



ADL Series DIN Rail Watt-hour Meter

Operation Manual

VERSION: 20090228



Shanghai Acrel Ltd.

ADD: No.253 Yulv Road, Madong Industrial Park, Jiading District, Shanghai, China ZIP: 201801

TEL:0086-21-69158338 FAX: 0086-21-69158303

EMAIL:acrel008@vip.163.com WEB: <http://www.acrel.cn>

Contents

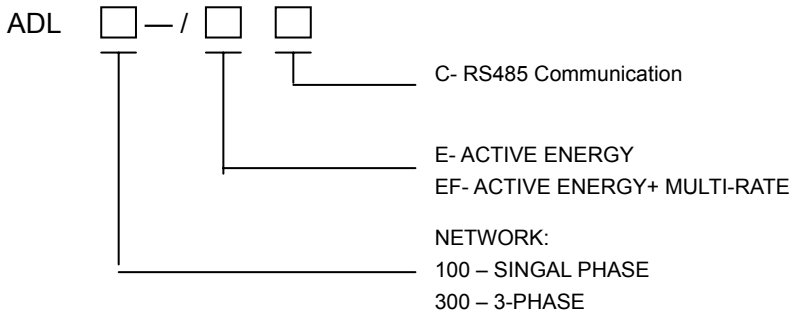
1. GENERAL	1
2. DESIGNATION	1
2.1 DESIGNATION METHODE.....	1
2.2 SPECIFICIATION.....	1
3. TECHNICAL FEATURE.....	1
4. INSTALLATION AND WIRING.....	2
4.1 Installation and Wiring	2
4.2 Attentions of installation and application.....	3
5. OPERATION GUIDE.....	4
5.1 PANEL.....	4
5.2 FUNCTION.....	5
5.3 DISPLAY.....	6
5.4 COMMUNICATION.....	8
5.5 ATTENTIION.....	14
6. TYPICAL APPLICATION.....	14
7. PURCHASE EXAMPLE.....	14

1. GENERAL

ADL Series DIN rail watt-hour meter is a kind of smart energy meter. There are 2 types: the single phase watt-hour meter ADL-100 and the 3-phase watt-hour meter ADL-300. It adopts micro-electronics technique, and it has many advantages such as compact, light, delicate, accurate. With their good capability of anti-emi and low-power, they comply with international standard IEC 60136:2000 and IEC 60512:1988.

2. DESIGNATION

2.1 DESIGNATION



2.2 SPECIFICATION

MODEL	TYPE	class	Un (V)	In (A)	Pulse constant (imp/kWh)
ADL100	With CT	1.0	220V	1.5 (6)	12800
				5 (20)	3200
	Without			10 (40)	1600
				20 (80)	800

MODEL	TYPE	class	Un (V)	In (A)	Pulse constant (imp/kWh)
ADL300	With CT	1.0	3×220/380V	1.5 (6)	6400
				5 (20)	1600
	Without			10 (40)	800
				20 (80)	400

3. TECHNICAL FEATURE

Parameter	Value	
	ADL100	ADL300
Accuracy	1.0	
Un	220V	3×220/380V
In	1.5(6)A, 5(20)A, 10(40)A, 20(80)A	
Frequency	50Hz or 60Hz	
Voltage supply	normal: 0.9 ~ 1.1Un ; maximal: 0.7 ~ 1.2Un	
Starting current	With CT	0.004Ib
		0.002In
consumption	For voltage	≤5VA / phase
	For current	<4VA / phase
Output of pulse	Width of pulse: 80ms±20ms open-collector photo-coupler pulse	
Digital communication	RS485, MODBUS-RTU	

Clock error	≤0.5s/d	
Environment	normal: -10℃ ~ +65℃, maximal: -20℃ ~ +70℃, storage: -40℃ ~ +80℃	
Relative humidity	≤95% (without dewing)	
Outline (L×W×H)	76×89×74 (mm)	126×89×74 (mm)

4. INSTALLATION AND WIRING

4.1 Installation photo and Wiring photo

4.1.1 Outline (unity: mm)

1) Single phase ADL100

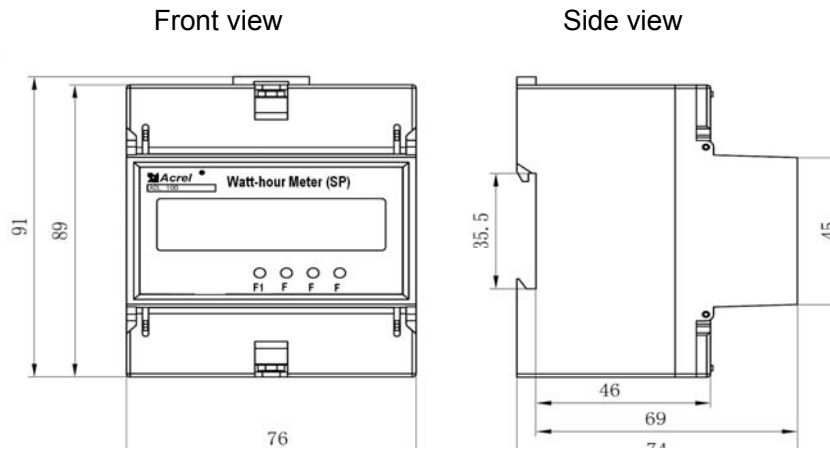


Photo 1 single phase ADL100 outline

2) 3 phase ADL300

Front view

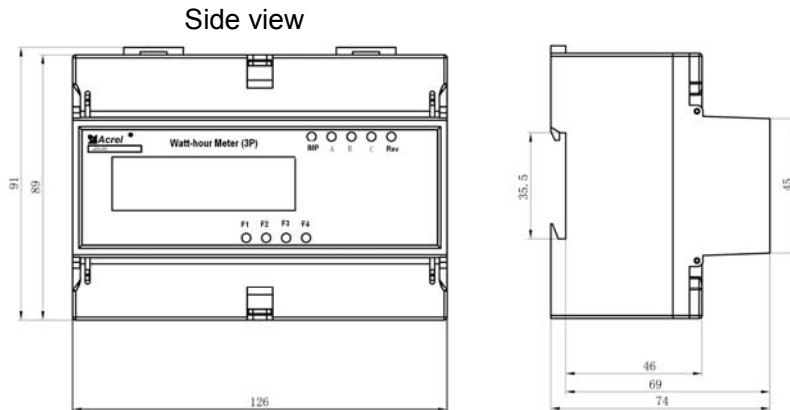


Photo 2 3-phase ADL300 outline

4.1.2 Installation photo

ADL series watt-hour meter is installed by standard 35mm DIN rail, as photo 3

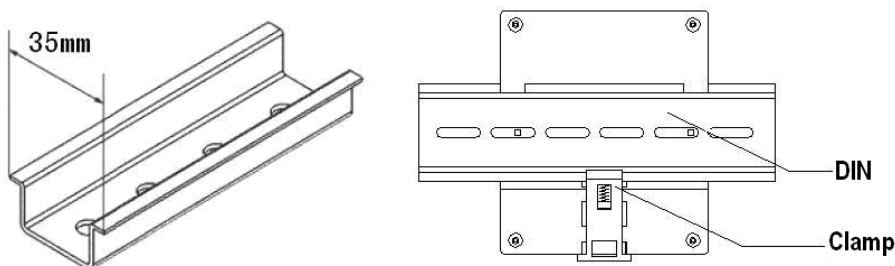


Photo 3

4.1.3 Wiring photo

ADL series meter is coded directly or is coded by CT.

(1) single phase ADL100

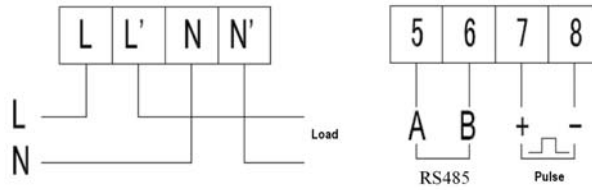


Photo 4 single phase without CT

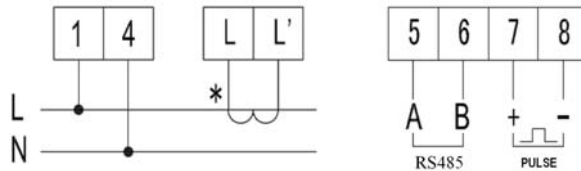


Photo 5 single phase with CT

(2) 3-phase ADL300

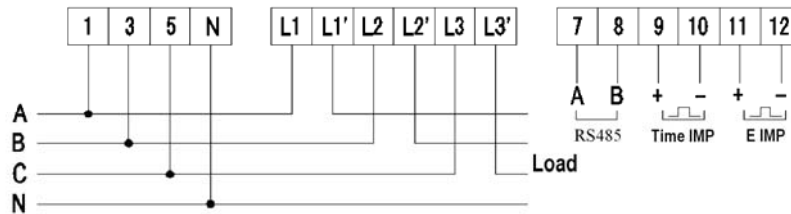


Photo 6 In 3-phase without CT

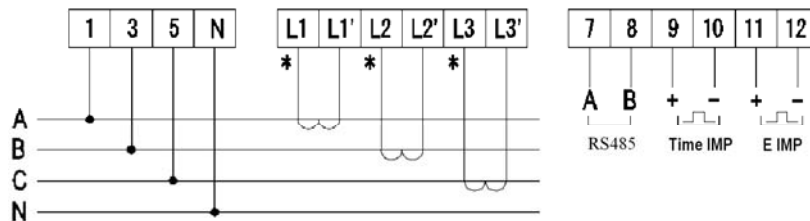


Photo 7 In 3-phase with CT

4.2 Attention of wiring

4.2.1 This meter has to be installed on the drying indoor, and in the standard 35mm DIN rail.

4.2.2 Please wire according to the wiring photo. If the meter is wired directly, you must have attention of the direction of input and output line. If the meter is wired by CT, you must have attention of polarity of secondary.

5. Operation guide

5.1 The front

5.1.1 Single phase ADL100

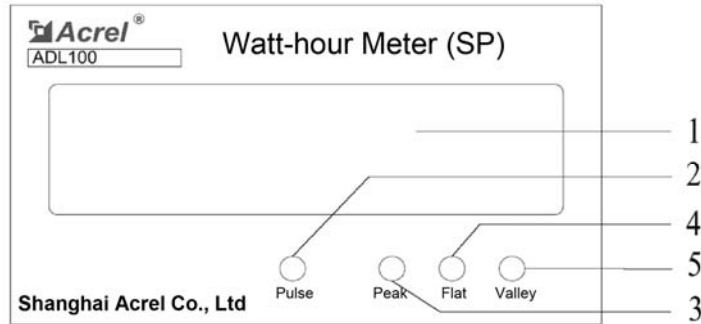


Photo 8 single phase ADL100

Code	Name	State	Function
1	LCD		LCD display
2	pulse	LED lightening	Display by power pulse
3	peak	LED lightening	Current tariff is Peak tariff
4	Flat	LED lightening	Current tariff is flat tariff
5	valley	LED lightening	Current tariff is valley tariff

Description of panel:

5.1.2 3 phases ADL300

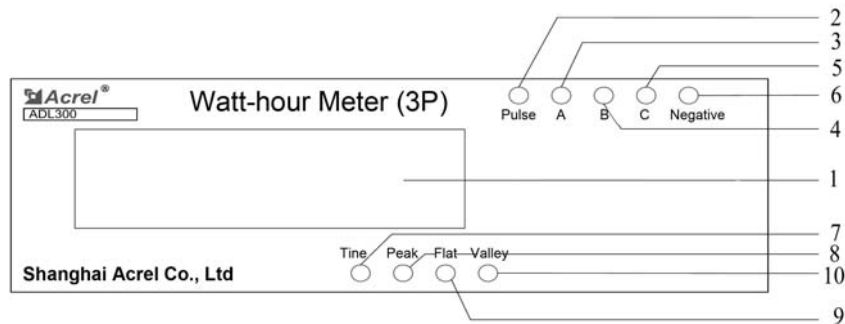


Photo 9 3 phases ADL300 panel

Code	Name	State	Function
1	LCD		LCD display
2	Pulse	LED ON	Display by power pulse
3	A phase	LED ON	A phase with power
4	B phase	LED ON	B phase with power
5	C phase	LED ON	C phase with power
6	Negative	LED ON	Indication of negative
7	Spike	LED ON	Current tariff is spike tariff
8	Peak	LED ON	Current tariff is Peak tariff
9	Flat	LED ON	Current tariff is flat tariff
10	Valley	LED ON	Current tariff is valley tariff

Description of panel:

5.2 Function

Measurement

- Count and store the energy by total, spike, peak, flat and valley.
- It stores the frozen data for 3 months,
The default data of frozen measurement is the end each month.
- After power off, all stored data exists for more than 10 years.

Clock and tariff / zone

- The error of clock is < 0.5s/day, it can switch automatically according calendar, time and leap year.
- Single phase ADL100 can be programmed as 3 rates: peak, flat and valley and as 8 zones of day; the minimal interval of zone is 1 minute.

3 phases ADL300 can be programmed as 4 rates: spike, peak, flat and valley and 8 zones of day; the minimal interval of zone is 1 minute

Display

- LCD displays 7 digitals
- It can loop display, the interval is 4s
- Pulse and the current rate and zone are indicated by LED

Output

- Active pulse output is for calibration and count of energy. Width of pulse: 80ms±20ms

Communication

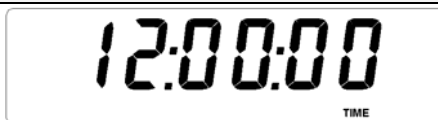
- Interface: RS485
- Protocol: MODBUS-RTU
- Speed: 9600bps (default), 4800bps, 2400bps, 1200bps optioned

5.3 Display

5.3.1 Single phase ADL100 display

In the default state, ADL100 loop displays time, date, total kWh, peak, flat, valley, voltage and current. Display interval is 4s.

NO	TYPE	FORMAT	EXPLANATION
1	Time	HH:mm:SS	hour: minute: second
It is 12 o'clock now.			
If LED of peak tariff is ON, it is peak tariff now :			



2	Date	YY.MM.DD	year month day
It is February 1st 2008			



3	Total kWh	XXXXX.XX or XXXXXX.X	5 integers, 2 decimals or 6 integers, 1 decimals
(the decimal can move automatically)			
The total kWh is 46.32kWh right now.			



4	Peak	XXXXX.XX or XXXXXX.X	5 integers, 2 decimals or 6 integers, 1 decimal
The peak energy is 24.12kWh			



5	Flat	XXXXX.XX or XXXXXX.X	5 integers, 2 decimals or 6 integers, 1 decimal
The flat energy 12.10kWh			



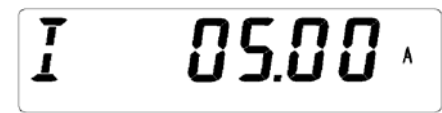
6	Valley	XXXXX.XX or XXXXXX.X	5 integers, 2 decimals or 6 integers, 1 decimal
The valley energy 10.10kWh			



7	Voltage U	XXX.X	3 integer, 1 decimals
---	-----------	-------	-----------------------



8	Current I	XX.XX	2 integer, 2 decimals
---	-----------	-------	-----------------------



9	Indication of direction of power: left arrow figures that active power is negative		
---	--	--	--



10	Indication of RS485, the phone sign figures meter is under communication.
----	---



11	Indication of low power: Please change the battery
----	--



5.3.2 3 phases ADL300 display

In the default state, ADL300 loop displays time, date, total kWh, spike, peak, flat, valley, Display interval is 4s.

NO	TYPE	FORMAT	EXPLANATION
1	Time	HH:MM:SS	hour: minute: second
It is 12 o'clock now.			
If LED of peak tariff is ON, it is peak tariff now :			



2	Date	YY.MM.DD	year month day
It is February 1st 2008			



3	Total energy	XXXXX.XX or XXXXXX.X	5 integers, 2 decimal or 6 integers, 1 decimal
(the decimal can move automatically)			
The total kWh is 46.32kWh right now.			



4	Spike	XXXXX.XX or XXXXXX.X	5 integers, 2 decimal or 6 integers, 1 decimal
The spike energy 57.52kWh			



5	Peak	XXXXX.XX or XXXXXX.X	5 integers, 2 decimal or 6 integers, 1 decimal
The peak energy 24.12kWh			



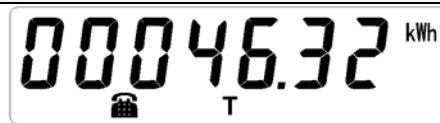
6	Flat	XXXXX.XX or XXXXXX.X	5 integers, 2 decimal or 6 integers, 1 decimal
The flat energy 12.10kWh			



7	Valley	XXXXX.XX or XXXXXX.X	5 integers, 2 decimal or 6 integers, 1 decimal
The valley energy 0.10kWh			



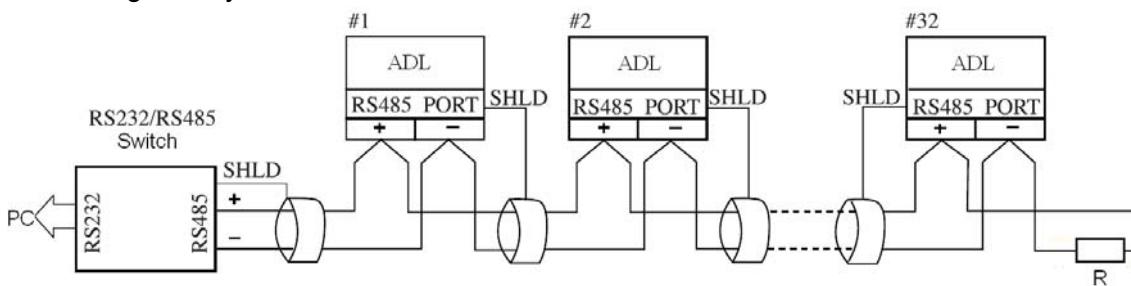
8	Indication of RS485, the phone sign figures meter is under communication.		
---	---	--	--



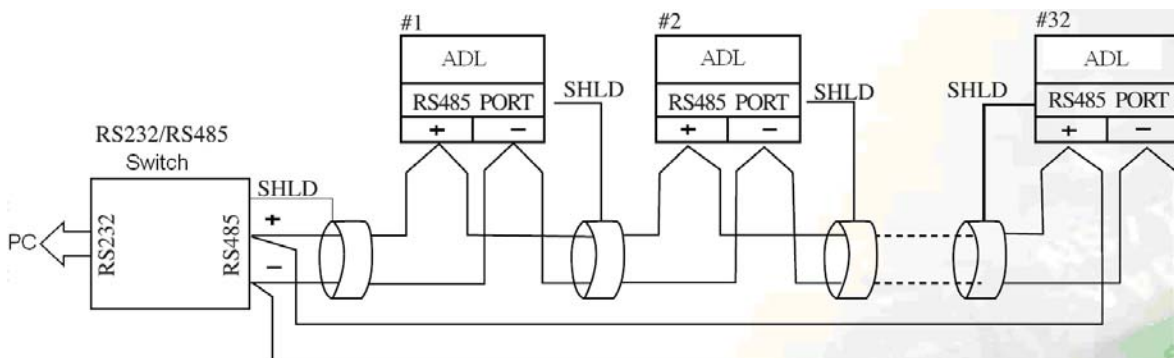
5.4 Communications

5.4.2 Wiring

- Wiring linearly



- Wiring loop



5.4.3 Protocol (MODBUS-RTU)

(1) Transmission mode

1 start bit

8 data bits

No parity

1 stop bit

(2) Frame format

Address code	Function code	Data area	CRC check code
1byte	1byte	n bytes	2 bytes

Address code is at beginning of frame, with 1 byte, decimal is 0~255. 1~247 can be used, the other is reserved. Each address code is unique.

Function code figures the functions of meters. .

Function	Definition	Operation
03H/04H	Read register	Obtain current binary system value of one or multiple register
10H	Multi register	Set binary system value into a series multi-register

Data area includes the measured data by ADL or the ADL's parameters.

CRC code occupies 2 bytes, including 1 hex value. CRC value is calculated by transmission device, and then it is attached to the data frame. While receiving, the receiving device calculates the CRC value again. If these 2 values is not equal, it shows a error..

5.4.4 Function code

(1) Function code 03H: Read register

This function permits user to obtain data and system parameters collected and recorded by the device. The data number requested by host computer for each time has no limit, but does not exceed the address range specified by Definition.

The following example is No. 01 slave computer Read 1 collected basic data (data frame every address occupy 2 byte). The measure data is total energy (4 bits), its address is 00H.

Master transmitting		Transmitting information	Slave return		Return information
Address code		01H	Address code		01H
Function code		03H	Function code		03H
Initial address	High byte	00H	Byte quantity		04H
	Low byte	00H	Register quantity	High byte	00H
Register quantity	High byte	00H		Low byte	12H
	Low byte	02H	Register quantity	High byte	D6H
CRC code	High byte	C4H		Low byte	87H
	Low byte	0BH	CRC code	High byte	44H
				Low byte	34H

(2) Function code 10H: Read-in register

Function code 10H permit user to change content of multiple registers, System parameters, switching output condition etc. may be written by using the function. Maximum once read-in data for the host computer is 16 (32 byte) data.

Below example shows: Preset address 01 is meter's date February 1st 2008 and time 12 o'clock.

Master transmitting		Transmitting information	Slave return		Return information
Address code		01H	Address code		01H
Function code		10H	Function code		10H
Initial address	High byte	00H	Initial address	High byte	00H
	Low byte	12H		Low byte	12H
Register quantity	High byte	00H	Register quantity	High byte	00H
	Low byte	03H		Low byte	03H
Byte quantity		06H	CRC code	High byte	20H
0012H data to be read-in	High byte	08H		Low byte	0DH
	0013H data to be read-in	High byte	01H		
Low byte		0CH			
0014H data to be read-in	High byte	00H			
	Low byte	00H			
CRC code	High byte	FFH			
	Low byte	A8H			

5.4.5 the list of communication address and their applications.

(1) list of address of single phase ADL100

Code	Name	R/W	Format of data	Format
0000H 0001H	Current total kWh	R/W	4 bytes / kWh	Dword
0002H 0003H	Current peak kWh	R/W	4 bytes / kWh	Dword
0004H 0005H	Current flat kWh	R/W	4 bytes / kWh	Dword
0006H 0007H	Current valley kWh	R/W	4 bytes / kWh	Dword
0008H 0009H	Negative kWh	R/W	4 bytes / kWh	Dword
000AH 000BH	Reactive kWh	R/W	reserve	Dword
000CH	Voltage	R	XXX.X V	word
000DH	Current	R	XX.XX A	word
000kWhH	P	R	reserve	word
000FH	Q	R	reserve	word
0010H	Cos	R	reserve	word
0011H	Frequency	R	reserve	word
0012H	Year, month	R/W	YY.MM.DD HH:mm:SS	word
0013H	Day, hour	R/W		word
0014H	minute, second	R/W		word

0015H High byte	address	R/W	001-247	char
0015H Low byte	Communication Speed	R/W	01 — 9600bps (default) 02 — 4800bps 03 — 2400bps 04 — 1200bps	char
0016H	Info of Tariff zone	R/W	high byte: rate of 1 st zone low byte: start time of 1 st zone - minute	word
0017H	Info of Tariff zone	R/W	high byte: start time of 1 st zone - hour low byte: rate of 2 nd zone	word
0018H	Info of Tariff zone	R/W	high byte: start time of 2 nd zone - minute low byte: start time of 2 nd zone - hour	word
0019H	Info of Tariff zone	R/W	high byte: rate of 3 rd zone low byte: start time of 3 rd zone - minute	word
001AH	Info of Tariff zone	R/W	high byte: start time of 3 rd zone - hour low byte: rate of 4 th zone	word
001BH	Info of Tariff zone	R/W	high byte: start time of 4 th zone - minute low byte: start time of 4 th zone - hour	word
001CH	Info of Tariff zone	R/W	high byte: rate of 5 th zone low byte: start time of 5 th zone - minute	word
001DH	Info of Tariff zone	R/W	high byte: start time of 5 th zone - hour low byte: rate of 6 th zone	word
001kWhH	Info of Tariff zone	R/W	high byte: start time of 6 th zone - minute low byte: start time of 6 th zone - hour	word
001FH	Info of Tariff zone	R/W	high byte: rate of 7 th zone low byte: start time of 7 th zone - minute	word
0020H	Info of Tariff zone	R/W	high byte: start time of 7 th zone - hour low byte: rate of 8 th zone	word
0021H	Info of Tariff zone	R/W	high byte: start time of 8 th zone - minute low byte: start time of 8 th zone - hour	word
0022H 0023H	Total kWh this month	R/W	4 bytes / kWh	Dword
0024H 0025H	Peak kWh this month	R/W	4 bytes / kWh	Dword
0026H 0027H	Flat kWh this month	R/W	4 bytes / kWh	Dword
0028H 0029H	Valley kWh this month	R/W	4 bytes / kWh	Dword
002AH 002BH	Total kWh last month	R/W	4 bytes / kWh	Dword
002CH 002DH	Peak kWh last month	R/W	4 bytes / kWh	Dword
002kWhH 002FH	Flat kWh last month	R/W	4 bytes / kWh	Dword
0030H	Valley kWh last month	R/W	4 bytes / kWh	Dword

0031H				
0032H	Total kWh	R/W	4 bytes / kWh	Dword
0033H	last last month			
0034H	Peak kWh	R/W	4 bytes / kWh	Dword
0035H	last last month			
0036H	Flat kWh	R/W	4 bytes / kWh	Dword
0037H	last last month			
0038H	Valley kWh last last month	R/W	4 bytes / kWh	Dword
0039H				

(2) 3 phases ADL300 address list

Address	Name of variable	R/W	Format of data	Format
0000H	Current total kWh	R/W	4 bytes / kWh	Dword
0001H				
0002H	Current spike kWh	R/W	4 bytes / kWh	Dword
0003H				
0004H	Current peak kWh	R/W	4 bytes / kWh	Dword
0005H				
0006H	Current flat kWh	R/W	4 bytes / kWh	Dword
0007H				
0008H	Current valley kWh	R/W	4 bytes / kWh	word
0009H				
000AH	Year, month	R/W	YY.MM.DD	word
000BH	Day, hour	R/W	HH:mm:SS	word
000CH	minute, second	R/W		word
000DH	address	R/W	0001 ~ 0247	Char
High byte				
000DH	Communication Speed	R/W	01 — 9600bps (default) 02 — 4800bps 03 — 2400bps 04 — 1200bps	char
Low byte				
000kWhH	Info of Tariff zone	R/W	high byte: rate of 1 st zone low byte: start time of 1 st zone - minute	word
000FH	Info of Tariff zone	R/W	high byte: start time of 1 st zone - hour low byte: rate of 2 nd zone	word
0010H	Info of Tariff zone	R/W	high byte: start time of 2 nd zone - minute low byte: start time of 2 nd zone - hour	word
0011H	Info of Tariff zone	R/W	high byte: rate of 3 rd zone low byte: start time of 3 rd zone - minute	word
0012H	Info of Tariff zone	R/W	high byte: start time of 3 rd zone - hour low byte: rate of 4 th zone	word
0013H	Info of Tariff zone	R/W	high byte: start time of 4 th zone - minute low byte: start time of 4 th zone - hour	word
0014H	Info of Tariff zone	R/W	high byte: rate of 5 th zone low byte: start time of 5 th zone - minute	word

0015H	Info of Tariff zone	R/W	high byte: start time of 5 th zone - hour low byte: rate of 6 th zone	word
0016H	Info of Tariff zone	R/W	high byte: start time of 6 th zone - minute low byte: start time of 6 th zone - hour	word
0017H	Info of Tariff zone	R/W	high byte: rate of 7 th zone low byte: start time of 7 th zone - minute	word
0018H	Info of Tariff zone	R/W	high byte: start time of 7 th zone - hour low byte: rate of 8 th zone	word
0019H	Info of Tariff zone	R/W	high byte: start time of 8 th zone - minute low byte: start time of 8 th zone - hour	word
001AH	Reserved			
001BH 001CH	Total kWh this month	R/W	4 bytes / kWh	Dword
001DH 001kWhH	Spike kWh this month	R/W	4 bytes / kWh	Dword
001FH 0020H	Peak kWh this month	R/W	4 bytes / kWh	Dword
0021H 0022H	Flat kWh this month	R/W	4 bytes / kWh	Dword
0023H 0024H	Valley kWh this month	R/W	4 bytes / kWh	Dword
0025H	Reserved			
0026H 0027H	Total kWh last month	R/W	4 bytes / kWh	Dword
0028H 0029H	Spike kWh last month	R/W	4 bytes / kWh	Dword
002AH 002BH	Peak kWh last month	R/W	4 bytes / kWh	Dword
002CH 002DH	Flat kWh last month	R/W	4 bytes / kWh	Dword
002kWhH 002FH	Total kWh last month	R/W	4 bytes / kWh	Dword
0030H	Reserved			
0031H 0032H	Total kWh last last month	R/W	4 bytes / kWh	Dword
0033H 0034H	Spike kWh last last month	R/W	4 bytes / kWh	Dword
0035H 0036H	Peak kWh last last month	R/W	4 bytes / kWh	Dword
0037H 0038H	Flat kWh last last month	R/W	4 bytes / kWh	Dword
0039H 003AH	Total kWh last last month	R/W	4 bytes / kWh	Dword

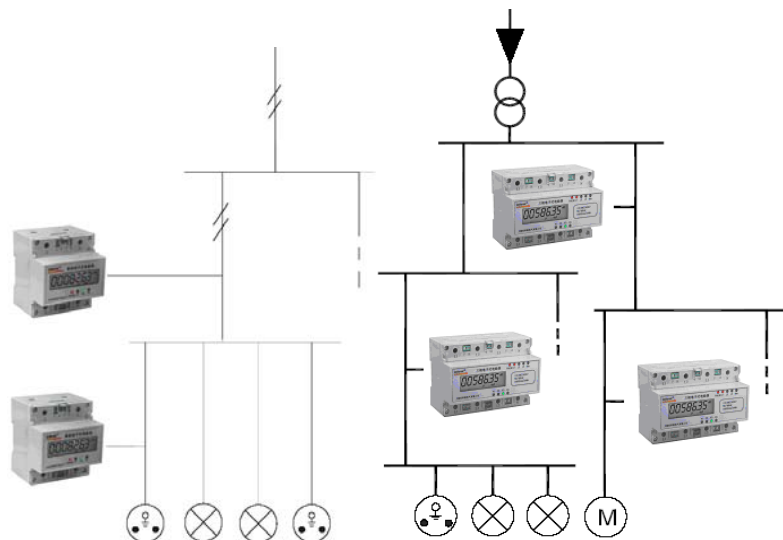
Note:

1. Read and write: “R” read only, read with the order 03H; “R/W” read and write, write with the order 10H. Forbid to write in the address non listed or non able to be written.
2. The address of the meter is decided when it is finished in factory, it can be read by our software.
3. The value of voltage has only one decimal as XXX.X, unit V; if the value of voltage sent by RS485 is 08C6H (2246), the real voltage value is 224.6V; the value of current has 2 decimals as XX.XX, unit A; if the RS485 value is 01F4H (500), the real current value is 5.00A;
4. The value of energy has 4 bytes, unit kWh. High byte is front and low byte is followed; if RS485 value is 0012D687H (1234567), the real kWh value is $1234567 \times 0.01 = 12345.67 \text{ kWh}$.

5.5 Attention:

- 5.5.1 Its capacity of charge is $0.05 I_b \sim I_{max}$ (directly) or $0.02 I_b \sim I_{max}$ (with CT) .And if the capacity overload them, the measurement won't be accurate.
- 5.5.2 If the meter is wired the network directly, the value is real energy value; If the meter is wired with CT, the real value has to be multiplied the ratio of CT.

6. Typical application



7. Order example

<p>Example1: TYPE: ADL100-EF/C Network: Single phase Mode of wiring: Directly Un: AC 220V In: 5 (20) A Measurable: Total kWh, multi-tariff kWh, U, I Option functions: RS485 The tariff and zone are indicated in orders</p>	<p>Example2: TYPE: ADL300-EF/C Network: 3P4W Mode of wiring: With CT Un: AC 3×220/380V In: 1.5 (6) A Measurable: Total kWh, multi-tariff kWh, Option functions: RS485 The tariff and zone are indicated in orders</p>
--	---