LoRaWAN Gas Meter Design Specs

1.Summary

The LoRaWAN gas meter has integrated traditional mechanical gas meter and electronic control circuit of high performance into an organic whole with local infrared communication and remote LoRa communication function.It follow the LoRaWAN protocol specification, can realize the remote data communication between the master station and the gas meter, and realize the meter-prepaid function. The system can not only keep the measuring accuracy , but also has the function of automatic management.

2.Main tech parameter

2.1 Mechanical tech parameter

ITEM		UNIT	MODEL		
			WG1.6A / WG1.6(S)	WG2.5A / WG2.5(S)	WG4A / WG4(S)
Nominal Flow Rate		m³/h	1.6	2.5	4
Max. Flow Rate		m³/h	2.5	4	6
Min. Flow Rate		m³/h	0.016	0.025	0.04
Measure Grade			1.5Degree		
Total Pressure Loss		Pa	≤250		
Working Pressure Range		kPa	0.5～30		
Cyclic Volume		dm³	1.2		
Permissible Error	Qmin≤Q<0.1Qmax	%	±3		
	0.1Qmax≤Q≤Qmax	%	±1.5		
Min. Recording Reading		dm³	0.2		
Max.Recording Reading		m³	99999.999		
Service life		年 year	10（Natural Gas）		
Connection Thread			M30×2(or Customization)		

2.2 Electrical tech parameter

Item	Unit	WG1.6A/WG1.6(S)/ WG2.5A/WG2.5(S)/ WG4A/WG4(S)
LCD Value Unit	m³	0.01
Valve Max. Action Current	mA	＜300
Operation Current for sleep	μA	＜10
Relative Humidity	%	≤93

Operation Ambient Temperature	℃	-10～+40
Storage Temperature	℃	-20～+55
Pulse Equivalent	m³	0.01（100 pulse equivalent per 1 cube meter）
Pulse Form		Double Pulse(Valid electrical level is more than 50ms)
Service Voltage		Double power supply(built-in 3.6DC6V,outlay four AA alkaline battery)

3.Main functions and performance

3.1   Gas accumulation and freezing function

Automatically accumulated for the used gas, the records of day and month freezing time will be aoutomaticly recorded . Upto 60 day or 12 month freeze data will be reserved.

3.2 Prepaid management function

Support online free card prepaid recharge.Recharge information can be uploaded any time after users pressing the button, it can also be uploaded during active reporting period of the gas meter . support gas volume valuation and settlement method, support daily and month freezing function.

3.3 LCD display function

The LCD can display the cumulative volume of used gas , current time, battery voltage, communication address , states flag and abnormal information etc. In a dormant state in case of without any operation, meanwhile, LCD will not display. It can be waked through   some operation such as gas pulse, button, switch valve etc.

3.4 Data communication function

The gas meter supports two external communication ports, one is Lora port another is infrared port. The infrared port is operating local maintenance and the Lora port is used for remote interaction with the master station.

The LoRa function is of two kinds of open mode, the first way: link to the screen display "-L-CLOSE"through the short selection buttons, then the Lora function will be opened through the long key, LCD display "-L-OPEN", this way is usually used for debugging use; the second way: automatically open LoRa function by infrared or a master set of regular reporting time.

The way of opening infrared function: link to the screen display "-L-CLOSE"through the short selection buttons, then the Lora function will be opened through the long key, LCD display "-L-OPEN",meanwhile, gas meter supports HHU and master station for data communication and maintenance by infrared. Infrared function will be closed after 5 minutes' no communication period.

3.5 Parameter setting and query function

The gas meter is able to receive and save the parameters setting by the main station, and support the the query of data parameters , the specific data parameters referring to the communication protocol between the master station and the instructions"

3.6 Abnormity protection and event logging

The gas meter can automatically record some event records for the master station to read and analyse such as first level and second level low power, key authorization valve-open, large flow, magnetic interference etc.. And automatically closing valve   in the process of air use when finding abnormal magnetic interference and large abnormal flow.

3.7Active reporting function

Gas meter can actively reports the used data to master station according to the setting active reporting cycle, Support up to 60 days' freezing meter reading data recovery in case of failure connection.

3.8 System self-inspection.

Battery voltage of Meter timely detecting system, if the voltage less than 1st alarm volume, the valve will closed and LoRa function will cancelled, meanwhile the meter will report to the consumer, In emergency, consumer may press the button for continue using, the Lora will reopen till 2nd alarm volume reached, after 2nd alarm colume reached, all function will open untill new batteries replaced.

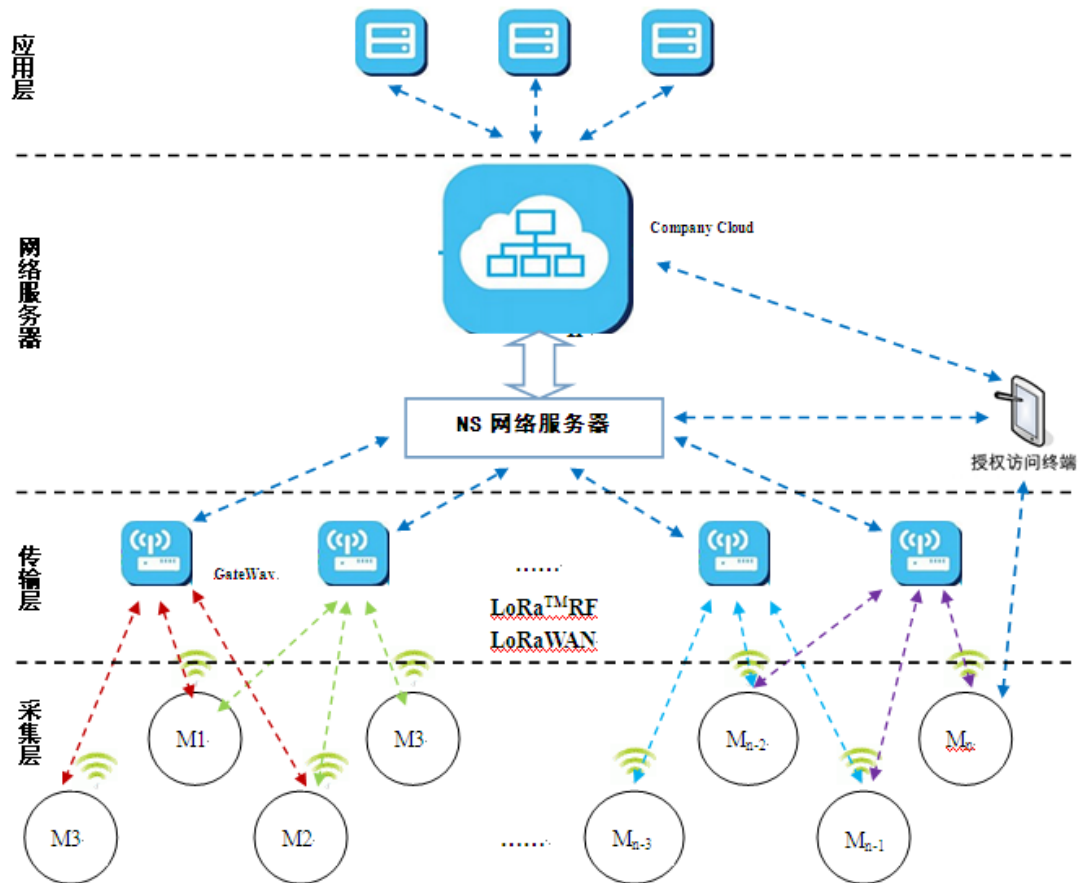### 3.9 Multi level access remote valve control

①Authorized valve

Administrator can send remote valve-close command to force off the valve of meter, then, user can not open the valve unless after getting the valve-open authority.
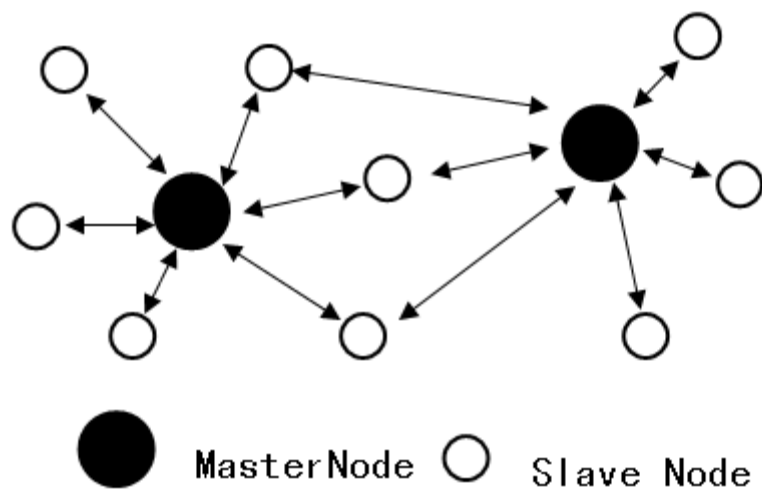
② Cost control valve

Meter can judge whether to open the valve or not after user information updated by pressing the button for a long while.
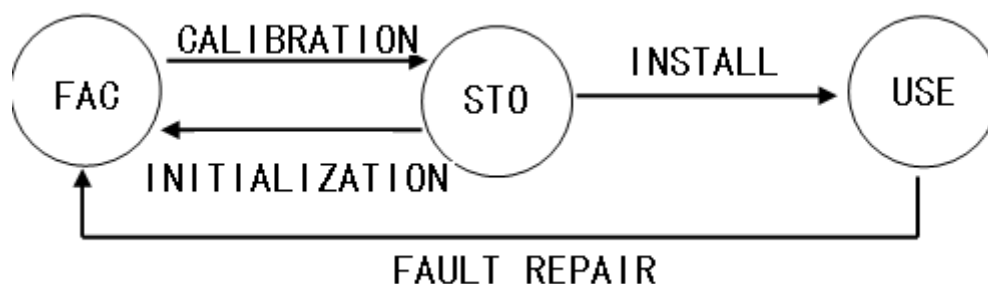
4 Network Structure
4.1 System Chart

应用层

网络服务器

Company Cloud

NS 网络服务器

授权访问终端

传输层

GateWay.

LoRa™RF
LoRaWAN.

采集层

M1.

M3.

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M₃.

M2.

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Mₙ₋₃

Mₙ₋₂

Mₙ₋₁

Mₙ.

4.2 Local network topology

MasterNode   ○ Slave Node

5 States transition of meter and process description

5.1 State of Production
Characterization of the table in the factory assembly test calibration status, able tocomplete the table with the production of custom settings

5.2 Storage State（STO）
Characterization of the table with the completion of the factory test storage to install the state before the installation, the specific process is as follows.

1、The third party measurement and on-site installation testing: without electricity, short press to open valve detection; once up to detection limit ,it will not be able to be used. Then ,we use electricity key to activate the infrared interface using a portable device to set the detection limit.

2、Account open（User, meter and system account binding ,account initialization）

① Account application: User business hall declaration or WeChat Public Account No. declaration. (fill in the user information, the application of system account), after the audit, the user enters into pre-open queue (push into account-open server), complete tasks of user information and account system binding.

② Account opening in live: engineers install gas meter from door to door, meter testing , key remote information retrieval, confirm and scan meter number and upload to the account-open server.

Trigger mode 1:After battery installation, press button in a short while, enter into 'INTO USE' interface, press button in a long while to trigger' LoRa communication', Gas meter communicate with account-open server through local network gateway, set gas meter working parameters through pre-open account information confirming and transfer the target server to the operation server, complete the binding between gas meter and system account , and transferred to the user state.

Trigger mode 2: After battery installation, press button in a short while, enter into 'H-CLOSE' interface, press button in a long while to trigger infrared communication, send infrared command and waiting gas meter's reply; LCD display 'PUSH' with buzzer alarming, after pressing button, gas meter open LoRa

automatically, communicate with account open server, set gas meter parameters through the confirmation of pre-open account information and transfer meter target server to operation server ,complete the binding between gas meter and system account, then turn into user state.

Long Press the button, if LCD shows ---, the Host no reply within 30 seconds, Error 11, open account failed.

5.3 Use State（USE）

after the binding between gas meter，meter system and user account, gas meter turn to operation state, pls check chapter 3 for the detailed function, pls see the control process as bellowing:
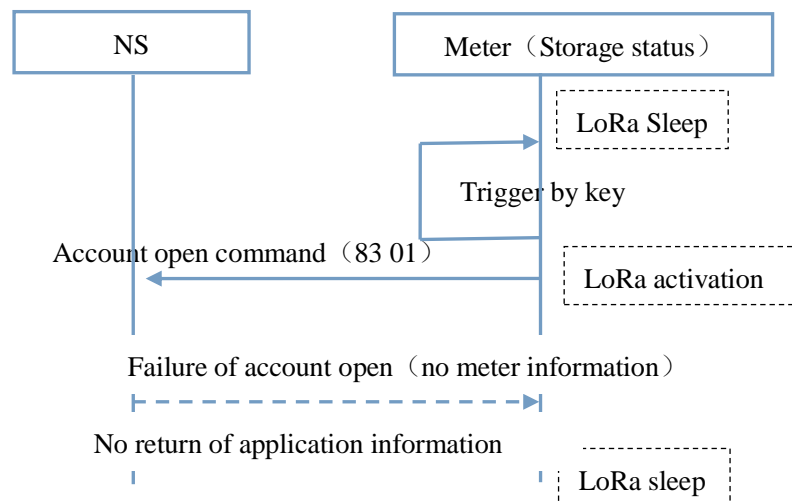
After account open, management system bind user and gas meter together. Customer can recharge by business hall or by Wechat public number, system check charge information and update account information, and authorize Front end processor for management. Update meter account information when meter report regularly or report by triggering by key, if residual gas volume is lower than the alarm line, meter valve will be closed and indicate to recharge.

Administrator can send valve control command remotely to force to close the valve. If so, customer can not open the gas meter until get the restart authority.
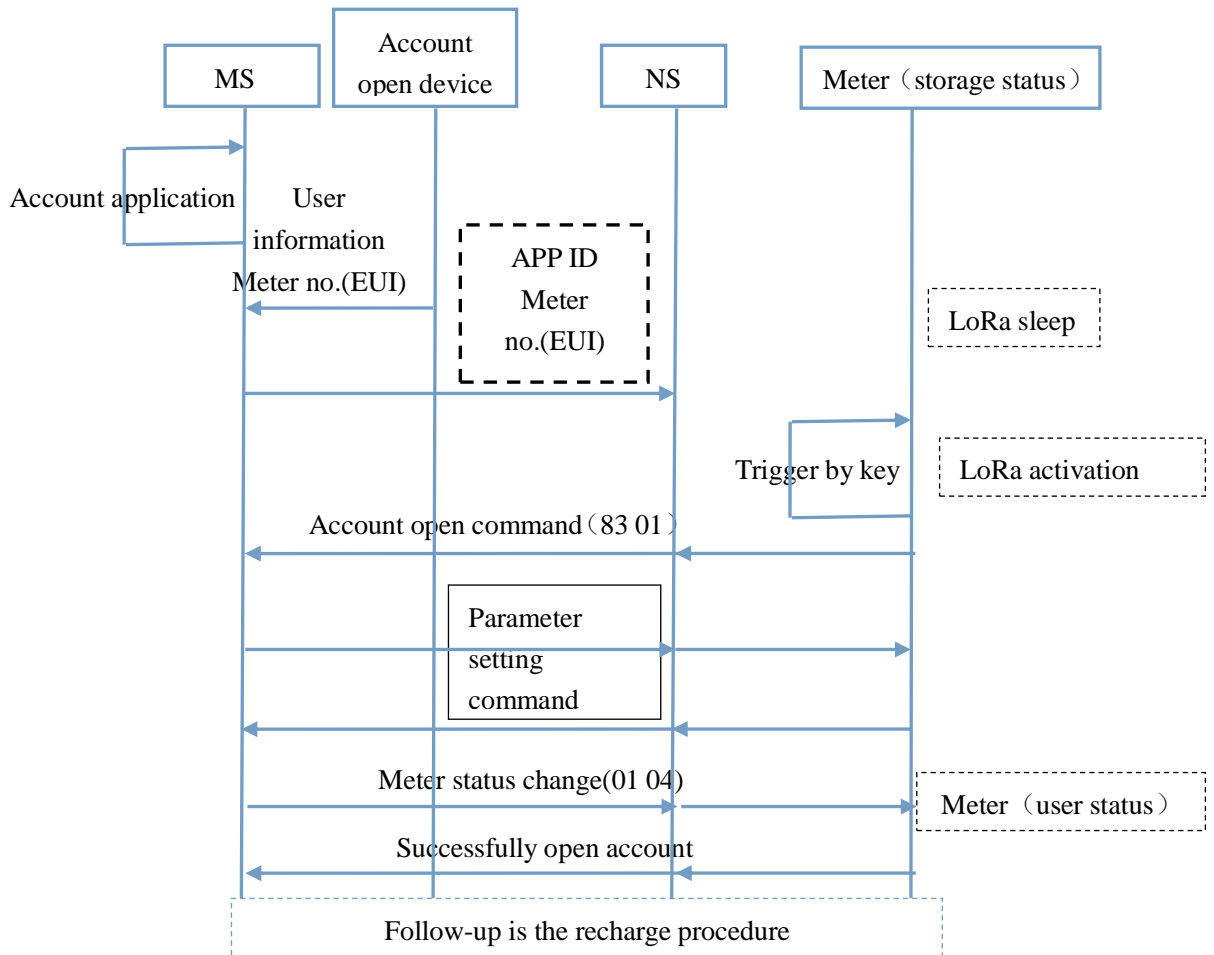
6.Typical process flow diagram

6.1 Meter installation network test

Remark: MS means 'management system', NS means 'network server'

6.2 Account open

Diagram 1: Account open procedure

Participants: **MS**, **Account open device**, **NS**, **Meter（storage status）**

- Account application
- User information Meter no.(EUI)
- APP ID Meter no.(EUI)
- LoRa sleep
- Trigger by key → LoRa activation
- Account open command（83 01）
- Parameter setting command
- Meter status change(01 04) → Meter（user status）
- Successfully open account
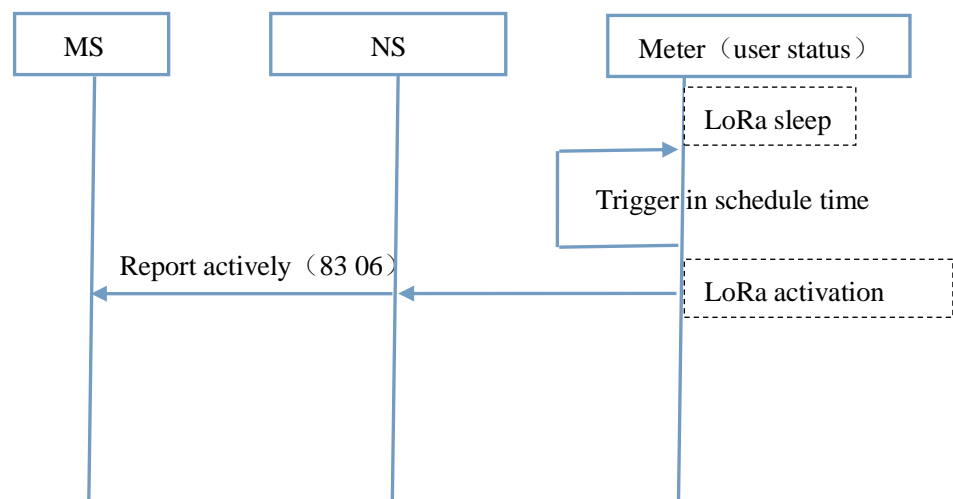- Follow-up is the recharge procedure

Remark：

1、APP ID and EUI matching table can be batch loading, management system will no needed for NS submitting.

6.3 Meter change

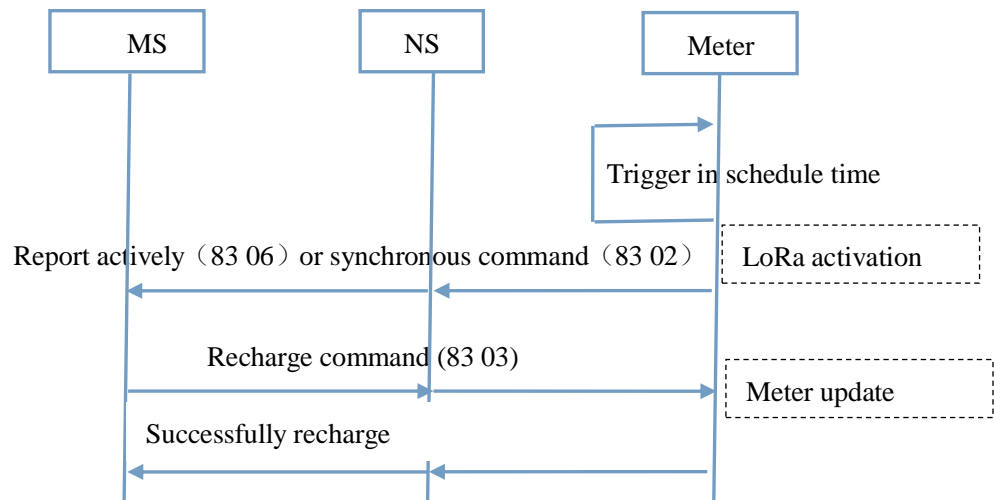The procedure of management system change is as the same with account open.

6.4 Report actively in cycle time

Remark: MS means 'management system', NS means 'network server'

Diagram 2: Report actively procedure

Participants: **MS**, **NS**, **Meter（user status）**

- LoRa sleep
- Trigger in schedule time
- Report actively（83 06）
- LoRa activation

6.5 Recharge

Remark: MS means 'management system', NS means 'network server'

Remark: Recharge key information use DES encryption, fill the user number at the first time to recharge and complete the binding between user and meter; Check the user no. and times of gas purchasing in the follow-up recharge process, only   if the times of gas purchasing in the recharge information is more than 1 time comparing with the times in the gas meter, the system judge the recharge information is valid.
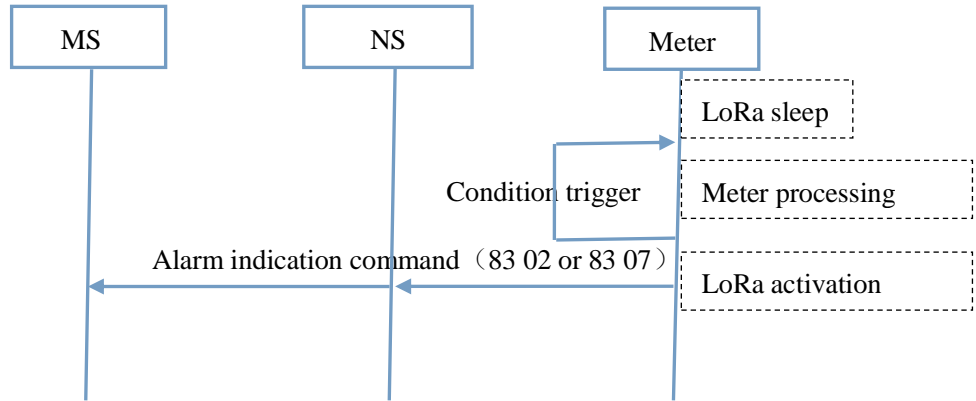
6.6 Valve switch control

Remark: MS means 'management system', NS means 'network server',
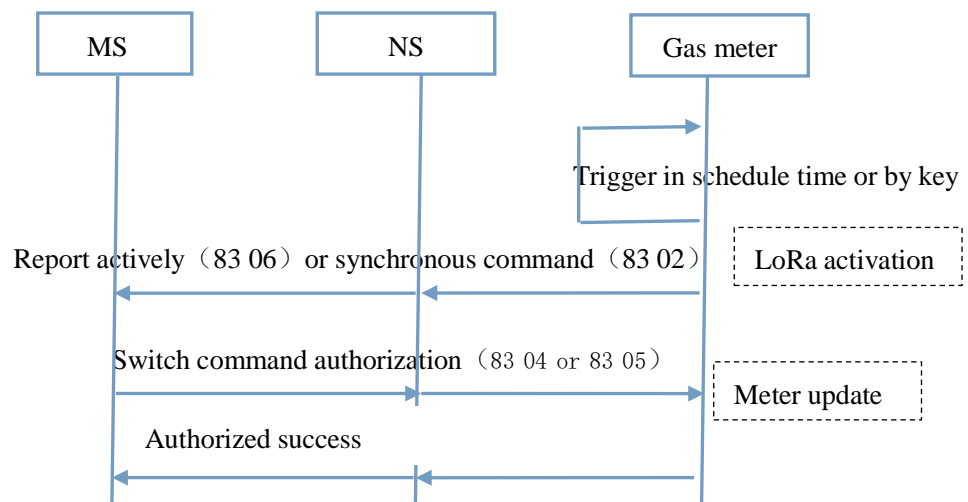
6.7 Alarm indication

Remark: MS means 'management system', NS means 'network server'

Remark:

1．Alarm indicating is composed of two type, one is to indicate actively reporting of information(Can be selected by the functional switch to start), For example, the tips of low gas amount , low power and valve .   such tips use the synchronous execution command (8302).the other one is abnormal alarm, it use local gas meter history record, master station actively acquire the record accordingly.

7. communication protocol
The communication protocol between mete and master station refer to <<LORAWAN gas meter communication protocol V1.4>>