MS1-7680 Ed01

ENERGY METER USER MANUAL

ULYS TD100-M EV Modbus

CHAUVIN ARNOUX
ENERGY

Table of contents

1 Safety Instructions

This manual does not contain all the safety measures necessary for operation of this meter because specific operating conditions or local standards may imply additional conditions. However, the information it contains must be observed for your safety and to avoid damage to the meter. This information is highlighted by the following pictograms:

 **Danger**

 ***Warning***

Failure to follow these instructions could result in death, serious injury, or substantial property damage.

Qualified personnel

Installation and use of this equipment must only be performed by qualified personnel. Persons previously trained and authorised to work in an electrical environment in accordance with local standards are considered qualified.

Use for intended purposes

This product must only be used according to the technical requirements specified in the catalogue or user manual.

Getting started

Optimal operation of the product requires appropriate transport, storage, installation and connection as well as appropriate maintenance operations. Certain parts of the meter may contain elements at a dangerous voltage.

- Only use tools suitable for the voltages for which this product is intended.
- Do not connect the meter before the facility has been powered off.
- Place the meter in a dry environment.
- The meter is intended for indoor use and must be installed in an enclosure, in accordance with local regulations.
- Do not install the meter in an explosive, too dusty or too humid area.
- Ensure that the wire gauges are suitable for the maximum current supported by this product.
- Check and tighten all connections before powering up.
- Do not touch the connection terminals with bare hands, metal, bare wire or any other conductive material as this could expose you to an electric shock which could cause serious injury or death.
- Ensure that the protective covers are in place after installation.
- Maintenance and repair of this meter may only be performed by qualified personnel.
- Do not open the meter and do not break any seals. This may affect the functionality and accuracy of the meter and voids any warranty.
- Do not drop the meter and avoid physical impact.

Exclusion of liability

We have checked the contents of this manual and particular care has been taken to ensure that the descriptions are as accurate as possible. However, although deviations from the description cannot be completely excluded, no liability can be accepted for errors or omissions in the information provided. The data contained in this manual is subject to regular checks and the necessary corrections will be incorporated in subsequent versions. Do not hesitate to contact us if you have any suggestions to submit.

Manual subject to change without notice

2 Characteristics

2.1 Technical specifications

General characteristics

Voltage AC (Un)	3×230 (400) V
Voltage range	80~120% Un
Base current (Ib)	10A AC
Max. current (Imax)	100A AC
Min. current (Imin)	5% of Ib
Starting current	0.4% of Ib
Power consumption	≤2W/10 VA for the voltage measurement circuit ≤4 VA for current measurement circuit
Frequency	50/60Hz (non MID); 50Hz (MID)
Alternating voltage withstand	4KV for 1 minute
Impulse voltage withstand	6KV for a 1.2μs waveform
Overcurrent withstand	30 × Imax for 0.01s
Power supply	self-powered
Display	Backlit LCD
Max. reading	99,999.9kWh

Performance criteria

Operating temperature	3K6 (-25°C to +55°C*), default 3K7 (-40°C à +70°C*)
Storage and transport temperature	-40°C to +70°C
Reference temperature	23°C±2°C
Relative humidity	0 to 95%, non-condensing
Altitude	up to 2,000m
Stabilization time	3s
Installation category	CAT III
Mechanical environment	M1
Electromagnetic environment	E2
Degree of pollution	2

Accuracy

Voltage	0.5%	≤0.1V
Current	0.5%	≤0.1A
Frequency	0.2%	≤0.2%
Power factor	1%	≤0.1
Active power	1%	≤0.1kW
Reactive power	2%	≤0.1kVAr
Active energy produced and consumed	1%	≤0.1kWh
Reactive energy	2%	≤0.1kVArh

Active energy	IEC62053-21 Class 1 (non MID) EN50470-1/3 Class B (MID)
Reactive energy	IEC62053-23 Class 2

Pulse output specifications

The unit has a pulse output for active energy. This output is passive.
Pulse constant:
1000 pulses/kWh
100 pulses/kWh
10 pulses/kWh
1 pulse/kWh
Pulse width: 60, 100, 200ms
Note: when the pulse constant is set to 1000 pulses/kWh, the pulse width must be 35ms and cannot be changed.
The pulse output type can be set to: total kWh, produced kWh, consumed kWh.

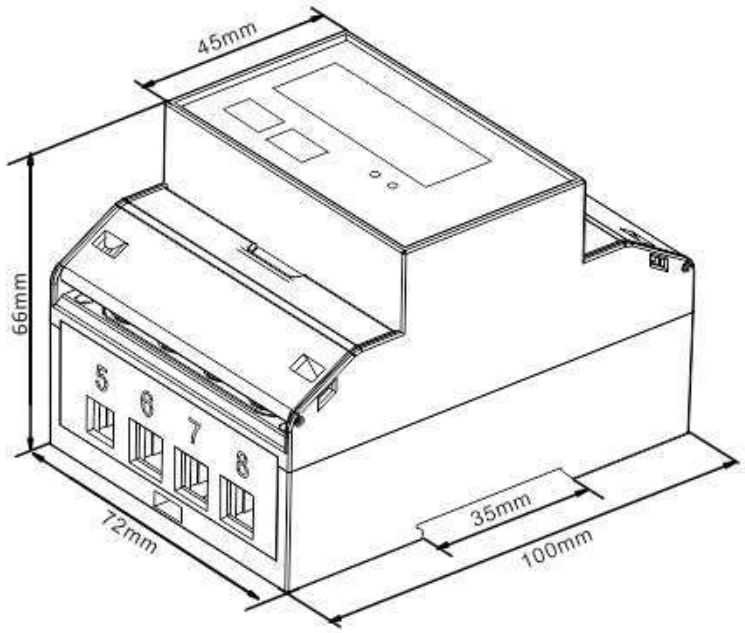
RS485 output specifications for Modbus RTU

The meter has an RS485 port for remote communication. Modbus RTU is the protocol used. RS485 communication parameters for Modbus RTU can be set in the configuration menu.

Bit rate: 1200, 2400, 4800, 9600, 19200 bps
Parity: none (default)/odd/even
Stop bits: 1 or 2
RS485 network address: nnn – 3-digit number, from 001 to 247
Modbus™ word order: The order of high/low bytes is automatically set to normal or reverse. It cannot be set in the configuration menu.

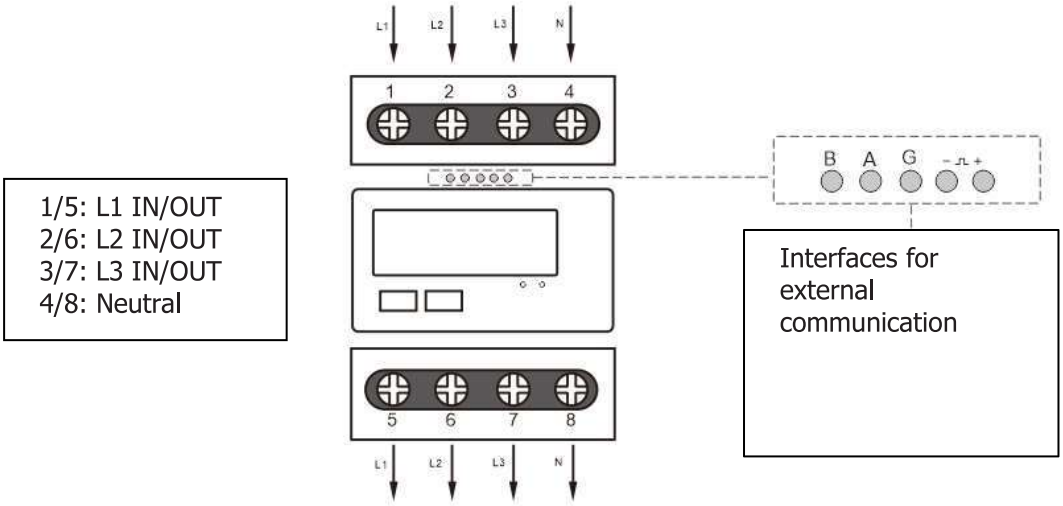
2.2 Footprint

DIN rail dimensions	72x100x66 (WxHxD) DIN 43880
Mounting	35mm DIN rail
Protection against dust and water ingress	IP51 (indoor)
Material	UL94V-0 self-extinguishing

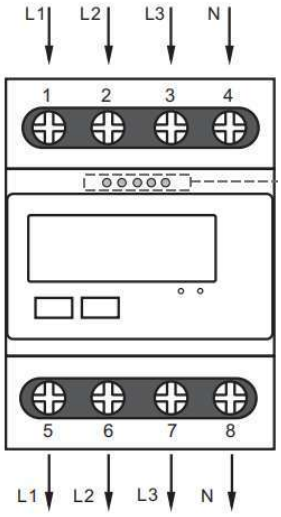


2.3 Connection schematic

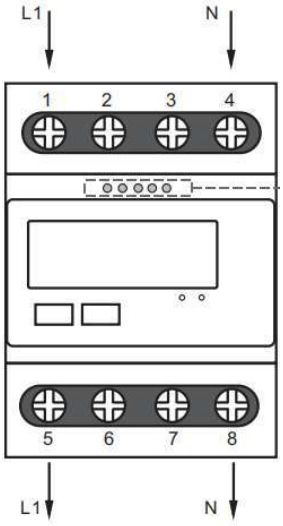
Cable connection must comply with the following schematics:



3 phases 4 wires



1 phase 2 wires



NOTE: Maximum wire section for main load: 25mm²

3 Installation

Danger

Warning

- Cut off all power sources of the meter and, if possible, of the equipment connected to it before any intervention
- Always use a voltage absence detection device to confirm that the power is off
- Installation must be carried out by qualified personnel familiar with the various standards in force
- Use insulated tools to install the product
- A fuse, a thermal circuit breaker or a single-pole circuit breaker must be provided and installed for protection and at least on the phase

- Cable sectional areas must be sized in accordance with local regulations regarding the maximum capacity of the circuit breaker or any other protection used in the circuit.
- An external protection must be installed on the supply circuit in order to isolate the meter from the electrical circuit. It is recommended to place this protection upstream and as close as possible to the meter. The protection used must comply with the building's electrical network specifications and local regulations.
- To avoid any alteration of the meter, use a suitable enclosure equipped with a closing device, in particular if it is exposed to dust or any other contaminant.
- The meter should be installed in a dry and ventilated place.
- The meter can be sealed immediately after installation and verification of its operation.
- The product can be installed on a 35mm DIN rail.
- The meter should be installed in a location where it can be easily read.
- If the meter is installed in an area subject to frequent overvoltages due, for example, to lightning, welding equipment, etc., it must be protected by suitable equipment.

4 Display

Indication of energy flow

The red LEDs on the front panel indicate the energy flows measured by the meter. When energy is flowing, the LEDs blink. The faster it blinks, the greater the flow. For this meter, the red LEDs blink every 0.1wh.

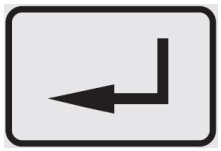
Start screens

When turned on, the meter initialises and performs the following loop:

1		Start screen This screen is displayed for 3 seconds.
2		Software version This screen is displayed for 3 seconds.
3		Pulse constant
4		Total active energy (kWh) Total = Produced + Consumed 5+2 -> 6+1 Max. reading: 999,999.9kWh

Meter display screens

The front panel has two buttons:

	- Scrolling of screens for data consultation. - Change of option in Configuration mode - Exit from Configuration mode
	- Enter Configuration mode - Validation

After initialisation and self-test, the meter displays the measured values. The default screen displays total kWh. If the user wishes to consult other information, he must press the button  on the front panel.

	Total active energy Total = Energy produced + Consumed
	Resettable partial energy
	Energy produced
	Energy consumed
	Total reactive energy

	Resettable reactive energy
	Voltage L1-N
	Voltage L2-N
	Voltage L3-N
	Current L1
	Current L2
	Current L3
	Active power L1

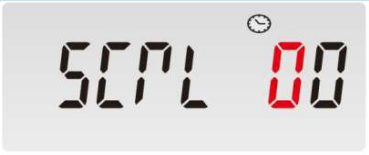
	Active power L2
	Active power L3
	Total active power
	Reactive power L1
	Reactive power L2
	Reactive power L3
	Total reactive power
	Power factor L1
	Power factor L2

	Power factor L3
	Total power factor
	Frequency
	Pulse output type: Default: kWh Pulse constant: 1000 pulses
	Modbus address
	Baud rate
	Parity
	Software version

Meter configuration screens

To enter Configuration mode, the user must press the "Input" button  for 3 seconds.

Configuration interface	Setting status	Options:
		Password By default: 1000
		Modbus address Range: 001~247 default: 001
		Communication speed Options: 1200, 2400, 4800, 9600, 19200 bps default: 9600 bps
		Parity: Options: None (n), Even (E), Odd (O) default: None
		Stop bit Option: 1, 2 default: 1
		Pulse output type: Options: Total kWh, kWh imported, kWh exported default: Total kWh
		Pulse weight: Options: 1000, 100, 10, 1 pulses/kWh

		Pulse width: Options: 60, 100, 200; unit: ms Note: If the pulse weight is 1000 pulses/kWh, the pulse width is fixed at 35 ms.
		Automatic scrolling of the display Range: 0~60, unit: second default: 05, i.e. no scrolling
		Backlight time adjustment Options: enabled (on), 5, 10, 30, 60, 120, disabled (off) unit: minute default: 60 minutes
		System: Options: 3P4W, 1P2W default: 3P4W
		Password: default: 1000
		Resettable partial energy

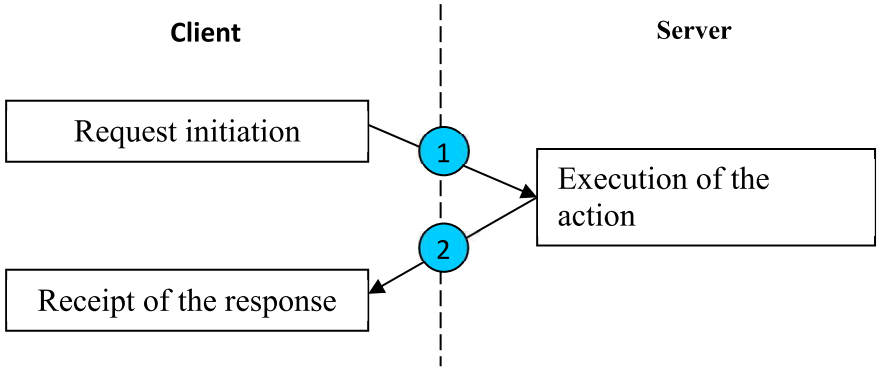
Press and hold the  button to exit configuration mode.

5 Modbus table and communication

5.1 Modbus communication

5.1.1 Modbus transactions

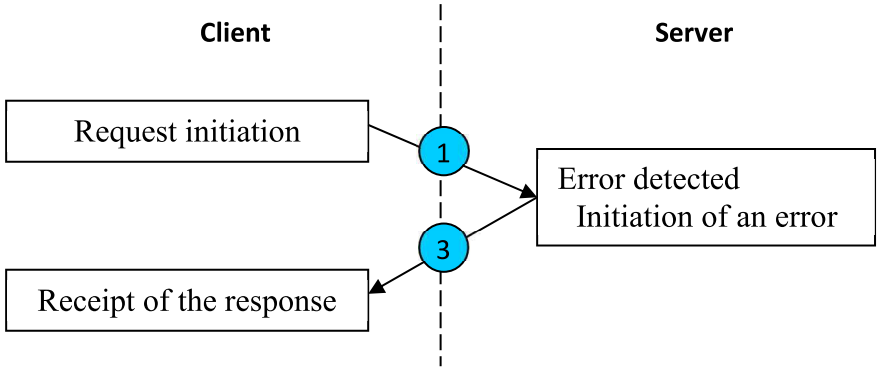
- A client sends a request to the server. The server performs the action related to the request and prepares the response. The server then returns the response and the client receives the response from the server.



Transition 1: Function code + data

Transition 2: Response: Function code + any data

- The server may detect an error when receiving the client request or while processing the request. In this case, an exception is returned to the client.



Transition 3: Error Flag + Function Code + Error Code

5.1.2 Addressing

In Modbus RTU

- The slave address is between 1 and 247.
- Address 0 is reserved for "broadcast" messages (a message addressed to several devices on the same bus).
- Addresses 248 to 255 are reserved.
- Two customers cannot have the same address.

In Modbus TCP

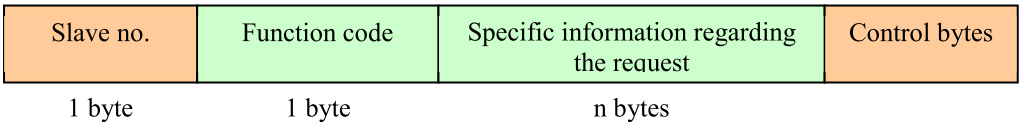
The notion of addressing is an IP address, the header also comprising an Identifier which allows a slave to be selected when it is on the serial bus of an IP gateway.

5.1.3 Modbus RTU frames

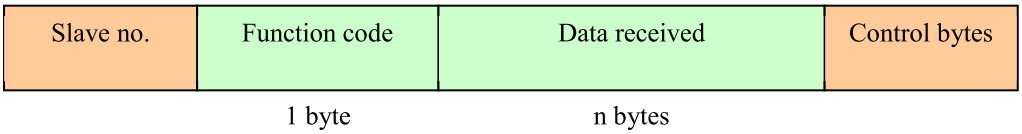
Frame data is encoded in Big Endian format. The maximum size of a Modbus/RTU frame is 256 bytes. Therefore, the maximum number of words that can be read (for example with function 3) is 125 and the maximum number of words that can be sent (function 16) is 123.

5.1.3.1 Modbus query

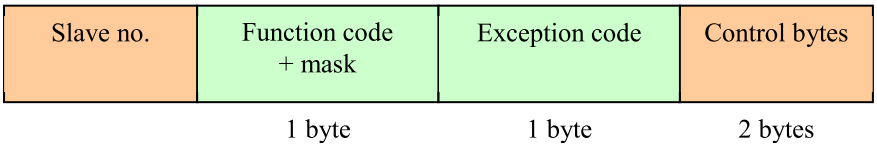
- The first byte contains the slave number to which the frame is addressed.
- The second byte contains a function code telling the addressed slave what type of action is requested.
- The data contains additional information that the slave needs to perform this function.
- The control bytes field allows the slave to ensure that the content of the query is complete. In Modbus, error checking takes the form of a 16-bit CRC with a polynomial of 0xA001. Please note that the two control bytes are transmitted in Little Endian.



5.1.3.2 Response



5.1.3.3 Exception response



The response frame contains the function code with the most significant bit at 1. Example, if the request function code is 0x03, an exception response will return a function code equal to 0x83.

The standard exception codes are the following:

Exception code	Modbus name	Comments
0x01	Illegal Function Code	Function not supported by the product
0x02	Illegal Data Address	Prohibited address
0x03	Illegal Data Value	Incorrect data
0x04	Server Failure	The Modbus server generated an error
0x05	Acknowledge	Release
0x06	Server Busy	Server busy
0x07	No acknowledge	Non-release
0x08	Write Error	Write error
0x09	Overlapped Area	Area overlap
0x0A	Gateway problem	Unable to access gateway
0x0B	Gateway problem	Exception generated by gateway

5.1.4 Modbus TCP

In this mode, the frames are amputated by two CRC bytes (data integrity is ensured by the TCP/IP layer) and a new header is appended to the start of the frame.

7 bytes up to 253 bytes

This header is called MBAP and contains the following information:

Field	Size	Description	Client	Server
Transaction Identifier	2 bytes	Identifies the Modbus transaction	Initialised by the client	Copied by the server into the response frame
Protocol Identifier	2 bytes	0 = Modbus Protocol	Initialised by the client	Copied by the server into the response frame
Length	2 bytes	Number of bytes that follow	Initialised by the client in the query	Initialised by the server in the response
Unit identifier	1 byte	Modbus identifier of a remote slave	Initialised by the client (set to 0xFF by default)	Copied by the server into the response frame

Modbus TCP uses reserved port number 502 and must therefore be freely accessible on the network, but the standard specifies that any Modbus/TCP server must be able to use a second listening port because certain security configurations prohibit port 502.

5.2 Modbus communication table

The meter can communicate with an external system via an EIA-485 interface (ex RS-485) under Modbus RTU Protocol. To read the meter registers, install and configure software beforehand. Use an RS485 converter if necessary to connect the system to the meter. The cable must be connected to terminals (A+) and (B-), respecting the polarity. The slave address (ID) of the meter is 1 by default.

A Modbus register corresponds to a 16-bit word.

Modbus function code	
04	To read I/O registers (read only)

Input registers			**Starting Modbus Address (Hex)**	
Parameters	**Unit**	**Format**	**High Byte**	**Low Byte**
Phase-to-neutral voltage V1	V	Floating	00	00
Phase-to-neutral voltage V2	V	Floating	00	02
Phase-to-neutral voltage V3	V	Floating	00	04
Current I1	A	Floating	00	06
Current I2	A	Floating	00	08
Current I3	A	Floating	00	0A
Active power P1	W	Floating	00	0C
Active power P2	W	Floating	00	0E
Active power P3	W	Floating	00	10
Apparent power S1	VA	Floating	00	12
Apparent power S2	VA	Floating	00	14
Apparent power S3	VA	Floating	00	16
Reactive power Q1	VAr	Floating	00	18
Reactive power Q2	VAr	Floating	00	1A
Reactive power Q3	VAr	Floating	00	1C
Power factor FP1	-	Floating	00	1E
Power factor FP2	-	Floating	00	20
Power factor FP3	-	Floating	00	22
Average voltage	V	Floating	00	2A
Average current	A	Floating	00	2E
Total current	A	Floating	00	30

Total active power	W	Floating	00	34
Total apparent power	VA	Floating	00	38
Total reactive power	VAR	Floating	00	3C
Total power factor (1)	-	Floating	00	3E
Frequency	Hz	Floating	00	46
Imported active energy	kWh	Floating	00	48
Exported active energy	kWh	Floating	00	4A
Compound voltage U12	V	Floating	00	C8
Compound voltage U23	V	Floating	00	CA
Compound voltage U31	V	Floating	00	CC
Average compound voltage	V	Floating	00	CE
Neutral current	V	Floating	00	D0
Total active energy (2)	kWh	Floating	01	56
Total reactive energy	kVArh	Floating	01	58
Total active energy with RAZ	kWh	Floating	01	80
Total reactive energy with RAZ	kVARh	Floating	01	82
Imported active energy with RAZ	kVArh	Floating	01	84
Active energy exported with RAZ	kVArh	Floating	01	86
Net total energy (Imp – Exp)	kWh	Floating	01	8C
Total imported active power	W	Floating	05	00
Total exported active power	W	Floating	05	02

Note:

1: The power factor has its sign positioned to reflect the direction of the current. Positive for a withdrawal current, negative for an injection current.

2: Total active energy = Import + export energy.

Modbus function code	
16	To write to an editable "holding register"
03	To read an editable "holding register"

Editable registers (Holding Registers)		Modbus address at start (Hex)		Description
Parameters	**Format**	**High Byte**	**Low Byte**	
Type of electrical network	Floating	00	0A	Write the type of electrical network: 1 = 1P2W; 3 = 3P4W (default); **Length: 4 bytes** (KPPA requested)
Pulse width 1	Floating	00	0C	Pulse width 1 in milliseconds: 60, 100 or 200, default 100ms. If the weight of the pulse = 1000pulses/kWh, the width is fixed at 35 ms and cannot be changed. **Length: 4 bytes**
Parity and number of stop bits	Floating	00	12	Write the parity/stop bits of the EIA485 port. Or: 0 = One stop bit, no parity 1 = One stop bit, even parity (default) 2 = One stop bit, odd parity 3 = Two stop bits, no parity Requires a reboot to take effect **Length: 4 bytes**
Meter Modbus ID (slave address)	Floating	00	14	Writes the Modbus identifier of the server From 1 to 247, ID by default: 1 **Length: 4 bytes**
Weight of the Pulse output 1	Hex	00	16	0: 1000 kWh/pulse (default) 1: 100 kWh/pulse 2: 10 kWh/pulse

				3: 1 kWh/pulse **Length: 2 bytes**
Password	Floating	00	18	Writes password, default = 1000 Length: 4 bytes
Transmission speed (Baud)	Floating	00	1C	Baud rate for MODBUS RTU, where: 0 = 2400 baud (default) 1 = 4800 baud. 2 = 9600 baud 5 = 1200 baud **Length: 4 bytes**
Display time (self scrolling)	Floating	00	3A	From 0 to 60s 0: (default) no automatic scrolling of the display **Length: 4 bytes**
Backlighting	Floating	00	3C	From 0 to 121 min 60: default 0: always on 121: always off **Length: 4 bytes**
Mode of the Pulse output 1	Floating	00	56	Writing the mode of pulse output 1: 1: Imported active energy, 2: Total active energy (Imp + Exp) 4: Exported active energy (default). **Length: 4 bytes**
Clear history	Hex	F0	10	00 00: RAZ of averages **Length: 2 bytes**
Serial number	int32 Unsigned	FC	00	Serial number **Length: 4 bytes**
Meter code	Hex	FC	02	Meter code = 00 84 **Length: 2 bytes** Note: Read only

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