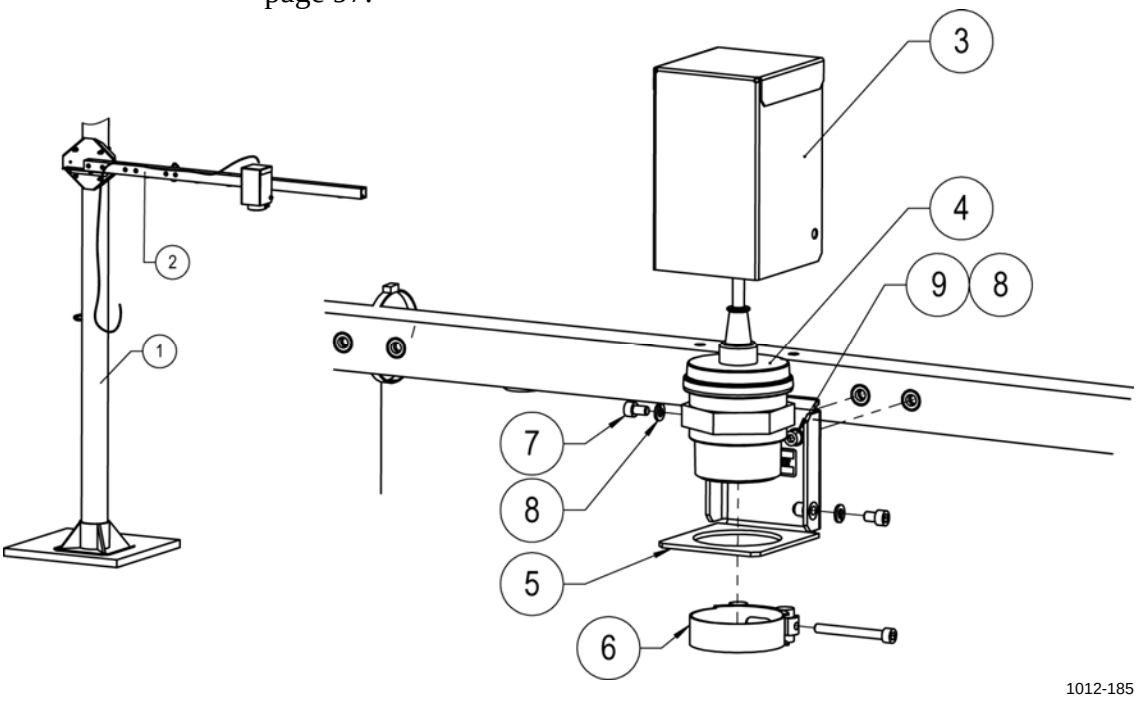


Figure 43 Snow Depth Sensor IRU-9429 Installation

The following numbers refer to Figure 43 above:

1 = Pole mast
2 = Sensor arm
3 = Cover IRUFIXSET
4 = Sensor IRU-9429
5 = Installation plate IRUFIXSET
6 = Hose clamp; use wrench 10 mm
7 = Screw M6x10 DIN912 A4, 2 pcs; use Allen key 5 mm
8 = Spring washer B6 DIN127 A4, 2 pcs
9 = Screw M6x16 DIN912 A4; use Allen key 5 mm

Installing Soil Temperature Sensor QMT110

Vaisala Soil Temperature Probe QMT110 is used for precision measurement of ground and soil temperatures. In AWS330, you can have up to two QMT110 sensors.

1. Choose a desired location for the sensor. Measurement site should be **undisturbed** ground, 1 m², and typical of the surface of interest. The ground surface should be level with respect to the immediate (10 m radius) area.
2. Make a hole with a shovel to a depth slightly deeper than the desired installation depth of the sensor.
3. To have good sensor contact with the soil, push the sensor into the **wall** of the hole **horizontally** until set firmly.
4. Fill the hole with the dug-up soil.
5. Connect the sensor cable to the **Soil T1** connector on the bottom of the enclosure. For two QMT110 sensors, use the **Soil T2** connector as well; see section Connecting Sensor Cables on page 97.

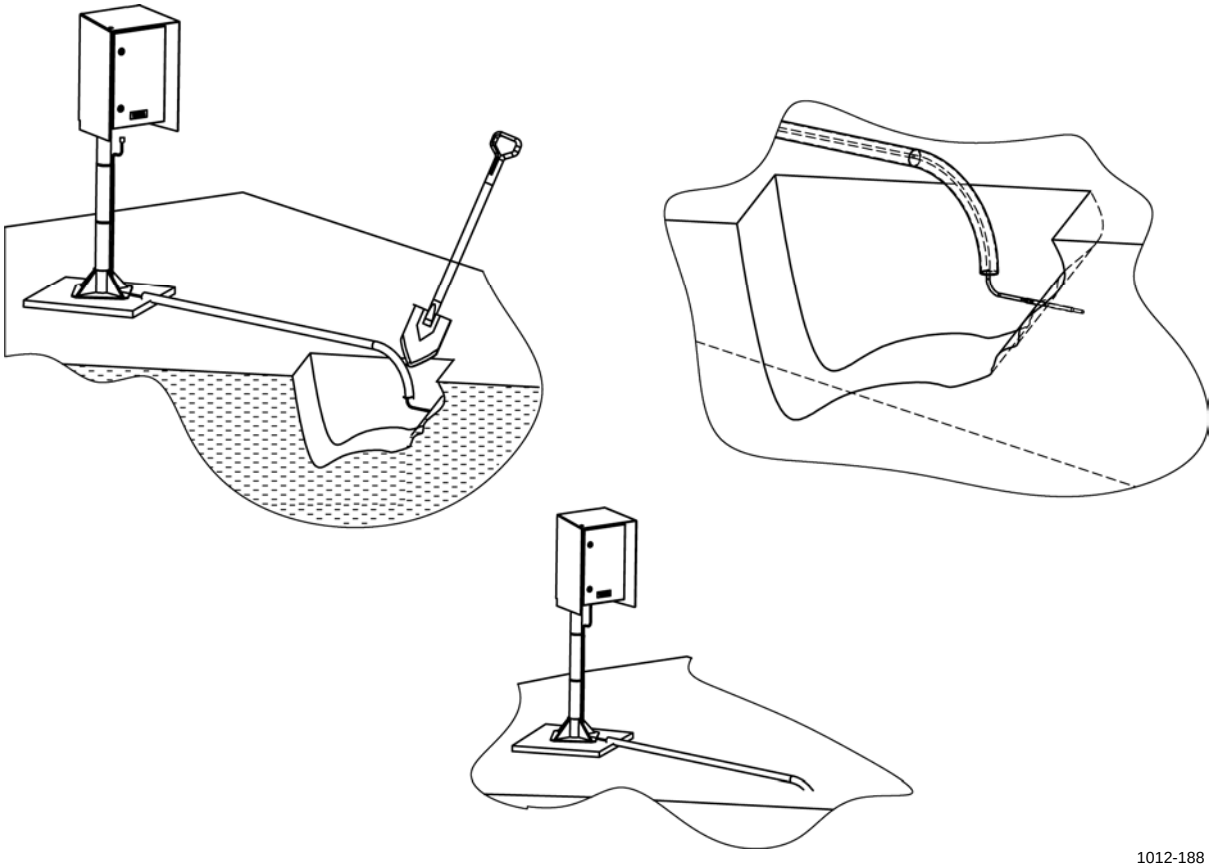


Figure 44 Installing Soil Temperature Sensor QMT110

Installing Rain Gauge RG13(H)

Vaisala Rain Gauge RG13(H) features a tipping-bucket mechanism that produces a contact closure every time the gauge receives a predetermined small quantity of rainfall (for example, 0.2 mm, depending on the model). The body and the funnel of the gauge are aluminum alloy. In RG13H, a heater element switches on at temperatures below +4 °C to melt possible snowfall and keep the moving parts from freezing. The rain gauge is installed on a stand.

The opening of the gauge must be in a horizontal plane, open to the sky, and above the level of in-splashing and snow accumulation. Objects should not be closer to the gauge than a distance four times their height above the gauge orifice.

In areas of dense vegetation, the height of the vegetation should be kept well below the gauge opening level by regular clipping. Avoid sites on a slope or on building roofs. Hard flat surfaces, such as concrete, should also be avoided to prevent in-splashing.

To mount the gauge and the stand, proceed as follows:

1. Drill holes to a concrete pad according to Figure 45 below. You can use the bottom plate of the stand as a guide when drilling.

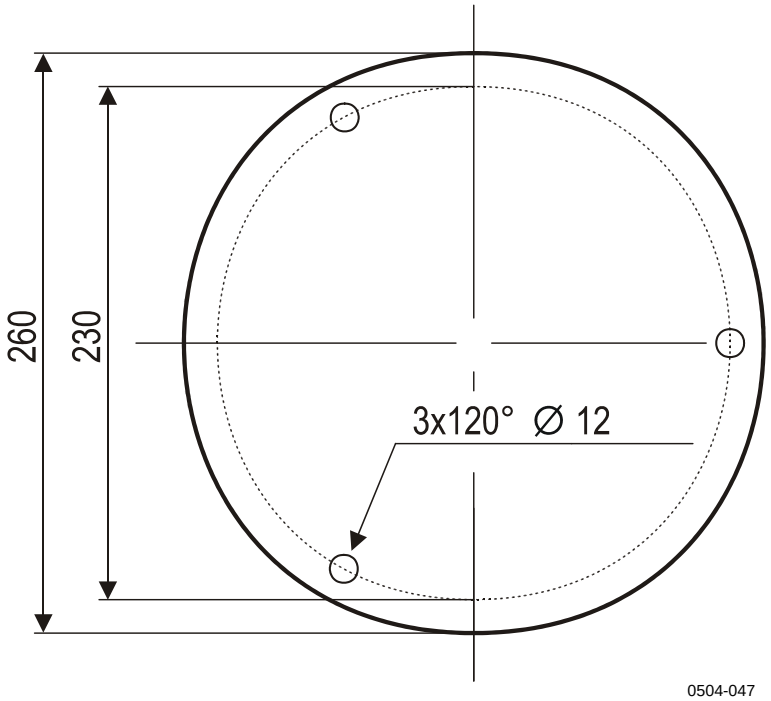


Figure 45 Installation Hole Placement for Rain Gauge Stand

2. Attach the stand (number 3 in Figure 46 on page 89) to the foundation with wedge bolts (6) and a hammer.

3. Place the base of the rain gauge (9) onto the stand and level it with the three leveling screws (2). Use the spirit level (13) on the rain gauge for the leveling. Finally, secure the locknuts (12).

NOTE Use the spirit level on the RG13(H) for the leveling (number 3 in Figure 46 on page 89).

4. Secure the base through the two holding lugs (14) with the provided Allen bolts, washers, and nuts (7, 8, and 10).
5. Carefully remove the rubber band (11), which is fitted for transit purposes, and check that the bucket pivots easily.

NOTE Remember to remove the rubber band from inside the RG13(H) (number 11 in Figure 46 on page 89).

6. Attach the outer tube of the rain gauge (1) onto the base and secure it with the locks.
7. Route the signal/power along the stand and secure it with cable ties (15 and 16).
8. Connect the signal/power cable to the **Rain** connector on the bottom of the enclosure; see section Connecting Sensor Cables on page 97.

The following numbers refer to Figure 46 on page 89:

1 = Outer tube of Rain Gauge RG13
2 = Leveling screw
3 = Pedestal
4 = Nut M10 DIN934 A4, 4 pcs; use wrench 17 mm
5 = Washer A10 DIN125 A4, 4 pcs
6 = Wedge bolts; use a hammer
7 = Allen bolt M8x30 DIN912 A4, 2 pcs; Allen key 6 mm
8 = Washer A8 DIN125 A4, 2 pcs
9 = Base of Rain Gauge RG13
10 = Nut M8 DIN985 A4, 2 pcs; use wrench 13 mm
11 = Rubber band
12 = Locknut
13 = Spirit level
14 = Holding lugs, 2 pcs
15 = Cable
16 = Cable tie

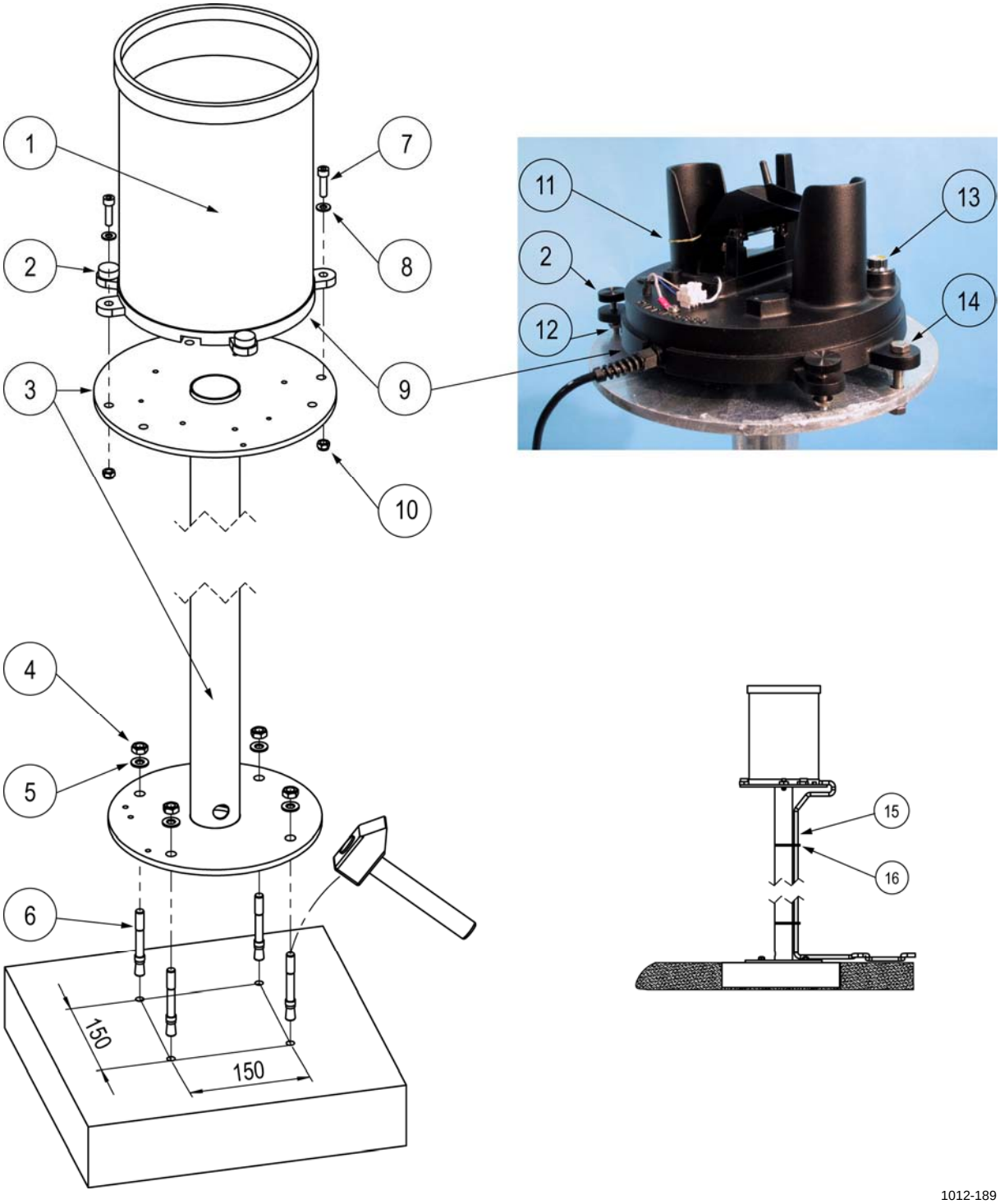


Figure 46 Installing Rain Gauge RG13(H)

Installing Enclosure

The stainless steel electronics enclosure houses the QML logger, communication modems, other system electronics and the backup batteries. All external devices are connected to the bottom flange of the enclosure. The wiring inside the enclosure is done at Vaisala. At the site, the customer needs to do the following mechanical installations:

- Mount the enclosure to a mast or on a wall.
- Mount the backup batteries inside the enclosure.
- Insert the SIM card to the GMS/GPRS modem inside the enclosure, if GSM/GPRS telemetry is used.
- Make sure that cables from individual sensors are connected to the connector flange on the bottom of the enclosure.
- Ground the enclosure from the grounding rail (4 fig 56) as instructed in section Grounding the Enclosure on page 94.

Enclosure Radiation Shield

The radiation shield is preinstalled at Vaisala to protect the enclosure in mast installations. The radiation shield can be removed for the installation phase to lighten the enclosure.

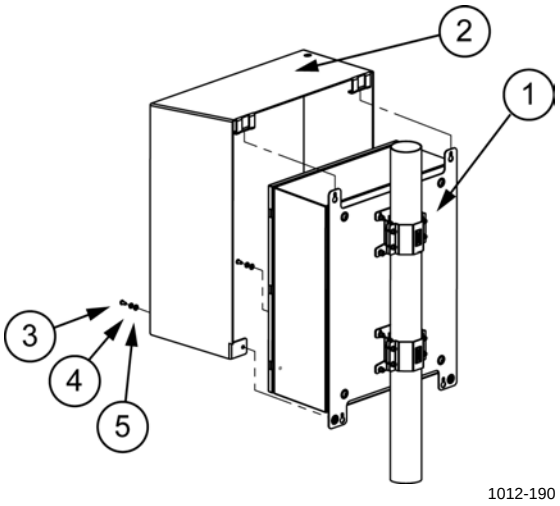


Figure 47 Installing Radiation Shield to Enclosure

The following numbers refer to Figure 47 above:

1 = Enclosure
2 = Radiation shield
3 = Screw M6x12 ISO7380 A4, 2 pcs; use Allen key 4 mm
4 = Spring washer B6 DIN127 A4, 2 pcs
5 = Washer A6.4 DIN125 A4, 2 pcs

Installing Enclosure to the Mast

In a mast installation, the enclosure is mounted below the sensor support. The bottom of the enclosure comes roughly 1 m from the ground. Mast mounting sets (number 7 in Figure 48 on page 92) are used for the installation, and the enclosure door should face **north** (in the northern hemisphere) to avoid solar radiation heating the enclosure.

1. Install the mast mounting sets. Tighten the sets lightly.
2. Screw the two uppermost screws and washers to the enclosure. Do this for both mounting sets. Leave the screws out by about 10 mm.
3. Lift the enclosure to the upper mast mounting set so that the screws slide to the mounting set slots (1).
4. Slide the lower mounting set to fit the lower screws of the enclosure. Tighten the screws (5) and install rest of the mounting set screws.
5. Loose the mounting sets and slide the enclosure to the desired height (roughly 1 m from the ground to the bottom of the enclosure). Make sure that the enclosure door is toward **north**. Tighten all screws.
6. If you have removed the radiation shield before installation, attach it again to the enclosure; see section Enclosure Radiation Shield on page 90.

Alternative Installation Procedure (More than One Person Available)

1. Screw the two front-most halves of the mounting set (7) using screws and washers (5, 6) firmly to the enclosure. Do this for both mounting sets.
2. Lift the enclosure and press the open mounting set halves firmly to the mast.
3. Attach the remaining mounting set halves to the open halves using the screws and washers (4, 3).
4. If you have removed the radiation shield before installation, attach it again to the enclosure; see section Enclosure Radiation Shield on page 90.

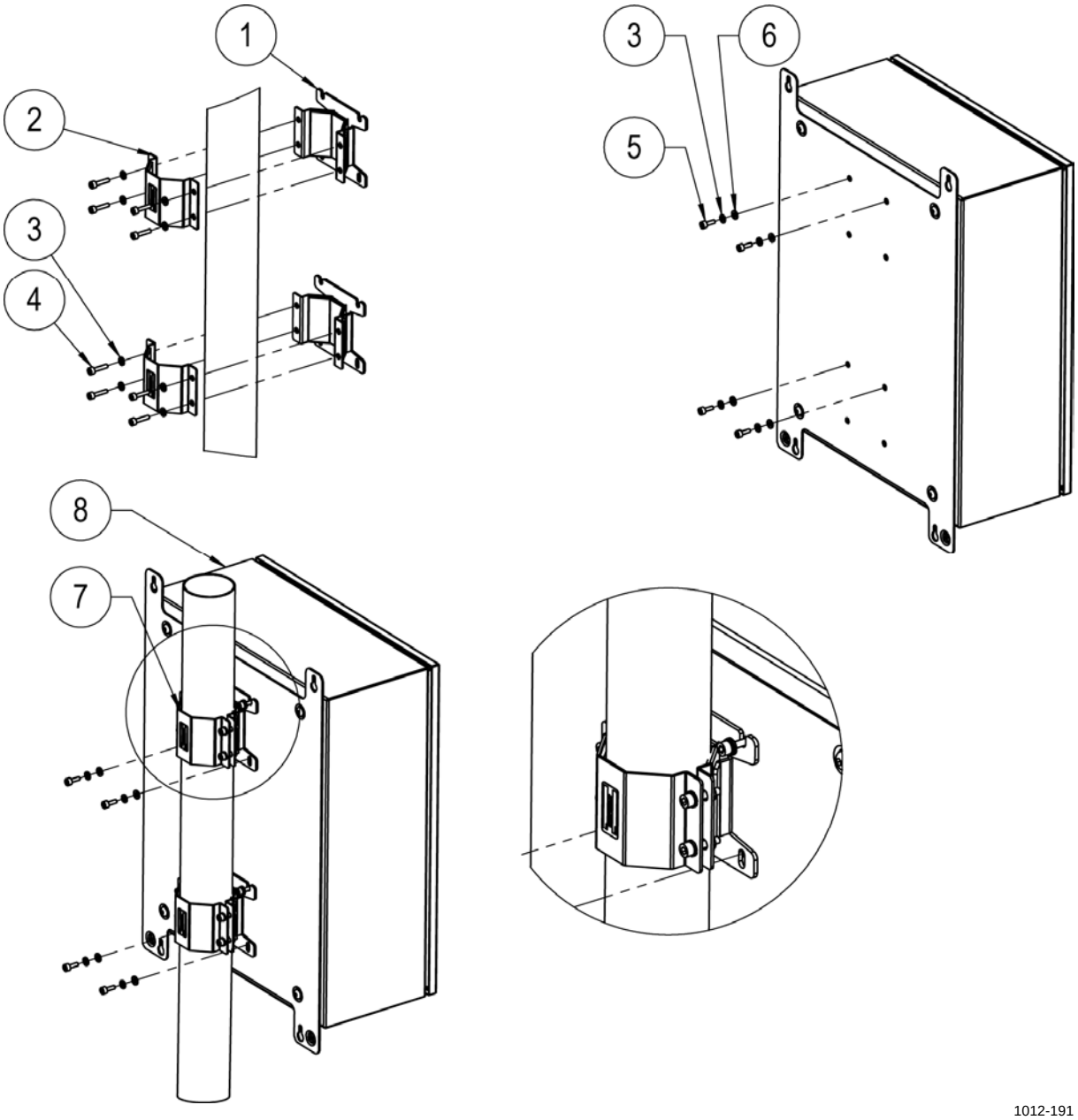


Figure 48 Installing Enclosure to Mast

The following numbers refer to Figure 48 above:

1 = Support plate, APPK-SET100
2 = Clamp plate, APPK-SET100
3 = Spring washer B6 DIN127 A4, 8 pcs
4 = Screw M6x25 DIN912 A4, 8 pcs; use Allen key 5 mm
5 = Screw M6x16 DIN912 A4, 8 pcs; use Allen key 5 mm
6 = Washer A6 DIN125 A4, 8 pcs
7 = Mast mounting set, APPK-SET100
8 = Enclosure

Installing Enclosure to the Wall

The correct installation height for the enclosure is approximately 1.5 to 1.7 m (eye height for best working access).

Insert the four installation screws through the mounting holes of the wall mounting plate attached to the back of the enclosure; see Figure 49 below.

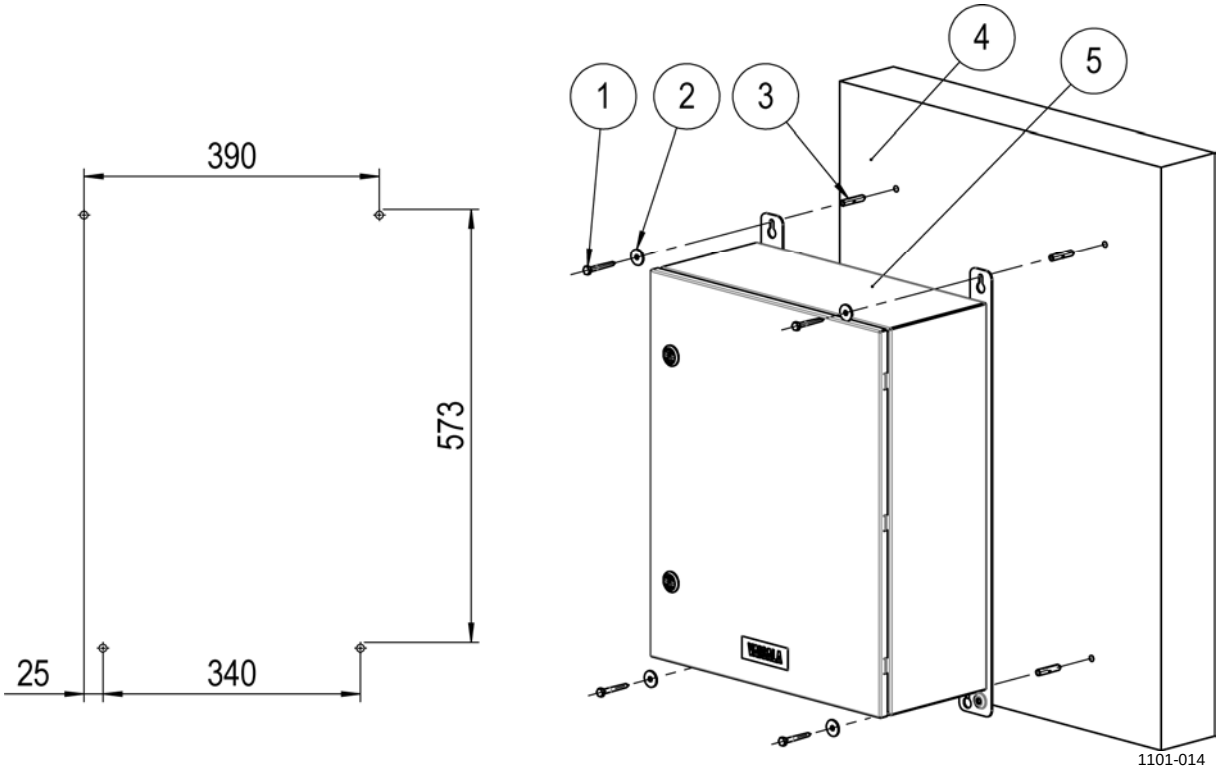


Figure 49 Installing Enclosure to Wall

The following numbers refer to Figure 49 above:

1 = Hexagonal head lag screw M6x50 DIN571 Fe/Zn, 4 pcs; use wrench 10 mm
2 = Washer, fender Ø6.6 DIN440 Zn, 4 pcs
3 = Anchor plug 8x40, 4 pcs, Ø8 mm depth 50 installation hole
4 = Concrete or brick wall
5 = Enclosure

Grounding the Enclosure

Equipment grounding and lightning protection grounding must be done separately.

For lightning protection grounding, see that the lightning rod has been grounded properly, as instructed in section Equipment Grounding and Lightning Protection on page 36. Connect the end of the lightning rod grounding cable to the grounding rod close to the guy wire foundation (number 1 in Figure 4 on page 37). Use proper copper wire for the connection.

For equipment grounding, connect the enclosure *grounding rail* (number 4 in Figure 53 on page 97) to grounding rod close to mast foundation (number 7 in Figure 4 on page 37). Use proper copper wire for the connection.

Installing Backup Batteries

Two backup batteries, each with 26 Ah capacity, provide backup power for the system. The batteries are charged through the battery regulator by the solar panel or the AC power supply. The batteries are sealed and maintenance-free. The batteries are mounted inside the enclosure as shown in Figure 50 below.

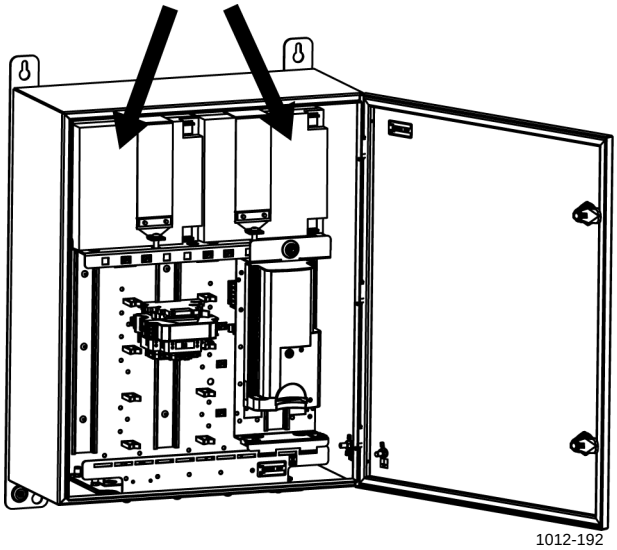


Figure 50 Backup Batteries Positioned Correctly

Mount the batteries inside the enclosure on the subframe as shown in Figure 51 below:

1. Hook the straps (number 3 in Figure 51 below) onto the subframe (5).
2. Position the batteries (4) under the straps.
3. Tighten the straps onto the front side of the subframe using the screws (2) and the spring washers (1).
4. Refer to section Powering Up the System on page 99 before connecting the batteries.

WARNING Do not connect the batteries until AWS330 is ready for powering. See instructions on powering and battery wiring in section Powering Up the System on page 99.

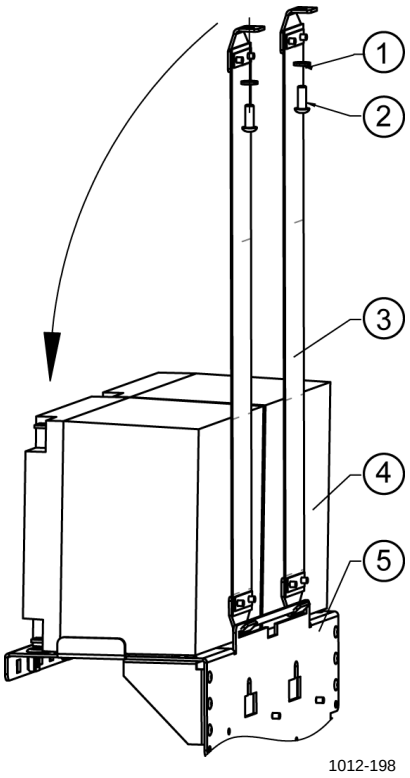


Figure 51 Attaching Strips over Battery

The following numbers refer to Figure 51 above:

1 = Spring washer B6 DIN127 A4, 2 pcs
2 = Screw M6x25 ISO7380 A4, 2 pcs; use Allen key 4 mm
3 = Battery strap, 2 pcs
4 = Battery 26 Ah, 2 pcs
5 = Subframe

Preparing GSM/GPRS Modem

GSM/GPRS modem provides wireless telemetry for AWS330. The modem is housed inside the electronics enclosure. Insert the SIM card into the retractable slide on the modem (number 3 in Figure 52 below).

Figure 52 GSM/GPRS Modem

The following numbers refer to Figure 52 above:

1 = Indicator LED
2 = Power cable connector
3 = Slot for SIM card

Configuration of GSM/GPRS telemetry is described in Chapter 5, Software Configuration and Operation, on page 101, and installing GSM/GPRS antenna on the mast is described in section Installing GSM/GPRS Antenna on page 72.

Connecting Sensor Cables

Connect the sensor cables to the enclosure after mechanically installing the sensors. All sensors, power supplies, and communication devices are connected to the system using environmentally-sealed connectors. All the connectors are labeled and located on the bottom flange of the electronic enclosure. See also Appendix A, Wiring Diagrams, on page 263 for an overview of AWS330 wiring.

NOTE	Be careful not to bend the connector pins when connecting the cables.

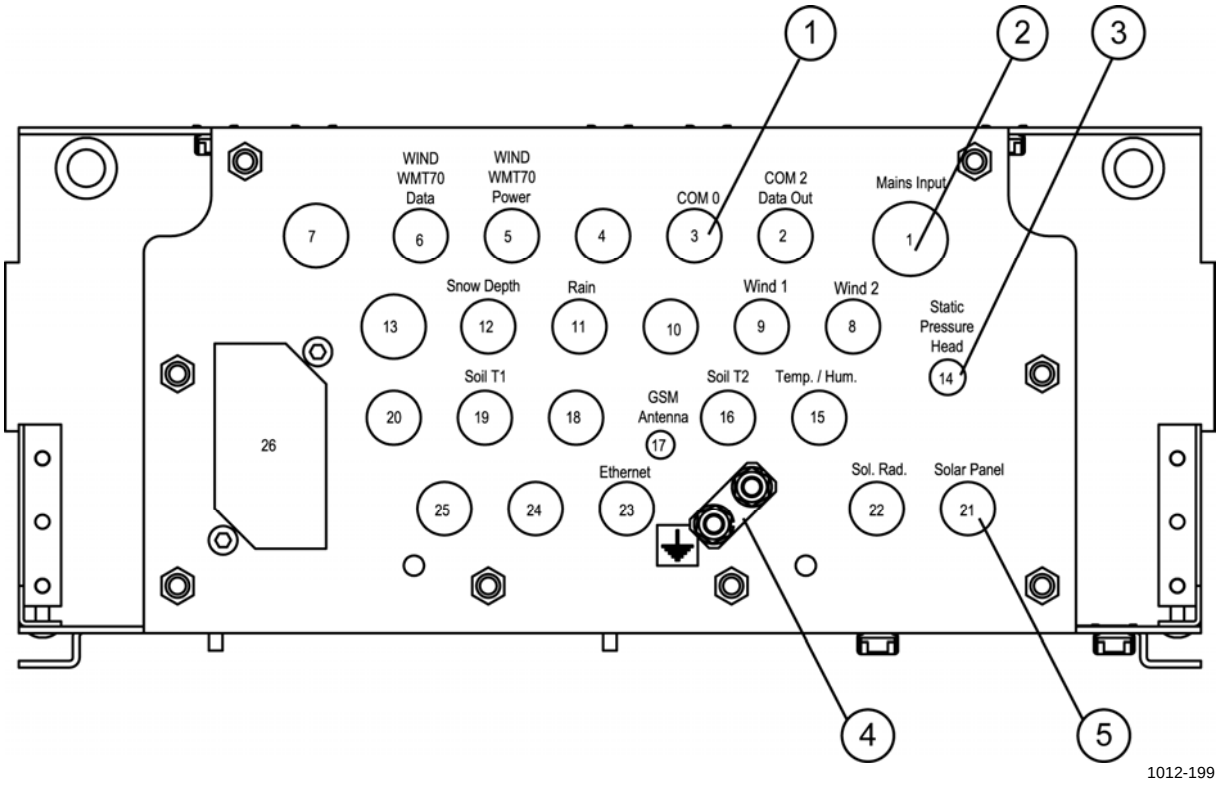


Figure 53 Connector Flange of the Enclosure

The following numbers refer to Figure 53 above:

1 = Maintenance terminal COM0 connector
2 = AC (mains) input power connector
3 = Static pressure head tube
4 = Grounding rail for common grounding point
5 = Solar panel connector

Static Pressure Head

Static pressure head (number 3 in Figure 53 above) minimizes field-induced error in pressure measurement.

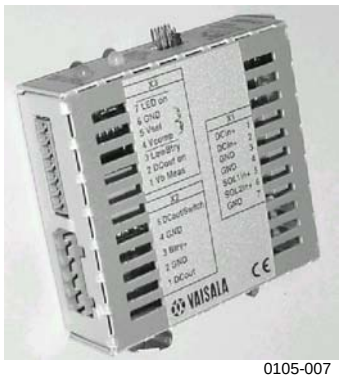
Transient Protection Devices

Each sensor input in the QML logger has varistor (VDR) protection against induced transients. The local data and Ethernet ports have transzorb diodes in their inputs. For maintenance information, see section Replacing Components on page 193.

Battery Regulator

Battery regulator is a charging and supervising device for sealed lead acid batteries. The battery regulator regulates the charging/discharging state of the batteries and allows simultaneous input from solar panel and AC power.

LED lamps indicate charging/discharging. The lamps are active only when the ON button is pushed.



0105-007

Figure 54 Battery Regulator

Powering Up the System

When the station is ready for powering, the backup batteries and the solar panel are connected first and then the AC (mains) power.

For battery connection, make sure the backup batteries are properly fastened; see section Installing Backup Batteries on page 94. Connect both brown wires marked with red to the + poles of the batteries. Connect the blue wires marked with black to the - poles of the batteries. Connect the solar panel cable to the **Solar Panel** connector on the bottom of the enclosure; see Figure 53 on page 97.

Battery wiring is as follows:

Battery Cable	Battery	Function
Brown with red marking	+	Positive pole +12 V
Blue with black marking	-	Negative pole (GND)

CAUTION Check the battery wiring carefully to avoid short-circuiting and injury to personnel.

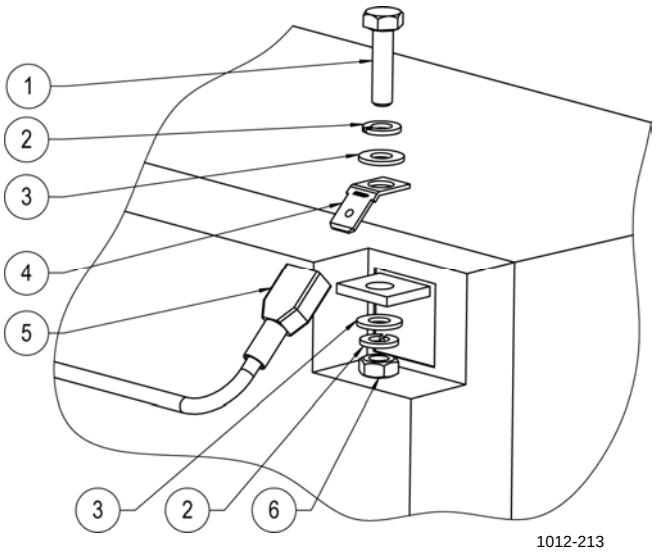


Figure 55 Connecting Battery

The following numbers refer to Figure 55 above:

1 = Screw M4x16 DIN933 A4; use wrench 7 mm
2 = Spring washer B4 DIN127 A4
3 = Washer A4.3 DIN125 A4
4 = Flat terminal
5 = Battery cable
6 = Nut M4 DIN934 A4; wrench 7 mm

For AC (mains) powering, make sure the site has been prepared according the instructions in section Site Preparation on page 35. Before connecting the AC (mains) power cable, ensure there is no power connected to the cable (by turning down the fuse or turning off the power switch). Connect the AC (mains) power cable to the **Mains Input** connector on bottom of the enclosure; see Figure 53 on page 97. Turn on the AC power.

CHAPTER 5

SOFTWARE CONFIGURATION AND OPERATION

This chapter contains information on operating AWS Client software and introduces optional Local Display QMD202.

AWS Client is used for working with the QML logger, for example, for setting station-specific parameters to the setup file and for downloading the log files.

Software Installation

To operate AWS Client software, you need a PC with Windows® operating system.

Install AWS Client as follows:

1. Insert the AWS Client installation CD-ROM disc into your computer's CD drive and run the file setup.exe.
2. The setup wizard will guide you during the installation process. Follow the instructions of the wizard to complete the setup.

Connecting AWS Client to AWS330

Installing USB Driver

If you are using a computer that does not have a RS232 serial port, such as most laptops, a USB to RS232 converter cable is provided for using a local connection to the AWS330 system. Install the driver for the cable as follows:

1. Insert *Vaisala USB Instrument Driver* CD to CD/DVD drive of your PC.
2. If the installation program is not started automatically, start it from the CD root directory, program *setup.exe*.
3. Follow the instructions given by the installation program.
4. When the driver installation is complete, connect the USB cable to a free slot on your PC. Allow the operating system to detect the driver for the cable automatically.
5. To check which port has been assigned for the USB serial port, launch program *Vaisala USB Instrument Finder* from the **Start** menu.

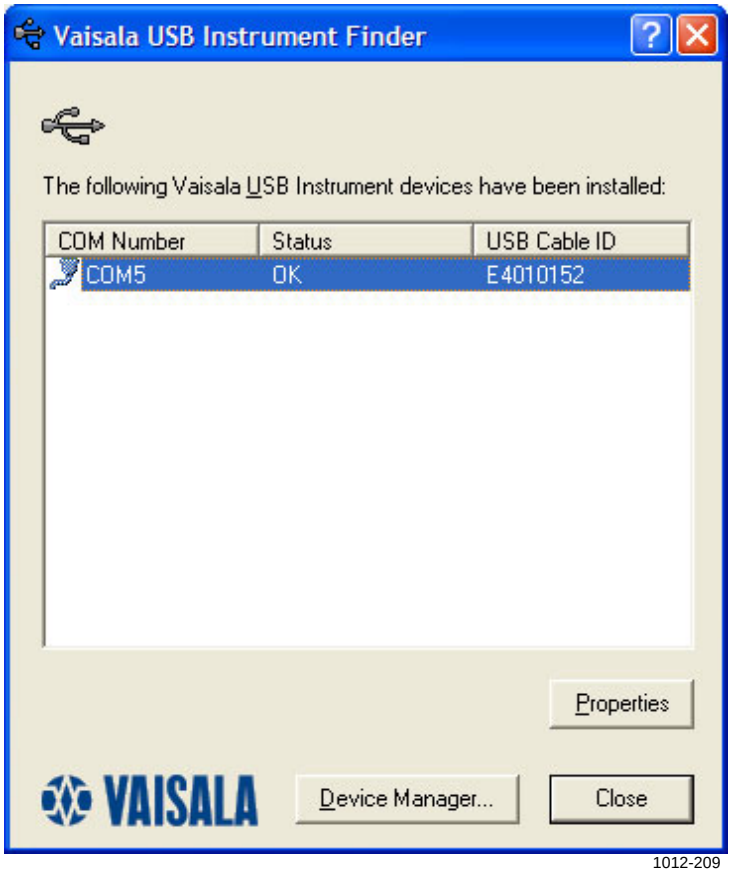


Figure 56 Finding Port Number for USB Serial Port

Connecting to AWS330

To connect your computer to the QML logger serial port, proceed as follows:

1. Connect the provided maintenance cable to the **COM0** connector on the bottom flange of the enclosure and to an available COM port on your PC; see Figure 57 below.

Figure 57 Connecting Maintenance Cable

2. Start AWS Client by clicking the **Start** button and selecting **All Programs** - **Vaisala** - **Vaisala AWS Client**.
3. In AWS Client, click **File** - **Connect** - select **Default** - click **OK**.

General Instructions on Using AWS Client

Starting and Exiting AWS Client

You can start AWS Client in Windows by clicking the **Start** button and then selecting **Programs** - **Vaisala** - **AWS Client**. AWS Client is opened with the terminal main window shown in Figure 58 below.

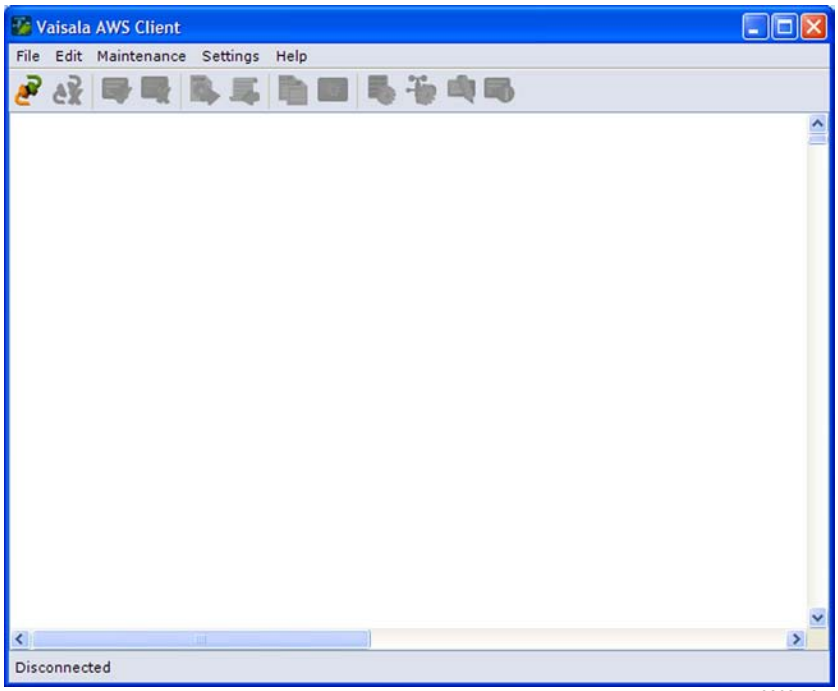


Figure 58 AWS Client Main Window

You can exit AWS client by selecting the **Exit** option from the **File** menu or clicking the red cross on the upper right corner.

Establishing a Connection

You can establish a connection with the QML logger by clicking the **Open connection** button or from the menu **File - Connect**. This will open a new window shown in Figure 59 below.

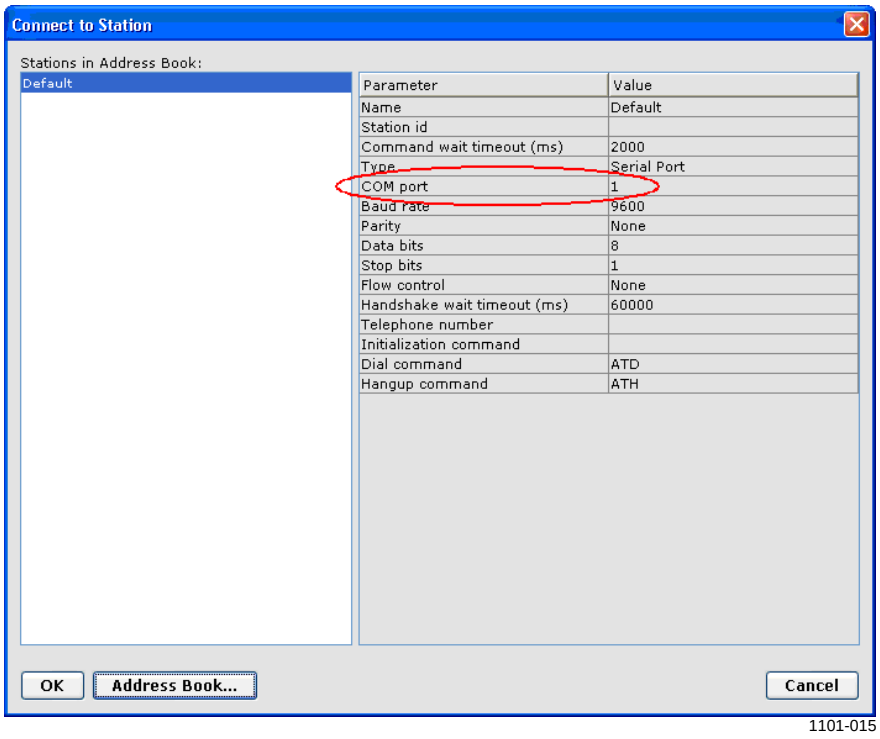
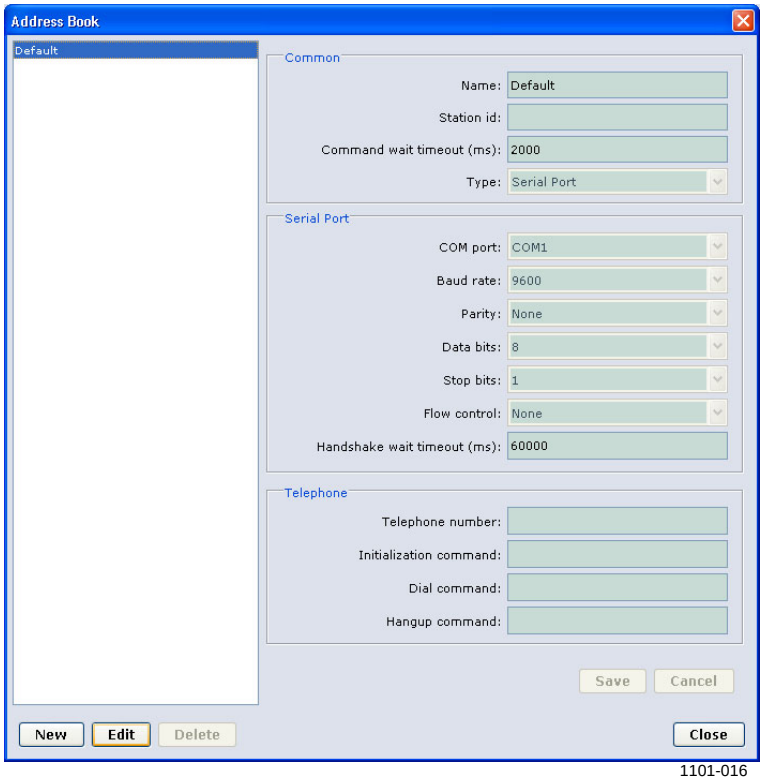


Figure 59 Establishing Connection

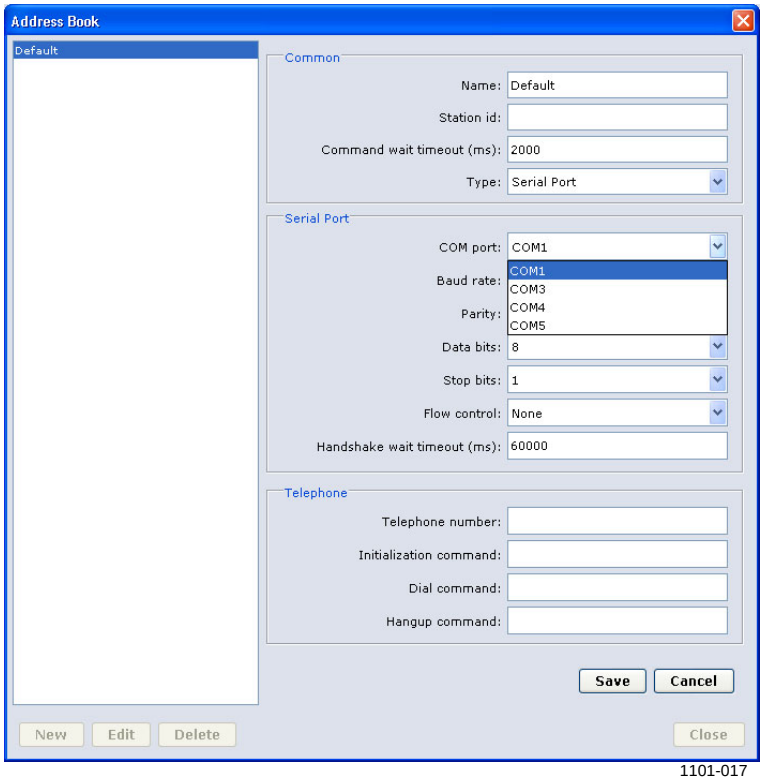
This window displays the connection parameters for the default connection. (You can add more connections. See section Using Address Book on page 138.) Note that in the default connection, the **COM port** is set to **1** as default. You need to check that this matches the assigned port as described in section Installing USB Driver on page 102 and change it when necessary.

To change the COM port in the connection parameters, click **Address Book** and a new window opens.



1101-016

Select **Default** from the white column on the left and click **Edit.**



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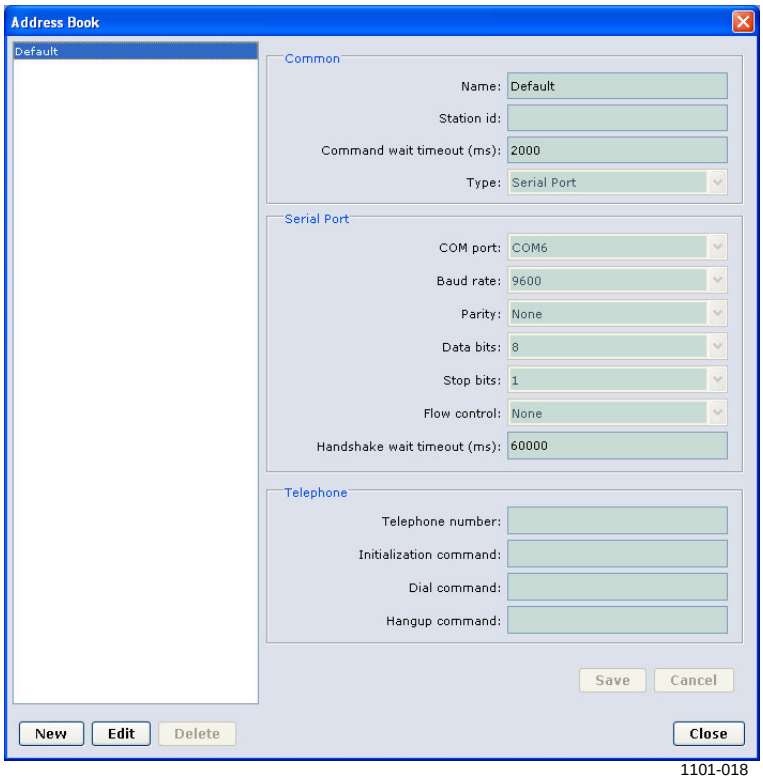
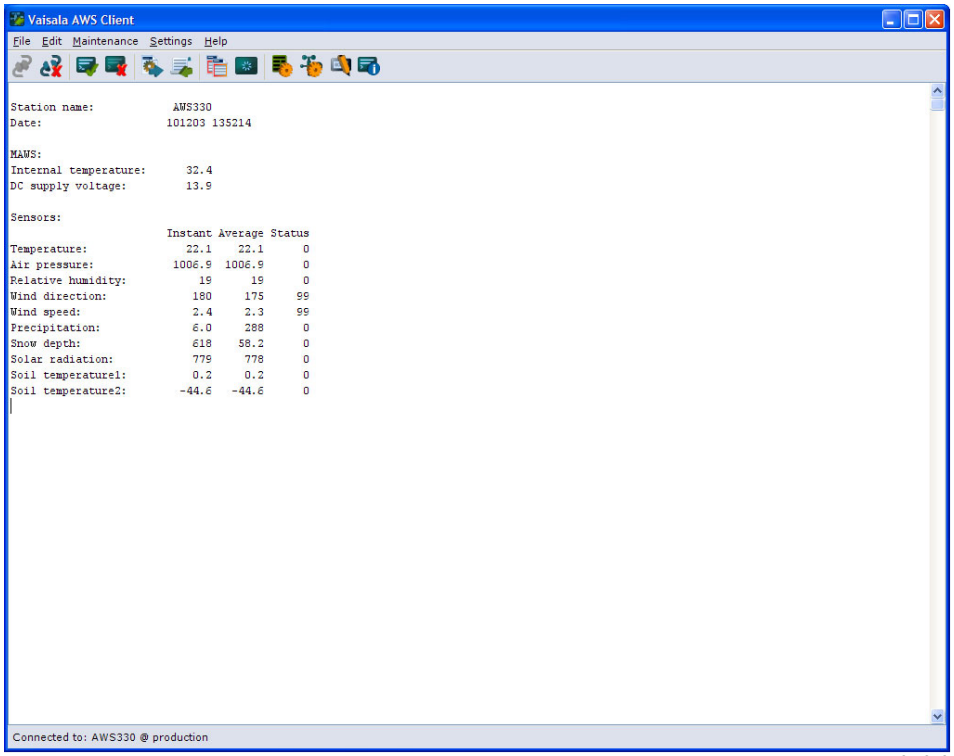
Now you are able to edit the connection parameters. You should leave all other parameters except **COM port** unchanged. Choose the correct assigned COM port from the drop-down menu and click **Save.**



1101-018

You have now changed the COM port for the default connection.

To return to the main menu and to connect to the station, click **Close - Ok.** When you are connected to the station but the service command mode is closed, the messages and reports appear on the main window as shown in Figure 60 on page 108.



1101-019

Figure 60 Terminal Showing Report

NOTE	The report type and appearance shown in Figure 60 above depends on your setup.

Configurations with AWS Client

AWS330 is pre-configured during manufacturing according to the ordered features. However, you must configure certain parameters, such as site information and telemetry settings. It is also possible to add features later by attaching additional standard AWS330 sensors and changing the appropriate configuration parameter(s).

Different options are controlled by station settings, also called *static parameters*, which are grouped into *parameter sets.* These parameters can be adjusted using Vaisala AWS Client software.

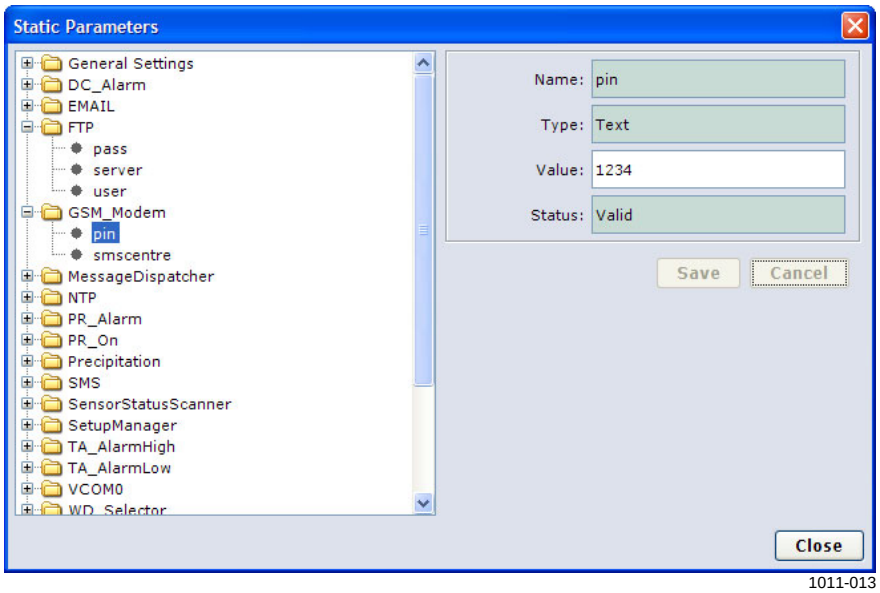


Figure 61 Configuring Parameters in AWS Client

To configure a parameter:

1. Start AWS Client from the **Start** menu by selecting **All Programs - Vaisala - Vaisala AWS Client**.
2. Establish a connection with the QML logger as instructed in section Establishing a Connection on page 105.
3. In AWS Client, open menu **Settings - Parameters - Static**.
4. Open a *parameter set* by clicking the + sign next to the set name. Close a *parameter set* by clicking the - sign next to the set name.
5. Select the *parameter* to be modified.
6. Enter new value to field **Value**. If the value is appropriate for the current parameter, the **Save** button is enabled.
7. Click **Save** to store the new value. Alternatively, leave the value unchanged by clicking **Cancel**.
8. Click **Close** to close the dialog when all changes have been made.

CAUTION Do not change values that are not instructed to be changed in this manual or by Vaisala personnel. Special care should be taken when updating parameters remotely, for example, over an IP connection. Incorrect settings can leave the AWS330 system inaccessible for further remote configuration and maintenance.

NOTE Even if some of the settings take effect immediately, it is always recommended that you reset the system when all planned changes to the settings have been completed.

Software Configuration Procedure

CAUTION	Configure AWS330 by following this procedure step by step.

NOTE	Navigating in the screens is explained in section General Instructions on Using AWS Client on page 104. **Read it carefully.**

1. Set Common Parameters as described on page 112.
2. Set Location Parameters as described on page 113 (optional).
3. Set time as described in section Time and Time Zone on page 114.
4. Set Sensor Parameters as described on page 116.
5. Select the message type you want to use with AWS330. For message type descriptions, see section Observation Messages on page 27.
6. Set message transmission interval for the selected message type as described in section Message Intervals on page 118.
7. Select observation messaging protocols(s) as described in section Messaging Protocols on page 119.
8. Select alarm messaging protocol(s) as described in section Alarming Protocols on page 121.
9. Set messaging protocol -dependent parameters. Based on the protocol(s) chosen in steps 7 and 8, refer to following section(s):
   - TCP-Socket (Virtual Com Port) on page 122.
   - File Transfer Protocol (FTP) on page 124.
   - eMail (SMTP) on page 126.
   - GSM SMS on page 129.
   - Local Serial Line on page 130.
   - For CSD dial-in, there is no protocol-dependent configuration required.
10. Set up telemetry configuration:
    - For IP over GPRS telemetry, see section GSM Modem on page 131 and GPRS on page 132.
    - For data call telemetry, see section GSM Modem on page 131 and CSD Dial-In (Data Call) on page 134.
    - For IP over Ethernet telemetry, see section Ethernet on page 135.
11. Set up alarm limits as described in Alarms on page 136.
12. To make parameter updates effective, reset the AWS330 system using AWS Client. From the AWS Client menu, select **Maintenance** - **Reset** - **Immediate**.

Common Parameters

The dialog presented in Figure 62 below contains the essential parameters for an operational station.

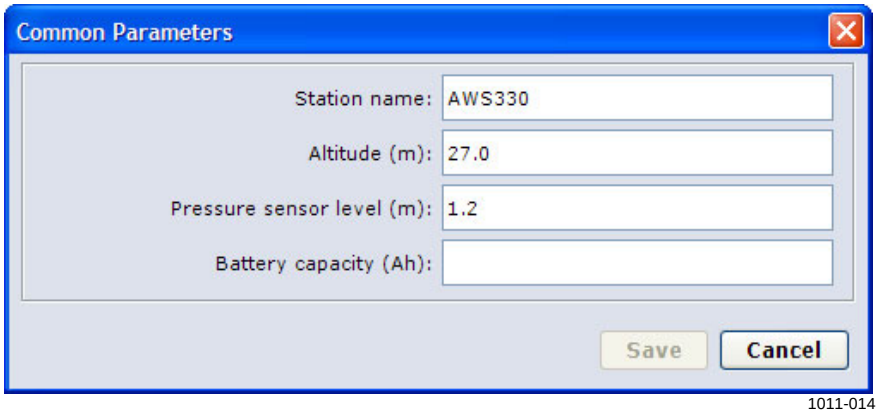


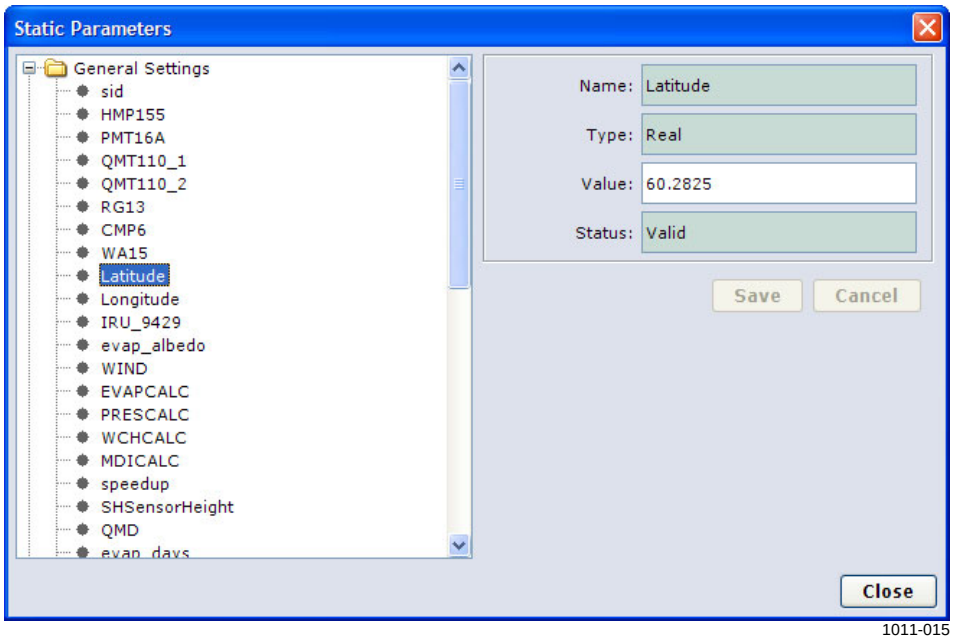
Figure 62 Common Parameters Dialog

To set the common parameters:

1. Open menu **Settings - Parameters - Common**.
2. Enter **Name** for the station. Do not use spaces or special characters in the station name.
3. Enter station **Altitude** in meters from mean sea level. This setting is needed only if the station provides measurement for barometric pressure.
4. Enter **Pressure Sensor Level** in meters from ground. This is the bottom flange height from ground. This setting is needed only if the station provides measurement for barometric pressure.
5. Parameter **Battery Capacity** is not used by AWS330, and has no effect.
6. Press **Save** to store the settings and close the dialog.

Location Parameters

Geographical location of the observation site is needed if sunshine duration calculation is used.



1011-015

Figure 63 Setting Location Parameters

Table 19 Location Parameters

Set Name	Parameter	Parameter Name	Use
General Settings	Latitude	Latitude	Site latitude. -90…90 [deg]
General Settings	Longitude	Longitude	Site longitude. -180…180 [deg]

Time and Time Zone

With AWS Client, you can either set the clock and time zone of the QML logger manually, or you can synchronize the logger clock with the clock on your PC. To set the QML logger clock, proceed as follows:

1. On the **Maintenance** menu, select **Synchronize Clock**. The **Set Logger Time** window, shown in Figure 64 below, is displayed.

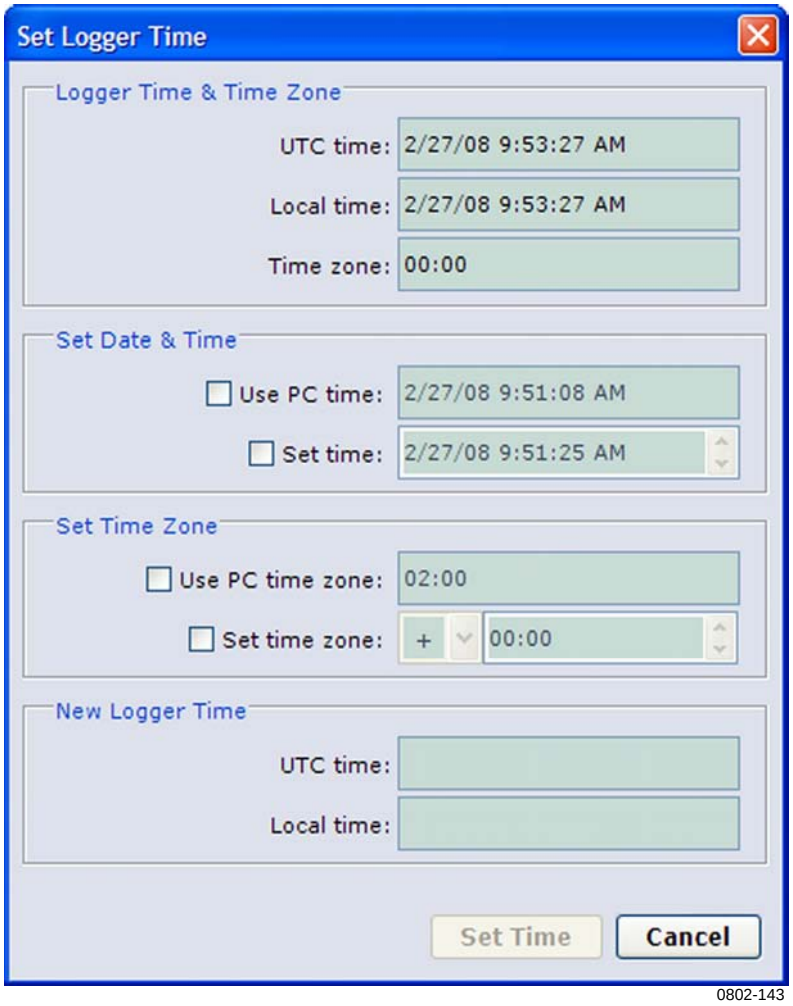
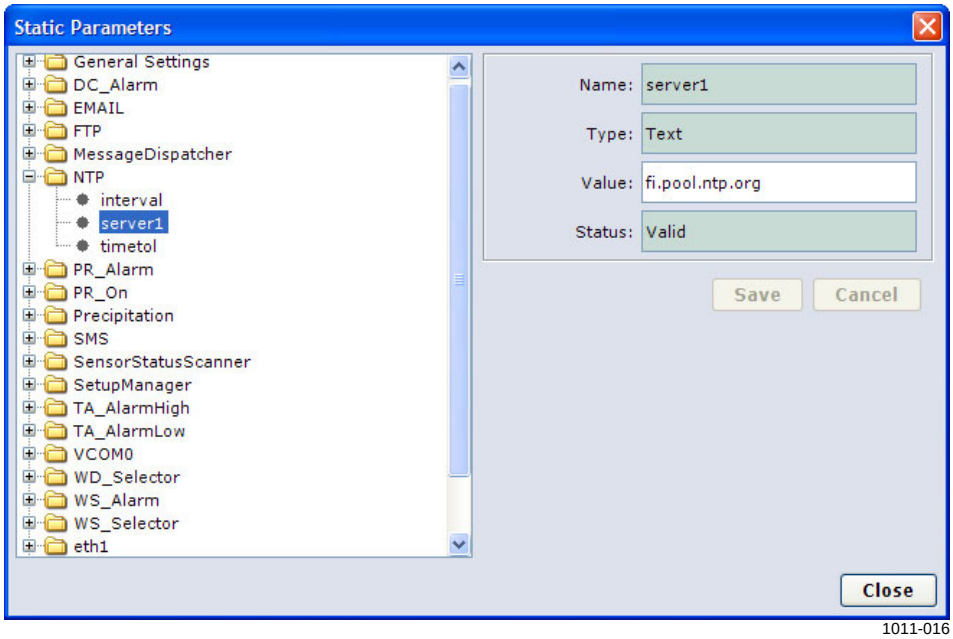


Figure 64 Set Logger Time Window

2. If you want to set the time manually, select the **Set time** option and enter the new time in that field; to synchronize the QML logger clock with your PC, select **Use PC time**.
3. If you want to set the time zone manually, select the **Set time zone** option and select your time zone; to synchronize the QML logger time zone with your PC, select **Use PC time zone**. The time zone is defined as a difference from UTC time; for example, for eastern United States in the winter, the time zone would be **-05:00**.
4. Set the QML logger clock by selecting **Set Time**.

If AWS330 is connected to the Internet or other network where NTP service is available, further timekeeping can be automated by configuring the NTP client into use.



1011-016

Figure 65 Setting NTP Client Parameters

Table 20 NTP Parameters

Set Name	Parameter Name	Use
NTP	interval	Interval [s] to check and adjust time. Once per hour (3600) is the recommended shortest period.
NTP	server1	NTP server to read the time from. For public servers, see http://www.pool.ntp.org/en/.
NTP	timetol	Time error tolerance [s] for adjusting the real time clock. In other words, if error is equal to or greater than this parameter, RTC is adjusted to match the NTP server time.

Sensor Parameters

The following sensor requires installation-specific parameters:

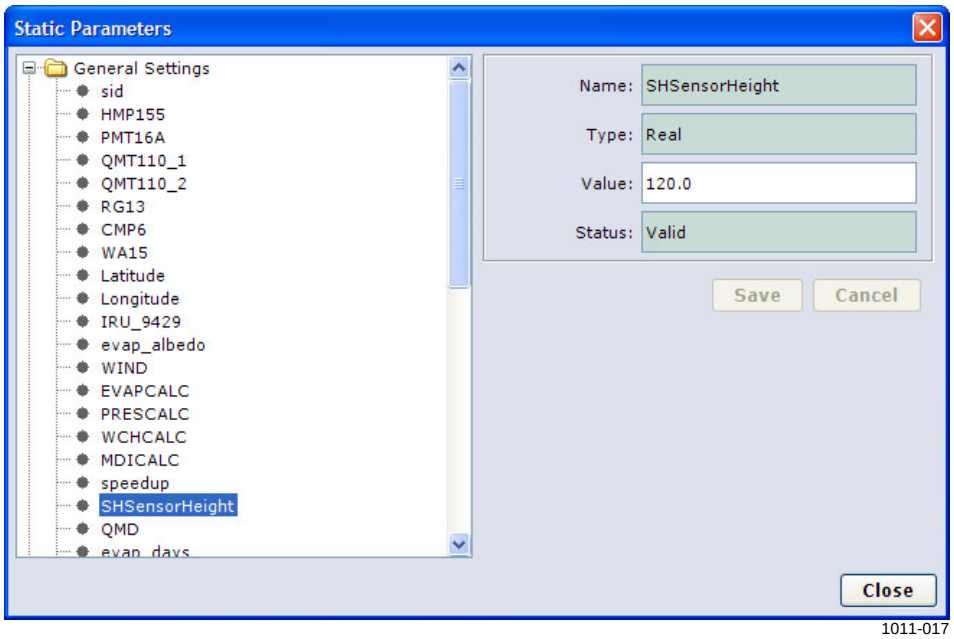


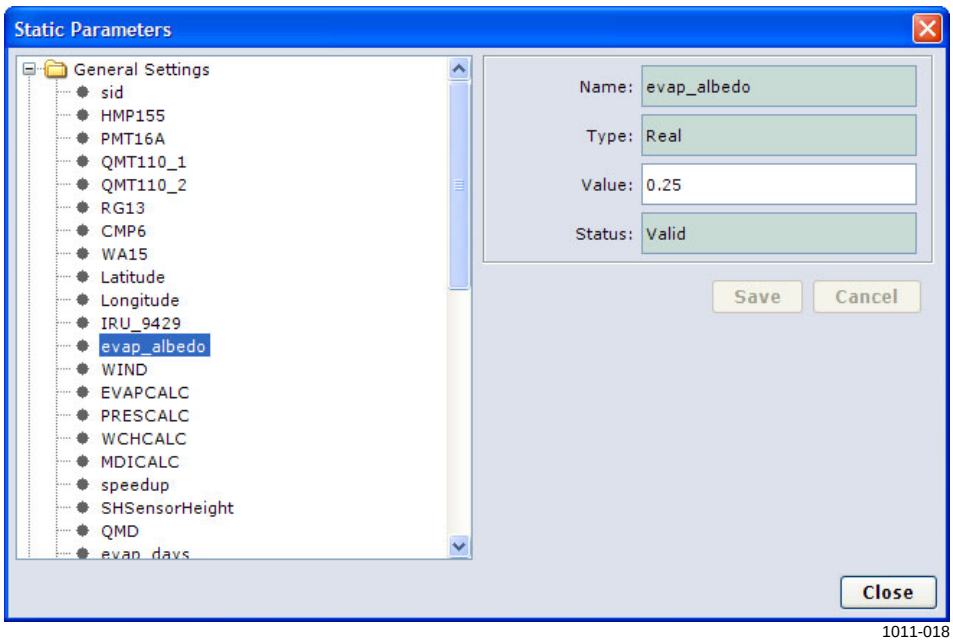
Figure 66 Adjusting Sensor Parameters

Table 21 Sensor Parameters

Sensor	Set Name	Parameter Name	Use
IRU 9429	General Settings	SHSensorHeight	Snow height sensor installation height (cm)

Calculation Parameters

The following calculation requires site/installation-specific parameters:



1011-018

Figure 67 Adjusting Calculation Parameters

Table 22 Calculation Parameters

Calculation	Set Name	Parameter Name	Use
Evapotranspiration	General Settings	evap_albedo	Soil albedo 0 ...1.0. Default is 0.25 (green grass).

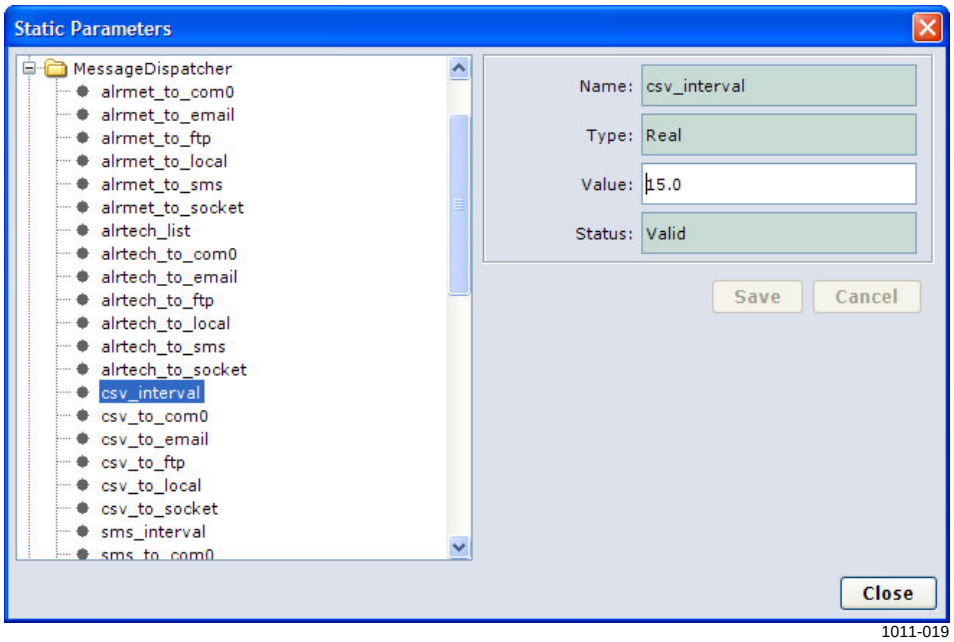
Messaging Parameters

The following sections describe parameters used to control messaging through telemetry and local communication devices.

NOTE Even if all listed parameters are present in AWS330 system, only those settings that have suitable hardware available are usable with that particular system.

Message Intervals

Intervals to create different messages for telemetry are defined by the following parameters:



1011-019

Figure 68 Setting Message Interval

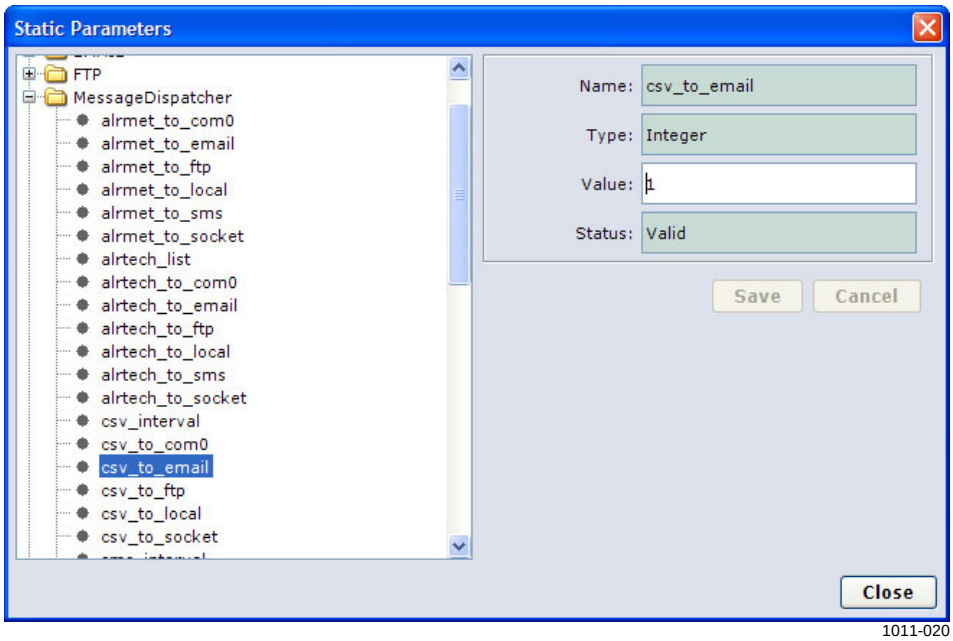
Table 23 Message Interval Parameters

Message	Set Name	Parameter Name	Use
CSV / OC	MessageDispatcher	csv_interval	Message interval [s]
SMS	MessageDispatcher	sms_interval	Message interval [s]
Table	MessageDispatcher	table_interval	Message interval [s]

NOTE Bear in mind the constraints set by the media and the protocol used. Generally, intervals under 1 minute should be used only for local connections, that is, serial line or Ethernet/LAN.

Messaging Protocols

Protocols used to transmit observation messages through telemetry and local serial links are selected as follows:



1011-020

Figure 69 Selecting Messaging Protocol

Table 24 Message Protocol Parameters

Message	Set Name	Parameter Name	Use
CSV / OC	MessageDispatcher	csv_to_com0	Send to COM0 (RS232)
CSV / OC	MessageDispatcher	csv_to_email	Send using eMail
CSV / OC	MessageDispatcher	csv_to_ftp	Send using ftp (1
CSV / OC	MessageDispatcher	csv_to_local	Send to Data Out (RS485)
CSV / OC	MessageDispatcher	csv_to_socket	Send using TCP-socket
SMS	MessageDispatcher	sms_to_com0	Send to COM0 (RS232)
SMS	MessageDispatcher	sms_to_email	Send using eMail
SMS	MessageDispatcher	sms_to_ftp	Send using ftp (1
SMS	MessageDispatcher	sms_to_local	Send to Data Out (RS485)
SMS	MessageDispatcher	sms_to_sms	Send using SMS
SMS	MessageDispatcher	sms_to_socket	Send using TCP-socket
Table	MessageDispatcher	table_to_com0	Send to COM0 (RS232)
Table	MessageDispatcher	table_to_email	Send using eMail
Table	MessageDispatcher	table_to_ftp	Send using ftp (1
Table	MessageDispatcher	table_to_local	Send to Data Out (RS485)
Table	MessageDispatcher	table_to_socket	Send using TCP-socket

(1 Only one message type can be selected for FTP transmission.

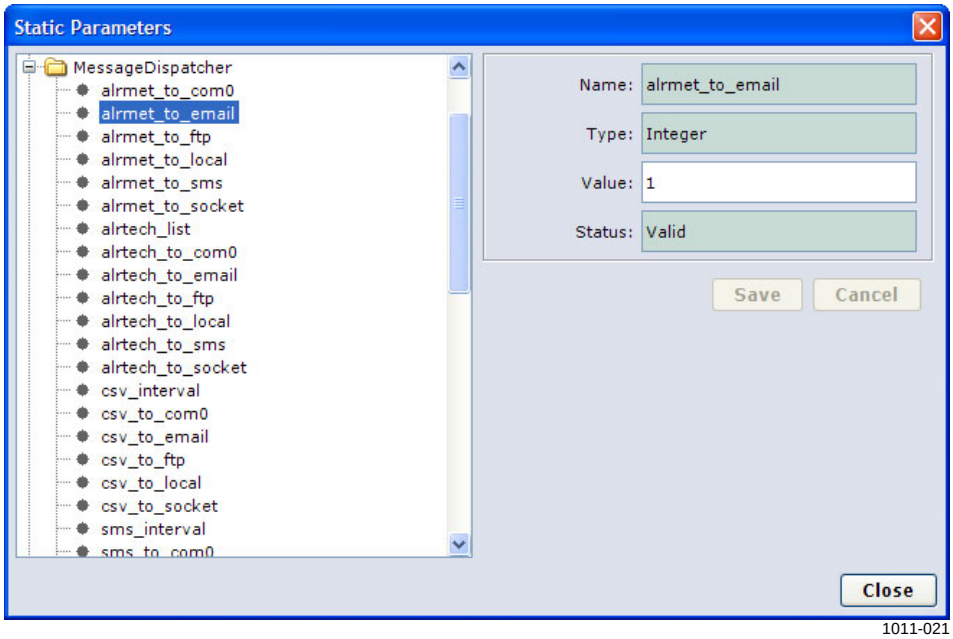
Settings: 0 = Message is not sent, 1 = Message is sent.

NOTE	Socket, FTP, and eMail transmission require an IP-capable media, that is, Ethernet or GPRS.

NOTE	All messages are not suitable for all protocols. *CSV* and *Table* messages cannot be transmitted using SMS due to the limited size of the SMS message (160 characters).

Alarming Protocols

Protocols used to transmit alarm messages through telemetry and local serial links are selected as follows:



1011-021

Figure 70 Selecting Alarming Protocol

Alarm messages are divided into two types: meteorological and technical. Meteorological alarms are based on observed values, for example, air temperature. Technical alarms are triggered by changes in system status, for example, a broken sensor.

Messaging configuration is done per type.

Table 25 Alarm Message Parameters

Alarm Type	Set Name	Parameter Name	Use
Meteorological	MessageDispatcher	alrmet_to_com0	Send to COM0 (RS232)
Meteorological	MessageDispatcher	alrmet_to_email	Send using eMail
Meteorological	MessageDispatcher	alrmet_to_ftp	Send using ftp
Meteorological	MessageDispatcher	alrmet_to_local	Send to Data Out (RS485)
Meteorological	MessageDispatcher	alrmet_to_sms	Send using SMS
Meteorological	MessageDispatcher	alrmet_to_socket	Send using TCP-socket
Technical	MessageDispatcher	alrtech_to_com0	Send to COM0 (RS232)
Technical	MessageDispatcher	alrtech_to_email	Send using eMail
Technical	MessageDispatcher	alrtech_to_ftp	Send using ftp
Technical	MessageDispatcher	alrtech_to_local	Send to Data Out (RS485)
Technical	MessageDispatcher	alrtech_to_sms	Send using SMS
Technical	MessageDispatcher	alrtech_to_socket	Send using TCP-socket
Technical	MessageDispatcher	alrtech_list	Create list of technical alarms

Settings: 0 = Alarm is not sent, 1 = Alarm is sent.

Protocol Parameters

Parameters required to configure different application-level protocols used for messaging are described in the following sections. Parameters for unused protocols must be left unchanged.

TCP-Socket (Virtual Com Port)

TCP-socket connection allows messages to be sent to data acquisition server hosting one or multiple TCP- server sockets, where QML loggers can connect to as TCP-client.

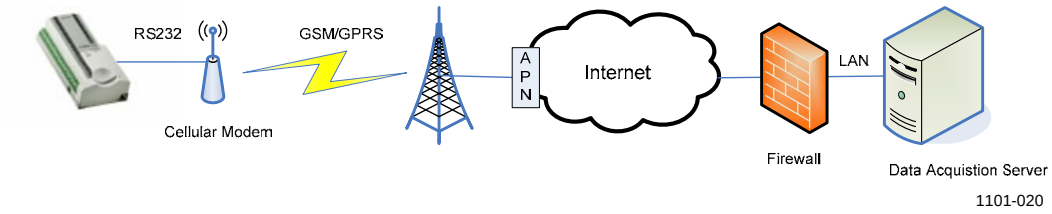


Figure 71 Example TCP-Socket for Message Transmission

NOTE	Raw TCP-sockets are commonly subject to blocking by firewalls. Therefore, opening ports in one or more firewalls may be required.

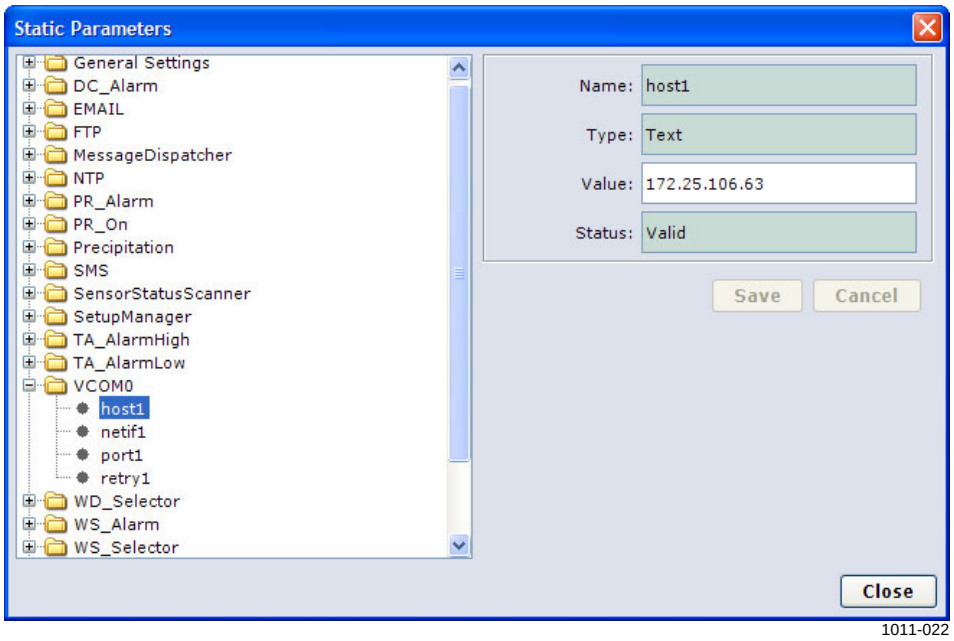


Figure 72 Setting TCP-Socket Parameters

Table 26 TCP-Socket Connection Parameters

Set Name	Parameter Name	Use
VCOM0	host1	Name or IP address of the Data Acquisition Server
VCOM0	port1	TCP port in Data Acquisition Sever
VCOM0	retry1	Number of retries for connecting
VCOM0	netif1	Network interface to use [1]

[1] Preset at factory. Do not modify.

To enable sending messages over TCP-socket, use the following parameters described in Table 24 on page 119 and Table 25 on page 121:

- csv_to_socket
- sms_to_socket
- table_to_socket
- alrmet_to_socket
- alrtech_to_socket

Set the interval of the selected observation message type by (see Table 23 on page 118):

- csv_interval
- sms_interval
- table_interval

File Transfer Protocol (FTP)

FTP enables QML logger to send messages as files to FTP server.

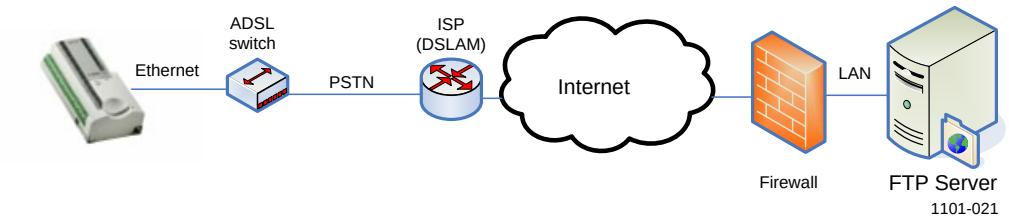


Figure 73 Example FTP Transmission

Messages appear in FTP server as single file per message, in the following directory structure, and named as:

<FTP root>
<AWS Home>
<Station Name>
Obs_FTP<YYMMDDhhmmss>.*rep*

where

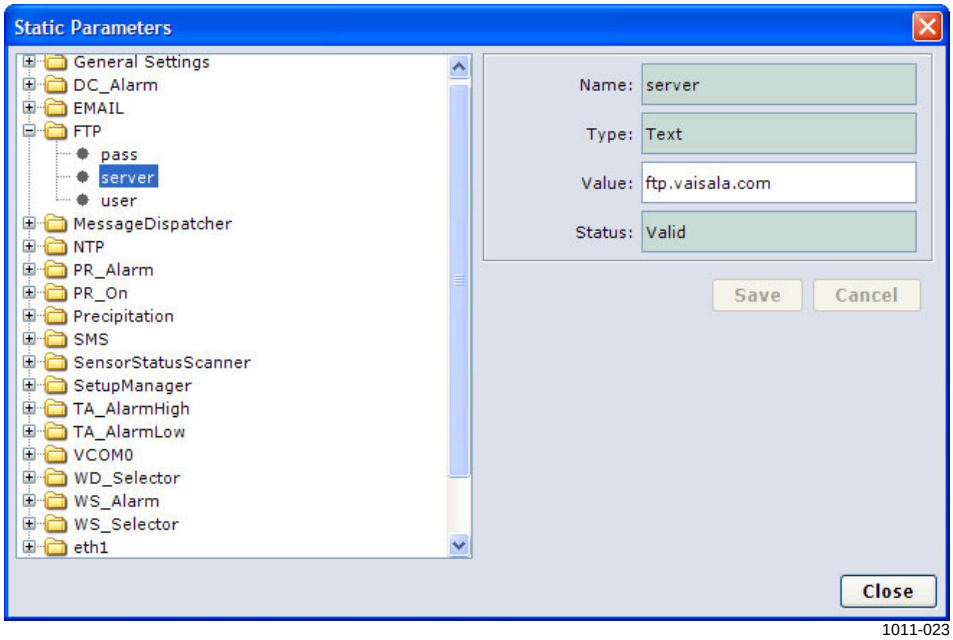
<FTP root>	=	Root directory defined for FTP server
<AWS Home>	=	User home directory defined for AWS login
<Station Name>	=	Station name as set to QML logger
<YYMMDDhhmmss>	=	Message creation timestamp UTC

Example filename:

Obs_FTP101123132213.rep

- Message was created at 2010/11/23 13:22:13 UTC

FTP uses the following station parameters:



1011-023

Figure 74 Setting FTP Parameters

Table 27 FTP Transmission Parameters

Set Name	Parameter Name	Use
FTP	server	Name or IP address for the FTP server
FTP	user	Username to login to the FTP server
FTP	pass	Password to login to the FTP server

NOTE QML logger uses passive mode FTP, which is less prone to be blocked by a firewall.

To enable sending messages to FTP server, use the following parameters described in Table 24 on page 119 and Table 25 on page 121:

- csv_to_ftp (1
- sms_to_ftp (1
- table_to_ftp (1
- alrmet_to_ftp
- alrtech_to_ftp

(1 You are allowed to select only one observation message type for FTP transmission.

Set the interval of the selected observation message type by (see Table 23 on page 118):

- csv_interval
- sms_interval
- table_interval

eMail (SMTP)

QML logger can be configured to send messages as eMail.

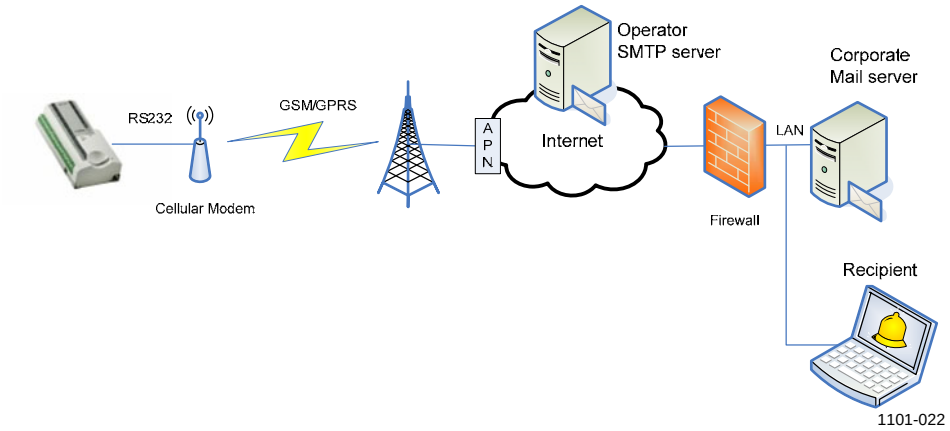


Figure 75 Example eMail Transmission

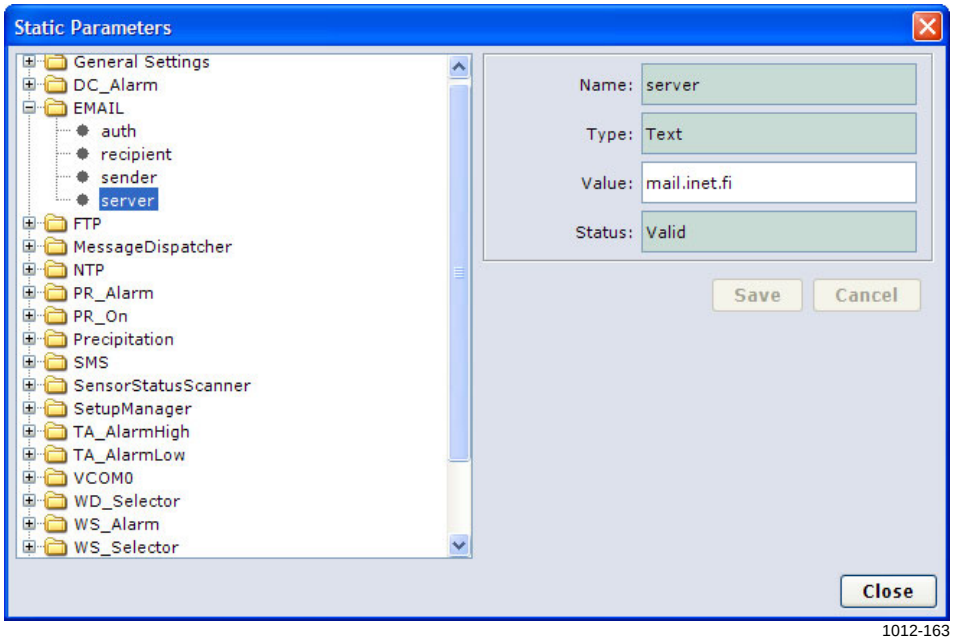
Messages appear in the recipient's eMail inbox as:

Sender: As set to station parameter sender; see Table 28 on page 127.

Subject: Obs_Email <Station Name> <YYMMDDhhmmss>

where

<Station Name>	=	Station name as set to the QML logger
<YYMMDDhhmmss>	=	Message creation timestamp UTC



1012-163

Figure 76 Setting EMAIL Parameters

Table 28 eMail Transmission Parameters

Set Name	Parameter Name	Use
EMAIL	server	Name or IP address for the operator SMTP server
EMAIL	recipient	Recipient eMail address
EMAIL	sender	Sender eMail address [1]
EMAIL	auth	Authentication type to use [2] none = No authentication plain = Authentication mode 'plain' login = Authentication mode 'login'

[1] eMail servers usually check that domain part in sender address is a known domain name, and reject messages from fake domains.
[2] See below for instructions on how to set credentials.

If other authentication mode than *none* is selected, credentials have to be created through the logger's service interface as follows:

1. Start AWS Client software (**Start - All Programs - Vaisala - Vaisala AWS Client**) and connect to the logger.
2. Open service connection by selecting from the menu **Maintenance - Terminal Connect**.

3. Enter the following commands:

   /> paramset hosts:<server>:smtp username <username>
   /> paramset hosts:<server>:smtp password <password>

   where

   <server> = Name of the operator SMTP server
   <username> = Username to use for login
   <password> = Password to use for login

   For example:

   /> paramset hosts:mail.inet.fi:smtp username me
   /> paramset hosts:mail.inet.fi:smtp password mysecret

4. Close the service connection by selecting from the menu **Maintenance - Terminal Disconnect**.

To enable sending messages via eMail server, use the following parameters described in on page 119 and Table 25 on page 121:

- csv_to_email (1
- sms_to_email (1
- table_to_email (1
- alrmet_to_email
- alrtech_to_email

(1 You are allowed to select only one observation message type for eMail transmission.

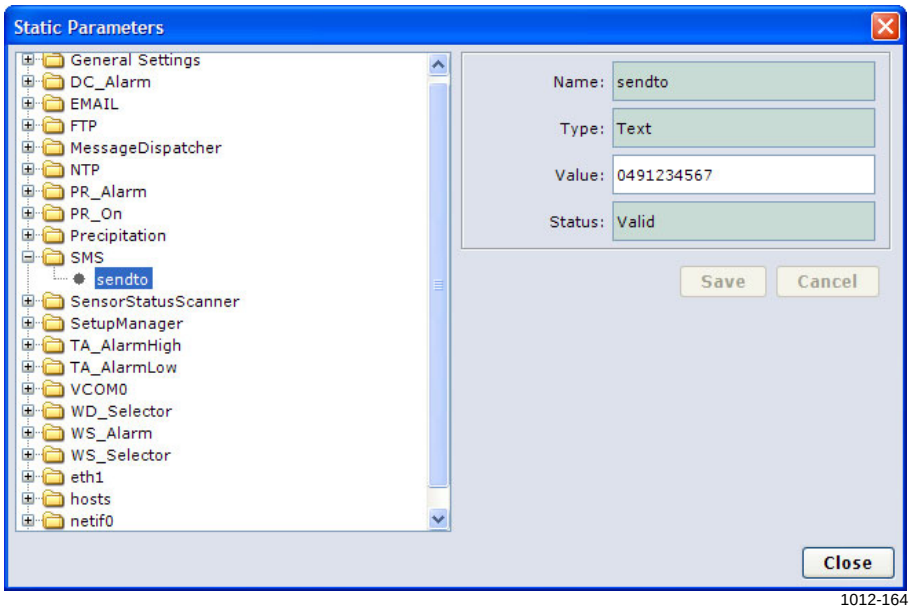
Set the interval of the selected observation message type by (see Table 23 on page 118):

- csv_interval
- sms_interval
- table_interval

GSM SMS

AWS330 can send basic meteorological parameters and alarms using SMS. Message contents are limited in size to fit into a single SMS: 160 characters.

NOTE Due to size limitation, it is not possible to send CSV or Table messages using SMS.



1012-164

Figure 77 Setting SMS Parameters

Table 29 SMS Transmission Parameters

Set Name	Parameter Name	Use
SMS	Sendto	Recipient phone number

NOTE In some cases, it may be necessary to manually set the operator SMS central number. See Table 31 on page 131.

To enable sending observation messages with SMS, use the following parameters described in Table 24 on page 119 and Table 25 on page 121:

- sms_to_sms
- alrmet_to_sms
- alrtech_to_sms

Set interval of observation SMS message by (see Table 23 on page 118):

- sms_interval

Local Serial Line

Observation and alarm messages can be sent over local RS232 and RS485 lines. The following line parameters are fixed in AWS for both COM0 (RS232) and Data Out (RS485):

Table 30 Serial Line Parameters

Parameter	Value
Speed	9600 bps
Data bits	8
Stop bits	1
Parity	None

Use the following parameters to control which messages are sent to local serial lines (see Table 24 on page 119 and Table 25 on page 121):

- csv_to_com0
- csv_to_local
- table_to_com0
- table_to_local
- sms_to_com0
- sms_to_local
- alrmet_to_local
- alrmet_to_com0
- alrtech_to_local
- alrtech_to_com0

Set interval of the selected observation message type by (see Table 23 on page 118):

- csv_interval
- sms_interval
- table_interval

Telemetry Parameters

Settings in the following sections are used to set telemetry parameters depending on the type of telemetry device used (GSM, Ethernet) and the selected protocol.

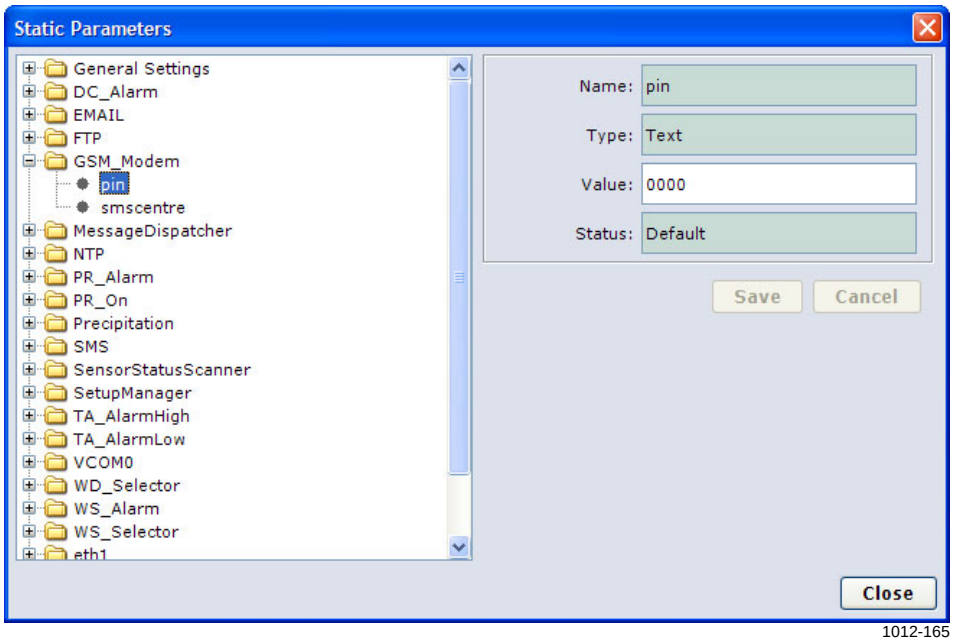
Connection Parameters

GSM Modem

Before starting to set up the GSM modem, you need to obtain a SIM card.

NOTE	Even if using a PIN code is optional, it is recommended that you use it to protect the SIM from unauthorized use. Use a mobile phone to set the PIN.

The following parameters are available for GSM modem:



1012-165

Figure 78 Setting GSM Modem Parameters

Table 31 GSM Modem Parameters

Set Name	Parameter Name	Use
GSM_Modem	pin	PIN code set to SIM card. Leave empty if not used.
GSM_Modem	smscentre	Number for operator's SMS centre. (1

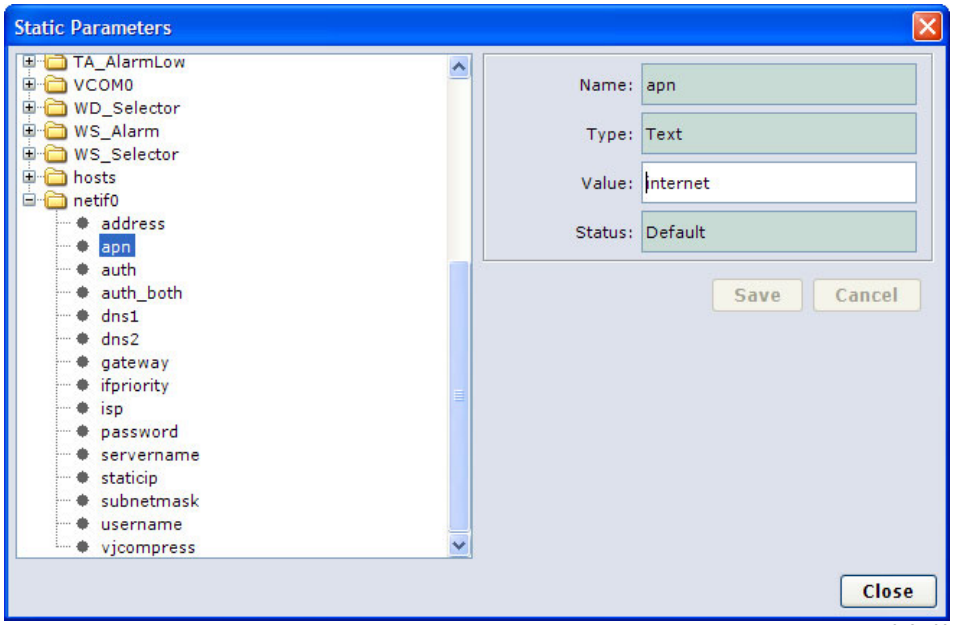
(1 Parameter is optional. Needed only if using SMS and the network does not provide this information automatically.

GPRS

To access IP services using GPRS, the following information is required:

- Operator-specific access point setting (APN)
- Operator-specific username and password. Only if APN requires user credentials
- IP settings for the operator's network (optional). Usually, this information is provided automatically by the network

NOTE	Typically, only APN and optionally user credentials need to be changed. Using other parameters, such as static IP settings, requires special subscription, that is, a private access point or equivalent.



1012-166

Figure 79 Setting GPRS Connection Parameters

Table 32 GPRS Connection Parameters

Set Name	Parameter Name	Use
netif0	apn	Operator-specific access point name
netif0	auth	Authentication type *none* = No authentication *any* = PAP or CHAP *pap* = PAP *chap* = CHAP
netif0	username	Username for authentication
netif0	password	Password for authentication
netif0	isp	Number to dial for connection. By default *99***1# (2
netif0	staticip	Static IP in use. 0 = No, 1 = Yes (2
netif0	address	AWS IP address (1,2
netif0	subnetmask	Network mask (1,2
netif0	gateway	Default gateway (1,2
netif0	dns1	Domain name server 1 (2
netif0	dns2	Domain name server 2 (2
netif0	vjcompress	Use IP header compression. (2
netif0	autoinit	Bring interface automatically up when AWS starts, and attempt to keep always open. Otherwise interface is open only when needed.

(1 Used only when staticip = 1.

(2 Do not modify setting unless explicitly instructed to do so by the network operator.

CSD Dial-In (Data Call)

Using AWS in dial-in mode does not require additional parameter settings.

NOTE CSD dial-in is enabled with GPRS for service purposes, but it should be noted that AWS cannot answer incoming calls while GPRS connection is active.

After connecting the AWS by calling, AWS accepts the following polls:

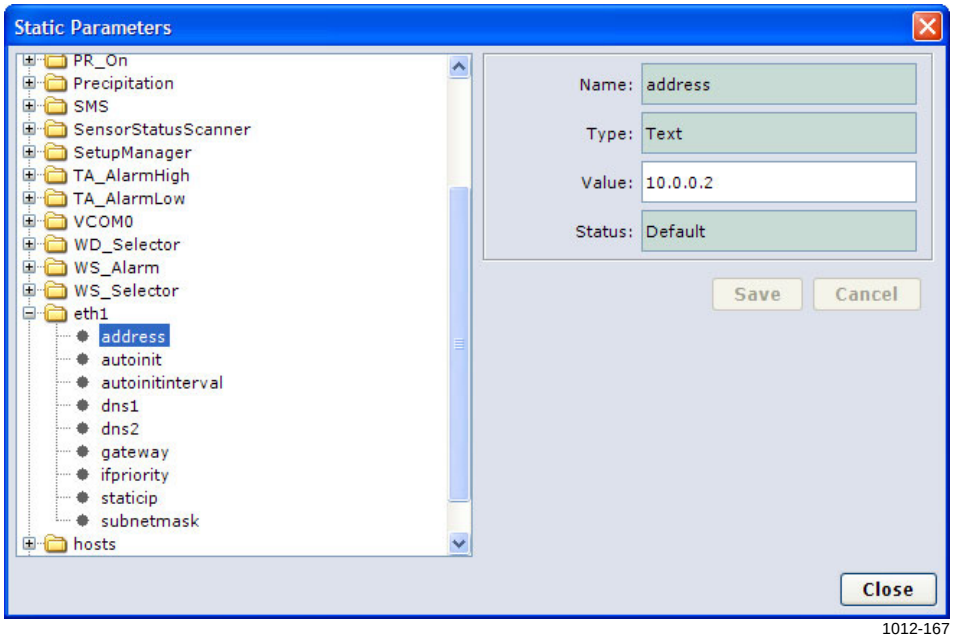
Table 33 Message Poll Commands

Poll Command	Output Message
CSV	CSV
TABLE	Table

Ethernet

AWS Ethernet board does not require any configuration. IP connection established over it uses the following parameters:

NOTE	By default, Ethernet is brought up when AWS starts, and it uses a dynamic IP address obtained from the DHCP server. The dynamic address can be checked using RS232 service connection to COM0 and issuing command **ipconfig**.



1012-167

Figure 80 IP Settings for Ethernet

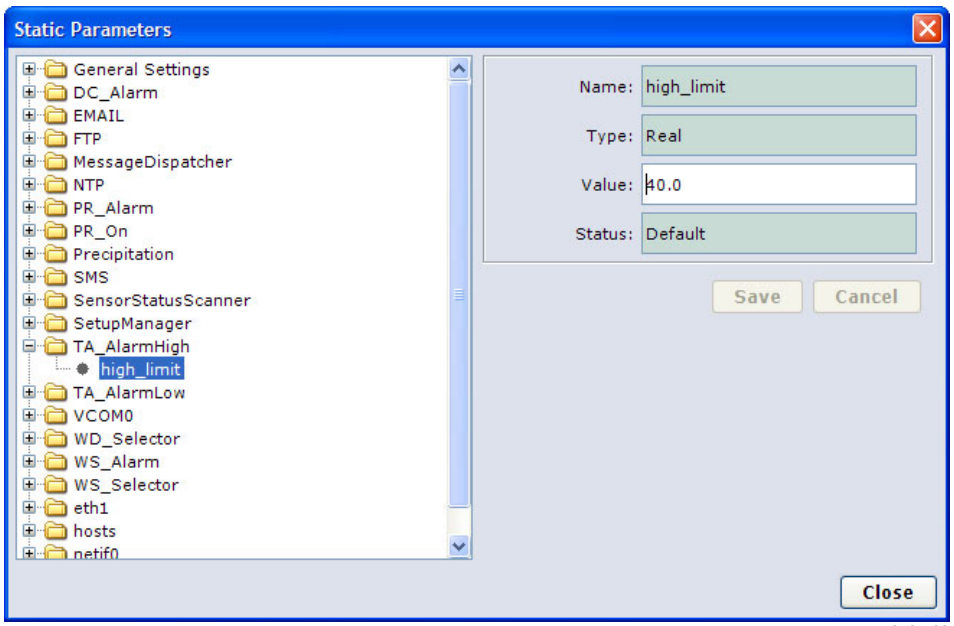
Table 34 Ethernet Connection Parameters

Set Name	Parameter Name	Use
eth1	Staticip	Static IP in use. 0 = No, 1 = Yes [(1]
eth1	Address	AWS IP address [(1]
eth1	Subnetmask	Network mask [(1]
eth1	Gateway	Default gateway [(1]
eth1	dns1	Domain name server 1 [(1]
eth1	dns2	Domain name server 2 [(1]
eth1	Autoinit	Bring interface automatically up when AWS starts, and attempt to keep always open. Otherwise, interface is opened only when needed.

[(1] Using static IP has to be approved by the organization operating the network.

Alarms

The following parameters provide limits for preconfigured alarms:



1012-168

Figure 81 Setting Alarm Limits

Table 35 Alarm Limit Parameters

Monitored Value	Unit	Alarm	Set Name	Limit Type	Default Limit
Air temperature instant	°C	High limit	TA_AlarmHigh	high_limit	40
Air temperature instant	°C	Low limit	TA_AlarmLow	Low_limit	0
Wind speed max 10 min	m/s	High limit	WS_Alarm	high_limit	20
Precipitation sum 1 hour	mm	High limit	PR_Alarm	high_limit	20
Datalogger temperature	°C	High limit	None	Fixed +65 °C	65
Datalogger temperature	°C	Low limit	None	Fixed -65 °C	-65
Datalogger supply voltage	VDC	Low limit	DC_Alarm	Low_limit	10.5

To enable transmission of alarm message with the selected media, use one of the options described in Table 25 on page 121.

AWS Client Main Window

On top of the main window, you find the AWS Client toolbar. All commands are accessible using the AWS Client menu, but you can also use the toolbar as a quick way to select functions.

Table 36 Toolbar Icons and Functions

Icon	Function	Description
	Open connection	Opens the address book for selecting the weather station to connect to.
	Close current connection	Closes the connection to the QML logger.
	Open command mode	Opens the service connection for issuing commands to the QML logger.
	Close command mode	Closes the service connection. The terminal window begins to show the messages and reports configured in the QML logger.
	Upload setup file	Selects the new configuration (setup) file you want to upload and starts uploading.
	Download log files	Selects the data log files you want to download and starts downloading.
	Copy selected text from terminal window	Copies the selected text from the terminal window to Windows Clipboard.
	Clear terminal window	Clears the commands and responses in the terminal window.
	Set common parameters	Opens the **Common Parameters** window for editing and viewing the parameter values.
	Set static parameters	Opens the **Static Parameters** window for editing and viewing the parameter values.
	Set manual sensor values	Opens the **Manual Sensors** window for viewing and setting manual sensor measurements.
	Show system information	Displays information on the QML logger with which the connection has been established.

Defining AWS Client Settings

When you start the software for the first time, you need to define the settings to be used during download. Use the **Settings** menu options for this purpose.

Read Only Mode

Multiple instances of AWS Client can be open simultaneously. However, changes to the AWS Client settings can be permanently saved only from the instance that was started first; all subsequent instances run in read only mode, and cannot be used for changing settings.

Using Address Book

The AWS Client Address Book, shown in Figure 82 below, is used for storing and maintaining information on connections and their parameters. The connection parameters to be configured depend on the connection type: serial line, dial-up connection, or TCP/IP socket connection. The following sections describe the parameters for each connection type.

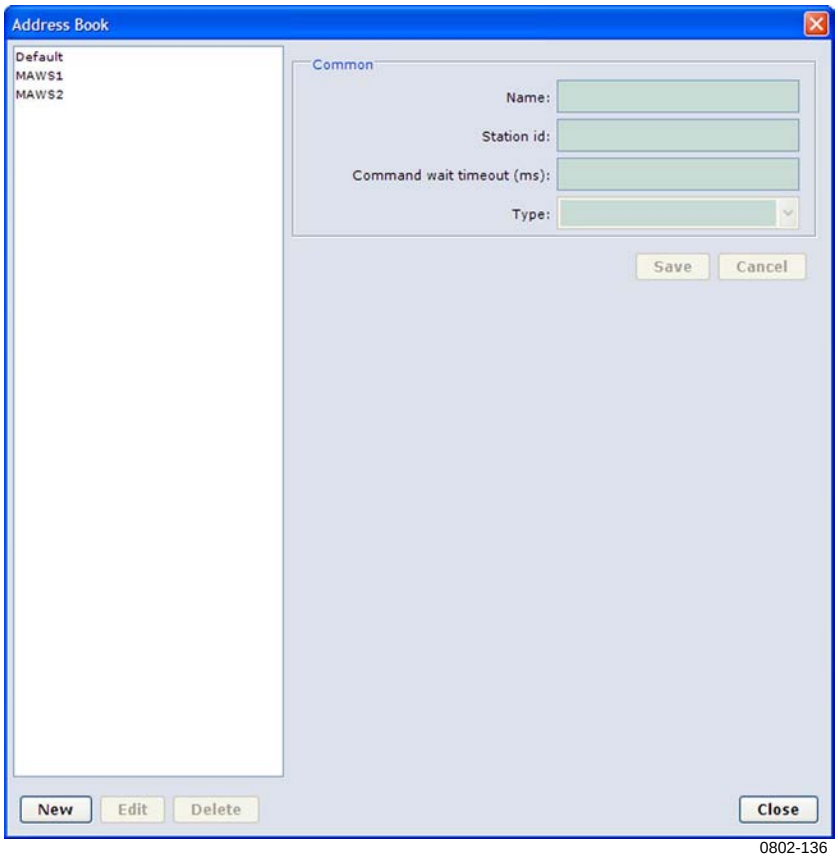
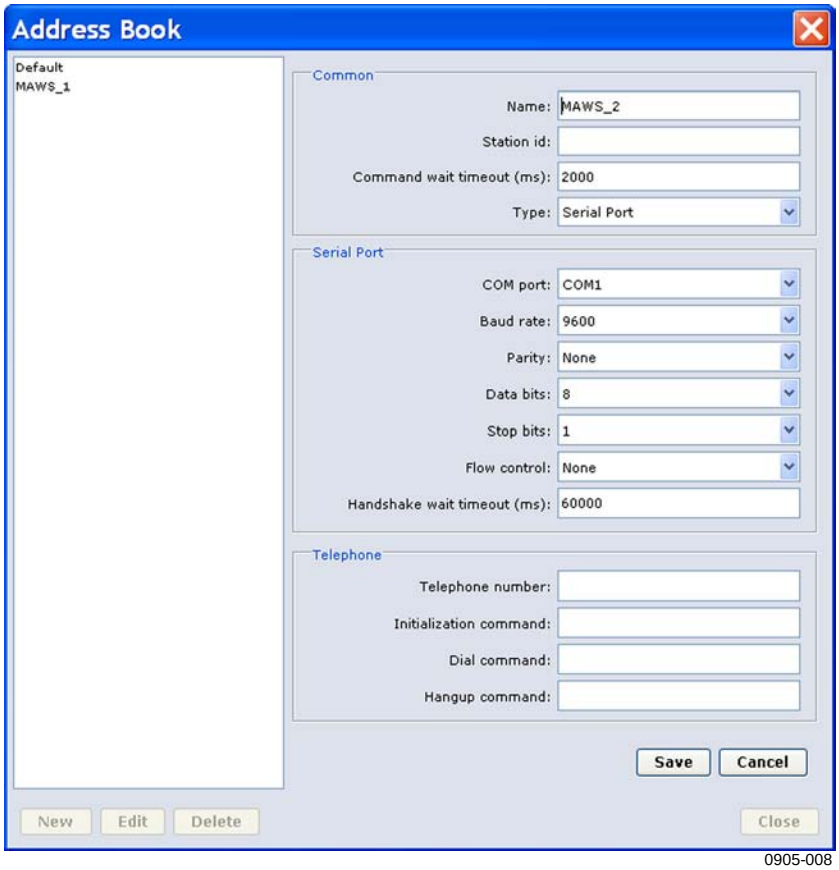


Figure 82 Address Book Window

Serial Line Connections

To add an Address Book entry for a serial line connection, proceed as follows:

1. On the **Settings** menu, select **Address Book**.
2. Select **New**. The fields for selecting new connection parameters are displayed.
3. From the **Type** list, select the type of the connection; that is, select **Serial Port.** The fields for selecting a serial port connection, shown Figure 83 below, are displayed.



0905-008

Figure 83 Creating Serial Line Address Book Entry

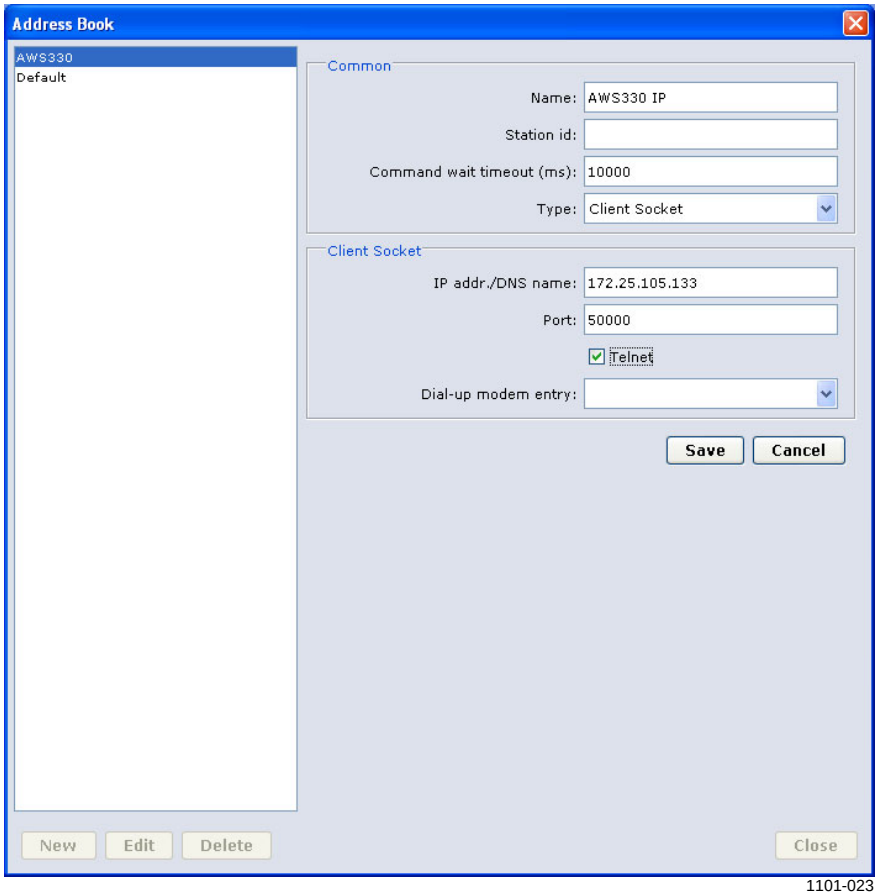
4. In the **Name** field, enter an alphanumeric string that uniquely identifies the connection you are creating in the Address Book.
5. If you have multiple QML loggers on the same network and you are going to access them over the same serial connection, you will need a unique identifier for each logger. To uniquely identify the logger for which you are creating an Address Book entry, enter a unique alphanumeric string in the **Station id** field. If you only have a single logger on the network, you can leave the Station id entry blank.

6. In the **Command wait timeout (ms)** field, enter a value in milliseconds that specifies for how long AWS Client will wait for the logger to respond when AWS Client sends a requests over the serial line connection. If the request, for instance, a log file download, succeeds within the timeout, a success message is displayed. If the request fails, a failure message is displayed instead, and you have the option to try again at a later time. Factors such as the current load on the logger, delays in the connection, and the response length affect whether or not the timeout will expire during a request.
7. From the **COM port** field, select the serial port to be used on your computer and the line parameters. The default line parameters for the QML logger are 9600 bps, No parity bit, 8 data bits, 1 stop bit, No flow control.
8. If you are using a modem to connect to the QML logger, enter also the **Telephone number** to dial, the modem **Initialization** and **Dial commands**, and the **Hangup command**. For instance, in the **Initialization command** field, you could enter "**ATE\rATX1**"; that is, multiple AT commands separated by a "**\r**". Likewise, in the **Dial-up command** field, you could enter **ATDT123456**; that is, an AT command immediately followed by a phone number.
9. Save your settings and return to the **Address Book** window by selecting **Save**.

TCP/IP Socket Connections

To add an Address Book entry for a TCP/IP socket connection, proceed as follows:

1. On the **Settings** menu, select **Address Book**.
2. Select **New**. The fields for selecting new connection parameters are displayed.
3. From the **Type** list, select **Client socket** or **Server socket** as the connection type. The fields for selecting the TCP/IP connection parameters, shown in Figure 84 on page 141, are displayed.



1101-023

Figure 84 Creating TCP/IP Socket Connection Address Book Entry

4. In the **Name** field, enter an alphanumeric string that uniquely identifies the connection you are creating in the Address Book.
5. If you have multiple QML loggers on the same network and you are going to access them over the same TCP/IP connection, you will need a unique identifier for each logger. To uniquely identify the logger for which you are creating an Address Book entry, enter a unique alphanumeric string in the **Station id** field. However, if you only have a single logger on the network, you can leave the Station id entry blank.
6. In the **Command wait timeout (ms)** field, enter a value in milliseconds that specifies for how long AWS Client will wait for the logger to respond when AWS Client sends a requests over the TCP/IP connection. If the request, for instance, a log file download, succeeds within the timeout, a success message is displayed. If the request fails, a failure message is displayed instead, and you have the option to try again at a later time. Factors such as the current load on the logger, delays in the connection, and the response length affect whether or not the timeout will expire during a request.

7. In the **IP addr./DNS name** field, enter the destination IP address or DNS name.

NOTE In order to use the DNS name, you must have access to a DNS server to be able to resolve the DNS name to the IP address of the destination host.

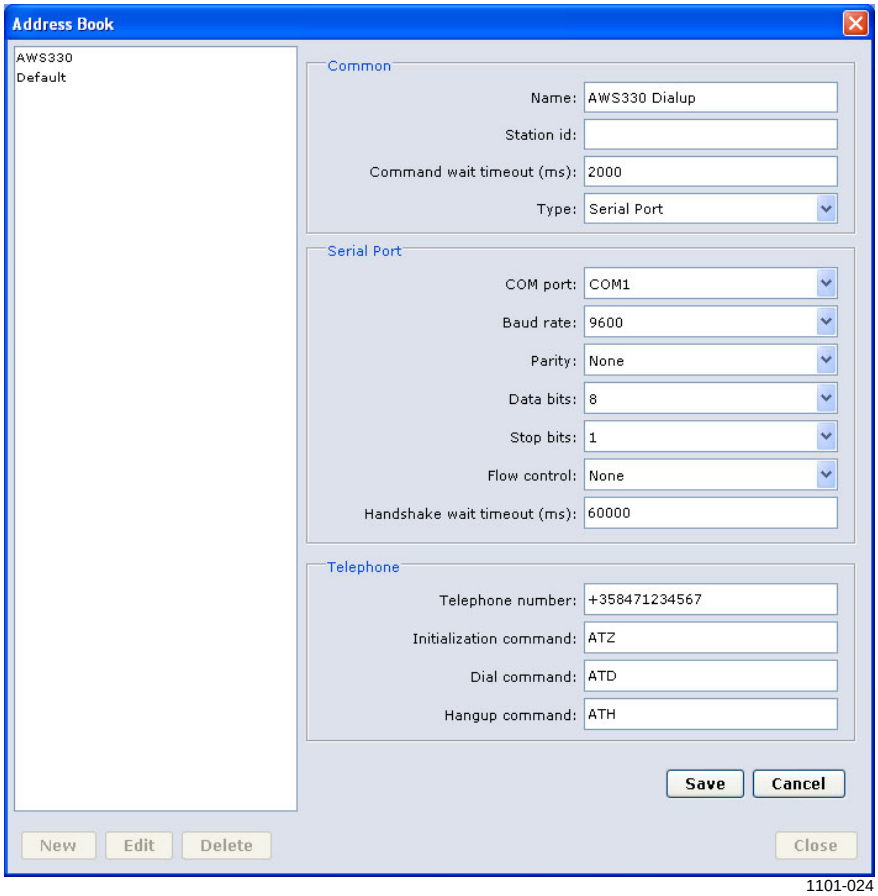
NOTE For **Server socket**, the target **IP addr./DNS name** is not available in the user interface.

8. Enter the port to be used in the **Port** field. Note that for **Client socket**, this must match the port set for incoming connections in the interface configuration in the QML logger. For **Server socket**, Host address and port defined for virtual COM port must match the AWS Client IP address and port.
9. If support for Telnet escape sequences for binary file transfer is required, select the **Telnet** option.
10. Save your settings and return to the **Address Book** window by selecting **Save**.

Dial-Up Connections

The dial-up connections are based on Windows Dial-Up Networking entries, so you first need to create the connection in Windows. For information on creating Windows Dial-Up Networking connections, please see the Windows online help. To add an Address Book entry for the dial-up connection, proceed as follows:

1. On the **Settings** menu, select **Address Book**.
2. Select **New**. The fields for selecting new connection parameters are displayed.
3. From the **Type** list, first select **Socket**. The field for selecting Windows Dial-Up Networking entries is available in the window shown in Figure 85 on page 143.



1101-024

Figure 85 Creating Dial-Up Connection Address Book Entry

4. In the **Name** field, enter an alphanumeric string that uniquely identifies the connection you are creating in the Address Book.
5. If you have multiple QML loggers on the same network and you are going to access them over the same dial-up connection, you need a unique identifier for each logger. To uniquely identify the logger for which you are creating an Address Book entry, enter a unique alphanumeric string in the **Station id** field. However, if you only have a single logger on the network, you can leave the Station id entry blank.
6. In the **Command wait timeout (ms)** field, enter a value in milliseconds that specifies for how long AWS Client will wait for the logger to respond when AWS Client sends a requests over the dial-up connection. If the request, for instance, a log file download, succeeds within the timeout, a success message is displayed. If the request fails, a failure message is displayed instead, and you have the option to try again at a later time. Factors such as the current load on the logger, delays in the connection, and the response length affect whether or not the timeout will expire during a request. In case the system has a large amount of static parameters,

the set static parameters command can require a long command wait timeout.

7. From the **Dial-up modem entry** pull-down menu, select an ISP Name, that is, the Windows Dial-up Networking entry that you created as a prerequisite for this address book entry.
8. Save your settings and return to the **Address Book** window by selecting **Save**.

Options Window

The **Options** window contains general settings for AWS Client. To open the window, select **Options** on the **Settings** menu. The Options window, shown in Figure 86 below, contains the items listed in Table 37 on page 145.

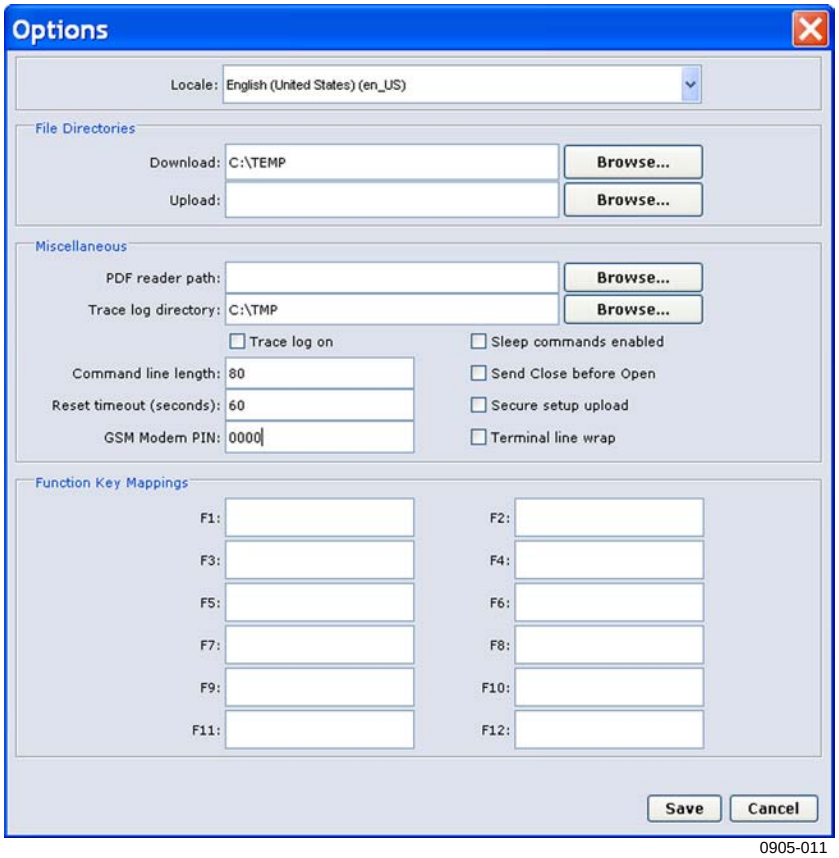


Figure 86 Options Window

Table 37 Settings in AWS Client Options Window

Setting	Description
Locale	User interface language used in AWS Client. If AWS Client has not been localized for the selected language, the user interface will remain in English. [1)]
Setup file download directory	Default download directory for QML logger setup files. You can either enter the path for your directory or select **Browse** and browse for the directory.
Setup file upload directory	Default upload directory for QML logger setup files. You can either enter the path for your directory or select **Browse** and browse for the directory.
PDF reader path	Location of the PDF reader on the workstation on which the AWS Client is installed. The AWS Client help file is in PDF format and needs a reader.
Trace log directory	AWS Client logs the information sent by the QML logger during the terminal session to a file. The trace log directory specifies the location of the trace log.
Trace log on	When selected, the **Trace log on** option causes a trace log to be created. For troubleshooting purposes, you can, for example, log your commands and the responses given by the QML logger.
Sleep commands enabled	Enables the **Sleep** command for setting the QML logger to a power-saving mode as well as the **Wakeup** command for powering up the logger after it is put to sleep.
Send close before open	Always send the **Close** command before attempting to open terminal connection.
Secure setup upload	Use secure setup upload procedure when uploading the setup. Using this option will cause the setup upload to take more time, but using the option is recommended especially when uploading setups over an unreliable connection.
Terminal line wrap	Folds overlong lines in the terminal window onto the next line.
Command line length	Maximum length for a command sent from the command line to the QML logger. The default value is 80 characters. This can be set to a smaller value, which, however, must match the value specified in the setup file on the logger. For URL settings, 80 characters might not be long

Setting	Description
	enough, and the value has to be set higher.
Reset timeout (seconds)	Maximum time to wait for the logger to execute reset.
GSM Modem PIN	The PIN code for the GSM modem SIM card.
Function Key Mappings	The function key mappings can be used for mapping frequently used QML logger shell commands to the function keys on your keyboard. Example (note that the command ends in a carriage return): **SYSINFO<CR>**

[1)] To convert dates correctly, the date format for the selected locale has to match the common date format set for the operating system.

Number Format

The number format used in AWS Client and QML logger configuration changes depends on the number format selected in the Windows regional settings.

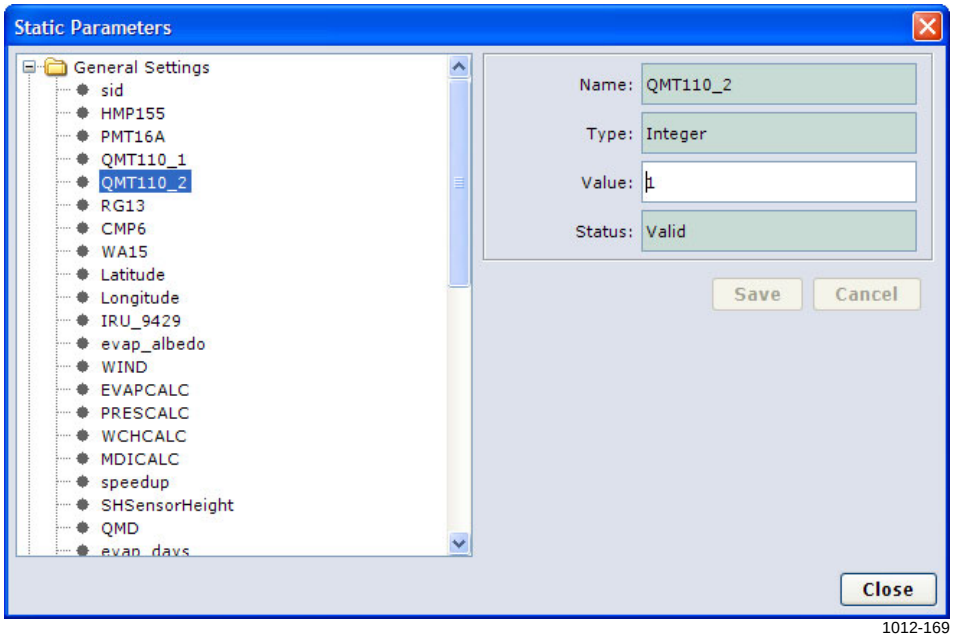
CAUTION Using the incorrect decimal symbol when changing QML logger parameters, for example, in sensor calibration or setting parameters, may result in errors. Always use the decimal symbol defined in the Windows regional settings.

You can change the Windows regional settings and the decimal symbol using the Windows Control Panel. For instructions, please refer to the Windows online help.

Changing Sensor Configuration

If standard AWS330 sensors are added to or existing sensors are removed from the configuration, sensor management parameters should be changed accordingly.

The following parameters are used to control sensor configuration:



1012-169

Figure 87 Changing Sensor Configuration

Table 38 Sensor Selection Parameters

Set Name	Parameter Name	Sensor
General settings	HMP155	Air temperature and relative humidity probe HMP155
General settings	PMT16A	Barometric pressure sensor BARO-1
General settings	QMT110_1	Soil/water temperature sensor QMT110
General settings	QMT110_2	Soil/water temperature sensor QMT110
General settings	RG13	Rain gauge RG13
General settings	CMP6 [1]	Global radiation sensor CMP6
General settings	IRU_9429	Snow height sensor IRU-9429
General settings	WIND	Wind sensor
General settings	WA15	Wind sensor type 0 = Ultrasonic WMT700 series 1 = Mechanical WAV15/WAA15

[1] Global radiation sensor CMP6 has unique sensitivity factor that needs to be entered to the AWS330 system as described in section Replacing CMP6 on page 182.

Settings: 0 = Sensor/option is not selected, 1= Sensor/option is selected.

In addition to sensor selection, certain calculations depending on multiple sensors need to be enabled and disabled separately.

NOTE If a sensor is removed from the AWS330 configuration according to table Sensor Selection Parameters on page 147, any depending calculations must be also removed by changing the corresponding selection parameter, as described in Table 39 below.

Table 39 Calculation Selection Parameters

Set Name	Parameter Name	Calculation(s)	Sensor Dependency
General settings	EVAPCALC	Evapotranspiration	HMP155, BARO-1, WAA15/WMT703, CMP6
General settings	PRESCALC	QFE, QFF, QNH, pressure tendency/trend	HMP155, BARO-1
General settings	WCHCALC	Wind chill	HMP155, WAA15/WMT703
General settings	MDICALC	Wet bulb temperature, vapor pressure	HMP155, BARO-1

Settings: 0 = Calculation is disabled, 1 = Calculation is enabled.

Opening Service Connection

Before you can download files or upload the setup file, you need to open a service connection to the QML logger.

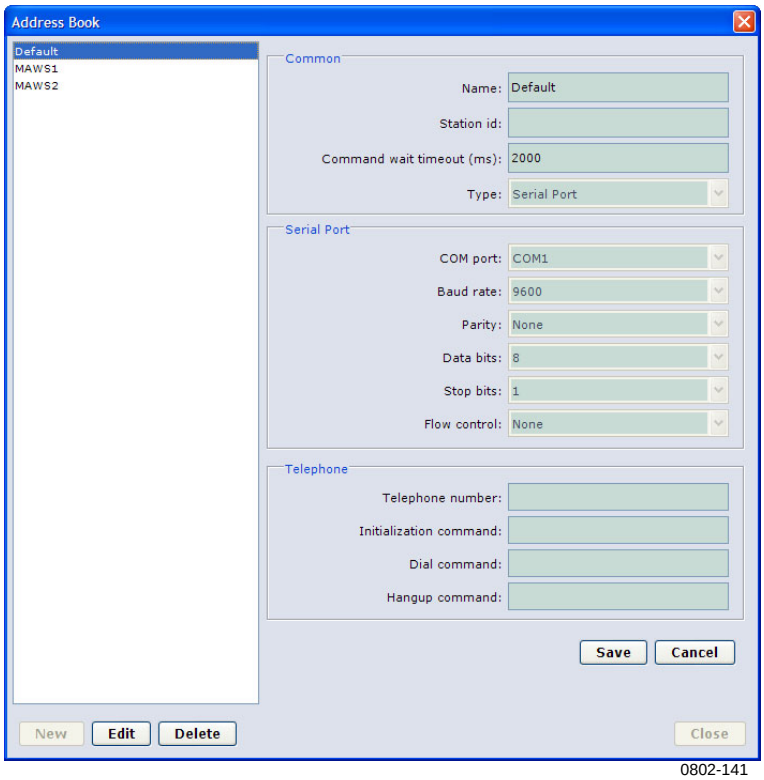
The supported connection types are serial port, TCP/IP socket, and dial-up using a modem.

AWS Client supports any number of serial ports available in the computer. The software reads which serial ports are installed from the Windows registry1.

This feature also enables the use of USB to RS-232 converter cables that are usually installed above any other COM ports installed on a computer. The COM port number of a converter cable depends on the system configuration. For example, in a desktop computer with only two physical COM ports (COM1 and COM2), a converter cable is installed as COM3.

When reassigning the COM ports after installation, for example, when changing COM5 to COM4 afterwards, you need to recreate the address book entry for the modified COM port manually.

To establish a connection to the QML logger, select **Connect** from the **File** menu. You can also click the **Open connection** icon. The **Address Book** window is displayed as shown in Figure 88 on page 149.



0802-141

Figure 88 Address Book Window

In the **Address Book** window, select the address book entry for the QML logger and click **OK**.

To open the service connection, select **Terminal Connect** on the **Maintenance** menu or click the **Open command mode** button on the toolbar. You can also type the **open** command with your keyboard and press **enter**. Note that the typed characters are not echoed on the screen.

When the connection is opened, the following text appears on your screen:

```
Service connection opened
/>
```

Giving Commands

When you have established the connection to the QML logger, you can use the commands described in Table 40 below to communicate with the QML logger. Commands are text strings sent from the PC or terminal to the logger.

To open the connection, select **Terminal Connect** on the **Maintenance** menu or click the **Open command mode** button on the toolbar. To close the terminal connection, select **Terminal Disconnect** on the **Maintenance** menu or click the **Close command mode** button on the toolbar. Logging is not affected unless it is stopped using the **logstop** command. In the closed mode, the serial line will be available for report sending.

NOTE Both **open** and **close** commands have to be typed in the exactly correct way before they can be executed. This means that you cannot use the BACKSPACE key to correct your typing. Simply retype the command and press **ENTER** to give the command again.

Most of the commands can be used for both setting a value for a parameter and viewing the set value of a parameter.

Type **help** to get a list of available commands. Each command must be entered using the correct syntax. You do not have to memorize complex commands since you can view a help text that shows the correct syntax at any time. Simply type **help** and the command name.

Table 40 Interpreting Help Texts (Correct Syntax)

Generic Representation	Example		Note
Use the parameter name	**warnings** [*clear*]	To see the warnings, type: **warnings**	Parameters shown in [ ] can be omitted.
		To remove warnings, type: **warnings** *clear*	
Replace parameter symbols with values	**time** [*HH MM SS YY MM DD*]	To see current time, type: **time**	
		To set new time, type for example: **time** *15 45 00*	
		To set new time and date, for example: **time** *15 45 00 07 06 18*	
	loggo <*group_id*>		Parameters shown in < > cannot be omitted.

NOTE	Commands have to be typed in the same case as indicated in the help texts, usually in lower case.

The command name and the following parameters are always separated by a space. Pressing **ENTER** (return) will execute the command so that the QML logger reads the typed command.

You can use BACKSPACE to delete the last typed character.

Use **CTRL+P** (hold down the CTRL key and press P) to repeat the previously typed command. Use **CTRL+P** (Previous) and **CTRL+N** (Next) to scroll through the list of previously typed commands. When you find the command you would like to repeat, simply press **ENTER**. File commands (**dir**, **del**, **copy**, **move**, **verify**) can be aborted with **CTRL+C**.

Closing Service Connection

If your connection to the QML logger works via a modem, remember to close the line after you finish working with the logger. To close the connection, choose **Disconnect** from the **File** menu.

If your connection to the QML logger is direct, you are recommended to close the service connection by entering the **close** command or selecting **Terminal Disconnect** on the **Maintenance** menu. The program closes the service connection automatically after 5 minutes.

Station Parameter Backup and Restore

AWS Client can be used to create a backup of station-specific settings from the logger, and to restore a backup file to the logger.

To create a station settings backup with AWS Client, proceed as follows:

1. Establish connection to the data logger.
2. Open the **Settings** menu and choose **Parameters** and **Backup from Logger**.

3. In the file dialog, select the destination file where the parameters are to be stored to. The file has XML format, so using extension *.xml* is preferred.

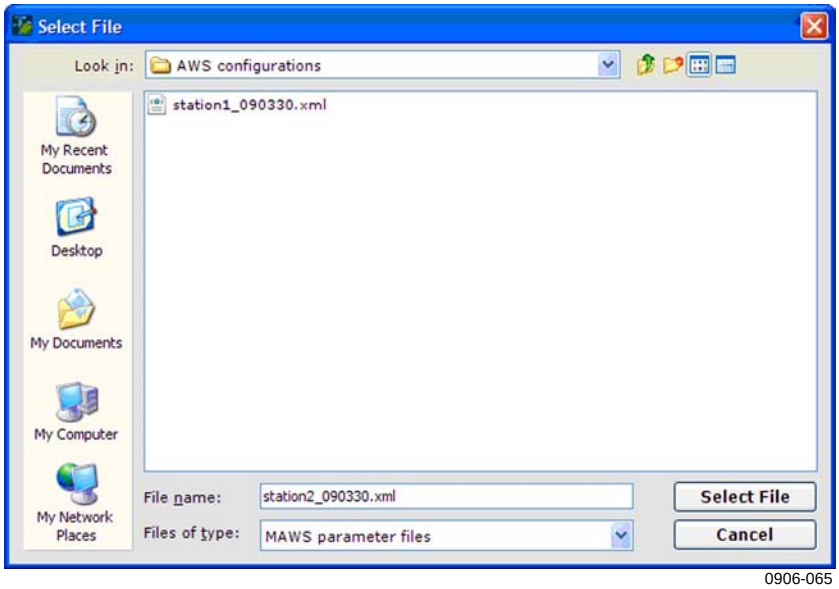


Figure 89 Selecting File for Station Settings Backup

4. Click **Select File** to start the backup.
5. A file download progress dialog appears, and the backup is complete when AWS Client displays the following window:

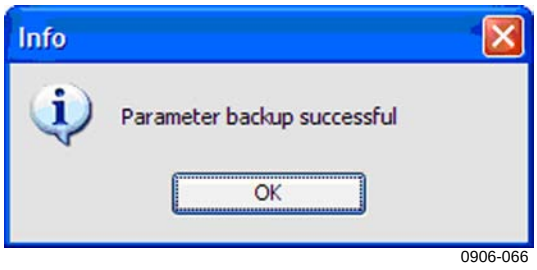


Figure 90 Parameter Backup Completed

To restore station settings backup with AWS Client, proceed as follows:

1. Establish connection to the QML logger.
2. Open the **Settings** menu and choose **Parameters** and **Restore to logger**.

3. In the file dialog, select the file containing the backup.

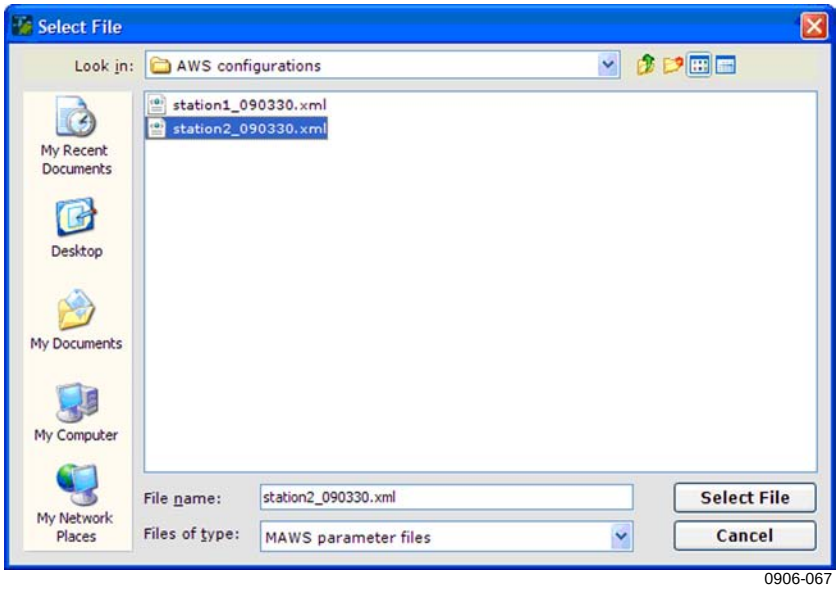


Figure 91 Selecting File for Station Settings Restore

4. Click **Select File** to start the restoring.
5. A file upload progress dialog appears, and the restoring is complete when AWS Client displays the following message:

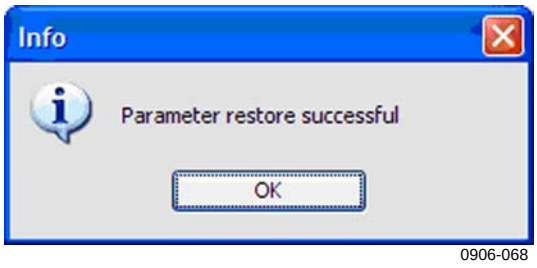


Figure 92 Parameter Restore Complete

Working with Data Log Files

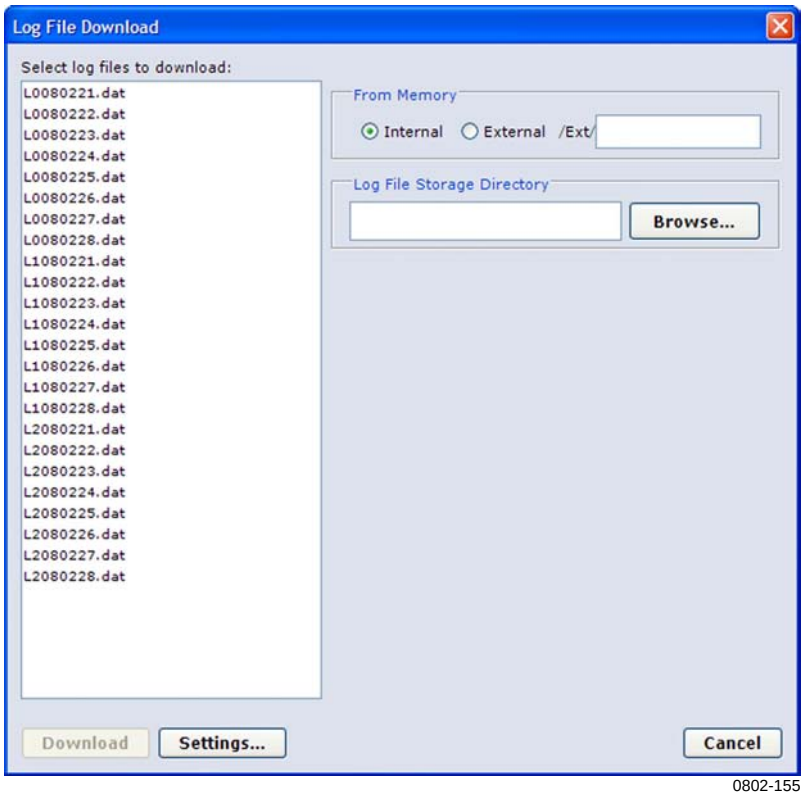
The most convenient way to get the logged data from the station is to use the AWS Client software. To do this, you need to open the service connection, download the files from the QML logger to your PC and convert them to CSV (Comma Separated Value) format. After the conversion, you can view the files directly in the AWS Client software or, for example, in Microsoft Excel.

Before you start downloading the files, you need to open a connection to the QML logger by selecting the **Connect** option from the **File** menu or clicking the **Open connection** button on the toolbar. For more information on opening the connection, see section Opening Service Connection on page 148.

Downloading Log Files

To download log files from the QML logger, proceed as follows:

1. In the **Maintenance** menu, select **Log File** and then **Download from Logger**. The list of log files available for downloading in the QML logger is displayed (see Figure 93 below). The files are arranged by log group. Each log group includes specific parameters as defined in the setup file. If you use an external memory card, select the **External** option and, if required, enter the directory to use on the external memory card.



0802-155

Figure 93 List of Log Files Available for Downloading

2. Select the files you want to download by clicking them on the list. To select multiple consecutive files, click the first file in the list, press and hold down the SHIFT key, and then click the last item. To select files that are not consecutive, press and hold down the CTRL key, and then click each item. To select all files on the list, press CTRL+A. Select the files you want to download by selecting the file name in the **Select files to download** list. If you decide not to download a file after all, you can remove its selection by clicking on the file name.
3. Select the folder for storing the downloaded log files by entering the path in the **Log File Storage Directory** field. You can also select **Browse** and then browse for the folder for storing the downloaded log files.

4. To set your download options, select **Settings**. The **Log File Download Settings** window shown in Figure 94 below is displayed.

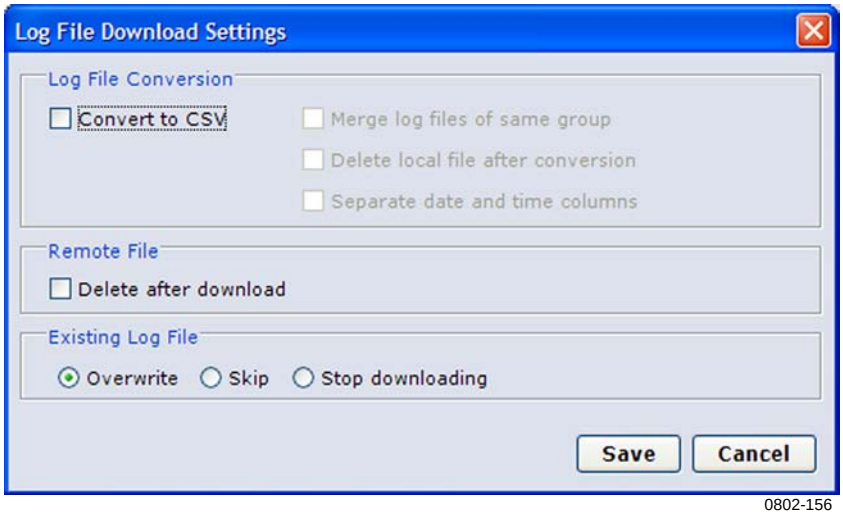


Figure 94 Log File Download Settings Window

NOTE	The date and time formats in the converted log files depend on the date and time formats specified in the AWS Client language options.

5. The options available in the window and their uses are described in Table 41 below.

Table 41 Log File Download Options

Option	Description
Convert to CSV	Converts downloaded log files to CSV format.
Merge log files of same group	Merges log files from different dates belonging to the same log group. In order to use this option, the **Convert to CSV** option must be selected.
Delete local file after conversion	Deletes downloaded binary log files after they have been converted to CSV format. In order to use this option, the **Convert to CSV** option must be selected.
Separate date and time columns	Converts the date and time string in the log file into separate columns for the date and time of the log entries. In order to use this option, the **Convert to CSV** option must be selected.
Remote File - Delete after conversion	Deletes the downloaded log file from the QML logger after it has been downloaded. Selecting this option will conserve storage space on the QML logger.
Overwrite	If a log file with the same name already exists in the log file download folder on your PC, overwrites the existing file with the new file.
Skip	If a log file with the same name already exists in the log file download folder on your PC, skips the new file with the same name when downloading.
Stop downloading	Stops downloading the selected log files if a log file with the same name already exists in the log file download folder on your PC.

NOTE	Download settings are stored on your PC, so any future downloads will automatically use the same settings.

6. Save your download options and return to the log file selection window by selecting **Save**.
7. Start downloading the log files by selecting **Download**. A download progress dialog is displayed (see Figure 95 below). If you want to cancel the download, select **Cancel**. When the files have been downloaded, you can close the download progress window and return to the main menu window by selecting **Close**. The downloaded log files are located in the folder defined in the **Log File Storage Directory** field.

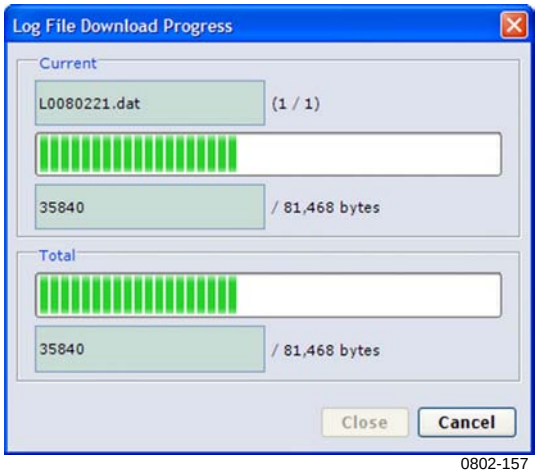


Figure 95 Log File Download Progress View

Converting Downloaded Log Files to CSV Format

You can use the CSV conversion functionality to convert log files downloaded to AWS Client in binary format to CSV format.

NOTE	The date and time formats in the converted log files depend on the date and time formats specified in the AWS Client language options.

To convert downloaded log files, proceed as follows:

1. In the **Maintenance** menu, select **Log File** and then **Convert**. The list of log files downloaded to AWS Client is displayed as shown in Figure 96 below.

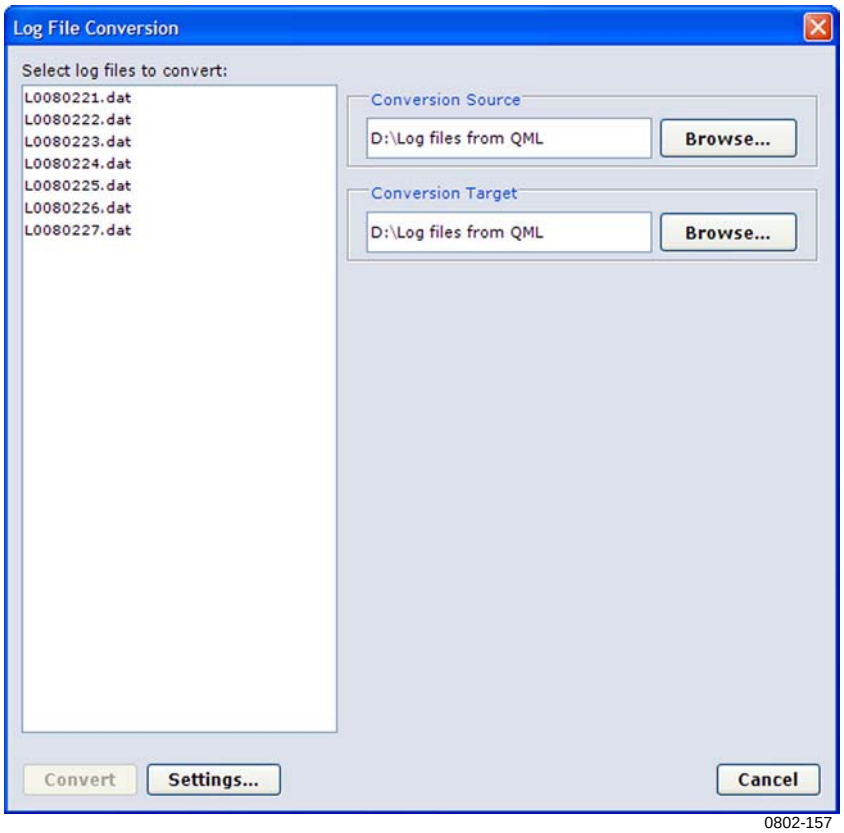


Figure 96 List of Log Files Available for Conversion

2. Select the log file conversion source folder by selecting **Browse** in the **Conversion Source** frame and then browsing for the folder containing the log files to convert.
3. Select the log file conversion target folder by entering the path in the **Conversion Target** field. You can also select **Browse** and then browse for the target folder.
4. Select the files you want to convert by clicking them on the list. To select multiple consecutive files, click the first file in the list, press and hold down the SHIFT key, and then click the last file. To select files that are not consecutive, press and hold down the CTRL key, and then click each item. To select all files on the list, press CTRL+A. If you decide not to convert a file after all, you can remove its selection by clicking on the file name.

5. To set your conversion options, select **Settings**. The **Log File Conversion Settings** window shown in Figure 97 below is displayed.

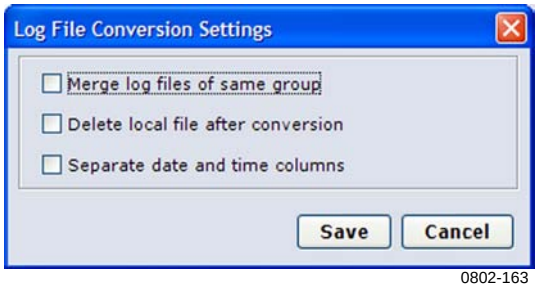


Figure 97 Log File Conversion Settings

6. The options available in the window and their use are described in Table 42 below.

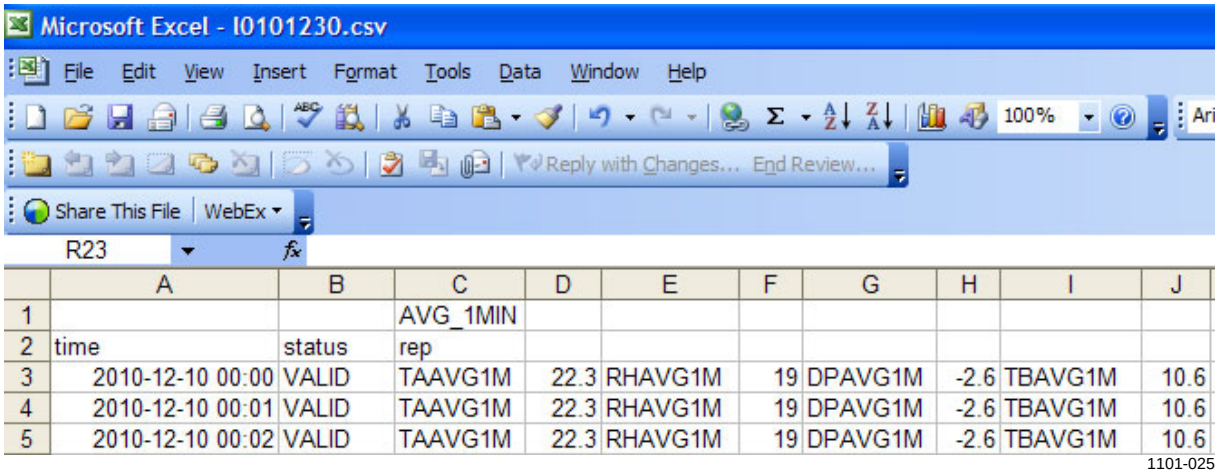
Table 42 Log File Conversion Options

Option	Description
Merge log files of same group	Merges log files from different dates belonging to the same log group.
Delete local file after conversion	Deletes downloaded binary log files after they have been converted to CSV format.
Separate date and time columns	Converts the date and time string in the log file into separate columns for the date and time of the log entries.

NOTE CSV conversion settings are stored on your PC, so any future CSV conversions will automatically use the same settings.

7. Save your conversion options and return to the log file selection window by selecting **Save**.
8. Convert the selected files to CSV format by selecting **Convert**. The converted log files are located in the folder specified in the **Conversion Target** field.

When a CSV file is opened to spreadsheet, it looks like the example in Figure 98 on page 159.



	A	B	C	D	E	F	G	H	I	J
1			AVG_1MIN							
2	time	status	rep							
3	2010-12-10 00:00	VALID	TAAVG1M	22.3	RHAVG1M	19	DPAVG1M	-2.6	TBAVG1M	10.6
4	2010-12-10 00:01	VALID	TAAVG1M	22.3	RHAVG1M	19	DPAVG1M	-2.6	TBAVG1M	10.6
5	2010-12-10 00:02	VALID	TAAVG1M	22.3	RHAVG1M	19	DPAVG1M	-2.6	TBAVG1M	10.6

1101-025

Figure 98 Logged Data in Spreadsheet Program

Using External Memory Card

The external memory card (CF card, CompactFlash) is used to store log files that have been copied or moved from the internal log directory. The data can be retrieved from the external memory card via terminal connection or by switching the memory card to an empty one.

NOTE

If the CF card has not been formatted, it must be formatted before use.

It is recommended that you format the card in a Windows PC. The file system to use is FAT (not FAT32). Also, do not select the quick format option.

To format the CF card in the QML logger, insert it into the CF slot of the QML logger. Give the **EXTFS***ERASE* command. After the card has been formatted, you can remove it from the slot.

The external memory card can be removed from the QML logger for data retrieval without interruptions to operations. The logger copies data from the internal log directory to the memory card daily at midnight, the default time is 00:00:30. Data is being written when the LED on the logger cover to the left of the external memory card is constantly on.

CAUTION

The memory card must not be removed from the QML logger while data is being written, or data may be lost. By default, data is transmitted to the memory card each day at 00:00:30.

When a new memory card is inserted into the QML logger, the software checks that the card is ready for use. The status of the memory card is indicated by a LED. Table 43 below describes the different blinking sequences and the card conditions they indicate.

Table 43 LED Blinking Sequences and Card Status Options

Blinking Sequence	Card Status
Long-long	Card is OK.
Constantly on	Data is being written.
Short-short-short for 5 seconds	Card is unformatted or corrupted.

Automatic Erase from External Memory Card

The log group -specific setting **Number of days to preserve log files**, specified in Lizard setup software, also affects the files stored to the external memory card. The functionality is the same as for internal log memory:

- Files older than the selected value [*days*] will be deleted automatically.
- Files are not erased, that is, the automatic cleanup is disabled.

When files are stored to the external memory card, the internal memory is used as the working memory for storing the log files of the current day. These working files are moved to the external card each day just after midnight when the new files have been created for writing.

Resetting the QML Logger

The **Reset** command is used for resetting the QML logger. You can either reset the logger immediately or after a specified delay. To reset the logger, proceed as follows:

1. On the **Maintenance** menu, select **Reset**.
2. The **Reset** menu includes two options for resetting the logger:
   a. To reset the logger immediately, select **Immediate**. The logger reset begins.
   b. To reset the logger after a specified delay, select **Delayed**. The **Delayed Reset** prompt is displayed.

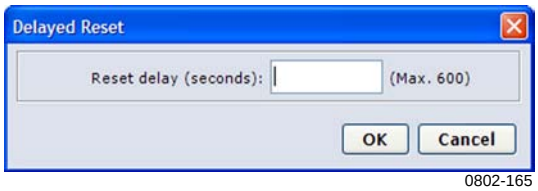


Figure 99 Delayed Reset Prompt

   - In the **Reset delay (s)** field, enter the delay (in seconds) after which you want the logger to be reset. The logger reset will begin after the specified delay has elapsed.
   - Select **OK**. The logger reset will start after the delay specified in the previous step.

Once the reset is complete and the setup is running without problems, the AWS Client terminal window displays the text **Setup running ok**, and the logger is again ready for use.

Operating Local LCD Display QMD202

The optional Local LCD display QMD202 provides views for instant measurements and basic system information. QMD202 is located inside the enclosure. Navigate between the views by pressing the buttons on the display.

NOTE	QMD202 is an optional device in AWS330 configuration, and is present as ordered.

In addition to measured values, all observation displays contain corresponding sensor status in the rightmost column. For sensor status values, see section Sensor Status List on page 293.

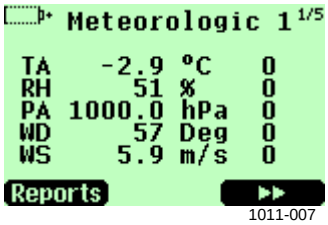


Figure 100 Meteorological Display 1

Table 44 Meteorological Display 1 Parameters

Heading	Parameter	Unit	Statistic	Period
TA	Air temperature	°C	Average	1 min
RH	Relative humidity	%	Average	1 min
PA	Barometric pressure	hPa	Average	1 min
WD	Wind direction	Deg	Average	10 min
WS	Wind speed	m/s	Average	10 min

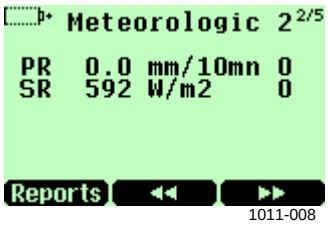


Figure 101 Meteorological Display 2

Table 45 Meteorological Display 2 Parameters

Heading	Parameter	Unit	Statistic	Period
PR	Precipitation	mm	Sum	10 min
SR	Solar radiation	W/m2	Average	1 min

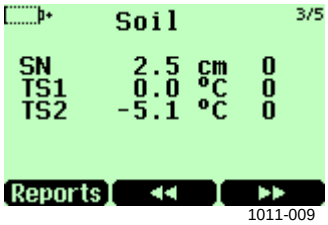


Figure 102 Soil State Display

Table 46 Soil State Display Parameters

Heading	Parameter	Unit	Statistic	Period
SN	Snow depth	cm	Average	1 min
TS1	Soil/water temperature 1	°C	Average	10 min
TS2	Soil/water temperature 2	°C	Average	10 min

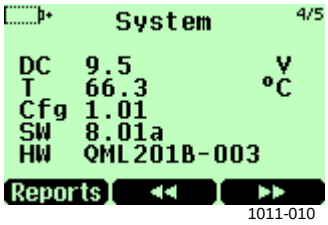


Figure 103 System Status Display

Table 47 System Status Display Parameters

Heading	Parameter	Unit	Statistic	Period
DC	DC supply voltage	V	n/a	1 min
T	Internal temperature	°C	n/a	1 min
Cfg	Configuration version	n/a	n/a	n/a
SW	Firmware version	n/a	n/a	n/a
HW	Hardware version	n/a	n/a	n/a

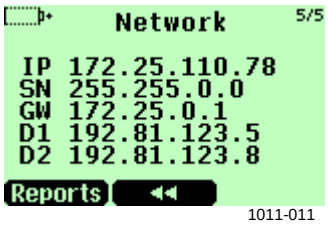


Figure 104 Network Status Display

Table 48 Network Status Display Parameters

Heading	Parameter
IP	IPV4 address
SN	Subnet mask
GW	Default gateway
D1	Domain name server 1
D2	Domain name server 2

CHAPTER 6

MAINTENANCE

This chapter provides information that is needed in the basic maintenance of AWS330.

Overall Checking

Check the mechanics and cabling for any damage and corrosion, and repair if needed. Wipe off or remove excess dirt, dust, sand, or leaves.

- Check signal and main cables, connectors, and connections.
- Check gaskets of the enclosures.
- Check all grounding cables, lugs, and so on.
- Check mechanical assemblies, bolts, nuts, and so on.
- Check the equipment for corrosion. Repair if needed.

CAUTION	Do not open the enclosure under poor conditions, for example, during rain or with dust in the air. In general, it is not advisable to repair sensors in the field.

NOTE	Use correct tools of good quality.

Site Maintenance

Keep the measurement site in good order to ensure reliable measurements:

- Check that the vegetation surrounding the station does not get too long/close to equipment. Regular clipping is advised.
- Check that snow does not touch or cover the enclosure and connectors.
- Avoid disturbing the possible snow cover under the Snow Depth Sensor IRU-2429 to have representative measurement.

Mast DKP210 Maintenance

Periodic Maintenance

Check the mast yearly for any damage to the coating. Inspect the guy wires for correct tightness yearly as well. When checking the mast, perform at least the following maintenance tasks:

- Check the guy wires from fraying.
- Check the guy wire clamps and tighten when necessary.
- Check the sensor support and tighten when necessary.
- Check the hinge bolts and tighten when necessary.

When devices installed on the upper assembly need maintenance, you need to tilt the mast. See section Tilting the Mast below.

Tilting the Mast

You need to tilt the mast when, for example, devices installed on the upper assembly need maintenance. The maintenance of the following sensors and accessories should be carried out when the mast is tilted:

- Ultrasonic Wind Sensor WMT703, as described in section Ultrasonic Wind Sensor WMT703 Maintenance on page 174
- Mechanical Wind Sensor Set WA15, as described in section Mechanical Wind Sensor Set WA15 Maintenance on page 184
- Solar Panel SOLAR33, as described in section Solar Panel SOLAR33 Maintenance on page 177
- GSM/GPRS antenna, as described in section GSM/GPRS Antenna on page 173

The following sections provide instructions on tilting the mast.

Disconnecting and Securing the Guy Wire

1. Disconnect the detachable guy wire 1 that is on the opposite side of the mast to the hinge. For the location, see Figure 5 on page 40.
2. Connect the snap hook of guy wire 1 to the hole in the hinge.

Using the Winch

1. Install the winch to the mast as instructed in section Installing and Using the Winch on page 56.
2. Open the securing Allen bolts in the hinge.

CAUTION Do not open the Allen bolts in the horizontal hinge axle.

3. Lower the mast slowly with the winch by turning the handle.

CAUTION Make sure to have a good control of the handle.

4. Install the tilting support to the end of the mast; see Figure 105 below.
5. Lower the mast slowly with the winch so that finally the mast rests on the tilting support and that there is no tension in the winch wire.

CAUTION Before lowering the mast, make sure that there is enough loose cable so you do not damage or bend the cables.

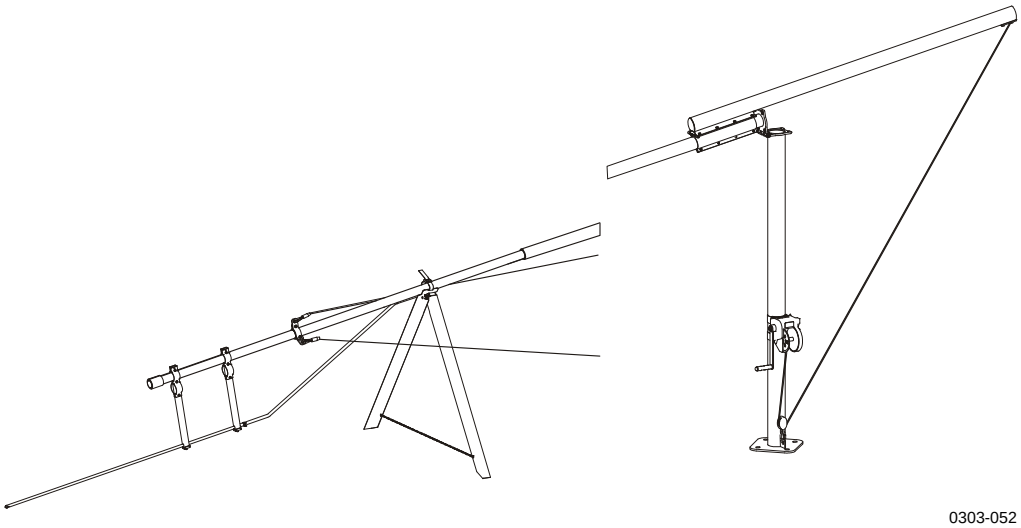


Figure 105 Tilted Mast on the Tilting Support

Erecting the Mast

To erect the mast after maintenance operations, refer to the section Erecting Mast DKP210 on page 56.

CAUTION	When erecting the mast, make sure that cables do not get damaged by the hinge.

Sensor Support Maintenance

When you check the mast, check that the sensor support is firmly attached. Check that the alignment is level with a spirit level.

Enclosure Maintenance

Visual Checking

The enclosure requires only a minimal amount of maintenance. Every six months, check that all screws of the mounting clamps are firmly tightened . Check also that the door gasket is undamaged. See also that the bottom connectors are not corroded and that they open easily. You can apply appropriate anti-corrosive/lubricant spray if required.

NOTE	After a heavy storm, open the enclosure door and check for any water leakage or other damage.

Cleaning

- Check and clean the connectors from, for example, spider web.
- Check that the door is firmly closed.
- Check inside the enclosure for spider webs or other dirt.
- Check and clean the static pressure head; see location of the static pressure head in Figure 53 on page 97.

Inside Enclosure Maintenance

Checking Battery

Battery status should be checked every 3 months. This is done either using a multi-meter on the batteries' plus and minus ends, or by pressing the QBR101 battery charger. Press the QBR101C battery charger status button to see the battery status and if the system has any power (AC(mains)/battery):

- If the LED is green, the battery is OK.
- If the LED is yellow, the battery voltage is low (charge <11.5 V).
- If the LED is red, the battery is empty (charge <10 V).

If the battery status is red even after charging for a while, the battery is old and needs to be replaced. The lead acid battery may age in 3 to 5 years and needs to be replaced with a new one.

Pressure Sensor BARO-1

Periodic Maintenance

Under normal operating conditions, BARO-1 needs only a minimal amount of maintenance.

- Keep the pressure port clean. Check the pressure port every time when visiting the site.
- Annually, compare pressure values against a calibrated portable standard.

Field Check

NOTE	Calibrating Pressure Sensor BARO-1 is a demanding, high-precision task that requires proper facilities. It is recommended that you have the sensor calibrated at Vaisala.

The AWS Client software provides means for one-point field check of the BARO-1 sensor.

Required equipment:

- Laptop PC with AWS Client software
- Traveling standard barometer (for example, Vaisala PTB330TS)
- Maintenance cable (included in the AWS330 delivery)

Field check procedure:

1. Establish terminal connection to AWS330 by connecting the maintenance cable to the COM0 port of AWS330 and to an available I/O port on your PC.
2. Lift the reference barometer to the same height as the pressure port.

NOTE	Make sure that the wind does not interfere with the reading of the reference barometer.

3. Read the reference barometer reading.
4. Give this reference reading to AWS330:
   - Type: **BARO1CAL***1003.7* (reference reading *1003.7* hPa).
5. Check the readings given by AWS330:
   - Value = Reference reading
   - Measured value = Measured by AWS330
   - Offset = Measured value - reference reading
6. Repeat the calibration if necessary.
7. Close the terminal connection by giving the **close** command.

Changing Pressure Sensor BARO-1

CAUTION	Use an antistatic wrist strap to protect yourself and the equipment from ESD (electrostatic discharge).

If the BARO-1 pressure sensor needs to be replaced, do the following:

1. Remove the QML201C logger cover.
2. Unscrew the four mounting screws (number 1 in Figure 106 below) holding BARO-1.
3. Unplug the pressure hose (2) that connects BARO-1 to the logger body.
4. Remove the BARO-1 pressure sensor from the logger.
5. Install a new pressure sensor in the reverse order.
6. Pack the old sensor in the padded antistatic package that the replacement sensor came in.

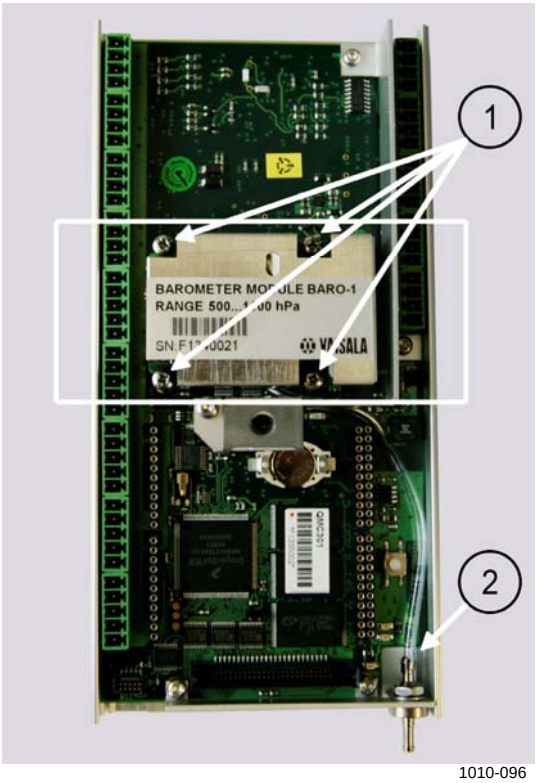


Figure 106 Changing BARO-1 Pressure Sensor

The following numbers refer to Figure 106 above:

1 = Mounting screws
2 = Pressure hose

GSM/GPRS Antenna Maintenance

The antenna requires minimal amount of maintenance. Field repairs are accomplished by changing the complete antenna.

AC (Mains) Power Supply Unit Maintenance

The AC (mains) power supply unit requires a minimal amount of maintenance. Field repairs are accomplished by changing the complete module.

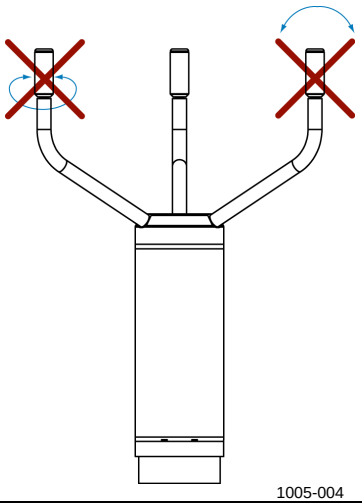
WARNING	All electrical installations must be carried by licensed experts. The power supply unit transmits electric voltages up to 230 volts.

WARNING	Do not open the AC (mains) power supply unit.

Ultrasonic Wind Sensor WMT703 Maintenance

WARNING Some WMT703 product versions provide heating for transducers and/or array arms. To avoid injury, do not touch the heated parts of the wind sensor when the heating is enabled.

CAUTION When handling WMT703, do not rotate, pull, strike, bend, scrape or touch the transducers with sharp objects. Any impact on the wind sensor array damages the device.



Periodic Maintenance

WMT703 is a very reliable and rugged sensor. Since no moving or consumable parts are used, no periodic maintenance is required. WMT703 has been calibrated at the factory, and you are not required to perform recalibration.

NOTE Periodic calibration of WMT703 is not required for technical reasons. However, some quality management systems may require regular calibration of the measuring instruments.

To fulfill these requirements, it is recommended that you recalibrate the wind sensor every 24 months. Contact Vaisala Service Center for more information (see www.vaisala.com/services/servicecenters.html.).

Visual Inspection

It is recommended that you carry out a yearly visual inspection of the wind sensor to ensure correct operation and clean the wind sensor if it becomes contaminated. If necessary, you can also test the operation of WMT700 with an optional verifier, which is a small echo-free chamber.

If any of the transducers have been bent, twisted or rotated, the measurement results might not be accurate.

To avoid errors caused by damaged array, check the following:

- Array has not been hit or bent. All transducers must be parallel to each other.
- Transducers have not been scraped or touched with sharp objects. The silicon rubber transducer sleeve must be undamaged.

Cleaning

Regular cleaning of WMT703 is not required. If the wind sensor becomes contaminated, you can clean it with a soft cloth moistened with some mild detergent. Do not use solvents or a pressure washer to clean WMT703, since they may damage the silicon rubber transducer sleeve.

Testing Proper Operation

WMT703 measures how long it takes for an ultrasonic signal to travel from one transducer to receiver. Therefore, the accuracy of the sensor depends on the distance between the transducers and the time-of-flight measurement circuit, which uses a crystal oscillator for its time reference.

If necessary, you can verify the distance between the transducer arms with the optional verifier. You can order the verifier from Vaisala as an accessory (order code: WMT70VERIFIER).

It is recommended that you perform the test every 12 months or if you suspect that the transducers may have been damaged. The test can be performed either in the field or in a laboratory. Do not perform the test when the wind speed is more than 10 m/s or when there is a risk of thunderstorm in the area.

NOTE	Disable heating before performing the verifier test. You can do this either by disconnecting the heater supply voltage or by setting the **heaterOn** parameter to **0**.

To perform the test:

1. Slip the verifier over the three transducers. Refer to Figure 107 below to see how the verifier fits over the transducers.
2. Start wind measurement. The command depends on the selected communication protocol.
3. WMT703 must read less than 0.5 miles per hour (0.22 m/s) with the verifier in place.
4. Remove the verifier.

NOTE	Some random data samples may be lost during the verifier test. This, however, does not indicate that WMT703 is faulty.

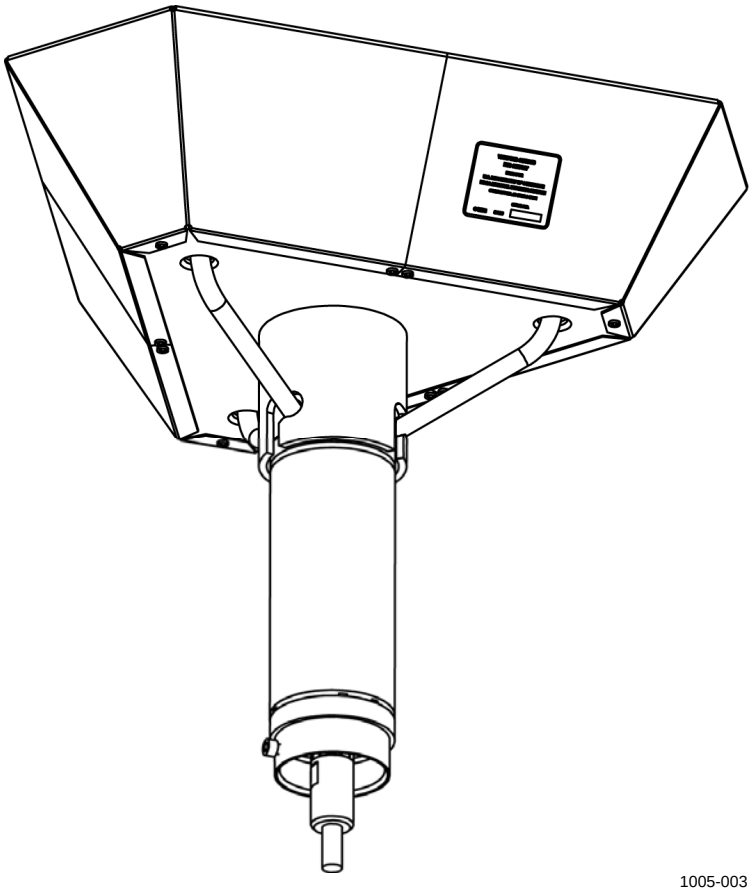


Figure 107 Testing WMT703 with Verifier

Snow Depth Sensor IRU-9429

Periodic Maintenance

Every month, check that the sensor alignment is correct and the sensor is firmly mounted. Check sensor operation if there is a reason to believe that the readings are erroneous or you receive a sensor status alarm. Check the sensor reading by measuring the depth of the snow with a ruler and comparing it with the reading given by the sensor. Clean the sensor from any dirt, spider webs, and so on with a lint-free cloth using water and mild detergent or alcohol.

Solar Panel SOLAR33 Maintenance

Periodic Maintenance

WARNING	Wear rubber gloves to protect yourself against possible electric shock.

CAUTION	Do not use a scrub brush; it can damage the module front surface.

Inspect the module at least twice a year for overall integrity. Make sure that connections to the battery are tight and free of corrosion.

Dirt accumulation on the module's front surface can reduce the light energy collected by the module. If the module surface is dirty, gently clean it with a soft cloth or sponge using water and a mild detergent.

Air Temperature and Relative Humidity Probe HMP155 Maintenance

Visual Check

Every three months, check that the temperature and humidity probe mounting is secured and that the cable is in good condition.

Cleaning

Clean the probe with a soft, lint-free cloth moistened with mild detergent.

Changing the Probe Filter

Every six months, change the probe filter:

NOTE	Depending on the conditions of the measurement site, such as air pollution and dust, the probe filter may need to be changed more frequently.

NOTE	When handling the probe, do not touch the sensor heads (numbers 3 and 4 in Figure 108 on page 179).

1. Remove the probe from inside the radiation shield.
1. Carefully remove the filter from the probe: screw it counter-clockwise, the pull it out without touching the sensor heads.
2. After removing the filter, check the O-ring and change it if necessary. See Figure 108 on page 179. Do not touch the sensor heads.
3. Without delay, install the new filter carefully on the probe without touching the sensor heads.

New filters can be ordered from Vaisala (order code: 219452SP, includes sintered Teflon filter and O-ring).

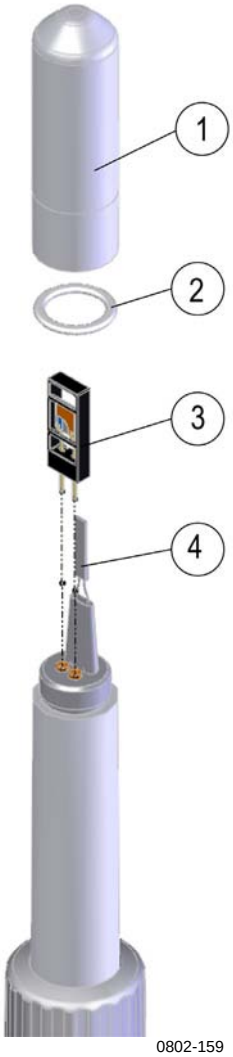


Figure 108 HMP155 Structure

The following numbers refer to Figure 108 above:

1 = Filter
2 = O-ring
3 = HUMICAP® sensor element
4 = Pt100 temperature sensor

NOTE	The Pt100 temperature sensor (number 4 in Figure 108 above) is soldered to the probe. Do not try to remove it. Due to the operating principles of the sensor, no maintenance is required.

For calibration instructions, see HMP155 User's Guide (M210912EN, Chapter 6, Calibration and Adjustment) on your installation CD and use the Vaisala USB cable delivered with the system.

Sending for Calibration

Every 12 months, send HMP155 to Vaisala for calibration and replace it with a calibrated spare probe:

1. Remove the old probe from inside the radiation shield.
2. Check the operation of the new probe by warming the sensor head with your hand, and monitor the value change.
3. Place the new probe inside the radiation shield.
4. Send the old probe to Vaisala for calibration.

Or, if a calibrated spare probe is not available, do the following:

1. Send the probe to Vaisala for calibration.
2. When the calibrated sensor arrives from Vaisala, check the operation of the probe by warming the sensor head with your hand, and monitor the value change.
3. Place the probe inside the radiation shield.

Calibration must always be done when there is reason to believe that the device is not within the accuracy specifications.

Changing HMP155

Contact Vaisala to replace HMP155.

Pyranometer CMP6

Periodic Maintenance

The pyranometer is an all-weather instrument. Once installed, the pyranometer needs little maintenance. It is recommended that you clean the glass dome of the sensor as part of a regular routine, using water or alcohol. Check the fixture and leveling of the sensor as needed.

A periodic check is recommended to ensure that the pyranometer is level and that the silica gel desiccant in the drying cartridge is still colored orange. When the silica gel is turned from orange to completely transparent (normally after several months), it must be replaced by fresh silica gel.

When changing the desiccant in the drying cartridge (indicated with an arrow in Figure 109 below):

- Make sure the surfaces of the pyranometer and the drying cartridge that touch the rubber O-ring are clean. Corrosion, dirt, and water can damage the sensor.
- The rubber O-ring is coated with a silicon grease to improve the seal. If the rubber O-ring looks dry, apply grease or Vaseline to it.
- Check that the drying cartridge is tightly threaded into the sensor body.

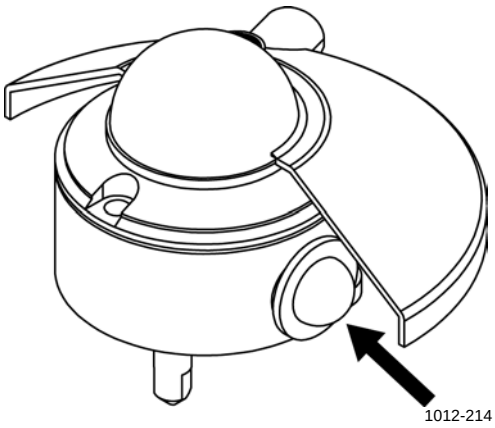


Figure 109 Pyranometer CMP6, Arrow Points to Drying Cartridge

O-ring type: 24 × 3.0 NBR (nitrite rubber).

Replacing CMP6

When the pyranometer is shipped from Vaisala for AWS330, it is already calibrated to the station. However, if the sensor is replaced with a new one, the calibration has to be done on site using AWS Client software. For details on the mechanical installation, refer to section Installing Pyranometer CMP6 on page 82. For configuring the pyranometer with AWS Client, proceed as follows:

1. Open AWS Client: From **Start** menu, select **All Programs** - **Vaisala** - **AWS Client**.
2. On the **Settings** menu, select **Calibration**.
3. The list of measurements available for calibration is displayed. Select the **Solar Radiation** measurement from the list.

   Figure 110 below illustrates radiation calibration. Radiation sensors tend to have individual characteristics; therefore, they always need to be calibrated prior to operation.

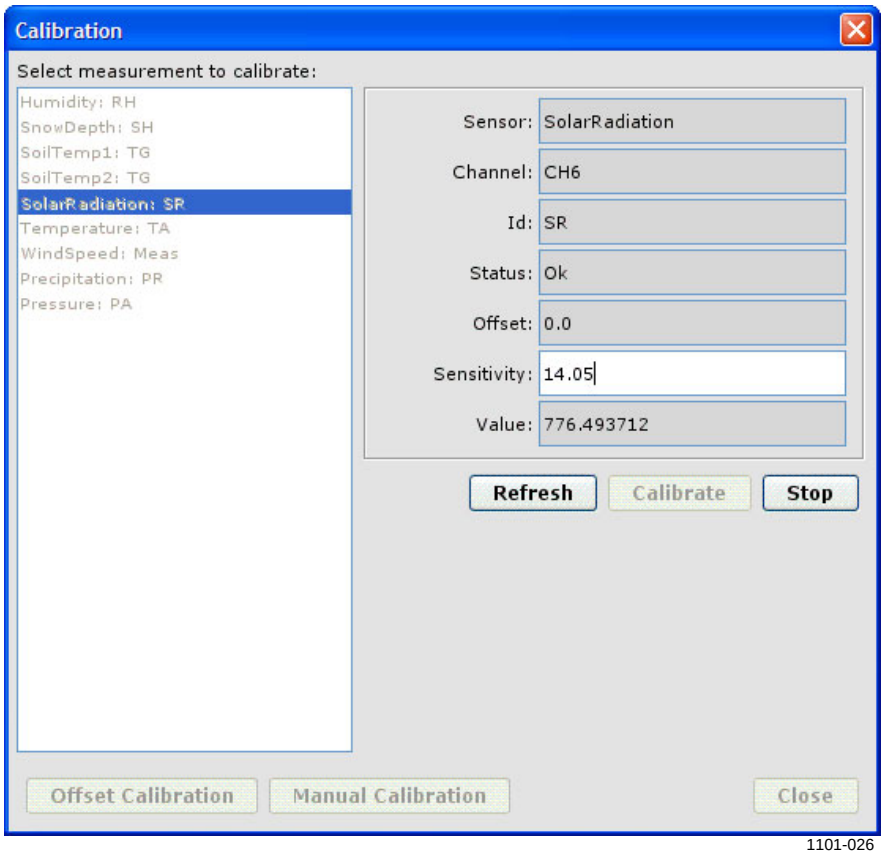


Figure 110 Manual Calibration Window

4. The **Factor** parameter has sensor-dependent use. It affects the gain of the measurement or the sensitivity of the radiation sensor. To calibrate radiation, enter the sensor-dependent sensitivity factor [V/Wm^{-2}], which is given in the type sticker or the calibration sheet of the particular sensor.
5. Calibrate the sensor by selecting **Calibrate**.

NOTE New sensor calibration values are taken into use in the QML logger after a reset with, for example, the **Reset** command. For further information on resetting the QML logger, see section Resetting the QML Logger on page 162.

Soil Temperature Sensor QMT110

Visual Checking

Check the connectors yearly. Check that the visible cable on the ground is in good shape.

The QMT110 sensor does not need any regular maintenance. Field repairs are accomplished by replacing the complete sensor. When the QMT110 sensor is extracted, clean the dirt accumulation on the sensor surface with a soft cloth or sponge using water and mild detergent. Field repairs are accomplished by replacing the complete sensor.

Mechanical Wind Sensor Set WA15 Maintenance

Periodic Maintenance

Replace the bearings yearly and check that the printed circuit board is not corroded. Check operation whenever you tilt the mast.

Cleaning

Heavy contamination in the vane, such as bird droplets or ice will deteriorate the accuracy of the wind vane. Clean the vane when necessary.

Testing Proper Operation

The sensor will hold its accuracy in all conditions for 1 year. If the rains are mostly casual and moderate, and the atmospheric corrosion is typical, the sensor accuracy will remain for 2 years.

However, the ball bearings must be checked once a year and the sensor shaft rotated manually. To do this, remove the vane assembly. To ensure proper operation, the shaft should spin smoothly and it should not create any detectable noise.

Replacing Bearings of WAV151

Replacement of the bearings should only be done by a trained technician. To replace the ball bearings, follow the procedure below and refer to Figure 111 on page 187 or send the wind set to Vaisala for maintenance.

1. Open the vane assembly fixing screw with a 2-mm Allen key. The correct screw is the lower one shown in Figure 111 on page 187. Remove the assembly.

CAUTION	The vane assembly fixing screw has been treated with sealant. Do not remove the fixing screw to ensure perfect sealing.

2. Loosen the hex nut of the connector with a 27-mm tool.

CAUTION Be careful not to bend the connector pins.

3. Loosen the three pan head screws at the bottom of the sensor body with a 7-mm tool.
4. Remove the lower body assembly by pulling it straight outwards.
5. Loosen the spacer screws with a 7-mm tool and disconnect the heating element outlet.
6. Remove the printed circuit board.

CAUTION Do not twist or bend the connector. This may break the pins.

7. Loosen the fixing screw of the code disc with a 2-mm Allen key and remove the disc.
8. Remove the external retaining ring (using narrow-pointed pliers).
9. Remove the spacer ring.
10. Remove the internal retaining ring at the bottom of the shaft (using narrow-pointed pliers).
11. Remove the lower bearing.
12. Push out the shaft downwards through the upper body.
13. Remove the top bearing.

To reassemble the sensor, reverse the earlier work order.

1. Take the previous steps in reverse order until assembling the code disc.

NOTE Be careful when handling the new ball bearings. Do not drop them or force them onto the shaft.

2. Attach the code disc (number 7 in Figure 111 on page 187) back onto the shaft. The disc has to be positioned so that it does not touch the opto-coupler on the printed circuit board (6). Tighten the fixing screw of the code disc.

CAUTION Make sure that the code disc does not touch the opto-coupler.

3. Attach the heating element outlet to the printed circuit board. Put the printed circuit board in place and fasten it with spacers (5).

4. Put the lower body assembly (4) carefully into place. Fasten the three screws (3) at the bottom of the sensor. Make sure that the bigger O-ring (14) is correctly positioned between the upper and the lower sensor bodies. Check also that the connector O-ring (14) is in place. The O-ring is recommended to be replaced with a new one after each opening.

NOTE When placing the lower body assembly, make sure that the O-ring is correctly positioned between the upper and lower bodies. It is recommended to replace the O-rings with new ones before reassembling.

5. Tighten the hex nut of the connector (2).
6. Connect the cable plug to the sensor body connector. Fasten the sensor body on the cross arm with three screws.
7. Mount the vane assembly onto the sensor body. Tighten the screw.

CAUTION The heating resistance element cannot be removed without special tools. To avoid any damage, it is recommended that replacement of the heating element be carried out by a trained technician.

The following numbers refer to Figure 111 on page 187:

1 = Vane assembly
2 = Hex nut of the connector
3 = M6 x 16 DIN7991 (3 pcs)
4 = Lower body
5 = Spacer (3 pcs)
6 = Printed circuit board (PCB)
7 = Code disc
8 = External retaining ring, body
9 = Spacer
10 = Internal retaining ring, shaft
11 = Ball bearings
12 = Shaft and Upper body assembly
13 = Ball bearings
14 = O-rings, 2 pcs

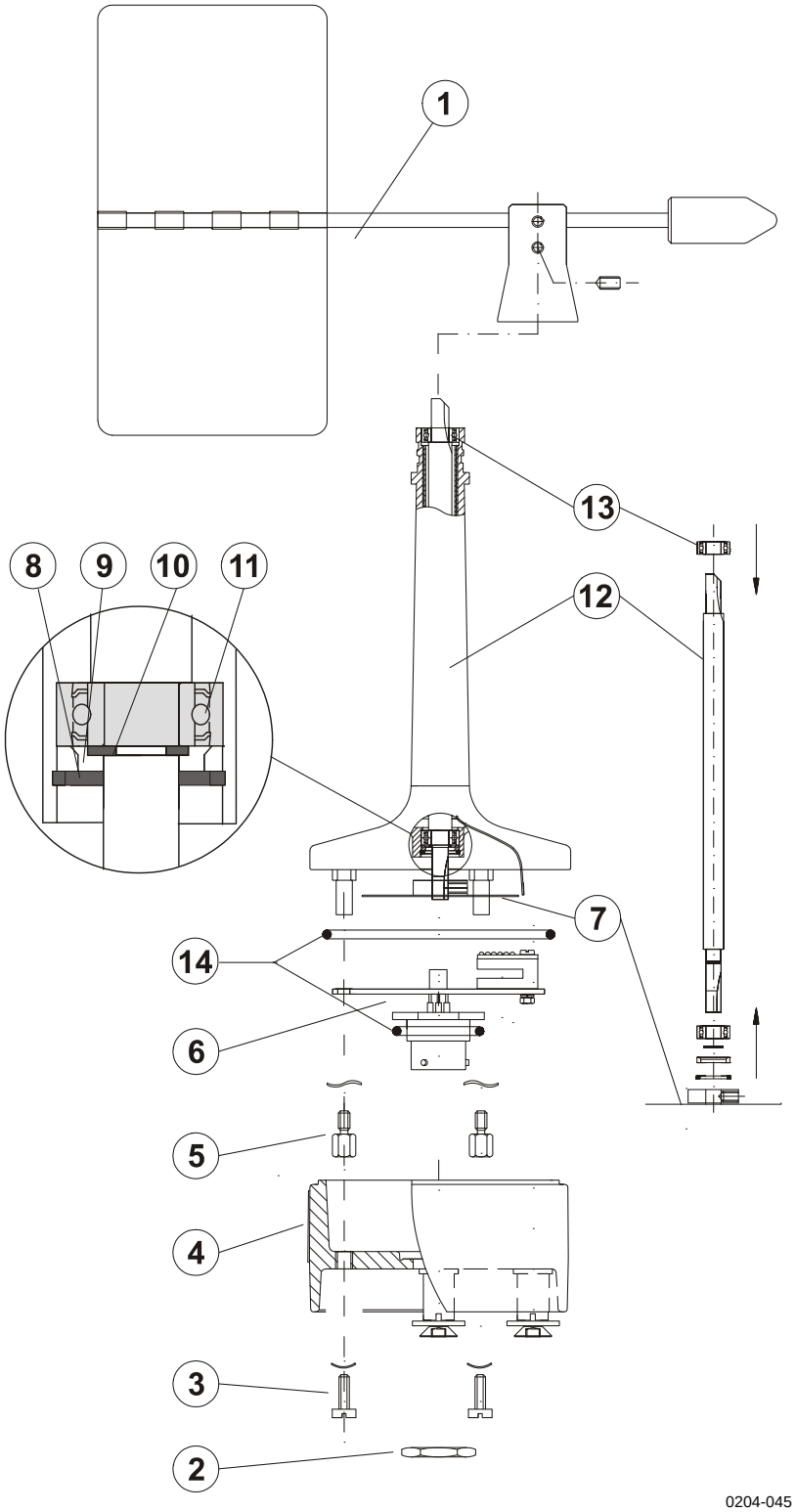


Figure 111 WAV151 Assembly

The wind vane has been counter-balanced at the factory but can be readjusted, if necessary. To do this, loosen the vane assembly and place it on its side on the table. A correctly balanced vane will stay in horizontal position.

Replacing Bearings of WAA151

Replacement of the bearings should only be done by a trained technician. To replace the ball bearings, follow the procedure below and refer to Figure 112 on page 191.

1. Open the cup wheel fixing screw with a 2-mm Allen key. Remove the cup wheel assembly.

CAUTION	The cup wheel fixing screw has been treated with sealant. Do not remove the fixing screw to ensure perfect sealing after reassembling.

2. Loosen the hex nut of the connector (use a 22-mm tool).

CAUTION	Be careful not to bend the connector pins.

3. Loosen the three pan head screws at the bottom of the sensor body (use a 7-mm tool).
4. Remove the lower body assembly by pulling it straight outwards.
5. Loosen the spacer screws with a 7-mm tool and disconnect the heating element outlet.
6. Remove the printed circuit board including the opto-coupler.

CAUTION	Do not twist or bend the connector. This may break the pins.

7. Loosen the fixing screw of the chopper disc with a 2-mm Allen key and remove the chopper disc.
8. Remove the external retaining ring (using narrow-pointed pliers).
9. Remove the spacer ring.
10. Remove the internal retaining ring at the bottom of the shaft (using narrow-pointed pliers).
11. Remove the lower bearing.
12. Push out the shaft downwards through the upper body.
13. Remove the top bearing after pulling out the shaft.

To reassemble the sensor, reverse the earlier work order.

1. Take the previous steps in reverse order until assembling the chopper disc.

NOTE Be careful when handling the new ball bearings. Do not drop them or force them onto the shaft.

2. Attach the chopper disc (number 7 in Figure 112 on page 191) back onto the shaft. The disc has to be positioned so that the disc teeth do not touch the opto-coupler (6) on the circuit board. Tighten the screw.

CAUTION Assure that the chopper disc teeth do not touch the opto-coupler. There should be 1 to 2 mm space between the bottom of the opto-coupler and the disc teeth.

3. Attach the heating element outlet (5) to the circuit board. Put the circuit board in place and fasten it with spacers (5).
4. Put the lower body assembly (4) carefully into place. Fasten the three screws (3) at the bottom of the sensor. Make sure that the bigger O-ring (14) is correctly positioned between the upper and the lower sensor bodies. The O-ring is recommended to be replaced with a new one after each opening. Check also that the connector's O-ring (14) is properly in its place.

NOTE When placing the lower body assembly, make sure that the O-ring is correctly positioned between the upper and lower bodies. It is recommended to replace the O-rings with a new ones before reassembling.

5. Tighten the hex nut of the connector (2).
6. Connect the cable plug to the sensor body connector. Fasten the sensor body on the cross arm with three screws.
7. Mount the cup assembly onto the sensor body. Tighten the fixing screw.

CAUTION The heating resistance element cannot be removed without special tools. To avoid any damages, it is recommended that replacement of the heating element be carried out by the manufacturer.

The following numbers refer to Figure 112 on page 191:

1 = Cup wheel assembly
2 = Hex nut of the connector
3 = M6x16 DIN7991 (3 pcs)
4 = Lower body
5 = Spacer (3 pcs)
6 = Printed circuit board (PCB)
7 = Chopper disc
8 = External retaining ring, body
9 = Spacer ring
10 = Internal retaining ring, shaft
11 = Ball bearings
12 = Shaft and Upper body assembly
13 = Ball bearings
14 = O-rings, 2 pcs

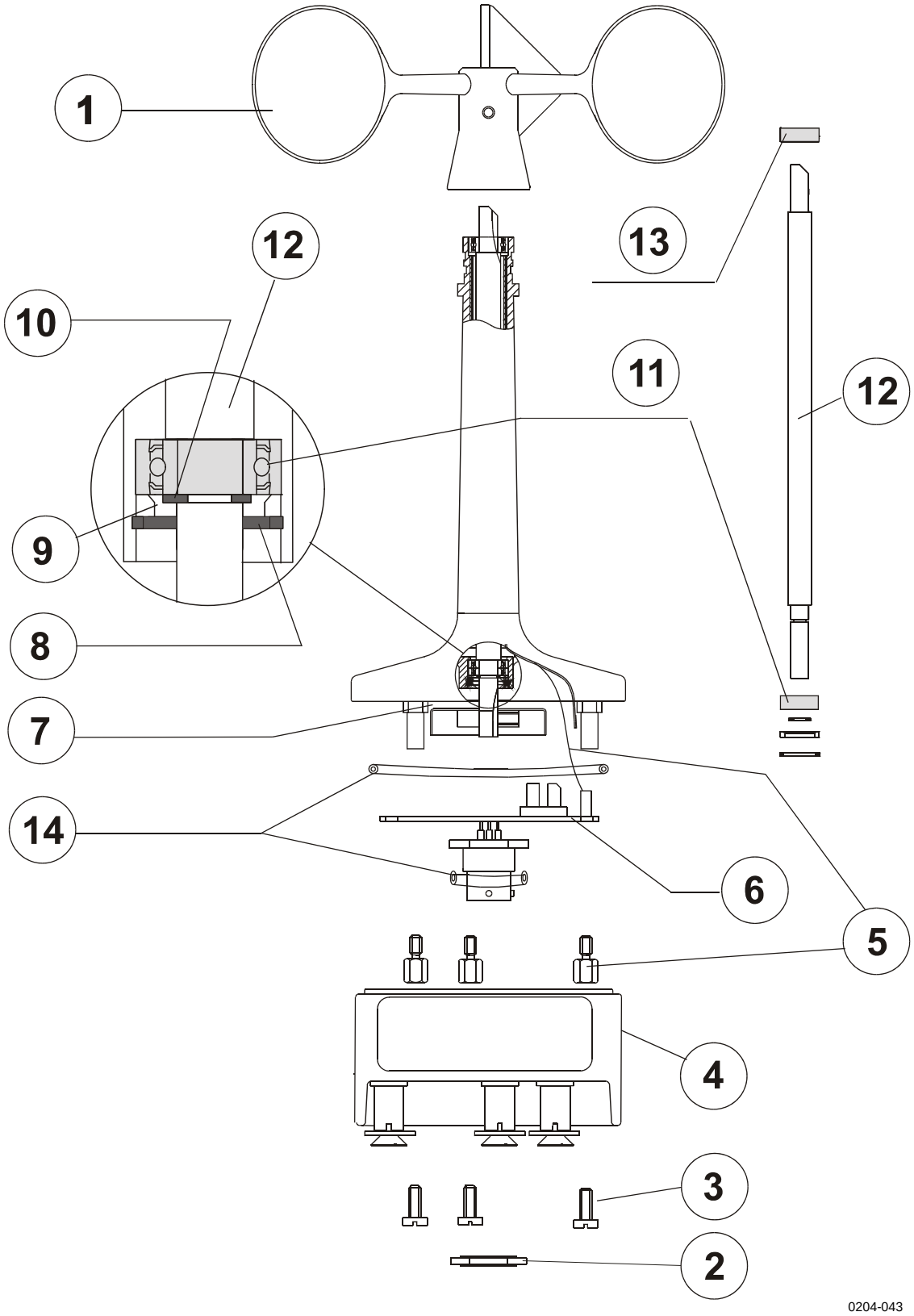


Figure 112 WAA151 Assembly

Rain Gauge RG13(H) Maintenance

Periodic Maintenance

Check Rain Gauge RG13(H) once a week. In the fall, or when leaves are falling and there is a lot of debris in circulation, it is recommended that you check the sensor daily or, at minimum, once a week.

NOTE	If the gauge is connected to the QML data logger and the data logger is operating, avoid tipping the cup assembly to avoid erroneous measurements.

- Inspect the funnel and filter for any damage or blockage. Remove any obstacles from the funnel, such as accumulated leaves, debris, dirt and dust. Clean the filter by removing the end cap from the filter tube.
- Yearly, remove the filter material carefully, clean and replace the filter and the cap.
- Once or twice a year, clean the spoon from dust and dirt once or twice a year to ensure precise measuring. Remove and clean any dirt from the bucket.
- Check that the gauge is still level. It is surprisingly easy for an apparently immovable gauge to become tilted as a result of small ground movements or vandalism.

If the rain gauge is disconnected from the logger or does not log data, it is a good idea to check the balance arm of the bucket for stiffness. The easiest way to do this in the field is to try to balance the bucket in its center position; doing this should be very difficult (if not impossible). If the bucket balances easily, examine the bucket closely for any dirt or wear on the pivot pin and bucket tubes.

Replacing Components

In some overvoltage conditions, such as the case of a lightning strike, some protective components might get damaged and need replacement. To replace other components than the ones described here or in the previous sections, contact Vaisala.

Changing Battery

1. Turn the power off from the main switch.
2. Unplug the battery wires.
3. Unscrew the screw holding the battery clamp around the battery.
4. Slide the clamp to the left.
5. Remove the battery.
6. Install a new battery in reverse order.

Changing the QML201 Logger

NOTE	This should only be done by a trained technician.

1. Turn the power off from the main switch.
2. Unplug the logger connectors. You might need to cut the cable ties holding the wires to have more slack in the wiring. Do this from the bottom side of the installation plate to avoid damaging the wiring.
3. Unplug the pressure tubing from the nozzle in the lower right corner of the logger.
4. Remove the logger from the DIN-rail in the installation plate by lifting from the left side of the logger bottom.
5. Install a new logger on the installation plate and connect the tubing and cabling in reverse order. Replace the cut cable ties with new ones.

Changing Communication Modules

CAUTION In general, it is not advisable to open the QML data logger cover in the field.

The communication modules of the QML201C data logger are attached to the circuit board of the logger. In case a communication module has to be replaced, remove the logger cover and the old module by pulling from the edges. Push the replacement module on the connector block MOD1 or MOD2. By default, the modules are installed as described in Table 49 below.

Table 49 Default Configuration for Communication Modules

Module	Connector Block	Module Placement
DSI486	MOD1	See Figure 113 below.
DSE101	MOD2	See Figure 113 below.

CAUTION When inserting the modules, be careful not to bend the connector pins.

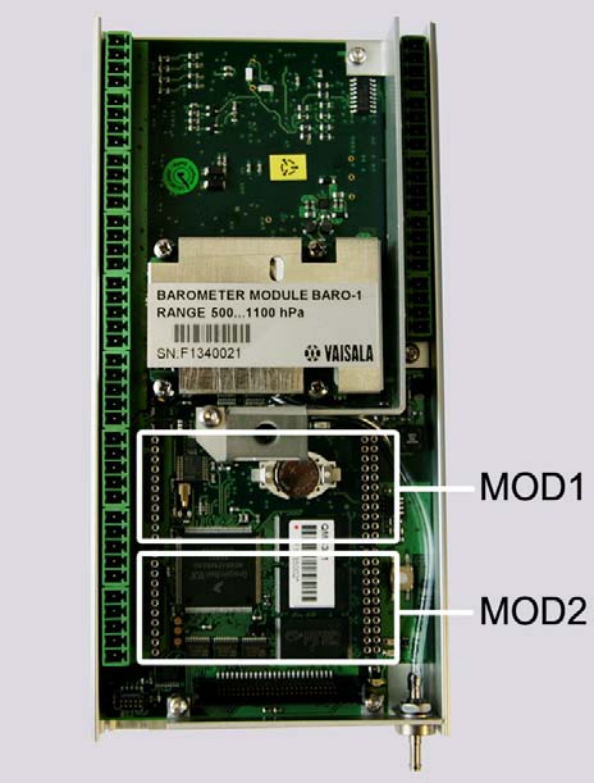


Figure 113 Communication Module Placement

Changing the Power Supply Set

1. Turn off the AC (mains) power to AWS330, that is, switch off the external AC (mains) inlet.
2. Unscrew the right-hand side installation plate and flip it down.
3. Remove the power supply set connectors.
4. Remove the cables from the screw terminals and the surge protector below the power supply units.
5. Remove the four screws (number 1 in Figure 114 below) in the power supply set (2).
6. Remove the power supply fixing plate set (5) with power supplies, terminals, and surge protector.
7. Replace the faulty power unit from the fixing plate.
8. Install a base plate set back in reverse order.

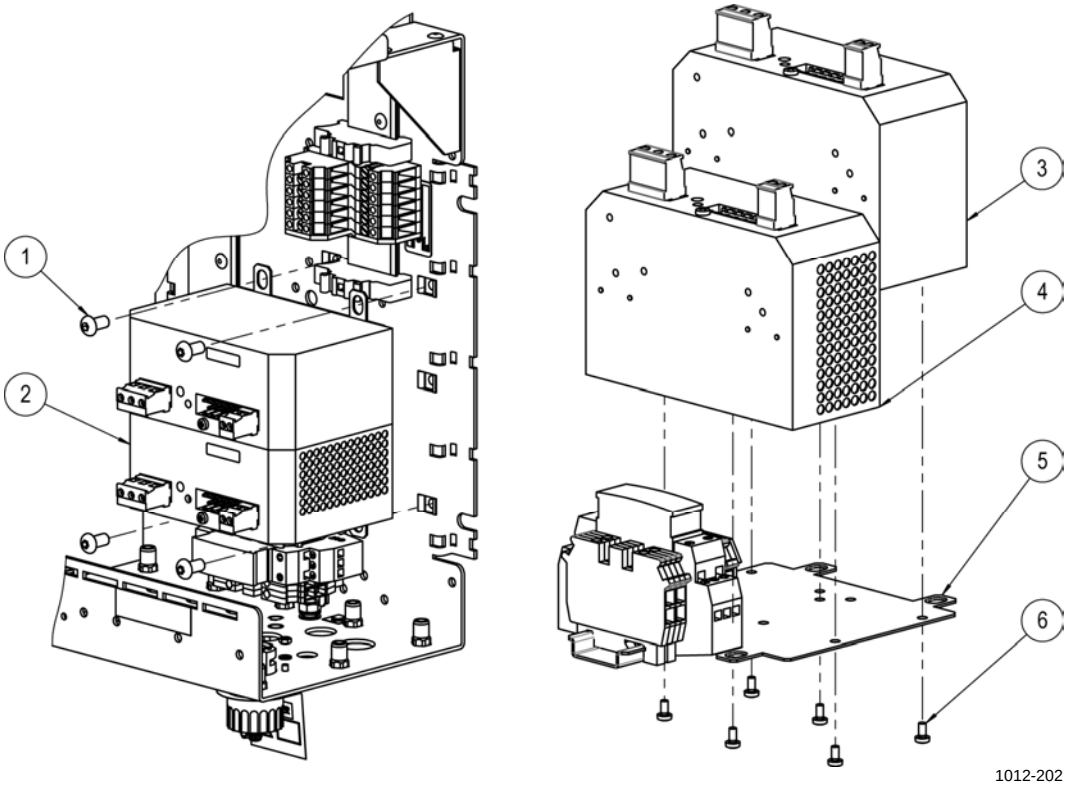


Figure 114 Removing Power Supply Set

The following numbers refer to Figure 114 above:

1 = Screw M6x12 ISO7380 A4, 4 pcs; use Allen key 4 mm
2 = Power supply set
3 = AC power supply 36 VDC 60 W
4 = AC power supply 15 VDC 60 W
5 = Fixing plate
6 = M3x6 DIN7985 A4, 4 pcs; use crosshead screwdriver

Changing the Surge Protectors

1. Turn off the AC (mains) power to AWS330, that is, switch off the external AC (mains) inlet.
2. For AC (mains) power surge protector, do the following:
   - Unscrew the right-hand side installation plate and flip it down.
   - If the indicator on the top of the surge protector plug is red, remove the plug module (indicated with an arrow in Figure 115 below) and replace the plug with a new one.

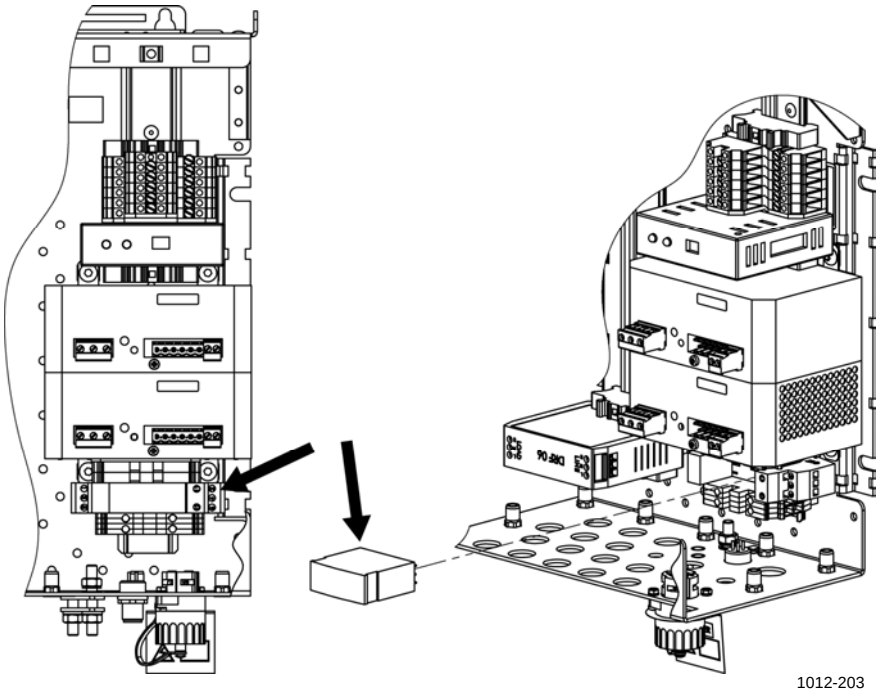


Figure 115 Removing AC (Mains) Power Surge Protector, Arrow Points to Surge Protector

3. For QSA224DC (data line) and PT5-HF-12DC-ST (Ethernet) surge protectors, do the following:
   - Unscrew the middle side installation plate and flip it down.
   - Disconnect the wires from the faulty surge protector and remove the surge.
   - Install a new surge protector in the reverse order.

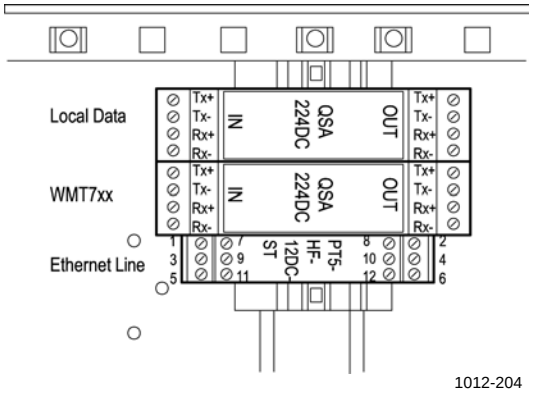


Figure 116 Removing Data Line and Ethernet Surge Protectors

Spare Parts

Table 50 Vaisala Automatic Weather Station AWS330 Spare Parts

Order Code	Common Name
19369SP	Sensor connector (5P,M12, shielded)
19954SP	Sensor connector
25003SP	Power connector
26935SP	AC (mains) line surge protection plug for 220 VAC
215050SP	VRLA Battery, 12 V 26 Ah (CB26-12)
DSE101SP	Ethernet communications module
DSI486SP	Dual RS485 module (2 pcs RS-485 I/O ports)
DTR503A	Radiation shield for HMP155
QBR101CSP	Battery regulator
QMD202SP	Local LCD Display (optional)
QMI102SP	SSI I/O interface for AWS330
QMI118SP	Digital I/O Module for AWS330
QML201CSP	QML data logger
QSA224DCSP	Surge arrestor for RS485 lines (2-wire)
BARO-1QMLSP	BARO-1 module for QML201C
219452SP	HMP155 filter
7150WA	Cup assembly WA15 (Anemometer WAA151)
6389WA	Vane assembly WA15 (Wind Vane WAV151)
16644WA	Set of bearings and gasket WA15 (WAV151 and WAA151)
1433WA	Sensor board for WA15 (Anemometer WAA151)
1434WA	Sensor board for WA15 (Wind Vane WAV151)
B1A2A004B1A2	Ultrasonic Wind Sensor WMT703 (non-heated)
B1B2A004B1A2	Ultrasonic Wind Sensor WMT703 (with heating)
D2AB11A0A1A1A0A	Air Temperature and Relative Humidity Probe HMP155
N1A2	Rain Gauge RG13 (0.1 mm resolution)
H1A2	Rain Gauge RG13H (0.1 mm resolution and with heating)
N2A2	Rain Gauge RG13 (0.2 mm resolution)
H2A2	Rain Gauge RG13H (0.2 mm resolution and with heating)

QML Logger QML201C Maintenance

Updating AWS330 Configuration File

AWS330 functionality is based on a configuration file that is pre-loaded to QML logger at factory. It may later become necessary to update the configuration file in the logger, for example to fix a problem or to introduce a new feature.

CAUTION	Update the configuration file only when instructed by Vaisala, with a file received or downloaded from Vaisala. If the configuration file is updated otherwise, for example, by using a file modified by the end-user, Vaisala will no longer provide support for such a system free of charge.

To update the configuration file:

1. Start AWS Client.
2. Open menu **Settings – Options**, and make sure that option **Secure Setup Upload** is selected. Close the dialog by clicking the **Save** button.
3. On the **Maintenance** menu, select **Setup File - Upload to Logger**.
4. The **Select File** window is displayed as shown in Figure 117 on page 200. Select the appropriate setup file and click **Select File**. Note that the default folder for uploading setup files is defined in the AWS Client **Options** window.

5. The **Select File** window is displayed as shown in Figure 117 below. Select the appropriate setup file and click **Select File**. Note that the default folder for uploading configuration files is defined in the AWS Client **Options** window.

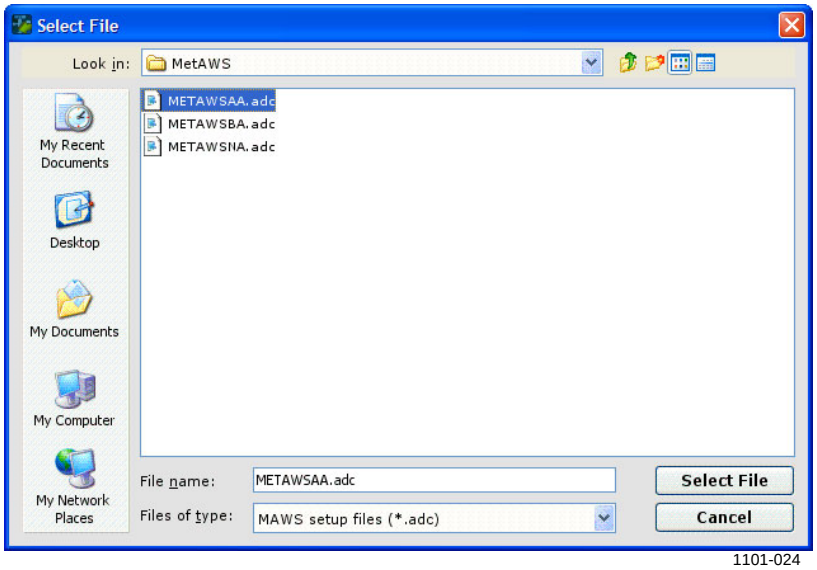


Figure 117 Selecting an Upload Configuration File

NOTE Make sure to select appropriate file for your system; see Table 51 below.

Table 51 AWS330 Setup Alternatives

File Name	Description
metawsaa.adc	Configuration for system with Ethernet telemetry
metawsba.adc	Configuration for system with GSM/GPRS telemetry
mewtawsna.adc	Configuration for system with RS232/RS485 serial links only

6. Uploading the setup file to the QML logger starts; you can follow the upload progress in the **Setup File Upload Progress** window displayed.

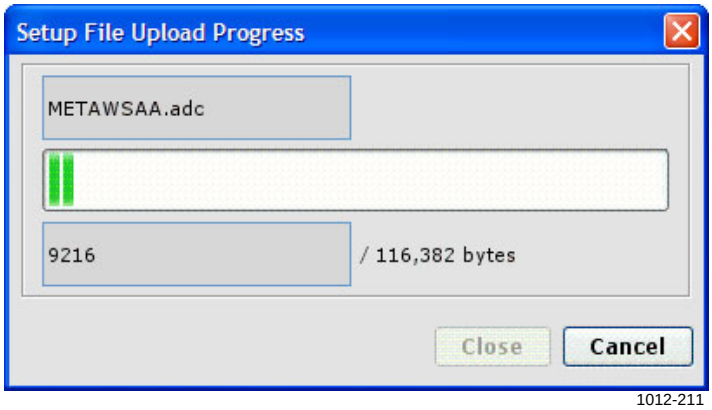


Figure 118 Setup Upload in Progress

7. When the file has been transferred, the QML logger starts executing the new setup according to the settings in the setup file.

Updating Software to the Logger

In order to be able to utilize new features when published by Vaisala, you may need to update the logger software.

CAUTION	Update the logger software only when requested by Vaisala.

Copying New AWS330 Software with Loader Program

To update the software to the logger, follow the instructions below:

1. Check that you have the loader program **loader.exe** and the AWS330 software **bin.mot** on your computer in the same folder.
2. By default, the **loader.exe** application uses the **COM1** port of the computer. When you can use the **COM1** port, proceed with step a. below; otherwise, proceed as instructed in step b.

NOTE	If any other COM port of the computer than **COM1** is used for loading the software to AWS330, you need to make a .bat file for software loading. Refer to step b.

   a. Connect the maintenance cable to the port **COM0** of the AWS330 system and to the **COM1** port on your computer.

b. Connect the maintenance terminal cable to the port **COM0** of the AWS330 system and to any free COM port on your computer. For example, if the free COM port is **COM3**, make the .bat file with Notepad, see Figure 119 below.

In the .bat file, the parameter *-s115200* indicates the bit rate (the default is 38400) and the parameter *-pCOM3* indicates the communication port (the default is **COM1**).

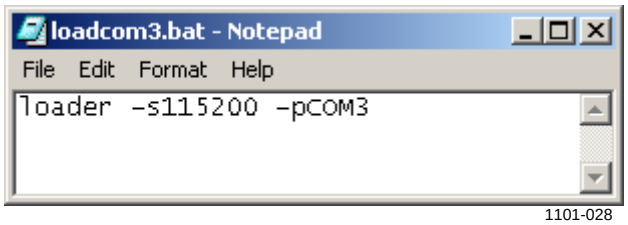


Figure 119 Making the .bat File in Notepad

3. Close any terminal connection to AWS330 so that the serial port is free for software loading.
4. Close all other Windows programs.
5. To load the software, follow the instructions given in either step a. or b.:
   a. When you are using the **COM1** port of your computer, open Command Prompt and change the directory to the folder where you have **loader.exe** and **bin.mot**. Type **loader** and press ENTER. The **Command Prompt** window shows `Waiting`.
   b. When you are using some other communication port, execute the .bat file created in step 2.b. The **Command Prompt** window shows `Waiting`.
6. Reset the logger by pressing the reset button.
7. The **Command Prompt** window shows `Erasing` for some time and then starts to show `Loading`. If you get a load error, try again from step 2.
8. After a few minutes, the display shows `Loading 100 %`.
9. The program restarts with an existing setup, and AWS330 is now ready to operate.

If you are having problems when loading software to the logger, for example, if loading is interrupted and you get the message `Load Error -1`, try again, with all other Windows programs closed except Command Prompt.

Loading may be interrupted due to a corrupted **bin.mot** file, or due to power save features, especially when a laptop PC is used.

Copying a New AWS330 Software from CF Memory Card

As an alternative for updating AWS330 software through the serial port using loader.exe you can receive a pre-programmed CF (CompactFlash) card from Vaisala including the latest software to be copied. Each time AWS330 starts up, the boot software checks if a new software is available for loading on the CF card.

To copy a new software into AWS330, proceed as follows:

1 Insert the CF card received from Vaisala into the CF card slot in the QML logger.

2. Launch copying the new software by issuing the command SWLOAD.

3. The AWS330 software checks that the boot code is valid and the CF includes Motorola's S-record at the specified address. The firmware also checks that the CF card is formatted and that there is a file on it named bin.mot.

4. When the application has been copied, the QML logger restarts automatically.

5. If **SWLOAD** refuses to copy the new software, the CF card does not include a valid software.

6. When the new application has been restarted, take the CF card out of the QML logger and store it for future use.

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CHAPTER 7
TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and provides contact information for technical support.

Troubleshooting QML Logger QML201C

When troubleshooting the QML logger, make sure you have the tools listed in Table 52 below.

Table 52 Recommended Tools for Troubleshooting

Tools List
Maintenance cable and a laptop PC with the applicable versions of the setup files and the AWS Client software
Keys for the enclosures
Multimeter
Flat head screwdrivers, especially small ones
Phillips screwdrivers, especially small ones
Set of open-end wrenches, different sizes
Set of Allen keys
Applicable spare parts, for example, a new QML logger
Safety helmet when tilting the mast

Opening a Service Connection through QML Logger

For instructions on operating AWS Client, refer to Chapter 5, Software Configuration and Operation, on page 101.

The command interface of the modem or a serial sensor can be accessed through the QML logger, for example, to send the AT commands manually. To control the modem or sensor directly, first open the service connection to the logger. Then enter one of the following commands:

Table 53 Opening Connection to Devices

Device	Command
GSM/GPRS modem	open MOD1_1
Ultrasonic Wind Sensor WMT703	open COM1

To terminate this operation, type **close**. While the direct connection to the modem or sensor is open, any automatic operation through the connected port is blocked.

Recording Terminal Connection Text

In problem situations, you can save the commands and program responses that you see in the AWS Client terminal connection window.

To capture all the text shown in the terminal window into a file, first select **Settings**, then **Options**, then select the **Trace log on** option. The program starts saving all text into a file of format *yyMMddHHmmSS.log*, where *yy* stands for year, *MM* for month, *dd* for day, and so on. The file is stored in the **Trace log directory** you have defined in the **Options** window.

NOTE AWS Client software keeps recording terminal connection history until the **Trace log on** option is cleared. Do not neglect to clear this option once you have recorded enough messages; otherwise, log files will accumulate over time and unnecessarily reserve your disk space.

When you no longer need the capture files, you can delete them from your PC. The capture file is in format *yyMMddHHmmSS.log*, which name is a time stamp of the file's creation. The file is saved in the **Trace log directory** you have defined in the **Options** window.

In problem situations, give the following commands: **errors**, **spset**, **SYSINFO**, and **warnings**. When **Capture all** is selected, the results are saved into a file for future use.

General Troubleshooting Procedure

Follow the procedure below to troubleshoot the QML logger. Refer to the applicable sections of this chapter for details when requested. The basic procedure for troubleshooting assumes that the person has weather station operating experience.

1. Check the cabling and mechanical structure visually for indications of vandalism, dirt, lightning strike damage, or other visible cause for the problem. Also check that all the connectors are properly attached. For visual check of the enclosure and the logger, refer to section Visual Check on page 210.
2. The system appears to be completely down.
   - Is the green LED on the QML logger blinking? Refer to section on page Determining QML Logger Operation Mode on page 211. If not, check the following:
   - Is there sufficient voltage (8 ... 16 VDC) present in the EXT-DC input of the logger?
3. The QML logger has power, but it is not functioning.
   - Connect the maintenance cable and start the AWS Client software.
   - Open the logger cover and press the reset button. Refer to section Resetting QML Logger on page 212. After a few seconds, the terminal should start to display logger startup messages.
4. The QML logger is not sending any data (nothing is seen on the screen).
   - After the system has been without power, for example, when you start it for the first time, check the time and date. Timed operations will not work as expected if the correct time is not set.
   - The setup is corrupted. Press and keep down the reset button for a few seconds. The QML logger will restart and display the text `Using blank configuration`. Reload the setup.
5. The QML logger starts up normally, but sends error messages during startup, for example, `!Erroneous setup file`.
   - Reload the setup.
   - Set the station parameters.
   - Restart the system.

6. Disconnect the power and replace the communication modules.
   - Replace one module at a time and try to restart the system to find out the damaged one.
   - Restart the system.
7. The QML logger does not receive commands entered in the AWS Client software.
   - Check the maintenance cable connection and that you have the correct maintenance cable in use.
   - The terminal connection is not open.
   - Type **open** and press ENTER. Note that the command must be typed exactly correctly before it can be executed and that the command is not echoed on the screen.
   - The port settings on PC and QML logger are not matching
   - Use settings 9600bps, 8 data, 1 stop, no parity on PC.
8. Has someone made any software or hardware changes to the station prior to malfunction? If so, could those changes have an effect on the operation?
   a. When you have loaded a new setup:
      - Make sure you have the original setup and the new setup saved as an .adc file.
      - Reload the original setup and verify that the system starts and runs with the original setup.
   b. When you have installed new hardware:
      - Disconnect the new hardware.
      - Reload the original setup and verify that the system starts and runs.
      - Connect the new hardware.
      - Reload the new setup and verify that the system starts and runs.
9. Sensor(s) are not working properly.
   a. Are there one or multiple malfunctioning sensors? Multiple simultaneous sensor malfunctions in the same QML logger often indicate a damaged logger.
   b. Check the output of the **warnings** and **errors** commands for indication of the probable cause.
      - Connect the maintenance cable and start the AWS Client software. Type commands **warnings** and **errors**. For details, see section Warnings and Errors on page 219.
      - Pay also attention to the message related to the excitation voltages. If the damaged sensor is powered by the logger, it may cause an overload.

c. If the malfunctioning sensor is measured by the logger:
   - Open the sensor calibration view in the AWS Client software; see section Determining Sensor Status on page 213
   - Check the sensor status and compare the value against the sensor status list Appendix D, Sensor Status Values, on page 293.

d. If the malfunctioning sensor is a so-called intelligent sensor, for example, WMT703, use its own diagnostic features.
   - Connect the maintenance cable and start the AWS Client software.
   - Service interface for the intelligent sensors can be accessed through the QML logger as explained in section Opening a Service Connection through QML Logger on page 206.

10. Communication is not working properly.
    - Whenever possible, use an external device to verify that the communication infrastructure is working properly. For example, use a cellular phone to verify that the signal strength in the site is sufficient or that the system SIM card has access to the network.
    - See also section Troubleshooting TCP/IP-Based Telemetry on page 215.
11. Data is not stored to a memory card.
    - Check the status of the memory card. It is indicated by a LED. Table 43 on page 160 describes the different blinking sequences and the card conditions they indicate.

Is the QML logger still not functioning? Replace the logger and return the damaged one to Vaisala for repair. For return instructions, refer to section Product Returns on page 234.

Visual Check

Open the enclosure and check that all the equipment is present. Check that the QML logger, power supply, and communication devices are connected properly. Remove the cover of the logger for visually checking the CPU board and other components located under the cover. In Figure 120 below, the logger is shown without the cover and the optional communication modules.

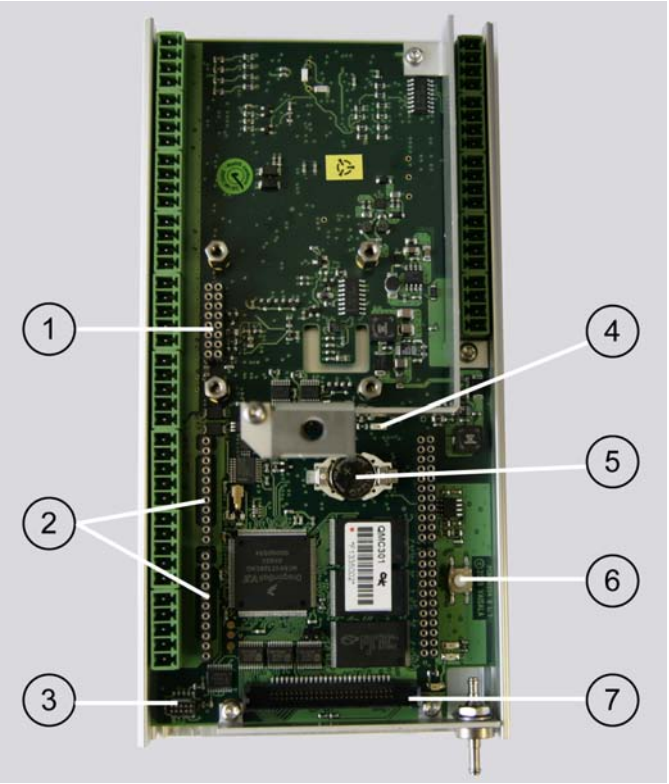


Figure 120 QML Logger without Cover

The following numbers refer to Figure 120 above:

1 = Pressure sensor connector
2 = Communication module places MOD1 and MOD2
3 = SPI connector
4 = Status LED (green)
5 = Lithium battery for RTC
6 = Reset button
7 = CF Card connector

Determining QML Logger Operation Mode

You can watch the status LED to determine the operation mode. The LED is located on the QML logger board and it is visible through the logger cover.

Table 54 Determining Operation Mode by LED Flashing

LED Flashing Interval	Operation Mode	Note
All the time	QML logger has been reset but setup has not been examined yet.	
Once per 5 seconds	Setup is running.	
Once per 10 seconds	Blank boot or configuration cannot be run.	
Quickly 2 times	Setup is running but there are warnings.	Interval determined by setup
Quickly 3 times	Setup is running but there are errors.	
Not at all	None	Check power supply.

Connection Problems

If you cannot connect to the QML logger, the service connection is not opened and you cannot work with the logger. In case of connection problems, check the possible problems as instructed in Table 55 below.

Table 55 Some Common Connection Problems and Their Remedies

Problem	Probable Cause	Remedy
You receive the following message: 	You are trying to connect to the wrong port.	Select the **Address book** option from the **Settings** menu to check the port numbers.
	Cables are not connected.	Check that the modem cable is connected properly.
You receive the following message: 	You are trying to connect to a port that does not exist in your PC.	Check the port settings.
	The port is reserved (some other program is connected to it).	It is possible that you have already opened the terminal program, minimized the window and forgotten you have already opened it, and then tried to open the program again.
You do not receive any messages.	Cables are not connected.	Connect the cables as shown in section Connecting AWS Client to AWS330 on page 102.

Resetting QML Logger

To reset the QML logger, enter the **reset** command (recommended), or press the reset button indicated by number 1 in Figure 121 below.

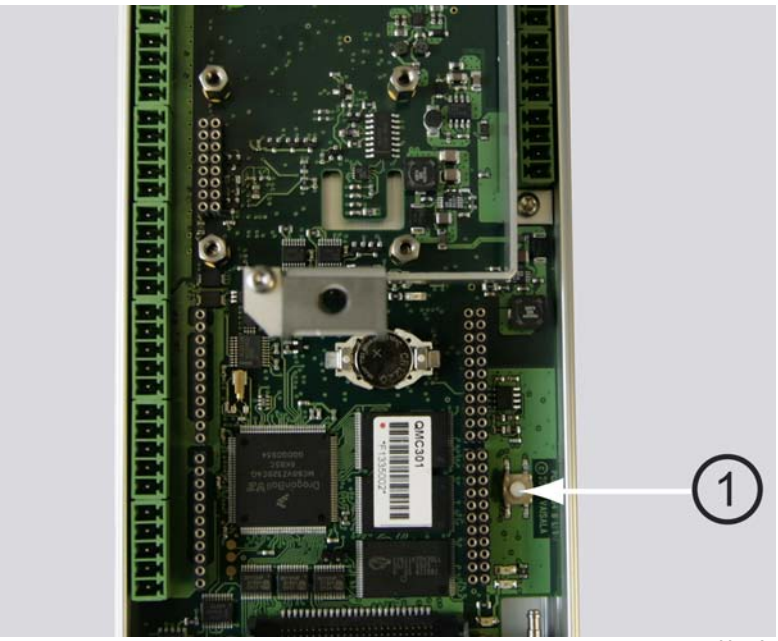


Figure 121 Reset Button on QML Logger

A short reset (pressing the reset button quickly) performs the same reset as giving the command and starts the program again. A long reset (pressing the reset button and keeping it down for a few seconds) restarts the program with a so-called blank setup. A blank setup does not run a setup file.

A blank setup may be useful if the setup is somehow defective and does not allow the opening of a terminal connection. When the blank setup is run, the QML logger communication parameters are restored to their defaults: *9600bps, 8 data, No parity, 1 stop bit*.

Determining Sensor Status

Sensor status values give indication about the general status of the sensor interfaces. You have two alternatives to view the status value for a sensor:

1. Status for all sensors is displayed in the **Table message**; see section Table on page 28. Table message can be polled into view by typing **TABLE** into the AWS Client terminal window while connection is established but QML logger is not in command mode. If QML logger is in command mode, type **CLOSE** first.
2. For conventional sensors, open the **Calibration** window from the **Settings** menu in the AWS Client software; see Figure 122 below. The sensor list is displayed on the left side of the window. The **Status** field shows the status of the selected sensor. To read the latest sensor status and measurement values, click the **Refresh** button. Table 56 on page 214 describes the other fields in the **Calibration** window.

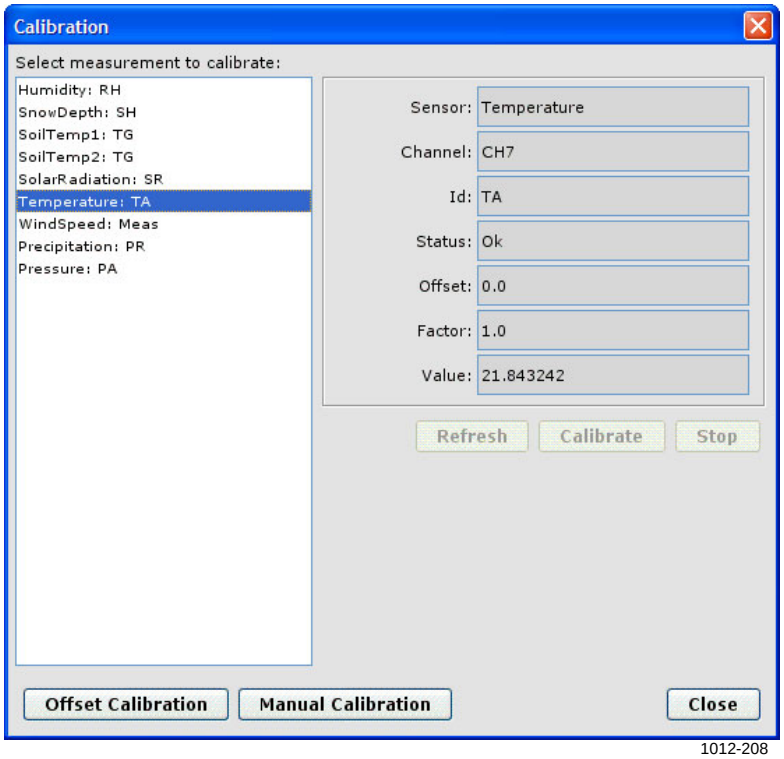


Figure 122 Settings Menu: Calibration Window

NOTE When **Value** is expressed as N/A, it indicates that the calibration factor has been altered but not saved, the sensor has not been measured or its measurement channel has failed, or the sensor is disabled. Further information about the possible reason can be obtained by comparing the value in the **Status** column against the values listed in Appendix D, Sensor Status Values, on page 293.

Table 56 Columns in the Sensor Calibration Tab

Column	Description	Input
Sensor	Sensor name as defined in the setup	n/a
Channel	Measurement channel of the sensor	n/a
ID	Measurement identifier	n/a
Status	Sensor status	n/a
Offset	Offset for the sensors	Overwrites the old offset value with the new one.
Sensitivity (1	Sensitivity value for Pyranometer CMP6.	Overwrites the sensor sensitivity value for the radiation sensor.
Factor (2	Measurement gain for the sensors other than radiation sensors	Overwrites the old gain value with the new one.
Value	The last measured sensor reading shown in physical units	Overwrites the sensor reading with the entered value, that is, changes the offset of the measurement.

(1 Displayed only for the radiation sensor.
(2 Displayed for others than radiation sensor.

Technical Support for QML Logger

When contacting Vaisala technical support, please send the following information with your technical enquiry or description of a fault:

- Serial number of the QML logger.
- The captured text of the **SYSINFO** command.
- If you have modified the setup file and the setup is possibly defected, please also send the captured *yyMMddHHmmSS.log* file and the setup file (.dtg). Refer to Vaisala HydroMet Data Collection Platform User's Guide, Volume 2, for instructions on how to export a setup file.

For contact information of Vaisala technical support, see section Technical Support on page 234.

Troubleshooting TCP/IP-Based Telemetry

Typical possibilities for troubleshooting TCP/IP-based telemetry operation with the QML logger are as follows:

NOTE	This manual will not attempt to give general guidelines on network design or troubleshooting issues, such as IP addressing. Troubleshooting IP networking usually also involves issues not related to the QML logger or its configuration; this section includes only the troubleshooting possibilities at the QML logger end.

1. Use the **warnings** command to check for any modem-related warnings.
2. Use the **net warnings** command to check for any IP-specific warnings.
3. Use the **ipconfig** command to see the current IP configuration in the QML logger. The command output gives you information on all open network interfaces and their configuration, such as IP addresses, gateways, and DNS servers.
4. Use the **netif** command to see whether the network interface you are trying to use is open. If required, the interface can be opened with the command **netif** *open* <*interface name*>.
5. Check that the IP addresses used for the QML logger interfaces are correct with respect to your overall network configuration.
6. Use the **ping** command to test the connection to the destination IP address or host. If the destination cannot be reached, you can test whether the connection to the gateway works; if it does, the problem might be in the connection between the gateway and the destination host.
7. For the FTP and NTP services, use the commands **ftp** *test* <*server*> and **ntp** *test* <*server*> to check the connection to the server. You can also use the **ping** command to check whether the server is reachable. Note that if you are accessing the destination server over the internet, the destination server needs to have a public IP address or port forwarding rules defined for NAT.
8. As applicable in your network, ensure that there are no firewalls blocking the traffic to/from the QML logger and the destination server.

9. To monitor different telemetry related services, a shell command can be used to enable extra output. Command format is

   DO <Service Name> DEBUG_ON <Port>

   where

   <*Service Name*> = Name of the service to monitor; see Table 57 below
   <*Port*> = Port where the information is sent to; see Table 58 below

   For example, the following shows how this command can be used to monitor EMAIL operation remotely via TCP service connection:

   /> DO EMAIL DEBUG_ON VCOM1

   Debugging enabled->VCOM1

   The following services can be monitored:

Table 57 List of Service Names

Service name	Description
FTP	FTP message transport
VCOM0	TCP socket message transport
EMAIL	eMail message transport
SMS	SMS message transport
GSM_Modem	GSM modem control
NTP	NTP timekeeping

Depending on the used connection, the following ports are available:

Table 58 Debug Ports

Connection	Port Name
Local service connection to COM0	COM0
Remote service connection using TCP socket	VCOM1
Remote service connection using CSD dial-in	DSI486_0_1

To stop monitoring a service, use the following command:

DO <Service Name> DEBUG_OFF

For example, to stop monitoring the EMAIL service:

/ > DO EMAIL DEBUG_OFF

Debugging disabled

10. To send the AT commands manually, the command interface of the modem can be directly accessed. To control the modem directly, open the service connection to the QML logger. With AWS330, the device is connected to the second DSI486 communication port at the module place MOD1, type **open** *DSI486_0_1*. To terminate this operation, type **close**. While the direct connection to the modem or sensor is open, any automatic operation through the connected port is blocked.
11. It is impossible to have default parameters that would work everywhere with all the different network infrastructures. If the default parameters do not seem to work, try to find out the correct parameters by establishing a manual connection between the weather station and the data collection system. Do this by, for example, using a PC terminal program. Also note that the default parameters are seldom optimal, for example, in minimizing the connection time.

Troubleshooting GSM/GPRS Modem

Below are listed some useful tips on how to troubleshoot problems with GSM connection.

1. Use a cellular phone to verify that the signal strength in the site is sufficient or that the system SIM card has access to the network.
2. Open a command connection to the GSM modem by entering the following commands to AWS Client terminal window in QML logger command mode:

   open MOD1_1
   ATE

3. To test the GSM modems with the AT commands, refer to Table 59 below.

Table 59 Test Commands for GSM/GPRS Modems

Parameter	Command	Value
Network registration	AT+CREG?	Registration status: <n>, <stat>, where <stat> 0 = Not registered 1 = Registered to home network 2 = Searching 3 = Registration denied 5 = Registered, roaming
Available operator	AT+COPS?	Returns the used operator
	AT+COPS=?	Queries all available operators, can be used to refresh the connection
Operator selection	AT+COPS=0/1	0 = Automatic 1 = Manual
Signal quality	AT+CSQ	Receive level 31 = Best 0 = Worst 99 = Not known Under normal conditions, value should be 10 or above.

Commands for Troubleshooting Purposes

For most of the sensor inputs, there are data validation parameters to check the following quality parameters for the measurement:

- Maximum value: the maximum climatological value for the sensor measurement.
- Minimum value: the minimum climatological value for the sensor measurement.
- Step change: the maximum step change for the sensor value between two consecutive measurements.

You can set all of these parameters with Lizard Setup Software. For more information, please refer to Vaisala HydroMet Data Collection Platform User's Guide, Volumes 2 and 3.

If the sensor value is outside the maximum or minimum values, or it has altered more than the maximum step change allowed, then data will be flagged as INVALID. Invalid data is typically displayed as ///// (this is a parameter that you can set). If a sensor displays invalid data, this is an indication that the sensor is faulty or out of calibration, or there is a problem in powering or measuring the sensor.

Warnings and Errors

There may be some problems if you see either of the following prompts:

```
/ E>
/ W>
```

`/ E>` means that there are errors, and `/ W>` means that there are warnings.

It is normal to have one or two warnings after the serial connection to the QML logger has been reset; for example, if you have turned your PC off, you can ignore these warnings.

To see active warnings, type **warnings**. To clear active warnings, type **warnings** *clear*. Warnings indicate that there are some problems in the software.

Example:

```
/ W> warnings
Warning: Break
  occurred 9 times first in uart.cpp[84]
  during thread: 00019F60 [AbsTimerT]
  object pointer: 106C [component: COM0]
Warning: Frame
  occurred 14 times first in uart.cpp[83]
  during thread: 00019F60 [AbsTimerT]
  object pointer: 106C [component: COM0]
```

The `Break` and `Frame` warnings mean that most likely you have turned your PC off and on again. This causes no trouble and you can clear the warnings.

```
Warning: Device reset
  occurred 1 times first in
c:/libs/MAWS/adcl/kernel/idle.cpp[52]
  during thread: 00001694 [Idle]
  object pointer: 163C [component: Idle]
```

The above warning means that you have reset the QML logger. This causes no trouble and you can clear the warning. If you have not reset the QML logger and the warning still occurs, contact Vaisala technical support (see section Technical Support on page 234).

```
Warning: Data missing
  occurred 2 times first in
h:/MAWS/software/adcl/report/confrep.cpp[414]
  during thread: 00019C0C [AbsTimerT]
  object pointer: 33A94 [component: MyRep1]
```

If you receive the above warning, check that the parameters **sname**, **pslevel**, and **altitude** are set.

To see active errors, type **errors**. To clear active errors, type **errors** *clear*. Errors indicate that there is something wrong with the sensors or configuration. Write down the error information and contact Vaisala technical support as described in section Technical Support on page 234.

Command SYSINFO

You can acquire a report that contains system information by using the **SYSINFO** terminal command. The command lists parameters that are useful especially when troubleshooting the system or when contacting Vaisala technical support.

Example:

```
/Ext > SYSINFO

Serial #        : F025195
Hardware        : QML201B-003
Software        : 8.00a
Checksum        : E5ABA1EC
Boot sw version : 8.00
Program flash   : 4096kB
System RAM      : 2048kB
Free memory     : 1112kB
Internal temp.  : 31.89'C
Active errors   : NO
Active warnings : YES
Piggyback - 0   : DSI486 rev: B serial no: 021426
Piggyback - 1   : DSE101 rev: B serial no: 822561
Setup file      : /Cfg/METAWSAA.adc
Setup for sw    : 7.00
Setup creator   : Vaisala
Setup created   : 2010-12-17T09:40:02+00:00
Setup info      : 1.01
Setup CRC       : 1BC3FD87
Lizard version  : 8.00
System uptime   : 6h 48min 20sec since Mon Dec 20 09:42:42 2010

/Ext >
```

NOTE	If program Flash checksum returns an error, reload the software. If reloading the software does not work, contact Vaisala.

where

Serial #	=	Serial number of the logger PCB
Hardware	=	Hardware revision of the logger PCB
Software	=	Software version for the operating software and its checksum
Boot sw version	=	Version of the QML logger boot software
Program flash	=	Total amount of program memory
System RAM	=	Total amount of memory on the logger
Free memory	=	Amount of free memory on the logger
Internal temp.	=	Internal temperature of the logger
Active errors	=	Existence of active errors: YES/NO
Active warnings	=	Existence of active warnings: YES/NO
Piggyback - 0	=	Type and serial number of the additional module installed in the module slot 1
Piggyback - 1	=	Type and serial number of the additional module installed in the module slot 2
Setup file	=	File path of the running setup
Setup for sw	=	Minimum logger firmware version required for running the current setup
Setup creator	=	Setup created by
Setup created	=	Setup creation time
Setup CRC	=	Setup checksum
Lizard version	=	Lizard version used to create the setup
System uptime	=	Total time that the system has been running, calculated from the last reset

The versions of installed communication modules can be seen from SYSINFO output or in the startup message if, for example, you need to find out the version of a DSI486 module.

Example startup message from the logger:

```
COM0: QML201C Startup - Cold Boot
Serial #        : F1335009
Hardware        : QML201C-003
Software        : 8.00
Checksum        : 815AED36
Boot sw version : 8.00
Program flash   : 4096kB
System RAM      : 2048kB
Free memory     : 1626kB
Internal temp.  : 24.65'C
Active errors   : NO
Active warnings : NO
Piggyback - 0   : DSI486 rev: D serial no: 932365
Piggyback - 1   : DSE101 rev: B serial no: 822561
Program flash checksum (815AED36) verification...Passed
```

Command netif

The **netif** command is used to control and check the status of network interfaces. The command syntax is:

netif [**open** <*ifname*> | **close** <*ifname*>]

Parameters for the **netif** command are described in Table 60 below.

Table 60 Parameters for Command netif

Parameter	Use
No parameters	Lists current status of all configured network interfaces
open	Opens the given interface
close	Closes the given interface
ifname	Name of interface to be opened or closed, for example, *netif0*

NOTE

In spite of an issued close command, the interface may still remain open if a service is using it. Closing will always be delayed by the specified idle time (set in configuration).

Depending on the connection used, changing the state of a network interface may take a while. For example, with the GSM modem, the **netif open** command will take time for establishing the telephone connection plus the time for network connection negotiation. This can easily total over one minute.

Examples of **netif** command output are presented below:

```
/> netif
Network interface states:
interface 0 (netif0) : Closed
interface 1 (eth0)   : Opened
Physical network interface states:
DSE101_0             : Opened   owned by 1
PhyNullModemWin_1    : Closed
/>netif open netif0
Trying to open network interface 0
interface 0 state: Opening
/> netif close netif1
Trying to close network interface 1
interface 1 state: Idle
```

Command ipconfig

The command **ipconfig** shows the IP configuration for all open network interfaces. The command has no parameters.

An example of **ipconfig** command output is presented below:

```
/> ipconfig
pp1: (default network interface)
ÜP POINTOPOINT NOARP MTU:1500
DHCP Enabled. . . : No
IP Address. . . . :  62.78.127.31
Subnet Mask . . . :  255.255.255.0
Default Gateway . :  62.72.127.1
DNS Servers . . . :  217.78.192.22
                     217.78.192.78
```

Command ping

Ping is a commonly used command for testing access to an IP address. The command syntax is:

ping <*destination*>

The parameter *destination* is the destination IP address or host name.

Response to the command shows:

- IP address of the destination
- Roundtrip time taken to reach the destination
- TTL, remaining time to live (= maximum number of hops)

NOTE	The **ping** command requires an open network interface to work. Use the **netif** command to open the appropriate interface.

An example of **ping** command output is presented below:

```
/ > ping www.vaisala.com
Pinging 62.61.78.68
Reply from 62.61.78.68: time=168ms TTL=241
```

Command net

The **net** command has multiple command options for showing various network statistics. The command syntax is:

net <*warnings* | *statistics* [*clear*]>

Parameters for the **net** command are described in Table 61 below.

Table 61 Parameters for Command net

Parameter	Use
warnings	Displays warning level events occurred in communication
statistics	Displays statistical information about protocols and active network interfaces
clear	Clears network warnings or statistics

NOTE All information is shown as the number of packets transmitted, except for the sent and received data counts per network interface, which are in bytes. Interface-related data is available only for currently open interfaces, and it is cleared when the interface is closed.

Examples of **net** command output are presented below:

```
/> net warnings
Warning: NTP server changeover (se.pool.ntp.org)
occurred 1 times first in ntpclient.cpp[827]
during thread: 00063938 [Worker_1]
object pointer: 6AEF0 [component: NTPClient_1]
Warning: Unable to resolve NTP server IP (fi.pool.ntp.org)
occurred 1 times first in ntpclient.cpp[738]
during thread: 00063938 [Worker_1]
object pointer: 6AEF0 [component: NTPClient_1]
/ > net statistics
Total packets per protocol
TCP
Sent: 22
Recd: 22
Drop: 0
UDP
Sent: 0
Recd: 0
Drop: 0
ICMP
Sent: 0
Recd: 0
Drop: 0
IP Sent: 42
Recd: 22
Drop: 0
Sent/recd bytes and dropped packets per interface
pp0
Sent: 339
Recd: 292
Drop: 0
/ > net statistics clear
```

Command ftp

FTP client functionality can be used from the QML logger command shell to transfer files and to test the connection to an FTP server. The **ftp** command syntax is

ftp <get | put | test> <source> [destination] [-if interface] [-user username] [-pass password] [-rst restart at] [-opt options]

Parameters for the **ftp** command are described in Table 62 below.

Table 62 Parameters for Command ftp

Parameter	Use
get	Gets file from server
put	Puts file to server
test	Tests connection to server
source	Name of the source depending on command, for example, a file on local or remote system.
destination	Name of the destination, that is, depending on command, a file on local or remote system.
interface	Interface to use; the default value is netif0.
user	Username to use
pass	Password to use
options	**f** = Force destination directory creation on remote server, **a** = Append to file, **d** = Write debug output

Examples of **ftp** command output are presented below:

```
/Ext > ftp test ftp.vaisala.com -user me -pass mypass
Opening interface...ok
Connecting ftp.vaisala.com...ok

/Ext > ftp put metawsaa.adc ftp.vaisala.com -user me -pass mypass
Opening interface...ok
Sent succesfully 116382 bytes
```

Command ntp

The command **ntp** can be used to manually set the QML real-time clock and to test the connection to an NTP server. The command syntax is:

ntp<*set* | *show* | *test* > <*server*[*:port*]> [*maxroundtrip*] [*interface*]

Parameters for the **ntp** command are presented in Table 63 below.

Table 63 Parameters for Command ntp

Parameter	Use
Set	Sets QML real-time clock to server time
Show	Shows server time
Test	Tests server connection and shows debug output
server[:port]	NTP server to contact. Port is optional and the default value is 123.
Maxroundtrip	Maximum allowed roundtrip in milliseconds, for example, time between request transmit and data reception. The default value is 5000 ms.
Interface	Interface to use. The default value is **netif0**.

Examples of **ntp** command output are presented below:

```
/> ntp test ntp.vaisala.com
Opening interface...
NTP: Sending datagram to ntp.vaisala.com
1B 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 C9 FF E0 96 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00
NTP: data received, time error [s] -8
Status: 00 -> Clock operating correctly
Ref updated:    Thu May 24 09:45:17 2007
Req txd :       Thu May 24 09:59:50 2007
Req rxd :       Thu May 24 09:59:58 2007
Resp txd:       Thu May 24 09:59:58 2007
Resp rxd:       Thu May 24 09:59:50 2007
roundtrip:      0
/> ntp set fi.pool.ntp.org:123 2000 netif1
Opening interface...
Time set to server UTC:  Thu May 24 09:15:46 2007
/> ntp show ntp.vaisala.com
Opening interface...
Received server UTC:  Thu May 24 10:15:18 2007
```

Problem Situations for Ultrasonic Wind Sensor WMT703

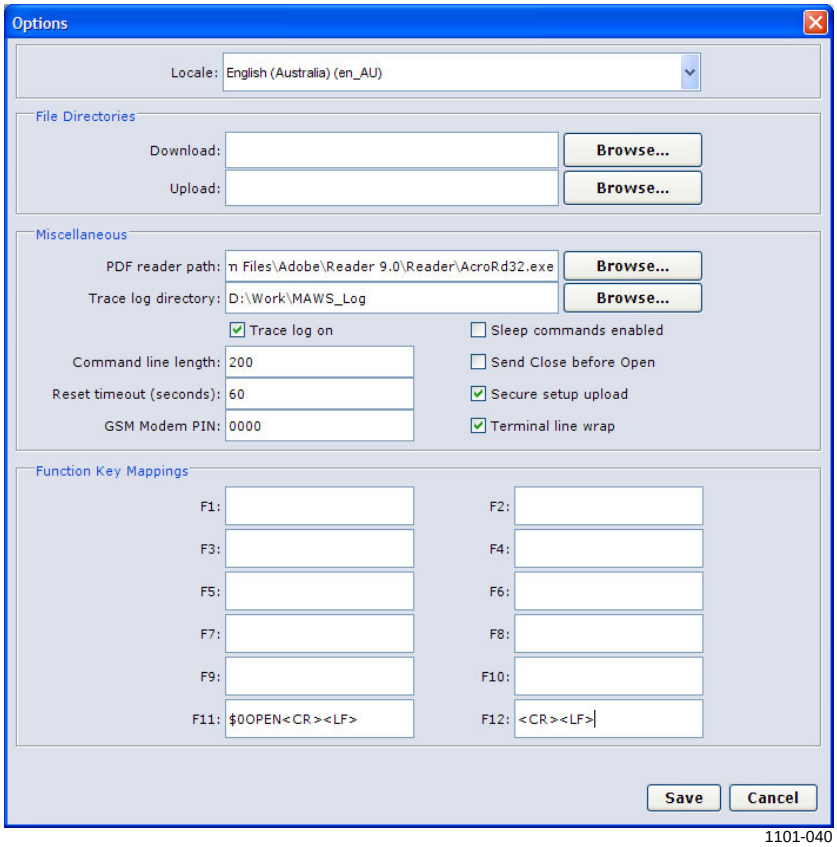
Table 64 Some Problem Situations and Their Remedies

Problem	Probable Cause	Remedy
Connection to WMT703 is lost.	Power supply is not sufficient.	Check the power supply for proper operation.
Wind measurement failure. WMT703 is sending irregular data values.	The installation site is causing measurement problems.	Check that the installation site matches the requirements listed in section Selecting Location on page 33.
	Snow, ice, a bird, or some other object is blocking the measurement path between the ultrasonic transducers.	Remove the blockage, and check that the wind transducers are not damaged. If the blockage is ice or snow, it melts after some time if you are using a heated version of WMT703. Duration of the blockage depends on the severity of the weather event. If birds are causing the blockage, consider installing a bird cage.
Reported wind direction is not correct.	WMT703 is misaligned, which causes an offset error.	Realign WMT703 according to section Aligning Ultrasonic Wind Sensor WMT703 on page 67.
There is a 180-degree offset error in the reported wind direction.	WMT703 is misaligned, which causes an offset error.	Rotate WMT703 to match the proper wind direction; see section Aligning Ultrasonic Wind Sensor WMT703 on page 67.
WMT703 does not respond to any commands, not even OPEN	Incorrect <CR><LF> settings in the terminal program.	Configure the terminal program to send both carriage return (<CR>) and line feed <LF>.
	The wiring might be incorrect.	Check the wiring; refer to Appendix A, Wiring Diagrams, on page 263.
	Sensor power	
Inconsistent serial communication or missing data.	Pin contacts of the connector have become oxidized or the connector is not firmly attached.	Change the WMT703 cable.

Command Connection to WMT703

In order to troubleshoot or reconfigure WMT703, you may need to open a command connection to the sensor as follows:

1. Start AWS Client software.
2. From the AWS Client menu, select **Settings - Options**.
3. Create two new function key mappings as shown in Figure 123 below.
   - $0OPEN<CR><LF>
   - <CR><LF>



1101-040

Figure 123 Defining Function Key Mappings for WMT703

4. Connect to QML201 logger as described in section Opening Service Connection on page 148.
5. Open command connection on QML201 by typing **open**<*CR*> to the AWS Client terminal window.
6. Type command **open** *COM1*<*CR*>. This should output a response `Terminal I/O re-routed to COM1`.
7. Press F11 (or other function key where the **open** command was programmed to in step 3 above) to send the **open** command to WMT703.

8. If WMT703 responds with prompt >, the connection has been successfully opened.

NOTE When entering commands for WMT703, instead of terminating command with ENTER, use the function key programmed in step 3 on page 230 to send <CR><LF> to the sensor. Also note that WMT703 does not echo characters when using RS485 link.

For additional troubleshooting instructions, see WMT700 User's Guide, manual M211095EN, included on the AWS330 installation CD.

Troubleshooting Mechanical Wind Sensor Set WA15

WA15 Cross Arm

Table 65 Some Common Problems and Their Remedies

Problem	Probable Cause	Remedy
Data is not received by the data collection system.	Improper or loose connections.	Check wiring and tighten the screw terminals.
Shaft heating of the 151 series sensors is not working.	Improper or loose connections.	Check wiring and tighten the screw terminals.
	Heating is not connected.	Check the connections.

WA15 Wind Vane

Table 66 Some Common Problems and Their Remedies

Problem	Probable Cause	Remedy
Data is not received from the sensor.	Sensor is not powered properly.	Check that the supply voltage is from 9.5 to15.5 VDC.
	After removing the connector's hex nut, the connector is bent, which breaks the connection wires.	Check the connector.
	Sensor is mechanically damaged.	Send the sensor to Vaisala for repair.
Sensor shaft is covered with ice and snow.	Heating element is not properly connected.	Open the sensor and check that the heating element outlet is connected to the connector on the printed circuit board. Refer to the instructions given in section Replacing Bearings of WAV151 on page 184 for details.
	Heating element does not function.	Send the sensor to Vaisala for repair. See section Product Returns on page 234 for details.
Output from the connector pins C to H do not have the right code or are not at the proper level.	The printed circuit board is damaged.	Replace the printed circuit board. Refer to the instructions given in section Replacing Bearings of WAV151 on page 184. See section Spare Parts on page 198 for spare part number.
Current consumption is either less than 17 mA or more than 25 mA when the shaft is rotated mechanically.		

WA15 Anemometer

Table 67 Some Common Problems and Their Remedies

Problem	Probable Cause	Remedy
Data is not received from the sensor.	Sensor is mechanically damaged.	Send the sensor to Vaisala for repair.
	After removing the connector's hex nut, the connector is bent, which breaks the connection wires.	Check the connector.
	The sensor is not powered properly.	Check that the supply voltage is from 9.5 to15.5 VDC.
Sensor shaft is covered with ice and snow.	Heating element does not function.	Send the sensor to Vaisala for repair. See section Product Returns on page 234 for details.
	Heating element is not properly connected.	Open the sensor and check that the heating element outlet is connected to the connector on the printed circuit board. Refer to the instructions given in section Replacing Bearings of WAA151 on page 188 for details.
Output from connector pin C tracked with an oscilloscope is not square wave.	Printed circuit board is damaged.	Replace the printed circuit board. Refer to the instructions given in section Replacing Bearings of WAA151 on page 188. See section Spare Parts on page 198 for spare part number.
Frequency is not equal to 14 times revolution rate.		

Troubleshooting Power Supply Units

Table 68 Troubleshooting Power Supplies

Problem	Probably Cause	Remedy
Power supply LED is not ON.	Blown fuse or main switch off	Check that AC (mains) power is connected and main switch is on. Replace the fuse.

Table 69 QBR101 Battery Regulator LEDs

LED	Color	Explanation
Battery status LED	Green	Charging
	Blank	Not charging
Charge LED	Green	OK
	Orange	Low
	Red	DC out OFF

Technical Support

For technical questions, contact the Vaisala technical support by e-mail at helpdesk@vaisala.com. Provide at least the following supporting information:

- Name and model of the product in question
- Serial number of the product
- Name and location of the installation site
- Name and contact information of a technically competent person who can provide further information on the problem.

Before returning a product, please request an RMA from Vaisala technical support; see section Requesting RMA on page 235.

Vaisala Service Centers

Vaisala Service Centers perform calibrations and adjustments as well as repair and spare part services. For contact information in your region, visit www.vaisala.com/services/servicecenters.html.

Vaisala Service Centers also offer accredited calibrations, maintenance contracts, and a calibration reminder program. Do not hesitate to contact them to get further information.

Product Returns

If the product must be returned for service, see www.vaisala.com/services/return.html.

For contact information of Vaisala Service Centers, see www.vaisala.com/services/servicecenters.html.

Requesting RMA

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

1. Read the warranty information.
2. Contact Vaisala technical support via e-mail or fax and request for RMA (Return Material Authorization) and shipping instructions.
3. Proceed as instructed by Vaisala technical support; refer to section Technical Support on page 234.

NOTE	RMA must always be requested from Vaisala technical support before returning any faulty material.

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CHAPTER 8

TECHNICAL DATA

This chapter provides the technical data of AWS330.

Wiring

QML Logger QML201C

The QML logger includes:

1. Ten measurement channels and one internal channel for pressure measurement.
2. One connector block for power supplies.
3. One connector block for communication channels.
4. Two blocks for optional communication modules.

Single-ended (H-C or L-C) or differential (H-L) measurements can be performed in the 10 measurement channels.

NOTE	Each sensor in a basic setup has its own dedicated channel. Table 70 on page 238 is to be used for reference purposes only.

Table 70 Analog Measurement Channels

Channels	Pin Name	Description
CH0, CH1, CH2, CH3 24-bit ADC	E	12 V/25 mA voltage excitation ON/OFF, voltage can be measured. OR: 100 µA/1mA current excitation.
	H	Analog input (High)
	L	Analog input (Low)
	C	The pin has been connected to ground (GND) via a 10 Ω resistor so that the current can be measured.
CH4, CH5, CH6, CH7 24-bit ADC	E	100 µA/1 mA current excitation
	H	Analog input (High)
	L	Analog input (Low)
	C	Common return and reference level for voltage measurements via the channel's own E-, H-, and L-pins. The pin has been connected directly to ground.
CHA, CHB Suitable for fast-changing input signals 12-bit ADC	F	Frequency input.
	E	0 ... 12 V/20 mA adjustable excitation voltage, can be measured.
	H	Fast analog input (High)
	L	Fast analog input (Low)
	C	Common return (Analog ground)

Table 71 Power Channels

Pin Name	Description
GND	Common ground
SDI-12	SDI-12 sensor signal pin
GND	Common ground
+ExtDC	Power input (8 ... 30 VDC)

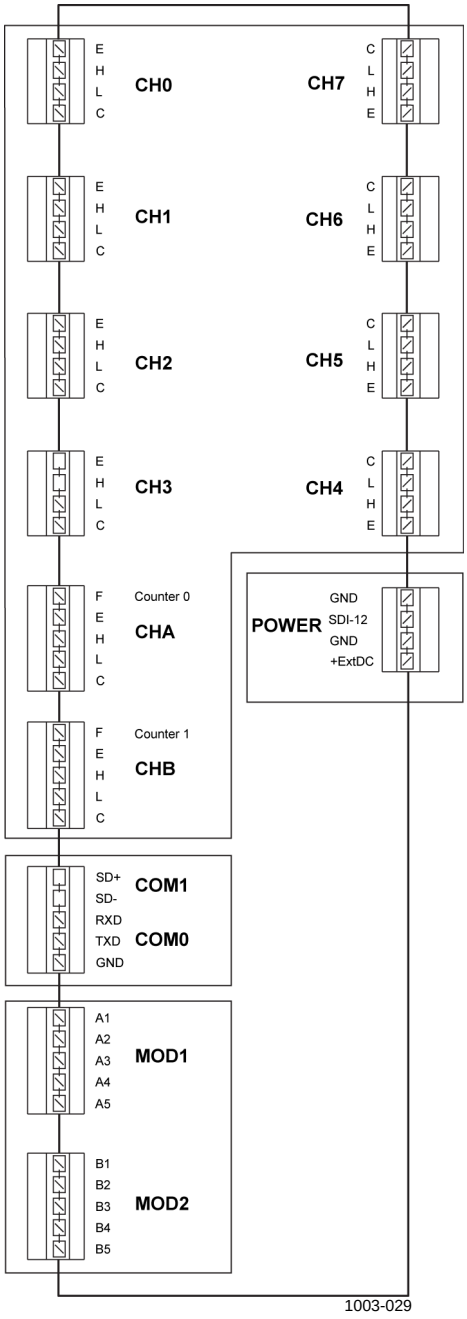


Figure 124 Connector Blocks

Communication Modules

The communication modules are housed inside the QML logger.

Dual RS-485 Module DSI486

Figure 125 Dual-Isolated RS-485 Communication Module DSI486

Data channel A is always used in the RS-485 mode. In 2-wire RS-485, both transmitted and received data is sent via this channel. In 4-wire RS-485, channel A can either transmit or receive, depending on the configuration.

Jumper X4 defines the line terminating resistor for channel A. Remove jumper X4 if you do not need the terminating resistor of the dual RS-485 module. Figure 126 below provides a schematic wiring diagram for dual RS-485.

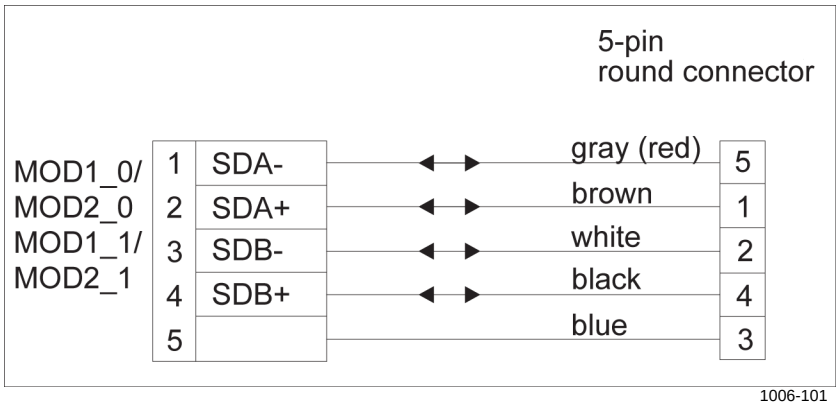


Figure 126 Dual RS-485 Module Wiring Diagram

Data channel B can be used either in the RS-485 mode or in the RS-232 mode. In 2-wire RS-485, both transmitted and received data is sent via this channel. In 4-wire RS-485, channel B can either transmit or receive, depending on the configuration.

Figure 126 on page 240 provides a schematic wiring diagram for the dual RS-485 connection, a dual 2-wire connection utilizing both channels. The correct jumper settings for the channel B are listed in Table 72 on page 242. The jumpers are located on the module as illustrated in Figure 127 below.

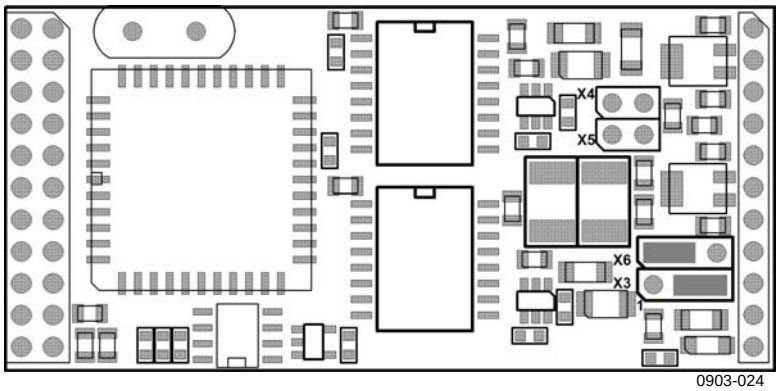


Figure 127 RS-232 Jumper Settings

Figure 128 below provides a schematic wiring diagram for the combination of the RS-485 and RS-232 connection. Jumpers X3 and X6 are used to select between the RS-485 and RS-232 modes for channel B. The correct jumper settings for channel B are listed in Table 72 on page 242.

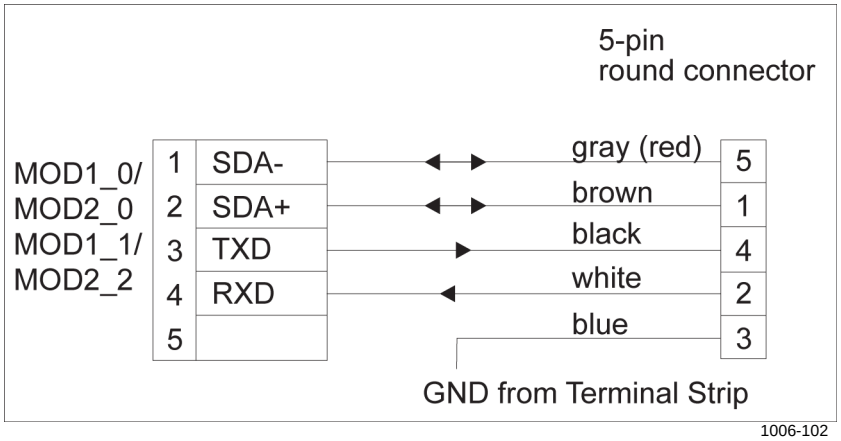


Figure 128 Dual RS-485 Wiring Diagram for RS-485 and RS-232

Table 72 Jumper Settings for DSI486-B

Jumper	Connected Pins	Function
X3	1-2	Channel B RS-232 mode
	2-3	Channel B RS-485 mode (default)
X6	1-2	Channel B RS-485 mode (default)
	2-3	Channel B RS-232 mode
X4	1-2	Channel A RS-485 line terminating resistor active
X5	1-2	Channel B RS-485 line terming resistor active. Do not use in RS-232 mode

The dual RS-485 module also provides an SDI-12 connection. The SDI-12 line uses one wire for data and is limited to the maximum length of 60 meters. Figure 129 below provides a schematic wiring diagram for the SDI-12 connection and the 12 VDC power supply for a sensor. The jumper settings should be as shown in Figure 127 on page 241.

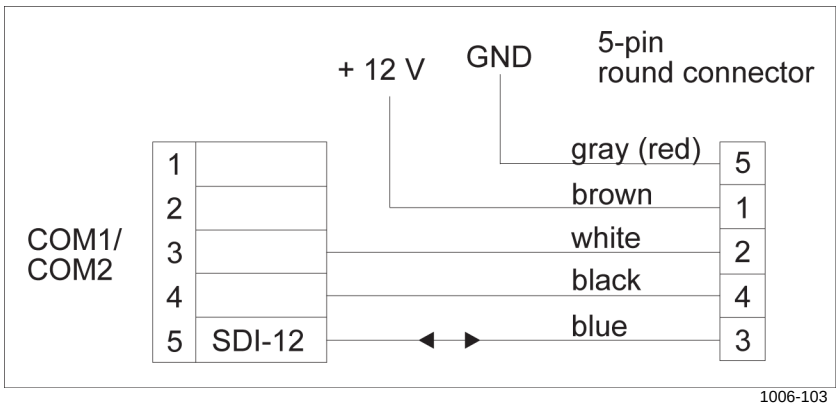
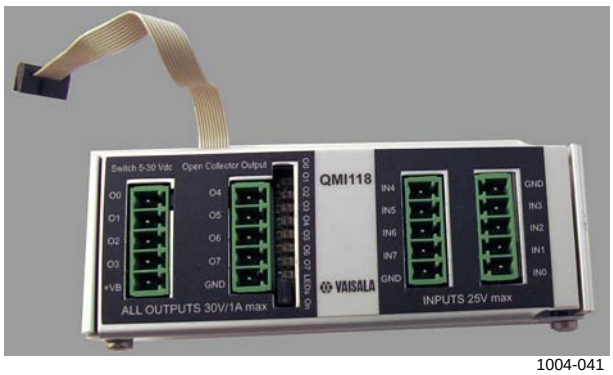


Figure 129 Dual RS-485 Wiring Diagram for SDI-12 and 12 VDC Power Supply

Simultaneously with the SDI-12, you can connect channels A and B in the 2-wire RS-485 mode.

Digital I/O Module QMI118



1004-041

Figure 130 Digital I/O Module QMI118

The QML logger provides the possibility to extend the I/O capacity with the optional digital I/O module QMI118 equipped with eight inputs and eight outputs. The digital I/O module interfaces to the logger via the SPI connector. The module is located inside the enclosure beside the logger, and it conforms to the same environmental immunity and emission standards as the logger.

The module has four open collector outputs and four outputs with high side switching capability. This means the module can switch, for example, +VB directly to the peripheral that needs it without additional relays. The high side outputs have the same rating as the open collector outputs, 30 VDC / 1 A, and 40 ms (typical) contact debouncing circuitry. They have a common positive terminal labeled +VB. The voltage does not have to be system battery voltage but can vary from 3.3 V to 30 V.

Note that the GND pin associated with the output block of O4 ... O7 should always be wired to the system GND if any of the outputs are used to switch currents that exceed 10 mA.

Table 73 QMI118 Technical Data

Property	Description/Value
Max. voltage all outputs, +VB	30 VDC
Max. current all outputs	1 A
Max. voltage all inputs	±25 V
Input default state	ON (max. 100 k weak pull up to 3.3 V built in)
Input debounce duration	40 ms typ., 60 ms max.
Input threshold	2 V
Input hysteresis	300 mV

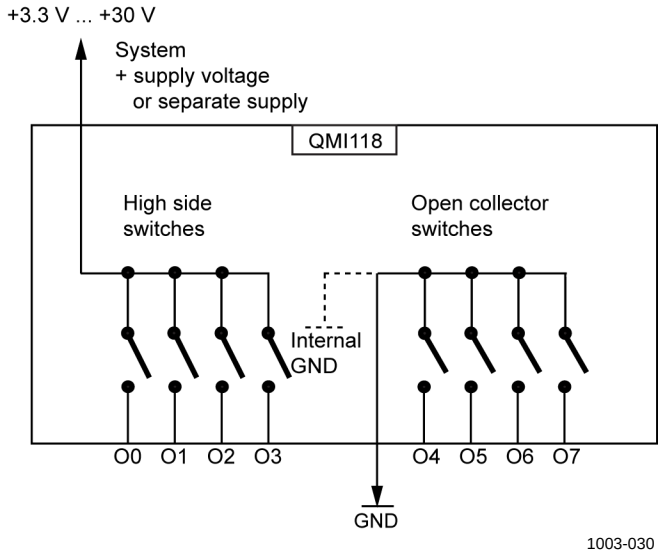


Figure 131 Digital I/O Module Wiring Diagram (Digital Outputs)

Ethernet Communication Module DSE101

Figure 132 Ethernet Communication Module DSE101

The Ethernet module DSE101 provides a 10base-T connection, which is compatible with 100 Mbps and 1 G switches; DSE101, however, operates at 10 Mbps. Supported by software, the module allows virtual serial port connections and socket connections to be established to the QML logger.

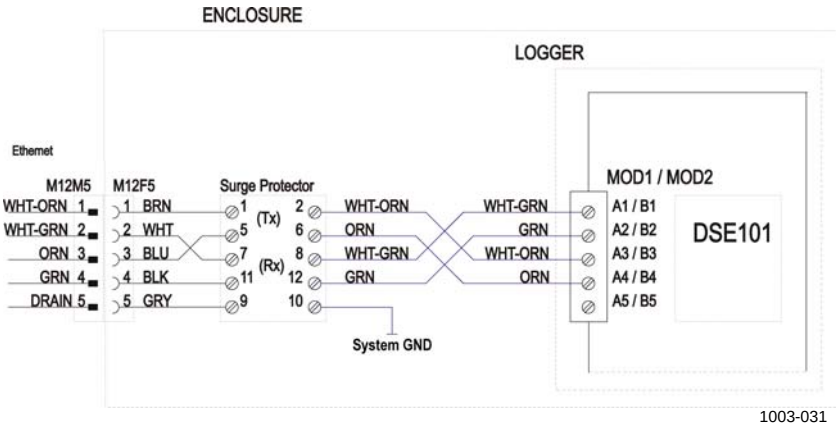


Figure 133 DSE101 Ethernet Module Wiring Diagram

Specifications

QML Logger

Table 74 QML201C Logger Specifications

Property	Description/Value
Processor	33 MHz, 32-bit Motorola
Memory	4 MB RAM and 4 MB program
A/D conversion	24-bit
Data logging memory	3.3 MB internal Flash memory
	Up to 2 GB on optional CF card
Sensor inputs	10 analog inputs (20 single-ended inputs)
	2 counter/frequency inputs
	Internal channel for BARO-1 pressure transducer
Serial communication	
Standard	One RS-232 and one RS-485 (two wire); one SDI-12
Optional	Two optional plug-in slots for communication modules to increase the number of the serial I/O channels up to 9 pcs (Note: Number depends on communication modules)
	Fast serial expansion bus for connecting, for example, digital I/O module
Speed	300 ... 38400 bps
Parameters	Configurable speed, start bits, data bits, stop bits, parity, XON/XOFF, and checksum
Ethernet communication	
Standard	IEE 802.3 Two plug-in slots for Ethernet modules DSE101
Speed	10 Mbs (10 BASE-T) Can also be connected to 100/1000 Mbps (100/1000 BASE-T) networks with 10 Mbps
Parameters	Full/half duplex with auto-negotiation
TCP/IP communication	
Supported protocols	ARP, UDP/IP, TCP/IP, FTP, SMTP, PPP (with PAP or CHAP authentication), HTTP (get), Telnet, ICMP Echo, DHCP, NTP, DNS, serial port tunneling over TCP/IP
Voltage (external powering)	8 ... 30 VDC
Power consumption	<10 mA (typically with basic 5 sensors)
Temperature (operating)	-50 ... +60 °C (-58 ... 140 °F); extended -60 ... +70 °C (-76 ... 158 °F)
Temperature (storage)	-60 ... +70 °C (-76 ... 158 °F); extended -60 ... +70 °C (-76 ... 158 °F)
Humidity	0 ... 100 %RH
Real-time clock (standard) backup time	5 years with CR1220 Lithium cell

Table 75 QML201C Logger Regulatory Compliances

Property	Description/Value
Emissions	CISPR 22 class B (EN55022)
ESD immunity	IEC 61000-4-2
RF field immunity	IEC 61000-4-3
EFT immunity	IEC 61000-4-4
Surge (lightning pulse)	IEC 61000-4-5
Conducted RF immunity	IEC 61000-4-6

Barometric Pressure

Table 76 Pressure Sensor BARO-1 Specifications

Property	Description/Value
Sensor type	Vaisala BAROCAP® (silicon capacitive)
Measuring range	500 ... 1100 hPa
Resolution	0.1 hPa
Operating temperature	-40 ... +60 °C (-40 ... 140 °F)

AC (Mains) Power Supply

Table 77 AC (Mains) Power Supply Specifications

Property	Description/Value
Output power	60 W
Operating principle	SMPS
Input voltage range	90 … 264 VAC
Frequency range	45 ... 65 Hz
Input current on full load:	
115 VAC	1.2 A
230 VAC	0.7 A
Output voltage	+15 VDC, adjustable 13 ... 18 VDC
Output current	4.0 A
Efficiency	80 % min.
Installation	Removable installation plate
Operating temperature range	-40 ... +55 °C (-40 ... +131 °F)

Power Supply Accessories

Battery

Table 78 26 Ah Backup Battery Specifications

Property	Description/Value
Type	Sealed, lead-acid
Nominal voltage	12 V
Nominal capacity	26 Ah
Self discharge	3% per month
Expected lifetime	4 … 5 years
Dimensions w × d × h	166 × 176 × 128 mm (6.5 × 6.9 × 4.9 in.)
Weight	8.7 kg (19 lb)

Local Line Surge Protector QSA224DC

Table 79 Local Data Output/Ultrasonic Wind Sensor WMT703 Surge Protector QSA224DC Specifications

Property	Description/Value
Interface	RS485, RS232
Data speed	Up to 115 kBps
Protection level with 8/20 µs voltage pulse Between signal lines (differential mode) Between signal lines and PE (common mode)	 <32.5 V <32.5 V
Surge current handling capability (1 x 8 / 20 µs pulse)	120 A

AC Power Surge Protector PT 2PE/S-230AC-ST

Table 80 AC Power Surge Protector Specifications

Property	Description/Value
Nominal voltage	230 VAC
Maximum AC current	26 A
Protection level with 1.2 / 50 µs and 6 kV voltage pulse Between N-PE and L-PE Between N and L	 1.5 kV <1.1 kV
Surge current handling capability (1 x 8 / 20 µs pulse)	10 kA
Approvals	CSA or UL

Battery Regulator QBR101C

Table 81 Battery Regulator QBR101C Specifications

Property	Description/Value
Maximum input voltage (SMPS and Solar Panel inputs)	30 VDC
Maximum input current (SMPS)	6 A
Solar panel input	55 W max.
Recommended input voltage from SMPS input	16 VDC
Max. load current (backup output)	3.5 A
Recommended battery capacity range	4 … 72 Ah
Battery charge current for 4 Ah battery (selections 0.5/1.0/2.0/2.5 A by jumper)	0.5 A
Max. battery discharge current	3.5 A
Battery charge voltage selection (with external resistor)	13.7 V for stand-by use (AC (mains) backup) 14.4 V for cycling use (solar panels)
Battery charge temp. comp. coefficient	-20 mV/°C typ.
Load disconnection threshold voltage (with Lo Btry Switch)	10.0 V typ.
Load reconnection threshold voltage	12.0 V typ.
Btry Low signal threshold voltage	11.5 V typ.
Self consumption from battery (with LEDs disconnected)	0.2 mA max. @ + 25 °C
Ground connection	Negative
Reverse voltage protection	Btry, solar panel
Dimensions (w × d × h)	90 × 80 × 25 mm
Weight	0.1 kg
Housing	Anodized aluminum, gray
Wire terminals Battery and load wires Solar panel, DC input and controls	Screw terminals, removable 2.5 mm^2 1.5 mm^2
Operating temperature range	-50 ... +60 °C
MTBF (parts stress method, MIL.HDBK 271F ground benign Ta +25 °C)	> 150 000 hours

Four-Wire Line Surge Protector PT5-HF-5DC-ST

Table 82 Ethernet Line Surge Protector PT5-HF-5DC-ST Specifications

Property	Description/Value
Total surge current (8/20) µ	20 kA
Ambient temperature (operation)	-40 ... +85 °C
Mounting	On base element
Nominal discharge surge current In (8/20) µs (Core-Earth)	10 kA
Nominal current	450 mA (45°C)
Direction of action	Line-Line & Line-Signal Ground/Shield & optional Signal Ground/Shield-Earth Ground
Nominal voltage	UN 5 V DC
Dimensions (w × d × h)	17.7 × 52 ×45 mm
Pitch unit	1 Div.

Power Supply Filter DRF06

Table 83 Power Supply Filter DRF06 Specifications

Property	Description/Value
Filter type	Single phase
Current rating	6 A
Voltage rating VAC	250 V
Capacitance	1 µF
Inductance	1.4 mH
Dimensions (w × d × h)	80 × 22.5 × 74 mm
Operating temperature	-25 ... 85 °C
Regulatory compliances	IEC950, UL, CSA, VDe
Supply frequency	Max. 440 Hz
Termination type	Screw
Mounting	DIN rail

Solar Panel

Table 84 Solar Panel SOLAR33 Specifications

Property	Description/Value
Peak power (Pp) at 1 kW/m^2 at +25 °C	33 W
Voltage at peak power (Vpp), typical	17.2 V
Current at peak power (Ipp), typical	1.92 A
Short-circuit current (Isc), typical	2.06 A
Temperature coefficient of current	0.58 mA/°C
Operating temperature	-40 ... +85 °C (-40 ... +185 °F)
Dimensions l × w × d	773 × 341 × 34 mm (30.4 × 13.4 × 1.3 in.)
Weight	3.8 kg (8.4 lb.)
Output cable	2 × 1.55 mm^2

Mast

Table 85 Mast DKP210 Specifications

Property	Description/Value
Height	10 m (32.8 ft.)
Diameter Lowest section Highest section	 100 mm (3.94 in.) 60 mm (2.36 in.)
Maximum wind speed With one set of guy wires With two sets of guy wires	 50 m/s (100 knots) 75 m/s (145 knots)
Weight (DKP210W with winch)	125 kg (275 lb.)
Pedestal tube and hinge	Stainless steel
Remaining parts of mast and lifting rod	Aluminum alloy
Guy wires Material Breaking strength Marking	 Stainless steel 28 kN (6 295 lbf) Black and yellow colored cable shrouds to the height of 2 m (6 ft.) from the ground
Threaded anchor bolts	Galvanized steel, thread M20, length 300 mm (11.8 in), with M20 wedge bolts (cast or drilled into concrete using the provided orientation plate)
Other parts, bolts	Stainless steel
Coating/Painting Pedestal tube Aluminum parts Steel parts Stainless steel parts	 Corrosion-resistant powder coating Anodized and painted Galvanized Uncoated
Temperature	-40 … +60 °C (-40 ... 140 °F)

Enclosure

Table 86 Large Stainless Steel Enclosure Specifications

Property	Description/Value
Material	Stainless steel
Protection rating	IP 66, equivalent with NEMA 4X
Maximum dimensions including radiation shield (h × w × d)	615 × 520 × 263 mm (24.2 × 20.5 × 10.4 in.)
Weight without radiation shield	13.7 kg (30.2 lb)
Wall mounting	By four M8 × 15 mm screws from rear side
Temperature range	-50 … + 100 °C (-58 ... +212 °F)

Displays

Local LCD Display QMD202 (Optional)

Table 87 Local LCD Display QMD202 Electrical Specifications

Property	Description/Value
Interface	SPI
Input voltage Vin	3.3 and 5.0 VDC powered from QML data logger
Power consumption Backlight OFF Backlight ON	 20 mW 85 mW
Connector	Connected to and powered by QML data logger via 10-wire flat cable

Table 88 Local LCD Display QMD202 Mechanical Specifications

Property	Description/Value
Dimensions	127 × 95 × 29 mm
Weight	230 g
Mounting	NS35 DIN rail foot
Enclosure material	Aluminum
LCD Display size (width × height)	20 × 6 characters

Table 89 Local LCD Display QMD202 Environmental Specifications

Property	Description/Value
Operating temperature	-25 ... +60 °C
Storage temperature	-60 ... +60 °C
Regulatory compliances	IEC(EN)-61326-1, for use in industrial locations
Vibration	IEC 60068-2-6, level 2 g

Communication Modules

RS-485 Module

Table 90 Dual-Isolated RS-485 Communication Module DSI486 Specifications

Property	Description/Value
Channels Channel A Channel B	 RS-485 RS-232 or RS-485
SDI	SDI-12
Isolation	Galvanic
Operating modes	Two 2-wire RS-485 and SDI-12 2-wire RS-485, RS-232, and SDI-12
Power consumption Idle Operating	 2.8 ... 4.3 mA 10.6 ... 12.4 mA
Connection distance (max.)	1500 m (4900 ft.)
Temperature (operating)	-40 ... +60 °C (-40 ... +140 °F)
Temperature (storage)	-50 ... +70 °C (-58 ... +158 °F)
Humidity	0 ... 100 %RH

Ethernet Communication Module DSE101

Table 91 Ethernet Communication Module DSE101 Specifications

Property	Description/Value
Operating mode	10Base-T
Power consumption (transmitting)	50 mA at 12 V
Temperature	Normal: -40 ... +70 °C (-76 ... 158 °F) Extended: -60 ... +70 °C (-76 ... 158 °F)
Humidity	0 ... 100 %RH

Sensors

Snow Depth Sensor IRU-9429

Table 92 Ultrasonic Snow Depth Sensor IRU-9429 Specifications

Property	Description/Value
Operating range	0.15 ... 10.67 m (½ ... 35 ft.)
Available outputs	4–20 mA, 4–20 mA + (2) NPN, 0–2.5V/0–5V (selectable via software)
Operating voltage	12–28 VDC
Programming voltage	15–28 VDC
Total current draw	75 mA at 24 VDC
Maximum power rating	2.5 W
Housing	Polycarbonate/PET blend
Transducer type	Electrostatic
Ratings	NEMA 12
Resolution	2.5 mm (0.1 inch)
Operating temperature	-40 to 60 °C (-40 to +140 °F)
Frequency	50 kHz

Pyranometer CMP6

Table 93 Pyranometer CMP6 Specifications

Property	Description/Value
ISO classification	First class
Response time (95%)	18 s
Zero offsets: - Thermal radiation (200 W/m^2) - Temperature change (5 K/hr)	 ±15 W/m^2 ±4W/m^2
Non-stability (change/year)	±1%
Non-linearity (0 to 1000 W/m^2 beam)	±1%
Directional error (at 80 ° with 1000 W/m^2 beam)	20 W/m^2
Temperature dependence of sensitivity	±4% (-10 ... +40 °C)
Tilt error (at 1000 W/m^2)	±1%
Other	
Sensitivity	5 ... 16 µV/W/m^2
Impedance	20 ... 200 Ω
Level accuracy	0.5 °
Operating temperature	-40 ... +80 °C
Spectral range (50% points)	310 ... 2800 nm
Typical signal output for atmospheric applications	0 ... 15 mV
Maximum irradiance	2000 W/m^2
Cable	10 m

Mechanical Wind Sensor Set WA15

Mechanical Wind Sensor Set WA15 consists of Vaisala Anemometer WAA151 and Vaisala Wind Vane WAV151.

Vaisala Anemometer WAA151

Table 94 Vaisala Anemometer WAA151, Wind Speed

Property	Description/Value
Measurement range	0.4 ... 75 m/s
Distance constant	2.0 m
Characteristic transfer function	U = 0.328 + 0.101 × R (where U = wind speed [m/s], R = output pulse rate [Hz])

Table 95 Vaisala Anemometer WAA151, General

Property	Description/Value
Operating power supply	U_{in} = 9.5 ... 15.5 VDC, 20 mA typical
Heating power supply	AC or DC 20 V, 500 mA nominal
Output	0 ... 750 Hz square wave
Transducer output level	
with I_{out} <+5 mA	High state > U_{in}-1.5 V
with I_{out} >–5 mA	Low state < 2.0 V
Settling time after power turn-on	< 30 µs
Plug 6-PIN	MIL-C-26482 type
Cabling	6-wire cable through cross arm
Recommended connector at cable end	SOURIAU MS3116F10-6P
Operating temperature with heating	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Material	
Housing	AlMgSi, gray anodized
Cups	PA, reinforced with carbon fiber
Dimensions	240 (h) × 90 (Ø) mm
Swept radius of cup wheel	91 mm
Weight	570 g

Table 96 Vaisala Anemometer WAA151, Test Compliance

Property	Description/Value
Wind tunnel tests	ASTM standard method D5096-90
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3
Complies with EMC standard EN61326-1:1997 + Am1:1998 + Am2:2001; Generic Environment	

Vaisala Wind Vane WAV151

Table 97 Vaisala Wind Vane WAV151, Wind Direction

Property	Description/Value
Measurement range at wind speed 0.4 ... 75 m/s	0 ... 360°
Starting threshold	<0.4 m/s
Resolution	±2.8°
Damping ratio	0.19
Overshoot ratio	0.55
Delay distance	0.4 m

Table 98 Vaisala Wind Vane WAV151, General

Property		Description/Value
Operating power supply		U_{in} = 9.5 ... 15.5 VDC, 20 mA typical
Heating power supply		AC or DC 20 V, 500 mA nominal
Output code		6-bit parallel GRAY
Output levels		
	with I_{out} <+5 mA	High state > U_{in} -1.5 V
	with I_{out} >–5 mA	Low state < 1.5 V
Settling time after power turn-on		<100 µs
Plug 10-PIN		MIL-C-26482 type
Cabling		10-wire cable through cross arm
Recommended connector at cable end		SOURIAU MS3116F12-10P
Operating temperature with heating		-50 ... +55 °C (-58 ... +131 °F)
Storage temperature		-60 ... +70 °C (-76 ... +158 °F)
Material		
	Housing	AlMgSi, gray anodized
	Wave	Alsi 12 anodized
Dimensions		300 (h) × 90 (Ø) mm
Swept radius of vane		172 mm
Weight		660 g

Table 99 Vaisala Wind Vane WAV151, Test Compliance

Property	Description/Value
Wind tunnel tests	ASTM standard method D5366-93 (for starting threshold, distance constant, transfer function)
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3
Complies with EMC standard EN61326-1:1997 + Am1:1998; Am2:2001; Generic Environment	

Ultrasonic Wind Sensor WMT703

Table 100 Wind Speed

Property	Description/Value
Measurement range	0 ... 75 m/s
Starting threshold	0.01 m/s
Resolution	0.01 m/s
Response time	250 ms
Available variables	Instant, peak, average, maximum, minimum, gust, lull

Table 101 Wind Direction

Property	Description/Value
Measurement range	0 … 360 °
Starting threshold	0.1 m/s
Resolution	1 °
Response time	250 ms
Available variables	Instant, average, maximum, minimum

Table 102 Outputs

Property	Description/Value
Digital output type	COM1: RS-485
Message format	NMEA Standard and Extended (version 0183),
Bit rate	9600
Readout update interval	Max. 4 Hz
Units available	m/s, knots, mph, km/h, V, mA, Hz
Operating mode	Automatic transmission or poll mode
Virtual temperature	Celsius degrees

NOTE In extreme weather conditions, ice or snow accumulation may cause a temporary wind measurement blackout even when heating is enabled. WMT703 indicates this with missing readings or in the data message.

Table 103 General

Property	Description/Value
Heating	Transducer heating 30 W
Operating temperature	-55 ... +70 °C
Operating voltage Absolute maximum	9 ... 36 VDC 40 VDC
Heating voltage Typical ranges Absolute maximum	 24 ... 36 VDC 40 VDC
IP class	IP66/IP67
Material Body Transducers Mounting kit	 Stainless steel AISI316 Silicone Stainless steel AISI316
Dimensions (h × w × d)	350 mm h × 250 mm × 285 mm
Weight	2 kg
Connector	Hummel 7.106 series

Dimensions

Figure 134 below and Figure 135 on page 259 show the dimensions of Ultrasonic Wind Sensor WMT703 and Mounting Kit FIX70.

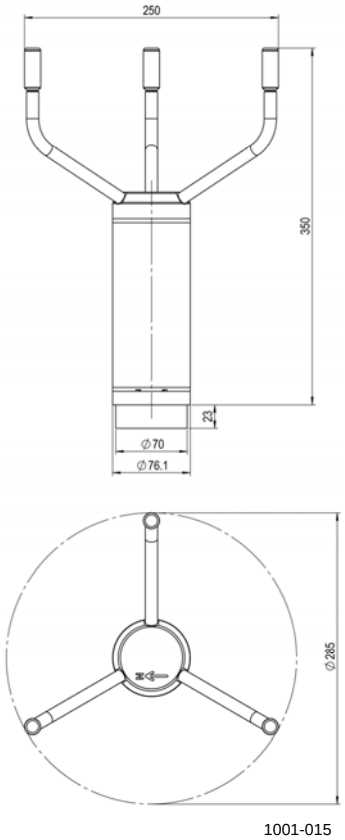


Figure 134 Ultrasonic Wind Sensor WMT703 Dimensions in Millimeters

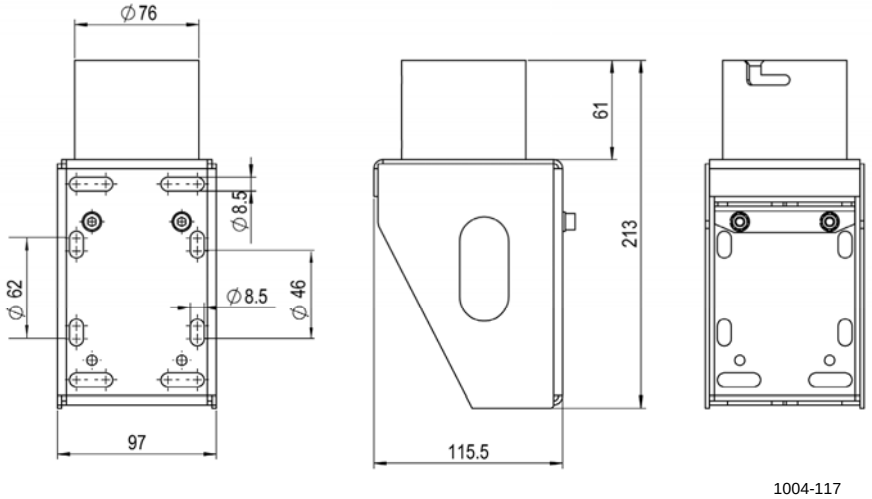


Figure 135 Mounting Kit FIX70 Dimensions in Millimeters

Rain Gauge RG13(H)

Rain Gauge RG13H features a heating element but otherwise complies with the same specifications as Rain Gauge RG13.

Table 104 Rain Gauge RG13(H) Specifications

Property	Description/Value
Diameter of aperture	225 mm
Area of aperture	400 cm^2
Rainfall capacity	Unlimited
Sensitivity (rainfall per pulse)	0.2 mm
Dimensions (height Ø)	390 300 mm
Weight	2.5 kg
Heater (in RG13H)	38 W/40 VAC
Thermostat operation	Opens at +11 °C (±3 °C) Closes at +4 °C (±3 °C) (in RG13H)

Air Temperature and Relative Humidity Probe HMP155

Table 105 HMP155 Outputs

Property	Description/Value
Voltage output	0 ... 1 V
Resistive Pt100 4-wire connection	
Average current consumption (+15 VDC, load 100 kOhm), 0…1 V output	< 3 mA
Operating voltage	7 ... 28 VDC
Setting time at power-up, voltage output	2 s

Table 106 HMP155 Mechanics

Property	Description/Value
User cable connector	M12 series 8-pin connector (male)
Cable coating	PUR
Max wire size	AWG 26
Service cable	USB connection cable 1.45 m (item 221040)
Filter	Sintered PTFE
Housing material	PC
Housing classification	IP66
Probe weight	86 g

Dimensions in mm (inches)

HMP155 Probe

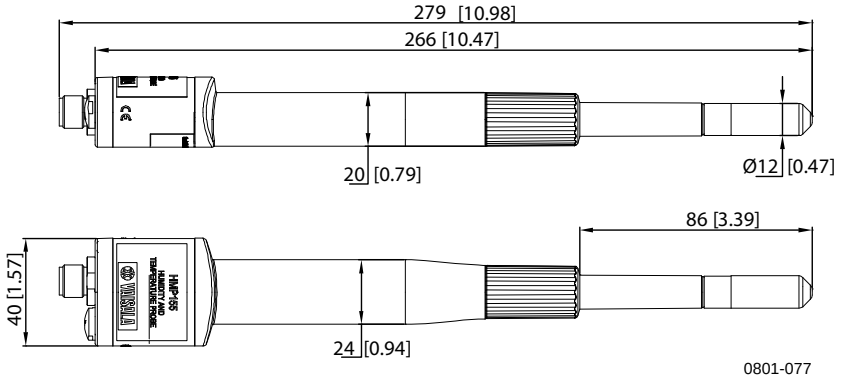


Figure 136 Probe Dimensions

Soil Temperature QMT110

Table 107 Soil Temperature Sensor QMT110 Specifications

Property	Description/Value
Sensor type	Pt100-type RTD element
Performance	1/4 DIN 43760B
Sensitivity	0.385 ohm/°C (DIN 43760)
Dimensions	Ø 6 mm, length 150 mm
Material	Stainless steel, AISI 316
Environmental	Watertight from 0.1 to 4 bar
Cable	PUR black, 5 × 0.5 mm^2 Cu, length 10 m
Ingress protection	IP68 (connector)

GSM/GPRS Modem

Table 108 GSM/GPRS Modem Specifications

Property	Description/Value
Sensitivity	-104 dBm
Quad band	850/900/1800/1900 MHz
Data transmission	GPRS class 10/8
	Full PBCCH support
	GPRS mobile station, class B
	CSD up to 14.4.kbps
	USSD
	V.110
SMS	Text and PDU mode, cell broadcast
Tx power	2 W (class 4)
	1 W (class 1)
Supply voltage	8 ... 30 V
Temperature range	- 30 ... + 75 °C
Weight	110 g (4 oz.)

Table 109 GSM/GPRS Antenna Specifications

Property	Description/Value
Frequency range	Dual band 805–960/1710–2170 MHz
No. of elements	1 omnidirectional
Gain	2 dBd
Polarization	Vertical
Cable	5 m

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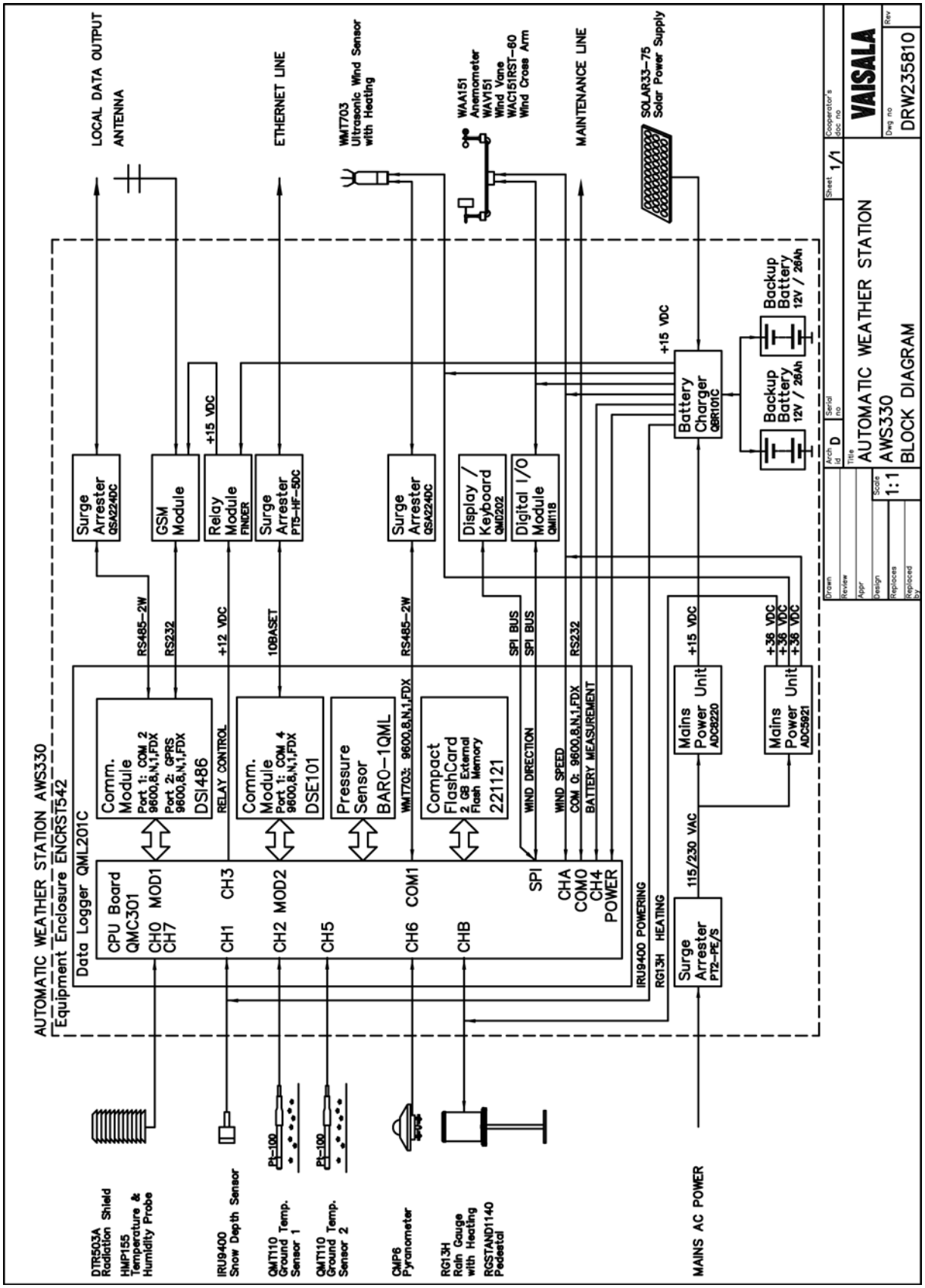
APPENDIX A
WIRING DIAGRAMS

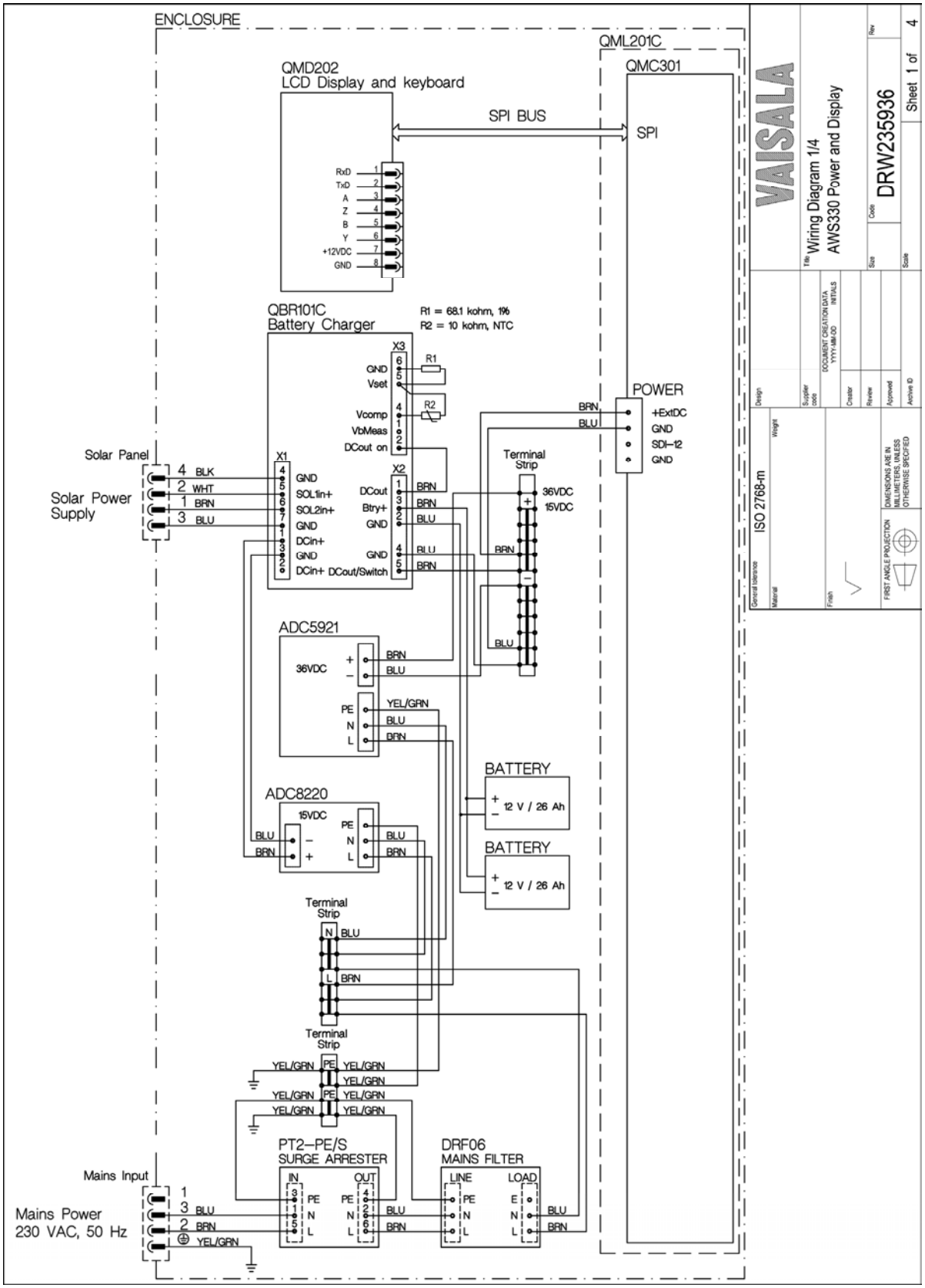
This chapter contains the wiring diagrams for AWS330.

AWS330 System Basic Wiring Diagrams

The following pages contain the wiring diagrams for the AWS330 system:

- DRW235810, Block diagram
- DRW235936, Power and display
- DRW235937, Data lines
- DRW235938, Wind sensors
- DRW235939, Sensor connections
- DRW235992, Sensor cables
- DRW235993, Connector flange
- DRW236056, AWS330 Enclosure Layout, Cover installation plates
- DRW236056, AWS330 Enclosure Layout, Inside view


AUTOMATIC WEATHER STATION AWS330
Equipment Enclosure ENCRST542
Data Logger QML201C
CPU Board QMC301
CH0 MOD1 CH7
CH1 CH3
CH2 MOD2
CH5
CH6 COM1
CHB
SPI
CHA
COM
CH4
POWER
Comm. Module Port 1: COM 2 9600,8,N,1,FDX Port 2: GPRS 9600,8,N,1,FDX DSI486
RELAY CONTROL
Comm. Module Port 1: COM 4 9600,8,N,1,FDX DSE101
Pressure Sensor BARO-1QML
WMT703: 9600,8,N,1,FDX
Compact FlashCard 2 GB External Flash Memory 221121
WIND DIRECTION
WIND SPEED
COM 0: 9600,8,N,1,FDX
BATTERY MEASUREMENT
IRU9400 POWERING
RG13H HEATING
115/230 VAC
RS485-2W
RS232
+12 VDC
10BASET
RS485-2W
SPI BUS
SPI BUS
RS232
+15 VDC
+36 VDC
+36 VDC
+36 VDC
Surge Arrester QSA224DC
GSM Module
+15 VDC
Relay Module FINDER
Surge Arrester PT5-HF-5DC
Surge Arrester QSA224DC
Display / Keyboard QMD202
Digital I/O Module QMI118
Mains Power Unit ADC8220
Mains Power Unit ADC5921
Surge Arrester PT2-PE/S
Battery Charger QBR101C
+15 VDC
Backup Battery 12V / 26Ah
Backup Battery 12V / 26Ah
LOCAL DATA OUTPUT
ANTENNA
ETHERNET LINE
WMT703 Ultrasonic Wind Sensor with Heating
WAA151 Anemometer WAV151 Wind Vane WAC151RST-60 Wind Cross Arm
MAINTENANCE LINE
SOLAR33-75 Solar Power Supply
DTR503A Radiation Shield
HMP155 Temperature & Humidity Probe
IRU9400 Snow Depth Sensor
QMT110 Ground Temp. Sensor 1
QMT110 Ground Temp. Sensor 2
QMP6 Pyranometer
RG13H Rain Gauge with Heating
RGSTAND1140 Pedestal
MAINS AC POWER
Pt-100
Pt-100
Drawn
Review
Appr
Design
Replaces
Replaced by
Arch id D
Serial no
Title
AUTOMATIC WEATHER STATION
AWS330
BLOCK DIAGRAM
Scale 1:1
Sheet 1/1
Cooperator's doc no
VAISALA
Dwg no DRW235810
Rev


ENCLOSURE
QML201C
QMC301
QMD202
LCD Display and keyboard
SPI BUS
SPI
RxD
TxD
A
Z
B
Y
+12VDC
GND
QBR101C
Battery Charger
R1 = 68.1 kohm, 1%
R2 = 10 kohm, NTC
X3
GND
Vset
Vcomp
VbMeas
DCout on
R1
R2
POWER
+ExtDC
GND
SDI-12
GND
BRN
BLU
Solar Panel
Solar Power Supply
4 BLK
2 WHT
1 BRN
3 BLU
X1
GND
SOL1in+
SOL2in+
GND
DCin+
GND
DCin+ DCout/Switch
X2
DCout
Btry+
GND
GND
BRN
BRN
BLU
BLU
BRN
Terminal Strip
36VDC
15VDC
ADC5921
36VDC
BRN
BLU
PE
N
L
YEL/GRN
BLU
BRN
BATTERY
12 V / 26 Ah
BATTERY
12 V / 26 Ah
ADC8220
15VDC
BLU
BRN
PE
N
L
BLU
BRN
Terminal Strip
N BLU
L BRN
Terminal Strip
YEL/GRN
PE
YEL/GRN
YEL/GRN
PE
YEL/GRN
YEL/GRN
PT2-PE/S
SURGE ARRESTER
IN
OUT
DRF06
MAINS FILTER
LINE
LOAD
Mains Input
Mains Power
230 VAC, 50 Hz
1
3 BLU
2 BRN
YEL/GRN
PE
N
L
BLU
BRN
VAISALA
Title Wiring Diagram 1/4
AWS330 Power and Display
Size
Code DRW235936
Rev
Sheet 1 of 4
Scale
Supplier code
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Design
Creator
Reviewer
Approved
Archive ID
ISO 2768-m
General tolerance
Material
Weight
Finish
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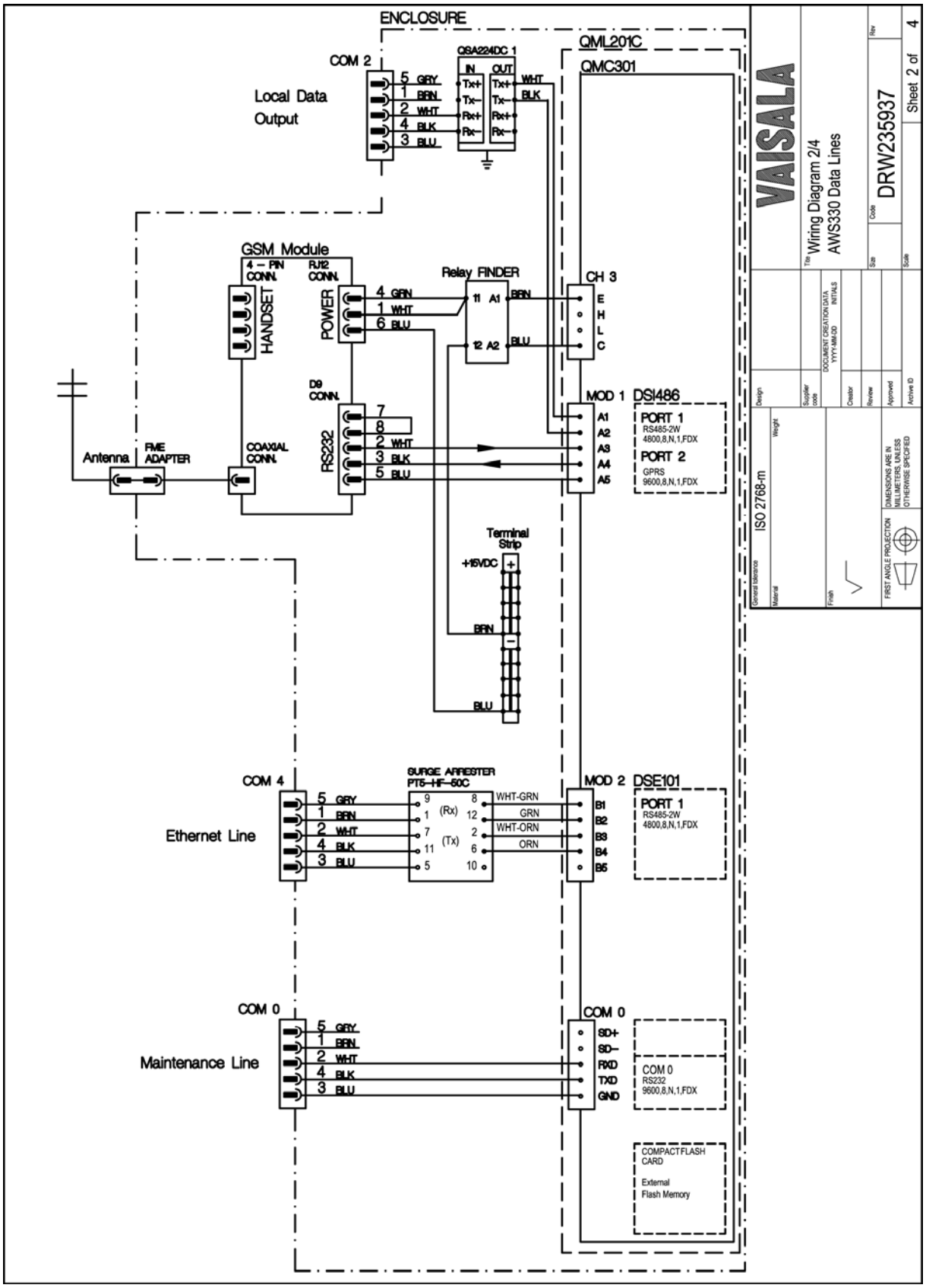
ENCLOSURE
QML201C
QMC301
COM 2
Local Data Output
QSA224DC 1
IN
OUT
GSM Module
4 – PIN CONN.
RJ12 CONN.
HANDSET
POWER
Relay FINDER
CH 3
D9 CONN.
RS232
MOD 1 DSI486
PORT 1
RS485-2W
4800,8,N,1,FDX
PORT 2
GPRS
9600,8,N,1,FDX
Antenna
FME ADAPTER
COAXIAL CONN.
Terminal Strip
+15VDC
COM 4
Ethernet Line
SURGE ARRESTER
PT5–HF–50C
MOD 2 DSE101
PORT 1
RS485-2W
4800,8,N,1,FDX
COM 0
Maintenance Line
COM 0
RS232
9600,8,N,1,FDX
COMPACTFLASH CARD
External
Flash Memory
VAISALA
Wiring Diagram 2/4
AWS330 Data Lines
DRW235937
Sheet 2 of 4
ISO 2768-m
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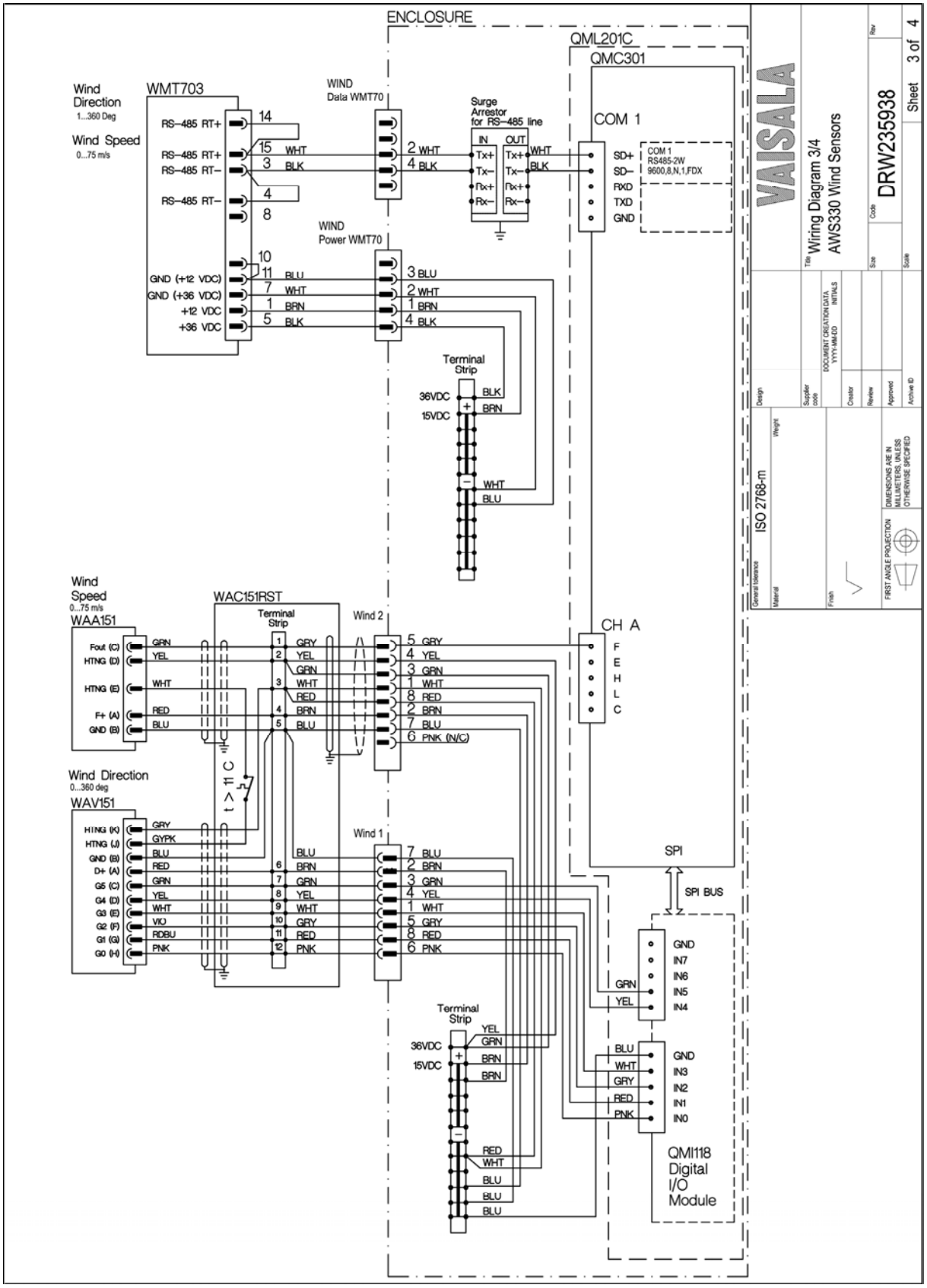
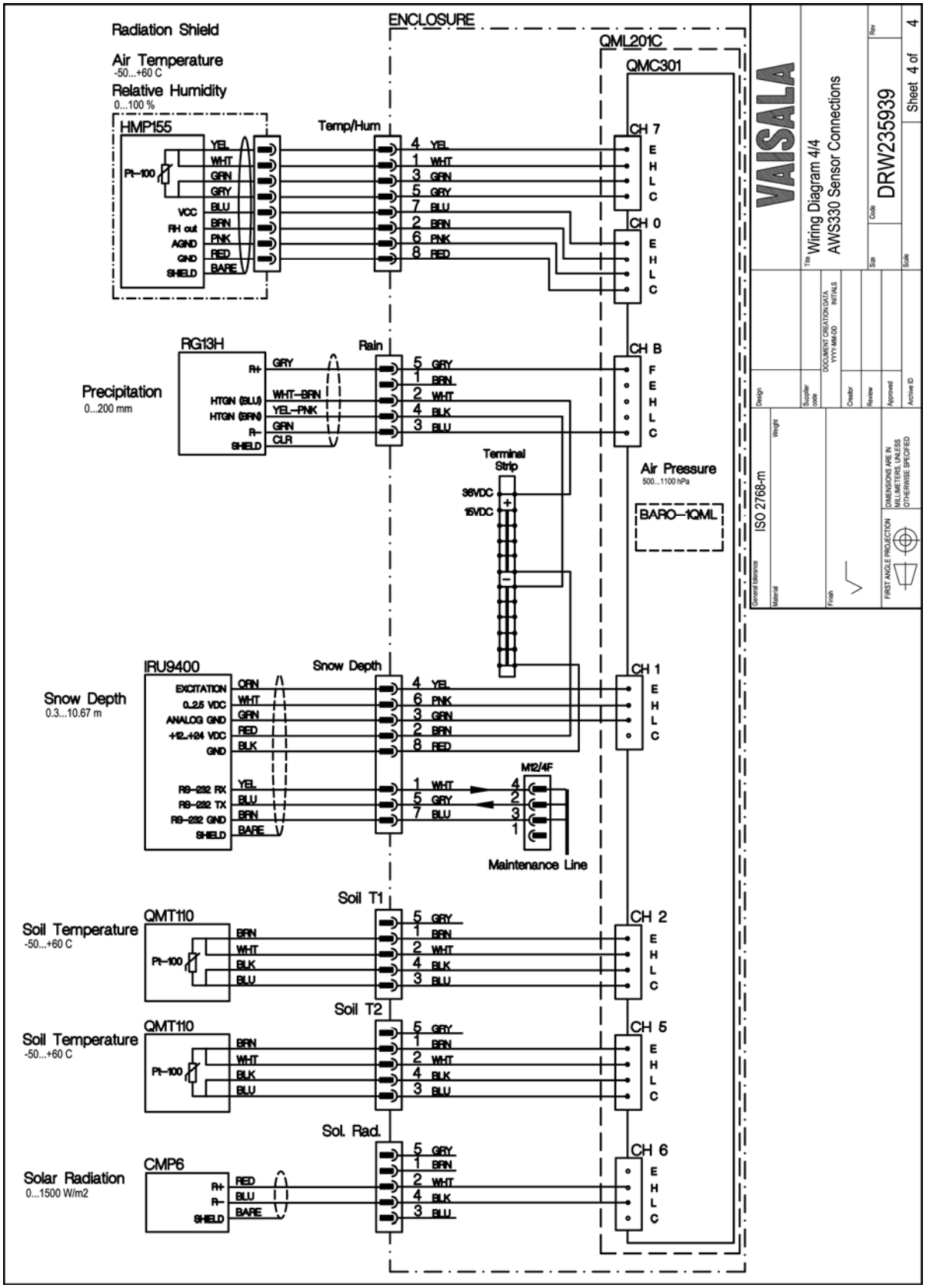

ENCLOSURE
QML201C
QMC301
COM 1
SD+
SD–
RXD
TXD
GND
COM 1
RS485-2W
9600,8,N,1,FDX
Wind
Direction
1...360 Deg
Wind Speed
0...75 m/s
WMT703
RS–485 RT+
RS–485 RT+
RS–485 RT–
RS–485 RT–
GND (+12 VDC)
GND (+36 VDC)
+12 VDC
+36 VDC
WIND
Data WMT70
WIND
Power WMT70
Surge
Arrestor
for RS–485 line
IN
OUT
Tx+
Tx–
Rx+
Rx–
WHT
BLK
BLU
BRN
Terminal
Strip
36VDC
15VDC
Wind
Speed
0...75 m/s
WAA151
Fout (C)
HTNG (D)
HTNG (E)
F+ (A)
GND (B)
WAC151RST
Terminal
Strip
Wind 2
Wind 1
t > 11 C
Wind Direction
0...360 deg
WAV151
HTNG (K)
HTNG (J)
GND (B)
D+ (A)
G5 (C)
G4 (D)
G3 (E)
G2 (F)
G1 (G)
G0 (H)
GRY
GYPK
RED
GRN
YEL
WHT
VIO
RDBU
PNK
CH A
F
E
H
L
C
SPI
SPI BUS
GND
IN7
IN6
IN5
IN4
IN3
IN2
IN1
IN0
QMI118
Digital
I/O
Module
VAISALA
Title
Wiring Diagram 3/4
AWS330 Wind Sensors
DRW235938
Sheet 3 of 4
ISO 2768-m
FIRST ANGLE PROJECTION
DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED


ENCLOSURE
Radiation Shield
Air Temperature
-50...+60 C
Relative Humidity
0...100 %
HMP155
Pt-100
YEL
WHT
GRN
GRY
VCC
BLU
RH out
BRN
AGND
PNK
GND
RED
SHIELD
BARE
Temp/Hum
4 YEL
1 WHT
3 GRN
5 GRY
7 BLU
2 BRN
6 PNK
8 RED
QML201C
QMC301
CH 7
CH 0
E
H
L
C
RG13H
R+
GRY
HTGN (BLU)
WHT-BRN
HTGN (BRN)
YEL-PNK
R-
GRN
SHIELD
CLR
Rain
5 GRY
1 BRN
2 WHT
4 BLK
3 BLU
CH B
F
Precipitation
0...200 mm
Terminal Strip
36VDC
15VDC
Air Pressure
500...1100 hPa
BARO-1QML
IRU9400
EXCITATION
0.2.5 VDC
ANALOG GND
+12..+24 VDC
GND
RS-232 RX
RS-232 TX
RS-232 GND
Snow Depth
0.3...10.67 m
Snow Depth
4 YEL
6 PNK
3 GRN
2 BRN
8 RED
CH 1
1 WHT
5 GRY
7 BLU
M12/4F
Maintenance Line
Soil T1
QMT110
Soil Temperature
-50...+60 C
BRN
WHT
BLK
BLU
CH 2
Soil T2
CH 5
Sol. Rad.
CMP6
Solar Radiation
0...1500 W/m2
RED
CH 6
VAISALA
Title
Wiring Diagram 4/4
AWS330 Sensor Connections
Size
Code
DRW235939
Rev
Sheet 4 of 4
Scale
Design
Supplier code
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General tolerance
Material
Weight
Finish
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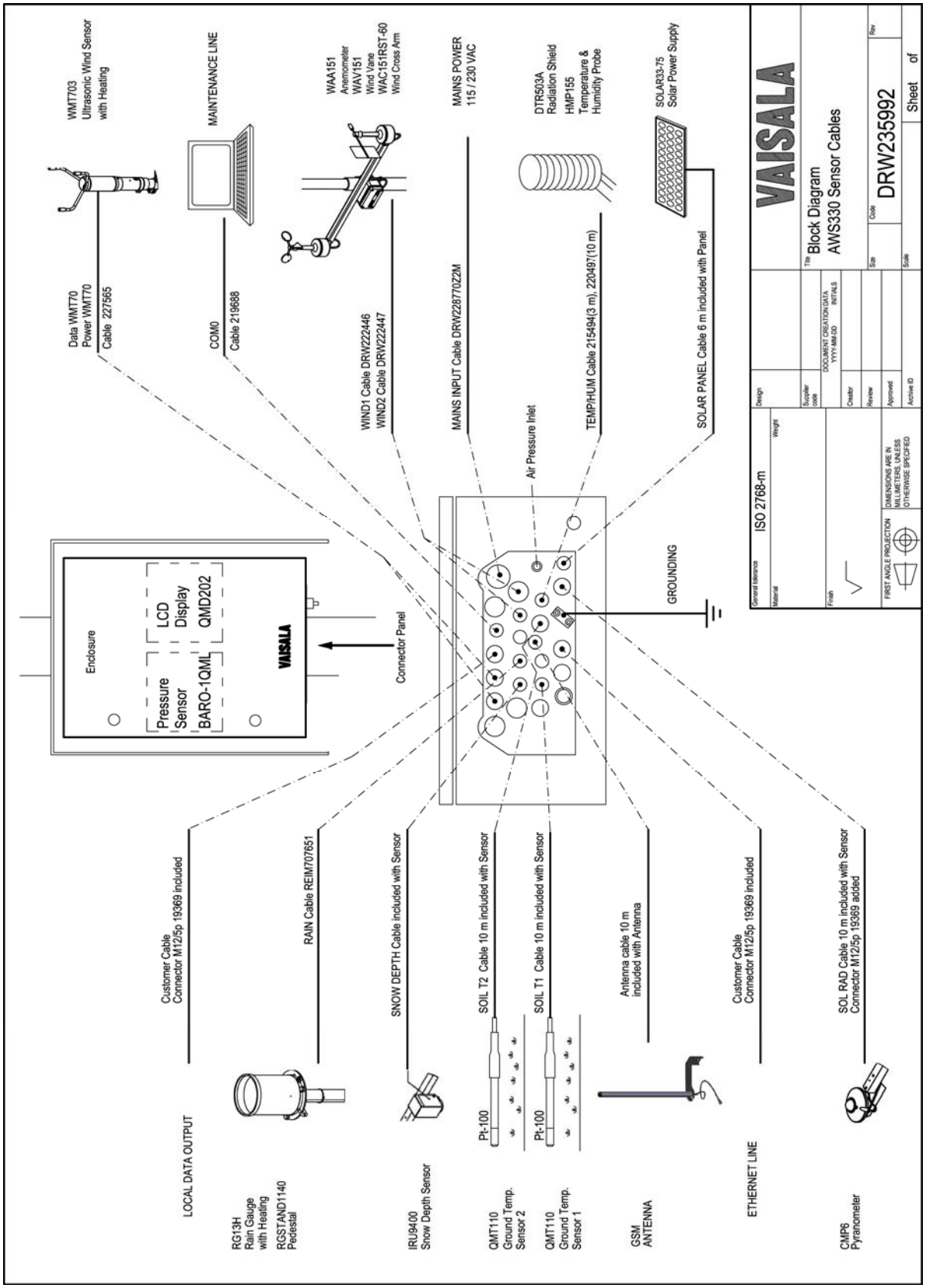
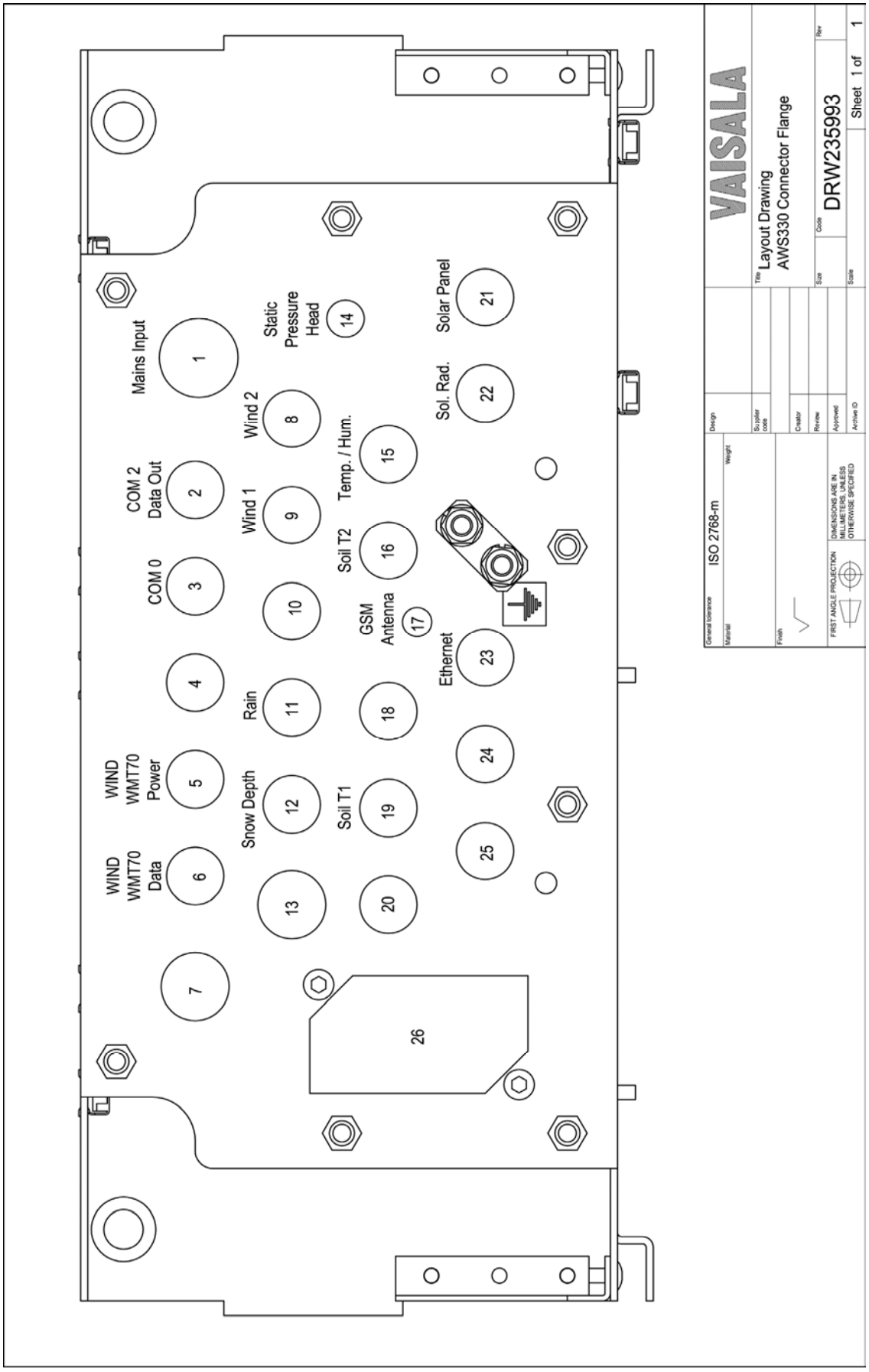
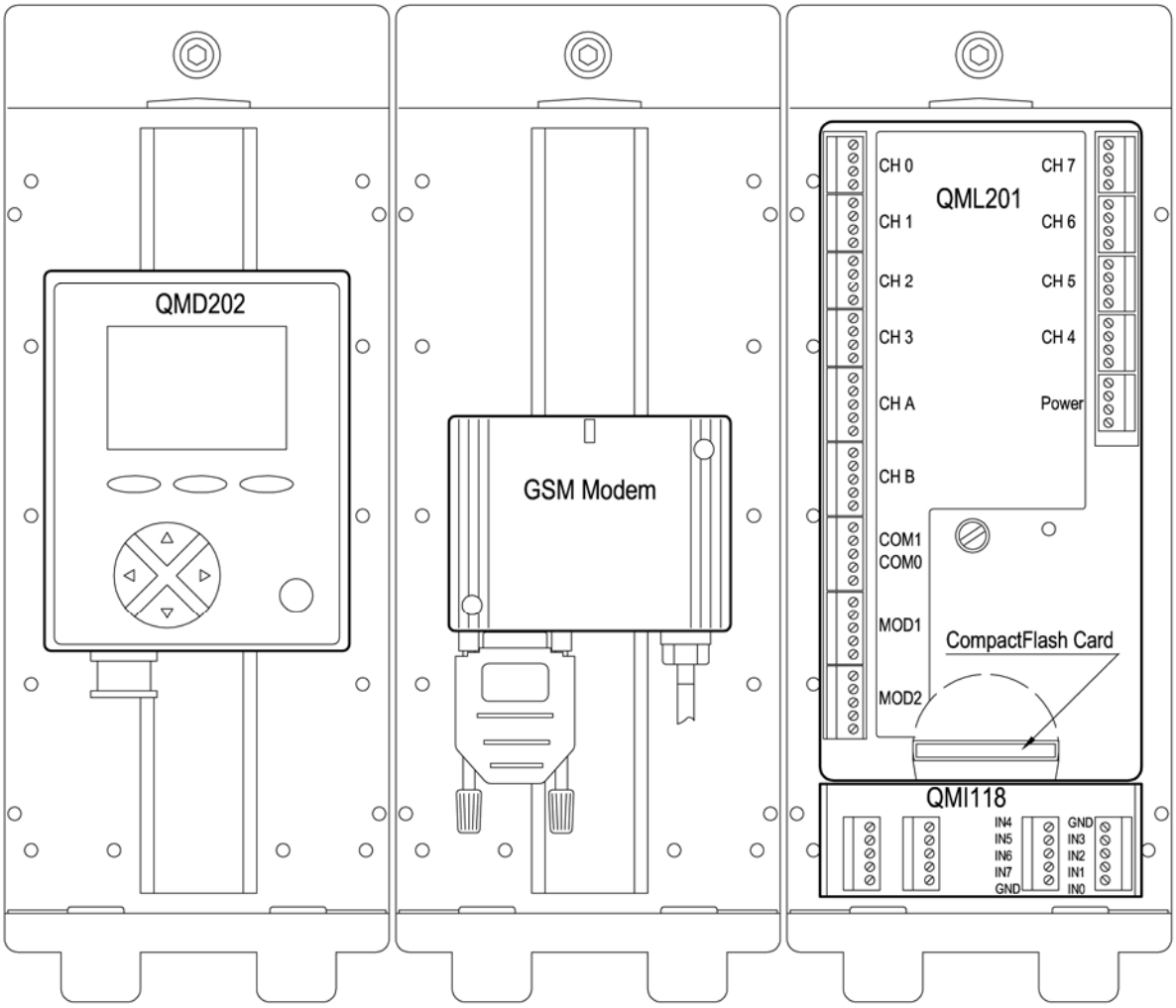
DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED


WMT703
Ultrasonic Wind Sensor
with Heating
MAINTENANCE LINE
WAA151
Anemometer
WAV151
Wind Vane
WAC151RST-60
Wind Cross Arm
MAINS POWER
115 / 230 VAC
DTR503A
Radiation Shield
HMP155
Temperature &
Humidity Probe
SOLAR33-75
Solar Power Supply
Data WMT70
Power WMT70
Cable 227565
COM0
Cable 219688
WIND1 Cable DRW222446
WIND2 Cable DRW222447
MAINS INPUT Cable DRW228770Z2M
Air Pressure Inlet
TEMP/HUM Cable 215494(3 m), 220497(10 m)
SOLAR PANEL Cable 6 m included with Panel
Enclosure
LCD
Display
QMD202
Pressure
Sensor
BARO-1QML
VAISALA
Connector Panel
GROUNDING
Customer Cable
Connector M12/5p 19369 included
RAIN Cable REIM707651
SNOW DEPTH Cable included with Sensor
SOIL T2 Cable 10 m included with Sensor
SOIL T1 Cable 10 m included with Sensor
Antenna cable 10 m
included with Antenna
Customer Cable
Connector M12/5p 19369 included
SOL RAD Cable 10 m included with Sensor
Connector M12/5p 19369 added
LOCAL DATA OUTPUT
RG13H
Rain Gauge
with Heating
RGSTAND1140
Pedestal
IRU9400
Snow Depth Sensor
QMT110
Ground Temp.
Sensor 2
QMT110
Ground Temp.
Sensor 1
Pt-100
Pt-100
GSM
ANTENNA
ETHERNET LINE
CMP6
Pyranometer
VAISALA
Block Diagram
AWS330 Sensor Cables
DRW235992
ISO 2768-m
FIRST ANGLE PROJECTION
DIMENSIONS ARE IN
MILLIMETERS, UNLESS
OTHERWISE SPECIFIED


Mains Input
1
COM 2
Data Out
2
COM 0
3
4
WIND
WMT70
Power
5
WIND
WMT70
Data
6
7
Snow Depth
12
13
Rain
11
Soil T1
19
20
Wind 1
9
10
GSM
Antenna
17
18
Soil T2
16
Temp. / Hum.
15
Wind 2
8
Static
Pressure
Head
14
Ethernet
23
24
25
26
Sol. Rad.
22
Solar Panel
21
VAISALA
Layout Drawing
AWS330 Connector Flange
DRW235993
Sheet 1 of 1
ISO 2768-m
FIRST ANGLE PROJECTION
DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED



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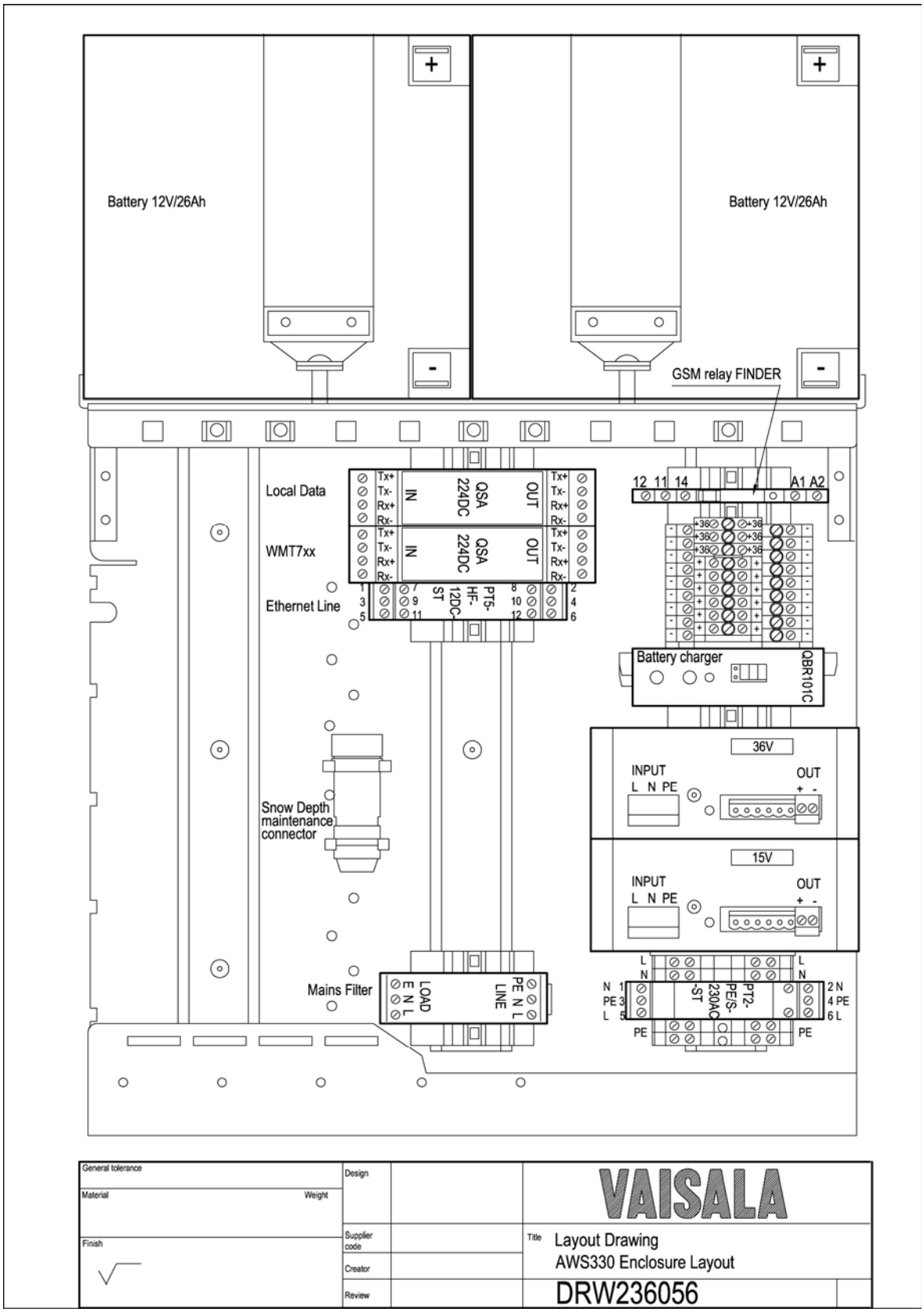
Finish	DOCUMENT CREATION DATA YYYY-MM-DD INITIALS		
	Creator		
	Review	Size	Code: DRW236056 / Rev
FIRST ANGLE PROJECTION DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED	Approved		
	Archive ID	Scale	


Battery 12V/26Ah
Battery 12V/26Ah
GSM relay FINDER
Local Data
WMT7xx
Ethernet Line
Snow Depth maintenance connector
Mains Filter
Battery charger
QBR101C
36V
15V
INPUT
OUT
L N PE
+ -
LOAD
LINE
PE N L
E N L
PT2-PE/S-230AC-ST
PT5-HF-12DC-ST
QSA 224DC
IN
OUT
Tx+
Tx-
Rx+
Rx-
12 11 14
A1 A2
+36
General tolerance
Material
Weight
Finish
Design
Supplier code
Creator
Review
Title
Layout Drawing
AWS330 Enclosure Layout
DRW236056
VAISALA

APPENDIX B

CALCULATION FORMULAS

This chapter contains information on the WMO-compliant calculation formulas used in the measurements.

Dewpoint Temperature

The dewpoint component calculates the temperature, where dew is beginning to form from moist air. This calculation is based on air temperature and relative humidity.

Dewpoint temperature (t_d) is calculated with the following WMO (Annex 4.B) formulas:

$$t_d = \frac{243.12 \cdot \ln\left(\frac{e'}{6.112 \cdot f(p)}\right)}{17.62 - \ln\left(\frac{e'}{6.112 \cdot f(p)}\right)}$$

and

$$U = 100 \cdot \frac{e'_w(p, t_d)}{e'_w(p, t)}$$

which give:

$$t_d = \frac{243.12 \cdot \ln\left[\left(U \cdot \exp\left[\left(17.62 \cdot t\right)/\left(243.12 + t\right)\right]\right)/100\right]}{17.62 - \ln\left[\left(U \cdot \exp\left[\left(17.62 \cdot t\right)/\left(243.12 + t\right)\right]\right)/100\right]}$$

Table 110 Inputs for Dewpoint Calculation

Input	Variable
Air temperature (t)	TAAVG1M; see Table 4 on page 22
Relative humidity (U)	RHAVG1M; see Table 4 on page 22

Heat Index

The heat index measures how hot it feels when the effect of humidity is added to high temperature. This calculation uses two source values, temperature and humidity, and produces one result value, the heat index. The calculation formula is as follows:

$$
\begin{aligned}
HI = {} & 16.923 + \\
& 0.185212 * TA + \\
& 5.379410 * RH - \\
& 0.100254 * TA*RH + \\
& 9.41695*10^{-3} * TA^2 + \\
& 7.28898*10^{-3} * RH^2 + \\
& 3.45372*10^{-4} * TA^2*RH - \\
& 8.14971*10^{-4} * TA*RH^2 + \\
& 1.02102*10^{-5} * TA^2*RH^2 - \\
& 3.86460*10^{-5} * TA^3 + \\
& 2.91583*10^{-5} * RH^3 + \\
& 1.42721*10^{-6} * TA^3*RH + \\
& 1.97483*10^{-7} * TA*RH^3 - \\
& 2.18429*10^{-8} * TA^3*RH^2 + \\
& 8.43296*10^{-10} * TA^2*RH^3 - \\
& 4.81975*10^{-11} * TA^3*RH^3
\end{aligned}
$$

where

RH = Relative humidity [%]
TA = Air temperature [F°]
HI = Heat index [F°]

Table 111 Inputs for Heat Index Calculation

Input	Variable
Air temperature (TA)	TAAVG1M; see Table 4 on page 22 [1]
Relative humidity (RH)	RHAVG1M; see Table 4 on page 22

1) Converted internally to degrees Fahrenheit.

Wind Chill (NWS 2001)

Wind chill, which is an estimate of the heat loss from an open surface, is calculated according to the formula updated by NWS in 2001:

$$W_{ch} = 13.13 + 0.62 \cdot T_A - 13.95 \cdot WS^{0.16} + 0.486 \cdot T_A \cdot WS^{0.16}$$

where

W_{Ch} = Wind chill [°C]
T_A = Air temperature [°C]
WS = Wind speed [m/s]

Table 112 Inputs for Wind Chill Calculation

Input	Variable
Air temperature (TA)	TAAVG1M; see Table 4 on page 22
Wind speed (WS)	WSAVG2M; see Table 6 on page 24

Wet Bulb Temperature

Wet bulb temperature is calculated iteratively as follows:

First the initial estimate of wet bulb temperature is calculated with the formula:

$$T_{wet} = 243.12 \cdot \frac{\log\left(\frac{P_{ws}(T_d)}{6.112}\right)}{17.62 - \log\left(\frac{P_{ws}(T_d)}{6.112}\right)}$$

Then the wet bulb temperature is iteratively re-calculated as long as $ABS(P_{hit}-P_{ws}(T_d))>0.01$ with the formula:

$$T_{wet} = T_{wet} - \frac{P_{hit} - P_{ws}(T_d)}{2 \cdot P_{der}}$$

where P_{hit} and P_{der} are calculated depending on the value of T_{wet}:

$T_{wet} > 0$:

$$P_{hit} = P_{ws}(T_{wet}) - 0.000662 \cdot P_A \cdot (T_A - T_{wet})$$

$$P_{der} = (P_{ws}(T_{wet} + 0.1) - 0.000662 \cdot T_A \cdot (T_A - (T_{wet} + 0.1)) - P_{hit}) \cdot 10.0$$

$T_{wet} \leq 0$:

$$P_{hit} = P_{wi}(T_{wet}) - 0.000583 \cdot P_A \cdot (T_A - T_{wet})$$

$$P_{der} = (P_{wi}(T_{wet} + 0.1) - 0.000583 \cdot T_A \cdot (T_A - (T_{wet} + 0.1)) - P_{hit}) \cdot 10.0$$

where

T_{wet}	=	Wet bulb temperature [°C]
T_d	=	Dewpoint temperature [°C]
T_A	=	Ambient air temperature [°C]
P_A	=	Ambient air pressure [hPa]
$P_{ws}(t)$	=	Aqueous vapor pressure of water at temperature t [hPa]
$P_{wi}(t)$	=	Aqueous vapor pressure of ice at temperature t [hPa]

$P_{ws}(t)$ is calculated with the formula:

$$P_{ws}(t) = \exp\left(\frac{b\_1}{v} + b0 + b1 \cdot v + b2 \cdot v^2 + b3 \cdot v^3 + b4 \cdot \log(v)\right) \cdot 0.01$$

where

b_1	=	-5800.2206
b0	=	1.3914993
b1	=	-0.048640239
b2	=	0.000041764768
b3	=	-0.000000014452093
b4	=	6.5459673

$$v = t - c0 - c1 \cdot t - c2 \cdot t^2 - c3 \cdot t^3$$

where

t	=	Temperature [K]
c0	=	0.4931358
c1	=	-0.0046094296
c2	=	0.000013746454
c3	=	-0.000000012743214

$P_{wi}(t)$ is calculated with the formula:

$$P_{wi}(t) = \exp\left(\frac{a0}{t} + a1 + a2 \cdot t + a3t^2 + a4 \cdot t^3 + a5 \cdot t^4 + a6 \cdot \log(t)\right) \cdot 0.01$$

where

a0 = -5674.5359
a1 = 6.3925247
a2 = -9.677843E - 03
a3 = 0.00000062215701
a4 = 2.0747825E - 09
a5 = -9.484024E - 13
a6 = 4.1635019
t = Temperature [K]

Table 113 Inputs for Wet Bulb Temperature Calculation

Input	Variable
Air temperature (T_A)	TAAVG1M, see Table 4 on page 22
Dewpoint temperature (T_d)	DPAVG1M, see Table 4 on page 22
Atmospheric pressure (P_A)	QFEAVG1M, see Table 5 on page 23

QFE/QFF Pressure

The reduced air pressure QFE (pressure at a certain level) or QFF (pressure at sea level) are calculated as follows:

$$QF = P_A \cdot e^{\frac{L}{T_1}}$$

where

T_1 = $7996 + 0.0086 * L + 29.33 * T_A$
L = Reduction level in meters
T_A = Air temperature [°C]
P_A = Atmospheric pressure [hPa]
QF = Reduced pressure (QFE or QFF) [hPa]

Table 114 Inputs for QFE/QFF Pressure Calculation

Input	Variable
Air temperature (T_A)	TAAVG1M; see Table 4 on page 22
Atmospheric pressure (P_A) OFE	PAAVG1M; see Table 5 on page 23
Atmospheric pressure (P_A) QFF	QFEAVG1M; see Table 5 on page 23
Reduction level (L) QFE	Station parameter 'pslevel'
Reduction level (L) QFF	Station parameter 'altitude'

QNH Pressure

QNH, the pressure reduced to mean sea level according to ICAO standard atmosphere, is calculated as follows:

$$QNH = QFE \cdot e^{\frac{T_1}{288.2+0.00325 \cdot ALT}}$$

where

T_1 = $0.03416 \cdot ALT \cdot [1 - 0.19025 \cdot (\ln (QFE) - 6.92087)]$
ALT = Station altitude [m]
QFE = Station level air pressure [hPa]
QNH = Sea level pressure [hPa]
ln( ) = Natural logarithm function

Table 115 Inputs for QNH Pressure Calculation

Input	Variable
Atmospheric pressure (QFE)	PAAVG1M; see Table 5 on page 23
Reduction level (ALT)	Station parameter 'pslevel'

Wind Calculation Formulas

Wind Speed Average

Instant wind speed average is calculated using the following formula (3 s calculation):

$$WSA = (\sum_{i=1}^{n} WS_i) / n$$

where

WSA = Wind speed average
Ws_i = Wind speed instant value
N = Number of wind speed instant values

When the source is a calculated data table, the following formula is used (2 and 10 minute calculations):

$$WSA = (\sum_{i=1}^{n} WSAT_i) / n \quad (16)$$

where

WSA = Wind speed average
$WSAT_i$ = Wind speed average stored to data table
n = Number of wind speed average values

Scalar Wind Direction Average Method

Wind direction average calculation using the Scalar method is based on the assumption that the source direction value does not differ more than 180° from the previous average value. The previous average value is marked as 0° and the source values are scaled with respect to that point so that the result varies between -180° and 180°. For example, if the previous average value was 10°, a source value of 355° would be converted to -15°. This method is also used when the wind direction maximum and minimum values are determined.

$WD_S = WD - WDA_{prev}$ (instant table) (17)

$WD_S = WDAT - WDA_{prev}$ (calculated table)

$$WDA_s = (\sum_{i=1}^{n} WD_{si}) / n \quad (18)$$

$$WDA = WDA_S + WDA_{prev} \quad (19)$$

where

WD	=	Wind direction instant value
WDAT	=	Wind direction average stored to data table
WD_S	=	Wind direction instant value scaled with respect to the previous average value
WDA_{prev}	=	Previous wind direction average value, if defined; otherwise the first source value
WDA_S	=	Wind direction average value scaled with respect to the previous average value
WDA	=	Wind direction average
n	=	Number of wind direction source values

Table 116 Inputs for Wind Calculation

Input	Sensor
Wind speed Ws_i	See Table 3 on page 21
Wind direction WD	See Table 3 on page 21

Sunshine Duration

Sunshine duration calculation reports whether the sun is shining or not. The sun is considered to be shining, if global radiation (G) is more than 120 W/m2. Also, the ratio G/G0, where G0 is the calculated extraterrestrial global radiation (on top of the atmosphere), must be over 0.4. Calculation of G0 requires stations position (longitude and latitude), current (= local) time, and day number (0-365).

The global radiation G is measured with a pyranometer (CM6B is recommended), using an analog measuring channel. Time and day number are composed using the QML logger internal time functions. Of course, user must set local time and time zone correctly to ensure proper operation.

Before G0 can be calculated, the zenith angle of the sun, at station location, must be less than 85 degrees. The G/G0 limit, zenith angle limit, and radiation limit are configurable.

The sunshine duration component returns Boolean-type data '1' if the sun is shining and '0' if it is not. This data is supposed to be logged by the QML logger or external system to retrieve a history of sunshine duration.

Calculation of Extraterrestrial Global Radiation G0

$$G_0 = 1367 \cdot (1.000110 + 0.034221 \cdot \cos\frac{2\pi \cdot DN}{365} + 0.000719 \cdot \cos\frac{4\pi \cdot DN}{365} + 0.000077 \cdot \sin\frac{4\pi \cdot DN}{365}) \cdot \cos(e)$$

where

DN	=	Day number (1-366)
e	=	Zenith angle (-90.0 - 90.0 degrees)
G_0	=	Extraterrestrial global radiation (0 - 1422 W/m2)

Calculation of Zenith Angle e

$$e = \arccos(\sin(Lat) \cdot \sin\delta + \cos(Lat) \cdot \cos\delta \cdot \cos\omega$$

where

Lon = Station's longitude
Lat = Station's latitude

$$\delta = (0.006918 - 0.399912 \cdot \cos A + 0.070257 \cdot \sin A - 0.006758 \cdot \cos(2A) + 0.000908 \cdot \sin(2A)) \cdot \frac{180}{\pi}$$

$$\omega = (TST - 12.0) \cdot 15$$

$$A = 360 \cdot \frac{DN - 1}{365}$$

$$TST = LMT + \frac{EQ}{60}$$

$$LMT = GMT + Lon \cdot \frac{4}{60}$$

$$GMT = CT - TS$$

$$EQ = 0.0172 + 0.4281 \cdot \cos A - 7.3515 \cdot \sin A - 3.3495 \cdot \cos(2A) - 9.3619 \cdot \sin(2A)$$

where

δ = Declination (-24.0 - 24.0 degrees)
ω = Hour Angle (-180.0 - 180.0 degrees)
TST = True Solar Time (in decimals)
LMT = Local Mean Time (in decimals)
GMT = Greenwich Mean Time (in decimals)
CT = Civil Time (in decimals)
TS = Time Shift

Table 117 Inputs for Sunshine Duration Calculation

Input	Variable
Global radiation (G)	GIRRAVG1M, see Table 9 on page 25
Latitude (Lat)	Station parameter 'Latitude'; see section Location Parameters on page 113
Longitude (Lon)	Station parameter 'Longitude'; see section Location Parameters on page 113

Evapotranspiration

Evapotranspiration is calculated using the Penman-Monteith equation. The evapotranspiration calculation estimates the loss of water from a vegetative surface trough the combined process of plant transpiration and soil evaporation. It is calculated with the following formula:

$$Eto = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T + 273} U_2 (e_a - e_d)}{\Delta + \gamma(1 + 0.34U_2)}$$

where

Eto	=	Reference crop evapotranspiration [mm/d]
R_n	=	Net radiation at crop surface [MJ/m^2/d]
G	=	Soil heat flux [MJ/m^2/d]
T	=	Average air temperature [°C]
U_2	=	Wind speed measured at 2m height [m/s]
(e_a-e_d)	=	Vapor pressure deficit [kPa]
Δ	=	Slope of vapor pressure curve [kPa(°C)]
γ	=	Psychometric constant [kPa(°C)]

Slope of the Vapor Pressure Curve (Δ)

$$\Delta = \frac{4098 e_a}{(T + 237.3)^2}$$

Net Radiation (Rn)

This is the average radiation from sensor. Net is calculated using surface albedo.

The radiation value [W/m^2] from measurements is converted to [MJ/m^2/d] by the calculation.

Soil Heat Flux (G)

$$G = c_s d_s \left(\frac{T_n - T_{n-1}}{\Delta t} \right)$$

where

T_n	=	Temperature on day n [°C]
T_{n-1}	=	Temperature on preceding day n-1 [°C]
Δt	=	Time period [days]
c_s	=	Volumetric heat capacity [MJ m^{-3} °C^{-1}] (2.1 for average moist soil is used)
d_s	=	Estimated effective soil depth [m] (0.2 m is used)

Psychometric Constant (γ)

$$\gamma = \frac{C_p P}{\varepsilon \lambda} \cdot 10^{-3} = 0.00163 \frac{P}{\lambda}$$

where

γ	=	Psychometric constant [kPa °C^{-1}]
C_p	=	Specific heat of moist air = 1.013 kJ kg^{-1} °C^{-1}
P	=	Atmospheric pressure [kPa]
ε	=	Ratio molecular weight water vapor/dry air = 0.622
λ	=	Latent heat of vaporization [ML kg^{-1}]

λ is given by the following formula:

$$\lambda = 2.501 - (2.361 \cdot 10^{-3}) T$$

Average Air Temperature (T)

Where hourly data is available:

$$T = \sum_{i=0}^{24} \frac{T_i}{24}$$

Wind Speed (U_2)

Estimate wind speed at 2 m height when measured at height z.

$$U_2 = U_z\left[\frac{4{,}87}{\ln((67.8z) - 5.42)}\right]$$

where

Uz = Wind speed measured at height z [ms^{-1}]
z = Height of wind speed measurement [m]

Vapor Pressure Deficit (e_a-e_d)

$$VPD = (e_a - e_d) = \left[\left(\frac{e_a(T_{\max}) + e_a(T_{\min})}{2}\right) - e_d\right]$$

where

e_a = Saturation vapor pressure [kPa]
e_d = Actual vapor pressure [kPa]

$$e_a(T_{\max}) = 0.611\exp\left(\frac{17.27T_{\max}}{T_{\max} + 237.3}\right)$$

$$e_a(T_{\min}) = 0.611\exp\left(\frac{17.27T_{\min}}{T_{\min} + 237.3}\right)$$

$$e_d = \left(\frac{1}{2}e_a(T_{\min})\frac{RH_{\max}}{100}\right) + \left(\frac{1}{2}e_a(T_{\max})\frac{RH_{\min}}{100}\right)$$

where

T_{max} = Maximum daily temperature [°C]
T_{min} = Minimum daily temperature [°C]
$e_a(T_{max})$ = Saturation vapor pressure at T_{max}
$e_a(T_{min})$ = Saturation vapor pressure at T_{min}
$e_d(T_{max})$ = Actual vapor pressure at T_{max}
$e_d(T_{min})$ = Actual vapor pressure at T_{min}
RH_{max} = Maximum daily relative humidity [%]
RH_{min} = Minimum daily relative humidity [%]

Table 118 Inputs for Evapotranspiration Calculation

Input	Variable(s)
Net radiation R_n	GIRRAVG1D; see Table 9 on page 25 Station parameter 'evap_albedo'; see Table 22 on page 117
Temperature values T, T_n, T_{n-1}, T_{max}, T_{min}	Daily statistical values derived from TAAVG1M; see Table 4 on page 22
Relative humidity values RH_{max}, RH_{min}	Daily statistical values derived from RHAVG1M; see Table 4 on page 22
Wind speed Uz	Daily average of WSAVG2M; see Table 6 on page 24. Wind speed reduction height z is 10 meters.
Atmospheric pressure P	QFEAVG1D; see Table 5 on page 23. Converted internally to kPa.

APPENDIX C

EXAMPLE MESSAGES

This chapter contains example AWS330 messages.

CSV Message

Note: The actual message does not contain linefeeds.

(S:AWS330;D:101129;T:061200;TAAVG1M:0.3;TAAVG1H:0.1;
TAAVG1D:-0.3;TAMIN1D:-0.6;TAMAX1D:2.3;RHAVG1M:67;
RHAVG1H:56;DPAVG1H:-7.4;DPAVG1M:-5.2;TBAVG1M:1.1;
TBAVG1H:-2.2;HIAVG1M:0.3;WCHAVG1M:2.0;
QFEAVG1M:1018.3;QFEAVG1H:1017.4;QFEMIN1H:1014.4;
QFEMAX1H:1020.1;QFEAVG1D:1020.1;QFEMIN1D:1020.1;
QFEMAX1D:1020.2;QFFAVG1M:1020.3;QFFAVG1H:1020.4;
QFFMIN1H:1020.4;QFFMAX1H:1020.1;QFFMIN1D:1020.1;
QFFAVG1D:1020.1;QFFMAX1D:1020.2;QNHAVG1M:1018.3;
QNHAVG1H:1018.4;QNHMIN1H:1018.4;QNHMAX1H:1018.1;
QNHAVG1D:1017.3;QNHMIN1D:1017.1;QNHMAX1D:1018.3;
PTREND3H:1.8;PTEND3H:0;VPAVG1H:3.4;WS:0.9;WD:60;
WDAVG2M:74;WDMIN2M:60;WDMAX2M:80;WSAVG2M:1.8;
WSMIN2M:0.1;WSMAX2M:4.1;WDAVG10M:63;WDMIN10M:45;
WDMAX10M:80;WSAVG10M:2.0;WSMIN10M:0.0;WSMAX10M:4.2;
WDWSMAX10M:53;PRSUM1M:0.0;PRSUM10M:0.0;
PRSUM30M:0.0; PRSUM1H:0.0;PRSUM3H:0.0;PRSUM6H:0.0;
PRSUM12H:0.0;PRSUM1D:0.0;PRFSUM1H:0.0;SNAVG1H:1274.8;
TS1AVG10M:-1.3;TS1AVG1H:-2.6;TS1MIN1H:-5.1;TS1MAX1H:0.0;
TS1AVG1D:-2.6;TS1MIN1D:-5.0;TS1MAX1D:-0.1;TS2AVG10M:-3.6;
TS2AVG1H:-4.5;TS2MIN1H:-4.5; TS2MAX1H:-2.8;TS2AVG1D:-4.5;
TS2MIN1D:-6.3;TS2MAX1D:2.7;GIRRAVG1M:700;
GIRRAVG1H:525;GIRRAVG1D:525;SDUR1D:244;EVAP1D:1.5;
UPTIME:18200;STATUS:0;EXTDC:10.7)

Table Message

Station name: AWS330
Date: 2010.11.26 10:29:13

MAWS:
Internal temperature: 17.7
DC supply voltage: 13.5

Sensors:

	Instant	Average	Status
Temperature:	0.3	0.3	0
Air pressure:	1000.0	1000.0	0
Relative humidity:	64	64	0
Wind direction:	68	77	0
Wind speed:	3.8	3.4	0
Precipitation:	0.0	0	0
Snow depth:	1275	12.5	0
Solar radiation:	630	630	0
Soil temperature1:	-0.7	-0.2	0
Soil temperature2:	-3.1	-2.7	0

SMS Message

Note: The actual message does not contain linefeeds.

(S:AWS330;D101207;T:150400;TA:-22.2;RH:20; DP:-30.5;PA:1002.7;
PR:0.8;WD:230;WS:2.5;SR:777;TS1:-10.2;TS2:-11.6;SH:120)

Alarm Messages

(S:AWS330;D:101129;T:090800;ALARM:Internal temperature;TINT:66)

(S:AWS330;D:101129;T:090800;ALARM:Temperature;TAAVG1M:-3.0)

(S:AWS330;D:101129;T:090700;ALARM:Supply voltage low;EXTDC:9.5)

(S:AWS330;D:101129;T:091500;ALARM:Windspeed;WSMAX10M:30.0)

(S:AWS330;D:101129;T:100100;ALARM:Precipitation;PRSUM1H:0.0)

Table Message with Alarm List

```
Station name:          AWS330
Date:                  101129 101209

MAWS:
Internal temperature:    66.0
DC supply voltage:        9.5

Sensors:
                       Instant    Average    Status
Temperature:            //////     //////        23
Air pressure:           1000.0     1000.0         0
Relative humidity:          61         61         0
Wind direction:             47      /////         0
Wind speed:               27.0     //////         0
Precipitation:             0.0          0         0
Snow depth:               1277     -127.7         0
Solar radiation:             0          0         0
Soil temperature1:        -1.5       -1.8         0
Soil temperature2:        -3.7       -3.9         0

Temperature sensor failure
```

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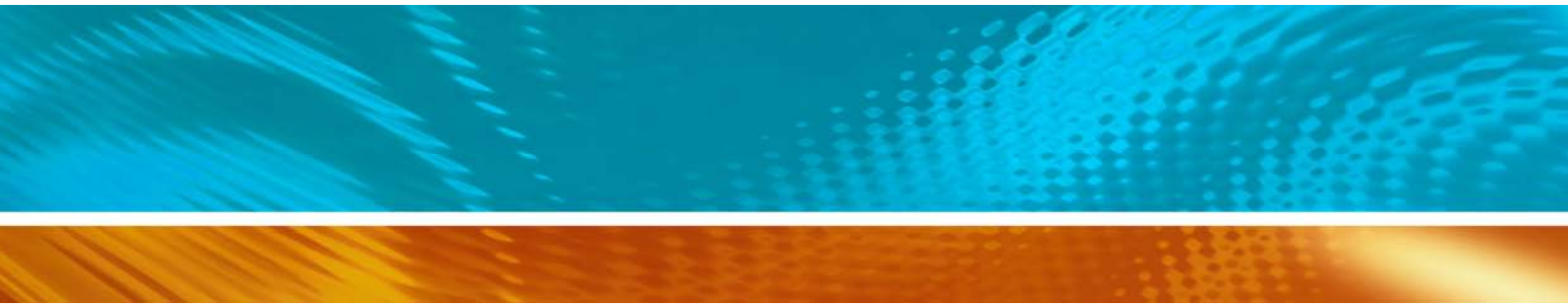
APPENDIX D
SENSOR STATUS VALUES

This chapter contains sensor status values.

Table 119 Sensor Status List

Value	Description	Notes
0	Sensor is working properly (OK).	
1	Not measured yet.	
2	Interface is not initialized.	[1]
3	Communication timeout has occurred.	[1]
4	Unknown data is received.	[1]
5	Communication is functioning, but the sensor reports errors. Use sensor's own service interface to find out the cause.	[1]
6	Sensor communication is paused because service connection is opened.	[1]
7	Message sequence numbers are overlapping in the Autotrac satellite transceiver interface.	[1]
8 ... 19	Not available.	
20	Excitation failure is caused by overload in the excitation output.	[1]
21	The input voltage is out of range or the A/D conversion has failed due to an internal error.	[2]
22	Sensor is disconnected or the connection cables are broken.	[2]
23	Sensor output exceeds the min/max limits defined in the **Measurements** view.	[2]
24	Change in sensor output has exceeded the maximum step defined in the **Measurements** view.	[2]
25	An internal configuration error has occurred.	[2]
26	Error in reference measurement, usually caused by damaged sensor/logger or electrical interference.	[2]
27	Internal voltage error occurred or the logger is damaged.	[2]
28	BARO-1 calibration data error.	[2]
29	Data is invalid for unspecified reason.	[2]
30	The measurement or the sensor has been manually disabled.	
99	Sensor status is not supported.	

[1] Value is available only for sensors with a serial interface.
2 Value is available only for sensors with a conventional, that is, analog or counter/frequency interface.



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