

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

Ver. Date: Feb,27th 2024

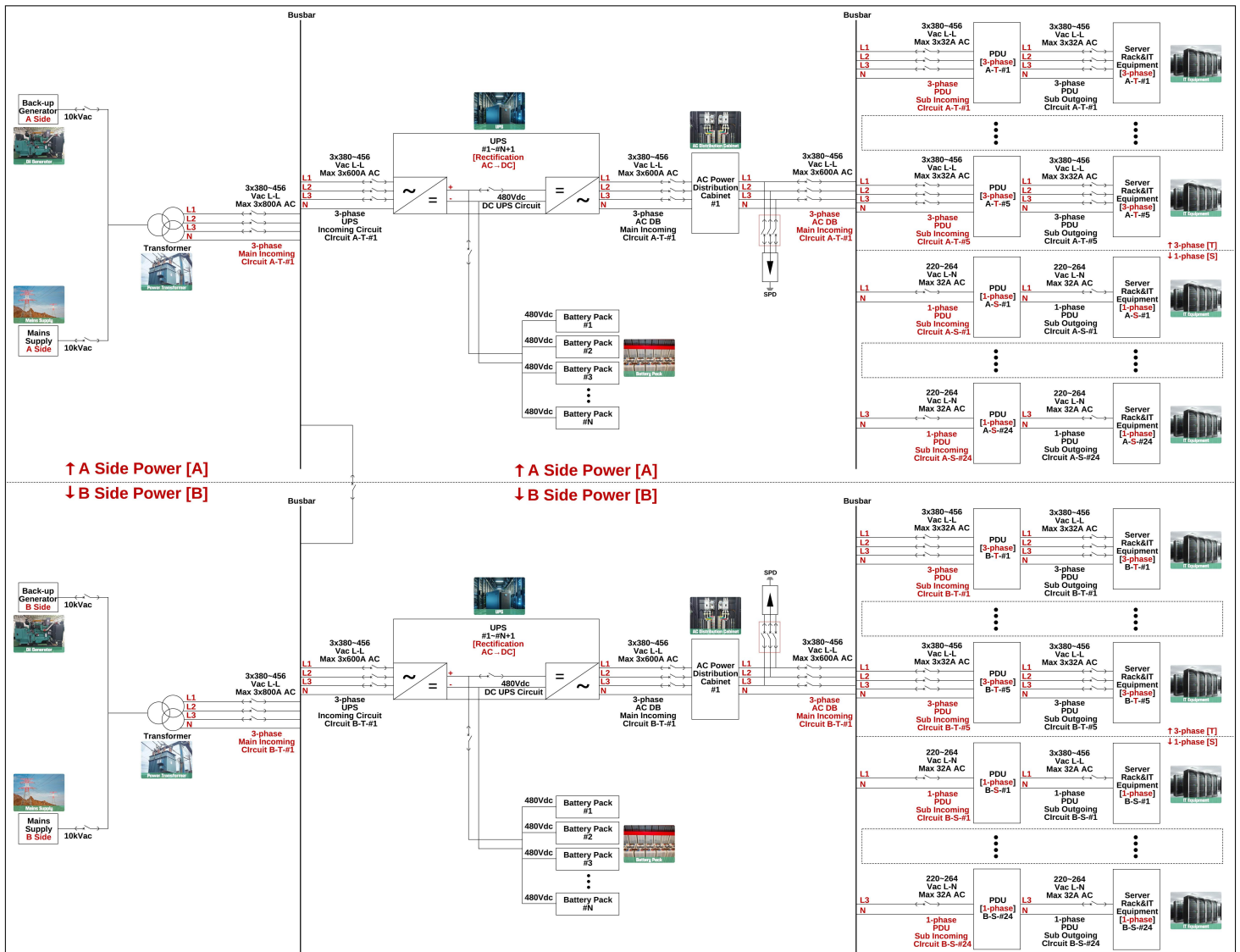
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0. Application Scenario

- (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].

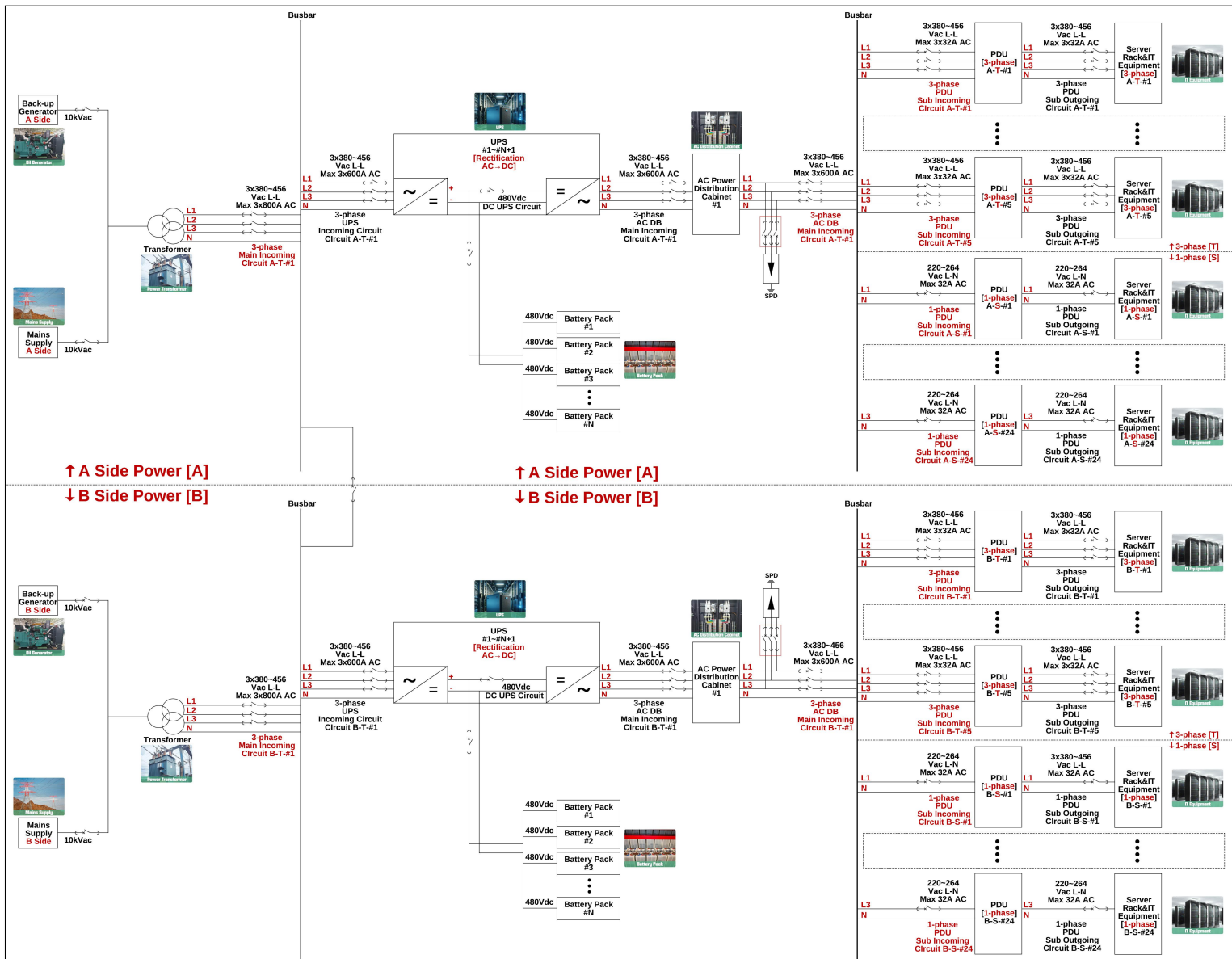


(1) Power system structure and major energy monitoring point of AC Data Center

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

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]

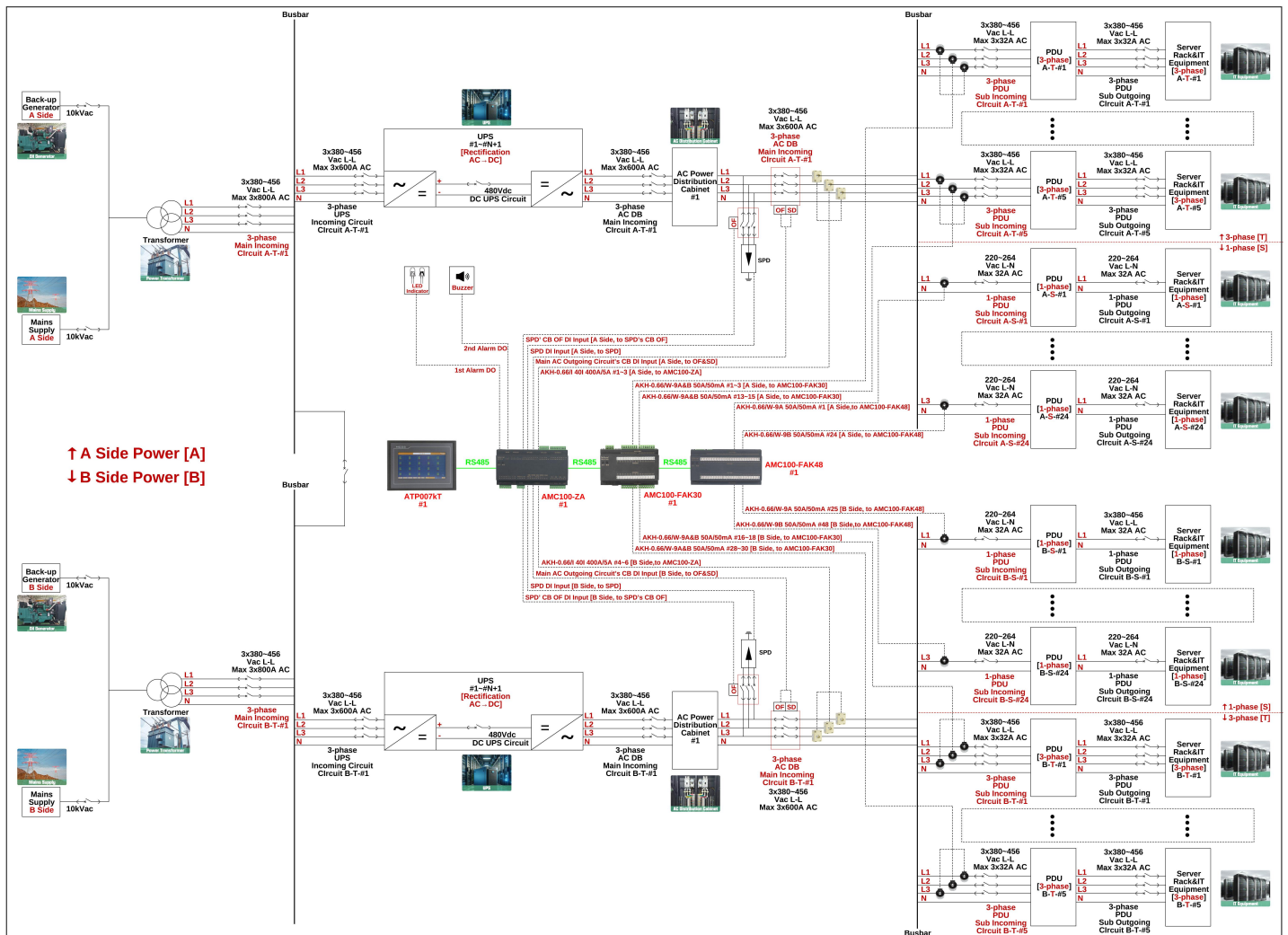
- 15* AKH-0.66/W-9B Solid-core Current Transformer [for AMC100-FAK30 current signal input]

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]

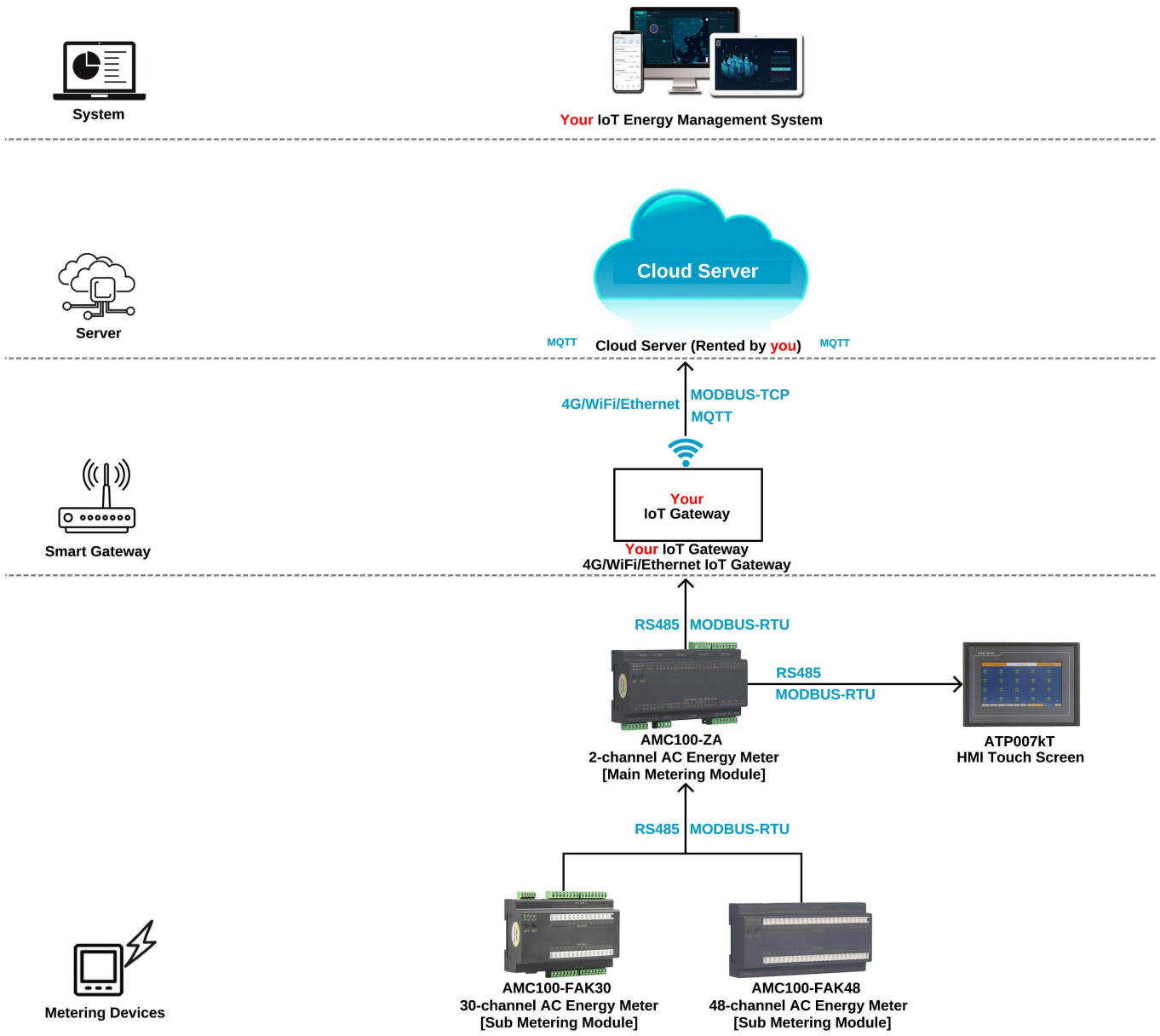


(1) Hardware Devices Deployment Plan for AC Data Center

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]



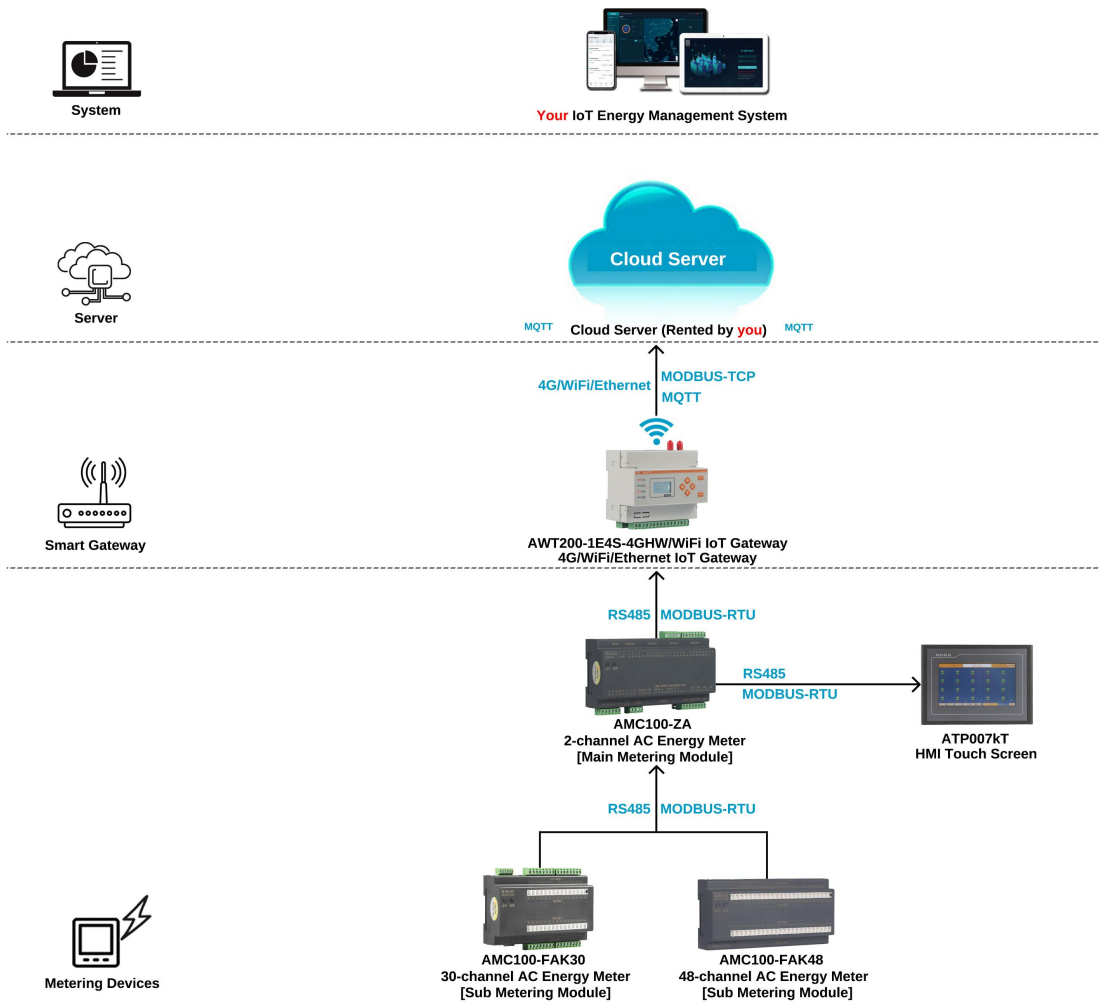
(1) Integration Communications Structure

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.

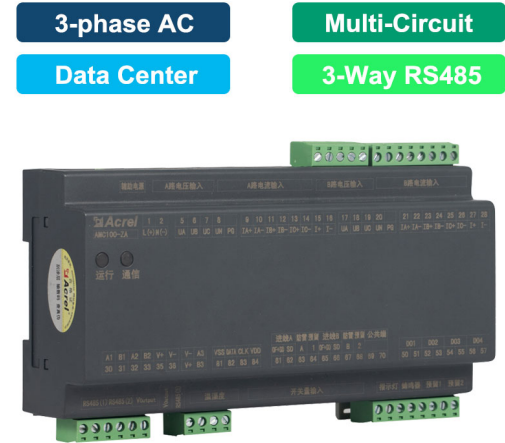


(1) Integration Communications Structure

4. Hardware Devices Overview

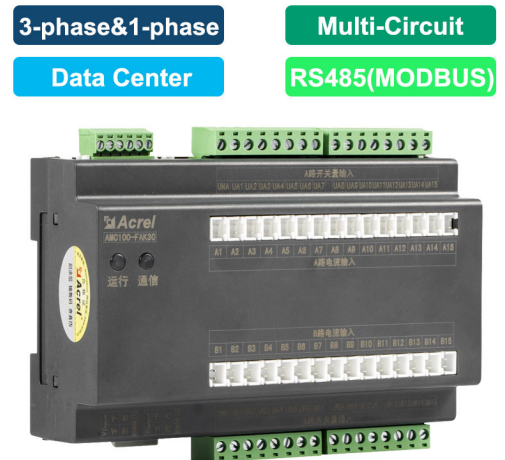
Model 1: AMC100-ZA Multi-circuit AC Energy Meter

- 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



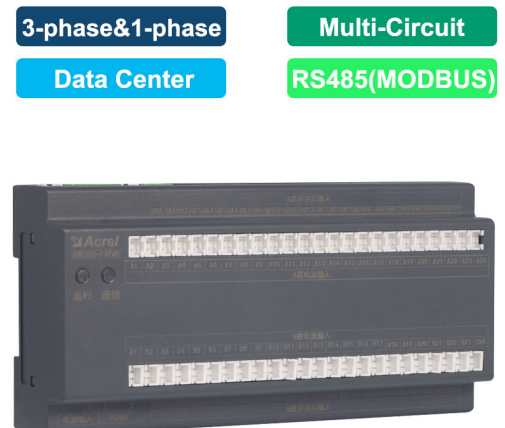
Model 2: AMC100-FAK30 Multi-circuit AC Energy Meter

- 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



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



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 series AC energy meter for current input
- Note: A or B stand for front and back arrangement [adapted to the size of general CB for better arrangement]



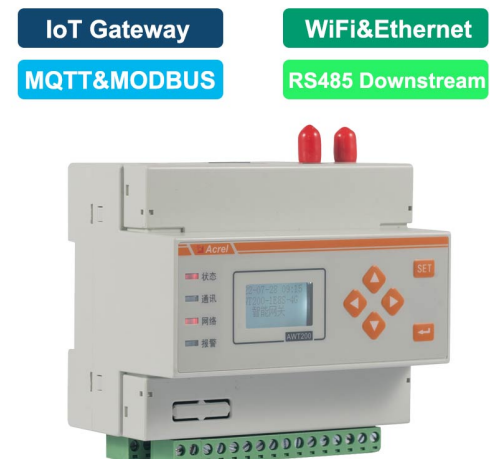
Model 5: ATP007kT Series Smart Touch Screen

- 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



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%



5. Overall Model Selection&Quotation

(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 circuits 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 circuits 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		

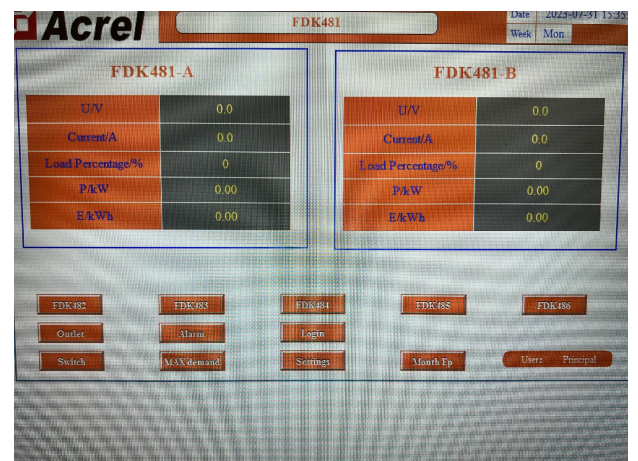
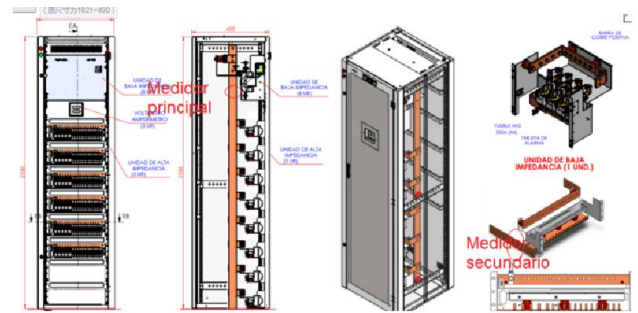
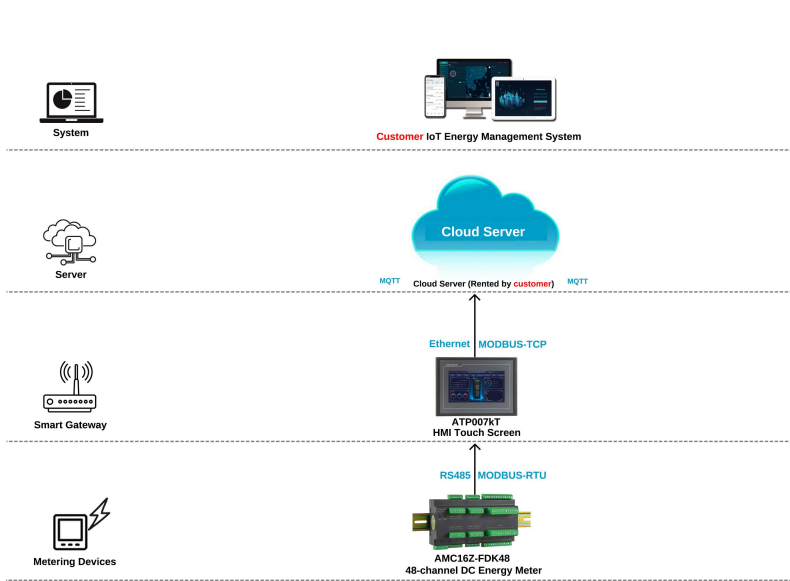
6. Project Sample #1 - Peru Data Center DC Power System Energy Management Project

(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

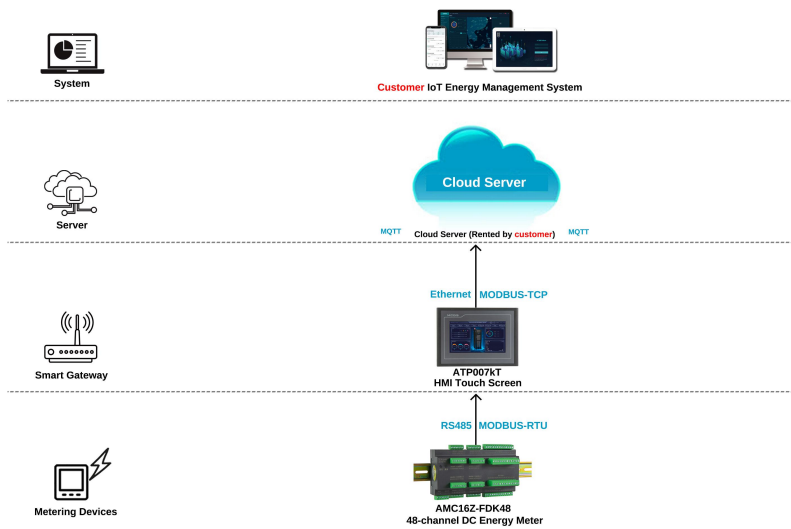
6. Project Sample #2 - Phillippines Data Center AC Power System Energy Management Project

(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