Data Center AC Power System Precision Energy Management Solution

AC Data Center, precise energy sub metering for PDU/Server Rack/IT equipment, multi-circuit metering, centralized alarm&display, 3rd party integration

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AC Data Center Precision Distribution Energy Monitoring [Local or to 3rd Party]

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0. Application Scenario

(1) This solution was designed for precision sub energy monitoring of AC Data Center.

(2) Normally, the power system of AC data center will be supplied by 2 independent mains supply for the stable and sustainable. Also, multiple UPS will be used for data center reliable power supply. And the most important loads of data center will be IT equipments power by PDU sourced from Main AC power distribution cabinet for these loads. Thus, the monitoring to this Main AC power distribution cabinet of both dual incoming circuits 3-phase sourced from 2 independant mains supply and multiple outgoing circuits for powering all PDU will be a key for a precise submetering for this AC data center.

(3) This solution was majorly for local energy monitoring, different from Acrel IoT Cloud energy monitoring solution which is designed for AC Data Center online cloud energy monitoring. In other hands, this solution could be also adapted to 3rd party IoT energy monitoring system by the integration between Acrel energy meter to 3rd party IoT gateways via RS485 [MODBUS-RTU protocol]. Or by the integration between Acrel IoT gateway and 3rd party IoT system via 4G, WiFi, Ethernet [MQTT or MODBUS-TCP protocol].
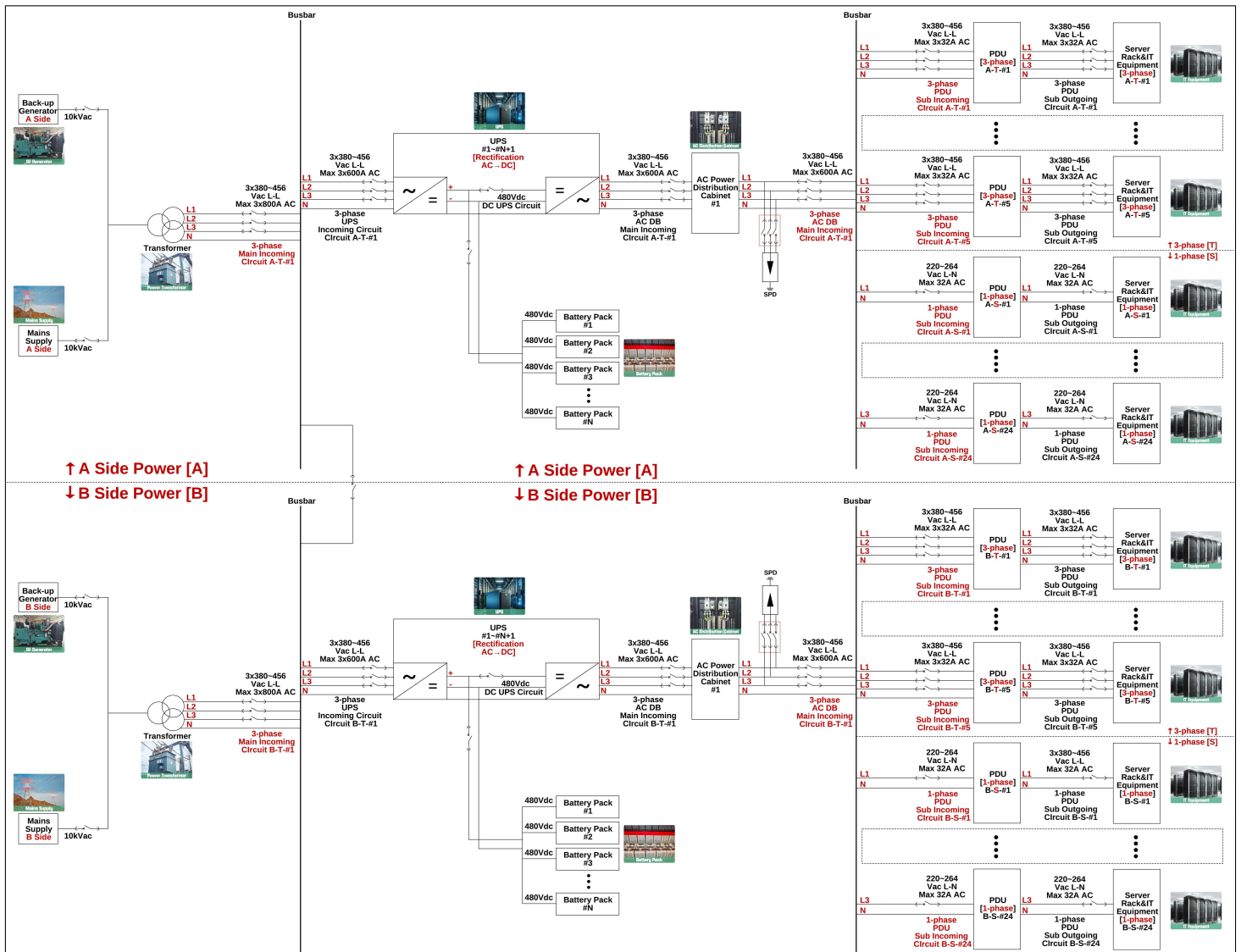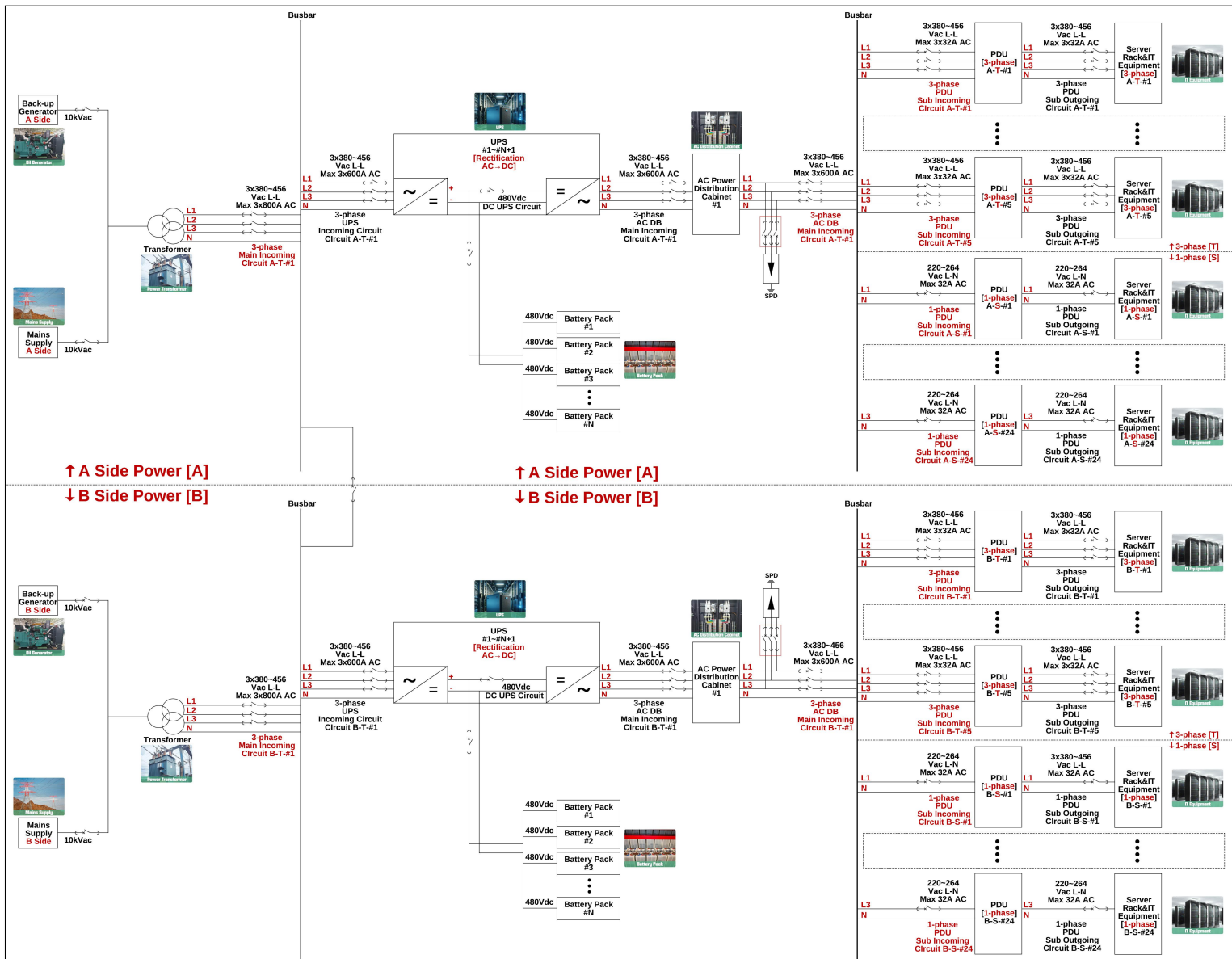

(1) Power system structure and major energy monitoring point of AC Data Center

AC Data Center Precision
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1. Scenario Preset

In order to see how will Acrel hardware devices actually deployed on actual site, we will preset a scenario according to actual site sample as following [divided as AC and DC parts]:

(1) 2 nos 3-phase Main Incoming Circuits of AC Power Distribution Cabinet [Sourced from 2 independent mains]: rated current 3x600A AC; rated voltage 3x380~456Vac L-L; monitoring circuit's busbar size will be 400mm² [40mm*10mm for each busbar]

(2) 10 nos 3-phase Sub Outgoing Circuits of AC Power Distribution Cabinet [Supplied to 10 nos 3-phase Server Racks/IT Equipments]: rated current 3x32A AC; rated voltage 3x380~456Vac L-L; monitoring circuit's cable size will be 1-core 6mm² [for each cable]

(3) 48 nos 1-phase Sub Outgoing Circuits of AC Power Distribution Cabinet [Supplied to 48 nos 1-phase Server Racks/IT Equipments]: rated current 32A AC; rated voltage 220~264Vac L-L; monitoring circuit's cable size will be 1-core 6mm² [for each cable]

(1) Scenario Preset for monitoring AC Data Center

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2. Devices Deployment

For centralized Data Display&Alarm and some basic Configuration

- 1* ATP007kT Smart Touch Screen [For centralized data display and alarm for all AMC100-ZA and AMC100-FAK metering module.]

For monitoring 2 nos 3-phase Main Incoming Circuits of AC Power Distribution Cabinet

- 1* AMC100-ZA Dual-circuit AC Energy Meter [For monitoring 2 circuits 3-phase; powering ATP007kT, AMC100-FAK sub module; collect data from AMC100-FAK and further upstream; DI port connected to CB OF/SD for on/off status monitor; DO connected to Buzzer/LED for alarm]
- 6* AKH-0.66/I 40I 600A/5A Solid-core Current Transformer [paired with AMC100-ZA for 3-phase current signal input]

For monitoring 10 nos 3-phase Sub Outgoing Circuits to 10 nos 3-phase PDU

- 1* AMC100-FAK30 Multi-circuit AC Energy Meter [For monitoring 10 circuits 3-phase]
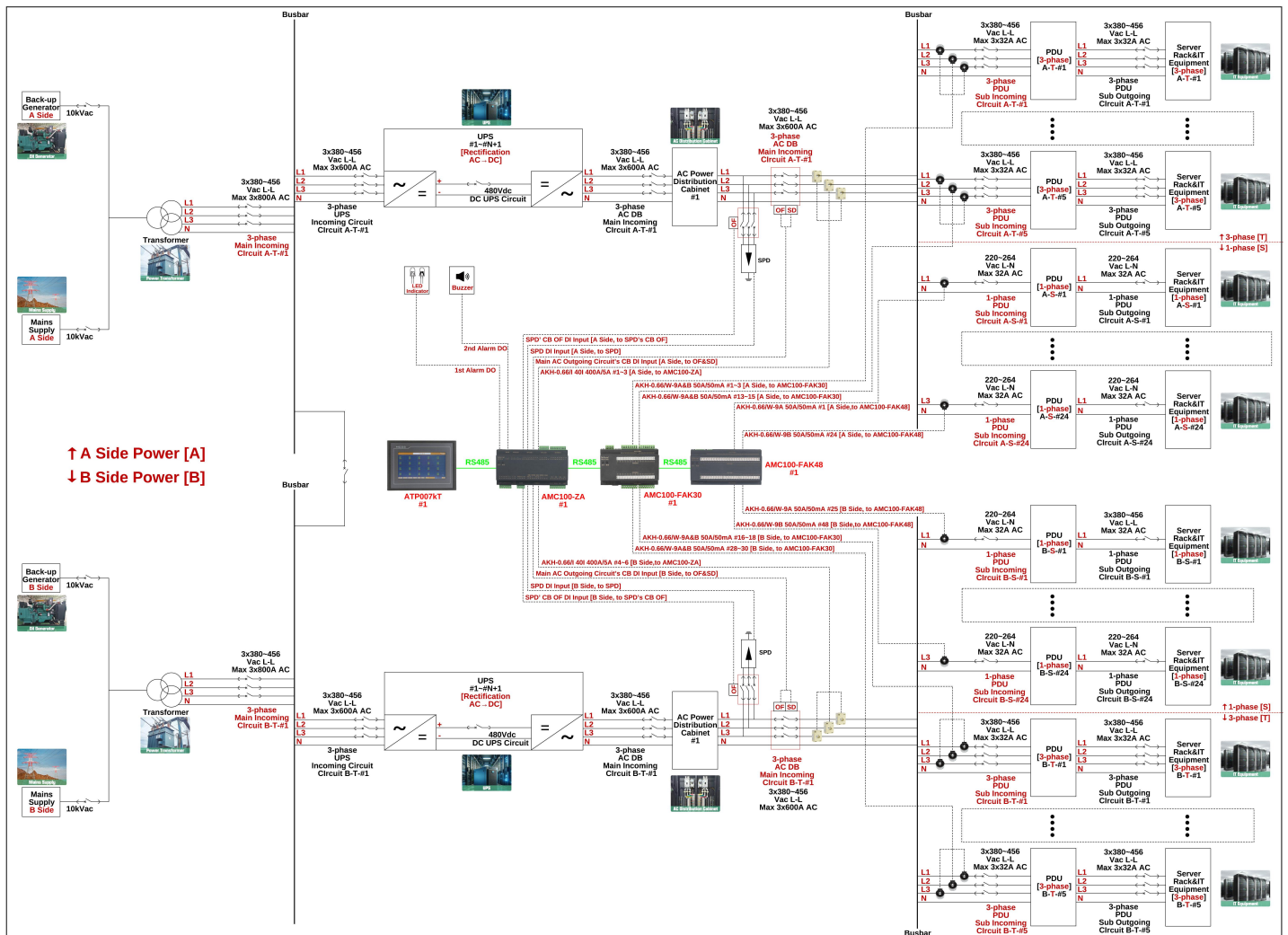- 15* AKH-0.66/W-9A Solid-core Current Transformer [for AMC100-FAK30 current signal input]
- 15* AKH-0.66/W-9B Solid-core Current Transformer [for AMC100-FAK30 current signal input]

For monitoring 48 nos 1-phase Sub Outgoing Circuits to 48 nos 1-phase PDU

- 1* AMC100-FAK48 Multi-circuit AC Energy Meter [For monitoring 48 circuits 1-phase]
- 24* AKH-0.66/W-9A Solid-core Current Transformer [for AMC100-FAK48 current signal input]
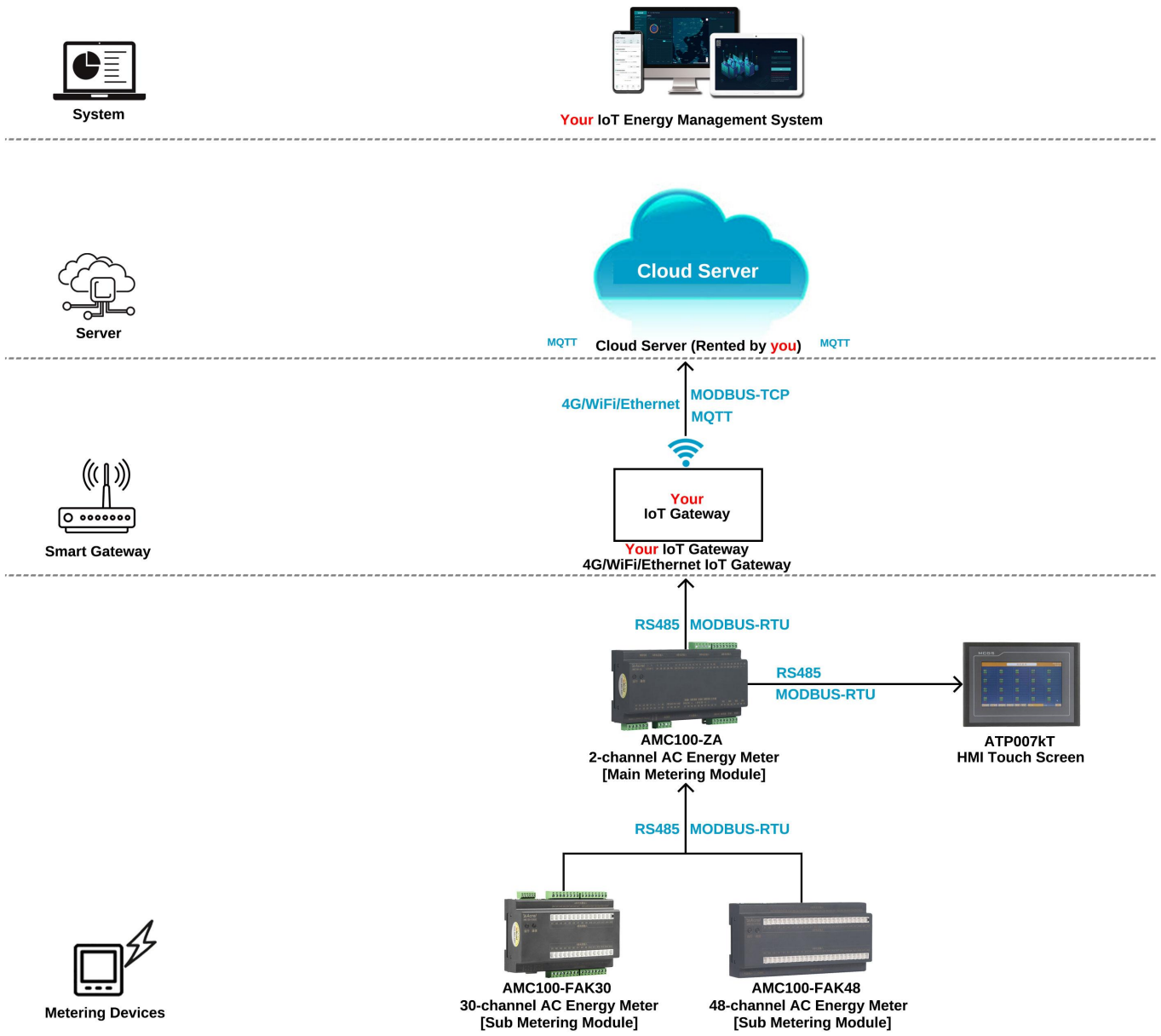- 24* AKH-0.66/W-9B Solid-core Current Transformer [for AMC100-FAK48 current signal input]

(1) Hardware Devices Deployment Plan for AC Data Center

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AC Data Center Precision Distribution Energy Monitoring [Local or to 3rd Party]

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3. Communication Structure&Logic [When integrated with 3rd party IoT gateway]

IoT Energy Monitoring is the trend of future. So, if the customer/your side already have your own IoT system platform and your own IoT gateway which has been already integrated with your IoT system. And in this case you don't need Acrel IoT gateway and IoT system, but you want to receive the data from Acrel Energy Meter to your system instead. Then, then integration between Acrel Energy Meter AMC100-ZA and your IoT gateway will be the key for overall system integration.

(1) AMC100-ZA support 3-channel RS485 communications based on MODBUS-RTU protocol. So, if your IoT gateway also support downstream communications of RS485 [MODBUS-RTU], then it will be possible to do the integration of this part. [Acrel side will provide MODBUS Mapping of energy meter for technical assistance]
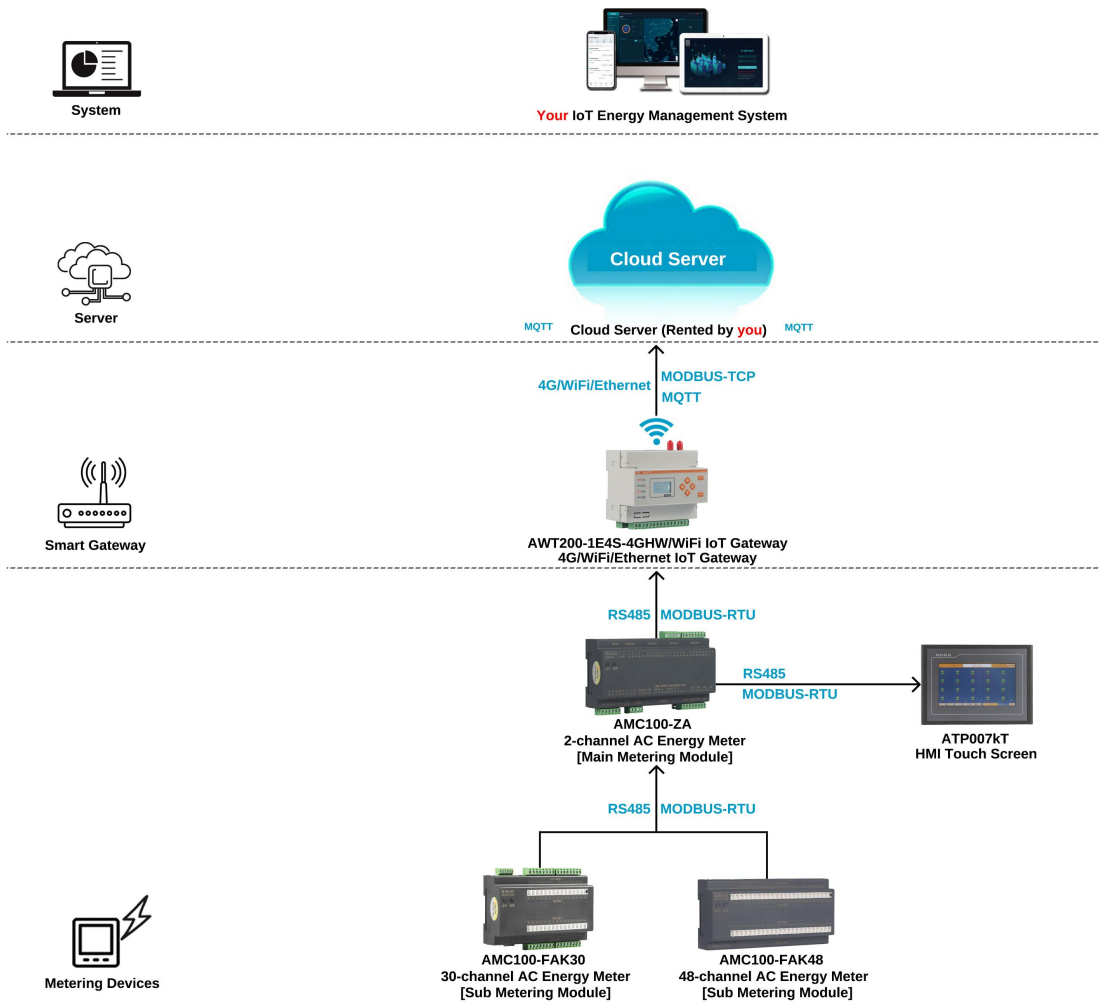

System

Your IoT Energy Management System

Server

Cloud Server

MQTT   **Cloud Server (Rented by you)**   MQTT

4G/WiFi/Ethernet   **MODBUS-TCP**
MQTT

Your IoT Gateway

Smart Gateway

Your IoT Gateway 4G/WiFi/Ethernet IoT Gateway

RS485 MODBUS-RTU

RS485
MODBUS-RTU

AMC100-ZA 2-channel AC Energy Meter [Main Metering Module]

ATP007kT HMI Touch Screen

RS485 MODBUS-RTU

Metering Devices

AMC100-FAK30 30-channel AC Energy Meter [Sub Metering Module]

AMC100-FAK48 48-channel AC Energy Meter [Sub Metering Module]

(1) Integration Communications Structure

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3. Communication Structure&Logic [When integrated with 3rd party IoT System]

IoT Energy Monitoring is the trend of future. So, if the customer/your side already have your own IoT system platform but don't have IoT gateway which has been already integrated with your IoT system. And in this case you don't need Acrel IoT system, but you want to receive the data from Acrel Energy Meter to your system instead. Then, the integration between Acrel AWT200-1E4S Series IoT gateway [either 4G, WiFi or Ethernet version] and your IoT system based on either MQTT or MODBUS-TCP protocol will be the key for overall system integration.

(1) Both AMC100-ZA Multi-channel AC Energy Meter and AWT200-1E4S IoT gateway support RS485 communications based on MODBUS-RTU protocol. And between these devices, the integration of RS485 [MODBUS-RTU] part has been already done in factory stage. [Since they are all Acrel produced products]

(2) Thus, to make the overall communications structure complete, we only need to do the integration between Acrel AWT200-1E4S Series IoT gateway with your IoT system via 4G, WiFi or Ethernet communications methods based on either MQTT or MODBUS-TCP protocol. To do this part, Acrel side will provide either MQTT or MODBUS-TCP protocol file to your side for system integration.


System

Your IoT Energy Management System

Server

Cloud Server

MQTT Cloud Server (Rented by you) MQTT

4G/WiFi/Ethernet **MODBUS-TCP**
MQTT

Smart Gateway

AWT200-1E4S-4GHW/WiFi IoT Gateway
4G/WiFi/Ethernet IoT Gateway

RS485 MODBUS-RTU

AMC100-ZA
2-channel AC Energy Meter
[Main Metering Module]

RS485
MODBUS-RTU

ATP007kT
HMI Touch Screen

RS485 MODBUS-RTU

Metering Devices

AMC100-FAK30
30-channel AC Energy Meter
[Sub Metering Module]

AMC100-FAK48
48-channel AC Energy Meter
[Sub Metering Module]

(1) Integration Communications Structure

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4. Hardware Devices Overview
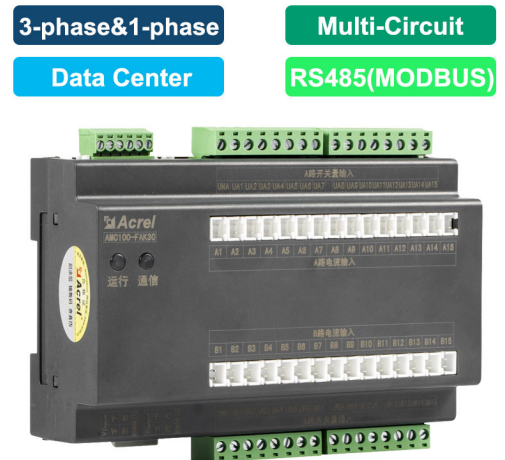
Model 1: AMC100-ZA Multi-circuit AC Energy Meter

- Monitoring: Up to 2 circuits 3-phase [AC Metering]

- Rated Voltage: 3x380~456Vac L-L & 3x220~264Vac L-N

- Rated Current: 5A AC (via -A/5A AC current transformer)

- Harmonic: 2nd~63rd and total Harmonic

- Leakage Current [optional]: 2-way leakage current monitor

- Temp.&Humidity [optional]: 1-way Temp &RH% monitor

- Communicaiton: 3-way RS485 Interface, MODBUS-RTU

Protocol; 1-way Ethernet [optional], MODBUS-TCP

- Input Frequency: 45~65Hz AC

- Digital Output: 4-channel DO [3A 250VAC/3A 30VDC]

- Digital Input: 8-channel DI [dry contact]
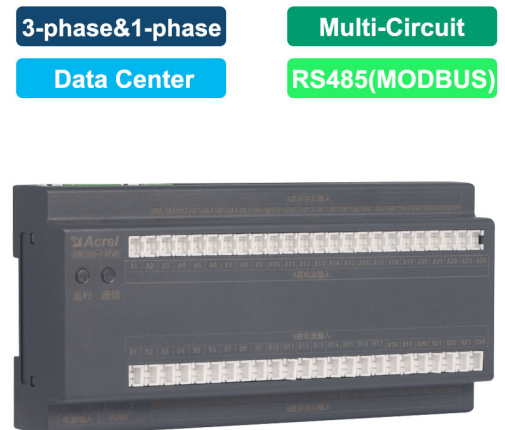
- Certificate&Standard: IEC; CE

3-phase AC	Multi-Circuit
Data Center	3-Way RS485
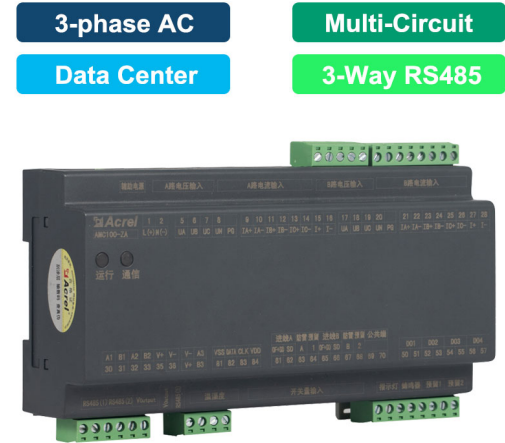
Model 2: AMC100-FAK30 Multi-circuit AC Energy Meter

- Monitoring: Up to 10 circuits 3-phase or 30 circuits 1-phase or mixed [AC Metering]

- Rated Voltage: 380~456Vac L-L & 220~264Vac L-N

- Rated Current: 50mA AC (via -A/50mA AC Current Transformer)

- Communicaiton: 1-way RS485 [MODBUS-RTU Protocol]

- Input Frequency: 45~65Hz AC

- Certificate&Standard: IEC; CE

3-phase&1-phase	Multi-Circuit
Data Center	RS485(MODBUS)

Model 3: AMC100-FAK48 Multi-circuit AC Energy Meter

- Monitoring: Up to 16 circuits 3-phase or 48 circuits 1-phase or mixed [AC Metering]

- Rated Voltage: 380~456Vac L-L & 220~264Vac L-N

- Rated Current: 50mA AC (via -A/50mA AC Current Transformer)

- Communicaiton: 1-way RS485 [MODBUS-RTU Protocol]

- Input Frequency: 45~65Hz AC

- Certificate&Standard: IEC; CE

3-phase&1-phase	Multi-Circuit
Data Center	RS485(MODBUS)

AC Data Center Precision Distribution Energy Monitoring [Local or to 3rd Party]

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4. Hardware Devices Overview

Model 4: AKH-0.66/W-9A/B 50A/50mA Solid-core CT

- Current Ratio: 50A/50mA AC [optional primary current in.]
- Accuracy: Class 0.2 high accuracy
- Aperture: 9mm [diameter, optional for other size]
- Application: Paired with AMC100-FAK seires AC energy meter for current intput
- Note: A or B stand for front and back arrangement [adapted to the size of general CB for better arrangement]

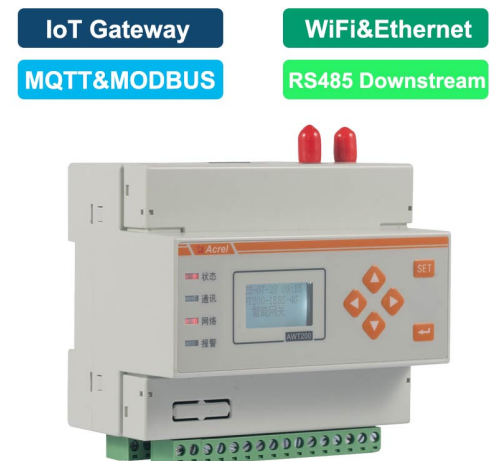Solid-core CT | 50A/50mA AC
0.2S Accuracy | AB Arrangement

Model 5: ATP007kT Series Smart Touch Screen

- Application: Centralized Data Display&Alarm for all AMC100 series Energy Meter
- Communications: 2-way RS485 [MODBUS-RTU]
- Size: 7 inches [optional 10 inches, module ATP010kT]
- Auxiliary Power Supply: 24Vdc

Touch Screen | Display&Alarm
Data Center | RS485(MODBUS)
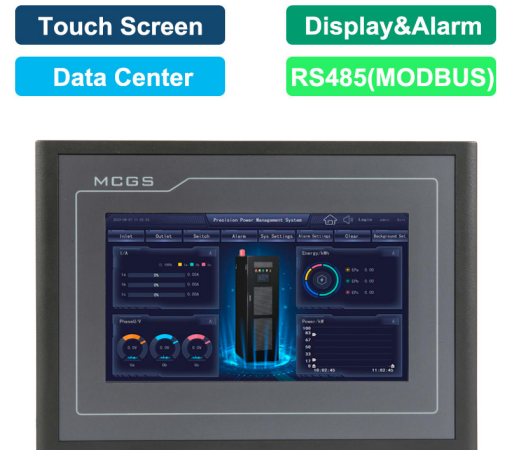
Model 6: AWT200-1E4S-WiFi/4GHW

- Upstream Comms.: 4G&WiFi&Ethernet Comms. [MQTT &MODBUS-TCP protocol]
- Downstream Comms.: 4-way RS485 [MODBUS-RTU protocol]
- Power Supply: 85~265Vac/Vdc
- Working Temperature: -20   +55
- Working Humidity: <=95%

IoT Gateway | WiFi&Ethernet
MQTT&MODBUS | RS485 Downstream

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5. Overall Model Selection&Quoation

(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.

Smart Touch Screen					
	Display Unit **ATP007Kt**	**Application:** Paired with AMC100Z Series for display&alarm all the data collected centralizedly **Downstream:** RS485 (MODBUS-RTU) Auxiliary Power Supply: 24Vdc **HS Code:** 8471609000	1 pcs		
Multi-circuit AC Energy Meter					
Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	Energy Meter **AMC100-ZA**	**Monitoring:** Up to **2** circuits 1-phase **Communication:** 3-way RS485 (MODBUS-RTU) **Rated Voltage:** 3x380~456Vac L-L & 3x220~264Vac L-N (45~65Hz) **Rated Current:** 5A AC (via paired -/5A CTs) **HS Code:** 9028309000	1 pcs		
	Energy Meter **AMC100-FAK48**	**Monitoring:** Up to **48 circuits 1-phase** or **16 circutis 3-phase** or mixed **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** 3x380~456Vac L-L & 3x220~264Vac L-N (45~65Hz) **Max Current Input:** 50mA AC (via paired -/50mA AC CTs) **HS Code:** 9028309000	1 pcs		
	Energy Meter **AMC100-FAK30**	**Monitoring:** Up to **30 circuits 1-phase** or **10 circutis 3-phase** or mixed **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** 3x380~456Vac L-L & 3x220~264Vac L-N (45~65Hz) **Max Current Input:** 50mA AC (via paired -/50mA AC CTs) **HS Code:** 9028309000	1 pcs		
Paired Current Transformer					
Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	Current Transformer **AKH-0.66/W-9A 50A/50mA**	**Current Ratio:** 50A/5A AC **Aperture:** φ9mm **Accuracy:** Class 0.2 **Noted:** A or B stand for front and back arrangement [adapted to the size of general CB for better arrangement] **HS Code:** 8504311000	39 pcs		
	Current Transformer **AKH-0.66/W-9B 50A/50mA**	**Current Ratio:** 50A/5A AC **Aperture:** φ9mm **Accuracy:** Class 0.2 **Noted:** A or B stand for front and back arrangement [adapted to the size of general CB for better arrangement] **HS Code:** 8504311000	39 pcs		

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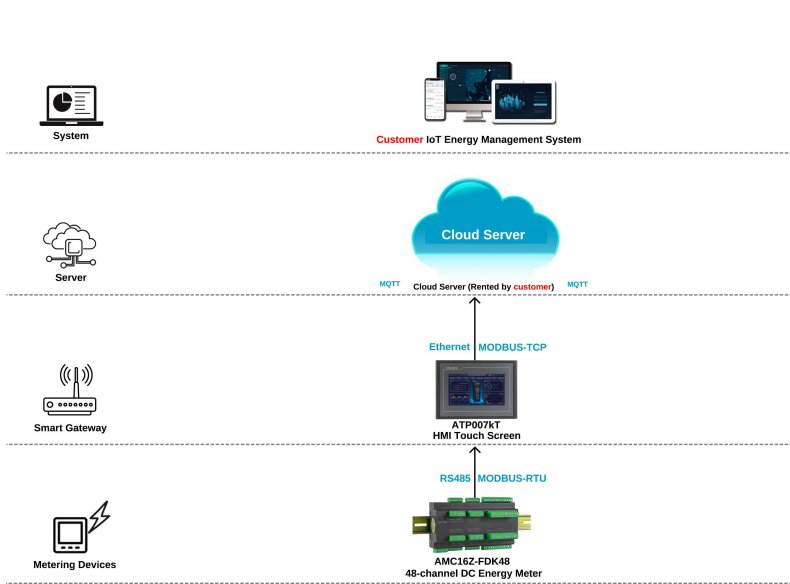E-mail: loki@acrel.cn
Website: www.acrel-electric.fr

6. Project Sample #1 - Peru Data Center DC Power System Energy Management Project
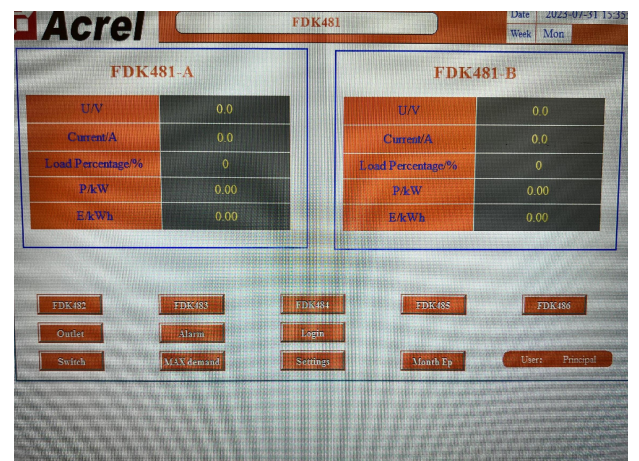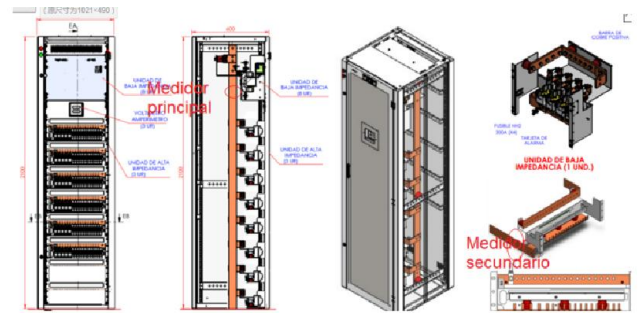
(1) Project Overview:

· **Customer:** INDUSTRIA EMALEXA S.A.C [Complete Set/Switchgear Factory]
· **Country:** Peru
· **Project Aim:** Use Acrel Multi-channel DC energy meter and smart touch to be integrated with customers's own DC Data Center Switchgear for precise energy sub metering and further upload the data to 3rd party monitoring system
· **Project Amount:** About 200.000 USD

(2) Applied Product Combination:

· **ATP007kT Smart Touch Screen** [for centralized monitoring and alarming all the data collected by AMC16-FDK48 and further uploading data to upstream system via Ethernet]
· **AMC16-FDK48 Multi-circuit DC Energy Meter** [for monitoring up to 48 circuits DC]
· **AHKC-E Hall Effect Sensor** [paired with AMC16-FDK48 for DC current signal input]
· **KDYA Series Power Supply Module** [Paired with other devices for auxiliary power supply input.]

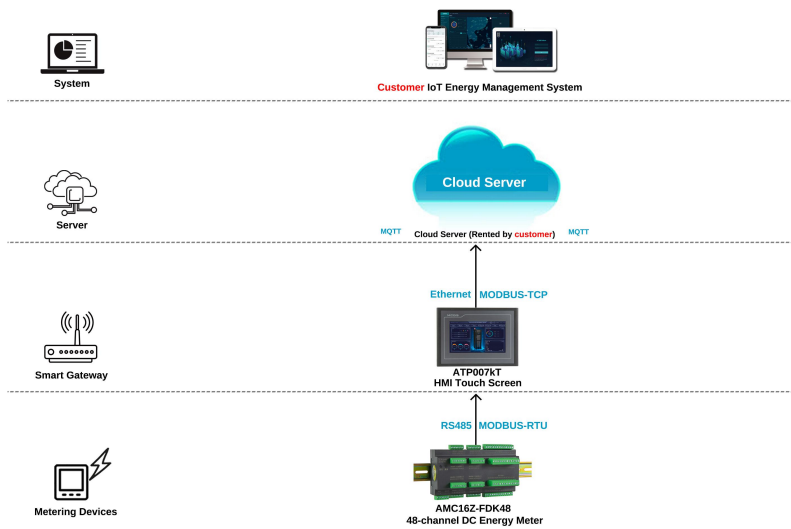(2) Product Combination&Comms. Topology

(2) Project Picture

AC Data Center Precision Distribution Energy Monitoring [Local or to 3rd Party]

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6. Project Sample #2 - Phillippines Data Center AC Power System Energy Management Project

(1) Project Overview:
· **Customer:** TOM'ELE-KT POWER SYSTEMS INC [Complete Set/Switchgear Factory]
· **Country:** Phillippines
· **Project Aim:** Use Acrel Multi-channel AC energy meter and smart touch to be integrated with customers's own AC Data Center Switchgear for precise energy sub metering and further upload the data to customer's monitoring system
· **Project Amount:** About 100.000 USD

(2) Applied Product Combination:
· **ATP007kT Smart Touch Screen** [for centralized monitoring and alarming all the data collected by AMC16-FDK48 and further uploading data to upstream system via Ethernet]
· **AMC16-ZA Multi-circuit AC Energy Meter** [for monitoring up to 2 circuits 3-phase]
· **AMC16-FAK48 Multi-circuit AC Energy Meter** [for monitoring up to 48 circuits 1-phase]
· **AKH-0.66/30I 250A/5A** [paired with AMC16-ZA for AC current signal input]
· **AKH-0.66/EMS 50A/50mA** [paired with AMC16-FAK48 for AC current signal input]

(2) Product Combination&Comms. Topology

(2) Project Picture