Leak location system
BAMOLEAK

USER MANUAL

BAMO INTERNATIONAL
22, Rue de la Voie des Bans · Z.I. de la gare · 95100 ARGENTEUIL
Tel **+33 (0)1 30 25 83 20** **Web** **www.bamo.eu**
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SUMMARY

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SAFETY INSTRUCTIONS

- Installation, commissioning and maintenance must be carried out by qualified technicians.
- The power supply must comply with the values specified in the technical features.
- Disconnect all the power sources of the device during interventions or maintenance tasks.
- The operation of the device must be in accordance with and strictly limited to the applications as mentioned below.

DESCRIPTION

BAMOLEAK allows to secure work areas where leaks are prejudicial for equipments, by detecting and precisely locating leaks of conductive liquids.
The sensor (cable) is laid along the monitored area or pipeline, and, connected to the converter. Leakage is detected by the converter, which determines, records and reports information via the analog output, relays and the RS485 Modbus interface.
Two complementary detectors can be connected to the converter (2 separated inputs) for instance for leakage monitoring in the control cabinet.

TECHNICAL FEATURES

Power supply	100 ... 240 V AC - 50/60Hz or 10 ... 30 V DC
Consumption	2 ... 5 W
Contact outputs	5 contacts, potential-free; To set as N.O. or N.C. contact

Note:
All contacts are open when de-energized.

Switching power	250 V AC; 2 A / 30 V DC; 1A

Note:
Contacts are not protected against overload, provide an external protective device.

Maximum cable length	3,000 m
Housing	46x100x127 mm; DIN rail mounting (EN 50 022; 35x7.5 mm)
Protection	IP40

Note:
The protection against accidental contact according to DIN EN 61010-1 is only guaranteed when the unit is installed in a closed cabinet with a protection IP5X or greater.

Ambient temperature limits	-10 ... +45 °C
Sensor (cable) temperature limits	-50 ... +150 °C
Connectors temperature limits	-20 ... +60 °C
Wall-mount cabinet (Option)	175x200x155 mm
Terminals	Screw connectors, cable diam. Max. 1.5 mm^2
Detection areas	1 to 12 areas; Setting of name/ TAG to each one
Accuracy on leak localization	<1%; ±1 m
Measuring loop	1 input for the 4 poles sensor (cable) 2 additional inputs for 2 one-point detectors (e.g. MAXITOP LWC B or WM25)
Power supply to sensor	Detector cable: Max. 20 V AC/DC; Max. 5 mA One-point detectors: Max. 30 mA for each
Analogue output, 4-20 mA	Active signal output (powered loop) 4 ... 5 mA: No alarm 5 ... 20 mA: Leak point localization = [cable length x (current value - 5mA)] / 15mA 21 mA: Fault
Adjustable delay	Leak detection: Delay before signaling from 0.5 up to 5 minutes
Real time clock	Integrated, with battery, automatic summer time switch can be activated
Logger	Automatic record of all events, max. 48 inputs, events can be acknowledged and deleted each by one
Language	To choose between English, French, German, Polish, Portuguese, Spanish
Key protection	PIN, by settings 4 digits; Can be deactivated
Signaling interface:	Display 2 line-text LCD Status of outputs/ events 5x Multicolour-LED
Digital communication	RS 485 MODBUS
Selections	Push/ Rotary switch on front panel

EC Conformity: The instrument meets the legal requirements of the current European Directives

MAINTENANCE

When operating according to the manual, the device does not require any special maintenance.

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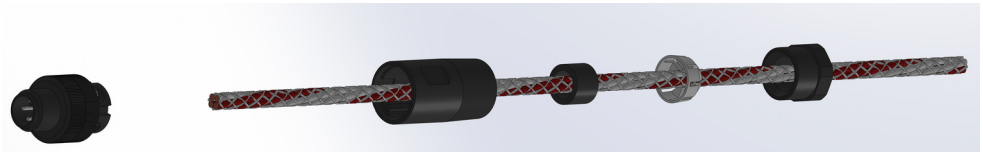
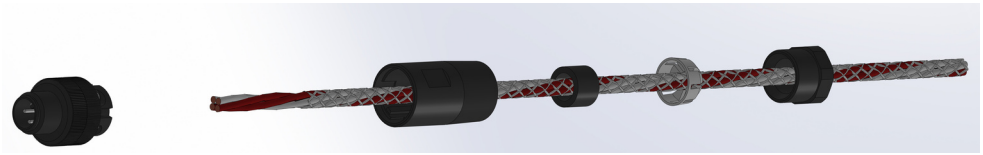
WIRING THE SENSOR CABLE WITH CET/M OR CET/F CONNECTORS

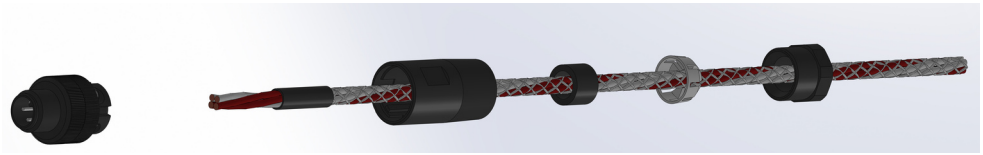
Place the parts on the cable



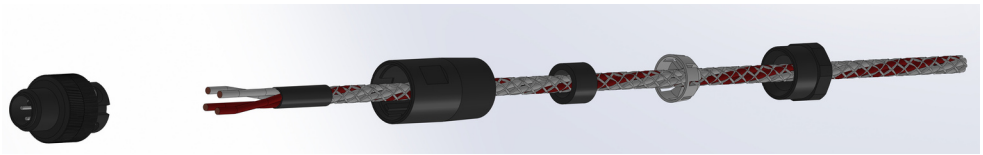
Remove 25mm of sheath

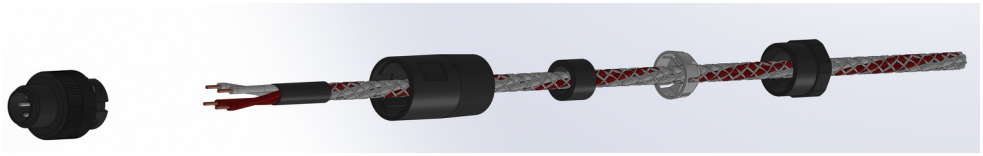


Position the heat-shrink tubing at 25 mm of cable end

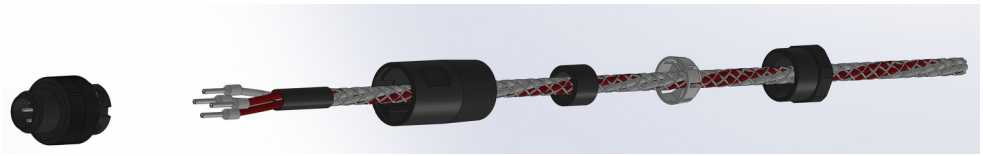


Strip the wires on 5 mm

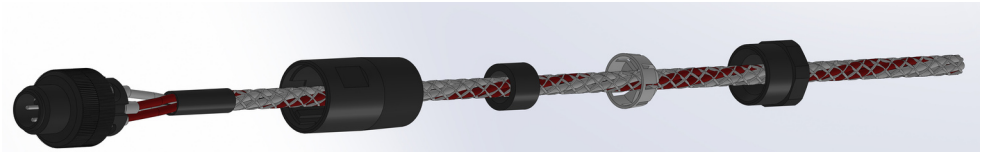




Crimp the lugs



Plug in the lugs and secured them on screw terminals of connector base (pins assignment: see below)



Sensor cable	**Pin number** Cable start (connector: CET/M 544 480) Cable end (socket: CET/F 544 481	**Terminal Nr** on BAMOLEAK CUB	**Wire colour** for Connection cable (544 485) (Plug: CET/F 544 481)
White perforated wire	1	18	White
White wire	2	17	Brown
Red perforated wire	3	20	Green
Red wire	4	19	Yellow

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SENSOR CABLE LAYING

All other work, including cleaning (see further on), must be completed before laying the sensor cable.
The substrate must be dry, free from dirt and dust.
The sensor cable must not be crushed against metal parts, as the electronics control the electrical resistance of the cable.
Make sure that condensation water dripping off pipes or cooling units does not wet the sensor cable.
To go through a wall: use a connection cable, not the sensor cable, or install a suitable adaptor.
In places where the sensor cable could be damaged, warning panels "Caution, sensor cable" must be installed.
The sensor cable must lie on the surface to be monitored (laying over obstacles such as cable tray are permitted if the leakage monitoring can be continued immediately afterwards).

TESTS BEFORE COMMISSIONING

Before commissioning, the parameters of the cables must be checked during and after laying.
The resistor value of the sensor cable can be checked at any time with an ohmmeter
However, the loop resistance can only be checked if the ending resistor (BAMOLEAK REP) is already installed.

Sensor cable type 1

Feature	Resistor value between:	Nominal value
Insulation resistance	Red nickel (perforated) and white nickel (perforated)	>300kΩ
Loop resistance A	Red nickel (perforated) and red copper	About 6.3 Ω/m
Loop resistance B	White nickel (perforated) and white copper	About 6.3 Ω/m

Detection cable type 2 or 3 (LISA)

Feature	Resistor value between:	Nominal value
Insulation resistance	LISA ribbon cable, wires 1 and 2	>300kΩ
Loop resistance A	LISA ribbon cable, wires 1 and 2 or connection cable (extension)	About 3.9 Ω/m
Loop resistance B	LISA ribbon cable, wires 1 and 2 or connection cable (extension)	About 3.9 Ω/m

Important: Record all measured values in the start-up report at the end of this document.

ROTARY/ PUSH BUTTON

BAMOLEAK settings are viewed and set via a rotary / push button switch.
LCD contrast display is adjustable by turning when pushing the knob while standard display is shown "BAMOLEAK OK".

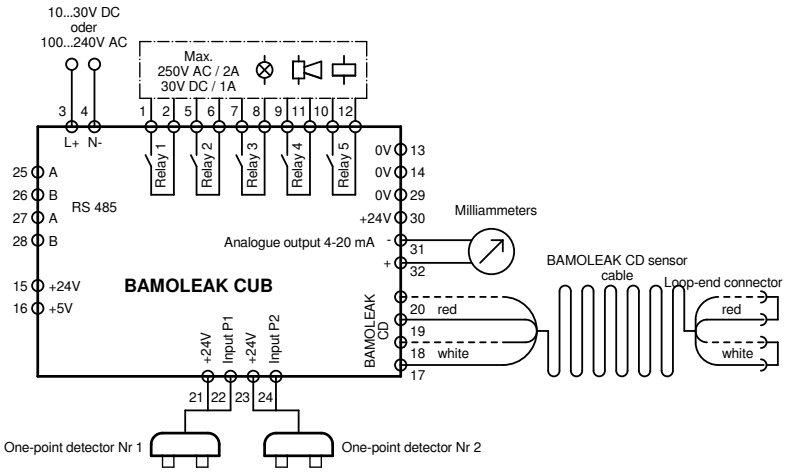
By pushing the knob, the display switches to the previous step menu.
Rotate the knob (clockwise) to choose the menu to select.
Push the knob to enter in a sub-menu
Then turn the knob to navigate inside the sub-menus.
Pressing a menu item again changes to a parameter field.
Values are set by turning the knob; pushing will save the value permanently and switches back to the respective sub-menu.

To switch the dispaly to an upper level: turn the knob on the left until it appears "BACK" and then push the knob.

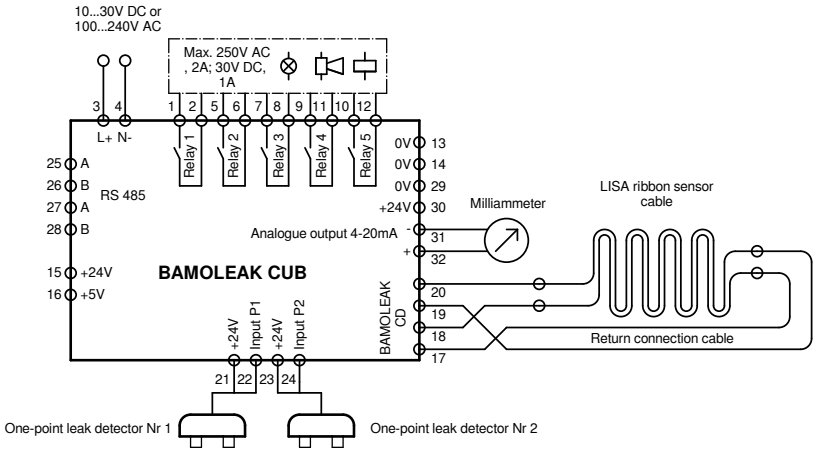
Note:
If you do not press the knob for an extended period of time, the system will automatically revert to the display "BAMOLEAK OK".
The delay is 30 seconds (default value), adjustable in the menu: "Options" / "LightOff".

ELECTRICAL CONNECTIONS

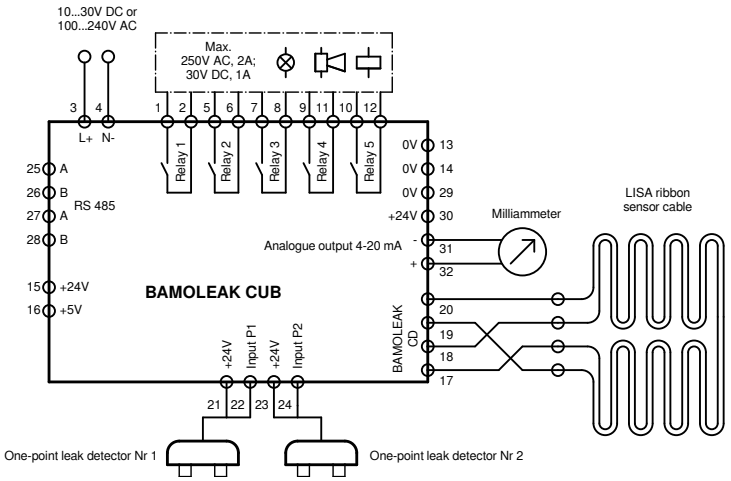
Sensor cable CD to BAMOLEAK CUB



LISA ribbon sensor cable to BAMOLEAK CUB, plus return 2-wire copper cable



LISA ribbon sensor to BAMOLEAK CUB



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COMMISSIONING

- Connect to the power and connect the sensor cable
- Confirm the cable type

Menu	Recorded type
Type 1	BAMOLEAK sensor cable CD (Standard)
Type 2	Lisa ribbon detector cable with return cable 2-wire 0.5mm²
Type 3	Lisa ribbon sensor in closed loop
Type 4	PVDF-EL spiral cable

- According cable type, shunt the cable end or connect the return cable (see ELECTRICAL CONNECTIONS).
- Select the correct cable type (displays: LL-Cable, Select, Type 1 /2 /3 /4); all corresponding values are saved automatically in all menus "Spec RNi", "Spec RCu", "Alert" and "Humid")
- Start the auto-setting, displays: "LL-Cable", "Auto Cfg", "Yes"; Cable length is measured automatically.
- Check the length and correct it if necessary, displays: "LL-Cable", "Length".
- Relay 1 is the leak alarm output by default (N.C., it opens when the cable is wet).
  Relay 2 is the system integrity alarm output by default (N.C., it opens for instance if cable is broken).
  Relay 3 is signaling an event, not yet acknowledged, recorded in "nc-Logfile" (N.C., it opens when new event is created)
  Other relay functions are available through the menu: Outputs may be selected.
- The leak detection is now operating.

Note:
If the push/ rotating knob is not operated for a while, the menu will return to the display "BAMOLEAK OK".

FACTORY SETTINGS

Parameter	Factory setting
LCD contrast	50%
Cable length	50m
Cable type	1
Nickel cable	6330Ω/km
Copper cable	77Ω/km
Alarm threshold	20kΩ
Humidity threshold	50kΩ
Measuring frequency	12t = 5 Hz
Delay (Filter)	2 min
RS485 adress	1
RS485 baud	9600Bit/s
RS485 parity	Even
Number of areas	1
Lighting off time	30 s
PIN reactivation time	30 min
Clock summertime	Automatic
PIN Standard	0000
Relais 1	Leak alarm, N.C.
Relais 2 function	System fault, N.C.
Relais 3 function	Daily event, not acknowledged, N.C.
Relais 4 function	Not assigned
Relais 5 function	Not assigned
P1 additional one-point probe	Not assigned
P2 additional one-point probe	Not assigned
Analogue output 4-20 mA	Not assigned
Area name	from 1 up to 12 areas
Daily events data	Empty memory

When resetting with "Reset" in menu "Options", above parameters are reset.

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DISPLAYS

When no event is pending:

If several events are pending, they are displayed successively every 3 seconds.
If only one event is pending, it is displayed continuously.

List of displayed messages	Meaning
Logfile Event	A non-acknowledged event is pending
4-20 Out Failure	The current of 4-20mA output deviates too much from the set point Possible origin: see the display
Battery Low	Battery voltage is less than 2.5 V
Battery Missing	Battery voltage is less than 1 V
TimeDate Wrong	Time or/and date are not yet set
LL-Cable Missing	Sensor cable is broken
LL-Cable Wrong	Sensor cable length deviates too much
LL-cable Short c.	Sensor cable is short circuited
LL Cable Broken	Leak detection cable is broken
Humid Alert	Leak detection cable, humidity warning alarm
Leakage Alert	Leak detection cable, leak alarm
P1-Probe Broken	P1 probe, loop is broken
P1-Probe Short c.	P1 probe, short-circuited loop
P1-Probe Alert	P1 probe, leak alarm
P2-Probe Broken	P2 probe, loop is broken
P2-Probe Short c.	P2 probe, short-circuited loop
P2-Probe Alert	P2 probe, leak alarm
logfile Full	Daily event memory is full

LED / RELAYS

One LED is dedicated to each of the 5 potential-free relays.
Meaning of colours:

LED off:	Relay not assigned to a function
LED, green:	Relay works well
LED, red:	Relay status: Alarming (leak detected)
LED, blue:	Event not acknowledged
LED, yellow:	Fault or warning for humidity

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DETECTION CABLE LF, SETTING MENU

Setting parameters of the detection cable in use

"Set type" — Direct selection of one of the four types
Selecting the cable type replaces the values "Spec Rni", "Spec Rni" inside the menu "LL-Cable" as well as the values "Alert" and "Humid" by the corresponding pre-recorded values in the menu "Measure".

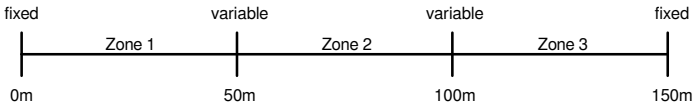
Preset values for the cables:

Selection	Cable type	Spec Rni (Detection)	Spec Rcu (Return conductor)	Alert	Humidity
Type 1	BAMOLEAK CD (Standard)	6330Ω/km	77Ω/km	20kΩ	50kΩ
Type 2	Lisa-T ribbon detector plus a return cable 0.5mm²	3939Ω/km	36Ω/km	50kΩ	100kΩ
Type 3	Lisa-T ribbon cable as a ring measuring loop	3939Ω/km	0,1Ω/km	50kΩ	100kΩ
Type 4	PVDF-EL spiral cable	13050Ω/km	200Ω/km	30kΩ	60kΩ

"Auto Cfg" — Automatic length determination of the connected cables.
"Length" — The detection cable length must be determined automatically; readjustments can be made here if necessary.
If the cable length is readjusted in the menu, the zone parameters are automatically modified accordingly.
The manual adjustment of the cable length in the menu is only intended for fine adjustment.
Always select the menu "Auto Cfg" after changing the sensor cable type.

DETECTION AREA (CABLE LF), SETTING MENU

"Zone" — Up to 12 zones can be defined to better determine the alarm position inside the monitored area.
The end of zone 1 is automatically the beginning of zone 2.
The value of the last zone is always the maximum cable length.
Special case: If only one zone is defined, the zone starts at 0m and ending at the value of entire cable length; In this case, the values cannot be changed.
"Count" — Define the number of required zones.
"List" — (Here you access to the settings and only of the selected zone)
"Zone 1" — "Zone 1 Begin"
Is always 0 m, as this is the beginning of the sensor cable.
"Zone 1 End"
Is the end of the first monitored zone.
"Zone 1 Name"
Enter a name (designation) of the zone; Proceed as well as for each zone (Max. 12 zones).



"Auto Set" — The total cable length is distributed evenly over all zones.
"Spec Rni" — The resistivity of the detection cable (nickel) in Ω/km is automatically set when the cable type is selected; Fine adjustment is possible here.
"Spec Rcu" — The resistivity of the return conductor (copper) in Ω/km is automatically set when the cable type is selected; Fine adjustment is possible here.

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DETECTION MEASURING LOOP, SETTING MENU

"Alert"	Resistance value of the liquid wetting in kΩ (standard 20kΩ), which must be fallen below for the leakage alarm. The value is set automatically when the sensor cable type is selected. Fine adjustment is usually not necessary.
"Humid"	Resistance value of the liquid wetting in kΩ (standard 50kΩ), which must be fallen below for the moisture warning. The value is set automatically when the sensor cable type is selected. Fine adjustment is usually not necessary.
"P1-Probe"	Selection of the point sensor P1 for leakage monitoring
"P2-Probe"	Selection of the point sensor P2 for leakage monitoring

Selection	Sensor type
"LWC BX"	MAXITOP LWC B or MAXIMAT LWC BX
"WM25"	Detector WM25

"Filter"	Time span over which the alarm must at least be active before it is reported, adjustable from 0.5 - 5 minutes (the alarm must also be inactive for a correspondingly long time until the alarm signaling is ended again).
"Cycle time"	Sensor cable measurement frequency, 2t: The fastest setting, ~ 10 Hz for demo purposes and tests (less precise) 12t: Standard setting, ~ 5 Hz (recommended) 42t: Slowest setting, ~ 2Hz (for very long cables or EMC-disturbed environment)

OUTPUTS MENU

Menu: "Outputs" – "Rel 1 ...5 nc/no"
A function can be assigned to each relay; The following values are possible:

Relays can be normally open ("no") or normally closed ("nc"); Menu: "Outputs" - "Rel1 ... 5 nc/no"
To each relay is assigned a LED (top of display), in normal operating status the respective LED lights up green.

"Off"	No function: LED is off
"Humid nc"	If the (resistance) value falls below the pre-alarm threshold for humidity, the LED turns yellow and the relay deactivates (it opens).
"Humid no"	If the (resistance) value falls below the pre-alarm threshold for humidity, the LED turns yellow and the relay is activated (it closes).
"Alert nc"	If the (resistance) value falls below the alarm threshold of leakage measurement, or when the P1 or P2 probe is in alarm, the LED turns red and the relay deactivates (it opens).
"Alert no"	If the (resistance) value falls below the alarm threshold of leakage measurement, or when the P1 or P2 probe is in alarm, the LED turns red and the relay is activated (it closes).
"Logfile nc"	In case of an unacknowledged event, the LED turns blue and the relay deactivates (it opens).
"Logfile no"	In case of an unacknowledged event, the LED turns blue and the relay is activated (it closes).
"Failure nc"	When a fault occurs, the LED turns yellow and the relay deactivates (it opens).
"Failure no"	When a fault occurs, the LED turns yellow and the relay is activated (it closes).
"4-20mA nc"	When the output current deviates from the 4-20 mA range, the relay deactivates (yellow LED).
"4-20mA no"	When the output current deviates from the 4-20 mA range, the relay is actvated (yellow LED).

Menu: "Outputs" – "4-20mA"

"4-20mA"	Output: switched "ON" or "OFF" When there is current (4-20mA), the display shows "4-20 Out" "Failure" Possible cause: A wire is broken, a cable is not connected or incorrectly connected.

OPTIONS, SETTING MENU

Personalized settings.

"Language"	English, German, French, Spanish, Portuguese, Polish
"PIN"	The PIN code prevents unwanted access to the menu. If 0000 is set as PIN, there is no more request of PIN.
"PIN time"	Time in minutes after which the PIN query is automatically repeated (standard 30 min).
"LightOff"	Set the time which the backlight is dimmed (standard 30 s). 10 ... 199 seconds or permanently ON (with 200 s) Meanwhile, the display changes to the standard screen.
"Reset"	All values are reset to factory settings, excepted for the language.
"Version"	Number of the version
"Reboot"	To restart the device.

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INTERFACE: MENU FOR RS485

List of all adjustable parameters for the integrated Modbus interface.

"Adress"	Local Modbus address of this device
"Baudrate"	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
"Parity"	even, odd, none

MENU DATE AND TIME

"Info"	Display of the current time and date
"Year"	Current year setting
"Month"	Current month setting
"Day"	Current day setting
"Hour"	Current hour setting
"Minute"	Current Minutes setting
"DlgtSave"	Activation of automatic Daylight saving time (DST)
"UTC"	Coordinated Universal Time

Note: The day in the week is automatically shown at the top right of screen.

LOGGER MENU

All the events that occurred are recorded in the logger. For example: Leak alert, humidity alert, broken cable and other malfunctions. The number of entries is up to 48 events.

"Entry" Select wich event to show.

After selecting an event number, the values are displayed.
By turning the control knob to the right, events are displayed one after the other:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

"All Acknowl."	All events are acknowledged.
"All Delete"	All events are deleted, except current events.

LOGGER MESSAGES

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ Time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

Possible displays for events from logger	Meaning
4-20 Out Malfunc."	The current of output 4-20mA deviates too much from the setpoint
"TimeDate Malfunc."	At least 1 time or date parameter was not set
"Battery Malfunc."	Dead or missing batterie
"LL-Cable missing"	Leak detectioncable is missing
"LL-Cable Wrong"	The length of leak detection cable deviates too much from stored value
"LL-Cable Schort c."	Leak detection cable is short-circuited
"LL-Cable Broken"	Leak detection cable was interrupted
"Humid Alert"	Detection of humid leak detection cable
"Leckage Alert"	Leak detected on leak detection cable
"P1-Probe Broken"	P1 probe, interrupted loop
"P1-Probe Short c."	P1 probe, loop is short-circuited
"P1-Probe Alert"	P1 Probe, leackage alert
"P2-Probe Broken"	P2 probe, interrupted loop
"P2-Probe Short c."	P2 probe, loop is short-circuited
"P2-Probe Alert"	P2 Probe, leackage alert
"Logfile Full"	Logger memory is full

LOGGER MESSAGES (continued)

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ Time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

Event status display	Meaning
"Not Ack. Ongoing"	A new event is pending.
"Acknowl. Ongoing"	New event is pending and the message was received and already acknowledged in the logbook by a person.
"Not Ack. Complete"	An event had occurred and ended.
"Acknowl. Complete"	An event had occurred and ended again and the message has already been acknowledged by a person in the logbook.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ Time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

Event display	Meaning
"23.11.19 15:03:00"	Start of the event

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ Time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

Event display	Meaning
"Duration 15,3h"	Total duration of the event

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ Time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

Note: Values 5 to 8 are only displayed for the event types leakage alert and humidity alert.

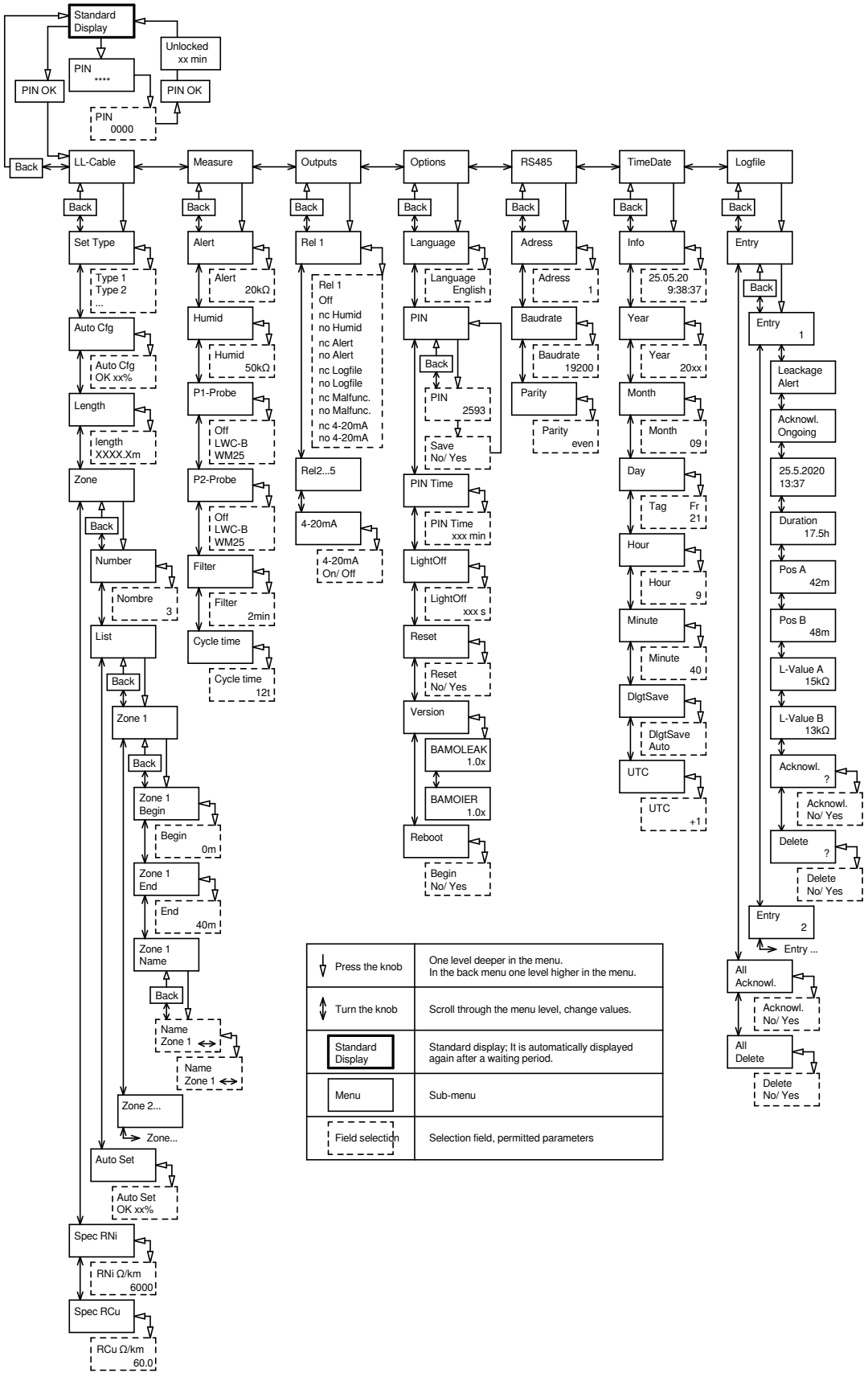
Displays for events from logger	Meaning
"Pos A 123m"	Position in metres where the Leakage/ Humid alert occured for the first time
"Pos B 128m"	Current position in metres of the leak location. If the leakage/ humidity alert has already ended, its last position is displayed.
"L-Value A 45 kΩ"	Liquid resistance in kΩ of the leak at the time at which the Leakage/ Humid alert first occured.
"L-Value B 42 kΩ"	Current liquid resistance in kΩ of the leak. If the leakage/ humidity alert has already ended, its last position is displayed.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Event type	Status	Date/ Time	Duration	L-Pos A	L-Pos B	L-Value A	L-Value B	Acknowledge	Delete

Once the event is displayed, the selected event can be acknowledged or deleted.

"Acknowl.?" The currently selected entry is to be acknowledged.
"Delete ?" The currently selected entry is to be deleted; Excepted for the ongoing events.

MENU DIAGRAM



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Leak location system
BAMOLEAK

22-04-2022 M-544.50-EN-AD

LEV

544-50 /13

COMMISSIONING PROTOCOL

Parameter	Plant values set up
Date	
Plant location	
BAMOLEAK serial number	
Power supply	
Cable type	
Automatically recognized cable length	
Installed cable length	

Cable type 1

Measured value	Resistance measured between:	TARGET value	Actual value
Insulation resistance	Nickel conductor red -perforated- & nickel conductor white -perforated-	>300kΩ	
Loop resistance A	Red nickel conductor -perforated- & red copper conductor	about 6.3 Ω/m	
Loop resistance B	White nickel conductor -perforated- & white copper conductor	about 6.3 Ω/m	

Cable type 2 or 3

Measured value	Resistance measured between:	Nominal value	Actual value
Insulation resistance	LISA wire 1 and LISA wire 2	>300kΩ	
Loop A resistance	LISA wires 1 & 2 or return cable	about 3.9 Ω/m	
Loop B resistance	LISA wires 1 & 2 or return cable	about 3.9 Ω/m	

Zone Nr	Zone name	Beginning/ Metre	End/ Metre
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

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