H1, H2 Hydro Logger

user manual version 1.10

Small telemetry station for water applications

FIEDLER
ELEKTRONIKA PRO EKOLOGII

1 Safety instructions

- The installation of the device with external power supply must be carried out by a person with the necessary qualifications for the installation of electrical equipment. The installer must carry out the installation in accordance with all instructions, regulations and standards relating to safety and electromagnetic compatibility.
- If the safety or health of persons or serious damage to property could be endangered as a result of a malfunction of the equipment, independent measures must be taken or equipment must be installed to eliminate this risk.
- All connected downstream equipment must comply with the relevant standards and safety regulations and be equipped with suitable anti-interference filters and surge protection.
- Do not use in explosion hazardous areas!
- Do not use in areas of excessive vibration**.**
- The manufacturer is not liable for damages resulting from improper installation, improper maintenance or use contrary to the recommendations in the operating instructions.

! **If used, the external power supply must meet all safety standards and be appropriate for the environment in which it will be operated.**

! **When installing a submersible level sensor, make sure that even at the maximum possible water level, the permissible measuring range of the sensor is not exceeded.**

2 Using Loggers H 1 , H2

The Hydro Logger H1 is primarily designed for data collection in the water industry. This requirement is met by a robust mechanical design with high IP67 protection, its own battery power supply rated for several years of operation, up to 4 pulse inputs for connecting OPTO and REED sensors from water meters, two current inputs for connecting pressure and level sensors, universal RS-485 serial interface for connecting probes and sensors under FINET or Modbus protocol.

Level Logger H2 is a variant suitable for the construction of local warning systems based on continuous monitoring of river, stream and reservoir levels as well as rainfall, where, unlike Hydro Logger H1, it allows the connection and calculation of rainfall using dynamically calibrated rain gauges.

The common features of both devices include their own data connectivity via a built-in GSM/GPRS module and software support on the server allows the Hydro Loggers H1 to form large-scale monitoring networks independent of external power supply.

TYPICAL EXAMPLES OF USE

- **Monitoring of smaller technological equipment (WWTP, DHW, ...)**
- **Basic element of a monitoring network for monitoring flows, pressures or levels via GSM/GPRS network**
- **Warning system alerting by sending an alarm SMS when limit values are exceeded.**
- **Replacement of missing or damaged cabling in CS-VDJ systems**
- **Remote reading of water meters.**
- **Measurement and data acquisition in the gas and energy sector**
- **Environmental monitoring**
- **Measurement of levels and flows in sewer networks**
- **Measurement of levels and flows in open river profiles**
- **Small weather stations with remote data transmission**
- **Universal measuring unit for scientific and research institutes**

3 Basic description

Both types of Loggers H1 and H2 are modern designed devices with very low current consumption. The applied manufacturing technology, careful selection of components with regard to a wide range of operating temperatures, high degree of protection of the electronic part of the device against condensing moisture and mechanical damage, guarantee high reliability of the device even in extreme operating conditions.

In the following, the description of the Hydro Logger H1 will also apply to the Level Logger H2.

Graphic display The display cyclically shows the measured values, the status of the power battery, the number of data sessions, etc. The display can also show, for example, the current GSM signal strength at the location of the GSM antenna when it is installed, humidity and temperature inside the device, selected statistical values, etc. In order to save the capacity of the power supply battery, the display and its backlight are switched off in normal mode and activated for a certain period of time by pressing a button.

Recording channels The logger allows you to set up to 8 recording channels K1-K8 for measuring selected physical quantities and 8 binary channels B1-B8 for recording states on binary inputs.

Control channels In addition to the recording and binary channels, the Logger also includes 7 K9-K15 control channels for recording the battery voltage magnitude, the remaining battery capacity expressed as a %, the current drawn by the connected sensors during measurement, and the temperature and humidity inside the instrument.

Data memory The capacity of the data memory is sufficient for several years of data recording in normal operation. When the memory is full, the oldest stored values are gradually overwritten. The data memory also records extraordinary events - receipt or sending of SMS, occurrence of an input error, data transfer to the server, etc.

Economical operating mode The logger operates in a power saving mode in which the instrument is hibernated most of the time and only wakes up and takes measurements at the set archiving interval. During the measurement period, power is supplied to the

connected sensors and transducers. The magnitude of the supply voltage is adjustable in the range of 6-17 V DC.

GSM communication

Logger - The telemetry station transmits the measured values via GSM/GPRS communication to a database on the server. In addition, the station can send warning or informative SMS and receive query or control SMS. Via GSM/GPRS data communication it is also possible to change parameter settings and perform FW upgrades.

Parameter settings

Setting of all H1 station parameters is done via MOST. Parameters can be changed from a PC (laptop) via cable connection or remotely via web browser and data server.

Battery power supply

For the power supply of the instrument is used 1 lithium battery size D, which allows many years of operation of the instrument even with daily transmission of measured data to the server via GSM/GPRS network. When the battery is depleted, indicated by the remaining capacity on the K13 control channel dropping to zero, the user can replace the battery himself.

External power supply

An external power source (battery or 12V DC power supply) can be connected to the instrument and the internal battery can only be used as a backup power source in case of external power failure.

3.1. Overview of program functions and procedures

The following overview briefly summarizes the program procedures and functions contained in the H1 station FW, which are fully available to the station users during its parameterization and setup. Most of these functions will be described in detail in the "Setup" chapter.

Calculations

- Calculation of instantaneous and cumulative flow from pulses from REED and OPTO sensors.
- Calculation and storage of the measured quantity in set units of measurement.
- Sliding sum over a configurable time interval over a selected channel (flow or rainfall) to activate an SMS alarm message.
- Calculation of instantaneous flow rate and leakage volume for commonly used gauge troughs and gauge overflows (Parshall or Venturi troughs, Thomson overflow, ...). In the H2 instrument, 14 equations for frequently used profiles are preset.
- Flow calculation for composite Parshall troughs (double and triple combinations).
- Calculation of the flow rate from the tabulated level/flow relationship.
- Calculation of rainfall and precipitation totals using pulse weighting, but also using a dynamically calibrated rain gauge table (H2 only)
- Sum and difference functions over two channels (sum and difference of measured quantities). Calculation of moving average and trend over any channel.
- The nonlinear output signals can be corrected by a 2nd order polynomial separately for each of the set channels.

Statistical calculations

- For channels recording flow or rainfall, both daily and monthly total flow is calculated.
- Motor hours with resolution to minutes for each binary channel.

Alarms

- Separate limit alarm for each recording channel.
- Separate gradient alarm for each recording channel.
- For the duration of an alarm on a channel, you can set a different frequency of data being written to memory than in normal operation and a different frequency of data being sent to the server.

Communication

- Data transmissions are performed under FINET or Modbus RTU protocols. Data packet transmissions via GSM/GPRS are performed under TCP/IP protocol.
- Regular sending of archived values via GPRS network to the Internet to the set IP address (to the server with installed MOSTNET-SERVER program).
- Phonebook for 10 recipients, up to 3 groups possible.
- Alert system based on 14 user configurable and 8 predefined SMS messages.
- Activation of sending SMS or transferring data to the server via GPRS network periodically in time or after reaching the limit value on the measuring channel, after activation of limit or gradient alarm, in case of sensor fault, low battery voltage, after activation of binary input or on request by query SMS.
- Configurable delay and hysteresis for limit SMS.
- 25 query and command codes to build a query or control SMS.
- Automatic insertion of the instantaneous value of the measuring channel into the SMS text.
- Program-controlled switching on of the modem for a specified time interval of hours to weeks.
- Set the time for sending daily SMS and the time and day for weekly SMS.
- Automatic switching between winter and summer time ensures regularity in sending SMS. Automatic archiving of the current parameter file on the server after each parameter change.

Operational diary

- The event log contained in the data memory records extraordinary events (switching on of selected inputs, power failure and power restoration, incoming and outgoing SMS, occurrence of an error signal at connected sensors, successful and unsuccessful data transfer to the server, etc.).

3.2. Mechanical design of the instrument

Metal box The electronic part of the Hydro Logger H1 is housed in a 160 mm x 90 mm x 60 mm metal casting, which consists of two parts. Between the two parts there is a silicone sealing profile. The screws that connect the two parts are located on the sides of the box under the plastic caps.

The lower part of the casting contains cable glands, a replaceable power battery inserted in a plastic holder and a PCB connection board with connection terminals and surge protectors.

The upper part of the box carries the main PCB of the device with graphic display, button and connectors for PC and GSM antenna connection. The configuration switch and SIM card holder are accessible from the bottom of the lid.

There is a flat cable between the two parts. This design allows the upper top part to be disconnected from the connection plate during installation, making it easier to connect the cables from the sensors to the terminal block.

The high IP67-rated metal box protects the electronic circuits from external interference as well as from adverse climatic conditions and is highly resistant to mechanical damage.

Cable glands As standard, the Hydro Logger H1 is equipped with 3 M12 cable glands for cables with a diameter of 3 to 6 mm and one M16 cable gland for cables with a diameter of 4 to 8 mm.

Mounting bracket The Hydro Logger H1 can be supplied with the DH1 mounting bracket, which is used for mounting the device on the wall. The bracket also includes 4 stainless steel screws and a set of dowels and screws.

3.3. Communication module

Using an internal communication module, the hydro Loggr H1 connects to a server on the Internet. The module is integrated into the device during the manufacturing and initial configuration of the device.

GSM/GPRS TECHNOLOGY

The communication module of the Hydro Logger H1 uses GSM/GPRS technology. It is a universally applicable technology with excellent local and global coverage, offering low operating costs and acceptable battery life even for devices not connected to an external power supply.

The communication module mediates all data transmissions between the station and the user. It is therefore usually not necessary to connect to the station from a PC (laptop).

Measured data stored in the station is automatically transferred via GPRS network to the database on the server at the specified time. Conversely, a parameter file is transferred from the server to the station if any changes to the station parameters are needed. The parameter file is transferred at the end of the data session and only if the user has changed at least one of the parameters and placed the new parameter file on the server. The MOST program is used to manage the parameter file.

The system of active stations and a passive server allows the GSM module to be permanently switched off and only switched on when the station requests to transfer measured data to the server or to send a warning SMS.

This concept allows the station to operate for many years without changing the power battery. In a practical test, it was tested that the H1 station is able to make up to 2,800 data sessions to the server (or send the same number of SMS alerts) without changing the battery.

The GSM/GPRS communication module enables two-way data communication including GPRS transmissions and sending or receiving SMS.

SIM CARD

The GSM/GPRS communication module can work with all types of prepaid and tariff SIM cards, including SIM deployment in roaming traffic, i.e. abroad.

Volume of transmitted data

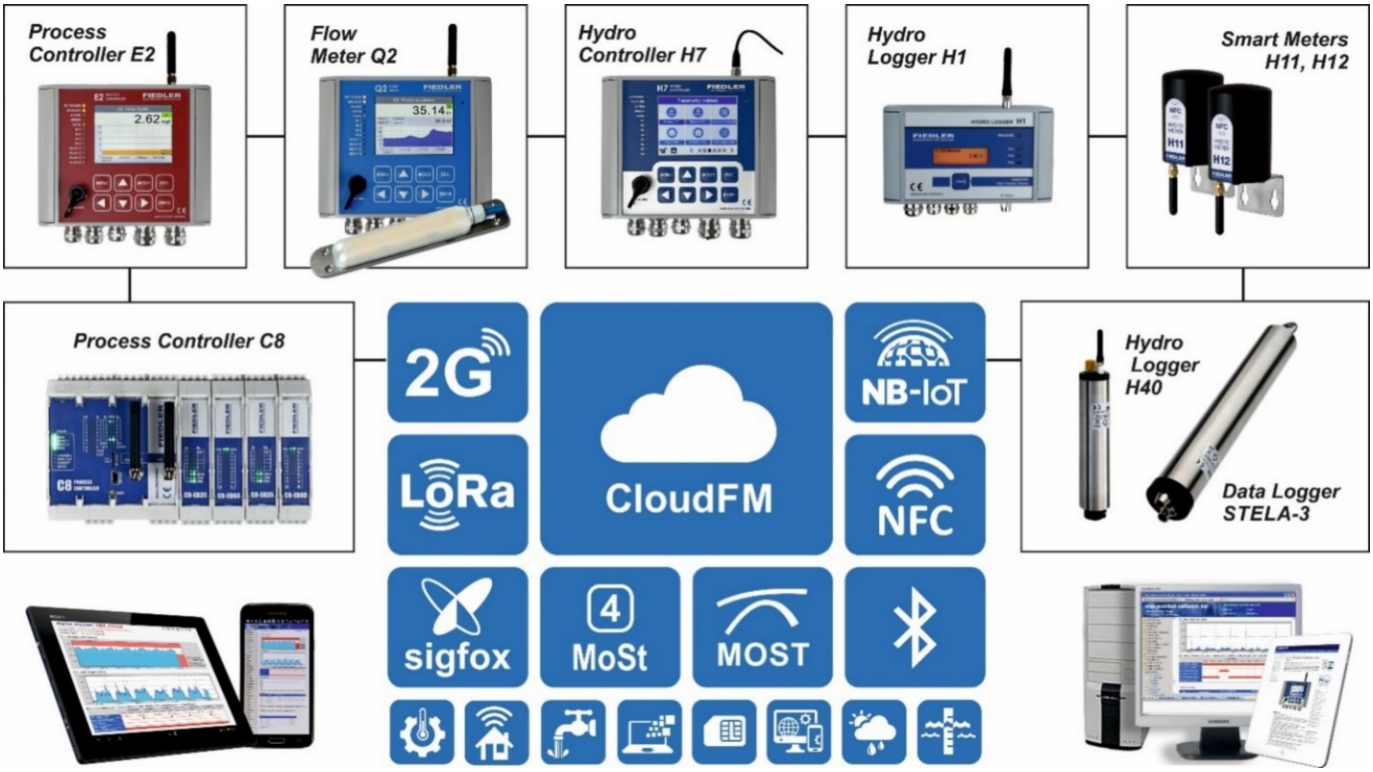
The amount of data transferred depends on the frequency of data sessions from the device to the server. Typical monthly data consumption is in units of MB.

Foreign SIM traffic

The device can be operated abroad using the local SIM card of the country in question. Then it is typically necessary to set up the unit according to the requirements of the local/domestic operator (APN parameters) or it is possible to use a SIM card of the Hydro Logger manufacturer with permanently allowed operation in another country, i.e. roaming. When operating the unit while roaming, higher operating costs for the SIM and application of the regulations of the country in question can be expected.

3.4. Architecture of automatic data collection via

The H1 telemetry station is equipped with a GSM/GPRS data module for automatic transfer of measured data from the device to the database on the server.



ACTIVE STATIONS SYSTEM

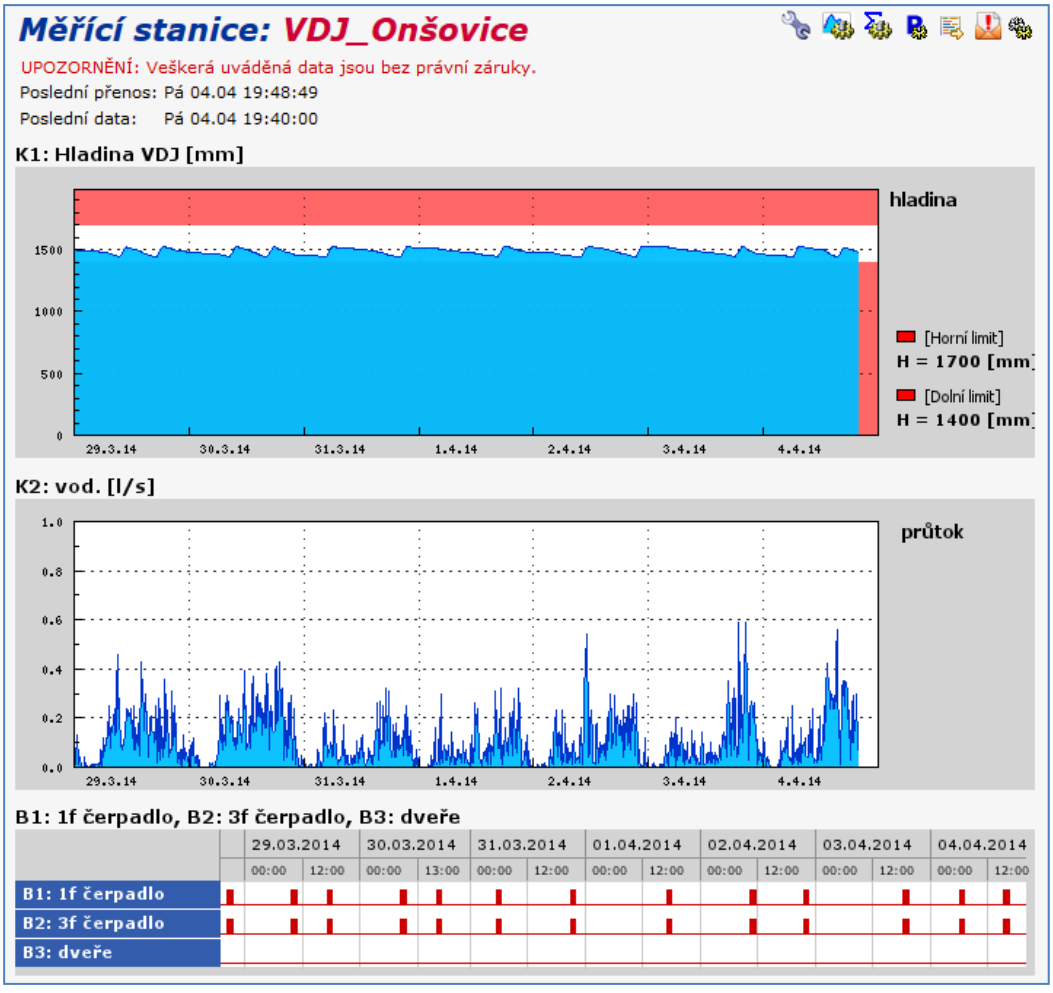
FIEDLER telemetry stations are characterized by long battery life and very low operating costs with regular data transmission to the server. This has been achieved by a system of active stations and a passive server:

- The server is always on and waiting for data from the individual telemetry stations, which themselves determine when the data will be transmitted to the server.
- The system can receive data from multiple stations simultaneously.
- The GSM/GPRS modem in the station is switched on only for the necessary time needed to transfer data from the station to the server - saving power of the power battery.
- If an extraordinary event occurs at the measurement location, the station can immediately transmit this information to the server - the usual delay of cyclical calling of stations by the server is eliminated.
- The system allows the use of operationally cheap types of tariff SIM cards without a fixed IP address in the stations. The fixed IP address is usually charged for and this increases the overall operating costs of the system.

DATA SERVER SERVICES

The data server is accessible via a standard web browser. After logging in, the user can use the services of the data server, which include:

- generation of graphs and tables of measured values
- exports measured values for the selected period to the user's PC
- automatic forwarding of received data from the station to another ftp server
- printing of graphs and monthly reports including statistical summaries
- creating virtual stations that can contain differently averaged, summed or otherwise adjusted data from different real stations in one graph
- automatic sending of e-mails to preset addresses after meeting the set conditions (exceeding or dropping of the measured value over the set limits, switching on/off of the binary channel, error conditions, ...).



SIM CARD RENTAL

The owner of the telemetry station can use any SIM card for data transmissions, which will be enabled for GPRS data transmissions and SMS messages. The data server operator also offers long-term loan of its own SIM cards together with the delivery of the station. These borrowed SIM cards have a low monthly fee and this includes 1 MB of free data/month. 1 MB of data is sufficient for the normal operation of the station in the vast majority of cases.

PARMATRIZATION OF THE STATION REMOTELY

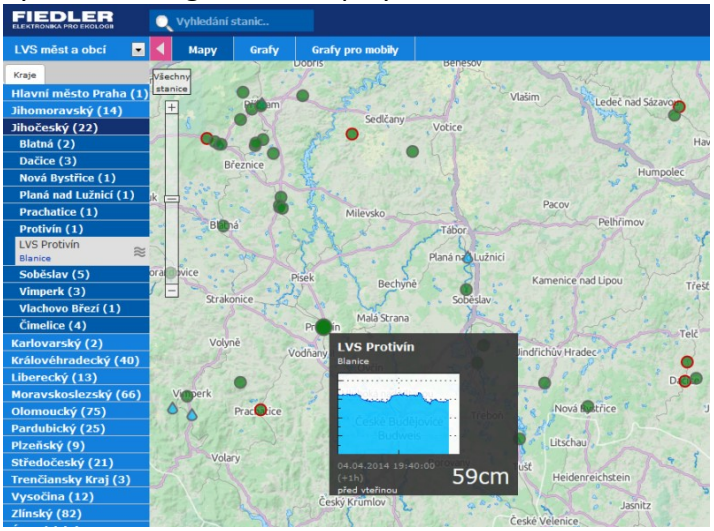
A special server service allows you to change the settings of the station parameters remotely over the Internet and GSM/GPRS network via the MOST program. All previous and current parameter files are stored in the server database, including the date and time of their change and the login name of the specific user who made the parameter change.

DATAHOSTING SUMMARY SERVICE

All of the above services are available to station users for a low annual fee, which is incomparable to the investment in the equipment of your own server and its regular maintenance. This makes the data collection system accessible to users of one or two telemetry stations as well as to operators of a large monitoring network.

MAP VISUALIZATION

In some applications, it may be advantageous to display the location of the station and its current status on a map base. The status can be both information about the station's trouble-free operation and the measured values of the selected channel.



An example is the freely accessible server www.hladiny.cz, which displays measured data from hundreds of stations installed on rivers and streams across the country.

Incorporation of the station into the system is performed by the server administrator at the request of its owner.

3.5. Communication with the device

Parameter setting and transmission of measured data can be done either remotely via the server and GSM/GPRS network as mentioned in the previous chapter, or locally via cable from a connected PC (laptop)

Cable connection

The local connection of the Hydro Logger H1 to a PC or laptop can be made using the KP232/M8 communication cable.

RS232 interface

On the PC side, the cable is connected via a nine pin connector to the RS232 port. If the PC or notebook is not equipped with an RS232 connector, it is necessary to add a USB/RS232 converter (a suitable type of converter can be ordered together with the communication cable from the device manufacturer).

On the side of the H1 unit, the M8 connector is located in the lower right corner of the unit for cable communication.

MOST programme

After connecting the HydroLogger H1 to a PC (notebook), the MOST program can be used to perform a complete setup of the instrument parameters, reading archived data from the instrument memory and saving them to a file, as well as visualizing the actual measured values from the connected sensors and transducers.

Restrictions on communication

A certain limitation for the communication between the PC and Hydro Logger H1 is the fact that this communication cannot be established while the GSM module is switched on in Hydro Logger H1. However, since the GSM module is rarely switched on when sending measured data to the server, this limitation does not play a significant role when setting parameters.

Communication cable KP232/M8

Connecting the pins of the M8 communication connector:

PIN	1	2	3
Signal	TxD	GND	RxD

USB/RS232 converter

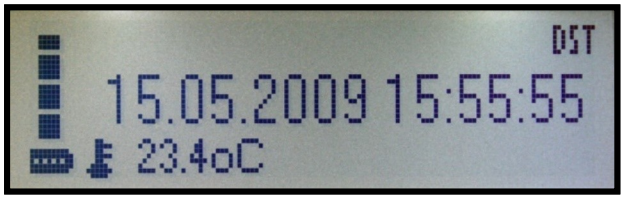
The USB/RS232 converter is used to convert signals between USB and RS232 interface for newer types of PCs and laptops without RS232 serial port

3.6. Power supply system

3.6.1. Battery power supply

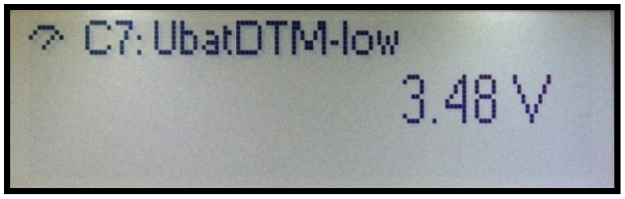
The HydroLogger H1 is supplied with an embedded 3.6V/13Ah lithium battery. Because the operating time of the device is extremely long when the parameters are set correctly, there is no need to change the battery for the first few years of operation.

Bargraph on display The remaining capacity of the power battery is displayed in the left part of the graphic display in the form of a bar graph for quick operator orientation. The bar graph is displayed at the beginning of the display cycle after the 1st press of the PRESS button.



At full battery capacity, 4 bargraph ticks are displayed above the battery mark. If this capacity drops below 25%, it is advisable to replace the battery.

Hybernation mode A further reduction of the capacity to 10% causes the instrument to enter hibernation mode, in which automatic GPRS transfers of measured data to the server and SMS sending are disabled and only the datalogger function with measurement and archiving of data from connected sensors and sensors remains active in the instrument. In hibernation mode, a low battery warning appears on the display every time the instrument wakes up by pressing a button.



Notification of transition to hibernation If the user has activated a warning SMS in the device parameters when the battery capacity drops, a warning SMS will also be sent to the same phone number notifying the user of the transition to the Hybernation mode. At the same time, this information is also stored in the database on the server with the last data transfer, so that the authorized client is also informed about the low battery capacity in the device (assuming that the data can be transmitted to the server when the battery voltage is low).

3.6.2. External power supply

The external power supply can be a mains power supply with an output voltage of 8 to 15 VDC or a solar panel supplemented with a rechargeable maintenance-free 12 V battery and a rechargeable RS13 charge controller. The H1 station has a very low idle power consumption from the external power supply and therefore two 12 V batteries can be used for external power supply and these can be changed and recharged regularly.

The external power supply of the H1 station is particularly suitable for use in cases where the sensor connected to the station has a high current consumption or where data transmissions to the server are to be made more frequently than once a day or in cases where warning or informative SMS are sent frequently.

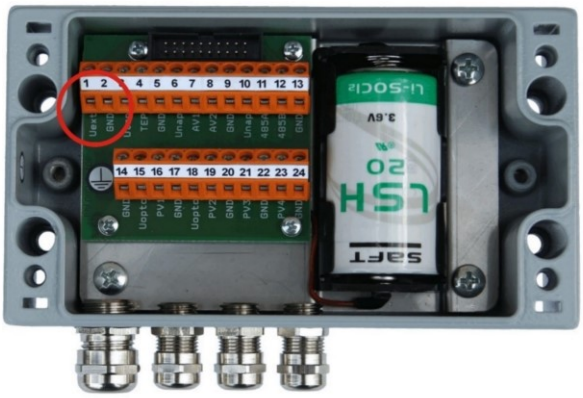
The internal lithium battery is automatically disconnected when external power is applied and serves only as a backup power source in case of external power failure.

3.6.3. Connecting H1 to an external power supply

The external power supply can consist of a mains power supply or a solar panel assembly, a maintenance-free battery of suitable voltage and capacity (usually 12V/9Ah) and an RS13 charge controller to prevent overcharging the battery. The battery should be supplemented by the power supply itself, which must then have a suitable output voltage (13.75 V DC).

Clamps for connecting external power supply

The external supply voltage is connected to terminals 1 (+Uext) and 2 (GND). The maximum size of the external power supply is 15 V DC. Higher voltages can cause damage to the protection circuits and to the Hydro Logger H1's own DC/DC converter. The external voltage magnitude is periodically measured and stored in control channel K9.

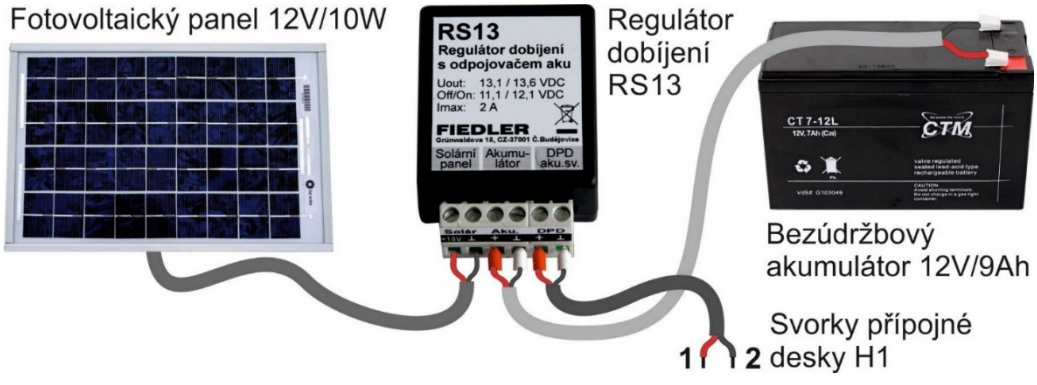


Low idle power consumption from an external source

The high efficiency of around 90% and the virtually zero self-consumption of the internal inverter do not burden the external power supply with a continuous consumption, but only when the Hydro Logger wakes up from sleep. Between measurements, the Hydro Logger H1 is put to sleep and only the inverter's quiescent current, which is on the order of tens of µA and less than the battery's self-discharge current, is drawn from the external power supply (usually a 12 V battery).

CONNECTING H1 TO THE SOLAR PANEL

The photovoltaic solar panel has an output voltage of up to 17 V. Therefore, it is connected to the battery via a limiting charging regulator RS13, which on the one hand switches off the charging of the battery after its full charge and on the other hand ensures disconnection of the battery from the load in case the battery voltage drops below 11 volts and thus prolongs the life of the used battery.



4 Installation

The installation of the Hydro Logger H1 and the entire telemetry system can be divided into:

- Mechanical placement of the instrument including sensor and transducer connections
- To insert an unblocked SIM card
- Finding the optimal GSM antenna location
- Setting instrument parameters

The detailed description and setting of individual parameters is covered in Chapter 5.

4.1. Mechanical placement of the device

If possible, then install the Hydro Logger in a location free of persistent condensing moisture. If this cannot be avoided, then use one of the protective enclosures described below for installation, or take extra care to tighten the cable glands with the cables passing through and to tighten the two parts of the metal enclosure that make up the housing of the H1. Before closing the enclosure, check that the silicone sealant profile of the lid is not dirty and, if necessary, lubricate it with silicone petroleum jelly to improve the sealing properties.

Temperature influences

The Hydro Logger H1 should not be installed in areas where the temperature consistently exceeds 30 °C, as this increases the self-discharge of the power battery and shortens its life. On the other hand, low temperatures below -10 °C reduce the capacity of the battery and this again results in a shorter overall operating time. The optimum location for the communicator in terms of battery life is ventilated underground spaces and similar cooler locations.

Protection from direct sunlight

The device should also not be installed in areas of direct sunlight, which can adversely affect the life of the device's front plastic label and also reduce the readability of the LCD display. Radiation can cause the front panel to become brittle over time, so when installing the instrument outdoors, it is advisable to cover it with a suitably sized shade cover or use one of the available cover enclosures.

4.1.1. Mounting bracket DH1

The Hydro Logger H1's simple stainless steel bracket has two mounting holes for quick attachment to the support structure. The bracket also includes a set of mounting screws and dowels.

The DH1 bracket is simply attached to the wall using two dowels and the supplied screws and then the bottom part of the Hydro Logger H1 is screwed to it using the 4 supplied M5x40 screws. Once the GSM antenna is connected, the mechanical installation is complete.

4.1.2. Protective enclosures for H1

The Hydro Logger H1 is supplied either separately with a simple DH1 stainless steel bracket for placing the device directly on a wall or other vertical structure, or it can be supplied built into one of the IP66-rated protective enclosures. These enclosures not only serve to protect the instrument in aggressive wet environments, but can also be used as a housing for an external 12V/9Ah power supply battery or as lockable protection for the instrument against mechanical damage and vandalism.

CABINET THALASSA-H1

Thalassa-H1 cabinet installed on SR03 rainfall gauge stand

The smallest and most affordable type of cabinet for housing the Hydro Logger H1. The cabinet is supplied with mounted stainless steel brackets with holes for clamps, with which it can be easily attached to a mast, rainfall gauge stand, etc. When ordering, please specify the required size of the stainless steel shackles supplied (1 1/4", 1 1/2", 2").

Thalassa-H1 cabinet with H1 unit installed

There is no space for inserting a 12V/9Ah backup battery in this type of protective enclosure.

THALASSA-H1 cabinet dimensions (h x w x d): 241 x 194 x 87 mm

ARIA-H1 CABINET

Universal plastic protective enclosure type ARIA32 with high IP66 protection is designed for fixed installation of H7 units.

To increase the mechanical strength, the polyester material of the enclosure is hot reinforced with glass fibre. The mechanical design of the cabinet is intended for outdoor and indoor areas where the stations can be fixed on a wall, pillar or on a special stand or mast. The substation is supplied in light grey (RAL 7035).

ARIA-H1 protective cabinet with H1 unit installed

When installing the cabinet outdoors, it is advisable to glue the supplied plastic canopy to the top edge of the cabinet on request.

Version -A/Z indicates a cabinet with a lockable handle and IP65 protection.

CABLE GLANDS

The plastic cable glands are located on the underside of the enclosure and are IP67 rated:

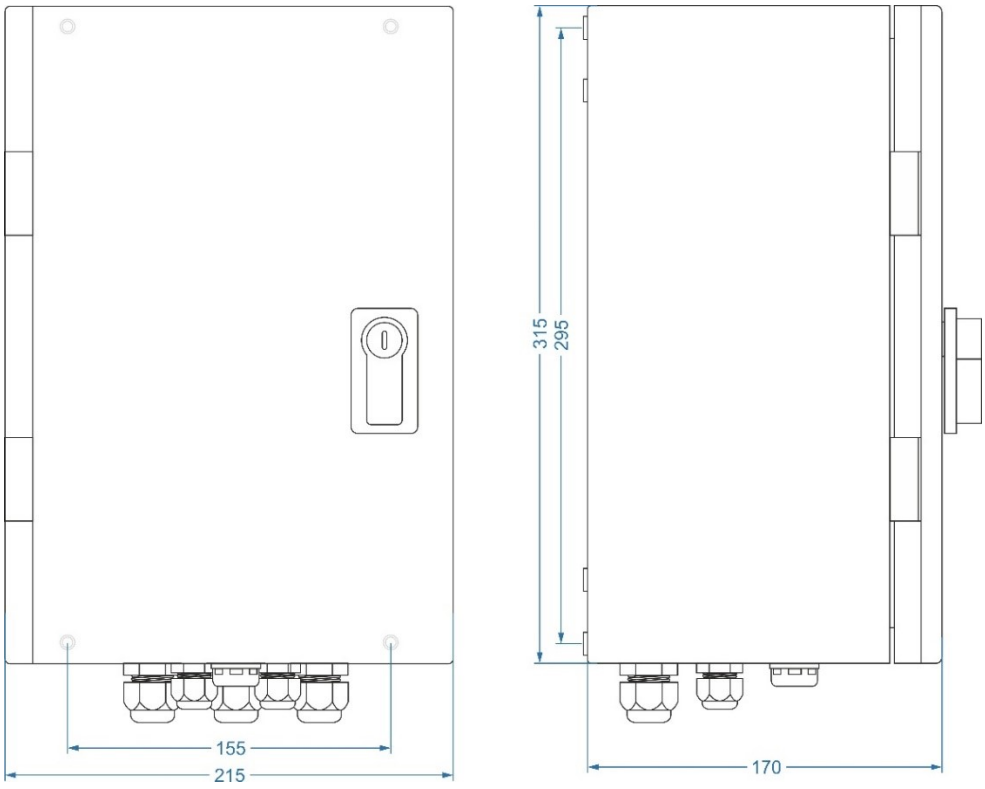
- 3x M20 gland (cable diameter 3 to 12 mm)
- 2x M16 gland (cable diameter 4 to 8 mm)
- 1x pressure compensator

On request, ARIA32 enclosures can be supplied with a different number of cable glands. The fitting of additional glands of the same type by the installer when installing the unit is also permitted.

ACCUMULATOR

A standard 12 V/7.2 Ah maintenance-free battery pack can be placed in the ARIA32 enclosure with the H7 unit as a backup power supply for applications recharged from a mains voltage source, or a 12 V/9 Ah battery pack for applications without external power supply or applications recharged by a solar panel.

DIMENSIONS OF THE ARIA-H1 CABINET



Dimensions of the ARIA32 enclosure (h x w x d): 315 x 215 x 170 mm, protection class: IP66

INSTALLATION METHODS

The ARIA32 cabinet is installed on a wall, pillar or other larger substation using 4 reinforced through holes in the corners of the cabinet. These are located outside the sealed area and are only accessible when the cabinet door is opened (anti-theft protection).

The mounting holes have a horizontal spacing of 155 mm and a vertical spacing of 295 mm and are blinded by the cabinet manufacturer (the holes must be "punctured" with a screwdriver or other sharp tool before installation).

INSTALLING THE CABINET ON THE COLUMN

The substation can be mounted on a pole or mast with a diameter greater than 40 mm using two stainless steel **DSS-2** brackets and 20 mm wide "Bandimex" strips.

The brackets can be ordered already mounted on the back of the ARIA32.

SCHNEIDER CABINET (-S, -S/Z)

Schneider's universal polyester enclosure is suitable for applications where a larger power battery needs to be placed in the enclosure along with the H7 unit.

The Schneider enclosure is designed for indoor and outdoor use (IP66 protection). The polyester is reinforced with fiberglass for added strength and durability.

The cabinet can be supplied either with handles (-S) or with two lockable closures (-S/Z). The closures are routed outside the sealed area and therefore do not affect the enclosure's degree of protection.

Space for a larger battery

A maintenance-free 12 V battery with a maximum capacity of up to 45 Ah can be installed in the Schneider enclosure together with the H7 unit.

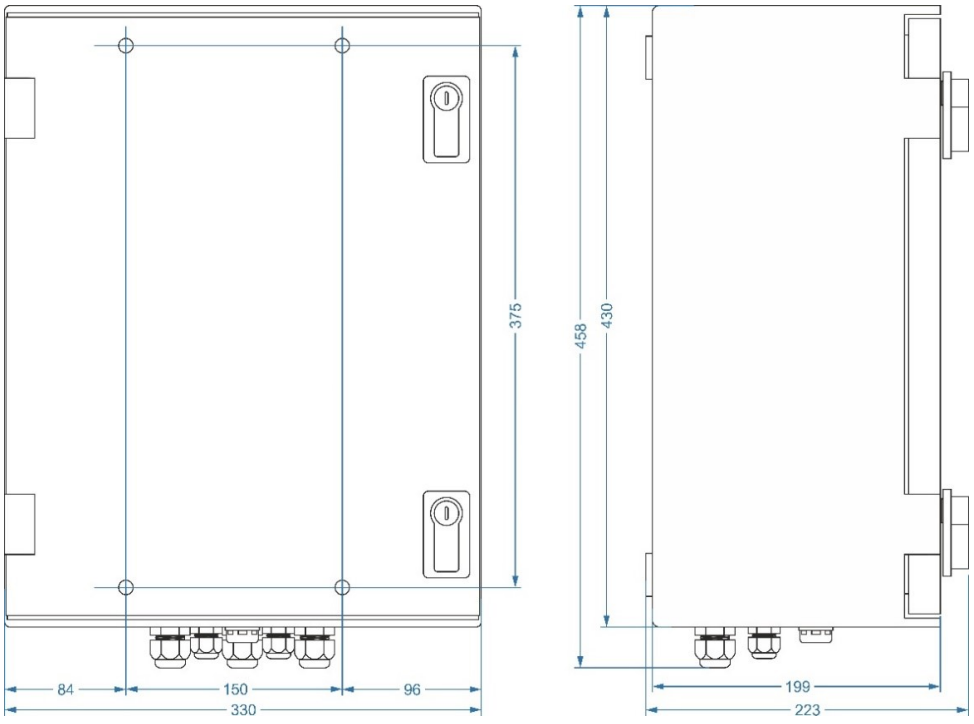
CABLE GLANDS

The plastic cable glands are located on the underside of the IP67-rated enclosure:

- 3x M20 gland (cable diameter 3 to 12 mm)
- 2x M16 gland (cable diameter 4 to 8 mm)
- 1x pressure compensator

Schneider enclosures can be supplied with a different number of cable glands on request. Additional glands of the same type are also permitted.

Cabinet dimensions and marked mounting openings



Schneider enclosure dimensions (h x w x d): 430 x 330 x 200 mm, protection class: IP66

STAINLESS STEEL CABINET (-N, -N/Z)

The robust stainless steel cabinet is particularly suitable for outdoor environments. Unlike plastic enclosures, the stainless steel material does not show signs of ageing even after years of exposure to weather conditions.

The enclosure is IP66 rated and comes with 2 locks as standard.

The stainless steel cabinet is installed on a pole or mast with a diameter of up to 60 mm by means of clamps and two guides placed outside the cabinet in its vertical axis.

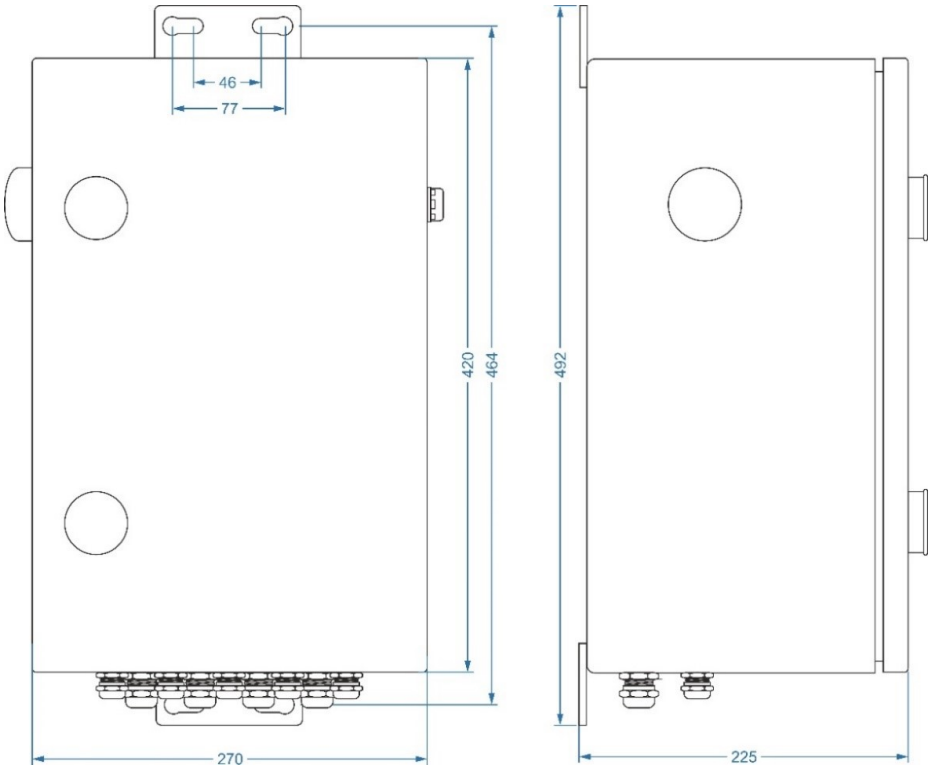
External GSM antenna

On the side of the cabinet there is a GSM antenna with cable outlet and 2 dBi gain. In case of a weak signal it is possible to try swapping it with a pressure compensator, which is located on the opposite side of the cabinet.

CABLE GLANDS

The metal cable glands are located on the underside of the enclosure and are IP67 rated:

- 4x M20 gland (cable diameter 3 to 12 mm)
- 5x M16 gland (cable diameter 4 to 8 mm)
- 1x pressure compensator on the side of the cabinet



Dimensions of stainless steel enclosure (h x w x d): 420 x 270 x 220 mm, protection class: IP66

STANDS AND POLES FOR ARIA CABINET PLACEMENT

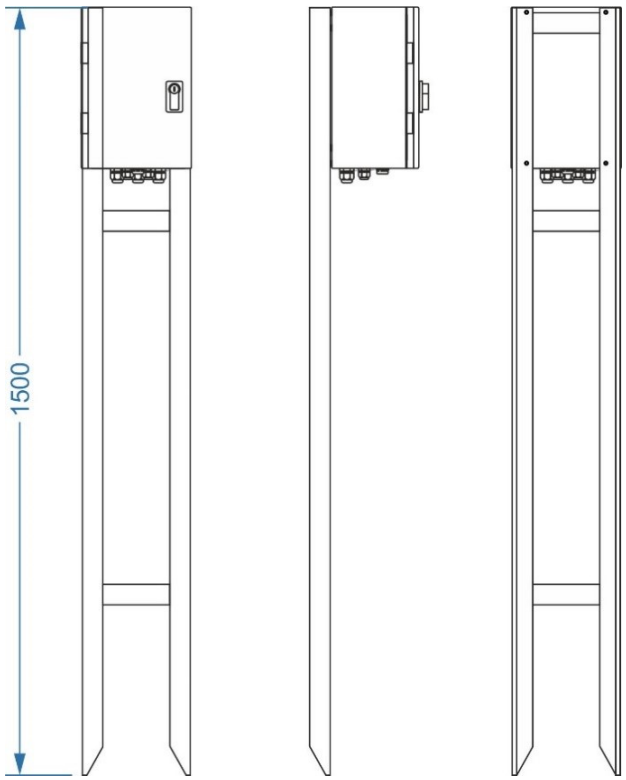
For installation of the ARIA-H1 in the field, a rack marked **ST2** or a mast type **STO-MET-02** can be used. These are sturdy weldments that are protected against weathering by hot-dip galvanizing.

STAND FOR SCHNEIDER CABINET PLACEMENT

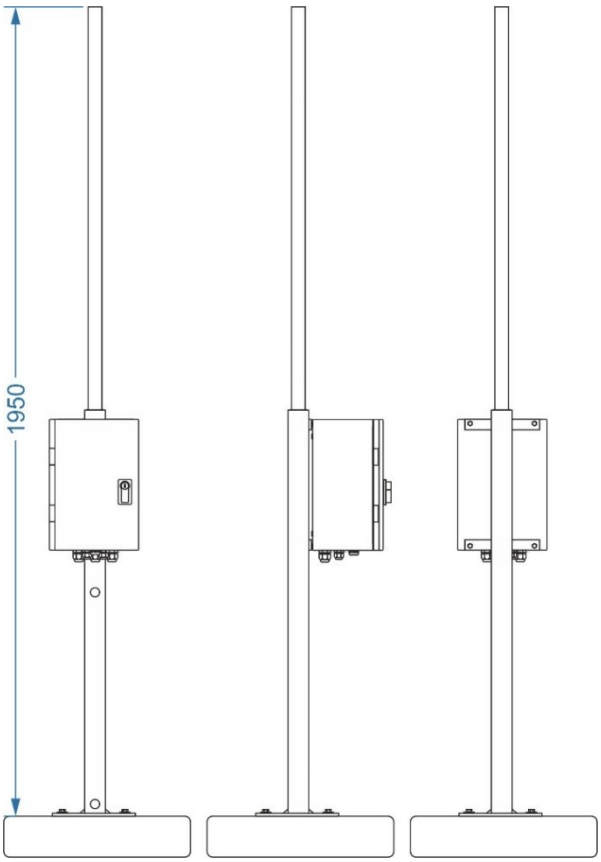
For the installation of the Schneider enclosure, either the hot-dip galvanized ST3 stand or the stainless steel DSS-2 brackets can be ordered for installation of the enclosure on a mast or pole using 20 mm wide "Bandimex" strips.

fixing the cabinet to the racks

The cabinet is attached to the ST2 or ST3 racks using the 4 supplied M5x30 screws. The mounting holes for the screws are accessible when the cabinet door is open, and because the screw heads are hidden in the cabinet, they make it impossible to disassemble the cabinet without forcing it open.



Stand ST2



Mast STO-MET-02

4.2. Insert your own SIM card

The SIM card must be activated by the operator before use in the level meter. Some operators activate the SIM with the sale, others only on a specific date they set or when it is inserted into the mobile phone.

As the SIM card is to transfer data, you must also activate this service with your operator (for example, by enabling MMS).

The long-term rental SIM cards supplied with the device are already activated and have data traffic enabled.

TO INSERT A SIM CARD

When inserting or replacing your own SIM card, please note the following:

Perform PIN unblocking (see above)

Before inserting the SIM card into the device, the SIM card must be unlocked to request a PIN code when the power is switched on (this can be done on the mobile phone - security function).

Long-term rental SIM cards supplied with the device have their PIN unlocked.

GSM module power off

When inserting and removing the SIM card, the power to the GSM module must always be switched off. In practice, it is sufficient to insert or remove the SIM card in the power saving mode of the device with the display switched off and avoid turning on the GSM module by pressing the control button for a long time (3 sec).

It is also advisable to know the time of the regular sending of data from the communicator to the server and to avoid this time period when handling the SIM card.

It is not recommended to switch off the modem power supply by removing the battery, as this may affect some previously set variables (real time, calculation of total leaked volume, ...).

To access the SIM card holder

The SIM card is inserted into a flip-out holder located on the communication module's circuit board. This is accessible by removing the top part of the device with the display. The top part is screwed to the bottom of the box with four M5 screws, which are accessible by removing the plastic covers located to the left and right of the display.

Tilt the SIM card holder. The SIM card holder contains a mechanical lock that can be locked. If the holder cannot be tipped out, slide the holder in the plane of the circuit board, there should be a slight shift to release the lock.

4.3. Antenna and its location

The device with built-in GSM/GPRS communication module includes an antenna. It is worth taking care to position the antenna well. With a better signal, the current consumption of the device is significantly reduced. The unit can communicate with lower transmit power, there is no connection dropout, no repeated connection attempts and the unit can enter power saving mode earlier.

Battery-powered units When the unit is battery operated, it is recommended to always install the best possible antenna to reduce energy consumption and extend the unit's operating time, even for situations where the signal is above the critical threshold.

Enclosed spaces When installing the station, it is important to take care of the appropriate location of the GSM antenna also from the point of view of its surroundings. Placing the equipment, including the antenna, in enclosed concrete spaces or all-metal cabinets rapidly reduces the characteristics and reception capabilities of the signal. In these cases, it is advisable to move the antenna out of the enclosure.

Minimum GSM field strength Reliable GPRS and SMS communication requires a GSM field strength at the antenna location of at least 25% of the optimum required strength measured by the unit during installation.

In case of lower signal strength, it may happen that some GPRS data sessions will not take place at the set time, but only on other days with better conditions for GSM signal propagation.

Antenna cable Antennas are typically supplied with an antenna coaxial cable of defined length. This cable can be extended if necessary. However, with each metre of cable there is signal attenuation, and it is recommended to use cables with low attenuation per metre for extension.

OVERVIEW OF GSM ANTENNAS

Depending on the type of mechanical design of the H1 unit's housing, the station is supplied with one of the following list of available GSM antennas with SMA-M connector:

AGSM-3dB-SMA	AGSM-9dB-SMA	AGSM-1dB-SMA	AGSM-3dB/P-SMA
			
attachment: magnet cable: 3m Suitable for wardrobe: **-A, -AZ, -AK,-S, -SZ**	attachment: magnet cable: 3.5m Suitable for wardrobe: **-S, -SZ**	attachment: - Cable. Suitable for panel mounting: **-P**	Mounting: M12 cable: 3m Suitable for wardrobe: **-N, -NZ**

Standard rod antenna AGSM-3dB-SMA

The basic and most common type of antenna supplied is AGSM-3dB-SMA. It is a dual-band rod antenna with a magnetic mount and a 3 m long cable terminated with an SMA-M connector. This antenna is usually placed inside a -A or -S type plastic enclosure and only in case of weak GSM signal it is necessary to place the antenna in a suitable place outside the enclosure and feed the coaxial cable to the unit through one of the cable glands.

The antenna is usually placed vertically because of the vertical polarization in the GSM network. If the signal level is not good, it is recommended to try horizontal placement of the antenna.

External antenna for metal enclosures

When installing the station outdoors, it is often the case that the station is placed in a metal enclosure, in the head of a borehole or otherwise shielded from the external GSM field. In this case, the station is supplied with a special hemispherical AGSM-3dB/P-SMA antenna, which is placed on the outer side surface of the metal enclosure. The antenna is mounted in a 12 mm diameter hole and secured against theft from the inside of the enclosure with a lock nut.

More powerful GSM antennas

In locations with very weak GSM signal, the usually supplied magnetic antenna with 3 dB gain can be replaced by a larger omnidirectional magnetic antenna with 9 dB gain type AGSM-9dB-SMA, or a small directional antenna with 12 dB gain type AGSM-12dB-SMA. The long directional antenna puts high emphasis on precise antenna pointing and homogeneity of the electromagnetic field, and its use has not been successful in practice. Beware of the usual vertical polarization in GSM networks when installing directional antennas! A small directional antenna (60 cm long) together with its bracket can be ordered from the manufacturer of the telemetry set.

Directional antenna AGSM-12dB-

Underground objects

In underground objects such as sumps, transfer shafts and similar objects equipped with a metal inlet cover, it has proven useful to simply attach the magnetic antenna to the lower metal part of the inlet cover frame (the rod antenna points downwards).

Only when this simple and surprisingly often successful solution fails, it is necessary to proceed to the external antenna placement. A suitable solution may be, for example, a plastic capped protector that contains the supplied rod antenna. The positioning of the shield above the ground should be done taking into account the height of the snow cover at the installation site.

Extension Cables

Finding the optimal antenna location often requires experimentation, sometimes with SIM cards from other operators. A coaxial extension cable, which can be ordered from the station supplier as an option, can also help. The length of this extension cable can range from 3 m to 10 m.

Extension cable PKGSM-5-SMA

Coaxial surge protector

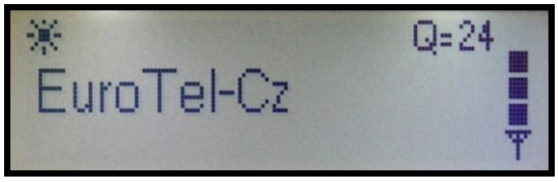
When using an external larger rod or directional antenna outdoors, it is generally recommended to terminate the coaxial line just before the unit with a coaxial surge protector that must be well grounded.

ANTENNA INSTALLATION

When installing the antenna, the current GSM signal strength at the antenna installation site can be displayed on the unit's display to optimize the final antenna placement.

PROCEDURE FOR DETECTING THE GSM FIELD STRENGTH:

- Connect the GSM antenna to the device and place it in the expected location of the highest GSM field strength.
- Press the button briefly to switch on the device. The following long press (3 sec - until beep) will command the HydroLogger to try to log into the GSM network. If there is at least the minimum GSM field strength at the antenna location, the instrument will log into the GSM network after approx. 20 sec. and the display will show the name of the operator and the measured GSM field strength will be shown in ticks in the right part of the display above the schematic mark of the antenna. The numerical expression of the GSM field strength can be found in the upper right corner of the display in the form Q=...



- Manipulate the antenna to achieve a GSM field strength of at least Q = 8 or higher. The measured Q value is refreshed at an interval of about 5 seconds.
- To extend the display on time, press the button briefly again before exiting the recalled mode. By default, the device is set so that the display backlight turns off after 1 minute from the last button press and the selected mode after another minute. Therefore, if you press the instrument button briefly at an interval of less than 1 minute, the instrument's backlit display will continuously show the measured GSM field strength. Any long press of the button (>=3 sec) will trigger the archived data to be sent via GPRS communication to the database server.
- After finding the maximum possible GSM field strength (the highest Q value), leave the instrument at rest. Two minutes after the last button press, the display will gradually show the set measurement channels and then the instrument will switch off - the instrument will enter its normal operating mode.

TREATMENT OF THE GSM CONNECTOR AGAINST MOISTURE

The used GSM connector type FME does not contain a seal to prevent moisture from entering the connector and therefore it is necessary to treat this connector when installing the station in a humid environment. The easiest way to do this is to wrap the joint with self-vulcanizing insulating tape (in a pinch, ordinary electrician's insulating tape.

4.4. Connecting sensors and transducers

RECORDING CHANNELS

The H1 telemetry station has the ability to record up to 8 measured physical quantities in its data memory. Each measured quantity occupies one recording channel K1 to K8. Unoccupied recording channels are not allocated and do not take up space in the data memory (so-called dynamic channel occupation).

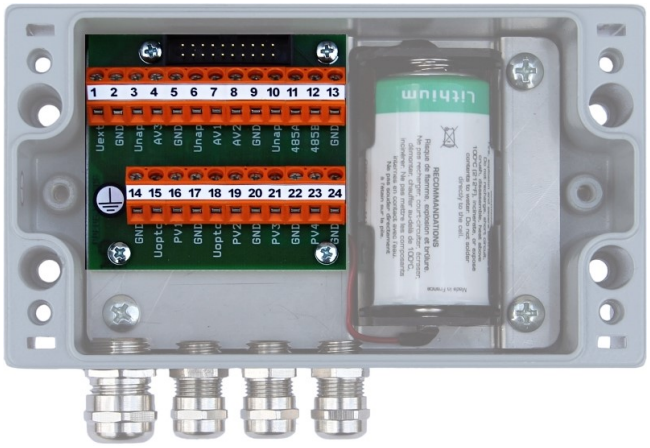
Recording channel settings

Any recording channel, if it is to be active, must first be set up. Setup is done via the MOST software either from a PC connected by cable or remotely via a web browser and special data server services. During setup, one input is assigned to each recording channel. In special cases, multiple recording channels can have one common input.

When setting up a recording channel, in addition to the input, the type of measurand, measurement method, units of measurement, number of decimal places and other necessary parameters are selected. The setting of recording channels is covered in detail in the chapter 6.3 Analog channel settings.

4.4.1. Inputs

The measuring sensors and transducers are connected to the Hydro Logger H1 via terminals on a connection plate located in the bottom of the metal housing of the instrument to the left of the lithium battery.



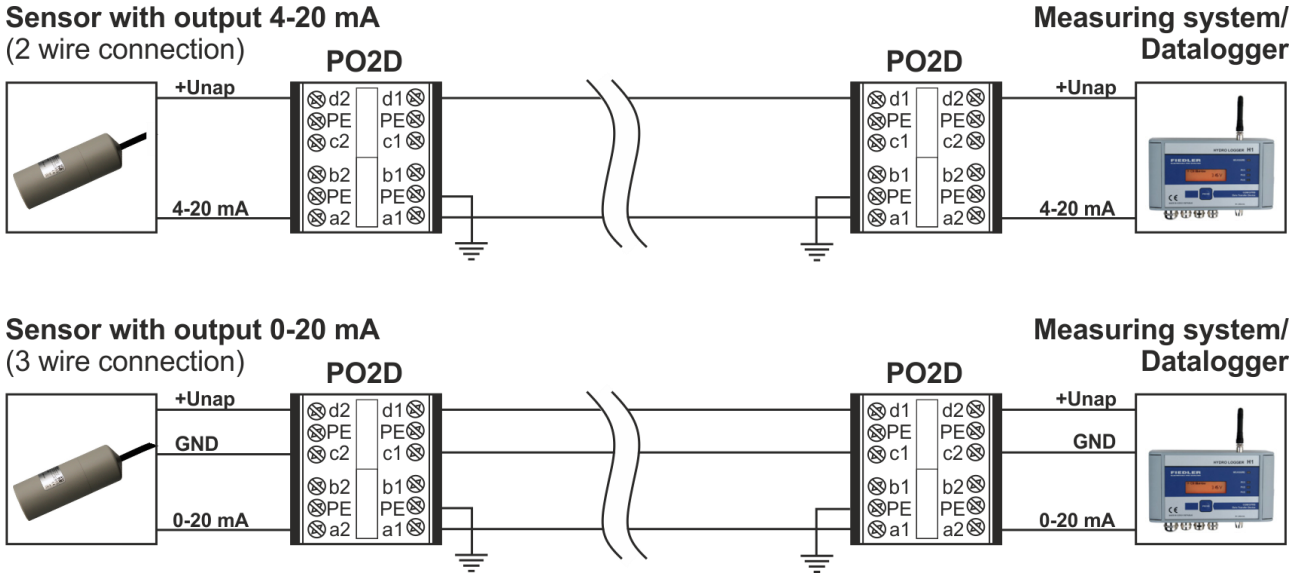
Inputs Hydro Logger H1

Inputs	Type of input	Clamp no.
PV1, PV2	Fast pulse inputs	16 (PV1), 19 (PV2)
PV2, PV4	Slow pulse-binary inputs	21 (PV3), 23 (PV4)
AV1, AV2, AV3	Inputs 0(4)-20 mA	7 (AV1), 8 (AV2), 4 (AV3)
RS485	RS485 (FINET, Modbus RTU)	11 (+485A), 12(-485B)

Surge protection of inputs

Despite the small size of the HydroLogger H1 connection board, all inputs and power terminals are protected against induced overvoltage by a solid-state surge protector with the ability to absorb short-term energy pulses of up to 600 W.

In the case of extremely long connection cables (over 100 m) or when installing the device and connected sensors in high-rise buildings (water tanks), it is advisable to reinforce the surge protection of the inputs with external PO2D surge protectors.



4.4.2. Power supply for connected sensors and transducers

In addition to the input terminals for connecting the measured signals, the Hydro Logger H1 also has 2 types of power terminals for powering the connected sensors and probes.

Power terminal +Unap

On the terminals marked +Unap (terminals 3, 6, 10) the supply voltage is present only during the measurement of signals from the connected sensors. The measurement interval is an adjustable parameter ranging from 1 minute to 24 hours.

Another adjustable parameter of the unit allows to switch on this power supply in advance of the actual measurement, so that the connected sensors have time to start up and correctly adjust the size of the output signal in proportion to the physical quantity being monitored.

The supply voltage at the Unap terminals is user adjustable from +6 V to +15 V. The choice of the supply voltage magnitude is determined by the user when parameterizing the instrument and depends on the type of sensors and measuring probes connected. For sensors and probes connected via RS-485, the lower voltage value is usually set near +6 V and for pressure or level sensors with a 4-20 mA output signal, the higher voltage value is usually +15 V.

The required supply voltage is generated by the integrated DC/DC converter in the instrument from the battery voltage. A lower supply voltage value extends the life of the power battery.

Power clamp +Uopto

Some sensors require a continuous uninterrupted power supply. Examples include OPTO sensors used for pulse sensing from propeller water meters. The Uopto terminals (terminals 15 and 18) are designed to supply power to such sensors, and a 3.6V battery voltage can be permanently present. This voltage must be permanently switched on when parameterizing the instrument.

Permanently powered sensors must not overload the battery in the station and therefore their current consumption should not exceed 200 µA. For example, OPTO sensors type VLP-8 to VLP-11 are suitable, which draw 80 µA from the +Uopto terminal.

4.4.3. Pulse-binary inputs PV1 to PV4

HydroLogger H1 contains 2 fast pulse inputs labeled PV1, PV2 (terminals 16 and 19) and two slow pulse-binary inputs labeled PV3, PV4 (terminals 21 and 23).

All pulse inputs are activated by their connection to the GND ground terminal and therefore the connected sensors must have either an open collector or a potential-free contact (relay contact) at the output. At rest, the voltage at the pulse input is 3.3V. When the input is switched on, the input circuit draws a current of 30 µA from the power supply battery and therefore it is advisable not to connect the input to the GND ground terminal in the quiescent state to avoid unnecessarily discharging the instrument battery (short pulses are optimal).

FAST PULSE INPUTS PV1, PV2

The two fast inputs PV1 and PV2 are primarily designed for reading fast and short pulses from sensors and meters. The minimum pulse length must be at least 10 mS for inputs PV1, PV2 and it follows that sensors with a maximum output frequency of 50 pulses/sec can be connected to these inputs.

The outputs of water meter speed sensors are usually connected to the fast pulse inputs PV1 or PV2. These sensors can be of the OPTO, REED or CYBLE type.

Installing the CYBLE sensor on the water meter

Pulse input counters

Each fast pulse input is assigned its own pulse counter. Each time the set archiving interval expires, the counter contents are stored in the instrument's internal data memory. The number of pulses read during one archiving interval must therefore not exceed 65,530 pulses, otherwise they will be lost (not all incoming pulses will be saved). Since the typical archiving interval is usually 10 or 15 minutes, the connected OPTO sensor would have to generate more than 70 pulses per second to reach this ceiling.

CALCULATION AND DISPLAY OF INSTANTANEOUS FLOW RATE

The Hydro Logger H1 continuously calculates the instantaneous flow rate from the pulse weight (a parameter expressed in litres per pulse) and the frequency of pulses. The instantaneous flow rate is displayed on the instrument display in cyclic mode.

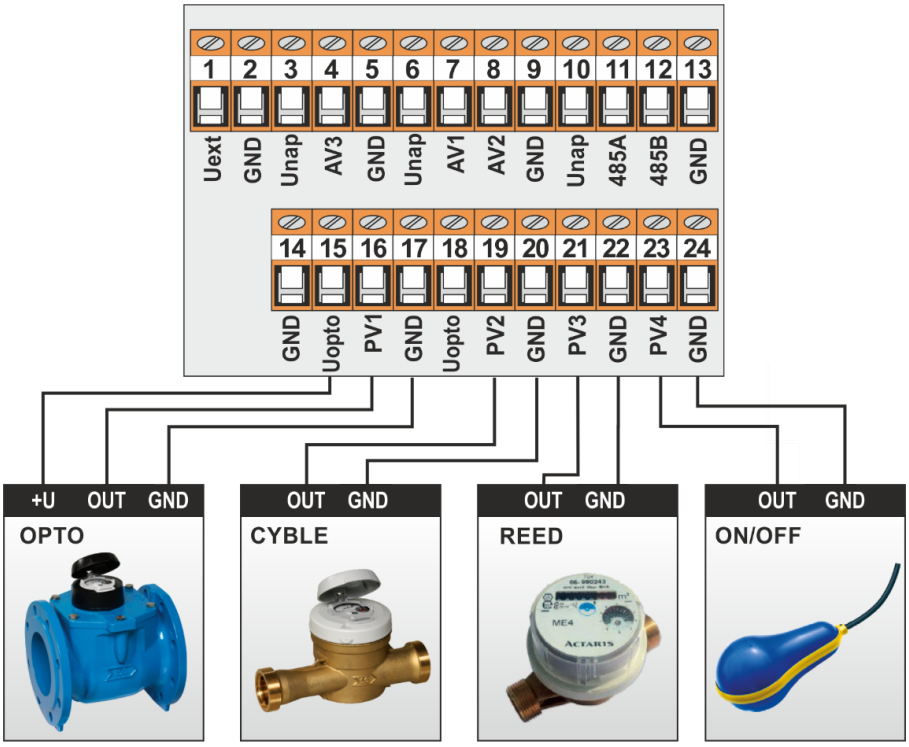
Exceeding the instantaneous flow rate above the set limit may trigger a warning SMS message.

CALCULATION AND DISPLAY OF LEAKED VOLUME

The number of pulses per archiving interval is stored along with the pulse weight in the instrument's data memory. From these stored partial flow volumes, the Hydro Logger H1 continuously calculates the total flow volume. The amount of leaked volume since the instrument was installed (or since the channel was initialized) is displayed in cyclic mode on the instrument display below the instantaneous flow rate.

CONNECTING THE TERMINALS OF THE CONNECTION PLATE

The pulse inputs are located in one bottom row of the instrument connection board terminals, along with the OPTO sensor power terminals and common GND ground terminals. The top row of terminals is reserved for connection of analog current signals and two terminals for bringing in external supply voltage.



Typical connection of water meter sensors and ON/OFF contact to H1 pulse inputs

SLOW PULSE-BINARY INPUTS PV3, PV4

The two slow pulse-binary inputs are mainly intended for connection of status sensors for pumps, blowers, building security outputs or for connection of the output signal of a rain gauge. However, they can also be used to monitor the pulse REED of water meter sensors with a frequency of max. 1 pulse / 2 sec.

The minimum pulse length at the PV3 and PV4 inputs must be at least 70 mS to safely record the pulse in the device memory.

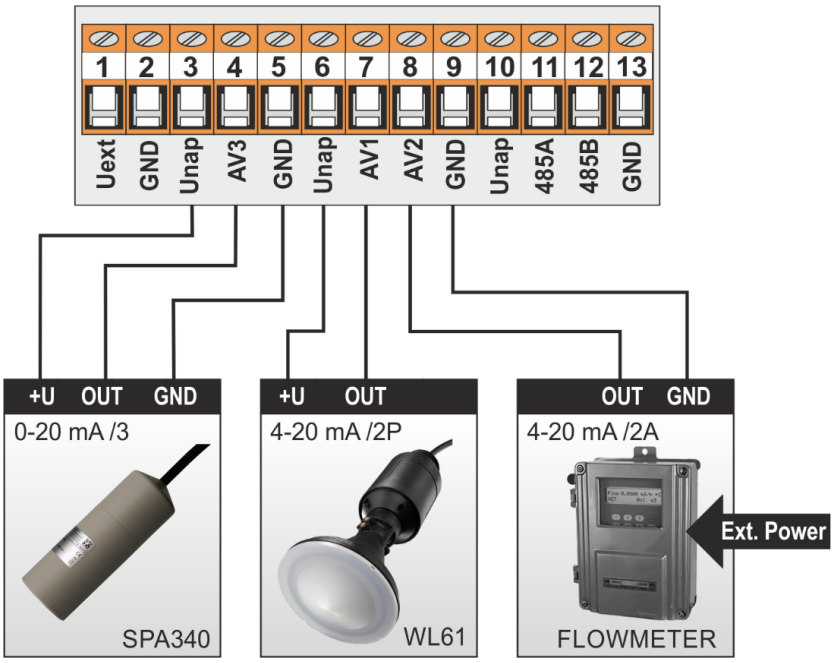
The required input type (pulse or binary) is determined by parameters when setting up the station.

4.4.4. Analog current inputs AV1, AV2

Inputs AV1, AV2 and AV3 (terminals 4, 7 and 8) can be used to connect sensors and transducers with current output signals of 0-20 mA, 4-20 mA, 0-1 mA, 0-5 mA or 1- 5 mA. The type of current signal is set in the instrument parameters.

The following figure shows 3 possible ways of connecting the sensors to the analog AV inputs of the instrument:

- The sensors connected in 3 wires are shown in the 1st box with the SPA340 sensor.
- The two-wire connection of the sensor powered by a passive current loop is represented by the 2nd box with the WL61 radar level sensor.
- Separately powered sensors with an active current loop are shown by the FLOWMETER in Box 3.



Three different ways to connect current analog signals to H1 inputs

Sensors and probes with current output include mainly strain gauge level sensors. However, many other measuring probes and sensors can be connected to the Hydro Logger H1 and H2 via these inputs, ranging from pressure sensors to ultrasonic or radar level gauges to inductive flow meters.

Voltage drop across inputs

The voltage drop across the AV input measuring resistor can be up to 2 V at 20 mA current. When connecting sensors powered over a two-wire current loop (radar sensor WL61 in the upper picture), it is necessary to increase the minimum supply voltage of the connected sensor declared by its manufacturer on the +Unap power terminal by this drop. On the other hand, an unnecessarily high +Unap supply voltage excessively depletes the capacity of the power supply battery.

The analogue signals fed to the AV1 and AV2 inputs are measured by a precision transducer with a digital filter that suppresses interference voltages induced in the input cable and performs automatic self-calibration of the measuring ranges.

4.4.5. RS485 serial interface

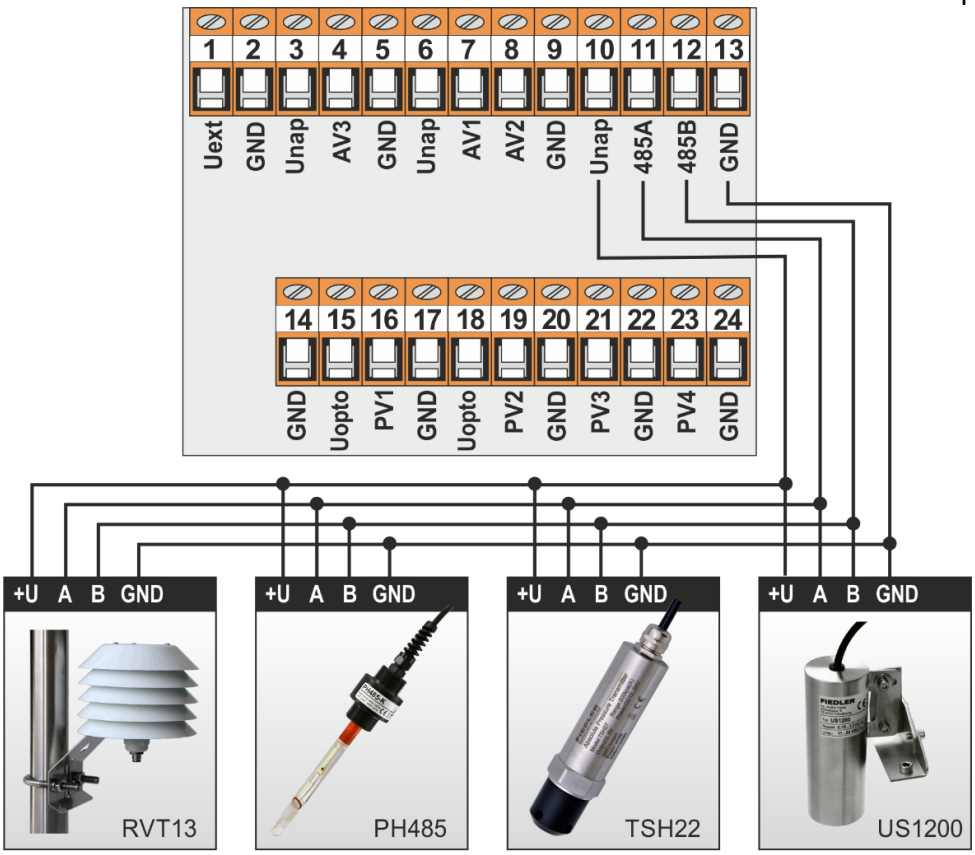
RS485 serial I/O interfaces allow connection of sensors and probes equipped with RS485 bus only under MODBUS RTU or FINET protocols. In this mode, the H1 unit works as a master and reads data from the measurement channels of individual sensors.

Communication protocols

For example, the ultrasonic or immersion level sensors US1200 and TSH22, the water conductivity sensors ESV11 and many other sensors and transducers listed in the table on page 50.

The MODBUS RTU and FINET communication protocols can also be operated together on one RS485 line. However, it is advisable to use a different communication speed for each protocol for trouble-free operation.

Detailed description of the FINET communication protocol can be found in the APL101 application note in the *Downloads - Documentation* section of the manufacturer's website www.fiedler.company.



Address

The request to transmit measured values from the probes and sensors to the Hydro Logger H1 is controlled exclusively from the Logger H1, which queries the individual measuring sensors in turn and reads out the last measured values. When setting the parameters of the measurement logger H1, the serial number of the internal channel of the measuring probe must be entered in addition to the address of the connected probe.

Current draw of sensors

When powering a large number of sensors from the H1 unit, care must be taken to ensure that the maximum current draw of 500 mA from the +Unap terminals is not exceeded.

4.4.6. General rules for RS485 bus wiring

Smooth use of the RS485 serial link requires compliance with established rules for this type of communication:

PO2D

surge protection of RS485 data and power wires

SHIELDED TWISTED DATA CABLE

Use a suitable shielded 4-core data cable with an impedance of 50 Ω, consisting of 2 pairs of twisted wires. In a 4 core cable, one pair is used for data and the other pair is used either to power the connected sensor or to connect the signal grounds (see below). Suitable cable types include, for example: **PAAR-TRONIC-Li-2YCY 2x2x0.34 QMM**

SINGLE-SIDED SHIELDED CABLE CONNECTION

The cable shield is only connected on the side (usually on the master side) because no current must flow through the cable shield. In the case of a double-sided grounded shield, differing ground potentials could cause this unwanted current to flow through the cable shield. The current flowing through the shield would be induced into the internal conductors of the cable and cause noise on the data bus.

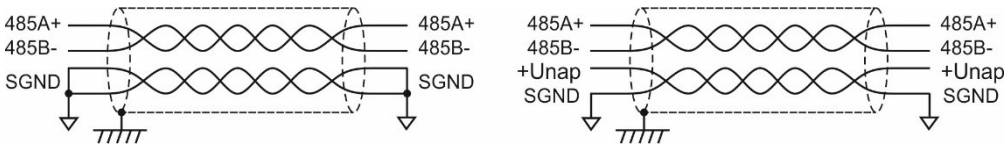
CONNECTING SIGNAL COUNTRIES

A 2-wire interface does not mean 2 wires. Although the RS485 bus is referred to as a 2-wire interface, it requires the connection of signal grounds on both sides of the interconnect cable for proper operation in order to shut off the current flowing through the data wires back to the exciter.

Usually this requirement is fulfilled in a short line when the master and slave are located close to each other or have a common supply voltage, i.e. their SGND signal grounds are connected.

Enhanced interconnection of signal countries

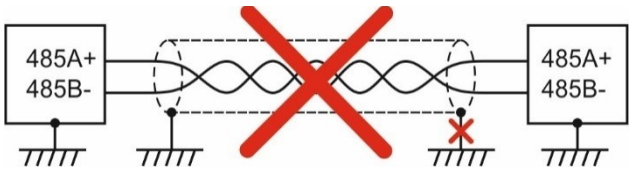
The lack of interconnection of signal lands also has a significant impact on the **reliability of data communication**, sometimes working and sometimes "inexplicably" dropping out. If the second twisted pair of the data cable is not used to power the sensor (the sensor is powered by a separate power supply at its installation location), then it is advisable to connect the two loose cores of the data cable and use them to connect the signal grounds of both devices (the lower ohmic resistance of the line will reduce the differential potential of the signal grounds).



Correctly connected interconnection cable without sensor power supply and with power supply voltage

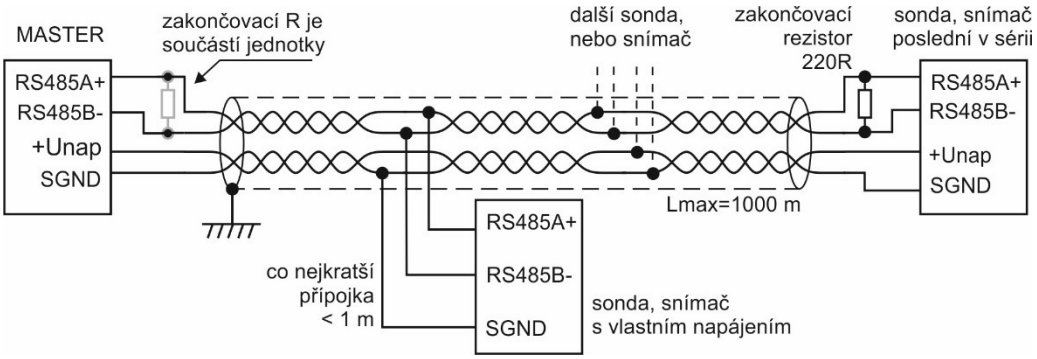
Missing signal ground

If no wire is used to connect the signal grounds of both communicating devices, the ground buffer current will be closed via the protective diodes of the RS485 exciters, which have only limited current immunity.



Incorrect RS485 bus wiring with signal ground connection via ground loop

As the length of the data cable increases, the ground potential difference between the two sides of the cable can increase, especially in industrial environments. If at least one device is floating, i.e. galvanically isolated from the earth potential at the installation site, this potential difference between the cable ends will not be a problem.



GALVANIC SEPARATION OF RS485 BUSES

If the two communicating devices are connected with different ground potential at the place of their installation, which can be in the order of tens of volts, then it is necessary to insert a suitable galvanic isolator of RS485 buses between them for the reliability of operation - e.g. the MIG485 module.

MIG485 Separator/ Splitter

The MIG485 isolator/splitter enables mutual galvanic isolation of RS485 buses up to 1 kV DC, while the individual buses are also isolated from the supply voltage of the MIG485 isolator.

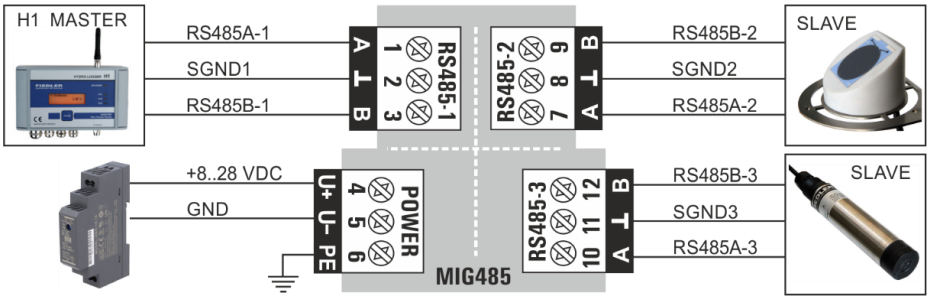
The MIG485 module contains two secondary RS485 buses in addition to one primary RS485 bus and can therefore be used not only for galvanic isolation of the buses but also for their branching into two different directions.

The splitter also protects against complete blocking of communication in case of a short circuit in one secondary RS485 branch, when the remaining 2 buses can still be functional.

Last but not least, this type of separator/breaker regenerates incoming data packets before they are sent.

Connecting the terminals of the MIG485 separator

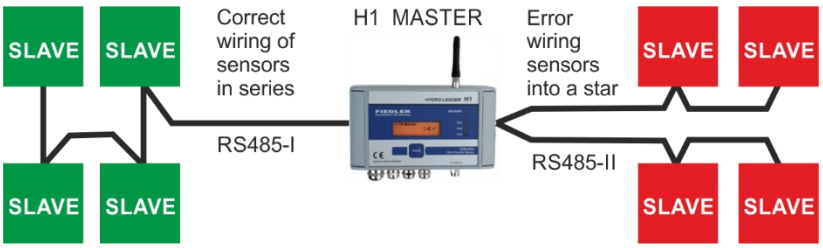
The following figure shows how the MIG485 module is connected between the H7 unit (master) and the measuring sensors connected to the two secondary RS485 buses.



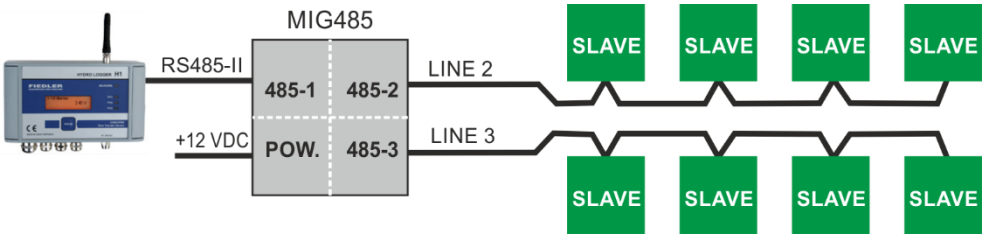
Connection of terminals of galvanic isolator/breaker MIG485

SUITABLE TOPOLOGY

Connecting more than one measuring probe to the unit requires care to ensure that the connection cable is pulled correctly. It is not advisable to connect a star-shaped network, but due to the requirements for suppression of reflections, it is advisable to connect the individual probes in series from the first to the last.



The following diagram shows the use of the MIG485 splitter to create two mutually separated branches. Each branch can be grounded at one point without balancing the currents through the ground loops due to galvanic isolation.



REST POTENTIALS OF TERMINALS A, B

The potentials of both RS485-A and RS485-B data lines must be voltage defined on the master side. The wiring of the H1 register unit already contains circuitry to define the quiescent state of the line: the RS485-A wire is held at a higher potential than the RS485-B wire by internal resistors.

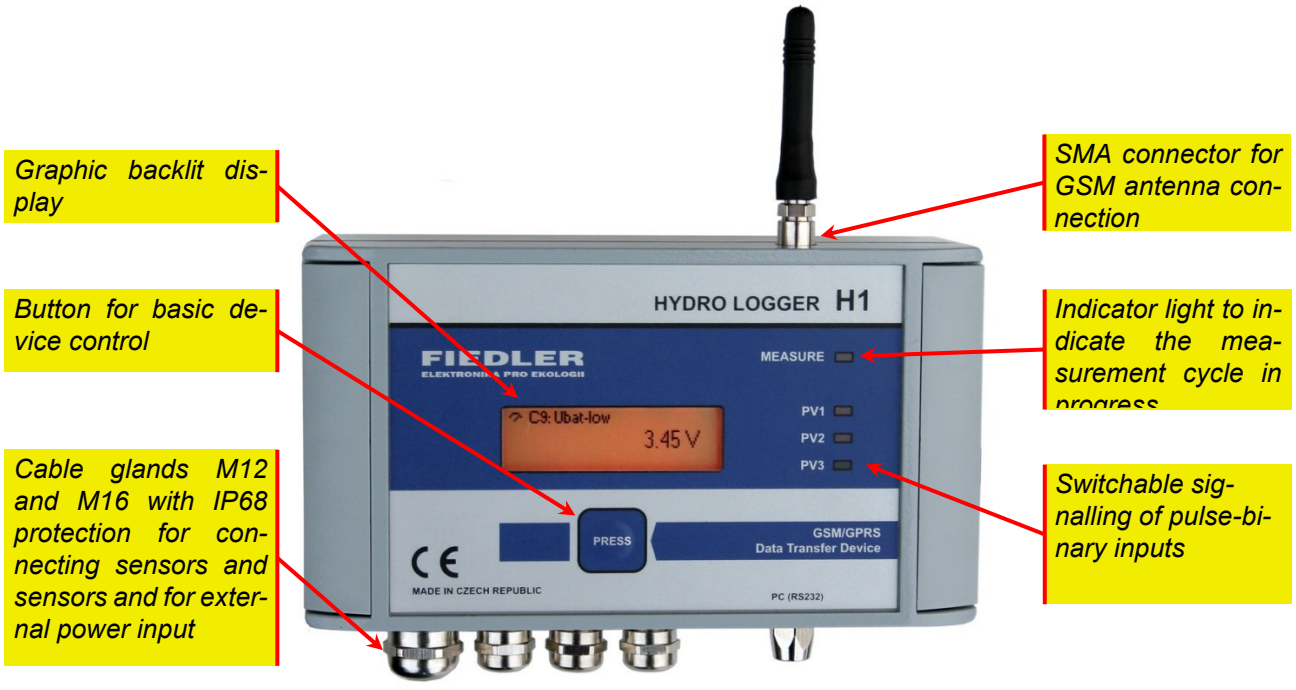
TERMINATING RESISTORS

Both ends of the RS485 network must be terminated with an impedance close to the impedance of the cable used to suppress reflections. On the H1 unit side, both RS485 serial lines are terminated with internal resistors.

In the case of a long line, it is advisable to strengthen this internal terminating resistor on the H1 side with an additional external resistor of 150 to 330 Ω located between the RS485-A and 485-B terminals. The other end of the RS485 line should always be supplemented with a terminating resistor. A 220 Ω resistor is connected between the RS485-A and RS485-B terminals.

5 Basic control of the device

The HydroLogger H1 is equipped with a graphic display and one button, which can be used to display some basic data such as measured values on individual channels, the status of the power battery or to monitor the status of GPRS data communication and test the GSM signal strength. The button can also be used to switch on the GSM modem and start (and stop) sending measured data to the server via the GPRS network.



5.1. Cyclic display of measured values

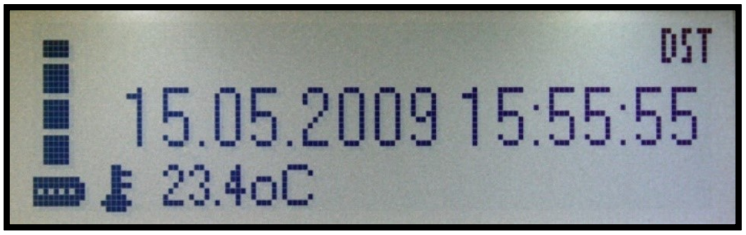
A short press of the button (1 sec) causes the display backlight to turn on and starts displaying the status of the set analogue and binary channels. The individual measured channels are displayed in cyclic mode with the period set in the parameters (see ch. 0). The cyclic display period is set by the manufacturer to 3 sec.

BASIC INFORMATION WINDOW

The basic information window is displayed first, which includes the current date and time set in the instrument, the status of the power battery, the temperature inside the instrument and, if applicable, the relative humidity value in the instrument.

Date and time The date and time are automatically compared when communicating with the server if they differ by more than 30 sec.

Temperature and relative humidity The temperature inside the instrument is only informative, as is the relative humidity. Elevated relative humidity is dangerous for the life of the electronic circuitry and indicates a leak in the instrument. If the humidity exceeds 80%, check the tightness of the cable glands and the metal cover of the instrument itself.



Basic information window

Battery status The battery symbol on the left edge is accompanied by a vertical bar showing the battery status (remaining capacity). This value is calculated from the difference in voltage between the loaded and unloaded supply battery.

CYCLIC IMAGING

The basic information window is replaced by individual windows containing one measuring channel each after the preset time (3 sec.). The analogue channels (Channels-A) are displayed first, followed by the binary channels (Channels-B). The meaning and settings of the individual measurement channels will be described in detail in chapter 6.4 on page 46.

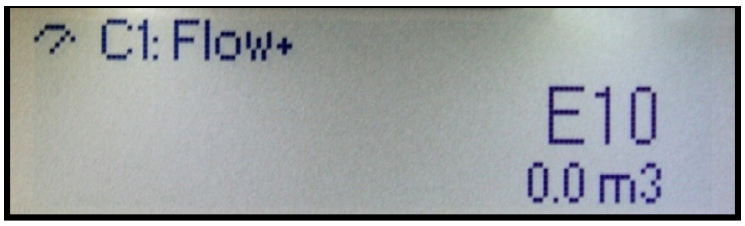
End of cyclic display Displaying the last set channel will automatically end the display cycle, turn off the display and the HydroLogger H1 will enter power saving mode, which is its normal operating state.

Extending the imaging cycle If the user presses the communicator button briefly (1 sec) at any time during the display, the display cycle will be executed 3 times in total and only then the display will be switched off and enter the power saving mode.

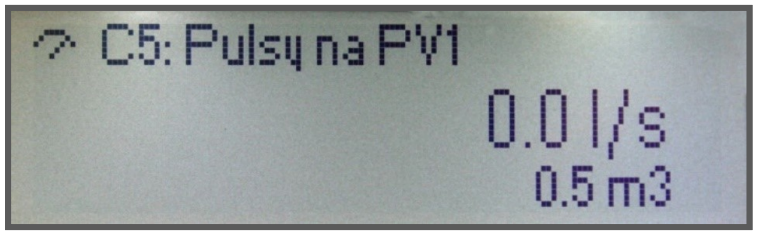
ANALOG CHANNEL DISPLAY

The following figure represents the analog channel window C1 (Channel 1). Channel 1 is usually set up to record the flow from a connected flow meter.

If the HydroLogger detects an error in the input measured signal, the display will show an error code with an E instead of the current measured flow value (shown in Figure E10). The bottom line of the display shows the total flow volume. Such an error can be a current less than 4 mA or greater than 20 mA flowing from a sensor with a 4-20 mA output signal or a broken cable for sensors communicating over the RS485 serial interface.



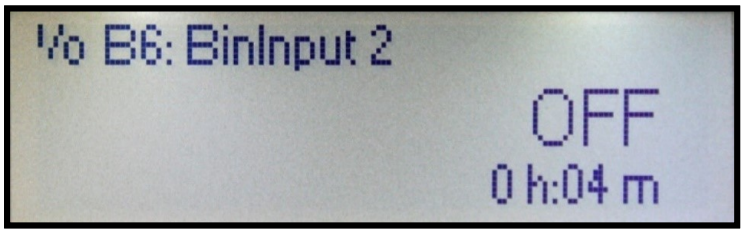
Analog recording channels can also be set up to measure flow via pulses fed from a suitable type of water meter to inputs PV1 to PV4 of HydroLogger H1. The following figure shows the window of channel C5 set up in this way.



Setting the analogue channel parameters is described on p. 46 in chapter 6.4

BINARY CHANNEL DISPLAY

Binary channels are used to record events that can be expressed by two states (ON/OFF). Typically, these channels record pump operation or failure, building entry , manhole flooding, etc.



Under the status of a binary channel, the total time of switching on (off) of this channel can also be displayed, the so-called motor hours or operating hours.

The setting of binary channel parameters is described on page 5.60.

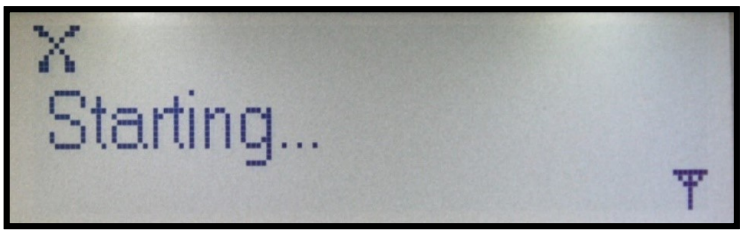
5.2. Switching on the internal GSM/GPRS module

A long press of the button (3 sec) during the cyclic display of the measurement channels causes the GSM module to switch on. If the Hydro Logger H1 manages to log in to the network (a suitable SIM card with an unblocked PIN entry requirement is installed, there is sufficient GSM signal at the antenna location and the power battery has sufficient capacity to power the GSM module), the Hydro Logger will be logged in the GSM network for two minutes. During this time, the GSM field strength is repeatedly detected with a period of approximately 10 sec and this value will be displayed on the display.

If you need to extend the display switch-on time - e.g. when searching for the optimal location of the GSM antenna, you can press the PRESS button briefly (1

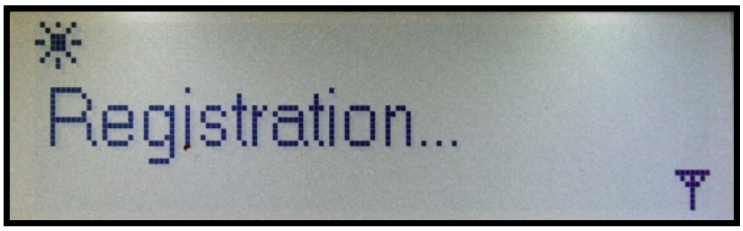
sec.) at any time during the module switch-on. The two-minute counter will reset and start from the beginning.

Sending a request to log into the GSM network:



The icon in the upper left corner of the display indicates that the GSM module has not yet acknowledged the request to log the module into the network.

Login to the GSM network:

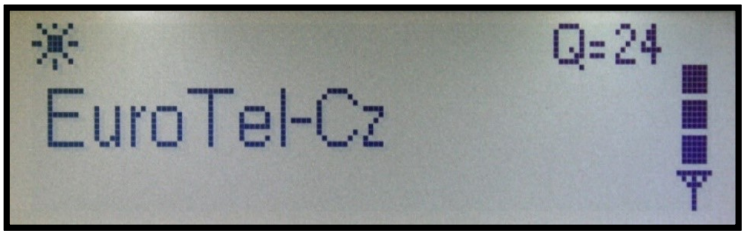


If the radio part of the module is switched on, the display changes from "Starting..." to "Registration...". The icon in the top left corner of the display also changes and its new shape shows the GSM module switched on.

Login time The time required to register the device to the GSM network depends on the quality and intensity of the GSM field. Under good reception conditions, the module registers to the network within 15 to 20 seconds. As the quality and intensity of the GSM field deteriorates, this time increases and in extreme cases the module will not register to the network even within one minute.

Repeated login If this situation occurs, the GSM module is automatically switched off and a new registration to the GSM network is attempted. The number of attempts is a configurable parameter. If the last, usually the third, attempt to log in is unsuccessful, the GSM module will remain switched off until the next request to log in to the network (long press of the knob) or until the time preset for regular transmission of measured data to the server.

Login to the GSM network:



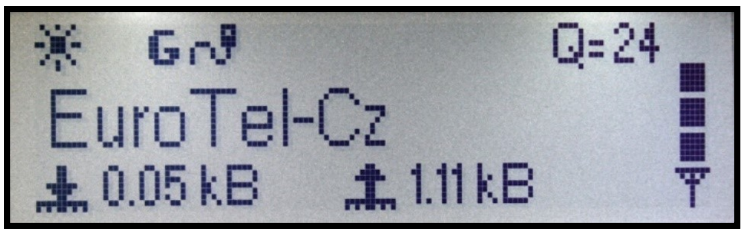
After the device is logged into the GSM network, the display shows the name of the operator and a numerical and graphical representation of the GSM field strength at the antenna location. This intensity is expressed as a numerical value from Q=1 to Q=31, with a higher number indicating a higher GSM field strength.

5.3. Extraordinary data upload to the server

A long press of the button (3 sec) on a device that is logged into the GSM network triggers an extraordinary transfer of the measured values to the server.

The G icon on the top left of the display indicates that the device has logged into the GPRS network. Another icon to the right of the **G** icon indicates that communication with the server has been established.

During the data packet transmission, the number of received and sent data in kB is displayed sequentially on the display as shown in the following figure:



Data communication repetition

In the parameters related to GPRS communication, the number of repeated attempts to transfer data to the server after an unsuccessful data session is a configurable parameter. From the manufacturer this number is set to a total of 3 attempts, while before the last attempt to transfer data to the server the power supply voltage of the GSM module will be briefly switched off to ensure a reliable reset.

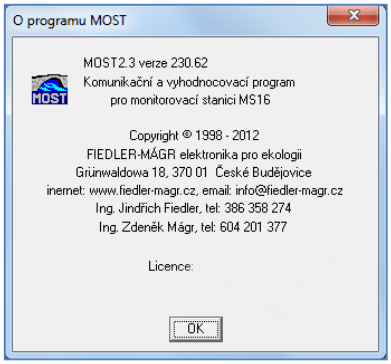
Switching off the GSM module

After the last measured data is transferred to the server, the modem is automatically switched off and the Hydro Logger H1 enters power saving mode.

Premature termination of the ongoing GPRS data communication can be done by another long (3 sec.) press of the PRESS button.

Parameter rearrangement

Note: The extraordinary data upload to the server can be conveniently used, for example, to immediately reconfigure the parameters of the Hydro Logger H1 if you are unable to connect to the communicator via a laptop at the installation site. This parameter resetting is based on the fact that every time data is sent to the server, it is automatically tested to see if a new parameter file is ready for the station in the parameter database on the server. If such a file is found, it is downloaded from the server to the instrument and the parameters are then reconfigured according to this new parameter file. If you prepare a new parameter file yourself or in cooperation with a colleague and place it in storage on the server, this file will be downloaded to the Hydro Logger H1 at the end of the emergency data upload without having to upload this file to the instrument via the data cable and the MOST program.



6 Parameter settings

Using the MOST program, the parameters of the Hydro Logger H1 can be read from the connected instrument, modified and saved back to the instrument or to a backup parameter file with the *.PRM extension.

Parameter setting can be done from the PC directly via RS-232 interface cable (from USB port via converter, which can be ordered together with the station), or it is possible to set parameters remotely from the server via GSM/GPRS network.

6.1. MOST programme

MOST is a universal communication, setup and evaluation program common to all FIEDLER instruments launched until 2015.

A detailed description of the program is given in a separate manual. The user who will use this program only for working with parameters will be satisfied with the description of individual parameter windows described in detail in the following text.

You can get the latest version of the program on the manufacturer's website. The MOST program is not included in the standard delivery of the telemetry set.

BASIC RULES FOR WORKING WITH PARAMETERS

After physically **connecting the** PC to the H1 station (via cable or dial-up connection via modems), the **connection** must first be made. For this purpose, either the menu in the "Communication" menu or the "COM" or "Telephone" icons are used. Both the connection and the connection are not necessary if you use the server service for setting or changing parameters.

At the beginning of working with parameters, it is advisable to first read the parameters from the connected device. You can also load the parameters from the database on the server (if you have the appropriate permissions), where they are automatically saved after each change, or from a backup file on the PC.

After setting the parameters, the new parameters must be saved in the instrument. This can be done from the "communication" menu or by using the icon.

When using a server, simply save the new parameter file to the server and the station will download the file at the next data communication.

6.2. Basic parameters

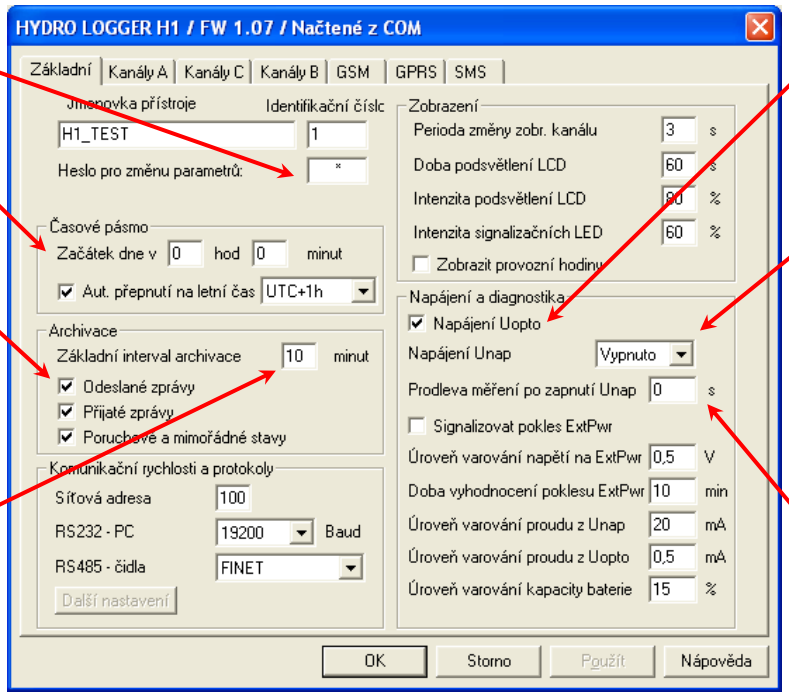
A group of basic parameters for setting station identification, measurement frequency, supply voltage control, data archiving and station communication with sensors.

A password value different from 0 will block access to the parameters.

Day boundaries for calculating daily flows.

SMS message archiving including text, phone number, date and time.

The interval at which the instrument is switched on and all inputs are measured. For each channel, you can specify its multiples for archiving (then the average of all measurements for the archiving in-



Permanent switching on of the supply voltage for the OPTO water me-

Selecting the size of the supply voltage Unap, which is switched on only during the measurement

The analog signal measurement delay from power on allows sensors with a long rise time of a valid signal from their connection to the supply voltage to be connected

IDENTIFICATION

Instrument nameplate

The basic parameters include the instrument nameplate, which can store a maximum of 17 ASCII characters characterizing the instrument. The name tag is preferably used to visually check the affiliation of an open parameter file to the connected instrument and can be seen at the beginning of the *.dta data file, inserted into sent SMS and serves as a station identifier on the server.

Note: the "Device Name" parameter is automatically transferred to the station name on the server. Therefore, if you need to rename a station on the server, just change the name tag in the parameters and the next time the station has a data session with the server, the name of the station on the server will automatically change.

Identification number

The value of this parameter serves as a station identifier on the server and is assigned by the server administrator. The *identification number* is stored together with the data in one data file and thus uniquely identifies the origin of the measured data. The parameter can take values in the range 1-65535.

Password to change parameters

Setting this parameter to a non-zero integer prevents further parameter changes without knowing the password. The password value can take values from zero to 9999. A zero value disables the check and allows unlimited overwriting of parameters.

TIME ZONE

Summer time By ticking the "*Automatically change to daylight saving time*" option, you allow the device to automatically adjust its internal functions during the time change, for example, to send regular text messages. This means that an informative SMS message will be sent automatically at a fixed time throughout the year - for example, every Monday at 8:00 am.

The data will always be recorded in the station's memory according to standard time, regardless of the parameter selection. This is so that the time sequence of the measured values is not disturbed.

Start of the day The setting of this parameter affects the calculation of daily leakage volumes, daily precipitation, etc. The parameter is used for example when loading data in an organization using shift operation, where the calculation needs to start with the start of a new shift (e.g. at 6:00).

ARCHIVING

Basic archiving interval
Data averaging for archiving This parameter can be set from 1 minute to 1440 minutes (1 day) and determines the frequency with which the instrument will wake up and measure the set measurement channels. Typical current consumption of a switched on station without GSM modem on with one 4-20 mA sensor is around 30 mA. Between measurements, the microprocessor and with it the whole station is put into a very low power consumption mode (20 uA).

Individual measurement channels can have their own "*Archiving Interval*" set differently, which must be a multiple of this basic recording interval. The average of as many measurements as the basic archiving interval fits within the archiving interval of the recording channel is then stored in memory.

Station H1 automatically sets the time of the first recording so that, regardless of the set archiving interval, the recording occurs at the full hour. For example, if the "Archiving Interval" is set to 10 minutes and the station starts measuring at the 13th minute of the current hour, the first memory entry will take place at the 30th minute and regularly every 10 minutes thereafter. Thus, the station will not store data at the 23rd, 33rd, 43rd, etc. minute.

Fault and emergency conditions The name of this option implies its meaning. Checking it allows to store extraordinary and unexpected conditions in the event memory, which can be, for example, disconnection of the measuring sensor, error signal of the intelligent probe, etc.

Sent messages Checking this option allows you to store information about sent SMS messages in the data memory. In addition to the sending time, the text of the sent message and the recipient's phone number are also recorded.

Note: The event memory is automatically loaded along with the reading of the data memory and its contents are stored in a file with the *.dte extension. The file name under the asterisk is the same as the measured data file name. When using the server for data acquisition, the event table is displayed last in the "GRAPH" section.

Messages received Similar to the previous choice. The checkbox enables storing the exact time of SMS messages receipt including their text and sender identification (his/her phone number) in the event memory.

VIEW

A group of parameters for setting the intensity and on time of the display.

Display channel change period The value of this parameter in seconds determines how long the display will show the current measured value while cycling through all set measurement channels. During the cycling, the total leaked volumes on the flow or rainfall channels are automatically included among the current measured values.

LCD backlight time and intensity After pressing the PRESS button, the display is switched on, including its backlight. As the backlight is energy intensive, the switch-on time and the intensity of the backlight can be adjusted. The backlighting time can be shorter than the display switch-on time, which is determined by the number of displayed measurement channels and the change period (see previous parameter).

Signalling LED intensity Similar parameter for setting the intensity of the signal LEDs. A lower percentage value of the parameter extends the life of the power supply battery. A zero value of the parameter switches off the signalling completely.

Remark: In normal mode, the MEASURE signal LED is lit for the measurement period at the interval specified by the Basic Archiving Interval. The measurement time depends on the number of measured channels and the type of probes and sensors connected to the analog inputs AV1, AV2 and to the RS485 serial interface. As a rough guide, a measurement time of 0.5 sec. can be assumed for one measurement channel. Signaling LEDs PV1 to PV3 indicate pulses on these pulse inputs.

View operating hours This option determines whether the temperature and humidity inside the instrument, or the operating hours of the instrument when switched on, and the length of time that a connected sensor error has been detected appear on the instrument's home screen when the PRESS knob is pressed. The displayed data is in days and hours. The display of the total on time and the time the measurement was incorrect is particularly important when measuring flow for billing purposes.

POWER

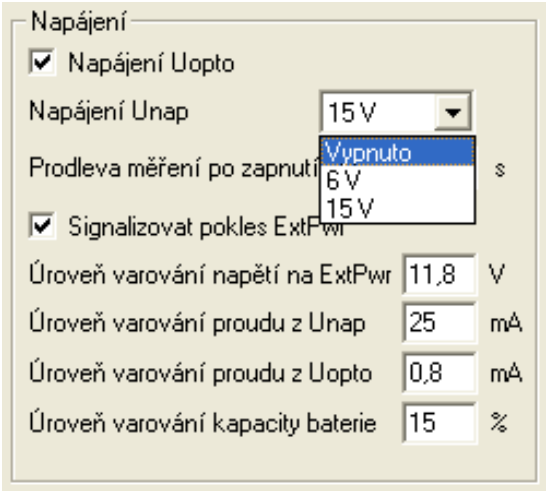
Parameters that affect the total current consumption of the Hydro Logger H1 and consequently the operating time from the power battery include, besides the setting of the measurement frequency (see the previous parameter "Basic archiving interval"), the time for switching on the power supply of the AV inputs in advance of the actual measurement and especially the frequency of data sessions to the server or the number of SMS messages sent.

Energy saving measurement mode In the idle state between measurements, the Hydro Logger H1 operates in a so-called power saving mode in which all the instrument's circuits are switched off except for the pulse counters and the binary input monitoring circuits. In power saving mode, the power draw from the battery is less than 30 uA (if no OPTO sensor powered from the Uopto terminal is connected to the instrument).

Power supply Uopto By checking this option, the 3.6V battery voltage will permanently appear on the Uopto terminals (terminals 15 and 18 on the Hydro Logger H1 connection board), which are used to power the OPTO sensors for the water meters. The maximum continuous draw of a single OPTO sensor should not exceed 0.1 mA to avoid a significant reduction in the operating time of a battery-only instrument.

Power supply Unap

This parameter determines the magnitude of the supply voltage at the Unap terminals of the connection board (terminals 6 and 10) for the duration of the measurement. You can choose between 6 V and 15 V depending on the type of probe to be connected to the Hydro Logger H1. Conventional pressure and level sensors require a higher supply voltage of 15 V, while measurement sensors and transmitters communicating via RS485 often make do with a lower supply voltage of 6 V. Since both voltages are generated by the DC/DC converter from the voltage of the lithium battery supply, it is more advantageous for battery life to use the lower supply voltage Unap if the type of connected sensor allows it.



If there is no sensor connected to the Hydro Logger H1 that requires a supply voltage, it is advisable to set this parameter to *Off*.

Measurement delay after switching on Unap

The value of the parameter in seconds determines how long after the Unap power supply voltage is switched on the device should start measuring the analogue signal from the connected sensors or start communicating with the smart probe via the RS485 interface. This parameter is important, for example, for some probes designed to monitor the water level, where a valid value is only available a few seconds or even tens of seconds after the power supply voltage is switched on - e.g. ultrasonic level sensor. Increasing this parameter shortens the total operating time from a single power supply battery.

POWER SUPPLY SIGNALLING PARAMETERS

Voltage warning level on ExtPwr

The value of this parameter determines the decision level when testing the external supply voltage. If the voltage at terminals 1 (Uext) and 2 (GND) drops below this set level, the unit's display will show a character indicating an external power supply failure. If the previous parameter *Signal ExtPwr drop* is set at the same time, this drop will also be recorded in the station log and transferred with the data to the server, where it will be detected by the warning target next to the station name.

The whole process works the other way around when the external supply voltage is restored (voltage rises above the set limit).

The Signal ExtPwr drop parameter should not be checked if the Hydro Logger H1 is powered only from the internal lithium battery - a target would be permanently lit on the server next to the station name to warn of external power failure.

ExtPwr drop evaluation time

The value of this parameter in minutes determines the time it takes to evaluate an external power supply failure. Thanks to this parameter, the Hydro Logger H1 does not send warnings during short power failures, which are usually not significant for the function of the instrument and can be easily bridged from the internal lithium battery.

Warning level of current from Unap

The Hydro Logger H1 is equipped with circuitry to measure the current drawn by connected sensors and transducers from the Unap terminals (terminals 6 and 10) on the connection board. A user-adjustable limit value of this current for normal operation of the device allows to warn the operator, for example, by means of an SMS message if this limit value is exceeded, which can indicate a failure of the connected probe or damage to the cable and, at the same time, prevent data loss caused by a malfunctioning probe or a low power battery.

Setting the appropriate SMS warning is covered in the chapter 6.9. on p. 68. In addition to the warning SMS, the increase in current consumption above the set limit is also stored in the station log and transferred to the database on the server together with the data, where the corresponding warning target is activated for the station name and the sending of a pre-prepared warning e-mail can also be activated.

The warning level of the stream from Uopto

Similar to the previous parameter for permanently powered sensors connected to the Uopto terminals (terminals 15 and 18 on the connection board). Because of the permanent power draw from these terminals, connected OPTO sensors should not draw more than 0.1 mA per sensor.

The recommended critical level for warning (sending a warning SMS, transferring information to the server) is twice the rated current of the connected sensors.

Battery capacity warning level

The C3 control channel contains an indication called *Battery Capacity*, which is expressed in %. This is calculated from the difference in voltage between the loaded battery (channel C2, current 300 mA) and the unloaded battery (channel C1, current < 10 mA) and is compared to the maximum allowable difference of 1.0 V (a parameter adjustable at the instrument factory). As the voltage difference increases, the *Battery Capacity* reading decreases and drops to zero when the difference between the two channels C1 and C2 is equal to or greater than 1 V.

The recommended critical level for warning (sending a warning SMS, transferring information to the server) is 15% of the battery capacity.

COMMUNICATION SPEEDS AND PROTOCOLS

RS-232

Serial interface for connection of H1 station to PC with MOST program.

The RS232 connection uses the FINET transfer protocol of the MOST program. The baud rate must be set to 19200 Bd.

6.3. Analog channel settings

The analogue channels form the basic structure of the recording part of the Hydro Logger H1. The analogue or pulse signals are measured, converted to the measured physical quantity and stored in memory in the selected units of measurement. Free channels can also be occupied by a value calculated from the values on the occupied channels (sum, difference and spec. functions). Each channel can have its own archiving interval and alarm limits.

By pressing the right mouse button over the selected channel you can copy, paste or delete its parameters

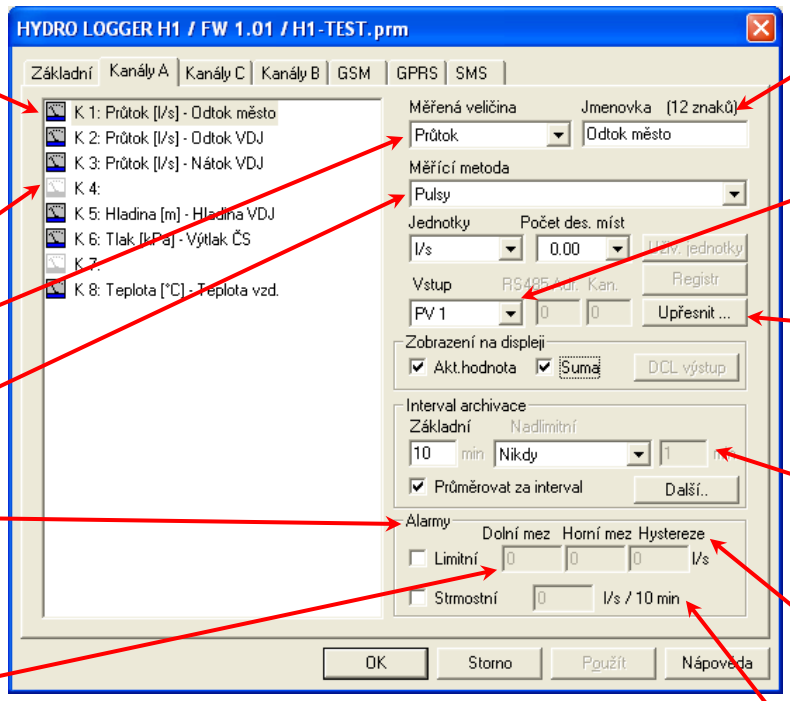
***Step 1 setup:** select a free channel.*

***Step 2:** Select the measurand*

***Step 3:** Select the measurement method*

Activation of alarms can trigger sending SMS or change the basic archiving interval to an overlimit

A limit alarm occurs when the measured value exceeds the upper limit or falls below the lower limit



The channel name will be displayed on the unit display and in SMS

Input may not correspond to channel nu-

Other important parameters dependent on the measurand and the measure-

The overlimit interval will help to record interesting waveforms in detail

Hysteresis prevents frequent switching on and off of the

The steep alarm is activated on both rise and fall above the set speed

6.3.1. Setup procedure and basic parameters

Channel

Each measurand occupies one channel in the station, whose parameters and memory space are fully available to this one measurand only. The user has the possibility to set a total of 8 analogue channels.

Do not confuse the channel with the input. A signal fed to one input can be processed and archived on multiple channels. Selecting the channel serial number is the first step in the setup.

Measured quantity

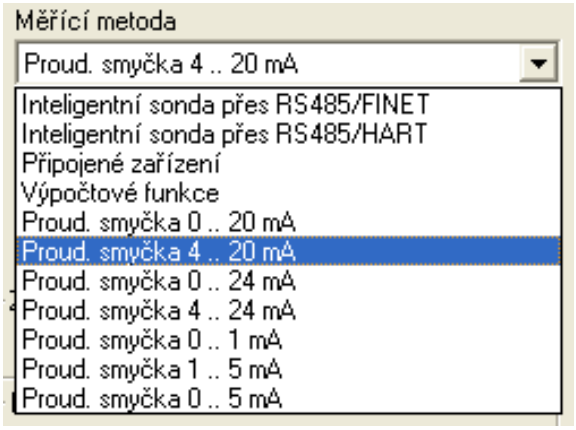
The selection of the measurand from the offered list must be the second step, because the list of offered units of measurement and the list of measurement methods depend on the selected measurand.

Measuring method

In the list of measurement methods, you need to select the appropriate signal type of the connected probe. For example, when measuring the level in a VDJ with a submersible pressure transducer with standard current output, select the method "**Current. Loop 4-20 mA**". When measuring flow with a propeller water meter using an OPTO or REED sensor, select the "**Pulse**" measurement method.

The measurement method called "**Calculation Functions**" has an important place in the Hydro Logger H1. With its help, it is easy to monitor the continuously calculated moving sum or moving average for a configurable time interval on a

separate channel and to activate an SMS alert according to this calculated value. It is usual that the archiving of this auxiliary channel is suppressed (see below). Other methods in the "Calculation functions" menu include, for example, the sum or difference of two channels.



RS485 Very often, measuring probes and sensors are connected to the telemetry station via the RS485 serial communication interface. With this method of communication between the station and the sensor, it is necessary to set the communication address of the sensor and the number of the internal measurement channel for the desired physical quantity (see overview table on the following page) in addition to the appropriate measurement method.

The measurement method "**Intelligent probe via RS485/HART**" is set for probes from BD Sensors s.r.o. equipped with RS485 interface.

The measurement method "**Intelligent probe via RS485/FINET**" is set for FIEDLER probes and sensors equipped with RS485 interface.

Units Some quantities, such as pressure or flow, have a rich list of units in which the desired quantity can be measured, archived and displayed. Other quantities, such as rainfall or battery voltage, offer only one set of units.

Number of decimal places An important parameter for determining the resolution of each monitored variable is the number of decimal places with which the measured variables are to be archived in the selected units of measurement. A higher number of decimal places is at the expense of the allowed range. An inappropriate choice of the number of decimal places may cause the maximum range to be exceeded, resulting in 'clipping' of out-of-range values.

The maximum possible magnitude that the measurand can take is 65535 for integers and it decreases decade by decade as the number of decimal places increases. Bipolar quantities such as temperature or voltage have half this maximum possible value. This "limitation" results from the 16 bit archiving of the measured instantaneous values.

The relationship between the number of decimal places and the allowable range of the monitored variable can be seen in the following table.

Tab. 1Maximum range of archived values

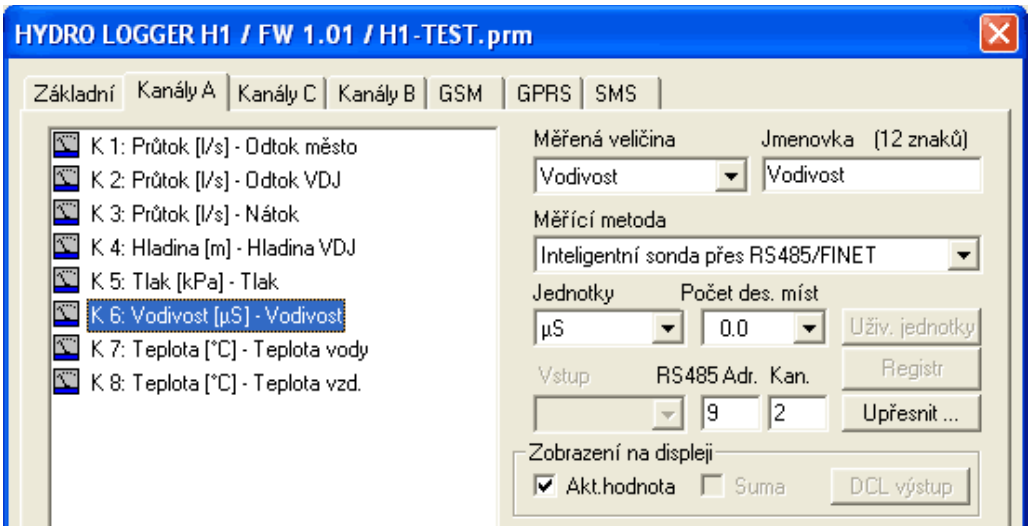
Number of decimal places	Resolution	Range of unipolar quantity	Range of bipolar quantity
0	1	0 ... 65535	-32767 to 32767
1	0,1	0,0 .. 6553,5	-3276.7 to 3276.7
2	0,01	0,00 .. 655,35	-327.67 to 327.67
3	0,001	0,000 .. 65,535	-32,767 to 32,767

Name tag

The twelve character long name of the channel being set will be transmitted with the data to the server, in SMS message format, and will be displayed on the display and when the archived data is retrieved.

Access This parameter determines which terminals (which input) will be used to connect the sensor. As mentioned in chapter. 4.4 on p. 28, the Hydro Logger H1 has four pulse inputs PV1 to PV4 and two current analog inputs AV1 and AV2.

RS485-address and channel setting If you select the measurement method "**Intelligent probe via RS485/FINET**", the MOST program will require the "**Address**" and "**Channel" parameters to** be set instead of the "Input" parameter. These parameters are necessary because the RS485 serial interface allows several measuring probes to be connected to a single RS485 data pair, but they must have different custom communication addresses set beforehand.

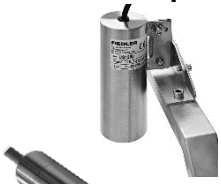


6.3.2. Overview table of frequently connected sensors and probes

In the table starting on the following page you will find selected types of various sensors equipped with RS485 interface together with information about the set basic communication address, type of communication protocol, required minimum supply voltage and occupancy of individual measuring channels by the measured quantity for individual probes and sensors.

Communication address If multiple probes of the same type or probes with the same communication address are required to be connected to one H7 unit, it is necessary to pre-set a unique address for each probe in the network using appropriate software and hardware, or order this service from the H7 probe and station supplier.

Addresses and measurement channels of sensors and transmitters with RS485 output








Type Sensors	Address	Unap* [V]	FINET*** MODBUS		Channel	Measured variable	Resolution	Units
Water level sensors								
US1200 ultrasonic hunger sensor.	5**	12	✓	✓	K1	Level (1200 mm from probe = 0 mm)	1	mm
					K2	Air temperature	0,1	°C
					K3	Book now	-	-
TSH22 pressure level sensor	14	6	✓	✓	K1	Level	1	mm
					K2	Water temperature	0,1	°C
					K5	Level only at t> 0°C (from FW 1.05)	1	mm
PSH30 float hunger sensor.	15	6	✓	✓	K1	Level	1	mm
					K2	Book now	-	-
					K3	Temperature inside the sensor	0,1	°C
Water quality sensors								
PH485 pH meter	6	6	✓	✓	K1	pH	0,01	pH
					K2	Water temperature	0,01	°C
					K3	pH not temperature compensated	0,01	pH
					K4	Electrode voltage output	0,01	mV
ORP485 redox meter	7	6	✓	✓	K1	Redox potential	0,01	mV
					K2	Water temperature	0,01	°C
ISE485 chlorine dissolved sensor	7	6	✓	✓	K1	Dissolved chlorine	0,01	mg/l
					K2	Water temperature	0,01	°C
					K3	Electrode voltage output	0,01	mV
ISE485 ISE electrode	7	6	✓	✓	K1	Electrode voltage output	0,01	mV
					K2	Water temperature	0,01	°C
ESP11 pH meter	6	12	✓		K1	Water temperature	0,1	°C
					K2	pH	0,01	pH
ESK11 oximeter	8	12	✓		K1	Water temperature	0,1	°C
					K2	Dissolved oxygen	0,01	mg/l
ESV11 conductivity sensor	9	8	✓		K1	Water temperature	0,1	°C
					K2	Conductivity linearly temperature compensated	1	µS/cm²
					K3	Conductivity of non-linear comp. EN27888	1	µS/cm²
					K4	Conductivity without temp. comp.	1	µS/cm²
Temperature and humidity transmitters and sensors								
TEP1	11	6	✓	✓	K2	Temperature, Pt100-A sensor	0,01	°C
TEP06	4	6	✓		K1-K6	Temperature on channel K, Pt100-A sensors	0,01	°C
RVT11 **RVT13** humidity and temperature sensors	11	6	✓	✓	K1	Relative humidity	0,1	%
					K2	Air temperature SHT (RVT01,RVT11)	0,1	°C
					K3	Air temperature Pt100 (RVT11) Dew point temperature (RVT13)	0,01	°C

** The Unap voltage magnitude represents the smallest supply voltage magnitude at which the sensor can still operate reliably. The maximum permissible supply voltage is greater than 15 V for all sensors listed in the table (they can be powered directly from the Unap terminals).*

*** US1200 sensors manufactured before 2008 have communication address 1.*

6.3.3. Alarms

Hydro Logger H1 allows you to set limit and steep alarm parameters for each channel. After activating the alarm, it is possible, for example, to record measured values more frequently (even on other channels) and to send warning SMS or to change the interval for sending data to the server.

Limit alarm The setting limits define the area in which the measured value can move. A drop in the instantaneous value below the *Lower Limit* reduced by the *Hysteresis* or, conversely, a rise in the instantaneous value above the *Upper Limit* increased by the Hysteresis will cause an immediate activation of the limit alarm. The alarm can only be switched off again after the instantaneous value has returned to the permissible range narrowed on both sides by the value of the *Hysteresis* parameter. The following figure illustrates these relationships:

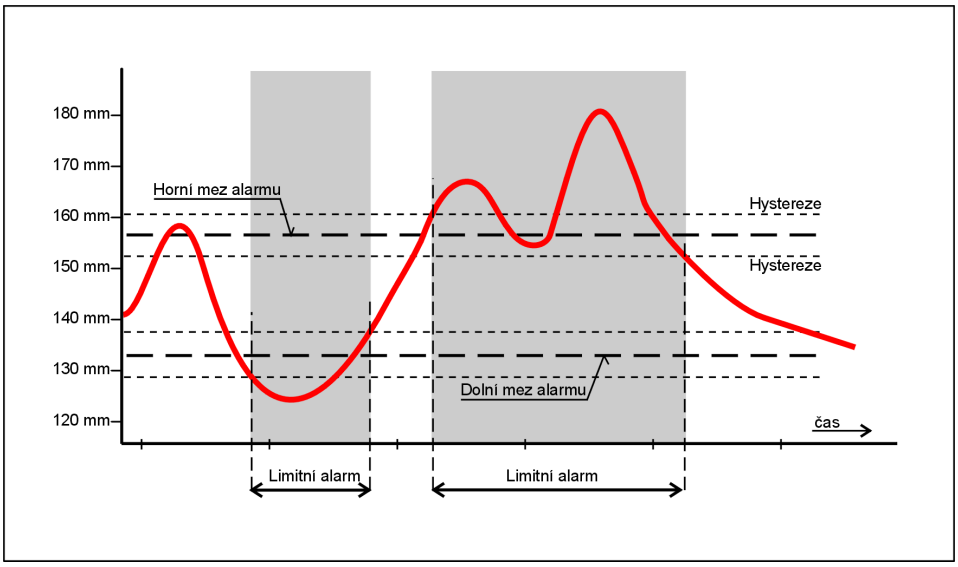


Fig. 1Limit alarm

To remember: A value within the limits is OK, an alarm occurs when the limits are exceeded by a hysteresis.

Steep alarm The steep alarm requires the input of a single parameter. This parameter is called the *Steepness Limit* and its value indicates the maximum allowable change in the monitored variable over the archiving interval. If this parameter is exceeded, either by an increase or decrease in the monitored variable, in a time less than or equal to the set archiving interval, a *Steep Alarm* will be activated on the channel.

6.3.4. Archiving

Each recording channel of the instrument has its own **Archiving Interval**, adjustable in multiples of the **Basic Archiving Interval** (it is located in the 1st tab of the parameters "Basic parameters" and is usually set to 10 min.). Less important quantities can therefore be recorded at a longer interval (e.g. 1 hour) and thus save both data memory and the time required for transferring the measured data to the server.

Remark: *Since the Archiving Intervals are stored in the instrument parameters as multiples of the Basic Archiving Interval, a change of this Basic Interval will be reflected in all Archiving Intervals for individual recording channels.*

Archiving suppression

A zero value of the "Archiving interval" parameter will exclude the set channel from archiving. This can be preferably used for those channels that are to be used only for activating SMS alerts.

SETTING THE NUMBER OF MEASUREMENTS

The number of samples from which the final value for archiving will be calculated using the weighted average method can be set by combining the *Basic Archiving Interval* and the *Archiving Interval* for each recording channel.

Averaged value storage

Hydro Logger performs one measurement on all set channels at the interval specified by the *Basic Archiving Interval* parameter. If this parameter is the same as the Archiving Interval of the measuring channel, this one measured value is stored in memory at the end of the archiving interval. However, if the *Basic Archiving Interval* is set to e.g. 10 min. and the *Archiving Interval of* the measuring channel to 30 min., the average value calculated from 3 measured samples is stored in the memory of the instrument every 30th minute.

The parameter settings can be seen from the following examples of settings:

Example A: Storing the current value measured at the end of every 30th minute

Basic archiving interval = 30 min

Archiving interval = 30 min

Example B: Store every 60th minute the average value of 6 measurements.

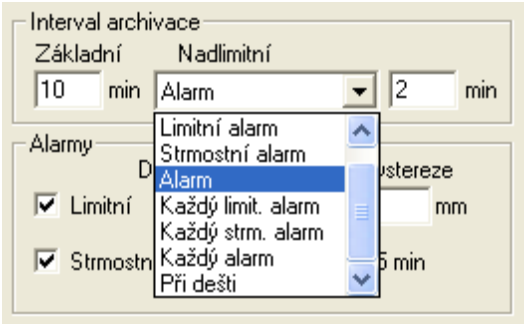
Basic archiving interval = 10 min

Archiving interval = 60 min

Warning:

Shortening the "Basic Archiving Interval" parameter below 10 minutes results in faster battery drainage, so set this parameter value judiciously. This note becomes less important when using an external power supply.

OVERLIMIT ARCHIVING INTERVAL



The figure shows the triggering conditions for the over-limit archiving interval. Setting it allows you to record in detail the progress of the incident on the measurement channel.

The overlimit interval (2 minutes in the example in the picture) can be triggered not only by activating an alarm on the channel itself (in the picture), but also by an alarm on another set channel (conditions "Every ..."), or by the start of rain and then, for example, to record minute-by-minute rainfall and thus actually capture the intensity of rainfall during one rain.

Suppressing the recording of unimportant data

Appropriate setting of the archiving parameters allows, for example, to suppress the recording of uninteresting low values of the measured variable and to store only values that exceed the set limit.

Example 1: Only store values greater than 30 ºC when measuring temperature

Basic archiving interval = 10 minutes (in the basic parameters window)

Archiving interval = 0 (in the channel window)

Limit alarm set (Lower limit = 0, Upper limit = 28, Hysteresis = 2)

Over limit trigger condition: limit alarm

Archiving interval overlimit value = 2 minutes

Example 2: When measuring the level, record detailed values greater than 160 mm

Basic archiving interval = 1 min (in the basic parameters window)

Archiving interval = 5 min (in the channel window)

Limit alarm set (Lower limit = 0, Upper limit = 155, Hysteresis = 5)

Over limit trigger condition: limit alarm

Archiving interval overlimit value = 1 min

The overlimit interval is specified in minutes and cannot be greater than the value of the base Archiving Interval.

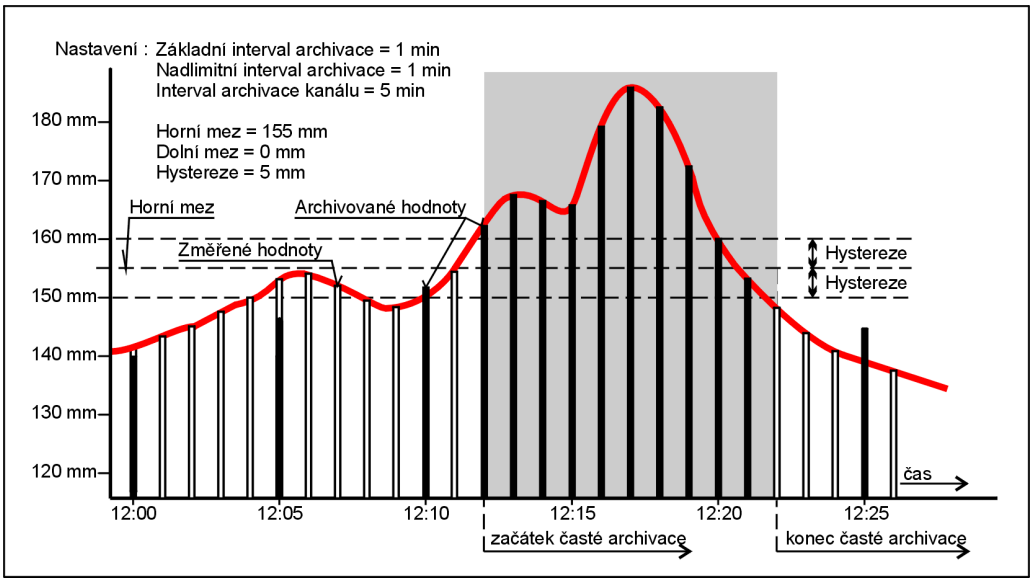


Fig. 2 Detailed record of the measured variable using the Over-Limit Archiving Interval.

Note: The trigger condition for going to the "Over Limit Interval" archiving of a given channel can be a Limit or Gradient alarm on the channel itself, or a Limit or Gradient alarm on any other channel. A special trigger condition for an "Over Limit Interval" may also be the start of rain (first flip of the boat rain gauge)

6.3.5. Advanced parameters

An important step in setting up a recording channel is to call up a window with advanced parameters. The shape of this window and the type of parameters it contains depends on the selected measurand. For example, there is a different window for setting up a flow measurement in an open profile, and another, much simpler window for measuring temperature. The setting of advanced parameters for some measured quantities will be explained by examples.

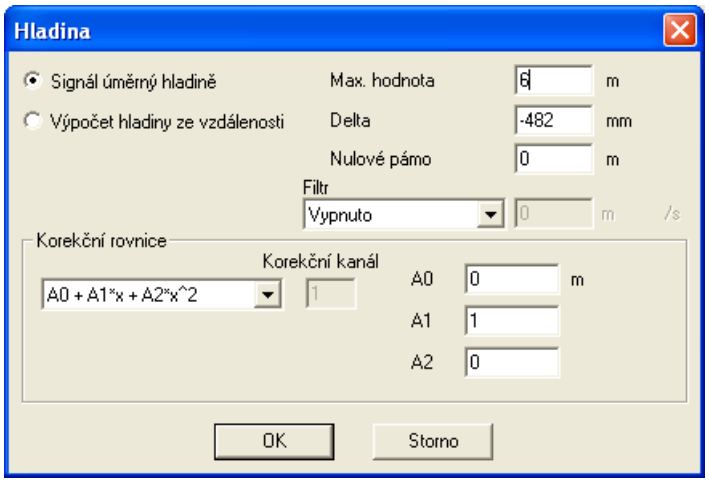
EXAMPLE 1.: MEASURING THE LEVEL

Most commonly, the level is measured with a pressure dipping probe or an ultrasonic probe placed above the maximum level.

Output signals

The output signal of the probes is either a 4-20 mA current output (0-20 mA, 1-5 mA) or an RS485 serial interface. Depending on the type of output signal, select the "Measurement method" parameter and set the Input number or address for RS485 communication.

After pressing the "Advanced" button, a window opens with parameters that define the measuring range, zero offset and possible correction coefficients for calculating the level.



Signal proportional to level

Use the first option "Signal proportional to level" for most probes. You only need to set the level vs. distance calculation for older US1000 ultrasonic probes, which sent the distance of the level from the probe instead of the level.

Max. value

This parameter is set for probes with current output, where the parameter value corresponds to the maximum possible measuring range of the probe. Therefore, for a pressure probe with a measuring range of 0 to 6 m of water column (corresponding to an output current of 4 to 20 mA), set the parameter Max. value = 6 m.

The Max. value parameter is set for ultrasonic probes type US1200, which send the already measured level directly in mm.

Delta

This parameter can be used to scroll the zero level value. The additive coefficient A_0 of the correction equation has the same meaning.

Zero band

The value of the parameter determines in set units the insensitivity band in which the signal will be artificially zeroed. In this way, various signal noises in the vicinity of the zero value are filtered out.

Correction equation

Finally, the measured value can be adjusted by a 2nd order polynomial. This option is retained for all measured quantities except flow and volume, where the individual parameters A_0 to A_2 take on different meanings.

Filter parameters

Blackout on

The value of this parameter determines the maximum possible change of the measured quantity in one second. A small value actually means a large dimming of the signal and vice versa. A zero parameter disables signal damping.

Error when changing o

If the measured value changes by the set limit value, the measured value will not be stored in the memory, but the corresponding error code will be stored.

EXAMPLE 2: INSTANTANEOUS FLOW MEASUREMENT

The setup window for flow measurement is similar to the one described in the previous chapter and therefore only new parameters or those that have a different meaning will be described here.

Signal proportional to flow rate

This option must be selected, for example, for a signal from an inductive flowmeter. The parameter "Max. value" must correspond to the max. range of the flowmeter.

When measuring the flow in open channels with a built-in gauge profile, the relationship between the level in the gauge profile and the instantaneous flow is used.

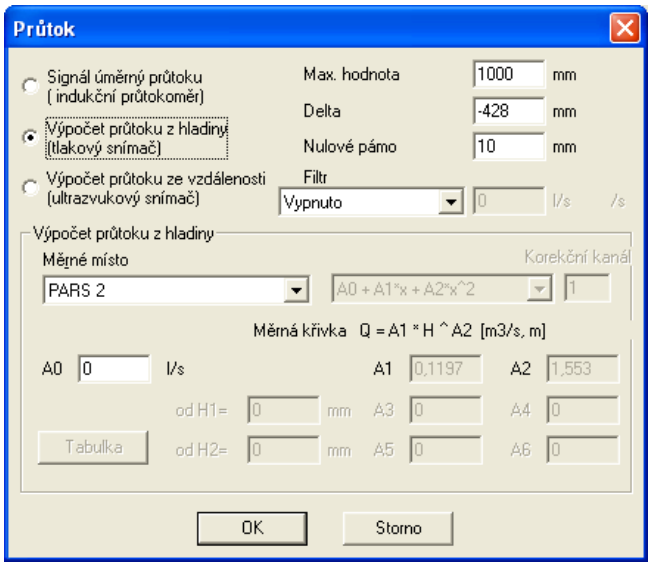
Calculation of the flow rate from the surface

Pressure probes and most ultrasonic probes have an output signal proportional to the level and therefore the "Calculate flow from level" option must be selected for measurement, not only for pressure submersible level transducers, but also when installing a US1200 ultrasonic transducer or when installing a MICROFLEX ultrasonic probe.

In contrast to the level measurement described in the previous window, the Delta parameter can no longer be replaced by the additive coefficient A0, because it is entered in the set flow rate units, whereas Delta is always intended for zero level displacement.

Measuring point

The list of measuring points shows the 14 most frequently occurring profiles for measuring instantaneous flow in an open channel with predefined coefficients of the consumption equation.



This menu is supplemented by the possibility of custom setting of the coefficients of the consumption equation A0 to A2 (optional profile) and the tabular input of the dependence between level and flow.

The consumptive equation is most often of the form :

$$\text{Flow} = A_1 * \text{Level}^{A_2} \quad [\text{m}^3/\text{s}, \text{m}]$$

If necessary, it can be supplemented with the additive coefficient A_0 . In the case of more complex composite gutters, additional auxiliary coefficients A3 to A6 and the heights of the built-in gutters H1 and H2 are added to the above coefficients (see figure on this page).

Table

There can be two tables (for two different measuring channels) and they are used to record the tabular relationship between the level height [mm] and the value of instantaneous flow [l/s]. Table 1 has 30 rows and Table 2 has 20 rows.

Only integers in the range from 0 to 65535 can be written to the tables. If the flow rate with a resolution of e.g. 2 decimal places is to be stored in the table, then the flow rate 100 times greater without decimal point is entered into the

individual rows of the table and the value 0.01 is set into the multiplicative coefficient A1 of the correction equation, thus the calculated flow rate is reduced back 100 times to the correct value.

EXAMPLE 3: RAINFALL MEASUREMENT - WARNING SYSTEM

H1 supports the connection of a rain gauge (e.g. SR02 or SR03 rain gauges). The rain gauge can be connected to one of the slow pulse inputs PV3 or PV4.

When setting the parameters of the channel recording the collisions (or even another channel reading the occasionally arriving pulses), the user has a choice between two recording options - to record the number of pulses in the archiving interval or the time of each pulse. The choice of variant is made by selecting the measurement method (Pulses or Pulse Time). It is also possible to record pulse times on one channel and the number of pulses per archiving interval (usually 1 minute) on the other channel. In this case, however, it is necessary to connect in parallel the two pulse inputs to which the rain gauge is connected and to allocate one of the inputs to each method.

Option to record each pulse

The exact flip time of the rain gauge measuring cell with a resolution of seconds is recorded on the channel with the measurement method set to "Pulse Time". The MOST program can read data from a recording channel set in this way and save it in a table and in a data file.

Fixed interval variant

The second, more common variant records at the end of the archiving interval the amount of measured rainfall in mm that fell during this interval (the calculation of rainfall in mm is done automatically in the station as a multiple of the number of pulses and the weight of one pulse in mm). As the intensity of the rain is also of interest, the unit automatically switches to a condensed recording after the first pulse with one minute of data stored in memory until the rain stops (the set number of minute intervals without pulse ends the rain).

When setting up this method of recording rainfall, select the measurement method "Pulses" and change the trigger condition for the overlimit archiving interval from "Never" to "When it rains". Set the overlimit interval to 1 minute. Then set the parameter "Pulse weight" in the advanced menu according to the rain gauge used.

The parameter "Pulse weight" depends on the type of connected rain gauge. A well set up SR02 rain gauge with a collection area of 200 cm^2 has a pulse weight calibrated by the manufacturer to 0.2 mm/pulse, the SR03 rain gauge has a pulse weight of half, i.e. 0.1 mm/pulse and is therefore more suitable for accurate measurements of even very low rainfall totals.

Calibration of the rain gauge in field conditions

The boat rain gauge can be individually calibrated - to determine its actual pulse weight - and set to the station. Calibration can be done in various ways, the simplest method is to drip a pre-measured amount of water through the rain gauge, for example through a small hole in a plastic bottle (remembering to include a second air hole) and then calculate the pulse weight from the measured number of pulses, the volume of water and the area of the rain gauge.

*Pulse weight [mm/pulse] =10 * water volume [ml] / (number of pulses * precipitationarea [cm^2]).*

Example: *750 ml of water flowed through the SR03 rain gauge with a 500 cm area^2 and the unit read 147 pulses. After being inserted into the sample:*

*Weight pulse = 10 * 750 / (147 * 500) = 0.102 mm/pulse*

Number of archiving intervals for rain termination

The long name of this parameter describes its meaning. If no pulse occurs during the set number of truncated archiving intervals, the rain will be declared complete. The end of the rain must be set in order to determine the start of the next rain and to allow the unit to return to the base archiving interval. From the start of each rain (first pulse) H1 automatically calculates the amount of rainfall in mm into a sum called "SS" and if the preset limit is reached, the station can send a warning SMS. SMS messages are covered in the chapter 6.8.

More warning SMS

Sending a warning message regarding rainfall (but also, for example, the number of pulses of the propeller flow meters) can also occur when other reasons are reached:

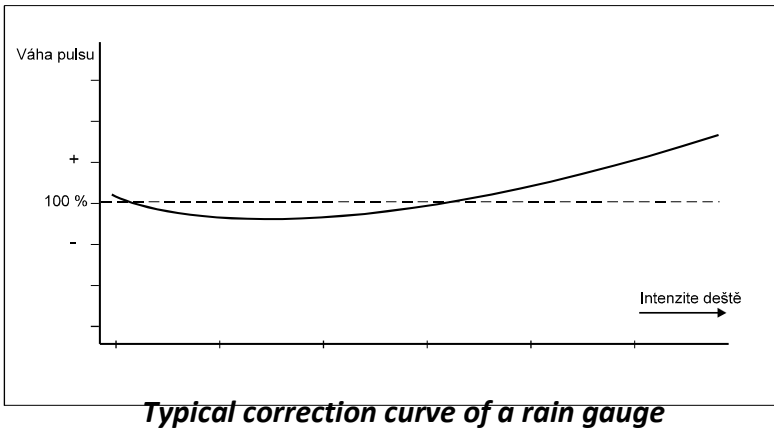
1. The magnitude of precipitation in the current archiving interval exceeds the limit [mm].
2. The running total of rainfall continuously calculated for the last X minutes exceeds the set level [mm].

DYNAMIC CALIBRATION OF THE RAIN GAUGE (LOGGER H2)

Calibrating the rain gauge at different rain intensities can reduce the error of the measuring boat, which fills differently in dripping water and in heavy rainfall, when water flows into the boat in an unbroken trickle. The calculation of rainfall using the dynamic calibration table is only included in the Logger H2 software.

Relationship between pulse weight and rainfall intensity

The figure shows that from a certain intensity of rain the weight of each pulse (the amount of water needed to turn the boat over) increases. Logger H2 is able to monitor the instantaneous rain intensity according to the time interval between each pulse and then calculate the actual pulse weight from the correction table.



Typical correction curve of a rain gauge

LEVEL LOGGER H2 CALIBRATION TABLE

When calibrating the rain gauge, the Logger H2 calibration table must be populated with pulse weights for different rain intensities (different peristaltic pump flow rates when calibrating the rain gauge). The pulse weight and the time between pulses form the columns of the calibration table.

When it rains, the Logger H2 then calculates the actual "Pulse **Weight**" in mm of rainfall using the table and the measured interval between each pulse of the tilt of the attached rain gauge.

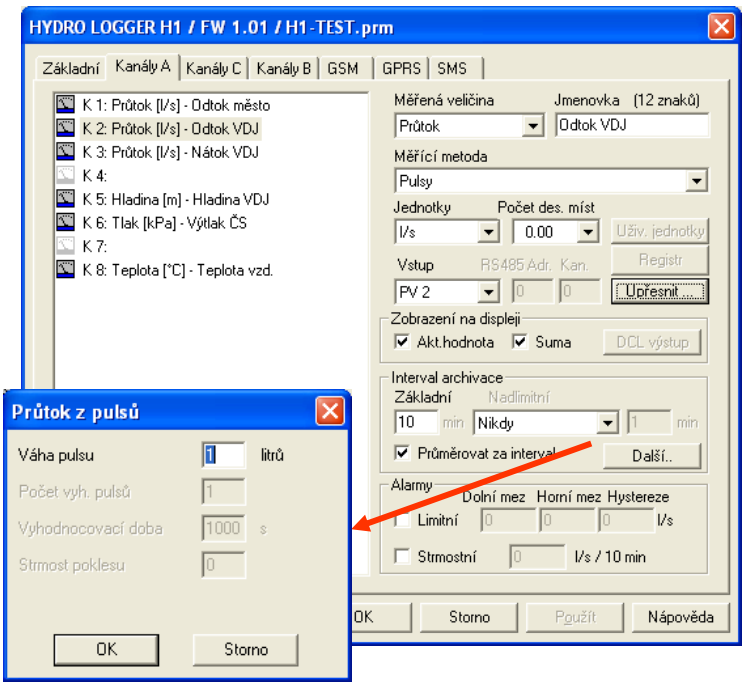
EXAMPLE 4: CALCULATING THE FLOW RATE FROM THE PULSES

In practice, the leakage volume is very often measured by propeller flow meters equipped with speed sensors. Up to 4 such sensors can be connected to the H1 station.

REED and OPTO speed sensors

OPTO or REED sensors can be connected to pulse inputs PV1 or PV2, which have integrated HW counters. Inputs PV3 and PV4 are only used to connect "slow" REED sensors or can be used to monitor a binary variable (e.g. flooding of the object, entrance to the object, etc.).

For all types of sensors it is necessary to ensure that the output of the sensor has an open collector or potential-free contact - all PV inputs of the station are activated by connecting the input to ground (GND).



Settings

When setting up First select the free channel, then the measured quantity (flow), the measuring method (pulses) and the units of measurement (l/s). The number of decimal places is selectable, as is the channel nameplate. As an example, the parameter side window can be used.

After selecting refine, MOST prompts you to enter another parameter: pulse weight.

Pulse weight

The value of this parameter expresses the weight of one pulse in liters. The usual pulse value for REED sensors is 100l (10l) and for OPTO sensors 1l (2l, 4l).

INSTANTANEOUS FLOW AND LEAKED VOLUME

The Hydro Logger H1 continuously calculates the instantaneous flow rate (usually in l/s) from the pulse weights and their frequency, which it displays in cyclic mode on its display.

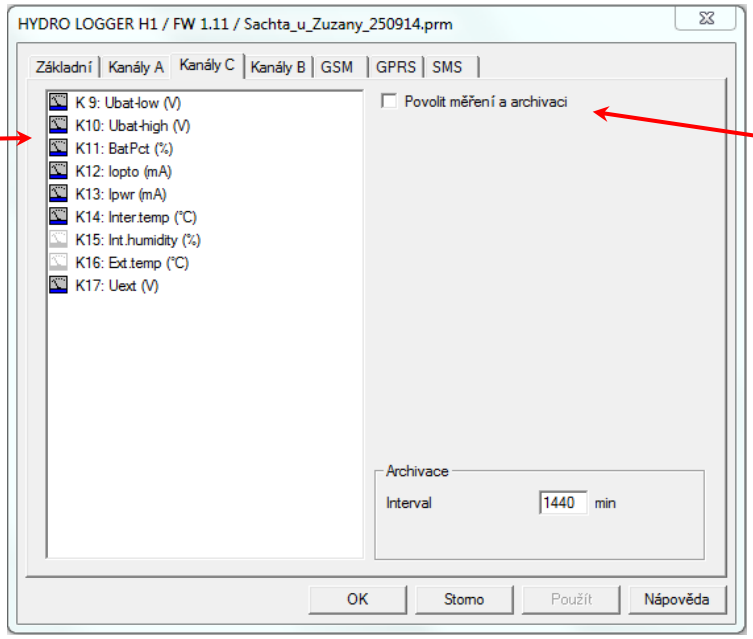
When calculating the leaked volumes, the number of pulses measured during the set archiving interval and the pulse weight are continuously stored in the unit's data memory. The size of the total leaked volume (usually expressed in m^3) is calculated from the weight and the number of pulses and is displayed on the unit display below the instantaneous flow rate. The total leaked volume is continuously calculated from the installation of the station or from the initialization of a given recording channel.

If the telemetry station uses Datahosting on the manufacturer's server, the daily and monthly leaked volumes in the form of tables, graphs and monthly summary reports are also available to authorised clients on this server.

6.4. Control channels

The Hydro Logger H1 contains 9 control channels K9 to K17 that monitor instrument operating parameters such as the capacity of the power battery, temperature and humidity inside the instrument, the magnitude of the external power supply voltage and the readings of connected sensors and probes.

Fixed preset control channels. Any control channel can be switched off or on for measurement and archiving.



Check this option to enable measurement and archiving of the selected control C-

The user has the option to enable/disable the selected control channel and set a common archiving interval. Usually this interval is set to 1440 min (=1 day) in order not to increase the volume of archived data too much.

Channel	Measured variable
K9. Ubat-low [V]	Unloaded lithium battery voltage (I=5 mA). Measurements are taken at 24 hour intervals or after each data session to the server.
K10. Ubat-high [V]	Voltage of the loaded lithium battery (I=100 mA). Measurements are taken at 24 hour intervals or at the end of each data session to the server.
K11. BatPct [%]	Capacity of the power battery calculated from the difference of Ubat-high and Ubat-low.
K12. Iopto [mA]	The amount of current drawn from the Uopto power terminals (terminals 15 and 18). Externally powered OPTO sensors are usually connected to these terminals. Since the power supply to the sensors is continuous, the current draw of the sensors should not exceed 0.1mA so as not to reduce the operating time from a single power battery.
K13. Ipwr [mA]	The amount of current drawn from the Unap power terminals (terminals 3, 6 and 10). Analog sensors with 4-20 mA output or probes communicating via RS485 serial interface are connected to these terminals. The power supply to external sensors and probes is only momentary for the duration of the measurement of the monitored quantities.
K14. Inter.temp [°C]	Temperature inside the device.
K15. Int. humidity [%]	Relative humidity inside the instrument. A value above 80% indicates a violation of the instrument's tightness and may lead to damage to the electronic circuits in the long term. An RH sensor is not standard with the instrument.
K16. Ext.temp [°C]	Temperature measured by external temperature sensor
K17. Uext [V]	External supply voltage at terminals 1 and 2. Internal lithium. The battery is automatically disconnected and the power supply to the instrument switches to the external power supply when the voltage exceeds 8 V at terminal Uext

6.5. Binary channel settings

A total of 8 binary channels are ready to record the state on binary input PV1 to PV4. Both switching on and off of a potential-free contact or an open-collector output of a connected sensor can be recorded. The change of state of the binary channel is stored in the unit's memory with a resolution of 1 sec.

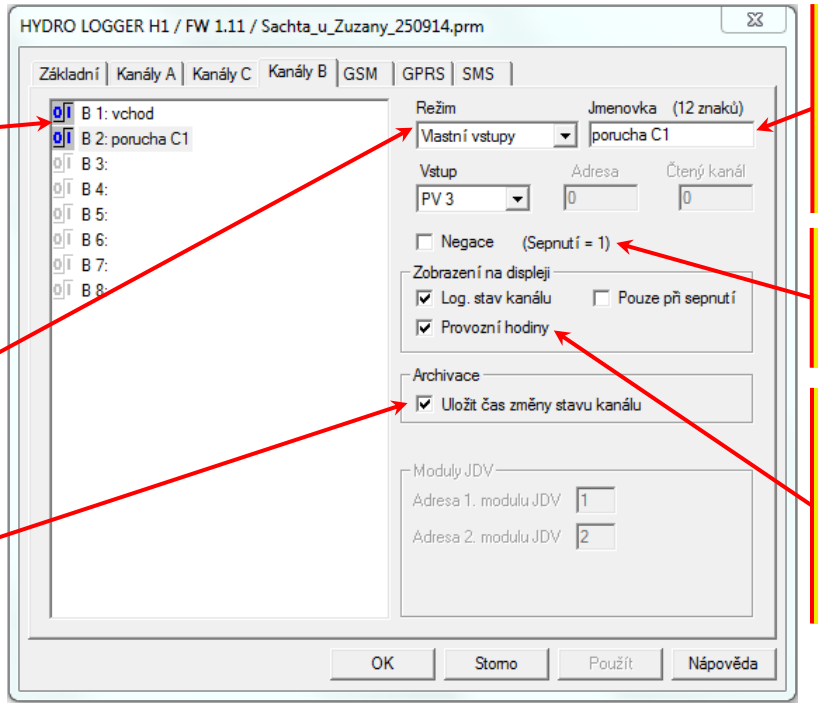
By pressing the right mouse button over the selected channel you can copy, paste or delete its parameters

The Mode option offers the following options:

***Own inputs:** (PV1 to PV4)*

***Read from device:** binary channel states of the connected device.*

Do not set for inputs that change state frequently



Channel name will be displayed on the display and in SMS (diacritics will be automatically suppressed before sending

You can change the stored variable from ON to OFF when the input is switched on

Operating hours (switch-on time) with resolution to minutes can be displayed on the H1 display and are also transferred to the database on

Channel nameplate This parameter has the same meaning as for analogue channels, i.e. it is displayed on the display, appears in the text of the SMS message and is transmitted together with the measured values to the PC and the server for further processing.

Custom inputs The "Custom Inputs" mode, allows to select the binary input to which the monitored signal is connected in the following parameter "Input". The H1 has a total of 4 inputs connected to the terminals of the connection board. The first two inputs PV1 and PV2 have an integrated HW counter and are therefore mainly used to monitor the instantaneous flow from connected pulse water meters. Inputs PV3 and PV4 are for connection of "slow" pulses from the rain gauge or binary signals (monitoring of building entry, float switch status, motor operation, pump failure, etc.).

Negation The binary input is inactive in the normal state. When the input is connected to a ground terminal (relay contact, open collector), the input is activated and a logic one is recorded in memory along with the time and date of the switching. When the pulse ends and the input returns to its normal state, a logic zero is stored in memory. In some cases, it may be appropriate to swap the logic symbols so that a logic zero is stored at the beginning of the pulse and vice versa. For these cases, the "Negation" option is available.

Save channel state change time Option for recording state changes on binary channels. Disconnection or disconnection of a contact, breach of security of the object and other reasons leading to a change in the state of one of the binary inputs will be recorded in the memory of the station immediately after the event occurs, including the date and time with a resolution of seconds. The *Basic Archiving Interval* parameter does not apply to binary channels.

6.6. GSM parameters

This tab contains parameters related to SMS communication, including access to SMS phonebook settings.

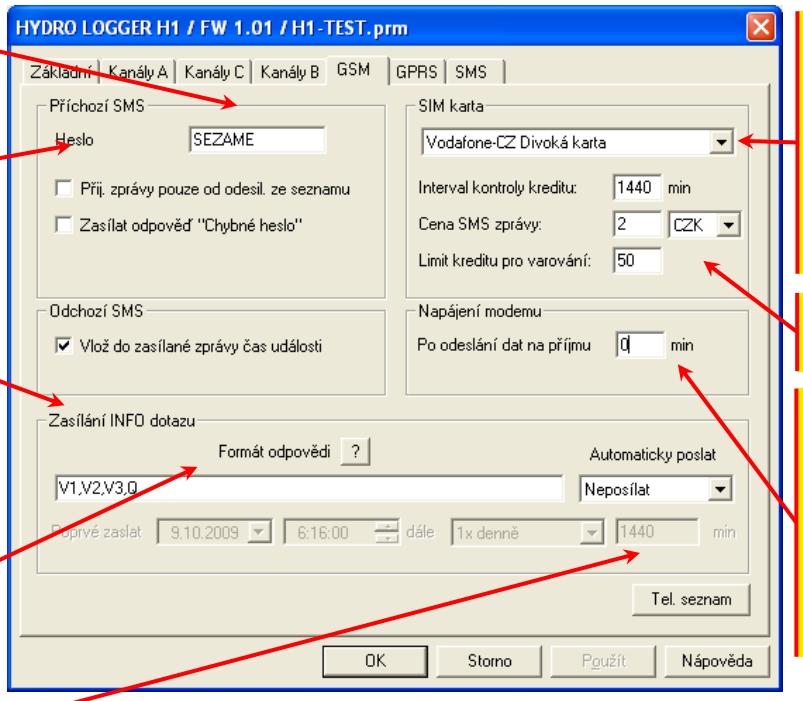
Password for query SMS (made of query codes)

Check if you want the communicator to reply only to users listed in the phone book

A command line according to which the unit composes an SMS message and sends it to the number from which the INFO request was sent. Do not set more than 6-8 commands as the SMS length is limited to 160

You can set the time and day of the week you wish to receive informative SMS

Access to a user-modifiable phone book.



Depending on the SIM card you are using, select the operator and card type from the list. This option is used to periodically check the credit amount of

Specifying credit check parameters.

After sending the data to the server, the GSM module can remain logged in for a short period of time for data calls or for receiving and sending SMS

Establishing credit

Recently, the formerly widely used prepaid credit SIM cards have taken a back seat and the use of flat-rate SIM cards, which usually include a certain amount of free data, has become more widespread.

For this reason, and also because the information about the remaining credit on the prepaid SIM provided by the operator often changed in the form and structure of the informative SMS, the device's FW stopped supporting the automatic calculation of the remaining credit on the prepaid SIM card. Therefore, if the user selects an option other than 'General flat rate card' in the device parameters for the SIM card type, the calculated remaining credit will most likely not correspond to reality.

The other GSM communication parameters can be left in the basic settings except for the command line for setting the content of the periodic or informative SMS. This command line should be set according to the actual channel occupancy and the requirements of the station operator. The list of codes used in the command line is given in the table on page 2. 65.

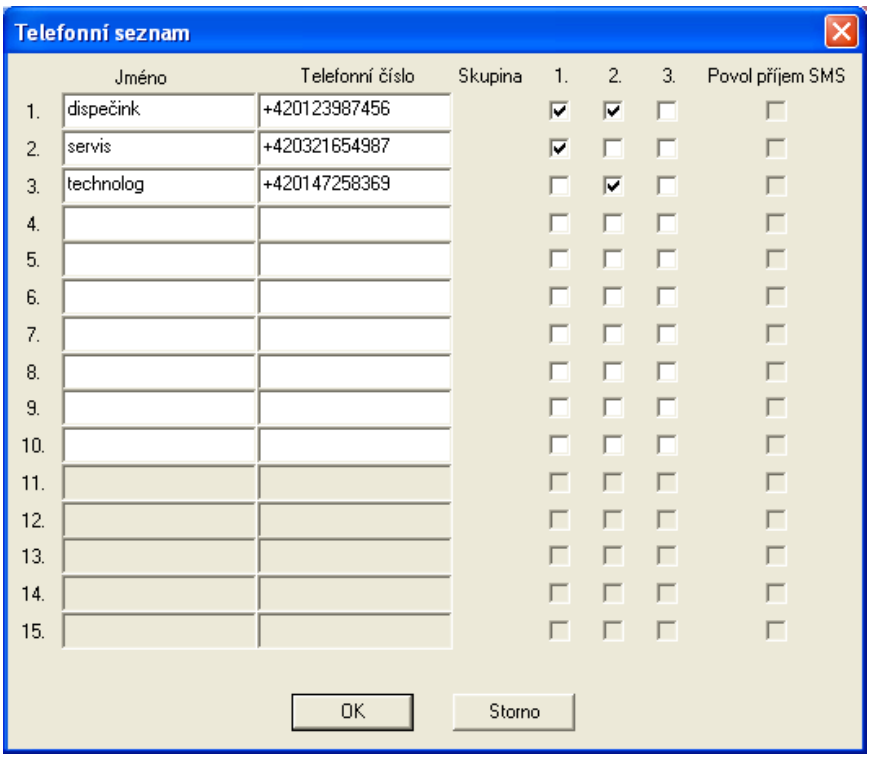
Note: The Hydro Logger H1 will also respond to incoming SMS containing individual codes separated by commas after the password.

The meaning of other parameters will be explained in chapter 6.8.3. "List of query and control codes**" on page 65.**

6.7. SMS communication

LIST OF AUTHORISED PERSONS

The basic settings of the GSM parameters include the creation of a list of persons to whose mobile phones warning or informative messages should be sent. The window with the phone list opens after pressing the "**Phone list**" button in the "GSM" parameters tab.



Group You can direct the sending of a specific message to a group of people, who will be sent the message sequentially according to the order in the list. You can create up to 3 groups of people in the list.

6.8. SMS distribution

This chapter will describe the setting parameters and SMS types that can be divided into basic categories:

SMS sent from the station	SMS received at the station
Informative SMS	Inquiry SMS
Warning SMS	
Control SMS	Control SMS

Informative and query SMS messages have a common group of codes that determine the content of the information transmitted from the device to its operator or, conversely, the command to compose an informative SMS on the device side and send it to the interviewer.

The sent control SMS can directly control the relay in the addressed opposite station. A received control SMS, on the other hand, causes the specified command to be executed. Warning SMS messages are dealt with in a separate chapter 6.9. on p. 68.

6.8.1. Informative SMS

In this text, we will refer to informative SMS as those messages that will be automatically sent from the communicator to a group of persons or an individual on request or at a regular time, independently of the actual value of the measured variable (as opposed to warning SMS, which are activated by reaching a set limit, a fault, an alarm, etc.).

INFORMATIVE SMS SENT REGULARLY

To activate the regular sending of informative SMS messages, select the recipient in the parameters window called "Automatically send". This drop-down parameter will offer all preset recipients from the phonebook, including groups.

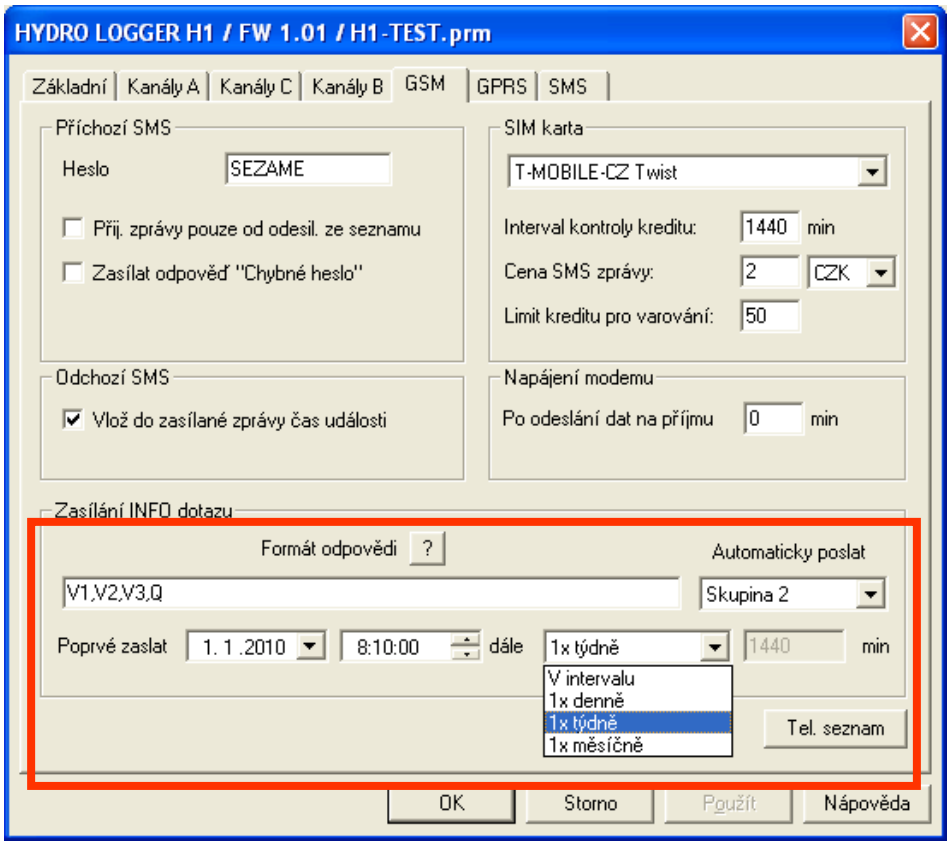
Regular sending

In the "First time send" setting window on the "GSM" tab, the time when the informative SMS message is to be sent is set. The "further" parameter determines the frequency of the message to be sent. It is possible to set monthly, weekly, daily sending or to specify any interval adjustable in minutes. In case of weekly and monthly sending, it is necessary to set the day of the week (month) when the sending should be done regularly.

From the point of view of saving battery power, it is advantageous to set the same time for GPRS communication and for periodic sending of informative SMS, because this way only one login of the Hydro Logger H1 to the GSM network takes place.

Creating an informative SMS

The content of the informative SMS is determined by the sequence of codes on the control line. The meaning of the individual codes and their overview is on the next page. The individual codes are separated by a comma, no spaces, no comma or full stop at the end:



6.8.2. Inquiry SMS

The second large group of informative messages consists of replies to incoming SMS inquiry messages. Depending on what query codes the query SMS contains, the station compiles the reply text and sends it to the interviewer immediately. The same rules apply for the composition of the query SMS as for the informative SMS.

Password: To prevent unauthorized persons from making queries, a password must be included at the beginning of the query SMS. This password is accessible to the user in the "GSM" tab.

INFO query A specific query SMS consists of a short message containing only one word "INFO". This can be written in lower case and must not be preceded by a PASSWORD. The device responds to the received INFO query with a message composed according to the codes contained in the control line.

6.8.3. List of query and control codes

Hydro Logger H1 does not distinguish between upper and lower case

Inquiry code Control command

COMMANDS (QUERY CODES CAN BE SEPARATED BY A COMMA IN THE QUERY SMS)

Bk	The current value of the binary channel *k* (1.. 8).
MHk	Motor hours of the binary channel *k* (1.. 8).
Vk	Current channel value *k* (1.. 17).
Sik	The sum from the installation of the channel *to* (1.. 17).
SDk	The sum from the beginning of the day channel *to* (1.. 17).
SMk	The sum from the beginning of the month channel *to* (1.. 17).
SLk	Sum of the last completed day of the channel *to* (1.. 17).
SKk	Sum of the last completed month of the channel *to* (1.. 17).
SS	Sum of precipitation since the start of the rain (only for the first precipitation channel).
LVk	Last stored channel value *k* (1-17.*)*
Every	The minimum value of today's channel is *k* (1.. 17).
Xk	The maximum value of today's channel *is k* (1.. 17).
Ilk	Minimum value of the previous day's channel *k* (1.. 17).
XLk	Maximum value of the previous day's channel *k* (1.. 17).
PO	Total number of messages sent.
PP	Total number of messages received.

Q	GSM signal intensity in the range 0.. 31.
KR	The amount of credit remaining on the prepaid card.
NA	*(No Answer)* Do not respond to the receipt of a control SMS.

Warning: Inquiry SMS are received only after the device is logged into the GSM network, and therefore the response to the inquiry SMS may be significantly delayed. For the H1 station, it is assumed that the modem is switched on and data is sent to the server at an interval of once a day.

For control commands, a different password can be set from the password for obtaining information from the unit.

EXAMPLE OF QUERY SMS

PASSWORD,V3,SD3,V4,U

PASSWORD ... access code
V3 ... query for the current value of the 3rd channel (flow rate)

V2 .. . query for the current value of the 2nd channel (level)
SD3 ... query for daily sum (leaked amount) on channel 3
U ... query for the battery voltage magnitude

ANSWER: (INFORMATIVE SMS)

NAME, V1=51.12 l/s, SD3=4255.8 m3, V2=1259 mm, U=12.62 V

NAME ... name of the station (configurable parameter).

Time of dispatch The station name can be followed by the date and the current time of the unit as information about the time of transmission of the message from the unit to the operator's network. In this case it is necessary to have the option "Insert event time into the sent message" checked in the "GSM" parameters page.

6.8.4. Special characters inserted in SMS text

When setting the parameters of SMS messages from the MOST program, it is possible to place special characters in the text of the warning SMS, which the control processor either transforms into another character string or does not send the SMS and instead performs an "alarm data sending to the server".

#V	**The current** value, including the units of measure, is inserted into the text of the sent SMS.
#G	The station performs an "Alarm data upload to the server". Based on the emergency data sent, for example, warning or informative emails can be sent from the server. The setting of the emails is described in the manual "Web browser control".

6.8.5. Control SMS incoming

The Hydro Logger H1 does not contain any relays and therefore, unlike the M4016-G3, the number of control SMS is severely limited. In fact, it is only a command to immediately send the measured data to a server on the Internet.

This command is usually used to immediately rebuild parameters according to a new parameter file on the server.

HESLO,DIAL0	After receiving this command, the measured data is immediately transferred to the server via the GPRS network and, if necessary, a new parameter file is downloaded from the server to the device (no waiting for a regular data session).

Security The stations have built-in two-level security against misuse of control commands by an unauthorized person.

Password: The first level of protection consists in the presence of a HESLA, which must be used to start every command message. The password can be any sequence of up to 12i characters, separated from subsequent commands by a comma.

Security Another configurable condition for executing the command is that the phone number from which the control message was received is present in the list of stations with SMS reception enabled (if the option "Receive messages only from senders in the list" is set in the basic GSM parameters window). **In this case, the phone number must be listed with the country identification, i.e. for the Czech Republic with the prefix +420.**

Response suppression The station responds to command SMS messages with a confirmation SMS message that the command has been received and is understandable. If this confirmation SMS is not to be sent, the special command NA (No Answer) must be included anywhere in the text of the control SMS.

EXAMPLE CONTROL SMS

HESLO,DIAL0

PASSWORD ... access code (enter the actual password set on the device).

DIAL0 ... the procedure is activated to send data to the server immediately

6.9. Warning and control SMS

Automatic sending of a preset warning or control SMS can be triggered not only by exceeding the preset limit value on the measuring channel, but also by a change in the state of the binary channel, an error in the measuring signal, activation or deactivation of an alarm on the channel, etc.

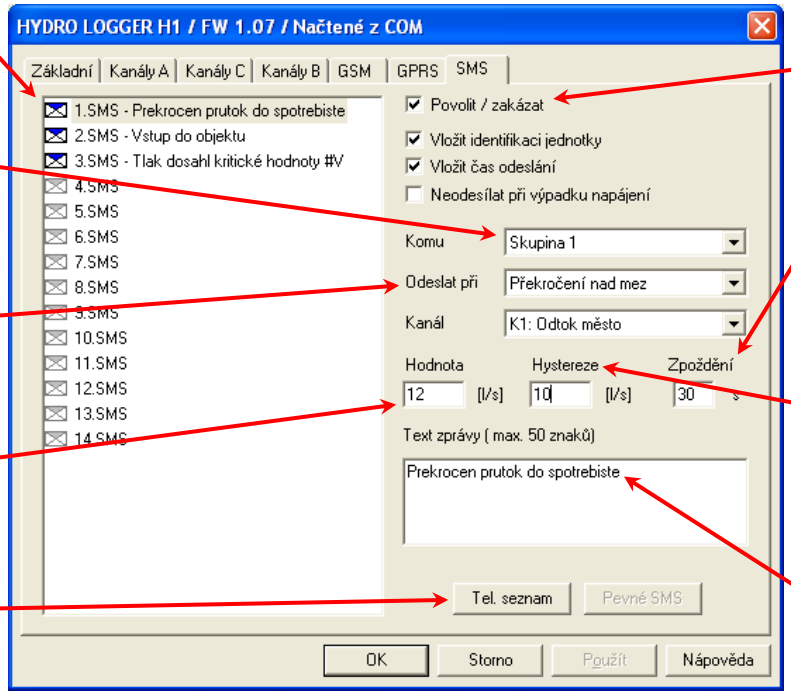
There are 14 SMS alerts

When you select a group as recipient, the same SMS is sent to each member of the group in turn

Trigger condition, after which the warning SMS is activated

Limit value, after which the warning SMS will be activated

Phonebook for 10 recipients that can be grouped together.



You can temporarily or permanently disable an SMS that you have already set up. The set parameters will be preserved.

SMS will be sent only after the continuous duration of the trigger condition

Prevents frequent sending of SMS when the variable moves around the li-

Text without accents. Special characters allow automatic insertion of the instantaneous value of the mea-

Starting conditions

The Hydro Logger H1 continuously evaluates the current measured values on both analogue and binary channels. If the value exceeds the set limit or if a binary input is switched on or off, it sends a pre-prepared SMS to selected mobile phones.

Activation by sum

For integral variables (instantaneous or cumulative flow, rainfall, number of pulses, ...), the activation of the SMS warning can also be triggered by exceeding a pre-set limit value for a certain time.

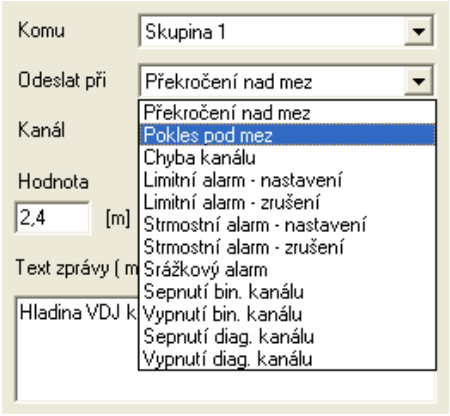
Properties of warning messages

Warning messages are the basic and most frequently used type of SMS in the communicator. The features of warning SMS can be summarized in the following points:

- The user can set the text of up to fourteen different warning messages.
- At the beginning of each alert SMS it is possible to automatically insert the name of the device sending the message and the current time in the device at the time of sending the SMS. Only then is the actual text of the message followed.

  Note: in special cases, such as sending a message to a special operator number that forwards incoming messages to e-mail, it is necessary to disable the automatic insertion of the name tag and time.
- For each message, you can select the recipient from a list of authorised persons. You can also create a group of persons to whom the SMS will be sent in turn.
- The sending of the message can be conditioned by the time period for which the activation condition of the message must be fulfilled

(overshoot, undershoot, binary state change, measurement error, alarm).



- Resending of the next warning message is activated only after the current value returns to the allowed area by at least the *Hysteresis* value and after the *Limit value* is exceeded again for the set Delay time.
- It is possible to insert the current measured value into the text of the warning SMS using the #V character pair. Not only the current measured value, but also the channel name and the set units of measurement are transferred to the SMS text.
- The text length of one SMS must not exceed 50 characters (this limit does not include automatically inserted texts - *Name tag*, time, current value).

PARAMETERS SETTINGS

The adjacent image shows an expanded menu of activation conditions that can ultimately trigger an automatic SMS alert. However, whether the SMS is sent still depends on the *Delay* parameter.

Delay This parameter is set in seconds and the activation condition must last as many seconds as the value of the parameter without interruption before sending the SMS. Even a short-term return of the input to the previous state resets the time counter and the time measurement starts from the beginning.

Activation conditions ***Alert SMS activation conditions table:***

Condition	Description
Exceeding the limit	The current value on the control channel has exceeded the *Value* parameter. For the integral variable, the SMS can be activated when the number of pulses, rainfall or flow rate in the current archiving interval exceeds the set *Value*. At the beginning of a new archiving interval, the read quantities are always reset (set the delay parameter to zero). If the "Calculation functions" method is selected from the list of measurement methods, the moving sum, moving average, sum or difference of two adjacent channels and some other special calculations can be registered on a separate channel. The calculated channel value will then be compared with the limit value of the SMS being set. The calculated values can only be used to activate the limit SMS and do not need to be archived
Decline below the limit	The current value on the selected channel drops below the size of the *Value* parameter. The same rules apply for the drop as for the overshoot.
Channel error	The occurrence of a communication error with the measuring probe connected to the channel or a detectable fault in the output

	signal of the connected sensor (current signal out of range, quantity out of the permitted range, ...).
Limit alarm - settings	The limit alarm value on the control channel has been exceeded by the set *hysteresis* - i.e. the limit alarm has been activated.
Limit alarm - cancellation	The limit alarm (return of the measured value to normal limits) has been terminated on the control channel.
Steep alarm - set.	A steep alarm value has been exceeded on the control channel.
Steep alarm - cancellation	The steady alarm on the control channel has been terminated.
Precipitation alarm	This option applies only to the first channel set to monitor rainfall. The Hydro Logger H1 continuously calculates the rainfall sum (called SS) during rain and a warning SMS is triggered if the SS sum exceeds the value of the *Value* parameter.
Binary channel switching	The control binary channel has been switched. You will be presented with a list of occupied binary channels as the control channel.
Binary channel unlinking	The control binary channel has been disconnected.
Diagnostic channel disconnection	The set limit value on the control channel, i.e. Iopto current (DG12) or Unap current (DG11), has been exceeded. The limit value is set on the first "Basic" tab of the parameters in the "Power supply and diagnostics" section.
Diagnostic channel disconnection	The measured value of the diagnostic channel has fallen below the set limit value, i.e. low battery (DG4) or external supply voltage (DG6). The limit value is set on the first "Basic" parameter tab in the "Power supply and diagnostics" section.

Channel When selecting a control channel, MOST will list all occupied channels including their names. For the last two activation conditions, a list of diagnostic DG channels is offered. Multiple limit messages can be activated with one channel.

Text The text length of one SMS message is limited to 50 characters. The text may contain commas and semicolons, but these characters are converted to non-diacritical characters when creating the SMS message. The length of the text does not include the *station name* parameter, which is usually automatically inserted at the beginning of the message, or the text with the date and time of sending.

Value The value of this parameter is the threshold for activating the SMS warning message. The value is entered in the same units of measurement that the control channel works with.

Hysteresis This parameter prevents frequent sending of the same SMS when the measured value fluctuates around the limit value. The same SMS is sent only after the measured value returns to normal by at least the *Hysteresis* value and then exceeds the limit value again. Unlike alarm or relay parameters, it is not necessary to exceed the limit value by the Hysteresis to activate the SMS message, but the SMS is sent immediately after the limit value is exceeded.

EXAMPLE 5: WARNING SYSTEM FOR MONITORING EXCESSIVE WATER CONSUMPTION

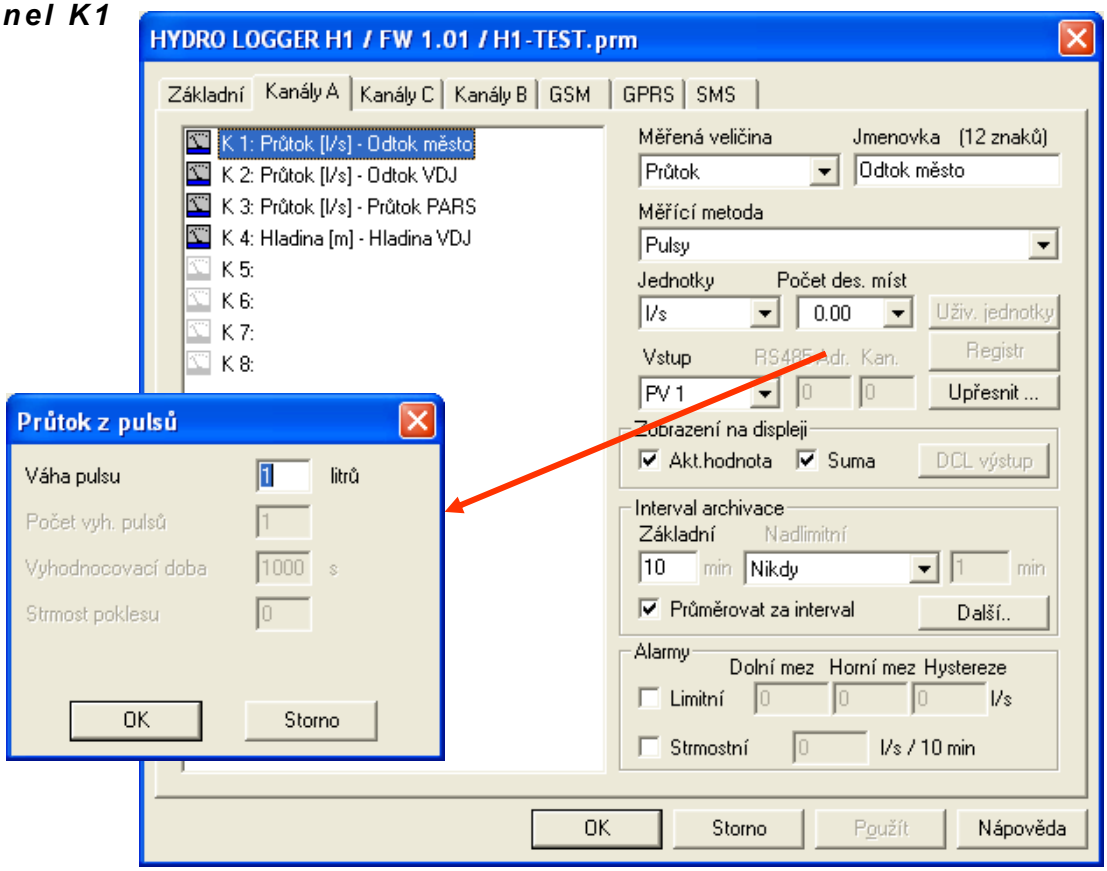
Connection: the flowmeter with optical pulse sensor (OPTO or REED) is connected to the pulse input of the PV1 communicator.

Task: Send a warning SMS if the amount of water continuously measured by the connected flow meter for the last 120 minutes is greater than 20 m^3 .

Parameter settings:

Measuring channel K1

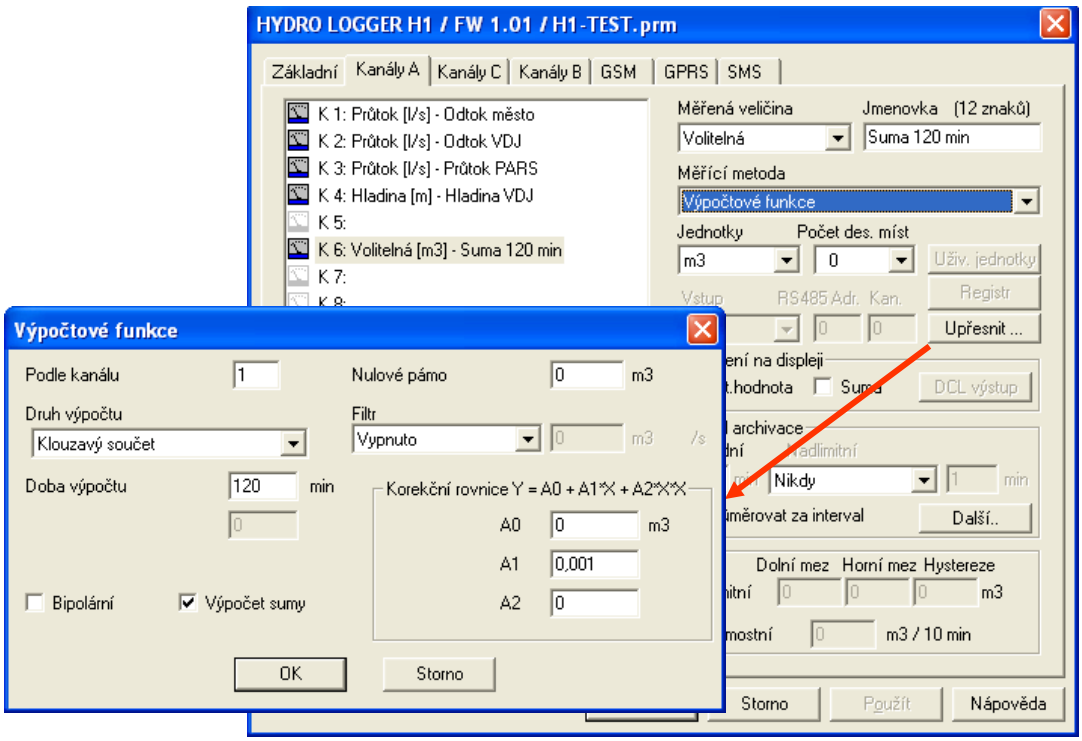
Set measuring channel K1 to record the instantaneous flow value:



In the help window under the "Advanced" button, set the actual pulse weight (usually 1 l/pulse for OPTO type sensors and 10 l/pulse or 100 l/pulse for REED type sensors).

Channel for calculating the sum

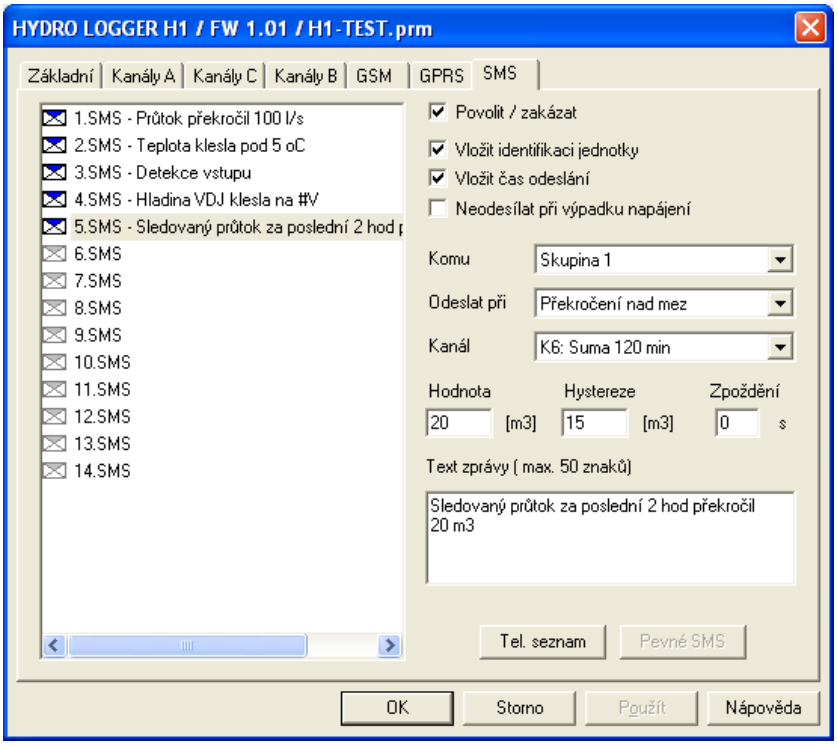
Set the free channel (e.g. K6) as an auxiliary channel for the calculation of **the running total** for 120 minutes without data archiving (parameter *Archiving interval* = 0).



The multiplicative coefficient A1 is set to 0.001 because the measuring channel K1 records the value of the instantaneous flow in litres and the sum channel K6 is set according to the specification in m3.

SMS alert settings

For example, set the SMS alert parameters as shown below:



Warning SMS No.5 will be sent immediately (*Delay=0*) after the sum on channel K6 exceeds the value of 20 m3. The same SMS will be sent again after the value on channel K6 drops below 5 m3 (*Hysteresis* parameter = 15, i.e. 20-15=5 m3) and the sum value on channel K6 increases back to 20 m3.

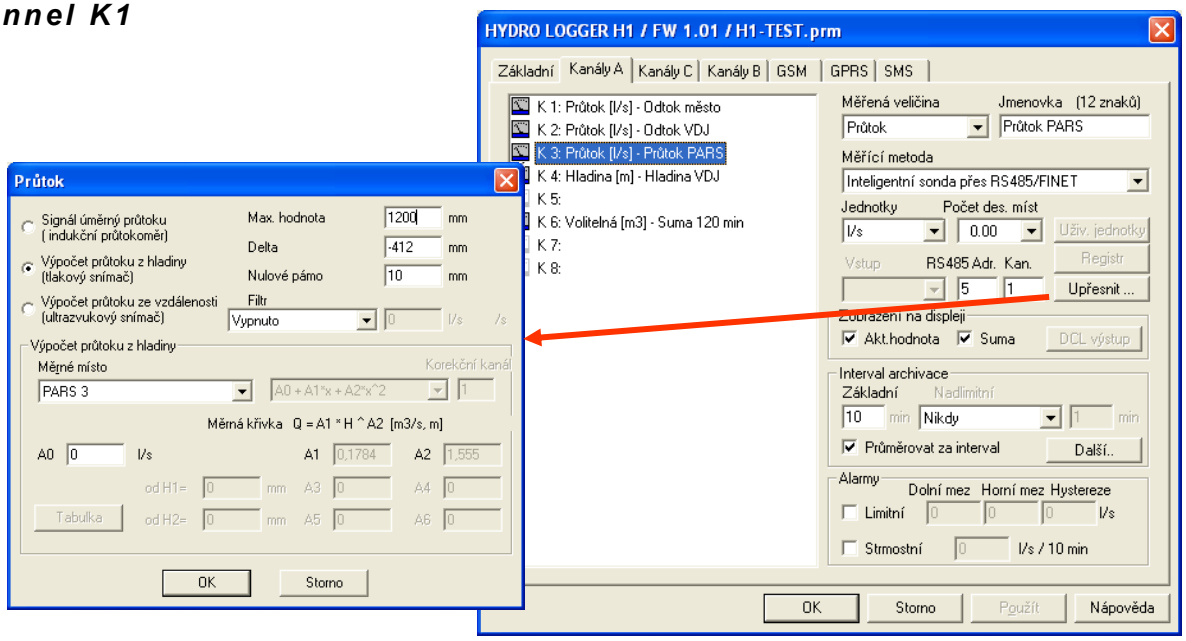
EXAMPLE 6: EXCEEDING THE LEAKAGE VOLUME IN AN OPEN PROFILE

Wiring: flow meter consisting of a measuring spillway (trough) and ultrasonic level sensor US1200 connected via RS485 serial interface.

Task: Send a warning SMS message if the amount of water continuously measured by the connected flow meter for the last 12 hours is greater than 50 m^3 .

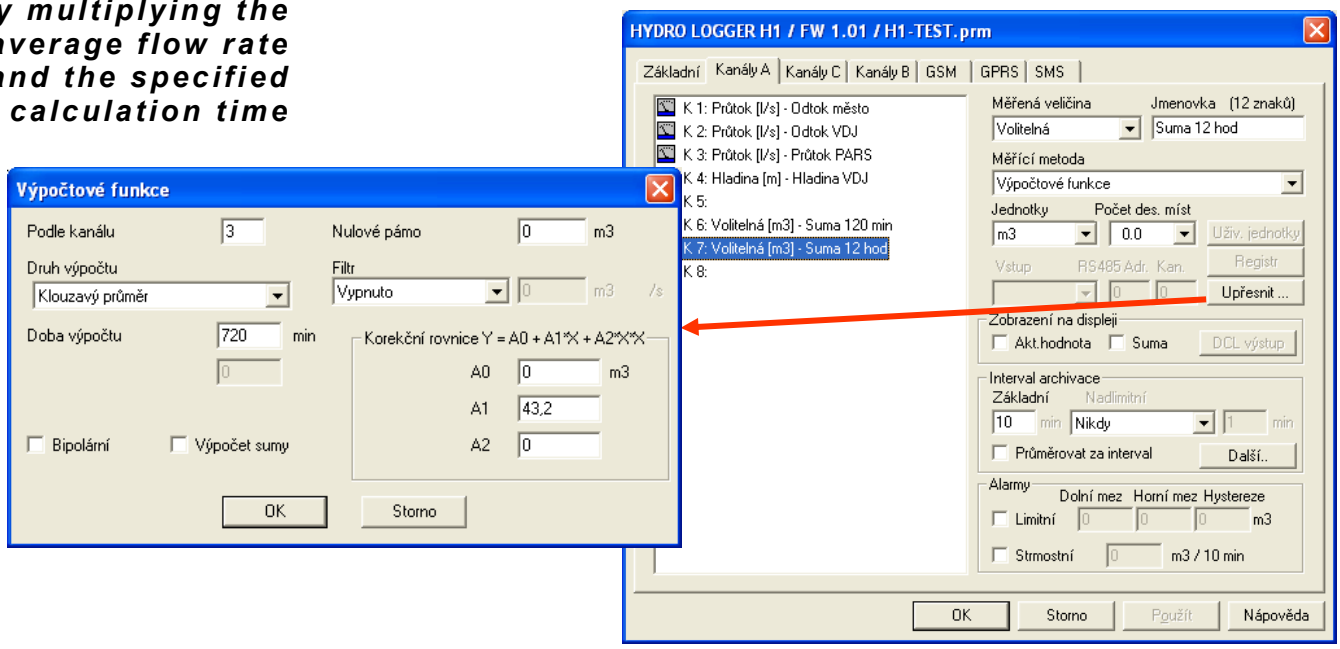
Measuring channel K1

Set measuring channel K5 to record the instantaneous flow value:



Channel to calculate the sum by multiplying the average flow rate and the specified calculation time

Set the free channel (e.g. K7) as an auxiliary channel for the calculation of the **moving average** over 720 min = 12 h).



The multiplicative coefficient A1 is set to 43.2 which is the value corresponding to the number of seconds in the monitored interval divided by one thousand (12 h x 3600 sec = 43200 sec).

SMS settings

Set the warning SMS in a similar way as in example A on the previous page (parameter *Value* = 50 m3).

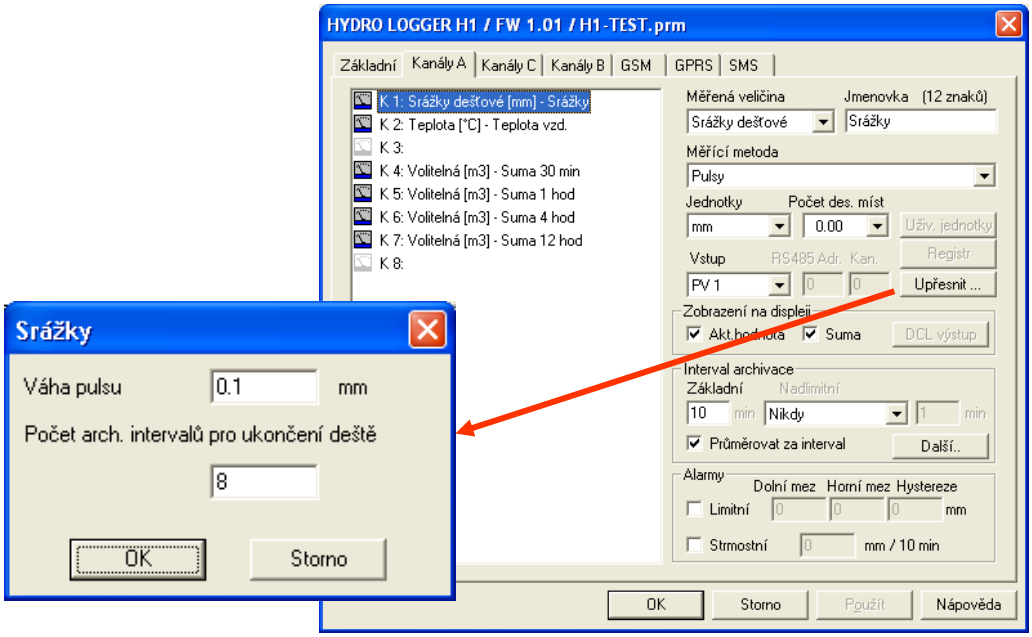
EXAMPLE 7: RAINFALL WARNING SYSTEM

Wiring: boat rain gauge connected to PV3 input. Pulse weight 0.1 mm.

Task: Send a warning text message if the amount of rainfall falling in 30 minutes is greater than 40 mm or the amount of rainfall falling in 12 hours is greater than 100 mm.

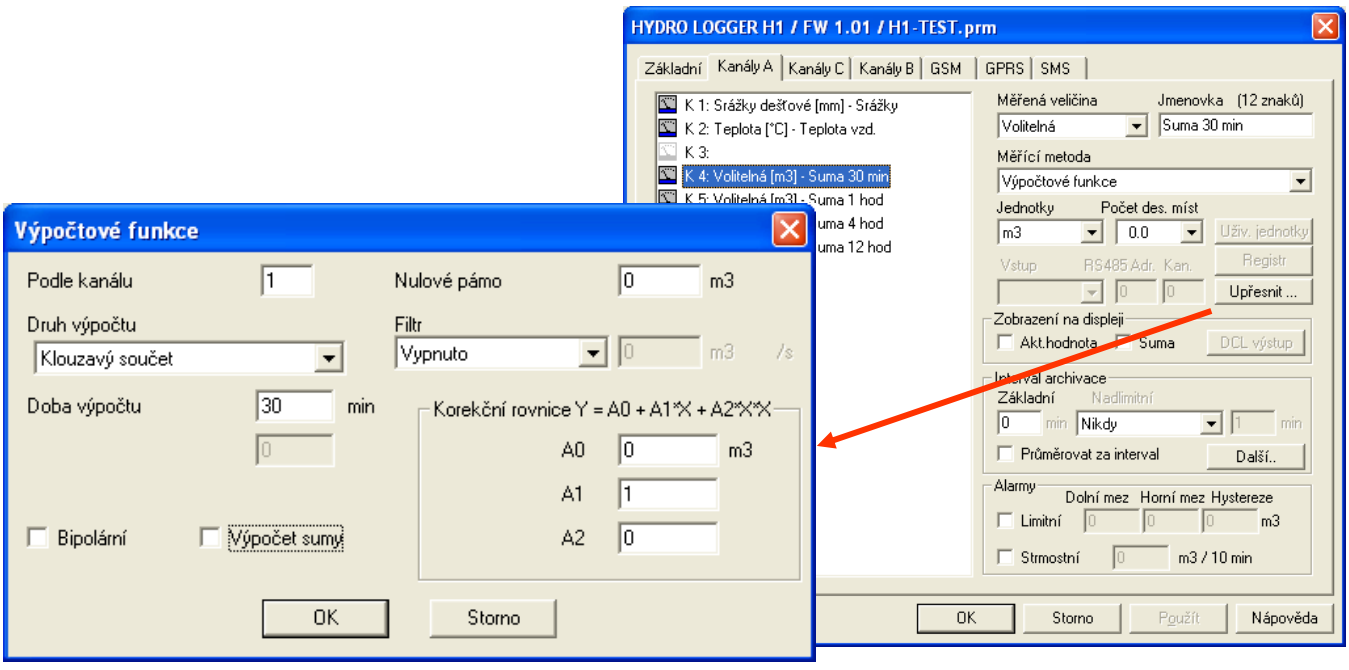
Measuring channel K1

Set measurement channel K1 to record rainfall. Set the pulse weight according to the type of rain gauge connected, or adjust it after calibrating the rain gauge by dripping the exact amount of water by the ratio of the expected and actual pulses.



Channel for calculating the sum

Set the K4 channel as an auxiliary channel to calculate the running total without archiving the data and without displaying the value on the display. Similarly, set the other free channels to calculate the sum for the desired time interval.

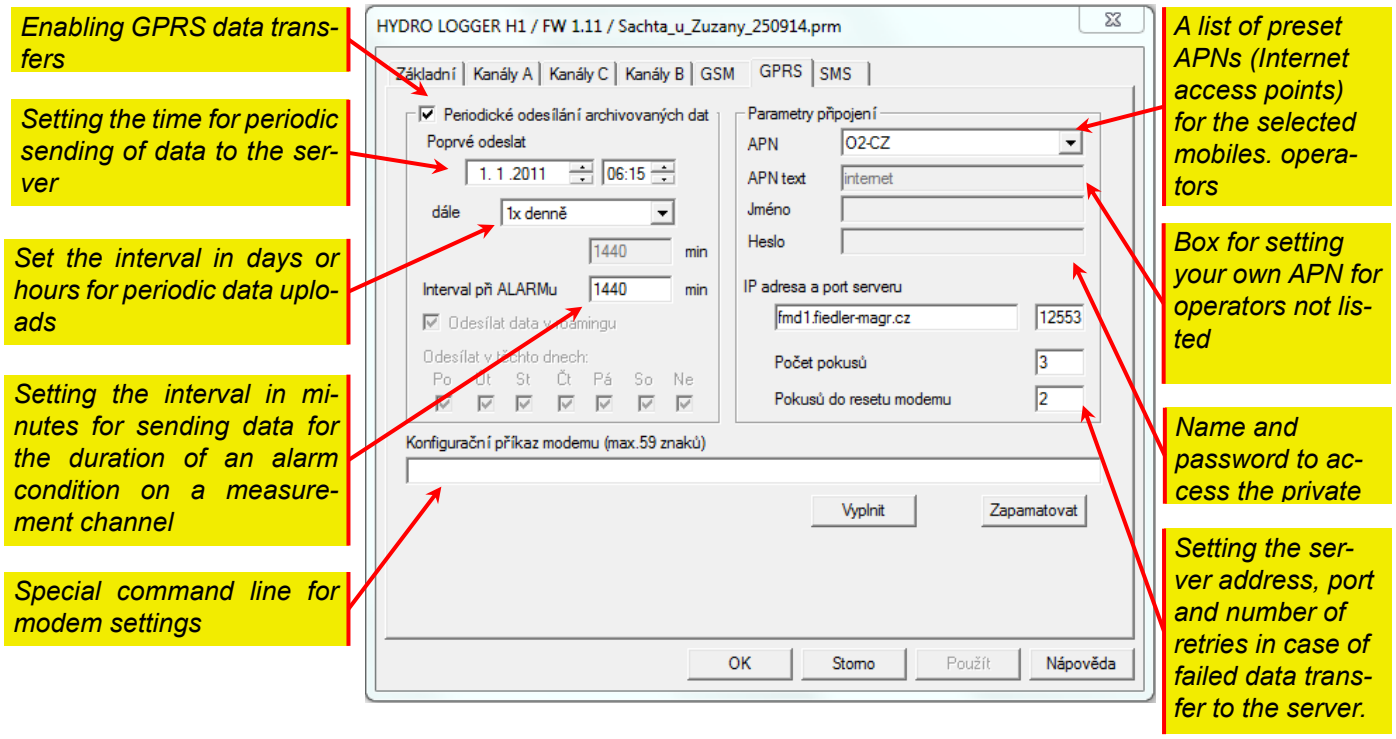


SMS settings

Set the warning SMS in a similar way as in example A (parameter *Value* = 40 mm and for the next SMS *Value* = 100 mm).

6.10. Parameters for sending data under TCP/IP protocol

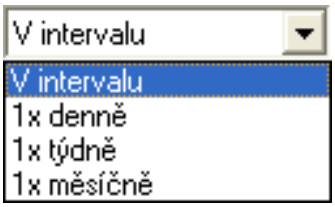
The "GPRS" tab contains the parameters needed to set up periodic sending of archived data via GSM/GPRS network to a server in the Internet.



Checking the "Periodic sending of archived data" option in the upper left corner of the window enables setting of individual parameters of this service. Uncheck this option to temporarily or permanently disable GPRS communication.

First time send Entering the date and time is used to set up regular data sending. Setting the date to a future day will enable sending from that day onwards. On the other hand, the "old" date in the setting does not matter, the first sending will be done at the nearest set hour and minute.

Further Under this option are the parameters for periodic data sending.



Alarm interval If an alarm condition occurs on any measurement channel (it does not matter whether it is a limit or a bridge condition), the communicator can send data to the server more frequently than in the normal "quiet" state. The value of the *alarm interval* parameter should not be less than 30 minutes. A shorter interval would unnecessarily burden both the communicator battery and the GSM/GPRS network, as well as the server itself receiving data from multiple stations, and would also negatively affect the cost of data services

APN (Access Point Name) The Internet access point must be selected from the offer presented, depending on the type of SIM card used and the operator. The "optional" option also allows you to specify special APNs of private corporate networks or foreign operators.

Server IP address and port These parameters are set at the factory and do not need to be changed. If the device will be operated in the customer's own system and the data will be transferred to the customer's own server, it is necessary to set the corresponding IP address and the port used.

7 Service and maintenance

The installed Hydro Logger H1 requires an occasional check of the cable connection status of the measuring probes and the GSM antenna. Especially when installed in the field, the cabling is stressed by weather and sunlight. Suitable cable protectors and a well-done installation of the station can ensure trouble-free operation of the station throughout its lifetime.

In humid areas, care must also be taken to ensure that the cable glands and the lid of the device are sufficiently tightened. The tightening of the cover screws should also be checked after each SIM card or power battery change.

7.1. Firmware updates e

The manufacturer of the H1 telemetry station maintains updated firmware versions for most of its products on its server **www.fiedler. company** in the "Firmware and Utilities" partner zone. The partner zone is accessible to authorized users by logging into the "Support" menu.

Firmware updates are performed from the menu of the MOST program, which must be licensed for service companies. A detailed description of how to update the firmware can be found on this website along with the individual firmware packages.

Follow these steps to update the firmware:

- Connect to the unit whose software you want to update with MOST
- Read the current parameters from the connected telemetry station and save them as a parameter file as a backup of the current instrument settings. Similarly, back up archived measurement data.
- In MOST, select the "*Firmware*" option in the "*Manufacturing*" menu
- Select the desired data file containing the firmware (*.hex) and load it into the PC by pressing the "Open" button.
- After the new firmware transfer is complete, the unit will automatically restart and MOST will display the message "Firmware update complete".

7.2. Procedure for replacing the power supply battery

It is advisable to change the battery in the time interval between measurements when the Hydro Logger is in a resting state and has minimum current consumption (the MEASURE LED is illuminated when a measurement is in progress). If the battery is changed within 1 minute, the real-time counter will not be delayed and the correct functioning of the instrument will not be impaired. Nevertheless, it is advisable to check the real time and date on the unit's display after changing the battery and adjust them if necessary. The date and time will also be compared automatically the next time the HydroLogger H1 communicates with the server.

Replacing the battery

The power battery is inserted in the holder inside the device. Therefore, before replacement, remove the outermost plastic screw caps and loosen the 4 corner screws until the lid of the instrument can be removed. Remove the battery from the holder and replace it with a new lithium battery type LSH20 or equivalent with a nominal voltage of 3.6V and a capacity of at least 13 Ah. You can order a new battery from the manufacturer or your Hydro Logger H1 supplier, where you can also send the used battery for environmentally friendly disposal.

You can disconnect the connecting flat cable between the instrument cover and the connection plate when replacing the battery. If the instrument is also powered from an external power supply, it is preferable not to disconnect the connecting cable, as it guarantees power not only to the time circuit of the Hydro Logger H1 but also to all other parts of the instrument, including the connected sensors or GSM module.

When the replacement is complete, be sure to tighten the screws in the lid properly to prevent moisture from entering the unit, which could condense on the cold metal parts and damage the Hydro Logger H1's electronic circuitry.

Technical parameters

Parameters of recording channels

Number and distribution of channels	1-8 recording measurement channels with 16-bit resolution 0-8 binary channels with status and change time storage 1 text channel for event logging (max. 220 B recording)
List of physical quantities from the station menu	Instantaneous flow [l/s, hl/s, m^3 /s, l/h, hl/h, m^3 /h] Cumulative flow [m^3] Level [mm, cm, m] Temperature [K,° C] Humidity [%] Pressure [Pa , hPa, kPa, Mpa, mm v.s., mbar] Rainfall [mm, pulse time] Current [uA, mA , A] and Voltage [mV, V] Optional variable [-] Pulse time [-] Number of pulses
Data storage	0 to 3 decimal places (0.000 to 65535; ±32767)
Channel nameplate	12 characters
Data memory capacity	2048 kB Flash type, 250,000 - 450,000 values including time
Main archiving interval	From 0 min. to 1440 min, 1 min increments, each channel separately
Auxiliary archiving interval	From 0 min to 255 min, automatic interval switching.
Motor hour counters	Counter with capacity 999 999 h : 59 min for bin. channel
Alarms	Limit and gradient alarm for each recording channel

Software for flow monitoring

Calculation of instantaneous flow from pulses	Calculation of instantaneous flow from pulse weight and pulse frequency, max. number of connected water meters: 2
Calculation of the total leaked volume	Archiving separately by channels, calculation of daily flows over data memory
Capacity of flow counters	0 - 4,290,000,000 [m^3]

Inputs

Slow pulse binary Inputs PV3 and PV4	min pulse width: 50 mS, max pulse frequency: 0.5 Hz Pulse counter capacity : 4.290.000.000
Fast Pulse Inputs PV1, PV2	min pulse width: 10 mS, max pulse frequency: 40 Hz Pulse counter capacity : 4.290.000.000

Other parameters

Binary Inputs PV1, PV2, PV3 and PV4	H > 10 kΩ L < 1 kΩ, active level: L (max.I= 1 mA) Input quiescent state: H level 3.3V (Ri=10 kΩ)
Power	Lithium battery 3,6V / 13Ah type LSH20 or similar
Current consumption	Type. 6 mA, 30 uA at rest (active PV inputs, not switched)
Dimensions	160 x 120 x 60 mm
Weight	1000 g including battery
Housing material	Robust Al casting
Degree of coverage	IP67
Connectors	Type M8, 3 and 4 poles, IP68
Working temperature	-25° C ... +55° C (storage temperature -30° C ... +70° C)

GSM module

GSM module type	M66
GSM	Frequency band: 850/900/1800/1900 MHz Sensitivity: -108 dB (typical value) Transmit power: CLASS 4 (2W @ 850/900 MHz) CLASS 1 (1W @ 1800/1900 MHz)
GPRS	Slots: Class 12 (4Rx / 4Tx, 5MAX)
Power	Internal controlled DC/DC converter: voltage. 1Tx/1Rx: max. 230 mA (peak 1.25A), 1Rx: max. 105mA, quiescent: < 5mA, off: 10 uA type
Working temperature	-25°C to 60°C (storage temperature -40°C to 85°C)
SIM card	Mini-SIM, access by removing the device lid, flip-out dr.
Antenna	Magnetic dual , FME, 3 m cable for outdoor location

CE

CE version

The instruments listed in this user manual comply with the EMC directives 89/336/EU including their supplements, as well as EN 61326-1:98 including supplements.

Notice

Used lithium batteries can be returned to the manufacturer of the assembly (FIEDLER-MÁGR, Grünwaldova 18, 370 01 České Budějovice), who has a contract with the importer of the batteries for the take-back of used batteries. Improper disposal of used batteries could damage the environment.

Disposal of equipment

The manufacturer has concluded a take-back contract with ASEKOL a.s. For a list of collection points in your area, please visit www.asekol.cz.

Installation according to this user manual may only be carried out by personnel at least competent according to § 5 of Decree 50/1978 Coll. or 51/1978 Coll.

Notes:

TXP0220423.110E
H1,2

Manufacturer:

FIEDLER AMS s.r.o.
Lipová 1789/9
370 05 České Budějovice

www.fiedler.company
Tel: +420 386 358 274