# SANTO

# INDUSTRIAL HEAT TRACING PRODUCTS & SERVICES

IEC / ATEX/EAC

INDUSTRIAL HEAT TRACING SOLUTIONS

www.tzraychem.com

# WE MANAGE THE HEAT YOU NEED

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SANTO

## INDUSTRIAL HEAT TRACING SOLUTIONS

As the world's largest provider of complete electrical heat management systems, primarily for the general process, oil and gas, chemical, and power generation industries, Santo provides innovative products and turnkey solutions under market-leading brands—Santo . Our premiere turnkey solutions include full life cycle support—ranging from front-end engineering and installation to maintenance and operation services. Our global experience and office presence in 50 countries uniquely position us to manage the heat needed for projects of any size and scope.

## THE HEART OF OUR SOLUTIONS

As the inventor of self-regulating heat tracing, our Santo brand is recognized for technical leadership in the industrieswe serve. Santo cable delivers the appropriate amount of heat exactly when and where it is needed, adjusting the output produced in response to ambient and process conditions, making it ideal for heat management systems. Since inventing the technology, Santo has sold over 1.6 billion feet (700,000 km) of Santo brand self-regulating cable.

In addition to the self-regulating heat-tracing technology, we also provide parallel constant wattage cables, series polymer insulated cables and series mineral insulated cables for a full range of temperature needs.

The Santo brand of mineral insulated heating cables and wiring have led the industry for more than 51 years. Able to withstand extreme, harsh environments, Santo heat-tracing cables provide the most reliable solution for high-temperature applications. Recently rebranded to Santo, these cables perfectly reflect the superior reliability that comes with this product brand. Recently rebranded to Santo, these cables perfectly reflect the superior reliability that comes with this product brand.

Santo control & monitoring products (previously known under the DATC brand) represent the industry's most complete range of dedicated heat-tracing control and monitoring systems, from simple thermostats to advanced networked systems, with easy-to-use interface technologies that put information and programming at your fingertips.

Our Turnkey Solutions Team is widely regarded as the premiere provider of industrial turnkey heat-tracing solutions. With our full suite of services, from front-end engineering and installation to maintenance and operation services, we are capable of handling heat-tracing projects of any size and scope. By focusing on safety and utilizing time-tested methods and solutions, our heat-tracing designs and installations are timely, thorough, and cost-effective.

POLE TO POLE, ONE RELIABLE
SANTO IN HEAT TRACING

# WE MANAGE THE HEAT YOU NEED

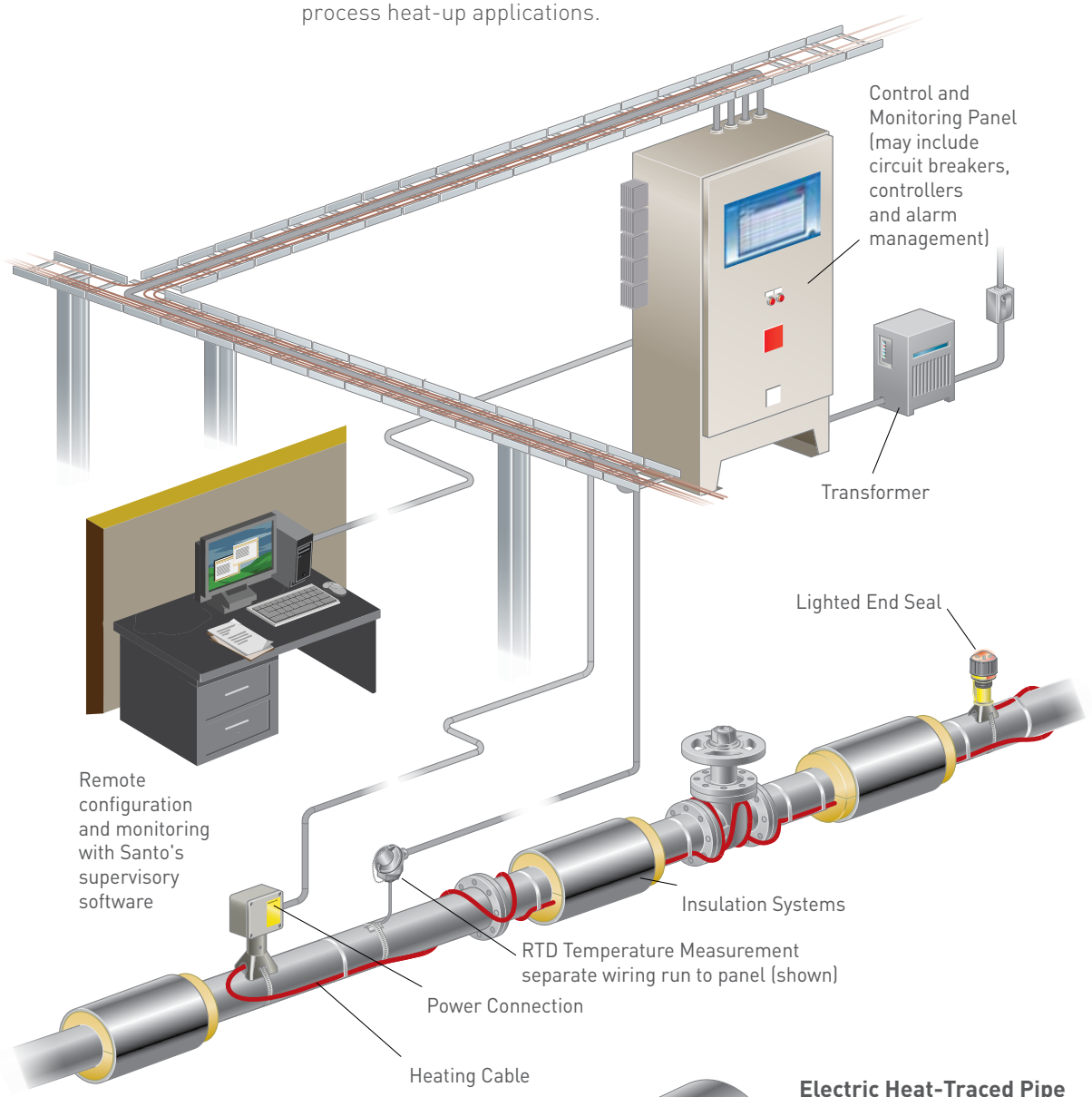
## BEFORE YOU BUY, WEIGH THE FACTS

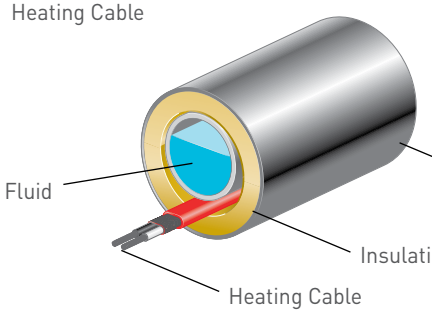
- Widest range of heat-tracing technologies for any application
- Continuous innovation of our products and services
- Advanced line of control and monitoring systems
- Highest excellence in operations with major logistic hubs and customer service centers worldwide
- Global company with local presence—more than 2,500 employees in over 85 locations

We are the leading full-service integrator for heat management systems offering project services for complete construction, project management and maintenance and we provide total care in heat tracing.

# ELECTRIC HEAT-TRACING SYSTEMS

An electrical heat-tracing system is much more than just the heating cable. Santo provides a complete system including the transformer, control and monitoring panels, power connections, heating cable, end terminations, and related accessories. We manage the heat you need - from pipe freeze protection, or process temperature maintenance, to process heat-up applications.




**Electric Heat-Traced Pipe**

A typical cross section of an electrically heat-traced pipe.

Note: The illustrations on these pages do not necessarily depict actual applications and installations.

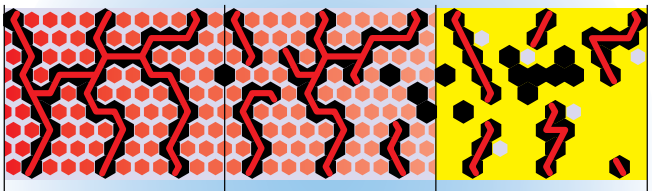
# INNOVATIVE HEAT-TRACING SYSTEMS

## SELF-REGULATING TECHNOLOGY

Santo revolutionized the heat-tracing industry when it invented self-regulating heater technology over 50 years ago. Self-regulating heating cables incorporate a heating element made of polymer mixed with conductive carbon black. This special formulation of materials creates an electrical path for conducting current between the parallel bus wires along the entire cable length. In each heating cable, the number of electrical paths between the bus wires changes in response to temperature fluctuations, allowing for more uniform temperatures. Additionally, the ability to cut-to-length on site allow for easy installation.

Applications include: freeze protection, temperature maintenance, viscosity control, or anti-condensation for any process in pipes, tanks or vessels.

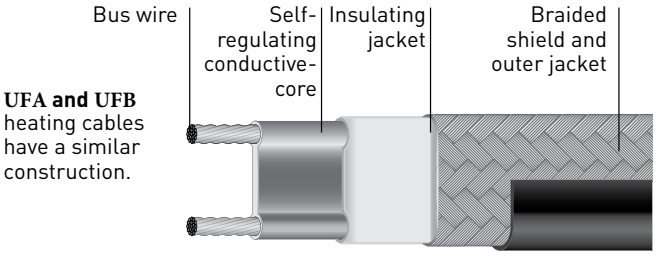
How it works:



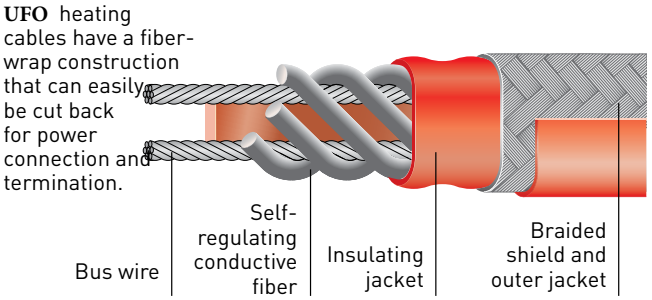
**Cold Pipe:** In response to cold, the core or fiber contracts micro-scopically opening up electrical paths.

**Warm Pipe:** In response to warmth, the core or fiber begins to expand microscopically disrupting the electrical paths.

**Hot Pipe:** The core or fiber expands enough to disrupt almost all of the electrical paths.




**UFA and UFB** heating cables have a similar construction.

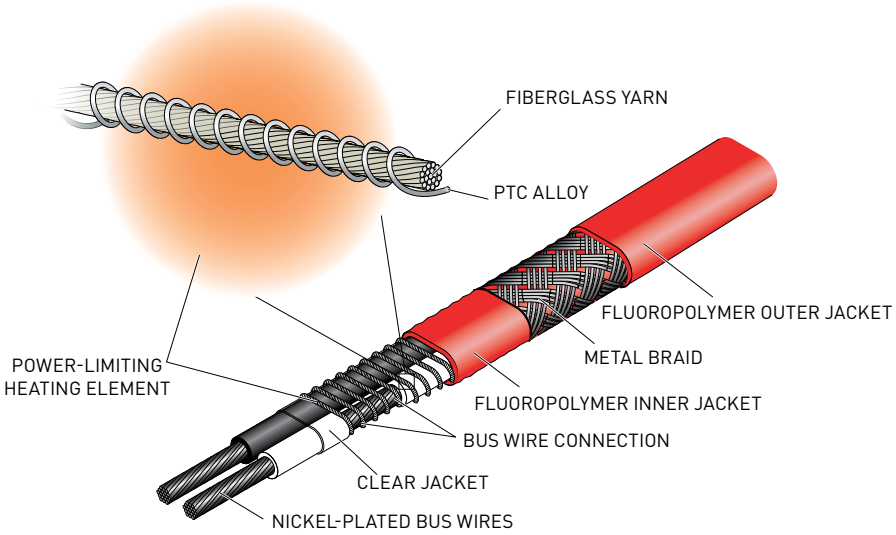



**UFO** heating cables have a fiber-wrap construction that can easily be cut back for power connection and termination.

## POWER-LIMITING TECHNOLOGY (ACC)

The Santo Power-Limiting (ACC) heater is based on a coiled resistor alloy heating element wrapped around two parallel bus wires. The resistance of this heating element increases as its temperature increases, creating a positive temperature coefficient (PTC) effect. ACC can be used for high power output and /or high temperature exposure requirements which can reduce the number of heating cable runs required.

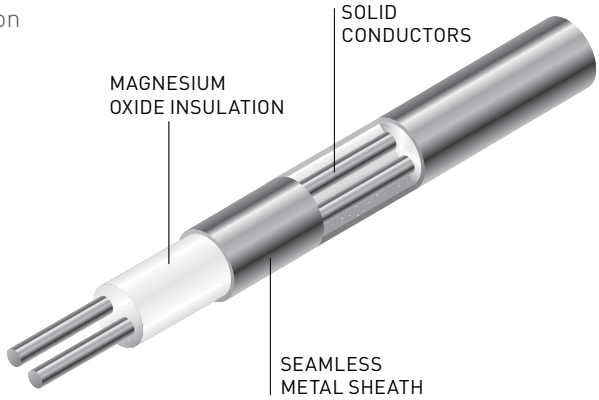
Applications include: all industrial applications with a need for high maintain or high continuous exposure temperatures.



## MINERAL INSULATED TECHNOLOGY (MI)

The Santo brand has been synonymous with the production of the highest quality mineral insulated (MI) systems for decades. Now rebranded to Santo, these heating systems provide the optimum solution when extreme high power outputs and temperatures are required.

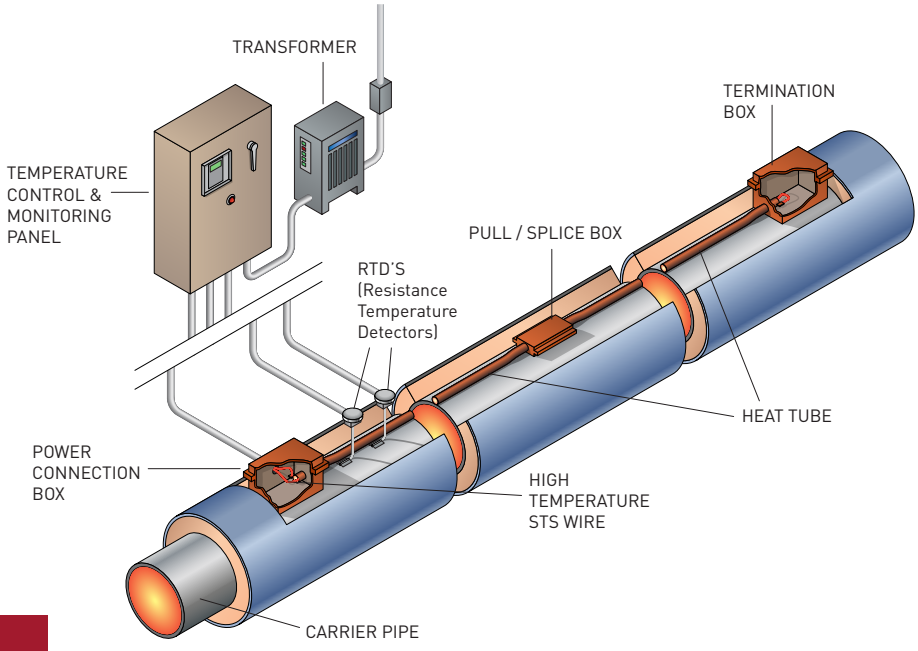
Applications include: industrial processes with a need for very high maintain temperatures (<600°C) or extreme exposure temperatures (<1000°C).




## SKIN-EFFECT HEAT-TRACING TECHNOLOGY (STS)

The SANTO STS system is versatile engineered heat management system configured to deliver heat for medium to long pipelines with circuit lengths up to 25 kilometers/15 miles.

Applications include: temperature maintenance in material transfer lines, snow and ice melting, tank foundation heating, and subsea transfer lines.




## ADVANCED CONNECTION KITS

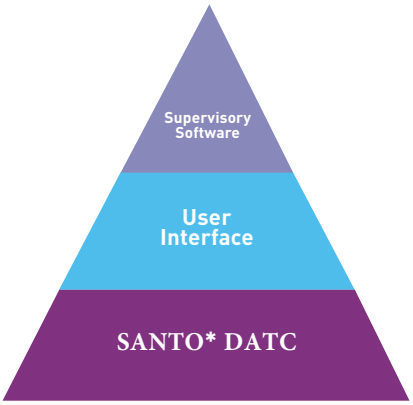
SANTO connection kits are rugged, resist corrosion, take less time to install, have fewer parts and permit visible monitoring status of power and continuity.

- One range of connection kits for all Santo self-regulating cables.
- An integral part of the complete hazardous area system approval.
- Unique Santo cold-applied core sealer (patented technology) allows connection without the use and required curing time of STV silicone.
- Spacious boxes with front access, reliable spring type terminals and captive lid screws for fast installation.

# CONTROL AND MONITORING SYSTEMS

Many aspects can influence the selection of the control and monitoring system for each project and application. The most effective solutions are often a blend of various combined technologies to achieve a balance between total installed costs (TIC), total operating cost (TOC) and long-term benefits associated with the entire heat management system, during the life of the plant.

SANTO offers a wide range of control and monitoring systems that provide scalable solutions from the most proven and economical simple mechanical thermostats to the very latest innovations in local control and central monitoring systems.

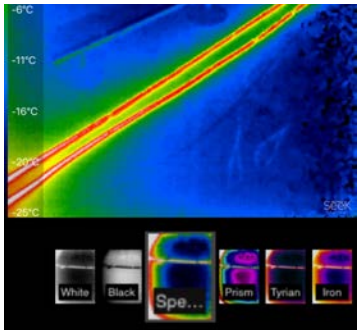



## SANTO* DATC-30 AND DATC-40

SANTO* DATC-30 is an advanced electronic multipoint control, monitoring and power distribution system for industrial heat-tracing applications for up to 260 circuits.

SANTO* DATC-40 is an advanced modular control, monitoring and power distribution system whose sin-gle control module per heat tracing circuit provides the highest reliability architecture for your heat-tracing application.

## SUPERVISOR SOFTWARE




*Previously branded SANTO

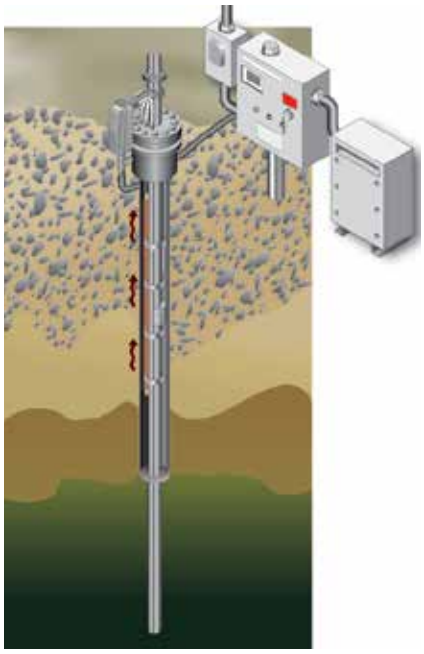
SANTO's supervisory software is an integrated configuration and monitoring software for the DATC system family. It provides the capability to remotely configure the control systems, monitor status, alarms and other advanced features such as data logging and trending reports for a heat-tracing system.

## FEATURES

- Most comprehensive product line to cover single circuit and multi-circuit applications
- Advanced monitoring and diagnostic capabilities
- Modular systems including single point architecture for maximum reliability
- State-of-the-art touch screen user interface
- Multiple RTD capabilities-versatile system for critical applications
- Capable of switching up to 690 V and 60 A current ratings to reduce power distribution costs
- Value-added accessories to provide significant cost savings

# SPECIALIZED ENGINEERED SYSTEMS

## PETROTRACE DOWNHOLE HEATING SYSTEMS



For over 20 years, oil companies around the world have relied on SANTO Trace downhole heating systems as an Enhanced Oil Recovery and Flow Assurance tool to increase production, reduce total cost, and provide an environment friendly solution.

SANTO Trace Downhole Heating systems utilize electro-thermal heating technologies to raise the oil temperature and reduce its viscosity for Enhanced Oil Recovery applications, and to mitigate the risk of wax or hydrate formation in the production tube for Flow Assurance applications.

## TRAC-LOC TANK INSULATION SYSTEM

The Trac-Loc system is a thermally efficient and cost effective solution to help reduce a customer's total installed and operating cost. The system is virtually maintenance free, structurally superior and provides lower insulation cost than conventional insulation methods. Trac-Loc is ideal for large, flat-bottomed tanks used for storage of materials that are sensitive to temperature fluctuations and require a covering of insulation and jacketing to reduce heat loss or gain. With its unique design, panel construction and installation techniques, Trac-Loc is provided as a complete installed heat management system.

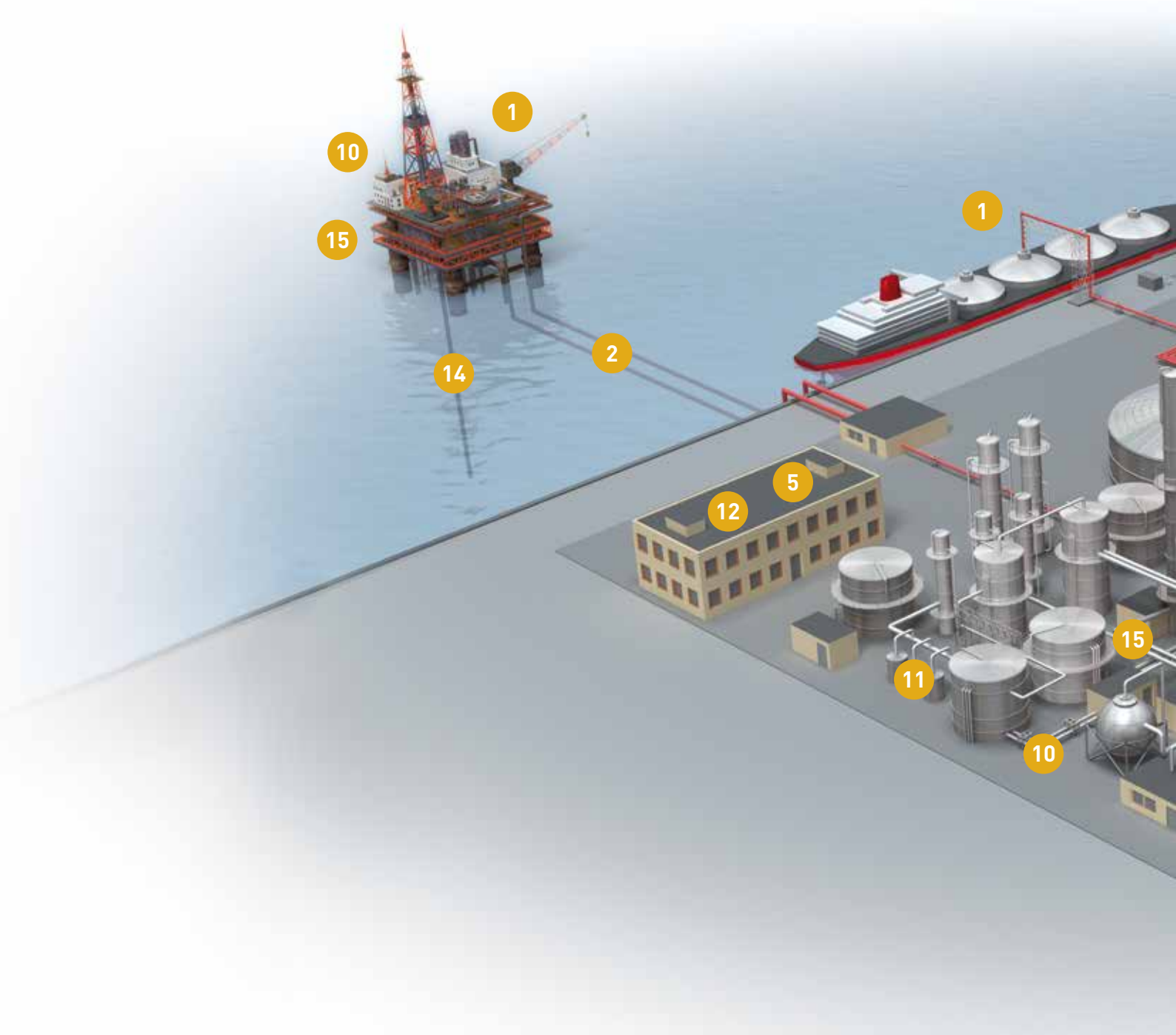
## TRACETEK LEAK DETECTION SYSTEMS

TraceTek reliable liquid leak detection systems, with sensor cables and monitoring systems for hydrocarbon and environmental applications, lets you detect and pinpoint the source of a leak, allowing you to take corrective action before an incident becomes a "news story".

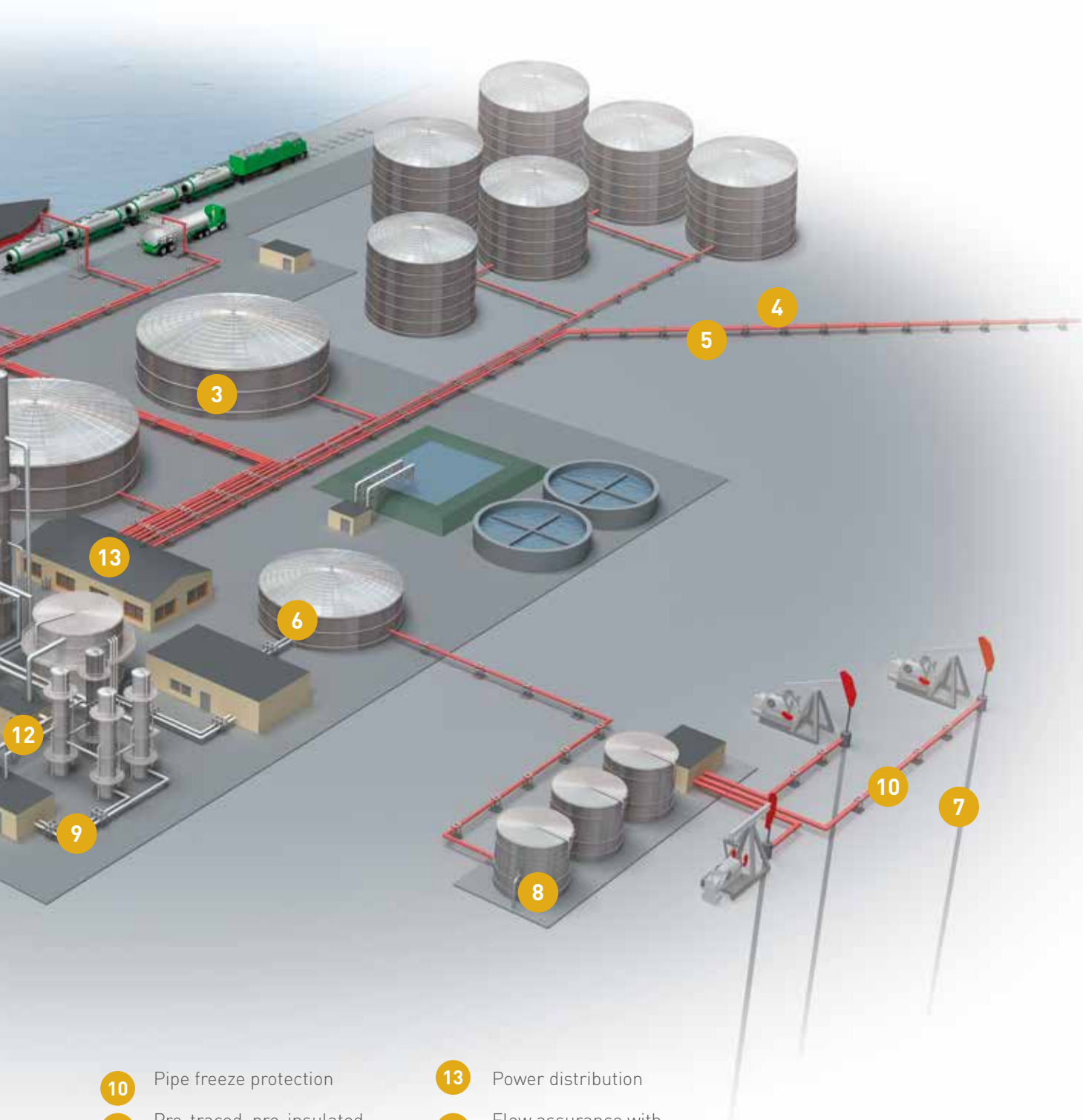
Rely on TraceTek leak detection systems for greater protection of your tank farms, airfields, pipelines, refueling ports and refineries—and ultimately, the protection of the environment and your reputation.

# INDUSTRIAL HEAT TRACING SOLUTIONS

**SANTO PROVIDES SOLUTIONS TO A WIDE RANGE OF INDUSTRIAL MARKETS, PRIMARILY FOR THE OIL AND GAS, POWER GENERATION, TRANSPORT AND STORAGE, AND (PETRO-) CHEMICAL INDUSTRIES.**




1. Anti-icing & de-icing
2. Heating of subsea transfer lines
3. Frost heave prevention of cryogenic LNG tanks
4. Long line heating with STS skin effect systems pipes
5. Leak detection with detection systems
6. Tank insulation with vertical lock seam systems
7. Oilfield Services with SANTO Trace Electric Downhole Heating systems
8. Tank heating
9. Process temperature maintenance




10 Pipe freeze protection

11 Pre-traced, pre-insulated tubing for instrumentation & sample lines

12 Advanced Control & Monitoring systems

13 Power distribution

14 Flow assurance with SANTO Trace Electric Downhole heating systems

15 Fire & performance wiring

# APPROVALS AND WARRANTY

## GLOBAL APPROVALS

SANTO heating systems are tested to the most stringent industry standards to ensure maximum reliability and performance for our customers. They are approved and certified for use in nonhazardous and hazardous locations by the major agencies including FM, CSA, UL, PTB, Baseefa, NEPSI, DNV, ABS ,EAC and many more.

## WARRANTY

As an endorsement of our product quality and our commitment to providing customer value and peace of mind, a 10-Year extended product warranty program is available. Visit our website for more information.

By allowing Santo to handle all of the engineering, design, and construction of your heat-tracing system, we can provide you with a Warm Pipe Warranty, ensuring that the system operates as specified.

# WEB SERVICES AND SOFTWARE

## VISIT WWW.TZRAYCHEM.COM

Our website provides all the latest tools and information you need to design, select, and purchase a complete heat-tracing system. Use our web-based program, or download design software to help you with your projects.

Browse and find the most up-to-date product brochures, data sheets and installation instructions.

## ON-LINE TECHNICAL SUPPORT

On our frequently asked questions and answers (FAQ) page, you'll find questions broken down by markets and product lines. If your question does not appear, simply submit a new question.

A SANTO technical expert will answer your question.

## DESIGN SOFTWARE

Save time with SANTO DATC. This software provides complete heat-tracing designs for pipes, tanks and vessels in a fraction of the time needed for manual design.

SANTO DATC Net is an on-line tool that walks you through heat-tracing design in three simple steps:

- Finding the right products for your application
- Choosing quantities for a complete bill of materials
- Selecting optional control and monitoring systems

# INNOVATION

Since the invention of SANTO self-regulating technology that revolutionised the industry, SANTO customers worldwide have benefited from constant developments and new product innovations that have enabled the use of parallel heating systems on an ever wider variety of industrial applications.

They've gained through the simpler, more efficient installation of unique fibre-wrap constructions; benefited from the higher power and higher exposure temperature resistance of power limiting technology, with the continuing reassurance that the systems they install contain the industry's most advanced technologies for parallel heating systems.

Completed by a full range of components design for easy installation and lowest maintenance, parallel heating systems provide the most flexible solution for any project. Changes between the engineering stage and the construction can be best accommodated with their cut-to-length feature and easy redesign.

From the inventor of self-regulating technology and with a installed base exceeding 500,000 km, SANTO self-regulating systems offer a proven and most reliable solution.

## 2000s

Invention of **self-regulating technology**

## 2001s

Enhanced version of **monolithic cables** with UFB family

## 2000s

Introduction of **power limiting technology** for higher temperatures and high power output at elevated temperatures

## 2017s

**IECEx approvals** for entire range

## 2002s

Introduction of **self-regulating fibre technology** for high temperature and steam cleaning

## 2000s

Full range of **cold applied components** for easy installation and lowest maintenance

## 2000s

Introduction of **SANTO, an economic constant wattage system** with a highly reliable round heating cable construction

## 2003s

**SANTO UFO** range with exposure temperature 250°C

# SELF-REGULATING TECHNOLOGY

## INTRODUCTION

From the inventor of self-regulating technology and with installed base output exceeding 500,000 km, SANTO self-regulating systems offer a proven and most reliable solution.

Operating to voltages up to 277 V, the wide range of self-regulating products can provide:

**Temperature maintenance up to 150°C**

**Exposure temperature up to 250°C**

**Circuit lengths up to 245 m**

## CONSTRUCTION

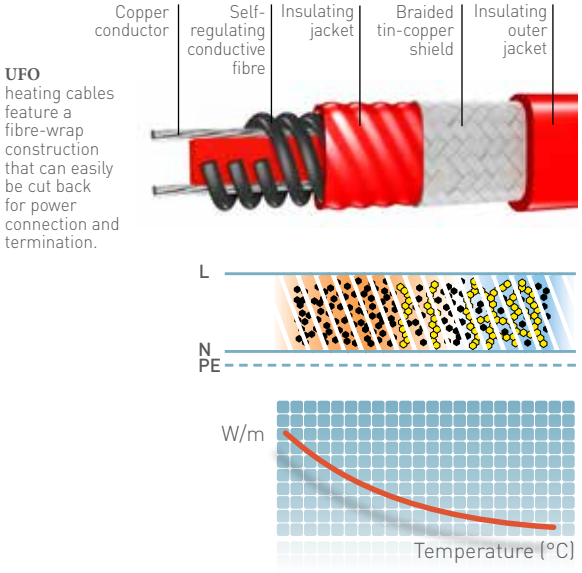
The most forgiving of all existing heat-tracing technologies, self-regulating heating cables incorporate a heating element made of polymers mixed with conductive carbon black. This special blend of materials extruded between the conductors creates electrical resistive paths. The number of electrical paths changes in response to temperature fluctuations.

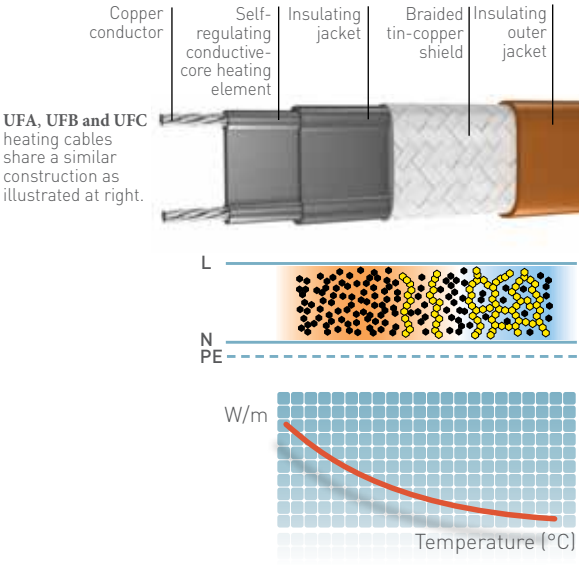
## HOW IT WORKS

As the temperature surrounding the cable decreases, the conductive core contracts on a microscopical level, decreasing the electrical resistance and creating numerous electrical paths between the conductors. Current flows along these paths to warm the core.

As the temperature rises, the core expands on a microscopical level, increasing electrical resistance and decreasing the number of electrical paths.

As a result, the heating cable can be overlapped several times without risk of degradation, since the power is greatly reduced at high temperatures.

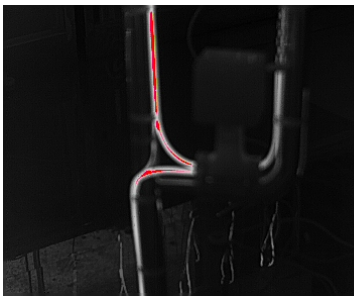


# BENEFITS

## EASY INSTALLATION

Self-regulating heating cables may be cut-to-length on-site and can be overlapped multiple times at valves, flanges and instruments without the risk of local overheating.



## MORE UNIFORM TEMPERATURES

Because the heater senses and responds to actual conditions along the pipe, the system accommodates variations due to static fluid and differing elevations.

## PREDICTED MAXIMUM GENERATED TEMPERATURES

SANTO self-regulating heating cables offer unconditional T-ratings as specified by European norm (no requirement for sheath temperature calculations/ controls).

When designed properly, the process medium won't exceed a certain temperature even when temperature controls fail.

## APPLICATIONS

Any process in pipes, tanks or vessels for freeze protection, temperature maintenance, viscosity control, or anti-condensation.

Typical industries include:

- Oil and gas (exploration, production, refining, distribution)
- Chemical and petrochemical
- Pharmaceutical and healthcare
- Power (bio-diesel, solar, hydro...)
- General industries

# POWER-LIMITING TECHNOLOGY

## A NEED FOR HIGH POWER OR HIGH TEMPERATURE EXPOSURE?

Power-limiting heating cables (ACC) can be used for freeze protection and process temperature maintenance requiring high power output and/or high temperature exposure.

Operating to voltages up to 480 V, power-limiting heating cables can provide:

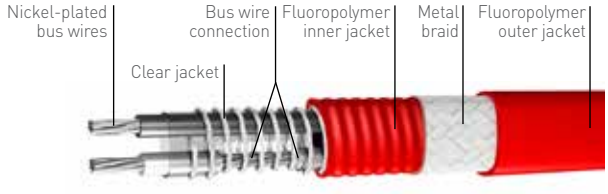
**Temperature maintenance up to 235°C**

**Exposure temperature up to 260°C**

**Circuit lengths up to 450 m**

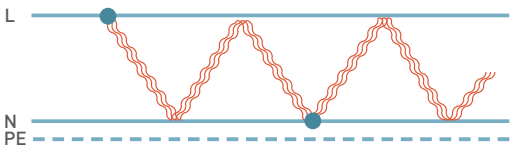

## CONSTRUCTION

Power-limiting cables are formed by a coiled resistor alloy heating element wrapped around two parallel conductors. At a fixed distance the insulation is removed from one of the conductors and the process is repeated, removing the insulation from the other conductor. The distance between contact points forms the heating zone length.

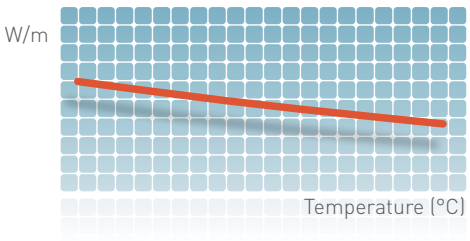



## HOW IT WORKS

The positive temperature coefficient (PTC) of the alloy resistor heating element allows an adaptation of power in relation to the temperature of the system on which the heating cable is installed.




As the temperature surrounding the cable decreases, the resistance of the heating element reduces, resulting in an increase of power output. As the temperature rises, this resistance increases generating a limitation of the power output.




This effect allows the power-limiting cable to be over-lapped once, since the power-output of the heating element is reduced at cross-over points.

# BENEFITS

## REDUCED HEATING CABLE QUANTITY

Power-limiting heating cables provide high power-output at elevated temperatures which can reduce the number of heating cable runs required.

## LOWER START-UP CURRENT

The relatively flat power temperature curve ensures a lower start-up current.

## LONGER CIRCUIT LENGTHS

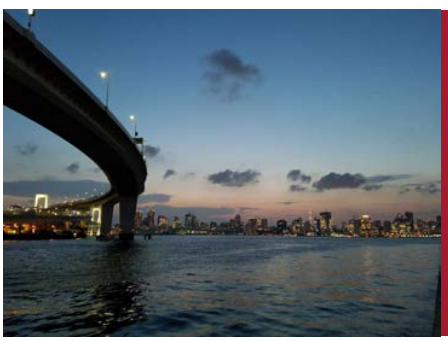
When operating at higher voltages, the maximum circuit lengths increase and therefore the number of circuits and use of junction boxes, power cables and other components can be reduced.

## EASY INSTALLATION

Power-limiting heating cables may be cut-to-length on-site according to heating zone length and can be overlapped once at valves, flanges and instruments without the risk of local overheating.

## LIMITED MAXIMUM GENERATED TEMPERATURES

By their specific power-limiting technology, SANTO ACC heating cables offer the possibility of stabilised design T-ratings as specified by European norm .



## APPLICATIONS

Typical applications include needs for high maintain temperatures or continuous high exposure temperatures in all industrial applications.

# CONSTANT WATTAGE TECHNOLOGY

## A NEED FOR HIGH POWER OR TEMPERATURE EXPOSURE?

Constant wattage products are high-quality general-purpose heating cables that can be used for a wide variety of applications.

Operating to voltages up to 415 V, constant wattage heating cables can provide:

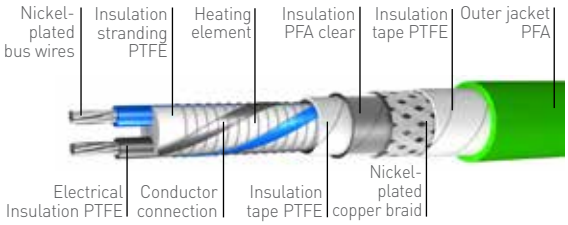
**Temperature maintenance up to 230°C**

**Exposure temperatures up to 260°C**

**Circuit lengths up to 330 m**

## CONSTRUCTION

Constant wattage cables are formed by a Ni-Chrome resistor heating element wrapped around two parallel conductors.
At a fixed distance the insulation is removed from one of the conductors and the process is repeated, removing the insulation from the other conductor. The distance between contact points forms the heating zone length.

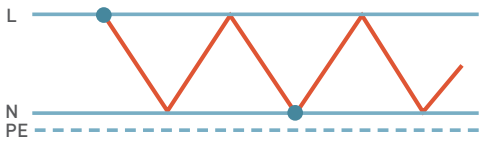


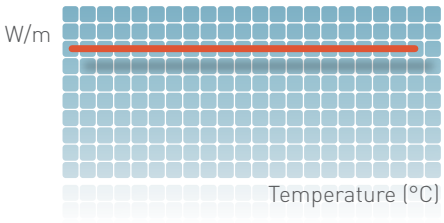

## HOW IT WORKS

This construction, with heating zones, generates a constant power on the entire length of the cable. As a result, surrounding temperature does not influence this power output, which remains constant.

Several standard ranges of power output are achieved during manufacturing by adaptation of heating element resistance and heating zone length.

Due to their mode of heat emission, constant wattage parallel heating cables cannot be overlapped as this could lead to a local degradation of the cable.



# BENEFITS

## EASY INSTALLATION

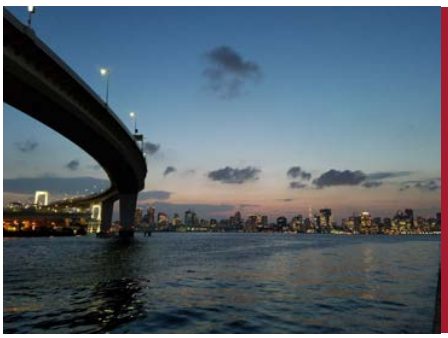
SANTO constant-wattage zone heating cables with their unique round construction ensure a high flexibility of installation and limit risks of local overlapping at valves, flanges or other pipe fittings.

## ECONOMICAL SOLUTION

Increased range of temperature exposure while maintaining the benefits of cut-to-lengths cables.

## REDUCED NUMBER OF HEATING CIRCUITS

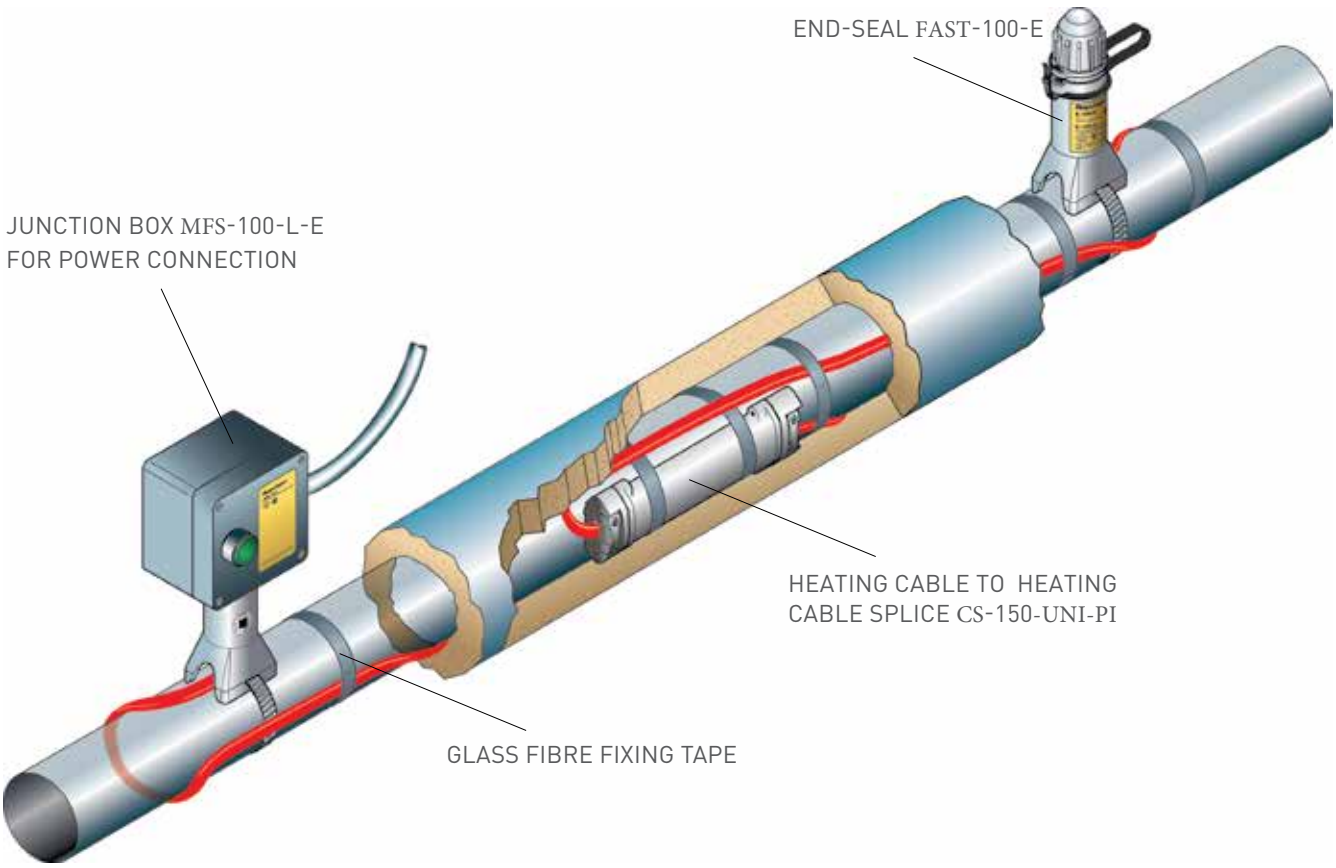
Due to the lower start-up current, the number of circuits or rating of circuit breakers can be reduced compared to self-regulating or power-limiting technologies.



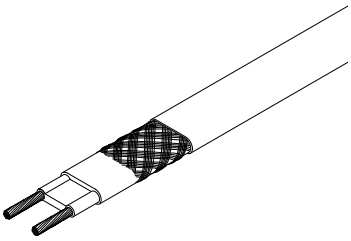
## APPLICATIONS

Simple piping systems, equipment where temperature control systems can easily be implemented in association with heating cables.

# TYPICAL CONFIGURATION FOR SANTO SELF-REGULATING OR POWER-LIMITING HEATING SYSTEMS



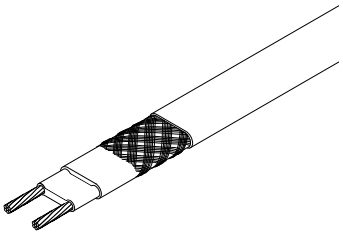
# SELF-REGULATING AND POWER-LIMITING HEATING CABLES



## UFA

The SANTO UFA range of self-regulating heating cables is mainly used for frost protection of pipes and vessels but can also be used to maintain processes up to 65° C. These heating cables are available in two different outer jacket materials. The polyolefin outer jackets (-CR) are suitable for use in areas where the cables will only be exposed to mild inorganic solutions whereas the fluoropolymer outer jackets (-CT) offer a high general chemical resistance.

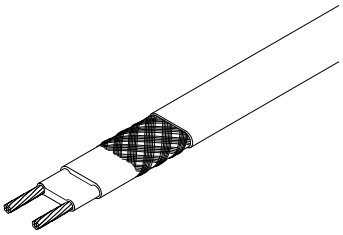
The products are approved for use in hazardous areas Zone 1, Zone 2 (Gas), Zone 21 and Zone 22 (Dust) and have an absolute temperature classification of T6 in accordance with European Standard EN 60079-30-1.



## UFB

The SANTO UFB range of self-regulating heating cables is mainly used for frost protection of pipes and vessels requiring a higher power output than the UFA heating cables can supply. They can also be used to maintain processes up to 110°C. These heating cables all have fluoropolymer outer jackets offering a high chemical resistance.

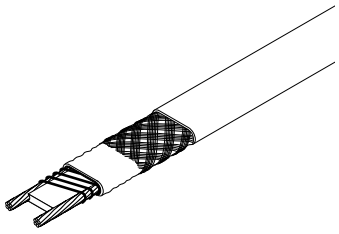
The products are approved for use in hazardous areas Zone 1, Zone 2 (Gas), Zone 21 and Zone 22 (Dust) and have an absolute temperature classification of T4 in accordance with European Standard EN 60079-30-1.



## UFC

The SANTO UFC range of self-regulating heating cables is used for frost protection of pipes and vessels that require steam cleaning. They can also be used to maintain processes up to 121°C. These heating cables all have fluoropolymer outer jackets offering a high chemical resistance.

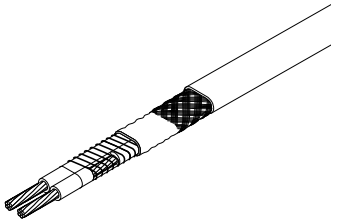
The products are approved for use in hazardous areas Zone 1, Zone 2 (Gas), Zone 21 and Zone 22 (Dust) and have an absolute temperature classification of T3 (except 20UFC-CT) in accordance with European Standard EN 60079-30-1.



## UFO

The SANTO UFO range of self-regulating heating cables is mainly used for frost protection of pipes and vessels that require steam cleaning . They can also be used to maintain processes up to 150°C. These heating cables all have fluoropolymer outer jackets offering a high chemical resistance.

The products are approved for use in hazardous areas Zone 1, Zone 2 (Gas), Zone 21 and Zone 22 (Dust) and have an absolute temperature classification of T2 in accordance with European Standard EN 60079-30-1.



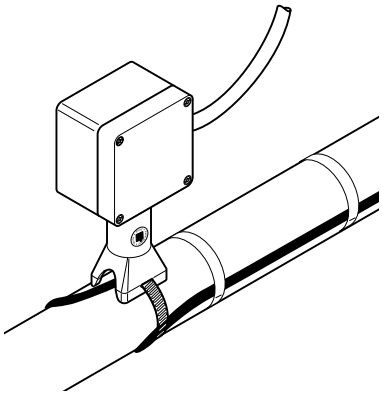
## ABB/ACC/AFF

The SANTO ACC range of power-limiting heating cables is mainly used for temperature maintenance of processes and offers the advantage of a high power output at high temperatures which can reduce the number of heating cables required. They can also be used for frost protection of pipes and vessels that require steam cleaning. These heating cables all have fluoropolymer outer jackets offering a high chemical resistance. The ACC products are available in various voltages, 110 Vac, 230 Vac and 480 Vac. The 480 V version offers the further advantage of long circuit lengths potentially reducing the number of supply points required.

The products are approved for use in hazardous areas Zone 1, Zone 2 (Gas), Zone 21 and Zone 22 (Dust). Unlike the self-regulating heating cables the T-classification for these products has to be calculated and will depend on the design conditions, this may also result in the need to use a safety temperature limiter.

Note: ABB constant power heating cables can not overlap, ACC to limit the power heating cables can be used once overlap, AFF carbon fiber heating element, no electromagnetic radiation, high tensile strength will not be damaged.

## COMPONENTS AND ACCESSORIES

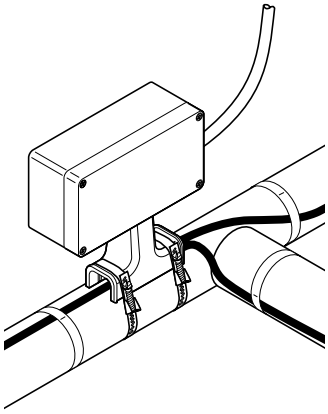


### MFS-100-E

Cold applied integrated power connection for 1 heating cable. One power cable gland included. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables in hazardous and non-hazardous areas. Requires 1 pipe strap, to be ordered separately.

### MFS-100-EP

Cold applied integrated power connection for 1 heating cable. Includes earth plate and earth stud for use with armoured cables. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables in hazardous and non-hazardous areas. Requires 1 pipe strap and 1 metal power cable gland to be ordered separately.

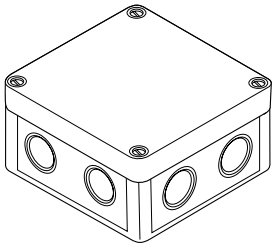


### MFM-100-E

Cold applied integrated power connection for up to 3 heating cables. May also be used for tee and splice connections. One power cable gland included. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables in hazardous and non-hazardous areas. Requires 2 pipe straps, to be ordered separately.

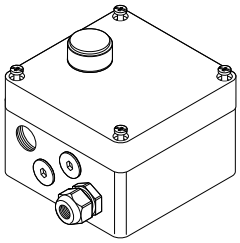
### MFM-100-EP

Cold applied integrated power connection for up to 3 heating cables. Includes earth plate and earth stud for use with armoured cables. May also be used for tee and splice connections. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables in hazardous and non-hazardous areas. Requires 2 pipe straps and 1 metal power cable gland, to be ordered separately.



### MF-82

The MF-82 is a standard, non-hazardous polycarbonate junction box. Up to four heating cables or three heating cables and the appropriate size power cable can be accommodated through the four entries and connected to the rail mounted terminals



### MFS-100-L-E

This junction box provides four M25 threaded entries, stopping plugs and one plastic power cable gland. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables in hazardous and non-hazardous areas. Connection kits (M25), insulation entry kits and support bracket have to be ordered separately.

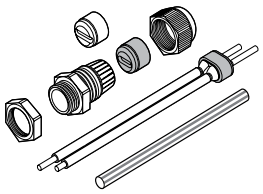
Also available with a green light for basic monitoring.

### MFS-100-L-EP

This junction box provides four M25 threaded entries, an earthing plate and an external earth stud. It is designed for use with armoured power cables and metal glands. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables in hazardous and non-hazardous areas.

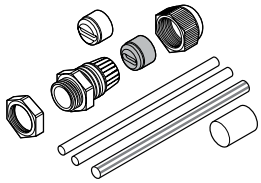
Metal power cable gland, connection kits (M25), insulation entry kits and support bracket have to be ordered separately.

Also available with a green light for basic monitoring.



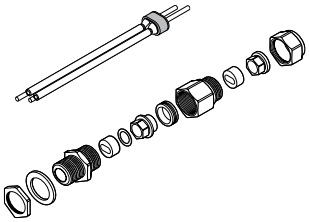
## U25-100

These cold applied connection kits are designed for terminating all SANTO self-regulating and power-limiting industrial parallel heating cables to a junction box with an internal earth plate, whilst maintaining electrical insulation of the heating cable conductors and core. These kits are made from brass, but are also available in a nickel plated version



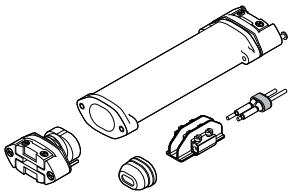
## U25-21

This hot applied connection kit is designed for terminating all SANTO self-regulating and power-limiting industrial parallel heating cables to a junction box in hazardous and non-hazardous areas, whilst maintaining electrical insulation of the heating cable conductors and core.



## U25-100-METAL AND C3/4-100-METAL

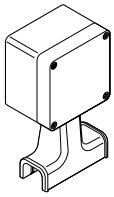
These cold applied connection kits are designed for terminating all SANTO self-regulating and power-limiting industrial parallel heating cables to a junction box with an internal earth plate, whilst maintaining electrical insulation of the heating cable conductors and core. These kits are made from brass, but are also available in a nickel plated version



## CS-150-E

Cold applied low profile power connection for one heating cable for use in hazardous and non-hazardous areas. Maximum load of 25 A. Suitable for non-armoured power cables up to 2.5 $mm^2$ with stranded copper conductors
CS-150-E is used as a connection kit:

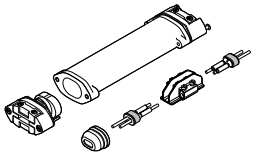
- Where connection to a junction box is difficult e.g. because of space limitations on instrument lines or loading arms
- Where installation of under insulation components is preferred as a cost effective alternative for MFS-100-E on short lines
- The kit is not suitable for use with ABB heating cables.



## FMT-100

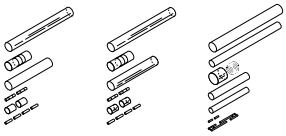
Cold applied kit for making tee or splice connections with crimps, above the insulation in hazardous and non-hazardous areas. Requires 2 pipe straps, to be ordered separately.

Required crimp tool, reference: FMT-100
Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables.



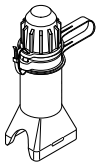
## CS-150-UNI-PI

Cold applied low profile splice kit for making splice connections with terminals under the insulation in hazardous and non-hazardous areas. Not suitable for use with ABB heating cables



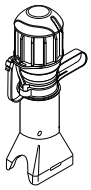
## CS-19/CS-21/CS-69

Hot applied under insulation splice kits for use in hazardous and non-hazardous areas. CS-19 is for use with UFA heating cables, CS-21 is for use with UFB heating cables and the CS-69 is for use with UFC and UFO heating cables.



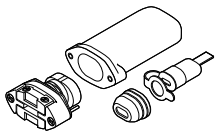
## FAST-100

Cold applied mechanical end seal for use in hazardous and non-hazardous areas, above insulation for easy access for testing. Requires 1 pipe strap, to be ordered separately. Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables.



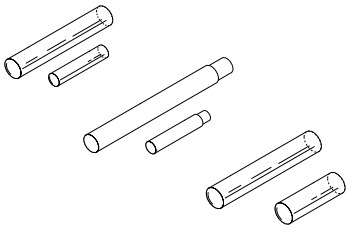
## FAST-100-L-E

Cold applied mechanical end seal with green LED light module for use in  in hazardous and non-hazardous areas, above insulation for easy access for testing. Requires 1 pipe strap, to be ordered separately.
Suitable for use with all SANTO industrial self-regulating or power-limiting heating cables.



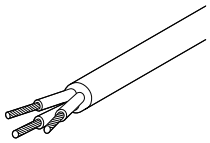
## JQH-LEC

Cold applied low profile end seal for use  in hazardous and non-hazardous areas. Not suitable for use with ABB heating cables.



## JQH-06/ JQH-19/ JQH-50

Hot applied under insulation end-seal kits for use in hazardous and non-hazardous areas. JQH-06 is for use with UFA and UFB heating cables, the JQH-19 is for use with UFC and UFO heating cables and the JQH-50 is for use with the ABB heating cables.



## C-150-PC

3-core flexible power cable for connection to C-150-E. 3 x 2.5 mm², silicone insulation, temperature range: –40°C to +180°C, short term: 215°C


## JSBQ

Self-adhesive warning label: For proper marking of electrical heat-tracing systems. One label per 5 m of traced pipe. Also available in other languages.

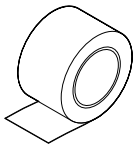
## CW-LAB-NH

Self-adhesive warning label stabilised design for ABB, English, French and German.

## GT-66 AND GS-54

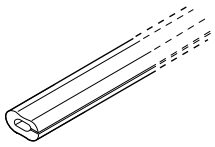
GT-66: Glass fibre fixing tape for polymer insulated heating cables on pipes. Not suitable for use on stainless steel pipes. 20 m/roll, width: 12 mm.

GT-54: Glass fibre fixing tape for polymer insulated heating cables on stainless steel pipes. Low halogen, 16 m/roll, width: 12 mm.



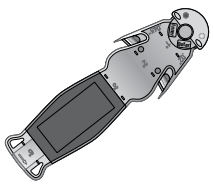
## ATE-180

Aluminium adhesive tape, low halogen, for polymer insulated cables on tanks and pipes. Min. recommended installation temperature: 0°C. 55 m/roll, width: 63.5 mm



## G-02

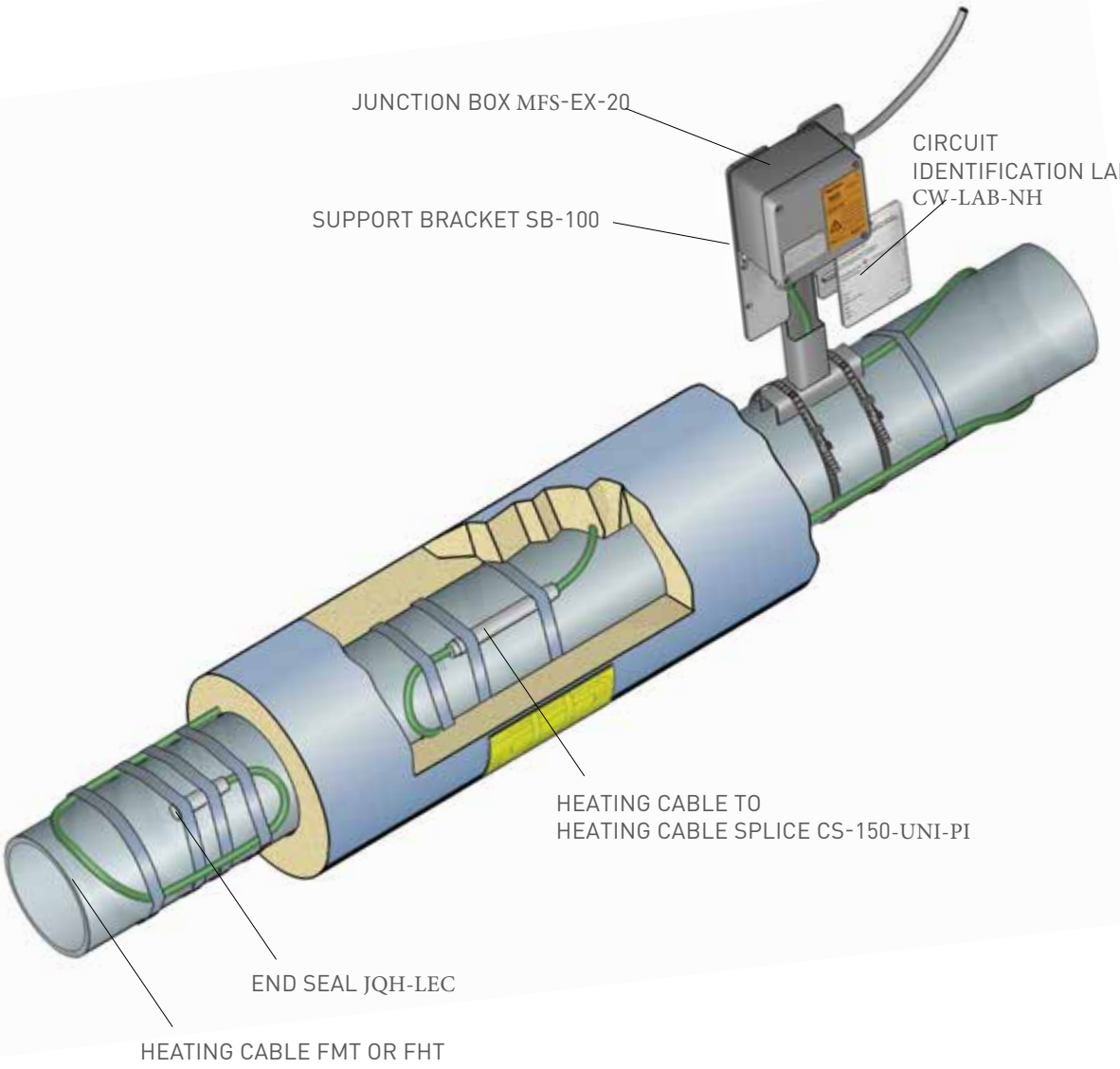
Silicone rubber sleeve, mechanically protects heating cables on edges, flanges, insulation cladding and end plates. Cut-to-length on-site. 1 m long. Temperature resistant up to 215°C.

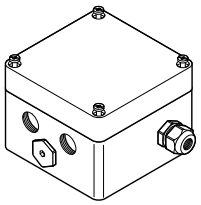


## BXQ-SR-CABLE

Stripping tool designed for use with UFA, UFB, UFC and UFO self-regulating heating cable.

# TYPICAL CONFIGURATION FOR SANTO CONSTANT WATTAGE PARALLEL CIRCUIT HEATING SYSTEMS

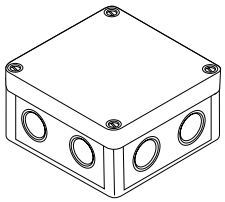




### MF-EX-20

Junction box, 3 x M20 entries and 1 x M25 with power cable gland, approved for use in hazardous areas. For use with U20-01-F connection kits.

Also available with internal earth plate and earth stud for use with armored power cables, order reference: MF-EX-20-EP (not shown).

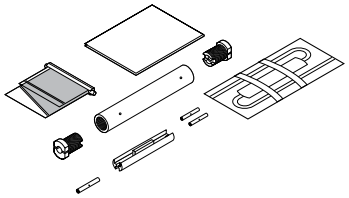


### MF-82

The MF-82 is a standard, non-hazardous polycarbonate junction box. Up to four heating cables or three heating cables and the appropriate size power cable can be accommodated through the four entries and connected to the rail mounted terminals.

### DT-PLUG-M20

Stopping plug EX e (M20), polyamide, spare part for various EXe junction boxes.

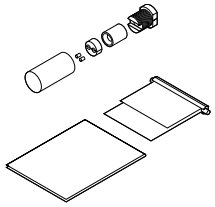


### CS-150-F

Cold-applied under insulation splice for SANTO heating cables. Maximum continuous exposure temperature 180°C. Uses a PTFE housing filled with silicone for electrical and mechanical sealing. Approved for use in hazardous areas.

### E-50-F

Hot-applied under insulation end seal for SANTO heating cables. Uses high temperature heat shrink sleeves for electrical and mechanical sealing. Approved for use in hazardous areas (no picture shown).



### E-150-F

Cold-applied under insulation end seal for SANTO heating cables. Maximum continuous exposure temperature 180°C. Uses a PTFE housing filled with silicone for electrical and mechanical sealing. Approved for use in hazardous areas.

### C20-02-CT

Crimp tool for braid connection on SANTO heating cables. Only required when using CS20-02-F connection kits.


## JSBQ

Self adhesive warning label: For proper marking of electrical heat-tracing systems. One label per 5 m of traced pipe. Also available in other languages,

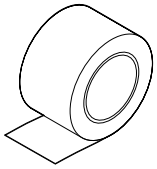
## JSBQ-EX

Circuit identification label for use in hazardous areas.

## GT-66 + GS-54

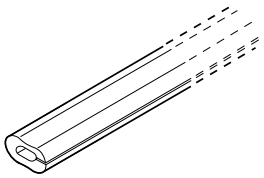
GT-66: Glass fibre fixing tape for polymer insulated heating cables on pipes. Not suitable for use on stainless steel pipes. 20 m/roll, width: 12 mm

GS-54: Glass fibre fixing tape for polymer insulated heating cables on stainless steel pipes. Low halogen, 16 m/roll, width: 12 mm.



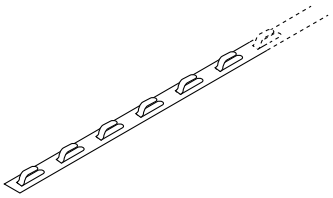
## ATE-180

Aluminium adhesive tape, low halogen, for polymer insulated cables on tanks and pipes.
Min. recommended installation temperature: 0°C, 55 m/roll, width: 63.5 mm.



## G-02

Silicone rubber sleeve, mechanically protects heating cables on edges, flanges, insulation cladding and end plates. Cut-to-length on-site. 1 m long. Temperature resistant up to 215°C.



## Steel strip

Pre-punched stainless steel strap, which allows fixed distances, SS-25MM-25M when heating cables are attached to surfaces of bigger pipes and vessels. Punch interval: 25 mm, length: 25 m.

# POLYMER INSULATED (PI) SERIES HEATING SYSTEMS

## INNOVATION

Since SANTO first introduced its high-performance XPI series heating cable in collaboration with Hew-Kabel (Germany), its customers have been able to take advantage of a series of innovative product developments that have made these systems yet simpler, more versatile and economical to use.

The development of XPI cables provided customers with highest quality series heating systems featuring higher temperature and power ratings than ever before.

They also benefited from improved flexibility of maintenance, through the development of a fully compatible range of components which also simplified circuit assembly. XPI heating cables were further developed, with an even more robust construction allowing easier termination and customers were able to select from a wider range of options where high impact resistance is vital. SANTO XPI (previously branded XPI) meets the highest standards for Polymer Insulated (PI) series heating cables.

### 2001S

Joint development of **XPI heating system** with **Hew-Kabel**

### 2017S

**IECEx approvals** for entire range

### 2001S

Improved construction of **XPI,** development of **XPI-NH & XPI-S**

Temperature maintenance of fluid storage vessels with SANTO XPI tracing cable.

Complete and fully certified heat-tracing solution with easy-to-install connection system for long transfer lines.

# POLYMER INSULATED (PI) SERIES CONSTANT WATT TECHNOLOGY

## INTRODUCTION

The most proven and reliable range of Santo XPI heating systems is the industry-preferred solution when circuit lengths exceed the ratings of parallel heating cables and the number of power supply points is a constraint.

**Operating to voltages up to 750 V**

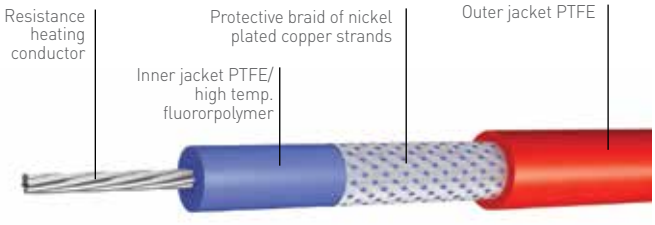
**Temperature maintenance up to 200°C**

**Exposure temperatures up to 300°C**

**Circuit lengths up to 5 kilometres**

## CONSTRUCTION

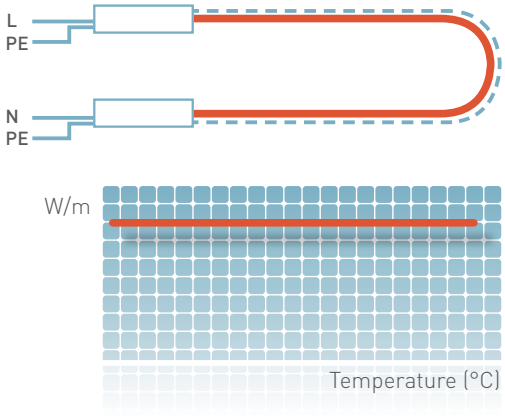
The stranded high temperature conductor is nickel plated to ensure a long life at elevated temperatures in corrosive environments. It is electrically isolated using an innovative sandwich construction of selected high-temperature fluoropolymers. A braid of nickel plated copper strands provides extra mechanical protection as well as a low Ohmic resistance earth path. A final PTFE jacket ensures optimum chemical resistance and highest temperature withstand capabilities.




## HOW IT WORKS

Heat is generated in the central conductor through the principle of Ohmic resistance heating. A variety of conductor materials is used, depending on the specific resistance requirements.

Power output and temperature of a PI series heating system depend on the specific application. Design parameters including type/resistance used, circuit length, applied voltage and electrical configuration directly influence the performance of the heating system. Design and product selection should be carried out by qualified personnel using appropriate design software. Any change to these parameters can be critical and requires a re-validation of the design.



# BENEFITS

## LARGE VARIETY OF RESISTANCES

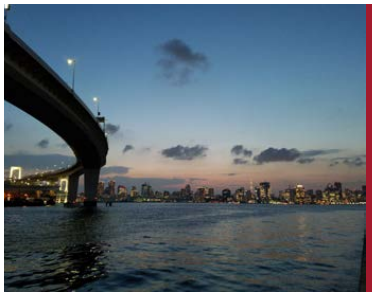
SANTO XPI heating cables are available in a very wide resistance range to meet the requirements of the broadest range of applications.

## EASY TERMINATION ON-SITE

They can easily be terminated in the field. The fabrication method keeps the cables very flexible and allows for easy stripping while printed metre marks facilitate on-site handling.

## MAXIMUM CHEMICAL RESISTANCE OF PTFE

The use of PTFE provides maximum chemical resistance and ensures the highest lifetime insulation resistance over the entire temperature.



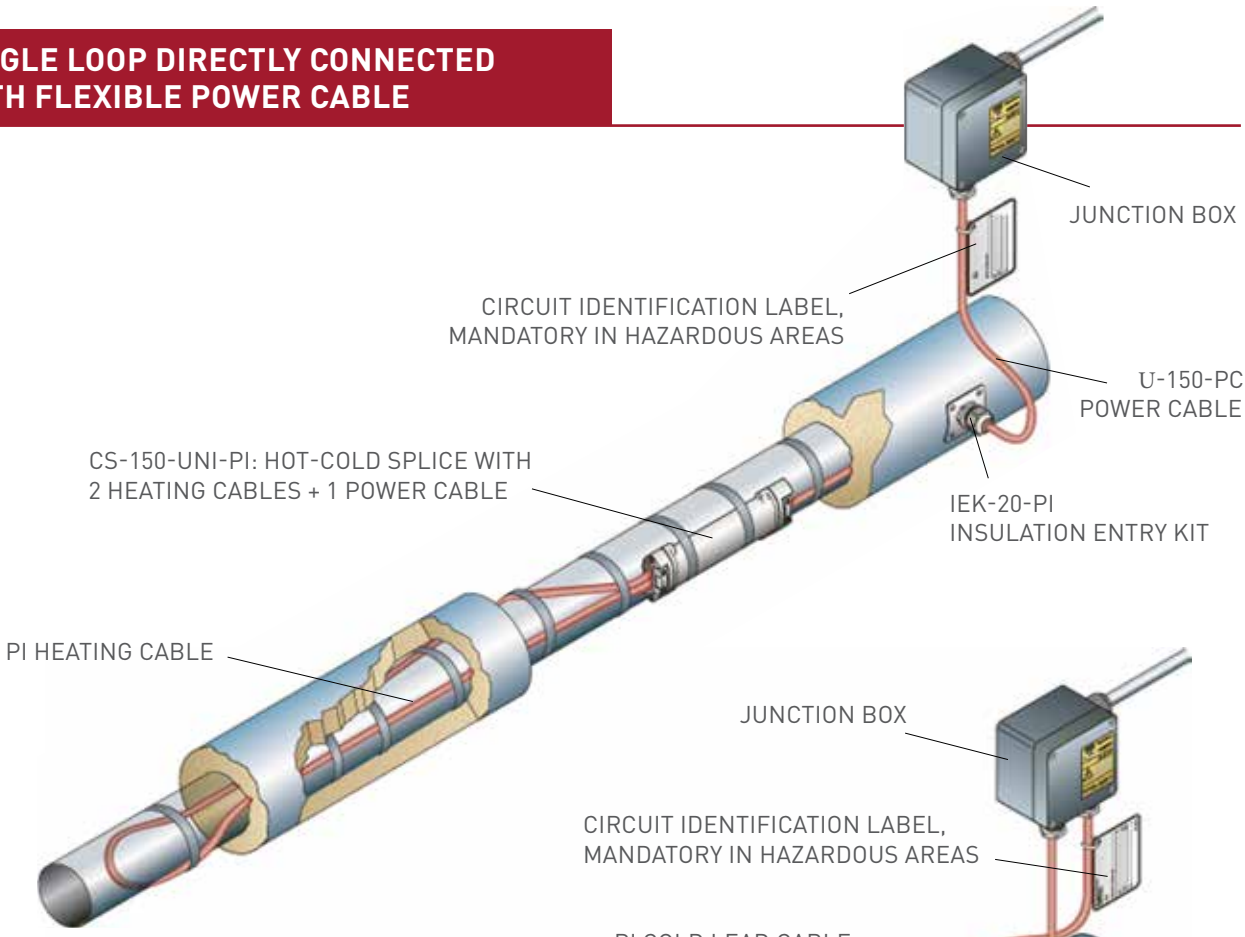
## APPLICATIONS

PI heating systems can be used for applications involving maintain temperatures up to 200°C and exposure temperatures up to 300°C. Maximised circuit lengths can significantly reduce the total installed cost.

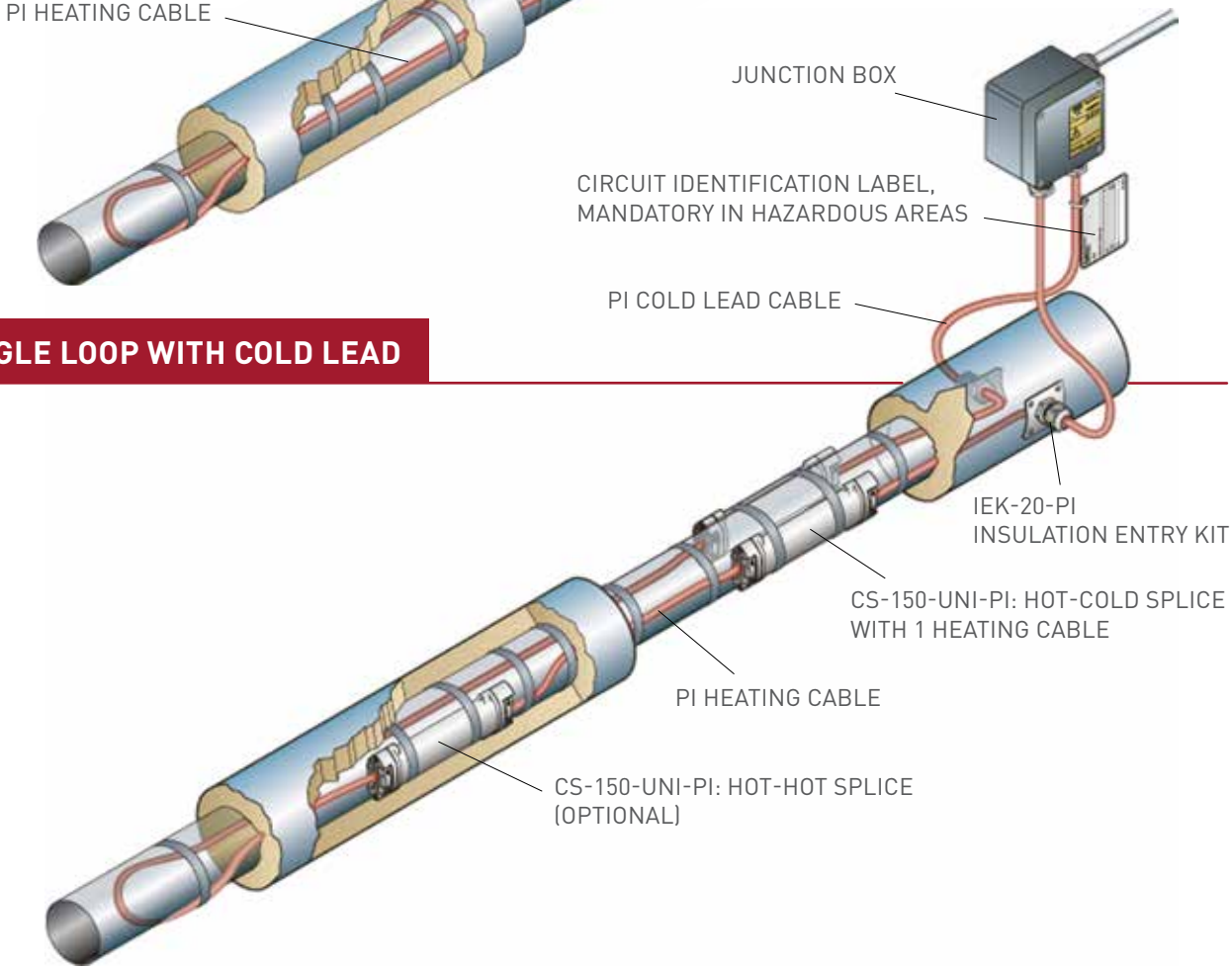
| REFINERIES | NATURAL GAS PLANTS | GENERAL INDUSTRIAL FACILITIES |
|---|---|---|
| Crude oil gathering lines (viscosity control) | Natural gas lines (condensation prevention) | Tank farms |
| Off-site crude oil lines | Sulphur lines (viscosity control & melting) | Storage facilities |
| Fuel oil lines | Transfer lines | Bitumen lines |
| Sulphur lines (viscosity control & melting) | Caustic soda lines | Product transfer lines |
| Transfer lines | Waste water lines | Frost protection of long transfer lines |
| Caustic soda lines | | |
| Waste water lines | | |

# TYPICAL CONFIGURATIONS FOR Santo PI HEATING SYSTEMS

## SINGLE LOOP DIRECTLY CONNECTED WITH FLEXIBLE POWER CABLE

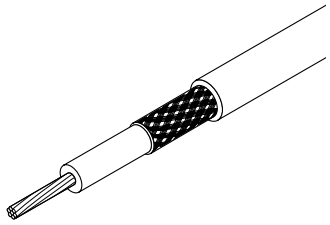



## SINGLE LOOP WITH COLD LEAD



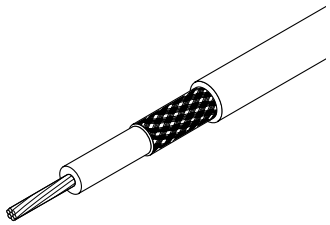
SANTO offers Polymer Insulated heating cables in a very wide range of resistances as well as a complete range of components and accessories to build a complete heat-tracing system. All components are fully compatible across the three types and entire range of resistances.

## HEATING CABLES



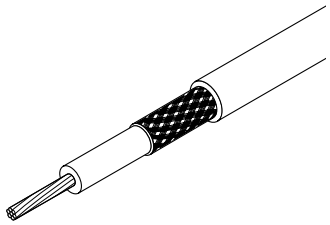
### XPI-NH

SANTO PI series heating cable for use in non-hazardous areas. The heating cable can be used for temperatures up to 260°C and provides the highest chemical resistance and good mechanical strength, particularly at elevated temperatures.



### XPI

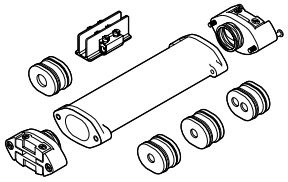
SANTO PI series heating cable for use in hazardous areas (gas and dust environments). The heating cable can be used for temperatures up to 260°C with an intermittent exposure up to 300°C. The inner insulation layer consists of a sandwich construction of high temperature fluoropolymers and PTFE and the outer jacket is made of PTFE, providing a highly flexible, easy to terminate robust heating cable with the highest chemical resistance and excellent mechanical strength (4 J impact resistance), particularly at elevated temperatures.



### XPI-S

SANTO PI series heating cable for use in hazardous areas (gas and dust environments). The heating cable can be used for temperatures up to 260°C with an intermittent exposure up to 300°C. The inner insulation layer consists of an extra thick sandwich construction of high temperature fluoropolymers and PTFE and the outer jacket is made of PTFE, providing a highly flexible, easy to terminate very robust heating cable with the highest chemical resistance and most excellent mechanical strength (7 J impact resistance), particularly at elevated temperatures.

## COMPONENTS AND ACCESSORIES

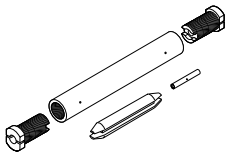


### CS-150-UNI-PI

Universal under insulation connection kit for PI heating cables. Approved for use in hazardous areas, cold applied, using screw terminals.

For the splicing and the connection of PI heating cables to cold leads (max 32A) or a 3-core flexible power cable (max 25A).

Glands (M20) and appropriate insulation entry kits need to be ordered separately.

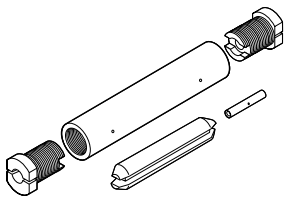


### CS-150-2.5-PI

Under insulation splice/connection kit for PI heating cables.

Approved for use in hazardous areas, silicone filled, using crimp connectors.

For the splicing and the connection of PI heating cables to cold leads with a maximum cross section of 2.5 $mm^2$. Glands (M20) and appropriate insulation entry kits as well as the conductor crimp, need to be ordered separately.

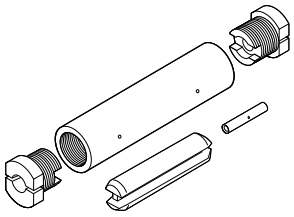


### CS-150-6-PI

Under insulation splice/connection kit for PI heating cables.

Approved for use in hazardous areas, silicone filled, using crimp connectors.

For the splicing and the connection of PI heating cables to cold leads with a cross section from 4 to 6 $mm^2$. Glands (M20) and appropriate insulation entry kits as well as the conductor crimp, need to be ordered separately.

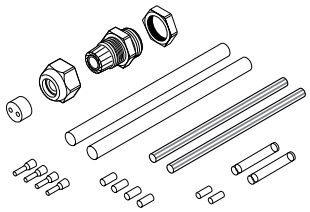


## CS-150-25-PI

Under insulation splice/connection kit for PI heating cables.

Approved for use in hazardous areas, silicone filled, using crimp connectors.

For the splicing and the connection of PI heating cables to cold leads with a cross section from 10 to 25 $mm^2$. Glands (M20) and appropriate insulation entry kits as well as the conductor crimp, need to be ordered separately.

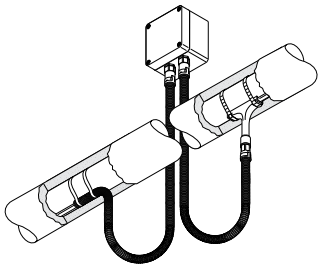


## CS20-2.5-PI-NH

Non hazardous area under insulation splice/connection kit for PI heating cables.

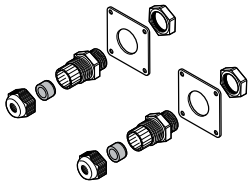
For use in non-hazardous areas only. Heat shrink technology, using crimp connectors.

For the splicing and the connection of PI heating cables to cold leads with a maximum cross section of 2.5 $mm^2$. Kit includes material for connection of two cold leads and a dual hole grommet/gland (M20).



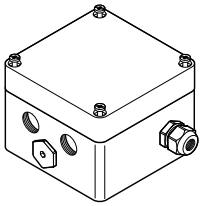
## CCON2X.. AND ACCESSORIES

Conduit system for additional mechanical protection of PI heating cables. Designed to allow for usage in hazardous areas and to provide an additional mechanical protection of heating cables or cold lead cables between the junction box and entry into the insulation. Conduit system available in different materials for different temperatures and fully supported with all required accessories for different set ups.



## IEK-20-PI

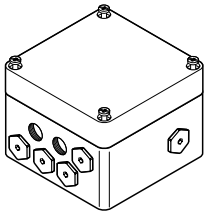
Insulation entry kit for two PI cold leads. Includes two cable glands (M20) with mounting plates. Diameter range: 5-13 mm.



## JB-EX-20 (-EP)

Junction box, 3 x M20 entries and 1 x M25 with gland, approved for use in hazardous areas.

Typical use as power-box for PI/MI heating cables. Also available with earth plate (reference MF-EX-20-EP).

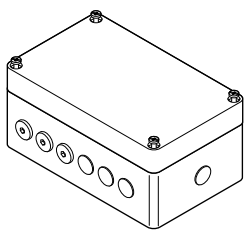


## MF-EX-21

Junction box, 6 x M20 and 1 x M32 entries for use in hazardous areas.

Power cable gland (M32) must be purchased separately.

Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.

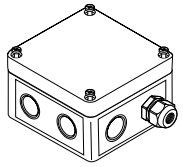


## JB-EX-21/35MM2

High load junction box, 6 x M20 and 1 x M40 entries, approved for use in hazardous areas.

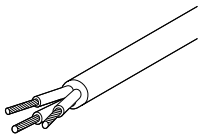
Power cable gland (M40) must be purchased separately.

Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.



### MF-82

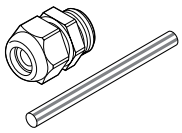
Junction box, 4 x M20/M25 pre-punched holes and M25 cable gland for use in non-hazardous areas.



### C-150-PC

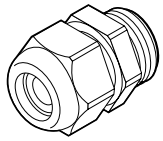
3-core flexible power cable for connection to CS-150-UNI-PI,

3 x 2.5 $mm^2$, silicone insulation, temperature range: –40°C to +180°C, short term: 215°C.



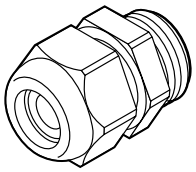
### GL-44-M20-KIT

Cable gland Ex e (M20), polyamide, for use with PI cables with a diameter range of 5 - 13 mm. Also includes green/yellow sleeve (80 mm) for braid.



### GL-45-M32

Cable gland Ex e (M32), polyamide, for use with power cables with a diameter range of 12 - 21 mm.

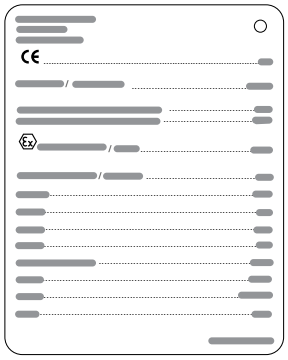


### GL-51-M40

Cable gland Ex e (M40), polyamide, for use with power cables with a diameter range of 17 - 28 mm.

### DT-PLUG-M20-EXE-PLASTIC

Stopping plug Ex e (M20), polyamide, spare part for various junction boxes.



### PI-LABEL-EX

Circuit identification label for PI heating cables, aluminium, required for marking in hazardous area applications, includes cable tie.

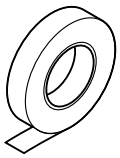
### PI-LABEL-NH

Circuit identification label for PI heating cables, aluminium, strongly recommended for marking in non-hazardous area applications, includes cable tie.


### JSBQ-I-01

Self adhesive warning label: For proper marking of electric heat-tracing systems.

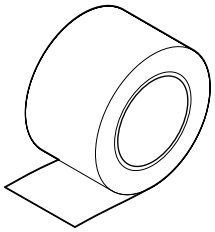
One label per 5 m of traced pipe.



## GT-66 AND GS-54

GT-66: Glass fibre fixing tape for polymer insulated heating cables on pipes. Not to be used on stainless steel. 20 m/roll, width: 12 mm.

GS-54: Glass fibre fixing tape for polymer insulated heating cables on stainless steel pipes. 16 m/roll, width: 12 mm.



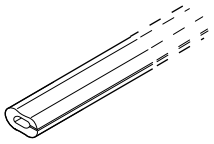
## ATE-180

Aluminum adhesive tape, for polymer insulated cables on tanks and pipes, including stainless steel. 55 m/roll, width: 63.5 mm.

## METAL-MESH-SS-50MM-10M

Stainless steel mesh for fixing heating cables on valves, pumps or other odd-shaped surfaces. This mesh provides optimum contact and heat transfer between heating cables and heated equipment and can be used for exposure temperatures of up to 400°C.

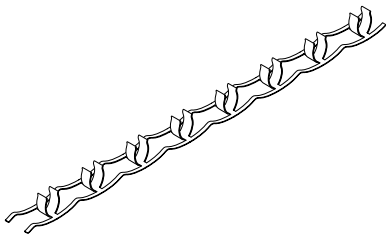
10 m/roll, width: 50 mm.



## G-02

Silicone rubber sleeve, mechanically protects heating cables on edges, flanges, insulation cladding. Cut-to-length on-site.

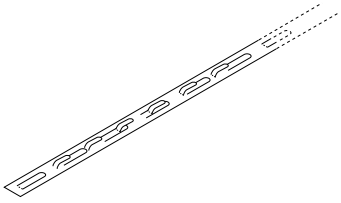
1 m long, temperature resistant up to 215°C.



## PI-FIX-SS-XMM-10M

Stainless steel clip band to attach polymer insulated series heating cables to pipes. Clips at regular distances to allow for even heater spacing. Band available in two sizes for different diameter ranges.

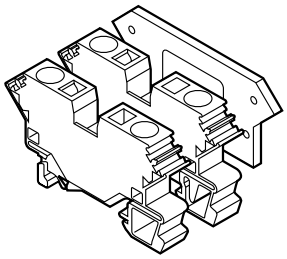
Rolls of 10 m.



## HARD-SPACER-SS-25MM-25M

Pre-punched stainless steel strap, which allows fixed distances, when heating cables are attached to surfaces of bigger pipes and vessels.

Punch interval: 25 mm, length: 25 m.



## HWA-WAGO-PHASE

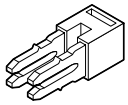
Phase/neutral terminal (Ex e), spare part for various junction boxes, max. 10 mm² solid/stranded.

## HWA-WAGO-EARTH

Earth terminal (Ex e), spare part for various junction boxes, max. 10 mm² solid/stranded.

## HWA-WAGO-ENDPLATE

End plate for terminals HWA-WAGO-..., 10 mm² terminals, spare part.



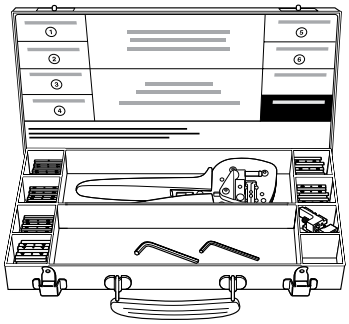
## HWA-WAGO-JUMPER

Jumper to bridge terminals HWA-WAGO-..., 10 mm² terminals, spare part.

## TEMPERATURE CONTROLS

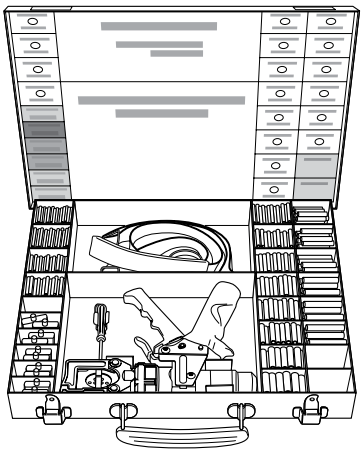
See control and monitoring product range.

## SPECIAL TOOLS



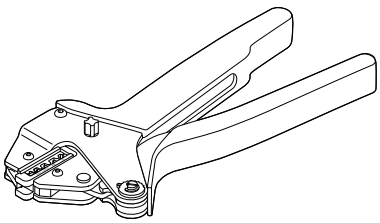
### PI-TOOL-SET-01

Metal toolbox containing a mechanical crimp tool, crimping dies and the crimps required for the connection of PI heating cables and cold leads in conjunction with the connection/splice kit type
CS-150-2.5-PI (cross section up to 2.5 $mm^2$). This tool is required for a reliable connection and is also recommended for maintenance purposes.



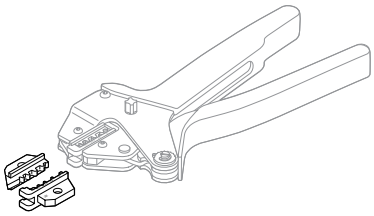
### PI-TOOL-SET-02

Metal toolbox containing a hydraulic crimp tool, crimping dies and the crimps required for the connection of PI heating cables and cold leads in conjunction with the connection/splice kits type CS-150-6-PI (cross section 4 - 6 $mm^2$) and CS-150-25-PI (cross section 10 - 25 $mm^2$). This tool is required for a reliable connection and is also recommended for maintenance purposes.



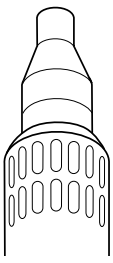
### CW-CT-KIT

Crimp tool with dies for installation of crimps for the connection/splice kits type: CS-20-2.5-PI-NH.



### CW-CT-DIE

Spare set of dies for crimp tool CW-CT-KIT and crimps of 2.5 $mm^2$.



### CV-1983-220V-3060W

High power heat gun for heat shrink based components. Power output: 3 kW.

# MINERAL INSULATED (MI) SERIES HEATING SYSTEMS

## INNOVATION

Industries worldwide have been benefiting from the unique high-performance capabilities of SANTO MI heating cables for over 75 years. Over the past decade SANTO customers have been able to take advantage of a range of innovative developments that have further enhanced the flexibility, reliability and cost-effectiveness of these industry-leading systems.

Alloy 825 sheathed MI heating cables exceed by far the corrosion resistance of standard materials and are most suitable for heat-tracing applications. The introduction of dual conductor heating cables offers economic advantages in particular for shorter circuits, as it requires only half of the length of the heating cable.

Laser welded joints give customers the assurance of the highest integrity and reliability in their heating systems even at highest temperatures and wattages.

### 2008S

Introduction of **Alloy 825** sheath material and dual conductor elements

### 2008S

Introduction of **laser welding capabilities**

### 2017S

**IECEx approvals** for entire range

The installation of MI heating units requires adequate training and sufficient experience. In particular for hazardous area applications, factory termination of the MI heating units is strongly recommended. Our team is widely regarded as the premiere provider of industrial turnkey heat-tracing solutions. With our full suite of services, from front-end engineering and installation to maintenance and operation services, we are capable of handling heat-tracing projects of any size and scope.

# MINERAL INSULATED (MI) SERIES CONSTANT WATT TECHNOLOGY

## INTRODUCTION

SANTO MI heating systems provide the optimum solution when power outputs and/or temperatures exceed the limits of any polymeric heating cables.

**Operating to voltages up to 600 V**

**Temperature maintenance up to 600°C**

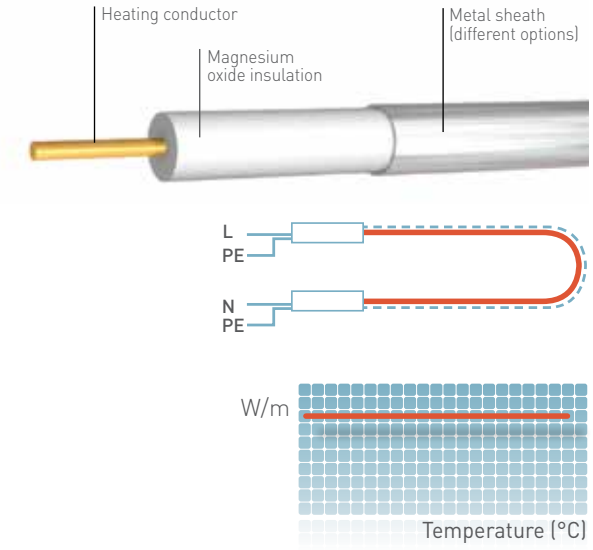
**Exposure temperatures up to 1000°C**

**Circuit lengths up to several kilometres**

## CONSTRUCTION

SANTO MI heating cables consist of one (single core) or two (dual core) conductors embedded in a highly dielectric magnesium oxide insulation surrounded by a seamless metal sheath. The cables are terminated at the extremities with a non-heating section and seal.

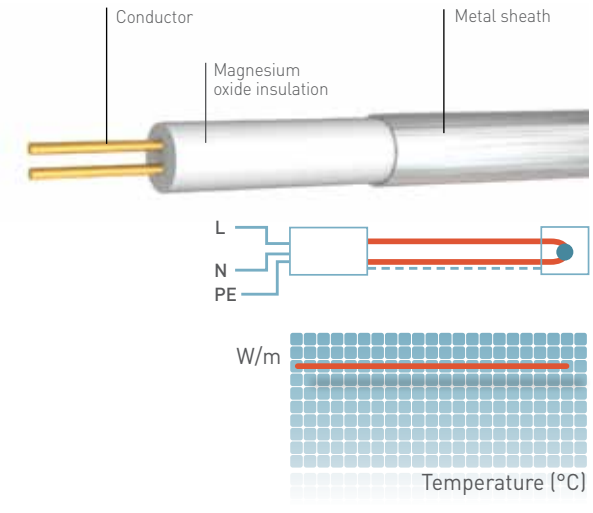
Heating elements are manufactured by brazing the heating cable with a cold lead, either on-site or at the factory.




## HOW IT WORKS

Heat is generated in the conductor(s) through the principle of Ohmic resistance heating (Joule effect). A variety of central conductor materials is used, depending on the specific resistance requirements.

Power output and temperatures of a MI series heating system depend on the specific application. Design parameters including type/resistance used, circuit length, applied voltage and electrical configuration directly influence the performance of the heating system. Design and product selection has to be carried out by qualified personnel using appropriate software. Any change to these parameters can be critical and require a re-validation of the design.



# CHARACTERISTICS OF SANTO MI CABLES

Due to their particular construction, based on a resistive heating element and metallic sheath material, the design of an application and selection of a relevant heating cable follows some specific rules:

- Evaluation of corrosive agents potentially existing in the environment in order to check compatibility of heating cable outer sheath (see table 1).
- Estimation of maximum sheath temperature and maximum output based on cable family and methodology of fabricating elements, brazing or laser welding (see table 2).
- Determination of the actual output power based on applied voltage, length and resistance of heating elements.

The cables are terminated at the extremities with a non-heating section and seal, a so called 'cold lead'. The connections and seals are critical factors for safe and reliable operation. Although on-site terminations are possible, they can only be executed by personnel experienced and trained in brazing techniques. SANTO MI heating systems can be supplied as factory-terminated and tested units to guarantee a consistently high level of quality. (see Figure 1).

Stainless Steel, Inconel 600 and Alloy 825 MI heating cables can be laser-welded. This creates connections of the highest reliability and enables them to be used at higher temperatures and/or loadings.

Heating cables with Alloy 825 sheath are also available in a dual conductor version, which offers a significant technical advantage when space is limited or when high resistances are required, such as for high temperature instrumentation lines or short branches. They also significantly reduce installation times, as only half of the length of the heating cable is required (see Figure 2).

## MI heating unit type B (single conductor)

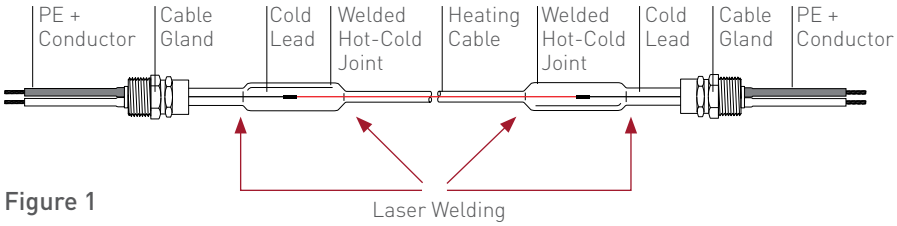



Figure 1

## MI heating unit type D (dual conductor)

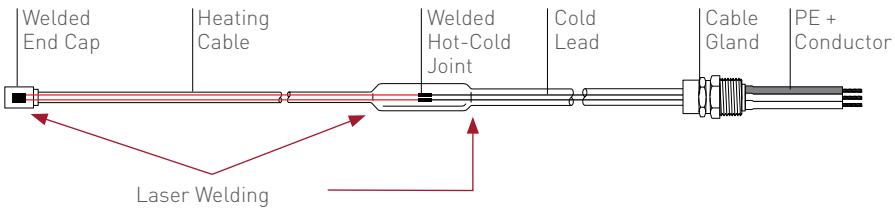



Figure 2

This table gives an indication of the corrosion resistance of the available sheath materials against different corrosive agents.

**Table 1**

| MI HEATING CABLE TYPE | SULPHURIC ACID | HYDROCHLORIC ACID | HYDROFLUORIC ACID | PHOSPHORIC ACID | NITRIC ACID | ORGANIC ACIDS | ALKALIS | SALTS | SEA WATER | CHLORIDES |
|---|---|---|---|---|---|---|---|---|---|---|
| HCC | NR | NR | A | A | NR | A | A | X | NR | X |
| HCCH | GE | GE | A | A | A | NR | A | A | A | A |
| HDC/HDF | NR | X | X | X | X | X | X | X | GE | GE |
| HSQ | NR | NR | NR | NR | X | GE | A | A | NR | NR |
| HIQ | X | X | A | X | X | GE | GE | GE | A | GE |
| HAx | GE | GE | GE | GE | GE | GE | GE | GE | GE | GE |

**GE** Good to excellent **A** Acceptable **X** Check for specific data **NR** Not recommended

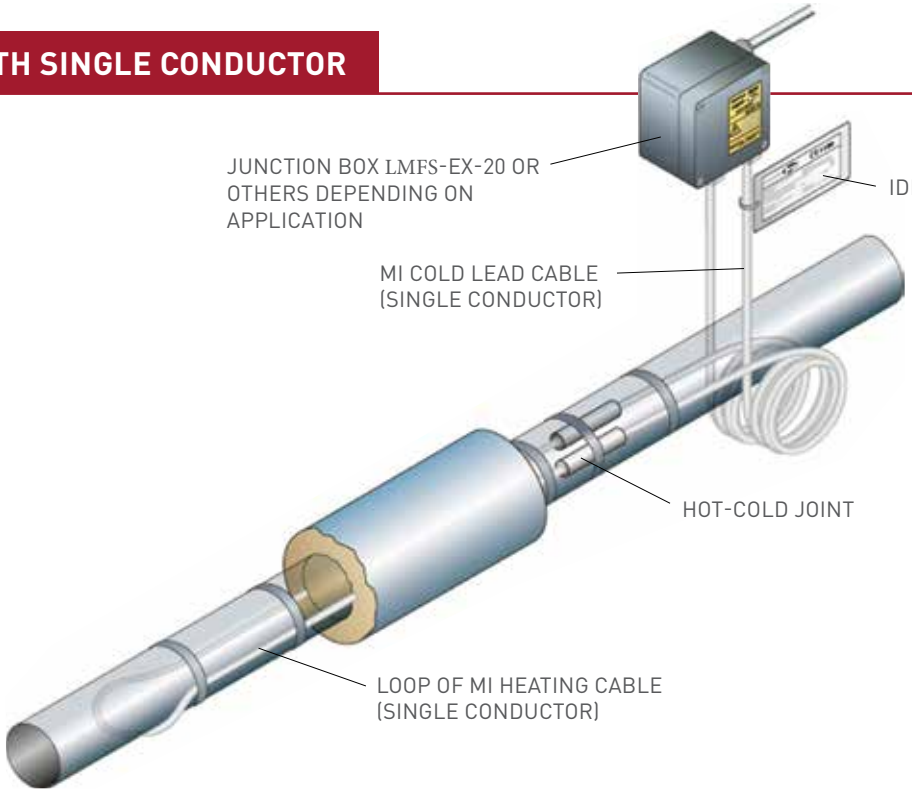
**Table 2**

| MI HEATING CABLE REFERENCE | SHEATH MATERIAL | MAX. SHEATH TEMPERATURE | MAX. TYPICAL [1] POWER OUTPUT |
|---|---|---|---|
| HCC (*) | Copper (*optional additional sheath "H" for HDEP ) | 200°C (limited to 80°C with HDPE) | 50 W/m |
| HDC/HDF | Cupro-Nickel (70/30) | 400°C | 70 W/m |
| HSQ | Stainless Steel 321 | 450°C (750°C with laser welded joints) | 150 W/m |
| HIQ | Inconel 600 | 450°C (750°C with laser welded joints) | 300 W/m |
| HAx | Alloy 825 | 450°C (750°C with laser welded joints) | 270 W/m |

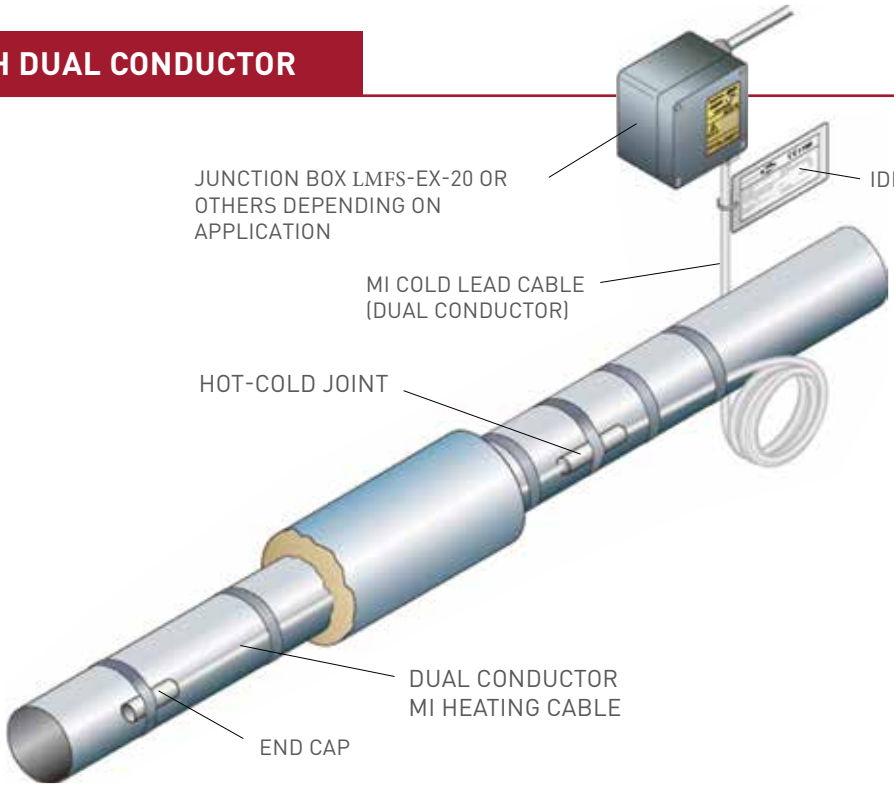
(*)Corrosion resistance data is dependent on temperature and concentration
(1) Typical value, allowed max. power output dependent on the application. Consult Santo for more information.

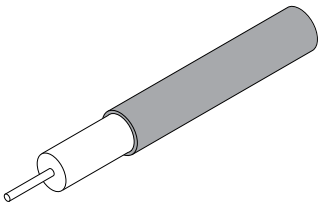
# TYPICAL CONFIGURATION FOR SANTO MI HEATING CABLE SYSTEMS

## SYSTEMS WITH SINGLE CONDUCTOR




## SYSTEMS WITH DUAL CONDUCTOR



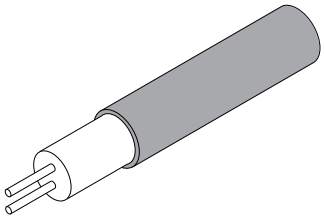


### HCH/HCC

Copper sheathed MI cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature s is 200°C and the typical maximum load is 50 W/m*. Copper cables are also available with an over-sheath in HDPE (max. 80°C) or FEP (max. 200°C) for enhanced corrosion protection.

### HDF/HDC

Cupro-nickel (70/30) sheathed MI cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature is 400°C and the typical maximum load is 70 W/m*.



### HSQ

Stainless steel (321) sheathed Mineral Series (MI) heating cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature is dependent on the technology used for the hot-cold joint assembly. Silver solder joints allow for exposure temperatures up to 450°C while laser welded joints can withstand 600°C.
The typical maximum load is 150 W/m*.

### HAx

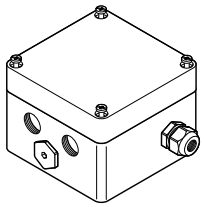
Alloy 825 sheathed MI cable approved for use in hazardous areas (gas and dust environments) are available in both single and dual conductor versions. Dual conductor heating cables are available for voltage ratings of 300 Vac (HAx2M) and 600 Vac (HAx2N). The maximum exposure temperature is dependent on the technology used for the hot-cold joint (and end cap) assembly.

Silver solder joints (and end caps) allow for exposure temperature up to 550°C while laser welded joints (and end caps) can withstand 650°C. The typical maximum load for single conductor cables is 210 W/m while dual conductors can be powered up to 270 W/m*.

### HIQ

Inconel 600 sheathed MI cable approved for use in hazardous areas (gas and dust environments). The maximum exposure temperature is dependent on the technology used for the hot-cold joint assembly. Silver solder joints allow for exposure temperature up to 450°C while laser welded joints can withstand 600°C. The typical maximum load is 300 W/m*.

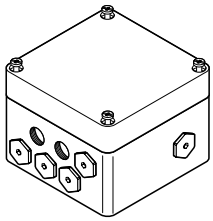
# JUNCTION BOXES



### MF-EX-20

Junction box, 3 x M20 entries and 1 x M25 with gland, approved for use in hazardous areas.

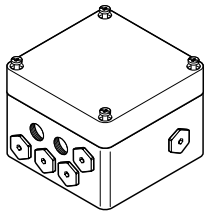
Typical use as power-box for PI/MI heating cables. Also available with earth plate (reference MF-EX-20).



### MF-EX-21

Junction box, 6 x M20 and 1 x M32 entries for use in hazardous areas. Power cable gland (M32) must be purchased separately.

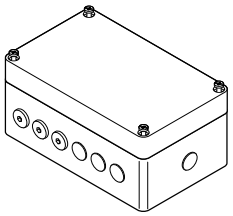
Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.



### MF-EX-21/35MM2

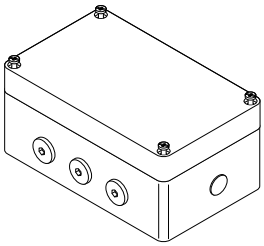
High load junction box, 6 x M20 and 1 x M40 entries, approved for use in hazardous areas. Power cable gland (M40) must be purchased separately.

Typical use as power-, splice- and end-box for 3-phase systems with PI/MI heating cables.



### MF-EX-25/35MM2

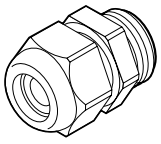
High load junction box, 6 x M25 and 1 x M40 entries, approved for use in hazardous areas. Power cable gland (M40) must be purchased separately. Typical use as power-, splice- and end-box for 3-phase systems with MI heating cables.



### MF-EX-32/35MM2

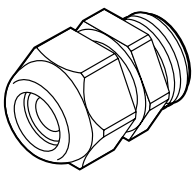
High load junction box, 3 x M32 and 1 x M40 entries, approved for use in hazardous areas. Power cable gland (M40) must be purchased separately.

Typical use as power-, splice- and end-box for 3-phase systems with MI heating cables, in particular for dual conductor heating elements.



### GL-45-M32

Cable gland Ex e (M32), polyamide, for use with power cables with a diameter range of 12 - 21 mm.

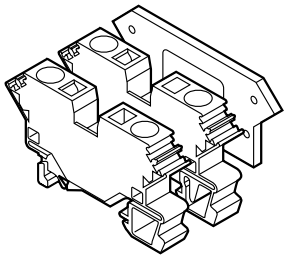


### GL-51-M40

Cable gland Ex e (M40), polyamide, for use with power cables with a diameter range of 17 - 28 mm.

### DT-PLUG-M20-EXE-PLASTIC

Stopping plug Ex e (M20), polyamide, spare part for various junction boxes.



### FJ-WAGO-PHASE

Phase/neutral terminal (Ex e), spare part for various junction boxes, max. 10 mm² solid/stranded.

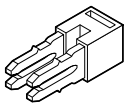
### FJ-WAGO-EARTH

Earth terminal (Ex e), spare part for various junction boxes, max. 10 mm² solid/stranded.

### FJ-WAGO-ENDPLATE

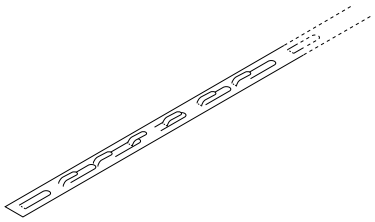
End plate for terminals FJ-WAGO-..., 10 mm² terminals, spare part.

### FJ-WAGO-JUMPER



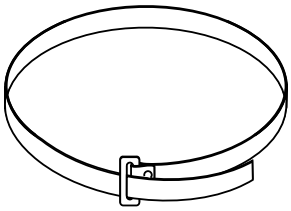
Jumper to bridge terminals FJ-WAGO-..., 10 mm² terminals, spare part.

## FIXING/INSTALLATION MATERIALS



### Steel strip

Pre-punched strap in stainless steel, which controls spacing distances when heating cables are attached to surfaces of bigger pipes and vessels. Punch interval: 25 mm.

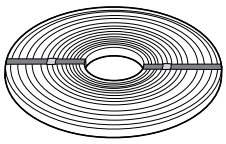


### AVAILABLE PIPE STRAPS

Stainless steel pipe straps for holding MI cable onto pipe. Tighten with pliers.

Allow one strap per 30 cm of pipe

| PART NO. | PIPE DIAMETER | PACKING QTY |
|---|---|---|
| PB 125 | to 1 ¼" (32 mm) | 50 pc |
| PB 300 | 1 ½" to 3" (38 - 75 mm) | 35 pc |
| PB 600 | 3 ½" to 6" (89 - 150 mm) | 25 pc |
| PB 1000 | 6" to 10" (150 - 250 mm) | 1 pc |
| PB 1200 | to 12" (300 mm) | 1pc |
| PB 2400 | to 24" (600 mm) | 1pc |
| PB 3600 | to 36" (900 mm) | 1pc |

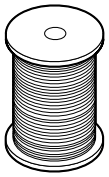


### SNLS

Plain stainless steel banding/strip for holding MI cables in place on pipes. 30 m roll. Secured with buckles.

### SNLK

Stainless steel buckles for use with metal banding strip type SNLS.



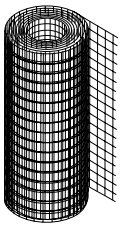
### RMI-TW

Tie wire for fastening steel heating cables on pipes. Especially suitable for irregular shaped objects such as pumps, valves, flanges. Supplied in 50 m reels.

**Do not use with copper or cupro nickel sheathed heating cables; use straps wherever possible.**

### ALLOWANCES FOR TIE WIRE AND BANDING ON PIPES.

| Pipe Size (mm) | 25 | 40 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 750 | 900 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Required length (m) per m of pipe | 0.8 | 1.1 | 1.2 | 1.6 | 2.1 | 2.8 | 3.5 | 4.2 | 4.6 | 5.2 | 5.9 | 6.5 | 7.9 | 9.8 | 11.8 | 15.7 |



### FT-19/FT-20

Zinc-plated metal mesh (FT-19) or stainless steel metal mesh (FT-20) for holding MI heating cables in place on pipes, tanks or other equipment.

Supplied in 25 m rolls (approx. width 1 m).

### FJ-MESH-SS-50MM-10M

Self adhesive warning label: For proper marking of electrical trace heating systems. One label per 5 m of traced pipe.

Attach to outside of thermal insulation weather barrier on both sides of pipe and also at equipment such as valves, pumps requiring periodic maintenance.

## WARNING LABELS


### JSBQ-MI

Self adhesive warning label: For proper marking of electrical trace heating systems. One label per 5 m of traced pipe.

Attach to outside of thermal insulation on both sides of pipe and also at equipment such as valves, pumps requiring periodic maintenance.

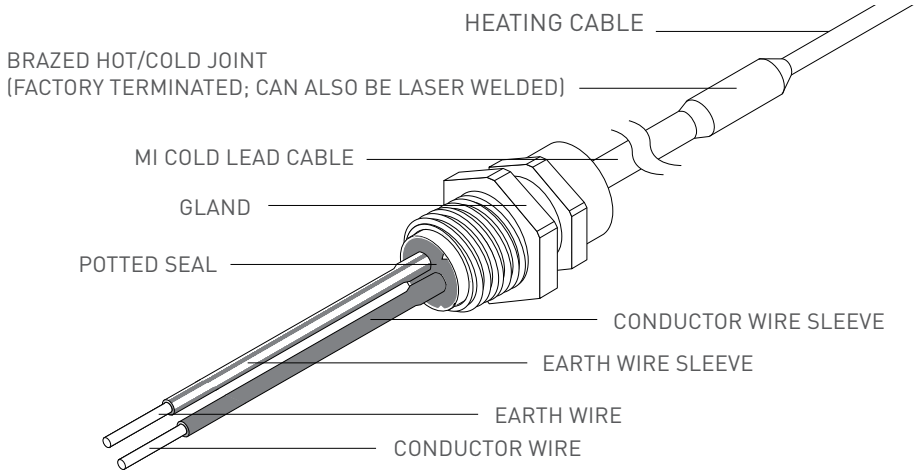
## TEMPERATURE CONTROLS

See control and monitoring product range.

The termination of MI heating units requires adequate training and sufficient experience. In particular for hazardous area applications, factory termination of the MI heating units is strongly recommended.

For possible combinations and detailed order information of glands, seals, joints and other accessories also refer to datasheet for **MI Termination Accessories** (reference DOC), or contact SANTO

## TYPICAL TERMINATION OF MI HEATING CABLE




## PRE-TERMINATED MI DOUBLE COLD ENDS

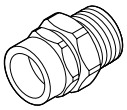
To facilitate occasional on-site termination and eventual repairs, SANTO offers Pre-terminated MI double Cold Ends (PCE).

The standard PCEs consist of 4m of cold lead cable of the appropriate type which ends are pre-terminated with a factory seal, gland assembly and insulated flexible tails. The use of Pre-terminated Cold Ends (PCE) significantly increases the reliability of field-termination and repairs of cold leads since they are fully factory tested and assembled in a controlled manufacturing environment.

A PCE with a single conductor cable includes two terminations, sufficient for the termination of an MI heating unit type B. A PCE with dual conductor cable includes two terminations, sufficient for the termination of two MI heating unit type D or for one MI heating unit type E.

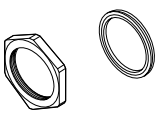
Any ingress of moisture is minimized, if the PCE is cut (typically in the middle) just before the connection to a heating cable. Unused ends can be sealed for storage using wax or other appropriate sealing methods. More details on the available types can be found in MI Termination Accessories (reference DOC).

## GLANDS, SEALS, JOINTS, FERRULES



### GL

Metric brass glands are standard.



### GLM20

M20 brass lock nuts for securing glands

### GLM25

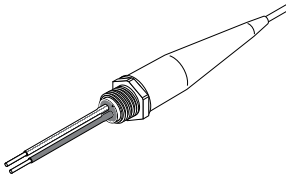
M25 brass lock nuts for securing glands.

### SATP20

Fibre washers for glands, M20

### SATP25

Fibre washers for glands, M25

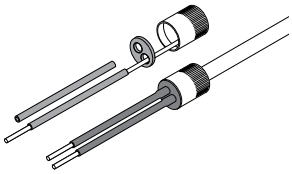


## GLHG20

M20 gland shrouds for enhanced gland protection

## GLHG25

M25 gland shrouds for enhanced gland protection



## U-MI

Hazardous and ordinary area seals are supplied with 300 mm tails including earth tail.

# CONTROL AND MONITORING SYSTEMS

## INNOVATION

Since the introduction of the DATC-Z 200 multi-circuit network system back in the last millen-nium, SANTO has continued to lead the field in advanced control and monitoring technology. Ground fault and line current monitoring and alarms have made systems safer and reduced costs.

The ability to combine local and cen-tral control systems has enabled the optimisation of total installation and total operating costs.

The introduction and continuous development of our innovative SANTO DATC-X family, its associated software and touch-screen technol-ogy keeps us at the forefront of control and monitoring for industrial heat-tracing applications.

### 2014

**DATC-Z 200** multi-circuit, networkable heat-tracing control and monitoring with PASC, line sensing etc.

### 2014

**DATC-X** adds a touchscreen and full integration with DATC Supervisory Software.

### 2014

**DATC-Z** first fully integrated EEx heat-tracing controller featuring **"local control-central monitoring"**.

### 2014

Advanced panel mounted modular control, monitor-ing and power distribution system with a single control module per heat-tracing circuit architecture.

# A VARIETY OF SYSTEMS TO SERVE YOUR PARTICULAR NEEDS...

The SANTO product range completes SANTO offering with a wide range of various systems for the control and monitoring particularly suited to electric heat-tracing (EHT) applications. SANTO control and monitoring systems encompass products that range from most proven and economical simple mechanical thermostats to the very latest innovations in local control and central monitoring systems.

Many aspects can influence the selection of the most appropriate control and monitoring solution for each project and application. The most effective solutions are most often a blend of various combined technologies to achieve a balance between total installed costs (TIC) and long-term benefits

associated with the entire heat management system, total operating cost (TOC), during the life of the plant.

# WHAT YOU SHOULD CONSIDER BEFORE SELECTING YOUR SYSTEM

## CHOOSE THE OBJECTIVE FOR YOUR CONTROL SYSTEMS

Each of our control systems provides its own level of technical features and benefits, depending on the process requirements and the number of circuits.

The objective of control in electrical heat-tracing can be:

### FROST PROTECTION

Applied to fluids that must be kept above a minimum temperature - typically 5°C – e.g. for water lines and where moderate overheating of the fluid is not a major concern.

### BROAD TEMPERATURE MAINTENANCE

Appropriate when the process temperature must be controlled within a moderate range. This is generally used for viscosity control to keep process fluids such as fuel oil flowing.

### NARROW TEMPERATURE MAINTENANCE

Applied to fluids that must be kept within a narrow temperature range to maintain viscosity and prevent fluid or pipe degradation. Typical examples include sulphur and acrylic acid lines.

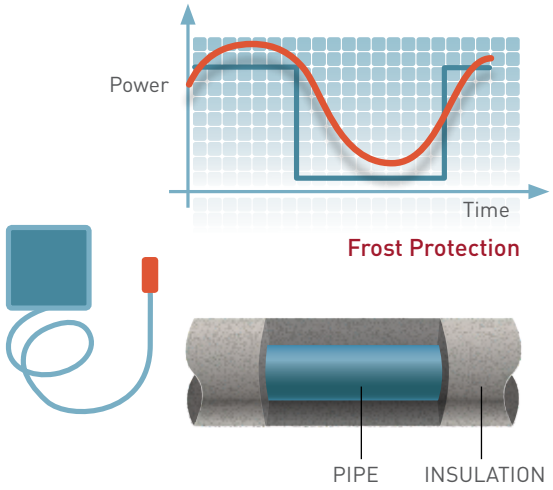
# WHAT YOU SHOULD CONSIDER BEFORE SELECTING YOUR SYSTEM

## SELECT THE APPROPRIATE METHOD OF CONTROL

The choice of the controller depends on whether the system is required to be controlled on the basis of ambient or pipe/equipment surface temperature, which is dependent on the process requirements and, possibly, the equipment limitations.

**There are three methods of control for EHT systems.**

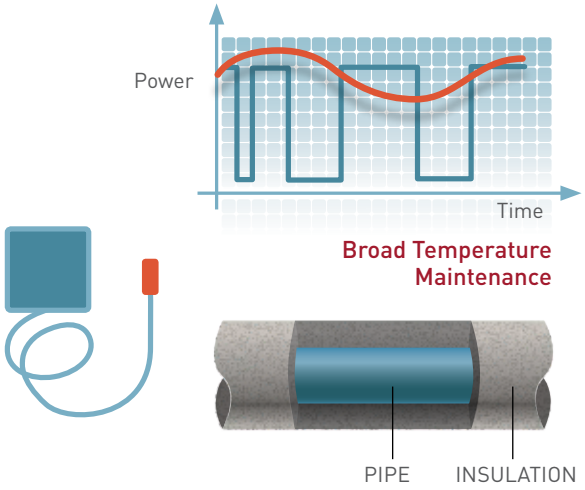
### AMBIENT SENSING CONTROL




Uses a simple on-off algorithm based on ambient temperature. It is more energy efficient than just self-regulating control because the heating circuit is energised only when the temperature descend below the set point.

The control device can be either a mechanical thermostat or an electronic controller. Ambient thermostats are generally sufficiently accurate and reliable to provide an economical solution for most frost-protection applications.

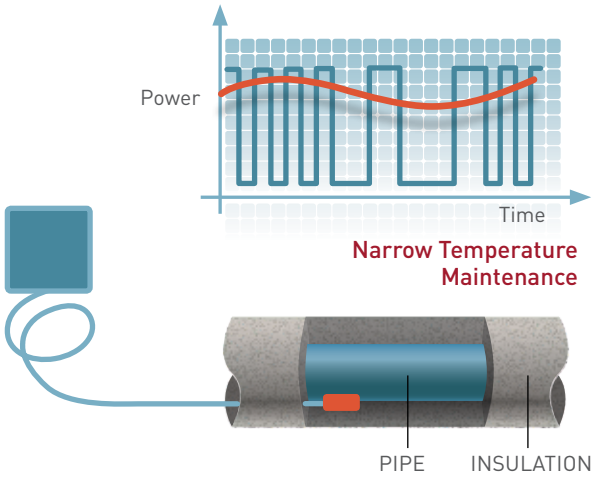
## PROPORTIONAL AMBIENT SENSING CONTROL (PASC)




Uses an electronic controller that senses ambient temperature and continuously matches the heat input to the predicted heat loss that occurs due to changing ambient conditions.

A pre-programmed algorithm calculates the cycle time that the heating circuits will be energised to maintain the desired temperature. PASC is suitable for all broad temperature-control and many narrow temperature-control applications. Compared to line sensing, the use of PASC can significantly reduce the number of circuits, as flow paths don't need consideration and can help reducing total installed cost of a project whilst reducing energy consumption.

## LINE SENSING CONTROL




Is based on the pipe/equipment temperature. With this option, each flow path has a separate circuit controlled by a mechanical line-sensing thermostat or electronic controller. The control unit turns on the heating circuit when the pipe temperature descend below the desired maintain temperature.

Line sensing offers the most accurate control for narrow temperature band applications.
Total installed cost of line sensing systems can be considerably higher than systems based on ambient temperature, as the average circuit length of the EHT system is typically significantly lower based on pipe lengths and possible flow paths.

# DETERMINE THE CONTROL AND MONITORING PHILOSOPHY

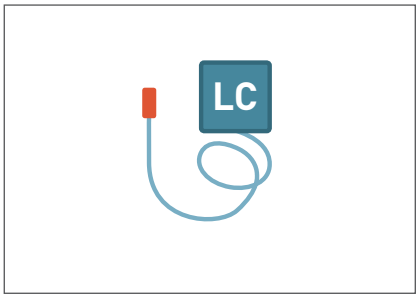
An overarching control and monitoring philosophy must be established for a project before any products can be selected. Types and methods of control and monitoring need to be chosen based on various aspects:

- Process requirements
  (temperatures, flow path considerations, alarm requirements, upset conditions)
- Maintenance strategy
  (simplicity, local or central monitoring, location of installation)
- Power distribution parameters
  (location of panels, substations, cabling requirements)
- Economical considerations (optimisation of TIC, TOC)

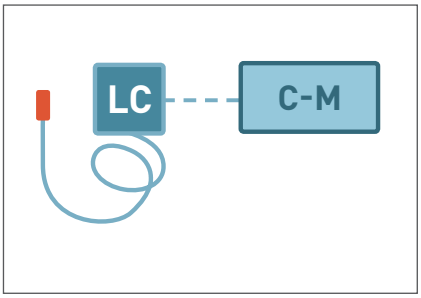
It is also worth considering incorporating a variety of monitoring options into the system design. The use of monitoring of the circuit integrity increases the overall system reliability as failures in the heating and power distribution systems can be reported to operations and maintenance personnel locally or at a central location.

**There are 3 main philosophies, each with it's advantages and limitations:**

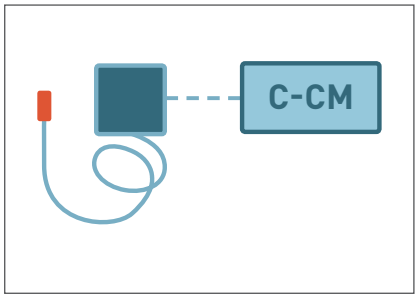
## LOCAL CONTROLS




## LOCAL CONTROLS WITH CENTRAL MONITORING




## CENTRAL CONTROLS AND MONITORING



# SELECT YOUR SYSTEM - FOR LOWEST INSTALLATION COST

## LOCAL CONTROL

This employs locally-mounted thermostats that are installed in the field and typically directly switch the heat-tracing circuit. It offers the lowest installation cost but is limited in its applicability and makes a minimal contribution to lowering total operational costs (TOC). The cost and complexity of maintenance for this philosophy is high unless it is combined with the possibility of central monitoring.

There are mechanical and electronic options, depending on process requirements, each of which offers models for use in both hazardous and non-hazardous areas.

**SANTO Mechanical thermostats** are based on the bulb and capillary principle and are used for frost protection or temperature maintenance with a relatively narrow temperature band.

### BENEFITS

Easy installation and commissioning

Low installation cost

Relatively accurate control

**They are limited by:** No temperature monitoring, imprecise setpoint setting, no maintenance information available , limited temperature range


**SANTO Electronic thermostats** measure temperature through an electronic circuit wired to a temperature sensor. More sophisticated models offer additional features such as a temperature display, high/low temperature alarms or proportional ambient sensing control. They are mainly used for temperature maintenance requiring a narrow temperature band.

### BENEFITS

Easy installation and commissioning
Low installation cost

Accurate control

Sensor leads can be extended

**They are limited by:** Monitoring capabilities only in the field, no maintenance information centrally available, so maintenance can only be carried out reactively

# SELECT YOUR SYSTEM - FOR INCREASED RELIABILITY, MINIMISED CABLING AND REDUCED TOTAL OPERATING COST

## LOCAL CONTROL - CENTRAL MONITORING

Advanced field-mounted controllers offer the option for direct switch-ing locally in the field with the monitoring and configuration capabilities of a centralised control system. The controllers communicate via a bus system to a central location and can be configured and monitored in the field, via a hand-held device or remotely, via a touch-screen user interface and supervisory software.

This control and monitoring philosophy offers advantages for critical processes, small pipe networks and for high hold-temperature applica-tions by minimising cabling costs, reducing total operating cost and the project schedule by standardising panel design.


## BENEFITS

- **Increased reliability,** by permanent supervision of the integrity of the circuits.
- **Cost savings,** by reduction of power cabling, RTD wiring and simplified power distribution.
- **Easier to install.** By making direct heater connections you can reduce field junction boxes, lowering power cable cost, installation time and maintenance.
- **Efficient process follow-up,** by monitoring & alarming of temperatures, ground-fault currents, operating currents and voltages.
- **Increased personnel safety** and **simplified maintenance,** by detailed problem reporting and accurate history logs.
- **Simplified maintenance activities** with hand held device (= monitoring of the heat-tracing system in the field without opening the control unit)

# SELECT YOUR SYSTEM - FOR ASSURED RELIABILITY AND REDUCED TOTAL OPERATING COST

## CENTRAL CONTROL - CENTRAL MONITORING

Central control and monitoring systems are typically installed in panels where they provide control and monitoring for several heat-tracing circuits or groups of circuits at the same time. They offer advanced features like measuring ground-fault levels, operating currents and provide a wealth of other maintenance-related information.

SANTO has a family of panel controllers with advanced control and monitoring capabilities specifically designed to meet the demands of industrial heat management systems. The controllers can be installed in any combination to deliver an optimised system for specific applica- tions.

### BENEFITS

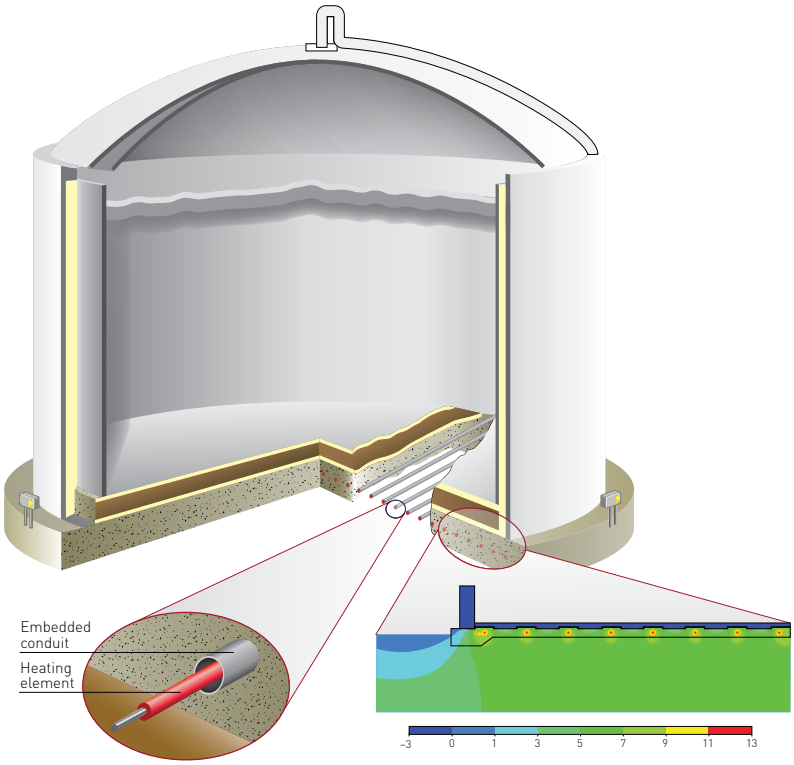
- **Increased reliability,** by permanent supervision of the integrity of the circuits.
- **Highest control flexibility** via 1-phase or 3-phase controllers
- **Highest safety integrity** level with the intelligent SIL 2 safety temperature limiter
- **Cost savings,** by reduction of power cabling, RTD wiring and simplified power distribution.
- **Efficient process follow-up,** by monitoring & alarming of temperatures, ground-fault currents, operating currents and voltages.
- **Full heat-tracing control** via dedicated temperature, power and current control algorithms
- **Increased personnel safety** and **simplified maintenance,** by detailed problem reporting and accurate history logs.

# SELECTION CHARTS

Where permanent monitoring of a heat-tracing circuit's integrity is required, the initial selection can be made from the advanced SANTO controllers table.

| CAPABILITIES | DATC-20 | DATC-30 | DATC-40 | DTC-915 | DATC-V-03 | CSD/20 |
|---|---|---|---|---|---|---|
| **LOCATION OF CONTROLLER** | | | | | | |
| Panel mounted | | x | x | x | x | x |
| Field mounted | x | | | | | |
| Hazardous area | x | | | | | |
| Control | | | | | | |
| Ambient sensing | x | x | x | x | x | x |
| PASC | x | x | x | x | | |
| Line sensing | x | x | x | x | x | x |
| Proportional | | x | x | | x | |
| Safety temperature limiter | x *2 | | x *2 | x | | |
| Adaptive current control | | | x | x | | |
| **MONITORING** | | | | | | |
| Ambient temp | x | x | x | x | x | |
| Pipe temp | x | x | x | x | x | x |
| Ground fault | x | x | x | x | | |
| 1-phase current measurement | x | x | x | x | | |
| 3-phase current measurement | | | x | | | |
| Voltage | x | x | | x | | |
| **COMMUNICATION** | | | | | | |
| Local display | x | x | x | x | x | x |
| Hand held wireless | x | | | | | |
| Remote display | x | x | x | | | |
| Supervisor software | x | x | x | x | | |
| DCS integration | x | x | x | x | | |
| Temperature range controller | –80°C +700°C | –73°C +482°C | –80°C +700°C | –60°C +570°C | –200°C +2400°C | –200°C +500°C |
| Temperature range limiter | –60°C +599°C | - | +50°C +500°C | –20°C +450°C (T1 to T6) | | |
| **NUMBER OF CIRCUITS PER CONTROLLER** | | | | | | |
| 1 circuit/controller | x | x | x | x | x | x |
| >1 circuit/controller | | x | x | | | |

***2: SIL2 certified**




Embedded heating elements

Thermal profile for conditions 2D FEA with 82% duty cycle

# STS - SKIN-EFFECT TRACING SYSTEM

The SANTO STS System is a versatile engineered heat management system configured to deliver heat for medium to long pipelines.

Applications include: material transfer lines, snow and ice melting, tank foundation heating, subsea transfer lines and prefabricated, pre-insulated lines. The industry leader in offering single source responsibility in heat management, SANTO brand are uniquely qualified to offer Skin-Effect Systems that combine system engineered expertise with proven procurement/construction capabilities.

## STS SYSTEMS CAN BE DESIGNED FOR:

- Circuit lengths up to 25 kilometers (15 miles)
- Power outputs up to 150 W/m (49.2 W/ft)
- Maintain temperatures up to 200°C (392°F)
- Exposure temperatures up to 250°C (482°F)

## WHY STS?

**Longline capability**
Circuit lengths up to 25 kilometers (15 miles) from a single power source.

**Flexibility**
Ideal for either factory fabricated, pre-insulated or field installed system.

**Maintainable**
Pull/splice boxes simplify access to the system without disturbing insulation.

**Safe**
Fully grounded system with zero electrical potential on pipe surfaces.

**Rugged and reliable**
Entire circuit is encapsulated within rugged heat tubes and steel boxes.

**Accurate control**
A closed loop control system includes redundant temperature sensing.

**Engineered**
Systems are custom engineered in accordance with ANSI/IEEE 844, NEC 426/427 and plant standards.

**Simulation studies**
Temperature profile plotting capability.

**Computerised design**
Runaway temperature, dynamic static heat-up/cool-down calculations available.

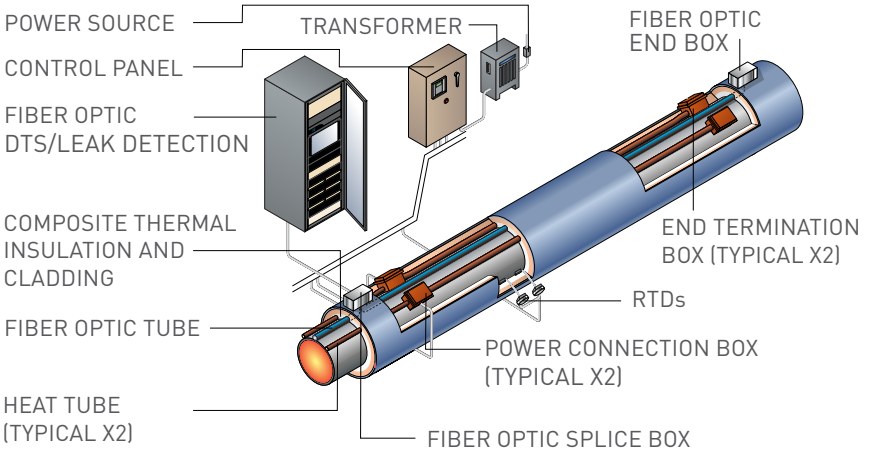

# STS TECHNOLOGY

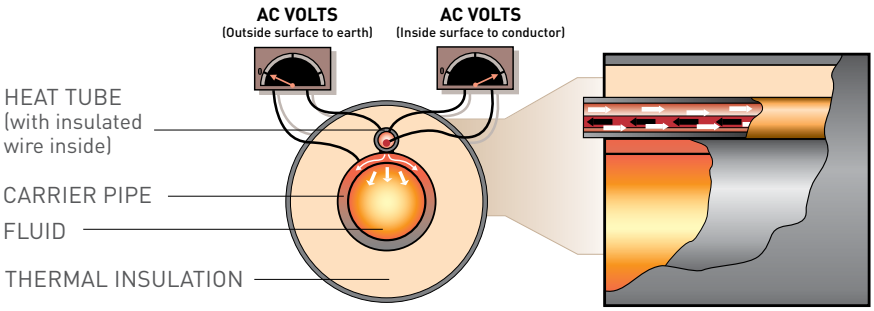
The SANTO STS System consists of a thermally rated, electrically insulated wire installed inside a ferromagnetic heat tube. The insulated wire is connected to the heat tube at the end termination, and an AC voltage source is connected between the heat tube and insulated wire at the power connection. AC current flows down the wire, returning on the inside surface of the tube.

The STS system is electrically safe and produces heat in the ferromagnetic tube through the effects of two well-known electrical phenomena: Skin Effect and Proximity Effect. These phenomena cause the current flowing in the heat tube to be concentrated on the inner surface; the current concentration is so complete there is virtually no measurable voltage on the outer wall of the heat tube. Heat is also generated due to the resistance of the heat tube and STS wire, and through eddy currents and hysteresis in the heat tube. Since the heat tube is attached to the process pipe and completely within the thermal insulation system, heat is efficiently transferred into the process pipe.

Circuit lengths are determined by a combination of cable size, cable voltage, temperature rating, heat tube size and attachment method. It is feasible to heat up to 25 kilometers (15 miles) from a single source using supply voltages approaching 5,000 volts. With the cable inside the tube and pull/splice boxes located along the line, any field modifications, cable replacements, troubleshooting, etc... becomes very simple. All can be accomplished without disturbing the insulation.

These systems can be provided as a pre-fabricated and pre-insulated piping system in which the steel tube is factory attached to the carrier pipe.

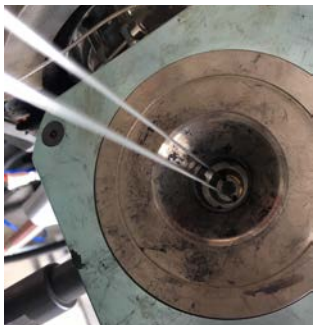


# PRODUCT DATASHEETS

## Heating cables

## Components



## Control and monitoring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| Maintain temperatures up to 110°C | Ex | UFB | 86 |
| Maintain temperatures up to 121°C | Ex | UFC | 88 |
| Maintain temperatures up to 150°C | Ex | UFO | 91 |

### Power limiting heating cables

| | | | |
|---|---|---|---|
| Maintain temperatures up to 230°C | Ex | ACC | 94 |

### Constant power heating cable

| | | | |
|---|---|---|---|
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### Polymer insulated (PI) series heating cables

| | | | |
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### Mineral insulated (MI) series heating cables

| | | | |
|---|---|---|---|
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## Components

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#### Integrated

| | | | |
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| | | | |
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| | | | |
|---|---|---|---|
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### End seals

| | | | |
|---|---|---|---|
| Above insulation end seal, cold applied | Ex | FAST-100-E / FAST-100-L-E | 176 |
| Under insulation low profile end seal, cold applied | Ex | JQH-LEC | 180 |
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## Control & Monitoring

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### Panel mount single-circuit electronic controllers

| | | | |
|---|---|---|---|
| Single-circuit electronic temperature controller | | DATC-CONT-03 | 215 |
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| Heat-tracing control system | | DATC-915-CONT | 220 |
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| | | | |
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| Panel mounted advanced modular heat-tracing control, monitoring and power distribution system | | DATC-40 | 238 |

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## Accessories

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| Hand held cable fault locator | | DET-4000 | 289 |

## Product/Technology - Selection table

| Typical maintain temperature range (°C) | | | | | | | | | | | | Product | Technology |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | | |
| 65 | | | | | | | | | | | | UFA | Parallel self-regulating Field-terminated |
| 110 | | | | | | | | | | | | UFB | Parallel self-regulating Field-terminated |
| 121 | | | | | | | | | | | | UFC | Parallel self-regulating Field-terminated |
| 150 | | | | | | | | | | | | UFO | Parallel self-regulating Field-terminated |
| 230 | | | | | | | | | | | | ABB | Parallel power-limiting Field-terminated |
| 230 | | | | | | | | | | | | ACC | Power limit heating cable |
| 230 | | | | | | | | | | | | AFF | Parallel Constant Wattage Zone Field-terminated |
| 160 | | | | | | | | | | | | XPI-NH | Polymer Insulated (PI) Series, Constant Wattage Field-terminated |
| 200 | | | | | | | | | | | | XPI | Polymer Insulated (PI) Series, Constant Wattage Field-terminated |
| 200 | | | | | | | | | | | | XPI-S | Polymer Insulated (PI) Series, Constant Wattage Field-terminated |
| 40 | | | | | | | | | | | | HCHH/HCCH (HDPE) | Mineral Insulated (MI) Series, Constant Wattage Factory-terminated |
| 120 | | | | | | | | | | | | HCH/HCC | Mineral Insulated (MI) Series, Constant Wattage Factory-terminated |
| 250 | | | | | | | | | | | | HDF/HDC | Mineral Insulated (MI) Series, Constant Wattage Factory-terminated |
| 450 | | | | | | | | | | | | HSQ | Mineral Insulated (MI) Series, Constant Wattage Factory-terminated |
| 550 | | | | | | | | | | | | HAx | Mineral Insulated (MI) Series, Constant Wattage Factory-terminated |
| 600 | | | | | | | | | | | | HIQ | Mineral Insulated (MI) Series, Constant Wattage Factory-terminated |
| 150 | | | | | | | | | | | | STS | Skin-effect Tracing System STS Engineered Product |

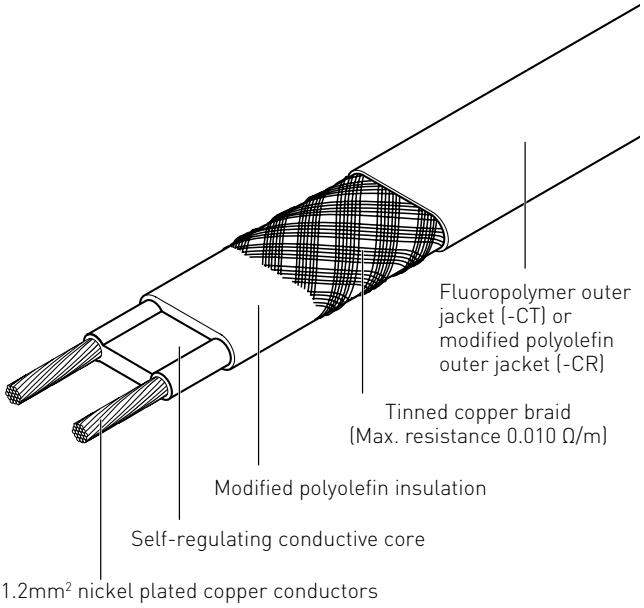
| Max. exposure temperature (°C) Continuous power on ♦ Power off | Temperature classification | T Class design method | | | Preferred control method | | | | Chemical exposure | | Mechanical resistance | | Typical pipe length range (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Unconditional | Stabilised design | Use of temperature limiter | No control | Ambient sensing | Broad temperature range (+/–10°C) | Tight temperature control (+/–3°C) | Organic | None | Normal | High | |
| 65 | T6 | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 0 - 400 |
| 110 | T4 | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 0 - 400 |
| 121 | T2-T3 | ■ | *T4 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 0 - 400 |
| 150 | T2 | ■ | **T3-T4 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 0 - 400 |
| 260♦ | T2-T4 | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 0 - 450 |
| 260♦ | T2-T4 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | | 0 - 400 |
| 260♦ | T2-T4 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | | 0 - 450 |
| 260♦ | Ordinary only | | | | | | ■ | ■ | ■ | ■ | ■ | | Up to 5000 |
| 260♦ | T2-T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | | Up to 5000 |
| 260♦ | T2-T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | Up to 5000 |
| 80♦ | T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | Up to 5000 |
| 200♦ | T3-T6 | | ■ | ■ | | | ■ | ■ | | ■ | ■ | ■ | Up to 5000 |
| 400♦ | T1-T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | Up to 2500 |
| 700♦ | T1-T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | Up to 500 |
| 700♦ | T1-T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | Up to 5000 |
| 1000♦ | T1-T6 | | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | Up to 500 |
| 250♦ | T2-T6 | | ■ | ■ | | | | ■ | ■ | ■ | ■ | ■ | 400 - 30.000 |

*Stabilised design, T2-T3 -> unconditional/ **Stabilised design, T2 -> unconditional

# SANTO UFA

## SELF-REGULATING HEATING CABLE

### HEATING CABLE CONSTRUCTION




Electrical heat-tracing for frost protection without steam cleaning.
The UFA-family of self-regulating, parallel circuit heating cables is used for frost protection of pipes and vessels. It can also be used for process temperature maintenance up to 65°C.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust)<br>Ordinary |
| Traced surface type | Carbon steel<br>Stainless steel<br>Plastic<br>Painted or unpainted metal |
| Chemical resistance | For organic corrosives: use -CT (fluoropolymer outer jacket)<br>For mild inorganic solutions: use -CR (modified polyolefin outer jacket) |

### SUPPLY VOLTAGE

230 Vac (Contact your local SANTO representative for data on other voltages)

### APPROVALS

The UFA heating cables are approved for use in hazardous areas by PTB and Baseefa Ltd.

The UFA heating cables are approved by DNV for use on ships and mobile offshore units.

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local SANTO representative.

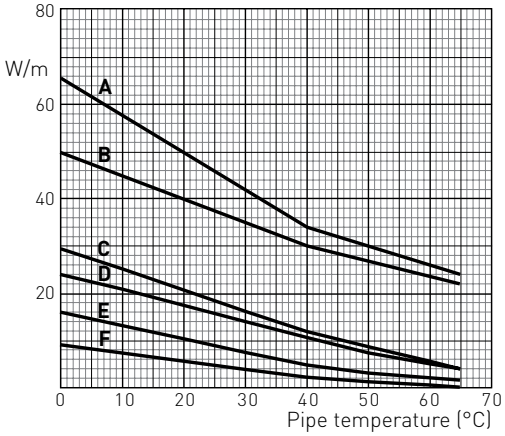
## SPECIFICATIONS

| | |
|---|---|
| Maximum maintain or continuous exposure temperature (power on/off) | 70°C |
| Maximum intermittent exposure temperature (power on/off) | 90°C<br>Maximum cumulative exposure 1000 hours |
| Temperature classification | T6 |
| Minimum installation temperature | –60°C |
| Minimum bend radius | at 20°C: 13 mm<br>at –60°C: 35 mm |

## THERMAL OUTPUT RATING

Nominal power output at 230 Vac on insulated steel pipes

**A** 20UFA-CT
20UFA-CR
**B** 15UFA-CT
15UFA-CR
**C** 10UFA-CT
10UFA-CR
**D** 8UFA-CT
8UFA-CR
**E** 5UFA-CT
5UFA-CR
**F** 3UFA-CT
3UFA-CR




| | 3UFA-CR<br>3UFA-CT | 5UFA-CR<br>5UFA-CT | 8UFA-CR<br>8UFA-CT | 10UFA-CR<br>10UFA-CT | 15UFA-CR<br>15UFA-CT | 20UFA-CR<br>20UFA-CT |
|---|---|---|---|---|---|---|
| Nominal power output (W/m at 10°C) | 9 | 16 | 25 | 29 | 50 | 66 |

## PRODUCT DIMENSIONS (NOMINAL) AND WEIGHT

| | | | | | | |
|---|---|---|---|---|---|---|
| Thickness (mm) | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| Width (mm) | 10.5 | 10.5 | 15.4 | 15.4 | 15.4 | 15.4 |
| Weight (g/m) | 110 | 110 | 153 | 153 | 153 | 153 |

## MAXIMUM CIRCUIT LENGTH BASED ON TYPE 'C' CIRCUIT BREAKERS ACCORDING TO EN 60898

| Electrical protection sizing | Start-up temperature | Maximum heating cable length per circuit (m) | | | | | |
|---|---|---|---|---|---|---|---|
| 16 A | –20°C | 155 | 110 | 70 | 45 | 34 | 25 |
| | +10°C | 200 | 160 | 110 | 65 | 50 | 38 |
| 20 A | –20°C | 195 | 140 | 90 | 55 | 41 | 30 |
| | +10°C | 200 | 160 | 125 | 85 | 70 | 55 |
| 25 A | –20°C | 200 | 160 | 110 | 70 | 55 | 30 |
| | +10°C | 200 | 160 | 125 | 105 | 85 | 70 |
| 32 A | –20°C | 200 | 160 | 125 | 90 | 75 | 60 |
| | +10°C | 200 | 160 | 125 | 110 | 90 | 75 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Part description | 3UFA-CR | 5UFA-CR | 8UFA-CR | 10UFA-CR | 15UFA-CR | 20UFA-CR |
| Part No. | 2000-001 | 2000-003 | 2000-005 | 2000-007 | 2000-009 | 2000-0011 |
| Part description | 3UFA-CT | 5UFA-CT | 8UFA-CT | 10UFA-CT | 15UFA-CT | 20UFA-CT |
| Part No. | 2000-002 | 2000-004 | 2000-006 | 2000-008 | 2000-010 | 2000-012 |

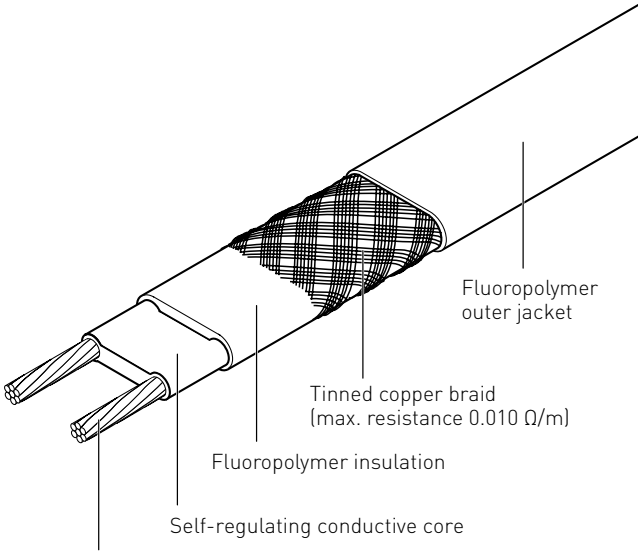
## COMPONENTS

SANTO offers a full range of components for power connections, splices and end seals. These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

# SANTO UFB

## SELF-REGULATING HEATING CABLE

### HEATING CABLE CONSTRUCTION




1.4 mm² nickel plated copper conductors (10 and 15UFB-CT)
2.3 mm² nickel plated copper conductors (20UFB-CT)

Electrical heat-tracing for process temperature maintenance applications up to 110°C which are not subject to steam cleaning.

The UFB family of self-regulating, parallel circuit heating cables is used for process temperature maintenance of pipes and vessels.

It can also be used for frost protection of large pipes and for applications requiring medium temperature exposure capability.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust)<br>Ordinary |
| Traced surface type | Carbon steel<br>Stainless steel<br>Painted or unpainted metal |
| Chemical resistance | Organics and corrosives<br>For aggressive organics and corrosives consult your local SANTO representative |

### SUPPLY VOLTAGE

| | |
|---|---|
| | 230 Vac |

### APPROVALS

| | |
|---|---|
| | The UFB heating cables are approved for use in hazardous areas by PTB and Baseefa Ltd.<br>The UFB heating cables are approved by DNV for use on ships and mobile offshore units. |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local SANTO representative. |

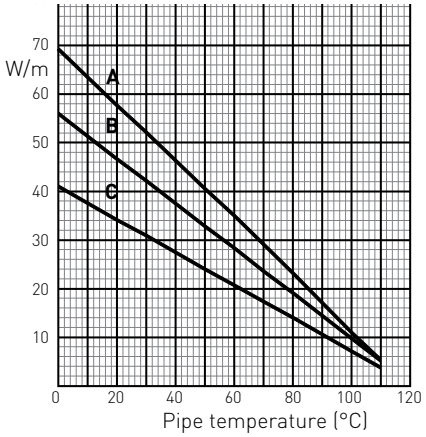
## SPECIFICATIONS

| | |
|---|---|
| Maximum maintain or continuous exposure temperature (power on/off) | 110°C |
| Maximum intermittent exposure temperature (power on/off) | 110°C |
| Temperature classification | T4 |
| Minimum installation temperature | –60°C |
| Minimum bend radius | at 20°C: 13 mm<br>at –60°C: 35 mm |

## THERMAL OUTPUT RATING

Nominal power output at 230 Vac on insulated steel pipes

**A** **20UFB-CT**
**B** **15UFB-CT**
**C** **10UFB-CT**




| | 10UFB-CT | 15UFB-CT | 20UFB-CT |
|---|---|---|---|
| Nominal power output (W/m at 10°C) | 33 | 50 | 66 |

## PRODUCT DIMENSIONS (NOMINAL) AND WEIGHT

| | | | |
|---|---|---|---|
| Thickness (mm) | 4.8 | 4.8 | 4.8 |
| Width (mm) | 12.5 | 12.5 | 12.5 |
| Weight (g/m) | 126 | 126 | 126 |

## MAXIMUM CIRCUIT LENGTH BASED ON TYPE 'C' CIRCUIT BREAKERS ACCORDING TO EN 60898

| Electrical protection sizing | Start-up temperature | Maximum heating cable length per circuit (m) | | |
|---|---|---|---|---|
| 16 A | –20°C | 65 | 63 | 47 |
| | +10°C | 80 | 63 | 47 |
| 25 A | –20°C | 95 | 75 | 60 |
| | +10°C | 115 | 95 | 75 |
| 32 A | –20°C | 115 | 100 | 75 |
| | +10°C | 115 | 100 | 95 |
| 40 A | –20°C | 115 | 100 | 95 |
| | +10°C | 115 | 100 | 115 |

| Part description | 10UFB-CT | 15UFB-CT | 20UFB-CT |
|---|---|---|---|
| Part No. | 2000-009 | 2000-010 | 2000-011 |

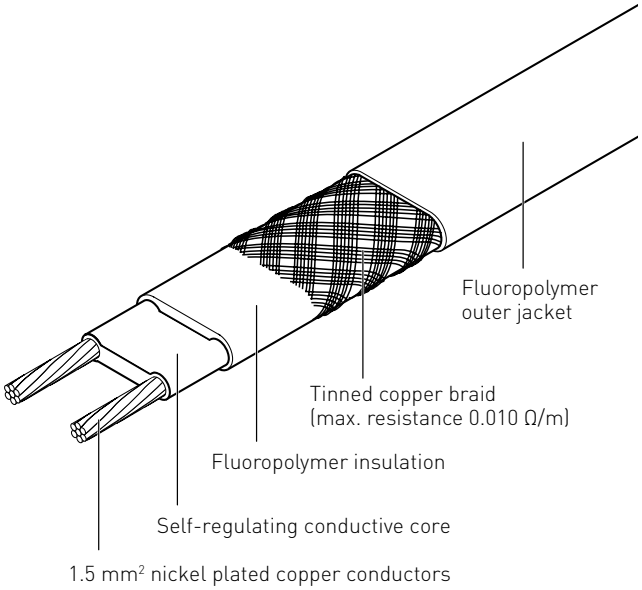
## COMPONENTS

SANTO offers a full range of components for power connections, splices and end seals.
These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

# SANTO UFC

## SELF-REGULATING HEATING CABLE

### HEATING CABLE CONSTRUCTION




Electrical heat-tracing for process temperature maintenance applications up to 150°C which may be subject to steam cleaning.

The UFC family of self-regulating, parallel circuit heating cables is used for process temperature maintenance of pipes and vessels.

It can also be used for frost protection of large pipes and for applications requiring high temperature exposure capability.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust)<br>Ordinary |
| Traced surface type | Carbon steel<br>Stainless steel<br>Painted or unpainted metal |
| Chemical resistance | Organics and corrosives<br>For aggressive organics and corrosives consult your local SANTO representative |

### SUPPLY VOLTAGE

| | |
|---|---|
| | 230 Vac |

### APPROVALS

| | |
|---|---|
| | The UFC heating cables are approved for use in hazardous areas by PTB and Baseefa Ltd.<br><br>The UFC heating cables are approved by DNV for use on ships and mobile offshore units. |
| | EAC (or Russia, Kazakhstan, Belarus)<br>For other countries contact your local SANTO representative. |

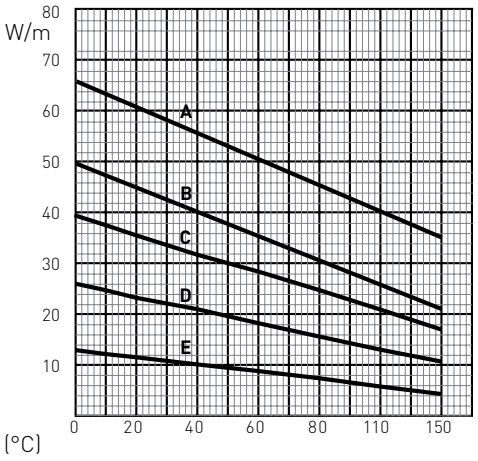
## SPECIFICATIONS

| | |
|---|---|
| Maximum maintain or continuous exposure temperature (power on) | 150°C |
| Maximum intermittent exposure temperature (power on/off) | 200°C (*)<br>Maximum cumulative exposure 1000 hours<br>(*) The 250°C rating applies to all products printed "MAX INTERMITTENT EXPOSURE 250C". |
| Temperature classification | T2: 20UFC-CT<br>T3: 4UFC-CT 8UFC-CT 10UFC-CT 15UFC-CT |
| Based on systems approach* | T3-T6 |
| Minimum installation temperature | –60°C |
| Minimum bend radius | at 20°C: 13 mm<br>at –60°C: 51 mm |

## THERMAL OUTPUT RATING

Nominal power output at 230 Vac on insulated steel pipes

**A** 20UFC-CT
**B** 15UFC-CT
**C** 12UFC-CT
**D** 8UFC-CT
**E** 4UFC-CT




| | 4UFC-CT | 8UFC-CT | 12UFC-CT | 15UFC-CT | 20UFC-CT |
|---|---|---|---|---|---|
| Nominal power output (W/m at 10°C) | 13 | 26 | 40 | 50 | 66 |

## PRODUCT DIMENSIONS (NOMINAL) AND WEIGHT

| | | | | | |
|---|---|---|---|---|---|
| Thickness (mm) | 4.5 | 4.5 | 4.8 | 4.8 | 4.8 |
| Width (mm) | 12.5 | 12.5 | 11.7 | 11.7 | 11.7 |
| Weight (g/m) | 130 | 130 | 130 | 130 | 130 |

## MAXIMUM CIRCUIT LENGTH BASED ON TYPE 'C' CIRCUIT BREAKERS ACCORDING TO EN 60898

| Electrical protection sizing | Start-up temperature | Maximum heating cable length per circuit (m) | | | | |
|---|---|---|---|---|---|---|
| 16 A | –20°C | 95 | 63 | 45 | 38 | 28 |
| | +10°C | 101 | 73 | 52 | 42 | 31 |
| 25 A | –20°C | 110 | 95 | 73 | 59 | 45 |
| | +10°C | 121 | 101 | 84 | 63 | 49 |
| 32 A | –20°C | 121 | 105 | 85 | 73 | 56 |
| | +10°C | 121 | 105 | 90 | 78 | 63 |
| 40 A | –20°C | 121 | 105 | 90 | 80 | 68 |
| | +10°C | 121 | 105 | 90 | 80 | 68 |

## ORDERING DETAILS

| Part description | 4UFC-CT | 8UFC-CT | 12UFC-CT | 15UFC-CT | 20UFC-CT |
|---|---|---|---|---|---|
| Part No. | 2000-012 | 2000-013 | 2000-014 | 2000-015 | 2000-016 |

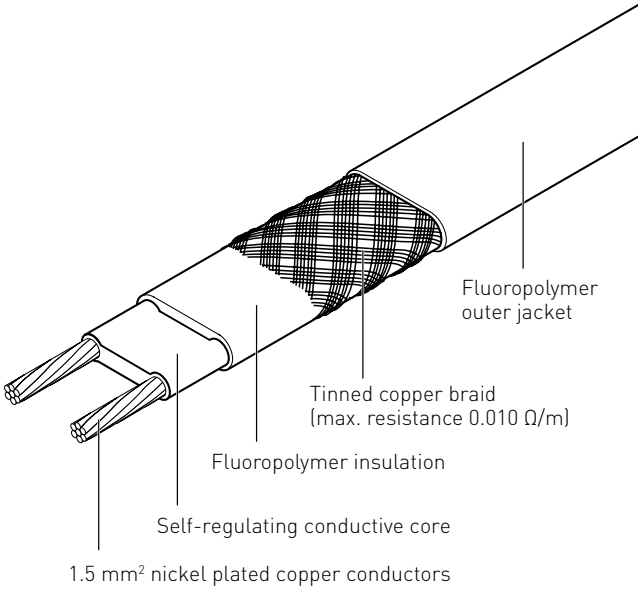
## COMPONENTS

SANTO offers a full range of components for power connections, splices and end seals.
These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

# SANTO UFO

## SELF-REGULATING HEATING CABLE

### HEATING CABLE CONSTRUCTION




Electrical heat-tracing for process temperature maintenance applications up to 150°C /200°Cwhich may be subject to steam cleaning.

The UFO family of self-regulating, parallel circuit heating cables is used for process temperature maintenance of pipes and vessels.

It can also be used for frost protection of large pipes and for applications requiring high temperature exposure capability.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust)<br>Ordinary |
| Traced surface type | Carbon steel<br>Stainless steel<br>Painted or unpainted metal |
| Chemical resistance | Organics and corrosives<br>For aggressive organics and corrosives consult your local SANTO representative |

### SUPPLY VOLTAGE

| | |
|---|---|
| | 230 Vac |

### APPROVALS

| | |
|---|---|
| | The UFO heating cables are approved for use in hazardous areas by PTB and Baseefa Ltd.<br><br>The UFO heating cables are approved by DNV for use on ships and mobile off shore units. |

EAC For Russia, Kazakhstan, Belarus.
For other countries contact your local SANTO representative.

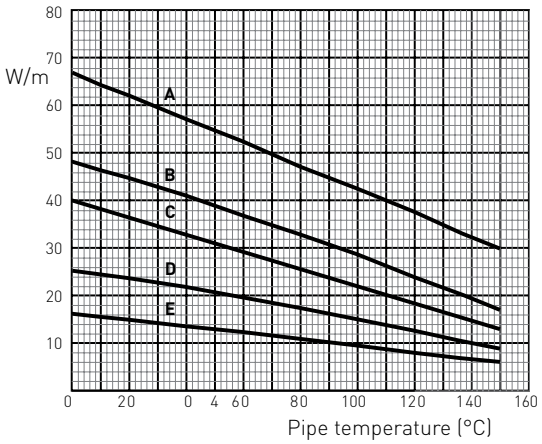
## SPECIFICATIONS

| | |
|---|---|
| Maximum maintain or continuous exposure temperature (power on) | 150°C/200°C |
| Maximum intermittent exposure temperature (power on/off) | 205°C/250°C (*)<br>Maximum cumulative exposure 1000 hours<br>(*) The 250°C rating applies to all products printed "MAX INTERMITTENT EXPOSURE 250C". |
| Temperature classification | T2 |
| Based on systems approach* | T3-T6 |
| Minimum installation temperature | –60°C |
| Minimum bend radius | at 20°C: 26 mm<br>at –60°C: 51 mm |

## THERMAL OUTPUT RATING

Nominal power output at 230 Vac on insulated steel pipes

**A** 20UFO-CT
**B** 15UFO-CT
**C** 12UFO-CT
**D** 8UFO-CT
**E** 5UFO-CT




| | 5UFO-CT | 8UFO-CT | 12UFO-CT | 15UFO-CT | 20UFO-CT |
|---|---|---|---|---|---|
| Nominal power output (W/m at 10°C) | 17 | 26 | 40 | 50 | 66 |

## PRODUCT DIMENSIONS (NOMINAL) AND WEIGHT

| | | | | | |
|---|---|---|---|---|---|
| Thickness (mm) | 5.2 | 5.2 | 5.2 | 5.2 | 5.2 |
| Width (mm) | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 |
| Weight (g/m) | 150 | 150 | 150 | 150 | 150 |

## MAXIMUM CIRCUIT LENGTH BASED ON TYPE 'C' CIRCUIT BREAKERS ACCORDING TO EN 60898

| Electrical protection sizing | Start-up temperature | Maximum heating cable length per circuit (m) | | | | |
|---|---|---|---|---|---|---|
| 16 A | –20°C | 71 | 66 | 54 | 42 | 28 |
| | +10°C | 85 | 73 | 59 | 45 | 31 |
| 25 A | –20°C | 107 | 78 | 70 | 63 | 45 |
| | +10°C | 121 | 86 | 78 | 70 | 52 |
| 32 A | –20°C | 121 | 95 | 85 | 75 | 59 |
| | +10°C | 121 | 95 | 87 | 80 | 70 |
| 40 A | –20°C | 121 | 95 | 87 | 80 | 73 |
| | +10°C | 121 | 95 | 87 | 80 | 77 |

## ORDERING DETAILS

| Part description | 5UFO-CT | 8UFO-CT | 15UFO-CT | 20UFO-CT |
|---|---|---|---|---|
| Part No. | 2000-017 | 2000-018 | 2000-019 | 2000-020 |

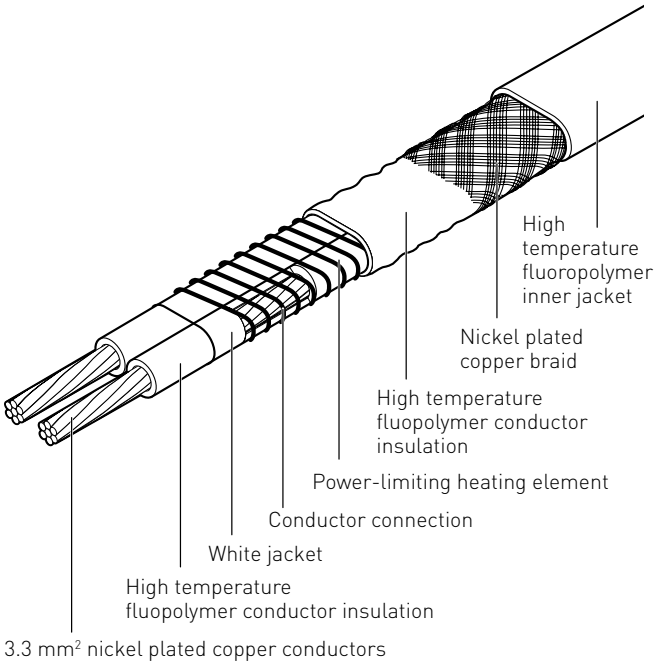
## COMPONENTS

SANTO offers a full range of components for power connections, splices and end seals.
These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

# SANTO ACC

## HIGH-TEMPERATURE POWER-LIMITING HEATING CABLE

### HEATING CABLE CONSTRUCTION




ACC is a family of power limiting heating cables designed for pipe and equipment heat-tracing in industrial applications.

ACC can be used for frost protection and process temperature maintenance requiring high power output and/or high temperature exposure. ACC can provide process temperature maintenance up to 230°C (depending on cable type) and can withstand routine steam purges and temperature exposure to 260°C with power off.

Power-limiting cables are parallel heaters formed by a coiled resistor alloy heating element wrapped around two parallel conductors. The distance between conductor contact points forms the heating zone length. This parallel construction allows it to be cut-to-length and terminated on-site. The power output of ACC heating cables decreases with increasing temperature. ACC heating cables can be overlapped once. The relatively flat power temperature curve of ACC ensures a low start-up current and high output at elevated temperatures. ACC cables are approved for use in hazardous areas. Approvals are listed below.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust) Ordinary |
| Traced surface type | Carbon steel<br>Stainless steel<br>Painted or unpainted metal |
| Chemical resistance | Organics and corrosives<br>For aggressive organics and corrosives consult your local SANTO representative |

### SUPPLY VOLTAGE

| | |
|---|---|
| | ACC2:208-277Vac<br>ACC4:400-480Vac |

### APPROVALS

| | |
|---|---|
| | The ACC heating cables are approved for use in hazardous areas by Baseefa Ltd.<br><br>The ACC heating cables are approved by DNV for use on ships and mobile off-shore units. |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local SANTO representative. |

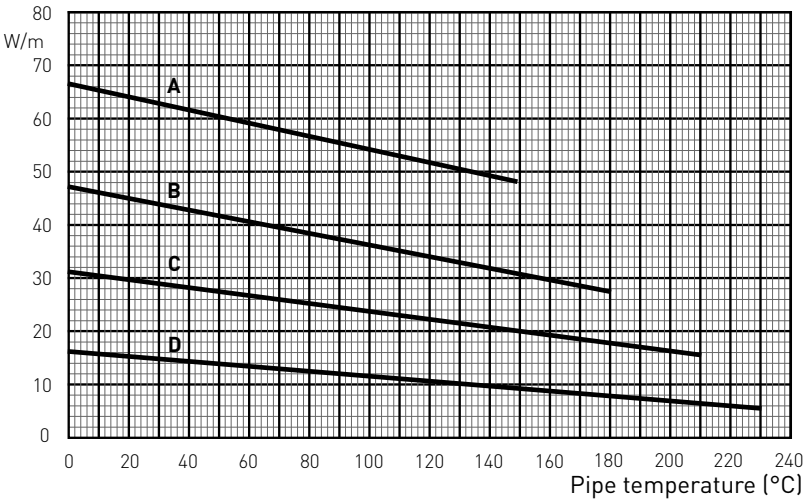
## SPECIFICATIONS

| | Cable | 208 V | 230 V | 254 V | 277 V | 400 V | 480 V |
|---|---|---|---|---|---|---|---|
| Maximum maintain or continuous exposure temperature (power on) | 5ACC2-CT | 235°C | 230°C | 225°C | 225°C | – | – |
| | 10ACC2-CT | 220°C | 210°C | 200°C | 195°C | – | – |
| | 15ACC2-CT | 200°C | 180°C | 145°C | 105°C | – | – |
| | 20ACC2-CT | 150°C | 150°C | – | – | – | – |
| | 5ACC4-CT | – | – | – | – | 230°C | 230°C |
| | 10ACC4-CT | – | – | – | – | 215°C | 205°C |
| | 15ACC4-CT | – | – | – | – | 195°C | 160°C |
| | 20ACC4-CT | – | – | – | – | 150°C | 150°C |
| Maximum continuous exposure temperature (power off) | 260°C | | | | | | |
| Temperature classification | To be established using the principles of stabilized design or the use of a temperature limiting device. | | | | | | |
| Minimum installation temperature | –60°C | | | | | | |
| Minimum bend radius | at –60°C: 20 mm \| at +20°C: 20 mm | | | | | | |
| Minimum clearance | 15mm | | | | | | |

## THERMAL OUTPUT RATING

Nominal power output rating on insulated steel pipes at 240 V and 480 V (power output of ACC4 at 400 V will be lower)

**A** 20ACC-CT
**B** 15ACC-CT
**C** 10ACC-CT
**D** 5ACC-CT




To choose the correct heating cable for your application use the TraceCalc design software.

## ADJUSTMENT FACTORS

| | | 5ACC2-CT | 10ACC2-CT | 15ACC2-CT | 20ACC2-CT |
|---|---|---|---|---|---|
| 254 V | Power output | 1.20 | 1.19 | 1.19 | Not allowed |
| | Circuit length | 1.05 | 1.04 | 1.04 | Not allowed |
| 277 V | Power output | 1.30 | 1.28 | 1.26 | Not allowed |
| | Circuit length | 1.13 | 1.11 | 1.09 | Not allowed |
| | | **5ACC4-CT** | **10ACC4-CT** | **15ACC4-CT** | **20ACC4-CT** |
| 400 V | Power output | 0.72 | 0.73 | 0.74 | 0.75 |
| | Circuit length | 0.86 | 0.87 | 0.89 | 0.90 |

| **Nominal power output (W/m at 10°C)** | **5ACC$_X$-CT** | **10ACC$_X$-CT** | **15ACC$_X$-CT** | **20ACC$_X$-CT** |
|---|---|---|---|---|
| ACC2 at 230 V | 15 | 30 | 45 | 61 |
| ACC2 at 240 V/ACC4 at 480 V | 16 | 33 | 49 | 65 |
| ACC4 at 400 V | 12 | 24 | 36 | 49 |

## PRODUCT DIMENSIONS (NOMINAL) AND WEIGHT

| | | | | |
|---|---|---|---|---|
| Thickness (mm) | 7.5 | 7.5 | 7.5 | 7.5 |
| Width (mm) | 10.7 | 10.7 | 10.7 | 10.7 |
| Nominal cold lead/ heating zone length (m) | 1.2 (ACC2) | 0.9 (ACC2) | 0.6 (ACC2) | 0.5 (ACC2) |
| | 2.4 (ACC4) | 1.7 (ACC4) | 1.3 (ACC4) | 1.1 (ACC4) |
| Weight (g/m) | 180 | 180 | 180 | 180 |

## MAXIMUM CIRCUIT LENGTH BASED ON TYPE 'C' CIRCUIT BREAKERS ACCORDING TO EN 60898

| ACC2 at 230 V | | 5ACC2-CT | 10ACC2-CT | 15ACC2-CT | 20ACC2-CT |
|---|---|---|---|---|---|
| **Electrical protection sizing** | **Start-up temperature** | **Maximum heating cable length per circuit (m) at 230 Vac** | | | |
| 16 A | –20°C | 195 | 100 | 70 | 50 |
| | +10°C | 215 | 110 | 75 | 55 |
| 25 A | –20°C | 220* | 155* | 105 | 80 |
| | +10°C | 220* | 155* | 115 | 85 |
| 32 A | –20°C | 220* | 155* | 130* | 100 |
| | +10°C | 220* | 155* | 130* | 110* |
| 40 A | –20°C | 220* | 155* | 130* | 110* |
| | +10°C | 220* | 155* | 130* | 110* |

| ACC4 at 480 V and 400 V | | 5ACC4-CT | 10ACC4-CT | 15ACC4-CT | 20ACC4-CT |
|---|---|---|---|---|---|
| **Electrical protection sizing** | **Start-up temperature** | **Maximum heating cable length per circuit (m) at 480 Vac and (at 400 Vac)** | | | |
| 16 A | –20°C | 390 (335) | 195 (170) | 130 (115) | 100 (90) |
| | +10°C | 425 (365) | 210 (185) | 140 (125) | 105 (95) |
| 25 A | –20°C | 450* (450) | 310 (265) | 205 (185) | 155 (140) |
| | +10°C | 450* (450) | 320* (290) | 220 (195) | 165 (150) |
| 32 A | –20°C | 450* (450) | 320* (320) | 260* (235) | 200 (180) |
| | +10°C | 450* (450) | 320* (320) | 260* (250) | 210 (190) |
| 40 A | –20°C | 450* (450) | 320* (320) | 260* (260) | 225* (225) |
| | +10°C | 450* (450) | 320* (320) | 260* (260) | 225* (225) |

## ORDERING DETAILS

| | | | | |
|---|---|---|---|---|
| Part description | 5ACC2-CT | 10ACC2-CT | 15ACC2-CT | 20ACC2-CT |
| Part No. | 2000-021 | 2000-022 | 2000-023 | 2000-024 |
| Part description | 5ACC4-CT | 10ACC4-CT | 15ACC4-CT | 20ACC4-CT |
| Part No. | 2000-025 | 2000-026 | 2000-027 | 2000-028 |

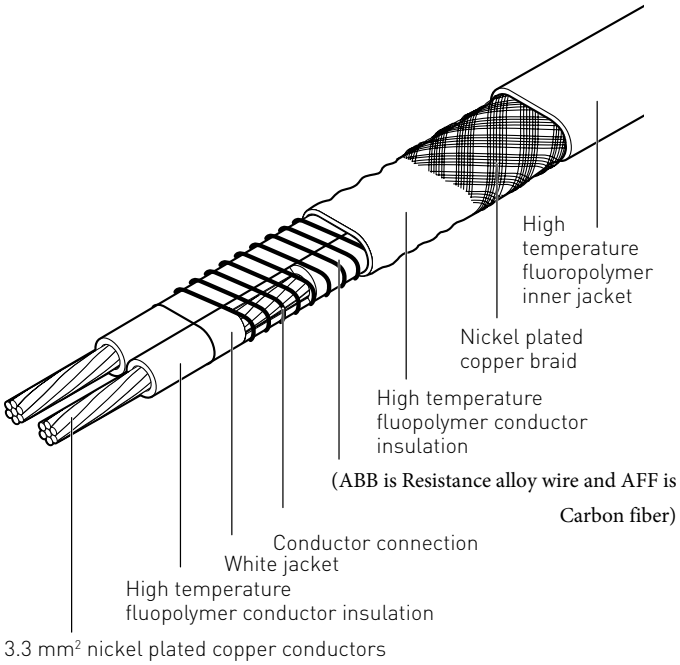
## COMPONENTS

SANTO offers a full range of components for power connections, splices and end seals.
These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

# ABB/AFF

## HIGH-Constant power heating cables in parallel

### HEATING CABLE CONSTRUCTION




ABB/AFF is a family of Constant power heating cables designed for pipe and equipment heat-tracing in industrial applications.

ABB/AFF can be used for frost protection and process temperature maintenance requiring high power output and/or high temperature exposure. ABB/AFF can provide process temperature maintenance up to 230°C (depending on cable type) and can withstand routine steam purges and temperature exposure to 260°C with power off.

Constant power heating cables are parallel heaters formed by a coiled resistor alloy or Carbon fiber heating element wrapped around
two parallel conductors. The distance between conductor contact points forms the heating zone length. This parallel construction allows it to be cut-to-length and terminated on-site. The power output of ABB/AFF heating cables decreases with increasing temperature. ABB/AFF heating cables can be overlapped once. The relatively flat power temperature curve of ABB ensures a low start-up current and high output at elevated temperatures. ABB/AFF cables are approved for use in hazardous areas. Approvals are listed below.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust) Ordinary |
| Traced surface type | Carbon steel<br>Stainless steel<br>Painted or unpainted metal |
| Chemical resistance | Organics and corrosives<br>For aggressive organics and corrosives consult your local SANTO representative |

### SUPPLY VOLTAGE

ABB2/AFF2:208-277Vac
ABB4/AFF4:400-480Vac

### APPROVALS

The ABB/AFF heating cables are approved for use in hazardous areas by Baseefa Ltd.

The ABB/AFF heating cables are approved by DNV for use on ships and mobile off-shore units.

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local SANTO representative.

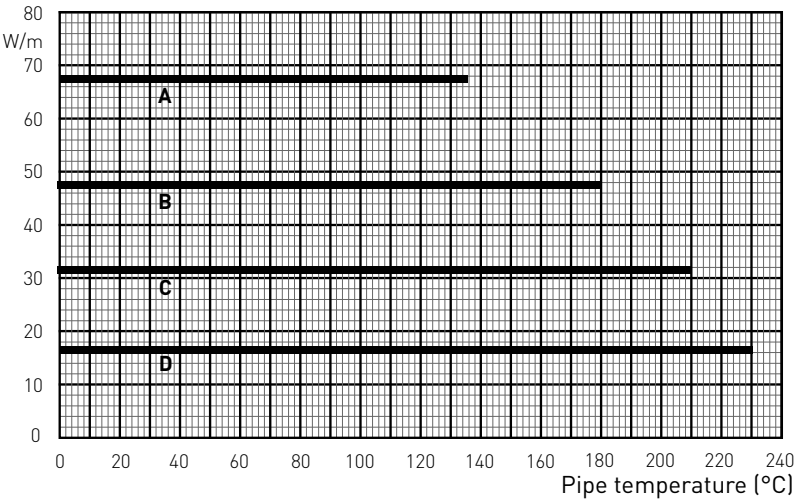
## SPECIFICATIONS

| | Cable | 208 V | 230 V | 254 V | 277 V | 400 V | 480 V |
|---|---|---|---|---|---|---|---|
| Maximum maintain or continuous exposure temperature (power on) | 5ABB2/AFF2-CT | 235°C | 230°C | 225°C | 225°C | – | – |
| | 10ABB2/AFF2-CT | 220°C | 210°C | 200°C | 195°C | – | – |
| | 15ABB2/AFF2-CT | 200°C | 180°C | 145°C | 105°C | – | – |
| | 20ABB2/AFF2-CT | 150°C | 150°C | – | – | – | – |
| | 5ABB4/AFF4-CT | – | – | – | – | 230°C | 230°C |
| | 10ABB4/AFF4-CT | – | – | – | – | 215°C | 205°C |
| | 15ABB4/AFF4-CT | – | – | – | – | 195°C | 160°C |
| | 20ABB4/AFF4-CT | – | – | – | – | 150°C | 150°C |
| Maximum continuous exposure temperature (power off) | 260°C | | | | | | |
| Temperature classification | To be established using the principles of stabilized design or the use of a temperature limiting device. | | | | | | |
| Minimum installation temperature | –60°C | | | | | | |
| Minimum bend radius | at –60°C: 20 mm \| at +20°C: 20 mm | | | | | | |
| Minimum clearance | 15mm | | | | | | |

## THERMAL OUTPUT RATING

Nominal power output rating on insulated steel pipes at 240 V and 480 V (power output of ABB4/AFF at 400 V will be lower)

**A** 20ABB/AFF-CT
**B** 15ABB/AFF-CT
**C** 10ABB/AFF-CT
**D** 5ABB/AFF-CT




## ADJUSTMENT FACTORS

| | | 5ABB2/AFF2-CT | 10ABB2/AFF2-CT | 15ABB2/AFF2-CT | 20ABB2/AFF2-CT |
|---|---|---|---|---|---|
| 254 V | Power output | 1.20 | 1.19 | 1.19 | Not allowed |
| | Circuit length | 1.05 | 1.04 | 1.04 | Not allowed |
| 277 V | Power output | 1.30 | 1.28 | 1.26 | Not allowed |
| | Circuit length | 1.13 | 1.11 | 1.09 | Not allowed |
| | | **5ABB4/AFF4-CT** | **10ABB4/AFF4-CT** | **15ABB4/AFF4-CT** | **20ABB4/AFF4-CT** |
| 400 V | Power output | 0.72 | 0.73 | 0.74 | 0.75 |
| | Circuit length | 0.86 | 0.87 | 0.89 | 0.90 |

| **Nominal power output (W/m at 10°C)** | **5ABB$_X$/AFF$_X$-CT** | **10ABB$_X$/AFF$_X$-CT** | **15ABB$_X$/AFF$_X$-CT** | **20ABB$_X$/AFF$_X$-CT** |
|---|---|---|---|---|
| ABB2/AFF2 at 230 V | 15 | 30 | 45 | 61 |
| ABB2/AFF2 at 240 V/ABB4/ABB4 at 480 V | 16 | 33 | 49 | 65 |
| ABB4/AFF4 at 400 V | 12 | 24 | 36 | 49 |

## PRODUCT DIMENSIONS (NOMINAL) AND WEIGHT

| | | | | |
|---|---|---|---|---|
| Thickness (mm) | 7.5 | 7.5 | 7.5 | 7.5 |
| Width (mm) | 10.7 | 10.7 | 10.7 | 10.7 |
| Nominal cold lead/ heating zone length (m) | 1.2 (ACC2)<br>2.4 (ACC4) | 0.9 (ACC2)<br>1.7 (ACC4) | 0.6 (ACC2)<br>1.3 (ACC4) | 0.5 (ACC2)<br>1.1 (ACC4) |
| Weight (g/m) | 180 | 180 | 180 | 180 |

## MAXIMUM CIRCUIT LENGTH BASED ON TYPE 'C' CIRCUIT BREAKERS ACCORDING TO EN 60898

| ABB2/AFF2 at 230 V | | 5ABB2/AFF2-CT | 10ABB2/AFF2-CT | 15ABB2/AFF2-CT | 20ABB2/AFF2-CT |
|---|---|---|---|---|---|
| Electrical protection sizing | Start-up temperature | Maximum heating cable length per circuit (m) at 230 Vac | | | |
| 16 A | –20°C | 195 | 100 | 70 | 50 |
| | +10°C | 215 | 110 | 75 | 55 |
| 25 A | –20°C | 220* | 155* | 105 | 80 |
| | +10°C | 220* | 155* | 115 | 85 |
| 32 A | –20°C | 220* | 155* | 130* | 100 |
| | +10°C | 220* | 155* | 130* | 110* |
| 40 A | –20°C | 220* | 155* | 130* | 110* |
| | +10°C | 220* | 155* | 130* | 110* |

| ABB4/AFF4 at 480 V and 400 V | | 5ABB4/AFF4-CT | 10ABB4/AFF4-CT | 15ABB4/AFF4-CT | 20ABB4/AFF4-CT |
|---|---|---|---|---|---|
| Electrical protection sizing | Start-up temperature | Maximum heating cable length per circuit (m) at 480 Vac and (at 400 Vac) | | | |
| 16 A | –20°C | 390 (335) | 195 (170) | 130 (115) | 100 (90) |
| | +10°C | 425 (365) | 210 (185) | 140 (125) | 105 (95) |
| 25 A | –20°C | 450* (450) | 310 (265) | 205 (185) | 155 (140) |
| | +10°C | 450* (450) | 320* (290) | 220 (195) | 165 (150) |
| 32 A | –20°C | 450* (450) | 320* (320) | 260* (235) | 200 (180) |
| | +10°C | 450* (450) | 320* (320) | 260* (250) | 210 (190) |
| 40 A | –20°C | 450* (450) | 320* (320) | 260* (260) | 225* (225) |
| | +10°C | 450* (450) | 320* (320) | 260* (260) | 225* (225) |

## ORDERING DETAILS

| | | | | |
|---|---|---|---|---|
| Part description | 5ABB2-CT | 10ABB2-CT | 15ABB2-CT | 20ABB2-CT |
| Part No. | 2000-029 | 2000-030 | 2000-031 | 2000-032 |
| Part description | 5ABB4-CT | 10ABB4-CT | 15ABB4-CT | 20ABB4-CT |
| Part No. | 2000-033 | 2000-034 | 2000-035 | 2000-036 |
| Part description | 5AFF2-CT | 10AFF2-CT | 15AFF2-CT | 20AFF2-CT |
| Part No. | 2000-037 | 2000-038 | 2000-039 | 2000-040 |
| Part description | 5AFF4-CT | 10AFF4-CT | 15AFF4-CT | 20AFF4-CT |
| Part No. | 2000-041 | 2000-042 | 2000-043 | 2000-044 |

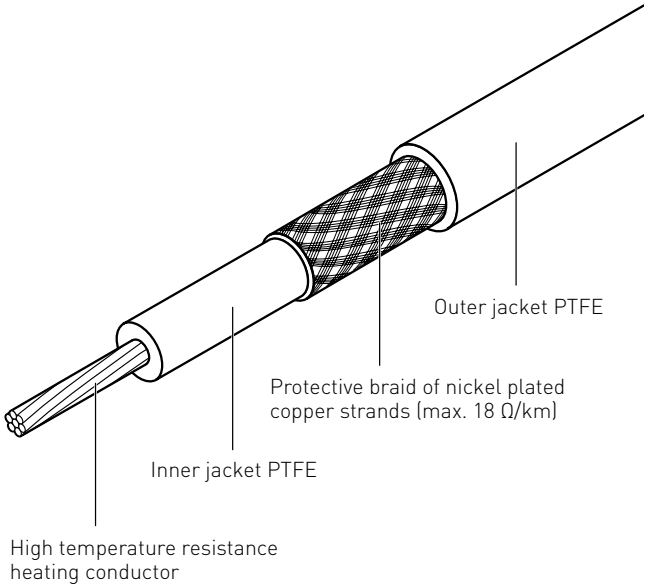
## COMPONENTS

SANTO offers a full range of components for power connections, splices and end seals.
These components must be used to ensure proper functioning of the product and compliance with electrical requirements.

# SANTO XPI-NH

## POLYMER INSULATED (PI) SERIES RESISTANCE HEATING CABLE FOR USE IN NON-HAZARDOUS AREAS

### HEATING CABLE CONSTRUCTION




XPI-NH is a polymer insulated (PI) series heating cable, for use in non-hazardous areas. It has been designed for use in freeze protection and temperature maintenance applications of pipes, tanks and other equipment. XPI-NH offers an economical solution for a wide variety of heat-tracing applications in non-hazardous areas, in particular for pipe lengths beyond the maximum circuit lengths of parallel heating cables.

The selection of PTFE for the inner and outer insulation makes XPI-NH a safe and reliable product. It provides highest chemical withstand and good mechanical strength, in particular at elevated temperatures.

XPI-NH heating cables can be used for temperatures up to 260°C. The heating cable is easy to install and has printed meter-marks. SANTO offers XPI-NH heating cables in a very wide range of resistances, starting from 0.8 Ω/km up to 8000 Ω/km as well as a complete range of components for connection and splicing of the cables.

### APPLICATION

| | |
|---|---|
| Area classification | Ordinary areas |
| Chemical resistance | Organics and corrosives |

### TECHNICAL DATA

| | |
|---|---|
| Max. exposure temperature | 260°C (power off, continuous) |
| Min. installation temperature | –60°C |
| Min. bend radius | 2.5 x cable diameter at –25°C<br>6 x cable diameter at –60°C |
| Min. clearance | 20 mm between heating cables |
| Max. power output | 25 W/m (typical value, depending on application) |
| Nominal voltage | Up to 300/500 Vac ($U_0$/U) |

## XPI-NH HEATING CABLE REFERENCES

| Order Reference | Nominal resistance [Ω/km @ 20°C] | Temp. coefficient [x $10^{-3}$/ K] | Outer diameter [mm nom.] | Nom. weight [kg/km] | Part Number PN |
|---|---|---|---|---|---|
| XPI-NH-0.8 | 0.8 | 4.3 | 11.5 | 388 | 2000-045 |
| XPI-NH-1.1 | 1.1 | 4.3 | 9.7 | 284 | 2000-046 |
| XPI-NH-1.8 | 1.8 | 4.3 | 8.2 | 196 | 2000-047 |
| XPI-NH-2.9 | 2.9 | 4.3 | 6.5 | 127 | 2000-048 |
| XPI-NH-4.4 | 4.4 | 4.3 | 5.5 | 89 | 2000-049 |
| XPI-NH-7 | 7.0 | 4.3 | 4.9 | 65 | 2000-050 |
| XPI-NH-10 | 10.0 | 4.3 | 4.4 | 52 | 2000-051 |
| XPI-NH-11.7 | 11.7 | 4.3 | 4.2 | 48 | 2000-052 |
| XPI-NH-15 | 15.0 | 4.3 | 4.1 | 44 | 2000-053 |
| XPI-NH-17.8 | 17.8 | 4.3 | 3.9 | 42 | 2000-054 |
| XPI-NH-25 | 25.0 | 3.0 | 3.9 | 42 | 2000-055 |
| XPI-NH-31.5 | 31.5 | 1.3 | 4.3 | 50 | 2000-056 |
| XPI-NH-50 | 50 | 1.3 | 3.9 | 42 | 2000-057 |
| XPI-NH-65 | 65 | 1.3 | 3.8 | 38 | 2000-058 |
| XPI-NH-80 | 80 | 0.7 | 4.1 | 44 | 2000-059 |
| XPI-NH-100 | 100 | 0.4 | 4.2 | 48 | 2000-060 |
| XPI-NH-150 | 150 | 0.4 | 3.9 | 42 | 2000-061 |
| XPI-NH-180 | 180 | 0.33 | 3.7 | 36 | 2000-062 |
| XPI-NH-200 | 200 | 0.40 | 3.8 | 38 | 2000-063 |
| XPI-NH-320 | 320 | 0.18 | 3.9 | 40 | 2000-064 |
| XPI-NH-380 | 380 | 0.18 | 3.8 | 38 | 2000-065 |
| XPI-NH-480 | 480 | 0.18 | 3.7 | 36 | 2000-066 |
| XPI-NH-600 | 600 | 0.18 | 3.5 | 34 | 2000-067 |
| XPI-NH-700 | 700 | 0.18 | 3.5 | 32 | 2000-068 |
| XPI-NH-810 | 810 | 0.04 | 3.6 | 35 | 2000-069 |
| XPI-NH-1000 | 1000 | 0.04 | 3.5 | 34 | 2000-070 |
| XPI-NH-1440 | 1440 | 0.04 | 3.4 | 31 | 2000-071 |
| XPI-NH-1750 | 1750 | 0.04 | 3.4 | 30 | 2000-072 |
| XPI-NH-2000 | 2000 | 0.35 | 3.6 | 34 | 2000-073 |
| XPI-NH-3000 | 3000 | 0.35 | 3.4 | 31 | 2000-074 |
| XPI-NH-4000 | 4000 | 0.35 | 3.4 | 30 | 2000-075 |
| XPI-NH-4400 | 4400 | 0.1 | 3.4 | 30 | 2000-076 |
| XPI-NH-5160 | 5160 | 0.1 | 3.4 | 30 | 2000-077 |
| XPI-NH-5600 | 5600 | 0.1 | 3.4 | 30 | 2000-078 |
| XPI-NH-7000 | 7000 | 0.1 | 3.4 | 30 | 2000-079 |
| XPI-NH-8000 | 8000 | 0.1 | 3.4 | 30 | 2000-080 |

Resistance tolerance: +10/–5%
In particular for cables < 31.5 Ω/km the resistance of the conductor materials is a function of temperature and the change must be considered for design purposes.

**RECOMMENDED COLD LEAD CABLES FOR XPI-NH** (cold lead cables from XPI-S can be used alternatively)

| Nom. cross section [mm] | Current rating [A] | Outer diameter [mm nom.] | Nominal resistance [Ω/km @ 20°C] | Temperature coefficient [x $10^{-3}$ /K] | Order reference | Part number PN |
|---|---|---|---|---|---|---|
| 2.5 | 32 | 5.5 | 7.0 | 4.3 | XPI-7 | 2000-081 |
| 4 | 42 | 6.1 | 4.4 | 4.3 | XPI-4.4 | 2000-082 |
| 6 | 54 | 6.9 | 2.9 | 4.3 | XPI-2.9 | 2000-083 |
| 10 | 73 | 8.6 | 1.8 | 4.3 | XPI-1.8 | 2000-084 |
| 16 | 98 | 10.1 | 1.1 | 4.3 | XPI-1.1 | 2000-085 |
| 25 | 129 | 11.9 | 0.8 | 4.3 | XPI-0.8 | 2000-086 |

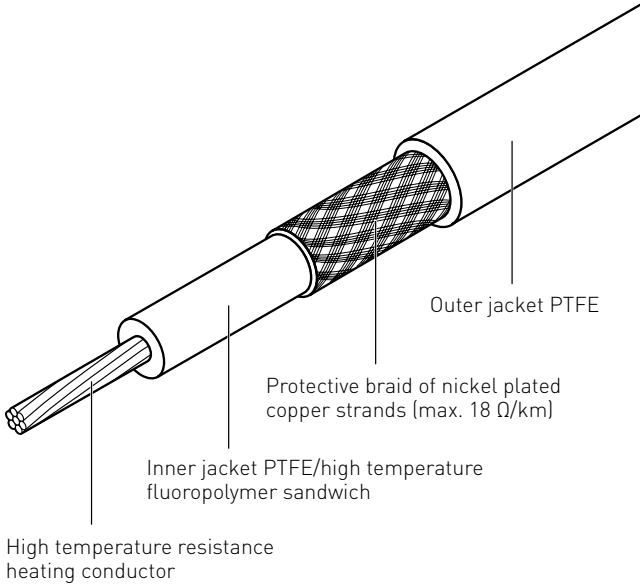
Notes: Delivery length depends on type of resistance and is limited by max. weight of 120 kg/spool, respectively 1000 m/run. To ensure practical and safe on-site handling, it is strongly recommended to limit spool lengths to 25 - 30 kg. Not all resistances are standard items and as such may not be in stock. Contact SANTO to confirm lead time. SANTO requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.

# SANTO XPI

## POLYMER INSULATED (PI) SERIES RESISTANCE HEATING CABLE

### HEATING CABLE CONSTRUCTION




XPI is a polymer insulated (PI) series heating cable, suitable for use in hazardous areas. It has been designed for use in freeze protection and temperature maintenance applications of pipes, tanks and other equipment. XPI offers an economical solution for a wide variety of heat-tracing applications, in particular for pipe lengths beyond the maximum circuit lengths of parallel heating cables.

The inner insulation is a sandwich construction of high temperature fluoropolymer and PTFE, the outer insulation is made of PTFE. This unique construction is very easy to terminate, highly flexible and makes XPI a very safe and reliable product. It provides highest chemical withstand and excellent mechanical strength, in particular at elevated temperatures.

XPI heating cables can be used for temperatures up to 260°C (continuous) and 300°C (intermittent short-term exposure). XPI is easy to install and has printed meter-marks. SANTO offers XPI heating cables in a very wide range of resistances, starting from 0.8 Ω/km up to 8000 Ω/km as well as a complete range of components for connection and splicing of the cables.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous area, Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust)<br>Ordinary area |
| Chemical resistance | Organic and inorganic corrosives |

### APPROVALS

| | |
|---|---|
| System (heating units) | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local SANTO representative. |

## TECHNICAL DATA

| | |
|---|---|
| Max. exposure temperature | 260°C (power off, continuous), 300°C (power off, intermittent for max 1000 h) |
| Min. installation temperature | –70°C |
| Min. bending radius at –70°C | 2.5 x cable diameter for cable diameter ≤ 6 mm<br>6 x cable diameter for cable diameter > 6 mm |
| Max. power output | 35 W/m (typical value, depending on application) |
| Nominal voltage | Up to 450/750 Vac (U0/U) |
| Min. impact resistance | 4 Joule (as per EN 60079-30-1) |
| Min. clearance | 20 mm between heating cables |

## XPI HEATING CABLE REFERENCES

| Order Reference | Nominal resistance [Ω/km @ 20°C] | Temp. coefficient [x 10-3/ K] | Outer diameter [mm nom.] | Nom. weight [kg/km] | Part Number PN |
|---|---|---|---|---|---|
| XPI-0.8 | 0.8 | 4.3 | 11.9 | 404 | 2000-087 |
| XPI-1.1 | 1.1 | 4.3 | 10.1 | 306 | 2000-088 |
| XPI-1.8 | 1.8 | 4.3 | 8.6 | 208 | 2000-089 |
| XPI-2.9 | 2.9 | 4.3 | 6.9 | 143 | 2000-090 |
| XPI-4.4 | 4.4 | 4.3 | 6.1 | 112 | 2000-091 |
| XPI-7 | 7.0 | 4.3 | 5.5 | 83 | 2000-092 |
| XPI-10 | 10.0 | 4.3 | 5.4 | 76 | 2000-093 |
| XPI-11.7 | 11.7 | 4.3 | 5.2 | 65 | 2000-094 |
| XPI-15 | 15.0 | 4.3 | 5.1 | 61 | 2000-095 |
| XPI-17.8 | 17.8 | 4.3 | 4.9 | 57 | 2000-096 |
| XPI-25 | 25.0 | 3.0 | 4.9 | 57 | 2000-097 |
| XPI-31.5 | 31.5 | 1.3 | 5.3 | 67 | 2000-098 |
| XPI-50 | 50 | 1.3 | 4.9 | 57 | 2000-099 |
| XPI-65 | 65 | 1.3 | 4.8 | 53 | 2000-100 |
| XPI-80 | 80 | 0.7 | 5.1 | 61 | 2000-101 |
| XPI-100 | 100 | 0.4 | 5.2 | 67 | 2000-102 |
| XPI-150 | 150 | 0.4 | 4.9 | 57 | 2000-103 |
| XPI-180 | 180 | 0.33 | 4.7 | 51 | 2000-104 |
| XPI-200 | 200 | 0.40 | 4.8 | 53 | 2000-105 |
| XPI-320 | 320 | 0.18 | 4.9 | 56 | 2000-106 |
| XPI-380 | 380 | 0.18 | 4.8 | 53 | 2000-107 |
| XPI-480 | 480 | 0.18 | 4.7 | 51 | 2000-108 |
| XPI-600 | 600 | 0.18 | 4.5 | 48 | 2000-109 |
| XPI-700 | 700 | 0.18 | 4.5 | 46 | 2000-110 |
| XPI-810 | 810 | 0.04 | 4.6 | 50 | 2000-111 |
| XPI-1000 | 1000 | 0.04 | 4.5 | 48 | 2000-112 |
| XPI-1440 | 1440 | 0.04 | 4.4 | 45 | 2000-113 |
| XPI-1750 | 1750 | 0.04 | 4.3 | 43 | 2000-114 |
| XPI-2000 | 2000 | 0.35 | 4.6 | 49 | 2000-115 |
| XPI-3000 | 3000 | 0.35 | 4.4 | 45 | 2000-116 |
| XPI-4000 | 4000 | 0.35 | 4.2 | 42 | 2000-117 |
| XPI-4400 | 4400 | 0.1 | 4.3 | 43 | 2000-118 |
| XPI-5160 | 5160 | 0.1 | 4.3 | 42 | 2000-119 |
| XPI-5600 | 5600 | 0.1 | 4.2 | 41 | 2000-120 |
| XPI-7000 | 7000 | 0.1 | 4.2 | 40 | 2000-121 |
| XPI-8000 | 8000 | 0.1 | 4.1 | 40 | 2000-122 |

Resistance tolerance: +10/–5%. In particular for cables < 31.5 Ω/km the resistance of the conductor materials is a function of temperature and the change must be considered for design purposes.

## **RECOMMENDED COLD LEAD CABLES FOR XPI** (cold lead cables from XPI-S can be used alternatively)

| Nom. cross section [mm²] | Current rating [A] | Outer diameter [mm nom.] | Nominal resistance [Ω/km @ 20°C] | Temperature coefficient [x 10-3 /K] | Order reference | Part number PN |
|---|---|---|---|---|---|---|
| 2.5 | 32 | 5.5 | 7.0 | 4.3 | XPI-7 | 2000-123 |
| 4 | 42 | 6.1 | 4.4 | 4.3 | XPI-4.4 | 2000-124 |
| 6 | 54 | 6.9 | 2.9 | 4.3 | XPI-2.9 | 2000-125 |
| 10 | 73 | 8.6 | 1.8 | 4.3 | XPI-1.8 | 2000-126 |
| 16 | 98 | 10.1 | 1.1 | 4.3 | XPI-1.1 | 2000-127 |
| 25 | 129 | 11.9 | 0.8 | 4.3 | XPI-0.8 | 2000-128 |

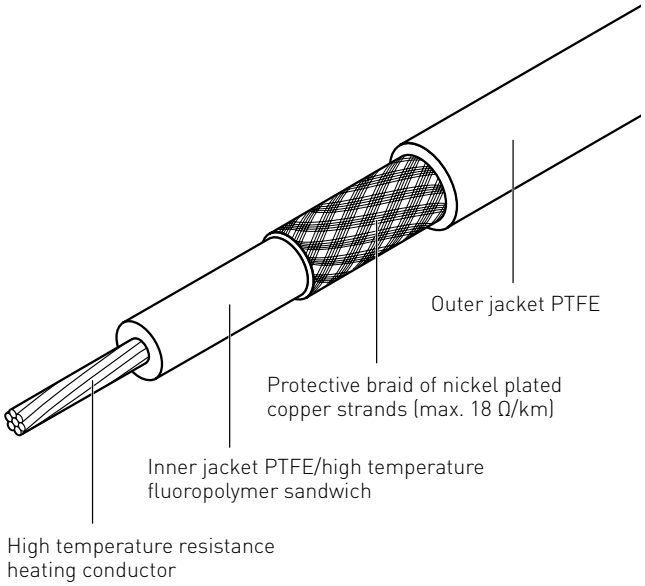
Notes: Delivery length depends on type of resistance and is limited by max. weight of 120 kg/spool, respectively 1000 m/run. To ensure practical and safe on-site handling, it is strongly recommended to limit spool lengths to 25 - 30 kg.Not all resistances are standard items and as such may not be in stock. Contact SANTO to confirm lead time. SANTO requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.

# SANTO XPI-S

## POLYMER INSULATED (PI) SERIES RESISTANCE HEATING CABLE

### HEATING CABLE CONSTRUCTION




XPI-S is a polymer insulated (PI) series heating cable, suitable for use in hazardous areas. It has been designed for use in freeze protection and temperature maintenance applications of pipes, tanks and other equipment. XPI-S is a re-enforced version of XPI, particularly suitable for areas with high demands on mechanical abuse of the heating cable. XPI-S offers an economical solution for a wide variety of heat-tracing applications, in particular for pipe lengths beyond the maximum circuit lengths of parallel heating cables (e.g. 250 m).

The inner insulation is a sandwich construction of high temperature fluoropolymer and PTFE, the outer insulation is made of PTFE. This unique construction is very easy to terminate, highly flexible and makes XPI a very safe and reliable product. It provides highest chemical withstand and most excellent mechanical strength, in particular at elevated temperatures.

XPI-S heating cables can be used for temperatures up to 260°C (continuous) and 300°C (intermittent short-term exposure). XPI-S is easy to install and has printed meter-marks. SANTO offers XPI-S heating cables in a very wide range of resistances, starting from 0.8 Ω/km up to 8000 Ω/km as well as a complete range of components for connection and splicing of the cables.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous area, Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust) Ordinary area |
| Chemical resistance | Organic and inorganic corrosives |

### APPROVALS

| | |
|---|---|
| System (heating units) | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local SANTO representative. |

## TECHNICAL DATA

| | |
|---|---|
| Max. exposure temperature | 260°C (power of, continuous), 300°C (power off, intermittent for max 1000 h) |
| Min. installation temperature | –70°C |
| Min. bending radius at –70°C | 2.5 x cable diameter for cable diameter ⩽ 6 mm<br>6 x cable diameter for cable diameter > 6 mm |
| Max. power output | 35 W/m (typical value, depending on application) |
| Nominal voltage | Up to 450/750 Vac ($U_0$/U) |
| Min. impact resistance | 7 Joule (as per EN 60079-30-1) |
| Min. clearance | 20 mm between heating cables |

## XPI-S HEATING CABLE REFERENCES

| Order Reference | Nominal resistance [Ω/km @ 20°C] | Temp. coefficient [x $10^{-3}$/ K] | Outer diameter [mm nom.] | Nom. weight [kg/km] | Part Number PN |
|---|---|---|---|---|---|
| XPI-S-0.8 | 0.8 | 4.3 | 11.9 | 405 | 2000-129 |
| XPI-S-1.1 | 1.1 | 4.3 | 10.1 | 307 | 2000-130 |
| XPI-S-1.8 | 1.8 | 4.3 | 8.6 | 209 | 2000-131 |
| XPI-S-2.9 | 2.9 | 4.3 | 7.1 | 149 | 2000-132 |
| XPI-S-4.4 | 4.4 | 4.3 | 6.5 | 116 | 2000-133 |
| XPI-S-7 | 7.0 | 4.3 | 5.9 | 88 | 2000-134 |
| XPI-S-10 | 10.0 | 4.3 | 5.8 | 84 | 2000-135 |
| XPI-S-11.7 | 11.7 | 4.3 | 5.6 | 76 | 2000-136 |
| XPI-S-15 | 15.0 | 4.3 | 5.5 | 71 | 2000-137 |
| XPI-S-17.8 | 17.8 | 4.3 | 5.3 | 68 | 2000-138 |
| XPI-S-25 | 25.0 | 3.0 | 5.5 | 72 | 2000-138 |
| XPI-S-31.5 | 31.5 | 1.3 | 5.9 | 82 | 2000-139 |
| XPI-S-50 | 50 | 1.3 | 5.5 | 72 | 2000-140 |
| XPI-S-65 | 65 | 1.3 | 5.4 | 66 | 2000-141 |
| XPI-S-80 | 80 | 0.7 | 5.7 | 75 | 2000-142 |
| XPI-S-100 | 100 | 0.4 | 5.8 | 79 | 2000-143 |
| XPI-S-150 | 150 | 0.4 | 5.8 | 78 | 2000-144 |
| XPI-S-180 | 180 | 0.33 | 5.6 | 71 | 2000-145 |
| XPI-S-200 | 200 | 0.40 | 5.7 | 72 | 2000-146 |
| XPI-S-320 | 320 | 0.18 | 5.8 | 76 | 2000-147 |
| XPI-S-380 | 380 | 0.18 | 5.7 | 73 | 2000-148 |
| XPI-S-480 | 480 | 0.18 | 5.6 | 70 | 2000-149 |
| XPI-S-600 | 600 | 0.18 | 5.4 | 67 | 2000-150 |
| XPI-S-700 | 700 | 0.18 | 5.4 | 65 | 2000-151 |
| XPI-S-810 | 810 | 0.04 | 5.5 | 69 | 2000-152 |
| XPI-S-1000 | 1000 | 0.04 | 5.4 | 67 | 2000-153 |
| XPI-S-1440 | 1440 | 0.04 | 5.6 | 69 | 2000-154 |
| XPI-S-1750 | 1750 | 0.04 | 5.5 | 67 | 2000-155 |
| XPI-S-2000 | 2000 | 0.35 | 5.8 | 74 | 2000-156 |
| XPI-S-3000 | 3000 | 0.35 | 5.6 | 69 | 2000-157 |
| XPI-S-4000 | 4000 | 0.35 | 5.4 | 65 | 2000-158 |
| XPI-S-4400 | 4400 | 0.1 | 5.5 | 66 | 2000-159 |
| XPI-S-5160 | 5160 | 0.1 | 5.5 | 66 | 2000-160 |
| XPI-S-5600 | 5600 | 0.1 | 5.4 | 63 | 2000-161 |
| XPI-S-7000 | 7000 | 0.1 | 5.4 | 61 | 2000-162 |
| XPI-S-8000 | 8000 | 0.1 | 5.3 | 60 | 2000-163 |

Resistance tolerance: +10/–5%. In particular for cables < 31.5 Ω/km the resistance of the conductor materials is a function of temperature and the change must be considered for design purposes.

## RECOMMENDED COLD LEAD CABLES FOR XPI-S

| Nom. cross section [mm²] | Current rating [A] | Outer diameter [mm nom.] | Nominal resistance [Ω/km @ 20°C] | Temperature coefficient [x10⁻³/K] | Order reference | Part number PN |
|---|---|---|---|---|---|---|
| 2.5 | 32 | 5.9 | 7.0 | 4.3 | XPI-S-7 | 2000-164 |
| 4 | 42 | 6.5 | 4.4 | 4.3 | XPI-S-4.4 | 2000-165 |
| 6 | 54 | 7.1 | 2.9 | 4.3 | XPI-S-2.9 | 2000-166 |
| 10 | 73 | 8.6 | 1.8 | 4.3 | XPI-S-1.8 | 2000-167 |
| 16 | 98 | 10.1 | 1.1 | 4.3 | XPI-S-1.1 | 2000-168 |
| 25 | 129 | 11.9 | 0.8 | 4.3 | XPI-S-0.8 | 2000-169 |

Notes: Delivery length depends on type of resistance and is limited by max. weight of 120 kg/spool, respectively 1000 m/run. To ensure practical and safe on-site handling, it is strongly recommended to limit spool lengths to 25 - 30kg. Not all resistances are standard items and as such may not be in stock. Contact SANTO to confirm lead time.

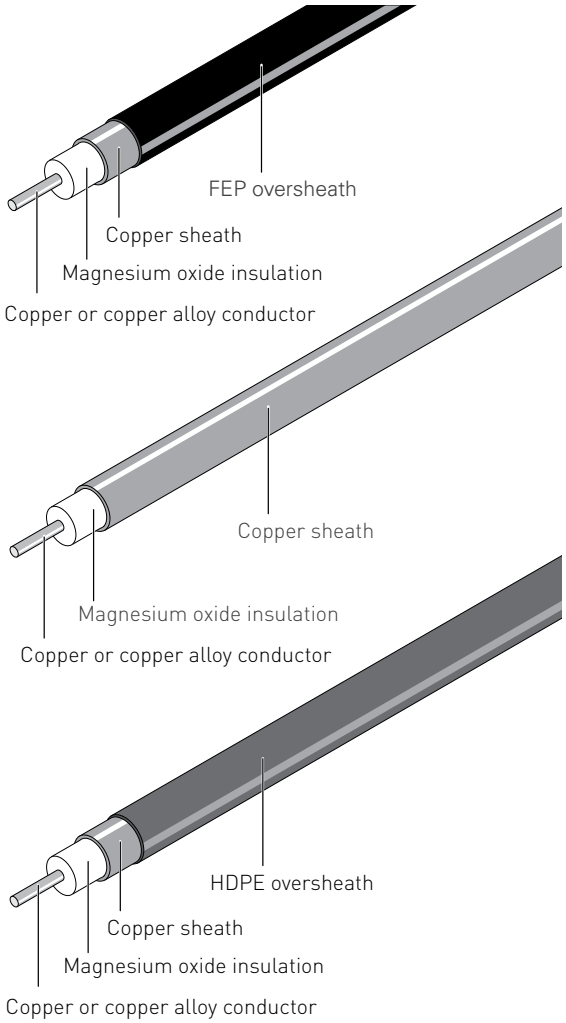
SANTO requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.

# HCH/HCC

## MINERAL INSULATED (MI) COPPER SHEATHED HEATING CABLE

### TYPICAL CABLE CONSTRUCTIONS




SANTO HCH/HCC mineral insulated (MI) Copper series heating cables are suited for use in hazardous areas. They are extensively used in a wide variety of industrial heat-tracing applications, such as long line heating or condensation prevention at low temperatures, and domestic applications, such as under floor or road and ramp heating applications. The copper heating cables with copper conductors (HCC) are available in very low resistances to allow for long line applications with a limited amount of supply points when the maximum operating sheath temperature does not exceed 200°C. The typical maximum power output goes up to 50 W/m. Optionally they are offered with an HDPE (High Density Polyethylene) over-sheath for enhanced corrosion protection up to 80°C, usually applied when buried in concrete. For temperatures in excess of 80°C, an FEP (Fluorinated Ethylene Propylene) over-sheath is available which can be used up to a maximum temperature of 200°C. The heating cables are offered as bulk cable as well as factory-terminated heating units to ensure optimum quality of the connections. The offering is completed with a full range of components for installation, connection and splicing of the heating cables.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous areas*, Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust)<br>Ordinary areas<br>*cable types HCH1L2000 and HCH1L1250 can only be used in ordinary areas |

### APPROVALS

| | |
|---|---|
| System (heating units) | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## TECHNICAL DATA

| | | |
|---|---|---|
| Cable sheath material | Copper | |
| Conductor material | Copper (HCC) or Copper Alloy (HCH) | |
| Max. exposure temperature | 200°C** | |
| Min. installation temperature | –60°C | |
| Min. bending radius | 6 x outer diameter at –60°C | |
| Max. supply voltage and power | Voltage (U0/U) | Max. power output* |
| | 300/500 Vac | 50 W/m |
| | | *typical value, depending on application |
| Earth leakage | 3 mA/100 m (nominal at 20°C, 230Vac, 50 - 60Hz) | |
| Min. cable spacing | 25 mm for hazardous areas | |

** Note: Cables available with optional additional oversheath for corrosion protection:
– HDPE (Max Sheath temp 80°C) – add H to ref. (ie. HCHH....)
– FEP (Max Sheath temp 200°C) – add P to ref. (ie. HCHP....)
For HDPE add 1.8 mm to cable OD. For FEP details available upon request.

## MI SERIES HEATING CABLES HCH/HCC

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient (x $10^{-3}$/K) | Max. coil length [m] | Nom.weight (kg/km) |
|---|---|---|---|---|---|
| HCH1L2000[1] | 2000 | 2.8 | 0.4 | 1200 | 31 |
| HCH1L1250[1] | 1250 | 2.8 | 0.4 | 1200 | 32 |
| HCH1M800 | 800 | 3.5 | 0.4 | 900 | 50 |
| HCH1M630 | 630 | 4.0 | 0.4 | 1100 | 65 |
| HCH1M450 | 450 | 4.0 | 0.4 | 1000 | 67 |
| HCH1M315 | 315 | 4.3 | 0.4 | 1000 | 77 |
| HCH1M220 | 220 | 4.5 | 0.4 | 1000 | 85 |
| HCH1M140 | 140 | 4.9 | 0.4 | 1000 | 102 |
| HCH1M100 | 100 | 5.2 | 0.4 | 800 | 125 |
| HCC1M63 | 63 | 3.2 | 3.9 | 2000 | 41 |
| HCC1M40 | 40 | 3.4 | 3.9 | 2000 | 46 |
| HCC1M25 | 25 | 3.7 | 3.9 | 1600 | 56 |
| HCC1M17 | 17 | 4.6 | 3.9 | 500 | 85 |
| HCC1M11 | 11 | 4.9 | 3.9 | 500 | 98 |
| HCC1M7 | 7 | 5.3 | 3.9 | 400 | 118 |
| HCC1M4 | 4 | 5.9 | 3.9 | 800 | 150 |
| HCC1M2.87 | 2.87 | 6.4 | 3.9 | 650 | 170 |
| HCC1M1.72 | 1.72 | 7.3 | 3.9 | 500 | 235 |
| HCC1M1.08 | 1.08 | 8.3 | 3.9 | 400 | 326 |

Resistance tolerance: ±10%
(1) Not approved for hazardous areas, maximum 300 Vac.

## RECOMMENDED COLD LEADS FOR HCH/HCC MI SERIES HEATING CABLES

| Nom. cross section [mm²] | Order reference | Max. current (design B) | Outer diameter (mm) | Standard gland size |
|---|---|---|---|---|
| 2.5 | CC1H2.5 | 34 | 5.3 | M20 |
| 6 | CC1H6 | 57 | 6.4 | M20 |
| 10 | CC1H10 | 77 | 7.3 | M25 |
| 16 | CC1H16 | 102 | 8.3 | M25 |
| 25 | CC1H25 | 133 | 9.6 | M32 |
| 35 | CC1H35 | 163 | 10.7 | M32 |

Brass glands are standard on all heating units. Other materials are possible, contact SANTO for more information.

Delivery length of bulk cable on coil depends on type of resistance and is limited by max. coil length as indicated in the table on top. Factory terminated elements are limited by a max. weight of 50kg, however to ensure practical and safe on-site handling, it is strongly recommended to limit element lengths to 25 - 30kg. Not all resistances are standard items and as such may not be in stock.

Contact SANTO to confirm lead time. SANTO requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.

Also refer to the components section for more details on heating units, accessories and nomenclatures.

## CHEMICAL RESISTANCE

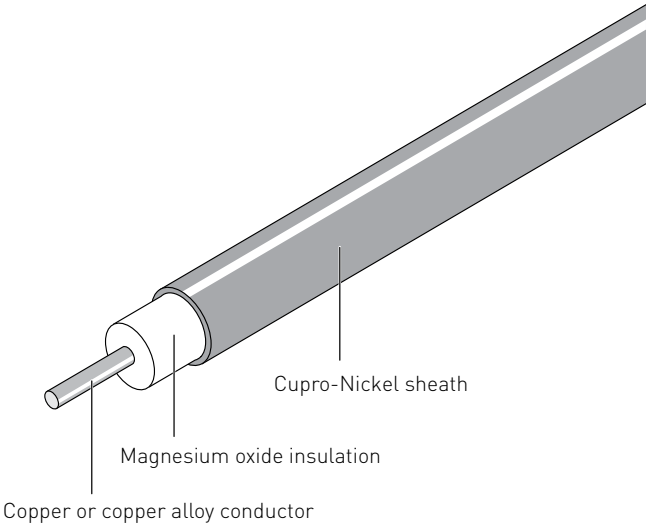
| Sheath Material | Maximum Cable Sheath Temp (°C) | Description | Sulphuric Acid | Hydro-chloric Acid | Hydro-fluoric Acid | Alkalis | Phosphoric Acid | Sea Water | Nitric Acid | Chloride | Organic Acid |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Copper-HDPE | 80 | Copper with high density polyethylene oversheath | GE | GE | A | A | A | NR | A | A | |
| Copper | 200 | Copper | NR | NR | A | A | NR | A | A | NR | X |
| Copper-FEP | 200 | Copper with fluorinated ethylene propylene oversheath | GE | GE | A | A | A | A | A | GE | GE |

Note: NR Not recommended, A acceptable, GE Good to excellent, X Check for specific data.
Corrosion resistance data is dependent on temperature and concentration.

# SANTO HDF/HDC

## MINERAL INSULATED CUPRO-NICKEL SHEATHED HEATING CABLE

### TYPICAL CABLE CONSTRUCTIONS




SANTO HDC/HDF mineral insulated (MI) Cupro-Nickel series heating cables are suited for use in hazardous areas. They are extensively used for a wide variety of industries, such as oil and gas, chemical and petrochemical, power generation, gas storage and many other industrial applications. Cupro-Nickel heating cables with copper conductors (HDC) are available in very low resistances to allow for long line applications with a limited amount of supply points, in particular for applications exceeding the capabilities of Polymer Insulated (PI) series heating cables. The heating cables can be used for exposure temperatures up to 400°C and a typical power output up to 70 W/m. The heating cables are offered as bulk cable as well as factory-terminated heating units to ensure optimum quality of the connections. The offering is completed with a full range of components for installation, connection and splicing of the heating cables.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous areas, Zone 1 or Zone 2 (Gas) and Zone 21 or Zone 22 (Dust)<br>Ordinary areas |

### APPROVALS

| | |
|---|---|
| System (heating units) | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local representative. |

### TECHNICAL DATA

| | | |
|---|---|---|
| Cable sheath material | 70/30 Cupro-Nickel | |
| Conductor material | Copper (HDC) or Copper Alloy (HDF) | |
| Max. exposure temperature | 400°C | |
| Min. installation temperature | –60°C | |
| Min. bending radius | 6 x outer diameter at –60°C | |
| Max. supply voltage and power | Voltage ($U_0$/U)<br>300/500 Vac | Max. power output*<br>70 W/m<br>*typical value, depending on application |
| Earth leakage | 3 mA/100 m (nominal at 20°C, 230Vac, 50 - 60Hz) | |
| Min. cable spacing | 25 mm for hazardous areas | |

## MI SERIES HEATING CABLES HDF/HDC

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient (x $10^{-3}$/K) | Max. coil length [m] | Nom.weight (kg/km) |
|---|---|---|---|---|---|
| HDF1M1600 | 1600 | 3.2 | 0.04 | 625 | 40 |
| HDF1M1000 | 1000 | 3.4 | 0.04 | 550 | 45 |
| HDF1M630 | 630 | 3.7 | 0.04 | 465 | 55 |
| HDF1M400 | 400 | 4.0 | 0.04 | 400 | 67 |
| HDF1M250 | 250 | 4.4 | 0.04 | 330 | 84 |
| HDF1M160 | 160 | 4.9 | 0.04 | 265 | 108 |
| HDC1M63 | 63 | 3.2 | 3.9 | 620 | 39 |
| HDC1M40 | 40 | 3.4 | 3.9 | 550 | 44 |
| HDC1M25 | 25 | 3.7 | 3.9 | 440 | 55 |
| HDC1M17 | 17 | 4.6 | 3.9 | 300 | 84 |
| HDC1M11 | 11 | 4.9 | 3.9 | 265 | 98 |
| HDC1M7 | 7 | 5.3 | 3.9 | 225 | 119 |
| HDC1M4 | 4 | 5.9 | 3.9 | 180 | 155 |

Resistance tolerance: ±10%

## RECOMMENDED COLD LEADS FOR HDF/HDC MI SERIES HEATING CABLES

| Nom. cross section [$mm^2$] | Order reference | Max. current (design B) | Outer diameter (mm) | Standard gland size |
|---|---|---|---|---|
| 2.5 | DC1H2.5 | 34 | 5.3 | M20 |
| 6 | DC1H6 | 57 | 6.4 | M20 |
| 10 | DC1H10 | 77 | 7.3 | M25 |
| 16 | DC1H16 | 102 | 8.3 | M25 |

Brass glands are standard on all heating units. Other materials are possible, contact  for more information.

Delivery length of bulk cable on coil depends on type of resistance and is limited by max. coil length as indicated in the table on top. Factory terminated elements are limited by a max. weight of 50kg, however to ensure practical and safe on-site handling, it is strongly recommended to limit element lengths to 25 - 30kg. Not all resistances are standard items and as such may not be in stock. Contact to confirm lead time.
Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.
Also refer to the components section for more details on heating units, accessories and nomenclatures.

## CHEMICAL RESISTANCE

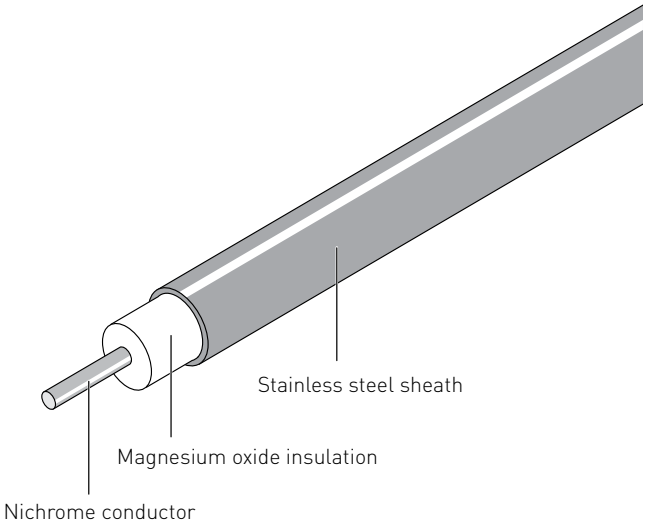
| Sheath Material | Maximum Cable Sheath Temp (°C) | Description | Sulphuric Acid | Hydrochloric Acid | Hydrofluoric Acid | Phosphoric Acid | Nitric Acid | Organic Acid | Alkalis | Sea Water | Chloride |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cupro-Nickel | 400 | Cupro-Nickel alloy 70% copper 30% nickel | NR | X | X | X | X | X | X | GE | GE |

Note: NR Not recommended, A acceptable, GE Good to excellent, X Check for specific data
Corrosion resistance data is dependent on temperature and concentration.

# SANTO HSQ

## MINERAL INSULATED (MI) STAINLESS STEEL SHEATHED HEATING CABLE

### HEATING CABLE CONSTRUCTION




SANTO HSQ mineral insulated (MI) Stainless steel series heating cables are suited for use in hazardous areas. The Stainless steel sheath offers excellent corrosive properties against a wide range of organic acids and alkalis in combination with a high temperature withstand capability. HSQ cables are typically used in bitumen plants, gas plants, oil refineries, reactors and vessels, sodium loops and a wide variety of other heat-tracing applications where temperature resistance, power output and durability are paramount. The heating cables can be used for exposure temperatures up to 700°C and a typical power output up to 150 W/m. Higher temperatures and power outputs can be achieved, contact SANTO for assistance. The heating cables are offered as bulk cables as well as factory-terminated heating units employing brazing or laser welding techniques to ensure optimum quality of the connections. The offering is completed with a full range of components for installation, connection and splicing of the heating cables.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous areas, Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust)<br>Ordinary areas |

### APPROVALS

| | |
|---|---|
| System (heating units) | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## TECHNICAL DATA

| | | |
|---|---|---|
| Cable sheath material | 321 Stainless steel | |
| Conductor material | Nichrome | |
| Max. exposure temperature | 700°C* (heating cables)<br>450°C (brazed heating units)<br>700°C* (laser welded heating units) | |
| Min. installation temperature | –60°C | |
| Min. bending radius | 6 x outer diameter at –60°C | |
| Max. supply voltage and power | Voltage (Uo/U) | Max. power output* |
| | 300/500 Vac | 150 W/m |
| | 460/800 Vac (laser welded heating units) | *typical value, depending on application |
| Earth leakage | 3 mA/100 m (nominal at 20°C, 230 Vac, 50 - 60 Hz) | |
| Min. cable spacing | 25 mm for hazardous areas | |

## MI SERIES HEATING CABLES HSQ

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient (x $10^{-3}$/K) | Max. coil length [m] | Nom.weight (kg/km) |
|---|---|---|---|---|---|
| HSQ1M10K | 10000 | 3.2 | 0.09 | 717 | 39 |
| HSQ1M6300 | 6300 | 3.2 | 0.09 | 717 | 39 |
| HSQ1M4000 | 4000 | 3.2 | 0.09 | 717 | 39 |
| HSQ1M2500 | 2500 | 3.4 | 0.09 | 639 | 46 |
| HSQ1M1600 | 1600 | 3.6 | 0.09 | 572 | 52 |
| HSQ1M1000 | 1000 | 3.9 | 0.09 | 499 | 62 |
| HSQ1M630 | 630 | 4.3 | 0.09 | 405 | 78 |
| HSQ1M400 | 400 | 4.7 | 0.09 | 342 | 96 |
| HSQ1M250 | 250 | 5.3 | 0.09 | 271 | 127 |
| HSQ1M160 | 160 | 6.5 | 0.09 | 180 | 191 |

Resistance tolerance: ±10%

## RECOMMENDED COLD LEADS FOR HSQ MI SERIES HEATING CABLES

| Nom. cross section [mm²] | Order reference | Max. current (design B) | Outer diameter (mm) | Standard gland size |
|---|---|---|---|---|
| 2.5 | SC1H2.5 | 34 | 5.3 | M20 |
| 6 | SC1H6 | 57 | 6.4 | M20 |

Brass glands are standard on all heating units. Other materials are possible, contact Santo for more information.

Delivery length of bulk cable on coil depends on type of resistance and is limited by max. coil length as indicated in the table on top. Factory terminated elements are limited by a max. weight of 50kg, however to ensure practical and safe on-site handling, it is strongly recommended to limit element lengths to 25 - 30kg. Not all resistances are standard items and as such may not be in stock. Contact Santo to confirm lead time. Santo requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.
Also refer to the components section for more details on heating units, accessories and nomenclatures.

## TABLE 3 CHEMICAL RESISTANCE

| Sheath Material | Maximum Cable Sheath Temp (°C) | Description | Sulphuric Acid | Hydrochloric Acid | Hydrofluoric Acid | Phosphoric Acid | Nitric Acid | Organic Acid | Alkalis | Sea Water | Chloride |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stainless Steel 321 DIN 1.4541 | 600* | 18/8 austenitic stainless steel with added titanium | NR | NR | NR | NR | X | GE | A | NR | NR |

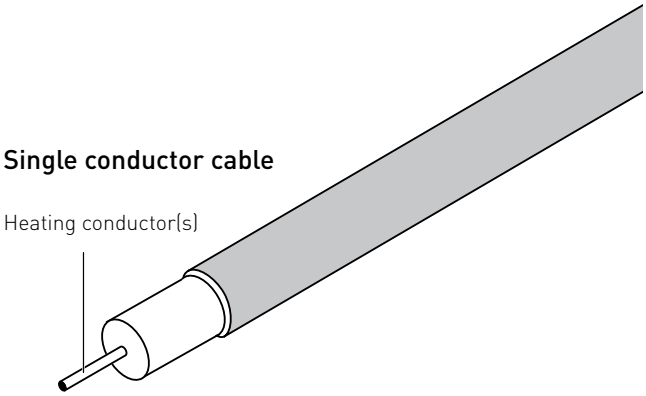
Note: NR Not recommended, A acceptable, GE Good to excellent, X Check for specific data
*Temperature limitation based on construction of heating element.
Corrosion resistance data is dependent on temperature and concentration.

# HAx

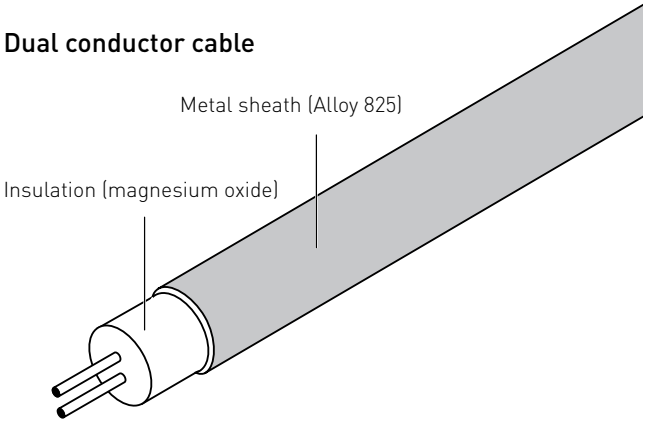
# MINERAL INSULATED (MI) ALLOY 825 HEATING CABLE

## TYPICAL CABLE CONSTRUCTIONS

### Single conductor cable




### Dual conductor cable




SANTO HAx mineral insulated (MI) Alloy 825 series heating cables are suitable for use in hazardous areas. They have been designed for use in freeze protection and temperature maintenance applications of pipes, tanks and other equipment.

MI heating cables of the HAx-series offer an ideal combination of ruggedness, high temperature withstand capability and corrosion resistance and can therefore be used for a wide variety of heat-tracing applications, in particular for applications with high power requirements and for temperatures exceeding the capabilities of polymer insulated (PI) series heating cables.

The heating cables can be used for exposure temperatures of up to 700°C and a typical power output of up to 270 W/m. Higher temperatures and power outputs can be achieved, contact Santo for assistance.

HAx mineral insulated (MI) heating cables are available as single and dual conductor construction and in a very wide range of resistances. The use of dual conductor heating cables can significantly reduce total installed cost and simplifies installation, in particular for small pipes and instrument tubing.

The heating cables are offered as bulk cable as well as factory terminated heating units employing brazing and laser welding technology. The offering is completed with a full range of components for installation, connection and splicing of the heating cables.

## APPLICATION

| | |
|---|---|
| Area classification | Hazardous area, Zone 1 or Zone 2 (Gas) or Zone 21 or zone 22 (Dust)<br>Ordinary |

## APPROVALS

| | |
|---|---|
| System (heating units) | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Cable sheath material | Alloy 825 | | |
| Conductor material | Various alloys and copper | | |
| Max. exposure temperature | 700°C* (heating cable), | | |
| | 550°C (brazed heating units) | | |
| | 700°C* (laser welded heating units) | | |
| Min. installation temperature | –60°C | | |
| Min. bending radius | 6 x OD (cable diameter) at –60°C | | |
| Max. supply voltage and power | Voltage ($U_0$/U) | Max. power output* | Heating cable type |
| | 600/600 Vac | 210 W/m | HAx1N Single conductor cable, 600 V |
| | 300/300 Vac | 200 W/m | HAx2M Dual conductor cable, 300 V |
| | 600/600 Vac | 270 W/m | HAx2N Dual conductor cable, 600 V |
| | | *typical value, depending on application | |
| Earth leakage | 3 mA /100 m (nominal at 20°C, 230 Vac, 50 - 60 Hz) | | |
| Min. cable spacing | 25 mm for hazardous areas | | |

## TABLE 1 MI SERIES HEATING CABLES HAX2M (Dual conductor cable, 300 V)

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient (x 10-³/K) | Max. coil length [m] | Nom. weight (kg/km) | Part Number PN |
|---|---|---|---|---|---|---|
| HAF2M36K | 36000 | 3.2 | 0.09 | 628 | 45.1 | 32SF1110 |
| HAF2M29.5K | 29500 | 3.6 | 0.09 | 542 | 52.2 | 32SF2900 |
| HAF2M24.5K | 24500 | 3.9 | 0.09 | 431 | 65.8 | 32SF2750 |
| HAA2M19.7K | 19700 | 3.4 | 0.09 | 632 | 49.3 | 32SA2600 |
| HAA2M13.2K | 13200 | 3.7 | 0.09 | 500 | 57.0 | 32SA2400 |
| HAA2M9000 | 9000 | 3.7 | 0.09 | 501 | 57.9 | 32SA2275 |
| HAA2M6600 | 6600 | 4.6 | 0.09 | 329 | 88.2 | 32SA2200 |
| HAA2M5600 | 5600 | 4.5 | 0.09 | 384 | 75.9 | 32SA2170 |
| HAB2M3750 | 3750 | 4.7 | 0.04 | 315 | 87.8 | 32SB2114 |
| HAB2M2300 | 2300 | 4.1 | 0.04 | 419 | 71.4 | 32SB3700 |
| HAQ2M1560 | 1560 | 4.7 | 0.5 | 317 | 85.6 | 32SQ3472 |
| HAQ2M1240 | 1240 | 4.7 | 0.5 | 317 | 85.9 | 32SQ3374 |
| HAQ2M965 | 965 | 4.7 | 0.5 | 314 | 87.4 | 32SQ3293 |
| HAQ2M660 | 660 | 3.7 | 0.5 | 503 | 58.6 | 32SQ3200 |
| HAQ2M495 | 495 | 4.1 | 0.5 | 419 | 71.3 | 32SQ3150 |
| HAQ2M330 | 330 | 4.6 | 0.5 | 332 | 91.7 | 32SQ3100 |
| HAP2M240 | 240 | 4.6 | 1.3 | 316 | 89.9 | 32SP4734 |
| HAP2M190 | 190 | 4.7 | 1.3 | 317 | 91.2 | 32SP4583 |
| HAP2M150 | 150 | 4.7 | 1.3 | 315 | 94.1 | 32SP4458 |
| HAC2M105 | 105 | 4.6 | 3.9 | 315 | 87.5 | 32SC4324 |

Resistance tolerance: ±10%

**TABLE 2 MI SERIES HEATING CABLES HAX2N** (Dual conductor cable, 600 V)

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient\| (x $10^{-3}$/K) | Max. coil length [m] | Nom. weight (kg/km) | Part Number PN |
|---|---|---|---|---|---|---|
| HAF2N36K | 36000 | 5.2 | 0.09 | 229 | 119.1 | 2000-170 |
| HAF2N29.5K | 29500 | 5.5 | 0.09 | 229 | 119.4 | 2000-171 |
| HAF2N19.7K | 19700 | 5.5 | 0.09 | 230 | 119.9 | 2000-172 |
| HAA2N13.6K | 13600 | 5.8 | 0.09 | 186 | 132.3 | 2000-173 |
| HAF2N6600 | 6600 | 6.3 | 0.09 | 177 | 158.8 | 2000-174 |
| HAT2N3750 | 3750 | 5.7 | 0.18 | 186 | 132.2 | 2000-175 |
| HAB2N2300 | 2300 | 6.8 | 0.04 | 151 | 186.9 | 2000-176 |
| HAQ2N1670 | 1670 | 5.7 | 0.5 | 194 | 127.2 | 2000-177 |
| HAQ2N940 | 940 | 6.0 | 0.5 | 176 | 141.5 | 2000-178 |
| HAQ2N660 | 660 | 6.3 | 0.5 | 177 | 157.7 | 2000-179 |
| HAQ2N495 | 495 | 6.3 | 0.5 | 177 | 159.2 | 2000-180 |
| HAQ2N330 | 330 | 6.7 | 0.5 | 152 | 189.4 | 2000-181 |
| HAP2N255 | 255 | 6.4 | 1.3 | 151 | 166.1 | 2000-182 |
| HAP2N185 | 185 | 6.7 | 1.3 | 138 | 183.8 | 2000-183 |
| HAP2N130 | 130 | 7.1 | 1.3 | 124 | 206.4 | 2000-184 |
| HAP2N92 | 92 | 7.5 | 1.3 | 110 | 236.2 | 2000-185 |
| HAC2N66 | 66 | 7.5 | 3.9 | 131 | 217.4 | 2000-186 |
| HAC2N43 | 43 | 7.9 | 3.9 | 115 | 252.1 | 2000-187 |
| HAC2N27 | 27 | 8.7 | 3.9 | 98 | 297.2 | 2000-188 |
| HAC2N17 | 17 | 9.2 | 3.9 | 81 | 267.3 | 2000-189 |
| HAC2N10.5 | 10.5 | 10.2 | 3.9 | 67 | 468.0 | 2000-190 |
| HAC2N6.6 | 6.6 | 12.6 | 3.9 | 46 | 706.6 | 2000-191 |
| HAC2N4.3 | 4.3 | 13.8 | 3.9 | 143 | 837.1 | 2000-192 |

Resistance tolerance: ±10%

**TABLE 3 MI SERIES HEATING CABLES HAX1N** (Single conductor cable, 600 V)

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient (x 10-3/K) | Max. coil length [m] | Nom. weight (kg/km) | Part Number PN |
|---|---|---|---|---|---|---|
| HAA1N6565 | 6565 | 3.7 | 0.085 | 519 | 52.8 | 2000-193 |
| HAA1N5250 | 5250 | 4.1 | 0.085 | 436 | 67.3 | 2000-194 |
| HAA1N4300 | 4300 | 4.1 | 0.085 | 415 | 67.6 | 2000-195 |
| HAA1N3300 | 3300 | 4.0 | 0.085 | 416 | 68.0 | 2000-196 |
| HAA1N2800 | 2800 | 4.3 | 0.085 | 368 | 77.1 | 2000-197 |
| HAA1N2300 | 2300 | 4.1 | 0.085 | 417 | 69.1 | 2000-198 |
| HAA1N1640 | 1640 | 4.5 | 0.085 | 329 | 88.1 | 2000-199 |
| HAT1N920 | 920 | 4.6 | 0.18 | 317 | 87.1 | 2000-200 |
| HAB1N660 | 660 | 4.6 | 0.04 | 330 | 88.7 | 2000-201 |
| HAB1N500 | 500 | 4.6 | 0.04 | 331 | 90.6 | 2000-202 |
| HAQ1N390 | 390 | 4.7 | 0.5 | 317 | 86.5 | 2000-203 |
| HAQ1N240 | 240 | 4.7 | 0.5 | 314 | 88.4 | 2000-204 |
| HAQ1N190 | 190 | 4.6 | 0.5 | 315 | 89.1 | 2000-205 |
| HAP1N155 | 155 | 4.7 | 1.3 | 317 | 87.1 | 2000-206 |
| HAP1N120 | 120 | 4.7 | 1.3 | 314 | 88.4 | 2000-207 |
| HAP1N95 | 95 | 4.7 | 1.3 | 315 | 89.1 | 2000-208 |
| HAP1N76 | 76 | 4.6 | 1.3 | 342 | 89.9 | 2000-209 |
| HAP1N60 | 60 | 4.7 | 1.3 | 316 | 91.1 | 2000-211 |
| HAP1N48 | 48 | 4.7 | 1.3 | 317 | 92.1 | 2000-212 |
| HAP1N37 | 37 | 4.7 | 1.3 | 335 | 96.0 | 2000-213 |
| HAC1N21.3 | 21.3 | 4.9 | 3.9 | 305 | 102.2 | 2000-214 |
| HAC1N13.5 | 13.5 | 5.1 | 3.9 | 294 | 107.3 | 2000-215 |
| HAC1N8.5 | 8.5 | 5.6 | 3.9 | 233 | 133.8 | 2000-216 |
| HAC1N5.3 | 5.3 | 6.9 | 3.9 | 158 | 214.6 | 2000-217 |
| HAC1N3.3 | 3.3 | 6.4 | 3.9 | 171 | 197.6 | 2000-218 |
| HAC1N2 | 2.0 | 8.1 | 3.9 | 115 | 311.0 | 2000-219 |

Resistance tolerance: ±10%

## TABLE 4 RECOMMENDED COLD LEAD CABLES FOR HAX MI SERIES HEATING CABLES

| Nom. cross section [mm²] | Reference Single Conductor Cable | Reference Dual Conductor Cable | Max. Current Design B* (single cond.) | Max. Current Design D. E* (dual cond.) | Nominal Diameter Single cond. (mm) | Diameter Dual cond. (mm) |
|---|---|---|---|---|---|---|
| 1.0 | – | AC2H1.0 | – | 18 | – | 7.3 |
| 2.5 | AC1H2.5 | AC2H2.5 | 34 | 28 | 5.3 | 8.7 |
| 6.0 | AC1H6 | AC2H6 | 57 | 46 | 6.4 | 14.0 |
| 16 | AC1H16 | AC2H16 | 102 | 98 | 9.0 | 14.7 |
| 25 | AC1H25 | AC2H25 | 133 | 128 | 10 | 17.1 |

All cold lead cables can be used for up to 600 Vac and use copper conductors with a temperature coefficient of 3.9 x 10-3 1/K.

Delivery length of bulk cable on coil depends on type of resistance and is limited by max. coil length as indicated in the table on top. Factory terminated elements are limited by a max. weight of 50kg, however to ensure practical and safe on-site handling, it is strongly recommended to limit element lengths to 25 - 30kg. Not all resistances are standard items and as such may not be in stock. Contact SANTO to confirm lead time. SANTO requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.

Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.

## TABLE 5 CHEMICAL RESISTANCE

| Alloy | Maximum Cable Sheath Temp (°C) | Description | Nominal chemical composition, % (major elements) | | | | High temperature resistance (+540°C) | | Corrosion resistance | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Nickel (+Cobalt) | Iron | Chromium | Other | Oxidation | Carburization | Sulfuric acid | Hydrochloric acid | Hydrofluoric acid | Phosphoric acid | Nitric acid | Organic acid | Alkalis | Salts | Seawater | Chloride cracking |
| INCOLOY Alloy 825 nickel-iron-chromium | 550°C* | Excellent resistance to a wide variety of corrosives. Resists pitting and intergranular type corrosion, reducing acids and oxidizing chemicals | 42.0 | 30.0 | 21.5 | Mo 3.0 Cu 2.2 | G-E | G-E | G-E | G-E | G-E | G-E | G-E | G-E | G-E | G-E | G-E | G-E |

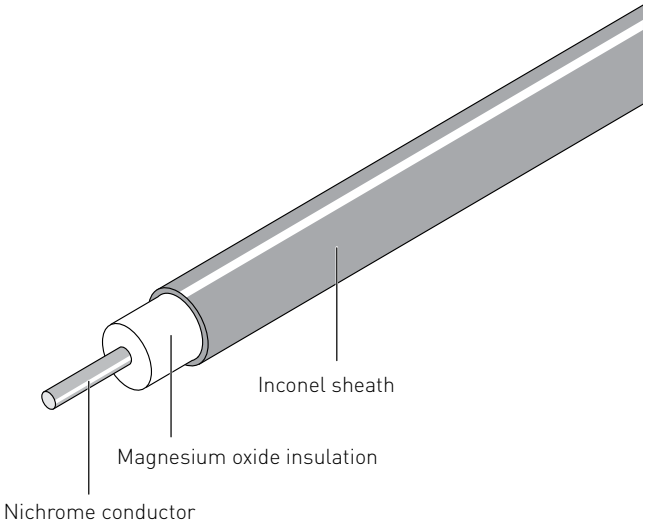
From Huntington Alloys Publication 78-348-2
Note: NR Not recommended, A acceptable, GE Good to excellent, X Check for specific data

* Temperature limitation based on construction of heating element.
Corrosion resistance data is dependent on temperature and concentration.

# HIQ

## MINERAL INSULATED (MI) INCONEL SHEATHED HEATING CABLE

### TYPICAL CABLE CONSTRUCTIONS




Santo HIQ mineral insulated (MI) Inconel 600 series heating cables are suited for use in hazardous areas. The Inconel 600 sheath offers excellent corrosive properties against a wide range of organic acids and alkalis, as well as chloride stress-corrosion cracking, in combination with a high temperature withstand capability. HIQ cables are typically used in bitumen plants, gas plants, oil refineries, reactors and vessels, sodium loops and a wide variety of other heat-tracing applications where temperature resistance, power output and durability are required and exceed the limitations of stainless steel sheathed MI heating cables. The heating cables can be used for exposure temperatures up to 700°C and a typical power output up to 300 W/m. Higher temperatures and power outputs can be achieved, contact Santo for assistance. The heating cables are offered as bulk cables as well as factory-terminated heating units employing brazing or laser welding techniques to ensure optimum quality of the connections. The offering is completed with a full range of components for installation, connection and splicing of the heating cables.

### APPLICATION

| | |
|---|---|
| Area classification | Hazardous areas, Zone 1 or Zone 2 (Gas) or Zone 21 or zone 22 (Dust)<br>Ordinary areas |

### APPROVALS

| | |
|---|---|
| | (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## TECHNICAL DATA

| | | |
|---|---|---|
| Cable sheath material | Inconel 600 | |
| Conductor material | Nichrome | |
| Max. exposure temperature | 700°C* (heating cables)<br>450°C (brazed heating units)<br>700°C* (laser welded heating units) | |
| =Min. installation temperature | –60°C | |
| Min. bending radius | 6 x outer diameter at –60°C | |
| Max. supply voltage and power | Voltage ($U_0$/U)<br>300/500 Vac<br>460/800 Vac (laser welded heating units) | Max. power output*<br>300 W/m<br>*typical value, depending on application |
| Earth leakage | 3 mA/100 m (nominal at 20°C) | |
| Min. cable spacing | 25 mm for hazardous areas | |

## MI SERIES HEATING CABLES HIQ

| Order Reference | Nominal resistance (Ω/km @ 20°C) | Outer diameter (mm) | Temp. coefficient (x 10-3/K) | Max. coil length [m] | Nom.weight (kg/km) |
|---|---|---|---|---|---|
| HIQ1M10K | 10000 | 3.2 | 0.09 | 772 | 39 |
| HIQ1M6300 | 6300 | 3.2 | 0.09 | 774 | 39 |
| HIQ1M4000 | 4000 | 3.2 | 0.09 | 776 | 39 |
| HIQ1M2500 | 2500 | 3.4 | 0.09 | 689 | 46 |
| HIQ1M1600 | 1600 | 3.6 | 0.09 | 617 | 52 |
| HIQ1M1000 | 1000 | 3.9 | 0.09 | 528 | 62 |
| HIQ1M630 | 630 | 4.3 | 0.09 | 437 | 78 |
| HIQ1M400 | 400 | 4.7 | 0.09 | 368 | 96 |
| HIQ1M250 | 250 | 5.3 | 0.09 | 292 | 127 |
| HIQ1M160 | 160 | 6.5 | 0.09 | 194 | 191 |

Resistance tolerance: ±10%

## RECOMMENDED COLD LEADS FOR HIQ MI SERIES HEATING CABLES

| Nom. cross section [mm²] | Order reference | Max. current (design B) | Outer diameter (mm) | Standard gland size |
|---|---|---|---|---|
| 2.5 | IC1H2.5 | 34 | 4.9 | M20 |
| 6 | IC1H6 | 57 | 6.4 | M20 |

Brass glands are standard on all heating units. Other materials are possible, contact Santo for more information. Delivery length of bulk cable on coil depends on type of resistance and is limited by max. coil length as indicated in the table on top. Factory terminated elements are limited by a max. weight of 50kg, however to ensure practical and safe on-site handling, it is strongly recommended to limit element lengths to 25 - 30kg. Not all resistances are standard items and as such may not be in stock. Contact Santo to confirm lead time. Santo requires the use of a 30 mA residual current device to provide maximum safety and protection from fire.
Where design results in higher leakage current, the preferred trip level for adjustable devices is 30 mA above any inherent capacitive leakage characteristic of the heater as specified by the trace heater supplier or alternatively, the next common available trip level for non adjustable devices, with a maximum of 300 mA. All safety aspects need to be proven.
Also refer to the components section for more details on heating units, accessories and nomenclatures.

## MI HEATING CABLE SHEATH CORROSION RESISTANCE AND TEMPERATURE DATA

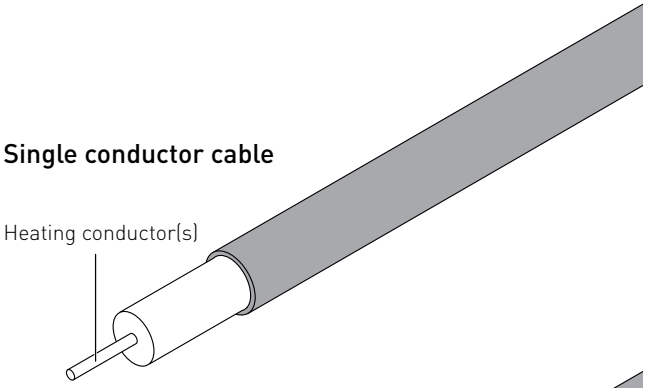
| Sheath Material | Maximum Cable Sheath Temp (°C) | Description | Sulphuric Acid | Hydrochloric Acid | Hydrofluoric Acid | Phosphoric Acid | Nitric Acid | Organic Acid | Alkalis | Sea Water | Chloride |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inconel 600 DIN 2.4816 | 600* | High nickel, high chromium content inconel alloy 600 | X | X | A | X | X | GE | GE | A | GE |

Note: NR Not recommended, A acceptable, GE Good to excellent, X Check for specific data
*Temperature limitation based on construction of heating element.
Corrosion resistance data is dependent on temperature and concentration.

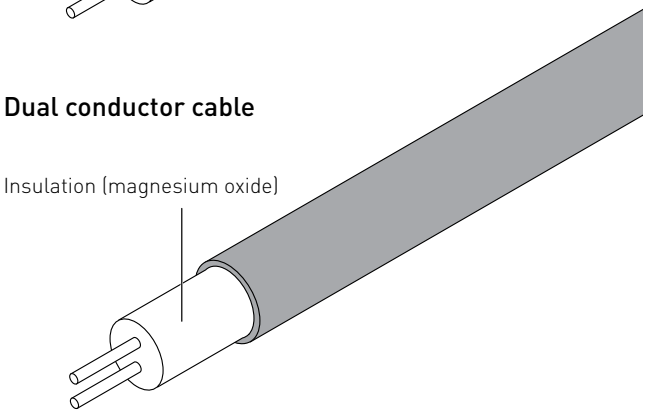
# NOMENCLATURE FOR MI HEATING SYSTEMS - MI HEATING CABLES (BULK CABLES)

## TYPICAL CABLE CONSTRUCTIONS

### Single conductor cable




### Dual conductor cable




Santo MI heating cables are available for a wide range of applications.

For more details about the different MI heating cable types, also refer to the product datasheets.

## VARIOUS CONSTRUCTIONS OF THE MI BULK HEATING CABLES ARE AVAILABLE:

| | |
|---|---|
| **HCC/HCH:** | Copper sheathed MI heating cables |
| **HDF/HDC:** | Cupro-nickel sheathed MI heating cables |
| **HSQ:** | Stainless steel sheathed MI heating cables |
| **HAx:** | Alloy 825 sheathed MI heating cables |
| **HIQ:** | Inconel sheathed MI heating cables |

## MI BULK HEATING CABLES ARE SUPPLIED IN A RANGE OF DIFFERENT CONSTRUCTIONS, THE PRODUCT REFERENCES USE THE FOLLOWING NOMENCLATURE:

**Example: HCHH1L2000BK**

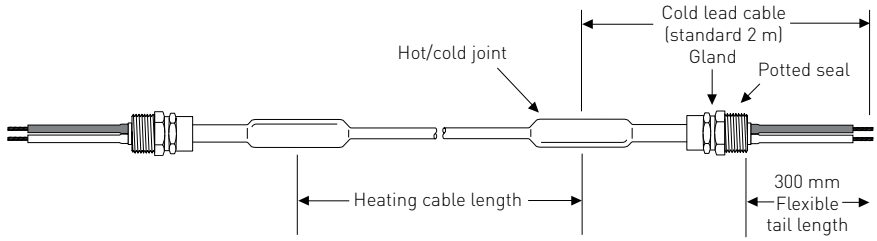
| | | |
|---|---|---|
| **H** | H denotes a heating cable | **H**=Heating Cable |
| **C** | Sheath material | **C**=Copper<br>**D**=Cupro-Nickel<br>**S**=Stainless steel<br>**A**=Alloy 825<br>**I**=Inconel 600 |
| **H** | Conductor material (examples) | **C**=Copper<br>**H**=Copper Alloy and a variety of other metal alloys |
| **H** | Oversheath material (optional for copper cables only) | **H**=HDPE P=FEP |
| **1** | Number of conductors | 1 or 2 |
| **L** | Normal operating voltages | Refer to datasheets of individual heating cables |
| **2000** | Conductor resistance | in Ω/km - i.e. 2000=2000 Ω/km |
| **BK** | Oversheath colour (optional) | **BK**=Black OR=Orange |

MI heating units consist of a heating cable, the hot-cold joint as well as the cold lead cables with an appropriate seal and gland. The connection and sealing of an MI heating unit is critical for a safe and reliable operation.

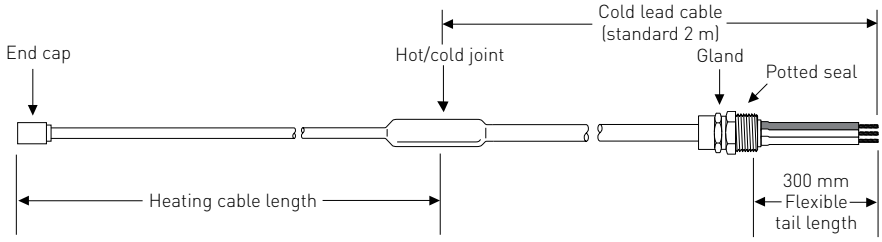
Santo strongly recommends the use of factory-terminated heating units, which guarantee a consistently high level of quality. The stainless steel (HSQ), Inconel 600 (HIQ) and Alloy 825 (HAx) can be delivered with laser welded joints and/or end caps to provide the optimum weld quality and highest reliability. We recommend the use of laser welded joints and/or end caps when the load or exposure temperatures cause element temperatures above 300°C. For use in hazardous areas, MI heating units need to be assembled by Santo or an authorized installer.

## MI HEATING UNITS ARE AVAILABLE IN DIFFERENT CONFIGURATIONS (unit types)

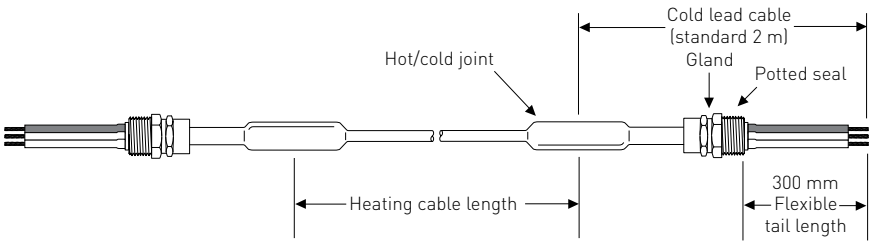
### MI heating unit type B (single conductor)




### MI heating unit type D (dual conductor)



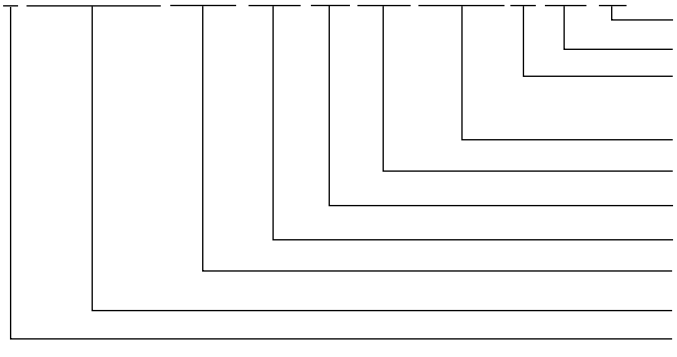

### MI heating unit type E (dual conductor)




The cold lead length includes 300 mm long flexible tails. Earth tails are supplied as standard on all heating units. Glands are fitted with washers and locknuts. Other configurations available on request.

## THE ORDER REFERENCE OF MI HEATING UNITS USES THE FOLLOWING NOMENCLATURE

**B/HSQ1M1000/43.0M/1217/230/2.0M/SC1H2.5/X/M20/EX**




When ordering, the complete order reference of the MI heating unit needs to be provided. For hazardous areas, information must also be provided about the T-rating and temperature data relevant to the application (max. sheath temperature data) to enable the correct representation of data on hazardous area tags attached to the completed heating unit in the factory.

Any missing detail may lead to potential delays in order processing.

## SELECTION OF MI COLD LEADS

Santo MI cold lead cables are available in different constructions:

CC: Copper sheath, copper conductor

CCH: HDPE jacketed copper sheath, copper conductor

DC: Cupro-Nickel sheath, copper conductor

SC: Stainless steel sheath, copper conductor

IC: Inconel 600 sheath, copper conductor

AC: Alloy 825 sheath, copper conductor

For selection of the MI cold lead, the environmental exposure (chemicals etc...), as well as the current rating need to be considered. Santo typically recommends using the same or superior sheath materials for the cold lead as used for the heating cable. Cold leads are normally selected based on the operating current of the heating unit at maintain temperature. For higher temperatures, the current can be significantly higher during the transitional start-up phase. If the application involves more frequent heat-up from lower temperatures, we recommend selecting the cold lead size based on the start-up current.

## HOT COLD JOINTS

The connection between the heating cable and the cold lead (hot-cold joint) is one of the most critical elements for the reliability of a MI heating unit. Various types are available for different sheath materials of the heating cables and cold leads.

| Sheath material for heating cable | Standard joint material for brazed units | Joint material for laser-welded units |
|---|---|---|
| Copper | Brass | N/A |
| Cupro-nickel | Brass for cupro-nickel cold lead | N/A |
| Cupro-nickel | Stainless for stainless steel cold lead | N/A |
| Stainless steel | Stainless steel | Stainless steel |
| Inconel | Stainless steel | Special alloy |
| Alloy 825 | Stainless steel | Special alloy |

The option for laser welded units is not available for MI heating cables with a copper or cupro-nickel sheath.

## COLD LEAD SELECTION TABLE

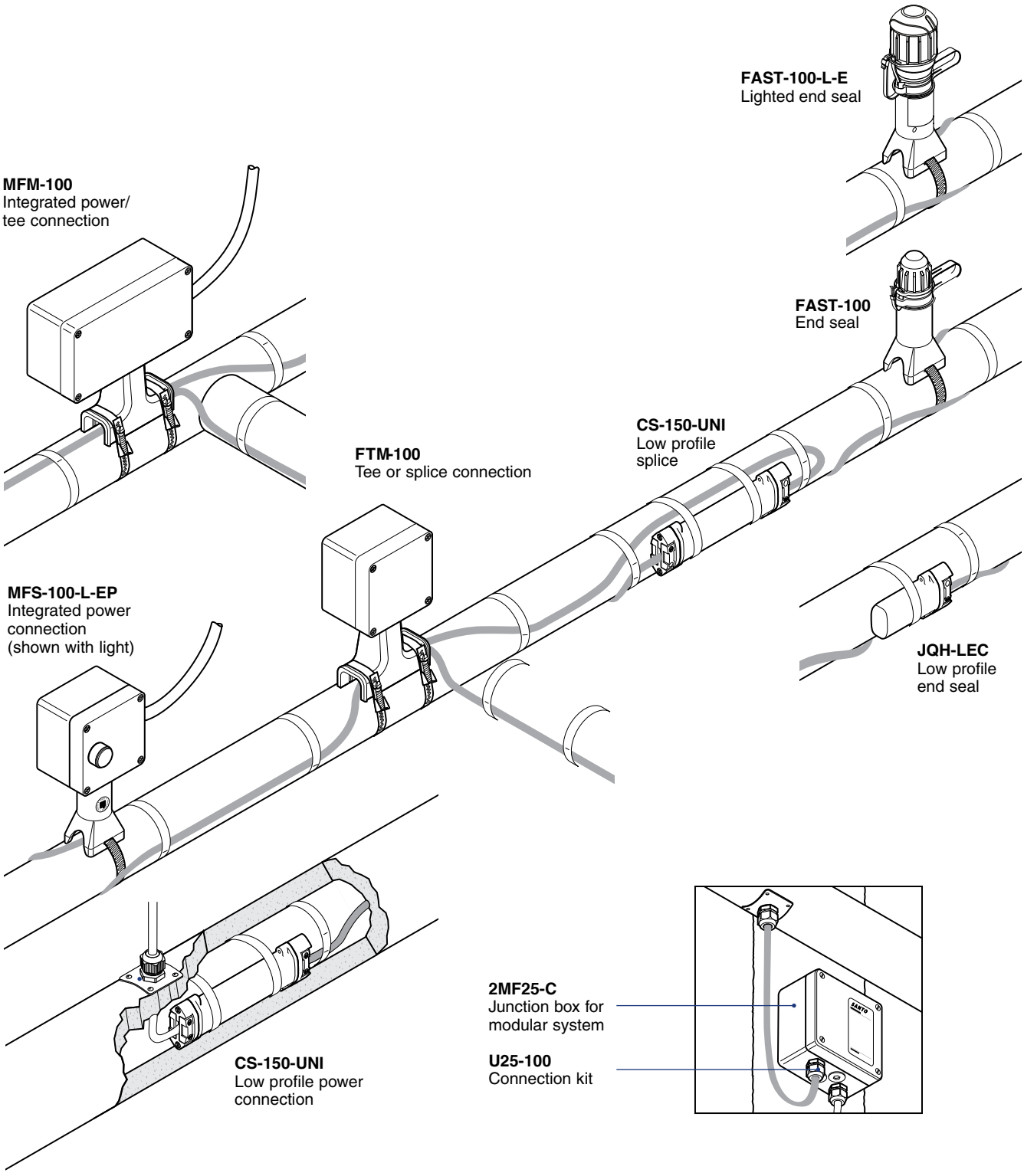
| Cross section | Numbers of conductors | Cold lead order reference | Diameter (mm) | Current rating (A) | Standard gland size |
|---|---|---|---|---|---|
| 1.0 | 2 | AC2H1.0 | 7.3 | 18 | M20 |
| 2.5 | 1 | CC1H2.5 | 5.3 | 34 | M20 |
| | | DC1H2.5 | 5.3 | 34 | M20 |
| | | SC1H2.5 | 5.3 | 34 | M20 |
| | | AC1H2.5 | 5.3 | 34 | M20 |
| 2.5 | 2 | AC2H2.5 | 8.7 | 28 | M20 |
| 6.0 | 1 | CC1H6 | 6.4 | 57 | M20 |
| | | DC1H6 | 6.4 | 57 | M20 |
| | | SC1H6 | 6.4 | 57 | M20 |
| | | AC1H6 | 6.4 | 57 | M20 |
| 6.0 | 2 | AC2H6 | 14.0 | 46 | M32 |
| 10.0 | 1 | CC1H10 | 7.3 | 77 | M25 |
| | | DC1H10 | 7.3 | 77 | M25 |
| 16.0 | 1 | CC1H16 | 8.3 | 102 | M25 |
| | | DC1H16 | 8.3 | 102 | M25 |
| | | AC1H16 | 8.3 | 102 | M25 |
| 25.0 | 1 | CC1H25 | 9.6 | 133 | M32 |
| | | AC1H25 | 10 | 133 | M32 |
| 35.0 | 1 | CC1H35 | 10.7 | 163 | M32 |

Brass glands are standard on all heating units.

The cold lead selection table does not show all possible combinations (other gland materials, sizes, optional PVC shrouds, etc.); contact Santo for more details.

For the on-site terminations and repair of cold leads, the use of MI double Cold Ends (PCE) is strongly recommended. Refer to Accessories for more information.

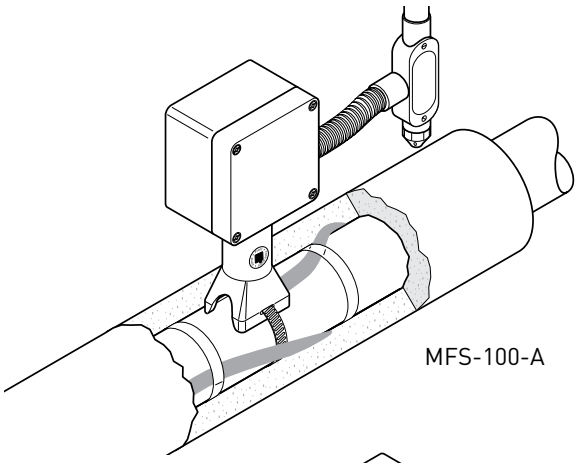
## Component overview of self-regulating and power-limiting heating cable system



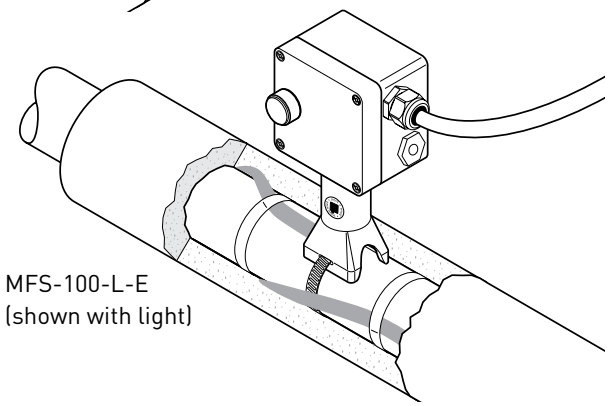

**Note:** CS-150, JQH-LEC & CS-150 Not available for ACC

# SANTO MFS-100

## SINGLE-ENTRY POWER CONNECTION WITH JUNCTION BOX



MFS-100-A



MFS-100-L-E
(shown with light)

The MFS-100 kit is designed to connect power to one Santo UFA, UFB, UFC, UFO or ACC industrial parallel heating cable. It is approved by FM, CSA,EAC and PTB for use in hazardous locations.

The MFS-100 integrates the functions of both connection kits and insulation entries. The rugged stand protects the heating cable and allows for up to 100 mm (4") of thermal insulation.

The core sealing boot does not require a heat gun or torch for the installation (no hot work permit necessary). The non-curing sealant (silicone free) in the boot allows easy installation and facilitates maintenance.

Spring-type terminals provide fast installation and safe, reliable, maintenance-free operation. This connection kit significantly reduces installation time. The kit is offered in three basic versions, customised for local installation practices. All kits are also available as a lighted version. These include a unique light module with a superbright LED that simply plugs into the terminals, and a lens in the lid. This provides indication that power is available in the box.

| DESCRIPTION | **MFS-100-A**<br>**MFS-100-L-A** | **MFS-100-E**<br>**MFS-100-L-E** | **MFS-100-EP**<br>**MFS-100-L-EP** |
|---|---|---|---|
| | This kit is for use in North America and has one through-hole for use with 3/4" conduit. | This kit is for use in Europe and provides two M25 threaded entries, one stopping plug, and one plastic power cable gland. | This kit is for use in Europe and provides two M25 threaded entries, an earthing plate, and an external earthing stud. It is designed for use with armoured cables. |
| **KIT CONTENTS** | | | |
| | 1 junction box with terminals<br>1 light module (for -L only)<br>1 stand<br>1 core sealer<br>1 green/yellow earthing sleeve<br>1 polywater sachet<br>1 cable tie | 1 junction box with terminals<br>1 light module (for -L only)<br>1 stand<br>1 core sealer<br>1 green/yellow earthing sleeve<br>1 M25 gland for power cable 8–17 mm in diameter<br>1 M25 stopping plug<br>1 polywater sachet<br>1 cable tie | 1 junction box with terminals, earth plate, and stud<br>1 light module (for -L only)<br>1 stand<br>1 core sealer<br>1 green/yellow earthing sleeve<br>1 M25 stopping plug<br>1 polywater sachet<br>1 cable tie |

## APPROVALS

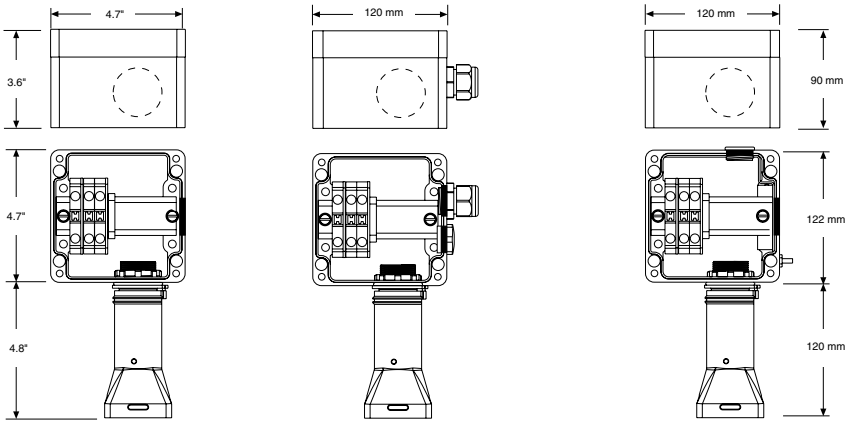
Hazardous locations

*For T-rating, see heating cable or design documentation
[1] Except ACC

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (NOMINAL)

| | MFS-100-A<br>MFS-100-L-A | MFS-100-E<br>MFS-100-L-E | MFS-100-EP<br>MFS-100-L-EP |
|---|---|---|---|




## PRODUCT SPECIFICATIONS

| | | | |
|---|---|---|---|
| Heating cable capability | UFA-CR, UFA-CT, UFB-CT, UFO-CT, ACC-CT, AFF-CT | | |
| Ingress protection | NEMA Type 4X | IP66/IP67 | IP66/IP67 |
| Entries | 1 x 3/4" | 2 x M25 including power cable gland for diameter 8 - 17 mm | 2 x M25 |
| Ambient temperature range | –50°C to +40°C | –50°C to +40°C* (MFS-100-E)<br>–40°C to +40°C (MFS-100-L-E) | –50°C to +40°C* (MFS-100-EP)<br>–40°C to +40°C (MFS-100-L-EP) |
| | *Extra conditions for safe use apply for ambient temperatures above +40°C. Please refer to the summary on page 179, the certificate or installation instructions for full details. | | |
| Min. installation temperature | –50°C | –50°C | –50°C |
| Max. pipe temperature | Refer to heating cable specification | | |
| Terminals | Spring-type terminals<br>2 line, 1 ground | Spring-type terminals<br>1 phase, 1 neutral, 1 earth | Spring-type terminals<br>1 phase, 1 neutral, 1 earth |
| Max. conductor size | 8 AWG stranded | 10 $mm^2$ stranded,<br>10 $mm^2$ solid | 10 $mm^2$ stranded,<br>10 $mm^2$ solid |
| Max. operating voltage | 277 Vac<br>*MFS-100-L-E and MFS-100-L-EP are limited to 254 Vac. Extra conditions for safe use apply for voltages higher than 254 Vac. | 480 Vac* | 480 Vac* |
| Max. continuous operating current | 50 A heating cable circuit | 40 A heating cable circuit | 40 A heating cable circuit |

## MATERIALS OF CONSTRUCTION

| | | | |
|---|---|---|---|
| Enclosure, lid, and stand | electrostatic charge-resistant glass-filled engineered polymer, black | electrostatic charge-resistant glass-filled engineered polymer, black | electrostatic charge-resistant glass-filled engineered polymer, black |
| Lid screws | Stainless steel | Stainless steel | Stainless steel |
| Lid gasket | Silicone rubber | Silicone rubber | Silicone rubber |
| Earth continuity plate | N/A | N/A | Steel, zinc plated, and blue chromated |

## OPTIONAL LED INDICATOR LIGHT

| | | | |
|---|---|---|---|
| Colour | Red | Green | Green |
| Voltage rating | 100-277 Vac | 100-254 Vac | 100-254 Vac |
| Power consumption | < 1 W | < 1 W | < 1 W |

Ordering details

## POWER CONNECTION

| | | | |
|---|---|---|---|
| Part Description | MFS-100-A | MFS-100-E | MFS-100-EP |
| PN (Weight) | 2000-M01 (2.5 lb) | 2000-M02 (1.2 kg) | 2000-M03 (1.3 kg) |

## POWER CONNECTION WITH LIGHT

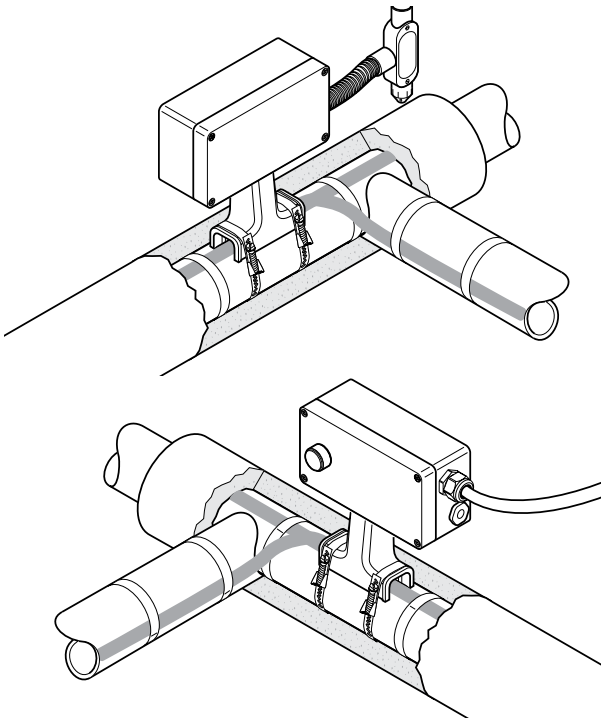
| | | | |
|---|---|---|---|
| Part Description | MFS-100-L-A | MFS-100-L-E | MFS-100-L-EP |
| PN (Weight) | 2000-M04 (3.5 lb) | 2000-M05 (1.6 kg) | 2000-M06 (1.7 kg) |

## ACCESSORIES

| | |
|---|---|
| Conduit drain 3/4" | 3/4IN (prevents condensate from collecting in the box) ONLY FOR MFS-100-L-A |
| Small pipe adaptor | MFS-SPA, required for pipes ⩽ 1" (DN 25) E90515-000 (bag of 5 adaptors) |

# SANTO MFM-100

## MUTIPLE-ENTRY POWER/TEE CONNECTION WITH JUNCTION BOX



The MFM-100 kit is designed to connect power to up to three Santo UFA, UFB, UFC, UFO, or ACC industrial parallel heating cables and is approved by FM, CSA, EAC and PTB for use in hazardous locations.

The MFM-100 integrates the functions of both connection kits and insulation entries. The rugged stand protects the heating cable and allows for up to 100 mm (4") of thermal insulation.

The core sealing boot does not require a heat gun or torch for the installation (no hot work permit necessary). The non-curing sealant (silicone free) in the boot allows easy installation and facilitates maintenance.

Spring-type terminals provide fast installation and safe, reliable, maintenance-free operation. This connection kit significantly reduces installation time.

The kit is offered in three basic versions, customised for local installation practices. All kits are also available as a lighted version. These include a unique light module with a superbright LED that simply plugs into the terminals, and a lens in the lid. This provides indication that power is available in the box.

| DESCRIPTION | **MFM-100-A**<br>**MFM-100-L-A** | **MFM-100-E**<br>**MFM-100-L-E** | **MFM-100-EP**<br>**MFM-100-L-EP** |
|---|---|---|---|
| | This kit is for use in North America and has one 3/4" through holes for use with 3/4" conduit. One stopping plug is supplied in the kit. | This kit is for use in Europe and provides two M25 threaded entries, one stopping plug, and one plastic power cable gland. | This kit is for use in Europe and provides two M25 threaded entries, an earthing plate, and an external earthing stud. It is designed for use with armoured cables. |
| **KIT CONTENTS** | | | |
| | 1 junction box with terminals<br>1 light module (for -L only)<br>1 stand<br>3 core sealers<br>3 green/yellow earthing sleeve<br>1 3/4" stopping plug<br>1 polywater sachet<br>1 spanner<br>1 strain relief assembly<br>2 grommet plugs | 1 junction box with terminals<br>1 light module (for -L only)<br>1 stand<br>3 core sealers<br>3 green/yellow earthing sleeve<br>1 M25 gland for power cable 8–17 mm in diameter<br>1 M25 stopping plug<br>1 polywater sachet<br>1 spanner<br>1 strain relief assembly<br>2 grommet plugs | 1 junction box with terminals, earth continuity plate, and stud<br>1 light module (for -L only)<br>1 stand<br>3 core sealers<br>3 green/yellow earthing sleeve<br>2 M25 stopping plugs<br>1 polywater sachet<br>1 spanner<br>1 strain relief assembly<br>2 grommet plugs |

## APPROVALS

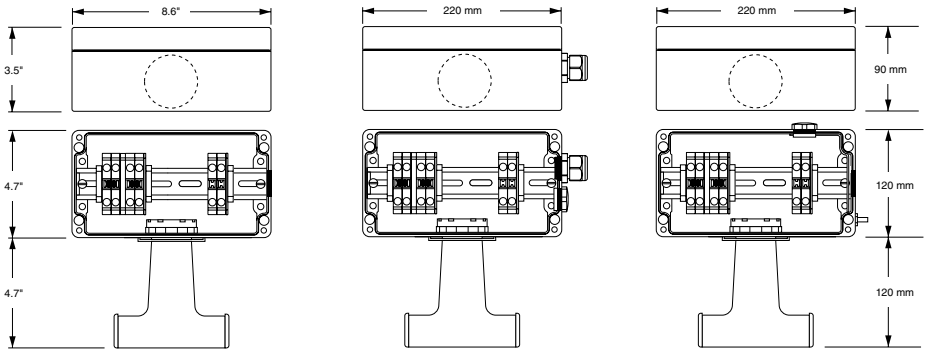
**Hazardous locations**

*For T-rating, see heating cable or design documentation
[1] Except ACC

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (NOMINAL)

| | MFM-100-A<br>MFM-100-L-A | MFM-100-E<br>MFM-100-L-E | MFM-100-EP<br>MFM-100-L-EP |
|---|---|---|---|




## PRODUCT SPECIFICATIONS

| | | | |
|---|---|---|---|
| Heating cable capability | UFA-CR, UFA-CT, UFB-CT, UFC-CT, UFO-CT, ACC-CT | | |
| Ingress protection | NEMA Type 4X | IP66 | IP66 |
| Entries | 1 x 3/4" | 2 x M25 including power cable gland for diameter 8-17 mm | 2 x M25 |
| Ambient temperature range | –50°C to +40°C | –50°C to +56°C* (MFM-100-E)<br>–40°C to +40°C (MFM-100-L-E) | –50°C to +56°C* (MFM-100-EP)<br>–40°C to +40°C (MFM-100-L-EP) |
| | *Extra conditions for safe use apply for ambient temperatures above +40°C. | | |
| Min. installation temperature | –50°C | –50°C | –50°C |
| Max. pipe temperature | Refer to heating cable specification | | |
| Terminals | Spring-type terminals line, 2 ground | Spring-type terminals 2 phase, 2 neutral, 2 earth | Spring-type terminals 2 phase, 2 neutral, 2 earth |
| Max. conductor size | 8 AWG stranded | 10 $mm^2$ stranded, 10 $mm^2$ solid | 10 $mm^2$ stranded, 10 $mm^2$ solid |
| Max. operating voltage | 277 Vac | 480 Vac* | 480 Vac* |
| | *MFM-100-L-E and MFM-100-L-EP are limited to 254 Vac. Extra conditions for safe use apply for voltages higher than 254 Vac. | | |
| Max. continuous operating current | 50 A heating cable circuit | 40 A heating cable circuit | 40 A heating cable circuit |

| MATERIALS OF CONSTRUCTION | | | |
|---|---|---|---|
| Enclosure, lid, and stand | Electrostatic charge-resistant glass-filled engineered polymer, black | electrostatic charge-resistant glass-filled engineered polymer, black | electrostatic charge-resistant glass-filled engineered polymer, black |
| Lid screws | Stainless steel | Stainless steel | Stainless steel |
| Lid gasket | Silicone rubber | Silicone rubber | Silicone rubber |
| Earth continuity plate | N/A | N/A | Steel, zinc plated, and blue chromated |

| OPTIONAL LED INDICATOR LIGHT | | | |
|---|---|---|---|
| Colour | Red | Green | Green |
| Voltage rating | 100-277 Vac | 100-254 Vac | 100-254 Vac |
| Power consumption | < 1 W | < 1 W | < 1 W |

**Ordering details**

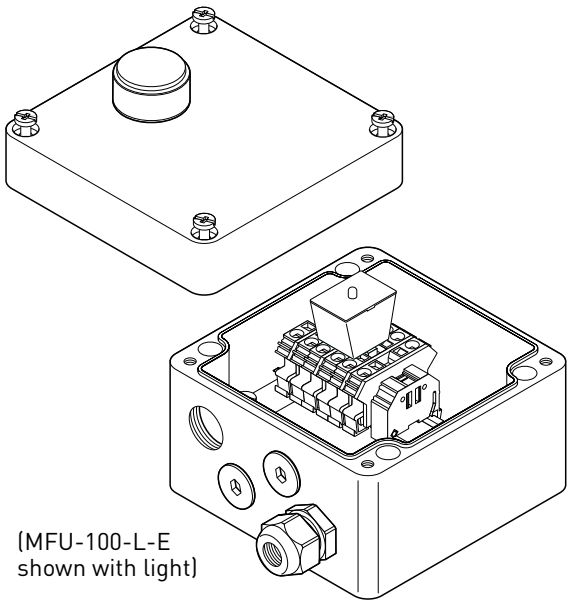
| POWER CONNECTION | | | |
|---|---|---|---|
| Part Description | MFM-100-A | MFM-100-E | MFM-100-EP |
| PN (Weight) | 2000-M07 (4.3 lb) | 2000-M08 (1.9 kg) | 2000-M09 (2.1 kg) |

| POWER CONNECTION WITH LIGHT | | | |
|---|---|---|---|
| Part Description | MFM-100-A | MFM-100-E | MFM-100-EP |
| PN (Weight) | 2000-M10 (5.3 lb) | 2000-M11 (2.3 kg) | 2000-M12 (2.5 kg) |

| ACCESSORIES | |
|---|---|
| Conduit drain 3/4" | MF-DRAIN-PLUG-3/4IN (prevents condensate from collecting in the box) ONLY FOR MFM-100-L-A |
| Small pipe adaptor | MFM-SPA, required for pipes ⩽ 1" (DN 25) D55673-000 (bag of 5 adaptors) |

# SANTO MFU-100

## JUNCTION BOX FOR MODULAR SYSTEM



(MFU-100-L-E shown with light)

The MFU-100 kit is designed to connect power to up to three Santo UFA, UFB, UFC, UFO or ACC industrial parallel heating cables and is approved by EAC for use in hazardous locations.

Innovative Spring-type terminals provide fast installation and safe, reliable, maintenance-free operation.

The box is part of the modular component system, it allows for maximum flexibility and can be either wall or pipe mounted.

Connection kits (M25) and insulation entry kits have to be ordered separately. The box is offered in two basic versions customised to local installation practices.

All kits are also available as a lighted version (-L). These include a unique light module with a superbright green LED that simply plugs into the terminals, and a lens in the lid. This provides indication that power is available in the box.

| DESCRIPTION | MFU-100-E<br>MFU-100-L-E | MFU-100-EP<br>MFU-100-L-EP |
|---|---|---|
| | This box is for use in Europe and provides four M25 threaded entries, stopping plugs and one plastic power cable gland. | This box is for use in Europe and provides four M25 threaded entries, an earthing plate and an external earth stud. It is designed for use with armoured power cables. |
| **KIT CONTENTS** | | |
| | 1 junction box with terminals<br>1 light module (for -L only)<br>1 M25 gland for 8-17 mm diameter power cable<br>2 M25 stopping plugs | 1 junction box with terminals with earth plate and external earth stud<br>1 light module (for -L only)<br>2 M25 stopping plugs |

## APPROVALS

Hazardous locations

Ex e II T*
Ex em II T* (for -L only)

DNV approval
DNV Certificates No. E-11564 and No. E-11565

ex e II T*
Ex em II T* (for -L only)

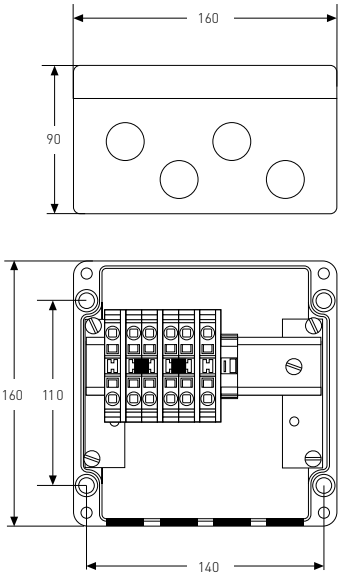
DNV approval

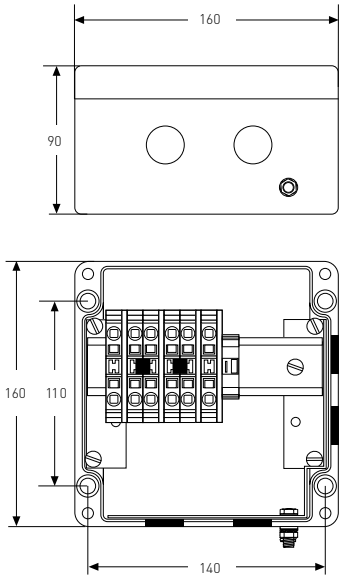
*For T-rating, see heating cable or design documentation

(Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (NOMINAL)

| | **MFU-100-E**<br>**MFU-100-L-E** | **MFU-100-EP**<br>**MFU-100-L-EP** |
|---|---|---|




## PRODUCT SPECIFICATIONS

| | | |
|---|---|---|
| Ingress protection | IP66 | IP66 |
| Entries | 4 x M25 | 4 x M25 |
| Ambient temperature range | –50°C to +56°C* (MFU-100-E)<br>–40°C to +40°C (MFU-100-L-E)<br>*Extra conditions for safe use apply for ambient temperatures above +40°C. | –50°C to +56°C* (MFU-100-EP)<br>–40°C to +40°C (MFU-100-L-EP) |
| Terminals | Spring-type terminals | Spring-type terminals |
| | 2 phase, 2 neutral, 2 ground | 2 phase, 2 neutral, 2 ground |
| Max. conductor size | 10 $mm^2$ stranded, 10 $mm^2$ solid | 10 $mm^2$ stranded, 10 $mm^2$ solid |
| Max. operation voltage | 480 Vac | 480 Vac |
| Max. current rating | 40 A | 40 A |

## MATERIALS OF CONSTRUCTION

| | | |
|---|---|---|
| Enclosure, lid | Electrostatic charge-resistant glass-filled engineered polymer, black | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Lid screws | Stainless steel | Stainless steel |
| Lid gasket | Silicone rubber | Silicone rubber |
| Earth continuity plate | N/A | Steel, zinc plated, and blue chromated |

## OPTIONAL LED INDICATOR LIGHT

| | | |
|---|---|---|
| Colour | Green | Green |
| Voltage rating | 100-254 Vac | 100-254 Vac |
| Power consumption | < 1 W | < 1 W |

Ordering details

## JUNCTION BOX

| | | |
|---|---|---|
| Part Description | MFU-100-E | MFU-100-EP |
| PN (Weight) | 2000-M13 (1.7 kg) | 2000-M14 (1.8 kg) |

## JUNCTION BOX WITH LIGHT

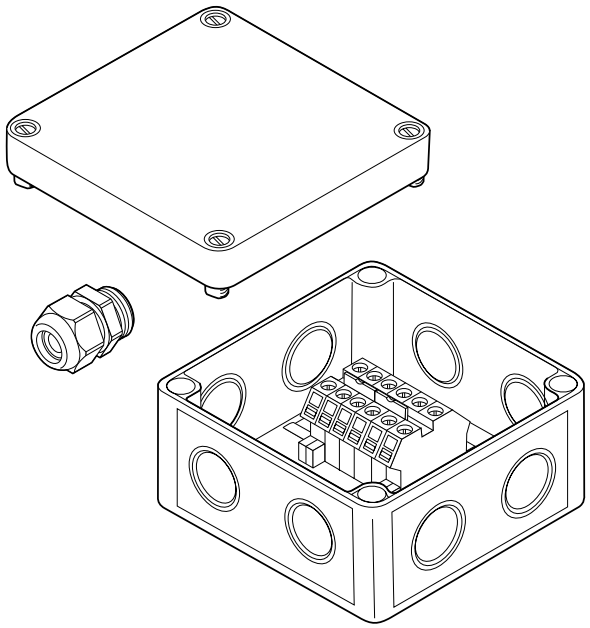
| | | |
|---|---|---|
| Part Description | MFU-100-L-E | JBU-100-L-EP |
| PN (Weight) | 2000-M15 (2.1 kg) | 2000-M16 (2.2 kg) |

## ACCESSORIES

| | | |
|---|---|---|
| Heating cable connection kits | U25-100, U25-21, UAON25-100 | U25-100, U25-21, UAON25-100, U25-100-METAL |
| Insulation entry kit | U-25-04 or U-25-PIPE | U-25-04 or U-25-PIPE |
| Power cable gland | GL-36-M25 (included) | GL-38-M25-METAL (optional) |
| Junction box support bracket (optional) | SB-100, SB-101 | SB-100, SB-101 |

# SANTO MF-82

## JUNCTION BOX



The MF-82 is a standard, non-hazardous polycarbonate junction box.

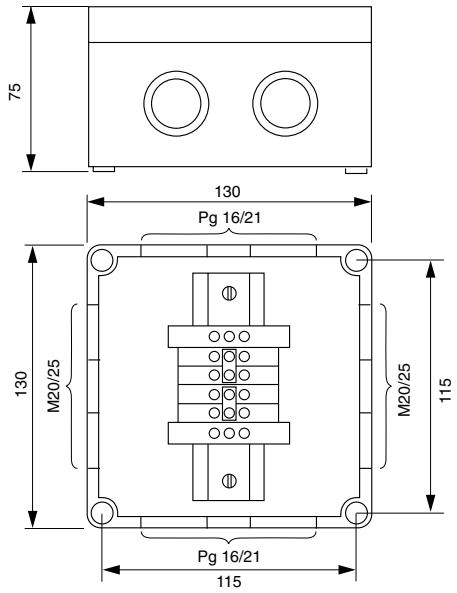
It may be used to make a power connection, splice, powered splice, powered tee or simple tee, for use with Santo industrial parallel heating cables.

Up to four heating cables or three heating cables and the appropriate size power cable can be accommodated through the four entries and connected to the rail mounted terminals.

For pipe mounting, it is recommended that this box is used with a Santo support bracket.

| ENCLOSURE | **MF-82** |
|---|---|
| Area of use | Ordinary (indoors and outdoors) |
| Protection | IP66 |
| Entries | 4 M20/25 |
| Exposure temperature | –35°C to +115°C |
| Base | Grey glass filled polycarbonate |
| Lid | Grey polycarbonate |
| Lid gasket | Foamed polyurethane |
| **PHASE TERMINALS** | |
| Conta-Clip RK6-10 | Din rail mounted |
| Voltage rating | 750 Vac |
| Max. conductor size | 0.5-10 $mm^2$ (solid and stranded) |
| Current rating | 61 A |
| Quantity | Two cross-connected groups of two |
| **EARTH TERMINALS** | |
| | 2 Conta-Clip SL10/35 |

## DIMENSIONS (IN MM)



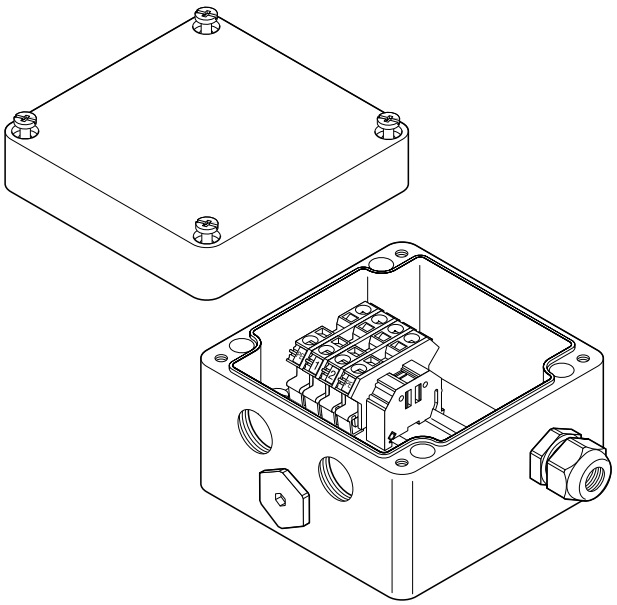

| MOUNTING | MF-82 |
|---|---|
| Through holes moulded in the base of the junction box | |
| Centres | 115 x 115 mm |
| Size | 5 mm diameter |
| Cable gland | Polyamide with locknut for cable diameters from 9 to 16 mm |

| ACCESSORIES | |
|---|---|
| Junction box support bracket | SB-100, SB-101, SB-110, SB-111 |

| ORDERING DETAIL | |
|---|---|
| Part description | MF-82 |
| PN (Weight) | 2000-M17 (0.47 kg) |

# SANTO MF-EX-20 AND MF-EX-20-EP

## MULTI PURPOSE JUNCTION BOX



Industrial junction box for use in hazardous areas with FMT, FHT, PI and MI heating cables. This box can be used to make connections between power cables, heating cables and cold lead cables. Depending on the configuration of the system, the box can accommodate heating cables, cold leads and a power cable. M20 connection kits have to be ordered separately depending on the type of heating cable being used.

Cable connection is via DIN rail mounted Spring-type terminals to provide fast installation and safe, reliable, maintenance-free operation.

The box can be either wall or pipe mounted via the four holes moulded in the base of the box. For pipe mounting, use one of the standard support brackets.

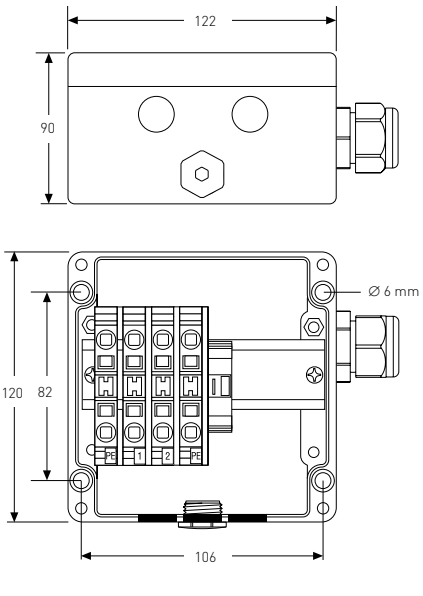
| TYPICAL USE | MF-EX-20 | MF-EX-20-EP |
|---|---|---|
| | Power supply box for series heating cables (PI & MI) and constant wattage parallel heating cables (FMT & FHT) or end box (star) for series heating cables (PI & MI), when using M20 connection kits | |
| **ENTRIES** | | |
| | 3 x M20<br>1 x M25 | 3 x M20<br>1 x M25 |
| **KIT CONTENTS** | | |
| | Junction box with spring-type terminals on DIN rail | Junction box with spring-type terminals on DIN rail, earthing plate and an external earth stud |
| | 1 x M20 stopping plug<br>2 x M20 rain plugs (temporary)<br>1 x M25 Hazardous area approved cable gland for power cables with ∅ of 8 to 17 mm<br>1 x terminal jumper allowing various wiring configurations (remove terminal plate) | 1 x M20 stopping plug<br>2 x M20 rain plugs (temporary)<br>1 x M25 rain plug (temporary) |
| **APPROVALS** | | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |

## MATERIALS OF CONSTRUCTION

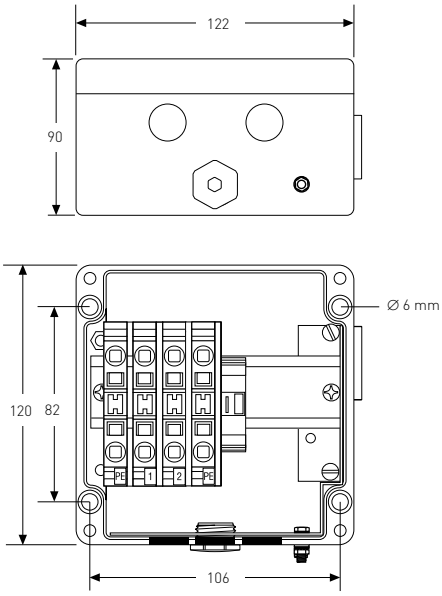
| | | |
|---|---|---|
| Box & lid | Electrostatic charge-resistant glass-filled engineered polymer, black | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Sealing gasket | Silicone rubber | Silicone rubber |
| Lid fixing screws | Stainless steel (captive) | Stainless steel (captive) |
| Earthing plate | N.A. | Steel, zinc plated and blue chromated |

## DIMENSIONS (IN MM)

**MF-EX-20**




**MF-EX-20-EP**




## INGRESS PROTECTION

| | | |
|---|---|---|
| | IP66 | IP66 |

## AMBIENT TEMPERATURE RANGE

| | | |
|---|---|---|
| | –55°C to +55°C | –55°C to +55°C |

## TERMINALS

| | | |
|---|---|---|
| Quantity | 4 pcs, spring-type | 4 pcs, spring-type |
| Labeling | 1, 2 + 2 x PE | 1, 2 + 2 x PE |
| Maximum conductor size | 10 $mm^2$ (solid & stranded) | 10 $mm^2$ (solid & stranded) |
| Maximum operating voltage | 590 Vac | 590 Vac |
| Maximum operating current | 53 A | 53 A |

## ACCESSORIES (TO BE ORDERED SEPARATELY)

| | | |
|---|---|---|
| Support bracket | SB-100, SB-101, SB-110, SB-111 | SB-100, SB-101, SB-110, SB-111 |
| Power cable gland | GL-36-M25 (included) | GL-38-M25-METAL (optional) |
| Loose terminals (*) | Phase/neutral terminal:<br>Earth terminal:<br>End plate:<br>Terminal jumper: | WAGO-PHASE<br>WAGO-EARTH<br>WAGO-ENDPLATE<br>WAGO-JUMPER |
| Connection kit for FMT and FHT heating cables | C20-01-F hot applied connection kit with plastic gland | C20-02-F cold applied connection kit with metal gland |
| Insulation entry kit for FMT and FHT heating cables | IEK-25-04 or IEK-25-PIPE | IEK-25-04 or IEK-25-PIPE |
| Gland for PI cold leads | GL-44-M20-KIT hazardous area approved gland | GL-44-M20-KIT hazardous area approved gland |
| Insulation entry kit for PI cold leads | IEK-20-PI | IEK-20-PI |
| Stopping plug | PLUG-M20-EXE-PLASTIC | PLUG-M20-EXE-PLASTIC |

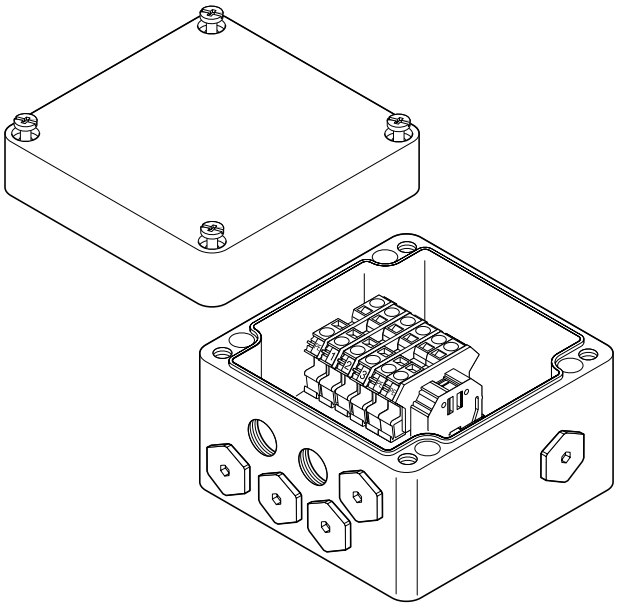
## ORDERING DETAILS

| | | |
|---|---|---|
| Order reference | MF-EX-20 | MF-EX-20-EP |
| Part number (Weight) | 2000-M18 (0.9 kg) | 2000-M19 (1 kg) |

(*) in total no more than 6 terminals of this type should be installed.

# SANTO MF-EX-21

## MULTI PURPOSE JUNCTION BOX



Industrial polyester junction box for use in hazardous areas. This box can be used to make connections between power cables, heating cables and cold lead cables using M20 connection kits. Depending on the configuration of the system, the box can accommodate six heating cables/cold leads and a power cable. M20 connection kits have to be ordered separately depending on the type of heating cable being used. Cable connection is accomplished via DIN rail mounted spring-type terminals.

The box can be either wall or pipe mounted via the four holes moulded in the base of the box. For pipe mounting use one of the standard support bracket.

| TYPICAL USE | |
|---|---|
| | Power supply box, end-box, splice box (3-phase and loop), marshalling box. |

| ENTRIES | |
|---|---|
| | 6 x M20<br>1 x M32 |

| KIT CONTENTS | |
|---|---|
| | 1 x junction box with terminals on DIN rail<br>4 x M20 stopping plugs<br>2 x M20 rain plug (temporary)<br>1 x M32 stopping plug<br>1 x terminal jumper allowing various wiring configurations (remove terminal plate) |

| APPROVALS | |
|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

| MATERIALS OF CONSTRUCTION | |
|---|---|
| Box & lid | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Sealing gasket | Silicone rubber |
| Lid fixing screws | Stainless steel (captive) |

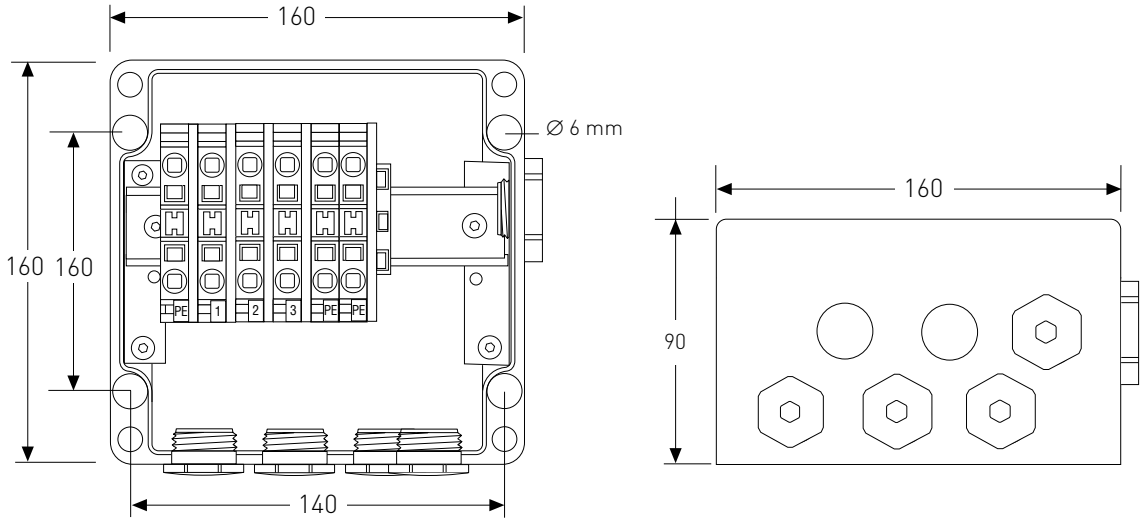
## INGRESS PROTECTION

| | |
|---|---|
| | IP66 |

## AMBIENT TEMPERATURE RANGE

| | |
|---|---|
| | –55°C to +55°C |

## DIMENSIONS (IN MM)




## TERMINALS

| | |
|---|---|
| Quantity | 6 pc. |
| Type | Spring-type |
| Labeling | 1, 2, 3, 3 x PE |
| Maximum conductor size | 10 $mm^2$ (solid & stranded) |
| Maximum operating voltage | 550 Vac |
| Maximum operating current | 53 A |

## ACCESSORIES (TO BE ORDERED SEPARATELY)

| | |
|---|---|
| Support bracket | SB-100, SB-101 |
| Gland for PI cold leads | GL-44-M20-KIT hazardous area approved gland for cables Ø 5.5-13 mm |
| Gland for MI cold leads | Contact Santo |
| Gland for power cable | GL-45-M32 hazardous area approved gland for cables Ø 12-21 mm |
| Loose terminals (*) | Phase/neutral terminal: WAGO-PHASE<br>Earth terminal: WAGO-EARTH<br>End plate: WAGO-ENDPLATE<br>Terminal jumper: WAGO-JUMPER |

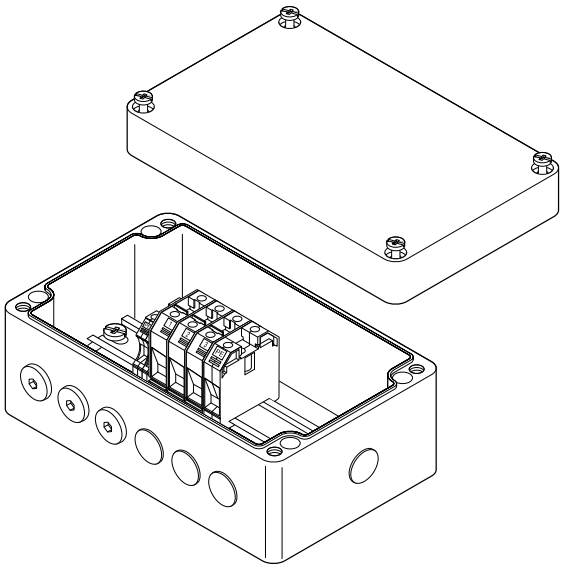
## ORDERING DETAILS

| | |
|---|---|
| Order reference | MF-EX-21 |
| Part number (Weight) | 2000-M20 (1.2 kg) |

(*) in total no more than 10 terminals should be installed.

# SANTO MF-EX-21/35MM2

## MULTI PURPOSE JUNCTION BOX



Industrial junction box for use in hazardous areas with PI and MI heating cables when large terminal sizes are required. This box can be used to make connections between power cables, heating cables and cold lead cables. Depending on the configuration of the system, the box can accommodate multiple heating cables/cold leads and a power cable.

The M20 connection kits have to be ordered separately depending on the type of heating cable being used.

Cable connection is accomplished via DIN rail mounted screw terminals from Weidmuller to provide safe, reliable and maintenance-free operation.

The box can be wall mounted via the four holes moulded in the base of the box.

| | |
|---|---|
| **TYPICAL USE** | |
| | Power supply box, end-box, splice box for series heating cables (PI & MI), when using M20 connection kits. Marshalling box for power cables. |
| **ENTRIES** | |
| | 6 x M20<br>1 x M40 |
| **KIT CONTENTS** | |
| | 1 x Junction box with screw terminals on DIN rail<br>3 x M20 stopping plugs<br>3 x M20 rain plugs (temporary)<br>1 x M40 stopping plug |
| **APPROVALS** | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## MATERIALS OF CONSTRUCTION

| | |
|---|---|
| Box & lid | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Sealing gasket | Silicone rubber |
| Lid fixing screws | Stainless steel (captive) |

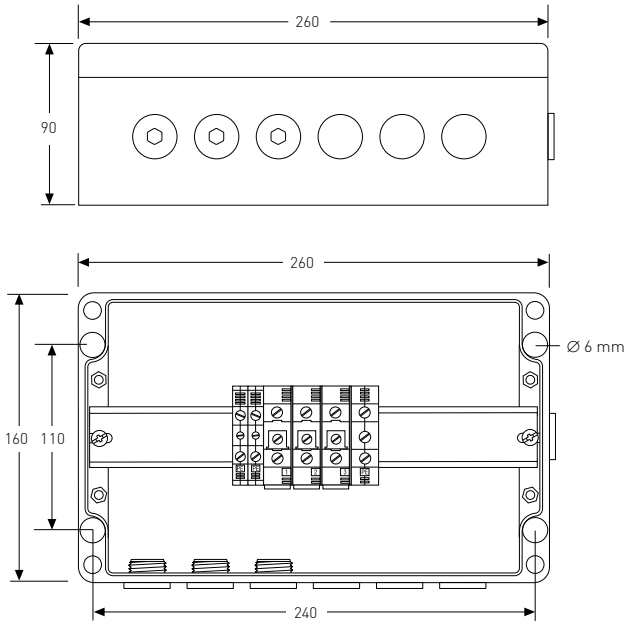
## INGRESS PROTECTION

| | |
|---|---|
| | IP66 |

## AMBIENT TEMPERATURE RANGE

| | |
|---|---|
| | –50°C to +55°C |

## DIMENSIONS (IN MM)




## TERMINALS

| | |
|---|---|
| Quantity & type | 3 pcs WDU35 screw terminals<br>2 pcs WPE10 earth terminals for heating cable earth leads<br>1 pc WPE35 earth terminal for power cable<br>Junction box can accomodate up to 6 fully loaded phase/neutral terminals (maximum 10 terminals in total) |
| Labelling | 1, 2, 3 + 3 x PE |
| Minimum conductor size | 2.5 $mm^2$ stranded & solid |
| Maximum conductor size | 35 $mm^2$ stranded & 16 $mm^2$ solid |
| Maximum operating voltage | 690 Vac |
| Maximum operating current | 100 A |

## ACCESSORIES (TO BE ORDERED SEPARATELY)

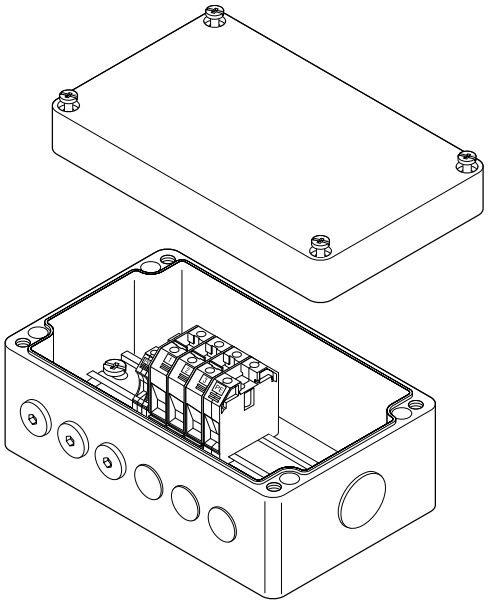
| | | |
|---|---|---|
| Glands for power cables | GL-51-M40 hazardous area approved gland for cables ∅ 17-28 mm,<br>GL-45-M32 hazardous area approved gland for cables ∅ 12-21 mm,<br>GL-50-M20 hazardous area approved gland for cables ∅ 5.5-13 mm | |
| Reducer | REDUCER-M40/32-EEXE hazardous area M40 male to M32 female reducer | |
| Loose terminals | 35 $mm^2$ phase/neutral terminal:<br>10 $mm^2$ earth terminal:<br>35 $mm^2$ earth terminal:<br>Endplate:<br>Terminal jumper (2):<br>Terminal jumper (3): | WDM-PHASE-35<br>WDM-EARTH-10<br>WDM-EARTH-35<br>WDM-PLATE<br>WDM-JUMPER-35-2<br>WDM-JUMPER-35-3 |
| Gland for PI cold leads | GL-44-M20-KIT hazardous area approved gland for cables ∅ 5.5-13 mm | |
| Insulation entry kit for PI cold leads | IEK-20-PI | |
| Gland for MI cold leads | In case of factory terminated units, already present. | |

## ORDERING DETAILS

| | |
|---|---|
| Order reference | MF-EX-21/35MM2 |
| Part number (Weight) | 2000-M21 (1.9 kg) |

# SANTO MF-EX-25/35MM2

## MULTI PURPOSE JUNCTION BOX



Industrial junction box for use in hazardous areas with MI heating cables when larger terminal sizes are required. This box can be used to make connections between power cables, heating and cold lead cables. Depending on the configuration of the system, the box can accommodate multiple heating cables/cold leads and a power cable. The M25 glands are already present in the case of factory terminated MI heating units. In case of on-site assemblies, refer for detailed information about the required accessories.

Cable connection is accomplished via DIN rail mounted screw terminals from Weidmüller to provide safe, reliable and maintenance-free operation.

The box can be wall mounted via the four holes moulded in the base of the box.

### TYPICAL USE

Power supply box, end-box, splice box for series heating cables (MI), when terminated with M25 glands. Marshalling box for power cables.

### ENTRIES

6 x M25
1 x M40

### KIT CONTENTS

Junction box with screw terminals on DIN rail
3 x M25 stopping plugs
3 x M25 rain plugs (temporary)
1 x M40 stopping plug

### APPROVALS

| | | |
|---|---|---|
| | PTB 00 ATEX 1002 | Ex II 2G Ex edm ia [ia] IIC T6, T5 and T4 |
| | | Ex II 2D Ex tD A21 IP66 T85°C, T100°C and T135°C |
| | IECEx PTB 08.0004 | Ex e ia II, IIC T6, T5, T4 |
| | | Ex tD A21 IP66 T 85°C, T 100°C, T 135°C |
| | EAC | (Russia, Kazakhstan, Belarus) For other countries contact your local Santo representative. |

## MATERIALS OF CONSTRUCTION

| | |
|---|---|
| Box & lid | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Sealing gasket | Silicone rubber |
| Lid fixing screws | Stainless steel (captive) |

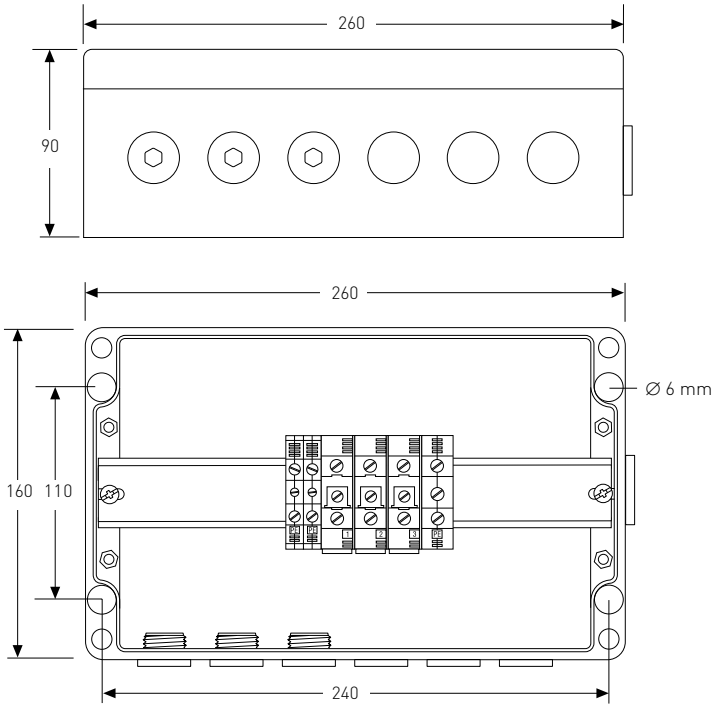
## INGRESS PROTECTION

| | |
|---|---|
| | IP66 |

## AMBIENT TEMPERATURE RANGE

| | |
|---|---|
| | –50°C to +55°C |

## DIMENSIONS (IN MM)




## TERMINALS

| | |
|---|---|
| Quantity & type | 3 pcs WDU35 screw terminals<br>2 pcs WPE10 earth terminals for heating cable earth leads<br>1 pc WPE35 earth terminal for power cable<br>Junction box can accomodate up to 6 fully loaded phase/neutral terminals<br>(maximum 10 terminals in total) |
| Labelling | 1, 2, 3 + 3 x PE |
| Minimum conductor size | 2.5 $mm^2$ stranded & solid |
| Maximum conductor size | 35 $mm^2$ stranded & 16 $mm^2$ solid |
| Maximum operating voltage | 690 Vac |
| Maximum operating current | 100 A |

## ACCESSORIES (TO BE ORDERED SEPARATELY)

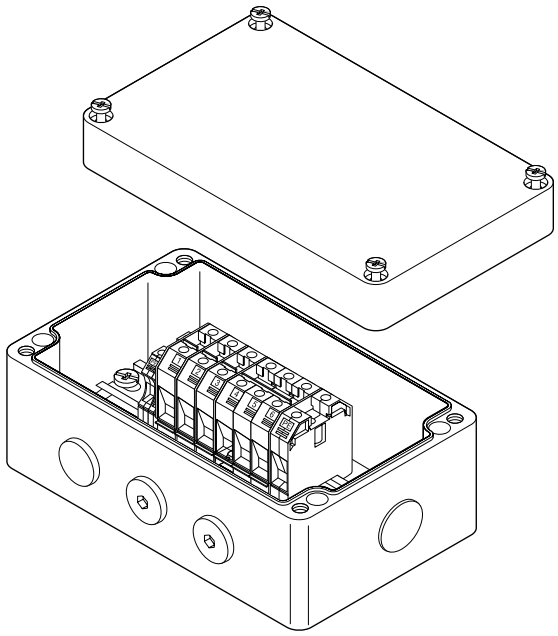
| | | |
|---|---|---|
| Glands for power cables | GL-51-M40 hazardous area approved gland for cables Ø 17-28 mm,<br>GL-45-M32 hazardous area approved gland for cables Ø 12-21 mm,<br>GL-36-M25 hazardous area approved gland for cables Ø 8.5-16 mm | |
| Reducer | REDUCER-M40/32-EEXE hazardous area M40 male to M32 female reducer | |
| Loose terminals | 35 $mm^2$ phase/neutral terminal:<br>10 $mm^2$ earth terminal:<br>35 $mm^2$ earth terminal:<br>Endplate:<br>Terminal jumper (2):<br>Terminal jumper (3): | WDM-PHASE-35<br>WDM-EARTH-10<br>WDM-EARTH-35<br>WDM-PLATE<br>WDM-JUMPER-35-2<br>WDM-JUMPER-35-3 |
| Gland for MI cold leads | In case of factory terminated MI heating units, supplied with MI units. | |

## ORDERING DETAILS

| | |
|---|---|
| Order reference | MF-EX-25/35MM2 |
| Part number (Weight) | 2000-M22 (1.9 kg) |

# SANTO MF-EX-32/35MM2

## MULTI PURPOSE JUNCTION BOX



Industrial junction box for use in hazardous areas with MI heating cables when large terminal sizes are required. This box can be used to make connections between power cables, heating cables and cold lead cables. Depending on the configuration of the system, the box can accommodate multiple heating cables/cold leads and a power cable.

The M32 glands are already present in the case of factory terminated heating units. In case of on-site assemblies, refer for detailed information about the required accessories.

Cable connection is accomplished via DIN rail mounted screw terminals from Weidmüller to provide safe, reliable and maintenance-free operation.

The box can be wall mounted via the four holes moulded in the base of the box.

### TYPICAL USE

Power supply box, end-box, splice box for series heating cables (MI), when terminated with M32 glands. Marshalling box for power cables.

### ENTRIES

3 x M32
1 x M40

### KIT CONTENTS

Junction box with screw terminals on DIN rail
2 x M32 stopping plugs
1 x M32 rain plug (temporary)
1 x M40 stopping plug

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## MATERIALS OF CONSTRUCTION

| | |
|---|---|
| Box & lid | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Sealing gasket | Silicone rubber |
| Lid fixing screws | Stainless steel (captive) |

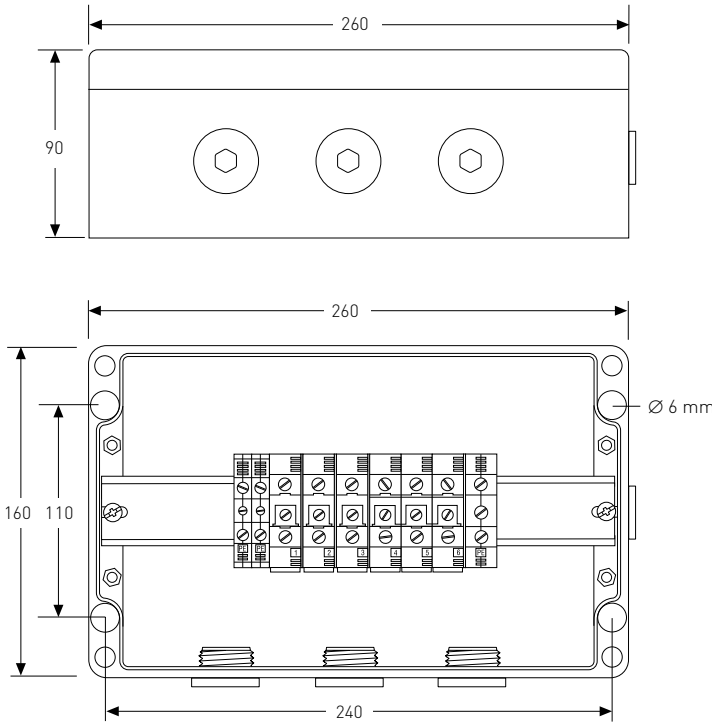
## INGRESS PROTECTION

| | |
|---|---|
| | IP66 |

## AMBIENT TEMPERATURE RANGE

| | |
|---|---|
| | –50°C to +55°C |

## DIMENSIONS (IN MM)




## TERMINALS

| | |
|---|---|
| Quantity & type | 6 pcs WDU35 screw terminals, 3 separate and 3 bridged,<br>2 pcs WPE10 earth terminals for heating cable earth leads,<br>1 pc WPE35 earth terminal for power cable,<br>Junction box can accomodate up to 6 fully loaded phase/neutral terminals<br>(maximum 10 terminals in total) |
| Labelling | 1, 2, 3, 4, 5, 6 + 3 x PE |
| Minimum conductor size | 2.5 $mm^2$ stranded & solid |
| Maximum conductor size | 35 $mm^2$ stranded & 16 $mm^2$ solid |
| Maximum operating voltage | 690 Vac |
| Maximum operating current | 100 A |

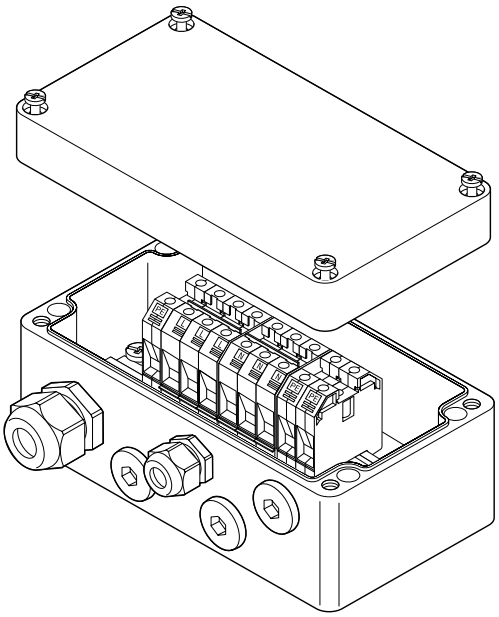
## ACCESSORIES (TO BE ORDERED SEPARATELY)

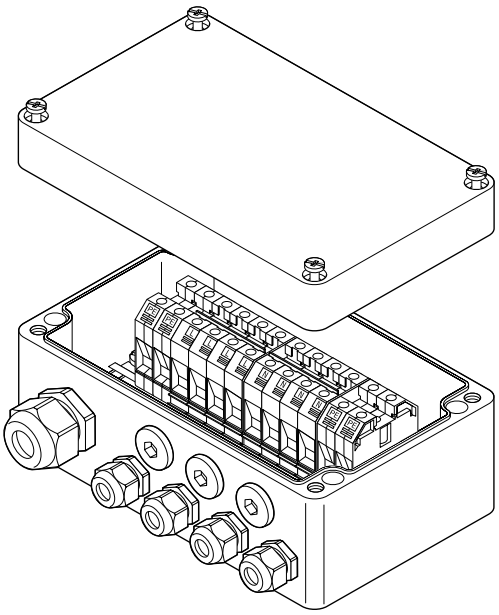
| | | |
|---|---|---|
| Glands for power cables | GL-51-M40 hazardous area approved gland for cables ∅ 17-28 mm<br>GL-45-M32 hazardous area approved gland for cables ∅ 12-21 mm | |
| Reducer | REDUCER-M40/32-EEXE hazardous area M40 male to M32 female reducer<br>REDUCER-M32/25-EEXE hazardous area M32 male to M25 female reducer | |
| Loose terminals | 35 $mm^2$ phase/neutral terminal:<br>10 $mm^2$ earth terminal:<br>35 $mm^2$ earth terminal:<br>Endplate:<br>Terminal jumper (2):<br>Terminal jumper (3): | WDM-PHASE-35<br>WDM-EARTH-10<br>WDM-EARTH-35<br>WDM-PLATE<br>WDM-JUMPER-35-2<br>WDM-JUMPER-35-3 |
| Gland for MI cold leads | In case of factory terminated units, already present. | |

## ORDERING DETAILS

| | |
|---|---|
| Order reference | MF-EX-32/35MM2 |
| Part number (Weight) | 2000-M23 (1.9 kg) |

# MF-MB-25/16MM2 AND MF-MB-26/16MM2 MARSHALLING BOX





Both connection boxes are EAC approved polyester marshalling boxes that can be used in hazardous areas.

The MF-MB-25/16MM2 is intended to split a power cable into a maximum of four subsequent heat-tracing feeders, while the MF-MB-26/35MM2 allows the connection of maximum seven subsequent heat-tracing feeders. They are particularly suited for powering multiple short heat-tracing circuits from a single supply point, typically in instrumentation areas or where the power infrastructure is limited.

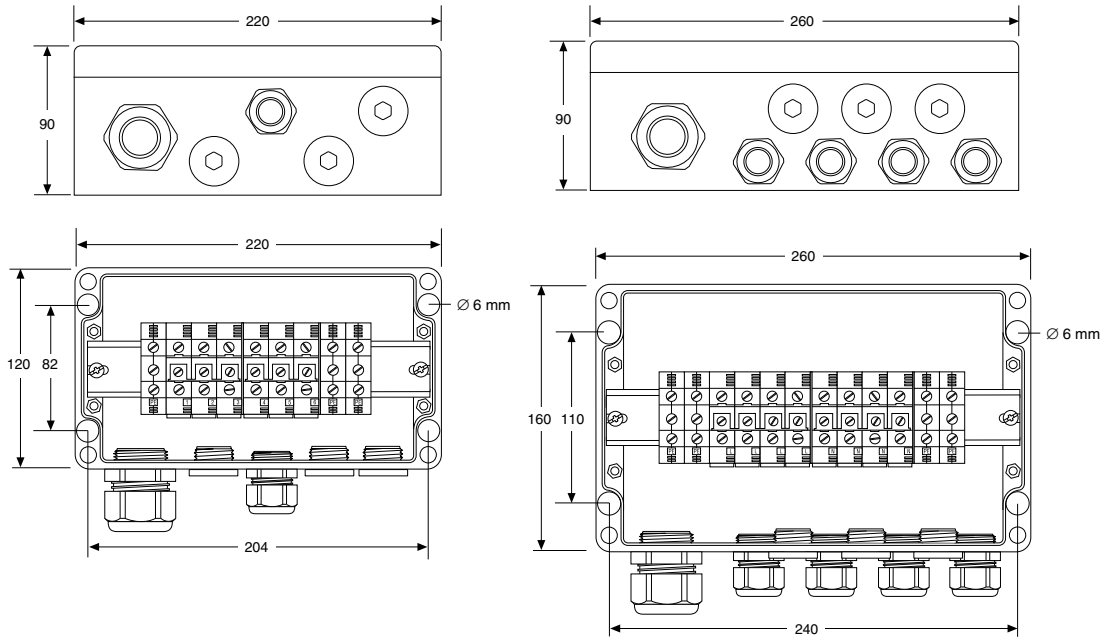
Cable connection is accomplished via DIN rail mounted screw terminals that allow the connection of a wide range of cable cross sections. The terminals are already equipped with the necessary terminal jumpers to minimize installation time.

Both boxes can be wall mounted via the four holes moulded in base of each box.

The MF-MB-25/16MM2 can also be pipe mounted with a standard support bracket.

| TYPICAL USE | MF-MB-25/16MM2 | MF-MB-26/16MM2 |
|---|---|---|
| | Marshalling box | Marshalling box |
| **ENTRIES** | | |
| | 1 x M32<br>4 x M25 | 1 x M32<br>7 x M25 |
| **KIT CONTENTS** | | |
| | 1 junction box with Weidmüller screw terminals on DIN rail, two sets bridged per three and three earth terminals,<br>1 M32 Hazardous area approved cable gland for power cables with ∅ of 12 to 21 mm,<br>1 M25 Hazardous area approved cable gland for power cables with ∅ of 8 to 17 mm,<br>3 M25 stopping plugs | 1 junction box with Weidmüller screw terminals on DIN rail,two sets bridged per four and four earth terminals,<br>1 M32 Hazardous area approved cable gland for power cables with ∅ of 12 to 21 mm,<br>4 M25 Hazardous area approved cable glands for power cables with ∅ of 8 to 17 mm,<br>3 M25 stopping plugs |

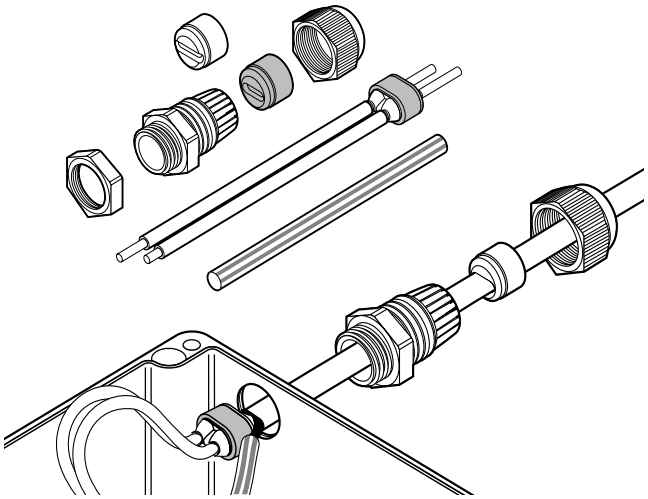
## DIMENSIONS (IN MM)



| MATERIALS OF CONSTRUCTION | MF-MB-25/16MM2 | MF-MB-26/16MM2 |
|---|---|---|
| Box & lid | Glass filled polyester | Glass filled polyester |
| Sealing gasket | Silicone rubber | Silicone rubber |
| Lid fixing screws | Stainless steel (captive) | Stainless steel (captive) |
| **INGRESS PROTECTION** | | |
| | IP66 | IP66 |
| **AMBIENT TEMPERATURE RANGE** | | |
| | –50°C to +55°C | –50°C to +55°C |
| **TERMINALS** | | |
| Quantity & type | 9 pcs Weidmüller screw terminals, bridged per 3, 6 x WDU16, 3 x WPE16, Max. 8 fully loaded phase/neutral terminals; max. 12 terminals in total | 12 pcs Weidmüller screw terminals, bridged per 4, 8 x WDU16 and 4 x WPE16, Max. 10 fully loaded phase/neutral terminals; max. 15 terminals in total |
| Labelling | 1, 2, 3, 4, 5, 6 and PE | L, N and P.E. |
| Minimum conductor size | 1.5 mm² stranded & solid | 1.5 mm² stranded & solid |
| Maximum conductor size | 25 mm² stranded, 16 mm² solid | 25 mm² stranded, 16 mm² solid |
| **MAXIMUM OPERATING VOLTAGE** | | |
| | 690 V a.c. | 690 V a.c. |
| **MAXIMUM OPERATING CURRENT** | | |
| | 50A | 50A |
| **ACCESSORIES (TO BE ORDERED SEPARATELY)** | | |
| Support bracket | SB-125 | N.A. (wall mounting) |
| M25 Power cable gland | GL-36-M25 (1 included) | GL-36-M25 (4 included) |
| M32 Power cable gland | GL-45-M32 (included) | GL-45-M32 (included) |
| M25 Stopping plug | PLUG-M25-PLASTIC (3 included) | PLUG-M25-PLASTIC (3 included) |
| 16 mm² Phase terminal | WDM-PHASE-16 (6 included) | WDM-PHASE-16 (8 included) |
| 16 mm² Earth terminal | WDM-EARTH-16 (3 included) | WDM-EARTH-16 (4 included) |
| Terminal jumper for bridging 2 terminals | WDM-JUMPER-16-2 | WDM-JUMPER-16-2 |
| Terminal jumper for bridging 3 terminals | WDM-JUMPER-16-3 | WDM-JUMPER-16-3 |
| Terminal jumper for bridging 4 terminals | WDM-JUMPER-16-4 | WDM-JUMPER-16-4 |
| Endplate | WDM-PLATE | WDM-PLATE |
| **ORDERING DETAILS** | | |
| Order reference<br>Part number (Weight) | MF-MB-25/16MM2<br>2000-M24 (0.9 kg) | MF-MB-26/16MM2<br>2000-M25 (1.9 kg) |

# SANTO U25-100

## COLD APPLIED CONNECTION KIT



This connection kit is designed for terminating all Santo UFA, UFB, UFC, UFO and ACC industrial parallel heating cables to a junction box, whilst maintaining electrical insulation of the heating cable conductors and core.
It is approved for use in hazardous areas.

The core sealing boot does not require a heat gun or torch for the installation (no hot work permit necessary). The non-curing sealant (silicone free) allows easy installation and facilitates maintenance purposes.

Two grommets supplied in this kit enable the gland to maintain optimum sealing under various ambient conditions. An additional locknut is provided for unthreaded entries.

### APPLICATION

| | |
|---|---|
| | Connection kit for UFA, UFB, UFC, UFO and ACC parallel heating cables. |

### KIT CONTENTS

| | |
|---|---|
| | 1 gland, 2 grommets, 1 locknut, 1 core sealer, 1 green/yellow tube,<br>1 installation instruction (multilingual) |

### APPROVALS

| | |
|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

### PRODUCT SPECIFICATION

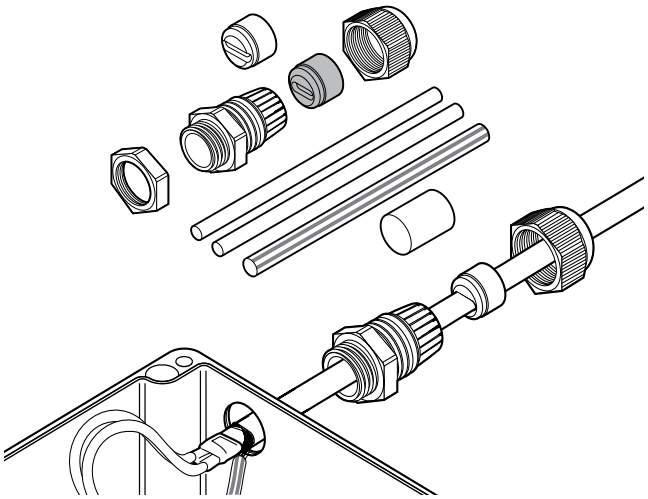
| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust)<br>Ordinary |
| Type | Cold applied |
| Thread size | M25 x 1.5 |
| Min. ambient temperature | –50°C |
| Max. exposure temperature (gland) | 110°C |

### ORDERING DETAILS

| | |
|---|---|
| Part description | U25-100 |
| PN (Weight) | 2000-M26 (0.07 kg) |

# SANTO U25-21

## HEAT-SHRINK CONNECTION KIT



This connection kit is designed for terminating all Santo UFA, UFB, UFC, UFO and ACC industrial parallel heating cables to a junction box, whilst maintaining electrical insulation of the heating cable conductors and core.

The sealing of the heating cable core is provided by Santo heat-shrinkable sleeves. Two grommets supplied in this kit enable the gland to maintain optimum sealing under various ambient conditions.

An additional locknut is provided for unthreaded entries.

### APPLICATION

| | |
|---|---|
| | Connection kit for UFA, UFB, UFC, UFO and ACC parallel heating cables |

### KIT CONTENTS

| | |
|---|---|
| | 1 gland,<br>2 grommets,<br>1 locknut,<br>1 green/yellow tube, heat-shrinkable sleeves for core sealing,<br>1 installation instruction (multilingual) |

### APPROVALS

The kit is certified as part of the system approval of the various heating cables.

| UFA | UFB | UFC | UFO | ACC |
|---|---|---|---|---|
| | | | | |

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

### PRODUCT SPECIFICATION

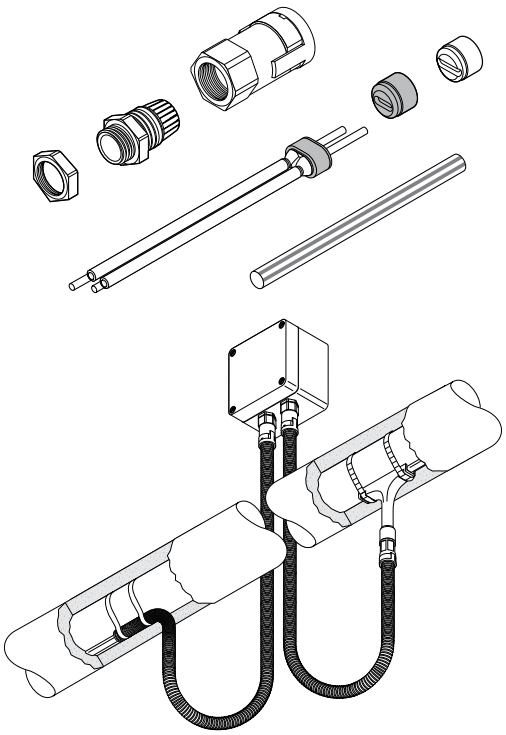
| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust) Ordinary |
| Type | Heat-shrinkable |
| Thread size | M25 x 1.5 |
| Min. ambient temperature | -55°C |
| Max. exposure temperature (gland) | 110°C |
| IP ingress protection rating | IP66 |

### ORDERING DETAILS

| | |
|---|---|
| Part description | U25-21 |
| PN (Weight) | 2000-M27 (0.06 kg) |

# SANTO UCON25-100

## COLD APPLIED CONDUIT CONNECTION KIT



This connection kit is designed for terminating all Santo UFA, UFB, UFC, UFO and ACC parallel industrial heating cables to a junction box, whilst maintaining electrical insulation of the heating cable conductors and core as well as providing a reliable and sealed connection to a conduit system. It is approved for use in hazardous locations.

The conduit system will provide supplementary mechanical protection of the heating cable between a junction box and the entry into the insulation. The conduit connection is fast and reliable and allows simple installation whilst maintaining an IP66 seal. The kit can be used with various types of conduits which can be cut-to-length as required in the field. The core sealing boot for the heating cable does not require a heat gun or torch for the installation (no need for a hot work permit). The non-curing sealant (silicone free) allows easy installation and facilitates maintenance purposes.

The conduit and eventually required insulation entry kit needs to be purchased separately.

### APPLICATION

Connection kit with conduit adaptor for Santo parallel industrial heating cables

### KIT CONTENTS

1 gland body,
1 conduit adaptor including safety retention clip,
2 grommets,
1 locknut,
1 core sealer,
1 green/yellow tube,
1 installation instruction (multilingual)

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## PRODUCT SPECIFICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust) |
| Thread size | M25 x 1.5 |
| Conduit compatibility | ND 23 mm, Santo conduits type CCON25-C... |
| Ambient temperature | –55°C to +40°C |
| IP ingress protection rating | IP66 |
| Surface resistance | < 1GΩ according to the requirements of EN 60079-0 and EN 61241-0 for use in hazardous areas |

## ORDERING DETAILS

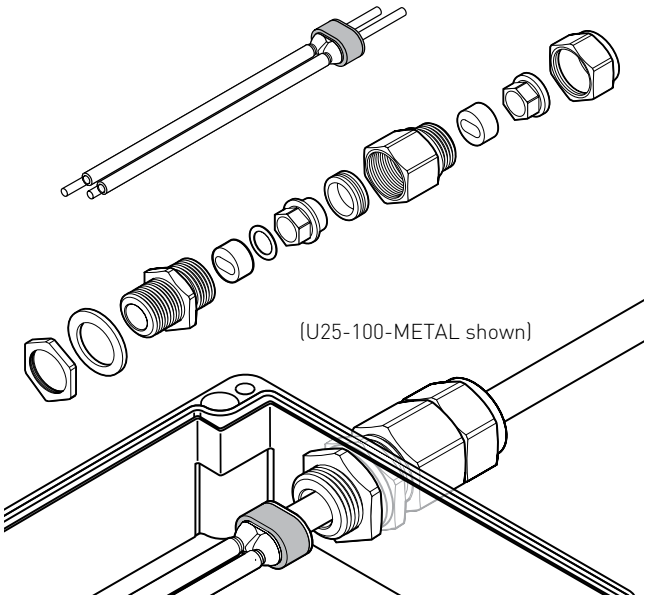
| | |
|---|---|
| Part description | UCON25-100 |
| PN (weight) | 2000-M28 (0.075 kg) |

## ACCESSORIES

| | |
|---|---|
| | For suitable conduits and insulation entry kits refer to the datasheet for UCON2x-C... |

# SANTO U25-100-METAL AND U3/4-100-METAL

## COLD APPLIED METAL CONNECTION KIT



(U25-100-METAL shown)

These connection kits are designed for terminating all Santo UFA, UFB, UFC, UFO and ACC industrial parallel heating cables to a junction box, whilst maintaining electrical insulation of the heating cable conductors and core.

The braid is directly connected to the metal gland body. The connection kits can be used with metal boxes or plastic boxes with internal earthing plate. They are approved for use in hazardous areas.

The core sealing boot does not require a heat gun or torch for the installation (no hot work permit necessary). The non-curing sealant (silicone free) allows easy installation and facilitates maintenance purposes.

The U25-100-METAL kit is designed for use with M25 entries, the U3/4-100-METAL for 3/4" NPT entries.

A metal locknut is provided for earth bonding in plastic junction boxes.

### APPLICATION

Connection kit for parallel heating cables

### KIT CONTENTS

1 gland,
2 grommets,
1 locknut and sealing washer (only M25),
1 core sealer,
1 installation instruction (multilingual).

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

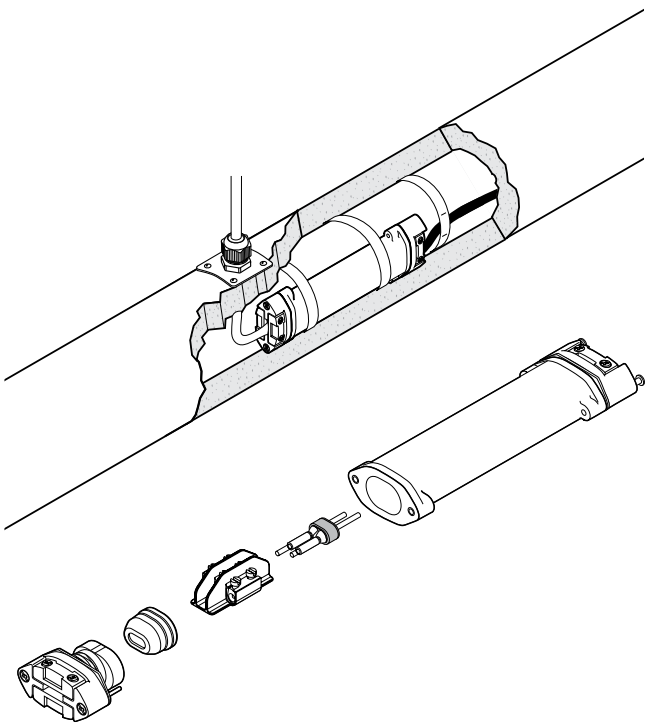
| SPECIFICATION FOR GLAND | U25-100-METAL | U3/4-100-METAL |
|---|---|---|
| Area classification | Hazardous Zone 1 and 2 (Gas), Zone 21 and 22 (Dust), ordinary In- and outdoors | Hazardous Zone 1 and 2 (Gas), Zone 21 and 22 (Dust), ordinary In- and outdoors |
| Thread size | M25 x 1.5 | 3/4" NPT |
| Gland material | Brass | Brass |
| Min. ambient temperature | –60°C | –60°C |
| Max. exposure temperature | 180°C | 180°C |

| ORDERING DETAILS | | |
|---|---|---|
| Part description | U25-100-METAL | U3/4-100-METAL |
| PN (Weight) | 2000-M29 (0.31 kg) | 2000-M30 (0.3 kg) |

| ACCESSORIES | | |
|---|---|---|
| Part description | U25-100-METAL-NP | U3/4-100-METAL-NP |
| PN (Weight) | 2000-M30 (0.31 kg) | 2000-M31 (0.3 kg) |

# CS-150-E

## COLD APPLIED LOW PROFILE POWER CONNECTION



The CS-150-E is a cold applied low profile power connection. The kit enables in line connection of Santo industrial heating cables, UFA, UFB, UFC and UFO, to a flexible power cable. It can be used in applications with temperature ratings from –50°C to 215°C. It is approved for use in hazardous areas.

A Santo supplied power cable such as CS-150-PC may be used or any suitable standard industrial power cable type 3 x 1.5 $mm^2$ or 3 x 2.5 $mm^2$ with stranded copper conductors and an outer insulation jacket. The power cable is connected by means of screw terminals to the conductors and the braid of the heating cable.

CS-150-E is used as connector:

- where connection to a junction box is difficult e.g. because of space limitation
- on instrument lines or loading arms
- where installation of "under insulation" components is preferred
- as a cost effective solution for short heat-tracing lines as an alternative for MFS-100.

### DESCRIPTION

Cold applied low profile splice for connection of UFA, UFB, UFC and UFO heating cables to a power cable

### KIT CONTENTS

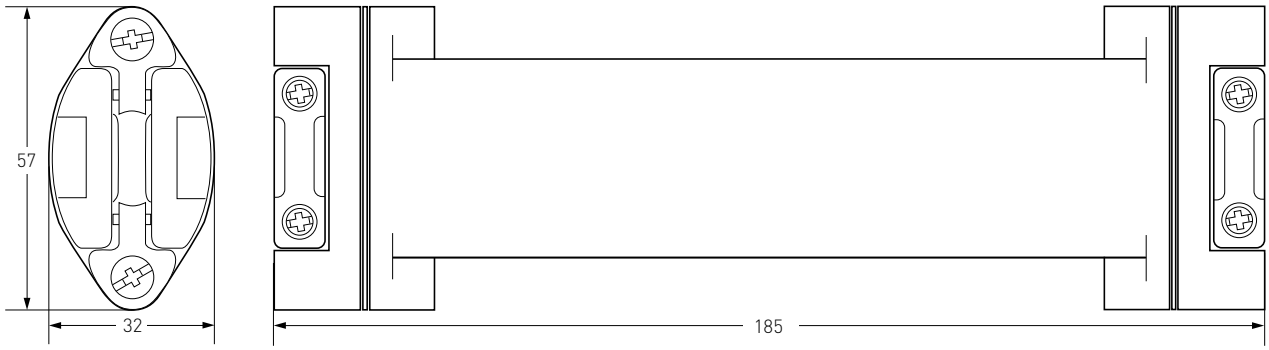
1 splice housing assembly including
  - 1 sealing grommet assembly for heater
  - 1 pressure plate/strain relief assembly

1 core sealer for heater
1 spacer including screw terminal
1 sealing grommet assembly for the power cable
1 pressure plate/strain relief assembly for the power cable
1 identification label
1 installation instruction

## APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (IN MM)




## PRODUCT SPECIFICATIONS

| | |
|---|---|
| Heating cable capability | UFA-CR, UFA-CT, UFB-CT, UFC-CT, UFO-CT |
| Power cable capability | For use with Santo's high temperature power cable CS- 150-PC or for use with other flexible cable such as: U07RN-F, Silicone insulated cables.<br>Minimum and maximum installation and operating temperatures, given by cable manufacturer, have to be considered by designer and installer. |
| Power cable dimension | -> outer diameter range 7.8 mm - 12.5 mm<br>-> 3 stranded copper conductors (3 x 2.5 $mm^2$ or 3 x 1.5 $mm^2$)<br>-> temperature range depending on the application |
| Maximum power cable length | Depending on power cable voltage drop and maximum current for Santo power cable CS-150-PC (3 x 2.5 $mm^2$): |
| | CB 16 A — 40 m |
| | CB 20 A — 32 m |
| | CB 25 A — 25 m |
| Ingress protection | IP66 |
| Minimum installation temperature | –50°C |
| Maximum pipe temperature | refer to heating cable specification |
| Maximum operating voltage | 277 Vac |
| Maximum current rating | depending on the power cable used and maximum current |

## CONSTRUCTION MATERIALS

| | |
|---|---|
| Housing, end plate, shim and spacer | Engineering polymers, black |
| Sealing grommets | Silicone rubber |
| Screws, compression spring | Stainless steel |

## ORDERING DETAILS

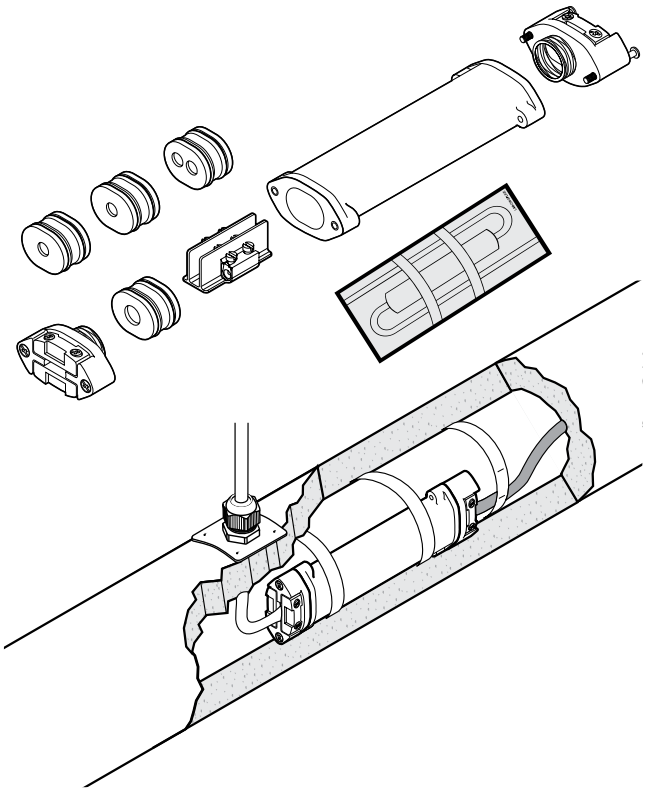
| | |
|---|---|
| Part description | CS-150-E |
| PN (Weight) | 2000-M32 (0.4 kg/0.8 lb) 1 |
| Pack size | bag |

## ACCESSORIES

| | |
|---|---|
| Power cable | CS-150-PC<br>3-core flexible power cable for connection to CS-150-E,<br>3 x 2.5 $mm^2$, silicone insulation, temperature range: –40°C to +180°C,<br>short term: 215°C |

# SANTO CS-150-UNI-PI

## COLD APPLIED LOW PROFILE POWER CONNECTION



The CS-150-UNI-PI is a universal low profile heating cable connector for the direct connection of single conductor Polymer Insulated (PI) series heating cables. It can be used in different configurations: for the connection of a cold lead to a heating cable (Variant C), as an under insulation connecting system for the connection of a three core power cable to a heating cable loop (Variant L), as well as for splicing two heating cables (Variant S).

The connector is certified for use in hazardous areas and doesn't require a hot work permit. The electrical connection is realized by means of screw terminals, so no special crimp tools are required. If used as a connection kit, an additional gland needs to be ordered separately.

### APPLICATION

"Cold" applied connection/splice for a single conductor polymer insulated (PI) series heating cables with an external diameter between 3.2 and 6.4 mm.
In hazardous area use only with EAC approved heating cable.
The CS-150-UNI-PI can be used in different configurations:

- connection of a heating cable to a cold lead cable 1 x 2.5 $mm^2$ or 1 x 4 $mm^2$ (Variant C)
- connection of a heating cable to a power cable 3 x 2.5 $mm^2$ (Variant L)
- splice of two heating cables (Variant S)

### KIT CONTENTS

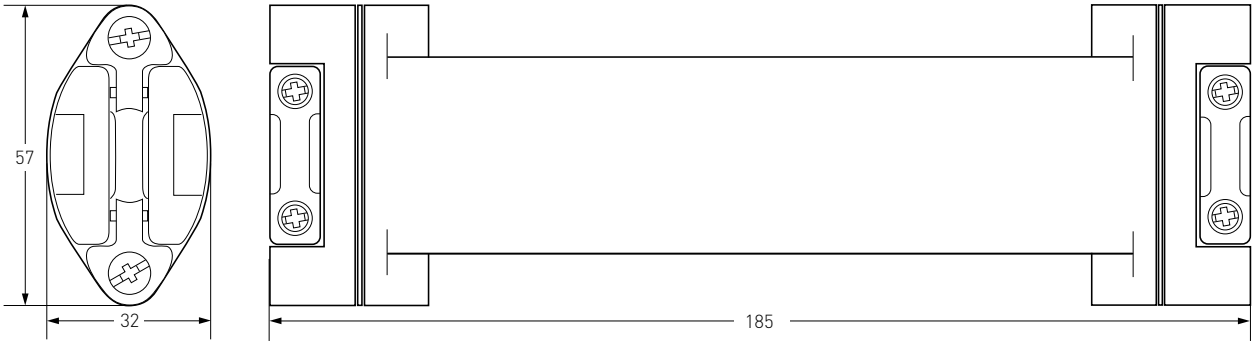
1 x temperature resistant and impact proof body.
1 x screw terminal block
4 x rubber seals (to be used according to application)
2 x strain relieve clamps with screws
1 x identification label
1 x tube of lubricant
1 x installation instruction

## APPROVALS

EAC For Russia, Kazakhstan, Belarus.
For other countries contact your local Santo representative.

Particular measures to maintain the T-classification of polymer insulated heating cables are to be taken in accordance with the appropriate EC - Type examination certificate (also refer to installation instructions).
Type examination certification applies for the use of EAC certified polymer insulated (PI) series heating cables.

## DIMENSIONS (IN MM)




## HEATING CABLE TYPES

| | |
|---|---|
| Heating cable capability | XPI-NH, XPI and XPI-S polymer insulated (PI) series resistance cable, for other types contact Santo. |

## MATERIALS OF CONSTRUCTION

| | |
|---|---|
| Housing, connection | Glass fibre reinforced temperature resistant engineering plastic |
| Support ring, spacer, screws and spring | Stainless steel |
| Cable seals | Silicon rubber |

## MAXIMUM OPERATING TEMPERATURE (*)

Power on: 180°C (may be limited by the temperature resistance of the supply cable)
Power off: 210°C (using variant L, dependent on the type of supply cable e.g. 200°C for silicon cables, unless the power cable connection is bent sufficiently far away from the heated surface).

## MINIMUM INSTALLATION TEMPERATURE

–50°C

## MAX. OPERATING VOLTAGE

Variant C and S = 750 Vac
Variant L = 420 Vac

## MAX. ALLOWED WATTAGE

The max. allowed cable output is limited depending on the application. Refer to the installation instruction for details.

## MAX. ALLOWED WATTAGE

| | |
|---|---|
| | The max. allowed cable output is limited depending on the application. Refer to the installation instruction for details. |

## MAX. PERMITTED NOMINAL CURRENT (*)

| | |
|---|---|
| | Variant S: 32 A<br>Variant C with 1 x 2.5 $mm^2$ supply cable: 25 A<br>Variant C with 1 x 4 $mm^2$ supply cable: 32 A<br>Variant L with 3 x 2.5 $mm^2$ supply cable up to 150°C: 25 A<br>Variant L with 3 x 2.5 $mm^2$ supply cable 151°C to 180°C: 20 A |

## SUPPLY CABLE DIMENSIONS

| | |
|---|---|
| | -> Multi-stranded copper conductors 3 x 2.5 $mm^2$, ∅ 7.8 -12.5 $mm^2$<br>-> Single conductor cold lead, max. 1 x 4 $mm^2$, ∅ 3.2 - 6.4 mm |

## SUPPLY CABLE REQUIREMENTS

| | |
|---|---|
| | The maximum permissible voltage drop is to be taken into consideration when selecting the cross-section of the power cable.<br>The maximum working temperature of the CS-150-UNI-PI can be reduced through the maximum permitted continuous use temperature of the supply cable, unless the supply cable is laid (at a sufficient distance from the heated surface) so that the maximum permitted continuous use temperature will not be exceeded. A suitable power cable is the silicon insulated cable type C-150-PC. |

## ACCESSORIES

| | |
|---|---|
| Cable gland | GL-36-M25 hazardous area approved gland for 8-17 mm power cables diameter<br>GL-44-M20-KIT hazardous area approved gland for PI cables. |

## ORDERING DETAILS

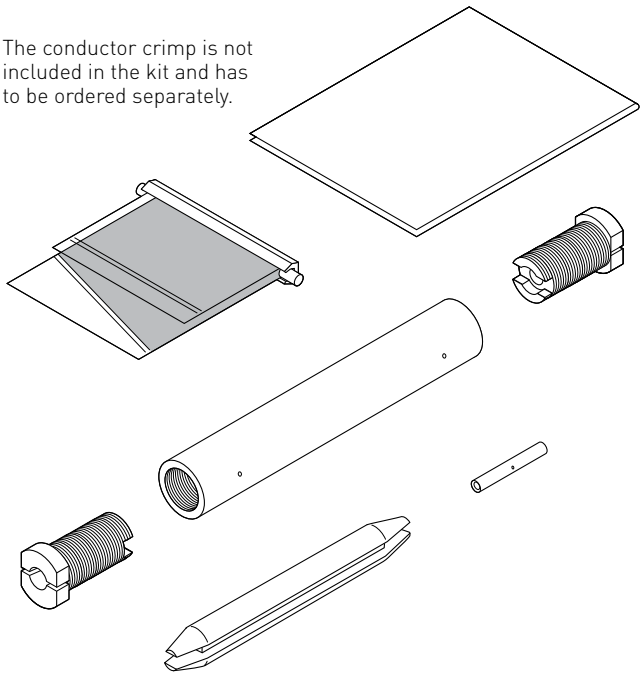
| | |
|---|---|
| Order reference | CS-150-UNI-PI |
| Part number (Weight) | 2000-M33 (0.4 kg) |

(*) For the full range of technical design details of the CS-150-UNI-PI refer to the installation instructions (INSTALL-064)

# SANTO CS-150-XX-PI

## COLD APPLIED CONNECTION AND SPLICE KIT WITH SILICONE SEALING FOR POLYMER INSULATED (PI) HEATING CABLES

The conductor crimp is not included in the kit and has to be ordered separately.



The kits CS-150-xx-PI are designed to connect a PI cold lead cable to a polymer insulated (PI) series heating cable as well as to splice two PI heating cables. The kit employs a two component silicone compound to provide durable and flexible moisture proof encapsulation.

Electrical continuation is maintained via specially engineered crimps that provide a highly reliable electrical connection.

It is very important that the electrical crimp connections are performed with the correct crimp tool (PI-TOOL-xx).

Due to its low profile design, the connection can be easily installed under the insulation directly on the pipe. If used as a connection kit, a cable gland, an insulation entry kit as well as a crimp for the connection between the cold lead and the heating cable, need to be ordered separately. If used as a splice kit, just the heating cable conductor crimp is needed additionally.

For simplified installation- and maintenance work, we offer a crimp toolbox that contains the suitable installation tool, crimping dies and a variety of crimps exactly matching common cable types. For all details concerning the crimping system, refer to the datasheet of the electrical connection system for PI heating cables (PI-TOOL-SET-xx).

### APPLICATION

Cold applied silicone sealed connection/splice for PI heating cables.

### KIT CONTENTS

1 x PTFE body
2 x PTFE plugs
1 x PTFE crimp separator
1 x two component silicone compound in plastic bag (shelf life is 12 months)
1 x identification label
1 x multilingual installation instruction

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

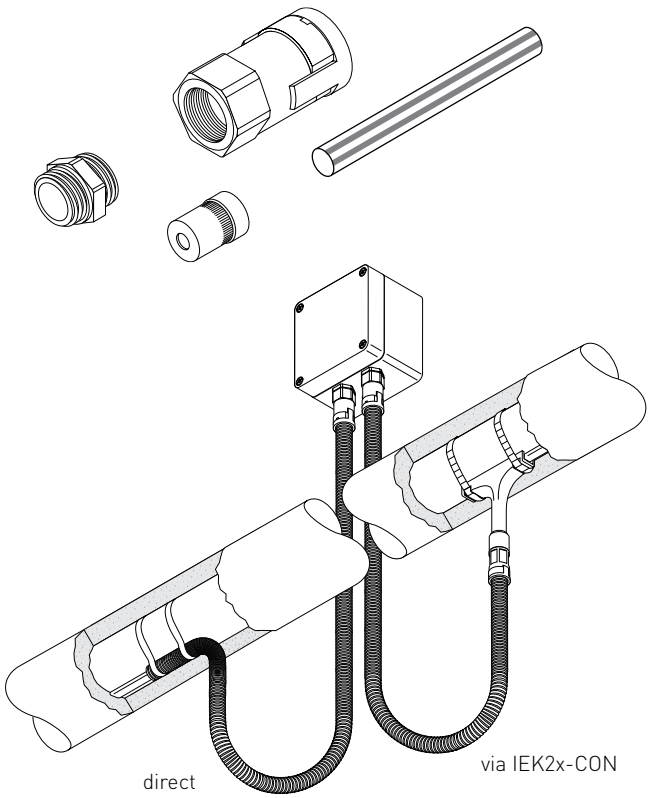
### DIMENSIONS

CS-150-2.5-PI: Overall length ~120 mm, ∅ ~17 mm
CS-150-6-PI: Overall length ~120 mm, ∅ ~26 mm
CS-150-25-PI: Overall length ~135 mm, ∅ ~35 mm

| TECHNICAL DATA | CS-150-2.5-PI | CS-150-6-PI | CS-150-25-PI |
|---|---|---|---|
| Max. operating temperature | 200°C continuous, (260°C intermittent) | | |
| Max. operating voltage | 450 Vac nominal | | |
| Max. operating current | Only limited by heating cable used | | |
| Cable/Cold leads | Up to 2.5 $mm^2$ | 4 to 6 $mm^2$ | 10 to 25 $mm^2$ |
| **ORDERING DETAILS** | | | |
| Order reference | CS-150-2.5-PI | CS-150-6-PI | CS-150-25-PI |
| Part number (Weight) | 2000-M34 (0.1 kg) | 2000-M35 (0.2 kg) | 2000-M36 (0.3 kg) |
| **ACCESSORIES** | | | |
| Cable gland for connection kit | GL-44-M20-KIT (one piece per cold lead connection; to be ordered separately) | | |

# SANTO UCON20-100-PI

## COLD APPLIED CONDUIT CONNECTION KIT




This connection kit is designed for terminating the full range of Santo XPI polymer insulated series heating cables and cold leads in to a junction box, as well as providing a reliable and sealed connection to a conduit system.

It is approved for use in hazardous locations. The conduit system will provide supplementary mechanical protection of the heating cable or cold lead between a junction box and the entry into the insulation. The conduit connection is fast and reliable and allows simple installation whilst maintaining at all time an IP66 seal.

The kit can be used with various types of conduits which can be cut-to-length as required in the field. The kit exists in three different versions, depending on the outer diameter of the heating cable or cold lead to protect. The conduit and possibly required insulation entry kit need to be purchased separately.

### APPLICATION

Connection kit with conduit adaptors for 2 PI series heating cables or cold lead cables

### KIT CONTENTS

2 metal gland bodies,
2 conduit adaptors including safety retention clip,
2 grommets,
2 green/yellow tubes for braid,
1 installation instruction (multilingual)

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## PRODUCT SPECIFICATION

| | |
|---|---|
| Area classification | Hazardous, Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust) |
| Thread size | M20 x 1.5 |
| Conduit compatibility | ND 17 mm, Santo conduits type CCON20-C..... |
| Ambient temperature | –55°C to +40°C |
| IP ingress protection rating | IP66 |
| Surface resistance | < 1GΩ according to the requirements of EN 60079-0 and EN 61241-0 for use in hazardous areas |

| TECHNICAL DATA | CCON20-100-PI-A | CCON20-100-PI-B | CCON20-100-PI-C |
|---|---|---|---|
| PI cable diameter range | 4.0 - 6.5 mm | 6.5 – 9.5 mm | 9.5 – 13 mm |

## ORDERING DETAILS

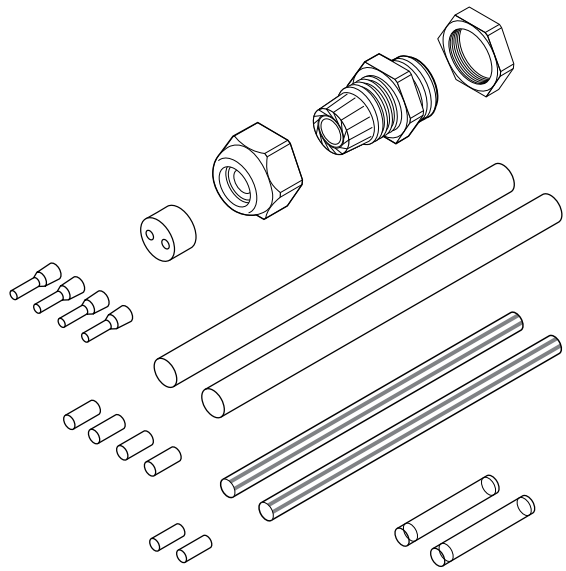
| | | | |
|---|---|---|---|
| Part description | UCON20-100-PI-A | UCON20-100-PI-B | UCON20-100-PI-C |
| PN (Weight) | 2000-M37 (0.1 kg) | 2000-M38 (0.1 kg) | 2000-M39 (0.1 kg) |

## ACCESSORIES

| | |
|---|---|
| | For suitable conduits and insulation entry kits refer to the datasheet for UCON2x-C... |

# SANTO US20-2.5-PI-NH

## HEAT-SHRINK CONNECTION OR SPLICE KIT FOR PI HEATING CABLES



The US20-2.5-PI-NH kit is designed for terminating polymer insulated (PI) series resistance heating cables.

The US20-2.5-PI-NH may be used in non-hazardous areas only. The kit contains components required for the installation of either: a connection of (2) cold leads- to a heating cable or for (2) splices between two heating cables. The splice kit employs easy to use heat shrinkable tubing that after installation forms a semi-flexible moisture proof encapsulation. Electrical continuation is maintained via crimps for both conductor and braid. Thanks to its low profile design the finished connection can be easily installed under the insulation directly on the pipe. The kit is designed for use with junction boxes with M20 entries.

Each US20-2.5-PI-NH kit contains 2 connection sets. The crimps must be installed using an appropriate crimp tool .

### APPLICATION

Heat shrink based connection/splice kit for single core polymer series resistance heating cable.

### KIT CONTENTS

4 x Heat shrinkable tubes (PTFE/FEP)
2 x green/yellow tube for the braid.
6 x Crimp connectors (crimp for conductor and braid)
1 x polyamide gland with dual hole sealing grommet M20 threaded, suitable for cables ranging from 4.8 to 7 mm diameter.
1 x Installation instruction

### APPROVALS

Suitable for non hazardous area installation only.

EAC For Russia, Kazakhstan, Belarus.
For other countries contact your local Santo representative.

### DIMENSIONS

Overall length ~130 mm, ∅ ~10 mm

### TECHNICAL DATA

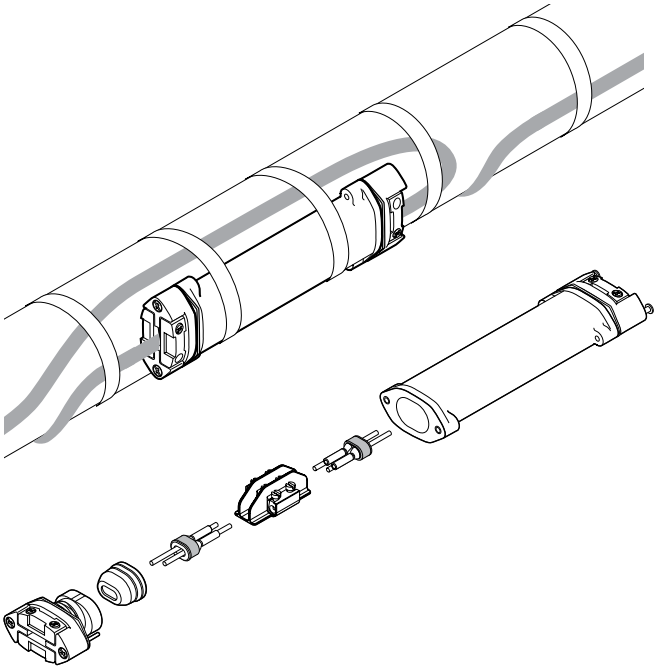
| | |
|---|---|
| Max. cold lead size | 2,5 $mm^2$ |
| Max. operating temperature | 205°C |
| Min. installation temperature | –50°C |
| Max. operating voltage | 750 Vac |
| Max. operating current | 25 A |

### ORDERING DETAILS

| | |
|---|---|
| Order reference | US20-2.5-PI-NH |
| Part number (Weight) | 2000-M40 (0.1 kg) |

# SANTO U-150

## COLD APPLIED UNDER INSULATION LOW PROFILE SPLICE



The U-150 is a cold applied low profile splice for in-line connection. This universal kit fits with all Santo industrial heating cables, UFA, UFB, UFC and UFO, meaning simplified product selection and reduced inventory to stock. It can be used in applications with temperatures ranging from –50°C to 215°C. It is approved for use in hazardous areas.

The unique design of the U-150 suits the demanding requirements of the industrial environment. The low profile housing can be installed on pipes and other surfaces. Spring loaded grommets make a first seal to maintain a water tight connection while the non-curing sealant (silicone free) used in Santo's core sealer adds a second seal, providing additional protection. The rugged construction of the splice makes it resistant to impact and suitable for high temperature variations and aggressive chemical exposure. The connection is made using screw terminals. The splice is re-enterable. The U-150 is a safe under the insulation in-line splice that can be relied upon over time.

The splice requires no heat source for installation, making maintenance work fast and easy. Each kit contains all the necessary materials to do one in-line splice connection.

### DESCRIPTION

Cold-applied in-line splice kit for use with UFA, UFB, UFC and UFO heating cables.

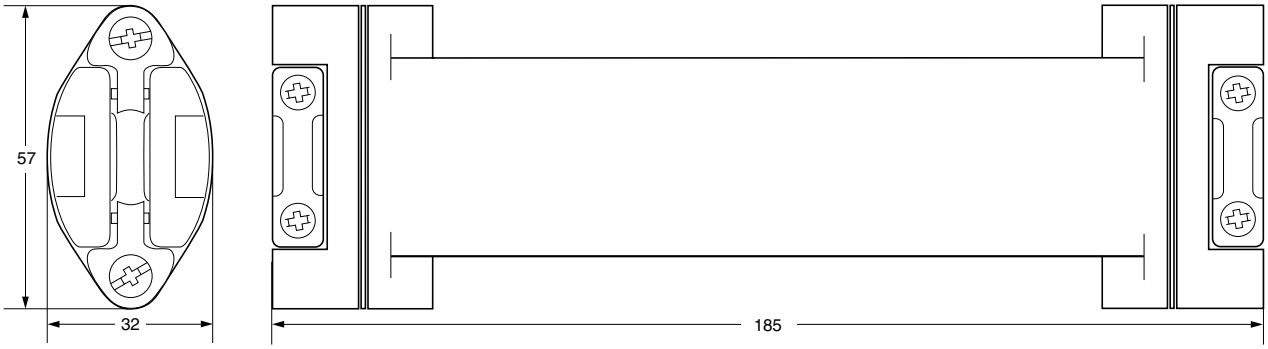
### KIT CONTENTS

1 splice housing
2 sealing grommets
2 core sealers
1 spacer including screw terminals
1 identification label

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (IN MM)




## PRODUCT SPECIFICATIONS

| | |
|---|---|
| Heating cable capability | UFA-CR, UFA-CT, UFB-CT, UFC-CT, UFO-CT |
| Ingress protection | IP66 |
| Minimum installation temperature | –50°C |
| Maximum pipe temperature | Refer to heating cable specification |
| Connection method | Screw terminals |
| Maximum operating voltage | 277 Vac |
| Maximum current rating | 40 A heating cable circuit for PTB |

## MATERIALS OF CONSTRUCTION

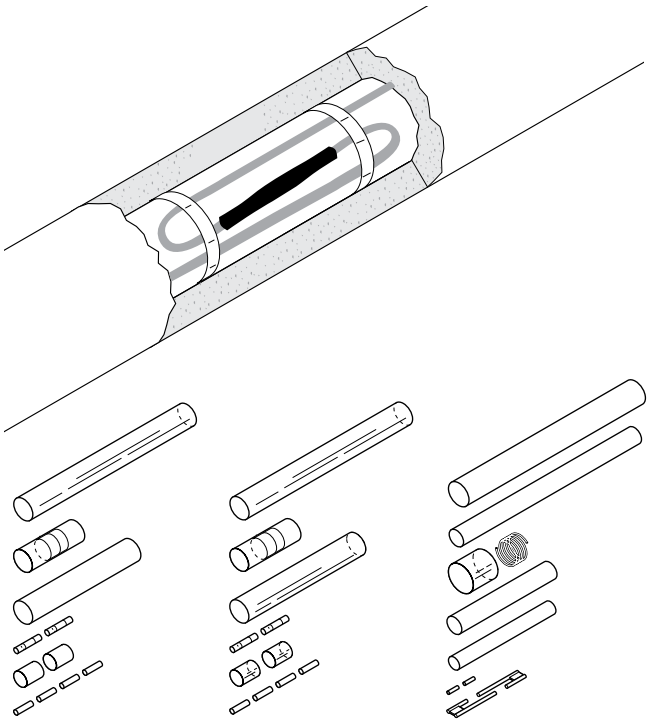
| | |
|---|---|
| Housing, end plate, shim and spacer | Engineering polymers, black |
| Sealing grommets | Silicone rubber |
| Screws, compression spring | Stainless steel |

## ORDERING DETAILS

| | |
|---|---|
| Splice connection | U-150 |
| PN (Weight) | 2000-M41 (0.4 kg/0.8 lb.) |

# SANTO U-19, U-21 AND U-69

## HEAT-SHRINK UNDER INSULATION IN-LINE SPLICE KIT



These splice kits are designed for the in-line joining of Santo selfregulating heating cables.

The kit U-19 is designed for use with UFA heating cables, the U-21 for UFB and the U-69 is for use with UFC and UFO heating cables.

All kits are approved for use in hazardous areas.

The splice kits employ easy to use heat-shrinkable tubing with an adhesive, that when heated forms a semi-flexible moisture proof encapsulation.

Electrical continuation is maintained via crimps for the conductors and a solder connection for the braid of the heating cable.

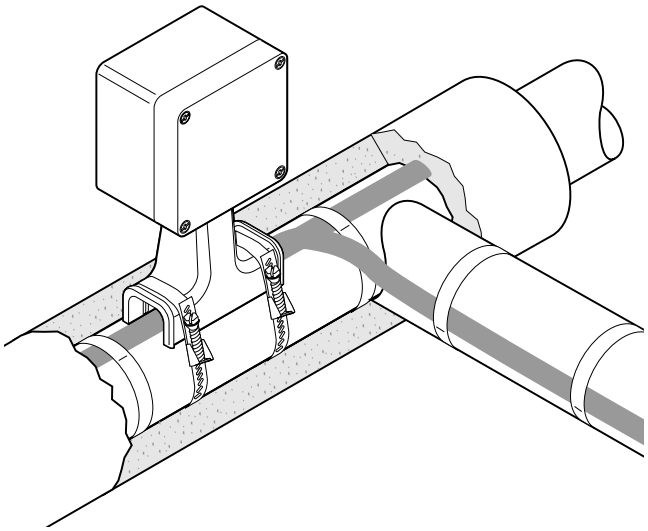
Due to its low profile design the finished splice can be installed under the insulation, directly on the pipe.

| APPLICATION | U-19 | U-21 | U-69 |
|---|---|---|---|
| | In-line splice kit for UFA heating cables | In-line splice kit for UFB heating cables | In-line splice kit for UFC and UFO heating cables |
| **KIT CONTENTS** | | | |
| | heat-shrinkable adhesive coated sleeves<br>insulation sleeves<br>solder sleeves<br>crimps | heat-shrinkable adhesive coated sleeves<br>insulation sleeves<br>solder sleeves<br>crimps | heat-shrinkable sleeves<br>adhesive liners<br>insulation sleeves<br>high temperature solder<br>crimps |
| **APPROVALS** | | | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | | |

| PRODUCT SPECIFICATIONS | U-19 | U-21 | U-69 |
|---|---|---|---|
| Max. exposure temperature | 85°C | 135°C | 160°C |
| Maximum current rating | 40 A | 40 A | 40 A |
| Dielectric strength | 1.3 – 3.5 MV/m | 2.2 MV/m | > 6 MV/m |
| Volume resistivity | $10^{12}$ Ω cm | $10^{13}$ Ω cm | $10^{10}$ Ω cm |
| Final dimensions | length approx. 180 mm | length approx. 180 mm | length approx. 300 mm<br>diameter approx. 20 mm |
| **INSTALLATION DETAILS** | | | |
| Heat shrinkable tubing | 125°C and 175°C | 125°C and 175°C | 200°C |
| Solder | 120°C | 120°C | approx. 240°C |
| Gas torch or equivalent | min. 1460 W hot air gun | min. 1460 W hot air gun | min. 1460 W hot air gun |
| **ORDERING DETAILS** | | | |
| Part description | U-19 | U-21 | U-69 |
| PN (Weight) | 2000-M42 (0.05) kg | 2000-M43(0.05 kg) | 2000-M44 (0.11 kg) |

# SANTO FMT-100

## SPLICE OR TEE CONNECTION KIT



The FMT-100 is an above-insulation splice or tee kit, designed for use with up to three Santo UFA, UFB, UFC, UFO or ACC industrial parallel heating cables. It is approved for use in hazardous locations.

The rugged stand protects the heating cable and allows for up to 100 mm (4") of thermal insulation.
The core sealing boot does not require a heat gun or torch for the installation (no hot work permit necessary).

The non-curing sealant (silicone free) in the boot allows easy installation and facilitates maintenance.
The T-100 significantly reduces installation and maintenance time and effort.

### DESCRIPTION

This kit is an above-insulation splice/tee, appropriate for use worldwide with no requirements for local customization.

### KIT CONTENTS

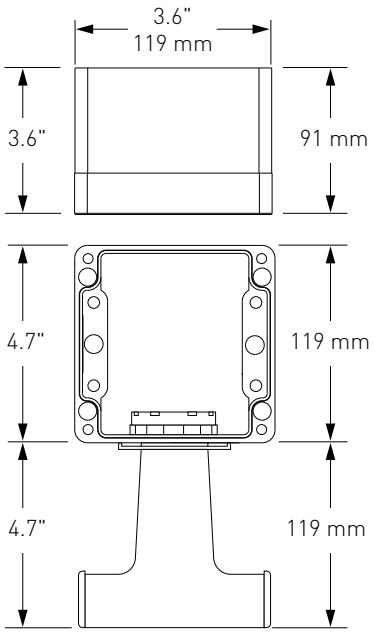
1 splice/tee enclosure and lid
1 stand assembly
3 core sealers
3 green/yellow earthing sleeve
3 compression crimps
3 crimping insulating tubes
1 polywater sachet
1 spanner
1 strain relief assembly
2 grommet plugs
1 installation instruction

### APPROVALS

Hazardous locations

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (IN MM)




## PRODUCT SPECIFICATIONS

| | |
|---|---|
| Heating cable capability | UFA-CR, UFA-CT, UFB-CT, UFC-CT, UFO-CT, ACC |
| Ingress protection | NEMA Type 4X IP66 and IP67 |
| Min. installation temperature | –50°C |
| Max. pipe temperature | Refer to heating cable specification |
| Ambient temperature range: | –50°C to +56°C |
| Max. operating voltage | 277 Vac for FM, CSA, 254 Vac for PTB |
| Max. continuous operating current | 50 A heating cable circuit for FM/CSA<br>40 A heating cable circuit for PTB |

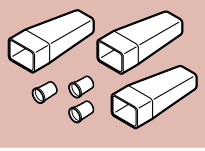
## MATERIALS OF CONSTRUCTION

| | |
|---|---|
| Enclosure, lid, and stand | Electrostatic charge-resistant glass-filled engineered polymer, black |
| Lid screws | Stainless steel |
| Lid gasket | Silicone rubber |

## ORDERING DETAILS

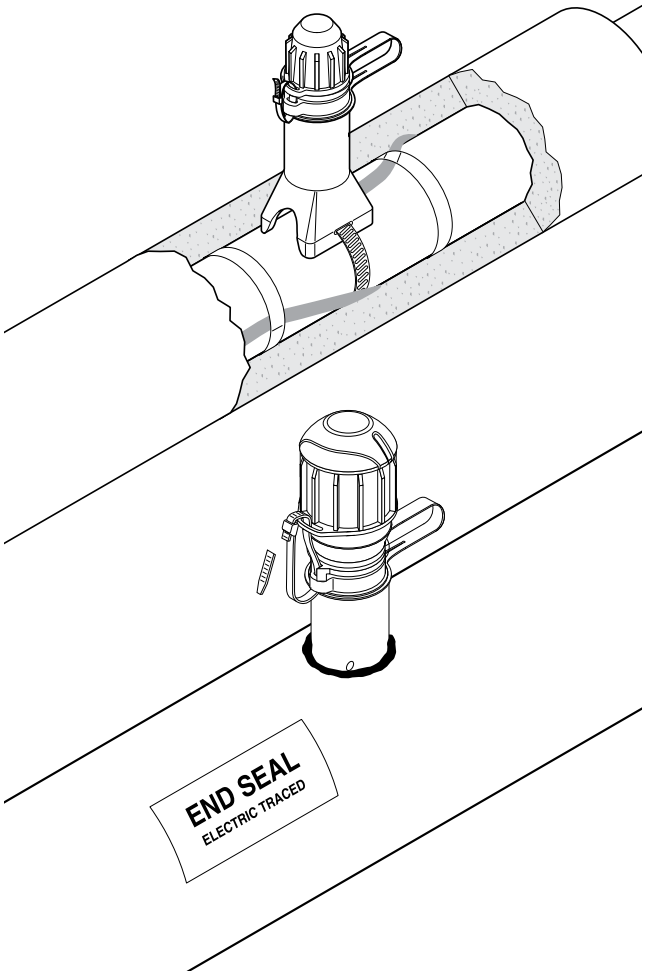
| | |
|---|---|
| Part description | FMT-100 |
| PN (Weight) | 2000-M45 (2.5 lb /1.2 kg) |

## ACCESSORIES

| | |
|---|---|
| Crimp tool | FMT-100-CT (not included in the kit, equivalent to Panduit: CT-1570) |
| PN | 2000-M46 |
| Spare crimps and insulating tubes | FMT-100-CRIMP-KIT (spare part only)<br>  |
| PN | 2000-M47 |
| Small pipe adaptor | MFM-SPA, required for pipes ⩽ 1" (DN 25), D55673-000 (bag of 5 adaptors) |

# SANTO FAST-100-E AND FAST-100-L-E

## END SEAL AND LIGHTED END SEAL




Both the FAST-100-E and FAST-100-L-E are accessible, re-entrable end seals, the E-100 without a light, the FAST-100-L with a signal light. Both end seals can be used with all Santo UFA, UFB, UFC, UFO ,ACC or AFF industrial parallel heating cables. They are approved for use in hazardous areas. They are extremely rugged - made of a strong, moulded part with 4 mm wall thickness.

The heating cable is firmly kept in place by the integral strain relief.

Sealing is done twice. First a dry compartment for the heating cable is created, then a boot filled with a non-curing sealant (silicone free) is placed over the end of the heating cable inside the compartment.

The end seals are mounted on the pipe and project through the cladding.
The light module of the FAST-100-L-E uses an array of super-bright green LEDs for long life and excellent visibility from almost any angle. The robust industrial-grade electronics are encapsulated to reliably seal out moisture.

Extra sealant filled boots for the FAST-100-E end seal can be ordered separately.

| KIT CONTENTS | FAST-100-E | FAST-100-L-E |
|---|---|---|
| | 1 end seal<br>1 cable tie<br>1 polywater sachet<br>1 installation instruction | 1 end seal with indicator light<br>1 cable tie<br>1 polywater sachet<br>2 insulated parallel crimps<br>1 core sealer<br>1 installation instruction |

| APPROVAL DATA | |
|---|---|
| Area of use | Hazardous or ordinary (indoors and outdoors) |

| APPROVALS | FAST-100-E | FAST-100-L-E |
|---|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |

| PRODUCT SPECIFICATIONS | FAST-100-E | FAST-100-L-E |
|---|---|---|
| Max. pipe temperature | Refer to heating cable specification (absolute maximum is 260°C) | |
| Max. operating voltage | 254 V*<br>*Extra conditions for safe use apply for voltages above 254V. Please refer to the certificate or installation instructions for full details. | 254 V |
| Ambient temperature range | –50°C to +40°C*<br>*Extra conditions for safe use apply for ambient temperatures above +40°C. | –50°C to +40°C |
| Min. installation temperature | –50°C | –50°C |
| Overall height | 171 mm approx. | 197 mm approx. |
| Outer diameter | 46 mm approx.<br>Usable with up to 100 mm thermal insulation | 66 mm approx. |
| Ingress protection | IP65 | IP65 |
| Impact resistance | EN 60079-30-1, ≥ 7 joules | EN 60079-30-1, ≥ 7 joules |
| UV stability | No degradation after > 1000 h | No degradation after > 1000 h |
| Solvent resistance | Excellent | Excellent |
| Strain relief | > 250 N | > 250 N |

| LIGHT SOURCE | | |
|---|---|---|
| Type | | Green LEDs |
| Voltage rating range | | 110-254 Vac, 50/60 Hz |
| Power consumption | | < 2 W |
| Electromagnetic immunity/emissions | | Complies with IEC61000-6 and IEC61000-4 |

| INSTALLATION DATA | | |
|---|---|---|
| Tools required | Cable knife, wire cutters, screwdriver | Cable knife, wire cutters, screwdriver, crimp tool , long nose pliers |

## ORDERING DETAILS

**End seal**

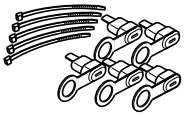
| Part description | FAST-100-E | FAST-100-L-E |
|---|---|---|
| PN (Weight) | 2000-M48 (0.22 kg)<br>Requires one pipe strap (not supplied) | 2000-M49 (0.63 kg)<br>Requires one pipe strap (not supplied) |

## ACCESSORIES

| | |
|---|---|
| Small pipe adaptor | MFS- SPA, required for pipes ⩽ 1" (DN 25), E 90515-000 (bag of 5 adaptors) |

## SPARE PART

Boot pack for FAST-100-E



| | |
|---|---|
| Part description | FAST-100-BOOT-5-PACK |
| PN (Weight) | 2000-M50 (140 g) |
| Pack size | 5 sealant filled boots and 5 cable ties |

| Replacement indicator light for FAST-100-L | |
|---|---|
| Part description: | FAST-100-LR-E |
| PN | 2000-M51 |

## SUMMARY OF SPECIAL CONDITIONS FOR SAFE USE WHEN USING MFS, MFM, MFU AND FAST-100 AT AMBIENT TEMPERATURES ABOVE +40°C OR VOLTAGES ABOVE 254 VAC.

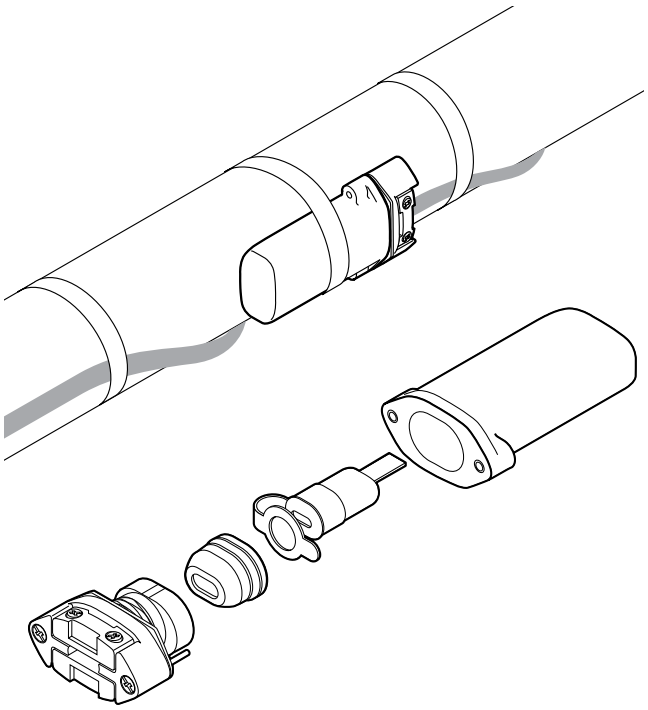
| Type | Ambient temperature range and rated Voltage range | | Special conditions of safe use |
|---|---|---|---|
| MFS-100-E<br>MFM-100-E | –50°C to +40°C and/or rated voltages < 254 V | | No additional requirements. Please refer to certificate. |
| MFS-100-L-E<br>MFM-100-L-E | –40°C to +40°C and/or rated voltages <254 V | | No additional requirements. |
| MFS-100-E<br>MFM-100-E | –50°C to +56°C and/or rated voltages as per table below: | | Additional conditions for use in environments with ambient temperatures exceeding +40°C and/ or rated voltages of 254 V<br>• Use a power cable with continuous temperature resistance of minimum +90°C<br>• Use a metallic power cable gland(s) (GL-33 or GL-34) |
| | UFA, UFB, UFC, UFO | Max. 277V | |
| | ACC1 | Max. 110V | |
| | ACC2 | Max. 230 / 254 V | |
| | ACC4 | Max. 480 V | |

| Type | Ambient temperature range and rated Voltage range | | Special conditions of safe use |
|---|---|---|---|
| MFU-100-E | –50°C to +40°C and/or rated voltages < 254 V | | No additional requirements. Please refer to certificate. |
| MFU-100-L-E | –40°C to +40°C and/or rated voltages <254 V | | No additional requirements. Please refer to certificate. |
| MFU-100-E | –50°C to +56°C and/or rated voltages as per table below: | | Additional conditions for use in environments with ambient temperatures exceeding +40°C and/ or rated voltages of 254 V<br>• Use a power cable with continuous temperature resistance of minimum +90°C<br>• Use a metallic power cable gland(s) (GL-33 or GL-34)<br>• Use a metallic connection kit for heating cable connection |
| | UFA, UFB, UFC, UFO | Max. 277V | |
| | ACC1 | Max. 110V | |
| | ACC2 | Max. 230 / 254 V | |
| | ACC4 | Max. 480 V | |

| Type | Ambient temperature range and rated Voltage range | | Special conditions of safe use |
|---|---|---|---|
| FAST-100-E | –50°C to +56°C and/or rated voltages as per table below: | | Additional conditions for use in environments with ambient temperatures exceeding +40°C.<br>Use metal tag plate with approval information (BQ-E-100-HT) |
| | UFA, UFB, UFC, UFO | Max. 275V | |
| | ACC1 | Max. 110V | |
| | ACC2 | Max. 230 / 254 V | |
| | ACC4 | Max. 480V | |
| FAST-100-L-E | –40°C to +56°C and/or rated voltages as per table below: | | Additional conditions for use in environments with ambient temperatures exceeding +40°C<br>Use metal tag plate with approval information (BQ-E-100-HT) |
| | UFA, UFB, UFC, UFO | Max. 275V | |
| | ACC1 | Max. 110V | |
| | ACC2 | Max. 230 / 254 V | |
| | ACC4 | Not Possible | |

# SANTO JQH-LEC

## LOW PROFILE END SEAL - COLD APPLIED



The JQH-LEC is a cold applied low profile end seal. This universal end seal is designed to fit with all Santo industrial self-regulating heating cables; UFA, UFB, UFC and UFO meaning simplified product selection and reduced inventory to stock. It can be used in applications with temperatures ranging from –50°C to 215°C. It is approved for use in hazardous areas.

The unique design of the JQH-LEC suits the demanding requirements of the industrial environment. The low profile housing can be installed on pipes and other surfaces. A spring loaded grommet makes a first seal to maintain a water tight connection while the non-curing sealant (silicone free) used in Santo's core sealing boot adds a second seal, providing additional protection. The rugged construction of the end seal makes it resistant to impact and suitable for high temperature variations and aggressive chemical exposure. The end seal is re-enterable. The JQH-LEC design provides a safe under the insulation end seal that can be relied upon over time.

The end seal requires no heat source for installation, making maintenance fast and easy. Each kit contains all the necessary materials to do one end termination.

| DESCRIPTION | |
|---|---|
| | Cold applied end seal for use with UFA, UFB, UFC and UFO heating cables. |

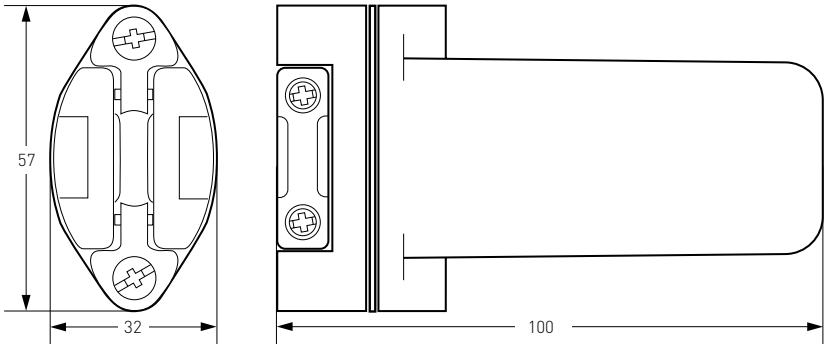
| KIT CONTENTS | |
|---|---|
| | 1 end seal enclosure housing<br>1 sealing grommet assembly<br>1 core sealing boot<br>1 identification label<br>1 installation instruction |

## APPROVALS

Hazardous locations

(Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

## DIMENSIONS (IN MM)




## PRODUCT SPECIFICATIONS

| | |
|---|---|
| Heating cable capability | UFA-CR, UFA-CT, UFB-CT, UFC-CT, UFO-CT |
| Ingress protection | IP66 |
| Minimum installation temperature | –50°C |
| Maximum pipe temperature | Refer to heating cable specification |
| Operating voltage | 277 V |

## MATERIALS OF CONSTRUCTION

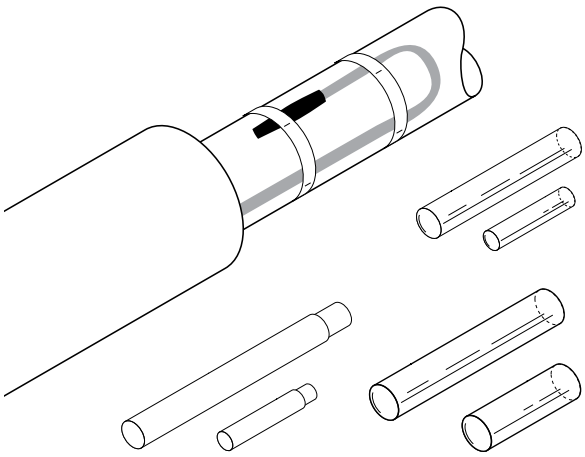
| | |
|---|---|
| Enclosure, end plate, and shim | Engineering polymers, black |
| Sealing grommet and core sealer | Silicone rubber |
| Screws, compression spring, reinforcement plate | Stainless steel |

## ORDERING DETAILS

| | |
|---|---|
| End seal | JQH-LEC |
| PN (Weight) | 2000-M52 (0.3 kg/0.6 lb.) |

# SANTO FAST-06, FAST-19 AND FAST-50

## HEAT-SHRINK UNDER INSULATION END SEAL KITS



These end seal kits are designed for the termination of Santo's industrial heating cables.

The FAST-06 is designed for use with UFA- and UFB heating cables, the FAST-19 is designed for use with UFC- and UFO heating cables, and the FAST-50 is for use with ACC heating cables. All kits are approved for use in hazardous areas.

The end seal kits FAST-06 and FAST-19 employ easy to use heat-shrinkable tubing with an adhesive, that when heated forms a semi-flexible moisture proof encapsulation. The end seal kit FAST-50 employs high temperature heat-shrinkable tubing with a plastic melt liner that when heated forms a semi-flexible moisture proof encapsulation. Due to the low profile design the finished termination can be installed directly on the pipe.

One end seal kit is required for each termination.

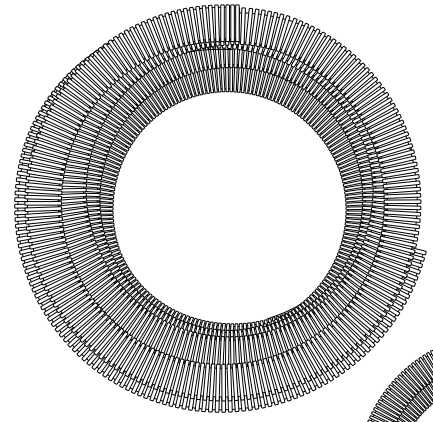
| APPLICATION | FAST-06 | FAST-19 | FAST-50 |
|---|---|---|---|
| | End seal for UFA and UFB self-regulating heating cables | End seal for UFC and UFO self-regulating heating cables | End seal for ACC power-limiting heating cables |
| **KIT CONTENTS** | | | |
| | Heat-shrinkable Adhesive coated sleeves<br>Installation instruction | Heat-shrinkable sleeves Adhesive liners<br>Installation instruction | Heat-shrinkable sleeves<br>Installation instruction |
| **APPROVALS** | | | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | | |

| PRODUCT SPECIFICATIONS | FAST-06 | FAST-19 | FAST-50 |
|---|---|---|---|
| Max. exposure temperature | 175°C | 200°C | 260°C |
| Dielectric strength | 2.2 MV/m | > 6 MV/m | > 40 MV/m |
| Volume resistivity | $10^{13}$ Ω cm | $10^{10}$ Ω cm | $10^{18}$ Ω cm |
| Final dimensions | length approx. 120 mm | length approx. 135 mm | length approx. 120 mm |
| **INSTALLATION DETAILS** | | | |
| Heat shrinkable tubing | 175 °C | 200 °C | 327 °C |
| Gas torch or equivalent | min. 1460 W hot air gun | min. 1460 W hot air gun | min. 3000 W hot air gun* |
| **ORDERING INFORMATION** | | | |
| Part description | FAST-06 | FAST-19 | FAST-50 |
| PN (Weight) | 2000-M53 (0.03 kg) | 2000-M54 (0.05 kg) | 2000-M54 (0.06 kg) |

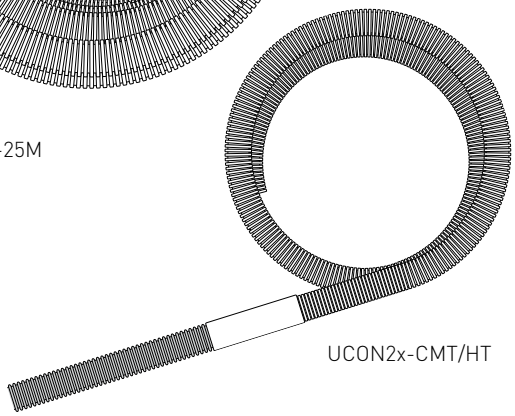
*The installation of the FAST-50 requires a high power heat gun and an experienced installer.

# SANTO UCON2X-C...

## CONDUIT FOR PROTECTION OF HEATING CABLES



UCON2x-CxT-25M



UCON2x-CMT/HT

These conduits have been designed for use in combination with the conduit connection kits UCON2x-100-... They provide supplementary mechanical protection of the heating cable or cold lead between a junction box and the entry into the insulation. The conduit materials have been selected to meet the requirements for use in hazardous locations.

The resistance of the conduits to fuels, mineral oils, fats, alkalies, acids and bases is excellent.

The conduits can be cut-to-length as required in the field and can either be entered in the insulation directly or by use of an insulation entry kit.

### APPLICATION

| | |
|---|---|
| | Conduit for protection of heating cables |

### APPROVALS

| | |
|---|---|
| | Meets electrostatic requirements for EAC in gas groups IIA and IIB.<br>For gas group IIC special marking required. (Do not clean with a dry cloth) |

| PRODUCT SPECIFICATION | M20 | M25 |
|---|---|---|
| Medium temperature conduit (150°C) | | |
| | UCON20-CMT-... | UCON25-CMT-... |
| Conduit size | ND 17 mm | ND 23 mm |
| Outer diameter (nominal) | 21.2 mm | 28.5 mm |
| Bending radius (static) | 40 mm | 45 mm |
| Weight (kg/100 m) | 5.7 | 9.9 |
| Material | Modified polyamide | |
| Temperature range (continuous) | –40°C to +135°C (compatible with surface temperature of all heating cables) | |
| Exposure temperature | 150°C (3000 h intermittent, cumulative) | |
| Impact strength | Minimum 6 J @ –40°C (empty conduit), min. 7 J with all heating cables | |
| Flame class | HB as per UL 94 | |

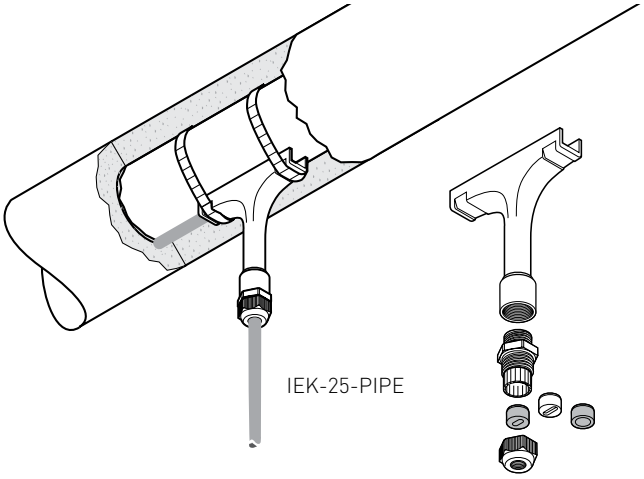
| | M20 | M25 |
|---|---|---|
| **HIGH TEMPERATURE CONDUIT (260°C)** | | |
| | UCON20-CHT-... | UCON25-CHT-... |
| Conduit size | ND 17 mm | ND 23 mm |
| Outer diameter (nominal) | 21.1 mm | 28.8 mm |
| Bending radius (static) | 15 mm | 26 mm |
| Weight (kg/100 m) | 8.3 | 14.8 |
| Material | PFA | |
| Temperature range | –200°C to +260°C | |
| Impact strength | Minimum 2.5 J (empty conduit), min. 7 J with all heating cables | |
| Flame class | V0 as per UL 94 | |

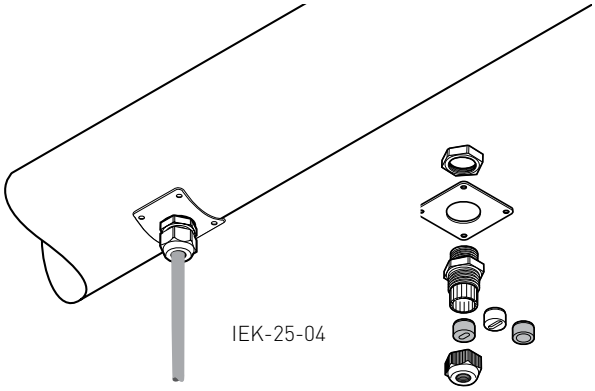
| **COMBINED MEDIUM AND HIGH TEMPERATURE CONDUIT** | | |
|---|---|---|
| | **UCON20-CMT/HT-1.67/0.33M** | **UCON25-CMT/HT-1.67/0.33M** |
| Ideal for direct entry into cladding for high pipe temperatures | 1.67 m length of medium temperature conduit for connection to the junction box connected to 33 cm of high temperature conduit for connection to the hot surface. | |

| **ORDERING DETAILS** | **M20** | **M25** |
|---|---|---|
| **CONDUIT SIZE** | **ND 17 MM** | **ND 23 MM** |
| Pack of 2 m of medium temperature conduit | UCON20-CMT-2M (PN: 2000-M55/Weight: 0.12 kg) | UCON25-CMT-2M (PN: 2000-M56/Weight: 0.20 kg) |
| Pack of 25 m of medium temperature conduit | UCON20-CMT-25M (PN: 2000-M57/Weight: 1.44 kg) | UCON25-CMT-25M (PN: 2000-M58/Weight: 2.25 kg) |
| Pack of 2 m of high temperature conduit | UCON20-CHT-2M (PN: 2000-M59/Weight: 0.16 kg) | UCON25-CHT-2M (PN: 2000-M60/Weight: 0.28 kg) |
| Pack of 25 m of high temperature conduit | UCON20-CHT-25M (PN: 2000-M61/Weight: 2.24 kg) | UCON25-CHT-25M (PN: 2000-M62/Weight: 3.90 kg) |
| 1 pc of combination med./high temperature conduit (1.67 m medium temperature with 0.33 m high temperature) | UCON20-CMT/HT-1.67/0.33M (PN: 2000-M62/Weight: 0.135 kg) | UCON25-CMT/HT-1.67/0.33M (PN: 2000-M63/Weight: 0.24 kg) |
| **ACCESSORIES** | | |
| Insulation entry kit comprising of pipe stand with conduit connection system | IEK20-CON (PN: 2000-M63) | IEK25-CON (PN: 2000-M64) |
| **KIT CONTENT** | | |
| | 2 pipe stands | 1 pipe stand |
| | 2 conduit connectors | 1 conduit connector |
| | Pipe straps need to be ordered separately | Pipe straps need to be ordered separately |

# SANTO IEK-25-PIPE AND IEK-25-04

## INSULATION ENTRY KIT




Insulation entry kits are designed to protect cables when passing through the thermal insulation cladding. The IEK´s are suitable for all type of parallel heating cables as well as power cables. Insulation entry kits may be used in hazardous and non hazardous areas.

The gland and the grommet provided in the kit provide strain relief and environmental sealing to avoid water ingress in the insulation.

The IEK-25-PIPE contains a protective guiding tube which is fixed to the pipe and allows the heat-tracing installation to be completed independently from the insulation work. The IEK-25-04 contains a stainless steel plate which can be screwed to the cladding.

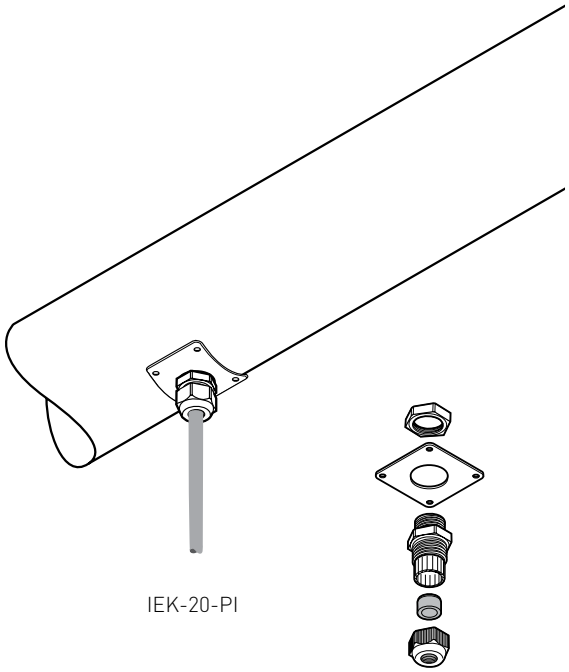
Insulation entry kits can be used for installations on pipes, tanks and vessels etc.

| APPLICATION | IEK-25-PIPE | IEK-25-04 |
|---|---|---|
| | Insulation entry kit for pipe mounting for heating- and power cables with an outside diameter in the range of 8 to 17 mm.<br>Kit contains 1 pc. | Insulation entry kit for pipes, tanks and vessels. Usable for all types of polymer heating cables and power cables with an outside diameter in the range of 8 to 17 mm.<br>Kit contains 1 pc. |
| **KIT CONTENTS** | | |
| | 1 x polymer “T” Tube<br>1 x plastic gland (M25) with round hole grommet for power cables<br>1 x bag with 2 silicon grommets for heating cables | 1 x stainless steel fixing plate<br>1 x plastic gland (M25) with round hole grommet for power cables<br>1 x bag with 2 silicon grommets for heating cables<br>1 x locknut |

| PRODUCT SPECIFICATIONS | IEK-25-PIPE | IEK-25-04 |
|---|---|---|
| Max. exposure temp. | | |
| gland | 110°C | 110°C |
| tube | 260°C | – |
| **APPROVALS** | | |
| | – | DNV Certificate No. E-11564 and E-11565 |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |
| **DIMENSIONS** | | |
| | Height 135 mm, width 120 mm | Plate 60 x 60 mm (22SWG) |
| **ORDERING INFORMATION** | | |
| Part number (Weight) | 2000-M65 (0.13 kg) | 2000-M66 (0.06 kg) |

# IEK-20-PI

## INSULATION ENTRY KIT



IEK-20-PI

Insulation entry kits are designed to protect cables when passing through the thermal insulation cladding.
The IEK-20-PI is suited for PI heating cables as well as for power cables.

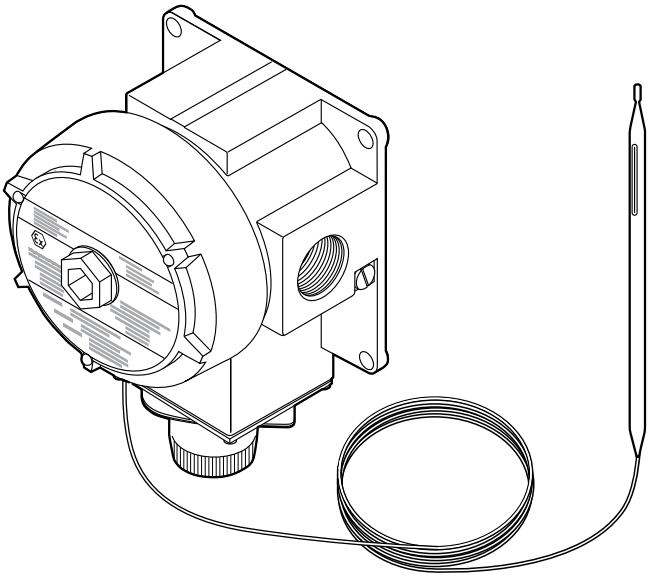
Insulation entry kits may be used in hazardous and non hazardous areas.

The gland and the grommet included in the kit provide strain relief and environmental sealing to avoid water ingress in the insulation. They contain a stainless steel plate which can be screwed to the cladding. Insulation entry kits can be used for installations on pipes, tanks and vessels etc.

| APPLICATION | **IEK-20-PI** |
|---|---|
| | Two-pack insulation entry kit for pipes, tanks and vessels. Usable for all types of PI cold leads as well as all other round cables with an outer diameter in the range of 5 to 13 mm. Kit contains 2 pc. |
| **KIT CONTENTS** | |
| | 2 x stainless steel fixing plates<br>2 x plastic glands (M20) with round hole grommet for power- or cold lead cables<br>2 x locknuts |
| **PRODUCT SPECIFICATIONS** | |
| Max. exposure temp. gland | 80°C |
| **DIMENSIONS** | |
| | Plate 60 x 60 mm (22 SWG) |
| **ORDERING INFORMATION** | |
| Part number (Weight) | 2000-M67 (0.08 kg) |
| **APPROVALS** | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

# SANTO E507S-LS

## SURFACE SENSING MECHANICAL THERMOSTAT



This EEx d approved surface sensing thermostat provides temperature control for all Santo UFA, UFB, UFC, UFO and ACC heating cables in hazardous areas. The switching temperature range is –4°C to +163°C and is adjustable externally to the Ex enclosure by a dial mounted under a bolted-on cover and seal.

The switching current capacity is 22 A. It has a single pole change-over switch with volt-free contacts.

Cable entry is through a single 3/4" NPT thread entry. Santo cable glands are available to suit non-armoured and armoured cable.

The 3 m long stainless steel fluid filled bulb and capillary give freedom to locate the enclosure remote from the bulb. The bulb exposure range is –50°C to +215°C.
The cast aluminium construction with stainless steel fittings gives a lightweight unit which can be pipe mounted using Santo support brackets or surface mounted.

### THERMOSTAT

| | |
|---|---|
| Area of use | Hazardous area: Zone 1, Zone 2 (Gas), Zone 21, Zone 22 (Dust)<br>Ordinary |

### APPROVALS

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

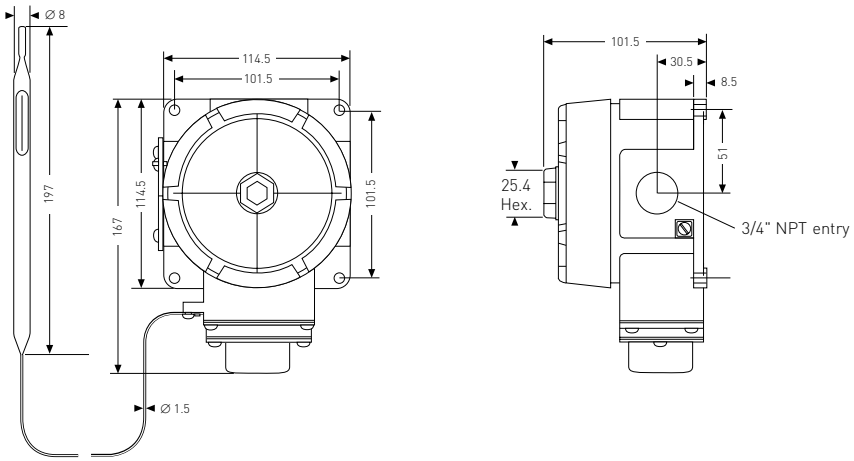
### ENCLOSURE

| | |
|---|---|
| Body and lid | Lacquer coated cast aluminium with stainless steel fittings and nitrile rubber internal lid seal |
| Protection | IP 65 if installed with Santo cable glands GL-33 or GL-34 |
| Lid fixing | Screw thread lid locked in place by a 2 mm hexagonal key grub screw |
| Entry | 1 x 3/4" NPT |
| Ambient operating temperature | –40°C to +60°C |

### TEMPERATURE SENSING

| | |
|---|---|
| Type | Fluid filled bulb and capillary |
| Dimensions | Capillary 3 m long, bulb 197 mm x 8 mm |
| Material | Stainless steel (Type 55316) |
| Exposure temperature | –50°C to +215°C |
| Minimum bend radius | Do not bend bulb, 15 mm for capillary |

## DIMENSIONS (IN MM)




## SWITCHING

| | |
|---|---|
| Type | Single pole change over volt free contacts (SPDT) |
| Rating | 22 A at 250 Vac, switching (100.000 cycles) |

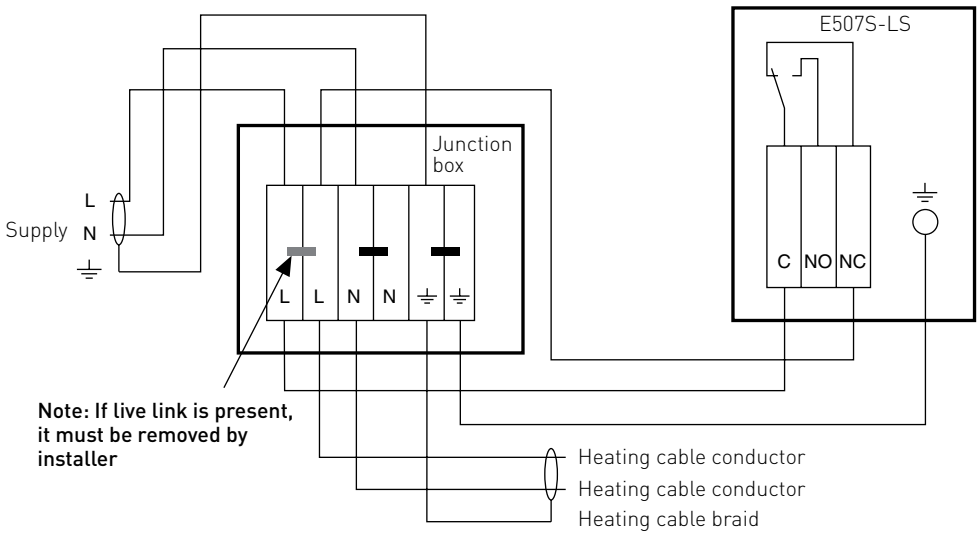
## SETTING

| | |
|---|---|
| Range | –4°C to +163°C |
| Repeatability | ±1.7 K |
| Differential | 5 K |
| Accuracy (switch on) | ±4.5°C at 21°C ambient and 50°C sensor temperature |
| Method | External knob and dial |

## CONNECTION TERMINALS

| | |
|---|---|
| Supply | 3 terminals for 1 to 4 $mm^2$ conductors |
| Internal earth | Single bolt for 1 to 4 $mm^2$ conductors |
| External earth | Single bolt and clamp for 1 to 4 $mm^2$ conductors |

## CONNECTION DETAILS AND THERMOSTAT CONTROL SYSTEM



**Maximum recommended heating cable lengths (230 V supply)**
The maximum recommended heating cable length is restricted by the electrical protection sizing or the switching capacity of the E507S-LS.

**For circuits and electrical protection rated up to and including 20 A**
Use the maximum recommended heating cable lengths, mentioned in the cable datasheet.

**For circuits and electrical protection rated above 20 A but less than or equal to 22 A**
Use the shorter length of the values given in the cable datasheet and those given for your switching temperature in the table below.

**For circuits and electrical protection rated above 22 A, E507S-LS must NOT be connected for direct switching.**

## HEATING- CABLE REFERENCE

| | 3UFA2-CT/-CR | 5UFA2-CT/-CR | 8UFA2-CT/-CR | 10UFA2-CT/-CR | 10UFB2-CT | 15UFB2-CT | 20UFB2-CT | 4UFC2-CT-T3 | 8UFC2-CT-T3 | 12UFC2-CT-T3 | 15UFC2-CT-T3 | 20UFC2-CT-T2 | 5UFO2-CT | 8UFO2-CT | 15UFO2-CT | 20UFO2-CT | 5ACC2 | 10ACC2 | 15 ACC2 | 20ACC2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Switching temp. (°C)** | **L max. (m) - Maximum recommended heating cable length** | | | | | | | | | | | | | | | | | | | |
| 5 | 200 | 165 | 120 | 105 | 110 | 85 | 65 | 230 | 145 | 105 | 85 | 65 | 200 | 145 | 90 | 65 | 220 | 145 | 95 | 70 |
| 10 | 200 | 165 | 120 | 105 | 110 | 90 | 65 | 235 | 150 | 110 | 85 | 65 | 205 | 145 | 90 | 65 | 220 | 150 | 95 | 70 |
| 15 | 200 | 165 | 120 | 105 | 115 | 90 | 70 | 245 | 155 | 110 | 85 | 65 | 210 | 150 | 95 | 65 | 220 | 150 | 95 | 70 |
| 20 | 200 | 165 | 120 | 105 | 115 | 95 | 75 | 250 | 160 | 115 | 90 | 65 | 215 | 155 | 95 | 70 | 220 | 150 | 100 | 70 |
| 25 | 200 | 165 | 120 | 105 | 115 | 95 | 75 | 250 | 165 | 120 | 90 | 70 | 220 | 160 | 100 | 70 | 220 | 155 | 100 | 75 |
| 30 | 200 | 165 | 120 | 105 | 115 | 95 | 80 | 250 | 170 | 125 | 95 | 70 | 225 | 160 | 100 | 70 | 220 | 155 | 100 | 75 |
| 35 | 200 | 165 | 120 | 105 | 115 | 95 | 85 | 250 | 180 | 130 | 95 | 75 | 225 | 165 | 105 | 75 | 220 | 155 | 100 | 75 |
| 40 | 200 | 165 | 120 | 105 | 115 | 95 | 90 | 250 | 180 | 135 | 100 | 75 | 225 | 170 | 105 | 75 | 220 | 155 | 105 | 75 |
| 45 | 200 | 165 | 120 | 105 | 115 | 95 | 95 | 250 | 180 | 140 | 100 | 75 | 225 | 175 | 110 | 80 | 220 | 155 | 105 | 75 |
| 50 | 200 | 165 | 120 | 105 | 115 | 95 | 105 | 250 | 180 | 145 | 105 | 80 | 225 | 180 | 115 | 80 | 220 | 155 | 105 | 75 |
| 55 | 200 | 165 | 120 | 105 | 115 | 95 | 110 | 250 | 180 | 145 | 110 | 80 | 225 | 180 | 115 | 85 | 220 | 155 | 105 | 80 |
| 60 | 200 | 165 | 120 | 105 | 115 | 95 | 110 | 250 | 180 | 145 | 110 | 85 | 225 | 180 | 120 | 85 | 220 | 155 | 110 | 80 |
| 65 | 200 | 165 | 120 | 105 | 115 | 95 | 110 | 250 | 180 | 145 | 115 | 85 | 225 | 180 | 125 | 90 | 220 | 155 | 110 | 80 |
| 70 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 120 | 90 | 225 | 180 | 130 | 95 | 220 | 155 | 110 | 80 |
| 75 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 120 | 90 | 225 | 180 | 130 | 95 | 220 | 155 | 115 | 80 |
| 80 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 125 | 95 | 225 | 180 | 130 | 100 | 220 | 155 | 115 | 85 |
| 85 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 130 | 100 | 225 | 180 | 130 | 105 | 220 | 155 | 115 | 85 |
| 90 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 130 | 100 | 225 | 180 | 130 | 110 | 220 | 155 | 120 | 85 |
| 95 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 130 | 105 | 225 | 180 | 130 | 110 | 220 | 155 | 120 | 85 |
| 100 to 110 | -- | -- | -- | -- | 115 | 95 | 110 | 250 | 180 | 145 | 130 | 110 | 225 | 180 | 130 | 110 | 220 | 155 | 120 | 85 |
| 115 to 120 | -- | -- | -- | -- | -- | -- | -- | 250 | 180 | 145 | 130 | 110 | 225 | 180 | 130 | 110 | 220 | 155 | 125 | 90 |
| 125 to 150 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 225 | 180 | 130 | 110 | 220 | 155 | 125 | 95 |

## MOUNTING METHOD

| | |
|---|---|
| | Santo support bracket SB-100, SB-101, SB-110, SB-111, SB-125 or surface mounting with 4 fixing holes (M6) on 101.5 x 101.5 mm centres |

## SETTING

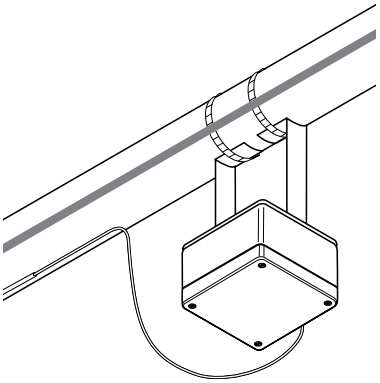
| | |
|---|---|
| Power cable gland for armoured cable | GL-33 |
| Power cable gland for non-armoured cable (to be ordered separately) | GL-34 |

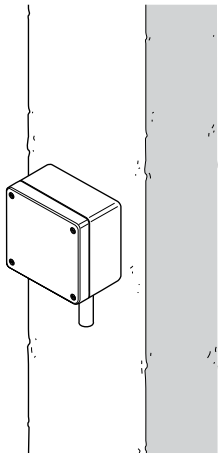
## ORDERING DETAILS

| | |
|---|---|
| Part description | E507S-LS |
| PN (Weight) | 2000-M68 (1.77 kg) |

# SANTO DATC-EX-03 AND DATC-EX-04

## SURFACE AND AMBIENT SENSING, ELECTRONIC





These electronic surface sensing and ambient thermostats provide accurate temperature control for heating cables.

The units can be supplied at nominal voltages of either 110 V 50/60 Hz or 230 V 50/60 Hz and have a double pole switch rated at 16 A. The switch contacts can be arranged to be volt free. Temperature setting is accurate via digital thumb wheel switches inside the enclosure.

The surface sensing version is supplied with a Pt 100 sensor and a 2 m long stainless steel sheathed extension cable giving freedom to locate the electronics remote from the sensor. The ambient version is supplied with a local Pt 100 sensor and a wind shield.

The enclosure is manufactured from high impact resistant glass filled polyester offering IP66 protection.

For pipe temperatures up to 215°C, the units can be mounted on the pipe using a support bracket.

| APPLICATION | DATC-EX-03 | DATC-EX-04 |
|---|---|---|
| | Surface sensing | Ambient sensing |
| **THERMOSTAT** | | |
| Area of use | Hazardous area: Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust) Ordinary | |
| **APPROVALS CERTIFICATION** | | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |

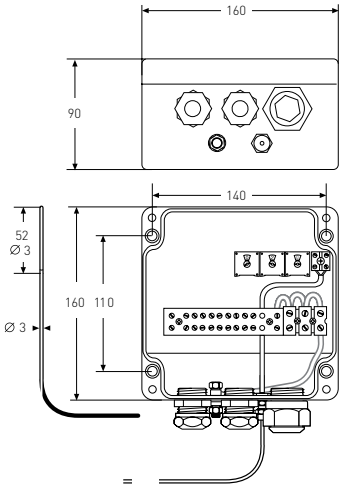
| PRODUCT SPECIFICATION | | |
|---|---|---|
| Temperature range | 0°C to 499°C | 0°C to 49°C |
| Ingress protection | IP66 | IP66 |
| Switching accuracy | ±1 K at 5°C<br>±1% of setpoint above 100°C | ±1 K at 5°C |
| Switching differential (Hysteresis) | ≈ 1°C at 100°C<br>≈ 2°C at 200°C<br>≈ 5°C at 499°C | ≈ 1°C |
| Output relay | Dual pole change overtype (DPDT)<br>(optional volt free) | Dual pole change over type (DPDT)<br>(optional volt free) |

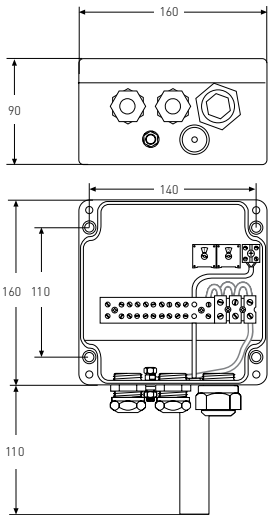
## PRODUCT SPECIFICATION (continued)

| | | |
|---|---|---|
| Switching capacity | 16 A 110 Vac ±10% 50/60 Hz<br>16 A 230/253 Vac ±10% 50/60 Hz<br>resistive load | 16 A 110 Vac ±10% 50/60 Hz<br>16 A 230/253 Vac ±10% 50/60 Hz<br>resistive load |
| Ambient temperature range | –50°C to +60°C | –50°C to +60°C |
| Supply voltage | 110 Vac ±10% 50/60 Hz<br>230/253 Vac ±10% 50/60 Hz | 110 Vac ±10% 50/60 Hz<br>230/253 Vac ±10% 50/60 Hz |
| Internal power consumption | 110 Vac ~ 4 VA, 230/253 Vac ~ 3 VA | |
| Terminal size | max. 4 mm² | max. 4 mm² |

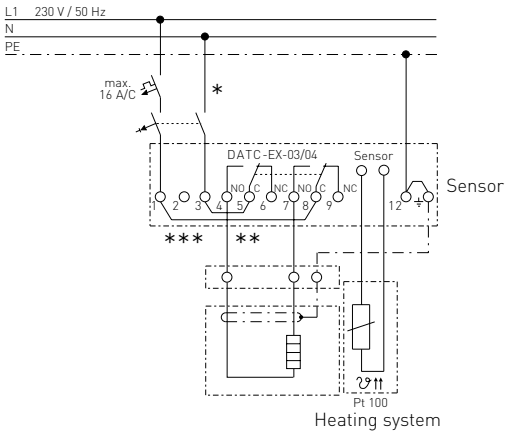
## DIMENSIONS (IN MM)

| | DATC-EX-03 | DATC-EX-04 |
|---|---|---|




## TYPICAL WIRING DIAGRAM FOR DIRECT SWITCHING




* Circuit breaker configurations may vary according to local standards/requirements
** Link 1-8 and/or 3-5 can be removed to provide potential-free contacts
*** Terminal 2: 110 Vac input terminal

| | | |
|---|---|---|
| Cable entries | 2 x M20 glands (cable ∅ 7.5 – 13 mm)<br>1 x M25 with M25(M)/M20(F) adaptor and (M20) plug | 2 x M20 glands (cable ∅ 7.5 – 13 mm)<br>1 x M25 with M25(M)/M20(F) adaptor and (M20) plug |
| Sensor | 2 wire Pt 100, stainless steel sensor, 2 m long | 2 wire Pt 100, stainless steel sensor, complete with wind shield |

## MOUNTING METHOD

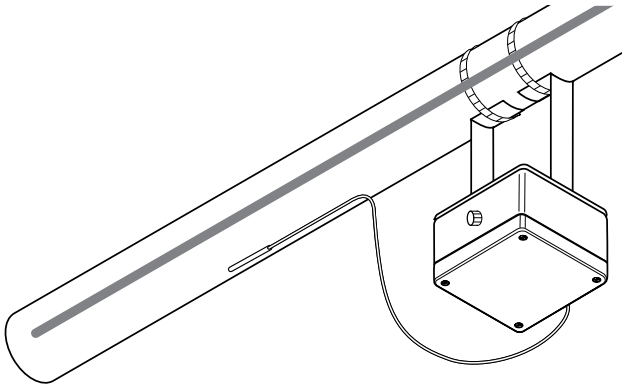
| | | |
|---|---|---|
| | Santo support bracket SB-100 or SB-101, SB125 or surface mounting with 4 fixing holes on 110x140 mm centres | Santo support bracket SB-100 or SB-101, SB125 or surface mounting with 4 fixing holes on 110x140 mm centres |

## ORDERING DETAILS

| Part Description | DATC-EX-03 | DATC-EX-04 |
|---|---|---|
| PN (Weight) | 2000-Z01 (3.0 kg) | 2000-Z02 (3.1 kg) |

# SANTO DATC-05

## SURFACE SENSING ELECTRONIC THERMOSTAT



### PRODUCT OVERVIEW

The Santo DATC-05 electronic surface sensing thermostat provides accurate temperature control for heating cables.

The DATC-05 is available in two versions. The DATC-05-L2-E is for temperatures up to 199°C, while the DATC-05-H2-E can be used for temperatures up to 499°C. The maximum nominal load is 32 A for both thermostats. Temperature setting is accurate via digital rotary switches inside the enclosure.

The DATC-05 has a LED indicator which indicates the status of the thermostat (powered on/off), the status of the heat-tracing cable (powered on/off) and the status of the sensor. In case of sensor failure the thermostat can switch to an on or off state, depending upon the users requirement.

### PRODUCT CHARACTERISTICS

| | DATC-05-L2-E | DATC-05-H2-E |
|---|---|---|
| Application | Surface sensing | Surface sensing |
| Area of use | Hazardous area: Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust) Ordinary | |

### APPROVALS CERTIFICATION

EAC (Russia, Kazakhstan, Belarus)
For other countries contact your local Santo representative.

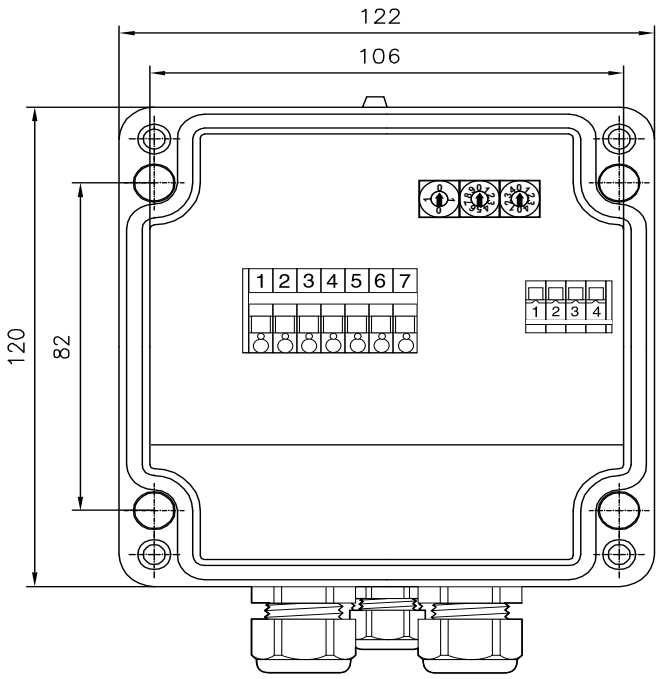
### PRODUCT SPECIFICATION

| | | |
|---|---|---|
| Temperature setpoint range | 0°C to 199°C | 0°C to 499°C |
| Temperature measurement range | –55°C to 260°C | –55°C to 585°C |
| Maximum sensor lead resistance | 20 Ohm | 20 Ohm |
| Ingress protection | IP66 | IP66 |
| Switching accuracy | ±1 K at 5°C | ±1 K at 5°C, 2°C at 499°C |
| Switching differential (Hysteresis) | ≈ 3°C | ≈ 3°C |
| Output relay | Single Pole change over type (SPST) | Single Pole change over type (SPST) |
| Switching capacity | 32 A resistive load | 32 A resistive load |
| Ambient temperature range | –40°C to + 60°C | –40°C to + 60°C |
| Supply voltage | 230 V +10% / -15% 50/60 Hz | 230 V +10% / –15% 50/60 Hz |
| Internal power consumption | 3 VA | 3 VA |
| Terminal size | max. 6 $mm^2$ | max. 6 $mm^2$ |
| Cable entries | 2 x M25:<br>1 x M25 gland for power cable in<br>1 x M25 rain plug for heating cable out | 2 x M25:<br>1 x M25 gland for power cable in<br>1 x M25 rain plug for heating cable out |
| Sensor | M16 gland with 3 wire PT100<br>flexible sensor, 2 m long | M16 gland with 3 wire PT100,<br>stainless steel sensor, 2 m long, |

## LED STATUS INDICATIONS

| | | |
|---|---|---|
| | Green: DATC-05 powered on, heat-tracing cable off | Green: DATC-05 powered on, heat-tracing cable off |
| | Yellow: DATC-05 powered on, heat-tracing cable on | Yellow: DATC-05 powered on, heat-tracing cable on |
| | Red flashing: Sensor failure - controller in fail safe mode | Red flashing: Sensor failure - controller in fail safe mode |

## DIMENSIONS (IN MM)



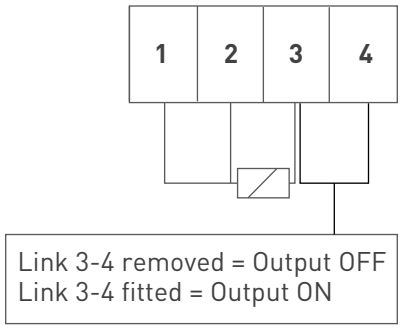

**Power Terminals**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Line Out | Neutral Out | Neutral Supply | 230V Supply | Earth | Earth | Earth |

Terminals 2 and 3 are joined electrically

Terminals 5, 6 and 7 are joined electrically

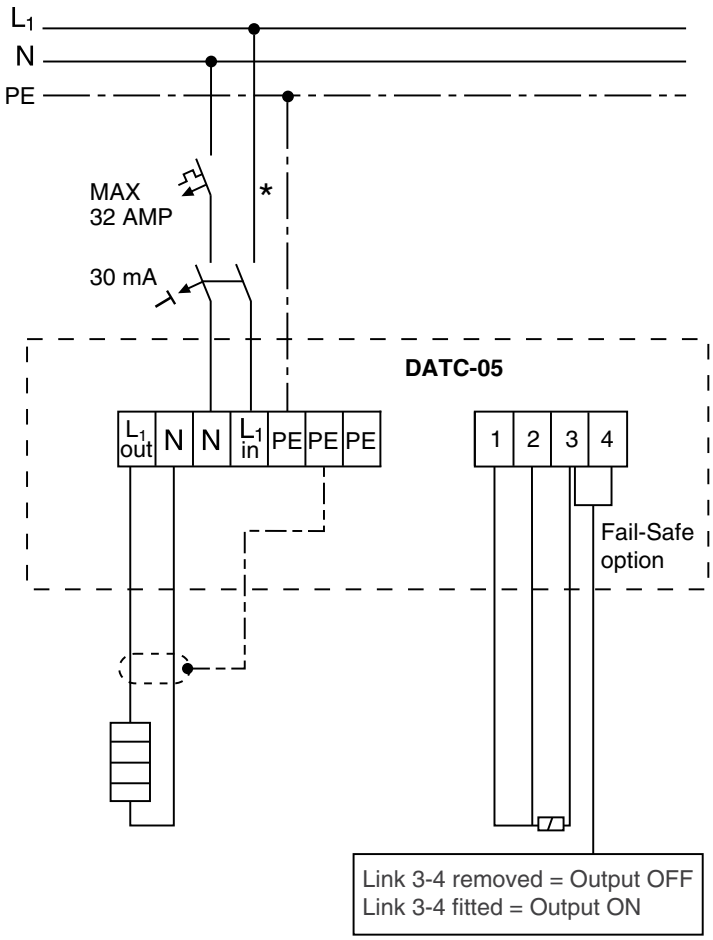
**Sensor/Failure Mode Select Terminals**




Terminals 1 to 3 allow for the connection of a three wire PT100 sensor.

Terminals 3 to 4 allow the user to select the default heating status on sensor error.
Without a link fitted the heating will turn OFF if a sensor error is detected (default)
With a link fitted the heating will turn ON if a sensor error is detected

## TYPICAL WIRING DIAGRAM FOR DIRECT SWITCHING




* Circuit breaker configurations may vary according to local standards/requirements

## MOUNTING METHOD

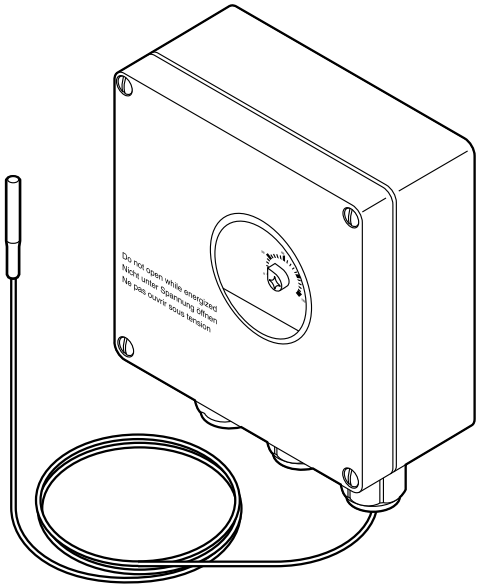
| | | |
|---|---|---|
| | Support bracket SB-100, SB-101, SB-110, SB-111, SB-130 or surface mounting with 4 fixing holes on 106 x 82 mm centres | Support bracket SB-100, or SB-101, SB-110, SB-111, SB-130 or surface mounting with 4 fixing holes on 106 x 82 mm centres |

## ORDERING DETAILS

| Product Name | DATC-05-L2-E | DATC-05-H2-E |
|---|---|---|
| Part number | 2000-Z03 | 2000-Z04 |

# DATC-TS-13 AND DATC-TS-14

## SURFACE SENSING THERMOSTAT, ELECTRONIC

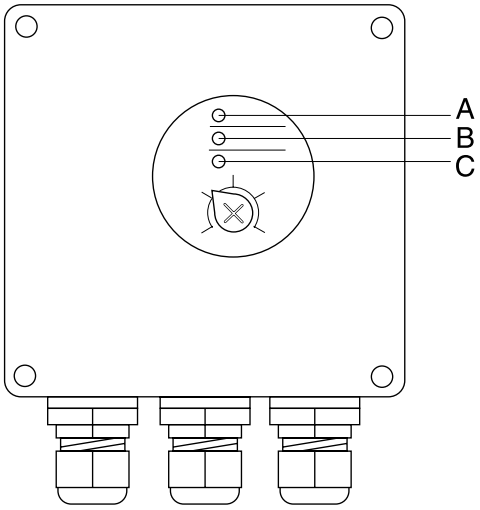


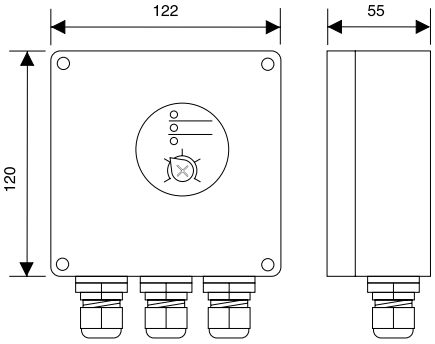

DATC-TS thermostats provide temperature control in safe area. The temperature set point can be checked through a window in the lid. LED´s are providing an indication when cables are energized (Heating ON) or when the temperature sensor is defect (sensor break or sensor short-circuit).

The temperature sensor has a length of 3 meter and can be shortened for ambient sensing operating. Direct connection of the heating cable is possible. Connection kits need to be ordered separately. The thermostat is available in 2 temperature ranges.

| GENERAL | DATC-TS-13 | DATC-TS-14 |
|---|---|---|
| Area of use | Ordinary area, outdoors | Ordinary area, outdoors |
| Supply voltage | 230 Vac +10% –15% 50/60 Hz | 230 Vac +10% –15% 50/60 Hz |
| Max. switching current | 16 A, 250 Vac | 16 A, 250 Vac |
| Max. conductor size | 2.5 $mm^2$ | 2.5 $mm^2$ |
| Switching differential | 0.6 K to 1 K | 0.6 K to 1 K |
| Switching accuracy | ± 1 K at 5°C (calibration point) | 2 K at 60°C (calibration point) |
| Switch type | SPST (normally open) | SPST (normally open) |
| Adjustable temperature range | –5°C to +15°C | 0°C to +120°C |
| **HOUSING** | | |
| Temperature setting | inside | inside |
| Exposure temperature | –20°C to +50°C | –20°C to +50°C |
| Ingress protection | IP65 according to EN 60529 | IP65 according to EN 60529 |
| Entries | 1 x M20 for supply cable (∅ 8-13 mm)<br>1 x M25 for heating element (∅ 11-17 mm)<br>1 x M16 for the sensor | 1 x M20 for supply cable (∅ 8-13 mm)<br>1 x M25 for heating element (∅ 11-17 mm)<br>1 x M16 for the sensor |
| Material | ABS | ABS |
| Lid fixing | nickel-plated quick release screws | nickel-plated quick release screws |
| Mounting | SB-110 and SB-111 or surface mount | SB-110 and SB-111 or surface mount |
| **APPROVALS** | | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |

## DIMENSIONS (IN MM)




A Green LED Heating cable on
B Red LED Sensor break
C Red LED Sensor short-circuit

| TEMPERATURE SENSOR | DATC-TS-13 | DATC-TS-14 |
|---|---|---|
| Type | PTC KTY 83-110 | PTC KTY 83-110 |
| Length sensor cable | 3 m | 3 m |
| Diameter sensor cable | 5.5 mm | 5.5 mm |
| Diameter sensor head | 6.5 mm | 6.5 mm |
| Sensor material | PVC | Silicone |
| Max. exposure temperature sensor cable | 80°C | 160°C |
| | The sensor cable may be extended to a maximum of 100 m using a 2-conductor wire with a cross-section of 1.5 $mm^2$. The sensor cable should be shielded if it is laid in cable ducts or in the vicinity of high-voltage carrying cables. The shield of the extension cable should be grounded at the controller end only. | |

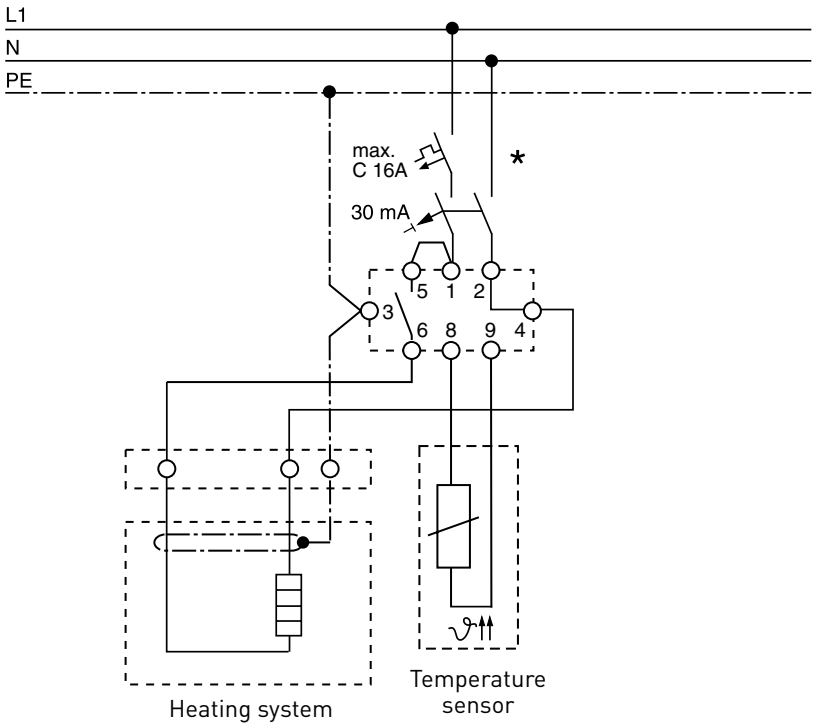
| OUTPUT PARAMETERS | | |
|---|---|---|
| Alarm on LED | Green LED: Heating Cable ON<br>Red LED: Sensor break<br>Red Led: Sensor short-circuit | Green LED: Heating Cable ON<br>Red LED: Sensor break<br>Red Led: Sensor short-circuit |

| ORDERING DETAILS | | |
|---|---|---|
| Part description | DATC-TS-13 | DATC-TS-14 |
| PN (Weight) | 2000-Z05 (0.44 kg) | 2000-Z06(0.44 kg) |

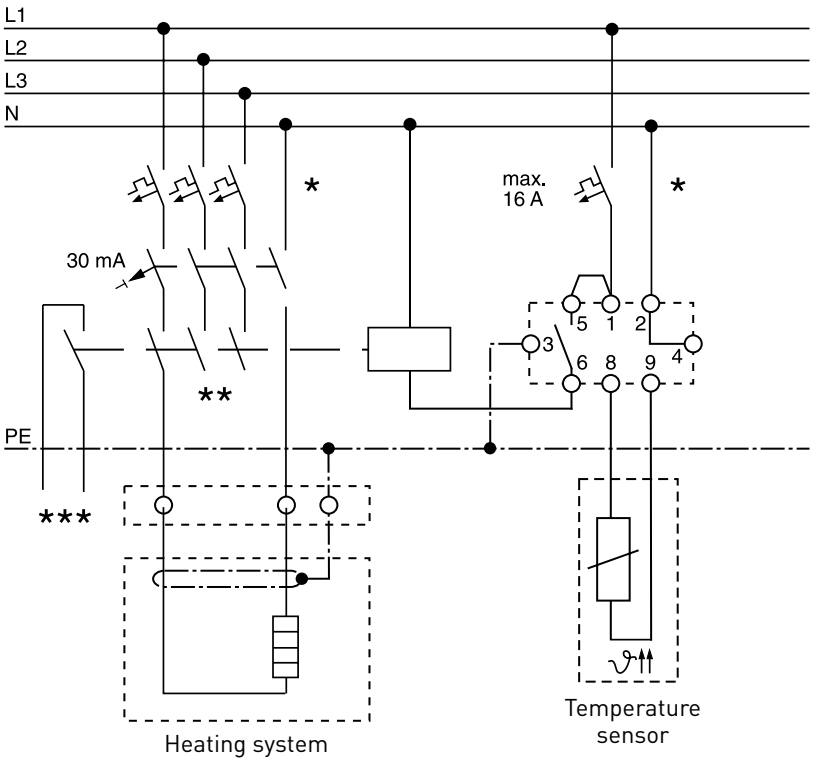
| ACCESSORIES | | |
|---|---|---|
| PA Reducer | Reducer M25 (M)/M20 (F) | Reducer M25 (M)/M20 (F) |
| PN | 2000-Z051 | 2000-Z061 |
| Spare temperature sensor | HARD-69 | HARD-69 |
| (AT-TS-13 and AT-TS-14) | (Max. exposure temperature 160°C) | |
| PN (Weight) | 2000-Z052(180 g) | 2000-Z062 (180 g) |

## WIRING DIAGRAM FOR THERMOSTAT

**DATC-TS-13 or DATC-TS-14**




**DATC-TS-13/14 with contactor**



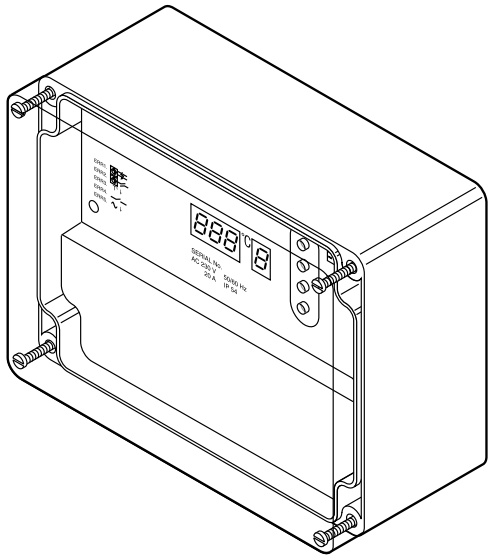

* Two- or four-pole electrical protection by circuit-breaker may be needed for local circumstances, standards and regulations

** Depending on the application, one- or three-pole circuit-breakers or contactors may be used

*** Optional: Potential-free circuit-breaker for connection to the BMS

# DATC-ECO-10

## AMBIENT SENSING ENERGY SAVING FROST PROTECTION CONTROLLER



The DATC-ECO-10 temperature controller is designed to control heating cables used for frost protection applications. It continuously adjusts the heat-tracing output based on the ambient temperature. Using a proprietary algorithm, the DATC-ECO-10 controller measures ambient temperature and determines the appropriate cycle time during which the heating cables will be energised.

Since ambient temperatures in winter are often below freezing point, but well above the minimum designed ambient temperature, significant energy savings are realised. Parameters are displayed and can be set easily. The controller includes a 25 A relay which allows direct switching of the heating circuit. The enclosure can easily be installed outdoors. The unit includes a Pt 100 sensor for determining ambient temperature in ordinary area.

The DATC-ECO-10 controller is designed to provide trouble-free, long term operation. In addition to the display, the controller includes an alarm relay that switches either upon low supply voltage, upon output fault or upon RTD failure thus allowing remote indication of system status.

### GENERAL

| | |
|---|---|
| Area of use | Ordinary area, outdoors |
| Ambient operating temperature range | –20°C to +40°C |
| Supply voltage (nominal) | 230 V +10% –10%, 50/60 Hz |
| Internal power consumption | ⩽ 14 VA |

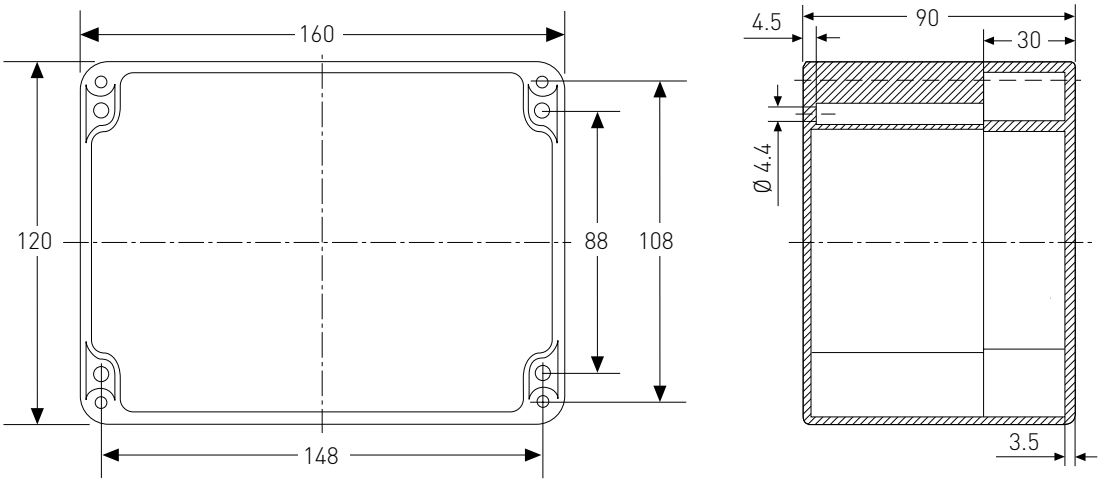
### ENCLOSURE

| | |
|---|---|
| Protection | IP65 |
| Base and lid | Grey polycarbonate base<br>Transparent lid |
| Lid fixing | 4 captive screws |
| Entries | 2 x M25, 1 x M20, 1 x M16<br>Direct entry of heating cable into unit with M25 connection kit |
| Gland plug | 1 x M20 |

### APPROVALS

| | |
|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## DIMENSIONS (IN MM)




## TEMPERATURE SENSOR

| | |
|---|---|
| Type | 3-wire Pt 100 according to IEC Class B |
| Area of use | Ordinary area |

Sensor can be extended with a 3-wire shielded cable of max. 20 Ω per conductor (max. 150 m with a 3 x 1.5 $mm^2$ cable). The sensor cable should be shielded if it is laid in cable ducts or in the vicinity of high-voltage carrying cables. The shield of the extension cable should be grounded at the controller end only.

## OUTPUT RELAYS

| | |
|---|---|
| Control relay | Single pole single throw relay, rating: 25 A at 250 Vac |
| Alarm relay | Single pole double throw relay, rating: 2 A at 250 Vac, voltfree |

## PARAMETER SETTINGS

| | |
|---|---|
| Maintain temperature set point | 0°C to + 30°C (heating 0% powered) |
| Minimum ambient temperature | –30°C to 0°C (heating 100% powered) |
| Heater Operation if Sensor Error | ON (100%) or OFF, user defined ON or OFF |
| Voltage Free Operation | YES or NO |

Parameters can be programmed without power supply (internal battery) and parameters are stored in non-volatile memory.

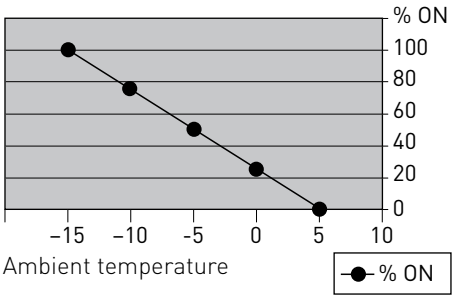
## ENERGY SAVING WITH PROPORTIONAL AMBIENT SENSING CONTROL (PASC)

Duty cycle (power to heater ON) depends on the ambient temperature.

For example:
If minimum temperature= –15°C and if maintain temperature (set point)= +5°C

| AMBIENT T° | % ON | |
|---|---|---|
| –15 | 100 | Min. Ambient |
| –10 | 75 | |
| –5 | 50 | |
| 0 | 25 | |
| 5 | 0 | Set point |

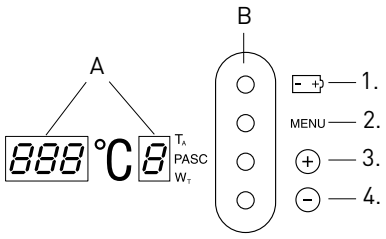
Result: At ambient temperature of –5°C, 50% energy is saved




## DIAGNOSED ALARMS

| | |
|---|---|
| Sensor errors | Sensor short/Sensor open circuit |
| Low temperature | Min. expected ambient temperature reached |
| Voltage errors | Low supply voltage/Output voltage fault |

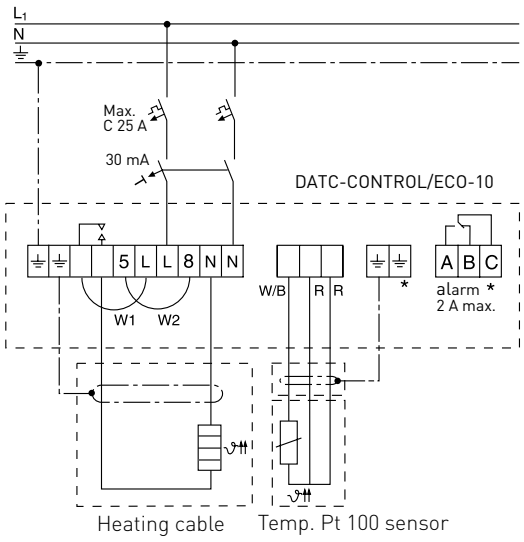
## DISPLAY LAYOUT



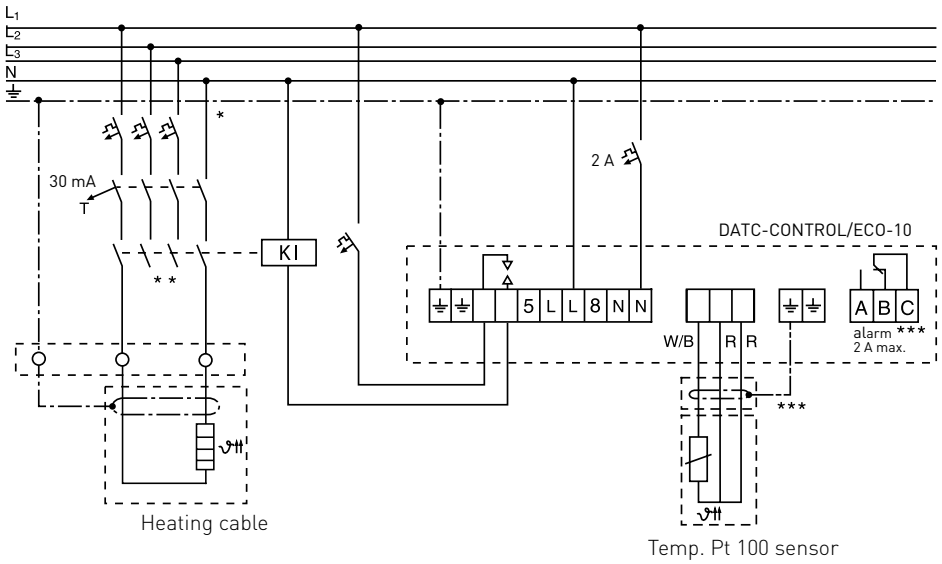

A. LED Display (parameter and error indications)
B. Push buttons
   1. Battery activation
   2. Parameter selection
   3. Increase value
   4. Decrease value

## CONNECTION DETAILS

**Normal operation**




## VOLTAGE FREE OPERATION: REMOVE LINKS W1 AND W2




* Electrical protection by circuit-breaker may be needed for local circumstances, standards and regulations.
** Depending on the application, one- or three-pole circuit-breakers or contactors may be used.
*** Optional

## CONNECTION TERMINALS

| | |
|---|---|
| Supply | 3 terminals for 0.75 $mm^2$ to 4 $mm^2$ |
| Pt 100 connection | 4 terminals for 0.75 $mm^2$ to 2.5 $mm^2$ |
| Control relay connection | 3 terminals for 0.75 $mm^2$ to 4 $mm^2$ |
| Alarm relay connection | 3 terminals for 0.75 $mm^2$ to 2.5 $mm^2$ |

## MOUNTING METHOD

| | |
|---|---|
| | Surface mounting with 4 fixing holes on 148 x 108 mm centres, M4 clearance |
| Support bracket | SB-100, SB-101 (SB-110 or SB-111) |

## ORDERING DETAILS

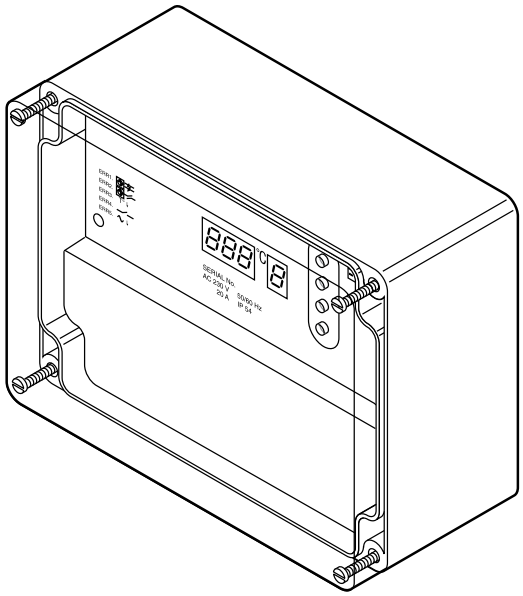
| | |
|---|---|
| Part description | DATC-ECO-10 |
| PN (Weight) | 2000-T20(0.8 kg) |

## ACCESSORIES

| | |
|---|---|
| PA Reducer | Reducer M25 (M)/M20 (F) |
| PN | 2000-T21 |

# SANTO DATC-CONTROL-10

## SURFACE SENSING PROGRAMMABLE THERMOSTAT WITH ALARM RELAY



The DATC-CONTROL-10 surface sensing thermostat is designed to provide user friendly measurement and control for heating cables. The thermostat has a 25 A control relay (that can be arranged to be volt free) and a 2 A volt free SPDT alarm relay.

Parameter and eventual alarm conditions are shown on the digital display and settings can be programmed easily, even without power supply.

The DATC-CONTROL-10 thermostat is supplied with a Pt100 sensor. This sensor has a 3 m long silicone extension cable giving freedom to locate the electronics remote from the sensor.

Two M25 entries allow for the power cable and heating cable to be connected directly into the unit. The units can be mounted on the pipe using the SB-100 or SB-101 support bracket.

### GENERAL

| | |
|---|---|
| Application | Surface sensing |
| Area of use | Ordinary area (indoors, outdoors)<br>Sensing in zone 1 or zone 2 possible with MONI-PT100-EXE (seperately available) |
| Ambient operating temperature range | –20°C to +40°C |
| Supply voltage (nominal) | 230 V +10% –10%, 50/60 Hz |
| Internal power consumption | ⩽ 14 VA |

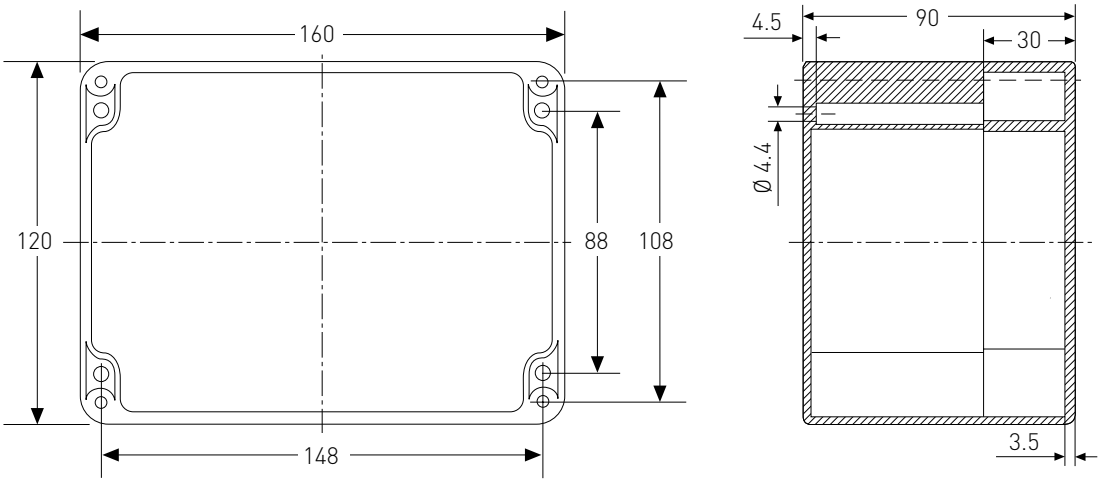
### ENCLOSURE

| | |
|---|---|
| | IP65 |
| Base and lid | Grey polycarbonate base<br>Transparent lid |
| Lid fixing | 4 captive screws |
| Entries | 2 x M25, 1 x M20, 1 x M16<br>Direct entry of heating cable into unit with M25 connection kit |
| Gland plug | 1 x M20 |

### APPROVALS

| | |
|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## DIMENSIONS (IN MM)




## TEMPERATURE SENSOR

| | |
|---|---|
| Type | 3-wire Pt 100 according to IEC Class B |
| Maximum exposure temperature | 200°C |
| Area of use | Ordinary area |

Sensor can be extended with a 3-wire shielded cable of max. 20 Ω per conductor (max. 150 m with a 3 x 1.5 mm² cable).
Sensing in hazardous area zone 1 or zone 2 can be done with MONI-PT100-EXE.
The sensor cable should be shielded if it is laid in cable ducts or in the vicinity of high-voltage carrying cables. The shield of the extension cable should be grounded at the controller end only.

## OUTPUT RELAYS

| | |
|---|---|
| Control relay | Single pole single throw relay, rating: 25 A at 250 Vac |
| Alarm relay | Single pole double throw relay, rating: 2 A at 250 Vac, voltfree |

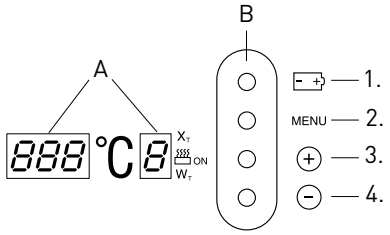
## PROGRAMMABLE PARAMETER SETTINGS

| | |
|---|---|
| Temperature setting | 0°C to +150°C |
| Hysteresis | 1 K to 5 K |
| Low Temperature Alarm | –40°C to +148°C |
| High Temperature Alarm | +2°C to +150°C or switched OFF |
| Heater Operation if Sensor Error | ON or OFF |
| Volt Free Operation | YES or NO |
| Parameters can be programmed without power supply (internal battery) and parameters are stored in non-volatile memory. | |

## DIAGNOSED ALARMS

| | |
|---|---|
| Sensor errors | Sensor short/Sensor open circuit |
| Low temperature | High temperature/Low temperature |
| Voltage errors | Low supply voltage/Output voltage fault |

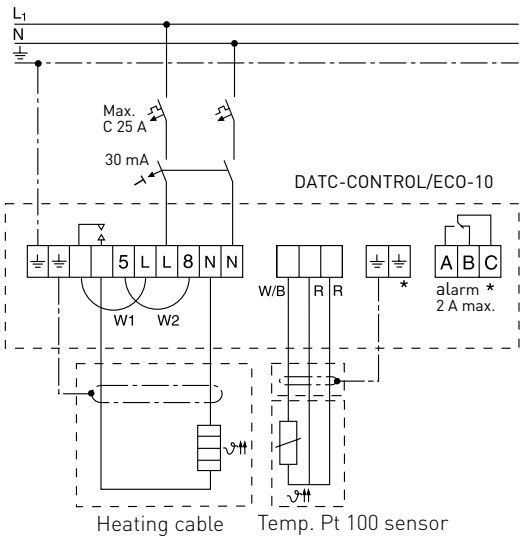
## DISPLAY LAYOUT



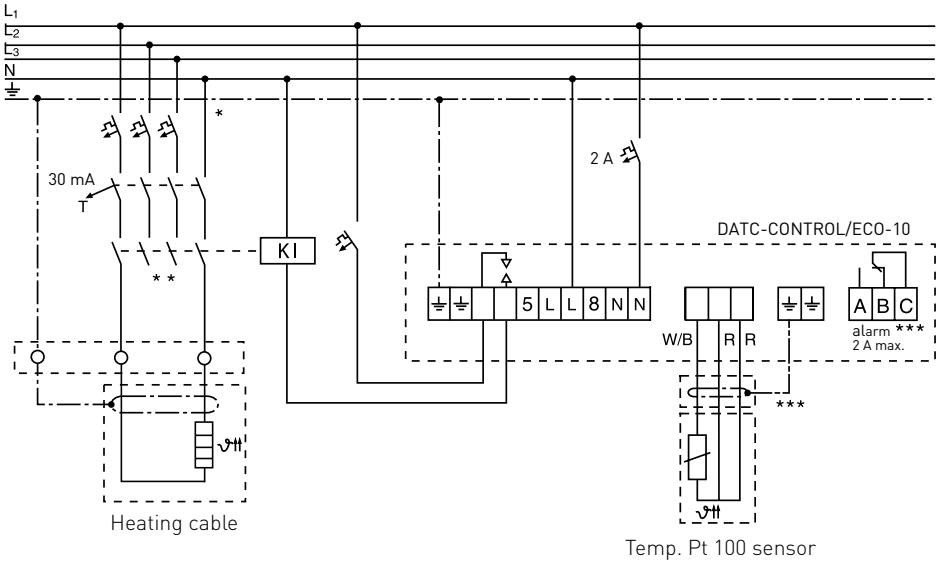

A. LED Display (parameter and error indications)
B. Push buttons
   1. Battery activation
   2. Parameter selection
   3. Increase value
   4. Decrease value

## CONNECTION DETAILS

**Normal operation**




## VOLTAGE FREE OPERATION: REMOVE LINKS W1 AND W2




* Electrical protection by circuit-breaker may be needed for local circumstances, standards and regulations.
** Depending on the application, one- or three-pole circuit-breakers or contactors may be used.
*** Optional

## CONNECTION TERMINALS

| | |
|---|---|
| Supply | 3 terminals for 0.75 mm² to 4 mm² |
| Pt 100 connection | 4 terminals for 0.75 mm² to 2.5 mm² |
| Control relay connection | 3 terminals for 0.75 mm² to 4 mm² |
| Alarm relay connection | 3 terminals for 0.75 mm² to 2.5 mm² |

## MOUNTING METHOD

| | |
|---|---|
| | Surface mounting with 4 fixing holes on 148 x 108 mm centres, M4 clearance |
| Support bracket | SB-100, SB-101 |

## ORDERING DETAILS

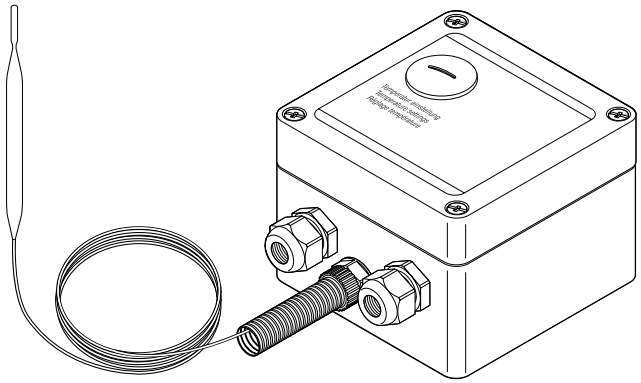
| | |
|---|---|
| Part description | DATC-CONTROL-10 |
| PN (Weight) | 2000-T22 0.8 kg) |

## ACCESSORIES

| | |
|---|---|
| PA Reducer | Reducer M25 (M)/M20 (F) |
| PN | 2000-T23 |

# SANTO DATC-M-10-S/+X+Y

## SURFACE SENSING THERMOSTAT



A surface sensing thermostat providing temperature control in safe areas.

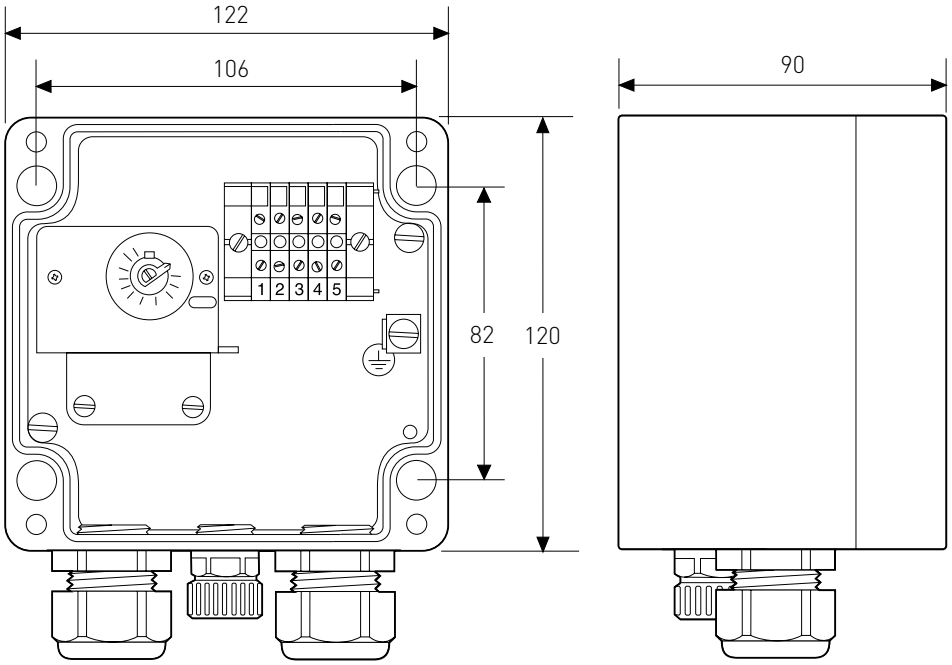
Temperature set point adjustment can be completed, without opening the enclosure, via a removable plug in the lid. The 2 meter long stainless steel capillary is protected at the enclosure by a flexible conduit.

Direct connection of the heating cable is possible.

The thermostat is available in 3 temperature ranges: 0–50°C; 0–200°C; 50–300°C.

| **GENERAL** | **DATC-M-10-S/+0+50C** | **DATC-M-10-S/0+200C** | **DATC-M-10-S/+50+300C** |
|---|---|---|---|
| Area of use | Ordinary area | Ordinary area | Ordinary area |
| **PRODUCT SPECIFICATION** | | | |
| Max rated voltage (nom) | 230 Vac | 230 Vac | 230 Vac |
| Temperature setting | 0°C to +50°C | 0°C to +200°C | +50°C to +300°C |
| Switching type | Single pole change over (SPDT) 100,000 cycles at 16 A | Single pole change over (SPDT) 100,000 cycles at 16 A | Single pole change over (SPDT) 100,000 cycles at 16 A |
| Switching capacity | Max 16 A | Max 16 A | Max 16 A |
| Hysteresis/Differential | 2.5% of temperature range | 2.5% of temperature range | 2.5%of temperature range |
| Accuracy | ±1.5% of setpoint for temperature setting in upper third of range (measured at 22°C) | | |
| Setting | Internal dial, through lid | Internal dial, through lid | Internal dial, through lid |
| Terminal size | 4 $mm^2$ | 4 $mm^2$ | 4 $mm^2$ |
| Ambient operating temp. range | –20°C to +80°C | –20°C to +80°C | –20°C to +80°C |
| **OUTPUT PARAMETERS** | | | |
| Control relay | Change-over switch | Change-over switch | Change-over switch |

## DIMENSIONS (IN MM)




| ENCLOSURE | | DATC-M-10-S/0+50C | DATC-M-10-S/0+200C | DATC-M-10-S/+50+300C |
|---|---|---|---|---|
| Protection | | IP65 | IP65 | IP65 |
| Dimension | | 122 x 120 x 90 mm | 122 x 120 x 90 mm | 122 x 120 x 90 mm |
| Materials body and lid | | Grey, polyester enclosure | | |
| Lid fixing | | 4 captive screws, stainless steel | | |
| Entries | | 2 entries:<br>1 x M25 Reducer M25 (M)/M20 (F) incl. M20 gland (∅ 8-13 mm)<br>1 x M20 gland (∅ 8-13 mm) | | |
| **TEMPERATURE SENSOR** | | | | |
| Type | | Fluid filled capillary, 2 m long | | |
| Dimensions | ∅ | 8 mm | 8 mm | 8 mm |
| | Length sensing element | 166 mm | 78 mm | 56 mm |
| Material | | V4A Stainless Steel | | |
| Exposure temperature | | –40°C to +60°C | –20°C to +230°C | –20°C to +345°C |
| Minimum bending radius | | 10 mm for capillary, the sensor cannot be bent | | |
| **MOUNTING METHOD** | | | | |
| Support bracket | | SB-110 or SB-111 or surface mount | SB-110 or SB-111 or surface mount | SB-110 or SB-111 or surface mount |

## ORDERING DETAILS

| Ordering references | PN Number | Weight |
|---|---|---|
| DATC-M-10-S/0+50C | 2000-T24 | 1 kg |
| DATC-M-10-S/0+200C | 2000-T25 | 1 kg |
| DATC-M-10-S/+50+300C | 2000-T26 | 1 kg |

## MEANING OF REFERENCE: T-M-10-S/+X+Y

T = thermostat

M = mechanical thermostat

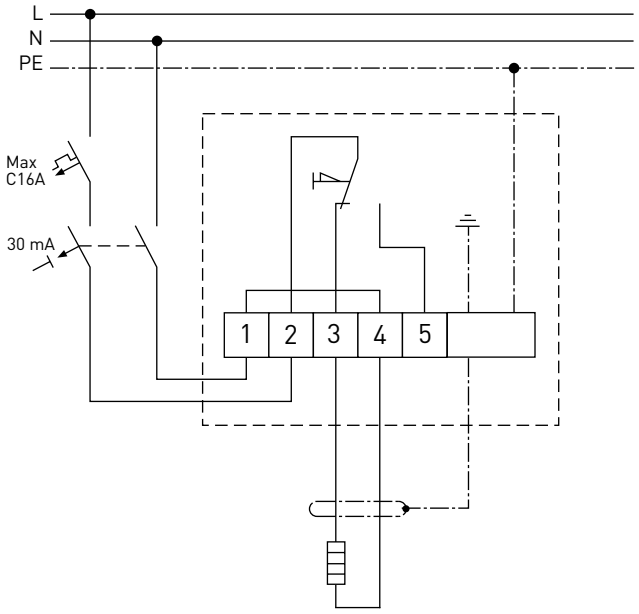
10 = control thermostat

S = surface sensing

x = min temperature of control range

y = max temperature of control range

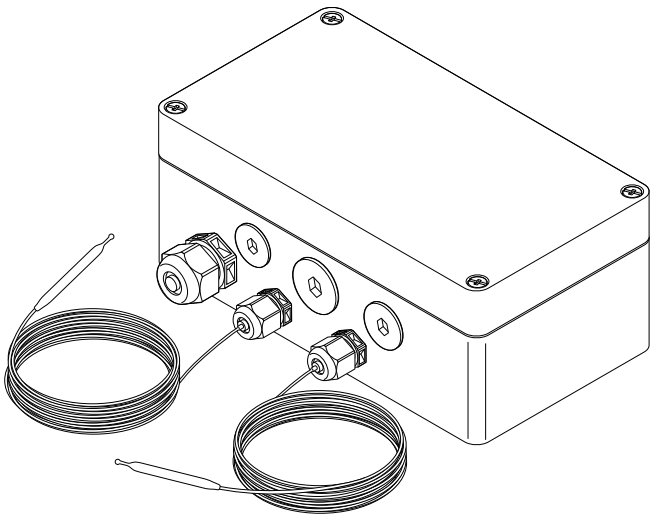
## CONNECTION DETAILS




Heating system

# SANTO DATC-M-20-S/+X+Y/EX

## SURFACE SENSING THERMOSTAT WITH SAFETY LIMITER FOR HAZARDOUS AREA Ex



A surface sensing thermostat providing temperature control and temperature limit in hazardous areas.

The safety limiter prevents the heating system exceeding a preset maximum temperature should the control function fail to operate or an unsafe process temperature occur. The maximum rated voltage is 400 VAC. The switching current capacity is 16 A maximum via independent Ex d single pole change over micro switches with volt-free contacts.

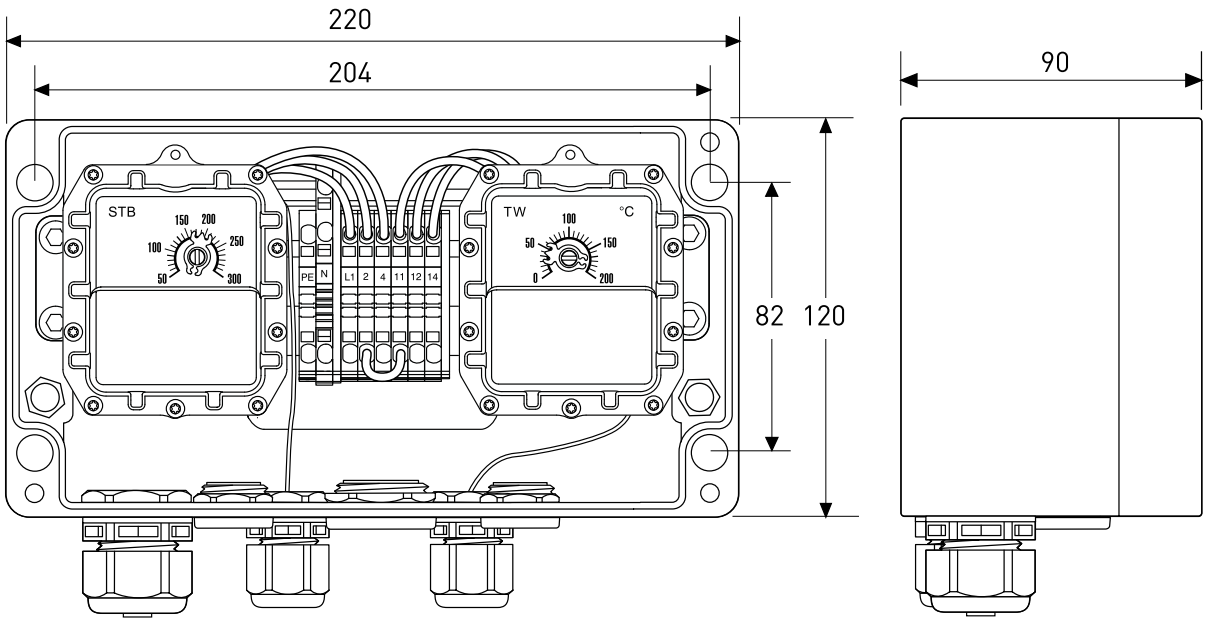
The switches are mounted within an Ex e enclosure together with a spring-type terminal block for fast easy connection. The sensors are 3 meter long stainless steel fluid filled bulb and capillary.

The thermostat is delivered with Ex approved power cable glands and plugs and the entries offer the possibility for a variety of connections such as connecting M25 and M20 glands for direct heating cable entry or alarm output.

The thermostat with limiter is available in 3 temperature ranges: +0°C +120°C, +0°C +200°C and +50°C +300°C

| **GENERAL** | | **DATC-M-20-s/+0+120C/EX** | **DATC-M-20-S/+0+200C/EX** | **DATC-M-20-S/+50+300C/EX** |
|---|---|---|---|---|
| Area of use | | Hazardous area: Zone 1 or Zone 2 (Gas) or Zone 21 or Zone 22 (Dust)<br>Ordinary | | |
| **APPROVAL CERTIFICATION** | | | | |
| | | Ex II 2G Ex d e IIC T4/T5/T6 Gb<br>Ex II 2D Ex tb IIIC T85°C /T100°C/T130°C Db | Ex II 2G Ex d e IIC T4/T5/T6 Gb<br>Ex II 2D Ex tb IIIC T85°C /T100°C/T130°C Db | Ex II 2G Ex d e IIC T4/T5/T6 Gb<br>Ex II 2D Ex tb IIIC T85°C /T100°C/T130°C Db |
| | | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | | |
| **PRODUCT SPECIFICATION** | | | | |
| Temperature setting | Controller | +0°C to +120°C | +0°C to +200°C | +50°C to +300°C |
| | Limiter | +0°C to +120°C | +50°C to +300°C | +50°C to +300°C |
| Switching type | | Single pole change over (SPDT) >100.000 cycles at I nom | Single pole change over (SPDT) >100.000 cycles at I nom | Single pole change over (SPDT) >100.000 cycles at I nom |
| Switching capacity | | Maximum 16A at 400 Vac, resistive load | Maximum 16A at 400 Vac, resistive load | Maximum 16A at 400 Vac, resistive load |
| Hysteresis/ Differential | Controller | max. 2.5% range, calibrated downwards | max. 2.5% range, calibrated downwards | max. 2.5% range, calibrated downwards |
| | Limiter | max 7% calibrated upwards | max. 7.5%, calibrated upwards | max. 7.5%, calibrated upwards |
| Setting | | Inside enclosure | Inside enclosure | Inside enclosure |
| Reset limiter | | Inside enclosure by means of a screwdriver | | |
| Terminal size | | 4 $mm^2$ | 4 $mm^2$ | 4 $mm^2$ |
| Terminal type | | spring-type terminals | spring-type terminals | spring-type terminals |
| Ambient operating temp. range | | –40°C to +70°C | –40°C to +70°C | –40°C to +70°C |

## DIMENSIONS (IN MM)




| OUTPUT PARAMETERS | DATC-M-20-s/+0+120C/EX | DATC-M-20-S/+0+200C/EX | DATC-M-20-S/+50+300C/EX |
|---|---|---|---|
| Control relay | Change-over switch | Change-over switch | Change-over switch |
| Limiter relay | Change-over switch with possibility for external alarm<br>Capillary leakage detection system | | |

| ENCLOSURE | | | |
|---|---|---|---|
| Protection | IP65 | IP65 | IP65 |
| Dimension | 220 x 120 x 90 mm | 220 x 120 x 90 mm | 220 x 120 x 90 mm |
| Materials body and lid | Black, glass filled polyester enclosure | Black, glass filled polyester enclosure | Black, glass filled polyester enclosure |
| Lid fixing | 4 captive screws, stainless steel | 4 captive screws, stainless steel | 4 captive screws, stainless steel |
| Entries | 6 entries:<br>1 x M25 gland (Ø 8-17 mm): power supply<br>1 x M25 stopping plug: output to heating cables<br>2 x M20 stopping plug: output to heating cables (possibility to connect single conductor heating element)<br>2 x M20: capillary sensors | | |

| TEMPERATURE SENSOR | | | | |
|---|---|---|---|---|
| Type | | Fluid filled capillary, 3 m long | Fluid filled capillary, 2 m long | Fluid filled capillary, 2 m long |
| Dimensions | Controller | Ø 6 mm; length sensing element = 90 mm | Ø 6 mm; length sensing element = 72 mm | Ø 4 mm; length sensing element = 135 mm |
| | Limiter | Ø 6 mm; length sensing element = 58 mm | Ø 4 mm; length sensing element = 78 mm | Ø 4 mm; length sensing element = 78 mm |
| Material | | | stainless steel | stainless steel |
| Temperature exposure | Controller | –40°C +138°C | –40°C +230°C | –40°C +345°C |
| | Limiter | –40°C +138°C | –40°C +345°C | –40°C +345°C |
| Minimum bending radius | | 5 mm for capillary (not for sensor) | 5 mm for capillary (not for sensor) | 5 mm for capillary (not for sensor) |

| MOUNTING METHOD | | |
|---|---|---|
| Support bracket | SB-120, SB-125 or surface mounting via 4 fixing holes at 204 x 82 centres | |
| PN | | SB-120 |
| | | SB-125 |

## ORDERING DETAILS

| Ordering references: | PN Number | Weight |
|---|---|---|
| DATC-M-20-S/+0+200C/EX | 2000-T27 | 2 kg |
| DATC-M-20-S/+50+300C/EX | 2000-T28 | 2 kg |
| DATC-M-20-S/+0+120C/EX | 2000-T29 | 2 kg |

## MEANING OF REFERENCE: T-M-20-S/+X+Y/EX

T = thermostat

M = mechanical thermostat

20 = control thermostat + limiter

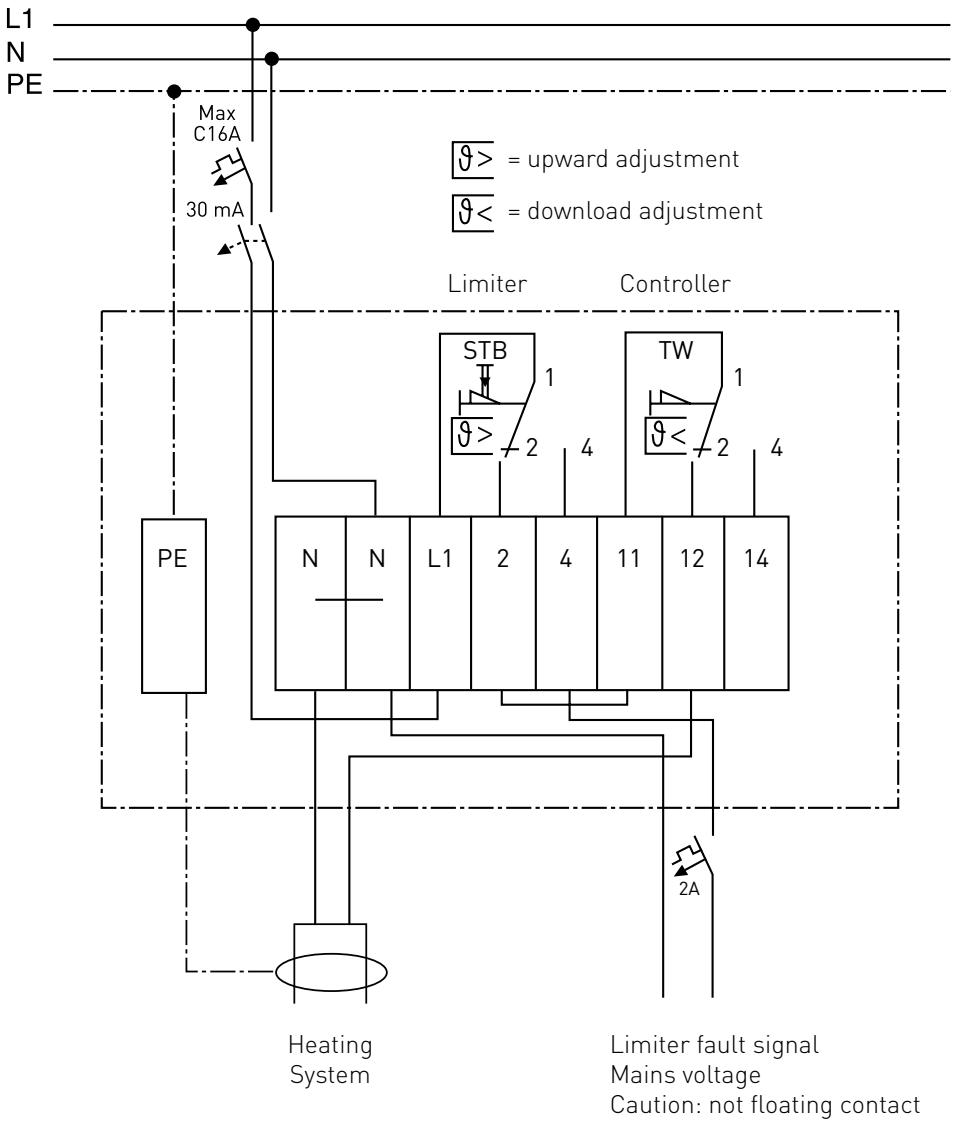
S = surface sensing

x = min temperature of control range

y = max temperature of control range

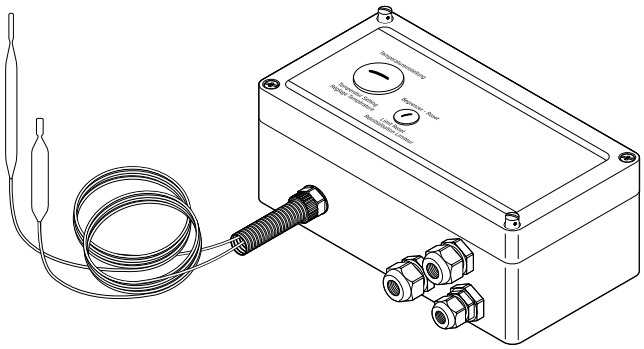
Ex = hazardous area

## CONNECTION DETAILS



# SANTO DATC-M-20-S/+X+Y

## SURFACE SENSING THERMOSTAT WITH LIMITER



A surface sensing thermostat providing temperature control and temperature limiter in safe areas. The high limit cut-out prevents the heating system exceeding a preset maximum temperature should the control function fail to operate or an unsafe process temperature occur.

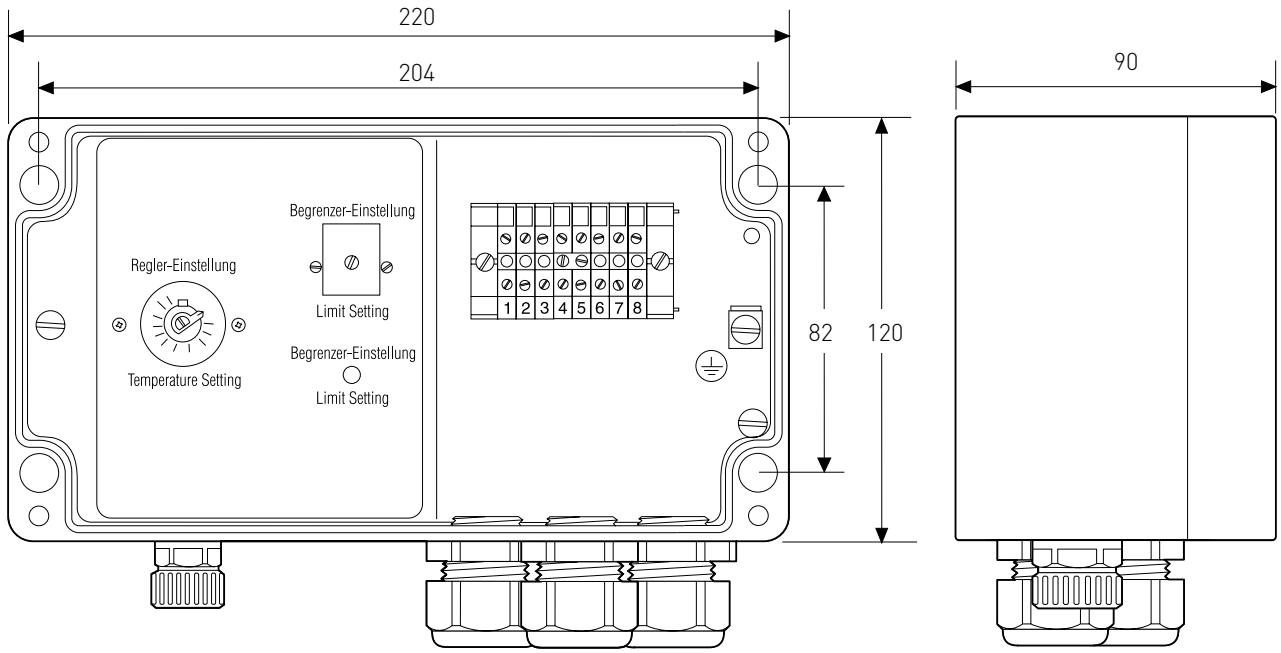
Temperature set point adjustment and limiter reset can be completed, without opening the enclosure, via removable plugs in the lid.

Both 2 meter long stainless steel fluid filled bulb and capillary are protected at the enclosure by a flexible conduit.

Direct connection of the heating cable is possible.
The thermostat is available in 3 temperature ranges.
0–50°C; 0–200°C; 50–300°C.

| **GENERAL** | | **DATC-M-20-S/0+50C** | **DATC-M-20-S/0+200C** | **DATC-M-20-S/+50+300C** |
|---|---|---|---|---|
| Area of use | | Ordinary area | Ordinary area | Ordinary area |
| **PRODUCT SPECIFICATION** | | | | |
| Max rated voltage (nom) | | 230 Vac | 230 Vac | 230 Vac |
| Temperature setting | Controller | 0°C to +50°C | 0°C to +200°C | +50°C to +300°C |
| | Limiter | +20°C to +150°C | +130°C to +200°C | +20°C to +400°C |
| Switching type | | Single pole change over (SPDT)<br>100,000 cycles at 16 A (controller)<br>500 cycles at 10 A (limiter) | | |
| Switching capacity | Controller | Max 16 A at 230 Vac | Max 16 A at 230 Vac | Max 16 A at 230 Vac |
| | Limiter | Max 10 A at 230 Vac | Max 10 A at 230 Vac | Max 10 A at 230 Vac |
| Breaking capacity | Controller | 3700 VA | 3700 VA | 3700 VA |
| | Limiter | 2300 VA | 2300 VA | 2300 VA |
| Hysteresis/Differential | | 2.5% of temperature range | 2.5% of temperature range | 2.5% of temperature range |
| Accuracy | | ±0.5% of setpoint in upper third of temperature range (at 22°C ambient) | | |
| Setting | | Internal dial, through lid | Internal dial, through lid | Internal dial, through lid |
| Terminal size | | 4 $mm^2$ | 4 $mm^2$ | 4 $mm^2$ |
| Ambient operating temp. range | | –20°C to +80°C | –20°C to +80°C | –20°C to +80°C |

## DIMENSIONS (IN MM)




| OUTPUT PARAMETERS | DATC-M-20-S/0+50C | DATC-M-20-S/0+200C | DATC-M-20-S/+50+300C |
|---|---|---|---|
| Control relay | Change-over switch (SPDT) | | |
| Limiter relay | Change-over switch with possibility for external alarm (SPDT) | | |

| ENCLOSURE | | | |
|---|---|---|---|
| Protection | IP65 | IP65 | IP65 |
| Dimension | 222 x 120 x 90 mm | 222 x 120 x 90 mm | 222 x 120 x 90 mm |
| Materials body and lid | Grey,<br>polyester enclosure | Grey,<br>polyester enclosure | Grey,<br>polyester enclosure |
| Lid fixing | 4 captive screws,<br>stainless steel | | |
| Entries | 3 entries:<br>1 x M25 Reducer M25 (M)/M20 (F) incl. M20 gland (Ø 8–13 mm)<br>1 x M20 gland (Ø 8–13 mm)<br>1 x M20 gland (Ø 8–13 mm) | | |

| TEMPERATURE SENSOR | | | | |
|---|---|---|---|---|
| Type | | Fluid filled capillary, 2 meter long | | |
| **Dimensions** | | | | |
| Controller | Ø | 8 mm | 8 mm | 8 mm |
| | Length sensing element | 166 mm | 78 mm | 56 mm |
| Limiter | Ø | 6 mm | 6 mm | 6 mm |
| | Length sensing element | 80 mm | 78 mm | 176 mm |
| Material | | V4A Stainless Steel | V4A Stainless Steel | V4A Stainless Steel |
| Exposure temperature | Controller | –40°C to +60°C | –20°C to +230°C | –20°C to +345°C |
| | Limiter | –40°C to +170°C | –20°C to +230°C | –40°C to +500°C |
| Minimum bending radius | | 10 mm for capillary, the sensor cannot be bent | | |

| MOUNTING METHOD | |
|---|---|
| Support bracket | SB-120 or surface mount |

## ORDERING DETAILS

| Ordering references | PN Number | Weight |
|---|---|---|
| T-M-20-S/0+50C | 2000-T30 | 1.9 kg |
| T-M-20-S/0+200C | 2000-T31 | 1.9 kg |
| T-M-20-S/+50+300C | 2000-T32 | 1.9 kg |

## MEANING OF REFERENCE: T-M-20-S/+X+Y

T= thermostat

M= mechanical thermostat

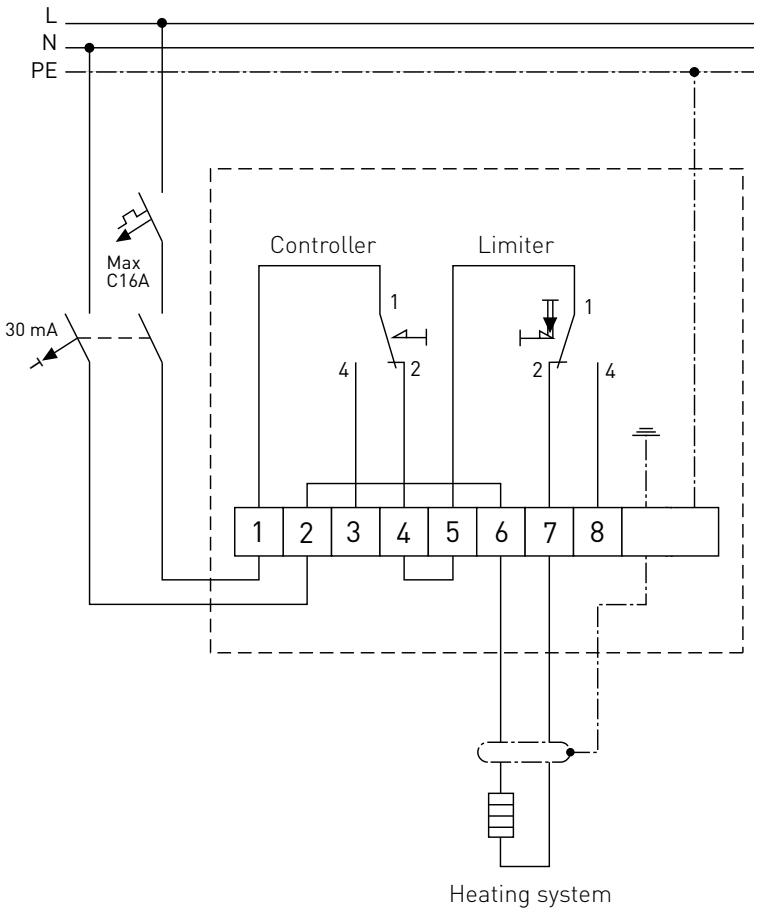
20= control thermostat + limiter

S= surface sensing

x= min temperature of control range

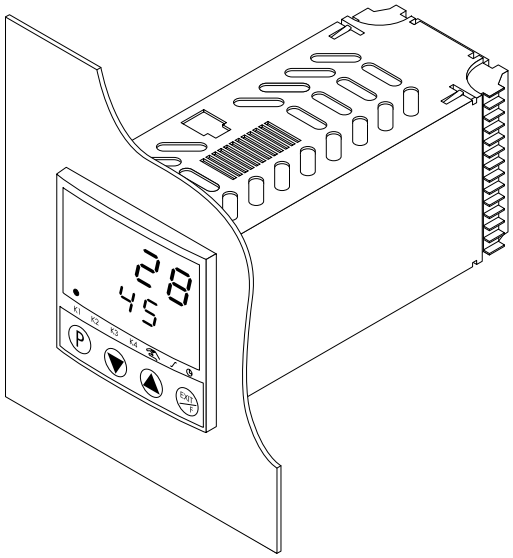
y= max temperature of control range

## CONNECTION DETAILS



# SANTO DATC-CONT-03

## SINGLE-CIRCUIT ELECTRONIC CONTROLLER WITH DUAL DISPLAY



The Santo DATC-CONT-03 family of electronic controllers provide accurate temperature control and centralized monitoring for individual heat-tracing circuits.

The compact panel mount DATC-CONT-03 has two displays for indicating the process value and the set point. During programming these displays provide user guidance and visual aid to simplify commissioning.

Alternatively, the optional and easy to use Santo DATC-CONT-03/CONFIG software can be used for computer aided configuration.

Santo DATC-CONT-03 units are factory configured for ON/OFF control and are suitable for most heat-tracing applications. Other types of control algorithms can be configured by the user.

Different hardware configurations are available: Units with a relay output for controlling electro-mechanical relays or solid state relays and DATC-CONT-03/MA units with an analog output for driving other types of actuators like thyristors. The health of the temperature input sensor is permanently monitored for failures. An alarm will appear in the event of sensor break or short circuit. In the event of a sensor failure the control output switches to a user defined state (ON or OFF)

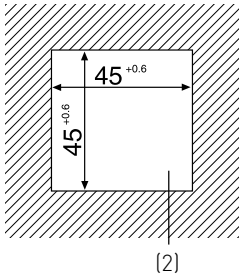
### SPECIFIC FEATURES:

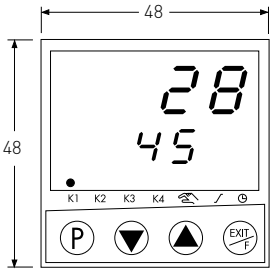
- Time delayed controller activation after initial power up (this can be used to avoid peak demands during start-up)
- Service counter included in order to count and eventually alarm on the number of relay operations.

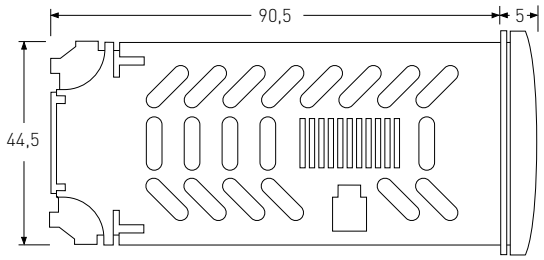
### GENERAL

| | | |
|---|---|---|
| Application | Santo DATC-CONT-03 units are panel mount controllers and are typically used for providing tight temperature control of individual heat-tracing circuits. | |
| Area of use | Non hazardous area indoors (panel mount – through the panel) | |
| Approvals/Certification | Electrical Safety to DIN EN 61010-1 over voltage category III, pollution degree 2<br>EMC DIN EN 61326, Class B to industrial requirements. | |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |
| Memory data backup | EEPROM based non-volatile memory.<br>No loss of configuration data after power outage or long term shut down. | |
| Display | 2 piece of 7-segment LED display with status indication LED´s (yellow/green) | |
| Supported control modes | ON/OFF, P, PI, PD or PID with auto-tuning are user selectable | |
| Measuring accuracy | Pt100 3-wire | error ⩽ 0.1%, |
| | Pt100 2-wire | error ⩽ 0.4% |
| | Thermocouples (incl. cold junction) | error ⩽ 0.25% |
| | Voltage and current inputs | error ⩽ 0.1% |

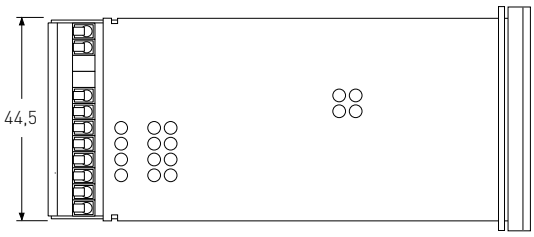
## DIMENSIONS (IN MM)




| Minimum spacing in between panel cut-outs | | Horizontal spacing | Vertical spacing |
|---|---|---|---|
| DATC-CONT-03 (all types) | Without Space for configuration connector | > 8 mm | > 8 mm |
| | With Space for configuration connector | > 8 mm | > 65 mm |




(1) Connector for optional programming interface
(2) Panel cut-out

## ELECTRICAL PROPERTIES

| | |
|---|---|
| Supply Voltage & own power consumption | 110 Vac to 240 Vac –15/+10%, 48 to 63 Hz & ~15 VA |
| Electrical connections | Via screw terminals on the back of the unit. Terminals are suitable for wires ranging from 1 to maximum 1.3 $mm^2$ solid core or 1 $mm^2$ stranded with cable shoe. Terminal strips are pluggable. |
| Supported output types (depending on model) | DATC-TCONT-03: 3 relay outputs (SPST) + 1 logic output<br>DATC-CONT-03/MA: 2 relay outputs (SPST) + analog output<br>DATC-CONT-03/COM: 3 relay outputs (SPST) + 1 logic output + RS485<br>DATC-CONT-03/COMA: 2 relay outputs (SPST) + analog output + RS485 |

## INPUT OPTIONS (ALL TYPES)

| | |
|---|---|
| Temperature sensor inputs | Pt 100, Pt 1000 RTD´s in 2- and 3 wire connection, KTY11-6 sensors<br>Thermocouple types: L, J, U, T, K, E, N, S |
| Electrical input signals | 0/4 .. 20 mA or 0/2 .. 10 V (Ri = 100 Kohm) |
| Temperature control range | From –200 to + 2400°C depending on the type of temperature sensor used |

## OUTPUT OPTIONS AND OUTPUT RATINGS (DEPENDING ON TYPE)

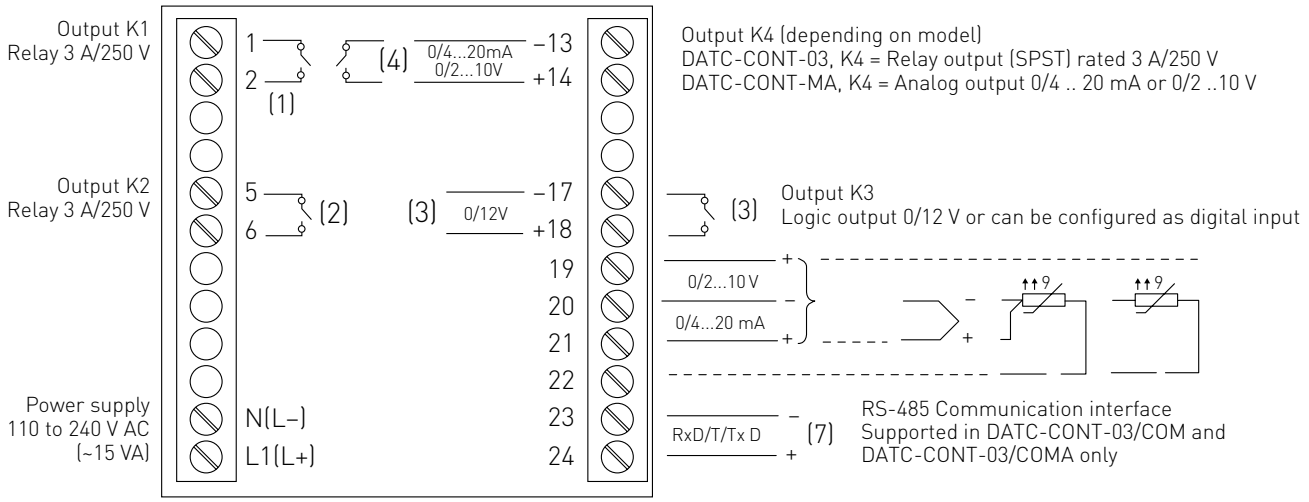
| | |
|---|---|
| TCONTROL-CONT-03<br>TCONTROL-CONT-03/COM | Control and alarm relay contacts (SPST) are rated 3 A at 230 VAC.<br>Expected lifetime: 350k operations at rated current or ~900K operations at 1 A<br>Logic output 0 .. 12 V. Maximum current 20 mA |
| TCONTROL-CONT-03/MA<br>TCONTROL-CONT-03/COMA | Control output, analog: 0/4 .. 20 mA Rload ⩾ 500 Ohm<br>Logic output 0 .. 12 V, maximum current 20 mA<br>Alarm relay contacts (SPST) are rated 3 A at 230 VAC.<br>Expected lifetime: 350k operations at rated current. 900k operations at 1 A |
| Communication options (*) | RS-485, Modbus at 9600, 19200 or 38400 BPS. Maximum up to 32 devices per network. (*) |
| Alarm options | 2 independently configurable alarm relay outputs are provided. DATC-CONT-03 units automatically alarm in case of sensor break or sensor short.<br>On top of the input sensor driven alarms up to 8 different temperature triggered alarm functions can be defined. (see installation instructions for details) |

## ENCLOSURE

| | |
|---|---|
| Housing type | Plastic enclosure approved to IEC 61554 (ABS) Suitable for installation in electrical distribution panels |
| Environmental protection | Front IP65, rear IP20 to DIN EN60529 |
| Max. operating temperature | –5 to +55°C |
| Max. storage temperature | –40 to +70°C |
| Relative humidity | 90% maximum, no condensation |
| Installation position | All positions allowed. |

(*) supported on DATC-CONT-03/COMx units onl

## CONNECTION DIAGRAM




## WIRING EXAMPLE

| Ordering details | Part description | Product Number | Weight |
|---|---|---|---|
| Control units | DATC-TCONT-03 | 2000-JT1 | ~ 0.125 kg |
| | DATC-CONT-03/MA | 2000-JT2 | |
| | DATC-CONT-03/COM | 2000-JT3 | |
| | DATC-CONT-03/COMA | 2000-JT4 | |

## ACCESSORY SELECTION TABLE

| | | | |
|---|---|---|---|
| Configuration and setup interface + software | DATC-CONT-03/CONFIG | 2000-JT5 | ~ 0.120 kg |

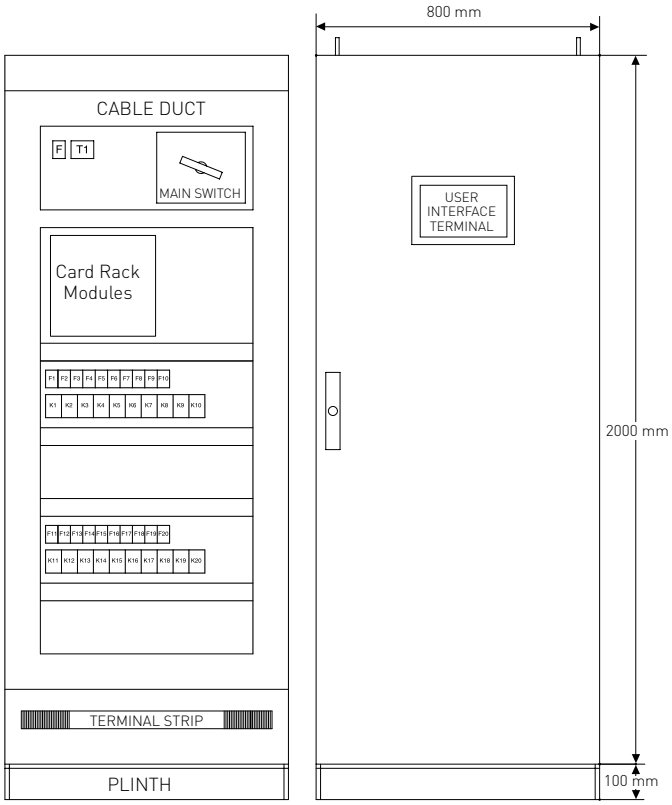
## ACCESSORY SELECTION TABLE

| | |
|---|---|
| Sensors for hazardous area | MONI-PT100-EXE (1), (2) |
| | MONI-PT100-4/20MA |
| Sensor for non-hazardous area | MONI-PT100-NH |
| Support bracket for temperature sensors | MF-SB-26 |

Note 1: Sensor can be extended with a 3-wire shielded cable of max 30 Ohms per conductor (max. 150 m with a 1.5 $mm^2$ cable).
The sensor cable should be shielded if it is laid in cable ducts or in the vicinity of high-voltage carrying cables.
The shield of the extension cable should be grounded at the controller end only.
Note 2: MONI-PT100-EXE temperature sensors can be directly connected to the DATC-CONT-03 input terminals.
There is no need to use current limiting devices such as zener barriers or isolators.
Note 3: Installed in ordinary area.

# DATC-30

## PANEL MOUNTED ELECTRONIC MULTI-CIRCUIT HEAT-TRACING CONTROL, MONITORING AND POWER DISTRIBUTION SYSTEM




### PRODUCT OVERVIEW

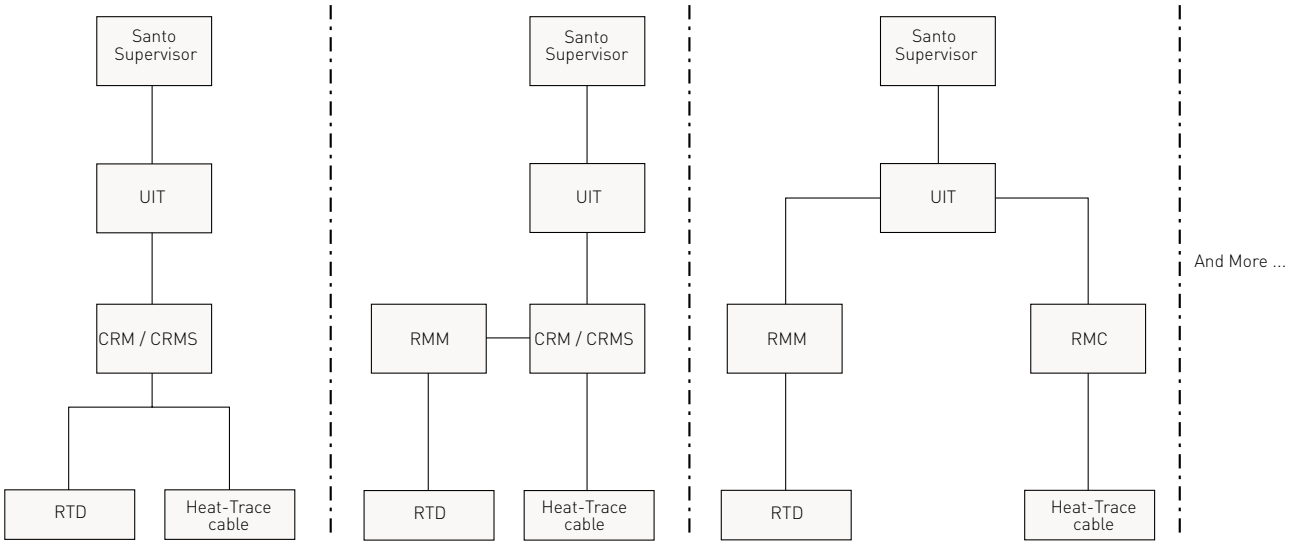
The Santo DATC-30 is a multi circuit electronic control, monitoring and power distribution system for heat-tracing used in process temperature maintenance and freeze protection applications. The system consists of multiple components covering a broad range of requirements from simple temperature monitoring to ground fault, voltage and current measurement, bringing valuable information about the status and health of the heat-tracing circuits from the field into a central location. The Santo DATC-30 system can minimise routine checks by transforming field data into valuable information for maintenance and operations.

### SANTO DATC-30 PANEL

The DATC-30 is available as a complete distribution panel system. Typical characteristics for these panels are easy access, pre-wired and all wiring landed on easy accessible terminals. The enclosure is based on industrial standards while the wiring is optimised for maintenance purposes. The panels are equipped with earth leakage circuit breakers and a main circuit breaker. In addition to these standard features the customer can select additional options based upon the heat-tracing monitoring and control requirements. For example the options include types of contactors (solid state or mechanical), number of circuits plus spare required, voltage monitoring, alarm light indications, panel size, cable entry location and other parameters. A Santo DATC-30 panel system can consist of multiple cabinets which are interlinked via a dedicated communication link. In general the master panel contains the User Interface Terminal (UIT), typically built into the door.

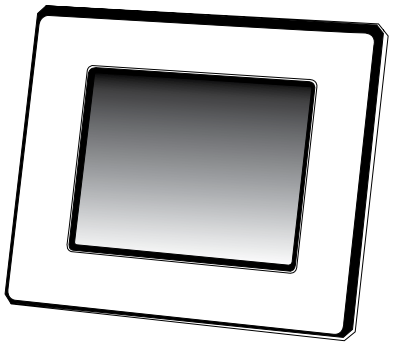
### SANTO DATC-30 COMPONENTS

Customers who wish to integrate the Santo DATC-30 system into their own control panels can obtain the individual components separately. The Santo DATC-30 system is configurable in different ways depending upon the requirements of the customer. The user interface for the Santo DATC-30 is the User Interface Terminal (UIT). As soon as ground-fault measurement, line current measurements or distributed control requirements become important, the components Card Rack (CR), Card Rack Modules for mechanical relays (CRM) and/or solid state relays (CRMS), Current Transformer Modules (CTM) and Voltage Module (CVM) should be chosen. Users who want to build on the known and proven technology used in the MoniTrace 200N-E can continue using the fully compatible components; Remote Monitoring Modules (RMM) and Remote Modules for Control (RMC).
The powerful Santo Supervisor (DTS) heat-tracing controller configuration and monitoring PC-software package completes the system. The Client - Server application enables the user to access all information from anywhere in the world, making Santo Supervisor a strong management tool for the entire Heat Management System.



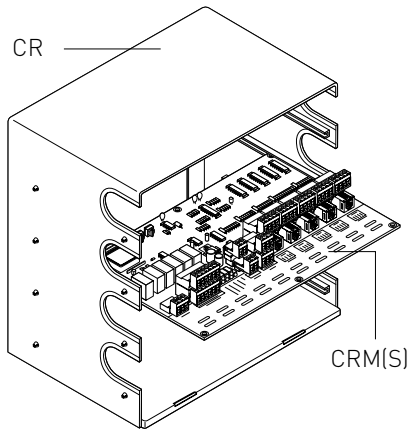

Examples of various Santo DATC-30 configurations
The following section gives an overview of the different components used in the Santo DATC-30 system.

## SANTO USER INTERFACE TERMINAL (UIT)



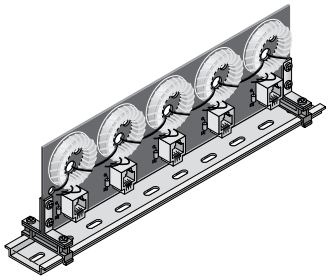
The Santo User Interface Terminal (UIT) is the central part of the Santo DATC-30 communication. The UIT can be used as well with the Santo DATC-20 (for more information see the Santo DATC-20 datasheet). It covers heat-tracing monitoring, configuration and maintenance purposes. The Santo User Interface Terminal (UIT) consists of a 8.4" LCD colour display using touch screen technology. This provides an easy user interface for programming without the need for keyboards or cryptic labels. The Santo UIT communicates via RS-485 to the field and via RS-232/RS-485/Ethernet (selectable) to the Santo Supervisory Software package as well as the plant process control system. The user interface terminal is available in two different models; the Santo DATC-UIT2-ORD, ideal for indoor applications, is for direct mounting on the Santo DATC-30 panel door. The Remote User Interface Terminal (DATC-UIT2-ORD-R) is a panel mounted display (DATC-UIT2-EX) for use with the Santo DATC-30 panel that allows for the user interface to be mounted remotely.
For detailed description see installation instruction DATC-UIT2-EX: INSTALL-168.

## CARD RACK MODULE (CRM/CRMS)



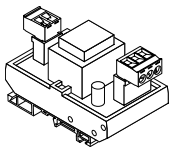

The Santo Card Rack Module controls up to 5 heat-tracing circuits. The Card Rack Modules are available in two versions, the Santo DATC-30 CRM (for mechanical relays) and the Santo DATC-30 CRMS (for solid state relays). Up to four of these Card Rack Modules can be installed in a panel mounted Card Rack. RTD's are either directly connected to the Santo CRM(S) or alternatively collected via RMM's locally or centralized in the field (distributed architecture). The CRM/CRMS solution can control up to 260 individual heat-tracing circuits and monitor up to 388 temperature inputs (including 128 temperature inputs via RMMs).

## CURRENT TRANSFORMER (CTM)



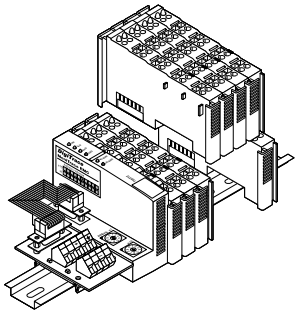
Santo Current Transformers are an important part of the Santo DATC-30 system. Santo CRM in combination with current transformers offer the capability of monitoring and alarming on ground-fault and operating currents. Circuits can be tripped by the controller on high ground-fault currents.

## VOLTAGE MODULE (CVM)



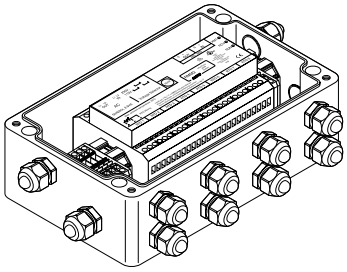
Santo Voltage modules (CVM), used in combination with a Santo CRM(S) offer the option to monitor the voltage in the panel. The Santo CVM module uses one channel on one Santo CRM board in a panel.

## REMOTE MODULES FOR CONTROL (RMC)



The Santo DATC-30 system also includes integrated control functionality. Multiple relay outputs to operate contactors of each heat-tracing circuit will be provided by Remote Modules for Control (RMC). Temperature inputs will be provided by Remote Monitoring Modules (RMM) while the control is executed by the UIT.
Santo RMC units are modular and may be configured with 2 to 40 relay outputs. Each RMC unit also includes two digital inputs (DI) to monitor the status of circuit breakers or power contactors. A single UIT control unit can communicate with up to 10 RMC modules via a single, twisted pair RS-485 cable to provide distributed control of up to 250 heating cable circuits with a maximum of 128 temperature inputs (see Santo RMM below). For more information refer to the datasheet of Santo MONI-RMC. Circuits controlled via RMCs, can't be combined with the current transformers (CTM).
The Santo DATC-30 system also supports building mixed systems of relay outputs via CRM(S) and RMCs, individual circuits can therefore be configured in the most appropriate way.

## REMOTE MONITORING MODULES (RMM)



Remote Monitoring Modules (RMM) provide temperature monitoring capability for the Santo DATC-30 system.
The RMM accepts inputs up to eight Pt 100 temperature sensors that measure pipe or ambient temperatures in a heat-tracing system. Up to 16 RMMs for a total monitoring capacity of 128 temperatures can be connected to the DATC-30 system. There are two versions available. The RMM2-E is without an enclosure. The RMM2-EX-E is build into a Hazardous approved enclosure. For more details see the RMM2-E/RMM2-EX-E datasheet in Technical Databook.

## SANTO SUPERVISORY SOFTWARE

The Santo DATC-30 system integrates seamless with the Santo Supervisor (DTS) heat-tracing controller configuration and monitoring software. It provides a graphical user interface for Santo communication and heat-tracing controller products. The software supports the latest Santo control systems via protocol. Santo Supervisor is a powerful client-server software package that gives the possibility to configure and monitor controllers from almost anywhere in the world, using the latest connectivity technologies. In addition to this functionality Santo Supervisor includes the following functions:

- Logging & trending,
- Configuration of alarms
- Batch & recipe processing,
- Scheduled events,
- Group displays for monitoring multiple controllers at the same time
- Virtual Private Network (VPN) functionality for monitoring possibility on global basis
- Plant Reference Model for structuring controller on a logical way
- Support of plant documentation reports like plant group, location, line/equipment number, breaker panel, controller panel, user and roles are included.

For more detailed information see Santo Supervisor datasheet.

## COMPATIBILITY WITH MONITRACE 200N-E

The Santo DATC-30 is an upgrade of Santo very successful DATC-200N-E system. It provides a state-of-the-art user interface and an opportunity for existing 200N-E installations to benefit from the new features of the Santo Supervisor software.
Using the new Santo DATC-30 UIT2, circuits in existing installations can now be upgraded to include monitoring functionality of ground fault and operating current and many other features as described in this document.

### Technical Details

## APPLICATION

| | |
|---|---|
| Type | Surface Sensing/Ambient Sensing/PASC (Proportional Ambient Sensing Control) |
| Area of use | Non-hazardous area indoors or outdoors typically panel mounted |

## APPROVAL CERTIFICATION

| | |
|---|---|
| NGC-UIT2-EX | CE All components for ordinary areas. |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

## ELECTROMAGNETIC COMPATIBILITY

| | |
|---|---|
| Immunity | All components tested for heavy industrial environments |
| Emissions | All components tested for residential/commercial/light industrial environments |
| Vibration | Santo DATC-30 UIT: meets requirements of IEC-60068-2-6 |
| Shock | Santo DATC-30 UIT: meets requirements of IEC-60068-2-27 |

## ENCLOSURE

| | |
|---|---|
| Protection | UIT: IP 65 (NEMA 4) when mounted in a panel door. |
| Ambient operating temperature range | UIT: –30°C to 60°C<br>CRM(S): –40°C to 60°C, storage temp –40°C to 75°C |

## ELECTRICAL PROPERTIES

| | |
|---|---|
| Connection terminals | UIT and CRM both are equipped with 2.5 mm² Phoenix style connectors with retaining screws. |
| Power supply | The DATC-UIT2-EX requires supply voltage of 9-30 V DC, 3.6-1.2 A.<br>The CRM's powered by 12 V DC @ 400 mA per board.<br>For more information about RMC and RMM see datasheets of individual components |
| Power consumption | UIT: 36 W max, CRM/CRMS: 5 W max. |
| Power output | CRM and CTM are calibrated for a maximum load of 60 A |
| Control output | Wired directly to contactor or SSR<br>CRM: SPST 3 A @ 277 V AC max 50/60 Hz<br>CRMS: 12 V DC @ 30 mA max per output |

**Communications**

## HARDWARE (UIT)

| | |
|---|---|
| Local port/ remote port;<br>Communication port 1 UIT | Isolated RS232/RS-485, selectable. Ports may be used to communicate with (Santo Supervisor Software) or DCS.<br>The local RS-232 is a non-isolated, 9 pin D sub male;<br>Remote RS-485 #2 is 2-wire isolated, 9 pin D sub male;<br>Data rate is 9600 to 57600 baud;<br>Maximum cable length for RS-485 not to exceed 1200 m (4000 ft).<br>Cable to be shielded twisted pair.<br>Max number of devices 247, Fail safe design with optional termination resistors<br>Max length 1200 m, Data rate to 9600 baud. |
| Field port; communication port 2 UIT | RS485, used to communicate with external devices like RMM, RMC and DATC-30. typical max. cable length 1200 m, cable to be shielded twisted pair.<br>Fail safe design with optional termination resistors |
| LAN UIT | 10/100 Base-T Ethernet port with link and activity status LEDs. Protocol Modbus via TCP/IP; can be used to communicate to Santo Supervisor |
| USB Port UIT | USB 3.0 Host port type A receptable |

## COMMUNICATIONS

| | | |
|---|---|---|
| Temperature (UIT) | | |
| | Low alarm range | –73°C to 482°C or off |
| | High Alarm range | –73°C to 482°C or off |
| Ground fault monitoring (UIT, CRM, CT) | | |
| | Alarm range | 10 mA to 200 mA |
| | Trip range | 10 mA to 200 mA or off |
| Operating current (UIT, CRM, CT) | | |
| | Low alarm range | 1 A to 60 A or off |
| | High alarm range | 1 A to 60 A or off |
| Voltage (CRM, CVM; optional) | Displays supply voltage to heat-tracing<br>(Note: requires one operating current input) | |
| Autocycle | Each loop can be programmed from 1 to 1000 or off | |
| Temperature sensor inputs | One input standard per control point on CRM, optional temperature inputs via max. 16 RMMs (8 RTDs per RMM) | |

## COMMUNICATIONS

| | |
|---|---|
| Control modes | EMR: line sensing on/off, ambient on/off,<br>PASC (proportional ambient sensing control) |
| | SSR: line sensing on/off, ambient on/off,<br>PASC (proportional ambient sensing control),<br>Proportional (includes soft start for all SSR control modes) |
| Units | °C or °F |
| Deadband | 1°C to 10°C |

## ALARM OUTPUTS

| | |
|---|---|
| | UIT: 3 (3 open collector outputs, to be combined with external relays) |

## CONTROL OUTPUTS

| | |
|---|---|
| Number of output relays | CRM: 3-pole mechanical<br>CRMS: 1, 2 or 3 pole solid state, normally open (NO) |
| Current maximum, used in combination with CRM(S) and CTM | SSR: 60 A at 40°C<br>EMR: 60 A at 40°C |

## NETWORK CONNECTION

| | |
|---|---|
| Number of RMM's | Up to 16, individually addressable, each with up to 8, 3 wire Pt 100 inputs |
| Number of CRM/CTM's | Up to 52 DATC-30-CRM may be connected to one DATC-30-UIT in combination with repeaters. 1 CRM has 5 circuits. In total 260 circuits per DATC-30 system. |

## DISPLAY

| | |
|---|---|
| Type | LCD is a XGA, colour TFT transflective device with integral LED backlight |
| Screen size | 175 mm x 132 mm |
| Touchscreen | 5-wire resistive touch screen interface for user entry, usable with gloved fingers |

## PROGRAMMING AND SETTINGS

| | |
|---|---|
| Method | Via touch screen or Santo Supervisor 2.1 or higher |
| Language(s) | English, Russian, French, German, Spanish, Czech, Chinese |
| Memory | Non-volatile, restores after power loss |

## ORDERING DATC-30 CONTROL SYSTEM

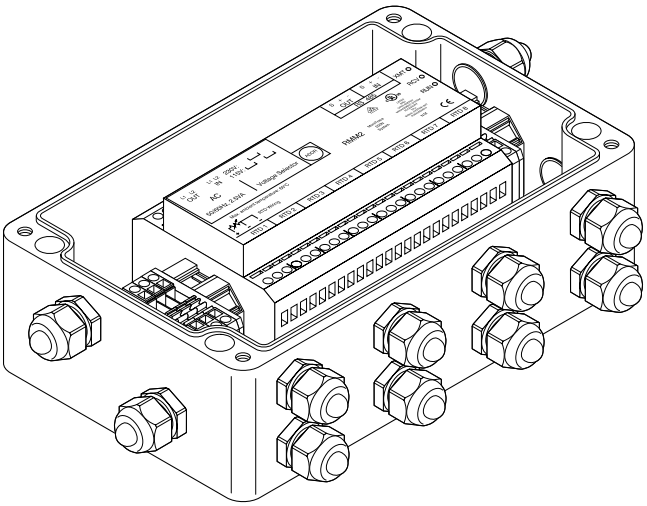
The DATC-30 is offered as a complete solution, where the control system is already integrated into fully engineered control and power distribution panels. Using standard industrial enclosures, specific care has been taken to design the systems to highest safety standards by enabling optimum access for easy maintenance, as well a clear layout of the functional blocks and terminals. Customers desiring to build their own systems, can use the individual components of the Santo DATC-30 and integrate them into their own power distribution panels. Below both options are described how to order the DATC-30 system.

## ORDERING DETAILS INDIVIDUAL COMPONENTS

| Product name | Description | Part Number (Weight) |
|---|---|---|
| DATC-UIT2-EX | User Interface Terminal | 2000-U001 (1.78 kg) |
| DATC-UIT2-ORD-R | User Interface Terminal with enclosure | 2000-U002 (8.86 kg) |
| DATC-30-CRM-E | Card Rack Module (EMR) | 2000-U003 (0.68 kg) |
| DATC-30-CRMS-E | Card Rack Module (SSR) | 2000-U004 (0.50 kg) |
| DATC-30-CTM-E | Current Transformer Module | 2000-U005 ( 0.36 kg) |
| DATC-30-CVM-E | Voltage Monitoring Module (CVM) | 2000-U006 (0.20 kg) |
| DATC-30-CR-E PS12 | Card Rack | 2000-U007 (3.66 kg) |
| | Transformer 12 V DC | 2000-U008 (0.18 kg) |

# SANTO MONI-RMM2-E

## HEAT-TRACING REMOTE MONITORING MODULE



The Remote Monitoring Modules (RMM2) provide temperature monitoring capability for Santo DATC controller family. The RMM2 accepts inputs from up to eight Pt 100 temperature sensors that measure pipe or ambient temperatures in a heat-tracing system. Multiple RMM2 units communicate with a single Santo DATC User Interface Terminal (Santo DATC-UIT) providing centralised monitoring of temperatures.

A single, twisted pair RS-485 cable connects up to 16 RMMs for a total monitoring capacity of 128 temperatures per Santo DATC controller network.

### CONTROL AND MONITORING

A Santo DATC network controls up to 260 circuits of heat-tracing per system based on ambient or pipe temperatures. The RMM2 may be used to collect both ambient and pipe temperatures for control or for extensive monitoring of the heat-tracing system. The RMM2 units are placed near desired monitoring locations, even in hazardous areas (Zone 2). Multiple temperature sensor inputs are networked over a single cable, significantly reducing installation cost for temperature monitoring.

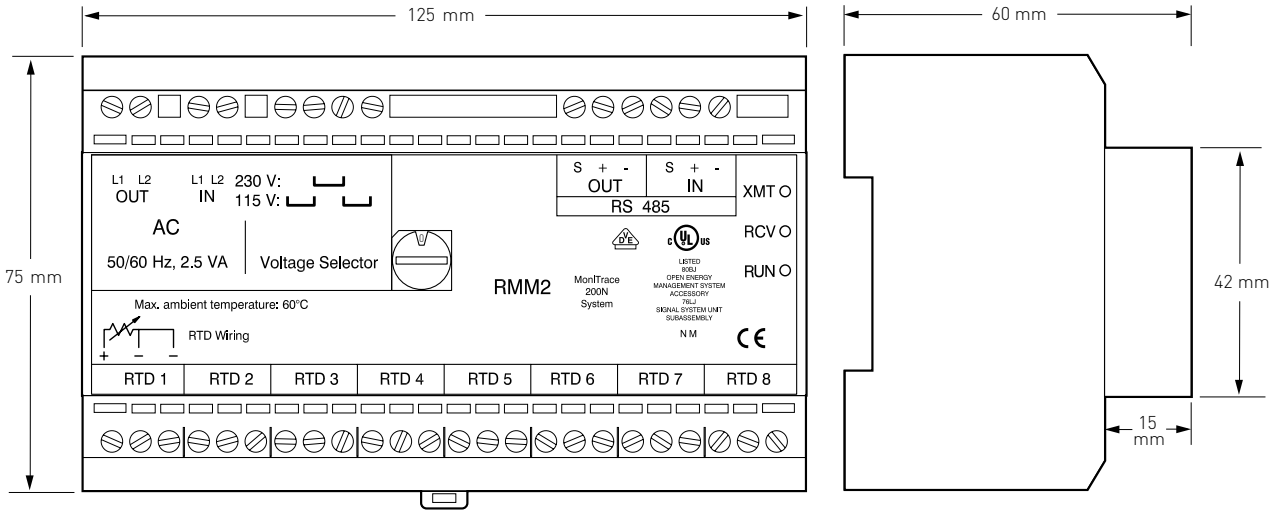
### ALARMS

Low and high temperature alarms may be set for sensors connected to the Santo DATC controllers via the RMM2. Alarm limits are set and alarm conditions are reported to the user. Additional alarms are triggered for failed temperature sensors and communication errors. Alarms may be reported remotely through an alarm relay in the Santo DATC-UIT or via Santo Supervisor.

### CONFIGURATIONS

The RMM2 is an electronic device that clips to a DIN 35 rail. The complete kit for ordinary and hazardous areas (Zone 2) include an RMM2 mounted in a rugged polyester enclosure with appropriate terminals and cable glands. For other installation options, contact Santo Thermal Management.

## DIMENSIONS (IN MM)




## GENERAL

| | |
|---|---|
| Area of use | Hazardous area (Zone 2) or non-hazardous area<br>RMM2-EX-E hazardous area zone 2 or non-hazardous area<br>RMM2-E panel mount, safe area |

## APPROVALS

| | |
|---|---|
| | Ⓔx II 3GD T70°C EEx nR II T6 (–20°C ⩽ Ta ⩽ 60°C) |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |
| Ambient operating temperature range | –40°C to +60°C |
| Ambient storage temperature range | –51°C to +60°C |
| Relative humidity | max. 95%, noncondensing |
| Supply voltage (nominal) | 115/230 Vac +10% -10% 50/60 Hz (jumper selectable) |
| Internal power consumption | 3 VA |

## RMM2 HAZARDOUS AREA ENCLOSURE — MONI-RMM2-EX-E

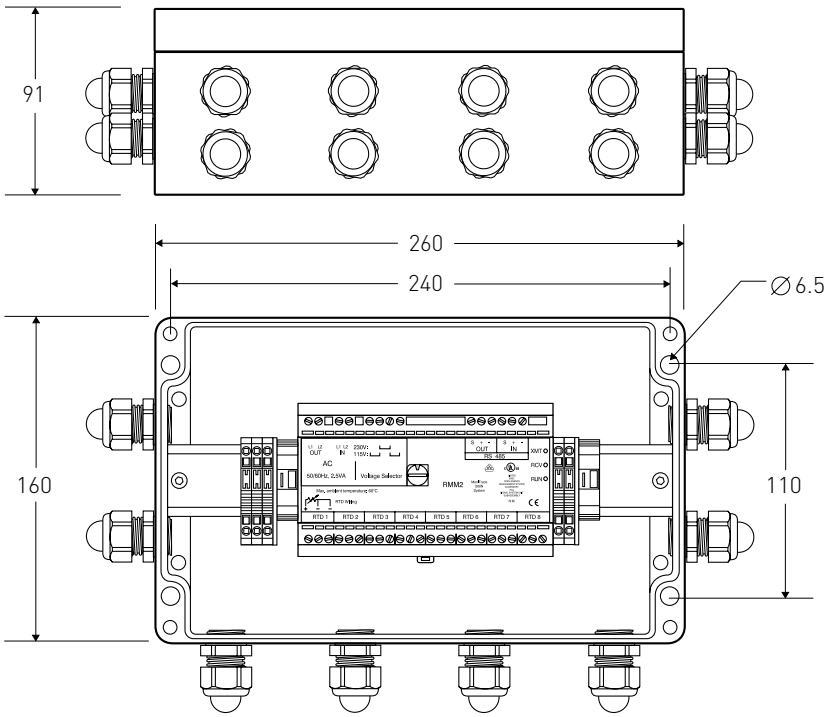
| | |
|---|---|
| Protection | IP66 |
| Base and lid | Material: glassfibre-reinforced polyester, lid seal: silicone |
| Colour | Black |
| Ambient temperature range | –20°C to +60°C |
| Lid fixing | 4 x M6, cheese-head, captive, stainless steel |
| Entries | 12 x M20 for cable diameters ranging from 6 to 12 mm |
| Glands provided (EEx e) | 12 x M20 with integral stopping plugs |
| Mounting | Surface mounting with 4 fixing holes on 240 x 110 mm centres<br>hole diameter: 5 mm |

## TEMPERATURE SENSORS

| | |
|---|---|
| Type | 3 wire Pt 100, temperature coefficient per IEC 751-1983 |
| Quantity to be connected | Up to 8 Pt 100 per RMM2<br>The sensor cable may be extended with a 3 (+PE)-wire signal cable adding 20 Ohms lead resistance maximum. When using 1.5 $mm^2$ cable this equals to ±150 m of cable. When the sensor cable is laid in cable ducts or in the vicinity of highvoltage carrying cables the sensor extension cable should be shielded. The shield of the extension cable should be grounded at the controller end only. |
| Area of use | Use sensors with the appropriate approvals required for the area of use |

## ENCLOSURE DETAILS - HAZARDOUS AREA ENCLOSURE RMM2-EX-E

### DIMENSIONS (IN MM)




### COMMUNICATION TO DATC-30-UIT SANTO DATC CONTROLLERS

| | |
|---|---|
| Type | RS-485 |
| Cable | 1 shielded twisted pair |
| Length | 1200 m max. |
| Quantity | Up to 16 RMM2 UIT per Santo DATC network |
| Address | Switch-selectable on RMM2 |

### CONNECTION TERMINALS

| | |
|---|---|
| Supply (in-out) | 4 terminals for cables 0.2 $mm^2$ to 4 $mm^2$ |
| Earth | 10 terminals for cables up to 4 $mm^2$ aside the RMM2 unit |
| Pt 100 connections | 8 x 3 terminals for cables 0.2 $mm^2$ to 2.5 $mm^2$ |
| RS-485 connection | 2 x 3 terminals for cables 0.2 $mm^2$ to 2.5 $mm^2$ |

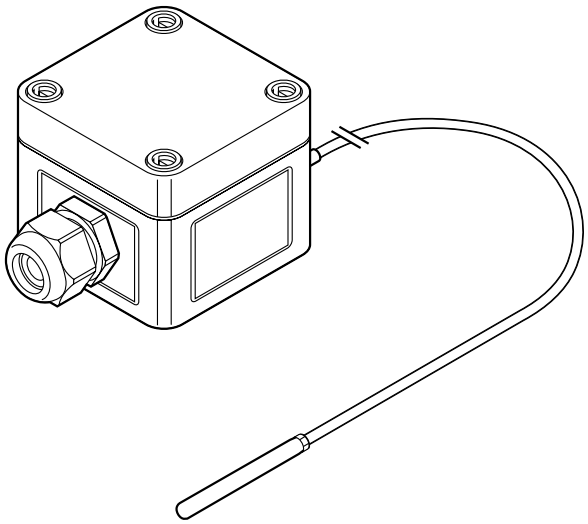
### ELECTROMAGNETIC COMPATIBILITY

| | |
|---|---|
| Immunity | Complies with EN 50 082-2 (heavy industrial) |
| Emissions | Complies with EN 50 081-1 (light industrial) |

### ORDERING DETAILS

# SANTO MONI-PT100-NH

## TEMPERATURE SENSOR FOR ORDINARY AREA



2 wire Pt 100 sensor with glass fiber reinforced polycarbonate junction box for installation in ordinary area.

### AREA OF USE

| | |
|---|---|
| | Ordinary area |

### APPROVALS

| | |
|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

### SENSOR

| | |
|---|---|
| Type | Pt 100 (2 wire)<br>DIN IEC 751, Class B |
| Material | Tip: stainless steel<br>Extension cable: silicone |
| Temperature measuring range | –50°C to +180°C |
| Temperature range extension cable | –50°C to +180°C (+215°C maximum 1000 hrs), max. exposure temp. tip: +400°C |
| Length | 2 m |
| Diameter | Extension cable ca 4.6 mm, tip ca 6.0 mm |
| Minimum bending radius | Extension cable: 5 mm, the measuring tip should not be bent |

### ENCLOSURE

| | |
|---|---|
| Ingress protection | IP66 |
| Material | Glass fiber reinforced polycarbonate (gray) |
| Dimensions | With = 65 mm Height = 65 mm Depth = 57 mm |
| Cable gland | M20 (polyamide) suitable for cable diameters ranging from 10 mm to 14 mm |
| Operating temperature | –30°C to +80°C |
| Lid sealing gasket material | CFC-free Polyurethane |
| Cover screws | Plastic |
| Mounting | For pipe mount use MF-SB-26 wall mount surface mount via moulded holes at 50 x 50 mm |

## INSTALLATION AND CONNECTION

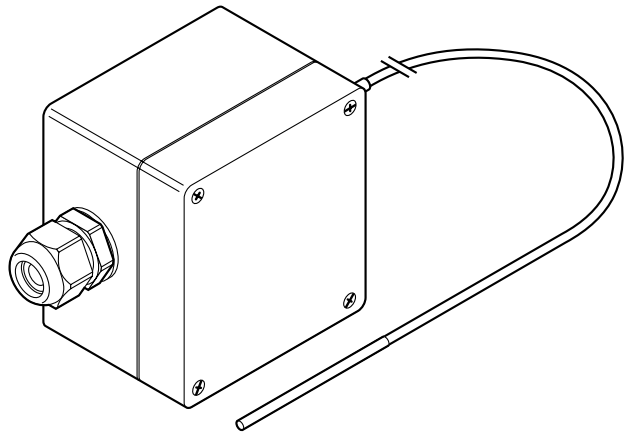
| | |
|---|---|
| Terminals | 3 front entry spring-type terminals (terminals 2 and 3 are bridged) |
| Terminal sizing | Terminals suitable for cables from 0.15 mm to 2.5 $mm^2$ |

## ORDERING DETAILS

| | |
|---|---|
| Part Description | MONI-PT100-NH |
| PN (Weight) | 2000-U50 (0.22 kg) |

# SANTO MONI-PT100-EXE

## TEMPERATURE SENSOR FOR HAZARDOUS AREAS



3 wire Pt 100 sensor connected to a black glass fiber reinforced polyester junction box with 4 front entry spring-type terminals.

M20 EEx e cable gland preinstalled.

### AREA OF USE

| | |
|---|---|
| | Hazardous environment Zone I |

### APPROVALS

| | |
|---|---|
| EAC | For Russia, Kazakhstan, Belarus.<br>For other countries contact your local Santo representative. |

### SENSOR

| | |
|---|---|
| Type | Pt 100 (3 wire)<br>DIN IEC 751, Class B. |
| Material | extension cable and tip both stainless steel (MI) |
| Temperature measuring range | –100°C to +500°C |
| Maximum exposure temp. tip | +585°C |
| Length | 2 m |
| Diameter | ca 3 mm |
| Minimum bending radius | extension cable: 20 mm, the measuring tip should not be bent |

### ENCLOSURE

| | |
|---|---|
| Material | Glass fiber reinforced polyester (black) |
| Ingress protection | IP66 |
| Dimensions | With = 80 mm Height = 75 mm Depth = 55 mm |
| Cable entry | M20 (EEx e) suitable for cable diameters ranging from 10 mm to 14 mm |
| Operating temperature | –50°C to +60°C |
| Sealing gasket material | tongue and groove system with silicone seal |
| Cover screws | Stainless steel M4 threaded |
| Mounting | For pipe mount use MF-SB-26 wall mount surface mount via moulded holes at 68 x 45 mm |

## INSTALLATION AND CONNECTION

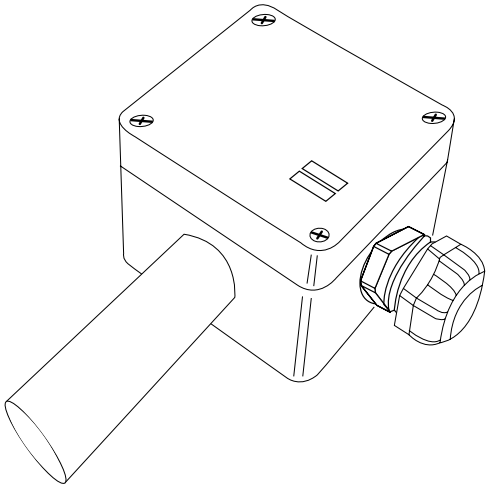
| | |
|---|---|
| Terminals | 4 front entry spring-type terminals |
| Terminal sizing | suitable for cables from 0.5 $mm^2$ to 2.5 $mm^2$ |

## ORDERING DETAILS

| | |
|---|---|
| Part Description | MONI-PT100-EXE |
| PN (Weight) | 2000-U51 (0.44 kg) |

# MONI-PT100-EXE-AMB

## AMBIENT SENSING TEMPERATURE SENSOR FOR HAZARDOUS AREA (PT100)



### PRODUCT OVERVIEW

The MONI-PT100-EXE-AMB 3-wire Pt 100 temperature sensor connected to glass fiber reinforced polyester junction box. The sensor is approved for hazardous area and can be used in safe area.
The protection tube not only mechanically protects the actual temperature sensor it also prevents the sensor from sudden temperature changes caused by direct sunlight and or wind.
The MONI-PT100-EXE-AMB sensors need to be installed such that they measure a temperature

### GENERAL FEATURES

| | |
|---|---|
| Area of use | Hazardous area Zone 1 or Zone 2 Gas (Zone 21, Zone 22 Dust) |

### APPROVALS

| | |
|---|---|
| | EAC For Russia, Kazakhstan, Belarus.<br>For other countries contact your local Santo representative. |

### SENSOR

| | |
|---|---|
| Type | Pt 100 (3-Wire) acc. DIN IEC 751, Class B |
| Material | Sensor: stainless steel (MI) Protection tube: brass |
| Temperature measuring range | Assembly –50°C to +60°C (Sensor measuring range from –100°C to +500°C) |

### ENCLOSURE

| | |
|---|---|
| Material | Glass fiber reinforced box (Black) M4 captive stainless steel cover screws. |
| Ingress protection | IP66 |
| Dimensions | Box: With = 80 mm Height = 75 mm Depth = 55 mm<br>Installed: with = ~110 Height = ~200 mm |
| Cable entry | M20 (Ex e) suitable for cable diameters ranging form 10 mm to 14 mm |
| Operating temperature | –50°C to +60°C |
| Mounting | Surface mount via molded holes centered at 68 x 45 mm.<br>Any installation position is allowed. |

### INSTALLATION AND CONNECTION

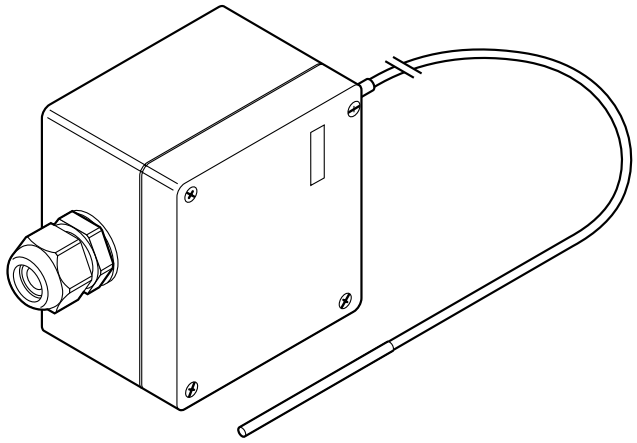
| | |
|---|---|
| Terminals | 4 front entry cage clamp terminals suitable for cables from 0.5- to 2.5 $mm^2$ |

### ORDERING DETAILS

| | |
|---|---|
| Part number | 2000-U52 |

# MONI-PT100-4/20MA

## 3 WIRE PT 100 SENSOR WITH 4 TO 20 MA TRANSMITTER FOR HAZARDOUS AREA



Pt 100 sensor connected to a 4-20 mA transmitter built in a black glass fiber reinforced polyester junction box with M20 cable gland (Blue).

### AREA OF USE

| | |
|---|---|
| | Hazardous environment Zone I |

### APPROVALS

| | |
|---|---|
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

### SENSOR

| | |
|---|---|
| Type | Pt 100 (3 wire)<br>DIN IEC 751, Class B. |
| Material | extension cable and tip both stainless steel (MI). |
| Temperature measuring range: | –50°C to +250°C (transmitter) |
| Maximum exposure temp. tip | +585°C |
| Length | 2 m |
| Diameter | ca 3 mm |
| Minimum bending radius | extension cable: 20 mm, the measuring tip should not be bent |

### ENCLOSURE

| | |
|---|---|
| Ingress protection | IP66 |
| Material | Glass fiber reinforced polyester (black) |
| Dimensions | Width = 80 mm Heigth = 75 mm Depth = 55 mm |
| Cable gland | M20, blue (EEx e) suitable for cable diameters ranging from 10 mm to 14 mm |
| Operating temperature | –20°C to +55°C |
| Sealing gasket material | tongue and groove system with silicone seal |
| Cover screws | Stainless steel M4 threaded |
| For pipe mounting use | MF-SB-26 |

## INSTALLATION AND CONNECTION

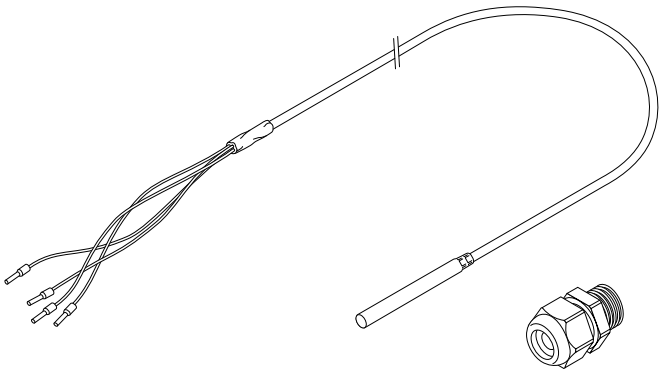
| | |
|---|---|
| Terminals | 2 screw terminals |
| Terminal sizing | suitable for cables from 0.5 mm2 to 1.5 mm2 |

## ORDERING DETAILS

| | |
|---|---|
| Part Description | MONI-PT100-4/20MA |
| PN (Weight) | 2000-U52 (0.46 kg) |

# MONI-PT100-260/2

## TEMPERATURE SENSOR WITH M16 GLAND



### PRODUCT OVERVIEW

MONI-PT100-260/2 temperature sensor is designed for providing accurate temperature measurements.

The MONI-PT100-260/2 sensor exhibits excellent mechanical, electrical and thermal properties what makes the sensor extremely useful for a broad range of applications. The sensor can be connected to the control device using 3-wire technology for providing highest accuracy and measuring stability.

### AREA OF USE

| | |
|---|---|
| | Non hazardous area or hazardous area Zone 1, Zone 21 or Zone 2, Zone 22 when connected to intrinsic safe circuits |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. |

### SENSOR

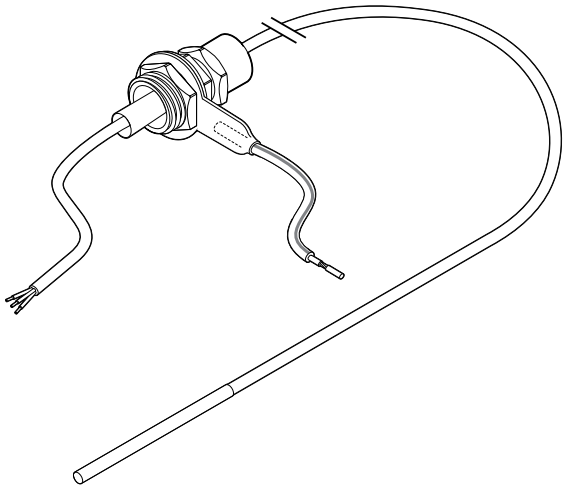
| | |
|---|---|
| Type | Pt 100 (3 wire)<br>DIN IEC 751, Class B |
| Jacket/Sheath Material | Extension cable PTFE (Fluoropolymer)<br>Measuring tip stainless steel (316 Ti) |
| Cable construction | Braided |
| Measuring range | –50°C to 260°C |
| Maximum exposure temp. tip | 400°C |
| Length | Total sensor length 2 m (other lengths are available on request)<br>Length of the measuring tip ca 50 mm |
| Nominal Diameter (OD) | Diameter of the sensor cable 4.8 mm<br>Diameter of the tip 6 mm. |
| Conductors | 4 x 0.5 $mm^2$ (Red, Red, White and braid)<br>PTFE insulated |
| Minimum bending radius | Sensor cable minimum 20 mm, The measuring tip should not be bent |

### CABLE GLAND

| | |
|---|---|
| Approvals | II 2GD EEx e II |
| Thread size (color) | M16 (Black) |
| Material | Polyamide (PA) Halogen-free |
| Temperature range | –40°C to +75°C |
| Cable acceptance size | Suitable for cables from 4 to 9 mm diameter |
| PN (Weight) | 2000-K01 (0.12 kg) |

# MONI-PT100-EXE-SENSOR

## TEMPERATURE SENSOR FOR HAZARDOUS AREA (WITHOUT JUNCTION BOX)



Certified EEx e II cable gland preinstalled on the sensor lead (M16, Brass, inclusive sealing washer, locknut and earth tag

### AREA OF USE

| | |
|---|---|
| | Hazardous environment Zone I |

### APPROVALS

| | |
|---|---|
| EAC | For Russia, Kazakhstan, Belarus.<br>For other countries contact your local Santo representative. |

### SENSOR

| | |
|---|---|
| Type | Pt 100 (3 wire)<br>DIN IEC 751, Class B. |
| Material | Stainless steel (MI). |
| Temperature measuring range | –100°C to +500°C |
| Maximum exposure temperature | +585°C |
| Length | 2 m |
| Diameter | ca 3 mm |
| Minimum bending radius | extension cable: 20 mm, the measuring tip should not be bent |

### INSTALLATION AND CONNECTION

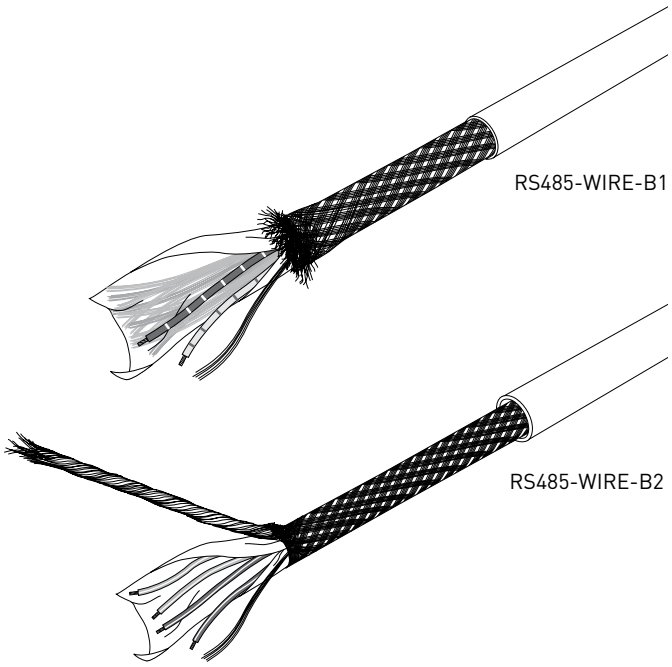
| | |
|---|---|
| M16 (Brass) compression gland pre-installed on the sensor. | |
| Sealing washer, earth tag and locknut included. | |
| Maximum operating temperature (for the gland) | –50°C to +60°C |

### ORDERING DETAILS

| | |
|---|---|
| Part Description | MONI-PT100-EXE-SENSOR |
| PN (Weight) | 2000-K02 (0.11 kg) |

# RS485-WIRE

## RS485 COMMUNICATION CABLES




### PRODUCT OVERVIEW

RS485-WIRE are braided and shielded type cables suitable for RS485 data transmission. Screen continuity and polarity must be maintained throughout the entire communication network. Connections must be made at each panel in accordance with the details provided in the appropriate product manual. Do not share communication cables with other signals or power. Keep data cables away from fluorescent lights, power cables and heavy duty machinery.

Zero Halogen (Low Smoke) cables of the same construction are available on request. (Flame retardant to IEC 60332-3C).

| **Type** | **RS485-WIRE-B1**<br>(Single pair construction) | **RS485-WIRE-B2**<br>(Single pair construction) |
|---|---|---|
| **GENERAL** | **Cables suitable for IEA RS-485 communications.** | |
| Typical use | RS485 communications, In- and outdoors | |
| Approvals/Certification | UL 2919, VW-1 | UL 2919, VW-1 |
| | EAC (Russia, Kazakhstan, Belarus)<br>For other countries contact your local Santo representative. | |

| **Construction** | **RS485-WIRE-B1**<br>(Single pair construction) | **RS485-WIRE-B2**<br>(Dual Pair construction) |
|---|---|---|
| Conductors | Two tinned Copper conductors<br>24AWG (7 x 0.20 mm) | Four tinned Copper conductors<br>24AWG (7 x 0.20 mm) |
| Insulation | Polyethylene (PE) | Polyethylene (PE) |
| Pairing | One single twisted Pair | Two twisted pairs |
| Identification | Blue/white + White/blue<br>Pair 2: White/Orange + Orange/White | Pair 1: Blue/white + White/blue |
| Screening | Aluminium polyester tape<br>Tinned Copper Braid (90% coverage) | Aluminium polyester tape<br>Tinned Copper Braid (90% coverage) |
| Jacket Type | RS485-WIRE-B1- and RS485-WIRE-B2 made of PVC (Polyvinylchloride) | |
| | RS485-WIRE-ZHB1- and RS485-WIRE-ZHB2 made of LSOH | |
| Colour | All type Grey | |

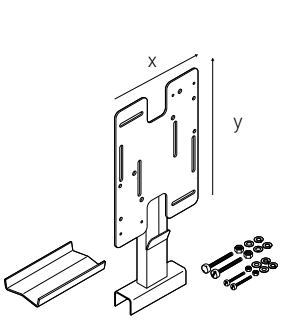
| ELECTRICAL PROPERTIES | | |
|---|---|---|
| Max operating voltage | 300 V RMS | 300 V RMS |
| Capacitance | 45 Pf/m (measured between conductors) | 45 Pf/m (measured between conductors) |
| Conductor resistance | 80 Ohm/km Ø 20°C | 80 Ohm/km Ø 20°C |
| Nominal Impedance | 120 Ohm | 120 Ohm |
| Velocity of Propagation | 66% | 66% |
| Max allowed Current | 2.10 A @ 25°C | 2.10 A @ 25°C |

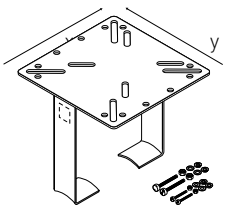
| PHYSICAL PROPERTIES | | |
|---|---|---|
| Nominal Diameter (OD) | 5.90 mm (±0.2 mm) | 8.64 mm (±0.2 mm) |
| Temperature range | –30°C to +80°C | –30°C to +80°C |
| Minimum Bend radius | 63 mm | 89 mm |
| Max continuous length | 1000 m | 1000 m |
| Polyvinylchloride types | RS485-WIRE-B1 | RS485-WIRE-B2 |
| Part number (Weight) | 2000-RJ01 (55 kg/km) | 2000-RJ03 (90 kg/km) |
| Zero Halogen types | RS485-WIRE-ZHB1 | RS485-WIRE-ZHB2 |
| Part number (Weight) | 2000-RJ02 (55 kg/km) | 2000-RJ04 (90 kg/km) |

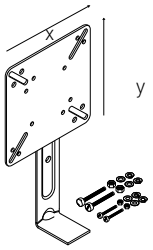
# ACCESSORIES

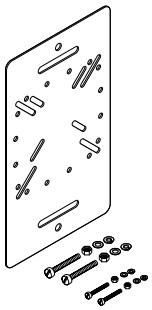
## SUPPORTS

Support brackets are used to fix equipment such as thermostats or junction boxes on pipes or cable trays. Support brackets require additional pipe straps which have to be ordered separately.
They include a set of M6 and/or M4 fixing screws, nuts, washers and spring lock washers for the fixation of one junction box or thermostat. They are fabricated in stainless steel (SS304, and passivation)
The table below outlines the typical compatibility of each bracket with relevant equipment, for other equipment please contact Santo representative.



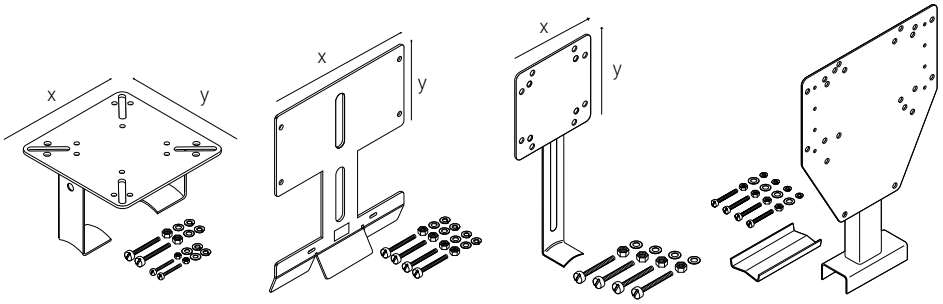



| | SB-100 2000-BN01 | SB-101 2000-BN02 | SB-110 2000-BN03 | SB-130** 2000-BN04 |
|---|---|---|---|---|
| DATC-TS-13 | x | x | x | x |
| DATC-TS-14 | x | x | x | x |
| MF-82 | x | x | x | x |
| MF-EX-20(-EP) | x | x | x | x |
| MF-EX-21 | x | x | | x |
| MF-EX-21/35MM2 | | | | |
| MF-EX-25/35MM2 | | | | |
| MF-EX-32/35MM2 | | | | |
| MFU-100(-L)-E(P) | x | x | | x |
| MONI-PT100-EXE | | x | | x |
| MONI-PT100-NH | | x | | x |
| MONI-PT100-4/20mA | | x | | x |
| DATC-CONTROL-10 | x | x | | x |
| DATC-ECO-10 | x | x | | x |
| DATC-EX-02 | x | x | x | x |
| DATC-EX-03 | x | x | | x |
| DATC-EX-04 | x | x | | x |
| DATC-20-C(L)-E | | | | |
| T-M-10-S/+x+y | x | x | | x |
| T-M-20-S/+x+y(/EX) | | | x | |

**Support bracket for fixation to cable trays

## TECHNICAL DATA

| | SB-100<br>2000-BN01 | SB-101<br>2000-BN02 | SB-110<br>2000-BN03 | SB-130**<br>2000-BN04 |
|---|---|---|---|---|
| Plate size (mm) X x Y | 160 x 230 | 160 x 160 | 130 x 130 | 180 x 315 |
| Distance pipe-plate (mm) | 100 | 160 | 100 | N.A. |
| Number of pipe straps required | 2 | 2 | 1 | 2 |
| Max. pipe temperature (°C) | 230 | 230 | 230 | N.A. |
| Weight (kg) | 0.70 | 0.59 | 0.40 | 0.62 |




| | SB-111<br>2000-BN05 | SB-120<br>2000-BN06 | JB-SB-26<br>2000-BN07 | SB-125<br>2000-BN08 |
|---|---|---|---|---|
| DATC-TS-13 | x | | | |
| DATC-TS-14 | x | | | |
| MF-82 | x | | | x |
| MF-EX-20(-EP) | x | | | |
| MF-EX-21 | | | | |
| MF-EX-21/35MM2 | x* | | | |
| MF-EX-25/35MM2 | x* | | | |
| MF-EX-32/35MM2 | x* | | | |
| MFU-100(-L)-E(P) | | | | x |
| MONI-PT100-EXE | x | | x | |
| MONI-PT100-NH | x | | x | |
| MONI-PT100-4/20mA | x | | x | |
| DATC-CONTROL-10 | | | | x |
| DATC-ECO-10 | | | | x |
| DATC-EX-02 | x | | | x |
| DATC-EX-03 | | | | x |
| DATC-EX-04 | | | | x |
| DATC-20-C(L)-E | | x | | x |
| T-M-10-S/+x+y | x | | | |
| T-M-20-S/+x+y(/EX) | | x | | x |

* Use 2 brackets per junction box

## TECHNICAL DATA

| | | | | |
|---|---|---|---|---|
| Plate size (mm) X x Y | 130 x 130 | 220 x 120 | 80 x 80 | 220 x 232 |
| Distance pipe-plate (mm) | 100 | 120 | 100 | 100 |
| Number of pipe straps required | 2 | 2 | 1 | 2 |
| Max. pipe temperature (°C) | 230 | 230 | 230 | 230 |
| Weight (kg) | 0.48 | 0.66 | 0.20 | 0.90 |

## LABELS AND TAGS


Warning labels indicate the presence of electrical heat-tracing under the insulation of the pipe or other equipment. (min. of 1 label per 5 m of heat-tracing line). Also suitable for stainless steel pipes (<5ppm leachable halide).

| Language | EHT label reference | Product number |
|---|---|---|
| Arabian | BQ-ETL-ARA | 2000-BQ01 |
| Bulgarian | BQ-I-01/bulgarian | 2000-BQ02 |
| Croatian | BQ-HR | 2000-BQ03 |
| Czech | BQ-CZ | 2000-BQ04 |
| Danish | BQ-DK | 2000-BQ05 |
| Dutch | BQ-I-23 | 2000-BQ06 |
| English | BQ-I-01 | 2000-BQ07 |
| Estonian/English | BQ-ETL-EST | 2000-BQ08 |
| Finnish | BQ-ETL-SF | 2000-BQ09 |
| French | BQ-I-05 | 2000-BQ10 |
| German/French/Italian (230V) | BQ-ETL-CH | 2000-BQ11 |
| German | BQ-G | 2000-BQ12 |
| German/French/Italian/ English (400V) | BQ-ETL-400 | 2000-BQ13 |
| Hungarian | BQ-ETL-H | 2000-BQ14 |
| Italian | BQ-I | 2000-BQ15 |
| Latvian | BQ-I-32 | 2000-BQ16 |
| Lithuanian | BQ-ETL-LIT | 2000-BQ17 |
| Norwegian | BQ-N | 2000-BQ18 |
| Norwegian/English | BQ-ETL-NE | 2000-BQ19 |
| Polish | BQ-PL | 2000-BQ20 |
| Portugese | BQ-ETL-POR | 2000-BQ21 |
| Romanian | BQ-RO | 2000-BQ22 |
| Russian | BQ-ETL-R | 2000-BQ23 |
| Russian/English | BQ-I-01/E/R | 2000-BQ24 |
| Russian/English/Azeri | BQ-I-01/AZ/R/E | 2000-BQ25 |
| Slovenian | BQ-SLO | 2000-BQ26 |
| Spanish | BQ-Spanish | 2000-BQ27 |
| Swedish | BQ-ETL-S | 2000-BQ28 |


| Language | Component label reference | Product number |
|---|---|---|
| English | BQ-I-02 | 2000-BQ29 |
| Russian/English | BQ-I-02/E/R | 2000-BQ30 |
| | BQ-ENDSEAL | 2000-BQ31 |
| English | BQ-END-SEAL | 2000-BQ32 |
| | BQ-SPLICE | 2000-BQ33 |

## STABILIZED DESIGN LABELS

If compliance to the T-class or A.I.T. cannot be achieved by the unconditional T-rating of the heating cable, the hazardous area regulations require that cable sheath temperature is determined by the rules of stabilized design as per EN 60079-30 and the heating circuit is marked accordingly. The following labels are available for this purpose (min.1 label per heating circuit)

### BQ-I-35

Stabilized design sticker. To be installed when power-limiting ACC heating cables are used in hazardous areas.
PN: 2000-BQ34 Weight: 0,0015 kg

### BQ-EX-UFC-UFO

Aluminum tag plate for UFC and UFO self-regulating heating cables. To be installed if T-class compliance was proven by stabilized design and not by unconditional T-rating.
PN: 2000-BQ35 Weight: 0.04 kg

### BQ-EX-FXT

Aluminum tag plate. To be installed when parallel constant wattage FMT or FHT heating cables are used in hazardous areas.
PN: 2000-BQ36 Weight: 0.04 kg

### BQ-LABEL-EX

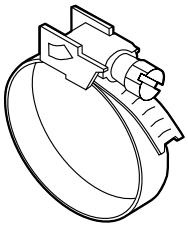
Aluminum tag plate. To be installed when series polymer insulated XPI & XPI-S heating cables are used in hazardous areas.
PN: 2000-BQ37 Weight: 0.04 kg

### BQ-LABEL-NH

Aluminum tag plate. To be installed when series polymer insulated XPI & XPI-S heating cables are used non hazardous areas. This label is not mandatory but highly recommended for future reference.
PN: 2000-BQ38 Weight: 0.04 kg

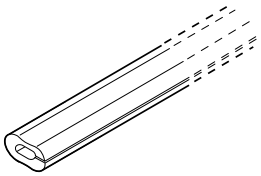
## PIPE STRAPS

Metal straps for pipe mounting of integrated power connections, above the insulation tees and end seals as well as support brackets and the tubular insulation entry.
Banding: stainless steel



| Pipe outer diameter in mm | (inches) | Pipe strap | PN (Weight) |
|---|---|---|---|
| 20 - 47 | (1/2" - 11/4") | PSE-047 | 2000-PS01 (0.017 kg) |
| 40 - 90 | (11/4" - 3") | PSE-090 | 2000-PS02 (0.024 kg) |
| 60 - 288 | (2" - 10") | PSE-280 | 2000-PS03 (0.052 kg) |
| 60 - 540 | (2" - 20") | PSE-540 | 20000PS04 (0.052 kg) |

## PROTECTIVE GROMMET



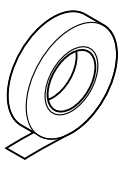
### G-02

Silicone grommet that protects the heating cable at sharp edges such as endplates of insulation cladding, flanges etc. It can be cut-to-length and resists temperatures up to 215°C.
Sold in pieces of 1 m.

PN: 2000-ZKT Weight: 0.37 kg/m)

## FIXING MATERIALS

Self-adhesive tape for fixing the heating cables on pipes or other equipment.

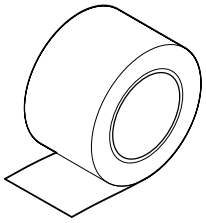


### GT-66

Glass cloth tape for attaching heating cable to pipe.
Not for stainless steel pipes or for installation temperatures below 5°C.
20 m per roll, 12 mm width.
PN: 2000-1066 Weight: 0.053 kg

### GS-54

Glass cloth tape with silicone adhesive system (<5ppm leachable halide) for attaching heating cable to pipe.
For stainless steel pipes or for any installation below 5°C.
16 m per roll, 12 mm width.
PN: 2000-1054 Weight: 0.048 kg



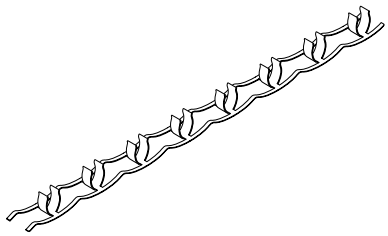
## ATE-180

Aluminium tape* for attaching heating cables and thermostat sensors to pipes and tanks. Minimum installation temperature: 0°C. Also suitable for stainless steel pipes (<5ppm leachable halide)
55 m per roll, 63.5 mm width.
PN: 2000-180 Weight: 0.84 kg
*Power output of selfregulating heating cables might increase when installed with aluminium tape or other heat transfer aids.

## SS-50MM-10M

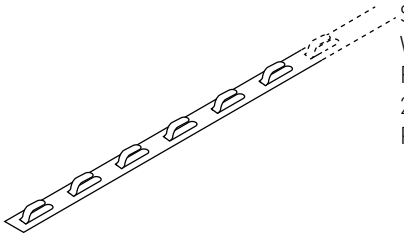
Stainless steel mesh for fixation of heating cables on valves, pumps or other odd-shaped surfaces. This mesh provides optimum contact and heat transfer between heating cables and heated equipment and can be used for exposure temperatures up to 400°C.
10 m per roll, 50 mm width.
PN: 2000-181 Weight: 0.36 kg

## SS-XMM-10M



Stainless steel clip band to attach Polymer Insulated series heating cables to pipes. Clips at regular distances to allow for even heater spacing. Band available in two sizes for different diameter ranges.
10 m per roll.
For diameters up to 5 mm
PN: 2000-182 Weight: 0.32 kg
For diameters up to 8 mm
PN: 2000-183 Weight: 0.52 kg

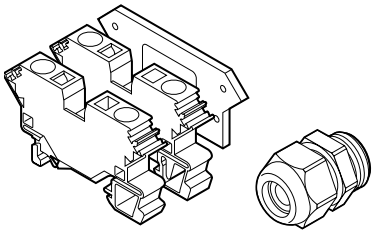
## SS-25MM-25M



Stainless steel spacer for fixing the heating cable on walls, tanks and vessels, etc.
Width spacer: 12.5 mm.
Fixing distance for cables: each 25 mm.
25 m per roll.
PN: 2000-184 Weight: 1.10 kg

EAC (Russia, Kazakhstan, Belarus) For other countries contact your local Santo representative.
Valid for following terminals, glands, plugs, adaptors and reducers.

## TERMINALS



### WAGO-TSTAT-KIT

Thermostat kit with supplementary terminals to connect thermostats of type DATC-EX-02 to the junction boxes MFS, MFM and MFU.
The kit includes 2 terminals Spring-type terminals (1 x L, 1 x PE),
1 power cable gland GL-36-M25, 1 end plate and 1 installation instruction.
PN: 2000-185 Weight: 0.073 kg

Ex II 2G Ex e II
Ex II 2D

and

Ex II 2G Ex e II
Ex II 2D Ex tD A21 IP66

### WAGO-PHASE

Phase/neutral terminal (Ex e), spare part for various junction boxes, max. 10 mm² solid/stranded.
PN: 2000-186 Weight: 0.019 kg

Ex II 2G Ex e II
Ex II 2D

### WAGO-EARTH

Earth terminal (Ex e), spare part for various junction boxes, max. 10 mm² solid/stranded.
PN: 2000-187 Weight: 0.027 kg

Ex II 2G Ex e II
Ex II 2D

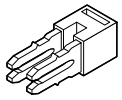
### WAGO-ENDPLATE

End plate for WAGO-..., 10 mm² terminals, spare part.
PN: 2000-188 Weight: 0.003 kg

Ex II 2G Ex e II
Ex II 2D

### WAGO-JUMPER

Jumper to bridge WAGO-..., 10 mm² terminals, spare part.
PN: 2000-189 Weight: 0.0004 kg



Ex II 2G Ex e II
Ex II 2D

### WDM-PHASE-35

Phase/neutral screw terminal (Ex e), spare part for MF-EX-xx/35MM2 junction boxes, max. 35 mm² solid/stranded.
PN: 2000-190 Weight: 0.052 kg

Ex II 2G Ex e II
Ex II 2D

### WDM-EARTH-35

Earth screw terminal (Ex e), spare part for MF-EX-xx/35MM2 junction boxes, max. 35 mm² solid/stranded.
PN: 2000-191 Weight: 0.077 kg

Ex II 2G Ex e II
Ex II 2D

### WDM-EARTH-10

Earth screw terminal (Ex e), spare part for MF-EX-xx/35MM2 junction boxes, max. 10 mm² solid/stranded.
PN: 2000-192 Weight: 0.030 kg

Ⓔx II 2G Ex e II
Ⓔx II 2D

### WDM-JUMPER-35-2

Jumper to bridge two WDM-... 35 mm² terminals, spare part PN: 2000-193 Weight: 0.013 kg

Ⓔx II 2G Ex e II
Ⓔx II 2D

### WDM-JUMPER-35-3

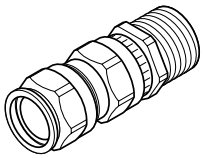
Jumper to bridge three WDM-... 35 mm² terminals, spare part
PN: 2000-194 Weight: 0.020 kg

Ⓔx II 2G Ex e II
Ⓔx II 2D

### WDM-PLATE

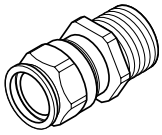
End plate for WDM-... 35 mm² terminals, spare part
PN: 2000-195 Weight: 0.005 kg

## GLANDS



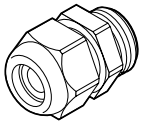
### GL-33

3/4" NPT power cable gland for DATC-EX-02 (Ex d IIC)
Nickel plated brass.
For use with armoured power cables with outer sheath diameter of 13.5 - 21 mm and inner sheath diameter of 10 - 16 mm.
PN: 2000-G011 Weight: 0.15 kg



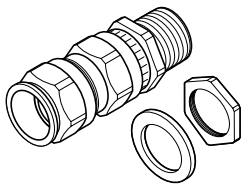
### GL-34

3/4" NPT power cable gland for DATC-EX-02 (Ex d IIC)
Nickel plated brass.
For use with non-armoured power cables with outer sheath diameter of 10 - 16 mm.
PN: 2000-G012 Weight: 0.07 kg



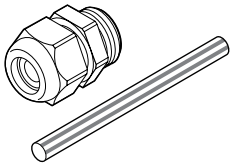
### GL-36-M25

M25 power cable gland (Ex e)
Polyamide.
For use with non-armoured power cables with outer diameter range 8 - 17 mm.
Spare part for MFS-100, MFM-100 and MFU-100.
PN: 2000-G013 Weight: 0.016 kg



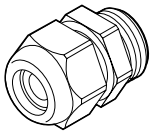
### GL-38-M25-METAL

M25 power cable gland (Ex e II and Ex d IIC) for use with junction boxes with internal earth plate (-EP) or metal boxes.
For use with armoured power cables with sheath diameter of 12 - 21 mm and inner sheath diameter 8.5 - 16 mm.
PN: 2000-G014 Weight: 0.15 kg



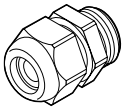
### GL-44-M20-KIT

M20 cable gland (Ex e), polyamide for use with PI cables with a diameter range of 5 -13 mm. With green/yellow sleeve.
PN: 2000-G015 Weight: 0.17 kg



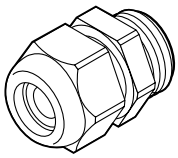
### GL-45-M32

M32 cable gland (Ex e), polyamide for use with power cables with a diameter range of 12 - 21 mm.
PN: 2000-G016 Weight: 0.028 kg



### GL-50-M20

M20 cable gland (Ex e), polyamide for use with power cables with a diameter range of 5.5 - 13 mm.
PN: 2000-G017 Weight: 0.009 kg



### GL-51-M40

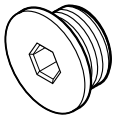
M40 cable gland (Ex e), polyamide for use with power cables with a diameter range of 17 - 28 mm.
PN: 2000-G018 Weight: 0.045 kg

## PLUGS

### DT-M20-EXE-PLASTIC

M20 stopping plug Ex e.
Polyamide.
Spare parts for various junction boxes.
PN: 2000-D010 Weight: 0.003 kg

Ⓔx II 2G Ex e II
Ⓔx II 2D Ex tD A21 IP66

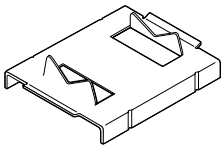


### DT-PLUG-M25-EXE-PLASTIC

M25 stopping plug Ex e.
Polyamide.
Spare parts for MFS-100, MFM-100 and MFU-100.
PN: 2000-D011 Weight: 0.007 kg

Ⓔx II 2G Ex e II
Ⓔx II 2D Ex tD A21 IP66

## SMALL PIPE ADAPTORS



### MFS-SPA

Small pipe adaptor required for pipes ⩽ 1" (DN25), applicable for MFS-100, FAST-100, FAST-100-L
2000-SP41 (bag of 5 adaptors)  Weight: 0.14 kg

### MFM-SPA

Small pipe adaptor required for pipes ⩽ 1" (DN25), applicable for MFM-100, FMT-100 2000-SP42 (bag of 5 adaptors)  Weight: 0.40 kg


E-MAIL:xjs0601@163.com