



SOTER

SENSING & PROTECTION SYSTEM

LDS

LEAK DETECTION SYSTEM

Addressable locating leak detection for data centres, critical facilities and heritage environments.

CONTENTS

This document

03	Why locating detection	The case for position, not just presence
04	Detection principle	How the cable senses a conductive liquid
05	Positioning principle	Resistance to metres, and the accuracy that follows
06	ST-LDS-01-MOD	Locating detection module – overview
07	ST-LDS-01-MOD	Terminals and specification
08	ST-LDS-CBL	Positioning sense cable – construction
09	ST-LDS-CBL	Specification and spool lengths
10	Accessories	Leader, jumper, connector, termination, fixings
11	System architecture	Field, local action and head end
12	Layout design	Coverage patterns and pipe-mounted detail
13	Installation rules	Fixing, length limits, sensitivity
14	Applications	Where the system is specified
15	Modbus RTU appendix	Register map and worked commands

HOW TO READ A MODEL CODE

ST-LDS-12-CBL

ST	Family stem – Soter
LDS	Sub-line – Leak Detection System
12	Zone or channel count, or spool length
CBL	Variant – CBL cable, MOD module

TWO NUMBERS TO KEEP APART

500 m is the maximum locating sense cable one detection module will drive, excluding leader and jumper runs. **200 m** is the figure to design to – it holds locating accuracy comfortably inside specification and leaves headroom for as-built variation. Both appear throughout this document and they are not interchangeable.

Dimensions in millimetres unless stated. Specifications are subject to change without notice; confirm against the current datasheet at the point of order.

THE TWO FIELD PRODUCTS



ST-LDS-01-MOD

Locating detection module

DIN rail. One sense run per module, position in metres on the module display, volt-free contact, Modbus RTU.



ST-LDS-CBL

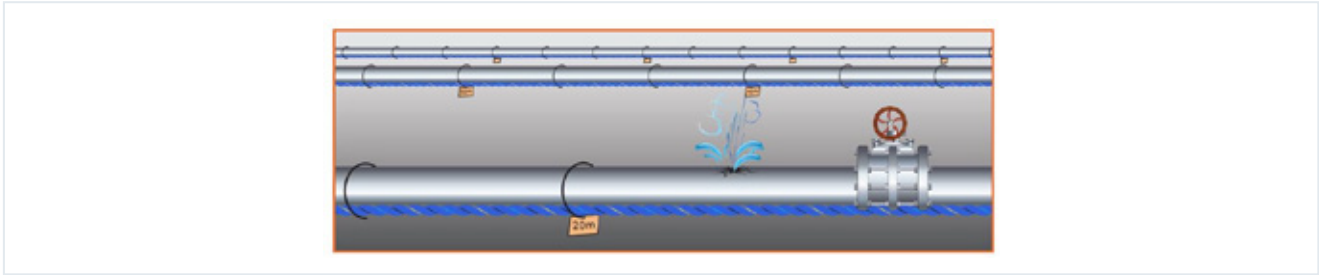
Positioning sense cable

Four-core, double helix, 13 Ω/m, 5.5 mm, no exposed metal. Water, oil, acid and alkali. Reusable once dry.

THE CASE

A leak you can find is a leak you can stop.

Water is the failure mode that turns a maintenance job into an outage. What separates the two is not how fast you are told – it is how fast you know where to go.



Sense cable strapped along service pipework. The alarm carries the distance to the wetted point, so the response starts at the leak rather than at the door.

Presence is not enough

A conventional zone system reports a state: this floor is wet. In a raised-floor data hall, a ceiling void or a three-pipe service run above a corridor, that leaves a search. Tiles come up, panels come down, and the volume of water grows while the team is still looking.

A locating system reports a position. The module measures the electrical distance to the wetted point and publishes it in metres along the installed run, so the response is directed to a point rather than to a room.

THE OPERATIONAL DIFFERENCE

The alarm is the same in both systems. The **time to isolate** is not, and that is the interval in which damage accumulates.

Set against zone detection

	ZONE DETECTION	SOTER LDS
What you learn	A zone is wet	Metres along the run
Search after alarm	Whole zone	Point
Devices per area	One per zone	One per 200 m run
Resolution	Zone granularity	Better than 2 % of length
To the BMS	Contact	Contact and position over Modbus
Cable recovery	Varies	Dry and reuse

2 %

LOCATING
ERROR

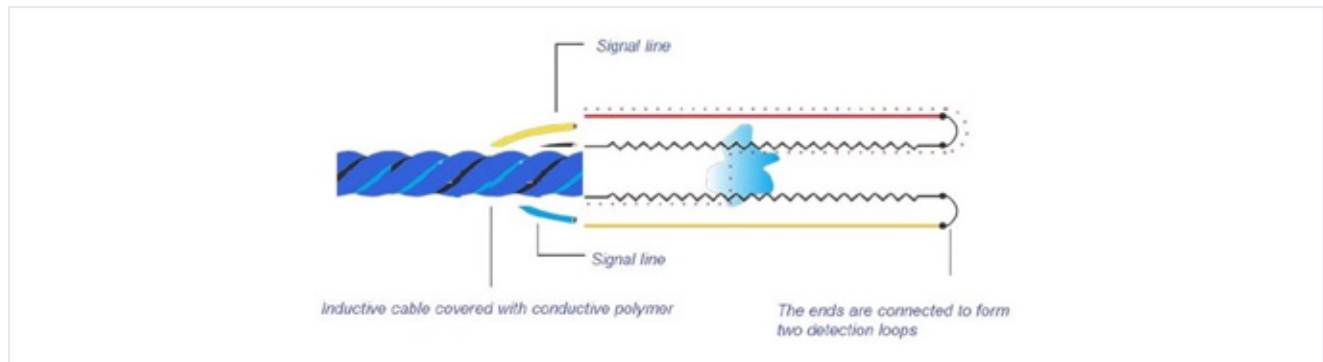
500 m

PER MODULE

1,200 m

RS-485 REACH

Two cores, one bridge.



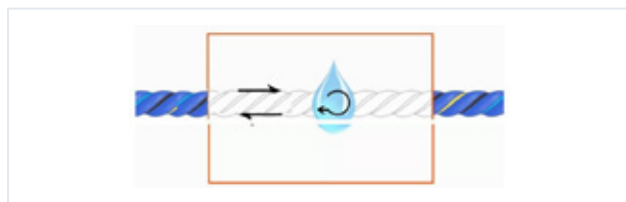
Two detection cores and two signal lines form two continuously monitored loops. A conductive liquid bridging the cores completes the circuit at that point.

The mechanism

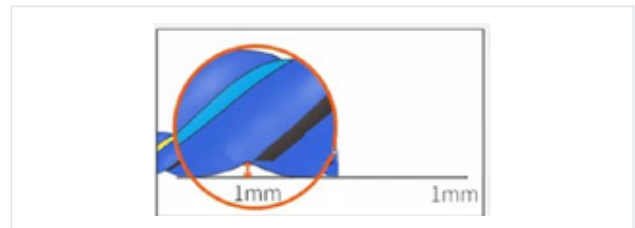
The sense cable carries two detection cores laid in a double helix around a central bearing rod, with two signal lines returning to the module. The cores are covered in a conductive polymer — there is no bare metal anywhere on the cable.

Where a conductive liquid reaches the cable it wicks into the helix and bridges the two cores. A weak current of roughly **2 mA** flows through the liquid, the module sees the resulting voltage change, and the alarm is raised.

Because the mechanism is conduction rather than absorption, the cable is not consumed by an event. Once the run is dry it returns to its normal state and the module clears.



Liquid bridging the two cores between helix turns.



The detection core stands approximately 1 mm clear of the mounting plane.

WHY IT DOES NOT FALSE-ALARM ON HUMIDITY

A condensation film on a floor slab or duct does not reach the cores; accumulating liquid does. Sensitivity is then trimmed on the module itself, from a single drop to standing water.

WHAT IT WILL DETECT

- Water — potable, chilled, condensate, fire main
- Oil and other conductive hydrocarbons
- Acid and alkali solutions

Non-conductive liquids — most refrigerants, pure deionised water and dielectric coolants — will not bridge the cores. Specify a different sensing method for those.

CONTINUOUS SUPERVISION

The module monitors the cable as well as the liquid. A cut, a disconnected connector or a faulty joint raises a separate service alarm rather than sitting silently as a dead run.

Resistance, converted to metres.

The calculation

The detection core presents a known resistance per metre — nominally **13 Ω/m**, with a production range of 13–14 Ω/m. When liquid bridges the cores, the module measures the loop resistance back to the wetted point and divides by the unit resistance.

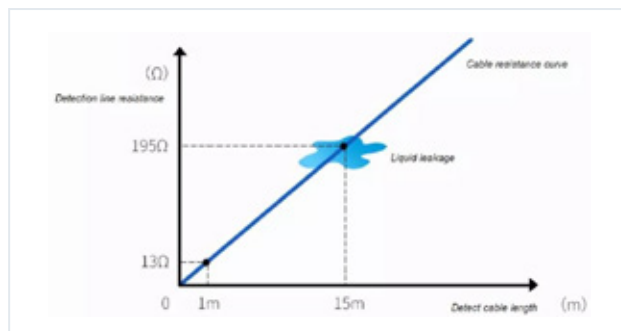
$$\text{position (m)} = \frac{\text{measured loop resistance (}\Omega\text{)}}{\text{unit resistance (}\Omega/\text{m)}}\text{}$$

The result is displayed on the module in metres and published to register **30003**. Distance is measured from the module along the sense cable in the order the cable was installed, so the as-built run order must match the drawing.

Unit resistance is itself a settable value — register **40006**, adjustable across 12.5–13.5 Ω/m. Trimming it against a measured wetting is the single step that turns a nominal figure into a site-accurate one.

WHAT MOVES THE NUMBER

- **Unit resistance spread.** A run built from cable at 14 Ω/m and read against 13 Ω/m will report roughly 7 % short. Trim, or the position is systematically wrong in one direction.
- **Run order.** Distance is counted from the module in the order the cable was physically installed. If the as-built order differs from the drawing, the metres are right and the location is wrong.
- **Jumper counted as sense cable.** Jumper contributes no detected length. Marking it on the drawing as though it does displaces every position downstream of it.
- **Connector resistance.** Each joint adds a small offset — a reason to shorten the run rather than widen the tolerance.



Loop resistance rises linearly with distance — 13 Ω at one metre, 195 Ω at fifteen. The module reads the resistance and returns the metre.

ACCURACY IN PRACTICE

INSTALLED RUN	STATED ERROR	WORST-CASE WINDOW
50 m	better than 2 %	± 1.0 m
100 m	better than 2 %	± 2.0 m
200 m DESIGN RULE	better than 2 %	± 4.0 m
500 m MODULE LIMIT	better than 2 %	± 10.0 m

Error is expressed as a percentage of installed cable length, not of the measured distance. A shorter run is therefore a more precise one — a further reason to design to 200 m per module rather than to the 500 m ceiling.

COMMISSIONING A RUN

01

Read the resistance

Run dry, read **30004** against installed length × 13 Ω.

02

Wet a known point

Water at a taped distance, a third of the way along the run.

03

Trim to agree

Adjust **40006** until the display matches the tape.

04

Record it

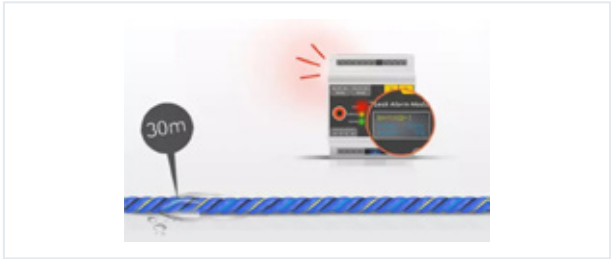
Trimmed value and run order onto the as-built.

LOCATING DETECTION MODULE

ST-LDS-01-MOD



DIN-rail locating detection module. One sense-cable channel, position display, Modbus RTU over RS-485.



Position reported in metres along the installed run.

Overview

A single-channel locating detection module on a 35 mm DIN rail. It drives one sense-cable run, displays the leak position in metres, switches a volt-free contact, and publishes status and position over Modbus RTU.

- **Position at the module.** Device ID, status and leak position in metres on the module itself — readable in the panel without a laptop.
- **One relay, four modes.** Volt-free SPDT contact configurable to operate on leak, on cable fault, on both, or not at all.
- **Addressable.** Software-assigned address, with no DIP switches to set or mis-set.
- **Two RS-485 ports in parallel.** Daisy-chain the trunk without a separate junction.
- **Supervised cable.** A break or a bad connector raises a service alarm distinct from a leak.
- **Stepless sensitivity.** 0–50 kΩ on a front trimmer, from a single drop to standing water.

500 m

MAX SENSE
CABLE

IP55

ENCLOSURE

200 g

WEIGHT

DETECTS

Any conductive liquid

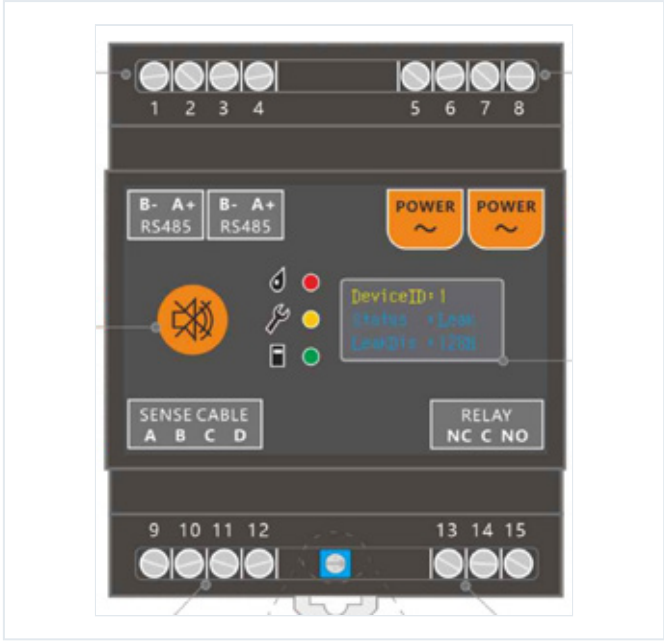
Water, oil, acid and alkali, on any compatible four-core positioning cable.

REPORTS

Status and position

Modbus RTU over RS-485, two ports in parallel, for BMS or DCIM integration.

Terminals and indicators



● LEAK ● SERVICE ● POWER

Front face. Confirm the supply variant against the terminal label before energising.

TERMINAL ALLOCATION

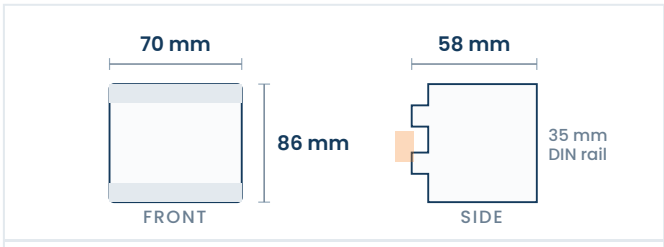
TERMINALS	FUNCTION
1–4	RS-485 — two ports wired in parallel, B- / A+. Shield ground is not connected.
5–8	Supply — two groups, interconnectable in parallel. No line sequence.
9–12	Sense cable A / B / C / D, in cable colour order: red, green, yellow, black.
13–15	Relay — 13 NC, 14 common, 15 NO.

RELAY MODES

VALUE	RELAY OPERATES ON
00	No action
01	Cable fault / disconnection only
02	Leak only
03	Leak and disconnection

Set at register **40005** or in the configuration software. Mode **03** is the recommended default for a supervised installation.

DIMENSIONS



Specification

IDENTIFICATION	
Model	ST-LDS-01-MOD
Description	Locating leak detection and alarm module
DETECTION	
Detectable media	Water, oil, acid and alkali — any conductive liquid
Compatible cable	Any four-core positioning detection cable
Sense cable channels	1 (terminals A / B / C / D are the four cable cores)
Max sense cable	500 m locating cable, excluding leader and jumper
Recommended design limit	200 m per module
Locating accuracy	Better than 2 % of installed cable length
Sensitivity	0–50 kΩ, stepless, front trimmer
Cable supervision	Continuous — open circuit raises a service alarm
INTERFACE	
Display	Device ID, status, leak position in metres
Indicators	Leak (red) · Service (yellow) · Power (green)
Controls	Mute / reset button; sensitivity trimmer
Relay output	1 × SPDT volt-free, 220 VAC / 2 A, NC-C-NO
Relay modes	None / fault / leak / leak + fault, settable
COMMUNICATION	
Protocol	Modbus RTU
Physical layer	RS-485, two-wire, two ports in parallel
Baud rate	9,600 · 8 data · no parity · 1 stop
Addressing	Software assigned, no DIP switches
Trunk length	1,200 m maximum
Poll interval	≥ 500 ms; 1 s recommended
POWER AND CONSTRUCTION	
Supply variants	12–24 VDC · 24 VAC · 220 VAC
Current	< 1 A
Enclosure	Flame-retardant ABS, IP55
Mounting	35 mm DIN rail
Dimensions	70 × 86 × 58 mm
Weight	200 g
Configuration	Windows configuration software, or over Modbus

ST-LDS-CBL



Spiral construction. The lay is what keeps the cores seated and the cable stable in handling.

Construction

Two detection cores and two signal lines are laid in a double helix around a central bearing rod. The spiral is the working part of the design: it holds the cores firmly in the bobbin, gives the cable its mechanical strength, and cancels induced interference that a parallel-laid cable would pick up.

5.5 mm

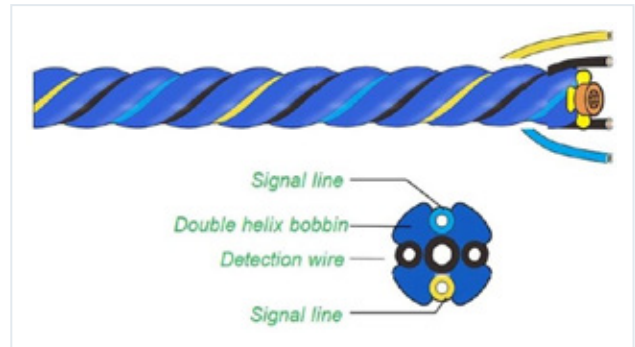
DIAMETER

13 Ω /m

UNIT
RESISTANCE

60 kg

BREAKING
STRENGTH



Two detection cores on one axis, two signal lines on the other, laid around the central bearing rod.

- **No exposed metal.** Conductive polymer over alloy detection wire — nothing to corrode at the sensing surface.
- **1 mm detection gap.** The cores stand clear of the mounting plane, so surface damp does not register.
- **Quick-drying sheath.** The run returns to normal once dry; no element is consumed by an event.
- **60 kg breaking strength.** Survives pulling into containment and repeated handling.
- **Recoverable.** Dry the run and the system resets. There is no consumable element to replace after an event.

WHY THE SPIRAL, NOT A FLAT CABLE

A parallel-laid detection cable picks up induced interference along its length and false-alarms where a floor is electrically noisy. The double helix cancels it, which is why the construction looks decorative and is not.

Specification

IDENTIFICATION	
Model	ST-LDS-CBL
Description	Four-core positioning detection cable
CONSTRUCTION	
Cores	2 × detection core, 2 × signal line
Lay	Double helix over a central bearing rod
Core covering	Conductive polymer over alloy detection wire
Exposed metal	None
Sheath	PE — flame retardant, low smoke, non-toxic
Colour	Blue
Detection standoff	Approximately 1 mm from the mounting plane
ELECTRICAL	
Unit resistance	13–14 Ω/m (13 Ω/m nominal)
Detection current	Approximately 2 mA at the bridge
Detectable media	Water, oil, acid and alkali solutions
MECHANICAL AND ENVIRONMENTAL	
Diameter	5.5 mm
Weight	38 g/m
Breaking strength	60 kg
Max exposure temperature	80 °C
Recovery	Reusable — dry the cable and the run resets
SUPPLY	
Standard spools	50 m, 100 m
Termination	Moulded connector at both ends
Non-standard lengths	To order

Spool lengths

MODEL CODE	LENGTH	NOMINAL LOOP RESISTANCE
ST-LDS-50-CBL	50 m spool	650 Ω
ST-LDS-100-CBL	100 m spool	1,300 Ω
ST-LDS-XXX-CBL	To order	length × 13 Ω/m

DESIGN THE RUN, THEN ORDER THE SPOOLS

Sense cable is joined with jumper cable between spools, and jumper length does not count toward the detected distance. Set out the run first, then order whole spools plus jumper to suit — cutting and re-terminating sense cable on site is not supported.

HANDLING AND STORAGE

- Keep clear of high temperature, open flame and strong magnetic fields.
- Do not drag over sharp edges — a scored sheath is a future false alarm.
- Do not paint, tape over or encase the cable; the detection gap must stay open.
- Store on the spool, dry, until the run is set out.

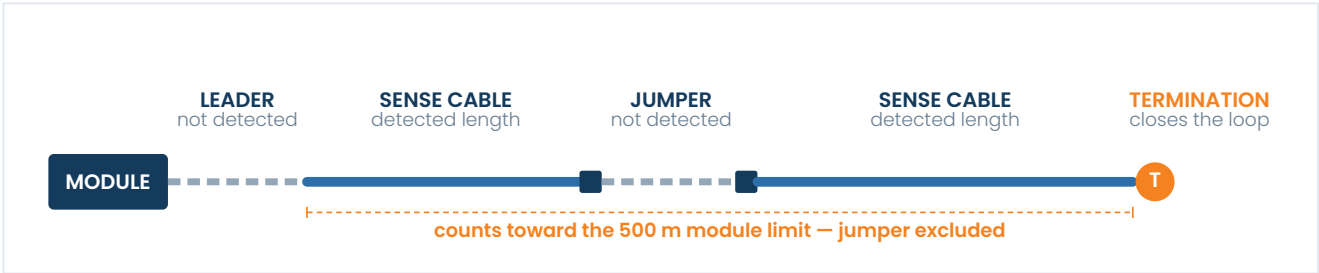
ACCESSORIES

The rest of the run.

Every metre of sense cable needs a way back to the module, a way between spools and a way to stay where it was installed. These are the parts that do that.

MODEL CODE	ITEM	FUNCTION	NOTES
ST-LDS-LDR-10	Leader cable, 10 m	Connects the module to the start of the sense run	Non-sensing. Length does not count toward detected distance.
ST-LDS-JMP-10	Jumper cable, 10 m	Bridges a gap between two sense cable sections	Non-sensing. Use to skip areas that need no coverage.
ST-LDS-CON	In-line connector	Joins two cable sections	Moulded, keyed. Keep out of standing water.
ST-LDS-TRM	End-of-line termination	Closes the detection loop at the far end	One per run. Without it the module reports a cable fault.
ST-LDS-CLP-100	Cable clip, box of 100	Fixes the cable at the correct standoff	Screw-fix or adhesive base. See page 13.

HOW A RUN IS COMPOSED



Leader and jumper cable are non-sensing: they carry the signal but contribute no detected length. Only the sense cable sections count toward the module limit and toward the displayed position.

Counting them

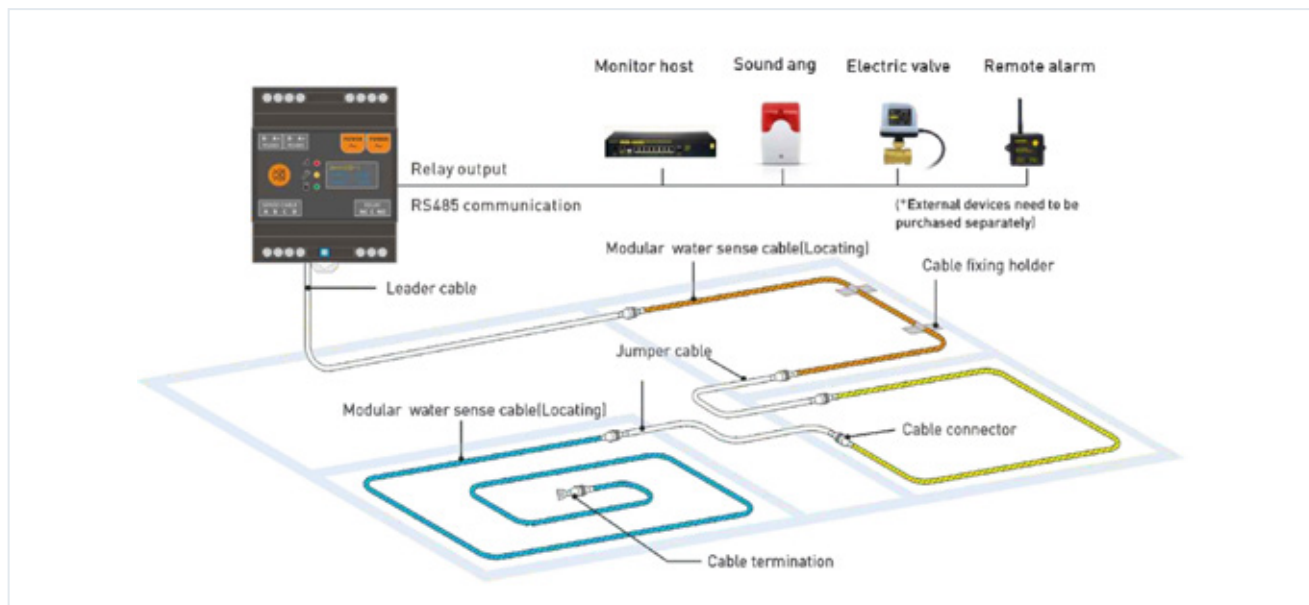
For a first-pass take-off the following ratios hold on most pipe-mounted and floor-void installations. Confirm against the layout drawing before they go into a bill of quantities.

ITEM	RULE OF THUMB
Leader cable	10 m per module
Jumper cable	≈ 0.5 m per metre of sense cable
Termination	1 per sense run
Cable clips	Per fixing centres — typically 0.5–1 m

MODULE COUNT FOLLOWS RUNS, NOT FLOOR AREA

Fix the runs on the drawing first — each under 200 m, each ending in a termination — and the module, leader, jumper and clip quantities fall out of it.

Field to head end.



Typical field architecture. Leader cable from the module to the start of the run, sense cable through the protected area, jumper cable across gaps, termination at the far end. The relay drives local devices; RS-485 carries status and position to the head end.

01 • FIELD

Sense cable is laid to the coverage pattern and returned to the module through leader cable. Each run ends in a termination. One module supervises one run.

02 • LOCAL ACTION

The volt-free contact drives whatever must happen without a network: close a solenoid valve, sound a local alarm, trigger an auto-dialler. This path keeps working if the network is down.

03 • HEAD END

Modules report status, position and cable resistance over Modbus RTU. Modules are housed in a panel per floor or per area; that panel sits on the trunk to the BMS or DCIM front end.

TRUNK DESIGN RULES

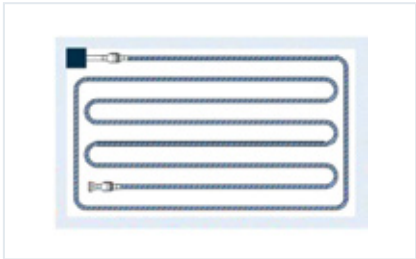
- Two-wire RS-485, daisy-chain topology. No stars, no spurs.
- 1,200 m maximum trunk length.
- Do not connect the shield ground terminal at the module.
- Terminate the trunk at both physical ends.
- Keep the trunk out of power containment.

DESIGN BOTH PATHS, NOT ONE

The commonest specification error on a leak detection system is to make the network the only route out. Set the relay mode to **03** and give every module a local consequence — a valve to close or a sounder to raise — so that detection still does something when the network does not.

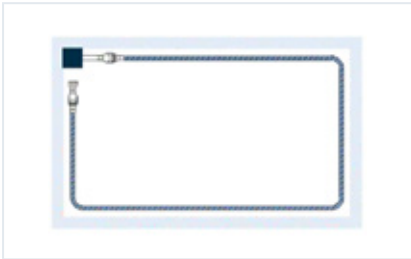
Three patterns, chosen by risk.

Coverage is a design decision, not a default. Pick the pattern from what you are protecting and what the water will do when it arrives.



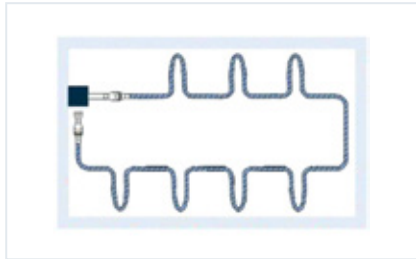
A — Full coverage

Serpentine across the whole area. Comprehensive protection for critical rooms.



B — Perimeter

Edge coverage. Prevents liquid immersing in or spreading out of the area.



C — Key point

Around known sources. Air-conditioning units, CRACs, valve sets, pumps.

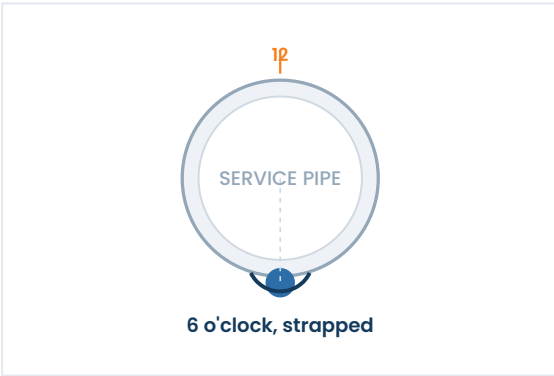
Choosing between them

PATTERN	USE WHERE	TRADE-OFF
A — Full coverage	Data halls, server rooms, UPS and battery rooms, archive stores — anywhere the floor void itself is the asset	Highest cable quantity; shortest search
B — Perimeter	Tank rooms, pump rooms, bundled plant — the objective is to catch spread before it leaves the room	Low cable quantity; will not find the source
C — Key point	Around AHUs, CRAC and FCU units, valve sets, strainers and known joints	Efficient; blind between the points covered

COVER THE ROOF AND THE RISERS

Tank farms, pump sets and vertical risers are routinely left out of a floor-by-floor take-off and are routinely where the event starts. Include them explicitly or record that they were excluded.

Pipe-mounted runs



Cable strapped at the 6 o'clock position, where a leak anywhere on the circumference will track to.

On exposed service pipework the cable follows the pipe rather than the floor. Strap it at the lowest point of the circumference, and run one cable per pipe where services are bundled — a single cable in a shared tray under three pipes finds the tray, not the pipe.

INSTALLATION

Fixing, limits, sensitivity.

FIXING THE CABLE



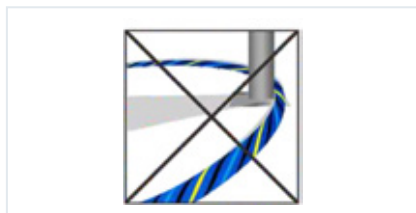
- ✓ **Dedicated cable clip**
Correct standoff, no crush.



- ✓ **Adhesive holder**
Where drilling is not permitted.



- ✓ **Strapped to pipework**
Hoisted along the pipe at 6 o'clock.



- ✗ **Under an air outlet**
Condensation reads as a leak.



- ✗ **Glued down**
Seals the detection gap. Not recoverable.



- ✗ **Bundled with metal**
Interference and crush damage.

LENGTH LIMITS

LIMIT	VALUE
Sense cable per module — absolute	500 m, excluding leader and jumper
Sense cable per module — design to	200 m
RS-485 trunk	1,200 m

Leader and jumper cable are non-sensing and are excluded from the sense cable limit, but they still add to the run the installer has to pull. Allow for them in containment.

SETTING SENSITIVITY

The front trimmer sets the threshold across 0–50 kΩ, stepless. Clockwise increases sensitivity.

- **High sensitivity** — a single drop will alarm. Use in data halls, server rooms and dry electrical rooms.
- **Low sensitivity** — standing water is needed to alarm. Use in plant rooms, wash-down areas and anywhere the floor is routinely damp.

Factory setting is normal. Set it per run, not per project — a corridor and a pump room do not want the same threshold.

COMMISSION BY WETTING, NOT BY ASSUMPTION

Wet the cable at a measured distance from the module, read the display, and trim unit resistance (register **40006**, range 12.5–13.5) until the two agree. Record the trimmed value against the run on the as-built. A system that has never been wetted has not been commissioned.

KEEP THE CABLE AWAY FROM

- Fire sources and surfaces above 80 °C
- Strong magnetic and RF fields, and power containment
- Air-outlet draught and condensate drip paths
- Dust-laden and abrasive environments
- Sharp edges, cut ends of tray, and threaded rod

APPLICATIONS

Where it gets specified.

The same cable and module cover all of these. What changes between them is the coverage pattern, the sensitivity setting and what the relay is wired to.



Data halls

Raised floor voids, cooling distribution, CDU and CRAC pipework, containment aisles.



Server and comms rooms

Ceiling voids and risers above unattended active equipment.



Hospitals

Plant serving theatres, imaging and wards, where an outage is clinical rather than commercial.



Archive and record stores

Deep storage where the contents cannot be replaced and damage is discovered late.



Museums and galleries

Stores, display cases and the services running above them.

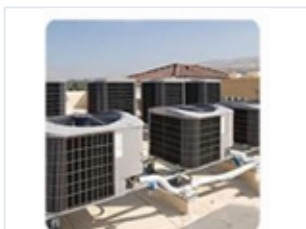


Equipment and plant rooms

AHUs, chillers, pump sets, valve stations, tank rooms and risers.



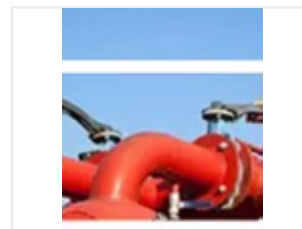
Data hall aisle



Rooftop chiller plant



Racked storage



Fire pump set

WHAT THE SYSTEM DOES NOT DO

It detects conductive liquid on a surface it is fixed to. It does not detect a leak inside a pressurised pipe that has not yet escaped, it does not measure flow, and it will not see non-conductive fluids. Where those are the requirement, specify accordingly.

The cable can only be fitted to pipework and voids that are accessible. Concealed runs need a different strategy or an accepted exclusion. Engineering, BMS integration, commissioning and installation labour are separate scope items.

APPENDIX

Modbus RTU integration.

LINK PARAMETERS

PARAMETER	VALUE
Protocol	Modbus RTU
Physical layer	RS-485, two-wire
Baud rate	9,600
Frame	8 data, no parity, 1 stop
Default address	01
Terminals	1–4, two ports in parallel
Shield ground	Do not connect
Min poll interval	500 ms
Recommended poll	1 s

Polling faster than 500 ms per device will return incomplete frames. On a large trunk, use the six-register block read rather than six separate requests — one transaction per device per second is enough for a leak detection system.

READ REGISTERS — FUNCTION CODE 04H

REGISTER	ADDRESS	CONTENT	INTERPRETATION
30001	0000H	Device address	1–255
30002	0001H	Status	00 normal · 01 disconnection · 02 leak · 03 both
30003	0002H	Leak position	Metres from the module. FF when no leak is present.
30004	0003H	Cable resistance	Measured, in metres equivalent
30005	0004H	Relay mode	00 none · 01 fault · 02 leak · 03 both
30006	0005H	Unit resistance	Value ÷ 10 = Ω/m. Default 130 → 13.0 Ω/m.

WRITE REGISTERS — FUNCTION CODE 06H

REGISTER	ADDRESS	CONTENT	RANGE
40001	0000H	Set device address	1–255
40005	0004H	Set relay mode	00 / 01 / 02 / 03
40006	0005H	Set unit resistance	125–135 → 12.5–13.5 Ω/m. Commissioning trim.

WORKED COMMANDS — DEVICE ADDRESS 01

OPERATION	REQUEST	RESPONSE	READING
Read status	01 04 00 01 00 01 60 0A	01 04 02 00 02 ...	Status 02 — leak present
Read leak position	01 04 00 02 00 01 90 0A	01 04 02 00 8F ...	0x008F = 143 → leak at 143 m
Read cable resistance	01 04 00 03 00 01 C1 CA	01 04 02 00 26 38 EA	0x26 = 38 → 38 m equivalent
Read all six registers	01 04 00 00 00 06 70 08	01 04 0C ...	Single-poll block read — preferred
Set relay to leak + fault	01 06 00 04 00 03 88 0A	echo	Recommended default
Trim unit resistance to 13.3	01 06 00 05 00 85 58 68	echo	0x85 = 133 → 13.3 Ω/m

CRC IS LITTLE-ENDIAN

The two CRC-16 bytes are transmitted low byte first, as shown. All frames above are complete and correct as printed — they can be pasted straight into a serial terminal for a bench test.

Position in register **30003** is only as good as the unit resistance in **40006**. If the head end reports a position that disagrees with the module display, the module has been trimmed and the head end has not — read the value, do not assume 13.0.



SOTER

SENSING & PROTECTION SYSTEM

Energia Technologies

[TELEPHONE — INSERT]

Specifications are subject to change without notice. All information is believed reliable; suitability for a specific application remains the user's assessment. Dimensions in millimetres unless stated.

SOTER-LDS-CAT-EN-01