# EMS Surveillance System

## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Profile</td>
<td>4</td>
</tr>
<tr>
<td>Design</td>
<td>5</td>
</tr>
<tr>
<td>Catalogue</td>
<td>13</td>
</tr>
<tr>
<td>Installation</td>
<td>27</td>
</tr>
</tbody>
</table>
epc technology a/s

Company profile
epc technology a/s develops, manufactures and installs surveillance systems, mainly for the district heating industry.

All necessary components for building a complete surveillance system are included in the product programme: Fault locators, detectors, cables, connecting boxes, end components etc.

Furthermore epc technology a/s offers service and support during designing, installation, testing and approval of new or existing district heating pipe systems.

The EMS surveillance system is based on the well-known simple copper wire principle, characterised by great reliability and by being economic attractive during installation as well as operation. The wires are robust and easily installed during pipe manufacture and system assembly. Consequently this system today is far the most widespread one and leading pipe manufacturers and district heating companies have selected the EMS system.
Design

System structure
A surveillance system consists of:
- Embedded copper wires in the delivered preinsulated pipes
- Components for connection of equipment
- Measuring equipment for permanent surveillance
- Circuit diagram of the total surveillance system.

Design and documentation of the wire run in a specific surveillance system are therefore an essential factor for the utilization of the surveillance system for fault location. With a surveillance system a fault is measured by means of the wire length to the fault location independent of the chosen system:
- Reference point system
- Detector system
- Fault locator system

Symbols
When designing an EMS surveillance system a set of symbols is used to show where to use the specific components, and also the electric length of each connected cable for connection of detector, fault locator, check points or jumper cables in the system.
The tinned wire in the pipes is used for surveillance of the pipe system and is marked on the circuit diagram with a full-drawn line.
The copper wire in the pipes is used as a signal wire, i.e. for relay or data transmissions from each unit in the system to a central surveillance, placed e.g. in the district heating station. It is also used when the signal is transmitted back and forth in the same pipe.
The copper wire is marked in the circuit diagram with a broken line.
See the paragraph, symbol key

Diagram structure
Design the circuit diagram so the highest possible utilization and accuracy are obtained when measuring the chosen system. For all types it is advantageous with as many check points (reference points) as possible. Max. distance between the checkpoints must be 500 m wire.
Check points are easily and in an inexpensive way established in connection with a branch where the wires are connected forth and back in the same pipe to the consumer. Max. length of this wire connection is 100 m. Checkpoints can also be established when connecting cables to a cabinet and back to the same muff. This method is used for transmission lines where there typically are no consumers. To maintain the accuracy in the surveillance system the total length of cables in the system must not exceed 10 % of the total wire length. See example of circuit diagram

Making diagrams
It is vital that the circuit diagram is finish before pipes are installed so the wire position can be correct. It is also vital that all changes of the pipe run are noted so a correct “as built”-diagram can be made. Correspondence between diagram and pipe drawing is a condition of correct location of a possible malfunction. epct technology a/s offers its assistance with the preparation of diagrams for surveillance systems.
Symbol key for the components

<table>
<thead>
<tr>
<th>Signature</th>
<th>Part. no.</th>
<th>Name</th>
<th>Illustration</th>
<th>Physical length metre</th>
<th>Electrical length metre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tinned copper wire</td>
<td></td>
<td>length pipe</td>
<td>length pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Copper wire</td>
<td></td>
<td>length pipe</td>
<td>length pipe</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td>Earth connection, short</td>
<td></td>
<td>0,90</td>
<td>1,00</td>
</tr>
<tr>
<td></td>
<td>1201</td>
<td>Earth connection, long</td>
<td></td>
<td>2,69</td>
<td>3,00</td>
</tr>
<tr>
<td></td>
<td>1210</td>
<td>Cable, 1 m</td>
<td></td>
<td>4,49</td>
<td>5,00</td>
</tr>
<tr>
<td></td>
<td>1216</td>
<td>Cable, 3 m</td>
<td></td>
<td>8,98</td>
<td>10,00</td>
</tr>
<tr>
<td></td>
<td>1212</td>
<td>Cable, 5 m</td>
<td></td>
<td>13,47</td>
<td>15,00</td>
</tr>
<tr>
<td></td>
<td>1213</td>
<td>Cable, 10 m</td>
<td></td>
<td>17,96</td>
<td>20,00</td>
</tr>
<tr>
<td></td>
<td>1214</td>
<td>Cable, 15 m</td>
<td></td>
<td>22,45</td>
<td>25,00</td>
</tr>
<tr>
<td></td>
<td>1215</td>
<td>Cable, 20 m</td>
<td></td>
<td>x</td>
<td>x / 0,90</td>
</tr>
<tr>
<td></td>
<td>1216</td>
<td>Cable, 25 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1217</td>
<td>Cable, x m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1220</td>
<td>Connecting link</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1221</td>
<td>Cable installation set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1230</td>
<td>Connecting box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1231</td>
<td>Junction box</td>
<td></td>
<td></td>
<td>0,75</td>
</tr>
<tr>
<td></td>
<td>1232</td>
<td>Junction box for 2 single cables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1233</td>
<td>Y-box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1240</td>
<td>Single cable connection</td>
<td></td>
<td></td>
<td>4,40</td>
</tr>
<tr>
<td></td>
<td>1241</td>
<td>Twin cable connection</td>
<td></td>
<td></td>
<td>4,40</td>
</tr>
<tr>
<td></td>
<td>1242</td>
<td>Double cable connection</td>
<td></td>
<td></td>
<td>5,50</td>
</tr>
<tr>
<td>Part No.</td>
<td>Description</td>
<td>Price (€)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1243</td>
<td>Jumper cable (steel muff), 3 m</td>
<td>1.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1244</td>
<td>Jumper cable (steel muff), 4 m</td>
<td>2.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1245</td>
<td>Jumper cable (steel muff), 5 m</td>
<td>2.91</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1250</td>
<td>Single cable connection (plastic muff)</td>
<td>8.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1251</td>
<td>Twin cable connection (plastic muff)</td>
<td>4.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1254</td>
<td>Twin cable connection (plastic muff)</td>
<td>8.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1252</td>
<td>Double cable connection (plastic muff)</td>
<td>8.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1253</td>
<td>Jumper cable (plastic muff)</td>
<td>4.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1300</td>
<td>End component, red for detector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1301</td>
<td>Adaptor box, red for detector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1302</td>
<td>End component, black</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1303</td>
<td>Adaptor box (black)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1304</td>
<td>Fault simulator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1305</td>
<td>Connecting link for relay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1306</td>
<td>T-box</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1308</td>
<td>End component (blue)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1309</td>
<td>Adaptor box (blue)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1400</td>
<td>Small cabinet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1401</td>
<td>Large cabinet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1516</td>
<td>Connection box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1517</td>
<td>Terminal box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1518</td>
<td>Extension box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>2000</td>
<td>Detector, 1 circuit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>2020</td>
<td>Detector, 2 circuits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D 1234</td>
<td>3000</td>
<td>Detector, 4 circuits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4000</td>
<td>Fault locator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D 1234</td>
<td>8000</td>
<td>Detector, 8 circuits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DLD 1234</td>
<td>8001</td>
<td>Detector, 4 circuits, long distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW 1234</td>
<td>8002</td>
<td>Detector, 8 circuits, wireless</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example of circuit diagram, made in accordance with symbol key
Reference point system

Description
This system is typically used between blocks of flats, inspection chambers etc.
Connect wires so they can be inspected from, for example, a cellar room by means of an external instrument e.g. a megger.
In case of fault the fault location is measured with a pulse reflectometer.

Design
This example is between 3 blocks of flats.
In building no. 1 tinned wires and copper wires are connected to connecting box no. 1230.
In buildings nos. 2-3 the wires are looped to obtain a circuit for each pipe.
Checking and measuring of malfunctions can be done from building no. 1.
Also see symbol key.

Detector system

Description
Unlike a reference point system, this system permanently monitors the pipe system with the connected detector.
In case of fault the fault location is measured with a pulse reflectometer.

Connection of detector in building
Detector 3000, installed in building no. 1 with cable 1212 to connecting boxes 1230 on the tinned wire.
End component 1300 is used where the circuit ends (the copper wire).
Install end component in the two circuits which are not used on the detector.
Each circuit can max. monitor 1000 m wire.
If the system is shorter than 1000 m, a 1-circuit detector 2000 may be used.
In addition, see symbol key.

Connection of detector on pipe run
Detector 3000, installed in cabinet and connected to the pipe system with cable 1240.
With this method all 4 circuits can be used with max. 1000 m.
Each circuit ends in a building with connecting boxes 1230, installed with end component 1300.
The copper wires in the main pipe are not used, but connected and may later be used to transmit signals.
Moreover, see symbol key.
Jumper cable
If the length of a branch is more than 100 m, connection back and forth in the same pipe cannot be used.
Or if the length of the single circuit is more than 1000 m, design with jumper cables as in the example shown may be used. It will reduce wire length.
The tinned wire is connected in the building with jumper cable between the 2 pipes. Here 1231 coupling box and 1210 cable are used for connection.
For branches jumper cable 1243 is used between the 2 muffs so one circuit now monitors the 2 pipes.
At the next branch the second circuit is used for the same connection method, so the measuring lengths are used optimally.
In addition, see symbol key and diagram

Ending in muff
A circuit can also be ended with an end component from a muff, when max. length of 1000 m has been reached with a detector.
Here design is made with a cable no. 1242 that is led to the cabinet where adaptor box no. 1301 is connected to the cables.
In addition, see symbol key and diagram
Fault locator system

Description
The fault locator system is designed on the same principle as the detector system, but the wire length for each of the 4 circuits may be up to max. 2500 m.
A fault locator gives permanent surveillance of the pipe system and possible faults can be read from the display of the fault locator.

Design with fault locator
In this example the design has been made with fault locator 4000 which can monitor 2500 m per circuit.
End component to end each circuit has now been replaced by 1302, which is used together with 1230 in the building.
1303 has now replaced the end component in connection with cables.
Note! All cable connections on a fault locator system, after connection of fault locator, must be designed with 200-ohm impedance.
It means that double cables and matching coupling boxes must be used.
For steel fittings 1242 - 1243 cables and for band muffs and shrink muffs 1252 - 1253 cables are used.
In addition, see symbol key
In principle jumper cables and endings in muff are made as shown in the paragraph Detector System

Central surveillance

A pipe system monitored by more detectors and/or fault locators can be centrally monitored by means of the copper wire to a computer, placed e.g. at the district heating station.
Central surveillance can also be established by means of external cables or with wireless connection.
Please contact epc technology a/s if you have any questions.

Design with central surveillance
In the shown example design has been made with central surveillance for 2 fault locators.
The copper wire in the building has been installed with 1230 connection box from where cable of the required length is connected with the central surveillance.
The copper wire is carried out to the individual fault locators by means of a 1240 cable - the same cable that is used for the tinned wire.
At the fault locator T-box 1306 is used to connect the 3 cables. Two cables from the copper wire and one cable for the relay of the fault locator.
Where the tinned wire is carried out to the end component, the copper wire is also carried out by means of a cable 1240 and joined with a connecting link 1220.
Moreover, see symbol key.
Catalogue

1101
Cleaning cloth (10 cloths)
Clean the wire ends with a synthetic cleaning cloth.

1102
Soldering paste
Acid-free soldering paste increases the flow ability of the tin solder.

1103
Tin solder, coil
Tin solder (dia. 2 mm) with resinous flux

1104
Crimp connector for single wire (100 connectors)
Use a crimp connector with centre stop to connect 2 wires.

1105
Crimp connector for 3 wires (25 connectors)
Use a crimp connector with full passage for T-point connection.

1106
Crimping tool
Use the ratchet crimping tool, recommended for pressing the crimp connectors.

1107
Installation wire (tinned, 25 m)
Carry out common wire extension at bends and branches with installation wire, dia. 1,39 mm (tinned).
**1108**

**Installation wire (insulated, 100 m)**

Especially at branches, insulated installation wire may be used.

**1109**

**Soldering set, gas**

Use soldering set for soldering and heat shrinking.

The soldering set consists of a hot air tube, soldering assembly, burners and gas valve and is used with gas cartridge 1110.

**1110**

**Gas cartridge**

Gas cartridge containing a gas mix of 35% propane and 65% butane. Use it with soldering set 1109.

**1111**

**Soldering iron, electric**

An electric soldering iron is recommended for soldering close to the insulation foam.

**1112**

**Felt (2 pcs.)**

Hygroscopic felt to pack the tinned alarm wire is delivered in parcels of 2, corresponding to 2 normal joints.

**1113**

**Wire holders (50 pcs.)**

Install the blank copper wire in wire holders, 3 per normal joint.
Coil of crepe tape (50 m)
Fix felt and wire holders to the service pipe with crepe tape. Do not use other types (e.g. PVC).

Flex (50 pcs.)
Use insulating sleeves to insulate the surveillance wires at for example, terminations, connections, branches and the like. Available in bags of 50. (25 red and 25 white). Also available in coils of 25 m (only white).

Insulating sleeve in coil (25 m)
Use insulating sleeves to insulate the surveillance wires at for example, terminations, connections, branches and the like. Available in coils of 25 m (white). Also available in bags of 50. (25 red and 25 white).

Check instrument (megger)
Check the wire installation continuously with the megger which can check the circuit and insulation resistance.

Earth connections, short
Weld earth connections on the service pipe where coupling boxes, cable connections and jumper cables must be installed. Short earth connections (10 + 5 sets of bolts in a bag) are primarily used inside the muff coupling.

Earth connections, long
Weld earth connections on the service pipe where coupling boxes, cable connections and jumper cables must be installed. Long earth connections (10 in a bag) are used where the coupling boxes must be accessible.
1210
Connecting cable, 1 m
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 1.00 m
Physical length: 0.90 m

1211
Connecting cable, 3 m
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 3.00 m
Physical length: 2.69 m

1212
Connecting cable, 5 m
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 5.00 m
Physical length: 4.49 m

1213
Connecting cable, 10 m
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 10.00 m
Physical length: 8.98 m

1214
Connecting cable, 15 m
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 15.00 m
Physical length: 13.47 m

1215
Connecting cable, 20 m
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 20.00 m
Physical length: 17.96 m
**1215**

**Connecting cable, 25 m**
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking.
Electrical length: 25.00 m.
Physical length: 22.45 m.

---

**1216**

**Connecting cable, “x” m**
Cable for coupling and extension cables are supplied in bags of 2, 1 with yellow and 1 with white marking. Cables in x m length can be made to order.
Electrical length x m.
Physical length: 0.90 * x m.

---

**1217**

**Connecting links**
Connect the coaxial cables by means of connecting links.
For joints in the ground use connecting link, PVC-tape, and butyl sheet.

---

**1220**

**Connecting links**
Connect the coaxial cables by means of connecting links.
For joints in the ground they are delivered with shrink tubing (2 sets).

---

**1221**

**Cable installation set**
For connection of cables in a cabinet, 4 connecting links with matching cable holders and screws are used.

---

**1222**

**Cable installation set**
For connection of cables in a cabinet, 4 connecting links with matching cable holders and screws are used.

---

**1223**

**PVC-tape**
Connect the coaxial cables by means of connecting links.
For joints in the ground use connecting link, PVC-tape, and butyl sheet.
**1224**

**Butyl sheet**
Connect the coaxial cables by means of connecting links.
For joints in the ground use connecting link, PVC-tape, and butyl sheet.

**1223**

**1230**

**Coupling box for single cable**
Use a coupling box with one coaxial connection to connect the fault locator or detector, when this is carried out at the pipe end in boiler rooms, cellars or dry wells (2 in bag).
Order earth connection separately.

**1231**

**Coupling box for double cable (jumper cable)**
Use coupling box with two coaxial connections to connect between pipes in boiler rooms, cellars or dry wells (2 in bag).
Order earth connection separately.
Electrical length: 0.75 m.

**1232**

**Coupling box for two single cables**
A double connection box is intended as a reference point on single pipes in detector or reference point systems, but may also be used as connection of 2 circuits from a detector or fault locator (2 in bag).
Order earth connection separately.

**1233**

**Y-box**
Use Y-box in 2020/8000/8002 detector systems when connecting installation cable and coaxial cable.

**1240**

**Single cable connection for steel muffs, 5 m**
Use single cable connection between fault locator or detector and the muff in the ground. Each bag contains 2 cables.
Electrical length: 5.00 m.
Physical length: 4.40 m.
**1241**

**Twin cable connection for steel muffs, 5 m**
A twin cable connection is used in the same way as 1240, but can connect 2 measuring circuits at the same time. Each bag contains 1.
- Electrical length: 5.00 m.
- Physical length: 4.40 m.

**1242**

**Double cable connection for steel muffs, 7 m**
Use double cable connection between the muff in the ground and a termination/check point in cabinet or building. Each bag contains 2 cables.
- Electrical length: 7.00 m.
- Physical length: 5.50 m.

**1243**

**Jumper cable for steel muffs, 3 m**
Use jumper cable between two muffs in the ground.
- Each bag contains 1 cable.
- Electrical length: 3.00 m.
- Physical length: 1.11 m.

**1244**

**Jumper cable for steel muffs, 4 m**
Use jumper cable between two muffs in the ground.
- Each bag contains 1 cable.
- Electrical length: 4.00 m.
- Physical length: 2.01 m.

**1245**

**Jumper cable for steel muffs, 5 m**
Use jumper cable between two muffs in the ground.
- Each bag contains 1 cable.
- Electrical length: 5.00 m.
- Physical length: 2.91 m.

**1250**

**Single cable connection for plastic muffs, 10 m**
Use single cable connection between fault locator or detector and the muff in the ground.
- Each bag contains 2.
- Electrical length: 10.00 m.
- Physical length: 8.89 m.
1250

**Twin cable connection for plastic muffs, 5 m**
Twin cable connection is used as 1250, but can connect 2 measuring circuits at the same time.
Each bag contains 1.
Electrical length: 5.00 m.
Physical length: 4.40 m.

1251

**Double cable connection for plastic muffs, 10 m**
Use double cable connection between the muff in the ground and termination/check point in cabinet or building.
Each bag contains 2 cables.
Electrical length: 10.00 m.
Physical length: 8.19 m.

1252

**Jumper cable for plastic muffs, 7 m**
Use jumper cable between two muffs in the ground.
Each bag contains 1.
Electrical length: 7.00 m.

1253

**Single cable connection for plastic muffs, 2 m**
Use single cable connection between fault locator or detector and the muff in the ground.
Each bag contains 2.
Electrical length: 2.00 m.
Physical length: 1.71 m.

1254

**Twin cable connection for plastic muffs, 10 m**
Twin cable connection is used as 1250, but can connect 2 measuring circuits at the same time.
Each bag contains 1.
Electrical length: 10.00 m.
Physical length: 8.89 m.

1255

**Single cable connection for plastic muffs, 5 m**
Use single cable connection between fault locator or detector and the muff in the ground.
Electrical length: 5.00 m.
Physical length: 4.7 m.
Each bag contains 2.
Electrical length: 5.00 m.
Physical length: 4.40 m.

1256

1260
Cable end protector
Protect open ends of coaxial cables against dirt and moisture during installation.
Use cable end protector 1260.

1261
Cable marking
Use cable-marking rings with the figures 1, 2, 3 and 4 for identification of cables.

1300
End component (red)
For the detectors 2000 and 3000.
Use an end component when the detector circuit is terminated in a building or the like. (Installed on a 1230)
Is available in sets of 2.

1301
Adaptor box (red)
For the detectors 2000 and 3000.
Use an adaptor box when a detector's circuit is terminated by means of cable connection in ground.
Delivered 1 at a time.

1302
End component (black)
Use an end component when a fault locator circuit is terminated in a building or the like. (Is installed on a 1230).
Is available in sets of 2.

1303
Adaptor box (black)
Use an adaptor box when the fault locator circuit is terminated by means of cable connection in the ground.
Delivered 1 at a time.
**Fault simulator**
Use a fault simulator when cable connections are made in order to determine the distance to reference points.
Delivered 1 at a time.

**Connecting link for relay**
When the relay of the fault locator is used, a connecting link is inserted between the DIN-outlet and the coaxial cable.
Delivered 1 at a time.
Also applicable for detectors.

**T-box**
A T-box is a service component, built into the signal transmission circuit (e.g. central surveillance) instead of a T-point connection on the wires. This makes it possible to measure/service the signal wire with a portable instrument.
Installation may take place together with the relay of the fault locator or as a reference point, for example a main pipe and a branch pipe with cables led into a cabinet.
Also applicable in a detector system.

**End component (blue)**
For the detectors 2020, 8000 and 8002.
Use an end component when the detector circuit is terminated in a building or the like. (Installed on a 1230).
Is available in sets of 2.

**Adaptor box (blue)**
For the detectors 2020, 8000 and 8002.
Use an adaptor box when a detector’s circuit is terminated by means of cable connection in ground.
Delivered 1 at a time.

**Cabinet for component installation, narrow**
Lockable cabinet for installation of components and surveillance equipment.
It is made of fibreglass with a sliding foot made of steel for installation in the soil or in concrete. The narrow cabinet is recommended for 1-circuit detectors and establishment of end points.

1400

Cabinet for component installation, wide
Lockable cabinet for installation of components and surveillance equipment. It is made of fibreglass with a sliding foot made of steel for installation in the soil or in concrete. The wide cabinet is recommended for installation of fault locator, 4-circuit detector and reference points.

1401

1403

Triangular key for cabinets
Special key for locking the cabinets 1400 and 1401.

1516

Connection box
Used for connecting the measuring wires in a pair of pipes to an installation cable from a detector 2020/8000/8002. The cabinet contains two diodes, which respectively block and open the measuring signal. The cabinet also contains a voltage transient protector. One connection box is used for each pair of pipes.

1517

Terminal box
Used for establishing easily accessible measuring points for control measuring and fault-location. The wire length between two measuring points should not exceed 800 m. Connection to pipes via installation cables.

1518

Extension cable box
Is used for connecting the measuring wires in one pair of pipes to an installation cable. Installation cables are used in the house to couple from one pair of pipes to another. One extension cable box is used for each pair of pipe.
1 circuit detector
A 1-circuit detector can monitor a pipeline up to 1000 m by means of the embedded wires in the pipe system. Registers open wire or moisture with red lamp. Green lamp means fault free. Is connected to 230 V. Can be connected to a central surveillance system by means of a potential free relay.

2-circuit detector
A 2-circuit detector can monitor up to 2 x 7000 m of pipeline by means of the embedded wires in the pipes. Registers open wire or moisture with red lamp. Green lamp means fault free. Indicates that the fault is a disconnection or moist/short circuit fault. Is connected to 230 V. Can be connected to a central surveillance system by means of a potential free relay.

4-circuit detector
A 4-circuit detector can monitor a pipeline up to 4 x 1000 m by means of the embedded wires in the pipes. Registers open wire or moisture with red lamp on the circuit in question. Green lamp means fault free. Is connected to 230 V. Can be connected to a central surveillance system by means of a potential free relay.

Fault locator
By means of the embedded copper wires in the pipe system the fault locator can monitor up to 4 x 2500 m pipeline. The fault locator screen can display:
- distance in meters to the measured fault
- distance from measured fault to preset reference point (5 pcs. per channel)
- reference (initial) curve from the start of the system
- impedance curve, indicating that the fault is a disconnection or moist/short circuit fault
- The curve also makes it possible continuously to assess the condition of the system. There are also other readings and setting possibilities. Automatically adjusts to 115 or 230 volts. By means of a potential free relay the fault locator may be connected to an external alarm and by means of a modem, (not standard) be connected to an actual central surveillance system with data transmission.

8-circuit detector
An 8-circuit detector can monitor up to 8 x 7000 m of pipeline by means of the embedded wires in the pipes. Registers open wire or moisture with red lamp. Green lamp means fault free. Indicates that the fault is a disconnection or moist/short circuit fault. Is connected to 230 V. Can be connected to a central surveillance system by means of a potential free relay.
8000

8002
8-circuit wireless detector
Designed for leak detection on preinsulated district heating pipes. Up to 8 measuring sections, up to 7000 meters each, may be connected to the detector.

During the leak detection process the detector measures the electrical resistance between service pipe and measuring wire of the district heating pipe. If the measured resistance drops below the specified limit, an alarm signal indicates the presence of moisture inside the insulation material of the pipe. A continuity check of the measuring wire is concurrently performed and a possible wire break will be signalled. Parallel to the leak detection process measurement of temperature may be performed on selected points of the district heating pipe net.

Alarm condition is announced locally by optical and acoustic signal and via the potential free relay output of the detector. Remote alarm announcement is made via SMS and wireless GSM transmission to the host computer. As each detector has got its own identification number and GSM number, any number of detectors can be served.

The result of all measurements will be stored locally on the detector and later transferred to the host computer at regular time intervals. The computer stores all data and is capable of generating alarm logbooks and statistical calculation and visualisation of the collected data. Working parameters may be updated from the detector’s keyboard or from the host computer, and also updating the detector’s software is carried out remotely.

Power is supplied from an external mains adaptor 230/14V with backup from an internal battery.

Functions:

- Leak detection by measuring the electrical resistance between the measuring wire and the service pipe
- Temperature measurement and logging
- Monitoring the continuity of the measuring wire
- Operation of the detector directly using the keyboard and the display
- Remote control from host computer using the GSM-net
- Signalling alarm condition via display – buzzer – potential free relay – SMS – host computer
- Storing measured data with time
- Storing alarm incidents with time
- Programming the detector locally or from the host computer
General

Fault locator

Description
The fault locator is designed for permanent installation from a 115-230 V AC supply. It can monitor max. 2500 m on each of the 4 circuits.
Mains voltage: 115-230 V ~
Mains connection: 1.5 m 3-conductor, round, black PVC wire 3 x 0.75 mm²
Power requirement: 33 W
Temperature range: -20°C to +40°C
Output signal: coded impulses
When a fault locator is installed and connected it will output the lengths of the connected circuits when they are fault free.
If there is a fault in one or more of the connected circuits in the form of moisture or open wire the distance to the fault on the circuit in question will be indicated.

Connecting fault locators and cables
Install the fault locators directly on a wall in a building or in a cabinet and connect them to 115/230 V AC.
Use coaxial connections on the bottom of the fault locators when connecting the fault locators to the pipe system.
Warning! Never measure with the control instrument, nor electrically weld or connect other measuring instruments to a pipe system connected to a fault locator.
Always number the cables in correspondence with the 4 connections.

Detector

Description
The EMS detector is available in two versions:
- A 1-circuit detector that monitors a pipe run of max. 1000 m, part no. 2000
- A 4-circuit detector that monitors 4 pipe runs - each of max. 1000 m, part no. 3000.
Mains voltage: 230 V AC ± 10%
Mains connection: 1.5 m 2-conductor plastic wire, 2 x 0.75 mm²
Power requirement: 1.7 W
Ambient temperature: -20°C to +50°C
Output signal:
Sine voltage, 3 kHz, 2.4 Vpp
Warning level: 120 ohm ± 10%
The detector registers open wire as well as too high concentrations of moisture in the insulation.
A green light indicates no fault. In case of a fault the light changes to red.
Connecting detector and cables
Install the detectors directly on a wall in a building or in a cabinet and connect them to 230 V AC. Use coaxial connections on the bottom of the detectors when connecting the detectors to the pipe system.
Warning! Never measure with the control instrument, nor electrically weld or connect other measuring instruments to a pipe system connected to a detector.
Always number the cables in correspondence with the 4 connections.

Relay Connection
Description
The detector or fault locator is supplied with a relay that is used for central surveillance. Connect by means of 3-pole DIN connector on the bottom of the detector or fault locator.
Relay contacts: close or open
Contact load:
- Max. 3 W
- Max. 100 V
- Max. 0.25 A
Normal connection:
- Connection between contacts 1 and 2 of the relay contact.
Connection in the case of a fault:
- Connection between contacts 2 and 3.
This can be seen in the illustration.

Connecting link for relay
Insert connecting link for relay, part no. 1305, when the relay of the fault locator is used.

Application of T-box
Use the T-box (part no. 1306) to connect detectors or fault locators to a signal circuit in connection with central surveillance.
Example of application of T-box: termination of signal wire from muff.
The illustration shows the symbol from the circuit diagram.

Earth connection
Earth connection/cables
Where the wiring for some reason exits the pipe system short earth connections (1200) are welded on to the steel pipe, so the measuring references of the steel pipe are correct.
The alarm drawing shows where to weld the earth connection onto the steel pipe. Do it at the same time as the pipes are welded together.
Earth connection/coupling boxes
In buildings and inspection chambers where coupling boxes are installed it is recommended to use a long earth connection (1201), so the coupling boxes are not hidden by the inside insulation.
Weld the earth connection on to the pipe 70 mm from the foam end.
The alarm drawing shows where to weld the earth connection on to the steel pipe. Do it at the same time as the pipes are welded together. Note! When an end-cap must also be installed it is necessary to install it before welding the earth connection on.

Cable cabinets
Description
If components cannot be placed in a building or the like, install them in a cabinet.
Part no. 1400 (628 x 303 x 155 mm)
Part no. 1401 (628 x 574 x 215 mm).
The cable cabinet is constructed for individual installation or as a uniform system built together.
The single cabinets are connected by means of corrugated nails and a coupling mounting.

Installing cable cabinets
Adjust the sole plate according to the ground or the depth of the cable trench.
Place the cabinet with marking on cabinet in ground.

To avoid moisture ingress fill the lower third of the cabinet with styropor balls.
Seal the balls with sealing wax, if necessary.

Wiring
General
Preparations
The two copper wires, embedded in the insulation, are delivered with protection against damage by winding and installing them in the two countersink holes of the insulation.
When installing the pipes in the trench follow the specifications of the wire position in the alarm drawing.
Place the pipes so the wires face upwards (10-to-2-o’clock position), and so the tinned wires and the copper wires are installed in pairs opposite each other.

At each joint there must only be one pipe label and it must face upward (12 o’clock position) in the surveillance system the alarm wires are placed at the top of the pipe in order to achieve:

- optimum installation conditions
- permanent accessibility of the wires when establishing branches.

Repairing wires
Examine the wires for possible damage. If a wire has been damaged, for example, during removal of the insulation, remove the insulation around the wire end and solder a new piece of wire on as described in the following. Note! Do not use a gas flame when soldering towards the insulation.

Preparations for checking the joint
When beginning the wire installation, connect the wires in the two pipes as shown in the illustration. Tinned wire to tinned wire and copper wire to copper wire. In this way 2 measuring circuits are established which must be used to check the wire connections on the subsequent joints.

Straightening
Wind the coiled wires from the countersink holes in the insulation when the pipes have been welded together. Remove dirt and moisture from the insulation of the pipe ends. Straighten the wires and clean the ends with steel wool or a cloth of synthetic textile (part no. 1101).

Adjusting the control instrument
Carry out 2 kinds of tests:
1. Check that there is good electrical connection through the connected wires.
2. Check that the wires have been correctly isolated from the steel pipe (15 mm). These checks are carried out at each joint with a special measuring instrument, a "megger" (part no. 1117). Before these tests adjust the instrument as follows:

- Insert the measuring wires and short-circuit them
- Place the switch in measuring range 2 "ISOL"
Test 1, resistance
- Connect the instrument wires to the cleaned tinned wires (alarm)
- Place the switch in measuring range 1 "ohm"
- Press the test knob

Test 2, insulation
- Connect one instrument wire to one of the wires in a pipe.
- Hold the other instrument wire against the steel pipe in the same pipe. Check that there is good electrical connection. Use the weld.
- Place the switch in measuring range 2 "ISOL".
- Press the test knob.
  The deflection of the indicator must be minimal and in the green part of the dial.
- If the indicator deflects into the red part of the dial, an incorrect installation (moisture) has been made in the previous joint.
- Check the joint.
- Remove possible moist foam
- Repeat the test.
- Check all the wires in the joints in this way.

Warning
Never use the megger with connected fault locators as the voltage emitted by the megger may damage the exits of the fault locator.
• Now move the instrument to the next pipe joint.

Wiring - straight joints

Connecting wires
Straighten the wires.
Cut the overlapping ends off and clean the wires.
Apply soldering paste to the ends.
Place a connector on one of the wires and crimp it with the crimping tool (jaw width 1.5 mm²).

Insert the other wire into the connector and crimp it.
A good mechanical connection is now ensured.
Note! The wires must be tight, i.e. the same length as between the foam ends.

Soldering the wires
Heat the connector with the soldering iron.
When its colour changes and becomes shiny the temperature is correct.
Add tin solder to both ends of the connector.

The soldering has been carried out correctly when the tin has been absorbed into the ends of the connector.
Now a good electrical connection has also been established.

Installing felt and wire holders
Place a piece of hygroscopic (absorbent) felt between the steel pipe and the tinned wire.
Check that both steel pipe and felt are dry prior to installation.
The felt must "hang" on the tinned wire.

The installation is correct if there are a couple of cm between felt and insulation.

Install the copper wire (the auxiliary or signal wire) in 3 wire holders that ensure the correct distance to the steel pipe.
Fasten the wire holders and felt with 3 strips of crepe tape.
Place the tape so the felt is not pressed against the ends.
Repeat test 2 after having installed felt and wire holders.
Warning: Do not install the surveillance system in rainy weather without the necessary cover. Replace wet felt immediately.
Insulate the muff the same day as the wires are installed at the latest.

**E-muffs**
Extend the wires with E-muffs.
Apply felt to the alarm wire and adjust the felt as follows:
Double felt on the steel pipe.
A single layer of felt on the E-muffs in order to ensure good insulation.
Apply a white covering flex to the wires that are placed on a single layer of felt.
Place the signal wire in a suitable number of wire holders.
Fasten it all with crepe tape.

**Shortening pipes**
When welding fitting pieces the tinned wires and copper wires must, of course, still be connected in pairs.
In large dimensions, for productional reasons, there may be 4 embedded wires (2 of each) of which only 2 are visible at the pipe ends.
Check with the meger which one to use.
One instrument wire is connected to the wire and the other to earth where there are 2 wires.
Place the switch in the measuring range "ISOL". When the connected wire is short-circuited against earth where shortening has been carried out, the meger will deflect.

**Wiring - bends**
**Installing felt and wire holders**
Extend and adjust the wires in order to ensure the correct distance to the steel pipe of 15 mm.
Apply felt that has been accurately adjusted to the alarm wire.
Push the felt pieces close together.
The connectors must be placed inside a piece of felt.
Check that both the steel pipe and the felt are dry during installation.
The felt must "hang" on the tinned wire.
Apply enough wire holders to the signal wire so that the wire cannot be pressed against the steel pipe.

Place the tape so the felt is not pressed against the ends. There must be tape around the joint on the felt pieces.

**Wire - branches**

**Steel muff branches**

Adjust the wires at the branches, so they have the correct distance to the steel pipe of 15 mm everywhere - also on the branch pipe piece. Use adjusted double felt on the main pipe and wire holders as usual. Apply unfolded felt (single layer) to the connecting branch and provide the wires with a flex tube; white for the tinned wire and red for the copper wire. Fasten it all with crepe tape. Place the tape so the felt does not press against the ends.

To extend the wire and replace the flex tube an insulated 1.5 mm² copper wire that is available in coils (part no. 1108) may be used.

**Branch saddles**

Adjust the wires at the branches so they have the correct distance to the steel pipe of 15 mm everywhere - including the branch pipe piece. Use adjusted double felt on the main pipe and wire holders as usual. Apply unfolded felt (single layer) to the connecting branch and provide the wires with a flex tube; white for the tinned wire and red for the copper wire. Fasten it all with crepe tape. Place the tape so the felt does not press against the ends.

To extend the wire and replace the flex tube an insulated 1.5 mm² copper wire that is available in coils (part no. 1108) may be used.

**Felt position**

Place the tape so the felt is not pressed against the ends.
Pre-insulated branches
Pre-insulated branches are available with 3 embedded wires: 1 tinned and 2 copper wires. Use the copper wire, which fits opposite the connected pipes. Cut the other one off.

Installation
Connect the wires in accordance with the drawing.
From the illustration it can be seen that the wires from the connected pipe are used. The 2 tinned wires from the pre-insulated branch are connected to the copper and tinned wires in the main pipe.
Install felt on the tinned wire.
Install wire holders on the copper wire as usual.

From the illustration it can be seen that the wires from the connected pipe are not used. The 2 tinned wires from the pre-insulated branch are connected. Install a felt piece on the wires so the distance to the steel pipe of 15 mm is correct.

Cable installation
Installing connecting cables, steel muffs
Overview
All cables for steel muffs are available with the same cable foot.

The cables are supplied with a white and yellow wire out of the cable foot. The white wire is connected to the alarm wire (the tinned one) and the yellow wire is connected to the earth connection.

The symbol of the alarm drawing shows which wire in the pipe to connect to the cable.

Always install cable feet on steel muffs in the lower part and always so that the cable is parallel with the pipes. The loop compensates for expansion movements.
Preparations
Mark and drill 3 holes in the lower part of the steel muff:
- 7 mm for the bolts.
- 10 mm for wire introduction.
Deburr the holes and remove chips.
Apply sealing strip to the bolts and the wire on the cable foot. Place an additional layer around the wires.
Tighten the cable foot so the sealing strip between the muff and the cable foot becomes visible.

Always use single cables when connecting the muff to a surveillance unit.
Use double cables everywhere else in the pipe system.

Earth connection in muffs
Connect the yellow wire from the cable foot to the earth connection.
It is important to remove any rust on the earth connection and tighten the bolt properly.

Connection to alarm wire
Connect the white wire from the cable foot to the wire in the pipe that is marked with the symbol for cable on the drawing.
NOTE! The white wire from the cable must always have a distance to the steel pipe of 15 mm. Adjust, connect and solder the wire.
Use adjusted double felt up against the foam ends.

Jumper cable, straight pipes
Use jumper cable when the tinned wire in the flow pipe is to be connected to the tinned wire in the return pipe in connection with ordinary muff joints or branches.
In pipe No. 2 the tinned wire from the branch pipe is connected to the tinned wire in the main pipe.
Between the two branch pipes, e.g. in a house, there will be connection between the wires.
When the tinned wire is now back in pipe No. 1 in connection with branches, it must be connected back to pipe No. 2 in order to continue in the same pipe.
This is done with jumper cable no. 1243, installed on the lower part of the branch bends. The circuit is now intact.
Connect the wires in the opposite pipe as in a straight muff.

Adjust the wires at the branch so they have the correct distance to the steel pipe of 15 mm.
Use adjusted double felt on the main pipe and wire holders as usual.
Use unfolded felt (single layer) on the connecting branch and apply flex tube to the wires. As an alternative insulated 1.5 mm² copper wire, which is available in coils, may be used.
NOTE! Install the cables on the side where the tinned wire is so the wires will not cross each other.
Installing connecting cables, band muffs

Overview
All cables for band muffs are delivered with the same cable foot to be welded into the outer casing.
The cables are supplied with a white and yellow wire out of the cable foot. Connect the white (tinned) wire to the alarm wire and the yellow one to the earth connection.
The symbol on the alarm drawing shows which wire in the pipe to use.

Use a plug welder to weld the cable into the outer casing.
Connect the plug welder to 230 V.

Preparations
Mark and drill a 43 mm conical hole 135 mm from the outer casing end.
Pay attention to the position of the wires so they are not damaged.

Drill 2 dia. 17 mm holes into the conical hole.
Remove surplus foam and dirt before installing the cable.

Welding in the cable foot
Pull the 2 wires from the cable foot through their holes towards the muff joint.
Connect the plug welder to 230 V and preheat it to 220°C which are adjustable on the thermostat.
Place the cable foot in the plug welder and preheat the plug before installing the plug welder in the outer casing.
When the lips of the HDPE-material have melted on the outer casing and cable foot, then pull the cable out of the plug welder and press the cable foot down into the melted material.
Keep the cable foot under pressure for approx. 1 minute, until the plastic has cured.

Earth connection in muffs
Connect the yellow wire from the cable foot to earth.
It is important to remove any rust on the earth connection and tighten the bolt properly.
When connecting cable in muffs always use short earth connection, part no. 1200 (10 connectors).

Connection to alarm wire. Single and double cables
Connect the white wire from the cable foot to the wire in the pipe that is marked in the drawing as the symbol for the cable.
NOTE! The white wire from the cable must always have a distance to the steel pipe of 15 mm.
Adjust, connect and solder the wire.
Use adjusted double felt up against the foam ends.

Installing - connecting cables, shrink muffs
Overview
All cables for shrink muffs are delivered with the same cable foot.
The cables are supplied with a white and yellow wire out of the cable foot.
Connect the white (tinned) wire to the alarm wire and the yellow wire to the earth connection.
The symbol on the alarm drawing shows which one to use.
1251

Use a plug welder to weld the cable into the outer casing.
Connect the plug welder to 230 V.

1252

Twin cable
(Note: Two surveillance wires)

1253

Preparations
Mark and drill a 43 mm conical hole 250 mm from the outer casing end.
Pay attention to the position of the wires so they are not damaged.

Drill 2 dia. 17 mm holes in to the conical hole from the foam end.
Remove surplus foam and dirt before installing the cable.

Welding
Pull the 2 wires from the cable foot through their holes towards the muff joint.
Connect the plug welder to 230 V and preheat it to 220°C that are adjustable on the thermostat.
Place the cable foot in the plug welder and preheat the plug before installing the plug welder in the outer casing.
When the lips of the HDPE-material have melted on the outer casing and cable foot, then pull the cable out off the plug welder and press the cable foot down into the melted material.
Keep the cable foot under pressure for approx. 1 minute, until the plastic has cured.
Earth connection in muffs
Connect the yellow wire from the cable foot to earth.
It is important to remove any rust on the earth connection and tighten the bolt properly.
When connecting cable in muffs always use short earth connection, part no. 1200 (10 connectors).

Connection to alarm wire
Connect the white wire from the cable foot to the wire in the pipe that is marked in the drawing as the symbol for the cable.
NOTE! The white wire from the cable must always have a distance to the steel pipe of 15 mm.
Adjust, connect and solder the wire.
Use adjusted double felt up against the foam ends.

Connection to alarm wire. Twin cables
Connect the white and red wire from the cable foot to the wire in the pipe, which in the drawing is marked with the symbol for the cable (e.g. R = red, W = white).

Installing cables and connecting links
Overview
Cables to be extended in the earth are connected with a connecting link and sealed with shrink tube.

Connection
Mount the couplings of the cables on the connecting link with the shrink tube pulled over one cable.
Note! The cable colours must correspond.

The connectors must be clean and tightened to achieve a good connection.
Shrinking

Shrink the shrink tube with hot air beginning from the middle and outwards to each side in order to make the air escape. Use soldering gas iron set, 1109/1110 with supplementary hot air tube.

On the finished shrink tube, mastic must be visible at the ends.

Installing check point

Establishing check point

Establish a checkpoint by joining together the cables in cabinets nos. 1400, 1401 or the like. Use cable installation set, part no. 1221 including connecting links (4), cable holders and screws to join a double cable. The illustration shows the symbol from the circuit diagram.

Check point

By opening the circuit and inserting a fault simulator, part no. 1304, a fault is simulated and the meterage is checked at the fault locator. Compare this distance with the figure registered (and entered into the circuit diagram) after installation. Note! The colour markings must correspond.

Marking and protecting cables

Cable protection

Protect the connector on the coaxial cables against moisture ingress. Install cable end protectors, part no. 1260, on cables pulled to a cabinet or the like.
Cable marking
All cables pulled from the pipe system to a cabinet or the like must be marked. Mark the cables systematically and enter the marking in the circuit diagram.

Relieving cables
The temperature difference in the pipe system will result in movements of the pipes. Consequently, relieve the cables with a U-bend before pulling them to the cabinet.

It is recommended to pull the cables between the pipe system and the cabinet through, for example, a PVC-duct. It gives a good protection and facilitates repairs of excavation damages and the like. Measure the connecting point on the pipes in relation to fixed points in the area.

Connecting and junction boxes
Application
Connecting and junction boxes are used when connecting a fault locator and when a jumper cable is installed in cellars or dry inspection chambers and when terminating circuits.

Installation in connection with end-cap
Place a piece of sealing strip on the end-cap prior to installation. Press the straightened wire into the sealing strip. Shrink the end-cap.
Weld the earth connection on 70 mm from the outer casing end.
Use long earth connection, part no. 1201 (10 pcs.) to raise the box above the insulation.
Fit the wire with flex, clean, connect and solder it.

---

The wire from the connecting/junction box must face towards the outer casing.
Long earth connection should be used to get the box over possible insulation.

---

**Connection box in connection with surveillance unit**

Use a connecting box no. 1230 with 1 coaxial bush, when terminating from the pipe system, connected to a surveillance unit.
This is made at the pipe end on introduction to boiler houses, cellars or dry chambers.
The illustration shows the symbol from the circuit diagram.

---

Use long earth connection, part no. 1201 (10 pcs.) so the box is raised above the insulation.

---

The cable between the connecting box and fault locator must be a minimum of 5 m.
The length between connecting box and detector is optional.
If the distance is larger, order a special cable of the required length.

---

**Junction box in connection with jumper connection**

Use junction box, part no. 1231, with 2 coaxial bushes, when a connection is made between the pipe ends within boiler houses, cellars or dry chambers.
The illustration shows the symbol from the circuit diagram.

---

Use long earth connections, part no. 1201 (10 pcs.) so the box is raised above the insulation.
Connect the 2 junction boxes with 1, 3 or 5 m cables. If the distance is larger, order a special cable of the required length.

Note! The colour marking, yellow/white, and the colours in the junction box must correspond.

End component and adaptor box, fault locator

Termination of circuit with end component

Use an end component (with black marking), part no. 1302, together with an adaptor box, part no. 1230, when a detector circuit is terminated in a building, dry inspection chambers or the like.

The illustration shows the symbol from the circuit diagram.

Termination of circuit with adaptor box

When a fault locator circuit is terminated in the earth, the signal is transmitted up from a muff joint by means of a double cable and terminated in a building or cable cabinet, part no. 1303. The illustration shows the symbol from the circuit diagram.

The cable colour must correspond with the colours on the connections of the adaptor box.
End component and adaptor box, detector

**Termination of circuit with end component**

Use an end component (with red marking), part no. 1300 together with an adaptor box, part no. 1230, when a detector circuit is terminated in a building, dry inspection chambers or the like. The illustration shows the symbol from the circuit diagram.

Use long earth connection, part no. 1201 to raise the box above the insulation.

**Termination of circuit with adaptor box**

When a detector circuit is terminated in the earth, the signal is transmitted up from a muff joint by means of a double cable and terminated in a building or cable cabinet, part no. 1301. The illustration shows the symbol from the circuit diagram.

The cable colour must correspond with the colours on the connections of the adaptor box.