

# Eaton Diagnose System

Temperature monitoring brings enhanced security to your switchboard



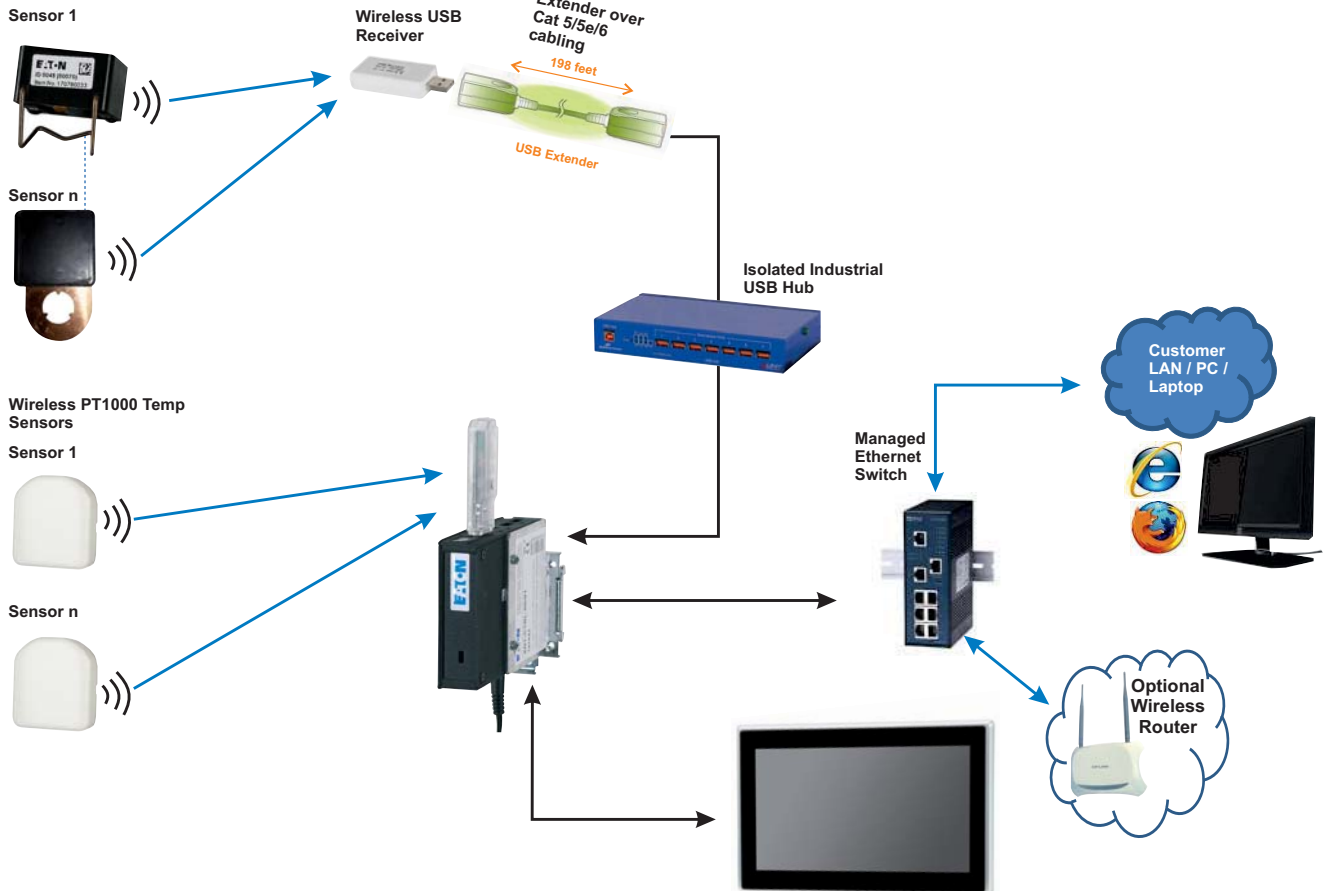
Catalogue 2018



*Powering Business Worldwide*



diagnose\_konfig4

**Busbar Temp Sensors****Description**

- Permanent monitoring
- Detection at an early stage
- Warnings
- Diagnostics
- Documentation
- Availability of the system
- Wireless – no wiring of the sensors
- Quick and easy installation
- No batteries in the sensors
- Permanent status transmission
- Log-file recording
- Integration into existing SCADA systems

Designation

Type  
designation

Article No.

Pack  
(pcs.)**Controller**

vt15317



Incl. USB receiver 868 MHz (CKOZ-00/14) for wireless detection of the ambient temperature

XNT-CTRL-00/01

191842

1

**USB receiver 2.4 GHz**

vt34515



Wireless measuring of the busbar temperature via sensors

XNT-REC

178660

1

**Temperature Sensor Busbar Temperature**

vt35115



Incl. holding brackets for 10 mm fl at copper

XNT-DIAG1

178303

1

XNT-DIAG3

178304

3

XNT-DIAG12

178305

12

**Adapter Plate**

vt34715



Incl. screws and Allen key

XNT-DIAG-A-3

178306

6

XNT-DIAG-A-4

178659

8

**Holding Brackets**

vt34915, VT34815



For 15 mm Cu material thickness

XNT-CLAP15

180071

100

For 20 mm Cu material thickness

XNT-CLAP20

180072

100

Designation

Type  
designation

Article No. Pack  
(pcs.)

### Temperature input Ambient Temperature

vt34415



RF module for capturing the ambient temperature  
Incl. fi xing bracket  
For max. 2 temperature sensors

CTEU-02/02

179344 1

### Temperature Sensor for Ambient Temperature

vt40315



PT1000, attachment hole 4mm, cable length = 1m

XNT-PT1000-4MM

179392 1

### USB extension

vt34315



Incl. fi xing bracket

XNT-USB-EXTENDER

178661 1

### Test device busbar sensors

vt34115



XNT-SENSOR-TEST

181584 1

Designation	Type designation	Article No.	Pack (pcs.)
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### USB-Hub



vt34015

7-Port USB-Hub	XNT-USB-HUB-7PORT	178662	1
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### Power supply for USB-HUB



01085341\_0

Rated voltage Input: 100-240V AC, 50/60Hz Rated voltage Output: 24V DC, (±3%) Rated current: 1.25A	EASY400-POW	212319	1
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### LCD monitor (HMI) for local visualization of the user interface

- A robust 12-inch display for industrial environments
- Can be built into the switchboard directly
- Degree of protection IP65 (front panel)
- Brightness: 600 cd/m<sup>2</sup>
- Resolution: 1024x768 (4:3))
- Contrast ratio: 700:1
- Supply voltage: 9 - 36V DC
- Operating temperature: -20°C bis +60°C
- Capacitive 2-finger touch
- Interfaces: 1x HDMI (display), 1x USB 2.0 (touch)
- Dimensions: 322,2 x 262,2 x 40,5 mm (BxHxT)
- Cutout dimensions: 304,8 x 244,8 mm (BxH)

**Attention!** Access via the display is "read-only" - configuration and sensor allocation are possible only via PC/laptop or remotely, provided that a network connection is active!



01260696\_0

12-Zoll Display (LCD Monitor)	DM-F12A *)	Manufacturer: <a href="https://www.ieiworld.com">https://www.ieiworld.com</a>
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\*) This model serves as a reference for possible display solutions, as it best matches our requirements and is available worldwide. The device is sold exclusively through IEI Integration Corp. or its local partners

Symbolfoto)

## Technical Data

### Introduction

Eaton DIAGNOSE was developed to provide permanent monitoring of our low-voltage main distribution boards. This results in a wide variety of advantages such as early detection, warning messages, diagnostics, documentation, increased system availability, optimized service intervals, reduction of infra-red scans, reduction of mechanical strain, ...

Thanks to permanent monitoring of the distributions boards any potential errors can be detected at a very early stage and be prevented (early detection). Such errors can be identified by a rise in temperature over a longer period of time, which usually would not be detected during a thermo-scan because there is no reference value available for a longer period of time. Another advantage is that sensors can be placed in areas of the system

that are difficult or impossible to access for thermo-scans. As it is no longer necessary to remove covers or planks for thermo-scans, it also results in increased safety for people and increased system availability, because enabling is only necessary when DIAGNOSE reports a pre-existing abnormality. Thanks to wireless signal transmission between sensors and analysis unit there is no need for any additional cables in the main and distribution busbar areas. And the time usually required for service jobs will be significantly shorter. You can immediately start with the usual revision jobs as thermo-scans and disassembly jobs are no longer necessary.

### Warning messages:

If DIAGNOSE detects any abnormality, it will be visually displayed in the software. So there are different colours for messages to indicate the degree of dysfunction.

Green = everything is okay

Yellow = no signal from the sensor, or the battery of the ambient temperature sensor is low

Orange = rail temperatures are getting close to critical values

Red = critical temperature values have been reached or exceeded

DIAGNOSE can be used as a stand-alone solution or it can be interlinked through the Internet, but it can also be incorporated into existing Scada systems in order to be able to react as efficiently and as automatically as possible to any potential errors

### Diagnostics:

Thanks to permanent monitoring of the system and thanks to documentation of the data it is possible to optimize trends and poorly aligned production processes. For example, if there are repeated and extreme load peaks which would normally not be noticed, this may be due to the fact that the entire system is exposed to high strain levels.

Such load peaks can easily be detected and prevented thanks to DIAGNOSE. In most cases all you need to do is optimize time-based processes in the production routine to get this type of problems under control.

### Documentation:

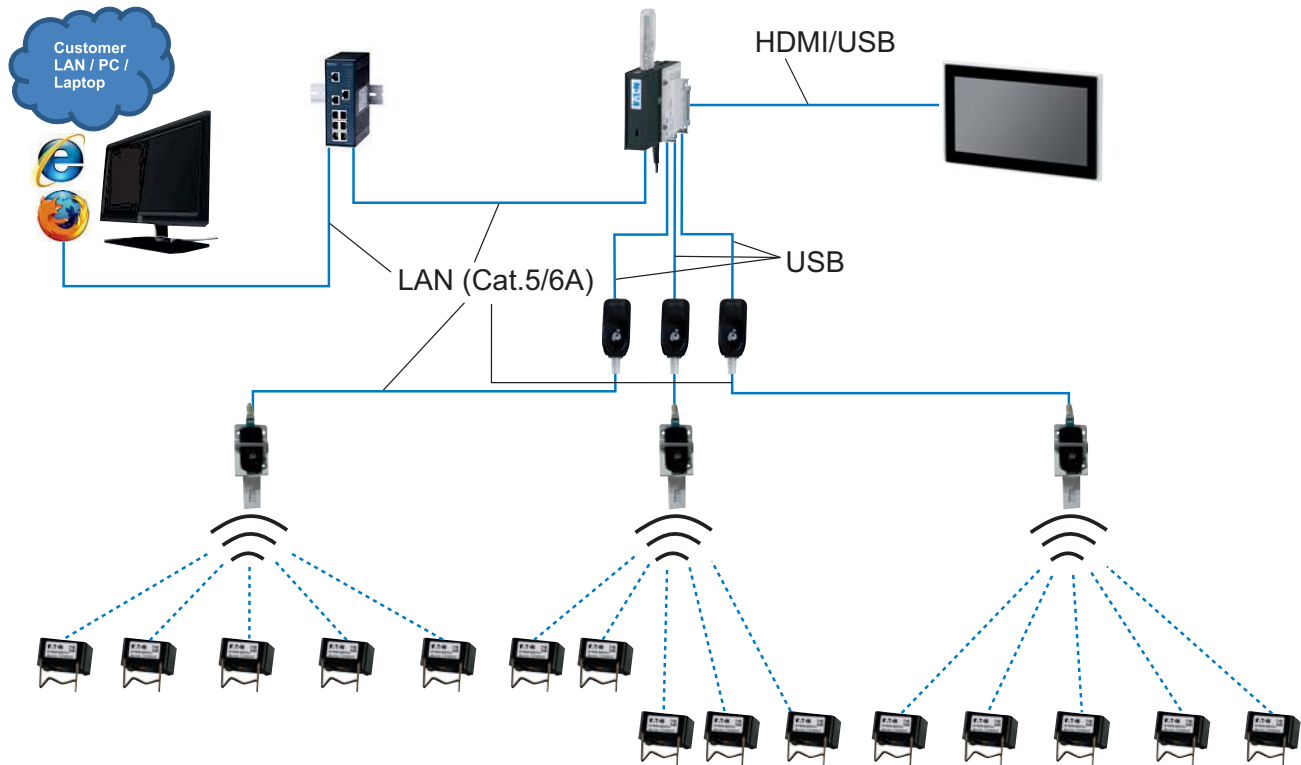
Every 10 minutes the sensors will be checked, their status will be recorded and their data will be saved. The log-file will be saved for one month. After one month, older data will be time-compressed. To prevent any overwriting of data, the DIAGNOSE Controller can be equipped with an additional memory card. Depending on the capacity of the memory card,

you can save log-files over very long periods of time. The log-file will be displayed both as a graph and in an Excel table. These data are the basis for displaying the analysis data in a chart.

## Possible arrangement of DIAGNOSE components in the switchgear assembly



## Functional overview



## System description

DIAGNOSE is a wireless and maintenance-free temperature monitoring system for busbar systems and ambient temperatures. It can be adapted to any system size and can be expanded to meet any requirements. The sensors can directly be fixed at the critical points in a system. These points are precisely defined in the installation instructions of each system; they are arranged according to field (section) types. Every 10 minutes every busbar sensors transmits its current status, receivers will receive the status and forward it to the DIAGNOSE Controller through a cable-based connection. In addition, the ambient air temperature of individual sections or the entire assembly can be measured and recorded. For this purpose, we provide PT1000 sensors with a cable length of one meter. This type of sensor can be connected to a temperature input. Every temperature input can be connected to 2 sensors. The temperature input transmits one reading per hour to the USB receiver. This default setting preserves battery life and thus extends the lifespan of the device.

The receiver sends the data it receives from the sensor to the Controller where they are processed/compared. The Diagnostics Controller processes the data it receives, compares them with the threshold limit values saved in the system and then shows the respective status. In the DIAGNOSE Controller all data will be collected and compared with the respective threshold limit values. If a temperature gets close to a maximum permitted

threshold limit, a pre-warning level will be triggered. This will be displayed in orange in the Diagnostics software. In the overview, the respective sensor will change its colour. If a temperature value exceeds the respective threshold limit, the sensor will turn red. If a sensor does not send any information (no current on the busbar), it will be indicated in yellow.

All the data collected will be displayed graphically and can be exported as an Excel table. Further processing of the data, e.g. in charts, can be done at any time. This ensures continuous long-time transparency which can make an analysis so much easier. A slight increase in temperature of individual connection points for example can be detected at a very early stage. This is usually a sign of contact loss which can usually be fixed with just a few touches (by tightening the screws for example).

## Internet or SCADA connection:

The Internet or SCADA connection can be realized through a network connection. Depending on the respective situation you can use a UMTS compatible router, a standard network router or a fibre-optic converter system. The system as such is based on an HTML

interface which can be opened any time through a standard Internet browser and can therefore be integrated into any network. If the Controller is connected with the Internet, it also offers the opportunity to automatically install any updates available from a server.

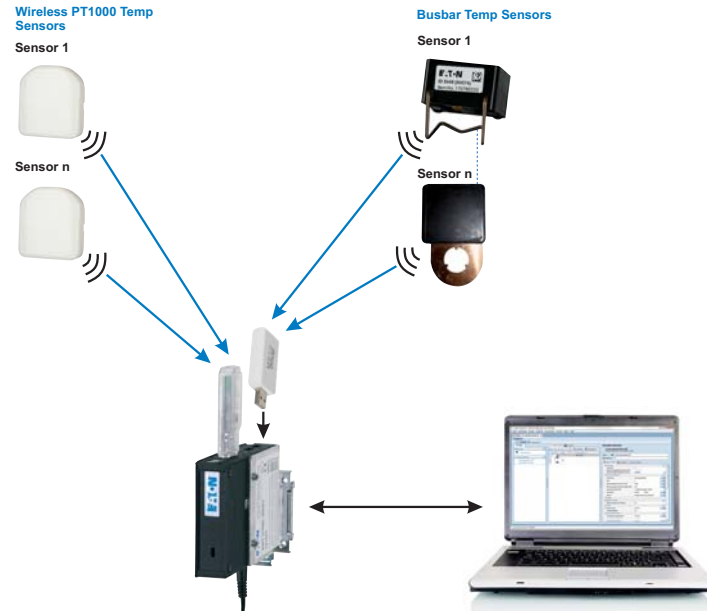


## System overview

### Basis Configuration 1:

Local connection to PC/laptop via static IP address, configuration and data readout via PC/laptop, no network connection required, max. 5 sections can be monitored with one USB receiver, additional monitoring of ambient air temperature as reference value. Since only one USB receiver is being used in this configuration, the size of the assembly is limited to 5 sections.

The reason for this is the transmission power of the sensors, as the metal separations may interfere with the signal. (Proposal: Install the controller, including the USB receiver, in the middle section to ensure reliable data transfer from the neighboring sections (2 sections to the left / 2 sections to the right).

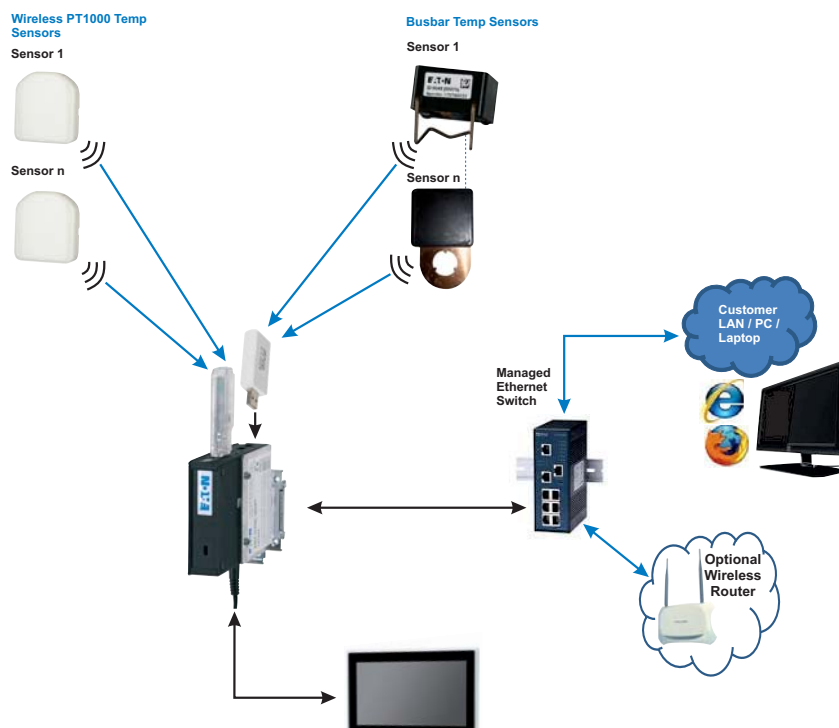


### Configuration 2:

Extended connection to the local network (LAN) using a dynamically generated IP address (via DHCP), configuration and readout of the data via remote access, the status and measured values can be displayed locally (HMI), a maximum number of 5 sections can be monitored with one USB receiver, additional monitoring of ambient air temperature as reference value.

Since only one USB receiver is being used in this configuration, the size of the assembly is limited to 5 sections.

The reason for this is the transmission power of the sensors, as the metal separations may interfere with the signal. (Proposal: Install the controller, including the USB receiver, in the middle section to ensure reliable data transfer from the neighboring sections (2 sections to the left / 2 sections to the right).



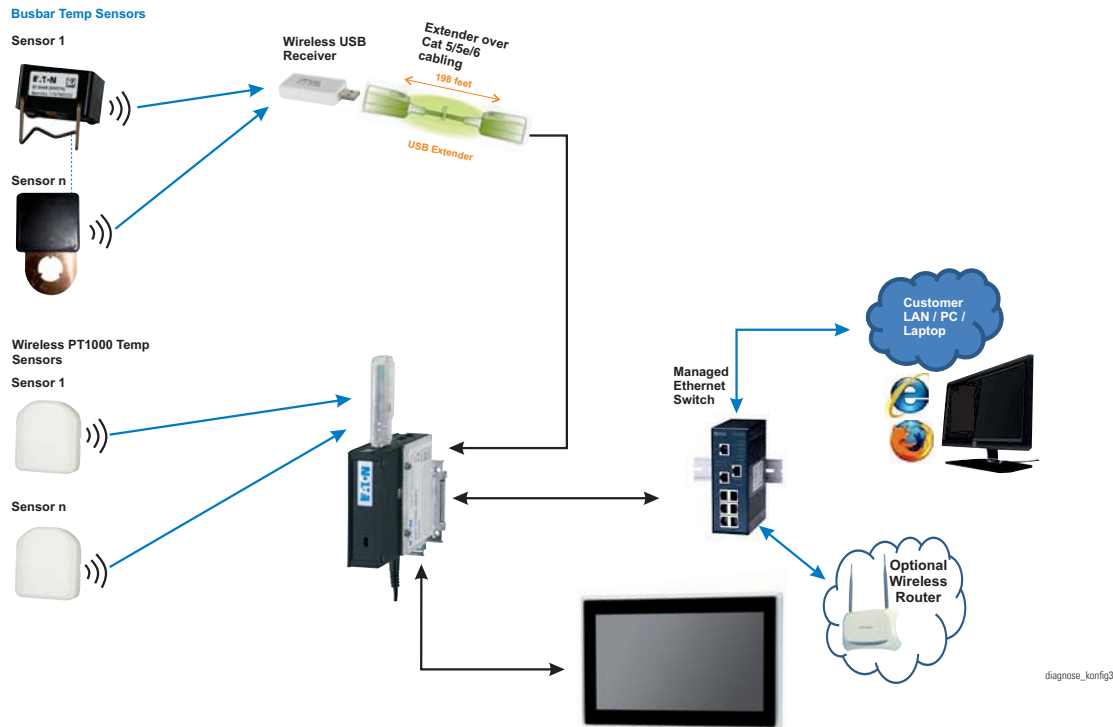
## System overview

### Configuration 3:

This is an extended version of configuration 2 - up to 4 USB receivers can be connected to the controller via so-called USB extensions, which allows for the monitoring of up to 20 sections.

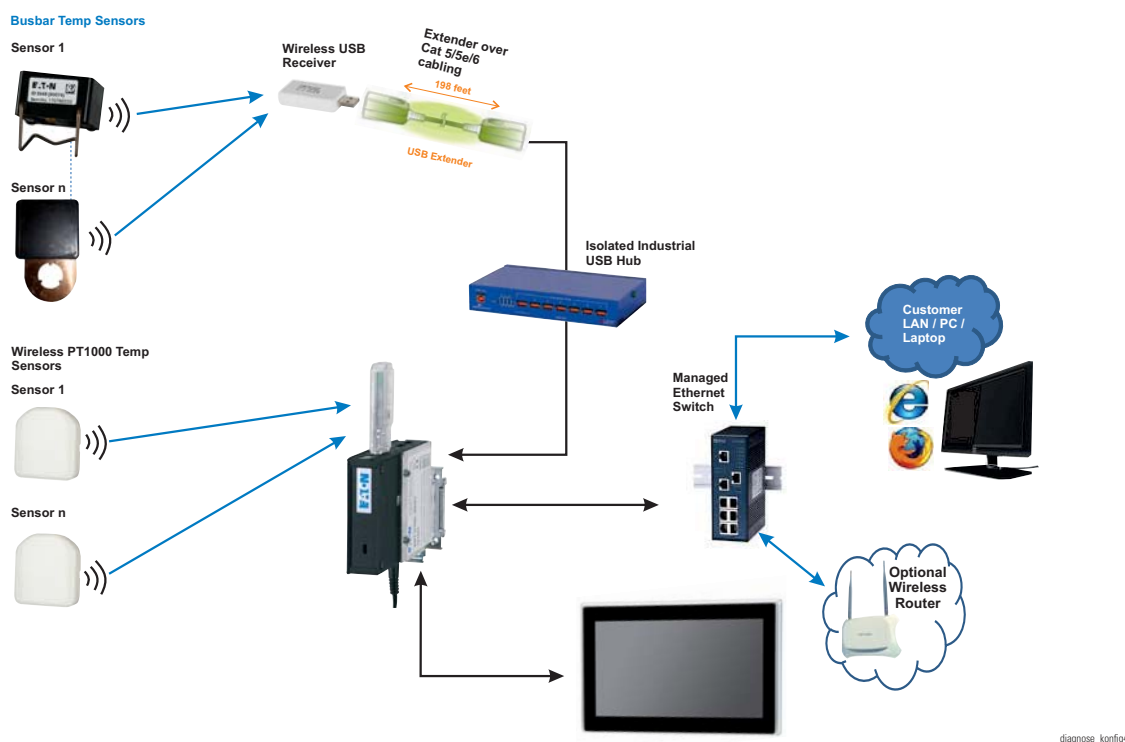
If the USB extension is to be used, the installation principle remain the same as in configuration 1 and 2.

This means that receiver 1 - which collects the data from the sensors in section 1 through 5 - should be installed in section number 3. Receiver 2 should be placed in section 8 and is responsible for the sensors in sections 6 to 10, etc. The distance to the central controller will be bridged via standard cabling (Cat 5 or higher).



### Configuration 4: It is possible to monitor up to 35 sections with one controller:

Via extensions, up to 7 USB receivers can be connected to a USB hub, which communicates directly with the controller and transmits the values from all sensors.



## Detailed explanation of the individual components

### DIAGNOSE-Controller:

The heart of Eaton DIAGNOSE is the DIAGNOSE Controller. This is where the system configuration is uploaded to and saved. The threshold limit values for the different field/section configurations are already pre-configured at the factory before delivery. After DIAGNOSE has been started up, all the data/temperatures collected will be saved for one month. Following that period, the first data saved will be gathered at a time.

#### Features:

- The controller is equipped with the following interfaces:  
USB (5x), HDMI (2x), LAN (1x)
- Wireless connection of the busbar sensors (XNT-DIAG) via the USB receiver
- Measurement range up to 150°C (rail)
- Limit temperatures default / freely definable
- Power supply 12V DC via plug-in power supply
- Measuring of ambient temperature via 868 MHz USB receiver (included in the delivery)
- The number of sensors depends on the selected measurement method (basic, standard, advanced)

### Sensors (busbar sensors):

Our sensors are designed for universal application. This means that one and the same sensor can be used for any configuration. However, there are differences in the fastening technology. In most cases the sensor can be mounted using the fixing bracket integrated on the device. This bracket is designed for a material (copper) thickness of 10 mm. In order to cover all the other cases of application there are brackets available for 15 and 20 mm

#### Features:

- Self-sufficient on induction principle („self-harvesting“)
- Temperature measuring range 0 - 150°C
- Clamp mounting 10 mm copper busbar
- Optional 15 or 20 mm clamp mounting
- Optional screw mounting on M10 / M12 copper plates

### Maintenance:

The sensors are equipped with a modern Energy-Harvesting-System, they don't need batteries and are therefore maintenance-free. Three minutes after a minimum current of 100A is available, the sensors start transmitting. After the sensors have been fully charged, they will transmit their status every 10 minutes.

### Sensors (ambient temperature):

To be able to measure the ambient temperature in a targeted way in the individual fields/sections, we provide a universal sensor that can be placed anywhere and is equipped with a cable connection. The cable needs to be connected to a temperature input which forwards the collected data. The cable length of 1 m allows both a placement directly at

#### Features:

- 1 Basis with connection of 2 channels
- 2 x PT1000 sensor
- Wireless connection to the controller via 868 MHz signal
- Every temperature input has a unique device ID (see sticker)

### Maintenance:

The sensor as such is maintenance-free. Only the temperature input is equipped with a coin cell which needs to be replaced every 5 years approximately.

Thanks to its large memory capacity, gathering data over the course of several years does not pose any problem for the DIAGNOSE controller. Should a software update become necessary while the internet connection is not active, this can also be implemented in the offline mode via the USB drive.

For first installation and configuration, please refer to the installation instructions.

- The configuration takes place via a standard Ethernet connection
- IP address via DHCP or fixed IP optional
- Automatic software update (available via FTP)
- Connection of up to 4 receivers (XNT-REC) either directly or using a USB extension (XNT-USB-EXTENDER)
- Max. 200 rail sensors / 100 environment sensors
- Connection to a SCADA system is possible via Modbus / TCP

thickness, too. These brackets need to be ordered separately and have to be changed on the sensor using an Allen key included in the delivery. In addition, there is an adapter plate available which makes it possible to screw-fasten the sensor at Cu connections. The holes in the adapter are placed in a way that an M10 screw can be used on one side or an M12 screw on the opposite side.

- Wireless connection to the controller via 2.4 GHz signal
- Every sensor has a unique device ID (see label).
- Message of relevant temperature data, energy storage and signal strength
- Can be installed and retrofitted simple, no service required

Although the sensors undergo comprehensive testing (100% routine test) prior to delivery, we nevertheless recommend individual testing of all sensors with a suitable testing device (XNT-SENSOR-TEST), in order to be able to react to any undefined state faults before the system is commissioned. (This also serves as an additional check of the signal strength between controller and installation site).

critical points in the cabinets and a freely selected placement of the temperature input that is easy to access at any time.

In addition, it is possible to place ambient temperature sensors in modules or in drawers. This is how we provide an uninterrupted monitoring chain.

- Message of relevant temperature data, battery voltage, etc.
- Battery life 5 years
- Can be installed and retrofitted simple
- Screw/adhesive mounting

## Detailed explanation of the individual components

### USB receiver 2.4 GHz

The USB drive serves as the interface between the controller and the sensors in the respective section of the main busbar. The number of sensors per receiver is limited to 200. The USB stick can be connected to the controller directly or by using a USB extension.

#### Features:

- 2.4 GHz signal
- A maximum of 4 USB receivers can be connected directly to the controller or through a USB extension (which allows for the monitoring of 20 sections)

In general, no more than 5 sections should be monitored through one receiver, to ensure that the signal is sufficiently strong to transmit the measurements.

- To monitor larger assemblies, a USB hub should be used

### Receiver holder:

To install the receiver in a safe and stable way in the cabinet, Eaton provides a mounting device which can easily be fixed at any point easy to access in the system. All you need to fix that holder is 2 screws.

### USB extenders:

They are necessary to establish a connection between the USB hub and the receiver (1 extender for each receiver). For the connecting lines you can use standard LAN cables CAT5 or higher.

The length of the LAN cables can vary depending on the distance between the receiver and the hub.

#### Features:

- USB Plug Socket Combination
- Connection of both components via LAN CAT. 6 Cable
- Power supply via USB port
- Incl. bracket for mounting

### USB-Hub:

The safe and reliable monitoring of larger assemblies makes the use of multiple USB receivers necessary. This hub is equipped with 7 USB ports, which allows for the active supervision of up to 35 sections.

The USB drive can be connected directly to the USB hub or by using a USB extension. The device is equipped with lateral mounting brackets that can be turned for flexible installation in various positions.

#### Features:

- 24 V DC power supply (adapter not included)

### Gateway/Switch:

A gateway or switch establish a connection to LAN/WLAN networks.

### Wireless router:

The wireless router cannot be specified by Eaton because it can be designed differently according to each network.

Please consult your local IT specialist to get the support you need (Security Policy).

Eaton is a power management company with 2017 sales of \$20.4 billion. We provide energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power more efficiently, safely and sustainably. Eaton is dedicated to improving the quality of life and the environment through the use of power management technologies and services. Eaton has approximately 96,000 employees and sells products to customers in more than 175 countries.

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