








# CONTACT WIRE DE-ICING

## PERMANENT SOLUTION TO AVOID ICE PROBLEMS

BlueWire is a heating cable solution, powered by the overhead wire system itself. A solution to increase traffic regularity and reduce cost for expensive mechanical ice-remover-vehicle or fancy liquids. The system works with overhead line systems from 600 to 900 V.

-  **Permanent solution**  
Always ready – in fully automatic mode or remotely at the tip of your finger.
-  **Secure early morning exit**  
of trains and trams out of the depot – every morning – on time
-  **Avoid heavy ice-build-up**  
to break down the wire system
-  **Secure electrical contact**  
to start driving from all stations
-  **Reduce cost for “night teams”**  
to remove ice on the OHL
-  **Extend the lifetime of all pantographs**
-  **Chemical and workforce free solution**



Eliminate costly interruptions of revenue service due to the effect of ice/frost accumulation on the contact wire.

Ice on the contact wire causes tramlines and light rail trains to lose power and in extreme cases leads to the contact wire / catenary system being brought down.

Arcing caused by the presence of ice leads to excessive wear to the pantograph conductors, all leading to traffic delays and service disruption.

Mechanical removal of ice is manpower and time consuming and mechanically stresses the contact wire.

### APPLICATIONS

BlueWire will typically be used along the line where ice on the contact wire is a more often seen problem than others. Here is a list of typical places.



#### Yards / Depots

Ice on the contact wire very often accumulates during the night. The vehicles cannot move due to ice accumulation causing revenue service interruptions.



#### In and out of tunnels

The air inside the tunnel maintains a constant temperature and humidity. Traffic in and out and the natural ventilation force the high humidity air to meet the cold environment outside the tunnel. Ice will be created as rime on the contact wire.

Water from the ceiling dripping down on the contact wire will create glaze.



#### On bridges crossing rivers

The air above the river is normally warmer and the moisture content higher. On the bridge the warmer humid air meets the cold contact wire. Both hoarfrost and rime will accumulate on the wire.

#### Passing under bridges

Water dripping down from the bridge ceiling hits the cold contact wire, resulting in glaze ice.



#### Lines along big lakes and rivers

Same problems as for bridges crossing rivers.



#### Up hill elevated lines

The temperature normally decreases at higher altitude. This means that along the elevated line we will see a big temperature difference. The risk of having rime/white frost conditions somewhere along the line is much bigger. Ice on the contact wire reduces the power when the vehicle needs it the most.



France:  
Nantes, near-river-station



Austria:  
Pöstlingbergbahn, up-hill



Norway: Bergen Bybane, Depot

## HEATING CABLE CONSTRUCTION

The heating cable is installed on the contact wire using special clips. The clips are made of phosphor-bronze to avoid galvanic corrosion.

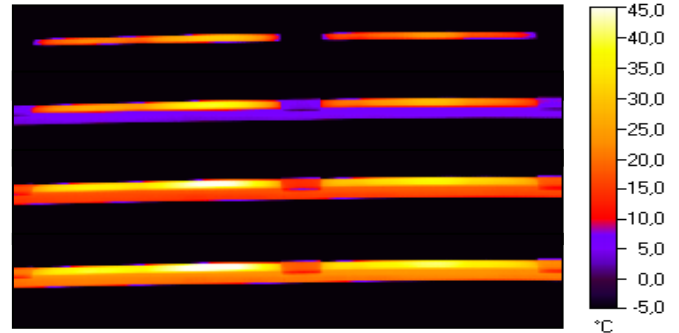


The heating cable is in a triangular shape. This makes it very easy to mount on top of the contact wire and the shape provides good thermal contact to the contact wire.

The shape also makes the fastening clips easy to handle and very efficient to mount.

## HEATING CABLE EFFICIENCY

Infrared picture of a heating cable on top of the contact wire. The series of pictures shows how fast the wire is heated.



From top: 1, 5, 10 and 15 minutes after turn ON heat

This series of pictures was taken at -5°C, wind speed 2-3 m/sec, 78% RH, Power 28 W/m.

After just 5 minutes the contact wire is above freezing temperature and ready to avoid icing of the wire.

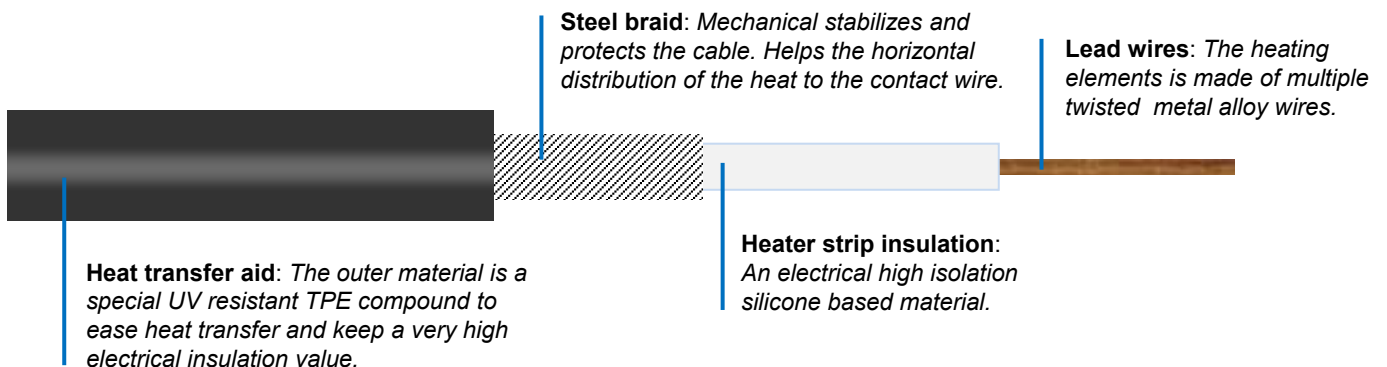
## BlueWire CABLE SPECIFICATIONS

The table shows the nominal length of heating cable to be installed based on the contact wire nominal voltage (OHL Voltage without trains).

Dimension: Triangle 6.5 x 6.5 x 6.5 mm  
 Weight/m: 85-95 g/m including 8 clips  
 Type: Serial constant wattage cable  
 Power output: Nominal 24 W/m  
 Voltage: Nominal up to 1.000 VDC  
 Circuit length: Nominal +10% -10%

Max. sheath temp.: 80°C without deformation.  
 Isolation Voltage: Minimum 5 kV

Cable type	BlueWire cable length		
	600 V meter	750 V meter	900 V meter
BW-100-025	297	371	446
BW-100-032	232	290	347
BW-100-040	185	231	277
BW-100-050	147	184	221
BW-100-073	101	126	152
BW-100-100	74	93	111
BW-100-130	57	71	85



### BlueWire - SYSTEM OFFERING

SAN Electro Heat offers a complete BlueWire solution for heating the contact wire to prevent ice from building up. The complete system offering covers:

- Heating cable and easy-to-mount clips
- Installation fittings including crossings etc.
- Manual disconnectors
- Controllers
- Weather stations
- Complete SCADA software for remote control and monitoring of the entire installation.
- Hosting (cloud) SCADA system
- Design of installation.
- Training of local technicians for Installation.
- Installation/commissioning assistance.

### BlueWire - CONTROL INSTALLATION

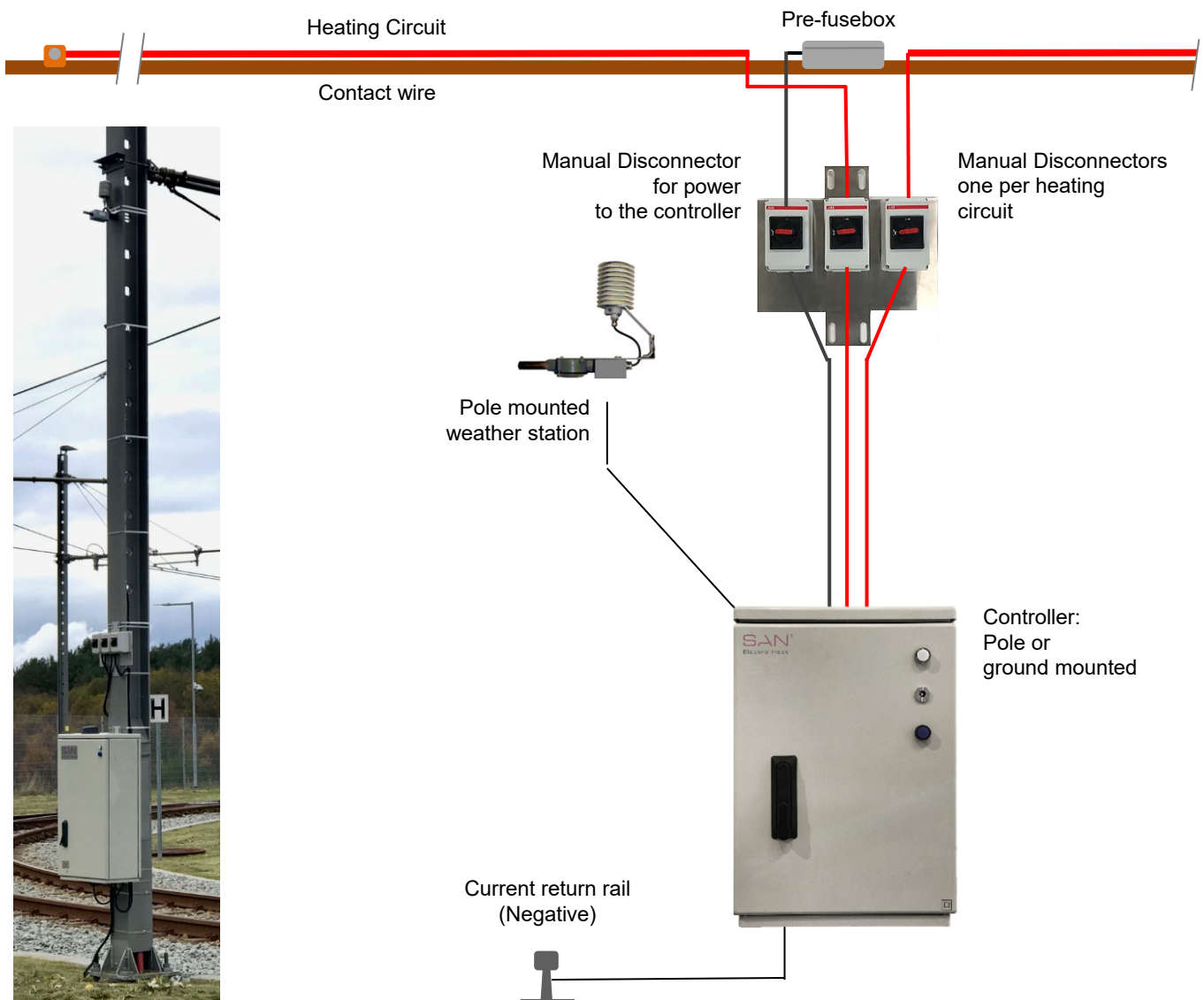
To control and operate the heating, a number of control installations are needed.

The heating cable is stationary connected to the contact wire. The heating power is switched ON/OFF on the negative end (rail).

The controller installation includes a manual disconnector to separate the heating circuit from the rail potential. This separator is mounted some meters above the controller on the same pole.

The controller turns ON the heat when predefined weather situations occur or by direct order.

Each controller is capable of controlling 1 to 4 heating circuits.



## BlueWire CONTROLLER FEATURE

BlueWire controllers can be configured from basic stand-alone controllers to advanced weather controlled network units. For all controllers counts that they use a powerful rugged RTU to control and monitor the operation.

### All controllers:

- Galvanic isolated power supply for all control
- Plastic on Aluminum as baseplate (safety)
- Separation of OHL voltage from control signals
- Automatic circuit breaker/fuse for control power
- Battery backup system
- Manual and Automatic push buttons
- Operator panel with 4,5" color touch screen for operation status, reading sensors, alarms and settings
- Weather station input
- OHL voltage measurements
- 2x LED for status and alarms, outside on cabinet door

### For each individual heating circuit:

- Separate contactor
- Heating failure alarm + contactless current measurement
- Automatic circuit breaker/fuse
- Manual disconnecter

### Communication:

- Hardwired remote interface (relays)
- RS-485 Modbus
- Ethernet TCP/IP Modbus
- Optional: Wireless WiFi or G3/G4 GSM modem

### Energy saving:

In automatic control the unit will use measurements from the local weather station. Heat will be controlled by Air temperature and Relative humidity.

The automatic mode can be assisted by weather forecast from the monitoring software (cloud based SCADA system). It is also possible to control the heat purely based on these very local and short-sighted weather forecasts.

### Controller Network:

Each controller could be part of a network of controllers. In a depot a configuration could be one Master (controller w. weather station) and a lot of Slaves (controller without weather station).

On slave units it is recommended to include option: Failsafe air thermostat. If the unit loses all communication it will run as a stand-alone unit based on this thermostat.

## CONTROLLER

Size:	Depth: 320mm Height: 1080mm Width: 590mm
Weight:	2 channel: xxx g 4 channel: xxx g
Color:	RAL 7035
Coating:	Yes, Antigravity
Casing:	IP 44 (54)

## CONTROLLER SPECIFICATIONS

Power (controller):	OHL power up to 900V DC or 230 VAC
Heating circuits:	2 or 4 circuits OHL up to 900 VDC
Each Heating Circuit:	Up to 25 A
Operator switch:	MANUAL - AUTOMATIC
Auto Heat Controlled by:	- Weather station - Master (controller with weather station) - Weather forecast - Air Thermostat (fail safe) - Remote (SCADA or Relays)
Heating circuit alarm:	Current measurement Over voltage
Communication:	RS-485 Modbus Ethernet Modbus Wireless GSM 4G/3G WiFi
LED indicator on door:	White: ON/OFF Blue: Sum alarm
<b>Optional:</b>	
Mechanical operation nozzle:	from outside
Dry contact signals:	Input: Demand Heat Output: OK, Heating, Fault Air-Thermostat
Failsafe operation:	
Built in compliance with:	EN 61439-1 2011 EN 61439-2 2011 EN 60204-1 2018



## CONTROLLER CONFIGURATION

<b>BW-500-MS</b>	Master Controller and 2x front LED
2	for 2x Heating Circuits
4	for 4x Heating Circuits
-750	Controller PSU, Line power 600-900 VDC
-230	Controller PSU, City power 230 VAC
-std	No further communication (std=RS485 + Ethernet)
-GSM	Wireless communication by 3G/4G network
-F02P	Fiberglas cabinet IP54 W:590 H:1080 D:322 - Pole mount
-F02G	Fiberglas cabinet IP54 W:590 H:1080+350+600 D:322 - Ground socket
-B000	Controller on an open aluminium board
	Options:
-T1	Failsafe Air thermostat
-W1	WiFi (900Mhz) communication to slave cubicles (for depot installations)
-S1	Manual key-switch to turn unit into operation from outside

Sample order:

**BW-500-MS 2<sup>750</sup> -GSM -F02P**

BLUE WIRE controller for 2 circuits, Controller power from OHL, Wireless Communication by GSM modem and antenna, Cabinet fiberglass on pole.

## WEATHER STATIONS

### BW-500-WS001

#### Air temperature – Humidity – Dew point temp.

Air temperature:	-50°C to +50°C
Humidity:	10 – 99% RH
Dew point	Calculated temperature
Contact wire:	-50°C to +50°C
Contact wire simulation:	100 mm Copper bar
Interface:	3x 4-20mA transmitters
Cable:	4 wire



### BW-500-WS002

#### Air temperature – Humidity – Dew point temp. - Cold Contact wire temp.

Air temperature:	-50°C to +50°C
Humidity:	10 – 99% RH
Dew point	Calculated temperature
Interface:	2x 4-20mA transmitters
Cable:	4 wire



### BW-500-WS003

#### Air temperature – Humidity – Precipitation (snow)

Weather station for pole mounting. Measurement of air temperature, humidity and snow/precipitation. This extended weather station can be used as a general weatherstation for not only BlueWire but also point heating and general report of weather situation on the line.

The precipitation part is the dual snow catch design. It will detect from the smallest snow flake to horizontal heavy drifting snow.

Air temperature:	-50°C to +50°C
Humidity:	10 – 99% RH
Dew point:	Calculated temperature
Snow/Precipitation:	Yes – Dual heated sensors
Interface:	RS485 – Modbus
Power supply:	48 VDC – included
Cable:	Special combined 4 wire cable

## BlueWire- SCADA – REMOTE MONITORING SOFTWARE

BlueWire SCADA is the scalable software package to monitor and control the complete installation.

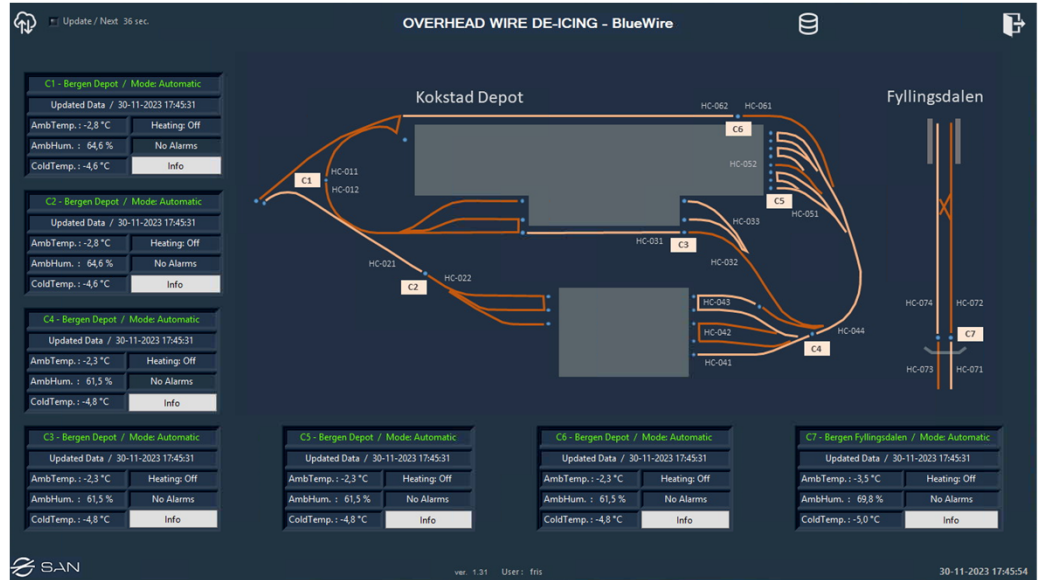
Manage the installation and generate quick actions on system alarms.

Manage the use of the stable tracks so trams will leave as schedule from de-iced contact wire stable tracks.

Energy optimise the system based on experience and the build-in statistics.

Valuable information at the fingertip for:

- Traffic Control Department.
- Maintenance Department.
- Technical Department.



Location	Date/Time	Mode	Air °C	Hum %	Cold °C	Dew °C	Main	Heat	Inrush	LowAirH	LowColdH	HighHumH	WhitefrostH	IL	C	H
Trinet 04	10.23.2018 02:40:01 PM	System Off	-66,8	25	32,0	-125,3	348,9	348,4	1	348,7	344,1	9,9	6,7	0	0	0
Trinet 05	10.23.2018 02:40:01 PM	System Off	-66,8	25	32,0	-125,3	348,9	348,1	0	348,3	343,8	9,9	9,7	0	0	0
Trinet 05	10.23.2018 02:20:01 PM	System Off	-66,8	25	32,0	-125,3	175,3	175,5	5	175,5	175,3	0,0	0	0	0	0
Trinet 04	10.23.2018 02:00:01 PM	System Off	-66,8	25	32,0	-125,3	348,2	347,7	7	348	343,4	9,9	9,7	0	0	0
Trinet 05	10.23.2018 02:00:01 PM	System Off	-66,8	25	32,0	-125,3	175,9	175,2	4	175,3	175,3	0,0	0	0	0	0
Trinet 04	10.23.2018 01:40:01 PM	System Off	-66,8	25	32,0	-125,3	347,9	347,4	6	347,7	343,1	9,9	9,7	0	0	0
Trinet 05	10.23.2018 01:40:01 PM	System Off	-66,8	25	32,0	-125,3	175,5	174,9	3	175	175	0,0	0	0	0	0
Trinet 04	10.23.2018 01:20:01 PM	System Off	-66,8	25	32,0	-125,3	347,6	347,1	5	347,3	342,6	9,9	9,7	0	0	0
Trinet 05	10.23.2018 01:20:01 PM	System Off	-66,8	25	32,0	-125,3	175,3	174,5	2	174,9	174,5	0,0	0	0	0	0
Trinet 04	10.23.2018 01:00:01 PM	System Off	-66,8	25	32,0	-125,3	347,2	346,7	4	347	342,4	9,9	9,7	0	0	0
Trinet 05	10.23.2018 01:00:01 PM	System Off	-66,8	25	32,0	-125,3	174,9	174,2	1	174,3	174,3	0,0	0	0	0	0
Trinet 04	10.23.2018 12:40:01 PM	System Off	-66,8	25	32,0	-125,3	348,9	348,4	3	348,7	342,1	9,9	9,7	0	0	0
Trinet 05	10.23.2018 12:40:01 PM	System Off	-66,8	25	32,0	-125,3	174,8	173,9	7	174	174	0,0	0	0	0	0
Trinet 04	10.23.2018 12:20:01 PM	System Off	-66,8	25	32,0	-125,3	346,6	346,1	2	346,3	341,8	9,9	9,7	0	0	0

### Operational status:

- Manual or Automatic operation
- Control mode
- Local weather conditions
- Heating circuits ON or OFF
- Heating circuit power
- Current measurement for each heating circuit

### Alarms - Instant message:

- Communication error
- Control power failure
- OHL power failure
- Heating circuit failure
- Temperature sensor failure
- Humidity sensor failure

### Remote settings:

- Turn individual circuits ON/OFF
- Temperature & Humidity levels for every control mode

### Statistics:

- Energy counters
- Total heating hours
- Heating hours per control mode
- Total hours of operation

## BlueWire SCADA AS A CLOUD SOLUTION

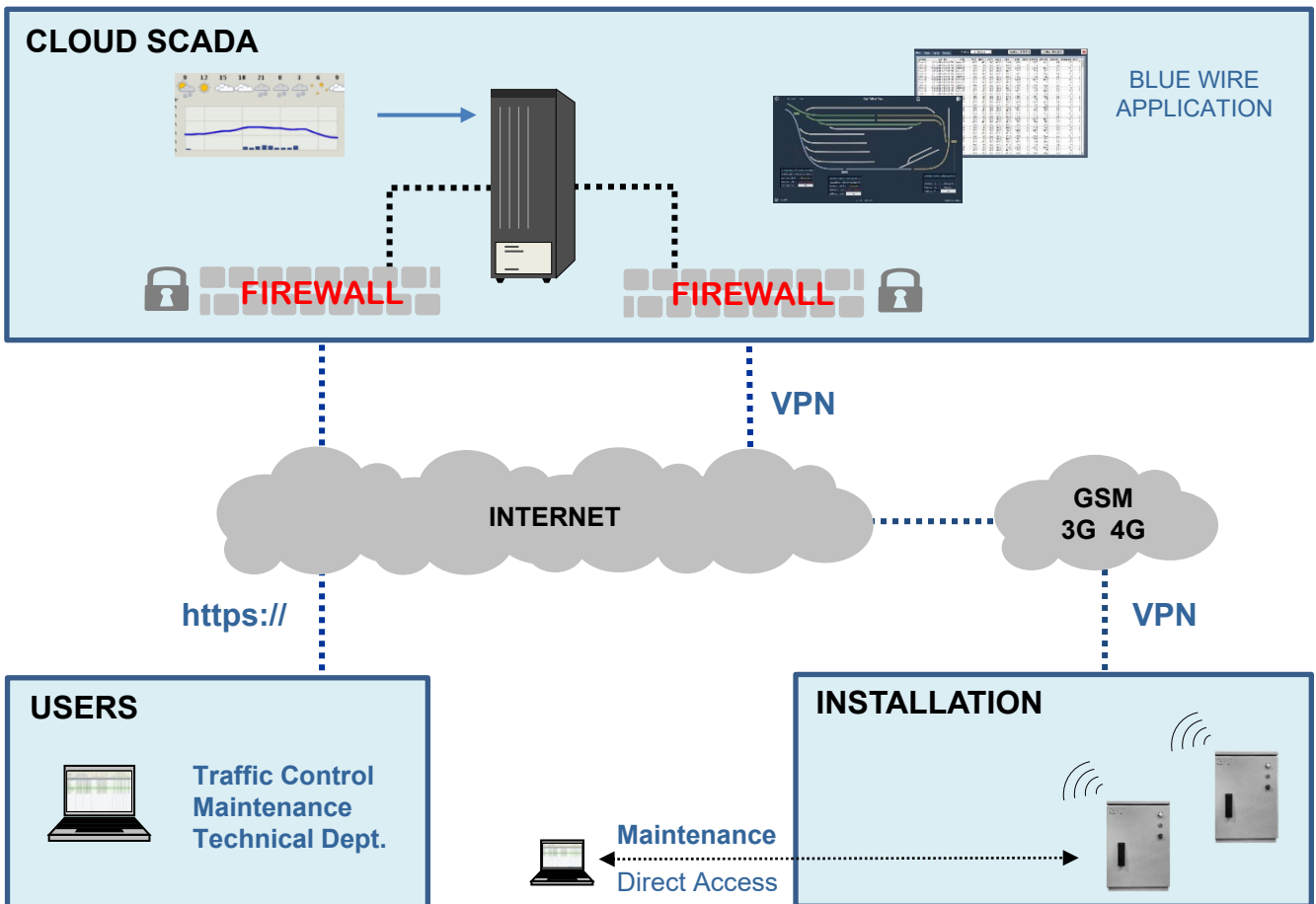
Complete SCADA – User access via the Internet

SAN Electro Heat offers the BlueWire SCADA package as a cloud solution. The solution is based on wireless GSM, 3G/4G communication technology to each controller and internet access for all users.

Safety solution: The solution is provided with a point-to-point VPN communication.

Cloud BlueWire SCADA benefits:

- No need for any IT hardware investments
- No need for maintaining a server application and the communication gateways
- SAN maintains the IT solution
- SAN can update, modify and implement changes very quickly.
- SAN has the experience from other similar cloud installations
- Easy to give an external maintenance partner access to the system.



## BlueWire SCADA – AS AN "ON PREMISE" SOLUTION

SAN Electro Heat offers the same easy to use SCADA solution to be installed on the company's own server in your own secure data network.

If a secure GPRS network is already in place and/or the communication is based on a wired network (ethernet or fibre optic cables) or GSM-R, it could make sense to host the solution in-house.



## TURN KEY, INSTALLATION AND TRAINING



Turnkey project and/or training (certification) of local staff. SAN Electro Heat delivers from components to complete projects including design, installing, training, inspection and maintenance.

## ICE CONDITIONS



Ice accretion can be categorized in 4 different main types of ice:

### Hoarfrost

Air humidity freezes on surfaces directly from the vapour phase if the contact wire is colder than the air temperature and below 0°C.

### Rime

Air humidity condensates on the contact wire when the air temperature is below the dew point temperature. The condensate will freeze if the contact wire is below freezing point.

### Glaze / Ice rain

Water droplets hits a contact wire colder than 0°C and freezes. Water droplets could be super cooled rain.

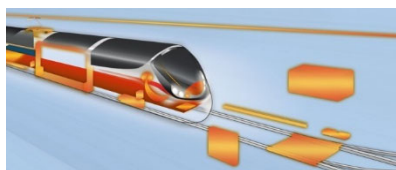
### Snow

Normally snow will not create ice on the contact wire, but wet snow (snow just around the freezing temperature) will react just like water droplets and will freeze to ice on a contact wire colder than 0°C.



### SAN Electro Heat a/s (Member of the NIBE group)

Danish located international company. More than 60 years of experience in development and manufacturing of advanced technical electric heating solutions and components. Focus on know-how divided into four business areas: Railway, Wind Power, Industrial Heating and Comfort Heating.



### SAN Electro Heat - Railway (Part of NIBE Element - Railway Solutions)

Rail Infrastructure: Focus on complete systems to secure optimum operation under any winter weather situations e.g. switch point heating, overhead wire de-icing, third rail de-icing and platform de-icing. Rolling stock: Comfort heating, door step de-icing, heating of hydraulic systems, toilet/waste water systems and test load resistors.

We supply highly efficient systems that reduce energy consumption and total cost of ownership. Our design has proven its reliability through thousands of installations all over Europe, Canada and USA.

### SAN Electro Heat a/s - Railway

Gillelejevej 30b  
3230 Graested, Denmark

san@san-as.com  
www.san-as.com

Information in this document is subject to change without notice.

©2022, by SAN Electro Heat A/S.  
All rights reserved.