Switchgear Electrical Nodes Wireless Temp. Monitoring Solution

Wireless Temp. Monitoring, for switchgear, local display, electrical nodes temperature monitoring

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Acrel Co., Ltd.

No.253 Yulv Road, Jiading District, Shanghai, China

2023/12/14 Ver.

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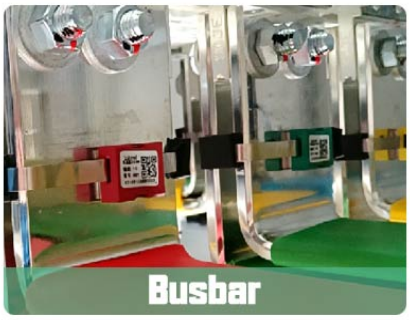
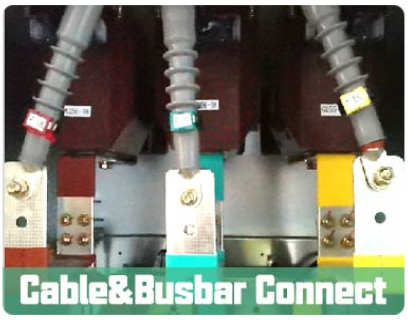
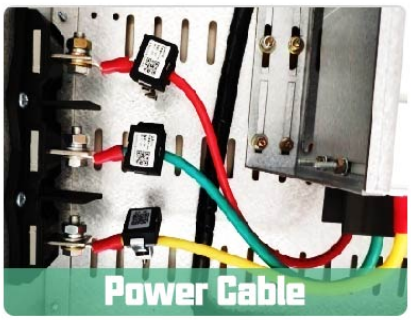
0. Application Scenario

(1) This wiressless temperature monitoring solution was majorly designed for monitoring and alarming the temperature of crucial electrical connection nodes in switchgear like busbar, power cable, cable&busbar connection, CB's fixed contact, CB's moving contact and etc.
(2) Such electrical connection nodes have the potential threat of fire hazard due to the aging of material, slackness of connection and etc. Thus a real-time temperature monitoring and alarm system will be necessary to prevent it from potential fire hazard causing by the rising of temperature.
(3) Solution here was major designed for local temperature display and alarm only. Distinguish from other Acrel wireless temperature monitoring soloution which also has IoT cloud system monitoring function.
(4) Unlike the traditional wired temperature monitoring solution, wireless temperature monitoring solution make the connection between temeperature sensor and temperature transceiver wireless. This will largely ease the installation and make the overall solution more flexible.







(1) Major Temperature Monitoring Nodes Showcase

Wireless Temperature Sensor　　Wireless Temperature Transceiver

(4) WIreless Connection for esasy installation

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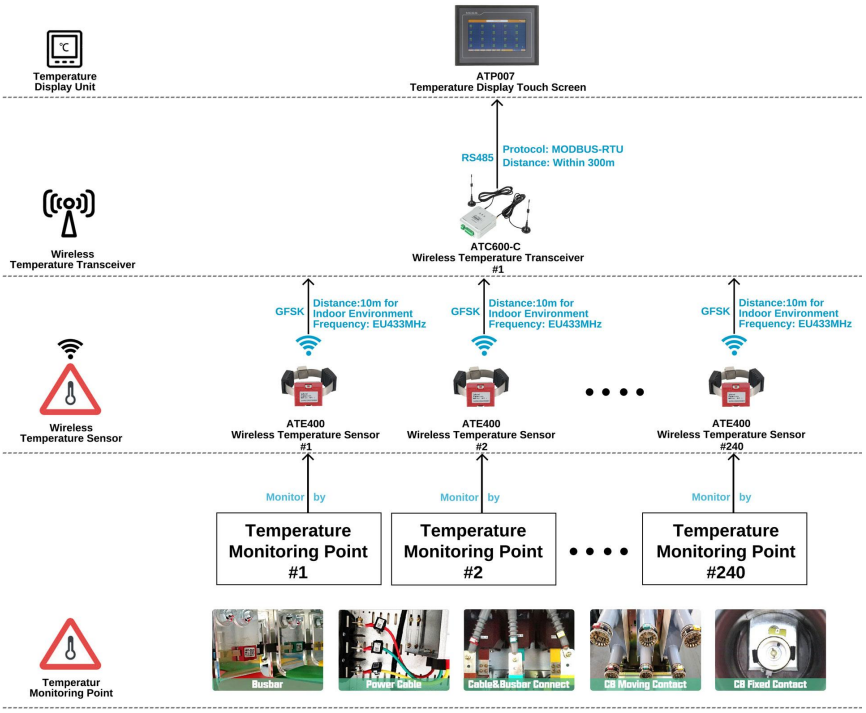
0. Solution Selection Logic

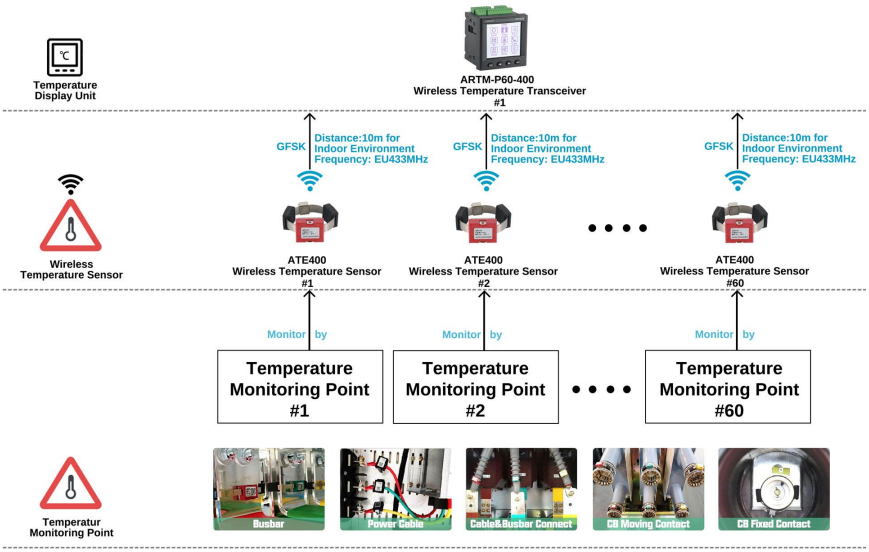
Judging by application scenario and function requirement, solution could be devided into 4 basic solution:

(1) Functional Wireless Temperature Monitoring Solution [Suitable for large quantity of monitoring nodes, touch screen local display, ATP007+ATC600+ATE400+KDYA-DG30-24K]

(2) Economic Wireless Temperature Monitoring Solution [Suitable for medium quantity of monitoring nodes, meter panel local display, ARTM-P60-400+ATE400]



(1) Functional Wireless Temperature Monitoring Solution



(2) Economic Wireless Temperature Monitoring Solution

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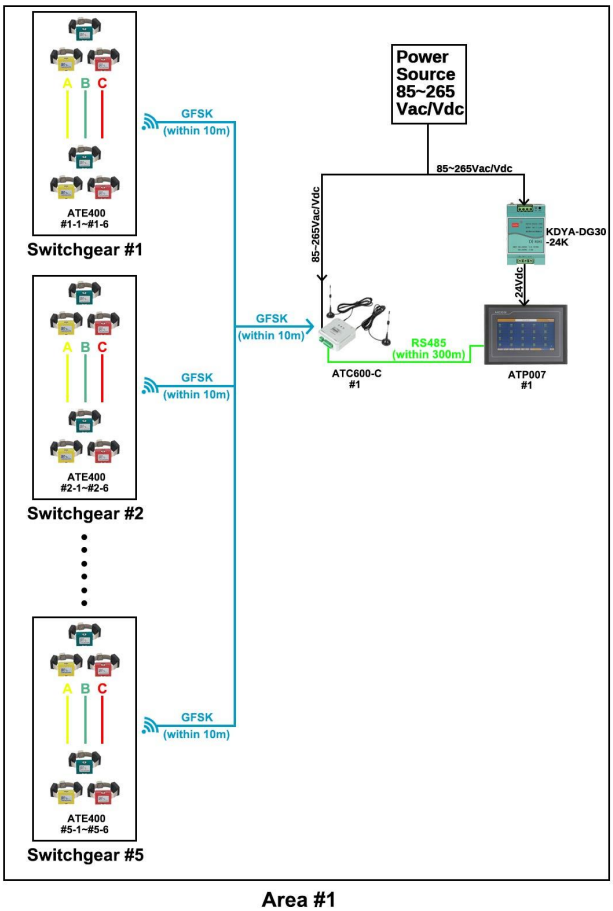
1. Scenario Preset [Functional Wireless Temperature Monitoring Solution]

(1) The target was to monitor and alarm the temperature of 5 switchgears deployed in a single room. Only local display and alarm of temperature was requested.
(2) Each switchgear require 6 temperature moniotoring points for electrical connection nodes. Thus there will be 30 temperature monitoring points in total.
(3) The system voltage of switchgear will be 10kV.
(4) For all temperature monitoroing points, there will be current going through when it's in normal operation. [more than 5A, since starting current of ATE400 need to be more than 5A]]

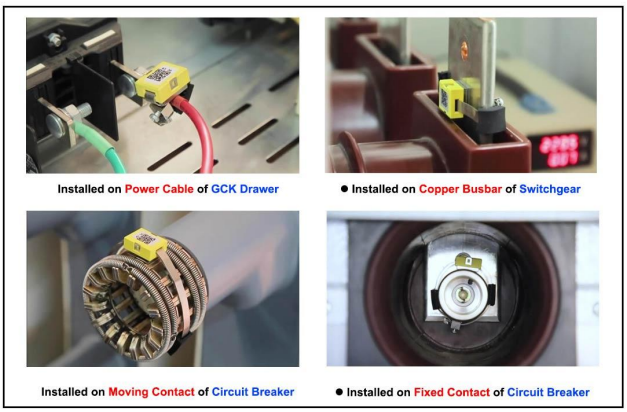
1. Devices Deployment [Functional Wireless Temperature Monitoring Solution]

Area #1 - Switchgear #1 ~ #5:

- 1* ATP007 Temperature Display Touchscreen [For display and alarm for all temperature data]
- 1* ATC600-C Wireless Temperature Transciever [For collecting the temp. data from ATE400 wireless temp. sensors and further upload the data to ATP007]
- 30* ATE400 Wireless Temperature Sensor [For monitoring the temperature of electrical connection nodes and send the data to ATC600-C via GFSK wirelesss Comms.]
- 1* KDYA-DG30-24K Power Supply Module [Paired with ATP007 for 85~265Vac/Vdc Power Supply input]



Area #1



Switchgear Temperature Monitoring Point Showcase

Note 1: Green line stand for RS485 Wired communcation line
Note 2: GFSK is a type of Radio Wireless Comms. Methods

(1) Devices deployment plan Illustraton

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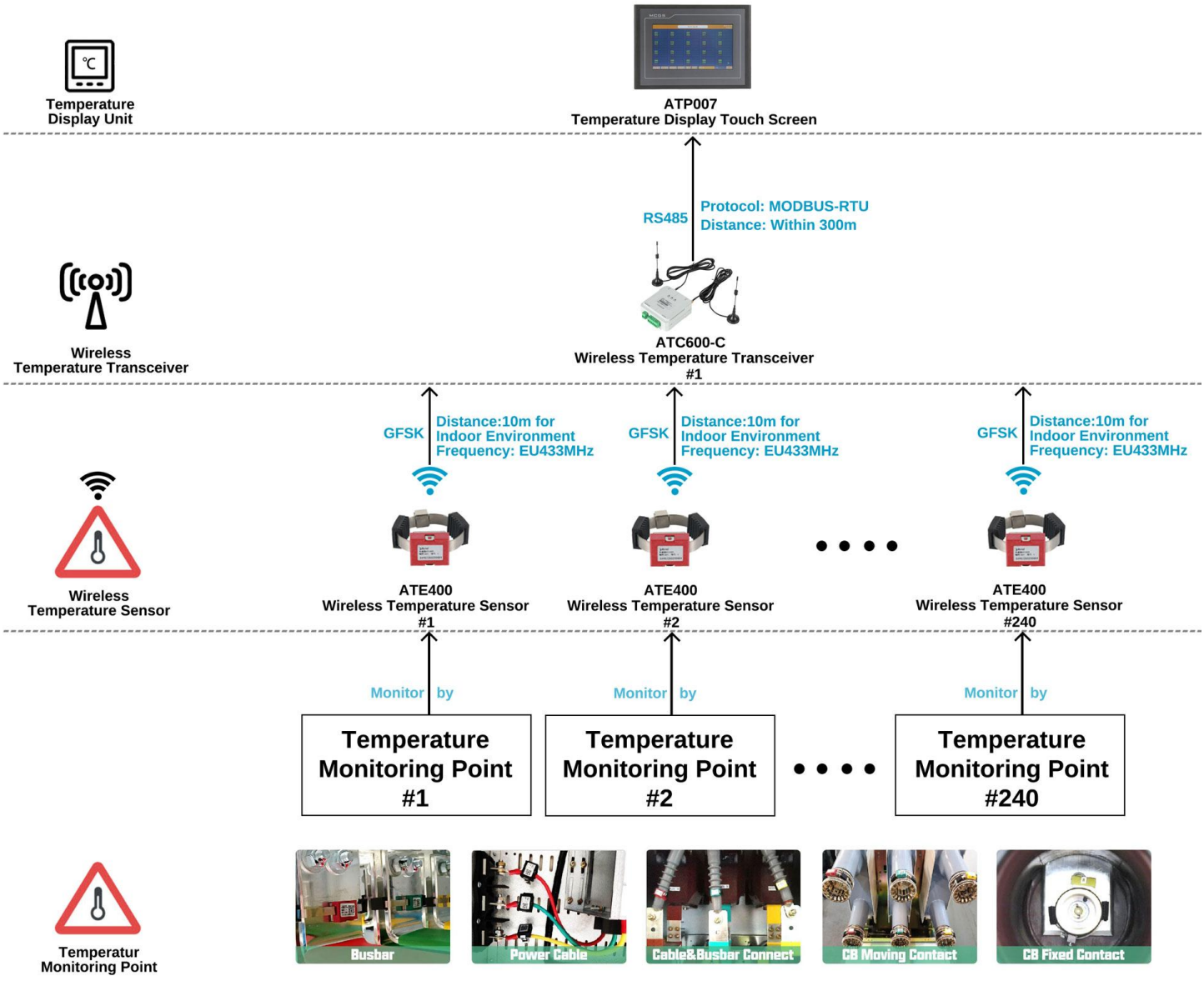
1. Communication Structure & Logic [Functional Wireless Temperature Monitoring Solution]

(1) Between ATE400 wireless temperature sensor and ATC600-C wireless temperature transceiver, we are using a radio wireless communications called GFSK. The communication distance is within 100m [when in open area] and is within 10m [when in indoor environment and penetrate 1 layer of metal cover of switchgear]. The communication protocol is self defined protocol. [1 ATC600 can support up to 240 pcs ATE400 if comms. distance allowed.]
(2) Between ATP007 smart touch screen and ATC600-C wierless temperature transceiver, we are using common RS485 communications based on MODBUS-RTU protocol. Although for this RS485 communication, it's wired comms. But normally the ATP007 and ATC600-C was installed closedly to each other, so that remain the most part of communication structure still wireless. [1 pcs ATP007 can support and display the temp. data of up to 240 pcs ATE400]



(1&2) Communication Structure

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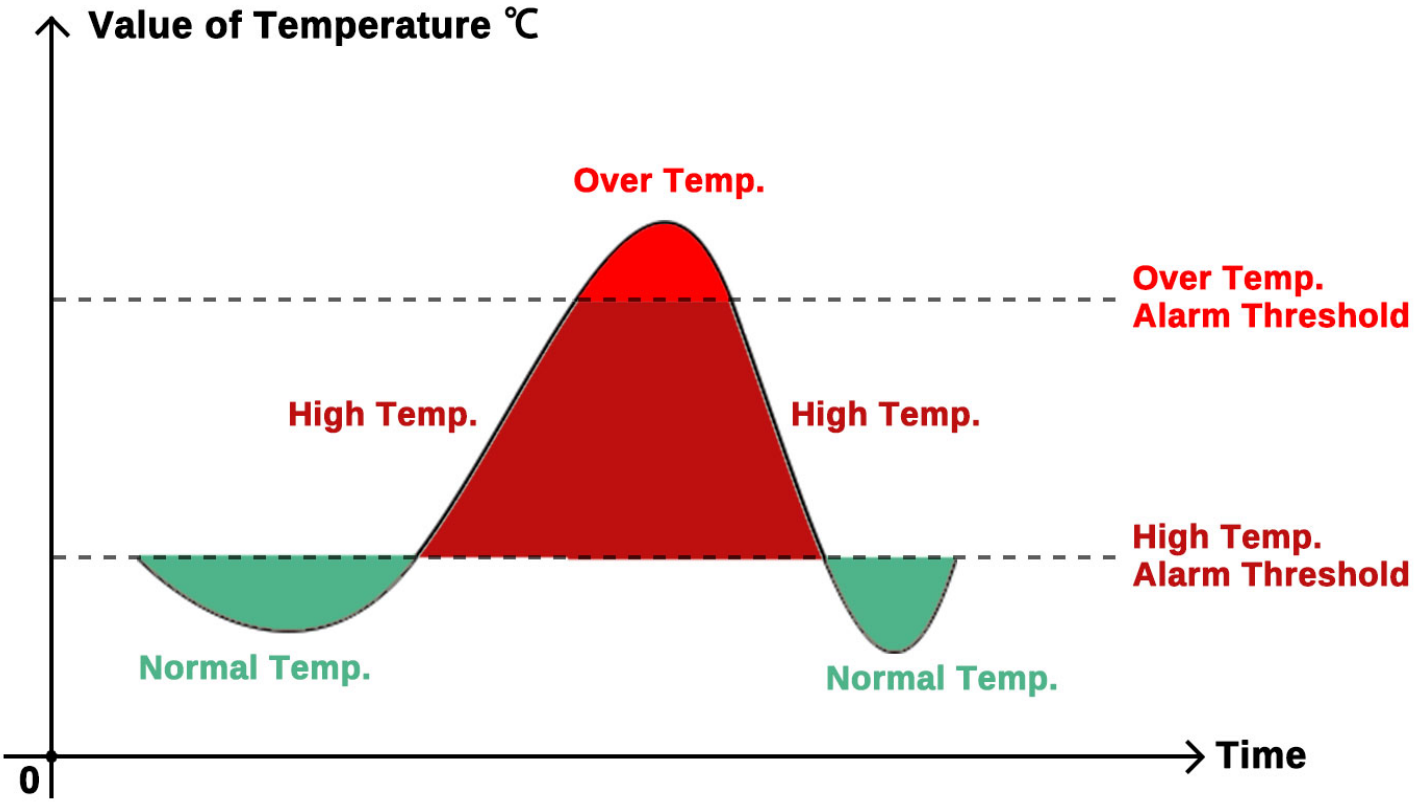
1. Temperature Alarm Function&Logic [Functional Wireless Temperature Monitoring Solution]

ATP Seires Tempearture Display Devices support 2 types of major temperature alarm logic. When any of the below alarm logic was set and triggered, it will alarm the buzzer up.

(1) High Temperature Alarm: When temperature of certain monitoring node was higher than a certain preset threshold value, this will twigger high temperature alarm. [Normally used as a pre-alarm for mentioning related person to take care of temperature rising issue in monitoring places]

(2) Over Temperature Alarm: Similar like high temperature alarm, but over temperature alarm normally will be preset a higher alarm threshold. [Normally used for alarming the related person that there are severe temperature rising issue happened and need to be solved immediately]



(1&2) High&Over Temperature Alarm

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1. Hardware Devices Overview [Functional Wireless Temperature Monitoring Solution]

Model 1: ATE400 Wireless Temperature Sensor

GFSK Wireless | -50℃~+125℃ [±1℃]
Temp. Sensor | 35kV&5000A below

- Temperature Measuring Range: -50℃~+125℃
- Measuring Accuracy: ±1℃
- Wireless Comms: GFSK Radio Comms. [self-defined protocol]
- GFSK Comms. Distance: 100m [open area] & 10m [indoor environment, penetrate 1 layer of metal cover of cover]
- Insulation Voltage: suitable for 35kV and below
- Max Working Current: up to 5000A
- Power Supply: CT Sensing Power [starting current >=5A]
- Lifespan: >= 10 years

Model 2: ATC600-C Wireless Temperature Transceiver

Temp. Transceiver | Up to 240 Sensors
GFSK Wireless | 1-way RS485

- Wireless Comms.: GFSK Radio Comms. [self-defined protocol]
- GFSK Comms. Distance: 100m [open area] & 10m [indoor environment, penetrate 1 layer of metal cover of cover]
- Wired Comms.: 1-way RS485 [MODBUS-RTU protocol]
- Support: up to 240 pcs ATE series Wireless Temperature Sensors based on GFSK
- I/O Function: 2-way DO output
- Power Supply: 100~265Vac/Vdc
- Working Temperature: -20℃~+55 ℃
- Working Humidity: <=95%

Model 3: ATP007 Temp. Display&Alarm Touch Screen

Touch Screen | 2-way RS485
Temp. Display | 1-way Ethernet

- Comms.: 2-way RS485 [MODBUS-RTU]; 1-way Ethernet [MODBUS-TCP]
- Support: Display the temp. data of up to 240 pcs ATE series temperature sensors.
- Power Supply: 24Vdc [±10%]; consumption 15W
- Screen Size: 7 inchs [10 inchs option available, module ATP010]
- Working Temperature: -10℃~+55 ℃
- Working Humidity: <=95%

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1. Hardware Devices Overview [Functional Wireless Temperature Monitoring Solution]

Input Range	Output Range
100~240Vac/Vdc	24Vdc

Model 4: KDYA-DG30-24K Power Supply Module

- Rated Input Range: 100~240Vac/Vdc
- Rated Outpu Range: 24Vdc
- Application: paired with ATP007 for power supply input

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1. Overall Model Selection&Quoation [Functional Wireless Temperature Monitoring Solution]

(1) This Quotation doesn't include freight charge. To gain a complete quotation, please refer the actual quantity that you want to request for the actual order, once we receiving it. We will issue a Official Proforma Invoice with Acrel Stamps on it for later procedure.

Temp. Display&Alarm Touch Screen					
Overview Picture	**USAGE&MODULE NAME**	**DESCRIPTION & SPECIFICATION**	**QUANTITY**	**FOB UNIT PRICE (USD)**	**AMOUNT (USD)**
	Touch Screen **ATP007**	**Comms.:** 2-way RS485 (MODBUS-RTU); 1-way Ethernet [MODBUS-TCP] **Support:** Up to 240 ATE series Transceiver. **Auxiliary Power Supoply**: 24Vdc **HS Code:** 8471609000	1 pcs		
Power Supply Module					
Overview Picture	**USAGE&MODULE NAME**	**DESCRIPTION & SPECIFICATION**	**QUANTITY**	**FOB UNIT PRICE (USD)**	**AMOUNT (USD)**
	Power Module **KDYA-DG30-24K**	**Rated Input:** 100~240Vac/Vdc **Rated Output:** 24Vdc **Application:** Paired with ATP007 for power supply **HS Code:** 8473309000	1 pcs		
Wireless Temperature Transceiver					
Overview Picture	**USAGE&MODULE NAME**	**DESCRIPTION & SPECIFICATION**	**QUANTITY**	**FOB UNIT PRICE (USD)**	**AMOUNT (USD)**
	Temperature Transceiver **ATC600-C**	**Upstream:** RS485 (MODBUS-RTU) **Downstream:** GFSK (EU433 MHz) **Support:** Up to 240 ATE series wireless temperature sensors using GFSK communication. **Power Supply:** 100~265Vac **HS Code:** 9025191010	1 pcs		
Wireless Temperature Sensor					
Overview Picture	**USAGE&MODULE NAME**	**DESCRIPTION & SPECIFICATION**	**QUANTITY**	**FOB UNIT PRICE (USD)**	**AMOUNT (USD)**
	Wireless Temperature Sensor **ATE400**	**Communication:** GSFK (EU433 MHz) **Measuring Range:** -50℃~+125℃ **Power Supply:** CT sensing power supply (starting current>5A) **HS Code:** 9025191010	30 pcs		

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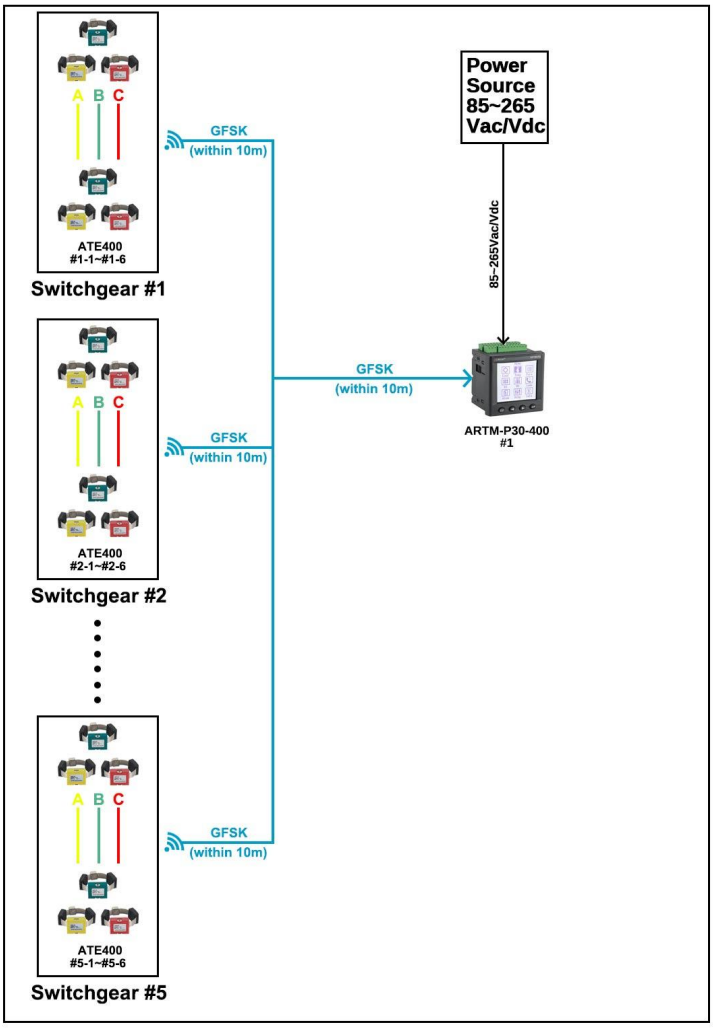
2. Scenario Preset [Economic Wireless Temperature Monitoring Solution]

(1) The target was to monitor and alarm the temperature of 5 switchgears deployed in a single room. Only local display and alarm of temperature was requested.
(2) Each switchgear require 6 temperature moniotoring points for electrical connection nodes. Thus there will be 30 temperature monitoring points in total.
(3) The system voltage of switchgear will be 10kV.
(4) For all temperature monitoroing points, there will be current going through when it's in normal operation. [more than 5A, since start current of ATE400 need to be more than 5A]

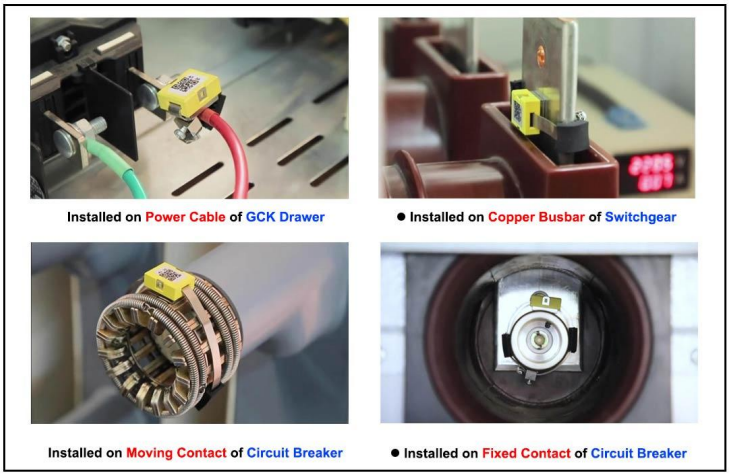
2. Devices Deployment [Economic Wireless Temperature Monitoring Solution]

Area #1 - Switchgear #1 ~ #5:

- 1* ARTM-P30-400 Wireless Temperature Transceiver and Display Unit [For collecting, displaying and alarming for all temperature data collected from ATE400]
- 30* ATE400 Wireless Temperature Sensor [For monitoring the temperature of electrical connection nodes and send the data to ARTM-P30-400 via GFSK wirelesss Comms.]



Area #1



Switchgear Temperature Monitoring Point Showcase

Note 1: Green line stand for RS485 Wired communcation line
Note 2: GFSK is a type of Radio Wireless Comms. Methods

(1) Devices deployment plan Illustraton

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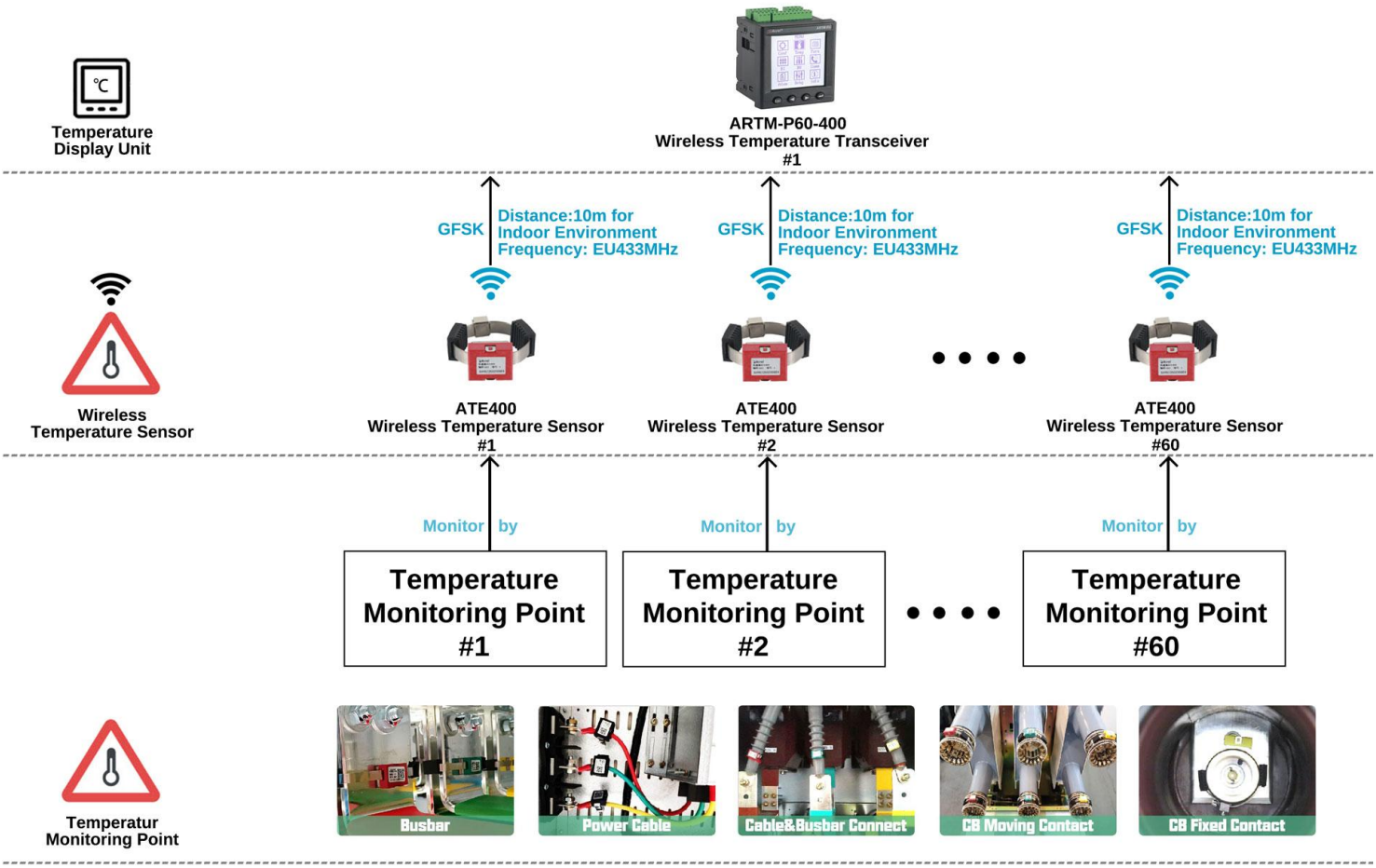
2. Communication Structure & Logic [Economic Wireless Temperature Monitoring Solution]

(1) Between ATE400 wireless temperature sensor and ARTM-P30-400 wireless temperature transceiver and display unit, we are using a radio wireless communications called GFSK. The communication distance is within 100m [when in open area] and is within 10m [when in indoor environment and penetrate 1 layer of metal cover of switchgear]. The communication protocol is self defined protocol. [1 pcs ARTM-Pn can support up to 60 pcs ATE400 if comms. distance allowed.]



(1) Communication Structure

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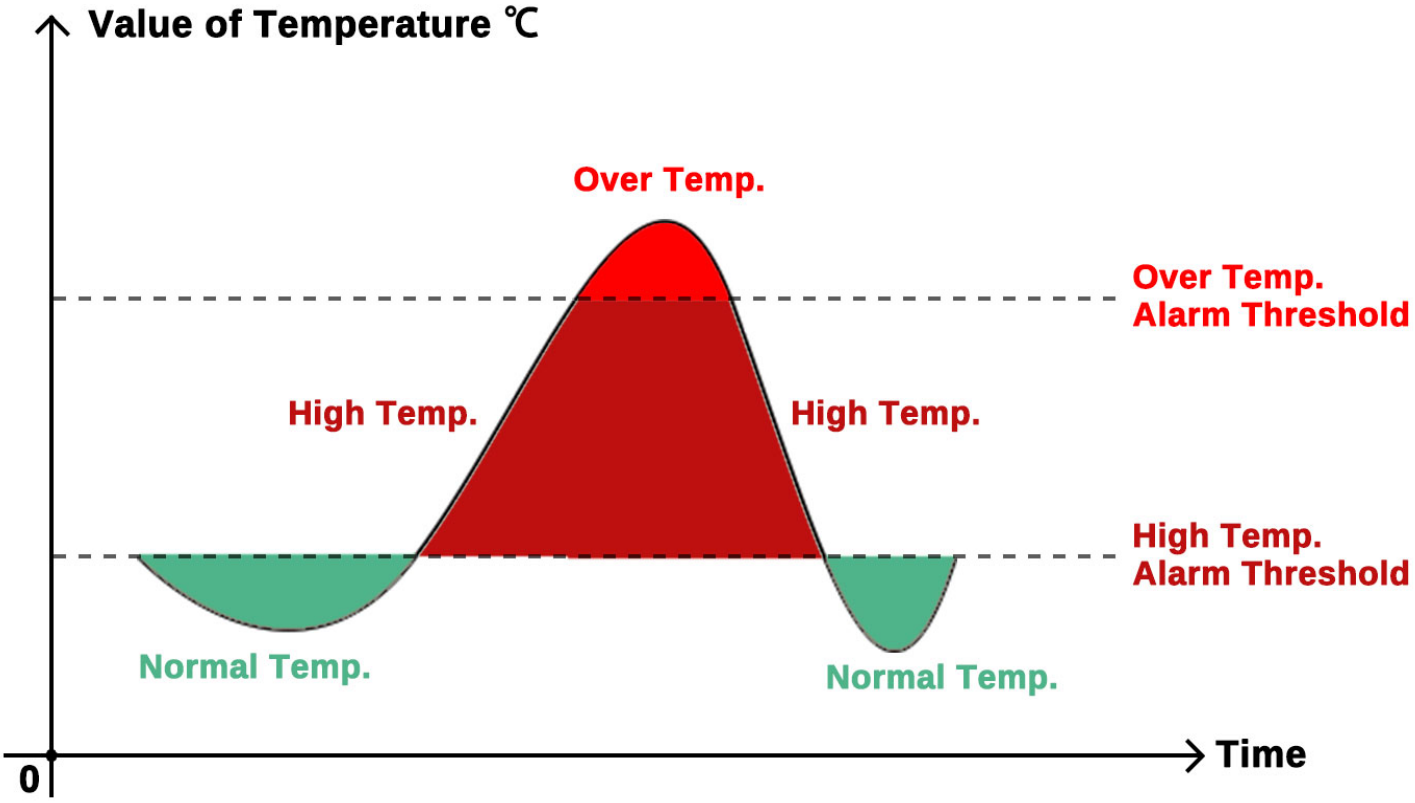
2. Temperature Alarm Function&Logic [Economic Wireless Temperature Monitoring Solution]

ARTM-Pn Seires Wireless Tempearture Transceiver and Display Devices support 4 types of major temperature alarm logic. When any of the below alarm logic was set and triggered, it will give a DO output to other indication devices like buzzer or LED light.

(1) High Temperature Alarm: When temperature of certain monitoring node was higher than a certain preset threshold value, this will twigger high temperature alarm. And eventually, this will trigger 1st way DO alarm output of ARTM-Pn. [Normally, High Temperature Alarm was used as a pre-alarm for mentioning related person should take care of temperature rising issue in monitoring places]

(2) Over Temperature Alarm: Similar like high temperature alarm, but over temperature alarm normally will be preset a higher alarm threshold. And once alarm was triggered, this will also trigger 2nd way DO alarm output of ARTM-Pn. [Normally, Over Temperature Alarm was used for alarming the related person that there are severe temperature rising issue happened and need to be solved immediately]



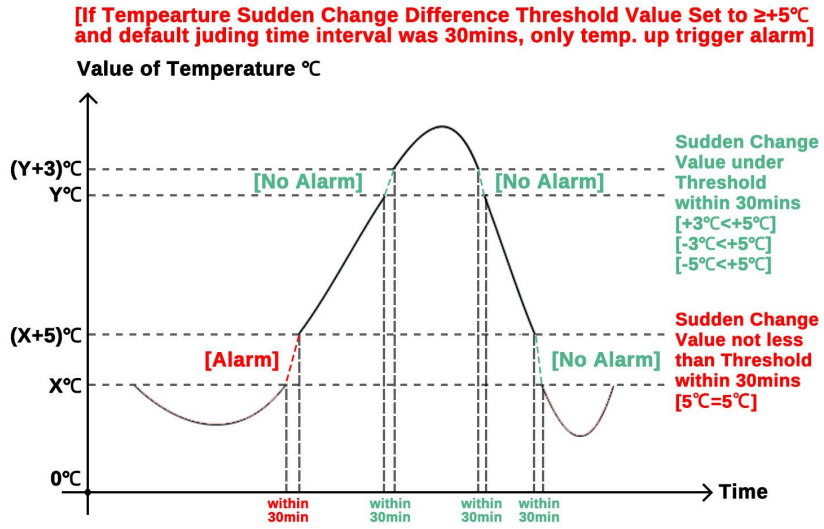
(1&2) High&Over Temperature Alarm

2. Temperature Alarm Function&Logic [Economic Wireless Temperature Monitoring Solution]

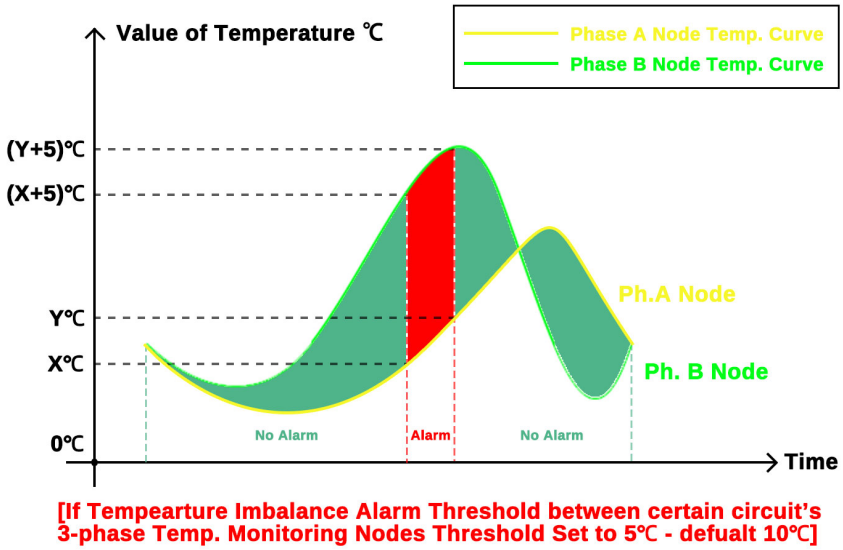
ARTM-Pn Seires Wireless Tempearture Transceiver and Display Devices support 4 types of major temperature alarm logic. When any of the below alarm logic was set and triggered, it will give a DO output to other indication devices like buzzer or LED light.

(3) Temperature Sudden Rising Change Alarm: When during a certain period [within 30mins], if there was large temperature sudden rising change happened, then it will trigger temperature sudden change alarm. [like +10℃ temperature rising during 5 mins for example , also, this temperature sudden change alarm threshold value could be set by customer between 0~125℃] Eventually, this will trigger 2nd way DO alarm output of ARTM-Pn. [Noted: This temperature sudden change alarm will only last for 5 mins at most once triggered.]

(4) Temperature imbalance alarm between 3* temperature monitoring nodes of certain circuit 3-phase: When the temperature difference between 3 monitoring nodes of cetain circuit 3-phase [like between phase A&B&C temperature monitoring nodes of circuit #1] was larger than a certain preset threshold value [take 10℃ temperature difference between any 2 of phase A&B&C temperature monitoring nodes of circuit #1 for example] This will trigger temperature imbalance alarm and eventually trigger 2nd way DO alarm output of ARTM-Pn.



(3) Temperature Sudden Change Alarm



(4) Temperature Imbalance Alarm Logic

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2. Hardware Devices Overview [Economic Wireless Temperature Monitoring Solution]

Model 1: ATE400 Wireless Temperature Sensor

GFSK Wireless | -50℃~+125℃ [±1℃]
Temp. Sensor | 35kV&5000A below

- Temperature Measuring Range: -50℃~+125℃
- Measuring Accuracy: ±1℃
- Wireless Comms: GFSK Radio Comms. [self-defined protocol]
- GFSK Comms. Distance: 100m [open area] & 10m [indoor environment, penetrate 1 layer of metal cover of cover]
- Insulation Voltage: suitable for 35kV and below
- Max Working Current: up to 5000A
- Power Supply: CT Sensing Power [starting current >=5A]
- Lifespan: >= 10 years

Model 2: ARTM-Pxx-400 Wireless Temperature Transceiver and Display Unit

GFSK Wireless | Up to 60 Sensors
Transceiver&Display | RS485 (MODBUS)

- Wireless Comms.: GFSK Radio Comms. [self-defined protocol]
- GFSK Comms. Distance: 100m [open area] & 10m [indoor environment, penetrate 1 layer of metal cover of cover]
- Wired Comms.: 1-way RS485 [MODBUS-RTU protocol]
- Support: up to 60 pcs ATE series Wireless Temperature Sensors based on GFSK
- Alarm Function: High temperature Alarm, Temperature sudden change alarm and etc.
- I/O Function: 2-way DO output, 4-way DI input
- Power Supply: 85~265Vac or 100~300Vdc
- Working Temperature: -20℃～+55 ℃
- Working Humidity: <=95%

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2. Overall Model Selection&Quoation [Economic Wireless Temperature Monitoring Solution]

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Wireless Temperature Transceiver and Display Unit					
Overview Picture	**USAGE&MODULE NAME**	**DESCRIPTION & SPECIFICATION**	**QUANTITY**	**FOB UNIT PRICE (USD)**	**AMOUNT (USD)**
	Temperature Transceiver **ARTM-Pn**	**Comms.:** RS485 (MODBUS-RTU); GFSK [Wireless Comms. with Sensor] **Support:** Up to 60 ATE series Transceiver. **Auxiliary Power Supoply**: 85~265Vac L-N **Alarm Function:** High temperature Alarm, Temperature sudden change alarm and etc **HS Code:** 9025191010	1 pcs		
Wireless Temperature Sensor					
Overview Picture	**USAGE&MODULE NAME**	**DESCRIPTION & SPECIFICATION**	**QUANTITY**	**FOB UNIT PRICE (USD)**	**AMOUNT (USD)**
	Wireless Temperature Sensor **ATE400**	**Communication:** GSFK (EU433 MHz) **Measuring Range:** -50℃~+125℃ **Power Supply:** CT sensing power supply (starting current>5A) **HS Code:** 9025191010	30 pcs		

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3. Project Sample #1 - Italy Enel Green Power Project

(1) Project Overview:

· **Customer:** SEL S.P.A [Switchgear Complete set factory]
· **Country:** Italy
· **Project Aim:** Integrate Acrel wireless temperature monitoring devices with switchgear s produced by SEL S.P.A for adding satety feature to their switchgear products.
· **Project Amount:** About 400.000 USD

SEL MADE IN ITALY

Wireless Temperature Sensor

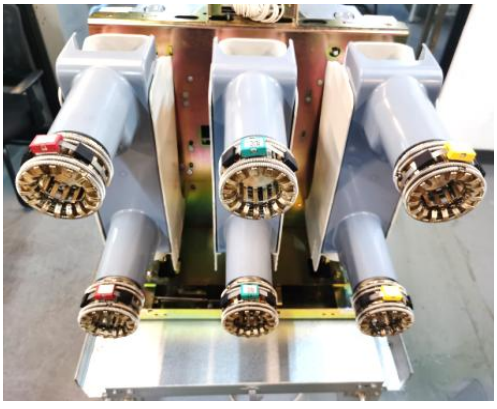
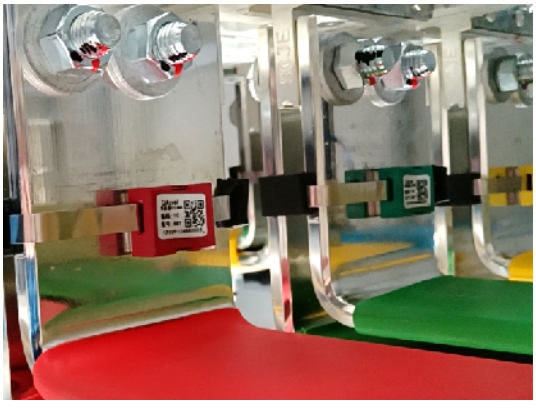
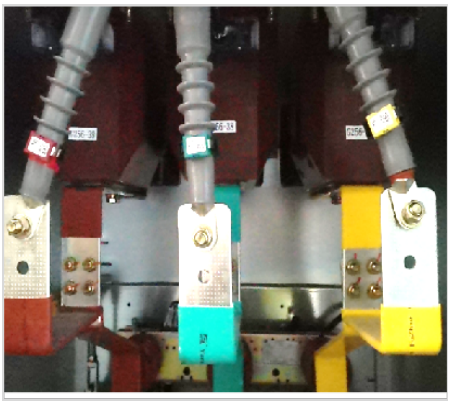

Wireless Temperature Transceiver and Display Unit

(1) Customer: SEL S.P.A [Switchgear Complete set factory]

(1) Project Aim: Switchgear Wireless Temperature Monitoring

(2) Applied Product Combination:

- ARTM-P30-400 Wireless Temperature Transceiver and Display Unit
[For collecting, displaying and alarming for all temperature data collected from ATE400]
- ATE400 Wireless Temperature Sensor
[For monitoring the temperature of electrical connection nodes and send the data to ARTM -P30-400 via GFSK wirelesss Comms.]

(2) Site Installation Picture

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3. Project Sample #2 - Vietnam Lotte Mart Project

(1) Project Overview:

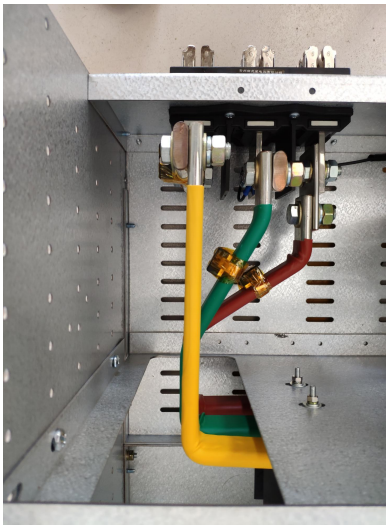
· **Customer:** V.T.E.C.H Electrical Technology Co., Ltd , EPC [Party A]
· **Country:** Vietnam
· **Project Aim:** Client use Acrel complete Cloud Wireless Temperature Monitoring Solution for monitoring and alarming electric cabinet in Lotte Mart to ensure electricity safety.
· **Project Amount:** About 100.000 USD

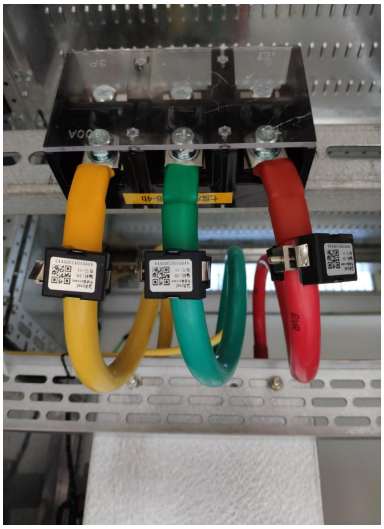
(1) Customer: V.T.E.C.H Electrical Technology Co., Ltd , EPC [Party A]

(1) Project Aim: Online IoT based Wireless Temperature Monitoring&Alarming

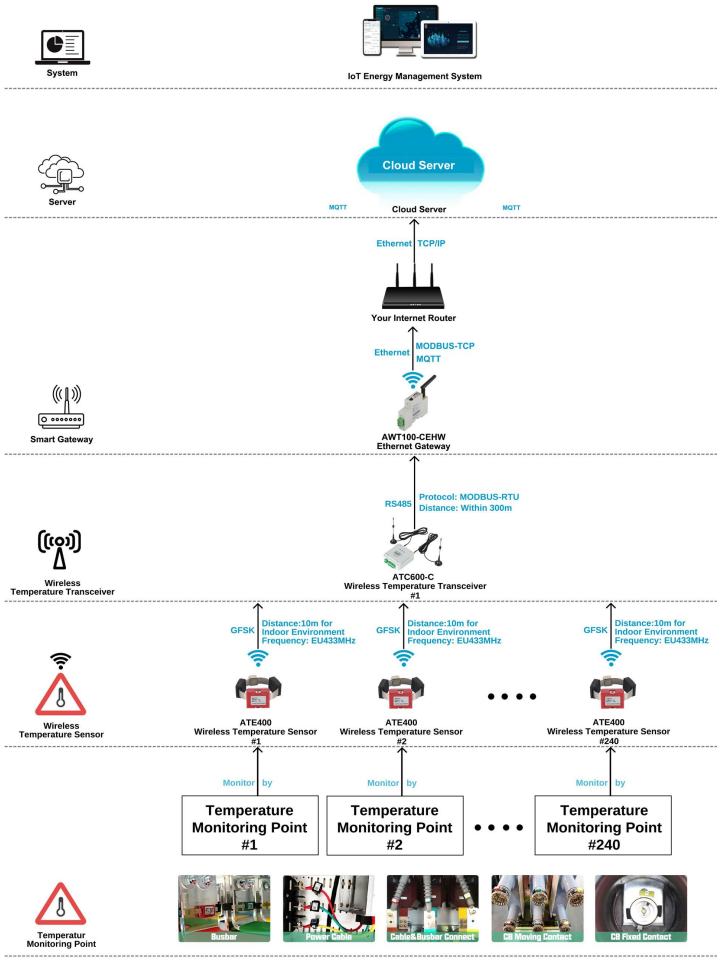
(2) Applied Product Combination:

- AWT100-CEHW Ethernet IoT Gateway
- AWT100-POW Power Supply Module
- ATC600-C Wireless Temperature Transceiver
- ATE400 Wireless Temperature Sensor





(2) Site Picture Gallery



(2) Solution Overall Structure