VAISALA

Vaisala HydroMet™ Systems

Optimized Solutions for All Your Applications

Field-Proven Reliability and Accuracy

Vaisala HydroMet™ Systems are compact, robust and easy to use systems which provide quality controlled data both in meteorological and hydrological applications. The systems are especially designed for unmanned operations at remote sites requiring high reliability and low power consumption. Vaisala HydroMet™ Systems MAWS100, MAWS110 and MAWS301 use field-proven and high accuracy data logger with advanced software. Each system is packaged to provide the most economical and optimized turnkey solution for your application.

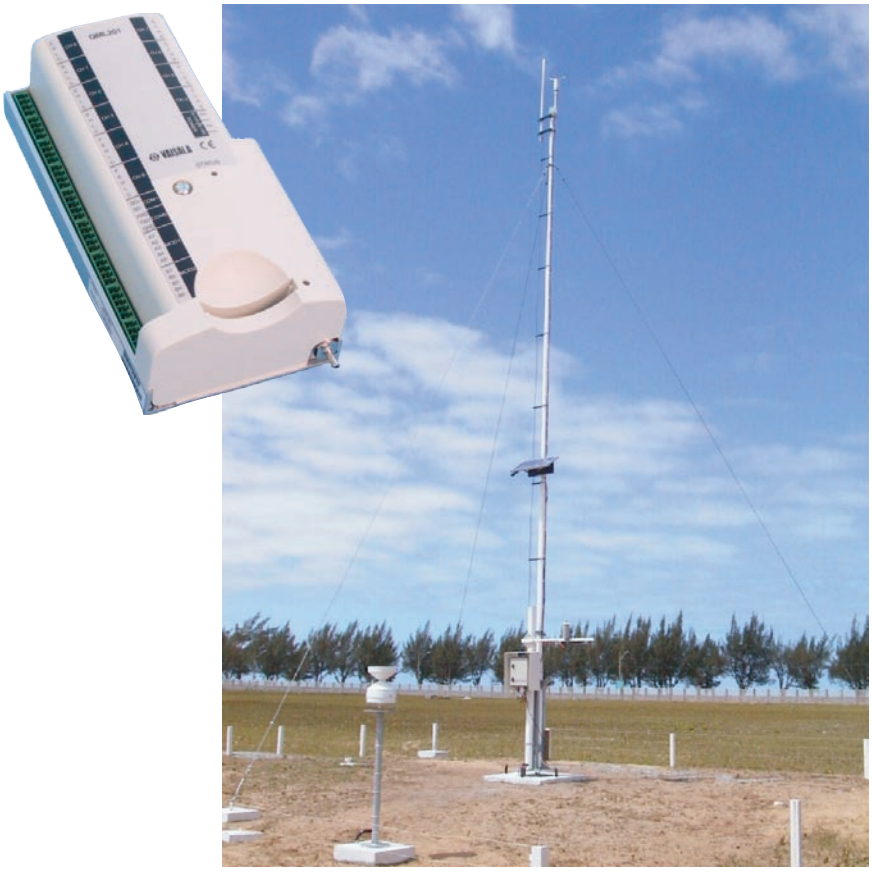
Ease of Use

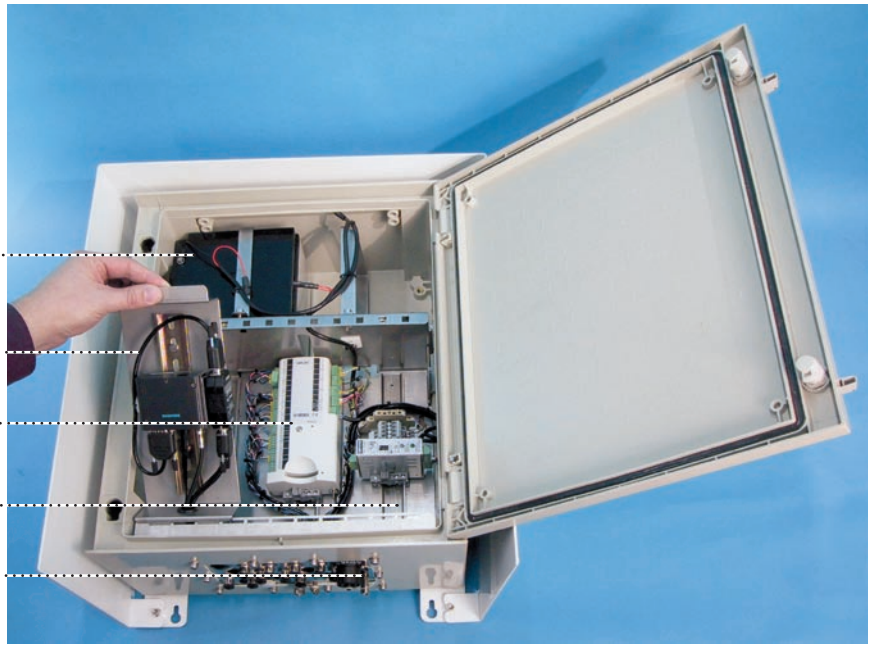
The Vaisala HydroMet™ Systems are easy to install and set up. Sensors are equipped with ready-made cables and connectors for quick installation. All modules are mounted on DIN– rails for easy maintenance. All components fit together and no special tools are needed. Sensor measurements, statistical calculations, data logging and data transmissions are performed according to a user-configured setup program. The setup can easily be developed with the help of the user-friendly Vaisala Setup Software Lizard. Not only is it easy and quick to use, but there are setup options and advanced features to satisfy even the most demanding users.

Enhanced Precision

The Vaisala HydroMet™ Systems combine Vaisala's own proven sensor technology with the compact data logger design based upon long-term expertise and in field experience. A 32-bit central processing unit (CPU), 16-bit A/D conversion (ADC), autocalibration of the ADC and measurement electronics coupled with advanced data quality control and validation software ensure the accuracy of your measured data. All data loggers are factory-calibrated to achieve high accuracy over extended operating temperature range.

- **Easy and economical to install, maintain and upgrade**
- **Field-proven reliability and accuracy in harsh environments**
- **Low power consumption**
- **Wide selection of sensors and telemetry options**
- **Extensive calculation and data logging capability**
- **Open and modular design allows high level of customization**
- **Low Total-Life-Cycle Cost**





MAWS301 - open and modular design allows high level of customization

Accurate measurements begin with accurate sensors and the system architecture is specially designed to support a broad range of sensors. A basic suite of sensors typically measures wind, pressure, temperature, relative humidity, and precipitation. In addition, measurements can be taken of including multi-depth soil temperature, soil moisture, evaporation and various types of solar radiation and others. The extended set of sensors also includes smart sensors such as cloud height ceilometer with the cloud coverage algorithm, visibility and present weather sensors. The supported sensor set also covers all hydrological parameters including water level and temperature, water flow and water quality. Generic and configurable 16–bit A/D conversions, generic frequency inputs as well as a serial ASCII string receiver support are included to allow you to integrate your own sensors.

Vaisala Present Weather Detector PWD22

Field-proven reliability

The Vaisala HydroMet™ Systems are rugged, compact and designed to be easily updated. Only the highest quality materials are used. The enclosures feature IP66 (NEMA4X) protection and printed boards have conformal coating. Cables are constructed of high-quality polyurethane, with molded connectors that are watertight to meet the IP68 standard. All the inputs have transient protection and all mains power and RF inputs are surge protected. The extended operating temperature range (-40° to +60° C) guarantee reliable operation under all weather conditions. The design of the systems ensures reliable operation combined with low maintenance costs.

Vaisala HydroMet™ Systems MAWS301 are currently being used in the NWS New England Pilot Coop Modernization Program. The NWS Coop Modernization Program will eventually be national in scope, and provide high quality data on a grid of approximately 20 x 20 miles. The benefits of this network are many, including: improved models for more accurate temperature forecasting, thus improving cost efficiencies in generating electricity; localized data points for monitoring severe storm activity and other natural weather hazards, providing local life-saving warning capability; improved climatological monitoring capability for better long-range forecasting. These benefits result in saving lives and reduction of operating costs for weather-related activities.

The MAWS301 qualified for the NWS program after extensive testing. Among its unequaled features, MAWS301 has high-reliability, extensive flexibility in accommodating various type sensors, telemetry, reporting formats and high speed/high accuracy data processing. Test configurations of the MAWS301 at the NWS sites have included up to 25 analog sensor readings, frequency inputs, both GOES and CDMA cellular telemetry, and provided full data reporting every five minutes. And the MAWS301 is capable of even more!

Vaisala HydroMet™ Systems MAWS301 were used in automating the whole hydrological network of the Swedish Hydrological and Meteorological Institute. Ninety MAWS301 systems were installed throughout Sweden. These systems measure water level using an absolute shaft encoder. In addition, the systems have inputs for weighing precipitation gauge, air and water temperature sensors, as well as other optional analog sensors. For telemetry, GSM cellular modems and PSTN modems are being used, some with spoken voice messages.

Photo courtesy of SMHI, Sweden.

Adaptable data outputs

The data output formats of the Vaisala HydroMet™ Systems can be freely and easily set up by the user to suit specific requirements and several ready-made templates are provided to ease the job. Logged data can be reported both in scan and channel ordered formats. Data transmissions can be self-timed, polled and/or based on user set alarms. Any measured and/or calculated parameter can have its alarms thresholds set by the user. Multiparameter alarms can be constructed using a flexible arithmetic module. In addition to sending messages, the alarm module can be set up to log data, set an excitation voltage or digital outputs to control external devices, or dynamically change timer intervals to control things such as reporting or measurement intervals. The ease of setting up multiple serial channels and telemetry options allows the same equipment to serve more than one purpose or application.

Extensive calculations

Standard statistical calculations include minimum, maximum, average, standard deviation and cumulative values calculated over user-defined intervals. All extreme values have time stamping options. In addition, an extensive library of calculations is available including unit conversions, dew point, frost point, QNH, QFF, QFE, evapotranspiration, sunshine duration, forest fire index, wind chill, heat stress and many others. Standard arithmetic operations are available to further extend user configurability.

Versatile data logging

Data logging is easy with Vaisala HydroMet™ Systems: 1.6 MB of secure flash memory is available for logging measured and calculated data, complete reports as well as to construct reports. Removable compact flash memory card provides an additional 200+ MB of memory further enhancing the logging capability. Data can be logged permanently or semipermanently for periods defined by the user. All logging parameters and schedules are user configurable for maximum flexibility.

Vaisala All Weather Precipitation Gauge VRG101

Power supply options

The systems have low power consumption. The basic MAWS100 system can be operated from a 6 Watt panel while typically only a 12 Watt solar panel is used for powering a MAWS110 or MAWS301. A 24 Watt solar panel as well as a mains (AC) power supply are optional to power extended systems with telemetry devices. Available back-up batteries range from the 5 Ah up to 52 Ah in the MAWS301.

Vaisala Absolute Shaft Encoder QSE104 requires no backup battery to retain its position data

Expand ability

The systems architecture enables systems to be easily upgraded with new sensors, calculations, output formats, and logging schedules at any time to accommodate the user's changing requirements. The MAWS110 and MAWS301 are expandable with the

QMU101 adds another 20 analog channels to your system

Vaisala Sensor Multiplexer QMU101 offering additional 10 differential analog channels. The Vaisala Digital I/O Unit QMI108 adds 8 digital outputs and 8 digital inputs for sensors, power optimizing and unmanned control functions based on user defined requirements. The large number of available sensor and telemetry options coupled with Vaisala's continuous and extensive research and development guarantees an upgrade path far into the future.

Advanced Telemetry

RS-232/RS-485/SDI-12: The basic system provides RS-233 and RS-485 ports for interfacing with almost any type of telemetry, terminal, displays as well as smart sensors. With optional plug-in modules the number of serial ports can be enhanced from 2 up to 8 ports, enabling multiple RS-232, RS-485 and SDI-12 connections. The systems can be effortlessly set up to take advantage of the latest telemetry technologies:

TCP/IP: The Vaisala HydroMet™ Systems can be connected directly to a LAN network using the DXE421 ComServer module. The module converts a standard RS-232 port to a 10/100Base-T Ethernet allowing easy data distribution via the Internet. The DXE421 is a compact module installed on the DIN -rail inside the enclosure.

PSTN modem and TCP/IP module are compact and easy to use devices

PSTN: Connection to Public Switched Telephone Network (PSTN) is an industrially hardened DXM421 modem, which has been designed for demanding environments and is rated for -40° to +60° C. The modem has low power consumption and includes both data compression and data correction functions. The maximum data transmission rate is up to 57.6 Kbits/second with built in line protection.

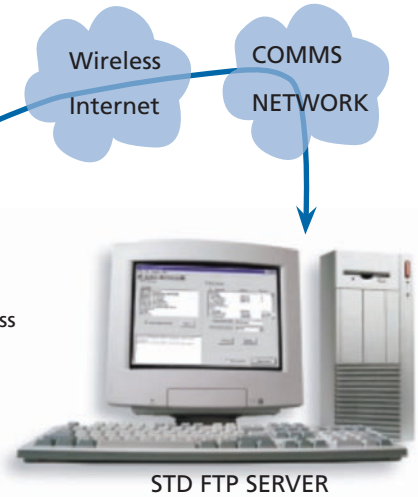
GSM/GPRS brings wireless TCP/IP to remotes sites

GSM/GPRS: The GSMTC35T-M3 is a dual band GSM terminal that is especially designed for demanding professional use. The data modem is small, has low power consumption and a wide operational temperature range. The GSM package comes complete with all the necessary RF- and data cables and installation accessories. A tri-band model is avail-able for cellular networks in the USA.

The GPRS (General Packet Radio Service) offers continuous and high-speed connectivity to the GSM network. In addition to standard GSM operation, this service offers more functions, which greatly facilitate data collection. Data transmission via GPRS can be initiated by the system using FTP (File Transfer Protocol) where the system acts as an FTP client placing files on the FTP Server's hard disk at user configurable intervals, when user set alarm conditions are detected by the system software, or when the daily log files are completed.

In practice, GPRS connectivity means the system is always on-line and data is available immediately at low operating cost.

MAWS HydroMet System:
FTP Client with fixed or dynamic IP address



FTP:
- reports, alarms, daily log file(s)

DATA CALL:
- maintenance, polling of missing data, control commands

CDMA: A rugged, intelligent wireless cellular CDMA data modem is used to enable real-time, two-way communications with remote systems. The CDMA unit provides a full embedded TCP/IP stack, which enables data transmission of serial data in the dynamic IP addressing environment of CDMA/1xRTT networks. The CDMA/1xRTT technology offers low cost and immediate access to the large amount of data from remote sites.

UHF radio modem: The Vaisala HydroMet™ Systems can also be equipped with UHF radio modems. These radio modems offer high-speed data transmission for up to 40 kms Line-Of-Sight with selectable error correction and in-built Message Routing. Message Routing is a versatile radio protocol, which takes care of routing messages across a radio modem network. Only one radio channel is required even in large networks. Any radio modem in the network can act as a repeater and have a station interfaced as well.

Spread Spectrum: The SS-RADIOMODEM-M3 spread spectrum transceiver has an operating frequency range of 2.45 to 2.48 GHz available without license in many countries worldwide. The radiomodem is a compact, rugged, low-cost transceiver transmitting at a power level of 50 mWatt. It uses 7 hopping frequency channels to avoid interference with other devices. These radio modems offer high-speed data transmission for up to 16 kms Line-Of-Sight (LOS) with high gain antenna.

Wireless Cable Replacement: The HANDYPORT-M3 is a 2.4GHz ISM wireless cable replacement for RS-232 port. Install one modem into the MAWS system and the other into your PC and you have a wireless and transparent replacement for your serial cable, with a range of up to 100m. The HANDYPORT-M3 kit includes two modems. These are supplied 'pre-paired' and there is no software to install on your PC.

The Vaisala HydroMet™ Systems MAWS110 are especially designed for unattended operations requiring high reliability and accuracy at sites with the mains power with the 7 Ah battery back-up. The MAWS110 offers space for an extended set of sensors and their heating power supplies, as well as telemetry devices, including satellite transmitters.

Satellite: Satellite telemetry offers access to most remote sites. The Vaisala HydroMet™ Systems support a wide variety of technologies:

- GOES High Data Rate, METEOSAT, INSAT and GMS transmitters for geostationary meteorological satellites

- Inmarsat-C, Iridium, Orbcomm and AutoTrac systems for commercial, 2-way communication, where data and commands are sent conveniently via e-mail. These systems give access to the data whenever needed.

Using the Vaisala HydroMet™ Systems' versatile telemetry technology together with the Vaisala MetMan Network Software, the mesoscale or national environmental monitoring networks can be easily and economically provided as a complete turnkey solution.

Vaisala HydroMet™ Station MAWS100 extends the field-proven quality and reliability of the existing Vaisala HydroMet™ Systems to new applications. The MAWS100 is a compact system for hydro meteorological monitoring when a small number of sensors is required. The MAWS100 is well suited for Vaisala Weather Transmitter WXT510 and cellular telemetry.

The MAWS100 uses the same reliable data logger and sophisticated software as other Vaisala HydroMet™ Systems. Flexible sensor interfacing, advanced statistical calculations, extensive data logging on a compact flash memory card and versatile data reporting functions allow the MAWS100 to be customized to variety of applications.

Data retrieval can be done by direct link to PCs utilizing a serial, TCP/IP connection, and a PSTN modem or using wireless cellular telemetry links. The Vaisala Real-time Display Software YourView is included for viewing real-time data when required.

Vaisala Weather Transmitter WXT510 – six weather parameters in one instrument

Sensors

The basic sensor suite measures wind speed & direction, pressure, temperature, relative humidity and precipitation. Optional sensors can be added to measure water level, soil/water temperature, global and net solar radiation and other parameters. The MAWS100 is well suited for Vaisala Weather Transmitter WXT510 offering a full set of sensors in one instrument, enabling you to easily set up your weather station with telemetry. The WXT510 measures wind speed and direction, liquid precipitation, barometric pressure, temperature and relative humidity — all in one instrument.

Power

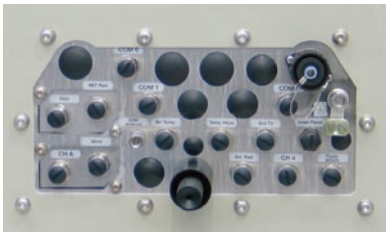
The MAWS100 is a low power device. The basic system is powered using mains power or a small 6 Watt/6 VDC solar panel and 1.3 Ah back-up battery. The 5 Ah battery and 12-Watt panel are available for the extended systems with telemetry.

Cost saving installation and maintenance

Vaisala HydroMet™ Systems include innovative solutions that significantly lower installation and maintenance costs.

Steel screw foundation

The steel screw foundation is an efficient, ready-to-use foundation for installing masts, stands, guy wire anchors and other installation hardware normally requiring laborious concrete foundations. The screw pole foundation penetrates the ground easily needing very little force and enables manual installation of screw piles even into frost-lifting soils using only an iron bar. The basic installation is vibration-free ensuring that sensors and devices, which are sensitive to vibration, like rain gauges can operate correctly. Using this technique a complete system can be installed within only a few hours.



Pre-wired connections

The Vaisala HydroMet™ Systems are complete with all wires connected and pre-tested at the factory prior to delivery. All sensors and telemetry devices are connected to the system using IP68 connectors allowing quick and trouble free installation even in adverse weather conditions. This solution offers significant advantages and cost savings when compared to the traditional wiring terminals

- Installation time at field is only a fraction of time spent wiring the sensors to wiring terminals, frequently under bad weather conditions.
- wiring is tested at the factory and there is no need for additional testing and re-wiring under difficult field conditions
- The quality of the wiring achieved in factory conditions is superior to that accomplished in the field.

This improves Mean-Time-Between-Failure rates for the systems.

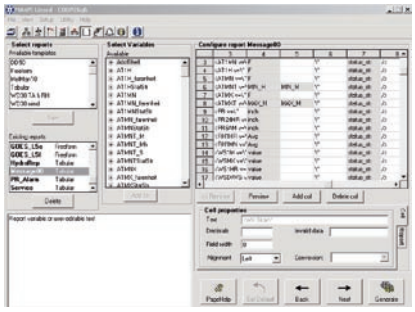
One-man tiltable mast

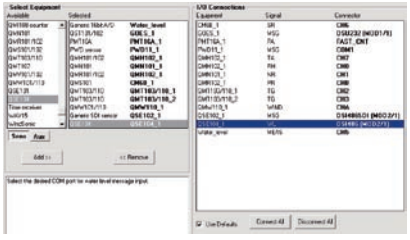
The Vaisala Series Tiltable Masts DKP200W support a wide range of hydrometeorological applications. The mast tubes are made of anodized aluminum and pained white. All remaining parts of the main assembly are made of stainless steel to resist weathering. One maintenance person can effortlessly and safely tilt the mast with the optional, easily detached winch in order to install and maintain the sensors and other equipment installed on the upper mast assembly. One man operation significantly reduces the costs associated with maintaining the automatic stations. The DKP200W Series includes mast with heights of 2, 3, 4, 6 and 10 meters

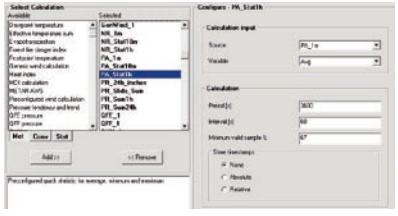
The Vaisala Setup Software Lizard

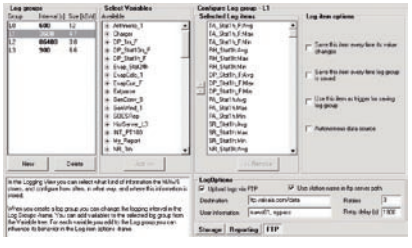
The Vaisala Setup Software Lizard provides intuitive set-up capability while also offering the ability to create highly configurable behavior. Instead of multi tiered commands, the setup software is based on a graphical user interface with icons, pull-down menus and dialog boxes. Most operations require only point and click operation and knowledge of any programming language is not required. Context sensitive Help function gives guidance during the configuration work.
Setups can be modified at any time to accommodate new sensors, telemetry or new data processing and reporting requirements. The setup software makes it easy to:

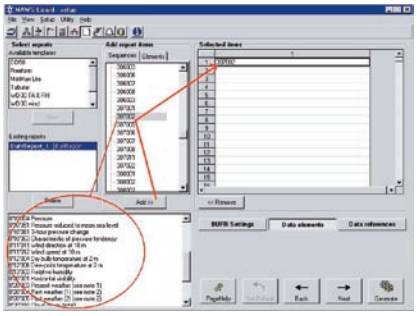
- Select the sensors and measurements sequences
- Set up the data quality control parameters
- Select calculations formulae from the extended library
- Set statistical calculations
- Create wind calculations with point-and-click access to over 20 derived parameters
- Create arithmetic operations with measured and/or calculated parameters
- Make unit conversions to view and report data in the units of your choice
- Define data formats for output, including XML and BUFR formats
- Set up multiple alarms when necessary
- Define the serial port parameters including handshake and check-sum methods
- Build communication events, including polling, self-timed transmissions or transmissions based on alarm conditions
- Organize multiple data logging schedules
- Define all timer parameters with 1 second to 24 hours intervals in 1 second increments.











Terminal software

The terminal software automates many routine operations such as:

- Manual or automated downloading of logged data files to a PC, also via telemetry and Internet
- Converting log files to comma separated value - formats, e.g. Microsoft® Excel and other standard software
- Uploading new station set-up files either locally or remotely via telemetry
- Setting station specific parameters locally or remotely
- Offline inquiries into the saved log files

Technical Information

Vaisala Data Logger QML201

Processor	32-bit Motorola
A/D conversion	16 bit
Data logging memory	1.6 MB flash memory
Optional:	32 to > 200 MB on compact flash memory card
Sensor inputs	
Analog	10 analog inputs (20 single-ended inputs)
Frequency	2 counter/frequency inputs
Internal channel for PMT16A pressure transducer	
Accuracy over operating temperature range	(-40 °C ... +60 °C)
Temperature (Pt-100) measurements	Range -50 °C ... +80 °C
Typical accuracy accross measured temperature	Better than ± 0.06 °C
Voltage measurement	
±2.5 V range	Better than 0.04 % reading ± 150 µV
±250 mV range	Better than 0.04 % reading ± 20 µV
±25 mV range	Better than 0.04 % reading ± 6 µV
±6.5 mV range	Better than 0.12 % reading ± 6 µV
Frequency measurements	0.003 % + resolution 241 nsec. (up to 4 kHz)
Common mode range	+5 V / -4 V
Real-time clock	Accuracy better than 20 sec/month
Serial communication	
Standard	RS-232 and RS-485
Optional	Two (2) optional plug-in slots for communication modules for increasing the number of serial I/O channels up to 8 pcs; RS-232, RS-485, SDI-12
Speed	300 ... 19,200 bps
Parameters	Configurable speed, start bits, data bits, stop bits, parity, XON/XOFF and check-sum
External powering	
Voltage	8 ... 14 VDC recommended (30 V max.)
Internal battery (optional)	1.3 Ah/6 V
Power consumption	< 5 mA/12 V, typically with 5 basic sensors
Solar panel/batteries	
Panel options	6 W/6 V (MAWS100) and 12, 24 , 50 W/12 V
Battery	Sealed lead acid, maintenance-free, 5, 7, 12, 26, 52 Ah
Mains power supply	85 ... 264 VAC, incl. surge arrestor

Environmental

Temperature	
Operating*)	-40 ... +60 °C
	*) for further extended range, please contact Vaisala.
Storage	–50 ... +70 °C
Humidity	0 ... 100 % RH
Emissions	CISPR 22 class B (EN55022)
Immunity	
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

For technical descriptions and specifications of the wide range of sensor and telemetry options for the Vaisala HydroMet Systems, please visit Vaisala web site www.vaisala.com

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