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LOGSTOR Surveillance Manual

Kingspan®

Surveillance

Table of Contents

Segment choice - Overview

Introduction

LOGSTOR's product assortment covers 4 segments with each their objective.

From the overview the types of surveillance systems which can be used within the individual segment appear.

Each segment has been assigned a colour code, indicating whether a section contains information relevant to the segment.

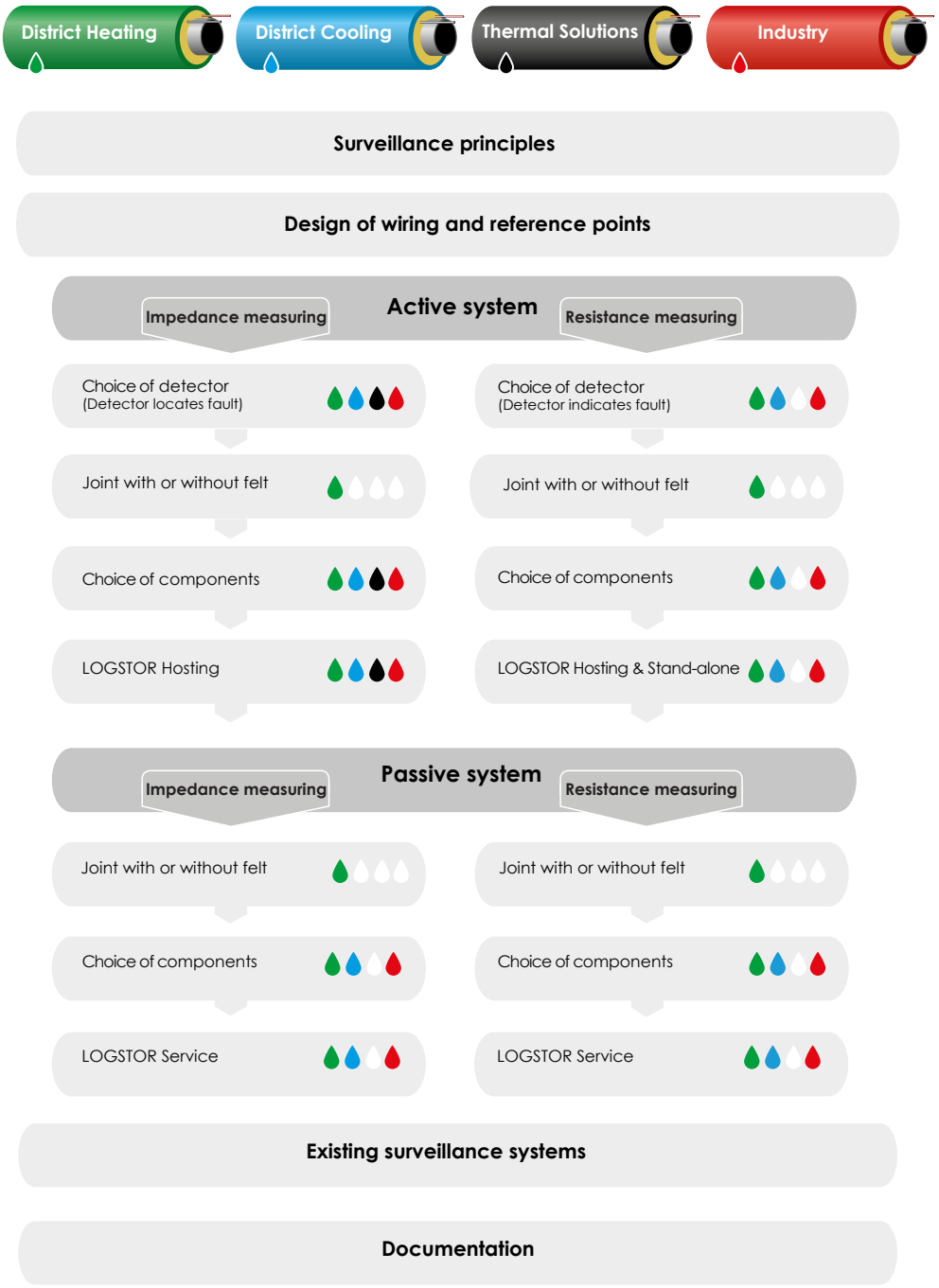
Contents

Segment choice - General

Application

From below diagram the type of surveillance applicable within each segment appears.

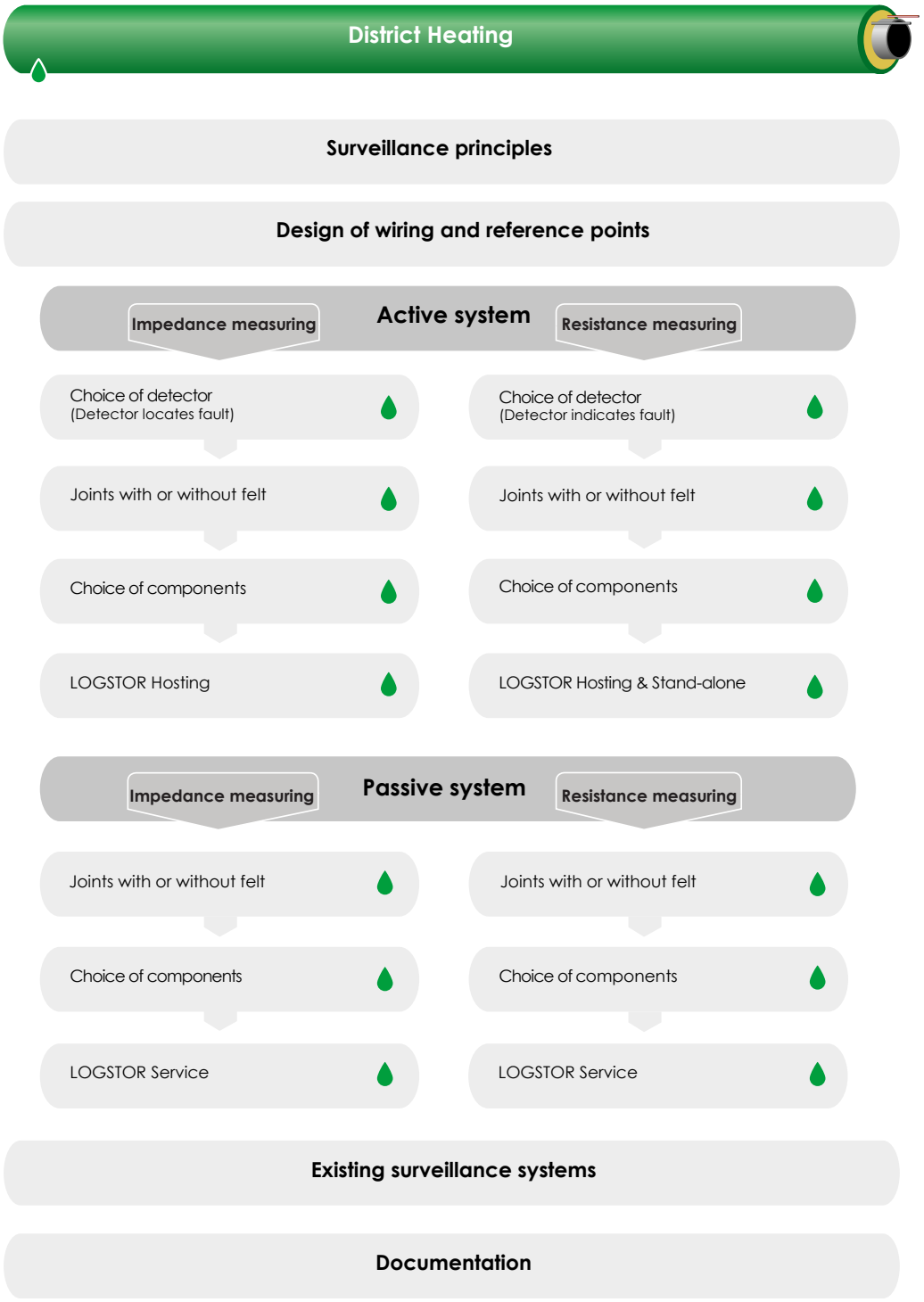
In the diagram reference is made to the relevant section, describing the possible applications.



Segment choice - District Heating

Application

From below diagram the options to consider in connection with design and establishment of surveillance for District Heating systems appear.



Segment choice - District Heating

Conditions

This section describes the pipes and components, manufactured in accordance with EN 253, applying to steel service pipe, PUR insulation, and outer casing as well as EN 14419, applying to surveillance systems.

The surveillance system is designed with a set of embedded alarm wires (2 pcs. wires of 1.5 mm^2 copper, of which one wire is tinned), placed in the same distance to the service pipe.

Requirements to the properties of the medium

The conductivity of the medium is significant for the type of surveillance detector to choose.

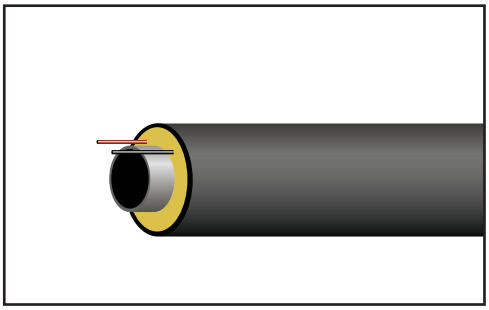
If the electric conductivity of the medium is >10µS/m, the detector types for resistance as well as impedance measuring can be used. See Surveillance principles for more details.

If the electric conductivity of the medium is <10µS/m, only the detector type for impedance measuring can be used.

Regardless of the conductivity of the medium faults due to moisture ingress from the outside can always be detected.

Type of alarm wires

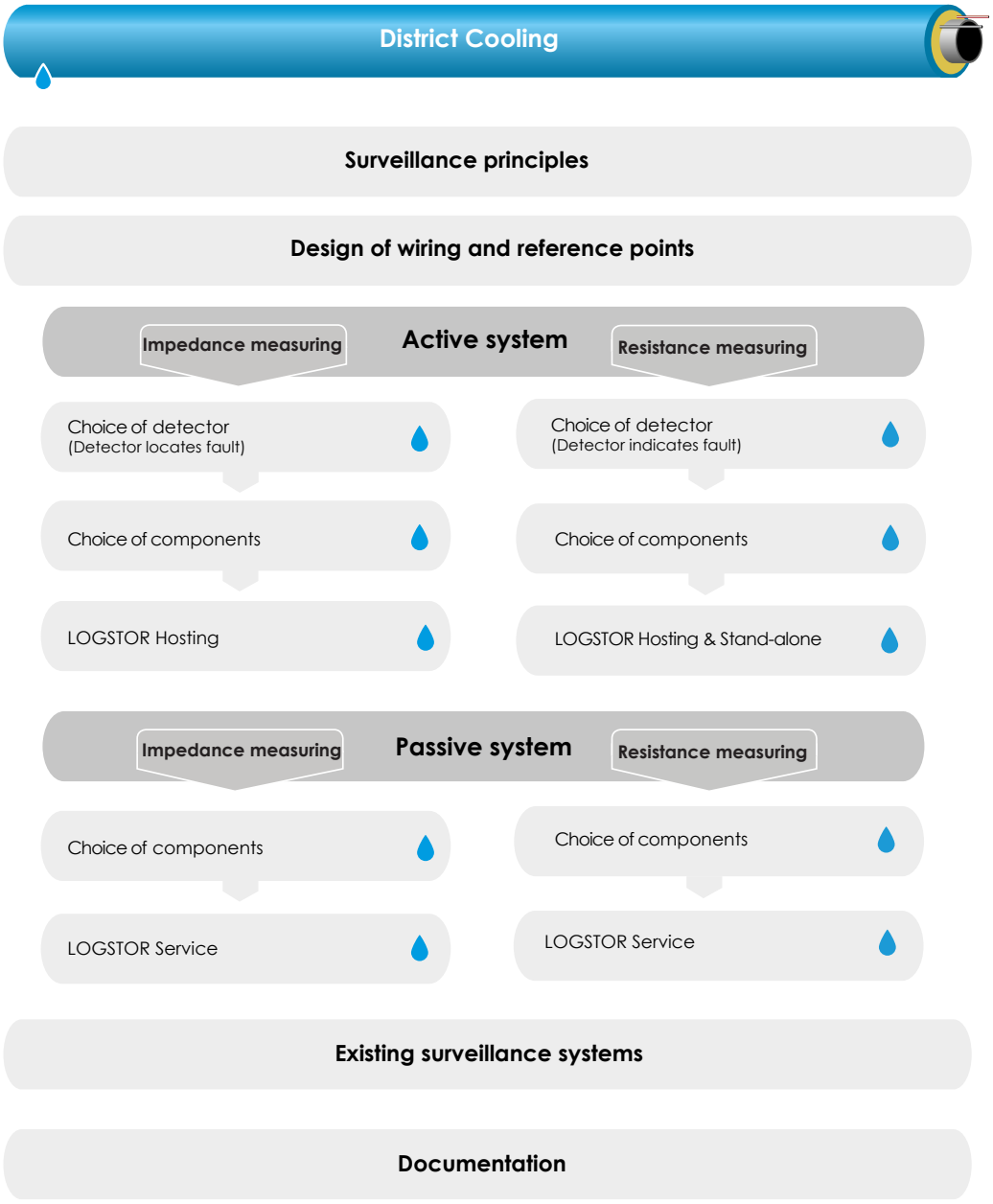
The surveillance system is designed with a set of embedded, insulated alarm wires (2 pcs. wire of 1.5 mm^2 copper, of which one wire is tinned), placed in the same distance to the service pipe.



Segment choice - District Cooling

Application

From below diagram the options to consider in connection with design and establishment of surveillance for District Cooling systems appear.



Segment choice - District Cooling

Conditions

This section describes pipes and components to be used in District Cooling systems.

If nothing else is specified, EN 17415-1 forms the basis for the system for the parameters which influence the surveillance system. Furthermore, EN 14419 applies to surveillance systems.

Requirements to the properties of the medium

The conductivity of the medium is significant for the type of surveillance detector to choose.

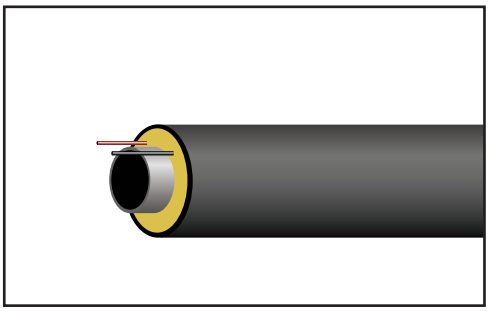
If the electric conductivity of the medium is >10µS/m, the detector types for resistance as well as impedance measuring can be used. See Surveillance principles for more details.

If the eletric conductivity of the medium is <10µS/m, only the detector type for impedance measuring can be used.

Regardless of the conductivity of the medium faults due to moisture ingress from the outside can always be detected.

Type of alarm wire, Nordic system

It is well-known that over time a little moisture (condensation) will gather in the insulation of District Cooling systems.



This condensation accumulation is especially problematic in case of repairs or connections, when the system is in operation and the surrounding temperature is higher than the media temperature. It is therefore important to ensure that the preinsulated system is completely tight at end terminations, at ventings, and in buildings prior to commissioning.

If the temperature is over service pipe temperature, a tent must be raised over the jointing place and the air temperature cooled down to the service pipe temperature or below.

Make sure there is no moisture at the foam ends by inserting a megger with two probes into the foam end and check the insulation. If there is moisture at the foam end, the wet foam must be removed.

The surveillance system is designed with a set of embedded alarm wires (2 pcs. wire of 1.5 mm^2 copper, of which one wire is tinned)placed in the same distance to the service pipe.

Resistance and impedance measuring can be used.

Segment choice - District Cooling

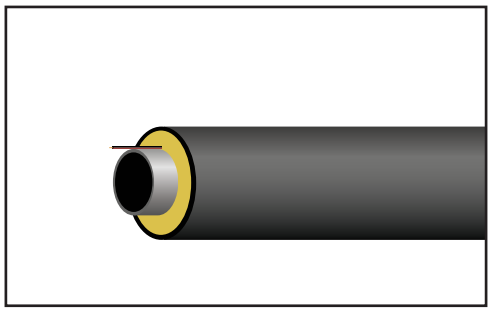
Type of alarm wire, insulated 3dc cables

It is well-known that over time a little moisture (condensation) will gather in the insulation of District Cooling systems.

This condensation accumulation is especially problematic in case of repairs or connections, when the system is in operation and the surrounding temperature is higher than the media temperature. It is therefore important to ensure that the preinsulated system is completely tight at end terminations, at ventings, and in buildings.

By using insulated 3dc cables the system can still operate despite the accumulation of moisture/condensation in the insulation. This is ensured by establishing new reference curves which take the built-in moisture into account.

Only impedance measuring can be used.



3dc cable

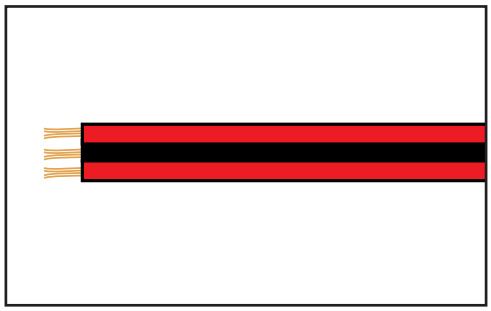
The 3dc cable consists of 3 conductors, each Ø 0.75 mm^2 Cu (stranded wire and not solid), embedded in one cable.

The conductor in the middle (marked with black) is used as a reference conductor in replacement of a steel service pipe.

The 3dc cable can be used in systems with steel carrier pipe as well as systems with plastic carrier pipe and also other types of carrier pipe which are electrically non-conductive.

The 3dc cable is used to monitor the entire pipe system by means of impedance measurements on the cable. The cable is fully insulated, also at connections.

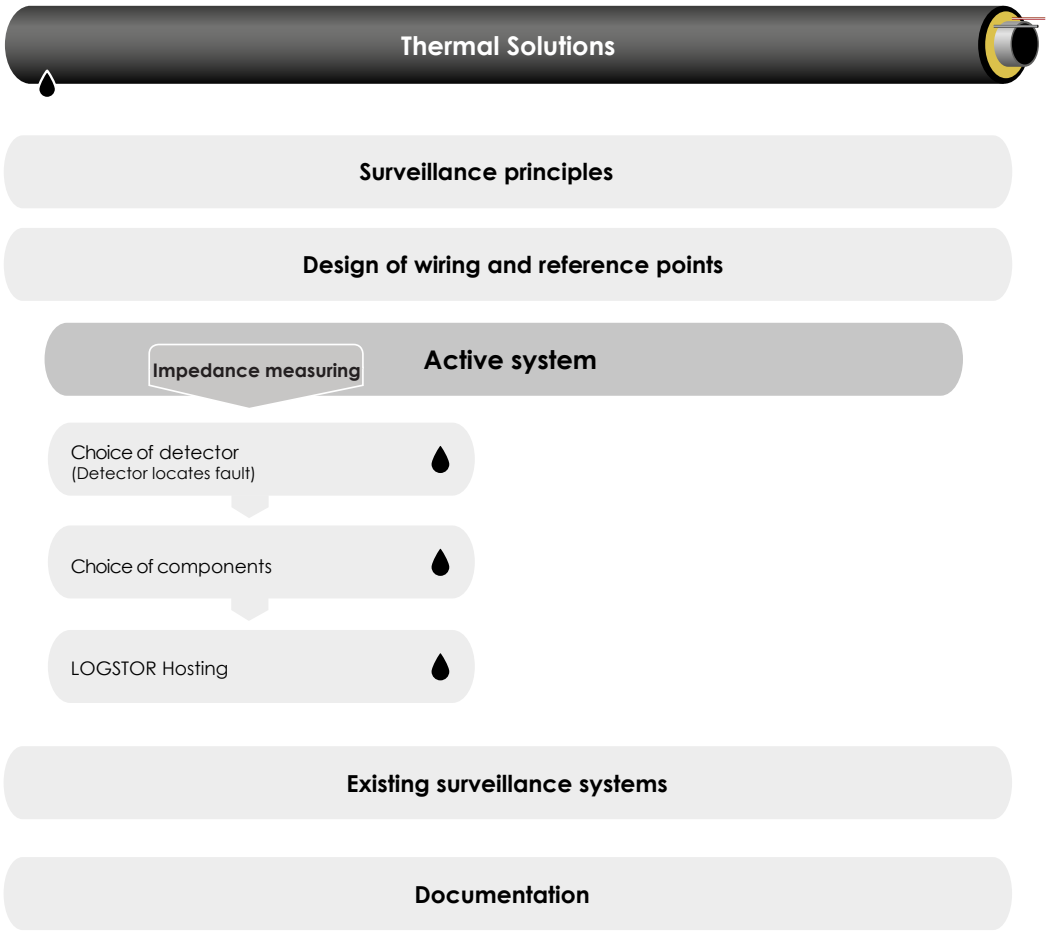
Measuring principle: The impedance is measured between the 2 outmost alarm wires in the cable (marked with red) and the black reference conductor.



Segment choice - Thermal Solutions

Application

From below diagram the options to consider in connection with design and establishment of surveillance for onshore pipelines appear.



Conditions

This section describes pipes and components, designed for a specific purpose within onshore pipe systems.

Where nothing else is specified EN 253 forms the basis for the system as regards the parameters which influence the surveillance system. Furthermore, EN 14419 applies to surveillance systems.

The insulation may consist of:

PUR (in accordance with EN 253)

PUR (density from 55 to 100 kg/m^3)

If the temperature profile is outside the scope of EN253, it must be examined, which type of surveillance system is suitable.

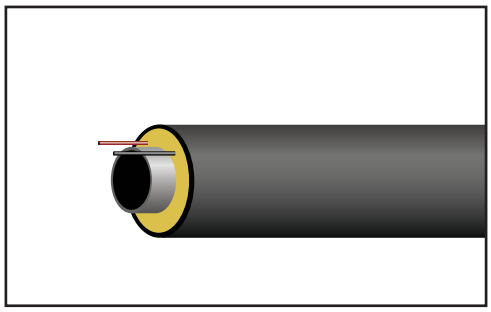
Segment choice - Thermal Solutions

Type of alarm wires

As surveillance system the following is used:

A set of embedded, uninsulated alarm wires (2 pcs. wire of 1.5 mm^2 copper, of which one is tinned), placed in the same distance to the service pipe.

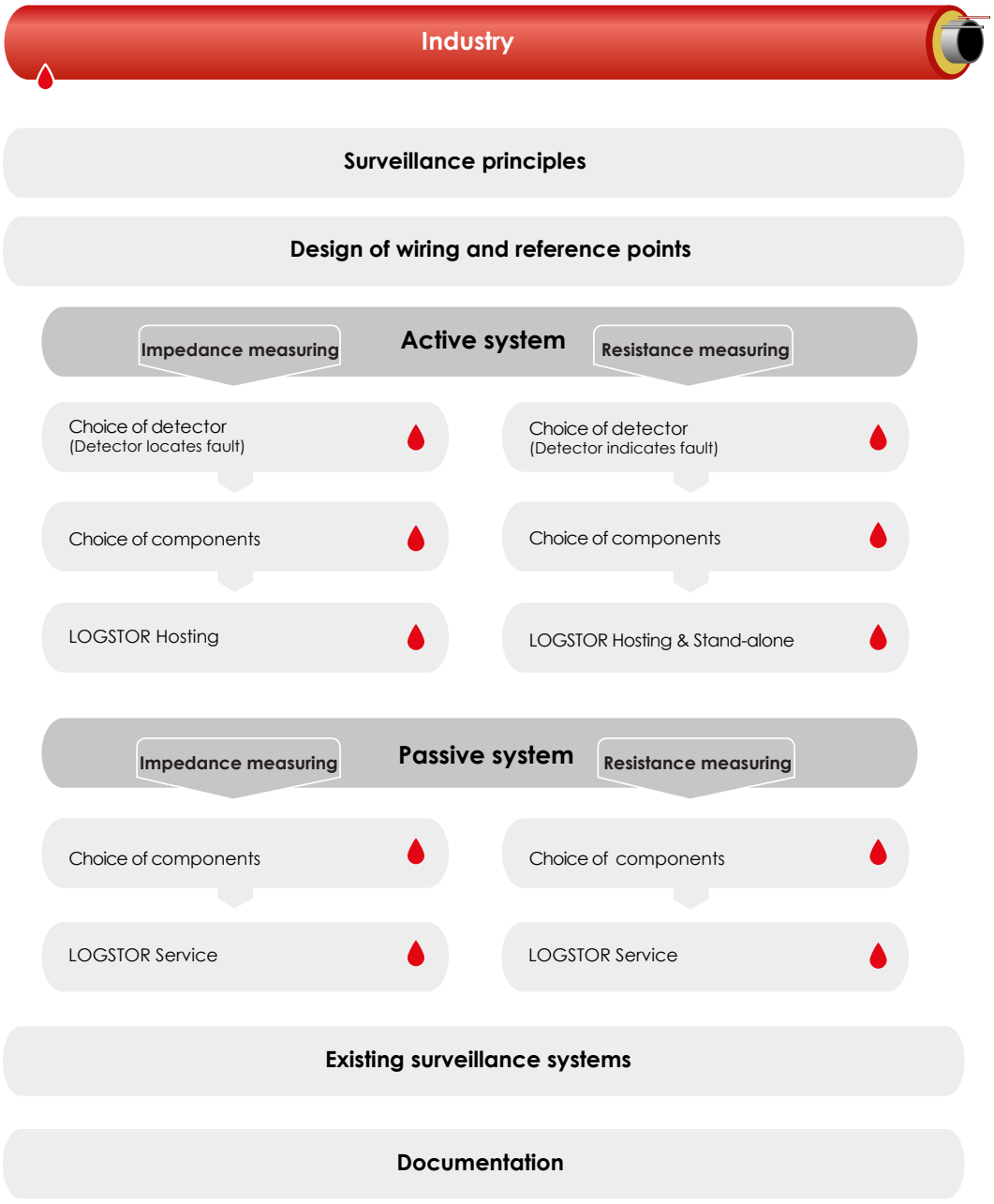
Typically, the surveillance system can only detect faults from the outside and open wire.



Segment choice - Industry

Application

From below diagram the options to consider in connection with design and establishment of surveillance for Industry systems appear.



Segment choice - Industry

Conditions

This section describes pipes and components which are designed for a specific purpose.

If nothing else is specified, EN 253 forms the basis for the system as regards the parameters, influencing the surveillance system. Furthermore, EN 14419 applies to surveillance systems.

The service pipe may consist of:

- Steel (in accordance with EN 253)
- Stainless steel
- Composite/plastic
- Glass reinforced plastic, GRP/GRE

The insulation may consist of:

- PUR (according to EN 253)
- PIR
- Mineral wool/PUR

The outer casing may consist of:

- PE (in accordance with EN 253)
- Spiral-folded pipes (outlet in buildings)
- Coated steel pipe

Requirements to the properties of the medium

The conductivity of the medium is significant for the type of surveillance detector to choose.

If the electric conductivity of the medium is >10µS/m, the detector types for resistance as well as impedance measuring can be used. See Surveillance principles for more details.

If the electric conductivity of the medium is <10µS/m, only the detector type for impedance measuring can be used.

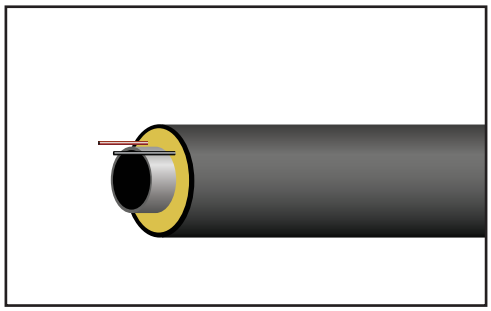
Regardless of the conductivity of the medium faults due to moisture ingress from the outside can always be detected.

Type of alarm wire

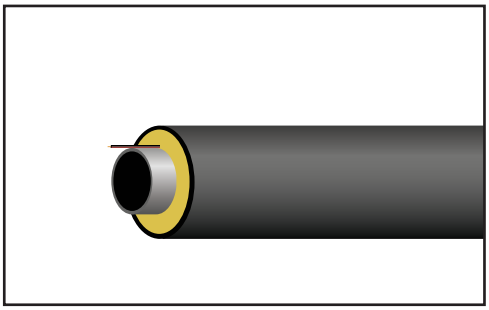
As surveillance system the following is used:

A set of non-insulated alarm wires (2 pcs. wire of 1.5 mm^2 copper, of which one is tinned).

Used in pipe systems with service pipe in accordance with EN 253.



- 3dc (3 conductors of each Ø 0.75 mm^2) Used in pipe systems with service pipe made of PE or glasfibre.



Surveillance principles - General

Introduction

This section describes the principles of resistance measurement, impedance measurement, and galvanic voltage for the Nordic system.

The principles apply to systems, designed in accordance with EN 253.

The following types of faults can be registered, when a given threshold limit value is exceeded:

- Broken wire

- Internal moisture fault (service pipe joint not tight)

- External moisture fault (casing joint not tight, damaged outer casing or condensation)

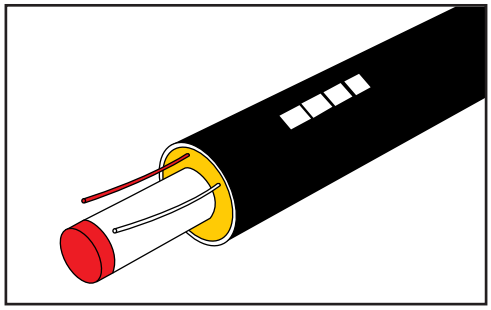
- Short circuit of alarm wires (wire/wire as well as wire/steel)

The section includes pipes and components, manufactured in accordance with EN 253 or 17415-1, applying to steel service pipes, PUR-insulation and outer casings as well as EN 14419, applying to surveillance systems.

Description

Pipes and preinsulated components are as a standard delivered with a set of uninsulated copper wires (2 pcs. wires of 1.5 mm^2 copper, of which one is tinned) embedded in the insulation (Nordic system).

LOGSTOR can offer delivery of systems with more sets of alarm wires.

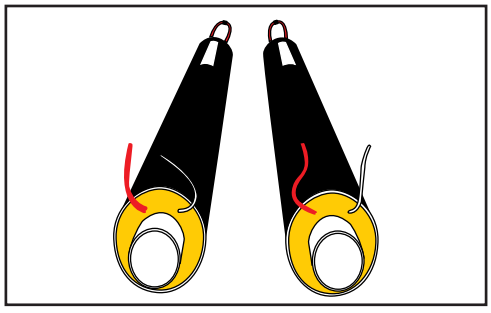


LOGSTOR Detect is based on the two wires being connected into a loop.

Detection is carried out on the part of the PUR-insulation between the copper wire and the service pipe.

Wire types for other surveillance systems can be delivered on request (e.g. Brandes HDW).

Within District Cooling and Industry insulated wires are also used, see description under the relevant segment under Segment choice.



Surveillance principles - General

Contents

Resistance measurement

Application

Resistance measurement is used to detect faults by measuring the wire resistance and the insulation resistance respectively.

Definition of wire resistance

The basic principle of wire resistance measurement is that the resistance of the alarm wire per running metre is known: Approx. 1.2 Ω per 100 m wire (1.5 mm2).

The alarm wires are connected in a loop and the wire resistance is measured.

When measuring the wire resistance in connection with the installation, the following can be checked:

- Broken wire. An infinite large resistance is a sign of a broken wire.

- Poor wire connection. If the measured resistance is higher than the calculated resistance of the alarm wire, there may be a poor wire connection.

- Short circuit

If the measured resistance is lower than the calculated resistance of the alarm wire, there may be a short circuit of the alarm wires or contact between alarm wire and steel pipe.

Definition of insulation resistance

The basic principle for measuring the insulation resistance is that the electric properties of the PUR-insulation change as a function of the moisture content.

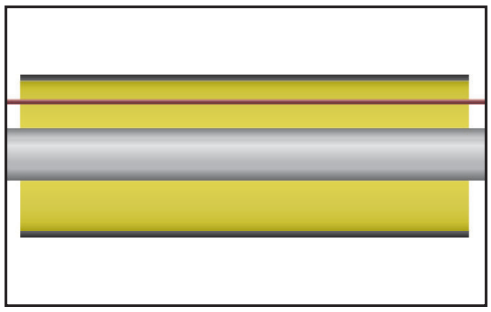
The conductivity of the PUR-insulation depends on the conductivity of the moisture (see Segment choice).

Direct voltage is applied to the copper wires and the service pipe and the insulation resistance is measured cf. Ohm's law:

$$R = \frac{U}{I}$$

Dry PUR-insulation:

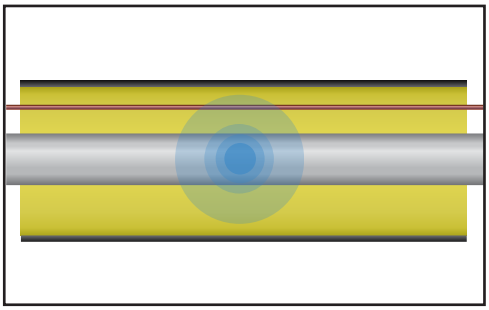
There is no current between alarm wire and service pipe through dry PUR-insulation, what results in an infinite large insulation resistance.



Resistance measurement

Moist PUR-insulation:

There will be a current between the copper wire and the service pipe through moist PUR-insulation, what results in a measurable insulation resistance cf. Ohm's law.



More areas with moist in the PUR-insulation:

If moisture is present in more areas in the pipe system as e.g. several poor casing joint connections, the resulting insulation resistance is measured as the sum of parallel resistances:

$$\frac{1}{\Sigma R_{iso,tot}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots + \frac{1}{R_n}$$

The sum of parallel resistances may result in sections which separately have an acceptable insulation resistance, but when summed up is a complete system with a too low insulation resistance. This may mean that the acceptance criterion for the system as a whole is not met.

$$\text{Acceptance criterion} \geq \frac{10\text{M}\Omega}{\text{km wire}} \ [\text{M}\Omega]$$

It can be extremely difficult to detect faults on systems with several joints where there are installation moisture. It is therefore essential that measurements are carried out from joint to joint during installation, so any installaton moisture is found and removed.

Pipe systems with less than 1 km wire are faultless, if the insulation resistance is minimum 10 MΩ.

Example 1

A pipe system with 1 km wire (= 0.5 km pipe) is thoroughly measured on handover. A 10V direct voltage is applied between copper wire and service pipe.

At a given current of 1µA the following insulation resistance is measured:

$$R = \frac{10V}{1\mu A} = 10M\Omega$$

The acceptance criterion is:

$$\text{Acceptance criterion} \geq \frac{10M\Omega}{1 \text{ km wire}} = 10M\Omega$$

The pipe system can be approved as being faultless according to the acceptance criterion.

Example 2

A pipe system with 5 km wire (= 2.5 km pipe) is thoroughly measured on handover. It consists of 10 locations with installation moisture which each has an insulation resistance of 1MΩ. 10V direct voltage is applied between copper wire and service pipe.

The resulting, measured insulation resistance is:

$$\frac{1}{\Sigma R_{iso,\,tot}} = \frac{1}{1M\Omega} + \frac{1}{1M\Omega} + \frac{1}{1M\Omega} + \cdots + \frac{1}{R_{10}} = 10\ M\Omega$$

$$R_{iso,tot} = 0.1\ M\Omega$$

The acceptance criterion is:

$$\Sigma R_{iso,\,tot} \geq \frac{10M\Omega}{5 \text{ km wire}} = 2M\Omega$$

The pipe system cannot be approved as being faultless according to the acceptance criterion.

Impedance measurement

Application

Impedance measurement (TDR = Time Domain Reflectometry) is used to locate a fault.

Definition of impedance

Impedance measurement works by sending a high frequency ac voltage out between the alarm wire and the steel service pipe. Changes in the impedance between the alarm wire and the steel pipe will be reflected back to the measuring device, and because the velocity of propagation is known the position of the fault can be localised.

- The impedance in the PUR-insulation depends on:

- The distance between alarm wire and service pipe

- The cross sectional area of the alarm wire

- The properties of the PUR-insulation.

As the above parameters are known in LOGSTOR's pipe systems, the impedance can be calculated to Z ~ 200 Ω.

The following can be identified by means of impedance measurement:

- Length of the alarm wire

- Distance to fault (number of metres of wire - localisation)

- Fault type (broken wire, moisture, short circuit)

- Loop

- Cable take-off

The impedance Z is the total resistance (R, L, C = ohmic resistance, inductance, capacitance).

Acceptance criterion

The acceptance criterion is defined on basis of the impedance measurement on commissioning (master curve) and deviations from this, which are detected at subsequent impedance measurements, are measured in per thousand. The acceptance criterion is typically maximum 50-100 ‰.

Galvanic voltage

Application

Measuring the galvanic voltage can be used on systems, designed in accordance with EN 253.

Galvanic voltage measurement is used to indicate moisture/water in the PUR-insulation.

Definition of galvanic voltage

The basic principle of galvanic voltage measurement is the electromotive series of metals. Is an electrolyte present in the PUR-insulation in the form of moisture or water, an electromigration will take place between the copper alarm wires and steel service pipe.

Unlike insulation measurement where a current is registered, here a voltage difference between alarm wire and service pipe, indicating the presence of moisture/ water between wire and steel pipe, is measured.

When measuring the galvanic voltage during operation the following can be checked:

- Dry PUR-insulation: No galvanic voltage is registered.

- Moist PUR-insulation: A galvanic voltage typically between 0.2-0.7V is registered.

The difference between insulation measurement and galvanic voltage measurement can be:

- Low insulation is not equivalent to moisture in the PUR-insulation: An example hereof is wire contact to the service pipe or if the wire is close to the service pipe.

If a galvanic voltage is measured it means that there is moisture in the system (electrolyte is present).

External water will have a higher conductivity and so result in a major galvanic voltage deflection. In this way it is indicated whether the fault is internal or external.

Alarm limits

The alarm limit is set on commissioning. Typical alarm limits are > 0.2-0.4V.

Illustrating fault types of the three measuring principles

Introduction

In the following examples, illustrating the fault types for impedance measurement, resistance measurement, and galvanic voltage measurement are given.

Faultless pipe system

For a faultless pipe system the measured values for impedance measurement, insulation and resistance measurement as well as galvanic voltage measurement are shown as appears below in XTool (graphic software for detector, see LOGSTOR Hosting).

The curves illustrate the progress between two reference points.

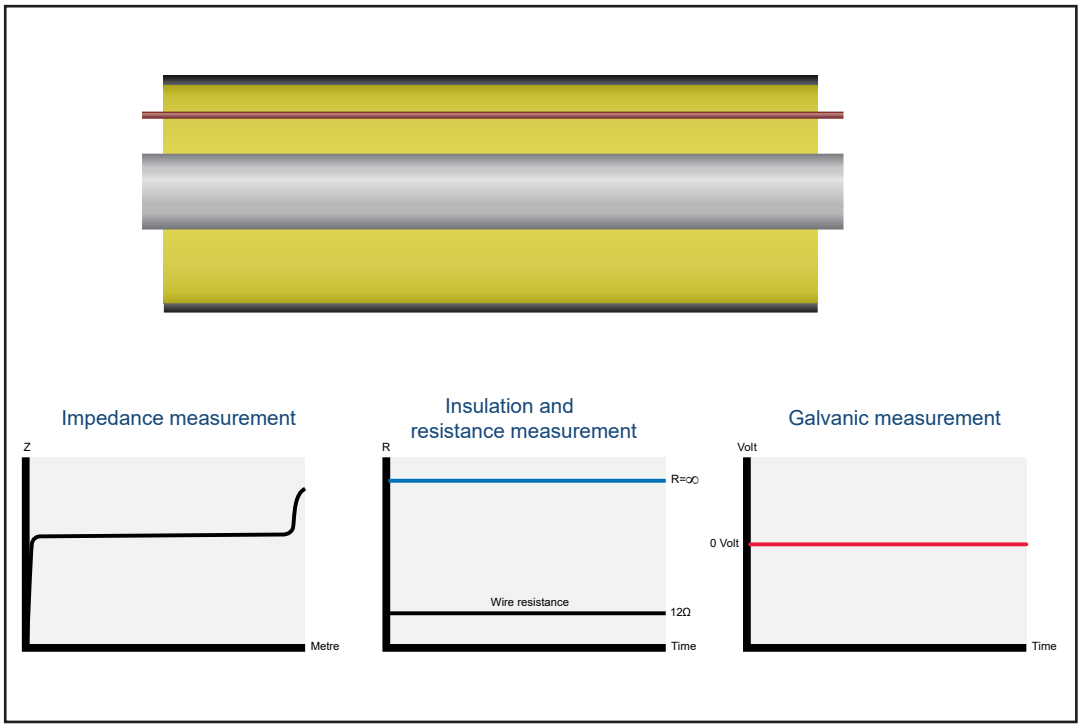
The impedance curve shows a constant impedance in the entire length of the wire without significant deflections.

The blue curve for insulation shows an infinite large ohmic resistance between wire and steel pipe (R=∞).

The black curve for the wire resistance shows 12 Ω, corresponding to the resistance in 1000 m wire (1 m wire = 0.012 Ω).

The curves for insulation and wire resistance will show a constant value.

The red curve shows the galvanic voltage between wire and steel pipe. The voltage is constantly 0 V, so no moisture is present between wire and service pipe.



Illustrating fault types of the three measuring principles

Broken wire

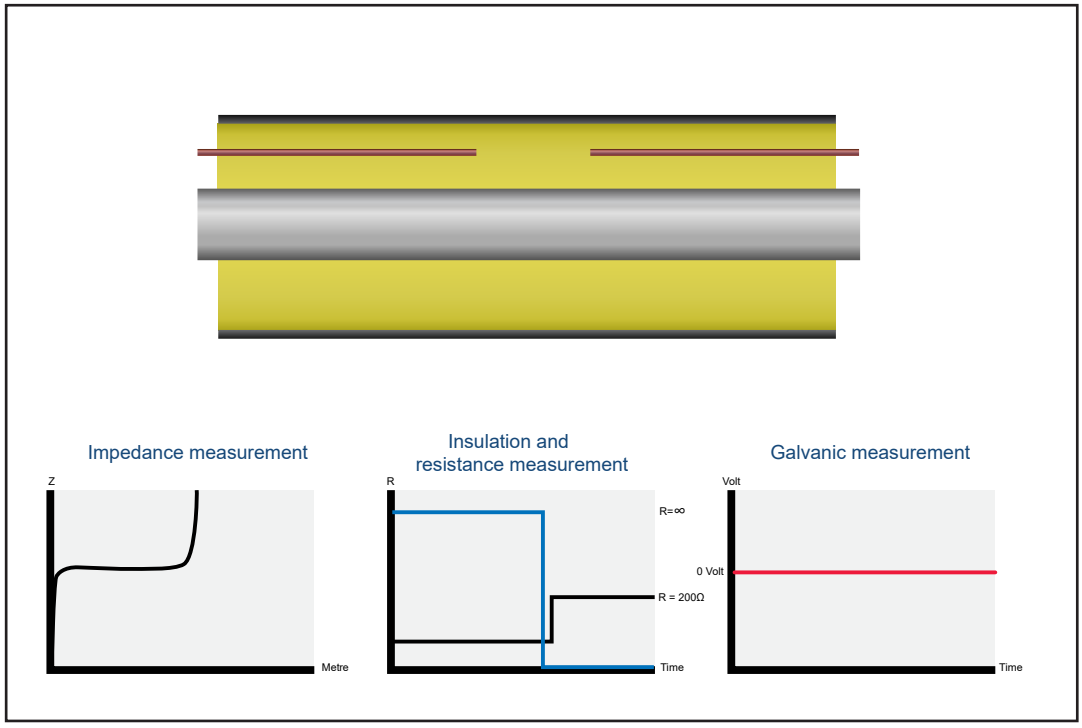
The impedance curve shows a considerable rise in the impedance where the fault is located.

The distance to the fault can be read from the horizontal axis, stated as metres of alarm wire.

The blue curve for insulation shows an infinite large ohmic resistance, until a broken wire occurs, after which it falls to 0.

The black curve for wire resistance shows a significant increase in resistance to > 200 Ω. The detector defines a resistance of 200 Ω as being a broken wire.

The red curve shows the galvanic voltage between wire and steel pipe. The voltage is constantly 0 V, so there is no moisture present in the pipe system.



Illustrating fault types of the three measuring principles

Moist insulation

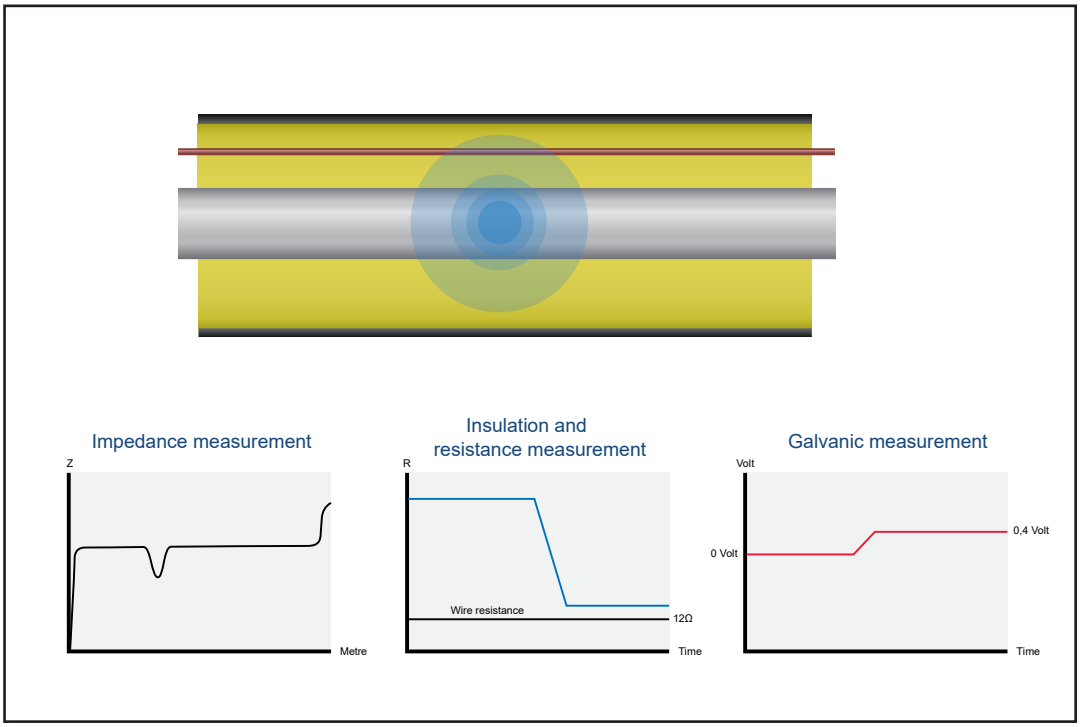
The impedance curve shows a clear drop in impedance where the fault is located.

The distance to the fault can be read from the horizontal axis, stated as metres of alarm wire.

The blue curve for insulation shows a decline in the insulation resistance. The decline is due to a current between wire and steel pipe at that location.

The black curve for wire resistance shows 12 Ω, corresponding to the resistance in 1000 m wire (1 m wire = 0.012 Ω).

The red curve shows a change in the voltage, because moisture functions as an electrolyte and so contributes to a galvanic voltage difference between the copper wire and the steel pipe.



Design of wiring and reference points - Overview

Introduction

This section describes the principles for design of wiring, wire length, as well as positioning take-offs and reference points.

Contents

Nordic Surveillance System:

- Design of wire lengths
- Systems with and without loop
- Wiring
- Reference points
- Earth connection

3dc cables in District Cooling and Industry

Symbol key

Marking cables

Examples of surveillance diagrams

Nordic surveillance system

General

A standard surveillance system in accordance with EN 14419 is based on a set of uninsulated alarm wires (2 pcs. of each 1.5 mm^2 copper, of which one is tinned).

To maintain a constant impedance and with it an easily read display of the pulse reflectometer it is significant that the alarm wires in pipes, components, and joints have a steady and even position in relation to the service pipe.

At take-offs from the buried pipe system it may be an advantage to use coaxial cables. In so doing you can freely choose a detector for either resistance measuring or impedance measuring.

Design of wire lengths

Systems with loop

In general the alarm wire is connected in a loop.

For loop systems each surveillance circuit, including take-off cables and reference points, must maximum be:

For X1L (resistance measuring):

4000 m trench (8000 m alarm wire)

For A1e (resistance measuring):

2500 m trench (5000 m alarm wire)

For X6 (impedance measuring):

3000 m trench (6000 m Nordic alarm wire per module)

1500 m trench (3000 m 3dc wire in loop per module)

An optimum position of the detectors doubles the range which can be obtained. Please contact LOGSTOR.

Systems without loop

For systems without loop (open systems) each surveillance circuit, including take-off cables and reference points, must maximum be:

For X6 (impedance measuring):

6000 m trench (6000 m Nordic alarm wire per module)

3000 m trench (3000 m 3dc wire per module)

For further information see Component choice.

In the design phase of an active measuring circuit it is important to allow for any future circuit expansions. The circuit should therefore be made shorter than the above stated wire lengths, so the maximum range of the detector does not exclude their surveillance.

Systems with and without loop

Systems with loop

In systems, where the wires are connected in loop the detector types X1L, A1e, and X6 can be used. If the wire is connected in loop 1 m pipe corresponds to 2 m wire.

Possibilities and limitations of X6:

1. Open wire:

In connection with a loop the entire circuit can still be measured, because a measurement can be carried out from both sides of the open wire.

2. Fault registration in the pipe system:

The fault can be measured from both sides, increasing the precision of the fault localisation.

3. Extensions after commissioning:

Changing an existing system from a loop to an open system without loop doubles the range.

For distribution pipelines loop is always recommended due to a higher uncertainty of the wire length in relation to the pipe length.

Systems without loop

In systems without loop detector X6 can be used. In these systems 1 m pipe corresponds to 1 m wire.

Possibilities and limitations of X6:

1. Open wire:

The detector can measure to the open wire. The remaining measuring circuit cannot be measured.

If both wires are monitored by the detector, the system can still be monitored via the other, not open wire.

2. Range:

The range is double in comparison to systems, connected in loop.

Wiring in joints

The wires should be led straight through the joint in the same distance to the servcie pipe as the preinsulated component. This also applies, if the wires from the two pipe ends are not placed opposite each other.

Please note! Crossing alarm wires in joints is NOT allowed.

Wiring in branches

As a standard the surveillance diagrams from LOGSTOR always indicate that branches are monitored.

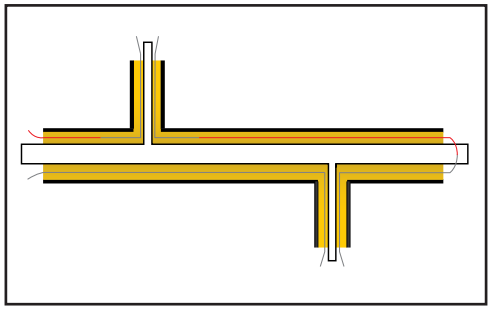
Right and left principle:

Branches to the right are connected to alarm wires to the right, and branches to the left are connected to alarm wires to the left.

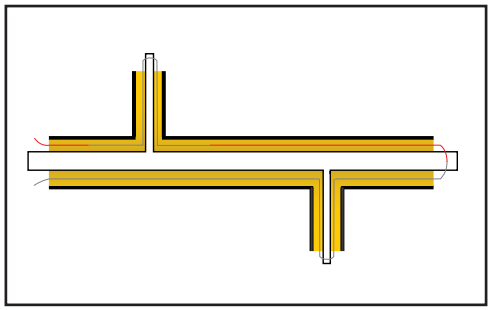
Please pay special attention to the wiring in connection with preinsulated, parallel branches. Make a control measurement in case of doubt.

As a standard preinsulated branches have 2 embedded alarm wires, of which the tinned wire is led out through the branch. So there are 2 possibilities of connecting the alarm wires:

1. Connecting the alarm wires, so main pipe and branch are monitored (standard).



2. Connecting alarm wires, so only the main pipe is monitored.



If the wiring is changed compared to the diagram e.g. choosing not to monitor preinsulated branches (principle No. 2), it is important to update the as-built documentation accordingly, because a correct registered wiring aqnd wire length is essential to a precise fault location.

Reference points

General

Each surveillance circuit is designed in accordance with the maximum range of the detector. When positioning reference points the surveillance circuits should be split into minor measuring sections. The minor measuring sections increase the possibility of a precise localisation of faults and fault types.

Causes which may result in a difference in wire length and pipe length:

- Displacement of wire position in relation to the pipe end - results in a longer wire
- Wiring in branches which are not correctly registered in the as-built drawing
- Position of take-off cables in relation to the service pipe
- Length of the take-off cables
- Inaccuracy of the measuring device

Reference points can be placed locally in cabinets, buildings or at TwinPipe valves.

Rules for reference points

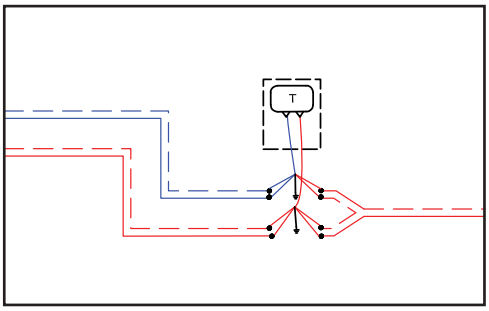
Take-offs for reference points should, whenever possible, always be connected to the alarm wires of the main pipe.

Take-offs on branch pipes should be limited, because branch pipes are only covered by one of the wires from the main pipe (see rules for wiring), resulting in an increased number of reference points.

Transition from pipe pair to TwinPipe system

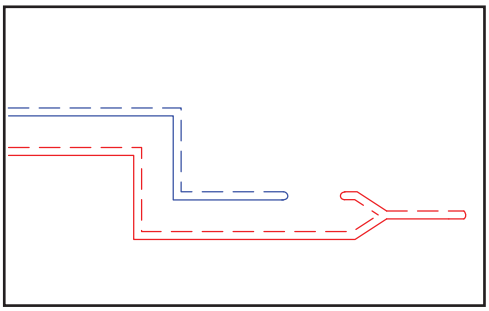
On transition from a pipe pair to a TwinPipe system where the TwinPipe section is >12 m a reference point must be established.

Take-off must be placed on single pipes.



On transition from a pipe pair to a TwinPipe system where the TwinPipe section is < 12 m a reference point is not required.

From the as-built drawing it must appear whether the surveillance circuit for flow or for return covers the TwinPipe system.



Distance between reference points

Distinction is made between distribution and transmission pipelines.

L_t is the recommended wire length of transmission pipelines with a limited number of branch pipes.

L_d is the recommended wire length of distribution pipelines with an unlimited number of branch pipes.

The wire length in TwinPipes is shorter, because unlike pipe pairs it is not possible to make a reference measurement.

Recommended wire length	Transmission pipelines (L_t), m	Distribution pipelines (L_d) m
Single pipe	1000	500
TwinPipe	800	400

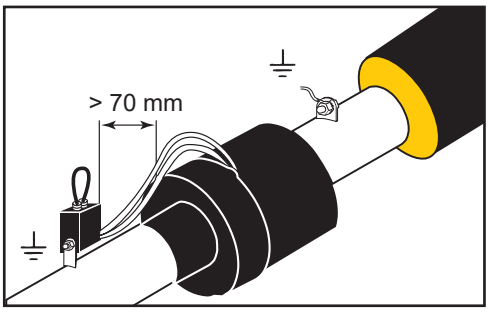
Earth connection

General

In all positions where the wiring exits the pipe system, earth connections must be welded on (carried out as part of the construction contract).

When establishing a reference point or take-off to a detector in a building, an earth connection must also be welded on. The earth connection is available in a short and a long design.

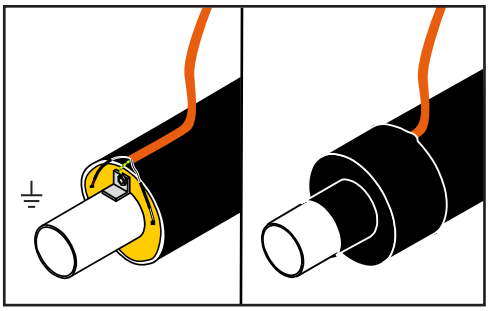
Welding on earth connections ensures a correct measuring reference to the steel pipe.



Earth connection after impedance principle.

From the surveillance diagram it appears where the earth connection must be established.

Earth connections should be established at the same time as the pipes are welded together.



Earth connection after resistance principle.

3dc cables in District Cooling and Industry

General

It is recommended to make 3dc systems with loops.

For 3dc cables the resistance of the alarm wire is approx. 3.2 Ω per 100 m wire (0.75 mm^2).

Design of wire lengths

See description under Nordic System.

Wiring in joints

The 3 wires continue through the joint.

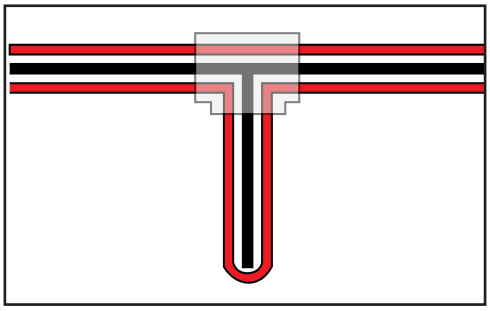
It is important that the two conductors with red insulation be in the same distance to the reference conductor, marked with black.

Wiring in branches

Branches are made with an embedded 3dc branch tee coupling where one of the conductors covers the branch.

The reference conductor in the branch is connected to the reference conductor in the main pipe.

The conductors in the branch pipe must always be connected in loop.



Reference points

See Nordic System.

Earth connections

In this system earth connections are not used, because only one reference conductor is used.

Symbol key

General Please find below the standard symbols used to prepare surveillance diagrams.

Signature	Name	Passive Impedance measuring	Passive Resistance measuring	X1L	A1e	X6
Nordic						
	Copper wire A - measuring circuit 1	x	x	x	x	x
	Copper wire B - measuring circuit 1	x	x	x	x	x
	Copper wire A - measuring circuit 2	x	x	x	x	x
	Copper wire B - measuring circuit 2	x	x	x	x	x
	Copper wire A - measuring circuit 3	x	x	x	x	x
	Copper wire B - measuring circuit 3	x	x	x	x	x
	Copper wire A - measuring circuit 4	x	x	x	x	x
	Copper wire B - measuring circuit 4	x	x	x	x	x
	Insulated wire A - measuring circuit 1	x				x
	Insulated wire B - measuring circuit 1	x				x
	Insulated wire A - measuring circuit 2	x				x
	Insulated wire B - measuring circuit 2	x				x
	Insulated wire A - measuring circuit 3	x				x
	Insulated wire B - measuring circuit 3	x				x
	Insulated wire A - measuring circuit 4	x				x
	Insulated wire B - measuring circuit 4	x				x
3dc cable						
	Copper wires - measuring circuit 1	x				x
	Copper wires - measuring circuit 2	x				x
	Copper wires - loop - measuring circuit 1	x				x
	Copper wires - loop - measuring circuit 2	x				x
X1L 1 2 3 4	Detector X1L		x	x		
A1e 1 2 3 4	Detector A1e		x		x	
X6 1 2 3 4	Detector X6					x
T	Terminal box		x	x	x	
PG	Connection box PG		x	x	x	
UHF	Connection box UHF		x	x	x	
UHF-3dc	Connection box UHF - 3dc	x				x
	Connection box 1232	x	x	x	x	x
⏚	Earth connection	x	x	x	x	x
	Cable take-off 5-conductor orange		x	x	x	
	Twin cable	x	x	x	x	x
	Twin valve with measung point	x	x	x	x	x
	Cabinet, narrow	x	x	x	x	x
	Cabinet, wide	x	x	x	x	x

Wire connection at cable take-offs and cabinets

1. To connect the wires at cable take-offs and cabinets correctly, please observe the drawings as much as possible.

2. The start is always at the heating station and/or the biggest dimension. The general rule is that the lowest number is closest to the biggest dimension/heating station. Please follow the dimensions, when placing the wires 1 & 2 to the right and 3 & 4 to the left in the pipe – seen vertically. As a rule tinned and copper wires are used, but please note that the wires may be twisted, i.e the tinned wire can be to the left in the pipe – the general rule for drawings is to place the tinned wire to the right in the pipe. If the direction of the flow is known and seen from a horizontal view to the take-off connect the wires as described:

Flow from the right:

Top wires: 1-2.

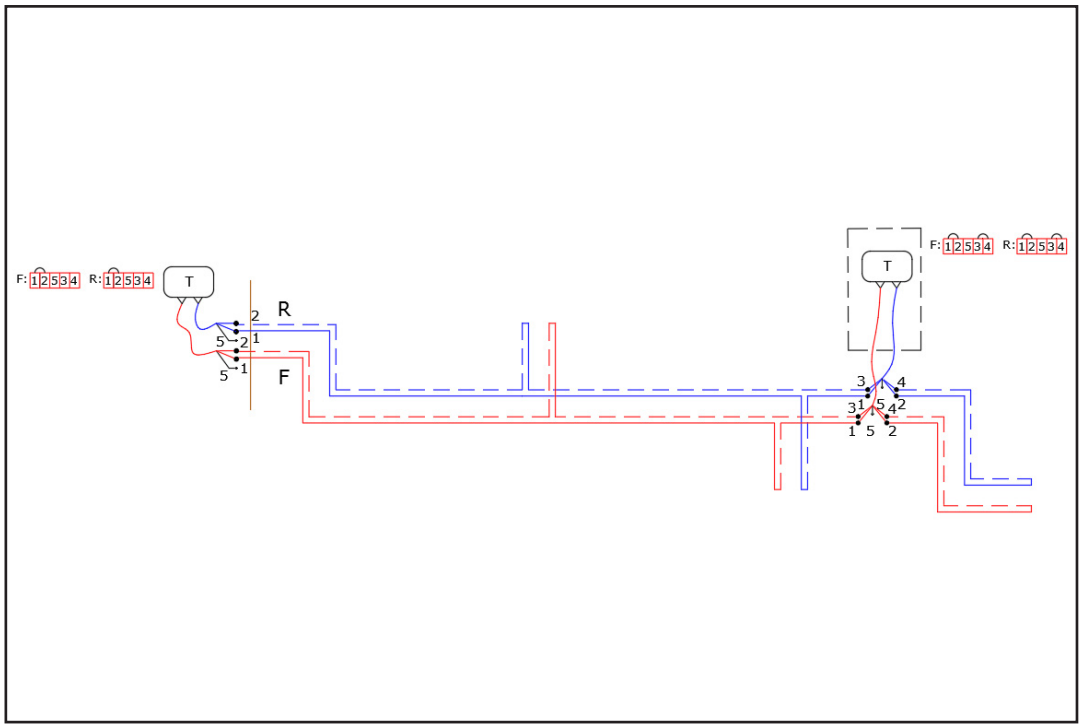
Bottom wires: 3-4

Flow from the left:

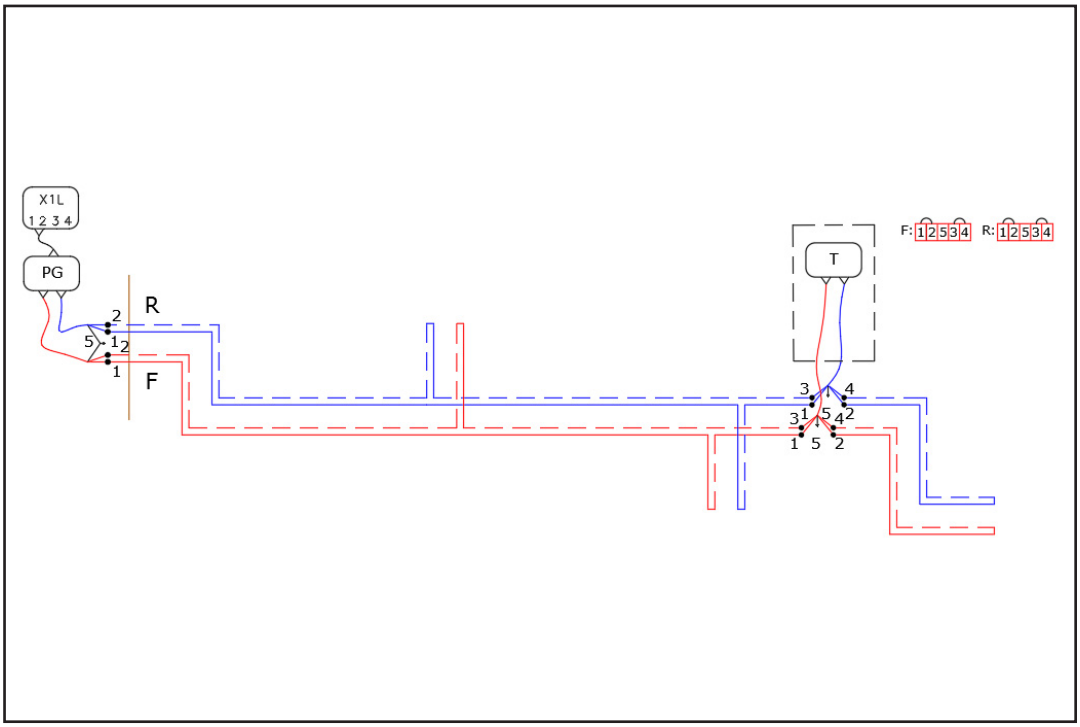
Top wires: 3-4.

Bottom wires: 1-2.

Wire connection in a passive system for resistance measuring



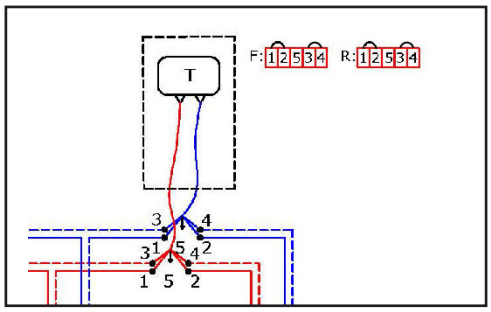
Wire connection in an active system with X1L for resistance measuring



Wire connection in an active system box 1517 as a reference point

The illustrations to the right clearly show the wire connection.

It is already known that the biggest dimension/the heating station/the flow direction is to the left. Start with the lowest wire numbers to the right from the biggest dimension and mark the wires 1 & 2, and mark the wires to the left from the biggest dimension 3 & 4. The lowest number is ALWAYS closest to the biggest dimension to the right of the pipe seen from the biggest dimension.



In other words: Horizontally seen, the biggest dimension is to the left:

- Top wires: 3 & 4

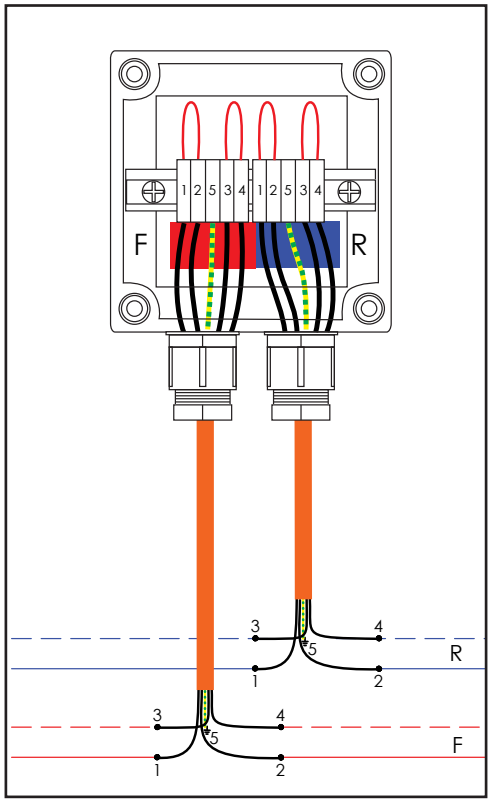
- Bottom wires: 1 & 2

Vice versa:

- Top wires: 1 & 2

- Bottom wires: 3 & 4

Remember always to mark the wires 1 & 2 to the right in the pipe (see also next page in connection with buildings).

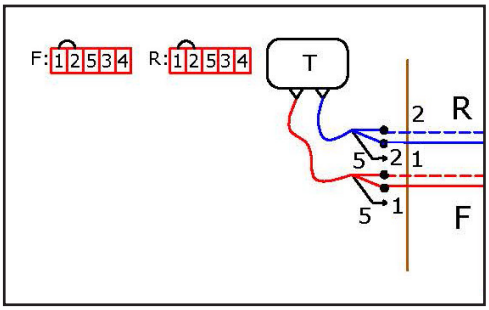


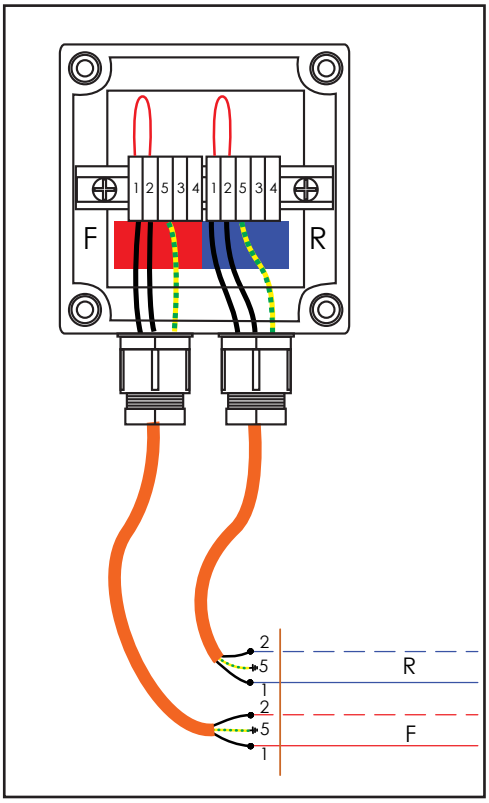
Wire connection in a passive system box 1517 at the beginning of a system

Please note that only 2 wires are connected per pipe at house connections.

This example shows the passive system, starting in the building where the box is placed.

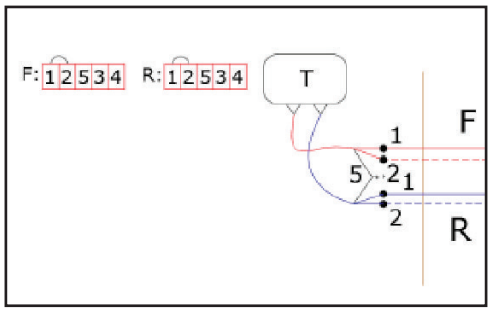
In this case number 1 should always be on the right wire.

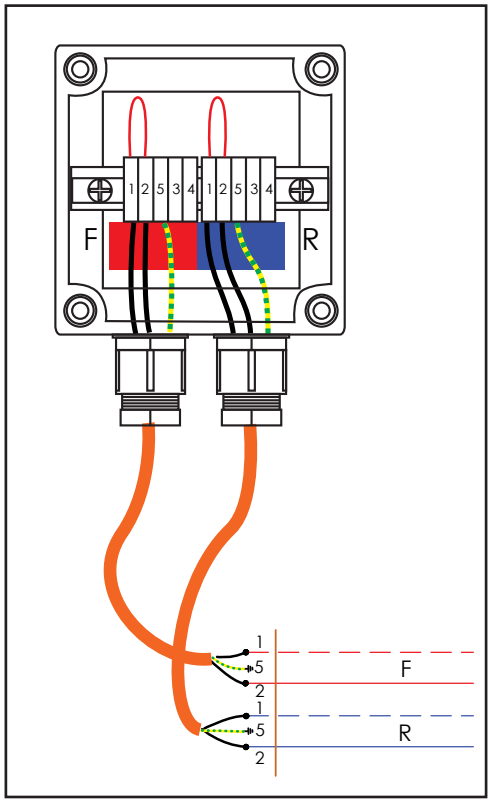




Wire connection in a passive system box 1517 at the end of a system

If the point ends in a terminal box, the wiring must be as illustrated.





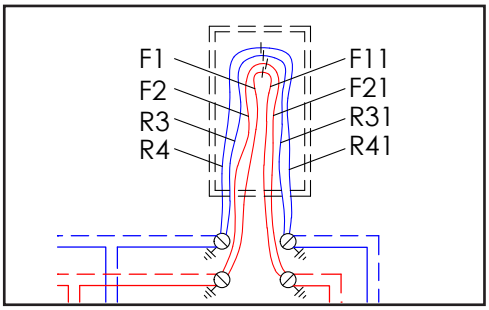
Wire connection in an active system X6

For coaxial cables the wiring is as illustrated.

The flow pipe is to the right seen from the biggest dimension and at the bottom seen horizontally.

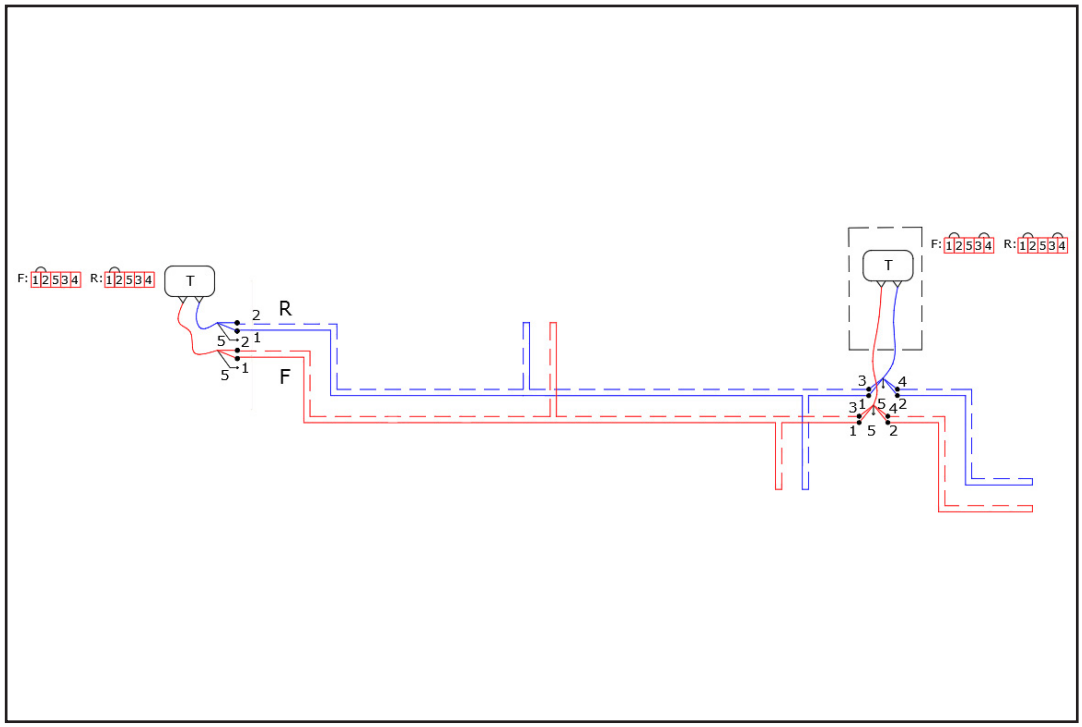
The cables of the flow pipe should always have numbers F1, F11, F2, and F21. Cable 1 must always be to the right of the flow pipe and from the side of the biggest dimension and continue (via connection link in the cabinet) with cable F11. Cable 2 must always be to the left of the flow pipe and from the side of the biggest dimension and continued (via connection link in the cabinet) with cable F21.

The rules for cables in the return pipe are exactly the same, but cables R3, R31, R4, R41 are used instead of F1, F11, F2, F21.

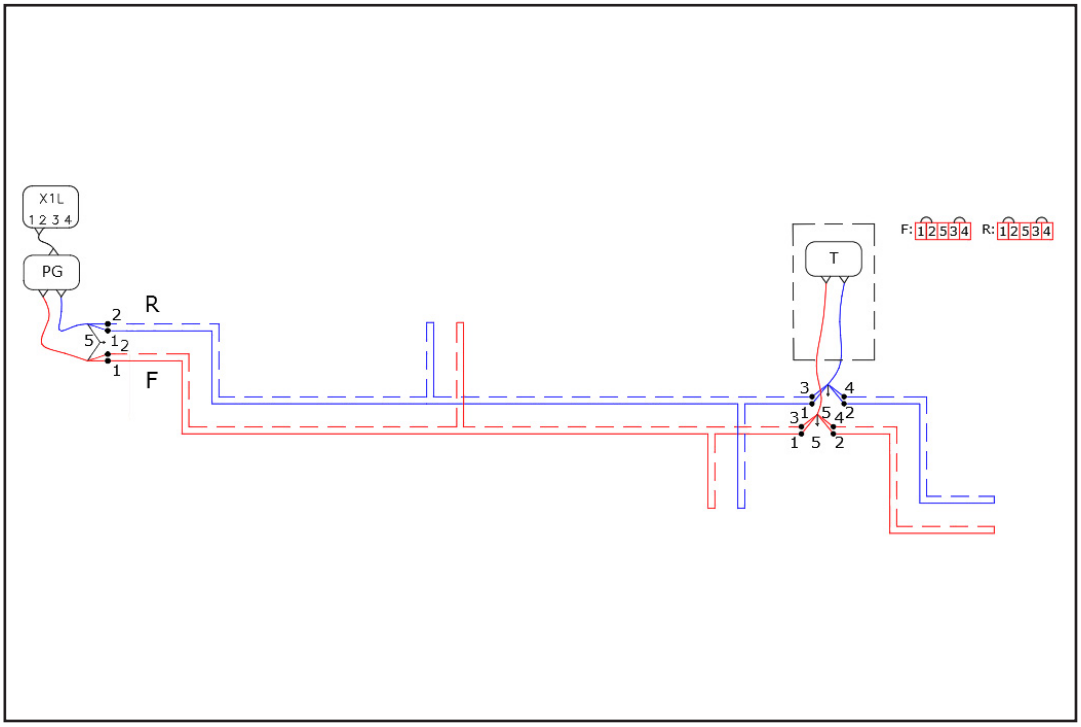


Examples of surveillance diagrams

Passive system for resistance measuring, Nordic

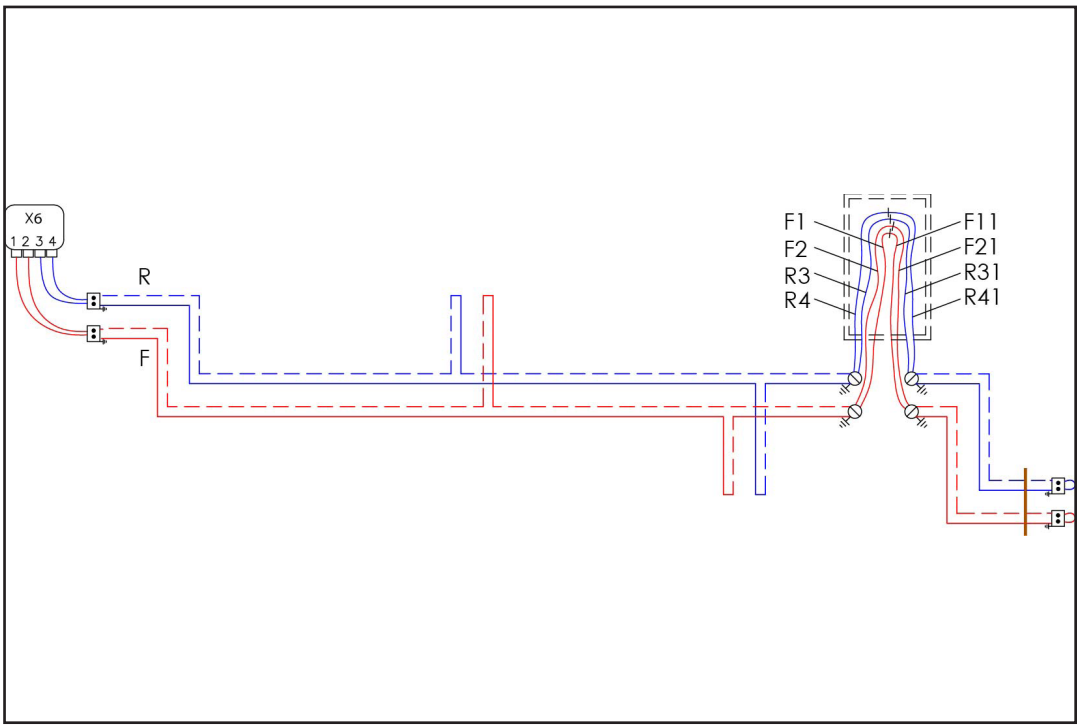


Active system with X1L for resistance measuring, Nordic

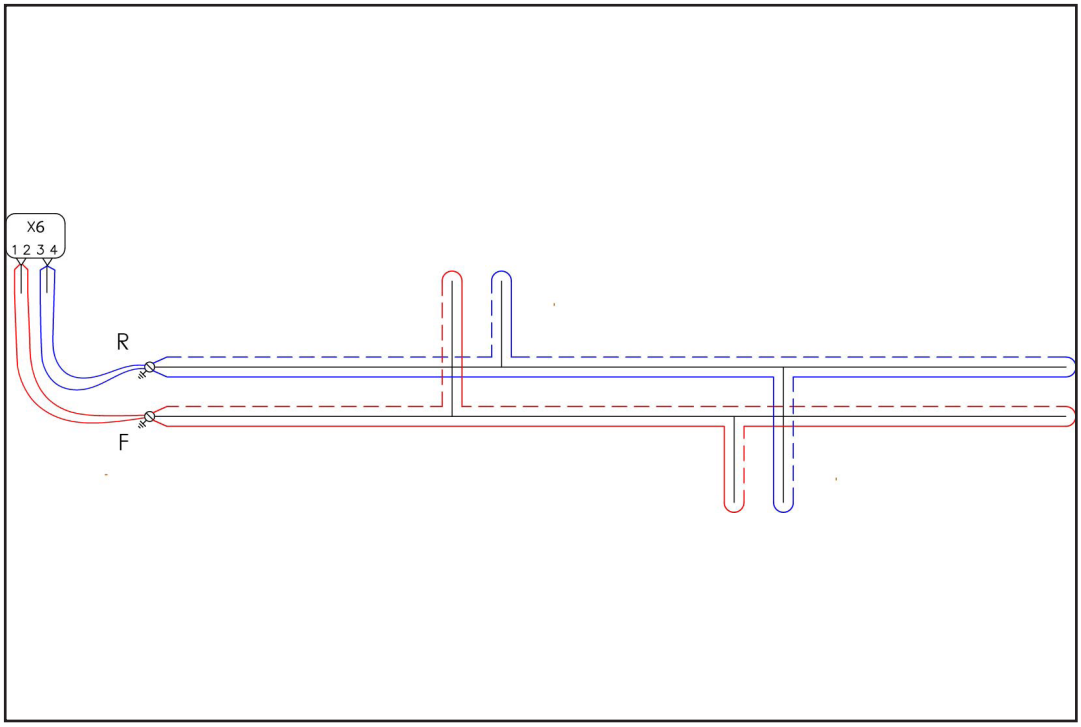


Examples of surveillance diagrams

Active system with X6 for impedance measuring, Nordic



Active system with X6 for impedance measuring (3dc Cooling and Industry), illustrated as a loop



Active and passive surveillance system

Introduction

Two different surveillance systems can be chosen for preinsulated pipe systems:

- Passive

- Active

A complete pipe system may consist of both passive and active sections.

It is always possible to upgrade a passive system to an active system by installing detectors, see Existing surveillance systems.

Passive system

A surveillance system in which the alarm wires are led to a reference point (terminal box), which is accessible in buildings or cabinets.

As needed or at fixed intervals the condition of the surveillance system can be manually checked by means of mobile measuring equipment.

LOGSTOR recommends that the pipe system is check measured on a continuous basis.

NOTE! The longer the interval between check measurements, the higher the risk of any fault developing with increased repair costs as a consequence.

Active system

A surveillance system in which the alarm wires are continuously monitored by a detector.

Dependent on which information is wanted from an active surveillance system, there are more detectors with different properties available:

Detector X1L-G:

- Visual/acoustic signal as well as possibility of signal for SCADA-system

- Graphic presentation of measured values in the Windows-based XTool-software

- Data acquisition and reproduction of measurements over time. Display of history

- Alarm via SMS and e-mail

Detector A1e-G:

- Visual/acoustic signal as well as possibility of signal for SCADA-system

- Graphic presentation of measured values in the Windows-based XTool-software

- Data acquisition and reproduction of measurements over time. Display of history

- Registration of pressure and temperature in the pipe system as well as chamber surveillance (water level)

- Alarm via SMS and e-mail

Active system, continued

Detector X6:

- Visual signal as well as possibility of signal for SCADA-system

- Graphic presentation of measured values in the Windows-based XTool-software

- Data acquisition and reproduction of measurements over time. Display of history

- Reproduction of changes in the surveillance system in relation to reference measurement.

- Indication of fault reasons as well as their location (distance to fault)

- Alarm via SMS and e-mail

Detectors, connected to XTool, make it possible for the customer continuously to monitor and analyse the measured values himself, see LOGSTOR Hosting. Damages can therefore be detected in due time, so any corrosion damages to the service pipe or serious moisture damages in the insulation can be prevented or minimised.

A proper functioning surveillance system is an essential contribution to the systematic maintenance of a pipe system, so operation costs are minimised and service life is prolonged.

Choice of components - Overview

Introduction

The segment - District Heating, District Cooling, Thermal Solutions or Industry - defines the components to use for resistance measuring and impedance measuring respectively.

The detector type is chosen after the principle for resistance or impedance measuring.

When a detector type has been chosen, the matching components to use for a complete system have also been determined.

Choice of components - Overview

Contents

Detector properties and specifications:

- X1L-G
- CNL 1
- CNL 2
- A1e
- X6

Lists of system components - resistance measuring:

- Passive system
- Active system - X1L-G
- Active system - A1e-G
- Active system - CNL1

Lists of system components - impedance measuring:

- Passive system
- Active system - X6
- Active system - X6 for 3dc
- Active system - CNL2

Lists of jointing components:

- Single pipe
- TwinPipe
- Impedance measuring for District Cooling (Nordic and 3dc)

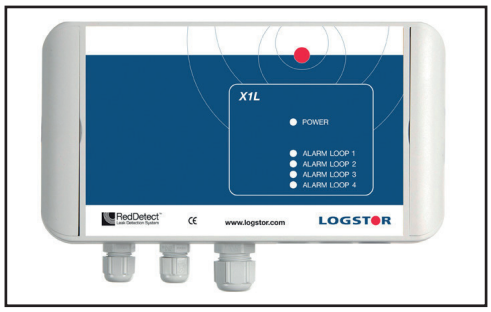
Detector properties and specifications

X1L-G resistance measuring

X1L is available in 2 versions dependent on the pipe system and the requirements to the surveillance:

1. X1L-G (incl. 2G/3G)

2. X1L-BG (incl. 2G/3G and battery supply)



X1L-G properties

4 channels:

4 exits/channels, each with a range of 4000 m pipe, corresponding to 8000 m alarm wire.

Acoustic/visual signal:

A visual and acoustic signal is emitted, if the detection level is exceeded.

SCADA:

Exit for analogue signal. Alternatively, connection via XTool/OPC Service to SCADA is available.

Communication:

The detector is equipped with 2G/3G as well as an antenna, enabling communication via LOGSTOR Hosting to XTool.

Setting alarm level:

Manual setting of alarm levels for insulation values. Versions with "G" can be remotely operated and set, as the detector communicates via 2G/3G.

Wire resistance:

Wire resistance is measured at intervals of 0-100 Ω. Broken wire when measuring > 200 Ω.

Galvanic voltage:

Galvanic voltage is measured at intervals of ± 0-1 V

Insulation resistance:

Insulation resistance is measured at intervals of 1 kΩ - 1 MΩ

X1L-G specifications

Dimensions:

L x W x H: 220 x 130 x 70 mm

Weight:

0.5 kg

Power supply:

Standard with transformer for 110/230VAC.

Versions with "B" are delivered with a lithium battery in replacement of the transformer.

Battery service life: Two different types with approx. 6 and 10 years' service life respectively dependent on the operating conditions.

Power consumption:

< 1W

Field of application:

-20°C to +70°C

Cable connection:

Installation cables or coaxial cables

Enclosure class:

IP67 - Polycarbonate, halogen free

The detector should be installed indoor in dry and frost free surroundings.

Approval:

CE

CSA/UL is available on enquiry

Detector properties and specifications

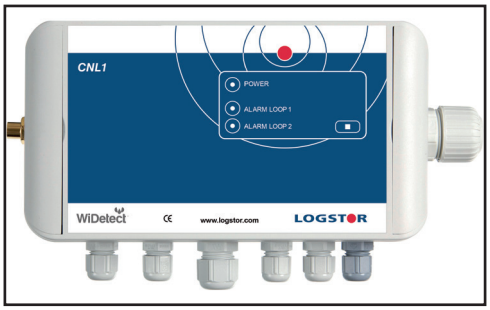
CNL - NiCr system

CNL is available in 2 versions dependent on the pipe system and the requirements to the surveillance.

Surveillance of NiCr-alarm wires:

1. CNL 1 - detection of moist and broken wire

2. CNL 2 - detection of moist and broken wire as well as locating fault position



CNL 1 - properties

2 channels:

2 exits/channels, each with a range of 1200 m pipe, corresponding to 1200 m NiCr.

Acoustic/visual signal:

A visual and acoustic signal is emitted, if the detection level is exceeded.

SCADA:

Exit for analogue signal. Alternatively, connection via XTool/OPC Service to SCADA can be offered.

Communication:

Both detector versions are equipped with 2G/3G as well as an antenna, enabling communication via LOGSTOR Hosting to XTool.

Setting alarm level:

Manual setting of alarm levels for insulation values. Versions CNL 1 and CNL 2 can be remotely operated and set, as the detector communicates via 2G/3G.

Wire resistance:

Wire resistance is measured at intervals of 0-10 Ω. Broken wire when measuring > 10 Ω.

Insulation resistance:

Insulation resistance is measured at intervals of 1 kΩ - 10 MΩ

Level surveillance:

Level surveillance possible (4 pcs. levels)

Temperature surveillance:

Surveillance of ambient temperature possible (4 pcs. PT1000)

Analogue entries:

Surveillance of pressure, flow possible (4 pcs. 4-20mA)

Sabotage protection:

Sabotage protection possible

CNL 1 - specifications

Dimensions:

L x W x H: 220 x 130 x 70 mm

Weight:

0.8 kg

Power supply:

Standard with transformer for 110/230VAC.

Power consumption:

< 5W

Field of application:

-20°C to +70°C

Cable connection:

Installation cables or coaxial cables

Enclosure class:

IP67 - Polycarbonate, halogen free. The detector should be installed indoor in dry and frost free surroundings.

Approval:

CE

CSA/UL is available on enquiry

Detector properties and specifications

CNL - NiCr system

CNL is available in 2 versions dependent on the pipe system and the requirements to the surveillance:

Surveillance of NiCr-alarm wires:

1. CNL 1 - detection of moist and broken wire

2. CNL 2 - detection of moist and broken wire as well as locating fault position

CNL 2 - properties

2 channels:

2 exits/channels, each with a range of 1200 m pipe, corresponding to 1200 m NiCr.

Acoustic/visual signal:

A visual and acoustic signal is emitted, if the detection level is exceeded.

SCADA:

Exit for analogue signal. Alternatively, connection via XTool/OPC Service to SCADA can be offered.

Communication:

Both detector versions are equipped with 2G/3G as well as an antenna, enabling communication via LOGSTOR Hosting to XTool.

Setting alarm level:

Manual setting of alarm levels for insulation values. Versions CNL 1 and CNL 2 can be remotely operated and set, as the detector communicates via 2G/3G.

Wire resistance:

Wire resistance is measured at intervals of 0-10 Ω. Broken wire when measuring > 10 Ω.

Locating:

Locating faults up to 1200 m pipe

Insulation resistance:

Insulation resistance is measured at intervals of 1 kΩ - 10 MΩ

Level surveillance:

Level surveillance possible (4 pcs. levels)

Temperature surveillance:

Surveillance of ambient temperature possible (4 pcs. PT1000)

Analogue entries:

Surveillance of pressure, flow possible (4 pcs. 4-20mA)

Sabotage protection:

Sabotage protection possible

CNL 2 - specifications

Dimensions:

L x W x H: 222 x 130 x 70 mm

Weight:

0.8 kg

Power supply:

Standard with transformer for 110/230VAC.

Power consumption:

< 5W

Field of application:

-20°C to +70°C

Cable conection:

Installation cables or coaxial cables

Enclosure class:

IP67 - Polycarbonate, halogen free. The detector should be installed indoor in dry and frost free surroundings.

Approval:

CE

CSA/UL is available on enquiry

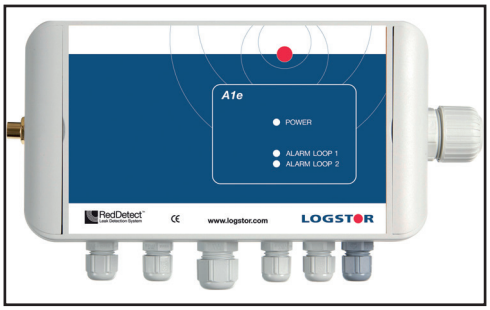
Detector properties and specifications

A1e - resistance measuring and chamber surveillance for District Heating

A1e is available in 2 versions dependent on the pipe system and the requirements to the surveillance:

1. A1e-G (incl. 2G/3G)

2. A1e-BG (incl. 2G/3G and battery supply)



A1e - properties

2 channels:

2 exits/channels, each with a range of 2500 m pipe, corresponding to 5000 m alarm wire.

12 entry points:

12 entry points for registering pressure and temperature in the pipe system as well as chamber surveillance (water level).

Acoustic/visual signal:

A visual and acoustic signal is emitted, if the detection level is exceeded.

SCADA:

Exit for analogue signal. Alternatively, connection via XTool/OPC Service to SCADA can be offered.

Communication:

Versions with "G" are equipped with 2G/3G as well as an antenna, enabling communication via LOGSTOR Hosting to XTool.

Setting alarm level:

Manual setting of alarm levels for insulation values. Versions with "G" can be remotely operated and set, as the detector communicates via 2G/3G.

Wire resistance:

Wire resistance is measured at intervals of 0-100 Ω. Broken wire when measuring > 200 Ω.

Galvanic voltage:

Galvanic voltage is measured at intervals of ± 0-1 V

Insulation resistance:

Insulation resistance is measured at intervals of 1 kΩ - 1 MΩ

Temperature range:

-50 to 150°C (Battery version cannot be used)

Pressure range:

0-16 bar (Battery version cannot be used)

Water level:

High-low level

Detector properties and specifications

A1e - specifications

Dimensions:

L x W x H: 200 x 110 x 60 mm

Weight:

0.5 kg

Power supply:

Standard with transformer for 110/230VAC. Versions with "B" are delivered with a lithium battery in replacement of the transformer. Battery service life: Two different types with approx. 6 and 10 years' service life respectively dependent on the operating conditions.

Power consumption:

< 1W

Field of application:

-20°C to +70°C

Cable connection:

Installation cables or coaxial cables

Enclosure class:

IP67 - Polycarbonate, halogen free. The detector should be installed indoor in dry and frost free surroundings.

Approval:

CE

X6 - impedance measuring

Detector X6 is delivered installed in a detector cabinet.

X6 - properties

2 (4) channels:

District Heating systems connected in loop: 2 exits/channels, each with a range of 3000 m pipe, corresponding to 6000 m alarm wire.

Systems connected without loop: 4 exits/channels, each with a range of 6000 m pipe, corresponding to 6000 m alarm wire.

Modules:

It is possible to select various types of modules for X6 dependent on the type of surveillance system (Nordic or 3dc).

Module for Nordic system: 1 module has 4 exits, each with a range of 6000 m wire. 3 extra modules can be connected, so the system can monitor up to 16 x 6000 m wire.

Module for 3dc: 1 module has 2 exists, each with a range of 3000 m 3dc cable. 3 extra modules can be connected, so the system can monitor up to 8 x 3000 m 3dc cable.

It is also possible to select a I/O module for disconnection to PLC.

SCADA:

The XTool software which handles the communication and analysis of measurement data can transmit data to mother systems like SCADA, GIS, BMS via the integrated OPC interface of XTool .

Communication:

The detector is equipped with a 2G/3G/4G modem as well as an antenna, enabling communication via LOGSTOR Hosting to XTool.

Protection:

Transient protection

Setting alarm level:

Via XTool alarm levels for insulation values, galvanic voltage, impedance, and broken wire can be set.

Wire resistance:

Wire resistance is measured at intervals of 0-200 Ω. Broken wire when measuring > 200 Ω.

Detector properties and specifications

X6 - properties, continued

Galvanic voltage:

Indication of moist/water in the PUR insulation.

Insulation resistance:

Insulation resistance is measured at intervals of 1 kΩ - 50 MΩ

Measuring accuracy:

Impedance measuring: Theoretically, ± 1 m wire, provided the signal velocity has been correctly set, and coaxial cable is used.

X6 - specifications

Dimensions:

Detector cabinet: L x W x H: 380 x 380 x 210 mm

Weight:

Detector, incl. detector cabinet: 12.4 kg

Power supply:

Standard with transformer for 110/230VAC. Alternatively, 12VDC.

Power consumption:

< 16W

Field of application:

-20°C to +60°C

Cable connection:

Coaxial cables

Enclosure class:

Detector cabinet: IP66

Detector: IP53

The detector cabinet should be installed indoor in dry and frost free surroundings.

Approval:

CE

CSA/UL is available on request.

Lists of system components

Introduction

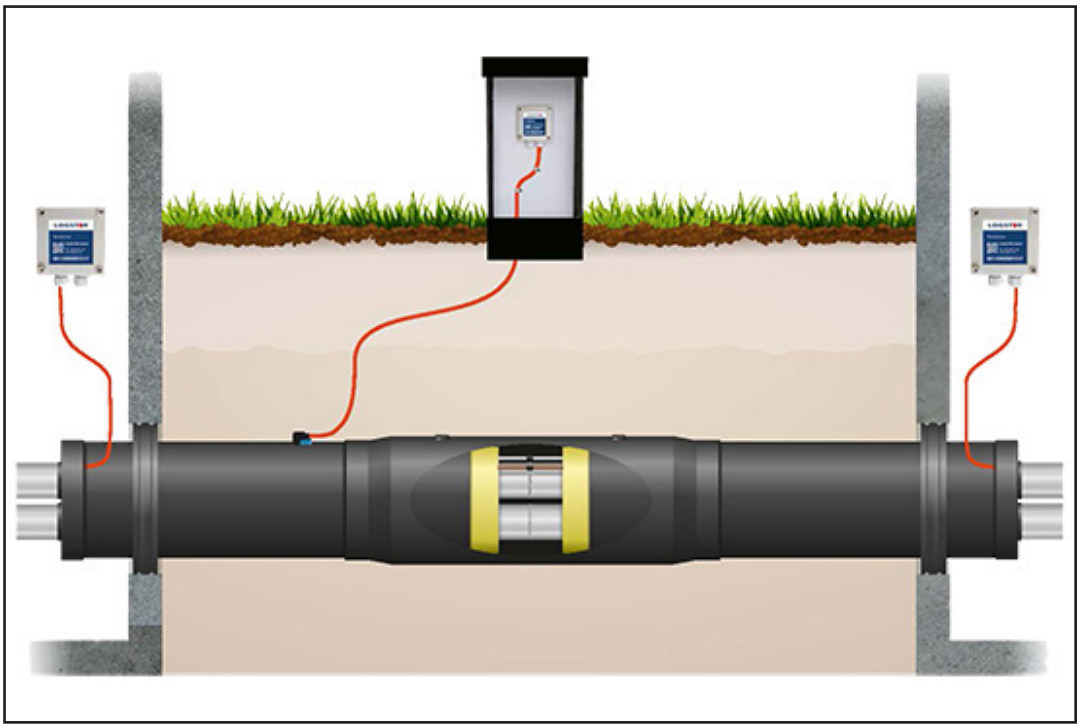
The following illustrations and lists are based on TwinPipes.

If a pair of pipes (2 single pipes) is monitored, additional take-offs from both pipelines to the cabinet or detector cabinet/terminal box must be allowed for, see Designing wiring and reference points.

Passive system, resistance measuring

Resistance measuring - passive system

For take-offs/reference points, prepared for resistance measuring.



Cable take-off at end cap

Component No. 9000 0000 024 000

5x0,75 mm², 2 m

Passive system, resistance measuring

Terminal box type 1517

Product No. 8011 0000 001 517

Cabinet, narrow

Product No. 8900 0600 220 002

628 x 303 x 155 mm

Fibreglass, army green

Cable take-off at casing

Product No. 8000 0000 005 047

Cable take-off is welded with a conical tool onto the casing pipe close to the casing joint.

A cable take-off consists of:

- earth connection
- a HDPE cable foot with conical weld end
- mastic and shrink hose for sealing towards the cable
- supporting block

Connection cable

Product No. 8100 0000 057 005

Connection cable 5x0,75 mm^2 (20 m)

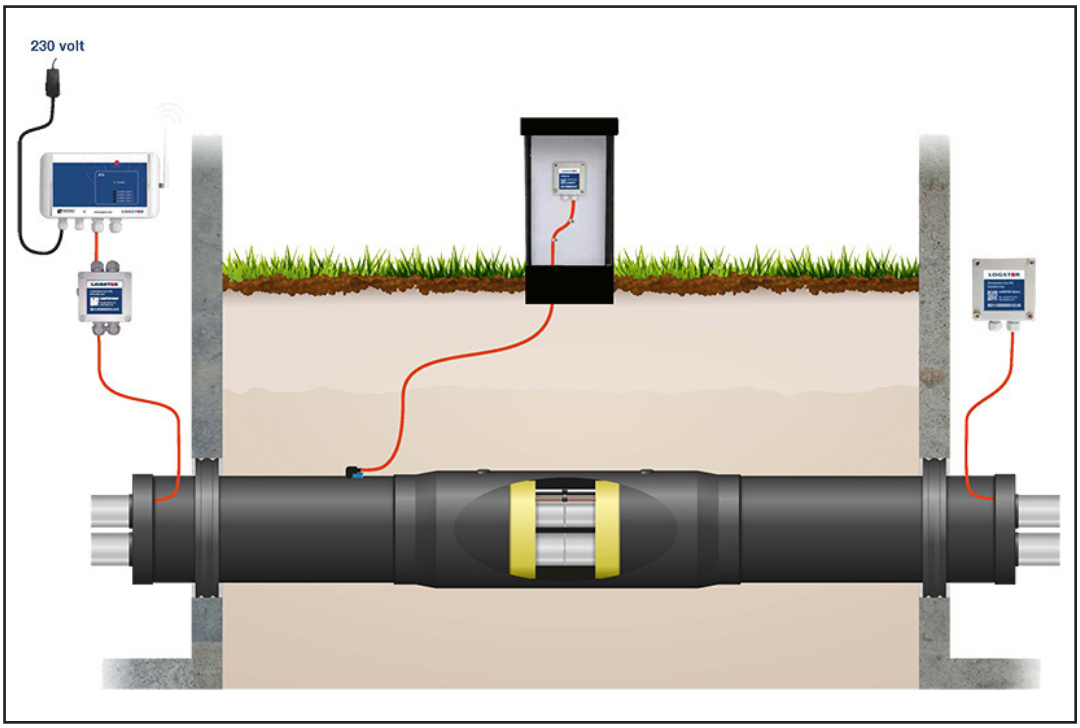
Product No. 8100 0000 057 006

Connection cable 5x0,75 mm^2 (fixed lengths)

Active system, resistance measuring - X1L-G

Resistance measuring - active system X1L-G

With connection to XTool Hosting via 2G/3G



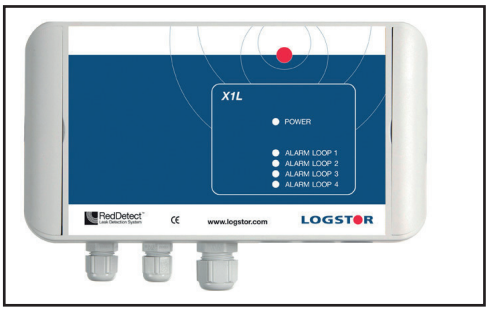
X1L-G and X1L-BG

Product No. 8000 0000 007 018

Detector X1L-G with transformer and antenna

Product No. 8000 0000 007 026

Detector X1L-BG with battery and antenna



Non-recurring costs

Product No. 9070 0000 000 110

XTool Hosting

Product No. 9070 0000 000 111

Setup/Configuration X1L

Active system, resistance measuring - X1L-G

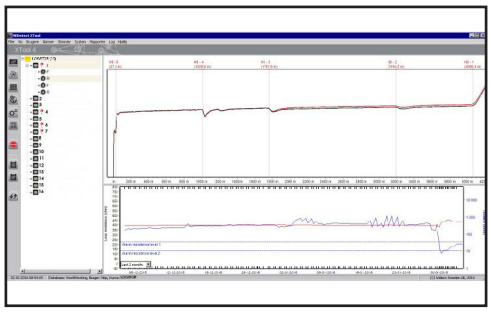
Monthly costs

Product No. 9070 0000 000 113

XTool Licence

Product No. 9070 0000 000 114

Licence per unit



Connection box PG

Product No. 8011 0000 001 516

Connection box PG, incl. transient protection

Cable take-off at end cap

Component No. 9000 0000 024 000

5x0,75 mm^2, 2 m

Connection cable

Product No. 8100 0000 057 005

Connection cable 5x0,75 mm^2 (20 m)

Product No. 8100 0000 057 006

Connection cable 5x0,75 mm^2 (fixed lengths)

Active system, resistance measuring - X1L-G

Cabinet, narrow

Product No. 8900 0600 220 002

628 x 303 x 155 mm

Fibreglass, army green

Terminal box type 1517

Product No. 8011 0000 001 517

Cable take-off at casing

Product No. 8000 0000 005 047

Cable take-off is welded with a conical tool onto the casing pipe close to the casing joint.

A cable take-off consists of:

- earth connection

- a HDPE cable foot with conical weld end

- mastic and shrink hose for sealing towards the cable

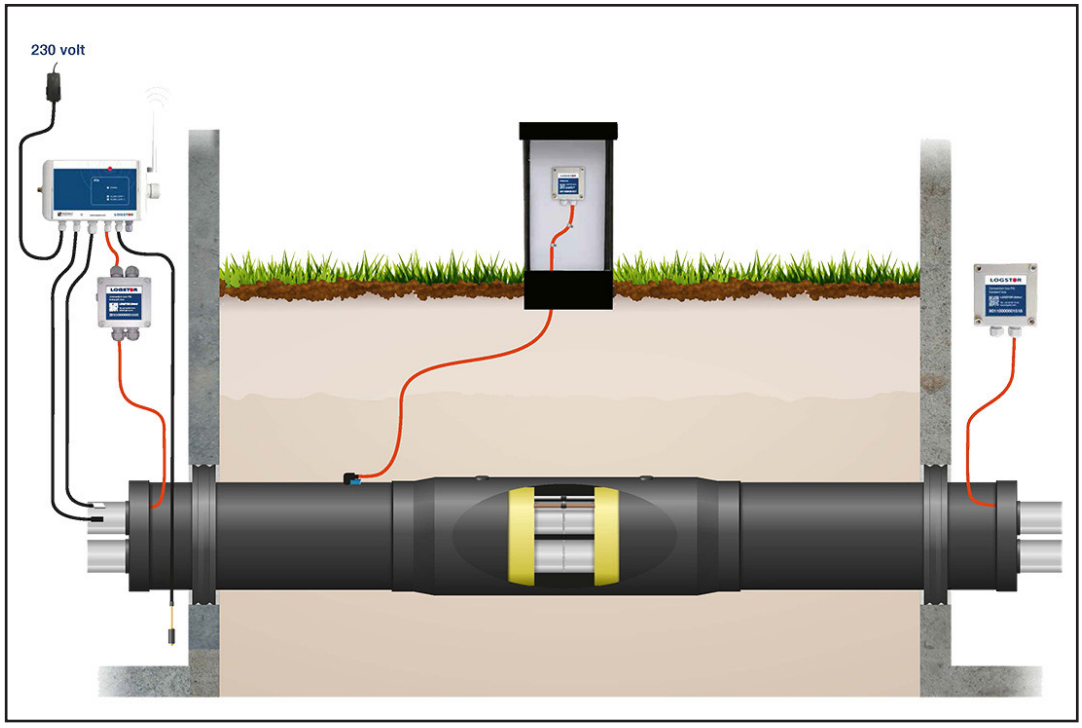
- supporting block

Active system, resistance measuring - A1e-G

Resistance measuring - active system A1e-G

With connection to XTool via 2G/3G

For registration of pressure and temperature in the pipe system as well as chamber surveillance (water level)



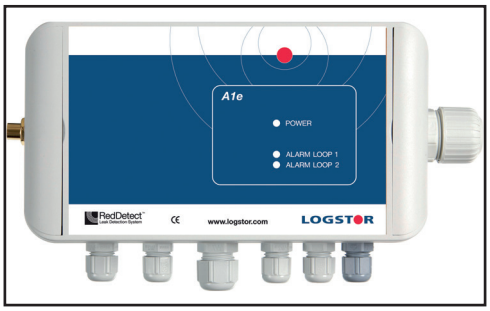
Detector A1e-G and A1e-BG

Product No. 8000 0000 007 030

Detector A1e-G with transformer and antenna

Product No. 8000 0000 007 029

Detector A1e-BG with battery and antenna



Non-recurring costs

Product No. 9070 0000 000 110

XTool Hosting

Product No. 9070 0000 000 111

Setup/Configuration X1L

LOGSTOR HOSTING

Active system, resistance measuring - A1e-G

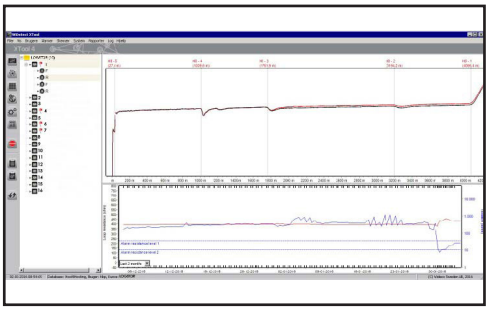
Monthly costs

Product No. 9070 0000 000 113

XTool Licence

Product No. 9070 0000 000 114

Licence per unit



Connection box PG

Product No. 8011 0000 001 516

Connection box PG, incl. transient protection

Cable take-off at end cap

Component No. 9000 0000 024 000

5x0,75 mm^2, 2 m

Connection cable

Product No. 8100 0000 057 005

Connection cable 5x0,75 mm^2 (20 m)

Product No. 8100 0000 057 006

Connection cable 5x0,75 mm^2 (fixed lengths)

Active system, resistance measuring - A1e-G

Cabinet, narrow

Product No. 8900 0600 220 002

628 x 303 x 155 mm

Fibreglass, army green

Terminal box type 1517

Product No. 8011 0000 001 517

Cable take-off at casing

Product No. 8000 0000 005 047

Cable take-off is welded with a conical tool onto the casing pipe close to the casing joint.

A cable take-off consists of:

- earth connection
- a HDPE cable foot with conical weld end
- mastic and shrink hose for sealing towards the cable
- supporting block

Temperature sensor PT 1000

Product No. 8000 0000 007 079

Sensor 2 m (Tape-on)

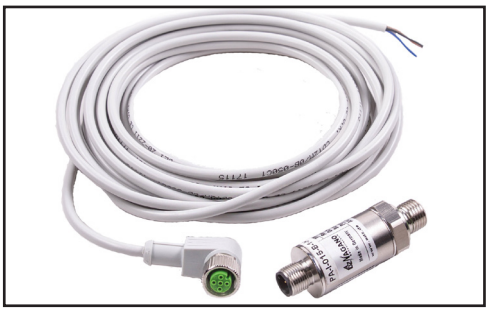
-50 to +150 C

Active system, resistance measuring - A1e-G

Pressure transmitter

Product No. 8000 0000 007 080

0 - 15 bar, 5 m



Water level gauge

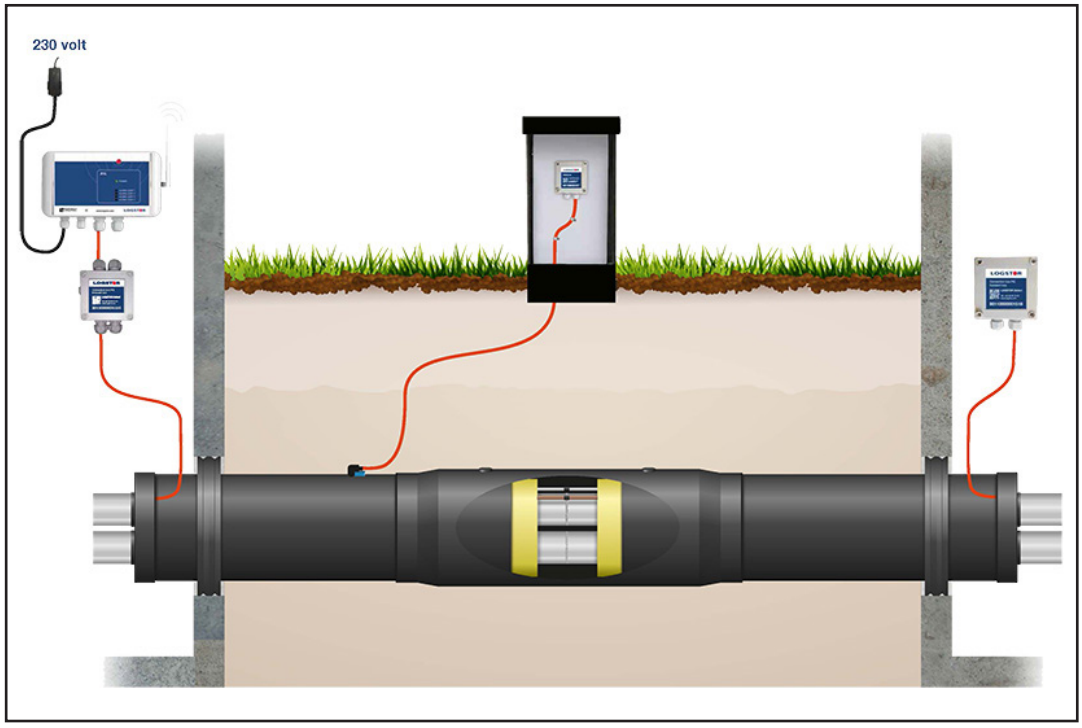
Product No. 8000 0000 007 081

Water level gauge with 2 m cable

Active system, resistance measuring - CNL1

Resistance measuring - active system CNL1

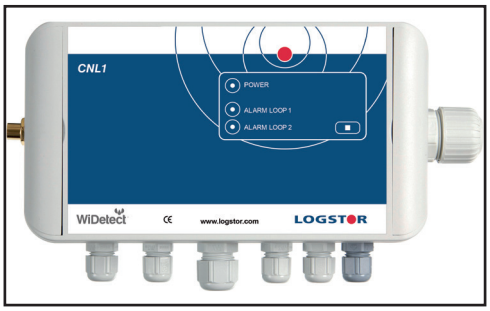
With connection to XTool Hosting via 2G/3G



Detector CNL1

Product No. 8000 0000 007 100

Detector CNL1 incl. transformer and antenna



Non-recurring costs

Product No. 9070 0000 000 110

XTool Hosting

Product No. 9070 0000 000 111

Setup/Configuration X1L

Active system, resistance measuring - CNL1

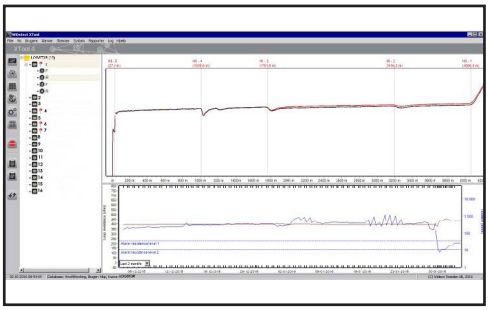
Monthly costs

Product No. 9070 0000 000 113

XTool Licence

Product No. 9070 0000 000 114

Licence per unit



Connection box PG

Product No. 8011 0000 001 516

Connection box PG, incl. transient protection

Cable take-off at end cap

Component No. 9000 0000 024 000

5x0,75 mm^2, 2 m

Connection cable

Product No. 8100 0000 057 005

Connection cable 5x0,75 mm^2 (20 m)

Product No. 8100 0000 057 006

Connection cable 5x0,75 mm^2 (fixed lengths)

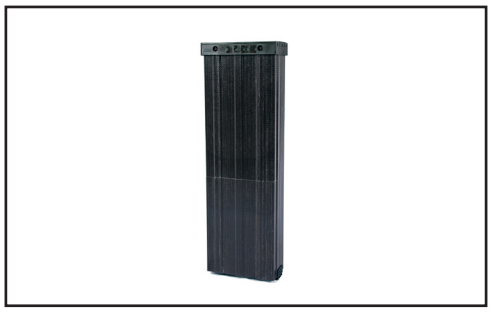
Active system, resistance measuring - CNL1

Cabinet, narrow

Product No. 8900 0600 220 002

628 x 303 x 155 mm

Fibreglass, army green



Terminal box type 1517

Product No. 8011 0000 001 517

Cable take-off at casing

Product No. 8000 0000 005 047

Cable take-off is welded with a conical tool onto the casing pipe close to the casing joint.

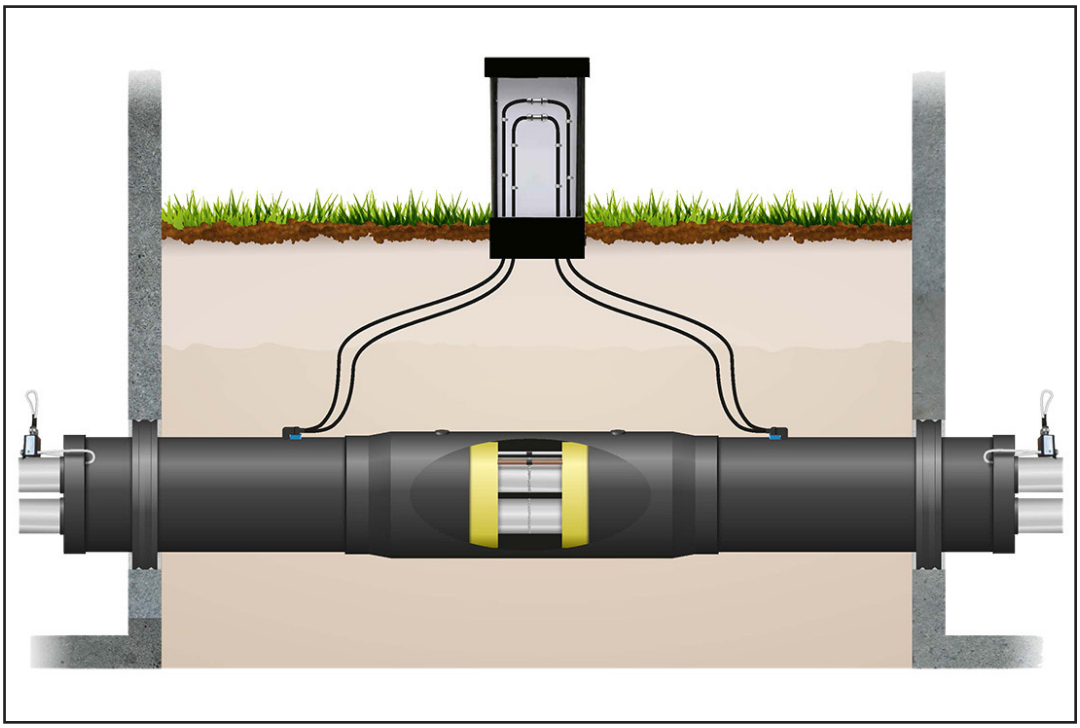
A cable take-off consists of:

- earth connection
- a HDPE cable foot with conical weld end
- mastic and shrink hose for sealing towards the cable
- supporting block

Passive system, impedance measuring

Impedance measuring - passive system

Components for take-offs/reference points prepared for impedance measuring.



Connection box 1232

Product No. 8021 0000 001 232

The product No. contains 2 pcs.

Connection box 1232

For indoor use

Passive system, impedance measuring

Coaxial cable twin closed socket welder 9 m

Product No. 8010 0000 018 030

Cable take-off for the two 125 Ω coaxial cables is welded onto the casing pipe close to a casing joint, using a closed socket welder.

Cable length, 9 m (measured electrically as 10 m).

A cable take-off consists of:

- Earth connection
- HDPE outlet with conic weld end
- Twin coaxial cable with UHF connector and conic plug with alarm wire outlet
- Mastic and shrink hose for sealing towards the cable
- Supporting block

Coaxial cable twin open socket welder 9 m

Product No. 8010 0000 018 015

Cable take-off for the two 125 Ω coaxial cables is welded onto the casing pipe close to a casing joint, using an opening socket welder.

Cable length, 9 m (measured electrically as 10 m).

Earth connection and supporting block are included

Connection links for coax cable (2 pcs.)

Product No. 8000 0000 013 000

For connection in cabinet

Passive system, impedance measuring

Connection links for coaxial cable with cable clamp

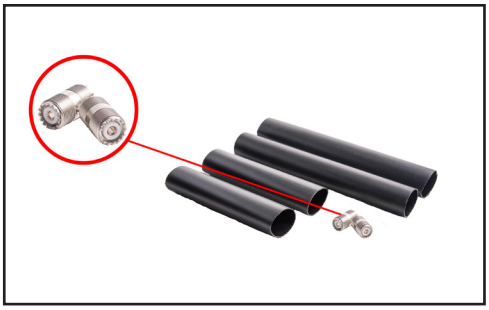
Product No. 8000 0000 013 001

For connection in cabinet

Connection links for coaxial cable incl. heat shrink tubings

Product No. 8000 0000 012 000

For connection in the field



Connection cable, UHF

Product No. 8000 0000 008 000

Connection cable UHF, 1m (2 pcs.)

Product No. 8000 0000 008 001

Connection cable UHF, 3m (2 pcs.)

Product No. 8000 0000 008 002

Connection cable UHF, 5m (2 pcs.)

Product No. 8000 0000 008 003

Connection cable UHF, 10m (2 pcs.)

Cabinets

Product No. 8900 0600 220 003

Cabinet, fibreglass, army green, wide, 628 x 574 x 215 mm (for pair of pipes with coaxial cable)

Product No. 8900 0600 220 002

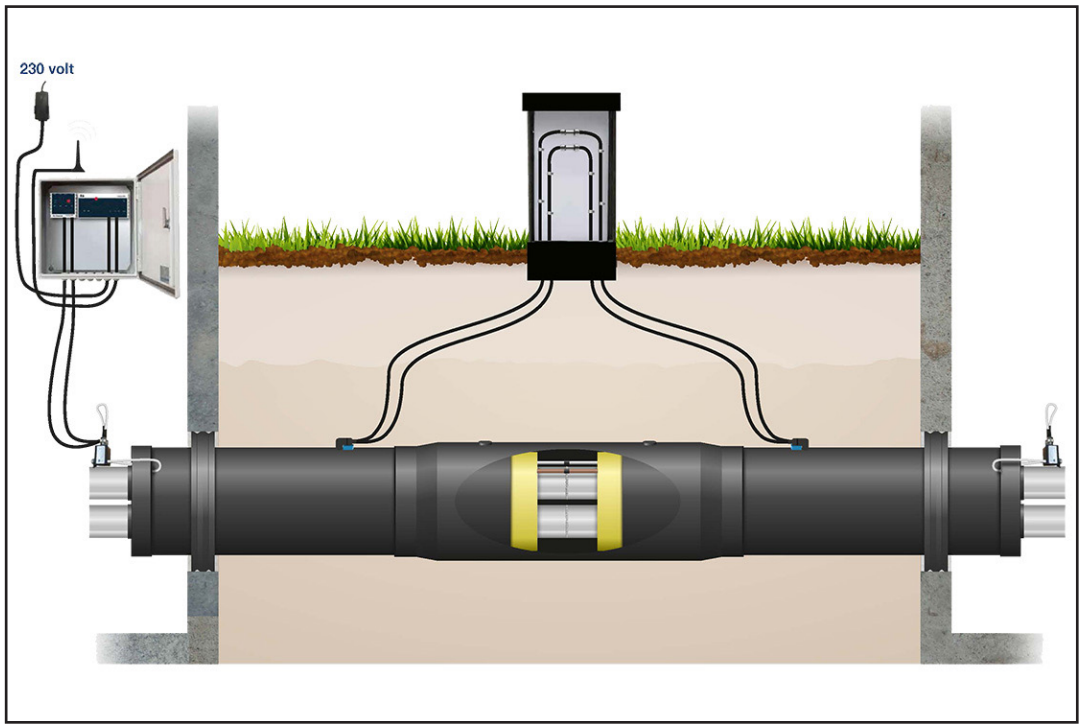
Cabinet, fibreglass, army green, narrow, 628 x 303 x 155 mm (for TwinPipes with coaxial cable and TwinPipe/pair of pipes/ connecting pipe with connection cable)

Active system, impedance measuring - X6, DH, Nordic

Impedance measuring - active system - X6

Components for active system for impedance measuring X6

With connection to XTool via 2G/3G/4G



Detector X6

Product No. 8000 0000 007 103

Detector X6 incl. cabinet, DH, Nordic incl. transformer, 2G/3G/4G, antenna, coaxial cable BNC (2.5 m) and transient protection

Extra module for X6, DH, Nordic

Product No. 8000 0000 007 107

Active system, impedance measuring - X6, DH, Nordic

Non-recurring costs

Product No. 9070 0000 000 110

XTool Licence

Product No. 9070 0000 000 112

Licence X6 per unit

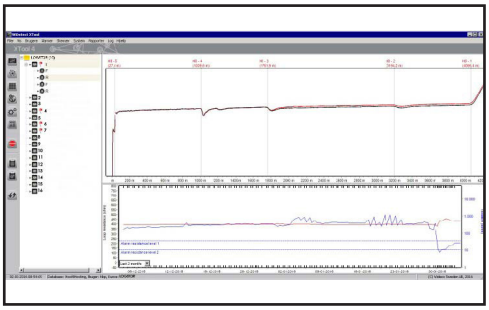
Monthly costs

Product No. 9070 0000 000 113

XTool Licence

Product No. 9070 0000 000 114

Licence per unit



Connection box 1232

Product No. 8021 0000 001 232

The product No. contains 2 pcs.

For indoor use

If the connection box is used to connect to X6 via BNC cable, use connection link UHF/male - BNC/female product No. 8000 0000 013 007.

Coaxial cable BNC

Product No. 8100 0000 007 010

Coaxial cable BNC, 2.5m (2 pcs.)

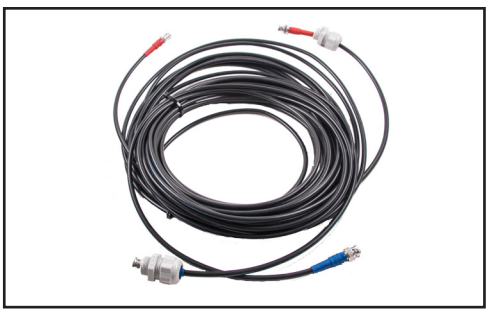
Product No. 8100 0000 007 011

Coaxial cable BNC, 5m (2 pcs.)

Product No.8100 0000 007 01

Coaxial cable BNC, 10m (2 pcs.)

Used in dry surroundings



Active system, impedance measuring - X6, DH, Nordic

Coaxial cable twin closed socket welder 9 m

Product No. 8010 0000 018 030

Cable take-off for the two 125 Ω coaxial cables is welded onto the casing pipe close to a casing joint, using a closed socket welder.

Cable length, 9 m (measured electrically as 10 m).

A cable take-off consists of:

- Earth connection
- HDPE outlet with conic weld end
- Twin coaxial cable with UHF connector and conic plug with alarm wire outlet
- Mastic and shrink hose for sealing towards the cable
- Supporting block

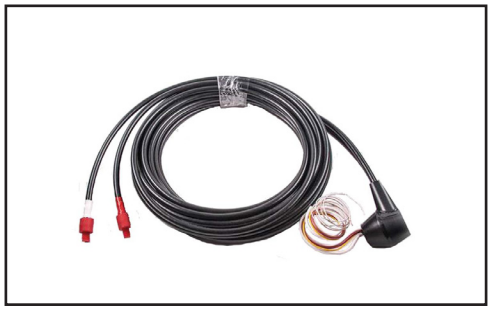
Coaxial cable twin open socket welder 9 m

Product No. 8010 0000 018 015

Cable take-off for the two 125 Ω coaxial cables is welded onto the casing pipe close to a casing joint, using an opening socket welder.

Cable length, 9 m (measured electrically as 10 m).

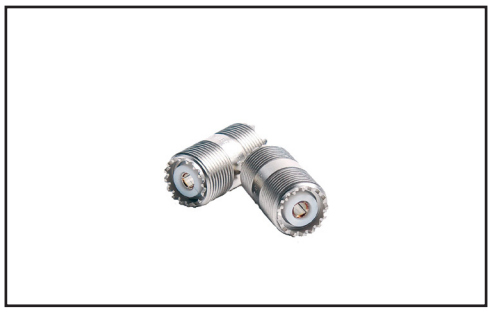
Earth connection and supporting block are included



Connection links for coax cable (2 pcs.)

Product No. 8000 0000 013 000

For connection in cabinet



Active system, impedance measuring - X6, DH, Nordic

Connection links for coaxial cable with cable clamp

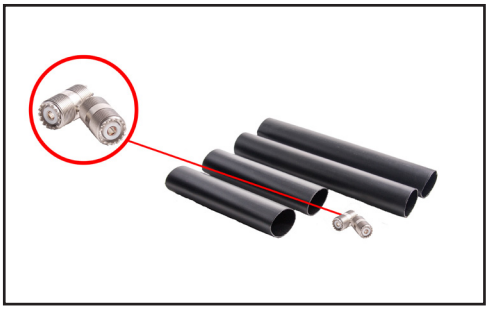
Product No. 8000 0000 013 001

For connection in cabinet

Connection links for coaxial cable incl. heat shrink tubings

Product No. 8000 0000 012 000

For connection in the field



Connection cable, UHF

Product No. 8000 0000 008 000

Connection cable UHF, 1m (2 pcs.)

Product No. 8000 0000 008 001

Connection cable UHF, 3m (2 pcs.)

Product No. 8000 0000 008 002

Connection cable UHF, 5m (2 pcs.)

Product No. 8000 0000 008 003

Connection cable UHF, 10m (2 pcs.)

Cabinets

Product No. 8900 0600 220 003

Cabinet, fibreglass, army green, wide, 628 x 574 x 215 mm (for pair of pipes with coaxial cable)

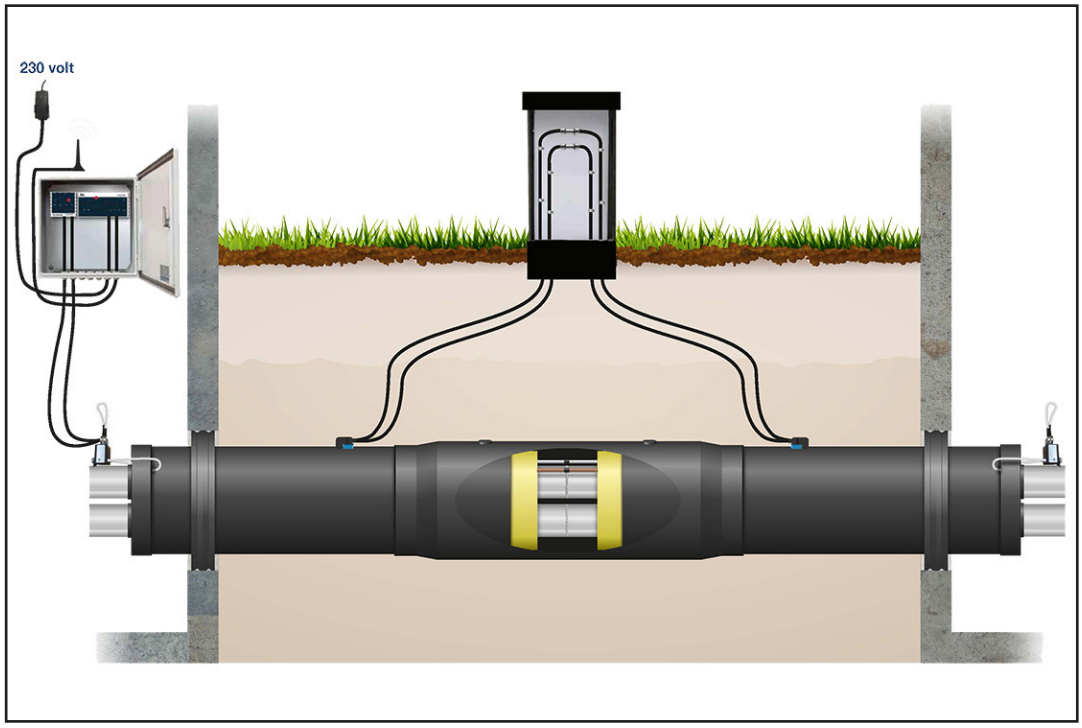
Product No. 8900 0600 220 002

Cabinet, fibreglass, army green, narrow, 628 x 303 x 155 mm (for TwinPipes with coaxial cable and TwinPipe/pair of pipes/ connecting pipe with connection cable)

Active system, impedance measuring - X6, DC and Industry (3dc)

Impedance measuring - active system
X6 - District Cooling and Industry (3dc)

With connection to XTool via 2G/3G/4G



Detector X6 incl. cabinet, DC, 3dc

Product No. 8000 0000 007 104

Detector X6 incl. cabinet, DC, 3dc incl. transformer, 2G/3G/4G, antenna, coaxial cable BNC (2.5 m) and transient protection

Active system, impedance measuring - X6, DC and Industry (3dc)

Extra module for X6, DC, 3dc

Product No. 8000 0000 007 108

Non-recurring costs

Product No. 9070 0000 000 110

XTool Licence

Product No. 9070 0000 000 112

Licence X6 per unit

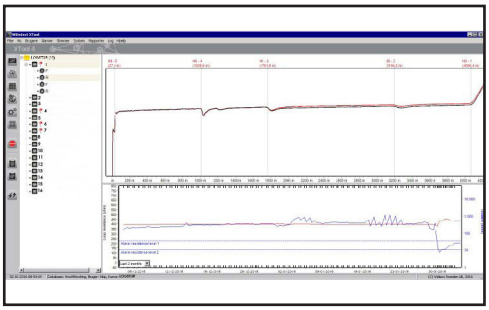
Monthly costs

Product No. 9070 0000 000 113

XTool Licence

Product No. 9070 0000 000 114

Licence per unit



Terminal box UHF

Product No. 8011 0000 001 520

Active system, impedance measuring - X6, DC and Industry (3dc)

Connection box 1232

Product No. 8021 0000 001 232

The product No. contains 2 pcs.

For indoor use

If the connection box is used to connect to X6 via BNC cable, use connection link UHF/male - BNC/female product No. 8000 0000 013 007.

Coaxial cable twin closed socket welder 9 m

Product No. 8010 0000 018 030

Cable take-off for the two 125 Ω coaxial cables is welded onto the casing pipe close to a casing joint, using a closed socket welder.

Cable length, 9 m (measured electrically as 10 m).

A cable take-off consists of:

- Earth connection
- HDPE outlet with conic weld end
- Twin coaxial cable with UHF connector and conic plug with alarm wire outlet
- Mastic and shrink hose for sealing towards the cable
- Supporting block

Coaxial cable twin open socket welder 9 m

Product No. 8010 0000 018 015

Cable take-off for the two 125 Ω coaxial cables is welded onto the casing pipe close to a casing joint, using an opening socket welder.

Cable length, 9 m (measured electrically as 10 m).

Earth connection and supporting block are included

Active system, impedance measuring - X6, DC and Industry (3dc)

Connection links for coax cable (2 pcs.)

Product No. 8000 0000 013 000

For connection in cabinet

Connection links for coaxial cable with cable clamp

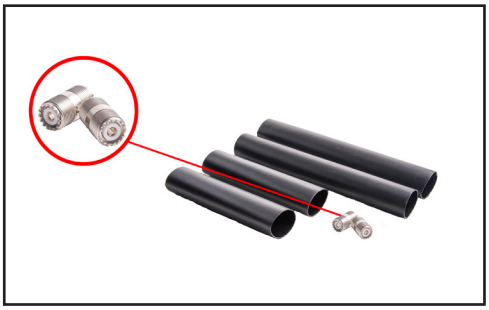
Product No. 8000 0000 013 001

For connection in cabinet

Connection links for coaxial cable incl. heat shrink tubings

Product No. 8000 0000 012 000

For connection in the field



Coaxial cable BNC

Product No. 8100 0000 007 010

Coaxial cable BNC, 2.5m (2 pcs.)

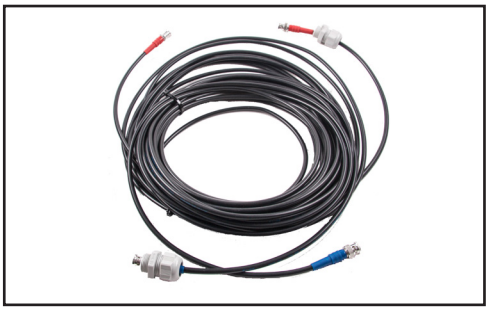
Product No. 8100 0000 007 011

Coaxial cable BNC, 5m (2 pcs.)

Product No.8100 0000 007 01

Coaxial cable BNC, 10m (2 pcs.)

Used in dry surroundings



Active system, impedance measuring - X6, DC and Industry (3dc)

Cabinet, wide

Product No. 8900 0600 220 003

Cabinet, wide (for pair of pipes)

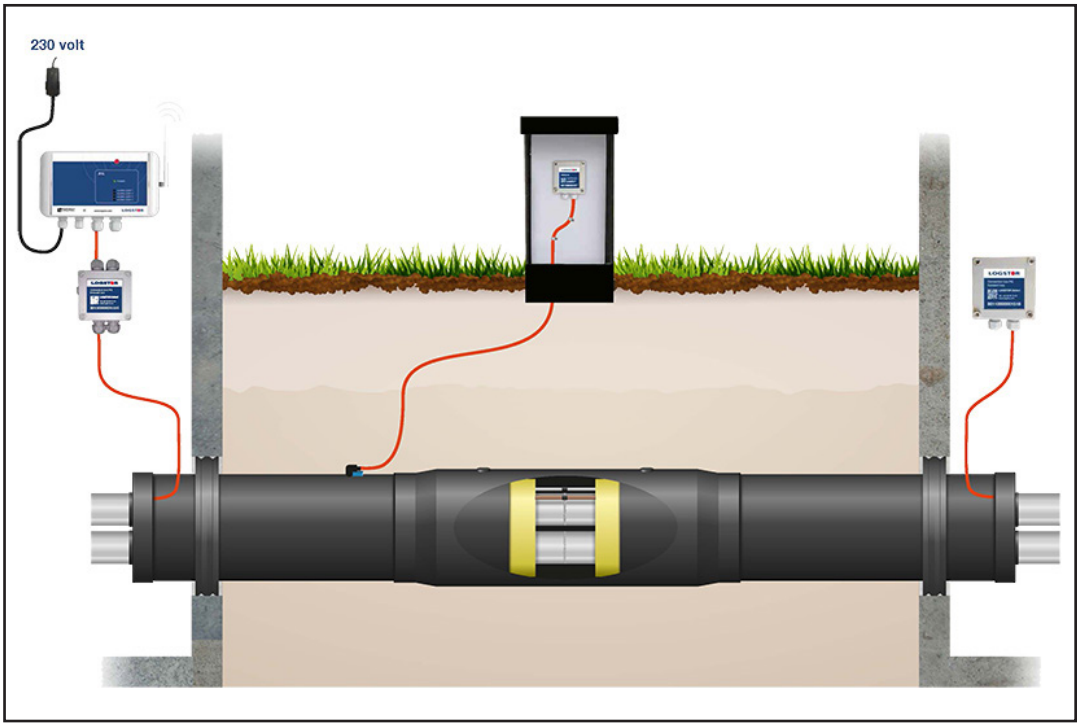
628 x 574 x 215 mm

Fibreglass, army green

Active system, impedance measuring - CNL2

Impedance measuring - active system CNL2

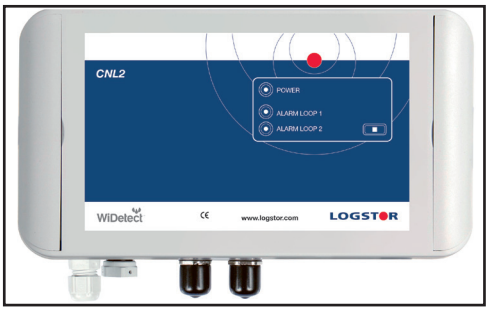
With connection to XTool Hosting via 2G/3G



Detector CNL2

Product No. 8000 0000 007 101

Detector CNL2 incl. transformer and antenna



Non-recurring costs

Product No. 9070 0000 000 110

XTool Hosting

Product No. 9070 0000 000 111

Setup/Configuration X1L

Active system, impedance measuring - CNL2

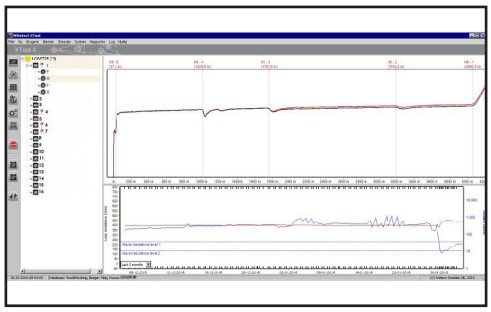
Monthly costs

Product No. 9070 0000 000 113

XTool Licence

Product No. 9070 0000 000 114

Licence per unit



Connection box PG type 1518

Product No. 8011 0000 001 518

Cable take-off at end cap

Component No. 9000 0000 024 000

5x0,75 mm^2, 2 m

Connection cable

Product No. 8100 0000 057 005

Connection cable 5x0,75 mm^2 (20 m)

Product No. 8100 0000 057 006

Connection cable 5x0,75 mm^2 (fixed lengths)

Active system, impedance measuring - CNL2

Cabinet, narrow

Product No. 8900 0600 220 002

628 x 303 x 155 mm

Fibreglass, army green

Terminal box type 1517

Product No. 8011 0000 001 517

Cable take-off at casing

Product No. 8000 0000 005 047

Cable take-off is welded with a conical tool onto the casing pipe close to the casing joint.

A cable take-off consists of:

- earth connection

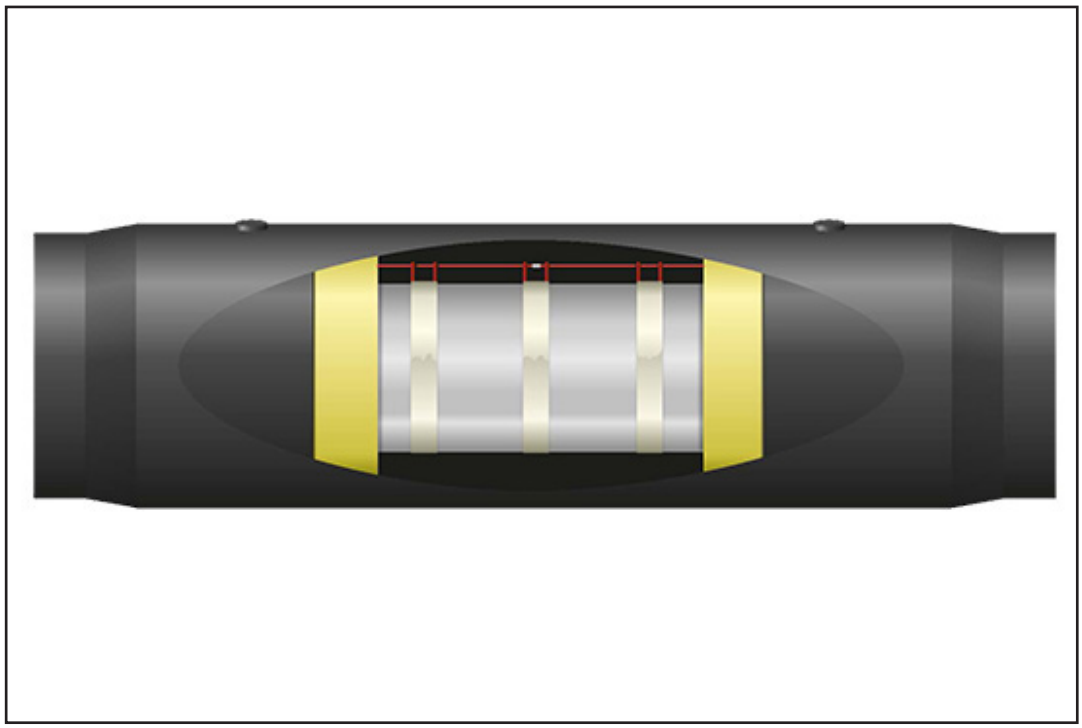
- a HDPE cable foot with conical weld end

- mastic and shrink hose for sealing towards the cable

- supporting block

Jointing single pipes without felt

Single pipe

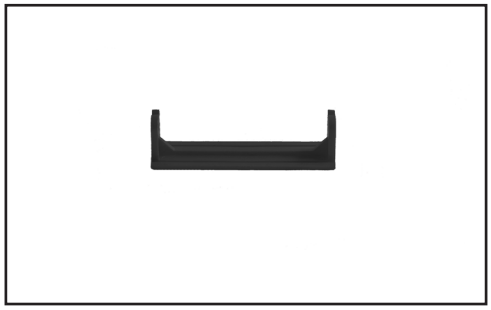


Wire holders

Product No. 1220 0000 003 006

50 pcs. per bag

Use 6 pcs. per casing joint

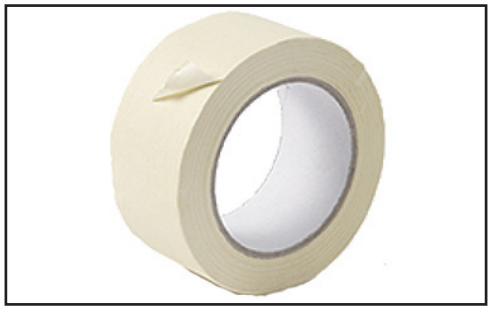


Heat resistant tape

Product No. 8000 0000 026 000

Roll of 50 m

Use a length equal to the circumference of the service pipe x 6 per joint



Jointing single pipes without felt

Crimp connectors

Product No. 8000 0000 002 044

100 pcs. per bag

Use 2 pcs. per casing joint

Tin solder with flux

Product No. 8000 0000 003 033

25 m tinned copper wire

Product No. 8100 0000 002 003

Jointing single pipes with felt

Felt

Product No. 8100 0000 003 015

2 pcs.

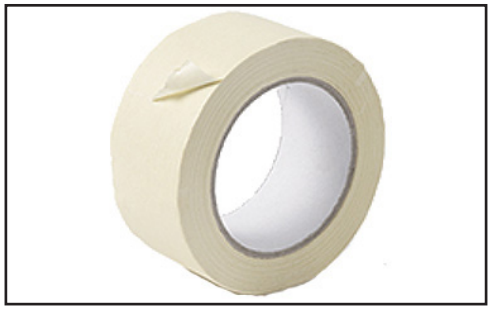
Use 2 pcs. per casing joint

Heat resistant tape

Product No. 8000 0000 026 000

Roll of 50 m

Use a length equal to the circumference of the service pipe x 6 per joint



Crimp connectors

Product No. 8000 0000 002 044

100 pcs. per bag

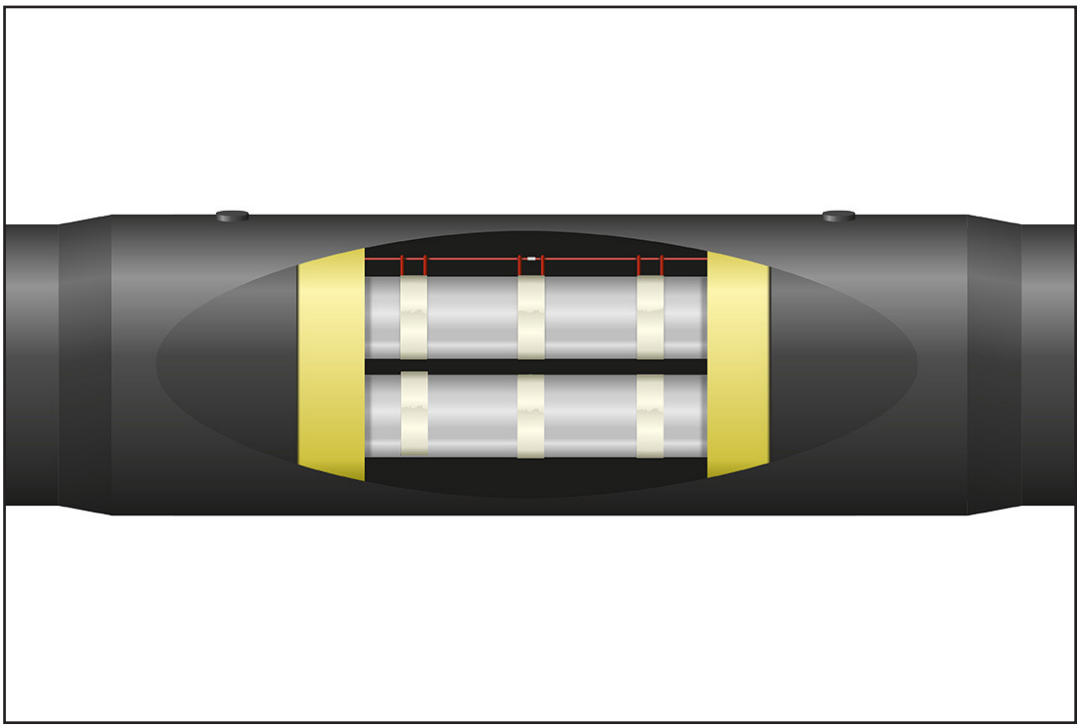
Use 2 pcs. per casing joint

Tin solder with flux

Product No. 8000 0000 003 033

Jointing TwinPipes without felt

TwinPipe

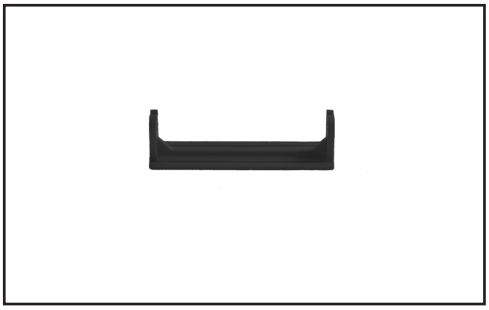


Wire holders

Product No. 1220 0000 003 006

50 pcs. per bag

Use 6 pcs. per casing joint



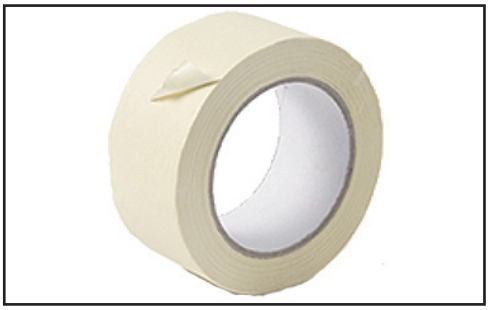
Heat resistant tape

Product No. 8000 0000 026 000

Roll of 50 m

Use a length equal to the circumference of the service pipe x 6 per joint.

However, for TwinPipes double length must be used.



Jointing TwinPipes without felt

Crimp connectors

Product No. 8000 0000 002 044

100 pcs. per bag

Use 2 pcs. per casing joint

Tin solder with flux

Product No. 8000 0000 003 033

25 m tinned copper wire

Product No. 8100 0000 002 003

Jointing TwinPipes with felt

Felt

Product No. 8100 0000 003 015

2 pcs.

Use 2 pcs. per casing joint

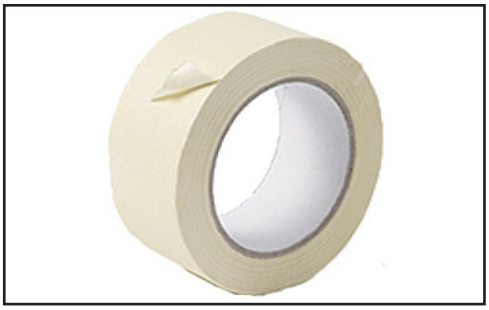
Heat resistant tape

Product No. 8000 0000 026 000

Roll of 50 m

Use a length equal to the circumference of the service pipe x 6 per joint.

However, for TwinPipes double length must be used.



Crimp connectors

Product No. 8000 0000 002 044

100 pcs. per bag

Use 2 pcs. per casing joint

Tin solder with flux

Product No. 8000 0000 003 033

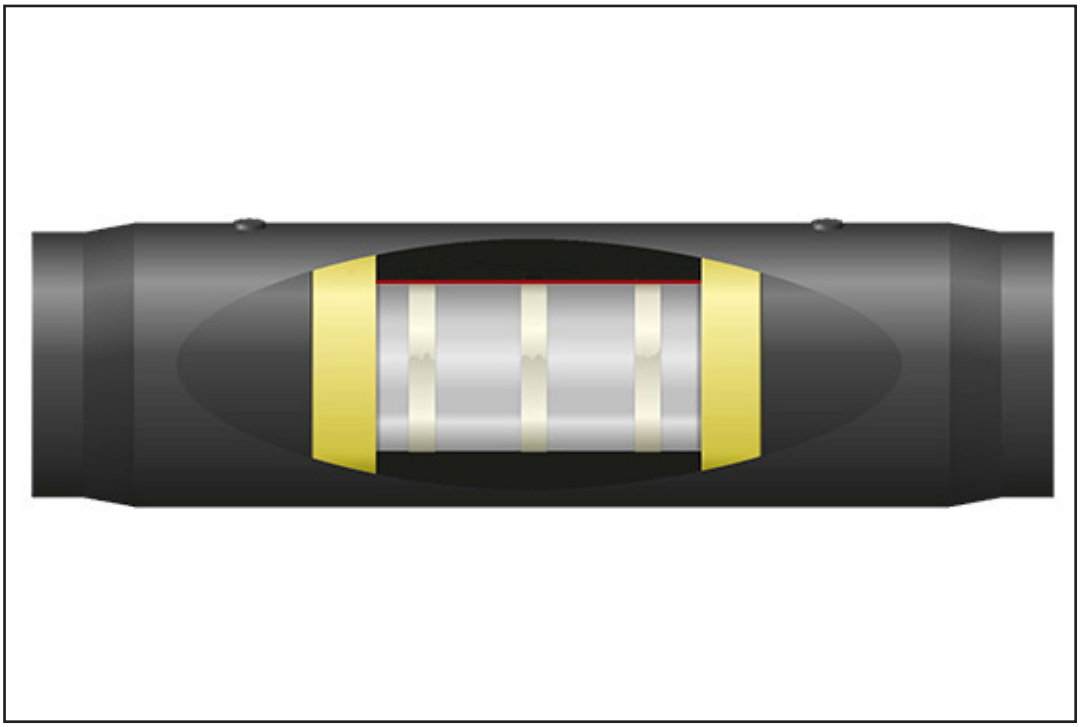
Jointing TwinPipes with felt

25 m tinned copper wire

Product No. 8100 0000 002 003

Joints, impedance measuring - DC and Industry (3dc)

Impedance measuring District Cooling and Industry - 3dc



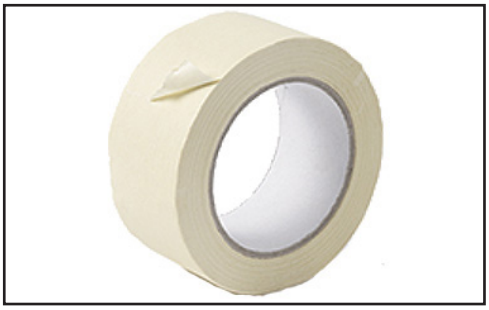
Heat resistant tape

Product No. 8000 0000 026 000

Roll of 50 m

Use a length equal to the circumference of the service pipe x 6 per joint.

However, for TwinPipes double length must be used.



Crimp connectors

Product No. 8000 0000 002 044

100 pcs. per bag

Use 2 pcs. per casing joint

Joints, impedance measuring - DC and Industry (3dc)

Shrink tubes for 3dc connections

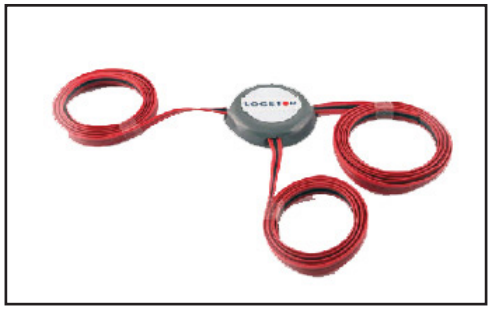
Product No. 8000 0000 007 087

100 pcs. per bag

3 pcs. are used per joint

3dc cables for installation tees

Product No. 8100 0000 007 008



Crimp tongs

Product No. 9000 0000 002 901

Jointing with or without felt

Introduction

A fault message from the surveillance system is triggered, when the moisture which may come from a leaky service pipe joint or a leaky outer casing joint becomes so concentrated that a given insulation resistance (threshold value) is exceeded

Surveillance of systems with and without hygroscopic (water-absorbing) felt in the joints each has their benefits, which are described in the following.

As a standard LOGSTOR Detect is offered without felt.

It is important that surveillance sections with and without felt are not mixed, so the choice must be made before startup.

In systems in which both types are used, they must be separated by means of take-offs.

Felt cannot be used in joints where insulation shells are used.

Jointing with felt

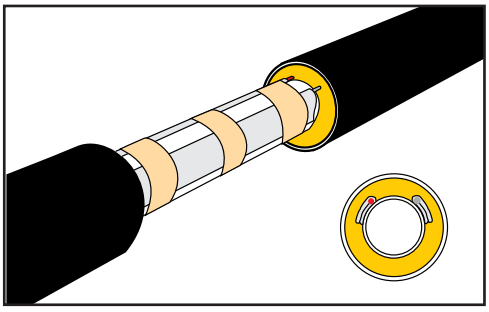
The use of felt gives a clearer indication of moisture in the joint.

By applying felt to the wires in a casing joint the speed at which moisture spreads through the felt is increased. The moisture spread through felt is faster than through the PUR foam insulation, consisting of closed cells.

In an active system a faster fault message is achieved in case of moisture in the joint.

Felt is installed around both wires to achieve the same sensitivity of both wires. Felt replaces wire holders.

In a surveillance system with felt the sensitivity in the casing joints is higher than in the rest of the pipe system.



Jointing with or without felt

When measuring with a pulse reflectometer a moisture fault will be clearer indicated in the pulse display, and localisation may therefore be easier. Moisture faults in the other system components will correspondingly appear less clear in the pulse display due to the difference in sensitivity.

On felt installation the fitter must be particularly aware of the increased sensitivity towards moisture. It is therefore important that the felt is dry during installation.

The continuous control of insulation values from joint to joint is the same as for joints without felt, see Handling & Installation.

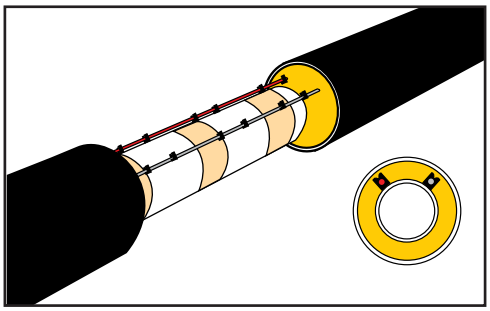
On handover the acceptance criterion of the insulation value for the total system is the same as for a system without felt.

Joints without felt

In a surveillance system without felt the sensitivity in pipes, components, and casing joints is the same.

When measuring with a pulse reflectometer the moisture fault will be displayed alike in the entire system.

Localisation of a fault in the rest of the system, e.g. caused by excavation damages, will therefore be indicated just as clearly as faults in the joints.



Hosting - General

Introduction

This section describes the Hosting concept which communicates and documents the condition of the pipe system

Description

LOGSTOR Hosting is a concept where the user applies the program "XTool" to handle data from the detectors in the surveillance system via an internet connection. The communication takes place via a 2G/3G/4G wireless transmission.

Hosting consists of a database with the XTool program, processing all measurement data and saving the information in the database. Hosting also comprises data safety, because backup is run on a continuous basis, and program updates are implemented automatically.

This is done by establishing a short cut on the user's PC to a remote desktop, used on connection to the host. The communications takes place via an encrypted VPN connection.

The detectors are delivered with a sim card for data transmission and are configured for automatic connection to the host server with a fixed IP address.

Application

Hosting makes it possible to use the surveillance system on two different levels:

1. The user manages the surveillance

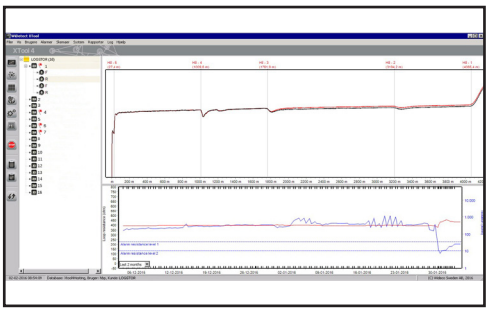
2. LOGSTOR manages the surveillance

1. The user manages the surveillance

As a standard the hosting solution is based on the user him-/herself receiving and monitoring the measurement data.

The user automatically receives fault alarms - either by e-mail and/or SMS. On basis of the received data the user analyses and considers which measures to initiate.

If required LOGSTOR can render support, because LOGSTOR's experienced technicians with the acceptance of the user can access the measurement data.



2. LOGSTOR manages the surveillance

The hosting solution gives the user the option to choose an extended service where LOGSTOR manages the surveillance of the user's entire pipe system.

The extended service includes:

- Continuous analysis of the measurement data

- Preparation of a monthly report

- Recommendation as to the fault repair

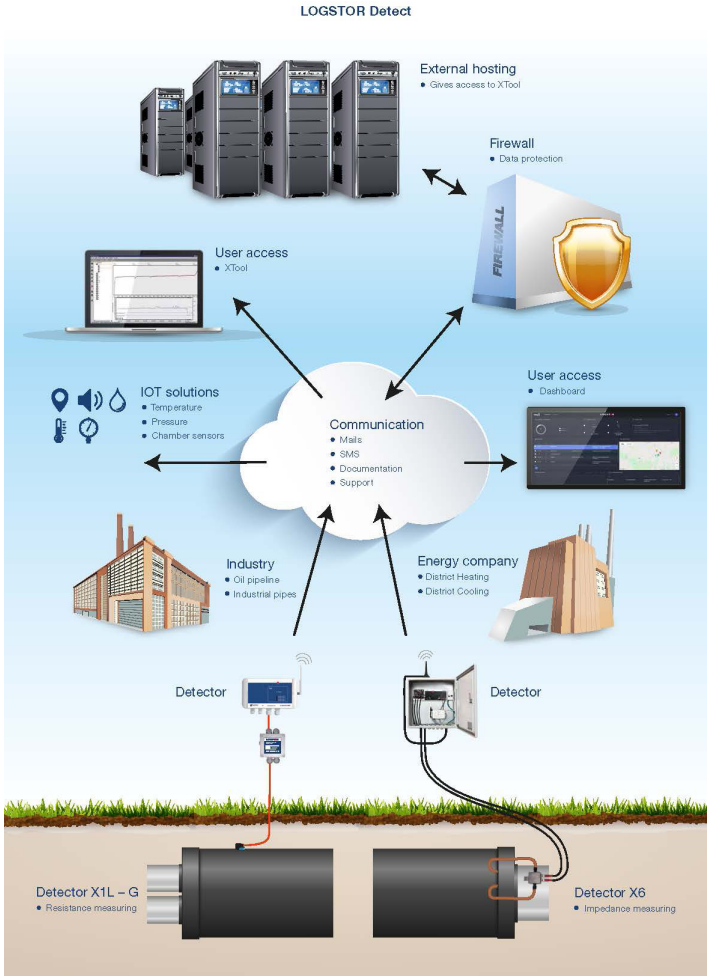
- E-mail/SMS-alarms are sent to LOGSTOR who informs the user of recommended measures

- The user is informed, when an acute damage arises

Communication flow

From below illustration the communication flow from the detectors on the user's pipe systems to the external host server, handling the XTool, appears.

The illustration also shows the user's access via PC, tablet, and smartphone with password protected login.



Hosting - XTool

Application

XTool is the graphic surveillance program, enabling proactive surveillance.

It handles a constant communication between the detectors and a host database server about the state of the pipe system.

Graphic display

XTool acquires the information from the surveillance units in a graphic display which makes it simple and clear to follow the state of the pipe system.

XTool illustrates the internal and external moisture faults in a pipe system as well as open wire.

XTool can also state the distance to a given fault.

Documentation

XTool can save the measurement values from the last 6 years in the database as documentation. On follow-up the history of the system can contribute to identifying and evaluating faults.

XTool can import surveillance diagramms, measuring reports, and images as well as the GPS positions of the detectors.

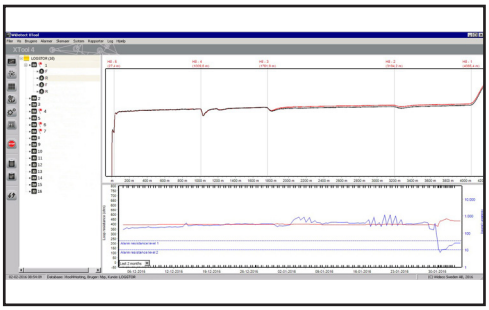
XTool enables the user to generate dynamic condition reports.

A unique analysis tool

XTool compares the incoming impedance and/or resistance measurements with the defined reference curves and states even the smallest irregularities in the pipe system. This makes it possible to plan repairs, before a fault, if any, develops.

On alarm an e-mail and/or SMS is generated.

XTool can be connected to the user's SCADA system as an analogue/digital on/off (I/0).



Service

Introduction

For passive surveillance systems LOGSTOR offers the following services:

1. Control measuring on handover
2. Control measuring and condition assessment
3. Update of surveillance diagrams

1. Control measuring on handover

In connection with the handover procedure LOGSTOR offers the following:

- Control of the wiring and of the surveillance system being complete
- Control measuring the insulation resistance and wire resistance
- Registration of faults, if any

The above is documented in a service report and an as-built diagram.

2. Control measuring and condition assessment

On pipe systems with terminal boxes and reference points for manual control measuring LOGSTOR offers to carry out control measuring and condition assessment.

The objective of this thorough measuring is to document the following:

- insulation resistance and wire resistance
- that any fault (e.g. moisture/water in the system or broken wire) is registered
- that terminal boxes and cabinets are intact
- that cable take-offs are undamaged
- that the surveillance diagram is updated
- that faults, if any, are localised and documented

On the basis of the above a service report is drawn up, and the surveillance diagram is updated, if necessary.

3. Updating surveillance diagrams

LOGSTOR offers an update to an as-built diagram, based on information from the user or LOGSTOR.

An updated surveillance diagram is important as regards measuring the fault. It should therefore ALWAYS be kept up to date as regards the wiring.

The surveillance diagram is returned electronically and/or in paper form.

Upgrading from passive to active system

LOGSTOR can upgrade a passive system to an active system.

The upgrade includes the following 3 phases:

1. Analysis

2. Installation

3. Commissioning

1. Analysis

In the analysis phase the documentation - primarily the surveillance diagram - of the existing, passive system is examined.

It is established how the existing surveillance circuit is connected:

- With or without loop

- As a single wire system

- Wire lengths

- Transitions between single pipe and TwinPipe system

- Installation cables or coaxial cables

Based on the customer's requirements and possibilities a proposal as to how the system can be converted into an active system is drawn up.

This entails:

- A new surveillance diagram, divided into sections

- Components to choose for the active system

- Detector type to choose

- Connection to LOGSTOR Hosting

A precondition for further progress is that any faults and shortcomings in the existing system are fixed.

2. Installation

In a start-up meeting with the customer the course and time schedule are agreed upon.

The sections are established in accordance with the new surveillance diagram, and at the same time the present condition of the system is inspected. In case of system faults these must be fixed prior to commissioning.

The following components are used:

- Terminal boxes/connection boxes

- Cable take-offs (installation or coaxial cables)

- Detectors

3. Commissioning

During the commissioning phase the following is implemented for LOGSTOR Hosting systems:

- A shortcut on the user's PC to the remote desktop, used for connecting with LOGSTOR Hosting is established
- Alarm limits for insulation resistance, broken wire, and galvanic voltage are established in XTool
- It is determined whom to contact in case of fault via e-mail and/or SMS
- The documentation in XTool is updated with surveillance diagrams, photos etc.
- Education and training in using XTool

For information about further support , see LOGSTOR Hosting.

Documentation

Introduction

This section describes the documentation of the surveillance system:

1. Surveillance diagrams
2. Service report
3. Commissioning detectors
4. Documentation of components
5. Manuals

1. Surveillance diagrams

Prior to initiating a project a surveillance diagram must be drawn up, which is a proposal as to how the wiring of the surveillance system must be established and where take-offs, reference points and earth connections are to be established.

It is important that this proposal is examined with the customer/consultant so any changes are clarified prior to commencing installation, especially the position of cabinets - reference points and where to set up the detector. For detectors, where 230V must be used, it is the responsibility of the owner to establish power supply for the location where it is to be set up.

It is a condition for commencing the installation that the fitter has received the surveillance diagram.

During the installation the fitter must register changes in the wiring and take-offs so changes are on record and documented as as-built documentation, when everything has been installed.

The measuring technician must finally make sure that take-offs and possible detectors appear from the diagram.

An updated surveillance diagram is important in connection with measuring the fault. It should therefore ALWAYS be up-to-date as regards wiring.

2. Service report

When LOGSTOR documents the surveillance system on handover/commissioning the following measurements are made:

- The insulation resistance of each wire section/loop is measured

- The wire resistance of each wire section/loop is measured

- The wire length of each wire section/loop is established by measuring the impedance

- The impedance curve can be forwarded, if so agreed in beforehand

In case of fault the fault is measured and the distance to the fault is stated in metres alarm wire. The customer/owner can now use the project documentation to determine where in the pipeline the fault is.

3. Commissioning the detector

In connection with commissioning an active surveillance system an installation report is drawn up which includes:

- Detector type and serial number
- Geographical position (address)
- IP-address
- Signal conditions
- Test of alarm by e-mail/SMS via XTool

4. Documentation of components

As a standard all LOGSTOR detectors are CE-approved and documentation hereof can be forwarded.

All X1L and X6 detectors can be delivered as approved in Canada and the USA in accordance with CSA/UL. Documentation hereof is available on request.

All detectors are delvered with calibration certificate and manuals.

5. Manuals

LOGSTOR Hosting:

LOGSTOR Hosting detectors are delivered with an installation manual.

Manuals about setup and instructions for XTool are forwarded on request.

As a standard the manuals are available in English. For manuals in other languages please contact LOGSTOR.

Contact details

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LOGSTOR Denmark Holding ApS
Danmarksvej 11 | DK-9670 Løgstør

T: +45 99 66 10 00
E: logstor@kingspan.com

For the product offering in other markets please contact your local sales representative or visit www.logstor.com

To ensure you are viewing the most recent and accurate product information, please scan the QR code directly above.

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