Empower the World

CHA120

Single Phase Smart ANSI Meter

User Manual



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README

Range of validity

The present user manual applies to the metering products specified on the title page.

Purpose

The user manual contains all the information required for application of the meters for the intended purpose. This includes:

- Provision of knowledge concerning characteristics, construction and function of the metering products
- Information about possible dangers, their consequences and measures to prevent any danger
- Details concerning the performance of all work throughout the service life of the metering products

Target group

The contents of this user manual are intended for technically qualified personnel of utility companies responsible for the metering products planning, installation, operation and maintenance

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1. Overview

CHA120 single phase smart ANSI meter is designed for FM1S, FM2S and FM4S users. Max current up to 200A. It has ultra Anti-Tamper features and multi communication channels, which can support Wi-SUN communication and cellular communication. It can be used for remote data collecting and load control. This smart meter can help the Utility company build smart home and AMI system easily.

Highlights：

- Ultra Anti-Tamper Features
- Multiple Communication Methods
- Various AMI Functionalites

2. Introduction

2.1. Device Description

Type	Connection	U_n	I_b (Imax)	f_n	Imp/kWh	Accuracy Class	
CHA120 FM2S	DC	120/240V	30(200)A	60Hz	1000 (by default)	Active	CA0.5
DC: direct connected							

2.2. Standards and References

Standard	Description
ANSI C12.10-2011	American National Standard for Physical Aspects of Watthour Meters—Safety Standard
ANSI C12.20-2015	American National Standard For Electricity Meters-0.2 and 0.5 Accuracy Classes
ANSI C12.1-2014	American National Standard for Electric Meters Code for Electricity Metering
IEC 62056-21-2002	Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local exchange
IEC 62056-6-2-2016	Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes
IEC 62056-61-2006	Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1:COSEM object identification system (OBIS)

3. Block Schematic Diagram

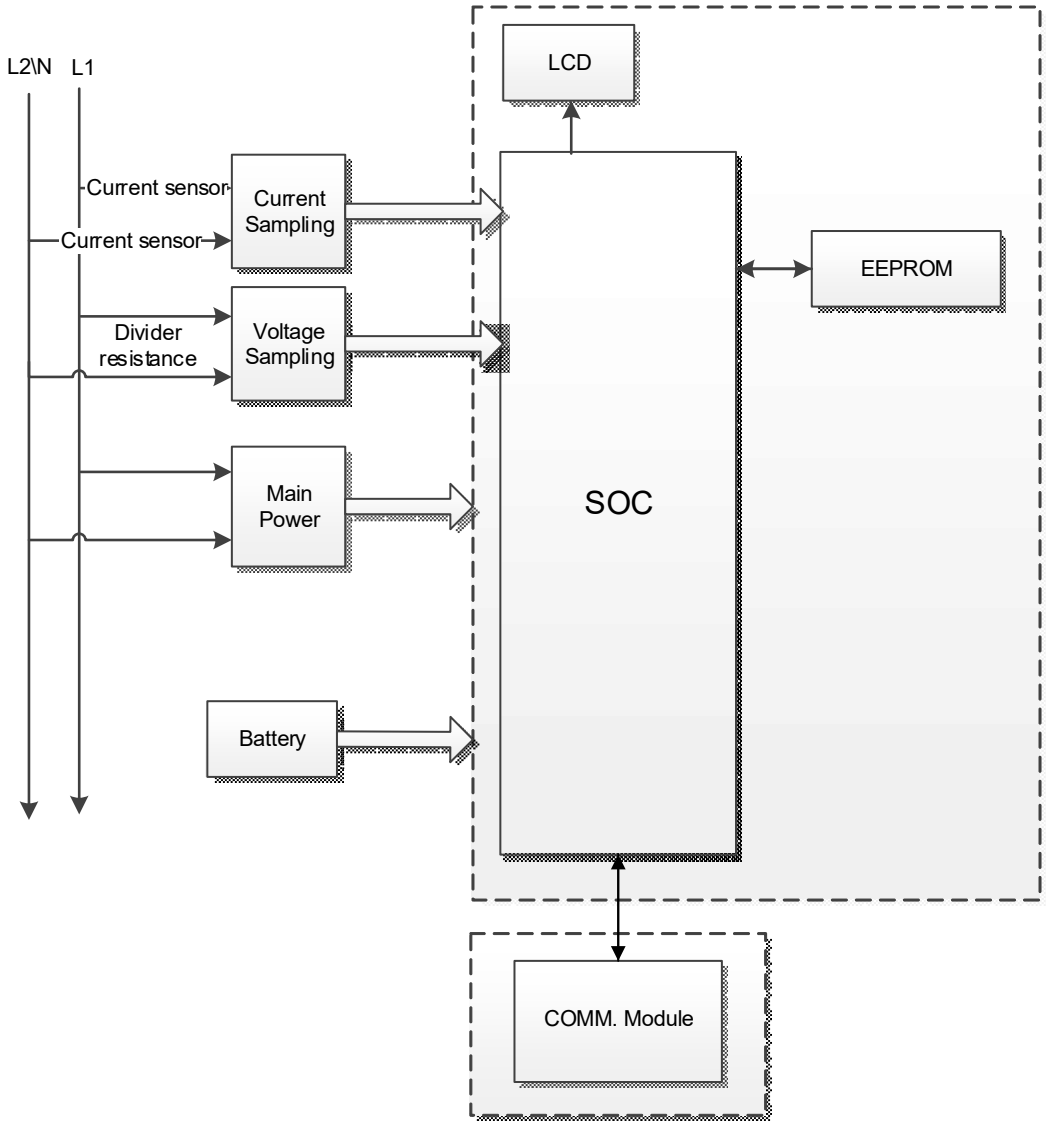


Figure 1: Block schematic diagram of (typical) of CHA120

The meter is mainly comprised of current sampling unit, voltage sampling unit, MCU, main power supply, backup power supply, LEDs, LCD, memory, and communication module.

The meter processes voltage and current sampling through SHUNT or CT and voltage sampling circuit, upon which the integrated energy data is used to drive the pulse output and passed to energy registration. Relevant controlling and meter reading function are all based on the registered energy data.

Besides the mains power supply, there are power backup which comprises of the internal super-cap and the replaceable battery. All together they provide a reliable power management scheme to fulfill the power requirement of a smart meter.

4. Basic Specifications

Table 1: Specifications of CHA120

Description	Values
Meter Type	FM2S
Active Accuracy	CA0.5
Nominal Voltage Un	120V / 240V
Current Range	30(200)A
Nominal Frequency fn	60 Hz, ± 2%
Starting Current	0.4% In
Meter Constant	1000 imp/kWh for FM2S
Start-up Time	≤ 5s
Power Consumption of Base Meter	Voltage circuit: ≦2W, 5VA Current circuit at I_n: ≦4VA
Operating Voltage Range	0.8Un ~ 1.15Un
Operating temperature range	-40℃ ~ +70℃
Storage and transportation limited temperature range	-40℃ ~ +80℃
Relative Humidity	Up to 95% non-condensing
Life expectancy	10 years
Dimensions	177mm (D) × 153.3mm (H)
Weight	1.0kg (Approx.)

5. Meter Construction

5.1. Appearance

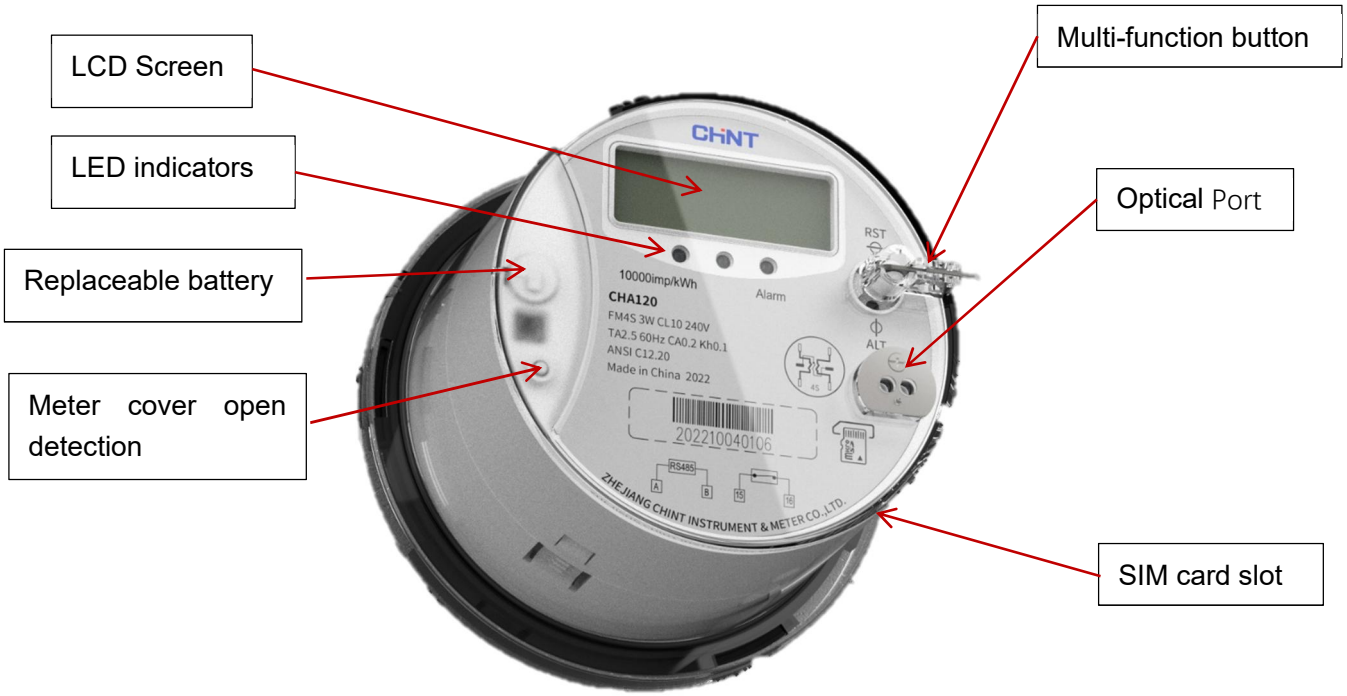


Figure 2: Meter appearance of CHA120

The mechanical housings are made of recyclable PC (UV light and solvent vapors resistant), subjected to class II insulation. The meter offers IP54 (non-suction) ingress protection level, compliant to IEC 60529.2 lead seals are used to protect the meter housing. Without breaking the seals it's impossible to access the internal parts of the meter.

There are nameplates in the meter cover, providing sufficient spaces for the utility to attach device and customer information.

5.2. Dimensions

5.2.1. Outline Dimensions

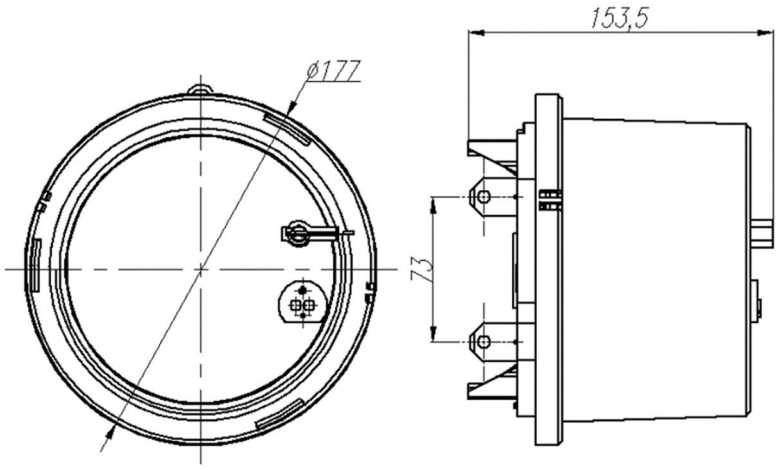


Figure 3: Dimension of CHA120

5.2.2. Installation Dimensions

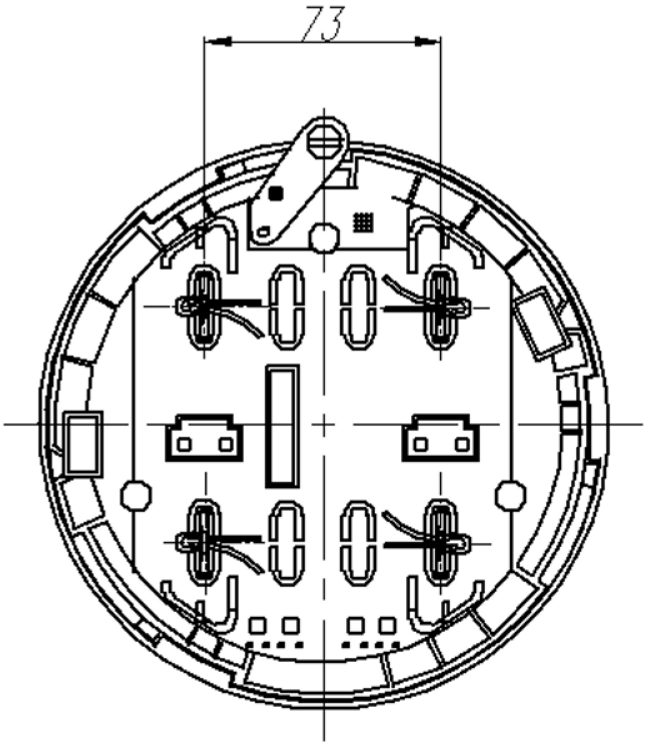


Figure 4: Installation size of CHA120

5.3. Wiring Diagrams

5.3.1. Main Wiring

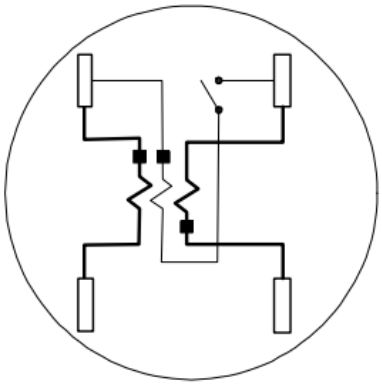


Figure 6: FM2S 3-wire wiring diagrams of CHA120

6. Meter Functionalities

6.1. Function List

Table 2: Function list of CHA120

Item	Sub-item	Parameter
LED & Display	LED	1 x Active pulse, 1 x Alarm LED by default Up to 4 LED indicators
	Energy Data Format	Active: 7 digits
	Instantaneous Value Format	Energy: XXXXXXX, unit:kWh Power: XX.xxx, unit:kW Voltage: XXX.xx, unit:V Current: XXX.xx, unit:A Demand: XX.xxx, unit:kW
	LCD	Size of LCD: 71 x 26mm (W x H) Size of digit: 7 x 12mm (W x H)
	Display Modes	- Auto scroll mode: interval by default is 6 seconds (configurable:1-99s). - Manual scroll mode - No power display.
	Display Symbol	- Tamper indicator - Direction of current - Communication Status - Other special event indicator
Measurement	Active Energy(Default)	Import Active Energy = |+A| Export Active Energy = |-A|
	Instantaneous	Phase Voltage (V) Phase Current (A) Active Power (kW) Demand
Communication	Optical Port	ANSI 12.10 compliant
	Optical Port Protocol	IEC 62056-21
	Communication Unit	Wi-SUN
	Protocol for Communication Unit	DLMS/COSEM

Item	Sub-item	Parameter
	Wired Interface	RS485 (optional)
	Protocol for Wired Interface	DLMS/COSEM
Clock (optional)	ToU	- Up to 4 tariff operations - Up to 12 season profiles - Up to 12 week profiles - Up to 8 day profiles, with each day 10 entries. - 50 configurable special days
	RTC Accuracy	≤0.5 s/day (at 23ºC)
	Backup Battery	- Battery for no-power RTC and display - 10-year battery lifetime
Maximum Demand & Billing	Maximum Demand	Optional average or sliding demand calculation Configurable demand interval: 5,10,15,20,30 or 60 minutes
	Billing(Maximum Demand Reset)	Three types of billing operation: - Billing through communication command. - Billing based on calendar of tariff. - Billing based on button manually
	Capacity of Stored Value (Billing Profile)	Number of captured objects up to 30
Load Profile	Number of Profiles	4
	Capacity of Profiles	Each profile has the capacity of storing 1500 records
	Profile Interval	1~1440minutes, configurable, 15 minutes by default
Event Function	Number of Profiles	4 different types of event logs
	Standard Event Log	Types of logs include: - Timing synchronization - Battery low - Max demand manual reset Event log reset - Power on / Power off Capture object configurable
	Tampering Detection Log	Types of logs include: - Meter cover open - Strong magnetic

Item	Sub-item	Parameter
		- Current bypass Capture object configurable
	Disconnect Log	Types of logs include: - Remote disconnect - Remote connect - Local disconnect - Local connect Capture object configurable
	Power Quality Log	Types of logs include: - Power outage - Under voltage - Over voltage - Over current - Over load Capture object configurable
Load Control	Disconnection Relay	Maximum Current:200A Maximum switching voltage: Up to 440VAC Support phase and neutral relay (optional) Up to 10000 operations
	Load Limiting	Configurable load limiting
Security	Access Level	Up to 3 access levels protected by password

6.2. Display

6.2.1. LCD display information

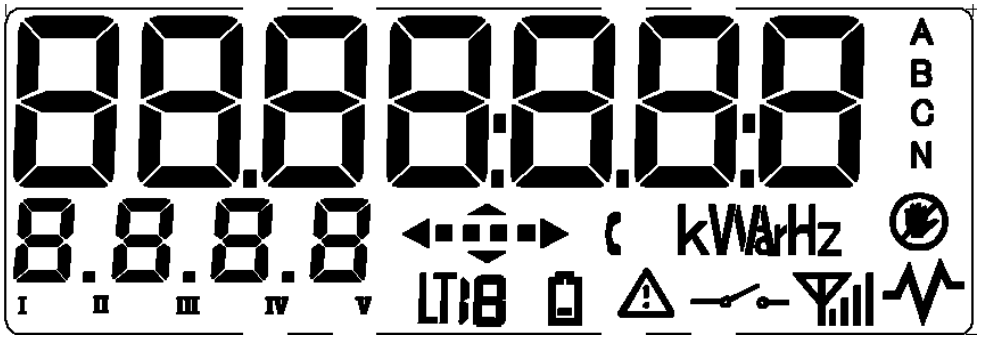


Figure 8: LCD screen of CHA120

Symbol descriptions:

Table 3: Symbol descriptions of CHA120

Section name	Display symbol	Description
1		Metering value
2		OBIS of display item
3		In communication
4		Signal strength
5		Reserved
6		Low battery voltage indication
7		Tampering indication
8		Alarm indication
9	A B C N	Phase voltage indication
10		Relay connection/disconnection
11	kWArHz	Units
12		Current import/export indication
13	I II III IV V	Tamper event specification
14		Step or multi tariff indication

6.2.2. Data item

Digits in this area has a size of 7 x 12 mm (W x H). Various type of meter value could be displayed in this area. If the meter value is longer than 8 digits, it will be segmented and displayed with separated screens

6.2.3. LED

There are 2 LEDs (by default) on the meter.

1) Energy impulse LED is used for active accuracy verification.

2) Alarm LED is used to indicate alarm state (configurable, current reversal by default).

The quantity of LEDs support up to 4, the function of LEDs can be customized.

6.2.4. Communication symbol

If the cellular module is connected, the symbol will be displayed, in addition to the signal strength indication:

The meter automatically identifies the type of the module being connected and display relevant symbols.

When the meter is being communicated locally or remotely, the communication symbol will be on.

6.2.5. Relay Indication

The relay on/off symbols can indicate the relay state, disconnection or connection. When the relay is in Ready_for_Reconnection state, the symbol will flash at a frequency of 0.5Hz.

6.2.6. Phase Voltage Indication

Voltage symbol A indicates status of phase A. If the phase voltage is normal, the symbol is on. If it is in overvoltage or under voltage state, the symbol will flash at a frequency of 0.5Hz.

6.2.7. Battery Indication

When the battery voltage is low, the symbol will display, should change the replaceable battery at this time.

6.2.8. LCD Display Modes

The meter has 3 display modes: auto-scroll, manual-scroll and no-power read. Display objects for each mode is configurable. The display time internal and display object list for each mode can be configured according to different requirement.

In auto-scroll mode the meter automatically scrolls the display at an interval of 5s by default.

Once the display button is pressed, the meter will get into manual-scroll display mode. And user can press the button to turn the display page. Through the following table for button operations, the meter could change the display behavior.

Table 4: Button operate type

Operate type	Operate interval	Display behavior	Display tip
Short press	Tp < 2s	Manual-scroll current display list	
Medium press	2s < Tp < 4s	Switch display list to the next one	PAGING

Long press	4s < Tp < 6s	Reset display list to auto-scroll	BACING
Extra-long press	Tp > 8s	Reset to auto-scroll mode	H-cnct

The meter is fitted with no-power read feature. When the meter is powered off, if the display button is pressed the meter will wake up and get into no-power displaying.
The backlight will turn on automatically when the power is turned on or there is a display button or a demand reset button. The backlight is turned on for 15s.

6.2.9. LEDs

There are 2 LEDs on the meter by default. The one energy pulse LEDs are used for active accuracy verification. One alarm indicator whether there are tampering event happens.

6.2.10. Button

The meter has one multi-function button, by rotation with different angle, it can support manual display scrolling function and billing reset operation (Maximum Demand Reset). This multi-function button also support lead seal.

6.3. Measurement

6.3.1. Energy pulse

Active energy pulse is output to relevant LED for accuracy verification. By default the meter constants are configured as 1000imp/kWh, which are also configurable based on application.

6.3.2. Energy values

The meter can measure and store the following energy quantities:

- Import active energy (+A),
- Export active energy (-A),
- Absolute active energy (|+A| + |-A|),
- Algebraic sum active energy (|+A| - |-A),
- Multi-tariff energy.

After the energy value reaches the maximum display limit, which is 99999.99 [kWh], it will overflow and reset to zero, meanwhile the overflow counter increments by one.

6.3.3. Demand

The method used for demand calculation of the meter could be either average demand or sliding demand.

By default it's configured as average demand.

For sliding demand the interval "T" used for demand calculation is determined by the two parameters: period and number_of_period, illustrated below:

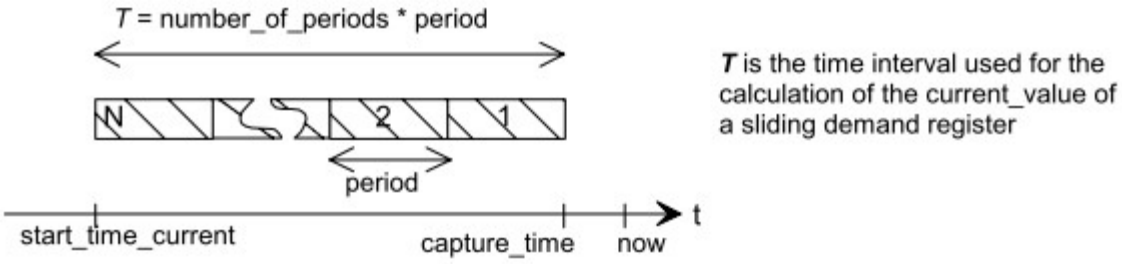


Figure 9: Demand period

For average demand, it can be regarded as a special type of "sliding demand" where the number of period is always 1.

Through the configuration of the above two parameters, the demand interval of the meter is defined. The following table shows the value range of the parameters.

Table 5: Calculation method

Calculation method	Demand internal (min)	Period(min)	Number of period
Sliding	1~60	1~60	1~60
Interval	1~60	1~60	1

Table 5: Demand type

Demand type	Measurement content
Import active demand (A+)	Current demand register (1.4.0) Demand of last interval register (1.5.0) Maximum demand registers – total and per tariff (1.6.x)
Export active demand (A-)	Current demand register (2.4.0) Demand of last interval register (2.5.0) Maximum demand registers – total and per tariff (2.6.x)

6.4. Communication

The meter offers 3 independent communication interfaces, which include an optical port, an RS485 wired port(optional) and a built-in communication module unit used for upstream communication.

6.4.1. Optical interface

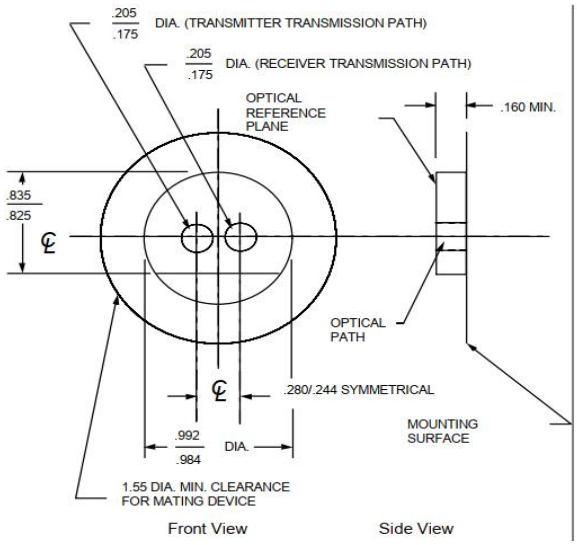


Figure 10: External view of ANSI optical port

- Compliant to ANSI optical communication physical interface
- Conform to DLMS/COSEM communication standard
- Configured as 9600bps, 7 bits, 1 even parity by default
- Supporting software and HHU can be used for local data exchange through optical interface.

6.4.2. RS485 communication interface (optional)

- DLMS/COSEM protocols
- Configured as 9600bps, 8 bits, no parity by default

6.4.3. Upstream Communication Interface

- DLMS/COSEM protocols
- Wi-SUN

6.5. Time of Use (optional)

6.5.1. General description

The meter offers up to 4 tariff operations, which feature is driven by its internal real time clock. The time table used for the tariff switching consists of the season tables, the day tables and the special day tables.

6.5.2. Real time clock

6.5.2.1. RTC features

- Automatic leap year switching
- Accuracy at 23° C less than 0.5s/day
- A 1Hz pulse output is available for quick clock accuracy verification
- 24-hour clock format
- If the real-time clock stops, a predefined tariff can be designated for tariff energy registration

6.5.2.2. RTC backup power

- Lithium battery (Optional)

One lithium battery with 1200mAh capacity, 3.6V supply voltage battery provides backup power to the RTC

6.5.3. ToU time table

The meter has 2 sets of TOU time tables, capable of up to 4 tariff operations. Each table consists of up to 12 season entries, associated to 12 week tables respectively, and up to 8 day tables, each with up to 10 day entries. Besides, the meter can define up to 50 special days.

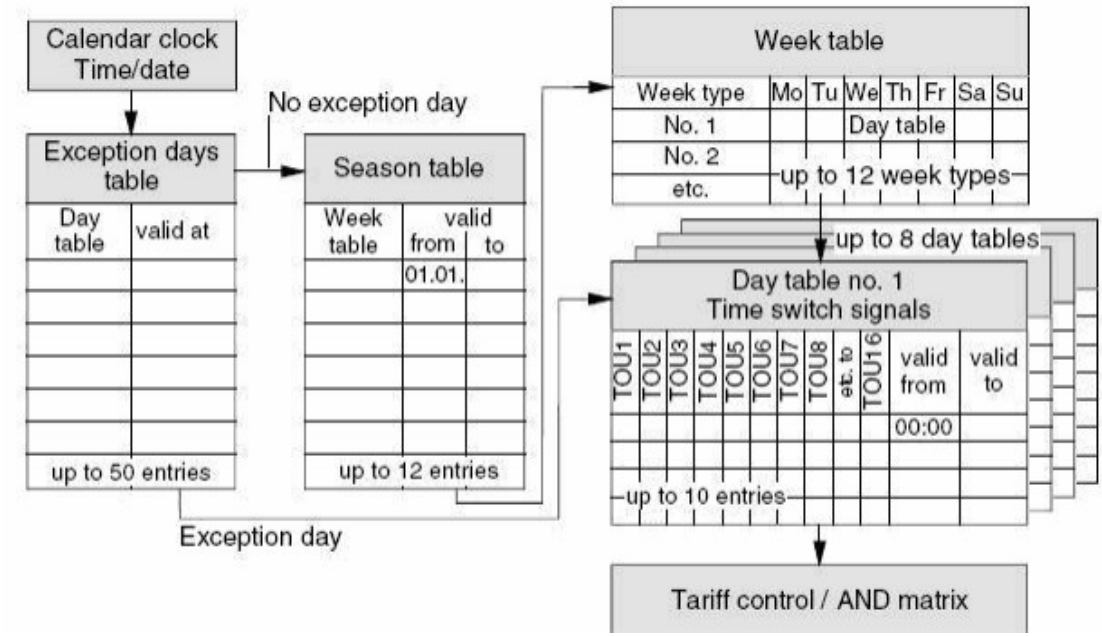


Figure 11: Schematic diagram of the calendar clock

6.5.4. Time table programming

The time table programming is always applied on the passive time table. The activation time of the passive time table is configurable. When the meter gets to the activation time the active and passive time table will swap. The names of active and passive time table are both configurable but cannot be the same.

The time table switching can be done remotely through a communication command.

6.6. Billing

There is a billing profile in the meter to store the billing values. The maximum demand registers reset and a record is generated in the billing profile either the predefined billing time is due or a manual billing operation (through MD Reset button) is detected.

6.6.1. Billing on predefined schedule

By default the billing schedule is configured to trigger the billing operation at midnight on the first day of each month. The number of captured objects for each billing entry can be up to 20.

The virgin startup of the meter generates a billing entry in the profile.

If a power outage or a time adjustment skips the billing time, the meter will complement the missed billing entry either after the meter is re-powered up or after the time adjustment is completed.

6.6.2. Operations associated to billing

When a billing operation is conducted, the meter will do the following:

- Generate an entry in the billing profile
- Reset maximum demand resisters,
- Generate MD reset event log.

6.7. Load Profile

Support 4 channels of load profile, each channel can register up to 1500 records. Interval of each load profile is configurable, configure by 15 min by default, can be 1 ~ 60 minutes. What values can be stored in each load profile is configurable. The records in the load profile is stored in the FIFO (First In First Out) manner, each entry with a timestamp. The load profile records can be read out flexibly by the entry or time range defined by the readout.

6.8. Event

The meter detects and records events. The event log is identified with unique event number. The generated event signal will be directed to generate alarm or error indication based on relevant configuration.

Event logs, alarm and error generation:

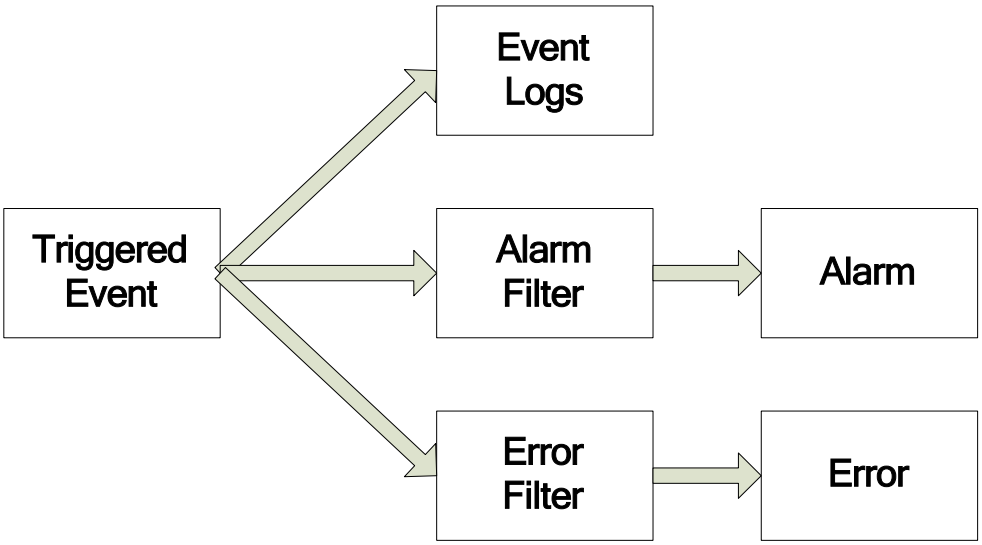


Figure 12: Triggered event

6.8.1. Event logs

The meter defines and records the following 4 type of event logs with separated event profile:

Table 6: Type of event logs

Types of event logs	Logical name	Description
Standard event log	0-0:99.98.0.255	General events such as time synchronization, meter configuration change, etc.
Tampering detection log	0-0:99.98.1.255	Events associated to tampering detection.
Disconnection event log	0-0:99.98.2.255	Events associated to Connect and Disconnect
Power quality event log	0-0:99.98.4.255	Event associated to power quality

6.8.2. Event alarming

There is an event register in the meter, containing a 32-bit data to indicate the on/off state of some predefined events. An alarm filter of 32-bit value, which is configurable, is defined to filter out what events have to trigger the alarm. The alarm indication includes the alarm LED, the backlight, the alarm symbol on the LCD and even the audible alarm.

- Alarm LED and backlight

When an alarm event occurs, the LCD backlight and alarm LED will flash continuously.

- Alarm symbol of LCD

6.9. Data Security

The meter offers different categories of users the following 3 access levels which are protected by access password.

- Public Reading
- Meter Reading
- Meter Configuration

7. Installation

It is recommended to refer to the wiring diagram for connecting the meter to the power network. If appropriate a meter cabinet can be used to protect the meter. Preferably the meter should be installed in a ventilated and environment.

7.1. Installation Procedures and Cautions

7.1.1. Installation Procedures

To ensure proper operation of the meter, follow the procedures below when install a meter:

- Fix the first screw on the wall, leave some space between screw head and the wall to allow the meter being able to hang on the screw
- Hang the meter on the screw
- Fix the other screws to install the meter on the wall
- Make sure the power is off and connect the power lines to the meter as per the wiring diagram
- Make sure the meter is firmly in place, power on the meter
- Check relevant indications of the meter to make sure the installation is proper

7.1.2. Cautions

Improper installation could damage the meter. Relevant verification must be done to ensure the meter is properly installed:

- Verify the operating voltage of the meter is within the range
- Verify the current range is proper for the application at the installation site
- Verify there is no visible mechanical or electrical damage on the meter
- Verify the factory seals of the meter have not been broken

7.2. Acceptance After Installation

After the meter is installed and power is connected, the following checking should be done on the meter:

- The phase voltage symbol on the LCD should be present
- If any load is applied on the meter the pulse LED should be flashing and the quadrant indicator should correctly indicated
- All seals should be installed.

7.3. Safety Regulations

Relevant national and international safety regulations must be complied with during the course of the meter installation. The installation must be conducted by qualified personnel.

Do not touch any of the live parts of the meter at any time when the power is on. Be aware that personal injury or equipment damage could result from improper wiring procedure.

FCC ID for CHA120 Wi-SUN type is: 2BXBXCHA12001

➢Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

8. Transportation and Storage

- The meter should be transported and unpacked violently. Do not apply power on when the case has been damaged or violently dropped during handling, access and installation. Contact the supplier as soon as possible.

- Save the energy meter should be in the original packaging, the ambient temperature is -40℃ ~ +85℃, the average relative humidity of not more than 75% of the air without corrosive gases.

  Meter stored in the warehouse, should be placed on the bench, the stack height not more than 10