Telecommunications Tower Base Station Energy Monitoring Solution

Telecommunications tower base station energy monitoring solution, AC&DC multi-channel metering, IoT cloud online monitoring.

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2024/01/22 Ver.

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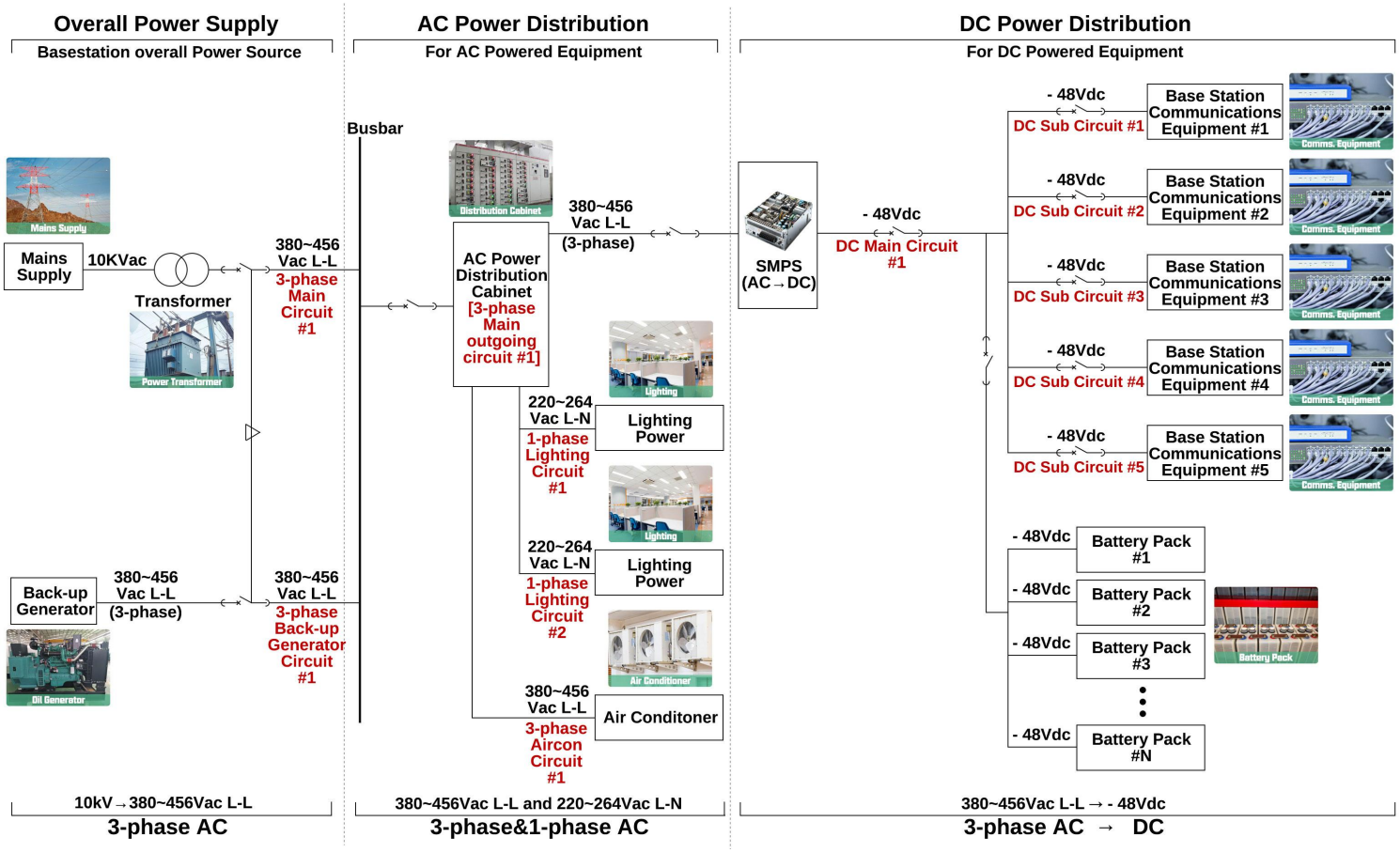
0. Application Scenario

(1) This solution was designed for IoT online precise sub energy monitoring of the overall telecommunications tower base station.
(2) Normally, the power system of base station could be devided into AC part and DC part [-48Vdc]. And usually request a multi-channel metering regarding the different energy usage like for different telecommunications service provider's base station communications equipment [DC side]. Or for either the mains supply, back-up generator, lighting, airconditioner of base station. [AC side] Thus, multi-channel DC or AC energy meter will be the key to solve such request.
(3) This solution was majorly for both cloud&local energy monitoring, different from Acrel local energy monitoring solution which is designed for base station local energy monitoring by providing only hardware. In other hands, this solution could be also adapted to 3rd party IoT energy monitoring system via API or SDK for data transferation



(1) Power system structure and major energy monitoring point of telecommunications tower base station

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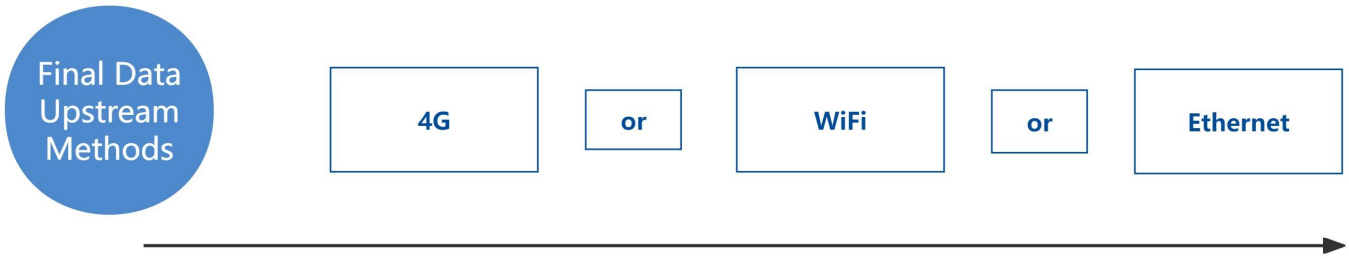
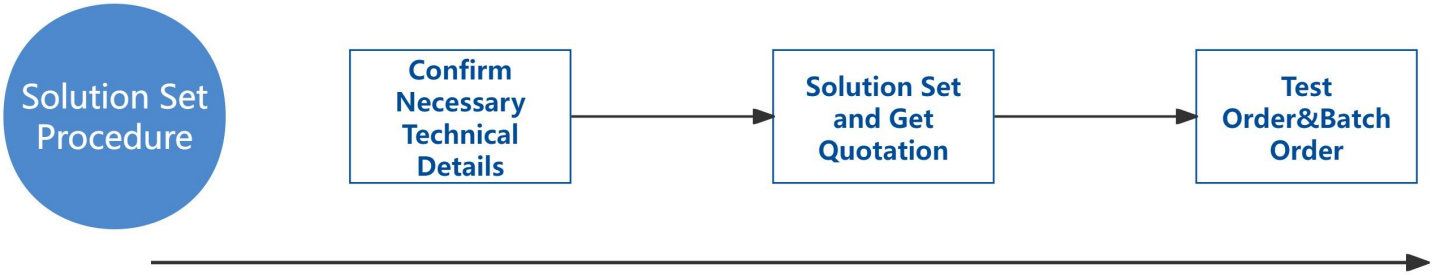
0. Solution Selection Logic

Judging by final data upstream methods which was decided by site network condition [4G, WiFi, Ethernet]. The solution could be divided into 3 basic types:
(1) 4G IoT Cloud Energy Moniotring Solution for Telecommunications Tower Base Station [with both Cloud&Local Display&Alarm, 4G based]
(2) WiFi IoT Cloud Energy Moniotring Solution for Telecommunications Tower Base Station [with both Cloud&Local Display&Alarm, WiFi based]
(3) Ethernet IoT Cloud Energy Moniotring Solution for Telecommunications Tower Base Station [with both Cloud&Local Display&Alarm, Ethernet based]



(1) Solution Selection Logic

Extra Noted: Of course, other than final data upstream methods, some curcial technical specs we also need to check for a complete solution as below:
1.How many 1-phase, 3-phase , DC circuits that we need to monitoring in total.
2.Rated current and voltage of monitoring circuits. [for DC side of telecommunications tower, we use -48Vdc for DC power system]
3.Cable/Busbar sizes of each monitoring circuits.
4.Any other special request for IoT Cloud Energy Monitoring System.
There are the things when we talk about the actual solution set for actual site. But for the sample solution that we gonna demo in the followings, some of the technical specs we will preset according to some existed site for a easy and better understanding.



(2) Common Working Procedure

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1. Scenario Preset [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

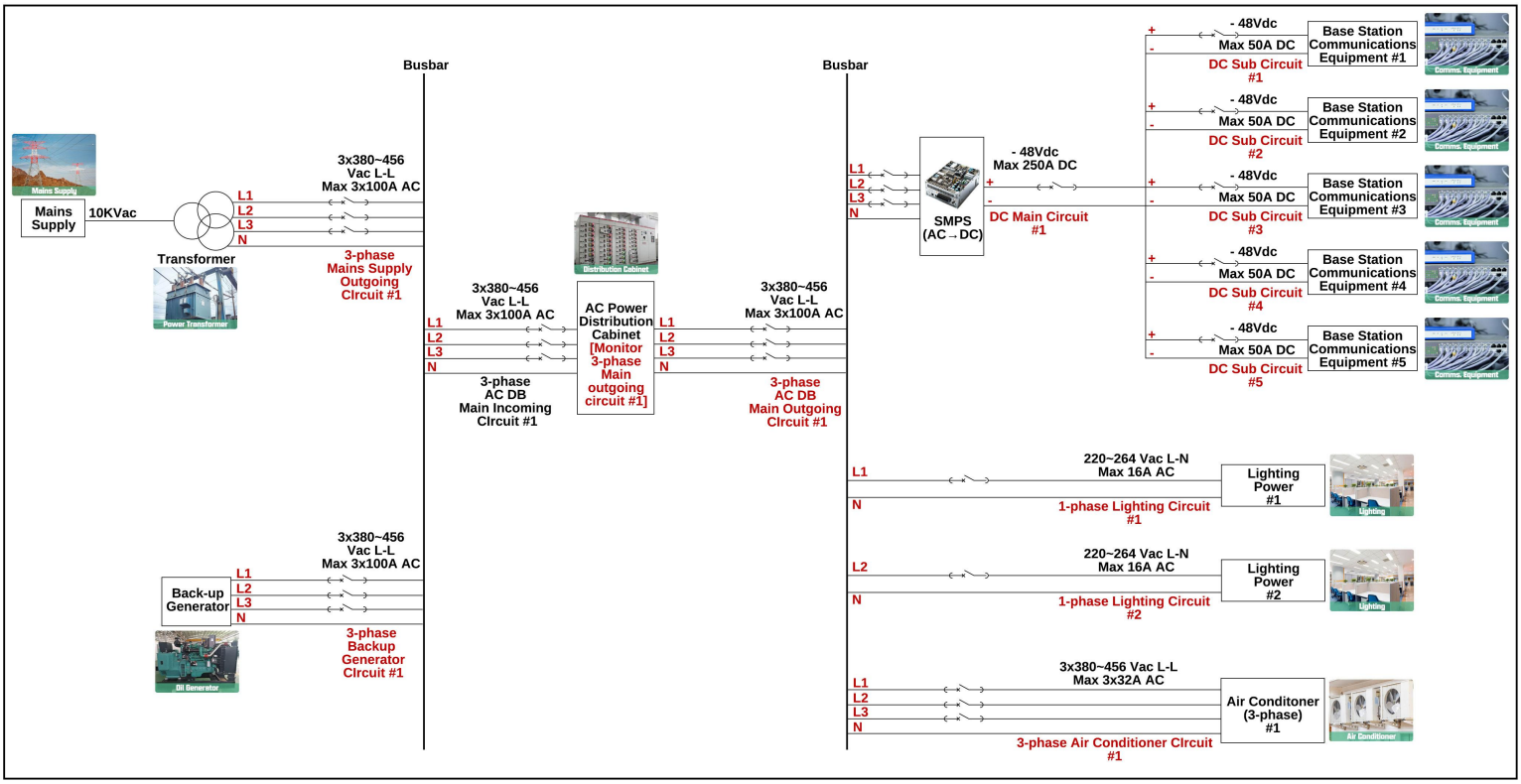
In order to see how will Acrel hardware devices actually deployed on actual site, we will preset a scenario according to actual site sample as following [divided as AC and DC parts]:

(1) AC Power System Side: 6 circuits AC need to be monitored in total:

- 1* AC circuit 3-phase for "Mains Supply" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter within 16mm.]
- 1* AC circuit 3-phase for "Back-up generator" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter within 16mm.]
- 1* AC circuit 3-phase for "AC Distribution Cabinet" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter size within 16mm.]
- 1* AC circuit 3-phase for "Air Conditioner" [Rated voltage 3x380~456Vac L-L, rated current 3x32A AC, circuit's cable cross-sectional diameter within 16mm.]
- 2* AC circuit 1-phase for "Lighting Power" [Rated voltage 220~264Vac L-N, rated current 16A AC, circuit's cable cross-sectional diameter within 16mm]

(2) DC Power System Side: 6 circuits DC needed to be monitored in total:

- 5* DC circuits for 5 "Base Station Communications Equipments" [Rated voltage -48Vdc, rated current 50A DC, circuit's cable cross-sectional diameter within 20mm.]
- 1* DC circuit for "DC Main Circuit" [Rated voltage: -48Vdc, rated current 250A DC, circuit's cable cross-sectional diameter within 40mm.]



Telecommunications Tower Base Station #1

(1) Scenario Preset for monitoring Telecommunications Tower Base Station

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1. Devices Deployment [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

For Overall Data Upstream Communications:

- 1* AWT100-4GHW IoT Gateway [For collecting data from DTSD1352-4S&AMC16L-DETT and further upload to Acrel IoT System via 4G Comms.]
- 1* AWT100-POW Power Supply Module [paired with AWT100-4GHW for 85~265Vac/Vdc Power Supply input]

For AC Power Metering - Mains Supply 3-phase Circuit #1, Back-up Generator 3-phase Circuits #1, AC DB Main Outgoing 3-phase Circuit #1, Air Conditioner 3-phase Circuit #1:

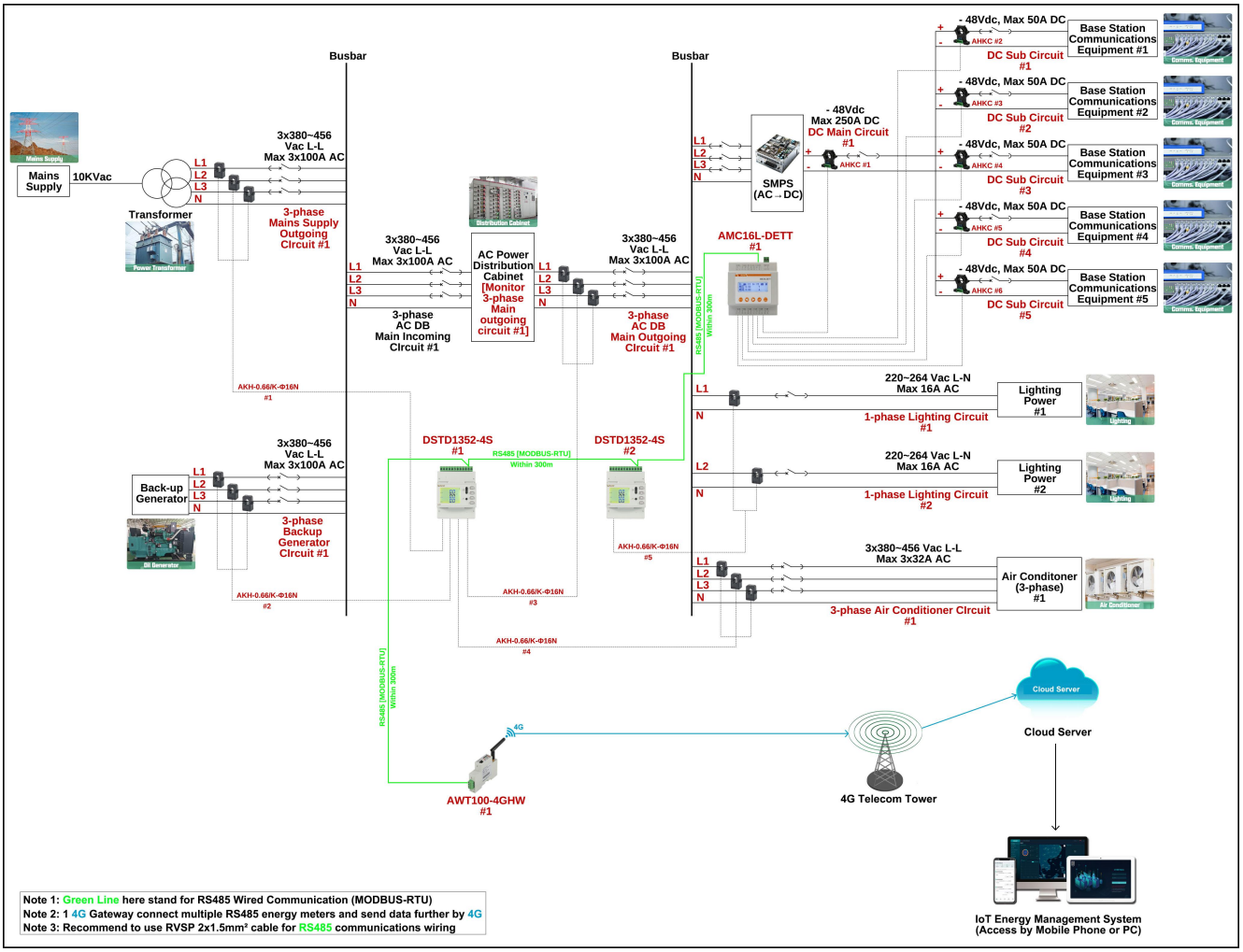
- 1* DTST1352-4S Multi-circuit AC Energy Meter [For monitoring 4 circuits 3-phase]
- 4* AKH-0.66/K-Φ16N 100A/50mA Split-core Current Transformer [1 set contain 3 CTs, paired with DTSD1352-4S for current signal input]

For AC Power Metering - Light Power 1-phase Circuit #1~2:

- 1* DTST1352-4S Multi-circuit AC Energy Meter [For monitoring 2 circuits 1-phase]
- 1* AKH-0.66/K-Φ16N 100A/50mA Split-core Current Transformer [1 set contain 3 CTs, paired with DTSD1352-4S for current signal input]

For DC Power Metering - Base Station Equipments DC Sub Circuit #1~5, DC Main Circuit #1:

- 1* AMC16L-DETT Multi-circuit DC Energy Meter [For monitoring 6 circuits DC]
- 5* AHKC-EKA (50A/5V) Split-core Hall Effect Current Transducer [Paired with AMC16L-DETT for current signal input]
- 1* AHKC-EKB (250A/5V) Split-core Hall Effect Current Transducer [Paired with AMC16L-DETT for current signal input]



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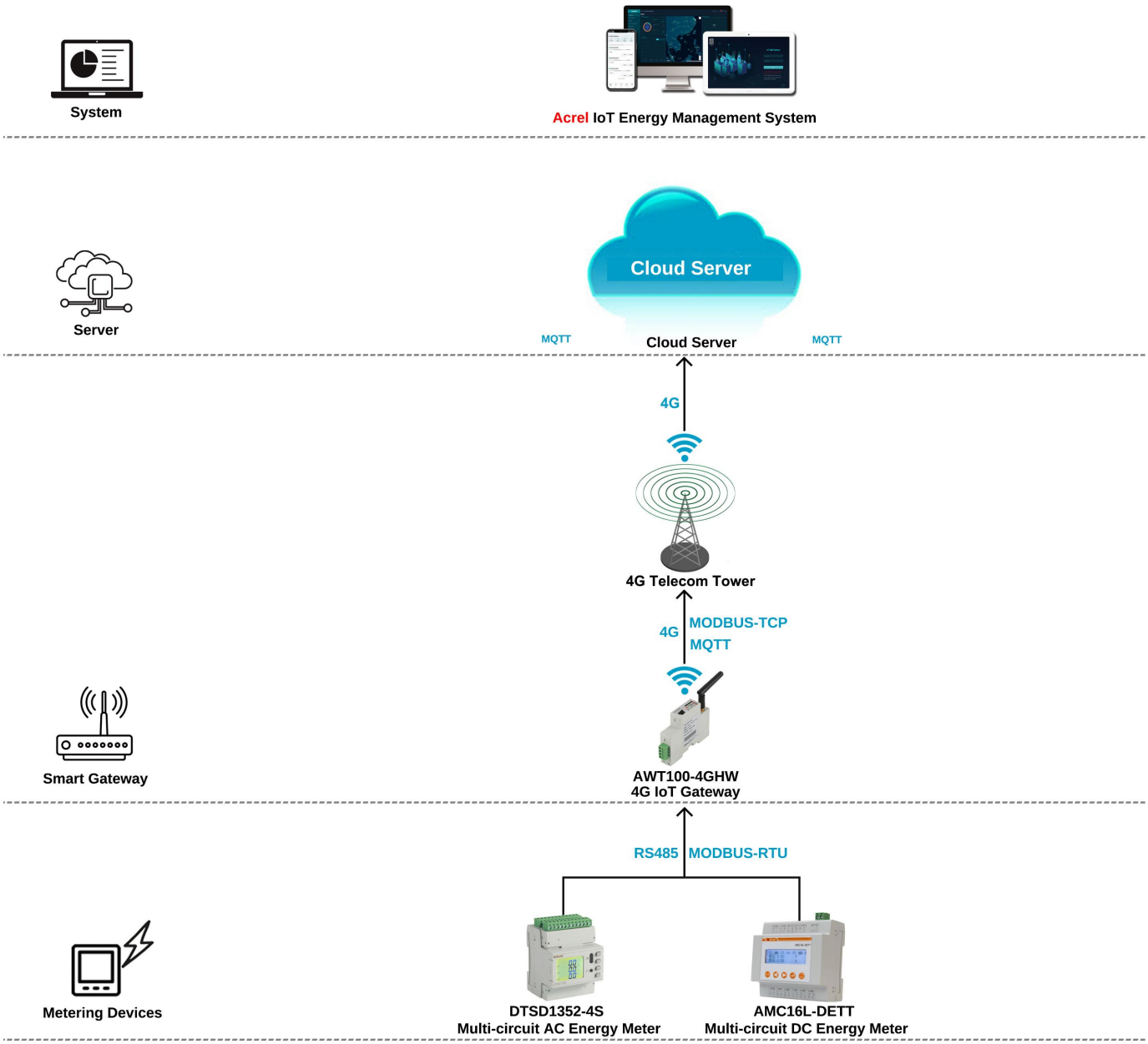
1.Communication Structure&Logic [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

If the customer don't have their own IoT system and would like to use all Acrel IoT system software and metering hardware, the overall communications structure will be like:

(1) Between AMC16L-DETT Multi-channel DC Energy Meter, DTSD1352-4S Multi-channel AC Energy Meter and AWT100-4GHW IoT Gateway we will use RS485 wired communications based on MODBUS-RTU protocol. Since these are all Acrel products, the communications protocol integration will be done in factory manufacturing stage.

(2) Between AWT100-4GHW IoT Gateway and Acrel IoT System, we are using 4G communications based on either MQTT or MODBUS-TCP protocol for data uploading. [protocol integration was also done in factory stage.]



(1) Integration Communications Structure

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1.Communication Structure&Logic [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

If the customer side have their own IoT system and would like to do the API/SDK integration between Acrel IoT system and their own IoT system, the overall communications structure will be like:

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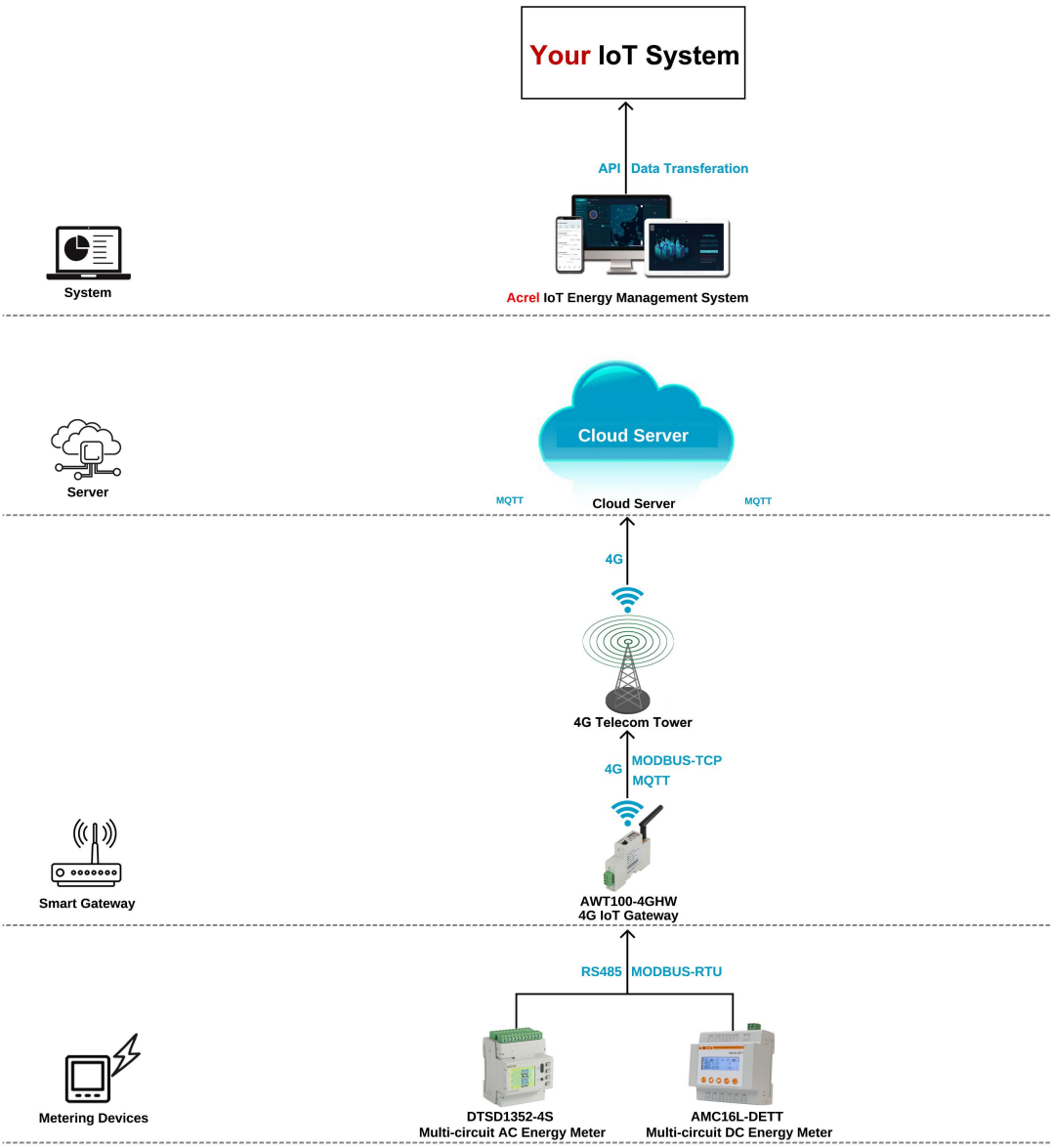
(2) Between AWT100-4GHW IoT Gateway and Acrel IoT System, we are using 4G communications based on either MQTT or MODBUS-TCP protocol for data uploading. [protocol integration was also done in factory stage.]

(3) Between Acrel IoT System and customer's IoT system, we will use API/SDK based on the related protocol.



(1) Integration Communications Structure

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1. Hardware Devices Overview [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

Model 1: AMC16L-DETT Multi-circuit DC Energy Meter

DC Metering | Base Station
6-channel | RS485 (MODBUS)

- Monitoring: Up to 6 circuits [DC Metering]
- Rated Voltage: -48Vdc
- Rated Current: 5Vdc (via -A/5Vdc hall sensor)
- Communicaiton: RS485 Interface, MODBUS-RTU Protocol
- Auxiliary Power Supply: -40~-60Vdc
- Power Output: 1 set of +12V/100mA,-12V/50mA power output serving as power supply of paired Hall Sensors.
- Data Storage: 2mb room for alarm and energy data.
- Certificate&Standard: IEC; CE

Model 2: DTSD1352-4S Multi-circuit AC Energy Meter

1-phase&3-phase | Multi-circuit
4-channel | RS485 (MODBUS)

- Monitoring: Up to 4 circuits 3-phase or 12 circuits 1-phase or mixed [AC Metering]
- Rated Voltage: 3x380~456Vac L-L & 3x220~264Vac L-N
- Rated Current: 50mA (via -A/50mA CT)
- Communicaiton: RS485 Interface, MODBUS-RTU Protocol
- Auxiliary Power Supply: 85~265Vac/Vdc
- Certificate&Standard: CE

Model 3: AWT100-4GHW IoT 4G Gateway

IoT Gateway | 4G/WiFi/Ethernet
MQTT&MODBUS | RS485 Downstream

- Upstream Methods: 4G LTE (Protocol: MQTT, MODBUS-TCP)
- Downsteam Methods: RS485 (MODBUS-RTU)
- Support: Up to 25 energy meter's monitoring circtuis via RS485 Interfacewithin 300m.
- Auxiliary Power Supply: 85~265Vac L-N (via AWT100-POW power supply module) or 24Vdc (default)
- Certificate&Standard: CE-RED

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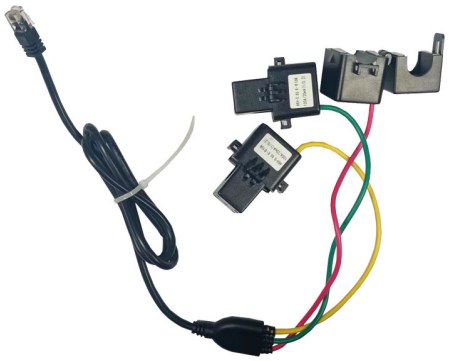
1. Hardware Devices Overview [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

AC Current | 3 CTs in 1 Set
16mm Aperture | 100A/50mA AC

Model 1: AKH-0.66/K-Φ16N 100A/50mA Split-core CT

- Current Ratio: 100A/50mA AC
- Accuracy: Class 0.5
- Aperture: 16mm
- Application: Paired with DTSD1352-4S AC energy meter for current intput
- Noted: 1 set include 3 CTs



Hall Effect | AC&DC Transducer
0~500A AC/DC In. | 0~±5/±4Vdc Out.

Model 2: AHKC-EKA Split-core Hall Sensor

- Current Input Range: 0~50A DC
- Current Output Range: 0~±5Vdc
- Aperture: φ20mm
- Auxiliary Power Supply: ±12Vdc (Supplied by AMC16L-DETT)
- Application: Paired with AMC16-DETT DC energy meter for current intput

Hall Effect | AC&DC Transducer
0~1000A AC/DC In. | 0~±5/±4Vdc Out.

Model 2: AHKC-EKB Split-core Hall Sensor

- Current Input Range: 0~250A DC
- Current Output Range: 0~±5Vdc
- Aperture: φ40mm
- Auxiliary Power Supply: ±12Vdc (Supplied by AMC16L-DETT)
- Application: Paired with AMC16-DETT DC energy meter for current intput

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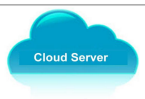
1. Overall Model Selection&Quoation [4G IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

(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.

System Software

Name	Description	System Price	Remark (Choose Host Service or Buy-out Service after 3-month Free Trial of **Cloud IoT System**)
 **Acrel Cloud IoT Energy Management System**	1.System support all the meters across the country whose data has been sent to cloud server through **4G**,**WiFi or Ethernet**. 2.Remote meter reading and data collection. 3.Provide **IoT APP** for **mobile phone** side and **IoT WEB** for **PC** side. 4.Generate energy data report of daily, monthly and annually period with year-on-yeay and period-on-period energy analysis. 5.Provide various alarm function to ensure a stable operation of the system and protect your property. 6.Offer 3-month free trial of system with full technical support	$0 (recommended in pilot project)	3-month Free Trail (Users don't need to rent a cloud server))
		$xxx/Year (For 12 Points) (Price for Host Service Only, recommended in pilot project)	$xx to buy Hosting Service for 1 monitoring points connected to the system 1 year (Users don't need to rent a cloud server)
		$xxxx/Permanent (Limitless Points) (Price for Buy-out Service Only,recommended in late project)	1-time charging of $xxxx for Buy-out Service of permanent use (Unlimited monitoring points and a cloud server need to be rent by users)

Cloud Server

Name	Description	Server Renting Price (For Reference Only)	Remark
 Cloud Server	1.Cloud Server could be rent on the cloud server provider like Amazon Cloud. 2.Users of **Cloud IoT Energy Management System** only need to rent cloud server when they choose **buy-out** service of our **Cloud IoT System**. And if they are using **hosting service** or **3-month free trial** of our Cloud IoT System, we will use our own cloud server which has been rent on Amazon so that users don't need to rent a cloud server. 3.The quotation of Cloud Server is only a reference price that we have rent on Amazon Cloud.	According to Specs of Rented Cloud Server	Below cloud server specs could support 1000~2000 monitoings points connected to the system (Server：8 core 16G Operation System：windows server 2016)

Smart Gateway

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	4G Smart Gateway **AWT100-4GHW**	**Upstream:** 4G LTE (MQTT, MODBUS-TCP) **Downstream:** RS485 (MODBUS-RTU) **Support:** up to **20~25** monitoring points within 400m using RS485 communication **Power Supply:** 85~265Vac/Vdc (via AWT100-POW Module); 24Vdc (Default)	1 pcs		
	Power Supply Module **AWT100-POW**	**Input:** 85~265Vac/Vdc **Output:** 24Vdc **Application:** paired with AWT100 Series gateway for 85~265Vac/Vdc power supply input	1 pcs		

AC Metering Devices Set

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	AC Multi-circuit Energy Meter **DTSD1352-4S**	**Monitoring:** Up to 12 circuits 1-phase or 4 circuits 3-phase or mixed [AC Metering] **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** 380~456Vac L-L & 220~264Vac L-N **Rated Current:** 50mA (via -A/50mA CTs) **Auxiliary Power Supply:** 85~265Vac/Vdc	2 pcs		
	Split-core Current Trasnformer **AKH-0.66/K K-φ16N 100A/50mA**	**Current Ratio:** 100A/50mA AC **Aperture:** φ16mm (diameter) **Accuracy:** Class 0.5 **Application:** Paired with DTSD1352-4S for current input **Noted:** 1 set include 3 CTs	5 pcs		

DC Metering Devices Set

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	DC Multi-circuit Energy Meter **AMC16L-DETT**	**Monitoring:** Up to 6 circuits [DC Metering] **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** -48Vdc **Rated Current:** 5Vdc (via -A/5Vdc Hall Sensor) **Power Output:** 1 set of +12V/100mA,-12V/50mA power output serving as power supply of paired Hall Sensors. **Auxiliary Power Supply:** -40~-60Vdc	1 pcs		
	Hall Sensor **AHKC-EKA**	**Current Input Range:** 0~50A DC **Current Output Range:** 0~±5Vdc **Aperture:** φ20mm **Auxiliary Power Supply:** ±12Vdc **Application:** Paired with AMC16-DETT for current input	5 pcs		
	Hall Sensor **AHKC-EKB**	**Current Input Range:** 0~250A DC **Current Output Range:** 0~±5Vdc **Aperture:** φ40mm **Auxiliary Power Supply:** ±12Vdc **Application:** Paired with AMC16-DETT for current input	1 pcs		

2. Scenario Preset [WiFi IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

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) AC Power System Side: 6 circuits AC need to be monitored in total:

- 1* AC circuit 3-phase for "Mains Supply" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter within 16mm.]
- 1* AC circuit 3-phase for "Back-up generator" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter within 16mm.]
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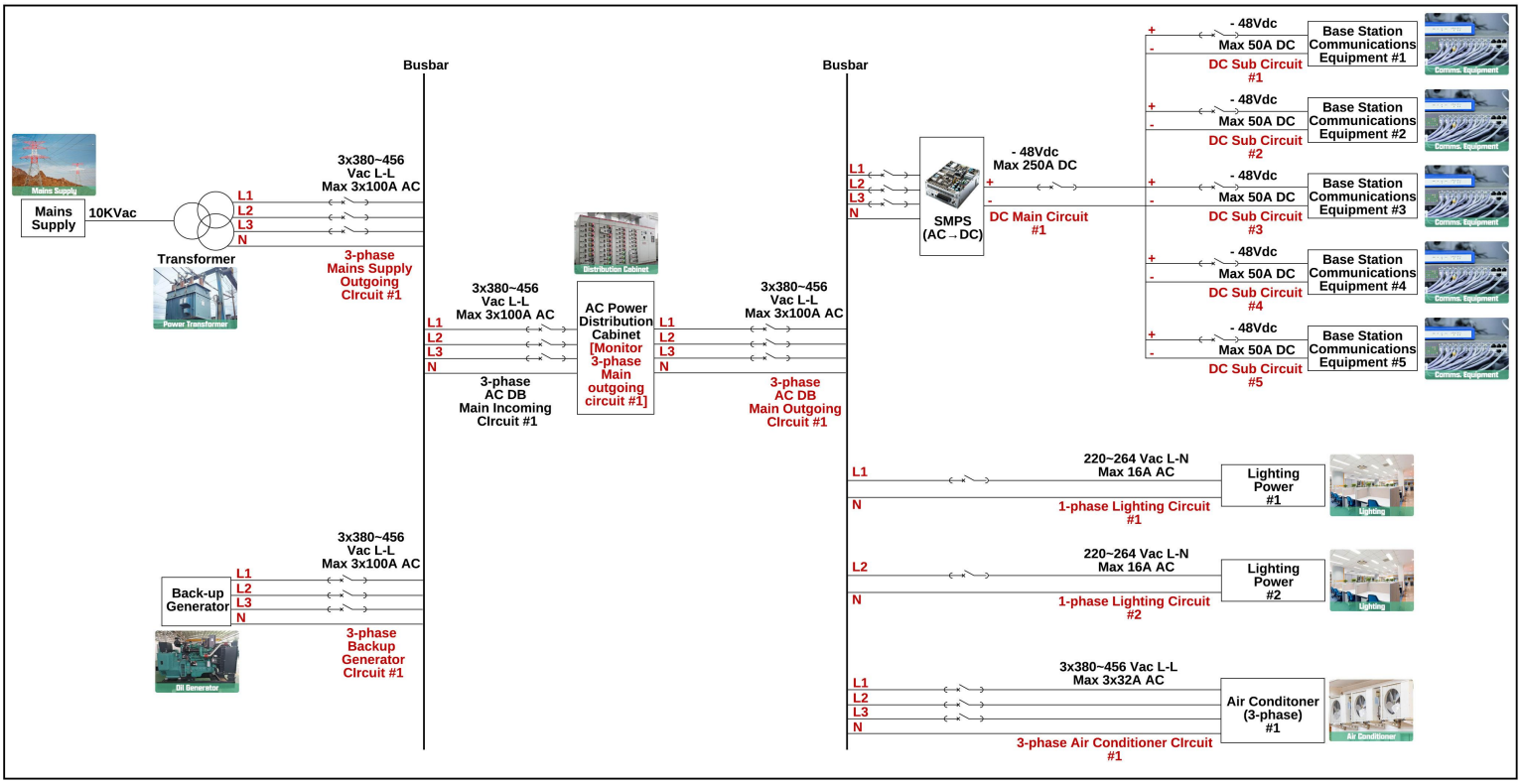
- 1* AC circuit 3-phase for "Air Conditioner" [Rated voltage 3x380~456Vac L-L, rated current 3x32A AC, circuit's cable cross-sectional diameter within 16mm.]
- 2* AC circuit 1-phase for "Lighting Power" [Rated voltage 220~264Vac L-N, rated current 16A AC, circuit's cable cross-sectional diameter within 16mm]

(2) DC Power System Side: 6 circuits DC needed to be monitored in total:

- 5* DC circuits for 5 "Base Station Communications Equipments" [Rated voltage -48Vdc, rated current 50A DC, circuit's cable cross-sectional diameter within 20mm.]
- 1* DC circuit for "DC Main Circuit" [Rated voltage: -48Vdc, rated current 250A DC, circuit's cable cross-sectional diameter within 40mm.]



Telecommunications Tower Base Station #1

(1) Scenario Preset for monitoring Telecommunications Tower Base Station

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2. Devices Deployment [WiFi IoT Cloud Energy Moniotring Solution for Telecom Tower Base Station]

For Overall Data Upstream Communications:

- 1* AWT100-WiFiHW IoT Gateway [For collecting data from DTSD1352-4S&AMC16L-DETT and further upload to Acrel IoT System via WiFi Comms.]
- 1* AWT100-POW Power Supply Module [paired with AWT100-WiFiHW for 85~265Vac/Vdc Power Supply input]

For AC Power Metering - Mains Supply 3-phase Circuit #1, Back-up Generator 3-phase Circuits #1, AC DB Main Outgoing 3-phase Circuit #1, Air Conditioner 3-phase Circuit #1:

- 1* DTST1352-4S Multi-circuit AC Energy Meter [For monitoring 4 circuits 3-phase]
- 4* AKH-0.66/K-Φ16N 100A/50mA Split-core Current Transformer [1 set contain 3 CTs, paired with DTSD1352-4S for current signal input]

For AC Power Metering - Light Power 1-phase Circuit #1~2:

- 1* DTST1352-4S Multi-circuit AC Energy Meter [For monitoring 2 circuits 1-phase]
- 1* AKH-0.66/K-Φ16N 100A/50mA Split-core Current Transformer [1 set contain 3 CTs, paired with DTSD1352-4S for current signal input]

For DC Power Metering - Base Station Equipments DC Sub Circuit #1~5, DC Main Circuit #1:

- 1* AMC16L-DETT Multi-circuit DC Energy Meter [For monitoring 6 circuits DC]
- 5* AHKC-EKA (50A/5V) Split-core Hall Effect Current Transducer [Paired with AMC16L-DETT for current signal input]
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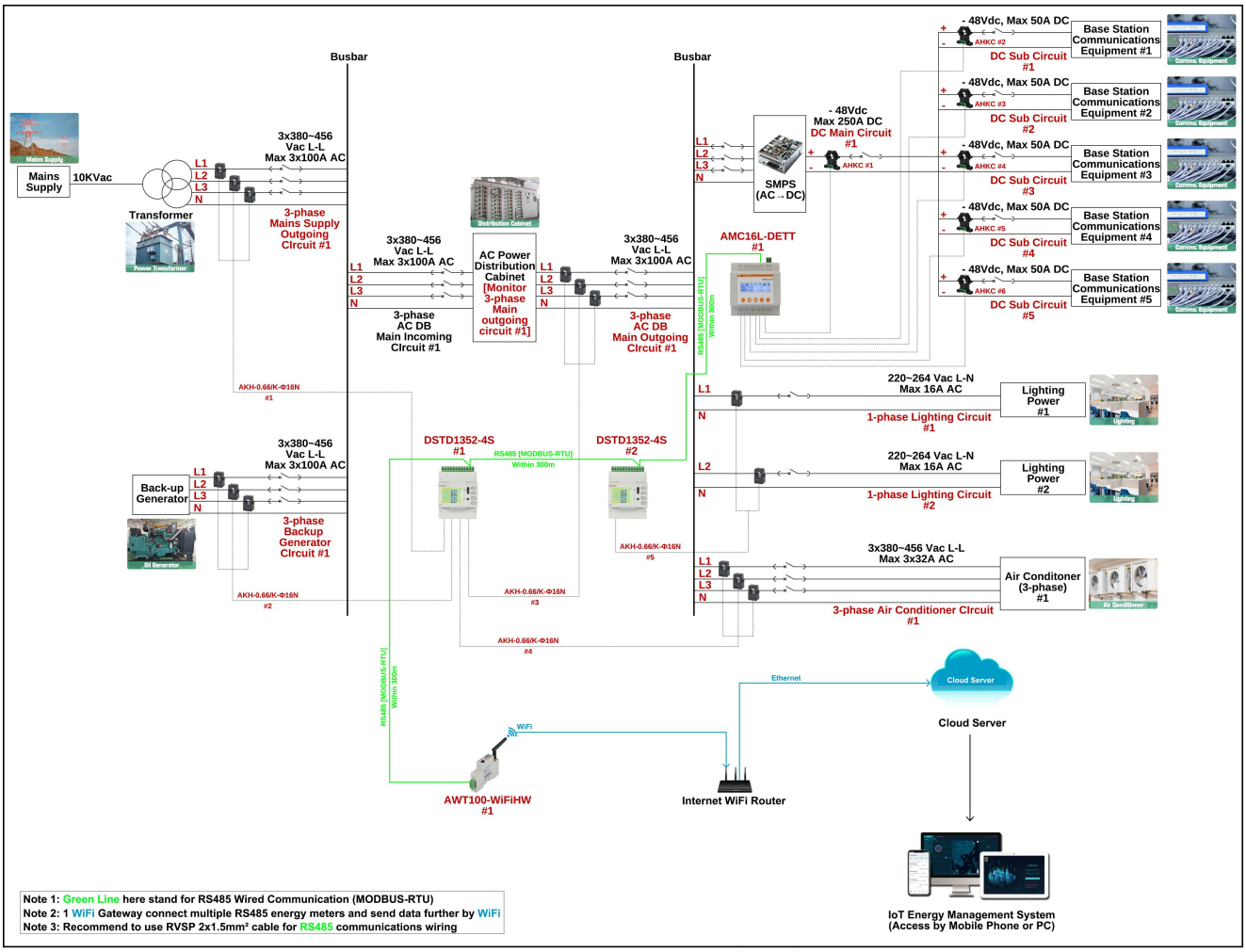

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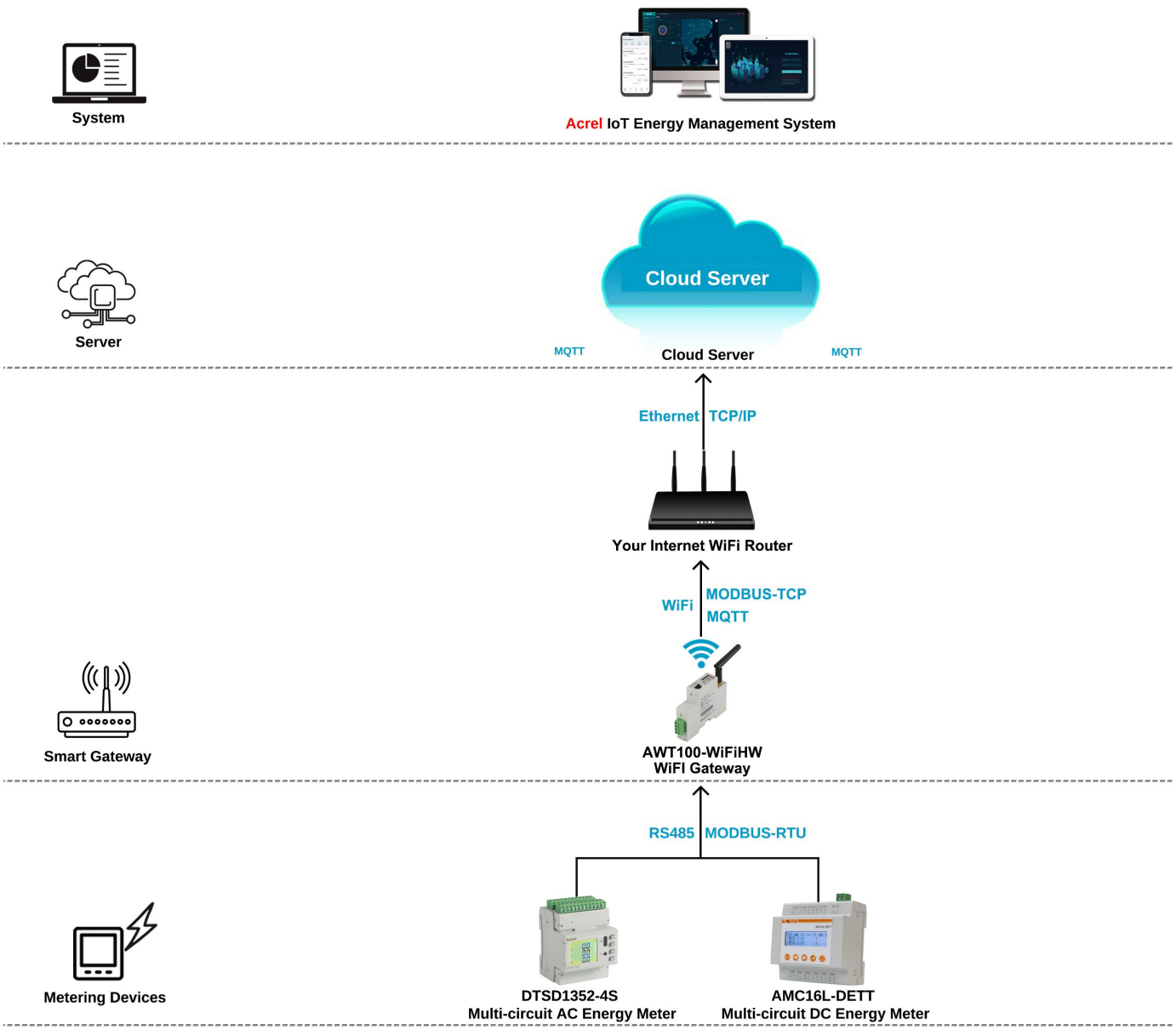

(1) Integration Communications Structure

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If the customer side have their own IoT system and would like to do the API/SDK integration between Acrel IoT system and their own IoT system, the overall communications structure will be like:

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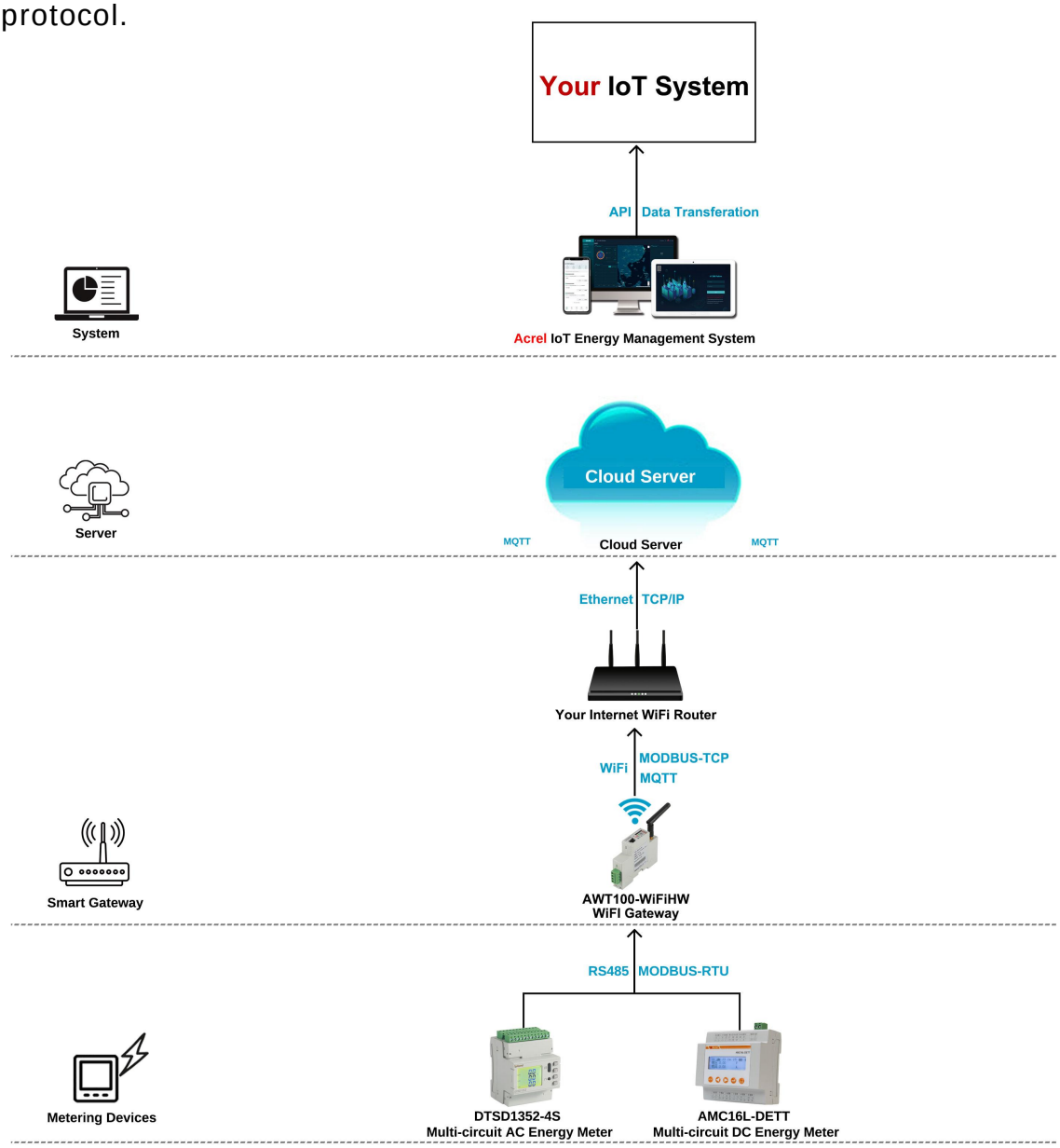

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Model 1: AMC16L-DETT Multi-circuit DC Energy Meter

DC Metering | Base Station | 6-channel | RS485 (MODBUS)

- Monitoring: Up to 6 circuits [DC Metering]
- Rated Voltage: -48Vdc
- Rated Current: 5Vdc (via -A/5Vdc hall sensor)
- Communicaiton: RS485 Interface, MODBUS-RTU Protocol
- Auxiliary Power Supply: -40~-60Vdc
- Power Output: 1 set of +12V/100mA,-12V/50mA power output serving as power supply of paired Hall Sensors.
- Data Storage: 2mb room for alarm and energy data.
- Certificate&Standard: IEC; CE

Model 2: DTSD1352-4S Multi-circuit AC Energy Meter

1-phase&3-phase | Multi-circuit | 4-channel | RS485 (MODBUS)

- Monitoring: Up to 4 circuits 3-phase or 12 circuits 1-phase or mixed [AC Metering]
- Rated Voltage: 3x380~456Vac L-L & 3x220~264Vac L-N
- Rated Current: 50mA (via -A/50mA CT)
- Communicaiton: RS485 Interface, MODBUS-RTU Protocol
- Auxiliary Power Supply: 85~265Vac/Vdc
- Certificate&Standard: CE

Model 3: AWT100-WiFiHW IoT WiFi Gateway

IoT Gateway | 4G/WiFi/Ethernet | MQTT&MODBUS | RS485 Downstream

- Upstream Methods: WiFi 2.4GHz (Protocol: MQTT, MODBUS-TCP)
- Downsteam Methods: RS485 (MODBUS-RTU)
- Support: Up to 25 energy meter's monitoring circtuis via RS485 Interfacewithin 300m.
- Auxiliary Power Supply: 85~265Vac L-N (via AWT100-POW power supply module) or 24Vdc (default)
- Certificate&Standard: CE-RED

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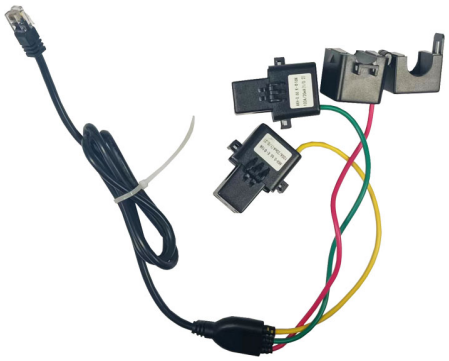
2. Hardware Devices Overview [WiFi IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

AC Current | 3 CTs in 1 Set | 16mm Aperture | 100A/50mA AC

Model 1: AKH-0.66/K-Φ16N 100A/50mA Split-core CT

- Current Ratio: 100A/50mA AC
- Accuracy: Class 0.5
- Aperture: 16mm
- Application: Paired with DTSD1352-4S AC energy meter for current intput
- Noted: 1 set include 3 CTs



Hall Effect | AC&DC Transducer | 0~500A AC/DC In. | 0~±5/±4Vdc Out.

Model 2: AHKC-EKA Split-core Hall Sensor

- Current Input Range: 0~50A DC
- Current Output Range: 0~±5Vdc
- Aperture: φ20mm
- Auxiliary Power Supply: ±12Vdc (Supplied by AMC16L-DETT)
- Application: Paired with AMC16-DETT DC energy meter for current intput

Hall Effect | AC&DC Transducer | 0~1000A AC/DC In. | 0~±5/±4Vdc Out.

Model 2: AHKC-EKB Split-core Hall Sensor

- Current Input Range: 0~250A DC
- Current Output Range: 0~±5Vdc
- Aperture: φ40mm
- Auxiliary Power Supply: ±12Vdc (Supplied by AMC16L-DETT)
- Application: Paired with AMC16-DETT DC energy meter for current intput

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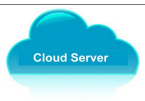
2. Overall Model Selection&Quoation [WiFi IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

(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.

System Software

Name	Description	System Price	Remark (Choose Host Service or Buy-out Service after 3-month Free Trial of **Cloud IoT System**)
 **Acrel Cloud IoT Energy Management System**	1.System support all the meters across the country whose data has been sent to cloud server through **4G,WiFi or Ethernet**. 2.Remote meter reading and data collection. 3.Provide **IoT APP** for **mobile phone** side and **IoT WEB** for **PC** side. 4.Generate energy data report of daily, monthly and annually period with year-on-yeay and period-on-period energy analysis. 5.Provide various alarm function to ensure a stable operation of the system and protect your property. 6.Offer 3-month free trial of system with full technical support	$0 (recommended in pilot projtect)	3-month Free Trail (Users don't need to rent a cloud server))
		$xxx/Year (For 12 Points) (Price for Host Service Only, recommended in pilot projtect)	$xx to buy Hosting Service for 1 monitoring points connected to the system 1 year (Users don't need to rent a cloud server)
		$xxxx/Permanent (Limitless Points) (Price for Buy-out Service Only,recommended in late projtect)	1-time charging of $xxxx for Buy-out Service of permanent use (Unlimited monitoring points and a cloud server need to be rent by users)

Cloud Server

Name	Description	Server Renting Price (For Reference Only)	Remark
 Cloud Server	1.Cloud Server could be rent on the cloud server provider like Amazon Cloud. 2.Users of **Cloud IoT Energy Management System** only need to rent cloud server when they choose **buy-out** service of our **Cloud IoT System**. And if they are using **hosting service** or **3-month free trial** of our Cloud IoT System, we will use our own cloud server which has been rent on Amazon so that users don't need to rent a cloud server. 3.The quotation of Cloud Server is only a reference price that we have rent on Amazon Cloud.	According to Specs of Rented Cloud Server	Below cloud server specs could support 1000~2000 monitoings points connected to the system (Server：8 core 16G Operation System：windows server 2016)

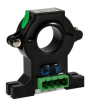
Smart Gateway

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	WiFi Smart Gateway **AWT100-WiFiHW**	**Upstream:** WiFi (2.4GHz, MQTT, MODBUS-TCP) **Downstream:** RS485 (MODBUS-RTU) **Support:** up to **20~25** monitoring points within 400m using RS485 communication **Power Supply:** 85~265Vac/Vdc (via AWT100-POW Module); 24Vdc (Default)	1 pcs		
	Power Supply Module **AWT100-POW**	**Input:** 85~265Vac/Vdc **Output:** 24Vdc **Application:** paired with AWT100 Series gateway for 85~265Vac/Vdc power supply input	1 pcs		

AC Metering Devices Set

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	AC Multi-circuit Energy Meter **DTSD1352-4S**	**Monitoring:** Up to 12 circuits 1-phase or 4 circuits 3-phase or mixed [AC Metering] **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** 380~456Vac L-L & 220~264Vac L-N **Rated Current:** 50mA (via -A/50mA CTs) **Auxiliary Power Supply:** 85~265Vac/Vdc	2 pcs		
	Split-core Current Trasnformer **AKH-0.66/K K-φ16N 100A/50mA**	**Current Ratio:** 100A/50mA AC **Aperture:** φ16mm (diameter) **Accuracy:** Class 0.5 **Application:** Paired with DTSD1352-4S for current input **Noted:** 1 set include 3 CTs	5 pcs		

DC Metering Devices Set

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	DC Multi-circuit Energy Meter **AMC16L-DETT**	**Monitoring:** Up to 6 circuits [DC Metering] **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** -48Vdc **Rated Current:** 5Vdc (via -A/5Vdc Hall Sensor) **Power Output:** 1 set of +12V/100mA,-12V/50mA power output serving as power supply of paired Hall Sensors. **Auxiliary Power Supply:** -40~-60Vdc	1 pcs		
	Hall Sensor **AHKC-EKA**	**Current Input Range:** 0~50A DC **Current Output Range:** 0~±5Vdc **Aperture:** φ20mm **Auxiliary Power Supply:** ±12Vdc **Application:** Paired with AMC16-DETT for current input	5 pcs		
	Hall Sensor **AHKC-EKB**	**Current Input Range:** 0~250A DC **Current Output Range:** 0~±5Vdc **Aperture:** φ40mm **Auxiliary Power Supply:** ±12Vdc **Application:** Paired with AMC16-DETT for current input	1 pcs		

3. Scenario Preset [Ethernet IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

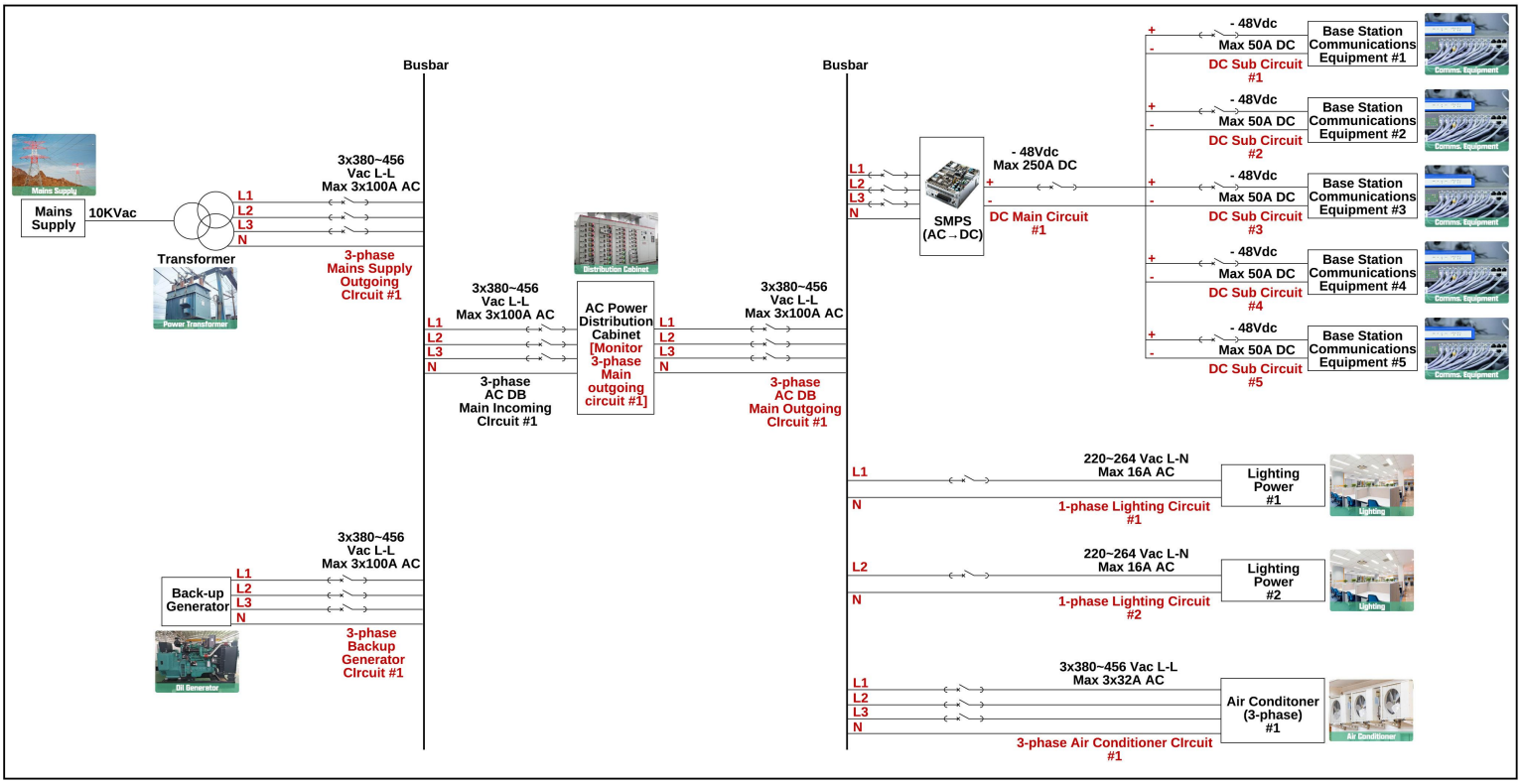
In order to see how will Acrel hardware devices actually deployed on actual site, we will preset a scenario according to actual site sample as following [divided as AC and DC parts]:

(1) AC Power System Side: 6 circuits AC need to be monitored in total:

- 1* AC circuit 3-phase for "Mains Supply" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter within 16mm.]
- 1* AC circuit 3-phase for "Back-up generator" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter within 16mm.]
- 1* AC circuit 3-phase for "AC Distribution Cabinet" [Rated voltage 3x380~456Vac L-L, rated current 3x100A AC, circuit's cable cross-sectional diameter size within 16mm.]
- 1* AC circuit 3-phase for "Air Conditioner" [Rated voltage 3x380~456Vac L-L, rated current 3x32A AC, circuit's cable cross-sectional diameter within 16mm.]
- 2* AC circuit 1-phase for "Lighting Power" [Rated voltage 220~264Vac L-N, rated current 16A AC, circuit's cable cross-sectional diameter within 16mm]

(2) DC Power System Side: 6 circuits DC needed to be monitored in total:

- 5* DC circuits for 5 "Base Station Communications Equipments" [Rated voltage -48Vdc, rated current 50A DC, circuit's cable cross-sectional diameter within 20mm.]
- 1* DC circuit for "DC Main Circuit" [Rated voltage: -48Vdc, rated current 250A DC, circuit's cable cross-sectional diameter within 40mm.]



Telecommunications Tower Base Station #1

(1) Scenario Preset for monitoring Telecommunications Tower Base Station

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3. Devices Deployment [Ethernet IoT Cloud Energy Moniotring Solution for Telecom Base Station]

For Overall Data Upstream Communications:

- 1* AWT100-CEHW IoT Gateway [For collecting data from DTSD1352-4S&AMC16L-DETT and further upload to Acrel IoT System via Ethernet Comms.]
- 1* AWT100-POW Power Supply Module [paired with AWT100-CEHW for 85~265Vac/Vdc Power Supply input]

For AC Power Metering - Mains Supply 3-phase Circuit #1, Back-up Generator 3-phase Circuits #1, AC DB Main Outgoing 3-phase Circuit #1, Air Conditioner 3-phase Circuit #1:

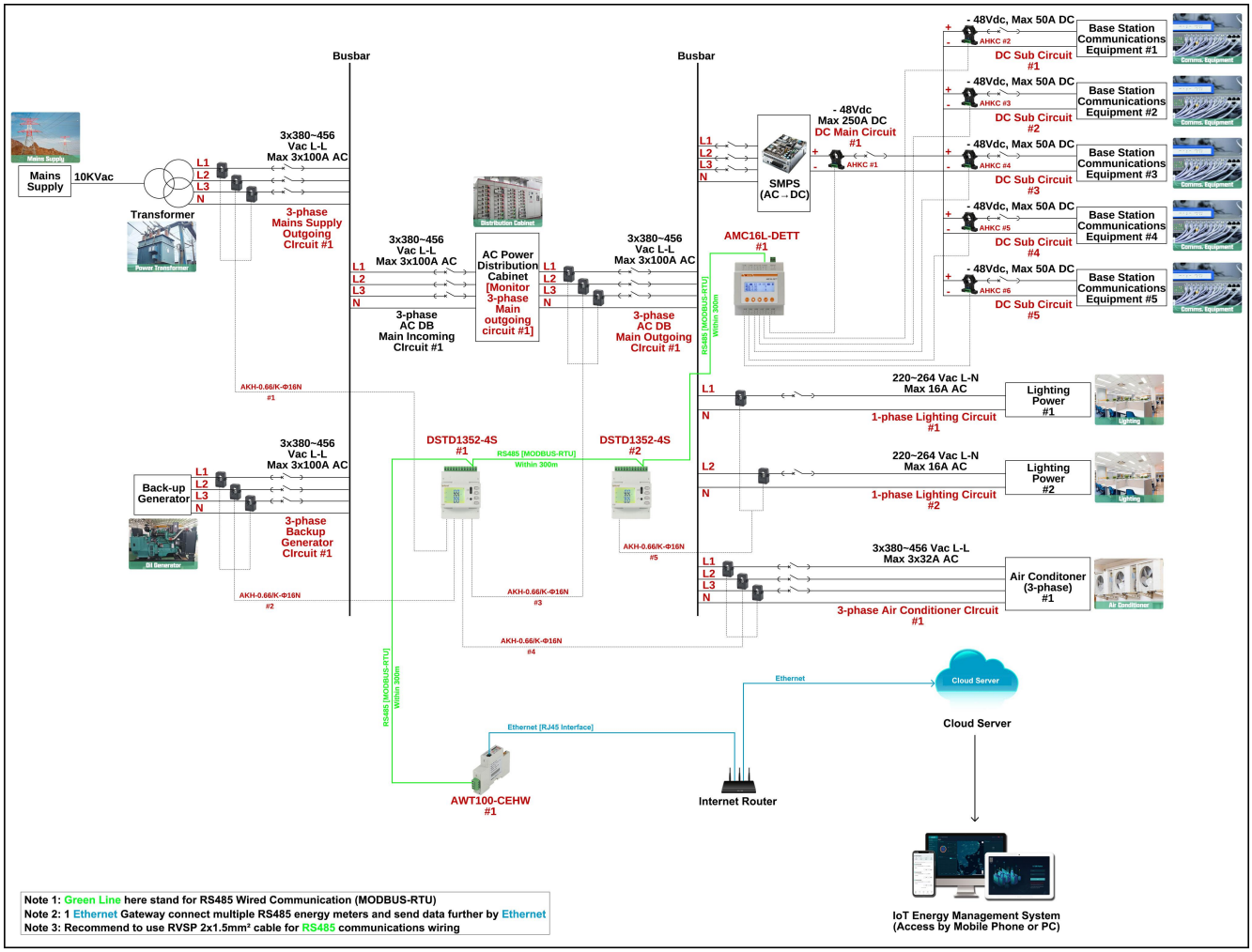
- 1* DTST1352-4S Multi-circuit AC Energy Meter [For monitoring 4 circuits 3-phase]
- 4* AKH-0.66/K-Φ16N 100A/50mA Split-core Current Transformer [1 set contain 3 CTs, paired with DTSD1352-4S for current signal input]

For AC Power Metering - Light Power 1-phase Circuit #1~2:

- 1* DTST1352-4S Multi-circuit AC Energy Meter [For monitoring 2 circuits 1-phase]
- 1* AKH-0.66/K-Φ16N 100A/50mA Split-core Current Transformer [1 set contain 3 CTs, paired with DTSD1352-4S for current signal input]

For DC Power Metering - Base Station Equipments DC Sub Circuit #1~5, DC Main Circuit #1:

- 1* AMC16L-DETT Multi-circuit DC Energy Meter [For monitoring 6 circuits DC]
- 5* AHKC-EKA (50A/5V) Split-core Hall Effect Current Transducer [Paired with AMC16L-DETT for current signal input]
- 1* AHKC-EKB (250A/5V) Split-core Hall Effect Current Transducer [Paired with AMC16L-DETT for current signal input]



Telecommunications Tower Base Station #1

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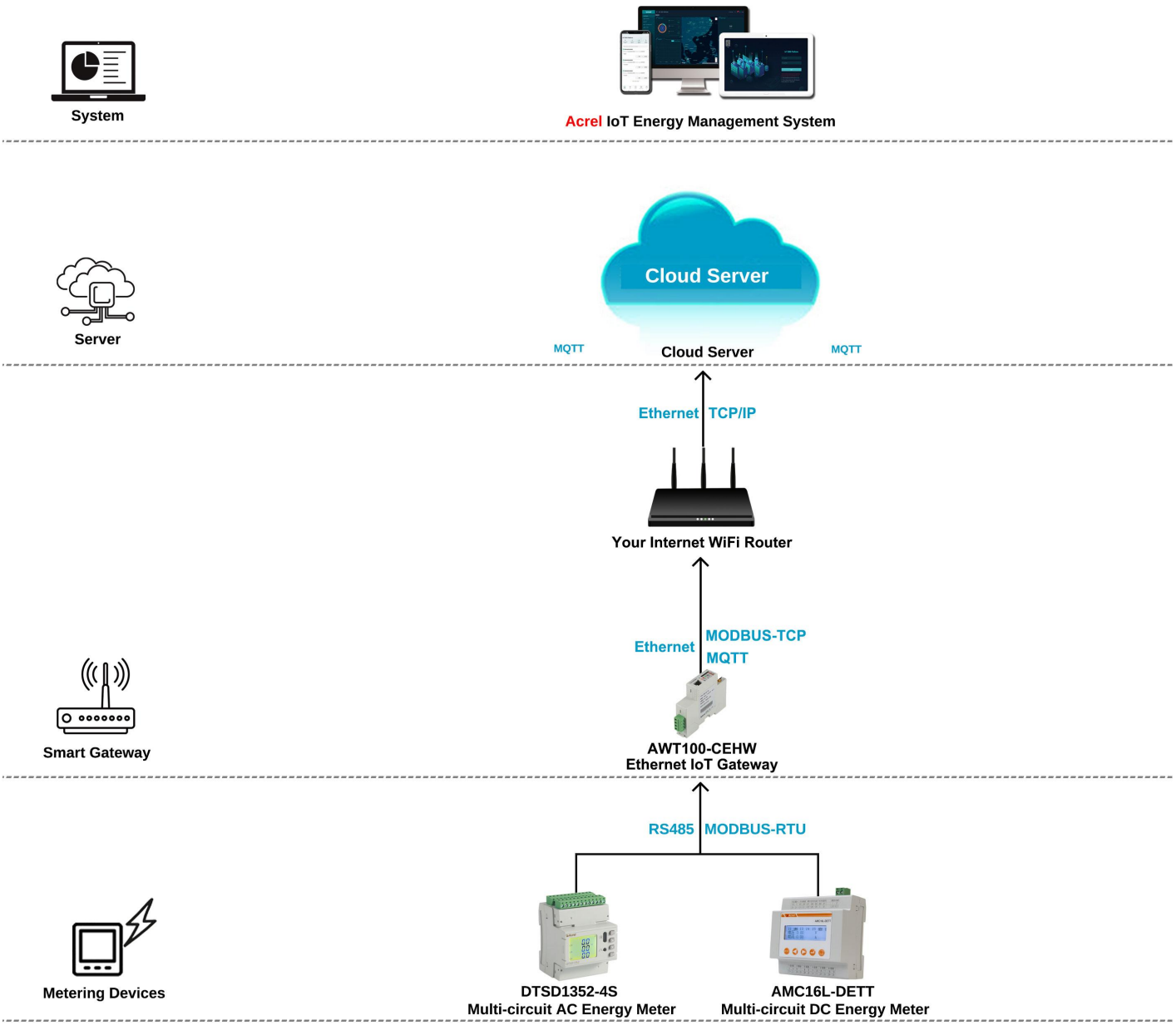
Website: www.acrel-electric.fr

3.Communication Structure&Logic [Ethernet IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

If the customer don't have their own IoT system and would like to use all Acrel IoT system software and metering hardware, the overall communications structure will be like:

(1) Between AMC16L-DETT Multi-channel DC Energy Meter, DTSD1352-4S Multi-channel AC Energy Meter and AWT100-CEHW IoT Gateway we will use RS485 wired communications based on MODBUS-RTU protocol. Since these are all Acrel products, the communications protocol integration will be done in factory manufacturing stage.

(2) Between AWT100-CEHW IoT Gateway and Acrel IoT System, we are using Ethernet communications based on either MQTT or MODBUS-TCP protocol for data uploading. [protocol integration was also done in factory stage.]



(1) Integration Communications Structure

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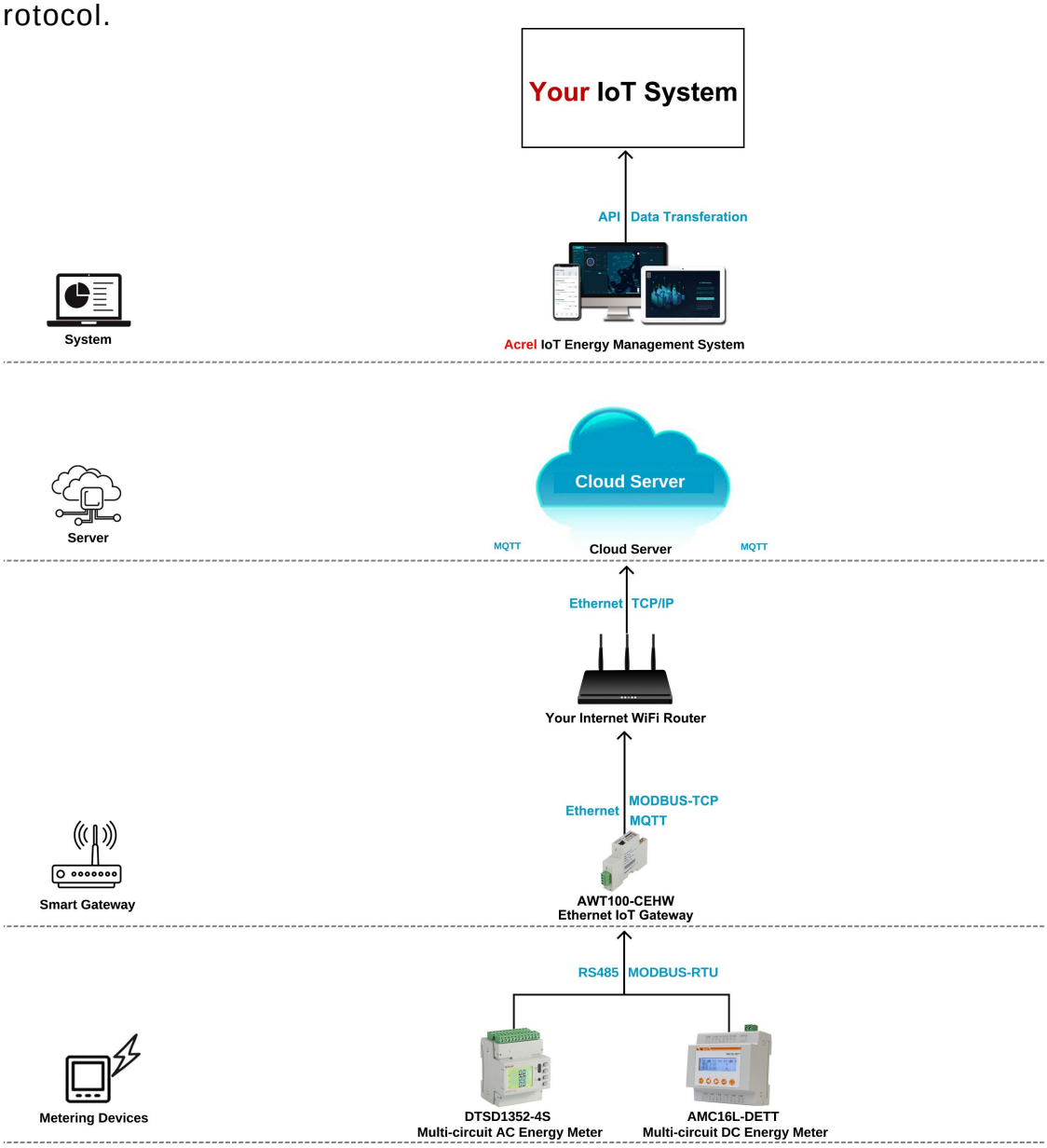
3.Communication Structure&Logic [Ethernet IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

If the customer side have their own IoT system and would like to do the API/SDK integration between Acrel IoT system and their own IoT system, the overall communications structure will be like:

(1) Between AMC16L-DETT Multi-channel DC Energy Meter, DTSD1352-4S Multi-channel AC Energy Meter and AWT100-CEHW IoT Gateway, we will use RS485 wired communications based on MODBUS-RTU protocol. Since these are all Acrel products, the communications protocol integration will be done in factory manufacturing stage.

(2) Between AWT100-CEHW IoT Gateway and Acrel IoT System, we are using Ethernet communications based on either MQTT or MODBUS-TCP protocol for data uploading. [protocol integration was also done in factory stage.]

(3) Between Acrel IoT System and customer's IoT system, we will use API/SDK based on the related protocol.



(1) Integration Communications Structure

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3. Hardware Devices Overview [Ethernet IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

Model 1: AMC16L-DETT Multi-circuit DC Energy Meter

DC Metering | Base Station | 6-channel | RS485 (MODBUS)

- Monitoring: Up to 6 circuits [DC Metering]
- Rated Voltage: -48Vdc
- Rated Current: 5Vdc (via -A/5Vdc hall sensor)
- Communicaiton: RS485 Interface, MODBUS-RTU Protocol
- Auxiliary Power Supply: -40~-60Vdc
- Power Output: 1 set of +12V/100mA,-12V/50mA power output serving as power supply of paired Hall Sensors.
- Data Storage: 2mb room for alarm and energy data.
- Certificate&Standard: IEC; CE

Model 2: DTSD1352-4S Multi-circuit AC Energy Meter

1-phase&3-phase | Multi-circuit | 4-channel | RS485 (MODBUS)

- Monitoring: Up to 4 circuits 3-phase or 12 circuits 1-phase or mixed [AC Metering]
- Rated Voltage: 3x380~456Vac L-L & 3x220~264Vac L-N
- Rated Current: 50mA (via -A/50mA CT)
- Communicaiton: RS485 Interface, MODBUS-RTU Protocol
- Auxiliary Power Supply: 85~265Vac/Vdc
- Certificate&Standard: CE

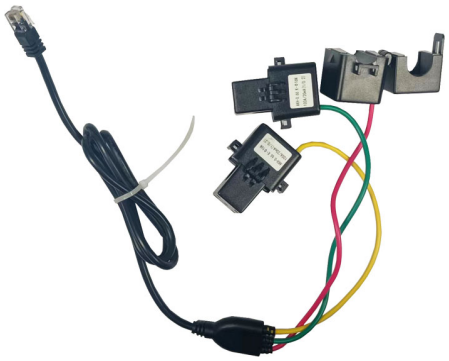
Model 3: AWT100-CEHW IoT Ethernet Gateway

IoT Gateway | 4G/WiFi/Ethernet | MQTT&MODBUS | RS485 Downstream

- Upstream Methods: Ethernet (Protocol: MQTT, MODBUS-TCP, support DHCP or static IP addressing)
- Downsteam Methods: RS485 (MODBUS-RTU)
- Support: Up to 25 monitoring circtuis via RS485 Interface within 300m.
- Auxiliary Power Supply: 85~265Vac L-N (via AWT100-POW power supply module) or 24Vdc (default)
- Certificate&Standard: CE-RED

3. Hardware Devices Overview [Ethernet IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

AC Current | 3 CTs in 1 Set
16mm Aperture | 100A/50mA AC



Model 1: AKH-0.66/K-Φ16N 100A/50mA Split-core CT

- Current Ratio: 100A/50mA AC
- Accuracy: Class 0.5
- Aperture: 16mm
- Application: Paired with DTSD1352-4S AC energy meter for current intput
- Noted: 1 set include 3 CTs

Hall Effect | AC&DC Transducer
0~500A AC/DC In. | 0~±5/±4Vdc Out.

Model 2: AHKC-EKA Split-core Hall Sensor

- Current Input Range: 0~50A DC
- Current Output Range: 0~±5Vdc
- Aperture: φ20mm
- Auxiliary Power Supply: ±12Vdc (Supplied by AMC16L-DETT)
- Application: Paired with AMC16-DETT DC energy meter for current intput

Hall Effect | AC&DC Transducer
0~1000A AC/DC In. | 0~±5/±4Vdc Out.

Model 2: AHKC-EKB Split-core Hall Sensor

- Current Input Range: 0~250A DC
- Current Output Range: 0~±5Vdc
- Aperture: φ40mm
- Auxiliary Power Supply: ±12Vdc (Supplied by AMC16L-DETT)
- Application: Paired with AMC16-DETT DC energy meter for current intput

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3. Overall Model Selection&Quoation [Ethernet IoT Cloud Energy Moniotring Solution for Telecomms. Tower Base Station]

(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.

System Software

Name	Description	System Price	Remark (Choose Host Service or Buy-out Service after 3-month Free Trial of **Cloud IoT System**)
 **Acrel Cloud IoT Energy Management System**	1.System support all the meters across the country whose data has been sent to cloud server through **4G,WiFi or Ethernet**. 2.Remote meter reading and data collection. 3.Provide **IoT APP** for **mobile phone** side and **IoT WEB** for **PC** side. 4.Generate energy data report of daily, monthly and annually period with year-on-yeay and period-on-period energy analysis. 5.Provide various alarm function to ensure a stable operation of the system and protect your property. 6.Offer 3-month free trial of system with full technical support	$0 (recommended in pilot project)	3-month Free Trail (Users don't need to rent a cloud server))
		$xxx/Year (For 12 Points) (Price for Host Service Only, recommended in pilot project)	$xx to buy Hosting Service for 1 monitoring points connected to the system 1 year (Users don't need to rent a cloud server)
		$xxxx/Permanent (Limitless Points) (Price for Buy-out Service Only,recommended in late project)	1-time charging of $xxxx for Buy-out Service of permanent use (Unlimited monitoring points and a cloud server need to be rent by users)

Cloud Server

Name	Description	Server Renting Price (For Reference Only)	Remark
 Cloud Server	1.Cloud Server could be rent on the cloud server provider like Amazon Cloud. 2.Users of **Cloud IoT Energy Management System** only need to rent cloud server when they choose **buy-out** service of our **Cloud IoT System**. And if they are using **hosting service** or **3-month free trial** of our Cloud IoT System, we will use our own cloud server which has been rent on Amazon so that users don't need to rent a cloud server. 3.The quotation of Cloud Server is only a reference price that we have rent on Amazon Cloud.	According to Specs of Rented Cloud Server	Below cloud server specs could support 1000~2000 monitoings points connected to the system (Server：8 core 16G Operation System：windows server 2016)

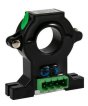
Smart Gateway

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	Ethernet Smart Gateway **AWT100-CEHW**	**Upstream:** Ethernet (DHCP or static IP, MQTT, MODBUS-TCP) **Downstream:** RS485 (MODBUS-RTU) **Support:** up to **20~25** monitoring points within 400m using RS485 communication **Power Supply:** 85~265Vac/Vdc (via AWT100-POW Module); 24Vdc (Default)	1 pcs		
	Power Supply Module **AWT100-POW**	**Input:** 85~265Vac/Vdc **Output:** 24Vdc **Application:** paired with AWT100 Series gateway for 85~265Vac/Vdc power supply input	1 pcs		

AC Metering Devices Set

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	AC Multi-circuit Energy Meter **DTSD1352-4S**	**Monitoring:** Up to 12 circuits 1-phase or 4 circuits 3-phase or mixed [AC Metering] **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** 380~456Vac L-L & 220~264Vac L-N **Rated Current:** 50mA (via -A/50mA CTs) **Auxiliary Power Supply:** 85~265Vac/Vdc	2 pcs		
	Split-core Current Trasnformer **AKH-0.66/K K-φ16N 100A/50mA**	**Current Ratio:** 100A/50mA AC **Aperture:** φ16mm (diameter) **Accuracy:** Class 0.5 **Application:** Paired with DTSD1352-4S for current input **Noted:** 1 set include 3 CTs	5 pcs		

DC Metering Devices Set

Overview Picture	USAGE&MODULE NAME	DESCRIPTION & SPECIFICATION	QUANTITY	FOB UNIT PRICE (USD)	AMOUNT (USD)
	DC Multi-circuit Energy Meter **AMC16L-DETT**	**Monitoring:** Up to 6 circuits [DC Metering] **Communication:** RS485 (MODBUS-RTU) **Rated Voltage:** -48Vdc **Rated Current:** 5Vdc (via -A/5Vdc Hall Sensor) **Power Output:** 1 set of +12V/100mA,-12V/50mA power output serving as power supply of paired Hall Sensors. **Auxiliary Power Supply:** -40~-60Vdc	1 pcs		
	Hall Sensor **AHKC-EKA**	**Current Input Range:** 0~50A DC **Current Output Range:** 0~±5Vdc **Aperture:** φ20mm **Auxiliary Power Supply:** ±12Vdc **Application:** Paired with AMC16-DETT for current input	5 pcs		
	Hall Sensor **AHKC-EKB**	**Current Input Range:** 0~250A DC **Current Output Range:** 0~±5Vdc **Aperture:** φ40mm **Auxiliary Power Supply:** ±12Vdc **Application:** Paired with AMC16-DETT for current input	1 pcs		